

A collage of images illustrating the evolution of libraries. It includes historical grand libraries, modern digital libraries, children reading, hands typing on a keyboard, a person using a laptop, and a network diagram, symbolizing the transition from traditional to digital knowledge storage and access.



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Volume I

Academic Libraries – Careers

Encyclopedia of
Library and
Information Sciences
Fourth Edition



John D. McDonald
Michael Levine-Clark

Encyclopedia of

**Library and Information
Sciences, Fourth Edition**

Volume 1

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Library and Information Sciences, Fourth Edition

Volume 1

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in Records and Information Management

Encyclopedia Edited By

John D. McDonald

and

Michael Levine-Clark



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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable. Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

They acknowledge and thank the Taylor & Francis Group editors, Claire Miller and Rich O'Hanley, as well as Susan Lee, who passed away at the early stages of the preparation of this edition, and more recently, Alexandra Torres, who supported and kept the editors and authors on track over the course of the years of work on this edition of the encyclopedia.

The editors thank the authors who wrote and revised entries, and the huge number of reviewers who refereed the entries. Without their dedication, expertise, and willingness to share their knowledge with others, there would be no encyclopedia. They also wish to thank the Editorial Advisory Board for their advice, suggestions of topics and authors, their hours spent writing or reviewing for the final edition. They also wish to thank the previous editors, Marcia Bates and Mary Niles Maack, whose organization and structure for ELIS-3 provided an excellent blueprint for ELIS-4.



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Academic Libraries

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Abstract

This entry provides an introduction to academic libraries throughout the world including an overview of the mission, history, governance, external influences, collections, services, organizational structure, personnel, administration, and facilities of academic libraries. The issues and future of academic libraries are also discussed.

INTRODUCTION

Academic libraries are libraries that belong to institutions of higher education, including publicly funded, federal, state, provincial, or national universities or colleges, privately funded universities or colleges, 2-year community or junior colleges that can be publicly or privately funded, tribal colleges, professional schools, and special focus institutions that offer a single or small set of programs. These institutions grant a range of degrees from the associate of arts to the baccalaureate and from the master's degree to the doctorate. This entry will provide an overview of academic libraries, including such topics as their mission, history, governance, external influences, collections, services, organizational structure, personnel, administration, and facilities.

The mission of academic libraries is to support the educational and research activities of their parent institution through the provision of collections, services, and user education. Providing support for teaching, learning, and research is the focus of academic libraries. Academic libraries are vital to the success of the academic enterprise of their institutions whose research and teaching agenda are greatly enriched by libraries whose collections are broad, rich, and diverse.

Academic libraries are found in almost all post-secondary educational environments. While there is no absolute count of the number of higher education institutions, there are at least 18,000 institutions of higher education throughout the world today as indexed by the *International Handbook of Universities*.^[1] There is no complete and final count of the number of academic libraries internationally. However, OCLC has a helpful spreadsheet revealing many academic libraries country by country.^[2] In the United States, there are 3700 academic libraries today according to the National Center for Education Statistics.^[3]

While the core mission of academic libraries remains consistent throughout institutions of higher education, academic libraries vary considerably from each other in

size, in resources, in collections, in services, in complexity, and in numbers of library facilities serving the institution. The variation is largely a product of the mission, the history, the size, and the funding of its parent institution. Looking at some examples of variations around the globe, there is the Harvard University Library founded in 1638^[4] to serve this institution's extensive research agenda and internationally recognized programs. It is the largest academic library in the United States by volumes held^[5] and has over 70 separate library units.^[6] Another example of variation is the University of Botswana formally established in 1982.^[7] Its library has a main and three branch libraries—two of which are located in other cities.^[8] Yet another example of variation is the University of the South Pacific, which has libraries located throughout its 12 member countries (Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu, and Vanuatu).^[9] This is in accordance with the University's vision of being "an exemplar of tertiary education in the Pacific region. . ."^[10]

HISTORICAL CONTEXT

From the early card catalogs to Online Public Access Catalogs (OPACs), from print indexes to periodicals via electronic article databases hosted online, the organization and access of academic library materials has changed dramatically over the past century. For hundreds of years, the predecessors of today's academic libraries relied on inventory lists, similar to contemporary archival finding aides, to keep track of books, scrolls, and tablets.^[11] During the nineteenth century, the rotary printing press, public funding for colleges and universities, and the emergence of the profession of librarianship laid the groundwork for the meeting of technology and user-centered services, which changed libraries in the twentieth century from a book focus to a user focus. As two academic librarians described in a popular online blog, the role of academic

libraries will be to meet the “Three Cs,” which are creation, collaboration, and contemplation.”^[12] New collaborative study spaces, creative media studios, or the silent mediation created in a reading room are continuing the rich history of academic library service to patrons as their needs change over throughout the years.

During World War II and throughout the Cold War, government funding for natural and social science research expanded to include area studies, such as Latin American studies. These new disciplines were integral in the development of new collections and the creation of new resources.^[13] The children of the World War II generation, the baby boomers, entered college during a time of great social and political change. Just as the student population increased, so did the collections in academic libraries, which now grew to 100,702,000 volumes.^[14] The Civil and Women’s Rights movements diversified the campus population and challenged the traditional research cannons. For libraries, as the population changed, so did library collections change with new subject areas, and so did new issues emerge in user services and education. With a large number of first-generation college students, the role of the academic library was not just to preserve a collection, but to continue a larger discussion within the profession, lasting into the twenty-first century about how to teach users to search independently and more effectively with a wealth of information now available in the library and online. For academic libraries, two great shifts in technology occurred during the twentieth century. The first shift occurred with the development of Machine-Readable Catalog (MARC) standards. In conjunction with MARC, the Anglo-American Cataloguing Rules provided the format for descriptive cataloging while the Library of Congress Subject Headings were used to describe the subject matter of a record.^[15] Automation of library records allowed computers to read information about a book using data elements, such as code. The first OPAC was launched in 1970 at Ohio State University and facilitated the sharing of library information between institutions, and in 1981 the Ohio State project would be known as the Online Computer Library Center (OCLC).^[16]

The second great shift, the 1990s, was the age of the Internet. For centuries, libraries were the primary source for information and materials, but the Internet broadened the meaning of library science and the potential for sharing information. Now, academic libraries were competing with information sources not just created by scholars, but sources created by everyday people who were challenging the library and faculty as the gatekeepers of knowledge. Libraries have responded by opening their collections to the public and increasing the sharing of resources to other libraries. Many archival collections have a portion of their materials, including photographs and finding aids, available online. Similarly, the OPACs are accessible through library homepages giving users throughout the world the ability to search the holdings at any particular institution,

at any time. More than a quarter century after OCLC was formed, WorldCat launched a public tool for searching over 2 billion items in over 10,000 libraries worldwide.^[17] In the years ahead, libraries in higher education face many hurdles: funding cutbacks, increased costs for electronic serials and books, and a changing student population with user-education needs. The demand for 24/7 access, cloud storage, and changes in publishing for books and distribution for films has impacted both the institution and library. The field itself is in a state of flux and self-discovery as academic libraries rethink their place in the larger world of information. Much of the strength of library resources lies in their print collection and knowledge of staff. Finding ways to package and promote services to a new generation of students and faculty will require opening the field to opportunities for increasing the sharing of resources, for cooperatively creating online tutorials and instructional components for the growing online classes. Our success will depend on the ability of the librarians and administrators to adapt to social, economic, and political changes that have impacted academic libraries throughout the twentieth century.

EXTERNAL INFLUENCES

Academic libraries, as a key component of the academic enterprise, are influenced by the same forces influencing education today. While these forces vary from country by country, such important issues of student enrollment and retention, student preparation for college, time to graduation, competitive salaries for campus personnel, trends in academic disciplines, distance instruction, changes in educational legislation, assessment, the rising cost of tuition, technology-based instruction, and adequate funding are universal and impact the library. The library must assist with solving the institution’s challenges, exist within the confines of its budget, and react to its changing needs. Other external influences related to accreditation, legislation, intellectual property, and the actions of organizations and associations can also impact the library very directly.

Accreditation is an important external influence in some countries. Within the United States, for example, there are regional commissions that accredit the universities because “in a quality assurance environment, accreditation is the most visible ‘report card’ regarding the quality of institutional effectiveness and performance.”^[18] Academic libraries are often evaluated as part of the accreditation process on the range of services, the depth of collections in a variety of subject fields, the outreach to the academic departments, the integration of the library into the academic enterprise, and the information literacy focus. The core question for accrediting agencies is, can this library support the stated educational and research mission of the institution?

To assist with this process, the Association of College and Research Libraries (ACRL) in the United States “promulgates standards and guidelines to help libraries,

academic institutions, and accrediting agencies understand the components of an excellent library.”^[19] An extensive list of standards, guidelines, and policies is provided,^[20] including the *Standards for Libraries in Higher Education*, which are “designed to guide academic libraries in advancing and sustaining their role as partners in educating students, achieving their institutions’ missions, and positioning libraries as leaders in assessment and continuous improvement on their campuses. Libraries must demonstrate their value and document their contributions to overall institutional effectiveness and be prepared to address changes in higher education. These *Standards* were developed through study and consideration of new and emerging issues and trends in libraries, higher education, and accrediting practices.”^[21]

Academic libraries can also be impacted and controlled by legislation or governmental regulations. For example, the American Library Association has raised concerns about provisions in the USA PATRIOT ACT, which may “endanger constitutional rights and privacy rights of library users.”^[22] Any legislation that impacts the user’s borrowing and searching history is a sea change as user privacy has been protected historically in most academic libraries.

Another example of an external influence is intellectual property, which has grown ever more complex with emerging technologies. As the American Library Association states, “Copyright issues are among the most hotly contested issues in the legal and legislative world; billions of dollars are at stake. Legal principles and technological capabilities are constantly challenging each other and every outcome can directly affect the future of libraries.”^[23]

Of course, in the global economy, intellectual property issues are not simply an issue for one country alone. For example, countries that are members of the World Trade Organization know of the “Agreement on Trade Related Aspects of Intellectual Property Rights, Including Trade in Counterfeit Goods,” which “sets out the obligations of member governments to provide procedures and remedies under their domestic law to ensure that intellectual property rights can be effectively enforced, by foreign right holders as well as by their own nationals.”^[24]

Another example of a global influence is the agreement between the European Union and the U.S. Department of Education with the European Union-United States Atlantis Program. Among other activities, “the Atlantis Program will fund collaborative efforts to develop programs of study leading to joint or dual undergraduate or graduate degrees.”^[25] Such cooperation is very desirable globally but may call upon academic libraries for increasing or new services.

PROFESSIONAL ASSOCIATIONS

Academic libraries are also participants in and influenced by professional associations. Such associations further the

success of academic libraries by providing a forum for the exchange of ideas, by influencing public policy relating to libraries and information and higher education, by providing opportunities to network with colleagues, by creating opportunities for cooperation and dialogue, and by providing leadership on emerging issues.

Library associations for academic libraries are all across the world. For example, there is the Association of Caribbean University and Research Libraries located in Puerto Rico; the International Association of Technological University Libraries located in Ireland; the Canadian Association of Research Libraries/Association des bibliothèques de recherche du Canada located in Ottawa or the Association of Libraries of Czech Universities located in Prague.^[26]

Academic libraries also participate in the International Federation of Library Associations and Institutions (IFLA). IFLA has an Academic and Research Libraries Section, which “provides members with the opportunity to exchange experiences and ideas with colleagues worldwide and is a vehicle for collaborative action.”^[27]

In the United States, the American Library Association has a division called the ACRL. ACRL is “dedicated to enhancing the ability of academic library and information professionals to serve the information needs of the higher education community and to improve learning, teaching, and research.”^[28]

Another example is the Association of Research Libraries (ARL) whose 125 member libraries are research-extensive universities in the United States and Canada. ARL is focused on “providing leadership in public and information policy to the scholarly and higher education communities, fostering the exchange of ideas and expertise, facilitating the emergence of new roles for research libraries, and shaping a future environment that leverages its interests with those of allied organizations.”^[29]

There are other associations and organizations that set standards, which have an impact on libraries. For example, the National Information Standards Organization (NISO) “is a nonprofit association accredited as a standards developer by the American National Standards Institute, the national clearinghouse for voluntary standards development in the United States.”^[30] NISO is “where content publishers, libraries, and software developers turn for information industry standards that allow them to work together. Through NISO, all of these communities are able to collaborate on mutually accepted standards—solutions that enhance their operations today and form a foundation for the future.”^[31]

GOVERNANCE AND HIERARCHY

The governance of academic libraries is subject to the governance structure of the colleges or universities of which they are a part. This governing structure establishes

the budget as well as the policies and the regulations with which the library must also comply.

The governance of institutions does vary but usually the institution reports to a lay governing board, often called a Board of Trustees, whose members are either elected or appointed from such groups as alumni, faculty, community members, major donors, or political or religious affiliates. Occasionally, there is a nonvoting student representative. A lay governing board governs within the charter and by-laws of the institution that lays out their rights and responsibilities and that is legally binding. One example of a lay governing board is from the University of Queensland in Australia, which is “governed by a 22-member senate representing University and community interests.”^[32] Another example comes from the University of British Columbia in Canada, which has a 21-person board of governors including 11 persons appointed by the lieutenant-governor of the province.^[33]

The head of the institution, frequently called a president or chancellor, reports directly to the lay governing board. In turn, the chief academic officer often called a provost, a vice chancellor, or vice president, reports to the president or chancellor.

The head of the library, who often uses such titles as university librarian (UL), dean, director, and occasionally vice-president or vice-provost, often reports to the chief academic officer because libraries are part of the academic enterprise or the activities of teaching, learning, and research, all of which are the domain of the chief academic officer.

Additionally, the library might also have faculty advisors appointed or elected by the academic senate of the institution. The academic senate, which not all institutions of higher education have, comprises faculty members elected by their peers to participate in the shared governance of the institution in matters pertaining to teaching, curriculum, research, and faculty personnel matters. These faculty senators work directly with the UL advising on such matters as policy, services, and budget as well as providing the UL with input on the changing needs of the faculty and students. These faculty advisors might also act as advocates for the library particularly in supporting the library's financial needs.

ORGANIZATIONAL STRUCTURE

The organizational structure, that is, the way that the service units within the library are organized hierarchically, varies substantially in academic libraries depending upon size, history, and need. The following is a general description of a common organizational structure with discussion on some variations. Generally speaking, many academic libraries are divided into Public Services and Technical Services, although there are many variations on the names. All services or units report into library administration.

Library administration usually comprises the Office of the University Librarian as well as management and staff personnel associated with planning, policymaking, budget, personnel, facilities, security, and fundraising. Often, the UL has one or more assistant or associate university librarians (AULs) responsible for various service units such as Public Services. Administration collectively is responsible for leadership and all its many dimensions, for the provision of resources and for decision-making. Administration also has a regulatory role to make sure that the library is in compliance with policies, regulations, and budgetary matters.

Public Services, which usually reports to an AUL or equivalent, is responsible for connecting the user to resources through the provision of direct services that make the library understandable, accessible, and easy to use. Public Services comprise service units such as reference or research services, user education such as information literacy or media literacy, circulation, interlibrary loan, media, government documents, maps, and other specialized services. Sometimes, outreach services to students is located here and sometimes in Administration. The reference services unit and the user education unit can often be separate services from Public Services.

Technical Services, which also reports to an AUL or equivalent, comprises the acquisition, the cataloging, and the processing of resources. It is the job of Technical Services to order, receive, and process resources in an expeditious fashion so that the resources are available to the user as soon as possible. Bindery and repair of resources are usually located in Technical Services. Many Technical Services units today have contract personnel because some of the traditional responsibilities of Technical Services, personnel are being outsourced such as the copy cataloging, bar coding, and labeling of books.

Collection development/bibliography, or the selection of resources, can be located in Technical Services or in Public Services, but it could also be a separate unit if the library is large enough. Personnel in this unit, usually librarians, are responsible for selecting all information resources, including print, electronic, and media. Librarians with collection development responsibility work closely with faculty in the academic departments so that the collection continually meets the changing curriculum and current research needs of the institution.

Library Systems, or the unit that is responsible for library technology, can exist as one unit managing the integrated library system, the web development, other online systems, and the computers and computer labs. Management personnel, such as a systems administrator or director of technology, usually are responsible for Library Systems. However, these duties can also be split into different areas. For example, the personnel who support the integrated library system might report to Technical Services. The web developer might report to Administration. Personnel

who manage the computers and computer labs might report to Administration or to Public Services.

Special collections of rare materials, archives, maps, oral histories, and other resources are usually a separate unit particularly in libraries of considerable size. Special collections are usually headed up by a curator or highly specialized librarian versed in both the subject matter and in the preservation and conservation of the materials. The curator may report to the AUL of Public Services or to the UL. Often, exhibits come under this unit as exhibits are an important way of making the academic community and beyond aware of these unique resources. Increasingly, digital archives or institutional repositories are embedded within special collections. However, these emerging fields are not yet stable in their operations, are usually interdepartmental by nature, and so could report anywhere in the library.

Large institutions of higher education usually have more than one library on the campus. In fact, large research universities can have dozens of libraries on campus. For example, Oxford University in England has over a 100 separate libraries serving 38 colleges and other units.^[34]

Sometimes, libraries in these large institutions are united under one UL, but often not. For example, the heads of medical or law libraries often report directly to the dean of the medical or law school rather than the UL. The head of an academic departmental library, such as a business library, could report to the dean of the college of business rather than the UL.

Sometimes, academic departments launch their own small library without regard for the professional management of libraries, for an ongoing budget, for staffing, for access, or for continuing acquisitions. Many of these little libraries end up shuttered after interest wanes, and materials go missing. Occasionally, an academic department eventually will ask the academic library for help, which presents an opportunity to rescue resources, some of which may be important donations, and to strengthen a partnership with this academic department.

Institutions of higher education that have developed satellite campuses to reach students in remote geographic areas usually have satellite libraries on those campuses. The heads of the satellite libraries might also report to the UL.

Regardless of the reporting line, it is increasingly important for the libraries in one institution to cooperate through a single technical integrated library system, by access to shared resources, by a common portal, common policies and procedures, and by shared Technical Services support. This cooperative and integrated approach benefits greatly the students and faculty.

The important issue is not how the library is organized but how efficient and effective its structure is and how well its systems and processes are integrated for the benefit of the user.

USER PRIVILEGES

The users of academic libraries are primarily students and faculty of the parent institution. Academic libraries also extend library privileges to visiting scholars and other researchers. Publicly funded colleges and universities may provide some limited library privileges to members of the greater community. Members of the Friends of the Library, a fundraising and support group, alumni, other significant friends, and donors also usually receive some limited library privileges. Sometimes, there is reciprocity between nearby academic libraries to extend library privileges to each other's faculty and occasionally students.

Library privileges in academic libraries are not consistent across groups of users. Along a continuum of increasing privileges, faculty members usually receive the most privileges as befitting their pivotal role in a teaching and research enterprise. After faculty come graduate students in terms of range of privileges and then undergraduate students. University staffs also receive privileges, which can vary widely but is often similar to the privileges of undergraduate students. Employees of the library may sometimes have special personal use privileges.

The range of library privileges include the ability to checkout resources including media; to use interlibrary loan; to request document delivery; to access online resources; to access course reserves; to use the computers; to browse closed stack areas; to use private study carrels and group study rooms; and to access rare and valuable materials.

RESOURCES AND SERVICES

Each generation of library users has had different expectations for service and access to their library's collection, resources, and services. In response, academic libraries are continually adapting to their user's needs and lifestyles.

The purpose of library services is to connect the user to resources and support research, instruction, and lifelong learning. However, the development of services throughout the years is based on the idea that the library should be user-friendly, straightforward, and rapid in response. Enhanced services and expert staff continue to add value to the library. The academic library is also a "community center" with experts to assist students, faculty, and surrounding neighborhoods.^[35]

Resources and Expertise

As information is more accessible online, experts in copyright, digital content management, and digital preservation are necessary for campuses with robust research and creative projects. Scholarly and instructional content created

by faculty and staff must be organized and preserved for the success of scholarly communication. More libraries are restructuring based on areas of expertise: instructional design, digital preservation, web services, and copyright. Resources include the instruction, research consultations, digital preservation and archiving, web services and information technology, rare books and special collections, and finally the ongoing role of librarians in copyright and accessibility issues. Many libraries inform patrons about services and resources via strategic outreach and marketing plans that often include social media.

Many academic libraries have a designated outreach librarian who informs the campus about new services and resources. Outreach is an education service provided by the library to raise awareness, educate patrons by bringing library services or information about services directly to them. Typically, the outreach librarian is tasked with the important work of making the services and resources of the library visible to new students and faculty. New faculty orientation and freshman welcome week are two opportunities for publicizing new services and collections to the campus community. Some outreach librarians also work directly with primary and secondary education in their service areas. A local teacher might want to bring his/her class to campus to visit an exhibit in special collections, tour the facilities, or request an information literacy session for a class. With school libraries underfunded, the college or university library often partners to ensure students have access to materials and prepared to enter a higher education institution.^[36] Most librarians have an outreach responsibility to their job description as a department or college liaison that is critical to disseminating information about services and resources to the campus.

Digital collections of a library are often materials from special collections and archives. It is important to note that digital collections are not entirely special collections and a great deal of work is happening to preserve the intellectual works of faculty. Staff with expertise in digital libraries, repositories, and preservation work directly with faculty on campus to make sure that copies of their scholarly publications, digital learning objects created for courses, or even creative projects are available online for future generations. This is a relatively new service provided by libraries and requires staff with technical expertise and an outreach plan to educate faculty about the benefits of contributing their works to a repository on their campus.

Copyright advisement is necessary on campuses with research or instruction foci. Staff at the library guide and advise faculty (and administrators) regarding fair use and equitable access of materials for instruction or research. Faculty seek advice when signing a contract for publication with a particular publisher and have questions about their contracts and what they are able to do with their work. Professors teaching an online class often need assistance locating materials in the collection that can be shared via a learning management system (LMS). For

works in archives, copyright becomes increasingly important as more pressure to digitize collections results in difficult questions about who owns the rights to unique and rare materials donated to the library. As more types of information, media for example, are easily shared and streamed, this continues to be an important issue for libraries and campus administration.

An area of continued growth is instruction, instructional design, and information literacy services provided by librarians for undergraduate and graduate classes. Librarians at a college or university teach users how to find, access, evaluate, and understand what information sources are needed (e.g., articles, books, media, and websites). Information literacy programs at academic libraries consist of a combination of in-person instruction and online learning objects to enhance student learning. The development and mainstreaming of instruction programs share a common purpose—provide students with the training to help them complete their assignments and develop critical thinking skills for their life during and post college. The popularity of these programs increased with major information literacy initiatives started, for example, by the California State University librarians who brought a program of information literacy to 23 campuses.^[37] In today's academic libraries, bibliographic/library instruction often takes place once a semester in a computer lab or online via a LMS, both types of instruction require collaboration with instruction faculty on campus and librarians to create meaningful information literacy learning outcomes for a class. Throughout the year, librarians teach a variety of sessions that cover a wide range of subject from general information literacy tasks to more specialized research skills.

Digital services and online instruction design positions at libraries provide faculty and students with resources such as customized tutorials, library guides for course projects, quizzes and assessment of learning outcomes, and new ways of accessing primary sources. Library staff and faculty collaborate to scaffold information literacy standards throughout the undergraduate curriculum. Often, undergraduate first-year experience classes and introductory writing classes have some type of information literacy requirement. The expertise of the staff and their ability to connect faculty and students to resources is a service to the campus, and while not contained by a traditional desk, their outreach to users in the digital space, LMS, is critical to the mission of the library.

Reference

The reference desk provides immediate one-on-one research assistance usually from a librarian. A reference interaction can be as simple as pointing out the circulation desk to a lost library visitor or can involve more complicated research questions. Most reference questions require extensive knowledge of the library's collection and a solid

subject specialization in a particular discipline. The role of the reference desk as a service point is a topic of continued debate in library science and among administrators. Statistics from ARL show a decrease in reference transactions between the years 1991 and 2004, by 24%.^[38] The statistics from ARL were further explored in a 2012, which indicated that more spending on electronic resources actually increased reference transactions.^[39] More libraries are moving to data collection systems, such as LibAnswers, to capture the different types of questions, duration of time spent helping the patron, and additional rich data that describes the interaction between library (or staff) and patron (undergraduate, graduate, faculty) that could be helpful in evaluating and improving library services in the future. Reference services are also handled through chat, e-mail, and texting services. Patrons can also request one-on-one research consultations with a librarian for more time-extensive questions. While some libraries have moved away from the reference desk, most offer a hybrid of services and see the desk at a critical site for outreach to patrons. Many visitors at the reference desk are first time library users and might not have found an online reference or office appointments.

Public Service

The entire library can best be understood as a network of services and resources that work together through careful coordination of library staff (and faculty) to provide seamless access, organization, and context to the information used by faculty and students. The traditional public service sites include the circulation desk, interlibrary loan, course reserves, and specialized departments, such as music and media collections.

Circulation: The circulation unit in the library is a key access service point. As library leadership looks to brand service points, changing the name of the circulation desk is happening as renovations and new outreach plans are created at academic libraries. At the circulation desk, users can checkout library materials, renew books, return materials, and pay fines; these functions are some of the more visible and traditional tasks associated with the circulation desk. Circulation personnel usually staff the library for all hours that the library is open. In addition to overseeing student employees, they shelve books, supervise group and individual study rooms, collect books from campus book drops, manage holds and fines, tag damaged items for repair, assist students with disabilities, troubleshoot printing and copying, oversee weeding/shaping of the print collections, and collect statistics when necessary. Staff in circulation serves as backup to other service desks, often managing problems or troublesome users and

responsible for contacting campus police or other emergency services as needed.

Interlibrary loan: Interlibrary loan broadens the user's access to a collection, beyond the holdings of their own library. There are three items that are typically requested via interlibrary loan (depending on institution): books, periodical articles, and dissertations or theses. Many libraries will also lend media and microfiche. Articles are usually delivered to users as a PDF unless there are strict copyright rules or the publication is not available online. As more libraries purchase e-book subscriptions, the loan of books is changing. Most ILL requests for books and dissertations are delivered physically through the mail or intersystem delivery services (i.e., University of California).^[40]

Course reserves: As the cost of textbooks increases, students and faculty continue to look to the library for affordable options to support instruction on campus. Academic libraries manage course reserves where faculty can place books, media, and articles on a limited check out for their students. Some course reserve programs coordinate with instructors and order a copy of a textbook for a library. Others are working with faculty to create a collection of readings (journal articles and book chapters) that are available through electronic course reserves. Electronic reserves includes selection of readings that are scanned and only students associated with the course are able to access with their login and password. Staff that work in course reserves are familiar with copyright and fair use because so much of their day-to-day work involves balancing fair use with the rights of users to have access to a particular subject. One challenge for academic libraries are the growing number of online courses and streaming rights for film that differ in cost greatly from what an individual can purchase and the pricing for an institution.

Systems and technology services: Most academic libraries provide computers for student use including laptop or tablet checkouts. Computer use is a common service associated with library systems, but their services extend beyond the hardware. Partnerships with campus information technology provide better quality services to users. One example is the integration of more cloud-based software by IT departments that are used by library patrons for research and projects. Systems and information technology departments within the academic library are also developing new services and technologies through a variety of initiatives to develop mobile sites, dynamic library websites, and Content Management Systems (LibGuides), blogs, wikis, indexed-based discovery systems, institutional repositories streaming servers, digital archives, and any other software

running off the servers that enhances the experience of library users. With hundreds of databases and thousands of e-books, the staff with technology expertise are necessary in making sure the patron's experience searching for sources and using resources at the seamless. Patrons continue to expect the same type of online experience at the library as they do with commercial services, the library systems/technology staff work to leverage resources (hardware/software) to meet these expectations within reason.

Imaging services: More campuses are reducing the amount of paper and printing generated on their campus; as they look for more alternatives to print, there are some instances when students need to print a paper, unofficial transcripts, or documents for presentation. These photocopy, printing, and even faxing needs still exist. Most libraries are unable to subsidize image services and opt to outsource to a vendor rather than provide them directly. A partnership is formed and both the library and vendor share in the profits (if any) from printing.

TECHNICAL SERVICES

Technical Services is responsible for acquiring materials for the collection in support of the mission of the research and educational priorities. Traditional functions included in Technical Services operations are acquisitions, cataloging, preservation, and conservation. After the bibliographer selects materials for the collection, an acquisitions unit, within Technical Services, is in charge of orders, payments, tracking budgets, and processing received materials. Academic libraries purchase books and other media that are printed by many different publishers, but dealing with so many publishers individually would be a logistical headache for the library's staff. To simplify purchases, there are vendors, sometimes known as jobbers, who act as the intermediary between the academic library and publisher. Many libraries work with several different vendors as opposed to thousands of different publishers. Vendors are not the only source of materials, but they help consolidate the purchasing process for a large number of items within the collection. Once materials are received (physically or digitally), the item moves to cataloging. Cataloging is the process by which entries are made into the library's catalog of holdings. These entries include descriptive information about the book, subject headings, and call numbers. An academic library in the United States generally uses the Library of Congress Subject Headings to describe content of a book, periodical genre, media, and, sometimes, special collections; one item can have several different subject headings. A call number is generated from the 21 main classes found in the Library of Congress.

Other classification schemes include the Dewey Decimal System, not often used in academic libraries, and the U.S. Superintendent of Documents classification system for federal documents. Cataloging at an academic library can take two different formats: copy cataloging and original cataloging. While copy cataloging, or the use of existing cataloging from a bibliographic utility, has helped institutions standardize their metadata, the more specialized and rare materials require original cataloging by a subject specialist. Next, the library's staff prepares each item for the stacks by placing checkout slips, ownership stamps, classification labels, security strips, and protective covers as needed on the item. With more vendors offering shelf ready materials, many libraries opt to pay upfront for these activities. Most libraries have a split with some items coming shelf ready and some being processed in-house. Some items will take a different path through Technical Services. For example, print journal subscriptions will be checked in with close attention being paid to verifying that the journal is on schedule or initiating the claiming process to the publisher if not. Electronic resources are very complex and require staff that specializes in their management. Activities include establishing and checking links to databases or e-books, ensuring that materials are still accessible, troubleshooting, and the monitoring of license agreements. Conservation and preservation are two additional functions of Technical Services. For print collections, the definition of conservation is the "noninvasive physical or chemical methods employed to ensure the survival of manuscripts, books, and other documents" and preservation can be a "broad range of activities intended to prevent, retard, or stop deterioration of materials or to retain the intellectual content of materials no longer physically intact."^[41] Both definitions describe conservation and preservation as it relates to print resource, but libraries are working together now to address some of the unique preservation issues involved in digital collections.^[42] An academic library's efforts in caring for its resources can vary widely from a small in-house repair effort to a substantial unit with specialized staff handling valuable and rare materials. As more collections are available online, and this is especially true for serials, the function and role of Technical Services will continue to develop. Two issues of interest for the future are outsourcing and the development of digital collections. First, outsourcing for cataloging and processing is an increasing option for academic libraries. Reaction to outsourcing is mixed. On one side, sending materials offsite decreases some of the staffing and work at the local level reducing costs. On the other side, outsourcing may adversely affect the quality of local cataloging. The second issue for academic libraries and Technical Services is the continuing development in electronic resources and digital content. This introduces

concerns such as the role of licensing agreements, assessing copyright for online journals and article databases, and the tracking and cataloging of these resources. One significant issue is that the idea of ownership is blurred with electronic resources. Once the subscription stops, the library has lost its investment unless back files have also been purchased. Librarians are now working for guarantees that the materials available today will be available and accessible for patrons in the years to come. This is referred to as perpetual access. This is problematic when there is no guarantee of the lifespan of a vendor or publishing company, and therefore, there are no guarantees that access will be the same. The role of Technical Services is the management of these resources and ensuring that both print and electronic resources are available to users.

ADMINISTRATION

Most academic libraries are multimillion dollar operations and as such require the same sound management principles that any business requires to succeed. Planning, leadership, policymaking, customer service, personnel management, assessment, marketing and outreach, communication, and budgeting are all vital components and must be managed with the same skill as in any other business.

Planning is vital for success in order to keep academic libraries viable with their academic community particularly by keeping up with the dynamic changes within the information and technological environment. Most academic libraries have a strategic plan to point the way forward. These plans are usually renewed every 5 years and are linked to the university's broader strategic plan. In one example, the University of Tasmania clearly states that "the UTAS strategic plan, Open to Talent, frames the context for the Library's plan."^[43]

Customer service is a vital component of academic libraries. A focus on the needs of the students and faculty is essential as the library is an important player in the teaching, learning, and research process. Students and faculty rely upon the library to provide them with essential knowledge resources. Some libraries, in order to understand user needs, have participated in LibQual, which is offered by the ARL and which is used to "solicit, track, understand, and act upon users' opinions of service quality."^[44] These and other assessment methods have helped libraries to continually understand their users and to make needed changes in resources and services as user needs alter.

Another example is marketing and outreach. In this increasingly complex electronic environment, libraries have many competitors for the users searching for information in spite of the depth of scholarly resources that academic libraries provide. In order to encourage usage and maintain visibility and viability, marketing and

outreach are vital. For example, most academic libraries issue information about new acquisitions or new services through social media, on the library's web pages or through informative, glossy newsletters that are often electronic now.

Libraries also offer programs to attract the academic and surrounding community such as speaking engagements with well-known authors or scholars and exhibit openings. These events frequently have a fundraising purpose also.

Outreach can take many other forms. Most libraries participate in new student orientations and new faculty orientations and offer workshops on library research. Some libraries participate in outreach efforts before the students enroll in college by offering advanced placement privileges for high school students.

Importantly, it is vital that the library, through its UL and its librarians, have close relationships with the colleges and the academic departments. While the UL works closely with college deans, librarians are often assigned academic departments and work closely with department chairs to make sure that the library is fulfilling the needs of that academic discipline.

Increasingly academic libraries are required to participate in fundraising to supplement the budget. Fundraising can take many forms including obtaining rare collections, endowments, support for library services, collections and programs, funding for buildings, equipment and furniture, and so on. In order to have successful fundraising, the library needs to have a director of development and other fundraising staff in order to work closely with the donors. It is a significant effort, which can have significant results but which requires a long-term effort.

In order to achieve economies of scale and expand their fiscal reach, some academic libraries are engaging in cooperative buying. A good example is the California State University. In their *Libraries of the Future* report, "The CSU has managed the cooperation of all 23 campuses to negotiate significant discounts in the cost of academic content, software licenses, and vendor training and support services."^[45]

Academic libraries that are in a consortium can also take advantage of membership in the International Coalition of Library Consortia (ICOLC), which comprises of 200 library consortia around the world. The ICOLC is "dedicated to keeping participating consortia informed about new electronic information resources, pricing practices of electronic information providers and vendors, and other issues of importance. . . ."^[46]

Vigilant, skilled, and supportive library management, dedicated supervisors and staff, close attention to the users, comfort in the face of continual change, and a deep commitment to quality service are some of the most important components in the successful administration of an academic library.

ACADEMIC LIBRARY PERSONNEL

Academic libraries are staffed by a mix of personnel. The proportion of librarians in libraries is relatively small to the total number of personnel. Most categories of staffing fall into librarians (i.e., persons with a degree in library or information science), library assistants (i.e., specialists in the work of libraries), clerical, student employees, and administrators. There are also other specialists in the fields of accounting, personnel, building management, and, of course, technology (See *Academic Librarians*).

LIBRARY BUILDINGS

Academic library buildings range greatly in size depending upon their purpose, history, size of collection, size of student population, and available funding. Regardless of size, many similar issues confront academic libraries today in terms of their buildings. The most challenging of these issues is the impact of digital information and therefore a common belief that library buildings are either not needed or can be greatly reduced when the physical collection is not growing at the rate it once did. A more sophisticated view is that the role of the library is expanding and changing and therefore demanding new uses of its facilities in addition to its traditional uses.

As Leighton and Weber point out, “the library is recognized more than ever as a locus for educational effort in a social setting. The building must meet the need for the ‘library as place’ within academe. . . .”^[47] The authors go on to say that “. . . this intangible characteristic is often a major force in shaping the academic objective of the library building to meet the institutional goals for the years ahead.”^[47]

One of the most compelling trends over the last two decades is the creation of an information commons that largely refers to a place where students have access to both information and technology resources. This concept emerged because students needed a place where they could use the latest technology, research and write their paper online, and/or create a multimedia presentation. Importantly, an information commons provides the students with a sense of place and shared community. The layout of the room often encourages collaboration and group work.

For a good example, see the University of Southern California (USC) in Los Angeles, which was one of the early pioneers in creating an information commons. The USC provides a full range of services, including computers, research and writing support and consultation, technical support, adaptive technologies, printing, and collaborative workrooms.^[48]

Study facilities have also changed significantly in recent years. There is a push for more student-friendly study areas largely out of concern that students will no

longer come to the library because of the remote access provided to digital resources. In order to encourage studying and learning in the library, more attention in the library today is directed at learning spaces that are more comfortable with better seating and wireless access. Additionally, students now need more collaborative and group study space in order to work on group projects assigned by their professors or simply to study together. These rooms or areas designated for collaborative study often have flexible seating, with technology supportive of group work.

In keeping with the need to attract students, libraries are also relaxing the rules about drinks and sometimes food in the library. Academic libraries are also adding coffee shops to lure students in and also to benefit from the proceeds. For example, the University of Waterloo’s Dana Porter Library in Canada has “Browsers,” which is a coffee shop located on the main floor of the library and which provides students with an area of relaxation for studying, being with friends and enjoying a cup of coffee.^[49]

What is still unknown is whether or not more comfortable spaces, increasing group study rooms, and providing cafes have actually increased students’ study time or improved their study habits.

Libraries in the United States today also need to be very conscientious to come into compliance with the Americans with Disabilities Act (ADA) of 1990, which gives civil rights protections for persons with disabilities. The ADA requires that buildings be both usable and accessible to a person with a disability including both customers and employees. A library today needs to make sure that it is removing barriers to access, designing for accessibility, or providing alternative access.^[50] Many libraries also go a step further by providing students with disabilities with special rooms and/or special assistive technology equipment such as adjustable furniture, Kurzweil reading machines, speech recognition software, magnifiers, and screen readers.^[51]

As print collections grow beyond the capacity of the library to retain, some libraries are weeding but more and more are developing alternative storage places. The world’s first automated storage and retrieval system was developed at California State University Northridge’s Oviatt Library. This system contains over 13,000 bins occupying an 8000 ft² facility that is 40 ft high and allows for over one million items to be stored. This library uses the storage facility for lesser used materials and older periodicals. The system interfaces with the library’s catalog and the user commands the system to retrieve the item needed.^[52] Approximately 20 libraries in the United States have this system.

Some academic libraries use offsite storage. For example, the University of California maintains the Southern Regional Library Facility, which is offsite storage for lesser used but still needed collections. Storage is not

its only responsibility. This service sends books for interlibrary loan, guaranteeing 24 hour service for its member UC libraries, and also is engaged in preservation and digitization.^[53]

Another example is the Harvard University Library's the Harvard Depository, which was designed to be modular so that more storage units can be added as resources increase. This depository is offsite, secure, and accessible as well as climate controlled. It is a cost-effective method to store resources in an environment that preserves resources for the long term.^[54]

Libraries now and in the future must be able to be flexible in their spaces, provide robust technology, and create collaborative study spaces and a more appealing environment. This is all coupled with the need to still provide for the care and housing of the collection for the wide range of services and of course a good environment for the users and the staff. This is particularly challenging in older buildings that may not be scheduled for renovation or rebuilding. The American Library Association has a useful web page for any academic library that is building a new building or renovating an older one. This page contains a wide range of resources.^[55]

CONCLUSION

The continually changing world of digital information continues to have a dramatic impact on academic libraries in terms of services, resources, facilities, and the skill set needed for personnel. As the premiere support service to teaching, learning, and research, academic libraries will continue to thrive and play an important role but their future will require vigilance. Academic libraries need to become easier to use in order to compete effectively against popular search engines and other online services and companies that are aggressively adding information sources including scholarly ones. The online presence of the library, including its services and its information resources, will need unflagging attention so that students and faculty have the 24 hour easy access that they have come to expect in a digital world. The rare collections of academic libraries must be digitized continually to provide access to unique resources. The environment will always need to be scanned for significant changes in technology and user needs so that the library's strategies can shift in keeping with the times. Marketing will play an important role in order for the voice of libraries to be heard above the crowded world of information. An enhanced focus on national and local policies affecting libraries including intellectual property is vital.

Given their strong sense of purpose, the richness of their resources, and the dedication of their staff, academic libraries will maintain their all-important mission of supporting teaching, learning, and research.

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Accessibility

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Abstract

Although libraries have come a long way in making their spaces, places, and Web sites in compliance with the Americans with Disabilities Act (ADA), there are still issues and challenges in providing services and materials to individuals who have a physical challenge or disability. This entry looks at traditional services and materials libraries have offered and also new technologies libraries should consider for serving this population. Because the ADA was passed almost 20 years ago, it did not really address the Internet and the World Wide Web. The ADA is a civil rights law to prevent discrimination because of disability. Disability is defined as “a physical or mental impairment that substantially limits a major life activity.” The ADA requires places and services for the public to be accessible, but there is no specific reference to the Internet as a public place of accommodation for people with disabilities. This is where Section 508 of the U.S. Code comes in. This entry will discuss specific ways in which libraries are complying with the ADA and Section 508 and where progress needs to be made.

SERVICES WHICH HELP WITH ACCESSIBILITY

For libraries that are Carnegie-type buildings or that cannot afford the changes necessary to their physical libraries to make them accessible, there are services they can offer that help make the library accessible and show the library as a concerned agency that wishes to serve everyone.

Making a Building Accessible

There are numerous ways the bricks and mortar library can make itself accessible. Entire books have been written on this topic, but basic building accommodations can include an elevator, an automatic door, a large restroom which can accommodate a wheelchair, a curb cut for smooth travel by a wheelchair, Braille signs around the building, and much more. In addition to building accommodations, below are services libraries can offer to improve accessibility.

Homebound Book Delivery

Home book delivery is a time-intensive but effective service for people who cannot make it to the library. Librarians or volunteers choose books of interest to the homebound on a biweekly or monthly basis and then physically deliver the books to the reader's home. They pick up the books the reader is finished with and return them to the library. Sometimes libraries require a note signed by a doctor or medical worker to verify they need the service. Since this is a time-intensive service, many libraries rely on volunteers to deliver the books. The volunteer picks the selected books up at the library and delivers them to the home of the person needing the service.

Books by Mail Service

A few libraries offer books by mail services. Some offer all the books available in the library and others have a special collection, for instance, of paperbacks which are less expensive to mail. The books are delivered to the reader via U.S. mail and returned in the same way. Many books by mail services are for people who live in rural areas and do not have access to a library. Some libraries offer books by mail to the homebound instead of relying on volunteers. The librarian selects the books for the reader and mails them with a postage paid return envelope the reader can use to return the books. Many libraries offering books by mail to the homebound require some verification from a medical doctor or agency that the individual is in need of the service.

Deposit Collections

Many libraries offer deposit collections to agencies like nursing homes, senior centers, and even day care centers. This way, residents have access to a large number of books for a certain period of time without having to visit the library. For many seniors in nursing homes and adaptive living centers, this brings the library to them.

Large Print Books

Many libraries have large print books with size 14 or 16 point or higher fonts for people with vision impairments. Large print publishing really only began as recently as 1964 in England. Although many people are eligible for the talking book program if they have problems reading regular print, many are not ready to give up reading print.

Large print books have increased in popularity and now most are published at the same time as the traditional print book. Most public libraries, even small ones, now carry large print books.

Braille Books

Some libraries have collections of Braille books for the blind. Braille is a system widely used for blind people to read and write and was invented by Louis Braille in 1821. Because of the space required for Braille, these books are very thick and one book can consist of a number of volumes. Most libraries refer the blind to the talking book program which carries a large Braille collection and is sent to readers through the mail.

Audio/Recorded Books

Many libraries offer collections of audio/recorded books in different formats for readers. These are enjoyed by everyone, not just people with disabilities. Audiobooks became popular on cassette in the 1980s and that is when public libraries started offering them. The talking book program started offering books on cassette in the 1970s to qualified readers. Audiobooks then became available on CD, and most recently as downloadables from the Internet. Readers qualified for the talking book program can supplement their book selections at the public library with different formats of audio/recorded books.

ADAPTIVE HARDWARE AND SOFTWARE FOR ADULTS

With shrinking budgets and the challenge of providing more materials in more formats, it is difficult for libraries to select which accessibility options to offer that will provide the greatest increase in accessibility to the greatest number of physically challenged library users. The majority of public libraries serve populations of under 25,000, which means many do not have professional librarians or decent budgets. Although making many services accessible can be simple and common sense, other accommodations can be expensive and cost prohibitive even for libraries who want to provide accessible materials and services. Even if grants are available, there is the problem that people with mobility and vision problems do not come to the library because they think the library does not have enough for them that is accessible. Because this population does not come to the library, the library staff thinks there is no need for the accommodations.

Another challenge for library staff is finding the latest information on adaptive software and hardware. Many states like Illinois have agencies which provide information about and access to adaptive equipment. The Illinois Assistive Technology Project has a toll-free number for

agencies and individuals with questions. The National Assistive Technology Project Partnership maintains a contact list of state offices funded by the Assistive Technology Act of 1998.

Closed-Circuit Television

Some libraries offer closed-circuit television designed for people with low vision. CCTVs can enlarge text up to 50 times and can change the color of background and print. CCTVs may be useful for the elderly or persons of any age with vision problems who come in to balance their check-book, read their bills, or to read a newspaper on their own.

Typing and Voice Recognition Software

For many with mobility impairments or arthritis, writing and typing may be impossible. There are resources that can help including check-writing guides, pencil grips, slip-on typing aids, and touch and type sticks. Voice recognition software may help those with mobility and vision problems. There have been major recent improvements in this technology. Voice recognition software used to require individual users to take a good amount of time to train the software to understand his or her own voice. Programs such as Dragon Naturally Speaking allow a user to dictate commands to the computer in order to open programs, create reports, e-mail and documents, and so forth.

Screen Reading Software

Screen reading software is used by the visually impaired to vocalize the written text on a computer screen, including the "alt" text embedded in Web pages that describes visual images and icons. It is available in a variety of synthetic voices and will read what is on a computer screen to a visually impaired user. The software will read whatever is on the screen, from windows, to word processing to Web sites.

Mouse Challenges

People with visual impairments cannot use a mouse because they cannot see the cursor. Those with mobility impairments may not be able to move the mouse effectively. Software with keystroke commands and which will work with function keys help with these challenges. There are also large mice, large track balls, switches, a head mouse, joybox, and other options.

Signing for Public Meetings

Some states require that libraries offer signing for hearing impaired patrons during public meetings. When these meetings are advertised publicly, these services must be offered. Those with hearing impairments planning to attend the

meeting notify the library a certain amount of time in advance so that the library can hire an interpreter.

TDDS and TTYS

Before the digital age, some libraries had TDDS/TTYS—telecommunications devices for the deaf. A hearing impaired person would phone the library and use a typing device to transmit information. When the library received the call from this person, they would view the message from the patron as it printed out on paper and staff would communicate with the hearing impaired user by typing back. For libraries without TDDS/TTYS, most states have a relay service which can transmit information either way for those with hearing impairments trying to communicate with the hearing population. Now, with the Internet, both populations can use communication software to talk with one another.

Talking Books

The National Library Service (NLS) for the blind and physically handicapped is a national program through the Library of Congress that offers books in Braille and audio recording for individuals who cannot comfortably read regular print because of a vision, physical, or certain learning disabilities. Most libraries offer large print and audiobooks in a variety of formats such as CD, downloadable, and Playaway. The NLS has more than 60,000 titles and provides a free cassette machine for eligible readers. More than 750,000 readers in the United States enjoy the talking book program. The NLS is moving to digital flash cartridges and downloadable digital audiobooks and has quit producing cassette machines, but it will be several years before the program is totally transitioned.

Other Digital Book Formats

The Recording for the Blind and Dyslexic continues to offer recorded textbooks for the visually impaired. Benetech developed Bookshare.org which provides print-disabled people in the United States with over 40,600 books and 150 periodicals which are converted to Braille, large print, or digital formats for text to speech audio. Originally, members had to pay a modest startup and annual registration fee for access to this rapidly growing library. Thanks to special funding from the Office of Special Education programs, memberships for schools and qualifying students is free.

Audiobooks and Playaways

Public libraries have had audiobooks on cassette since the 1980s. In the twenty-first century, the popularity of audiobooks continues to rise while the sale of print remains flat. In addition to audiobooks on cassette, libraries make them available on CD. Digital audiobooks are now available via

download through vendors like netLibrary and OverDrive. A new company called Findaway developed the Playaway in 2005 which allowed libraries to buy a self-contained audiobook. Patrons who do not want to download and then upload on to an MP3 player or mobile device can borrow a self-contained unit with digital quality and the portability of a handheld player. Again, with shrinking budgets, it is a challenge for libraries to purchase audiobooks in many formats.

Audio Description

Audio description of plays and movies for the visually impaired provides narration during places in the performance that have no dialog or sound effects. Many libraries and talking book centers offer audio described videos which can be enjoyed by the sighted and sight impaired alike. The narrative is professionally written and recorded and is not intrusive. The Illinois State Library has funded an effort by the Alliance Library System to provide audio description for historical digital images on Web sites. Without audio description, digital images are almost totally inaccessible except for metadata tags which do not fully describe an image. This effort is very much in its infancy and there are few agencies providing audio description for even a few of their images.

Outreach Efforts

Users and nonusers of your core service population who would benefit tremendously from accessibility initiatives often are difficult to identify and reach out to. Often they may be trying to use the online systems, collections, and services offered by your library, because their personal return on investment in their search for information may be better online than in person. When designing your outreach efforts to this population, use this fact to your advantage. Because many print-impaired users are extraordinarily adept at using computers and networks, use the power of the Web and the Internet to reach out to this underserved population.

Web Sites

Section 508 is a law requiring federal agencies in the United States to make electronic and information technology accessible to people with disabilities and requires organizations to comply with the standard for content accessibility outlined in the statute if they wish to do business with the federal government. There are books and training programs which should help Web designers to learn how to create accessible Web sites. There are programs like BOBBY which take a look at the coding on Web sites to make sure it is accessible and provide information on what about the site is not accessible. Yet, as Web sites contain more and more media and high-end

graphics, more Web sites are not accessible to the visually impaired. Accessibility means more and easier access for everyone, yet most sites are not accessible or easy to use.

Virtual Reference

Twenty-first century libraries are offering more and more services on the Web. Virtual Reference is no exception. In 2008, OCLC Question Point and Tutor.com are the primary services libraries use to offer Web-based chat reference services. At first, these programs required separate downloads by librarian and client and had high overhead and hardware requirements. The programs are simplified, but that does not mean they are now accessible. Several talking book libraries worked with OCLC to create an accessible VR program called InfoEyes for use by the visually impaired. Visually impaired users were able to use Question Point for e-mail questions and a Web conferencing program by Talking Communities, a company led by a visually impaired gentleman, for live chat sessions.

Web Conferencing

Again, as more and more business is conducted on the Web, the visually impaired and others with disabilities comprise a large number. Talking Communities has created an accessible Web conferencing platform which is used by talking book libraries to provide live, Web-based reference services. Online Programming for All Libraries (OPAL) uses the accessible conferencing software to provide accessible library programs of all kinds. Talking book libraries, academic and public libraries use this easy-to-use conferencing software to offer book discussions, guest lectures, training programs, and all kinds of

library programs to their patrons on the Web. Not all Web conferencing programs are accessible. Elluminate is one of the few other programs that is accessible.

CONCLUSION

Although technology improves opportunities for accessibility, many technologies create a more complex environment for a person with a disability. Libraries need to keep up as much as possible with technology or who to ask to continue to improve library services for people with disabilities.

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Accreditation of Library and Information Studies Programs in the United States and Canada

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Abstract

The entry details the purposes, definition, historical and operational contexts, and future prospects for accreditation of library and information studies programs by the American Library Association.

INTRODUCTION

Accreditation is a quality assurance process guided by standards, policies, and procedures. The process entails the assessment of educational quality and the continued enhancement of operations through the development and validation of standards. Accreditation is also a condition wherein an accredited status signifies that the education provided is of quality.^[1]

PURPOSE OF ACCREDITATION

Accreditation provides for quality assessment and enhancement, with quality defined as the effective utilization of resources to achieve appropriate educational objectives. The purpose of accreditation is to assure the public, members of a profession, employers, students, and the educational community that an institution or program 1) has clearly defined educationally appropriate objectives, 2) maintains conditions under which their achievement can reasonably be expected, 3) is in fact accomplishing them substantially, and 4) can be expected to continue to do so.^[2] Accreditation does not result in the ranking of programs or institutions, but rather respects the uniqueness of each, while ensuring that all meet appropriate standards.

The fundamental assumptions of accreditation are that 1) self-regulation in education is preferable and in the long run is more effective than governmental regulation (in accordance with the 10th Amendment), 2) a system of quality assurance can be effective only to the extent that it recognizes and builds upon constituent willingness to engage in the process, 3) self-regulation is possible if expectations are clear, 4) most institutions will self-regulate if it is believed that they might otherwise be identified by their peers as doing something wrong, and 5) only a few institutions deliberately engage in behavior that they know is not in the public interest.^[3]

The American Library Association (ALA) *Standards for Accreditation of Master's Programs in Library and*

Information Studies express the purpose of accreditation as protecting "the public interest" and providing guidance "for educators." The ALA "Committee [on Accreditation] offers a means of quality control in the professional staffing" for "library and information services."^[4]

CONTEXT

Accreditation is a voluntary, nongovernmental, collegial process of self-study and external review. It involves a framework of international, national, regional, vocational, specialized, and professional accrediting organizations. In the United States, there are 67 accreditors recognized as reputable by the U.S. Department of Education (USDE) or the Council for Higher Education Accreditation (CHEA) and some accreditors by both.^[5]

"Regional" and "national" organizations accredit whole institutions, while specialized and professional agencies accredit programs and free-standing institutions. These organizations, while based in the United States, may accredit institutions and programs of study outside the United States. The ALA, for instance, also accredits programs at the master's degree level in library and information studies (LIS).

ALA is recognized by the CHEA, whose requirements state that accreditors "[must maintain] appropriate and fair policies and procedures that include effective checks and balances."^[6] ALA *Accreditation Process, Policies, and Procedures*, developed by the ALA Office for Accreditation (OA) and approved by the ALA Committee on Accreditation (COA), guide the process. The OA conforms to good accreditation practice as set forth by the CHEA and the Association of Specialized and Professional Accreditors (ASPA).

As a member of the ASPA, the ALA follows the *ASPA Code of Good Practice*, which states that a member must exhibit "a system of checks and balances in its standards development and accreditation procedures. [A member must avoid] relationships and practices that would provoke

questions about its overall objectivity and integrity.”^[7] The ALA process includes appeal policies and procedures that provide a system of checks and balances to protect the integrity and fairness of the process for the institution in which programs reside.^[11]

The ALA accredits the professional degree in librarianship, established by the ALA governing council as the master’s degree. The ALA is recognized by the CHEA as the accreditor for LIS programs offered under the degree-granting authority of regionally accredited institutions located in the United States, Puerto Rico, and by agreement with the Canadian Library Association, in Canada. The ALA is one of the 20 ASPA member agencies that accredit educational entities in both in the United States and Canada.^[8] CHEA recognition requires that an accreditor undergo review every 5 years to confirm eligibility and demonstrate compliance with its standards.

The ALA falls outside the scope of the USDE recognition, which by statute does not concern itself with accreditors that do not perform a Title IV “gate-keeping role” for federal loan and grant funds. That gate-keeping role falls to the institutions in which LIS programs reside, which are regionally accredited. The ALA standards require a program in the United States to reside within a regionally accredited institution.^[4]

Canadian institutions of higher education, however, operate under provincial legislation, with older institutions likely to have an act specific to themselves. As the number of postsecondary institutions seeking degree-granting powers has increased through the 1990s to the present, provinces have devised their own mechanisms for considering these requests; for example, the Province of Alberta operates the Campus Alberta Quality Council, and Ontario has the Higher Education Quality Council of Ontario. However, while the processes for obtaining provincial approval to offer degree programs may have similarities to accreditation processes (incorporating self-studies and external reviews), the language in Canada is not that of “accreditation” of each institution.

Individual academic programs in Canada are subject to accreditation processes, as is the case with library and information science education. In recognition of cross-border mobility between the two nations, Canadian accreditation processes often recognize the American program in some way. The Canadian Medical Association accredits graduate medical education, and its accreditation committee includes two observers from the Accreditation Council for Graduate Medical Education, from the United States. The Canadian Architectural Certification Board comprises only Canadians, but acknowledges a close working relationship with NAAB (National Architectural Accrediting Board).

The COA has 12 members, stipulated by the ALA Committee on Organization as five practitioners and five academics who are ALA members, and two public-at-large members, all appointed by ALA presidents-elect. The ALA members serve a 4-year nonrenewable term,

while the public-at-large members are appointed to serve a 2-year term, renewable once.

HISTORY

The origins of accreditation are traced to the progressivism movement of the mid-nineteenth through mid-twentieth centuries, which saw the rise of higher education in the United States beginning in 1862 with the passage of the Morrill Act, which came to be known as the Land Grant College Act.^[9]

Accreditation of postsecondary education developed in parallel with library studies education. Through efforts led by Melvil Dewey, the first library school was founded in 1883 as the School of Library Economy at Columbia College (now Columbia University). Similar schools elsewhere followed, and in 1900, accreditation of library studies was born when the ALA established the Committee on Library Training that formulated the first standards of quality for library education.^[10]

The first comprehensive study of library education was undertaken in 1921 with Carnegie Corporation funding by librarian and economist Dr. Charles C. Williamson. His report *Training for Library Service* stressed the need to draw a strong distinction between professional and clerical work in libraries, recommending that library education schools require applicants to hold an undergraduate degree.^[11] It was not until 1951, however, that the master’s degree was established by ALA policy 54.2 as the professional degree.

The ALA Board of Education for Librarianship (BEL) was established in 1924 to develop “minimum standards for library programs.” The Carnegie Corporation used these quantitative training measures as a basis for endowing existing and newly formed schools, including the Graduate Library School at the University of Chicago, the first library school to offer a graduate educational program in librarianship.^[12]

As library education moved into more traditional academic contexts within university settings, the next revision of the standards in 1933 was more descriptive of the principles and practices of the profession and less prescriptive and training oriented. This revision was a cooperative effort between the BEL and the Association of American Library Schools [AALS; now the Association for Library and Information Science Education (ALISE)]. At that time, there were 25 LIS schools in the United States and Canada.

The next revision was undertaken by the BEL, the AALS, and the ALA Library Education Division and approved by the ALA Council on July 15, 1951. These standards incorporated the premise that the professional degree be a minimum of 5 years of study beyond secondary school and should lead to a master’s degree.

In 1955, the COA was established as the decision-making body for accrediting professional degree programs

in LIS. The work of the COA is administered by the OA, formerly the Office for Education. The OA also coordinates reviews of school library media teacher education programs.

The COA established a standards revision subcommittee in 1970 that produced the 1972 *Standards for Accreditation*, which notes that its requirements and recommendations emphasize “qualitative rather than quantitative considerations... and that, therefore the standards lend themselves to some variation in interpretation... The standards are indicative but not prescriptive.” The 1972 standards guided programs until the ALA Council adopted the *Standards for Accreditation of Master’s Programs in Library and Information Studies 1992*, which became effective January 1, 1993.

Between the 1972 and 1992 standards, a grant from H.W. Wilson funded the ALISE to convene a conference of 17 organizations including ALA to discuss whether the accreditation process could be broadened to provide for governance and operation through a collaborative, mutually supported mechanism.^[12] That same year, the U.S. Department of Education funded the COA to explore implementation of a collaborative accreditation structure. As a result of that exploration, the COA prepared a report *Accreditation: A Way Ahead*, released April 1986.

In 1999, members of the ALA, the ALISE, the American Association of Law Libraries, the Medical Library Association, and the Special Libraries Association convened as a steering committee for the first Congress on Professional Education (COPE I) to focus on “initial preparation for librarianship.” Their report included 30 recommendations.^[13] Following those recommendations, COA revised its process policies and procedures, including a streamlined appeals process and a policy requiring that a program be placed on conditional accreditation status before accreditation could be withdrawn. Those revisions are published as *ALA Accreditation Process Policies and Procedures*, effective December 15, 2006. New editions followed in 2012 and 2015.

In 2002, a COA subcommittee reviewed the standards, surveyed constituents, and provided a report with recommendations. That report led to a draft of proposed changes that were released for comment on November 17, 2006. A revised version of the *Standards* was approved for adoption by the ALA Council on January 15, 2008. A 5-year COA standards review (2009–2014) resulted in a revised edition approved for adoption by the ALA Council on February 2, 2015.

STANDARDS AND PROCESS

Revisions of the ALA standards over the years reflect the evolution of accreditation in general from quantitative to qualitative. The ALA standards emphasize improvement by stating that the intent of the standards is “to foster excellence through a program’s development of criteria

for evaluating effectiveness, developing and applying qualitative and quantitative measures of these criteria, analyzing data from measurements, and applying analysis to program improvement. The Standards stress innovation, and encourage programs to take an active role in and concern for future developments and growth in the field.” In each of the standards, emphasis is on a program demonstrating “how the results of evaluation are systematically used” for improvement and “plan for the future.” Programs must demonstrate use of “the results of their evaluations for broad-based, continuous program planning, development, and improvement.”^[4]

The standards define the field as “concerned with recordable information and knowledge, and the services and technologies to facilitate their management and use. Library and information studies encompasses information and knowledge creation, communication, identification, selection, acquisition, organization and description, storage and retrieval, preservation, analysis, interpretation, evaluation, synthesis, dissemination, and management.”^[4]

A 5-year review of the 2008 *Standards* conducted by the ALA COA in public discussion with stakeholders, virtually through webinar and website comment collection, and in face-to-face meetings, resulted in a revision adopted by the ALA Council on February 2, 2015, at the ALA Midwinter Meeting. The 2015 standards specify five areas for determining program quality: Standard I. Systematic Planning; Standard II. Curriculum; Standard III. Faculty; Standard IV. Students; and Standards V. Administration, Finances, and Resources.

Programs seeking initial or continued ALA accreditation status address how they are meeting the *Standards* by following the established *Accreditation Process Policies and Procedures*. A primary function of the OA is to administrate the review process. The process entails preparation of a self-study that is verified by an external review panel at least every 7 years as part of the comprehensive review process, an annual statistical report, and a biennial narrative report addressing changes since the last comprehensive review.

FUTURE PROSPECTS

Interest in accreditation as a quality assurance mechanism remains intense, especially with the ongoing development of online program delivery. Currently, 29 of the 59 institutions offering an ALA-accredited program are providing a 100% online program. Regional accreditors depend on specialized accreditors and vice versa. ALA accreditation requires programs to reside within regionally accredited institutions.

Most developed countries outside the United States rely on governmental entities such as ministries of education to assure educational quality. Visitors to the ALA and attendees at accreditation conferences from outside the United States express interest in the collegial peer-review

nongovernmental nature of accreditation as practiced in the United States. Visitors to the OA have expressed admiration of the clarity and brevity of the ALA *Standards* and the well-developed review process.

It is the self-regulatory nature of accreditation as practiced in the United States that appears to promise a greater potential for the kind of agility sought to meet demand for education on a global scale. Based on the U.S. Census Bureau Population Division International Database, the Center for Higher Education projects that global demand for higher education will continue to grow exponentially from 48 million learners in 1997 to 159 million by 2025. Programs are likely to proliferate in an effort to meet this demand, and with that, quality assurance will become all the more important.^[14]

Master of library and information studies programs in the United States and Canada continue to come forward seeking ALA accreditation. In January 2014, an eighth Canadian program was granted initial accreditation. Yet another program domestically was initially accredited in 2015 to bring the total number to 64. Two programs in the United States are currently in Candidacy status under review for initial ALA accreditation.^[15]

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Acquisitions Institute at Timberline Lodge

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Abstract

This entry describes the history and program content of the Acquisitions Institute at Timberline Lodge. The institute is an annual international library conference, held in mid-May in Oregon, focusing on issues pertaining to acquisitions, collection development, and technical services, primarily as relates to academic libraries.

DESCRIPTION OF THE ACQUISITIONS INSTITUTE AT TIMBERLINE LODGE

The Acquisitions Institute at Timberline Lodge is an annual international library conference held in mid-May at Timberline Lodge, Oregon. The conference focuses on topics relating to library acquisitions, collection development, and technical services. The scope of the institute is not, in theory, confined to any particular type of library, but in practice nearly all presenters and delegates are from academic libraries or commercial vendors who serve the academic market. Most attendees are from institutions in North America, but librarians from Africa, Australia, the Middle East, New Zealand, and South America have also attended. Although sometimes referred to as “the Timberline Institute” or “the Timberline conference,” the formal name of the meeting is “The Acquisitions Institute at Timberline Lodge.”

HISTORY AND EVOLUTION OF THE INSTITUTE

The institute has been held under two different names and in two different locations. The origins of the conference can be traced to a conversation between two librarians and a bookseller at the annual American Library Association meeting held in San Francisco in June, 1987. By then the Charleston Conference had become well established as a smaller, more focused meeting relating to acquisitions. Richard Brumley, then Head of Acquisitions at the California Polytechnic State University, San Luis Obispo; Tom Leonhardt, then Dean of Libraries at the University of the Pacific in Stockton; and Scott Alan Smith, then with Blackwell's, pondered the question as to whether acquisitions policies and procedures in the West differed from acquisitions practice in the East. The three agreed the topic was worthy of exploration and over the course of the next few years began working on what was envisioned, initially, as a one-time event.

As plans for the meeting coalesced, Leonhardt noted that the University of the Pacific had an off-site conference facility located in the Sierras known as the Feather River Inn. (The Inn was built in 1914 and acquired by the university in 1977. It was sold to a private equity company in 2005.) After initial discussions with the Inn in 1989, plans were made to hold a meeting the following May. The first Feather River Institute was held on May 18–20, 1990. The keynote speaker was Melvin Voight, University Librarian Emeritus at the University of California, San Diego. His keynote address was titled “Historical perspective on acquisitions/collection development.” Other presentation titles that first year included “Lonesome dove: doing business in the West”; “Boom or bust”; “How the West was won”; “Gunfight at the OK Corral: Holding your own with collection development”; and “Young guns: library education today” (a complete list of keynoters, presenters, and institutional affiliations is included as an appendix).

During the wrap-up session, the group agreed that in fact there is nothing unique about acquisitions in the West. The meeting was deemed productive and successful, however, and the delegates felt the idea of making this an annual event had merit. Eight more Feather River Institutes were held through 1998 (there was no conference in 1993).

In part due to the rustic and informal nature of the Inn, the Institute had a decidedly relaxed and laid-back style. Far from being unprofessional, however, this somewhat unconventional atmosphere fostered a candid and fertile environment for presentations, discussions, and debates among and between librarians, publishers, book vendors, serials agents, and others associated with the library community.

One of the unusual characteristics of the conference was the fact that, from the beginning, there were no exhibits. Nearly a third of the attendees were vendors, but they came as colleagues, not as company representatives motivated to sell product. A strict policy of “noncommercial behavior” was established early on and has been observed with but a few transgressions. Most vendors expressed genuine gratitude for the opportunity to engage

in substantive conversations on topics germane to the library world without the burden of normal conference exhibit demands.

Moreover, to the consternation of some attendees, name badges do not reflect institutional affiliation. This is deliberate; the organizers feel this helps stimulate conversations and initially break the ice.

Some of the vendors and publishers who have attended the institute over the years include Alibris, Blackwell's, Brill Academic, University of California Press, Cambridge University Press, Casalini, University of Chicago Press, Credo Reference, EBSCO, Elsevier, Gale/Cengage Learning, Harrassowitz, Innovative Interfaces, Kluwer Academic Publishers, Martinus Nijhoff, University of Minnesota Press, now publishers, Oxford University Press, Puvil, SAGE, Springer, Stanford University Press, Swets, Syndetic Solutions, Taylor & Francis, University of Washington Press, John Wiley & Sons, and YBP Library Services.

During the Feather River years, outside sponsorship for the institute was not necessary. With the move to Timberline, it was deemed appropriate to develop an ongoing network of corporate supporters; many of the aforementioned vendors have been steadfast contributors to the institute.

By 1999, the planning committee consisted of Scott Alan Smith (now library director at the Langlois Public Library, Oregon), Richard Brumley (by then Head of Acquisitions and Collection Development at Oregon State University; now retired), and Nancy Slight-Gibney (then Head of Acquisitions; now Director, Library Resource Management and Assessment, University of Oregon). For a variety of reasons, the committee decided to investigate a different venue for the conference. After considering a number of possible sites, Smith selected Timberline Lodge. The conference was renamed The Acquisitions Institute at Timberline Lodge, and the first institute at Timberline was held on May 20–23, 2000. With the exception of 2006, when no conference was held, the institute has met annually.

Prior to the move to Timberline, the conference organization had been very informal. By the time the decision to relocate had been made, it was apparent the group had outgrown its initial structure, and more traditional organizational models were considered. Today, the institute is a 501 (c) 3 nonprofit corporation, EIN 71-1001116; Oregon nonprofit corporation 361549-95.

TIMBERLINE LODGE—THE FACILITY

Timberline was built in 1936–1937 as a project of the Works Progress Administration. The lodge is sited at 6000 ft on the south slope of Mt. Hood, approximately an hour east of Portland. With the exception of six massive timber columns that came from what is now the Gifford

Pinchot National Forest on the Washington side of the Columbia Gorge, most of the building materials were gathered within a mile of the lodge.

During the depths of the Great Depression, the WPA and the Civilian Conservation Corps sought to give unemployed, desperate people a living wage and, just as importantly, a sense of self-worth and dignity. The results at Timberline are magnificent and enduring.

Gilbert Stanley Underwood, who had designed lodges at Bryce Canyon and Yosemite, was retained as consulting architect. Marjorie Hoffman Smith served as the interior designer, and Ray Neuffer supervised the woodworking shop. Under Smith's direction, workshops were established in Portland to weave cloth for the lodge; Neuffer oversaw workers who evolved into craftsmen, building unique furniture that is still in use today.

On September 28, 1937, Franklin D. and Eleanor Roosevelt visited Oregon and dedicated the Bonneville Dam and Timberline Lodge. In 1975, a conference wing was added—named the C. S. Price Wing, after one of Oregon's foremost artists and whose work is featured in the lodge. In 1977, the lodge was declared a national landmark, and in 1981 the Wy'East Day Lodge was opened to help accommodate the heavy ski, snowboard, and snowshoe traffic the facility serves year round. Today more than two million people visit the lodge every year.

THE ACQUISITIONS INSTITUTE TODAY

Smith selected Timberline as the new home for the conference because it is uniquely Oregonian, and its size and configuration readily meet the objectives of the conference. The conference planners intend to keep the meeting small. The immediacy and collegiality of the conference are values that would likely be sacrificed were the institute to grow too large.

The schedule deliberately allows time outside of the formal program to allow delegates to network. There are no breakout sessions; everyone attends all presentations together. The goal of the planning committee is to give all attendees the best conference experience possible.

Program content has evolved over the years, reflecting changes in libraries and publishing. Today the focus of many presentations is access of content rather than the acquisition and management of print collections.

THE PLANNING COMMITTEE

As of February, 2014, the Planning Committee consists of

Kristina DeShazo, Acquisitions and E-Resources Librarian, Oregon Health and Science University

Stacey Devine, Assistant Head, Acquisitions and Rapid Cataloging, Northwestern University
 Nancy Slight-Gibney, Associate Professor, Director, Library Resource Management, University of Oregon
 Scott Alan Smith, Library Director, Langlois Public Library

APPENDIX—PREVIOUS CONFERENCE PROGRAMS

Feather River Institute, May 18–20, 1990
 Conference title: Acquisitions in the West.
 Keynote address: Melvin Voight, University Librarian
 Emeritus, University of California, San Diego
 Historical perspectives on acquisitions/collection development
 Lonesome Dove: Doing business in the West.
 Adrian Alexander, The Faxon Company
 Marcia Anderson, Arizona State University
 Dana D'Andraia, University of California, Irvine
 Steve Pugh, Yankee Book Peddler
 How the West was won.
 Marion Reid, California State University, San Marcos
 Marilyn Myers, Arizona State University West Campus
 Melvin Voight, University Librarian Emeritus, University of California, San Diego
 Gunfight at the OK Corral: Holding your own with collection development.
 Henry Yaple, Whitman College
 Young guns: library education today.
 Bill Fisher, San Jose State University

Feather River Institute, May 29–June 1, 1991
 Conference title: Acquisitions conference.
 Whether it is better to be loved or feared: Librarianship as Machiavelli might have described it.
 Jan Maxwell, University of Oregon
 Personnel management: a vendor's perspective.
 Bob Mastejulia, Baker & Taylor
 Acquisitions personnel management—a librarian's perspective.
 Richard Brumley, Cal Poly, San Luis Obispo
 Toward greater objectivity: formal production standards for processing units in libraries.
 Andrew Shroyer, University of California, Santa Barbara
 Selection and development of library professionals as sales representatives.
 Adrian Alexander, The Faxon Company
 The Changing role of the library supplier.
 Don Satsky, Blackwell North America

Collection development and automation: threat or promise?
 Margo Sasse and Patricia Smith, Colorado State University
 A knowledge-based expert system application in library acquisitions: monographs.
 Pam Zager, Iowa State University
 Acquisitions or access: impact and implications of electronic publishing.
 Bill Fisher, San Jose State University

Feather River Institute, May 28–31, 1992
 (No unique conference title in 1992.)
 Haven't I seen you somewhere before?: a history of acquisitions.
 Karen Schmidt, University of Illinois, Urbana-Champaign
 Acquisitions principles and the future of acquisitions.
 Joe Barker, University of California, Berkeley
 The Tenets of acquisitions?: library acquisitions: practice and theory.
 Joyce Ogburn, Yale University
 How the Richard Abel Company changed the way we work.
 Ann O'Neill, University of North Carolina, Chapel Hill
 A Brief history of the Richard Abel Company.
 Dora Biblarz, Arizona State University
 Ethics: vendor perspectives.
 Mary Devlin, The Faxon Company
 Acquisitions ethics: the evolution of models for hard times.
 Mary Bushing, Montana State University
 Firing an old friend, painful decisions: the ethics between librarians and vendors.
 Roger Presley, Georgia State University
 Coordinating collection development in a hostile environment: the impact of reduced funding on organization for collection development.
 Wanda Dole, SUNY Stony Brook
 History of library-vendor relations since 1945.
 Bill Fisher, San Jose State University

There was no conference in 1993.

Feather River Institute, May 19–22, 1994
 Conference title: Dealing with change, or changing the deal.
 Developing a vision for acquisitions.
 Karen Schmidt, University of Illinois
 The Upside of downsizing.
 Karen Cargille, University of California, San Diego
 Peter Stevens, University of Washington
 Library organizational culture in strategic planning.
 Joe Barker, University of California, Berkeley

Postmodern acquisitions: organizing to change.

Sharon Propas, Stanford University

Darwinism in technical services: natural selection in an evolving information delivery environment.

Christian Boissonnas, Cornell University

Does TQM really help anyone?

Bill Fisher, San Jose State University

Awards from the front lines: participative recognition of peer performance.

Steve Marquardt, University of Wisconsin, Eau Claire

Academic librarians: acculturation and efficacy.

Mary Bushing, Montana State University

Case studies of ethics and business practices.

Mary Devlin, The Faxon Company

Meta Nissley, California State University, Chico

Profiling the internet: can vendors survive in cyberspace?

Stephen Pugh, Yankee Book Peddler

Rick Lugg, Yankee Book Peddler

Feather River Institute, May 18–21, 1995

Conference title: Controversies and debates in acquisitions.

The Economics of monographs acquisitions: results of a time/cost study.

Pam Rebarcak, Iowa State University

Building bridges between acquisitions and collection development: communication models for the electronic environment.

Margaret Axtmann and Barbara Stelmasik, University of Minnesota

Prioritizing firm order costs and vendor services.

Scott Alan Smith, Blackwell's

Richard Brumley, Oregon State University

Debate: Any technical services operation can sustain a 25% budget reduction without significant erosion of service.

Reorganization revisited: acquisitions as an endangered species.

Eleanor Cook, Appalachian State University

Sleeping with the enemy: the love/hate relationship between acquisitions and collection development.

Karen Cargille, University of California, San Diego

Douglas Cargille, California State University, San Diego

I Love me, I love not: schizophrenic behavior among acquisitions/collection development librarians.

Terry Allison, California State University, San Marcos

What Does acquiring require, or, Is there a librarian in the acquisitions department?

Kirk Russell, Brigham Young University

Borderline ethics and business practices: case studies.

Mary Devlin, Blackwell's

Meta Nissley, California State University, Chico

Library management: the latest fad, a dismal science, or just plain work?

Bill Fisher, San Jose State University

Debate: Consolidation of purchases with a single vendor makes good business sense - yes or no.

Feather River Institute, May 16–19, 1996

Conference title: Death and rebirth in library acquisitions.

History of forgotten library technologies.

Karen Schmidt, University of Illinois, Urbana-Champaign

When bad things happen to good vendors: lessons for librarians.

Adrian Alexander, Swets

Mike Markwith, Swets

Rearranging the universe: reengineering, reinventing, and recycling.

Sharon Propas, Stanford University

The Fugitive: gifts, exchanges, and booksellers to acquire the elusive monograph.

Tom Leonhardt, University of Oklahoma

Panel debate: Libraries are businesses.

T2: Theory in acquisitions revisited.

Joyce Ogburn, Old Dominion University

Applying serials and acquisitions skills on the "other side".

Nancy Chaffin, Arizona State University West

Realities of the team model in library technical services.

Rita Echt, Michigan State University

Evolution of acquisitions in the electronic information realm.

Chris Hector, University of Waikato

Analysis of acquisitions and collection development web pages.

Steve Johnson, Clemson University

Acqnet & Acqweb: past, present, and future.

Eleanor Cook, Appalachian State University

Feather River Institute, May 15–18, 1997

Conference title: Oh, the Change is going to do me good. . .

Library schools and library education: change agents for the profession.

Bill Fisher, San Jose State University

What's for dinner? Continuing education after the MLS.

Ann O'Neill, University of South Carolina

Unhurried change.

Larry Ostler and Terry Dahlin, Brigham Young University

Acquisitions packages and licensing agreements: changing the way we do business.

Scott Wicks, Cornell University

Licensing information: where can we go from here?

Steve Bosch, University of Arizona

Kittie Henderson, EBSCO

Brian Schottlaender, UCLA

Acquisitions and collection development in an era of full-text and package deals.

Nancy Persons, Sonoma State University

Scott Wicks, Cornell University

Changing roles, changing services: partnerships in the new information age.

Mike Markwith, Swets

Developing a relationship with your new subscription agent/understanding your new client: 1001 Thai burritos on the road to great two-way communication.

Sandy Barstow, University of Wyoming

Barbara Woodford, EBSCO

Dynamic partnerships in the library marketplace.

Kit Kennedy, Blackwell's Periodicals

Anne McKee, Blackwell's Periodicals

Got any spare change?

Ron Ray, University of the Pacific

The Books are shelf ready, are you?

Rick Lugg, Yankee Book Peddler

Albert Joy, University of Vermont

The Undead in library technical services: activities and attitudes that have exhausted their life, but which refuse to die.

Ron Ray, University of the Pacific.

Integrating solutions: examining the collection management process using OCLC's Electronic Collections Online as a model.

Elizabeth Cooley, OCLC

Chip Nilges, OCLC

Feather River Institute, May 14–17, 1998

Conference title: "As I walked through the wilderness of this world" - Acquisitions: the Pilgrim's progress.

The Five blind men and the elephant: differing perceptions of the introduction of an approval plan.

Martin Cohen, McGill University

James Galbraith, Blackwell's

Slicing the pie: implementing and living with a journal allocation formula.

Robert Sorengfrei, Colorado School of Mines

How far have we come: benchmarking time and costs for monograph purchasing.

Nancy Slight-Gibney, University of Oregon

When write is wrong: a look at the professional literature in library and information science.

Bill Fisher, San Jose State University

Publishers on the web: from Addison to Ziff.

Virginia Scheschy, University of Nevada, Reno

Who's number one: evaluating acquisitions departments.

Peter Stevens, University of Washington

Libraries and vendors working together for a change.

Keith Schmiedl, Coutts

Libraries "in Dutch": their response to the Elsevier-Kluwer merger.

Carol MacAdam, Swets

There was no conference in 1999.

The Acquisitions Institute at Timberline Lodge, May 20–23, 2000

Conference title: Acquisitions and Collection Development in the twenty-first century.

Core competencies for the acquisitions librarian.

Bill Fisher, San Jose State University

Aiming for continuous improvement: performance measurement in a re-engineered technical services.

Glenda Smith, Griffith University

Physical setting and organizational success.

Mary Ellen Kenreich, Portland State University

Consortial purchases: are they really worth it?

Deborah Carver, University of Oregon

Be careful what you wish for; or, all for nothing—nothing for all.

Julia Gammon, University of Akron

Rick Lugg, R2 Consulting

Making one size fit all: a legislative mandate for Minnesota State Colleges and Universities.

Diane Richards, Minnesota State University, Mankato

E-Journals: The OhioLINK experience.

Carol Pitts Dietrich, Ohio State University

California State University journal access core collection.

Marc Langston, California State University, Chico

There is more to OP ordering than searching the internet.

Sharon Propas, Stanford University

James Bryant, Backer-Bryant Academic Library Services

A New social contract for acquisitions and collection development.

Martin Cohen, McGill University

Book selection responsibilities for the reference librarian.

Robert Sorgenfrei, Colorado School of Mines

Christopher Hooper-Lane, Colorado School of Mines

Collection development for the digital age.

Sandra Kerbel, University of Virginia

E-Book panel discussion.

Bonnie Allen, Oregon State University

Carol Pitts Dietrich, Ohio State University

Scott Alan Smith, Blackwell's

The Acquisitions Institute at Timberline Lodge, May 19–22, 2001

Conference title: Acquisitions and collection development: The Beat goes on—cool jazz or hard rock?

Keynote address: Deregulation and the Academy:
Opportunities and strategies under the new rules
for resource gathering.

Frank D'Andraia, University of Montana

Collections and systems: a new organizational para-
digm for collection development.

John Webb, Washington State University

E-Journal databases—a long term solution?

Nathalie Schultz, Griffith University

Evolution of the supply chain in library
bookselling.

Jackie Coats, University of Washington

Matt Nauman, Blackwell's Book Services

Brian Elliott, Alibris

Jeff Dixon, Amazon.com

Robert Rooney, Taylor & Francis

E-Books, the latest word.

Bonnie Allen, Oregon State University

Len Liptak, ebrary

Katharine Phenix, netLibrary

Robert Rooney, Taylor & Francis

Accounting for access (costs and benefits).

Karen Schmidt, University of Illinois

Nancy Slight-Gibney, University of Oregon

Putting theory into practice: needs analysis.

Karen Rupp-Serrano, University of Oklahoma

Finding the right balance: campus involvement in
the collections allocation process.

Lisa German, University of Illinois

Karen Schmidt, University of Illinois

Impact of organizational structure on acquisitions
and collection development.

Bill Fisher, San Jose State University

On the nature of our business: A forum.

Richard Brumley, Oregon State University

The Acquisitions Institute at Timberline Lodge, May
18–21, 2002

Conference title: Acquisitions and collection devel-
opment on the mountain.

Keynote address: Vessels and voyagers: some
thoughts on reading and writing, books and
libraries.

Dr. Richard Hume Werking, U.S. Naval Academy

Print to electronic journal conversion: criteria for
maintaining duplicate print subscriptions.

Sandy Campbell, University of Alberta

Joint remote storage projects.

Carol MacAdam, JSTOR

The California State University E-Book pilot
project.

Marc Langston, California State University, Chico

Nancy Noda, San Francisco State University

Publishing and library bookselling: trends in pub-
lishing and information distribution.

Adam Chesler, Kluwer Academic Publishers

Matt Nauman, Blackwell's Book Services

Robert Rooney, Taylor & Francis

Jannette Schuele, YBP Library Services

Jonathan Weiss, Oxford University Press

Collection assessment: what do you do with the
data?

Peggy Cooper, Boise State University

Marita Kunkel, Oregon Institute of Technology

Faye Chadwell, University of Oregon

Electronic resources librarians.

Bill Fisher, San Jose State University

Going back to the future: Deconstructing a subject
based acquisitions structure.

Karl Debus-Lopez, University of Wisconsin

Automating selection through cataloging: workflow
redesign.

Jackie Coats, University of Washington

Joe Kiegel, University of Washington

Acquisitions and collection development in the age
of content.

Christa Easton, Stanford

Digitization projects in acquisitions.

Jackie Coats, University of Washington

Lisa Spagnolo, University of Washington

The Acquisitions Institute at Timberline Lodge, May
17–20, 2003

Conference title: Library collections and informa-
tion access: Great notion or cuckoo's nest?

Keynote address: Collection development in inter-
esting times.

Michael Gorman, California State University,
Fresno

Publishers and publishing: panel discussion.

Bonnie Allen, Moderator, Oregon State
University

Pat Soden, University of Washington Press

Laura Driussi, University of California Press

Sloane Lederer, Cambridge University Press

Amy Yodanis, Blackwell Publishing

Now you see it, now you don't.

Bill Fisher, San Jose State University

Copyright law for librarians.

Robert Ogden, Gursky & Ederer, LLP

Gearing up for the next insanely great thing: training
for new skill sets and new mindsets.

Marita Kunkel, Oregon Institute of Technology

Kit Kennedy, Swets Blackwell

External forces impacting twenty-first century
library collection development—the transforma-
tion of decision-making power.

Carolyn Henebry, University of Texas at Dallas

Ellen Safley, University of Texas at Dallas

Managing electronic resources in a time of
shrinking budgets.

Emily Miller-Francisco, Southern Oregon
University

Collection assessment: panel discussion.

- Nancy Slight-Gibney, Moderator, University of Oregon
 Laurel Kristick, Oregon State University
 Cyril Oberlander, Portland State University
 Diane Richards, Minnesota State University, Mankato
 Mark Stengel, California State University, San Marcos
 Dan Streeter, Portland State University
 Collection management as risk management.
 Mary Casserly, University at Albany, State University of New York.
- The Journal stop: a complete serials information system.
 Peggy Cooper, Boise State University
 Dan Lester, Boise State University
- The Case for acquisitions standards in integrated library systems.
 Katherine Farrell, Princeton University
 Marc Truitt, University of Notre Dame
- Bringing library content to the palm of users' hands.
 Denise Koufogiannakis, University of Alberta
 Pam Ryan, University of Alberta
- Outsourcing your overflow (let the vendor do the work for you).
 Jeff Earnest, National University, San Diego
 Bud Sonka, National University, San Diego
- The Acquisitions Institute at Timberline Lodge, May 15–18, 2004
 Conference title: New discoveries on Lost Lake.
 Keynote address: Golden rods, tub files, encumbrances, and how to put the cat among the pigeons—or, what I learned in acquisitions, 1973–1987.
 Henry Yapple, Whitman College
- Defining functional requirements for acquisitions records: vendor metadata.
 Katherine Farrell, Princeton University
 Marc Truitt, University of Houston
- Panel discussion: Acquisitions standards.
 Martha Gettys, VTLS
 Katherine Farrell, Princeton University
 Dan Miller, Blackwell's Book Services
 Jannette Schuele, YBP Library Services
 Marc Truitt, University of Houston
- The Impact of technology on reading behavior.
 Bill Fisher, San Jose State University
- A Leap in the dark: a pilot project for an e-only engineering collection.
 Laurel Kristick, Oregon State University
 Margaret Mellinger, Oregon State University
- Migration to electronic journals: one library's journey.
 Gwen Bird, Simon Fraser University
- The Scholarly journal: an editor's perspective.
 Pat Wheeler, Oregon State University
- Panel discussion: publishers and publishing.
 Bonnie Allen, Moderator, Oregon State University
 Daviess Menefee, Elsevier
 Peter Milroy, University of British Columbia Press
 Niko Pfund, Oxford University Press
- Changing horses midstream: restructuring collection development.
 Stefanie Wittenbach, University of California, Riverside
- Cooperative collection development in an interdisciplinary subject.
 Sarah George, Illinois Wesleyan University
- Serials decision database: selection, management and evaluation of print and online journals.
 Diane Carroll, Oregon Health & Science University
- From data to decisions: using surveys and statistics to make collection management decisions.
 Julie Blake, St. Cloud State University
 Susan Schleper, St. Cloud State University
- The Ethics of academic collection development in a politically contentious era.
 Wendy Highby, University of Northern Colorado
- The Acquisitions Institute at Timberline Lodge, May 14–17, 2005
 Conference title: The View from the mountain.
 Keynote address: Wines of fear, wines of conviction.
 Lewis Miller, Butler University
- Retail bookselling and libraries.
 Phil Wikelund, Great Northwest Bookstore
- Publishers and publishing: panel discussion.
 Bonnie Allen, Oregon State University
 Ellen Endres, Brill Academic
 Greg Giblin, Wiley
- Living with e-books.
 Carolyn Henebry, University of Texas at Dallas
 Ellen Safley, University of Texas at Dallas
- New opportunities for technical services: reconsidering Priorities, reshaping processes.
 Kathy Carter, University of Alberta
 Marilyn McClary, University of Alberta
 Kit Wilson, University of Alberta
- Problem analysis and appreciative inquiry for acquisitions management.
 Cynthia Coulter, University of Northern Iowa
- The Impact of technology on learning.
 Bill Fisher, San Jose State University
- Making serials purchasing decisions using pay per view usage statistics.
 Beth Bernhardt, University of North Carolina, Greensboro
- The Contours of collection development in a consortial setting.

Faye Chadwell, University of Oregon
 Cara List, University of Oregon

There was no conference in 2006.

The Acquisitions Institute at Timberline Lodge, May
 19–22, 2007

Publishers and publishing: panel discussion.

David Jackson, Stanford University Press

Medhi Khosrow-Pour, IGI Global

Pascal Schwarzer, Springer Verlag

Mitigating loss of content in times of shrinking col-
 lections budgets.

Bonnie Allen, University of Montana

Library support for open access publishing.

Faye Chadwell, University of Oregon

Developing a print repository in a consortial
 environment.

Linda DiBiase, University of Washington

Susan Hinken, University of Portland

Mark Watson, University of Oregon

Thinking critically about critical thinking: the
 impact of information literacy on teaching
 and learning.

Bill Fisher, San Jose State University

Black, white, or grey: organizing acquisitions
 and collection development.

Paula Popma, California State University, Fresno

Kimberly Smith, California State University, Fresno

It's no longer the tip of the iceberg: navigating
 change in technical services.

Bill Kara, Cornell University

Anna Korhonen, Cornell University

Post-modern acquisitions revisited.

Sharon Propas, Stanford University

Building a high quality flexible acquisitions
 workflow in a Web 2.0 world.

Adam Wathen, Kansas State University

New liaisons, new ideas, new energy.

Peggy Cooper, Boise State University

Memo Cordova, Boise State University

Melissa Kozel, Boise State University

Richard Stoddart, Boise State University

Metadata planning: keys to communication.

Sheila Bair, Western Michigan University

The Acquisitions Institute at Timberline Lodge, May
 17–20, 2008

Keynote address: Achieving the impossible? Reflec-
 tions on transformational change in the system of
 scholarly communication.

Ray English, Oberlin College

Strategically building collections: attempts to coor-
 dinate budgeting, tracking, data gathering, and
 policy making.

Adam Wathen, Kansas State University

The Lois Hole Campus Alberta Digital Archive:
 building collections for a diverse community

Kit Wilson, University of Alberta

“Core” and “long tail” materials in collection devel-
 opment consortia.

Katalin Radics, UCLA Collections 2.0

Margaret Mellinger, Oregon State University

New liaison, new ideas, new energy: one year later.

Peggy Cooper, Boise State University

Melissa Kozel, Boise State University

Richard Stoddart, Boise State University

From fraught to unfettered: developing tools to help
 librarians improve e-book selection.

Sarah Polkinghorne, University of Alberta

Denise Koufogiannakis, University of Alberta

Collection development in an open access world.

Karen Estlund, University of Oregon

John Russell, University of Oregon

Making sure we have well qualified staff to do the
 work of acquisitions.

Leo Agnew, University of Missouri, Columbia

Mike Arnold, Blackwell's Book Services

Karen Daring, University of Missouri, Columbia

Recruiting librarian to careers in technical services.

Deborah Thomas, University of Tennessee

Bill Fisher, San Jose State University

Collections connection: streamlining the interface
 between collection development and acquisitions.

Katherine Treptow Farrell, Princeton University

Adventures in wonderland: subject librarians and
 assessment in collection development.

Allison Level, Colorado State University

Michelle Wilde, Colorado State University

The Acquisitions Institute at Timberline Lodge, May
 16–19, 2009

Keynote address: Open data: encouraging open
 source and integration between vendors and the
 library developer community.

Terry Reese, Oregon State University

Going next gen: OCLC's WorldCat Local and
 Acquisitions.

Keith Powell, University of California, Irvine

Lisa Spagnolo, University of California, Irvine

But how do we pay for it? Realigning the budget to
 support new access models.

Elizabeth Mengel, Johns Hopkins University

R. Cecilia Knight, Grinnell College

Patricia Tully, Wesleyan University

Streaming video: issues, challenges, and new horizons.

Mike Hill, Brigham Young University

Rebecca Schroeder, Brigham Young University

Julie Williamsen, Brigham Young University

Managing personnel resources in tough times:
 things we've learned to do (and to avoid next
 time).

Karen Darling, University of Missouri, Columbia

Priorities and policies for gift operations: best prac-
 tices for handling gift materials.

- Michael A. Arthur, University of Central Florida
Kelli Getz, University of Houston
Squeezed between the e's: electronic resources, print monographs, economic woes.
Lisa Barricella, East Carolina University
Joseph Thomas, East Carolina University
Herding cats: providing oversight, support, and coordination to library liaisons at a small academic library.
Karen Jensen, University of Alaska, Fairbanks
Collecting together: developing the Crater Lake Digital Research Collection.
Anne Hiller Clark, Oregon Institute of Technology
Lia Vella, Oregon Institute of Technology
All the water in the ocean—all the books on the sea: collaborative collection development in Oregon's Marine Laboratory Branch Libraries and beyond.
Barb Butler, University of Oregon
Janet Webster, Oregon State University
- The Acquisitions Institute at Timberline Lodge, May 15–18, 2010
Welcoming remarks: Camila Alire, President, American Library Association
Keynote address: Katina Strauch, College of Charleston
E-books: taking the next step.
Diane Carroll, Washington State University
Evidence based decision making: data mining for serials cancellations.
Dean Walton, University of Oregon
Developing a new allocation model for the library budget.
Sandra Shropshire, Idaho State University
Assessing the Evergreen Acquisitions Module from an academic library perspective.
Karen Clay, Eastern Oregon University
Whither journals? or wither journals?
Faye Chadwell, Oregon State University
Kittie Henderson, EBSCO
Daniel Morgan, Elsevier
Mary Nugent, Taylor & Francis
Twittering for books: patrons using social media for library collection requests.
Joan Petit, Portland State University
Buy request: just in time versus just in case as OSU Libraries.
Uta Hussong-Christian, Oregon State University
Kerri Georgen-Doll, Oregon State University
OARS: toward automating the ongoing subscription review.
Jonathan H. Harwell, Georgia State University
The Serials decision database as a research tool.
Diane Carroll, Washington State University
Joel Cummings, Washington State University
What to do with reference collections?
- Paul Frantz, University of Oregon
Cheryl Middleton, Oregon State University
Overcoming the shrinking budgets blues—creative and collaborative acquisitions strategies at Cornell
University Library in a time of financial constraints.
William J. Kara, Cornell University
Boaz Nadav-Manes, Cornell University
The Consortial balancing act: how your consortium impacts collection development.
Alice Crosetto, University of Toledo
Round book in a square hole: providing access to artists' books.
Cara List, University of Oregon
- The Acquisitions Institute at Timberline Lodge, May 14–17, 2011
Welcoming remarks: Molly Raphael, President-Elect, American Library Association
Keynote address: The Opening hand.
Joseph Janes, University of Washington
This is not a test. . . Patron-driven acquisitions.
Marcia Anderson, Arizona State University
Ginny Sylvester, Arizona State University
The e-book ecosystem: what are the challenges?
Panel discussion.
Douglas Armato, University of Minnesota Press
Emily McElroy, Oregon Health and Science University
Michael Zeoli, YBP Library Services
Using academic course data to assess library collection strength.
April Henson, Naropa University
Mark Kille, Naropa University
Project GIST: The Getting it System Toolkit; tools to enhance and streamline workflows.
Cyril Oberlander, SUNY College at Geneseo
GIST for you!
Kristina DeShazo, Oregon Health and Science University
Rethinking the role of collection development librarians.
Kerry Scott, University of California, Santa Cruz
Demand-driven acquisitions: patrons riding shotgun.
Linda DiBiase, University of Washington
Alison Bobal, Oregon State University
Collection use from the other side: assessing print collection usage by humanities faculty.
Charlene Kellsey, University of Colorado, Boulder
Jennifer Knievel, University of Colorado, Boulder
Blended libraries: becoming one family.
Cheryl Adams, Utah State University
Lori Brassaw, Utah State University—College of Eastern Utah

- Angela Dresselhaus, Utah State University
 Betty Rozum, Utah State University
 Moving beyond 10Ks: collecting and providing access in a business library.
 Nathan Rupp, University of Michigan
 Maintaining an LGBT studies collection in an academic library.
 Rachel Wexelbaum, St. Cloud State University
 Science video journals in academic research and education.
 Moshe Pritsker, JoVE
 A Patron-driven acquisition project in a consortial environment.
 Catherine Davidson, York University
 Tony Horava, University of Ottawa
 Jumping without a parachute: transitioning to on-demand purchasing for journal articles.
 Camila Gabaldon, Western Oregon University
 Implementing an e-preferred approval plan: assessing duplication.
 Carmelita Pickett, Texas A&M University
 Demonstrating the value of scholarly collections through ROI and other methods.
 Kira Cooper, Elsevier
 Regina Mays, University of Tennessee
 Carol Tenopir, University of Tennessee
 The Future of collection development and acquisitions.
 Panel discussion.
 Faye Chadwell, Oregon State University
 Peggy Cooper, Boise State University
 Mel DeSart, University of Washington
 Stephen Pugh, Oranjarra Partners
 Scott Alan Smith, Kent State University
- The Acquisitions Institute at Timberline Lodge, May 19–22, 2012
 Welcome message: Molly Raphael, American Library Association.
 Keynote address: The Changing landscape of academic libraries.
 Susan Gibbons, Yale University
 Using service design thinking to reinvent acquisitions.
 Steven Sowell, Oregon State University
 All textbooks in the library! The Portland Community College experience.
 Tony Greiner, Portland Community College
 Scholarly publishers, research data and implications for academic library collections.
 Jeremy Kenyon, University of Idaho
 Nancy Sprague, University of Idaho
 Patrons: the new subject selectors?
 Kerri Georgen-Doll, Oregon State University
 E-books: they're a heartache, nothing but a heartache.
 Stacey Marien, American University
 Kari Schmidt, American University
- E-books at the tipping point? How faculty view e-books for teaching and research.
 Laurel Kristick, Oregon State University
 Margaret Mellinger, Oregon State University
 The Value of purchasing e-book collections from a large publisher: a usage-based analysis of Oxford University Press e-books.
 Jennifer W. Bazeley, Miami University, Ohio
 Aaron K. Shrimplin, Miami University, Ohio
 Beyond ROI: transitioning assessment into action.
 Denise Pan, University of Colorado, Denver
 Leslie Williams, University of Colorado, Health Sciences
 Additional authors not attending:
 Yem Fong, University of Colorado, Boulder
 Gabriella Wiersma, University of Colorado, Boulder
 Discussion among all participants about the impact of Web-scale discovery service.
 Alice Eng, University of North Florida
 Stephanie Weiss, University of North Florida
 Managing electronic resources with open source software: perspectives from a small and medium sized academic library.
 Roen Janyk, Okanagan College
 Sandra Wong, Simon Fraser University
 Stanford University Libraries and everyday electronic materials.
 Sharon Propas, Stanford University
 Electronic sandbox: cross-organizational electronic resource management.
 Jesse Koennecke, Cornell University
 Colleen Major, Columbia University
 Boaz Nadav-Manes, Cornell University
 Greening your acquisitions from A to Z.
 Marie Bloechle, University of North Texas
 How suite it is: rehabbing acquisitions at UNC.
 Caroline Norton, University of Northern Colorado
 Rick Kerns, Creighton University
 Managing and preserving unique library collections.
 Scott Devine, Northwestern University
 Show and tell: new artists' books at the University of Oregon's Architecture and Allied Arts Library.
 Cara List, University of Oregon
- The Acquisitions Institute at Timberline Lodge, May 18–21, 2013
 Keynote address: Beyond measure: valuing libraries.
 Chris Bourg, Stanford University
 Should we buy Angry Birds? And other questions for collection development and acquisitions librarians in a world of iPads and Apps.
 Juleah Swanson, Ohio State University
 All that counts: evaluation of an aggregator package from three libraries.
 James Bunnelle, Lewis & Clark College
 Jill Emery, Portland State University

Emily McElroy, Oregon Health and Science University
 New models for publishing, packaging, and purchasing: implications for libraries and suppliers.
 Panel discussion.
 John Dove, Credo Reference
 Kittie Henderson, EBSCO
 Zac Rolnik, now publishers
 Michael Zeoli, YBP Library Services
 Maine shared collections strategy.
 Sara Amato, University of Maine
 Two versions on MI-SPI: a collaborative approach to deselection and collection management.
 Randy Dykhuis, Midwest Collaborative for Library Services
 Pamela Grudzien, Central Michigan University
 Monographs: titles cited in faculty-authored works.
 Amy Lana, University of Missouri, Columbia
 Citation analysis as a tool for collection development and instruction.
 Karen Kohn, Arcadia University
 Americans with Disabilities Act compliance and library acquisitions.

Angela Dresselhaus, University of Montana
 Library transitions: collections and access before, during and after a library renovation.
 Eric Hanson, University of Portland
 Susan Hinken, University of Portland
 Collaborative endeavor between TRNLN, OUP, and YBP.
 Lenny Allen, Oxford University Press
 Ann-Marie Breaux, YBP Library Services
 Nancy Gibbs, Duke University
 Consortial patron driven acquisitions.
 Marc Langston, California State University, Chico
 Jodi Shepherd, California State University, Chico
 Adding a use factor measure to a materials allocation plan for books in an academic library.
 Lisa Barricella, East Carolina University
 What is unique about unique? An Assessment to uncover and value distinct collections within the main library collections.
 Laurel Kristick, Oregon State University
 Rick Stoddart, Oregon State University
 Andrea Wirth, Oregon State University

African Librarianship

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Abstract

Africa is a continent of contrasts, comprised of 54 countries that vary in size from the expansive Sudan to small island nations. Diversity of languages and cultural traditions abound both among the nations within this second largest continent and within each nation. Each nation has diverse human populations, mineral resources, biological diversity, and political and social histories. Several have written records and libraries that date back centuries such as the Library of Alexandria in Egypt, and the Ge'ez scripts housed in the monasteries of Ethiopia and Eritrea. One possible unifying factor among the African nations, with the exception of Ethiopia and Liberia, is the legacy of colonialism, which greatly permeates life today despite independence in the 1960s. African libraries were modeled after European libraries, frequently created to serve the colonials themselves or to exert intellectual or religious control over indigenous populations. New approaches and views of African librarianship began to be articulated following the end of the colonial era, calling for a revisioning of African librarianship reflecting on the social and cultural values of Africans.

INTRODUCTION

Africa is the second largest continent, measuring approximately 5000 miles (8000 km) from north to south and approximately 4600 miles (7400 km) from east to west.^[1]

Excluding the associated dependent island nations and contested states such as Somaliland and Western Sahara, Africa comprises 54 countries, each recognized by the United Nations.^[2,3] Although the second largest continent, Africa constitutes 13.2% of the world population in the year 2000.^[4] Despite a small population density, it is an extremely diverse continent with regard to human populations, mineral resources, biological diversity, and political and social histories. Its people use approximately 2000 indigenous African languages that represent a third of the world's linguistic diversity,^[5] as well as five international or colonial languages (English, French, Portuguese, Spanish, and Arabic).

A comprehensive definition and discussion of African librarianship is therefore extremely difficult, if not impossible. For purposes here, however, the main historical events and evolving trends, perceptions, and practices that have contributed to African librarianship over time will be highlighted. The developments in the past decade that indicate new directions and paths for African librarianship will also be discussed.

AFRICAN LIBRARIES: THE HISTORICAL CONTEXT

Precolonization

The continent of Africa was home to some of the oldest libraries and collections of documents in history, The Library of Alexandria in Egypt, being the most famous example from classical antiquity. The Alexandrian Library was founded by the Ptolemies in the third century BC. While physically located on the African continent, the library was principally composed of Greek literature and was modeled on the organization of libraries in Athens.^[6] It has been argued that for the Greeks of the Ptolemaic empire, their literature represented the culture that legitimized their rule over indigenous populations of the region. Similarly, their literature united them against the Egyptians as an intellectual community.^[7] By these accounts, then, imperialism and cultural hegemony played an early role in library development on the African continent.

Early indigenous examples of African libraries include the monasteries of Ethiopia and Eritrea where Ge'ez script texts were housed and preserved for centuries. Similarly, the Mali and Songhai empires during the thirteenth to sixteenth centuries in West Africa contained resource centers with many scholarly texts. Sankoré University in

Timbuktu (in present day Mali) remained a vitally important center of higher learning during the middle ages.^[8] Another example of early African print culture is the East African history, *Kitab al-Sulwa* (known in English as *The Kilwa Chronicle*) written in Arabic by an unknown author in the early to mid-sixteenth century.^[9] While few libraries that housed print resources existed on the African continent before European penetration and colonization, the practice of oral tradition played an extremely strong and similar role to traditional print libraries across Africa for centuries. Anaba A. Alemna points out that, “There is ample evidence to indicate that oral librarianship is appropriate within the African context, given that African traditional societies did have information specialists whose official and social functions resided in the narration of local history in public places.”^[10] While libraries and graphic records were by no means strangers to the African soil before colonialism, for much of the continent, the greatest venues for the preservation and transmission of knowledge and cultural values were distinctly in the realm of oral tradition and the arts.^[11]

European Colonization and Librarianship

Despite the early examples of African libraries and librarianship mentioned above, the story of African librarianship has been heavily influenced by, and in many respects entwined with, the story of European colonization and imperialism, most particularly in sub-Saharan Africa.^[12] Apart from Ethiopia, which had only a brief occupation by Italian forces for five years from 1936 to 1941, and Liberia, founded in 1822 by the American Colonization Society (ACS) as a colony for American free blacks who elected to immigrate to Africa until it gained its independence in 1847,^[13] European colonization had a significant and enduring influence on all African nations that carried over into library development and librarianship. African colonization was carried out by Belgium, Great Britain, France, Germany, Italy, Portugal, and Spain. The apex of European colonization of Africa is represented by the Berlin Conference of 1884–1885 that effectively eliminated African self-governance and autonomy. Most African countries emerged from colonial rule in the early 1960s.

Colonial administrators and missionaries brought their European-modeled libraries with them during the period of African colonization. In some cases, these libraries were created exclusively to serve the colonials themselves, but in other cases they were used to exert a type of intellectual or religious control over the indigenous African populations. The Western-modeled libraries were stocked with materials that the colonial powers believed to be important for local populations. Indigenous knowledge and local systems of information sharing were disparaged.^[14] For many local African populations, the colonial libraries were often viewed as propaganda tools for colonial administrators.^[15] Collections in these

libraries often glorified the Western powers or denigrated the primitiveness of indigenous populations. The African libraries that sprang up during the colonial period reflected Western ideals of librarianship in multifaceted ways—in their physical facilities, their materials, and in their ideology. The colonial powers and religious missionaries believed strongly that they could import the philosophy of librarianship that had developed in Europe and the United States to the continent without modification or respect for existing models of knowledge transmission and preservation. It was essentially expected that African populations would adapt to this model of librarianship rather than libraries adapting to the needs and desires of the African populations.^[16] Western colonialists viewed the written word and the book as the pinnacle of knowledge and imposed this view on others. Colonial languages were favored and indigenous ones were dismissed. There was also no recognition that information needs might vary between communities, or between local populations and European populations. The imposition of such foreign structures resulted, for the most part, in the alienation of African communities from library services. While impressive buildings were sometimes erected to house these libraries, over time the collections and services tended to be seriously neglected.^[17] This was particularly pronounced in public and school libraries, though academic libraries were in no way immune to this situation. As the economies and stability of many African countries declined after the optimism of the 1960s and 1970s, all types of libraries suffered setbacks. Books were often in short supply as a result of the national economic situations, lack of infrastructure in the book trade, and restrictions on imports.^[18] Afeworki Paulos writes “But in general, the level of knowledge production of Africa’s cultural output remained very low in post-colonial Africa. . . Further, as early as 1980s, university libraries in Africa were in serious financial difficulty. . . In the 1980s and the 1990s, library resources in most African universities no longer met the basic needs of users. The library was marginalized in the life of the university and it led to the use of ‘alternative methods of accessing and acquiring information’.”^[14] Public libraries often housed collections that had little to no relevance to local populations while academic libraries in universities often contained outdated materials with little research value.^[16]

Independence and Postcolonization Period— African Librarianship Responds

Despite gaining independence, the majority of African countries in the early 1960s maintained dependency relationships with their former colonial powers and such influence persisted for institutions, including libraries, across the continent. African libraries continued their colonial heritage in ways that were often stifling. Even after independence, many of the pioneer librarians were expatriates

from Europe.^[16] By the 1960s, there were three dominant European languages on the continent: English, French, and Portuguese. The role and importance of libraries in those countries and cultures associated with these languages differed greatly depending on whether the African nation was colonized by Britain, France, or Portugal. Portugal, for example, had a weak library tradition itself, and this was reflected in the lack of strong library institutions in the Portuguese colonies Angola, Cape Verde, Guinea-Bissau, and Mozambique. Similarly, the French library tradition was primarily intended for the scholar and bibliophile rather than the ordinary citizen. French libraries symbolized the heritage of a civilization rather than serving as an instrument for further progress. In the former French colonies, its few libraries had hardly any qualified staff and extremely limited public access to collections of published information. Sturges and Neill have suggested however that a positive aspect of this may be that the former Francophone countries had more freedom within which to invent new responses to information needs and provisions than the former British colonies had at independence.^[19]

In contrast to France and Portugal, Britain passed on a legacy of library development that saw the library, particularly the public library, as a key component of a modern and complete nation state. Although this model of the library in the African colonial countries originally was almost exclusively racially restrictive, by the mid-twentieth century, just before independence, the library was being promoted as a means to expand literacy. The 1953 UNESCO Seminar at Ibadan, Nigeria, was an important turning point in library development serving as the affirmation of the belief that the expansion of public libraries in Africa would help increase literacy. Of the 29 participants, however, only eight were Africans. Also significant, several of the participants were not librarians but had other interests with regard to literacy and illiteracy. One tangible result of this seminar was the establishment of the West African Library Association. Another recommendation was the adoption of the UNESCO Public Library Manifesto that called for the public library to be a democratic institution, open for free and equal use by all members of the community. This would become the basis on which national public library service should be built in Africa. At the time of the seminar and adoption of the manifesto, public library service in Africa differed widely in achieving its ideals.^[20]

The Anglo-American library tradition that was embodied in the UNESCO Manifesto had an effect on libraries throughout Africa after the UNESCO Seminar, particularly in the Anglophone countries. This tradition had firmly placed national library services as the foundation for all library services. However, there was limited success in providing what many would expect of a national library in terms of a national legal deposit collection, national bibliography, interlibrary loan services, and other cooperative programs. Instead, national libraries have

generally functioned as a centralized national public library service coordinating regional branches and postal loans or mobile libraries in some locations, and to mixed degrees of success. In contrast to these public libraries, the special library sector in Africa has been stronger and longer established. These include geological, agricultural, and other special libraries tied to government ministries, NGOs, and parastatals. Similar to public libraries, academic libraries were in a relatively weak state at the time of independence. The majority of academic libraries were established after the Second World War during a period of significant expansion in African educational efforts. Despite this expansion, the library was often placed in a central location, both physically and in the rhetoric espoused by these new African universities, the reality was that a great majority of these institutions could not afford to keep up a high-quality library collection to support teaching and research.^[21] This had, and continues to have, a serious impact, on scholarship and teaching in most African countries.

In spite of the imposition and primarily negative legacy left by the colonial powers on library development in Africa, new approaches and views of African librarianship began to be proposed and articulated following the end of the colonial era in the 1960s. These views occasionally came from Europeans themselves though the majority of the calls for change came from within the continent. For example, one early European promoter of a revisioning of African librarianship came from Ronald Benge who fleshed out his ideas in his book *Cultural Crisis and Libraries in the Third World* after recognizing that Africa had its own social and cultural values and that librarianship in Africa should reflect and build on these values rather than simply following European models of the profession.^[22]

Many African librarians also took up this cause. One of the strongest examples of this anticolonial call for a nonhegemonic library tradition can be found in Adolphe Amadi's book *African Libraries: Western Tradition and Colonial Brainwashing* published in 1981. Amadi detailed the negative effects and history of the colonial influence on African libraries and called for a radically different approach to information provision.^[23] Another key contributor in this area was Kingo J. Mchombu whose article "On the Librarianship of Poverty" published in 1982, made the case that the conditions of poverty must be addressed in any discussion of information work in underdeveloped countries. In this way, Mchombu directed concerns in African librarianship to neglected populations living in the rural areas. He elaborated four principles that he saw as being necessary to make information work socially relevant in African countries:

1. That the chief factor determining information work in developing countries should be poverty rather than affluence.

2. That information work in developing countries differs markedly from information work in developed countries.
3. That it is possible to gather a body of knowledge on how best to meet this challenge.
4. That information workers must play an active role in the process of socioeconomic development.^[24]

Mchombu's piece became a rallying cry for a whole generation of African librarians (and some of their European allies) who accepted his challenge to produce a new library and information model for Africa, particularly among rural communities. Mchombu argued that information services in developing countries should not blindly follow those of developed countries and that information workers need to develop an aggressive attitude and participate fully in the social struggle for national development. Mchombu concluded, unequivocally, "...Information workers must look for solutions to their problems within their own societies rather than depending on foreign aid."^[25] During the second half of the twentieth century, many African librarians and information scholars carried forth Mchombu's challenge in a variety of ways. Some focused their efforts on the need for greater research on community needs and existing patterns of information transfer. Others examined ways that information services could repackage information into forms that were more culturally and socially acceptable by local populations. Others emphasized the importance of utilizing the oral tradition itself as an information resource within African libraries and the issues of availability of resources in local African languages. Related to this, many stressed the importance of recognizing the information needs and abilities of nonliterate.^[26] By the closing of the twentieth century, there were many voices from within Africa as well as some from outside that had articulated, researched, and written about a substantial reordering of priorities for African librarianship than those presented in the model that had been imposed on the continent by the colonial powers.

Liberalization of Higher Education in Africa and Its Impact on Libraries

Liberalization of higher education, beginning in the 1990s, had a significant impact on higher education and on libraries within those institutions of higher education. Damtew Teferra noted, "The number of institutions in sub-Saharan Africa has increased from half a dozen in the 1960s—when most of the nations in the sub-region declared independence—to over 300 in 2003."^[27] The total of institutions of higher education that grant four-year undergraduate and/or postgraduate degrees and that are officially recognized, licensed, or accredited by national or regional bodies in 2013 number over 600.^[28] This rapid growth placed a heavy burden on the nations involved since these states provided upward of 90% of support for

the education of qualified students.^[29] Paul Tiyaambe Zeleza and Adebayo Olukoshi note that the "liberalization of African Universities has increasingly manifested itself in the growth of private universities and the privatization of programmes and funding sources."^[30] Mahlubi Mabizela further reflects on the effects of global pressures, "The contemporary or new generation private HE is largely a direct consequence of the hegemonic neo-capitalist and neo-liberal post cold war social context."^[31]

Public or private, this growth in the number of institutions of higher education has placed both added challenges and opportunities for the libraries serving those institutions. Budget cuts curtailed the acquisition of journals, core textbooks, and encyclopedias in a number of libraries, acknowledged the Association of African Universities.^[32] Furthermore, Muyoyeta Simui states, "Inadequate funding for the purchase of new books and subscriptions to journals and other information resources rank amongst the most severe obstacles faced by African university libraries."^[33] According to Simui, factors affecting funding range from "growing populations exerting new and expanded demands on government, debt burden, structural adjustment programmes whose conditions are unfavourable to social services like education to changes in government policy."^[34] ICT (Information and Communication Technologies) has the potential to be the great equalizer as the continent adopts these technologies. Teferra cites L.A. Levey in stating, "despite numerous hurdles, the major factor that catalyzed the development of ICT in the continent (especially e-mail) was the great thirst and enormous need for academic and scholarly communication in the land of forbidding cost and extremely poor communication services."^[35] Libraries are responding to these challenges through consortia, use of open source products, and the promotion, use, and creation of open access (OA) journals and directories, all of which are discussed below. One library that exemplifies the modern African university library and the possibilities for these challenges to be overcome is Kenyatta University in Nairobi.^[36] Services provided by the library include a robust online catalogue (KOHA, Open Source Integrated Library Management software), institutional repository, e-books, electronic journals, chat reference, a full complement of professional staffing, adaptive technology, 370,000 volumes of books and bound periodicals, current journals, audio visual magazines and dailies, and 74 computers for student use. The library is a member of the following organizations: Kenya Library and Information Services Consortium (KLISC) and the Kenya Library Association (KLA).^[37]

NEW DEVELOPMENTS IN AFRICAN LIBRARIANSHIP

Several new developments since the end of the twentieth century and the beginning of the twenty-first century have

influenced visions for a new way forward for African librarianship. These new visions revolve around the themes of unity, pan-African responses, and a revisioning and redefining of information ethics and Library and Information Science (LIS) education for the African context.

Pan-African Responses: African Library Summits and Emergence of New Organizations

Beginning in the late twentieth century, a greater effort was being made to have a pan-African response to library and information challenges in Africa. One such example of this is the biennial conference of the Standing Conference of Eastern, Central and Southern African Library and Information Associations (SCECSAL). SCECSAL derived its origins from the East African Library Association (EALA), which was founded in 1957. When the EALA dissolved in 1970, members agreed to continue to hold a biennial conference and invited other countries in the subregion. SCECSAL is now one of the largest and fastest growing library and information professional associations in Africa. Membership to SCECSAL is open to national library and information associations from the following countries: Angola, Botswana, Burundi, Congo Republic, Democratic Republic of Congo, Djibouti, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Madagascar, Mauritius, Mozambique, Namibia, Rwanda, Seychelles, Somalia, South Africa, South Sudan, Sudan, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe. The first SCECSAL conference was held in Dar es Salaam, Tanzania, in 1974. There have since been a total of 20 SCECSAL conferences to date, which have rotated within the countries represented in the organization. Themes of SCECSAL conferences have included a wide range of topics from “Enhancing democracy and good governance through effective information and knowledge services” to “From Africa to the World—the globalization of indigenous knowledge systems.”^[38]

Given the nature of shared commonalities, histories, and challenges in African librarianship, attempts at continent-wide solutions and attempts at unified pan-African LIS have been growing. A major development in this area has been three all-African LIS summits. The first was the African Library Summit held in Muldersdrift, Gauteng, South Africa, from May 11 to 13, 2011. The theme of the conference was “The Future of African Librarianship.” The summit was hosted by the University of South Africa (UNISA) Library, the IFLA (International Federation of Library Associations and Institutions) Regional Office for Africa, and the IFLA Africa Section.^[39] The summit brought together 158 LIS policy makers, senior managers, educators, and researchers from 24 African countries and four countries outside Africa. During the deliberations, participants compiled thematic frameworks for the future of African library development. The summit delegates

recommended that a task team investigate forming a continental African Library Association or a Federation of African Library Associations, and that national library associations establish chartering bodies to regulate and accredit the LIS profession and education programs. Issues of indigenization versus internationalization of LIS education and curricula were also debated and discussed.^[40]

Following the first African Library Summit, the African Public Libraries Summit was held in Johannesburg, South Africa, September 19–21, 2012. This summit, intended solely for the public library sector, was organized around the theme “Informing Africa, Developing Africa” and was funded by the Bill & Melinda Gates Foundation and IFLA. This summit was a direct result of the first African Library Summit where a framework for public libraries had been discussed and developed. Its framework encouraged public libraries to “...examine the broadest context and develop strategies to reach the underserved and disadvantaged. They should innovate and provide a wide range of services. Public libraries should be open, flexible, multipurpose community spaces. They should add value, tap into opportunities through one voice in Africa and aggressively align and advocate within Government strategies to participate within the national development process.”^[41] In addition to public library directors and decision makers from 44 African countries and 8 countries outside the continent, the summit was also attended by government ministers, permanent secretaries, director generals, members of the African Union Commission, United Nations Economic Commission for Africa, and a variety of other commission members and development practitioners and researchers.^[42] The summit was much more of a “think tank” environment than a traditional academic conference.

Following the African Public Libraries Summit, a second African Library Summit was held in Pretoria, South Africa, July 2–5, 2013. This time the theme was “The Horizon and Beyond.” This second all-continent, all-sectors, summit was hosted by the UNISA Library, the IFLA Regional Office for Africa, and the IFLA Africa Section.^[43] This second summit attracted 280 participants from 35 countries representing greater participation from across Africa than that of the first summit. The three days of the summit focused on the themes of leadership, innovation, and cooperation. In addition to common sessions, breakout sessions took place in which more focused conversations and planning occurred by sector and topic including African library associations; training of LIS practitioners; public and community information practitioners; school libraries; academic, research, and special libraries; and LIS in Francophone Africa and Lusophone Africa. The conclusion of the summit saw the launch of three important new initiatives: the African Library and Information Association and Institutions (AFLIA), the Public Library Network, and the Conference of African National Libraries (CANL).

AfLIA's vision is to be the association of choice for strategic growth of the library and information profession in Africa, while its mission is to be the trusted African voice for the library and information community and to drive equitable access in information and knowledge for all. AfLIA's membership currently does not include an option for individuals but rather it is an organization that represents other associations or institutions from across the continent.^[44] Similarly, the Public Library Network is an effort to assist the public library community in Africa by expanding on the networking and knowledge sharing that occurred at the Public Library Summit. It is also intended to enable African public librarians to push for the placement of public libraries firmly on the development agenda with a unified voice.^[45] And finally, the CANL emerged as an independent organization of chief executives of national libraries. Its goals are to facilitate discussion and promote understanding and cooperation on matters of common interest across the continent; facilitate the exchange of information, training opportunities, sharing of resources, experiences, and expertise and promoting research; improve regional cooperation and visibility; set standards against which performance can be measured; be a representative body, recognized at national, regional, continental, and international levels; provide guidelines whenever needed; enable and promote communication; and reach out to countries without national libraries.^[46]

The three all-Africa summits have been an important step in moving African librarianship forward into the twenty-first century with a pan-African strategy for improving information provision and adapting libraries to the specific needs of African communities and contexts. What remains to be seen is if these efforts can truly be pan-African in scope. While there was representation from Francophone and Lusophone countries at the three summits, the vast majority of participants were from the Anglophone regions of Africa. Unless this changes, the countries that were former colonies of France and Portugal may continue to lag behind the rest of Africa in terms of strengthened libraries, library associations, and professional development opportunities in the LIS field.

Information Communication Technology

Improved access to ICTs, including mobile-cellular phones, has made a substantial impact on information access and provision worldwide, and Africa is no exception. Despite this, Africa lags behind the rest of the world in a number of areas. Estimated mobile-cellular penetration in Africa in 2013 was 63% compared to developing countries overall (89%) and developed countries (128%). Similarly, in 2013, Africa had the lowest Internet penetration rate at 16%, only half the penetration rate of Asia and the Pacific and far below the Americas and Europe. An estimated 7% of households in Africa had Internet access

in 2013. In Africa, as in other developing areas, fixed-broadband services continue to be extremely expensive, accounting for 30.1% of average monthly incomes. There was a substantial gap in fixed-broadband penetration rates with less than 1% in Sub-Saharan Africa compared to 27.2% in developed countries. Although mobile broadband penetration was also lower in Africa in 2013 at 11% than in other parts of the world, Africa is the region with the highest growth rates over the past three years in this arena. While mobile broadband is considerably cheaper than fixed-broadband services, mobile broadband services remain prohibitively expensive in Africa where the price of a computer-based plan with 1 GB of data volume is on average 50% of gross national income per capita.^[47]

Scholarly Publishing

Due to these ICT issues and the traditionally high cost of access to peer-reviewed scholarship in journals and databases, researchers in Africa and other developing countries have been least able to pay to access vital scientific information. Additionally, research output from Africa has had a very difficult time reaching an international audience. Both of these results have had a significant and damaging impact on the progression of scientific and scholarly progress on the continent.^[48] Starting in the 1990s, several initiatives began that were designed to increase the availability of scholarly information in Africa and thus address the deteriorating situation in which most African institutions and researchers were finding themselves. These projects were primarily driven and funded by donors and nongovernmental or nonprofit institutions. Some examples of these programs are the Programme for the Enhancement of Research Information (PERI) from the International Network for the Availability of Scientific Publications (INASP), Electronic Information for Libraries (EIFL), JSTOR's Africa Access Initiative, The Essential Electronic Agricultural Library (TEEAL) from Cornell University, and projects related to the United Nations such as the Health InterNetwork Access to Research Initiative (HINARI), Access to Global Online Research in Agriculture (AGORA), and Online Access to Research in the Environment (OARE).^[49] While most of these efforts have primarily been focused on increasing the flow of scholarly and scientific information from outside Africa to the continent, there have also been efforts to reverse this information flow and promote the publications and research output of African researchers and institutions to the rest of the world. Examples of this include NISC in South Africa, a bibliographic database publishing company that compiles licenses and aggregates bibliographic databases with a mission to promote the publications and research output of Africa. Another example is African Journals Online (AJOL), a nonprofit organization whose mandate is to promote access to African research output and support African scholarly publishing.^[50]

Open Access Initiatives: Open Access Journals and Institutional Repositories

OA initiatives have also been seen as a potential leveling mechanism through which African scholars and institutions may gain much needed access to scholarly publications and may broaden their reach with their own research outputs. OA literature has been defined as “digital, online, free of charge, and free of most copyright and licensing restrictions.”^[51] OA literature is also subject to the same rigorous peer-review process as traditionally published scholarly literature. Proponents of OA recognize the importance of the flow of scientific literature for human development. While several different economic models have developed for covering the costs of OA literature production, it is relatively common for OA publishers to charge article processing charges (APCs) for the articles that are selected after the peer-review process. This has the potential to continue the imbalances between developed and developing countries in the process of scholarly dissemination. For that reason, many OA publishers, such as BioMed Central, support research output from developing countries by providing automatic waivers for APCs for all research published from low-income or lower-middle-income countries.^[48] Not only are African scholars publishing in OA journals published in other parts of the world, they are also creating their own OA publications. These are being created and published on a number of different platforms. Some are created using Open Journal Systems (OJS), an open source software for the management of peer-reviewed academic journals created by the Public Knowledge Project.^[52] Additionally, many OA journals have been created using the AJOL system which provides free hosting for over 400 peer-reviewed journals from 30 African countries.^[53] Other platforms include AOSIS Open Journals (formerly known as OpenJournals Publishing), which utilizes the OJS system, and South African Bibliographic and Information Network (Sabinet) Open Access Collection.^[54,55]

African higher education institutions are also getting increasingly involved in the creation of OA institutional repositories, which are a significant and important development as an alternative OA route (the so-called green road of OA) designed to help disseminate scholarship from the continent to the larger scientific community. Similarly, digitization projects have gained momentum across the continent, which are helping to preserve rare and unique documents and collections. The software most commonly used in African countries for both these initiatives, institutional repositories and digital preservation projects, is the DSpace software, an open source product.^[56]

Open Source Initiatives

Another outcome of improved access to ICTs is the increase in library automation, oftentimes replacing card

catalogues with open source products. Open source software is software that can be freely used, changed, and shared. Many people can contribute to the development of the software, and it is distributed under licenses that comply with the Open Source Definition.^[57] Open source software provides an inexpensive alternative to commercial solutions. Source code is available to libraries and can be modified or developed to the library's needs. Implementation costs are also more affordable than commercial software products. Open source products do require technical expertise to operate and maintain requiring skilled professionals in house.^[58] Koha has been adopted by a number of libraries including Rwanda National Public Library, Strathmore University Library (Kenya), Addis Ababa University Libraries (Ethiopia), and Bibliothèque de l'Université de Kinshasa Bibliothèque Centrale (Congo).^[59]

Consortiums and Networks

As African libraries become more automated, there are increased opportunities for resource sharing through the development of consortiums and consortial agreements and through networks. Typically, consortia are formed of similar types of organizations to meet a common end, be it resource sharing, a common project such as a unified catalogue, collaborative purchasing, or the sharing of expertise. Ngozi Blessing Ossai, Delta State University in Nigeria, states “Globally, the development of new technologies with a concomitant exponential increase in the amount of information available has made the building and expansion of library consortia an imperative.”^[60] Sabinet, a private company since 1996,^[61] was established as a nonprofit network in 1983. It is an aggregator of southern African publications as well as providing access to South African Union. It provides access to African Electronic Journals (SA ePublications), South African Union Catalogue (SACat), South African National Bibliography (SANB), Index to South African Periodicals (ISAP), the Union Catalogue for Theses and Dissertations (UCTD), and African Digital Repository.^[62] Library consortiums served by Sabinet include SANLiC—South African National Library and Information Consortium (SANLiC) NPC, CALICO—Cape Library Consortium, SEALS—South East Academic Library System, and ESAL—Eastern Seaboard Alliance of Libraries.^[63]

Of the 200 participating consortia in ICOLC (International Coalition of Library Consortia), two are from Africa: Consortium of Ethiopian Academic and Research Libraries and the SANLiC.^[64] The EIFL, founded in 1999, partners with libraries and library consortia in more than 60 developing and transitioning countries in Africa, Asia, Europe, and Latin America.^[65] Of the 23 African nations listed, 17 have consortia including Botswana, Cameroon,

Egypt, Ethiopia, Ghana, Kenya, Lesotho, Malawi, Mali, Nigeria, Senegal, Sudan, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe.^[66]

Privately Funded Public Libraries

The scarcity of publicly funded libraries has given rise to social entrepreneurs who give up both time and capital to build libraries and develop programs. Two such endeavors include the Busia Community Library and its partner organization, Maria's Libraries (Kenya), and the Axumite Heritage Library in historic Axum, Ethiopia. The Busia Community Library is the 1988 vision of community leader Maria Wafula and serves a population of 500,000 along the Kenya-Uganda border.^[67] In 2008, it formally affiliated with the new umbrella library network, Maria's Libraries.

The Axumite Heritage Library is a project of the Axumite Heritage Foundation, a subsidiary of the Ethiopian Community Development Council (ECDC). The library is housed in the former Governor's palace (the *'Inda Nebri'id*) in Axum, Ethiopia, and opened its doors as a temporary facility in 2002. The Axumite Heritage Foundation was established to oversee the creation of the new Axumite Heritage Library, the museum, and eventually the Institute of Axumite Studies. The construction of a permanent facility is nearby on the ground of the former Governor's palace.^[68]

Innovative Outreach to Rural Communities

Scarcity of library services in rural areas has resulted in innovative outreach to members of the community. These include the use of camels for transportation of materials in Kenya,^[69] cloth pocket libraries in Ethiopia,^[70] bicycles in Kenya,^[71] and Kindles in Ghana, Kenya, Malawi, Rwanda, Tanzania, and Uganda.^[72]

Growth and Changes in Library and Information Science Education

The original training of professional librarians in Africa took place primarily overseas in institutions located in the former colonial powers or through correspondence courses from those same countries and was often criticized for being too remote from the reality of the African geographic, cultural, social, economic, and political environment. African countries began to develop library education programs of their own to meet their own needs for professional training and to counter some of these criticisms.^[73] With the exception of South Africa, which began LIS education as early as 1938, the majority of LIS programs only began to develop in the 1960s.^[74] The first was the Institute of Librarianship at Ibadan University followed by the Library School in Accra. Shortly afterward, regional library schools were

founded such as those in Dakar, Senegal, for Franco-phone Africa and the East African School of Librarianship at Makerere University in Uganda, which was designed to cater to Eastern African countries.^[73] Today, the majority of African countries have at least one library school or training program, and several countries (such as Kenya, Nigeria, and South Africa) have multiple schools for LIS education. While there has been great expansion in access to LIS education since independence from the colonial powers, a fair amount of recent reflection on the aims, quality, and relevance of LIS programs in Africa has been occurring, particularly since the turn of the twenty-first century. While a plethora of research publications and sessions at the pan-African conferences mentioned above give testimony to the fact that collaboration and a unified vision and standards for LIS education in Africa are strongly desired, substantial disparities between programs and countries exist. For example, although students and faculty across the continent have a strong desire to learn and use ICTs in their LIS educational programs, LIS institutions in South Africa have a much greater capacity and are more effective at exploiting ICTs in their programs than other countries in sub-Saharan Africa.^[75]

CONCLUSION

African librarianship has evolved significantly since the postcolonial era beginning in the mid-twentieth century when it was conceived as a distinctly different type of librarianship with unique perspectives, challenges, and needs. As Kingo Mchombu articulated toward the end of the second African Library Summit in 2013, African librarianship is not a static phenomenon, rather, it is one that has been changing over many years. While the idea of the "barefoot librarian" who worked in African villages, received an honorarium for homegrown library and information work, and participated in literacy work (among other services) was put forward by Mchombu and other African librarians in the 1970s and 1980s, he noted that that concept was a particular response to the information and political environment of the time. Although these environments and landscapes have now changed, the role of the library as a tool for human development and elevation is just as important in the African context as it was in the immediate postcolonial period. However, Mchombu has pointed out that the relationship between African librarianship and emerging technologies is now of great interest, importance, and challenges. African libraries and librarians cannot afford to ignore the new challenges brought about by increasing ICTs. The primary challenge is how to make the technology work for African communities and libraries rather than allowing those same communities to be overpowered and devoured by such technologies. The

ongoing question to be negotiated in African librarianship is how to use ICT as enabling tools without these same technologies becoming “the master” that disregards the unique needs and environment in which the majority of African populations live. As Mchombu stated, “African society is changing rapidly as well, which we must take full advantage of. The stakes are much higher now. Failure is not an option but we must realize we are riding the tiger—we cannot afford to get down and there’s no way back.”^[76] The future and precise meaning of African librarianship is being written and revised, daily, across the continent.

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Altmetrics

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Abstract

Altmetrics provide a new way to measure the impact of research. New channels of evaluation for scholarly work have become available by tracking its activity through usage, captures, mentions, social media, and citations. This allows researchers to gain a faster, broader picture of research as it is viewed, shared, and critiqued.

INTRODUCTION

Traditionally, citations in scholarly literature were used as a proxy to establish the quality of scholarly output with higher citation counts generally interpreted to represent higher scientific impact of the scholarly output. Used in this way, citations have limitations in that they are a substitution for quality and that they can be influenced by superficial factors. The Journal Impact Factor (IF) is another way frequently used to judge the impact of scholarly output, as it counts the average number of citations to recent articles published in a journal. But the Journal Impact Factor is highly controversial as it has a number of limitations such as skewed distributions within journals and manipulation by a journal's editorial policy.^[1] There is a need to assess research on its merits rather than on the basis of the journal in which it is published.

Altmetrics was a response to the limitations of these traditional metrics. As the volume of academic literature has exploded in the past decade, citation counts are not sufficient for measuring the impact of research. Given the large amount of online sharing of research articles and the discussions on the web about research, there are new ways to filter science for importance. Altmetrics provide a way to measure scientific impact through the conversations, bookmarks, and shares happening daily on websites around the world.

According to the Altmetrics Manifesto, "altmetrics is the creation and study of new metrics based on the Social Web for analyzing and, information scholarship."^[2] The term "altmetrics" was coined by Jason Priem, a graduate student at the School of Information and Library Science at University of North Carolina-Chapel Hill. Altmetrics is also a general-purpose term for "alternative metrics" (Fig. 1).

THE USE OF ALTMETRICS

The use of altmetrics aims to capture a broader view of scholarly research by tracking the activity of this research

as it is viewed, shared, critiqued, cited, and built upon. Some metrics are primarily used to track scholarly activity, while other metrics are used to show the public interest in scholarly research. Altmetrics measures not just articles but datasets, code, blogs, comments, and "nanopublications."

Altmetrics are gathered from a number of sources through public APIs. The data that is gathered is generated more rapidly than traditional metrics such as citations, so researchers do not have to wait years to show their worth. By providing this information, altmetrics can be used to show the impact of scientific research not just by researchers through citations but also the impact of the research to the public through the Social Web.

As outlined in "Overview of the Altmetrics Landscape,"^[3] altmetrics are generally categorized in the following ways:

- *Usage:* The measurement of the use of a research object. This includes the number of HTML views of an article on a publisher's website, the number of times that the article PDF and XML have been downloaded, and how many times its supplemental data has been accessed.
- *Captures:* The number of times an article has been stored as a bookmark or in a reference library. This includes how often an article has been bookmarked on CiteULike and how many times an article has been shared on Mendeley readers/groups.
- *Mentions:* The discussions about a research article. This includes blog posts, news stories, Wikipedia articles, comments, and reviews about a research article.
- *Social Media:* The use of an article in the Social Web. This includes tweets about an article, the number of Facebook likes, and how many times an article has been shared on social networks such as LinkedIn.
- *Citations:* The number of citations to an article that shows the long-term contribution of an article to scholarly literatures. This includes article citations from Scopus, CrossRef, and Pubmed Central (Fig. 2).

rfishbase: exploring, manipulating and visualizing FishBase data from R.

(2012) Boettiger, Lang, Wainwright. Wiley Blackwell (Blackwell Publishing). Journal of fish biology



Fig. 1 ImpactStory percentiles showing that an article was highly saved by scholars in Mendeley and highly discussed by the public through Tweets.

Source: CC-BY license 2.0 ImpactStory.com 2013. As shown on article “rfishbase: exploring, manipulating and visualizing FishBase data from R.” Reprinted with permission.

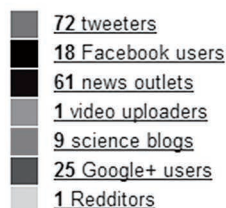


Score in context

Puts article in the top 5% of all articles ranked by attention

[show more...](#)

Mentioned by



Readers on



Fig. 2 Altmetric score with the number of mentions across different social media outlets.

Source: Altmetric.com 2013. Reprinted with permission.

Altmetrics can be customized to address the needs of researchers, publishers, institutional decision-makers, and funders. Researchers can track the impact of their research, filter research to their individual needs, and share the research with others. They can use altmetrics to show the impact of their scholarly output beyond a journal's impact factor. Research institutions can access up-to-date metrics on the research published by their faculty members and use this information for tenure and promotion decisions. Publishers can gain an understanding on how their publications are accessed and distributed. Funders can effectively track the impact of their grant awardees and measure the wider engagement of the research that they funded.

The altmetrics movement builds on previous work by other researchers. Johan Bollen has studied usage on articles for over a decade. He started MESUR (<http://mesur.informatics.indiana.edu/>) in 2006 as a large-scale usage data collection for scientific research. The MESUR database currently contains over one billion article-level usage events obtained from publishers, institutions, and aggregators.^[4] Eigenfactor is a rating of the total importance of a scientific journal. It was created in 2007 by Jevin West and Carl Bergstrom of the University of Washington as an academic research project to rank journals based on a vast network of citations.^[5]

There are a number of organizations already collecting altmetrics and aggregating the data including ImpactStory (<http://impactstory.org/>), Mendeley (<http://www.mendeley.com/>), Altmetric (<http://www.altmetric.com/>), Plum Analytics (<http://www.plumanalytics.com/>), and Public Library of Science (PLOS) (<http://article-level-metrics.plos.org>).

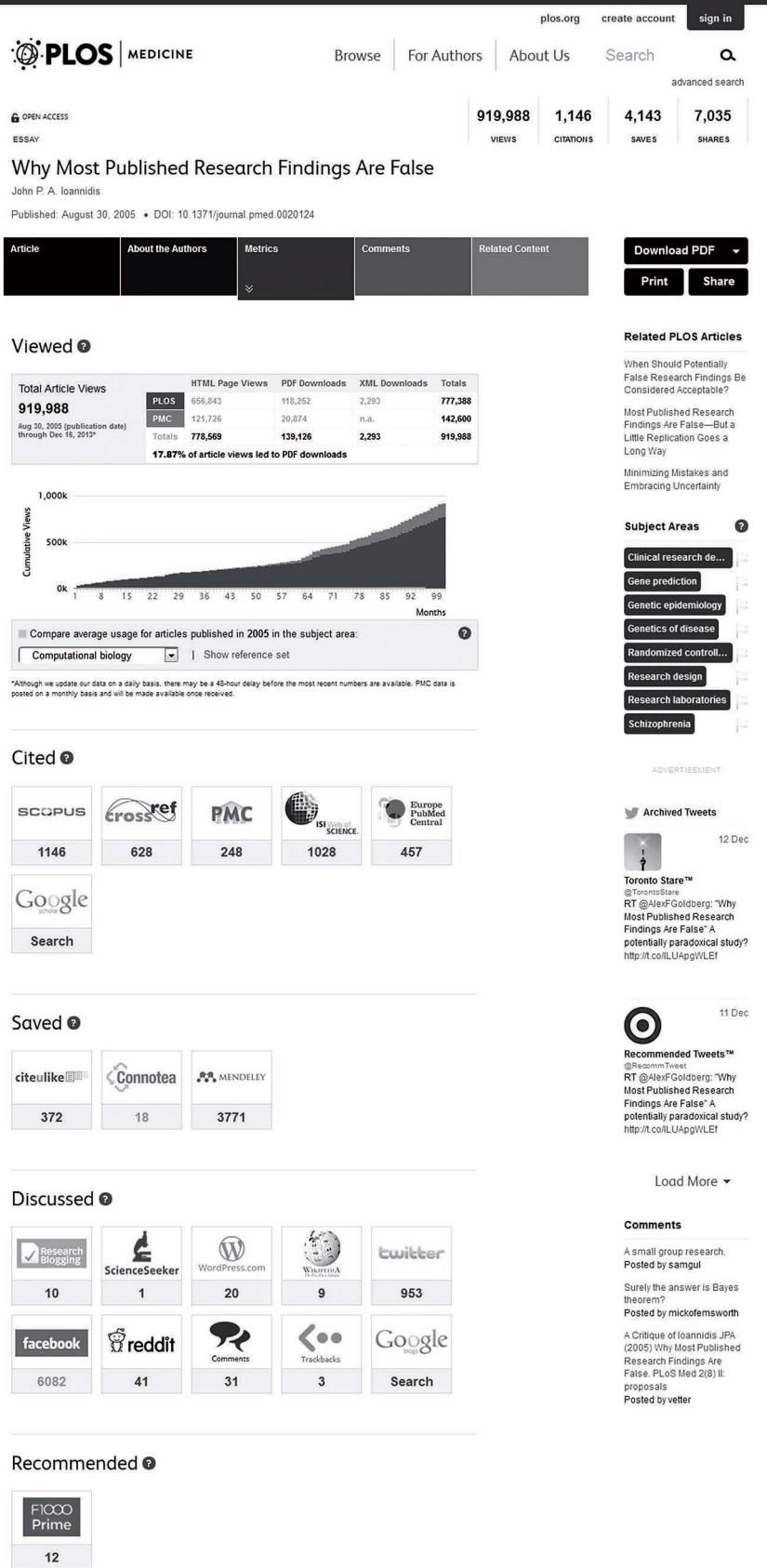


Fig. 3 PLOS Article-Level Metrics displaying the usage statistics, the number of citations, the number of bookmarks, the discussions, and the recommendations for an article.

Source: Creative Commons Attribution License 3.0 PLOS 2013. As shown on the article "Why Most Published Research Findings Are False." Reprinted with permission.

Publishers of scientific research have enabled altmetrics on their articles, open source applications are available for platforms to display altmetrics on scientific research, and subscription models have been created that provide altmetrics. There are also a number of applications using altmetrics, including ReaderMeter (<http://readermeter.org/>), PeerEvaluation (<http://www.peerevaluation.org/>), Research Scorecard (<http://researchscorecard.com/>), and PLOS Article-Level Metric (ALM) Reports (<http://almreports.plos.org/>).

Altmetrics are sometimes conflated with ALMs. ALMs are an attempt to measure impact at the article level. ALMs include many of the same data points as altmetrics but also include usage statistics and traditional metrics such as the number of citations to an article. ALMs are typically associated with the publisher PLOS, who introduced ALMs on all PLOS articles in 2009^[6] (Fig. 3).

CONCLUSION

Altmetrics provide a way for researchers to measure the impact of research by tracking its activity through usage, captures, mentions, social media, and citations. Altmetrics can be customized for use by researchers, publishers, institutional decision-makers, and funders. Altmetrics can also be used to understand a researcher's influence beyond a journal's impact factor. A handful of companies have

started to collect and aggregate altmetrics and a number of publishers have enabled altmetrics on their articles. The idea of altmetrics has recently gained a lot of traction, but there is still work to be done to promote the use of altmetrics to measure scholarly impact. Altmetrics will continue to evolve along with the ways that the scholarly community views, shares, and critiques scholarly activity.

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American Association of Law Libraries (AALL)

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Abstract

The American Association of Law Libraries (AALL) was founded in 1906 by a group of 24 law librarians who heeded the call of A.J. Small (Curator, Law Department of the Iowa State Law Library) to form a national organization to create a professional identity for those who dealt with the burgeoning body of legal publications.

That first meeting brought together participants from state libraries, bar associations, and law school libraries, among others. Diversity among venues for the profession continues to infuse and strengthen the association, which had grown to 5041 members by September 30, 2007. This entry focuses on the recent history and the state of the organization. For a detailed review of AALL's founding and history, see earlier editions of the *Encyclopedia of Library and Information Science*, which cover the period from AALL's founding through the late 1990s, or the chronology in the *AALL Directory and Handbook*, which is updated yearly.

INTRODUCTION

The American Association of Law Libraries (AALL) was founded in 1906 by a group of 24 law librarians who heeded the call of A.J. Small (Curator, Law Department of the Iowa State Law Library) to form a national organization to create a professional identity for those who dealt with the burgeoning body of legal publications.

That first meeting brought together participants from state libraries, bar associations, and law school libraries, among others. Diversity among venues for the profession continues to infuse and strengthen the association, which had grown to number 5041 members by the year 2007.

This entry focuses on the recent history and the state of the organization and the profession. For a detailed review of AALL's founding and history, see the first edition of the *Encyclopedia of Library and Information Science*, which covers the period from AALL's founding to the late 1960s. For a detailed review of AALL at the turn of the new century, see the second edition of the *Encyclopedia of Library and Information Science*, or the chronology in the *AALL Directory and Handbook*, which is updated yearly.

AALL MISSION AND VISION

Since its founding in 1906 and later incorporation in 1935, AALL has been a leader in promoting the value of law libraries, fostering the profession of law librarianship, and providing leadership in the field of legal information and policy. Since 1990, AALL and law librarians have become even more vocal, more visible, and more effective in representing their needs and interests beyond the profession itself.

Members are AALL's core and set its priorities. The current 15-member staff handles administration and carries out the directives of the membership. William H. Jepson was appointed the first executive director in 1981, followed by Judith Genesen in 1989, Roger H. Parent in 1993, Susan E. Fox in 2003, and Kate Hagan in 2007.

AALL 2005–2010 Strategic Directions

In July 2005, the AALL Executive Board adopted a new strategic plan (called "Strategic Directions") for the years 2005–2010 at the Annual Meeting in San Antonio. These strategies for the future will strengthen AALL's core purpose and values and will give AALL the direction and flexibility needed to grow as an organization, while placing primary focus on members.

Core purpose of AALL

The American Association of Law Libraries strengthens the profession of law librarianship and supports the individual efforts of our members.

Core values of AALL

AALL values:

- Lifelong learning and intellectual growth.
- The role of the law librarian in a democratic society.
- Equitable and permanent access to legal information.
- Continuous improvement in the quality of justice.
- Community.

GOALS AND OBJECTIVES

Goal I: Leadership

Law librarians will be recognized and valued as the foremost leaders and experts in legal information, research, and technology.

Objectives:

- Provide tools to increase members' abilities to position themselves as essential to the mission of their organizations.
- Provide leadership training opportunities.
- Expand mentoring programs and opportunities.
- Increase AALL participation in organizations within the legal and library communities.

Goal II: Education

Law librarians will have the education and training they need to meet and leverage the challenges of the changing information environment.

Objectives:

- Expand the scope of educational offerings to meet the ever-changing needs of members.
- Develop partnerships to increase the range of educational offerings.
- Use a wide range of delivery means and opportunities to provide education beyond the Annual Meeting.
- Increase the number of library school programs for law librarianship and increase awareness of law librarianship as a profession.
- Increase the number and amount of grants and scholarships.

Goal III: Advocacy

Law librarians will influence the outcome of legal information, technology policy, and librarianship issues of concern to AALL members.

Objectives:

- Increase resources available for advocacy efforts.
- Continue to expand international role.
- Improve grassroots participation in advocacy efforts.

MEMBERSHIP AND STRUCTURE

A September 2007, tally of AALL's 5041 members showed a division into the following types of library categories: 36% (a total of 1826 members) worked in academic law libraries; 11% (578 members) in state, court, and county law libraries; 37% (1865) in private law firm

and corporate law libraries; and 15% (772) in other organizations.

The American Association of Law Libraries members worked for more than 2000 different institutions, including 1073 law firms, 233 law schools, 179 corporations, 200 state or municipal government agencies, 150 state or municipal courts, and 52 federal government agencies. Other employers included vendors, independent self-employed librarians, other public or academic libraries, and associations.

In 2007, AALL members' libraries had a total combined information budget—hard copy and electronic—of more than \$1.3 billion; the average information budget per library was \$1.1 million. Libraries were spending growing percentages of their budgets on electronic resources, varying considerably by library type: academic libraries, 18%; government, 20%; and private law firms, 62%.

SPECIAL INTEREST SECTIONS

The American Association of Law Libraries' special interest sections (SIS) help members focus on issues of personal interest or concern to their daily work. At a forum held in 2000, the leaders of the SISs defined themselves as "a self-selecting group of members with a common interest, which serves as a forum, contributes educational value, serves as a resource for expertise, advocates, and provides leadership group opportunities."

These SISs hold meetings, produce publications, and provide a vehicle for networking and the exchange of information. Individual memberships in SISs remained high through the years. For example, in December 2007, AALL's members held 7172 memberships in its SISs:

Academic Law Libraries: 1220
 Computing Services: 501
 Legal History and Rare Books: 243
 Legal Information Services to the Public: 313
 Foreign, Comparative, and International Law: 423
 Government Documents: 323
 Micrographics and Audiovisual: 82
 Online Bibliographic Services: 321
 Private Law Libraries: 1512
 Research Instruction and Patron Services: 800
 Social Responsibilities: 205
 State, Court, and County Law Libraries: 541
 Technical Services: 688

AALL Entries

In addition to the SISs, members early on recognized the value in allying along geographic lines. Some 31 entries now provide members a forum for their AALL and region-specific interests.

Atlanta Law Libraries Association
 Association of Law Libraries of Upstate New York
 Arizona Association of Law Libraries
 Chicago Association of Law Libraries
 Colorado Association of Law Libraries
 Dallas Association of Law Librarians
 Greater Philadelphia Law Library Association
 Houston Area Law Librarians
 Law Libraries Association of Alabama
 Law Library Association of Greater New York
 Law Library Association of Maryland
 Law Librarians Association of Wisconsin, Inc.
 Law Librarians of New England
 Law Librarians of Puget Sound
 Law Librarians Society of Washington, DC, Inc.
 Mid-America Association of Law Libraries
 Minnesota Association of Law Libraries
 Michigan Association of Law Libraries
 New Jersey Law Librarians Association
 New Orleans Association of Law Librarians
 Northern California Association of Law Libraries
 Ohio Regional Association of Law Libraries
 San Diego Area Law Libraries
 Southern California Association of Law Libraries
 Southeastern Entry of the American Association of Law
 Libraries
 South Florida Association of Law Libraries
 Southern New England Law Librarians Association
 Southwestern Association of Law Libraries
 Virginia Association of Law Libraries
 Western Pacific Entry of the American Association of
 Law Libraries
 Western Pennsylvania Law Library Association

AALLNET

Since the late 1990s, AALL's Web site, AALLNET, has served to foster the mission and Strategic Directions of the Association. The American Association of Law Libraries NET promotes law librarians, law librarianship, and the Association itself to as wide an audience as possible.

It is a valuable tool, providing members with archived information about the Association's past, up-to-date information about AALL and law librarianship, and information to help law librarians who wish to continue their professional education.

Through the years, AALLNET has continually evolved in order to provide its members with valuable tools, including:

- In 2004, the AALL general election was held electronically for the first time. This gave members the ability to electronically submit a ballot anytime of the day at anytime of the week during the election.

- In 2005, the same online election system was modified so that AALL entries and SIS may conduct their elections electronically.
- In 2006, AALLNET launched a calendar of events. Sustained by the contributions of AALL members, information about events pertaining to law librarianship can be found online.
- In 2007, audio and video recordings of professional development programs, which were the result of continuing professional education (CPE) grants, were made available in the Members Only Section.

FOSTERING MEMBER GROWTH

The American Association of Law Libraries is committed to building the profession of law librarianship in numerous ways, including providing financial aid for library school and law school education, and helping new professionals become successful through student memberships and mentoring programs.

CPE

The American Association of Law Libraries provides increasing support to the professional development of its members. In the fall of 2005, the Association held an Education Summit to connect AALL members who expected their Association to provide more opportunities for continuing education between AALL's Annual Meetings. This need expressed by members aligns with AALL's three Strategic Directions—leadership, education, and advocacy—the core service goals of AALL from 2005 to 2010. A number of initiatives grew out of the Education Summit.

In January 2006, AALLNET launched a calendar of events, which includes listings of professional education events throughout the country and abroad that are of interest to law librarians. Built largely by contributions of AALL members, the calendar lists upcoming and archived events that are sponsored by a wide variety of entities.

By May 2006, AALLNET included a Speakers Directory, which provides names of speakers suggested by AALL members. Searchable by either name or area of speaker expertise, this database showcases the expertise of AALL members and makes known the names of speakers who have presented to law librarian groups.

Eager to participate in providing continuing education tailored to meet the needs of law librarians, Michael Chiorazzi, director and professor of law at the University of Arizona College of Law Library, and Mark Estes, director of library services at Holme Roberts Owen LLP, quickly developed programs for AALL members. Chiorazzi and Estes received approval and funding for their proposals from the AALL Executive Board at its Spring 2006 meeting.

Longtime supporter of AALL professional education activities, BNA Inc., which had generously sponsored the Education Summit, agreed to largely fund Estes' program on law firm library management.

Then Vice President Sally Holterhoff formed the AALL CPE Committee. The stage was set to revitalize AALL's role in providing more high-quality professional education opportunities for law librarians.

The new approach to determining content for continuing education programs is to be member driven, and the CPE Committee's role is to work with staff to make these events happen as quickly and seamlessly as possible for everyone.

In 2007, the Association added new content and resources to AALLNET, the Association's Web site, including streaming media. Now posted as free, members-only educational resources are more than 40 video and audio programs, including *How to Use Competitive Intelligence to Win Clients*, *The Creative Conflict Resolution Toolbox*, and *The Future of Cataloging*.

Bringing select Annual Meeting content to members was also part of new effort to repackage and extend learning opportunities to members who could not attend the Annual Meeting.

These resources allow geographically-dispersed members to have access to online content. These resources also allow members to see and/or hear specific speakers and use them for a future program. The content serves as a springboard for education sessions. One example includes members who utilized one of the videos for staff training and discussion.

The American Association of Law Libraries continues to provide quality educational programs at the AALL Annual Meeting and Conference. Nearly 1700 registrants attended the 100th AALL Annual Meeting and Conference in New Orleans, July 14–17, 2007. The theme, "Rise to the Challenge," reflected both the challenges facing the host city in the aftermath of Hurricane Katrina and those currently faced by law librarians. Thanks to the hard work and flexibility of AALL staff and members, the Annual Meeting schedule provided a balance of educational programming, membership entity meetings, and networking time within a four-day time frame (one day shorter than previous Annual Meetings), beginning with the Opening Event on Saturday evening and concluding with the Closing Banquet on Tuesday night.

Presented in New Orleans were 66 conference programs and four workshops, which had been selected by the 2007 Annual Meeting Program Committee. These, plus 23 special interest section-sponsored programs, covered a wide range of topics.

Scholarships and Grants

Each year, AALL offers a number of different scholarships and grants to both students and practicing law

librarians to either complete their education or further continue it.

The American Association of Law Libraries has four different scholarship funds from which approximately 20 scholarships are given each year. These scholarships are funded by a combination of an AALL endowment and contributions from both individual members and legal publishers. These scholarships are given to students that have chosen law librarianship as their career to help with their education expenses.

The American Association of Law Libraries also awards more than 20 grants each year to attend that Annual Meeting and/or educational workshops. These grants are supported by both individual member contributions and donations from legal publishers. The AALL grant program was started in 1952. Since the inception, more than 1000 law librarians have been given funding assistance to attend the Annual Meeting and educational programs.

A CPE Grant Program has also been established by AALL. The Strategic Direction of education is to endure that the law librarians receive the education and training needed to meet and leverage the challenges of the changing information environment. The purpose of the grant program is to encourage program development and promote sharing among AALL entities. The grants program provides funding to AALL Headquarters, entries, SIS, member institutions, caucuses, and individual AALL members to assist in providing ongoing quality continuing education programming outside of the AALL Annual Meeting, which can be distributed to a wider audience.

New Members: Conference of Newer Librarians

Mentoring new members has been an Association priority. A program developed by the Mentoring Committee helps newer members—or those needing career guidance—establish personal contact with experienced law librarians, who act as resources and advisers on the profession and the Association. The Conference of Newer Librarians is now a standing committee and will conduct an annual program to take place at each AALL Annual Meeting.

Ethics and Diversity

The American Association of Law Libraries members recognize their professional roles in the broader legal and social environments.

In 1999, AALL's members endorsed updated "Ethical Principles" produced by the AALL Special Committee on Ethics, to replace the Association's prior "Code of Ethics." The principles offer standards for law librarians to follow when serving diverse clientele, building business relationships, and fulfilling their professional responsibilities.

A symposium on diversity is held annually, supporting AALL's commitment toward diversity in the profession. The sessions at each Annual Meeting examine law librarian's roles in providing legal information to all citizens, including cultural minority groups. The symposia help participants appreciate how ethnic, cultural, and lifestyle differences affect law librarianship, and provide guidance on how to address these issues in daily work.

AALL LEADERSHIP IN SHAPING THE LEGAL INFORMATION ENVIRONMENT

The American Association of Law Libraries continues to advance its unique role as a twenty-first century leader in the legal information arena. It provides the enhanced credibility that a national presence on many fronts can bring to both the Association and to its membership. Due to the impact of the rapid pace of technological change on libraries, as well as the opportunities and challenges of the digital age, AALL's policy work is among the top priorities of the Association.

AALL's Washington Affairs Office

The American Association of Law Libraries' Washington Affairs Office has become a driving force in policy debates affecting members and is a leader on information policy issues. Its staff adheres to the AALL Government Relations Policy approved in March 2001. Washington Affairs Representative Robert Oakley (director of the law library and professor of law, Georgetown University Law Center) was a national and international expert on copyright law until his untimely death in November 2007. The American Association of Law Libraries' Washington Affairs Office staff led the Association's efforts to ensure that law librarians' views are voiced and considered in the formation of state, national, and international policy, focusing on copyright and fair use, legal publishing, the digital information environment, and public access to government information.

The Washington Office actively represents member interests to executive, judicial, and legislative policy makers through formal comments and testimony. The staff also participates in important coalitions of information professionals, including the Library Copyright Alliance (the library community's united voice on copyright issues such as fair use and preservation) and OpenTheGovernment.org (a broad-based coalition that seeks to advance the public's right to know and to reduce secrecy in government). In addition, the Washington affairs representative serves as AALL's liaison to a number of government agencies and organizations.

The American Association of Law Libraries' Washington presence means that the Association can act quickly to advocate member interests as issues emerge, whether they

relate to legal publishing, legislative, or policy concerns. The office also alerts members to important federal and state issues, and encourages grassroots advocacy campaigns that involve members of AALL and its entries in promoting the Association's policies and the profession of law librarianship.

As a national leader in information policy, in 2003 AALL published the groundbreaking *State-by-State Report on Permanent Public Access to Electronic Government Information* that researched and reported what, if anything, state governments were doing to meet the enormous challenges of ensuring permanency and public accessibility of government information on the Web. This report raised national awareness and encouraged states to take steps to ensure permanent public access to electronic state government information. As a result, to date nine states have enacted legislation requiring permanent public access to their electronic government information.

In order to focus on an equally important requirement of the life cycle of electronic government information, in 2007 AALL published a second groundbreaking report, the *State-by-State Report on Authentication of Online Legal Resources*. It examined the results of a state survey that investigated whether government-hosted legal resources on the Web are *official* and capable of being considered *authentic*. In researching the question of how trustworthy state-level primary legal resources on the Web are, the report concluded that a significant number of state online resources are *official* but none are authenticated or afford ready authentication by standard methods. State online primary legal resource are, therefore, not sufficiently trustworthy.

The report also found that many states are discontinuing the print versions of legal sources, especially administrative materials, and substituting online versions that are neither official nor authenticated. The American Association of Law Libraries' *Authentication Report* raised concerns that must be addressed by all levels of government, both as high-level policy decisions and as technical issues.

The American Association of Law Libraries convened a National Summit on Authentication of Digital Legal Information in Chicago in April 2007. Approximately 50 delegates from the judiciary, legal community, state governments, and interested organizations, all of whom share AALL's concern about ensuring the authenticity of digital legal information, participated in discussions about the *Authentication Report* findings. The American Association of Law Libraries continues to work with these new allies to explore legal and technological solutions to ensure that state online legal resources are authenticated and trustworthy.

The following illustrate the broad range of policy issues addressed by AALL. The Association:

Advocated for adequate funding for the U.S. Government Printing Office (GPO) and the National

Archives and Records Administration to enable these agencies to meet the challenges of the digital age in providing access to and preserving electronic federal government information;

Promoted public access to government information through the Federal Depository Library Program and GPOs Federal Digital System that will bring the program into the twenty-first century, particularly in regards to digital authentication;

Collaborated with other library associations to advocate for balance in federal copyright law as a member of the Library Copyright Alliance;

Participated in filing several amicus briefs in *Greenberg v. National Geographic Society*, a case that alleged copyright infringement by National Geographic Society due to the publication of 100 years of past issues of its magazine on CD; AALL believed that digitizing past issues of the magazine is a permitted revision of the collective works;

Participated in a coalition to promote openness in government and fight secrecy, including through legislation such as the OPEN Government Act of 2007 (P.L. 110–175);

Worked with our entries to engage them in our advocacy work and built a successful member grassroots advocacy program that is critical to our legislative and policy successes.

UNIVERSAL CITATION GUIDE

In 1995, the Task Force on Citation Formats issued its report addressing the controversial issue of vendor- and medium-neutral citations to legal authorities. At a special meeting in July, the executive board adopted the report's recommendations regarding public domain case citation form.

The American Association of Law Libraries became the first national organization to recommend a new standard for citing primary law, case, constitution, statutory, and administrative law in response to member expectations for vendor-neutral citations and the increasing use of electronic information sources. The new format—using standardized abbreviations and other detailed specifications—was published in AALL's *Universal Citation Guide* in 1999. This publication, culminating three years' work by AALL's Committee on Citation Formats, was published by the State Bar of Wisconsin. The work allows users to cite court opinions as issued, regardless of the format in which they appear. The American Bar Association Special Committee on Citation Issues endorsed AALL's citation format and recommended that it become a national standard. In the late 1990s, several states adopted public domain citation for their bodies of case law and recognized AALL's leadership. As of January 2008, 15 states had adopted a medium and vendor-neutral citation system.

A second edition of the guide, published and distributed by William S. Hein & Co., Inc., was released in 2004. The new edition updates the material presented in the original guide.

PUBLISHER RELATIONS

The American Association of Law Libraries' advocacy work with legal publishers is headed up by the Committee on Relations with Information Vendors (CRIV). This committee facilitates communication among information vendors, legal publishers, and Association members. It monitors legal publishing developments, presents the annual new product award, and investigates complaints from members.

The CRIV Sheet, the committee's newsletter that comes out three times per year, tracks industry developments and presents substantive articles about complaint resolutions and legal publishing issues. On its Web site, the CRIV lists CRIV Tools, such as checklists, sample forms, or sample letters, to aid acquisitions and serials librarians in the performance of routine tasks or to assist them in solving commonly occurring problems.

The committee also conducts periodic site visits to legal publishers to learn more about their plans and operations and to represent the interests and concerns of members. In recent years, the CRIV has visited Commerce Clearing House, Inc. (CCH), Lexis Publishing, William S. Hein and Company, Aspen Publishing, West Group, and the Bureau of National Affairs, Inc. Each year at the Association's Annual Meeting, the CRIV sponsors a forum for legal publishing leaders and members.

The CRIV gained considerable importance in the Association during the 1990s, as information vendors increasingly merged to form megapublishers. In 1999–2000, AALL created a Special Committee on Fair Business Practices to prepare guidelines to replace the recently expired Federal Trade Commission's *Guides for the Law Book Industry*. In 2002, the AALL Executive Board approved the *AALL Guide to Fair Business Practices for Legal Publishers* and created a Fair Business Practices Implementation Task Force. The task force steered the distribution and promotion of the new guide as the accepted standard in the industry and monitored its ongoing interpretation, revision, and evaluation. A second edition of the guide was published and distributed to AALL members in 2007.

The *AALL Guide to Fair Business Practices for Legal Publishers* describes standards for the business practices of publishers that most directly affect law librarians and covers the full range of their interactions, from advertising and solicitation to purchases and customer support. It consists of five general principles, each of which is accompanied by subprinciples and examples. It does not explicitly require any methods of operation because it is not intended to interfere with particular business models. As

indicated in the introduction, the guide “is designed to allow legal publishers to take advantage of evolving technology and to foster innovation while adhering to principled business practices that will ensure fair and appropriate treatment for customers.”

In 2002, recognizing the growing role of license agreements in law library acquisitions, AALL created a Special Committee on Licensing Principles for Electronic Resources. The committee was charged to review the Principles for Licensing Electronic Resources endorsed by the AALL Executive Board in July 1997 and revise and update them as needed.

In 2004, the AALL Executive Board approved the new Principles for Licensing Electronic Resources. The revised principles provide expanded guidance in the areas of access, interlibrary loan, archiving, usage statistics, and dispute resolution. The organization of the document facilitates its use as a checklist for reviewing license agreements, so it is a valuable tool for librarians and vendors alike. The principles are not intended to dictate specific licensing terms, but rather are intended to serve as guidelines and best practices for parties involved in the licensing process.

ENCOURAGING VALUED PARTNERSHIPS

The American Association of Law Libraries’ many accomplishments are the result of collaborative efforts with other sister associations and of activities generously supported by legal publishers. These partners work with AALL to advance the interest of law libraries in many important areas.

In July 2008, AALL will again cosponsor a Joint Study Institute, “Harmonization and Confrontation: Integrating Foreign and International Law into the American Legal System” to be held at Georgetown University Law School. The American Association of Law Libraries joins four other law library associations, the Australian Law Librarians’ Association, British and Irish Association of Law Librarians, Canadian Association of Law Libraries, and the New Zealand Law Librarians’ Association, in sponsoring the event.

The American Association of Law Libraries also provides funds for designated leaders or the executive director to represent the Association at other national organizations that share common objectives. This presence leads to greater law librarian involvement in the library and legal communities, such as consulting on library standards and sponsoring joint educational programs. The AALL supports involvement with such organizations as

American Bar Association
American Library Association

Association for Library and Information Science Education
Association of American Law Schools
Association of Legal Administrators
British and Irish Association of Law Librarians
Canadian Association of Law Libraries
Center for Computer-Assisted Legal Instruction
Federal Depository Library Council
Friends of the Law Library of Congress
Institute of Museum and Library Services
International Association of Law Libraries
International Federation of Library Associations
Legal Information Preservation Alliance
Legal Marketing Association
Mayflower II Conference
National Center for State Courts
National Commission on Libraries and Information Science
National Equal Justice Library
National Information Standards Organization
Self Represented Litigation Network
Special Libraries Association
Special Libraries Association Legal Division

PUBLICATIONS

AALL Spectrum

In September 1996, the AALL launched its new magazine, *AALL Spectrum*, which is now issued nine times each year, monthly except for January and August with a combined September/October. The full-color magazine replaced the former newsletter and positioned the Association toward new editorial directions. It focuses on broad issues of interest to members and others in the larger legal and library communities. It also covers Association news and legislative reports from the Washington Affairs Office.

AALL Spectrum includes three regular inserts. *The CRIV Sheet* is written and coordinated by the AALL CRIV three times per year to provide general information on vendor/library relations and to foster a constructive dialogue between the legal publishing/legal information industry and the law library community. *Members’ Briefing* also appears three times per year and is written by member subject experts who summarize important issues and present practical ideas for handling them in the workplace. Lastly, each June issue includes a city survival guide with important travel information for AALL members attending the Annual Meeting. Other regular features of *AALL Spectrum* include practice-oriented columns on “Practicing Law Librarianship,” “Public Relations,” and “Teaching Legal Research,” as well as popular interactive departments like “Member to Member” and “Views from You.”

Law Library Journal

Law Library Journal (LLJ) has been the official publication of the association since it was first published in 1908 in a combined format with the *Index to Legal Periodicals*. Although the *Index to Legal Periodicals* has long since become a separate publication, the *LLJ* has been continuously published on a quarterly basis ever since. As the premier publication in the law library profession, it features scholarly articles on law, legal materials, and librarianship, as well as practice-oriented articles, book reviews, AALL Executive Board election information, and proceedings of the business sessions of the AALL Annual Meeting. In addition to its traditional print format, *LLJ* is currently available in a variety of electronic sources, including four online databases. In recent years, the *LLJ* has had three editors: Richard A. Danner, volumes 77–86, 1984–1994; Frank G. Houdek, volumes 87–99, 1995–2007; and Janet Sinder, volumes 100–present, 2008–present. The editor is assisted by the *Law Library Journal/AALL Spectrum* Editorial Board and Advisory Committee.

AALL Directory and Handbook

Published annually, the *AALL Directory and Handbook* is distributed to all dues-paying members of the Association. It provides an alphabetical listing of all members, as well as listings of all libraries where members are employed. The handbook section contains Association policies and guidelines, committee charges and rosters, and other pertinent Association information. The directory was first published as *List of Law Libraries in the United States and Canada* in 1940 for the Association through the courtesy of CCH. It has been continuously published by CCH, now Wolters Kluwer Law & Business, ever since.

AALL Biennial Salary Survey

The American Association of Law Libraries is a definitive source for information and statistics about the salaries paid to law librarians and about trends in law library expenditures and services. Every 2 years, since 1995, AALL has gathered meaningful information about members' libraries through the *AALL Biennial Salary Survey and Organizational Characteristics*, which provides such statistics as ratios of attorneys to librarians and expenditures for hard copy versus electronic information. The survey's results help librarians manage their own libraries and leverage AALL's influence with publishers and opinion leaders in the legal community.

Index to Foreign Legal Periodicals

The *Index to Foreign Legal Periodicals* is a multilingual index to articles and book reviews appearing in approximately 540 journals and annuals published worldwide. It

provides a subject, author, and geographic approach to comparative and foreign law and the law of all jurisdictions throughout the world, except the United States, United Kingdom, Canada, and Australia. It also provides in-depth coverage of public and private international law.

In addition to periodical publications, the *Index to Foreign Legal Periodicals* analyses about 80 individually published collections of legal essays, Festschriften, Melanges, and congress reports each year. Beginning in 1960, the *Index to Foreign Legal Periodicals* was first published by the Institute of Advanced Legal Studies of the University of London. In 1984, the *Index to Foreign Legal Periodicals* moved to its present location in the Garret W. McEnerney Law Library at Boalt Hall School of Law at the University of California, Berkeley, where it utilizes the library's international and foreign law collection, the largest and most comprehensive in the western United States.

The *Index to Foreign Legal Periodicals* is published quarterly with an annual bound cumulation by the University of California Press. Each single issue consists of approximately 2600 articles and 300 book reviews. In addition to the hard bound volume, the index is also available electronically via Ovid Technologies. Ovid offers complete online coverage of the index from 1985 to the present.

Subscription information and a complete list of all serials currently indexed, as well as links to the index's electronic publishing partners, are available at the Index Web site (<http://www.law.berkeley.edu/library/iflp>).

AALL Price Index for Legal Publications

The *AALL Price Index for Legal Publications* is an annual table-based index that documents the mean cost of titles and percentage increases over previous years for monographs, serial publications, legal periodicals, looseleaf services, commercially-published court reporters, and legal continuations. The *Price Index* concludes with an appendix of all products and legal vendors that were surveyed. Pricing information is compiled each year by the AALL Price Index for Legal Publications Committee, which is comprised of seven AALL members.

AALL Publications Series

This series of monographs, sponsored by the Association, began in 1960 with the assistance of the Fred B. Rothman Company as publisher. It continues today in partnership with W.S. Hein and Company Inc. as publisher. It now includes more than 60 individual titles and contains a wealth of information for law librarians, including *Practicing Reference: Thoughts for Librarians and Legal Researchers*, *United States Tribal Courts Directory*, and *Werner's Manual for Prison Law Libraries*. Potential manuscripts for the series are reviewed and evaluated by the AALL Publications Committee, which manages the series.

American Association of Museums (AAM)

Elizabeth E. Merritt

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Abstract

Founded in 1906, American Association of Museums (AAM) is an organization whose mission is “to enhance the value of museums to their communities through leadership, advocacy and service.” It is the only organization representing the entire scope of museums and the professionals and nonpaid staff who work for and with museums. As of 2008, it represents more than 15,000 individual museum professionals and volunteers, 3000 institutions, and 300 corporate members.

HISTORY

The American Association of Museums (AAM) was organized in 1906 to develop standards and best practices for museums, gather and share knowledge, and provide advocacy on issues of concern to the entire museum community. AAM is the only organization representing the entire scope of museums and the professionals and nonpaid staff who work for and with museums. As of 2008, it represents more than 15,000 individual museum professionals and volunteers, 3000 institutions and 300 corporate members. Individual members span the range of museum occupations, including directors, curators, registrars, educators, exhibit designers, public relations officers, development officers, security managers, trustees, and volunteers. Every type of museum is represented, including art, history, science, military, maritime, and youth museums, as well as aquariums, zoos, botanical gardens, arboretums, historic sites, and science and technology centers.

The association was established at a meeting of representatives of 21 U.S. museums held at the American Museum of Natural History on May 15, 1906. It filed for incorporation in 1920, and in 1923 established a headquarters in Washington, D.C., at the Smithsonian Castle. Notable accomplishments include

- 1925: Publication of *Code of Ethics for Museum Workers*.
- 1930: Publication of the comprehensive *Museums in America*.
- 1968: AAM accreditation committee chartered.
- 1969: *America's Museums: The Belmont Report* assessed the future and the needs of American museums, developing a solid case for federal support.
- 1970: AAM designates the first accredited museums.
- 1973: *Museum Studies: A Curriculum Guide for Universities and Museums* offers guidelines and minimum standards for museum studies programs.

- 1980: Museum Assessment Program (MAP) begins.
- 1994: *Museum Counts*, the first comprehensive survey of U.S. museum finances and practice.
- 1992: *Excellence and Equity*, a landmark report outlining museums' educational and public service roles.
- 1995: *Museums in the Life of a City: Strategies for Community Partnerships*, which laid the groundwork for a more expansive role for museums in community service.
- 2002: *Mastering Civic Engagement: A Challenge to Museums*, a call to action to museums to realize fully their potential as active, visible players in the lives of their communities.
- 2006: To mark AAM's centennial, the publication of *Riches, Rival and Radicals: 100 Years of Museums in America*, a history of the evolution of museums in the United States.
- 2008: *National Standards and Best Practices for U.S. Museums*, the current, field-wide operating standards in all areas of museum operations, published for the first time.
- 2009: The founding of AAM's Center for the Future of Museums, the field's think tank and forum for discussions on how best to prepare for and shape the future of the nation's museums.

STRUCTURE AND GOVERNANCE

AAM is a 501(c) 3 tax-exempt organization whose mission is “to enhance the value of museums to their communities through leadership, advocacy and service.” It is governed by a board of directors consisting of 3 officers of the association (chair, vice-chair, and immediate past chair) and 18 board members-at-large elected by the membership. Its bylaws establish various committees, notably the International Council of Museums-United

States (ICOM-US), which helps the association represent museums within the United States to ICOM as well as ICOM's interests within the United States. The International Council of Museums (ICOM) is dedicated to improving and advancing the world's museums and the museum profession as well as preserving cultural heritage while respecting the culture from which it comes. To join ICOM, museum professionals within the United States join their national committee, ICOM-US.

AAM actively seeks the opinions and counsel of its members and is advised by a variety of committees and associations throughout the museum field. Per the association's bylaws, these advisers include three groups. The Standing Professional Committees, open to AAM members and representing specific disciplines such as curators, development, membership, education, media and technology, PR, and marketing and small museum administrators. The Council of Regional Associations informs AAM of policy deliberations that may have an impact in the museum field; it comprises the New England Museum Association, Mid-Atlantic Association of Museums, Southeastern Museums Conference, Association of Midwest Museums, Mountain-Plains Museums Association, and Western Museums Association. The Council of Affiliates, made up of associations of professional categories such as state and local history, conservation, museum stores, volunteers, computers, and trustees, in addition to discipline-specific museum associations representing, for example, zoo, aquariums, colleges, children, science, and Jewish and African American history and culture.

In addition, AAM has created Professional Interest Committees, which enable people and institutions with common interests or needs to develop professional associations. They are open to AAM members. Committee interests range from those of Asian Pacific Americans, Latinos, Native Americans, and gays and lesbians to professionals in the areas of historic house museums, traveling exhibitions, and visitor services.

ACTIVITIES AND PRIORITIES

The association also presents forums for museum professionals to share information and experience. Principal among these is the annual meeting and MuseumExpo™, open to participants from around the world. It is the world's largest conference of museum professionals, offering educational opportunities through its sessions and events at local museums as well as job-hunting forums and the MuseumExpo's extensive showcase of museum products and services.

A key AAM priority is advocating for the value of museums, especially before Congress and within the federal government. The association addresses legislative and regulatory issues that affect museums, particularly increased

funding, and strives to keep advocates informed about issues in Washington through regular communications to AAM's Museum Advocacy Team network and its member newsletter, *Aviso*.

AAM's projects and initiatives serve as a venue and catalyst for new ideas to address issues facing the field, resulting in a variety of products and services. Examples include International Museum Day, Museums and Diversity, the Nazi-Era Provenance Internet Portal, and Small Museums initiatives, and collaborations such as the Non-Profit Listening Post Project; Museums, Archives and Libraries and Partners in Tourism. AAM also seeks to serve new audiences by identifying groups such as Emerging Museum Professionals—those in the profession for less than 10 years. The association offers "EMPs" person-to-person and online networking and mentoring, fellowships, blogs, events, and other resources to guide their career path.

AAM provides a number of services to the field at large. Many are available to museums that are not members. These include the following:

The Accreditation Program serves as the field's primary vehicle for quality assurance and self-regulation, formally recognizing museums' commitment to excellence, accountability, high professional standards, and continued institutional improvement. It accomplishes this by employing a standardized process of self-study and peer review to assess how well each museum achieves its stated mission and goals and meets the standards and best practices generally accepted in the museum field. Any museum can apply for accreditation. Reaccreditation is required after 10 years.

The Museum Assessment Program (MAP), established and administered in collaboration with the Institute of Museum and Library Services, helps maintain and improve operations through a confidential, consultative process, providing guidance in meeting priorities and goals and understanding how a museum compares to standards and best practices. The four categories of assessment are institutional, collections management, public dimension, and governance.

AAM's online bookstore provides publications on a full range of topics relevant to the field. A notable recent example is *AAM Standards and Best Practices for U.S. Museums*, which spells out voluntary national standards and best practices—benchmarks against which museums measure their own performance. A key goal is to help policy makers, media, philanthropic organizations, donors, and members of the public to assess museums' achievements.

The Professional Education Program offers tools for finding solutions to some of the most critical issues in the field. Seminars and workshops are held throughout the year across the United States, in addition to webinars and Web conference programs, addressing the needs of museum professionals at all levels of their careers—emerging, mid-level, executive, and beyond. Topics address exhibitions,

and legal issues, visitor experience, executive leadership, technology, interpretation, and historical administration.

SERVICES TO MEMBERS

Beyond its service to the entire field, AAM offers its members the following benefits: It helps them save money, become more influential in their communities and profession, and better serve their public. Its resources include free subscriptions to publications; discounts on books and annual meeting registration, access to peer groups, full access to jobHQ and the Information Center, professional education seminars, books, free and discounted admission to participating member museums and affinity partners; and more. Advantages include the following.

JobHQ allows members to tailor their job searches, receive e-mail alerts when new jobs are posted and post resumes. Employers can list jobs 24 hr a day, track and measure online recruitment activity, and search a database of highly qualified candidates.

AAM's publications department produces members-only benefits such as *Museum*, an award-winning, bimonthly magazine; *Aviso*, a monthly e-newsletter that reports on museums in the news, federal legislation affecting museums, upcoming seminars and workshops, federal grant deadlines and AAM activities and services; bookstore discounts; and Web Exclusives: special online articles and extras, including Practically Speaking (hands-on information); "Day in the Life," first-hand accounts on how active professionals do their jobs; and audio clips of interviews and excerpts.

The Information Center offers fast, easy access to extensive online resources to AAM members and staff of AAM member museums: fact sheets, glossaries, and hundreds of links that have been individually reviewed and described for their usefulness to museums. Staff of AAM

member museums also receive confidential, customized reference services within two business days, as well as access to more than 900 sample documents in more than 50 categories, from a variety of types and sizes of museums.

The association's awards and competitions celebrate excellence in the museum field. Two popular competitions open to museum staff around the world are the Publications Competition (Pub Comp), honoring 16 categories from books, catalogs and posters to marketing materials and annual reports, and the Brooking Paper on Creativity in Museums. Other awards include the Nancy Hanks Memorial Award for Professional Excellence, the Award for Distinguished Service to Museums, and more. The Museums and Community Collaborations Abroad (MCCA) is a new grant program designed to strengthen international connections through innovative, museum-based exchanges; funding is provided through a partnership with the U.S. Department of State Bureau of Educational and Cultural Affairs. AAM also provides fellowships for attendance at its annual meeting and professional education seminars and webinars.

CONCLUSION

As AAM embarks on its second century, it is guided by new leadership, structure, and vision—for itself and the field at large. Its new Strategic Framework contains ideas and goals that will drive the association's behavior and activities into the future and guide decisions. The upcoming Center for the Future of Museums will bring in thought leaders from a variety of professions to identify and shape new directions. AAM welcomes input from all who care about museums and their critical role in American society. For additional information or to contact the association, please visit the AAM Web site at <http://www.aam-us.org>.

American Association of School Librarians (AASL)

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Abstract

The American Association of School Librarians (AASL), a type-of-library division of the American Library Association (ALA), serves the needs of over 10,000 school library media specialists. Its mission is to advocate excellence, facilitate change, and develop leaders in the school library media field. This entry discusses the history of AASL, describes its organization and governance, and highlights its major accomplishment.

INTRODUCTION

The American Association of School Librarians (AASL), a type-of-library division of the American Library Association (ALA), is interested in the general improvement and extension of school library services for children and young people.

The American Association of School Librarians has specific responsibility for: planning of programs of study and services for the improvement and extension of library services in elementary and secondary schools as a means of strengthening the educational program; evaluation, selection, interpretation and utilization of media as it is used in the context of the school library program; stimulation of continuous study and research in the school library media field and to establish criteria of evaluation; synthesis of the activities of all units of the American Library Association in the areas of mutual concern; representation and interpretation of the need for the function of school libraries to other educational and lay groups; stimulation of professional growth, improvement of the status of school librarians, and encouragement of participation by members in appropriate type-of-activity divisions; conduct activities and projects for improvement and extension of service in the school library media center when such projects are beyond the scope of type-of-activity divisions, after specific approval by the ALA Council.^[1]

DESCRIPTION

Vision

The American Association of School Librarians is

- A proactive organization that addresses issues, anticipates trends, and sets the agenda for the profession.

- An advocate for the indispensable role of school library media programs with school library media specialists, for best practices in school librarianship, and for the core values and ethics of the library profession.
- An open, friendly, welcoming organization that embraces cultural and ethnic diversity.
- An inclusive professional home for all school library media specialists and a partner in mutual interests with educators, technologists, researchers, vendors, and other librarians.
- An essential resource for school library media specialists seeking professional development, leadership opportunities, communication with peers, and the most current information, research, and theory in the field.
- A flexible, responsive organization that models effective management practices.^[2]

Mission

The mission of the American Association of School Librarians is to advocate excellence, facilitate change, and develop leaders in the school library media field.

Goals

AASL works to ensure that all members of the school library media field collaborate to

- Provide leadership in the total education program.
- Participate as active partners in the teaching/learning process.
- Connect learners with ideas and information.
- Prepare students for lifelong learning, informed decision-making, a love of reading, and the use of information technologies.^[3]

Values

AASL will

- Make a difference for members of the field/profession by addressing the important issues.
- Have a national presence and a national identity.
- Encourage diversity in its membership.
- Be organized to clearly address the identified essential functions.
- Have a structure to allow members to be represented in the decision-making process.
- Provide involvement opportunities that will be varied and geographically dispersed.
- Be fast, focused, friendly, flexible, and fun.^[4]

EARLY BEGINNINGS

Although the formation of the AASL can be traced back to the ALA Midwinter Meeting in 1914, it did not achieve division status until 1951. In 1914, the Normal and High School Librarians Roundtable petitioned the ALA Council to form a school libraries section. The petition was granted and the section held its first meeting in June of 1915 and elected Mary E. Hall as its president. Two other groups outside the ALA were also interested in promoting school libraries. The National Council of Teachers of English had a Library Section from 1913 until 1919. In July 1896, the National Education Association (NEA) established a Library Department, and, in September of that same year, the ALA Executive Board appointed the Committee on Cooperation with the NEA to foster cooperative efforts with the NEA. However, the school library group affiliated with the ALA became the sole national professional association for school librarians when the Committee on Cooperation with NEA evolved into the School Libraries Committee, which existed from 1931 until 1935. The School Libraries Committee merged with the School Librarians Section in December 1935. The School Libraries Section became one of two sections within the Division of Libraries for Children and Young People in 1941 and changed its name to the American Association of School Librarians in 1944. In 1947, the number of sections within the Division of Libraries for Children and Young People was increased to three and now consisted of the Children's Library Association, Young People's Reading Round Table, and the AASL. In 1951, the AASL became a separate division of ALA.^[5] Margaret K. Walraven was elected the first president of the AASL as a division of the American Library Association and Mildred Batchelder became the first executive secretary of the association.^[6]

ORGANIZATION AND GOVERNANCE

Board of Directors

The policy-making body of the AASL is its board of directors, which meets at the ALA Midwinter Meeting and Annual Conference. The officers of the association are president, vice-president/president elect, treasurer, and immediate past president. Members of the board are the division officers, a representative of each section, and the AASL representative to the ALA Council, regional directors chosen from nine geographical regions, two members at large, and the executive director. Board members elected from the geographical regions are elected for a 4-year term. They serve 2 years as members of the Executive Committee of the Affiliate Assembly and are designated observers of the AASL Board of Directors. During the second 2 years of their term, they are voting members of the AASL board. The association's executive committee consists of the officers, the division representative to the ALA Council, one member elected by the board of directors, and the executive director.

Executive Committee

The executive committee of the AASL consists of the president, president-elect, and treasurer, immediate past president, the AASL division councilor and one member elected on an annual basis by the board of directors. The executive director serves as an *ex-officio* nonvoting member. The executive committee acts as the budget committee of the association and is restricted to acting on policy and fiscal issues requiring action between meetings of the board.^[7]

Affiliate Assembly

The Affiliate Assembly is a more formalized version of the old State Assembly, which had its origins in the AASL Council. The council originated with the practice Ruth Ersted began during her presidency in 1947 and was continued by Frances Henne in 1948–1949. They had invited state leaders to attend AASL Executive Board meetings to establish a forum to communicate with the state leaders and get feedback from them.^[6] The assembly is composed of two representatives from state or regional school library media associations affiliated with the AASL. It was established to provide a mechanism for the affiliates to communicate the concerns of their members to the AASL Board of Directors and to report the actions of AASL to their members. To be eligible for affiliation, the president of an organization must be a member of AASL and 25 members or 10% of the association members, whichever is smaller, must also be members of AASL. The assembly

meets once a year at the ALA Annual Conference to conduct business and holds a caucus at the ALA Midwinter Meeting for the leaders of the affiliates to discuss mutual problems or attend training sessions to improve the leadership skills of the affiliate representatives. The assembly has an executive committee that meets at the ALA Midwinter Meeting and Annual Meeting and consists of its officers and the regional directors-elect.^[8]

Sections

The AASL Bylaws provide for the formation of sections, which consist of at least 25 members who represent a distinct special field of activity within the profession. Each section has a chair, a chair-elect, a secretary, and a representative to the AASL Board of Directors. Currently, there are three sections.

The Independent Schools Section provides a means for the discussion of and action on the problems relating to all phases of nonpublic school librarianship.

The Supervisors Section provides a means for discussion of and action on the problems relating to all phases of school library supervision.

The Educator of School Library Media Specialists, whose purpose is to exchange ideas, review and study curricula, and develop research activities for educators in colleges and universities whose programs focus on school library media education and training.^[8]

Committees

The programs of the association are conducted by its standing committees, special committees, and task forces. Standing committees are established to carry on the continuing work of the association. The AASL bylaws provide for three standing committees: budget, nominations, and bylaws. The president may establish additional standing or special committees or task forces at any time with the approval of the board of directors. Special committees are established for a 2-year term to deal with a specific issue. A task force is established with a specific charge to study a specific issue and recommend solutions to the board of directors. A task force exists until it has completed its charge or is dismissed by the board of directors. Currently, there are 38 standing and special committees and three task forces.^[7]

PUBLICATIONS

AASL publishes one print journal, *Knowledge Quest* (KQ), one electronic journal *School Library Media Research*, and an electronic newsletter, *AASL Hotlinks*. Each journal has an editor appointed by the president with

the consent of the board of directors and an advisory board consisting of members of the association.

Knowledge Quest, published bimonthly September through June, is devoted to offering substantive information to assist building-level library media specialists, supervisors, library educators, and other decision makers concerned with the development of school library media programs and services. Articles address the integration of theory and practice in school librarianship and new developments in education, learning theory, and relevant disciplines. *Knowledge Quest* is mailed to all members and is available to nonmembers by subscription.

Provided at no cost, *KQ on the Web* (<http://www.ala.org/aasl/kqweb/>), expands *Knowledge Quest* via the Internet. It contains "KQ Extra" items supporting one feature article and columns published in *Knowledge Quest*. These Web-only items are referenced within the relevant print article or column and direct the reader to the online content. Abstracts of feature articles and information on becoming a member of AASL or subscribing to *Knowledge Quest* are also provided.^[9]

School Library Media Research (<http://www.ala.org/aasl/SLMR/>), a refereed research journal published electronically, is the successor to *School Library Media Quarterly Online*. The purpose of *School Library Media Research* is to promote and publish high-quality original research concerning the management, implementation, and evaluation of school library media programs. The journal also emphasizes research on instructional theory, teaching methods, and critical issues relevant to school library media. *School Library Media Research* is currently available at no charge.^[10]

AASL Hotlinks is the text-only monthly e-mail newsletter of the AASL. *AASL Hotlinks* is primarily composed of brief summaries with links to more in-depth content, and includes previews of upcoming association activities and continuing education programs, news from AASL and all of ALA, valuable Web resources, highlights of new products and services, summaries of new articles from AASL's print and online journals. This text-based newsletter is sent to AASL members with valid e-mail addresses on file in the ALA member database. Additional "pass along" distribution occurs through AASL members, who are encouraged to share each issue with colleagues and administrators in their school and district, and AASL's state and regional affiliate organizations, which can redistribute the newsletter to their own members.^[11]

In addition to these two journals, AASL publishes pamphlets, brochures, small monographs, and resource guides designed to assist school library media specialists in establishing and operating school library media programs. There is a nominal charge for some of these publications, but others are available at no charge on the AASL home page (<http://www.ala.org/aasl>).

AWARDS, GRANTS, AND SCHOLARSHIPS

Generous contributions made to AASL by a number of sponsors enable AASL to fund the following awards, grants, and scholarships.

AASL Collaborative School Library Media Award

Established in 2000, the \$2500 award, sponsored by Highsmith, Inc. recognizes and hopes to encourage collaboration and partnerships between school library media specialists and teachers in meeting educational goals outlined in *Information Power: Building Partnerships for Learning*^[12] through joint planning of a program, unit, or event in support of the curriculum and using media center resources. Applicants must be AASL personal members.

ABC-CLIO Leadership Grant

Established in 1986, the grant, up to \$1750 donated by ABC-CLIO, is given to school library media associations that are AASL affiliates for planning and implementing leadership programs at the state, regional, or local levels.

Beyond Words: Dollar General School Library Relief Fund

Dollar General, in collaboration with the American Library Association (ALA), the American Association of School Librarians (AASL) and the National Education Association (NEA), sponsors the school library disaster relief fund for public school libraries in the states served by Dollar General. The fund will provide grants of \$5,000–\$15,000 to public schools whose school library program has been affected by a natural disaster (tornado, earthquake, hurricane, flood, etc.). Grants are to replace or supplement books, media, and/or library equipment in the school library setting.

Distinguished School Administrators Award

Established in 1985, the \$2000 award sponsored by ProQuest, honors a school administrator who has made worthy contributions to the operations of an exemplary school library media center and to advancing the role the school library media center in the educational program. Nominations must be made by AASL personal members.

Distinguished Service Award

Established in 1978, the \$3000 award donated by Baker and Taylor recognizes an individual member of the library profession who has, over a significant period of time, made an outstanding national contribution to school

librarianship and school library development. Nominations must be made by AASL personal members.

Frances Henne Award

Established in 1986, the \$1250 award sponsored by the Greenwood Publishing Group recognizes a school library media specialist with 5 years or less experience in the profession who demonstrates leadership qualities with students, teachers, and administrators to attend an AASL conference or ALA Annual Conference for the first time. Applicants must be AASL personal members.

Information Technology Pathfinder Award

Established in 1985 as the Microcomputer in the Media Center Award, this award of \$1000 to the school library media specialist and \$500 to the library is sponsored by the Follett Software Company. The award recognizes a school library media specialist who demonstrates vision and leadership through the use of technology. The award is given in two categories—elementary (K–6) and secondary.^[7–12] Applicants must be AASL personal members.

Innovative Reading Grant

Established in 2006, the \$2500 grant sponsored by Capstone Publishers supports the planning and implementation of a unique and innovative program for children, which motivates and encourages reading, especially struggling readers.

Intellectual Freedom Award

Established in 1982, the award, \$2000 to the recipient and \$1000 to the media center of the recipient's choice, is sponsored by ProQuest and recognizes a personal member of AASL who has upheld the principles of intellectual freedom. Applicants must be AASL personal members.

National School Library Media Program of the Year Award

Established in 1963, the award, \$10,000 (\$30,000 total) in three categories, sponsored by Follett Library Resources, recognizes school districts and single schools for exemplary school library media programs that are fully integrated into the school's curriculum. Winners receive a crystal obelisk and \$10,000 each, one district award and two single schools.

President's Crystal Apple Award

Established in 1992, the crystal apple award is given at the discretion of the AASL president to an individual or group

who has had significant impact on school libraries and students.

School Librarian's Workshop Scholarship

The scholarship, \$3000 sponsored by Jay W. Toor, president, Library Learning Resources, recognizes a full-time student preparing to become a school library media specialist at the preschool, elementary, or secondary level. The recipient must pursue graduate level education in an ALA-accredited library school program or in a school library media program that meets the ALA curriculum guidelines for the National Council for Accreditation of Teacher Education.^[13]

CONFERENCES AND EVENTS

National Conference and Exhibition

The first AASL national conference was held at the Commonwealth Convention Center in Louisville, Kentucky, in 1980. The daunting task of planning the first conference was undertaken by Rebecca Bingham, a former president of AASL and director of Library Media Services for Jefferson County (Kentucky) Public Schools, as chairperson of the conference planning committee. To bring programs and commercial exhibits closer to its members, AASL has held a national conference in a different geographical region every 2 years since that first conference. The number of attendees, the scope of the programs, and the number of exhibits have increased with each conference.

Regional Institutes

AASL licenses regional institutes to organizations who pay AASL a fee for a one-time presentation. AASL provides the organization with promotional information that it can use to develop publicity about the institute, the content for the institute and the honorarium, and all travel expenses of the presenter it provides. The organization sets its own registration fee and is responsible for all local planning, logistics, and publicity.

Fall Forum

In the fall of the years when AASL does not hold its national conference, the association provides a multiday national institute. The forum provides several speakers making presentations that deal with different aspects of a central topic. Time is provided for forum participants to interact with the presenters and each other in small discussion groups. Topics in the past have included "Assessing Student Learning in the Library Media Center" and "Collaboration and Reading to Learn @ Your Library."^[14]

GUIDELINES AND STANDARDS

School Library Programs

A preliminary report of the Commission on Library Organization and Equipment of the National Education Association and the North Central Association of Colleges and Secondary Schools chaired by C.C. Certain, principal of Cass Technical High School in Detroit, Michigan, was published in 1917.^[15] The final report, *Standard Library Organization and Equipment for Secondary Schools of Different Sizes*,^[16] became the first school library standards and was published by the ALA in 1920. Mary E. Hall, librarian at Girl's High School in Brooklyn, New York, and Hannah Logasa, librarian at the University of Chicago School of Education, both early leaders in the development of the concept of school libraries, were members of the commission. In 1925 a joint committee of the National Education Association and the American Library Association, chaired by C.C. Certain, coauthored *Elementary School Library Standards* that established standards for elementary school libraries.^[17] The next set of standards for school libraries was published in 1945 by the ALA; *School Libraries for Today and Tomorrow*^[18] was prepared by the Committees on Post-War Planning of the ALA, Division of Libraries for Children and Young People and its section, the AASL under the chairmanship of Mary Peacock Douglas. In 1960, the ALA published the third set of school library standards, *Standards for School Library Programs*.^[19] The AASL, by now a division of the ALA, prepared these standards in cooperation with the Association for Colleges for Teacher Education. *Standards for School Media Programs*,^[20] published in 1969, were the first standards jointly developed by AASL and the Department of Audiovisual Instruction [now Association for Educational Communications and Technology (AECT)]. The standards, *Media Programs: District and School*,^[21] published in 1979, were jointly developed by the AASL and the AECT and published by the ALA.

In 1988, AASL and AECT jointly prepared *Information Power: Guidelines for School Library Media Programs*. Leaders of the two associations realized that the two associations lacked authority to establish national standards but could establish national guidelines. Therefore, for the first time, the national document focusing on the development of school library programs was called guidelines rather than standards. In 1998, AASL and AECT prepared a new edition of the guidelines entitled *Information Power: Building Partnerships for Learning*,^[12] which was published by the ALA. In 2009, the American Association of School Librarians authored a new set of guidelines, *Empowering Learners: Guidelines for School Library Media Programs*, published by the ALA.

As minimal as the "Certain standards" may seem today, they were the first published national standards that provided some guidance to school administrators attempting

to organize a school library. The 1945 standards established the model that still impacts school library media programs today and established AASL as the authority in the field. The 1960 standards recognized the impact of the school library media program on the educational goals of the school and the teaching role of the school library media specialist. They were also the first to discuss the importance of the collaboration between classroom teachers and the school library media specialist. The 1969 standards attempted to emphasize the inclusion of resources other than print items in school library collections and the perceived new role of the school librarian by eliminating the word “library” and using the terms media, media specialist, and media center. The 1975 standards placed a heavy emphasis on quantitative standards but also provided a set of guiding principles for each area of the standards. It also, as the title implies, addressed the role of the district, as well as the local school, in the development of school media programs. The emphasis in the 1988 standards was the role of the school library media specialist and library media program in the achievement of the school’s curricular goals. The term “library” was reinstated and used along with “media” (e.g., library media specialist and library media program). There was also a strong emphasis on collaboration with the various members of the school community. The major addition to the new edition of the 1988 standards, published in 1998, is the *Information Literacy Standards for Student Learning*.^[21] In 2009 the Association published a new set of guidelines, *Empowering Learners: Guidelines for School Library Media Programs*. These new guidelines reflect the heightened influence of technology and evidenced-based learning on school library media programs and the necessity of producing successful learners skilled in multiple literacies.^[22]

Other National Guidelines and Standards

In 1998, AASL collaborated with the Alliance for Curriculum Reform in the development of the National Study of School Evaluation’s (NSSE) standards-based guide for program evaluation of library media services. This publication, *Program Evaluation: Library Media Services*,^[23] is one volume of the study’s Indicators of Quality Program Evaluation Series. The NSSE serves as the research and development branch of the regional accrediting commissions, which accredit the educational programs of elementary, middle, and secondary schools and colleges and universities. Its board of directors is composed of representatives from each of the six regional accrediting associations in this country. The director of the project to develop the guide extended a special thanks to the members of the AASL staff, Julie Walker and Barbara Herrin, and members, Betty Marcoux, Carol Newman, and Barbara Stripling, for their extensive contribution to the development of the guide.^[24]

The AASL, with 11 other national associations, was a partner of the International Society for Technology in Education (ISTE) in their development of the *National Educational Technology Standards for Teachers* and *National Educational Technology Standards for Students*. The standards were developed as a part of the ISTE initiative, National Educational Technology Standards, funded by the National Aeronautics and Space Administration in consultation with the U.S. Department of Education, the Milken Exchange on Education Technology, and Apple Computer. The student standards were designed to provide teachers, technology planners, and other educational decision makers a framework to establish learning environments supported by technology. The framework incorporates educational technology skills into relevant curricular areas.^[25] The intent of the teacher standards is to establish a set of performance-based standards for the institutions preparing teachers in order for teachers to be able to provide a technology-supported learning environment for students.^[25]

MAJOR GRANT PROJECTS

Knapp Project

In 1962, the Knapp Foundation provided a grant in excess of \$1 million to AASL to develop model elementary and secondary school library programs through improving library resources and personnel. Peggy Sullivan from Montgomery County, Maryland, was appointed project director. The Knapp School Libraries Project was to be developed in three phases with the funding spread over a 5-year period. The purpose of the project was to establish model programs throughout the country that could be visited by librarians, educators, and community members in order that they might replicate these model school libraries in their communities.^[6]

In 1968, the Knapp Foundation made a second grant of over \$1 million to AASL for the Knapp School Library Manpower Project. The grant was made in response to the identified need for qualified school librarians in the field. Robert N. Case was appointed the project director and Anna Mary Lowrey was appointed the associate director. The purpose of the program was threefold: 1) perform a task and job analysis of professional and nonprofessional school library staff members; 2) identify a manpower pool for recruitment to the profession; and 3) identify experimental and demonstration educational programs for the development of school librarians.^[6]

DeWitt Wallace *Reader’s Digest* Library Power Project

From 1988 through 1998, the DeWitt Wallace *Reader’s Digest* Fund provided major funding, through a grant to

the ALA, for the AASL to coordinate the National Library Power Program. Ann Carlson Weeks served as the national coordinator of the project from its beginning until she left AASL; Donald Adcock was named to fill that position until the conclusion of the project. This \$41 million initiative provided 19 communities with 3-year grants to improve school library media programs. Funding to the local communities was made to local education funds rather than directly to the schools. The AASL coordinated the national program, provided administrative and technical assistance to the 19 Library Power sites, and collaborated with the Public Education Network, who provided technical assistance to the local education funds. The initiative was based on *Information Power: Guidelines for School Library Media Programs*. Its purpose was to “create a national vision and new expectations for public elementary and middle school library programs and to encourage new and innovative uses of the library’s physical and human resources.” Library Power provided funds for professional development for teachers, administrators, and school library media specialists; to renovate school library media centers; to match local funds for library books and other library resources; and to hire project staff. To participate in the program, the local school agreed to provide a full-time, certified school library media specialist, keep the library open throughout the school day with schedules that provided for open access to the library, support release time for staff to attend Library Power professional development activities, and cover labor costs for renovation and remodeling of school library media facilities. Library Power projects were located in the following cities: Atlanta, Georgia; Baton Rouge, Louisiana; Berea, Kentucky; Cambridge, Massachusetts; Chattanooga, Tennessee; Cleveland, Ohio; Dade County (Miami), Florida; Denver, Colorado; Lincoln, Nebraska; Lynn, Massachusetts; Mon Valley (McKeesport), Pennsylvania; Nashville, Tennessee; New Haven, Connecticut; New York, New York; Paterson, New Jersey; Philadelphia, Pennsylvania; Providence, Rhode Island; Tucson, Arizona; and Wake County (Raleigh), North Carolina.^[26] In 2001, The AASL and the Public Education Fund collaborated with the ALA to publish *The Information-Powered School*, edited by Sandra Hughes-Hassell and Anne Wheelcock. Each chapter of the publication deals with a specific aspect of Library Power and was written by a member of one of the 19 sites. The intent of the publication is to show how other schools can use the lessons learned by the Library Power participants to implement any part, or all, of Library Power.

CONCLUSION

As it has throughout its history, the AASL will continue being the professional school library organization that provides a national voice that advocates providing each

student in elementary and secondary schools access to a school library media program with access to the inviting environment of a school library media center and the human and intellectual resources that allow them to become effective users of information. It will continue to be the voice that calls attention to the importance of providing each school with a qualified school librarian to work with other members of the school community to provide students with the skills necessary to locate, select, evaluate, and use information effectively. The AASL will continue to collaborate with other national educational organizations to advocate for the improvement of the quality of elementary and secondary education and the preparation of those who work with children and youth in our schools. Additional Information about the American Association of School Librarians and its programs, activities, publications, and organization can be found at <http://www.ala.org/aasl>.

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American Library Association (ALA)

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Abstract

The American Library Association (ALA) was founded in 1876 in Philadelphia, at a conference held at the Pennsylvania Historical Society. The defined purposes of the ALA are fundamentally public service purposes—primarily public and educational, rather than professional. ALA is, therefore, characterized as a nonprofit corporation under Section 501(c)(3) of the U.S. Internal Revenue Service code and has, from its formation, been open to “any person, library, or other organization interested in library service and librarianship. . . upon payment of the dues provided for in the Bylaws.”

INTRODUCTION

The American Library Association (ALA) was founded in 1876 in Philadelphia, at a conference held at the Pennsylvania Historical Society. The purposes described in the enabling resolution would later be expressed succinctly in Article II of the ALA Constitution: “The object of the ALA shall be to promote library service and librarianship.”^[1] This founding conference grew from an 1853 meeting in New York, initiated by Charles B. Norton, publisher; Hastings Grant, librarian of the New York Mercantile Library; Charles Jewett, librarian of the Smithsonian Institution; and others. A committee was appointed in 1853 and charged to draft a constitution and bylaws—and to call a second meeting.^[2]

Civil war and its aftermath delayed that second conference. Then, with the United States moving toward its centennial, various library leaders suggested a congress of librarians. On April 22, 1876, a letter from James Yates, a public librarian from England, was printed in Frederick Leypoldt’s “Library and Bibliographical Notes” column in R.R. Bowker’s *Publishers Weekly*, commenting on the fact that no congress of librarians had been called, though other scientific, educational, and professional groups were convening. The call was picked up and pushed forward by Melvil Dewey, then librarian of Amherst College. *Publishers Weekly* advertised both the impending conference and the birth of the *American Library Journal* in September 1876.^[3]

The conference arrangements committee for the Philadelphia conference included: Justin Winsor, Boston Public Library; Lloyd P. Smith, Philadelphia Library Company; and William F. Poole, Chicago Public Library. One hundred and three persons attended the conference, including 13 women. Justin Winsor was elected president (1876–1885) and Melvil Dewey was elected secretary.^[2]

In 1879, the ALA was officially incorporated under the laws of the commonwealth of Massachusetts, by Justin

Winsor, C.A. Cutter, Samuel S. Green, James L. Whitney, Melvil Dewey, Fred B. Perkins and Thomas W. Bicknell. The language of the charter echoed the founding resolution:

for the purpose of promoting the library interests of the country by exchanging views, reaching conclusions, and inducing cooperation in all departments of bibliothecal science and economy; by disposing the public mind to the founding and improving of libraries; and by cultivating good will among its members. . .

In 1942, the Charter was revised, restating the purposes of the Association to include “promoting library interests throughout the world,” and adding that the Association might fulfill its mission “by such other means as may be authorized from time to time by the Executive Board or Council of the ALA.”

ALA VALUES, PRIORITIES, AND MISSIONS

In 1986, the ALA Council approved this mission statement:

The mission of the American Library Association is to provide leadership for the development, promotion, and improvement of library and information services and the profession of librarianship in order to enhance learning and ensure access to information for all.^[4]

The 1995 report of the ALA Organizational Self-Study Committee (OSSC), comparing this mission to the 1879 charter, as amended in 1942, noted: “The fact that they are similar is one of the enduring strengths of ALA.”^[5]

Over the years, ALA has defined its directions and priorities within the broad contexts of social, economic, and political change. A 1986 statement of organizational and operational priorities notes: “Any organization as

large, diverse, and dynamic as ALA must periodically reassess priorities. . . .”^[6]

In 1959, the ALA Council adopted the first *ALA Goals for Action*; a revision was approved in 1967. The 1984 *ALA Annual Report* noted formation of a Process Planning Group to guide ALA’s “first comprehensive long-range planning process”—Strategic Long-Range Planning (SLRP). The following year, the ALA Office for Research and Statistics surveyed over 450 members of the leadership and general membership. On January 9, 1985, ALA Council approved the process outline. A planning session at the 1985 ALA Annual Conference was attended by more than 400 individuals.

From this process, six “priority areas” were defined in 1986.^[7]

- *Access to information:* ALA will promote efforts to ensure that every individual has access to needed information at the time needed and in a format the individual can utilize, through provision of library and information services.
- *Legislation/funding:* ALA will promote legislation at all levels that will strengthen library and information services. Means will be developed for facilitating the effective competition of libraries for public funds as well as for funds from the private sector.
- *Intellectual freedom:* ALA will promote the protection of library materials, personnel, and trustees from censorship; the defense of library personnel and trustees in support of intellectual freedom and the Library Bill of Rights; and the education of library personnel, trustees, and the general public to the importance of intellectual freedom.
- *Public awareness:* ALA will promote the role of librarians and the use of libraries and their resources and services as well as the awareness of their importance to all segments of society.
- *Personnel resources:* ALA will promote the recruitment, education, professional development, rights, interests, and obligations of library personnel and trustees.
- *Library services, development, and technology:* ALA will promote the availability of information tools and technologies which assist librarians in providing services responsive to the changing needs of society.

These six priority areas were supported by three “organizational support goals,” which defined organizational philosophies regarding roles and relationships, finances, and human resources.

These priorities remained in the ALA Policy Manual until 2006.^[8] Over the next two decades following 1986, ALA approved additional statements of goals and programmatic priorities. There is striking continuity in the successive goals and statements, across several generations of leadership.

On February 6, 1995, the Association approved ALA Goal 2000, which called for the ALA to be “as closely associated with the idea of the public’s right to a free and open intellectual society—intellectual participation—as it is with the idea of intellectual freedom.” Originally presented to the ALA Executive Board in October 1994, by then executive director Elizabeth Martinez, the plan’s tactical recommendations included expansion of the ALA Washington Office, establishment of an Office of Information Technology Policy and establishment of an independent charitable foundation called the Fund for America’s Libraries.^[9]

Arising from analysis of Goal 2000, the ALA Executive Board defined five “key action areas”—arenas in which the Association must be active in order to fulfill its mission and ALA Goal 2000. Beginning January 13, 1998, at the Midwinter Meeting in New Orleans, the ALA Council approved these “key action areas” annually, through 2005, as the Association’s current “programmatic priorities”: diversity, intellectual freedom, equity of access, twenty-first century literacy, and education and continuous learning.

As 2000 approached, ALA leaders began development of a new statement of vision and goals. In July 2000, the ALA Council approved ALAction 2005, including the following goals:

- By 2005, ALA will have increased support for libraries and librarians by communicating clearly and strongly why libraries and librarians are both unique and valuable.
- By 2005, ALA will be recognized as the leading voice for equitable access to information resources in all formats for all people.
- By 2005, ALA will be a leader in the use of technology for communication with, democratic participation by, and for shared learning among its members.
- By 2005, ALA will be a leader in continuing education for librarians and library personnel.

With the approach of 2005, the Association again looked at its strategic directions. This time, the ALA Executive Board and ALA Management undertook the most ambitious effort, since the 1980s, to secure member input: focus groups at the American Association of School Librarians (AASL) (Fall 2003) and Public Library Association (Spring 2004) National Conferences and at the 2004 ALA Midwinter Meeting and Annual Conference, including one focus group specifically related to academic libraries; open ALA Forums at chapter conferences, including student chapters; an email questionnaire completed by 17,000 members; analysis of planning documents from ALA divisions and other groups; telephone interviews with nonmembers; collection of a broad array of external environmental scan information; and, widespread dialogue with leadership.

In Fall 2004, the ALA Executive Board, ALA Division presidents, ALA Round Table representatives, and senior ALA and Division staff met to develop the first stage of a 2010 plan. The process continued at the 2004 joint meeting of the ALA Executive Board and executive committees of the 11 divisions. Following review of a draft plan by ALA divisions, round tables, committees at others at the 2005 ALA Midwinter Meeting, a proposed plan—ALA Ahead to 2010—was distributed for review and approved by the ALA Council at the 2005 ALA Annual Conference.^[10]

The approved plan includes six major goal areas, each with several specific objectives:

Goal Area I: Advocacy/Value of the Profession: ALA and its members are the leading advocates for libraries and the library profession.

Goal Area II: Education: Through its leadership, ALA ensures the highest quality graduate and continuing education opportunities for librarians and library staff.

Goal Area III: Public Policy and Standards: ALA plays a key role in the formulation of national and international policies and standards that affect library and information services.

Goal Area IV: Building the Profession: ALA is a leader in recruiting and developing a highly qualified and diverse library work force.

Goal Area V: Membership: Members receive outstanding value for their ALA membership.

Goal Area VI: Organizational Excellence: ALA is an inclusive, effectively governed, well-managed, and financially strong organization.^[11]

In Fall 2005, the ALA Executive Board recommended revised programmatic priorities—or key action areas—to increase alignment with the new plan. The revised programmatic priorities are diversity, equitable access to information and library services, education and lifelong learning, intellectual freedom, advocacy for libraries and the profession, literacy and organizational excellence. The new priorities have been presented to and approved by the ALA Council annually since January 2006.^[12]

MEMBERSHIP AND ORGANIZATIONAL CHANGE

The defined purposes of the ALA are fundamentally public service purposes—primarily public and educational, rather than professional. ALA is, therefore, characterized as a nonprofit corporation under Section 501 (c) (3) of the U.S. Internal Revenue Service code and has, from its formation, been open to “any person, library, or other organization interested in library service and librarianship...upon payment of the dues provided for in the Bylaws.”^[13]

As of August 31, 2007, ALA membership included the following personal membership categories: Regular, Student, Library Support Staff, Trustees and Friends, Associate Members (including those not employed in library and information services or related activities), Retired, Non-Salaried, and International, as well as Life Members and Continuing Members. Within each category, dues are flat rate—not on a salary-based sliding scale, with the exception that a new (first-time) member pays a reduced rate during the first and second years of membership. In 1986, the membership year changed from the calendar year to the “anniversary” year, marked from the month in which the member initially joined the Association. Organizational membership (based on budget size) and corporate membership (patron or contributor) is also available.

Basic ALA membership does not include membership in any ALA division or round table, which is separately selected with (as of August 31, 2007) approximately 67% of ALA membership belonging to one or more division or round table. In aggregate, almost as many division and round table membership are purchased (approximately 61,000) as ALA personal memberships (approximately 62,000). All division and round table members must first be members of the ALA.

As early as 1918, when ALA membership was 3380 (smaller than many current ALA divisions), the question “is ALA too big?” was raised.^[2] In 1989, a major milestone was reached when Wendy Sinnott became the 50,000th member of ALA. Ten years later, 1998–1999, ALA experienced its largest 1-year growth—adding 3459 members in 1 year, for a total of 58,777.

On August 31, 2007, the ALA had 3480 organizational members, 266 corporate members, and 60,983 personal members—a total of 64,729. ALA’s membership retention rate has been notable, ranging from 85% to 87% over a 10-year period.

ORGANIZATIONAL DEVELOPMENT: GROWTH AND DEMOCRATIZATION

ALA has sought, from its earliest history, to maintain an organizational structure characterized by democratic processes, individual member participation, and effective operations—though the understanding of these has varied significantly.

The original ALA constitution called for members to elect an executive board of five members, which in turn had the power to select additional members and to elect officers from the executive board so constituted. Nominating and election practices resulted in a largely self-perpetuating and homogenous governance body.^[3] In 1892, the constitution was revised to add the ALA Council. Recommendations in regard to library policy and creation of new sections within ALA both required Council action. This first council consisted of 10 councilors, elected by the

membership. At the same time, the constitution established direct election of officers.^[14] The 1899 constitution did not clearly delineate the division of power between the council and the executive board. With the 1909 constitutional revision, the council grew to include the executive board (*ex officio*), all ex-presidents of the Association, and 50 additional members, one-half chosen by Council and one-half chosen by the membership. No questions of policy could be voted by the membership without prior consideration by Council. The “business affairs” of the Association were entrusted to the executive board.^[14] In 1919, further revisions made the Executive Board the governing body of the Association—a move viewed with some suspicion by many members.^[14] Further constitutional revisions would continue to alter the composition of both the Council and Executive Board and to redefine the distribution of powers.

PERIODIC SCRUTINY

In 1928, at the West Baden, Indiana, conference, the ALA Council approved a special committee report which recommended:

A periodic scrutiny of Association activities within 3 years and not less frequently than every third year thereafter, by a committee appointed by the president, such scrutiny to include as complete consideration of the effectiveness and results of the various activities as is warranted and practicable, with a view of suggesting to Council possible changes of policy.^[15]

Over the next two decades, four such committees were appointed.

The First Activities Committee report (December 1930) covered library extension, adult education, education for librarianship, foundation projects, financing, publishing, membership, personnel practices, and ALA headquarters. The Second Activities Committee report (December 1934) noted the ALA Executive Board’s increasing tendency to systematically review the Association’s activities and recommended that committees be appointed to survey the Association’s activities only every 6 years, unless particular circumstances warranted more frequent survey.

Five years later, in 1939, the Third Activities Committee produced a report calling for a more democratic organization, particularly for a revised Council that would be completely elective, based on specific interests and on geography,^[14] as well as establishment of a sliding scale of membership dues, based on individual salary or (for institutional members) library budget. Also included in the report were recommendations to give more authority to sections within the Association and call them divisions,

and to give those divisions an allotment of 20% of the dues paid by their members to ALA.

In 1949, against a background of fiscal concerns, the report of the Fourth Activities Committee was presented to the ALA Council in two parts. Its recommendations would lead, by 1951, to an increase in dues—referred to a mail vote of the membership and approved.^[16]

TAKING THE MODERN SHAPE: CRESAP, MCCORMICK, AND PAGET

For ALA’s next “periodic scrutiny,” authorized by the ALA Executive Board in July 1954, the management consulting firm of Cresap, McCormick, and Paget was employed.

The final report, based on intensive study of the ALA membership organization, headquarters organization, and fiscal policies and practices, was discussed by Membership and unanimously approved by the ALA Council in July 1955, in Philadelphia. Among the major recommendation of this report were the following:

- Establishment of divisions by type of library and type of activity.
- Assignment of greater responsibility to Council.
- Closer relationship between the Council and the Executive Board.
- Appointment of divisional executive secretaries by the ALA executive secretary, with the approval of the division concerned.
- Simplification of the dues structure.

The special committee appointed to guide implementation of the management report adopted several guiding principles: (1) a closer relationship between the organization and its 20,000 members, accompanied by greater membership participation; (2) decentralization of responsibility and authority; (3) strengthening of the Council as the governing body of the organization; and (4) allowance for more planning, control, and flexibility in managing the financial resources of the organization.^[14]

By the late 1950s, the present shape of the ALA became visible. The divisional framework was restructured and type-of-library and type-of-activity divisions were designated, with some decentralization of responsibility. The ALA Council was clearly designated as the policy-making body of the Association. The Executive Board was elected by Council from among its members, to act for Council. Council representation became more democratic—with some councilors representing geographic areas, some divisions, some elected at-large. Member oversight of the budget was assigned to the Program Evaluation and Budget Committee, its membership then made up of past officers of the 12 divisions, plus the ALA treasurer, immediate past president and president-elect.^[14]

REVOLUTION AND REFORM: ACONDA/ANACONDA

Arising from the social turmoil of the 1960s, forces for continuing change within ALA reached the stage of “revolution” at the 1968 annual conference in Kansas City and the 1969 conference in Atlantic City. From Kansas City, the momentum was maintained by the “Congress for Change” in Washington, DC, as well as New York organization of “Librarians for 321.8” and “Libraries to the People”—culminating at the Atlantic City conference. Requested changes ranged from asking Council candidates for a statement of views, to taking activist roles in intellectual freedom, library education, and recruitment for the profession.

Incoming president William Dix suggested appointment of a committee to examine the objectives and program of ALA. The Activities Committee on New Directions for ALA (ACONDA) was appointed and charged “to recognize the changes in the interests of ALA members,” to provide “leadership and activities relevant to those interests,” to reinterpret and restate “the philosophy of ALA to provide a meaningful foundation which is capable of supporting a structure and program which reflects the beliefs and priorities of the profession.” It was also to reexamine priorities and organizational structure.^[17]

The committee’s final report, presented at the 1970 conference in Detroit, suggested a broad array of changes, including changes to the composition of Council, the nominating process, Association communications, the number and types of divisions, and ALA organizational structure. The resulting furor resulted in Membership Meetings which lasted 15 hr—and did not cover all the recommendations.^[18]

Council approved the first three ACONDA recommendations in July 1970:

1. ALA’s “overarching objective” would remain improvement of library service and librarianship. It would continue to be an organization of libraries and librarians.
2. An Office for Social Responsibility—changed by Council to Office for Library Service to the Disadvantaged—would be established.
3. The Intellectual Freedom Office would be expanded.

To aid in completely articulating the remaining recommendations, Council charged an Ad Hoc Council Committee (later dubbed ANACONDA) to work in conjunction with ACONDA. Their work was considered by Membership and Council through 1971. At the Midwinter Meeting in 1971, ACONDA/ANACONDA reiterated ACONDA’s strong recommendation that ALA needed restructuring, with ACONDA pointing out issues of overlapping interests and duplication of effort.

ACONDA criticized the makeup of Council, recommending a smaller council elected on a district basis. ANACONDA recommendations also attempted to deal with problems of democratization and reorganization.^[14] At the 1971 Annual Conference, Council passed a new policy statement implementing bylaws provisions for Council membership. All Council terms would end at the close of the 1972 Chicago conference and a new Council would be seated for the first time at the 1973 Midwinter Meeting. With this change, ALA past presidents were no longer automatically members of Council.^[19]

ACONDA/ANACONDA would have an impact on subsequent strategic planning within the Association, leading to establishment of a Planning Committee “to provide the thorough planning necessary to achieve the long-range goals of the association.”^[20] The strategic planning role was later moved to the ALA Executive Board following the work of the Official Self-study Committee. ACONDA/ANACONDA also resulted in adoption of statements of goals and objectives, though there was a lack of clarity regarding priority.^[21]

In 1977, the Future Structures Committee would note “there is no established means by which the individual member’s priorities can be tapped to provide a firm basis on which to assign the association’s resources,” and recommended that a member survey be undertaken. That survey was conducted in 1979, with results released in 1980. The survey results, along with ACONDA/ANACONDA reports, recommendations from the 1st White House Conference on Library and Information Services and other reports, formed the basis for recommended priorities, considered by Council in 1981.^[20]

CONTINUED CHANGE: THE HOLLEY COMMITTEE TO OSSC

In 1981, the Special Committee to Review Program Assessment Processes and Procedures (SCRAPP), chaired by Edward G. Holley, identified Association needs in the area of planning and budgeting: for clearly understood common purposes; a clear set of goals, objectives, and priorities; balance between overall association interests and unit (i.e., division or round table) interests; more effective use of resources—including staff and member time, as well as dollars; resource allocation based on priorities; and a process for ongoing planning and evaluation.^[22]

The Executive Board’s management role was one focus of SCRAPP (commonly known as “the Holley Committee”).^[23] The report noted: “There is no formal mechanism within ALA which brings together within a total management system the authority and the responsibility for planning, resource allocation, and program assessment.” The special committee recommended that the ALA Executive

Board assume responsibility for overall financial planning and control. That recommendation would be echoed in the mid-1990s in Part I of the report of the OSSC.^[24]

In January 1985, the ALA Council approved an outline for SLRP. The Council-approved document pointed to ALA's "tradition of flexible patterns of participation by individuals and groups who address association-wide and unit goals and an enormous range of issues facing libraries and librarians."^[25] It articulated roles and responsibilities: for Council and its sub-entities—the Committee on Program Evaluation and Support (COPEs) and the Planning and Budget Assembly (PBA), for the Executive Board and its sub-entities—the Directions and Program Review Committee and Process Planning Committee, for consultants, and for staff. The SLRP was to be characterized by broad communication and participation, and opportunities to address "critical issues," would result in clear goals and objectives, and would be evaluated continuously. In 1986, ALA adopted the resulting "priority areas" which remained in ALA's policy manual until 2006.^[8] Indeed, the continuity between these priorities and subsequently adopted programmatic priorities is striking.

ORGANIZATIONAL SELF-STUDY: 1992–1995

In June, 1992, then president-elect Marilyn Miller, with Council approval, appointed an ALA Self-study Committee, chaired by past-president William Summers. The proposal to the Executive Board and Council noted:

There has been neither an internal nor an external study of ALA since the 1955 ALA Management Survey conducted by Cresap, McCormick, and Paget. Since the reorganization prompted by the Cresap study, the ALA structure has remained virtually unchanged except for those modifications we have made to respond to democratization and to accommodate new units.

The proposal further noted that the "present pattern of division fiscal responsibility is a given," that "management by coalition based on coalescing principles will continue to be the predominant management force..." and that the then-present (1986) ALA goals and objectives should stand.^[26]

Phase I of the Self-study was a management study, conducted by Consensus Management Group and focused primarily on the roles and responsibilities of the ALA Council, ALA Executive Board, and ALA Executive Director. Phase II of the OSSC Report, in January 1995, contained recommendations relating to management and governance of the association. Among the recommendations implemented were provision for membership ballot initiatives; an increase (to 1% of membership) in the number of members required to petition for a mail vote to overturn an action of Council; elimination of the ALA

Planning Committee, with responsibility for strategic planning clearly designated as an Executive Board role; a restructuring of fiscal oversight processes, with the COPEs becoming the Budget Analysis and Review Committee and including significant representation from the Executive Board; a decrease in the term of members of the Council and Executive Board from four to three (excluding the ALA Treasurer), whose term remained at four until subsequently reduced to 3 years in 2003, when ALA members ratified the action taken by Council in June 2002.

Among the OSSC management and governance recommendations either not considered or rejected were term limits for members of ALA Council and elimination of the Membership Meeting in favor of a Membership Forum. In initially proposing the latter, the committee noted:

The Membership Meetings at Annual Conference have been a cause of concern for a number of years. Attendance at the meetings is very low, representing a small proportion of the members attending the conference and a very low proportion of the total membership. Yet at these meetings, questions are posed and actions recommended, which have far reaching consequences for the Association.^[27]

In subsequently deciding not to seek approval of that recommendation, the committee noted that membership had recently (1994) approved an increase in quorum size for a Membership Meeting. The issue remained a significant one within the Association. At the 2001 Annual Conference, Council requested establishment of a Special Presidential Task Force on Membership Meeting Quorum. Recommendations of that task force led to reduction of the quorum to one-half of 1% and removed the authority of the Membership Meeting to set aside actions of Council. In 2003, a Membership Meeting Committee (standing) was established to plan the agenda for Membership Meetings, identify topics of potential interest for discussion, and encourage participation. In 2005, the quorum for the Membership Meeting was reduced to 75 personal members.^[28]

FOLLOWING CONTROVERSY

The OSSC also made extremely controversial structural recommendations. As a result of the heated discussions within both the ALA Membership Meeting and ALA Council, in 1995 the ALA Council established an Ad Hoc Task Force on Structure Revision (SRTF), chaired by Sarah M. Pritchard.

Its report to Council, February 1997, noted:

The SRTF is not recommending major structural revision of the divisions and other membership groups since we

believe that, to be effective, such change must come from the direct collaboration and initiative of those groups rather than as a top-down design. . . . Nor do we believe the general governing concept of a delegate council and an executive board needs to be changed. These structures have a long tradition in the ALA and extensive member support; the effort to change them might well distract us from our primary professional goals for years on end with no guarantee that a different structure would be any more effective. We propose to concentrate instead on improving, enhancing and modernizing the operations we now have.

Acknowledging other ongoing work within the Association (including ALA Goal 2000 and establishment of new committees such as the ALA Conference Committee), the SRTF determined to focus its efforts on the structure of Council.^[29] The SRTF presented its final report in June 1997. Among the resulting changes was the addition of six round tables representatives to the ALA Council.

ORGANIZATIONAL DEVELOPMENT: ALA DIVISIONS AND THE ALLIED PROFESSIONAL ASSOCIATION

It was clear early in ALA's history that provision would have to be made for specialization, to accommodate various institutional perspectives and the growing diversity of librarianship itself. In 1889, the college and reference librarians formed the first special section and held their first separate meeting apart from the general body of the Association. In 1890, the trustees formed a special section, followed by the catalogers in 1900.

With acceptance of the recommendation of the Third Activities Committee (December 1939), ALA's growing sections gained increased authority within the Association and became divisions. In 1952, grants were made to divisions from ALA endowment capital to enable them to have executive secretaries, based on the ALA Executive Board's conviction that staff would enable divisions to develop and maintain more effective programs for their members and the entire Association. The resulting division membership gains were to fund staff following expiration of the grants.

DIVISIONS AFTER 1955

The 1955 Cresap, McCormick, and Paget report defined type of library and type of activity divisions, headed by executive secretaries appointed by the ALA executive secretary. Among the specific provisions were that each division encompasses a field of activity clearly distinct from that of other divisions, that basic ALA dues include one type-of-activity and one type-of-library division, and that

the "60-40" allocation of dues be replaced by an allotment proportional to number of members, with additional funding based on proposals to the Association's budget committee. This report shaped the basic divisional structure in operation today. The final reorganization eventually resulted in the formation of 12 divisions and 6 round tables.

By 1975, with ALA membership at 33,491, 73% of ALA members selected at least one division. By 1976, with membership at 34,491, it was 64%. In 1982, with total ALA membership at 38,330, 65% of ALA members selected at least one division. That percentage proved to be reasonably stable. In 1984, with 39,000 ALA members, 66% selected at least one division. By January 2007, 67% selected at least one division or one round table, with 7 of 10 being Division memberships and 3 of 10 round table memberships.

THE DUES SCHEDULE TRANSITION DOCUMENT

Based on the recommendations of a succession of reviews, by the 1970s ALA had moved to the principle of funding divisions from income derived from division dues and other division activities. This required a basis on which to separate those areas of division financial responsibility from those of the ALA "General Fund." That basis was provided by the "Dues Schedule Transition Document," adopted by the ALA Council in January 1976.

The "Dues Schedule Transition Document" ended inclusion of division membership within the ALA basic dues; members now paid additional dues to each division joined. Divisions became largely self-supporting at this point, assuming financial responsibility for cost of staff, publications, and programs. The ALA General Fund assumed responsibility for a defined set of "indirect cost" items, including office space, administrative services (including both fiscal and human resources services) and other similar kinds of expenses. In 1975, ALA divisions spent just under \$600,000 for programming. By 1980, division expenditure on programming reached \$1.3 million and by 1983, a short 3 years later, exceeded \$2 million. With the passage of time, the several revisions of the ALA dues structure, and the move into the new headquarters building, by April 1982 it was time for a new statement.^[30]

THE OPERATING AGREEMENTS

Responsibility for preparation of a new statement outlining the fiscal relationship between ALA and its divisions was given to the COPEs. Initial discussions between COPEs and divisions began in 1981 and resulted in a draft operating agreement, which was presented to ALA Council in July 1982, and approved as an "Operating

Agreement between ALA and its Membership Divisions.” This operating agreement articulated its primary purpose as

to define those services which divisions receive from ALA at no cost and those for which charges are made to divisions. In addition, the document seeks to establish a cooperative framework in which the inevitable questions of organizational relationship can be addressed and resolved.^[31]

The document approved called for revision in not more than 5 years.

In 1984, executive directors of ALA divisions met with COPEs to discuss the relationship between the divisions and ALA. In December 1986, a revised draft was presented to COPEs. Members of COPEs, division representatives, ALA officers and staff met in Lisle, IL, November 11–13, 1988, to discuss revision of the 1982 Operating Agreement. The current “Policies of the American Library Association in Relation to Its Membership Divisions” was approved by the ALA Council on June 28, 1989.^[32] It was implemented through a series of “management practices,” providing the flexibility to accommodate changes in technology and other conditions.

The 1989 Operating Agreement was based on four “fundamentals:”

1. ALA and all its units abide by the ALA Constitution, Bylaws, and policies adopted by the ALA Council.
2. ALA is one legal, financial, and organizational entity, with indivisible assets.
3. All staff are employees of the ALA, and subject to ALA personnel policies.
4. All ALA units use services provided by ALA (including such services as personnel, membership services, telephone, insurance, purchasing, fiscal services, legal services, archives and general administrative services) and are housed in property owned or leased by ALA.^[31]

Just prior to the 1988 Lisle meeting, addressing a concurrent meeting of the division executive committees, then ALA executive director Thomas Galvin said:

In the words of the ALA Business Plan, “ALA as a whole and its individual units exist in an environment of mutual programmatic and financial interdependence.” ALA is only as programmatically strong as its most fragile unit, only as financially robust as its most impoverished entity....^[33]

DIVISIONS AND THE SELF-STUDY

In their 1995 Phase II Report, the OSSC defined “guiding principles” as a context for organizational change and also noted current issues or concerns:^[5]

1. “ALA provides holistic participation in the Association.” OSSC noted overlap among divisions (and other units) as they responded to emerging issues and sought to address the various concerns of their members.
2. “ALA’s governance structure fosters quick, concerted, and coordinated national action.” Here the committee noted that members “experience frustration” when an opportunity to act on an issue quickly is lost because of the need to consult with many different units.
3. “ALA speaks externally with one voice.” OSSC noted the need to provide opportunities for internal disagreement, examination of different perspectives, and development of consensus, in order to “ensure that ALA speaks with one voice in its external communications.”
4. “Governance structures facilitate decision-making and consume a minimal amount of the Association’s resources.” The committee recommended a “flatter” and “more streamlined” governance structure.
5. Membership in ALA is a satisfying, positive professional experience.

Believing that responses to a 1994 “concept paper” distributed by the OSSC indicated support for these guiding principles, the OSSC proposed a broad range of organizational changes, including expanding networks with state and regional groups, consolidating organizational units, regrouping or clustering existing units, replacing some units with different ones, implementing an active “sunrise” philosophy, adding new offices and creating new groupings such as “policy councils.” These recommendations proved controversial—and were not adopted. The Membership Meeting at which the proposal was discussed (Chicago, 1995) was one of the few during the late nineties to achieve a quorum.

FORMATION OF THE ALA-ALLIED PROFESSIONAL ASSOCIATION

One of the recurring overtones in ALA’s long history is the pull—for resources and attention—between a focus on libraries and a focus on the individual library practitioner. This normal condition—stemming from ALA’s broad mission and scope—was exacerbated by the increasing body of law and regulation governing tax-exempt organizations.

In July 1996, boards of two ALA divisions—the Public Library Association (PLA) and Library Administration and Management Association (LAMA)—voted to support a proposal to establish a “certified public library administrator program.” Based on interest expressed by other divisions, PLA and LAMA, joined by the Association of Specialized and Cooperative Library Agencies (ASCLA),

recommended that ALA create a special committee to develop a “framework” certification proposal for ALA Executive Board approval. Until 2001, activity proceeded along several tracks: (1) the definition of such a “framework” by the ALA Committee on Education;^[34] (2) the continued development of a “standard for professional practice” by PLA and LAMA, now joined by the ASCLA; and (3) the definition of a legally permissible strategy to enable certification. In June 2001, the ALA Council approved the following statement:

Toward fulfillment of its declared mission to provide leadership for the development, promotion, and improvement of the profession of librarianship, the American Library Association establishes an allied professional association to certify individuals in areas of specialization beyond the ALA-recognized masters degree.^[35]

Overlapping this strand of ALA development were the issues of the salaries and status of librarians. In Spring 1999, the report of the 1st Congress on Professional Education recommended that ALA “address the need to improve salaries.” In Spring 2001, then-president Nancy Kranich, in response to issues raised by members, appointed a Task Force on the Status of Librarians, chaired by Tom Wilding, charged to articulate status issues, recommend strategies to address them and outline the issues that must be resolved in order to follow those strategies. In Fall 2001, ALA president-elect Maurice J. Freedman appointed a presidential initiative committee, chaired by Patricia Glass Schuman—the Better Salaries Task Force. In December 2001, the task force outlined Options for Action, recommending that the scope of the allied professional organization be broadened to enable it to undertake a variety of activities related to status and salaries.

In Fall 2001, the ALA Executive Board appointed a working group, including the chairs of both the Status Task Force and Better Salaries Task Force, to coordinate development of a proposal to broaden the scope of the Council-authorized allied professional organization.

At the 2002 Midwinter Meeting, the ALA Council approved preliminary Bylaws for an ALA Allied Professional Association, broadening its scope “to promote the mutual professional interests of librarians and other library workers.” An ALA–APA Transition Team, chaired by Nancy Kranich, was appointed in March 2002, reporting to Council in May 2002. The ALA–APA Board of Directors met for the first time at the 2002 Annual Conference. In July 2002, the ALA Allied Professional Association was incorporated in the State of Illinois. It subsequently received tax-exempt status under Section 501 (c) (6) of the U.S. Internal Revenue Code. In November 2002, the ALA–APA Board of Directors accepted a business plan for the ALA–APA and, based on that plan, requested a \$250,000 establishment loan from the ALA.^[36]

ALA STRUCTURE TODAY

ALA Council

The governing body of the ALA is the ALA Council. Council is empowered by the ALA Constitution to “determine all policies of the Association.” Its decisions are binding upon the Association, except when “set aside by a majority vote by mail in which one-fourth of the members of the Association have voted.”^[37] A majority vote of the Council may also refer a question of policy to the Association for vote at either a Membership Meeting or by mail. Only personal members of ALA may serve on the Council.

As of August 31, 2007, the ALA Council includes 186 members. There are 100 councilors at large, elected by ALA membership. Members of each of ALA’s 11 divisions elect one councilor. Members of the each round table whose membership is equal to or greater than 1% of the total ALA personal membership, as of August 31 of the year preceding the election, elect one councilor; members of the remaining round tables jointly elect one councilor. Finally, there are 53 chapter councilors, representing the 50 states, the District of Columbia, Guam and the Virgin Islands. Members of the ALA Executive Board, including the treasurer and immediate past president, are members of the ALA Council. Officers of the ALA Council are the ALA president and president-elect. The ALA executive director is the secretary of Council. Councilors serve a 3-year term. ALA Council must meet at least twice a year, once at the annual conference and once not less than 3 months prior to the annual conference, by current practice at the ALA Midwinter Meeting.

ALA Executive Board

The ALA Executive Board includes the president, president-elect, immediate past president, treasurer—all elected by the ALA membership—and eight members elected by the ALA Council from among its members. The ALA executive director is a non voting member of the Executive Board. Members of the Executive Board serve a 3-year term.

The ALA Executive Board “acts for the Council in the administration of established policies and programs.” The Executive Board “manages within this context the affairs of the Association,” delegating management of day-to-day operations to the ALA Executive Director. The Executive Board also makes recommendations to Council regarding policy.^[38]

ALA Divisions

ALA has 11 membership divisions, each focusing on a type of library or type of service. Divisions offer

programs, publications, institutes, and workshops; and provide other services to their members. Three divisions—the American Association of School Librarians, the Association of College and Research Libraries, and the Public Library Association—currently hold biennial national conferences. Division members must be members of the ALA. Division staff members are ALA staff members.

Each division has, by policy:

- A statement of responsibility developed by its members and approved by ALA Council.
- A set of goals and objectives established by its members, which drive its activities.
- An Executive Director and other personnel as necessary to carry out its programs.
- Responsibility for generating revenue to support staff and carry out its programs.
- A separate Board of Directors, elected by its members, and responsible to ALA Council.

ALA Bylaws [Article VI, Section 2 (b)] give divisions authority “to act for the ALA as a whole” within their Council-designated areas of responsibility. An operating agreement—ALA Policy 6.4.1 “Policies of the American Library Association in Relation to its Membership Divisions”—outlines a collaborative and intertwined relationship between ALA and its divisions. The policy notes that ALA:

...is unique among American associations in the manner in which it is structured. It is one association, with indivisible assets and a single set of uniform administrative, financial, and personnel policies and procedures. It is governed by one Council, from which its Executive Board is elected, and is managed by an Executive Director who serves at the pleasure of that Board. It is also the home for eleven Divisions. . . .^[32]

Each division is represented on the ALA Council, in the PBA and on other association-wide assemblies.

ALA Round Tables

In accordance with ALA Bylaws, Council may authorize organization as an ALA Round Table by any group of not less than 100 members of the Association “who are interested in the same field of librarianship not within the scope of any division. . . .”^[39] Interested members must petition for the formation of a round table and that petition must include a statement of the proposed purpose. As of August 31, 2007, ALA had 17 round tables.

Round tables may charge dues, issue publications (with the approval of the ALA Publications Committee) and affiliate with regional, state or local groups with the same interests. Round tables do not have their own staff. ALA

staff are assigned “liaison” responsibility for round tables. Round tables may not “commit the Association by any declaration of policy.”^[40] Round tables have been represented on the ALA Council since 1999–2000. In Spring 2006, ALA Membership ratified a change to Article VI of the Bylaws, to provide that any round table with personal membership equal to or greater than 1% of ALA’s total personal membership may elect one councilor. The remaining round tables, those with less than 1% of ALA’s total personal membership, jointly elect one councilor.^[41] As of June 2008, nine round tables were individually represented in Council, with a 10th, elected in the Spring 2008 election, to be individually represented beginning in 2008–2009.

Standing Committees

ALA Bylaws provide for standing, special, interdivisional and joint committees. Standing committees may be committees of the Association or committees of Council. By Council action (July 1969), the Executive Board and Council may also create ad hoc committees, to pursue a designated project for a specific period and not continuing beyond the life of that project. ALA currently has approximately 35 standing committees, including both Association and Council committees, as well as five joint committees—committees jointly created by the ALA and one or more external organization. Many standing committees have associated subcommittees, assemblies and other subordinate bodies. Approximately, 350 ALA members serve on these standing committees.

Member Initiative Groups

Membership Initiative Groups (MIGs) were initially authorized in 1979 at the Annual Conference in Dallas, with implementation guidelines approved in 1980. In 1985, ALA Council approved a recommendation from the ALA Committee on Organization (COO) that MIGs be continued and given organizational status in the Bylaws. Council and members subsequently approved a Bylaws amendment [Article VIII, Section 2 (b) (ii)] enabling COO to authorize MIGs. MIGs may not assume any of the delegated responsibilities of other units and may not speak for the Association. Originally conceived as a short-term organizational vehicle to provide for prompt, organized membership activity on topics of mutual interest, MIGs were limited to a 3-year life, after which they must either cease to exist or “apply for a place within the ALA structure.” In 2008, recognizing shifts in the way members sought to organize themselves for work, the COO authorized Member Initiative Groups to repetition for successive 3-year terms of existence. Since 2000, there have been four Member Initiative Groups formed: Libraries Fostering Civic Engagement, Information

Commons, Virtual Communities and Libraries, Games and Gaming.^[42]

Chapters

Under Article V of ALA's Bylaws, Council

may establish a chapter. . . in any state, province, territory, or region in which a majority of ALA members residing within the area involved and voting on the issue favors such action; provided, however, that the total number of persons voting on the issue shall not be less than ten percent of the total number of ALA members residing within the area.^[43]

Council representation is through the state chapter, unless chapters in a region choose to take representation through the regional chapter, in which case the regional chapter would elect one representative from each state or provincial chapter included in the region. As of August 31, 2000, all state chapter representation was through state chapters, not regional chapters. Chapters may admit members who are *not* members of the ALA.

It is important to note that many states have more than one library association. Particularly, school library media specialists frequently have separate associations. These separate school library media associations are generally affiliated with the AASL, a division of the ALA, but are not represented on the ALA Council. AASL has a separate Affiliate Assembly. Other ALA divisions also have state or regional affiliates.

Affiliated Organizations

The ALA Council may, by vote, affiliate with the Association or any of its subdivisions "any national or international organization having purposes similar to those of the Association or its subdivision."^[44] Likewise, it may affiliate the Association with such an organization. No subdivision of the Association may separately affiliate with an organization to which the Association as a whole is affiliated. Affiliated organizations are not represented in the ALA governance structure. Representatives of affiliated organizations meet informally at ALA conferences.

BEYOND STRUCTURE: INTERNATIONAL CONNECTIONS AND WEB-BASED NETWORKING

International Connections

From the earliest period of its history, ALA has seen its role and the interests of its members in an international context. James Yates, librarian of the Free Library of Leeds (England) was an invited delegate at the 1876 founding conference. A year later, following the 1877

conference in New York City, 12 American librarians went to England, where they were present at the organization of the Library Association of the United Kingdom. International contact continued to expand, with many international librarians attending the 1904 conference in St. Louis.^[2]

In 1917, the ALA Executive Board appointed the Committee on Mobilization and War Service Plans (later the War Service Committee). Herbert Putnam served as general director of the program. ALA undertook to supply books and periodicals to military personnel at home and overseas. The initial campaign raised \$1 million for camp libraries, as well as including a book drive.^[2] In August 1918, ALA opened a library for U.S. military personnel in Paris; others followed. Following the Armistice, there was significant pressure from Americans in France to keep these facilities open. ALA promised to leave the books and equipment and to provide a \$25,000 "endowment." On May 20, 1920, the American Library in Paris was incorporated as a private, nonprofit organization under the laws of the state of Delaware.^[45]

This spirit of missionary librarianship was further evidenced in the establishment of the Biblioteca Benjamin Franklin in 1942,^[2] as well as later projects such as the Keio Library School in Tokyo and the Institute of Librarianship in Ankara, both in the 1970s. In 1988, a delegation of Soviet librarians attended the ALA Annual Conference for the first time. In the United States, they signed a protocol opening the way to exchange of current national bibliographic data. ALA's international participation would accelerate by the beginning of the twenty-first century, through visits, workshops, and bi-national conferences around the globe.

In 1942, the ALA Council approved establishment of a "board" on International Relations. In October 1942, a grant from the Rockefeller Foundation made possible the establishment of the ALA International Relations Office in Washington, DC, in space donated by the Library of Congress, to "lend effective aid to libraries and advance the interests of librarianship."^[2] The office operated for the next 5 years using further grants, serving as secretariat to the International Relations Board. The scope of operations was broad, with funding from both the Rockefeller Foundation and the U.S. State Department to supply library science literature to libraries overseas, to distribute bibliographies, to assist in administration of library schools in Latin American countries, to administer the program for bringing foreign librarians to the United States to study and observe American libraries, to purchase American journals for distribution to newly forming libraries in the post-World War II period, and other projects.

The International Relations Board became ALA's International Relations Committee in 1956. That same year, another grant from the Rockefeller Foundation and a supplemental grant from the Council on Library Resources made possible the establishment of the

International Relations Office, operating both at the Chicago headquarters and in Washington, DC. Its original purpose was to offer assistance, direct or indirect, to the underdeveloped countries in Asia, Africa, Latin America, and the Near East, particularly promoting education for librarianship in those countries. The scope of the Office was later broadened. An international relations office existed 1943–1949 and again 1956–1972, when it temporarily fell victim to ALA financial stresses in the 1970s.^[2]

In 1986, ALA received a grant from USIA for the Library/Book Fellows Program, which was to continue until 1998—sending over 100 U.S. librarians to over 70 countries, and bringing 40 librarians from 35 countries to the United States. In 1989, the chair of the ALA International Relations Committee, E.J. Josey, reported to the ALA Executive Board on the outcomes of a November 1988 planning meeting convened to reassess ALA's international role, develop a strategy for identifying that role within ALA's organizational priorities, and achieve funding to support that role. Establishment of an International Relations Office within ALA was proposed—and in the late 1990s the ALA International Relations Office was established, using ALA operating funds rather than grant funds. It continues today.^[46]

The first steps toward an international library organization had been taken at ALA's 50th anniversary conference in 1926. The International Library Committee met in Edinburgh in 1927, the 50th anniversary of the Library Association, with ALA as one of the founding members. In 1952, the Committee became the International Federation of Library Associations.^[2]

Six U.S. based associations within IFLA—the American Association of Law Libraries, the ALA, the Art Libraries Society/North America, the Association of Research Libraries, the Medical Library Association, and the Special Libraries Association—together with U.S. IFLA members and the National Commission on Libraries and Information Science, joined together to sponsor the 1985 IFLA Conference in Chicago, drawing delegates from more than 86 countries. In 2001, IFLA again met in the United States, setting a new attendance record with approximately 5500 attendees in Boston.

ALA in the Networked World

By 2007, the impact of rapid expansion in use of social networking tools was visible within the Association. In Spring 2008, an informal census of “web 2.0” deployment revealed 70 blogs (doubled since Spring 2007), 125 wikis (quadrupled since Spring 2007)—both supplementing, and in some cases supplanting, the more than 948 discussion lists in use by ALA groups. Some 15 individuals a day were joining the ALA group in Facebook—which totaled 3800 by September 2008—and other ALA-related groups had formed on other social networking sites.^[47] ALA staff and members had held events—celebrating traditions such

as Banned Books Week and National Library Week—in Second Life and ALA leaders were meeting and speaking in Second Life. A series of videos created by American Libraries for National Library Week (2008) received over 78,000 views, with comments appearing on YouTube, Blip, AL Focus and other sites. In 2007, the ALA Council authorized formation of a special ad hoc Task Force on Electronic Member Participation, chaired by Janet Swan Hill, to explore ways of integrating “virtual” participation into the organizational fabric of ALA. The special committee is due to report in January, 2009.

ALA CONFERENCES, SERVICES, AND OPERATIONS

To support its mission and its members, the ALA provides core services and products generally common to all associations, including publishing, conferences, standards and guidelines, research and statistics, and awards and scholarships. These and other functions are managed through a headquarters operation.

ALA Publishing

Professional literature on librarianship was minimal prior to the mid-nineteenth century. In 1886, the ALA formed the publishing section for publication of catalogs, indexes, and other bibliographical tools not easily produced by individual libraries.^[2] Early ALA publications were printed and distributed by other organizations, including Melvil Dewey's own Library Bureau, Houghton Mifflin and the U.S. Government Printing Office.^[48] In 1900, a Publishing Board was created, replaced by an Editorial Committee in 1921, and reestablished in 1966, retaining the Editorial Committee in an advisory capacity. As the Association grew, both the editorial and technical work of publishing became increasingly the work of staff. The Association's publication program is now guided by the ALA Publishing Committee, a standing committee of Council.

ALA's present publishing business began in 1886 with starting capital of \$486. In 1902, Andrew Carnegie provided increased impetus with the gift of a \$100,000 endowment for “the preparation and publication of reading lists, indexes, and bibliographical aids.”^[2] The program made available to libraries small publications that might not have been economically feasible without such support. That endowment, now the Carnegie–Whitney endowment, still supports such lists. By 1922, ALA Publishing sales had reached almost \$24,000. By 1966, ALA's publishing department had sales in excess of \$990,000. By 2000, ALA Publishing had published over 1520 titles—not including titles published through individual divisions of the Association.

In 1904, at the conference in Atlantic City, discussion began which would lead to the establishment of *ALA Bulletin* in 1907, competing with both *Library Journal* and *Public Libraries*, begun by Dewey in 1896. While the new *ALA Bulletin* was given the “Proceedings” of the Association to publish, it was not designated ALA’s “official organ.” That designation was retained by *Library Journal* until 1908, when the *ALA Bulletin* was so-designated.^[14] The *ALA Bulletin* was published through December 1969—a total of 63 volumes. In January 1970 volume one of a new journal—*American Libraries*—appeared and continues today as ALA’s official organ, with a standing advisory committee. *American Libraries* committed to four-color coverage in January 1980 for its report on the White House Conference.^[49] *American Libraries* has continued to change with the Association, expanding to include *AL Direct*, a weekly online newsletter, in 2006 and opening *AL Focus*, a video and discussion site, in 2007.

In 1905, the Carnegie endowment made possible the establishment of *The Booklist*—a book review journal. The number of subscriptions rapidly grew to 3000, with state library commissions purchasing multiple copies.^[14] Originally published eight times a year, *Booklist* is now published 22 times a year and has a print subscription of over 20,000. *Booklist* reviews are licensed by numerous electronic publishers, in both CD and online formats. In 1994, *Booklist* spawned a companion journal, *Book Links*, which has over 18,000 subscribers, as of August 2001. *Book Links* is focused on connecting books, libraries, and classrooms. In 2006, 100 years after its initial establishment, *Booklist* opened a new era with the release of *Booklist Online*.

As of August 2008, ALA Publishing’s journals include *American Libraries*, *Booklist*, *Booklist Online*, *Book Links*, and *ALA TechSource*. ALA Editions publishes approximately 30 new or revised titles a year, with a backlist of over 300 titles. The *Guide to Reference*, long a staple—under a variety of titles—of the ALA Editions catalog, released as an online title in 2008 (Appendix).

ALA Graphics provides posters and other promotional items supporting libraries, literacy, and reading. ALA Graphics has also played a key role in ALA’s advocacy for libraries. In 1921, ALA commissioned Chicago Tribune cartoonist John T. McCutcheon (the 1932 Pulitzer Prize winner) to draw a poster advocating use of libraries. Copies of the poster were made available to libraries—at \$5.00/100 posters, \$3.50/1000 bookmarks.^[50]

In 1981, ALA inaugurated its celebrity “Read” posters—now a staple offering in the ALA Graphic catalog. The first “star” to be featured was not a person but a cartoon—Mickey Mouse. ALA produced its first set of celebrity “Read” posters in 1984–1985. Posters featured such stars as Bette Midler, Paul Newman, Mikhail Baryshnikov, and Michael J. Fox. Of that first set, the most popular would be a poster of “Bill Cosby and

friends”—with over 26,000 copies sold by the end of the decade.^[51] Current posters feature Tony Hawk, Rachel Ray, Corbini Bleu and Common, among others. In addition to the celebrity “Read” posters, ALA Graphics also markets a “Read” CD, enabling libraries across the country to produce their own posters—featuring staff and local celebrities.

ALA Conferences

Annual conference: Growth and development

The first ALA conference was held in 1876. With the exception of 1878, 1880, and 1884, the Association then held annual conferences until the war years of 1943–1945. Six of these meetings were international conferences, held in European cities in conjunction with European associations. Four conferences were held in Canada—but were not considered “international.”^[2] The fifth Canadian conference, in Montreal in 1960, was a joint ALA–Canadian Library Association conference. In June 2003, the American and Canadian Library Associations once again held a joint conference in Toronto. With registration underway—and on track for a record attendance—an outbreak of SARS (Severe Acute Respiratory Syndrome) was reported in Toronto. Both ALA and CLA staff and leaders would spend the countless hours over the next months in consultation with public health agencies, medical practitioners, and others—and, in the end, the ALA, along with CLA, would be the first major convention and exhibit to keep its commitment to meet in Toronto following the SARS outbreak.

In 1903 (Boston), conference attendance surpassed 500 for the first time—setting a new record at 1018 at a time when total ALA membership was 1152. By 1938 (New York), attendance had reached the 5000 mark. Over 12,000 gathered to celebrate ALA’s Centennial in 1976. In 1990, *American Libraries* reported: “Back in January, portents of a possibly impossibly large Annual Conference were evident.”^[52] With ALA membership at the 50,000 mark, famous speakers scheduled (including Tom Wolfe, Ray Bradbury and Senators Paul Simon and Patrick Leahy), ALA celebrating its 100th anniversary, attendance totaled 19,982—surpassing the previous year’s attendance in San Francisco by 2776. Total attendance 10 years later, at the 2000 Annual Conference in Chicago, was 24,913. In June 2007, ALA set a new Annual Conference participation record, in Washington, DC, at 28,499, including registrants, exhibitors, staff, press, and guests.

Throughout ALA’s history, conferences have served the purposes of governance, education, business, and entertainment. In 1891, following ALA’s first conference in San Francisco, ALA president Samuel S. Green, elected to replace an ailing Dewey, suggested that future conferences be held in locations with fewer non-conference enticements.^[14] That meeting was attended primarily by westerners, with only 40 ALA members making the then-lengthy trek from the east coast.

Member complaints about meeting conflicts at conferences are also almost as old as the Association. In 1889, the newly formed College and Reference Section held its first meeting apart from the general body of conference attendees. Within a few years, members were complaining about missing meetings because of conflicts. Growth in membership and growth in demand for establishment of separate units within the Association to address special needs led to a continuing escalation in the number of meetings during the annual conference—as well as to increasing numbers of pre- and post-conference meetings. By 1967 (San Francisco), there were 987 meetings at the annual conference. By 2000 (Chicago), there were approximately 2500 meetings, programs, and events. That number has remained fairly stable.

Exhibits also began early. The Chicago conference of 1893, in conjunction with the World's Fair, included a model library, architectural exhibits, the Leyden Books, and the Rudolph continuous indexer.^[14] By the 1967 San Francisco conference, there were 375 commercial exhibits. By the 2001 San Francisco conference there were 1600 booths.

The Midwinter Meeting

In 1908, ALA began holding an annual business meeting—the Midwinter Meeting—in Chicago. Over the next four decades, that meeting expanded steadily in number of registrants and types of meetings. Beginning in 1952, the Midwinter Meeting was limited to the meetings of the ALA Council, the Executive Board and the business meetings of all ALA units, thus beginning a continuing cycle of expansion and restriction. In 1958, Council acted to further restrict the Midwinter Meeting, eliminating “programs, general business, or Membership Meetings of the divisions, sections, or round tables.” Following that restriction, the Midwinter Meeting again began to broaden.

In response to member pressures, in the Spring 1965, a committee of the Executive Board and Council, chaired by Katherine Laich, was appointed to study and make recommendations regarding the Midwinter Meeting. The committee's recommendations, at the 1966 Midwinter Meeting, were adopted without discussion. While the Midwinter Meeting would continue to be primarily “for carrying out the business of the Association through meetings of the Council, boards, and committees,” and while there would continue to be “be no programs, general business, or Membership Meetings of the divisions, sections, or round tables,” the Executive Board now had the power to authorize “a limited number of program meetings, institutes, conferences, or workshops. . . .”^[53]

The report also allowed the ALA Executive Board to “authorize the occasional movement of the Midwinter Meeting to an appropriate center other than Chicago. . .” and authorized ALA staff “to experiment with a limited number of commercial exhibits at the Midwinter Meeting,

whether in Chicago or elsewhere.” By March 1987, a headline in *American Libraries* declared: “A burgeoning ALA gobbles up 3800 hr of meetings in six days as it programs for information access and a library-card campaign.”^[54] That Midwinter Meeting in Chicago drew 6337 registrants (a 12% increase over the previous year) and a “house full of exhibitors.” In 2001, 13,989 gathered for the 2001 Midwinter Meeting in Washington, DC, including 10,249 registrants and exhibits visitors, as well as 3819 exhibitors, plus staff, press, and guests.

The educational function of the Midwinter Meeting has continued to grow, both based on and encouraging strong regional attendance. Early in the twenty-first century, ALA Divisions and other groups began offering “Pre-Midwinter Institutes” in conjunction with the ALA Midwinter Meeting. The number of such institutes grew over the next several years. The Midwinter Meeting has been particularly characterized by a rich, and growing, array of discussion groups, interest groups, and other “communities of interest.” Approximately, 200 such groups currently convene. In 2007 (Seattle), the ALA Executive Board authorized a speaker series—currently called the “Sunrise Speaker Series”—designed to give first-time and regional attendees a “taste” of the Annual Conference.

Conferences: Change and controversy

ALA's strong support for key values has, at times, affected conference site selection.

The ALA Annual Conference was held in Richmond, Virginia, in 1936. African-American members of the Association were faced with segregated lodging and eating facilities. Faced with protests from members, the ALA Council, on a recommendation from the new Committee on Racial Discrimination in 1937, adopted a policy that ALA would not meet in cities where access to conference hotel and meeting rooms was not available on equal terms. It would be another 20 years before the Association would meet in the South again. In 1977, the ALA, having gone on record in support of the Equal Rights Amendment in 1974, joined a “conference boycott” of states that had not approved the ERA. It would be 7 years before an ALA Annual Conference or Midwinter Meeting returned to Chicago when the 104th Annual Conference would set a new record with 10,152 paid attendees, breaking the 1980 record set in New York (9479). Issues related to gay rights would later result in the shifting a Midwinter site from Cincinnati to Philadelphia, as well as a Council resolution calling on the Association not to complete conference site contracts with jurisdictions that discriminate by law, with the ALA Executive Board to determine the appropriate action in each case, based on information to be provided by ALA Conference Services.^[55]

If ALA's strong values have sometimes led the Association to boycott sites, values have also been a key factor in staying with sites under difficult circumstances. Late in

the 2005 hurricane season, Katrina devastated New Orleans, scheduled site of the June 2006 ALA Annual Conference. That fall, following a brief visit to the city by key ALA staff, and extensive consultation, the ALA Executive Board agreed with a management recommendation that the 2006 ALA Annual Conference would proceed in New Orleans. Again, as in Toronto, ALA would be the first major conference and exhibition to make that commitment. In June, in addition to gathering for a conference, almost 1000 ALA members fanned out to volunteer sites across the city to assist in recovery efforts.

ALA's demographic profile and commitment to participation was reflected in a 1985 recommendation by the Committee on the Status of Women in Librarianship, endorsed by the ALA Executive Board, to ask Annual Conference Local Arrangements to provide a list of recommended child care services in host cities. Today, "Camp ALA" is a regular part of each ALA Annual Conference.^[56]

Reflecting rising national awareness of physical fitness, in 1984, at the Annual Conference in Dallas, ALA held its first Annual Conference Fun Run. 1st ALA Fun Run. Runners completed a 3 mi course in approximately 16.35.^[49] The ALA Fun Run ended following the 2004 Annual Conference, falling victim to rising costs and competition for scarce resources. Health concerns made a return to the ALA Annual Conference, however, in 2008, with ALA President Lorie Roy's Wellness Fair.

Awards and Scholarships

ALA grants and awards are presented for distinguished service to the profession, for publication and for research. Grants and awards, including some of the best known awards (such as the Caldecott and Newbery Medals), are given by ALA and by its Divisions and Round Tables. The ALA Awards Committee coordinates the work of the ALA awards juries and provides a broad policy and procedural framework within which the awards committees of various ALA units function. "Awards" initially encompassed all types of awards, including scholarships. In 2005, with the growth in the number of awards and scholarships, the ALA Scholarships and Study Grants committee was established, dividing the responsibility with the ALA Awards Committee.

"Check off" contributions to ALA scholarship endowments, through the annual ALA membership renewal process, began in 1976, with contributions going either to the David H. Clift scholarship or the Minority Scholarship. In 1977, the latter was renamed the Louise Giles scholarship in honor of a past president of Association of College and Research Libraries (ACRL). Over the next 3 decades, scholarship programs would increasingly—though not exclusively—focus on increasing diversity. The first Louise Giles Minority Scholarship was awarded by ALA in 1977. By 1991, the Library and Information

Technology Association, a division of ALA, began offering a minority scholarship (LITA/OCLC, LITA/LSSI). In 2000, the ASCLA Century Scholarship was established, to recruit people with disabilities to the profession.

In 1997, the ALA Executive Board approved the Spectrum Initiative, a 3-year, \$1.35 million, recruitment and scholarship initiative providing 50 \$5,000 scholarships/year to students from four traditionally under-represented racial/ethnic groups, as well as an ongoing Spectrum Institute (valued at \$1500/scholar), designed to build connections and community, and to facilitate the transition to professional leadership.^[57] The Spectrum Initiative subsequently developed into the "Spectrum family" of scholarships, including, as of 2008 the Giles, Albert, Teeple, Gordon, and Turock Scholarships, as well as the Spectrum scholarships, [Scholarship] Bash Scholarships, and a scholarship from the Medical Library Association. By 2008, the total number of Spectrum Scholars, past and current, had reached 560. Growth in the Spectrum program was significantly aided by the receipt of two awards (2004, 2007) from the federal Institute of Museum and Library Services (IMLS), under the Laura Bush 21st Century Librarian program. In 2006, IMLS awarded a grant to the University of Pittsburgh, working with ALA, for a Spectrum Doctoral Fellowship. The first Spectrum Doctoral Fellowships were awarded through ALA in 2006.

Standards and Guidelines

Over the course of its history, ALA has promulgated standards and guidelines for college, school, state, public, hospital, and institutional libraries. ALA is not a regulatory body and these standards have been promulgated for use by autonomous institutions. Standards have, nevertheless, been seen as valuable in providing a guide for self-measurement. Libraries have used ALA standards in seeking increased support, improved legislation. Standards and guidelines are reviewed by ALA's Standards Committee for consistency with ALA policy. A current list of standards and guidelines is available on the ALA Web site.

ALA Offices

ALA's programmatically focused Offices largely mirror the member-determined priority areas of the Association. As of August 31, 2008, ALA Offices included the following:

Chapter Relations Office, Development Office, Diversity Office, International Relations Office, Office for Accreditation, Office for Government Relations (in Washington, DC), Office for Human Resource Development and Recruitment, Office for Information Technology Policy (in Washington, DC), Office for Intellectual Freedom, Office for Library Advocacy, Office for Literacy and Outreach Services, Office for Research and Statistics, Office for ALA Governance, Public Information Office, Public Programs Office, Washington Office (in Washington,

DC). ALA maintains a headquarters Library and Knowledge Management Center—serving members and staff, as well as the public. Most offices work with standing advisory committees of members.

Headquarters offices

For the first 30 years of its life, ALA conducted all its activities, except publishing, without a permanent headquarters office and, generally, without paid staff. In 1906, ALA leased office space on Newbury Street in Boston—a lease that would be terminated by the end of 1907. By 1909, following a protracted debate over location, ALA took a small step toward establishment of a permanent headquarters, using space provided by The Chicago Public Library in its Central Library.^[2]

By 1924, the Association was outgrowing its quarters at the Chicago Public Library and part of the headquarters staff moved across the street to quarters provided by the John Crerar Library.^[2] Then, in May 1929, the entire ALA staff, 50 people, moved into rented quarters at 520 North Michigan Avenue, Chicago. In July 1946, the Association moved into the former Cyrus H. McCormick mansion at 50 East Huron, which the Association had purchased and remodeled. Despite debate—but with addition—ALA continues at that site.

With headquarters established in Chicago, in 1944 ALA Council approved a Library Development Fund drive, to raise money from ALA membership for the temporary support of an ALA Washington Office.^[58] In 1946, ALA opened its federal office in Washington, DC; the first director was Paul Howard. The fund would continue to support the Washington Office until 1949, when closure was threatened due to the Fund depletion. An alternative funding proposal—including both ALA operating and endowment funds, as well as contributions from state library associations and individuals—was proposed by Ralph Lindquist, then chair of ALA's Federal Relations Committee, and ALA's Washington Office continued.

Soon after the Chicago headquarters moved into the McCormick mansion, in 1949, the Fourth Activities Committee recommended that all ALA headquarters activity be in Washington, DC. (ALA already housed government-relations staff there.) While this recommendation was rejected at the time, the issue of headquarters location remained a significant one to many association leaders. In 1957, the Executive Board Subcommittee on Headquarters Location recommended the sale of the Chicago property and relocation of its headquarters to Washington, DC, by the beginning of 1959, citing greater convenience to the majority of members and officers, proximity to other national associations with which ALA maintained working relationships, the economy and administrative efficiency of combining the Chicago and Washington operations, and legal matters. While the ALA Council approved the recommendation (82–34), the ALA

membership exercised its right to set aside Council action, petitioned for a mail vote by the membership, and reversed the Council decision (5739–2199).

In 1963, during the Annual Conference in Chicago, ALA dedicated its own building, at 50 E. Huron Street in Chicago, erected on the site of the old McCormick mansion. The staff then numbered 164. ALA had, however, entered a period of rapid programmatic growth. A short 2 years later, headquarters space was again a problem, the publishing department was moved to rented space, and the new headquarters building was remodeled (1966). It was obvious that additional space would be required, which again brought up the question of moving to Washington, DC. Again, in 1967, a subcommittee of the Executive Board recommended that the ALA headquarters be moved to Washington, DC. Again, Council supported the Board's recommendation and, again, membership petitioned for a mail vote and overturned the Council action.

Following lengthy debate and some lean years, in 1974 ALA President Jean Lowrie signed the agreement which would lead to ALA's new headquarters building, adjoining the 50 E. Huron facility. In November 1977, ALA entered into a complex development agreement that would exchange approximately 26,000 ft² of undeveloped property owned by ALA—and used by ALA staff for parking—for six floors of office space, lobby, and related facilities.^[59]

In addition to the Chicago headquarters, ALA also owns and maintains offices in Washington, DC for staff involved in government relations, as well as the Office for Information Technology Policy. The staff of *CHOICE* magazine, a publication of the ACRL, a division of ALA, is located in a Middletown, CT office. In 2008, ALA began the process of purchasing office space for *CHOICE*.

CONCLUSION

Reporting at the end of FY2007, ALA Treasurer Rod Hersberger presented a complex, but healthy, organization, with total FY2007 revenues over \$50 million and a consolidated balance sheet showing net assets in excess of \$36 million. As of the end of fiscal year 2008, the total staff of the ALA had grown to about 280.^[60] Various reports on the state of the association would present a strong organization facing significant challenges—from rapidly changing technology to a faltering economy, from challenges to privacy and intellectual freedom to the complexities of copyright in a networked global society.

Looking back over ALA's history, however, provides grounds for optimism. From the late nineteenth century to the early twenty-first century, you see an organization that has held steadfastly to its core mission “to promote library service and librarianship.”^[1] To enable that essential continuity, it has been willing to periodically review and change its structure, develop and modify policies to

address an increasingly diverse and globalized society and take advantage of a succession of new technologies. Current programmatic priorities—advocacy, diversity, education and lifelong learning, equitable access to information, intellectual freedom, literacy—run like bright threads through the long and complex history, knitting together the organization, policy, and public stance. That persistence of mission and message is essential and it provides a foundation for organizational change.

APPENDIX

American Library Association: Membership Statistics, August 2008^a

American Library Association	66,624
<i>ALA Divisions</i>	
American Association of School Librarians (AASL)	9,013
Association for Library Collections & Technical Services (ALCTS)	4,749
Association for Library Service to Children (ALSC)	4,222
Association for Library Trustees and Advocates (ALTA)	1,173
Association of College and Research Libraries (ACRL)	12,782
Association of Specialized & Cooperative Library Agencies (ASCLA)	896
Library Leadership, Administration and Management Association (LLAMA) ^b	5,104
Library and Information Technology Association (LITA)	4,018
Public Library Association (PLA)	11,934
Reference and User Services Association (RUSA)	4,960
Young Adult Library Services Association (YALSA)	5,702
<i>ALA Round Tables</i>	
Continuing Library Education Network and Exchange Round Table (CLENERT)	432
Ethnic and Multicultural Information Exchange Round Table (EMIERT)	647
Exhibits Round Table (ERT)	450
Federal and Armed Forces Libraries Round Table (FAFLRT)	387
Gay, Lesbian, Bisexual, Transgendered Round Table (GLBTRT)	954
Government Documents Round Table (GODORT)	1,039
Intellectual Freedom Round Table (IFRT)	1,709
International Relations Round Table (IRRT)	1,797
Library History Round Table (LHRT)	571
Library Instruction Round Table (LIRT)	1,643
Library Research Round Table (LRRT)	1,486
Library Support Staff Interest Round Table (LSSIRT)	622
Map and Geography Round Table (MAGERT)	374
New Members Round Table (NMRT)	1,906
Social Responsibilities Round Table (SRRT)	2,213
Staff Organizations Round Table (SORT)	195
Video Round Table (VRT)	284

^aTotal membership, including Personal, Organizational, Corporate.

^b2007–2008 name change—previously Library Administration and Management Association.

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American Medical Informatics Association (AMIA)

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Abstract

The American Medical Informatics Association (AMIA) incorporated 20 years ago through the merger of three existing informatics groups: the Symposium on Computer Applications in Medical Care (SCAMC), the American Association for Medical Systems and Informatics (AAMSI), and the American College of Medical Informatics (ACMI). AMIA has nearly 4000 members from over 55 countries worldwide, including informatics professionals, students, institutions, and corporations. Together they represent all basic, applied, and clinical interests in informatics. AMIA is the trusted source of knowledge about the effective use of informatics to transform health care within three domains: clinical informatics (including health care, research, and personal health management), public health and population informatics, and translational bioinformatics. AMIA holds several meetings each year—the Summit on Translational Bioinformatics in March, the Spring Congress in May, an Academic Forum meeting in the summer, and two fall meetings, the Health Policy Meeting in September and its signature event, the Annual Symposium held in November.

AMIA—THE PROFESSIONAL HOME FOR BIOMEDICAL AND HEALTH INFORMATICS

American Medical Informatics Association (AMIA) is the premier professional organization in the United States dedicated to the development and application of informatics in the support of health and patient care, public health, teaching, research, administration, and related policy. AMIA incorporated 20 years ago as the American Medical Informatics Association through the merger of three existing informatics groups, the Symposium on Computer Applications in Medical Care (SCAMC), the American Association for Medical Systems and Informatics (AAMSI), and the American College of Medical Informatics (ACMI). AMIA has nearly 4000 members from over 55 countries worldwide. Members include informatics professionals, students, institutions, and corporations and together, they represent all basic, applied, and clinical interests in informatics. AMIA is governed by a Chairman and Board of Directors and calls upon its members to serve in volunteer roles on task forces, committees, and working groups. AMIA office is led by the President and CEO who works with a professional staff to manage AMIA's programs and services.

AMIA is the trusted source of knowledge about the effective use of informatics to transform health care within three domains: clinical informatics (including health care, research, and personal health management), public health and population informatics, and translational bioinformatics. AMIA is frequently called upon as a source of informed and scholarly opinion on policy issues relating

to the national health information infrastructure, uses and protection of personal health information, and public health considerations and international dimensions of informatics education and research. AMIA publishes a leading industry cited scholarly journal, *the Journal of the American Medical Informatics Association (JAMIA)*, proceedings of its meetings, the e-News Weekly, an electronic newsletter, and digest of syndicated news as well as AMIA's Standards Standard bulletin, a periodic review of international health-related standards.

In 2005, the Board of Directors, members and AMIA staff undertook a strategic planning exercise to review and where needed redefine the vision, mission, and goals of the association. Now, 4 years later, AMIA has cemented its standing in the health care community as the professional home for biomedical and health informatics. AMIA continues to work on new projects to advance health and health care with the development of educational offerings and programs, public policy and advocacy initiatives, scientific meetings and symposia, white papers and reports, and ongoing membership activities.

AMIA holds several meetings per year—the Summit on Translational Bioinformatics in March, the Spring Congress in May, an Academic Forum meeting in the summer, and two fall meetings, the Health Policy meeting and the Annual Symposium. Summit programming includes informatics research emerging from the analysis of molecular and clinical data and measurement; relating and representing phenotypes and disease; delineating disease through the study of organisms, evolution, and taxonomy; and computational approaches to finding molecular

mechanisms and therapies for disease. The congress program engages attendees to develop a common view of the opportunities and challenges facing informatics. Congress topics include the development of effective electronic health records and the evaluation of their impact on care delivery; the incremental definition of personal health records and the new challenges associated with emerging approaches to Personal Health Records (PHR) development and use; the technologies, policies, research, and social structures required to create a stronger public health informatics infrastructure; and the opportunities, challenges, and progress associated with accelerating the field of clinical research informatics.

AMIA's Annual Symposium is the premier scientific meeting for new research and development in biomedical and health informatics. It is the place to hear about leading edge scientific work, to learn about evolving standards and policies for the management of biomedical information, and to understand how cutting-edge information and communication technologies can best be developed and deployed. The symposium provides a wide range of formats for education and discussion and includes half-day tutorials, expert panels, papers, posters, and invited talks. Over 2000 biomedical and health informatics professionals attend this signature event each year. AMIA's education, training, and academic-related opportunities are rigorous and independently evaluated, and we continue to develop new programs and services. Our 10 × 10 program to train 10,000 health care professionals in applied health and medical informatics by the year 2010 continues to grow. In 2007, AMIA launched a 5-year cooperative agreement with the Centers for Disease Control and Prevention. The purpose of the program is to strengthen the breadth and depth of the public health workforce by providing a training in public health informatics and encourage new explorations of innovations at the intersection of public health and health informatics. AMIA also continues to support nursing informatics through the Alliance for

Nursing Informatics, the TIGER initiative, and our own educational endeavors. AMIA received the exciting news in 2007 that it was selected to host NI2012, the 11th triennial Congress on Nursing Informatics. This is the premier meeting for nurses and informatics experts representing global communities and working with informatics applications in nursing care, administration, research and education, and will bring together thought leaders of the nursing informatics community.

In 2008, AMIA launched the Academic Forum and it now has 45 members. The Forum provides a unique platform for surveying and analyzing activities in academic units dedicated to biomedical and health informatics, and for recommending best practices related to education, scholarship, faculty development, salary structures and retention, and other selected issues relating to the academic enterprise.

One of AMIA's newest agenda items is to develop through its membership in and collaboration with the International Medical Informatics Association (IMIA), an international distance learning continuing education program in informatics for low-resource environments. Working under a global umbrella program known as 20/20 e-Health Capacity Building, AMIA is creating *Health Informatics Building Blocks* to improve basic clinical informatics skills.

Also relating to the association's e-Health Capacity strategy, AMIA received a \$1.2 million grant from the Bill & Melinda Gates Partnership to support the development of a blueprint to create a robust global health informatics education and research infrastructure in low-resource settings. Through this Global Partnership Program (GPP), AMIA will lead a team of experts to develop scalable approaches to e-health education, and help address the need for a global informatics workforce and scholarly network.

More information about AMIA may be found on its Web site: <http://www.amia.org>.

American National Standards Institute (ANSI)

Jana Zabinski

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Abstract

The American National Standards Institute (ANSI) is a private, nonprofit organization that oversees the standards and conformity assessment system in the United States.

INTRODUCTION

The American National Standards Institute (ANSI) is a private, nonprofit organization that oversees the standards and conformity assessment system in the United States, and represents the needs and views of U.S. stakeholders in standardization forums around the globe. ANSI's membership comprises government agencies, organizations, corporations, academic and international bodies, and individuals. The Institute represents the interests of more than 125,000 companies and 3.5 million professionals.

The American National Standards Institute approves standards that are developed by accredited organizations comprised of representatives of standards developing organizations (SDOs), government agencies, consumer groups, companies, and others. The Institute also accredits organizations that carry out product or personnel certification in accordance with requirements defined in international standards. (See Fig. 1.)

Standards ensure that the characteristics and performance of products are consistent, that the same definitions and terms are used, and that products are tested the same way. For example, standards ensure that libraries can share electronic card catalog information, and patrons can search those catalogs from connected computers with Internet access.

HISTORY

By the twentieth century, the need for coordination among U.S. standards-setting groups became evident. In October 1918, three government agencies and five private sector organizations joined together to form a coordination body known as the American Engineering Standards Committee, the predecessor of what is now known as ANSI.

Today, the U.S. standardization community is comprised largely of nongovernmental SDOs and consortia; these groups are primarily supported by industry participation.

OVERVIEW OF THE U.S. STANDARDIZATION SYSTEM

Standardization encompasses a broad range of considerations—from the actual development of a standard to its promulgation, acceptance, implementation, and demonstration of compliance. A primary facilitator of commerce, standardization has become the basis of a sound national economy and the key to global market access.

Voluntary consensus standards serve as the cornerstone of the distinctive U.S. standardization system. These documents arise from an open process that depends upon data gathering, a vigorous discussion of all viewpoints, and agreement among a diverse range of stakeholders. Thousands of individual experts representing the viewpoints of consumers, companies, industry and labor organizations, and government agencies at the federal, state, and local level voluntarily contribute their knowledge, talents, and efforts to standardization activities.

“Voluntary” refers only to the manner in which the standard was developed; it does not necessarily refer to whether compliance to a consensus standard is optional or whether a government entity or market sector has endorsed the document for mandatory use.

AMERICAN NATIONAL STANDARDS

The Institute oversees the creation, promulgation and use of thousands of norms and guidelines that directly impact businesses in nearly every sector: from manufacturing and construction to agriculture, food service, software engineering, energy distribution, and more. Likewise, ANSI-accredited standards developers span the full gamut of industry sectors and services.

Though ANSI itself does not develop standards, the Institute facilitates the development of American National Standards, also known as ANS, by accrediting the procedures of standards developing organizations. ANSI accreditation signifies that the procedures used by these bodies meet the Institute's essential requirements for openness,



Fig. 1 ANSI Logo.

balance, consensus, and due process. Currently, more than 200 active SDOs are accredited under the *ANSI Essential Requirements: Due process requirements for American National Standards*. Approximately 10,500 American National Standards carry the ANSI designation.

Hallmarks of the American National Standards process involve

- Consensus by a group that is open to representatives from all interested parties.
- Broad-based public review and comment on draft standards.
- Consideration of and response to comments.
- Incorporation of submitted changes that meet the same consensus requirements into a draft standard.
- Availability of an appeal by any participant alleging that these principles were not respected during the standards-development process.

For example, the National Information Standards Organization (NISO) develops and maintains standards for information systems, products, and services relating to bibliographic and library applications. NISO's standards span both traditional and new technologies, and address the full range of information-related needs, including retrieval, storage, and preservation.

Another ANSI-accredited standards developer, the Data Interchange Standards Association (DISA) writes standards that support e-commerce and business-to-business data exchange, from order processing to electronic payment. DISA also serves as the secretariat for the ANSI-Accredited Standards Committee (ASC) X12, which develops e-business exchange standards in XML and X12 EDI formats.

ANSI INVOLVEMENT IN INTERNATIONAL STANDARDS ACTIVITIES

In the international arena, ANSI promotes the use of U.S. standards abroad, advocates U.S. policy and technical positions in international and regional standards and conformity assessment organizations, and encourages the adoption of international standards as national standards where appropriate. The Institute is the official U.S. representative to the two major international standards organizations,

the International Organization for Standardization (ISO) and, via the U.S. National Committee (USNC), the International Electrotechnical Commission (IEC). ANSI is also a member of the International Accreditation Forum (IAF).

Through ANSI, the U.S. has immediate access to the ISO and IEC standards development processes. ANSI and the USNC frequently carry U.S. standards forward to ISO and IEC where they are adopted in whole or in part as international standards. U.S. positions are developed by U.S. Technical Advisory Groups (TAGs) that have been accredited by ANSI or approved by the USNC. Participation in a U.S. TAG is open to all affected stakeholders.

On behalf of ANSI, NISO administers the U.S. TAG to ISO Technical Committee 46 (TC 46), *Information and Documentation*. TC 46 develops international standards relating to records management and museum documentation, as well as publishing, archiving, and indexing.

ASC X12 serves as the U.S. TAG administrator to ISO TC 154, *Processes, Data Elements and Documents in Commerce, Industry and Administration*, which supports international standardization activities in the field of industrial data. ISO TC 154 standards address business administration processes and information interchange between individual organizations.

CONFORMITY ASSESSMENT

On the other side of the standardization coin is conformity assessment, a term used to describe the evaluation of products, processes, systems, services, or personnel to confirm adherence to the requirements identified in a specified standard. In general, conformity assessment includes sampling and testing, inspection, supplier's declaration of conformity, certification, and management system assessment and registration. It can also include accreditation of the competence of those activities by a third party and recognition (usually by a government agency) of an accreditation program's capability.

Conformity assessment forms a vital link between standards that define product characteristics or requirements and the products themselves. It can verify that a particular product meets a given level of quality or safety, and it can provide explicit or implicit information about the product's characteristics, the consistency of those characteristics, and/or the performance of the product.

The American National Standards Institute's role in the conformity assessment arena includes accreditation of organizations that certify that products and personnel meet recognized standards. The ANSI-American Society for Quality National Accreditation Board (ANAB) serves as the U.S. accreditation body for management systems certification, primarily in areas such as quality (ISO 9000 family of standards) and/or the environment (ISO 14000 family of standards). ANSI also is involved in several international and regional organizations to promote multilateral

recognition of conformity assessments across borders to preclude redundant and costly barriers to trade.

The American National Standards Institute's accreditation programs themselves are created in accordance with international guidelines as verified by government and peer review assessments.

STANDARDS PANELS

Through its standards panel program, ANSI provides standards-based solutions to national and international priorities. Each of the Institute's panels engages a broad range of stakeholders in the coordination and harmonization of standards and conformity assessment activities relevant to the panel's area of focus.

In 2004, the ANSI Homeland Security Standards Panel (ANSI-HSSP) supported a special project on private-sector emergency preparedness that had been requested by the 9/11 Commission. The panel continues to provide ongoing support for the Department of Homeland Security and other agencies.

At the request of the Office of Science and Technology Policy in the Executive Office of the President, ANSI launched the Nanotechnology Standards Panel (ANSI-NSP) to facilitate the development of standards for nanotechnology nomenclature and terminology; materials properties; and testing, measurement, and characterization procedures.

The Healthcare Information Technology Standards Panel (HITSP) is under contract with the Department of

Health and Human Services to assist in establishing a national health IT network for the United States.

The Identity Theft Prevention and Identity Management Standards Panel (IDSP) is supporting all citizens in its efforts to facilitate the identification and development of standards to secure and protect personal information.

Launched in May 2007, the ANSI Biofuels Standards Panel (ANSI-BSP) is a cross-sector coordinating body established to promote the development and compatibility of standards and conformity assessment programs to support the large-scale commoditization of biofuels.

CONCLUSION

The American National Standards Institute provides the forum through which all affected stakeholders may cooperate in establishing, improving, and recognizing consensus-based standards and certification programs that are dynamically responsive to national needs. ANSI continues to be fully involved in its support of the goals of U.S. and global standardization and remains committed to enhancing of the quality of life for all global citizens.

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American Society for Information Science and Technology (ASIST)

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Abstract

The American Society for Information Science and Technology (ASIST) was founded as the American Documentation Institute in 1937. In response to the evolution of the field, the society has grown and changed its structure and focus. This entry describes the Society's history, purpose, structure (regional chapters plus topical special interest groups), governance, meetings, and publications. This entry is based on the History of ASIST section of the Society's Web site, <http://www.asis.org>.

INTRODUCTION

The American Society for Information Science and Technology, ASIST, is an association of researchers and information professionals leading the search for new and better theories, techniques, and technologies to improve access to information. Among its membership are some 4000 specialists from such fields as computer science, linguistics, management, psychology, librarianship, engineering, law, medicine, chemistry, and education; individuals who share a common interest in improving the ways society stores, retrieves, analyzes, manages, archives, and disseminates information, coming together for mutual benefit.

American Society for Information Science and Technology provides educational and conference programs, highly regarded journals, and other publications, as well as professional services for information systems developers, online professionals, information resource managers, librarians, record managers, and others who bridge the gaps between research and application, and between developer and user. The Society's flagship publications are the highly regarded *Journal of the American Society for Information Science and Technology* and *Annual Review of Information Science and Technology*. The American Society for Information Science and Technology is a nonprofit 501(c)3 professional association organized for scientific, literary, and educational purposes.

HISTORY

1937—Beginnings in Documentation

The American Society for Information Science and Technology was founded on March 13, 1937, as the American

Documentation Institute (ADI), a service organization made up of individuals nominated by and representing affiliated scientific and professional societies, foundations, and government agencies. Its initial interest was in the development of microfilm as an aid to learning. Watson Davis, the Institute's first president (1946–1943), was the editor of *Science News Letter* and director of Science Service, a nonprofit organization founded to promote public appreciation of science. The American Documentation Institute compiled an impressive record of achievement in its early years: development of microfilm readers, cameras, and services; fostering negotiations and research that resulted in the so-called “gentleman's agreement” covering the photo-duplication of copyrighted materials; establishment of programs for the storage and reproduction of auxiliary publications in support of journal editors; operation of an Asian scientific literature service during World War II; support of Interlingua, an early rival of Esperanto, to foster international science communications; and cosponsorship of the 1958 International Conference on Scientific Information.^[1–4]

1950s—Transition to Modern Information Science

As the number of people engaged in developing new principles and techniques in the many areas of documentation and information services increased, the Bylaws were amended in 1952 to admit individual as well as institutional members. Thus, ADI became the national professional society for those concerned with all elements and problems of information science. With the 1950s came increasing awareness of the potential of automatic devices for literature searching and information storage and retrieval. As these concepts grew in magnitude and potential, so did the variety of professional interests.^[1,4,5]

1960s—The Information Explosion

During the 1960s, membership increased sevenfold as the problems created by the “information explosion” became of national concern. Reflecting this change in its total range of activities, as well as the emergence of information science as an identifiable configuration of disciplines, the membership voted to change the name of the ADI to the American Society for Information Science (ASIS). The name change took effect January 1, 1968, and emphasized the fact that the membership of ASIS was uniquely concerned with all aspects of the information transfer process, and that the Society was a national professional organization with regional chapters for those concerned with designing, managing, and using information systems and technology. Harold Borko’s frequently cited article, “What Is Information Science?,” helped to define the field:

Information science is that discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. It is concerned with the body of knowledge relating to the origin, collection, organization, storage, retrieval, interpretation, transmission, and utilization of information.^[6]

One of the Society’s flagship publications, the *Annual Review of Information Science and Technology (ARIST)*, was launched in 1966, under the editorship of Carlos A. Cuadra and with support from the National Science Foundation.

1970s—The Move to Online Information

The transitions from batch processing to interactive interaction and from mainframe to mini- and micro-computers accelerated in the 1970s. Traditional boundaries among disciplines began to fade; many library schools and some departments of computer science added “information” to their titles. In 1974, the Society’s *Newsletter* became the *Bulletin of the American Society for Information Science*, a mainstay membership publication of the Society. During this decade, ASIS made the midyear meeting an annual event focusing on a single topic of current interest and sponsored a bicentennial conference (1976) on the role of information in the country’s development. From 1970 to 1974, ASIS administered the Educational Resources Information Center (ERIC) Clearinghouse on Library and Information Sciences; the Society was also an active participant in the planning and implementation of the 1979 White House Conference on Library and Information Services.

1980s—Personal Computers Change the Market

By the 1980s, large databases such as Grateful Med at the National Library of Medicine and user-oriented services

such as Dialog and CompuServe, were for the first time accessible by individuals from their personal computers. The American Society for Information Science added to and revised its special interest groups (SIGs) to respond to the changes establishing groups on office information systems and personal computers as well as international information issues and rural information services. By the end of the decade, SIGs had been formed and reformed to represent various interests, including nonprint media, social sciences, energy and the environment, and community information systems, and ASIS had its first non-North American chapters.

1990s and 2000s—The Human/Social Perspective

The social implications of information and communication technologies became increasingly apparent in the 1990s and the Society responded. Ann Prentice’s “environmental scan” identified key topics that were expected to reshape work and the workforce, including public access to and ownership of information, internationalization, and increasing expectations of information technology. Themes that appeared regularly in the Society’s *Bulletin* and at national meetings included information management, globalization, intellectual property, computer networks (National Research and Education Network, the Internet), and digitization of text and visual information. Interest in representation of information found new applications in, for example, markup languages, taxonomy, metadata, and information architecture. Understanding of information retrieval was broadened and deepened by such developments as hypertext, the World Wide Web, search engines and browsers, and the addition of new domains to the Text Retrieval Conferences.

The Society experienced changes in its own use of information technology. Merri Beth Lavagninio introduced the ASIS-L listserv in 1992. The Society created its first Web site in 1995;^[7] it was chosen as a Yahoo! “Pick of the Day” in 1996. After considerable deliberation about making the Society’s publications available electronically, a digital library was unveiled in 2006. In 2007, the *Bulletin of the American Society for Information Science and Technology* became an electronic-only publication.

The Society’s work reflected the increasing interest in social and historical aspects of information science in other ways as well. In 1991, it renamed and reoriented one of the SIGs to focus on the History and Foundations of Information Science, and in 1992, ASIS adopted its first professional guidelines. Conferences cosponsored with the Chemical Heritage Foundation on the History and Heritage of Scientific and Technical Information Systems were held in 1998 and 2002.

Reflecting both internal and external influences, the Society again changed its name in 2000, becoming the American Society for Information Science and Technology. President Eugene Garfield championed the change,

calling attention to the importance of practical, information-technology focused programs. The Society continued its annual meetings, but discontinued the midyear meeting in favor of “summits” featuring topics such as information architecture, knowledge management, and digital archives for engineering and scientific research.

PURPOSE

ASIST’s mission is to advance the information sciences and related applications of information technology by providing focus, opportunity, and support to information professionals and organizations.

The Society seeks to stimulate participation and interaction among its members by affording them an environment for substantive professional exchange. It encourages and supports personal and professional growth through opportunities for members to extend their knowledge and skills, develop and use professional networks, pursue career development goals, and assume leadership roles in the Society and in the broader information community. The American Society for Information Science and Technology increases the influence of information professionals among decision makers by focusing attention on the importance of information as a vital resource in a high technology age; in this way the organization seeks to promote informed policy on national and international information issues. It supports the advancement of the state-of-the-art and practice by taking a leadership position in the advocacy of research and development in basic and applied information science.

To accomplish these goals, ASIST edits, publishes, and disseminates publications concerning research and development; convenes annual meetings providing a forum for papers, discussions, and major policy statements; holds smaller local and special interest meetings, as well as special symposia; and acts as a sounding board for the promotion of research and development and for the education of information professionals.

CHAPTERS AND SIGS

To give scope and focus to the diverse interests of its members, special interest groups (SIGs) were established in 1966. These groups are, in effect, small professional organizations within ASIST that encourage the discussion and development of both theoretical and practical issues. The introduction and widespread adoption of the World Wide Web encouraged and supported five virtual SIGs: Bioinformatics; Blogs, Wikis, and Podcasts; Critical Issues; Information Architecture; and Metrics. As of 2009, the other 17 SIGs are Arts and Humanities; Classification Research; Digital Libraries; Education for Information Science; History and Foundations of Information

Science; Human–Computer Interaction; Information Architecture; Information Needs, Seeking and Use; Information Policy; International Information Issues; Knowledge Management; Library Technologies; Management; Medical Informatics; Scientific and Technical Information Science; Social Informatics; and Visualization, Images, and Sound.

All ASIST members are automatically enrolled as members of SIG/CON, which seeks to “explore the fundamental notions of information science, and expose them for what they are.”^[8] The official SIG/CON Web site describes the initial meeting: “Those who stumbled into the first SIG/CON session found it to be one of the most informative and intellectually challenging sessions of the conference, a tradition which continues to this day.”^[8] Dr. Llewellyn C. Puppybreath III, founder and perpetual chair of the group, has yet to appear at any of its meetings. The breadth of topics covered is evident in this list of titles from presentations: “Baloonean Logic” by Ev Brenner, “Conical Classifications” by C. David Batty, “Titular Colonicity” by Candy Schwartz, and “Early Binary Separation: Implications for Information Retrieval (relevance judgments by identical twins separated at birth)” by Joseph Janes.

At a local and regional level, ASIST has, in 2009, 18 chapters in major cities and regions in the United States and around the world: Arizona, Carolinas, Central Ohio, Europe, Florida, Indiana, Los Angeles, Metropolitan New York, Michigan, Minnesota, New England, New Jersey, Northern Ohio, Pacific Northwest, Potomac Valley (Washington, D.C. area), Southern Ohio, Taipei, and Wisconsin. These chapters provide local forums for discussion and information exchange for members in a given locality.

In addition, 39 student chapters encourage the discussion and are in development of research and education, and are a medium for channeling student interest toward issues of concern to the profession: Catholic University of America, Drexel University, European Student Chapter, Florida State University, Indiana University, Long Island University, Louisiana State University, North Carolina Central University, Ohio Virtual, Pratt Institute, Rutgers University, San Francisco Bay Area, Simmons College, St. John’s University, State University of New York-Albany, State University of New York-Buffalo, State University of New York-Oswego, Taipei University, University of British Columbia, University of California at Los Angeles, University of Denver, University of Hawaii, University of Illinois at Urbana-Champaign, University of Iowa, University of Kentucky, University of Maryland, University of Michigan, University of North Carolina Chapel Hill, University of North Texas, University of Pittsburgh, University of South Carolina, University of South Florida, University of Tennessee, University of Texas-Austin, University of Toronto, University of Washington, University of Wisconsin-Madison, University of Wisconsin-Milwaukee, and Wayne State University.

GOVERNANCE

The ASIST Board of Directors consists of the president, president-elect, immediate past president, treasurer, a parliamentarian, directors chosen by the SIGs and chapters, and six directors-at-large. The American Society for Information Science and Technology maintains headquarters under an executive director at 1320 Fenwick Lane, Suite 510, Silver Spring, Maryland 20910. The Society's Web address is <http://www.asis.org>.

The Executive and Budget and Finance committees are standing committees of the Board of Directors; standing committees of the Society are Awards and Honors, Constitution and Bylaws, Information Science Education, International Relations, Leadership, Membership, Nominations, Publications, and Standards. An annual business meeting of the membership is held during the ASIST annual meeting.

The presidents of the Society have been:

ADI

Watson Davis 1937–1943
 Keyes D. Metcalf 1944
 Waldo G. Leland 1945
 Watson Davis 1946
 Waldo G. Leland 1947
 Vernon D. Tate 1948–1949
 Luther H. Evans 1950–1952
 E. Eugene Miller 1953
 Milton O. Lee 1954
 Scott Adams 1955
 Joseph Hilsenrath 1956
 James W. Perry 1957
 Herman H. Henkle 1958
 Karl F. Heumann 1959
 Cloyd Dake Gull 1960
 Gerald J. Sophar 1961
 Claire K. Schultz 1962
 Robert M. Hayes 1963
 Laurence B. Heilprin 1964–1965
 Harold Borko 1966
 Bernard M. Fry 1967

ASIS

Robert S. Taylor 1968
 Joseph Becker 1969
 Charles P. Bourne 1970
 Pauline A. Atherton 1971
 Robert J. Kyle 1972
 John Sherrod 1973
 Herbert S. White 1974
 Dale B. Baker 1975
 Melvin S. Day 1976
 Margaret T. Fischer 1977
 Audrey N. Grosch 1978
 James M. Cretsos 1979
 Herbert B. Landau 1980

Mary C. Berger 1981
 Ruth L. Tighe 1982
 Charles H. Davis 1982–1983
 Donald W. King 1984
 Bonnie C. Carroll 1985
 Julie A. C. Virgo 1986
 Thomas H. Hogan 1987
 Martha E. Williams 1988
 W. David Penniman 1989
 Toni Carbo 1990
 Tefko Saracevic 1991
 Ann E. Prentice 1992
 José-Marie Griffiths 1993
 Marjorie M.K. Hlava 1994
 James E. Rush 1995
 Clifford Lynch 1996
 Debora Shaw 1997
 Michael Buckland 1998
 Candy Schwartz 1999
 Eugene Garfield 2000

ASIST

Joseph A. Busch 2001
 Donald Kraft 2002
 Trudi Bellardo Hahn 2003
 Samantha Hastings 2004
 Nicholas Belkin 2005
 Michael Leach 2006
 Edie Rasmussen 2007
 Nancy Roderer 2008
 Donald Case 2009

PUBLICATIONS

Publication affords a major channel of communicating current significant research reports, development work, and professional activities, both to the membership and to the interested public. It also serves as an historical record of achievement. In addition to a substantial monograph series, ASIST produces four continuing publications.

The *Journal of the American Society for Information Science and Technology* is a highly ranked and frequently cited source for reports of research and development in information science. The *Journal of Documentary Reproduction* (edited by Vernon D. Tate and published by the American Library Association, 1938–1942) is considered the predecessor of the Society's journal. In 1950, it was reborn as *American Documentation*. With the Society's changes of name it became the *Journal of the American Society for Information Science* (in 1970) and subsequently the *Journal of the American Society for Information Science and Technology* (in 2001). The *Journal* serves as a forum for new research in information transfer and communication processes in general, and in the context of recorded knowledge in particular. Concerns include the generation, recording, distribution, storage,

representation, retrieval, and dissemination of information, as well as its social impact and management of information agencies. The *Journal of the American Society for Information Science and Technology* consistently ranks at or near the top in assessments of influence in the field. It has gradually increased from four issues per year (1950–1969) to 14 issues per year (1998 to date). The *Journal* has been edited by Vernon D. Tate (1950–1951), Mortimer Taube (1952), Jesse H. Shera (1953–1960), Luther H. Evans (1961), James D. Mack (1962–1963), Arthur W. Elias (1964–1976), Charles T. Meadow (1977–1984), Donald H. Kraft (1985–2008), and Blaise Cronin (2009 to date).

The Annual Review of Information Science and Technology was first published in 1966. It surveys the landscape of information science and technology, providing the reader with an analytical, authoritative, and accessible overview of recent trends and significant developments. The initial volumes of this series were supported by a grant from the National Science Foundation. *ARIST* has been edited by Carols A. Cuadra (1966–1975), Martha E. Williams (1976–2001), and Blaise Cronin (2002–to date).

The proceedings of the annual meetings collect significant contributed papers. These proceedings are available on disc to meeting registrants and electronically through the ASIST digital library (which also includes the *Journal*, *Annual Review*, and *Bulletin*).

The *Bulletin of the American Society for Information Science* (formerly the Society's *Newsletter*) began publication in 1974. It is a bimonthly news magazine focused on developments and issues affecting the field, pragmatic management reports, opinion, and news of people and events in the information science community. Irene Travis was named editor in 1997; in 2007 the *Bulletin* became an electronic-only publication.

MEETINGS

Both the annual meeting, held in the fall of the year, and the special symposia provide important forums for communication among people of diverse interests. The annual meetings bring together researchers and professionals from virtually every field: attorneys, bankers, electronic and print publishers, government officials, businesspersons, librarians, engineers, social scientists, information managers, computer scientists, and many others. The topical summits feature presentations from research and industry leaders, opportunities for intense personal interaction, and awards recognizing excellence in all aspects of the field.

Special interest groups also organize and present specialized meetings. The SIG on Classification Research has conducted the highly regarded Workshop of Classification Research each year since 1990. The SIG on Information Needs, Seeking, and Use holds a research symposium in conjunction with ASIST annual meetings.

Table 1 Recipients of the Award of Merit and Watson Davis Award.

Year	Award of Merit recipients	Watson Davis Award recipients
1964	Hans Peter Luhn	
1965	Charles P. Bourne	
1966	Mortimer Taube	
1967	Robert Fairthorne	
1968	Carlos A. Cuadra	
1969	[not awarded]	
1970	Cyril W. Cleverdon	
1971	Jerold Orne	
1972	Phyllis Richmond	
1973	Jesse H. Shera	
1974	Manfred Kochen	
1975	Eugene Garfield	
1976	Laurence Heilprin	James M. Cretsos Laurence B. Heilprin Lois F. Lunin Gerald J. Sophar Herbert S. White Arthur W. Elias Irene Farkas-Conn Simon M. Newman Roy D. Tally Mary C. Berger Joe Ann Clifton Charles H. Davis
1977	Allen Kent	Frank Slater Gerard O. Platau Jan Krcmar Edmond Sawyer Toni Carbo Margaret T. Fischer Robert Tannehill, Jr. Lawrence Woods Michel Menou N. Bernard Basch George Abbott Barbara Flood Bonnie C. Carroll Madeline Henderson G. Daniel Robbins Julie Virgo Mickie Voges-Piatt Marianne Cooper Debora Shaw Audrey Grosch Martha Williams Donald Kraft Marjorie M.K. Hlava Karla Petersen Judy Watson Jessica L. Milstead Candy Schwartz Julie Hurd Thomas Hogan Nancy Roderer Joseph Busch Michael Buckland Trudi Bellardo Hahn Steve Hardin Paula Galbraith
1978	Calvin N. Mooers	
1979	Frederick Kilgour	
1980	Claire K. Schultz	
1981	Herbert S. White	
1982	Andrew A. Aines	
1983	Dale B. Baker	
1984	Joseph Becker	
1985	Robert L. Chartrand	
1986	Bernard M. Fry	
1987	Donald W. King	
1988	F. Wilfrid Lancaster	
1989	Gerard Salton	
1990	Pauline Atherton Cochrane	
1991	Roger K. Summit	
1992	Robert S. Taylor	
1993	Robert M. Hayes	
1994	Harold Borko	
1995	Tefko Saracevic	
1996	Jean Tague-Sutcliffe	
1997	Dagobert Soergel	
1998	Henry Small	
1999	José Marie Griffiths	
2000	Donald R. Swanson	
2001	Patrick G. Wilson	
2002	Karen Spärck Jones	
2003	Nicholas J. Belkin	
2004	Howard D. White	
2005	Marcia Bates	
2006	Blaise Cronin	
2007	Donald H. Kraft	

AWARDS

The American Society for Information Science and Technology's Award of Merit is the Society's highest honor. It is bestowed on individuals who have made noteworthy contributions to the field of information science, including the expression of new ideas, the creation of new devices, the development of better techniques, and outstanding service to the profession of information science. The Watson Davis Award commemorates the Society's founder. It is given to members who have shown outstanding continuous contributions and dedicated service to ASIST. The recipients of these awards are listed in Table 1.

CONCLUSION

The American Society for Information Science and Technology has responded to more than seven decades of change in our understanding and use of information technologies. It has evolved from an organization of institutions to an individual membership society. ASIST's meetings reach academic, industry, and professional audiences and the

society's long-standing publications increase their already high impact as they move to electronic formats.

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Approval Plans

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Abstract

An approval plan is an acquisitions method under which a library receives regular shipments of new print books or activation of new ebooks selected by a vendor. The selections are based on a formalized profile of local collection interests, and a library has the right to reject what it decides not to buy. The dealer also provides electronic new title announcements which the library may use to place orders for titles fitting the profile less perfectly. Approval plans were first implemented in the 1960s and following a period of controversy, by the 1990s had become the predominant way larger academic libraries in the United States and Canada acquired new books. By 2010, the rise of ebooks, new acquisitions models, and new financial pressures had caused many libraries to stop or to reduce the size of their approval plans. The underlying profile mechanisms first developed to support approval plans, however, are still widely used for new title announcements and to support "Patron-Driven" or "Demand-Driven" acquisitions programs, as well as to generate new title selection records for use by librarians.

INTRODUCTION

An approval plan is an acquisitions method under which a library receives regular shipments of new print books or activation of new ebooks selected by a vendor. The selections are based on a formalized profile of local collection interests, and a library has the right to reject what it decides not to buy. Approval plans were first implemented in the 1960s, and following a period of controversy, by the 1990s had become the predominant way larger academic libraries in the United States and Canada acquired new books. By 2010, the rise of ebooks, new acquisitions models, and new financial pressures had caused many libraries to stop or to reduce the size of their approval plans. The underlying profile mechanisms first developed to support approval plans, however, are still widely used to support "patron-driven" acquisition (PDA) or "demand-driven" acquisition (DDA) programs, as well as to generate new title selection records for use by librarians.

HISTORY OF APPROVAL PLANS

The forerunners of the modern approval plan were begun after World War II, when mass-buying programs such as the Farmington Plan were organized to enable North American academic libraries to acquire books from areas of the world where war had disrupted the book trade or where buying books was otherwise difficult. Various types of domestic gathering plans or blanket order plans, as they were known, also appeared in the postwar years, when support from the federal government increased book budgets to the point where library staffs strained to spend their money through title-by-title firm orders.

In the early 1960s, Richard Abel, the manager of Portland, Oregon's Reed College Book Store, which had grown an extensive business with academic libraries, began a company dedicated to this market. His insight that vendor advance buying in anticipation of library orders could preempt the orders themselves, if books were shipped to libraries automatically, was the core of the approval plan concept. Within a few years, approval plans were widespread among North American academic libraries, growth enabled by automation of many of the company's processes.

The scale of Abel's operation outpaced his finances, however, and in 1974 the firm failed. To alarmed librarians and publishers, this put the future of the approval plan in doubt. But the venerable U.K. firm Blackwell's company bought the remains of the Richard Abel Company; by then, many libraries had come to depend on approval plans and several competitors offered their own programs. The idea not only survived the Abel demise but approval plans continued to spread.^[1-3]

Acceptance did not occur without dissent, however, because many librarians vigorously opposed approval plans. The most important forum for debate was a series of four conferences held from 1968 to 1979, organized by Western Michigan University's Peter Spyers-Duran.^[4-7] Some librarians argued against handing over to commercial interests the professional activity of book selection, fearing that lapses of undependable or unstable vendors and omissions by vendors focused on moneymaking would leave damaging gaps in library collections. Vendor concentration on mainstream, profitable books would produce library collections that were too much alike, without the collective richness resulting from local selection in support of local needs.

Vendors were aware, as these critics pointed out, that far more often than not libraries would keep a book shipped on approval, thus putting many marginal titles into collections. At the same time, it was difficult to predict whether a needed title would be shipped at all. A significant monitoring effort would be necessary to prevent gaps, to minimize unwanted titles, to eliminate duplication, and to stay within budget. The expense of this work, and the costly handling of returns, would erase any savings a library might gain with an approval plan.

None of these objections ever disappeared, but arguments in favor of approval plans proved stronger during this era. Efficiencies won from approval plans allowed libraries to reallocate staff to other duties, even to operate with less staff. Discounts, passed on from vendors able to buy from publishers in volume, helped to stretch budgets. The ability to acquire new books soon after publication, while sought by patrons and still safely in print, and to make selection decisions based on the book itself, rather than on reviews or publisher advertisements, were other reasons to establish an approval plan. Librarians administering budgets valued evenness in spending across the year, and librarians overseeing collections liked the subject balance approval plans ensured, even without strong local subject expertise.

Although Spyers-Duran and others debated critics of approval plans, the argument already had been won in the venue that truly mattered, library operations themselves. A survey published in 1977, only 3 years after the Abel Company's failure, found that 79% of respondents had approval plans.^[8] In 1979, Oryx Press saw enough demand to publish a handbook, *Practical Approval Plan Management*.^[9] A survey of Association of Research Library (ARL) members published in 1982 documented that 85% of these large libraries maintained approval plans, about the same percentage recorded by an earlier survey of ARL libraries in 1969.^[10] ARL surveys published in 1988 and 1997 remarked on the stability of the concept through good and bad financial times and found that more than 90% of ARL libraries used approval plans.^[11,12]

In 1999, a survey of nearly 300 libraries found high satisfaction with approval plans.^[13] Because many of these libraries reported annual approval plan expenditures under \$100,000, this survey documented what had long been evident in the literature, that use of approval plans had spread beyond research libraries. In fact, approval plans became nearly as common among medium-sized as among large academic libraries in North America, as well as among law, health sciences, art, and other specialized academic libraries. A study published in 2008 concluded that use of approval plans by college libraries had not declined.^[14]

TRANSFORMATION OF APPROVAL PLANS

In that same year, however, 1999, the first of four major events took place that directly or indirectly would

transform approval plans. This was the launch of netLibrary, an ebook platform heavily marketed to academic libraries. Other platforms offered by other companies followed, and the idea that ebooks might be included in approval plans was a natural result. Then, in 2005, Google announced a mass digitization project in cooperation with five research libraries, raising questions about the value of local collections. By then, the out-of-print book market had largely moved to the Web and it was no longer difficult to obtain most print books when and if needed, even long after publication, undermining what had always been an approval plan advantage. Finally, the financial crisis of 2008 overturned assumptions about the stability of library funding for collections.

Academic libraries responded to these changes by experimenting with new arrangements. In 2007, the University of Vermont's library stopped approval shipments for three large publishers. Instead, patrons were invited to request orders for these print books by using an online form resulting from an OPAC search, the library promising 3-day delivery if desired.^[15] Nova Southeastern University, in Fort Lauderdale, Florida, reported an ebook approval plan begun in 2009, and in 2010 Texas A&M University reported implementation of an "e-preferred" approval plan.^[16,17]

Academic librarians had only sporadically expressed interest about usage of their print collections. But the rise of ebooks and other electronic resources, where usage measures were common, combined with financial pressures after 2008, and with concerns over building space claimed by growing print collections, led many librarians to look critically at approval plans. A study completed in 2009 by librarians at Penn State University and the University of Illinois at Urbana-Champaign raised as a problem the high percentage of unused books acquired on their approval plans.^[18] The findings of a Cornell University Library task force published in 2010 did not directly question approval plans, but raised the same concern over books that did not circulate.^[19]

These concerns were widely shared, leading to a surge in the use of PDA or DDA programs.^[20–23] Often, approval plan profiles were modified to produce MARC records for use as patron selection vehicles, instead of or in addition to the traditional outputs of automatic book shipments and selection slips intended for librarians' use. The practice became widespread quickly enough for the chair of the Cornell 2010 task force to remark in 2011 that a summary was difficult to achieve, and to ask if U.S. academic libraries had not reached a "tipping point" toward the new method of acquiring books.^[24]

PROFILES

While many libraries have reduced or eliminated their approval plans, one enduring component of approval plans

has been the “profile” recording local collection interests and guiding the vendor in identification of pertinent titles. Vendors have their own systems of documentation, but all work with customers to create and then revise over time a profile that will be at the heart of an approval plan, or a profile devoted entirely or in large part to selection records for librarians, or today, a PDA/DDA program. Often, libraries establish multiple profiles with a vendor, by subject, publisher, library location, print/ebook format, or some combination of these. Libraries may also establish their own combinations of approval plans, librarian selection plans, and DDA programs, all working in parallel.

Profiles have several basic components that can be configured to produce the optimal combination of automatic purchases, library or patron selection records, and exclusions. Subject parameters are recorded by using standard library classification systems supplemented by a vendor’s own controlled vocabulary of subject terms. Vendors also designate categories of nonsubject descriptors for dozens of bibliographic categories such as textbook, reprint, country of origin, language, binding, and price. Publisher parameters are established as well. A list of authors important to a library might be included in an approval plan profile, and some vendors make it possible for libraries to incorporate book awards or significant review notices into a profile. Libraries may also embed their own descriptors for budget/fund and location in a profile, so that these local terms for fiscal and selection responsibility are assigned to each title generated by the profile, enabling ongoing analysis and accounting by both the vendor and library.

The advent of ebooks introduced a new set of components into profiles. A preference for ebook or print can be supported, as can an agreed upon number of days a library is willing to wait for their preferred format when it is not the first available. Libraries can also incorporate into their profiles preferences for the ebook platforms offered by different ebook aggregators and publishers, and for the various usage models defined by the license types those companies offer.

VENDORS

Vendors provide an array of services closely associated with their approval plans. Library approval plans often incorporate some level of technical services, where the vendor might provide cataloging records and, for print books, physical processing, which can include the application of spine labels, ownership stamps, security devices, and barcodes, as well as binding services. When physical processing is provided, libraries waive their right of return and no longer truly have an “approval” plan. These libraries, after having achieved a very low rate of return—perhaps 2% or 3% or even lower—calculate that the cost of returns outweighs any savings. Librarians may,

however, already have “approved” shipment of either print or ebooks using their vendor’s online interface. These online services are integral to approval plans, providing access to profiles, review of shipments, ordering and selection support, and management reporting. Vendors can also provide title metadata and library holdings information to OCLC’s WorldCat (Online Computer Library Center) and to discovery service providers.

Many vendors proved unable to provide the level of support approval plans require, one factor leading to consolidation in the industry. The 1999 acquisition of Academic Book Center by Blackwell’s, the 2006 acquisition of Coutts Information Services by Ingram, the 2009 acquisition of Blackwell North America by Baker & Taylor, the 2012 merger of the French vendors Aux Amateurs de Livres and Librairie Internationale Touzot, the 2013 acquisition of the United Kingdom’s Blackwell Library Services by Dawson Books, and the respective 2015 acquisitions first of YBP Library Services by EBSCO, and then of Coutts by ProQuest, were the most significant of these changes in the vendor landscape.

While many smaller vendors were also acquired or went out of business, other vendors continue to offer specialized approval plans. Among those providing European books are Casalini Libri, East View Information Services, Harrassowitz, and Puvill Libros.^[25] Other vendors include Rittenhouse Book Distributors and Matthews Book Company, for medical books; Theodore Front Musical Literature, for music scores; Worldwide Books, for art publications; and Midwest Library Service, who markets to smaller academic libraries.

CONCLUSION

Approval plans, which began as mechanisms for the mass acquisition of print books, have evolved into an interwoven set of systems for academic libraries and their patrons to discover titles in both print and electronic format, and for libraries to acquire the most locally pertinent in an efficient manner. While questions have been raised about the value of the collections academic libraries built through approval plans, due to the efficiencies they offer approval plans continue in use by many large academic libraries in the United States and Canada. There is no question, finally, that approval plans and the profiles now supporting PDA and DDA programs succeeded in what has always been one central goal, that is, to enable librarians to focus their work on activities other than book selection.

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Arab Federation for Libraries and Information (AFLI)

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Abstract

This entry provides an overview of the founding and the history of the Arab Federation for Libraries and Information (AFLI). The federation's objectives, membership, and organizational structures are discussed as well as its financing and conferences. The Arab Federation for Libraries and Information holds training and workshops in different Arab countries, publishes a newsletter "Sada al Ittihad" and publishes the proceedings of the yearly conferences in cooperation with the Association or the institution in the country where it is held. It also publishes a journal named IALAM twice a year. The Arab Federation for Libraries and Information also encourages and gives awards to the outstanding professionals in the field of library and information science.

INTRODUCTION

In the last 30 years of the twentieth century, many library schools were established at various Arabic universities. As a result, large numbers of students graduated in the specialty and needed jobs at different levels in libraries and in documentation and information centers. This growth in the number of trained professionals lead to the establishment of national level library associations in Arab countries. The oldest of these are the Egyptian Library Association, the Jordanian, and Iraq Library Associations.

From the point of view of library professionals these associations were not adequate to meet a deep-felt need for cooperation among Arab librarians. A broader organization was needed in order for this new generation of professionals to formulate mutual goals and work together for their accomplishment. Several Arab libraries recommended establishing an Arab federation for libraries and for information professionals. For example, the Round Table of the Regional Studies to Improve Libraries in the Arab Countries, which was held in Beirut in 1959, recommended the establishment of national associations as well as a regional association.^[1] The Seminar on Library and Information Science, which was held in Baghdad in 1977, recommended that the Iraqi Libraries Association to establish an Arab Libraries Association; then it recommended the same project at the seminar in Tunisia in 1979, but no progress was made in implementing the project at that time. The Jordanian Library Association requested the same project in 1984. The Jordanian Library Association then sent the proposal to the Arab Associations and Institutions involved in libraries and library sciences, and requested that they study it, and give their opinions. This project was revisited as well during the Seminar of Cataloging the Arab Books, which was held under the sponsorship of the Higher Institute of

Documentation in Tunisia in 1984. Despite all of these efforts, there were no positive outcomes.^[2] The second Arab Seminar held by the Higher Institute of Documentation (in Tunisia from April 5 to 7, 1985), focused on the theme "the benefits drawn from the services of the libraries and the Arabic documentation centers." Participants in the second seminar also stressed the importance of creating of an Association for Arab librarians, and they identified a need to create a directory of professionals and libraries in the Arab world.^[3]

FOUNDING

The project remained a dream for librarians, professionals, and information specialists in Arab libraries until January 19, 1986, when the 3rd Arab seminar was held in Qayrawan, Tunisia from January 16 to 20, 1986, where there was a round table to study this important project. Professor Dr. Abdul Jalil al Tamimi, the former director of the Higher Institute of Documentation in Tunisia, and at that time the owner of the Tamimi Institution of the Scientific Research, played a key leadership role during this seminar. In attendance were professionals in library science from Tunisia, Algeria, Saudi Arabia, Sudan, Syria, Iraq, Kuwait, Libya, Egypt, and Yemen. These professionals drafted some general policies during a series of four meetings and officially founded what they called "the Arab Federation of the Arab Librarians and the Specialists in Information." This name was later changed to "the Arab Federation for Libraries and Information (AFLI)." The first elected Executive Board included seven members; the chairperson was Dr. Wahid Qdoura, Professor at the Higher Institute of Documentation in Tunisia. However, the key leader who struggled to create the Arab

Federation was Dr. Abdul Jalil Al Tamimi formerly director of the same institute in Tunisia.

Beginning in 1986, the AFLI began to be active under the leadership of this Institute, which fully supported it. After a few years, the Tamimi Institution of the Scientific Research took over the responsibility of leading AFLI. Step by step, AFLI developed successfully due to the perseverance of information professionals and librarians. Its crucial role is to advocate for the development of libraries and to increase public awareness of the impact of libraries on cultural development in general.^[1]

OBJECTIVES

Like every federation, association, and institution, AFLI has its own objectives.

These objectives are to:

1. Strengthen cooperation among the societies and institutions in the Arab world.
2. Introduce and preserve the audiovisual and written Arab heritage everywhere.
3. Support all efforts to promote the profession and librarianship.
4. Conduct and encourage scientific research and studies in the field of libraries and information science, as well as hold specialized seminars, symposiums, and conferences.
5. Endeavor to improve the standard of preservice and in-service training institutes for librarians and specialists in information.
6. Work on the unification of information and library terminology.
7. Attempt to issue statutes and regulations concerning libraries and information institutions.
8. Participate in the publication of specialized guides and in the development of the profession.
9. Encourage the establishment of national societies of libraries and information specialists in those Arab countries where such societies have not yet been established.
10. Issue a specialized professional periodical as the organ of the federation.
11. Cooperate with those international and Arab organizations concerned with the same objectives of the federation.^[4]

MEMBERSHIP

There are four categories of membership in AFLI:

1. Category A includes library and information associations in the Arab countries.
2. Category B includes libraries, departments, and institutes of library and information science.
3. Category C includes qualified librarians or those who possess experience in the field of libraries and information for no fewer than 5 years.
4. Category D includes the honorary members who have made outstanding contributions to the profession and to AFLI.^[5]

ORGANIZATIONAL STRUCTURES

The Arab Federation for Libraries and Information organization consists of the following:

1. General Assembly
The General Assembly is the highest committee in the federation. It includes all the members of AFLI. It has the authority to assign general policy, and to define the program of its activities by considering suggestions which have been made by the executive board and members. It also decides the federation budget, and it examines and makes appropriate decisions on the following matters:
 - “The reports and recommendations submitted by the committees on the duties assigned to them by the executive board.
 - “The reports of the secretary general and the treasurer on the federation activities during the general assembly’s terms.
 - “Matters related to the field of librarianship and all items in the agenda.
 - “Suggestions on amendments to the statute and executive acts.
 - “Elects the federation chairman and members of the executive board.
 - “Approves the federation budget, and defines the annual subscription fees.”^[5]
2. The Executive Board
The general assembly elects an executive board every 3 years; it consists of seven members, divided into five groups as follows: Chairman, Vice Chairman, Secretary General, Treasurer, and three additional members. The executive Board has seven essential functions, which are:
 - Prepare the agenda of the general assembly, as well as the federation budget and the program of its activities.
 - Follow up on implementation of the program approved by the general assembly.
 - Transfer some of its powers as appropriate, to the chairman of any of its members.
 - Form the committees that it deems necessary to be responsible for the implementation of its functions.

- Invite individuals or representatives of institutions to attend its meetings as consultants, if it considers this necessary for the undertaking of its functions.
- Consider applications for membership of the federation.
- The chairman, or any member of the execution board assigned by the chairman, is authorized to sign contracts or bonds for selling or buying properties, or for paying rent.^[5]

Through 2007 there have been eight executive boards, chaired by:

- Temporary executive board: Chairman: Prof. Dr. Shaaban Khalifah (Egypt).
 - 1st executive board: Chairman: Prof. Dr. Wahid Qdoura (Tunisia).
 - 2nd executive board: Chairman: Prof. Dr. Wahid Qdoura (Tunisia).
 - 3rd executive board: Chairman: Prof. Dr. Abdul Jalil al Tamimi (Tunisia).
 - 4th executive board: Chairman: Prof. Dr. Abdul Jalil al Tamimi (Tunisia).
 - 5th executive board: Chairman: Prof. Dr. Wahid Qdoura (Tunisia).^[1]
 - 6th executive board: Chairman: Prof. Dr. Mabruka Mhiri (Libya).
 - 7th executive board: Chairman: Dr. Saad al Zahri (Saudi Arabia).^[6]
 - 8th executive board: Chairman: Prof. Dr. Hassan A. Alserihy (Saudi Arabia).^[6]
3. The General Secretariat
The General Secretariat works on editorial assignments, and implements the General Assembly and Executive Board's decisions.
 4. The Working Committees
Working committees are formed as needed. For example, standing working committees have been formed for bibliography, budget, knowledge production, training, terminologies standards, and international relations.

FINANCE

The Arab Federation for Libraries and Information obtains its financial resources and support from the subscriptions of members; from any profits of its conferences, services, and activities; and from the donations, grants, and other income. Financial decisions must be approved by the Executive Board.^[5]

LOCATION

The permanent location of AFLI is in Tunisia at the Tamimi Institution of the Scientific Research. This

foundation was established in 1989, by the greatly appreciated efforts of Professor Dr. Abdul Jalil al Tamimi, in Zaghwan, a city in Tunisia about 55 km from the capital of Tunis. The Tamimi foundation building consists of a library that contains more than 18,000 titles. The Foundation also produces three journals, the *Magazine of Maghrebi History*, the *Arab Magazine of Archives, Documentation and Information* and the *Arab Historical Review for Ottoman Studies* (AHROS).^[7]

CONFERENCES

The Arab Federation for Libraries and Information organizes yearly scientific seminars and conferences. The first six seminars were held in Tunisia. Dr. Abdullatif Soufi (former professor in Library Science at the University of Constantine in Algeria) then suggested that AFLI start holding its conferences in different Arab countries, and the organization began doing so starting with its seventh seminar. This was an important challenge and step that led to AFLI being known to a wider range of librarians and professionals in all Arab countries. From that point onward, membership tripled, until it grew to about 450 attendees per conference. These seminars and conferences were held as follows:^[1]

- 1st Arab Seminar: held in Hamamat (Tunisia) from February 23 to 26, 1988. Titled "Indexing and classification in the Arab information centers."
- 2nd Arab Seminar: held in the capital of Tunisia from January 18 to 21, 1989. Titled "Information and telecommunications technology in the Arab world: the challenges of the future."
- 3rd Arab Seminar: held in Zaghwan (Tunisia) from October 20 to 23, 1991. Titled "Information in the development service in the Arab world."
- 4th Arab Seminar: held in Tunisia from December 4 to 6, 1993. Titled "University libraries under the service of scientific research and education in the Arab world."
- 5th Arab Seminar: held in Zaghwan (Tunisia) from October 21 to 23, 1994. Titled "the position of studies in libraries and information science in our Arab world: perspectives of the future."
- 6th Arab Seminar: held in Tunisia from October 24 to 26, 1995. Titled "National and public libraries, their roles in the elaboration of national systems of information."
- 7th Arab Conference: held in Amman (Jordan) from November 2 to 6, 1996. Titled "Edition and bibliographic control in Arab scholarly publishing."
- 8th Arab Conference: held in Cairo (Egypt) from November 1 to 4, 1997. Titled "Information technologies in the libraries and information centers in Arab countries: current and future trends."

- 9th Arab Conference: held in Damascus (Syria) from October 21 to 26, 1998. Titled “The unified Arab strategies of information in the era of telecommunications and other studies.”
- 10th Arab Conference: held in Nabeul (Tunisia) from October 8 to 12, 1999. Titled “Electronic publishing and information services in Arab world: perspectives on future trends.”
- 11th Arab conference: held in Cairo (Egypt) from August 12 to 16, 2000. Titled “Towards building a strategy to enter Arabic printed literature into cyber space.”
- 12th Arab conference: held in Sharjah (United Arab Emirates) from November 5 to 8, 2001. Titled “Arab libraries in the third millennium: infrastructure, technology, and manpower capabilities.”
- 13th Arab Conference: held in Beirut (Lebanon) from October 29 to November 1, 2002. Titled “Electronic information directory: knowledge and efficiency.”
- 14th Arab Conference: held in Tripoli (Libya) from December 14 to 18, 2003. Titled “Knowledge engineering in Arab world.”^[8] During 2004 to 2005, AFLI had some problems concerning changing the location of AFLI from Tunisia, where AFLI was born, to Cairo. Because of these problems, AFLI held two conferences: the first in 2004 in Egypt and the second in Tunisia in early 2005. After this, the conflicts were resolved.
- 15th Arab Conference: held in Alexandria (Egypt) from December 27 to 30, 2004. Titled “Arab libraries and the educational development in a challenging world.”^[9]
- 16th Arab Conference: held in Hammamat (Tunisia) from March 2 to 5, 2005. Titled “Libraries and documentary information services: contribution to the emergence of the knowledge society.”^[10]
- 17th Arab Conference: held in Algiers (Algeria) from March 19 to 22, 2006. Titled “Access to information for all: partnership between librarian and archivists.”^[11]
- 18th Arab Conference: held in Jeddah (Saudi Arabia) from November 17 to 20, 2007. Titled “Librarianship: current challenges and the future and its role in the free access to scientific information.”
- 19th Arab Conference: held in Cairo (Egypt) from November 24 to 26, 2008. Titled “Cooperation among Arabic Information Institutions in the digital era.”
- 20th Arab Conference: will be held in Casablanca (Morocco) from December 9 to 11, 2009. Titled “Towards a new generation of Information systems and Information specialists: a future look.”

TRAINING AND WORKSHOPS

From time to time, AFLI organizes workshops and continuing education for librarians, and also sponsors workshops in cooperation with the national library associations

and information centers (like the Arabian Advanced Systems), in order to develop librarians’ knowledge and capabilities in the use of information technologies, and the use of new systems. Any member from any Arab country who wishes to learn more about these technologies may attend. The Arab Federation for Libraries and Information also cooperates with the International Federation for Libraries and Information.^[12]

AFLI PUBLICATIONS

The Arab Federation for Libraries and Information cooperates with other Arab institutions, like libraries, universities, and other federations, in regards to publishing the proceedings of the yearly conferences. These publications include abstracts and papers which were presented at the conferences. The proceedings are distributed free of charge to members who present papers at the conferences. Others may purchase a copy. The Arab Federation for Libraries and Information also publishes a periodical, “Sada Al-Ittihad” that reports on AFLI’s activities during the current year, provides information on its members accomplishments, and lists current research in the field, as well as published books, conferences, and seminars. The Arab Federation for Libraries and Information also provides additional activities at every conference, such as book exhibitions, new technology exhibits, etc.^[1]

RELATIONSHIPS AND COOPERATION

The Arab Federation for Libraries and Information maintains relationships with other library associations both in Arab countries and internationally. It organizes its conferences in cooperation with national library associations (depending on the country where the conference is being held), such as the Egyptian Library Association, Jordanian Library Association, and with Arab universities and with other organizations such as The League of Arab States, The Arab Club of Information in Damascus, etc. The Arab Federation for Libraries and Information tries to support these relationships by setting the yearly conferences in different Arab countries, in order to allow the largest number of librarians in each country to contribute to and attend its conferences.^[2]

HONORS AND AWARDS

Beginning in 2000, AFLI started to give awards to its outstanding members, who had contributed with distinction to excellence in the field of Library and Information Science, either through scholarly contributions or by working on committees. Until now, AFLI has presented four outstanding member awards, as follows:

1. Prof. Dr. Shaaban Abdelaziz Khalifah (Egypt), Professor in the Egyptian universities, received the award at the tenth AFLI conference in 1999 in Tunisia.^[1]
2. Prof. Dr. Abdullatif Soufi (Algeria), Professor in Library Science in the University of Mentouri Constantine, Algeria, received the award at the 13th AFLI conference in 2002 in Beirut.
3. Prof. Dr. Abduljalil Al-tamimi (Tunisia), Owner of the Tamimi Institution of scientific research, and former president of AFLI, received the award at the 14th AFLI conference in 2005 in Libya.
4. Prof. Dr. Wahid Qdoura (Tunisia), Professor at the Higher Institute of Documentation (Tunisia), received the award at the 16th AFLI conference in 2006 in Algeria.^[6]
5. Prof. Dr. Mohamed Fathi Abdulhadi (Egypt), Professor at the Institute of Library and Information Sciences (Cairo University), received the award at the 18th AFLI conference in 2007 in Jeddah (Saudi Arabia).
6. Prof. Dr. Abubakr El Houshe and Prof. Dr. Mabruka Mhiriq (Libya), Professors at the Institute of Library Science (Libya), received the award at the 19th conference in 2008 in Egypt.

CONCLUSION

The Arab Federation for Libraries and Information, is the only such federation in the Arab countries. It brings together professionals and specialists in the Arab libraries and information institutions for purposes of communication and provides a forum for discussing the current situation and the future trends of their profession. It supports cooperation and encourages research. The Arab Federation for Libraries and Information supports professional

development and assists in the training of librarians in the Arab universities and institutions. It also works on codifying terminologies and encourages formation of national library associations. In addition, AFLI strengthens the relationships between these national library associations and international associations in the profession. Finally, AFLI continues to hold its yearly conferences in different Arab countries, and grant honors and awards to outstanding professionals.

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Archival Appraisal and Acquisition

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Abstract

Archival appraisal is the analytic process involved in determining how long records are required, thus driving acquisition strategies, and determining the archival record left for the future. Developing as a major archival function during the twentieth century, appraisal has been subject to intensive professional discussion as archivists search for theoretically sound approaches and techniques. The advent of the digital environment has created great challenges for appraisal theory and practice. This entry outlines the purpose and principles underlying appraisal, discusses the development of traditional appraisal practices, identifies professional concerns with traditional appraisal practices, and discusses methodologies and approaches proposed as alternatives to traditional appraisal methods to address digital recordkeeping challenges.

INTRODUCTION

Appraisal is the set of recordkeeping processes involved with determining how long to keep records, and what ultimately will become the archival representation for the future. Appraisal is possibly the most contested of archival functions and the most discussed in the professional literature. Definitions of what appraisal encompasses and methods of achieving reliable and replicable appraisal outcomes are in discussion.

Perhaps most strongly associated with the public (or government) record tradition, appraisal also has a manifestation in acquisition strategies employed by collecting archives, that is, those archives that target specific records for acquisition into focused collections held in a dedicated repository maintained independently by a third party as distinct from the record-creating body/person. These traditions are not the same, one focusing on a selection process, a winnowing of the extant records into a kernel for continuing preservation, and the other focusing on identifying records which are of sufficient significance to justify expenditure of a third party entity collecting and therefore implicitly undertaking the expense and responsibility for continuing preservation of the records. While there is a relationship, one is a selection process and one is a collection process. These processes therefore have different techniques associated with appraisal.

In recent years, the advent of digital recordkeeping has challenged recordkeeping processes in general, and appraisal techniques developed to suit the paper-based world have been subject to extensive discussion. The paper-based, reactive, and physical examination-dependent techniques of the past are widely acknowledged to be unscalable to meet the challenge presented by the digital environment. The struggle to rearticulate appraisal

techniques and develop an appraisal theory that is coherent, timely, and effective in the digital environment, is an ongoing process.

This entry

- Outlines the purpose and principles underlying appraisal.
- Discusses the development of traditional appraisal practices.
- Identifies professional concerns with traditional appraisal practices.
- Discusses methodologies and approaches proposed as alternatives to traditional appraisal methods to address digital recordkeeping challenges.

WHAT IS APPRAISAL?

Traditionally, archivists define appraisal as the intellectual process of determining the value of records. By determining the value of records, it is then possible to arrange for their orderly disposal/disposition by organizing their transfer to a secondary storage facility or to an archival institution for destruction or retention as appropriate. Usually formal documentation is devised, following the evaluative process, which lays out the classes of records requiring similar disposal action. It is, in simple terms, the process which determines which records should be kept and which should be destroyed. It is therefore the most important archival activity around which all other tasks revolve as it determines what is acquired by an archival institution.

Appraisal evaluates records in their recordkeeping, organizational, and wider social context; in terms of their origin, their functional, evidential and research

characteristics; their relationship with other records; their age, volume, and physical format and the long-term cost of preserving them in appropriate archival storage or their destruction once they have fulfilled their administrative and legal requirements. Traditionally, appraisal occurred when records were no longer of current administrative use.

APPRAISAL TRADITIONS

Prior to the mid-twentieth century, appraisal, or the determination of which records should be retained as archives, largely evolved in practice. There was little articulated theory of appraisal, but rather codification of specific practices. The practices evolved dependent on the nature of the archival system in place.

European Traditions

In European archival theory, appraisal was initially the responsibility of the record-creating body. The identification of which documents were superseded by others or which were destroyed was embedded in procedures undertaken as routine by record-creating bodies. In more modern times categories of records able to be destroyed were formalized by regulations devised by Committees established for this purpose. Within this tradition, some forms were seen as requiring more secure protection and were removed for safe keeping outside the records creating body. From the 1920s European archivists gradually established the principle that they should be consulted before any records were destroyed.^[1] Archivists were involved in determining what should be retained once the material was no longer needed for administrative purposes.

The European recordkeeping tradition argues that the presence of records in the archives repositories creates a web of relationships between the records which in itself constitutes meaning. The archivists' role was not to select, but to protect these records and their context. Archivists actively involved in selecting within these designated records risk destroying the archival bond and alienating the characteristics of authenticity and reliability.^[2] This was incorporated into English-speaking traditions through the work of Sir Hilary Jenkinson in his *A Manual of Archival Administration*, first published in 1922. Jenkinson stressed the impartiality of the archivist and physical and moral duties to the record. He warns against active involvement of archivists in destruction which can equate to the archivist and/or historian having a role in records creation and at risk of imposing a personal judgment of value. Such actions negate the principle of impartiality of the archives and involves the archivist in the contested territory of determining the historical record. Jenkinson's view places the appraisal processes including disposal decisions with the individual agency/office of origin.^[3]

Guidance on appraisal criteria was established as early as 1901 within the German tradition, encompassing principles such as respect for age, that records created for temporary purposes generally should be able to be destroyed, that the nature of the administration (both function and structure) should determine the relative importance of records for continuing retention.^[4]

Further into the twentieth century, archivists began to be more actively involved in setting appraisal standards. The efforts of Prussian archivists to reject the *laissez-faire* *fingerspitzengefühl* (finger in the wind) methods of determining appraisal were reported in 1937,^[5] resulting in more defined appraisal criteria based on an analysis of the relative functions and positioning of the creating body.

A more function/structure approach was developed to combat subjectivity in appraisal decision making. The Prussian archivists were concerned primarily with the "quality" of the record for historical research. In 1926, Karl Otto Muller proposed a division of records according to administrative level—central, intermediate, and local authorities—with the proposition that central agencies of government would create more valuable records than local ones. This subsequently developed into the 1950s proposition that rather than looking at the record level, the agency as a whole could be defined as being "more or less worthy of permanent preservation" and that agencies could be ranked according to their importance. The administrative level of the agency and the degree of independence in decision making were factors in the ranking. Georg Wilhelm Sante:

Archivists must make their selection with a view to the function of the departments and the significance attached to that function. They must begin by analyzing the functions of the individual agencies, and only thereafter can the records produced by these agencies be appraised.

—(1956–1957). Quoted in Booms.^[6]

By 1957 in Germany there was a call to "cease the practice of simply disposing of valueless records and to adopt instead the principle of selecting valuable records." This interesting concept reverberates through a number of traditions of appraisal. Ole Kolsrud in discussing the 1981 Wilson Report reviewing the Public Record Office U.K.'s appraisal system writes "it suggested that the time had come to concentrate more on preservation than destruction" and similarly in Australia, "The Australian Archives records disposal policy in 1979 shows a shift in emphasis from the need to justify the destruction of records to a requirement involving the critical appraisal of material to justify permanent retention" in Dianne Easter "Records Disposal in the Australian Archives" *Archives Conference 1979. Papers Presented to the Second Biennial Conference of the Australian Society of Archivists, Sydney May 18–20, 1979*, Supplementary Volume, p. 37. The German practice also strongly argued that records could not be appraised in isolation but must be placed in their

administrative context.^[7] These ideas were not particularly well translated into practice at the time. However these ideas clearly influenced Schellenberg, through the translation of the lectures and papers of Adolf Brenneke, cited in the Introduction to *Modern Archives*. These ideas similarly had an influence on the work of Hans Booms in the 1970s and indirectly through Booms on Terry Cook in the 1990s.

In Britain, the demands for paper salvage efforts associated with World War II led to the first articulation of appraisal principles in relation to government records, stressing again that those responsible for the conduct of the business should decide which records should be preserved for business purposes, and that an additional set of criteria would be added to that to serve the requirements of historical or general uses. The historical or general uses were to show history of the organization concerned, to answer technical questions regarding its operations and to meet possible scholarly needs for the information that is incidentally or accidentally contained in the records.^[7]

Post World War II, a huge proliferation of records occurred as a result of the rapid expansion of government functions, the diverse scope of their activities, and the ability of machines to duplicate records. Large-scale destruction of records became inevitable. The costs of preserving more than a small fraction of the records produced was prohibitive.^[8]

American Traditions

T.R. Schellenberg codified the American practice in 1956 in his highly influential book *Modern Archives*. This work built on practices already in place within the (then) National Archives and Records Service, articulating criteria for appraisal work based on the distinction between “primary” (or values to the originating agency) and “secondary” (values for other agencies and private users). Records having secondary values were broadly categorized as having “evidential” and “informational” value. Schellenberg defines these categories quite broadly. Evidential value does not reference the Jenkinsonian notion of the sanctity of evidence in archives that is derived from unbroken custody, nor of the value that inheres in public records because of the merits of the evidence they contain. Rather, evidential value is the value that depends on the importance of the matter evidenced, that is the organization and functioning of the agency that produced the records. Informational value is “the information they [records] contain on persons, corporate bodies, problems, conditions, and the like, with which the government body dealt.” Schellenberg’s text went on to consolidate what constituted examples of both of these value criteria.

Following Schellenberg, much of the writing on appraisal during the last half of the twentieth century focused on developing criteria through which to assess

value. Taxonomies of values were developed: evidential, financial, administrative, research values are still the most common means of evaluating records in practice. Appraisal criteria based on these taxonomies of value became the norm, and for many archivists today, continue to be the basis for appraisal decision making.

APPRAISAL TOOLS

Collecting or Acquisition Policies

During the 1980s, particularly in America, collecting archives borrowed from the library tradition of collection development.^[9] A response to limited and contracting resources and to an expanding universe of responsibility saw collecting archives attempt to rationalize and define boundaries for their collecting activity.

The collecting policy, or acquisition policy, establishes the scope of the collecting remit—defining what will be accepted and under what conditions. They enable decision making against an established framework to determine whether specific material identified or offered to a collecting archives will be accepted for continuing preservation as archives.

Collecting policies typically cover

- Information about the legal status of the repository and its authority to collect.
- Information about scope or limitations of the policy (e.g., geographical area, subject name, chronological period or genre/media).
- Information about the process of collection, such as methods of acquisition—donations, loans, and conditions associated with ownership.
- Information about the rights to dispose or deaccession material.
- Information about access to the material.^[10]

Initially a tool used by collecting archives, by the late 1990s many government archives had adopted this tool to broadly outline the rationale for decision making on what records would be accepted into archival custody.

Disposal/Retention Schedules

Early twentieth century appraisal practice in European countries favored the development of lists of records proposed for destruction. These lists were examined by archivists and authorized prior to destruction of records. As archival practices became more codified, archival institutions were increasingly granted authority over the appraisal process or the business of determining which records to keep through archival legislation which generally provided the mandate for their responsibility to determine which records would be selected as archives.

As a development from the simple listing and authorizing of specific records for destruction, formalized disposal/retention schedules were developed. These tools were issued by an archival authority to enable the ongoing authorization of destruction or transfer to archival storage of records nominated within the schedule. Particularly associated with the work of the U.S. National Archives and Records Administration (and its predecessors), the technique of issuing disposal authorities is still the most common form of records disposal/disposition authorization.

Disposal/retention schedules list categories of records which are assigned a retention span based on a time period. Categories in such schedules which share a retention period are known as disposal classes. Disposal authorities can be specific to one agency, or part of an agency, or may cover records that are common/general to many agencies. They provide, for the period of their currency, a continuing authority for agencies to destroy records which fall within the disposal classes, without any further authorization from the authorizing body.

Responsibility for preparing disposal/retention schedules was variously placed with archival authorities or with records staff in agencies. Compiling disposal schedules embodies appraisal decision making. The process of developing a disposal schedule typically involves identification of the records to be covered, an analysis of the related function/process/transaction, an analysis of recordkeeping systems and information flow, compilation of information about the records being targeted (including volume, system of arrangement, physical condition, frequency of use etc.), development of broad classes of records sharing a retention period, consideration of appraisal criteria and, more recently, justification of the retention period proposed against mandates such as operating legislation and internal and external stakeholder requirements.

Generally agencies are responsible for the determination of the primary value (i.e., the values for the originating agency itself) and archivists in an archival institution are responsible for the determination of secondary values (i.e., values for other agencies and private users).

Systemic Reviews

Practice in the U.K. post-Jenkinson era modified his position on appraisal as reflected in the practices of the Public Record Office (PRO). Following the recommendations of The Grigg Report of 1954,^[11] the PRO implemented a system of regulated life cycle reviews which comprised the basis of their practices from the 1950s to the 1990s. The practice was based on a network of departmental record officers responsible for working sequentially with records creators and Public Record Office Inspecting Officers to undertake a series of reviews at different points of time each with a predetermined point of view.

At the point when records were no longer required for current business, they were moved to remote storage. Five to seven years after their movement to remote storage they were reviewed by administrators 'to determine whether the organization needs the records for its own administrative purposes . . . interpreted broadly to encompass issues such as continued accountability.' While originally there was an assumption that records would have no research value, modifications to the methodology over time introduced a consideration of research or informational value. Once the first review was completed, the remaining records continued to be stored in remote storage until 25 years after the creation of the record. A second review by Departmental Officers accompanied by a Public Record Office Inspecting Officer was undertaken at this time on a file by file basis with the primary consideration the research value of the records. The records determined to possess this value were transferred to the Public Record Office.^[12]

Sampling

Case-based records, or particular instance papers as they were known in the British tradition, caused problems for archivists with their voluminous nature and their basically repetitive structure—for example, taxation files, personnel files, or individuals' medical files, in which each document records the same basic process conducted for many individual instances with differing circumstances reflecting individual experiences. The technique of sampling such series became the accepted practice. Sampling could be either random (using genuine statistical methods), illustrative (selecting cases that illustrated the business process), chronological (selecting the complete records of a given period of time), or sequential (selecting every 10th case).^[13]

Implementing appraisal decisions, whether embodied in a collecting policy, in disposal/retention schedules or in sampling plans, involved a physical process of examining records and determining whether or not they and their history of compilation were such that they fitted into specific categories. Depending on which categories, the records would be designated either archives and destined for retention in archives or allocated a retention period after which they could be (with appropriate documentation) destroyed.

UNEASE WITH APPRAISAL PRACTICE

Appraisal has always been a contested process. Described as evaluation, it involves application of individual judgment, which, even when bounded by rules or criteria, will always be subject to differing opinions. Using the same rules and processes, will two appraisers always reach the same conclusions on value?

Lack of documentation, or inadequate documentation, of appraisal decision making in the past, and records taken into archival custody in last minute emergency rescues have all raised the controversial specter of reappraisal.^[14] When, in what circumstances and how should records determined to be archives be deaccessioned?

The techniques of implementing appraisal as articulated in these methodologies was physically focused—records were examined and evaluated against the appraisal criteria, collection policy, or retention/disposal schedule. The determination of value came after the record was finished—at the end of its administrative usefulness. By the mid-1980s the flood of material requiring coordinated appraisal swamped the capacity of any archival organization or collecting body to deal with the physical universe within its jurisdiction or collecting domain. As David Bearman put it, archivists were failing in their mission using these methods by orders of magnitude,^[15] and this assessment was made before the tsunami of digital records, which are unable to be physically inspected, had much impact on mainstream professional practice.

The results of archival appraisal were implicitly recognized to be the creation of a “representative” reflection of our society. But representative of what? Whose view was to be represented? Was it to be representative of all recorded memory, of activities or members of society, or of those aspects determined at a particular time to be important to social activity?

At much the same time, the growth of social history was focusing much historical scholarly activity on the experience of individuals, reflected in the archival records amid the case files or particular instance papers. Traditional archival appraisal practices using samples to deal with this type of record were being questioned.

From the archival institutions themselves came concerns with the foundation of appraisal on taxonomies of values, approaching appraisal from the bottom up and being overwhelmed by the vastness of the records to appraise and being unable to formulate methods which will work with the digital environment of the modern office.

Perhaps most of all, these unsettling questions that arose during the last decades of the twentieth century pointed to the lack of capacity to evaluate the success or otherwise of the appraisal decision-making processes. To what extent were archivists accountable for their appraisal decision making and how did they report on and justify their appraisal practices?

These questions arose from professional practice at the same time as the postmodernism philosophy was extending into humanities disciplines provoking a reconsideration of the reading of texts. The postmodernist discourse also raised a greater awareness of the real and symbolic exercise of social power in decision making about the representation of the past.

ALTERNATIVE APPROACHES TO APPRAISAL

Documenting Society

Inherent in the notion of evaluation of records is the notion of framing or shaping the form that the archival record will take for future generations. The evaluation appraisal criteria introduced by Schellenberg contrasts with the more passive notions of accumulation or elimination of the valueless which is the characteristic advocated by the European and Jenkinsonian approach. But the subjectivity that this approach introduces requires models for active documenting and these models are generally lacking. There is however, a history of attempts to address this issue, and the influence of the collecting traditions become particularly important in this regard.

Hans Booms, writing in German in 1971 (translated into the English professional literature in 1987), rejects the notion that administrative structure and positioning is the appropriate basis for appraisal. He argues for a much more socially situated approach to “the formation of a documentary heritage” focusing on the content of the records to reflect social processes. This requires a comprehensive view of the total societal development process and an interpretation of the way in which society has actually developed and forms a documentation model from which the archivist forms the documentary heritage.

East German archivists were actively experimenting with appraisal during the 1970s and beyond. Their practice was based on the proposition that “the value of archives is determined by the social importance of the events, activities and subjects it refers to”^[16] and that

documents got their value through their importance for fulfilling of the manifold tasks a socialist society sets itself for carrying through the historic mission of the working class. Furthermore it was declared that the function and the place of an administrative body defines essentially the information potential and relevance of its documents . . . and thereby their value.

East German attempts to implement Booms’ ideas during the 1980s resulted in the development of a list of some 500 events which ought to be documented. Angelika Menne Haritz warns of the problem in this approach which “fits the records into a politically desirable image of history,”^[17] references great difficulty in implementation and warns

As important decisions are delegated to authorities outside the profession, archivists are reduced merely to executing guidelines that we cannot investigate, even if they cause us to act as instruments for political purposes we would not support as individuals.^[17]

Documentation Strategies

Within the collecting archives domain, the concept of documentation strategies was articulated initially by Helen Samuels in the mid-1980s. This appraisal strategy articulates active and targeted documenting according to a collaborative cross institutional strategy. In essence a documentation strategy

is a plan formulated to assure the documentation of an ongoing issue, activity, or geographic area. The strategy is ordinarily designed, promoted, and in part implemented by an ongoing mechanism involving records creators, administrators (including archivists), and users. The documentation strategy is carried out through the mutual efforts of many institutions and individuals influencing both the creation of the records and the archival retention of a portion of them. The strategy is refined in response to changing conditions and viewpoints.^[18]

Reports on one of the projects which attempted to faithfully follow the theoretical proposal concluded that the methodology is “to supplement rather than replace the traditional methods of archival appraisal.”^[19] The idea of the documentation strategy is in the tradition of the documentation plan articulated by Hans Booms and also has echoes in the collaborative collecting of library institutions. Now seen as something of an unachievable aim, the concepts have had some influence, most notably in focusing attention on under represented areas of collection and cross institutional cooperation.

Macro Appraisal

Influenced by Hans Booms, and the writings of sociologists such as Anthony Giddens, Terry Cook has articulated the concept of macro appraisal, the first coherent appraisal theory. Macro appraisal attempts to capture the significant activities of government and its interaction with the society in which it exists. That is, it attempts a more holistic and strategic approach to appraisal of government records. Macro appraisal adds a layer of appraisal methodology that sits above the appraisal of individual agencies.^[20]

Archivists seek to understand why records were created rather than what they contain, how they were created and used by their original users rather than how they might be used in the future, and what formal functions and mandates of the creator they supported rather than what internal structure or physical characteristics they may or may not have.^[21]

The theoretical focus of macro appraisal is the

“image” of society—that is to say, not on the objective reality of society per se, which can never be known absolutely, but rather on the mechanisms or loci in society

where the citizen interacts with the state to produce the sharpest and clearest insights into societal dynamics and issues It is at these points of sharpest interaction of the structure, function, and client that the best documentary evidence will be found.^[21]

Essentially the focus is on “documenting the process of governance rather than of governments governing and corporations operating.”

The critical feature of macro appraisal is the need for detailed analytic work in advance of consideration of the records of an agency. It is a “top-down” approach that provides a solid and justifiable framework for decision making about records of individual functions. It enables prioritization of scarce resources to focus on those functions of government identified which require the most intensive documentation into the future as part of the archives. It is a media-neutral strategy, equally applicable to records in all formats, although implementation strategies for various media may need different approaches. It removes the reliance on the physical examination, moving appraisal to an intellectual process made within a stated framework.

Macro appraisal theory has influenced practice internationally,^[22–24] and can be seen as a part of a broader professional refocusing on the notions of provenance as a core archival tenet.

Minnesota Method—Functional Analysis for the Collecting Domain

The notion of functional analysis moved further into discussions of acquisition strategies for collecting archives with the development of the “Minnesota method,” a combination of collection analysis, documentation strategy, appraisal, and functional analysis.^[25] Originally articulated in the late 1990s,^[26] this approach developed to address the reality that collection or acquisition policies for most collecting archives were unachievably large. This approach involved defining and analyzing the particular area in the collecting policy, determining the documentary universe for that area, defining criteria for prioritizing and applying the criteria, defining the functions most appropriate to the collecting area and the level of documentation to support those functions.

Functions-Based Appraisal

If macro appraisal with its inherent requirement for a formalized and well-defined analytic framework established in advance of any appraisal decision making was too grand an undertaking for many archival institutions, the revitalized emphasis on functions as the basis of appraisal practice was not.

The integration of functions as a core recordkeeping tenet was reinforced in the International Standard on

Records Management, published in 2001. Function and activity is defined as the basis for both records classification in current records systems and as the basis for decision making on retention or destruction periods. The explicit linking of the two recordkeeping processes enabled the implementation of appraisal decisions at the time of records creation, thus providing both an intellectual coherence to recordkeeping processes which could be established in advance of records creation, and proactively addressing the process of decision making on length of retention.

REVIEW OF TRADITIONAL APPRAISAL METHODS

By the late 1990s and early years of the twenty-first century all archival institutions were acknowledging that the traditional methods of appraisal and implementing appraisal decisions were not adequately coping with the volume of records to be appraised, the resources available, or the nature of the increasingly digital record in the workplace. Various strategies have been adopted by individual archives.

The most developed implementation of macro appraisal is at the (now) Library and Archives Canada, where framework documents for the approach include an Acquisition Policy, Appraisal Strategy, Government Wide plan, and institutional profiles. The outcomes of the approach are Multi Year Disposition Plans “which formally set down records disposition project targets over a period of time according to criteria and priorities mutually agreed between the National Archives and the client at a senior management level, and Implementation Timetables. Revisited and modified in 2003–2004, macroappraisal continues to underlie the practices of Library and Archives Canada and has proven successful in enabling a coherent approach to the growing volume of government records and encompassing records in all media.”^[20]

At the same time that the Canadians were implementing macroappraisal strategies, the Dutch government were also undertaking an appraisal process focused on analyzing the functions of government in order to intellectually identify those functional areas of government producing the records required as archives.^[27]

The National Archives (TNA) United Kingdom revised its appraisal framework in the late 1990s, continuing to use the notion of graduated time-based reviews established by the Grigg Report framework of 1954 for paper-based records, but varying the time intervals. New tools, Operational Selection Policies, apply the selection criteria established in the Acquisition Policy to records of individual government agencies or cross institutional themes. These are issued either as ongoing authorities or for records covering a specified time period. Combined with a focused acquisition strategy, TNA has a more proactive strategy for digital records and data sets.^[28]

The U.S. National Archives and Records Administration (NARA) is similarly experimenting with approaches to appraisal. In 2004 its strategy for flexible scheduling was introduced to overcome the reality that NARA’s previous methodology for appraisal was too resource-intensive for agencies to implement. The revisions to the process sought to transfer much greater responsibility to agencies to determine both the levels and the groups of records which would be treated as disposal classes. It encouraged agencies to use flexible scheduling, big buckets, and records retention bands.

Flexible scheduling provides for concrete disposition instructions that may be applied to groupings of information and/or categories of records. Flexibility is in defining the record groupings, which can contain multiple records series and electronic systems.

A “big bucket” or large aggregation schedule is a type of flexible schedule. Flexible scheduling using ‘big buckets’ or large aggregations is an application of disposition instructions against a body of records grouped at a level of aggregation greater than the traditional file series or electronic system that can be along a specific program area, functional line, or business process.

Record retention bands “Specify a time band that provides both minimum and maximum retention periods for records. Example: Destroy when records are no less than 3 years old but no more than 6 years old.”^[29] The new policy direction was accompanied by four strategies aimed at coordinating records scheduling to business areas and lines of business defined in the government’s information architecture framework.^[30]

In Australia, the National Archives of Australia established strictly regulated processes based on the “Developing and Implementing a Recordkeeping System” (DIRKS) methodology, a version of which had been incorporated into the International Standard on Records Management (ISO 15489). This approach adopted the framework of records continuum thinking and sought to establish partnerships between agencies and archives in establishing consistent recordkeeping frameworks for the whole of government’s records, for however long they are required. This approach explicitly linked the creation of business classification schemes to appraisal decision making. Proposals on the appropriate retention period for records were made by agencies to the Archives, based on extensive documentation and risk analysis. The Archives then reviewed individual agency proposals for consistency with their published appraisal directions. Revised substantially in 2007 the degree of agency justification and documentation for records recommended for short-term retention has been minimized to focus on a more balanced risk-based approach, focusing on those records determined to have continuing value.

These approaches, while all responding to the individual needs of the jurisdiction, have features in common. They all stress a more coherent function basis for appraisal decision making. There is less emphasis on identifying and documenting individual records series, and greater emphasis on identification and documentation of functions that create records. The resulting disposal/disposition instruments are media-neutral enabling agencies to vary the format and media of records relating to specific functions rather than having authorizations tied to specific records, series, or formats. The principles of risk management have been acknowledged in these approaches, with greater latitude for agency decision making in the realm of appraisal, particularly for those records deemed not to have continuing value.

In contrast to some appraisal decision making of the past which was generally recognized to be inadequately documented, the practices of the major archival institutions have redressed this by specifying requirements for detailed appraisal justification documentation. In doing so, requirements may have swung too far and the documentation burden on those submitting appraisal recommendations have been recognized to be unduly onerous, resulting in revisions to adopt more risk-tolerant strategies and documentation. At the same time, archival institutions have themselves become more open and transparent about their appraisal decision making, through published appraisal or acquisition policies, publishing of disposal/retention schedules on Web pages and calls for public comments on disposal/retention schedules prior to their authorization.

DIGITAL RECORDKEEPING

Appraisal theory and practice has embraced requirements for digital recordkeeping by moving away from targeting specific records towards appraising functions and consequently the records (in any form) that they create. Embodying appraisal decision making into tools which formally authorize destruction will continue to be required and disposal/disposition tools are being subtly transformed to encompass changes to suit the digital environment. However, there are continuing debates about whether these are the correct tools to manage appraisal decision making into the future, with concerns about how implementable our traditional levels of appraisal decision making are in constantly changing workplaces.

The digital environment forces archival practices to change. Digital records are fragile and difficult to sustain, involving layers of technology dependence each requiring management to prevent records from being unusable and uninterpretable through technology change. Most pressing in the digital world is the requirement to ensure that robust records are made in the first place.

The Australian records continuum approach to recordkeeping has redefined appraisal to encompass the decision-making processes associated with determining what records need to be made and captured to document a business activity. "Appraisal is an analytic process which determines: (1) which records should be captured into recordkeeping systems and (2) how long such records should be maintained."^[31] This redefinition was included into the Australian Standard on Records Management, AS 4390, published in 1996, which formed the basis of the International Standard on Records Management. While the idea of proactively determining what records to capture was transferred into the International Standard, the broadening of the concept of appraisal to encompass this was not adopted.

The digital environment requires proactive involvement of archivists (recordkeepers) in appraisal decision making. The older model of leaving appraisal decision making until the record is not required for continuing business use, is unviable in the digital world where records will not survive technology change and obsolescence without active intervention. Rather, digital records require continuing intensive management in systems necessary to ensure that they will survive to serve personal, corporate, or societal memory in the form of archives.

Records continuum approaches have redefined appraisal as a continuous process, occurring at multiple sites of intervention. In this reconceptualisation, we appraise

- Transactions and the actors initiating them for whether documents should be created.
- Activities and those involved in them for how evidential the process of records capture needs to be.
- Functions in an organizational context for the place of records in the memory of the organization and its archive.
- In a broader institutional or societal context for their purpose and their place in collective memory.

Appraisal becomes an ongoing process with multiple points of specific intervention—not just about selecting "archival records," but intimately concerned with managing robust records from the time of their creation/capture within environments that will sustain them for as long as they are required. Appraisal in this view is not only the domain of the archivist operating externally to agency recordkeeping frameworks, but rather, one of a team of recordkeeping professionals operating at various points of active intervention in the existence of records, affected by social, legal, and sometimes political factors.

This view is acknowledged within Australian recordkeeping practice and supported by coherent recordkeeping guidance issued to agencies. The archival tools and techniques have yet to transform significantly to suit the digital world.

For many archives, engagement with the digital world has been slow. Dealing with a set of paper-based practices that are essentially reactive has enabled many archivists to avoid engagement with digital realities. The necessary retooling of professional practice has yet to be incorporated into many work practices. Digital repositories and the capacity to take custody of digital archives have lagged the digital library community's uptake of the challenge. Appraisal decision making for the digital world must be accompanied by robust accompanying tools such as agreed metadata standards to enable records to move between system boundaries on a continuing basis, while retaining all contextual data essential to maintaining records, rather than digital objects.

Other information professionals are engaging with discussions on appraisal. The sophistication of the engagement ranges from provocative responses of the information technology community that information storage is cheap, we should just keep everything, to sophisticated interdisciplinary approaches to address particular needs, such as research data in the higher education sphere or scientific data. For example, see "An Australian e-Research Strategy and Implementation Framework."^[32] For collaborative work in scientific data, see "Appraisal of Scientific Data."^[33] Much of the discussion is arising and being conducted in the digital preservation discipline rather than in the archival discipline. The potential uses and capacity to manipulate born digital records in new and continually evolving ways substantially challenges archival practices such as sampling of case-based material. Archivists are increasingly collaborating with other information colleagues in addressing appraisal of complex digital records and data sets. See for example, <http://www.interpares.org>;^[34] The work of the Digital Curation Centre at Glasgow University, particularly Harvey;^[35] and The collaboration between the Public Record Office and the UK Data Archive for managing UK government data sets.

The digital recordkeeping environment has also raised profound challenges for collecting archives, responsible traditionally for taking custody of material created and managed by others after their administrative or business uses have ended. The challenge of digital collecting has been taken on by some major institutions supported by digital library repositories. Recent collaborative projects, such as the "Paradigm" project, have resulted in appraisal models for digital personal papers,^[36] and the British Library "Digital Lives" project is investigating use of computers to store personal memory, aiming to devise strategies for collecting such material into the future.^[37]

CONCLUSION

Appraisal is the professional recordkeeping function of applying a conscious process to determine what "records to keep." It developed as a key archival function in the

twentieth century as a result of the overwhelming bulk of modern documentation and initially took the form of an evaluative process based on physically examining records and evaluating them against a set of criteria.

By the late twentieth century, the emergence of digital records, fluid organizational structures, and the concern that anything can be of value to someone, it became clear that existing appraisal thinking and processes were not able to be scaled up to meet demands. New thinking and experimentation in appraisal theory and methodologies emerged. Largely based upon the archival notion of provenance, these newer approaches stress the intersection of function and structure, advocate a greater acceptance of risk management and involve greater accountability in appraisal decision making. Many of these new methods have been incorporated into proactive recordkeeping standards to address recordkeeping from the time of creation for as long as the records are required.

While a ferment of appraisal thinking and experimentation has been underway, the practice of archivists is often still lagging, often remaining in the older paper-based criteria model. Appraisal has been the subject of constant professional discussion, as archivists strive towards methodologies that meet objectives, are coherent, timely and cost effective.

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Archival Arrangement and Description

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Abstract

Arrangement and description are processes traditionally associated with the transformation of an individual or corporate archive into a broader archival framework in order for it to function, alongside other such archives, as accessible collective memory. They are integral to maintaining the authenticity, integrity, and reliability of records in an archival environment so that they may continue to function as evidence of the activities and contexts in which they were created and used. This entry outlines the principles underlying archival arrangement and description, discusses the construction of arrangement and description traditions, and explores their transformation in response to the recordkeeping challenges of the twenty-first century.

INTRODUCTION

Arrangement and description are processes traditionally associated with the documentation and processing of records into archival systems at, or near, the time of their transfer to archival institutions. Archival systems document, manage, and enable the ongoing accessibility of records of continuing value under the control of an archival institution. They have been shaped by a number of social, political, cultural, economic, and technological factors in different countries and at different times. This has given rise to different traditions for arrangement and description that reflect the nature of records, the contexts in which they are created and maintained, and the archiving contexts into which they are transferred. However, despite their differences, all archival arrangement and description practices are fundamentally a practical application of underlying archival principles of *respect des fonds*, provenance, and original order.

In the late twentieth century, the uptake of digital information and communications technologies in society in general, and in archival institutions in particular, has had a significant impact on arrangement and description practices. On the one hand, descriptive processes have been codified into various national (a selection of guides and manuals for arrangement and description produced or sponsored by national professional associations for archivists is provided at the end of the entry) and international standards (see entries on “International Standards for Archival Description,” p. 2950, and “Encoded Archival Description (EAD),” p. 1699) to enable cross-institutional sharing of archival documentation and automated processing and to assist in retrieval of archival data. On

the other hand, the fundamental change in the nature and structure of records and on business and recordkeeping processes brought about by computing technologies has exposed the practices of arrangement and description as reflective of a physical focus based strongly in the prevailing paper-based paradigm of their origin.

This entry

- Outlines the purpose and principles underlying archival arrangement and description.
- Discusses the construction of arrangement and description traditions.
- Explores how these traditions are changing to address the recordkeeping challenges of the twentieth and twenty-first centuries.

It is limited to canvassing archival practices in English-speaking countries as this reflects the experience of the authors.

ARRANGEMENT AND DESCRIPTION PRINCIPLES

The articulation of archival principles fundamental to arrangement and description arose during the nineteenth century. Their development represented a reaction to the practices employed during the previous period of consolidation of archival records in specifically designated repositories geared to serve the purposes of historical research. Those practices were intent on guiding the researcher to the most “interesting” documents typically identified by subject. The physical arrangement of the material, then, was

ordered to reflect that of the guide.^[1] In reaction to this practice, which put a subjective, imposed order on records, the principle of *respect des fonds* was articulated. Subsequently translated into the English principles of provenance and original order, these have formed the basis of all ensuing archival arrangement and descriptive practices.

***Respect des fonds*, Provenance, and Original Order**

Respect des fonds is the nineteenth-century French dictum that the authenticity and integrity of records depends, at least in part, on tracing their origin and history. To preserve records as evidence, the functional structural context of their creation must be explicitly revealed. *Respect des fonds* aims to maintain the integrity of records in relation to their documentary, provenancial, functional, and jurisdictional contexts. The *fonds* or archive is defined as

... the whole of the documents of any nature that every administrative body, every physical or corporate entity, automatically and organically accumulated by reason of its function or of its activity. (p. 40)^[2]

It has both exterior dimensions, relating to the external jurisdictional and functional structures in which records are created or accumulated, and interior dimensions, relating to its internal recordkeeping structures. The principle of *respect des fonds* is about preserving the interior and exterior dimensions of a corporate or individual archive within an archival environment so that its authenticity and integrity is maintained, allowing the records to function as part of collective memory.^[2]

In English-speaking communities, *respect des fonds* has been translated into the principles of provenance and original order. The principle of provenance is about preserving “the relationship between records and the organizations or individuals that created, accumulated, and/or maintained and used them in the conduct of personal or corporate activity” (p. 11).^[3] The principle of original order is about maintaining the ordering and grouping of records used by a creating organization or individual so that they reliably reflect the creator’s business and recordkeeping activities. Keeping records in an archival environment according to these principles maintains their authenticity, integrity, and reliability (pp. 15–16).^[4]

Table 1 gives definitions of *respect des fonds*, provenance, and original order from key publications associated with arrangement and description traditions in North America, the United Kingdom, and Australia. It illustrates that the definitions of these principles tend to be expressed in terms of their application in practice, with that practice, by and large, reflecting the physicality of paper recordkeeping environments.

Arrangement and description practices have been constructed around applying the principles in paper

Table 1 Definitions of arrangement and description principles.

<i>Respect des fonds</i>	One axiom holds that records created or accumulated by one records creator must be kept together and not intermixed with the records of other creators, often referred to as <i>respect des fonds</i> . (<i>Rules for Archival Description</i> , p. xv) <i>Respect des fonds</i> is the principle that the records created, accumulated, and/or maintained and used by an organization or individual must be kept together in their original order, if it exists or has been maintained and not be mixed or combined with the records of another individual or corporate body. (<i>Arranging and Describing Archives and Manuscripts</i> , p. 33) Respect for the principle of provenance that the archives of an agency or person are not mixed or combined with those of other agencies or people. (<i>Keeping Archives</i> , p. 479)
Principle of provenance	<i>Provenance</i> is defined as “the relationship between records and the organizations or individuals that created, accumulated, and/or maintained and used them in the conduct of personal or corporate activity.” The principle of provenance states that records should be maintained according to their origin and not “intermingled” with those of another provenance that is those created by another person or agency. They should be kept together on the basis of the organization that created, used, or accumulated the group of records and in the groupings of records the person or organization created. (<i>Arranging and Describing Archives and Manuscripts</i> , p. 15) In archival theory, the principle of provenance requires that the archives of an agency or person not be mixed or combined with the archives of another, that is, the archives are retained and documented in their functional and/or organizational context. (<i>Keeping Archives</i> , p. 476)
Principle of original order	A second axiom follows from the observance of <i>respect des fonds</i> : the way archives are described depends on their arrangement. Implicit in the archivist’s observance of <i>respect des fonds</i> is the assumption that the way a creator “automatically and organically created and/or accumulates records” will affect the way archivists arrange a fonds. (<i>Rules for Archival Description</i> , p. xv) The principle of original order involves keeping records in the order by which they were kept by the person or organization that created, accumulated, assembled, or maintained them. The groupings, file system, subdivisions, and other physical structuring provided by the records creator should be

(Continued)

Table 1 Definitions of arrangement and description principles.
(Continued)

	maintained. Keeping records in the order the creator kept them provides information about the context and use of those records. (<i>Arranging and Describing Archives and Manuscripts</i> , pp. 15–16)
	The order in which records and archives were kept in active use, that is, the order of accumulation as they were created, maintained, and used. The principle of original order requires that the original order be preserved or reconstructed unless, after detailed examination, the original order is identified as a totally haphazard accumulation making the records irretrievable (but not an odd, unorderedly, or difficult arrangement). (<i>Keeping Archives</i> , p. 475)

recordkeeping environments and also tend to be defined in terms of their application in particular traditions, as illustrated in Table 2.

ARRANGEMENT AND DESCRIPTION PRACTICES

Arrangement and description are processes traditionally associated with the transformation of an individual or corporate archive into a broader archival framework in order for it to function, alongside other such archives, as accessible collective memory. They are integral to maintaining the authenticity, integrity, and reliability of records in an archival environment so that they may continue to function as evidence of the activities and contexts in which they were created and used. As archival functions, their principal aim is to establish, capture, and sustain the physical and intellectual controls that enable an archive to be comprehensible and accessible for future use beyond the environment in which it originated.

Archival arrangement and description processes differ from other cataloging, classification, and organizing practices in that they are not seeking to impose order and structure but to reveal the inherent relationships between the records and their contexts of creation and use. The focus of arrangement and description is on explicating the relationships of records to the business and recordkeeping processes of their creators, not on classifying their subject matter or format. While cross-referencing into classification frameworks utilized in other information management traditions may be useful for accessibility, and physical arrangement based on format may be more efficient for repository management, neither one should dictate the way in which records in archival institutions are principally arranged and described. One of the potential advantages of digital and networked technologies is that

Table 2 Definitions of arrangement and description.

Arrangement	Arrangement involves analyzing the records to see who or what created them, how and why they were created, what functions and activities they document, when they were created, and what their physical nature is. (Basic RAD, http://scaa.sk.ca/rad/section1.htm) Arrangement is the process of organizing materials with respect to their provenance and original order, to protect their context, and to achieve physical and intellectual control over the materials. (<i>Arranging and Describing Archives and Manuscripts</i> , p. 11) The intellectual and physical process of putting archives and records into order in accordance with accepted archival principles, particularly those of provenance and original order. If, after detailed examination, the original order is identified as a totally haphazard accumulation making the records irretrievable (but not an odd, unorderedly, or difficult arrangement), the archivist may (after documenting this original order) impose an arrangement that presents the records objectively and facilitates their use. (<i>Keeping Archives</i> , p. 464) The intellectual and physical processes and results of analyzing and organizing documents in accordance with archival principles. (<i>ISAD(G)</i> 2nd edition, p. 10)
Description	Description is the process of explaining that arrangement so that people—researchers, administrators, whomever—who want to use the records know where to look to find the answers to their questions. Arrangement, therefore, is the process of studying the records to discover how they relate to the entities that created them. Description is the way of sharing that knowledge with everyone else. (Basic RAD, http://scaa.sk.ca/rad/section1.htm) Description is the creation of an accurate representation of a unit of archival material by the process of capturing, collating, analyzing, and organizing information that serves to identify archival material and explain the context and record system(s) that produced it. (<i>Arranging and Describing Archives and Manuscripts</i> , p. 13) The process of recording information about the nature and content of the records in archival custody. The description identifies such features as provenance, arrangement, format, and contents and presents them in a standardized form. (<i>Keeping Archives</i> , p. 467) The creation of an accurate representation of a unit of description and its component parts, if any, by capturing, analyzing, organizing, and recording information that serves to identify, manage, locate, and explain archival materials and the context and records systems which produced it. This term also describes the products of the process. (<i>ISAD(G)</i> 2nd edition, p. 10)

they may more efficiently enable such cross-referencing and inventory management without compromising archival principles.

Record Group Traditions

In the late nineteenth/early twentieth century, when archivists were mainly dealing with closed, complete, paper, records series from the records systems of relatively stable and long-lived administrations, reconstructing the physical arrangement of records in the archival repository “inherently reflect[ed] the functions, programmes, and activities of the person or institution that created them” (p. 35).^[2]

The principle of *respect des fonds* was implemented through the segregation within archival repositories of records from different creators, with the physical arrangement of these groups representing “the external structures in which each particular archive had been formed, thus also reflecting the functions and activities of the records creator” (p. 166).^[5] Internal filing structures among record series within these groupings were then also physically recreated, maintaining original order and thus also preserving the interior dimensions of the *fonds*. Once arranged, the resultant record groups were then described in archival finding aids to produce a surrogate of the “physical manifestation of the archive or *fonds* on the repository shelf.”

These arrangement and description practices reflect the recordkeeping and archiving contexts of their time, characterized by relatively stable and long-lived administrative structures, simpler and hierarchical organizational structures, and archival institutions mainly handling records of past administrations. In these circumstances, taking records into custody once they were closed, identifying the boundaries of a *fonds*, nominating a single records creator, and capturing the documentary, provenancial, functional, and jurisdictional relationships of the *fonds* through physical arrangement was relatively straightforward. This gave rise to the record group approach to description, involving the successive depiction of whole-part relationships between levels of physical arrangement.

In the record group approach, a representation of the *fonds* is captured by successive enumeration of its hierarchy from the top down, that is, the overall *fonds* is described and contextualized, followed by each of the series making up the *fonds*, and within each series the files making up the series, and (resources permitting) within each file the items making up the file. Implicit in this is the view that there are only one-to-one relationships between the levels of arrangement and their provenancial and functional contexts, and between the levels of arrangement themselves. The arrangement also preserves the filing order of the records systems, thereby representing the activities of the records creator. With the

record group approach, description takes place after arrangement, proceeds from the general to the specific, and emphasizes the importance of multilevel rules to avoid redundancy and repetition in the production of paper-based finding aids. The arrangement hierarchy implicitly captures relationships of the records to the recordkeeping contexts of the creator of the *fonds*, with physical arrangement reconstructing these relationships within the archival institution.

With the increasing complexity of recordkeeping processes and contexts throughout the twentieth century, these arrangement and description practices have been put under stress.

As the dynamics of social institutions changed, administrative structures become more volatile, organizations became larger, more complex and more variably structured, archival institutions came to be concerned with modern records (*fonds* in the process of becoming, rather than already formed in any sense), more than one records creator came to be associated with a single *fonds*, and they and any number of successor organizations might be responsible for transferring to archival custody subsets of records belonging to the same *fonds* at different points in time, archival systems based on the old rules of arrangement and description became increasingly dysfunctional as archivists struggled to solve insurmountable problems associated with scalability, defining the boundaries of the *fonds*, and creating a one-to-one relationship between a *fonds* and a records creator (p. 167).^[5]

This has given rise to alternative approaches to arrangement and description based on decoupling physical and intellectual control and viewing the *fonds* as a logical rather than a physical construct. In this approach, arrangement and descriptive processes focus on capturing multiple, virtual relationships between records, and their contexts of creation and use. Relationships in the records are virtually reconstructable rather than physically reconstructed by arrangement. Finding aids that reconstruct the *fonds* are an output from the system rather than being the unit of description. Description documents contexts rather than cataloging an arrangement. According to this approach, an archival system is in essence a register of recordkeeping systems, as well as itself being a form of recordkeeping system.

Context Control Systems

Registry systems

The recordkeeping tradition known as registration systems, or registries, was widespread throughout Northern Europe (particularly in Prussia) and the United Kingdom. It formed an important part of the control tools associated with the administration of empire, consequently spreading in the English-speaking world to Australia, Canada, and

other colonies. Registry systems, as their title suggests, center on the concept of registration and are based on the notion of controlling documentation from the time it is received by or authored within an organization. In the German recordkeeping tradition, the Registratur is “the office that controls the flow of incoming and outgoing correspondence and preserves, arranges, and services those parts of it that remain with the agency until they can be transferred to archival custody.”^[6] Documents are registered (controlled) into the system as soon as they enter the organization, or as they are dispatched, being always managed conceptually as records. A number of indexing schemes complement the registration process—typically an alphabetic name index and a topic or subject index. In the German tradition, “since the eighteenth century, there has existed a common agreement that the registry . . . must arrange its holdings in accordance with the main functions of the administrative unit it serves” (p. 91).^[6] Registry systems thereby apply archival functions to records that are still current.

Registry systems associate incoming documents with any previous transactions of relevance, in many cases physically gathering together the associated documents. The system then directs the records around the organization to those that need to take relevant action, tracking the work that is done, or needs to be done, in proto-workflow systems. The records travel through the organization gathering the documentation associated with the work as it is carried out, finally ending up once action is completed in the registry. Here, all correspondence being dispatched outside the organization is also registered in separate sequences and linked to the records related to it. The registry then stores the records of completed business in various sequences, commonly either the original sequential registration number or by any later registration number given to a subsequent document arising from action. If the latter option is adopted, sequences of records related to a business action are gathered together. These are the antecedents of the “file” that grew out of the inability to cope with the demands of registering every document in the paper explosion of the mid-twentieth century.

Registry systems separate out the physical from the intellectual, relying on multiple indexes constructed around the records to provide entry points for retrieval to serve multiple purposes. They focus on controlling documents from the moment they are received or created, with records acting as enablers and drivers of business action, sequencing activity. In paper registry practices, indelible bonds between documents and actions are created through physical markings on records, physical arrangement, and in registry control systems, for example, card indexes that also serve as retrieval tools. These practices embody the principle of original order. The physical manifestation of the record sequences can, and do, change depending on the documents brought together for action. Registry systems allow for the actual storage arrangements of the

documents to be quite separate from the constructs brought together for the actioning of work.

This recordkeeping tradition is not universal and was not the norm in twentieth-century American administration, the source of much of the first wave of office automation software. The disappearance of registries and records functions at the time of initial automation of work processes was based on the presumption that these paper-based behemoths epitomized outdated practices. Undoubtedly, understandings of the importance of records and recordkeeping were swamped by the routine undertaking of day-to-day activity in automated systems. Out-of-control, chaotic recordkeeping resulted as the old registry systems broke down and oftentimes were not replaced with any commensurate organizational systems.

With the increased application of computing technologies to the processes of document and records formation and structuring, the concepts behind many of the practices embedded in registry systems are finding new life in electronic recordkeeping best practice. Indeed, all IT systems work on registration of some kind even if it is not explicit. Simple sequential numbers as locators, rather than the bearers of embedded meaning; the development of classification systems for current records based on the work that is done in organizations, as manifested in activities and functions; the provision of multiple indexing points as aids to searching and retrieval; and workflow grouping of sequences of actions reflected in records are some examples. These characteristics are implicit or explicit in the registry systems of the nineteenth and twentieth centuries. Reworking of these concepts can be found in best practice statements for recordkeeping in the electronic world, where they can be delivered in ways attuned to automation and minimal manual intervention (see entry on “International Organization for Standardization (ISO),” p. 2917).

Series systems

In Australia, the circumstances leading to the establishment of the Commonwealth Archives Office in 1961 were quite different from those that formed the context for the establishment of national archives in Europe and the United States. In the Commonwealth of Australia (formed at federation in 1900), recordkeeping problems were essentially those presented by twentieth-century records, with all their complexity and volume. Australian recordkeeping was plagued with difficulties arising from the penchant for administrative change. Agencies were created and abolished with quite amazing regularity,^[7] and this trend increased dramatically in the second half of the twentieth century. This resulted in records series being split, merged, and resplit as functions moved through multiple agencies. The notion of documenting provenance in terms of the last creating agency was not sustainable as it could create a substantially distorted view of the provenance of the records.

The so-called Series System was developed to address these and other problems.^[8] Its designers were very conscious of requirements to maintain conceptual compliance with the core archival principles of *respect des fonds*, provenance, and original order. It also drew heavily from the recordkeeping systems in place to manage current records. To these, it added a further layer of control—a registration system for recordkeeping systems imposed by an external (archival) authority. In this system, record series are allocated a simple sequential number—a registration number that bears no inherent meaning. A separate registration process documents the records-creating agencies, with a different simple sequential number. Thus, two types of entities are independently registered and documented. They are then linked in as many ways as are relevant to each other. Using the notion of previous and subsequent relationships inherited from the earlier registration systems, each record series is linked to any and all relevant agencies. These relationships become the pivotal mechanism in allowing complex depiction of provenance in a continually cumulating archival documentation system. This approach enables representation of multiple roles in relation to records, thus documenting these roles over time and as they change. Thus, the system maintains all the traditional requirements for *respect des fonds* through enabling a very detailed representation of provenance, both at a specific point in time and over time.

The “Series” System addressed a number of problematic areas in Australian attempts to apply traditional archival description. The nexus between the physical arrangement of records in a repository and their intellectual arrangement was broken. As in a registry system managed through multiple registers and indexes, it was no longer necessary to locate the records derived from a single agency together in one place, or even all parts of a record system together. The arrangement was an intellectual construct. While agencies and records series were the two entities and aggregation layers defined by Scott and his colleagues for the purposes of archival description at the Commonwealth Archives Office, other entities and layers of aggregation can, and have been, introduced and managed in different implementations using exactly the same concepts. Multiple, layered, and complex relationships between agencies (and other entities, such as function) and records can be constructed and expressed to reflect the volatility of the administrative structures of the government. Roles and rights associated with these relationships can also be clearly delineated—for agencies, these were initially defined as “creating,” “controlling,” and “transferring” when linked to records series.

Similarly, this system is not dependent on records being in custody. The circumstances of recordkeeping in volatile administrative contexts mean that the earlier the documentation of agencies and recordkeeping systems are documented, the easier it is to get an accurate depiction.

This is ideally undertaken at the time of change of government through the management mechanisms of the machinery of government announcements (e.g., administrative arrangement orders). Documentation of recordkeeping systems can, in theory, be carried out by anyone involved in recordkeeping regardless of their designation as an archivist or records manager. Description occurs before any arrangement and can encompass all of the records—both documents and files, those extant and those that have been destroyed at various times. The system is not restricted to depicting the records held in archival custody as if they are the whole of the records. The “archieff” of Muller, Feith, and Fruin can therefore be much more faithfully represented in this system of archival documentation than in the traditional representation of a *fonds* as a catalog of surviving records.

The “Series” System implemented in the Commonwealth Archives Office was also based on pragmatism. In being pragmatic, it achieved a high adherence to the principle of original order, using the contemporary documentation of records’ creators rather than creating independent lists of records once received into archival custody. The fledgling archives could not hope to process voluminous twentieth-century records to the level of detail of calendars and many other traditional archival finding aids recommended by European antecedents. Instead, the system was based on the controls that were in place at the time the records were created. If the agency relied on the registers and indexes that they created to manage the records, so too would the archives and the archives users. Additional layers of description could be added to provide additional interpretative material where necessary, but whole-scale reprocessing need not be undertaken. With hindsight, these wholly pragmatic decisions are now a fundamental component of ensuring the authenticity of records.

All these characteristics of the “Series” System—connection to the whole of the records; the treatment of agencies and records as independent entities; documenting multiple relationships over time to maintain links between agencies and records as they change; multiple points of registration; inheritance of the records controls created to manage records in a different context—can be seen reverberating through the rich conceptual thinking embedded in the Records Continuum Model (see entry on “Records Continuum Model,” p. 4447).

DIGITAL AND NETWORKED ENVIRONMENTS

As already noted, the world of digital recordkeeping and networked environments has brought substantial challenges to traditional arrangement and descriptive practices. The complexity of modern recordkeeping, the heterogeneity of modern records, the exigencies of repository management, and the advent of computing

technologies mean that increasingly the connection between records in an individual or corporate archive and their originating context is constructed as an intellectual rather than a physical exercise. A major challenge for archivists in the face of increasing complexity and virtualization of recordkeeping with the introduction of copying, digital, and networking technologies has been to come to a greater conceptual understanding of the principles underlying arrangement and description, so that practices can be constructed to meet past, present, and future recordkeeping realities as required. In Canada, Cook and other Canadian archivists have written about the need to view the *fonds* as an intellectual rather than physical construct and of the need for arrangement and description practices to enable representation of “a dynamic interconnection between the abstract description of the records creator(s) and of the concrete description of the actual records (series, files, items)” (p. 74).^[2]

Recent definitions of arrangement emphasize that it is an analytical process, in which the records of an individual or corporate entity and their contexts are examined in order to establish by whom, how, and why they were created and used.^[9] Arrangement and description are also increasingly perceived as intertwined and interdependent functions rather than sequential activities, with interconnection to other functions such as appraisal, preservation, and access.^[4] There has been recognition of the need to capture appropriate records of arrangement and description activities, along with the notion that these processes may occur throughout the records existence rather than just at the point of archival transfer. This challenges the idea of description as merely a cataloging activity that explicates archival arrangement.

The past few decades have also seen an increasing interest in standardization of archival arrangement and description practices in order to capitalize on the capabilities of computing technologies for archival processing, access, and retrieval. This has resulted in the codification of arrangement and description practices (to varying degrees) in a number of manuals, guides, and other kinds of publications that have then been shared within communities of practice. These publications provide a set of rules for implementing arrangement and description processes that reflect the type of jurisdictional and functional arrangements, organizational structures, and recordkeeping processes of their places and times. They are also shaped and limited by available recordkeeping and archiving technologies. The International Council of Archives (ICA) has supported the development of ISAD(G), ISAAR (CPF), ISDIAH, and ISF as a suite of international archival descriptive standards, aimed at developing better understanding of arrangement and description principles in order to construct more unified practices. The ICA’s latest project, the Expert Group on Archival Description (EGAD), is seeking to develop an overarching conceptual model of archival description to

facilitate the standardization of descriptive systems and allow for the combination of descriptive information from different sources to foster collaboration among memory institutions. Such a higher-level abstract model is necessary for semantic interoperability across descriptive schemas not just within the archival community, but also with those used in library, museum, and other information systems. Conceptual descriptive models allow for common and distinctive areas to be identified, enabling the integration of description from different perspectives and sources in ways that preserve and respect meanings. However, while these kinds of standardization activities may enable greater sharing of information about archival holdings across institutions, the practices either implied or codified in the standards are mainly those relating to existing cumulated holdings of archives and reflect essentially paper-based practices. They do not address the challenges of digital and networked records and recordkeeping.

Standards for Arrangement and Description in Digital Environments

In a digital world, records do not exist as fixed artifacts. The relationships between records, once preserved by their physical ordering, can no longer be represented by physical arrangement. This provides a substantial challenge to the notion of original order as traditionally articulated and applied. All records are accessed and viewed through the mediation of a machine. What order the machine stores them in is unknown. The best that can be asserted is that the digital components of a specific record are managed within a known application. Protocols of presentation embedded in that application structure the ways the records are presented to a viewer. Records are virtual constructs—what we see on a machine in a form and format that looks familiar to a paper-based mind is only a representation of the record, rendered to appear in that given form and format. Records are brought together on the fly. They can be composed on multiple fragments and drawn from many different underlying parts of a system. Breaking traditional thinking from a physical to a virtual mindset is essential if we are to maintain the ability to present records in context to users of the future.

In a virtual world, location is irrelevant. An electronic record can live anywhere from the time it is initially created—it can live in an organization; it can be shared by multiple organizations; it can be stored by a third party; it can be lodged with an archival institution from the time it is locked into a defined format. Any of these physical locations are possible and may coexist. Thus, the archival endeavor of description is to ensure that when represented to a user (any user, at any time) the record is meaningful, able to be rendered on the technology of choice, and possesses the characteristics that make it reliable, authentic, and trustworthy.

The need for digital preservation processes to focus on capabilities to represent records is a key finding from the International Research on Permanent Authentic Records in Electronic Systems (InterPARES) Project. The project reached the conclusion that preservation of records in digital environments is about preserving the ability to reproduce records, rather than the electronic records *per se*.^[10] Reproducing records involves assembling preserved digital components into the proper arrangement to represent their intrinsic documentary form and extrinsic archival bond, essentially to maintain and render relationships to transactional contexts in order to enable the transmission of authentic, reliable records through time and space. Preservation and description functions are thus inextricably linked.

Along with the undoubted challenges of ensuring that digital records survive in readable format long enough to reach the portals of an archival institution comes awareness that reconstructing provenance and other contextual linkages for such records is unachievable when applied retrospectively. This combined set of challenges has pushed the locus of descriptive activity into recordkeeping environments more contemporary with the creation of the record. To achieve this, understandings about what descriptive processes for recordkeeping entails must be broadened out and embedded into all recordkeeping environments, commencing from the initial point of a record's capture. A corollary is the requirement to standardize these understandings in the form of professionally accepted practice (see entries on "International Standards for Archival Description," p. 2950, and "International Organization for Standardization (ISO)," p. 2917). Using such means, the locus of the application of the descriptive standards can be changed and the record can be created with many of the components required to ensure the survival of the record, connected to the business activities it documents, through time, and across multiple locations.

Moving away from description as a professional practice associated only with the work of archivists within an archival institution has required a thorough review of the purpose and nature of the work of arrangement and description. An Australian archivist, Hurley,^[11] argues that the traditional role of all archival finding aids is to maintain the linkages of records, now in archival custody, to the circumstances of their creation and management. This posits a very critical role for finding aids as a mechanism for maintaining the authenticity of records through exposition of the processes of formation of records, rather than just a presentation of explanatory material for users to facilitate access.

Reconceptualizing description as an archival function that ensures authenticity of records over time provides an immediate link back to the creating environment as there too the authentic nature of records is a key concern. The recordkeeping endeavor then becomes a shared one across multiple sites of implementation. The requirement to

define the characteristics and components that will ensure that records survive over time is an inherent part of the records-creating process. Enhancing the context of creation with other layers of descriptive information as the record moves through multiple points of creation and management, and weaving different relationships as it travels through multiple uses, reuses, and sites of interaction become components in a cumulative process of records formation.

In digital environments of increasing complexity, grounding recordkeeping theory in a strong understanding of the rationale of records becomes vital. Concepts such as cascading regions of recordkeeping actions that reflect different points in registration processes, and the primacy of relationships and notions of aggregations become essential to effective intervention in the design and development of systems to create and maintain records over time. The ability to depict complex and dynamic relationships becomes the key to maintaining records authenticity.

Recordkeeping Metadata Models

Recent international recordkeeping metadata initiatives (see entry on "International Organization for Standardization (ISO)," p. 2917) are a direct result of conceptualizing the world of recordkeeping in this way. ISO 23081 defines recordkeeping metadata as

data describing the context, content, and structure of records and their management through time. As such metadata is structured or semi-structured information that enables the creation, registration, classification, access, preservation, and disposition of records through time and within and across domains . . . metadata can be used to identify, authenticate, and contextualize records and the people, processes, and systems that create, manage, maintain, and use them and the policies that govern them.^[12]

It specifies different layers of aggregation and different sites of implementation of recordkeeping metadata in order to enable the continual construction and weaving of relationships as the record appears in multiple sequences of action. This approach is predicated on the proposition that records need to be actively defined, and that at the initial point of capture of a record object, a set of metadata about its content, structure, and immediate context of action also needs to be captured and persistently linked to it. Moreover, record objects can only exist through time if they are persistently linked to an accumulating set of metadata, providing broader layers of context, and recording the business, recordkeeping, and archiving actions that manage them. This recordkeeping metadata is itself a record and so must incorporate metadata about its "recordness," that is, who created it, when, etc.

With this view archival description is another layer of recordkeeping metadata that maintains evidential

contextualization when records are represented outside of their originating environments in transfer to an archival institution. Recordkeeping metadata about the recordkeeping metadata enables intellectual separation of that which is created by the originating and archival contexts.

Emerging metadata standards and models, including the ISO, take as their frame of reference a conceptual model of recordkeeping metadata in business and socio-legal contexts developed by the Australian SPIRT Recordkeeping Metadata Project (Fig. 1). This model extends the Australian Series System concepts of context, drawing on records continuum thinking relating to a record's complex and dynamic social, functional, organizational, procedural, and documentary contexts of creation, management, and use in and through spacetime. It is also informed by the insights of Hurley and Cook. The model defines layers of descriptive metadata about the following:

- Records at any layer of aggregation
- The people or agents involved in creating, managing, and using records
- The organizational and social structures in which they interact
- The activities and transactions in which the people or agents are engaged, and related social and business purposes and functions
- The recordkeeping functions, activities, and transactions that capture, manage, and make accessible the records of these activities and transactions
- The complex, multiple, and dynamic relationships between all of these entities
- The warrants or mandates that govern all of this social and organizational activity, including metadata about social mores, laws, business policies, and rules

Other research initiatives are also investigating requirements for recordkeeping metadata and frameworks for its

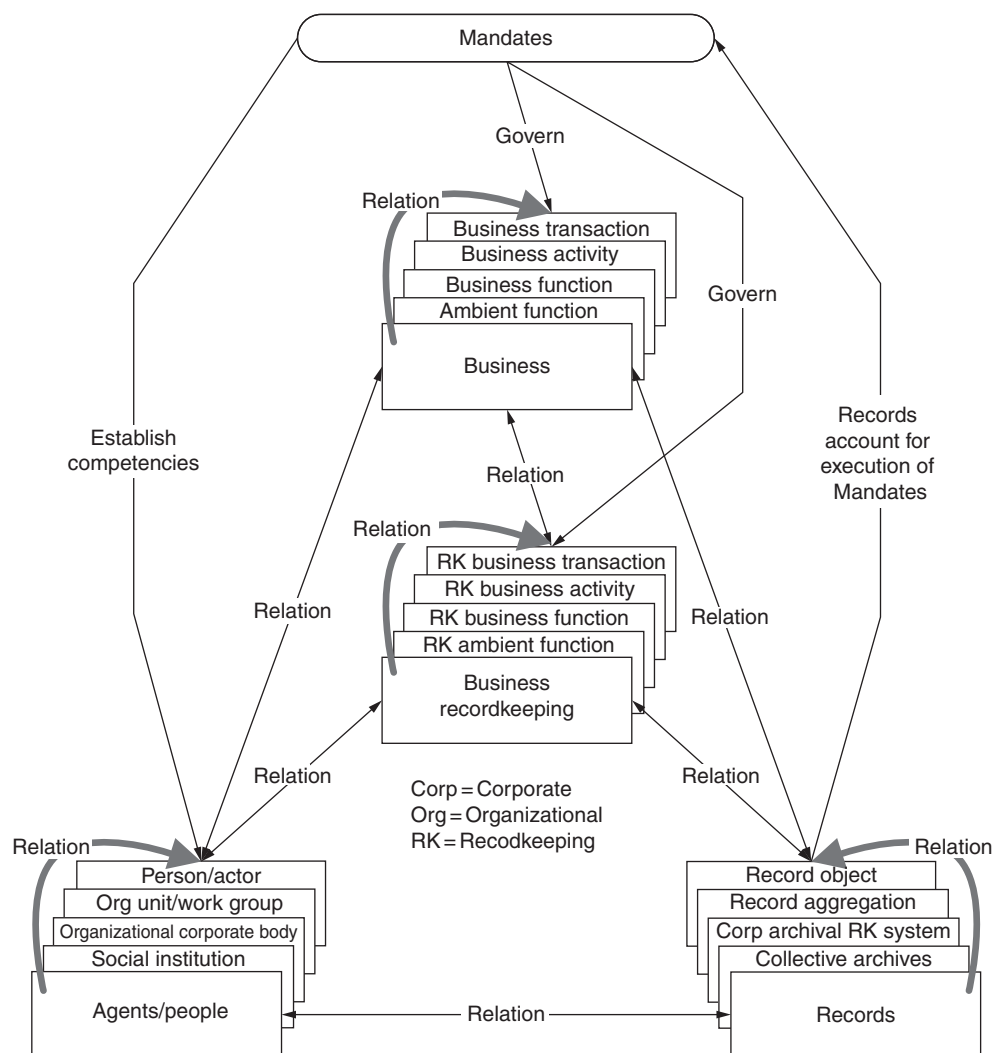


Fig. 1 Conceptual model of recordkeeping metadata in business and socio-legal contexts.

Source: From McKemmish et al.^[13]

management in electronic environments. The Clever Recordkeeping Metadata Project, involving researchers at Monash University in partnership with the National Archives of Australia, State Records Authority of NSW, and the Descriptive Standards Committee of the Australian Society of Archives, explored the automated capture and re-use of recordkeeping metadata,^[14] while the InterPARES 2 Description Research Team prototyped a Metadata Schema Registry for describing and analyzing extant metadata schemas and archival descriptive standards against emerging recordkeeping warrants.^[15]

ARCHIVAL DESCRIPTIVE SYSTEMS OF THE FUTURE

Recordkeeping metadata initiatives implemented in digital networked environments have the potent to enable simultaneous multiple views of recordkeeping realities. While most implementations of archival description document, and therefore privilege, the role of a singular records creator, representing their context rather than that of other parties to the transactions that the records evidence, and draw on functional classification schemes and thesauri developed at the level of the corporate or individual archive, the frameworks could enable alternative readings of our society, to ensure that the voices of other parties to transactions in which records are created, captured, and used are heard.

Hurley's writings have extended the conceptual basis and principles of the "Series" System to encompass the challenges of describing context and records entities and their complex, multidimensional relationships in the virtual world of the beginning of the twenty-first century. His further development of the conceptual framework for the Series System includes two layers of contextual entities, higher-level ambient entities representing organizational structures, jurisdiction-based or functional groupings, or functions themselves, corresponding to the French view of the external dimension of the *fonds*, and lower-level German-like provenance entities representing records-creating units and activities.

This extension of the Series System and emerging recordkeeping metadata models enable archivists to go beyond Peter Scott's original vision of sequential multiple provenance to address what Hurley has named parallel and multiple simultaneous provenance.^[16]

Recognising that the documentation created within the New Zealand national archives system largely reflects the cultural views of the Pakeha majority, but living in a society in which bi-culturalism is more than mere rhetoric, Hurley began to question how the views of the Maori could be accommodated in systems defined by Pakeha standards, and to seek a set of alternative, equally valid ways of viewing and documenting the records. (p. 192)^[15]

Postmodern ideas are informing the critique and refiguring of archival processes and systems. Ketelaar has also posited a different approach to archival descriptive practice with reference to the concept of "communities of records" as developed by Bastian, and associated ideas about shared ownership and joint heritage. Bastian defines a community of records as "the aggregate of records in all forms generated by multiple layers of actions and interactions between and among the people and institutions within a community."^[17] According to this view, "the records of a community become the products of a multi-tiered process of creation that begins with the individual creator but can be fully realized only within the expanse of an entire community of records"; thus, "all layers of society are participants in the making of records, and the entire community becomes the larger provenance of the records." Drawing out the implications of these conceptual approaches, Ketelaar^[18] points to the matrix of mutual rights and obligations of all the parties involved and how they would extend to all aspects of recordkeeping and archiving, including description. Archival descriptive systems of the future need the capabilities to negotiate such matrices of mutual rights and obligations and manage integrated archiving and recordkeeping processes to fulfill these multiple purposes.

Frameworks for capturing layers of rich contextual metadata, along with multiple contexts of creation, management, and use are emerging. The advent of Web 2.0 technologies has seen archival institutions experiment with adding user annotation, tagging, and transcription capabilities to their online discovery systems. While labeled as participatory archives, many would argue that more radical transformation is needed to enact more dynamic and democratic models of archival description. Huvila has identified three characteristics of a participatory archives approach, namely "decentralized curation," "radical user orientation," and "contextualization of both records and the entire archival process" and describes it as "not a complementary layer, but a primary knowledge repository about records and their contexts."^[19] In a participatory paradigm, the role of an archivist shifts from crafting descriptions to providing frameworks for creating, capturing, and connecting recordkeeping metadata, across, not just within, archival repositories. Such frameworks should also have the potential to make archival description of value and use in other information management contexts, for example, digital humanities, big data management, information governance, etc., where accountability, traceability, and authority of information, reuse, sharing, retention, and disposal are required.^[20]

Participatory archival approaches reposition what have traditionally been viewed as the subjects of records and recordkeeping processes as participatory agents with legal and moral recordkeeping rights and responsibilities.

By expanding the definition of record creators to include everyone who has contributed to a record's creative

process or been directly affected by its action, notions of co-creation and parallel or simultaneous multiple provenance reposition 'records subjects' as 'records agents'. They support a broader spectrum of rights, responsibilities, and obligations relating to the ownership, management, accessibility, and privacy of records in and through time. (p. 132)^[21]

Documenting and servicing those rights requires abandoning the concept of singular records creation, ownership, and custody that dominates extant archival description practices and standards and embracing models that enable representation of a plurality of perspectives. Furthermore, in confronting the power of records and archival frameworks to empower, disempower, harm, and protect, Gilliland has also identified an ethical platform for participatory description, based on five facets—acknowledging, respecting, enfranchising, liberating, and protecting—and with individual and community rights to name, self-identify, respond, disclose, take down, and be secure.^[22]

CONCLUSION

Arrangement and description processes, as well as the understanding of these practices, are undergoing transformation as archivists attempt to deal with records created and kept in newer information technologies, business systems, and social environments. This entry has explored the principles underlying arrangement and description processes, along with how these processes have been shaped by the recordkeeping and archiving contexts in which they are constructed. It has also outlined emerging metadata management frameworks to inform the development of the recordkeeping and archiving systems of the future.

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Archival Documentation

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Abstract

Archival documentation is the term used to refer to those documents that record the activities of an archival program. As the term archives has come to mean different things in different contexts, the term archival program has come into common use to represent that wide range of tasks and roles undertaken by people when endeavoring to ensure that information is preserved as evidence. This entry does not attempt to prescribe the specific forms of records that archival documentation should create, as circumstances will vary widely from jurisdiction to jurisdiction and from country to country. Rather, the entry outlines the fundamental issues and purpose of archival documentation in order to help the reader judge the adequacy of existing systems and plan for improved forms of documentation. The guiding principle of archival documentation is that it helps tell the story of the materials managed by an archival program.

INTRODUCTION

Archival documentation is the term used to refer to those documents that record the activities of an archival program. As the term archives has come to mean different things in different contexts, the term archival program has come into common use to represent that wide range of tasks and roles undertaken by people when endeavoring to ensure that information is preserved as evidence. The description and management of materials in an archive is described elsewhere (see entry on “Archival Arrangement and Description,” p. 130) and is not covered in detail here. There is an underlying assumption in this entry that the materials being managed by an archival program are created elsewhere. This could be in another place within the same organization or, as with a collecting archive, from people or organizations from the outside world. In all cases the archival program needs to create adequate records that document its activities, as these provide the essential operational framework in which the archival materials are managed.

This entry does not attempt to prescribe the specific forms of records that archival documentation should create, as circumstances will vary widely from jurisdiction to jurisdiction and from country to country. Rather, the entry outlines the fundamental issues and purpose of archival documentation in order to help the reader judge the adequacy of existing systems and plan for improved forms of documentation.

The guiding principle of archival documentation is that it helps tell the story of the materials managed by an archival program. These materials, once managed by an

archival program, are generally referred to as archives and in this sense the term refers to a body of records generated by an entity, i.e., a person, an organizational unit or some other agent, in the course of their activities. The aim of the archival program is to ensure that the materials for which it is responsible can be meaningfully interpreted by users at any time in the life of the records, from the moment of receipt into the archival program, through the period of custody and curation, and, if it eventuates, the removal of the materials from the archival program. In order to fulfill this aim archival documentation must be created that records the actions of the archival program with respect to all the materials under its control.

Archival documentation, a critical component in the capture of contextual information surrounding archival materials, is created, kept, and made available:

1. To support the effective and efficient management of an archival program.
2. To maintain the authenticity, integrity, and reliability of records under the control of the archival program.
3. To make the records under the control of an archival program accessible and meaningful to its users.

It encompasses the documentation of records within an archival program, as well as documentation of the archival program itself. Its various forms reflect the complex and heterogeneous nature of archival material, along with the physical, virtual, multi-entity, and multilayered dimensions of records, including the recordkeeping systems in which they are created, managed, and used. All archival activities—initial survey and appraisal; acquisition,

transfer of custody and ownership; preservation and conservation; arrangement and description; location management; reference, access conditions, and copyright; and public programming and outreach—are sources of archival documentation and indeed each of these functions relies on information from the others to work effectively.

Most extant archival programs are based around the handling of paper records, generally generated from paper recordkeeping systems. Archivists are facing a challenging time in determining the documentation requirements for records created and managed in digital and networked environments. Consequently, archival programs need to manage the paper/digital hybrids of the last few decades as well as new forms of “born digital” records. Practices and processes need to not only deal with the technicalities of digital records, but also the changing nature of digital and networked recordkeeping systems, and in particular the new narratives or stories that the digital technologies make possible for materials managed by archival programs.

This entry will

- Establish principles governing archival documentation.
- Detail the archival documentation associated with the different phases of a traditional archival program.
- Discuss the impact of digital and networked technologies on documentation requirements and practices.

ARCHIVAL DOCUMENTATION PRINCIPLES

To tell the story of archival materials throughout their life in an archival program, the program itself will need to establish systematic, thorough, and integrated record creation and keeping systems. The emergence, in the latter decades of the twentieth century, of digital database technologies to assist in this process has significantly altered what archival programs can achieve in this area. However, it is not effectively possible to build a computerized database system that can deal with all the variables that may need to be documented in the life of archival materials. Indeed, this is why more generalized recordkeeping systems appeared and still remain an essential part of an archival documentation system. So, it is more than likely that comprehensive archival documentation will be found in a range of systems within an archival program. It is important that these systems are interrelated and cross-reference each other in clearly articulated ways so that future archivists and users can trace and track specific information about the materials as required. The careful use of unique identifiers within archival program documentation systems will aid in the unambiguous interconnection of related information.

Archival materials are assembled and managed on the understanding that they will ultimately be used without recourse to the originating entity or indeed the people

responsible for their transfer into an archival program. It is important that specific information held only in the minds of those people is captured and systematically documented so that both the archivists of the future and those wishing to use the materials understand why the materials are where they are and why they are in the form or structure in which they have been preserved in the archive.

Although it is generally understood by archivists, it is not more commonly understood by others outside the profession that, unlike libraries (as a rule), the logical and actual arrangement of materials in an archival program is not determined by a preexisting classification system. Indeed, the description and arrangement of archival materials is predominantly determined by the actions of the entities responsible for the creation and initial purpose of the materials and the recordkeeping systems they created to manage them while they were in the first phase of their life. In accepting materials into an archival program, archivists are sensitive to the provenance of the materials, and to the relationships between materials determined by that shared provenance. Archival documentation must ensure that these relationships are preserved. Very closely aligned with that guiding principle is a respect for the actual juxtaposition of materials as determined by the filing structures, systems, and arrangement of the material at the time they are transferred to the archival program. What should emerge from an engagement with archival materials is a sense of the structure and function of the materials in that first, operational phase of their life. What should also be clear is what has happened to those materials since they entered the archival program. The hand of the archivist should not be invisible but clear and evident to all users of the materials.

The challenges facing those responsible for archival documentation are significant as each case, each new set of materials, each relationship with a transferor and indeed each user will be highly individualized and arise from its own context. Therefore, what remains fundamental to successful archival documentation is the application of consistent and well-recorded processes for handling the materials at all stages in their life.

THE PHASES OF AN ARCHIVAL PROGRAM

The main phases of an archival program involve

- Establishment of the archival program (policy, mandate, scope, governance, rights management, workplace and storage buildings, location control, digital repository systems, and documentation systems and processes).
- Entry or acceptance of materials into the program (survey, accession, mapping and registration, transfer of custody, transfer of ownership, registration of rights, and appraisal).

- Archival processing incorporating
 - Provenance identification, registration, and description.
 - Inventory identification, registration, and description.
 - Collection/series identification, registration, and description.
 - Preservation actions (type and nature of containers for physical objects, type and nature of the digital repository(ies) for digital objects).
- Location, conservation, and access management (storage locations, movements between locations, conservation actions, registration of users, and documentation of use).
- Review of holdings (reappraisal, deaccessioning).

The passage of materials through an archival program is often a discontinuous process. All phases of the program must be meticulously and carefully managed and documented so that all those involved in the various phases of the program have ready access to explicit information that documents where the materials are in the program. However, before materials can commence their journey the archival program itself has to exist.

Establishment

Setting up an archival program is a serious business and with it comes obligations to individuals and organizations that may be moral, ethical, and legal. Consequently, it is essential that there are documents that record the establishment of the program and include the following: the purpose, mandate and authority; reporting requirements; the governance framework; the collecting policy; the access policy; a statement articulating the appraisal process; the roles of the people in the program; privacy policies; copyright management processes; and where required systems that deal with legally enforced freedom of information rights.

Associated with these fundamental administrative records are the operational administrative records that deal with finance, human resources, procurement, and day-to-day management. Although they form an important element of the records of an archival program they have more in common with general administrative practice rather than archival documentation so will not be dealt with here.

However, the records that tell the story of why the archival program was established and who is responsible for its ongoing life are important for users of the records. The reasons why some records may have been kept and others not, and why records may have been documented in a particular way, may be found in the policies of the program or indeed in the policies of the mandating organization. In the contemporary era it is not uncommon for changes in operational and organizational frameworks to occur in frequent although ad hoc phases. It is important that changes in policy and operational frameworks are

clearly documented as they occur. In dealing with this sort of change over longer periods of time, it is worthwhile producing comprehensive annual reports that restate clearly the operational and policy framework under which the archival program is operating, making special note of when there are changes, what they are, and the implications for the program.

An archival program requires places for people to work and systems for the storage and preservation of the materials. The extent of the provision of these practical aspects of the program will be determined by the budget for the program and the technologies available at the time. Therefore records documenting the characteristics, design, commissioning, and upgrading of buildings including repository storage systems (physical and digital) are essential.

Allied with these records are the records dealing with the design, establishment, and commissioning of the systems to manage archival documentation. It is likely that these will evolve over time as technologies change and more productive tools become available, allowing better integration and interconnection. In an ideal world, archival documentation systems would be fully self-explaining, but the world is far from ideal so external systems documentation and explanation is necessary. It will be critical for most of these records to be kept for at least as long as the materials in the archival program exist. In other words, the plan should be to keep them indefinitely.

Entry into the Archival Program—The Survey

With the exception of the records mentioned above, the materials managed by an archival program come from outside the program. In order for the materials to become part of an archival program they must be identified and registered. The crossing of the boundary into the archival program is probably the most significant moment in the life of a record. If it survives the day-to-day rough and tumble of life in the operational zone and is kept for whatever reason, it may become a candidate for an archival program. It is not uncommon for life in the operational zone to be quite dynamic and recordkeeping systems to be highly localized and idiosyncratic. The archival program rarely has any influence over what happens in this zone but there are exceptions—it is possible that archival program requirements can influence the identification, management, and appraisal of key records, for example, records of governance, minutes of boards, and similar materials. However, once the archival program boundary has been crossed things need to change dramatically for the record.

Although it is accepted that the ability to interpret archival materials requires knowledge of the context of their life in the operational zone, the best that the archival program can usually achieve is a snapshot of how they were positioned at the time they crossed the archival program boundary. To prepare for this transition an initial survey of the

materials in situ needs to be undertaken. New digital documentary tools such as digital cameras, sound recorders, and video recorders can bring significant productivity gains to this process. Archival program management systems should allow for the systematic integration of these items into the documentation process. This will assist in enabling the traceability of the items from this context-as-found through to their preservation location within the archive. Images of materials on shelves, in offices, with the people who use them, or even in garages after years of neglect help capture their story in ways not possible when only using words. Interviews with staff, family, and others associated with the materials, especially stories around the people and circumstances of the projects and activities associated with the materials, can be invaluable.

Transfer and Accessioning

The accession, or the formal registration of the materials as found, is the traditional entry point for records into an archival program. As a rule, the formal custody arrangements of the materials will change during this aspect of the archival program. Therefore, appropriate instruments documenting, authorizing these changes, and articulating the terms of transfer should be utilized. In some cases an exchange of letters may be sufficient, whereas in other cases, forms and other legal documents may be appropriate. For many materials the accession registration may be the first concrete anchor point where their story is documented. The systematic collection of data about the materials at this point is critical. Meticulous attention to detail in process and description is an imperative. For example, data that documents terms and conditions of ownership and custody, date of registration, location of registration, detailed information about the transferee, storage unit labeling, description of contents, notes about the condition of the materials and thoughts about future processing issues, and the provenance of the materials are critical elements of the archival documentation of this process.

The ability to produce a range of accession reports that reproduce the information gathered during the accession process can be most useful. These should be made available to all authorized stakeholders as evidence of the work undertaken and the condition or state of the records on entry into the archival program. All stakeholders should have the opportunity to contribute knowledge to the archival program. This point in the process provides an important opportunity to assess the descriptions of the materials, identify records where there may be ambiguities of interpretation, and check the allocation of key terms and other forms of controlled classification. Each accession or transfer should be allocated a unique identifier within the registration system.

During the accession process information can be gathered about how the incoming material relates to material

already managed by the archival program. Is the new material an addition to an existing series or collection or is it something completely new? Documentation that captures this information and analyses it in a systematic way will help with the eventual description, management, and use of the materials. The funding of archival programs is known to be problematic. As a result there can be significant gaps in time between the accession registration and further archival processing or documentation. These gaps are sometimes measured in decades. Indeed, there are archival programs that undertake no further archival processing and use their accession registers as their primary form of control and access.

An accession once registered, consistently documented, and housed in uniquely identified containers, can be responsibly relocated into appropriate storage without comprising the integrity of the records and minimizing the risk of materials going missing. The systematic documentation of the sequence of any new locations is therefore a new requirement of the archival program. The completion of this phase is only the beginning of the archival program but if this phase is undertaken in a painstaking and careful manner, the following phases, rather than being problematic, can be responsibly and efficiently managed.

Once in the Archival Program—Description, Housing, and Management

Once formally established within an archival program subsequent archival processes which require documentation include more detailed identification of materials, the registration and description of entities associated with provenance, the identification and registration of collections, series, record groups, box lists, and inventory items. Again, the allocation of unique identifiers to each of these entities will enable the systematic interlinking of elements of the documentation systems.

The selection of the levels and elements at which an archival program chooses to arrange and describe the materials varies from archival program to archival program. The issues surrounding arrangement and description are covered elsewhere and are therefore not covered here. Most importantly, what is required is clear documentation of the processes, practices, and protocols used by the archival program. There is no right answer or indeed correct arrangement of archival materials but what must be evident to the user are the actions taken by archives staff in preparing the materials for use.

The International Council on Archives has prepared standards that describe the elements of description that should be gathered as part of archival documentation at this phase of an archival program: ISAD(G)—the International Standard for Archival Description (General) and ISAAR(CPF)—the International Standard for Archival Authority Records (Corporations, Persons and Families).

Some countries have developed more detailed local rules for archival documentation during this phase of the archival program and these should be consulted as necessary.

Appraisal—It Happens All the Time

Of all the traditional archival functions, appraisal and the selection of materials for long-term retention is probably one of the most difficult to systematize and therefore document. Appraisal and selection is a process that can and is often undertaken in all phases in the life of materials and is an essential function of the archival program. From the initial survey to the review of materials based on use and changing values, appraisal and selection can be invoked. This may lead to either the noninclusion of materials or the removal of materials from an archival program. The appraisal of materials can also include the identification of any sensitivity associated with the materials due to personal, cultural, or legal circumstances. Archival materials are rarely the province of just one stakeholder, so it is necessary that these issues are identified and clearly documented, even if these sensitivities and resultant restrictions on use remain uncertain. The clear and unequivocal documentation of these actions and processes wherever undertaken is critical.

Uses of Archival Materials—The Role of Feedback

Archival programs may produce a range of guides, finding aids, online databases, and other documentary instruments that enable users to locate, request, and utilize the materials managed by the archival program. These are all important elements of the framework of archival documentation. However, these public instruments generally do not reveal all the information pertinent to the story of the materials, some of which may not be suitable, for privacy or other reasons of sensitivity, for the general public. As a rule access to archival materials, even those that do not have access restrictions, requires users to register with the archival program and agree to abide by a set of local rules. These rules may cover such things as copyright and moral rights obligations. In an ideal setting all the information resulting from this user documentation and any other feedback or additional information the users might provide about the materials they are viewing should be systematically incorporated into the descriptive documentation of the materials. If well done this could be used to enrich guides and finding aids, identify communities of users and aid in appraisal reviews.

IMPACTS OF DIGITAL AND NETWORKED TECHNOLOGIES

From the use of digital capture documentation tools such as cameras, and video and sound recorders in the archival

survey and accession process, to the use of imaging and digitization technologies of the materials themselves for enhanced access, security, and preservation, these technologies are not only transforming archival practice but also reconfiguring archival documentation.

The impact of digital and networked technologies on archival programs has been profound and seems likely to continue to drive significant transformation. Not only are most materials destined for archival programs now produced in the first instance in digital forms but there is increasing pressure to radically increase the rate of digitization of analogue materials. However, this is just the beginning of the data revolution facing archives programs. Further manifestations of digitized archival materials where content is extracted and marked up, for example in XML schemas, are being created and these new records must also be documented and integrated into the archival program.

The advent of sophisticated digital repository systems makes possible the effective archival preservation of digital materials. These systems rely extensively on the use of unique identifiers to manage digital objects as well as the related metadata elements required for management and preservation. Digital preservation is a vast topic that is covered elsewhere but there a few points worth reiterating, especially the use of nonproprietary formats, the ability to store the objects on a range of media, the automated checking of integrity and the management of file type migration to enable use through time and changing technologies.

Therefore, it is critical that system description and documentation is well maintained and that data disaster recovery processes are regularly tested. Like the storage and location management systems for paper materials, these systems form only part of a full archival program. The challenge for the archivist is to ensure that all components remain integrated.

Digital systems are becoming increasingly interconnected via the World Wide Web and its underlying services. It is an area that is still to be fully explored by archivists but users are driving the need for better interconnection and cross-referencing of the materials managed by different archival programs. This will add yet another dimension to the archival documentation matrix. The quality and the information architectures utilized by archival programs in their documentation systems will determine how quickly and efficiently these frameworks of connectivity may emerge.

However, despite the challenges posed by rapid technological change, archival programs are shaped by the needs of the human beings and their relationships with archival materials—as the creators of records, the subjects of records, and as the users of records. It is this ongoing narrative, this interplay between people and the evidence of their world, and the stories that make their lives meaningful, that lay the foundations for archival documentation. Archival documentation is driven by epistemological,

ethical, and practical imperatives that can all be traced back to the telling of the story of records. Without the stories of the records the stories in the records become increasing difficult for future users to decode.

SUMMARY

Archival documentation involves

1. Records of establishment, including governance, policies, reporting, and administration with a focus on capturing change in these parameters over time.
2. Records of archival systems, including the design, building, and commissioning of archival record-keeping systems (including both database and other systems) and the way they are interconnected and integrated, e.g., contact files/database, collection files/database, accession registers, consignment forms, and disposal records.
3. Records of survey and transfer, including making contact, surveying, appraising, consigning, accessing, physical and custodial transfer, in other words formal registration in the archival program.
4. Records of rights, sensitivities, and access conditions.
5. Records of arrangement and description including further appraisal and assessment, structural analysis, identification of related materials, and processing tasks.
6. Records of location, preservation, and conservation.
7. Records of access and use, including the guides, finding aids and user interfaces to archival documentation; the registration of users and their usage (including publications); annotation, qualification, addition of new information; and management access for restricted or sensitive material.
8. Records of the interconnections and cross-references with other archival programs.

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The following references represent a small and highly selective subset of the literature that either talks directly

or indirectly about archival documentation. This encyclopedic entry has not attempted to be scholarly in the citation of sources as an element of presentation and style but the authors acknowledge the broad range of experience and literature they have been able to draw on in writing this entry.

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Archival Finding Aids

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Abstract

Archival finding aids serve as the primary means by which users can obtain intellectual access to collections of primary source materials be they archives or manuscripts. Although the term may reference the general guide to a repository's collections as a whole, it is more commonly thought of as the guide to an individual collection within a repository. In addition to describing the physical contents of an archival collection, the finding aid comprises other identifying, contextual, and administrative information about the materials. The online environment has led to significant changes in the archival finding aid in the past decade with the development of the encoded archival description, *Describing Archives: A Content Standard*, archival collection management systems, links to digital content, and the addition of Web 2.0 features that seek to add interactive qualities to online finding aids. The future is certain to see continued development and refinement of the finding aid as more materials are born digital or are digitized and ways are developed to describe them in the context of a user-friendly finding aid.

INTRODUCTION

In its broadest conception, the archival finding aid can be considered as any type of descriptive tool that provides intellectual access to the materials held in an archival or manuscript repository on a collective or individual level. Thus, this definition holds that a summary guide to the various record groups and/or collections held in a repository or a document providing box, folder, or item-level description to an individual collection in that repository are both considered finding aids. Whether “published or unpublished, manual or electronic,” its purpose is “to establish physical and/or intellectual control over records and/or archival materials”^[1] and serve as the means by which users “gain access to and understand the materials.”^[2]

Although the finding aid can take a variety of formats and is referred to by various names, including inventories, calendars, registers, guides, and container lists, it is generally thought of by most archival practitioners as the primary descriptive tool by which they and users can access materials in an individual archival or manuscript collection. Thus, this entry will focus on the finding aid primarily in its function as an access tool to an individual collection. It will provide a brief introduction to the archival finding aid by considering its function, structure, and content, and efforts at standardization that have evolved with the presentation of finding aids in the online environment. The entry will also discuss recent developments that may affect the creation and presentation of finding aids in the future. Suggestions for further resources in which to find more detailed information and examples of finding aids can be found at the end of the entry.

DEFINING THE ARCHIVAL FINDING AID

Whether a guide that focuses broadly on the totality of records or manuscripts in a repository, or a document that describes an individual collection within that repository, the finding aid is the central means of access and description for archival or manuscript materials. In this manner, it serves much the same function as an index or table of contents does in a book. Thus, it reflects the intellectual and physical organization of a collection and provides descriptive information on these materials at a collection, series, folder, or item level. The level of description and organization reflected in a finding aid can vary and depends on the collection, the processor, and the policies of an institution.

Although they serve much the same purpose, archival finding aids have in the past been referred to by different names depending on whether they were found in an archives or a manuscript repository. In the former, they were traditionally called inventories, while in the latter, they were known as registers. Calendars, a name typically reserved for the most lengthy, detailed finding aids created to list documents at an item level, are more likely to be found in a manuscripts repository where such detail may be helpful for particular formats of personal papers such as correspondence. This difference became less of a concern in recent years, as noted by O'Toole, with the move toward standardization of archival description in the late 1970s. According to O'Toole, “archivists acknowledged this to be a distinction without a difference, since all repositories wanted to know and record the same things about their collections in the effort to understand them and make them usable.”^[3] Specifically, he credits the

publication *Inventories and Registers: A Handbook of Techniques and Examples* as the work that demonstrated “graphically how much alike the supposedly different approaches were.”^[4]

ARRANGEMENT AND DESCRIPTION IN THE FINDING AID

Whatever its nomenclature, the finding aid can only be created after the essential business of arrangement and description of materials, be they archives or manuscripts, has taken place. Thus, most guides to arranging and describing archives and manuscripts^[5–7] consider the finding aid embodies the concept of archival description. During the physical processing of a collection, for instance, as the archivist rehouses and arranges the archival material at hand, he or she takes notes and focuses on what information will eventually need to be placed in the finding aid in order to make both the content and context of the collection clear to users.

The archivist’s decisions about how the materials in a collection will be intellectually and physically arranged are also reflected in the finding aid. In fact, before any work is done on the organization of individual items or folders, the archivist must determine the appropriate level of arrangement for the collection as a whole. This arrangement may be at a record group, series, or subseries level depending on the type of materials being processed. Although rare, the correspondence or diaries of a notable person may be described at an item level while it is more likely that the records of an institution or organization may only be described at the series or box level. Following the concept of original order (*respect des fonds*), some materials, such as the archives of an organization or business, should retain something of the natural record group or series arrangement they had as functioning records in a working business or organizational environment; they can then be easily arranged in series and subseries due to the fact that their previous functions are easy to discern.

Other materials such as personal papers and manuscripts, however, may lack any type of obvious arrangement. As a result, the archivist will generally create the arrangement for personal papers during the course of processing by grouping them into series and sometimes subseries based on elements such as formats, time periods or the roles, occupations or interests of the person whose papers are being processed. The series and subseries arrangement provides the necessary hierarchical structure for the physical and intellectual organization of the materials that will then be conveyed in the description presented in the finding aid.

Beyond the larger concepts of arrangement, finding aids, as guides to individual collections of records or papers, typically consist of a number of both administrative and descriptive elements designed to provide

intellectual and physical control over the materials being described. Additional descriptive elements typically included in an archival finding aid serve as a means to provide contextual information such as size, date span, access restrictions, and organizational or individual history. Such information forms part of what Miller^[5] described in 1990 as an “archival description system” that should be included in the creation of all finding aids. This system consists of various elements: information *about* the records and their creators, their intellectual content, use of the records including access and relationships to other records, physical characteristics, and gaining access to the records.

Some 15 years later, Roe’s^[7] version of these necessary elements is somewhat similar but with differences that reflect the development of the encoded archival description (EAD) standard for the structuring of finding aid content. She describes the elements needed for archival description within the finding aid as comprised of the following: core identifying information, contextual information, physical characteristics, administrative information needed to support use, informational content, and access/index points. Whatever these subtle differences, however, the elements described by Miller and Roe both comprise the descriptive information that a finding aid *should* ideally contain even if the structure and presentation of these elements may differ in terms of the detail and scope decided on by the archivist (processor) or the policies dictated by the archival repository.

Within these general categories of descriptive information are the detailed elements that will form part of the finding aid. For instance, the core identifying information may contain details such as the title, dates, and quantity. Contextual information consists of the biographical sketch of an individual or the administrative history of an organization or business. The section on physical characteristics may contain details on the quantity/extent of records and the actual organization and arrangement of the collection. Administrative information regarding use may describe any restrictions or copyright issues that apply to the records. Finally, there is the heart of the collection—the series, folder, or even item-level listing that describes the content of the collection at the highest level of detail.

CREATING THE FINDING AID

Once the archivist has compiled this information, he/she transforms it into the finding aid. Structurally, a finding aid is divided into two parts—the front matter and the container list. In combination, the two parts illustrate the arrangement and description of the collection of records, archives, or manuscript material as described earlier. The front matter contains the identifying, contextual, administrative, and physical information about the collection, while the container list is comprised of the content—the

listing of all box and/or folder (sometimes item) titles in the collection. See Fig. 1 for a sample finding aid that follows this format.

For finding aids that describe materials that are particularly rich in content, such as literary manuscripts, diaries, correspondence, photographs, or maps, some archivists may choose to include an item-level inventory in the

container listing. Typically, because of the extra effort and resources needed to create finding aids at this level of detail, archivists only produce item-level description when it is anticipated that a collection will be used heavily.

Until the advent of word processing software, finding aids were usually created on typewriters and the resulting print copies were only available within, or by user request

Collection Name: Desert Breeze Hotel Casino Collection
Collection Number: MS 105
Creator: Desert Breeze Hotel
Extent: 5 linear feet, (5 boxes)
Dates: 1948-1979 (bulk 1955-1965)
Prepared by: Cecilia Sinatra, 1990

Organizational History

The Desert Breeze Hotel Casino opened in 1949 on the Las Vegas Strip. For thirty years it was located on Las Vegas Boulevard just north of the legendary Flamingo Hotel Casino resort. The hotel was built in what was a cutting-edge design at the time and is now referred to as mid-century modern design. It was known for its lush landscaping and the many ponds and waterfalls that dotted the property. The Desert Breeze was also renowned for the top caliber of entertainment it featured in its showrooms and for its famous line of chorus girls – the Breezettes. Prominent singers from the opera and jazz worlds as well as Hollywood singing stars graced its stages frequently as did vaudeville performers and comedians.

A scandal befell the hotel in 1965 when it was found that individuals connected with organized crime in New York City had been skimming the casino profits for millions of dollars over a period of five years.

Despite the bad press, the Desert Breeze bounced back and was still regarded as one of the top hotels in Vegas in the early 1970s. After many successful years, however, the Desert Breeze Hotel began to fall into disrepair in the late 1970s. In 1979, the Desert Breeze Hotel Casino was sold by its owners and imploded to make way for the Tropical Sands Hotel Casino Resort.

Scope and Content

The Desert Breeze Hotel Casino Collection is comprised solely of materials from the public relations department of the hotel. The materials document the hotel's efforts at promoting itself within the Las Vegas community and nationwide. The public relations department was charged with initiating publicity stunts in order to promote the hotel and with advertising the casino in a variety of media including print, radio, and television. The collection includes correspondence from the head of the public relations department to a variety of newspapers and public relations figures across the country as well as press releases and press clippings on the hotel. Scrapbooks created by the public relations are also included in the collection.

Arrangement

The collection is arranged into two series:

- I. Correspondence, 1948-1978
- II. Publicity, 1948-1979.

Series I: Correspondence

Extent: 2 linear feet, (2 boxes)

Date: 1948-1978

Scope and Content

This series is comprised of correspondence from the public relations department of the Desert Breeze Casino. The majority of correspondence is from the head of the Desert Breeze Hotel public relations department, Sid Smith, who worked in this capacity from 1948-1972. The remaining correspondence is from various individuals who worked in the Public Relations department after Smith's departure. It also contains Christmas cards from various celebrities and entertainers who either stayed at the hotel or performed in the showroom.

Arrangement

Material is arranged chronologically.

<u>Box</u>	<u>Folder</u>	<u>Contents</u>
1	1	Incoming Correspondence, 1948-1960
	2	Outgoing Correspondence, 1948-1960
	3	Incoming Correspondence, 1960-1975
	4	Outgoing Correspondence, 1960-1970
	5	Incoming Correspondence, 1975-1978
2	1	Christmas Cards, 1948-1955
	2	Christmas Cards, 1956-1960
	3	Christmas Cards, 1961-1965
	4	Christmas Cards, 1966-1975

Fig. 1 Sample finding aid (fictional collection).

Series II: Publicity**Extent:** 3 linear feet, (3 boxes)**Date:** 1948-1979**Scope and Content**

This series is comprised of materials generated by the public relations department of the Desert Breeze Hotel Casino and articles clipped from local and national newspapers.

Arrangement

The series is arranged according to format: press clippings, press releases and scrapbooks.

<u>Box</u>	<u>Folder</u>	<u>Contents</u>
3	1	Press clippings: local, 1948-1960
	2	Press clippings: local, 1965-1975
	3	Press clippings: national, 1948-1960
	4	Press clippings: national, 1961-1975
4	1	Press releases, 1948-1960
	2	Press releases, 1966-1970
	3	Press releases, 1972-1975
	4	Press releases, 1976-1979
5	1	Scrapbook, 1950-1955
	2	Scrapbook, 1956-1960
	3	Scrapbook, 1961-1965
	4	Scrapbook, 1966-1972

Fig. 1 (Continued).

from, the repository in which they were created. Initially, only those institutions with the resources and staff to produce published versions of their finding aids were able to see them in wider circulation as these versions could be purchased by other individuals or libraries. In 1983, the development of the *National Inventory of Documentary Sources in the United States (NIDS-US)*, a compilation of finding aids on microfiche (and later CD-ROM) for collections located at the Library of Congress, federal and state repositories, and select historical societies and academic libraries, did provide a wider degree of access to some finding aids. Even then, however, this access was limited to those who had access to a library that held *NIDS-US*.^[8] Fortunately, this situation has changed dramatically as a result of the Internet and the development of the EAD standard for the encoding of finding aids. Archival and manuscript repositories throughout the United States and the world now regularly place their finding aids online, providing a greater degree of access for a much wider range of users than was previously possible.

Developing Archival Standards for Finding Aids

Prior to EAD standardization, efforts in the archives community were centered around efforts to make the *summary descriptions* of collections available through the national bibliographic utilities (at the time the Online Computer Computer Library Center, Inc. and the Research Libraries Group) that had enabled libraries to make the existence and location of published works known—first in print catalogs and then over networked computing systems. In adapting the MARC standard for archival materials (through the work of the National Information Systems Taskforce of

the Society of American Archivists), the USMARC Archival and Manuscripts Control (MARC AMC) format was created as a means to make it possible for archives and manuscripts to share summary descriptions of individual collections within their repositories in bibliographic catalogs. As Pitti^[9] has noted, however, MARC AMC was a content encoding standard only and not a standard for the content of the records themselves. Only with the publication of the *Archives, Personal Papers, and Manuscripts (APPM)* cataloging rules by Steven L. Hensen in 1983 (revised in 1989) were archive and manuscript repositories able to fully utilize the MARC AMC format and create catalog records of their individual collections to place into the national bibliographic utilities.

Although this was a giant step in the direction of providing greater access to archival materials at the collection level, the development of EAD brought this access to the next level by providing the means to place complete finding aids online. Although early computer applications such as SPINDEX I, II, and III (1960s–1970s) had provided greater access to collections by enabling the automation of finding aids, they did not have the delivery mechanism of the online environment.^[2] The EAD standard addressed the structure of a finding aid and enabled a visual representation in the online environment that would reflect the hierarchical organization and structure of the finding aid. Developed by Daniel Pitti and a committee of other archival description experts in 1995–1996, EAD is a data content standard that enables users to markup (encode) the contents of a finding aid using the Extensible Markup Language (XML) standard, thus providing a structure for describing an entire collection and its various components. Tags surrounding different elements (such as

the scope and content note, biography, or organizational history or related materials) in a finding aid encoded using EAD enable the contents of a finding aid to be searched at various hierarchical levels of description from the broadest collection level to the more granular series, subseries, or folder level. Beyond the individual finding aid, however, EAD tags also enable searching on a larger scale within union catalogs of finding aids or in a potential federated search of multiple finding aids systems.

Although finding aids have traditionally varied in style across repositories, the structural requirements of EAD have encouraged the existence of more standardized finding aid content and presentation in many repositories. EAD has been widely adopted in the archival community and has become a true international standard.^[10] However, adoption is still unattainable for some and despite the increased access afforded by EAD barriers to implementation still remain. These range from a lack of staff, resources, and technology expertise to a concern with revising existing finding aids to fit EAD structures to questioning its propriety as a standard or how it might fit in within a repository (see for example: Tatem,^[11] Meissner,^[12] Roth,^[13] Marshall,^[14] Yakel and Kim,^[15] and Yaco.^[16])

EAD/XML editing software such as Archivists' Toolkit, Archon, and, most recently, ArchivesSpace have removed some barriers by minimizing the time and expertise needed to convert older finding aids and place EAD encoded finding aids online. Archon and ArchivesSpace provide all-in-one software that can be utilized to encode finding aids and output them in several formats such as HTML, XML, or PDF.^[17]

ArchivesSpace is also being designed to support another recent XML encoded standard: Encoded Archival Context for Corporate Bodies, Persons, and Families (EAC-CPF). Adopted by the Society of American Archivists in 2001 and maintained with the Berlin State Library, the EAC-CPF standard is a means to improve creator description. EAC-CPF supports linkages between creators (agents) to show the relationship among record-creating bodies with additional links to record description and other related entities. According to Weimer, EAC-CPF will "eliminate the need for redundant administrative/biographical information in various finding aids; enable the linking of access by creator to records within a single repository, or across multiple repositories; and ease the maintenance of variant and related names."^[18] Users gain a better understanding of records through information about the context of how agents created and used the material.^[19] The number of EAC-CPF implementers is set to grow in the coming years with increased education and training on the subject, but use thus far is modest. Only 5% of respondents in a recent survey claim use of the standard at their repository.^[20]

Another standard that had a significant effect on finding aids occurred with the release of *Describing Archives: A*

Content Standard (DACS). Whereas EAD was created to reflect and standardize the hierarchical *structure* of a finding aid, DACS serves as a standard for describing both archival catalog records and finding aid content. Following both internal SAA committee reviews and input from the archival community, it was officially approved by the Society of American Archivists as an SAA standard in 2004.

DACS superseded the APPM standard, while also supplementing and extending the skeletal rules of description found in Chapter 4 of the *Anglo-American Cataloging Rules* (AACR2). Its rules for describing archival content are compatible with both the EAD and MARC formats. It also serves as the US implementation of international descriptive standards (primarily ISAD(G) and ISAAR (CPF)). What is significant about DACS with regard to finding aids is that it allows for the description of archival and manuscript material at any level of description from the collection to the item level, leaving behind the bibliographic approach that was inherent in AACR2 and followed to some degree in APPM. In 2013, SAA released the second edition of DACS with the intent of harmonizing its rules to the standards of ICA, ISAD, and Resource, Description, and Access (RDA) framework.^[10] RDA was published in 2012 as the primary standard for bibliographic description in libraries, replacing AACR2.^[21]

Current and Future Finding Aid Developments

With more and more repositories using EAD as the means to present their finding aids online, there has been a corresponding increase in the concern over the usability of these archival finding aids in the online environment. In addition, with online finding aids reaching a more varied audience unfamiliar with the function and structure of these guides, archivists have realized the need to develop a greater awareness of these elements as they design finding aids for the online environment. Thus, both user studies and usability testing of online finding aids have increased. Archival journals such as the *American Archivist*, *Archival Issues*, and the *Journal of Archival Organization* have all featured case studies on the usability tests carried out by various repositories in different stages of implementing EAD (see for example: Roth,^[13] Prom,^[22] Yakel,^[23] Coats,^[24] and Daines and Nimer^[25]). Conclusions are varied, but all suggest the need to pay closer attention to issues of terminology, navigation, display, and structure. In particular, there has been criticism about the simple transfer of the print finding aid into the web environment with little consideration of how this structure should be adjusted, either cosmetically or structurally, to take advantage of the features offered by the online environment. User expectation of finding aids and ease of navigation is also a concern.

The continued development of online finding aids is also making possible other innovations such as the linking

of digital objects representing selected collection materials to their description in the finding aid. Light and Hyry emphasize the potential of enriching online finding aids with web-based annotations, suggesting that this enhanced description could promote discovery by augmenting existing access or by offering alternative descriptive language for researchers. In this enriched form, they argue, the finding aid could truly become “the center for the accumulation of knowledge about a collection, instead of residing in the experience and knowledge of seasoned reference archivists.”^[26] Speaking from a postmodern perspective, Light and Hyry (2002) also advocate for placing colophons in finding aids as a means to inform researchers about the (processing) archivist’s role in representing and interpreting a collection—a means to acknowledge his/her editorial contribution and “acknowledge our mediating role in shaping the historical record.”^[27] It appears adoption of Light and Hyry’s suggestion has been minimal thus far. In a 2014 survey, a low percentage of respondents answered “yes” to whether or not they included commentary and annotations to their institution’s finding aids, expressing concern with time required to address feedback and changes, as well the quality of user feedback.^[28,29]

Recently, as user-generated content on the web (blogs, RSS feeds, user feedback, podcasts, and wikis) has become more pervasive, some archives have begun to look at these technologies as a means to transform their online finding aids and provide them with these more interactive qualities. The “Next Generation Finding Aids” project at the University of Michigan’s School of Information that began in 2005 is one prominent example; in seeking to expand the capability of EAD, its goals have been to use these Web 2.0 technologies (collaborative filtering and social navigation mechanisms in this case) to “challenge the traditional finding aid structure” by making the archival and research experience “collaborative and participatory.”^[30,31] Calisphere by the California Digital Library is an accessible interface for K-12 audiences and an example of the relationship between online finding aids and images.^[32,33] With archival repositories continually looking for ways to make their websites and finding aids responsive to user needs, research continues into the means by which Web 2.0 can enrich and transform the capabilities of online finding aids.

Another development in the archival world that has affected the creation of finding aids is the 2005 Greene–Meisner study, which addresses a problem common to many archival repositories: the existence of large processing backlogs. The study suggests a number of physical and intellectual methods for the minimal processing and description of archival collections that can reduce processing times and the subsequent creation of finding aids. While acknowledging the critical importance of archival description, Greene and Meisner’s rubric, succinctly expressed as “More Product, Less Process,” acknowledges the critical importance of archival

description while arguing that “it needn’t be long-winded, laborious or minutely detailed to be effective.”^[34] To this end, they suggest that not all collections require the same level of description, and that even within collections the same level of description may not be needed for every series. Archival repositories are implementing some or all of these guidelines in processing their collections (see for example: McCrea,^[35] Weideman,^[36] and Meisner and Greene^[37]). Even DACS offers guidelines on the description of minimally described collections in the form of “minimum” requirements as opposed to “optimum.”^[38]

CONCLUSION

The archival finding aid, as the primary means by which users obtain intellectual access to collections of primary source materials, plays an essential role in a researcher’s information-seeking behavior within an archives or manuscripts repository. Although the term may reference the general guide to a repository’s collections as a whole, it is more commonly thought of as the guide to an individual collection within a repository. In addition to describing the physical contents of an archival collection, the finding aid is comprised of other identifying, contextual, and administrative information about the materials. The online environment has led to significant changes in the archival finding aid with the development of the EAD and DACS descriptive standards, links to digital content, archival collection management systems, and the potential addition of Web 2.0 features that seek to add interactive qualities to online finding aids. The future is certain to see continued development and refinement of the finding aid as more materials are born digital or are digitized and ways are developed to describe them in the context of a user-friendly finding aid. Ultimately, however, the task of the finding aid, whether in the print or online environment, is to provide adequate access and information on archival collections, and it is important not to lose sight of that fact in the face of whatever advantages technology may provide in the future.

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Archival Management and Administration

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Abstract

This entry provides a detailed overview of the key elements involved in managing archival institutions in the twenty-first century. Focus is on effective leadership exercised in the paradigm of organizational complexity and relationships. Core management functions of organizing work; planning; and managing financial and human resources are described in the context of dramatic societal change and the unique role which archives fulfill in society. The transformative role of information technology in revolutionizing archival work processes and providing access to potentially unlimited numbers of users forms a key underpinning of contemporary archival management.

INTRODUCTION

Archival institutions in the first years of the twenty-first century are in the midst of a profound transformation. The revolution in information technology and the advent of the digital era have challenged traditional concepts of how records are created and used; how archives manage and preserve their collections; and, most importantly, provide access. Access to records and archives is a hallmark of a democratic society. Thus, whether in the public or private sectors the demand for transparency and accountability has a dramatic impact on the management of archival institutions.

Archival institutions in most instances face stiff competition in obtaining needed recognition and resources. In the era of Web and online access the continued relevance of amassing collections and managing them in the traditional manner is under continual challenge. Archival managers are faced with a workplace in transition. New technologies, new work processes, and a diverse and demanding workforce pose particular challenges for archival managers.

Though there are professional and management issues specifically relevant to the archival setting, at its heart, management as Mary Parker Follett, an early twentieth century management theorist, put it, “is the art of getting things done through other people.”^[1] This succinctly captures the essence of management work. Managers must lead in organizing work and aiding workers in being productive. From the perspective of management guru Peter Drucker, management is the key organ of any institution, responsible for the performance and survival of the organization.^[2]

Management is basically about people, what they do, and the organizations in which they work. From this perspective, archives are like any other organization. The basic management tasks of judiciously applying available

resources (i.e., money, people, space, technology, and equipment) to mission-related work are carried out in a variety of organizational frameworks and settings.

This entry presents a management paradigm, organizational complexity, as a particularly useful method to understand the web of relationships—personal, professional, and organizational—around which the work of complex modern organizations revolves.^[3] Though many archival organizations may be relatively small in size, almost all are located in larger, hierarchical organizations such as libraries, museums, historical societies, and at all levels of government. In addition to purely internal relationships all archival entities are constantly involved in a web of complex external relationships including resource allocators, donors, stakeholders, customers, the media, and oversight bodies.

Administrators who seek to succeed in leading archival institutions must be able to understand the complex systems and subsystems that undergird all organizations. Mastery of organizational complexity enables the administrator to lead, organize work, manage resources, and communicate in a variety of forums essential to achieving the mission of the archives. Archival management, as is management in any other setting, is complicated and often confusing without a clear foundation in theory as well as practice.

MANAGEMENT THEORY AND PRACTICE

Modern management theory is principally derived from the world of business and industry. Beginning with the Industrial Revolution in the mid-nineteenth century, theorists such as Belgian industrialist Henri Fayol and American engineer Frederick W. Taylor identified the basic management functions which formed the basis for organizing work in the emerging factory system. These

functions—planning, organizing, budgeting, directing, and controlling—also formed the basis for managing the increasingly large bureaucratic organizations that began dominating modern society's landscape.

The development of the human and social sciences has profoundly affected management theory and practice moving far beyond Taylor and Fayol's "scientific" approach which viewed work and the organization from a "machine" perspective emphasizing the division of work into specialized tasks or functions with a command and control management structure. Concepts from psychology and sociology, in particular, such as group behavior, group dynamics, and collaborative work processes have found their way into contemporary management and organizational theory.

Theorists and management practitioners draw from a variety of concepts and theories in order to better understand and lead organizations situated in a rapidly evolving knowledge-based economy. Contingency theory, resource dependence theory, institutional theory, and organizational learning, among others, provide different insights and approaches into understanding the nature of work and organizations, and the critical impact of societal change on organization culture.

An ongoing workplace revolution is underway which is transforming society, organizations, and the role of managers. This definitely includes archives and archival managers at all levels of the organization. The management functions identified by Fayol and Taylor and modified by their successors remain required in the workplace. Leadership in management continues as an essential function required for organizational success. Yet, how these functions are carried out is undergoing great change. Information technology has revolutionized communications within organizations and between organizations and the external environment. The modern workforce is educated, diverse, and demands autonomy in the workplace. Managers are no longer commanding or directing staff and passing decisions down and information up the hierarchical ladder. Rather, in a world increasingly based on the effective acquisition and utilization of knowledge swiftly absorbed and communicated, the new paradigm for managers is one of complex organizational relationships. Picture for a moment a web of relationships connecting the managers with staff, other parts of the parent organization (the usual situation for archives), and numerous groups external to the organization. Successful management is based on understanding the complicated and changeable nature of organizational relationships and developing relationships to further the archival mission.

Particularly in any organization which is totally knowledge-based such as archives, managers cannot operate self-contained units. The varying ways in which managers relate to staff, to other parts of the institution, and to the complex world of customers (i.e., patrons, researchers, constituent groups, and the general public) demands a

new set of skills. The ability to manage diverse relationships is the ultimate measure of a manager's success.

Archival organizations operate in a variety of settings including the public sector, not-for-profit organizations, religious denominations, and corporations, among others. All have archival entities embedded in them. But archives in all of these settings increasingly operate within a reengineered and automated workplace. Managers can no longer just assign and monitor work, report to their supervisors, and operate in traditional ways. The flood of information coming in via the Internet, the Web, and the intranet is transforming the work environment. Staff members are able to communicate and perform their jobs in this automated milieu across the organization, the city, the state, the nation, and the world. Staff members are not really constrained to operate and communicate within traditional hierarchical channels. Management theories and techniques such as total quality management, business process reengineering, or knowledge management emphasize the critical importance of staff empowerment and investment in the institution's mission if long-term success is to be achieved. Corporate restructuring and tight budget times for all levels of government place archival organizations and staff members in potential peril.

Role of the Manager

The manager's principal contribution to achieving success for the archives is in managing multiple relationships. The archival and program staff must be "managed" in new ways. The manager more and more assumes the role of coach and mentor. The educated, Internet-savvy, and mobile workforce of today requires leaders who assist staff in developing individually and as a group. Teamwork, whether formal, ad hoc or a mix, dominates the workplace. The manager as coach must aid the staff in gaining the skills and the autonomy needed to make decisions about the work at hand.

The information-age manager must aid staff in learning decision-making and consensus-building skills so they can make as many work-process-related decisions as possible. This empowerment of staff, whether it takes place on the factory floor or the archives processing room, reflects widespread technological and social changes that have dominated the past 50 years. This new relationship is one where tasks previously considered as solely the prerogative of management are shared. The manager in the role of leader and coach shares responsibility and authority with those directly involved in a particular work process or project. This shared approach can take place in a variety of guises grouped under the term teamwork. Generally teams range from those tasked with ad hoc special projects to those working on recurring processes such as accessioning, archival processing, or reference service. Teams, to a greater or lesser extent, participate in such management responsibilities as planning, assigning work,

and performance evaluation. The relationship of shared responsibility and commitment with the staff is vital for the archival unit to perform at full effectiveness.

The successful manager must relate with the staff as more than the coach. Organizations can seem fragmented to staff as they and their functions undergo reengineering, restructuring, and outsourcing. The manager must become a builder aiding the staff to communicate with each other and with those outside the unit who share similar interests and needs. The manager must be flexible, open-minded, and knowledgeable of techniques such as communities of practice and hot groups. All this fosters creativity and the sharing of expertise and breaks out of the confines of rigid hierarchical systems built around stove-piped work processes and bureaucratic structures.

The manager must also build and sustain relationships beyond the archival unit. This is a critical aspect of the manager's full-time job in networking and relationship building. All archival managers operate in a competitive, cost-conscious, and technologically driven organizational climate. In a number of settings, such as universities, corporations, and the public sector, there are other parts of an organization that can compete with the archives as the provider of information and even records. Building relationships with other parts of the institution and with constituent groups outside the institution is extremely important. The manager must market the archives for its value, service, and contributions to the bottom line.

Building Partnerships

The demand for quality work and competitive efficiency is relentless. Regardless of the sector of the economy, archival programs seen as ineffective, too expensive, or irrelevant will disappear, most likely through elimination or consolidation with another unit. The basic mindset that the archival manager must have for external relationship building is the concept of partnership. Forming partnerships with corporations, relevant constituent groups, or other organizations with a compatible mission, services, or holdings is essential in meeting the archival program's objectives. Partnership aids in exploiting opportunities and coping with threats. For example, a partnership with a nonprofit organization or a corporation could be essential in digitizing and making available a particularly important collection. Getting the collection digitized and online could raise the archives' profile and earn additional support. To achieve these results, the archival manager must master the communication tools of negotiation and persuasion in reaching out to the external environment.

All this means that the manager must constantly demonstrate that the archives are so valuable, so essential for organizational success, that the archives not only survive but also grow. Organizations (like individuals) either move forward or decline. The status quo is never truly maintained. The manager's major responsibility is to

ensure that the archives move forward. Management is not an additional duty or a step up the organizational ladder. It is a calling with results for success and penalties for failure. The roles of the manager include that of mentor, coach, negotiator, and partner. But first and foremost the manager is a leader.

LEADING PEOPLE

Our understanding of the nature of leadership has evolved tremendously from the days of the nineteenth century British historian, Thomas Carlyle, who propounded the "Great Man" theory of history that claimed that leadership is reserved to those with certain personality or character traits. In other words, leadership is innate and always male. Contemporary theorists using a variety of different models offer what is called the "Networked Talent Model" for understanding the nature and role of leadership in modern, knowledge-based organizations.^[4]

From this perspective all members of the organization have leadership responsibility. Leadership roles will vary according to the individual's duties in the organization. Executives and managers must articulate a leadership philosophy and philosophy to guide the organization. But all staff members must have the opportunity (and responsibility) for input into the leadership philosophy and organizational vision. In a team-based environment, increasingly the norm in knowledge-based organizations, management and staff must work together to develop the most effective and efficient work processes to meet customer needs. This collaboration must result in products and services that are cost-effective and at an appropriate level of quality.

Everyone must exhibit leadership through commitment to the mission, the vision, values, products and services of the archives. Staff members must understand their place in achieving the mission and their responsibility for their own performance and that of the unit. A team-based work environment with an at least relatively flat organizational structure is most conducive to the "Networked Talent Model." With archives facing turbulent internal and external environments a collaborative management and work process is the only practical way to proceed.

While leadership is at all levels and throughout the organizations, managers have particular leadership tasks. Management as a team must begin the process leading to the articulation of a leadership philosophy for the unit. There is a wide range of possibilities ranging from the direct autocracy to a participatory style that puts a premium on widespread input, collaboration, and consensus. With the workforce in general (and archives in particular) ever more diverse, educated, and independent the participatory leadership style is the most appropriate for long-term organizational success.

In leading people the manager has an obligation to serve as a mentor for others in the organization. The

archival manager is responsible not only for his or her own self-knowledge and development, but also for the development of leadership and management skills by all others on the staff. Most importantly, this can be done by example. An organized, competent, and effective manager who focuses on the mission of the organization and of the staff becomes a model of professional leadership. Attention to big-picture issues as well as to routine management chores such as timely and accurate personnel performance appraisals demonstrates how a concerned manager operates.

Mentoring includes assisting employees in developing individual development plans for professional growth and advancement. Where appropriate and in keeping with the perspective of the "Networked Talent Model" these plans should have leadership and management components. The mentoring manager should identify training courses or educational programs that will aid employees in developing leadership and management skills. Training assignments in other parts of the organization, e.g., may be part of a mentoring effort, as well as allowing staff members to "shadow" managers to observe firsthand the duties and responsibilities of management.

The archival manager should work with the institution's Human Resources Department to utilize existing mentoring programs or to develop one if needed. Leadership and management competency is not a gift. It is a set of skills developed over time through education, training, and experience. Part of any good manager's legacy is leaving behind competent leadership to assume the responsibilities of management.

Communication

There is one critical ingredient necessary for the manager to succeed as leader, coach, mentor, team-builder, negotiator, and partner. This is the ability to effectively communicate. It is almost a cliché to blame everything on "poor communication." Yet in many situations it is a fundamental problem. What most managers do not understand is that though we communicate everyday and the process seems normal, it is in fact a complex phenomenon involving the senses, emotions, and logic. Linguists have long-studied the two-way process called communication. Whenever communication occurs, either between individuals or in a group setting, there is similar abundance of sensory stimuli as well as emotional factors, sometimes labeled biases or blinders, so that what is said or heard is only a highly condensed or abstract version. Lack of communication is a fertile area for workplace difficulties.

There are several elements that comprise communication: verbal, nonverbal, and listening. Words can be spoken or written and the communication expressed through words is more than a linear progressive unfolding of logic. Words reflect cultural backgrounds, have different meanings in different contexts, and can be difficult to interpret

if the words or thoughts are too abstract. Nonverbal messages (i.e., tone of voice, body language, and facial expressions), in fact, are estimated to account for more than 90% of communication between people, while verbal communication is estimated at 10%. Listening, a skill that can be supported and strengthened through training, is another critical element of communication. Effective listening is acutely impacted by sensory overload, feelings and emotions which, in turn, affect what is heard or understood.

Clearly, the manager alert to the manifold issues affecting communication should expect more often than not to be misunderstood. When it is all said and done, the basic task the manager must achieve is creating and sustaining a communications network. The manager's task is to appropriately create, use, and disseminate information. From the perspective of the organizational complexity and relationship paradigm the manager and staff must identify the basic needs of the archival unit as well as the parent institution; identify the specific information needs of staff and public; and create a communications process that enables effective decision-making and policy dissemination.

There are many tools and strategies that can be used to build an effective communications network. Well-structured meetings and presentations with an agenda, "rules of the road," and definite start and end points are essential to every organization. Judiciously using tools such as e-mail, the Web, the Internet, and intranet can keep management and staff involved with and informed about policies, procedures, and administrative information. This can contribute to organizational knowledge, assist in democratizing the workplace, and enhance productivity. Never underestimate the power of informal hallway conversations to further the communication goals of the organization. But above all communication is about trust. If the manager is perceived as fair, approachable, and competent by the unit, the manager will survive the times of stress and turmoil arising from inevitable communication problems.

Leadership and management are clearly complex tasks. Among the many relationships the manager must build and sustain is the one with the Human Resources Department. A key element of the administrative and communications process is to have fair, transparent, and clear personnel rules and processes. The manager must work closely with the Human Resources unit in analyzing work processes and staffing needs; and in structuring positions, writing position descriptions, and recruiting staff appropriate to the needs of the organization. All these steps involve administrative, legal, and regulatory requirements that must be met. A close working relationship with Human Resources specialists is critical to managing a fair personnel system.

In today's society the manager must be alert to the reality and demands of a diverse workforce. This directly impacts on the need for a personnel system perceived as fair, and an effective communications process.

How policies, e.g., are crafted and written can be problematic. The needs of a workforce transformed by profound social and cultural change must be harmonized with the requirements of the archives' mission and services to its customers. All of this is best undertaken with a leadership philosophy that is participatory and inclusive, and with the sure understanding that everything communicated will be filtered through sensory stimuli and emotions, as well as logic.

MANAGING INFORMATION

Management theory and practice, leadership, and communications are the foundation for the other tasks of archival management. Foremost among these is managing the key asset of information. Within this broad rubric is strategic and operational planning, information technology, and the specific skills involved with project management. Every archival organization, regardless of its institutional setting, is engaged in a fierce competition for resources and relevancy. Careful planning supports an effective strategy-making process which enables management to meet the requirements of the archives' mission and to obtain the financial, personnel, and other resources needed for success. Careful strategic thinking, planning, and decision-making are critical for survival, much less success. Done effectively, planning is at the heart of mission achievement.

Planning

Planning is how archives attempt to create its future situation by setting goals and strategies to reach those goals. This involves looking ahead with the information available to estimate what is likely to occur using a variety of tools and techniques. The effectiveness of archival planning depends on the quality of the planning process itself as well as the quality of the strategic thinking and decision-making which planning supports. Archives must develop plans and strategies to meet their mission, goals, and objectives and relate them to the direction and purpose of the parent institution. Planning serves as the focal point that integrates all the organization's activities needed to meet the mission and goals of the archives. In broad terms, planning is both strategic and operational.

Strategic planning is a concept and practice deeply embedded in corporate, governmental, and academic institutions. There are three ways to create strategy: learning, vision, and planning. All three must be utilized and integrated in any process used in developing a strategic plan. The actual nature of the strategic planning process will be determined by the type of organization (i.e., hierarchical and centralized; hierarchical and decentralized; flat, less hierarchical), and by the management's leadership philosophy. For example, organizations which put a premium on a participatory management philosophy will use a team approach

to strategic planning. Staff members and management from all levels work as a team to develop strategies and plans, with all employees provided a chance for input.

Whatever model or approach is adapted, the first step is analyzing the archives' strengths, weaknesses, opportunities and threats (SWOT analysis). This analysis looks at external factors such as funding, technology, and demographic changes, as well as internal factors such as organizational culture, quality of staff, and technical and facility infrastructure. It is also critically important to have a trained, outside facilitator to assist in guiding the strategic planning process. In addition, outside experts and constituent and user groups must provide input so that the environmental SWOT provides as accurate as possible perception of the environment.

The SWOT environment is part of the learning methodology in creating strategy. Mission and vision are also needed to define effective strategies. This is defining the organization's reason for existence at the highest level. In other words, what makes the archives unique, those whom the organization serves, and the holdings which the archives acquire, preserve, and provide access. The vision puts the mission in broader societal terms and purposes. Also, a statement of institutional values needs to be developed as part of the process. Values are those that the archival organization seeks to inculcate in its employees and in the organization's culture.

After the SWOT analysis is completed and the mission—vision—values are crafted, strategic goals are identified. These should be overarching, responsive to the articulated mission and vision, reflective of the opportunities and challenges facing the archives, and what the organization must achieve to be successful. Strategies must be determined which lay out the various avenues that should be pursued in order to fulfill the strategic goals. Strategies may include forging new institutional partnerships, exploiting technology in a different manner, or creating additional sources of funding. Because strategic plans cover anywhere from a 5 to 10-year time frame, it is necessary to identify objectives or tasks on a yearly basis as measurable milestones toward achieving the strategic goals. Objectives are assigned to units in the archives, with performance plans for managers tied, at least in part, to achieving the objectives.

In addition to the strategic plans, the archival manager must also ensure that a yearly operational plan is developed which covers all program activities and functions of the archives. The operating plan accounts for the hours to be expended for the year ahead by all categories of employees (including volunteers). The plan should also account, by function, for the units of work to be accomplished by the staff. Each program activity should be broken into major subcategories that constitute the tasks to be carried out. The program functions, activities, and subcategories that constitute the tasks will vary from archives to archives but must cover all the records of life-cycle activities carried out by the archives.

Policies and Procedures

A key activity related to planning is the development of policies and procedures that provide the structure and content needed for successful operations. A policy is a governing principle that provides overall guidance to the way in which archive conduct their business. Policy guidance, which is general in nature, is refined and standardized through the use of specific archival procedures. An access policy, e.g., outlines who may use archival collections, when they are open for research, and how researchers can gain access to closed collections. Procedures outline how staff members are to deal with researchers when they visit or communicate with the archives. For example, access procedures would cover such issues as how written requests for information (letter, fax, e-mail) should be handled; how the research room will be managed, addressing issues such as where personal belongings of researchers are to be placed; and what specific steps should be taken when researchers request access to restricted collections. To implement all this, manuals should be prepared that codify the policies and procedures. This is critical both for staff training purposes and for reference when questions arise from staff members or researchers.

Any planning effort is only as good as the results. It is vitally important to have a management performance measurement system in place to monitor organizational performance. Managers and staff together are responsible for setting measurable objectives and setting up systems to measure the quantity and quality of work necessary to achieve program goals and objectives. Quality is a particularly important issue. With limited resources all archives must meet customer expectations, process collections, and preserve holdings. Work must be done well the first time. Quality work is the only answer. Quality standards should be incorporated into the archives' procedures. Further, quality of work must be included in the performance measurement system. Quality can be measured. For example, standards can be developed that addresses the extent of research to be undertaken into a reference inquiry or the elements that must be included in a quality response. Managers and teams can use auditing or sampling techniques to review reference responses for adherence to quality standards. Quality standards should be incorporated into standardized procedures, and then into individual and team performance standards.

Project Management

An important component in the effective use of organizational information and knowledge is project management. The Project Management Institute defines a project as "a temporary endeavor undertaken to create a unique product or service."^[5] Successful project management requires effective teamwork, good planning, and the creative use of available information. Projects are really building

blocks in the design and execution of an organization's strategic goals and objectives. Projects often involve a matrix management where horizontal teams pulled together from across organizational boundaries are grafted on, for a time, to the vertical hierarchical structure. Projects by definition are temporary, finite, and goal-oriented.

Project management involves the overall context in which the project takes place (i.e., organizational environment, role of stakeholders), scope management and planning, human resources management, and integrating the project into the products, services, and work processes of the organization. Because projects and project teams are temporary, cross-functional, and operate under tight time and logistical constraints, a clear understanding of roles and responsibilities within the organization is critical for success. Project managers and team members must be carefully selected based upon their skills and expertise and the requirements of the project. The project manager must be able to negotiate and obtain the resources and support to complete the project. Senior management is responsible for ensuring that the needed support is provided by other parts of the archives.

Careful planning and execution of all aspects of the project life-cycle forms the basis for project accomplishment. Every project goes through four stages: conception, definition, acquisition, and operation. Although projects impact on existing systems of operation and organization already in place, the project itself as it goes through the four phases of the life-cycle is also a system of people and resources integrated, organized, and managed to achieve the goals of the project. The project manager and the team must understand the project as a system and manage all the parts and relationships.

As an example of how a project can impact an archival system, consider how most archives permit copies of records to be made for research purposes. To carry this out, most institutions will have some sort of order fulfillment system. The parts of such a system include archivists, conservators (for fragile records), accountants (financial controls) and, in many cases, information technology staff if the system is automated. Researchers are also part of the system. A project to devise a new order fulfillment system or even to change one component must involve looking at the big picture of how the whole system operates and the interrelationship of the parts.

There are also a number of methodologies available for systems or project management. These include systems analysis, systems engineering, and systems management. The basic principles in any methodology involve looking at an entire work process and how systems relate to one another. When analyzing a system or process, the project manager and the team must understand how a change in one part of the system affects other parts (systems thinking). For example, a change in the pricing structure may impact the number of copies made and this will have an impact on other parts of the system. Another principle

utilizes problem solving (systems analysis) as the basic project tool or methodology. Problem solving includes clarity about requirements and project objectives, setting criteria for making decisions, and examining alternative strategies to achieve the desired goals of the project. Thus, if the project manager and the team do not take a holistic approach to the project, the chances of achieving the desired result are markedly diminished.

In every contemporary organization the effective acquisition, use, and distribution of information is profoundly affected by information technology. Information technology is basically a tool; like other tools, designed to assist in planning, decision-making, program support, and customer service. All management tools or instruments must be designed and implemented to carry out the archives' mission (effectiveness) in the most business-like manner (efficiency). All tools and instruments must be evaluated on the basis of these two fundamental criteria. This is particularly critical given the cost and complexity involved with information technology.

Archival managers cannot expect to become experts in the information technology arena. But the archival manager does need to bring archival skills and knowledge about records and records systems together with information technology. For example, the ways in which records are appraised and scheduled, described, and made available are increasingly affected by information technology through use of the Web and distinctive markup language (hyper text markup language, HTML).

To manage in this complex environment the archival manager must engage in systematic information technology analysis, planning and decision-making. The use of information technology must flow from the archives' mission, goals, objectives, and business needs. The core of effective information technology planning (as with all other planning) focuses on customers, products, and related work processes. The International Council on Archives have developed a planning and decision-making process for the use of information technology in archives.^[6] In addition to identifying the customers in the archives' strategic plan, other steps include identifying products and sources required by the customers, and business processes designed to produce the products and services. Archivists are expected to understand these business requirements, and to work with information technology experts in determining appropriate information technology architecture; hardware, software, and communication tools; and the application, acquisition, and development of the information technology support system.

MANAGING MONEY, FACILITIES, AND RELATIONSHIPS

As if mastery of management theory and practice, leading people, organizing work, and managing information were

not enough, the archival manager must also master the management of financial resources, the operations of archival facilities, and building effective public relations. As in every other aspect of management, finance requires a careful review and understanding of an organization's operating environment. The manager must understand how the archives receive its funds, the sources of the funding, and the procedures involved in obtaining the funding. On the other side of the financial ledger are expenses. How do the archives expend the resources allocated to it? What authorities must grant permission before the archives commit resources to personnel, facilities, equipment, or other costs? The answers to these questions represent the financial control function of management.

Managers must fully integrate financial planning with plans for the acquisition and use of personnel, facilities, and other resources. The plan—and its attendant costs—must be matched against the revenues likely to be available to the organization. All revenue projections should be realistic in that they reflect possibilities that might actually occur. For example, an organization applying for grant money to accomplish a project is realistic in calculating the availability of the requested funds, especially if it has successfully competed for grants in the past. As part of the financial planning all fixed resources must be prioritized. The archives must know which operations have the first claim in money coming in, which comes next, and so on. In most instances, current operations—being able to sustain ongoing efforts—come first. Expansion and new projects must compete for whatever is left. This emphasis, though it may seem to discourage innovation and experimentation, is entirely appropriate for archives, which are essentially conserving institutions.

Budgets

Careful budgeting is another key element of financial management. Budgets are necessary for planning and controlling funds, as products of the planning process, and as tools by which managers control the expenditure of resources. Effective budgeting is part of a multiyear (three to five) process in advance of planned activities. There are various types of budgets such as line-item budgets and program budgeting that are appropriate for both small archival operations as well as more complex organizations. Whatever type of budgeting is used, archival managers must bear responsibility for cost controls. Records of expenditures must be kept in whatever format the institution requires. Expenditures need to be tracked on at least a quarterly basis to ensure that the basic tenets of the financial plan are being met.

Resource Development and Outreach

The archival manager's financial management responsibilities may include participating in fund raising and

development for the archives. This involves planning and identifying program needs beyond what can be met through the organization's regular funding mechanism. This involves seeking external funding and working with the development office of the archives or the parent organization to seek grants or initiate capital or endowment campaigns. Federal, local, and state governments provide a variety of grants through a number of grant-giving agencies. In addition, there is extensive philanthropic giving by foundations.

Involvement with managing archival facilities seems the most mundane and tedious of tasks. Yet, it is one of the most critical management tasks. Archivists must be able to work with facility managers, conservators, architects, engineers, and contractors to ensure that the archival holdings are kept in appropriate storage conditions; that supplies and equipment obtained are archivally sound from a preservation perspective; and that adequate space is designed and obtained for the archives. All archivists are faced with planning for the best use of their facilities as well as for the purchase of supplies and equipment. Such decisions have a significant impact on the total program and should always be carefully considered. Through applied common sense backed by thorough research and information gleaned from conservation experts, the archivist should be able to make decisions which lead to positive results and an improved archival program.

All that has gone before in describing the elements of archival management rests upon the need for an effective public relations program. Public relations are the communication or dialog which archives have with individuals or groups inside and outside their institutional setting intended to convey information about services and goals. This can be done in a variety of forms: up to date and informative Web sites, press releases, communications between staff and researchers, or annual reports prepared for the parent organization.

Public relations also include special events designed to invite specific groups to ceremonial openings or other events. Communication must be a part of a well-planned program designed to explain the archives' mission and involve people in its programs. Public relations is an integral part of archival management. It must be a deliberate effort and should be included in the strategic planning process. Plans for public relations should evolve from the archives' mission statement that defines not only program goals but also the constituencies to which the archives are responsible. A variety of communication tools should be used to approach these groups—open houses, lecture and film series, exhibits, press releases, newsletters, listserves, e-mail lists, and fax lists. With limited resources the public relations effort must target the audiences it wishes to reach and the methods that will most effectively communicate with particular groups.

Public relations are critical in developing and maintaining support for the archival program. With the

information overload felt by individuals in modern society, people will not go out of their way to learn about new programs or new ideas. Information about archives must be brought to people in familiar and understandable ways. Failure to build support for the archives through a public relations program may lead not only to a lack of funding but also to the demise of the program itself. Successful archival managers must find ways for their programs not only to survive, but also to prosper, and this can only be done through a planned and thorough public relations program.

CONCLUSION

Contemporary archival management is complex. The pressure for high performance grows steadily more intense, with sustained, effective leadership as perhaps the single most important ingredient for organizational success. Leadership at all levels of the archival enterprise must build an organizational commitment to the mission, vision, and values of the archives, with a pledge to meet customer needs by providing quality products and services in a timely and cost-effective manner. Archives are cornerstones of memory, community, and the historical record. Those engaged in the work of archival management play a key role in maintaining a democratic society rooted in the right of access to records and information.

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Archival Reference and Access

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Abstract

This entry introduces reference services in archival and manuscript repositories and concepts of access to archival holdings. Archival holdings and reference services differ significantly from those typically provided in library settings. This entry is distilled from my book, *Providing Reference Services for Archives and Manuscripts*. Archives are tools; like all tools, they are kept to be used. Archives allow people to communicate information and evidence through time. Reference services in archival and manuscript repositories assist users, and potential users, in using archival holdings and locating information they need. This entry discusses the nature of archival holdings, institutional settings, and the range of uses and users of archival records. It explores information seeking and its relationship to archival reference services. The essay discusses the intellectual, interpersonal, and administrative elements of providing reference services in archives and manuscript repositories. It concludes with a brief consideration of outreach, management, and evaluation.

INTRODUCTION

Reference services" in archives provide "intellectual," "legal," and "physical" access. "Intellectual access" is provided through arrangement, description, and reference services. Traditionally, reference services have been mediated. Increasingly, however, they are provided through the repository website or online finding aids and are unmediated or mediated through e-mail, tutorials, or Web 2.0 tools. In a mediated setting, interpersonal dynamics between reference archivists and users are critical to successful transactions.

Second, the word "access" can also be used in a narrower, "legal," sense, meaning permission or authority to use archival records. Third, "physical access" means providing opportunities to examine records, traditionally in person in a repository, but also through copies, digital surrogates and loans.^[1]

ARCHIVAL REFERENCE

People create documents to communicate across space and through time. Records provide "evidence" of the actions that created them, long after the actions are completed. Records also provide "information" about the people, events, and objects that were the subject of these actions.^[2–4]

The mission of the archival profession is to identify records that have continuing usefulness, preserve them, and make them accessible through time. The use of archives depends, in part, on the mission of the parent organization. Three common rationales for maintaining archives are:

- Continuing administrative use by the creating institution.
- Public use of government records in a democracy to provide oversight of government actions, ensure accountability, and preserve the rights of its citizens.
- Research by users from a wide variety of disciplines.

Reference services were slower to develop an identity than other functions of archival administration, perhaps because early archivists assumed that reference services fall at the end of a continuum that begins with the creation of the records in the originating office (shaped by records management), followed by appraisal, accessioning, arrangement and description, and concluding with reference services and outreach activities. Driven by the need to manage and protect large quantities of records, archivists initially thought of reference services as a series of administrative decisions made after records had been appraised, accessioned, arranged, and described. Since the 1970s, however, archives have become user-centered and recognize the importance of reference services. This interest has led to new research into the users of archives, which has increased with electronic access to archives. The archival profession moved from a custodial role, in which the archivist's primary duty was to protect repository collections by limiting use, to an activist role in which the archivist's primary duty is to promote the wider use of archives.

Uses and Users of Archives

Many people use archives, both directly and indirectly, to find information or evidence for a purpose outside the repository. Practical needs bring most people to archives;

most are less likely to seek entertainment or recreation than they might in many libraries (Fig. 1).

to build structures and they are needed for as long as the structure is maintained.

THE USES OF ARCHIVES

Primary Uses of Records

Organizations and individuals create records initially to carry out administrative, fiscal, economic, social, legal, or other activities.^[5] These uses may continue as long as the organization continues. Architectural records are created

Secondary Uses of Records

Some records, however, can be used by a wide variety of users beyond the creator. These secondary uses may be of three types. “Informational” use describes the continuing usefulness of the information in records about people, events, objects, or places. “Evidential” use is the continuing usefulness of the evidence (or information) that records provide about their creators, their activities, or the

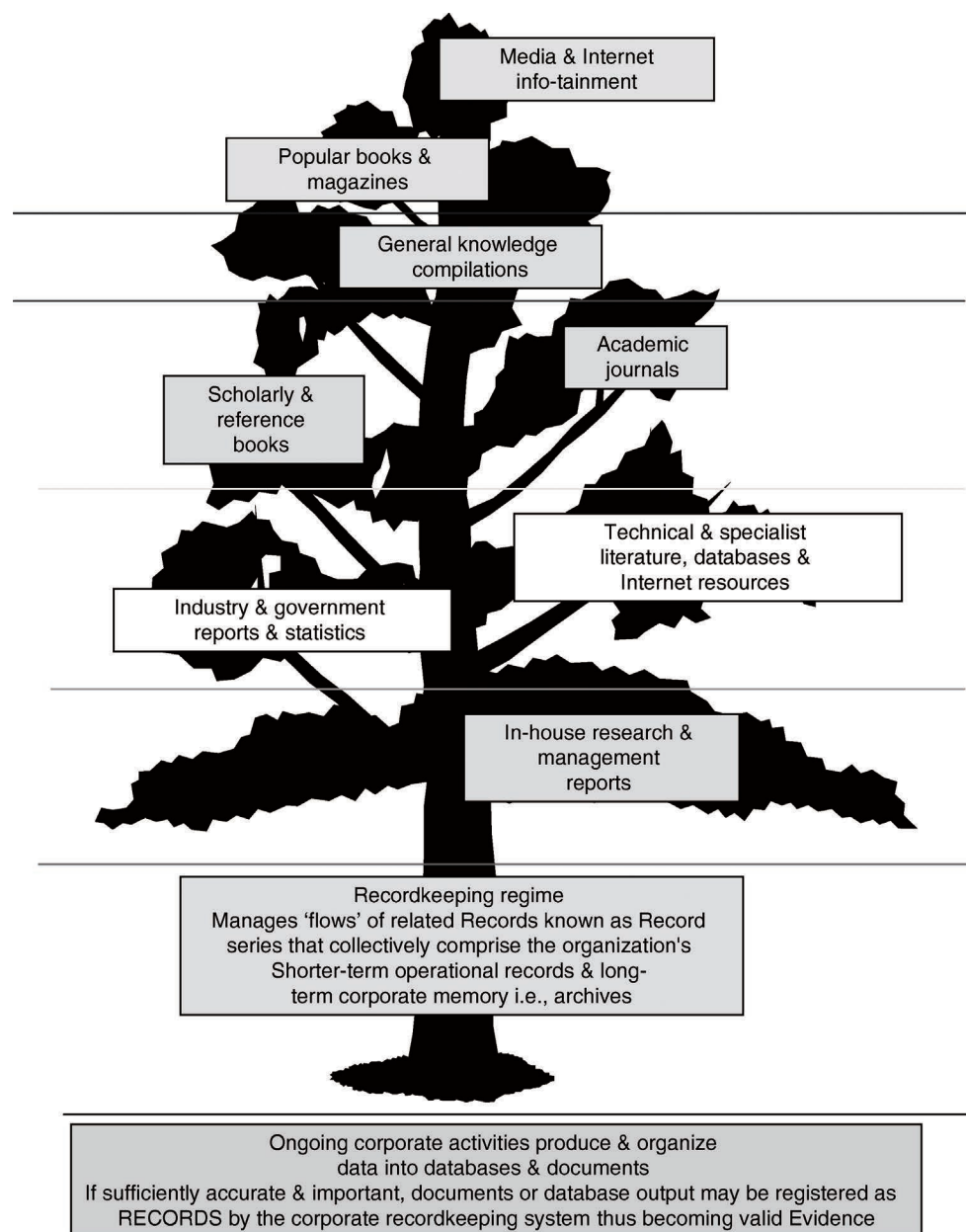


Fig. 1 The information family tree.

Source: From Understanding society through its records, by Pederson, A., <http://john.curtin.edu.au/society/evidence/tree.html>.

actions that generated the records. File contents and filing structures can be as important for documenting the flow of information as for retrieving it. “Intrinsic” use describes records as artifacts—as symbols, or tangible links to the past. Although uses are practical, users often find the age, authenticity, or beauty of original documents as important as the information or evidence they contain. Authentic documents often move and even awe people.

Direct Use of Archives

Direct use occurs when someone obtains information from a record or uses a record as evidence of the activity that it documents. Direct use can be measured when someone reads a document in the repository, obtains a copy by mail, or receives information by telephone, e-mail, or letter. Loaning documents is another type of direct use. Placing records on the Internet means that many remote users can consult them directly, but this direct use is harder to measure.

Indirect Use of Archives

Identifying and measuring indirect use is more difficult still. Indirect users may never enter an archives or archival Web site, but benefit nevertheless from archival information by using the many and varied products arising from direct use. Though a relatively small number of researchers actually uses archives, their work has a “multiplier effect,” transmitting information that affects how others think about themselves and their past.^[6] Books, newspaper and periodical articles, dissertations and theses, genealogies, speeches, term papers, films, television documentaries, slide shows, exhibits, Web sites, legal briefs, environmental impact statements, and other policy documents are some of the products that convey information and evidence derived from archival holdings.

UNDERSTANDING INDIVIDUAL NEEDS

People come to archival repositories because they need to solve problems that require historical information or evidence of past activities. Direct users have a variety of needs depending on several variables.

Research Purpose

Research purpose is in part determined by whether the user’s information problem is motivated by work requirements or by personal interest. Most people come to archives because their work requires it, whether on behalf of a business, government, association, university, class assignment, or client. They are motivated by external rewards. Other researchers come to archives because

they seek information for enjoyment, recreation, or personal growth.

Intended Use

The intended use—report, film, exhibit, family history, book, article, legal brief, advertisement, or environmental impact statement—affects the types of information sought and the questions asked. It is helpful to distinguish between the form or genre of information and the media on which it is stored. Reference archivists need to understand the form of evidence that researchers require for their intended use. For example, minutes of meetings may be found as paper summaries, paper transcripts, audio-recordings, video recordings, or electronic documents.

Type of Question

Factual researchers typically ask closed-ended questions, seeking a particular document or specific information about a particular person, place, object, or event. Their questions are precise and focused, asking, “Who, What, Where, When, How many, or How much?” Although precise, such questions may require considerable time and ingenuity to answer.^[7,8] Interpretive researchers ask more abstract questions, intended to increase general understanding or competence. Such users read comprehensively through bodies of records to tell a story, develop a narrative, or test a hypothesis. Posing open-ended questions, they seek to answer broad questions of motivation, causality, and change. They ask the question, “Why?” William L. Joyce formulates a similar distinction.^[9]

Joyce.^[9] Experience and Preparation

Many users, regardless of education, occupation, or nature of inquiry, are not well versed in archival research. They may need help in conceptualizing the research process, analyzing the process of finding relevant documentation, and devising search strategies. Once launched on research, they may need assistance in understanding the context of the records, or practical help deciphering handwriting, understanding dating conventions and abbreviations, or interpreting slang and references to contemporary event.

IDENTIFYING USER GROUPS

Identifying Vocational User Groups

Staff of the parent organization are an important user population. Archives, the corporate memory of the institution, are preserved so that the parent institution can understand its history and the sources of current policy and can maximize its return on its investment in information resources. Archives are used to ensure continuity, build

on experience, and identify solutions for current problems. Since administrators of the parent institution are simultaneously creators and users of archives, access and reference policies may give priority to their requests. Archivists are the employees most likely to know an institution's history and organizational changes and can identify precedents, policies, and documents relevant to current issues.

Staff from other organizations also use archival resources in their work. These users represent many professions, such as lawyers, legislators, engineers, landscape architects, preservationists, urban planners, architects, film and television producers, picture researchers, journalists, and publishers. These professionals are direct users linking archival sources to many indirect users. They use archival information on behalf of groups, clients, firms, governments, or professional associations.

Many assume that *scholars* are the primary constituency for archives, but in most repositories their numbers are significantly smaller than other user groups. As direct users of archives, however, scholars transfer information from archival sources to indirect users of archives. Many disciplines use archival holdings—history, geography, political science, demography, sociology, literature, medicine, epidemiology, among other. Whatever their field, scholars are more likely to be interpretive researchers.

Students are a major constituency of many repositories, particularly university archives and manuscript libraries on or near college campuses. Secondary school classes have become significant users of archival material as some state curriculum standards require this component. In addition, the National History Day competition brings requests from students as young as middle school, following instructions to use primary sources in their research. Using archives can make history come alive for students, whether young or old. Providing access to archives empowers students to learn and discover on their own. Most students, like the general public, respond enthusiastically to the authenticity of original source materials.

For *teachers* archives are laboratories for research in the humanities and social sciences and archivists and teachers work together to instruct students in research. Archivists have new opportunities to collaborate with K–12 teachers in local schools and with universities who teach potential teachers to improve teachers' knowledge, understanding, and appreciation of American history.^[10-17]

Identifying Avocational User Groups

Avocational users are “recreational” or “leisure” users. Archives play a significant role in educating the general public, providing opportunities for lifelong learning for a public that is better educated and living longer. Many people who found classroom history boring or even alienating search eagerly for a personal, usable past.

Genealogists: Many Americans seek meaningful connections with the past through family history. Genealogy, one of the most popular hobbies in America, appeals to all economic, racial, and ethnic groups. Genealogists have been called “historians of their own family,”^[18,19] and they often share the results of their research with other family members. Because the direct impact of genealogy beyond individuals is not easily measured and because of its past association with elitist societies, its value has been discounted or dismissed as idle curiosity. Many genealogists are expert researchers who have completed many projects using primary sources and have wide-ranging and sophisticated interests and research skills.

Local historians are examples of avocational historians. Like genealogists, their interests reflect a modern society's need for a usable past. Community celebrations and anniversaries often stimulate interest in local history. These may focus on the community as a whole or on its many parts: churches, civic groups, businesses, schools, labor unions, ethnic groups, hospitals, or other institutions. Homeowners or business owners seek information about the history of their house or company.

Hobbyists find meaning in the past by focusing on selected historical objects and events. For almost any common object or event, a group is devoted to its preservation and history: trains, ships, lighthouses, bottles, circuses, automobiles, carousels, prospecting, and military engagements.

INFORMATION SEEKING AND ITS RELATIONSHIP TO ARCHIVES

Information retrieval is the identification, preservation, and description of information, anticipating user queries. In contrast, information seeking focuses on the needs, characteristics, and actions of the information seeker. Information surrounds us all (Fig. 2). People use their mental models for events, experiences, and domains of knowledge to run scenarios for contemplated actions. Information seekers in organizations tend to turn first to people, then to readily available personal collections and electronic resources to answer information needs. Libraries are seldom the first choice, archives almost never are.

Seeking Information from People

Face-to-face oral communication remains a preferred means of communication, because much human communication remains nonverbal and nonverbal elements carry meaning. Personal interaction also provides the opportunity to clarify meaning. Seeking information from others is so ingrained in our daily behavior that we take it for granted. People seek information from other people because such information is filtered and, more importantly,



Fig. 2 Information seekers are surrounded by information.
Source: From Pugh.^[1]

authenticated by experience. Information givers responsible for their actions are given credence.

Seeking Information from Documents

Common information-bearing objects are found in personal collections, records, electronic networks, and libraries. Research suggests that people will use accessible information, regardless of whether it is the best. The “principle of least effort” is well documented.^[20]

Personal collections

People tend to turn first to personal collections. They compile some tools personally, such as calendars and lists, reach for familiar books close at hand, such as procedures manuals and reference books. Most of these information sources are organized and retrieved by physical location and by form, such as size, shape, and color. People select sources close at hand, not because they are lazy, but because these sources are authenticated by personal experience, annotated to reflect recent changes, and accommodate time constraints in the press of daily business.

Records

People also turn to their working files, such as reports, research notes, and correspondence. This observation also helps archivists understand why staff members are often reluctant to send their records to the archives. Organizations, whether corporate, governmental, non-profit, religious, or community, embed evidence of activities and

corporate knowledge in documents and capture them in records systems.

Electronic resources

Personal reference files are now created and retained mostly in personal computers. As computers are linked in local area networks within organizations or through the Internet to other organizations, users now rely on online tools and information resources. These convenient tools also add powerful modes of retrieving and repurposing information.

Libraries

To turn to libraries, people must first conceive that a book or article might be published on the subject of interest, that is, the user must have a mental image of finding the information in a publication. Library users have effective search techniques beyond the catalog, and studying actual information-seeking behaviors offers insight into the assumptions and expectations of information seekers as they approach archives.

Many users prefer browsing, which provides full-text retrieval. By scanning the table of contents and bibliography, users can quickly determine the relevance of a publication. Library classification systems collocate material by subject, and propinquity reinforces the serendipity of discovery. Browsing emphasizes to the physical nature of information seeking. Users accustomed to this powerful technique may be frustrated by closed stacks and gray boxes arranged by provenance in archives.

Chasing footnotes is another common behavior. A footnote is information in context. The nuances of a subject reference can be very precise when a footnote barks at the heels of a sentence, in a way that subject headings in a catalog cannot. Further, the footnote also evaluates a source. Footnotes are a means of authenticating an argument, but they are also a means for people to communicate about sources of information.^[21] Although we think that users are looking for all bits of information, these search techniques indicate that they are often looking for authenticated, evaluated information in context, the kind of evidence found in archives.

Information Seeking in Organizations

When seeking information for their daily work, staff members typically rely first on their own memory or on readily accessible records that document their knowledge and actions, whether analog or digital.^[22–25] For information beyond their memory, files, and scope of activity, staff consult other people. People trust information selected and authenticated by the person responsible for the action. An employee summons knowledge of the organization and its functions to infer what person or department is responsible for activity and its associated

information. Employees (and their clients or customers outside the organization) find information by asking, “Who is responsible? Who keeps that information? Who would know or need to know about this problem?”

Often this information-seeking behavior is so ingrained that people do not think about these processes, and the search for information is so obvious that the process is transparent. Information seeking is grounded in a world of personal networks and increasingly in networked electronic environments.

Information Seeking in Archives

Information seeking in institutional archives builds on these patterns in the parent institution. Although people leave, the organization continues. Records documenting significant actions with continuing consequences are transferred to organizational archives so that later incumbents or others seeking evidence of past actions, can find them. Some staff members know that records of their predecessors are in the archives. Other staff ask, “who would have created this information in the organization in the past and where are the records now?” As time passes, however, the reference archivist is needed to assist staff members in asking these questions and locating information.

An important question is, “How do people find archives?” Researchers still find their way to archival repositories through informal personal networks, that is, by word of mouth. Electronic networks are, however, becoming increasingly important.^[26,27] Archivists must be part of the personal and electronic networks of their organizations or communities.

Reference Services in Archives

Reference services are the activities by which archivists bring users and records together to meet user needs. Reference services assist users in person in the research room or remotely by telephone, mail, fax, or e-mail systems. Public programs also provide reference services. On the Internet, reference services assist users who discover them there (Fig. 3).

- Intellectual elements
 - Arrangement
 - Description
 - Reference services
- Human dimension: Interpersonal elements
- Administrative elements

Fig. 3 Fundamental elements of reference services in archives. Source: From Pugh.^[1]

INTELLECTUAL DIMENSIONS OF REFERENCE SERVICES

Intellectual access, provided both through arrangement and description of records and through reference assistance, is the process of identifying and locating records likely to contain information useful for solving problems.

Facilitating Research

Because archives are the products of activities and recording technologies, understanding and evaluating archives requires knowledge of the organizations and individuals creating them and the historical context, organizational communication patterns, and recording technologies producing them. Archival arrangement according to provenance, though critical to understanding organizational context, is unfamiliar to many users and may be difficult for users outside the organization or even for later users from the organization.

Facilitating research requires continuing interaction between archivist and user throughout the research project and may not be completed until the last question regarding copyright or citation is answered. In addition to using records and descriptive tools within the repository, reference archivists often facilitate research by referring researchers to other sources beyond the repository.

Undertaking Research

Undertaking research is a second important intellectual role. Reference archivists undertake research to learn about the parent organization and records creators, to understand the functions and forms of records, to place the finding aids and records in context, to locate information in the records for others who cannot do so, and to evaluate records or information. They also undertake systematic analysis of the use of their holdings to improve access and services.

Educating Users

Educating users is a third essential intellectual function. Instructing users in the research room is an important part of daily work. Few users have experience with primary sources, and most are unprepared for the complexity of archival sources, finding aids, and archival practice. Most have no experience integrating and understanding the undigested mass of information so often found in primary sources. Archivists impart an understanding of archival theory and practice, to provide “archival intelligence” which is an “intellectual framework for understanding both the organizational principles behind archival records as well as the multiplicity, interconnectedness, and appropriate selection of one type of access tool over another.”^[28]

Reference archivists also participate in more formal educational programs. Orientation sessions, class presentations, workshops, publications, tutorials, and online presentations extend the ability of the reference archivist to help users to be more efficient in exploiting archives. Increasingly, these educational programs are presented through a repository's Web site.

INTERACTING WITH USERS TO PROVIDE INTELLECTUAL ACCESS

The extent of reference interaction varies from simple to complex, depending on the nature of the repository, the kinds of finding aids available, the research problem, and users' research skills. Not all users require, or even desire, all elements of the reference process, nor do all repositories have sufficient staff to carry them out. The reference interaction has both intellectual and administrative elements and is powerfully affected by interpersonal dynamics between user and archivist (Fig. 4). The quality of reference service depends on acknowledging and successfully resolving the complicated dynamics of reference transactions. An effective reference interaction enables a user to exploit archival resources fully, while meeting the administrative requirements of the repository.

Question Negotiation

As an intellectual exchange, the reference interaction consists of three activities: "query abstraction," "resolution," and "refinement," through three phases—initial interview, continuing assistance, and follow-up activities.^[29] Query abstraction and query resolution usually take place during the initial interview. Since query refinement takes place during research, interaction between user and archivist may be needed throughout the research project. Interaction may be extended by phone or e-mail follow-up activity after the researcher leaves (Fig. 5).

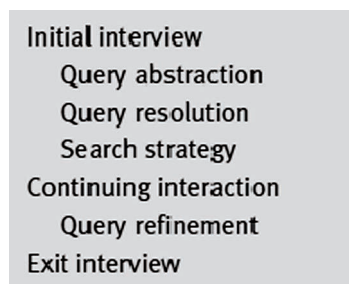


Fig. 4 Intellectual dimensions of reference services in archives.
Source: From Pugh.^[1]

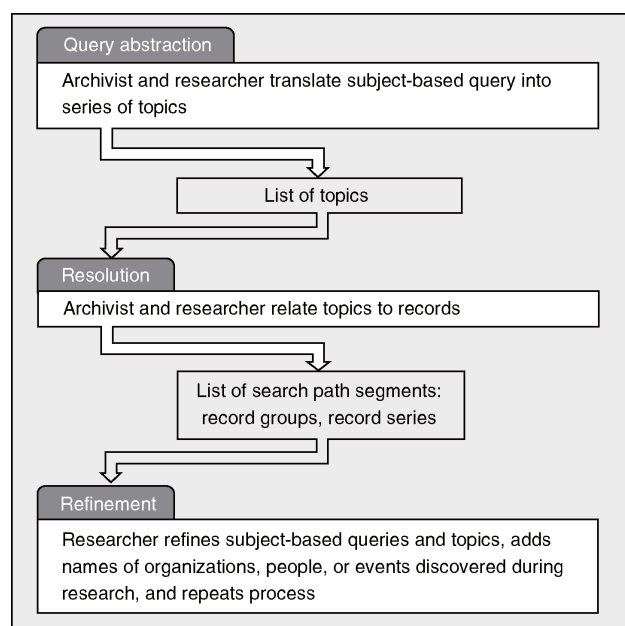


Fig. 5 Question negotiation.

Source: From Pugh.^[1]

Initial Interview

The initial interview, an intellectual interchange between archivist and user, is the archivist's opportunity elicit what information the user needs for the inquiry, and the amount, variety, level, and complexity of the source materials needed to resolve it.

Query abstraction

The initial interview begins with question abstraction, in which the seeker and the archivist identify the topic, delimited by time, place, and the researcher's intended use. The archivist tries to glean enough information to translate the user's natural language into the retrieval language of the finding aid system. Reference staff and researchers ask questions to determine which archival and manuscript collections will be most useful. Asking such questions helps to educate researchers about the process of finding information in archives (Table 1).

Query resolution

In the second stage, the archivist and the user analyze the problem to form a search strategy. The archivist assesses available sources, identifies records, and suggests an order in which the researcher might use them. Based in part on an assessment of the probability of finding useful information, the archivist helps the user identify some sources as highly relevant, others as possibly useful, and others as of marginal interest. The arrangement of a series may dictate the sequence for the research strategy. For example, to use

Table 1 Question negotiation.

Question	Information sought
Who would have needed this information or evidence?	Names of persons, organizations, places, and events. Research subjects must be linked with the activities of specific individuals and organizations and their records.
Why would someone have needed this information or evidence?	Functions that would have required this information or evidence suggest organizational entities or individuals whose records might be useful.
What time period is of interest?	Date range
How might this information been recorded?	Recording technologies available at the time. Forms of records likely to have relevant information: textual, audio, visual, graphic, digital.
Where would those records be now?	Archival access tools to locate likely sources.
What product will result from the research project?	Assists in identifying the most useful types of sources and alerts the archivist to potential legal ramifications, such as copyright.
How much time is available for this research?	Research for a speech to be given tomorrow differs that for a dissertation or book.
Is the user asking on behalf of someone else?	A question is altered as it passes through an administrative assistant or research assistant. An intermediary may not know why information is needed or the full ramifications of the project. Archivists can give much better service talking directly to the person with the question. In organizational archives, speaking to the actual user, often higher in the organizational chart, is an important means for advocating for the archives.

a series arranged by name, the researcher must have the names of individuals.

The archivist's response depends in large measure on the level of description and the types of finding aids available. Sometimes the archivist identifies terms for searching catalogs and databases. For other queries the archivist identifies likely record groups and series. In other cases, the archivist locates and explains the use of finding aids.

The resolution stage of question negotiation is particularly important in institutional archives. The archivist translates a question about a subject into a question about the related organizational functions. Knowledge of institutional history is necessary to ascertain which agencies were responsible for those functions in the period under investigation and likely to have recorded the needed information. The archivist also uses knowledge of the forms in which information was recorded to infer which series might bear on the subject, to suggest, for example, that

annual reports will be more fruitful than minutes. To refer users to relevant information sources outside the repository, archivists may also use national reference sources and their knowledge of holdings of other repositories or of records retained by creating departments within the parent organization.

Locating information in archives is often inferential, based on what is known about the records, their creators, and the circumstances of their creation. Reference archivists link subject queries to the records and the functions that created them, extending the user's information seeking in the creating organization into the past. Archivists play a vital role in this process because of their understanding of the universe of documentation and how a user's questions fit within that universe.

By explaining their reasoning to users, archivists help researchers build their research skills, to help them understand record creation, finding aids, and the process leading to a particular search strategy. Fig. 6 suggests the complicated relationships among archivists, finding aids, records, and users in resolving questions. Archivists strive to make users as independent as possible by helping them to think archivally—that is, functionally and hierarchically. As teachers, archivists help users to think, "Who would have been likely to record the information I am seeking, how would it have been recorded and filed, and where are the records now?"

Continuing Interaction

In the third, or query refinement stage, interaction between archivist and user continues to refine the problem and search strategy. Research in archives is iterative. As users work through archival materials, they discover new aspects of their topic, including the names of other organizations and individuals whose activities bear on the subject of research.

Researchers also discover questions about records as they work through them. Provenance-related questions, or external evidence, about the source, creation, or custody of records help users judge the authenticity of documents, understand bias or interpretation, or explain gaps in the records. Users also may need technical assistance—deciphering handwriting, identifying archaic words or references, resolving problems with dating, or using difficult file structures. Archivists also may help users understand how best to use formats new to them, such as architectural drawings, photographs, maps, or electronic records.

Exit Interview

Ideally, the reference interaction is closed by an exit interview as long and thorough as the initial interview, but this is seldom realized. Because users do not always announce their departure, it is wise to request and, if possible,

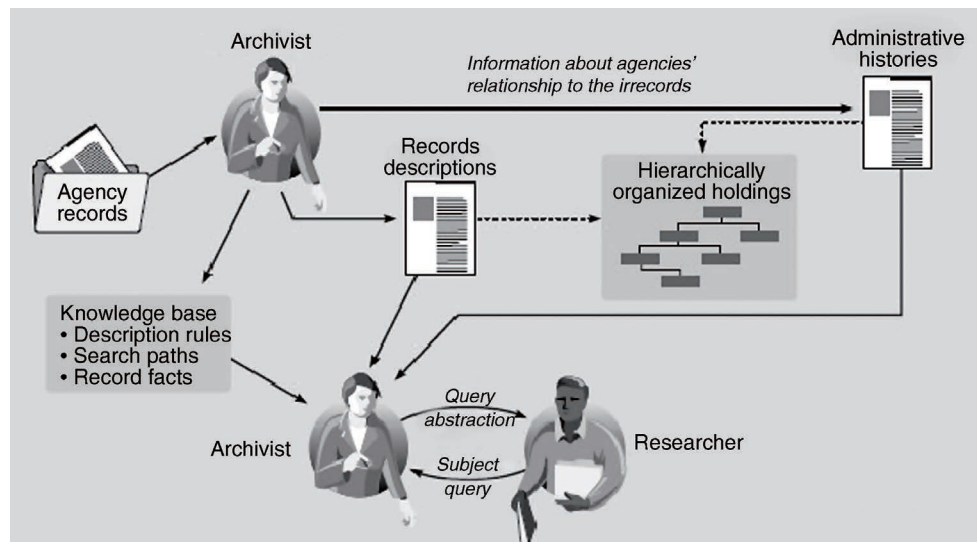


Fig. 6 Inside the black box.

Source: From Pugh.^[1]

schedule an exit interview during the initial interview. Although continuing interaction during research helps to ensure that researchers have seen all pertinent materials, an exit interview provides an opportunity to review the sources used and to discover if additional materials warrant another visit.

The exit interview is an opportunity to capture the knowledge and expertise of researchers and use it to enhance collection descriptions. Researchers often bring, or discover, additional information about collections or creators. An exit interview also is an opportunity to evaluate reference services, assess finding aids, report on arrangement and preservation, or suggest leads for acquisition. Now Web 2.0 interactive finding aids allow researchers to add information to finding aids, and surveys and other tools allow them to evaluate services.

HUMAN DIMENSIONS OF REFERENCE SERVICES

Reference Interactions in Person

All phases of reference interaction—initial interview, continuing assistance, and exit interview—are affected by interpersonal dynamics between user and archivist. Reference encounters in libraries are usually short and voluntary, each devoted to a single question. In contrast, reference transactions in archives are more likely to be substantive, obligatory, and continuing.^[30,31] Because reference archivists frequently mediate among users, finding aids, and records, understanding the human dimension is critical to providing intellectual access to archives. Beyond assisting individual users, reference

archivists also provide services to groups of users and potential users through public programs.

Good communication between users and archivists is critical. Archivists and users may have very different expectations about the reference interaction. Discrepancies in expectations may cause confusion, disappointment, or failure to use archival holdings effectively. Users and archivists may differ in their expectations of the conditions under which archival materials are to be used. Expecting archives to be like libraries, users may feel rebuffed if they cannot be accommodated without an appointment and disappointed that documents do not circulate. Archives must ensure the integrity of unique materials, users may find registration and security procedures intrusive.

Users and archivists may also have different expectations about the appropriate role of the archivist and the amount of time required to locate needed information.^[32,33] Most archivists expect to provide instruction in using finding aids and guidance to records, but users may expect archivists to furnish information directly. Research in archives requires an effective partnership between archivists and users. Archivists strive to make every user feel welcome and to treat all users fairly. Sensitivity, clarity, and a genuine spirit of public service are needed to ensure successful interpersonal relationships in archival reference services. Nonverbal signs and symbols are significant components of interpersonal communication. Positive body language makes users feel more comfortable approaching a staff member with a question.

The first question, the initial inquiry

Reference archivists quickly learn that the first question is usually not the real question, or at least not a full statement

of need. Experienced reference archivists marvel at the gap between what researchers say and what they need. Understanding this gap leads to better reference service. People often feel vulnerable when asking questions, at a psychological disadvantage because they expose need or ignorance to a stranger whose response is unknown. Active listening is more important than talking when the reference archivist seeks to understand the full ramifications of a question or research project.

Another impediment to successful initial interviews may be repository administrative needs. In most repositories, numerous practical matters must be settled before researchers even get to the “first question.” These administrative details can consume considerable time and are likely to be distracting.

Cues for researchers

Researchers need clear cues to identify the reference archivist. Layout and signage can facilitate the interpersonal exchange by making it clear that the reference archivist is to be approached and marking clear pathways to the reference workstation.

Interpersonal dynamics of continuing interaction

If a good relationship is forged during the initial interview, interpersonal communications are less likely to be a problem in continuing interaction and the exit interview. Staff members cannot control the behavior of users, but they do have control over their responses to users. They strive to be pleasant and courteous to all users, regardless of their demeanor. If staff members cannot provide requested information or services, they explain such limitations fully and politely.

Reference Interaction with Remote Users

Off-site users direct inquiries to the archives through letters, telephone calls, electronic mail, and fax.^[34–36] For some users, such inquiries initiate or continue research conducted in person, but for many users they are the sole means of interacting with the repository. Remote inquiries often request archivists to do research for them. Usually archivists have neither the time nor the resources to do so. Policies and priorities must be clearly and convincingly communicated; they must also be reviewed regularly to recognize changing publics, user needs, and technologies.

Reference Services on the Web

Many elements of reference services are moving to the Internet and the World Wide Web, which expand both archival services and researcher expectations. For collecting repositories, information about researcher needs may require assessment of researcher patterns in the

repository, of scholarly networks, and of kindergarten through 12th grade curriculum standards. Collecting repositories can export collection-level descriptions to national bibliographical networks that provide a link in the MARC record to the Web-based finding aid. Analysis of e-mail reference questions can also assist in designing interfaces for electronic information systems.

Web 2.0 tools may enable use of interactive finding aids as a platform for communications.^[37–41] In addition to browsing and searching one or more finding aids, users can create bookmarks and follow link paths of other users. Users can post user profiles and add comments to the finding aid and discuss questions and share information with archivists and other users. Max Evans introduces the concept of “commons-based peer-production” in which users determine the level of intellectual access to archival materials through collaborative tools. Users might add value to the finding aid by identifying, indexing, and digitizing and posting documents, using such tools as Flickr.

Archivists in institutional archives find opportunities through the organizational network electronic information systems to integrate archival information resources into the information ecosystem of the organization. An institutional archives can use the intranet to become a clearinghouse for all organizational information, beyond information about the records it holds. The archives can integrate information about organizational functions, activities, and forms of records, whether paper, visual, audio, or digital, and regardless of whether records are in offices, records center, or archives. The organization chart could be used as an information interface. Better yet, using the business processes or functions of the organization provides a more useful map of the organization. The provenance method of information retrieval can be made explicit and can empower the information seeker.

LEGAL ACCESS

In a narrower sense, access is “the permission to locate and retrieve information for use (consultation or reference) within legally established restrictions of privacy, confidentiality, and security clearance.”^[42] Access in this sense is “Who gets to see what and when.” The repository must face these issues before users request to use records. Access policies are determined in consultation with all interested parties, applying relevant laws, in the context of the mission and resources of the repository and are a foundational document for the repository.

Providing reference services and determining access to records are separate functions, yet they are linked in access policies, first because reference assistance is critical to obtaining access in the broader intellectual sense, and second because reference archivists usually administer physical access and supervise researchers using documents. Reference archivists are responsible

for administering and explaining to users any restrictions on access to records. Access policies are administered, but not determined, at the reference desk.

Records created for personal or internal use may contain private or confidential information that cannot be disseminated immediately. Legal and ethical issues may condition the use of archives: most importantly, privacy, confidentiality, and freedom of information. Archivists strive to provide fair, equitable access to records in their care but must also protect information affecting creators or third parties until it is no longer sensitive. Further, the copyright law, which allows for access to documents, may govern the secondary uses that can be made of them, such as publication.

Archivists have a dual responsibility to the creators and subjects of the records on one hand and to scholarship and the public good on the other. Archivists seek to make as much information as possible available to users as soon as possible, but recognize that some information must be withheld to protect legitimate interests of privacy and confidentiality. Archivists maintain a delicate balance between encouraging use and protecting the rights of creators and third parties. Without some restrictions on access to recent and sensitive materials, individuals may be harmed. Furthermore, without such protection, creators may destroy records rather than transfer them to archives, or they may not record certain kinds of information at all.

Policies for access in its larger intellectual sense and its narrower legal sense must be in place before users actually examine records and obtain information from them. Access policies protect records from harm and some information from premature disclosure, while making as much information available to researchers as possible. An access policy mediates among the competing demands of privacy, confidentiality, public right to know, and equality of access. Some of these concepts are embodied in law, others in deeds of gift, and still others in ethical norms. Access policies also allocate repository resources for reference services as equitably possible. Policies and procedures help the archivist to balance user needs against the staff resources available to meet them while also protecting archival holdings from harm.

Understanding the concepts underlying the laws, regulations, and policies governing access to archival materials is important when designing repository access policies. Four concepts are particularly relevant: privacy, confidentiality, right to know, and equality of access. These guiding concepts are expressed in various forms. The first three are expressed in privacy and freedom of information laws affecting records generated or accumulated by institutions such as federal, state, and local governments, colleges and universities, businesses, and other corporate bodies. Agreements regarding privacy and confidentiality are embodied in contracts in deeds of gift or

transmittal documents. Ethical norms also govern access policies.

Information to be protected is identified and segregated during acquisition and processing, so that the reference archivist does not have to judge the motives or wisdom of individual researchers at the reference desk.

Archivists strive to provide equality of access to repository holdings, although they find they often must educate both records creators and records users about appropriate access to sensitive information. In general, repositories grant access to all users to all materials, with the exception of those covered by law or other restrictions. Insofar as possible, records open to one user are open to all users. No exclusive use of materials is allowed. When interested users approach the repository, archivists strive to treat them equally. Equality of access is now the governing principle for use of records in most repositories.

In addition to advocating equal access for all users, archivists strive to give equal service to all users. Archivists in both archives and manuscript repositories are unlikely, however, to have sufficient resources to be able to serve all users equally and must therefore devise policies to administer reference services fairly. In some settings limitations on services must be acknowledged (Fig. 7).

PHYSICAL ACCESS

Access also means “physical” access, the opportunity to examine documents. To find information in records, someone must consult documents, whether in analog or digital form. Providing physical access means that repositories maintain regular and sufficient hours of operation and provide space to study records.

Most information in archives remains in tangible forms in unique aggregations, although information is increasingly “born digital,” that is, created and maintained in electronic form. Records must be protected from tampering and from accidental or careless damage. The evidential value of archives depends on preserving their integrity, proven through an unbroken line of responsible custody. Archival documents are often unique, and the aggregations of documents in one record group are unique. If the document or the order of documents is lost, it cannot be recovered. Records need physical protection from all types of hazards. Repositories protect records from environmental threats such as fires, floods, and other natural catastrophes, and extend the life of records by creating a stable environment. Archivists protect records while making them available to users.

Planning for security and preservation must be integrated with planning the services to meet users’ needs. Providing physical access primarily means setting administrative policies, but these policies have important consequences for the ability of users to perform their

1. User communities. Identify the communities of users to be served by the repository.
2. Resources and restrictions. State generally the types of records held by the repository. State the types of information that may need to be restricted. Identify applicable laws and institutional information policies that apply to information in the repository, and append them to the policy. Indicate how restrictions will be applied.
3. Intellectual access and reference services. Describe the finding aids, levels of reference services, and the relationship between the two. If necessary, specify distinctions in service levels. Describe searching services, copying services, and services for remote users, whether by phone, email, fax or mail.
4. Fees. Indicate fees for services.
5. Physical access and conditions of use. Describe how records will be made available for research. Include rules for using materials and policy statements for researchers.
6. Use of information. Establish policies to respond to requests for permission to publish from holdings. Indicate forms for citations. Determine terms for staff user of holdings.
7. Loan of materials. Specify conditions under which materials will be loaned.

Fig. 7 Elements of an access policy.
Source: From Pugh.^[1]

work efficiently. The access policy should specify the physical conditions under which research materials may be used.

Further, potential users find it difficult to come to a repository to carry on their research. Archivists must respond to requests from individuals unable to visit personally for information from their holdings and for research services. Remote users request archivists to locate documents, search them, and provide information from them. Policies must address ways of providing information and documents for remote users. It may be necessary to spell out in some detail how much research reference archivists can do for remote users. It is permissible to provide more research time for the parent institution than for other users.

Access for people with disabilities is a matter of public law.

Security

Security is a basic function for all staff members, not just those in reference. Three components interact to provide security for documents: secure storage, description of holdings, and protection of materials while in use. Records are most at risk when they are in active use, and reference archivists or their assistants are generally responsible for ensuring that they are protected during use.^[43]

Preservation

Records also need protection to minimize the wear and tear inherent in handling, copying, loaning, and exhibiting

them. Providing physical access to archives and manuscripts means negotiating a balance among the needs of users, records, and staff. While meeting these needs of current researchers, archivists must also consider those of future users by protecting archives from theft or abuse and from wear and tear.

PROVIDING INFORMATION FROM ARCHIVES: COPIES, DIGITAL SURROGATES, OR LOANS

Copies

Physical access may also be provided through copies and loans. When users begin to use materials, they often request copies of them. Responding to requests for copies is a significant administrative component of reference service. Copying raises questions of technology, preservation, and copyright. To use information found in archives, users note it, copy it, or borrow the documents in which it is found. They request copies for research use, legal use, publication, and exhibition. Individuals also often request information from holdings rather than about holdings. Some requests for such information can be provided by the reference archivist, but most such requests are answered by providing copies.

Digital Surrogates or Electronic Records

Today, copying often means creating digital surrogates disseminated electronically through the Internet or other digital means. Repositories are placing archival documents

online, first in exhibition-like presentations, but more recently, through mass digitization of collections or series of records, mediated through interactive finding aids. “Born digital” documents are also provided electronically.

Loans

Although most archival materials do not circulate, repositories do loan records. The three most common requests for loans are administrative use, research use, and exhibition. Ensuring preservation and security of records are critical to making loans, which are recorded in a loan agreement.^[44–46]

OUTREACH

Reference archivists are integral to outreach programs in their repository. The daily activities of providing reference services profoundly affect public relations. For better or worse, the reference archivist contributes daily to the public perception of the repository and the profession.

Developing Personal Networks in the Parent Organization

For institutional archivists, developing networks of people and constituencies is as important as developing electronic networks. Archivists recognize and build on the information-seeking patterns that staff in organizations use to find information through other people. Developing networks within the parent institution has two important benefits. First, staff members may add the archives to their mental map of information resources and think to call when they have information needs. Second, building such networks reinforces the usefulness of archives; staff will understand why the archival program is important to the organization.

Developing Networks Outside the Parent Institution

Building outside networks is another important aspect of outreach. Archivists should participate in conferences of scholarly associations in relevant subject areas; visit with records creators, donors, and collectors; develop relationships with teachers and faculty; and prepare public programs describing the repository’s records and how they could assist current work.

PUBLIC PROGRAMS

Some users’ needs can be met more effectively through public programs for groups of users than through personal reference interaction.

Managing Reference Services and Evaluating the Use of Archives

To meet users’ needs, protect records, and use staff effectively, repositories organize, administer, and evaluate reference services. Staff qualified to provide reference services must be recruited, trained, supervised, and organized in reporting relationships conducive to meeting user needs. Managing reference services requires planning policies and procedures. Effective management of reference services also depends on measuring and evaluating the use of archives through routine data collection and user studies.

ADMINISTRATIVE COMPONENTS OF REFERENCE SERVICES

Administering the daily tasks of reference services, or managing the staff providing them, may be the most time-consuming aspect of archival reference services. These tasks include receiving, identifying, registering, and orienting users; locating, retrieving, and reshelving materials; and supervising research use, copying, and loans.

ORGANIZING REFERENCE SERVICES

Repositories typically organize reference staff in one of three models: (1) a curatorial organization, in which reference services are integrated with arrangement and description, often in a subject or format area; (2) a rotating organization, in which all staff members take turns providing reference services in rotation; and (3) a functional organization, in which reference services are organized as a separate department. The effectiveness of each of these arrangements depends on the staff, the size and complexity of the holdings, and the nature of the finding aids. In most organizations, the functional model works best, so that reference archivists have a distinct identity, accountable for ensuring service for users and advocating for their needs.

STAFF QUALIFICATIONS

No matter what pattern or combination of patterns is employed, service to users must be the foundation of all archival programs. Reference staff must be capable of meeting both the intellectual and personal needs of users. Archivists have a genuine spirit of public service, but all reference staff must be dedicated to public service, whether professional, paraprofessional, or clerical. A repository’s image is largely shaped by the services provided to users.

Reference staff members must also be knowledgeable about repository finding aids and holdings, understand the organizational history, functions, and record forms of the records creators, and possess or develop subject knowledge of the activities documented by repository holdings. Since appropriate referrals to other information sources are an important element of good service, knowledge of the information universe is also necessary, as is familiarity with general reference tools and online sources. Reference archivists must be familiar with laws and ethics relating to access and copyright.

MANAGING REFERENCE SERVICES

Managing reference services requires planning, establishing reference and access policies, implementing those policies in procedures, and administering these policies and procedures. It also requires advocacy and communication. Planning for reference services should be integrated into repository planning, both for strategic planning and annual planning. Establishing policies for reference services rests on repository policies embodied in the access policy. A procedures manual that outlines the details of reference procedures saves time and helps ensure consistent reference practices.

Time management is difficult, but because of that very difficulty, it is vital. In the research room the time constraints of staff and users intersect and sometimes conflict. No repository can be all things to all users or potential users. Each repository acknowledges its limitations of staff and budget and establishes policies that serve the greatest number in terms of its overall mission. At the same time, the repository can work to identify unmet needs and seek resources to meet them. Priorities must be set as rationally as possible; it is unfair both to users and to reference archivists to make such decisions on an ad hoc basis.

Reference archivists are advocates for the needs of users in repository planning, reporting regularly to repository management on use and user needs. Providing meaningful information to management is necessary to obtain adequate space and equipment, a sufficient number of well-trained staff members, usable finding aids, appropriate public programs, and useful publications. Reference archivists also communicate user needs to other staff members, especially those in technical services and acquisitions.

MEASURING AND EVALUATING THE USE OF ARCHIVES

Archivists measure and evaluate the use of archives at three levels: at the reference function or department, the repository, and the profession.^[47] Evaluating the

effectiveness of the reference function means measuring the uses and users of records. Qualitative assessments of service outputs evaluate such attributes as promptness, thoroughness, courtesy, care, and adequacy of response. Evaluating performance of individual reference staff members requires a set of objectives for reference performance linked to behaviors that can be observed. Meaningful evaluation of reference services compares performance with some standard—either repository objectives or professional standards.

At the repository level, understanding the use of the holdings is necessary to plan descriptive programs, set processing priorities, develop acquisition strategies, and plan public programs. Quantitative and qualitative measures justify the value of archives to resource allocators. Evaluating repository performance requires assessment of such qualitative factors as accessibility, quality of finding aids, comfort, quality of holdings, and accuracy of information provided. Quantitative measures can evaluate timeliness, costs, and other aspects of user satisfaction.^[48]

At the broadest level, understanding and communicating the use of archives contributes to greater public understanding of the value of preserving them and the need to support archival and manuscript repositories.^[49]

CONCLUSION

The archival system is now less predicated on interaction between the user and the archivist. Researchers can directly access finding aids and increasingly locate documents online. Remote inquiries come through e-mail, often from “accidental users,” and are increasing exponentially. Web 2.0 technologies allow researchers to annotate, update, and index archival finding aids, and the next generation finding aid may serve as the basis for a community of learners, including archivists.

Information-seeking behaviors are changing rapidly as information is increasingly “born digital,” recorded in electronic forms, especially in networked environments. A search engine on the World Wide Web may yield a list of archival repositories or archival holdings, available to the public in ways undreamed of a decade ago, but it will list them among hundreds, or thousands, or tens of thousands of sites. Understanding the information needs and research methods of significant users of archives is even more important now as archivists compete for the attention of users.

Perhaps a greater concern is the new popular illusion that all information is available online, especially when this illusion is coupled with the normal consequence of the “Principle of Least Effort.” This combination militates against searching for information that is not online, even though most archival records will remain in analog forms for the foreseeable future. Changing researcher

expectations mean that archivists have to develop innovative ways to connect with them. Although archivists are increasingly linked to users via telecommunication networks, personal networks remain the most important means by which users find archival repositories. Archivists connect with those personal networks to ensure that archives will be on the mental maps of users. Users must think of archives as an information resource.

A reference archivist is a guide not only to finding aids and records, but to the structures and forms of the information landscape of the repository and beyond. The reference archivist is not a barrier, nor a gatekeeper, but rather a partner, a facilitator, and a guide in the joint quest to find meaning in the past to understand the present and plan for the future.

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Archival Science

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Abstract

Archival science is the academic and professional discipline concerned with the theory, methodology, and practice of the creation, preservation, and use of records and archives. It encompasses the creation, preservation, and use of records in their functional context, whether organizational or personal, and the wider social, legal, and cultural environment within which records are created and used. In the United Kingdom the discipline is known as archives and records management, although in other cultural contexts, archives management and records management are sometimes separated, and sometimes bound more closely together, for example, by proponents of the records continuum. Organizations and individuals create records in the conduct of their current business, to support administration, to ensure accountability, and for cultural purposes, to meet the needs of society for collective memory and the preservation of individual and community identity and history. This entry serves as an introduction to the field of archival science. The first section gives a broad overview of the nature of archives and records. The main section provides some definitions and an introduction to the core concepts and principles which are central to the discipline, including records, archives, and activities; attributes of records; the records lifecycle; the records continuum; provenance and original order; postmodernist ideas around archive fever. The entry concludes with a discussion of the professional discipline of archives and records management, an overview of the key functions of archives and records services, and a brief history of archival science in the Western world.

INTRODUCTION

Archival science is the academic and professional discipline concerned with the theory, methodology, and practice of the creation, preservation, and use of records and archives. It encompasses the creation, preservation, and use of records in their functional context, whether organizational or personal, and the wider social, legal, and cultural environment within which records are created and used. In the United Kingdom the discipline is known as archives and records management, although in other cultural contexts, archives management and records management are sometimes separated, for example in Germany and in North America, where separate education programs and professional bodies have developed for each subfield. Sometimes archives and records management are bound more closely together than in the United Kingdom, for example, by proponents of the records continuum in Australia. Organizations and individuals create records in the conduct of their current business, to enable actions to be taken and decisions to be made. Records used for business purposes support administration, regulation, public or professional services, economic activity, and dealings between individuals and organizations. Records can be used to ensure accountability, to make people and businesses account for their actions and obligations and when there is a need to prove that organizations have complied with legal or regulatory requirements or recognized best

practice. Records enable organizations to meet legal, regulatory, and financial requirements, and to protect their assets and rights. They help to support the expectations of a democratic society for transparency and they protect citizen's rights. They enable governments to deliver electronically enabled services to citizens (e-government) and facilitate citizen participation through the provision of information and digital interaction. Records support life-long learning, education, and training for people of all ages, from school children to senior citizens. Some records are preserved for posterity as archives, ensuring that they are available for historical, demographic, sociological, medical, scientific, genealogical, or biographical research, for cultural purposes, and to meet the needs of society for collective memory and the preservation of individual and community identities and histories. Increasingly, writers including Andrew Flinn and Sue McKemmish are interested in the role of archives outside traditional organizations and the ways in which archives provide evidence of individuals and communities.

This entry serves as an introduction to the field of archival science and many of the topics which are covered briefly here can be found discussed in more detail in related entries. The first section gives a broad overview of the nature of archives and records. The main section provides some definitions and an introduction to the core concepts, theories, and principles which are central to the discipline, including records, archives, and activities;

attributes of records; the records lifecycle; the records continuum; provenance and original order; postmodernist ideas around archive fever. The entry concludes with an overview of the professional discipline of archives and records management, a discussion of the key functions of archives and records services, and a brief history of archival science.

OVERVIEW OF ARCHIVAL SCIENCE

The Nature of Archives and Records

Archives and records can be created or maintained in any media and format, including paper, parchment, and digital, maps, plans, and technical drawings, volumes and files, photographs and prints, moving images, films, audio and videos, voicemail, other materials such as clinical samples and specimens, Web sites and computer-generated records of all kinds. Records are traditionally text-based but often also contain nontextual material such as sound, images, or three-dimensional objects. Recent literature has challenged some of the more traditional ideas about the nature of the record and its attributes, to encompass ideas of orality, community archives and fluidity. Some writers, such as Terry Cook and Ciaran Trace, emphasize the social context of records creation and suggest that records cannot be neutral: this is supported by the work by Verne Harris in a South African context.

In the traditional view, a record is not defined by its physical format, but rather by its purpose and use. There is significant discussion in the literature about the nature of a record or archive, but a simple definition is that a record is “recorded evidence of an activity” and that archives are those records “recognized as having long-term value.” Extracts from Shepherd and Yeo^[1] used throughout this entry are reproduced with permission of the publisher. Records management is the “field of management responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records” according to the International Standard.^[2] Archives management is “the selection, preservation, maintenance, arrangement, description and access to materials of continuing value for the long term.”^[3]

CORE CONCEPTS AND THEORIES

Records, Archives, and Activities

If we accept the definition of a record as “recorded evidence of an activity,” we need to understand what an activity is. An activity is “an action or set of actions undertaken by an individual, a group of individuals or a corporate body, or by employees or agents acting on its behalf, and resulting in a definable outcome.”^[1] An

activity has an identifiable starting point in time and also an end point. Some activities, such as drafting and note taking, only involve one party (or actor). In an organizational context most significant activities involve two or more actors: some form of transaction or communication takes place between them. One or more of the actors may be external to the organization (such as a customer or supplier). Other transactions may be purely internal (for example, between a manager and a staff member, or between one department and another). Where more than one party is involved in the activity each party may create its own record; alternatively the second party may receive and retain the record transmitted to it by the creator, while the creator retains a copy of it. Records may be created either in the course of the activity, or afterwards in a conscious act of record keeping. A transaction may be effected in whole or part by the creation or transmission of records such as letters, invoices, or purchase orders. On the other hand, minutes of meetings, staff training records, equipment maintenance records, personal diaries, and the registration of births, marriages, and deaths, are created in order to provide evidence of activities which are already complete.

Records maintained digitally are known as digital records (or electronic records). These terms refer to records created or received digitally which are then maintained in digital form, as opposed to records which are created using word-processing or other software and are then printed out on paper. Such records are sometimes called “born digital,” to distinguish them from paper records which are digitized, i.e., turned into digital images of the original. In most organizations, records are a mixture of formats and media, and include both paper-based and digital records. Most organizations operate hybrid records systems which accommodate records and archives in any medium.

More recently the concept of the record has been extended to include records from different cultures and traditions, including stories, oral records of all kinds, and other cultural objects including dance, song, and painting, which provide evidence of community histories and identities.

Attributes of Records

If a record is to function effectively as “evidence of an activity,” it must be compliant with any external requirements in the environment where the organization operates. Requirements for records may derive from legislation, regulation, mandatory standards, codes of best practice and ethics, or community expectations. Many traditional aspects of fixity in records have now come into question, but a summary of the established view is given here.

Records must possess content, context, and structure. The content of a record must reflect the facts about the activity. For a reliable record these should be accurate (the

facts should be correct) and complete (everything of significance should be recorded). The context of a record must be supported by information about the circumstances in which it was created and used. Records cannot be fully understood without adequate knowledge of the activity which gave rise to them, the wider function of which that activity forms part, and the administrative context, including the identities and roles of the various participants in the activity. Contextual information must be captured in the records themselves or in the systems that are used to maintain them. The structure of records and records systems must reflect the relationships between their constituent parts. In a business letter, for example, there is a formal structural relationship between the details of the addressee, the date, the body of the text divided into paragraphs, and the signature at the end. There are also structural relationships between the individual letters in a file or folder, and between records in a series. The structure of a record forms a link between content and context. Structure organizes the content in such a way as to denote context, and thus contributes to a user's understanding of the record.

Records should also have the qualities of authenticity, integrity, usability, and reliability. The authenticity and integrity of records need to be guaranteed over time, so that users can be confident that records are genuine and trustworthy and that no illicit alterations have been made to them. Records need to be usable: they must be accessible to authorized users and provide sufficient evidence of the context of their creation to support a user's understanding of their significance. Records created within an organization should also be reliable and accurate in their content.

For this to be achieved, records must be created and maintained systematically. Sufficient measures are needed to ensure that records are what they purport to be. If this is not clear the weight of a record as evidence of an activity will be diminished. Records may be destroyed when no longer required, but for as long as they are kept they should remain unaltered. Moreover their usability must be preserved so that they can be retrieved, consulted, and interpreted when they are needed.

Records can be used as sources of information as well as evidence. The information in a textual record may be in the form of raw data (name, address, etc.) or may be derived from narrative. Records typically contain information relating to the parties involved in an activity and to the contents or subject matter of the activity itself, but may also contain information relating to other matters such as the political, organizational, or social environment within which the activity occurred. Users may refer to a record to obtain information of this kind, quite independently of any need to use the record as evidence. Users are also likely to employ other methods of obtaining information, and may not consciously distinguish between records and other information sources.

Archives and records management systems have, therefore, to meet both informational and evidential needs.

Records Lifecycle

The records lifecycle is a concept which is in common use in archival science. It seeks to show that records are not static, but have a life similar to that of biological organisms: they are born, live through youth and old age, and then die. The idea was developed in the 1950s in the United States by T.R. Schellenberg, who wrote about "the life span" of records which included their current use and final destiny.^[4] Since the 1950s many variants on the records lifecycle concept have been developed. Most models aim to show a progression of actions at different times in the life of a record: typically, its creation, capture, storage, use, and disposal. Some writers show this as a linear progression, while others describe a loop or a circle, see Fig. 1.

A different model of the concept suggests that records pass through three ages (or stages), as shown in Fig. 2 a current or active stage, when they are used for business; a semi-current or semi-active stage, when their business value is reduced; and a noncurrent or inactive stage, when they have little or no business value but may be used for secondary, research purposes. Writers who use this version generally also emphasize the physical movement of paper records to alternative storage at each phase of their life, together with the destruction of unwanted records at each stage. There are varying views on where archives fit into this picture, for instance, are they all encompassed within the noncurrent records stage or can archives be identified at other stages in the lifecycle? Records that have continuing significance to the organization, for example, as evidence of its ongoing rights and obligations, can be identified as archives while they are still current.

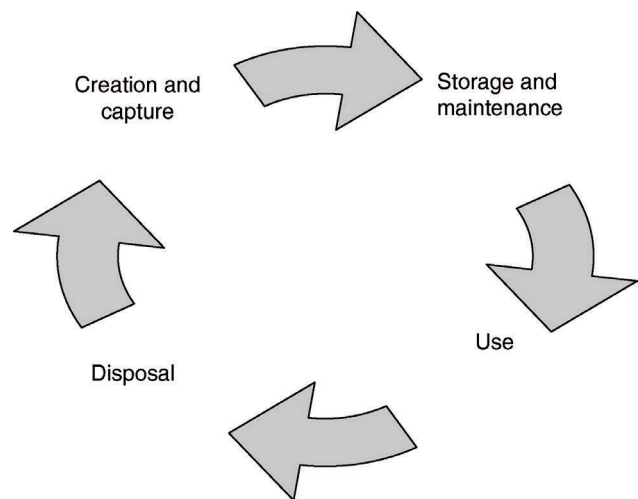


Fig. 1 "Progression of actions" lifecycle model.

Source: E. Shepherd; G. Yeo.^[1]

Current records are records regularly used for current business of an organisation and which continue to be maintained in their place of origin.



Semicurrent records are records required infrequently for current business which should be transferred from offices to a records centre awaiting their ultimate disposal.



Noncurrent records are records no longer needed for current business.

Fig. 2 “Three ages” lifecycle model.

Source: Adapted from International Council on Archives, *Dictionary of Archival Terminology*, Walne, P., Ed., 1988.

Cultural values can also be identified at an early stage, as well as later.

In the 1980s and 1990s, the lifecycle concept was subject to much adverse criticism. Critics noted that some records do not “die,” but are retained indefinitely because of their continuing value. The division between stages of the lifecycle in the “three ages” model is seen as artificial: for example, records which have been thought to be noncurrent may have a renewed period of currency if the activity which gave birth to them is revived. Lifecycle models do not appear to allow for iteration or repetition of stages or actions, or for stages to be omitted, though in practice this frequently happens. It has also been argued that the lifecycle concept perpetuates an artificial

distinction between records kept for business purposes and records kept for historical or cultural reasons and between the two professions of archivist and records manager. Critics of the lifecycle models also suggest they are too focused on records as physical entities and on operational tasks, especially those associated with the custody of paper records. Digital records rely on logical rather than physical structure, and the tasks associated with the physical storage of paper are largely irrelevant to their management.

Records Continuum

The records continuum concept was developed in the 1980s and 1990s, particularly by academics in Australia. As Fig. 3 shows, managing records is seen as a continuous process. In the continuum there are no separate parts or stages, but one element of the continuum passes seamlessly into another. Dimensions in the continuum are said not to be time-based, but rather represent different perspectives on the management of records. The circles move out from the creation of records of business activities, to ensuring that records are captured as evidence, and to their inclusion in formal systems for records management within the organization; while the fourth dimension looks out toward the needs of society for collective memory. In contrast to the older view that records are kept for organizational purposes during the early stages of their lives, and only later come to meet the needs of a wider society as

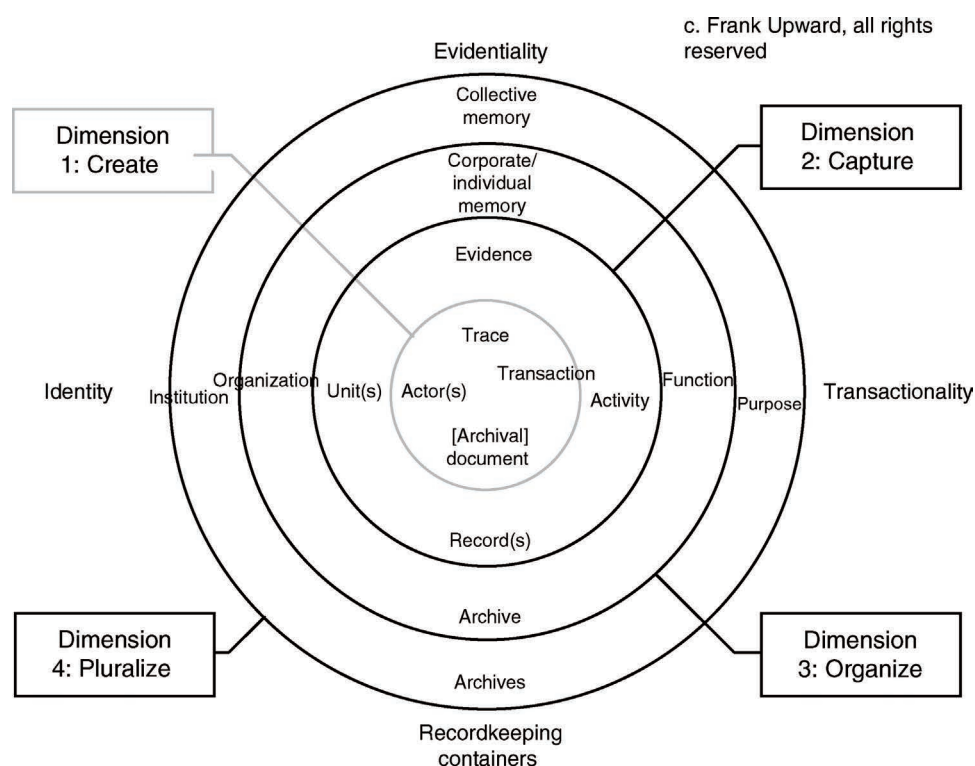


Fig. 3 Records continuum model. Copyright F. Upward.

archives, the continuum takes the view that records can function simultaneously as organizational and collective memory from the time of their creation.^[5]

Many archivists and records managers have rejected the lifecycle concept altogether and promote the continuum concept as offering a truer insight. In fact the two concepts may not be incompatible. The continuum is flexible and able to reflect a range of issues surrounding the role of records in contemporary organizations and society. However when planning and executing a program of archives and records management in an organization, formulations based on the lifecycle concept can provide a useful practical framework and can help to identify stages and actions which have to be taken.

Provenance and Original Order

The establishment of public national archives following the French Revolution led to a separation between record keepers in government administration and archivists in national archives. Initially archivists were content to receive records selected by the administration, seeing their role, in a purely custodial light, as the preservation, arrangement, and description of records, and the provision of access to them. For these purposes, archivists developed a coherent body of theory based on the innate characteristics of records, summed up in the principles of provenance and original order. These are called in French, *le respect des fonds*, and in German, *Provenienzprinzip*.

An early coherent explanation of these European principles was given in the Dutch *Manual for the arrangement and description of archives* in 1898 by Samuel Muller, Johan Feith, and Robert Fruin.^[6] They defined archives as “the whole of the written documents, drawings and printed matter, officially received or produced by an administrative body of one of its officials. . .” and said that archives “must be kept carefully separate” and not mixed up with the archives of other creators, thus preserving the principle of provenance. In addition, they said that the arrangement of such archives “must be based on the original organization of the archival collection, which in the main corresponds to the organization of the administrative body that produced it” and not placed into artificial arrangements based on chronology, geography, or subject, which is a statement of the principle of original order.

It is worth noting that at this time the U.K. Public Record Office finding aids were based on subject arrangements rather than on strict archival principles of provenance. For example, Scargill-Bird’s *Guide* appeared in 1891: the 3rd edition in 1908 changed from an alphabetical subject arrangement to one respecting groups and classes. Giuseppi’s *Guide* (begun in 1914 and published in 1923–1924) was more fully provenance-based.

Hilary Jenkinson of the Public Record Office was the author of the first significant U.K. text on archives, *A Manual of Archive Administration* published in 1922.^[7]

Jenkinson stated that the Primary duty of the archivist was to safeguard the archives in his custody and his Secondary duty was to provide for the needs of historians and researchers. Jenkinson subdivided Primary duty into, first, the physical defense (preservation and conservation) and, secondly, the moral defense (unbroken chain of custody, preservation of original order), and stated that “The good Archivist is perhaps the most selfless devotee of Truth the modern world produces.” Jenkinson’s Moral defense embraced his belief that records accumulate naturally as a result of administration and are untainted evidence of acts. They require an unbroken chain of custody to maintain their authenticity. As a result, the archivist should not interfere with the order in which documents were received or with original bindings or filing or undertake appraisal, since the archivist’s role was to keep and not to select archives. Only the administrator could select archives for preservation.

Jenkinson’s understanding of the principles of arrangement were that “the only correct basis of arrangement is exposition of the administrative objects which the archives originally served” and that the archivist should “establish or reestablish the original arrangement.” He noted that the immediate source of acquisition of the archive should not necessarily be regarded as its true provenance and “whatever else we do we must not break up the Archive Group.” In this he adopts the French *respect des fonds*.

These early theories up to 1930s were developed by archivists who worked in national archives mainly with medieval and early modern records from stable administrations. They described archives in order to make them accessible through calendars and lists.

The principles rely on an idea of the fonds, which is the whole of the records, regardless of form or medium, organically created and/or accumulated and used by a particular person, family, or corporate body in the course of the creator’s activities. The fonds, or in English the archive group, is an organic whole, which can be subdivided. One main level of subdivision is the series, that is archives arranged in accordance with a filing system or maintained as a unit because they result from the same accumulation or filing process, or the same activity; have a particular form; or because of some other relationship arising out of their creation, receipt, or use. These levels of description are made manifest in late twentieth century standards for archival description, in particular the International descriptive standard, ISAD(G), which gives general guidance for the preparation of archival descriptions, which themselves identify and explain the context and content of archives.^[8]

Traditionally understood as referring to the administrative origin of records, the term provenance is now often reinterpreted to include an understanding of the functions and activities which underlie records creation and maintenance.

The principle of retaining the original order relates to records in the paper world: it preserves context by

protecting the physical structure of archives, for example, the physical juxtaposition of a record to other records, typically in a file or cabinet. To extend this concept into the digital world, where storage is random and the physical juxtaposition of records has no significance, it is necessary to reinterpret it in terms of the intellectual relationships between one record and another. These long-standing principles are still valid, but postmodernist reinterpretations of provenance include understanding the role of the archivist as a cocreator and wider ideas such as societal provenance, developed in particular by Canadian writers.^[9]

Archive Fever

Philosophers and cultural theorists, such as Derrida, Foucault, structuralist Levi-Strauss, and Ricoeur, in recent decades experienced uncertainty about positivist approaches which fix identities and meaning, and they questioned whether concepts and phenomena have distinctive and unchanging identities and whether it is possible to accept scientifically verifiable facts or truths. Since 1970s various forms of constructivist and relativist thinking, loosely labeled “postmodernism,” have become prevalent. Postmodernist writers commonly argue that there are no meanings independent of human experience, only interpretations which arise within particular social or cultural contexts. They propose legitimate parallel readings of the same concepts, concepts which are not fixed and can vary over time, cultures, and languages. Archivists began to pay attention to the trend in the 1990s, especially after the publication in English of Derrida’s *Archive Fever* in 1996.^[10] Relativism affects how we think of and conceptualize archives and records and the role of archivists. Derrida suggested that the archivist’s role is to do with context and creation of meaning, setting boundaries around context (provenance), and giving title and order through hierarchization (original order). Archival writers, including Terry Cook and Tom Nesmith, suggest that archivists, who create, transmit, keep, arrange, destroy, and use records, are cocreators of the record, and that archival activities are a part of the provenance and context of the record, which is an evolving and not fixed concept.^[11] Archivists may have custody of the record for centuries, far longer than the original creator, and thus shape the record and its provenance more than any other actor. These ideas also raise the issue of the representativeness or diversity of archives.

Key Functions of Archives and Records Services

Most organizations have a need for an archives and records management service to ensure that records and archives are created, preserved, and made accessible to the right people in a timely fashion for agreed purposes. Many larger organizations have a formal archives and records service which employs professional and support

staff to ensure that a quality service is provided. Although there has been recent debate about the nature of an archives and records service in a digital environment, a number of key functions can be identified, which may typically be available.^[1,3]

Organizational analysis and records creation

Records managers and archivists need first to understand the records which are produced, the organizational activities which generate records, and the systems used to control them. In addition, they should have a thorough understanding of the organization itself. To gain this understanding, they must analyze the role and responsibilities of the organization, study its structures and working methods, and discover how these have changed during its life. They also need to identify the broader issues which influence the way the organization operates, including its corporate culture and the interests and expectations of stakeholders both within the organization and externally. The next task is to acquire a deeper understanding of its functions and the activities which are performed to support them, using techniques such as functional and systems analysis. The knowledge gained from these investigations can then be used to assess how each of these factors affects the organization’s needs for evidence and information, and the degree to which its needs are met by the existing records and records systems. The archivist and records manager can then design and implement a program which fits the organization’s requirements.

Much organizational activity leads naturally to the creation of records, but few organizations seek to record everything that they do. Written communications generate records, but most spoken communications leave no record unless a written note is made, and manual and physical tasks can also pass unrecorded. However, new ways of working and new technologies often make it simpler to create records where none were created in the past. With the growth of e-mail, many messages that might once have been verbal are now written; voicemail has made it easier to capture evidence of telephone communications when records are required. Archivists and records managers advise an organization on its records creation strategy, which helps to ensure that records meet the appropriate standards of authenticity, integrity, usability, and reliability, and that they are captured into a secure and effective records system so that these qualities will remain intact over time. Archivists may be responsible for the procedures for identifying records that need to be captured and for managing the systematic capture of records in both paper and digital form.

Appraisal

Appraisal is the process by which an organization identifies its requirements for maintaining records. Records

managers have developed appraisal techniques primarily to support decisions about retention: which records can be destroyed at an early stage, and which merit longer-term or indefinite retention? According to the Australian records management standard, appraisal seeks “to determine which records need to be captured” into a records management system as well as “how long the records need to be kept” (AS 4390.1-1996, clause 8.1).^[12] Appraisal can also be used to support other decisions, such as which records require special measures for protection or security. In an archival context, appraisal helps to determine which records have long-term value and are worthy of permanent preservation as archives. Appraisal decisions must take account of the organization’s requirements for records for business use and accountability. Decisions about retention also acknowledge cultural interests, and the interests of external users, to ensure the preservation of corporate or societal memory. In practice, these wider interests will carry greater weight in some organizations than others. In the private sector, an organization may choose to keep only those records needed for its own purposes. In a democracy, public sector bodies and some private ones can be expected to take a broader view. Appraisal systems need three components: methodologies for making appraisal decisions, documentation of decisions, and operational measures for their implementation. Much theoretical and methodological work has been done on appraisal, from Schellenberg’s taxonomy of values (primary and secondary, evidential and informational), through to macro and functional appraisal approaches developed by Terry Cook and others, which are discussed in the related entry.^[13]

Acquisition

One of the outcomes of appraisal is archival acquisition. Acquisition is the process by which an archives service adds to its holdings by accepting archives as a transfer, donation, loan, or purchase. There are two simple models of archival acquisition. First, by managing the archives of the employing organization (either seamlessly with the records management service or separately from it) in order to document the organization which created them: these are institutional archives. Second, by acquiring archives from outside the employing organization, in order to preserve records about some activity external to the organization that maintains the archives: these are collecting repositories. Collecting repositories generally have an acquisition mandate which is defined by one or more themes, such as a particular geographical area (a region or state), a subject (such as literature or women’s studies), a specific individual, group, event, or era (such as a prime minister or president, trades unions, or a particular war or conflict), the media of the records (such as film archives), or a time period. Many archives services in fact adopt both of these two models alongside each other, combining an

institutional mission with a collecting responsibility. The archivist should publish a clearly defined statement of acquisition policy which indicates the mandate, such as the subject areas within which records are sought and acquired and the media for which storage and access facilities are available. As well as being a reference tool for staff and potential depositors, the acquisition policy makes acceptance or rejection decisions less subjective, it provides a basis for cooperation with other archives services and for future service development. A well-crafted acquisition policy, backed up by an active acquisition strategy, helps to ensure that the archive is diverse and representative of the community it seeks to document.

Preservation

Preservation is a key activity, whether the intention is to maintain records for a short time for business purposes, or permanently as archives. With paper records, the main emphasis is on storing the physical media and protecting them from loss or damage. Digital records require a different approach: the physical carriers are likely to be short-lived, but the records must be maintained over time and probably across several generations of storage media. While preservation of paper records is costly in terms of space occupancy, electronic storage media are compact and relatively inexpensive, but costs are incurred in ensuring that records remain accessible. Older paper and parchment archives may require active intervention from a specialist conservator to ensure their physical preservation. There is a whole separate discipline of preservation management, archival conservation, and materials science which concerns itself with the preservation of archives, and archivists must work closely with their preservation colleagues to plan and implement a preservation strategy and program.

Arrangement and description

Archivists and records managers need to classify and describe records and document the context of their creation, so as to exercise intellectual control over records and facilitate their management and use over time. For records managers, a key element in this is the classification scheme, which provides links (both intellectual and physical) between records which originate from the same activity or from related activities, helps to determine where a record should be placed in a larger aggregation of records, and assists users in retrieving and in interpreting records. In a paper-based system, the classification scheme determines the identity of the file in which each item is housed and the place of each file within the system as a whole. Classification schemes play an equally important role in digital records systems, where paper files do not exist, and in hybrid systems, where paper and digital records exist side by side. Classification schemes are based on an

analysis of functions, processes, and activities and are based on the business activities which generate records. They document the structure of a records system and the relationships between records and the activities which generate them. The archival activity of arrangement and description builds on the descriptive systems devised to manage records while they were in current use. Arrangement is rooted in the archival principles of provenance and original order, referred to earlier in the entry. Archivists usually create a range of finding aids, which might include descriptive catalogs, inventories or lists of each fonds, repository guides which list all the different types of records held by a single archive, subject guides which bring together archives relating to a specific research topic (such as family history or gardening), together with access and index points (which enable a user to ask about a specific person or topic) and authority records which provide contextual or biographical information. Increasingly finding aids are made available online in shared systems and may be cross searched by users. Catalogs or inventories are usually the main hierarchical representation of an archival fonds and are constructed following one or more of the available archival description standards. The key international description standard, ISAD(G) and its supplements, issued by the International Council on Archives, sits alongside national guidelines and rules. These include the *Canadian Rules for Archival Description*, in the United States *Describing Archives: a content standard*, and in the U.K. *Manual of Archival Description*.^[14–16]

Access and use

In order to design effective description and retrieval systems, archivists need an understanding of user requirements and search behaviors, since the purpose of description is to enable users to access archives and records. At the time of their creation, records are normally accessible only to the creator workgroup. When they are captured into a records management system, they normally become more widely accessible. Once they have been designated as having value as archives, and especially when they have been transferred to archival custody, wider access to them needs to be provided, including to users from outside the organization. In countries where citizens have rights of access under freedom of information or other legislation, access requests must be handled by someone with appropriate knowledge of the legal obligations. Increasingly archivists are concerned to provide equality of access for all communities, across different legislative, constitutional and cultural frameworks, seeing access to public archives as a right in a democratic society. Most countries have developed standards for access to archives: for example in the United Kingdom, the Public Services Quality Group published a *Standard for Access to Archives* which helps archivists to think about equity, openness, responsiveness and

effectiveness in their access services and to capture these in a written access policy.^[17] Archives provide reference services, which typically include onsite access to archives and to finding aids and other explanatory and supplementary materials, and online access to digital copies of archives, searchable finding aids of various kinds and other services. Archives services increasingly engage in other advocacy and outreach activities. Archives which are visually attractive are a prime resource for marketing and public relations, for instance in advertising or promotional materials. Exhibitions and publications are popular and most archives now have educational programs and online learning resources.

This is necessarily a rather brief overview of the key activities offered by archives and records management services: other entries deal with many of these in much greater detail.

The Professional Discipline

Archival science is a professional discipline and those who practice the discipline to provide archives and records management services are called archivists and records managers. Other job titles include manuscript curator, special collections archivist, access to information manager and data specialist. Archivists and records managers can work in any organizational context. Government agencies and authorities at every level (international, national, federal, county, local, city), universities and schools, hospitals, museums, businesses of every kind including multinational corporations, charities and not-for-profits, professional organizations, families and individuals all create and use records and archives and, potentially, offer work to archivists and records managers. Archives and records management services may form part of library and information services, cultural and leisure services, history and local studies, risk and compliance, access and data privacy, legal and chief executive's department, corporate and facilities services, information and communication technology departments or public relations. Sometimes archives services are administered separately from records management, although within a single organization; some organizations only offer one or the other; and sometimes they are a single seamless service.

Entry to professional work is generally through specialist higher level university education, in many countries at Masters or doctoral level, followed by a period of professional development in post, guided by the requirements of national professional bodies. For instance in the United Kingdom, the normal requirement is for a Masters level qualification (for example, a 1-year M.A. in archives and records management) from a university program recognized by the professional body, the U.K. Society of Archivists, preceded by a period of work experience in an archives or records management service, and followed by a portfolio of achievement for continuing professional

development. In the United States, entry-level positions generally require an undergraduate and a graduate degree. Although archivists take a variety of undergraduate majors, most receive graduate degrees in history or library science, which may include archival courses and a practical work placement. The Society of American Archivists (SAA) is North America's largest national archival professional association. It serves the educational and informational needs of its members and provides leadership to ensure the identification, preservation, and use of records of historical value. The largely separate profession of records management in the United States is supported by ARMA International, a not-for-profit professional association for those interested in managing records and information. ARMA supports the certification process for experienced professionals in records and information management which leads to the Certified Records Manager (CRM). In Canada, the Association of Canadian Archivists (ACA) provides leadership to the archival profession and a number of universities offer Masters level qualifications in archival science. In Australia, the profession is served by both the Records Management Association of Australasia (RMAA) and by the Australian Society of Archivists (ASA).

BRIEF HISTORY OF ARCHIVAL SCIENCE IN THE WESTERN WORLD

This section examines, briefly, some of the key events and issues arising in archives and records development in England, continental Europe, the United States of America, Canada, and Australia. Archives have been created and preserved by literate societies for several millennia, and some writers trace the history of archives back to ancient Babylonian clay tablets and Egyptian papyri.^[18] However, the modern history of archival science is generally agreed to have emerged after the French revolution of 1789 and the Napoleonic period, which resulted in the upheaval of law, administration and government across Europe. After 1794 French citizens were given the right to have access to public archives, which had previously been closed: as Duchein said, "the notion that research in archives was a civic right was increasingly recognized" in Europe.^[19] A shifting of purpose can be seen in many countries, including the Netherlands after 1795, when the "administrative-legal" function was lost and a new "historical-antiquarian" interest emerged. In the nineteenth century, new national archives were established which, Duchein suggests, maintained an historical stance at least initially. These included as the Archivo Historico Nacional in Spain in 1866, the appointment of the first national archivist in the Netherlands in 1802, and the PRO in England in 1838. Duchein identifies two distinct traditions in Europe from this period. The first was in those countries, including Germany and much of

central Europe, which adopted a "registratur" system "by which each administrative document is registered with a registry number corresponding to a methodical schedule known as the Aktenplan." The second tradition emerged in other countries, including France, Belgium, the Netherlands and England, where archivists had to arrange and classify records after their transfer to the archives. This need to classify led to the development of the theoretical debate over the arrangement of archives, initially by subject-based classification schedules which were adopted in France, Prussia, Austria, and England, and then the emergence of the provenance-based approach, especially notable in the Netherlands, which respected the fonds or creating body. The principle of provenance, defined in 1841 by Natalis de Wailly, and respect for original order first articulated in Prussia in 1880, provided the distinctive European approach to archives from the late nineteenth century, and were expressed in the influential texts by the Dutchmen, Muller, Feith, and Fruin in 1898 and by Hilary Jenkinson in 1922.

Although no comprehensive study of the modern development of the archival profession across Europe has been published, there is an emerging body of research into the history of archives and archivists across cultures and in specific countries, mostly unpublished so far, but including studies of the profession in France, England, and in the Netherlands.^[20] In late eighteenth century England, for example, public records were scattered between sixty buildings in London and Westminster. The Record Commission, which was active between 1800 and 1837, reported that "the first and most obvious defect in the present system is that records are deposited in different and widely scattered buildings." It recommended a single central repository for public records and laid the foundations for the Public Record Office Act 1838. In 1851 a new building was begun in Chancery Lane, London to provide a home for the public records, initially records of the courts, but from 1852 including central government department administrative records. A new Public Records Act 1958 made significant changes, including the introduction of the Grigg two-stage appraisal process. The history of the Public Record Office up to 1969 has been comprehensively discussed by John Cantwell, a former Assistant Keeper.^[21,22] In 1869, a Royal Commission for Historical Manuscripts was appointed, initially only for 5 years, to address questions of private records. Its purpose was to identify and describe the records of private individuals and families held in the great country houses. The two bodies, the Public Record Office and the Historical Manuscripts Commission, were independent of each other, although they shared premises and staff for many decades, but they were brought together in an administrative arrangement in 2003 to form The National Archives and are now both housed on a single site in Kew, Surrey. Outside the Public Record Office, local, university, business and specialist archives developed in England during

the twentieth century. The 1880s saw burgeoning interest in local record publications, the foundation of local antiquarian and record societies and a growth in genealogy. The study of local history developed. After the establishment of county council authorities in 1889, a number of different models of local archives provision developed: some justices and clerks of the peace preserved the records of quarter sessions, city and borough authorities maintained their records and public libraries acquired manuscripts alongside printed materials. In a few places, privately run antiquarian and archaeological societies, trusts and museums collected archives in the absence of, or sometimes in conflict with, official bodies. Bedfordshire can claim the earliest established county record office, appointing its Records Committee in 1898 and establishing an archive in 1913, led by G H Fowler. Gradually through the twentieth century, each county area established an archives service which usually preserved the official records of the local government and acquired the records of local churches, families, societies and businesses. Independent university, business and specialist archives also developed in the later twentieth century. In the United Kingdom, there is no single piece of national archives and records legislation. Instead separate legislation regulates the records of various types of institutions (such as central or local government, the established church, manors), and for different jurisdictions within the United Kingdom (Scotland, Northern Ireland, Wales) and responsibility is divided among government departments.

The history of archival science in the United States has been recounted by, among others James O'Toole and Richard Cox.^[23] Their account of the history of archives and the archival profession in the United States referred back to the European (Old World) antecedents and explored the American traditions. They propounded the view, explored by a number of writers, that the American tradition was two-fold: the public archives tradition alongside a historical manuscripts tradition. The historical manuscripts tradition emerged from state historical societies, beginning with Massachusetts in 1791, which collected mainly private papers useful for the study of the past, alongside museum artifacts and other objects. Notable names in this movement included Jared Sparks, the American historian and educator, who edited the letters of George Washington and of Benjamin Franklin. O'Toole and Cox suggest that in the nineteenth century much greater scholarship was devoted to historical manuscripts, while the public records were relatively neglected, kept simply as an adjunct to the current business of government.

The establishment of the Public Archives Commission in 1899 was "a catalyst in the formation of state archives." Gradually, state archives departments were established, starting in 1901 with Alabama: the state archives network was eventually completed in 1978 with New York. The 1930s were the decade of real progress, according to

O'Toole and Cox. In 1933 construction finally began on a building to house federal records and the following year legislation was passed which established the National Archives as an independent federal agency and the first Archivist of the United States, Robert Connor, was appointed. Adopting ideas of provenance from the European writers, American archivists, notably Margaret Cross Norton, Illinois State archivist, and T.R. Schellenberg of the National Archives, developed ideas about the links between record creators and record groups, the administrative value of records and their place in the public archives. These ideas became very influential, not only in the United States.

In the 1950s and 1960s, records management in the United States developed as a distinct activity, driven by the huge increase of records in wartime. The distinctiveness of the new activity was perceived by some to constitute a separate profession. This perception was marked by the separation of the committee concerned with selection and appraisal from the Society of American Archivists to form a new organization, the American Records Management Association (ARMA) in 1956. Standardization of archival description emerged earlier in the United States than in England, perhaps partly as a result of the dominance of manuscript archivists, often working in a library context, in America. American archivists led the way with the publication of U.S. MARC-AMC (Machine Readable Cataloguing—Archival and Manuscripts Control) in the mid-1980s and a decade later, Encoded Archival Description (EAD), based on an international standard markup language (SGML), which allowed archivists to construct searchable finding aids in an online environment. According to O'Toole and Cox, "for all practical purposes, this movement in the direction of standardization resulted in a merger of the distinct public archives and historical manuscripts traditions." It led to the emergence of more unified professional practice, especially in areas such as archival description.

The Canadian archival tradition evolved differently from those in Europe and America. In Canada, government archives preserved not only the official records of the state, but also private and other records which related the history of the area, in a model not dissimilar to English local record offices, except that in Canada, "total archives" were embraced within the official mandate of many publicly funded cultural agencies. Millar suggested that Canadian archives developed in three phases.^[24] In the first phase, the collection and copying of records relating to Canada from many sources was funded by government. The Literary and Historical Society of Quebec, established in 1824, pioneered the work, followed by Nova Scotia in the 1850s. In 1872 Douglas Brymner was appointed to preserve the archives of the Dominion of Canada. The Public Archives Act 1912 enshrined the collecting approach and allowed the Public Archives to acquire "public records, documents and other historical

material of every kind.” During the second phase, 1900 to the 1970s, the growing sense of national identity and the need for the public sector to manage its institutional records meant that many Canadian archivists pursued the preservation of both institutional records and those from private sources: what became known as the “total archives” approach. The appointment of W. Kaye Lamb as Dominion Archivist in 1948 led to the transformation of the archival profession in Canada. In 1967, the Public Archives joined the National Library in a new building, where acquisition programs expanded to include the preservation of film and television archives and machine readable archives. Provincial archives gradually emerged across the country, with institutions in place in all provinces by 1968, although the services offered and the funding to support activities varied widely. Some, but not all, provincial archives had a role in the records management of their province.

The third phase of development, characterized by Millar as running from the late 1970s, saw significant changes. The Canadian Council of Archives was established in 1985 to support the development of a coordinated archival system, including identifying national priorities, facilitating improved communications across regions, and advising on mechanisms for consistent and sustainable funding and support. In 1975, a new Association of Canadian Archivists was established, launching a new scholarly and professional journal, *Archivaria*, and developing plans for archival education in cooperation with a university.

In Australia, soon after federation in 1901, there were proposals to establish a Commonwealth Archives. The Commonwealth Parliament’s Library took an interest and in the 1920s the Commonwealth National Library brought Australian history collections together. In 1917 the Australian War Records Section was established, which developed in 1925 into the Australian War Memorial, with both museum and archival functions. More extensive national archival developments began in the 1940s, with the establishment of the War Archives Committee in 1942 and the appointment of government archivists in half of the Australian states. In 1944, Ian Maclean was appointed as Archives Officer in the Commonwealth National Library, the precursor to the Commonwealth Archives Office, founded in 1961, which finally separated the archives from the national library.

During the 1950s and 1960s, many archivists in Australia were strongly influenced by practices from the United States, partly because of the famous visit by T.R. Schellenberg in 1954, to give the series of lectures which were the basis of his book published in 1956 as *Modern Archives*; another influence was the visit by Ian Maclean to the United States in 1958 to study American practices. The Commonwealth Archives Office became Australian Archives in 1974 and the Commonwealth Archives Act was passed in 1983.

In 1975 the Library Association recommended winding up its Archives Section and setting up an independent Australian Society of Archivists, which took over the publication of the journal, *Archives and Manuscripts*. This marked the Australian archivists’ emancipation from the library profession. It also marked the beginning of the intellectual contributions made by Australian archivists, confirming the importance of the work by Peter Scott on the record series and encouraging research into the changing role of the archivist, the influence of postmodernism on the profession and the development of the records continuum.

Archival Education and Research

In nineteenth century European countries, the potential loss of archival skills of palaeography and diplomatics led to the establishment of specialist independent schools to teach historical sciences: the Scuola del Grande Archivio in Naples in 1811, the Archivische Unterrichtsinstitut in Munich in 1821, and the Ecole des Chartes in Paris, also in 1821. These schools taught archivists as a specialist professional group, generally separately from librarians. In some countries including France from 1850, only graduates from these schools could be employed in the national archives.

In other countries, the history of archival science as an independent academic discipline has a more recent genesis. In the United Kingdom, university teaching of palaeography, librarianship, local history, and diplomatics developed in the period between the two World Wars. These eventually coalesced into archival education in the immediate postwar period when training schools for archivists were established at the Universities of Liverpool and London in 1947, followed by two courses in the University of Wales (Bangor 1954 and Aberystwyth 1955), together with a practical scheme at the Bodleian Library, Oxford, which ran from 1947 to 1980. Most of these universities offered a 1-year graduate program leading to a Diploma in archive studies. The syllabuses typically comprised subjects including palaeography, archaic languages, diplomatics, English constitutional and administrative history, the study of archival materials, and practical work in a repository. For the next 25 years or so a steady stream of classically trained archivists emerged from the remarkably uniform university schools. Later, new programs emerged, such as archives diploma at University College Dublin from 1973 and the Society of Archivists correspondence course (1980–2000). In the 1990s new subjects, such as records management (at the University of Northumbria) and digital preservation (at the University of Glasgow) were offered. The academics teaching these programs were also active in research, although in the early years, research interests were in diplomatics, palaeography, and historical sciences, mainly undertaken by lone scholars. In the 1990s the archives and

records academics began to move from a scholarly, historical approach to research toward a social science model, which enabled research projects and collaborative and cross disciplinary research to develop. In 2008, there were several active research groups in the United Kingdom, with interests as diverse as community archives and identities, digital preservation and humanities computing, the history of archives and records, and records compliance and management.

American archival education developed rather late by European standards, although there had been calls for such education since the early twentieth century. In the 1930s, the Society of American Archivists established a Committee on Training of Archivists to discuss archival education in the wake of the establishment of the National Archives, which created a need for qualified staff. This committee recommended that archivists should be educated in history or political science, together with a practical training in an archive. The National Archives evolved its own training for staff. Most archivists came into the profession through historical studies. In the 1970s some education programs began in American universities, either in history departments where it often became associated with public history programs, or in library schools. Generally, archives studies formed a small part of the curriculum, which was heavily weighted toward the predominant interests of the parent department. The programs usually included an internship or practical experience project and sometimes required a thesis. During the 1970s and 1980s, there were intense debates between library and history programs about the proper place of archival education. In 1977 the Society of American Archivists published graduate education guidelines in an attempt to produce some uniformity in the curriculum for the profession, although these recommendations endorsed the approach of small numbers of credits for archival studies within wider programs of library science or history. By the late 1990s most programs were in information science schools. A growing number of archival educators were appointed in American universities, estimated by Cox to stand at about 30 faculty by the end of the twentieth century. This group of archival academics undertook teaching and research and enabled an academic discipline to develop, through dissemination, publication, and doctoral research, which began to establish a sound knowledge foundation for the archival profession.

Canadian archival education took a different route from its neighbor, the United States. A range of graduate programs focusing on archival studies were established, first at the University of British Columbia (UBC) in 1981 and then at the University of Manitoba in 1991. Other programs included an archival studies specialization in the Library School at the University of Toronto, which expanded into a broader information studies degree, and courses in the oldest library school in Canada, at McGill University in Montreal, which established archival studies

as a distinct part of its information studies curriculum in 2002. Many of the Canadian schools now have strong research programs, including the INTERPARES projects at UBC.

In Australia, the 1970s saw developments in archival education. Since 1963, the University of New South Wales had offered archives options in its Diploma of Librarianship, but no separate archives qualification existed. In 1973, a new Diploma in Archives Administration began. In the 1990s, archival education in Australia developed significantly, with the Records Continuum Research Group at Monash University, in Victoria and the distance learning program offered at Edith Cowan University in Perth. Each offered something quite distinctive to the Australian, and international, educational scene. Extensive research began into records issues, especially by the Monash University research group, which brought leading thinkers together and generated significant research projects, such as the recordkeeping metadata projects. The publications of these researchers marked a distinctive Australian contribution to the profession.

CONCLUSION

This entry serves as an introduction to the field of archival science and many of the topics which are covered briefly here can be found discussed in more detail in related entries. The first section gave a broad overview of the nature of archives and records. The main section provided some definitions and an introduction to the core concepts and principles which are central to the discipline, including records, archives, and activities; attributes of records; the records lifecycle; the records continuum; provenance and original order; postmodernist ideas around archive fever. The entry concluded with an overview of the professional discipline of archives and records management, a discussion of the key functions of archives and records management services, and a brief history of archival science.

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Archives

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Abstract

This entry provides an overview and comparative analysis of the varied manifestations and roles of archival institutions across the world. The entry argues, and illustrates by example (many of which are from Australia), that archival institutions are contingent and mutable creations with ever-shifting, always-contested forms and missions that reflect the dynamic nature of human experience, aspiration, and activity. A secondary argument of the entry is that archival institutions are simultaneously reflectors of and active shapers of their time and place—institutions whose form and function change as the dynamics of societal power relations evolve and transform around them.

INTRODUCTION

Common dictionary definitions of “archives” state that they are either places where historical records are kept or the organizations responsible for collecting and storing such documents. Beneath such seemingly simple, straightforward, and innocuous definitions lies a fascinating and far more interesting terrain of complex, contestable and dynamic views of archives and their role in society. It is the aim of this entry to explore this interesting terrain—to dig beneath the deceptively unproblematic conventional static view of archives as being merely “dusty old stuff.” In short, there is much more at stake in archives than might first meet the eye.

One of the features that has characterized all human societies since time immemorial has been an instinct for collective cultural self-preservation. While culture is contestable and ever-evolving, human beings nevertheless like their cultures and cultural achievements and experiences to endure across generations. This cultural persistence is made possible through the preservation of stories, both orally and in writing and through dance, rituals, art, music and performance. The keeping of many of these valuable cultural “records” is fostered and institutionalized in an “archive(s).” The forms, functions, and mandates of archival programs and institutions have varied and continue to vary enormously depending on the nature of the society in which they exist and the objectives of those who own or have control of the archives.

This entry provides an overview and comparative analysis of the varied manifestations and roles of archival institutions across the world. One of the aims of the entry is to illustrate by example, some of which come from international archival history while others come from the author’s Australian context, just what mutable creations archival institutions really are. Recognition of this seemingly obvious fact is argued as a counterpoint to any

tendency that other authors may have to argue in favor of universal laws and immutable truths about the nature of the archival institution. While common themes, objectives, and issues can be identified through such a comparative analysis, the main argument of this entry is that there is no universal law governing the form and mission of archival institutions. All archival institutions fulfill their mission by, as a minimum, controlling and preserving the records that constitute the archive, but the nature of the mission served can and does vary from case to case. The ever-shifting, always-contested form and mission of the archive reflects the dynamic nature of human experience, aspiration, and activity in all its infinitely rich variety.

The secondary aim of this entry is to illustrate not only that all archival programs and institutions are the contingent products of their time and place, but also that they are active shapers of their time and place. In the words of Verne Harris, archives “at once express and are instruments of prevailing relations of power.”^[1] Indeed, as we shall see, it is the nature of the prevailing power relations and the particular roles archives play as contested sites of power struggle that determine the forms and functions of archival programs—forms and functions that can and do change as the dynamics of societal power relations evolve and/or transform around them.

ARCHIVES AND HUMAN IMPULSES: THE INSTITUTIONALIZATION AND PLURALIZATION OF THE RECORD

Records are made as a means of conducting and/or remembering activities. They are created for pragmatic or symbolic purposes—as enablers and evidence of experience and activity, as aids to memory and/or as artifacts. Some of these records are consciously retained for future reference as archives in order to transmit the activity and

experience through time. As authors such as James O'Toole and Sue McKemmish have argued, human beings throughout the ages have demonstrated impulses to save and to bear witness.^[2,3] Human beings are the sum of their memories. The nature of their interaction with other humans, indeed their very identity, is determined by their memories. While all memory is cognitive, literate individuals learn to rely at least to some extent on the written word to document, express, and supplement cognitive processes. In turn, these cognitive processes give meaning to the archives for, as Jacques Derrida says, the archive does not speak for itself—users inscribe their own interpretations into it.^[4]

When these impulses move beyond the purely personal and take on a broader collective or societal purpose the archives so retained take on a more formal character. One manifestation of this phenomenon is that the records can become part of an archival program or institution. This institutionalization of the record, which Derrida calls *domiciliation*, marks the passage of information from the private to a collective domain (p. 2).^[4] For instance, when a novelist decides to offer for sale her personal papers to a publicly funded manuscript collecting program and when that program assesses the papers and agrees that they would constitute a worthwhile addition to its collection, the records are simultaneously institutionalized and made public property. The novelist is acting on an individual impulse to pluralize her private records for the benefit of current and future generations, while the broader community is acting (through its publicly funded manuscript collecting program) on an impulse to preserve and provide public access to the evidence of a novelist's creative processes and private life.

There are a wide variety of reasons why records may be institutionalized in this way:

- Organizations need to retain their archives in order to meet their legal obligations, to protect and advance their rights and entitlements, and to retain corporate memory of the decisions and activities of the collective over time to support future decision making and organizational continuity.
- Communities, including entire nations, retain archives as a means of remembering and connecting with their pasts, their origins. There are many complex and subtle variations driving this kind of institutionalization of memory. Eric Ketelaar describes archives in this sense as “time machines”—“a bridge to yesteryear.”^[5] Others describe the need to capture and retain ancestral voices or to listen to the whispers of the souls of long ago.^[6,7] In serving this role archival institutions have much in common with other cultural and memory institutions such as museums.
- Similarly, communities and nations often establish archives to inform, enlighten, educate, and sometimes to entertain. Related to this is the collective need to

support and control storytelling about the pasts and origins of the community. Often archives are retained as a means of expressing, asserting, and preserving a unifying group consensus on the nature of its identity, as forged through a shared history—or alternatively to support competing articulations of group identity and plurality.

- Organizations and communities retain archives for their symbolic significance. Objects stored in the archives can themselves be invested with and convey enormous symbolic significance.^[8,9] The creation of a national archives can be symbolically significant as a form of solidification and memorialization in the context of nation building.^[10] The heavy symbolism of the archives and its contents can in turn cause the archives to be a site of mythmaking and myth perpetuation.^[11] Powerful rulers or administrators often establish archives as symbolic monuments to their own power and as a means of controlling and directing mythmaking activities concerning their achievements. See, for instance, Verne Harris on the role of the South African Archives Service as “an important vehicle for Afrikaaner nationalist historiography, with the legitimization of white rule and the exclusion of oppositional voices being key objectives in the selection policy.”^[12]
- Powerful rulers create archives not only as symbolic monuments to their greatness, but also to legitimize, reinforce, and perpetuate their power. The deeds, treaties, and founding documents in such an archive can legitimize power in a legalistic and evidential sense, while the information on individual subjects and their relationships and activities in such an archive can provide the information such rulers need to control their dominions and perpetuate their power. Moreover, because archives exercise control over selective memory, they are a source of power that is of enormous utility to autocratic rulers. When endeavoring to control the past, deciding what should be forgotten is just as important as deciding what should be remembered. As Antoinette Burton says, “the history of the archive is a history of loss.”^[13]
- Conversely, in democratic societies archives are meant to enable democratic accountability by providing access to the evidence of governance that can empower citizens against potential maladministration, corruption, and autocracy. In addition to, or perhaps instead of, protecting the rights and entitlements of rulers and governments, such archives are meant to protect the rights and entitlements of the governed. In the words of John Fleckner, such archives are bastions of a just society where “individual rights are not time bound and past injustices are reversible,” where “the archival record serves all citizens as a check against a tyrannical government.”^[14]

As it will be seen, these reasons for the existence of archival institutions are not mutually exclusive. Most such

institutions exist for a combination of these reasons. Indeed, many archival institutions struggle either consciously or subconsciously with the ambiguities, complementarities, and contradictions associated with serving these multiple purposes, whether the purposes are served explicitly or implicitly. The ongoing crisis of identity of government archives in democratic countries is a major theme of this entry. Are archives a part of government or a check on it? Do government archives exist to serve the legal and administrative needs of government and/or the people, or do they exist primarily as cultural and memory institutions? How do archival institutions balance the often-competing demands of public and private interests and the differing imperatives of public and private records and their uses? What is the interplay of symbolic roles with these other functions and mandates? Most importantly, what factors influence responses to these dilemmas in practice and what are the consequences of the different responses?

Of course, being brought under the control of an archival institution is not the only form of institutionalization that can be experienced by records. Registrar style arrangements in public administrations, identification by auditors, records commissions and/or documentation programs are all examples of alternative forms of institutionalization, some of which will be explored later in this entry.

INSTITUTIONAL FORM AND FUNCTION SINCE THE DAWN OF TIME

Ernst Posner has argued that the first archives were created by the Sumerians in the middle of the fourth millennium B.C. These records took the form of clay tablets with cuneiform characters. The archives were used to support commercial activity and property ownership. Later ancient societies such as the Hittites, Assyrians, and Mesopotamians all kept archives, although one can only speculate today on just how institutionalized these archives were and what form, if any, such institutions took? In at least some of these societies, archives were kept in temples and courts for religious, legal, administrative, commercial, and genealogical purposes.^[15]

During the second and third millennium B.C. the Egyptians developed an extensive system of archives to support their empire, as did the later Persian Empire. These archives existed primarily to serve the legal, administrative, and military purposes of the rulers. An early indication of the perceived role of archives as tools of political oppression occurred in Egypt around 2200 B.C. when, during a revolt, an angry mob destroyed a records office “as the custodians of hated property rights.”^[15] Persian archives often incorporated the captured archives of defeated governments to help establish control over the newly occupied territories.

Archives in China can be traced back almost as far as the Sumerians. These records were inscribed on bones and tortoise shells for religious, administrative, and symbolic purposes. By 700 B.C. bamboo, silk, and stone tablets were in use, with records of military value being stored in secure buildings. While the Egyptians used papyrus, the Chinese began using plant fiber paper after 200 B.C. The Chinese also demonstrated an early interest in the use of archives to control the writing of history. In the first century A.D. the Han Dynasty established a Bureau of Historiography.

The Greek city-state of Athens began housing its archives in the Metroon, the temple of the mother of the gods next to the courthouse, by around 400 B.C. This archive contained laws, decrees, minutes, financial and diplomatic records, contracts, records of court proceedings, and manuscripts of plays by Sophocles, Euripides, and others. In what was perhaps the first example of an archival institution fulfilling the function of public access to records and consistent with the democratic principles of Athenian government, private citizens could obtain copies of the records in the archives.

The power that resides in the archives is illustrated in the etymology of the word archives, which can be traced to this time. The Greek *archeion* referred to the office of the magistrate or *archon* and the records kept by that office. *Archontes* wielded executive power, which in large part was legitimized by the legal documents in the *archeion*. Similarly, the Greek *arkho* meant to command or govern. The Latin *archivum* was likewise the residence of the magistrate and the place where records of official legal and administrative significance were kept.

Rome's first public archives was founded about 509 B.C. in the Aerarium, or treasury, of the temple of Saturn and housed laws, decrees, reports, and financial records. Like the Metroon, the laws housed in this archives could be consulted by all citizens. When the Aerarium was destroyed by fire in 83 B.C. it was replaced by the Tabularium, a large stone building. In later imperial Rome the Tabularium adopted a narrower mission as the archives of the Senate. It was supplemented by imperial archives and a network of provincial, municipal, military, and religious archives. Various emperors, most notably Justinian I, were keen advocates of archives. The Justinian Code of 529 A.D. was not only written with the assistance of archives, it also included a section on the role of archives and archivists. This code emphasized the importance of archives as a public place of deposit and as guarantors of the integrity and authenticity of the records housed therein.

Most medieval European archives were maintained in ecclesiastical settings, often in “muniment rooms.” By the middle of the sixth century a papal archives had been established. In the eighth century, the Venerable Bede was able to make use of archives to write his landmark history of the church in England. Following the collapse of

the Roman Empire a number of municipal archives persisted in Italy and France until the ninth and tenth centuries. Venice and Florence established archives during the eleventh and thirteenth centuries respectively. It was common practice for royal archives in Europe to have no fixed location, but instead to travel with the King's household. Toward the end of the twelfth century, however, there were some moves toward the establishment of a central government archives in England. A century later Exchequer rolls began to be housed in the Tower of London.^[16] In time, this archives was expanded to include all of Britain's Chancery records. In 1323, the first inventory of English archives was completed and served as a model for similar initiatives elsewhere in western Europe. In 1346, the archives of the kingdom of Aragon were created.^[17]

In 1524, the archives of the crown of Castille was established by Charles V at Simancas near Valladolid. The archive was greatly expanded by Philip II, who regarded archives as vital for controlling, administering, and legitimizing an empire and who also viewed archives as symbols of power and prestige. The Simancas archive is now regarded as the classic prototype of a centralized "national archives." Two hundred years later the Archives of the Indies was established in Seville for the same reasons. When Cortes conquered the Americas, it was considered essential to not only burn the archives of the conquered Incas and Aztecs,^[18] but also ensure legitimate documentation of the occupation by a legally appointed Notary, whose records were eventually deposited in archives back in Spain.^[19] Between the sixteenth and early eighteenth centuries royal archives repositories were established in France, Sweden, Denmark, and China. The combined effect of the advent of the printing press and the emergence of the modern administrative state generated a significant growth in records creation and, as a consequence, archives holdings.

The creation, control, and use of archives became increasingly important in the context of religious, legal, and political power struggles such as the Reformation and parliamentary reform movements, when opposing factions used records to support their arguments. The Renaissance had created demand for access to information for the purpose of supporting scholarly enquiry as opposed to the more common political, financial, legal, administrative, and symbolic purposes. Nevertheless, access to archives was strictly controlled by their owners, usually monarchs or churches, who very often kept them inaccessible to all except themselves and their functionaries.

THE FRENCH REVOLUTION AND THE NINETEENTH CENTURY

The French Revolution provides perhaps the clearest example of the mutable nature and purpose of archives

and their tendency to inspire extremes in human emotion. Between 1789 and 1793, much of the archives of the *Ancien Régime* were attacked and destroyed by mobs or in state-sponsored bonfires and paper recycling campaigns, with the aim of obliterating what the revolutionaries regarded as symbols of their erstwhile oppression. While such actions might sometimes have had the practical benefit of destroying the evidence of feudal debts and obligations, by and large they were cathartic acts of retribution and ritual cleansing of the body politic.

In the midst of this destruction of old archives there coexisted a desire to create new archives, out of which emerged a new archival system for the new society. A legislative repository was provided for by the new Assembly just two weeks after the fall of the Bastille. In September 1790 a law was passed establishing a new National Archives that was to be open to the public and which was to report to the Assembly. By 1794 the desire to destroy the documentary evidence of the *Ancien Régime* had been replaced by a desire to preserve and manage those records as nationalized public property, reinvented for the purpose of symbolically highlighting the glory of the new Republic in contrast to the sinful decadence and oppression of the old regime. A decree issued in June 1794 granted the National Archives jurisdiction over the records of government agencies, provinces, communes, churches, universities, and noble families, thus creating the world's first centrally controlled national archival system. The same decree also proclaimed the right of public access to these records, thus establishing the first modern instance of archives fulfilling a legal role as protectors of the rights and entitlements of the people and as instruments of accountability and transparency in government. The creation of national archives as both symbols of nation building in the midst of turbulent change and ideological—indeed almost mythological—assertions of legitimacy by new orders is a pattern that has been repeated often since. The fate of the archives of the *Ancien Régime* testify to the fact that no archives can assume an eternal mandate—in the words of Judith Panitch, they are forever "subject to the judgment of the society in which they exist."^[19,20]

Another aspect of the impact of the French Revolution on archives is worth exploring at this point. Luciana Duranti has argued that the 1794 decree created for the first time a dichotomy between administrative and historical archives—the distinction between the archives of the Republic and the archives of the *Ancien Régime*. Duranti considers this an unfortunate development in that it represents a usurpation of the administrative and legal functions of archives by social and cultural functions—a usurpation that has echoes in various places and times since the Revolution.^[21] Other commentators, however, beg to differ. Judith Panitch, for instance, argues that in the 1790s the notion of French archives as sites of "historical or cultural scholarship had yet to take hold." While they had acquired the new function of public access for the new purpose of

accountability, their essential role as legal, administrative, and symbolic institutions remained unaltered.^[22]

Nevertheless, Duranti is correct in highlighting the distinction between the administrative/legal and cultural/historical roles of archives—a source of contestation that shall be explored in more detail later—even if the cultural role of French archives did not become apparent until some decades after the Revolution. Duranti's portrayal of one role as being innately superior to another is, however, a position that is far more difficult to sustain, as we shall see. Nor, as we have already seen, is it true that the world had to wait until the late eighteenth century to witness an example of an archives that was established for cultural and historical purposes. While such phenomena were indeed unusual, they were not unprecedented—see for example the case of the Han Dynasty Bureau of Historiography referred to above.

The creation of a centralized national archives in France provided a model for archival development in a number of other countries such as Finland, Norway, the Netherlands, and Belgium during the nineteenth century. Similarly, in Sweden, Denmark, and Prussia central archives evolved out of pre-existing royal or administrative repositories. Forty eight years after the creation of the French national archives, the English followed suit, but for very different reasons and in much less dramatic circumstances. Between 1800 and 1837 a variety of committees and commissions of inquiry had highlighted the scattered and poorly controlled and preserved state of public records in that country. These efforts culminated in the passage of the Public Records Act in 1838 and the eventual establishment of the Public Record Office during the 1850s by a government that was concerned to ensure the proper care and preservation of records that guaranteed the legal rights and entitlements of English people. Lawmakers in Westminster were no doubt aware of the fact that their counterparts in Scotland had beaten not only themselves but also the French in establishing a national archives, when the principal collection of Scottish public records had been assembled in Edinburgh's General Register House as early as 1784.

By the middle of the nineteenth century the growth in historical scholarship based on the use of written sources was becoming an important factor in the evolution of European archival institutions. Selected series of historical documents were published, such as the "Roll Series" and the "Calendars of State Papers" in England. In 1869, the Historical Manuscripts Commission was established in the United Kingdom to identify, describe, and promote the preservation and use of significant historical records that were not otherwise catered for under the Public Records Act. The Commission, which existed until April 2003 when it was amalgamated with the Public Record Office to form a re-branded National Archives, is probably the best example of a state-sponsored documentation program for the nationally distributed holdings of historically significant private records.

ARCHIVAL INSTITUTIONS IN THE TWENTIETH CENTURY: THE POSTCOLONIAL ERA

Globalization, the spread of modern bureaucracies and the worldwide interest in history and cultural/national identity together provided the impetus for the emergence of archival systems around the world during the twentieth century. Soon after the Bolshevik revolution the Soviet Union established a highly centralized archival system as both a reflection and enabler of centralized state power. In contrast to democratic states, access to archives in totalitarian states was not a guaranteed right of the citizen.

In Asia, Latin America, Africa, and the South Pacific, European colonial powers were responsible for the creation of administrative archives that in turn formed the basis for national archives once independence was achieved.^[23,24] For instance, the National Archives of Malaysia was established in 1957 and was based on the model of the Public Record Office in London.^[25] In Vietnam the French colonial administrators established an Archives in 1917. This was eventually superseded by the State Archives Department in 1962, which in turn was consolidated by the 1982 Decree on the Protection of National Archives Documents. The scope of this decree is, however, limited to government records.^[26] In many such territories archival development has also benefited from a strong precolonial archival tradition. Thailand, which was never colonized by a European power, inherited an impressive system of royal legal/administrative and cultural archives of palm leaf manuscripts and bark paper stretching back many hundreds of years. This system was overlaid with a more western approach, including the adoption of a registry system, during the late nineteenth century. In the early twentieth century records retention schedules were introduced and a National Archives was established in 1952 with responsibility for preserving the historical records of government administration.^[27]

A common feature of archival institutions in the postcolonial developing world is that institutions established with the best of intentions on a European model have often struggled to fulfill expectations in the harsh economic and political reality of independent governance. Just as these emerging nations have struggled to consolidate inherited democratic institutions, so too have inherited archival institutions often failed to establish themselves as robust organic components of the culture and governance of postcolonial societies. (See, for instance, the summary of current issues and developments from the Proceedings of the 9th Conference of the Pacific Regional Branch of the International Council on Archives.)^[28,29] Not only have administrators often been inclined to view archives as at best luxuries and at worst irrelevant western white elephants, but also citizens living in predominantly oral cultures have often been slow to develop attachments with institutions primarily associated

with preservation of the written word for use by western academics.^[30] Indeed, an interesting variant on the traditional archival institutional model in non-Western territories has been the emergence of alternative forms of memory institutionalization such as so-called “keeping places”^[31] and memory institutions that deal primarily with orality in preference to written records.

Archival institutions in these territories are having to develop flexible new conceptions of indigenous knowledge ownership, control, and access in response to a rejection of the inappropriate aspects of Eurocentric archival theory, which support the systematic marginalization and dispossession of the indigenous by dominant global discourses. The more successful of these have been able to demonstrate the potential of archives to support the rediscovery of suppressed cultural identities and the redressing of past injustices.^[32] Indeed, the often-tenuous place of archival institutions in oral societies tells us much about the mutable and contingent nature of such institutions. While many have endeavored to increase their relevance by instituting oral history programs, others argue that such activities fail to comprehend the difficulties involved in converting fluid orality into fixed material custody without destroying the very thing that the archives is trying to capture. In the words of Verne Harris there exists “A reluctance to engage indigenous conceptualizations of orality not as memory waiting to be archived, but as archive already.”^[33,34]

ARCHIVAL INSTITUTIONS IN NORTH AMERICA

Contrary to the more usual pattern of legal/administrative archives gradually acquiring a cultural/historical role (or alternatively being supplemented by the establishment of separate cultural/historical records programs), in North America the primary impetus for the creation of archival institutions were cultural/historical imperatives. The Public Archives of Canada was established in 1872, only 5 years after confederation, following a petition to government by the Quebec Literary and Historical Society. Of particular concern to Canadian historians was the desire to have access to records of Canadian historical interest held in Britain and France. Driving the cultural/historical interest was a perceived need to build national unity and identity through the study of the origins of the Canadian people. Although the Public Archives of Canada lacked both proper facilities and a legislative mandate during its early decades, these shortcomings were rectified in 1906 with the construction of an archives building and in 1912 with the passage of archival legislation. This legislation was informed exclusively by the need to preserve records for historical rather than for legal/administrative purposes.

From its outset the Canadian archival endeavor encompassed both public and private records, a concept later articulated as “total archives.”^[35,36] The total archives

concept reflects a long-standing social consensus that public funds should be used to preserve a wide range of Canadian documentary heritage, regardless of its origins and format, and that this preservation effort should be pursued via a planned national system. As a result Canada has not experienced the emergence of separate (and sometimes warring) archival tribes or traditions for public records and historical manuscripts, as has been the case in the United States and Australia. With Canadian national identity constantly at risk of being swamped by the more dominant identity of its southern neighbor, recognition of the need to take coordinated action to preserve something distinctly Canadian has compelled generations of Canadians to take a holistic approach to the preservation and management of their archival heritage. The National Archives of Canada (since 2004, Library and Archives Canada) has, at least in theory, always given equal priority to the preservation of records originating in the private sector and to the preservation of records originating in the public sector. Nevertheless, it was not until the 1950s that the then Public Archives of Canada began to exert authority over public records and perform the legal/administrative role that provided the original basis for its counterpart institutions in Europe.^[37,38]

Like Canada, it was cultural/historical concerns that led to the creation of a national archives in the United States. Unlike Canada, which wasted little time in establishing a central archival program, the United States had to wait until 1934—over 150 years after the Declaration of Independence—before its national archives was established. This represented the culmination of many decades of agitation by historians, most notably the American Historical Association. By that time the desire to rescue, preserve, and provide access to historical records had manifested itself in the emergence of the so-called “historical manuscripts tradition.” This tradition, which dated back to the earliest years of the nation, had been shaped by an antiquarian collecting instinct and had become institutionalized in organizations such as state historical societies and the Library of Congress, where the main focus was the collecting, researching, and publishing of the private papers of prominent individuals.

Why did the United States take so long to establish a national archives? In 1939, Ernst Posner argued that a major contributing factor was American ambivalence, if not hostility, toward state bureaucratic power. So, while manuscript collecting endeavors pursued for scholarly purposes were considered laudable, proposals to create an archival institution as an integral part of the state bureaucracy was something that was regarded, at least subconsciously, with suspicion.^[39] Americans had to wait until the latter part of the twentieth century before there was a clear articulation of the role of archives as guarantors of the democratic rights of citizens and as means of holding public officials to account—a role that, while recognized as an ideal, is yet to be fully realized both in practice and in public perception.

Just as the Public Archives of Canada was established for historical purposes and had to wait until the 1950s to acquire an administrative/legal role, so too the U.S. National Archives had to wait until 1950, with the passage of the Federal Records Act, before it acquired a role as a supporter and enabler of public administration. Public records archivists such as Margaret Cross Norton from Illinois pursued a campaign to articulate and assert an administrative and legal accountability role for archives in the face of the primacy of the historical/cultural role.^[40] While Norton had very good reasons for pursuing these efforts, they had the unfortunate effect of creating a polarization of the American archival community—a polarization that persists to this day in a profession which seems unable to attain a comfortable and balanced view of the dual role of archival institutions.^[41,42]

The American experience highlights in sharp relief the tensions and contradictions that have emerged in the roles of archives worldwide since the nineteenth century and which represent contested ground everywhere. Arguably, the polarization is more pronounced in the United States because there is more at stake. Archives in Europe were initially established for legal and administrative purposes, thus conferring on them a valuable legitimacy in the eyes of government that has enabled them to acquire a cultural/historical role from a position of strength. In contrast, at the time of their establishment American archives had no such legal/administrative legitimacy and have had to struggle ever since to attain such a role and the government support and funding that it could attract. The addition of democratic accountability to the legal/administrative role by proponents such as Margaret Cross Norton merely helped the struggle to work against itself. So, while the general public may be suspicious of the legal/administrative role of archives and supportive of the accountability role, the reverse is very often the case from the perspective of those that control the corridors of power in government. Once again we see the mutable nature of archives and the fact that they are forever subject to the judgment of the societies in which they exist.

PUBLIC RECORDS INSTITUTIONS IN AUSTRALIA

The emergence of archival institutions in Australia mirrors in many respects the experience of the United States. As in the United States, the establishment of government archival authorities was the result of advocacy from historians, with a unique Australian contribution coming from leading librarians. In most jurisdictions the government archives programs started their lives as units within the government research libraries, which themselves inherited control of colonial-era records from heterogeneous administrative locations.^[43,44]

The decision to establish a Commonwealth Government archives was made during World War II, 40 years

after Federation, and was informed primarily by the desire to “ensure the availability of material for the preparation of a history of the war.”^[45,46] The Archives Division was initially located administratively within the Commonwealth Parliamentary Library, later the National Library. Despite these cultural/historical origins, early Commonwealth archivists were heavily influenced by the legal/administrative tradition as embodied in the writing of English archivist Sir Hilary Jenkinson. While this was partly a reflection of the British origins of the Australian bureaucracy, it also reflects the simple fact that Jenkinson provided the only archival handbook in the English language to which neophyte archivists could turn for guidance.^[47,48]

Two North American visitors to Australia exerted a significant subsequent influence on archival development in Australia. T.R. Schellenberg from the U.S. National Archives and W. Kaye Lamb from Canada were both firmly of the historical/cultural tradition. Schellenberg toured Australia in 1954 on a Fulbright Fellowship at the invitation of National Librarian Harold White.^[49] Perhaps Schellenberg’s most enduring legacy in the Australian profession was his philosophy regarding the appraisal of voluminous modern public records. While Schellenberg’s cultural/historical message may have registered well with Harold White, the government archivists themselves were determined to stick to the Jenkinsonian path—a determination that manifested itself in a desire to break free from their cultural/historical roots and what they saw as the ill-informed control of librarians. Doubtless also by this time, the North American debates surrounding the campaign of Margaret Cross Norton were resonating in Australia. Despite their philosophical differences on the role of archival institutions, the local Jenkinsonians nevertheless also found in Schellenberg an ally in their arguments in favor of separation from the Library. A Committee of Inquiry recommended separation of the Archives Division from the Library, influenced partly by the differences between the two professional disciplines and partly by the view that the role of the Archives was to manage government records for the benefit of the government and its departments—a very different role than that asserted by Harold White of building a systematic record of national life and development.^[50]

In 1961, the Commonwealth Archives Office separated from the National Library. The newly independent Office then proceeded to bury itself deep into the Federal bureaucracy and largely turn away from any cultural/historical role—indeed from the rest of the profession in Australia, a situation that persisted into the 1990s. The most positive aspect of this bureaucratic focus was, through the efforts of Ian Maclean and Peter Scott, the development of an innovative and enduring Australian school of thought on the management and intellectual control of current records.^[51–53] Nevertheless, throughout the 1960s and 1970s the Australian Archives, as it became known in

1974, proved to be ambivalent about pursuing an active role in support of democratic accountability in the manner that opinion leaders such as Sir Paul Hasluck and Margaret Cross Norton had advocated. It appeared to define its role solely in terms of supporting the administrative and legal requirements of the Commonwealth Government.^[54,55]

At this time the Government was contemplating the need for legislation to govern the work of the national archives. Canadian Dominion Archivist Kaye Lamb was invited to investigate and recommend a way forward. Lamb's 1973 report was critical of the lack of support and assistance provided to researchers by the Archives and recommended legislation that gave the organization a broad cultural and administrative mandate and a leadership role at the centre of a national archival system.^[56] Lamb's recommendations were eventually enacted in legislation with the passage of the Archives Act in 1983—itsself part of a suite of administrative law reform bills including a Freedom of Information Act. This law created the Archives as a quasi-independent entity with an appointed Advisory Council.

While the advent of legislation gave the Archives a mandate to pursue a range of activities, during the 1980s only those activities relating to a narrowly defined administrative/legal role were pursued with any vigor. Although lack of resources and institutional inertia help explain this situation, changes initiated by George Nichols as Director-General during the 1990s resulted in the Archives pursuing a vibrant and proactive role as both a cultural institution^[58] and an agent of democratic accountability.

In State Government jurisdictions archival institutions have suffered from a variety of malaises including underfunding, lack of public visibility, and control by the sometimes stifling hand of librarians. More recently, however, new public records legislation in a number of jurisdictions has given State and Territory archives greatly enhanced powers as cultural institutions and as semi-independent agents of democratic accountability. In many cases these positive developments have been assisted by spectacular examples of failed public administration, assisted at least in part by a lack of regulation regarding public recordkeeping.^[58–60] Time will tell if the State and Territory Archives are given the resources and the true independence both to reinvent themselves organizationally and pursue their new mandates with the vigor that they deserve.

THE COLLECTING TRADITION IN AUSTRALIA

An Australian equivalent of the Historical Manuscripts Tradition, in the form of a network of State and Commonwealth Government research libraries, was the first to apply serious endeavor to the business of identifying, preserving, and making available valuable archival materials.

These efforts grew out of the antiquarian work of private collectors and historical societies and, until the 1940s were characterized by a desire to preserve documents relating to the origins of European settlement in Australia. The Mitchell Library, opened in Sydney in 1910, was founded on the bequest of the prodigious collector David Scott Mitchell. Similar, though less extensive, collections of personal papers preserved along side other categories of historical source material were subsequently established in State Libraries in each of the other jurisdictions.^[61]

During the 1950s and 1960s there was an almost exponential expansion in the institutional collecting of private archives in Australia. At the forefront of this expansion was the National Library in Canberra,^[62,63] but also significant was the emergence of new collecting programs such as the University of Melbourne Archives^[64] and the Australian National University's Archives of Business and Labour, which have specialized in collecting the records of Australia's leading businesses and trade union organizations.^[65] In large part this expansion reflected a similar expansion in the study and teaching of Australian history in Australia's rapidly expanding university system. According to Stuart Macintyre, the number of full-time professors and lecturers in history in Australian tertiary institutions expanded from fewer than 20 in 1939 to more than 700 in 1973.^[66]

The emergence of new collecting programs and the simultaneous expansion and shift in collecting emphasis by the existing programs stemmed from a desire to serve the needs of this expanding researcher clientele. Both phenomena reflected a more self-confident, nationalistic, and prosperous Australia, a nation that was keen to apply the methods of scientific history to the task of understanding and articulating a national identity. There was also continuity between the old amateur collecting paradigm and the new professional, institution-building paradigm. Both types of collecting constituted, in the words of James Clifford, "a form of western subjectivity" and a "crucial process of Western identity formation."^[67] Human beings are storytelling creatures. Every society develops mechanisms for the formation and persistence of collective memory for storytelling purposes. Archives, when they pursue a cultural/historical role, provide one such mechanism that will very often secure and retain the support of the society in which they exist.

Just as the growth of social history, with its commitment to uncovering the lived experience of ordinary people, provided a major boost to the collection and preservation of textual archives, so too did it foster the growth of associated documentation and preservation programs such as oral history, film and sound archives and, more recently, computer data archives. The National Library commenced gathering and preserving sound recordings and transcripts of oral history interviews with prominent Australians during the 1950s as an adjunct to its manuscript collecting program. Initially based on the

Columbia University model of an oral history program, the Library's efforts have since expanded to encompass thematic social history projects such as the history of the timber industry and documentation of the HIV/AIDS epidemic. The Library's oral history holdings now include some 30,000 hr of original recordings. The program also incorporates a component of field recordings of folkloric tales and music, similar to that pioneered by the U.S. Library of Congress.^[68] Over 400 similar, though much smaller, oral history collections have been established in libraries and archives such as the Northern Territory Archives Service.^[69,70]

The National Library also pioneered the collecting of another category of Australia's documentary heritage in the form of films and sound recordings. As early as 1935 the Library established (as a result of a Cabinet decision) a "National Historical Film and Speaking Record Library." After some years of lobbying by the film and sound industry and others, the National Film Archive and Sound Recording Section were eventually separated from the Library in 1984 as a new institution called the National Film and Sound Archive (NFSA), with its headquarters in Canberra. Although it currently lacks a strong legislative mandate and the kind of bureaucratic independence that is enjoyed by both the National Library and the National Archives, the NFSA enjoys a solid international reputation for professional excellence in the field of film and sound preservation and is an active participant in international professional forums such as the International Association of Sound Archives (IASA) and the International Federation of Film Archives (FIAF). For the most part the NFSA restricts its collecting activity to the output of the Australian private sector media industries, with the various public records archives in each jurisdiction being responsible for the control and preservation of archival value audio visual records produced in the public sector.^[71-74]

Another strand in the collecting archives scene can be found in the area of data archives. The leading archive of this type in Australia, the Social Science Data Archives, was established at the Australian National University in 1981. Its brief is to collect, preserve, and make available for use computer readable data and statistical sets emanating from social, political, and economic research projects in the disciplines of the social sciences. The creators and depositors of these data sets include academics, government and private organizations, and individuals. Such initiatives are consistent with an international tradition of data archiving in the sciences and social sciences, as represented by the activities of the International Federation of Data Organisations and institutions such as the U.K. Data Archive, based at the University of Essex. In recent years data archives have made great use of the World Wide Web to help identify and disseminate qualitative and quantitative statistical data sets for secondary use research and learning.

Unlike their public records counterparts, collecting archives programs have been little troubled by existential dilemmas caused by the need to either combine or choose between the often conflicting roles of supporting a bureaucracy, enabling democratic accountability and supporting cultural/historical endeavor. The collecting archives' sole *raison d'être* is a cultural/historical one. In this, they have much in common with museums, which are themselves significant players in the collecting and preserving of archival materials in Australia.^[75] For instance, one of the country's best known museums, the Australian War Memorial in Canberra, also acts as a collecting archive and as a repository of Commonwealth records relating to Australia's various military endeavors.^[76]

The expansion in funding for archival collecting activities during the 1950s and 1960s provides ample evidence of the value Australian society placed on the pursuit of their role of documenting society by means of collecting.^[77] Today the funding and relative fortunes of the collecting programs may not appear as impressive as they were during this earlier period of rapid growth. This is in part a reflection of declining support for academic history coupled with changes in historiographical philosophy, which nowadays places less emphasis on finding "truth" in source documents. Certainly the quantity of holdings, in terms of items and shelf meters, in Australia's various collecting archives today is dwarfed by that of the public records institutions. Nevertheless, the collecting archives enterprise in Australia today remains impressively robust and continues to enjoy good public support and a reasonable, though sometimes uncertain, level of funding, including the provision of taxation incentives for donors in the form of the Commonwealth Government's Cultural Gifts Program.

In the field of science and technology the work of collecting archives is also complemented by the long-standing contributions of the University of Melbourne's e-Scholarship Research Centre, formerly the Australian Science and Technology Heritage Centre (first established as the Australian Science Archives Project in 1985). This noncollecting archival documentation program locates, identifies, describes, and publicizes significant archival material relating to scientific endeavor in Australia and, when necessary, arranges for the preservation of such records by a suitable collecting organization (see the Center's Website at <http://www.esrc.unimelb.edu.au/>).

The distributed national collection of private records in Australia is, however, not without problems. Graeme Powell has highlighted the lopsided nature of these holdings—the fact that certain areas of activity such as politics and literature are very well represented, while other significant areas of human endeavor in Australia are grossly underrepresented.^[78,79] Doubtless a contributing factor to this is the ad hoc acquisitions policies of the various collecting programs, a problem accentuated by a lack of a

centrally coordinated national archival system,^[80] such as exists in many other countries.

BUSINESS ARCHIVES IN AUSTRALIA

At the beginning of this entry it was argued that many archives combine multiple roles. Good examples of this can be found in Australian business and university archives. Mention has already been made in our examination of collecting archives of the University of Melbourne Archives and the Australian National University's Archives of Business and Labour (now called the Noel Butlin Archives Centre). Both archives were established with the main aim of collecting the records of Australian businesses, primarily to serve the needs of economic historians. In the case of the Australian National University this occurred at the instigation of historian Noel Butlin, while in Melbourne the initiative came from one of the most interesting and significant groups ever to exert an influence on recordkeeping in Australia, the Business Archives Council of Australia (BACA).

BACA was established at the University of Sydney in 1954 and was modeled on the British Records Association. It brought together historians, archivists, librarians, and businessmen with the aim of promoting awareness among the business community of the importance of and methods for preserving valuable business records in order to support the pursuit of business history. Initially the aim of BACA was to encourage good recordkeeping within companies, including the establishment of in-house archives. The collecting of business records by other organizations was very much an afterthought. A Victorian Branch of BACA was established in 1957 at the suggestion of the ubiquitous and indefatigable Harold White. White used his contacts with senior Melbourne librarians, history professors, and captains of industry to assemble a formidable alliance of business archives advocates. Inevitably, White was attracted to this endeavor by the prospect of eventually enriching the National Library's collection with the records of some of Australia's leading businesses. This collecting aim was, however, a longer term objective. To achieve that objective White recognized that the collecting archives had to both establish a positive working relationship with the potential donors and also provide immediate assistance to businesses to ensure that the most valuable records were properly identified and managed by their creators in the short term. By emphasizing the business benefits of the latter to his corporate audience White hoped to also achieve the former—a positive working relationship that could lead to later donations of records from the corporate sector.^[81]

The Victorian Branch of BACA was based at the University of Melbourne, where leading historians like John La Nauze and Geoffrey Serle decided that Melbourne should emulate the collecting efforts that Noel Butlin was

energetically pursuing in Canberra. Before long, Harold White found himself in collecting competition with not one, but two university archives. Eventually White agreed that the National Library would leave the collecting of business archives to the universities, but the concession was not granted without a bitter struggle. In the meantime White, Frank Strahan (inaugural University of Melbourne Archivist), and others had pursued a campaign under the auspices of BACA to educate businessmen in the fundamentals of professional records management, using the argument that good recordkeeping is good for business. This was a rare and relatively successful example of archivists with overriding cultural/historical objectives adopting and pursuing objectives associated with supporting the business needs of organizations (pp. 77–85).^[81]

The innovative adoption of a dual historical/administrative role by archivists operating in a private sector records environment proved to be quite successful, especially considering the relatively low level of total resources that constituted the combination of BACA and the two university archives. A survey of the state of Australian business archives conducted by Simon Ville and Grant Fleming in the late 1990s found a remarkably high retention rate of archives of Australia's top companies for the first 60–70 years of the twentieth century—preserved either by in-house archives such as the Archives of Westpac Bank or BHP Billiton or by collecting archives.^[82,83] It is not unreasonable to attribute this success, at least in part, to the work of BACA and the major collecting archives. Sadly, they and others have noted an alarming decrease in the preservation of significant Australian business records dating from the early 1970s after BACA had effectively ceased to operate, a situation that may also reflect a decline in interest in economic history in the tertiary education sector.^[84,85]

EDUCATIONAL AND RELIGIOUS ARCHIVES IN AUSTRALIA

The significance of the role of two university-based collecting archives, the Noel Butlin Archives Centre and the University of Melbourne Archives, has already been discussed in some detail. Similar collecting programs have also been established at university archives in Wollongong and Newcastle and at the University of New England in Armidale and Charles Sturt University in Wagga Wagga, each of which adopt a regional emphasis in their collecting programs.^[86,87] The University of Queensland's Fryer Library has for many years collected records associated with literary endeavor in Australia as, more recently, has the Australian Defence Force Academy's Library in Canberra. These university-based collecting archives are generally the product of the energies of enthusiastic and committed individuals responsible for the creation and

continued existence of collections that relate to their research interests. In theory they exist primarily to support the research and teaching activities of the university concerned, although in practice their continued existence often relies on patronage and is, as a consequence, tenuous.

Equally precarious is the existence of in-house university archives responsible for the universities' own records. While most of Australia's 38 publicly funded universities have records officers and/or records managers, they do not always have an in-house archives. Those in-house archives that do exist find themselves in a variety of structural reporting arrangements, with some reporting to the university librarian and others associated with the administrative/chancellery arm of the university. In many cases the in-house archives that do exist are severely under-resourced. As a result of recent legislative changes in some State jurisdictions, university recordkeeping requirements are now more formally mandated, with the relevant State Archives exercising overall responsibility for setting recordkeeping standards and authorizing the destruction of university records.

Some university archives combine a collecting and an in-house function. Don Boadle has argued that this marriage is not always a successful one, with university administrators and in some cases the archivists themselves being unable to articulate a clear and compelling mission for a unified archival program. Indeed, in some cases it could be argued that the combined function has resulted in an identity crisis that suggests the worst of both worlds rather than the best of both worlds.^[88–90] As with many of their State and Commonwealth Archives colleagues, these archivists have struggled to achieve consensus on the value of simultaneously pursuing legal, administrative, cultural, and accountability roles, much less consensus on how such an integrated vision might actually be pursued and achieved in an environment where support from senior university administrators is often ambivalent at best. Moves toward a national or even State-based strategy in this area will, if past experience is any guide, struggle in the face of the tendency by universities to guard their independence and autonomy with jealousy and vigor.

Finally, there exist a very large number of in-house archival programs in Australia's various independent (nongovernment) schools and religious organizations. These programs are often staffed by part-time and/or volunteer staff and struggle to attain resourcing commensurate with the scope of their operations.^[91] Church archives house records of dioceses, parishes, and/or religious orders. In recent years their work has been thrust into the spotlight because of the role churches played in the now controversial and emotive issues of child migration and the Aboriginal "stolen generations." The access policies of these archives have been greatly tested in the context of the churches coming to terms with their role in these unfortunate episodes of Australian history and their

relationships with aggrieved individuals who were separated from their families and often badly mistreated in the hands of church officials.^[92,93]

ARCHIVES AS A PLACE AND VIRTUAL ARCHIVES

Throughout the ages one of the regularly recurring functions of archival institutions is to provide a secure place for the safekeeping of valuable records to guarantee the ongoing legal authenticity of those records. This is especially common for archives that serve solely or primarily a legal/administrative role, where control and possession of the records is recognized as a source of power. Luciana Duranti has highlighted the importance of this function in archives stretching back to the days of the Justinian Code and the Tabularium in Ancient Rome, while Michel Duchein has identified the same issue as being important to archives in Flanders and Hungary. One of Sir Hilary Jenkinson's more influential contributions to the archival discourse is the related notion of the need to guarantee an uninterrupted transmission of custody from records creator to archival institution—the physical and moral defense of the record. Duranti has argued that when records "cross the archival threshold" they are attested to be authentic and henceforth guaranteed to be preserved as such by an archives that is independent from the records creating office and for which the preservation of the authenticity of its holdings is its *raison d'être*.^[17,94,95]

While this is a common theme in the history of archival institutions, it is not a universal one. Duchein has argued that there are many countries in which the notion has never existed, including France "where the fact of its being preserved in a public archival repository does not give a document any guarantee of authenticity."^[17] Similarly, while the preservation of authenticity is undoubtedly an objective of most collecting/historical archives programs, it cannot be said to be their *raison d'être*. More recently, archivists who agree with Duranti and Jenkinson about the absolute importance of guaranteeing the authenticity of records have disagreed with Duranti's argument that this can only be achieved by means of archival institutions taking physical custody of the records. To these critics adequate control of records to guarantee authenticity in the digital age can be achieved without the need for archives to provide a physical place of safekeeping. In the digital age the very physicality of records is superseded by a virtual concept or "performance" where the idea of a record having a set physical location becomes meaningless. These critics also object to the notion of records crossing an "archival threshold" at some point in time after their creation. They argue that the "archival bond" and subsequent guarantees of authenticity should commence at the point of records creation which, by definition cannot be physically in the archives (See the entry on

“Diplomatics,” p. 1593 for an explanation of the concept of the “archival bond.”). If the archival bond is achieved and guaranteed at the point of records creation the decision when or whether to perform a physical act of custodial transfer to an archives becomes a minor administrative consideration, not a matter of central significance.^[96–99]

Another strand to this topic is the architectural use of archival buildings to make symbolic statements about the role and significance of archives in society. Many archival buildings throughout the ages have architectural features suggestive of solidity, impenetrability, durability, and authority. Indeed, such featurism is so common as to be almost a cliché—something which itself speaks volumes about perceptions of archival institutions. Recent, more imaginative architectural representations of the form and function of archives, such as the Gatineau Preservation Centre in Canada, have attempted to convey an image of archives as “the epitome of liberal-humanist and objective-scientific activity,” but perhaps unwittingly reflect instead the ultimately indeterminate and mutable nature of the archival pursuit.^[100]

One feature of the “archives as a place” debate has been the perhaps naïve assertion by the post-custodialists^[101] that technological change has made it possible, indeed essential, for digital records to be archivally captured, described and controlled in such a way as to guarantee the authenticity and integrity of the records from the instant of creation onwards. A good explanation of post-custodial archival thinking was provided by Terry Cook in 1994 when he said “. . . our traditional focus on caring for the physical things under our institutional custody will be replaced or (at the very least) enhanced by a focus on the context, purpose, intent, interrelationships, functionality, and accountability of the record and especially its creator and its creation processes. All this goes well beyond simple custody, and thus has usefully been termed post-custodial.” Perhaps the closest archivists have yet come to achieving this vision is with the “VERS encapsulated objects” of the Victorian Electronic Records Strategy (VERS).^[102] The fact remains, however, that the assertion remains an unproved—though appealing—hypothesis.

Ultimately, different archives will make their own choices as to how important guarantees of authenticity are and, if they are considered vital, which strategies they feel will give them the best chance of achieving that objective. Certainly, the post-custodialists argue for a more proactive and virtual “archives without walls” as an antidote to the traditional passive custodial view, although there is no reason why a custodial approach could not also be combined with a more proactive role. Jeannette Bastian has recently argued that (distributed) custody and authenticity should not be ends in themselves, but rather means to a more important end—that of facilitating use of the archives by those who stand to benefit from such activity.^[103] As Frank Upward has argued, “the externalities of place are becoming less significant day-by-day . . . the

location of the resources and services will be of no concern to those using them. . . .”^[104]

In the online world the development of virtual archives is not only desirable, but also essential for continued relevance and survival. Users will wish to be assured of authenticity, but will not care less about the existence of or necessity for places of custody. It will be interesting to watch as archival institutions respond to new user expectations of 24-hr online virtual access and the opportunities offered by digitization programs for transforming and democratizing archival access programs.^[105]

CONCLUSION

We have seen how archives in different times and in different places take different forms, pursue different strategies and different combinations of objectives. We have seen that these differences can be explained with reference to the political and cultural environment in which archives exist and the objectives of those who own, control, or are responsible for the existence of the archives. We have seen that archives are not passive, objective, and “neutral repositories of facts,” but rather active and subjective participants in and shapers of political and cultural power relations.^[106] The power to decide which records constitute the archives and, conversely, which records do not, coupled with the power to determine who can have access to the archives are powers that can be used for good or for bad. Usually, they are used by those who control the archives to support and bolster their own political and economic position, views, and mythologies. In democracies, however, there is at least the potential for archives to act as enablers of citizen empowerment and democratic accountability and transparency—a potential that unfortunately remains more latent than actual in most cases. While public records archives in democratic nations should be substantially independent from the executive government of the day, so that they can play a proactive role in ensuring the accountability of that government, most such archives are in fact a part of executive government and enjoy only limited independence. This suggests that the main role of these archives is to serve the legal, administrative, and culture constructing objectives of the government, rather than any truly democratic purpose. Even in democracies, governments do not surrender lightly the power of archival consignment.

We have also seen that the political and social purposes of archives are never eternal. These purposes are always being contested, reconsidered, reinvented, and transformed, reflecting the judgments of and changing power relations in society. This was seen most dramatically as a result of the French Revolution, but there are other notable examples, such as the transformation of archives in post-Apartheid South Africa, in post-Communist Eastern Europe and in post-Colonial Asia and the Pacific. We have also seen that archives that were originally established to serve the narrow

legal, economic, and administrative purposes of a ruling elite can also be transformed and reinvented to serve broader cultural objectives of society—objectives that are themselves eternally subject to contestation and reinvention.^[24,107–110]

The consequences of these lessons depend on your values and perspectives. From this author's perspective the best archives are those that serve broad social, cultural, and democratic accountability purposes. In reality, we have seen that such archives often struggle to emerge from or succeed within a governance environment that does not place high value on such purposes. In more tightly controlled and less democratic environments archives that serve the narrow political, legal, economic, and symbolic objectives of the ruling elite will generally enjoy greater funding, support, and patronage. As we have seen, however, circumstances can change. Any archives are better than no archives and those which today serve a narrow set of power interests may tomorrow be reinvented to serve broader social and democratic interests. The key is for archivists to understand the roles that they play and to remain ever alert and sensitive to the political and social dynamics in which their archives operates. Archivists should always be ready to take advantage of changing circumstances that may permit their archives to serve more pluralistic, socially inclusive, and democratically empowering roles.

Any discussion of the role of archives as enablers of wider democratic transparency and accountability cannot ignore the issue of archival institutions themselves being accountable and transparent. If the archives should help to hold a government accountable, to whom is the archives accountable? The answer should be the wider community. Unfortunately, however, most archives have a long distance still to travel before they can claim to practice what they preach with regard to transparency and accountability for their own politically charged decisions and activities. Too often archives and archivists are guilty of making their decisions behind closed doors and justifying their actions with spurious claims of sacrosanct professionalism and scientific objectivity. The first steps for archives in a democracy to become truly effective enablers of transparency and accountability are for this role to be effectively communicated to and understood by the wider community and for the archives itself to become fully transparent and accountable for its own operations and decisions.

Depending on their social and political circumstances and on their own choices and actions, archives can pursue missions that can either hinder or assist society in being civil, pluralistic, open, just, and democratic.

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Archivists and Collecting

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Abstract

Archival collecting is seen by archivists in some countries principally within the context of well-established archival appraisal practices and principles. The author argues for a specifically North American approach to collecting, where the notion of collecting has been the strongest, most well-developed, and most debated. However, many traditional aspects of collecting have been and are being challenged.

INTRODUCTION

Archival collecting—the acquisition of organizational records and personal papers for housing, management, and use in archival and historical records repositories—has a long and tangled history. In many cases, archivists equate appraisal, the identification of records with continuing or enduring value, with collecting (and vice versa). Some archivists believe that records do not become archives without the blessing of archivists through an appraisal process or, at the least, the physical housing (by whatever means) within archives and historical manuscripts repositories. Others place records on a continuum, and they equate a record as archival based on a continuing value because of the importance of the warrant or function generating the record. In the midst of this comes the much older idea of collecting, bringing records into centralized repositories for convenience of research use.

These are complicated matters, cutting into cultural, political, professional, and personal concerns. There are differences with archival collecting within American, European, and other nations. Europeans, operating within a more centralized and controlled regime, tend not to think about collecting in the way North Americans approach this matter. In the younger nation of Australia, the collection of personal and private papers has not been a primary emphasis, at least when compared to the focus on institutional and governmental records.^[1] Many archivists on both continents adhere to a view of appraisal advocated more than half a century ago by Hilary Jenkinson, who believed that the creators of records made selection decisions and that this ensured an objectivity that is impossible to achieve by any other means.^[2] That American archivists have stressed more pragmatic ideas about collecting can be seen in the response to the Duranti essay (where she argues for a more theoretical basis) by Boles and Greene.^[3] American archivists, however, have focused on a serendipitous form of collection, as well as more systematic appraisal approaches, reflecting their less regimented national archival system.^[4] Some would argue

that the greatest emphasis, both practical and theoretical, on *collecting* has come from the North Americans, and as a result, this article concentrates on the topic of the archivist and collecting from a distinctly North American perspective.

BASIC DEFINITIONS

Some observers have connected the ability to document the past with the strength of the archival and historical manuscripts repositories that have been formed. In an assessment of how well America was caring for its historical records, Gerald George (then director of the National Historical Publications and Records Commission, the national funding arm of the U.S. National Archives) wrote: “In the ongoing struggle with capricious fortune, the nation’s collective success in documenting its history is directly connected to the strength of archival and historical institutions, the security of their facilities, the scope of their holdings, their ability to provide access, and the aggressiveness of their collecting—or their ability to persuade others to preserve materials accessible to historians.”^[5] The issue of collecting is what this article is about, but the degree of aggression or activity George emphasizes seems to me to be far from the main issue to be worried about. Collecting has played an important role in forming what archivists do, but it has also wrecked havoc with systematic or standardized approaches to the management of archival records.

For the past century, the nature of U.S. archives and historical manuscripts programs that might collect records has remained fairly constant. Fifty years ago, one archivist provided a typology of collecting programs in this fashion: “Basically there are four types of collecting agencies: 1) the private collector; 2) historical agencies devoted to the preservation of research materials—including manuscripts—primarily for cultural or historical purposes; 3) archival agencies serving their own governments, businesses, or organizations; and 4) agencies that combine

both manuscript-collecting and archival functions.”^[6] This aptly describes the nature of archival programs until recently. New types of community and indigenous archives have gained prominence, part of a remarkable international movement.^[7] While such programs are more diverse and greater in number today, they still fall largely within these categories, and just as they did a century ago, there are tensions caused by the existence of these various collecting groups. Some of these tensions are reflected in the newer community and indigenous programs.

In the United States, the development of archives and historical records programs has been connected to two distinct traditions, which have been built around the manner in which they acquire records. The historical manuscripts tradition relates to collecting repositories such as historical societies and colleges and universities. The public archives tradition is connected to the local, state, and federal archives in which records are acquired primarily through regular transfers, usually as part of a records management program.^[8] Even public archives have “collected,” generally in their formative years as they discover older records, deal with the recovery of older records found by agencies, and evaluate records delivered to them unannounced and without any relationship to formal records retention and disposition schedules.^[9] The movement for the U.S. National Archives was largely focused on gathering and centralizing the archives of the nation.^[10–15] Many state governments worked in the early nineteenth century to copy records related to their colonial past in the archives of Europe, constituting a primitive kind of archival collecting.^[16] In addition, most states labored to gather, copy, and preserve their oldest records.^[17] For a long time, one could not find a formal definition of archival “collecting” within the main professional glossary, but it is still the case that the physical acquisition of records is what most archivists have their sights set on. There are definitions for “acquisition” and “acquisition policy,” but there is no formal definition for the idea of collecting.^[18] The expanded Society of American Archivists (SAA) glossary includes a brief entry for “collecting archives,” a slight improvement.^[19] These definitions are remarkably lifeless when considering the dynamic processes of acquiring records, including the personal, psychological, cultural, economic, and other facets making up such processes.

PIONEER COLLECTORS AND COLLECTING

The collecting emphasis in the American archival profession stems substantially from the role of nineteenth-century historical societies in forming the foundation of the modern archives profession. These historical societies were part of a major shifting by Americans to develop a usable past for their young nation, developing in tandem with historical novels, museums, autograph collecting, and other such

activities and trends. One historian even characterized this period as one beset by “documania.”^[20–23] The historical societies were also modeled after English and European organizations that were established in the Renaissance, generally with similar antiquarian and nationalistic motives to their American descendants.^[24] The equating of archives with their collecting has long been associated with nationalism, as in some nations’ war memorials, including not just the erection of monuments but the collecting of records related to the conflict.^[25] It is also the case that the U.S. National Archives appealed to veterans’ groups looking for a means to commemorate their service, especially as recounted in Victor Gondos’ book on Jameson and the National Archives cited earlier.^[10]

It is not accidental, therefore, that the earliest historical societies were established in the first years of the American Republic. The Massachusetts Historical Society was the first historical society, formed in 1791, and it was followed by a few others in the subsequent decades. Between 1820 and 1860, historical societies were established in nearly every hamlet, major urban center, and certainly every state. By the end of the nineteenth century, hundreds of these repositories existed, each generally subscribing to a “collect-everything” mission. As many have pointed out, these were the main protectors of America’s historical records before the advent of government, institutional, and university and college archives. Historical societies often primarily collected to reflect the interests of their board members, and they often acquired items in a highly competitive way. Admittedly these institutions operated long before there was an archival profession, professional standards, and distinctions between the business of libraries and archives, but their highly charged desire to collect everything and anything set a tone that still permeates large sections of the modern archival profession. Despite the fact that we can discern some narrowing in collecting foci by these institutions as they ran out of space, faced increasing competition from other repositories, identified particular constituencies, and hired more professionally trained staff, there is still no question that by any standard their acquisition desires remained broad and sometimes quite eclectic.^[26,27] In some ways, the general American’s intense interest in the past, including collecting, continues today, and it serves as a reminder that archivists, despite training and vocational choice, are part of the general populace as well.^[28]

One of the devices used by these historical societies was the issuance of wanted lists, circulated to individuals and communities in order to advise them of important and valuable archival records and historical manuscripts. The practice continued well into the twentieth century, when organizers of historical pageants often put out calls for historical documents and artifacts.^[29] Beyond such pageants, modern historical societies, such as the Minnesota Historical Society’s issuing of a brief pamphlet in 1951, effectively did the same. This pamphlet carried an age-old

sentiment: “Between the records and those who would destroy stands the collector. He knows that it is impractical or impossible to save everything, for only a fraction of all the records that have been created have enough historical value to warrant the investment of time and money necessary to preserve them. But, out of the mass, the collector must select the essentials, the manuscripts that will insure remembrance of our past.”^[30] In this statement, the collector was the state or local repository; a century ago it would have been *both* institution and individual.

The historical societies served many roles, but it was primarily as a collecting agency—even if somewhat unfocused—that these organizations made their most important contributions to the development of a documentary heritage. For example, long before government archives were established in the early twentieth century, historical societies often acquired public records that might have otherwise been lost due to neglect or willful destruction.^[30] Still, it is also obvious that these organizations at times inflicted damage on public records by removing them from their records context, treating them as isolated personal papers rather than organizational records, and removing the responsibility from governments to care for their archives. In this way, they reflected the activities of earlier English and European collectors who gathered up stray public records, personal papers, artifacts, and other materials in the pursuit of documenting the past for present use while arguing for their more systematic care.^[31]

One of the roles of these historical societies was to acquire printed ephemera and nontraditional record sources. Over a century ago, it was likely that ephemeral material would be swept up just as eagerly as other more substantial records. Many of the most valuable ephemera collections reside in these older institutions. Now archivists are developing methodologies to help them identify criteria for dealing with ephemera and other nontraditional records.^[32] Sometimes what seem to be fairly routine business records take on more useful importance to repositories and society where their research value is recognized beyond their business utility. The obsolete files of publishers and literary agents have become sought after, for example, because of what they reveal about particular writers as well as the publishing industry.^[33] Archival collecting can become messy and undisciplined when missions are set so broadly, even when individual researchers attest to the potential and actual value of such collections. Without some criteria or parameters, the older antiquarian tradition of collection for collecting’s sake becomes the guiding principle. The question remains what has become the primary objective in archival work; it is easy to state an archival mission or mandate but harder to explain it in plain, understandable language. The digital era has opened up new challenges and opportunities for documenting aspects of society and its organizations seemingly unobtainable just a decade ago.^[34] Will collecting continue?

COLLECTING AND THE FORMATION OF THE EARLY MODERN PROFESSION

Acquisition, collecting, appraisal, and selection have long been thought to be critical functions of the modern archival profession. The profession is usually considered to have started in the late nineteenth century in Europe and in the early twentieth century in North America.^[35] German archivist Karl Otto Muller, working as the American archival profession was forming, is considered by some to be the first to state that selection was the primary matter for archivists to resolve, and he argued that “What is not worth preserving, should never be allowed into an archive.” In the years since then, archivists worldwide have developed a variety of models, methods, and mandates for guiding archival appraisal and acquisition, ranging from allowing the records creator to make the decision to elaborate cooperative planning approaches.^[36] Always working against the systematic approach to appraisal and selection have been the more romantic stories of the great collectors, the pursuit of important collections, and the defying of odds in saving significant records and sources. Such stories are often a main attraction for individuals to become professional archivists and manuscripts curators.^[37–39]

The romance of collecting fits well with what occurred during the Second World War. The obsession that is collecting can be seen most dramatically in tragic events in which one people’s misfortunes become an opportunity for another’s collecting.^[40] For centuries, conquering nations have carried off the archives of other nations (when they haven’t destroyed them), although the reasons are often complicated; motivations for destroying a people’s identity are often stronger than those for making a profit or acquiring an object.^[41] The Second World War was particularly troublesome in this regard, as the Nazis carted off art and historical treasures, including many historical manuscripts. These documents and objects came onto the market, and many wound up in the hands of both private collectors and public repositories. In the 1980s and 1990s, as records of the warring nations were declassified and as the generation of Holocaust survivors began to die off, the looting of Europe became more public and controversial with shifting attitudes about events such as the Holocaust.^[42–45] The question as to why it took 50 years for some of these issues to become of sufficient public and media scrutiny is also complicated and has much to do with broader political, nationalistic, ethnic, and cultural events.^[46] The end of the Cold War also has brought new attention to matters such as these, especially with calls for the return of displaced archival treasures.^[47] The increased public scrutiny on the events of the Second World War also brought more intense light on the troublesome aspects of the international trade in antiquities, art, and archives.^[48,49]

SHIFTING NOTIONS OF ARCHIVAL COLLECTING

There have been noteworthy changes in archival collecting in the past half-century in the United States and around the world, some caused by societal developments and others generating from within the profession itself. Philip Mason, a leading labor archivist and archival educator, sees a substantial change after 1950, when “emphasis on elite groups continued to dominate the collecting priorities of established archival institutions but increasingly attention was devoted to new areas.” As Mason sees it,

the major change in the focus of archives came about through the efforts of the newly established archival programs, especially those affiliated with colleges and universities. Unfettered by traditional collecting practices and the free from conservative governing boards, the new archives branched out into new subject fields. Some chose a geographical area or region as their focal point of collecting, whereas others selected a subject theme around which to develop an archives.^[50]

In fact, the origins of many nationally and internationally known repositories developed because of perceived gaps in collecting or due to the need to locate archives and records closer to the researchers.^[51–53] This is a very different emphasis from what propelled such pioneers as Jeremy Belknap (founder of the Massachusetts Historical Society) in the early years of the historical societies; when there were few repositories, researchers resorted to building their own collections, and critical records were viewed as “monuments” in claiming a past for the young nation.^[27]

After a century of the wide-scale founding of state and local historical societies, the twentieth century became a period of more focused collecting by repositories, either to document specific groups or to support the research of scholars.^[54,55] Those programs that did not refocus their collecting efforts often discovered that the financial burden of collecting had become substantial, requiring them to either rethink their mission or to face escalating costs that threatened to put them out of business.^[56] Nonetheless, archivists persistently have collected virtually every type of record representing every discipline, topic, and trend, such as science,^[57] publishing,^[58] law,^[59] ethnic groups,^[60,61] and labor.^[50,62] Most of these collecting areas developed because historians and other scholars identified gaps in or needs for the collecting of sources missing from repositories for their research. While these efforts have often had noteworthy results, they have also contributed to the general randomness of collecting and often minimized more rigorous standards for appraisal in favor of “we better acquire these records just in case they are valuable” or because “they might be of use to some researcher, at some time.” Such views are particularly vulnerable as the future brings immense changes in

records technology, the use of records, and how society understands and approaches such fundamental matters as evidence and information. Within the archival profession, this can be seen in the massive recent writing on the nature of records and record keeping. For citations to the extensive literature on this topic, refer to.^[63–66]

THE FUTURE OF COLLECTING

If anyone wonders where archival collecting might lead, a reading of Thomas Mallon’s fictional article about the National Archives in the year 2099 will inspire thoughts. Archives II, the newer building of the National Archives in College Park, Maryland, has been turned into condos since all the records have been digitized and the space is no longer needed. The National Archives collects artifacts, or as one of the characters in the short story mutters, “junk is the Archives’ business.”^[67] This is a major shift from what has actually occurred in recent years, when there has been evidence of a shift to criteria used by public archivists to the practices of collecting institutions. In general, collecting was driven by the desire to acquire almost anything or to serve the needs of researchers. Meanwhile, public records staff have begun to shift to more critical matters, such as accountability. Some have argued that such matters are also relevant for collecting repositories, such as in environmental issues and political freedom.^[68] Despite two centuries of collecting and continued reflection on what it means to acquire records for archives, archivists and their predecessors have spent little time in gathering data about why people donate records to repositories. This is a fruitful area for research,^[69] as is almost any aspect of archival appraisal and collecting.^[70,71]

While the emphasis of collecting in the nineteenth century was on the papers of individuals and families rather than institutions (and when institutional records that were acquired were treated as personal papers), many believe today that the emphasis has shifted too far to stress government records, especially as they have had to deal with electronic records. Some have even argued that the archivists who collect personal papers have been victims of a “marginalization.”^[1,72,73] Some of these commentators have stressed that the changing record-keeping technologies necessitate the need for both collecting and organizational repositories to cooperate as well as to develop similar approaches to appraising records.^[74] Other archivists have gone even farther with this concern, worrying that the shifts to contending with information (the emphasis of electronic records management) will have archivists forget about the artifacts of record keeping. One archivist contends that archives do not store information but they hold “artifacts in which information inheres.” Archives are, according to such a perspective, like a “documents museum.”^[75] There has also been increasing tension between archivists, who seem to emphasize responsibility

for organizational records, and researchers (especially historians), who worry about where privately created records are being acquired.^[76–79] Such debates indicate that archivists are both worried about what they will be able to collect and whether or not they will be relegated to lesser roles as places to store old and obsolete documents.

COLLECTING INSTITUTIONS AND INDIVIDUAL COLLECTORS

The idea of professional collecting does butt up against the avocation of collecting by private individuals. Despite the connection of collecting to various stages in the history of the archival profession and the formation of a genuine documentary heritage, in the past few decades, there has been increasing tension between private collectors (individuals, not institutions) and the role of repositories from government archives to collecting programs in universities and historical societies. One case involved the state government of North Carolina seeking legal action against an autograph dealer who offered in his catalog records that had been in the state government's hands a long time before.^[80] A famous incident arose in the 1950s regarding a question of ownership (were the manuscripts the property of the federal government, which commissioned the expedition, or of descendants of the explorers?) of the records of the Lewis and Clark expedition to the Pacific Ocean in the early nineteenth century.^[81] Another replevin case in the early 1980s occurred when one repository, the Western Reserve Historical Society, deaccessioned a group of surveyors' drawings and notes related to Louisiana and adjacent states and put the records up for auction. Pursued by the Historic New Orleans Collection, a private repository, and the Louisiana State Museum, a public agency, the state ultimately attempted to seize a portion of the records as having belonged to the government. While the contention that these were public records appeared a bit specious, the various parties managed to reach a compromise whereby the entire collection was acquired by the Historic New Orleans Collection.^[82]

From the archivist's viewpoint, the concept of collecting and ownership is generally very clear: "The archives and institutional collections that are now established have taken the place of the private collector as the major agent for the preservation of our documentary heritage," or "Replevin actions for public archival estrays sustain a historical view and belief that official records belong to the people as represented by their governments."^[83] Private individual collectors have, of course, a very different take on the matter. While private collectors had played a critical role in the nineteenth century, they are now seen with the multitude of established programs as threats to security, access, and other matters.^[84] More recently, archivists have begun to do research revealing

that replevin is a far more complex issue, with many questions and aspects still needing to be resolved.^[85,86]

The tension between private collectors and archival repositories should not be surprising. In many cases, individuals and institutions compete for the same items. Sometimes, collectors use institutions such as libraries as ways of building their own private holdings (as libraries unsuspectingly weed out rare and valuable materials).^[87] Just as often, archival programs acquire the collections of private collectors. This has been more documented in terms of literary collections, such as Watson.^[88] In rare but important cases, private collectors establish important repositories for their collections, blurring the distinction between personal and institutional collecting as professional staffs become involved in the new institutions.^[89] At the very least, many archivists, manuscripts curators, and special collections librarians relished collecting with the same passion as private collectors. University librarian Lawrence Thompson noted that "Strict objectivity, total indifference to partisan issues on the site of collecting, and an unmitigated passion for identifying the truth are the hallmarks of the collector's trade."^[90] Collectors were identified as being both individuals and institutions.

The problems represented in this aspect of collecting are due to how popular the autograph trade has become in an investment hedge—important enough to be featured in articles such as those appearing in *Forbes*.^[91,92] The continuing interest in personal autograph collecting can be seen in the ongoing proliferation of how-to books on the subject.^[93–96] Despite this fascination with autographs, we do not have a good social history of such collecting, but rather we possess isolated studies on autograph albums as genres^[97,98] and the autograph business.^[99] There are no particularly scholarly studies of individual autograph collectors. The journal *Manuscripts*, the publication of the Manuscript Society, an organization dominated by individual collectors and dealers, contains many articles on individual autograph collectors. The rising monetary value of manuscripts also contributes to other problem activities, such as forgery, although the history of forgery is also connected to other developments in record keeping (such as the transition to written records as the primary form of evidence and changing trends in scholarship).^[100,101] Some forgery cases, such as the Hitler diaries debacle or the celebrated case concerning the forgeries of Mormon documents in the 1980s, have become international events and leave no doubt that the primary motive was to make money.^[102–104]

Even today, conflict between the appraisal of government records and the collecting of records exists, evident in litigation concerning the U.S. National Archives' appraisal of FBI records and the maintenance of electronic mail concerning the Iran–Contra affair.^[105,106] Such cases are less problematic than the ethical aspects of collecting. Older versions of the Society of American Archivists' code of ethics suggests that any archives or historical

manuscripts repository ought to have a collecting policy and adequate resources for maintaining the records acquired, work against excessive donor restrictions, use legal documents in making acquisitions, and seek acquisitions in a fair manner.^[107] Most repositories do have these elements in collecting or acquisition policies, but the specter of theft and other problems haunts these repositories and the profession. Again, the more human aspects of collecting often overwhelm the mundane but necessary elements of maintaining archives. Thoughts of publicity or of beating another repository in acquiring a particular collection can lessen the influence of even ethical issues.

Despite the intense discussion and development of new appraisal methods and planning over the past several decades, the fact remains that many collecting programs still acquire the collections of private collectors. Many of the core holdings of historical manuscripts programs are actually private collections later donated to them. The stress between private and institutional collectors is somewhat modified by this relationship. Private collectors often create trends in collecting or have the financial resources to build collections; it is often up to institutional repositories to house them and make them available for researchers.^[108] It is precisely at this intersection between private collector and institutional repository that the most dramatic aspects of the psychological nature of collecting are seen.

THE PSYCHOLOGY OF COLLECTING AND THE COLLECTING IMPULSE

In some cases, archivists have exhibited some of the most blatant desires for collecting as a human and competitive instinct. Howard Gotlieb, a long-time archivist at Boston University and the chaser of records of celebrities and other noteworthies, was described as collecting to preserve a moment in time; thus, he pleads that each member of his ever-growing “family” save every scrap of paper upon which a little or just one single word has been written or typed. He claims that each manuscript or type-script piece of paper is like an irreplaceable painting, as it is the only one extant. Gotlieb is so persnickety about this matter that he, on occasion, sends empty boxes to collectees to use as receptacles for any paper discards that they may have. “We want everything,” explains Gotlieb.^[109]

Such sentiments are supported by the many volumes of memoirs of collectors and dealers who describe the thrill of the chase, ecstasy in finding treasures in dung heaps, and the pleasures associated with outdoing individual and institutional competitors.^[110,111] This is a far cry from those archivists who struggle to understand whether a systematic analysis of organizational records can lead to the type of documentation needed for purposes of organizational memory and future research use. For example, Canadian archivists B. Corbett and E. Frost^[112] examine

whether or not records retention/disposition schedules lead to a fuller archival documentation of government agencies.

Collecting has been connected to all sorts of human instincts and interests from the personal^[113] to societal consumerism.^[114] A significant challenge to the archivist and collecting is the archivist’s impulse to collect. Most archivists remain fearful of the prospect of losing potentially valuable records if they do not step in to save them.^[115] Writing about the more than 1000 human rights organizations in North America, Bruce Montgomery stated that the lack of research about human rights “stems largely from the paucity of archival evidence in research universities and other educational institutions, and illustrates the danger to the historical record when significant materials on leading worldwide social and political movements remain uncollected.”^[116] While some of this stems from personal and psychological impulses to collect, some also extends from the importance of assembling archives in new areas. As an archivist of dance writes,

The emergence of new archives can only offer greater nourishment and benefit to any tradition . . . It is also a fact that the growth of an archive has a direct impact on a community and a country’s sense of self or their personal self-esteem. It is a force which guards its heritage, while at the same time providing educational materials on traditions of the past and customs of the present for its members.^[117]

A part of coming to terms with the psychological dimensions of collecting has been a substantial rethinking of archival appraisal and collecting in the past two decades.

RETHINKING ARCHIVAL APPRAISAL AND COLLECTING

In the 1970s and 1980s, concerns rose on how effective collecting was led by efforts to systematize the development of archival collecting policies. Here is where archival appraisal and collecting approaches crossed over, both hindered by a sense that the records (and other materials) that archivists and manuscripts curators were gathering were inadequate for a full or balanced documentation of society.^[118] There was some borrowing from librarians’ experience with the development of collecting policies, stressing planning, selecting, evaluation, and cooperative activities.^[119] The fullest articulation of what goes into a collecting policy for manuscripts was also developed in this time period, emphasizing a statement of purpose, types of programs supported by the collection, clientele served by the collection, priorities and limitations of the collection, cooperative agreements affecting the policy, resource sharing, deaccessioning, procedures for

supporting the collecting policy, and procedures for monitoring the development of the collection.^[120] By the early 1990s, archivists such as Barbara Craig were stating this about appraisal (and by the implication, acquisition, and collecting): “We do not create the past like an artist creates a work of art; rather we aim to control the past, or more accurately, to control the documentation of the past, like a systems methodizer, balancing aims, objectives, resources and demand.”^[121]

In some ways, the opening salvo in this reconsideration of collecting by archivists was fired by F. Gerald Ham in his 1974 presidential address to the Society of American Archivists. Ham, then state archivist for Wisconsin, lamented that archivists and manuscripts collectors seemed to be prey to dealing with the constantly changing foibles of research trends and practices. Ham argued that archivists needed to take the lead by acquiring records that would both support current research and open up new avenues for historical research.^[122] Ham’s eloquent message brought both short-term and long-term responses. Typical of the short-term response was that of Lester Cappon, drawing on 50 years’ experience, who argued that

On the archival edge the archivist as collector is confronted with certain dilemmas, not inherently new in the twentieth century, that are insoluble, to some degree, but open to accommodation. On the one hand, the quantity of certain records demands drastic measures wisely to save and to destroy; on the other hand, the paucity or lack of certain records attributable to telephone communication, tempts him to fill the void by creating records for the service of scholarship.^[123]

The challenges facing archivists in collecting and appraising are, of course, difficult and complicated.

Because of dissatisfaction with what has long seemed to be random or skewed collecting, the decades of the 1970s and 1980s were a time in which archivists devoted considerable attention to developing a system for acquisition. Archivists began to question the usual approaches, by which they sought to appraise records, and this ultimately affected the standard means by which archivists collected. There were some efforts to develop a more objective appraisal process, although the development of models and the use of models differed wildly.^[124] Archival documentation strategies emerged as a model of such an approach, promising to bring together archivists, records creators, and the users of archives into a forum that would support clearer planning and literal collecting.^[125,126] Archival macroappraisal approaches, stressing functions of records creation, also emerged in this period, although they have been more directed to organizational realms such as government and corporations.^[127–129] Since these professional discussions, there has been some contentious debate about the foundation of archival appraisal and acquisition, generally revolving around notions of archival

science versus historical approaches to appraising and collecting.^[130,131] The documentation strategy model or concept (it has been termed various things) was attractive enough that it was discussed as a foundation for documenting certain aspects of society, such as adult education,^[132] higher education,^[133] medicine and health care,^[134] and geographic regions.^[135] While the core ideas of documentation strategy have continued to generate debate,^[136,137] these ideas have deeply influenced the archivist’s means for thinking about their appraisal and collecting approaches.^[138,139]

This transformation of thinking about appraisal and collecting led to a consideration of more standardized approaches and a reevaluation of cherished ideas and values. For a long time, the assumption and practice of collecting records has been to focus on their informational value (i.e., their value beyond the immediate uses to the creators of the records—the evidential value). Some case studies suggest that such distinctions are quite artificial.^[140] On the other hand, some archivists have come to see the degree of use as the only means by which appraisal or acquisition can be effectively evaluated.^[141] At the least, there is some room for connecting archival appraisal, records management scheduling, and the more systematic collecting approaches.^[142]

The most recent move to reconsider archival appraisal generally stemmed from the realization that records were voluminous and increasing in volume, leading to more calls for discipline, restraint, and intelligence in collecting.^[143] As some might argue, as the nature and breadth of records systems increased, appraisal (and collecting) has simply become more difficult.^[144,145] The challenges of volume have been commented on by every archival thinker or theoretician for the past century, however. There must be other motives for such reevaluation. While government records have become subject to reappraisal^[146,147] (the systematic reevaluation of records acquired by archival programs), for example, the records and manuscripts acquired by collecting repositories have not been the topic of such reexamination. Since the notion of reappraisal or deaccessioning surfaced 30 years ago, there still seems to have been little effort to incorporate this approach into repositories. Little research has been done, but what has been done suggests reappraisal and deaccessioning are not being used. An example of such research is Hempe.^[148] Collection analysis (closely related to reappraisal), the systematic reevaluation of holdings against perceived or assumed collecting objectives, has had a mildly better history, with some intense case studies and follow-up examinations.^[149,150] The lack of attention to such analysis suggests the importance of developing careful collecting criteria in the first place and that systematic approaches still have not reinvented the appraisal or collecting practice. It may be other factors that transform the basic archival attitudes toward collecting.

BARRIERS TO COLLECTING

Many problems persist in the modern collecting of personal papers, such as privacy regarding those still living.^[151–153] In fact, personal privacy has become so significant an issue that popular novels have focused on questions about the role of archivists and manuscript collectors in preserving manuscripts that reveal the private lives of public figures.^[154] Life imitates art, as the daughter of writer Bernard Malamud laments anyone having access to her late father's papers, contemplating why such personal papers might be better off destroyed.^[155] Some of these problems have persisted for a long time, such as the recognition of the complicated and laborious relationship between repositories and the donors of archives and manuscripts.^[156] The most famous (or infamous) case was that of access to the Sigmund Freud papers at the Library of Congress, placed on deposit and controlled by Freud disciples.^[157] Such challenges extend beyond the nature of the materials, requiring that hard questions be asked. It is no wonder that many archives and historical manuscripts programs have shied away from confronting (and collecting) controversial topics.^[158]

Those programs that have tried to deal with controversial topics by acquiring the records of such organizations as the Ku Klux Klan have found it difficult to contend with public reaction and media attention.^[159,160] Indeed, we could ask today whether it is possible to collect at all and avoid controversy. Nearly every aspect of history, historical interpretation, and historical sources have been caught up in controversies, ranging from national history standards in education to exhibitions in major museums.^[161–163] The American archival profession seems timid in dealing with such issues, suggesting that acquiring records posing the slightest problems may be overlooked in favor of collecting less contested and often older materials. While there are continuing challenges to access to government records, it is difficult to find evidence of a dynamic archival profession arguing for a more liberal interpretation of classification regulations. The best recent volume on the importance of records and the challenges of access to government records is Theoharis^[164] and the best recent example is the work of the National Security Archive,^[165] showing a weakened archival profession not willing to try to enforce existing records legislation or to work for strengthened legislation.

The records of American businesses have presented a particularly difficult aspect of collecting, as archivists realized that the businesses themselves were rarely establishing institutional archives and that the records were voluminous in comparison to what other types of records represented.^[152] Archival programs with a national scope in documenting businesses often had to reevaluate just how they were conducting their mission. Harvard University's Baker Library shifted from a national scope to one focused on the New England region,

and even then it had to develop more aggressive criteria in reducing the size of its holdings—at a time long before the archival profession began to develop theoretical foundations for such work.^[166–168] In the mid-1990s, a national conference on the appraisal of American business records tried to deal with the myriad challenges posed by corporate records, but whether or not it really helped get any closer to developing workable solutions is unclear. The American archival profession still sees itself as collectors of such records, while the quantity and complexity (especially the uses of electronic information technology) of these records defy the possibility of acquisition.^[169] Calls for the profession to work on establishing institutional or corporate archives have gone largely unheeded. The specter of an archival fascination with acquisition seems to suggest the problems with archivists who view themselves as collectors.^[170,171]

Cooperation has also been recognized as a critical but elusive element for collecting and appraising. Government archivists pushed for cooperation, especially in sharing scheduling information, so as to bring control to the housing of voluminous qualities of records. In 1988, the Inter-governmental Records Project, uniting in 1990 with Research Libraries Group's Government Records Project to share descriptive information, started as a pioneering effort at some sort of joint appraisal effort.^[172] Cooperation has not been a general success, however, even though it is obviously needed in the archival community. When surveys accumulate data about collecting practice, interest in and activity supporting cooperative approaches generally come up as the weakest link.^[173] Some would contest this conclusion. In the early 1980s, Philip Mason had this description about labor archives: "The issue of competition between labor archives is no longer the problem that it was 20 or 30 years ago when the "scarcity" theory of collecting dominated the field. Archivists now recognize that not only are there enough important and valuable collections for all archives to share, but indeed, the existing programs cannot begin to collect and preserve the available union sources. Cooperation has replaced competition among labor archivists."^[50] If this is the case, such cooperation is a rarity.

There have been other documented instances in which two or more repositories have worked together to deal with voluminous or complex records.^[174] These have been either rare occurrences or rarely documented, however. The establishment of statewide regional networks in the late 1960s seems to be the apogee of such archival cooperation, but they have been well documented as being more effective in nurturing use than in coordinating collecting and acquisitions. See Cameron, Ericson, and Kenney^[175] for the most balanced assessment of these networks. Some have argued that the networks helped manuscript collecting, such as Fogerty.^[176] Forty years ago, archivists realized that they needed to be organized in some manner that would enable more focused

collecting and that would reduce competition. In the United States, a number of states set up regional systems, usually under the direction of the state archives.^[177] There is another tension here, however. For generations, archival repositories seemed to thrill in the competitive hunt for personal papers, family manuscripts, and similar materials. Increasingly there has been recognition that there must be strong and able cooperation.^[178]

There have been other persistent barriers to collecting. Prior to such ideas of systematic analysis and collecting, archivists tended to focus on approaches promising flexibility and experimentation from a conviction of the inability to assess the overall documentation universe.^[179] In the not-too-distant past, many archivists stressed more good public relations and cooperative efforts rather than a high degree of analysis that could be called appraisal.^[180] The amazing growth in thematically oriented collecting programs also created new programs for such institutions as colleges and universities. The fact that a single faculty member with a diverse career and research interests might be the target of two or more such programs generated the need for more cooperation between repositories.^[181] This is a different problem from trying to develop such criteria as tenure status, reputation, institutional service, and community role as the basis for collecting decisions.^[182]

Some aspects of appraisal and collecting require multi-institutional partnerships, such as moving image records, that somehow move the process far beyond just a collecting function, although thousands of repositories worldwide probably acquire motion pictures when they are offered.^[183] Still images—photographs—have been even more problematic. They are generated in the millions by government, corporations, artists and commercial photographers, and private citizens, yet they are eagerly collected, often violating provenance, without much regard to rigorous standards (although such standards have been around for quite a while).^[184] Some record materials, such as sound recordings, require so many accommodations for technical issues of maintenance and use that their collecting is dictated by many different factors than the normal or traditional paper-based records systems.^[185]

It has long been recognized that one of the greatest challenges is the lack of a national system in appraising and acquiring records, leading to some early calls for better communication about appraisal decisions.^[186] Many other countries have recognized problems with the lack of national policies that provide some guidance for coordinated work such as appraisal and collecting.^[187,188] There have been some considerations of the legal implications of such problems, with the usual laments about weak national, regional, and local legislation supporting the acquisition and maintenance of records.^[189]

As a result of such problems as these barriers, some archivists have called for sensitivity in appraising large accumulations of government records such as case files for underdocumented elements of society.^[190] This

concern brings up the question of what the collecting mission of any archives should be. Examining the collecting of Native American visual records, Canadian archivist Jim Burant laments that too many archivists are “driven” to meet researcher’s needs “rather than attempting to take a more all-embracing approach to documenting and reflecting society.” Burant continues that “as an archivist, as a native Algonquin, and as a human being, I feel that public institutional archives must reflect as broadly as possible the nature, fabric, and conflicts of the society from which they spring.”^[191] Others have made similar pleas for a social sensitivity in appraising and collecting,^[190,192] but the uninhibited human nature of collecting works against any kind of uniform approach for dealing with such matters.

COMPLICATED TIMES

There is little question that how archivists perceive their holdings, their collections, and, consequently, their mission has become more complicated. Archivists are now far more sensitive to issues like privacy, accountability, public memory, truth, politics, identity, and the ethical implications of their actions. Some of these matters affect deeply how archivists think of collecting, a function they once took for granted.^[193] The mission is changing. Especially important to the transformation of the archival mission has been the increased role of indigenous and community groups in taking responsibility for their own records. This works against established, traditional archives sweeping up records as they have for decades, while increasing the possibility of preserving and protecting a greater and more diverse portion of our documentary heritage.^[194,195] Along with this transformation has come some particularly difficult stress points, such as those witnessed with the debate about the proposed Native American Archival Materials and, more recently, the claims about social justice being a purpose for archives.^[196–198] The notion of collecting is being challenged, or, at least, the assumptions about collecting are being questioned.

CONCLUSION

Archival collecting is not just a mindless exercise in sweeping up old records or sitting back and waiting for the important records to appear for maintenance by an archives; rather, collecting is a process enmeshed with political, theoretical, psychological, and historical elements. More research is needed about the nature of archival collecting. More understanding by society about how archives and historical manuscripts repositories are formed is needed as well. The image of an archivist as an Indiana Jones-type character hunting out the treasures

of the past in exciting pursuits is romantic but inaccurate; rather, archivists are flawed humans trying to develop clear and reliable methods for identifying records that should be acquired by archives. Much of merit has been accomplished by archivists and manuscripts curators gathering records, but more reflection and experimentation needs to be done on this topic. It seems that the new archival hunters and gatherers will be using very different techniques to sleuth about in the sophisticated record-keeping technologies of the twenty-first century.

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Area and Interdisciplinary Studies Literatures and Their Users

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Abstract

Interdisciplinary scholars and their literature pervade modern academia, reaching into the humanities, social sciences, and natural sciences. Their publication formats include standard monographs and journals, as well as a rich array of gray literature. Online searching remains, however, problematic with library services and collections struggling to meet their information needs. Using both formal and informal information networks, interdisciplinary scholars construct and maintain their own knowledge domains. Variations in the information experiences and literatures of interdisciplinary work in the humanities, social sciences, and natural sciences continue to require focused support mechanisms.

INTRODUCTION

The stock phrase “increasingly interdisciplinary” describes so much of modern academia that many fields within the humanities, the natural sciences, and the social sciences now expect disciplinary boundary crossing as part of their intellectual landscape.^[1,2] Interdisciplinary studies are characterized by their deep integration of the theories, methods, perspectives, and basic concepts of two or more disciplines with a resultant body of scholarship that moves beyond the boundaries of any single discipline. Area studies, a subset of interdisciplinary studies, concentrate holistically on the culture, nature, concerns, and problems of a particular geopolitical or cultural region, thereby generating that essential integration of disciplines. The resultant information landscape of any interdisciplinary and area studies (IAS) field is inherently rugged and unstable. The goal of this entry is to synthesize current understanding regarding IAS information structures and the related experiences of scholars who use and contribute to those structures. Included in this synthesis are materials on IAS scholars’ experiences in using available publication formats, finding primary sources and gray literature, online searching, using library services and collections, using informal information systems, and building and maintaining their knowledge domain. A brief research agenda and bibliography provide support for additional study.

UNDERSTANDING IAS

Definitions

At its simplest, interdisciplinary work may be defined as the deep integration of the theories, methods, perspectives, and basic concepts of two or more disciplines with

a resultant body of scholarship that moves well beyond the boundaries of any single discipline.^[3,4] However, academic disciplines, like ecosystems, are in almost constant flux and the tidy categorization of a field as “interdisciplinary” may ignore roots which still impact the direction of its growth. (For an in-depth explication of these complex issues and forces, see Palmer).^[5] Therefore, understanding the context, measures, artifacts, and drivers of interdisciplinarity supports any effort to strengthen relevant information infrastructures.

Disciplinarity is not, of course, a binary proposition; single-discipline and IAS fields are not the sole forms. Other boundary crossing^[6–8] approaches include multidisciplinary, transdisciplinarity, and information probing. Multidisciplinary research entails the use of two or more disciplines in examination of a research question without any integration of approach, method, theory, or tools; parties bring their own expertise to the table, and the resulting research is quilted together by connecting disparate segments rather than integration. Disciplines are respected, boundaries maintained, and applications focus on the research problem. Transdisciplinary research transcends disciplinary boundaries entirely, building on an overarching perspective to synthesize research. While interdisciplinary fields are indeed academic disciplines with all the infrastructure and information ecologies appertaining thereto, transdisciplinary research consciously eschews academic disciplinary boundaries. It does not integrate or absorb them but, rather, utilizes whatever is needed at any given moment with no intent to form a new discipline.^[1,9] “Information probing”^[10] is an individual’s effort to test the waters of another field by examining information resources, data, theories, and/or principles in light of a particular information need. Such probing may lead to active participation in transdisciplinary/multidisciplinary/interdisciplinary work but it may also be a onetime experience.

Measures and Artifacts of Interdisciplinarity

Measures and artifacts of interdisciplinarity have been studied for almost 50 years in an effort to understand the boundaries of intellectual domains and the consequences of changes in those boundaries.^[11–14] The bibliometric concept of “scatter” underpins much of this work by measuring scholars’ output (for example, journals and monographs) as well as the meta-structures of the field (for example, periodical indexes and digital libraries). In “high scatter” fields, scholars publish in a wide range of journals and monographic series so that numerous periodical indexes and digital libraries are required in any comprehensive search of the literature. In “low scatter” fields, scholars publish primarily in a handful of forums which are readily indexed in a few key tools. IAS fields are, inherently, “high scatter” in that they publish in, are cited by, and choose to cite in a wide range of forums as they pull from various disciplines. The interdisciplinarity of particular journals can actually be measured through social network analysis using “betweenness centrality” as an indicator to denote where a journal lies in relationship to the disciplinary location of other journals.^[15,16]

Apart from bibliometric analyses, the academic infrastructure has a powerful influence on hiring faculty, providing the intellectual freedom of tenure, and building research support. In any field, including those of IAS, that infrastructure develops in relationship to life cycles in research specializations which develop and redefine their intellectual boundaries. The typical pattern is an initial period of slow growth which moves into an explosion of research that gradually tapers off to a steady state.^[17] In much of academia, that steady state has been reached when faculty work within a funded infrastructure that actively supports the tenure of effective scholars. Since IAS fields, however, are formed outside that academic norm, they must choose to either construct their own infrastructure or deliberately live outside of it. On any given campus, an IAS faculty may work to gain program, research center, or school status with line-item appointments for permanent faculty, an appropriate tenure system, and research support. Many will start with faculty who hold formal line appointments in multiple departments, run projects based in multi-jurisdictional research centers, hold appointments in departments other than those in which their doctoral work was completed, regularly teach and/or hold research concentrations in multiple departments, and build collaborative research connections across academic units.^[18]

Drivers of Interdisciplinarity

The drivers of IAS impact users’ experiences and the development of the literature. The histories of modern IAS fields are far too varied to permit a complete list of their origin patterns. For example, those of the natural

sciences alone include subsets of, variations on, and additions to the patterns explicated below.^[19] Nevertheless, these three broad patterns directly influence the information ecologies within which IAS scholars must function^[12] and, therefore, merit delineation.

In many IAS fields, isolates built and continue to develop their own academic infrastructure around their own discipline because their original “home-discipline” colleagues deemed their work too activist, unimportant, or offensive for support. Those who hold political and economic power could, and do, simply deny tenure, refuse research support, and reject curricular change. The growth of women’s studies exemplifies the isolates’ drive for disciplinary autonomy. The work of Florence Howe and Catharine Stimpson, among many others, eventually resulted in the development of women’s studies courses, degrees, and graduate programs as well as such infrastructure elements as the Feminist Press and journals such as *Signs*, *Feminist Studies*, and *Women’s Studies*.^[20] These scholars construct their own publications streams, academic organizations, and networks within, across, and beyond campuses.

Isolate driven fields often live with a certain degree of tension between scholarship and activism that adds a particular layer of complexity to their entire information stream. As new materials are created, published, and indexed both within and outside of academia on a wide range of issues, such fields must “rescue” works which have been ignored as unimportant, archive the nonacademic results of social change, and otherwise integrate social outcomes with scholarly endeavors. In Black Studies, for example, the intellectual output of both scholarship and activism is used by individual adherents of both approaches.^[21]

In contrast with the isolates approach, most area studies are built on a broad but robustly integrated, sociopolitical approach that is rooted in the nexus between culture and history. Although politically unpopular at times and/or driven by governmental needs relating to foreign policy (for example, Middle Eastern Studies), area studies focus on the cultural region as a whole. For example, American Studies grew from the pre-World War II development of a widely held conceptualization of U.S. values, traditions, and ideals. Nourished by such books as Ruth Benedict’s *Patterns of Culture* (1934) and championed by such intellectually pluralistic individuals as President Roosevelt’s vibrant Librarian of Congress, Archibald MacLeish, the American Studies movement, from its inception, genuinely involved art, history, literature, journalism, sociology, and political science.^[22] These scholars redeploy, reconfigure, and redevelop existing infrastructure to meet new demands; they work from an intellectual space which is more within than apart from the academic norm.

More recently, deliberately developed interdisciplinary research groups and institutes have formed around broad research areas (for example, biomedicine), social/physical problems (for example, global warming), or technology

(for example, the Internet or the Advanced Photon Source at the Argonne National Laboratory) with the intention of weaving together an effectively chosen array of disciplines. For example, the Rockefeller Institute/University, with its 23 Nobel laureates, 5 McArthur fellows, and 12 National Medal of Science winners, produces stellar biomedical research without utilizing a traditional academic disciplinary organizational structure.^[23] Scholars in this type of intentionally constructed, interdisciplinary organization utilize existing publication and indexing structures but augment them through the development of their own networks for both formal and informal information dissemination.

All of these approaches share a critical, common element, i.e., a focus on the research questions. As Karl Popper noted 45 years ago, “We are not students of some subject matter, but students of problems. And problems may cut right across the borders of any subject matter or discipline.”^[24] Scholars, with few exceptions, focus on their work rather than the information structures supporting that work. To a certain extent, IAS scholars have had to build their own information dissemination mechanisms (for example, new journals and monograph series in women’s studies), construct their own information networks (for example, conferences and associations in American Studies), and design their own information access systems (for example, data archives and clearing-houses in biomedicine). These actions provide a degree of self-definition and demarcate arenas of intellectual responsibility. Library and information studies (LIS) scholars and practitioners must take those factors into account when building support structures to help IAS scholars find the information they need.

ISSUES IN THE STRUCTURE AND FINDING OF INFORMATION

Six issues repeat in the numerous analyses of IAS information structures, activities, and concerns. They are publication formats, primary sources and gray literature, online searching, library services and collections, informal information systems, and knowledge-domain maintenance. Obviously they overlap and intersect to some extent but each issue provides a valuable perspective on IAS work.

Publication Formats

As IAS fields coalesce into established programs with all the support structures of academia,^[25] their professional associations and university presses begin to produce journals, monographs, conference proceedings, and book series in support of their scholarship. Journals may be focused on the field directly (for example, *Internet Mathematics* and *Neuropsychopharmacology*) while others will deliberately include connections to the latest IAS research

within the publications of sister disciplines (for example, *Cell*’s regular section highlighting materials recently published in interdisciplinary journals such as *Neuron* and *Immunity*).^[26]

Gray literature, discussed more fully below, is defined as research and professional materials published outside of mainstream formats and generally overlooked by indexing tools. It is often integral to the development of interdisciplinary fields, particularly in the early stages of their development. In some underfunded fields, gray literature remains crucial and actively calls on IAS scholars’ time. Archaeology, for example, produces reams of primary material that is intended to support additional studies as well as reports that are meant to, in part, inform the public. Much of it, however, is in the form of gray literature found through Web-accessed databases that are voluntarily populated by scholars.^[27]

All publication formats are embroiled in the broader concerns of information-technology development. For those nascent and less well funded IAS fields, the lure of information technology is complex. In archaeology, for example, moving decades of paper records to a digital format is alluring, but migration is extremely expensive for the original effort, much less any subsequently required migration.^[29] Digital libraries (for example, Archnet) and databases (for example, the National Archaeological Database) develop from professional organizations and subgroups taking on the responsibility of utilizing information technology, but the autonomy of scholars combines with their focus on producing, rather than disseminating, research to prevent comprehensive digitization programs. The Internet’s ability to permit scholarly communities to define their own boundaries has long been recognized as a significant support for IAS communities^[28] but significant work in building on that support still requires substantial organization, connectivity, and resources.

Primary Sources and Gray Literature

In addition to the general publication format issues already highlighted, IAS scholars face particularly complex problems in their access to primary sources and gray literature. The barriers to creation, publication, indexing, and collecting are profound. The solutions, often strengthened by user-controlled information technology, are neither comprehensive nor standardized.

Certain materials are simply not kept because they are not recognized as worth keeping by those with the power to do so.^[29] Original writing, art, music, archives, and instructional materials are, therefore, lost and not always susceptible to rescue. Again, women’s studies provide concrete examples of voices that are not privileged, such as Florence Howe’s 1971 effort to teach a course on “Women and Identity” at Goucher, which was rejected as “offensive.”^[30]

Many important collections have been developed locally, particularly in women's studies, but they often lack substantive off-site access.^[31] Creating digital libraries of these primary source materials is far too costly and labor-intensive for most IAS fields to support on the basis of internal infrastructure and funding. Even the simple effort to create online finding aids for primary source material and gray literature, including archives, is beyond the scope of possibility. Historians, as well as others, still want the type of item-level record that is not really feasible in most archives.^[32] In fields where much of the gray literature has moved to the Internet, such as social policy research, the access mechanisms have not kept pace, which has led to the paradoxical outcome that users have difficulty in culling out the unwanted material.^[33]

Nevertheless, strategies and techniques to maximize access continue to develop. Organizations, libraries, and even individuals have long been gathering oral histories, letters, and other unconventional documents as a way to provide voice to the unheard, dismissed, and marginalized of society and academia.^[32] Designing electronic portals to institutional, shared, and library-managed repositories of otherwise unpublished material on a global scale requires substantial will, cooperation, and effort but has been explored in various areas including the problem-based arena of geology's work on karst formations^[34] and the global environmental change community.^[35] Constructing the controlled vocabulary that best facilitates access to these collections adds a layer of complexity but can also involve scholars in reflective monitoring of their field's conceptual developments.^[36] Electronic finding aids available on the Web and constructed by librarians who know both their collections and their users are increasingly used by historians.^[35]

Online Searching

The three interconnected problems in online searching for IAS information are vocabulary failures, inadequate indexing, and multi-database use. Consistently applied and universally understood terminology tends to be more sought than available. Terms do not map across disciplines^[37] or even across the databases within a single discipline.^[38] For example, the "elusive" nature of terminology in anthropology combines with the wide range of its subject matter to make information seeking particularly difficult. Post-coordinate indexing, like keyword searching, gives the user control over conceptualizing connections among ideas and approaches in an IAS field^[39] but it also requires more thought, self-awareness, and skill than would an effectively pre-coordinated controlled vocabulary. Even apart from disciplinary jargon, words such as "culture" carry very different meanings in various disciplines so that a kind of intellectual "translation" is needed to actually mine the databases of disparate fields. IAS scholars often find the adaptation to multiple

intellectual vocabularies quite problematic.^[40] The advent of keyword searching on the natural language used by authors in the titles, abstracts, and even full text of their works opens the floodgates of information access but provides none of the mapping or translation required to hone a search. Reliance on keyword alone overlooks the difficulties inherent in navigating multiple perspectives using unstable language. IAS scholars must, therefore, develop deep online search skills that enable them to use both controlled vocabulary and natural language in databases and search engines.

Even well-developed skills are useless, however, if they cannot be applied. Search skills can only be applied when indexes are available and when those indexes cover the needed material. The cost of indexing journals, conference proceedings, collected works, and monographic series is substantive, and commercial companies follow the market, investing in that effort only after the market demand makes their effort financially viable. Particularly in the newer IAS fields, problems with indexing are common so that finding the best research in specific journals is not always easy. In women's studies, for example, the majority of the journals were inadequately indexed over a decade ago,^[41] a situation that is neither uncommon nor readily resolved although a great number of new resources are available including some which are free.^[42] In both economics and psychology coverage of the many subdisciplines within these interdisciplinary fields varies widely.^[43] Of 11 indexes covering quaternary studies, relevancy rankings on broad searches ranged from 49% to 99%.^[44]

Between language problems and indexing inadequacy, most IAS scholars need to search several databases efficiently.^[45] Using a single database is almost always insufficient for a comprehensive IAS search^[46] but using multiple databases requires mastering so many search skills and techniques that this, too, poses significant problems. In social work, for example, both *Social Work Abstracts* and *Social Service Abstracts* are required for a substantive search since these two indexes complement each other, rather than overlap.^[47] In later-life migration studies there is so little overlap among the 12 most relevant databases, both disciplinary and multidisciplinary, that scholars need to search all of them when recall is paramount.^[48]

Fortunately, both database availability and search options are improving for IAS scholars. New databases are developing to address specific fields and to deliberately include an array of fields,^[50] although their use is not uniformly productive for all users.^[49] Citation searching, a favorite information seeking technique for people in many social science and humanities-rooted IAS fields, is increasingly available via ISI Web of KnowledgeSM.^[32] Meta-database searching^[32,50] is available via vendors' standardized interfaces that allow end users to search several databases simultaneously. Although still developing,

Google Scholar already covers 27% more core articles in one IAS field than the next most nearly complete database, Social Sciences Citation Index.^[51]

More specialized refinements are still limited but their potential is encouraging. Visual search interfaces, although still rudimentary, show promise of particular interest to IAS scholars who must search multidisciplinary databases. The ability to both identify and refine subtopics may be enhanced by the visual search mode.^[52] An ontological approach to mapping knowledge domains can support scholars' exploration of concepts, theories, research questions, and relationships with, perhaps, greater effectiveness than a subject approach to controlled vocabulary.^[34] Similarly, the social network approach of tagging provides a user-driven avenue for identifying worthwhile information; such control might be particularly useful in developing and/or rapidly changing IAS fields.

Using Library Services and Collections

As a natural by-product of their effort to locate, integrate, and manage information from multiple disciplinary perspectives, IAS scholars have more reference questions than do single-discipline scholars, as has long been understood.^[13] In addition to more numerous questions, IAS scholars need holistic, continuous reference service that is integrated into their research streams. Librarians should actively partner with these researchers, helping them identify connections, language, viable resources, authoritative sources, and accessible experts with whom to network.^[53] Developing the detailed understanding of IAS scholars' work that makes such in-depth service effective can be developed by bibliometrically mapping the intellectual environment in which the scholars work.^[54]

In addition to vigorous reference services, libraries provide rich collections of valued information in multiple formats. Overly narrow libraries undercut IAS connections to sister disciplines^[55,56] but even the most open collection management policies are stymied by practicalities of the IAS information stream. Frequently monographic print-runs are small so that scholars, as well as librarians, note that materials are out of print quickly.^[57] Some IAS clusters are so small and informal that their needs can be unmet by efforts to meet the needs of the majority.^[58] Establishing purchasing structures which deliberately account for the needs of IAS research through development of funding lines and procedures is essential. For example, more than half of the monographs reviewed in major history journals are actually classed outside of "history" in the LC system.^[59]

The serials crisis has long made adding new titles, without cutting old ones, almost impossible, but IAS fields commonly generate and require new journals in which to publish the research that is not acknowledged or valued in scholars' "home" disciplines. Some libraries lack budget lines, procedures, approval plans, and staff who are

properly trained for building print and digital collections to support IAS fields^[60] although systems for properly identifying core IAS journals offer some support.^[61,62] In racial and ethnic studies libraries frequently lack the depth of journal collections that most fully support a developing program; for example, one study indicates that less than a third of Association of Research Libraries collections include half of the Latino research titles.^[63]

In addition to standard collection management and reference service concerns, the large number of IAS fields that use government documents requires government document librarians to review their priorities and patterns. Integrating government documents collections into the main collections exemplifies the extreme of collection management and service concerns. Librarians who merge collections, properly bolstered by reference and information literacy services, must balance the potential for greater access via browsing and searching^[64] with the potential loss of access due to variable formats and heavy reliance on the most complex of corporate author systems. As government publications continue to migrate to electronic format, accessibility may increase use in some IAS fields.^[65]

As already noted, classification and subject-heading choices privilege certain perspectives in library catalogs. Perhaps the most obvious connection between the librarian's codification and the discipline's self-definition lies in Melville Dewey's insistence that the nascent field of "Home Economics" be classed as a "Useful Art" (600s) rather than a form of Sociology (300s).^[66] Efforts to correct, update, expand, and refine Dewey, LC, and other organizational systems to enhance access across the range of IAS fields are long-standing. Examples of such efforts include the following: *A Women's Thesaurus*,^[67] *Women in LC's Terms*,^[68] an empirical analysis of subject headings on women's studies with amelioration recommendations,^[69] an entire IAS adaptation process for classifications,^[70] and NASA's Global Change Mastery Directory.^[71]

Informal Information Systems

In all of academia, the informal information systems embedded in social networks, conference structures, and collegial connections are often more a part of the scholar's daily information life than is the library. In IAS fields, however, the disciplinary influences on language mentioned earlier play a role in the development and efficacy of these informal information systems. Interpersonal communications, regardless of channel or context, require some means of reaching a shared understanding of terminology. "Fundamental terminology should be established early and reviewed regularly. This may mean that the minority chooses to speak the majority tongue."^[72] Time to learn how to communicate across disciplines, attitudes of willingness to engage in developing a shared

understanding, and the real and/or virtual proximity needed to make regular contact convenient are essential for deep collaborations of a genuinely interdisciplinary nature.^[73]

Evidence of these patterns is found in the norms of interdisciplinary research centers, which have been shown to foster interpersonal connections across disciplines more than within disciplines. Indeed, one study determined that an average of 84% of these connections develop after individuals join the center. Although center directors and select senior faculty act as nodes for cross-disciplinary communication, the greatest range of connections to different disciplines is found among graduate students and postdoctorates who actually build the links among faculty.^[74]

In both social science and natural science interdisciplinary, research collaboratories, the informal information networks among the scholars yield more than simple factual information. Exchanges are productive in terms of learning new processes, research methods, and technology skills, as well as in terms of generating new ideas.^[75,76]

The proliferation of discussion lists supports the informal seeking and exchange of information as well as the general discussion of ideas; small groups of people, however, tend to be most active in these endeavors.^[77] Some disciplines, for example, music, utilize unstructured, interpersonal connections but prefer in-person contact to electronic channels.^[78] The development of Web-based communities (WBCs) supports both IAS communication and development of customized resources. Although the lack of research on WBC generates more questions than answers, the potential for active, global information support of an informal nature is well worth further examination.^[79]

Knowledge Domain Maintenance

As might be expected within these parameters, many IAS scholars have long had to work extremely hard to both construct and maintain their domain knowledge. The difficulties of keeping up with the growth in their fields are part of their academic life.^[80] Engineers, for example report that the fragmentation of their literature and the sheer volume of publications combine to create a sense of information overload, generating the conviction that they are not finding all they need for their work.^[81] Obviously various current-awareness tools and alerting services, such as *Current Contents*, can be helpful; one study noted that about two-thirds of faculty in natural resources made use of them.^[82] In women's studies, one exemplary complaint of scholars is that keeping up "in the way that discipline-specific folks do is impossible" and those who do gather material effectively may well echo their colleague's statement that "I don't have a sense how to organize the materials. . . ."^[67]

One aspect of this continuous effort to gather useful information is the increasingly common problem of discerning quality. Surviving the academic promotion and tenure process is vital for most humanities and social science scholars who want to continue their work, as well as those natural science scholars who want to work within academic rather than governmental or corporate environments. As IAS fields mature, recognized and generally acknowledged standards of publication quality develop, which support consistent application of promotion and tenure requirements.^[83] In nascent or rapidly changing fields, however, those widely accepted benchmarks are lacking, and this adds another layer of uncertainty to the information seeking. The ability to rapidly recognize indicators of quality scholarship is a hallmark of the expert but even expertise in a new IAS field may be insufficient to support efficient analysis across the multiple channels and formats of information available.

DISCIPLINARY OVERVIEW

Within the context of all six of the information concerns delineated above, IAS scholars share, to some degree, a primary information-seeking trait, i.e., an open-minded approach to work in other disciplines. This willingness to consider other academic perspectives, theories, language, assumptions, research, and applications colors their information experiences. In the IAS fields of the humanities, social sciences, and natural sciences, that open-minded approach leads to serendipitous information encounters,^[84] the use of multiple disciplinary vocabularies, a drive to maintain currency in multiple areas, and a strong need for effective information management skills.^[85] Within that overarching context, an examination of information experiences more common to each broad arena is presented below.

Humanities

In the humanities, scholars still prefer "footnote chasing, colleague networks and their own files over online systems" with the lack of retrospective access still a significant problem. Working independently, these researchers build their own personal collections through browsing and expect to travel in order to access distant collections. Making use of personal bibliographic control software and image-capturing tools, some scholars build their own databases and collections which reflect their own analytic perspective, for example, chronological or thematic.^[86]

Analysis of several IAS fields within the humanities reveals more focused concerns. Medieval studies, for example, includes women's studies, art history, archaeology, and sociology, as well as a growing focus on history. Nevertheless, the International Medieval Congress papers remain conceptually housed in literature^[87] as do

monographic publications in cultural studies.^[88] Databases of visual collections remain clumsy and counter-intuitive for art historians so that the vast majority of their work is still done in print formats.^[89,90]

Unfortunately, scholars with roots in the humanities generally lag behind those of the physical and social sciences in development of Internet and database search skills. Those who most need effective databases are the ones least likely to have them. Almost 86% of music scholars make use of materials in “criticism, literature, art history, philosophy, anthropology, or psychology” with informal information seeking among colleagues a quite common part of the research process.^[91]

Social Sciences

A reliance on journals, informal networking with colleagues, and citation-tracing is still the hallmark of the social sciences^[92] although an increasing number of substantive databases support keyword searching across disciplines. The widely accepted information-seeking model of social scientists applies to many of the IAS scholars with its emphasis on six basic patterns (starting, chaining, browsing, differentiating, monitoring, and extracting)^[93] but the four additional patterns employed by scholars studying stateless nations (accessing, networking, verifying, and information managing)^[94] are of particular interest.

In the social sciences, foci often integrate in clusters of sister disciplines. Demography, for example, clusters more closely around the triad of sociology, family studies, and economics than it does around its next most common cluster of public health and medicine.^[95] Interdisciplinarity is more of a continuum than a pervasive characteristic in some social science arenas; for example, those historians who take a problem-centered approach utilize works from sister disciplines far more frequently than do more traditional historians.^[96]

Access to these clusters of information is found in various journals covered by both discipline-specific indexes (for example, for history, *America*, *History*, and *Life*) and discipline-spanning indexes (for example, for public administration, *Expanded Academic Index*).^[97] Full-text journals are in demand but not always readily available (for example, European archaeologists have a few online publications but none provide substantial coverage of work on American sites).^[98] Personal libraries remain the primary information source for faculty in social work/family studies, who read their few online publications on more of a monthly basis. Younger faculty, who are, presumably, still building their personal libraries, make more extensive use of interlibrary loan than do senior faculty.^[99]

A few areas have been studied in sufficient depth to permit more focused patterns to emerge. The advent and development of electronic resources have moved scholars

in history to a heavier use of indexes but have not fundamentally altered their basic practices of using print materials, following citations closely, browsing, and using book reviews.^[100] Their reliance on archival material requires them to orient their information-seeking to the structure of each separate archive, including the appropriate finding aids and collections, before building the contextual knowledge that allows them to identify relevant material.^[101] Anthropologists rely on journals, visual materials (for example, maps), their own personal data and libraries, and interlibrary loan.^[102] In women's studies, faculty value librarian support in the early stages of their literature review process, need detailed access to primary sources, find indexes and monograph collections inadequate, struggle to keep current on their research issues from multiple fields, and want to work with well-educated, enthusiastic librarians who evaluate Internet resources rigorously.^[63,103]

In its relationship to other social science IAS fields, LIS is uniquely situated in that it is itself both interdisciplinary and information-seeking. LIS produces resources that are used by other fields seeking information, and it actively connects to other interdisciplinary, information-seeking fields.^[104] LIS both studies and exists within an environment of interdisciplinarity. Widely integrated, LIS has been established as an interdisciplinary field for the past 40 years with its boundaries continuing to broaden.^[105] One study found that almost half of its cites came from outside LIS while only 18% of computer science cites did so.^[106]

Natural Sciences

In the natural sciences, interdisciplinarity is more embedded and extensive than might, at first, appear. Although cross-disciplinary citations are decreasing in the last 20 years for the biological sciences, they do continue there and are actively increasing in the areas of agriculture^[107] and chemistry.^[108] Chemistry cites non-chemistry journals almost half the time.^[109] Bradford's law of scatter describes the dispersion of forestry journal citations in which 50% of the citations come from 35 journals and the other 50% from 1234 journals.^[110]

In one sense, IAS scholars working in the natural sciences are prone to even greater vocabulary problems than their counterparts in the humanities and social sciences. Terminology, while often precisely defined, still varies substantially in disciplinary contexts; for example, “gene” had five different meanings in one conversation.^[111] While most researchers expect to come to a shared understanding of broad terms such as “culture,” fewer would expect that “gene” requires similar attention.

Journal literature is far more commonly used than any other format but not simply because it contains more recent materials than do monographs. In neuroscience, for example, over 80% of citations are to journals but 30% of

those journals are 15 years old or older.^[112] The fundamentals of the field are established enough to make older material of use. Multidisciplinary science journals are heavily cited in support of new work.^[113]

In geography, the focus on more scientific aspects of the field involves a greater use of journals while books are used in those areas of geography that focus more on the social aspects of the field.^[114] Initial research indicates that almost half of geography publications entail at least two different disciplines.^[115] Using approval plans to effectively collect appropriate works in geography requires substantial analysis but can be worthwhile.^[116]

In the less generously funded fields, such as archaeology, comprehensive databases remain elusive^[117] although efforts to consolidate local systems continue. For example, the ARGOS multiunion catalog of 14 libraries in 10 languages^[117] was not fully successful but later developed into Ambrosia, a more functional catalog of two libraries in two languages.^[118]

The inherent tension between problem-centered researchers and structure-centered administrators poses information access problems for scientists who construct, or try to construct, their working environments on the basis of integration rather than administration. Many must work in teams, making their reliance on these administrative structures more critical than that of the more independent scholars in the social sciences and humanities. Administrative support for interdisciplinary research involves administrators in data archiving, organization, mining, and maintenance.

Although long-recognized as early adapters to electronic information resources, scientists in interdisciplinary fields can be somewhat unskilled and even naïve in using Google, databases, and the Internet in general. Not only do they have little sense of the differences (for example, comprehensiveness and search options) between Google and databases, but they are not always well informed about the authority of the resulting documents.^[119]

CONCLUSION

Research on interdisciplinary studies integrates the theories, methods, perspectives, and basic concepts of two or more disciplines to create a body of scholarship that moves beyond the boundaries of any single discipline. The resultant information ecology requires scholars and librarians to maximize access to journals, gray literature, and primary sources. Problems with variable terminology, inadequate indexing, online searching, thin research collections, and subject access support structures are part of the landscape. Information technology provides both the risk of costly retrospective conversions and the promise of enhancing informal information networks. Digital libraries, Google scholar, multidisciplinary databases, and digital archives are developing throughout IAS fields although

the pace of the growth is directly connected to the funding available in various fields or to the possibility of fiscal feasibility.

In the coming generation of IAS scholarship it should be possible to address several research questions in some depth. The varying nature of information support structures in IAS fields involves inherent tensions in the more common adaptations to information technology. Fields in which individuals produce heavy loads of original data (for example, archaeology) and fields which are still struggling to find baseline funding in academia (for example, women's studies) benefit from the grassroots autonomy provided by the Internet, but they have little experience in the information architecture and usability work needed to maximize that freedom. Research is still needed on the best practices, adaptation techniques, informatics, and usability criteria of IAS fields.^[120] Digital library and archive development, as well as nurtured growth of WBC, requires carefully planned design^[120] to be followed by evaluation.

From the perspective of information retrieval, an LIS-centric analysis of IAS fields provides raw data that can be used to better construct databases, communication infrastructure, gray literature repositories, and focused digital libraries. The evolving nature of IAS, influenced by academic power structures and external funding source priorities,^[121] provides a moving target for such analysis at the microlevel. The analytic lens might be directed toward homogeneities of approach to knowledge generation.^[121] For example, while characterizing the information experiences and preferences of Hispanic Studies scholars provides certain insights, a more productive path might be derived from analysis of ethnic/racial studies communities and biomedical studies communities. What do those research approaches and environments have in common and what information architecture designs best meet their needs?

Concurrently, however, additional research is needed on the most effective means of supporting IAS scholarship in terms of directly addressing the disciplinary issues and opportunities available to these scholars who deliberately embrace research in multiple fields. The IAS scholars' mental models of academic information-seeking certainly differ from those scholars whose work carefully stays within limited disciplinary boundaries. How do controlled vocabularies and indexing systems best support the intellectual exploration of multiple perspectives? Parsing large concepts more finely, for example, may lead to more effective searching in gender studies.^[122] Using Bradford's work on scatter, libraries might maximize serials access to support needs across disciplines by identifying indexes which serve as nexus points among disciplinary views.^[123] Digital libraries have the potential to serve as creative, information-rich, highly connective, and dynamic, scholarly spaces in which the complex needs of IAS scholars can be actively anticipated.^[124]

The growing meta-awareness of IAS approaches continues to generate deliberate efforts to integrate widely different disciplinary methods, theories, and principles. The relationship, for example, between art and nanotechnology has been proposed as a new approach to consciousness.^[125] In terms of knowledge discovery and theory generation, what information infrastructures are most supportive? As new IAS fields are created, how can LIS best anticipate information needs and become integrated into the information resource development processes?

IAS scholarship addresses the living framework of intellectual life in a global, complex, and problematic world. Bringing to bear the most appropriate tools, these fields address social, technological, scientific, and human concerns at the point of need. LIS is uniquely positioned both within and in support of IAS. The opportunity is also a responsibility.

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ARMA International, Inc.

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Abstract

ARMA International is a not-for-profit professional association dedicated to the management of records and information. Its primary focus is education and advocacy for its membership. As a professional association, it is the primary resource for persons needing education or networking in records management.

BACKGROUND

ARMA International (<http://www.arma.org>) is a not-for-profit professional association dedicated to the management of records and information. It provides educational resources such as seminars, conferences, and publications to records and information management (RIM) professionals and others responsible for managing organizations' information assets, creates standards and guidelines related to records management, and advocates for records management with the governments of the United States, Canada, and the European Union. The mission of the association

is to provide education, research, and networking opportunities to information professionals to enable them to use their skills and experience to leverage the value of records, information, and knowledge as corporate assets and as contributors to organizational success.

Headquartered in the Kansas City metro area, ARMA International's 11,000-plus members include records managers, attorneys, information technology managers, archivists, consultants, and others involved in various aspects of managing records and information. The association also supports approximately 125 chapters, which provide additional programs at the local and regional levels. Most of the chapters are in the United States and Canada with chapters in the Caribbean, Europe, and Japan and a growing membership outside of North America.

For many years, ARMA International has been known worldwide for its active participation in setting standards and best-practice guidelines in the field. It is the only association in the United States that develops RIM-specific standards approved by The American National Standards Institute (ANSI), which coordinates the U.S. voluntary standardization system. ARMA International is also actively involved in the International Organization of Standards (ISO), the world's largest developer and publisher of international standards. ARMA played a key role

in developing and launching the only international records management standard, ISO 15489. The association also works closely with other organizations, including The Sedona Conference, on groundbreaking guidelines.

ARMA is also well-known for advocacy in the United States, Canada, and more recently, the EU. ARMA testified in the U.S. Congress and organized a letter-writing campaign to ensure the Paperwork Reduction Act of 1980 was passed. In 2004, ARMA's association president testified in Washington, DC before a federal panel of judges on recommended changes to the Federal Rules of Civil Procedure that went into effect in 2006.

HISTORY

Business Records Management

Although the practice of records management has been traced back to the Sumerian civilization in 5000 B.C.,^[1] the profession is comparatively a much newer concept. In the late nineteenth century, many companies in the United States discovered the burgeoning number of typed and gel-pressed documents and records was making effective and efficient work nearly impossible. Several different social, political, and technological trends in the nineteenth century brought about the rise in records management independent of archives. The rise of the notion that society could be engineered and that government should intervene on behalf of citizens led to a greater need to document activities.

The narrow scholarly aspect of many of these traditional archives was to make it difficult for them to adjust to the information revolution unleashed by modern administrative and managerial practices. Across Europe and North America in the late nineteenth century, spurred by increasing state intervention in society, central administrations were growing in relative terms, and creating increasing masses of paper. In the private sector similar developments were under way which led, especially in the United States, to the emergence of new forms of records management.^[2]

Experts in Scientific Management applied their techniques to the office environment improving what we now call the “active phase” of the life cycle. Referred to as “Filing and Transferring” nearly everything we understand in the practice of records management was present by 1920.

In the United States, by World War I, the Warren Filing Association was founded in Chicago.

In 1914 Irene Warren, librarian at the University of Chicago, brought together a group of people interested in records-handling and began the Warren Filing Association. This was associated with the Warren School of Filing, which she had also founded for the training of filing clerks and supervisors.^[2]

In 1920, the Filing Association of New York was founded in New York City. The Chicago Filing Association was established in 1932 primarily for file personnel.

Government Records Management

After the Civil War, the U.S. federal government recognized that agencies exercised little, or no management of records through several congressional studies like the Hays Commission study of 1877 recommending fireproof buildings for storage of veteran’s records. An 1888, Senate study of recordkeeping processes produced many descriptions of problems of records having been kept long past any useful life and recommended the destruction of such records. In 1889, the General Records Disposal Act was passed but made very little difference to the burgeoning number of documents. In 1913, the Taft Report recommended using some of the methods adopted by business for handling, managing, and destroying information. By World War II, the number of U.S. federal records had grown past a size such that the National Archives, established in 1934, could possibly manage. A number of archivists and records officers within the federal government established several concepts such as the life cycle and retention schedules that became the foundations of modern U.S. records management.^[3]

CREATION OF ARMA

The Chicago Filing Association changed its name to the Records Management Association of Chicago and was incorporated in 1952, reflecting the contribution made by the U.S. federal government to the field. In the early 1950s, the New York association was renamed the Records Management Association of New York and was incorporated in 1955. In that same year, 12 records managers in New York formed the Association of Records Executives and Administrators (AREA).

At that time, some believed that the other records-related organizations were centered too much on filing and

retrievals and not enough on the management aspects of records. The Association of Records Executives and Administrators membership increased steadily, and other chapters were chartered in the mid-1960s.

ARMA became international in the 1960s when Canadian chapters joined including Montreal in 1968, Toronto in 1969, Vancouver in 1970, Ottawa in 1971, and Edmonton in 1975.^[2]

Shortly after its inception, ARMA began developing resources for records management professionals. In 1956, it launched a member newsletter and held its first annual conference. Four years later, the association debuted its first “official” publication, *Records Review*, and published the technical resource *Rules for Alphabetical Filing*, which eventually became an ANSI standard. In 1958, ARMA became part of the International Records Management Federation, a “steering committee” between ARMA, the Records Management Association of Australia, and the Records Management Association of South Africa. The International Records Management Federation’s goal was to help develop records associations in countries in need of such organizations.

ARMA continued to extend its reach and its activities in the 1970s. Then in 1975, it merged with AREA and became ARMA, the Association of Records Managers and Administrators. As the association’s influence both in North America and internationally grew, the association added “International” to its logo and became known as ARMA International in 1987. The board of directors decided in 1995 to officially do business as ARMA International, dropping the “Association of Records Managers and Administrators” in general use; this remains the official business name of the association today.

In 1997, ARMA signed an agreement with the International Records Management Trust and the International Council on Archives (ICA) to foster the development of records management standards and education globally. The agreement ended in 1999, but the relationship between ARMA and the ICA has continued, particularly in the area of standards development, such as competencies.

In 2005, ARMA extended its administrative reach to include Europe and European issues such as Data Security. This initiative was so popular among European members that they requested, and the Board of Directors granted, the creation of a member unit in Europe where cross-jurisdictional issues could be discussed.

DEFINING MOMENTS FOR THE ASSOCIATION AND THE PROFESSION

During the last 50-plus years, there have been a variety of noteworthy occurrences helping to fuel the growth and recognition of RIM in the business community. A major

boost came from passage of the Paperwork Reduction Act in 1980. This legislation addressed the need to manage information as a resource that is planned, managed, and included in the budget.

When several high-level e-mails became public in the Microsoft antitrust case (*United States v. Microsoft*) in the late 1990s, many executives expressed surprise that their e-mails could become part of litigation and be made public.

The effects of ISO 15489, the standard on records management unveiled at the 2001 ARMA conference in Montreal, Canada, made records management a global practice. Until the release of the standard, records management was primarily an Anglophone activity, the concept of “records” being an English-only word.^[4] Non-U.K. European companies struggled to conform to this new standard.

Nothing could equal the effect of the infamous Enron Corporation scandal. The handling of information played a critical supporting role in the drama that unfolded in 2001. It was played out in *U.S. v. Arthur Andersen, LLP*, which is generally regarded as the most widely publicized criminal case involving the destruction of business records. Andersen, one of the nation’s largest public accounting firms, was accused of destroying accounting records for audits it had performed for Enron after the U.S. Securities and Exchange Commission had begun its investigation into Enron. Andersen was eventually convicted of obstruction of justice, but the damage was done before the verdict was even announced. Customers fled. The Enron case and Andersen’s alleged role in it ultimately led to the rapid and bloody demise of the powerhouse accounting firm. Andersen was later acquitted, but too late for the thousands of employees and partners who had worked so hard and had lost, in some cases, a lifetime of work.

Later that year, Congress reacted to the Enron scandal and other widely publicized reports of corporate accounting irregularities by passing the far-reaching Sarbanes-Oxley Act of 2002. The act made regulatory compliance a higher priority than ever before for publicly traded companies, regardless of whether they were U.S.-based or simply traded on the U.S. stock exchange. For the first time, chief executive officers began to feel the very real threat—including a jail sentence and hefty financial penalties—that could result from mismanaging their corporate information assets. More and more, executives began turning to their legal, information technology, and RIM professionals to ensure their companies did not go the way of Andersen and others in the headlines. An important part of Arthur Andersen’s sudden decline occurred because employees had been told to, and did, destroy e-mails relating to their engagement with Enron. The employees as well as the persons instructing them did not know that the e-mails could easily be restored from back-up tapes. Many in information technology were surprised

to discover that e-mails could be relevant to a case of regulatory compliance and that back-ups could be viewed as business records and be subpoenaed for litigation.

That same surprise was compounded when a judgment against Morgan Stanley (*Coleman v. Morgan Stanley*) was issued for \$1.4 billion in part because the brokerage firm had not been able to deliver all the appropriate e-mails in the discovery phase of the trial. The judgment was reversed on appeal, but it sent shockwaves through the information technology community as well as the legal community. Another high-profile case that was not reversed, *UBS Warburg v. Zubulake*, cost the global banking giant, UBS Warburg \$38 million. Producing a few relevant e-mails each of the seven times the judge in the case ordered the company to produce what Ms. Zubulake knew and could prove they had, UBS Warburg became a victim of its own poor record-keeping. The e-mails involved in this case, however, were not “records” in the sense that governments define them, as having to do with the business of the organization. The e-mails the judge was compelling UBS Warburg to produce involved the authors’ beliefs in Ms. Zubulake’s “fitness” to be a broker.

While the judgment of \$38 million was far smaller than in *Coleman v. Morgan Stanley*, the *UBS Warburg v. Zubulake* case came only a few months before the 2006 revisions to the Federal Rules of Civil Procedure. One of the effects of those revisions was to clarify what could be produced for litigation from specific format references like, “documents” and “databases,” to all “electronically stored information.” Many companies as well as government entities struggled, and are still struggling, to ensure the organization can produce all information, whether electronically stored or not, relevant to a discovery subpoena. As case after case of lost or destroyed electronically stored information comes to light, all organizations continue to struggle to implement life-cycle management from creation to final disposition.

ASSOCIATION STRUCTURE

ARMA’s decision-making body is the Board of Directors. Lead by the President, the Board makes strategic and governance decisions. Membership is primarily geographical, with most members living near a Chapter belonging to that Chapter. Each Chapter is incorporated and has a board of directors as well as bylaws. The role of Chapters is primarily to provide education, and leadership and networking opportunities. Chapters are geographically organized into Regions. Regions are lead by a Region Manager, and several Coordinators whose job it is to advise the Chapters and give help where necessary. ARMA also has Committees that perform various duties including reaching out to membership, education, awards, public policy advice, and governance. ARMA creates task forces when a specific, limited action is required. The

Board makes decisions by first gathering information from its members' wants, needs, and preferences. The association also has an annual strategic planning meeting in which information gathered from members as well as reports from analysts and ideas from attendees are sorted through to determine what ARMA should be doing over the next few years. ARMA's records management competencies, published in October 2007, were the result of the first strategic planning meeting and are now the basis for all education in ARMA. Attendees to strategic planning includes all members of the Board, a member of ARMA's Company of Fellows, a member of the ARMA International Education Foundation, a regent from the Institute of Certified Records Managers (ICRM), and a Region Manager.

The Company of Fellows is made up of individuals selected by the Awards Committee. On an annual basis, the Awards Committee reviews nominations for Fellow of ARMA International (FAI), scores the nominations and determines whether any rise to the high standard set for this recognition to the furtherance of the profession. Individuals selected for this honor are permitted have the designation FAI after their name.

The ARMA International Educational Foundation was created as an independent foundation with its own Board of Trustees in 1996 for the purposes of funding research and education in the area of records management.

MEMBERSHIP

ARMA has more than 11,000 members globally. The backgrounds of members is extremely diverse as most people who become records managers are simply handed the job. At the last survey, more than two-thirds of members had some college or a college degree. A decade before, only half had some college. The reason for the change is the aging and retirement of a demographic group that could obtain gainful employment in business administration with only a high school degree. As this population has aged and retired, job descriptions for records managers have changed and now require a college degree. Most members do not have the title "records manager" as titles vary from level to level, organization to organization, and industry to industry. In addition, records managers have never reported to a single area or level of responsibility. There is some evidence that records managers are reporting to an executive instead of a manager and are reporting to an enterprise-wide function like compliance or legal rather than to an administrative function like facilities over the past decade. This lack of consistency makes identifying the person in charge of an organization's records very difficult and makes recruiting new members very difficult. Before the profile of records management and ARMA rose in the late 1990s, the only way to recruit new members was by word of mouth.

Anyone may join ARMA, including members and employees of associations considered competitors. Many members of ARMA joke that there are actually two qualifications for joining ARMA, one is a love of jigsaw puzzles, crossword puzzles, or Sudoku, and the other is to have a controlling, bordering on obsessive-compulsive, personality. Those two characteristics: a predilection for pattern recognition over logical thought, and a desire to put the pattern in order are very common personality characteristics for records managers. This does not mean that straight-line logical thinking is uncommon among ARMA members, but pattern-recognition is a commonly preferred mode of thought.

PUBLICATIONS

ARMA publishes the *Information Management Journal*, the world's only publication devoted solely to records management and the issues that impact records management professionals, quarterly and *InfoPro Online*, focused on association news, monthly. ARMA publishes three monthly newsletters that impact the practice and profession, the *Washington Policy Brief*, devoted to news from the U.S. federal government, the *European Policy Brief*, devoted to news from the European Union government, the *Canadian Policy Brief*, devoted to news from the Canadian federal government, and the *Information Management NewsWire*, devoted to issues outside the government. ARMA also publishes standards, textbooks, and practitioners monographs on issues including, technology, risk management, compliance, and industry issues.

Most Chapters have a newsletter or a Web site where articles and news of local interest is also published.

STANDARDS

Most notable of ARMA's standards is the Alphabetic standard mentioned above, which is a guide to creating file systems for active records. Other ARMA International Standards and Guidelines include, Glossary of RIM Terms, Guideline for Evaluating Offsite Records Storage Facilities, ISO 15489 Information Documentation—Records Management—Part 1: General, ISO 15489 Information Documentation—Records Management—Part 2, ISO/S 23081-1—Information and Documentation—Records Management Processes, Procedures, and Issues for Managing Electronic Messages as Records, Records Center Operations, Records Management Responsibility in Litigation Support, Retention Management for Records and Information, Revised Framework for Integration of electronic document management (EDMS) & electronic records management (ERMS), Requirements for Managing Electronic Messages as Records, The Digital Records Conversion Process: Program Planning, Requirements,

Procedures, Vital Records Programs: Identifying, Managing, and Recovering Business Critical Records, Working Collaboratively in an Electronic World.

ARMA creates and partners with other organizations and associations to create standards that impact records management professionals. Frequent partners include the Association for Imaging and Information Management (AIIM) and Society of American Archivists (SAA). ARMA is now partnering with the Object Management Group to create a technology framework for government records management that will retire DOD 5015.2.

COMPETENCIES AND CERTIFICATION

ARMA's independent certifying body is the ICRM. The ICRM creates, revises, and administers a six-part test leading to the designation of CRM, Certified Records Manager. Recognized globally, the CRM is currently held by more than 800 records managers. To deal with the ever-burgeoning duties and importance of records managers, ARMA created a set of competencies for the records management profession. Validated in the United States and Canada, the competencies, created by ARMA were created independently of the CRM. A recent joint task force mapped the CRM body of knowledge to the ARMA competencies and found nearly 100% agreement between the competencies and the ICRM test outline, further validation of both. Both the ICRM test outline and the ARMA competencies also reflect the broadly-based need to work with electronic records and all other forms of electronically stored information including e-mail and instant messaging.

EDUCATION

Nearly all of ARMA's educational offerings are now mapped to the competencies. Education is delivered to ARMA's members primarily through Chapter meetings. Approximately one-sixth of the membership attends the annual conference, the purpose of which is primarily education, but also networking. Conference attendees can choose from nearly a hundred sessions offered by practitioners and consultants in the meeting rooms and from nearly the same number of technology advisory sessions provided by vendors on the exposition floor. The accompanying exposition has technology vendors, shelving and archiving vendors, storage vendors, as well as consultants. Monthly webinars permit the reach of education to extend to anyone with an Internet connections. Additional conferences, such as the "E-Discovery and Beyond" conference have arisen as the need for more specialized education arises.

ARMA'S ROLE IN INFORMATION AND RECORDS MANAGEMENT

ARMA is a major hub in a network of networks. It functions as a professional network, an educational network, a sales network, and a social network. Its most important role is as a professional network. At various types of meetings: geographically or regionally focused, industry focused, nationally and internationally focused, members meet to listen to presentations by practitioners, consultants, educators, and vendors on issues relevant to their work lives. Because the speakers are vetted by records management professionals, or by staff well-educated in records management issues, ARMA meetings of all types are the only place where one can go and be assured of hearing a relevant, high-quality presentation. Conversations break out among participants with similar problems as a result of the presentations. Problems may be industry-related, geographical, life cycle, media, migration or conversion, vendor, business, resource, political, etc. Members share their experiences, both good and bad, making ARMA meetings the best place to learn the ins and outs of being a records manager. In this way, ARMA is truly a Community of Practice in Wenger's sense of the term.

ARMA is a vendor network. Vendors can become members of ARMA as membership is not limited to practitioners. However, only individuals can become members. Companies can join ARMA by paying for membership for its employees. Vendors have all the same privileges as members, but are asked not to use ARMA meetings to make sales pitches. ARMA chapters often request a vendor to speak at a meeting about their product or subject. For example, shredding companies are asked to speak about data security and privacy. ARMA meetings and vendor expositions at ARMA conferences, seminars, and chapter meetings are good venues for vendors to get their messages across to members in a low-key environment. ARMA practitioners and consultants are usually not decision-makers for vendor products, but they are recommenders. For all types of soft and hard products, ARMA members are key links in the sales of records management products and services. Because ARMA addresses the risk side of document life-cycle management, the rising profile of records management in litigation made ARMA a natural place for attorneys interested in electronic discovery to receive and provide education.

As the profile of records management has risen, more organizations ask information management vendors to address the risk side of information. Vendors of electronic content management (ECM), EDM, and imaging were targets of this request. To remain relevant these vendors, including IBM, FileNet, OpenText, Interwoven, and Stellent purchased or developed ERM modules. The trend in all industries toward consolidation of companies also lead these companies to buy each other: IBM bought FileNet, Oracle bought Stellent, OpenText bought Hummingbird, etc.

Consolidation within this multibillion dollar a year industry created reduced income for the trade association that represents most of those companies, AIIM, by reducing the number of large company members that pay much more than other members. Before these vendors realized their products were deficient in life-cycle management and were actually creating more expensive problems for organizations than they were solving (discovery being a seven-figure problem where productivity increases were only six-figure problems), they all showed at the AIIM show, which was attended primarily by information technology professionals responsible for managing documents rather than data. At about the same time, consolidation was rapidly increasing and records management was becoming a higher profile problem. AIIM sold its trade show to Questex (an organization that services associations primarily with publications and conferences), which combined the AIIM show with the On Demand show (output management), creating an annual shopping mall for information technology vendors managing documents. The Association for Imaging and Information Management has also ventured into records management education, but geared primarily toward the information technology professionals who were previously the primary decision-makers for ECM, EDM, and imaging technology. The education provided is at a very elementary level and is primarily focused on what a consumer would need to know in order to purchase ECM, EDM, and ERM applications.

The change in focus of purchasers from creation and distribution of information to full life-cycle management of information meant that vendor members showing at both the AIIM and the ARMA shows were spending twice as much money as they would if all potential purchasers were at one show. Another trend is the shift in decision-making regarding information management technology from the information technology department to the legal department. Because attorneys were more inclined to attend the ARMA show than the AIIM show, vendors found themselves forced to purchase space at both vendor shows in order to reach the information technology professionals, records management professionals, and legal professionals who would together make the decision to purchase document-related information technology. The expense and employee time required to have a booth at both shows, has lead vendors to request AIIM and ARMA to merge. While this suggestion has been made twice by AIIM and once by vendors to ARMA, there has been no movement as no model for merging a trade association where dollars are votes with a professional associations where individual members are votes has been suggested. The Association for Imaging and Information Management continues to be a valued partner of ARMA, providing education about document-related information technology products, and working with ARMA on document-related information technology standards.

For the same reasons and causes, ARMA is an education network. Until the past decade, ARMA was one of the few places one could go to get education in records management. Only recently have institutions of higher education offered courses in records management. Until that time records management was taught primarily at the community college level by practitioners and consultants. Two universities had faculty who taught records management, one in a department of business and one in library science, but only one of those had a program in records management. Neither program had a degree in records management. Most of these programs, both at the community college and university level ended when the faculty member or practitioner moved on or retired. Consequently, the only place a student of records management could be assured of a steady supply of education was through ARMA meetings, seminars, and conferences. Practitioners and consultants have been and still are the main source of education in records management. Product vendors also provide education through ARMA either in a regular program meeting or seminars advertised through ARMA publications and newsletters. Such sessions are focused primarily on content their products address, though some address broader industry issues.

Another problem with education in records management, as noted above, is that records management could as easily be associated with business and with library and information science programs. There is also a very strong legal component. This lack of fit into a normal university curriculum makes records management a very poor fit in any particular school, much less a single department. With the widespread use of computers another component has arisen that is normally associated only with Ph.D. studies in information technology, enterprise information architecture (EIA). EIA has three components: technology, information, and people, but departments of information technology usually only deal with one and one-half of those: technology and databases—documents are not addressed in the standard IT curriculum. Records management deals with how people use information, regardless of whether it is hard copy or electronic, i.e., regardless of whether humans are interacting with computers or paper; how people use documents—the best-known form of records; and with how governance impacts how people use and abuse information. The lack of understanding within most of the information technology community about EIA means that most software applications that handle information are created to function within a small department and to assist in the creation and distribution of information, not in the actually life-cycle management of information. Microsoft products are an excellent example of this, as are all ECM, EDM, ERM, and imaging applications. Schools of library and information science have begun to address these issues over the past decade, but still wrestle with the problem that records management addresses business objects whereas library science,

archival science, and information science address cultural objects. Despite all the changes in records management education over the past decade, perhaps the strongest network for getting education in records management is still ARMA meetings and seminars, as well as seminars advertised by education providers and vendors through ARMA publications.

As noted above in the publications section, ARMA International is the only place where one can find education in and discussions of cross-jurisdictional issues. Canadians and U.S. residents take this for granted and both share information and knowledge about political, economic, social, and technology issues without thinking. Other Anglophone countries have records management societies, but those associations are focused on a single country. With 50 states and as many different laws and regulations, it is the norm for U.S. members and Canadian members working for companies doing business in the U.S. to need cross-jurisdictional discussions. Canadian ARMA members have worked for many years to try to educate U.S. members on the need to pay attention to European Union issues. This finally sunk in over the past 5 years when European members told ARMA representatives that ARMA meetings were the only place where they could discuss cross-jurisdictional issues. Happy with their countries' records management associations, they needed a place to discuss EU and pan-European issues such as data security.

Conversations that begin at ARMA meetings continue off-line often to become warm friendships. A friend who can commiserate with the challenges and frequent lack of respect records managers have experienced is a special friend. For example, a records management Listserv completely independent of ARMA sprang up in the mid-1990s that discusses subjects related to records management. Rambunctious at times, the Listserv provides a way to remain connected while at work. Sometimes the discussion gets off-topic, and many posts are made in jest. The conversation includes frequent contributions from members in Australia as well as in Canada, and the U.S. Most

members of the Listserv are also ARMA members, and there are frequent discussions of the association. Many Listserv members meet at a party arranged at the annual conference. People place names and postings to faces and grow closer. While social networking is not the reason one becomes a member of ARMA, it is one of the reasons members remain members.

Because ARMA is the only place one can go to get a thorough understanding of records management, both as a profession and for complete, formal education in records management, the association has credibility and magnitude that is unparalleled worldwide. As the past decade has seen a rise in visibility for records management, membership has become even more diverse, including lawyers, accountants, information technology professionals, and compliance professionals. Instead of weakening the various types of networks, this has strengthened the various networks, both expanding and strengthening them.

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Armenia: Libraries, Archives, and Museums

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Abstract

Throughout the millennial history and worldwide dispersion of the Armenian nation, libraries have played and continue to play a critical role. They have been instrumental in collecting and preserving the written works which embody the creativity of the Armenian mind, and making widely accessible recorded knowledge about the history, language, and literature of one of the oldest peoples on earth. This entry presents an overview of the establishment and development of libraries, museums, and archives, with special emphasis on those institutions functioning today in the Republic of Armenia.

INTRODUCTION

Throughout the millennial history and worldwide dispersion of the Armenian nation, libraries have played and continue to play a critical role. They have been instrumental in collecting and preserving the written works that embody the creativity of the Armenian mind; and making widely accessible recorded knowledge about the history, language, and literature of one of the oldest peoples on earth.

This entry presents the establishment and development of libraries, museums, and archives, with special emphasis on those institutions functioning today in the Republic of Armenia (Fig. 1). Following an historical overview and a brief discussion of Armenian libraries in the Diaspora, the entry introduces the academic, public, children's, school, and special libraries of Armenia within the regional context of the South Caucasus during the Soviet era and following the declaration of Armenia as an independent republic in 1991. Profiles of Armenia's major libraries are followed by a discussion of the Armenian Library Association, its activities, its role in continuing education, and its involvement in international and regional cooperation. A brief overview of Armenia's national archives and museums concludes the entry. Appendix 1 provides facts about Armenia, and Appendix 2 contains a chronology of Armenian libraries, archives, and museums.

History

The earliest information about Armenian libraries comes to us from the fifth-century historian, Ghazar Parpet'si, who tells us about the establishment at the Catholicosate of Ejmiatsin of a scriptorium ("gratun") which contained Armenian and Greek manuscripts. Surviving time, the elements, and hostile armies, copies of these and other texts can be viewed today in the "Matenadaran," the manuscript

library in Yerevan, Armenia, named after the visionary monk Mesrop Mashtots, who created the Armenian alphabet ca. 405–406 A.D.

Throughout the centuries, Armenian libraries continued to develop and flourish in centers of education, almost always as part of Armenian monasteries, and sometimes as separate facilities. Manuscripts were also stored in nearby caverns and in wall recesses. Entire libraries started coming into being. It is said that in 1170 the Seljuks destroyed a library in Siwnik consisting of 10,000 Armenian manuscripts. These encompassed religious subjects as well as philosophy, music, and calligraphy. The first Armenian academic libraries were established during the eighteenth and nineteenth centuries, away from the Armenian homeland, in Venice, Vienna, Constantinople, Tiflis (Tbilisi), and Moscow.

LIBRARIES OF EURASIA AND CENTRAL ASIA DURING THE SOVIET ERA

Prior to the 1991 break-up of the Soviet Union, its vast territory was administratively structured into 15 union republics (SSRs), which in turn contained 20 autonomous republics (ASSRs), 10 autonomous areas (or National Okrugs), 6 territories (Krais), and 130 regions (Oblasts), eight of which carried the qualifier "autonomous." The union republics and the various autonomous divisions were created to foster, or at least to contain, national or ethnic groups with distinct cultures, languages, or dialects. One may wonder about the origin of all these peoples, with their more than one hundred languages and diverse ethnic backgrounds. In nearly all cases, their established cultures predate both the Soviet and earlier tsarist expansions, which gradually drew them into a sprawling, contiguous Imperium.



Fig. 1 Map of Republic of Armenia, 1991.

Source: From CIA World Factbook 2008. https://www.cia.gov/library/publications/the-world-factbook/geos/countrytemplate_AM.html (accessed July 17, 2009).

During the seven decades of the Soviet regime, the closed societal nature of the USSR promoted an essentially Russian culture, with Russian as the language of administration, law, and military affairs, as it had been during the Tsarist Empire. Government policy toward the minorities, decreed by Lenin and carried on by Stalin and his successors, nominally allowed for the equality of the national languages with Russian, the right to self-determination and development, and the minorities guaranteed, and strongly encouraged, access to socialist federation within the union. There had been numerous long-term and short-term adjustments to the nationalities policy throughout the years, but difficulty always characterized the Soviet Union's attempts to ease or promote the merging of its people.

Libraries of the Soviet Union, as reflections of the cultural and societal institutions of the various countries and their peoples, were centralized and carefully controlled by the state, with the USSR Council of Libraries in Moscow as the ultimate authority on their governance, their resources, and services. Hierarchies of libraries were firmly established. Library directors were spared most of the decision-making. Norms for library work were prescribed with the same kind of central planning that decided in Moscow how many hectares would be planted in Armenia.

Librarians were told how many books of each kind must circulate in their library and filled out their reports accordingly. The usefulness of Soviet libraries was never

contested, nor were libraries especially threatened by closing. Librarians enjoyed a certain stature as "cultural workers." Their libraries, especially the large, important ones, were highly esteemed. Soviet librarianship was proud of huge collections, of the universal literacy in their state, and of excellent bibliographic control. The unmasking of Soviet libraries began during the last years of "glasnost," when librarians began to complain in their professional journals about the formalism of work, the necessity to inflate statistics, the collections full of redundant material that no one wanted to read. Some even began to question the premise that the librarian's most important job was to be a propagandist for the Communist party.

This was the general climate when the Soviet Union disintegrated in August 1991, with participants in the International Federation of Library Associations and Institutions (IFLA) Congress in Moscow as eye-witnesses. Instead of one rigid and homogeneous system, there suddenly were 15. In each case, librarianship had to reform and carry on, to choose what should be kept of the old ways, and to discard what should be thrown out with old party slogans.

The 1988 Earthquake

On December 7, 1988, a killer earthquake devastated the northern region of Armenia. The tremor affected territory of almost 30,000 sq. km. In a few short seconds, it took tens of thousands of lives, crushed by falling debris, and left half a million people injured, maimed, and homeless. It toppled the buildings of many social and cultural institutions, including libraries. Soviet President Mikhail Gorbachev cut short his visit to the United States to return to the earthquake site. Armenian communities world-wide sprang to their feet and worked feverishly to send humanitarian aid to their brothers and sisters in the homeland.

Three weeks later, at the American Library Association Midwinter Meeting in Washington, D.C., a resolution by its International Relations Committee was presented to the decision-making ALA Council, under the presidency of William F. Summers. On January 10, 1989, the Council responded swiftly and unanimously by establishing a \$5000 emergency fund and establishing the Armenian Earthquake Disaster Committee to help restore libraries and library services in the Armenian earthquake belt.

October 7, 1994, marked the inauguration of the Library Association of Armenia. Ten years later, the decennial conference of ArLA took place in Yerevan, with the participation of 119 delegates and 64 guests.

LIBRARIES IN THE REPUBLIC OF ARMENIA

The book has been considered a national treasure since the creation of the Armenian alphabet at the beginning of the fifth century of our era. Armenia's libraries have long been

the mainstay of its rich culture. They are considered as centers of education, surviving time, the elements, and hostile armies. Most of the contemporary libraries of Armenia were established during Soviet rule, from 1921 to 1991. Based on the Soviet formula of one library per 1000 persons, in 1975, there were approximately 3300 libraries: one-third of them public; one-third, school; and the rest, technical, trade union and others. A reorganization of the libraries took place between 1975 and 1980, as a result of which independent city, regional, and rural libraries were unified into 42 centralized library systems, serving three and a half million people. In 1989, the total number of libraries numbered 2883.

The Armenian Book Chamber was established on December 27, 1922. This institution registers and records all published works in the Republic, including books and brochures, periodical publications, posters, postcards, music scores, and maps. The Chamber has been publishing the current national bibliography, *Tpagrut'ian taregirk* = The Yearbook of Printing, since 1925.

With the collapse of the Soviet Union, the challenges of dramatic changes from relative plenty to economic instability and political volatility hit hard. Abridgement of services and reorganization were disturbing. While librarians thought and spoke in terms of their team efforts, unlike a team, they were discouraged from individual initiative and certainly from collaborative networking. The concept of librarians as controllers of information, rather than as facilitators of its flow, would be slow to change.

The work of libraries since the collapse of the Soviet Union has been difficult. Insufficient finances, the disintegration of the book acquisition system, deregulation of the price of books, social hardships, and the energy crisis have disrupted and brought to a halt library functions and services. Some libraries were closed, and the number of users decreased. Presently, efforts are under way to overcome the challenges, and ground is being prepared to move library life into the new technological age.

Academic Libraries

Academic libraries are divided into two groups. The first group includes the Armenian Academy of Sciences library network, consisting of a main library and 31 specialized libraries in its various institutes. The second group of academic libraries includes the libraries of the Republic's 12 state higher educational institutions. The largest of these is the Yerevan State University Library, which functions as the methodological and coordinating center for about 60 libraries affiliated with institutions of higher education in Armenia.

Since the Armenian Republic's declaration of independence in 1991, a few private and non-governmental universities were established and formed their own libraries. Notable among these is the Papazian Library of the American University of Armenia, a WASC-accredited affiliate of the University of California system.

Public Libraries

A well-organized network of public libraries is spread throughout Armenia. These libraries function under the auspices of the Ministry of Culture, Sports, and Youth, and are also accountable to their local governmental bodies. Their services are free of charge to the public. However, in the last decade, public libraries have adopted fee-based services, such as photocopying, computer training, and bibliographic searching.

Notable in the most recent developments have been increased efforts in grant-writing toward the establishment special library areas focusing on English language materials to raise awareness about the United States. These "American Corners" serve as regional resource centers for information and programs highlighting American culture, history, current events, and government.

Children's and School Libraries

Information services to young readers are provided in three types of libraries: separate children's libraries; Centralized Library System children's sections; and school libraries. The Yerevan Centralized Children's Library System, formed in 1979, consists of a Central Library and 14 branch libraries with a total of 350,000 volumes in 1994. This library system caters to 40,000 children annually. Every school has its own library. In the Republic there are 1349 school libraries, with over 18.4 million items, of which 10 million are textbooks. The methodological center of the children's and school libraries is Khnko-Aper Apor National Children's Library, established in 1932.

Special Libraries

In this category are scientific-research, medical institute, museum, and military libraries. Notable among these is the Republic's Scientific-Technical Library, under the Health Ministry. Established in 1946, this library has begun the task of creating and computerizing a network of 19 medical libraries, which primarily serve physicians, surgeons, and medical researchers. The Library of the Eghishe Charents State Museum of Literature and Art, established in 1954, contains books, ps, manuscripts, photographs, audiotapes, musical instruments, works of art and other realia, connected to the renowned literary giant.

PROFILES OF ARMENIA'S MAJOR LIBRARIES

National Library of Armenia

The National Library of Armenia was established in 1919, and subsequently named the Alexander Miasnikian State Library. The 1920s were a crucial period for the formation

and growth of the Library's collections, with the acquisition of items provided by the Lazarian Institute in Moscow, the Nersisian School of Tbilisi, the Armenian Benevolent and Armenian Publishers Societies of the Caucasus, the Yerevan Men's Gymnasia (established in 1831), and private contributions made by prominent scholars and intellectuals. In July 1990, it was renamed the National Library of Armenia (NLA) (Fig. 2). The largest library of Armenian books in the world, as of 2000, the collections numbered some 6.2 million items in Armenian, Russian and other world languages, available for on site use and loan to some 40,000 registered readers.

The first legislation regarding the national Deposit of Publications was adopted in February of 1924. Since 1925, the NLA has gained depository rights to a copy of every item published in Armenia. Presently, an amended and improved version of this law, reviewed and ratified in

1959, is in force. In addition to this function, the NLA also serves as the methodological center for all the public libraries in the Republic.

The Library's Old, Rare and Archival Literature Collection contains single copies of every Armenian publication. Its oldest book is the first printed Armenian book *Urbatagirk* (Friday Prayer Book, or, *A Book on Remedies against Witchcraft*), published in Venice in 1512 by Hakob Meghapart, the first Armenian printer. The Library also has a separate, specialized department for performing arts, cartography, music, and literature in world languages.

Beginning in March 2004, the NLA has begun issuing a monthly newspaper, *Hogevor Hayrenik* (*Spiritual Homeland*).

American University of Armenia Papazian Library

Soon after Armenia's declaration of independence in September 1991, the American University of Armenia, an affiliate of the University of California, opened its doors in the capital city of Yerevan. Offering a graduate program in engineering and business, the mission of the university was to prepare a new generation of leaders of the new democracy.

Established with a \$1 million endowment by Swiss-Armenian benefactors Pinna and Simon Arman Papazian, the University's library has evolved at a rapid pace, implementing contemporary Western-style methods of management and technology.

Since its humble beginnings in 1991, the Library has grown in capacity and readership, currently housing some 28,000 volumes in open stacks and serving over 9000 members—students, faculty, and staff of the University, as well as students, scholars from other institutions, and the community at large. With the American Embassy's USIS library collocated on the same site, a state-of-the-art library would be created to serve as a hands-on, Western-style prototype of what might be possible throughout the country and its existing more than 3000 multitype libraries. At first, the library would occupy a large space on the first floor of the University's building, formerly the site of Communist education headquarters.

What began as a single unit has now evolved into a small information resource network, together with the University's Legal Research Center and the Krikor Soghikian Public Health Reference Room.

Khanko-Aper National Children's Library

Named after a noted author and teller of children's stories, the Khanko-Aper Library was established in 1932 and celebrated its 70th anniversary in October 2003 (Fig. 3). Its mandate is to collect and develop Armenian children's literature. At the entrance to the library building is a sign, which urges children, "Every day, read one page from a new book." Open

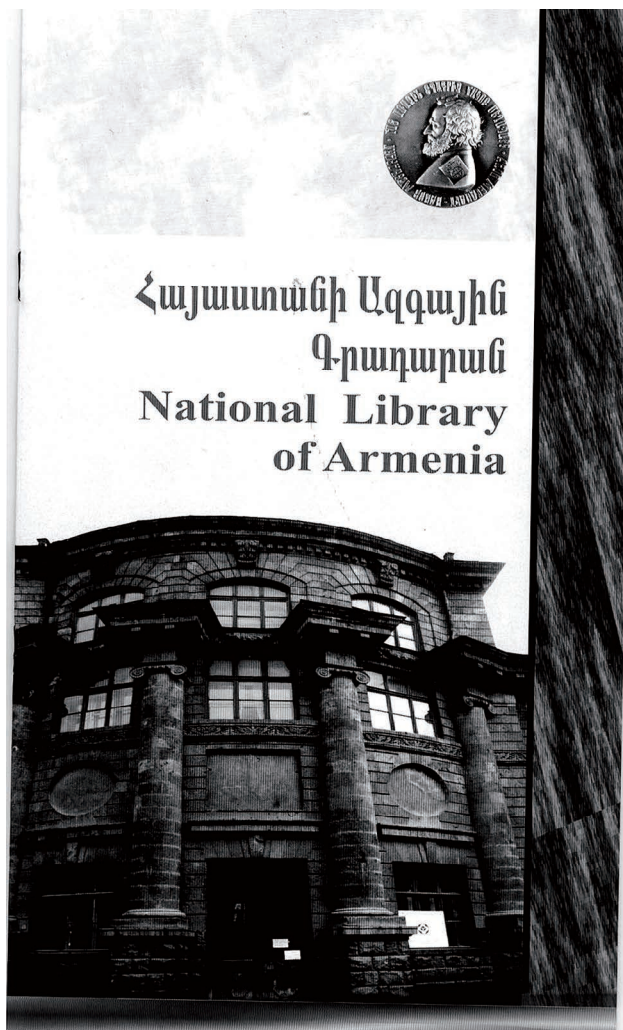


Fig. 2 National Library of Armenia, main entrance, Yerevan (Note: Sylva Natalie Manoogian was contributor and translator into English of Armenian text).

Source: From SNM photos, permission granted 2009.



Fig. 3 Khnko-Aper National Children's Library, Yerevan.

Source: From SNM photos, permission granted 2009.

to children from the age of 4 up until the 9th form, the Library's collections number nearly one half million items. Adults are allowed only if accompanied by a child.

National Academy of Sciences of Armenia Library (NAS RA)

The National Academy of Sciences of Armenia Library (NAS RA), which was established in November 1943 as an affiliate of the USSR Academy of Sciences, unifies scientific and research institutes, subsidiary services and the governing body of this state scientific organization. The Presidium of the Academy includes more than 50 scientific institutions and other organizations in five scientific divisions: Mathematical and Technical Sciences; Physics and Astrophysics; Natural Sciences; Armenology and Social Sciences; Chemistry and Earth Sciences.

The NAS RA Web site currently lists 71 full members, 54 corresponding members, 4 honorary members, 117 foreign members, 59 honorary doctors, and 180 deceased members.

The total number of the workers in the system of the Academy is 4395.

More than four million items can be found in the Academy's libraries, with more than half in the main library. Of these approximately one fourth are in languages other than Armenian and Russian. Annually, this information resource center serves some 20,000 users. The Library is organized to serve the needs of its members and is also part of the Consortium of Libraries engaged in automation.

Republican Scientific-Medical Library (RSML)

In 1990, the RSML of the Ministry of Health of Armenia, in collaboration with the Fund for Armenian Relief, created a vision of a national library network supported by information technology. This vision incorporated four goals: (1) to develop a national resource collection of biomedical literature accessible to all health professionals; (2) to develop a national network for access to bibliographic information; (3) to develop a systematic mechanism for sharing resources; and (4) to develop a national network of health sciences libraries. The RSML has achieved significant progress toward all four goals and has realized its vision of becoming a fully functional national library, now providing rapid access to the biomedical literature and training health professionals and health sciences librarians of Armenia in information system use.

Yerevan State University Library

The University's library, with its 10 divisions, is one of the largest libraries in Armenia, with 12 specialized reading rooms in a number of faculties, housing collections constantly enhanced by the further addition of academic and scholarly literature, and a division of antiquarian and rare books dating from the beginning of the seventeenth century. Over 14,000 readers, students, lecturers, postgraduates, researchers, and other affiliates of the University have access to the University collection of approximately two million books.

Among the University's 100 partners in the international exchange of books are the United States Library of Congress, the National Library of the Russian Federation, and university and academic libraries in the United States, France, Germany, Italy, Argentina, and elsewhere. In 1989, the Library received an award as a first-rate scholarly library.

LIBRARY EDUCATION

Degree programs in library science were established in Yerevan State University in the 1950s. Since 1969, librarians are being trained at the Yerevan Armenian Pedagogical Institute, in a 4-year program leading to a diploma in library science, with 25 graduates each year. The curriculum includes both general subjects and technical courses in library and information science. The Holy See of Ejmiatsin Library College has been offering secondary library training to its seminarians since 1931.

The Armenian Library Association (ArLA) has also taken responsibility for continuing professional education for the Republic's librarians and other library personnel, with funding from various sources, such as IREX, OSI, and the Carnegie Corporation, among others. In addition to continuing education courses, consideration is being given to the establishment of a graduate program of information studies offering master's and doctoral degrees at the American University of Armenia.

ARMENIAN LIBRARY ASSOCIATION, 1994–2008

The first steps toward creating a professional library association in Armenia were taken toward the end of the 1980s. During the same time period, the first library associations were also being established in Moscow and St. Petersburg. In the Baltic States librarians re-established their library associations, which had been forbidden during the Soviet years.

Based on a strong, millennial tradition of the book as a national icon, the libraries of Armenia had continued to thrive during the 70-year Soviet era, with a total of 2883 multitype (public, academic, higher education, technical, health, school, and children's) libraries in 1989.

The tiny land-locked republic of the Caucasus was still reeling from the aftershocks of the earthquake and the effects of hastened democratization, exacerbated by the chokehold of an economic blockade from neighboring Azerbaijan to the east and Turkey to the west.

Libraries had stayed open during the winter, even when schools and businesses were closed. Of Armenia's 7000 library workers, 53 librarians, representing 10 of Yerevan's leading multitype libraries, participated in a short course, entitled "Strategic Planning for Armenia's Libraries," offered through the Extension Department of

the American University of Armenia, from May 23 to June 9, 1993.

The librarians participating in the course were organized into a planning group, representing the major libraries of Armenia, took active part in the following goals:

- To develop the constitutional structure of the Armenian Library Association
- To convene the inaugural conference of the Association in 1994
- To develop strategic plans for the improvement and automation of its 3000 multitype libraries.

On October 7, 1994, the Armenian Library Association conference was convened in the National Library of Armenia. The Inaugural Conference participants were 119 delegates from all parts of the Republic and 64 guests, including four representatives of the American Library Association. Representing all major research, academic technical, special, public, and children's libraries of the Republic, and with delegates from nearly all of the nation's regional libraries, the participants were 100 women and 19 men.

The initiators of Armenia's new Library Association were the National Library of Armenia, the Academy of Sciences Library, the Republican Scientific-Medical Library, the Republican Scientific-Technical Library, the Khnko-Aper Republican Children's Library, the Avetik Isahakyan Yerevan City Central Library, and the Republic of Armenia Ministry of Culture.

The conference approved the Association's constitution and elected a 21-member administration. Nerses Hayrapetyan, currently Director of the U.S. Embassy's Information Resource Center, was elected the first president of the Library Association. Upon examining the status of library work in the Republic, the inaugural meeting approved the mission statement submitted to the library workers, the intellectuals, and the public, which states:

We, the participants in this inaugural meeting, are applying to our co-workers and to all those supporters of library work, asking them for their enthusiastic support of the goals of the Association. The free development of our national culture and knowledge depends on the expression of our individual intellectual strength. Libraries, as centers for the preservation of national spiritual values, moral upbringing, cultural and historical traditions, must assume the place of utmost importance in the sphere of illumination and education.

See the Web site of the Armenian Library Association (ArLA) for organizational constitution and by-laws.^[3]

The Association was officially registered with the Republic of Armenia Ministry of Justice in March 1995 under the name "Library Association of Armenia." On March 6, 1998, by decision No. 9/1–3 of the Ministry of

Justice, the organization was reregistered under a new name, "Armenian Library Association (ArLA)."

During the 10th anniversary of ArLA, October 7 was designated as National Library Day, with the motto: "New Century; New Libraries."

The ArLA and the National Library of Armenia play key roles as regulative, normative, and cultural-cognitive institutions. They are the leaders in the Consortium of Armenian Libraries, currently involved in automation of the nation's information institutions, and also as collaborators with the libraries of the neighboring South Caucasus republics of Azerbaijan and Georgia.

Association Activities

Since its establishment, the Association has had the purpose of utilizing the specialized abilities of its members for the development of library work in Armenia, to improve access to services and resources by means of modern methods and computer technology.

Toward this end, Association members have enthusiastically participated in approving government documents concerning library work, developing library legislation. The Association has organized and implemented numerous and various types of library programs (Table 1), as follow:

- The Association also implements various types of large and small programs. Among these should be mentioned the subscription for Armenia's libraries, through the support of the South East Florida Library Information Network (SEFLIN), to the EBSCO publications company's EIFLDirect program
- Taking into account the low probability of Internet access in Armenia, approval was given to secure CD and DVD subscriptions for libraries. From January to June 2000, through a "Technical means for participants in the EIFLDirect program" grant, nine regional libraries acquired DVD players.
- In cooperation with the International Research and Exchanges Board (IREX), the Armenian board of the Internet Access and Training Program is currently preparing to mount individual pages on the World Wide

Web for the Armenian Library Association and regional public libraries.

The Association and Continuing Education

One of the main priorities for the Association is the organization of continuing education courses for Armenian librarians (Table 2).

The Association cooperates with Armenia's only institution of higher education for the preparation of library specialists, the faculty of library science and bibliography of the Khachatur Abovian Armenian Pedagogical University. The Association has organized lectures by American library specialists for the student body.

Many of the Association's members participate in international scholarly conferences, seminars, and retrainings. Numerous representatives of the Association are participating in the largest conferences convened throughout the Commonwealth of Independent States, the annual conferences in Crimea. In December 1998, in cooperation with the Russian Library Association, St. Petersburg Library Association member, Karine Arabyan participated in the planning of the seminar, "The role of special organizations in the work of shaping the library into a modern facility." Several members of the Association have also participated in the Open Society Institute Central European University, Bucharest, summer school program.

International and Regional Cooperation

One of the goals of the Association is to participate in international library cooperation (Table 3). Toward that end, in 1995, the Association applied to the governing bodies of IFLA (International Federation of Library Associations and Institutions), indicating its interest in membership in that most important international library organization. In August 1996, during the 62nd IFLA congress in Beijing, the Armenian Library Association was elected as a national association member.

Table 1 Armenian Library Association library programs.

Date	Participants	Program
May 10, 1996	ArLA, National Library of Armenia, National Book Palace	Round table: "The current status of the receipt of obligatory copies of documents of the Armenian Republic and visions of cooperation within the Commonwealth of Independent States."
July 10, 1996	ArLA, National Library of Armenia, Yerevan State University Scientific Library, Khnko-Aper Children's Library, Republican Scientific-Medical Library, and others	Round table: "Status of Armenia's libraries"
October 1994–present	ArLA	Annual conference

Table 2 The Armenian Library Association and continuing education.

Date	Participants	Program
March to June 1998	78 library workers from nine libraries in Yerevan	4-session course: "Education of Library Workers"
October 21–24, 1998	18 representatives from nine regional libraries of the Republic	3-day seminar
March to April 1999	60 library workers	3-week training course, in collaboration with Ararat Republican Regional Library

The Association is registered in four of IFLA's working group sections: national libraries, scientific-technical libraries, national libraries, and information technologies.

Regional relations with Georgian and Azeri library workers began in 1996–1997. During those years, after the break-up of the former Soviet Union, the first immediate linkages among the three nations' library workers took place.

As a result of such collaborative efforts, several librarians from Armenia have received fellowships to study library and information science in the United States so that they can return to the homeland and train their colleagues in new ideas and techniques for improved library service. They have taken courses at the University of Illinois-Urbana/Champaign, Mortenson Center; University of Pittsburgh; and Louisiana State University, among others. They have also served internships in several U.S. libraries, including the Library of Congress, Los Angeles Public Library, and the Bakersfield Public Library, in California.

ARMENIAN LIBRARIES OF THE DIASPORA

With the loss of statehood and the tragedy of the first genocide of the twentieth century, Armenians were compelled to leave their homeland on the Armenian plateau, east of the Euphrates River. Because of their affinity for global exploration and adaptability to new environments, they settled in all corners of the world, carrying with them and re-establishing their cultural institutions in émigré colonies. They built churches, founded schools and libraries, and established printing presses, thus bridging the past and present of their unique heritage.

In the United States, as early as 1875, the quest to preserve the language and instill the history of Armenia led various groups to organize reading rooms and lycea, usually

in a church, library, or office building. There, Armenian and English-language periodicals and books were made available. College students and visiting intellectuals spoke to reading-room subscribers in Armenian on matters of current political and literary interest. In 1890, before the city of Fresno, California, had a public library, the Fresno Armenian Library Union was organized, an example emulated by Armenians in the California cities of Fowler and Los Angeles. The desire for a public library was so ardent that even the tiny Armenian community in Kenosha, Wisconsin, raised funds at an Armenian wedding in 1905 for an Armenian reading room.

The number of multitype and specialized Armenian libraries in the Diaspora today is significant. A listing of no fewer than 302, surveyed for their holdings of books printed between 1512 and 1800, can be found in a compilation prepared by three bibliographic scholars and published under the title *The Armenian Book in 1512–1800* (Yerevan: 1988). Notable among them are the libraries of the Mekhitarist Order in Vienna, Austria, and San Lazzaro in Venice Italy; the Monastery Library of Isfahan, Iran; and the Calouste Gulbenkian Library of the Armenian Patriarchate of Jerusalem.

In its latest edition, the *Armenian American Almanac* (Los Angeles: 1995) devotes an entire section to libraries in the United States and Canada which house Armenian collections, categorizing them as organizational and research, public, school, college and university, church and seminary, special and private collections.

NATIONAL ARCHIVES OF ARMENIA

The Web site of the National Archives of Armenia (<http://www.armarchives.am>) provides a detailed chronology of significant events from the establishment of the Archives

Table 3 ArLA and regional and international cooperation.

Date	Participants	Program
May 5–6, 1997	ArLA with 15 Georgian librarians and two from the United States	Regional conference: "The Library as an information center: A new model" took place in Yerevan
May 5–8, 2001	Representatives of ArLA, Library Associations of Azerbaijan, Georgia, and American Library Association	Regional conference, Tbilisi, Georgia: "Strengthening Library Associations in the South Caucasus"
September 27–30, 2002	Representatives of ArLA, Library Associations of Azerbaijan, Georgia, and American Library Association	Regional conference, Yerevan, Armenia: "The Role of Academic Libraries in Fostering Civil Society"

in 1921–2006. Also included are summaries of organizational structure, archives legalization, description of holdings, and information about archives of state bodies and organizations in the Republic of Armenia and the Autonomous Republic of Nagorno-Karabakh. The *Law of the Republic of Armenia Concerning Archive Keeping* was accepted on June 8, 2004 and its 10-chapter content can be accessed online.

MUSEUMS OF ARMENIA

A visitor to Armenia will be amazed by the beauty of its natural environment, often described as “a museum of antiquities,” with its mountains, caves, rivers and lakes, and ancient monasteries and fortresses. “Armeniapedia.org” offers brief descriptions of some 24 museums in the capital city of Yerevan and environs. “TACentral.com” provides a more extensive list of museums in Yerevan and 52 museums throughout the Republic.

The Armenian State Teachers University named for Khachatur Abovian offers Master’s Courses in Museology and Protection of Monuments.

The following table lists the Yerevan museums by name and summarizes the regional museums by quantity (Table 4).

Mesrop Mashtots Institute (“Matenadaran”) of Ancient Manuscripts

After its confiscation by the Soviets, the scriptorium of the Holy See of Ejmiatsin, which housed an extensive collection of Armenian and Greek manuscripts, became the basis for the “Matenadaran,” the manuscript library in Yerevan, Armenia, named after the visionary monk Mesrop Mashtots, who created the Armenian alphabet ca. 405–406 A.D.

The “Matenadaran” is one of the oldest and richest book depositories in the world and, as such, it is listed on the UNESCO Memory of the World Register Nominated Documentary Heritage (Fig. 4). Its collection of some 17,000 manuscripts includes almost all the areas of ancient and medieval Armenian culture and sciences—history, geography, grammar, philosophy, law, medicine, mathematics-cosmography, theory of calendar, alchemy-chemistry, translations, literature, chronology, art history, miniature, music and theatre, as well as manuscripts in Arabic, Persian, Greek, Syrian, Latin, Ethiopian, Indian, Japanese and others. In this cultural heritage repository, many originals, lost in their original languages and known only because of their translations into, have been saved from disappearance.

Genocide Museum and Institute

Principal activities of the Armenian Genocide Institute and Museum include: Scholarly exhibitions of historical-

Table 4 Museums of Armenia.

Yerevan	Tags
Armenian Craft Museum	Arts and crafts
Minas Avetisyan Museum	Armenian painter and stage designer
Yeghishe Charents Museum	Armenian poet
Children’s Art Gallery	Center for aesthetic education
Contemporary Art Museum	Contemporary painting, drawing, sculpture
Erebuni Fortress Museum	Archaeology
Genocide Memorial and Museum	Armenian genocide, 1915–1923
Geological Museum	Metals and minerals; fauna and flora
Avetik Isahakyan House-Museum	Armenian poet
Aram Khachaturian Museum	Armenian composer
Matenadaran Manuscript Museum	17,000 manuscripts in Armenian and other languages
Middle East Museum	Arts of the Mediterranean
Museum of Modern Art	Contemporary arts
Sergei Parajanov House-Museum	Armenian cinematographer
Martiros Sarian House-Museum	Armenian landscape painter
Alexander Spendiarian House-Museum	Armenian composer and composer
State History Museum	
State Picture Gallery	
Hovhannes Tumanian Museum	National poet and folklorist
Wood Carving Museum	Folk art
Aragatsotn region (Ashtarak)	Four House-Museums
Ararat region	One House-Museum and one Art Gallery
Armavir region (Ejmiatsin)	11 Museums and Art Galleries
Gegharkunik region (Sevan)	Four Museums and Art Galleries
Lori region (Vanadzor)	Eight Museums and Art Galleries
Kotaiik region (Tsaghkadzor)	Five Museums
Shirak region (Giumri)	Five Museums
Siunik region (Sisian-Goris-Meghri)	Nine Museums
Vayots Dzor region (Yeghegnadzor)	Five Museums

documentary materials, archival documents, photos on the Armenian Genocide in 1915–1923; guided tours of the Museum in English, French, German, Russian and Armenian; continuing research. The Genocide Museum and Institute cooperates with various scholarly institutions in Germany, France, United States, Austria, Italy, Russia, and other countries. In 1996 the Museum organized an international conference in collaboration with Italian and



Fig. 4 Mesrop Mashtots Institute of Ancient Manuscripts, Yerevan.
Source: From SNM photos, permission granted 2009.

German scholars devoted to the memory of Armin Wegner, the noted German writer and journalist, a witness of the Genocide. In 1998, the Museum sponsored an international conference dedicated to the 140th anniversary of the birth of Johannes Lepsius, a great friend of the Armenian people. The Museum also conducted international conferences in 1999 devoted respectively to Henry Morgenthau, United States Ambassador to Turkey during the Genocide, and Anatole France, famous French author and supporter of the Armenian cause. On April 23, 2001 it convened an international conference on the occasion of the 86th anniversary of the Armenian Genocide, attended by scholars from all over the world.

Children's Art Gallery and Aesthetic Center^[5]

"The World through the Eyes of Children" is the name of an exhibit that opened in the Artists' Union of Armenia in 1968 on the initiative of art expert Henrik Igitian. Soon after, the Children's Art Gallery was founded in 1970 and was later reorganized as the Museum of Children's Art. The Gallery has a permanent exhibit and a showroom where individual and thematic exhibitions are organized. It accepts children's paintings from all over the world and exchanges some of its own with institutions abroad. In 1975 the British Prime Minister Harold Wilson donated 100 paintings by British children

to the Gallery. The Gallery has about 200,000 exhibits (paintings, sculptures, graphic works, ceramics, appliqué, carpets, rugs, and embroidery) from about 120 countries of the world. Artwork from the Museum's stock has been sent to exhibitions staged in the United States, France, Italy, Czech Republic, Slovakia, Japan, and elsewhere, and shown at the Children's Paintings Exhibition "From Fuji to Ararat" displayed in 1997 in Yerevan at the gallery of the Armenian Painters Union, where 400 paintings from 160 countries were displayed. With the founding of the National Aesthetic Education Center in 1978, the Gallery became the Armenian Museum of Children's Artwork (with branches in Gyumri, Vanadzor, Goris, Kapan, Sevan, Spitak, and Meghri). The Center also has painting and decorative applied arts studios, a symphony orchestra, theaters, and a film studio. The Children's Art Gallery was the first museum of children's artwork in the world.

CONCLUSION

This overview of Armenia's libraries, archives, and museums aims to introduce these information institutions against a millennial historical backdrop, within a socio-cultural and organizational context, in order to demonstrate their importance in preserving, promoting, and

perpetuating Armenian patrimony, cultural heritage, and ethnic identity.

Armenia was a full participant in the World Summit on the Information Society in Geneva (2003), with President Robert Kocharian and his staff representing the Republic. All of the documents from the Summit regarding Armenia are available on-line in English and Armenian. The Republic was also represented at the Tunis World Summit in 2005.

The Armenian Library Association, with its National Library Day motto: “New Century; New Libraries,” promises to sustain itself and grow as an advocate for the Armenian Republic’s libraries and librarians. Through its participation in the international arena, it has become an active participant in the globalization of its libraries. Future plans for library, archival, and museum specializations include research on educational reform in the South Caucasus, with an aim to establish an integrated graduate information studies program and training center for the region.

APPENDIX 1

 Republic of Armenia = Hayastani Hanrapetut’yun

Government

National: Republic with a unicameral National Assembly (Parliament—131 seats); 5-year term for President; 4-year term for Parliament; universal suffrage; 18 and older (CIA World Fact Book, 2008)

Official Languages: Armenian is the primary official language (97.7%); Yezidi, 1%; Russian, 0.9%; other; 0.4% [2001 census] (CIA World Fact Book, 2008)

Capital City and Administrative Divisions: Yerevan and 11 *marz-es* (provinces)—Aragatsotn, Ararat, Armavir, Geghark’unik’, Kotayk’, Lorri, Shirak, Syunik’, Tavush, Vayots’ Dzor (CIA World Fact Book, 2008).

Legal System: Based on civil law system. Has not accepted compulsory ICJ jurisdiction (CIA World Fact Book, 2008).

Key Dates: September 21, 1991 (Independence from Soviet Union) (CIA World Fact Book, 2008)

People and Economy

Total Population: 2,968,586 (July 2008 est.); Rank (World Bank): 131 (2007 est.) (CIA World Fact Book, 2008)

Major Ethnic Groups (%): Armenian (97.9%); Yezidi (Kurd) (1.3%); Russian (0.5%); other (0.3%) (2001 est.) (CIA World Fact Book, 2008)

Religious Affiliation (%): Armenian Apostolic (94.7%); other Christian (4%); Yezidi (monotheist with

elements of nature worship) (1.3%) (CIA World Fact Book, 2008)

Gross domestic product (GDP in 000s US \$ and rank): \$17.15 billion and 111

(2007 est.) (CIA World Fact Book, 2008)

GDP Per Capita (US \$ and rank): \$4,900 and 111 (2007 est.) (CIA World Fact Book, 2008)

Education

Adult Literacy Rate: 99.6% M; 99.0% F (2005 regional avg.) (CIA World Fact Book, 2008)

Preprimary School Enrollment: NA/29% M; NA/27% F (2005 regional avg.) (CIA World Fact Book, 2008)

Primary School Enrollment: 101% M; 100% F (2005 regional avg.) (CIA World Fact Book, 2008)

Secondary School Enrollment: 91% M; 87% F (2005 regional avg.) (CIA World Fact Book, 2008)

Tertiary School Enrollment: 25% M; 27% F (2005 regional avg.) (CIA World Fact Book, 2008)

Higher Education Enrollment: (number of institutions—16 State, 72 non-State Universities; 42,505 and 19,755 students, respectively)

Information Infrastructure and Institutions

Number of Books Published: 516 (1999) (UNESCO – UIS, 2008)

Circulation of Daily Newspapers (per 1000 inhabitants): 7.60 (2004) (UNESCO - UIS, 2008)

Radios (per 1,000 inhabitants): 850,000 (1997) (CIA World Fact Book, 2008)

TV Sets (per 1,000 inhabitants): 825,000 (1997) (CIA World Fact Book, 2008)

Films (number produced and seats per 1,000 inhabitants): 38.70 (1995) (UNESCO - UIS, 2008)

Internet Hosts (total): 8,270 (2007) (CIA World Fact Book, 2008)

Internet Users (total): 172,800 (2006) (CIA World Fact Book, 2008)

APPENDIX 2

Chronology of Armenian libraries, archives, and museums

Dates	Event
301 A.D.	Armenia accepts Christianity as state religion
405–406 A.D.	Mesrop Mashtots creates the Armenian alphabet, launching the Golden Age of Armenian literature (5 th century), and establishment of monastic libraries and centers of education

(Continued)

Chronology of Armenian libraries, archives, and museums
(Continued)

Dates	Event
1512	Publication of first Armenian printed book by Hakob Meghapart, San Lazzaro, Venice, Italy
18 th –19 th centuries	Establishment of academic libraries in Diaspora
1875	Inception of reading rooms and lycea in United States Armenian communities
• 1890	Establishment of Fresno Armenian Library Union
• 1905	Armenian reading room established in Kenosha, Wisconsin
1895	Hamidian massacres (Ottoman Empire)
1909	Massacres at Adana, Cilician Armenia
1915–1923	Armenian genocide, Western Armenia
1917	Eastern Armenia becomes part of the USSR
1919	Establishment of National Library of Armenia
1921	Establishment of National Archives of Armenia
December 27, 1922	Establishment of Armenian Book Chamber
1932 November	Establishment of Khnko-Aper National Children's Library
1943 November	Establishment of National Academy of Sciences of Armenia
1950s	Establishment of degree programs in library science, Yerevan State University
December 7, 1988	Earthquake in northern region of Armenia
August 1991	Collapse of Soviet Union
September 21, 1991	Armenia declares independence; American University of Armenia established
October 7, 1994	Inaugural meeting of Armenian Library Association
May 5–8, 2001	Regional conference: "Strengthening Library Associations in the South Caucasus"
September 27–30, 2002	Regional conference: "The Role of Academic Libraries in Fostering Civil Society"
October 7, 2004	Decennial of Armenian Library Association and declaration of National Library Day

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Art Galleries

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Abstract

The transition of the support structure for the arts from one of patronage to a primarily market-based environment provided an opportunity for art connoisseurs to establish private commercial art galleries. With the growth of the art market, the gallery system has developed into the primary enterprise for distributing art, as well as the dominant venue for introducing and presenting new art. Art galleries reflect the diversity in the art world and are similarly differentiated in terms of high and low, popular and elitist, avant-garde, and commercial. This entry defines the ideal-typical art gallery and describes its operations and role in the distribution of art. The qualities that distinguish galleries are situated within the cultural hierarchies of the art world as a way to better understand the various roles of art galleries within an integrated, but stratified system for the production and consumption of art.

INTRODUCTION

In the broadest sense, an art gallery is any architectural space utilized for the display of art or artifacts. The Western concept of the gallery originated during the Renaissance when noble residences featured colonnades, balconies, and eventually entire rooms for displaying art, antiquities, and cabinets of curiosities. These galleries were primarily private affairs, functioning as symbols of wealth, status, education, and taste for the benefit of the aristocracy and cultured elite. Only in the eighteenth century did public spaces begin to be designated as exhibition galleries for art, most often within institutions such as academies, universities, museums, libraries, and other civic organizations. (For a history of the establishment of museums see Bazin^[1] and Impey and MacGregor.^[2]) Thus, a large museum is generally a collection of galleries, with each exhibition space often dedicated to a specific period, discipline, genre, artist, or theme.

But art galleries are more than exhibition spaces: they are also organizations in and of themselves, and when we think of art galleries today, particularly in the United States, we generally refer to privately owned, commercial businesses operating as retail enterprises that buy and sell works of art.

As with any creative endeavor, the arts are measured in degrees of competency, excellence, and significance, and art galleries reflect these distinctions. Galleries can be located on a continuum between art created for the sake of aesthetics and expression at one end, and art produced for its marketability on the other. The paradox of the contemporary art world lies somewhere along that stretch of multiformity, a balance, (some would say compromise), between artistry and success.^[3] That is, the art world is a tiered system that distinguishes galleries by those that handle fine art and high culture from those that promote

commercial art and popular culture. Fine arts galleries are closely allied with museums, curators, auction houses, and others in the international art market, while commercial galleries lean toward interior design and decoration. The majority of galleries are a composite, yet the ideal-typical gallery conforms largely to the top-tier model: a large, minimalist white room, single works of art, and dramatic lighting characterize the common notion of an art gallery. (For an interpretation of the aesthetics of display in art galleries and exhibit design in museums see O'Doherty^[15] and Staniszewski.^[4])

This entry begins with a definition of the quintessential contemporary art gallery and its role in the presentation and distribution of contemporary art. Although the model gallery is not unusual, a variety of specializations exist among them, while others appeal to quite different markets altogether and operate with dissimilar business models and organizational structures. Differentiation among galleries, particularly for those involved in the international contemporary art market, is situated within the cultural hierarchies of the art world as a way to better understand the various roles of art galleries within an integrated, but stratified system for the production and consumption of art. A brief history of the development of the modern art market places the establishment of art galleries in context. The diversity within the field is described to provide an introduction to the range of variance.

DEFINITION

Art galleries are, basically, retail establishments exhibiting and selling original works of art. More importantly, however, art galleries facilitate the distribution of art through a cooperative enterprise, providing art

collectors a mediated and authoritative source for acquiring works of art, while at the same time integrating artists into society by helping them transform their vision, talent, and investment in materials into financial support for their creations, by converting aesthetic value into economic worth.^[5] The following description more specifically represents what is, perhaps, the archetypal art gallery within this system, albeit a top-tier one selling art by living artists in the international contemporary art market.

Operations

An art gallery is a small business, generally a sole owner/director supported by a few staff.^[6] The dealer or gallerist, as the owner is known, represents a select group, or stable of artists, usually around 20, and exhibits their work publicly. Galleries present an annual schedule of six to ten changing exhibitions, including solo shows that feature the work of an individual artist, or group exhibitions of multiple artists organized by artistic theme or affiliation.

Exhibitions are an opportunity to not only present each artist's new work, but also, more importantly, to promote the artists to art critics and museum curators. Dealers then use their confirmation of artistic merit to cajole collectors to purchase artwork. Ideally then, growing collector interest, particularly among museums, bolsters the artist's reputation, which in turn leads to appreciating value for their work, and ultimately results in a sustained artistic career. Financially, the gallery generally assumes all the expenses associated with presenting and publicizing the art and artist, and in return receives a percentage of the sale price. The standard commission is 50%, although individual business arrangements vary. Dealers may also purchase their artist's work outright—artist stipends are less common today—and then resell it, making an additional profit if the value increases over time.

As promoters, dealers must be able to convince others that their artists have the potential to become important in the art historical context, and consequently collectible. As part of the promotional process for building an artist's reputation, dealers advertise in the major art magazines, e.g., *Art in America*, *Artforum*, *ArtNews*, (these influential trade journals are an important resource for current events and a leading indicator of trends in the international contemporary art market) and mail announcements of exhibit openings to a large, but targeted audience. Dealers then begin to establish a demand in the market, or a following for their artists by encouraging critics—who hopefully will write positive reviews and topical articles—and curators—who may include their artists in museum exhibitions and/or collections—to also recognize and acclaim an artist's importance.

A collector's reputation can also affect the reputation of the artists they collect. Dealers are able to increase the value, both economic and aesthetic, of an artist's work by placing it in a high profile, well-respected collection, a

museum for example. Dealers actively cultivate their collectors, be they individuals, corporations, or museums by networking and providing value-added services such as art education, investment counseling, appraisals, and financing in order to maintain this relationship. Unlike a typical commercial business where all buyers are welcome, generally on a first-come-first-served basis, art dealers may even restrict sales, if demand allows, of important artwork to their best clients in an effort to maximize the benefits. Establishing prices for art works and increasing their value over time is a complicated formula involving more than just basic supply and demand, but also, as with other luxury goods, more intangible factors as status, reputation, provenance, and fashion. (For more on the economics of art see Robertson.^[26])

Role

As the primary distributor for art, galleries function in a somewhat similar capacity as both publishers and book-sellers do for literature. However, the role of the art dealer is often not limited to publicity and sales, but may also include discovering and premiering new artists, and directly brokering the relationship between artist and collector. In this capacity, an art dealer is perhaps more like a literary agent. Dealers constantly wade through a sea of new artists, often received as unsolicited submissions to the gallery. The dealer evaluates an artist's work, rejects those they regard as unworthy of exhibition and unlikely to advance, and accepts for a trial run those whom they feel have potential. The artists who fail to garner critical notice, or lucrative sales, are released, while those that succeed are retained and promoted. Each dealer has individual artistic preferences, or aesthetic points of view, and chooses artists to represent accordingly.

Museums rarely exhibit work by young, untested artists, so galleries function as the proving ground for emerging artists—although rarely lauded for providing a public service, art galleries significantly enhance cultural life by presenting free public exhibitions of art, much of it for the first time. Since galleries are the dominant venue for introducing and presenting new art, dealers also assume the role of gatekeeper,^[6] first, by initially deciding which works will be exhibited and which will not, and second, by being as selective as possible about the type of collectors to whom they are willing to sell, particularly when it comes to their best artists. One way to evaluate an art dealer, as art critic Lawrence Alloway^[7] sees it, is to “. . .measure dealers. . .by their power to sell art, infiltrate museums, and generate art criticism.”

Art dealers who follow this model for seeking out the rising stars of the art world are more interested in choosing unrecognized artists they feel are breaking new artistic ground, ones that are truly avant-garde, than in artists who may be more of sure thing financially. While some dealers prefer to represent these emerging artists, others

favor artists who are more established and already recognized, and consequently their work is more likely to sell. Still other galleries do not even represent living artists, but only historical artwork. These differences in focus or specialization among galleries are only some of the ways in which they vary. Regardless of which type of gallery a dealer develops, the style is often a reflection of the owner's individual tastes, goals, and values, as is the case with most small independent businesses. (For more on the idiosyncrasies of individual dealers see Klein.^[8]) So while the description above represents the common idea of an art gallery, it does not sufficiently describe all art galleries.

DISTINCTION

Perhaps the most common way to distinguish one type of gallery from another is by the quality of the artwork exhibited. This method is, however, highly subjective and invariably leads to applying something like a high- vs. low-culture framework. (For an investigation of high vs. low culture see Gans^[9] and Bourdieu.^[10]) The top tier of galleries adopting this criterion present only museum-quality art, i.e., art that meets rigorous standards regarding the artist's education, aesthetics, art historical significance, etc., and which could conceivably be exhibited in an art museum.^[3] A second criterion for the quality of art and the galleries that handle it would be investment potential. These two benchmarks distinguish elite galleries from more commercially-oriented galleries, frame shops with art displays, and similar retail stores offering more popular, or less aesthetically challenging decorative art and graphics, mass-produced posters, functional crafts, and tourist mementos.

The 2002 US Economic Census^[11] reported more than 6000 galleries in the United States; however, the number handling museum-quality art is much smaller. The national art magazine *Art in America* publishes an annual guide to artists, arts organizations, and art services. In 2007 it provided free listings for just over 4000 commercial galleries.^[12] The classified exhibition directory, *Gallery Guide*, included just over 3000 paid gallery listings the same year.^[13] The number of galleries in invitational organizations is much smaller: Art Dealers Association of America lists only 170 members, all of which are top ranked and most of which are located in New York. The four major national associations of art and antique galleries in the United States (see Resources, below), represent approximately 400 members, or less than 10% of the total number of establishments. These gallery groups operate in all three economic markets, and handle the great majority of the most sought-after museum, and investment-quality art represented in major museum exhibitions and collections.

Among these 400 or so elite galleries, distinctions become more complex and involve the dealers' access to,

and levels of, participation in social networks, and their degree of professional reputation. Artist Martha Rosler^[14] recounts a conversation with a dealer who pointed to his coffee table and said, "See this table? That's the art world. And you're either on it or you're not." Only a small group of galleries meet the top criteria, and have achieved influence and power within the small network of players in the fine arts.

THE ART WORLD

Since the middle of the twentieth century, art galleries have operated as part of what is broadly referred to as the art world. Art critic Lawrence Alloway^[7] describes the art world as a system: an integrated network of artists, dealers, critics, museum curators, historians, collectors, and staff affiliated with for-profit and nonprofit galleries, museums, academies, publications, auction houses, government cultural agencies, etc. Within this system, art moves through various spheres or stages as its audience changes. Artworks are first created in the artist's studio, where the initial audience includes the artist's friends. The audience expands to a specialized, interested public when the work is presented at a gallery exhibit. Works that are sold then reach the collector's circle. Museum exhibits, and publication in catalogs, magazines, and newspapers, expand the audience to a broader public.

Sociologist Howard Becker^[5] describes the relations between artists and audiences in terms of "patterns of cooperation." He too sees the art world as an interdependent system or network of social relationships that define the production and consumption of art. Rather than seeing artists in the cliché of isolated, romantic mythically gifted individual creators toiling alone in their studios, they are part of integrated spheres of colleagues, styles, movements, regions, etc., their efforts being shaped by interactions among various participants. For Becker, art worlds are composed of all those whose cooperation and coordinated collective activities, utilizing a set of shared conventions, are required to produce, distribute, and consume art, rather than any essential quality or inherent characteristics of the art work itself. Membership in the art world is, at least in the commercial sector, self-determined, since there are no regulations that control entry into the field, and no required training, certification, or licensing for art dealers.

Therefore, there is no singular art gallery, beyond the basics of an architectural space for exhibiting art and a business engaged in selling it. While general occupations and affiliations may be easily attributed to the art world and membership within those categories seem clearly determined, for example, any business calling itself an art gallery is an art gallery, the sheer number of galleries and artists encourages not only specialization and market segmentation, but hierarchies as well that help distinguish the relative position of participants and organizations.

For many, the extent to which art galleries engage in elitism is problematic. Artist and art critic Brian O'Doherty's^[15] important series of critical essays on contemporary galleries as exhibition space captures what has become for many, particularly artists, a persistent problem with galleries, chiefly that the "gallery space still gives off negative vibrations." Three perceptions contribute to the bad connotations, according to O'Doherty, first "esthetics are turned into a kind of social elitism—the gallery space is exclusive. . . [second] esthetics are turned into commerce—the gallery space is expensive. . . [and third] without initiation. . . art is difficult."

For better or worse, fine art continues to function as, or at the very least is still perceived symbolically to be a luxury commodity that conveys status. As a result, it is often classified in a stratified pyramid of cultural production and consumption that defines works of art in terms of high and low, popular and elitist, avant-garde and commercial.^[3] Determining the value of that status is often quite subjective and it is generally established by complicated interactions among various, but unequal art world constituents.^[10]

FROM PATRONAGE TO MARKET

Although there has been an arts trade for as long as there have been artists and patrons, the practice of art as commerce is a product of the modern era.^[16] Patronage had been the dominant system for supporting the arts up until the seventeenth century. An art patron, that is, the church, court, or aristocrat, would commission works directly from artisans, who usually worked as part of a guild. The patron often dictated the subject, if not the style and method, and effectively controlled the market, such as there was one. The Medici family of Florence, for example, was a significant art patron during the Renaissance. Again, these artworks were symbols of the patron's prestige and their sponsorships required a certain amount of knowledge about the subject, usually history or religion, as well as about aesthetics and craftsmanship. Eventually, however, structural changes that fostered the development of bourgeois society made possible shifts in the production and consumption of art from the aristocracy to a developing upper-middle class, from commissioned patronage by the elite to public participation in a commercial market.^[17]

For these new admirers, art was mostly acquired through inheritance, as gifts or travel mementos, or at estate auctions, rather than directly through commissions. Art entered the marketplace as early as the seventeenth century, with the Dutch art trade being one of the earliest examples.^[18] Shops and merchants of various types began to sell paintings and prints, but the art was more often intended as interior design pieces along with furniture, decor, and curios, recognized more for their craftsmanship and not yet generally regarded as "high" art. Similarly, as

the demand for art grew, especially among an aspiring new class of merchants, tastes changed as well, with a growing preference for landscapes, portraiture, and domestic scenes, as opposed to the grand historical narratives and religious allegories commissioned by the state or church. To meet this demand, the number of artists increased dramatically, and so did various academic and artist associations, which began organizing expansive public art exhibitions. The most renowned during the seventeenth and eighteenth centuries was the Salon, the official art exhibition of the Académie des Beaux-Arts in Paris, France, with equally important exhibitions organized by the Royal Academy of Arts in London, which provided an opportunity for both burgeoning groups to connect. As art schools and academies were established and artists trained and professionalized, art movements with specified philosophies, styles, and manifestos developed, and consequently, interpretation, criticism, and the historicization of art. Soon, what was and was not art became formalized, specialized, and debatable. For those who were unfamiliar with art history and these new artistic trends—the cultural avant-garde—the need, or at least the opportunity for an arbiter between artists and this new audience developed. And it was not long before connoisseurs entered the world of art in order to help negotiate an exchange and make a profit for themselves along the way.^[19–21]

The developing moneyed classes of the nineteenth century, in the United States in particular, wanted to establish their social status by building their cultural capital in addition to their increasing economic fortunes. However, most had not inherited a history of arts patronage, and therefore had little experience acquiring an art collection. This became an opportunity for entrepreneurs to insert themselves as intermediaries and aspirant brokers in art between now-independent artists and the nouveaux patrons-cum-collectors. With the novice collectors' aspirations in mind, the galleries tended, early on, to mostly feature paintings by well-established, prominent European masters, rather than unknown provincial American artists. The dealers recognized that consecrated works would more readily convey the sophistication of their collectors. The Duveen Brothers was a prominent gallery at this time. But as the interest in collecting art grew and art galleries flourished, Old Masters and other prominent art became harder to acquire relative to the growing demand, so dealers increasingly began to feature art work by living artists in addition to the classics. At the same time, artists were asserting their creative freedom to produce innovative work and were gradually being recognized as legitimate. By the late nineteenth century, art galleries exhibiting and offering original works of art exclusively as fine art, rather than merely decorative items, were becoming well-established. Two important galleries that were established at this time, and continue to operate today, are Knoedler and Co. and Wildenstein and Co.^[22]

The rise of art dealers and their establishment of galleries marked a significant change in the development of a

new art market as they assumed the role of middleman. But art dealers gradually undertook a much more significant role than merely facilitating transactions. In this new capacity, gallery owners expanded their function in the art trade, becoming impresarios of the fine arts who represented artists, presented exhibitions, and built audiences. Alfred Stieglitz was one of the earliest art dealers of this type, opening his New York gallery in 1905. Other important galleries were started by Betty Parsons and Sidney Janis, both in the late 1940s, and Leo Castelli in 1957. (Today's prominent dealers include Arnold Glimcher and his PaceWildenstein gallery, Mary Boone, and Larry Gagosian.)^[22]

Much as theater producers sought new plays, art dealers sought to discover and premiere new artists, only selling art instead of tickets. Ultimately, they assumed the role of gatekeepers, deciding which art works to display, and which artists to promote, and became tastemakers, courting critics and favorable reviews, and cultivating collectors by advising them on what to buy. The gallery eventually developed as the primary outlet for an artist's work. While artists have periodically initiated alternatives to the dealer-artist relationship, e.g., nonprofit cooperative galleries run by artists, for the most part, artists need to be represented by a gallery, similar to actors having an agent, in order to regularly exhibit, promote, and sell their art. This relationship became firmly established with the fall of the Parisian art market after World War II and development of the contemporary avant-garde art movement in New York and its assumption as the art world capital.^[6]

Diversity in the Market

The transition of the support structure for the arts from one of patronage to a primarily market-based environment provided an opportunity for art dealers to facilitate the distribution of art. With this system established, the overall expansion of the United States in the second half of the twentieth century was set to easily accommodate a significant boom in the arts. As a growing population of professionally educated artists began producing more and more art, a commensurate number of entrepreneurial connoisseurs joined the gallery system as dealers to negotiate its distribution. And as the market expanded and segmented, with artists creating work in endless styles and media, art dealers differentiated their galleries from one another to meet equally diverse tastes.

According to the 1970 census, the number of individuals classified as professional artists ("Professional artists" refers to the census occupational classification of painters, sculptors, craft-artists, and artist printmakers. This is a distinct category from performing artists, authors, etc.) was 87,000.^[3] By 2000, this figure had increased to 231,000.^[23] The number of art galleries grew at an even faster rate. The 1982 US Economic Census reported 1563 establishments; just 10 years later 4543 galleries were

counted, and the 2002 report totaled 6328 galleries.^[11,24] These totals represent significant growth in the sector. In New York City alone, for example, there were approximately 150 galleries in 1946; by 1975 the total had increased to 761.^[3] By 2007, New York had more than 1000 commercial galleries.^[12]

Just as the entertainment business is often referred to as an industry, e.g., the film industry, the buying and selling of works of arts is a well-established commercial enterprise, with art dealers and their galleries playing a central role. This industry is part of the U.S. retail trade sector, is classified by the North American Industry Classification System as 453920-*Art Dealers*, and defined as "establishments primarily engaged in retailing original and limited edition art works. Included in this industry are establishments primarily engaged in displaying works of art for retail sale in art galleries."^[11] The category includes auction houses selling art, in addition to art dealers and art galleries selling art to retail customers. These are distinct from retail establishments selling reproduction art or art supplies, art galleries displaying art not for retail sale (e.g., museums and other similar arts organizations), or those selling art without a physical location (e.g., electronic home shopping or direct sales). The sector is responsible for generating annual sales in the United States of more than \$4 billion in 2002,^[11] up from \$3 billion in 1997, and \$2 billion in 1992,^[24] art galleries account for approximately 70% of this market,^[25] half of which is generated by galleries in New York, California, and Florida.^[24] Auction houses are responsible for the remaining 30% of sales in the sector.^[25] There are about 100 art auction houses in the United States,^[11,13] but the market is dominated by two international companies, United States-based Sotheby's and United Kingdom-based Christie's, who together account for approximately 80% of auction sales.^[25]

For economists, and others concerned with art as a commodity, the art market is broadly divided into the primary, secondary, and tertiary markets. The primary, or source, market refers to contemporary art works being sold for the first time, and this generally means the work of young, emerging artists, although unknown artists from previous generations whose work has never been sold are occasionally discovered. The secondary market deals in the resale of artworks, either the work of recognized artists who have built a following among collectors, or other established historical pieces. The sale of fine art by auction houses is classified as the tertiary market. Art dealers participate in this market when they buy and sell artwork at auction.^[26]

Similarly, art galleries can be segmented by the same market categories based upon the type of artwork for sale, i.e., emerging or established artists, or auctionable art. Given the quantity of art produced, the majority is only ever sold in the primary market, if it is sold at all. There is very little demand for most art beyond its initial purchase, since very few artists gain enough of a reputation to build a secondary market. Auction houses, particularly the large

international ones, are becoming increasingly selective about the art they accept on consignment for sale; therefore an artist's reputation and an artwork's provenance are increasingly important.

As with individual businesses in any commercial sector, galleries specialize in a number of different ways beyond these broad market categories, according to the types of art they handle and other factors. The art market and galleries can also be divided by artistic discipline, in art historical terms, or by category,^[26] in economic terms (e.g., paintings, prints, or photographs); by period and region, or sector, respectively (e.g., Italian Renaissance, Twentieth Century American, or Chinese Contemporary); by style and movement, or type (e.g., Impressionism, Modernism, or Pop Art); by genre (e.g., portraits, landscapes, or sporting); or by media (e.g., ceramics, film and video, or textiles). For example, one gallery might

concentrate on anything from the more general category of contemporary art by emerging artists, another in world folk art, while others might focus narrowly on American nineteenth century marine paintings, or black-and-white photography. The various concentrations are nearly endless. (See Table 1 for a listing of categories and sectors in the art and antiques market used by the two major international auction houses, Sotheby's and Christie's. These are closely aligned with gallery specializations.)

Galleries may also focus on a particular type of customer. The connoisseur and institutional collector was the clientele of choice for the galleries described earlier. However, galleries cater to many other types of art buyers as well. Some galleries may appeal to tourists by featuring themed art on local attractions, history, or culture, or by promoting only local artists (e.g., American Indian ceramics in Santa Fe, New Mexico, or plein-air paintings

Table 1 Structure of international art market by category and sector.

Discipline or category	Period and region or sector
Ancient and Ethnographic Arts	Aboriginal Art; African and Oceanic Art; American Indian Art; Antiquities; Islamic Art; Pre-Columbian Art
Asian Art	Chinese Ceramics and Works of Art; Chinese Classical and Modern Paintings; Chinese Contemporary Art; Indian and Southeast Asian Art; Japanese Art; Korean Art; Southeast Asian Paintings
Books and Manuscripts	Atlases, Maps, Natural History, and Travel; Continental Books and Manuscripts including Science; English Literature, History, Private Press, and Children's Books; Printed and Manuscript Music; Printed and Manuscripts Americana; Western Manuscripts; Medieval Illuminated Manuscripts
Ceramics and Glass:	English and Continental porcelain and pottery from the early eighteenth to nineteenth century; glass and paperweights from the fifteenth to the nineteenth centuries; and, Chinese export porcelain.
Collectibles and Memorabilia	Arms, Armor, and Militaria; Automobiles; Collectibles and Memorabilia; Sporting Guns
Fashion	Lace, costume, textiles, fans, needlework, quilts, and samplers dating from the sixteenth to the twentieth centuries, as well as haute couture from the 1920s onward.
Furniture and Decorative Arts:	Nineteenth Century Furniture, Sculpture, and Decorative Works of Art; Twentieth Century Decorative Arts and Design; American Furniture, Decorative Works of Art and Folk Art; Arcade: Furniture, Decorative Works of Art, and Carpets; Decorative Arts and Jewelry Department; English Furniture and Decorations; European Furniture; European Sculpture and Works of Art; French and Continental Furniture, Decorations and Tapestries; Garden Statuary and Architectural Items; General Furniture and Decorations; House Sales; Judaica; Rugs and Carpets
Jewelry	Modern and period jewels, signed and unsigned, precious stones, as well as jewelry from specific periods, styles, or jewelers.
Musical Instruments	Stringed, fretted, and wind, as well as early keyboard instruments
Paintings, Drawings, and Sculpture	Nineteenth Century European and British Paintings; Twentieth Century British Art; American Paintings, Drawings, and Sculpture; Australian Art; British Drawings, Watercolors, and Portrait Miniatures; British Paintings 1500–1850; Canadian Art; Contemporary Art; Fine Arts (the following collecting areas: Old Masters and Nineteenth Century European Art, Impressionist and Modern Art, American Paintings, Drawings, and Sculpture, and Contemporary Art); German and Austrian Art; Greek Paintings and Sculpture; Impressionist and Modern Art; Irish Art; Israeli and International Art; Latin American Art; Marine Paintings and Nautical Works of Art; Old Master Drawings; Old Master Paintings; Orientalist Paintings; Scandinavian Paintings; Scottish Art; Spanish Paintings; Sporting Art; Swiss Art; Victorian and Edwardian Art
Photographs	Photographs; Picture Library
Prints	Old Master, Modern, and Contemporary Prints
Silver, Russian, and Vertu	American Silver; English and European Silver and Vertu; Russian Paintings, Works of Art, Faberge, and Icons
Stamps, Coins, and Medals	Coins; Postage Stamps
Watches and Clocks	Clocks, Watches, Barometers, and Mechanical Music
Wine	Fine and Rare Wine

Source: Compiled from the Specialist and Sales Departments of the auction houses Sotheby's and Christie's.

in Laguna Beach, California). Other galleries may cater to interior designers or corporate art curators, for example, by providing reasonably priced prints that might integrate easily in a home or office setting, or by offering professional discounts.

Art galleries often locate near one another in order to take advantage of a shared audience. Clusters of galleries may exist in specific neighborhoods that are designated as art districts, especially in large urban centers. New York has the highest number of galleries in the United States and several recognized art districts, such as SoHo, Chelsea, and 57th Street, and its galleries' influence continue to dominate the international art market. However, arts communities in other locations (e.g., Los Angeles, Chicago, San Francisco, Washington, D.C., and the metropolitan areas of Florida and Texas) have proliferated and grown in influence recently. Successful galleries also operate in smaller cities that have large populations of artists, or the so-called art colonies, which in turn attract art collectors (e.g., Santa Fe and Taos, New Mexico). Many small local markets throughout the country also support artists and galleries, albeit in proportionally fewer numbers, and with lesser influence in the wider national and international markets.^[3]

CONCLUSION

Private commercial art galleries have developed as the primary enterprise for distributing art to collectors and appreciators of art. The art market in general, and the market for museum-quality art in particular, has expanded quite measurably to become a not-insignificant part of the retail sector. The diversity and quantity of art being produced combined with increasing public participation in the arts has fostered an equal expansion of galleries to meet the supply and demand. Consequently, art dealers have worked to distinguish themselves in a number of ways, through specialization, market segmentation, and status in order to succeed.

The independence of art galleries as entrepreneurial businesses operating in a relatively unregulated marketplace, combined with no real alternative system for introducing and presenting new artists, enables art dealers to exercise significant control over what art is, and is not exhibited. This gatekeeping role is further stratified by a closed network that distinguishes and privileges elite galleries within the art world. This closed network, comprised of a fairly small group of dealers, collectors, curators, and auctioneers, enables a recurring number of conflicts of interest and ethical dilemmas, particularly among interactions with the public nonprofit side of the art world. Although these galleries represent a small percentage of the total number of establishments they are most often presented as the model art gallery and the focus of the majority of press and research on the international art market.

Most artists have maintained a love/hate relationship with art dealers and their galleries, and periodically organize for themselves alternative venues and systems for exhibiting and selling their art with limited success. The relationship is somewhat similar to that between musicians and record companies. The recent trend in that medium to self-produce and distribute may be an indication of new alternative approaches for artists to the art gallery.

RESOURCES

Professional Associations

The Art Dealers Association of America, <http://www.artdealers.org>

International Fine Print Dealers Association, <http://www.ifpda.org>

The Art and Antique Dealers League of America, <http://www.artantiquedealersleague.com>

The National Antique & Art Dealers Association of America, <http://www.naadaa.org>

The Private Art Dealers Association, <http://www.pada.net>

CINOA: Confédération Internationale des Négociants en Oeuvres d'Art, or International Confederation of Traders in Works of Art (an international organization of art dealer's associations), <http://www.cinoa.org>

The Fine Art Dealers Association, <http://www.fada.com>
Association of International Photography Art Dealers, <http://www.aipad.com>

New Art Dealers Alliance NADA, <http://www.newartdealers.org>

Magazines and Journals

Art in America, <http://www.artinamericamagazine.com>
Artforum, <http://artforum.com>

ARTnews, <http://artnewsonline.com>

FlashArt, <http://www.flashartonline.com>

The Art Newspaper, <http://www.theartnewspaper.com>

Art + Auction, <http://www.artinfo.com/artandauction>

American Art Collector, <http://www.americanart-collector.com>

The Burlington Magazine, <http://www.burlington.org.uk>

Art History Journal of the Association of Art Historians, <http://www.blackwellpublishing.com>

Art Bulletin, <http://www.collegeart.org/artbulletin>

Directories and Archives

Gallery Guide monthly exhibition listings, <http://www.artinfo.com/galleryguide>

artguide, *Artforum* magazine's monthly exhibition listings, <http://www.artforum.com/guide>

e-flux, an electronic listing of exhibitions, <http://www.e-flux.com>

Art-Collecting.com, Online Art Gallery Guides and listings of fine art galleries located in the United States

Smithsonian Institution's Archives of American Art: A Guide to Commercial Art Gallery Records in the Archives of American Art, <http://www.aaa.si.edu/guides/pastguides/artgall/artgalac.htm>

Art in Context is a Web-based reference library providing public access to information concerning artists around the world. The site maintains an extensive international gallery directory, <http://www.artincontext.org/gallery>

The Art Reference Resource Center a Web site maintained by the Albright-Knox Art Gallery Library that includes a listing of galleries throughout the world. <http://www.albrightknox.org/resourcecenter>

Fairs, Festivals, and Biennials

Art Basel, <http://www.artbasel.com>

Art Basel Miami Beach, <http://www.artbasel-miamibeach.com>

The Armory Show, The International Fair of New Art, <http://www.thearmoryshow.com>

Art Chicago, <http://www.artchicago.com>

Art Forum Berlin, <http://www.art-forum-berlin.com>

Art Los Angeles, <http://www.artfairsinc.com>

Venice Biennale, <http://www.labiennale.org>

Whitney Biennial, <http://www.whitney.org/biennial>

São Paulo Art Biennial, <http://bienalsaopaulo.globo.com>

Documenta, Kassel, <http://www.documenta.de>

ARCO Madrid, <http://www.arco.ifema.es>

Blogs, Galleries, and Auctions Online

ArtsJournal, <http://www.artsjournal.com>

Modern Art Notes, <http://www.artsjournal.com/man/>

CultureGrrl, <http://www.artsjournal.com/culturegrrl>

art:21, <http://blog.art21.org/>

Rhizome, <http://www.rhizome.org>

Saatchi Gallery Online, <http://www.saatchi-gallery.co.uk>

Artnet, <http://www.artnet.com>

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Art Librarianship

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Abstract

Art librarianship is a profession that unites academic backgrounds in the visual arts, art history, architecture, and allied fields together with an advanced degree in library science and information management. The collections art librarians manage continue to be mostly comprised of print resources although technological advances, such as digitization of images and the creation of online databases and catalogs, have significantly impacted art research methodology. Art librarians work in several library settings such as academic, museum, public, and visual resources. Depending on the size and scope of the collection, responsibilities can include management, collection development, reference, bibliographic instruction, research, and cataloging. Art librarians work closely together through worldwide professional organizations, contribute to the literature through articles and book reviews, and write essential reference works and standards for the field.

HISTORICAL INTRODUCTION

Since the early twentieth century, art librarians have been building comprehensive collections in order to meet the needs of art historians, scholars, and curators in public, academic, and museum institutions, both large and small. Surprisingly, no one monograph exists that provides comprehensive descriptions of prominent libraries such as the National Art Library at the Victoria and Albert Museum in London, the Metropolitan Museum of Art's Libraries, Harvard's Fine Arts Library, the New York Public Library, the Canadian Centre for Architecture's Library in Montreal, to name a few. Sarah Scott Gibson traces the development of art librarianship and origins of art libraries in her article "The Past as Prologue: The Evolution of Art Librarianship."^[1] The article is part of an issue with the theme "The State of Art Librarianship." A seminal work on art librarianship that continues to be relevant is *The Art Library Manual: A Guide to Resources and Practice*.^[2] Edited by Philip Pacey, it covers all types of art libraries and resources housed, for example artists' books, photographs, exhibition catalogs, books, and periodicals. Pacey describes his other title, *A Reader in Art Librarianship*, as being

about how and why art librarianship has developed into a distinct branch of librarianship; about what it takes to be an effective art librarian; about how art librarians differ from other librarians; and about how and why art librarians have developed their own associations.^[3]

Another early work appeared in an issue of *Library Trends*,^[4] edited by Guy Marco and Wolfgang Freitag and entitled "Music and Fine Arts in the General Library." The contributors represent a "Who's Who" in art

librarianship in the mid-1970s. Two publications include *A History of Art Libraries in Canada*^[5] covering a chronological history of Canadian art libraries from 1632 to present and biographies of Canadian art librarians no longer living. *Art Museum Libraries and Librarianship*,^[6] edited by Joan Benedetti, provides a series of essays contributed by art librarians currently working in museums worldwide, with a bibliography covering additional sources on museum librarianship. Ann Abid's introduction provides a brief history of the major museum libraries in the United States, from the late 1800s to present.

Another way to identify art collections and their librarians, is through directories, both historical and current. Beginning in 1923, the *American Library Directory*^[7] was one of the first directories to record the existence of art libraries, included under the heading of "Special Libraries." Within this listing are some of the early American museum libraries such as the Cleveland Museum of Art Library, the Ryerson Library at the Art Institute of Chicago, and the Cincinnati Art Museum Library. It was not until the late 1960s and early 1970s that the first professional art librarian organizations were formed in Europe and North America: the Art Libraries Society (now ARLIS/UK and Ireland), the Art Libraries Society of North America (ARLIS/NA), and the International Federation of Library Association's (IFLA) Art Libraries Section. Each had the goal of creating specialized art directories that would provide researchers with a reference that described art library collections. After publishing three preliminary lists, the IFLA Section of Art Libraries published its *Directory of Art Libraries*^[8] under the direction of Jacqueline Viaux, the first chairwoman of the IFLA group which in 1977 was called the Round Table of Art Librarians. Its North American counterpart, *The Directory of Art Libraries and Visual Resource Collections in North*

America^[9] was compiled by Judith Hoffberg, the founder of ARLIS/NA. Today, the *International Directory of Art Libraries*^[10] provides almost 3000 listings to art, architecture, and archeology libraries and over 4000 art librarians worldwide. The print edition is complemented by an online directory of the same title.^[11] Histories of individual art library collections can also be found in the periodical literature, for example Susan Allen's "*Toward an International Art Library: The Growth of the Research Library at the Getty Research Institute 1979–2002*."^[12]

The role of the art librarian in the first half of the twentieth century was to serve the information needs of faculty, students, curators, collectors, and art professionals, and to focus on collecting, organizing, cataloging, maintaining, and preserving the largest collections with the greatest historical significance. At the same time, the modern art library began to proliferate in national libraries, museums, and academic institutions throughout Europe and the United States. Access to these library collections was provided onsite to users via a card catalog. Many of the prominent art libraries published catalogs of their holdings in printed format, such as Harvard University's Fine Arts Library^[13] and the Victoria and Albert Museum.^[14] Art librarians purchased these catalogs and, in turn, were able to provide their patrons with bibliographic access to some of the largest art library collections.

In the 1980s, art librarians focused on converting card catalog records into machine readable format and the first computerized local catalogs became available. The Internet now makes it possible to search holdings of almost all major art libraries worldwide, either by looking at an individual online public access catalog (OPAC), such as the *Getty Research Institute Research Library Catalog*^[15] or *Watsonline*, the catalog of the libraries of the Metropolitan Museum of Art.^[16] Over 9000 library catalogs worldwide can be searched via the Online Computer Library Center's *Worldcat*.^[17] The database *CAIRNS* (Cooperative Information Retrieval Network for Scotland)^[18] includes 52 library catalogs. *The European Library*^[19] online catalog provides bibliographic access to the holdings of 47 national libraries across Europe, including access to online books and images. There are still many art libraries in the United States and Europe that have not completely converted all of their card catalog records into their OPACs and others have created databases that are not accessible via the Internet.

TWENTY-FIRST CENTURY TRENDS

The new millennium has brought changes to art librarianship through continuing technological advancements. One of the most significant trends is the digitization of analog image and slide collections. Paula Hardin provides a model for implementing this new technology in her chapter *Integrating the Digitization of Visual Resources into Library*

Operations.^[20] Another area that has been impacted by digitization is special collections material. Various rare collections from art libraries all over the world are being scanned and text and images will become available for those resources through finding aids. Historical maps, architectural drawings, manuscripts, and rare books are examples of formats that lend themselves well to the two-dimensional scanning process. The Institute of Museum and Library Services' *IMLS Digital Collections Registry* is currently funding the digitization of archives in several museums and libraries.^[21] The third area that has received much attention is the mass book digitization projects supported by Google, Microsoft, and Yahoo begun in 2006 through partnerships with over 27 libraries. Books in all disciplines published prior to 1923 and considered to be in the public domain, are being scanned and their full text, along with illustrations, is becoming accessible to the public.

One of the major differences between arts and humanities users versus those in social sciences and science disciplines is their preference for high-quality color reproductions in beautifully published books, often oversized. Today's art historians and curators still deem the printed book the most desirable format. Even when a special collection is available digitally, many scholars will travel to the library to examine the original object, the paper, the ink, and the binding; a similar process to that of viewing an original work of art. One study, *Art History and its Publications in the Electronic Age*,^[22] discusses the state of scholarly publishing for the discipline of art history.

Despite the overall increase in digitized resources, today's art librarians are still collecting primarily print-based collections. Only a small percentage of art journals are being published electronically in full-text format. *JSTOR: the Scholarly Journal Archive*^[23] is a database for archiving academic journals. It includes full text for approximately 64 art and art history-related journals, excluding the last 5 years. Major print-based art periodical indexes such as the *Bibliography of the History of Art*,^[24] *Art Full Text* and *Art Index Retrospective*,^[25] *ARTbibliographies Modern*,^[26] and the *Avery Index to Architectural Periodicals*^[27] are now available as Web-based searchable databases. *Oxford Art Online*^[28] includes *Grove Art Online*, the only scholarly art encyclopedia available online with full text and images. After many years of development, the Mellon Foundation has published *ARTstor*,^[29] the largest digital image database available complementing academic art and architecture teaching and scholarship. The *Imageline* project is a proposal "to assess the feasibility of establishing an international web gateway providing access to sources of images."^[30]

EDUCATIONAL REQUIREMENTS

Professional art librarian positions require an accredited master's degree in library science (M.L.S.) or library and

information science (M.L.I.S.). In the United States, there are numerous American Library Association-accredited library degree programs but currently only three that grant a dual master's in library science and art history: Pratt School of Information and Library Science in New York City; the School of Library and Information Science, Indiana University; and the University of North Carolina Chapel Hill School of Information and Library Science. In the United Kingdom, the Chartered Institute of Library and Information Professionals^[31] accredits undergraduate and postgraduate library and information courses in England, Wales, and Scotland. Many librarians obtain a master's degree in library science after completing either an undergraduate or graduate degree in studio art, art history, architecture, or allied discipline.

The publication *Core Competencies & Core Curricula for the Art Library and Visual Resources Professions* "identifies the fundamental knowledge, behaviors, and skills currently essential to most professional positions within the art information field."^[32] The document *Criteria for the Hiring and Retention of Visual Resources Professionals* provides standards for visual resources positions.^[33] Position listings for art librarians can be found through professional organizations' listservs as well as periodicals such as *Library Journal* and the *Chronicle of Higher Education*.

ART LIBRARY SETTINGS

With an accredited library degree, a professional librarian interested in pursuing a career in an art library has a variety of settings from which to choose: academic (art, architecture, art, and design school), museum, public, and visual resources. The size and staffing of libraries in all of these settings can vary greatly, from a small one-person library to a large internationally prominent collection with numerous staff.

Academic

Academic art libraries can cover one or more of the fine arts disciplines. Art history, architecture, landscape architecture, archaeology, urban design and planning, and studio art curriculums often serve undergraduates and graduate students, both masters and Ph.D.s. The focus of an academic art and architecture collection is generally on history and theory while studio art and design collections may be broader in scope and include practical manuals on drawing, painting, etc. Fine arts libraries are typically housed in a separate facility and are commonly referred to as branch or subject specialty libraries. At some universities, these collections may be integrated into a main library complex. Although collections can vary from large (150,000 + volumes) to very small (10,000 + volumes), the types of resources most often collected include print

and online reference sources, databases, periodical indexes, books, periodicals, exhibition catalogs, catalogue raisonnés, visual resources such as print reproductions, slides and digital image databases, and media (CDs, DVDs, video). Collections of local theses and dissertations may also be housed. Special collections in the art library can include unique archival and primary source material such as artists' books, ephemera, and artists' papers. Microform sets such as the Courtauld Institute of Art's *Conway Library* or the *Museum of Modern Art Artists Files* provide access to unique archival material. Comprehensive academic art collections house resources published in all languages with an emphasis on Western European languages.

No published ranking of academic art libraries exists; however, the Association of Research Libraries provides rankings and statistics for the top academic libraries in the United States.^[34] The accreditation bodies and requirements for the accrediting process related to academic art libraries are described in detail in *The Library and the Accreditation Process in Design Disciplines: Best Practices*.^[35]

Museum

In the museum library setting, art librarians primarily serve the needs of museum curators and the institution's exhibition and educational outreach programs. Museum library collections usually include books, periodicals, exhibition catalogs, catalogue raisonnés, reference sources, periodical indexes, and sales catalogs from auction houses such as Christie's and Sotheby's. Subscriptions to online auction catalog databases are also integral to the museum library. Special collections often include primary sources such as artists' books, artists' files, artists' archives, and oral histories, along with the museum's historical correspondence and administrative archives. These collections are focused on the interests of the museum's art collections by period, e.g., Museum of Modern Art and/or cultural emphasis, e.g., Asian Art Museum of San Francisco. The publication *Art Museum Libraries and Librarianship*^[6] provides a current overview of this field. (See also the entry Art Museum Librarians in the second edition of the *Encyclopedia of Library and Information Science*.) In the United States, museums go through an accreditation process sponsored by the American Association of Museums and the museum library participates in this review.

Public

Many public libraries support art collections that might complement a strong local community interest in the arts. These collections tend to include popular art books and magazines, how-to guides for artists, along with access to one or more of the major online art periodical

indexes. Public art librarians serve patrons with little or no initiation to the field, or with a general interest in art, along with researchers and professionals, such as architects who may not have a college or university library available in the area. Although most public art librarians do not have the funding to build extensive collections, some of the public libraries established in the late nineteenth or early twentieth century, such as the New York Public Library and the British Library, house comprehensive research-level art collections similar to those found in academic libraries. Heather Rowland's chapter in the book *Information Sources in Art, Art History and Design*,^[36] provides a history of art resources in public libraries in the United Kingdom along with current trends in collection management and reference sources.

Visual Resources

Visual resource curators manage pictorial material such as slides, digital images, and prints (reproductions and photographs). These collections are often found in the art library settings described above, and in university or art school settings can be large, stand-alone operations that report directly to an academic department rather than the institution's library. Collections are often comprised of images photographed or scanned in-house from books and journals, purchased image collections, and gifts. Curators are responsible for cataloging these collections with many professionals choosing to follow national standards by using the *VRA Core*^[37] and the Getty Research Institute's Getty Vocabulary Program databases^[38] such as the *Art and Architecture Thesaurus*, *Union List of Artist Names* and the *Getty Thesaurus of Geographic Names*. For additional information see the entries "Visual Resources Association (VRA)," p. 5572, and "Visual Resources Management, in Cultural Institutions," p. 5578, in this edition of the *Encyclopedia of Library and Information Sciences*.

PROFESSIONAL RESPONSIBILITIES

Depending upon the scope of the position, size of library and setting, art librarians can be responsible for one or all of the following areas: collection development, reference, bibliographic instruction and research, cataloging, and management of staff, budget, and library facilities.

Collection Development

One of the most important roles the art librarian fulfills is determining which resources should be added or deleted from the collection. A collection development policy can provide an overview of the scope of collections such as areas, period and languages covered, collecting level, and

types of materials collected. The publication *Collection Development Policies: for Libraries & Visual Collections in the Arts*^[39] provides art librarians with examples of collection development policies along with guidelines for writing a policy.

Both historical and recently published art bibliographies are helpful tools for building core reference and monograph collections. One title, *Guide to the Literature of Art History 2*^[40] complements an earlier edition, *Guide to the Literature of Art History*,^[41] providing the most comprehensive art bibliography published. The titles *Fine Arts: A Bibliographic Guide to Basic Reference Works, Histories, and Handbooks*^[42] and *Art Books: A Basic Bibliography of Monographs on Artists*^[43] provide a core list of important art books and catalogue raisonnés for well-known artists.

Book review publications that focus on art resources include *The Art Book: Issues, News and Reviews*,^[44] *Bookforum: The Book Review for Art and Culture*,^[45] the College Art Association's *CAA Reviews*^[46] and *ARLIS/NA Reviews*.^[47] The *Art Libraries Journal (ALJ)*^[48] provides reviews of books about, or relevant to, art librarianship, such as major art-related bibliographies and reference works. Other library journals such as the Association of College and Research Library's *Choice Magazine*^[49] provide reviews for all disciplines including the fine arts.

Art librarians may opt to use art-based approval plans to obtain recently published museum and gallery exhibition catalogs along with trade and university press titles. Books are shipped automatically or selected title-by-title following pre-determined parameters that are based on the library's collection development policy. Art approval plans are available from several vendors located in the United States and Europe. Some of the most widely known vendors that supply European imprints include Erasmus Boekhandel,^[50] Casalini Libri,^[51] Touzot,^[52] and Harrassowitz.^[53] Worldwide Books^[54] provides international coverage of exhibition catalogs as well as current trade publications. Two approval vendors that cover titles published in the United States and United Kingdom include Yankee Book Peddler^[55] and Blackwell.^[56] Art librarians with limited budgets might prefer to place orders directly to publishers of interest. Titles can be ordered through *Amazon.com* along with European counterparts such as *Amazon.co.uk* (United Kingdom), *Amazon.fr* (France), *Amazon.de* (Germany), *Bol.it* (Italy), and *FNAC.com* (Spain).

Art books, especially exhibition catalogs, are generally published in small runs, and can quickly go out-of-print. A list of art-related antiquarian and out-of-print art book dealers worldwide can be found by searching the International League of Antiquarian Booksellers' Web page.^[57] Online ecommerce search engines such as *Bookfinder*, *Abebooks*, and *AddAll* provide extensive lists of new, used, rare, and out-of-print art books linking to individual booksellers worldwide.

Reference, Bibliographic Instruction, and Research

Art librarians serve primary clientele, local art professionals, and the general public with questions related to myriad art topics. The increase of online art resources combined with the continued publication of printed resources, has made the research process more complex for patrons to locate, navigate, and evaluate relevant publications which in turn has expanded the art librarians' role in both reference service and bibliographic instruction. Reference "points" for most art librarians can include a reference desk with scheduled hours, online chat, email, telephone, or by appointment.

Bibliographic instruction can include tours, general library orientations, in-class research seminars on a particular subject, or locally published research guides that might describe one source comprehensively or provide annotated bibliographies for an art-related topic. The guide, *Library Instruction for Students in Design Disciplines*,^[58] provides descriptions of a variety of art-related courses taught by art librarians in academic institutions throughout the United States.

Art librarians also create library Web sites providing links to important art resources available, both licensed and free. Blogs, or Web logs of text that might describe recent acquisitions or new trends, often are included as well. In addition, art librarians are beginning to utilize Google's *You Tube* as another means to promote research to their users—for example the tutorials created by librarians and faculty at Otis College of Art and Design.^[59] Librarians are also utilizing social networking destinations such as *MySpace*, *Facebook* and *Twitter* to reach their audiences.

Art librarians are responsible for original research and publication and continue to be the major contributors to the art library journal literature, primarily *Art Documentation* and the *Art Libraries Journal*. Article content can be searched using the periodical index *Library Literature*. Combined, these two journals, along with newsletters published by the Art Libraries Society and other art library organizations, provide a comprehensive history of the field of art librarianship.

Cataloging

The cataloging of all types of art materials requires subject background and coursework based on the *Anglo-American Cataloguing Rules* (AACR2)^[60] and *MARC21 Concise Format for Bibliographic Data*.^[61] One-person art libraries, museum libraries, and visual resources collections usually catalog their own collections onsite, where academic institutions generally catalog books in a central cataloging unit housed within the technical services department. In the academic setting, art catalogers might cover the fine arts as well as additional humanities

disciplines, such as theater, dance, and music. Art catalogers communicate across institutions and through professional organizations such as the Visual Resources Association (VRA) and the ARLIS/NA Cataloging Section^[62] about current cataloging trends and art-related issues. The *Cataloguer's Toolbox*^[63] created by Memorial University, Newfoundland, provides a variety of international cataloging resources.

Management

The head of the art library is responsible for numerous administrative activities such as hiring, training, supervising and evaluating staff (professional, paraprofessional, students, interns, and volunteers), long-range planning, annual reports, statistics, and budgets.

The management of facilities is an area requiring increased attention, as print collections often outgrow available stack space. Art librarians must carefully determine whether to withdraw or store materials off-site if that option is available. Security is another critical issue as a result of the increased value of rare art books and special collections.

Six art library facilities appear in a special issue of *Art Libraries Journal*.^[64] Two examples of art libraries designed for the twenty-first century are the Fleet Library at the Rhode Island School of Design (Fig. 1) and the



Fig. 1 Interior, Fleet Library, Rhode Island School of Design, Office dA.

Source: Courtesy of John Horner, 2006.



Fig. 2 Exterior, Docklands Campus Library and Business School, University of East London.
Source: Courtesy of David Barbour/Building Design Partnership.

Docklands Campus Library and Business School at the University of East London (Fig. 2). The key to a successful art library project is the articulate communication of needs from the art librarian to the architect during the programming phase. The handbook *Planning Academic and Research Library Buildings*^[65] is a key reference along with *Facilities Standards for Art Libraries and Visual Resources*^[66] (currently under revision) and IFLA's *Libraries as Places: Buildings for the Twenty-first Century*.^[67] Macken's article, *The Art Library as Place*, examines "the impact of changing technology on the physical space of the academic art library and the relevance of current trends in space planning to the art library of the future."^[68]

PROFESSIONAL ORGANIZATIONS

There are several organizations that support the field of art librarianship. Art librarians often participate in a variety of professional organizations and affinity groups depending upon their specialty.

ARLIS/UK and Ireland

The Art Libraries Society United Kingdom and Ireland (ARLIS/UK and Ireland)^[69] was founded in 1969 to promote all aspects of the librarianship of the visual arts, including architecture and design. Approximately 350 members work in academic settings, museum libraries, and public libraries, and include booksellers, publishers,

and professional practice libraries. Publications include a scholarly quarterly journal *Art Libraries Journal*, and a bi-monthly newsletter *ARLIS News-Sheet* providing news, bibliographic information, and scholarship for art librarians internationally. An annual conference is held at a university location in the United Kingdom or Ireland. Members can communicate via *ARLIS-LINK*,^[70] its online discussion listserv.

ARLIS/NA

The Art Libraries Society of North America (ARLIS/NA)^[71] is the primary professional association for art librarians in the United States, Canada, and Mexico. Inspired by ARLIS/UK and Ireland, it was founded by Judith Hoffberg and nine other charter members in 1972.^[72] The stated mission in the ARLIS/NA Strategic Plan 2006–2009 is "to foster excellence in art and design librarianship and image management."^[73] Its 1000 members include art and architecture librarians working in art libraries and visual resources collections as well as students, book publishers, dealers, and gallery owners. Members can participate on a local level by joining one of the Society's chapters. An annual conference includes workshops, tours, and juried sessions that respond to a programmatic theme. Publications include a journal, *Art Documentation*, an *Occasional Papers* series and *Bibliographic Notes*, an online column that includes recent articles and books covering topics devoted to art librarians and art librarianship. ARLIS/NA hosts an open, moderated listserv, *ARLIS-L*.^[74]

ART LIBRARIES SOCIETIES WORLDWIDE

- ARLIS/ANZ (Australia and New Zealand): <http://arlisanz.anu.edu.au/>.
 ARLIS/NL (Netherlands) – Overleg Kunsthistorische Bibliotheken Nederland: <http://www.okbn.nl/>.
 ARLIS Norden (Scandinavia): <http://www.arlis.org.uk/link/link.html>.
 ARLIS Flanders/Belgium: <http://www.vvbad.be/okbv/engels>.

VRA

The Visual Resources Association: The International Association of Image Media Professionals (VRA)^[75] grew out of a long history of involvement with other art-related organizations, the College Art Association (CAA), the Art Libraries Society of North America (ARLIS/NA), and the Mid-America College Art Association (MACAA). The VRA was formally established in 1982 and has over 800 members. The purpose of the VRA is to support and educate image professionals on the creation, description, and distribution of both analog and digital images, primarily for art- and architecture-related collections and to develop standards for the profession. The association also has regional chapters. The *VRA Bulletin* is the association's quarterly journal featuring conference reports and scholarly articles. *Images Newsletter* is published bi-monthly as an electronic journal and contains member and organization-related news. The *VRA Special Bulletins* are occasional publications covering current trends and topics of interest to the profession. The *VRA-L* online discussion list is open to members only.

IFLA

Although the International Federation of Library Associations and Institutions (IFLA) was formed in 1927, its Art Libraries Section evolved in 1982 through the efforts of French art librarian Jacqueline Viaux.^[76] The Section "endeavors to represent libraries and organizations concerned with all formats of textual and visual documentation for the visual arts, including fine arts, applied arts, design, and architecture."^[77] J. Margaret Shaw's article^[78] provides an account of the Art Libraries Section's 25-year history, including its officers, and a list of its publications and projects. A strategic plan^[79] outlines its mission and goals. The Art Libraries Section meets annually at the IFLA World Library and Information Congress. Serial publications include the *International Directory of Art Libraries* and the electronic journal, *IFLA Art Libraries Section Newsletter*. The IFLA Publication series covers numerous topics on librarianship, some focused on art librarianship, e.g., *Multilingual Glossary for Art Librarians*.^[80] An online discussion list, *IFLAART*, is a closed, moderated list, with approximately 250 subscribers.

ADDITIONAL ART-RELATED LIBRARY AND AFFINITY ORGANIZATIONS

American Association of Museums (AAM): <http://www.aam-us.org/>.

Established in 1906, AAM has developed standards and best practices, promoted gathering and sharing of knowledge, and provided advocacy on issues of concern to the entire museum community. Every type of museum is represented, including art.

American Library Association (ALA), Association of College and Research Libraries (ACRL), Arts Section: <http://www.ala.org/ala/acrl/aboutacrl/acrlsections/arts/arts.cfm>.

A section of ACRL, a division of ALA, which provides an umbrella organization for librarians and specialists working in or interested in the fields of visual and performing arts.

Arbeitsgemeinschaft der Kunst- und Museumsbibliotheken (AKMB) (Germany): <http://www.akmb.de/>.

The Association of Art and Museum Libraries supports education, training, and cooperation for art librarians working in Germany. Affiliated with ARLIS/NA.

Association of Architecture School Librarians (AASL): <http://www.architecturelibrarians.org/>.

Established in 1979 at the annual meeting of the Association of Collegiate Schools of Architecture, AASL's goal is to enhance various aspects of academic architectural librarianship. Affiliated with ARLIS/NA.

Association des Bibliothécaires de France (ABF): <http://www.abf.asso.fr/>.

Founded in 1906 and recognized as a public utility in 1969, ABF is the oldest library association in France. The Groupe des Bibliothèques d'art is one of its several working groups. Affiliated with ARLIS/NA.

College Art Association (CAA): <http://www.collegeart.org/>.

Founded in 1911, CAA's members are committed to the practice of art, teaching, and research. Affiliated with ARLIS/NA.

Japan Art Documentation Society (JADS): <http://www.soc.nii.ac.jp/jads/eng/index.html>.

Founded in 1989, with the object of promoting the development of art documentation, members include librarians, curators, art history students, media representatives, and computer specialists. Affiliated with ARLIS/NA.

Kunstfaggrupper (Denmark): <http://grupper.bf.dk/kunst/>.

Organization dedicated to all aspects of art librarianship, including education and training.

Museum Computer Network (MCN): <http://www.mcn.edu/>.

Affiliated with ARLIS/NA. See the entry "Museum Computer Network (MCN)," p. 3711, in this edition of the *Encyclopedia of Library and Information Sciences*.

Museum Documentation Association (MDA) (U.K.): <http://www.mda.org.uk/>.

Organization devoted to working with professionals in museums, libraries, and archives to promote best practices, accreditation guidelines, standards, and training.

Redarte-SP (Sao Paulo, Brazil): <http://www.goethe.de/ins/br/sap/prj/red/ptindex.htm>.

Network of information services related to art that brings together professionals who work in libraries, museums, and archives. The group develops projects that promote the broad dissemination of art information within the city of Sao Paulo.

Society of American Archivists (SAA): <http://www.archivists.org/>.

Founded in 1936, SAA is North America's oldest and largest national archival professional association which provides leadership to ensure the identification, preservation, and use of records of historical value. Affiliated with ARLIS/NA.

Society of Architectural Historians (SAH): <http://www.sah.org/>.

International organization that promotes the study and preservation of the built environment worldwide. Affiliated with ARLIS/NA.

Special Libraries Association (SLA), Museums, Arts, and Humanities Division: <http://units.sla.org/division/dmah/>.

Vitruvio: <http://www.vitruvio.cpaupage.com/>.

Organization for architecture, art, design, and urbanism librarians working in academic settings in Argentina and Latin America.

Established in 1929, the Division includes librarians and information specialists from all types of museums from historical societies, institutions, and other organizations having special departments or special collections devoted to the arts, decorative and performing arts, architecture, and humanities.

CONCLUSION

Over the past two centuries, art librarians have played a major role in building art libraries that support the world's finest academic and public institutions. The role of the art librarian will continue to expand as technological advances improve and affect the way resources are published, delivered, and received in the arts and humanities. The art librarian of the future will need to respond to the technological needs of future generations and at the same time give consideration to the preservation of rare, out-of-print materials. Some efforts, such as the Institut National d'Histoire de l'art in Paris,^[81] that combine several important art libraries into one facility, may be a trend for future collaborations worldwide. Perhaps the words Pacey wrote in 1985 still hold true,

Now as never before the collective power of art librarians must be exercised, on the one hand to safeguard what has been achieved hitherto, on the other to seek and to share

new solutions to old problems, and at all times to exercise art library power for the benefit of civilization.^[82]

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Art Museums

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Abstract

The urge to collect things of beauty and significance goes deep into history. Art museums safeguard art for future generations. Works of art have power, and that power has been coopted throughout history by those who wish to assert authority, position, and wealth. The evolution of the display of art for the public reflects social, economic, and political developments, and can best be understood historically. This entry traces that history from ancient times on to the Renaissance, the Enlightenment, and the nineteenth century and on to modern times. Art museums provide an opportunity for civic pride, and for an architectural statement. The past three decades have seen a boom in new museum building. They are popular gathering places, and in catering (literally) for their growing audiences with cafés, special events, functions, and stores, they have to keep a proper balance between commercial activities and their core mission. Good governance is essential. Success should be measured in ways other than just by number of visitors. Temporary exhibitions should be worthwhile and not just crowd-pleasers. An issue of concern in collection management is ensuring that works of art have not been looted or expropriated. The popularity of art museums in a digital age is likely to continue as screen captives escape to look at real objects.

INTRODUCTION

An art museum is an institution that collects, preserves, and presents art for the public run by a professional staff driven by a mission to encourage a love and appreciation of art and working according to considered standards and procedures. While other museums show objects to explain, art museums show objects to inspire, nourish, and transport: explanation is an aid rather than the point. The spiritual aspect of art museums, and their often imposing buildings, gives them a kind of standing as secular cathedrals. As such they define the values, aspirations, and civilization of their cities, communities, and countries.

Not all art museums have “museum” in their title; sometimes they are called “gallery” or “institute” or “collection.” Art museums come in all sorts of sizes and can be categorized in different ways. In the United States there are over 4000 of them, mostly small, with around 200 of the leading ones with budgets of over \$2 million qualifying their directors for membership in the Association of Art Museum Directors (AAMD). A few art museums are encyclopedic, covering wide swathes of visual culture in depth. Some are general, with several substantial collections. Many specialize in, for example, sculpture, portraits, photography, textiles, decorative arts, Asian art, arts and crafts, and regional art; or in one artist. There are museums that are completely or predominantly the collection of one collector. There are museums that are parts of universities or other institutions. Most museums collect, but some simply mount exhibitions: the German word *Kunsthalle* (literally art hall) is apt but does not have an

English equivalent. One thinks of a museum as a building, but there are also open-air sculpture parks. Museums that are not art museums but historical or ethnographic or house museums have art works and objects in them, but in order to tell a story or provide context rather than to focus on aesthetics. Museums can also be classified by ownership: government, municipality, trustee, private individual.

Art museums with their cafés and stores are visitor attractions in the exploding area of cultural tourism. Some have become icons of economic regeneration and urban renaissance. Architecturally ambitious new museums and new additions have been springing up all over the world. As they have become larger, more complicated and more expensive to run, museums have confronted issues surrounding their collecting policies, focus, governance and management, and the potentially competing claims of increasing admissions and deepening scholarship. As not-for-profit organizations, relying increasingly on donations, they need to retain the high measure of public trust that has been reposed in them.

Museums can best be understood in a historical context. The word stems from the Greek word *mouseion*, meaning “temple of the Muses.” The range of what is considered collectible art has widened over time, usually following controversy about what is in the canon. The history of the art museum and its antecedents mirrors the history of culture. It illustrates the urge to collect things of beauty, significance, and interest made by imaginative and skillful humans; to use objects to seek affinity with other beings, human or supernatural; to share them with other

connoisseurs and people of taste; to demonstrate the “superiority” of western culture against the mere artifacts of native peoples—and latterly to celebrate those artifacts as works of art in their own right and manifesting a culture equal to that of the West; to show off works of art as evidence of wealth; and to make them available to the general public as part of a mission to improve, set standards and educate that public.

HISTORY

There has been considerable debate about whether the history of museums is linear and evolutionary or discontinuous. In the preface to the book they edited, Impey and Macgregor^[1] state:

With due allowance for the passage of years, no difficulty will be found in recognizing that, in terms of function, *little has changed*; along with libraries, botanical and zoological gardens, and research laboratories, museums are still in the business of “keeping and sorting” the products of Man and Nature and in promoting understanding of their significance.

The emphasis was added by Berelowitz,^[2] who takes a contrary view, influenced by Michel Foucault, that each period should be considered within its world view; there are huge disjunctions between them; and historians should avoid the temptation of presenting a story of continuous betterment from primitive to civilized. The brief account of the history of museums that follows takes a middle view: some things have remained constant, like keeping and sorting, but the meaning and context in which this has taken place has varied enormously.

Museums in Antiquity

While there is archaeological evidence of ancient peoples collecting things without obvious practical use, it was in the Hellenistic period that a taste for art and for the collecting of art developed. Greek temples, or *mouseions*, were dedicated to the various Muses of the arts and sciences. Votive offerings, often war booty, were stored in *thesauroi*, or treasuries, and were a visible display of power and influence. The temples became places of learning as well as offering. Whereas Plato’s lyceum taught through argument and induction, Aristotle’s drew deductions from an observation of things that were collected and categorized and stored. The lyceum needed a *mouseion*. Ptolemy I Soter (ca. 367–283 B.C.E.) incorporated objects as well as texts in his great library of Alexandria.

In 212 B.C.E., General Marcus Claudius Marcellus brought back treasures from Syracuse and the Romans discovered the wonders of Greek art and became avid collectors. Generals put their booty on display to the

public to demonstrate their successes and as a show of power. The collecting habit spread to the rich. Roman artists copied Greek originals and adopted their style, increasing supply. The statesman and General Marcus Agrippa (63 BC–12 BC) urged that statues and pictures should be viewable by the public instead of being stashed away in villas. “This was the first explicit declaration of the value of an art collection as a cultural heritage and of the right of the public to share in its enjoyment.”^[3]

Christianity understood the iconic power of art and attacked pagan art. Many ancient collections were destroyed, although in the Eastern Empire Constantine brought antique statues to his new capital.

Art Museums in the Middle Ages

In the Middle Ages churches were also museums—the only places where the public could see art. Art was no longer votive, or to celebrate victory in battle, or to flaunt individual wealth, but primarily devotional. Cathedral workshops and monasteries became centers of artistic production and recipients of gifts. Soaring Gothic arches and the glitter of gold objects emphasized to worshippers where authority resided. As society developed under the influence of trade and prosperity, courts and the bourgeoisie started collecting as well as the church, and works of art again became appreciated for themselves rather than for their symbolic value; artists gradually began to be valued as creators and not just artisans.

Art Museums in the Renaissance

Fittingly it was in Florence, heart of the Renaissance, the explosion of creativity in literature, sculpture, painting and architecture, and during its “High” phase in the sixteenth century, that the first art museum was constructed. Known as the *Uffizi* because state offices were on the ground floor, the palace was designed in 1560 by Giorgio Vasari (1511–1574) with the second floor *galleria* (hence probably “gallery” as a place for a collection of paintings) purpose-built for the display of art. The Medici installed their art collection and it was opened to the public (at first by appointment only) in 1591. Vasari, the first art historian and author of the *Lives of the Artists*, stressed the importance of the antique as an inspiration to modern artists and gave credit to the idea of genius and to historical development. He was a founder of the first official academy of art, the Accademia del Disegno, incorporated in 1563. While in the modern age art is associated with museums, art of a level rarely exceeded since had already been on public display in the form of Ghiberti’s bronze doors in the Florence baptistery (completed in 1452), Brunelleschi’s dome for the cathedral (1436), and Michelangelo’s *David*, put on display to widespread awe in 1504. Renaissance man witnessed the “rebirth” in the streets.

Art Museums in the Enlightenment

How did the idea of a place of contemplation and study open to the public develop? From several roots.

Art museums developed originally from what we would now classify more as science museums. Private collections of objects from the natural world, science collections, antiquities, manuscripts, and books put together in a spirit of inquisitiveness, go back to the Middle Ages, but spread from the Renaissance onward. Various known as *Wunderkammer*, or as “cabinets of curiosity,” they were open not to the general public but to like-minded seekers of a universal pattern in what to today’s eyes would seem a jumble. In 1683 Elias Ashmole presented his collection to the University of Oxford and the Ashmolean Museum became the first private collection to enter the public domain. The “use of the term “Museum” was a novelty in English: a few years later the *New World of Words*” (1706) defined it as a Study, or Library; also a College, or Publick Place for the Resort of Learned Men.”^[4] The physician, naturalist, and collector Sir Hans Sloane (1660–1753) bequeathed his large collection to the nation and the British Museum was created by Act of Parliament in 1753. It was a new type of institution in that it was governed by a body of trustees responsible to Parliament; its collections belonged to the nation, with free admission for all. Entry was given to “all studious and curious Persons,” linking public enjoyment with education.^[5]

Art museums also developed from the spread of art collecting around Europe in the seventeenth and eighteenth centuries. Art dealers and auction houses sprang up. Rome was the artistic capital of Europe until the Popes decided that art was too much of a distraction, and collections moved elsewhere. Rubens advised Duke Vincenzo I Gonzaga of Mantua about collecting. After the Duke’s death a large part of his collection was sold in 1627 to Charles I of England, an avid collector. The Spanish collected the more Catholic art of Flanders, and Philip IV sent Velázquez to Italy in 1649 to buy Italian art. The Dutch collected from around Europe as well as their home-grown artists enjoying a golden age. The French saw collecting as an expression of royal authority. The British nobility returned from their Grand Tours laden with art and artifacts to fill their country houses. Lord Burlington brought back the drawings of Palladio and changed the style of architecture of those houses. Art emerged from the cabinet into the long gallery, was arranged, and labeled.

Third, with the Enlightenment came the establishment of art academies (after Florence’s, came France in 1648, Venice in 1750, and London in 1768), with their collections to inspire and teach students, and their exhibitions. The annual shows of works by Academicians at the Royal Academy of Arts were selling exhibitions open to the public for a fee and were hugely popular. Appreciation of

art became more widespread. Collectors who did not want their collections broken up gave to the growing number of art and archaeology academies.

A fourth factor in the development of art museums was egalitarianism. While several art collections were opened to the public voluntarily by rulers (the Gemäldegalerie in Kassel by William VIII of Hesse in 1760, the Schloss Belvedere gallery in Vienna by Joseph II ca. 1781) it was the French Revolution that decisively put art into the public domain. With the fall of Louis XVI on August 10, 1792, the royal collection was declared the property of the nation, and the National Assembly moved fast to assemble choice works from the royal and church collections together in the Louvre, where Louis had been constructing a Grand Gallery until the Revolution broke out in 1789. The Louvre was also home to the Academy. A year later, to celebrate the anniversary, the Louvre was opened as part of a Festival of National Unity, and those who visited the Museum “would have come away with a . . . sense of Revolutionary triumph over despotism.”^[6] The Museum was for education; it was also for propaganda. The two were linked. The Academy’s master-pupil relationship was deemed elitist and it was crushed. The eclectic display of 1793 was deemed to hark back to the *Ancien Régime* and was replaced by 1801 by the more rational, enlightened arrangement by school and period. What mattered was that the “Louvre contained the greatest collection of Western art ever assembled under one roof, and nothing was to prevent that fact from being self-evident to the beholder.”^[6] In the same year the government decreed the establishment of 15 other museums around France.

Art Museums in the Nineteenth Century

The nineteenth century saw a boom in museum building in Europe and later in the United States. Monarchs wanted to appear more democratic by opening up their collections to the public. Nation-states and cities within them emphasized their power and prestige by establishing important collections in impressive buildings. The rising middle classes wanted to enjoy the polite arts as well as the useful arts of manufacturing and transportation. Educational reformers wanted to improve the lot of the working classes and saw art as a civilizing influence.

At the beginning of the century Napoleon brought vast quantities of art back from his conquests for the Louvre (renamed Musée Napoléon) and the provincial museums, but he also established museums in the lands that he conquered, for example, the Galleria dell’Accademia in 1807 in Venice as part of the art school established 17 years earlier, and the Museo del Prado in 1809. After his defeat in 1815, the art was seized back. In Berlin the returned art was put on display by Frederick William III, King of Prussia, who called for a national museum, the Altes Museum, possibly inspired by visits to the Louvre during

the peace negotiations. Karl Friedrich Schinkel, professor of architecture and Berlin's city planner, designed the purpose-built museum and worked with an art historian, Gustav Friedrich Waagen, on the display of only original works of art and only of masterpieces. They argued that the state's provision of aesthetic reverence would promote social unity and defuse the fervor for dissent. The Altes Museum opened in 1830.

Royal collections were in one way or another opened up in most of Europe. Not so in Britain. For one thing, the magnificent collection of Charles I had been auctioned off by Oliver Cromwell in 1649 to no popular protest other than about the poor prices realized. Subsequent monarchs, particularly George III, rebuilt it to some extent but had no intention of letting the public have access. In 1777 John Wilkes, a member of Parliament, argued for the purchase by the nation of Robert Walpole's superb Houghton Collection, but to no avail. When Catherine the Great moved it to Russia, a commentator on this occasion protested: "The riches of a nation have generally been estimated according to as it abounds in works of art. . . ."^[7] In 1811 the Dulwich Picture Gallery opened as the first public art gallery in Britain. The collection was given to Dulwich College in the absence of a national gallery. Arguments for a national collection grew, although the Royal Academy of Arts wanted national to be defined as British art only. In 1824 the connoisseur George Beaumont donated his collection to the nation, Parliament voted funds and the National Gallery was born. In competition with schools and sewers, it remained underfunded in spite of the arguments of Radical thinkers that access to works by Old Masters would improve the level of taste and thus make British textiles more competitive with the high-end products of France and Germany and that free entry would wean the working class off drink.^[7] In the second half of the century, municipal museums spread around the country. In response to the demands to show British art, and as a condition of Sir Henry Tate's gift of his collection, the Tate Gallery was spun out of the National Gallery in 1894 (but had its remit expanded to international modern art in 1917).

Art Museums in the United States

While some museums in the United States were established in the first half of the century (Wadsworth Atheneum, Hartford, CT, 1842), most were formed in the economic boom that followed the Civil War, in the great growing cities of the North and in many of the smaller cities as well. The Metropolitan Museum of Art in New York was founded in 1870, the Museum of Fine Art in Boston in the same year, the Philadelphia Museum of Art in 1876, the Art Institute of Chicago in 1879, the Los Angeles County Museum of Art in 1910, and the Cleveland Museum of Art in 1916. These museums were established by wealthy donors who wanted prestige for

their cities and for themselves. Whereas in Europe access to museums was symptomatic of the bourgeois struggles to end aristocratic privilege, in the United States museums were overt displays of privilege.^[8] The titans of industry and commerce collected on a grand scale, often aided by the great dealer Sir Joseph Duveen: Altman, Frick, Johnson, Kress, Morgan, Mellon, Walters, and Widener gave their works away to existing museums or to new ones that preserved their heritage and gave prominence to their names. When the Metropolitan Museum expanded in 1925, the *New York Times* commented that the Met was "not so much an institution for the instruction and pleasure of the people as a sort of joint mausoleum to enshrine the fame of American collectors."^[8] In a salute to them, the Met organized in 2007 an exhibition of all its seventeenth-century Dutch art, *Rembrandt and his Time*. The art was presented neither chronologically nor by artist but by the date when the works were acquired. Andrew Mellon, more self-effacing than most, donated his collection to create the National, rather than Mellon, Gallery of Art in 1937.

The art museum was to serve many purposes, besides the obvious ones of providing enlightenment, education, and pleasure: first, to prove that the dynamic American economy knew the value of higher things. At a dedication in Chicago in 1913, the sculptor Loreda Taft said "art and culture had arrived to crown commercial life as was crowned commercial life of Athens and Florence and Venice."^[8] Since Europe was the model, it was predominantly European art that was collected in preference to American art which was often considered inferior. "During the late nineteenth and early twentieth century, history's largest transfer of cultural wealth from one hemisphere to another took place."^[9] Second, since the church, separated from the state, could not provide homogeneity of values for the disparate immigrant hordes, impressive museums were to be organs of acculturation, providing a set of core values. Third, galleries with displays of decorative arts modeled on those in the influential Victoria and Albert Museum in London (founded in 1857 as the South Kensington Museum and renamed in 1899) would provide the lower middle classes with aspirational models for their households and inspire manufacturers to produce goods of superior design.

Art Museums in the Modern Period

Two world wars and dire economic conditions put a damper on museum building until the 1950s. But from then on the momentum of building new museums and museum extensions gathered pace. Collections grow and need to be shown to the public rather than being kept in storage. Funding shifted from almost complete reliance on a few wealthy patrons, who, while still very much in evidence in the United States, were joined by corporations, foundations, and museum members, with agendas of broadening audiences and enhancing access.

Art museums have become less stuffy and are gathering places for the community, with gourmet restaurants, high-end stores, and sought-after venues for weddings and receptions. They have become more popular—too popular for some who fear the spread of commercialism.

Notable new museums or extensions of the second half of the twentieth century that were architecturally adventurous included the extension to the Kröller-Müller Museum in Otterloo, Holland, designed by Henry van de Velde (1953); the Milwaukee County War Memorial, Wisconsin, United States, by Eero Saarinen (1957) containing the Milwaukee Art Center; the Louisiana Museum of Art, Humlebaek, near Copenhagen, Denmark, by Jorgen Bo and Vilhelm Wohlert (1958); the Whitney Museum of American Art, New York, by Marcel Breuer (1966); the Hayward Gallery, London, by London County Council architects, part of a cultural center on London's South Bank (1968); the Neue Nationalgalerie, Berlin, West Germany, by Ludwig Mies van der Rohe (1968); the Kimbell Art Museum, Fort Worth, TX, by Louis Kahn (1972); the Sainsbury Centre for the Visual Arts, Norwich, England, by Norman Foster (1977); the East Wing of the National Gallery of Art, Washington, D.C., by I.M. Pei (1978), and Pei's pyramid for the Louvre (1989); Neue Staatsgalerie, Stuttgart, West Germany, by James Stirling and Michael Wilford (1984) and their Clore Gallery extension to London's Tate Gallery (1986); the Menil Collection, Houston, TX, by Renzo Piano (1987); the Museum of Contemporary Art, Barcelona, by Richard Meier (1995) and his Getty Center in Los Angeles (1997); the Quadracci

Pavilion extension to the Milwaukee Art Museum by Santiago Calatrava (2001) (Fig. 1), the de Young Museum, San Francisco, by Herzog and de Meuron (2005); the Bloch Pavilion at the Nelson-Atkins Museum of Art, Kansas City, MO, by Stephen Holl (2007); the Hamilton Building at the Denver Art Museum, Colorado, by Daniel Libeskind (2007); the Broad Contemporary Art Museum at the Los Angeles County Museum of Art, by Renzo Piano (2008), and his extension for the Art Institute of Chicago (2009). Museums provide rare opportunities for architects to show talents not sought in commercial real estate development.

The explosion of modern art from the early part of the twentieth century onward presented art museums with a dilemma: to collect only art that had stood the test of time or to collect challenging contemporary art. The solution most commonly adopted was to lag well behind the times, thus creating a gap for new museums for new art in new buildings.

The unrivalled pioneer and a model for others, the Museum of Modern Art (MoMA) in New York was set up under its formidable director Alfred H. Barr in 1929 and moved into its first purpose-built structure on West 53rd Street, designed by Philip Goodwin and Edward Stone, in 1939. The Museum embraced all aspects of visual culture with departments of architecture and design, film (and later video and digital), and photography. The latest and largest of several expansions, by Yoshio Taniguchi, opened in 2004, and has made MoMA a must-visit attraction.



Fig. 1 Milwaukee's Santiago Calatrava – designed Quadracci Pavillion extension: The museum as art object.

Source: Photograph by Fritz Jusak, courtesy of the Milwaukee Art Museum.

The industrialist Solomon R. Guggenheim began to show his extensive collection of “nonobjective art” from the 1930s and, advised by Hilla Rebay, he continued to collect until his death in 1949. Ten years later (and six months after the death of the architect, Frank Lloyd Wright), the museum bearing his name opened on Fifth Avenue. The startling round shape and spiral gallery of the Guggenheim signaled the new adventurousness in architecture, and set off a continuing debate on whether dramatic new museum buildings outshine the art inside them.

In France, discussions were held about creating a modern art museum in Paris in the 1930s, but the war intervened. Making up for lost time, the Pompidou Center in the Palais Beaubourg was opened in 1977, housing a library and contemporary music center as well as a huge collection of modern art. The young architects who won an international competition, Richard Rogers (English) and Renzo Piano (Italian), introduced new concepts: large spaces unimpeded by columns, services on colorful display instead of being hidden, a feeling of openness and transparency. It was and has remained a huge popular success.

In 1997 the Guggenheim Bilbao, an asymmetrical sculpture clad in titanium designed by American architect Frank Gehry, opened to international notice and visits. The museum was paid for by the Basque government as part of a comprehensive economic development plan to reinvigorate a failing industrial area. Since the opening of Guggenheim Bilbao, other cities have been opening new museums and museum additions hoping for a “Bilbao effect,” but without the accompanying investment in subways, airports, and infrastructure. The art came from the extensive collection of the Guggenheim Foundation, and other Guggenheim branches were opened in Las Vegas (with Russia’s Hermitage in 2001; it closed in 2008), Berlin (with Deutsche Bank, 1997) and another vast one also designed by Frank Gehry is planned for Abu Dhabi. The Peggy Guggenheim Collection opened in Venice in 1951 and is part of the international family.

In 2000 the international modern and contemporary art collections of Tate (in rebranding having lost “the” and “Gallery”) were split off into Tate Modern and installed in a disused power station remodeled by the Swiss architects Herzog and de Meuron who had won an international competition. The cavernous Turbine Hall is transformed each year with an installation by a contemporary artist. The combination of the drama of the building, an enticing art program, the site on a revived stretch of river, and, importantly, free general admission (with payment for special exhibitions) has made Tate Modern one of the most popular art museums in the world, with an annual attendance of some 5 million.

Museums focusing variously on modern or contemporary art sprung up in San Francisco (1935), Chicago (1967), and Los Angeles (1979). The Boston Institute of Contemporary Art opened a bold building by Diller and

Scofidio in 2006, and the New Museum of Contemporary Art opened a subtle and complex building by the Japanese practice SANAA on New York’s Bowery in 2007. Some institutions such as the Institute of Contemporary Art in London (1947) and the Walker Art Center in Minneapolis (originally 1927; focus on contemporary in the 1940s) have spaces for dance, theater, and film.

Many traditional museums like the Metropolitan Museum have long collected modern art as the passage of time venerates it into art history, but in recent years, seeing the popularity of contemporary art, they have been less and less willing to cede a monopoly of the new to specialist museums. The large and elegant extension to the Art Institute of Chicago is called the Modern Wing and contains modern art, contemporary art, photography, design and architecture, and sets a challenge to Chicago’s forbidding Museum of Contemporary Art, designed by Josef Paul Kleihues (1996).

Some of the underlying reasons for the building boom mirror those of the nineteenth century: pride in city, economic prosperity, a cause and consequence of higher education. A new driving force is the wish to stimulate the creative economy as the manufacturing economy moves to low-wage countries and attract those industries whose workers are looking for quality of life and not just quantity of salary.

The spate of museum building has fostered criticism that the star architect or “starchitect” usually commissioned often create grandiose structures that deflect attention from the art to their own creations. Victoria Newhouse, in *Towards a New Museum* is the most influential of such critics.^[10]

ETHICS AND GOVERNANCE

Museums are repositories of values as well as of objects. Those who control the museum should regard themselves as stewards and trustees, not owners: they have to act unselfishly for the long-term good of the institution. The museum should safeguard and protect the art it collects for future generations, and that includes cataloging and documentation. The museum should be run by the museum’s director and staff with integrity and in accordance with the highest ethical principles and with professional standards. Written policies should cover key areas such as acquisition, deaccessioning, and loans. The museum should have a mission statement and a long-range strategy or plan that ensures long-term financial stability. While overseeing management, trustees should not become involved in it. Trustees should avoid conflicts of interest.

Museums should be run in a businesslike way, but they are not businesses. They often do things that puzzle the business mind, like putting on an expensive exhibition that is artistically worthwhile even though it will not draw in a large audience. Of course such a course of action is only

sensible provided the resources are available to pursue it, but the very notion can raise the business eyebrow.

In the United States, the usual pattern is to have a large board to encompass wealthy individuals, collectors, captains of local industry and commerce, civic leaders, ethnic minorities, and local politicians. Much work is typically done in committees. Museums can readily tap local expertise to create strong committees of finance, audit, investment, remuneration and human resources, and fund-raising. Committees for acquisition, exhibitions, and education have mixed motives: oversight and advice, but also to engage members so that they are more likely to be generous to the museum.

Museums are porous. They are influenced by trustees, by members, by support and special interest groups, by donors, by local politicians, by community groups, and of course by the public, who have access to each other and to the director and to the staff. It is up to the director to ensure that the museum is led rather than being led. It is up to the chairman of the board of trustees to ensure that the director is supported in leading. It is up to the trustees to ask the tough questions to ensure that the direction in which the director is leading is sensible and fiscally responsible.

In Britain, boards are smaller, and at Tate and the National Portrait Gallery their members include artists. In the rest of Europe, museums are typically under the control of the state or of a local municipality with perhaps an advisory board of lay people.

MONEY AND OTHER MEASUREMENTS

Broadly, art museums in the United States are financed by the private sector, in Europe by the state, and in England by both. It must be remembered that in the United States the federal government is a “silent partner.” As part of a long-standing policy of encouraging the not-for-profit sector, charitable donations of money and of art can be deducted by individuals from their taxable incomes, and so their giving is subsidized. Britain under a Labour government has moved towards the American practice of making it attractive to give money to museums and other charities.

This is an age of measurement and evaluation. What are the “outputs” and “deliverables” by which a board can judge its management and a community its museum?

The annual operating statement of a museum should demonstrate that revenues and expenses are in balance. There are three categories of operating revenue: contributed (donations, grants from foundations, sponsorship, government support); earned (admission fees, typically 5–10% of revenues), membership (sometimes categorized as contributed), store, café, rental, exhibition fees); and transfer from endowment funds (usually set at between 4% and 6% of the value of endowment assets). The higher

the endowment in relation to the other sources of revenue, the greater the likelihood of fiscal stability; the smaller it is, the more the museum has to depend on courting donors or earning more. Expenses are usually categorized by function—curatorial, education, development, marketing, administration—and by type—of which salaries and benefits is the largest, typically about half of operating costs. A persistent operating deficit indicates a mismatch between ambition and means and should send out a warning to the board to take action.

The number of people who come to visit a museum is clearly an important indicator of how it is connecting to the community. If a museum is heavily dependent on admission revenue and store and café revenue that goes up and down with foot traffic, then the number of tickets sold is obviously of great concern. However, if a museum is tempted to put on exhibitions intended purely to draw a crowd, then it is substituting for the high-minded mission of bringing art to the people the less noble one of bringing people to the museum any way it can. There is a possible cost in credibility and integrity. The Solomon R. Guggenheim Museum put on an exhibition on the *Art of the Motorcycle* in 1998, sponsored by the car and motorcycle manufacturer BMW, that was criticized on just those grounds.

A better way of making museums more accessible is to abolish admission fees. During the Thatcher government of the 1980s, the major British museums were set free of control by the Treasury (ministry of finance) and encouraged to raise more money from the private sector and charge for entry if they wished. Many did. In 2001 the Labour government abolished admission fees: the result has been a dramatic increase in visitorship. The profile of visitors did not change, but since there were many more of them, the number of less-affluent visitors did go up in absolute terms. The Walters Museum of Art in Baltimore and the Baltimore Museum of Art were both given extra money by the city to allow free admission in 2006, and the Indianapolis Museum of Art, which has a large endowment, went back to free admission in 2007.

In an influential paper entitled “Metrics of Success for Museums,”^[11] Maxwell Anderson, now director at the Indianapolis Museum of Art, argues for looking at measures of quality such as the number of scholarly publications, the size of the library, and loans made to other museums in an attempt to free museums from chasing numbers of bodies. It remains true that the most important function of a museum—the experience of being moved by or challenged by or uplifted by a work of art—is problematic to measure.

EXHIBITIONS

Most museums put on exhibitions of works of art brought especially together from one or many lenders. While not a

new phenomenon, the size and frequency of exhibitions grew from the 1970s and museums carved out space devoted specifically to them. Some of these exhibitions are labeled “blockbusters,” a term of praise in the cinema but of mild abuse in museums. Exhibitions such as *Monet in the Twentieth Century*, mounted by the Royal Academy of Arts in London and the Museum of Fine Arts in Boston in 1998, and *Picasso/Matisse*, mounted by Tate and MoMA in 2000, brought huge crowds. The Royal Academy set a trend for such exhibitions by being open all night on the last Saturday of the run. The Monet exhibition drew attention to the twentieth century art of a great artist considered as a nineteenth century figure and the Picasso and Matisse exhibition explored the creative rivalry between two great twentieth century artists. They were great visual experiences but the exhibitions added to scholarship and understanding. Popularity was the by-product. However, given the appeal of Impressionist and Postimpressionist artists, for example, there have been exhibitions of them where popularity was the goal, and this has generated debate about the role of all temporary exhibitions, blockbuster or otherwise.

The case against blockbuster shows begins with the argument that exhibitions detract attention and curatorial and other resources away from the museum’s own collection. The public is led to expect a linear progression of art and argument and then finds the collection dull by comparison. Fragile works of art traveling to the several venues of a tour have to endure the hazards of transportation. Marketing departments are let loose in ways that undermine the mission of the museum. Museums follow the false gods of money and attendances. On a proper allocation of expenses, including overhead, they do not really make a profit. The attendant exhibition store and special merchandise bring commercialism into the museum.

The case for blockbusters is that such exhibitions bring a focus on an artist or theme that would be impossible in any other way. They enable scholarship that would otherwise not get done. They do bring a sense of event and excitement to the museum that does, indeed, usually bring in a higher audience—an audience for whose time and attention museums are in competition with a plethora of other activities. The appropriate exhibition can bring in minorities that do not usually come to museums: *The Quilts of Gee’s Bend*, an exhibition of quilts by African-American women, attracted the local black population wherever it was shown. Exhibitions are exciting for the public and for curators. They foster international collaborations.

Museums have reacted to the criticism by making more of an exhibition of the “permanent” collection. Tate Britain rotates the display of its collection annually. The Metropolitan Museum’s exhibition of Dutch art referred to above came entirely from the Met’s own collection. However, it remains a true criticism of many museums

that scholarship and publication of the collection have taken second place to exhibition-making.

GLOBALIZATION

The Guggenheim Foundation, rich in collection and poor in endowment, has a strategy of international expansion on the Guggenheim Bilbao model: to lend its curatorial and architectural expertise, traveling exhibitions, and collection in return for a fee. Lest this be seen as the exclusive preserve of American institutions following the profit-maximizing strategies of global corporations, the government-financed Louvre has agreed to do exactly the same thing with a rich Gulf oil state. In March 2007, France and Abu Dhabi agreed to the Abu Dhabi Louvre, with the Louvre benefitting to the tune of approximately \$1 billion. The architect is Jean Nouvel, thus providing France an opportunity for one of its star architects. Protesters argued that the Louvre was selling its soul, exporting culture for cash and contributing to the Disneyfication of artistic experience. The full meaning of these international exploits has yet to sink in. Since museums are busy digitizing images of their works of art to make them internationally available, why not follow up by making some of the real works themselves viewable in conditions set by museum professionals? Is it not better to have the works on display than in storage? But if the works are from storage, is the museum sending its best works out? The director of the Louvre, Henri Loyrette, is keen on enhancing the international brand of the Louvre, and has sent part of the collection on long-term loan for a fee to the High Museum in Atlanta. Is it too commercial to use the consumer-goods concept of branding for a museum—or is he simply being realistic about the way the world now works? The Louvre is a national museum, financed by the state, and should one argue if the state wishes to add a cultural dimension to its diplomacy?

OWNERSHIP OF ART

In late 2007 the Russian authorities threatened to cancel a blockbuster exhibition of art from four Russian collections at the Royal Academy of Art in London. The exhibition was already installed in Dusseldorf, Germany. Germany has a law that prevents the filing of legal claims for the restitution of art in loan exhibitions; Britain had delayed the implementation of such a law. The Russians, fearing a suit from an heir of the Shchukin family, whose art has been confiscated after the Russian Revolution, said they were too worried to lend (the deterioration in relations between Britain and Russia also played a role: art is a weapon of diplomacy). The law was brought forward in Britain, and the crisis defused. The United States has a similar law in place, though with loopholes. While

sensible to protect cross-country traveling exhibitions in this way, the incident did highlight one of the major issues facing museums in recent years: giving back art to its rightful owners. This issue has four main strands.

The first is confiscation under totalitarian regimes in the twentieth century. Russia's current government does not accept that confiscation during the revolution is an act for which restitution needs to be made. During the Nazi era, art owned by Jews was either confiscated, or fleeing Jews were forced to sell for low prices. After several decades of prevarication, and under pressure from the American Department of State, the German museums and their municipal owners have been cooperating in giving back to heirs art where there is good evidence of ownership. The Austrians have been less helpful. Museums in Europe and the United States are under pressure to research the provenance of Nazi-era acquisitions. In 1998 the AAMD issued guidelines encouraging American museums to research their collections and if they suspect they have such works to try and trace the heirs, and if they cannot find them, to publish any details known about the work.

The second strand is antiquities that might have been looted. The Italian and Greek authorities have since the early part of the twenty-first century been active in pursuit and in 2007 the Getty Museum and the Met were obliged to give back important objects once they were confronted with good evidence that these objects had been looted. Art museums are under pressure not to acquire objects whose provenance back to 1970—the date of a UNESCO resolution—is not clear. Some feel that the imposition of this arbitrary date will mean the disappearance of such objects on the market into the hands of private collectors and that it would be better to acquire them for the public realms and display them and publish what is known on the Web.

The third strand concerns objects collected by museums during their ethnographic phases that turn out to be sacred to the peoples that once owned them. The American government passed the Native American Graves Protection and Repatriation Act (NAGPRA) in 1990 to provide a process to return certain Native American cultural items to living descendants and affiliated Indian tribes. Australia and New Zealand have similar policies.

The fourth is what might turn out not to be the special case of the Elgin Marbles, bought for the British Museum by Lord Elgin from the Ottoman Empire, the then occupying power of Greece. The Elgin Marbles (also known as the Parthenon Marbles) are ever more actively being sought by the now sovereign Greek government that in 2007 opened a museum to house them on their return. The British Museum, the Metropolitan Museum, and the Louvre, the three great encyclopedic museums of the world, argue that it is in the interests of everyone for antiquities marking the birth of Western civilization to be dispersed rather than given back to governments who happen now to govern the territories from which they once derived.

CONCLUSION

This entry has concentrated on art museums as institutions rather than on the art within their walls.

We are in an age that values imagination and creativity. We are also in the digital age. We are in an age of a profusion of visual images. Art sparks the imagination. In a screen-based society, people increasingly appreciate the single, authentic object. Contemplation of art in museums provides a welcome respite from the rush of imagery. The boom in art museum expansion is likely to continue after the 2009 recession is over, provided that museums remain true to themselves.

In an influential book of essays by leading museum directors entitled *Whose Muse*,^[12] James Wood, then director of the Art Institute of Chicago and subsequently president of the J. Paul Getty Trust eloquently sums up the implicit contract of museums with the public:

Ultimately the American art museum's authority must flow from its ability to be one of the most tangible and accessible forums for the experience of excellence, the affirmation of tolerance, the appreciation of personal expression, and the pursuit of the individual happiness embodied in our Constitution. Guaranteeing the integrity of this forum has never been more important, and to the degree that we succeed, our museums will indeed be worthy of the public trust.

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Artificial Intelligence

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Abstract

Artificial intelligence (AI) is a multidisciplinary subject, typically studied as a research area within Computer Science. AI study aims at achieving a good understanding of the nature of intelligence and building intelligent agents which are computational systems demonstrating intelligent behavior. AI has been developed over more than 50 years. The topics studied in AI are quite broad, ranging from knowledge representation and reasoning, knowledge-based systems, machine learning and data mining, natural language processing, to search, image processing, robotics, and intelligent information systems. Numerous successful AI systems have been deployed in real-life applications in engineering, finance, science, health care, education, and service sectors. AI research has also significantly impacted the subject area of Library and Information Science (LIS), helping to develop smart Web search engines, personalized news filters, and knowledge-sharing and indexing systems. This entry briefly outlines the main topics studied in AI, samples some typical successful AI applications, and discusses the cross-fertilization between AI and LIS.

INTRODUCTION

This entry is about artificial intelligence (AI),^[1–4] a multidisciplinary subject, typically studied within Computer Science. Ever since the dawn of civilization, humans have constantly asked questions regarding mechanisms of human intelligence. Human's abilities to think, reason, learn, act to achieve goals, adapt to changing environment, etc., which are central to intelligence, fascinated philosophers, scientists for centuries. There is a long history of human endeavor in unveiling the mystery of human intelligence and building artificial systems capable of doing smart things like humans do. The early works in understanding human intelligence focused on studying how humans "know" the world around them and how the human thinking and reasoning are performed. As early as 2300 years ago, Aristotle, a great Greek philosopher, studied the laws of thought and proper ways of reasoning. In his work "Prior Analytics,"^[5] Aristotle defines syllogism, a kind of logical argument, which allows deduction of a valid conclusion from two given premises. For example, from the premises that "All men are mortal" (major premise) and "Socrates is a man" (minor premise), one can infer by syllogism that "Socrates is mortal." Over the long time after Aristotle, logicians such as Freg, Russell, Leibniz, Godel, Tarski, and others, have fully developed formal logic systems such as propositional logic and predicate logic, which formalize the thinking and reasoning process of humans. Moreover such formal logic systems open up the possibility of being implemented on computational systems.

Endeavors of constructing mechanical/electronic artifacts to do calculation, concept manipulation, reasoning, and game playing can be found in many eras of human

history. Such efforts contribute significantly to the foundations of AI. See Entry 1.1^[1,2] for more discussions on the foundations of AI. Around twenty-sixth century B.C., the Chinese invented the abacus, the first mechanical tool in human history for performing arithmetic calculations (Entry 1.1.1).^[2] Similar calculating equipments were also discovered in Roman relics, in India, and Egypt from ancient times. In 1623, Wilhelm Schickard, a German mathematician, created a calculating clock for addition and subtraction. Soon after in 1642, the famous calculating machine Pascaline was created by Blaise Pascal, a great French philosopher and mathematician. Pascaline is capable of addition and subtraction with carries and borrows. Pascal noted^[6] "The arithmetical machine produces effects which approach nearer to thought than all the actions of animals." Gottfried Wilhelm Leibniz, a great German philosopher and mathematician, believed that human reasoning could be reduced to mechanical calculations of some kind, and thus one could use the calculation results to find out who is right and who is wrong in cases of conflicting opinions. He wrote^[7]

The only way to rectify our reasonings is to make them as tangible as those of the Mathematicians, so that we can find our error at a glance, and when there are disputes among persons, we can simply say: Let us calculate [calculemus], without further ado, to see who is right.

He envisioned that a machine could be devised for automatic derivation of scientific knowledge by deductive inference. In the late 1950s and early 1960s, amid the initial enthusiastic development of AI, Arthur Samuel developed^[8] a computer program that learns to play the game of Checkers, which could learn to improve its

game-playing skills by playing against a copy of itself, playing with human players, and storing good moves from Master game books. In 1997, IBM's Deep Blue Chess program,^[9] with a combination of parallel processing, fast search, and AI ideas, scored a historical win against world Chess champion Kasparov.

As can be seen from the brief descriptions above, the philosophical roots of AI can be traced back to over 2300 years ago. The recent past 200–300 years have witnessed a rapid development in mathematics and science. The formalization of mathematics and science has laid the intellectual foundations of AI. AI as a multidisciplinary area draws on the development in diverse disciplines in addition to philosophy and mathematics, including economics, psychology, linguistics, control theory and cybernetics, and neurosciences. In particular, the birth of the electronic computer in the 1940s was instrumental and crucial to making AI a viable distinctive scientific discipline within Computer Science. The availability of digital computers in late 1940s made it possible for researchers at that time to write computer programs for playing games, performing logical reasoning, and problem-solving. Researchers could then empirically study the computer's performance and analyze whether the computer demonstrated some kind of intelligence. In 1956, at Dartmouth College in Massachusetts, a two-month summer workshop was held^[1] and attended by 10 prominent researchers of AI, including John McCarthy, Marvin Minsky, Claude Shannon, Arthur Samuel, Allen Newell, and Herbert Simon. The workshop was a milestone that signified the birth of AI—a name suggested by McCarthy and agreed by all the attendees of the workshop.

In the early 1950s, researchers and the general public were all fascinated by the possibilities made prominent by the advent of the electronic computer era. People asked numerous questions about whether computers could be intelligent, e.g., do things that used to require human intelligence, what is intelligence, what would it take for us to consider a computer to be intelligent. Objecting views were raised by many to the idea that indeed a computer could be intelligent given sufficient storage memory and processing power. Alan Turing, a great British mathematician and considered by many as the founding father of Computer Science/AI, proposed in 1950^[10] the famous Turing test. Turing proposed to replace the question “Can machines think?” by the question of whether a digital computer can pass the Turing test. In the Turing test, a human interrogator converses in natural language with a computer and a human participant, that are located in rooms separated from the interrogator. The questions from the interrogator and the answers from the computer/human participant are transmitted via online typed messages (similar to today's computer-relayed talk or instant messaging). After conversations for 5 min, the human interrogator needs to identify which one is the computer/human participant. According to Turing, a computer should be

considered as “intelligent” if it passes the Turing test, i.e., if it fools the human interrogator over 30% of the time in many repeated trials. The central idea behind the Turing test is that a system is deemed intelligent if it can behave like humans. This conceptualization of intelligence (behaving like humans) makes it easier to discern intelligence because one does NOT need to know the inner workings of a system to judge whether the system is intelligent or not—it is sufficient to just look at the system's behavior. Turing predicted that by the year 2000, man could program computers with large storage capacities (109 units) so well that the computers would easily pass the test with an average human interrogator. Although his prediction was not realized, the discipline of AI certainly has achieved great advancement over the 58 years from the proposal of the Turing test.

After over 50 years of development, AI has become an industry and a gradually maturing subject. Theories of AI—computational theories of intelligence, have advanced significantly, with many flourishing research topic areas developed and numerous successful AI systems deployed in real-world applications. Today, we enjoy the great benefits of modern computer and information technology in our daily lives, many with important AI components. We have smart online shopping tools that can recommend suitable products catering to the specific preferences of customers; personalized message filtering tools that help to sort out spam e-mails; robots that perform (or assist doctors to perform) medical procedures with great precision; intelligent online information tools that allow us to know what is going on in the world with the click of a mouse, and to obtain, create, and share knowledge efficiently. We have seen the great miracle of electronic computers and AI that our great intellectual pioneers have envisioned, and much much more. Today, AI is more exciting than ever as a research area, playing an increasingly important role in the age of information technology. See Buchanan^[11] for a brief account of AI history.

The rest of the entry is organized as follows. In the next entry, the major topics of AI will be briefly described. Entry on “Artificial Intelligence and Application” presents some sample applications of AI, along with a brief discussion of the impact of AI on Library and Information Science (LIS), and is followed by the conclusion. Readers interested to know more about the AI subject can consult leading text books^[1–3] and other online sources.^[4]

TOPICS OF STUDIES IN AI

In this entry we survey some representative topics of AI study. Since AI is a very big and broad field, it is impossible to make a complete coverage of all topics of AI within the limited space of one entry. The omission of a topic in

this entry is by no means an indication that the topic is not important.

Heuristic Search and Problem Solving

Heuristic search is a topic studied since the early days of AI. Researchers realized long ago that many AI problems could be viewed as a search problem. The concept of problem-solving as state space search was introduced in the 1950s.^[12] In problem-solving, each possible scenario related to the task at hand is formulated as a state, and the entire collection of all possible states is called the state space, which contains the initial state of the problem, and the desired solution state (often called goal state). A state S has a number of neighboring states $N(S)$ which could be reached from state S in one step (by applying some state-transition operators). A state space could then be modeled as a (possibly weighted) graph with nodes representing states and edges connecting neighboring states. Given this view, solving a problem amounts to searching the state space (graph) to find a sequence of states that leads from the initial problem state to the goal state. For example, in computer checkers game playing, each feasible board configuration constitutes a state in the search space. The initial state corresponds to the initial game board configuration and a board configuration in which the player (the computer) has won the game is one of the many goal states. A move of a piece in board configuration S transits it into a board configuration which is a member of $N(S)$. The problem of playing the checkers game successfully against an expert human player is reduced to finding a sequence of moves (states) in response to the human player's moves such that the final state is a winning state for the computer.

For most search problems with real-world application, the search space is huge (or even infinite). Any blind exhaustive search method (such as breadth-first search, depth-first search) would suffer from combinatorial explosion that renders such search impractical. How to efficiently search the state space becomes a critical issue if we want to build useful AI applications. Heuristic search methods have been developed by AI researchers^[13] to efficiently search the state space and overcome combinatorial explosion. Typical heuristic search methods are based on using a heuristic evaluation function h to guide the search process. The best-known heuristic search algorithm is perhaps the A^* algorithm^[14] for searching a weighted graph for shortest path from the starting node ns to the destination node nd . The algorithm maintains a list of open nodes and a list of closed nodes. Each open node n corresponds to a current partial path $ns, \dots, n$ which could be extended into a path from ns to nd via n . For each open node, a measure $f(n) = g(n) + h(n)$ is used to estimate the length of the shortest path from ns to nd via n , where $g(n)$ is the actual length of the path $ns, \dots, n$ and $h(n)$ is the heuristic estimate for the length of the shortest

path $n, \dots, nd$. The A^* algorithm always selects from the open list the node n with the lowest $f(n)$ value, considers the neighbors of node n for expanding the current partial path in search for the shortest path from ns to nd . It has been shown^[14,15] that if the heuristic function h is admissible, namely $h(n)$ is always an underestimate of the actual length of the shortest path from node n to nd , then the A^* algorithm is optimal in that it is guaranteed to find the shortest path from ns to nd . Various improvements of the A^* algorithm have been proposed in the literature, including memory bounded A^* (MA) and simple memory bounded A^* (SMA), etc.

In using heuristic search for problem solving for specific applications, the design of the heuristic function h is a nontrivial task. One has to carefully analyze the specific problem at hand, formulate the search problem, and choose the h function by considering characteristics of the problem to be solved.

Knowledge Representation and Automated Reasoning

An intelligent agent must “know” the world around it, have knowledge about how to achieve goals (namely, what actions are needed to bring about a desired outcome), and can infer useful information from what it already knows in making intelligent decisions. Therefore, an intelligent agent should be a knowledge-based agent, with the ability to represent knowledge and perform automated reasoning from its knowledge.

Knowledge representation research (KR)^[16] studies and develops formal systems for representing knowledge in a knowledge base, whereas automated reasoning research^[17] focuses on finding efficient algorithms for inference from a given knowledge base represented in some formalization. These two areas of study are closely related.

Logic-based formalism is perhaps the most commonly used knowledge representation form in AI systems. See Genesereth and Nilsson^[18] for more discussions of logical foundations of AI. Under a logic-based knowledge representation scheme, an intelligent agent's knowledge base is a set Δ of logical sentences in the representation logic language, and the inference problem faced by the agent becomes the problem of deriving logical consequences of Δ using valid inference rules of the logic. Propositional logic and first-order logic are most frequently used in practice for knowledge representation and reasoning.

When using logic as a tool for knowledge representation, one has to first define the syntax of the language for the logic, which specifies the basic symbols, logical connectives, and rules to formulate well-formed expressions (well-formed formulas) in that logic. For example, in propositional logic, the basic symbols are propositional symbols (typically represented by uppercase letters such as P, Q, R) each representing a proposition that can be true

or false. The logical connectives in propositional logic includes $\wedge$, $\vee$, $\neg$, etc. So if P , Q are propositional symbols, then $P \wedge Q$, $P \vee Q$, and $\neg P$ are all well-formed formulas in the logic.

A logic must define the semantics of the language. Intuitively, semantics defines the “meaning” of well-formed formulas. The semantics of a logic defines the truth value of each formula for each possible world. The truth value for any well-formed formula in a possible world is obtained compositionally from the truth value of the basic proposition symbols in that possible world. For example, consider a propositional logic with two proposition symbols P and Q , where P stands for the proposition “John is a professor at Harvard” and Q denotes the proposition “John lives in Boston.” Here we have totally 4 possible worlds: $\{TT, TF, FT, FF\}$, where each possible world spells out the truth value assignment for P and Q , in that world. For example, the possible world “TF” tells us that P is true and Q is false in this world. Thus in this world, the well-formed formula “ $P \wedge Q$ ” will be assigned the truth value “false (F)” because “ $P \wedge Q$ ” is true in a possible world if and only if both “ P ” and “ Q ” are true in that world.

Once the semantics of a logic is defined, we can use logic for the purpose of reasoning, namely, we can ask the question, “can we derive conclusion ϕ given our knowledge base Δ ”? This is the problem of checking whether ϕ is a logical consequence of Δ —whether ϕ is true in all possible worlds in which Δ is true. Automated reasoning is responsible for this task. Automated reasoning research aims at finding efficient, valid inference algorithms to support derivation of logical consequences. For automated reasoning in propositional logic and first order logic, AI researchers pioneered by Alan Robinson have developed the resolution inference rule^[19] and many of its variants. Since the logical reasoning problem in propositional logic is essentially reduced to the satisfiability (SAT) problem, which is known to be computationally hard, many heuristic methods have been developed which aim to find efficient solvers for the SAT problem.^[20–22] The development of resolution-based inference in first-order logic and the drive for a unified language for declarative knowledge representation and automated reasoning have led to the logic programming technique, hallmarked by the language PROLOG.^[23] In using PROLOG, one represents knowledge by a PROLOG program, and automated reasoning is carried out by the PROLOG interpreter which essentially performs resolution.

Researchers have developed a plethora of non-monotonic logics for representing commonsense knowledge in the 1980s and 1990s. The idea is based on the observation that human commonsense knowledge is not well represented by propositional or first-order logic, so something new needs to be developed. Among the various frameworks proposed, we have Reiter’s Default Logic,^[24] McCarthy’s circumscription,^[25] etc. The studies

on non-monotonic logics and reasoning are closely related to the study of logic programming. Logics for dealing with time, events, knowledge, and belief have also been developed by AI researchers in order to more accurately model the real world. For example, situation calculus^[26] and event calculus,^[27] and temporal logic^[28] as well as logic about actions^[29] deal with time-event-action related representation issues. Various logics on knowledge and beliefs^[30] handle problems of representing (and reasoning about) beliefs and knowledge.

Knowledge representation studies involve not only developing formalisms (logic, etc.) for representing the real world, but also methodologies as to how to model the real world and represent the model within the chosen formalism. Generally speaking, decision on how to represent the world would require the identification of an ontology, which specifies the concepts (categories) for modeling the world and the taxonomy (inheritance hierarchy) relating the concepts. Other semantical relationships among concepts can also be included in an ontology. For example, when building an ontology for a university, we would identify concepts such as students, professors, courses, departments, employees, staff, etc. We can also organize the people in the university into a taxonomy (a tree) T with top node labeled as “person.” The two children nodes below the root would be labeled by “student” and “employee,” indicating a student is a person, and an employee is a person too. We could also identify other semantical relationships among concepts in this domain: for example, the relationship “enrolled-in” can be identified between “student” and “course,” indicating that students take courses. This kind of ontology specification bears close similarity with Semantic Networks,^[31] a representation scheme developed in early years of AI research. Clearly, tools supporting the construction and maintenance of ontologies are highly desirable. Current research on knowledge representation appears to focus on developing formal systems and tools for representing and processing ontologies with applications in the Semantic Web.^[32] This includes the studies of a unified knowledge representation framework based on XML, RDF, OWL (Web Ontology Language),^[33] etc. and development of tools for extracting/editing ontologies using the unified representation, and studies of inference procedures for query-answering with such representations. Some current works investigate the problem of knowledge acquisition by agent with commonsense knowledge formalized by some logic.^[34]

Machine Learning

An intelligent system must have the ability to learn new knowledge so as to adapt in an ever-changing world around it. Machine Learning^[35,36] study focuses on developing computational theories and algorithms that enable computers to learn. Since the early years of AI

development, many researchers have pursued the ideas of a learning machine, and the field of Machine Learning is now a quite matured subfield within AI. Machine learning is closely related to the fields of data mining^[37] and pattern classification.^[38]

A typical intelligent agent with learning capability could be modeled as consisting of a learning element, a knowledge base, and a performance element. The agent interacts with the outside environment by performing some tasks (by the performance element) in the environment, and getting experience through observing the environment and its feedbacks to the agent. The learning element of the agent learns useful knowledge from the experiences, such that the learned knowledge will enable the performance element to do better on the task in the future. For example, consider a computer program that learns to play the game of checkers. The performance element here is a component that plays the game by using an evaluation function f on board configuration features to choose the next move. The outside environment is another copy of the program itself, and the experience gained by the computer will be a sequence of games between the computer and its opponent, as well as the game outcomes (win, loss, or draw). The learning element of the system could be a least-mean square-based linear function learning algorithm, if we define the evaluation function f to be a linear function of the game board features. Arthur Samuel's Checkers program^[8] has tested such set-ups.

Machine learning tasks can be classified as supervised, unsupervised, and reinforcement learning dependent on the kind of experience available to the learning agent. In supervised learning, the task is learning (an approximation of) a function f from a set of input-output pairs for f : $\{x_1, f(x_1), \dots, x_m, f(x_m)\}$. Here the experience is encoded in the supervision: the function values at the points $x_1, \dots, x_m$. In the case of learning to classify Web pages as "interesting" or "uninteresting," the function value $f(x_i)$ for a Web page x_i will be just binary: 1 or 0 (denoting whether a Web page is interesting or uninteresting). In unsupervised learning, we do not have a beneficial teacher providing the labels ($f(x_i)$) for each observed x_i , we can only identify the patterns present in the observed data $\{x_1, \dots, x_m\}$. In some sense, unsupervised learning basically amounts to forming clusters from the data and thus identifying the inherent structures in the data. For reinforcement learning, the agent does get some feedbacks from the environment, but not in the form of direct supervision $f(x)$ for each observed instance x . Instead, the agent would perform a sequence of actions in the environment and then receive a "reinforcement" signal after performing the action sequence. For example, consider a robot exploring an open area with obstacles and trying to reach a specific goal location without bumping into the obstacles. Here we do not give specific supervisions as to what is the best move for each location—because such supervision may not be available anyway in practice. Instead, reinforcement signals could

be assigned to reward or punish a sequence of actions. If the robot reached the target location through several moves without bumping into obstacles, it would get a positive reward. It would get a negative reward (punishment) when stumping into an obstacle.

Symbolic learning approaches represent the knowledge to be learned in symbolic forms such as decision trees, formulas in propositional logic, logic programs, etc., and learning often takes place in some form of symbolic manipulation/inference, loosely speaking. One popular learning algorithm is Quinlan's Decision Tree learning algorithm,^[39] which constructs a decision tree from a set of training examples, in a top-down fashion. Each example is represented by a vector of attribute-value pairs, together with a class label for the example. In each step of the tree construction, the algorithm checks to see if the examples associated with the current node are of the same class. If so, the node is a leaf node, and marked by the class name. Otherwise, the algorithm chooses the "most discriminating attribute" A to subdivide the examples associated with the node into disjoint subsets, and thus growing the tree. Then the tree construction process is applied recursively until the resulting subsets are "pure," namely, consisting of examples from one class. Various works have been done on learning Boolean functions, learning decision lists, and learning logic programs.

Artificial Neural Networks (ANN)^[40,41] follow a different approach to the learning task. ANN research was motivated by the desire to construct simplified mathematical, computational models that mimic the way human brain works, and hoping to achieve better performance on tasks requiring human intelligence. It is observed that human brains consist of large number of biological neurons, which are massively connected, each with relatively low switching speed in communications compared with the switching speed of electronic circuits. However, humans can perform, with amazing speed, complex cognitive tasks such as recognizing a familiar face, which is still a difficult task for computers in spite of their speed advantages. This suggests that the processing power of the human brain may come from its highly parallel mode of information processing, and the connections patterns among the neurons are crucial in making such massively parallel processing possible. The study of ANN models represents efforts in trying to simulate this model of human brains. An ANN consists of a number of simple processing units, called neurons, each capable of computing simple functions such as linear functions and threshold functions, and sigmoid functions. The neurons are interconnected with real-valued weights. Neural networks can be used to do predictions, to perform classification tasks, to approximate functions, and to find clusters in input datasets. Learning in ANN amounts to adjusting the numerical-valued weights that connect the neurons. Such learning could be supervised, unsupervised, or a hybrid of supervised and unsupervised. In the supervised learning,

perhaps the most well-known learning algorithms are perceptron training algorithm for a single linear threshold unit, and the backpropagation algorithm for training multilayer feedforward networks. Neural networks have been used widely in many successful applications.

Genetic Algorithms (GA)^[42] are another distinctive family of methods for learning. GA are search algorithms that patterned after natural evolution. In using GA for learning, we are interested in searching for good solutions for a problem by selecting candidate solutions and recombining parts of candidate solutions guided by the mechanics of natural selection (survival of the fittest) and natural genetics (children inherit good traits from parents, with occasional mutations). GA maintains a current population of strings, each encoding a candidate solution to the problem. A fitness function f is defined that measures the merit of a string as a solution to the problem. The objective of GA is to search for the best string which maximizes the fitness value. GA applies the genetic operators reproduction, crossover, mutation to the current population in generating the next population of candidate solutions. In the reproduction process, strings from the current population are sampled with probabilities proportional to their fitness values. Crossover operations will produce two new strings from two parent strings by exchanging segments of the parents. And finally mutations may be applied to randomly alter one bit in a string. Through evolutions of strings from one generation to the next, GA perform structured yet randomized search of the space of all possible strings, often efficiently, in looking for the optimal or near optimal solutions. Koza's genetic programming^[43] further extends the idea of GA by evolving computer programs for problem solving. GA research is closely related to studies of Artificial Life and evolutionary computing.

Another type of machine learning is statistical learning,^[44] utilizing probabilities and Bayesian theories for learning. In particular, graphical models aim at generating models represented as directed or undirected graphs with (conditional) probability tables attached to each node in the graph, and the entire graph captures joint distributions of a set of random variables. This includes learning Bayes Belief Networks,^[45] learning (conditional) Markov Networks, etc. In recent years Probabilistic Relational Models (PRM) and related learning models have also been developed.

Natural Language and Speech Processing

An intelligent system must have the capability to communicate and interact effectively with the outside world. Effective communications include receiving information (in various forms) from the world, understanding such information, and sending out information in suitable forms understandable to the outside world. Natural language processing and speech processing address the problems involved for an intelligent computer to communicate with

humans using natural (written or spoken) language such as English.

Natural language processing^[46] research mainly handles the task of communicating with written natural language. The main topics studied include language understanding, language generation, and machine translation. The inputs to a natural language understanding system are written texts (articles, or paragraphs or sentences) of some language, and the desired outputs are semantical structures represented in some form, which capture the semantic meanings of the inputs. Language generation handles the opposite side of the problem: Given semantic meanings to be communicated to the outside world, a natural language generator produces correct natural language sentences (paragraphs, articles) that convey the meanings accurately. Machine translation tackles the task of automated translating texts from the source language to the target language, say, from English to French.

In speech processing,^[47] the tasks are speech understanding and speech generation. Clearly, the apparatus of natural language processing techniques can be used as components of a speech processing system. For speech understanding, the main hurdle is speech recognition, which requires the capability of converting the spoken language inputs into written texts (so that natural language understanding tools can be utilized subsequently). Similarly, for speech generation, the major task is to map written texts to speech utterance. Converting continuous speech signals to written text requires multiple steps, from the initial step of signal sequence segmentation, to the step of phoneme recognition, followed by the step of mapping phonemes to texts. Signal processing techniques are needed to handle speech signal noise removal and segmentation. Neural Networks and Hidden Markov Models are commonly used techniques for speech recognition and generation.^[48] Speech recognition and generation techniques^[49] are widely used in day to day applications such as automated information systems in airlines, banks, etc.

Natural language processing requires several important techniques. First, syntactical analysis tools such as parsers are necessary for analyzing the syntactical structures of sentences according to the language grammar—to find the subject, predicate, and the object in a sentence. Semantical analysis tools are needed to give semantic interpretation to the sentences. Contextual information and pragmatic background knowledge are also essential for semantic disambiguation (word meaning disambiguation, reference resolution, etc.). Thus knowledge representation is also an important topic related to natural language processing.

Natural language processing is closely related to text-mining, which is an active area of study involving computer science and LIS. Text-mining aims to discover useful knowledge from large collections of textual documents, which can be seen as a generalization of natural language understanding. The studies in text-mining

include text summarization, concept extraction, and ontology extraction.

Signal, Image Processing, and Robotics

The communications between an intelligent agent and the outside world can take various forms, such as visual and audio signals, in addition to utterances in natural language. Moreover an intelligent agent should be able to act in the world and thus effecting changes to the world around it as well. Signal and image processing research develops techniques that support computer perception and understanding of information in image, audio, and other sensory forms (such as radio signals, infrared, GPS signals). Robotics put together the techniques of AI study and build robots that can act intelligently, change the world, and achieve desired goals.

Although signal processing has been mostly studied by researchers in Electrical Engineering (EE), it has close connection to building fully autonomous intelligent agents. Image processing^[50] and computer vision^[51] are important topics in AI and EE. In image processing, the main task is image understanding, namely, to build a semantic model of a given imagery; and in computer vision, the main task is visual scene understanding, i.e., to building a model of the world (the perceived visual scene). Further extension of visual scene understanding would include understanding video streams (sequence of scenes). The “understanding” of a visual scene/image involves recognition of the objects present, the relevant photometry/geometry features of the objects, and the (spatial or other) relationships among the objects. To achieve the objectives of image/scene understanding, several stages of image processing operations are needed. Initial processing of images includes low-level operations such as smoothing to filter out noise in the image signals, edge detection, and image segmentation to decompose the image into groups with similar characteristics. These low-level processing operations are local computations and require no prior knowledge about the images for the particular application. The next stage processing involves object recognition, which requires isolating each distinctive object, determining the object’s position and orientation (relative to the observer), and identifying the object shape. Objects are outlined by edges and described by a set of features, which are chosen by the designer of the image processing system. The feature could be shape-based (geometric features) or photometric features (such as textures, brightness, shading). For this processing stage, the computations are not necessarily local, features for characterizing different objects could require computation involving the pixels of the entire image. Supervised learning or pattern classification^[38] methods are typically used for object recognition. The problem of object recognition from images is still highly challenging: a good object recognition system must perform well in spite of variations in the input image. The variations include changing

illumination of the image, different pose and orientation of the objects, and translation, scaling of the objects. We humans are very good at recognizing, for example, familiar faces even if the faces are varied by wearing eye glasses, putting on a hat, having a different facial expression, or being illuminated differently. But such variations are still very hard to handle by computers.

Robotics^[52] studies the techniques for building robots, i.e., intelligent agents with capabilities to act in the physical world. The research in Robotics concerns with both the hardware and software aspects of robots. A robot possessed a set of sensors for perceiving its surrounding environment and a set of effectors (also called actuators) for effecting actions in the environment. For example, for a mobile robot such as the planetary rovers that explore the surface of Mars, it has range sensors for measuring distance to close-by obstacles and image sensors (cameras) for getting images of surrounding environment. It also has effectors such as wheels/legs, joints for moving around. Robots can be classified into three categories: (1) Manipulators, which are robotic arms physically anchored at a fixed location, for example, garbage collection robot arms on the garbage van; (2) Mobile robots that move around using wheels, legs, etc.; and (3) Hybrid—mobile robots with manipulators. In particular, recent years have witnessed an increasing interest in building the so-called humanoid robots which, resemble humans in physical design and physical appearance.

The research problems studied in robotics call for utilization of all major AI techniques. A robot must be able to perceive its environment and represent the state of its environment in some knowledge representation form, it must be able to learn from its past experiences, it must be able to perform inference in making decisions about the correct move, and it must be able to plan and act intelligently, it must be able to handle uncertainty, and it must be able to communicate effectively to teammates and human users. Robotic perception addresses the problem of constructing internal models/representations of the environment from the sensory signals of the robot. This includes the study on localization, i.e., locating the position of specific objects, on environment mapping which allows the robot to construct a map of its environment by observation and exploration. Robotic motion research concerns with the planning and control of robot moves by the effectors. Various control architectures have been proposed in the literature.

Robotics has found wide range of successful applications in the real world. We will present some in the next entry on AI applications.

AI APPLICATIONS

AI has found many successful applications in various sectors of the real world. Here we sample some of them. The online resource from Wikipedia^[53] gives more samples.

Game playing. Since early days of AI, researchers have studied the problem of computer game playing using heuristic search methods and machine learning. Arthur Samuel's Checkers playing program pioneered the studied in this aspect. Along with the advances in computing power and AI research, many successful computer game playing systems have been developed that can compete at human master levels. TD-Gammon^[54] is a neural network based program that plays the game of Backgammon very well. The most well-known computer game player is perhaps the Deep Blue^[9] Chess program from IBM. In a 6-game match against world Chess champion Kasparov, Deep Blue achieved 2 wins, 3 draws, and 1 loss, thus overall it has won the match. Today there are many online computer game playing programs (chess, go, checkers, backgammon, etc.) that people can play with and have fun. Almost all such game programs utilize ideas from AI in one way or the other.

Financial applications. Prominent financial firms in Wall Street have employed proprietary software systems for predicting stock-market trends and predicting stock prices for assisting mutual fund managers to boost investment returns. Although the details of such proprietary systems are held secret, it is known that at least a number of them used neural networks.

Medicine and health care. In more than 100 hospitals across the United States, nurses receive help from robotic "tugs"^[55] that tow carts that deliver everything from meals to linens. Miniature robots have been used in surgery procedures for a number of diseases.^[56] Data mining and machine learning techniques have been applied to find patterns of diseases and treatment effects of various medications from huge amounts of medical data. Intelligent medical imaging tools have been widely used to identify tumors/nodules from x-ray/CT-scan images for early detection and diagnosis of cancers. Moreover, computational biology combined with microarray technology in biological sciences has enabled the medical scientists to quickly identify or pin-point the genes responsible for certain diseases.^[57] The construction of large online medical knowledge bases and the availability of such medical knowledge to ordinary people contribute significantly to boost preventive care in public health.

Engineering and manufacturing applications. The ideas of heuristic search and GA have been widely used in solving optimization problems commonly seen in engineering applications such as job-shop scheduling and air traffic scheduling. In manufacturing, utilization of robotic arms at assembly lines is quite common, and such application enhances the productivity tremendously.

Environment protection. Remote-sensing techniques have been widely used for gathering information about the oceans, the atmosphere, the space, and the earth. It is a difficult task to process the huge amount of environment data and find trends in environment change so as to meet the challenge of climate change and global warming. AI

methods such as image processing, pattern classification, and data clustering have been applied successfully for analyzing environment data to assist scientists in environment-related research.^[58]

Space science explorations. Mobil robots have been used to explore the unknown terrains on Mars. According to the Mars rover's web page,^[59]

NASA's twin robot geologists, the Mars Exploration Rovers, launched toward Mars on June 10 and July 7, 2003, in search of answers about the history of water on Mars. They landed on Mars January 3 and January 24 PST, 2004 (January 4 and January 25 UTC, 2004). The Mars Exploration Rover mission is part of NASA's Mars Exploration Program, a long-term effort of robotic exploration of the red planet.

After more than four years of geological surveying the Mars Exploration Rovers robots have ceased to communicate (November 11, 2008).

Intelligent information systems. AI research has significantly impacted the studies in LISs. Ideas in AI have been widely applied in information technology to build smart information systems. On the other hand, the explosive development of the Internet and the Web has fueled AI with many interesting and challenging research problems. Along with the challenges are the great opportunities to bring AI closer to ordinary people's day-to-day lives. Nowadays we take it for granted that we can find information about anything by using online search engines such as Google, Yahoo, or Microsoft Live. Millions of consumers utilize online shopping tools to buy services and products. Digital libraries are a commonplace accessible to a much larger audience than before. What people probably did not realize is that behind all these nice and fascinating online tools and services (such as search engine, online shopping tools, etc.) there are important contributions of AI. For example, association rule mining and other AI methods are routinely used in many major online shopping Web sites so that related products can be recommended to consumers.

Intelligent information systems studies have developed a number of AI-based approaches in information extraction, indexing, and smart information retrieval. In information extraction, text-mining and natural language processing methods are developed to obtain semantical information from texts in the form of concepts and their relationships. Such information is then used for indexing the source texts to facilitate retrieval.^[60] User profiles can be constructed by fuzzy clustering on user information-seeking behaviors (Web-click streams, etc.) to personalize the information service to individual users.^[61] User information-seeking behavior includes not only current session Web-click streams of the user, but also previously logged Web search activities that help to model the user. Fuzzy rule, Neural Networks, and GA have been applied to adapt user queries for better retrieval performance.

There are continuous efforts in building large-scale commonsense knowledge bases and making information/knowledge in the collection accessible to ordinary people. The Wikipedia is one of such knowledge bases.^[62] On the other hand, the studies in Semantic Web^[32] aims at building large knowledge bases in formats such that the semantics (contents) of the information can be interpreted and processed by computers across the Web. Clearly Semantic Web would promote knowledge sharing and intelligent query-answering beyond what the current Web search engines would support. Along this line, the CYC project is another notable example.^[63]

Many multimedia information retrieval systems have been constructed, resulting in various interesting applications such as music retrieval system,^[64] video-clip retrieval system,^[65] etc. Image retrieval for security surveillance has been in practical use for quite some time.

Machine translation. Machine translation is one special type of intelligent information system service, which supports automatic translation of texts from a source language to a target language. Today one can use machine translators at various online search engines, for example, Google. Although the performance is still not as good as that of human translators, machine translators are very useful in several ways. For one thing, human translators are highly specialized professionals and thus expensive to hire. Secondly, human translators would get tired and could not work as fast as computers. The common practice in using machine translation is to let the machines do the first (quick) cut of the translation and then let human translators polish the results produced by machines. This would greatly enhance the productivity of translation.

CONCLUSIONS

AI is an exciting research area. AI research is multidisciplinary in nature, drawing on advances in mathematics, philosophy, logic, computer science, information theory, control, cognitive science, and linguistics. The objective of AI is to understand the nature of intelligence and to build computer systems that behave intelligently. AI research covers a wide range of topics, many of which are briefly discussed in this entry. AI has found many successful applications that impact our daily life significantly. The entry samples some AI applications. AI and LISs have close connections, and cross-fertilization of research efforts between the two fields has been fruitful. Looking forward, we see great opportunities as well as challenges in realizing the dream of AI, which we embrace wholeheartedly.

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Artificial Neural Networks and Natural Language Processing

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Abstract

This entry gives an overview of work to date on natural language processing (NLP) using artificial neural networks (ANN). It is in three main parts: the first gives a brief introduction to ANNs, the second outlines some of the main issues in ANN-based NLP, and the third surveys specific application areas. Each part cites a representative selection of research literature that itself contains pointers to further reading.

INTRODUCTION

Two preliminary notes:

- NLP is here regarded as language engineering—i.e., the design and implementation of physical devices that process human linguistic input in some application and not as cognitive modeling.
- The discussion is concerned solely with text. This is not meant to imply that speech processing is any sense less important in NLP than text processing—far from it. It is, rather, simply a consequence of space limits on this entry, which preclude consideration of what has become a research discipline in its own right.

ARTIFICIAL NEURAL NETWORKS

An ANN is an artificial device that emulates the physical structure and dynamics of biological brains. There are two broad approaches to such emulation. One approach regards ANNs as biological models that capture aspects of brain structure and dynamics as accurately as possible. The other sees ANNs as computational systems, which, although neurally inspired, can be developed in line with required computational properties without regard to biology. Historically, these two approaches have proceeded more or less independently, but recently, with rapid advances in brain-imaging techniques and consequent improved understanding of the brain, there are clear signs of convergence. This discussion focuses on ANNs as computational systems.

ANNs were first proposed by McCulloch and Pitts^[1] in 1943 and were developed throughout the 1950s and 1960s.^[2,3] But, in 1969, Minsky and Papert^[4] showed that there were computable functions that the ANN architectures of the time could not compute,^[5] as a consequence of which ANN-based research activity diminished significantly. Some researchers persevered, however, and by the

early 1980s interest in them had begun to revive.^[6] In 1986, Rumelhart and McClelland published their now-classic *Parallel Distributed Processing*^[7] volumes. Among other things, these proposed the backpropagation learning algorithm, which made it possible to train multi-layer nets and thereby to overcome the computational limitations that Minsky and Papert had demonstrated. The effect was immediate. An explosion of interest in ANNs ensued, which continues today. This has generated a considerable variety of network architectures; details are available from numerous textbooks.^[8–10]

ISSUES IN ANN-BASED NLP

Motivation

In general, a new technology is adopted by a research community when it offers substantial advantages over what is currently available. NLP has from the outset been dominated by a technology based on explicit design of algorithms for computing functions of interest and implementation of those algorithms using serial computers, an approach widely known as “symbolic NLP.” It is only since the early 1980s that alternative technologies have been extensively used, among them ANNs. In what follows, we look briefly at the main advantages and disadvantages of ANNs relative to symbolic NLP.

Advantages

Of the various advantages referred to in the literature, the following two are arguably the most important:

- **Function Approximation**
It has been shown that certain ANN architectures, including widely used ones, can approximate any computable function arbitrarily closely.^[11–14] The function f which a given ANN approximates is determined by

its parameter values, or weights, and these parameter values are learned from a data set $D \subset f$. In principle, therefore, NLP functions can be approximated from data using ANNs, thereby bypassing the explicit design of algorithms for computing those functions.

Why should one want to dispense with explicit design? Looking back on several decades' work on symbolic NLP, and artificial intelligence (AI) more generally, some researchers have come to believe that a variety of problems are too difficult to be solved by algorithm design given the current state of software technology^[15] and have instead turned to function approximation techniques like ANNs. A, and probably the, chief advantage of ANN technology for NLP, therefore, is that it offers an alternative way of implementing NLP functions which symbolic NLP has thus far found it difficult to implement.

- Noise Tolerance

Practical NLP systems must operate in real-world environments characterized by noise, which can for present purposes be taken as the presence of probabilistic errors in the data (e.g., spelling or syntax errors). A frequent criticism of symbolic AI/NLP systems is that they are brittle in the sense that noisy input, which the designer has not taken into account, can cause a degree of malfunction out of all proportion to the severity of the input corruption. The standard claim is that ANNs are far less brittle, so that the performance of an ANN-based system will “degrade gracefully” in some reasonable proportion to the degree of corruption.

Noise tolerance is a by-product of ANN function approximation. ANNs approximate a function from data by fitting a regression curve to data points, and the best approximation—the one which generalizes best—is not the curve that passes through the data points, but the one that best captures the general shape of the data distribution.^[16,17] Most of the data points in a noisy environment will be at some distance from the regression curve; if the input corruption is not too severe, the regression model will place the corresponding output in or near the training data distribution.

Disadvantages

Scaling. Given some ANN architecture, the aim of learning is to find a set of connection strengths that will allow the net to compute a function of interest. Empirical results have repeatedly shown that the time required to train an ANN increases rapidly with the number of network connections, or network complexity, and fairly quickly becomes impractically long. The question of how ANN learning scales with network complexity is therefore crucial to the development of large nets for real-world

applications. The answer is that learning is an NP complete or intractable problem—“We cannot hope to build connectionist networks that will reliably learn simple supervised learning tasks.”^[18]

This result appears to bode ill for prospects of scaling ANNs to large, real-world applications. It is all very well to know that, in theory, ANNs with suitable architectures and sufficient complexity can implement any computable function, but this is of little help if it takes impractically long to train them. The situation is not nearly as bad as it seems, however. The intractability result is maximally general in that it holds for all data sets and all ANN architectures. Although theoretically interesting, such generality is unnecessary in practice^[19] and a variety of measures exist, which constrain the learning problem such that intractability is either delayed or circumvented. These include restricting the range of ANN architectures used,^[19] developing mechanisms for determining optimal network complexity for any given learning problem such as network growing and pruning algorithms,^[18] biasing the net toward data to be learned,^[20,21] explicit compilation of knowledge into network weights,^[22] preprocessing of inputs by feature extraction, where the features extracted reflect the designer's knowledge of their importance relative to the problem,^[16] incremental training,^[20] and transfer of weights from a net that has successfully learned a problem similar to the one of interest.^[23,24]

Inscrutability. A network that has learned its training data and generalizes well realizes a desired behavior, but it is not immediately obvious how it does so; the set of connection strengths determine the behavior, but direct examination of them does not tell one very much. Because of this, ANNs acquired a reputation as “black box” solutions soon after their resurgence in the early to mid-1980s and have consequently been viewed with some suspicion, particularly in critical application areas like medical diagnosis expert systems where unpredictable behavior, or even the possibility of unpredictable behavior, is unacceptable. ANNs are, however, no longer the black boxes they used to be. Mathematical tools for understanding them have been developed,^[13,14] and inscrutability has become less of a disadvantage in the application of ANNs.

Discussion

It needs to be stressed that the intention here is not to argue that ANN-based NLP is necessarily “better” than its symbolic counterpart in a partisan sense. They are alternative technologies, each with its strengths and weaknesses, and, in an NLP context, can be used pragmatically in line with one's aims. The current position with respect to NLP is that ANN-based systems, “while becoming ever more powerful and sophisticated, have not yet been able to provide equivalent (let alone alternative superior) capabilities to those exhibited by symbolic systems.”^[25]

ANN-Based NLP

NLP is historically intertwined with several other language-oriented disciplines, including cognitive science, AI, generative linguistics, and computational linguistics. In general, the interaction of these disciplines has been and continues to be important. It remains, however, that each discipline has its own research agenda and methodology, and it is possible to waste time engaging with issues that are simply irrelevant to NLP. Now, it happens that ANN-based research into natural language has been strongly cognitive science oriented. For present purposes, it is important to be clear about the significance of this for NLP.

The formalisms invented in the 1930s and 1940s to define computable functions were soon applied to modeling of aspects of human intelligence including, of course, language. There have been two main strands of development. One is based on automata and formal language theory and has come to be known as the “symbolic” paradigm. The other is based on ANNs and is known as the “connectionist” or “subsymbolic” paradigm. Until fairly recently, the symbolic paradigm dominated thinking about natural language in linguistics, cognitive science, and AI. It reached its apotheosis in the late 1970s, when Newell and Simon^[26] proposed the Physical Symbol System Hypothesis (PSSH), in which “physical symbol system” is understood as a physical implementation of a mathematically stated effective procedure, the prime example of which is the Turing Machine. The PSSH was widely accepted as the agenda for future work in linguistics, cognitive science, and AI: in essence, the first two proposed cognitive virtual architectures, and the third implemented them. At this time, however, interest in ANNs was being revived by cognitive scientists who saw them as an alternative to the dominant symbolic paradigm in cognitive modeling, and a debate soon arose on the relative merits of the PSSH- and ANN-based approaches to cognitive modeling. The PSSH case was first put in 1988 by Fodor and Pylyshyn,^[27] who labeled what we are here calling the symbolic as the “classical” position, and Smolensky^[28] argued the ANN-based case;^[29–32] between them they set the parameters for subsequent discussion.^[33–43] The essentials of the debate are as follows.

The symbolist position (all quotations are from Fodor and Pylyshyn)^[27] descends directly from the PSSH and thus proposes cognitive architectures, which compute by algorithmic manipulation of symbol structures; the mind is taken to be a symbol manipulation machine. Specifically, there are representational primitives—symbols. Being representational, symbols have semantic content (i.e., each symbol denotes some aspect of the world). A representational state consists of one or more symbols, each with an associated semantics,

in which 1) there is a distinction between structurally atomic and structurally molecular representations, 2)

structurally molecular representations have syntactic constituents that are themselves either structurally molecular or structurally atomic, and 3) the semantic content of a representation is a function of the semantic contents of its syntactic parts, together with the syntactic structure.

Transformations of mental states “are defined over the structural properties of mental representations. Because these have combinatorial structure, mental processes apply to them by virtue of their form.” Therefore,

if in principle syntactic relations can be made to parallel semantic relations, and if in principle you have a mechanism whose operation on expressions are sensitive to syntax, then it is in principle possible to construct a syntactically driven machine whose state transitions satisfy semantic criteria of coherence. The idea that the brain is such a machine is the foundational hypothesis of classical cognitive science.

The subsymbolic position (all quotations are from Fodor and McLaughlin)^[28] defines cognitive models that are “massively parallel computational systems that are a kind of dynamical system.” The primitives are subsymbols, which are like classical symbols in being representational, but unlike them in being finer-grained: they “correspond to constituents of the symbols used in the symbolic paradigm..Entities that are typically represented in the symbolic paradigm as symbols are typically represented in the subsymbolic paradigm as a large number of subsymbols.” The difference between symbolic and subsymbolic models lies in the nature of the semantic content. The subsymbolic position distinguishes two semantic levels, the conceptual and the subconceptual: “The conceptual level is populated by consciously accessible concepts, whereas the subconceptual one is comprised of finer-grained entities beneath the level of conscious concepts.” In classical models, symbols typically have conceptual semantics (i.e., semantics, which correspond directly to the concepts that the modeler uses to analyze the task domain, whereas subsymbols in subsymbolic models have subconceptual semantics; the semantic content of a subsymbol in a subsymbolic ANN model corresponds directly to the activity level of a single processing unit in an ANN. Subsymbolic representations are, moreover, not operated on by processes, which manipulate symbol structures in a way that is sensitive to their combinatorial form because subsymbolic representations do not have combinatorial form. Instead, they are operated on by numeric computation. Specifically, a subsymbolic ANN model is a dynamical system whose state is a numerical vector of the activation values of the units comprising the net at any instant t . The evolution of the state vector is determined by the interaction of the current input, the current state of the system at t , and a set of numerical parameters corresponding to the relative strengths of the connections among units.

How do the symbolic and subsymbolic paradigms relate to one another as cognitive models? In the symbolist view,

classical and connectionist [=subsymbolic] theories disagree about the nature of mental representations. For the former but not the latter, representations characteristically exhibit combinatorial constituent structure and combinatorial semantics. Classical and connectionist theories also disagree about the nature of mental processes: for the former but not the latter, mental processes are characteristically sensitive to the combinatorial structure of the representations on which they operate. These two issues define the dispute about the nature of cognitive architecture.

Now, any adequate cognitive model must explain the productivity and systematicity^[44–46] of cognitive capacities. Symbolic models appeal to the combinatorial structure of mental representations to do this, but subsymbolists cannot: “Because it acknowledges neither syntactic nor semantic structure in mental representations, it treats cognitive states not as a generated set but as a list,” and among other things lists lack explanatory utility. Because they cannot explain cognitive productivity and systematicity, subsymbolic models are inadequate as cognitive models; they may be useful as implementations of symbolically defined cognitive architectures, but this has no implications for cognitive science.

In the subsymbolist view, on the other hand, subsymbolic models refine symbolic ones rather than, as the symbolists maintain, implementing them. In a now-famous analogy, the relationship between symbolic and subsymbolic paradigms is likened to that which is obtained between the macrophysics of Newtonian mechanics and the microphysics of quantum theory. Newtonian mechanics is not literally instantiated in the world according to the microtheory, because fundamental elements in the ontology of the macrotheory, such as rigid bodies, cannot literally exist according to the microtheory. In short, “in a strictly literal sense, if the microtheory is right, then the macrotheory is wrong.” This does not, however, mean that Newtonian mechanics has to be eliminated, for it has an explanatory capacity, which is crucial in a range of sciences and branches of engineering and which a (strictly correct) quantum mechanical account lacks; such explanatory capacity is crucial in the subsymbolic view. Thus, cognitive systems “are explained in the symbolic paradigm as approximate higher-level regularities that emerge from quantitative laws operating on a more fundamental level”—the subconceptual—“with different semantics.” Or, put another way, symbolic models are competence models that idealize aspects of physical system behavior, whereas subsymbolic models are performance models that attempt to describe physical systems as accurately as possible.

What are the implications of this debate for ANN-based NLP? First, the debate has forced a reexamination

of fundamental ideas in cognitive science and AI, and, because much of the ANN-based research on NL is done within a cognitive science framework, ANN-based NLP cannot afford to ignore developments in the corresponding cognitive science work. This is not bland ecumenism, but a simple fact of life.

Second, notwithstanding what has just been said, it remains that the cognitive science focus of the debate can easily mislead the NLP researcher who is considering ANNs as a possible technology and wants to assess their suitability. The debate centers on the nature of cognitive theories and on the appropriateness of symbolist and subsymbolist paradigms for articulation of such theories. These issues, although intrinsically interesting, are orthogonal to the concerns of NLP as understood here. Cognitive science is concerned with scientific explanation of human cognition, including the language faculty, whereas NLP construed as language engineering has no commitment to explanation of any aspect of human cognition, and NLP systems have no necessary interpretation as cognitive models. The symbolist argument that the ANN paradigm is inadequate in principle for framing cognitive theories is, therefore, irrelevant to NLP, as are criticisms of particular ANN language-processing architectures in the literature on the grounds that they are “cognitively implausible,” or fail to “capture generalizations,” or do not accord with psycholinguistic data.

Third, once the need for cognitive explanation is factored out, the debate reduces to a comparison of standard automata theory and ANNs as computational technologies.^[38] So construed, the relationship is straightforward. We have taken the aim of NLP to be design and construction of physical devices that have specific behaviors in response to text input. For design purposes, the stimulus-response behavior of any required device can be described as a mathematical function (i.e., as a mapping from an input to an output set). Moreover, because the stimulus-response behavior of any physical device is necessarily finite, the corresponding input-output sets can also be finite, with the consequence that every NLP function is computable; in fact, the sizes of the I/O sets are specifiable by the designer and can, therefore, be defined in such a way as to make the function not only finite and therefore theoretically computable but also computationally tractable. As such, for any NLP mapping, there will be a Turing Machine—a PSS—which computes it. But we have seen that certain classes of ANN are Turing equivalent, so there is no theoretical computability basis for a choice between the two technologies. The choice hinges, rather, on practical considerations such as ease of applicability to the problem in hand, processing efficiency, noise and damage tolerance, and so on.

And, finally, the debate has set the agenda for ANN-based language-oriented research in two major respects: the paradigm within the research is conducted, and the ability of ANNs to represent compositional structure. These are discussed in the following sections.

Research paradigms

The symbolist/subsymbolist debate has resulted in a trifurcation of ANN-based natural language oriented research, based on the perceived relationship between PSSH- and ANN-based cognitive science and AI:

- The symbolic paradigm^[47,48] accepts the symbolist view of the position of ANNs relative to cognitive science. It regards ANNs as an implementation technology for explicitly specified PSS virtual machines and studies ways in which such implementation can be accomplished.
- The subsymbolic paradigm^[49–51] subdivides into what is sometimes called “radical connectionism,” which assumes no prior PSSH analysis of the problem domain but relies on inference of the appropriate processing dynamics from data, and a position which in essence regards prior PSSH analysis of the problem domain as a guide to system design and/or as an approximate or competence description of the behavior of the implemented system. *Neural Networks and a New Artificial Intelligence*^[42] exemplifies the radical position, and Smolensky, in a manner of speaking the father of subsymbolism, has in various of his writings^[28,52–54] taken the second.
- The hybrid paradigm,^[38,55–60] as its name indicates, is a combination of the symbolic and the subsymbolic. It uses symbolic and subsymbolic modules as components in systems opportunistically, according to what works best for any given purpose. A subsymbolic module might, for example, be used as a preprocessor able to respond resiliently to noisy input, whereas the data structures and control processes are conventional PSS designs.

Interest in the hybrid paradigm has grown rapidly in recent years, and, to judge by relative volumes of research literature, it is now the most often used of the above three alternatives in engineering-oriented applications like NLP. It is not hard to see why this should be so. The hybrid paradigm makes full use of theoretical results and practical techniques developed over several decades of PSSH-based AI and NLP work and supplements it with the function approximation and noise resistance advantages of ANNs where appropriate. By contrast, the symbolic and subsymbolic paradigms are in competition with established PSSH-based theory and/or methodology. On the one hand, the symbolic paradigm has yet to demonstrate that it will ever be superior to conventional computer technology as an implementation medium for PSS virtual machines. On the other, the subsymbolic paradigm essentially disregards existing PSSH-based NLP theory and practice and starts afresh. Of the three paradigms, therefore, it is the least likely to generate commercially exploitable systems in the near future, although it is the most intriguing in pure research terms.

Representation

The most fundamental requirement of any NLP system is that it be able to represent the ontology of the problem domain.^[61–63] One might, for example, want to map words to meanings or strings to structural descriptions: words, meanings, strings, and structures have to be represented in such a way that the system can operate on them to implement the required mapping. Most ANN-based NL work has been directly or indirectly concerned with this issue, and this section deals with it in outline.

There are two fundamentally different approaches to ANN-based representation:

- Local representation: Given some set E of objects to be represented and a set N of network units available for representational use, a local representation scheme (or “local scheme” for short) allocates a unique unit or group of units $\in N$ for each object $e \in E$.
- Distributed representation: Given the same sets E and N , a distributed representational scheme uses all the units $n \in N$ to represent each $e \in E$.

The difference is exemplified in the pair of representational schemes for the integers 0–7 shown in Fig. 1. In the local scheme, each bit represents a different integer, whereas in the distributed one all the bits are used to represent each integer, with a different pattern for each. Because, in the local scheme, each bit stands for one and only one integer, it can be appropriately labeled, but in the distributed scheme, no bit stands for anything on its own; no bit can be individually labeled, and each is interpretable only on relation to all the others.

Local and distributed schemes both have advantages.^[41,61,64,65] Much of the earlier work used localist representation, and although the balance has now shifted to the distributed approach, significant localist activity remains.^[47,66–69] In what follows, local and distributed approaches to representation of primitive objects and of compositional structure in ANNs are discussed separately.

	Local	Distrib
1	0000001	0000001
2	0000010	0000010
3	0000100	0000011
4	0001000	0000100
5	0010000	0000101
6	0100000	0000110
7	1000000	0000111

Fig. 1 Local and distributed representational schemes.

Local representation. *Representation of primitives.* Local representation of primitive objects is identical to that in the PSSH approach: in a PSS, each object to be represented is assigned a symbol, and in local ANN representation, each object is assigned a unit in the net.

Representation of structure. Local representation of primitive objects is straightforward, but representation of compositional structure is not. The difficulty emerges from the following example.^[70] Assume a standard AI blocks world consisting of red and blue triangles and squares. A localist ANN has to represent the possible combinations. One unit in the net is allocated to represent “red,” another for “blue,” another for “triangle,” and yet another for “square.” If one wants to represent “red triangle and blue square,” the obvious solution is to activate all four units. Now represent “blue triangle and red square” using the same procedure. How can the two representations be distinguished? The answer is that they cannot, because there is no way to represent the different color-to-shape bindings in the two cases. In other words, there is no way to represent constituency in a net like this. Localists have developed a variety of binding mechanisms to overcome this problem.^[25,64,70,71]

Distributed representation. *Representation of primitives.* In distributed ANNs, each primitive object is represented as a pattern of activity over some fixed-size group g of n units, or, abstractly, as a vector v of length n in which the value in any vector element v_i represents the activation of unit g_i , for $1 \leq i \leq n$. Such representation has significant advantages over the localist approach.^[17]

Representation of structure. The symbolist/subsymbolist debate made representation of compositional structure a major issue in ANN-based cognitive science on account of its explanatory capacity. The symbolists claimed that ANNs were incapable of representing structure, and for that reason dismissed them as inadequate for cognitive modeling. In response, adherents of ANN-based cognitive science have developed a variety of structure-representing mechanisms. But, as noted, NLP as construed here is not primarily interested in explanation, but in implementing mappings of interest, and many ANN architectures can implement any computable mapping without—as the symbolists observe—any recourse to compositional structure. Whatever its importance for cognitive science, therefore, is representation of compositional structure an issue for ANN-based NLP? The answer is that, in principle, compositional structure is not necessary for NLP, although it may be useful in practice. A discrete-time, continuous space dynamic system, such as a two-layer feedforward ANN with sigmoid activation function, may theoretically be capable of implementing any computable function, but, for some particular function, is finding the required weight parameters computationally tractable, and will network

complexity have reasonable space requirements? It may well turn out that compositional structure makes implementation of certain NLP functions easier or indeed tractable; the need for compositional structure in ANN-based NLP is an empirical matter, and for that reason researchers need to be aware of the structuring mechanisms developed by ANN-based cognitive science.

Using a distributed ANN to represent compositional structure is difficult because arbitrarily complex structures have to be represented with a fixed-size resource (i.e., over some specific group of units). To see this, assume that the primitive objects in a given domain are represented as feature vectors. An ANN that uses distributed representations by definition uses all the available units for each vector. There would be no difficulty about individually representing “man,” for example, or “horse.” But how would the net represent “man” and “horse” at the same time? Even more difficult is representation of relations, such as “man on horse.” The problem, therefore, has been to find ways of overcoming this difficulty.

The crucial insight came from van Gelder in 1990.^[72] He argued that distributed representations can be compositional but not necessarily in the sense intended within the PSSH paradigm. Van Gelder’s article has become very influential in ANN-based cognitive science generally; its importance for present purposes lies in the distributed compositional representation, which it proposes and which underlies several distributed ANN-based representational mechanisms. Space limitations preclude a detailed account of it here. Suffice it to say that, as an alternative to the concatenative compositional representation used by symbolic cognitive science, where the symbol tokens of an expression’s constituents are spatially present in the compositional expression, van Gelder proposes nonconcatenative representation, where this is not the case. The importance of such nonconcatenative representation is that it breaks the link between abstract complexity and spatial representation size: because it does not require constituent tokens to be physically present in an expression token, it becomes possible in principle to represent abstract constituency relations over a fixed-size resource. What is needed in ANN terms are “general, effective, and reliable procedures”^[80] to compose constituent tokens into and to decompose them from expression tokens represented over the representational units of the net. Several such nonconcatenative mechanisms have been proposed, chief among them tensor products,^[73,74] recursive auto associative memories (RAAM),^[75–78] and holographic reduced descriptions.^[79–81]

Sequential processing

Text processing is inherently sequential in the sense that word tokens arrive at the processor over time. ANN-based work on NL has addressed this sequentiality^[82,83] by using three main types of network architecture:

- Multilayer perceptrons

MLPs are a feedforward architecture in which time is not a parameter: they map inputs to outputs instantaneously. MLPs consequently appear to be inappropriate for sequential processing. Nevertheless, the earlier ANN-based NL work used them for this purpose by spatializing time. Given a set of symbol strings to be processed, the MLP is given an input layer large enough to accommodate the longest string in the set, as in Fig. 2. This was unwieldy both because, depending on the input encoding scheme, it could result in large nets that take a long time to train and because of the inherent variability in the length of NL strings. It is now rarely used.

- Time-delay neural networks

A time-delay neural network (TDNN) is an MLP whose input layer is a buffer k elements wide, as shown in Fig. 3. It processes input dynamically over time $t_0, t_1, \dots, t_n$ by updating the input buffer at each t_i and propagating the current input values through the net to generate an output. The problem here is buffer size. For example, any dependencies in a string whose lexical distance is greater than the buffer size will be lost. In the limiting case, a buffer size equal to the input string length reduces to an MLP. TDNNs have been successfully used for finite state machine induction and in NLP applications.^[84–86]

- Recurrent networks

Recurrent networks (RANN) use a fixed-size input layer to process strings dynamically. RANNs used for NL work are discrete-time, and input successive symbols in a string at time steps $t_0, t_1, \dots, t_n$, as in Fig. 4. The net's memory of sequential symbol ordering at any point in the input string is maintained in the current state, which is fed back at each time step.

RANNs are dynamic systems that can be understood in terms of standard automata theory. A RANN that is driven through a trajectory in continuous-state space by a sequence of input signals is interpretable as an automaton driven through a trajectory in discrete space by an input symbol string, and the response of that RANN to a set of signal sequences as an automaton that defines a string set. Moreover, if the dynamics of the RANN are learned from input-output data rather than explicitly compiled into the net, then the RANN can be taken to have inferred an automaton which defines some language L or, equivalently, to have inferred the corresponding grammar.

There has been a good deal of work on the use of RANNs for grammatical inference, both for formal and for natural languages, and using a variety of RANN architectures.^[82,87–100] The training of a Simple Recurrent Network (SRN) as a finite state acceptor is paradigmatic:

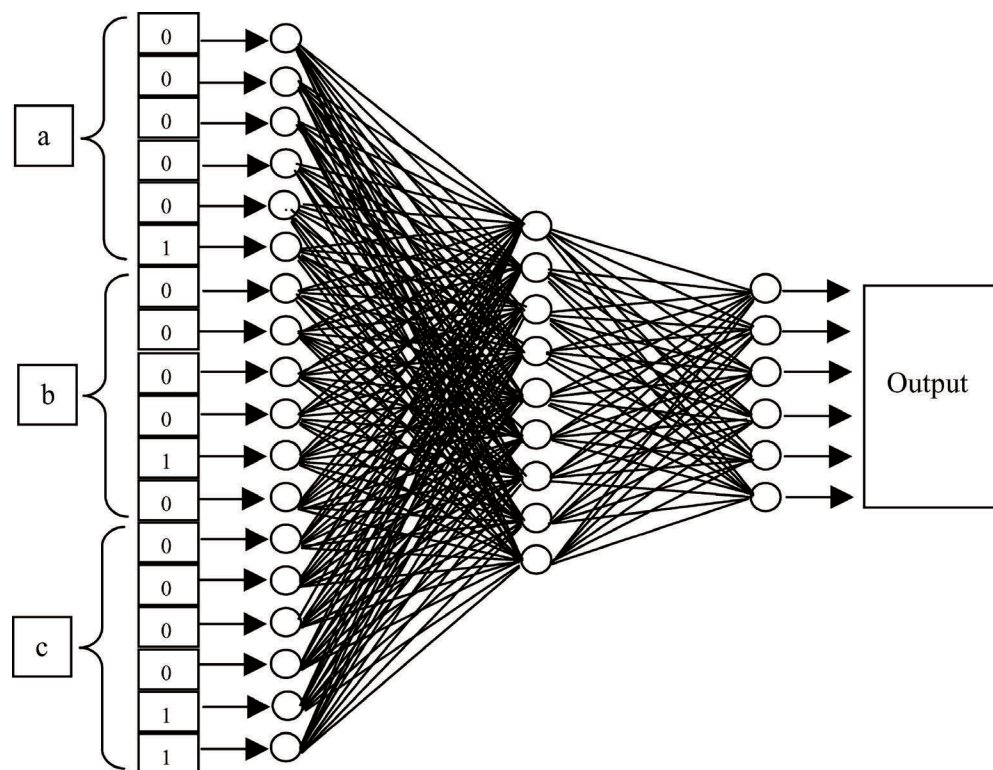


Fig. 2 A feedforward ANN for string processing.

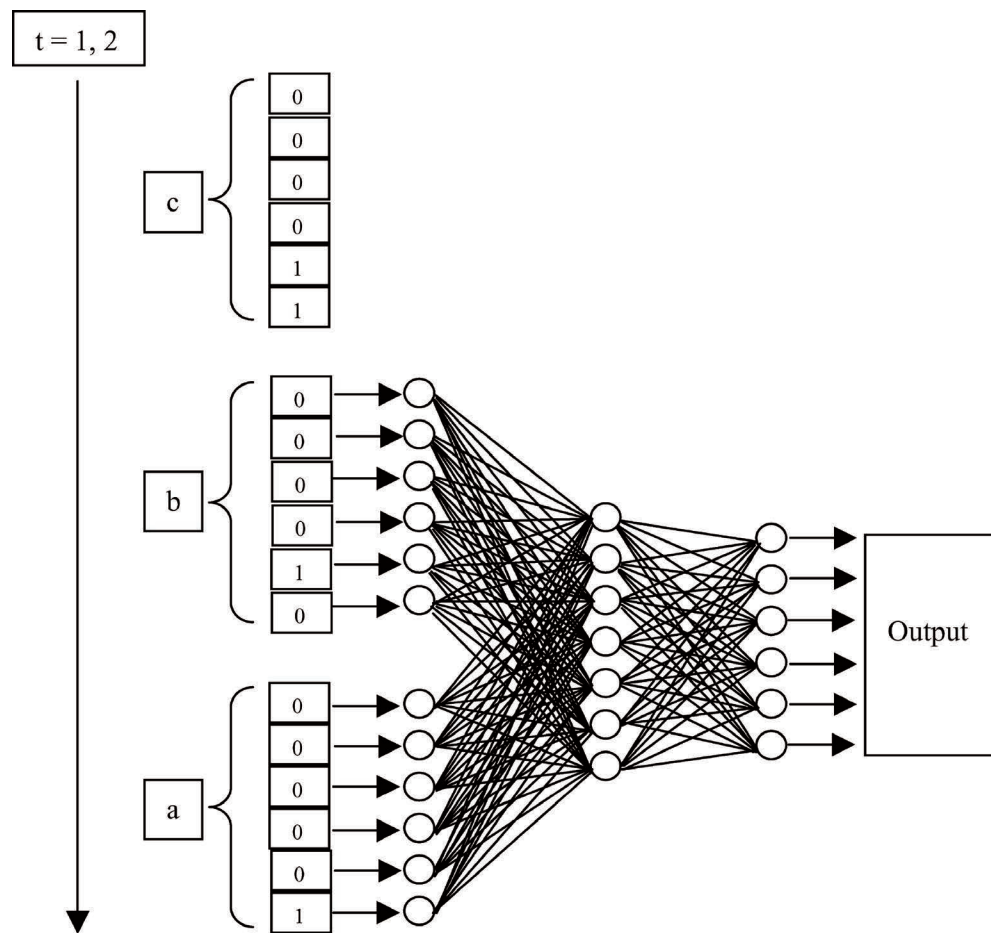


Fig. 3 A TDNN for string processing.

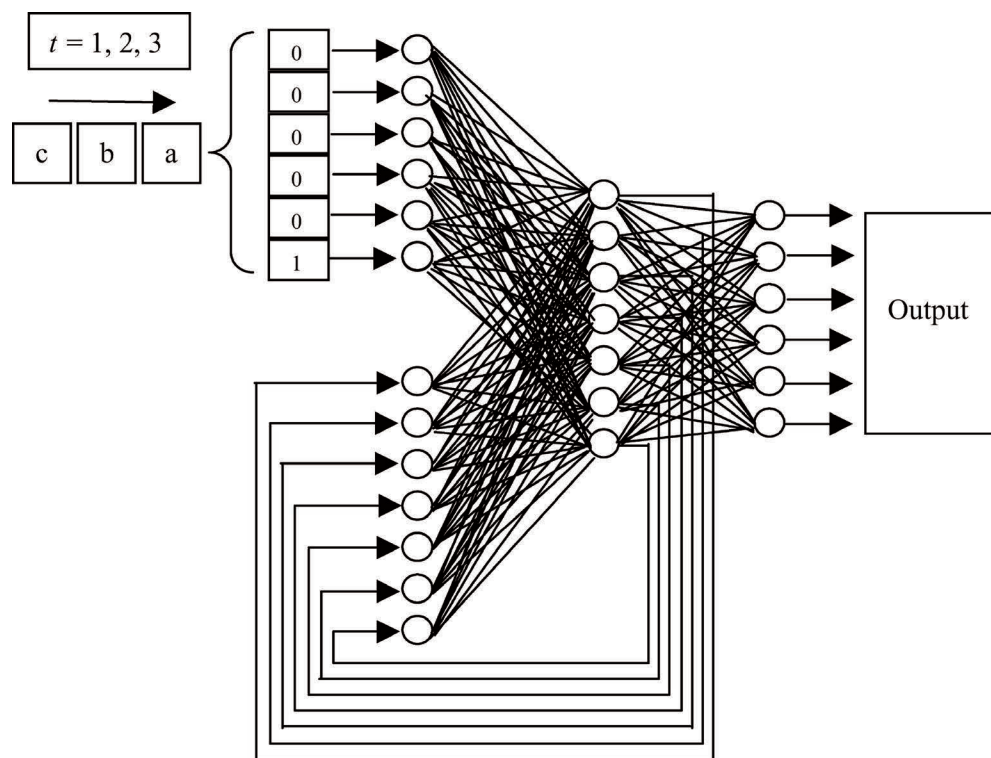


Fig. 4 A RANN for string processing.

given a language L and a finite set T of pairs (a, b) , where a is a symbol string and b is a boolean which is true if $a \in L$ and false otherwise, train an SRN to approximate a finite state acceptor for L from a proper subset T' of T . The SRN, like various other RANN architectures used for grammatical inference, is a discrete-time, continuous-space dynamic system. To extract discrete computational states, the continuous ANN state space is partitioned into equivalence classes by using, for example, statistical clustering algorithms based on vector distance, and each cluster is interpreted as a single computational state. Any finite state machine extracted in this way is a possible computational interpretation of the RANN, but it is not unique, because the number of states extracted depends on the granularity of the continuous-space partitioning and on the partitioning algorithm used.

Meaning representation

There are some NLP applications, like document search, where the meaning of the text being processed is not an issue. In others, semantic interpretation of text is necessary but reasonably straightforward; an example would be an NL command interpreter for a database front end, where both the syntax of input strings and the semantic interpretations to which they are mapped are both well defined and severely restricted relative to normal linguistic usage. However, when one moves to AI-oriented applications, such as (more or less) unrestricted NL understanding systems, semantic interpretation becomes a difficult and still largely unresolved problem. ANNs do not provide an easy solution, but they do offer a promising alternative to existing PSSH-based approaches.

Meaning is variously understood by different disciplines and by researchers within them. It does, however, seem uncontroversial to say that meaning of NL linguistic expressions has to do with denotation of states of the world and that semantic interpretation is a mapping from strings to denotations. That, in any case, is what is assumed here. PSSH-based AI and NLP systems have implemented the mapping by constructing system-internal representations of some aspect of the world—the “domain of discourse”—and then relating input strings to the representation.^[101] How best to represent the world has become a research discipline in its own right—knowledge representation—and numerous formalisms exist. Some ANN-based work on semantic interpretation continues in the PSSH tradition in the sense that they use explicitly designed domain representations. Other work takes a radically different approach, however: input strings are mapped not to explicitly designed representations of the world, which, inevitably, reflect a designer’s analysis of what is significant in the task domain, but to representations that are learned from the world via transducers without designer intervention. At its most ambitious task, this line of research aims to embed NLP systems in robotic

agents that not only receive inputs from an environment via, say, visual, acoustic, and tactile transducers, but also interact with and change the environment by means of effectors. The aim is for such agents to develop internal world representations by integrating inputs and internal states via self-organization based on adaptive interaction with the environment: “Concepts are thus the ‘system’s own,’ and their meaning is no longer parasitic on the concepts of others (the system designer).”^[102] In particular, agents would learn to represent the meanings of words and expressions from their use in specific environment-interactive situations. Work on this is proceeding,^[42,43,102–112] although it must be said that, to keep experimental simulations tractable, the goal of real-world interaction is often reduced to explicitly designed microworlds reminiscent of ones like the famous SHRDLU in the PSSH tradition.

ANN-BASED NLP: AN OVERVIEW

ANN-based NL research^[17,25,113–115] began, fairly slowly, in the early 1980s with articles on implementing semantic networks in ANNs,^[116] visual word recognition,^[117–119] word sense disambiguation,^[120] anaphora resolution,^[121] and syntactic parsing.^[122–124] In 1986, Lehnert published an article^[125] on the implications of ANN technology for NLP, an indication that this early work had by then attracted the attention of mainstream work in the field. Also in 1986 the *Parallel Distributed Processing* volumes^[7] appeared, and these contained several chapters on language: McClelland and Kawamoto on case role assignment, McClelland on word recognition, and Rumelhart and McClelland on English past tense acquisition. All of these were to be influential, but the latter had an effect out of all proportion to the intrinsic importance of the linguistic issue it dealt with. Rumelhart and McClelland presented an ANN that learned English past-tense morphology from a training set of (past tense/present tense) verb form pairs, including both regular (“-ed”) and irregular formations. They regarded their net as a cognitive model of past tense morphology acquisition on the grounds that its learning dynamics were in close agreement with psycholinguistic data on past tense acquisition in children, and, because it was able to generalize the regular tense formation to previously unseen present tense forms after training, that it had learned was an aspect of English morphology. Crucially, though, the net did this without reference to any explicit or implicit PSS architecture. This was quickly perceived as a challenge by symbolist cognitive scientists and became a test case in the symbolist versus subsymbolist debate outlined above. Pinker and Prince^[126] made a long and detailed critique of the Rumelhart and McClelland model, in response to which the model was refined by a succession of researchers.^[51,127–132]

From an NLP point of view, the chief importance of Rumelhart and McClelland's work and its successive refinements is not in its validity as a cognitive model but in the impetus that it gave to ANN-based NL research. It made 1986 a watershed year in the sense that the number of language-oriented articles has increased dramatically since then: disregarding speech and phonology on account of this article's focus on text processing, there has been further work on a wide variety of topics, a representative selection of which follows:

General language acquisition: see also the above discussion of sequential processing.^[41,89,90,133–135]

Morphology: see also the above discussion of past tense formation.^[23,136,137]

Lexical category learning^[89,90]

Lexical semantics^[49,64,68,102–111,138–143]

Syntax and parsing^[41,49,89,90,115,144–154]

Sentence semantics^[49,155–159]

Metaphor interpretation^[160,161]

Text understanding^[49,162–164]

Language production^[49,50,140,165–168]

Dialog systems^[49,50]

Character recognition^[169–172]

Text classification^[173–176]

Data mining and text summarization^[177–181]

Text compression^[182]

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Arts Literatures and Their Users

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Abstract

The various arts disciplines such as dance, painting, and sculpture are often considered to belong to the larger category of the humanities. User studies in the humanities have focused primarily on the needs of scholars and academic researchers. User studies in the arts have also investigated the information needs of practicing artists and others involved in arts-related activities. While these studies are often exploratory in nature, they do point out that the needs of practicing artists go well beyond the information services traditionally provided by academic libraries. With the advent of the World Wide Web, artists and other users of information about the arts have access to some of the greatest libraries and museum collections in the world without ever leaving their homes. However, retrieval of textual, image, and sound data still poses significant challenges for the user.

INTRODUCTION

Arts literatures, or works about the arts, are as broad a field of materials as the various topics they cover. Until recently, information about the arts would have been found predominantly by seeking out primary materials or by consulting books or journal articles. However, due in large measure to the advent of the World Wide Web, the wealth of digital information sources has increased dramatically. These sources have changed the ways in which people look for and interact with information about the arts.

While users of information about the arts range from children looking for material to include in school assignments to retirees looking for information about museums they plan to visit, the main focus of this entry will be on the users most closely involved with the arts—scholars working in the various disciplines of the arts and the creative artists themselves. These user groups have specialized information needs and have been the subject of several previous research studies. In addition to examining what we know about art scholars' and artists' use of information, this entry will also address some of the current issues in retrieving information in the arts.

DEFINITION OF THE ARTS

Aristotle was the first to make the distinction between the arts and the sciences—a distinction that has been preserved in the academic traditions of today. For Aristotle, the sciences were concerned with the natural world while the arts focused on the “artificial.” During the Middle Ages, the term “liberal arts” came to be applied to the academic fields of grammar, rhetoric, logic, arithmetic, geometry, music, and astronomy, while many of the disciplines that we now think of as comprising the arts (such as dance,

painting, and sculpture) were considered to have little or no intellectual value. In modern times, the arts are often regarded as a subcategory of the humanities—those disciplines that are concerned with the study of human culture compared to the more empirical disciplines of the natural and social sciences. Blazek and Aversa, for example, include the visual and performing arts in the list of fields covered by their definition of the humanities.^[1]

One definition of the arts is offered by the National Foundation on the Arts and the Humanities Act, which established the National Endowment for the Arts and the National Endowment for the Humanities in 1965. In it, “the arts” were decoupled from the humanities and defined to include, but not be limited to “music (instrumental and vocal), dance, drama, folk art, creative writing, architecture and allied fields, painting, sculpture, photography, graphic and craft arts, industrial design, costume and fashion design, motion pictures, television, radio, film, video, tape and sound recording, the arts related to the presentation, performance, execution, and exhibition of such major art forms, all those traditional arts practiced by the diverse peoples of this country. [sic] and the study and application of the arts to the human environment.” National Foundation on the Arts and the Humanities Act (20 U.S.C. 952(c)). See <http://www.arts.gov/about/Legislation/Legislation.pdf>.

ARTS OCCUPATIONS

According to data released by the National Endowment for the Arts' Office of Research and Analysis, more than 2.1 million U.S. workers have artist occupations as their primary jobs. This number represents more than 7% of the total workers in all professional occupations. In addition, more than 300,000 workers hold secondary jobs as artists.^[2]

Table 1 Artist occupations.

	Primary jobs	Secondary jobs	Self-employed (%)	Postsecondary education or training
Designers	803,000	55,000	27	Bachelor's or associate's degree
Architects	239,000	6,000	20	Bachelor's degree
Fine artists and animators	245,000	32,000	62	long-term on-the-job experience
Musicians and singers	223,000	96,000	41	long-term on-the-job experience
Writers and authors	185,000	33,000	68	Bachelor's degree
Photographers	158,000	37,000	69	long-term on-the-job experience
Producers and directors	129,000	13,000	30	degree plus work experience
Announcers	63,000	21,000	25	long-term on-the-job experience
Actors	55,000	5,000	17	long-term on-the-job experience
Dancers and choreographers	35,000	3,000	19	long-term on-the-job experience
Other entertainers and performers	29,000	3,000	n/a	not available

As shown in Table 1, almost half of the total number of primary jobs belong to designers (a term that covers commercial and industrial designers as well as window dressers) and architects; the remaining categories include fine artists (i.e., painters, sculptors, and illustrators) and animators, musicians and singers, writers and authors, photographers, producers and directors, announcers, actors, dancers and choreographers, and other entertainers and performers.

Approximately one-third of artists are self-employed. This percentage is highest among photographers, writers and authors, and fine artists and animators. With the exception of designers and architects, most artists rely on on-the-job experience rather than formal academic education or training. These characteristics support a popular image of artists as solitary, eccentric, and preoccupied with their own creative processes that originated in the sixteenth century and has persisted ever since.^[3] However, most artists today “live and work in the same mundane world of dollars and deadlines as their professional colleagues” (p. 344)^[4] and so have many information needs not associated with their creative processes.

The numbers shown in Table 1 do not include academics and scholars who teach or do research in these areas unless they are also practicing artists. According to the Bureau of Labor Statistics, there are 72,100 postsecondary teachers of art, drama, and music. Data extracted from the Bureau of Labor Statistics Occupational Statistics homepage: <http://www.bls.gov/oes/home.htm> for Standard Occupational Classification code 251121 on March 30, 2008. In addition, the arts world includes many professionals who are neither practicing artists nor academic scholars but who do have specific job-related information needs.^[5] The diversity of user groups in the arts and the variety of their information needs make a simple definition difficult, but the following review provides some insights into the characteristics of these users.

USER STUDIES IN THE ARTS

Users in the humanities have been studied systematically by researchers for over 30 years. Early projects to identify

information needs in the humanities were carried out by the Centre for Research on User Studies at the University of Sheffield;^[6,7] further descriptions of the information needs of humanities scholars appeared in the early 1980s with the publication of articles by Weintraub^[8] and Stone.^[9] While the Weintraub article focused primarily on the implications for library services, the Stone study identified certain characteristics of humanities scholars that have been confirmed repeatedly by subsequent research. These include the tendency to work alone, to browse extensively, and to rely heavily on primary materials in addition to books and journals. Since the publication of the Stone study, researchers have discussed and expanded on the characteristics of humanities scholars^[10–14] and tracked changes in their information behavior in response to technology.^[15–18] A more thorough consideration of the humanities literatures and their users may be found elsewhere in this work, and it is not the intention of this entry to do more than indicate the context in which research on user groups in the arts has been conducted.

The overlap among the subject areas considered to be part of the humanities in general and those that are more strictly defined as belonging to the arts specifically is reflected in the studies of users in these areas. The distinction between the two areas is further complicated by the fact that often users of information about the arts are not themselves artists, but rather scholars such as art or music historians. These arts scholars may share more characteristics in common with other humanities scholars than with the visual or performing artists whose works they study. Furthermore, user studies point out that “scholars in the humanities do not have a homogeneous information-seeking behavior or homogeneous information needs” (p. 195).^[11] That this is also true of users in the arts becomes apparent when looking at studies of users in specific arts disciplines.

A further characteristic of user studies in the arts is that they, like the studies of users in the humanities, often take a library-centric perspective. That is, the focus of many studies has been on users' interactions with libraries and how library services might be better designed to serve these user groups' information needs.^[19–22] This perspective may not

fully reflect either the information needs or the information-seeking behavior of users in the arts, especially practicing artists. Users in the arts, whether scholars or practicing artists, often look beyond traditional academic library resources when searching for information or inspiration.

The concept of serendipity, and the role that it plays in the creative process, is addressed in several studies related to users in the arts.^[4,23] This concept is also well documented in studies of humanities and interdisciplinary scholars.^[24,25]

Art Historians

Among the earliest user studies specifically addressing a particular group in the arts was Stam's 1984 dissertation summarized in the article "How Art Historians Look for Information."^[26] Drawing on Allen's technology transfer model,^[27] Stam "attempted to establish some normative data about these scholars as a first step" towards providing better library and information services for these users.^[27] Stam's study found that art historians, like other humanities scholars, relied heavily on institutional and personal libraries. Art historians who were also college faculty augmented their personal libraries with a significant number of slides. Stam further found that art historians visited museums an average of eight times per year. This behavior was consistent with Stone's earlier finding on the range of materials needed by humanities scholars including "primary materials such as . . . works of art . . ." (p. 296).^[9] Stam's study also found that art historians working in museums used informal channels of communication (telephone calls, social/professional events, and correspondence) more frequently than did their counterparts working in academic environments. Both groups, however, interacted more with institutional colleagues than they did with librarians. Stam's conclusion from her data was that "information seeking among art historians seems to be a fairly private activity. . . . The process . . . appears to be a contemplative undertaking involving objects of art, reproductions of those objects and related objects, and written descriptions and observations about works of art" (pp. 29–30).^[27] Even those arts scholars working in interdisciplinary areas, where collaboration is often the norm, are "definitely loners" (p. 358).^[28]

The art historians' need for visual information, whether from primary or secondary sources, is a defining characteristic of this particular user group. The art object, or at least a visual representation of it, is essential to the art historians' research activities.^[29,30] This characteristic is shared by art students and artists in both the fine and the applied arts.^[20,23,31] A study of visual arts students confirmed that extensive browsing is another characteristic that this user group shares with more experienced art historians. However, as might be expected, student browsing was more general in nature than that of arts historians. Students in the study "claimed they looked for images that

broadened their knowledge about art or a specific area of art, that addressed specific creative problems and inspired or offered relief from creative block" (p. 448).^[20] Students were also interested in survey material on the history of Western art and in material that described specific works of art in the artist's own words. However, when asked whether they sought help in finding appropriate library resources to meet their information needs, only a few students in the study admitted that they had asked a librarian for assistance. Most students worked on their own or relied on other students for help and advice on where to find information. Further studies have confirmed that while library resources appear to be important in the development of student artists, finding ways to support their information seeking remains a challenge for academic librarians.^[19,32]

The question of how art historians have responded to the advent of online information and digital images has been addressed by several researchers. In 1995, results of a 2 year project to study the use of online databases at the Getty Center for the History of Art showed that "scholars' response to online searching was positive, if fraught with some anxiety" (p. 36).^[15] However, scholars were not comfortable with the new technology and did not use it as a routine part of their information-seeking process. In 1999, a further Getty report on the information needs and seeking of scholars and artists in relation to multimedia materials^[33] predicted that the speed of adoption of new technology by users of the Getty Institute would be slower than that shown by social scientists and natural scientists. This apparently limited use of technology by art historians is particularly surprising given the dependence on visual images as a source of information mentioned in many of the user studies cited above. Results of a survey conducted in 1999/2000 of 121 art historians based in British institutions of higher education indicated that less than half of the respondents (47.1%) felt that access to digital images had affected their work methods, while only 24.8% felt that digital images had affected their actual research interests.^[34] Further studies have continued to confirm this impression of art historians^[35,36] and conclude that "many have a rather limited awareness of electronic resources and haven't fully developed the skills to utilize them to their fullest potential" (p. 6).^[37]

Music Scholars

In contrast to art historians, scholars working in the area of music have been the subject of only a few formal studies. Most frequently they are mentioned, if at all, in the context of other scholars working in the humanities^[11,14,15,38] or as a member of the fine arts faculty.^[22] Those instrumental instructors who are members of the fine arts faculties may also have secondary jobs as practicing musicians. Other areas of music scholarship include historical musicology, the study of music theory and composition, music education,

ethnomusicology, and electronic music.^[39] Like other humanities scholars, those working in the area of music are frequently interdisciplinary. The information resources they need include, but are not limited to “recordings and music scores including study scores, performance scores, and the scholarly collected editions” (p. 229).^[22] Especially for music scholars who are not instrumental instructors, the information resources will also include material from other disciplines, both within and outside of the humanities.

A useful model of the research process used by music scholars has been developed by Brown.^[40] Her model, based on interviews with 30 full-time noninstrumental music faculty was further tested through a survey of 175 music scholars in the United States and Canada. The model defines six stages in the research process, from idea generation to dissemination, and identifies information resources associated with each stage. The model, which built on research into the scholarly process of literary critics,^[41] shares many characteristics in common with those describing the work of art historians and confirms several of the major findings already identified in the literature such as the predominately solitary nature of the scholarly process, the reliance on personal as well as institutional collections for information, and the importance of browsing in the information-seeking process.^[26] Like Stam’s art historians, these music scholars also used informal channels of communication to keep up with current trends in their fields. Although these scholars did use e-mail and discussion groups to stay in touch with colleagues, they preferred face-to-face communication and personal interactions at conferences.^[42] Use of technology in general seems to have followed the distribution curve identified by Bates,^[43] although this in itself is surprising given that the study was conducted 5 years after the report of the Getty End-User Online Searching Project was released. However, no more recent data are available on the use of technology by scholars in the arts.

Other Arts Scholars

Research on other academic user groups in the arts (dance, film, theatre, etc.) is difficult to find. Faculty from dance and theatre were included in the study by Reed and Tanner focused on improving library services for fine arts faculty.^[22] Other insights into the information-seeking process of these scholars may be gleaned from the types of materials that are made available to them in specialized library collections.^[44] Librarians in art, music, and other specialized collections have long been intimately involved in the scholarly activities of their users and strive hard to understand their needs.^[45,46] However, an absence of user studies in this area has left a gap in our knowledge of how these users’ information needs and information-seeking behavior is changing as a result of the proliferation of online information resources.

Fine Artists

Very few studies have been done on practicing artists as a user group,^[47,48] and what exists can only be considered suggestive because of the small numbers that have been studied. A review of what literature there is about fine artists, including an annotated bibliography, may be found in the online version of Cowan’s 2004 article.^[49] As with the studies of scholars in the arts, what has been written about practicing artists has looked primarily at artists’ use of libraries, both actual and potential, and has not focused on their broader information needs. Studies of this type include Cobbledick’s interviews with four artists—a sculptor, a painter, a fiber artist, and a metalsmith—and Powell’s interviews with nine studio artists.^[4,50] Cowan’s own study reports the results of a series of interviews with a single artist. While none of these studies produced generalizable results, they do point to some common characteristics among artists. Like other humanities user groups, fine artists tend to work alone and to browse extensively in search of inspiration or useful information. However, Cobbledick points out that, “the extent and importance of browsing can be overstated,” since the artists she interviewed looked for information with a specific need in mind and browsed only within a limited range of material (p. 362).^[4]

Musicians

User studies of practicing musicians are at least equally scarce and, like other studies of users in the arts, have focused primarily on the information needs that can be addressed by library services.^[51,52] A 2006 study of composers of electroacoustic music notes that, not only are there no user studies of this “idiosyncratic group,” but also “the larger community of composers of music” has not been addressed (p. 1 and 3).^[53] Similar to the studies of fine artists, the findings about electroacoustic composers are based on a very small sample—five composers who were graduate students in American universities. However, an important characteristic of these users may have relevance for other groups of artists as well. While their creative output situates these composers in an arts discipline, their information needs include resources from computer science, engineering, and mathematics. Even though these types of interdisciplinary needs were not identified specifically in the studies of fine artists, the increasing use of computer technology in all forms of art makes it likely that other types of practicing artists would have similar information needs. In addition, artists of the generation just now entering into its most productive years are individuals who grew up with technology. The tools for their creative processes will most likely include a higher number of interdisciplinary resources than ever before.

Another significant characteristic of this user group is its dependence on Internet-facilitated information sources

such as e-mail, Listservs, and Web sites. The composers in the study reported using Listservs to find information on technical questions, while Web sites of professional organizations provided information on conferences and festivals. Personal Web sites were used by the composers to find information on other composers and to communicate information about themselves. While communication with colleagues was seen as an important source of information for both scholars and artists,^[4,12,42] the artists interviewed by Cobbledick in 1995 did not embrace the use of the available technology to support their information-seeking or communication activities. Whether this is a characteristic of fine artists compared to musicians or whether this is a generational effect requires further research to determine. An interesting insight into the creative process of musicians can be found in the discussion by Eaglestone, Ford, Brown, and Moore.^[54]

Other Artists

Reports about the information needs of practitioners in other arts disciplines are largely anecdotal. National service organizations such as the American Composers Forum, American Music Center, Chorus America, Dance/U.S.A., League of American Orchestras, Meet the Composer, National Performance Network, OPERA America, and Theatre Communications Group provide information services to both organizational and individual members as well as hosting conferences and meetings at which information is exchanged. Much of the information provided by these organizations is practical in nature, addressing the mundane needs of the users, such as employment opportunities, rather than supporting their creative activities. However, these organizations also provide fora for discussions of artistic issues, information about trends in the disciplines, and opportunities for networking with colleagues. Since these organizations serve a national membership, much of the information they provide is disseminated electronically through e-mail, Listservs, discussion boards, and organizational Web sites. Other organizations such as the Performing Arts Data Service (PADS) in the United Kingdom maintain Web sites that offer a wide variety of digital resources to researchers and other users in the areas of music, film, broadcast arts, theatre, and dance.^[55] Most of these organizations keep statistics on user requests and make some effort to identify user needs. However, systematic studies are yet to be done in these areas.

IDENTIFYING AND RETRIEVING ARTS INFORMATION

Although simple text retrieval has long been the norm for traditional library literature, information retrieval in the arts is no longer primarily text-based. Other sources of information, especially digital images and sound, play

important roles in satisfying the information needs of scholars and practicing artists. Each type of information—textual, graphic, and sound—presents different challenges to users looking for arts information.

Subject Retrieval

Subject retrieval (e.g., by a particular artist, work, or theme) has traditionally been one of the common ways in which users access material about the arts. Results from the Getty End-User Online Searching Project show that 49% of the scholars in the study used individual names as subjects in their searches and 57% used some other common term.^[43] However, a persistent obstacle to building large-scale subject retrieval systems in the humanities has been the “diversity and complexity of textual, graphic, aural and artifactual sources used by scholars in their research” (p. 608).^[56] According to Tibbo, “the interdisciplinary and unique research interests of humanistic scholars make convenient subject coverage with appropriate index terms challenging” (p. 616).^[56] With the increase in full-text databases, especially of secondary material, there “seems to be an assumption that full-text searching is the solution to all information retrieval problems” (p. 228).^[57] Unfortunately, full-text searching is not a panacea, and users often become discouraged or frustrated by the number and range of the items that are retrieved. This leads East to predict that, even though vast amounts of secondary material is now being made available digitally, “it seems all too likely that they [scholars] will use these digital collections to look for documents that they have identified from other sources rather than performing subject searches to discover further resources” (p. 239).^[57] This is consistent with earlier findings that humanities scholars do not make regular use of abstracting and indexing tools except when “venturing into unfamiliar areas,” but prefer to follow bibliographic references from sources already known to them (p. 204).^[58]

Image Retrieval

The advent of searchable databases of digital images has dramatically changed the way users look for graphic materials. In 2000, all of the major information sources for the visual arts listed in Blazek and Aversa’s guide were print materials.^[1] Today, few students or scholars would rely on print material but would look instead for digital images.^[21] There are now numerous large image collections available to researchers all over the world. For example, in 2001, The Andrew W. Mellon Foundation launched ARTstor, a collection of digital images available on the Web for use by scholars and educators.^[59] The collection includes approximately 700,000 images in the areas of art, architecture, the humanities, and social sciences. ARTstor: Images for Education and Scholarship, see: <http://www.artstor.org/index.shtml>. Other major image databases

exist, providing access to some of the most extensive library and museum collections in the world.^[60] One result of the shift to digital images from print material is that “more and more users perform searches on their own,” rather than relying on the help of human intermediaries such as art librarians (p. 696).^[61] This trend has made research into user issues such as relevance criteria essential. How users look for images and evaluate what they find continues to be an area for fruitful investigation. Two studies funded by the British Institute for Image Data Research (IIDR) and Resource: The Council for Museum, Archives and Libraries have provided a foundation for further research.^[62,63] Additional issues arise in the area of multimedia retrieval, which involves the retrieval of two or more media, i.e., text, image, or sound.^[62,64] In multimedia retrieval, as in image retrieval, the success of the process depends on the appropriate representation of the item content and the indexing tools available to describe it.

Melodic Retrieval

In the past, users looking for a particular piece of music needed to know the title, and preferably the composer, of the work they wanted. The difficulty of such a task may be imagined from the fact that the Music Division of the Library of Congress has several million pieces of published sheet music, most of which is not fully cataloged. The Library of Congress, Performing Arts Reading Room, see: <http://www.loc.gov/tr/perform/askalib/aboutsheetmusic.html>. Although music scholars and practicing musicians may have the expert knowledge to find the music sources they need, the general public often asks a librarian to identify a piece of music based on a few hummed bars. Since the 1990s, with the increase of digital music collections, information retrieval researchers have been studying the possibility of electronically searching musical databases by means of direct acoustical input.^[65] An important characteristic of the “query-by-humming” approach is that the user of the system does not need to have expert knowledge of music notation or theory.^[66] In its simplest form, query-by-humming allows the user to “sing a few bars and have all melodies containing that sequence of notes retrieved and displayed” (p. 11).^[65] Approaches to melodic retrieval have been investigated by a number of researchers. Results of several studies may be found at the University of Illinois’ music-ire Web site <http://www.music-ir.org/>. These results show that mismatches between the query and the desired retrieval target are still frequent.^[67] Difficulties occur both because of the “limitations of amateurs in the vocal production of melody,” (p. 688),^[66] and because of the technical aspects of the retrieval process. However, work in this area is sure to become more sophisticated due to the increasing popularity of searching for music to download from the Web.

CONCLUSION

In the conclusion to her study on fine artists, Cobbledick wrote:

Artists need to have access to the universe of knowledge, not merely to some of its parts, and libraries that would meet their information needs must become access points to that universe. The development of computer networking, full-text databases and electronically stored images can help make this access a possibility, but it remains to be seen how the artist community as a whole will respond to these new sources of information once they become more readily available (p. 365).^[4]

It is unlikely that in 1996, Cobbledick could have foreseen how soon this prophesy would come true. Over the past 15 years, the impact of the World Wide Web as a growing source of information has been felt in the arts as in every other aspect of life. With an ease that was unthinkable when the early studies of users in the humanities were conducted, and was still unfamiliar when the 1995 report from the Getty Online Searching Project was released, scholars and practicing artists can now search for information from the greatest libraries and museum collections without ever leaving their homes. However, retrieval of textual, image, and sound data still poses significant challenges for the user. Research into various types of retrieval systems as well as the broad range of users’ information needs is still necessary. Traditional user studies in the arts have focused primarily on scholarly research, with some exploratory studies into the information-seeking behavior of practicing artists. While these have provided insights, research is needed to investigate more fully the contexts in which users search for information as well as the barriers that exist to meeting their information needs.

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Abstract

ASLIB was, from 1924 to 2010, an independent membership organization for special librarianship, technical and commercial information work, and latterly for information management. It was highly influential in the development of documentation and information science, in the United Kingdom and worldwide. Its activities included research and consultancy, training, professional development, publishing, and technology development. ASLIB was for many years the *de facto* UK center for information research, especially information and library management, information organization, and computer applications. It has had several names, being at times the Association of Special Libraries and Information Bureaux, ASLIB, the Association for Information Management, and ASLIB. In 2010, ASLIB became a part of Emerald Group Publishing, and activities ceased in 2016.

INTRODUCTION

ASLIB was, from 1924 to 2010, an independent membership organization for special librarianship, technical information work, and information management. It was highly influential in the development of documentation and information science. Since 2010, it has been a part of Emerald Group Publishing. It has had several names, and name variants, over the years, and for convenience it is referred to as ASLIB throughout this entry. This entry is structured into five chronological sections, reflecting major changes in ASLIB's status.

ORIGINS

ASLIB was founded as a direct result of a conference held at Hoddesdon, Hertfordshire, England, in September 1924, at which delegates from British special libraries and information bureaux met to discuss the desirability of an association to represent their interests. For a full account of its origins, see Muddiman^[1,2] and Hutton,^[3] and for personal recollections, see Pearce.^[4]

Its origins, like much of the information environment emerging at that time, can be traced to the "second industrial revolution," beginning about 1870, in which new industries developed, based on the rapid developments in chemistry, materials science, metallurgy, electricity, and precision engineering. These industries were "information intensive," needing access to knowledge from scientific research, to data of all kinds, and to commercial and technical intelligence. Experience in the 1914–1918 war had shown the necessity for unimpeded access to such information, coordinated at national level.^[4,5]

This led to the need for individuals and departments who could provide such information, actively and in detail, in a way different from traditional libraries. Inspiration for such work was provided by the documentation movement, pioneered in Continental Europe by Paul Otlet and Henri Lafontaine.^[6,7] This used novel technical methods, particularly index cards, and intellectual tools, especially classification, to provide access to information at much finer levels of granularity than heretofore. (It may be noted that information technology and information organization have remained major themes throughout ASLIB's activities.) Companies, government-supported research associations for specific areas of science-based industry, universities, and larger public libraries throughout Britain began to set up special libraries, intelligence bureaux, and technical information sections. These efforts were largely uncoordinated and without any cooperation. Some initiatives had been undertaken, including a Conjoint Board of Scientific Societies founded by the Royal Society, which had advised on library/information matters between 1916 and 1923, and conferences organized by the government Department of Scientific and Industrial Research (DSIR) on these themes, but there was little to show for these efforts.

It was to attempt to improve this situation that the Hoddesdon conference was convened from September 5 to 8, 1924, at the initiative of staff from metallurgy research associations.

The conference was stated to be "open to all men and women who need to utilize information systematically, or who are interested in the conduct of information bureaux, intelligence services and special libraries." It is interesting to note that from this earliest stage ASLIB was open to information users, and those with any sort of interest in information matters; it was never envisaged as an

organization solely for what would come to be termed “information professionals.” Eighty-four delegates attended and resolved to appoint a standing committee of 16 members who had the task of creating an organization to promote cooperation and mutual assistance among information departments, to come into being within two or three years. Discussions with the (UK) Library Association about possible affiliation came to nothing; a story that was to be repeated 70 years later. A second conference in 1925 with over 200 delegates, addressed by Paul Otlet, showed continuing enthusiasm. At a meeting in London on March 29, 1926, the Association of Special Libraries and Information Bureaux, with the acronym ASLIB, was created, as an independent voluntary association. The association was formally incorporated on November 30, 1927. Its main objective was stated to be “To facilitate the co-ordination and systematic use of sources of knowledge and information in all public affairs and in industry and commerce and in all the arts and sciences . . .”

1924–1948

This period in ASLIB’s history is examined in detail by Muddiman^[1,2]; see also Ditmas.^[8]

The new association established itself in the Bloomsbury area of London, initially in Bloomsbury Square, and from 1928 in larger premises in Bedford Square, with a small office staff. In 1931, with the economy faltering and income dropping, there was a move to smaller offices in Russell Square. Its secretary at this point was Edith Ditmas, a formidable woman to whom Muddiman^[1] attributes a major role in ASLIB’s survival in these difficult times. (Muddiman notes that the *Daily Mirror* newspaper dubbed her the “Woman Oracle of Russell Square”.) Ditmas^[8] (p. 269) contrasted ASLIB’s position at “the centre of a spider’s web of contacts, each with a vast range of sources of information” with its situation as “an organisation whose only visible assets were one small room on the top floor of a tall Bloomsbury house, some ill-assorted office equipment which so filled the room that the wall-cupboards could only be opened when some of the furniture was moved to the landing, two typewriters and a typist.” The association lived in these straitened circumstances throughout the 1930s, moving to slightly larger premises in Museum Street in 1936, while managing to develop and extend its activities. Further discussions were held with the Library Association between 1928 and 1930 as to whether some form of amalgamation might be possible but in the end failed, due to partly ASLIB’s insistence that its interests were in the organization, management, and use of information, rather than in libraries *per se*. The nature of the ASLIB membership, institutional rather individual, and catering for users of information as much as for those directly involved in its management, also made integration problematic.

Its funding came largely from membership subscriptions, with limited support from grants from the Carnegie United Kingdom Trust. Membership, almost entirely institutional rather than individual, was 220 in 1927: the largest sections of membership were private sector companies (53) and scientific or technical associations (50) but also included were research associations (18), higher education institutions (18), and public libraries (17). Membership rose to over 400 by 1932, dropped to 280 in 1934 under the influence of economic depression, and had risen to 1043 by 1949, but the general balance of the membership categories remained largely constant throughout. Although ASLIB’s office remained London-based, regional branches were formed in the 1930s, two for the north of England, in Lancashire and Cheshire and in Yorkshire, and one for London and the Home Counties in southeast England. Internationally, ASLIB became closely tied into the pan-European efforts to develop the documentation movement into what became in 1937 the Federation International de Documentation (FID). From its earliest days, it had close links with the British Society for International Bibliography, an affiliate member of Otlet’s International Institute of Bibliography. The two organizations worked closely together on issues of classification and indexing, and on promoting documentation principles. There were also links with the United States: Hutton^[3] notes that a representative from the U.S. National Research Council was present at the Hoddesdon conference, and thereafter there were few ASLIB meetings without an American representative or contribution.

ASLIB’s main objectives throughout this period were to foster cooperation within the special library sector, to enable interaction and exchange of experience between those working in the area, to act as a clearinghouse for specialized information, and to promote, and lobby for, the wider dissemination and better use of published information. While there was never any intention of ASLIB’s creating its own central collection of information, its first chairman, J.G. Pearce of the British Cast-Iron Research Association, suggested that it should promote a “free trade in non-confidential information” and thereby “unlock the intellectual capital of Britain.”^[4]

The ASLIB annual conferences, initially attracting 200 delegates from the United Kingdom and overseas, rapidly became a fixture, known for their successful mix of the theoretical/technical and the practical/vocational. Their topics covered developments in bibliography, documentation and classification, technical advances such as microforms and reprographic techniques, and planning and management processes. Most notable was the conference of 1938, held jointly with the FID with large numbers of international delegates, meeting under the shadow of the Munich crisis, and which may be seen as foreshadowing the end of the internationalist documentation movement.^[9]

An enquiry service was launched at an early stage, offering advice by telephone on the best sources for specialized information. A register of specialist translators was established in 1931, an indicator of an area in which ASLIB was to be heavily involved for several decades.

Publications was also an early area of activity: the first *ASLIB Directory: a guide to sources of specialised information in Great Britain* appeared in 1928; the *Aslib Information* newsletter in 1929, initially quarterly, and later monthly; and in 1935, the quarterly *ASLIB Book List*, an alerting service of significant new scientific and technical books. From the mid-1930s, publication of reference works began, typically annual listings of technical books, directories, and yearbooks.

Education and training for special libraries was also a concern for ASLIB, and attempts were made from 1929 to persuade educators to give this greater attention. As a result of ASLIB's lobbying, the library school at University College London introduced an elective special libraries course that ran intermittently throughout the 1930s, while the Library Association included the topic in the syllabus for its Fellowship examinations, though not for the more widely followed Associate examinations. This was not regarded as satisfactory, and education and training for the special library and technical information sector was to become a major theme for ASLIB in the following decades.

The 1939–1945 conflict initially caused predictable problems for ASLIB, as its regular activities and membership decreased due to wartime conditions. However, in the longer term, its contributions to the war effort greatly increased its profile, and established it on its postwar path. There was a need to keep up, and increase, the flow of information for industrial and military purposes, in face of the disruption to the normal publication and communication channels, due to shortages of materials and personnel and the cessation of communication with continental Europe, as well as potential and actual destruction of collections through bombing. In 1941, ASLIB was funded by the Royal Society and the Rockefeller Foundation to research the problems and propose solutions. This led to ASLIB designing and managing a service to obtain difficult-to-obtain materials of all kinds, generally those originating in hostile or occupied countries, obtained through neutral nations, reproduce them on microfilm, and distribute them to Allied scientific, industrial, and military recipients worldwide. Funded by the UK and U.S. governments, and based at the Science Museum in London, the service, kept secret throughout the period of its operation, made a considerable contribution to the war effort and was maintained after the war's end, management being passed on to the Royal Society of Medicine.^[10,11] Other contributions included a series of *War Time Guides to Specialized Sources of Information* in important technical and industrial areas (essentially sections of the *ASLIB Directory*, revised and updated to

reflect the wartime situation), and an expanded enquiry service. A series of short training courses in special librarianship were also run from 1943 onward and proved very popular. ASLIB's first textbook, a *Manual of Special Library Technique*, was published to supplement these courses. The value to the nation of these activities was recognized by the British government, which, in 1944, made a substantial grant to ASLIB over a five-year period, via the DSIR.

In the immediate postwar period, and with its newly found success, ASLIB reflected on its future course.^[1] Should it become an individual member professional association, or focus on a role as a national documentation center? If the latter, should it remain independent, or seek to become a part of a monolithic state-run information institute? Eventually, it settled upon development as a partly state-supported independent entity, focusing on a continuation of its role as a coordinator and facilitator of the national system of special libraries and technical information centers. Its high status as a result of its wartime contributions saw ASLIB participating in numerous committees and official bodies relating to information and documentation, and it took a significant role in the highly influential Scientific Information Conference organized by the Royal Society in 1948.

With this aim made possible by an increased membership, and a government grant linked to membership income, ASLIB expanded its activities considerably in the late 1940s, with its membership rising to over 1000 and its staff to 16. Its main areas of focus were enquiries (with over 3,000 telephone enquiries and over 30,000 written enquiries *per annum* by the end of the decade); conferences and education; expansion of international activities; promotion of, and lobbying for, the importance of special libraries and technical information; and publications.

In respect of publications, in 1947, ASLIB launched an academic and theoretical journal, *Journal of Documentation*, to complement its more ephemeral and practical serial publications. The following year, *Aslib Proceedings* was launched, for the publication of papers given at conferences of ASLIB and related organizations.

In the education area, the 1948 ASLIB annual general meeting passed a resolution agreeing to develop a postgraduate qualification in information work. This ambitious proposal was never followed up, and instead ASLIB embarked on creating an extensive program of short training courses.

Muddiman^[1] sums up the situation at the end of this phase of ASLIB's life by agreeing with its claim that it was generally recognized as the main British clearing-house for specialized information and had scope for expanding this role in several ways in an increasingly information-conscious environment. It was at the center of the emerging field of documentation, which would develop into information science.

1949–1980

Issues in the period have been reviewed in part by Muddiman,^[2] and by Wilson,^[12] who draws attention to the way in which ASLIB reached out to those beyond the library world with an interest in information and focused on information management as an integral part of management as a whole.

As a response to its new situation, ASLIB transformed itself into a new organization with a new corporate structure, and a new name. Proposals for a “new ASLIB” had been announced in 1948, and on May 24, 1949, the association formally combined with the British Society for International Bibliography, with which it had long had close links. The new association was simply titled “ASLIB.” The joining of the two organizations, one with a largely institutional membership and one with exclusively individual members, gave a unique flavor to the organization. So too did the mix of funding: partly direct government support, partly membership subscriptions, and partly fees for the increasingly wide range of services provided. The 1977 annual report comments that, because of this mixed membership, people had different ideas about what ASLIB was, decades after its restructuring.

Edith Ditmas retired as director at this point, to devote herself to study and research, and also to do editorial work for ASLIB. She was succeeded as Director by Lesley Wilson who saw himself as a modernizing manager, and who steered ASLIB through the growth of the next three decades.

With the security of a further five-year grant-in-aid from the DSIR, matching membership subscriptions, ASLIB moved to larger premises in Palace Gate in west London, to cater for the increased staff numbers: 16, serving a membership of just over 1000. The new building gave the director an individual office for the first time, together with a glass-enclosed veranda used for meetings. The membership at that time comprised 32% research associations and learned societies, 20% industrial and commercial, 20% overseas members (uncategorized), 9% UK government departments, and 19% individuals, and it grew steadily year on year, reaching a highpoint of nearly 3000 by 1966. Staff numbers increased to match, reaching 29 by 1955, 51 by 1964, and attaining a maximum of 69 in 1971, reflecting the much wider range of activities being undertaken by then. The director always had a major influence on the organization’s direction, advised by a council largely comprising senior figures from the information world, from the scientific establishment, and from industry. The first chair of the council in the new ASLIB structure was Harry Hyams of Shell Petroleum; three decades later, his nephew, Montagu Hyams of Derwent Publications, was to be appointed vice president of the ASLIB Council. In a manner typical of a British organization of the time, its council always included a proportion of Honorary Members, representing the upper strata of society.

In 1958, it could count an earl, a baroness, and four knights among its members; 10 years later, it had a viscount, two lords, three knights, and a vice admiral.

Although ASLIB remained headquartered in London throughout the period, regional branches for Northern England and for Scotland were established in the new structure, joined by a branch serving the English Midlands in 1951. These regional branches remained unchanged throughout the life of ASLIB as an independent organization. An ASLIB office opened in Birmingham, in the Midlands region, in 1968, sharing facilities with other organization and staffed by one liaison officer. Overseas membership remained significant, at least 20% of the total, throughout the period, and there were proposals for an overseas branch structure. Nothing came of this, perhaps due to the wide geographical spread of membership, with over 70 countries generally represented.

A new initiative was the setting up of special interest groups among the membership: in 1951, groups were set up for aerospace, textiles, economics, and food and agriculture, and in the following two years these were joined by engineering, fuel and power, and chemicals. This set of groups was fluid through this period, as groups formed, merged, renamed themselves, and disbanded. Most common were groups, liked those named above, devoted to information in a particular industry or sector; they were later joined by groups for the furniture industry, for film libraries, for biosciences, for social sciences, for transport, and for electronics. Other groups focused on processes and techniques, such as the technical translation, mechanization (later computer applications), and coordinate indexing (later informatics) groups. Only one, the One-Man Band group, brought together those working in similar environments (a note in the February 1990 issue of *Aslib Information* pointed out that although women were in a majority of the membership and the committee, the group liked the imagery of the male name, rather than the gender-neutral One-Person Library). Some of the larger groups, with memberships of several hundred, had activities and reach equivalent to that of professional bodies in their own right, and some undertook original research; see, for example, the Informatics group’s study of the indexing process.^[13] The branches and groups contributed greatly to ASLIB’s activity, with extensive programs of events and publications complementing the central provision.^[14]

Conferences and meetings were a major preoccupation. The ASLIB annual conference became one of the major events of the year for the information professions, and a great variety of both regular and *ad hoc* conferences and meetings were organized, both centrally and by groups and branches, and covering the whole gamut of topics relevant to the wide interests of the ASLIB membership. A few themes are constant throughout the period: management processes and costs; demonstrating the value of information; planning and control of operations; document handling and reproduction; subject-specific resources;

classification and indexing; dealing with publishers and other suppliers; new technologies and research results; translations and the language barrier; and reports of international developments. A particularly notable venture was the organization, on behalf of FID, of the influential Dorking conference on classification in information retrieval.

Training programs were developed further, the main offerings being courses for newcomers to special library and information work at either junior or senior levels, soon joined by a course of intermediate-level staff.

In all, there were typically at least 10 ASLIB events, including training courses, per month throughout this period, rising at times to 20.

The publications program continued, based around the four periodicals—*Aslib Information*, *Aslib Proceedings*, *Journal of Documentation*, and *Aslib Book List*—regularly updated directories, and bibliographies and guides to information sources in specific subjects. An *Index to Theses* from British universities commenced annual publication in 1953. The register of specialist translators, which in 1950 included 126 names, was complemented by an *Index to Scientific and Technical Translations*, later renamed the *Commonwealth Translations Index*. A similar register of specialist indexers was established later but was never so successful as that for translators; this was attributed to the competing services of the Society of Indexers, whereas ASLIB was alone in providing access to translators.

A series of ASLIB manuals, providing detailed and practical advice on special library topics, was established. In 1956, the first issue of the highly regarded and influential *Aslib Handbook of Special Librarianship and Information Work* was published. In subsequent years, the publication program expanded to encompass textbooks and monographs on a variety of information-related topics.

The enquiry service, renamed later as the information service, continued its work of providing answers and referral to technical queries. It was complemented by a new in-house ASLIB library, with a collection of journals, books and pamphlets, and facilities for document reproduction. This dealt with queries on library/information issues. To give an idea of the early scale of operations, in 1950, 100 periodicals were taken in the library and 271 books and 228 pamphlets added to the stock. There were 138 personal enquiries, 868 by post, 1310 by telephone, 718 loans of material, and 94 requests for translations. As an extension of this kind of work, a consultancy service was established in 1952, to deal with enquiries needing considerable work to solve. The use made of the service grew dramatically, so that in 1956 more than 30,000 requests were made, attributable in part to a large number of new members from small or one-person information departments.

Lobbying and promotion activities, as throughout all of ASLIB's existence, involved a continual process of direct

contacts with government ministries and agencies, and with international organizations, on many information-related topics. ASLIB were also represented on numerous national and international committees and working groups of many organizations: the British National Committee on Documentation, British Standards Institute, International Standards Organization, National Book League, British National Bibliography, UNESCO, the British National Committee of UNISIST, and IFLA, to name but a few. ASLIB also served as the British representative to FID and in a joint panel with the Confederation of British Industry considering industrial information issues.

In 1956, a "staff employment register" was established by the membership department. This later developed into a full recruitment agency activity.

The last of ASLIB's major activities was initiated in 1957, when a research committee was formed, and produced an outline for a research program into aspects of library and information work; this covered a wide area, including library procedures, information retrieval, costs and effectiveness of services, indexing, bibliographic control, abstracting services, and access to non-English material. From the start, it had an emphasis on rigorous research with clear practical application that became the hallmark of ASLIB's research in later years. The research department was set up in the following year, its first remit being the oversight of the Cranfield retrieval experiments on behalf of the funders, the U.S. National Science Foundation. Projects over the next few years included studies of the language barrier, on interlibrary loan in special libraries, on abstracting journals and on gray literature, and a major study of information users in science and technology.

As early as 1955, with 29 staff and 1187 members, there had been complaints that the ASLIB headquarters was cramped, so that, for example, members could not read in the library. Two years later, with 32 staff and a membership doubled to 2254, the situation became impossible, and in 1958 ASLIB moved to its own buildings in the imposing surroundings of Belgrave Square, in London's West End. The move was supported by a government grant and donations by members to a building fund. The effort was worth it, as the following year's annual report concluded that the building provided, for the first time in ASLIB's history, fully satisfactory conditions for staff, committee meetings, courses (which could now be held in-house), the library, and other activities.

The new building, together with a further DSIR five-year grant and a steadily increasing membership, led to a general expansion of activities. To the existing training courses, which provided a general introduction for new special library staff, were added specialized courses on a range of topics including patents information, classification, Eastern European material, and document production. The courses typically lasted between three and five days, indicative of a less time-pressured age. The space in

the new building allowed courses to be complemented by demonstrations and exhibitions of equipment and procedures, such as photocopying and journal binding. Training was now seen as so significant that in 1960 the post of education officer was established to plan new courses. ASLIB also joined in discussions with the UK Institute of Information Scientists on formal training for those engaged in technical information work and endorsed the syllabus of the two-year evening course at Northampton College of Advanced Technology (later City University London), which later became the MSc Information Science.^[15] In 1963, ASLIB produced a leaflet on "Information work as a career," aimed at school leavers and college students, which was effective for many years in bringing more publicity to what had been a little known profession.

By the time ASLIB's 40th anniversary was celebrated in 1964, it was approaching its peak in term of size, with a full staff complement of 70 serving a membership of nearly 3000. It was a major force on the national and international information scene, in particular in respect of its conferences, publications, and research, as well as its lobbying and influencing.

Peak member numbers were reached in 1966. The annual report covering that year recorded 2887 members: 1014 industrial and commercial members, 205 from UK government departments and agencies, 272 public and national libraries, 459 universities and colleges, 403 other nonprofit organizations, and 534 individuals. Thereafter, a gradual decline in membership set in; by the end of this period, in 1980, the total membership was 2082.

The nature of government support for ASLIB changed around this time. A new government department, the Office for Scientific and Technical Information (OSTI), was formed in 1965, partly a result of ASLIB's representations for the need for long-term government policies toward information services. One of OSTI's first initiatives was a joint investigation with ASLIB on ways of strengthening ASLIB's research, consultancy, and training activities. One result was a decision to focus on computer applications. Another was a strong steer toward applied rather than basic research, and to make a closer link between research and consultancy. The report recognized ASLIB as a prime mover in information research.

Thereafter, government support for ASLIB came from OSTI, and later from the British Library's Research and Development Department, and was focused on supporting specific activities and programs, rather than the previous open grant-in-aid arrangements. As a result, the research department expanded considerably, and produced a remarkably wide body of results,^[16] becoming the *de facto* national center for research in information science and documentation. In 1966, it had a staff of 15, divided into teams focusing on mechanization, operations, and surveys. It also offered consultancy and advice services, which brought in a significant income, and contributed

books and reports to ASLIB's publishing program. The following year it moved into its own premises in Hobart Place, close to the main ASLIB building, with new projects on cost-effectiveness, on bibliographic records, on computer typesetting, on clerical processes in libraries, and on the use of metals information. In 1970, it changed its name to the Research, Development, and Consultancy Division (in 1979, this would become simply Research and Consultancy), reflecting a renewed focus on helping members to solve their information problems, with a particular focus on cost-effectiveness and on new technology. In 1975, the department, now with 17 research staff and 5 full-time consultants, moved to still larger premises in Bedford Row, Bloomsbury.

The training program also expanded along the lines recommended in the OSTI report, launching courses in mechanization, microforms, dissemination of information, systems design, information retrieval, and thesaurus construction, as well as information for subject-specific areas such as business, finance, food and agriculture, pharmacy, and medicine. The training program took on, for the first time, an international dimension: a course was held in Nairobi for participants from several East African countries, and other courses were organized in London for visiting groups from overseas.

The events program diversified further. The annual conference was held outside the United Kingdom for the first time, in the Netherlands in 1966 and in Germany in 1971. An annual ASLIB lecture series was started.

The publications program also diversified, with a number of new monographs on topics such as mechanization, classification, and thesaurus construction, a new *ASLIB Reader* series, bringing together significant writings of topics of central importance, and a range of directories and bibliographies. A third, and much expanded, edition of the *ASLIB Handbook* was produced. The contents list for this handbook give a good indication of what ASLIB considered to be core elements of its area of operation at this stage:^[17] the special library and information service, administration, selection and acquisition, classification, information retrieval, filing and storing, technical report literature, library planning, service routine, subject enquiries and literature searching, abstracting, publications of the information department, mechanical aids in library work, and organizations in the special library field.

A new *Aslib Occasional Publications* series was started to disseminate reports from the research department: early examples dealt with the changing nature of the scientific journal, the use made of technical libraries, and the library/information literature. A new journal, *Program*, dealing with library automation and formally published by the School of Library Studies at the Queen's University Belfast, was incorporated into ASLIB's periodicals portfolio, as was the *Technical Translators Bulletin*, formerly published by the special interest group, and *Audiovisual Librarian*, previously published by the Audiovisual group.

Publication of *Forthcoming International Scientific and Technical Conferences* was taken over from the UK government Department of Education and Science. In 1969, ASLIB partnered with the Library Association in producing the new *Library and Information Science Abstracts* secondary publication, this arrangement continuing until 1980.^[18]

The employment register, now established as a licensed recruitment agency, was renamed the Professional Appointments Register and became one of the few agencies specializing in library and information jobs.

The library took on the role of systematically collecting thesauri, subject heading lists, classification schemes, and bibliographies, and regularly listing them.^[19,20] In 1979, this was formalized by ASLIB being nominated by the British Standards Institute as the official clearinghouse for British thesauri, including those planned or in preparation.

By the mid-1970s ASLIB was still at the peak of its activities and influence, a small decline in membership having been offset by income from other sources, particularly consultancy to large national and international bodies. However, changes in the economic, social, and technical environment began to cause concern for the future. One immediate response was for ASLIB to rationalize its idiosyncratic membership structure. Individual members were offered a reduced fee as affiliates, without the voting rights of full, institutional, members, and the anomaly by which any UK government department could have free membership by virtue of the grants supplied by the government was removed. Student membership was introduced to attract the new generation.

At an ASLIB conference on “The information worker: identity, image and potential” held in London in November 1976, Dennis Lewis of ICI Plastics Division gave a talk entitled “There won’t be an information profession in 2000 AD”; Lewis’s “Doomsday Scenario” came to have a major influence on the future of ASLIB. In the following year, ASLIB suffered its first major cutback, when rising costs forced the reduction of the research department from 17 to 11. In 1980, it was further reduced by three, and its separate premises were given up.

Other trends at the time were positive, with ASLIB becoming a European center for the promotion of the new technology of online searching, which led to a focus on this topic in the library, which hosted an online information center, research projects, training courses, and publications, including monographs, particularly J.L. Hall’s influential *Online retrieval sourcebook*, a “European user” series, how-to guides, and a new monthly newsletter, *Online Notes*. In 1978, ASLIB’s long-standing interests in technical translation and in applications of technology came together in the organization of the first of the *Translating and the computer* conferences, which were to continue for over three decades.

In an environment starting to give concern to all information-related professional organizations, there was a renewed interest in cooperation. A Joint Consultative Committee, involving ASLIB, the Library Association, the Institute of Information Scientists, the Society of Archivists, the British Library, and the SCONUL academic library group, was revised after some years of dormancy, and a tripartite conference between the first three organizations was held in Sheffield in September 1980.

1980–2010

This next stage of ASLIB’s story is one of an attempt to adapt to a changing environment, which saw some innovation and success, but overall a decline and retrenchment, which, at the end of period, saw ASLIB lose its independent status.

The reasons for this somewhat depressing state of affairs are multiple and affected many other information-related organizations in similar ways. Most immediately, the UK government ceased to offer direct financial support, in the way that it had for nearly four decades. This not only affected ASLIB directly but also the research associations and similar bodies that made up a significant part of the membership. The decline of British science-based industry over the period had a direct effect on ASLIB’s membership, as did changes in the information environment that led to the merging, downsizing, or closure of many special libraries (appropriate enough, one the 1980 conferences addressed the topic of “cuts and the special library”). Organizations of diverse type, including consultancies, publishers, and universities, were increasingly involved in the activities that previously had been left to organizations like ASLIB. Finally, social changes posed changes for very many membership-based professional bodies, and ASLIB, despite its unique position and generally loyal membership base, was far from immune to this.

Dennis Lewis, who had predicted the demise of the information professional, took over in 1981 as Director from Basil Saunders, who had served for a short period following the retirement of Leslie Wilson. He produced a development plan for ASLIB, which, in view of the deteriorating financial situation, was put into action in 1985, earlier than anticipated, moving toward a “slimmer and trimmer” organization, run on fully commercial lines.^[21] ASLIB left the fading splendor of its Belgrave Square location for premises in the Holborn area of central London. The research and consultancy division was closed, the research staff continuing to work on British Library projects, and the consultants forming an independent “Information Partnership.” ASLIB still offered a limited consultancy, associated with the information service and the training program, as it does to the present day. The cessation of ASLIB research caused dismay to many in the

information world and is still seen by many as marking the end of ASLIB's unique position in that world. Small survey research was still carried out at ASLIB; see, for example, a survey of IT use by the information service.^[22]

The new vision was for a focus on membership services, publications, and professional development, with ASLIB undertaking a positive leadership role in the development of information management in the United Kingdom. At the time, the byline "The Association for Information Management" was added to the ASLIB name.

The branches and groups continued active programs, with some new groupings added, most notably the Information Resources Management Network.^[23] The Informatics group was involved in organizing a series of Information Retrieval Package fairs. The nature of the conference program changed, with the long-standing annual conference supplanted by less regular multipartite events with other information organizations. The staff register was spun off as "ASLIB Professional Recruitment," an independent wholly owned subsidiary of ASLIB.

Publications expanded, with an ambitious program of new books, and new journals in local area networking and records management. More emphasis was placed on shorter publications, particularly addressing topical issues: these included a series of monthly newsletters on topics such as information technology, library automation, and business information, and a series of short "Know How Guides" on a variety of information technology and information management topics.

The training program, now offering almost exclusively one-day courses, was further expanded, particularly in areas of technology and online searching. More than 50 courses were run in 1985, more than half dealing with some aspect of online searching. Ten years later, the ASLIB training program was similarly responsive to the needs of moment in focusing on Internet-related courses.

In 1989, Dennis Lewis was succeeded as Director by Roger Bowes, a former newspaper executive, who continued Lewis's policy of downsizing to profitable areas, and on corporate information management as ASLIB's focus. The organization moved premises again, to Old Street in the eastern part of Central London. Advantage was taken of the layout of the new building to create a "One-Stop Information Shop," with services including quick reference, desk research, library, consultancy, and recruitment visible and accessible from the street. The Society of Archivists took up space in the building, and it was hoped to make it a focus for other information organizations. However, this did not happen, and ASLIB moved again to occupy two floors of an office building in the City of London.

The Saunders report of 1989 recommended the merger of the independent UK information-related associations, to form a single body to represent the information professions. ASLIB took an active part in the discussions, particularly with the Library Association and the Institute

of Information Scientists, but concluded that the association was too different in nature and purpose for a merger to be feasible. ASLIB therefore stood apart from the merger of the other two organizations that formed CILIP; many considered this a missed opportunity to carry ASLIB's values and perspectives further.

In 2002, a further major downsizing took place, as ASLIB abandoned their publication activity, selling their books business to Taylor & Francis, and their journals to Emerald Group Publishing, with ASLIB members given favorable terms as purchasers and subscribers. Only a monthly *Managing Information* newsletter, the successor to *Aslib Information*, remained. Thereafter, ASLIB and Emerald worked increasingly closely together in providing services to the membership.

Shortly thereafter, the ASLIB library and information service closed, and its stock and the organization moved to smaller premises near Victoria Embankment. By 2005, membership had halved in three years, to less than 800, and in the same period staff numbers had fallen from 40 to 10. In December 2005, ASLIB went into voluntary liquidation.

It reemerged in early 2006 as a private company, having been bought by the former director, Roger Bowes. Operating from premises in Shoreditch, East London, it continued to offer professional development and recruitment services. The training program remained active, offering about 50 one-day courses, one of a wide variety of topics in information management, library/information skills, information organization, management, information governance, information technology, and subject-specific information. Onsite courses, on the customer's premises, were offered, and the first ASLIB distance-learning course, in thesaurus construction, was launched. There was still activity in some of the groups and branches, though most were becoming inactive, but the only regular conference was the long-standing *Translating and the Computer* meeting; ASLIB otherwise supported the meetings and conferences of other groups.

At the end of 2008, ASLIB moved to its final London location, an office suite in Goswell Road, Finsbury. With no in-house training facilities, courses were run, as in ASLIB's early days, in hired venues. The recruitment agency ceased operating during the course of the year, and the training courses, *Managing Information* magazine, and the *Translating and the Computer* conference were ASLIB's only remaining activities. The only active group was the combined engineering and technology special interest group; all the other groups and branches were dormant. Clearly, the organization was no longer viable as an independent entity.

2010-DATE

In April 2010, ASLIB was acquired by MCB Group, the holding company for Emerald Group Publishing Ltd. The

April issue of *Managing Information* noted that “Aslib will operate as a sister organization to Emerald, drawing on Emerald staff and resources, but still retaining its independence.” The London offices were closed, and ASLIB activity centered on Emerald’s headquarters in Bingley, Yorkshire. In the next issue, it was noted that “Our original ethos, which still applies today, was ‘to serve those engaged in the collection, treatment and dissemination of information in many departments of human activity’.”

Membership arrangements continued largely unchanged, though with an increased emphasis on Emerald’s general management information benefits. Training and group activity was initially suspended, though the annual *Translating and the Computer* conference was held, and the ASLIB yearbook and membership directory published online, and the *Managing Information* newsletter continued to appear, with a new emphasis on research reports drawn from Emerald publications. A new design and branding saw the uppercase “ASLIB” restored as the organization name, still with the “Association for Information Management” byline.

ASLIB was relaunched with a member meeting at the London Online Information Meeting in December 2010. Five Emerald staff were initially named as assigned to the association’s activities. An advisory council was formed, though sadly without any peers, knights, or admirals. A survey of the membership showed that training was the most highly regarded service, and the training program resumed in 2011, with public courses in London, onsite courses, and an increased distance-learning provision. The courses were categorized as business and official information sources, cataloging and classification, copyright and intellectual property, general management and communication skills, library and information management skills, and web and Internet. Most were based on courses offered formerly, but there were new offerings in social media and in web profiles and privacy. The engineering and technology group restarted activity, and a business information community of practice was formed.

Over the next three years, the program was slowly expanded. New training courses were introduced, in areas familiar from old ASLIB days, including information governance, information management, general management, and intellectual property. Some were in a half-day format, some ran outside London, and two-day “masterclasses” ran in Malaysia and Hong Kong. The 70th anniversary of ASLIB training activities was celebrated with a feeling that this element of the old association was still vibrant.

A program of member evening meetings and joint meetings with other bodies was started, and a two-day ASLIB Knowledge and Information Strategy Seminar at the British Library was held in December 2013, with the aim, again familiar from former days, of bringing together researchers and practitioners. Publishing activities under the ASLIB name restarted, with a series of monographs published by

Emerald “in association with Aslib,” and a new quarterly newsletter, *Privacy and Data Protection*, was launched.

However, Emerald proved no more able to sustain a membership-based organization than had the old ASLIB. It was announced at the end of 2014 that ASLIB would focus its efforts on expanding its professional development program. ASLIB membership and associated benefits, including group membership, ended, and the two newsletters ceased publication.

As from January 1, 2015, ASLIB was integrated with the wider Emerald organization, providing, in effect, a library/information professional development arm. No longer an association, it is known simply as “ASLIB.” The name also lives on in Emerald’s *Aslib Journal of Information Management* (formerly *Aslib Proceedings*). At that time, 34 courses were offered, as public courses in London and Manchester and as onsite training, with some via e-learning, in eight main areas: business and official information sources, information organization, copyright and intellectual property, customer services skills, knowledge management, general management, marketing and communication, and writing and editing.

In July 2015, Emerald announced that, in view of changing professional development requirements, ASLIB training courses would cease. All activities with the ASLIB name, other than publication of *Aslib Journal of Information Management* ceased in May 2016.

CONCLUSIONS

Richards wrote that the history of documentation, or information science, in Britain is largely synonymous with that of ASLIB, its members, and their activities.^[11] Muddiman^[11] suggested that ASLIB could fairly be regarded as an innovative organization, which actively shaped the development of the “informational turn” in society, and, in its earlier days, gave impetus to the involvement of the sciences of information and documentation in an increasingly information-intensive world. Both are correct, and we might also reflect on the number of the discipline’s thought leaders who have been involved with ASLIB: Brian Vickery, Blaise Cronin, Steve Robertson, and Alan Gilchrist to name but four. So multifaceted have its activities been that it is difficult to single out the most significant achievements, but they must certainly include the promotion of the idea of rigorous, applied research, support for the effective introduction of several generations of information technology into library/information settings, and a continual insistence on the importance of the information disciplines and professions.

The influence of ASLIB has been very great throughout its history, as it has reinvented itself through changing times, and we should remember that ASLIB’s story may not yet be over.

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Association for Information Science and Technology

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Abstract

The Association for Information Science and Technology (ASIS&T) was founded as the American Documentation Institute in 1937. In tandem with the evolution of the field, the association has continued to grow and change its structure and focus. This article describes the Association's history, purpose, structure (regional chapters plus topical special interest groups [SIGs]), governance, meetings, and publications.

INTRODUCTION

ASIS&T is an association of researchers and information professionals leading the search for new and better theories, techniques, and technologies to improve access to information. Among its membership are some 2000 individuals and organizations in over 50 countries. They have expertise in a variety of fields, such as information science, computer science, linguistics, management, psychology, library science, engineering, law, medicine, chemistry, physics, and education. They share a common interest in improving how individuals, organizations, and society store, retrieve, analyze, manage, archive, share, and disseminate information. Members come together for mutual benefit.

ASIS&T provides online and face-to-face educational and conference programs, a highly regarded journal and other publications, and local and international networking opportunities. These activities bridge the gap between research and practice and between theory and products. The Association's flagship publication is the highly regarded *JASIST*, the *Journal of the Association for Information Science and Technology* (formerly the *Journal of the American Society for Information Science and Technology*). ASIS&T is a nonprofit 501(c)3 professional association organized for scientific, literary, and educational purposes.

HISTORY

1937— Beginnings in Documentation

ASIS&T was founded on March 13, 1937, as the American Documentation Institute (ADI), a service organization

made up of individuals nominated by and representing affiliated scientific and professional societies, foundations, and government agencies. Its initial interest was in the development of microfilm as an aid to learning. Watson Davis, the Institute's first president (1937–1943), was the editor of *Science News Letter* and director of Science Service, a nonprofit organization founded to promote public appreciation of science. ADI compiled an impressive record of achievement in its early years: the development of microfilm readers, cameras, and services; fostering negotiations and research that resulted in the so-called gentleman's agreement covering the photo duplication of copyrighted materials; the establishment of programs for the storage and reproduction of auxiliary publications in support of journal editors; the operation of an Asian scientific literature service during World War II; support of Interlingua, an early rival of the artificial language Esperanto, to foster international science communications; and cosponsorship of the 1958 International Conference on Scientific Information.^[1–4]

1950s— Transition to Modern Information Science

As the number of people engaged in developing new principles and techniques in the many areas of documentation and information services increased, the Bylaws were amended in 1952 to admit individual as well as institutional members. Thus, ADI became the national professional society for those concerned with all elements and problems of information science. With the 1950s came increasing awareness of the potential of automatic devices for literature searching and information storage and retrieval. As these concepts grew in magnitude and potential, so did the variety of professional interests.^[1,4,5]

1960s—The Information Explosion

During the 1960s, the problems created by the “information explosion” gained national attention and ADI membership increased sevenfold. Reflecting this change in its total range of activities, as well as the emergence of information science as an identifiable configuration of disciplines, the membership voted to change the name of the ADI to the American Society for Information Science (ASIS). The name change took effect January 1, 1968 and emphasized the fact that the membership of ASIS was uniquely concerned with all aspects of the information transfer process. The new Society was a national professional organization with regional chapters for those concerned with designing, managing, and using information systems and technology. Harold Borko’s frequently cited article, *What Is Information Science?*, helped to define the field: “Information science is that discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability. It is concerned with the body of knowledge relating to the origination, collection, organization, storage, retrieval, interpretation, transmission, and utilization of information.”^[6] One of the Society’s flagship publications, the *Annual Review of Information Science and Technology (ARIST)*, was launched in 1966, under the editorship of Carlos A. Cuadra and with support from the National Science Foundation. Contributors to *ARIST* provided overviews and syntheses of research on contemporary topics.

1970s—The Move to Online Information

The transitions from batch processing to interactive computing and from mainframe to mini- and microcomputers accelerated in the 1970s. Traditional boundaries among disciplines began to fade; many library schools and some departments of computer science added “information” to their titles. In 1974, the Society’s *Newsletter* became the *Bulletin of the American Society for Information Science*, a mainstay membership publication of the Society. During this decade, ASIS made the midyear meeting an annual event that focused on a single topic of current interest. In 1976, the Society sponsored a bicentennial conference on the role of information in the development of the United States. From 1970 to 1974, ASIS administered the ERIC Clearinghouse on Library and Information Sciences; the Society was also an active participant in the planning and implementation of the 1979 White House Conference on Library and Information Services.

1980s—Personal Computers Change the Market

By the 1980s large databases, such as MEDLINE at the National Library of Medicine, and user-oriented services,

such as Dialog, SDC, and CompuServe, were for the first time accessible by individuals from their personal computers. ASIS added to and revised its SIGs to respond to the changes, establishing groups on office information systems and personal computers as well as international information issues and rural information services. By the end of the decade, SIGs had been formed and reformed to represent various interests, including nonprint media, social sciences, energy and the environment, and community information systems, and ASIS had its first regional chapters outside of North America.

1990s and 2000s—The Human/Social Perspective

The social implications of information and communication technologies became increasingly apparent in the 1990s and ASIS responded. Ann Prentice’s “environmental scan” identified key topics that were expected to reshape work and the workforce, including public access to and ownership of information, internationalization, and increasing expectations of information technology. Themes that appeared regularly in the Society’s *Bulletin* and at national meetings included information management, globalization, intellectual property, computer networks (National Research and Education Network, the Internet), the digitization of text and visual information, bibliometrics, information retrieval, and human-information interaction. Interest in the representation of information found new applications in, for example, markup languages, taxonomy, metadata, and information architecture. The understanding of information retrieval was broadened and deepened by such developments as hypertext, the World Wide Web, search engines and browsers, and the addition of new domains to the Text Retrieval Conferences.

ASIS experienced changes in its own use of information technology. Merri Beth Lavagnino introduced the ASIS-L LISTSERV in 1992. The Society created its first website in 1995;^[7] it was chosen as a Yahoo! “Pick of the Day” in 1996. After considerable deliberation about making ASIS’s publications available electronically, a digital library was unveiled in 2006. In 2007, the *Bulletin of the American Society for Information Science and Technology* became an electronic-only publication.

The Society’s work reflected the increasing interest in social and historical aspects of information science in other ways as well. In 1991, it renamed and reoriented one of the SIGs to focus on the History and Foundations of Information Science, and in 1992, ASIS adopted its first professional guidelines. Conferences cosponsored with the Chemical Heritage Foundation on the History and Heritage of Scientific and Technical Information Systems were held in 1998 and 2002.

Reflecting both internal and external influences, the members changed the name in 2000, becoming the American Society for Information Science and

Technology (ASIS&T). President Eugene Garfield championed the change, calling attention to the importance of practical, information technology–focused programs. ASIS&T continued its annual meetings but discontinued the midyear meeting in favor of “summits” featuring topics such as information architecture, knowledge management, and digital archives for engineering and scientific research.

2010s—Connecting across Boundaries in the Digital World

New possibilities emerged with digital technologies, along with new socioeconomic challenges, and presentations at the Annual Meeting and papers published in *JASIST* and the *Bulletin* reflected this. Topics such as data analytics, research data archiving and sharing, information visualization, health informatics, crisis informatics, mobile information seeking, and collaborative information behavior emerged as new themes at the Annual Meeting and in *JASIST* and the *Bulletin*.

ASIS&T-sponsored webinars (digital audio and visual seminars) were introduced in 2010. Free to all members, the webinars provide synchronous and asynchronous learning opportunities. Typically 60 minutes in length, they address current topics and trends in information science such as metadata, search engine optimization, digital preservation, health informatics, research data archiving, web analytics, information architecture, and information visualization. Other webinars provide career coaching, such as advice on publishing in international journals, conducting blended learning courses, and mentoring. The webinars are conducted by individual members, affiliated groups, and SIGs.

In 2012, the membership voted overwhelmingly to change the association’s name from the American Society for Information Science and Technology to the Association for Information Science and Technology, keeping the acronym ASIS&T. The name change reflected the increasing global challenges that information science addresses and the increasing benefits from addressing these challenges collaboratively across sociopolitical and geographic boundaries. ASIS&T also increased its international activities, providing reduced membership fees based on gross national income per capita, establishing an Asia-Pacific Chapter, and holding its first annual meeting outside North America in 2016.

PURPOSE

The mission of the ASIS&T is to advance the information sciences and related applications of information technology by providing focus, opportunity, and support to information professionals and organizations.

The Association seeks to stimulate participation and interaction among its members by affording them an environment for substantive professional exchange. It encourages and supports personal and professional growth through opportunities for members to extend their knowledge and skills, develop and use professional networks, pursue career development goals, and assume leadership roles in the Association and in the broader information community. ASIS&T increases the influence of information professionals among decision makers by focusing attention on the importance of information as a vital resource in a high-technology age; in this way the organization seeks to promote informed policy on national and international information issues. It supports the advancement of the state-of-the-art and practice by taking a leadership position in the advocacy of research and development in basic and applied information science.

To accomplish these goals, ASIS&T edits, publishes, and disseminates publications concerning research and development; convenes annual meetings providing a forum for papers, discussions, and major policy statements; holds smaller local and special interest meetings, as well as special summits; and acts as a sounding board for the promotion of research and development and for the education of information professionals.

CHAPTERS AND SIGS

To give scope and focus to the diverse interests of its members, SIGs were established in 1966. These groups are, in effect, small professional organizations within ASIS&T, which encourage the discussion and development of both theoretical and practical issues. As of 2017, the Association’s 16 SIGs were Arts and Humanities; Classification Research; Digital Libraries; Education for Information Science; Health Informatics; History and Foundations of Information Science; Information and Learning Services; Information Needs, Seeking and Use; Information Ethics and Policy; International Information Issues; Knowledge Management; Management; Metrics; Scientific and Technical Information; Social Informatics; and Visualization, Images and Sound.

All ASIS&T members are automatically enrolled as members of the humorous and ironic SIG/CON, which seeks to “explore the fundamental notions of information science, and expose them for what they are.”^[8] The official SIG/CON website describes the initial meeting: “Those who stumbled into the first SIG/CON session found it to be one of the most informative and intellectually challenging sessions of the conference, a tradition which continues to this day.”^[8] Dr. Llewellyn C. Puppybreath, III, founder and perpetual chair of the group, has yet to appear at any of its meetings. The breadth of topics covered is evident in this list of titles

from presentations: “Baloonean Logic” by Ev Brenner, “Conical Classifications” by C. David Batty, “Titular Colonicity” by Candy Schwartz, and “Early Binary Separation: Implications for Information Retrieval (relevance judgments by identical twins separated at birth)” by Joseph Janes.

At a local and regional level, ASIS&T had, in 2017, 13 chapters in major cities and regions in the United States and around the world: Arizona, the Asia-Pacific Region, the Carolinas, Central Ohio, Europe, Indiana, Los Angeles, New England, New Jersey, Northern Ohio, the Pacific Northwest, Potomac Valley (Washington D.C. area), and Taipei. These chapters provide local forums for discussion and information exchange for members in a given locality.

In addition, 39 student chapters channel student interest and engagement in information science: the Catholic University of America, Drexel University, Europe, Florida State University, Indiana University, Long Island University, Louisiana State University, McGill University, North Carolina Central University, Pratt Institute, Rutgers University, San Jose State University, Simmons College, St. John’s University, State University of New York (Albany), State University of New York (Buffalo), State University of New York (Oswego), Taipei University, University of Alabama, University of British Columbia, University of California at Los Angeles, University of Denver, University of Hawaii, University of Illinois at Urbana-Champaign, University of Iowa, University of Maryland, University of Michigan, University of Missouri, University of North Carolina at Chapel Hill, University of North Texas, University of Pittsburgh, University of South Carolina, University of South Florida, University of Tennessee (Knoxville), University of Texas (Austin), University of Toronto, University of Washington, University of Wisconsin-Milwaukee, and Wayne State University. Additional regional and student chapters in South America and Africa are being established.

GOVERNANCE

The ASIS&T Board of Directors consists of the president, president-elect, immediate past president, treasurer, a parliamentarian, directors chosen by the SIGs and chapters, and six directors-at-large. ASIS&T maintains its headquarters under an executive director in the Silver Spring area in Maryland. The Association’s web address is www.asist.org.

The Executive and Budget and Finance committees are standing committees of the Board of Directors; the standing committees of the Society are Awards and Honors, Constitution and Bylaws, Information Science Education, International Relations, Leadership, Membership, Nominations, Publications and Scholarly

Communications, and Standards. An annual business meeting of the membership is held during the ASIS&T annual meeting.

The presidents of the Society have been the following:

American Documentation Institute

Watson Davis 1937–1943
 Keyes D. Metcalf 1944
 Waldo G. Leland 1945
 Watson Davis 1946
 Waldo G. Leland 1947
 Vernon D. Tate 1948–1949
 Luther H. Evans 1950–1952
 E. Eugene Miller 1953
 Milton O. Lee 1954
 Scott Adams 1955
 Joseph Hilsenrath 1956
 James W. Perry 1957
 Herman H. Henkle 1958
 Karl F. Heumann 1959
 Cloyd Dake Gull 1960
 Gerald J. Sophar 1961
 Claire K. Schultz 1962
 Robert M. Hayes 1963
 Laurence B. Heilprin 1964–1965
 Harold Borko 1966
 Bernard M. Fry 1967

American Society for Information Science

Robert S. Taylor 1968
 Joseph Becker 1969
 Charles P. Bourne 1970
 Pauline A. Atherton 1971
 Robert J. Kyle 1972
 John Sherrod 1973
 Herbert S. White 1974
 Dale B. Baker 1975
 Melvin S. Day 1976
 Margaret T. Fischer 1977
 Audrey N. Grosch 1978
 James M. Cretsos 1979
 Herbert B. Landau 1980
 Mary C. Berger 1981
 Ruth L. Tighe 1982
 Charles H. Davis 1982–1983
 Donald W. King 1984
 Bonnie C. Carroll 1985
 Julie A. C. Virgo 1986
 Thomas H. Hogan 1987
 Martha E. Williams 1988
 W. David Penniman 1989
 Toni Carbo 1990
 Tefko Saracevic 1991
 Ann E. Prentice 1992
 José-Marie Griffiths 1993
 Marjorie M.K. Hlava 1994

James E. Rush 1995
 Clifford Lynch 1996
 Debora Shaw 1997
 Michael Buckland 1998
 Candy Schwartz 1999
 Eugene Garfield 2000

American Society for Information Science and Technology

Joseph A. Busch 2001
 Donald H. Kraft 2002
 Trudi Bellardo Hahn 2003
 Samantha Hastings 2004
 Nicholas Belkin 2005
 Michael Leach 2006
 Edie Rasmussen 2007
 Nancy Roderer 2008
 Donald O. Case 2009
 Gary Marchionini 2010
 Linda C. Smith 2011
 Diane H. Sonnenwald 2012

Association for Information Science and Technology

Andrew Dillon 2013
 Harry Bruce 2014
 Sandra Hirsch 2015

PUBLICATIONS

Publication affords a major channel to communicate current significant research reports, development work, and professional activities, both to the membership and to the interested public. It also serves as a historical record of achievement. In addition to a substantial monograph series, ASIS&T produces three continuing publications.

The *Journal of the Association for Information Science and Technology* (*JASIST*, formerly the *Journal of the American Society for Information Science and Technology*) is a highly ranked and frequently cited source for reports of research and development in information science. The *Journal of Documentary Reproduction* (edited by Vernon D. Tate and published by the American Library Association, 1938–1942) is considered the predecessor of the Association's journal. In 1950, it was reborn as *American Documentation*. With the Association's changes of name, it became the *Journal of the American Society for Information Science* (in 1970), the *Journal of the American Society for Information Science and Technology* (in 2001), and the *Journal of the Association for Information Science and Technology* (in 2014). The journal, also known as *JASIST*, serves as a forum for new research in information transfer and communication processes in general, and in the context of recorded knowledge in particular. Concerns include the generation, recording,

distribution, storage, representation, retrieval, and dissemination of information, as well as its social impact and management of information agencies. *JASIST* consistently ranks at or near the top in assessments of influence in the field. It gradually increased from four issues per year (1950–1969) to its current monthly publication. The journal has been edited by Vernon D. Tate (1950–1951), Mortimer Taube (1952), Jesse H. Shera (1953–1960), Luther H. Evans (1961), James D. Mack (1962–1963), Arthur W. Elias (1964–1976), Charles T. Meadow (1977–1984), Donald H. Kraft (1985–2008), Blaise Cronin (2009 to date), Blaise Cronin (2009–2015), and Javed Mostafa (2016 to date).

The proceedings of the annual meetings collect significant contributed, peer-reviewed papers. Since 2002, these proceedings are available to meeting registrants and digitally through the ASIS&T Digital Library and the Wiley Online Library. All *JASIST* issues are also available in the ASIS&T Digital Library.

The *Bulletin of the American Society for Information Science* (formerly the Society's *Newsletter*) began publication in 1974. It is a bimonthly news magazine focused on developments and issues affecting the field, pragmatic management reports, opinion, and news of people and events in the information science community. Irene Travis was named editor in 1997; in 2007, the *Bulletin* became a digital-only publication. It is currently available free of charge via the ASIS&T website.

A fourth publication, the highly regarded *ARIST* was published from 1966 to 2011. *ARIST* surveyed the landscape of information science and technology, providing the reader with an analytical, authoritative, and accessible overview of recent trends and significant developments. The initial volumes of this series were supported by a grant from the National Science Foundation. *ARIST* was edited by Carlos A. Cuadra (1966–1975), Martha E. Williams (1976–2001), and Blaise Cronin (2002–2011). Many *ARIST* volumes are available in the ASIS&T Digital Library. The *Advances in Information Science* series published in *JASIST* continue the *ARIST* tradition of in-depth reviews of the field.

MEETINGS

Both the annual meeting held in the fall of the year and the special summits provide important forums for communication among people with diverse interests. The annual meetings bring together researchers and professionals from virtually every field: attorneys, bankers, electronic and print publishers, government officials, businesspersons, librarians, educators, engineers, social scientists, information managers, computer scientists, and many others. Activities specially held for students include a student design competition, student paper awards and presentations, a doctoral colloquium, and a newcomer's

Table 1 Recipients of the Award of Merit and Watson Davis Award

Year	Award of Merit Recipients	Watson Davis Award Recipients
1964	Hans Peter Luhn	
1965	Charles P. Bourne	
1966	Mortimer Taube	
1967	Robert Fairthorne	
1968	Carlos A. Cuadra	
1969	[not awarded]	
1970	Cyril W. Cleverdon	
1971	Jerrold Orne	
1972	Phyllis Richmond	
1973	Jesse H. Shera	
1974	Manfred Kochen	
1975	Eugene Garfield	
1976	Laurence Heilprin	James M. Cretsos Laurence B. Heilprin Lois F. Lunin Gerald J. Sophar Herbert S. White Arthur W. Elias Irene Farkas-Conn Simon M. Newman Roy D. Tally
1977	Allen Kent	Mary C. Berger Joe Ann Clifton Charles H. Davis Frank Slater Gerard O. Platau Jan Krcmar Edmond Sawyer Toni Carbo Margaret T. Fischer Robert Tannehill, Jr.
1978	Calvin N. Mooers	
1979	Frederick Kilgour	
1980	Claire K. Schultz	
1981	Herbert S. White	
1982	Andrew A. Aines	
1983	Dale B. Baker	
1984	Joseph Becker Martha Williams	
1985	Robert L. Chartrand	Lawrence Woods Michel Menou N. Bernard Basch George Abbott Barbara Flood Bonnie C. Carroll Madeline Henderson G. Daniel Robbins Julie Virgo Mickie Voges-Piatt Marianne Cooper Debora Shaw Audrey Grosch Martha Williams Donald Kraft Marjorie M.K. Hlava Karla Petersen Judy Watson Jessica L. Milstead Candy Schwartz Julie Hurd Thomas Hogan Nancy Roderer Joseph Busch
1986	Bernard M. Fry	
1987	Donald W. King	
1988	F. Wilfrid Lancaster	
1989	Gerard Salton	
1990	Pauline Atherton Cochrane	
1991	Roger K. Summit	
1992	Robert S. Taylor	
1993	Robert M. Hayes	
1994	Harold Borko	
1995	Tefko Saracevic	
1996	Jean Tague-Sutcliffe	
1997	Dagobert Soergel	
1998	Henry Small	
1999	José Marie Griffiths	
2000	Donald R. Swanson	
2001	Patrick G. Wilson	
2002	Karen Spärck Jones	
2003	Nicholas J. Belkin	
2004	Howard D. White	

(Continued)

Table 1 Recipients of the Award of Merit and Watson Davis Award (Continued)

Year	Award of Merit Recipients	Watson Davis Award Recipients
2005	Marcia Bates	Michael Buckland
2006	Blaise Cronin	Trudi Bellardo Hahn Steve Hardin Paula Galbraith Samantha Hastings Edie Rasmussen Barbara Wildemuth Robert Williams K.T. Vaughan Beata Panagopoulos Vicki Gregory Michael Leach Donald O. Case Diane H. Sonnenwald
2007	Donald H. Kraft	
2008	Clifford Lynch	
2009	Carol Tenopir	
2010	Linda C. Smith	
2011	Gary Marchionini	
2012	Michael Buckland	
2013	Carol C. Kuhlthau	
2014	Marjorie M.K. Hlava	
2015	Michael E.D. Koenig	
2016	Peter Ingwersen	

brunch. The topical summits feature presentations from research and industry leaders, opportunities for extensive personal interaction, and awards recognizing excellence in all aspects of the field.

SIGs also organize and present specialized meetings. The SIG on Classification Research has conducted the highly regarded Workshop of Classification Research each year since 1990. The SIG on Information Needs, Seeking and Use holds a research symposium in conjunction with ASIS&T annual meetings. Other SIGs that periodically hold seminars and workshops include the SIG on Metrics, the SIG on Social Informatics, and the SIG on Knowledge Management. In 2012, a one-day seminar on international perspectives on the history of information science and technology was held to help celebrate ASIS&T's 75th anniversary. (Seminar co-chairs were Toni Carbo and Robert Williams.)

AWARDS

ASIS&T's Award of Merit is the Association's highest honor. It is bestowed on individuals who have made noteworthy contributions to the field of information science, including the expression of new ideas, the creation of new devices, the development of better techniques, and outstanding service to the profession of information science. The Watson Davis Award commemorates the Society's founder. It is given to members who have shown outstanding continuous contributions and dedicated service to the ASIS&T. The recipients of these awards are listed in Table 1.

Twelve additional awards are given annually to recognize students, academics, and practitioners for their contributions to information science education, research, and the Association. There are six chapters and three SIG awards presented annually as well.

CONCLUSION

ASIS&T has responded to more than seven decades of change in our understanding and use of information technologies. It has evolved from an organization of institutions to an individual membership society. As ASIS&T advances into the twenty-first century, its meetings reach academic, industry, and professional audiences, and its long-standing publications retain their high impact as they expand to digital formats.

The text describing the history of ASIS&T through the 1980s can be found on the ASIS&T website and is used with permission from ASIS&T. An earlier version of this article appeared in Davis, C.H.; Shaw, D. *American Society for Information Science and Technology (ASIS&T). Encyclopedia of Library and Information Sciences*; Taylor & Francis, 2009, DOI: 10.1081/E-ELIS3-120044410.

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Association for Information Systems (AIS)

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Abstract

The Association for Information Systems (AIS) is a professional organization whose membership is made up primarily of business school academics who specialize in information systems (IS) development, implementation, and evaluation. The current membership is 3965, which is over 50% saturation of the overall population of an estimated 7000 IS academics worldwide.

The Association for Information Systems (AIS) is a professional organization whose membership is made up primarily of academics who specialize in information systems (IS) development, implementation, and evaluation. As the majority of early academics in the field were housed in business schools, much of our research still has a focus on the “bottom line”—the business consequences of IS choices. This special perspective is reflected in the mission statement of AIS:

To advance knowledge in the use of information technology to improve organizational performance and individual quality of work life.

Worldwide, most recently, there are also many members housed in computer science and information science programs as well, but the organizational perspective remains.

OBJECTIVES OF AIS

The purpose of AIS is to serve as the premier global organization for specialists in IS in order to:

- Create and maintain a professional identity for IS educators, researchers and professionals, researchers, and educators;
- Promote communications and interaction among members;
- Provide a focal point for contact and relations with bodies in government, the private sector, and in education that influence and/or control the nature of IS;
- Improve curricula, pedagogy, and other aspects of IS education;
- Create a vision for the future of the IS field and profession;
- Create and implement a modern, technologically sophisticated professional society;

- Establish standards of practice, ethics, and education where appropriate; and
- Include professionals worldwide.

To these ends, AIS conducts conferences and meetings, publishes books, journals, and other materials; cooperates with other organizations interested in the advancement and practice of IS, stimulates research; promotes high professional standards and promotes the growth of IS and the profession’s quality throughout the world.

BACKGROUND ON IS IN BUSINESS SCHOOLS

The IS area developed in business schools in the late 1960s with an initial focus on programming business applications of computers, often through the use of COBOL, a business-oriented computer programming language. This addition to business curricula was controversial with some faculty arguing that business students would never become computer programmers and others arguing that managers needed to be informed “end users,” to understand the nature of the tasks that analysts and programmers perform, and to develop a realistic awareness of the capabilities and limitations of computer “solutions.”

This programming emphasis rapidly shifted to one that emphasized the “fit” between computer systems and the business enterprise as illustrated by the development of planning processes for deciding how computer systems could best be used to aid in the achievement of business goals.

HISTORY OF AIS

In the early days of IS in business schools, most academics in the area came from other disciplines such as economics,

accounting, organizational behavior, operations research, and management science. Because of this, most IS academics had professional affiliations in other underlying disciplines. Thus, some did not see IS as a distinct professional field even though they were teaching and researching IS topics.

Nonetheless, as the field grew explosively in the 1970s and 1980s with ever-greater demands for new IS programs and class offerings, the notion of IS as a professional field of study and practice grew. Many IS academics saw the need for an organization that could represent the professional values and aspirations of IS business-school academics. Although the focus differs somewhat from region to region, the predominant approach was, and still is, to recognize the different needs of IS academics from those of faculty in computer and information science.

Interestingly, the first major effort in this direction came in 1980 with the creation of a major international research conference—the annual International Conference on IS (ICIS)—a nonprofit organization with a governing executive committee that was responsible for site selection and choosing the conference chair and other key positions for upcoming conferences. This conference was created through a grass-roots effort by senior IS academics, primarily from North America. It rapidly became a major focal point for the research interests of academics across the world.

As ICIS grew and prospered, various informal groups met there to discuss the need for a professional organization to more broadly represent the interests of IS academics. Several studies and surveys were conducted with mixed results and little action.

Finally, a study was planned by a group of senior people who met informally and commissioned Dr. William R. King, University Professor at the University of Pittsburgh to organize a task force to comprehensively study the issue of creating a professional organization, and to assess the level of support for the idea. King contacted numerous senior people to get their ideas; he found that they almost unanimously favored the creation of such an organization. So, rather than leading a study, King formed an organizing committee of about 40 senior academics from around the globe. While this group was creating the general design for a new organization, King attended academic conferences held by related professional organizations and regional IS conferences that had recently been initiated. At those conferences, he held information sessions to discuss the objectives of the proposed organization and to solicit ideas.

The organizing committee conducted an electronic constitutional convention to agree on a constitution for the new organization and appointed King to be its first Executive Director. Operating out of his university office with the help of his assistant and a doctoral student, he proceeded to solicit members and had a membership roster of 1800 charter members within 6 months. The charter

members elected King as the first President of AIS in an election that also filled various officer and council slots.

GOVERNANCE OF AIS

The Association for IS is led by a president who is annually elected from one of three world regions—the Americas, Europe and Africa, and Asia-Pacific—on a rotating basis. The governing Council is made up of elected functional vice-presidents and other officers and council members who are elected in the three world regions. There are also some appointed positions, such as secretary and treasurer. Thus, AIS is truly a global organization that can reflect the diverse interests and needs of business-school academics all over the world.

EVOLUTION OF AIS

The Association for IS was initially operated out of a single office at the University of Pittsburgh with only one part-time paid employee, King's administrative assistant, and many activities conducted by member-volunteers. In 1997, it became apparent that more professional management was necessary, and the Council circulated a request for proposals for a permanent site and staff. Georgia State University submitted the winning proposal and the organization operated from there, with Dr. Ephraim R. McLean of Georgia State as Executive Director for 10 years. Currently, AIS has a paid Executive Director and a small number of staff members and contractors to handle membership, conferences, technology, and finances. Some degree of outsourcing allows AIS to reduce its dependence on volunteers.

In spite of professionalizing many operations, AIS still involves a great deal of volunteer work. There are several elected positions, including that of the President (and Past-President and President-Elect), Regional Representatives, and VPs. The VPs cover technology, communications, chapters, meetings and conferences, Special Interest Groups (SIGs), member services, and accreditation. Holding one of these positions carries with it an expectation of traveling to one or two meetings per year, responding to communications throughout the office-holder's tenure, and, most importantly, being innovative, and responsive to emerging issues and challenges.

Special Interest Groups began to be created in 2001. In November 2000, VP of Member Services Dennis Galletta conducted a survey of 11 other professional associations, and AIS fortunately compared favorably to those associations when considering dues amount and services to members. One of the most striking services in many of those associations was in the area of SIGs, not yet offered by AIS at that time. After evaluating 12 proposals, a first slate of six were created. As of early 2009, there are 33 AIS

SIGs. Many SIGs serve as valuable resources to members, as many of them provide valuable research and teaching resources, as well as newsletters, pre-conference activities, and conference tracks. With funding (actual and in-kind) from AIS, SIGHCI (Human-Computer Interaction), Syracuse University, and the University of Pittsburgh, Council has just created the first *Transactions* journals: *AIS Transactions of HCI (TOHCI)*, edited by Dennis Galletta and Ping Zhang, and *AIS Transactions on Enterprise Systems (TES)*, edited by Norbert Gronau. If these journals are a success, Council will entertain proposals from other SIGs for further *Transactions*.

Given the costs inherent in AIS initiatives and operations, it is important for AIS to generate revenue to cover a wide range of activities. Fortunately, one of the most important AIS activities is that of conferences, which both provide benefits to members and generate funds for the Association. Currently, 70% of the \$1.6 million AIS budget is funded by conferences. Based on strategic planning exercises initiated by President Michael Myers in 2006, Council has begun to explore ways in which the organization can use its intellectual capital to fund more of the costs of AIS. The recent move to expand memberships to practitioners will also broaden our base of revenue.

Milestones in the Evolution of AIS

The details of the evolution of AIS, as well as its truly global nature, may best be characterized by describing the foci of each president's term. As well, such a description may provide a useful case-study of the creation and development of a successful academic professional organization. The accomplishments are not necessarily reflective of a particular president but of the timing of the milestone. In many cases, the initiatives were accomplished over several presidential terms. Also, the affiliations of the President at that time are provided; in some cases they have either moved to other universities or retired.

1995 (Bill King, University of Pittsburgh, United States of America)

Bill King's administration represented the culmination of a history of imagining and planning. As described earlier, years of discussion about creating the Association were put into place at that time. Initial meetings were held to determine what the name of the organization would be (which was surprisingly difficult because of the diverse language structures and cultures), what services it would provide, what its structure would be, and to develop a strategic plan for its future development.

King arranged for AIS to support existing nascent conferences in Europe and Asia (ECIS—European Conference on Information Systems; PACIS—Pacific Asia Conference on Information Systems) and asked Dennis Galletta to organize the Inaugural Americas Conference

on IS (AMCIS) in Pittsburgh in August of 1995. The strategy for the conference was for it be complementary to ICIS in being inclusive, with a higher acceptance rate than that of ICIS (which is normally significantly lower than 20%), and with more of a focus on teaching. The first AMCIS generated 239 paper submissions and 149 were accepted by the program committee (chaired by Hugh Watson of the University of Georgia), representing a 62% acceptance rate. The 587 attendees in that first Americas regional conference enjoyed keynote talks by Tom Davenport, Herbert Simon, and James Wetherbe.

Attendees enjoyed a dinner/dance riverboat ride on the three rivers of Pittsburgh to kick off the Inaugural Conference. Such amenities were common at ICIS and AMCIS carried on this tradition. The conference was innovative in several ways: it featured electronic submissions and reviewing, electronic registration via Web site, teaching workshops, technology briefings, tutorials, and software demonstrations. Since 1995, the conference has been held each year in August, and attendance has risen to around 1000 attendees as membership in AIS has risen to nearly 4000.

Before the Inaugural AMCIS conference was held, there was some controversy as some Council members feared that regional conferences would erode the popularity of ICIS, which was generally perceived to be of such high quality that it constituted a "crown jewel" of the field. The fears proved to be unfounded as ICIS continued to attract 1000–1500 participants, and as all regional conferences have prospered.

The Association for IS began by making arrangements with several existing journals to provide a discounted subscription to a journal of choice to each member. Currently, members deal directly with any of 32 journals and provide their membership number to obtain the discount.

1996 (Niels Bjorn-Andersen, Copenhagen Business School, Denmark)

President Bjorn-Andersen worked to make sure that AIS was established as a true global organization. When he took office, his main efforts were aimed at stimulating support in the various regions through traveling to the major regional conferences. His message was that the field needed a global organization, and that AIS was not exclusively run by Americans. He garnered more members from the non-American regions and worked to make sure that officers represented all regions.

Council established membership for researchers from developing countries at a very affordable level, and Bjorn-Andersen initiated a series of negotiations on enlisting already existing local IS faculty organizations as chapters.

He stimulated improvements in the faculty directory service and integrated a European directory of faculty into the global directory done so well by Dave Naumann and his colleagues at the University of Minnesota.

1997 (Ron Weber, University of Queensland, Australia)

Several key milestones were reached in 1997. The seeds for a merger of AIS, ICIS, and ISWorld were planted. Discussions were held about making the *MIS Quarterly* available to all AIS members electronically. Also, two electronic AIS journals were begun: *Journal of the AIS* and *Communications of the AIS*. The first editor of the *Journal of the AIS* was Philip Ein-Dor, and the first editor of the *Communications of the AIS* was Paul Gray, both of whom developed the journals into the highly-ranked publications that they are today. Key decisions that year include the formation of an audit review committee, keeping the new journals in an electronic-only format, the development of strategic planning for AIS, and the genesis of the first AIS chapter (Southeastern United States of America).

1998 (Gordon Davis, University of Minnesota, United States of America)

Much of the complexity involved in building a global association was exhibited in this time period, as many initiatives took several years to come to fruition. For example, merger discussions between AIS and ICIS reached a crescendo during 1998. Also, trying to normalize many conference procedures as AMCIS began to mature, and ICIS continued in its 19th year. Significant attention was paid to conference and AIS finances, as there were some difficulties with an outside contractor who handled funds and conference implementation. During this period, relationships were cultivated with organizations worldwide for potential alliances.

1999 (Bob Galliers, University of Warwick, United Kingdom)

During 1999, plans for new Lyons Electronic Office (LEO) and Fellow awards were drafted to honor contributors to the field. Named after the world's first commercial application of computing (The LEO), the purpose of the LEO Award is to recognize truly outstanding individuals in the IS community, both academics and practitioners, who have made exceptional lifetime contributions to research in and/or the practice of IS. As of 2009, 21 LEO awards have been conferred.

The AIS Fellow award recognizes individuals who have made outstanding contributions to the IS discipline in terms of research, teaching, and service. A Fellow need not have excelled in all three categories. Nonetheless, she or he is expected to have made exceptional contributions in at least one of these categories and to have made significant contributions in the other two categories. A Fellow is also expected to have made significant global

contributions to the IS discipline as well as outstanding local contributions in the context of their country and region. As of 2009, 48 Fellow awards have been conferred.

2000 (Mike Vitale, University of New South Wales, Australia)

During 2000, final consolidation of AIS and ICIS was planned. Attorneys drew up the necessary paperwork, and the AIS constitution and other legal documents were thoroughly reviewed and updated to reflect the new nonprofit corporate structure. Also, functions and procedures were refined for the office in Atlanta. Also that year, it was decided that a periodic member survey would be conducted and that AIS would become involved in curriculum and accreditation efforts.

2001 (Blake Ives, Louisiana State University, United States of America)

The consolidation of AIS and ICIS was finally completed and celebrated in New Orleans, Louisiana, in December 2001, complete with a wedding cake inscribed with "AIS + ICIS." Also that year, AIS became involved in *MIS Quarterly's* Policy Committee by having its VP of Publications as a member of the Committee, by appointing a member, and by choosing the Committee's chair every other term. Also, a contract was signed with *MIS Quarterly* and *MISQ Executive* to offer them both free to AIS members electronically. The Minnesota IS Faculty directory was integrated into the "ISWorld" online portal. That year, AIS responded formally to Association to Advance Collegiate Schools of Business, the premiere accreditation agency for academic business programs, which had omitted MIS from its business program accreditation guidelines; AACSB subsequently "fixed" its guidelines and added a requirement for business programs to include MIS. This one initiative has led several schools to create a required MIS course, or to make sure that the required course was retained despite any curriculum innovations. Heavy membership discounts were offered to IS academics in "non-rich" countries. Finally, AIS began studying accreditation as a possible avenue for program development.

2002 (Phillip Ein-Dor, Tel Aviv University, Israel)

Budgetary integration of AIS and ICIS was accomplished for the first time in 2002, which was largely accomplished by AIS Treasurer Richard Elnicki. Also, global geographical integration was encouraged. New affiliations were struck with German and French IS Societies. An agreement was reached with *MISQ Executive* to provide the journal electronically to all members. The electronic

version of the *MIS Quarterly* was built. Previous ICIS and AMCIS proceedings were also provided online.

2003 (K.K. Wei, National University of Singapore)

In 2003, memberships from Region 3 achieved a greater than twofold increase, thus making AIS into a truly global community. A large number of chapters were created in 2003, including new chapters representing Chinese-speaking individuals and also those spanning different continents including Europe (Ireland, Italy, Slovenia, and United Kingdom), Middle East (Israel and Morocco), and Asia (Pakistan). Wei initiated a new strategic planning function for AIS. A new Code of Research Conduct was adopted by the AIS Council. A member survey was undertaken, which indicated a high degree of member satisfaction. Particular areas were noted for future decision making.

2004 (Richard Watson, University of Georgia, United States of America)

In 2004, two successive losses exceeding \$200,000 underscored the importance of cost cutting. Establishing the financial viability of AIS monopolized action during this term. The budget was scrutinized, and the cycle of losses was turned into more than a \$100,000 surplus. A number of actions were taken to establish the long-term financial health of AIS, including an analysis of the operations of AIS by the Finance Committee, chaired by Joe Valacich, and a review of the financial contributions of AMCIS and ICIS by a committee chaired by Malcolm Munro, VP of Meetings and Conferences.

Also, AIS replaced its in-house Web site system with an open-source content management system to reduce costs and improve the currency of the site.

2005 (Claudia Loebbecke, University of Cologne, Germany)

The e-library was enhanced in 2005 by allowing cross-searching of all AIS conferences. Also, new conferences were added to the e-library (those from conferences in Australia/Asia (ACIS), Bled, and Europe (ECIS)). Internationalization efforts continued, and hundreds of new members from China marked the success of that initiative. Also, membership fees in developing countries were lowered again to broaden the membership of AIS. The open source Web site was implemented. Model curricula were approved in conjunction with IEEE and ACM. The Distinguished Member award was initiated for honoring deceased members. As of 2008, there are three such members (Claudio Ciborra, Gerardine DeSanctis, and Heinz Klein). Finally, a new conference management firm was appointed to help with conference negotiation, planning, and execution.

2006 (Michael Myers, University of Auckland, New Zealand)

In 2006, a key event was a strategic planning meeting for AIS Council to provide a clear vision and direction for the future growth and development of AIS. This meeting marked the inauguration of a firm strategic planning function within AIS. Strategies were developed by AIS Council for internationalization, communications, journals, chapters and SIGs, conferences, accreditation, corporate sponsorship, and membership growth, amongst other things. Council developed a vision to transform AIS into a more professional association. An orientation program was established, whereby all new Council members are introduced to the principles of association leadership, the state of the association, the strategic plan, and the opportunities and challenges of their particular role whether it be vice-president or region representative. The AIS Technology Committee met and had its own strategic planning session. Recommendations that were adopted by AIS Council were the following: 1) Scholar One was adopted as the electronic review system for all AIS journals and conferences; 2) A revamped AIS Web site was launched, including regularly updated content on AIS SIGs and chapters; and 3) AIS Council agreed to fund an AIS association management system, an AIS e-library system and to bring together into one unified portal the AIS Web site and AISWorld. An affiliation of *Information Systems Journal* with AIS was approved. Two new journals were launched: an AIS Journal in Spanish and the Pacific Asia Journal of the AIS. Finally, a VP of Technology was introduced and the position filled by presidential appointment.

2007 (Dennis Galletta, University of Pittsburgh, United States of America)

During Galletta's term, a task force explored how to increase membership value and another worked on issues of member diversity. In a bold move to increase membership, Council decided to include practitioners as an important additional membership category. This move enables student chapters to provide a "membership path" for future members, and for graduates to serve as contacts for us and our current students. We also adopted a German language journal into the e-library, and Council insisted that full German text be included rather than only incorporate English abstracts. To address the enrollment downturns that had been experienced in the early twenty-first century, a committee maintained an AIS wiki for storing materials and strategies for student recruitment. A brochure "Picture yourself studying IS" was created for co-branding with interested schools. Further, a student video competition was held, and a Second Life half-island was purchased. To increase value to members, an AIS

discussion forum was created entitled “What in the World can AIS do for you?” AIS adopted the Senior Scholars’ “Basket” of six top IS journals and featured it prominently on the AIS Web site. Including six journals in the basket was seen as a solution to enhance the promotability of academics in a relatively new field in which the quality assessments of journals was previously highly variable across universities. The basket includes our own *Journal of AIS*, providing welcome recognition of the journal’s quality. Finally, the AISWorld and AIS Web sites were integrated based on a design contest that was won by Dave Haseman and Craig Claybaugh of University of Wisconsin at Milwaukee.

THE FUTURE OF AIS

The next two Presidents as of 2009 are David Avison (2008) of ESSEC Business School in Paris, and Bernard Tan (2009) of National University of Singapore. The member initiative, run by David Avison during 2007, and continued by Bernard Tan after Avison took over as President in July 2008, is a key component in determining the future of AIS. He has found that there is no shortage of ideas for extending the impact of AIS and broadening its reach. As of early 2009, the current membership is 3965, which is estimated to be over 50% saturation of the overall population of an estimated 7000 IS academics worldwide. Tables 1–3 provide details of the current AIS membership.

Conferences, journals, and associations are contacting AIS on an accelerating basis to explore partnering or merger. The international organization is taking on more regular roles in providing AIS plenary presidential addresses to all three regional conferences (AMCIS, ECIS and PACIS) in addition to ICIS. The Association for IS’

Table 1 Membership by category.

Academic	2609
Student	1273
Professional	59
Retired Academic	24
Total	3965

Table 2 Membership by region.

The Americas	2038
Europe and Africa	1289
Asia Pacific	638
Total	3965

Table 3 Top ten membership levels by country.

United States	1768
Canada	170
Germany	165
United Kingdom	161
Australia	156
France	132
China	98
Taiwan	90
Sweden	79
Italy	74
Total top ten	2893

intellectual capital is recognized to be one key to improving the ability of AIS to become more self-sustaining and to reduce fund-raising pressure on conferences.

The Association for IS has come a long way from having nearly all operations completed by volunteers to having a professional staff and bank of consultants. The “professionalization” of the office has been gradual but dramatic. Memberships have grown over the years on a healthy basis. The decision to include practitioner members and student chapters should take AIS to a new level.

Association for Library Collections and Technical Services

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Abstract

The Association for Library Collections and Technical Services (ALCTS) is one of the 11 divisions of the American Library Association (ALA). In 1957, this division was established from the merger of several ALA units with common interests. It was called the Resources and Technical Services Division until 1989 when the present name was approved by the membership. ALCTS focuses on six areas: standards, best practices, publications, continuing education, professional development, and information exchange.

INTRODUCTION

The Association for Library Collections and Technical Services (ALCTS) is responsible for the following activities: acquisition, identification, cataloging, classification, and preservation of library materials, the development and coordination of the country's library resources, and those areas of selection and evaluation involved in the acquisition of library materials and pertinent to the development of library resources. ALCTS has specific responsibility for

1. Continuous study and review of the activities assigned to the division
2. Conduct of activities and projects within its area of responsibility
3. Synthesis of activities of all units within the American Library Association (ALA) that have a bearing on the type of activity represented
4. Representation and interpretation of its type of activity in contacts outside the profession
5. Stimulation of the development of librarians engaged in its type of activity, and stimulation of participation by members in appropriate type-of-library divisions
6. Planning and development of programs of study and research for the type of activity for the total profession

DESCRIPTION

Vision

ALCTS is the recognized dynamic leader and authority for principles, standards, best practices, continuing education, and new developments in the selection, management, and preservation of all information resources.

Mission

To shape and respond nimbly to all matters related to the selection, identification, acquisition, organization, management, retrieval, and preservation of recorded knowledge through education, publication, and collaboration.

ALCTS is one of 11 divisions of ALA. With about 3500 personal, organizational, and international members, ALCTS represents a wide range of the library community, public, academic, and special. Members of ALCTS have the opportunity of joining one of five sections: Acquisition (AS), Cataloging and Metadata Management (CaMMS), Collection Management (CMS), Preservation and Reformatting (PARS), and Continuing Resources (CRS). Each of these sections represents specific areas of interest within ALCTS and offers members an opportunity to meet and discuss issues, trends, and developments with others with similar interests.

A staff of three, who specialize in specific areas, manages ALCTS, which supports the ongoing work of the association. The Executive Director is responsible for the overall management and fiscal health of the association. Other staff oversee the website, continuing education, programming, meeting management, publications, and membership.

Products, Services, and Member Benefits

The association focuses on six areas: standards, best practices, publications, continuing education, professional development, and information exchange. Within these six areas, ALCTS offers products and services for librarians throughout their careers.

Standards

The purpose of ALCTS is to develop, evaluate, revise, and promote standards. Standards are vital to the organization

of information, such as metadata standards, cataloging revisions, resource description and access (RDA), and preservation. Through its own committee structure and liaison work with outside organizations, ALCTS members make a significant impact. ALCTS appoints the ALA representative to the National Information Standards Organization (NISO), who informs the association of critical changes in U.S. and international standards.

Best Practices

The association is the authority on many vital issues confronting libraries today. Its members provide input to national bodies such as ALA on practices and programs relating to technical services.

Publications

The association publishes outright or has significant input into many of the crucial publications in technical services including RDA and the Library of Congress subject headings. The ALCTS publications cover the range of our interests from e-publications to monographs to directories to guides. *Library Resources & Technical Services (LRTS)*, ALCTS quarterly research journal, consistently ranks as one of the premier research journals in library technical services. The *ALCTS News*, a timely news source, keeps the membership informed of the activities of the association.

Continuing Education

Substantial and high-quality conference programming including outstanding preconferences is offered by ALCTS. The association offers nearly 12–15 programs on a variety of topics at each ALA Annual Conference. ALCTS offers web-based continuing education on a broad array of topics. The ALCTS e-Forum brings a monthly discussion of current topics to over 4000 subscribers.

Professional Development

ALCTS offers great opportunities for members to increase their knowledge and further their professional careers. Besides serving on committees, there are opportunities to work with outside groups and organizations in developing important policies for the library community. Members represent the library community on the RDA Steering Committee, the Program for Cooperative Cataloging, and the NISO.

Information Exchange

There are forums for the exchange of information among members and nonmembers. Twice a year, at the Midwinter Meeting and the Annual Conference, over 40 topical

interest groups meet to address some important issues facing the library community. There are numerous electronic discussion lists available for subscription.

HISTORY

ALCTS has been a division of ALA since 1957, when the Resources and Technical Services Division (RTSD) was formed from the merger of several ALA units with common interests. In 1989, the membership of RTSD voted to change the name of the division to ALCTS. It was during this same period that ALCTS began a cooperative shared staffing arrangement with the Library Administration and Management Association. This shared staffing arrangement lasted over a decade. In January 2001, the boards of each division approved the dissolution of the arrangement effective September 1, 2001. The first bylaws for RTSD provided for four sections: Acquisitions, Cataloging and Classification, Copying Methods, and Serials. In 2007, ALCTS celebrated its 50th anniversary as a division of ALA. In 2014, ALCTS celebrated the 25th anniversary of the name change from RTSD to ALCTS.

The Acquisitions Section was formed from the Board on Acquisition of Library Materials, created in 1951. In 1973, the Resources Section was formed by the merger of the RTSD Resources Committee and the AS. In 1991, the Resources Section changed its name to Acquisition of Library Materials Section, and some of its committees were assigned to a newly formed Collection Management and Development Section (CMDS). In 1992, the section again adopted the name Acquisitions Section.

CaMMS dates from 1900 when the Cataloging Section of ALA was founded. In 1940, the section became the Division of Cataloging and Classification (DCC). The DCC included a Council of Regional Groups, formed by Margaret Mann in 1923.

The Copying Methods Section became the Reproduction of Library Materials Section in 1967. This section dates to 1936, when the Committee on Photographic Reproduction of Library Materials was created. In 1948, the committee changed its name to Committee on Photoduplication and Multiple Copying Methods. This committee was replaced by the Copying Methods Committee, which joined RTSD as the Reproduction of Library Materials Section in 1957. In 1994, the section merged with the Preservation of Library Materials Section (PLMS) to form the PARS.

The CRS has its origins in the Serials Round Table formed in 1929.

In 1980, the original four sections were joined by the PLMS, in recognition of the growing awareness and knowledge of preservation issues. In 1994, PLMS merged with the Reproduction of Library Materials Section to form the PARS.

GOVERNANCE

Bylaws

The ALCTS bylaws govern and guide the association. In its 17 articles and numerous subsections, the bylaws lay out the essence of ALCTS.

Board of Directors

A 19-member Board of Directors governs ALCTS. The board has authority over the affairs of ALCTS. It sets the policies and programs of the association in relationship to the goals and objectives identified by the membership and by ALA. The Board of Directors is composed of voting and nonvoting officers and members. These officers and members have particular duties as set forth in the ALCTS bylaws. The voting members of the board include the president, president-elect, past-president, ALCTS councilor to the ALA Council, three directors-at-large, the chairs of the sections of ALCTS, and the chairs of the Budget and Finance Committee, the Organization and Bylaws Committee, the Planning Committee, and the Affiliate Relations Committee. The ALCTS Executive Director, the editor of the ALCTS News, and the board Intern are ex officio nonvoting members.

The Executive Committee of the board meets to plan or carry out actions resulting from previous board action, to review financial matters of the association, and to plan future board action. The Executive Committee is composed of the president, president-elect, past-president, councilor, and the Executive Director.

Each of the five ALCTS sections is governed by its own executive committee, which is elected by its membership. The chair of the section serves on the ALCTS Board of Directors.

STRATEGIC PLAN

In 2015, the ALCTS Board reviewed and approved a revised strategic plan. This plan guides the association in the development and implementation of a wide range of activities, policies, and goals.

ALCTS Strategic Plan 2015

Adopted June 26, 2015

Preamble

This 3 yr strategic plan was developed by the ALCTS Planning Committee and approved by the Board of Directors at the 2015 ALA Annual Conference. The plan,

similar in design to its 2011 predecessor, is not meant to encompass the whole of ALCTS activities, but rather those areas where increased focus is needed. The plan is fluid, that is, achieved objectives may roll off the plan prior to its expiration, while emerging areas of strategic importance may be added as warranted. The Planning Committee will make such recommendations to the Board of Directors annually, and the plan will be updated accordingly. The strategic plan in its entirety will be reviewed and updated during the 2017–2018 term with the expectation that a new plan will be approved at the 2018 ALA Annual Conference.

1. Increase awareness of the ALCTS mission and activities to outside groups.
 - a. Raise awareness of our mission and our contributions to the profession.
 - b. Strengthen advocacy for user access to resources and information.
2. Increase participation in ALCTS activities.
 - a. Encourage a culture of year-round participation in meetings in all formats.
 - b. Expand opportunities for virtual members to participate in the association's activities.
 - c. Reach out to underrepresented and underinvolved groups (support staff and students) to encourage their participation in webinars and online meetings.
3. Develop ALCTS as a vibrant, relevant organization.
 - a. Give special attention to member retention.
 - b. Develop a culture of continuous review and examination of programs and services to maintain relevance.
 - c. Recruit new members, particularly students and faculty in iSchools and library programs, and public and special librarians.
 - d. Identify and address requirements for the financial sustainability of ALCTS, particularly fund-raising.

Financial Plan

A sound and responsible financial base that is derived from a broad range of revenue streams supports ALCTS' vision and mission. Planning and management of ALCTS' financial resources ensures the association's fiscal health.

The environment in which ALCTS operates is distinguished by a rapidly changing technology; a level-declining and changing membership base; increased opportunities in nontraditional library fields; changing member expectations and types of involvement; increased competition; increasing the number of initiatives requiring sophisticated technology; changing attitudes of leaders and potential members about how the association operates; evolving staffing patterns, levels, and responsibilities within acquisitions, cataloging, serials,

preservation, and collection development areas; an increased need for practical staff training; and an increased international influence.

In response, ALCTS recognizes the need to ensure efficient use of association resources through a continued sound and broad-based financial infrastructure to support its broad-based activities and initiatives. Providing the necessary revenue and staff to support important standards-driven programs and community-based programs is crucial in supporting ALCTS interests in relevant standards-based activities in the United States, internally within ALA and externally in cooperation with other library organizations and internationally working with the International Federation of Library Associations and Institutions (IFLA). Membership recruitment and retention is the foundation upon which any association is based. ALCTS strives to increase its membership revenue and membership base by providing diverse opportunities, creating services that appeal to staff who have paraprofessional library positions, exploring ways to attract nonlibrary information management professionals, and focusing membership campaigns on ALCTS new and existing programmatic areas. Continuing education and professional development programs offer reliable and consistent revenue, in addition to supplementing the career advancement of library professionals and paraprofessionals. A key to any financial plan is a well-rounded publishing endeavor. This informs members and nonmembers of current trends and issues in librarianship and enables ALCTS to maintain a high visibility.

Revenue growth and fiscal responsibility ensure that ALCTS has the resources to continue to develop programs and services for its members in the long term.

THE DIVISION

Committees

Committees of ALCTS support the operation of the association, produce revenue through publications and continuing education, support the advocacy of the association in areas of interest, and provide a forum for members and nonmembers on a wide variety of topics. Association-wide committees give operational support to ALCTS, produce the products and services ALCTS is known for, provide a forum for the discussion of trends and issues important to the library community in ALCTS areas of interest, and help to promote and develop ALCTS members and leaders. These committees fall into four broad areas: operational, revenue, advisory, and topical.

Operational Committees

The operational committees of ALCTS advise, recommend, implement, and guide the association. The Budget

and Finance Committee, which is primarily responsible for the fiscal health of the association, reviews, approves, and recommends acceptance of the ALCTS annual budget. This committee performs budget analyses and fiscal planning based on the ALCTS financial plan. It advises all ALCTS groups on fiscal matters, including fiscal implications of all division publications and programs. The Organization and Bylaws Committee advises the Board of Directors and through it the association on the establishment, functions, and discontinuance of sections, committees, and other groups as the needs of the association may require. It reviews documents and practices and advises the officers of the association and its sections on the bylaws, policies, and procedures of the association. It has authority on questions of the bylaws and any amendments needed to that document. With the adoption of the ALCTS Strategic Plan and the continuing planning efforts, the Planning Committee is a key contributor to the operations of ALCTS. It oversees this planning effort by continually updating the strategic issues, by coordinating the planning initiatives of the association and its sections, and by informing the ALCTS leadership through workshops and announcements on planning in general.

Revenue Committees

The ALCTS Revenue Committees are Continuing Education, Fund-raising, Membership, Program, and Publications. Each has a specific charge and area of responsibility. The Continuing Education Committee oversees the association's programs outside the conference setting. It develops criteria for continuing education, reviews continuing education plans, recommends approval of continuing educational offerings, and researches the educational needs of library staff at all levels in the areas supported by ALCTS. The Fund-raising Committee establishes fund-raising goals and priorities that support the association's strategic and financial plans. It also secures financial and in-kind support for ALCTS activities and further develops relationships with the commercial and private sectors. The Membership Committee is charged as the primary resource to the development and implementation of a continuous campaign to recruit and retain members for ALCTS (see Membership section). The Program Committee oversees the conference and preconference program planning, recommending a slate of programs to the board, and provides advice to those planning programs and preconferences. It is the work of the Publications Committee that produces the range of monographic and serials publications. This committee coordinates the association's publication program and provides a forum for discussion of the editorial policy for ALCTS' serial publications.

Advisory Committees

There are a number of committees whose purpose is to monitor trends and issues outside ALCTS, provide for the professional development of ALCTS members, and offer a forum to discuss research: Advocacy and Policy, Standards, Affiliate Relations, International Relations, Leadership Development, and *LRTS* Editorial Board. International Relations recommends members to serve on international committees, particularly within IFLA, and to monitor international developments. Leadership Development is responsible for the professional development of ALCTS member leadership through orientation and leadership training. The *LRTS* Editorial Board advises the editor on matters relating to editorial policies and journal content and assists in the selection of contributors and the evaluation of manuscripts. The Standards coordinates ALCTS input, development, and information on the wide range of standard-producing organizations. Affiliate Relations is the primary contact group with state and regional technical services organizations. Advocacy and Policy purpose to monitor state, national, and international advocacy and public policy developments and issues.

INTEREST GROUPS

The informal discussion of developments, trends, and issues is supported by ALCTS through its interest groups that are managed by the Interest Group Coordinator. Any group of ten or more members of ALCTS, for divisional groups, or section, for those interested in discussing common problems, which fall within the interests of ALCTS or the section, may form an interest group upon written petition, describing the purpose of the group, and upon approval of the Section Executive Committee or ALCTS Board. The petition shall include the requirements for membership. The ALCTS interest groups offer the library community a forum to explore a variety of topics and that addresses the needs of technical services professionals at different levels and in different types of libraries. The ALCTS interest groups include

- Creative Ideas in Technical Services
- Electronic Resources
- Electronic Resources Management
- Functional Requirements for Bibliographic Records
- Linked Library Data
- MARC Formats Transition
- Metadata
- New Members
- Newspaper
- Public Libraries Technical Services
- Publisher–Vendor–Library Relations
- Role of the Professional Librarian in Technical Services
- Scholarly Communication

- Technical Services Managers in Academic Libraries
- Technical Services Directors of Large Research Libraries
- Technical Services Workflow Efficiency

For information on section level discussion groups, visit each section's website listed under "Sections."

SECTIONS

The five ALCTS sections, AS, CaMMS, CMS, CRS, and PARS, are important contributors to the association. Through the sections, members of ALCTS have an opportunity to interact with other members who share common interests and concerns. The sections consider issues, trends, and policies related to their specific area of expertise. The sections produce programs and publications and in many cases serve as the voice of ALCTS on a variety of matters that go beyond ALCTS. Any group of 50 or more members of ALCTS or of ALA, whose interest falls within ALCTS but is distinct from that of any existing section, may be established as a section upon written petition, and upon approval by the association. The name of the new section must clearly indicate its field of activity. Each section defines its own functions and manages its own affairs, provided, however, that no section shall adopt bylaws or other rules for the transaction of its business that are inconsistent with those of ALCTS or engage in any activity in conflict with the activities of ALCTS. Each section is governed by an executive committee, which is elected yearly by its members. The chair of the section serves on the ALCTS Board of Directors.

Acquisitions Section

This section is dedicated to acquisition and associated bibliographic control for all formats of information resources through purchase, lease, and other access methods and in all types of libraries.

The AS does this through programs and publications specifically targeted to library staff whose primary responsibility is acquisitions and related areas. Members of AS can contribute through a number of committees and discussion groups within the section. Each year, the AS presents the HARRASSOWITZ Leadership in Acquisitions Award to a person who has shown outstanding leadership in the field of acquisitions. The committees of AS are Acquisitions Organization and Management, Education, Leadership in Library Acquisitions Award, Policy and Planning, Publications, Research and Statistics, and Technology.

Cataloging and Metadata Management Section

CaMMS' primary focus is on providing leadership to the library community on cataloging, metadata and related

discovery, and access issues through encouragement and promotion of activities relating to all formats and to all types of institutions. CaMMS does this not only through programs and publications but also as a significant contributor to the revisions of cataloging rules and metadata standard policies nationally and internationally. The Committee on Cataloging: Description and Access and the Subject Analysis Committee, representing a broad range of ALCTS members, ALA units, and national and international organizations, advise regularly on the structure and function of the foundation tools the library community utilizes to make information accessible to its users. The prestigious Margaret Mann Citation, given yearly to the person who has made superlative contributions to cataloging and classification, is presented by CaMMS. Its members have the opportunity of serving on these other CaMMS committees, Cataloging: Asian and African Materials; Cataloging of Children's Materials; Continuing Education; Research and Publications; Recruitment and Mentoring; and Policy and Planning. In addition to the committees, CaMMS supports numerous task forces, subcommittees, and six discussion groups.

Collection Management Section

The CMS contributes to the library community in all matters relating to collection management and development, selection, and evaluation of library materials in all types of institutions. It does this through interest groups, which address administration, electronic resources, practical issues, and evaluation and assessment for collection management. Other interest groups aim at collection management professionals at varying levels of management in three distinct library organizations: Chief Collection Development Officers of Large Research Libraries, Collection Development Librarians of Academic Libraries, and Collection Management in Public Libraries. The CMS gives one award: the ProQuest Coutts Award for Innovation. Members can gain valuable experience by serving on one of CMS' committees: Continuing Education, Planning, and Publications.

Continuing Resources Section

The CRS has its role in fostering the importance of serials through the distribution of information concerning serials, through open discussion of the trends and issues of serials, and through publications. The CRS seeks to encourage specialized training for librarians and other library staff in the field of continuing resources and supports the need for a serials curriculum. The CRS gives two awards: the Ulrich's Serials Librarianship Award for superior serials librarianship and the First Step Award, a Wiley Professional Development Grant, to new librarians committed to serials librarianship. Members of the CRS have many opportunities to participate in the section, including

committees and discussion groups. The CRS committees are Acquisitions, Education, Research and Publications, Continuing Resources Cataloging, Policy and Planning, Standards, and Holdings Information. The two interest groups are College and Research Libraries and Access to Continuing Resources.

Preservation and Reformatting Section

The PARS provides leadership in the areas of librarianship relating to the preservation and reformatting of library materials in all types of institutions and in the application of new technologies to assure continued access to library collections. It is most noted for the Preservation Administrators Interest Group (PAIG), which serves as one of the most prominent communication vehicles for preservation staff in the country. The PARS has three awards: Paul Banks and Carolyn Harris Preservation Award, the George Cunha and Susan Swartzburg Award, and the Jan Merrill-Oldham Professional Development Grant. PARS members are responsible for revising the ALA Preservation Policy, one of ALA's major policy statements for the library community, adding digital preservation to the policy in 2008. The PARS provides members with many opportunities to serve and influence the preservation community. Its interest groups include Books and Paper, Intellectual Access, Digital Conversion, Digital Preservation, and Promoting Preservation. Its committees include Program, Planning, and Publications, and Preservation Standards and Practices. It has 1000 members.

PUBLISHING

ALCTS publishing is a diverse effort from serials to monographs, from web publications to "best practices." Publications cover all the areas of ALCTS interest: acquisition, cataloging and classification, collection management and development, preservation and reformatting, and serials.

Library Resources & Technical Services

Established in 1957, *LRTS* is the official electronic quarterly journal of ALCTS supporting the theoretical, intellectual, practical, and scholarly aspects of collection management, acquisitions, cataloging and metadata, preservation and reformatting, and continuing resources, by publishing articles (subject to double-blind peer review), book reviews, editorials, and correspondence. Each issue includes reports of current, ongoing research on technical services, and related issues. The articles serve as the record of scholarly communication in the field. *LRTS* is one of the most frequently cited journals in the field. *LRTS* includes shorter notes reporting unique and evolving technical processes and research methods and substantive

book reviews on new publications. *LRTS* is read by librarians in all types of libraries worldwide.

ALCTS News

The *ALCTS News* is the primary public communications voice of the association. Published as a continually updated news source, *ALCTS News* features the association's news, committee and discussion group reports, reports of programs and preconferences, election results, informative editorials, and related news. *ALCTS News* is free to anyone interested in ALCTS activities, products, services, and news.

Guides Series

The Guides series, acquisitions and collection management, offers "best practices" and "hands-on" information on a variety of topics across ALCTS.

Sudden Selector's Guides

This series helps library workers get familiar with new subject areas by covering the tools, resources, people, and organizations they will need to keep collections relevant.

Monographs Collection

The Monographs Collection publishes relevant monographs on highly relevant topics of interest to the library community.

z687

z687 is an online collection of white papers and think pieces by library technical services professionals for their peers. This publication series has been discontinued.

MEMBERSHIP

ALCTS has 3500 members representing all types of libraries and library staff. Although personal members account for most of the membership, ALCTS also has 420 organizational and corporate members. Many members belong to at least one section. Section membership is free and members can join as many sections as they wish.

CONTINUING EDUCATION AND PROGRAMMING

In this era of rapid change, the need for many quality venues for Continuing Education and Programming (CE) is critical. Targeted, affordable, and accessible CE is one of the most requested benefits of members. This requires CE offerings to be both practical and theoretical,

providing basic information on a variety of topics for the beginner, but also providing advanced information for the seasoned librarian.

ALCTS offers CE opportunities to its members and the library community in general in a variety of formats: Annual Conference preconferences, Annual Conference programs, web-based courses, webinars, Midwinter symposium, virtual symposia and preconferences, and e-Forums.

Programs offered at the ALA Annual Conference bring to one place topics of particular importance in the areas in which ALCTS has an interest. These programs represent topics that are of immediate concern; offer updates to new developments, issues, and trends; and in general educate the library community as a whole.

Preconferences and symposia bring ALCTS expertise to a setting at the ALA Annual Conference and Midwinter Meeting in which the entire library community can benefit from timely topics and knowledgeable speakers. These preconferences and symposia address a specific topic over one or two days at both the practical and theoretical level.

The development of web-based CE continues as a high priority for ALCTS. Through web-based learning, library staff from across the country and internationally can participate in a meaningful educational experience. ALCTS web-based courses are intended to address the continuing educational need of those who cannot attend workshops in person. These courses address the need for basic, practical information.

The Continuing Education Committee is charged with providing leadership and coordinating the overall development of the continuing education initiatives. The Program Committee is charged with providing leadership and coordinating the overall development of programs and preconferences presented at the ALA Annual Conference and Midwinter Meeting.

AWARDS

The ALCTS Awards Program recognizes significant contributions by those working in libraries in ALCTS areas of interest. ALCTS presents 13 awards for lifetime achievement, excellence in publishing, excellence in acquisitions, cataloging, preservation, serials, innovation, collaboration, and leadership, for librarians new to the profession who show particular promise, and for support staff travel to the ALA Annual Conference. ALCTS also awards the Presidential Citation to members who have contributed significantly in recent years to the association but who do not qualify for any of the other ALCTS awards.

Ross Atkinson Lifetime Achievement Award

This award was established in 2007 to honor the legacy of Ross Atkinson, distinguished library leader, author, and scholar, whose extraordinary service to ALCTS and the

library community at large serves as a model for those who follow.

The award, sponsored by EBSCO, is given to recognize the contribution of a library leader through demonstrated exceptional service to ALCTS and its areas of interest (acquisitions, cataloging and classification, collection management and development, preservation and reformatting, and serials). The award consists of a citation and \$3000.

Edward Swanson Memorial Best of *LRTS* Award

The Best of *LRTS* Award is given to the author(s) of the best paper published each year in *LRTS*. Each of the papers published in the volume year is eligible for consideration with the exception of official reports and documents, obituaries, letters to the editor, and biographies of award winners. The award is given to the paper whose content is a significant contribution about one or more issues addressed by ALCTS and its sections. In 2011, it was named in memory of Edward Swanson in recognition of his numerous contributions to making *LRTS* an outstanding professional journal.

ALCTS Outstanding Publications Award

This award honors the author or authors of the year's outstanding monograph, article, or original paper in the field of technical services, including acquisitions, cataloging, collection management, preservation, continuing resources, and related areas in the library field. Papers published in *Library Resources & Technical Services*, the ALCTS journal, are ineligible.

Ulrich's Serials Librarianship Award

The Ulrich's Serials Librarianship Award is presented for distinguished contributions to serials librarianship demonstrated by such activities as leadership in serials-related activities through participation in professional associations and/or library education programs, contributions to the body of serials literature, conduct of research in the area of serials, development of tools or methods to enhance access to or management of serials, and other advances leading to a better understanding of the field of serials. ProQuest sponsors the Ulrich's Award.

First Step Award, a Wiley Professional Development Grant

The First Step Award, offered by John Wiley & Sons, provides a librarian new to the serials field with the opportunity to broaden perspectives and supports professional development by funding travel to the ALA Conference and by participating in Serials Section activities. All ALA members with five or fewer years of professional experience in the serials field, who have not previously attended

an ALA Annual Conference, are eligible. This award is presented to the librarian who shows a commitment to professional development in the serials field as evidenced by participation in continuing education activities, workshops, previous participation in professional activities, and a commitment to or interest in serials-related work.

HARRASSOWITZ Leadership in Library Acquisitions Award

The Leadership in Library Acquisitions Award, sponsored by HARRASSOWITZ in honor of Dr. Knut Dorn, is given to recognize the contributions by and outstanding leadership of an individual to the field of acquisitions librarianship. This recognition is made for individual achievement of the highest order.

Margaret Mann Citation

The Margaret Mann Citation is awarded by CaMMS for outstanding professional achievement in cataloging or classification through either publication of significant professional literature, participation in professional cataloging associations, or valuable contributions to practice in individual libraries. A \$2000 scholarship is donated by OCLC to the U.S. or Canadian library school of the winner's choice. The Mann Citation represents the highest recognition of a professional in the cataloging or classification area.

Esther J. Piercy Award

The Esther J. Piercy Award was established by the RTSD of ALA in 1968 in memory of Esther J. Piercy, editor of the *Journal of Cataloging and Classification* from 1950 to 1956 and of *LRTS* from 1957 to 1967. This award, sponsored by YBP, Inc., recognizes the contribution of a librarian with not more than 10 yr of professional experience who has shown outstanding promise for continuing contribution and leadership to those areas of librarianship included in library collections and technical services.

Paul Banks and Carolyn Harris Preservation Award

The Paul Banks and Carolyn Harris Preservation Award, sponsored by Preservation Technologies, L.P., recognizes the contribution of a professional preservation specialist who has been active in the field of preservation and/or conservation for library and/or archival materials and who has shown superb leadership in professional associations at local, state, regional, or national level; has made significant contributions to the development, application or utilization of new or improved methods, techniques, and routines and to the professional literature; and has been a leader in training and mentoring in the field of preservation.

George Cunha and Susan Swartzburg Award

Established in 2007 by the PARS, the award honors the memory of George Cunha and Susan Swartzburg, early leaders in cooperative preservation programming and strong advocates for collaboration in the field of preservation.

The award, sponsored by the Library Binding Institute (\$1250), acknowledges and supports cooperative preservation projects and/or rewards individuals or groups that foster collaboration for preservation goals. Recipients of the award demonstrate vision, endorse cooperation, and advocate for the preservation of published and primary source resources that capture the richness of our cultural patrimony. The award recognizes the leadership and initiative required to build collaborative networks designed to achieve specific preservation goals. Since collaboration, cooperation, advocacy, and outreach are key strategies that epitomize preservation, the award promotes cooperative efforts and supports equitable preservation among all libraries, archives, and historical institutions.

ProQuest Coutts Award for Innovation

The ProQuest Coutts Award for Innovation is given to recognize the contribution of an individual who has demonstrated innovation and excellence in the practice of electronic collection management and development. This new award has been established by the CMDS to recognize significant and innovative contributions to electronic collections management and development practice. The award consists of a citation, a listing on the ALCTS Awards website, and \$2000.

Outstanding Collaboration Citation

This Outstanding Collaboration Citation recognizes and encourages collaborative problem-solving efforts in the areas of acquisition, access, management, preservation, or archiving of library materials. It recognizes a demonstrated benefit from actions, services, or products that improve and benefit in providing and managing library collections.

Jan Merrill-Oldham Professional Development Grant

The Jan Merrill-Oldham Professional Development Grant is awarded by the ALCTS PARS to provide librarians and

paraprofessionals new to the preservation field with the opportunity to attend a professional conference and encourages professional development through active participation at the national level. The grant is to be used for airfare, lodging, and registration fees to attend the ALA Annual Conference.

Presidential Citations

These very special awards honor ALCTS members who make significant contributions to the association and to the profession but whose accomplishments do not fall within the criteria for ALCTS' other awards. They are awarded by the current ALCTS President. The Presidential Citation is intended to recognize distinguished achievement by a member or members.

ALCTS Honors

ALCTS Honors is intended to recognize ALCTS members who have dedicated themselves to ALCTS through their service. That service can be holding an office, being a committee member, a committee chair, task force member, or other service as deemed applicable. It is the totality of service that this award seeks to acknowledge.

CONCLUSION

ALCTS, as one of the "functional" divisions of ALA, represents the voice of the library community in matters that reflect its interests, issues, and concerns: acquisitions, cataloging and metadata, collection management, preservation and reformatting, and continuing resources. In this role, ALCTS is seen as the "expert" by a vast array of constituent organizations and individuals, nationally and internationally. ALCTS advocates for creating, collecting, organizing, delivering, and preserving information resources in all forms to the library and information communities through the development and promulgation of principles, standards, and best practices. ALCTS leads through its members by fostering educational, research, and professional service opportunities. ALCTS is committed to quality information, universal access, collaboration, and lifelong learning.

Association for Library Service to Children (ALSC)

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Abstract

The Association for Library Service to Children (ALSC) is one of 11 divisions of the American Library Association (ALA). Its members are drawn from the ranks of children's and school librarians, library educators, commercial vendors, and representatives of the children's book publishing community. Starting as the Club of Children's Librarians in 1900, it now boasts more than 4000 members and a broad-based program of activities focusing on advocacy, education, and partnerships. While best known outside of the library community for its implementation of the Newbery and Caldecott awards for distinguished contributions to American children's literature, the Association today engages in many activities and initiatives aimed at improving library services for children through the identification and promotion of best practices, the professional development of its members, and a strong program of advocacy.

INTRODUCTION

The Association for Library Service to Children (ALSC), one of 11 divisions of the American Library Association (ALA), is the primary American professional association for those who are concerned with the advancement of library service to children. Its members include children's librarians, school librarians, library educators, commercial vendors, and members of the children's book publishing community.

This entry looks briefly at the historical development of ALSC and discusses its current mission and activities. Among its more significant contributions to library service to children are the implementation of prestigious book awards, initiatives aimed at improving practice, continuing education and professional development, and advocacy.

HISTORY

Several of the pioneers of library service to children saw the need for both networking among their ranks and for acceptance within the larger library community. To this end, Caroline Hewins, Alice Jordan, and Anne Carroll Moore brought together a group of like-minded colleagues at the ALA Conference in Montreal in 1900; they called themselves the Club of Children's Librarians.^[1] A year later, in 1901, the Section for Library Work for Children was recognized by the parent organization, the ALA. Jacalyn Eddy notes that this was an important event in the recognition of library work for children as a bona fide specialization within the library profession.^[2] That section evolved into the American Association of School Librarians in 1915 and the Children's Library Association and

the Young People's Reading Roundtable in 1930. In 1941, those two associations and the roundtable merged to become the Division for Children and Young People. When ALA went through a restructuring in the mid-1950s, that division split into the Children's Library Association and the Association of Young People's Librarians, the latter being concerned with the relatively new specialization of teen services. In 1958, the Children's Library Association was renamed the Children's Services Division of the ALA and announced that it had "responsibility to speak for the ALA on those matters which concern children's books and other library materials and their use in libraries in any type which serve children."^[3] In 1976, the association changed its name to the Association for Library Service to Children, and it has retained this name since then.

ALSC TODAY

There are currently more than 4000 members of ALSC, making it the largest organization in the world dedicated to library services for children. Its 2006–2011 Strategic Plan claims as its core purpose: Creating a better future for children through libraries. It aims to accomplish that purpose through three primary goals involving advocacy, education, and collaboration.^[4]

Governance

ALSC accomplishes its goals and objectives through a complex governance structure. An elected Board of Directors provides leadership to the Association as a whole. Members participate directly in the work of the Association through committees. Membership on most committees

is by appointment of the vice president or president; but a few, specifically the more prestigious awards committees, are comprised of a mixture of elected and appointed representatives. Traditionally, ALSC committee members were required to attend both the midwinter and annual conferences. However, the development of new forms of electronic communication has made it possible recently for some committees to accomplish their work virtually without actually being present at the conferences.

ALSC committees are divided into eight priority groups: Child Advocacy, Evaluation of Media, Professional Awards and Scholarships, Organizational Support, Projects and Research, Awards, Partnerships, and Professional Development. A Priority Group Consultant, ordinarily an ALSC veteran with much experience serving on committees, is assigned to each of these committee clusters and is available to troubleshoot, answer questions, and provide leadership and guidance where needed.^[5]

ALSC maintains collegial relationships with the other two ALA divisions that promote library services to young people: The Young Adult Services Association (YALSA) and the Association of School Librarians (AASL). Their Boards meet together regularly to discuss matters of mutual concern, and their representatives on the ALA Council, along with other youth services librarians serving on that body, meet informally as a Youth Caucus.

The work of the association is funded through membership dues, grants, merchandise sales, and endowments. An Executive Director and office staff located at the ALA Headquarters in Chicago support the volunteer efforts of the membership.

Activities

Awards

Probably the activity for which ALSC is best known to the general public is its implementation of the Newbery and Caldecott Medals, the oldest and most prestigious awards given to children's literature in the United States. The idea for the Newbery Medal, an award given to the most distinguished contribution to American children's literature in a given year, came not from a librarian, but from the secretary of the American Bookseller's Association, Fredric G. Melcher. In 1919, he had launched Children's Book Week, a national initiative designed to promote the output of the emerging children's book publishing industry. Invited to speak about Children's Book Week at the 1921 ALA conference, he saw the possibilities within the library community for wider organized support for children's books. Writing in 1965 as he looked back on the evolution of the award, he noted many benefits that had occurred. Children's librarians had become more interested in the new books being published each year. Their status as a profession had increased. Creative people were more likely to write for children because award-

winning books had a longer life. He also paid tribute to the children's librarians in ALA who had cultivated the strict standards that gave the medal its luster.^[6]

Seventeen years later, children's book publishing had proliferated sufficiently to warrant a separate award for distinguished illustration. Again, Melcher was responsible for proposing the Caldecott Medal, which has been awarded every year since 1938. Originally, the Caldecott Medal book and runners-up were chosen by the same committee that named the Newbery Medal. In 1980, a separate Caldecott Committee was established.^[7] The prestige of these two awards has grown immensely. They are now announced, along with other ALA awards given to significant contribution to children's literature and film, at a press conference at the annual Midwinter Conference in the largest auditorium at the conference site. The award-winning author and illustrator and the ALA President are traditionally invited to appear the next morning on the *Today* show, and the awards are announced in the national news media. The gold seals on the books have become symbols of quality in literature for children.

Over the years, the ALSC leadership, with ALA's approval, has added many additional awards to highlight and promote contributions to different aspects of children's literature and related media. The Laura Ingalls Wilder Award was first given to its namesake in 1957; it honors an author or illustrator whose books published in the United States have made a lasting contribution to literature for children. Between 1960 and 1980, the Wilder Award was given every 5 years. From 1980 to 2001, it was awarded every 3 years. Beginning in 2001, it has been awarded every 2 years.^[8] The Mildred L. Batchelder Award honors a former executive director of the Association for Library Service to Children. Established in 1966, it is a citation awarded to an American publisher for a children's book for the most outstanding book originally published in a foreign language in a foreign country and subsequently translated into English and published in the United States.^[9] The Andrew Carnegie Medal for Excellence in Children's Video was awarded for the first time in 1991.^[10] In 1996, ALSC and Reforma, the National Association to Promote Library and Information Services to Latinos and the Spanish-Speaking, established the Pura Belpré Award, presented to a Latino/Latina writer and illustrator whose work best portrays, affirms, and celebrates the Latino cultural experience in an outstanding work of literature for children and youth. Originally given every other year, it becomes an annual award in 2009.^[11] Nonfiction, while eligible for both the Newbery and Caldecott awards, is singled out for special attention with the Robert F. Sibert Informational Book Medal, established in 2001.^[12] Awards that honor contributions by African-American authors and illustrators are not given by ALSC; they are an activity of the Coretta Scott King Task Force of the Ethnic and Multicultural Materials Information Exchange Roundtable (EMIERT) of ALA.^[13] More recently, the American Indian

Library Association, an ALA affiliate association, has launched its own awards honoring American Indian authors and illustrators of books for children.^[14] The Theodor Seuss Geisel Award, established by ALSC in 2004 and first presented in 2006, is given to the author and illustrator of the most distinguished American book for beginning readers.^[15] The newest award is the Odyssey Award for Excellence in Audiobook Production. It is jointly administered by ALSC and the Young Adult Library Services Division.^[16]

The awards administered by ALSC have done a great deal to publicize quality children's literature and have helped to legitimize the role of children's librarians in promoting the best in children's books. However, ALSC has also worked to improve the practice of children's librarianship in areas other than book evaluation and the related area of collection development.

Improving Practice

This entry will focus on just three activities undertaken by ALSC that have as their objectives the improvement of library service to children. The first of these is the development of a set of core competencies for children's librarians. Established in 1999, the competencies outline a broad range of skills, knowledge, and aptitudes required for those professionals who practice the specialization of children's librarianship. The competencies are divided into seven broad categories: knowledge of client group; administrative and management skills; materials and collection development; programming skills; advocacy; public relations, and networking skills; and professionalism and professional development. As the authors of a book that provides resources and examples of best practices related to the competencies point out, children's librarians are "the original multitaskers of the library world."^[17] The ALSC competencies are intended to guide children's librarians as they develop their professional skills and also to inform public library administrators about what they can and should expect from these specialists.

Every Child Ready to Read (ECRR) is a collaborative initiative sponsored by ALSC and the Public Library Association (PLA). ECRR began with a partnership between PLA and the National Institute of Child Health and Human Development (NICHD). In 2000, NICHD had released the National Reading Panel's Report outlining research-based findings on reading development in America's children. PLA partnered with NICHD to disseminate the report through public libraries. The next step in the collaboration was to develop model public library programs that incorporated the research. PLA contracted with two emergent literacy researchers, Dr. Grover C. Whitehurst and Dr. Christopher Lonigan, to develop a model program for parents and caregivers that would give them the skills for preparing young children to read.

ALSC joined PLA as a partner in this endeavor. They selected 20 demonstration sites representing a broad range of library size and population demographics. The sites tested and evaluated the materials. In 2002, a second round of evaluation testing was conducted at 14 sites. Finally, the materials that were developed by Whitehurst and Lonigan were packaged as scripted workshops and made available for purchase or through free downloads on the ALA Web site.^[18] In addition to the research-based curriculum that is aimed at encouraging early literacy skills in infants, toddlers, and preschoolers, there is an emphasis on modeling techniques such as dialogic reading during regular library storytimes.^[19] Anecdotal evidence suggests that the ECRR approach to library-sponsored parent and caregiver education has been widely adopted, but an evaluation study is currently being conducted to see just how broadly the materials are being used.

Finally, *El día de los niños/El día de los libros* (Children's Day/Book Day) is an activity that calls attention to the growing Latino and Spanish-speaking population of the United States. *Día*, as the initiative is known, is a celebration of children, families, and reading that emphasizes the importance of literacy for children of all linguistic and cultural backgrounds. Children's book author Pat Mora proposed linking the already existing observation of Children's Day with literacy. ALSC has joined with REFORMA to sponsor the annual event, now celebrated on April 30. Funding from the W.K. Kellogg Foundation and Target has helped to generate promotional materials and national interest. Public libraries have observed *Día* in a number of ways, from community festivals to author visits and booklists celebrating Latino culture and heritage.^[20]

Continuing Education and Professional Development

Programs such as ECRR and *Día* are initiatives designed to generate best practices in particular areas of library service to children. Through a wide program of continuing education, ALSC aims to provide multiple forums for children's librarians to develop professionally and presumably to then provide increasingly effective service to children.

There are three primary vehicles for providing continuing education opportunities to the ALSC membership. These are conference programs, regional institutes, and publications. The ALA holds two conferences each year. The Midwinter Conference is intended as a working meeting for the leadership of the Association and its divisions. Boards, divisions, roundtables, task forces, and committees meet, but association policy dictates that there be no programs for the general membership.

The Summer Conference, on the other hand, is a three-ring circus with program offerings from morning to night from Saturday through Monday. Many ALSC committees organize programs designed to educate and update members

on emerging trends and current thinking about best practices. The preliminary program for the 2008 summer conference in Anaheim indicates a wide array of continuing education offerings for ALSC members on topics ranging from readers' theater to programming for non-English-speaking preschoolers and their families to Library 2.0 for children's librarians and gaming for elementary school children. The summer conference is also a venue for showcasing authors, illustrators, and distinguished speakers from related fields. Distinguished pediatrician, Dr. Barry Brazelton, was the keynote speaker at the ALSC President's Program in 2008.

In addition to the programming offered through the annual summer conferences, ALSC has made a practice of holding a 2-day national institute every 2 years. These institutes, held in different parts of the country, have tended to focus on two or three current issues. In September, 2008, for example, the Institute features three tracks: technology and children's services, programming in the new millennium, and reading promotion with an emphasis on "twens."^[21]

Advocacy

ALSC organizes its working committees into priority groups, and Priority Group 1 is concerned with child advocacy. The function statement for this cluster of activities reads: "To identify, evaluate and make recommendations on issues, legislation and services concerning children on the local, state and national levels."^[22] The Committees charged with this general function include Intellectual Freedom, International Relations, Legislation, Library Service to Special Population Children and their Caregivers, Early Childhood Services and Programs, Public Awareness, and School-Age Programs and Services. The International Relations committee has been active recently, calling attention to books that foster global perspectives and international understanding. Both the Intellectual Freedom and Legislation committees also meet with their counterparts from other ALA divisions in larger assemblies of interest. Together, these committees help to ensure that ALSC meets its responsibilities to advocate for the well-being of children in the larger society as well as within the library profession.

CONCLUSION

As ALSC embarks on its second century of service, it faces new challenges and opportunities. Its existing leadership is drawn from the ranks of librarians who are facing retirement; in fact, both its 2008–2009 president and vice president/president-elect have already retired. There is some danger that the Association, with its many years of tradition, may be perceived as being a little stodgy. It must find a way to attract more young librarians to join, become

active, and be judged ready to assume responsible positions in the very near future. These younger professionals promise to bring fresh perspectives that may revitalize current activities of the association and suggest important new directions. One of the strategies being used to draw in younger professionals is an increased use of digital media to communicate with members—the ALSC wiki and blog as well as its discussion list—and the opportunity to participate in some committees virtually without the need to be physically present at conferences.

While the hundred-plus years of history may sometimes feel like an albatross around the neck of those members who would like the Association to be more innovative, this sense of tradition and stability also attracts many potential partners to work with its staff and leaders. Head Start, NASA, and producers of public television programs such as *Between the Lions* and *Dora the Explorer* have all initiated partnerships with ALSC.

ALSC has made a permanent imprint on children's book publishing and children's reading through the prestigious awards it bestows on works of distinction. It has yet to make the same impact on digital media for children, in spite of its efforts to promote "great Web sites for kids." Perhaps this will be a contribution of the second 100 years.

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Association of College and Research Libraries (ACRL)

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Abstract

The Association of College and Research Libraries (ACRL) is the higher education association for librarians. Representing more than 10,500 academic and research librarians and interested individuals, ACRL (the largest division of the American Library Association) is the only individual membership organization in North America that develops programs, products, and services to help academic and research librarians learn, innovate, and lead within the academic community. Founded in 1940, ACRL is committed to advancing learning and transforming scholarship. ACRL represents librarians working with all types of academic libraries—community and junior college, college, and university—as well as comprehensive and specialized research libraries and their professional staffs. ACRL activities are guided by the core values, vision, and goals in ACRL's strategic plan, the Plan for Excellence. The core purpose of ACRL is to lead academic and research librarians and libraries in advancing learning and transforming scholarship. ACRL advances its work by serving as a channel of communication among academic librarians, faculty, students, administrators, other information professionals, higher education organizations, federal, state, and local governments, and the larger society. It is the leading professional organization of choice for promoting, supporting, and advancing the values of academic libraries to the higher education community. ACRL and, indeed, the American Library Association itself, were founded to establish regular channels for communication among librarians. Today ACRL is a dynamic, inclusive organization that has grown into a large association encompassing all types of positions in all types of academic and research libraries.

INTRODUCTION

The Association of College and Research Libraries (ACRL) is the higher education association for librarians. Representing more than 10,500 academic and research librarians and interested individuals, ACRL (the largest division of the American Library Association) is the only individual membership organization in North America that develops programs, products, and services to help academic and research librarians learn, innovate, and lead within the academic community. Founded in 1940, ACRL is committed to advancing learning and transforming scholarship. ACRL represents librarians working with all types of academic libraries—community and junior college, college, and university—as well as comprehensive and specialized research libraries and their professional staffs. In July 2015, ACRL had a total of 10,598 members (accounting for 18.9% of ALA's membership): 9,941 personal members, 639 organizational members, and 18 corporate members. Approximately 43% of the personal members work in research/doctoral-granting institutions, 24% in comprehensive institutions, 15% in four-year colleges, 12% in two-year/technical institutions, 1% in independent research libraries, and 1% in information-related organizations. ACRL activities are guided by the core values, vision, and goals in ACRL's strategic plan, the Plan for Excellence. The core purpose of ACRL is to lead academic and research librarians and libraries in advancing learning and transforming scholarship.

ACRL advances its work by serving as a channel of communication among academic librarians, faculty, students, administrators, other information professionals, higher education organizations, federal, state, and local governments, and the larger society. It is the leading professional organization of choice for promoting, supporting, and advancing the values of academic libraries to the higher education community. ACRL and, indeed, the American Library Association itself, were founded to establish regular channels for communication among librarians. Today ACRL is a dynamic, inclusive organization that has grown from its early origins of college and reference librarians to a large association encompassing all types of positions in all types of academic and research libraries. ACRL members hold a variety of positions and responsibilities in the areas of management, public and information services, technical services, online services, assessment, information literacy, data curation and management, collection development, rare books and special collections, nonprint media, and distributed education.

ORIGINS OF ACRL

Since the late nineteenth century, conferences and meetings of professional groups have been an American institution. They reflect our penchant for association and our passion for professional self-improvement. In 1853 American librarians held their first convention in New York City.

About one-fifth of the 81 librarians who attended the meeting were college librarians.^[1] Not until a generation had passed, however, and the crisis surrounding the Civil War was over, did American librarians hold a second national meeting. In the spring of 1876, Melvil Dewey and Frederick Leypoldt sent out their famous call for a conference of librarians to promote “efficiency and economy in library work.”^[2] Of the 103 librarians present when the conference convened in Philadelphia on September, 10 were college librarians.^[3] The focal point of the 1876 meeting was the reading of papers on practical library subjects such as cooperative cataloging, indexing, and public relations. The response to the program was apparently positive because the conference participants voted on the final day of the meeting to establish the American Library Association and to hold Annual Conferences.^[4]

From the beginning, the American Library Association was a predominantly public library organization. But, the areas of common interest between public and academic libraries are extensive, and for the first dozen years of the association’s existence the college librarians attending ALA conferences did not hold separate meetings. Finally, in 1889, a group of 13 college librarians caucused at the Annual Conference in St. Louis and recommended that a college library section be formed. The following year at the 1890 Annual Conference in the White Mountains of New Hampshire, 15 librarians representing most of the major colleges of the Eastern seaboard, including Harvard, Yale, Columbia, the Massachusetts Institute of Technology, and Brown, held the first meeting of the College Library Section.^[5] The new section was a small, relatively informal discussion group attended for the most part by administrators who could afford long distance travel. The annual meetings of the section provided a forum for the presentation and discussion of papers on such topics as reference work, cataloging, departmental collections, union lists, and the like.^[6]

In 1897, the section acquired a new name, the College and Reference Library Section (to recognize the participation of reference librarians) and, after the turn of the century, began to select officers to plan annual meetings. Not until 1923, however, did the section adopt its own bylaws and thereby cross the line that separates a discussion group from a section within ACRL today. The 1923 bylaws regularized the existence of the section by establishing a Board of Management with three officers to conduct the business of the section between conferences and provided for the levying of annual membership dues of 50 cents.^[7] During the course of the 1920s, attendance at section meetings grew from 90 in 1923 to 240 in 1926 and peaked at 800 in 1928 before dropping off to 600 in 1929. The meeting program of the section during the twenties and thirties included general sessions for the whole section as well as separate roundtables for college and reference librarians. The topics discussed at the early section meetings are issues that still confront academic librarians today: faculty status and personnel classification, teaching students, interlibrary loan, library standards, etc.^[8]

From 1890 to 1938, the College and Reference Library Section served primarily as a forum for discussion. But, beginning in the 1920s, pressure began to build in the academic library profession for the creation of a stronger professional organization capable of undertaking a broad range of activities, programs, research, and publications. The occasion for a radical restructuring of the section came in the mid-1930s when ALA roundtables representing teachers, college librarians, and junior college librarians expressed the desire to affiliate with the College and Reference Library Section. In 1936, the chair of the section appointed a Committee on Reorganization to develop plans for restructuring the section. The final report of the committee in 1938 recommended the adoption of new bylaws that would transform the section into an Association of College and Reference Libraries with full autonomy over its own affairs. The new bylaws provided for the creation of subsections within the association for college libraries, junior college libraries, teachers college libraries, university libraries, and other groups that might wish to affiliate.

ACRL BECOMES A DIVISION

The section approved the proposed bylaws in June 1938 and officially became the Association of College and Reference Libraries (ACRL) by the end of the year. The ALA Council responded by ratifying a new ALA constitution that made provision for the creation of self-governing divisions within ALA, entitled to receive a share of ALA dues.

ACRL swiftly prepared a new constitution to meet the conditions for division status, and the ALA Council recognized ACRL as ALA’s first division on May 31, 1940.^[9] The Association of College and Reference Libraries started its new life with six nearly formed subsections of its own: Agricultural Libraries Section, College Libraries Section, Junior College Libraries Section, Librarians of Teacher Training Institutions Section, Reference Libraries Section, and University Libraries Section. When the Reference Libraries Section departed to join the newly formed Library Reference Services Division in 1956, ACRL substituted “Research” for “Reference” in its name and became the Association of College and Research Libraries.^[10] With its sections, chapters, and discussion groups, ACRL grew rapidly after its beginnings in 1938: membership jumped from 737 in 1939 to 2,215 in 1941, rose to 4,623 in 1950, increased to 9,324 in 1975, reached 11,524 in 2000, and dropped back to 10,598 in July 2017.^[11]

ACRL Office

First executive secretary

ACRL and its network of sections and committees grew so rapidly after 1938 that by the end of World War II the association could no longer, as A. H. Kuhlman put it, “be expected to run of its own accord.”^[12] The elected leaders

of ACRL were convinced that it was now essential to have a professional executive secretary, working under the direction of the president and Board of Directors, to integrate the activities and services of the association. As early as 1931, the ALA Council, recognizing that the interests of academic libraries had not always received adequate attention at ALA headquarters, authorized the appointment of a College Library Advisory Board (CLAB) to advise the ALA Board of Directors on academic library questions. One of the first recommendations of CLAB was that a full-time academic library specialist be employed at ALA headquarters to provide information and advisory services for college librarians. The ALA Council approved this recommendation for a college library specialist in principle, but throughout the rest of the 1930s and the war period, ALA never found the money to fill the position.^[13] The issue came to a head in 1946 when ACRL, with its growing membership and pressing need for professional staff, made clear that it would seriously consider withdrawal from ALA if the question of funds for a paid executive was not resolved satisfactorily. ALA responded within the year by appropriating funds to finance an ACRL headquarters staff.^[14]

Orwin Rush, the librarian of Clark University, came to ALA headquarters in the spring of 1947 as ACRL's first executive secretary. After launching the new ACRL office and clearing the way for its future, Rush departed for the University of Wyoming in 1949. In his place came "young Arthur Hamlin, fresh from the University of Pennsylvania." Hamlin described the ACRL office in the early fifties this way: "Physically, the ACRL headquarters office is a second floor front room, complete with fireplace, in the large, old-fashioned, reconverted mansion which is ALA headquarters at 50 East Huron Street in Chicago. Here an active staff of four, the executive secretary, the publications officer, a secretary and a clerk-typist, with their typewriters, telephones, file cabinets, and visitors hold forth. Like many a library staff area, ACRL headquarters is a noisy, crowded, active place."^[15] In 1961, a modern headquarters building replaced the old mansion.

Communities of Practice

One of ACRL's primary strengths is the effectiveness of its communities of practice, including committees, discussion groups, editorial boards, interest groups, sections, and chapter affiliates in meeting the interests of ACRL's diverse membership. Membership in ACRL provides opportunities to become involved with communities of practice that focus on specializations within the profession. The 44 chapter affiliates provide members with networking opportunities at the local level throughout the North America.

Chapters

In 1952, ACRL took the first step toward encouraging participation at the local level by recognizing its first local

chapter—the Philadelphia Area Chapter. ACRL currently has 44 chapters, two of which include Canadian provinces. In 2017, two new chapters formed: a second Michigan chapter affiliated with the Michigan Academic Library Association, and the ACRL Idaho chapter. The purpose of the chapters is to bring the national organization closer to individual members and to provide programs beneficial to members at the local level.

Discussion Groups

In the 1970s, ACRL added a new community of practice to its national organization—the discussion group. As of September 2017, ACRL had 22 discussion groups. In a sense, the discussion groups are a reincarnation of the original College Library Section. They provide a relatively informal framework for librarians with similar interests to gather to exchange ideas and information.

Interest Groups

In 2008, ACRL members approved a bylaws change allowing for the creation of Interest Groups. As of September 2014, ACRL members can affiliate with an unlimited number of sections and interest groups with no additional charge. By October 2009, seven new interest groups were established including Academic Library Services to International Students, Health Sciences, Image Resources, Numeric and Geospatial Data Services in Academic Libraries, Residency Programs, Universal Accessibility, and Virtual Worlds. In May 2011, the Digital Curation Interest Group was approved by the Board. In June 2012, the Librarianship in For-Profit Educational Institutions Interest Group and the Library and Information Science (LIS) Education Interest Group were approved by the Board. In June 2013, the Technical Services Interest Group was approved by the Board. In 2017 the Board approved the 5 new interest groups including the Academic Library Services for Graduate Students Interest Group, the Asian, African, and Middle Eastern Studies Interest Group, History Librarians Interest Group, Institutional Research Interest Group, and Library Services for Graduate Students Interest Group. As of 2017, ACRL had 21 interest groups.

Sections

By 1979, the association had 13 sections: the three "types-of-libraries" sections (College, Community College, and University) plus the Arts Section, Asian, African, and Middle Eastern Section (which became an interest group in 2017), Anthropology Section, Instruction Section (name changed from the Bibliographic Instruction Section in 1995), Education and Behavioral Sciences Section (into which the old Teachers Training Section was incorporated), Public Policy and International Relations Section

(name changed from Law and Political Science Section in 2016), Rare Books and Manuscripts Section, Science and Technology Section (with which the Agricultural Section was merged), European Studies Section (created by a merger of the Slavic and East European Section and the Western European Studies Section in 2017). Between 1987 and 1990, three more sections were formed: Women's Studies Section in 1987 (name changed to Women and Gender Studies in 2011); African-American Studies Librarians Section in 1989 (which became an interest group in 2016); and the Distance Learning Section in 1990 (name changed from Extended Campus Libraries Services Section in 1998). In 1994, the Literatures in English Section (name changed from English and American Literature Section in 2000) was formed. By 1997, ACRL had 17 sections, and this number remained static until 2017 when the number dropped to 15 sections following the merger of SEES and WESS as well as the transition of AAMES and AFAS to interest groups. The Digital Scholarship Section was created in 2017.

Coordination and Oversight

It is the responsibility of the ACRL executive director and staff to coordinate the work of ACRL's 55 committees, 16 sections, 22 division-level discussion groups, 9 editorial boards, 21 interest groups, 22 discussion groups, and 44 chapters. To ensure the smooth operation of this complex structure, the headquarters staff monitors the many procedural details associated with appointments, archiving, awards, budgets, elections, meetings, programs, reports, and so on. ACRL currently has 15.75 FTE approved positions for its Chicago office (housed in the ALA headquarters) and 22.4 positions for its *CHOICE* office in Middletown, Connecticut. The ACRL office works closely with committees and sections to plan stimulating meetings at ALA conferences, and also manages the arrangements for ACRL preconferences and conferences. Planning for these conferences begins years in advance as detailed arrangements are worked out for hotel space, meeting times, exhibits, programs, publicity, and finances.

The ACRL office supports ACRL's publication program by providing assistance to the editors of *C&RL*, *RBM*, and *Publications in Librarianship*, by working closely with the editor of *CHOICE* who reports to the executive director, by publishing and distributing the many publications of ACRL committees and sections, and by writing, editing, and publishing *C&RL News*, the association's monthly news publication. With the exception of *CHOICE*, the ACRL staff based in Chicago manages the production of all ACRL books and journals.

Clearinghouse

Together with the ALA Headquarters Information Center, the ACRL office serves as a clearinghouse for information on academic library concerns and issues. The office

handles inquiries regarding policies and practice. It also offers information about ALA activities and services and is in daily contact with the staff of other ALA divisions and offices, including the Washington Office.

Ambassador

ACRL serves as the ambassador for academic libraries and librarians at ALA headquarters. The ACRL Executive Director plays a key role in representing the association to other library and information associations as well as to higher education and government communities. In this role, the executive director attends meetings and gives presentations in many parts of the country each year. In doing so, the director strives to maintain and establish lines of communication between the academic library profession and other communities. In 1984, a new standing committee, the Professional Liaison Committee, was established to further cooperative efforts and to put stronger emphasis on ACRL's liaison efforts with other associations. To build upon this work, in 1995, the ACRL Board developed the Professional Liaison Committee as the Council of Liaisons, identifying an initial nine important higher education associations to which it will send a liaison. The Council and the Board annually review the list of liaison organizations. In 2009, the Board expanded its liaison work and reconstituted the Council of Liaisons as the Liaison Coordinating Committee.

Strategic Planning

Guiding all association activity is the strategic planning process adopted by ACRL. This process relies on member input to articulate the direction of the professional organization, and to identify areas of highest priority for association activity. Since 1981, ACRL has updated its strategic plan, mission, and vision on a regular basis. Each year the ACRL Board of Directors sets the priorities and performance indicators for the association. At the 2003 Midwinter Meeting, the Board authorized contracting with Tecker Consultants to lead a strategic planning process. Extensive data gathering took place including telephone interviews, focus groups, leadership sessions, and an all-member web-based survey. The Board reviewed the data, drafted a plan, tested its thinking with the members, and made revisions. The new strategic plan, "Charting Our Future: ACRL Strategic Plan 2020," was approved by the Board at the 2004 Annual Conference and is reviewed annually with minor changes being made each fall at the Fall Executive Committee Meeting. The Board is now working to encourage ACRL's units to align their work with the strategic plan. The Board began a new strategic planning cycle at the 2010 Midwinter Meeting which culminated in a new "Plan for Excellence" which was approved in June 2011. The Board reviews progress on the plan at its annual Strategic Planning Session and makes

adjustments as needed. In September 2015, the Board began discussion on the revision of the Plan for Excellence and in March 2016 approved updates to the goals and objectives.

IMPACT ON HIGHER EDUCATION, SCHOLARLY COMMUNICATION, AND CIVIC DEVELOPMENT

ACRL is ALA's key link to the higher education community, and one of ACRL's strategic directions is to ensure that the contributions of academic and research libraries and librarians to higher education, scholarly communication, and civic development are recognized by society. To this end, ACRL has undertaken several initiatives.

Working with Higher Education Associations

In 1995, ACRL identified a number of higher education organizations with which to share ideas and implement programs in areas of mutual interest. ACRL assigned member liaisons to these organizations and these individuals comprised the ACRL Council of Liaisons. The ACRL Board expanded the work of its liaison program in 2010 under the umbrella of a Liaison Coordinating Committee that encouraged ACRL units to explore liaisons and work with other associations. These organizations currently include: the Academy of Criminal Justice Sciences (ACJS), American Anthropological Association (AAA), American Association for the Advancement of Science (AAAS), American Association of Community Colleges (AACC), American Chemical Society (ACS), American Institute of Biological Sciences (AIBS), American Physical Society (APS), American Political Science Association (APSA), American Society for Engineering Education (ASEE), American Sociological Association (ASA), Association for Information Science and Technology (AIST), Association for Library and Information Science Education (ALISE), Association for the Study of African American Life and History (ASAALF), Council of Botanical and Horticultural Libraries, Council of Independent Colleges (CIC), EDUCAUSE Learning Initiative (ELI), International Association of Aquatic and Marine Science Libraries and Information Centers, Medical Library Association (MLA), Modern Language Association (MLA), National Resource Center for the First-Year Experience, National Women's Studies Association (NWSA), Society for College and University Planning (SCUP), Society for Information Technology and Teacher Education (SITE), Special Libraries Association (SLA), and the United States Agricultural Information Network. One of ACRL's early successful liaisons was with the American Association for Higher Education (AAHE), which ceased operations in mid-2005. Sample collaborative activities included joint sponsorship of a provosts' luncheon at the AAHE annual conference and AAHE participation in developing the Information Literacy

Competency Standards for Higher Education. ACRL has also developed subject-specific information literacy standards in collaboration with subject discipline organizations. ACRL also belongs to the Council for Higher Education Management Association (CHEMA), and the Coalition for Networked Information (CNI), which has led to increased collaboration. In 2011, ACRL partnered with the Association for Institutional Research (AIR), the Association of Public and Land-grant Universities (APLU), and the Council of Independent Colleges to convene two national summits as part of the IMLS-funded project "Building Capacity for Demonstrating the Value of Academic Libraries." In September 2012, ACRL continued its partnership with AIR and APLU on the three-year "Assessment in Action: Academic Libraries and Student Success" program, made possible by IMLS. ACRL has also collaborated with CIC through participating and supporting CIC's Information Literacy and Fluency workshops for campus teams of librarians, subject-discipline faculty, and administrators. Beginning in 2010, ACRL increased its presence with the American Council of Learned Societies, and the executive director has been invited to make several presentations on scholarly communication and open access.

Standards and Guidelines

Developing standards is an area where ACRL committees have made some of their most important contributions to academic librarianship. In 1957, the ACRL Committee on Standards, after two years of work, produced the "first real set of 'Standards for College Libraries' to enjoy the consensual support of the profession."^[16] Since then, ACRL committees have developed standards for university libraries and two-year learning resources programs. In 2004, the ACRL Board approved the outcomes-based "Standards for Libraries in Higher Education," inclusive of all academic libraries, and this standard was revised in 2011. ACRL recruited and hired a team of trainers and have a licensed one-day workshop, "Planning, Assessing, and Communicating Library Impact: Putting the Standards for Libraries in Higher Education into Action," to a variety of campuses and chapters. Guidelines have also been developed in many specific areas including cultural competencies, personnel, instruction, branch libraries, library services for distance education, rare books and special collections, and undergraduate libraries. "Standards for Libraries in Higher Education" (2011) took the 2004 outcomes model a step further and are designed to guide academic libraries in advancing and sustaining their role as partners in educating students, achieving their institutions' missions, and positioning libraries as leaders in assessment and continuous improvement on their campuses.

In January 2000, the ACRL Board approved the "Information Literacy Competency Standards for Higher Education." The American Association of Higher Education and the Council of Independent Colleges have endorsed these

standards and they are widely used on campuses across the country. There is global interest in the information literacy competency standards and they have been translated into 8 languages. Discipline-based information literacy guidelines have been developed for anthropology and sociology, journalism, literatures in English, political science, psychology, science and technology, as well as teacher education.

In June 2012, the Board approved recommendations of a review task force that ACRL's "Information Literacy Competency Standards for Higher Education" be extensively revised. In spring 2013, a second task force began the revision process, leading to the development of a draft "Framework for Information Literacy for Higher Education." Following a process that included several drafts and public comment periods, the Board took the official action of approving the Framework at the 2017 ALA Annual Conference in Orlando.

Among its guidelines in the personnel arena, the ACRL Committee on Academic Status in 1971 drew up "Standards for Faculty Status for College and University Libraries." The ACRL Board approved the Standards in June 1971, and as a corollary, ACRL drafted a "Joint Statement on Faculty Status of College and University Librarians" with the American Association of Colleges (AAC) and the American Association of University Professors (AAUP). ACRL, AAC, AAUP, and a host of other associations endorsed the statement, which laid down a clear definition of the obligations and benefits of academic status. This Joint Statement was reaffirmed by the ACRL Board of Directors at the 2007 Annual Conference. In 1992, "Standards for Faculty Status for College and University Librarians" was revised—"the first revision of this seminal document in the 21 years that had elapsed since its approval by a voice vote of the membership at Dallas in 1971."^[17] At the 1993 Midwinter Meeting, the ALA Council, by consent, approved the incorporation of the revised Standards into the ALA Handbook of Organization. Council's exceptional action reaffirms "faculty status as the desired and appropriate condition of academic librarians nationally and lends the document the support of the prestigious parent body."^[18] A new revision of the Standards was approved by the ACRL Board of Directors at the 2011 Annual Conference.

In 1997, the Board approved changing the name of the Academic Status Committee to the Academic Librarians Status Committee, and by 2013, the Board decided it was best to take up the revision of these guidelines with task forces as needed and dissolved the standing committee. At the 2005 Annual Conference, the ACRL Board of Directors approved an updated version of the "Guidelines for the Appointment, Promotion, and Tenure of Academic Librarians." At the 2006 Midwinter Meeting, the ACRL Board of Directors approved the "Guidelines for Media Resources in Academic Libraries" and a revision of the "Guidelines for Academic Status for College and University Librarians." The 2007 Annual Conference saw the ACRL Board of Directors reaffirm the 1989 "Statement on the Certification & Licensing of Academic Librarians"

and the "Statement on the Terminal Professional Degree for Academic Librarians," and approve the "Standards for Proficiencies for Instruction Librarians and Coordinators." 2009 through mid-2011 saw a number of standards revised and developed, including "ALA-SAA Joint Statement on Access to Research Materials in Archives and Special Collections Libraries," "Guidelines for Curriculum Materials Centers," "A Guideline for Appointment, Promotion and Tenure of Academic Librarians," "A Guideline for the Screening and Appointment of Academic Librarians," "Information Literacy Standards for Teacher Education," "Psychology Information Literacy Standards," "Standards for Proficiencies for Instruction Librarians and Coordinators: A Practical Guide," "Statement on the Certification & Licensing of Academic Librarians," and "Statement on the Terminal Professional Degree for Academic Librarians."

New and revised standards approved from 2012 through 2017 include "ACRL Statement on Academic Freedom," "ACRL/RBMS Guidelines For Interlibrary And Exhibition Loan of Special Collections Materials," "Characteristics of Programs of Information Literacy that Illustrate Best Practice: a Guideline," "Competencies for Special Collections Professionals," "Guidelines for Recruiting Academic Librarians," "Diversity Standards: Cultural Competency for Academic Libraries," "Framework for Information Literacy for Higher Education," "Guidelines for University Library Services to Undergraduate Students," "Joint Statement on Faculty Status of College and University Librarians," "Proficiencies for Assessment Librarians and Coordinators," "Roles and Strengths of Teaching Librarians," and "Standards for Distance Learning Library Services."

Awards

The ACRL awards program honors the best and brightest stars of academic librarianship. Sixteen awards recognize and honor the professional contributions and achievements of ACRL members. This special recognition by ACRL enhances the sense of personal growth and accomplishment of its members, provides its membership with role models, and strengthens the image of its membership in the eyes of employers, leadership, and the academic community as a whole. Among its most prestigious achievement awards are the Academic/Research Librarian of the Year Award and the Excellence in Academic Libraries Awards, both sponsored by GOBI Library Solutions from EBSCO.

There are three basic types of ACRL awards: achievement and distinguished service, research/travel grants, and publications. Achievement and distinguished service awards are intended to honor academic and research librarians for significant past achievements, such as publications, program development, or general leadership in the profession. Such awards include a plaque and may also involve a cash award. Research and travel awards, normally in the form of grants, can also recognize past

achievements, but their main purpose is to assist academic and research librarians in completing a research project, usually relating to some aspect of academic or research librarianship. Publication awards are given for outstanding articles, bibliographies, catalogs, etc. ACRL awards are given to either individuals or groups. Depending upon the terms of the award, recipients do not necessarily need to be members of ACRL.

Value of Academic Libraries

As librarians are increasingly called upon to demonstrate the value of academic libraries and their contribution to institutional goals, ACRL is responding with research and resources to support the profession in meeting this challenge. ACRL's Value of Academic Libraries Initiative, part of the 2011 Plan for Excellence, is a multiyear project designed to provide academic librarians with competencies and methods for demonstrating library value relative to the mission and goals of postsecondary institutions.

ACRL has long been concerned with accountability, assessment, and student learning. In the early 1980s, ACRL was on the cutting edge of these issues with a publication on assessment to "stimulate librarians' interest in performance measures and to provide practical assistance so that librarians could conduct meaningful measurements of effectiveness with minimum expense and difficulty." The association is a national authority that the higher education community looks to for standards and guidelines to enhance library effectiveness.

Building on this work and given the emphasis on assessment issues, ACRL leadership and staff held an invitational meeting in 2009 with members of the library research community to discuss actions related to assessing and documenting library value. ACRL then commissioned a report on existing research and literature on the topic: *The Value of Academic Libraries: A Comprehensive Research Review and Report*. This report recommends that ACRL create a professional development program to build the profession's capacity to document, demonstrate, and communicate library value in alignment with institutional goals.

In response, ACRL, together with three partners – the Association for Institutional Research, Association of Public and Land-grant Universities, and the Council of Independent Colleges – was awarded an IMLS grant in 2011 from the Federal Institute of Museum and Library Services for a National Leadership Collaborative Planning Grant Level II. The grant proposal, "Building Capacity for Demonstrating the Value of Academic Libraries," submitted in February 2011, covered costs to convene two national summits in late fall 2011 to determine the professional competencies that librarians need. College and university chief academic officers, senior institutional researchers, representatives from accreditation commissions and higher education organizations, and academic librarians attended the summits to share their best thinking. A white paper, "Connect, Collaborate, and

Communicate: A Report from the Value of Academic Libraries Summits" summarizing the findings and setting a framework for future action was published in June 2012.

As a direct result of the IMLS collaborative planning grant, ACRL submitted a follow-up proposal in early 2012 and was awarded a National Leadership Demonstration Grant of \$249,330 by the IMLS for the program "Assessment in Action: Academic Libraries and Student Success" (AiA) in September 2012. A professional development program to strengthen the competencies of librarians in campus leadership and data-informed advocacy has been designed, implemented, and evaluated. The project goals and anticipated outcomes consider the experiences of students in academic libraries and the impact of the library on student learning and success. Over 200 institutions have participated in the three-year project. Each participating institution identified a team, consisting of a librarian and at least two additional team members as determined by the campus (e.g., faculty member, student affairs representative, institutional researchers, academic administrator). The librarians participated as cohorts in a 14-month long professional development program that included team-based activities carried out on their campuses. Supported by a blended learning environment and a peer-to-peer network, the librarians led their campus team in the development and implementation of an action-learning project, examining the impact of the library on student success, and contributing to assessment activities on their campus. In January 2015, ACRL released a report synthesizing the project reports of the first 75 teams to participate in the AiA program. A report synthesizing the second-year projects was issued in fall 2015, "Academic Library Contributions to Student Success: Documented Practices from the Field." Additional reports were published in 2016 ("Documented Library Contributions to Student Learning and Success: Building Evidence with Team-Based Assessment in Action Campus Projects") and 2017 ("Academic Library Impact on Student Learning and Success: Findings from Assessment in Action Team Projects").

In 2011, the ACRL Plan for Excellence identified "Value of Academic Libraries" as one of three areas for strategic focus for 2011–2016. The goal is to have academic libraries demonstrate alignment with and impact on institutional outcomes.

Additionally, in 2011, ACRL established a standing committee on the Value of Academic Libraries to continue the association's commitment to and focus on this work. The Committee's first years have produced an active blog and a value bibliography. In 2015, ACRL began planning a research project in which a small number of questions would be replicated using the same research approach at a variety of academic institutions.

Research and Scholarly Environment

In 2002, ACRL embarked on a three-year scholarly communications initiative as one of its highest strategic

priorities; this initiative continues today through the work of ACRL's Research and Scholarly Environment Committee (which had been named the Scholarly Communications Committee until July 2012), established as a standing division level-committee. The committee coordinates the association's scholarly communications activities and hosts a discussion group for further exploration of these issues beyond the initial three-year launch of the program.

Addressing issues critical to the future of all academic libraries, the association works to reshape the current system of scholarly communications, focusing on education, advocacy, coalition building, and research. Broad goals of the initiative include creating increased access to scholarly information; fostering cost-effective alternative means of publishing, especially those that take advantage of electronic information technologies; and encouraging scholars to assert greater control over scholarly communications.

ACRL has partnered with the Association of Research Libraries (ARL) and the Scholarly Publishing and Academic Resources Coalition (SPARC) signing on to letters in support of a number of calls for broader access to scholarly works, including several regarding the National Institute of Health's (NIH) policies on open access for federally funded research. ACRL and SPARC partnered to offer an invitational only webcast to prepare committed grassroots advocates to take action in 2007. ACRL has participated in the Information Access Alliance (IAA) and the Open Access Working Group (OAWG), cosponsoring a symposium on anti-trust issues.

ACRL partnered with ARL to create the ARL/ACRL Institute on Scholarly Communication, which offered its signature event in July 2006, December 2006, and July 2007. This immersive learning experience prepares participants as local experts within their libraries and equips them with tools for developing campus outreach strategies. ACRL and ARL formalized their agreement and offered the first licensed regional institute for December 2007 and a second in December 2008. A regional event allows the ACRL to support institutions that would not, for whatever reason, attend a national event. This move to a regional event as a natural evolution in the life of the institute will enable the ACRL to refocus its national efforts to meet the changing needs of the library community. Under the ARL/ACRL Institute on Scholarly Communication name, ARL and ACRL also jointly offered an in-person workshop in conjunction with the ACRL 2009 Conference, an 8-part webinar series in 2010, and in-person workshops in conjunction with ACRL 2013, ACRL 2015 and the Library Assessment Conference.

In May 2009, the Board identified six as strategic priorities for 2009–2013, one of which was to, “enhance ACRL members’ understanding of how scholars work and the systems, tools, and technology to support the evolving work of the creation, personal organization, aggregation, discovery, preservation, access and exchange

of information in all formats.” Given this focus and the perceived need to help members of the profession develop a basic awareness and understanding, ACRL invested in this workshop to extend the reach from a one-off workshop to a subsidized travelling program, now called “the road show.” In its seventh year, and with the 2014 workshops completed, the road show will have visited 26 different states, the District of Columbia, 1 U.S. territory, and 1 Canadian province. The 36 workshops offered over the program's six year will have reached over 2200 participants from over 600 colleges and universities. Additionally, in summer 2014, the presenters began offering webinars through ACRL eLearning that allow for deeper exploration of specific topics.

ACRL and ARL partnered with SPARC to offer 4 webcasts on author rights during Fall 2006–Spring 2007. ACRL again partnered with SPARC to offer a full-day institute in conjunction with ALA MW 2015 on Tackling Textbook Costs Through Open Educational Resources: A Primer. ACRL convened an invitational meeting in July 2007 to collectively brainstorm the evidence needed to inform strategic planning for scholarly communication programs. In November 2007, ACRL issued a resulting white paper, “Establishing a Research Agenda for Scholarly Communication: A Call for Community Engagement.”

In 2009, ACRL joined the Library Copyright Alliance (LCA) and submitted briefs and comments for the courts and the Department of Justice regarding the proposed Google Book Settlement. LCA has submitted other amicus briefs of the court, as appropriate, to support the doctrine of fair use. Other action through the LCA include communicating concerns to the U.S. Trade Representative on the Anti-Counterfeiting Trade Agreement, releasing issue briefs on international copyright and the legal status of streaming films, supporting the U.S. statement on copyright exceptions for the blind and visually impaired before the World Intellectual Property Organization. In November 2012, LCA convened an invitational meeting in Washington, D.C., with approximately 20 library leaders in order to explore, articulate, and prioritize anticipated copyright-related issues facing the library community. The purpose of the meeting was to develop an appropriate strategy with articulated priorities to help inform the library associations' work.

In 2011, ACRL appointed a visiting program officer to develop a robust and sustainable model for the Scholarly Communications 101 road show workshop, support the work of the Scholarly Communications Committee, and develop other initiatives to advance ACRL's work in this area.

In 2011, the ACRL Plan for Excellence identified “Research and Scholarly Environment” as one of three areas for strategic focus for 2011–2016. The goal is to have academic librarians accelerate the transition to a more open system of scholarship. The objectives were revised in 2017 as follows:

1. Increase the ways ACRL is an advocate and model for open dissemination and evaluation practices.
2. Enhance members' capacity to address issues related to scholarly communication, including but not limited to data management, library publishing, open access, and digital scholarship.
3. Increase ACRL's efforts to influence scholarly publishing policies and practices toward a more open system.

In March 2013, ACRL published the white paper, "Intersections of Scholarly Communication and Information Literacy: Creating Strategic Collaborations for a Changing Academic Environment," written by a working group of leaders from many areas of the association. A formal task force was charged in October to promote its use. Also in 2013, members of the Research and Scholarly Environment Committee (formerly Scholarly Communications Committee) began to update content in the popular scholarly communication toolkit and migrated from Drupal to WordPress. It is routinely promoted in September in advance of October's Open Access Week.

In June 2015, the ACRL Board approved funding for curriculum design of two new ACRL licensed workshops to follow the popular "road show" model and ACRL now offers workshops on data management and the intersections of scholarly communication and information literacy.

Student Learning

ACRL has undertaken a number of initiatives related to information literacy. For those working in information literacy, ACRL supports programs in the areas of professional development, assessment, and instructional development. Spearheading many of these programs was the Institute for Information Literacy (IIL). IIL was charged with preparing librarians to become effective teachers in information literacy programs; supporting librarians, other educators, and administrators in taking leadership roles in the development of information literacy programs; and forging new partnerships within the educational community to work toward information literacy curriculum development. Conceptualized by Cerise Oberman, dean of libraries at SUNY Plattsburgh, the Institute for Information Literacy (IIL), was established by the ACRL Board at the 1997 ALA Annual Conference under the name National Information Literacy Institute. IIL is now known as the Student Learning and Information Literacy Committee (SLILC) and the Immersion program is now coordinated by the Immersion Program Committee.

ACRL approved the "Information Literacy Competency Standards for Higher Education" at Midwinter 2000. In response to inquiries from members about their use on campuses, a training program was developed and was made available to members during Annual

Conferences and Midwinter Meetings. In 2016, the Board approved the "Framework for Information Literacy for Higher Education" and rescinded the "Information Literacy Competency Standards for Higher Education."

A visiting program officer for information literacy was hired to develop educational content to help the profession use the Information Literacy Framework and those outside the profession to understand its application to the curriculum.

Many ACRL sections have developed discipline-specific standards for information literacy including "Information Literacy Standards for Science and Technology," (approved in 2006), "Research Competency Guidelines for Literatures in English" (approved in 2007), "Information Literacy Competency Standards for Anthropology and Sociology," "Political Science Research Competency Guidelines" (approved in 2008), "Psychology Information Literacy Standards" (approved 2010), "Information Literacy Standards for Teacher Education" (approved in 2011), "Visual Literacy Competency Standards for Higher Education" (approved in 2011), "Information Literacy Competency Standards for Journalism Students and Professionals" (approved in 2011), "Information Literacy Standards for Teacher Education" (approved 2011), "Information Literacy Standards for Nursing" (approved 2013). ACRL has also reviewed information literacy standards for music developed by the Music Library Association.

ACRL has also developed a number of standards to assist practitioners in developing and maintaining strong educational programs including: "Guidelines for Instruction Programs in Academic Libraries" (approved 2011), and "Characteristics of Programs of Information Literacy that Illustrate Best Practices: A Guideline" (first approved in June 2003 and revised in 2012).

Grant-funded projects

In 2000, ACRL received a \$150,000 National Leadership grant from the Federal Institute of Museum and Library Services to develop tools and training to help librarians better assess student learning outcomes in information literacy courses. The work of 30 librarians and their campus teams in implementing and assessing information literacy courses was widely disseminated through presentations and publications.

In 2006, ACRL's Rare Book and Manuscript Section (RBMS) received funding from IMLS to offer scholarships to newer and aspiring professionals in these fields to its annual conference, which in 2006, has a special focus on issues of mutual interest to special collections librarians, archivists, and museum professionals. A total of 33 attendance scholarships were offered with preference given to applicants from professionally underrepresented backgrounds. The purpose was to increase the conference participants' knowledge of allied fields and increase their interest in communicating and collaborating with allied

professionals. In addition, the aim was to stimulate scholarship recipients to show greater interest in pursuing or continuing a career as special collections librarians, archivists, or museum professionals.

In 2011, ACRL's RBMS members were also instrumental in getting a small (\$3000) grant from the Gladys Krieble Delmas Foundation to support the mounting of back files of *Rare Books and Manuscripts Librarianship* on the *RBM/HighWire* website. The Gladys Krieble Delmas Foundation generously awarded ACRL/RBMS \$5000 in 2013 and \$8000 in 2017 to support scholarships to attend the annual RBMS conference.

In 2011, ACRL, together with three partners—the Association for Institutional Research, Association of Public and Land-grant Universities, and the Council of Independent Colleges—was awarded an IMLS grant from the Federal Institute of Museum and Library Services for a National Leadership Collaborative Planning Grant Level II. The project entitled “Building Capacity for Demonstrating the Value of Academic Libraries” had a budget total (direct and indirect) of: \$162,076, with the Grant subtotal: \$99,985 and Cost Share subtotal: \$62,091. The grant covered costs to convene two national summits in late fall 2011, to determine the professional competencies that librarians need. College and university chief academic officers, senior institutional researchers, representatives from accreditation commissions and higher education organizations, and academic librarians attended the summits to share their best thinking.

In 2012, ACRL was awarded a follow-up National Leadership Demonstration Grant of \$249,330 by the IMLS for the three-year program “Assessment in Action: Academic Libraries and Student Success” (AiA). The grant funded a professional development program to strengthen the competencies of librarians in campus leadership and data-informed advocacy.

Public Policy Advocacy

In September of 1997, the Association of College and Research Libraries (ACRL) in concert with the ALA Washington Office embarked upon its public policy initiative. The goal was to educate academic librarians about legislative/public policy issues pertinent to academic libraries and higher education. ACRL staff, the ACRL Government Relations Committee, the ACRL Research and Scholarly Environment Committee, the *ACRL Legislative Network*, the ACRL Board, the ALA, Washington Office, and other appropriate ACRL entities carry out the advocacy work. These groups work together to develop a legislative agenda that identifies ACRL policy priorities.

ACRL communicates information on its policy priorities via many means. A Legislative Network consisting of a representative from each of the 42 ACRL chapters and an electronic distribution list (LEGNET) was established

to share the legislative agenda with other ACRL members, their institution's administration and their congressional representative. Information on issues is also disseminated using the ACRLLeads electronic distribution list, *C&RL News*, flyers, letters, and the ACRL Legislative web site (<http://www.ala.org/acrl/issues/washingtonwatch>). When the ALA conference takes place in Washington, D.C., ACRL has offered advocacy preconferences designed to acquaint academic librarians with federal legislative issues and to equip them with the skills needed to deliver effective messages to congressional representatives. ACRL also encourages participation in ALA Legislative Day, and has, in the past, provided travel grants for first time attendees and hosted a special luncheon to highlight issues of importance to academic librarians.

The Board approved the recommendations of ACRL's Task Force on National Advocacy at the 2005 Midwinter Meeting. To supplement the existing ACRL Legislative Network, ACRL created a new position of Legislative Advocate. Legislative Advocates work as much as possible with other library legislative efforts in the state or region. 45 Legislative Advocates served in the inaugural group, appointed in Spring 2007. ACRL hired a short-term Visiting Program Officer Michael McLane in late 2007 to expand the program, organize training opportunities, and undertake assessment. This program has since been phased out as sophisticated web-enabled “action alerts” have made it easier to communicate directly with librarians in specific congressional districts.

In 2009, ACRL joined the Library Copyright Alliance and has been active in submitting briefs and comments to courts and agencies as appropriate. ACRL is also active in the Open Access Working Group, a coalition to promote legislative and policy that would expand access to results of publicly funded research. ACRL regularly releases a legislative agenda in conjunction with National Library Legislative Day. The 2017 agenda includes federal funding for libraries, network neutrality, privacy and government surveillance.

@Your Library Campaign and Grassroots Advocacy

Although generally viewed positively, libraries are often taken for granted. Recognizing this challenge, in 2001, the American Library Association launched The Campaign for America's Libraries, a five-year commitment, to speak loudly and clearly about the value of libraries and librarians to our communities, schools, academic institutions, and businesses, as well as to our society, democracy, and the new digital age. Based on research and crafted to target key audiences, The Campaign worked to raise public understanding that libraries are dynamic, modern community centers for learning, information, and entertainment. The campaign was designed to

heighten awareness regarding the vibrancy, vitality, and real value of today's libraries, to galvanize public support, and influence public policy. Working under the umbrella of the American Library Association @Your library campaign, ACRL led the effort to develop a public relations campaign for academic libraries. Consumer research was undertaken in order to develop promotional materials. A toolkit was developed, mailed to all ACRL members, distributed at the 2003 ACRL Conference.

ACRL also launched a multiyear effort to emphasize the importance of academic libraries and librarians to the higher education community. A series of ads, focusing on the exciting things happening @Your library, was placed in *The Chronicle of Higher Education* beginning in 2001. Testimonials from faculty, students, and administrators were an important component of this campaign. ACRL's Excellence in Academic Libraries award winners have also been recognized in the ads. In 2003, the Board established the Marketing Academic and Research Libraries (MARL) Committee to continue developing @Your library campaign tools for academic and research libraries and to eventually update the toolkit. In 2005 and 2007, MARL presented a Best Practices in Marketing @Your library Award. In early 2010, MARL launched the ACRL Marketing Minute, a biweekly series of quick tips and insights on marketing research, trends, and data delivered through Facebook and Twitter.

ACRL President Camila Alire continued efforts to emphasize the value of academic and research libraries and librarians during her presidential year in 2006. A grassroots advocacy toolkit focusing on "The Power of Personal Persuasion" was developed and mailed to every ACRL member. ACRL President Pamela Snelson continued the advocacy role by commissioning research on what senior academic administrators expect from librarians, and subsequent ACRL Presidents have also focused on advocacy.

ALA ended the Campaign for America's Libraries in 2015, and ACRL continues its advocacy for academic libraries through the ALA Libraries Transform campaign.

Recruitment to the Profession

Professional associations such as the American Library Association, the Association of College & Research Libraries, the Association of Research Libraries (ARL), and state-based associations are key stakeholders in recruitment and retention efforts. The work of the profession is changing and association can help in recruiting talented individuals and in providing training to those already in the profession. Over the years, ACRL has undertaken a number of initiatives. The Personnel Administrators & Staff Development Officers Discussion Group of the Association of College & Research Libraries (ACRL) established the Ad Hoc Task Force on Recruitment & Retention Issues in early 2001 to examine how academic libraries can successfully recruit

and retain professionals in an increasingly competitive environment. In 2002, ACRL and ARL formed a joint task force to work on recruitment issues. A short video, "Faces of a Profession @Your Library" highlighting the benefits of careers in academic and research libraries, was developed under the Task Force's leadership. This video is freely available for downloading from the web.

In 2007, ACRL released "Achieving Racial and Ethnic Diversity among Academic and Research Librarians: The Recruitment, Retention, and Advancement of Librarians of Color," a white paper commissioned by the ACRL Board of Directors working group on diversity. Building on the 2002 ACRL white paper, "Recruitment, Retention & Restructuring: Human Resource in Academic Libraries," the authors discuss efforts to promote, develop, and foster workplaces that are representative of a diverse population, along with addressing the development of a workplace climate that supports and encourages the advancement of librarians from underrepresented groups.

In 2003, ACRL founded the ACRL Spectrum Mentor Program and committee to encourage ALA Spectrum LIS students to pursue academic librarianship. To date, ACRL has contributed \$102,500 to the ALA Spectrum program, sponsoring 12 Spectrum Scholars, and has also matched more than 120 Spectrum Scholars with an ACRL member mentor. More than 20 Spectrum Travel Grants consisting of registration and a travel stipend have also been awarded to help scholars attend every ACRL Conference since 2005, with a total value of more than \$20,000.

Summits

- *Summit on Technology and Change in Academic Libraries*—In November 2006, ACRL convened a roundtable of librarians, higher education administrators, publishing, and information industry leaders to address how technologies, on the one hand, and the changing climate for teaching, learning, and scholarship, on the other, will likely recast the roles, responsibilities, and resources of academic libraries over the next decade. One of the outcomes of the roundtable was a roadmap for ACRL to help its members deal with the ongoing changes in the profession and the academy. A white paper entitled "Changing Roles of Academic and Research Libraries" was posted to the ACRLog. Then Vice-President Julie Todaro provided a detailed response to the essay and invited others to comment.
- *Stepping Through the Open Door: A Forum on New Modes of Information Delivery in Higher Education*—In March 2007, ACRL joined EDUCAUSE and the National Association of College Stores to jointly sponsor an invitation-only forum focused on changing roles within higher education. An article from a participant appeared in *C&RL News* and the report was issued by the conveners in September 2007.

- *Building Capacity for Demonstrating the Value of Academic Libraries*—The summits convened in 2011 as part of ACRL's Value of Academic Libraries Initiative, are described in the "Value of Academic Libraries" section of this chapter.
- *Forum on Data Management*—In January 2014, ACRL hosted a forum on data management with Drexel University Libraries. The goal of this forum was to have a dialogue between disciplinary faculty and academic librarians on the management, curation, and sharing of research data. The faculty agreed that they would want to share most of their data, although they allowed for the possibility that some data might need to remain private for a period of time, depending on the nature of the data and whether or not the scholar was still working with it. They saw strong roles for librarians including providing consultation on data management plans, curation, and long-term preservation of data. ACRL offered two workshops on data management in 2015 and now offers a licensed workshop.

COMMITMENT TO PROFESSIONAL DEVELOPMENT AND GROWTH

ACRL supports and enhances the professional development and growth of academic and research librarians through its numerous professional development activities.

ACRL Conferences

On its 40th birthday in 1978, ACRL took a giant step forward by convening its first National Conference, distinct from ALA, in Boston. The conference featured a 3-day program of major addresses and research papers that attracted 2625 participants. Participants praised the conference for focusing on academic librarianship, for stimulating research on the issues facing academic librarianship, and for bringing together librarians with a common professional interest in academic libraries.

The conference, now held every odd year and begun primarily as an outlet for presenting formal research papers, has responded to member interests and changes in the profession by diversifying its content over the years and attracting a more global audience. ACRL dropped the "National" from the Conference name in 2011, as the conference now welcomes attendees from over 26 countries. New programming has been developed by adding panel sessions, by inviting noted leaders to write papers on current topics, by adding more opportunities for networking and informal dialogue (e.g., roundtable discussions, dinner with colleagues), and by engaging attendees more actively in the learning process with a wider range of session formats. The 1999 National Conference offered first ever "conference-within-a-conference" on the topic of student learning

and the first live Web broadcast. The 2005 conference saw the first full-fledged Virtual Conference offered in conjunction with a National Conference. The 2007 conference held the first Cyber Zed Shed, now known as TechConnect Presentations, which demonstrate technology-related innovations. IdeaPower and THATCamp formats were added to the 2011 and 2013 conferences, respectively, to allow for more late-breaking and spontaneous generation of content.

Interest in presenting at the conference has steadily increased since 1978. Typically the conference will feature about 84 contributed papers, 60 panel sessions, 6–7 preconferences, 16 workshops, 30 TechConnect presentations, 200 poster sessions, and 100 roundtable discussions. Acceptance rate, on average, has been around 20–30%, depending on the proposal type. Attendance at the conference has climbed over the past few years with about 3000 attendees, 1000 exhibitors, and 500 virtual participants for each biennial conference. Slidecast recordings have been available on demand to broaden the reach to those unable to attend or those who want to review F2F content again after the conference. ACRL also launched its first Virtual Conference online community in 2005, and has continued the practice since to allow attendees the opportunity connect and access the conference content for up to one year after the event.

Since its first Conference in 1978, ACRL has gone on to hold successful conferences in Minneapolis (1981, 1881 participants), Seattle (1984, 1754 participants), Baltimore (1986, 2309 participants), Cincinnati (1989, 2735 participants), Salt Lake City (1992, 2241 participants), Pittsburgh (1995, 2721 participants), Nashville (1997, 2973 participants), Detroit (1999, 3080 participants), Denver (2001, 3388 participants), Charlotte (2003, 3427 participants), Minneapolis (2005, 3946 participants), Baltimore (2007, 4784 participants), Seattle (2009, 4321 participants), Philadelphia (2011, 5312 participants), Indianapolis (2013, 4824 participants), Portland (2015, 5072 participants) and Baltimore (2017, 5200 participants).

The ACRL 2019 Conference, "Recasting the Narrative," will be held in Cleveland, Ohio, April 10–13, 2019.

E-Learning

ACRL offers online courses that provide low-cost continuing education opportunities for librarians in a format that allows them to work around their busy schedules. Courses are typically 3 weeks long and include real-time and asynchronous activities. Current offerings include, "Designing Curriculum and Developing Educators for the Information Literacy Courses of Tomorrow."

In 2004–2005, ACRL also began offering live webcasts, providing participants with interactive learning experiences on topics such as information literacy, standards, scholarly communication, and distance learning. Webcasts typically last 60–90 min and feature a live audio

presentation accompanied by PowerPoint slides, web sites, and other resources. Participants can interact with instructors through text chat, asking questions using a microphone, and responding to polls. ACRL established a group registration rate for webcasts in April 2006. The group rate allows an institution to register multiple people and project the session to participants in the same location. ACRL introduced e-learning scholarships in 2010 and were supported again in 2011 and 2012. In FY12, five scholarships that covered the cost of a webcast registration fee (\$50 each) and five scholarships that covered the cost of a multi-week course (\$135) were awarded. In partnership with TLT Group in the 2000s, ACRL offered a three-part online information literacy seminar series, featuring webcasts on assessment, collaboration, best practices, and information literacy resources.

For the fourth time, ACRL offered a multi-day online-only professional development institute in the spring of a nonnational conference year. The 2012 Spring Virtual Institute, "Extending Reach, Proving Value: Collaborations Strengthen Communities," featured a keynote presentation, concurrent live webcasts, and asynchronous lightning talks. The SVI program explored how libraries of all types are capitalizing on community collaborations. As the webcasts increased, interest in a multiday, themed virtual conference decreased, so additional virtual institutes have not been planned.

In spring 2008, ACRL offered its first Springboard Event. The 90-min Springboard webcast, now an annual program, is available for free to the full ACRL membership, with the archived content available afterwards to the world via the web. Approximately 230 ACRL members participated in ACRL's 3rd annual Springboard webcast featuring John Palfrey, Henry N. Ess III Professor of Law, Vice Dean, Library and Information Resources, Harvard Law School, and Faculty Co-Director, Berkman Center for Internet & Society, and co-author of "Born Digital: Understanding the First Generation of Digital Natives." The topic of privacy was chosen in conjunction with ALA's Office of Intellectual Freedom's inaugural "Choose Privacy Week."

ACRL and Choice have teamed up to offer sponsored webinars which have proven to be an attractive vehicle for communication between librarians and vendors. The ACRL/CHOICE webinar series have proven popular with librarians, too, with hundreds of librarians registering for each event.

Leadership

With the quantity of information growing exponentially and the expansion of technology into all aspects of the educational process, higher education is looking for those who can lead the way in utilizing these new tools wisely and navigate the numerous challenges facing us all. It is more important than ever for academic librarians to step

up and guide administrators, faculty, and students through the minefields of this new information environment.

ACRL takes its responsibilities for developing leaders seriously. Since 1999, it has partnered with the Harvard University Graduate School of Education to offer a 5-day institute designed to increase the ability of library directors to lead and manage. The Institute helps participants to assess their own leadership capabilities and to analyze how well their own organizations are positioned to meet current and future challenges. Sessions focus on such topics as managing change, human resources, applying technology, team building, and staff motivation. Learning is through the case study method. ACRL held reunions for the alumni of this program at the Midwinter Meeting during the early/mid-2000s and reoffered a reunion at the 2017 Midwinter Meeting. In addition, ACRL partnered with Harvard to offer the Advanced Leadership Institute for Senior Academic Librarians. This new institute was designed exclusively for senior library leaders and alumni of the Leadership Institute for Academic Librarians and addressed critical leadership issues including collaboration and alliances, influence and leadership, managing expectations of presidents and provosts, and the future role of the academic library. The program was offered in March 2008. While programmatically successful, the recessionary economy dampened registration for the March 2010 session and it was cancelled, but was held in March 2012.

In addition, ACRL collaborated with six other higher education associations to offer the Women's Leadership Institute in December 2008. This unique program brought together mid-level administrators from across campus functions to share experiences, develop a better understanding of the campus as a workplace and culture, and create new networks and networking skills. The success of this endeavor led the associations to offer it the program again and ACRL has participated annually since the initial offering. The next Women's Leadership Institute will be offered on December 3–6, 2017.

Mentoring and Training Programs

Recognizing the importance of training and mentoring, ACRL developed the Academic Library Internship for Administrators of Black College Libraries, an internship program for librarians of predominantly black institutions. In December 1973, the Andrew W. Mellon Foundation agreed to underwrite the program with grants totaling \$350,000. During the four-year period of the program (1974–1978), 25 librarians from predominantly black institutions of higher education served as management interns for periods of 3–9 months at nationally known academic libraries. The evaluation conducted at the end of the program suggests that the interns carried back to their home institutions a broad understanding of the management techniques and styles employed in large academic libraries. In 1987, ACRL received another grant from the Mellon Foundation

to conduct a planning project to assist staff in libraries of historically black colleges and universities.

Under the leadership of Larry Hardesty, the College Libraries Section developed a mentoring program for new college library directors, which is now in its twentieth year. In 2012, Irene Herold succeeded Hardesty as the President of the Board and a new Board was created, which consisted of seven former participants in the program. The faculty for the seminar is now led by Susan Barnes Whyte and Melissa Jados. The program had received funding from the Council on Library Resources, is now primarily self-supporting with participants bearing the costs, and is now a separate 501(c)3 program and is not an official ACRL project. Since its inception, over 333 first-year college library directors and over 152 experienced library directors have participated in the program.

The ACRL Board established the (ACRL Dr. E.J.) Josey Spectrum Scholar Mentor Committee in 2003, to provide conference programs on mentoring, recruit and maintain a pool of academic and research librarians to serve as mentors to Spectrum Scholars. In 2011, the E.J. Josey Spectrum Scholar Mentor Committee revised its mentor recruitment, requirements, and training to more effectively manage the mentor/Scholar matching process. The Committee has forged a strong relationship with the ALA Spectrum Scholar Program staff at ALA.

“Your Research Coach” was established in 2004–2005 by the CLS Research for College Librarianship Committee to help academic librarians with research and scholarly projects. The program provides mentoring to librarians whose institutions cannot offer such support, and who need to publish or present to attain tenure. As of 2015, there are 13 coaches, with 12 assigned, taking part in the program. The committee will open up the program to other sections, starting with the Instruction (IS) and Distance Learning (DLS) sections, once they are able to find more coaches.

Information Literacy Immersion Programs

The ACRL Information Literacy Immersion Program provides information literacy training and education for librarians in the areas of pedagogy and leadership. The popular 4.5 day “Classic” Immersion program provides two tracks for intensive training and education of librarians: 1) the teacher track, focusing on individual development for those who are interested in enhancing, refreshing, or extending their individual instruction skills; and 2) the program track, focusing on developing, integrating, and managing institutional and programmatic information literacy programs. A national faculty of 15 outstanding instruction librarians has been assembled to design, write, and teach the immersion program. The first immersion program was held in July 1999, at Plattsburgh State University of New York and was geared toward academic librarians. Since then, the program has been offered

annually with a total of 26 immersion programs training more than 1900 people have been held or licensed in California, Canada, Colorado, Florida, Illinois, Iowa, Massachusetts, Ohio, Rhode Island, Texas, Vermont, Washington, and Wisconsin. While most immersion programs have been held for librarians only, some have been developed to include both librarians and teaching faculty. In addition, ACRL licensed its first institutional-based Immersion program to Cornell University in FY12. The model was very successful and ACRL licensed a similar program to a Hong Kong academic library consortium in FY13, Yale University in FY14, and the Singapore academic library community in FY15.

In fall 2006, the Immersion faculty offered an addition to the Immersion program: “Intentional Teaching: Teaching: Reflective Practice to Improve Student Learning.” The Intentional Teaching program provides 3.5 days of learning and reflection for academic librarians and offers a mixture of structured and co-constructed learning segments such as peer discussions, individual reading, and reflection times, and participant-led communities of practice.

The ACRL Institute for Information Literacy announced another new addition to the Immersion program in 2008. The *Assessment: Demonstrating the Educational Value of the Academic Library* is intended for librarians active in teaching and learning and those with leadership roles for information literacy program development who want to improve their knowledge and practice of both classroom and program assessment. The inaugural Assessment Immersion Track was offered in December 2008.

A new structure to the Immersion Program was introduced in 2009. Intentional Teacher and Assessment tracks have been offered simultaneously since fall 2009, while Teacher Track and Program tracks continue to be offered together in summer. This new schedule blends immersion programs with similar formats and lengths to offer a more cohesive immersion experience.

Two new Immersion Programs were offered in FY13, “Practical Management for the Instruction Coordinator” and “Teaching with Technology & Instructional Design Program.” The Practical Management was reoffered in FY15.

Workshops and Preconferences

ACRL sponsors workshops, seminars, and preconferences at ALA conferences. Most notable in this area are the conferences developed by the ACRL Rare Books & Manuscripts (RBMS). For 55 year, RBMS has provided 3 days of programming for rare books, special collection, archives, and manuscripts librarians at its annual conference.

ACRL also offers a variety of programs through its extensive chapter network. Local and regional chapters

typically offer annual conference programming. To support these efforts, the ACRL Board of Directors has allocated funding for the ACRL president, vice-president/president-elect, and the executive director to visit ACRL chapters. Currently, funds to support 10 visits per year are budgeted. The ACRL Chapters Speakers Bureau fosters closer relations between the Association and its members by creating opportunities for leaders to share perspectives and concerns at the regional and national level.

Annual Conference Programs

As a means of addressing issues of concern and to increase the knowledge of academic librarians, ACRL units and members develop programs to present at the ALA Annual Conferences. ACRL Sections, interest groups, committees, and personal members submit program proposals to the ACRL office 9 months prior to the Annual Conference at which the program is to be presented. This includes programs that are not requesting funding, as well as those that are asking for funds. ACRL encourages its units to cosponsor programs with other ACRL or ALA units and outside organizations. The ACRL Professional Development Committee (PDC) reviews and selects programs for presentation.

The ACRL Board of Directors provides \$27,500 from ACRL's budget to support Annual Conference programs (including the ACRL President's Program and excluding cost of audiovisual equipment, which is largely paid for by ALA). The PDC determines how these funds are allocated among the program proposals. How well proposals meet the program criteria is one of the determining factors in whether it is funded or not.

Career and Job Services

ACRL offers three ways for academic librarians to find out about career opportunities and for employers to build a pool of highly qualified individuals from which to recruit for vacant positions: 1) as the only magazine targeted specifically to academic/research librarians, *College & Research Libraries News (C&RL News)* is a print vehicle to advertise in print academic library job listings; 2) the ALA JobLIST online career center (joblist.ala.org), launched in 2006, is a joint project of *American Libraries (AL)* magazine, *C&RL News*, and ALA's Office for Human Resource Development and Recruitment (HRDR), which incorporates the formerly separate *AL* and ACRL job sites and many services of HRDR, including placement services at the ALA Midwinter Meeting and Annual Conference; and 3) at each ACRL Conference, the association works with HRDR to offer a job placement service. Since 2009, JobLIST has also maintained an active presence on social media sites, including Facebook, Twitter, and LinkedIn. Content shared on these sites includes notifications of new job listings, news items specifically about

the job market for librarianship, and general job searching tips and strategies. In 2011, a free biweekly e-newsletter, *ALA JobLIST Direct*, was also launched to reach yet another target audience with a selection of job search and career advice content, as well as promoting the online service.

ACRL Consulting Services

ACRL has offered library consulting services to member and non-member libraries since 2007. ACRL consultants have worked to provide services including external reviews, staff retreats, and strategic planning facilitation for Appalachian State University, Arkansas State University, Association of Academic Health Sciences Libraries (AAHSL), Buffalo State University, California State University – San Marcos, Center for Research Libraries, Central Michigan University, Chadron State College, Community College of Philadelphia, Dominican University, Duquesne University, Fairleigh-Dickinson University, Georgia College, Gonzaga University, Hampshire College, Kean University, Lamar University, Lewis University, Louisiana Tech, Loyola University, MIT, Mount Holyoke, New Mexico Institute of Mining and Technology, New Mexico State University, North Park University, Northeastern Illinois University, Our Lady of the Lake University, Purdue University, St. Xavier University, SUNY Council of Library Directors, Texas A&M, Triangle Research Libraries Network (TRLN), Tufts University, University of California – Merced, University of California – Riverside, University of California – San Diego, University of Illinois at Chicago, University of Kansas, University of Maryland Baltimore County, University of North Carolina - Charlotte, University of Puerto Rico, University of Saint Francis, University of Wisconsin – Milwaukee, University of Wisconsin – Stout, Western Michigan University, and Wheaton College. ACRL staff consultants, Kathryn Deiss and Kara Malenfant, authored a chapter, "Successful external reviews: Process and practicalities," for *Reviewing the Academic Library: A Guide to Self-Study and External Review*, which guides library leaders and external reviewers in planning and conducting an external review and effectively using the results for future planning.

Building the Knowledge Base

ACRL strives to be a national and international interactive leader in creating, expanding, and transferring the body of knowledge of academic librarianship. One of the principle motives for creating a separate unit for academic librarians in 1938 was to stimulate research and publication in academic librarianship. The ALA First Activities Committee, a body appointed in the 1920s to review the activities and structures of ALA, reported in 1928 that the ALA publishing program had neglected scholarly and

bibliographic publication, the areas of greatest interest to academic librarians. This neglect, said the committee's report, had been so extensive "as to threaten at times actual withdrawal of the College and Reference Section from A.L.A."^[19]

C&RL and C&RL News

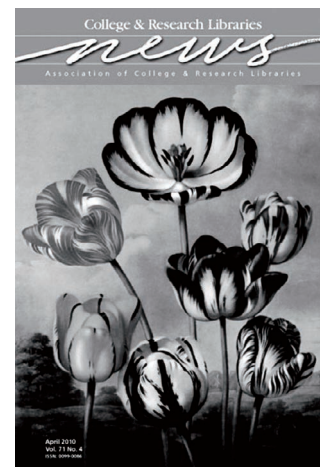


A year after its creation in 1938, ACRL established an official journal called *College & Research Libraries* (*C&RL*). The first issue of the new quarterly publication appeared in December 1939. It was at one and the same time a professional journal, an official organ of ACRL, and a vehicle for the exchange of news about libraries and librarians. A. F. Kuhlman, the first editor of *College & Research Libraries*, believed that "the absence of a professional journal devoted specifically to the interests of college, university, and reference libraries . . . no doubt accounts to a large extent for the lack of a definitive literature dealing with these institutions."^[20] Under a series of able editors, from Kuhlman in the 1940s to Wendi Arant Kaspar who assumed the editorship in 2016, *C&RL* established itself as a premier scholarly journal for the publication of empirical research in academic librarianship and helped to build a body of knowledge and intellectual technique for the academic library profession. In 1950, Arthur Hamlin, then ACRL's executive secretary, called *C&RL* "the principal jewel in the Association crown."^[21]

The ACRL Board of Directors decided in 1951 to make *College & Research Libraries* a membership benefit so that all members would receive the journal without charge. This far-reaching decision made it possible for *C&RL* to play a key role in unifying the association and the profession. In light of the growing quantity and quality of research about academic librarianship, the Association decided in 1956 to publish *C&RL* on a bimonthly rather than a quarterly basis. The Board approved making *C&RL* an open access publication starting in April 2011.

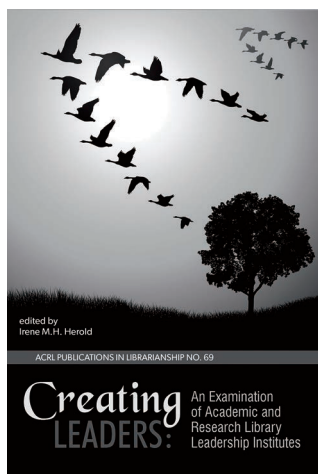
At the 2012 ALA Annual Conference, the Board approved transitioning *C&RL* to an online-only publication beginning with the January 2014 issue.

In November 2011, the University of Illinois at Urbana-Champaign began a volunteer project to digitize the remaining backfiles of *C&RL*. The back content was added to the main *C&RL* website during the 2012–2013 fiscal year. All current content and complete back issues, beginning in 1939, are freely available to the public on publication website at <http://crl.acrl.org>. The ACRL Board of Directors expressed their thanks to Illinois for this generous contribution through a formal resolution.



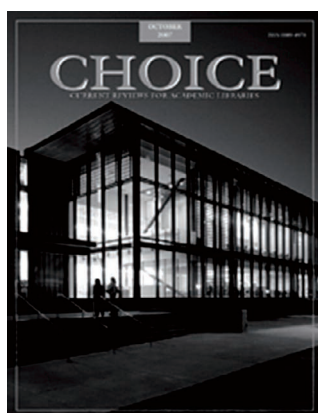
In 1967, the people and news portions of *C&RL* were separately published, allowing the journal to focus on its role as a scholarly journal. Since 1967, *College & Research Libraries News* has served as the official magazine of record of the association and as a clearinghouse for news about academic libraries, librarians, and higher education. A history of the first 30 year of *C&RL News* appeared in the September 1996 issue as part of an anniversary celebration. In 1993, *C&RL News* became the first ALA print publication available through the Internet. In 2002, *C&RL News* began offering an electronic contents service and, also in 2002, *ACRL Update*, an electronic biweekly news publication, was launched to provide more current information and news. RSS feeds of *C&RL News* contents were launched in 2008. The full text of all *C&RL News* articles from 2004 to the present is freely available to all on the web at <http://crln.acrl.org>.

In January 2010, the online versions of ACRL's three serial publications (*C&RL*, *C&RL News*, and *RBM*) moved to a new home through a partnership with HighWire Press. The move of ACRL's publications from the association website to the HighWire platform provided a number of benefits, including improved search capabilities both within and across publications, increased Web 2.0 functionality, and online access for individual and institutional non-member subscribers.



ACRL Publications in Librarianship. In 1952, ACRL began the ACRL Monographs series. By 2014, the series had grown to 66 titles and is now called ACRL Publications in Librarianship. The first volume in the series was Joe W. Kraus's *William Beer and the New Orleans Public Libraries, 1891–1927*. PIL #58, *Centers for Learning* (Elmborg & Hook) won the 2007 Ilene E. Rockman Publication of the Year Award. Recent titles include *Interdisciplinarity and Academic Libraries* (PIL #66, Mack & Gibson 2012), and *The Changing Academic Library, 2nd Edition* (PIL #65, Budd 2012: *Not Just Where to Click: Teaching Students How to Think About Information* (Swanson and Jagman, Editors), *Assessing Liaison Librarians: Documenting Impact for Positive Change* (Mack and White, Editors), and in Fall 2015, ACRL issued what could be the final PIL volume: PIL #69, *Leadership Development Programs for Academic Libraries* (I.M.H. Herold, Editor).

Choice



Founded in 1963 with a grant from the Council on Library Resources, Choice is the Middletown, Connecticut-based publishing unit of ACRL with an annual operating budget of more than three million dollars. In 2008 the ACRL and ALA Boards approved the purchase of office space for

Choice in the form of a condominium located on Main Street in Liberty Square. In 2009 Choice moved into its top floor space. The design is LEED-certified by the U.S. Green Building Council. Choice is the publisher of Choice magazine, the premier U.S. academic review journal; *Choice Reviews*, a continuously updated database of our reviews; and other publications, described below.

Choice360

The Choice website, www.choice360.org organizes our content and provides librarians with an easy way to view our webinars, download bibliographic essays, listen to our podcasts, get free trials for our subscription products, or contact our editorial staff. It also features the “The Open Stacks” blog, which publishes a wide variety of Choice content.

Choice Reviews. *Choice's* concise, critical, and authoritative reviews have been called “the best short critical evaluations of new titles available anywhere.” By a wide margin, subscribers rate *Choice* #1 among the review sources they use to select materials for academic libraries. *Choice Reviews* (www.choicereviews.org) contains every review published by the Choice staff since September 1988, with some 6000 records added each year. Updated daily, the database functions both as a collection-development resource for academic libraries and as a discovery tool for bibliographic research by students and researchers.

Choice. *Choice* magazine has been in continuous publication since 1964. In addition to its reviews, *Choice* is home to “Ask an Archivist,” a series of interviews with curators of special collections; guest editorials; lists of forthcoming titles in various disciplines; an annual guide to academic book pricing; the “University Press Forum”; and the “Digital Resources Buying Guide,” published each August. *Choice's* highly esteemed Outstanding Academic Titles list, representing the “best of the best” new titles reviewed during the preceding year, is published each year in January and is widely regarded as comprising the essential titles for purchase by undergraduate libraries. *Choice* reviews are also available under license in other widely used products and services.

ccAdvisor. A collaboration between Choice and The Charleston Company, *ccAdvisor* (www.ccadvisor.org) is a new review service dedicated to the identification and assessment of academic databases, web sites, and tools. Each review features a scoring matrix that rates resources by the quality of their content, user experience, price, and purchase and contract options.

Resources for College Libraries. Released in 2006, *Resources for College Libraries* (www.rclinfo.net) is the

digital successor to *Books for College Libraries*, 3rd edition. The product of a collaborative effort between Choice and ProQuest, RCL is published under the direction of more than seventy subject-area experts, who update the work on an annual basis, and lists almost 90,000 works across 61 curricular areas. With the publication of its companion product, *Career Resources*, in 2009, RCL now includes over 4500 core works for vocational-technical subjects as well.

Choice Bibliographic Essays

Written by subject area experts, these comprehensive essays contain discussion and annotation on hundreds of titles. Essays from recent years are available on the LibGuides platform (www.ala-choice.libguides.com).

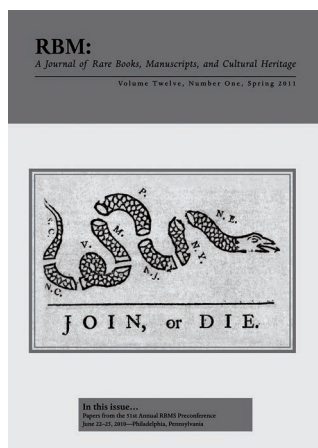
The Authority File

In 2017 Choice launched, “The Authority File: A Choice podcast,” which features weekly episodes of author/editor conversations about new books and products, thought-leadership interviews and discussions, and technology and product case studies.

ACRL-Choice Mobile App

The ACRL-Choice app allows users to interact with ACRL content in a new and more convenient way, with articles, blog posts, webinars, and other content conveniently organized around membership and community, professional development, and content development.

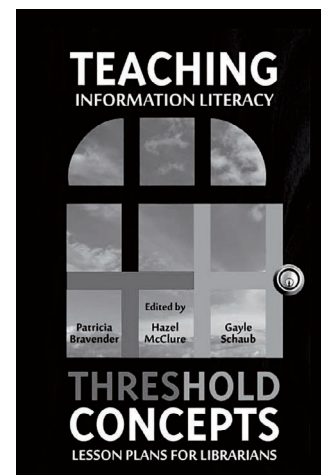
RBM: A Journal of Rare Books, Manuscripts, and Cultural Heritage



RBM, a semiannual publication, began in the spring of 1986 as *Rare Books and Manuscripts Librarianship (RBML)* on a trial basis under the leadership of the Rare Books and

Manuscripts Section. The journal was incorporated into the ACRL publishing program in 1988. In 2000, the journal underwent a major revision, including a new name, a new graphic treatment, and a new editorial focus. The editorial focus was broadened to include all types of special collections in a variety of media in order to address the broad range of issues and concerns of professionals who work with such collections. Full contents of the past 12 months of *RBM* are available online to subscribers at <http://rbm.acrl.org>. Contents older than the past 12 months are freely available to all. Thanks to a generous grant from the Gladys Krieble Delmas Foundation, the complete backfiles of *RBML* were digitized and added to the publication website in spring 2011.

ACRL Nonserial Publications



Monographic works pertinent to academic and research librarianship are published by ACRL. ACRL publishes books on a broad spectrum of topics. ACRL has worked to challenge standard publishing models and has experimented with open access and digital publications as well as traditional publications. Typically, ACRL publishes 8–12 titles annually, each with an intended audience of 500–1500. The publications program is intended to be self-supporting.

Titles published in 2016-2017 include: *2016 Academic Library Trends and Statistics*, *2015 Academic Library Trends and Statistics*, *Bridging Worlds: Emerging Models and Practices of U.S. Academic Libraries Around the Globe* (Pun, Collard, and Parrott, Editors), *Choosing to Lead: The Motivational Factors of Underrepresented Librarians in Higher Education* (Olivas, Editor), *Critical Library Pedagogy Handbooks—Vol. 1: Essays and Workbook Activities and Vol. 2: Lesson Plans* (Pagowsky and McElroy, Editors), *Collaborating for Impact: Special Collections and Liaison Librarian Partnerships* (Totleben and Birrell, Editors), *Creative Instructional Design: Practical Applications for Librarians* (West, Hoffman, and Costello, Editors), *Curating*

Research Data—Vol. 1: Practical Strategies for Your Digital Repository and Vol. 2: A The First-Year Experience Cookbook (Pun and Houlihan, Editors), *Handbook of Current Practice* (Johnston, Editor), *Librarians: Exploring Selves, Cultures, and Autoethnography* (Deitering, Stoddart, and Schroeder, Editors), *Mobile Technology and Academic Libraries: Innovative Services for Research and Learning* (Canuel and Crichton, Editors), *Reading, Research, and Writing: Teaching Information Literacy with Process-Based Research Assignments* (Broussard), *Rewired: Research-Writing Partnerships within the Frameworks* (McClure, Editor), *The Small and Rural Academic Library: Leveraging Resources and Overcoming Limitations* (Kendrick and Tritt, Editors), *Students Lead the Library: The Importance of Student Contributions to the Academic Library* (Arnold-Garza and Tomlinson, Editors).

CLIPP (Formerly ClipNotes)

The popular ClipNotes series, developed by the ClipNotes Committee of the College Library Section (CLS), has undergone a significant change: it will henceforth be known as simply CLIPP (College Library Information on Policies and Procedures). The change is not merely cosmetic; there will be a substantive change to the way content is treated. Essays in CLIPP volumes will be more analytical of best practices while retaining the survey method used in the ClipNotes series. The CLS CLIPP Committee is currently seeking proposals for this new series.

Library Statistics

ACRL's involvement in library statistics goes back to 1906 when James T. Gerould read a paper to the College and Reference Library Section on comparative statistics. Gerould himself started an annual compilation of Statistics for Academic Libraries. Known in the 1920s as "Princeton Statistics," the compilation later became *ARL Statistics*.^[22] In 1941, ACRL began to collect statistics for college and university libraries and continued to do so until the late 1950s when the service was discontinued in order to avoid duplicating the efforts of the National Center for Educational Statistics. In 1979, however, the ACRL University Library Section, citing the need for up-to-date comparative library statistics in a usable format, proposed that ACRL collect comparative statistics for the university libraries not covered by *ARL Statistics*. This led to the publication of *ACRL University Library Statistics 1978–1979* in 1980. Additional statistical studies of university libraries were published in 1983 and 1985. In 1984 and 1985, a special Task Force on Library Statistics worked to define the statistical needs of academic libraries. Its work served

as the basis for the new standing committee on Academic Library Statistics (now known as the ACRL Academic Library Trends and Statistics Editorial Board). This committee recommended expanding the survey universe to include the "ACRL 100 libraries" and also revised the survey form to match that used by the federal government. These survey results were published in 1987. In 1989, the survey returned to the non-ARL university libraries. Also in 1989, ACRL issued a compilation of the data from 1979 to 1989 in machine-readable form. Since 1989, the ARL-like survey was administered and published covering the years 1990–1991, 1992–1993, 1994–1995, and 1996–1997.

In 1998, ACRL published the final edition of *University Library Statistics*, covering 1996–1997, and initiated a new statistics project, *Academic Library Trends and Statistics*. This annual comprehensive data gathering effort includes libraries at all institutions of higher learning in the United States and Canada. Until 2015 the ARL survey instrument was used with permission. A core set of data, intended for comparative analysis over time, consists of four major categories: Collections, Expenditures, Personnel and Public Services, and Networked Resources and Services. Additional questions are used to gather data on a variety of topics of interest to the profession and to identify trends and other changes that are having an impact on library operations. Results, arranged by Carnegie classifications, are published, as well as made available on an annual subscription basis through ACRL Metrics.

In June 2006, based on information provided by the University of Illinois Graduate School of Library and Information Science Library Research Center (LRC) and committee discussion, the ACRL concluded that some libraries are burdened by a subset of the ARL survey questions and the effort necessary to gather data in support of these questions, have resulted in diminishing response rates. Beginning with the 2006 survey, ACRL produced two shortened versions of the existing ARL survey and tailored it to better meet the unique needs of member libraries. The following versions of the existing ARL instrument were offered to ACRL member libraries: ARL survey (existing instrument); four-year college survey (shortened version of existing ARL instrument); community college survey (shortened version of existing ARL instrument). Four-year colleges and community colleges had the option of submitting the complete ARL survey (including supplementary e-metrics questions). Beginning in 2007, 4-yr colleges, community colleges, and non-ARL doctoral libraries had the option of completing the new ARL supplementary statistics in addition to the annual survey. In 2010, ACRL partnered with Counting Opinions to develop a longitudinal database, providing access to annual trends and statistics data collected since 1999. ACRL Metrics was launched in June 2010, and provides

access to ACRL data from 1999–2014 as well as the NCES Academic Library Survey data from 2000–2012. In 2015, ACRL began using the current IPEDS Academic Libraries (AL) component augmented with key questions from the 2012 NCES Academic Library Survey instrument.

Section Newsletters

Most of the 16 ACRL sections publish a semi-annual newsletter. These newsletters provide information about the section's activities. A few sections, such as the Western European Studies Specialists and the Slavic and East European Section (SEES) produce in-depth newsletters. The SEES newsletter, published since 1985, averages 75–80 pages and serves as the official record of the section, reporting on section activities and on relevant activities in the field of Slavic and East European librarianship. Minutes from SEES mid-winter and annual committee meetings are included, along with the minutes of AAASS (American Association for the Advancement of Slavic Studies) Bibliography and Documentation, a reports section, information on new grants and significant acquisitions, new professional appointments, and a bibliography of recent publications. Profiles of special library collections and papers from the annual SEES program are frequently included. The newsletter is distributed internationally and serves as an archival record of Slavic and East European librarianship in North America. In FY2010, sections transitioned from print to electronic only publishing.

ACRL Website

The web provides a powerful opportunity for ACRL units to share information with their membership and with the academic community at large. The URL of the ACRL webpage is <http://www.acrl.org>. The site maintains comprehensive information about ACRL and its programs, including mission and goals, strategic plan, advocacy, information literacy, conferences, institutes, pre-conferences, publications, standards, membership and links to sections and chapters. ALA launched a new information architecture in September 2008. After conducting user studies, ACRL redesigned its website in 2009, using the ALA design as a guide. ACRL Sections and committees are encouraged to mount their pages on the ALA server, but are also free to choose non-ALA servers. In 2011, ALA began using Drupal for its content management system and ACRL's web pages were converted to the new systems. An alternative to ALA Connect where members can work, share documents, vote, and have threaded discussions will be implemented in the fall of 2017. The Web Management Group is also working on

Responsive Redesign of the current website and all associated microsites.

ACRL Insider

In January 2008, ACRL launched a new weblog titled ACRL Insider. Primarily written by staff and ACRL officers, ACRL Insider provides updates on ACRL activities, services, and programs, including publications, events, conferences, and eLearning opportunities. The blog also keeps readers up-to-date on ACRL operations, including updates from members of the Board of Directors. Through ACRL Insider, ACRL fosters openness and transparency by providing an outlet for connection between members and the Board and staff. ACRL Insider complements ACRLog to provide a big picture view of the association. A weekly Member of the Week post spotlights the diversity and accomplishments of the ACRL membership, and is one of the blog's most popular features. ACRL Insider is available online at www.acrl.org/acrlinsider/.

ACRLog

To provide a forum for major issues, the ACRLog, ACRL's issues blog, was launched in October 2005. On an average day, the ACRLog is visited 4000–4500 times and more than 4600 individual posts are read. ACRLog is the work of a team of regular contributors in addition to guest posts featuring a variety of voices, including first-year librarians. ACRLog is available at acrlog.org/.

Keeping Up With...

In April 2013, ACRL launched Keeping Up With... an online current awareness publication featuring concise briefs on trends in academic librarianship and higher education. Each edition focuses on a single issue including an introduction to the topic and summaries of key points, including implications for academic libraries. Keeping Up With... has featured information on digital humanities, flipped classrooms, altmetrics, MOOCs, critical librarianship, competency-based education, net neutrality, and more on the ACRL website at http://www.ala.org/acrl/publications/keeping_up_with.

ACRL Podcasts

ACRL Podcasts have provided fresh dimensions on the issues and events in academic librarianship since January 2007. Podcasts include discussions of ACRL publications, interviews with *C&RL News* article authors, recordings of ACRL Candidate Forums, interviews with ACRL

Conference invited speakers, a series of podcasts on the Value of Academic Libraries initiative, and an interview with filmmaker John Waters at the ACRL Conference in Baltimore. ACRL Podcasts are available on the ACRL Insider blog and through iTunes. In addition, several ACRL groups, most notably the Residency Interest Group, produce podcasts on topics specific to their constituencies.

ACRL Social Media

Over the past several years, the association has been on the cutting edge of new technologies to communicate and connect with members. As of December 2015, ACRL's Facebook page (<http://www.facebook.com/ala.acrl>) boasts 6,429 fans, while 13,692 interested parties receive daily updates on association activities on Twitter (http://www.twitter.com/ala_acrl), and 385 follow the association on Pinterest. These social media tools allow ACRL to create community with members in new and exciting ways.

CONCLUSION

Academic libraries are moving into a century of change that calls for strengthening our collaborations and community relationships if we are to succeed. Through its publications, professional development programs, public policy advocacy, and work with higher education associations, ACRL will continue to enhance the effectiveness of academic and research librarians to advance learning, teaching, and research in higher education. Scholarly communication, student learning, and articulating the value of academic libraries will be of particular concern to the profession and the association in coming years. ACRL initiatives in these areas will help academic librarians learn from one another, become more effective in their work, advance the quality of academic library service, and to promote a better understanding of the role of libraries in academic and research institutions.

ACRL Presidents (beginning with 1938)

1938–1939 Frank K. Walter	1947–1948 William H. Carlson
1939–1940 Phineas L. Windsor	1948–1949 Benjamin E. Powell
1940–1941 Robert B. Downs	1949–1950 Wyllis E. Wright
1941–1942 Donald Coney	1950–1951 Charles M. Adams
1942–1943 Mabel L. Conat	1951–1952 Ralph E. Ellsworth
1943–1944 Charles B. Shaw	1952–1953 Robert W. Severance
1944–1945 Winifred Ver Nooy	1953–1954 Harriet D. MacPherson
1945–1946 Blanche Prichard McCrum	1954–1955 Guy R. Lyle
1946–1947 Errett Weir McDiarmid	1955–1956 Robert Vosper

(Continued)

ACRL Presidents (beginning with 1938) (Continued)

1956–1957 Robert W. Orr	1987–1988 Joanne R. Euster
1957–1958 Eileen Thornton	1988–1989 Joseph A. Boissé
1958–1959 Lewis C. Branscomb	1989–1990 William A. Moffett
1959–1960 Wyman W. Parker	1990–1991 Barbara J. Ford
1960–1961 Edmon Low	1991–1992 Anne K. Beaubien
1961–1962 Ralph E. Ellsworth	1992–1993 Jacquelyn McCoy
1962–1963 Katherine M. Stokes	1993–1994 Thomas Kirk
1963–1964 Neal R. Harlow	1994–1995 Susan K. Martin
1964–1965 Archie L. McNeal	1995–1996 Patricia Senn Breivik
1965–1966 Helen Margaret Brown	1996–1997 William Miller
1966–1967 Ralph E. McCoy	1997–1998 W. Lee Hisle
1967–1968 James Humphry III	1998–1999 Maureen Sullivan
1968–1969 David Kaser	1999–2000 Larry Hardesty
1969–1970 Philip J. McNiff	2000–2001 Lizabeth (Betsy) Wilson
1970–1971 Anne C. Edmonds	2001–2002 Mary Reichel
1971–1972 Joseph H. Reason	2002–2003 Helen H. Spalding
1972–1973 Russell Shank	2003–2004 Tyrone H. Cannon
1973–1974 Norman E. Tanis	2004–2005 Frances J. Maloy
1974–1975 H. William Axford	2005–2006 Camila Alire
1975–1976 Louise Giles	2006–2007 Pamela Snelson
1976–1977 Connie R. Dunlap	2007–2008 Julie B. Todaro
1977–1978 Eldred R. Smith	2008–2009 Erika C. Linke
1978–1979 Evan I. Farber	2009–2010 Lori A. Gotsch
1979–1980 Le Moyne W. Anderson	2010–2011 Lisa Janicke Hinchliffe
1980–1981 Millicent D. Abell	2011–2012 Joyce L. Ogburn
1981–1982 David C. Weber	2012–2013 Steven J. Bell
1982–1983 Carla J. Stoffle	2013–2014 Trevor A. Dawes
1983–1984 Joyce Ball	2014–2015 Karen A. Williams
1984–1985 Sharon J. Rogers	2015–2016 Ann Campion Riley
1985–1986 Sharon Anne Hogan	2016–2017 Irene M.H. Herold
1986–1987 Hannelore B. Rader	2017–2018 Cheryl A. Middleton
CHOICE Editor & Publishers	1982–1984 Rebecca Dixon
1963–1966 Richard Gardner (founding editor)	1984–1995 Patricia Sabosik
1966–1972 Peter Doiron	1995–2013 Irving Rockwood
1972–1978 Richard Gardner	2013–present Mark Cummings
1978–1979 Louis Sasso	
1979–1982 Jay Poole	
Publications in Librarianship Editors	1977–1982 Joe W. Kraus
1952–1953 Lawrence S. Thompson	1982–1988 Arthur P. Young
1953–1956 David K. Maxfield	1988–1993 Jonathan A. Lindsey
1956–1960 Rolland E. Stevens	1993–1998 Stephen E. Wiberley Jr.
1960–1966 William V. Jackson	1998–2003 John M. Budd
1966–1970 David W. Heron	2003–2008 Charles Schwartz
1970–1972 Edward G. Holley	2009–2014 Craig Gibson
1972–1977 Kenneth G. Peterson	

(Continued)

ACRL Presidents (beginning with 1938) (*Continued*)

C&RL Editors	1984–1990 Charles Martell
1939–1941 A. F. Kuhlman	1990–1996 Gloriana St. Clair
1941–1948 Carl M. White	1996–2002 Donald E. Riggs
1948–1962 Maurice F. Tauber	2002–2008 William Gray Potter
1962–1963 Richard Harwell	2008–2012 Joseph Branin
1963–1969 David Kaser	2013–2016 Scott Walter
1969–1974 Richard M. Dougherty	2016–2019 Wendi Arant Kaspar
1974–1980 Richard D. Johnson	
1980–1984 C. James Schmidt	
C&RL News Editors	1980–1990 George M. Eberhart (staff)
1967–1979 member editors include:	1991–2001 Mary Ellen K. Davis (staff)
David Kaser, David Doerr, Michael Herbison, Alan Dyson, Susana Hinojosa, Mary Frances Collins, Anne Dowling, John V. Crowley	2001–2002 Maureen Gleason, acting editor (staff)
1979 Jeffrey T. Schwedes (First staff editor)	2002–2007 Stephanie Orphan (staff)
	2007–present David Free (staff)
RBM (formerly RBML) Editors	2003–2008 Richard Clement
1986–1989 Ann S. Gwyn	2008–2013 Beth Whittaker
1989–1993 Alice D. Schreyer	2014–2017 Jennifer Karr Sheehan
1993–1999 Sidney E. Berger	
1999–2003 Lisa Browar/Marvin Taylor	
ACRL Executive Directors	1968–1972 J. Donald Thomas
1947–1949 N. Orwin Rush	1972–1977 Beverly P. Lynch
1949–1956 Arthur T. Hamlin	1977–1984 Julie Carroll Virgo
1956–1957 Vacant	1984–1990 JoAn S. Segal
1957–1961 Richard Harwell	1990 Cathleen Bourdon (Acting)
1961–1962 Mark M. Gormley	1990–2001 Althea Jenkins
1962–1963 Joseph H. Reason	2001–present Mary Ellen K. Davis
1962–1968 George M. Bailey	

ACKNOWLEDGMENTS

The authors wish to acknowledge former ACRL staff whose history of ACRL (Chapter 15 in the *ACRL Guide to Policies and Procedures*) provides the basis for this entry.

Name of the Association

“The ACRL Planning Committee discussed changing the name of the division from the Association of College and Research Libraries to the Association of College and

Research Librarians. The ACRL Planning Committee did not recommend such a change. Since this issue comes up from time to time the Planning Committee set down some of the reasons for the recommendation to provide a record for the future.

1. The term ‘libraries’ is used generically to include librarians and the mission and goals of librarianship. ACRL supports the needs of libraries and their goals through supporting legislation and promoting access to information as well as a wide variety of other ways. These activities relate to libraries more directly than to librarians.
2. The term ‘libraries’ rather than ‘librarians’ includes users and their needs.
3. The time involved in the bureaucracy of changing the name would take away from the business of the association. That time expenditure is not justified since the name change would not affect the direction of the association.
4. There are costs involved in changing the name on printed materials such as stationary and brochures.”

Source: ACRL Board, January 1986.

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Association of Library Trustees, Advocates, Friends and Foundations (ALTAFF)

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Abstract

The Association of Library Trustees and Advocates (ALTA) was a division of the American Library Association (ALA) and the only division developed for lay supporters and citizens who govern libraries. Founded as the Trustees Section in 1890, this division was one of the oldest units within the ALA. The mission of ALTA was to provide programs and publications designed to help America's library trustees increase their effectiveness both in terms of library governance and, more recently, in terms of library advocacy. On February 1, 2009 Friends of Libraries U.S.A. (FOLUSA), an independent NGO founded to support library friends groups, merged with the ALTA. This merger resulted in an expanded division of ALA that is now called the Association of Library Trustees, Advocates, Friends and Foundations (ALTAFF).

HISTORY

Founded in 1890 as the Trustees Section, this unit was authorized by the Council as the Trustees Division in 1940. In 1951, it merged with the Library Extension Division and the Division of Public Libraries, becoming part of the Public Libraries Division. In 1961, it again became an independent division, the American Library Trustee Association. In 1999, the Association of Library Trustees and Advocates (ALTA) undertook a name change from the American Library Trustee Association to the Association for Library Trustees and Advocates, retaining the acronym ALTA, in order that the American Library Association (ALA) members, other divisions and units of ALA, the profession at large, and the general public will understand the important role of advocacy for libraries that ALTA plays. The ALTA is the only division of the ALA dedicated to providing resources, programs, publications, and services to America's public library trustees and advocates.

MISSION AND RESPONSIBILITIES AND MEMBERSHIP

The mission of ALTA is to support the development of effective library service for all people in all types of communities and in all types of libraries. In the discharge of this mission ALTA assists the efforts of all those who govern libraries, promote libraries, and advocate for libraries.

ALTA has the specific responsibility for:

- Education through a continuing and comprehensive program for Library Trustees to enable them to

discharge their responsibilities in a manner best fitted to benefit the public and the libraries they represent.

- Providing a means for Trustees to have access to information and ideas that will prove useful to them in the governance of their libraries.
- Promoting strong state and regional Trustee organizations.
- Providing to all who value libraries the materials and support they need to be effective advocates for their libraries on the local, state, and national levels.

Membership

With a membership of over 5,000 ALTA represents library trustees and advocates throughout the United States and Canada. Members receive a quarterly newsletter, discounts on publications, reduced conference registration fees, opportunities to network with trustees from across the country, and a subscription to *American Libraries*, the magazine of ALA.

GOVERNANCE AND STRUCTURE

ALTA is governed by a Board of Directors comprising the President, the Vice-President, the Second Vice-President Elect, the immediate Past President, and committee cluster chairs. The work of the organization is done through its committee structure which is, in turn, organized under clusters.

The committee cluster structure and charges are as follows.

Advocacy Committees Cluster

- *Advocacy Committee*—To identify and encourage library advocates; provide information to support library advocacy; to identify, explore, and publicize current and emerging advocacy issues; to provide ongoing education about advocacy issues; and to create strategic alliances with other organizations promoting library advocacy.
- *Awards Committee*—To concentrate on the administration, promotion, and development of awards; to evaluate nominations and select worthy recipients for citations; to evaluate each award every three years; to serve as hosts during the Annual Conference to award recipients who are first-time attendees and/or who are not actively involved in ALTA activities; to approve and recommend to the ALTA Board of Directors all new awards.
- *Intellectual Freedom Committee*—To foster the principles of intellectual freedom among public library trustees; to advise the ALTA Board on matters relating to intellectual freedom; and to serve as liaison to the ALA Intellectual Freedom Round Table, and the ALA Intellectual Freedom Committee.
- *Legislative Committee*—To monitor national legislation for its impact on public library service; to encourage trustee participation in ALA and state legislative activities; to represent the interests of the ALTA division with the ALA Legislation Committee and with other appropriated groups having similar goals.

Business Committees Cluster

- *Development*—To encourage and develop relationships between ALTA and the private sector for the support of ALTA activities and services; to develop a recognition program for those vendors or others who contribute to the ALTA development program; and to develop procedures for working with the ALTA office for coordination of these activities.
- *Leadership Development*—To identify and develop ALTA member leadership; to prepare and present an annual orientation and leadership program for all ALTA volunteers that will provide an essential understanding of the division and its policies and procedures.
- *Membership Committee*—To develop and pursue an aggressive and continuous campaign to recruit and retain members for ALTA from existing and potential member groups such as library trustees, librarians, and friends of libraries.
- *Nominations Committee*—To prepare an ALTA slate of candidate for inclusion in the ALA Election Ballot.

Education Committees Cluster

- *Annual Conference Programs*—To coordinate conference programs sponsored by ALTA at Annual Conferences; to ensure broad coverage; diversity, and limited

duplication of programs; to receive conference program requests and review them for adherence to established procedures and budgets. To encourage the presentation of successful programs; to submit program requests along with the committee's recommendations to the ALTA Board for its action.

- *Regional Programming*—To develop or identify programs or speakers who can present programs around the country on behalf of ALTA; to identify successful local and state program agendas that can be shared with the state representatives and replicated in other areas of the country.
- *President's Events*—To plan the ALTA President's events including the President's Reception at the Midwinter Meeting and the President's Program at the Annual Conference.
- *PLA National Conference*—To work with Public Library Association (PLA)'s national conference committee to develop and identify programs of interest to trustees and advocates for the PLA National Conference.

Publications Committee Cluster

- *Newsletter*—To solicit or write articles for the *VOICE* in conjunction with ALTA and ALA staff.
- *Publication Development*—To initiate and coordinate the publication of books and pamphlets pertinent to the role of public library trustee service; evaluate the need for revision of published materials; to aid in originating new publication, and in defining the purpose, audience, and scope of each publication. To identify existing publications throughout the country that might be brought to ALTA for national exposure and sale.
- *Web Site Development*—To advise office staff on the development of the ALTA Web site and to represent the interests of ALTA to the ALA Web site Advisory Committee; to contribute to the development and management of Web 2.0 technologies including online communities, blogs, wikis, photo-sharing sites, etc.

THE MERGER OF ALTA AND FOLUSA

In 2008, the ALTA Board in conjunction with the Board of Friends of Libraries U.S.A. (FOLUSA) established a joint task force to determine whether and how these two organizations could combine to create a new, larger division for trustees, advocates, friends, and foundation members. FOLUSA was founded in 1989 as an independent NGO whose mission was to support library friends groups and encourage library advocacy.

The ALTA/FOLUSA joint task force developed a new set of bylaws that would effectively combine these organizations into a new, expanded division of ALA. The ALTA

Board unanimously approved sending the new bylaws to ALTA members for their approval in September 2008.

On February 1, 2009 FOLUSA officially merged with ALTA to become the Association of Library Trustees, Advocates, Friends and Foundations (ALTAFF). According to its bylaws, "The purpose of ALTAFF is to support the development of effective library service for all people in all types of communities and in all types of libraries." The new division will have a minimum of four sections: 1) Trustee Section; 2) Friends Section; 3) Foundation Section; and 4) Corporate Friends Section.

The bylaws also define the role of the new division:

<http://www.ala.org/ala/mgrps/divs/alta/Final%20ALTAFF%20Bylaws%20.pdf>.

Article II. Purposes and Responsibilities.

Section 3. ALTAFF has the specific responsibility for:

1. Educating through a continuing and comprehensive program for Library Trustees to enable them to discharge their responsibilities in a manner best fitted to benefit the public and the libraries they represent.
2. Encouraging and assisting the formation of and the development of Friends of Library groups and Library Foundations.
3. Providing a means for Trustees to have access to information and ideas that will prove useful to them in the governance of their libraries.
4. Providing Friends of Library groups and Library Foundations access to information and ideas that will prove useful to them in fundraising, library promotion, and the operation of their organizations.
5. Promoting strong state and regional Trustee and Friends of Library organizations.
6. Providing to all who value libraries the materials and support they need to be effective advocates for their libraries on the local, state, and national levels.
7. Making the public aware of the existence of formalized citizen groups such as Trustees, Friends of Library groups, and Library Foundations, and the services they perform to encourage and develop expanded citizen participation in the support of libraries across the country.

Association of Research Libraries (ARL)

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Abstract

The Association of Research Libraries (ARL) is a not-for-profit membership organization comprising over 120 libraries of North American research institutions. ARL influences the changing environment of scholarly communication and the public policies that affect research libraries and the diverse communities they serve. ARL pursues this mission by advancing the goals of its member research libraries, providing leadership in public and information policy to the scholarly and higher education communities, fostering the exchange of ideas and expertise, and shaping a future environment that leverages its interests with those of allied organizations. This account of association priorities and activities updates the entries in the first and second editions of the encyclopedia and focuses on the years 2001–2007.

FOUNDING AND FOUNDATION

For seventy-five years, ARL has addressed issues of concern to the library, research, higher education, and scholarly communities. The Association was established at a meeting in Chicago on December 29, 1932, by the directors of several major university and research libraries who recognized the need for coordinated action and desired a forum to address common problems. Forty-two libraries adopted a constitution that stated, “the object shall be, by cooperative effort, to develop and increase the resources and usefulness of the research collections in American libraries.” On December 5, 1961, the Association was incorporated under the laws of the District of Columbia and certified that “the particular business and objects of the society shall be: Exclusively for literary, educational and scientific purposes by strengthening research libraries.” A grant from the National Science Foundation in 1962 enabled the Association to establish a full-time secretariat in Washington, D.C., with a paid executive director and staff.

In 1987, a series of member discussions led to the construction of a vision statement that portrayed the future aspirations for the Association. Following the statement’s review by the membership and adoption by the Board of Directors, ARL undertook a planning process to develop the Association’s strategy for the 1990s. These efforts culminated in a new mission statement, a values statement, revised programmatic objectives, and a set of financial principles to guide the ARL leadership. In 1988, a new Executive Director was hired and charged with building the Association’s capacity to implement the strategic plan.

ARL’s mission and objectives were reviewed and updated in 1994. The ARL Board annually adopted priorities

to guide the ARL program for the current year and developed a statement of priorities to guide the Association programs for the next 3–5 years. In 2001, the membership undertook a review of core ARL programs. In February 2004, the ARL Board recognized it was time for a comprehensive membership-wide review and assessment of the ARL agenda. This plan was developed by the Strategic Planning Task Force, based on member input and with guidance from the ARL Board.

Guiding Principles

The following principles guided the Task Force in its work. (The “we” in these statements refers to the Association.)

Distinctive mission

- We complement and build on the strengths of other organizations.
- We rethink historic assumptions.
- Our policy positions guide our strategies.

Community

- We are a member-driven organization.
- We are accountable to our members.
- We provide opportunity for full engagement by all member representatives.
- We respect the diversity of our membership.

Intellectual freedom and scholarly communication

- We promote and advocate barrier-free access to research and educational information resources.

Collaboration

- We build relationships with other higher education societies and associations.
- We work closely with other library-related associations, councils, federations, etc.

Diversity

- We encourage and support our members as they strive to reflect society's diversity in their staffing, collections, leadership, and programs.
- We strive to employ a diverse staff.

Operational effectiveness

- We are focused on the needs of our member libraries.
- We allocate our resources wisely and practice sound fiscal management.
- We promote continuing staff development and growth.

The resulting strategic plan identified key priorities for ARL for 2005–2009, areas where the members agreed ARL should play a leadership role at this point in time. The three strategic directions identified in the plan relate to scholarly communication; information and public policy; and research, teaching, and learning. <http://www.arl.org/arl/governance/stratplan.shtml>.

Summary of Strategic Directions (2005–2009)

Strategic Direction I

ARL will be a leader in the development of effective, extensible, sustainable, and economically viable models of scholarly communication that provide barrier-free access to quality information in support of teaching, learning, research, and service to the community.

Strategic Direction II

ARL will influence information and other public policies, both nationally and internationally, that govern the way information is managed and made available.

Strategic Direction III

ARL will promote and facilitate new and expanding roles for ARL libraries to engage in the transformations affecting research and undergraduate and graduate education.

SCHOLARLY COMMUNICATION

ARL members have had a long-standing interest in issues of scholarly communication, initially focusing on the increasing costs of journal subscriptions. In 1989, the membership voted to establish a formal office to address their concerns. The Office of Scientific and Academic Publishing (OSAP) was created in 1990 to understand and influence the forces affecting the production, dissemination, and

use of scientific and technical information. The Office's agenda expanded to address all forms of scholarly information and in 1995 the name was changed to the Office of Scholarly Communication (OSC) to reflect the broadened scope. The OSC promotes Strategic Direction I by working to create new models for scholarly exchange that build on the widespread adoption of digital technologies and networking for research, teaching, and learning; improve the traditional systems of scholarly exchange; and increase the purchasing power of libraries and the terms and conditions under which content is made available. <http://www.arl.org/sc/index.shtml>.

New Publishing Models

ARL has been a leader in advocating the development of innovative systems that offer barrier-free access to research and educational resources. As libraries, research institutions, scholarly societies, commercial publishers, and others experiment with a variety of models to provide digital, online, unfettered access to scholarly information, a number of business models have emerged utilizing different approaches to handling publication costs, managing collections, and providing user access.

In early 2002, an ad hoc task force met to review ARL's strategy for managing intellectual property in the best interests of the academic community and the public. The task force recommended that ARL promote "open access to quality information in support of learning and scholarship." Open access, in this context, refers to works created with no expectation of financial remuneration and available at no cost to the reader on the public Internet for purposes of education and research. The task force developed a 5-year action agenda to promote open access. Activities were identified in seven major areas: education, advocacy, legal, legislative, new funding models, global alliances, and research. The task force also identified essential partners to engage in these efforts, including scholars and scientists, the higher education and library associations, university counsels, scholarly societies, and numerous others.

In February 2002, ARL signed on to the Budapest Open Access Initiative (BOAI), a movement to accelerate progress in the international effort to make research articles in all academic fields available on the public Internet at no cost to the user. Hundreds of individuals and organizations around the world, including scientists and researchers, universities, laboratories, libraries and library organizations, foundations, journals, publishers, and learned societies, have signed the initiative.

ARL published *Open Access Bibliography: Liberating Scholarly Literature with E-Prints and Open Access Journals* in early 2005. This compilation presents over 1300 selected English-language books, conference papers (including some digital video presentations), debates, editorials, e-prints, journal and magazine articles, news articles, technical reports, and other printed and electronic

sources that are useful in understanding the open access movement. It also includes a concise overview of key concepts that are central to the movement. <http://www.escholarlypub.com/oab/oab.htm>.

Since 2002, when DSpace and other institutional repository software began to be available, an increasing number of research libraries and their parent institutions have established institutional repositories to collect and provide access to diverse locally produced digital materials. A 2006 survey of ARL member libraries found that they are rapidly implementing this approach to asset management. Their repositories house a wide range of content, including theses and dissertations, preprints, postprints, and many other formats. <http://www.arl.org/bm~doc/spec292web.pdf>.

In 2006, in concert with other members of the Open Access Working Group, a coalition committed to collective advocacy of open access to research, ARL offered a statement of support in response to the Research Councils U.K. policy that mandated open access in digital repositories for funded works. The statement notes,

We believe that open access research dissemination is an indispensable part of the overall remedy to the serious problems now facing the system of scholarly communication. Moreover, open access is a necessary ingredient in any plan to fully realize the social benefits of scientific advances. While these advantages are important no matter the source of the funding, it is particularly critical when the research is publicly funded and the resulting output is a public good.

<http://www.arl.org/sparc/advocacy/oawg.html>.

A growing number of research libraries have entered into agreements that carry the collections they have built and nurtured beyond their institutions and into the world in digital format. In response to concerns that these agreements, particularly for mass digitization projects, provide responsible management of these collections, ARL engaged a consultant to provide guidance when negotiating such agreements. The consultant identified seven core library interests in evaluating digitization partnerships. He advised that “strategic, community-wide, and societal interests. . . must be an explicit part of the negotiation” and that, as stewards of their collections, libraries should consider carefully issues of exclusivity, uses of the digital files, respect for the public domain and copyright, preservation, use of standards, the quid pro quo, and transparency. Developed at the request of ARL’s Scholarly Communication Steering Committee, a checklist suggested some of the questions negotiators should ask themselves as they define their objectives in entering an agreement. <http://www.arl.org/resources/pubs/br/br250.shtml>.

Scholarly Publishing Market

OSC collects data that provides libraries with information on changes and trends in the market for scholarly

publications. Given the significant and increasing investment research libraries are making in electronic journals, ARL undertook a series of surveys of its members’ electronic journal subscriptions to better understand the issues libraries are facing in ensuring that electronic resources can be used effectively on campus.

ARL developed the first survey in 2002 to gather information about members’ subscriptions, expenditures, and licensing terms for a set of 16 commercial and not-for-profit publishers to determine how many titles libraries were subscribing to from each publisher, what they were spending, and under what pricing model. Another survey sent out in 2003 gathered information on additional issues in licensing, particularly how libraries were thinking about their upcoming negotiations for many of their electronic journal packages. A summary of the results is available at <http://www.arl.org/resources/pubs/br/asit.shtml>.

In 2005, ARL surveyed member libraries on their experiences with large bundled collections of journals to build understanding of the market practices for these bundles. The survey responses provided a broad picture of journal bundling practices and journal collecting as members provided insights into their acquisition rates, satisfaction with pricing terms, the frequency of nondisclosure agreements, contract lengths, cancellation terms, protection of bundled titles in cancellation projects, and other topics.

Information Access Alliance

OSC tracks mergers and acquisitions in the scholarly publishing arena and endeavors to raise awareness of library concerns about the increased consolidation of the publishing industry with antitrust authorities. The Information Access Alliance (IAA), formed by ARL and six other library organizations, advocates a revised analysis of publisher mergers. The IAA urged U.S. Justice Department scrutiny of two mergers of large journal publishers, the Candoover and Cinvens acquisition of Kluwer and Springer and the John Wiley & Sons acquisition of Blackwell Publishing.

In 2005, the IAA and the American Antitrust Institute hosted an invitational symposium on “Antitrust Issues in Scholarly and Legal Publishing.” The meeting presented perspectives from the library community, economists, and antitrust experts in the legal community to an audience of federal and state regulators, economics and antitrust scholars, and librarians. Participants explored issues surrounding consolidation in the scholarly and legal publishing industry and related issues arising from the development of bundling as a pricing strategy.

ARL offered comments on the “Study on the Economic and Technical Evolution of the Scientific Publication Markets in Europe” from the European Commission (the executive branch of the European Union). The study provides a detailed analysis of the journal publishing market and makes a number of policy recommendations

encouraging broader support for public access and open access approaches, regulation of journal bundling, and more vigorous antitrust review of mergers. ARL commented on antitrust and journal bundling issues through the IAA. <http://www.informationaccess.org/>.

Institute on Scholarly Communication

Strategic Direction I also focuses on “the development of library professionals who have the expertise and knowledge to contribute to enhanced and transformed systems of scholarly communication.” To this end, ARL and the Association of College & Research Libraries (ACRL) jointly sponsor the Institute on Scholarly Communication. The institute provides an immersive learning experience to prepare participants as local experts within their libraries and equip them with tools for developing campus outreach strategies. With the number of participants growing, the institute is developing additional resources, such as webcasts and survey instruments, to support library outreach efforts. <http://www.arl.org/sc/institute/index.shtml>.

SPARC

OSC was instrumental in establishing the Scholarly Publishing and Academic Resources Coalition (SPARC), an international alliance of academic and research libraries working to correct imbalances in the scholarly publishing system, in 1998. SPARC has become a catalyst for change. Its pragmatic focus is to stimulate the emergence of new scholarly communication models that expand the dissemination of scholarly research and reduce financial pressures on libraries.

SPARC’s role in stimulating change focuses on educating stakeholders, including authors, publishers, and libraries, about the problems facing scholarly communication and the opportunities for change; advocating policy changes that advance the potential of technology to advance scholarly communication and that explicitly recognize that dissemination is an essential, inseparable component of the research process; and incubating real-world demonstrations of business and publishing models that advance changes benefiting scholarship and academe. SPARC has advanced this agenda by:

- Stimulating the development of increased publishing capacity in the not-for-profit sector and encouraging new players to enter the market;
- Providing help and guidance to scientists and librarians interested in creating change;
- Creating an environment in which editors and editorial board members claim more prominent roles in the business aspects of their journals;
- Demonstrating that new journals can successfully compete for authors and quickly establish quality;

- Effectively driving down the cost of journals; and
- Carrying the methods and message of change to international stakeholders.

In 2007, membership in SPARC numbered nearly 800 institutions in North America, Europe, Japan, China, and Australia. SPARC worked with the Ligue des Bibliothèques Européennes de Recherche (LIBER) and other European organizations to establish SPARC Europe in 2001. SPARC also is affiliated with major library organizations in Australia, Canada, Denmark, New Zealand, the United Kingdom and Ireland, and North America. <http://www.arl.org/sparc/>.

Create Change

Originally designed in 2000, the Create Change Web site has been a significant resource for librarians and faculty members seeking to improve the scholarly communication system. In 2006, ARL and SPARC partnered to update the site to reflect new developments. The redesigned site highlights the perspective of faculty members to provide both an understanding of key issues in scholarly communication and ideas for taking action to promote change. One of the most popular features of the site, the “Cases in Point” section, highlights interviews of faculty members actively working with new scholarly communication models. <http://www.createchange.org/>.

PRESERVATION

The nature of library collections is changing and with change come new challenges for preservation. Paper-based books and manuscripts have been the mainstay of scholarly communications and library collections for hundreds of years. But in less than two decades digital information has become a mainstay of research in all disciplines. Web documents, moving images, sound recordings, and data sets are growing more important and mainstream for scholarship. The continued work of developing preservation strategies in research libraries requires a new level of intensity to succeed in an information landscape that is more complex and less stable than ever.

Recognizing research librarians’ fundamental role and responsibility for preservation, the ARL Committee on the Preservation of Research Library Materials held retreats in 2000 and 2001 to refocus its agenda and develop a new action plan. A statement developed by the committee and approved by the board in 2002 reaffirmed the commitment of ARL members to preserving collections as basic to an understanding of intellectual and cultural heritage through an active stewardship that enables current and future consultation and use of library resources. The statement also acknowledged the difficulties faced by libraries in trying to effectively balance

preservation needs and available resources. http://www.arl.org/preserv/presresources/responsibility_preservation.shtml.

Approximately 150 people attended the 2002 conference "Redefining Preservation, Shaping New Solutions, Forging New Partnerships" that was cosponsored by ARL and the University of Michigan Libraries. Fifteen high-priority actions were identified as needing national attention. Representatives of ARL, the Library of Congress, the Council on Library and Information Resources (CLIR), and the National Endowment for the Humanities subsequently met to review the recommendations and suggest individual and collective strategies for action. The preservation of audio-visual materials was identified as a key area needing attention. As a first step, the Preservation and Conservation Studies program of the School of Information at the University of Texas at Austin, the Library of Congress Preservation Directorate, the National Recording Preservation Board, and ARL cosponsored "Sound Savings: Preserving Audio Collections" in 2003. The program covered topics ranging from assessing the preservation needs of audio collections to creating, preserving, and making publicly available digitally reformatted audio recordings. Conference attendees articulated seven areas for future action to move the field effectively forward. http://www.arl.org/preserv/sound_savings_proceedings/.

In 2004, the ARL Board endorsed digitization as an acceptable preservation reformatting option and released the paper "Recognizing Digitization as a Preservation Reformatting Method" as a first step in building community support and facilitating the development of policies, standards, guidelines, and best practices. CLIR, the Coalition for Networked Information (CNI), OCLC, and RLG joined ARL in supporting digitization as a viable preservation reformatting strategy. http://www.arl.org/bm~doc/digi_preserv.pdf.

In 2005, ARL endorsed the statement "Urgent Action Needed to Preserve Scholarly Electronic Journals." It reflected ARL's recognition that it was a crucial time for the library community to act in support of initiatives that will ensure enduring access to scholarly e-journals. The statement arose out of a meeting of library leaders hosted by The Andrew W. Mellon Foundation and articulated four actions needed to support the development of qualified preservation archives for scholarly e-journals. http://www.arl.org/bm~doc/ejournalpreservation_final.pdf.

During a two-day invitational workshop hosted by the University of North Carolina at Chapel Hill in 2006, 30 leaders in preservation and research libraries discussed the future of preservation programs and activities within research libraries as well as at ARL. Participants included program leaders from organizations active in the preservation realm, including CLIR, CNI, the Library of Congress, The Andrew W. Mellon Foundation, the Preservation and Reformatting Section (PARS) of ALA/ALCTS and RLG-OCLC. Discussion focused on which organizations could

take various roles and what the responsibilities of research libraries are in a new era of preservation needs. Informed by the conversations and ideas generated, the Task Force on the Future of Preservation in ARL Libraries developed recommendations for an action agenda relating to ARL's three strategic program areas. A summary of the recommendations is available at <http://www.arl.org/bm~doc/arlbr251preserv.pdf>.

PUBLIC POLICIES AFFECTING RESEARCH LIBRARIES

It was no accident that the ARL offices were established in Washington, D.C. Research libraries are part of a larger community of higher education and scholarly societies that tended, in the 1960s, to congregate offices in Washington to influence federal policy. Since one of the key roles member libraries look to ARL to perform is to represent their interests before Congress and other federal agencies, the Association has a history of engagement in federal legislation affecting information policies and appropriations. Initially, it was exclusively the role of the executive director to monitor developments and look for occasions when the interests of research libraries should be articulated before the Federal Government. In some years, trying to influence legislation was an all-consuming activity for the Association's executive director and elected officers. By the early 1980s, ARL members concluded that the range of federal relations issues was expanding enough to warrant a dedicated capacity to engage these developments. In 1984, ARL added a federal relations program officer to bring focus to the increasing array of issues. In 1996, the program officer registered as a lobbyist.

A primary goal of Strategic Direction II is to influence legislative action that is favorable to the research library and higher education communities. To achieve this goal, the public policies program helps ARL members keep abreast of the legislative landscape, as well as rapidly changing issues, players, regulations, and community priorities. Program staff track the activities of state and federal legislatures as well as regulatory and government agencies in North America and abroad. Staff analyze, respond to, and seek to influence public initiatives on information, intellectual property, and telecommunications policies. In addition, the program promotes funding for numerous agencies and national institutions and advances ARL members' interests on these issues. The program works with a variety of agencies and offices on public policy issues including the National Science Foundation, United States Geological Survey, Government Printing Office, Office of Science and Technology Policy, Institute of Museum and Library Services, and the Office of Management and Budget, among others. <http://www.arl.org/pp/>.

Copyright and Intellectual Property Policies

Copyright and related intellectual property laws have important and substantial effects on the nature and extent of information services libraries provide to their users. As a key focus for Congress, the courts, and state legislatures became updating copyright and intellectual property laws to meet the challenges of the networked environment, the ARL Board identified intellectual property and copyright as a defining set of issues for the future of scholarly communications. The Digital Millennium Copyright Act, the Sonny Bono Copyright Term Extension Act, peer-to-peer file sharing and digital rights management, and legislation to create additional protections for databases have dominated the public policies agenda. Other areas of concern include orphan works—those works whose owners are difficult or even impossible to locate; Internet neutrality—the concept of keeping the Internet open to all lawful content, information, applications, and equipment; and fair use legislation. <http://www.arl.org/pp/ppcopyright/>.

The public policies program participates in a number of collaborative efforts with a diverse constituency of library, education, legal, scholarly, consumer, and public interest associations; hardware and software manufacturers; and telecommunications providers to advance its agenda and raise library and scholarly community awareness of issues associated with copyright and intellectual property management. Through these partnerships the program has represented ARL interests in a number of *amici curiae* briefs that were filed in copyright and intellectual property court cases. <http://www.arl.org/pp/ppcopyright/copyresources/intlcourt.shtml>.

Changes to copyright laws extend around the globe and the program has a growing emphasis on international copyright treaties. To help address national and international copyright issues, ARL and four other library associations created the Library Copyright Alliance (formerly named the Shared Legal Capability). The purpose of the alliance is to work toward a unified voice and common strategy for the library community in responding to and developing proposals to amend national and international copyright law and policy for the digital environment. Its mission is to foster global access and fair use of information for creativity, research, and education. Intellectual property laws are currently undergoing major changes in response to the growth in the use of digital formats for works. The alliance is principally concerned that these changes do not harm, but rather enhance, the ability of libraries and information professionals to serve the needs of people to access, use, and preserve digital information. <http://www.librarycopyrightalliance.org/>.

To assist member libraries with their copyright education activities, ARL engaged a Visiting Scholar for Campus Copyright and Intellectual Property projects. Working closely with the Public Policies Steering Committee and key ARL and SPARC staff, the visiting scholar leads the

planning and development of a multiphase ARL Copyright Education Initiative to offer information, resources, and tools that are reflective of library principles and goals and are specifically targeted to major campus constituent groups. The Know Your Copy Rights® Web site, which provides resources for librarians working on positive copyright educational programs for academic users of copyrighted materials, was launched in 2007. The site offers a range of tools to help librarians view copyright education from the perspectives of key academic stakeholders. The new resources will help librarians develop messages that are targeted to different campus groups such as faculty, students, legal counsel, academic leadership, and library staff. <http://www.knowyourcopyrights.org/>.

Public Access Policies

The U.S. government funds research with the expectation that new ideas and discoveries from the research will propel science, stimulate the economy, and improve the lives and welfare of Americans. ARL has promoted legislation and selected agency initiatives that would make federally funded research publicly available under certain circumstances. Enhancing access to federally funded research is a priority for the library community as such initiatives improve access by the public, provide for effective archiving strategies for these resources, and ensure accountability of the federal investment. <http://www.arl.org/pp/access/index.shtml>.

ARL has been a strong supporter of the National Institutes of Health (NIH) Public Access Policy. The NIH policy requested that, beginning May 2, 2005, all NIH-funded investigators submit to PubMed Central an electronic version of their final manuscripts upon acceptance for publication in peer-reviewed journals. <http://www.arl.org/pp/access/accessfunded/nihaccess.shtml>.

The Federal Depository Library Program is an important program that enables public access to federal government information. ARL and others in the library community are engaged in reexamining the role of the Federal Depository Library Program in the networked environment. <http://www.arl.org/pp/access/fdlp/index.shtml>.

Privacy, Security, and Civil Liberties

One of the key concerns of the library community has been legislation intended to promote homeland security but that may restrict access to information and have a negative impact on civil liberties. There is a need to balance the interests of public access to information, privacy, and security concerns. The USA Patriot Act and related antiterrorism measures broadened the surveillance capabilities of law enforcement and contained new provisions governing criminal and foreign intelligence investigations. ARL, with others in the library and higher education communities, worked extensively with House and Senate staff

and met with representatives of the FBI, law enforcement, and the Office of Management and Budget to discuss these measures. The program continues to monitor new legislation in this arena.

Cyberinfrastructure

An NSF-funded ARL workshop in 2006 examined the role of research and academic libraries in the stewardship of scientific and engineering digital data. Participants explored issues concerning the need for the new partnerships and collaborations among domain scientists, librarians, and data scientists to better manage digital data collections, necessary infrastructure development to support digital data, and the need for sustainable economic models to support long-term stewardship of scientific and engineering digital data for the nation's cyberinfrastructure. The workshop report reflects the recognition that digital data stewardship is fundamental to the future of scientific and engineering research and the education enterprise and hence to innovation and competitiveness. <http://www.arl.org/bm~doc/digdatartpt.pdf>.

Federal Funding

ARL, with others in the library and education communities, supports the annual appropriations of a number of federal and congressional agencies, national libraries, and agency programs and initiatives. These include the Institute of Museum and Library Services, the Library of Congress, the National Agricultural Library, the National Archives and Records Administration, the National Endowment for the Humanities, the National Science Foundation, and the U.S. Government Printing Office.

RESEARCH, TEACHING, AND LEARNING

The transformation of research libraries mirrors to a large degree the ongoing evolution of research institutions, especially the changes underway in the very processes of research, teaching, and learning. The 2005–2009 strategic planning process identified the need for Strategic Direction III, which focuses on new and expanding roles for ARL libraries to engage in the transformations affecting research and undergraduate and graduate education.

In 2005, the webcast “Teaching, Learning & Research: Libraries and Their Role in the Academic Institution” convened library staff to discuss the role libraries play in academia and highlighted the way one library is moving to more fully engage with faculty and students in this process.

In 2006, the Research Teaching and Learning (RTL) Steering Committee focused on establishing subgroups to pursue ARL's newest strategic direction. The RTL Steering Committee established a Task Force on Library

Roles in Enhanced Environments for Teaching and Learning to advise on a strategic agenda to advance research library roles in teaching and learning. The task force recommended undertaking a broad environmental scan of member activities in support of teaching and learning; securing professional assistance in defining a public relations campaign that addresses the roles research libraries play in the teaching and learning enterprise; strengthening partnerships that leverage common interests, particularly with the EDUCAUSE Learning Initiative and CNI; enabling professional development opportunities for library staff; and identifying best practices for library facilities. The RTL Steering Committee and the Scholarly Communication Steering Committee together established a Joint Task Force on Library Support for E-Science to recommend and initiate strategies to address emerging issues in the role of research libraries in e-science. Other subgroups within Strategic Direction III address special collections and diversity. In 2007, a Program Director for Research, Teaching, and Learning was hired to support these activities.

DIVERSITY INITIATIVES

The need for support in the recruitment and training of librarians, especially minority librarians, was expressed as early as the 1960s and 1970s in funding provisions of the Higher Education Act Title II-B. For many years, ARL worked with members to address their growing concerns about recruiting and retaining a diverse workforce in research libraries. Two grants from the H. W. Wilson Foundation in 1990 and 1991 enabled ARL to establish the project “Meeting the Challenges of a Culturally Diverse Workforce” and hire a part-time Diversity Consultant. Demand for seminars, resource materials, and consulting services on diversity topics continued to grow. By 1993, the ARL membership recognized the need for a full-time program to address minority recruitment and retention. A grant from the Gladys Krieble Delmas Foundation in 1994 assured a stable beginning for the program.

ARL's Diversity Initiatives encapsulate a suite of efforts implemented across the strategic directions that aid the Association in defining and addressing diversity issues in ARL libraries. This program seeks to encourage exploration of the rich gifts and talents that diverse individuals bring to the library. ARL staff work closely with a broad range of libraries, graduate library education programs, and other library associations to promote awareness of career opportunities in research libraries and support the academic success of students from groups currently underrepresented in the profession.

ARL launched the Leadership and Career Development Program (LCDP) in 1997. The 18-month program prepares mid-career librarians from underrepresented racial and ethnic groups to take on increasingly demanding

leadership roles in ARL libraries and addresses the needs of research libraries to develop a more diverse professional workforce that can contribute to library success in serving increasingly diverse scholarly and learning communities. Over the course of four LCDP offerings, 80 librarians completed the program and a large percentage of them have either been promoted within their libraries or have taken new positions with significantly expanded responsibility.

In 2005, ARL conducted an evaluation of the program's effectiveness. The feedback confirmed the continued need for this program and recommended that its instructional design be tied directly to ARL's strategic directions. The goal of the redesigned LCDP is to provide meaningful exposure to and experience with the strategic issues that are shaping the future of research libraries and to prepare professionals of color for increasingly demanding leadership roles in ARL libraries.

The Initiative to Recruit a Diverse Workforce began in 2000 with support from ARL member libraries. The Institute of Museum and Library Services (IMLS) provided additional support in 2003. The program offers a stipend of up to \$10,000 over two years, a mentoring relationship with an experienced librarian, and a leadership training curriculum to MLIS students from underrepresented groups who are interested in careers in research libraries. This multi-year initiative reflects the commitment of ARL members to create a diverse academic and research library community that will better meet the new challenges of global competition and changing demographics. In 2006, the program was awarded a three-year grant through the IMLS Laura Bush 21st Century Librarian Program. These additional funds allow ARL to address the growing need for specialized librarians to help users who create and need access to digital resources and scientific data. The primary goal of the project is to educate, develop, and hire new librarians from underrepresented racial and ethnic groups, especially those with a background in applied and natural sciences and information technology. Forty-five graduate students will receive stipends, mentoring, and leadership development experiences to launch their careers in an ARL library.

The ARL Academy: Careers in Academic and Research Libraries was designed to recruit, educate, and promote visibility within the profession of MLIS students who bring previously gained educational and professional experiences to academic and research libraries. The Academy was a partnership between ARL and three library and information science schools—Catholic University of America, Simmons College, and the University of North Carolina at Chapel Hill. The program was generously supported through an IMLS Recruiting and Education Librarians for the 21st Century grant.

Each fall, from 2004 through 2006, five students from each of the three schools were selected as ARL Academy Fellows. Fellows brought Ph.D.'s or specialized educational

accomplishments to the program. As part of the program, Fellows were immersed through their classes in the core philosophical and theoretical context necessary to successfully contribute within libraries at professional levels. Simultaneously, they gained mentored work experience in an ARL library to significantly increase their exposure, competence, and marketability upon graduation.

LEADERSHIP DEVELOPMENT

For over 30 years, the Office of Leadership and Management Services designed and facilitated effective and well-attended library staff development programs and offered services that helped research libraries serve their clientele through the training and strategic deployment of talented individuals. During the 2004 strategic planning process neither professional development and training nor organizational development emerged as top priority issues for ARL members.

In 2005, the membership expressed a range of views about ARL's ongoing involvement in leadership development, especially about the appropriate level of investment of dues to address issues in this arena. The Board established a Task Force on Leadership Development to provide advice on ARL's future approach to addressing executive leadership development issues on behalf of its member libraries. The task force was asked specifically to identify and clarify needs for executive leadership development and succession planning in research libraries and to develop recommendations for strategies to be adopted by the Association for addressing those needs. The responses to a survey conducted by the task force indicated a convergence of views on the need for leadership development resources, especially for executive leadership roles, yet a range of views on how ARL should contribute to meeting those needs. The task force recommended that ARL make a targeted investment to address a set of leadership development needs in the evolving research library environment.

ARL and five member libraries piloted the ARL Research Library Leadership Fellows Program in 2005. This new executive leadership program identifies the unique demands facing directors of large research libraries and prepares participants to develop the skills and professional networks to move into those positions. The pilot program was sponsored by the University of California at Los Angeles; Columbia University; University of Illinois at Urbana-Champaign; University of Texas at Austin; and University of Washington. The second offering began in 2007 and was sponsored by the University of California, Berkeley and the California Digital Library; Harvard University; University of Minnesota; North Carolina State University; Pennsylvania State University; and the University of Toronto. The program offers an opportunity for development of future senior level leaders in large

research libraries. It exposes and engages library staff who have the desire and potential for leadership at ARL libraries to themes and institutions that will enhance their preparedness.

COLLECTIONS AND ACCESS

Global Resources

The importance of foreign materials to research libraries was a concern to the Association almost from its beginning. The Farmington Plan, proposed in 1942 by a committee of the Librarian's Council of the Library of Congress, was sponsored by ARL in 1944 and began operation in 1948. The plan was a voluntary agreement under which some 60 libraries attempted to bring to the United States at least one copy of each new foreign monograph of research value. In 1968, with a grant from the Ford Foundation, ARL established its Center for Chinese Research Materials to help bring rare and scattered Chinese materials to libraries at a reasonable cost. The center became a separate organization in 1986.

The ARL Foreign Acquisitions Program, begun in 1991 with support from The Andrew W. Mellon Foundation, assessed the state of global resources in research libraries in North America. The project found a pattern of retrenchment across most collecting areas and an aggregate reduction on the number of unique titles acquired from overseas. A variety of strategies to monitor and respond to this situation were recommended. In 1995, the ARL Board approved the strategic plan for the AAU/ARL Global Resources Program (GRP) as part of the Association's collections activities. The program began in early 1997 with funding from The Andrew W. Mellon Foundation. Originally intended to be a three-year grant, the funding enabled over five years of activity focused on improving access to international research materials through cooperative structures and the use of new technologies, and on generating increased communication with the scholarly community regarding future information needs. In addition, the GRP funding served as seed money for the regional projects, two of which received significant additional funding from the U.S. Department of Education's Title VI Program for Technological Cooperation and Innovation for Foreign Information Access. The regional projects sponsored by the GRP addressed seven countries or world areas: Africa, Eastern Europe, Germany, Japan, Latin America, South Asia, and Southeast Asia. Each developed differently, based on the needs of scholars who use materials from the area and on the perceptions of area specialist librarians of the most pressing challenges for information access.

In 2003, the GRP Advisory Committee, comprised of leaders from both libraries and the academy, reaffirmed the program's importance as a sustainable, broad-gauged

vehicle through which AAU and ARL could combine cooperation with technology in order to expand access to international information. The report, "Scholars, Libraries, and the AAU/ARL Global Resources Program," framed a discussion of several different organizational scenarios and the associated financial options. As a result, the GRP was reframed as the Global Resources Network (GRN).

On January 1, 2006, the Center for Research Libraries (CRL) assumed leadership, governance, coordination, and services of the GRN. During the transition year, the existing GRN Advisory Committee continued to provide intellectual leadership and direction to the network, ensure a smooth transition, and provide ARL oversight while ARL members contributed to GRN funding. CRL now provides administrative, technical, legal, financial management, and communications support for the regular activities of the GRN and its related projects.

Special Collections

For research libraries, special collections are a point of considerable pride. Indeed, these collections are what distinguish and differentiate research libraries. ARL conducted surveys of special collections in member libraries in 1979 and 1998. The goals of the 1998 survey were to equip members to protect and promote special collections as an essential element of research libraries; to articulate the role of special collections within the library program; and to visibly integrate special collections with the goals of the library and the university. The survey results found that special collections constitute a vast and varied resource that is growing not only in size but in scope. http://www.arl.org/bm~doc/spec_colls_in_arl.pdf.

In 2001, a symposium was held at Brown University to explore the prospects and promise of special collections in the expanding electronic environment. "Building on Strength: Developing an ARL Agenda for Special Collections" brought together ARL directors, heads of special collections, invited guests, and speakers to articulate a long-term programmatic agenda for special collections in research libraries. <http://www.arl.org/rtl/spccoll/spcollres/>

An ARL Special Collections Task Force was formed in late 2001 and charged to engage and advance the agenda that emerged from the symposium. This group brought together ARL directors and special collections librarians, including representatives of the ALA Rare Books and Manuscripts Section (RBMS) and the Society of American Archivists (SAA). They developed a report and an action plan that addresses key points in the symposium agenda, including: enhancing access to collections and backlogs; coordinating planning for collecting nineteenth and twentieth century materials and those in new formats; defining core competencies among special collections librarians and creating training opportunities; and incorporating

special collections topics into the agenda of ARL standing committees. <http://www.arl.org/rtl/speccoll/spcolltf/>.

Over 190 participants from libraries, archives, and funding agencies attended the “Exposing Hidden Collections” conference in 2003 to explore the challenges of providing access to uncataloged and unprocessed archival, manuscript, and rare book materials. One of the major recommendations from the conference was identification and promotion of a shared commitment to certain themes and subjects to encourage cooperative action among libraries and archives to process this material. A survey assessed the interest of libraries and archives in cooperative projects on the themes and also asked for brief descriptions of the top three hidden collections a library or archive was most eager to process, regardless of theme, format or vintage. The task force recommended the development of a position statement to encourage libraries and archives to expose hidden collections through some form of expedited access; a recommendation for a technical strategy for an inventory of unprocessed collections that includes establishing cooperative ties to the Program for Cooperative Cataloging and with the group revising the rare book cataloging standard; and an ACRL/RBMS pre-conference on using collection level records to deal with backlogs of unprocessed special collections. The white paper and a summary of the conference discussions are available at <http://www.arl.org/rtl/speccoll/hidden/>.

Throughout the work of the Special Collections Task Force, the urgent need to develop the next generation of special collections librarians and administrators has been a recurring theme. A small working meeting was held in 2003 that brought together library directors, special collections librarians and archivists, and library and information science educators to discuss possible responses to this critical situation. The white paper “Education and Training for Careers in Special Collections” found a pressing need for recruitment, education, and training of special collections professionals at all career levels. It calls for the articulation of professional competencies needed for positions in special collections, the development of a shared culture among librarians and archivists, and encouragement of the provision of opportunities for development and professional growth for mid-career practitioners. <http://www.arl.org/rtl/speccoll/spcolltd/>.

A statement of principles, “Research Libraries and the Commitment to Special Collections,” contained the key message that

Special Collections represent not only the heart of an ARL library’s mission, but one of the critical identifiers of a research library. . . . The development, preservation, support, stewardship, and dissemination of major special collections is both a characteristic of the true research library, and an obligation assumed by all members of the Association of Research Libraries.

The statement also articulates the kind of actions that member libraries of ARL should take to support special collections, including providing reliable funding for the support, staffing, and preservation of special collections; building special collections in keeping with institutional collection development policies, existing strengths, and regional or national commitments; and entering a new collection area only if there is a firm commitment to develop the collection and make it accessible to users. <http://www.arl.org/rtl/speccoll/speccollprinciples.shtml>.

In 2006, the RTL Steering Committee reviewed the final report of the Special Collections Task Force and identified priority elements for ARL’s future agenda on special collections as encouraging concerted action and coordinated planning for collecting and exposing nineteenth and twentieth century materials in all formats (rare books, archives and manuscripts, audio, and video); and identifying criteria and strategies for collecting digital and other new media material that currently lack a recognized and responsible structure for stewardship. The steering committee established a new Special Collections Working Group in 2007 to pursue this new agenda. <http://www.arl.org/rtl/speccoll/spcolltf/status0706.shtml>.

Resource Sharing

For many years the access services program undertook activities to support resource sharing among research libraries in the electronic environment and to improve access to research information resources while minimizing costs for libraries. This program worked to strengthen interlibrary loan and document delivery performance, interoperability among library systems, cooperative cataloging programs, and policies that increased user access to information both onsite and remotely.

A centerpiece of the program was the North American Interlibrary Loan and Document Delivery (NAILDD) Project, initiated by ARL in 1993 to facilitate the development of standards, software, and system design capabilities to improve interlibrary loan and document delivery (ILL/DD) services for users, and to make them more cost effective for research libraries. The NAILDD Project involved the collaboration of over 40 key ILL/DD vendors and system suppliers.

The first Directors Forum on Managing ILL/DD Operations was held in 1995 and marked the beginning of concerted efforts to understand and improve interlibrary loan and document delivery services. The Interlibrary Loan/Document Delivery Performance Measures Study was a two-year effort to measure the performance of ILL departments in 119 North American research and college libraries. The study, funded by The Andrew W. Mellon Foundation, examined four performance measures: direct cost, fill rate, turnaround time, and user satisfaction. This study highlighted the characteristics of high-performing borrowing and lending operations in research libraries.

Techniques to implement these “best practices” were the basis for the “From Data to Action” workshops. Over 400 librarians and representatives from the commercial community attended the twelve workshops offered between October 1998 and March 2001.

The Assessing ILL/DD Services Study in 2002 and 2003 was ARL’s third effort in a decade to measure the performance of interlibrary loan operations in North American libraries. The study tracked the performance of mediated and user-initiated ILL/DD operations in 72 research, academic, and special libraries including unit cost, fill rate, and turnaround time for mediated borrowing and lending services. These same measures were also taken for seven user-initiated services. The final report of the study, “Assessing ILL/DD Services: New Cost-Effective Alternatives,” confirmed that, in general, user-initiated services have lower unit costs, higher fill rates, and faster turnaround times than mediated ILL/DD services. The report also identified high-performing borrowing and lending operations and laid out strategies for libraries seeking to improve local services.

STATISTICS AND MEASUREMENT

The ARL Statistics and Measurement Program focuses on describing and measuring the performance of research libraries and their contributions to research, scholarship, and community service. ARL serves a leadership role in the development, testing, and application of academic library performance measures, statistics, and management tools. Grounded in the tradition of the North American research library environment, the program provides analysis and reports of quantitative and qualitative indicators of library collections, personnel, and services by using a variety of evidence gathering mechanisms, and tools. <http://www.arl.org/stats/>.

ARL Statistics

ARL Statistics is a series of annual publications that describe the collections, expenditures, staffing, and service activities for the member libraries of the Association of Research Libraries. The annual statistics series also includes the *ARL Academic Health Sciences Library Statistics*, the *ARL Academic Law Library Statistics*, and the *ARL Preservation Statistics*.

The *ARL Annual Salary Survey* is a compilation of data covering over 12,000 professional positions in ARL libraries. Tables display average, median, and beginning salaries; salaries by position and experience, sex, and race/ethnic background; and salaries in different geographic regions and sizes of libraries. Additional tables cover law, medical, Canadian, and nonuniversity research libraries. <http://www.arl.org/stats/annualsurveys/>.

Performance Measures

New measures that address issues of service quality, electronic resource usage and value, and outcomes assessment are also being developed. StatsQUAL®, is a gateway to library assessment tools that describe the role, character, and impact of physical and digital libraries. Through StatsQUAL®, libraries gain access to a number of resources that are used to assess library’s effectiveness and contributions to teaching, learning, and research. StatsQUAL®, presents these tools in a single powerful interactive framework that integrates and enhances data mining and presentation both within and across institutions. StatsQUAL®, includes instruments and data such as LibQUAL+®, DigiQUAL®, and MINES for Libraries®, as well as a growing dataset of survey results.

LibQUAL+® is a rigorously tested Web-based survey that libraries use to solicit, track, understand, and act upon users’ opinions of service quality. Results have been used to develop a better understanding of perceptions of library service quality, interpret user feedback systematically over time, and identify best practices across institutions. <http://www.libqual.org/>.

The DigiQUAL® project is modifying and repurposing the existing LibQUAL+® protocol to assess the services provided by digital libraries. DigiQUAL® has identified 180+ items around twelve themes related to digital library service quality. The first phase of DigiQUAL® involved testing subsets of these elements with five pilot sites.

MINES for Libraries®™ is an online transaction-based survey that collects data on the purpose of use of electronic resources and the demographics of users. As libraries implement access to electronic resources through portals, collaborations, and consortium arrangements, the Measuring the Impact of Networked Electronic Services (MINES) protocol offers a convenient way to collect information from users in an environment where they no longer need to physically enter the library in order to access resources.

To address the issues of learning outcomes, ARL supported Project SAILS (Standardized Assessment of Information Literacy Skills). This 2003–2006 project was funded through an IMLS grant to Kent State University to develop a Web-based standardized test that allowed cohorts of students to be evaluated against the ACRL Information Literacy Competency Standards for Higher Education. Kent State made the project operational at the end of 2006. <http://www.projectsails.org>.

ARL is helping libraries develop effective, sustainable, and practical assessment activities that demonstrate the libraries’ contributions to teaching, learning, and research. “Effective, Sustainable, and Practical Library Assessment,” grew out of a two-year project called “Making Library Assessment Work,” which involved 25 libraries during 2005–2006. The service involves a site visit to each participating library, a report to each library with

recommendations on practical and sustainable assessment, and follow-up assistance in implementing the recommendations. It is now open to both ARL member and nonmember libraries. <http://www.arl.org/stats/initiatives/espassessment/>.

TECHNOLOGY

As a strategic response to the realization that telecommunications networks would play a major role in the reform and enrichment of teaching, learning, and education in the twenty-first century, ARL, CAUSE, and EDUCOM (now EDUCAUSE) formed the Coalition for Networked Information (CNI) in 1990. CNI is an organization dedicated to advancing the transformative promise of networked information technology for the advancement of scholarly communication and the enrichment of intellectual productivity. In establishing CNI, the sponsor organizations recognized the need to broaden the community's thinking beyond issues of network connectivity and bandwidth to encompass networked information content and applications. Reaping the benefits of the Internet for scholarship, research, and education demands new partnerships, new institutional roles, and new technologies and infrastructure. The Coalition seeks to further these collaborations, to explore new roles, and to catalyze the development and deployment of the necessary technology base. <http://www.cni.org> (See the entry on "Coalition for Networked Information (CNI)," p. 1080.)

ARL's Web site was established in 1994 and by the end of 2006 had grown to be extremely large and complex, consisting of over 50,000 pages. In January 2007, ARL launched a newly designed Web site. The updated, streamlined design was developed to improve navigation within the site. The new site focuses on current activities of the Association and many legacy files were not migrated. These were archived and are made available upon request.

MEMBERSHIP

Membership in the Association of Research Libraries is necessarily limited to research institutions sharing common values, goals, interests, and needs. The members of ARL are research libraries distinguished by the breadth and quality of their collections and services. Each member also makes distinctive contributions to the aggregation of research resources and services in North America. Membership is based on the research nature of the library and the parent institution's aspirations and achievements as a research institution. Membership is by invitation upon the recommendation of the Board of Directors and approval of the membership. Once achieved, membership is presumed

to be continuing. The criteria for ARL membership derive from efforts to define a universe of similar institutions that share a commitment to providing the materials and services needed for serious study and research. The principles and procedures of membership are explained at <http://www.arl.org/arl/membership/qualprin.shtml>. A list of member institutions is at <http://www.arl.org/arl/membership/members.shtml>.

GOVERNANCE

ARL's Board of Directors is composed of 12 member library representatives who are elected by the membership to serve 3-year terms. ARL committees, task forces, and working groups are also composed of member representatives who wish to work on specific issues important to the Association membership. There are steering committees for each of the three strategic directions: Scholarly Communication, Public Policies Affecting Research Libraries, and Research, Teaching, and Learning. The chairs of these committees serve as nonvoting ex officio members of the ARL Board. Other standing committees include the Membership Committee, Nominating Committee, and Statistics and Assessment Committee. A number of Advisory Committees, Working Groups, and Task Forces work on specific projects and programs of the Association. They are ongoing or temporary as appropriate. <http://www.arl.org/arl/governance/cmte.shtml>.

There are two membership meetings each year to transact business, provide a forum for discussion of emerging issues, and build the Association's agenda. Since the 1970s, member representatives and invited guests have gathered at an October meeting in Washington, D.C., and a May meeting hosted by and near a member library. During the fall meeting, in addition to committee meetings and group discussion sessions, the membership approves the dues for the coming year and elects new Board members. The spring meeting agenda is built around a specific topic of concern to research libraries. Minutes, and later Proceedings, of meetings 1–133 are available in print. Proceedings since meeting 124 are available at <http://new.arl.org/resources/pubs/mmproceedings/>.

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Association of Specialized and Cooperative Library Agencies (ASCLA)

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Abstract

The Association of Specialized and Cooperative Library Agencies (ASCLA) is a division of the American Library Association (ALA). ASCLA is the professional home for state library agency personnel, librarians serving special populations, multitype librarians, and consultants and other independent librarians. The ASCLA members were strong advocates of the Library Services and Technology Act (LSTA) and will be active in urging reauthorization of the act. The ASCLA also sponsors the Americans with Disabilities Act (ADA) Assembly, an ALA-wide group designed to foster coordination of efforts to meet the challenges and opportunities presented by the ADA legislation.

INTRODUCTION

The Association of Specialized and Cooperative Library Agencies (ASCLA), a division of the American Library Association (ALA), enhances the effectiveness of library service by providing networking, enrichment and educational opportunities for its diverse members, who represent state library agencies, libraries serving special populations, multitype library organizations and independent librarians. It is a community that focuses on evolving issues that cut across library boundaries. Emphasizing the future, ASCLA supports individuals in their personal development and career growth.

DEFINITIONS

State library agencies are those organizations created or authorized by the state government to promote library services in the state through the organization and coordination of a variety of library services.

Specialized library agencies are those organizations that provide materials and services to meet the information needs of persons whose access to library services and materials is limited because of confinement, sensory, mental, physical, health, or behavioral conditions.

Multitype library cooperatives are combinations, mergers, or contractual associations of two or more types of libraries (academic, public, special, or school) crossing jurisdictional, institutional, or political boundaries, working together to achieve maximum effective use of funds to provide library and informational services to all persons above and beyond those that can be provided through one institution. Such cooperative agencies may be designed to serve a community, a metropolitan area, a region within a region, or may serve a statewide or multistate area.

Independent librarians provide services outside of the traditional library setting.

MEMBERSHIP

The ASCLA has the distinction of being the ALA's smallest division yet it has the most diverse membership. With just over 1000 members, ASCLA is the professional home for state library agency personnel, librarians serving special populations, multitype librarians, and consultants and other independent librarians. These four groups joined together over the years when various other ALA divisions and roundtables merged. For example, in 1977, two ALA divisions, the Association of State Library Agencies and the Health and Rehabilitative Library Services Division merged and took on the name ASCLA. The independent librarians joined ASCLA in 1998 when their ALA roundtable, Independent Librarians' Exchange Round Table voted to merge with the division.

ORGANIZATION

The ASCLA is organized into four membership sections: Independent Librarians' Exchange Section, Interlibrary Cooperation and Networking Section (ICAN), Libraries Serving Special Populations Section (LSSPS), and State Library Agency Section (SLAS). Each section offers members committee and discussion group opportunities. The ICAN offers discussion groups on interlibrary cooperation, the virtual library, and network management. The LSSPS offers the following forums: Library Service to People with Visual or Physical Disabilities, Library Service to the Deaf, Library Service to the Impaired Elderly, and Library Service to Prisoners. The SLAS offers

discussion groups for Library Services and Technology Act (LSTA) coordinators, consultants for services to children and young adults, consultants to institutional libraries, and state library consultants.

The ASCLA also sponsors the Americans with Disabilities Act (ADA) Assembly, an ALA-wide group designed to foster coordination of efforts to meet the challenges and opportunities presented by the ADA legislation.

PUBLICATIONS

The ASCLA publishes *Interface*, a quarterly newsletter containing news of division activities. The association also publishes monographs; recent titles include *Guidelines for Library Services for People with Mental Illnesses*; *Revised Standards and Guidelines of Service for the Library of Congress Network of Libraries for the Blind and Physically Handicapped*; *The Functions and Roles of State Library Agencies* and *Library Networks in the New Millennium: Top Ten Trends*.

AWARDS AND SCHOLARSHIPS

The ASCLA sponsors the following awards and scholarships:

- The ASCLA Exceptional Service Award: A citation presented to recognize exceptional service to patients; to the homebound; to medical, nursing, and other professional staff in hospitals; and to inmates.
- The ASCLA Leadership and Professional Achievement Award: A citation presented to recognize leadership and achievement to one or more ASCLA members in the following areas of activity: consulting, multitype library cooperation, networking, statewide service and programs and state library development.
- The Cathleen Bourdon Service Award: A citation presented to recognize an ASCLA personal member for outstanding service and leadership to the division.
- The ASCLA/National Organization on Disability Award: A \$1000 award and certificate for a library organization that has provided outstanding services for people with disabilities.
- The Francis Joseph Campbell Award: A citation and medal presented to a person who has made an outstanding contribution to the advancement of library service for the blind and physically handicapped.
- The Century Scholarship: Up to \$2500 annually to be used for accommodations or services not provided by law or the university to a student or students with a disability pursuing a degree in library and information science at an ALA-accredited library school. The award supports the ALA mission of improving service at the local level through the development of a representative

workforce that reflects the communities served by all libraries in the new millennium.

CONTINUING EDUCATION OPPORTUNITIES

During the ALA Annual Conference, the ASCLA offers programs on topics such as planning and implementation of open source software for cooperatives and consortia, universal accessibility of physical and virtual collections and of the physical plant, outreach and leadership. The association also presents full-day workshops before the ALA Annual Conference on topics such as accessibility, strategic planning, and sustainability. Finally, the ASCLA has developed an online continuing education course on the topic of selecting Spanish-language materials for adults, an introductory course to help public library staff learn the basics of developing a Spanish-language collection.

STANDARDS

The ASCLA sets standards on recommended performance for the profession. The association has adopted the following standards:

- The Functions and Roles of State Library Agencies, 2000.
- Guidelines for Library and Information Services for the American Deaf Community, 1995.
- Library Standards for Adult Correctional Institutions, 1992.
- Library Standards for Juvenile Correctional Institutions, 1999.
- Library Services for People with Mental Retardation, 1999.
- Revised Standards of Service for the Library of Congress Network of Libraries for the Blind and Physically Handicapped, 1995.

PROBLEMS AND ISSUES

One of ASCLA's challenges is to increase membership rates. Although there are advantages to being a small organization with a diverse membership, it is critical that ASCLA recruit more members. Building the membership will help provide a better financial footing for the organization. Another challenge is to find effective and economical ways of providing continuing education to members, particularly those members who are unable to attend ALA conferences. ASCLA has begun a program on online continuing education and has plans to increase the number of topics in this area.

CONCLUSION

The ASCLA members were strong advocates of the LSTA and will be active in urging reauthorization of the act. The ASCLA members closely worked with the ALA Washington Office on the development of a website database that provides stories of the impact LSTA funds have had on local communities and ASCLA's Legislative Committee works to strengthen ALA's advocacy efforts in this arena.

Members of the ADA Assembly will continue to assist libraries in making their services and collections assessable to people with disabilities through such policy statements and development of new guidelines for libraries.

In 2007, the ASCLA ICAN members and other librarians from networks, cooperatives and consortia, participated in the development of the first-ever database of information about how networks and cooperatives operate and the many ways in which these collaborative

organizations help to advance learning communities. The ASCLA will encourage participants from the base study to regularly update directory information and the data derived from the surveys to keep the data as up-to-date as possible. The final report database is housed on the ASCLA web. Data was collected from over 200 participating library networks, cooperatives and consortia. The data was collected through a project administered by the ALA Office for Research and Statistics (ORS) and funded in part by a grant from the Institute of Museum and Library Services.

BIBLIOGRAPHY

1. More information on the Association of Specialized and Cooperative Library Agencies, including full-text of policies and links to disability resources is available on the ASCLA website, <http://ascla.ala.org>.

Australia: Libraries, Archives, and Museums

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Abstract

Over the two centuries since European settlement, Australia has developed fine archives, libraries and museums which are guided by strong curatorial professions. Globally linked and technologically proficient, their standards conform to international models of good practice and sometimes lead the way. The particular challenges posed by distance within a very large country and distance from major centers of curatorial practice and the opportunities offered by an advanced economy have enabled Australia's museologists, archivists and librarians to engage with distinctive issues including those relating to the development of a new multicultural national identity which celebrates both the ancient Indigenous knowledge systems and those brought by visitors and settlers since 1788.

INTRODUCTION

Occupied by humans for some 60,000 years, Australia has long traditions of preserving and transmitting knowledge both orally and through iconographic art as well as the development of technology. However, it was with the arrival of British colonizers from 1788 that European modes of keeping records, gathering collections and publishing observations and opinions as well as the habits of reading and book-based study came to the southern continent. The colonizers brought with them the emerging concepts of modern libraries, museums and archives that were being developed in northern Europe and North America and which were significantly shaped by the Enlightenment. And the explorers and colonizers displayed a need both to share their new found knowledge about the vast land which they encountered and to stay in touch with developments at “home” on the other side of the world.^[1]

As settlement proceeded through the nineteenth century, the establishment of museums and libraries marked the growing maturity of the developing colonial cities of Sydney, Hobart, Melbourne, Brisbane, Adelaide and Perth and some significant ports and regional centers. The creation of those institutions confirmed to the European sensibilities of both settlers and visitors that the new cities were truly becoming civilized and that the frontier of settlement was receding from them. In postgold rush “Marvelous Melbourne,” for example, the establishment and construction of the imposing Museum and Library of Victoria on one of the grand avenues, Swanston Street, signaled that the city's aspiration to be considered one of the great cities of the British Empire.

After protracted negotiations, the colonies agreed to federate to create a new nation, the Commonwealth of Australia, on January 1, 1901. The words of the first prime minister of Australia, Sir Edmund Barton, “For the first

time in history, we have a nation for a continent and a continent for a nation,”^[2] expressed the greatest challenge to all institutions in Australia, the “tyranny of distance.”^[3] While the nation spreads across an area (7,682,300 km² or 2,966,153 mi²) which is almost the same as the total size of the contiguous United States of America, much of the country is arid and the northern part is tropical and mostly extremely remote. The population (now approximately 21 million) was, and continues to be, concentrated in cities and major towns along the coastline, especially in the southeastern quarter. With the exception of the national capital which is located 147 km (92 mi) inland in the purpose built city of Canberra, both governments and major civic and private institutions have been located in the coastal capitals. With vast distances and thin populations it has been difficult to provide services across the nation to smaller cities, towns and remote communities (Fig. 1).

The other key aspect of distance, the distance from the primary centers of professional validation in Europe and North America, constrained Australia's libraries, archives and museums in the early years but has been a lesser concern since the spread of modern transport and telecommunications technologies which place Australians less than 24 hr flight or a few mouse clicks from those centers. Although Australia lacks any borders with adjoining nations, its peoples have long had links to other countries. They extended from the trade and cultural links that the Yolgnu of northeastern Arnhem Land enjoyed for centuries with the Macassan trepang (*Holothuria* sp. also known as *bêche de mer* or sea cucumber) fishermen from their north to today's complex of familial, cultural, trade and professional linkages. That diverse globalism was vastly enriched through the large-scale mass migration programs initiated after World War II. A continuing process, it has brought people from some 200 nations to Australia, changing it and its institutions from the



Fig. 1 Map of Australia from *CIA World Factbook*.

formerly predominant orientation towards British institutions and models to a confident transnational outlook.

One of the first nations to introduce free, secular and compulsory elementary education with the pioneering Education Acts in Victoria and the other colonies from 1872, Australia has long enjoyed high standards of education and high levels of literacy. A culture of reading was well established even in nineteenth century rural life and Australia continues to rank highly in international comparisons of literacy and numeracy. Its researchers produce some 2% of the recognized international scholarly literature, a proportion much higher than its population would indicate. Science was inspired by the unique flora and fauna (first noted by early visiting explorers and collectors, notably Sir Joseph Banks on James Cook's *Endeavour* in 1770), the need to develop agriculture appropriately for the various climatic regions and soils, and the identification of ore bodies. Research and technological development has tended to follow those priorities with marked international standing in biomedicine, agriculture and the extractive industries.

Those strengths echo the orientation of Australia's economy to global trade essentially in agricultural, mining and energy commodities and, more recently, financial, professional and educational services. A domestic manufacturing sector has been reshaped by the progressive removal of trade barriers since the 1980s so that most manufactured goods are imported and a fairly small number of companies produce for export. Publishing and other creative industries in Australia face a considerable challenge from imported media and consequently focus on

generating Australian cultural products with low levels of governmental support.

As in the United States, the Australian states have considerable autonomy within the federation so the early differences among them and their institutions have persisted to a significant extent. The national institutions have lacked the authority to direct state and local institutions and their status as the leading national institutions has in some cases been contested by longer established state institutions. Only the National Library of Australia has had legislated authority to provide leadership within its sector but even it has had to attempt to lead by persuasion rather than direction and the legitimacy of that role has sometimes been questioned.

However, the combination of relatively small professional communities with quite strong professional associations has led to good communication and sharing across the memory professions. This has resulted in consistent standards of practice which have been shaped by well-regarded professional education programs and which rate highly in international comparisons. English speaking, welcoming to expatriates from other countries and willing to travel, Australian professionals have been well informed about developments in other countries, especially the British Isles and North America and have been known as innovators and early adopters of innovations. An increasing number have practiced in other countries or have provided leadership in their professions internationally.

LIBRARY AND INFORMATION PROFESSIONS, SYSTEMS AND SERVICES

Origins and Legislation

Following examples imported from Britain, the earliest libraries in Australia were subscription libraries and mechanics' institutes.^[4] The Australian Subscription Library and Reading Room, established in Sydney in 1826, replaced a cooperative lending system created by some of the town's leading citizens who had made a shared catalog of their private libraries in 1821. By fits and starts, this led to the opening of a free public reference library in 1869 and the establishment of a lending branch in 1877 and a country-circulating department in 1883. The lending branch was subsequently transferred to the corporation of the city of Sydney in 1909 and added a children's section in 1915.

Melbourne's experience was happier. A mechanics' institute had been initiated in 1840 but Judge Redmond Barry's establishment of a free circulating library in 1842 was the genesis of the first free public library in Australia. Its construction and the purchase of books were approved by the parliament of the colony, newly separated from New South Wales and rich from gold discoveries, with

Barry as chairman of the board of trustees. The other colonies (which became states following their federation for forming the Australian nation in 1901) followed similar patterns during the late nineteenth century (Fig. 2).

However, the development of libraries in Australia was somewhat slow and patchy until the middle of the twentieth century. The landmark investigation by Ralph Munn and Ernest Pitt which was supported by the Carnegie Corporation of New York and whose report, known eponymously as the Munn-Pitt Report,^[5] was published in 1935 demonstrated that much had to be done to provide adequate library services across the continent. Implementation of its recommendations was delayed by World War II but the report laid the foundations for the well-regarded libraries of modern Australia.

In common with other institutions in Australia, libraries open to the public have been largely initiated in response to public pressure but then funded and administered by government. Public library provision is a responsibility of local authorities in urban municipalities and rural shires sometimes through collaborative regional services. State libraries are established by state legislation, such as the Library Board of Western Australia Act 1951. Together with the state libraries and the University of Sydney, the National Library benefits from legal deposit legislation applying to printed publications, although its scope has yet to be extended to digital publications. Other legislation of particular relevance to libraries includes the Copyright

Act 1968, Classification (Publications, Films and Computer Games) Act 1995 and complementary state laws, Disability Discrimination Act 1992, national and state privacy legislation, and laws relating to online services. Australia lacks a national charter of rights but freedom of expression and freedom of access to information have been substantially protected under the common law system.

National Library and Information Services

In 1901, the first federal parliament recognized the need to establish a collection and services to support its work. The Commonwealth Parliamentary Library was transferred to the new capital, Canberra, with the parliament in 1926. Earlier, the growing collection had been significantly augmented when the Australiana collection of E.A. Petherick was acquired in 1909, laying the foundation for the Commonwealth National Library. That function was eventually separated from the Parliamentary Library by the National Library Act 1960 which gave it several responsibilities: the development of a national collection which would be comprehensive in relation to Australia and the Australian people, provision of bibliographical services, and cooperation in library matters including “the advancement of library science.”

The National Library has vigorously pursued the creation of the national collection which now extends to digital



Fig. 2 The statue of the founder of the State Library of Victoria, Sir Redmond Barry, surveys the passing throng before its imposing building on Swanston Street, Melbourne (Photographer Alex Byrne).

resources as well as the traditional printed, pictorial, cartographic and audiovisual resources. In spite of some competition from state heritage collections, especially the rich resources held by the Mitchell Library at the State Library of New South Wales, its collections have achieved the status which was required by the Act. Establishment of the Australian Bibliographic Network in 1981 as a vehicle for collaborative development of bibliographic services demonstrated the foresight and innovation of Australian librarians. Now known as Libraries Australia, the combination of the Australian National Bibliographic Database and various shared services have positioned Australian libraries well to take advantage of new technologies including the emerging Web 2.0 capabilities. It is an excellent example of collaboration which has involved libraries of all types and returned benefits to all and to their clients. In a related area, the National Library coordinates the national cooperative interlibrary loan service, so vital for a very large nation.

In other aspects, the National Library's attempts to show leadership have been more contested. The Australian Libraries Summit convened in October 1988 under the leadership of Warren Horton, then Director-General of the National Library, brought together leaders of the profession from all sectors but few of its recommendations had far reaching results. More recently, his successor as Director-General, Jan Fullerton, has encouraged less publicized but more strategically focused collaboration as a member of National and State Libraries Australasia (NSLA which includes the National Library of New Zealand/Aotearoa). Among the innovations which that collaboration has delivered is PictureAustralia that has exposed the invaluable image collections of NSLA members and other participants, resources which were previously very difficult to access. It has been followed by other collaborative services such as MusicAustralia and PeopleAustralia. Partnership also underpins the operation of the PANDORA Web Archive which was initiated in 1996 and aims to preserve the Australian Web domain. The collaborative traveling exhibition, *National Treasures from Australia's Great Libraries*,^[6] which followed the 2002 blockbuster *Treasures from the World's Great Libraries*,^[7] demonstrated the value of library heritage collections to a broad public as it was shown across Australia to enthusiastic crowds of visitors.

Various attempts have been made to develop national library and information plans but have been frustrated by the constitutional division of power and authority in the nation's federal structure, a factor which has similarly bedeviled many attempts at national planning in other spheres. For example, following the Scientific and Technological Information Services Enquiry Committee's report,^[8] the National Library attempted to establish a national science and technology library and information service in cooperation with the national scientific research organization, the Commonwealth Scientific and Industrial

Research Organisation (CSIRO). This failed to gain adequate financial support and the National Library eventually largely vacated the field, leaving the delivery of scientific and technological information to CSIRO, university and special libraries. However, the National Library maintained an important focus on collecting international publications in the social sciences and humanities, thereby fulfilling a role to inform Australians about the world.

State and Public Libraries

The state and territory library systems operate as the peak libraries for the public within their jurisdictions. They provide major reference libraries, maintain documentary heritage collections and provide support and coordination to public libraries. Some have additional responsibilities for the provision of services to government ministries or to schools. Because they were the first substantial libraries within their jurisdictions and are centrally located within the capital cities, the state libraries fulfill major roles as reference and research libraries and have substantial collections, especially on their home state or territory. Pre-eminent among those heritage collections is the Mitchell Library within the State Library of New South Wales. Founded by the gift of David Scott Mitchell which was announced in 1898, the collection is unsurpassed in the strength of its collections of Australian and particularly in items from or relating to the early settlement of Australia.^[9] His collection joins with the State Reference Library, the Dixson Collection and many other specialist collections to form a quasistate library operating at the state level to provide a rich resource for consultation by the general public as well as researchers. It is not a lending library but coordinates and supports the state's public library network under a regime which requires adherence to minimum standards in return for financial grants—a model broadly followed by all states and territories.

Although early library services in Australia were provided by private subscription libraries, mechanics' institutes and schools of arts, few private lending libraries survive. They were supplanted by the developing public library network. A notable exception is the Athenaeum Library in Melbourne which continues to offer a fine collection, comfortable reading room and a lively program of speakers.

Funding for each state's public library network is provided by state and local governments. Federal Government interest in public libraries was evident briefly when the Whitlam Labor Government commissioned an enquiry into public libraries under the chairmanship of Allan Horton, the University Librarian at the University of New South Wales and a forceful advocate for libraries in Australia.^[10] Its recommendations, unfortunately, were sidelined due to a change in government and economic difficulties in the late 1970s. Nevertheless, services have

continued to be expanded so that in Western Australia, for example, there are now 239 registered public libraries throughout a very large state.

The public libraries are lending libraries with relatively small reference collections and specialized services to assist such segments of their populations as the housebound, young children and business. Many operate mobile libraries and services to institutions such as nursing homes for the elderly. All provide Internet access which is usually filtered due to federal government law to protect children from exposure to undesirable materials. The libraries are sometimes operated through regional consortia spanning a number of local government areas particularly outside the major cities where they wrestle with the challenges of providing services to thinly dispersed populations. Other services of benefit to the public include those provided in hospitals and prisons and in remote mining communities (Fig. 3).

The particular challenges faced by Indigenous communities in remote areas have led to the development of the Indigenous Knowledge and Library Centre models, which have been pursued by the Northern Territory Library Service and the State Library of Queensland. Recognized by receiving the Access to Learning Award of the Bill and Melinda Gates Foundation in 2007, the Northern Territory approach seeks to offer Indigenous peoples a means of recording and holding traditional knowledge in culturally

appropriate ways as well as access to the mainstream information required to support education and community activity.

School and College Libraries

There are some 20,000 school libraries in Australia at both primary and secondary levels and located in the state and Roman Catholic diocesan school systems as well as in independent schools. Generally poorly housed and equipped until the late 1960s, except in the richer independent schools, they developed quickly after the Federal Government responded in 1968 to a library association campaign by providing earmarked funding to support their establishment.^[4] Staffing, however, remains variable with the best staffed by teacher librarians (who hold combined qualifications as teachers and librarians) but others staffed only by library technicians or supervised part time by a teacher.

Combined school community models provide a means of offering satisfactory library services in many areas outside major cities and towns, especially in South Australia and the Northern Territory. Although they can be challenging to manage because of the different needs of the student and general populations, the models have been successful and have been emulated in other countries.



Fig. 3 The striking Brisbane City Library defines a new public space across the river from the State Library of Queensland (Photographer Alex Byrne).

Australia's well-developed system of technical and further education is supported by good library services in the state operated technical colleges but little library support is evident from the private providers of technical education. The same must be said of private tertiary colleges, including those which offer courses to international students particularly in such fields as business, information technology, design and English language.

Academic and Research Libraries

Established in 1859, the University of Sydney was Australia's first university. It was soon followed by the University of Melbourne and at intervals by universities in each of the other colonial (state following federation) capitals. Originally modeled on U.K. universities, Australian universities tended to import academic staff and did not offer doctoral degrees until 1948. They were all established and to a considerable degree funded by government, benefiting only little from philanthropy.

After World War II, the drive to industrialize the economy and the commencement of very large infrastructure projects—notably the Snowy Mountains Scheme—created a demand for technologists. With the support of the federal Menzies Coalition Government, universities began to expand and the Australian National University (ANU) was established. It was followed by others until, by 1988, there were twenty-one universities in Australia as well as a network of state established colleges of advanced education and institutes of technology both of which were accredited to offer degrees but had extremely limited capacity to undertake research. In 1989, the federal Labor Government initiated a process by which the colleges and institutes merged with existing universities or with each other to form new universities. It also began to cap budgetary allocations to higher education by reinstating tuition fees with a system which permitted deferred payment via taxation surcharges. Extension of this policy by the succeeding Federal Coalition Government continued to reduce the proportion of government funding to higher education with the share at some universities declining from over 90% to around 30% by 2007. All now supplement their revenues by attracting large numbers of international students, enrolling almost 80,000 from more than 12 nations in 2002. However, the university system remained essentially government sponsored and regulated with 37 public but only three private universities.

At first, university libraries developed slowly. By the time of the Munn-Pitt report, their collections remained inferior to the state libraries and were almost all poorly housed and staffed. But, like their universities, they developed quickly during the decades following World War II. Quick to adopt new technologies, they benefited from close professional contact with colleagues in the United Kingdom and the United States and, increasingly, other nations. To support the expanding range of degree

programs and increasing emphasis on research, collections ballooned during the 1960s and 1970s and continued to grow steadily in spite of the difficulties caused by the increasing cost of serials and unfavorable exchange rates. Perhaps for that reason, Australian university libraries rapidly introduced policies to prefer digital journals. The Council of Australian University Librarians (CAUL), established as a committee of the universities' chief librarians who began meeting from 1927, became a much more businesslike vehicle for consortial purchasing as well as other collaborative activities (Fig. 4).^[11]

As the new millennium was reached, Australian university libraries were very well regarded internationally. They were considered to be leaders in a number of areas including their long-standing leadership in supporting distance education, the rapid adoption and application of information technologies, and the development of the focus on information literacy which has accompanied the emergence of the information society and the rapid spread of the Internet. Many university librarians assisted colleagues in universities elsewhere, particularly Southeast Asia and China. Among many acknowledged leaders were: Harrison Bryan who repositioned the libraries of the Universities of Queensland and Sydney as well as the National Library of Australia; John Shipp who drove the development of CAUL and promoted international relations as well as serving as University Librarian at the Universities of Wollongong and Sydney; Meg Cameron who promoted high standards of service to distance education students during her long service as University Librarian at Deakin University; and Arthur Ellis who promoted the development of the Australian Bibliographic Network during his service at the National Library of Australia and as University Librarian at the University of Western Australia.

Special Libraries

As the Australian economy matured, government departments, hospitals and business and industrial enterprises saw the need to establish libraries and information services to support their activities. Fine special libraries developed in companies such as the mining and steel giant BHP, publishing companies such as Fairfax and legal firms. Major acute hospitals were expected to have adequate library services which were often linked to university library services in support of medical and, later, nursing education. Government departments in particular frequently gave their libraries a broad ambit to collect widely. Improvements in the professional education of librarians created new expectations of professional service to their organizations and collaborative resource-sharing networks were established.

Extensive agricultural extension services were an early response to the need for development across a vast but thinly populated landmass. They led to the establishment



Fig. 4 The bronze-clad Fisher Library constructed in the 1960s contrasts with original neogothic sandstone buildings of the University of Sydney (Photographer Alex Byrne).

of agricultural colleges and many government research organizations that were established to investigate and provide advice on the development of the agriculture, mining and manufacturing sectors and, more recently, environmental protection. They included such bodies as the Sugar Research Institute, state departments of primary industries, the Australian Institute of Marine Science and the Great Barrier Reef Marine Park Authority and almost all developed good library services. Foremost among them was the national research and development body, the CSIRO, which provided in effect the national science and technology library and information services. Among the leaders of those services was Des Tellis who pioneered the Australian Earth Sciences Information System (AESIS).

However, changing priorities during the 1990s led to the closure or curtailment of many of these library and information services. Major research collections were transferred to university or other libraries or dispersed when tighter fiscal policies demanded narrower focus. The libraries and information services that survived demonstrated a capacity to visibly add value to their enterprises. Legal and medical services continue to be strong but many services in business and government have been eliminated or severely reduced.

Librarianship as a Discipline and Profession

Preeminent among Australian librarians and library educators must be John Metcalfe, long-term Principal Librarian of the Public (now State) Library of New South Wales, University Librarian at the University of New

South Wales and founder of what became the School of Information, Library and Archive Studies, University of New South Wales.^[4] His achievements as a library director, educator and innovator brought him international recognition.

Metcalfe was also instrumental in the establishment of the Australian Institute of Librarians in 1937, one of the immediate consequences of the Munn-Pitt report. It would become the Library Association of Australia (LAA) and subsequently the Australian Library and Information Association (ALIA).^[12] It replaced the LAA which had been established with representatives from all the Australian and New Zealand colonies in 1896 but had become defunct in 1928. Nevertheless, the creation of that first “LAA.” within two decades of the start of the first professional library associations in the United Kingdom and the United States demonstrated the commitment and ambition of Australian librarians to advance their field.^[13] Other specialist and regional associations have been established, including notably the Australian School Library Association, but ALIA remains the national professional organization which seeks to influence governments while fostering professional discourse and setting standards for professional education.

Professional education for librarians was introduced into universities and colleges of advanced education only from the late 1960s. Before that time it had been offered through a system of mentoring with admission to the profession regulated through examinations conducted by the professional association, the LAA. In university libraries, assistant librarians were expected to have a degree and to

then sit for the registration examinations while public librarians often took only the registration examinations. Many studied by correspondence with the assistance of colleagues in the workplace, some attended the three library schools which operated in at the state libraries in Sydney and Melbourne and the National Library in Canberra.

One of the major achievements of the national association lay in the transfer of professional education into universities and colleges because that step enhanced professional recognition, generated a stream of well-qualified librarians, provided opportunities for further professional development and expanded research and publishing in the field. A dual system of qualifications replaced the registration process: three- or four-year-long undergraduate degrees and generally one year long postgraduate diplomas. The latter have largely been replaced by master's degrees in recent years. Fine library and information science schools were established in many universities and were led by distinguished library educators such as Jean Whyte, John Balnaves and Margaret Trask. However, most of these schools found themselves in considerable difficulty and many closed in the face of changing university priorities from the late 1990s. Their reconstruction so that they may contribute to the renewal of an ageing professional workforce is now a major issue for the association and its members.

The profession in Australia has also benefited enormously from the association's championing of the education and recognition of library technicians, a paraprofessional element of the library workforce. Trained in technical colleges, library technicians have proven to be an innovation which has significantly enhanced the operation of libraries and information services.

Although the transfer of professional education into universities and colleges was a key stage in professionalization, the battle for professional recognition was not entirely won since salaries for librarians lagged behind those in other fields with comparable qualifications. The principle of wage parity was recognized when librarians at the State Library of New South Wales successfully argued their case although the resultant increase in salaries did not automatically flow onto those employed in other libraries.^[14]

International Influences

Professional leadership extended to many aspects of practice and participation in a wide range of international initiatives as well as those at a national level. They have included the technological innovations pioneered by such organizations as OCLC in the United States and the Joint Information Systems Committee in the United Kingdom. Frequent travelers, Australian librarians have participated in many international organizations and often visit overseas colleagues. Reciprocal visits to Australia are encouraged

and Australia has hosted all of the major international library congresses including those of the International Federation of Library Associations and Institutions, the International Association of Music Libraries and the International Association of Technological University Libraries. Australian librarians have served as presidents and senior officials in many such bodies as well as contributing to the work of specialist committees and projects.

Perhaps one of the most significant Australian contributions will prove to lie in the attempts of the profession to engage with the library, information and knowledge issues relating to Indigenous peoples. Work which started in Australia in the early 1990s^[15] has been both locally and internationally influential.^[16]

ARCHIVES AND ARCHIVAL SCIENCE

In the military and naval traditions to which they were accustomed, the authorities of the first settlements in New South Wales and Van Diemen's Land (now Tasmania) kept records of the progress of the new colony, including births and deaths, marriages, law cases, stores, arrival of ships and land grants. Because they were penal colonies, many of the early records concern the assignment of convicts, keeping of order and punishments. Similar patterns were followed as the other Australian colonies were established including the convict free settlements in South Australia and Western Australia. The records were transmitted to London so the principal early Australian records were located in repositories in the United Kingdom. They had to be copied in the twentieth century through the Australian Joint Copying Project, a major project of repatriating records which began in 1945.^[17] Nevertheless, the practice of record keeping was established early and maintained continuously with records offices established as each of the Australian colonies achieved responsible self-government.

National and State Archives

As for libraries, official archives in Australia are split between levels of government. The National Archives of Australia manages records at the federal level.^[18] However, the formalization of that responsibility came fairly late in Australia and its achievement was protracted. The first national archivist, Ian Maclean, was appointed in 1944 and served to 1968. During his term, the Director of Archival Management at the U.S. National Archives in Washington, T.R. Schellenberg, visited to propose in 1954 the establishment of national archives. Two decades later in 1974, W. Kaye Lamb, former Dominion Archivist of Canada, reaffirmed the need to take responsibility for government archives. His report was followed by the 1975 appointment of Robert Neale as the first Director-General

of the Australian Archives. He served until the Archives Act 1983 came into force, finally providing legislative assurance that Australia's national archives would be protected. Thanks to the commitment of his successors, including the long-serving George Nichols, the National Archives of Australia became a recognized national cultural institution and provided leadership especially in electronic recordkeeping.

Despite its long delayed establishment, the National Archives of Australia now enjoys major recognition for its high standards and has been able to guide Australian Government agencies to adopt good record keeping practice and to select and preserve the national archival collection. Under the Archives Act records in that collection that are over 30 years old are made publicly available, offering valuable insights to historians and the general public.

State records offices perform similar functions at the state and territory level. In South Australia, for instance, the State Records Act 1997, Freedom of Information Act 1991, and Information Privacy Principles provide the legal and regulatory framework for government recordkeeping including both state and local government records.^[19] The Director of State Records develops standards and issues guidelines relating to the management of official records, including their destruction with the approval of the State Records Council. Although provisions are similar, the ambit of legislation varies among the jurisdictions. In some states, local government authorities maintain their own archives.

The nexus between record keeping and transparency in government is well established in Australia although many, especially media organizations, object to the charges levied and restrictions imposed on access under freedom of information legislation.^[20] In most jurisdictions, ministers and sometimes public servants have wide powers to apply "conclusive certificates" which prevent the release of documents sought by investigators. In the absence of a constitutional right to information, Australians can only appeal to courts to order disclosure on the basis of public interest.

One of the most important achievements of the national and state archives in Australia resulted from the tragic events uncovered by the national inquiry into the forced removal of Indigenous children from their parents under eugenics policies.^[21] Included among its recommendations was the need for those who had been removed to access files relating to them and their families so that they could recover their history and reconnect with their families. Indigenous staff members have been employed by the archives to assist enquirers in obtaining access to sensitive and sometimes restricted records. The Indigenous access teams liaise with Indigenous support groups such as Link-up to ensure that counseling and support will be available to those who undergo such emotional experiences.^[22]

Similar, although usually much less traumatic, needs to discover "roots" drive much of the growing interest in

genealogical inquiry. Government archives in Australia are vital to such inquiry because they hold official migration and shipping records as well as records relating to births, marriages and deaths. Of particular interest are the records relating to transportation of convicts to some of the Australian colonies by British authorities. Once a source of considerable shame, today the identification of a convict ancestor can be welcomed because it identifies the family as early, if involuntary, settlers. Many of the records have been copied to microform or directories and sometimes digitized so that they may be consulted in state libraries and some larger public libraries as well as the libraries of genealogical associations.

Nongovernmental Archives

Universities, colleges and other public and private organizations including businesses, universities and associations generally maintain their own archives although those established by legislation, including universities and public corporations, are usually subject to the state records requirements of their jurisdiction which may include transfer of important records to the state authority. The Noel Butlin Archives Centre is a nationally significant collection of primary source material relating to business and labor which was established in 1953 at the ANU in Canberra. Holding the records of Australian companies, trade unions, employer and professional associations and industry bodies from the 1820s to the present, the Centre is named after Noel Butlin, the first Professor of Economic History at the ANU who began the collection.^[23]

Other significant archives include the Bob Hawke and John Curtin Prime Ministerial Libraries (modeled on the presidential libraries of the United States), the Reserve Bank of Australia Archives, the National Library of Australia manuscript collection and the very important records of Australians at war in the Australian War Memorial. Of particular interest is the Archives of the Benedictine Community of New Norcia which holds records of the missionary work of the monks at New Norcia near Perth and in the north of Western Australia.^[24] The material—in Spanish, Catalan, French, English, Italian and Latin—includes official correspondence with Rome, records of the abbey and town, and lexicographical work in the various Aboriginal languages of the districts in which the monks worked.

Another important initiative, especially because of Australia's strong record in science and technology, is the Australian Science and Technology Heritage Centre.^[25] It was established by the University of Melbourne in 1999 to continue the academic, research and heritage activities of the Australian Science Archives Project, started in 1985, to foster the preservation and promotion of the heritage of Australian science, technology and medicine. Its central Internet accessible resources are Bright Sparcs, which incorporates biographical and bibliographical details about

Australian scientists, and the Virtual Library for the History of Science, Technology and Medicine.

Among the technologies adopted early in Australia were photography, film, sound recording and radio. The National Film and Sound Archive (NFSA) was established in 1984 following a disagreement on the management of audiovisual resources within the National Library. Although the National Library continues to hold valuable audiovisual resources, responsibility for preserving those elements of the national documentary heritage rests with the NFSA which has been an independent statutory authority since July 1, 2008 and works in collaboration with producers such as Film Australia. *australianscreen* delivers online clips from Australian feature films, documentaries, TV programs, shorts, home movies, newsreels, advertisements, and sponsored films produced over the last 100 years.^[26]

Archival Science as a Discipline and Profession

The Australian Society of Archivists is the national professional association for archivists^[27] and the Records Management Association of Australia is the peak organization for records managers.^[28] Both provide opportunities for professional interaction through conferences and publications and guide standards and professional education. Several Australian universities offer courses in archives and records management usually via one year full-time graduate diploma. A master's degree normally requires an additional year of full-time study or original research. Interest in doctoral study is increasing.

At the institutional level, the Council of Australasian Archives and Records Authorities comprises the heads of the government archives authorities of Australia, New Zealand and each of the Australian states and territories.^[29] A key undertaking is its Australasian Digital Recordkeeping Initiative launched in 2004 to promote a single Australasian approach to digital public record-keeping across all jurisdictions and to pool resources and expertise to find better ways to ensure that digital records are preserved and made accessible for the future.^[30] It was sparked by a paper by the influential head of the Department of Prime Minister and Cabinet, Dr. Peter Shergold, "Digital amnesia: the danger in forgetting the future."^[31]

The Register of Australian Archives and Manuscripts is a guide to collections of personal papers and nongovernmental organizational records held by Australian libraries and archives.^[32] It succeeds the *Guide to Collections of Manuscripts Relating to Australia* which was published by the National Library of Australia from 1965 to 1995. It includes more than 37,000 records of collections of manuscript and archival material held in Australia, whether of Australian origin or not; photocopies or microfilms of Australian manuscript or archival material, including nongovernment overseas material relating directly to Australia; personal records held in government

archives; and single unpublished primary sources such as a letter, deed or diary. But it does not include government records, unpublished secondary sources, or material that is entirely in pictorial, video, cartographic, musical or sound formats.

MUSEUMS AND MUSEOLOGY

To an even greater extent than libraries, a central role for museums in Australia has been to present the cultures and heritage of the world to the citizens of a far-off land. The major galleries attempted to build representative, "study" collections of artists and art movements recognized to be significant in the metropolitan centers Europe. Many of the museums similarly presented world cultures and manufactures but many also strove from early times to build collections which would represent and enable study of the new land. Collection of biological and ethnographic objects began before colonization as navigators and naturalists took curiosities back to their metropolitan centers. However, Aboriginal peoples had already established keeping places in which important and sacred objects, such as the *tjurungas* of Central Australia were preserved.

For a nation established through colonization, the frontier of cultural contact is in many ways commemorated through material culture as Philip Jones has shown in his landmark study, *Ochre and Rust*.^[1] The adoption and adaptation of European materials and tools by Aboriginal peoples and sometimes the reciprocal use of Aboriginal technologies demonstrated the moveable and contested nature of the frontier. But it also highlights the changing perspectives of museology as artifacts, which were once considered to exemplify contamination of traditional Indigenous technology, are now seen to be evocative of cultures in collision. The embracing of Australia's Indigenous heritage and the contemporary vitality of Indigenous art and culture has been a major theme in the development of Australian museums and galleries.

National and State Museums and Galleries

The state art gallery of Victoria, entitled the National Gallery of Victoria (NGV) was established in 1861 and continues under that name, operating two major galleries, the NGV International which presents art from Europe, North America and Asia and the Ian Potter Centre: NGV Australia which shows Australian art, including many works by Indigenous artists. Benefiting enormously from the generous Felton Bequest in 1904, the NGV was enabled to construct an outstanding collection of Western art which fulfilled the mission of presenting world culture to the residents of the antipodes.^[33] The Art Gallery of New South Wales, in contrast, had to wait until the last decades of the twentieth century to develop its collections to a noteworthy standard, following the appointment of

Edmund Capon as Director in 1978.^[34] As an expert in Asian art, he has developed a major collection of Asian art as well as building the Indigenous and modern art collections. His flair for publicity has generated record attendances especially for major exhibitions including the populist annual Archibald Prize and visiting “blockbuster” exhibitions for which visitors queue for long periods. The Queensland Art Gallery’s has gained reputation and built its collections similarly by exploiting its flagship international art event, the “Asia-Pacific Triennial of Contemporary Art,” a series of exhibitions uniquely focusing on the contemporary art of Asia and the Pacific, including Australia.^[35]

Although the original city plan for Canberra included two galleries, typically for most of the museums and galleries at the truly national, federal level, the National Gallery of Australia, was only established in 1973, long after its state rivals.^[36] With federal government funding it built a significant study collection of international works, including controversially Jason Pollock’s *Blue Poles*, and a major collection of Australian Indigenous art.^[37] It developed a fully professional curatorial capacity which enabled it to solicit major exhibitions from overseas galleries with the risk underwritten through a federal government program now known as Art Indemnity Australia. Now complemented by other programs backed by state governments and extended to state and regional galleries and museums, this is a very necessary provision if precious

and sometimes fragile works are to be entrusted to the rigors of touring to and around a far-off continent.

In 1998, the National Gallery was complemented by the National Portrait Gallery, also in Canberra. It aims “to increase the understanding of the Australian people – their identity, history, creativity and culture – through portraiture.”^[38] Together with the major pictorial collections held by the National Library of Australia, a significant collection at the ANU, the works of war artists at the Australian War Memorial, a number of fine smaller private and public galleries and many practicing artists, these major galleries have made Australia’s “bush capital” a city of art which is promoted as destination for tourists with cultural interests. In doing that, Canberra has finally overcome the initial advantage of the state capitals although they—especially Melbourne, Sydney and Brisbane—continue to be major centers for art exhibition (Fig. 5).

Similar tardiness at the national level was evident in the creation of museums with the National Museum of Australia opening in Canberra only in 2001 although its enabling Act had been passed in 1980, it had been building collections for many decades and it had occupied temporary exhibition spaces for some years.^[39] The Australian National Maritime Museum, located in Sydney and opened in 1991, celebrates Australia’s maritime history and includes one of the world’s largest collections of floating vessels which can be visited.^[40]



Fig. 5 The innovative architecture and enticing public spaces at the Ian Potter Centre: NGV Australia at Federation Square, Melbourne (Photographer Alex Byrne).

The Australian War Memorial is an exception to the belated creation of museums and galleries at the national, federal level.^[41] Conceived in 1916 by the writer of the official history of Australia's participation in World War I, C.E.W. Bean, it was shaped by its first Director, Lieutenant Colonel J.L. Treloar, who occupied the position from 1920 to 1952. A wealth of resources for the researcher and lay person—records of military engagements, collections of war relics and depictions of battle—began to be collected in 1917. A temporary exhibition opened in Melbourne in 1922, moved to Sydney in 1925 and closed in 1935 with the permanent Memorial opening in Canberra in 1941 during World War II. The almost unique combination of memorial, museum, gallery and documentation centre commemorates Australia's long history of participation in international conflicts and peacekeeping operations and provides a major research facility.

The major state museums have tended to have a natural history and ethnographic focus. The oldest, the Australian Museum in Sydney, is an important research institution with specializations in taxonomy, anthropology and mineralogy. It was founded in 1827 when Earl Bathurst, Secretary of State for the Colonies, wrote on 30 March, to Lieutenant-General Darling, Governor of New South Wales, offering up to £200 per annum for "... the Government to afford its aid towards the formation of a Public Museum at New South Wales where it is stated that many rare and curious specimens of Natural History are to be

procured ..."^[42] It opened to the public in 1857 in its current location on College Street, Sydney and continues to attract strong attendances to visit both its continuing displays and special exhibitions including some imported "blockbusters" (Fig. 6).

Similar models were followed in other colonies and subsequently states and territories, some combining museum and art gallery, including Tasmania and the Northern Territory. Perhaps reflecting Australian pragmatism and the pressing need to understand the nature of the settlers' new country, curatorial traditions developed more quickly in regard to scientific priorities than art. In keeping with the belief that Australia's Indigenous peoples would disappear, ethnographic interest emphasized traditional cultures and technologies rather than those which were developing across the frontier of contact. The South Australian Museum in Adelaide has an especially rich collection of Aboriginal artifacts which have been represented in the outstanding Australian Aboriginal Cultures Gallery.^[43] Curated in consultation with traditional owners and with over 3000 items on display in an interactive setting, the Gallery exhibits the largest collection of Aboriginal artifacts and archival material in the world. It endeavors to tell the story of one of the world's oldest and most continuous cultures in a context which recognizes contemporary Indigenous life as well as traditional cultures and technologies. Although it retains the commitment to scientific rigor and public education, today's



Fig. 6 The floating collection of the Australian National Maritime Museum in Darling Harbour, Sydney (Photographer Alex Byrne).

South Australian Museum is a far cry from the original, somewhat dilettante, conception of a museum to satisfy intellectual pursuits such as literature, arts, history and natural science that had been proposed with the foundation of the South Australian Literary Association in London on August 29, 1834.

Other Museums, Galleries and Curated Environments

Museums and galleries proliferated during the nineteenth century as the Australian colonies developed and the immigrant population swelled. Especially after the discovery of gold in Victoria and later other areas, towns and cities grew and soon wanted a museum, gallery or combination. Many survive today and have been joined by new institutions established through local effort or specialist interest, often with government support in the form of establishment grants and, more rarely, continuing subventions. Australia has largely lacked the tradition of munificent philanthropy found in the United States because of its later settlement, much smaller population and lesser industrialization. Galleries and museums have consequently been unable to acquire overseas works on the scale of the major collections to be found in the United States. Many have nevertheless developed strong collections which increasingly focus on Australia and its broader region, including East and Southeast Asia and the Southwest Pacific.

Among the regional museums and galleries, the Bendigo Art Gallery has built on its colonial heritage to become a highly recognized gallery featuring a strong permanent collection and a stimulating program of locally curated and touring temporary exhibitions.^[44] Close by is the Bendigo Joss House which is managed by the local council in association the National Trust of Australia and continues to be used as a place of worship.^[45] The only surviving building of its kind in regional Victoria, it commemorates the influx of many Chinese sojourners during the gold rushes. Other properties classified and sometimes managed by the National Trust in and around Bendigo—including the Shamrock Hotel, Post Office and Castle-maine Market—reflect the wealth of the Victorian goldfields. Together with other museums, botanic gardens, national parks and many other curated attractions, this one regional city illustrates not only the widespread interest in and support for preservation and presentation but also the depth of curatorial capacity and expertise that is evident across Australia.

Specialist museums and galleries abound including the Powerhouse Museum in Sydney which was developed from the Museum of Arts and Sciences and has rich technological collections.^[46] The Museum of Sydney presents the history and archaeology of the first European settlement in Australia^[47] while the Sydney Jewish Museum commemorates the Holocaust as well as displaying the

culture and experiences of the Jewish migrants to Australia.^[48] Others extend from toys and photography to public transport and militaria. The large museums are complemented by smaller specialist museums, a variety of art galleries, many historic houses which can be visited, others that are heritage listed for preservation, and historic sites and precincts. Although as Australia's largest city Sydney is more richly endowed than many other localities, the variety is typical of that to be found in other cities and towns.

Many have taken advantage of new technologies to engage visitors and stimulate understanding interactively including the South Australian Museum presentation of Indigenous culture and technology. The Questacon, located in Canberra, is Australia's National Science & Technology Centre which promotes interest in science, especially by children, through quirky and exciting exhibits and the use of young explainers who take touring exhibitions and outreach programs across Australia.^[49]

The museums and galleries are joined by a range of other curated environments that includes zoos and botanical gardens, aquaria and national parks. The major botanical gardens trace their histories back to the colonial era when they were conceived partly as pleasure grounds and partly as scientific facilities which experimented with the acclimatization of exotic plants to the very different biogeography of Australia as well as the growing of native plants in controlled conditions and preparation of specimens for transmission to European herbaria, especially the famous Kew Gardens in London.

Zoos and aquaria also followed the European models until recent decades when they were influenced by the new open style developed at ZSL Whipsnade Zoo in the United Kingdom and elsewhere. Many are now focused on sustainable practices and the preservation of endangered indigenous and exotic species with strong scientific programs. Although most of the major facilities are to be found in capital cities, some such as the Taronga Western Plains Zoo near Dubbo, New South Wales, are located in rural areas (Fig. 7).

Scientific work and conservation is advanced through the extensive network of national parks across the vast landmass of Australia and stretching northwards to Christmas Island off Java and southwards to the Australian Antarctic territories.^[50] They include national parks within metropolitan boundaries, the Sydney Harbour National Park being an outstanding example, as well as relatively small parks surrounding geographical features, such as the Naracoorte Caves Conservation Park in South Australia, large tracts of significant landforms and vegetation, including the impressive Kakadu National Park in the Northern Territory, and marine parks, notably the Great Barrier Reef Marine Park which extends more than 2300 km from the tip of Cape York down the Queensland coast. Australia was early to recognize the importance of national parks with the establishment in 1879 of the Royal



Fig. 7 Powerful rock art at Nourlangie Rock in Kakadu National Park which has been added to the World Heritage List for reasons of both natural and cultural richness (Photographer Alex Byrne).

National Park just beyond the southern suburban fringe of Sydney, the world's second oldest national park after Yellowstone in the United States. However, widespread proclamation and the scientific management of national parks only occurred a century later, in the last decades of the twentieth century. Many are vital to the preservation of endangered native species of fauna and flora as well as sensitive landforms and a growing number is managed in collaboration with the traditional Indigenous owners of the land areas.

As in other developed countries, there are very many commercial, specialist and local museums, galleries and collections across Australia. Some are well curated, others amateurish. A vibrant art sector is reflected in the commercial galleries as well as private and institutional collections. Universities have built art collections, often including an Indigenous component, and some have museums that reflect their research fields such as the Nicholson and Macleay Museums at the University of Sydney and the Ronald and Catherine Berndt Museum at the University of Western Australia.

Museology

Early collectors included visiting scientists, explorers and pastoralists who often collected for donation or sale to museums in Europe or elsewhere. Their personal collections

frequently passed to the major public museums or were used to establish local museums and, in some cases university museums. Some found their way to the market for curiosities and many continue to be sold through the major auction houses.

From a museum perspective, almost certainly the most influential Australian collector was the botanist Baron Sir Ferdinand Jakob Heinrich von Mueller.^[51] His story is, in many ways, emblematic of a settler society bringing diverse traditions and seeking to understand a very different continent. It explains much about the development of Australian science and museology. Fiercely patriotic to his new country, Mueller was driven by scientific curiosity to investigate the flora of the colonies of South Australia, Victoria and other regions including remote North Australia and Papua. But he was also conscious of the need to develop viable industries and consequently looked for applications of Australian flora as well as the acclimatization of exotic plants. At a time in which settlers tended to look to known European agronomy, Mueller identified uses of Australian plants for medicinal and commercial purposes and was responsible for exporting eucalyptus seeds to California, India, Algeria, Hong Kong and elsewhere as a measure to combat malaria, an initiative which has had global impact. In his later years, his preoccupations extended to the promotion of the exploration of New Guinea and Antarctica.

After emigrating from Germany to Adelaide at the end of 1847, Mueller investigated the South Australian flora and contributed papers to the Linnean Society in London, the German *Linnea* and Adelaide newspapers. Moving to Melbourne in 1852, he was appointed Victorian government botanist in 1853. His initial explorations and collection of specimens added new genera to the flora of Australia. As botanist with A. C. Gregory's North Australian Exploring Expedition in 1855–1857, he observed nearly 2000 species, including some 800 not previously identified in Australia. Appointed director of the Botanical Gardens in Melbourne, Mueller developed a herbarium and prepared his *Fragmenta Phytographiae Australiae* published in twelve parts 1858–1882. He had long hoped to write a flora of Australia and had compiled much material towards it, but with extreme reluctance was compelled to assist George Bentham in preparing *Flora Australiensis* 1863–1878. The tension between science and the creation of public pleasure grounds led to Mueller's dismissal from the directorship of the botanic garden in 1873 since "no foundations exist . . . neither are statues erected . . . works of art we can call forth at pleasure, while time lost in forming the plantations cannot be regained." Despite that major disappointment, he continued his scientific investigations as government botanist, dying in 1896 just before the Australian colonies federated.

As Mueller's career and extraordinary achievements demonstrate, Australian museology was scientifically focused and internationally linked from the outset. Although some of the motivation for establishment of the early museums derived from the desire to demonstrate that the colonies were becoming civilized, as it did for the colonial public libraries, a major impetus came from curiosity about the settlers' new land. Unlike the galleries which tended to emphasize education and the fostering of intellectual life through the presentation of civilization to the residents of distant colonies, the museums collected and exhibited the flora, fauna, geology, ethnography and developing manufactures of those colonies and surrounding regions, especially in the Southwest Pacific.

Museology is well developed as a discipline and profession in Australia with active professional associations and a range of professional educational options. Museums Australia is the national organization for the museums sector.^[52] It promotes development of the museum sector, articulates ethical standards, facilitates training and raises public awareness. Many other associations represent more specific interests. At the institutional level, the major organizations are the Cultural Collections Council of Australia, Council of Australian Museum Directors and Council of Australian Art Museum Directors.

Courses range from those more focused on the technical aspects to those that emerge from scientific disciplines or ethnographic and cultural studies.^[53] Australian universities which provide cultural and museum studies courses

include Deakin, Macquarie, Western Sydney, Sydney, Curtin and the ANU.

Key Contemporary Issues

The international links forged in the early days of Australian curatorial practice continue. Australian museums and their staff are active participants in the major international organizations dealing with curatorial issues, especially the International Council of Museums and the International Council on Museums and Sites. They have vigorously supported UNESCO sponsored initiatives such as the World Heritage List on which are inscribed many natural areas—such as the Australian Fossil Mammal Sites at Riversleigh and Naracoorte (1994), Gondwana Rainforests (1986) and Great Barrier Reef (1981), some cultural areas—Melbourne's Royal Exhibition Building and Carlton Gardens (2004) and the Sydney Opera House (2007)—and areas meeting both criteria—such as Kakadu National Park (1981).

The handling of Indigenous material culture and art has long been a major issue for Australian museums and galleries.^[54] Curators have developed considerable understanding of the proper ways to manage both the collections built up since the early days of settlement and contemporary cultural expression. Most work closely with relevant Indigenous organizations and communities to ensure effective consultation and, where possible, engagement with curation. Some have established "keeping places" to which cultural objects, particularly those of a secret or sacred nature, may be returned for safekeeping under appropriate cultural conditions while still being preserved from deterioration. Concerns about the treatment of human remains no longer surface in Australia but Australian curators continue to work with Indigenous peoples to recover those still held in overseas museums, resulting in periodic successful negotiation for return for burial with appropriate ceremony.

International recognition of contemporary Australian Indigenous art over recent decades has led to its inclusion in all major Australian galleries, many galleries in other countries and many other public and private collections in Australia and overseas. The opening of the Musée du Quai Branly in Paris in 2006 was a signal of that recognition: not only were Australian Aboriginal artworks included in the collection but Aboriginal artists contributed to the decoration of the museum itself.^[55] While this has been criticized as a manifestation of exoticism, it has forcefully demonstrated that Indigenous art is no longer considered to be of ethnographic interest only but it is now seen as expression of continuing cultural traditions.

CONCLUSION

Over the century since Australia became a nation, its memory institutions and their practitioners have drawn on

the professional dispositions brought by settlers and the much older Indigenous traditional knowledge to develop distinctive patterns of practice. Globally linked and technologically proficient, their standards conform to international models of good practice and sometimes lead the way.

The particular challenges posed by distance within a very large country and distance from major centers of curatorial practice and the opportunities offered by an advanced economy have enabled Australia's museologists, archivists and librarians to gain reputations as "early adopters" and innovators. The development of the institutions and the modes of practice have been shaped by those challenges and by the competitiveness inherent in a federation. That has now largely been replaced by cooperation and a degree of convergence which is expressed through the Cultural Collections Council of Australia and in other forums.

The memory institutions have been central to the development of a new multicultural national identity which celebrates both the ancient Indigenous knowledge systems and those brought by visitors and settlers since 1788. Not uncontested, that identity is developing its own shape through reconciliation with Indigenous Australians, celebration of the diversity of modern Australia and recognition of the particular needs and challenges of the "wide brown land."

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Australian Library and Information Association (ALIA)

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Abstract

The Australian Library and Information Association (ALIA) is the professional association for the Australian library and information services sector. It seeks to empower the profession in the development, promotion and delivery of quality library and information services to the nation, through leadership, advocacy, and mutual support. The ALIA represents the interest of 6000 members, the profession and Australia's 12 million library users.

The objects of the Association are listed in its constitution. They are

- To promote the free flow of information and ideas in the interest of all Australians and a thriving culture, economy, and democracy.
- To promote and improve the services provided by all kinds of library and information agencies.
- To ensure the high standard of personnel engaged in information provision and foster their professional interests and aspirations.
- To represent the interests of members to governments, other organizations, and the community.
- To encourage people to contribute to the improvement of library and information services through support and membership of the association.

INTRODUCTION

The Australian Library and Information Association (ALIA) is the professional organization for the Australian library and information services sector. It seeks to empower the profession in the development, promotion and delivery of quality library, and information services to the nation, through leadership, advocacy, and mutual support (Fig. 1).

The Association is governed by a Constitution and is guided by a vision, mission, objects, and values. Our policy statements are developed by an elected Board of Directors and implemented by the ALIA National Office.

The Association's Web site is <http://www.alia.org.au>.

HISTORY OF THE ASSOCIATION

In 1937, the Australian Institute of Librarians (AIL) was formed as a result of the Munn-Pitt survey of public libraries, the work of John Metcalfe, principal librarian of the Public Library (now the State Library) of New South Wales, and the support of the Carnegie Corporation, in the United States, which was also providing financial support for the Free Library Movement in Australia. Metcalfe introduced a national system of examining and certifying librarians, under the auspices of the new organization. This met one of the principle aims of the AIL: improvement in the professional education and status of librarians.

The Institute supported at every opportunity the appointment of librarians to professional positions in libraries.

Carnegie and British Council grants helped the postwar development of the Institute. A Carnegie grant enabled the launching of the Institute's professional periodical, the *Australian Library Journal*, in 1951. The Institute expanded its professional activities to include conferences, more publications, and surveys of library needs, particularly the expansion of public library services. In 1949, the Institute changed its name to the Library Association of Australia (LAA).

From 1944 until 1980, the Association's board of examiners set the syllabus and examined candidates for the LAA's professional registration examinations. From 1961, when the LAA recognized the course of the first Australian School of Librarianship at the University of New South Wales, the Association gradually moved from providing professional education to setting and monitoring its standards. The LAA developed a system for the recognition of tertiary-level courses, which gradually superseded the Association's registration qualifications.

In the 1960s, the LAA also articulated the need for specialist training for archivists, teacher-librarians, and library technicians. Courses for archivists and teacher-librarians were established through the 1960s and 1970s in universities and colleges of advanced education, which later became universities. The Association passed responsibility for course recognition for archivists to the Australian Society of Archivists in the 1980s.



Australian Library and Information Association

Fig. 1 ALIA logo.

The Association played a major part, in the 1970s, in formalizing an educational and career structure for library technicians within the library and information sector. Library technicians deal with library processes, such as acquisition, cataloging, circulation, interlibrary lending, and simple reference queries. At a senior level, they review operating procedures, evaluate equipment, assist in promotional programs, and supervise staff. The Association established a benchmark for standards that enabled all members of the sector to compare library technician qualifications nationally. The Association also created a section for the technicians and an annual award for achievement.

Features of the Association's work in the 1970s included the promotion of federal government funding for libraries and the encouragement of special interest groups within the Association, including a strong interest in the growing computerization of and networking opportunities for library and information services.

In 1989, recognizing the development of librarians as information providers and managers, the Association changed its name to the Australian Library and Information Association. After much discussion the Association created a permanent office in Canberra, the national capital of Australia. The ALIA House was opened in November 1990.

In 2000, the Association was incorporated as a public company limited by guarantee.

The Australian Library and Information Association has joined with other like-minded member organizations, such as National and State Libraries Australasia, the Australian School Library Association, Council of Australian

University Librarians and Public Libraries Australia to present a united front in advocating on behalf of our profession. Developing international relations is also part of ALIA's agenda, especially in light of Brisbane being selected to host the International Federation of Library Associations and Institutions 2010 World Library and Information Congress.

The year 2007 marked ALIA's 70th anniversary since the establishment of the AIL. As a membership organization, ALIA continues to focus on high level customer service in every part of its business. With close to 6000 members, ALIA provides a wide range of services for those in the library and information services sector.

CONSTITUTION

The Australian Library and Information Association is incorporated under Australian Corporation Law and operates predominantly for the promotion, development, and attainment of its Objects. It is a not-for-profit organization. The Objects as set down in the constitution are

1. To promote the free flow of information and ideas in the interest of all Australians and a thriving culture, economy, and democracy.
2. to promote and improve the services provided by all kinds of library and information agencies.
3. to ensure the high standard of personnel engaged in information provision and foster their professional interests and aspirations.
4. to represent the interests of members to governments, other organizations and the community.
5. to encourage people to contribute to the improvement of library and information services through support and membership of the Association.

ALIA CORE VALUES

A thriving culture, economy, and democracy requires the free flow of information and ideas. Fundamental to that free flow of information and ideas are Australia's library and information services. They are a legacy to each generation, conveying the knowledge of the past and the promise of the future.

Library and information service professionals therefore commit themselves to the following core values of their profession: promotion of the free flow of information and ideas through open access to recorded knowledge, information, and creative works; connection of people to ideas; commitment to literacy, information literacy and learning; respect for the diversity and individuality of all people; preservation of the human record; excellence in professional service to our communities; and partnerships to advance these values.

GOVERNANCE AND STRUCTURE

The Association is governed by a Board of Directors. The ALIA Board of Directors is the elected policy-making body of the Association. There are eight members of the Board, seven of whom are elected: the president, the vice-president, and five elected directors.

The President, Vice-President and four Directors are elected by the membership at large; one Director is elected by institutional members. The ALIA Executive Director is the eighth (non-voting) member of the Board.

All voting directors must be personal members and represent the interests of the organization as a whole, rather than those of a particular constituency. Terms of office are for 2 years with a maximum of two consecutive terms.

Standing Committees are formed by the Board to advise it on key priority areas. Current Committees include: the Governance Standing Committee; Finance, Audit and Risk Management Standing Committee; Education and Professional Development Standing Committee; Membership and Awards Standing Committee; and the Research and Publishing Standing Committee.

There are 10 Advisory Committees whose members are endorsed by the Board. These committees provide expert advice in areas such as copyright and intellectual property, online content regulation, interlibrary lending, research, public libraries, special libraries, new generation issues, and TAFE (Technical and Further Education).

A National Advisory Congress is convened each year to provide members with the opportunity to participate in discussion on policy, planning and any topical issues relevant to the Association. An ALIA Board Director facilitates each of the regional meetings, with a national meeting convened that includes regional representatives.

Groups and committees within the Association provide a focus for communication and participation for members. There are over 50 endorsed self-nominating ALIA groups that are based on states, regions, sectors, and special interests. Groups run a wide variety of activities ranging from e-lists, networking, and social activities, through to professional development events, workshops, and symposiums.

The Association is supported by a national secretariat based in ALIA House in the nation's capital, Canberra.

ADVOCACY

The Australian Library and Information Association undertakes an active advocacy role supporting the objects and core values of the Association in a wide range of forums both nationally and internationally. The Australian Library and Information Association contributes to and participates in Commonwealth, State, and Territory government committees and inquiries, writing submissions, media releases, and lobbying. The main issues for advocacy include information access, online content regulation,

national broadband strategy, copyright, privacy, and government information.

The Australian Library and Information Association supports programs encouraging wide ranging community engagement, and providing the opportunity to promote the role and value of libraries, and library and information professionals. The public campaigns include Library Lovers Day, Library and Information Week, Information Awareness Month, and National Simultaneous Storytime. The Australian Library and Information Association also organizes the annual Summer Reading Club, with libraries across the nation holding a range of events aimed at enticing the public, especially children, to make use of the services available in libraries over the summer months.

EDUCATION AND TRAINING: EDUCATION STANDARDS

The Australian Library and Information Association sets and maintains standards for entry into the library and information profession in Australia through ALIA's course recognition program. It plays a vital role in ensuring that education for the profession produces graduates who have the ability to provide excellent library and information services to benefit the nation and individual clients and who can respond to and meet the ever-changing information needs of a dynamic society.

The Australian Library and Information Association works collaboratively with educators and training providers, employers, and practitioners to promote the development and continuous improvement of courses in library and information management. Initial education should prepare library and information graduates who can achieve excellence in practice.

Library and information professionals have a responsibility to commit to professional development and career-long learning. Similarly, their employers and the ALIA have a responsibility to provide opportunities which enable library and information professionals to maintain excellent service delivery.

The Association's commitment to its members achieving their career goals is demonstrated by providing mechanisms which enable members to plan and undertake learning and other development activities; offering a mentoring program to assist members in their ongoing professional development; organizing partnerships with other professional and training organizations to make available learning activities and opportunities in library and information management and other disciplinary studies; formally recognizing members who participate in ALIA's professional development scheme; facilitating forums where knowledge can be created, shared, and disseminated to enable members to better understand the dynamic environment in which they, as library and information professionals, and their clients operate.

The ALIA Professional Development Scheme enables ALIA members to accumulate Professional Development (PD) points which provides recognition of ongoing learning through the use of the Certified Practitioner (CP) post-nominal.

MEMBERSHIP

Membership of ALIA is open to individuals and organizations. The only membership requirement is an interest in the sector.

Membership of ALIA entitles members to a wide range of benefits, free publications, online services, and discounts on conferences. Members of ALIA can belong to as many ALIA interest groups as they wish. The membership year runs from 1 July to 30 June.

Associate members hold an ALIA-recognized library and information science qualification at under-graduate or post-graduate levels. They are entitled to use the post-nominal letters AALIA while a financial member of ALIA. They are also entitled to membership of the professional development scheme. Graduates in the allied fields of records management, archives, and computing studies whose qualifications are recognized by their professional body may be admitted to associate membership. They may then use the post-nominals: AALIA(RecMan), AALIA(Arch) or AALIA(CS), respectively.

Library technician members hold an ALIA-recognized library technician qualification. A library technician member is entitled to use the post-nominal letters ALIATec while a financial member of the Association. They are also entitled to membership of the professional development scheme.

Associate fellow members have to demonstrate current professional or technical knowledge and skills. To qualify for Associate fellow, the applicant must demonstrate a minimum of 5 years associate or library technician membership of ALIA; continuity of participation in the professional development scheme and compliance for at least the previous 5 years; and current employment in the Australian library and information sector or an allied sector. Associate fellows may use the post-nominal AFALIA or AFALIATec.

Students and retirees also have membership categories.

Institutional members of ALIA have the right to vote in ALIA elections and to take advantage of the many benefits offered—both core services and “value-adding”. A nominated institutional representative holds the formal right to vote. There are six grades of institutional membership based on the non-salary budget of the library and information service within the institution.

AWARDS AND SCHOLARSHIPS

The Australian Library and Information Association awards, at the national and group level, are presented

each year to reward members of the library and information community and to celebrate their achievements.

Premier peer-nominated awards include: the HCL Anderson Award honoring outstanding achievement within the library and information sector by an Associate member; Redmond Barry Award honoring outstanding contribution to the library and information sector by an individual not eligible for associate membership; and the Ellinor Archer Pioneer award recognizing pioneering in new areas of library and information science by an individual or institutional member.

The ALIA Fellowships recognize the attainment of an exceptionally high standard of proficiency in library and information science and a distinguished contribution to the theory and practice of library and information science.

Research awards include: Study Grant; Dunn & Wilson Scholarship; Ray Choate Scholarship; YBP/Lindsay & Croft Research Award for Collection Services; and Twila Ann Janssen Herr Research Award for Disability Service. Excellence is recognized by the ALIA Excellence Award and the Metcalfe Award. Other awards include Aurora Scholarship, student awards, merit awards, Letters of Recognition, group-based awards, and a silver pin for recognizing volunteers who serve five terms on ALIA committees.

COPYRIGHT ADVICE SERVICE

The Australian Library and Information Association supports balanced copyright and related laws that advance the interests of society as a whole. The ALIA's Copyright and Intellectual Property Advisory Committee monitors copyright and intellectual property policy and legislative developments of interest to members and advises the Board of Directors on these matters. The Australian Library and Information Association is also a member of the Australian Libraries' Copyright Committee and the Australian Digital Alliance.

The ALIA's Copyright Service provides members with up-to-date information on copyright and how it affects the library and information sector. The service responds to members' queries about implementing their obligations under copyright and intellectual property law.

INDUSTRIAL RELATIONS ADVICE SERVICE

The Australian Library and Information Association provides a range of industrial and employment services and support including an online list of job vacancies, current salary rates, information on changes to industrial relations laws, library workforce data, rights and obligations when facing redundancy, etc.

INTERLIBRARY LOAN VOUCHER SCHEME

The Australian Library and Information Association operates an interlibrary lending voucher system, with vouchers used by libraries as payment for interlibrary loans, photocopies or microform copies made for retention by another library. The scheme was introduced to provide a simple and secure form of interlibrary currency with a minimum of record-keeping.

CONFERENCES

The Australian Library and Information Association's conferences provide professional development opportunities, promote excellence in practice, provide networking opportunities, promote research and innovative use of technologies, and build relationships with sector trade organizations.

Major conferences include the ALIA Biennial Conference, ALIA Information Online Conference, National Library and Information Technicians Conference, and the New Librarians Symposium. A number of annual symposiums, conferences, and workshops are organized by ALIA groups.

PUBLICATIONS

The Australian Library and Information Association's publishing program relates directly to ALIA's mission and values. The publishing program facilitates the flow of information and ideas as part of ALIA's engagement with members, the wider library sector, and the Australian community.

aliaNEWS is a free monthly e-newsletter available to any person interested in ALIA and the library and information sector.

The Australian Library Journal began in 1951. Published quarterly, it contains a wide coverage of Australian library issues ranging from ongoing research to day-to-day news from the workplace. It is the acknowledged flagship publication of the ALIA, and an appropriate vehicle for publishers, suppliers, and agencies wishing to reach the decision-makers. The journal is available through subscription.

Australian Academic and Research Libraries is a quarterly journal devoted to all aspects of librarianship in university and college libraries, including the TAFE sector, and in research libraries of all types. It publishes original, refereed contributions on all aspects of librarianship past and present, pure and applied bibliography, publishing, information science, and related subjects. All articles appearing in *AARL* are fully peer-refereed.

inCite is the premier news magazine for the library and information sector in Australia. Published monthly, it is distributed to all ALIA members and to subscribers around the world.

Other ALIA publications include ALIA's *Annual report*, *Australian Dictionary of Acronyms and Abbreviations*, and *Uniting a Profession: The Australian Institute of Librarians 1937–1949*.

CONCLUSION

The Australian Library and Information Association is the professional organization for the Australian library and information services sector. The Australian Library and Information Association celebrated its 70th anniversary in 2007. The Association is governed by a Constitution and an elected Board of Directors. The National Office is based in the nation's capital, Canberra.

The Australian Library and Information Association focuses on providing high quality services for its members and for the library and information profession in Australia, including national conferences, publications, copyright and industrial relations advice, a professional development scheme, an awards program, e-lists to facilitate communication, and support for over 50 self-nominating groups across the country. Through its course recognition process, ALIA ensures high educational standards for graduates of ALIA-recognized courses.

The Australian Library and Information Association's advocacy focuses on promoting the value of libraries and information services in ensuring the free flow of information and ideas in the interest of a thriving democracy, culture, and economy.

Authentication and Authorization

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Abstract

Information systems security, access management, and privacy are normally understood through the processes of authentication and authorization. This entry provides a brief historical context and then describes several methods of authentication, such as passwords, digital signatures, network topology, smart cards, biometrics, and public key cryptography. It also discusses the most popular methods of authorization, including mandatory, discretionary, and role-based access control.

AUTHENTICATION

Authentication is the process of validating an assertion of identity. It normally involves the assertion of identity by an entity to a computer system and the procedures followed by that system to assess the truth of the assertion (i.e., whether the entity is who it claims to be). An entity may be an individual person, or it may be an organization, an account, a document, a device, or another computer system. Typically, an individual supplies an identity code and a password, as confirmation of the identity, to a computer system to gain access to services associated with that system. The establishment of identity does not necessarily result in access to services. Decisions concerning what level of access is permitted, and to which services, is made by an authorization process, described below, which may be entirely independent from authentication.

Authentication mechanisms must validate identity, protect against disclosure of secure information used to establish identity, and provide nonrepudiation—that is, preventing retraction or denial of an identity assertion. The level of confidence in an identity depends on the type of authentication and on the procedures used to implement it. These vary widely. Higher levels of trust usually require additional administrative and technical complexity. Ideally, authentication methods and implementation procedures are chosen to guarantee a level of confidence appropriate to the situation. For example, impersonation of identity may pose a higher risk in military or medical systems than it would in other cases.^[1]

Well into the 1980s, most computer systems served a small community exclusively. Establishment of individual identity was often a direct personal transaction with a system administrator. The principle methods for accessing a computer system were either through a device directly connected to the computer, such as a punch card reader, or over a communications network in which each device had a unique wiring path to the computer (i.e., wires were not

shared). Compromising someone's identity by tapping the correct set of wires was relatively inconvenient. Subsequent developments in communications technology and systems architecture have had an important impact on the requirements and characteristics of authentication infrastructures.

The introduction of shared networks and distributed system architectures, beginning in the 1970s, encouraged the decentralization of services and administration. Authentication became a distinct network service, an intermediary between a community of individuals and an assortment of other services on the network.^[2] Services such as e-mail, printing, and file sharing could be obtained independently from numerous distinct devices attached to the network. Individuals' workstations were attached to the network in the same way. Authentication transactions occurred frequently among an individual's workstation, the authentication service, and the destination services. The shared network architecture also made it possible for any device attached to the network to examine all traffic that passed across the network, making spying much easier. Today's Internet uses a similar distributed architecture.

An authentication service is an arrangement between a community of individuals and an administrative organization in a position to verify their identities. The scope and characteristics of the community served by an authentication authority therefore becomes an important consideration in distributed architectures generally, and in the Internet in particular. Individuals may perform a wide variety of activities on the Internet and may be considered members of many separate communities of use, such as those who are employed by a particular company or those who purchase products from a particular retailer. It is not currently practical or desirable for a single authentication service to manage the identities of all communities and as independent services proliferate it will become increasingly cumbersome for an individual to authenticate his or her identity separately with each distinct service to which access is desired.

Methods of Authentication

Authentication methods for individuals fall into three broad classes: those based on what one knows (e.g., a password); those based on what one possesses (e.g., a “smart card”); and those based on what one is (e.g., a fingerprint).

Shared secrets

Authentication that depends on the use of shared secrets is by far the most widespread. In this type of authentication, the individual and the system responsible for validating the individual’s identity share a common piece of information, the secret, often a string of characters commonly called a password. In the simplest systems, after someone transmits an identity code and password, the system checks an internal table and, if a match is found, the system authenticates the person for whatever access is deemed appropriate by the authorization process.

Such password-based schemes have several difficulties. Passwords may be stolen by observing the traffic on the communications lines or by simply looking over someone’s shoulder. Passwords may be shared explicitly. Passwords may be discovered by, for example, programmatically trying every word in a dictionary. Choosing passwords well (e.g., selecting nondictionary words) and changing them often improves security somewhat.

The Kerberos authentication service was an important improvement in password-based shared secret methods.^[3] Kerberos was developed at the Massachusetts Institute of Technology and first used there in 1986. It takes advantage of the ability of an individual’s workstation to perform cryptographic processing. When using Kerberos, a password is transmitted across the network encrypted, only once, to retrieve what is referred to as a ticket. The ticket is itself largely encrypted and can be used as proof of authentication for a fixed interval—perhaps for several hours—to obtain access to other services on the network.

Kerberos uses a central administrative authority service to perform the initial authentication and also to establish secondary tickets for each network service the individual uses. The set of services and individuals listed in the central administrative database are called a Kerberos realm. Kerberos first made common the use of a single authority over a set of highly distributed entities and remains an important contribution.

One-time passwords

The security of passwords is substantially improved when a password is changed after each time it is used. In one such scheme, the individual and the authenticating system arrange for a quantity of perhaps 1000 passwords in advance.^[4] Each time a password is used it is discarded, the next password on the list is used for the next authentication, and so on.

In a variant method, the correct password changes as a function of the time, changing each minute, for example.^[5] The individual possesses a small device, the size of a credit card, that continually calculates and displays the current correct password. The authenticating system validates identity through software that performs the same calculations.

Another method is based on the individual and the authenticating system having knowledge of numerous shared secrets, which are ideally chosen so that only the individual is likely to know them all, such as a favorite color, childhood address, friend’s birthday, etc.^[6] For each authentication, the system challenges the individual to confirm a random subset of the secrets, asked in a random order. This method is interesting because it combines properties of both shared secrets and one-time passwords. Each authentication is somewhat unpredictable, and the individual does not need to possess a list or a device to answer the questions.

Public key encryption

Public key refers to an encryption technology based on the mathematical properties of two carefully chosen numbers. The numbers are chosen so that they are inverses of each other: information encrypted with one number may be decrypted only with the other, and vice versa. The numbers are also chosen so that knowing one of them gives no clue to what the other is. One number is designated the private (or secret) key, the other the public key. The private key is never divulged; the public key is distributed widely.

An individual may encrypt information with their private key. Anyone who possesses the corresponding public key may decrypt the encrypted information and may further infer that the information must have originated with the individual. Similarly, information encrypted by anyone using the individual’s public key can only be decrypted by the individual, using the private key. This elegant mechanism reduces the task of authentication to simply decrypting an arbitrary encrypted transmission with the individual’s public key, because only that individual could have created it.^[7]

Authentication systems built on public key methods are largely concerned with the administrative procedures needed to ensure that the system possesses the correct public key in the first place, and that the private key has not been divulged. Some of these procedures are discussed below.

Smart cards

A smart card, or smart token, is a small computer with low power requirements, making it appropriate for uses that require portability.^[8,9] The computer is usually embedded in a plastic card the size of a credit card, but objects such

as rings and buttons are also used. They are designed to protect the information stored within them both by performing only specific, well-defined communications and by employing safeguards against physical tampering.

For authentication, smart cards are especially useful for storing a private key and for performing the computations needed to encrypt or decrypt information using that key. This enables public/private key authentication to be performed with the private key never leaving the smart card.

Often, smart cards have security features that enable it to verify the identity of the possessor of the card. The card itself thus engages in an authentication process with the possessor—most often using a simple password or “PIN”—before performing further operations.

Smart cards may communicate through physical contact with another device, such as a conventional computer, a telephone, or a satellite receiver, or they may communicate by radio contact within a short distance (a few inches) of a device, as do the proximity cards used to gain access to a building or a mass transit system. It is interesting to note that possession of a smart card does not imply possession of the information stored within it. In most existing implementations, the issuer of the card controls this information.

Biometric

A biometric method of authentication identifies an individual through personal physical characteristics. Biometric systems exist for analysis of fingerprints, handprints, voices, faces, and patterns in the iris and retinal blood vessels of the eye. Details of these methods vary widely, with a corresponding variance in accuracy and efficiency. There are few standards in place.^[10]

These systems compare the characteristics presented by an individual with a database of those previously stored. In the context of authentication, an individual asserts a claim of identity and uses the biometric as supporting evidence. Biometrics are also used to discover an unknown identity by searching through the database of characteristics. The latter method is common in, for example, law enforcement.

Related to biometric methods are those that measure the characteristics of an individual's performance of an action, for example, systems that measure the pressure, direction, and rate of a stylus when a person signs their name; such systems are considered to be relatively reliable. In another method, identification can be determined by the latency pattern of keystrokes, the speed and timing with which the keys are struck, when an individual types a particular phrase on a keyboard.^[11] Robust biometric systems can prove the most reliable, nonforgeable means of authentication, assuming the individual has the body part being measured, but they have come under criticism for their invasive nature and for privacy concerns.

Other kinds of authentication

The most effective forms of authentication probably use a combination of several of the methods described above. For example, using a biometric means to authenticate an individual's identity to a smart card, and then using the card to perform further authentication for some fixed period of time is a relatively secure and convenient scheme.^[12] Smart cards with fingerprint sensors are currently available. Choosing the appropriate combination of authentication methods requires a careful analysis of the requirements and risks of the environment.

Authentication increasingly happens between entities in which neither party is an individual person. All the methods above, except for biometrics, may be used for an organization's accounts, and for hardware and software systems.

Between computer systems on the Internet, a popular form of mutual authentication relies on the correspondence of identification with network addresses (Internet Protocol or IP addresses). In other words, one system authenticates to another only by virtue of its topological location in the network. Reliance on particular network addresses is increasingly unreliable as networks are growing and changing quickly and as services are becoming increasingly distributed.^[13]

Digital Signatures

Authentication as discussed so far has been in the context of a transaction between two entities. Another important form of authentication is with respect to digital documents or other digital objects. The goals are the same—to ensure identity, integrity, and nonrepudiation—but in this case it applies to a set of fixed data. Authentication of this type is commonly called a digital signature.

Public key methods provide a natural foundation for digital signatures. Data encrypted with someone's private key are in some sense “signed” by that person. Although anyone may decrypt these data using the corresponding public key, only the holder of the private key can have created it.

More typically, however, it is desirable to separate the data from the signature so that decryption is only required when signature verification is required. In this case, a *characteristic function* (also called a *message digest function*) is used. A characteristic function of a particular block of data has two properties: it is significantly smaller than the original data, and no other data will generate the same characteristic function. Thus, it can be considered a unique “fingerprint” of the original data. Encrypting this fingerprint with the private key creates a signature that may be attached to the original data. The data may be verified by recomputing its characteristic function, decrypting the signature with the public key to obtain the

original characteristic function and comparing them to see if they match.

Process and Authority

In many of the methods discussed above, the individual or entity presents some form of authenticating information to a system that performs the authentication by comparing the presented information with information stored internally, perhaps after some computation. The internally stored information must be established by an initialization process.

Initialization processes vary widely, becoming more complex depending on the degree of trust required in the identity thus established and on the risk involved in impersonation. If the risk is considered relatively low, as it is with many free services on the Internet, initial identity may be established simply by requesting it in the course of first using the service. If the risk is considered to be greater, independent confirmation of identity, as by transmitting a copy of a government-issued identity document or by appearing in person with such documents before an official of the authenticating organization, may be required.

These kinds of procedures parallel conventional methods for confirming identity. Once identity is established, the authentication methods described above are used for ongoing access. When identity is compromised, for example, by a stolen password or private key, all or part of the initialization process normally needs to be repeated.

Public key systems present an additional challenge to the initialization process. Public keys may be distributed widely, to any entity to which one wants to send encrypted information, but it is impractical to engage in an identity initialization transaction with every other entity who may want to decrypt or authenticate using the public key. There are two popular methods employed to solve the problem of distributing public keys: ITU-T international standard X.509 certificates^[14] and PGP (Pretty Good Privacy).^[15–17]

X.509 relies on formalized Certificate Authorities (CA), who are responsible for asserting that a particular public key corresponds to a particular entity. In this scheme, an entity engages in an identity initialization process with a CA, resulting in a digital document containing the name of the entity and its public key; this document is digitally signed, as above, by the CA. Such a document is known as a digital certificate. Subsequently, the entity uses this certificate, rather than the public key alone, for authentication transactions because the certificate carries the assertion and trust-risk value of the CA. In other words, the CA's digital signature represents a measure of due diligence in confirming the correspondence between the individual's identity and the public key. Additional information may also be carried in the certificate, usually relating to the nature of the original identity initialization,

the purposes for which identity has been assured, and the level of trust in the identity.

The CAs themselves possess certificates, which may be signed by a higher order CA. The higher order CA assures the correspondence of the lower order CA and its public key, as above, and also asserts that the lower order CA has appropriate policies and procedures to issue trusted certificates. The higher order CA may also have a certificate signed by an even higher CA; this process can continue through many levels of authority until reaching an ultimate or "root" authority, who signs its own certificate. In current practice, there exist many root authorities, and the number of levels between a root and an end entity (e.g., an individual) is usually small (less than five).

In addition to policy relationships that may be established by hierarchies of certificate authority, there may also exist "bridge" CAs, who specify formal agreements and mappings among the policies of two or more CAs that are not part of the same hierarchy.^[18–20]

Although digital certificates are in increasing use today, there is less experience with the potentially complex interactions of the policies of the supporting CAs. An alternative to using a certificate with an intricate set of policies behind it is to use a number of different certificates, each with a relatively simple policy, for different purposes.

In the PGP architecture, certificate authorities are not used to invest trust in the correspondence between an identity and a public key. Instead, PGP certificates contain any number of digital signatures, with each signature investing a degree of trust in the identity-key correspondence asserted by the certificate. The validity of a PGP certificate is determined by the sum of trust in the signers. The validity of each signer is determined by the same process, establishing a network or "web of trust" among certificates.

Public key systems must also have special procedures when someone's private key becomes compromised or is revoked for cause (e.g., termination of employment). Current designs recommend that the authenticating system consult a list of revoked certificates, which is normally maintained by the CA. In PGP, individual signers may revoke their own signature, and maintaining a centralized list of revoked certificates is similarly suggested.

It is also recommended that these systems should establish procedures for recovering a private key if it is lost. Traditional backup methods may not provide adequate security protection. In cases where a key is associated with a role, such as Chief Financial Officer, rather than an individual, a lost private key may have far-reaching impact. In business, conventional escrow procedures may suffice. More generally, schemes have been developed to divide a key into segments, or "shares," that are distributed to trusted parties so that more than one party must cooperate to reconstruct the key.

Processes to support longer-term digital signatures are not well developed. After a private key is revoked or

expires, documents signed with that key should remain valid if they were signed while the key was still valid; this suggests an archive of private keys. The policies and procedures for creating, maintaining, and accessing such an archive have yet to be adequately specified or implemented.

Traditional signatures are used, for example, to assert authorship of a document, agreement with a document, and witnessing of an event, but there is no current method to express these semantics with digital signatures.^[21] Traditional methods for verifying the authenticity of a document, such as corroboration by an expert, forensic analysis, consistency of dating, provenance, and common sense, are not addressed by the purely computational nature of digital signatures. Additional research is necessary to better understand these issues and to suggest procedures and infrastructures to support them. None of the authentication methods discussed, and the processes to support them, adequately address historical expectations of privacy.

One method for improving privacy protection is to introduce an intermediary authenticating service, which performs authentication with an individual and then acts as a proxy for further transactions on behalf of that individual.^[22] There is little consensus on the behavior, responsibilities, policies, and trust relationships of such intermediaries, and the intermediary itself may willingly or, if compromised, unwillingly disclose private information, tying individuals to their proxied activities.

Privacy concerns are an active area of social and legal discourse as well as of technical research. Traditional libraries have historically acted as intermediaries for access to information, and have carefully implemented policies and procedures to guarantee individual privacy. The library community has taken an active role in translating those methods to digital information.^[23,24]

AUTHORIZATION

Authorization, sometimes called Access Control or Access Management, is the process by which an individual or other entity is permitted to perform some operation on a computer system. Authorization may apply to an organization as well as to individuals, or to automated processes acting on their behalf. In the technical literature, the individual, organization, or process is referred to as the “subject.” Authorization happens in the context of (i.e., subsequent to) authentication. The authorization decision is, in other words, given someone’s identity, what may they do? What information may they see; what may they create or destroy; what may they change?

The earliest authorization process was implicit: if one had physical access to the computer, one could do anything with it. (To some extent, this holds true today for personal computers.) When computing and information resources, or “objects,” as they are called, are shared among many

subjects, more elaborate methods are necessary to ensure that appropriate access is granted to each.

Current authorization systems divide access rules into three broad categories: whether a subject may retrieve an object (“read”); whether a subject may create, change, or destroy an object (“write”); and the extent to which a subject may alter the authorization rules themselves. These categories are called “operations.” Thus, authorization is the process of determining which operations are permitted between a given subject and object.

Operations are performed by computer software applications. In early systems, the authorization decisions were made directly in the application, and the behavior of the program logic depended explicitly on the subject’s authenticated identity. This method has been superseded by independent authorization systems and infrastructures that interact with applications in a range of ways. For example, in some cases, an application explicitly consults the authorization service to determine if an operation is permitted. Or the authorization service may be part of the underlying operating system, automatically enforcing permissions on operations requested by applications. Analysis of application and operating system logic and their interactions can offer a relative measure of security or trust in the authorization service.^[25]

Authorization may be considered an implementation of policy,^[26] and an important goal of authorization systems is flexibility, accuracy, and efficiency in implementing policies. Actual policies can be highly complex, involving classifications, hierarchies, interrelationships, exceptions, degrees, and emergencies. They may be motivated by legal, business, or political needs. They may change frequently. Not surprisingly, the development of effective authorization systems is an active area of research. Three principle system models are currently most common: mandatory, discretionary, and role based.

Mandatory Access Control

In mandatory access control (MAC) or “lattice-based” access control systems, a security administrator assigns classification labels to all subjects and all objects. These labels are ordered to reflect the levels of security required, for example, “unclassified,” “confidential,” “secret,” and “top secret.” Objects may be further categorized within a security level. Subjects are assigned labels corresponding to their maximum security clearance, and to the categories within that clearance that they may access.

A principal concern of MAC systems is the control of the information flow between levels. A typical implementation, for example, may permit subjects to read objects only at their own or lower levels and to write objects only at a higher level. The strict controls on information classification and flow, coupled with the central authority of the security administrator, make MAC systems attractive in military applications. The policy known in the financial

community as the “Chinese Wall,”^[27] which is designed to prevent financial analysts from reading objects that could create a conflict of interest with respect to other objects they have already seen, may be enforced with a variant of a traditional MAC implementation.

Discretionary Access Control

Discretionary access control (DAC) relies less on a central security administrator, putting more of the burden on an object’s owner. The owner is usually the subject that created the object. In DAC, the owner may change the access permissions of an object, granting, for example, read or write access to other subjects. In some implementations, the owner may delegate this granting ability itself to other subjects or may transfer ownership of an object to another subject.

Although DAC is much more flexible than MAC, the security is weaker. For example, in DAC, it is possible to make a copy of an object that has fewer restrictions than the original. Because security policy is not governed by a single authority but is distributed across all owners, it is difficult to assess the overall security of a DAC implementation. Nonetheless, DAC is widely popular in many operating systems and databases.

Role-Based Access Control

Role-based access control (RBAC) has gained significant attention for its power and flexibility.^[28] Within RBAC, subjects are assigned one or more roles, with each role embodying one or more permissions. Permissions may be read, write, and the ability to adjust the authorization system itself.

Roles typically are identified with a business or organizational capacity, such as “Chief Financial Officer” or “enrolled student,” and thus simplify making changes in permissions when a subject’s role changes (because you just change the person’s role instead of revamping all the permissions that person has). Roles may be organized in hierarchies, so that certain roles imply others through inheritance. Constraints may be placed on the system to implement desired policies (e.g., multiple signature requirements, performance of tasks in a particular order, enforcement of the separation of responsibilities).

RBAC systems are also considered flexible enough to implement both MAC and DAC policies.^[29]

There is much ongoing research on RBAC devoted to such goals as improving its performance in highly dynamic settings^[30] and improving its ability to express complex policies.

Other Kinds of Access Control

The methods above play a predominant role in existing implementations and in research. But the goal of enforcing

policy is broad and may be approached in many ways. For example, the “trust management” approach combines the trust relationships of digital signature authentication with the expressions of policy.^[31] Generally, the digital rights management community has been highly active in developing mechanisms to express trusted policy assertions on the Internet.^[32–35]

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Automated Acquisitions

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Abstract

“Automated Acquisitions” describes the automation of acquisitions work, which began with the development of simple ordering and receiving systems. Over the years, these systems have expanded to automate acquisitions work generally and to integrate acquisitions with other major library functions such as cataloging, circulation, and collection development. Automation has also promoted electronic interfaces with monograph and serial vendors and with institutional accounting systems. Increasing growth of electronic collections requires additional system development to accommodate the various components of this complex workflow. Workflows in acquisitions are enhanced by online cataloging services, such as OCLC’s Promptcat or vendor-provided MARC records, which allow libraries to receive books cataloged and shelf-ready; and electronic books have led to many interesting new models of acquisitions, including demand-driven acquisitions. To promote operability among various systems, standards adopted by publishers, vendors, and libraries are increasingly important and a focus of development in the field.

INTRODUCTION

Libraries have automated acquisitions for a variety of reasons, including lowering unit costs, improving access and service to users, speeding the ordering–cataloging process, accessing ordering, and in-process information, collecting and organizing acquisition data, gathering data for assessing collections, and linking with other systems both inside and outside the library to assure efficient workflows. The complexity of electronic resource management (ERM) has added new challenges for workflows, data collection, and system linking.

When selecting a system, librarians should consider 1) the capacity of the system, that is, whether it will handle the required number of orders, funds, and the like; 2) the cost of installation and maintenance; 3) compatibility with other systems; and 4) functionality, that is, whether it offers the functions required and whether staff can easily perform them. If a system appears to meet these criteria, then the library should verify performance by requesting written documentation from the vendor and securing references from institutions using the system. Most libraries also prepare a formal request for proposal (RFP) from several vendors, a proposal that lists all the library’s requirements.

As a minimum, automated acquisition systems should perform some or all of the same activities required in a manual acquisitions operation but with the added requirement that the system perform them more efficiently and effectively. Automated systems can achieve these ends by making data transfer more accurate, by reducing costs through economy of scale, and by collecting new data or manipulating it in new ways.

THE EVOLUTION OF SYSTEMS

Automation of acquisitions functions began in the 1930s and 1940s, before the computer age, with the use of punch-card systems for in-process control and ordering. Because of the complexity of acquisitions processes and the difficulty of integrating them with local accounting policies and procedures, these early efforts relied on single-function systems.

Great impetus to automated acquisitions came in the 1960s when research libraries and many medium-sized libraries, especially in the United States, were growing rapidly. Federal grants, the PL480 program, and the expansion of higher education all contributed to a phenomenal increase in acquisition budgets for both academic and public libraries, but with no or limited increase in staffing. Coinciding with the dawning of the computer age, the pressure generated by these large budgets and significant gifts led individual libraries in the 1960s and 1970s to rely increasingly on computerized single-function or multiple single-function systems. Developed in-house, these simple, typically machine-dependent systems operated in a batch mode; that is, the data were collected and processed periodically, and order forms, reports, or other printed products or electronic files were the result. Generally, libraries automated only parts of the acquisitions process, usually order/receiving, in-process files, or accounting functions. These systems typically operated on a general purpose mainframe computer housed and managed outside the library.

Other libraries using the same hardware sometimes borrowed or purchased these systems but doing so typically required significant local programming to run

effectively. Because these programs were machine dependent, library literature from this period contains close descriptions of the computer hardware required. Few libraries, of course, had the resources to develop such systems, nor were early commercial vendors able to create successful generic programs for acquisitions because practices from library to library vary so much more than, for example, those in circulation.

In 1969, Baker and Taylor released BATAB, the first jobber-supplied, commercial acquisitions system. BATAB was a batch software package that ran on a local mainframe and featured a range of acquisitions functions, including selection lists and purchase orders; claims and cancellation lists; detailed fund accounting; and historical, open-order, and in-process reports. BATAB focused on relations between libraries and book jobbers, Baker and Taylor in particular, where orders could be placed by output via magnetic tapes. Other book vendors followed suit, and in less than a decade, Brodart offered the first jobber-supplied online order service, Instant Response Order System (IROS). Released in 1978, IROS gave customers online files and online ordering. Marketed primarily to public libraries, IROS did not offer fiscal or processing management, but online access to jobbers' publication databases, nonetheless, remains today a constant of book and serial vendors.^[1]

The advent of online capability in the later 1970s meant that in 1982 Washington Library Network (WLN), a bibliographic utility, brought out an acquisitions system as part of its networked services to libraries. Other major utilities—Online Computer Library Center (OCLC), Research Libraries Information Network (RLIN), and University of Toronto Library Automation Systems (UTLAS)—soon followed.^[2] These networked systems brought an important advance over then-current systems for acquisitions by offering integration with other library processes including circulation and cataloging and provided full-function acquisitions services. As a result, the bibliographic utilities gave birth to the first integrated library systems (ILSs).

ILSs proliferated in the 1980s as commercial designers joined the marketplace to create multifunction, multiuser systems combining cataloging, circulation, serials, and acquisitions modules. Acquisitions data could now be shared among all modules and displayed for users in the online catalog. These commercial systems continued to evolve throughout the 1990s although fewer than half of the academic libraries implementing new systems opted to include acquisitions or serials components during this period.^[3] A decade later, however, most academic and larger public libraries had fully functioning ILSs and could choose among several types: 1) turnkey systems where the library is responsible for little more than turning the key to the system, that is, the commercial vendor installs the software and hardware for the library, connects the library to the network, and provides most technical

support; 2) standalone systems where the library essentially stands alone, that is, the library purchases or is free to purchase the hardware and software separately, installs both, and independently administers the system except for such limited technical support as hardware and software commercial vendors normally provide; 3) hosted systems where the library buys the commercial vendor's software but the vendor hosts the software on its server, which library staff access through the Internet; and 4) service-as-a-subscription (SaaS) systems where, rather than buying the software, the library pays a subscription for online access to its own version of the commercial vendor's ILS software.^[4]

ILSs provided by commercial vendors were typically proprietary systems that guaranteed performance but restricted access to the source code, thus preventing customization for local needs. Responding to rising library dissatisfaction with this lack of flexibility, ILS commercial vendors have made their systems more "open," especially by offering application programming interfaces (APIs). APIs allow libraries to do such local programming as establishing interfaces with a parent institution's financial system.^[5] Since vendors charge for additional features, costs have risen as well, leading to more library frustration with traditional ILS commercial vendors.

As an alternative to proprietary systems, libraries continue to explore open source software in hopes of finding more affordable and customizable systems. Open source systems strive for the same functionality as commercial ILSs, but members of an open source community share in the development of the source code, which is free for anyone to download and update.^[6] The success of these efforts varies, and users have found important functionality lacking in some.^[7] Two systems working primarily with public libraries and consortia are Koha (www.koha.org), which first appeared in 1999, and Evergreen (<http://evergreen-ils.org>). Open Library Environment (OLE) by the Kuali Foundation (www.kuali.org/ole) is an important initiative by academic libraries.

Into this mix of systems has come yet another potentially revolutionary force. As electronic collections began to appear in the early 2000s, librarians realized that the automated acquisitions and serials modules of the traditional integrated library system were not capable of tracking all the necessary information or of accommodating workflows that ERM requires.^[8] Many libraries developed home-grown databases, spreadsheets, or standalone systems to fill the gaps. Recognizing the disorganization of this approach, the Digital Library Foundation (DLF) and the National Information Standards Organization (NISO) established a steering group to guide the development of standards, specific data elements, and functionality for ERM to foster interoperability (ERMI) among various applications.^[9]

Encouraged by library interest and guided by this ground-breaking DLF ERMI report, automation vendors

began to produce standalone ERM systems or to incorporate ERM as modules of their ILS. Open source ERM systems have also appeared. CUFTS, an extension of a suite of open source discovery tools developed at Simon Fraser University,^[12] and the University of Notre Dame Libraries' Centralized Online Resources Acquisitions and Licensing (CORAL) are standalone open source ERM systems. Librarians have also tried to address the obvious need for ERM and ILS interoperability, especially with the acquisitions module, and in 2008 another DLF subcommittee studied this issue and identified key acquisitions elements requiring interoperability. This report also saw the need for an identifier unique to each resource for accurate interfacing.^[10]

Ongoing, critical analysis by librarians of changing workflows will continue to be an indispensable part of achieving an effective system for ERM.^[11] Essential elements that have been identified include tracking acquisitions and budget information, license terms and conditions, and administrative and contact information for individual electronic resources. Giving users ready access to electronic materials is also important. Providing full texts, for example, requires such tools as OPEN URL link resolvers and knowledge bases. Reports and data analysis going beyond current ILS capabilities, too, must be developed for collection assessment and selection. Per-use cost for individual electronic journals, particularly those in serial publisher's "big deal," for example, is another primary need. Although standards such as Counting Online Usage of Networked Electronic Resources (COUNTER) and products like the Standardized Usage Statistics Harvesting Initiative (SUSHI) are available to facilitate compiling and reviewing statistics on the use of a library's electronic resources, such tools are still incomplete in their coverage and application and vendor data are inconsistent.^[12] Additional statistics and data often have to be gathered from individual vendor webpages and tracked and manipulated in local spreadsheets. In short, tools and methods for assessment and evaluation of electronic usage still require research and development.^[13]

Responding to current needs, major automation developers introduced new systems in 2012 variously referred to as library management systems, web-scale management solutions, or library service platforms (LSPs). These new systems seek to consolidate in a single interface the essential functions of a traditional ILS for print materials with the multiple tools needed for ERM. These platforms or services combine acquisitions, ERM, serials, reporting capability, link resolvers, discovery programs, and other relevant library software under a comprehensive knowledge base or information center.^[14] The Global Online Knowledge bases (GOKb) project being funded by a Mellon Foundation grant and led by the University of North Carolina Libraries (<http://gokb.org/>) is a current effort to provide a comprehensive knowledge base and will be

adopted for Kuali/OLE's open source library platform—freely available to anyone whether a librarian, a commercial system vendor, or a publisher. Since major institutions in Europe and the United States are contributors, GOKb promises to be a significant source of information and metadata needed to manage electronic resources.^[15] Unlike the traditional ILS that comes with a prescribed user interface, these new systems permit libraries to implement the discovery tools they choose, even a product from another commercial vendor. These systems also seek to improve ERM by simplifying other processes such as input on trial databases, adding holdings for titles, and coping with licenses. To address the need for improved data to aid decision making regarding electronic resources, LSPs also propose to support more sophisticated reporting, using analytics and data mining across various components of collections.^[16]

Another potential advantage of these new systems is that, based on cloud-computing with its reduction in both upfront costs for equipment and for local maintenance staff, libraries may be able to achieve important savings. Depending on the annual subscription fees, these services may also be options for small libraries that have little or no automation.^[17] Major commercial vendors offering LSP services include Alma by Ex Libris, Sierra by Innovative Interfaces, Intota by Serials Solutions, and WorldShare by OCLC, and OLE by Kuali Open Library Environment.^[18] In 2014, the University of Chicago launched OLE; a number of other universities are scheduled to become early adopters of OLE in 2015.

As libraries consider the emerging options for improving or replacing their current systems, much—as always in automated library acquisitions—remains to be learned about impacts on costs, staff, and workflow.

BASIC COMPONENTS OF AN AUTOMATED ACQUISITIONS SYSTEM

A 1999 model RFP in *Library Technology Reports*^[19] and the ongoing experience of acquisitions librarians make it possible to list the basic features desirable in an automated system. The elements in this RFP are standard features in the acquisitions modules that commercial vendors provide in an ILS and are primarily based on the acquisitions of print materials. Acquiring electronic publications also involves similar ordering information and budget control, but additional tools will be required to manage other aspects of electronic collections.

Verification of bibliographic data for new orders: An automated system for acquisitions should include a link to a source of bibliographic data in MARC format that can be downloaded into the new order file. The source of these data can be a bibliographic utility such as OCLC, Library of Congress MARC

records, or a database of MARC or MARC-like bibliographic records from a materials vendor. Vendor records usually have the added advantage of including price and invoice data that can be loaded into the system, thus reducing posting time by staff.

Centralization and integration of on-order and in-process information: Even the most basic systems maintain an automated file of titles on order or in process. When acquisition is part of an integrated library system or has links to other systems in the library, this file, at the discretion of the librarian, can be accessed through the online catalog. In this case, the file should be interactive so that changes made in the acquisitions record are also reflected in other library files. Patrons and selectors should be able to access the data in standard ways: author, title, series, ISBN, LCCN, keyword. Acquisitions staff and searchers should be able to access information with appropriate local keys, such as purchase order number, and be able to find titles cataloged or on order so that duplicate orders can be rejected and relationships to other titles in the collection can be identified. If the librarian is ordering an added copy or added volume, the system should permit borrowing of a bibliographic record from the online catalog or from an acquisitions file.

Generation of printed and/or electronic purchase orders and quotations requests: The system should handle different formats—print, nonprint, and hybrid monographs and serials that have associated electronic components. It should accommodate a full range of order types, including serials, standing orders, rush orders, prepaid orders, deposit account titles, and gifts. Once a purchase order has been entered, the system must not only store all bibliographic and purchasing information but also index and link critical elements so that the record can be retrieved by all appropriate search keys. The system should produce orders in print or send them electronically to vendors that have such capability.

Online vendor files: Each vendor record should store and index a variety of information about itself, including ordering and pay-to addresses, claiming intervals, names of contacts and phone numbers, and notes such as discounts. If the order system links vendors to an institutional accounting system, the record should contain a field for vendor numbers matching the number in the institution's file. Vendor records should also provide the link needed to generate an electronic order to that vendor.

Automated review of order records for claims or cancellations: The system should offer file management options such as alerts for claiming or canceling, but ideally the library should have the option of setting the system to claim or cancel automatically if the vendor permits automatic cancellations. The system

should produce electronic and printed claim/cancellation requests or offer a list for librarians to review and track the date and type of requests generated.

Recording of receipt information: The system should be able to handle titles that are received in full and titles where only part of the order is received. When partial receipts are recorded, the system should disencumber only the cost of the part or the volume received and keep remaining parts of the order open.

Payment of invoices: When invoices are received, staff should be able to enter invoice data automatically into each individual purchase-order record associated with that invoice. If the system does fund accounting, the system should create an electronic invoice record that can be approved online. Approval of the invoice should produce, electronically when possible, a voucher or a check.

Fund accounting: Basic fund accounting should include a fund record file with the capability of handling all the funds needed by the library. The system should record encumbrances, disencumbrances, and expenditures against each fund as transactions occur. Users should be able to view online the fund allocation, the amount encumbered, the amount expended, and the uncommitted and cash balances. The system should likewise validate fund codes entered during ordering and disallow incorrect codes. Each fiscal year, the system must provide the end-of-fiscal-year processing needed to move to a new fiscal year. Since requirements vary by library, the system should be flexible enough to establish new fund records for the new fiscal year or to leave a purchase order linked to a previous fiscal year so that it is paid with funds from the appropriate fiscal year.

Management reports: Automated systems should include a report generator adaptable to local needs in the type and timing of reports and offer options for online or printed output. The data should be compatible with standard database or spreadsheet software. Basic reports include fund reports, vendor-performance statistics, and staff performance statistics. Other reports should be available for collection development, for example, a list of titles acquired by fund or selector linked with data in other library modules, such as circulation or cataloging.

Security: Automated systems should provide for a variety of password levels, with two being an absolute minimum. Many functions such as fund control require secondary password levels so that unauthorized staff cannot create or change records. Ideally, passwords should be controlled at the local level by authorized staff and be constructed so that one log-on unique to an individual staff member serves to authorize all the functions that the person is permitted to perform. Histories of transactions

with associated passwords should also be maintained by the system so that supervisors can review actions to see who has performed them. The system should, finally, perform validity checks for funds and other elements deemed critical by local auditors.

Archiving: Since most libraries periodically archive completed acquisitions and fund data, the system should provide common archiving options: tape, microform, or disk. Another desirable option for easy retrievability would be to have the archive reside on a separate file as part of the integrated library system. Should a library migrate to another system, the system should be able to provide a copy of the library's acquisition files in an electronic format.

Other features that augment this list should include OPAC searching options, links to other databases or modules in an ILS, Z39.50 clients and servers, and web-based clients. Librarians now expect systems to include ERM components, which allow them to track individual holdings, licenses, and usage statistics associated with electronic products. The acquisitions system should have the qualities of good library systems, such as system integrity, file output for data sharing or migration, logical screen and function layouts, and user support.

Finally, fully automated systems should support interoperability with other local and external systems related to acquisitions of library collections and adhere to industry standards that enable effective exchange of data.

INTERFACES WITH EXTERNAL ACCOUNTING SYSTEMS

An important interface that many libraries require as part of its process for paying vendors is a linkage with the parent institution's automated financial system where the check is generated. Automating this accounting interface between the two accounting systems can be beneficial to both the library and the larger institution.^[20] Such an interface should permit vendor and voucher information to be sent to the parent system and must provide for consistency and security of data between the two systems. Since financial systems, security requirements, and audit controls vary widely from institution to institution, most links to parent accounting systems have been locally developed in cooperation with an institution's auditors. The emergence of APIs as an ILS function has assisted these local efforts to customize financial interfaces.

Before implementing an automated payment system, librarians must acquaint themselves both with the institution's audit requirements and with the automated system's internal controls. Traditional auditors still require some parts of the old paper trail for invoices, but use of

electronic file transfer protocol (FTP) and reliance on electronic passwords for authorizing transactions will eventually make most paper records obsolete. Generally, too, auditors require that the functions of ordering, receiving, and payment be separated and that records of who performed these transactions be maintained for verification with lists of authorized signatures. As automation advances, even signatures will be replaced with authorized lists of electronic passwords. Electronic fund transfer (EFT) from the account payable unit of an institution to the bank of the vendor is becoming increasingly common.

INTERFACES WITH THE BOOK AND SERIAL INDUSTRY

By the 1990s, book and serial vendors had automated the majority of their internal operations and could offer libraries a broad range of automated services, including everything from order processing, claiming, and invoicing to approval-plan profiling and management.^[21] The sophistication of these processes will vary among vendors depending on the library market they serve. Smaller vendors may not offer the range of services a larger academic vendor can; therefore, libraries need to explore with their vendors what they can provide. In many cases, vendors are willing to work with a customer to develop a service.

Various online ordering models are available. Serial vendors, for example, offer password access to their databases to allow customers to verify, order, and claim serials within the serial vendor's database. Book vendors have also automated their publication databases and offer online access to libraries. The result is that before placing a firm order, libraries can now call up specific titles to see if the title will come as part of the library's approval plan or as a standing order and, in some cases, check the jobber's inventory to see if a copy of the book is in stock. While online with the jobber, library staff can also place orders or request that a title be sent as part of the approval plan. The jobber's system then creates a file that acquisitions staff can use to download electronically into the library's acquisitions system, creating an order record in the process. This download requires specially programmed loaders to map and link the data from the book jobber's system to the formats required by the library's acquisitions system. After library staff members determine that the title is not a duplicate and that funding is available, they can confirm the order with the vendor by returning the order electronically to the book jobber. MARC cataloging records can also be provided by the jobber in this model or the vendor can send the title to OCLC's Promptcat service for cataloging before it is sent to the library. The Promptcat service has been merged with OCLC's WorldCat Cataloging Partners program, which also includes the former Cataloging Partners program. OCLC provides a list of the print and e-book

vendors that participate. As another alternative for expediting firm orders, staff can set up in their local acquisitions module an address for participating vendors and send electronic orders directly from the ILS without going online to the vendor. Other services include electronic invoicing via FTP.

Approval plan vendors, such as Coutts Information Service or YBP Library Services, routinely supply books shelf-ready. For each shipment, they will provide the library an electronic file of bibliographic records with attached invoices that can be loaded into the library's acquisitions system to create an order record facilitating payment. Working with the WorldCat Cataloging Partners model, libraries can use these records to also serve as the basis for the library's cataloging record. The vendor sends a manifest of the libraries' approval titles to OCLC's cataloging service. While the books are being shipped to the library, OCLC uses automated search algorithms to check OCLC's bibliographic files for a matching cataloging record and puts that record in a file for the library to load into its local online system. An advantage of using OCLC's service for cataloging records for those libraries that maintain their holdings symbol in OCLC is that the WorldCat Cataloging Partners' program automatically sets the library's holdings symbol in OCLC according to a time frame predetermined by the participating library, eliminating the need for staff to upload records to OCLC once the book is available for check out.

The advent of electronic books has brought new interfaces incorporating vendor-provided discovery records which may not meet the standards of a full MARC record. As a result, patrons can find available titles in the library's online catalog and request a short-term loan (STL) at some fraction of the list price. After a specified number of such requests, the library purchases the title. When the library purchases these titles, however, the discovery records can be upgraded to a full catalog record by the vendor or the library or sent to OCLC's cataloging services, using the capabilities of automated systems at the e-book vendor. If the item comes via an approval plan, the record exchange involves yet one more system in this complex array of interfaces.

STANDARDS

Standards are the key factor for successful interfaces between vendors and library acquisitions/ERM systems. This exchange of electronic data in a standardized form from one computer to another is called electronic data interchange (EDI). For EDI to work, two standards are necessary, one for the contents of the message and a second for the packaging of the transmitted information.

The creation of standards has fallen to voluntary professional and industry associations. One of these, the Accredited Standards Committee (ASC) (<http://web.ansi.org/>), part of the American National Standard Institute

(ANSI), has taken responsibility for establishing standardized formats for ordering, shipping, receiving, payment, and claims. The specific standard for electronic data interchange is X12, and the ANSI X12 formats were created for transmitting and receiving information. Another group, the (NISO, <http://www.niso.org/>), which is accredited by ANSI, has taken responsibility for standards relating to metadata and retrieving, storing, repurposing, and archiving information.

The Book Industry Standards and Communications Committee (BISAC, <http://www.bisg.org/index.html>) has established fixed formats for transmitting orders and claims for monographs. A parallel organization, the Serial Industry Systems Advisory Committee (SISAC), has promoted voluntary standards for electronic transmission of serials information. In 1998, these committees merged into a group named Book and Serial Industry Communications (BASIC, <http://www.bisg.org/basic.html>) to continue to foster standards for EDI formats for books and serials based on the international EDI standards. This group, which is officially a working group of the Book Industry Study Group (BISG), coordinates its efforts in creating standards with EDItEUR, a nonprofit agency with members from various countries around the world, including the United States (<http://www.editeur.org>). EDItEUR supports the EDIFACT guidelines for transactions used in the book trade and also manages important identifiers such as the international ISBN and ISSN as well as maintaining the ONLINE INFORMATION EXCHANGE (ONIX) standard for publishers to use for data fields (e.g., ISBN, title, author, reviews, etc.) when sending information describing books to libraries or book stores. ONIX is also extending to journal subscriptions and licenses.

In 2007, the 10-digit ISBN was replaced by the 13-digit ISBN and required everyone in the book supply chain from publishers, jobbers, and libraries to make certain their systems would support the full 13-digit ISBN. As a result, many systems have dropped BISG/BISAC and require the EDIFACT formats for transmitting orders electronically.

The transition to electronic collections has led to major efforts to develop standards or guidelines for exchanging data for usage statistics, license information, and other facets of electronic publications. NISO is sponsoring an initiative called Standardized Usage Statistics Harvesting Initiative (SUSHI, <http://www.niso.org/committees/SUSHI/>) using a standard data container for transferring COUNTER statistics into a digital repository. Integrated library systems are now employing SUSHI to gather usage statistics for a library. Project COUNTER is an effort to produce guidelines for counting electronic use statistics and is widely supported by publishers and libraries. The Digital Library Federation (DLF, <http://www.diglib.org/>) supported the Electronic Resource Management Initiative (ERMI), which has developed guidelines for defining elements of electronic resources and their associated licenses.

An extension of this effort is the joint NISO/EDItEUR ONIX-PL Working Group developing a standard for exchanging license information between publishers and libraries. The Knowledge Base and Recommended Practice (KBART) project (www.niso.org/workrooms/kbart) is an ambitious effort to provide guidance to content providers and knowledge base creators for metadata formatting so that knowledge bases and link resolvers get users to the desired content. Many additional standards exist and many more will continue to emerge.

THE INTERNET AND E-COMMERCE

Acquisitions librarians have found a variety of uses for the Internet that add convenience to daily routines and increase access to resources. The listserv and social media have become popular forums for discussion of acquisitions and serials issues and an excellent way to stay abreast of major trends. ACQNET-L and SERIALIST-L are two of the common forums for monograph and serial acquisitions. LIBLICENSE-L is important for obtaining information regarding the licensing of digital publications and other legal issues. ERIL-L promotes discussion of issues related to managing electronic resources. Techniques in Electronic Resource Management (TERMS) is an ongoing project to develop best practices for ERM and uses Facebook, Twitter, and a blog (<http://www/6terms.tumblr.com>) to share ideas.

Websites offer a wealth of sources for collection development and acquisitions. Borrowing ideas or procedures from the web pages of other acquisitions departments has become common practice. Staff can also access other library catalogs to find citations to aid in bibliographic verification. Many libraries also order titles from Amazon.com or Barnes & Noble's online store as a quick source for rush items.

And nowhere has using the Internet been more gratifying to librarians than in helping them find out-of-print materials. The formerly idiosyncratic and disorganized world of used and antiquarian book dealers has seen new markets develop as buyers and hundreds of dealers embrace the Internet as a distribution center.

The use of credit cards for e-commerce is now common. Among the advantages are ease in dealing with e-commerce dealers and reduction of check-writing for petty sums. On the down side, credit card transactions require extra steps in tracking and do not interface directly with library systems.

IMPACTS ON WORKFLOW AND ORGANIZATION

Automation of acquisitions data and integration of that data with other library systems has led to major

reexamination of workflows and organization within technical services. Traditionally, acquisitions departments did preorder searching and ordered materials, while cataloging departments performed the bibliographic and authority searching necessary for cataloging a book. When the online bibliographic utilities such as WLN, RLIN, and OCLC became available, acquisitions and cataloging librarians realized that the order verification information could also be used by the catalogers if staff agreed on policy and procedures. The recognition that the knowledge, skill, and tools employed by acquisitions and cataloging staff are similar led many technical services librarians to consolidate preorder and precataloging searching into a single unit that might report to either acquisitions or cataloging departments. As the integration between acquisitions and cataloging modules on automated systems evolved, acquisitions and cataloging librarians gave greater attention to generating accurate bibliographic records at the earliest possible stage of processing. In particular, staff could eliminate several searching and keying steps, thereby reducing the costs of searching bibliographic databases and shortening the time between receipt and cataloging for a book. As a result, some libraries adopted cataloging at the point of receipt for selected materials so that the staff member who searched and found acceptable bibliographic copy for a book when it was received could also catalog that book. This combination of tasks has led to the creation of fast cataloging units in many libraries. Increasingly, acquisitions department staff members now perform cataloging using Library of Congress MARC records retrieved from bibliographic utilities or from jobber-supplied MARC records received with the book. Discovery records provided by e-book vendors to help libraries and patrons find titles for short-term loans in demand-driven acquisitions (DDA) products can also be upgraded to full cataloging records by acquisitions staff.

Automated acquisitions has also brought important benefits for collection development librarians, and the traditional lines separating acquisitions from selecting have begun to show signs of blurring as well. Budget reports now can be drawn with greater frequency and timeliness, while the increased ability of automated systems to correlate acquisitions data with circulation and cataloging data has improved the management reports that can be compiled for collection analysis. Selectors, moreover, can now access the centralized file of orders to review the status of their orders without relying on the acquisitions department.

Because selection has also become more automated, many libraries have moved away from collection bibliographers toward subject/reference librarians who use the time gained for instruction and reference as well as selection of print and electronic materials. Certainly, the automation of a large portion of the publishing universe allows the possibility of more sophisticated purchase plans

replacing the costly title-by-title examination selectors once practiced with traditional approval plans. The possibility of receiving approval books shelf-ready and the increased use of OCLC's WorldCat Cataloging Partners service for cataloging has led to further implementation of plans where the books are not returned to vendors. As these purchase plans replace approval plans, collection developers and acquisitions librarians will increasingly focus on becoming expert designers and managers of profiles and systems.

Another area of staffing change has come with the creation of ERM librarian positions within acquisitions or serials units. The more traditional serials librarian roles have also changed to include greater focus on electronic acquisitions and require a greater need for expertise with licensing, authenticated access/proxy servers, open uniform resource locator (URL) linking, and creation of A to Z database and journals lists. ERM librarians often help gather and organize usage statistics and provide licensing and cost data to collection development librarians who then incorporate the metrics into the selection and evaluation process for the library.^[22]

The ease of sharing data from automated acquisition systems means also that collection developers operating within consortia can now remove significant obstacles to resource sharing and cooperative acquisitions. Sharing acquisition data allows members to tag titles automatically for cancellation or purchase and so to expedite cooperative ventures.

ELECTRONIC PUBLICATIONS AND PATRON-DRIVEN ACQUISITIONS

Electronic book products have raised new questions of distribution, pricing, ownership, and contracting for the acquisitions librarian. E-books are promoted to academic libraries in several ways including 1) publishers offering direct marketing of content to the library, 2) specialist aggregators packaging and presenting books in particular subject areas, 3) large aggregators offering e-books in many disciplines from multiple publishers, and 4) library vendors offering e-books and print books from both the aggregators and from individual publishers.^[23]

1. Direct purchases of individual e-books from publishers usually allow libraries more permissive digital rights management (DRM) and give patrons greater freedom to download or share. Some publishers, however, opt to sell only an entire "package" of titles and do not make individual titles available for purchase. Other publishers offer an evidence-based model (EBM) allowing access to a specific list of titles for a set period of time. In this model, a library agrees to pay a specified dollar amount at the beginning of the time period, and then at the end of the period, the library selects the titles to

purchase, up to the defined dollar amount. The pool of titles available to the patrons during the open period is quite extensive and represents a dollar amount several times greater than the amount paid upfront by the library. At the end of the EBM specified period, the library reviews the "evidence" provided by usage statistics to guide final title selections.

2. Specialist aggregators often bundle titles around related subject areas or types of books such as reference materials. Bundling can be a benefit for users since the e-books are collected together by subject or type, and the specialist aggregators often have a search feature that allows searching across all content in the specialist package. But like database/journal aggregators, titles can change and move into and out of the specialist packages.
3. Large aggregators offering e-books from multiple publishers permit librarians the significant advantage of automating and streamlining the process for discovery records, book purchase, and use of e-books by users. The advantage for users is that they see their books through the same platform.
4. Library vendors selling e-books and print books from aggregators and individual publishers offer a variety of different purchasing models. The standard model permits libraries to purchase books title by title and own the book outright. Another model is common for approval plan vendors. Here libraries add electronic books via their approval plan profiles, which then link the approval plan with e-book aggregators or e-book publishers. Finally, some vendors offer patron-driven acquisitions (PDA) or DDA by which libraries acquire books only as patrons ask for them, often with an option for an STL first, before repeated uses trigger purchase of a book. In 2014, NISO announced a recommended practice on DDA that covers these various options and will serve to guide libraries, publishers, aggregators, and vendors on management of DDA services.^[24]

The PDA or DDA model is also moving into use by library consortia. The Orbis Cascade Alliance and the Colorado Alliance of Research Libraries are two groups operating a DDA selection model cooperatively among several libraries. Formerly, the choices for "ownership" were limited to purchase or lease; now there are options for the number of simultaneous users of a particular title, limits on the status of users, and sometimes frequent changes in what access a particular publisher will allow. As Rick Anderson describes, "There are many PDA models currently under development, and we can expect that they will proliferate and be refined over time. While some libraries will (and should) still be building monumental collections in 2021, I am confident that the standard approach for most research libraries will be patron-driven."^[25] Whether to acquire e-books as collections or singly or as subscriptions

or with perpetual access are just some of the issues acquisitions librarians now face.

For electronic journal articles, acquisitions librarians have yet another patron-driven model now poised for further development. In the past, requests for articles not available from an academic library's current subscriptions went to an interlibrary loan (ILL) department and could be sent electronically by direct document delivery to patrons. A vendor- or publisher-supplied model for journal articles has emerged by which some academic libraries now fill requests on an article-by-article or pay-by-the-drink basis. A library, working through a publisher or vendor, provides money on deposit so that affiliated researchers can request the needed article directly from the publisher or vendor. Expanded use of patron-driven direct document delivery from vendors and publishers permits delivery with little or no staff intervention and may eventually offer an alternative to conventional e-journal subscriptions.

The e-book and direct article delivery models are in flux as publishers and vendors are still testing the market with a variety of ways to offer e-books and journal articles. Spending on electronic materials will continue to outpace spending on print.^[26] Libraries are still pondering effective models for acquisitions and making changes to workflows and budgets accordingly.

THE FUTURE

As library technology and electronic resources become more pervasive and more complex, demands for automated acquisitions systems meeting a variety of needs will continue. System vendors and libraries will continue to improve functions that assist in comprehensively managing electronic resources. The concept of a publisher will be pushed to new limits by electronic information. Exploration of patron-driven acquisitions will continue. Article databases and document delivery will supplement and may replace current subscriptions models. Consortial purchasing will grow and open new opportunities for development in both library and vendor systems. Librarians, publishers, and vendors will develop new standards to speed sharing and accuracy. Yet unknown forms of online resources and services will be required.

As electronic resources replace print materials, the need for traditional automated acquisitions may diminish as acquisitions becomes nothing more—nor less—than providing users fast and convenient ways of accessing the world's vast body of information in the cloud.

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Automatic Abstracting and Summarization

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Abstract

After lying dormant for a few decades, the field of automated text summarization has experienced a tremendous resurgence of interest. Many new algorithms and techniques have been proposed for identifying important information in single documents and document collections, and for mapping this information into grammatical, cohesive, and coherent abstracts. Since 1997, annual workshops, conferences, and large-scale comparative evaluations have provided a rich environment for exchanging ideas between researchers in Asia, Europe, and North America. This entry reviews the main developments in the field and provides a guiding map to those interested in understanding the strengths and weaknesses of an increasingly ubiquitous technology.

GENRES AND TYPES OF SUMMARIES

It is almost impossible to conceive of a world without summaries. Daily, we skim over headlines to decide what news to read. We go over scientific abstracts to decide what papers to study. We read reviews to decide what books to buy. And we browse television guides to decide what movies to watch.

Most of the summaries that we use today are produced manually by trained abstractors. However, an increasingly large number of researchers is now tackling the problem of automatic summarization. This turns out to be quite difficult because even defining the scope of the problem is not an easy feat. Consider, for example, the text fragment in Fig. 1a, which is taken from *Time* (October 2, 1997).

What is a good summary of the text in Fig. 1a? A *headline* such as that in Fig. 1b may convince a layperson who is hit annually by a flu to read the whole article. However, a molecular biologist interested in the function of various enzymes may be more interested in an abstract such as that shown in Fig. 1c.

As the examples in Fig. 1b and 1c illustrate, the communicative goal with which a summary is written and the background knowledge of the intended audience clearly influence the information that one may consider to be important.

The intended communicative goal and the background of the audience are only two of the facets that are useful when characterizing summaries. Other facets that have received significant attention are listed below [see Hovy,^[1] Mani,^[2] and Jones^[3] for a list of dimensions along which summaries can be characterized].

- *Usage*. When they can be used only for quick categorization, summaries are called *indicative*. When they

can be used as substitutes of the original documents to access significant content, summaries are called *informative*.

- *Relation to source*. When summaries contain sentences/clauses that are “lifted” verbatim from the input source, they are called *extracts*. When the important information in a text is paraphrased to ensure cohesion, coherence, and a higher degree of compression, summaries are called *abstracts*. A particular type of abstract, which is extremely short and uses a peculiar syntax is the *headline*. For example, the texts in Fig. 1d and Fig. 1e are extractive summaries of the text in Fig. 1a, the text in Fig. 1b is a headline, and the text in Fig. 1c is a short abstract.
- *Purpose*. When summaries provide the author’s view, they are called *generic*. When they reflect the user’s interest, often expressed in the form of a query, they are called *query oriented*.
- *Source type*. When they are based on only one text, they are called *single-document summaries*. When they fuse information provided in multiple texts, they are called *multidocument* or *multidoc summaries*.

The dimensions above are not always clearly cut. A summary can be at the same time indicative and informative. Or it can be indicative for one audience and informative for another. A summary that is obtained by selecting important sentences and then simplifying them by deleting unimportant words and phrases is not really an extract because it contains clauses/sentences that are not part of the input. But it is not an abstract either because paraphrasing is not employed extensively. By the same token, one may argue that it is not appropriate to call “abstract” and extract in which only the pronominal dangling references have been replaced by the corresponding noun phrases.

a.	Running nose. Raging fever. Aching joints. Splittig headache. Are there any poor souls suffering from the flu this winter who haven't longed for a pill to make it all go away? Relief may be in sight. Researchers at Gilead Sciences, a pharmaceutical company in Foster City, California, reported last week in the <i>Journal of the American Chemical Society</i> that they have discovered a compound that can stop the influenza virus from spreading in animals. Tests on humans are set for later this year. The new compound takes a novel approach to the familiar flu virus. It targets an enzyme, called neuraminidase, that the virus needs in order to scatter copies of itself throughout the body. This enzyme acts like a pair of molecular scissors that slices through the protective mucous linings of the nose and throat. After the virus infects the cells of the respiratory system and begins replicating, neuraminidase cuts the newly formed copies free to invade other cells. By blocking this enzyme, the new compound, dubbed GS 4104, prevents the infection from spreading.
b.	Headline: Flu stopper — A new compound is set for human testing
c.	Short abstract: The neuraminidase enzyme enables the flu virus to replicate and invade uninfected cells.
d.	Coherent extract: Researchers at Gilead Sciences, a pharmaceutical company in Foster City, California, reported last week in the <i>Journal of the American Chemical Society</i> that they have discovered a compound that can stop the influenza virus from spreading in animals. Tests on humans are set for later this year.
e.	Incoherent extract: The new compound takes a novel approach to the familiar flu virus. By blocking this enzyme, the new compound, dubbed GS 4104, prevents the infection from spreading.

Fig. 1 Sample text and various types of summaries.

SUMMARY EVALUATION

The discussion in the previous section is much more important than first meets the eye. The facets and summary types enumerated above do not merely provide a common vocabulary to natural language researchers. Rather, they set the foundation for addressing a serious concern: If there are so many facets and factors that influence the way summaries are constructed and presented, how can one measure the quality of a summary? What makes a summary good and another one bad? Unless these questions can be answered adequately, it is impossible to assess progress in the field of automatic abstracting.

The first metrics for measuring the quality of a summary have been proposed in the context of producing generic extracts. Given a document, one or more human judges are asked to mark the sentences that are important. The sentences on which a majority of the judges agree to be important are taken to be the “gold standard.” The quality of automatic summarizers is measured in terms of recall—the number of important sentences correctly identified by the summarizer divided by the total number of sentences in the gold standard—and precision—the

number of important sentences correctly identified by the summarizer divided by the total number of sentences selected by the summarizer. Note that both recall and precision have to be taken into consideration as one can easily rig one of the metrics. By marking as important all sentences in a text, one can easily obtain a 100% recall. Clearly though, the precision is going to be much smaller. A metric that summarizes the recall and precision metric is the F-value metric, which is a harmonic average of precision and recall ($F = 2 R P / (R + P)$). The F-value is a number between recall and precision that it is higher when recall and precision are closer.

The F-value cannot be rigged the same way recall and precision can when considered in isolation. Unfortunately, the use of the F-value metric can also pose problems. Let’s say that five human judges mark as important sentences in a document that has 20 sentences. Let’s say that each judge marks 10 sentences as important but a majority of the judges agree on only two sentences. Is this two-sentence gold summary of any good? If five judges randomly choose sentences from a document and mark them as important, just by the laws of odds it is likely that two sentences will be marked as important by a majority of

them. This is clearly a problem as it corresponds to a case where there is no agreement between human judges with respect to what is important in a text (see Carletta,^[4] Krippendorff,^[5] and Siegel^[6] for methods of computing agreement between multiple judges). If humans cannot agree on what is important, it means that a summarizer that chooses sentences randomly is as good as a human.

Some of the summarization studies that are referred to in this entry were carried out before statistical methods for measuring interannotator agreement and adequate experimental design techniques became part of the tools used by natural language researchers. For example, a classic summarization paper published by Edmundson^[7] measured the performance of various summarization methods in terms of recall with respect to a gold standard built by only one human. Forty years after the experiment of Edmundson was carried out, it is impossible to tell how difficult the texts given as input were to summarize—no human agreement figures are reported in the paper. Still, as the reader can see in this entry, we still take many such results as indicative of the performance of various methods. Understanding how to measure the quality of a summary is by itself a research area^[8] that evolves concurrently with research aimed at developing increasingly sophisticated summarization techniques.

The recall, precision, and F-value metrics represent only a small fraction of the metrics proposed to measure the quality of a summary. Alternative metrics have been proposed to address their limitations. For example, Radev et al.^[9] proposed an evaluation metric in which sentences are not judged on a boolean scale as important or nonimportant, but are given a utility score. A summarizer that selects sentences of high utility is given a higher reward than a summarizer that selects sentences of medium or low utility.

To enable the evaluation and encourage the development of systems that produce not extracts but abstracts, the Document Understanding Conferences^[10,11] use human judges to measure the degree of overlap between a model summary and abstracts/extracts produced by various systems. In addition to the informational content, systems participating in DUC are also evaluated in terms of output grammaticality, cohesion, and coherence.

The metrics discussed so far pertain to the intrinsic quality of a summary. However, in many scenarios, summaries are also evaluated extrinsically, with respect to their utility for solving specific tasks. For example, systems that participated in the SUMMAC evaluation^[12] were evaluated by measuring how often their outputs could be used by humans to determine whether the documents for which the summaries were generated were relevant to a given topic. In another task, summarization systems were judged by measuring how often their outputs could be used to successfully carry out a document categorization task.

Reviewing all research in summary evaluation is beyond the scope of this entry.^[1,2,8,10–12] In the rest of this entry, whenever the “performance” of a summarization system is referred to without using any additional qualifiers, the F-value of that system, as measured against a gold standard, is meant. When the performance of a system was measured using a different metric, this is made explicit. Because the science of evaluating summaries is not stable and because a generally accepted evaluation standard is yet to emerge, comparing the performance of various summarization algorithms and techniques is challenging.

SUMMARIZATION-SPECIFIC COMPONENTS

Overview

In dealing with the facets discussed previously, researchers in summarization developed numerous components/techniques that are now part of many summarization systems. Importance identifiers are used to determine the most important sentences and clauses in a document or collection of documents. Sentence compression algorithms are used to compress extracts further, by deleting nonimportant phrases and clauses in long sentences. Paraphrasing components are used to increase the compression and readability of the output. Information extraction and natural language generation systems are used to generate abstracts via semantic-based representations. Headline generators use specialized techniques to determine the most representative concepts in a text and to render them using a language that is often different from that used in typical English.

Fig. 2 shows the components that have received significant attention (the components are represented as ellipses) and the summary types these components are meant to produce (the summary outputs are represented in bold fonts surrounded by boxes). Each summarization pipeline in Fig. 2 takes as input a document and some optional parameters, such as the desired compression, a user query, etc. Additional components that were developed to generate multidocument summaries are discussed later in this entry.

Importance Identifiers

Arguably, most of the effort in the summarization research field has gone into the development of algorithms and methods for identifying important sentences/clauses in single document texts.

Position-based method

Many of the summarization systems assume that sentences that occur at the beginning of documents are more likely

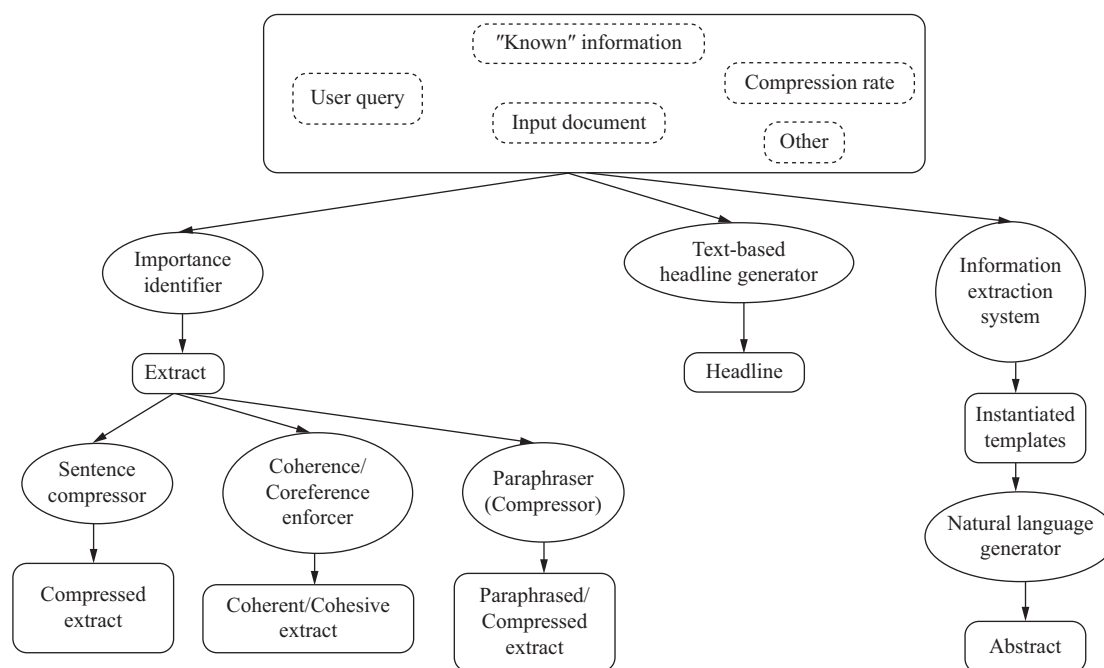


Fig. 2 Components (ellipses) and sought outputs (bold rectangles) of single document summarization systems.

to be important than sentences that occur at the end. The simplest way to operationalize this assumption is to build a summarizer that always selects the first sentence in a text; or the first k sentences in a text, when a smaller degree of compression is required.

Empirical evaluations of algorithms that implement this assumption have revealed that the position-based method is the best^[7,13] or second best^[14] single method for identifying important sentences in text. Although the performance of this method varies significantly with text genre and compression rate, this method is usually capable of identifying around 33% of the important sentences in a text.^[7,13,14]

An extensive study aimed at deriving a genre-dependent optimum position policy have been carried out by Hovy and Lin^[15] who showed that in technical articles that announce computer-related products, the sentence that is most likely to be important is the first sentence of the second paragraph, then the first sentence of the third paragraph, then the second sentence of the second paragraph, and so on; in news articles, the sentence that is most likely to be important is the first sentence of the first paragraph, then the first sentence of the second paragraph, and so on.

Title-based method

Edmundson^[7] was the first to show that the words in titles and headings are more likely to be used in important sentences in a text than in nonimportant sentences.

Systems that employ this heuristic in combination with others tend to yield summaries of higher quality. For example, the title-based method increased the performance of Edmundson's position-based summarizer by 8% and the performance of Teufel and Moens's^[14] cuephrase-based summarizer by 3%.

Cuephrase method

Cuephrase-based systems capitalize on the observation that important sentences contain "bonus phrases," such as *significantly*, *in this paper we show*, and *in conclusion*, whereas nonimportant sentences contain "stigma phrases," such as *hardly* and *impossible*. The cuephrase method yielded the best results when used to identify important sentences in scientific articles^[14]—it identified 55% of the important sentences in a text—and was shown to increase the performance of summarization systems by 7% to 9% on other genres, when applied in conjunction with other methods.^[7,13]

Word-frequency method

To my knowledge, the claim of Luhn^[16,17] that important sentences in a text are those that contain words that occur "somewhat" frequently has not been validated empirically in any summarization system. In Edmundson's experiments,^[7] this method decreased the performance by 7% when combined with other methods. In Kupiec et al.'s experiments,^[13] this method decreased performance by 2%.

The method appeared to mildly help only in Teufel and Moens's system,^[14] where it increased performance by 0.2% when combined with other methods. In spite of not being properly validated, the word-frequency method continues to be used in many implemented systems.

Cohesion-based methods

The working hypothesis that constitutes the foundation of all cohesion-based methods is that important sentences/paragraphs are the highest connected entities in more or less elaborate semantic structures. There are several approaches to characterizing the level of connectedness. They are based on word co-occurrences, local salience and grammatical relations, coreference, lexical similarity, and combinations of the above.

Word-based. The most straightforward approaches apply Information Retrieval techniques to compute the similarity between the paragraphs in a text.^[18–20] The paragraphs that have the highest collective similarity to the other paragraphs are assumed to be central/important to the document in which they belong. When evaluated against a collection of encyclopedia articles, this method did not improve significantly over a position baseline.^[20] The assumption that important sentences are those that contain important concepts have been also explored in a different representation space, using methods specific to latent semantic analysis.^[21]

Lexical chains-based. Lexical chains are successions of semantically related words that create a context and contribute to the continuity of meaning.^[22] For example, a lexical chain defined over the text in Fig. 1a, may contain the semantically related words (nose, fever, headache, flu, pill). Lexical chains are automatically built^[23–25] using large lexical databases, such as thesauri and the Wordnet.^[26] Lexical-chain-based approaches to text summarization^[23,25] assume that important sentences are those that are “traversed” by “strong” chains, where the strength of a chain is defined by its length and number of distinct words in it. Empirical evaluations have shown promising results but have not provided yet uncontroversial evidence that this summarization method yields higher performance than others.

Connectedness-based. The connectedness-based method^[27] fuses many of the elements specific to cohesion-based methods. Systems that use this method first map the words in a text into nodes in a graph and then create arcs between the nodes whenever an adjacency, grammatical, coreference, or lexical-similarity-based relation holds between the words corresponding to the nodes. The sentences that contain the most connected words are considered important. The method has been shown to produce good results when evaluated extrinsically, on a document categorization

task.^[12] The author is not aware of intrinsic evaluations of this approach.

Discourse-based

The working hypothesis of the discourse-based method is that the hierarchical discourse structure of texts^[28] can be used to determine the important sentences/clauses in a text.^[29–32] Intuitively, if a paragraph p in a text elaborates on a sentence i in the same text, it is reasonable to assume that a summary should contain only the sentence i as the information in paragraph p is subsidiary to that in i .

Marcu^[30] presented various algorithms for automatically deriving the hierarchical discourse structure of texts, and Marcu^[30] and Carlson et al.^[33] discussed methods for exploiting the discourse structure to determine the most important sentences/clauses in a text. For short texts, the performance of discourse-based summarization systems approaches that of humans.

Integration of the methods

None of the methods above has proved to provide consistent, high-performance results across all text genres, document lengths, and compression rates. In fact, experiments carried out by Jing et al.^[34] suggested that many of these methods are quite unstable. Systems that perform well in a given summarization setting may perform poorly in a different one. To increase robustness, many summarization systems do not rely on only one of the above methods. Rather, they use supervised machine learning techniques, such as naïve Bayes,^[13,14] decision trees,^[35,36] inductive learning,^[35] and rhetorical parsing tuning,^[30] to adjust the contribution of each summarization method in determining the most important sentences in a text. In stable experimental conditions, summarization systems that use machine learning to integrate various methods/techniques always outperform systems that use only one summarization method.

Sentence Simplifiers/Compressors

Professional abstractors do not create abstracts by simply copying the most important sentences in a text. Often, they delete nonimportant segments in the important sentences to yield summaries of higher compression.^[37–39] For example, a sentence such as that in Fig. 3a, can be simplified as shown in Fig. 3b.

To simplify sentences, some researchers^[40–45] manually developed collections of rules that posit, for example, that during compression all adjectives and relative clauses in a sentence should be dropped. As one may expect, this approach can often yield ungrammatical outputs. To address this problem, other researchers^[39,46] tackled the sentence simplification problem in a probabilistic framework, using a noisy-channel approach similar to that

a.	Although the modules themselves may be physically and/or electrically incompatible, the <i>cable-specific jacks</i> on them <i>provide industry-standard connections</i> .
b.	<i>Cable-specific jacks provide industry-standard connections.</i>

Fig. 3 Sentence compression example.

employed in speech recognition,^[47] machine translation,^[48] part-of-speech tagging,^[49] and information retrieval.^[50]

Using an automatically collected corpus of sentences and their human-generated compressions, Knight and Marcu^[39,46] developed generative probabilistic models that explain how short sentences can be rewritten as long sentences through a sequence of syntax-based stochastic operations. Mathematically, any long sentence *L* can be generated from a short sentence *S* with a probability *P*(*L*|*S*). A language model component assigns a probability *P*(*S*) to any possible sentence: grammatical sentences have high probability, whereas nongrammatical sentences have low probability. Once the probability distributions *P*(*L*|*S*) and *P*(*S*) are estimated, given a sentence *l*, sentence compressions of arbitrary length can be generated by looking for sentences *s* that maximize the product *P*(*l*|*s*) *P*(*s*) [i.e., sentences that are both good compressions (*P*(*l*|*s*) is high) and grammatical (*P*(*s*) is high)]. Empirical evaluations of Knight and Marcu’s sentence compression algorithms showed that the noisy-channel approach outperforms two baseline algorithms that compress sentences by dropping words randomly or by choosing subsequences of maximal *n*-gram probability. However, Knight and Marcu’s compression system still does not come close to human performance levels.

Sentence Paraphrasers

The simple deletion of syntactic constituents in long sentences is not the only way professionals create abstracts.

Often, information from multiple sentences is fused together or, for coherence, cohesive, and stylistic effects, information in one or multiple sentences is paraphrased. Numerous researchers studied in detail the types of paraphrase operations employed during summarization^[38,51,52] and applied them in implemented systems.^[38,52] However, systems capable of generating multiple paraphrases of arbitrary sentences are yet to be developed.

For example, it is not clear at all what kind of computational processes one should use to produce the short abstract in Fig. 1c, which paraphrases some of the information in the text in Fig. 1a, while making explicit information that is not rendered in the original text. Or consider the examples of compression/paraphrasing in Figs. 4 and 5, in which two sentences were compressed/paraphrased into one (the text in italics has been preserved or modified slightly during compression).

Both examples of compression/paraphrasing in Figs. 4 and 5 were produced by professional abstractors. Mimicking this process automatically is not within the capability of many summarization systems. Fortunately, the recognition and generation of paraphrases is currently on the radar of many research communities. Researchers in natural language generation and summarization,^[53] data mining and question answering,^[54] and information extraction^[55] methods for automatically learning paraphrase-specific information by exploiting bilingual, parallel texts,^[54] or large corpora of monolingual text.^[54,55] It is likely that progress in this area will have a significant impact on the next generation of automatic abstraction systems.

a.	He <i>holds a bachelor's degree in chemistry</i> .
b.	“Maintaining an organization like ISFUG is like building a castle in the sand; it just requires constant work to keep it trim,” said <i>Berkman, an economist with the Commerce department’s Bureau of Economic Analysis</i> .
	Compression with paraphrasing: <i>Berkman, who holds a bachelor's degree in chemistry, is an economist with the U.S. Department of commerce.</i>

Fig. 4 Compression/paraphrasing example 1.

a.	<i>Nonetheless, policies on its use vary.</i>
b.	<i>Agencies such as the Internal Revenue Service and the Farm Credit Administration promote shareware use, but one NASA center shuns it.</i>
	Compression with paraphrasing: Federal agencies generally use shareware, but policies on its use vary.

Fig. 5 Compression/paraphrasing example 2.

Coherence/Coreference Enforcers

Although extraction-based summaries contain, by construction, only well-formed grammatical sentences, they often do not sound right. For example, the summary extract in Fig. 1e of the text in Fig. 1a sounds odd because it is not clear to what entities “the new compound,” “this enzyme,” “the new compound,” and “the infection” refer. Also, even if we could felicitously solve these references, the two sentences still do not seem to go well together because the discourse relation between the two is not clear.

Numerous techniques have been proposed to rewrite extracts so as to yield more readable summaries. Many of the systems tested as part of the large-scale summary evaluations carried out in conjunction with the DUC^[10,11] use anaphora resolution techniques to replace with name entities some of the pronouns in the extracts they produce. More sophisticated summary revision operations, such as aggregation of constituents of two sentences on the basis of referential identity and reduction of coordinated constituents were proposed by Mani et al.^[56] Aggregation operations specific to events have been proposed by Maybury.^[57] Sentence-reordering algorithms have been proposed by Barzilay et al.^[58]

In an attempt to deal with sentence and document compression in a uniform framework, Daumé and Marcu^[59,60] showed how the noisy-channel approach to sentence compression of Knight and Marcu^[39] can be extended to the text level. Their empirical evaluations show that a document compression system that integrates the deletion of syntactic constituents with the deletion of clauses and sentences outperforms a compression system that sequentially simplifies the sentences in a text.

HEADLINE GENERATORS

The vast majority of the work on headline generation has been carried out in a statistical-based noisy-channel framework.^[61–64] Given large collections of «text, headline» tuples, which can be easily collected from the Web,

one can estimate probability distributions, $P(w_d|w_h)$, that reflect the likelihood of a word w_d occurring in a document when another word w_h occurs in a headline. By treating documents and headlines as bags of words, one can easily estimate the probability, $P(D|H)$, of a document given a headline. A classic trigram language model, $P(H)$, can be trained to differentiate between well- and ill-formed headlines. Once the parameters of these models are estimated, one can construct document headlines by searching for sequences of words h that maximize the product, $P(d|h)P(h)$. The headlines generated in this manner tend to contain the most representative words in a document; however, the n-gram language models that were employed so far in headline generators seem to be too weak to enforce that the generated headlines are grammatical.

A different approach to headline generation is taken by Daumé et al.,^[65] who first identified the input document type. This type can fall into one of these four classes: single event, multiple event, biography, and natural disaster. In addition to the type, Daumé et al. also automatically determined the most salient entities and relations in the input. Depending on the input type, they use a set of predefined templates to produce grammatical headlines. For example, when a multievent template of the form “MainEvents in Location1, Location2, and Location3” is instantiated using entities specific to a collection of documents about eclipses, it yields the headline “Eclipses in Hawaii, Mexico, and Bay Area.” The method produces impressive results when the document type and salient entity identifiers work correctly, but produces odd results when these components fail.

SUMMARIZATION VIA SEMANTIC REPRESENTATIONS

Most of the light semantic-based summarization systems developed to date implement the pipeline architecture in Fig. 2. An information extraction system specialized in dealing with certain events, such as “terrorism” or “natural disasters,” first extracts from the document(s) to be

SOURCE:	Reuters
SOURCE: DATE	Febr 27, 1993
INCIDENT: DATE	Febr 26, 1993
LOCATION:	World Trade Center
TYPE:	Bombing
NUMBER OF VICTIMS:	at least 5

Fig. 6 Example of template from the “terrorism” domain.

summarized text fragments that fit a predefined template (see Fig. 6 for an example). Once the template has been filled, a natural language generation component is used to map the information in the template into well-formed natural language sentences.^[66,67]

Because the types of entries associated with information extraction templates are limited, before generation, one can apply additional operations to modify, delete, and aggregate information extracted from text.^[67] This is particularly useful in the context of multidocument summarization, where the information extracted from multiple articles may be inconsistent.

This approach produces good summaries in the limited domains for which the information extraction and natural language generation systems have been tuned. Unfortunately, the approach does not generalize easily to arbitrary domains. In general, the role of semantics in summarization is still to be determined. What constitutes an appropriate, computable representation for the semantics of texts that can be exploited in the context of summarization applications remains a controversial issue. Some researchers^[68] map texts into description logics and perform condensation operations on formal representations. Other researchers^[65,66,69] tend to use intermediary representations that are closer to the surface and/or syntactic forms. No researcher in the field claims that high-performance summarization systems can be built without a deeper understanding of the semantics of texts than current technology supports. But where the middle ground between formal elegance and coverage is remains an open question.

MULTIDOC SUMMARIZATION

A multidocument summarization system takes as input a collection of documents and produces a summary of the entire collection. In some instances, producing generic multidocument summaries is easier than producing generic single document summaries. If a collection of documents is about the same event, let's say an earthquake, it is likely that many of the input documents contain sentences describing the number of victims, location, time, and strength of the earthquake. Clustering techniques that measure the word overlap between sentences are usually sufficient for choosing from the set of all sentences in a collection one that is similar to many others. If a sentence and its variants were produced by many

authors, it is likely to be important. In such instances, important information can be, hence, detected using simple word overlap. In other instances, producing multidocument summaries is more difficult than producing single document summaries. When the collection given as input is heterogeneous and describes multiple events of the same kind, for example, earthquakes that happened in various locations over a time interval, it is no longer easy to determine what information is most important.

Besides the challenges specific to single document summarization, multidocument summarizers have to address a whole range of additional problems. When one summarizes document collections, it often happens that the information given in them is inconsistent. One document may claim that a car crash has produced six victims, whereas another document may claim seven. Which document should one believe? How can one determine that the two documents talk about the same car crash to begin with?

Determining the absolute time of the events reported in the input documents becomes an important factor in deciding what should go in a summary. If a collection reports the saga of a military conflict, what should go in a short summary? The cause of the conflict? The major steps in the conflict? Or only the outcome?

Equally important is the explicit mentioning of the dates/times at which the events occurred.^[70] If the dates/times associated with the reported events are not explicitly mentioned, there is a serious danger for human readers to make incorrect inferences. The simple juxtaposition of some sentences may mislead readers to believe that, for example, an event in one sentence caused the event in the subsequent sentence, if the reader cannot infer from the summary that the events took place 10 years apart.

Collections about similar events tend to contain significant amounts of redundant information. But recognizing where redundancies occur is by no means a trivial problem because the relation between sentences in arbitrary documents is difficult to characterize.^[71] sentences can be semantically equivalent, they can subsume each other, or the information they convey can partially overlap. Recognizing the exact relation that holds between two arbitrary sentences is still an open problem.

The field of multidocument summarization has created the context and need for research in various areas. It led to the development of methods that are well suited for generating nonredundant summaries;^[72,73] methods that can be used to detect and track events over time while producing “evolving,” temporal summaries;^[74] methods for fusing sentence fragments^[66,69] to produce grammatical sentences; and in-depth studies of specific summary types (biographical).^[2]

Since 2001, the DUC^[10,11] in North America and the NTCIR Workshop on Evaluation of Chinese & Japanese Text Retrieval and Text Summarization^[75] in Asia

provided an excellent forum for evaluating and comparing various multidocument summarization algorithms. Participants in large-scale evaluations worry not only about building useful systems, but also about figuring out how to measure their performance.^[76,77] It appears that a significant gap exists between the summarization systems that participate in DUC and NTCIR evaluations, which are capable of handling unrestricted document collections using simple surface-based techniques, and the systems developed to advance the state of the art in information fusion,^[66,69] paraphrasing,^[53] or text compression.^[59] It would be interesting to see how and when the latter work gets integrated into robust summarization systems capable of handling arbitrary text types.

OTHER KINDS OF SUMMARIES

Throughout this entry, the focus has primarily been on techniques and algorithms developed for producing single document and multidocument generic summaries. By no means does this cover all the work in text summarization. For example, Teufel and Moens^[78] went beyond generic summarization to devise algorithms for classifying sentences in scientific articles according to their rhetorical goal (Background, Topic/Aboutness, Related Work, Purpose/Problem, Solution/Method, Result, Conclusion/Claim). A system capable of recognizing these roles can be used to generate summaries tailored to specific communicative goals.

An increasingly significant body of work has been focusing on summarizing dialogues and meeting transcripts,^[79–81] video^[82,83] diagrams,^[84] soccer games,^[85] and web pages for personal digital assistant access.^[86] As we make progress in developing new methods for representing and accessing nontextual media types, it is likely that we will develop additional techniques for summarizing nontextual information that exploits peculiarities specific to various media types. For example, Amitay and Paris^[87] proposed a method for summarizing Web pages that makes use of the text in the links that point to a page.

CONCLUSION

The field of natural language summarization has come a long way since the initial experiments of Luhn.^[16] Although we still struggle to define summaries and attempt to evaluate them, there is much reason for optimism. Summarization systems are no longer the appanage of a small research community. Summarization technology is used daily to summarize news (<http://www.cnn.com>), to consolidate and summarize news published by multiple sources (<http://www.cs.columbia.edu/nlp/newsblaster/>), to provide handheld device access to information (<http://www.diglib.stanford.edu/~testbed/doc2/>

<http://www.voxera.com>), to enable voice-based navigation of the Web (<http://www.voxera.com>), and to provide feedback to students on their written essays (<http://www.etstechnologies.com>). Given the increasing success of the technology, there is a certain danger to believe that summarization is a solved problem. It is certainly not. The success of the technology is not determined so much by the quality of the output as by the willingness of the users to tolerate anything that enables them to deal easier with the deluge of information to which they are subjected. As the expectations of the users increase, the need for developing new techniques for automatic abstracting will also increase. Building a summarization system that is better than one that selects the first n sentences in a news article continues to be a significant intellectual challenge.

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Automatic Discourse Generation

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Abstract

Automated discourse generation, also known as natural language generation (NLG), is a subfield of computational linguistics focusing on theories and methods for creating natural “texts” of all kinds automatically by machine. This entry provides an overview of the main application areas of natural language generation, motivations for adopting natural language technology, the theoretical problems addressed, and the technical solutions adopted.

INTRODUCTION

Automated discourse generation (also commonly known as “text generation” or “natural language generation”: hereafter: NLG) is a branch of computational linguistics, or natural language processing, concerned with the question of how “texts” in natural human languages can be created automatically by machine. Very many NLG systems have now been created, ranging from fielded application systems to research prototypes aimed at investigating particular aspects of the language generation problem. In general, an NLG system has the task of converting representations of information maintained in some computationally accessible form (e.g., in databases, numerical sources, knowledge representations, or ontologies) into appropriate textual renditions of that information expressed in natural human languages. NLG as a field therefore concerns itself with the construction of such systems, with the identification of appropriate system architectures, their component modules, interconnections between modules, suitable processing schemes, reliable algorithms, and evaluation methods.

The range of texts addressed in the field of NLG is very broad and continues to expand. Generated texts may be written (still the majority) or (increasingly) spoken; they may be extended in length, be single paragraphs (the majority), or consist instead of single phrases or sentences—as is often the case in database responses, diagram caption generation, machine translation, question-answering, etc. The texts produced may consist of simple character strings or invoke more sophisticated text formatting, punctuation, or page layout; they may exhibit a linear structure (the majority), be part of a dialogue or interactive setting (increasingly), or be (partially) organized as hypertext. The texts may also be explicitly tailored for audiences differing in expertise, knowledge, interest, or cognitive load; they may be produced in a variety of natural languages; they increasingly combine natural language (sentences, paragraphs) with nonlinguistic material such

as graphs, pictures, or diagrams; and they may even target nonverbal languages such as sign language. In short, wherever we find natural human language being employed, we are dealing with a potential field of application for NLG. Established NLG applications include the generation of weather reports from meteorological data in multiple languages, customer response letters, health information leaflets and letters, environmental reports, software documentation, dialogic human–computer interfaces, and many more.

NLG also provides a significant set of methods for linguistic research, particularly overlapping with text linguistics, discourse analysis, pragmatics, and semantics. Moreover, most theories of syntactic description developed within linguistics have also been explored within NLG systems, providing additional valuable input concerning the formal and computational properties of those theories. This applies also to functional theories of linguistics, an area underrepresented in computational linguistics otherwise. This is due to the basic orientation within NLG to uncovering the language *choices* that are available when constructing texts and the *motivations* for those choices; this makes clear connections with the general goals of functional linguistics. In all these areas, a computational account of the human linguistic system that is sufficiently well specified to allow the automatic generation of natural texts needs to combine a breadth and detail of linguistic description unusual in noncomputational text linguistics, semantics, and syntactic theory and thus serves to push the articulation of linguistic theory further along a broad front of issues.

A variety of techniques are employed when constructing NLG systems, ranging as we shall see below from simple “fill-in-the-gaps” to deep intention-based reasoning. However, whereas systems employing simpler techniques are increasingly finding general use, as in dynamically generated Web pages or mail-merge, more sophisticated NLG systems are still rarely deployed. This is due partly to the inherent complexity of the task of language production and

the overheads that constructing usable systems necessarily bring on the one hand, and partly to a lack of awareness of NLG technology and approaches on the other. As NLG becomes more well known and the supporting technology more streamlined, we can expect increasingly rapid transfer of research results into challenging applications. Research on applied NLG is therefore a particularly dynamic and active area.

The kinds of applications where it is worthwhile investigating the use of NLG can be characterized as follows. First, when there is a high volume of constantly changing but highly restricted text, as in weather reports or other numerically based summaries, then an NLG system specifically tailored to the demands of the required text type can offer significant benefits. This is further multiplied if, on the basis of the same underlying data, versions of the text are required in multiple languages (as in the early weather report systems employed in Canada for parallel English/French versions). Second, when some combination of variables means that very many possible texts might be required (as in “comparison” texts that describe on demand differences between two objects, products, situations, etc.), although each single text is relatively simple, automatically generating the required text can be a better option. Third, when the particular text required depends on some user-specific variable, such as level of expertise concerning a subject (as in medical reports from a single medical record for patients and doctors), or on the time available to the user or the cognitive load that the user is under (as in car navigation systems where the driver might at some point need to deal with a difficult traffic situation or be traveling at speed), or on particular difficulties (such as hearing, restricted vision, etc.), then the flexibility inherent in full automatic NLG might be the only option for producing appropriate natural language output. This is particularly the case when the effects of any of these variables needs to be *combined*.

In general, the more flexible, context-dependent, and user-adaptive a piece of language needs to be, then the more appropriate sophisticated NLG techniques become. In dialogue situations, e.g., a system needs to respond quickly and effectively to user input, selecting appropriate levels of complexity, detail, and styles for its answers. But simpler techniques can only reproduce more straightforward interactions. We are already seeing a marked increase both in the requirements being placed on such systems and in the expectations of their users and so more sophisticated techniques will certainly be necessary.

NATURAL LANGUAGE GENERATION: BASIC COMPONENTS

We can characterize NLG in two ways: first, there are the kinds of problems that need to be solved when producing natural language and, second, there are the kinds of

computational techniques and components that are being developed to provide those solutions. There is a close relationship between these views. The more flexible and situation-dependent the language to be produced is, the more complex the computational techniques necessary become. Simple, inflexible language does not require advanced techniques. For example, the simplest method of generation appears in every automated bank teller machine and is responsible for printing out Welcome. Please insert your card (and all the other messages). Obviously, the text can be made arbitrarily sophisticated, with as many sentences as required. However, the system has no way of exploiting commonalities across sentences, and hence no way of recombining parts of existing sentences to produce new ones—not even to change Good morning! into Good afternoon!. “Canned text” systems of this kind illustrate how simplicity comes at the expense of power.

The obvious generalization is to create templates instead of canned sentences or paragraphs. Every form letter that contains spaces into which your name and address and the date are automatically entered is an example of such a text template. Though enabling some saving of space, template systems by and large suffer from the same lack of combinatory power that hampers canned text systems. As a consequence, template systems are made progressively more complex by including various conditions on which particular template is to be used. For example, changing the grammatical subject of a sentence to be filled by a plural noun phrase rather than a singular noun phrase will also require a change to the verb, otherwise a nongrammatical sentence results. For languages with more morphology than English (i.e., the majority of languages), the number of templates multiplies explosively. Nevertheless some quite successful generation systems have been built on sophisticated notions of templates that avoid the pitfalls of simple template combination.^[1]

The kinds and degrees of flexibility required in any particular application or research project in NLG vary widely, however, and so there is an accompanying diversity of opinion concerning the components and architectures best adopted for building NLG systems. Attempts to provide overall systematicity or standardization in the field are still of arguable generality.^[2] Nevertheless, one commonly adopted structure is Reiter’s so-called *pipeline* architecture,^[3] which sees generation as a process whereby data is progressively transformed, structured, and augmented in order to produce the final text. This is shown graphically in Fig. 1.

Historically, development has moved from the bottom of this architecture to the top. The first NLG systems were very much concerned with organizing grammatical sentences so that their production could be controlled. Here various views of grammar and syntax from linguistics were employed, often augmented with conditions so that particular structures could be selected according to the precise textual information to be expressed. NLG was

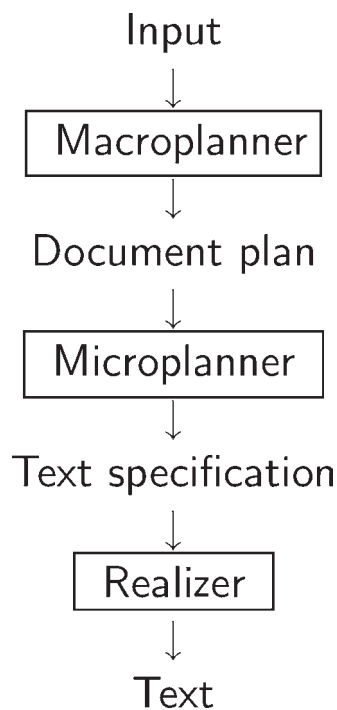


Fig. 1 Reiter's pipeline architecture for NLG.

therefore seen from very early on as a problem of choice under a variety of communicative constraints. Deciding on appropriate grammatical structures and lexical material is called *tactical generation* and answers the basic question of *how* information is to be presented. The corresponding computational components are responsible for *realization* and are therefore called *realizers*. Such realizers can either be targeted toward specific, narrowly defined areas of grammatical competence for particular kinds of texts, or can aim for general grammatical coverage. In the latter case, the grammatical resources drawn upon can become extremely extensive, rivalling standard reference grammars.^[4,5] Some realizers aim for ease of use rather than broad coverage.^[6] The input to realizers also varies: some require substantial grammatical information, thereby pushing grammatical decisions “upstream” in the entire generation process,^[6] others abstract away from grammatical information so that input can already be semantic.^[4] In the latter case, the realizer takes over responsibility for the grammatical decisions to be made.

In both cases, there are a range of phenomena to be covered to do with the fine-detailed organization of the sentences to be produced: Are simple sentences to be grouped together into more complex sentences? Are pronouns to be used to refer to repeated entities? Which words are to be selected when there are several similar in meaning available? All these issues are referred to as *microplanning*. The output of a microplanning component needs to be a specification suitable for passing to some realiser. Within this specification, decisions are recorded concerning which option is taken from a range of options

that are all grammatical but which differ in their textual import. They cannot therefore be made by a grammar alone but need to be responsive to the overall communicative plans guiding the generation process.

Microplanning then contrasts with *macroplanning* or, *text planning*, which is responsible for deciding on the overall organization of a generated text. It is the text planner that decides on *what* is to be expressed and how that content is to be organized—argumentatively, narratively, rhetorically, etc.—in order to make its point. This area of the generation task is termed *strategic generation*. Commonly, a text or document plan is created either by kinds of templates for entire text structures or by planning methods developed from Artificial Intelligence. In the latter case, the plans rely on the specification and satisfaction of communicative goals which, as a by-product, select particular “chunks” of content to be expressed. A completed text plan then includes structured chunks of content plus specified relations holding between those chunks. These relations eventually drive the selection of linking phrases and conjunctions, such as “therefore,” “because,” etc. by the realizer. Text plans can also be used to select suitable formatting options, such as bulleted lists for sequences of similar information, etc.

NATURAL LANGUAGE GENERATION: AN EXAMPLE

Consider the following short biography text:

Anni Albers is American, and she is a textile designer, a draughtsman and a printmaker. She was born in Berlin on June 12, 1899. She studied art in 1916–1919 with Brandenburg. Also, she studied art at the Kunstgewerbeschule in Hamburg in 1919–1920 and the Bauhaus at Weimar and Dessau in 1922–1925 and 1925–1929. In 1933 she settled in the USA. In 1933–1949 she taught at Black Mountain College in North Carolina.

This is not a sophisticated text; indeed, it could be improved in many ways. Its relevance for us here is that it was generated fully automatically by an NLG system as one of several hundred similar texts on the basis of information acquired by a prototype information system in the area of art history.^[7] The biographical texts used here reflect the information that was held at some particular time within the experimental information system: there is no claim of historical or factual accuracy.

In order to produce the text, the generation process ran through the components of the NLG pipeline shown above. A macroplanning step produced a textual organization appropriate for a biography anchored to particular chunks of information from the system's knowledge base. This was then passed on to a general-purpose realizer containing a large-scale grammar of English. Clearly, if

this text were the only possible result from the system when considering the selected artist, then there is no particular win in employing NLG technology rather than some simple template methods, or even a human writer. Consider, however, the following text:

Anni Albers. American textile designer, draughtsman and printmaker. Born in Berlin June 12, 1899. 1916–1919 studied art with Brandenburg. 1919–1920 studied art at the Kunstgewerbeschule in Hamburg. 1922–1925 and 1925–1929 studied at the Bauhaus at Weimar and Dessau. Albers settled in the USA in 1933. 1933–1949 taught at Black Mountain College in North Carolina.

This text was also produced automatically by the same system, and what is more, it was produced from *the same set of data* using the same lexicon and grammar. It is different to the first text for the simple reason that its intended purpose is slightly different. In the latter text we are producing a biography sketch in note form; it might be more appropriate laid out as a table, or as additional information to a diagram or “info-graphic.” However the text is presented, its different function is appropriately accompanied by linguistic variation. Compared to the first text we see elements in different places, different connections between sentences, and so on.

Whereas the production of an alternative text in response to differing communicative goals and user requirements would represent a major overhead for a non-NLG-based text production system, this fine-grained matching of text and function is precisely what an NLG system undertakes to provide. The variations shown in this second text could be produced by some transformation of the first version, but it should be clear that making such a transformation work reliably for a wide range of artists with differing amounts and kinds of information held about them would be an endeavor requiring very careful attention.

When we change the intended function slightly again and go on to consider a further variant, we see another different set of “transformations” again:

Anni Albers, the American textile designer, draughtsman and printmaker who was born in Berlin on the 12 June 1899, taught at Black Mountain College in North Carolina from 1933 until 1949 after settling in the USA in 1933. Previously, she had studied art with Brandenburg in 1916–1919, at the Kunstgewerbeschule in Hamburg in 1919–1920 and at the Bauhaus at Weimar and Dessau in 1922–1925 and 1925–1929.

Any *one* of the three example texts could probably be constructed (although not particularly easily) with carefully handcrafted transformations of some “underlying” information, but this approach does not naturally lend itself to the creation of the alternatives. When variable text production is going to be an aim for some information

presentation system, for whatever reason, then it becomes appropriate to consider whether more sophisticated NLG techniques could be usefully employed. This is particularly relevant for current moves being investigated in the pursuit of message/text “personalization”; the requirement that text be produced flexibly is therefore by no means nowadays an unlikely situation.

The range of variation in these three examples illustrates a very small subset of the linguistic variations actually possible. This is a significant NLG issue in its own right because all such variations in linguistic phenomena need to be *orchestrated* so as to indicate the coherence and textual unity of the resulting product. In much NLG work, therefore, the point of interest is not what kind of variations are *possible*—large-scale generation systems will in any case be able to produce the grammatical variation exhibited here—but rather the question *when* and *why* any one variant is to be selected rather than another. Generation is fundamentally a matter of *choice* and of uncovering the reasons why one choice may be better than another in any particular context of use: this is the essential task of strategic generation and text planning.

NATURAL LANGUAGE GENERATION AND LINGUISTIC VARIATION

Above we described a generic architecture for an NLG system. We can also characterize NLG systems and their architectures from the perspective of *the range of language phenomena* that they handle. To do this requires more linguistic sophistication and so is not generally favoured within the NLG community itself. There characterizations in terms of the “standard” modules that we have seen are more common: tactical generation, microplanning, text planning, and so on. But considering the linguistic phenomena at issue provides an equally, if not more, insightful characterization because the phenomena are not shaped or restricted by architectural decisions within any particular NLG system.

To gain a theoretical hold of the linguistic phenomena and the alternatives that are relevant for building NLG systems, it is useful to employ the linguistic notion of *stratification*. Stratification refers to the differing kinds of information, at differing levels of abstraction, that contribute to the organization of any text. Thus, we can talk of lower levels of linguistic abstraction, such as phonology, morphology, syntax, or lexicogrammar (typically placed within the realiser component), and semantics and the higher levels of abstraction, such as those of text structure and style (the responsibility of macroplanning). Texts might then vary in their use of different text structures, of different syntactic structures, of different phonologies (when spoken), and so on. Regardless of an NLG component’s actual inputs and its context of application, we can identify generation tasks in relation to the level of

linguistic abstraction, or stratum, at which variation is being offered or controlled and consider appropriate computational mechanisms for their support.

A minimally necessary (but not sufficient) set of organizations capable of explaining how a text works—i.e., capable of explaining its “textuality”—consists of the two least abstract linguistic strata:

- Lexicogrammar: certain sequences of elements can be recognized as belonging to English (or some selected language) while others are not. The possible grammatical structures used in a language and the associated words that may (or may not) occur in them define a very constraining organization that must be adhered to in any text. Sentences are not arbitrary combinations of words.
- Semantics: in addition to knowing which structures and words are possible, there is also a clear organization that constrains the selection of knowledge in general to the particular kinds of knowledge necessary for linguistic expression. This varies across languages—for example, some languages require the textual status of definiteness to be expressed in the grammar (English) whereas some do not (Chinese, Russian).

The former area has been widely addressed within linguistics and can draw on a host of work on syntactic theory; the most commonly employed approaches for NLG include Combinatory Categorical Grammar (CCG), Head-Driven Phrase Structure Grammar (HPSG), Systemic-Functional Grammar (SFG), and Tree-Adjoining Grammar (TAG). For the latter area, a particularly useful orientation is to consider the consideration of the *semantic control* that a detailed lexicogrammar requires in order to make its selections. Early representations of such control information annotated structural rules or lexical units with “semantic” or “pragmatic” information as needed for particular effects.^[8] Now there are several more sophisticated accounts available that offer a broader range of controlling/constraining semantic information for motivating lexicogrammatical generation. Even though particular NLG systems will differ in the precise input form they adopt, *linguistic semantic* representations provide a good basis for considering alternatives independent of particular implementations.

The most obvious semantic area for controlling lexicogrammatical decisions—particularly from the perspectives of logic, natural language understanding, or applications of NLG—is the “propositional content” of individual sentences: the traditional “who did what to whom (when and how).” This can be used to guide the lexicogrammatical selection of basic units (such as, often, clause *vs.* noun phrase *vs.* adverbial, etc.) and the basic grammatical structures used within these categories (e.g., intransitive, transitive, or ditransitive clause structures). For example, a “logical” form “*study*! (*Albers*!, *art*!, *t_i*),”

that is intended to represent a predicate of studying that relates Anni Albers to the discipline art at some time *t_i*, might drive the lexicogrammar to select a clause with a transitive structure such as *Albers studies art*. A full representation of this aspect of a clause’s meaning would then require at least additional information concerning temporal relations (particularly with respect to the time of speaking in order to control grammatical tense decisions), logical scopes of various quantifiers, etc. Various representations are used for this kind of information, termed *ideational*, but nowadays these show considerable commonalities. In particular, most adopt a so-called Neo-Davidsonian semantics involving two essential features: first, “events” are considered proper objects in their own right and, second, the relations between participants and events are characterised by a small set of named relations.

An example is shown in Fig. 2, couched in the widely used “Sentence Plan Language” originally developed for representing inputs to the realizer of the Penman text generation system. This semantics again represents a logical form for a sentence involving Albers studying art. Semantic-based inputs allow a system to abstract away from particular sentences as they might need to appear in the concrete texts generated and so provide more support for variation. They even allow in many cases a generalization across different languages, so that parallel versions of the same text might be produced by employing different realizers or different grammars.^[9] Similar kinds of information are now provided in many modern semantics formalisms and can be expressed in description logics, minimal recursion semantics,^[10] hybrid dependency logic,^[11] and others. Within NLG, it is description logic (including its most recent manifestation in the Web Ontology Language, OWL) that is now the most common.

Much information necessary for controlling a realizer is, however, left unspecified in this representation. Missing information includes particular choices of words, grammatical selections such as active or passive, word orders, pronominalizations, tense, focusing constructions, etc. The constraints for selecting these are generally drawn from two further sources of control, termed *textual* and *interpersonal*, respectively.

Textual meaning is involved because NLG is concerned with producing coherent texts and not just isolated sentences. Almost all examples of texts actually generated

```
e1 / study
      : actor (x1 / female :name Anni-Albers)
      : actee (x2 / art)
      : temporal-locating (t1 / time :year 1916))
```

Fig. 2 Example skeleton semantics for: “Anni Albers studied art in 1916.” e1, x1 and x2 are logical variables; the terms following forward slashes are semantic types; terms introduced by colons are roles or properties.

to date (including our example texts above) have problems related to their expression of textual meaning—i.e., there are places where a human text producer would have made selections resulting in a more “fluent,” or natural, text. A central research problem in NLG is then to isolate and describe the sources of constraint for lexicogrammatical decisions that influence textuality: i.e., again, how to control a lexicogrammar. The richer the lexicogrammatical resources that are represented, the more complex the problem becomes. If a lexicogrammar offers few possibilities, then issues of control are reduced; but possibilities for fluency are then also reduced. Many current approaches to NLG therefore concentrate on finding appropriate control constraints for general resources rather than on relying on artificial restrictions on the resources themselves—either by extending the semantics to include suitable statements or by weighting the selections made in the grammar probabilistically according to the desired language style.^[12]

Purely probabilistic methods are problematic, however, in that textual organization can be employed strategically to improve text flow and is not simply a matter of style. Any reasonable lexicogrammatical resource of English will offer, e.g., in addition to the sentences that appeared in the example texts, sentences such as:

- e. With Brandenburg, she studied art in 1916–1919.
- f. In 1916–1919, Anni Albers studied art with Brandenburg.
- g. She studied art with Brandenburg in 1916–1919.
- h. The third artist shown above studied art with Brandenburg in 1916–1919.
- i. Moreover, she studied art in 1916–1919 with Brandenburg.
- j. It was in 1916–1919 that she studied art with Brandenburg.

Sentences (e)–(g) might be argued not to differ in propositional content, although they have different preferred contexts of use in texts; sentence (h) introduces semantic content to refer deictically to the artist in question, thereby bringing in issues of *referring expression* generation; sentence (i) makes its relation to the preceding text more explicit and so can also be taken as introducing more information; and sentence (j) has a similar function, but uses a particular grammatical structuring to realize that function.

Moreover, different linguistic units can include more or less of the content to be expressed. Some consequences of this for sentences appropriate to our Bauhaus texts are illustrated in the following examples:

She studied art with Brandenburg in 1916–1919, and at the Kunstgewerbeschule in Hamburg in 1919–1920, the Bauhaus in Weimar in 1922–1925 and the Bauhaus in Dessau in 1925–1929.

She studied art with Brandenburg. That was in 1916–1919.

Albers studied with Brandenburg in 1916–1919. She studied at the Kunstgewerbeschule in Hamburg in 1919–1920. She studied at the Bauhaus in 1922–1925. . . .

Anni Albers was a text designer, draftsman, and printmaker, who was born in Berlin on 12 June 1899.

Here, sentence (k) includes both the original sentence and further content closely related to that of the original, while sentence (l) divides the original content over two sentences and uses “discourse deixis” to bind the sentences together into a text fragment. Sentence (m) then goes to the extreme and separates out the events grouped together in (k), each studying period is realized in a separate sentence. Sentence (n) shows a similar decision, where the first two sentences of the example text have been combined into one.

The phenomenon at issue in all these sentences is termed *aggregation* in NLG; detailed rules and heuristics for controlling this grouping have been suggested as an important component of microplanning. A similar phenomenon applies at all linguistic levels: sentences (k)–(m) could also be expressed as (o), while the first sentence of the first example text above would read better as (p) and the similar variations found in the latter two example texts.

Anni Albers was an art student from 1916 to 1929.

Anni Albers is an American textile designer, draftsman and printmaker.

In (o) many events have been combined and covered in a single property attribution: *being an art student*; similarly in (p) the nationality and professions have been combined in a single complex property. The decisions for these presentational forms depend again on the particular granularity goals of the text being produced, which in turn depends on the situation and hearers/readers involved.

The second area of control, the *interpersonal* meaning, is important because any natural language utterance obviously does more than simply express an intended propositional content. Clauses also express the attitude of the speaker to the content being expressed. This is minimally necessary in order to motivate control of variation such as the following based on the sentence “She studied art in 1916–1919 with Brandenburg” from the example texts:

Did she study art with Brandenburg in 1916–1919?

She studied art with Brandenburg in 1916–1919, didn’t she?

Actually, she studied art with Brandenburg in 1916–1919.

Here, sentence (q) changes the speech function of the sentence to a query; sentence (r) changes the speech function to request support from the hearer; and sentence (s)

introduces more content, but here that information reflects the speaker's speech act force. In systems for spoken generation, there is also the further variation:

She studied art with Brandenburg in 1916–1919?

In (t), the sentence structure is as for an assertion, but the intonation selected indicates a question. There are several accounts of intonation used in generation and sources of control for lexicogrammars should then include provision for such variation. Interpersonal meanings can also have a decisive influence on other aspects of a text. For example, expressions of various speaker attitudes will partially determine the most appropriate words selected (“artist” vs. “charlatan”; “artwork” vs. “junk”). When generation systems have access to words varying in this way, they need to make sure that they do not select inappropriately. Interpersonal force is also important for the correct realization of requests, orders, statements, etc. and so can have substantial consequences for grammatical selections as well as word selections.

The appropriate control of a lexicogrammar therefore requires many additional constraints over and above the propositional content to be expressed. Providing such information enables broad coverage lexicogrammars to produce textually appropriate lexicogrammatical structures. This concerns the “how” to express what is to be expressed issue of NLG: i.e., tactical generation. We can say linguistically that any text reveals many “predispositions” of the speaker that pervasively influence both the information selected for expression and its form of expression. This consistency in selected semantic options is then a common issue across all three of the areas of meaning described here. Ideational, interpersonal, and textual selections all exhibit a unity that is characteristic of textuality. One abstract mechanism proposed to describe this is the systemic-functional notion of *register*. The theory of register states that language varies systematically according to its situation of use: consistency in situation therefore calls for consistency in the takeup of semantic options.^[13] Several systems now attempt to provide stylistic control, often employing probabilistic language models to select a particular slant from a broad range of “over-generated” possibilities.^[12]

TEXT PLANNING

The next—and many researchers in NLG would consider the main—task in NLG is to guarantee that *sequences* of such constraint specifications are produced in such a way that they are mutually consistent and together combine to create recognizable *text*. Thus, as always in NLG, it is not sufficient that a full NLG system offers the means for controlling lexicogrammars to produce textually varied constructions, such a system must also be able to select

from the theoretically available possibilities those that are most appropriate for the instantial text being produced. Texts are not arbitrary combinations of sentences.

Early attempts to organize texts relied on the intrinsic organization of the knowledge being expressed; i.e., the organization of the knowledge determined the structure of the texts produced. This cannot be guaranteed to give an understandable or suitable text for any particular communicative purpose and so is inappropriately rigid. To achieve more flexibility, NLG now commonly plans out text structure independently of the content to be expressed, appealing to notions of “discourse structure.” Currently the most commonly used approach here is *Rhetorical Structure Theory* (RST).^[14] RST provides a general description of the relations holding among segments of a text, whether or not they are grammatically or lexically signalled.

Descriptions of texts, or texts generated using RST, are decomposed hierarchically into a nested set of related text “spans.” RST defines approximately 25 relations which may hold between these spans, motivated originally on the basis of detailed descriptive linguistic analyses of some 400 texts of varying content and genres. An RST analysis of the Bauhaus biography text illustrating some of the relations defined is shown in Fig. 3. This analysis claims that the main point of the text (obtained by following the straight vertical lines downward from the top) is the fragment stating that Albers taught at Black Mountain College, thereby spreading the Bauhaus movement; other information is related to this as indicated by the identified rhetorical relations—i.e., background, circumstance, elaboration, and sequence. This particular rhetorical analysis brings out the fact that the text is intended to stand as an illustration of the spread of the Bauhaus movement to the United States and not as a neutral biography, which would typically consist of a simple sequence of events arranged chronologically.

RST definitions bring constraints to bear on the kinds of meanings that the related text spans must carry, and on the communicative effect achieved by the combined set of text spans. Constructing discourse structure in terms of RST relations has proved itself to be useful for supporting selections of linking forms and textual connectives, such as the “moreover” of sentence (d), or the deliberate *non*-selection of a conjunction: it is only because the discourse is being developed in a particular way that a particular form is appropriate. Once an NLG system has an RST-style text plan available, it has much of the additional information discussed above as necessary for motivating nonpropositional semantic choices. RST has also been used to constrain the recency relationship for anaphors, choices of theme, intonational phrasing, hyperlink generation, summarization options, and selections of focus. Several detailed overviews of the development of rhetorical relation-based NLG methods have been given,^[15] as well as introductory examples showing text planning using

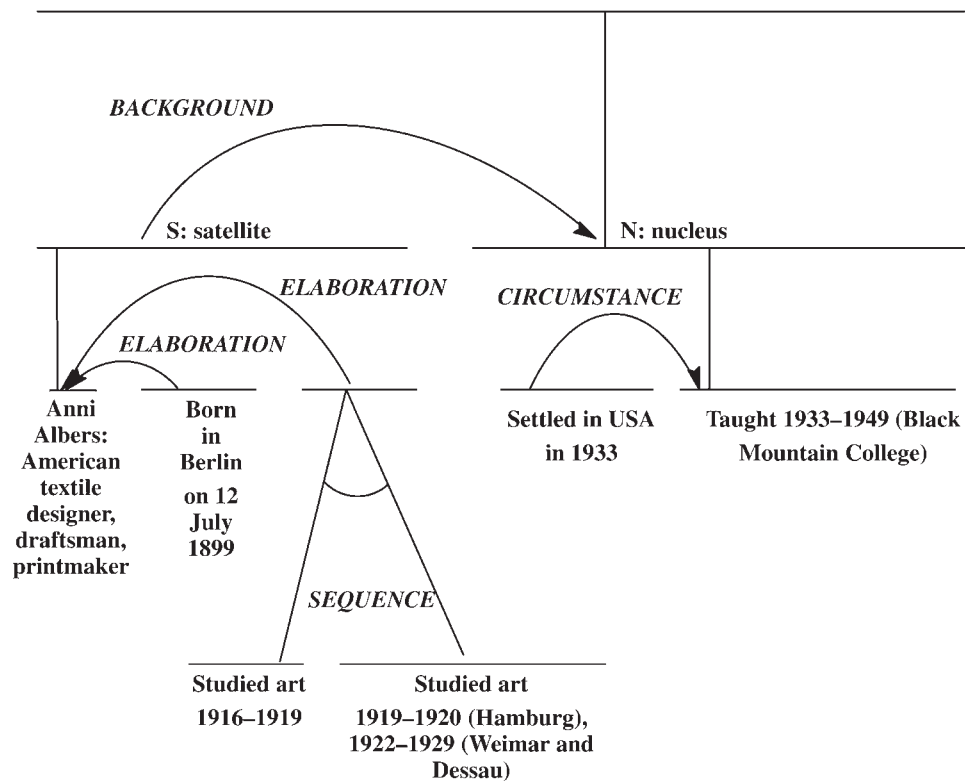


Fig. 3 Example RST analysis of a Bauhaus biography text.

RST in action.^[16,17] Other commonly used approaches to text structuring are *text schemas* introduced to NLG by McKeown^[8] and, more recently, discourse grammars based on tree-adjoining grammars.^[18] All take on the task of selecting and structuring content to be expressed in a text flexibly responsive to communicative goals.

CONCLUSIONS: CURRENT DEVELOPMENTS AND OUTLOOK

The demand for natural language texts providing information of every conceivable kind is rocketing. Thus it is certain that NLG will form a key information technology in the future—there is scarcely an area of information presentation where beneficial applications of automatic text production cannot be imagined. Although it may still be some time before NLG techniques begin making a substantial impact on systems in everyday use, increased awareness of the potential will certainly be the most crucial aspect in hastening their adoption.

Several extensions to the field that have already occurred will contribute to this. Early on NLG moved away from considering text production in a single language to parallel generation in several languages.^[9] More recently, there has also been a move away from generating only texts to consider the automatic production of combinations of text, graphics, diagrams, and pictures.^[19,20] Moreover,

generation techniques are now increasingly being employed in the originally rather separate field of dialogue systems. As the dialogues expected of question–answer systems, information systems, robotic systems, avatar generation (involving speech, facial expression, and gesture), etc. become more sophisticated, it is natural to turn more to the tools of NLG. There is clearly very much more to learn here concerning how these modalities can be combined appropriately and a regular conference has now been started to present research in this area.^[21]

NLG systems are now beginning to appear on the World Wide Web, the pervasiveness of this new media giving fresh impetus to previously more academic explorations of automatic hypertext generation. Many aspects of NLG—including text planning, multimodal information presentation, and tactical (surface) generation are now combining in the construction of (possibly partially) synthetic hyperdocuments. This area is certain to be highly significant in increasing the acceptance and use of NLG technology, as well as in driving future NLG research. Until recently, the most significant technical bottleneck preventing the wider exploitation of NLG technology was the availability of sufficiently well-structured knowledge sources; clearly the closer we come to the Semantic Web, the easier it will be to employ NLG technology productively.

Partly as a move toward supporting applicability, the topics covered in international conferences relevant to

NLG over the past 5 years now include substantially more work on *evaluation methods* than was previously the case and there is ongoing discussion of how this can be furthered. Several “shared tasks” are being defined so that alternative approaches and systems can be compared. The most well accepted of these tasks so far is that of generating referring expressions, since this can be seen as a relatively modular component of the NLG task overall. The other topics now being addressed most include dialogue, stylistic control, and text planning in general.

FURTHER INFORMATION

Further information about natural language generation, ongoing work, and upcoming conferences, can be found on the Web site of the Association for Computational Linguistics (ACL) Special Interest Group on NLG (SIGGEN): <http://www.siggen.org>. There are two biannual conferences dedicated to NLG: the International Natural Language Generation Conference (running in even years) and the European Natural Language Generation Workshop (running in odd years). The proceedings of these conferences can be found in the ACL electronic paper archive.

Slightly more technical introductions to NLG can be found in several encyclopedias or handbooks,^[16,17,22,23] while Reiter and Dale^[3] have produced a textbook level introduction to the field. Finally, an almost complete list of natural language generation systems, with domains of application, references and theoretical foundations, is maintained in Bateman and Zock’s “B-to-Z of Natural Language Generation Systems” at <http://www.purl.org/net/nlg-list>.

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Back-of-the-Book Indexing

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Abstract

The book index occupies a special niche in the information retrieval world. Each index is a unique, authored work. Each book is a closed system. The text presented in a book does not change; the material is stable and fixed. Book indexers provide readers with a nonlinear way to access information in a text. Even though closed-system indexing predates the development of the printing press, a book index can be thought of as hypertext.

INTRODUCTION

We have all used book indexes. Generally they appear in nonfiction books in the back of the book. Most people do not realize that book indexes are written by people. They are not generated by computers. A table of contents presents some of the topics discussed in the book in a linear fashion, from the book's beginning to the end. The back-of-the-book index is an information map that systematically brings together access points to every important topic discussed in a book, including concepts and nuances developed by the book author.

Although the word index is used in many diverse contexts today—index of economic indicators, consumer price index, database indexing, and search engine indexing—a book index has a particular meaning and application. Susan Klement provides a useful framework for discussing indexing in “Open-system versus closed-system indexing: A vital distinction”^[1] when she writes:

Closed-system indexing assists people finding a unit or units of relevant information *within a document*, while open-system indexing is designed to facilitate the retrieval of one or more *documents* that contain relevant information.

Internet search engines are examples of open-system indexing. An index to a periodical such as *Forbes* is also an open-system index. The Internet grows every day; it also changes every day as Web pages are edited or removed. *Forbes* will continue to add new issues as long as the magazine is published. Open systems are in a state of flux.

A book is a closed system. There is a beginning, a middle, and an end. The book and its audience is a self-contained universe. Unlike an open-system index that casts a wide, but shallow net, a book index deeply presents a systematic guide to the information contained in a text in a manner that enables readers to quickly find specific topics or concepts.

It is the insular nature of a book index that sets it apart from many other information retrieval devices or finding aids. While there may be 20 books about Web page design, each will be unique. The books will likely cover similar topics, but the presentation and writing styles of the authors will be different. The indexes for these books will also be unique. The indexes will reflect not only specific topics covered in the text, but also conceptual relationships that are presented in unique ways by each author.

Book indexing has a long history that will be reviewed briefly. It is important to recognize that a book index is not simply an alphabetic list of words that appear in the text. There are several critical elements that appear in book indexes that we do not find in computer-generated word lists. These elements and presentation formats for indexes will be discussed along with publishers' style guides and international standards. Although it is difficult to generalize about the way indexes are prepared, the basic mechanics of indexing will be presented. Lastly, indexing specialization, training, and professional associations are discussed.

A BRIEF HISTORY OF BOOK INDEXING

Closed-system indexing has a long history. It is natural to assume that the book index did not appear until books were printed. However, if we think of this particular information retrieval device as a closed-system index it is apparent that the need for an index of this type emerged before bound, printed books were produced. Hans Wellisch^[2] writes:

Indexing of books did not begin, as is commonly thought, after the invention of printing. It started with the rise of universities in the 13th century. Although no two manuscripts of the same work were exactly alike and folio or page numbers were seldom used, indexes to theological treatises, lives of the saints, medical and legal compendia

and, most of all, to collections of sermons were compiled, using chapter and entry numbers instead of pagination.

Bella Hass Weinberg^[3] has dated a Hebrew manuscript citation index back to the twelfth century. Hazel K. Bell in *From Flock Beds to Professionalism: A History of Indexer-Makers*^[4] suggests that “perhaps the first known indexer is Ptolemy, who produced an index to his first world atlas c. A. D. 150.”

When documents that could not be easily browsed were produced, there was a need for a finding aid. The development of the printing press made possible the mass production of bound books. Pagination of the books made possible the compilation of book indexes for each title. These indexes are referred to as “back-of-the-book indexes” because they usually appeared in the back of books. Today we are witnessing the transition of books from printed pages to electronic media. Although the media for book presentation may be changing, it is still useful to remember that need for a book index has not changed. Closed-system indexing exists independent of presentation media.

WHAT IS AN INDEX?

In the United States, the National Information Standards Organization (NISO)^[5] defines an index as “a systematic guide designed to indicate topics or features of documents in order to facilitate retrieval of documents or parts of documents” (p. 39).

The International Organization of Standardization’s (ISO) *ISO 999*^[6] defines an index as an

alphabetically or otherwise ordered arrangement of entries, different from the order of the document or collection indexed, designed to enable users to locate information in a document or specific documents in a collection.

(Entry 3.5)

Many find these definitions too broad and imprecise. More thorough and lengthy descriptions of the purpose of an index can be found in the *British Standard*’s “Function of an Index”^[7] and the American Society for Indexing’s (ASI) “Criteria for the H.W. Wilson Award.”^[8]

For general purposes, I find this definition useful: “An index is a structured sequence—resulting from a thorough and complete analysis of text—of synthesized access points to all the information contained in the text.”^[9]

A computer-generated list of words in the text, even arranged alphabetically, is not an index. For example, a concordance does not require analysis and synthesis of a text and its meaning. The concordance can only list words that appear in the text; it cannot include concepts or indicate relationships between topics. An alphabetical list of

words does not truly qualify as the structured sequence that we associate with a proper book index.

ELEMENTS OF AN INDEX

A book index includes several major components: headings, locators, cross-references, and an arrangement scheme. Headings are composed of terms that readers are likely to look up. Locators indicate where in the text the heading can be found. Often locators are page numbers. Cross-references are linking devices that provide navigation guidance for synonyms or other related terms within the index itself. The arrangement of entries in an index is usually alphabetical. Here is an example:

nutrition, 34–40
adults, 125–130
children, 67–73
infants, 53–59
See also supplements

Headings

In the example above “nutrition” is the main heading and “adults, children, infants” are subheadings. Often headings are terms that appear verbatim in the text. For example, “Art Trading Fund, 22,” will be found on page 22. Some types of entries are inverted in indexes. A common example of an inverted heading is a personal name: “Lakoff, George, 12.” The nutrition example above is a conceptual heading. The word “nutrition” may or may not appear on the pages referenced. However, the indexer has determined that nutrition is discussed on these pages and has provided access to the discussion.

Locators

Each heading is followed by a locator. In the example above the locators are page numbers in a book. Locators must be precise and accurate. In some books, such as dense legal texts, a page number lacks precision. Instead, the locator may take the form of chapter number and paragraph number, such as “reserve against returns, 12.34(a).” Additionally, locators must be helpful. A main heading followed by a string of 30 separate locators is not helpful. Instead, subheadings should be provided that help guide the reader to specific information about the main heading.

Cross-References

The last line in the nutrition example is a *See also* cross-reference that directs readers to another closely related heading, in this case the “supplements” heading. Another type of cross-reference, the *See* cross-reference, performs a vocabulary control function. For example, “food. *See*

nutrition,” tells readers that information about food will be found at the “nutrition” heading.

The main heading and the entire block of information that follows it is referred to as an entry or entry array. The “nutrition entry” is composed of the main heading, subheadings, locators, and the cross-reference.

Arrangement of Entries

Lastly, a major element of any index is the systematic arrangement of entries. Book indexes are usually arranged in alphabetic order. There are two basic forms of alphabetic orders, word-by-word and letter-by-letter. To further complicate matters, many index entries include elements that are not letters of the alphabet:

Lakoff, George
San Francisco
!ls command
War of 1812

All four terms contain spaces. The first and third terms include punctuation marks and the last term contains a number. Any arrangement scheme must take all elements of an index entry into consideration. *NISO TR03: Guidelines for Alphabetical Arrangement of Letters and Sorting of Numerals and Other Symbols*^[10] provides the most cogent discussion of alphabetical arrangement. Briefly, *NISO TR03* presents the following rules for the order of characters:

1. Space that precedes any other character (hyphen, dash, and slash are treated as a space).
2. Punctuation marks are ignored.
3. Symbols other than numerals, letters, and punctuation marks precede numerals and letters.
4. Numerals precede letters.
5. Letters follow numerals.

Word-by-word alphabetizing

If the rules above are followed, the resulting arrangement order is called word-by-word.

type font
type foundry
Type/Specs Inc.
Type4You Inc.
typeface
typeset

Letter-by-letter alphabetizing

The letter-by-letter form of alphabetizing eliminates *NISO TR03*'s first rule, the space character (including hyphens, dashes, and slashes) is ignored.

Type4You Inc.
typeface
type font
type foundry
typeset
Type/Spec Inc.

These two styles of alphabetizing yield very different results, particularly in long indexes. Most users of book indexes do not think about various ways to alphabetize entries. They expect an entry to be in a particular place. If they do not find the entry, they may assume that the topic is not discussed. Choosing an arrangement order that works for users is critical. Unfortunately, as James Anderson^[5] points out, there is a lack of agreement regarding arrangement:

Two de facto standards widely used in libraries and databases in the United States are the American Library Association (ALA) and the Library of Congress (LC) filing rules. The guidelines for alphanumeric arrangement in *The Chicago Manual of Style* are used as a de facto standard by many publishers. These three codes of alphanumeric arrangement are, however, incompatible with each other (Entry 9.1).

Many book publishers follow their own alphabetizing styles. North American publishers often follow the guidelines in *The Chicago Manual of Style*, published by the University of Chicago Press, which calls for letter-by-letter alphabetization. It is important to note that Chicago's form of letter-by-letter alphabetization does not strictly follow the recommendations of *NISO TR03* discussed earlier. Style guides will be discussed in more detail later.

PRESENTATION FORMATS FOR INDEXES

There are two basic presentation formats of indexes: indented style and run-in style. Before discussing these formats it is important to keep in mind that the layout of an index is directly related to its usability.

The main goal of an index is to provide quick and easy access to information contained in the text. Unlike other types of text, indexes are not read in a linear fashion from beginning to end. Instead, readers jump into the index at various points. They scan for particular entries. The design of an index should enhance scanning by readers. They should be able to quickly determine at any place where they are in the index. Indexes that are dense and cluttered will frustrate users. The ideal index is almost transparent. Readers turn to the index, quickly find the desired entry, and locate the information in the text of the book. They are in and out of the index very quickly.

The indented and run-in formats for indexes are distinguished by the way subheadings are formatted. The indented style begins each subheading on a separate line,

indented under the main heading. The run-in style separates subheadings with a semicolon and runs them all together as one block of text indented under the main heading. Here are some examples:

Indented style:

nutrition, 34–40
adults, 125–130
Asian perspective on, 200–202
children, 67–73
European perspective on, 210–212
infants, 53–59
See also supplements

Run-in style:

nutrition, 34–40
adults, 125–130; Asian perspective on, 200–202;
children, 67–73; European perspective on,
210–212; infants, 53–59. *See also* supplements

Above, the indented format uses seven lines, whereas the run-in style uses only four lines. Saving space is the main reason some publishers prefer run-in format. However, the indented format is easier to scan and use. In a complex index that includes sub-subheadings a run-in format cannot easily accommodate the extra level of detail. There are times when a hybrid style can be used with good effect. The indexes in the 15th edition of *The Chicago Manual of Style* and the 2nd edition of *Indexing Books* use a combination of the two styles. Subheadings are presented in indented format while sub-subheadings are run-in. There are many more issues related to the presentation format of indexes. For a more detailed discussion see “Format and Layout of the Index” (pp. 191–217) in *Indexing Books*.^[11]

STYLE GUIDES

As mentioned earlier, most North American publishers follow the indexing style requirements of the University of Chicago Press, in particular Chapter 18 “Indexes” in *The Chicago Manual of Style*.^[12] The chapter about indexes is published as a separate booklet that is often given to authors preparing their own indexes.

Some publishers use a modified form of “Chicago style” or devise their own indexing style guide that meets their unique needs. At minimum an indexing style guide will include rules for five elements:

1. Alphabetizing of main headings.
2. Arrangement of subheadings.
3. Format of entries.
4. Format of reference locators.
5. Format and placement of cross-references.

Of course, there are many other elements included in publishers’ style guides. For example, a scholarly publisher

will provide rules for the indexing of endnotes or footnotes. A technical publisher will have guidelines for the arrangement of numbers and symbols in index entries.

In the United Kingdom, *The Oxford Guide to Style*^[13] includes a detailed discussion of the index style requirements for Oxford University Press.

STANDARDS

Currently the United States does not have a standard for the presentation of indexes. The NISO makes available a technical report, *Guidelines for Indexes and Related Information Retrieval Devices*^[5] that did not garner enough votes to become a standard.

The ISO released *ISO 999: Information and Documentation; Guidelines for the Content, Organization, and Presentation of Indexes* in 1996.^[6]

MECHANICS OF INDEXING

Generally book indexing does not begin until the pagination for a book is complete. Most book publishers send the indexer a set of printed, paginated pages. The pages are not bound and there is printing only on one side of the paper. Some publishers send indexers electronic copies of the book, usually as a PDF file.

One question indexers are often asked is “Do you have to read the entire book?” Yes, the indexer reads the entire book! Some indexers scan through all the book pages and mark possible index entries on each page. Others skim the table of contents and then start indexing.

Professional indexers use specialized indexing software. The programs can be set up to produce an index that conforms to the publisher’s style. Index entries are typed into the program along with their locators. The software handles the alphabetizing along with many other tasks. For example, professional indexing software will perform cross-reference checking: if a cross-reference is created for an index entry that does not exist, the indexer will be warned. The three major indexing programs are Macrex (<http://www.macrex.com/>), SKY Index (<http://www.sky-software.com/>), and CINDEXT (<http://www.indexres.com/>).

In the United States most publishers’ book contracts stipulate that the book author must provide the index. Since professional software is costly, currently around \$500.00, many book authors prepare indexes using their word processors. Some authors still use index cards to compile the entries. A more detailed discussion of manual methods of indexing can be found in *Indexing Books*.^[14]

Regardless of the tools used to compile an index, going through the text and creating index entries is only the first step. The index must be edited and checked for accuracy. Some indexers set aside 25% of their time for editing

tasks. Of course, the actual proportion of indexing time devoted to editing will vary from book to book. More time may be needed for a lengthy (500+ pages) book than for a shorter one.

Often book authors are shocked to discover that their editor expects the index to be delivered in a short span of time. Often 2 weeks is the time budgeted for indexing a 300-page book. The indexing process is demanding. Even professional indexers find it difficult to index for much more than 6 hours a day. Book authors, many without any experience or training in indexing, are often overwhelmed.

The most difficult aspect of indexing is term selection. Indexers must decide not only which terms go in the index, but also the form of the term. Some terms are obvious. For example, a book about California geography will surely include index entries for various mountain ranges such as the Sierra Nevada, Siskiyou, and Santa Lucia mountains. Unfortunately not all term selection is so straightforward. Often authors use synonymous words to describe the same topic. The indexer must make vocabulary control decisions and choose one term for the index entry and provide a *See* cross-reference from the term that is not used. If the author uses both “autos” and “cars,” the indexer may decide to use “cars” as the index entry and add a cross-reference (autos. *See* cars).

As the indexer works through the text an intricate mapping structure begins to emerge. Many indexers find themselves returning to index entries written earlier and tweaking them so that they fit better into the overall index. The ability to keep the entire index structure in one’s mind while working is critical. An index must always treat similar concepts and terms in a consistent manner. Users of indexes depend on this consistency to locate desired information. Using the autos/cars example, it is a disservice to readers to scatter information between two entries, as in:

autos, 23, 44–45
cars, 23, 56–58, 60

Readers looking at only one of the entries above will not get all the reference locators. They should not need to look in two places in the index. The more consistency the indexer can add to the index structure while writing the index, the less editing will be required after the initial term selection is complete.

The preferred vocabulary for an index is always the author’s vocabulary. The indexer is not free to impose an external vocabulary on an index. But while indexers must remain true to the author’s language, they must also anticipate the vocabulary needs of the readers. This often requires reconciling the readers’ external vocabulary with that of the book through the use of cross-references. Take the example of a book about British dog shows that will be distributed in the United States. An American reader might not know that the “herding group” is called the “pastoral group” in the United Kingdom. The astute

indexer will provide a cross-reference: “herding group. *See* pastoral group.”

As the indexer works, the index itself is massaged into a form that will provide quick and complete access to the information contained in the book. If the indexer does a good job, the index structure will be transparent to users. Readers will not think about index structure. Rather, they will quickly locate their desired information and return to the text. Such a transparent and functional information access structure does not emerge on its own. It is the result of deliberative work.

SPECIALTIES

Many indexers are generalists. They can comfortably index on a wide variety of topics. Most nonfiction books that are mass distributed to the general public can be indexed by any competent indexer. However, there are many books that require special skills due to either the genre of book or the subject of the book.

Genre Specialties

Cookbooks and biographies are books that have unique indexing requirements. Cookbook indexes, when done well, are extremely detailed. While not every ingredient in a recipe is indexed, the main ingredients are often indexed along with the recipe name and type. In a barbecue cookbook, “Jimmy’s Down Home Sauce,” would likely be indexed by its name. Since it appeared in the “pork” entry of the book, it would also be indexed under “pork sauces.” Likely, there is also entry under “sauces,” and the type of sauce that it is, “St. Louis style,” “North Carolina style,” or “Memphis style” to name a few. It may also appear under “tomato-based sauces.” Jimmy’s secret ingredient may be bourbon, so it could also appear under “bourbon.”

“Jimmy’s Down Home Sauce” is just one recipe. Many cookbooks have more than one recipe per page, so the density of indexing per page can be quite high. Some cookbook indexers specialize within the genre. Some indexers may feel very comfortable with dessert and bread baking books, but they may not feel confident about indexing an Indian cookbook. More information about cookbook indexing can be found at the Culinary Indexing Special Interest Group of the American Society for Indexing (<http://www.culinaryindexing.org/>).

Biographies, autobiographies, and letters pose their own set of indexing issues. How does one handle the indexing of the main character? How does one arrange the subheadings: alphabetic or chronological order? What if the subject led a colorful life? How does one index scandals? Hazel K. Bell has written extensively about this type of indexing. The 3rd edition of Bell’s *Indexing Biographies and Other Stories of Human Lives* is an excellent

reference.^[15] In this book she also briefly discusses the indexing of fiction, yet another genre specialty. Bell writes:^[15]

Although by no means standard practice, the indexing of fiction has been undertaken from time to time. Serious novels may be indexed in the same way as biographies or histories, as narratives concerning groups of people and the events in their lives.

It should be noted that Bell has written many fiction indexes, including indexes for five novels of A.S. Byatt.

Subject Specialties

Some books, because of the subject matter, require that the index be prepared by a specialist. Some indexers specialize in medical or legal indexing. Even within these two groups there are subspecialties. One medical indexer may easily work with a 600-page textbook on renal disease, while not feeling comfortable with a radiology textbook. Indexers who specialize in a particular subject area often have advanced degrees in the subject and keep in touch with the current terminology and advances in the field. Such intimate subject knowledge is needed when writing complex indexes for a technical book. The indexer must be fluent with the terminology so that appropriate cross-references can be provided and scattering information among synonymous terms can be avoided.

TRAINING

In the past many book indexers were self-taught. Formal coursework in book indexing is rarely offered in curricula of graduate schools of library and information science. Courses in “indexing and abstracting” are offered by some schools. However, it is often the case that the “indexing” part of the course does not cover book indexing in depth.

With only a few notable exceptions, most training courses are unaccredited. Some are offered through professional associations, while others are offered through continuing/adult education programs of colleges and universities. The ASI maintains a list of courses and workshops at <http://www.asindexing.org/site/courses.shtml>.

It is natural to wonder if training in indexing is necessary. But given the number of poorly written book indexes it is obvious that people are not born with an innate ability to index! There are two main benefits of book indexing coursework: students find out if they like the nature of indexing work and if they are able to do it well. Liking the work and doing it well are prerequisites for a successful career in book indexing. Since most book indexers work in a freelance capacity, it is also necessary that prospective indexers enjoy running their own small business. Some courses lightly cover the business aspects of book indexing.

Authors who must index their own books are often referred by their publishers to *The Chicago Manual of Style*. Unfortunately many writers find the discussion of indexing in *The Chicago Manual of Style* difficult. Another option is to contact the ASI and find a professional indexer.

PROFESSIONAL ASSOCIATIONS

Founded in 1957, the Society of Indexers (SI) in England is the original professional association for indexers. Over the years other indexing societies have affiliated with SI. Since 1958, SI has published *The Indexer: The International Journal of Indexing* (<http://www.theindexer.org/>). Below, the affiliated and nonaffiliated societies are listed in alphabetic order along with the current URL for their Web sites. Many of the Web sites provide a great amount of supplemental information about indexing.

ASI: <http://www.asindexing.org/>

Association of Southern African Indexers and Bibliographers (ASAIB): <http://www.asaib.org.za/>

Australian and New Zealand Society of Indexers (ANZSI): <http://www.aussi.org/>

China Society of Indexers (CSI): <http://www.chindex.fudan.edu.cn/>

Deutsches Netzwerk der Indexer (DNI): <http://www.d-indexer.org/>

Indexing Society of Canada/Société canadienne d'indexation (ISC/SCI): <http://www.indexers.ca/>

Nederlands Indexers Netwerk (NIN): <http://www.indexers.nl>

SI: <http://www.indexers.org.uk/>

SUMMARY

A back-of-the-book index is a human-authored text that provides a structured sequence of access points to the information contained in the book. A book, whether it is printed on paper and bound, or presented as pixels on a screen, is a closed system. The closed-system index is not constrained by information that may or may not be added in the future. Instead, the closed-system index focuses on a contained universe of information that is static. The very nature of the book, a human-authored text, demands a hand-crafted, human-authored index that is unique to each book.

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Bibliographic Control [ELIS Classic]

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Abstract

Bibliographic control is the process of creation, exchange, preservation, and use of data about information resources. Formal bibliographic control has been practiced for millennia, but modern techniques began to be developed and implemented in the nineteenth and twentieth centuries. A series of cataloging codes characterized this period. These codes governed the creation of library catalogs, first in book form, then on cards, and finally in electronic formats, including Machine-Readable Cataloging (MARC). The period was also characterized by the rise of shared cataloging programs, allowing the development of resource-saving copy cataloging procedures. Such programs were assisted by the development of cataloging networks such as OCLC and RLG. The twentieth century saw progress in the theory of bibliographic control, including the 1961 Paris Principles, culminating with the early twenty-first century Statement of International Cataloguing Principles and IFLA's *Functional Requirements for Bibliographic Records* (FRBR). Toward the end of the period bibliographic control began to be applied to newly invented electronic media, as "metadata." Trends point toward continued development of collaborative and international approaches to bibliographic control.

Bibliographic control is the process of creation, exchange, preservation, and use of data about information resources. These resources may be of any type: ink on paper (e.g., books, scores, maps); recordings (e.g., music, spoken word); visual media such as photographs, films, paintings; three-dimensional objects such as sculptures or coins; electronic media, including digital reproductions of any of the previously mentioned media and original digital productions; and any other medium in existence or not yet invented, covering the whole array of intellectual creation. Such resources appear in various publication patterns—monograph, serial, or hybrids (currently known as integrating resources), and may be published or unpublished. Techniques of bibliographic control may also be extended to resources that are not the product of intellectual creation such as inanimate objects (rock specimens, chemicals), living creatures (plants and animals), or created objects that are not traditionally thought of as being subject to bibliographic control, such as clothing, buildings, or food products, indeed anything that an individual or institution might want to collect or keep track of.

Individuals and institutions wish to control these resources for a number of reasons. Collectors may want to ensure that they do not collect more than one copy of a given resource, or they may wish to learn of resources within the scope of their collection that they do not yet have. Institutions such as libraries have an interest in helping their users find materials already within their collection or that they may have access to. Publishers need to know who their authors are and at what stage their projects are, and when resources are completed they need to keep

track of their availability for sale. Retailers need to know whether a resource is available in their own inventory and at what price, or whether they can order a copy for a customer. Libraries and collectors may need to keep track of treatment needed periodically in their collections (such as conservation of deteriorating books, or "refreshing" digital collections as new platforms and systems arise). Tools created during the process of bibliographic control are necessary to fulfill all of these purposes.

There are many ways to control such resources. Many individuals practice a form of bibliographic control in their home library by a simple shelf arrangement method, perhaps grouping books by genre or author, or arranging their CD collection by composer. This allows them to easily find a wanted resource, or to verify that they already own (or do not own) a copy. This type of bibliographic control requires no record-keeping at all, except in the sense that the collection itself is the record. However, as their collection grows, individuals may begin keeping inventory lists, especially if the collection is too large to scan visually or if they intend to dispose of the collection in some way and want to record what they had.

The earliest libraries and archives appear to have used shelf arrangement systems to control their holdings. Scrolls or tablets may have been arranged on shelves in a fixed order logical to the creator of the archives, with the objects positioned so that a label or text was visible. A description of early Greek (Minoan-Mycenaean) filing systems is found in Staikos.^[1] Once collections got beyond room size, however, shelving arrangement was not enough, so lists and catalogs were created. For a useful

summary of early catalogs, see Carpenter.^[2] The most famous of these is *The Pinakes* of Callimachus, one of the keepers of the Library of Alexandria, a collection that numbered in the hundreds of thousands. Konrad Vössing estimates that the library contained 500,000 scrolls during the third century B.C.^[3] Ancient estimates went as high as 700,000. Callimachus's 120-volume work was a bibliography of all of Greek literature, based on the holdings of the Library, of which it was in effect a catalog. It was arranged by broad subject, and identified individual resources in the library by citing the first line of each work and the number of its lines. The combination of first line of a scroll with its number of lines was an important identification device in early manuscripts, since they often lacked titles.^[4] It is unknown whether *The Pinakes*, which have not survived, had directional aids such as location listings, but the work presumably had some use as a finding aid and possibly for inventory control.

Inventory lists such as that of Callimachus seem to have been the rule through the Middle Ages. These lists often followed the pattern of *Pinakes* in dividing collections into broad categories, frequently subdivided by size (folio, quarto, octavo). As these lists grew in size they took the form of books. Among the earliest of these book catalogs were the seventeenth century catalogs of the Bodleian Library, some of which were arranged alphabetically.^[5]

The idea that the construction of tools for bibliographic control should follow explicitly formulated rules did not really take hold until the mid-nineteenth century. Antonio Panizzi's famous (and at the time controversial) 91 rules for the compilation of the British Museum's catalog was one of the first such attempts. These rules were printed before the text of the catalog itself, so that users of the catalog could understand its arrangement and manner of construction.^[6] Other single-author codes followed, notably those of Jewett^[7] and Cutter.^[8]

These and other codes were followed (or not) based on their merits, but before the end of the nineteenth century no particular need was felt for agreement between libraries on cataloging standards. As long as a library's catalog was consistent within itself, for purposes of bibliographic control it mattered little if its compilers followed different rules from those of other libraries. However, a new development caused a hasty move toward agreement on standards: the invention of the card catalog and the availability of catalog cards for sale.

Until the mid-nineteenth century catalogs were created in book form. This caused obvious problems when libraries expanded: in a growing library, the day after the book catalog came off the press it was already out of date. Blank sheets could be interleaved within a book catalog for manuscript additions, but eventually these filled up and a new edition had to be published at great expense. Indeed, the impetus for Panizzi's formulation of his 91 rules was the need to publish a new edition of the British Museum's book catalog. An ingenious solution to this problem was

the invention of the card catalog. New cards, each containing bibliographic data for a single resource, could be interfiled with the old, allowing the catalog to expand indefinitely without the need for new editions or republication.

The publication of book catalogs did not stop after the adoption of card catalogs, because they had one great advantage over card catalogs. In most cases the card catalog existed in a single instance only, usually a prominent feature of the library's reference room. Book catalogs were published in multiple copies, in some cases until the end of the twentieth century, and those of prominent libraries such as the Library of Congress, the British Museum, the Bibliothèque Nationale, or the New York Public Library were purchased by institutions around the world. Knowledge of the holdings of libraries other than one's own is clearly important to bibliographic control, allowing collectors to learn of resources outside their own institutions and allowing institutions to borrow from one another.

Such needs prompted the publication of printed union catalogs, the most prominent of which was the National Union Catalog (NUC), a compilation that attempted to include a reproduction of a catalog card for every book held in the major libraries of the United States and Canada, together with a list of all libraries that held each book. The main set, which included printed works published before 1956, ran to 754 folio-sized volumes (published 1968–1981), and was followed by several supplements. This enormous work is still not entirely superseded even in an age of massive bibliographic databases. A recent study discovered that more than 25% of the works represented in the NUC had not yet been recorded in OCLC.^[9] The figure has undoubtedly shrunk somewhat since the publication of Beall and Kafadar^[9] because of the merger of the RLIN database with OCLC.

A logical extension of the invention of the card catalog was the concept of sharing cataloging. If new cards created by a library's catalogers could easily be added to its catalog, so too could they be copied and added to another library's catalog. In 1898 the Library of Congress began to print its catalog cards, and began offering them for sale to other libraries in 1901. Purchasing ready-made catalog cards rather than creating them from scratch for some of the books in a library clearly made economic sense, but in order to be usable these cards had to be compatible with cards already in the library's catalog. This was particularly important in the matter of headings—resources in alphabetic (or “dictionary”) card catalogs needed to group together under authors, titles, and subjects, but if different standards were followed to work out these headings, chaos could result. To a lesser extent standards of description needed to be compatible between cards as well, if for no other reason than to avoid confusing catalog users. So in order to benefit from the economic advantages of shared cataloging, shared standards needed to be agreed on.

So it is not entirely coincidental that the first of these shared codes appeared within a decade of the start of LC's card program, in 1908. As a beginning of standardization within the English-speaking world, the American Library Association and the (British) Library Association attempted to work out a set of mutually agreed-upon rules. This was unsuccessful, and two editions of the code were published.^[10] Nevertheless, agreement between libraries within a single nation was a significant step forward, and the two codes were similar. It is probably also significant that these codes dealt primarily with the formation of entries. As already noted, agreement on the form of headings is probably more important in a shared environment than agreement on descriptive conventions. Indeed, it was not until the publication of the first edition of the *Anglo-American Cataloging Rules* (AACR) that rules for entry and description appeared together for the English-speaking library community within a single code.^[11] As with the 1908 rules, AACR1 unfortunately was published in two editions.

AACR followed an important international agreement concluded in 1961 by the International Federation of Library Associations and Institutions (IFLA). Known as the Paris Principles, the agreement has become the foundation of subsequent standards-making work in the cataloging world. The definitive text of the Paris Principles is International Conference on Cataloguing Principles, Paris, 1961, *Statement of Principles*, annotated edition with commentary and examples by Eva Verona (London: IFLA Committee on Cataloguing, 1971). The principles began with a statement of the function of the catalog, which is also a good summary of some of the principal purposes of bibliographic control:

2. Functions of the Catalog
The catalog should be an efficient instrument for ascertaining
- 2.1 whether the library contains a particular book specified by
 - a. its author or title, *or*
 - b. if the author is not named in the book, its title alone, *or*
 - c. if the author and title are inappropriate or insufficient for identification, a suitable substitute for the title; *and*
- 2.2
 - a. which works by a particular author *and*
 - b. which editions of a particular work are in the library.

The Principles established the importance of such basic concepts as uniform headings, personal and corporate authorship, and the function of main and added entries.

At the turn of the millennium the international cataloging community has created a new document intended as an updated version of the Paris Principles. The Statement of International Cataloguing Principles was developed by the IFLA Meeting of Experts on an International Cataloguing

Code during five annual meetings held in Frankfurt, Germany (2003), Buenos Aires, Argentina (2004), Cairo, Egypt (2005), Seoul, Korea (2006), and Pretoria, South Africa (2007). The final text is available in several languages at <http://www.ifla.org/en/publications/statement-of-international-cataloguing-principles>. It is expected that this document will become the basis for future cataloging codes throughout the world.

The Statement recites a number of objectives for the catalog, basic principles of bibliographic control that have become current in the years since the Paris Principles were promulgated. These are

- *Convenience of the user* of the catalog: cataloging decisions should be made with the user in mind.
- *Common usage*: standardized vocabularies should reflect the vocabulary the majority of catalog users would expect.
- *Representation*: descriptions and controlled forms of names should be based on the way entities describe themselves.
- *Accuracy*: the description should be faithful to the entity described.
- *Sufficiency and necessity*: only those elements that are essential to uniquely identify an entity should be included.
- *Significance*: elements should be bibliographically significant.
- *Economy*: bibliographic control should be achieved by the simplest or least costly method.
- *Consistency and standardization*: descriptions and access points should be standardized as far as possible in the interest of consistency and sharing of records.
- *Integration*: description of and access to all types of materials should be based on a common set of rules as much as possible.
- The rules in a cataloging code should be *defensible* and *not arbitrary*.

The formulation of the Paris Principles and the first edition of AACR in the 1960s coincided almost exactly with another significant development for bibliographic control, the use of computers as an aid to cataloging. The Machine-Readable Cataloging (MARC) standards were first developed at the Library of Congress in the mid-1960s under the leadership of Henriette Avram. A readable introduction to the MARC format in the United States is *Understanding MARC Bibliographic: Machine-Readable Cataloging*, 7th ed.; Library of Congress: Washington, DC, 2003, also available at <http://www.loc.gov/marc/umb/>. There remain numerous national MARC standards but the English-speaking world generally conforms to a standard currently called MARC21. First intended as an automated method for printing catalog cards, MARC's potential for exchange, retrieval, and display of records soon became evident, and MARC became the foundation

of electronic catalog databases. Just as significantly for bibliographic control, the MARC format allowed the creation of electronic union catalog databases (such as Research Libraries Information Network [RLIN] and OCLC, discussed below), which combined the advantages of card catalogs (easy extensibility and revisability) and printed book catalogs (access beyond the premises of the library) and eventually led to the near demise of both.

Another important bibliographic control standard, the International Standard Book Number (ISBN), was initiated in 1968 in Great Britain as the “Standard Book Number,” a nine-digit number assigned to individual editions of a publisher’s output. Within the same year the concept was extended worldwide to become the ISBN, the number expanding to 10 digits. In 2007 the number expanded again, to 13 digits. Since 1970 the ISBN system has been overseen by the International ISBN Agency in Berlin. Blocks of numbers are assigned to publishers by national agencies within the 166 member countries. The website of the International ISBN Agency is <http://www.isbn-international.org/>.

ISBN as an identifier of a discrete edition of a book is of obvious significance to bibliographic control, and the concept quickly expanded to other formats. There are now standard numbers for serials (ISSN) (administered by the ISSN International Centre, <http://www.issn.org/>), music (ISMN) (administered by the International ISMN Agency, <http://www.ismn-international.org/>), audiovisual materials (ISAN) (administered by the ISAN International Agency, <http://www.isan.org/>), recordings (ISRC, International Standard Recording Code) (administered by the International Federation of the Phonographic Industry (IFPI), http://www.ifpi.org/content/section_resources/isrc.html), and others. Any of these can be recorded within the MARC record for the appropriate resource as an identifier, a link, or finding device.

The ability to create electronic catalog records using the MARC format was as significant a leap forward for sharing cataloging as the Library of Congress’s sale of its printed cards, and it allowed a much wider community of cataloging participants. Although LC was not the only library producing such cards, an institution had to be relatively large and respected in order to afford to publish, and to expect a market for, its catalog cards. On the other hand, the only thing any library needed under the MARC regime to produce catalog records of potential worth to other libraries was a computer system capable of deploying MARC and a way to distribute the records. Further, before the advent of MARC it was cumbersome, if not impossible, to revise cataloging a library might receive on cards, e. g., to note local characteristics (such as inscriptions, unique bindings, or defects in the library’s copy). In an electronic environment it was not a difficult matter to enhance “copy” (the electronic catalog record a library might receive from another cataloging agency) not only for local characteristics, but also to enhance and correct the records for other

reasons. In a shared cataloging environment this benefited all who came after (and who, themselves, could continue to enhance a given record).

At about the same time as these developments the Library of Congress initiated a new program to enhance the ability of libraries in the United States and elsewhere to perform bibliographic control, the Cataloging in Publication (CIP) program. LC had conducted an experiment called “cataloging in source” in 1958 and 1959 under which its staff cataloged approximately 1000 books prior to their publication from page proofs so that cataloging information could be printed on the verso of title pages. Although the experiment showed that this could be done successfully, the Library ultimately dropped the project, feeling that the disadvantages outweighed the benefits, both to itself and to the publishers. However, the concept was revived in 1971 with the establishment of the CIP program. A good account of the beginnings of the program is found in Clapp.^[12] The program’s current home page is <http://cip.loc.gov/>. The purpose of the program was to “provide the recipient with standardized and professionally prepared cataloguing information that he cannot generate himself, but not to supply data which are readily available to him in the book which he holds.”^[13] Consequently, LC’s CIP would not include subtitles, imprint information, or physical description. However, CIP data would include main entry in its authorized form, a brief identifying title, series statements, notes about the resource, LC subject headings, added entries in their authorized forms, LC call number, a Dewey class number, the LC card number, and any ISBNs associated with the resource. These cataloging data would be supplied based on galley proofs, and a CIP record would be returned to the publisher to reproduce on the verso of the title page of the final publication.

CIP instantly became a very popular service and is now included in the publications of most major American publishers. It was also an excellent match for the newly developed MARC record exchange format: a record might potentially become available to libraries before the resource was even published, and was easily revised when the resource became available in its final form. CIP programs now exist around the world, involving many national libraries including the British Library, Library and Archives Canada, the National Library of Australia, and the Deutsche Nationalbibliothek. LC’s CIP program has recently migrated to an “eCIP” program (“electronic CIP”) under which rather than paper galleys publishers send the Library electronic versions of the manuscript. This has not only resulted in faster and more efficient processing, but it has allowed the Library to consider expanding its partners. It has recently invited major university libraries to participate by producing eCIP for the output of their university presses and has also expanded the program to allow libraries with subject or other specialties to produce eCIP for specialist publishers.

The advent of electronic cataloging did not spell the immediate end of card catalogs for bibliographic control: some libraries continued to use their card catalogs well into the twenty-first century. However, most libraries in the Western world had by then retrospectively converted their cards to electronic format so that the bulk of their inventory was controlled by their Online Public Access Catalog (OPAC). But the idea of sharing electronic cataloging did give rise to the idea of Universal Bibliographic Control (UBC).

UBC was an ideal under which all the world's information resources, whether published or unpublished, would be placed under bibliographic control, i.e., cataloged.^[14] Two approaches were proposed: the creation of a single worldwide bibliography, or alternately (and more realistically), the creation of national bibliographies. The promotion of UBC occupied much of the attention of the cataloging world during the second half of the twentieth century. IFLA spearheaded the movement with its IFLA Universal Bibliographic Control and International MARC Programme (later "Core Activity") (UBCIM). For background on the now-defunct IFLA UBCIM, see documentation at the IFLA website, <http://archive.ifla.org/VI/3/ubcim.htm> and <http://archive.ifla.org/VI/3/ubcim-archive.htm>. During the last 30 years of the century, UBCIM promoted not only the idea of UBC, but was also responsible for the publication of the ISBDs and UNIMARC, an IFLA-sponsored version of the MARC standard developed by the Library of Congress.

The International Standard Bibliographic Descriptions (ISBDs) were first envisaged in the late 1960s to allow a standardized form of content and exchange of bibliographic data. The value of and need for such documentation in the context of UBC is clear and the ISBDs have enjoyed a remarkably broad worldwide acceptance. The first ISBD (for monographs) was published in 1971, and other format-specific ISBDs followed in the ensuing decades. A consolidated version was published in 2007, harmonizing the format-specific ISBDs. A digital version of the consolidated edition of ISBD (Munich: Saur, 2007) is available at http://www.ifla.org/files/cataloguing/isbd/isbd-cons_2007-en.pdf. Nearly all cataloging codes developed since the publication of the ISBDs, including the second edition of AACR, have been based on them.

With the advent of electronic and digital formats and especially the rise of the Internet and the World Wide Web, a serious increase in the amount of information resources occurred, and as of the early twenty-first century, thanks to this rapid increase of these resources, many of the goals of UBC appeared unattainable. The UBCIM Core Activity was disbanded by IFLA in 2003, replaced by the IFLA-CDNL Alliance for Bibliographic Standards (ICABS), a federation of a number of national libraries charged with continuing to support goals of bibliographic control, but with less

emphasis on the ideal of UBC. For information about ICABS, see <http://archive.ifla.org/VI/7/icabs.htm>.

Given the demise of an explicit goal of UBC on the international level, it is somewhat ironic that the notion of a single worldwide bibliography may actually be coming to fruition through the rise of OCLC to near-monopoly status as the database containing the world's cataloging data. As mentioned above, one of the obvious benefits of the invention of MARC was the ability to share and exchange cataloging electronically. However, in order to do this efficiently some exchange mechanism had to be set up. During the late 1960s and early 1970s numerous library consortia organized themselves explicitly for the purpose of creating electronic union catalog databases. This would benefit libraries beyond allowing the sharing of records and thus lowering the cost of cataloging. Such union catalogs were also efficient mechanisms for purposes such as interlibrary loan, allowing the discovery of the location of wanted items. In addition they allowed libraries to see each other in ways they had not been able to before, particularly for comparison of their collections.

Three of the principal consortia developed in the United States during this period were The Ohio College Library Center (OCLC), The Research Libraries Group (RLG), and The Washington Library Network (WLN).

The Washington Library Network was founded in 1976 as a regional union database for libraries in the state of Washington. In view of its expansion to areas of the North American west coast and northwestern Rocky Mountains it changed its name to Western Library Network in 1985, and then to WLN in 1990. Although the focus of WLN was the northwestern United States, it did support libraries from outside the region in Australia, New Zealand, and South Africa. In 1999 WLN merged with OCLC.

RLG was founded in 1974 by Columbia, Harvard, and Yale Universities and the New York Public Library. Its membership expanded across the United States to many other university and research libraries, and its union catalog became known as RLIN. Throughout its history RLG retained its character as a consortium of research libraries, and so its catalog reflected the character and needs of its members, including strong holdings in special and rare materials, and the ability to catalog using vernacular scripts such as Chinese, Japanese, Korean, and Arabic.

RLIN's structure was based on a "clustering" concept. Every member library input its own records for its own holdings (usually "deriving" a new record from some other library's record for a given resource), but records for a single edition of a resource clustered together through a set of complex algorithms. The clustered structure of the database allowed libraries to see the records of any other RLG member, which might differ from one another.

This was a particularly suitable arrangement for research libraries, which often had significant special

collections holdings. Patrons of these collections were often interested in researching unique aspects of the collections, such as books that once belonged to a prominent historical figure, information that could be found on the records of individual libraries.

Aside from RLIN, RLG also developed a number of tools for archival bibliographic control, allowing better access to the holdings of the research libraries' manuscript collections, as well as, later on, tools for union access to members' new digital collections. In 2006 however RLG, like WLN, merged with OCLC. It retains a presence within OCLC as RLG Programs.

Although not the only bibliographic database on the stage today, with 100,000,000 bibliographic records (and counting) OCLC is clearly now the principal source of the world's bibliographic data. OCLC's home page is <http://www.oclc.org/>. A free version of the bibliographic database is available at <http://worldcat.org/>. OCLC was founded in 1967 as the Ohio College Library Center. Like WLN, it was originally the database of a regional library consortium. As it grew it changed its name to Online Computer Library Center, and is now officially known simply as OCLC. OCLC had a different character from RLG, attracting more public and school libraries, although a number of university and research libraries also joined (some were members of both OCLC and RLG). The structure of its database was different as well. Rather than the clustering model followed in RLIN, OCLC had a "master record" model wherein each edition of any resource would have one and only one record. Libraries added a holdings record to the master record to notify database users that they owned an item, and a select group of libraries was allowed to revise master records.

OCLC's merger with RLG precipitated a change in OCLC's database structure. RLG members were accustomed to using the clustered organization of the database and many wanted to continue to receive the benefits of being able to see each others' records after they moved to the OCLC environment. In order to accommodate this, OCLC changed its database structure to allow for "institution records." Under this structure the master record remains the principal record for a given edition of a resource, but a library may, at its discretion, link its own record (the "institution record") to the master record. When the RLIN and OCLC databases merged in 2007 a number of RLG member libraries had their RLIN records added to the OCLC database as institution records, and the number of such records has continued to grow.

In addition to maintaining its mammoth bibliographic database, OCLC is also a significant player in research into various aspects of bibliographic control through its Programs and Research division, supporting undertakings such as analysis of and data mining within the OCLC database, research into automatic classification, projects developing open and persistent URLs, and the development of a "virtual international authority file," a project that is exploring

the feasibility of combining the name authority files of the Library of Congress, the Deutsche Nationalbibliothek, and the Bibliothèque Nationale de France.

There have been a number of recent developments in bibliographic control of potentially great importance to the future. The Statement of International Cataloguing Principles has been noted above. This statement was based in part on two new documents, Functional Requirements for Bibliographic Records (FRBR) and its companion document Functional Requirements for Authority Data (FRAD). FRBR is available at http://archive.ifla.org/VII/s13/frbr/frbr_current_toc.htm (HTML version) or http://www.ifla.org/files/cataloguing/frbr/frbr_2008.pdf (PDF version). The final version of FRAD, when published, will be available through the IFLA Cataloguing Section's home page <http://www.ifla.org/en/cataloguing>.

FRBR is not a cataloging code, but instead a conceptual model of the bibliographic universe. Based on the entity-relationship database model, FRBR works out how bibliographic entities interact with each other. Entity-relationship is a model introduced in the 1970s in which a given data universe is divided into specific entities linked by specific relationships, each of which have specific attributes. In FRBR and FRAD 11 entities are defined: work, expression, manifestation, item, person, corporate body, family, concept, object, event, and place.

The first four of these are called the primary entities because they have to do with resources familiar to bibliographic control, the objects of intellectual creation. "Work" is defined as "a distinct intellectual or artistic creation." When a work is set down in some form it becomes an "expression": "the intellectual or artistic realization of a work in the form of alphanumeric, musical, or choreographic notation, sound, image, object, movement, etc. or any combination of such forms." If the content or form of an expression changes (as when a writer revises a novel, or when the novel is translated into another language) this usually results in a new expression of the same work, or if the change is extensive enough, it can result in a new work. "Manifestation" is "the physical embodiment of an expression of a work." This usually means a publishing event, such as the 1936 publication of Margaret Mitchell's *Gone with the Wind*. If the same content is published again, for example, the 2006 publication of *Gone with the Wind*, this becomes a second manifestation of the same expression. "Item" is a single instance of a manifestation, i.e., a copy.

All FRBR entities have explicit relationships with each other. For example, the work entity might have a "created by" relationship with a person entity (the author). The manifestation entity might have a "produced by" relationship with a corporate body entity (the publisher). A person entity might have a "member of" relationship with a family entity.

FRBR also defines what it calls the "user tasks," i.e., the reasons users come to bibliographic databases.

According to FRBR these are four: 1) users need to *find* materials relevant to their needs; 2) once they have found a group of potential records or resources they need to *identify* the resource retrieved, i.e., confirm that the resource is what they were looking for; 3) they then need to *select* from the resulting group a resource appropriate to their needs; and 4) they need to *obtain* the selected resource.

The focus of FRBR on these user tasks is based on the principle of user convenience, one of the core principles underlying the Statement of International Cataloguing Principles discussed above.

FRBR works best within the entity-relationship database model. In such a database every instance of an entity would have one and only one record, and all entity records would be linked to other entity records by relationship links. For example, the work record for *Gone with the Wind* would be linked to the person record for Margaret Mitchell; the expression records for all expressions of the work (text, spoken word, etc.); concept entity records for the topics of the work (e.g., Scarlett O'Hara, the U.S. Civil War) and forms (e.g., Historical fiction, War stories); and so on. In turn, the person record for Margaret Mitchell would be linked to any other work records for works she created (e.g., *Lost Layson*); the concept entity records would be linked to any other related works (e.g., the concept record for Scarlett O'Hara would be linked to the work record for the film version of *Gone with the Wind* and other works in which she figures prominently such as *My Beloved Tara* by Jocelyn Mims). The expression records would be linked to their appropriate manifestation records, which would be linked in individual libraries to item records.

This exponentially expanding web of linked entity records is very different from the flat-file MARC universe, in which all details pertaining to a single publishing event (the work, the expression, the manifestation, the author, the concepts, etc.) are contained within in a single record. At first glance the complexity of entity-relationship caused many to doubt the utility of such a massive change, but there are overriding advantages both to the creator of the database (e.g., the cataloger) and to the users of the collection.

In the current MARC environment, every time a new record is created for one of the hundreds of publications of *Gone with the Wind*, including translations, revised editions, etc., everything to do with the work has to be repeated in every record. This includes information about the author (including the required standardized form of her name), subject headings, summaries, notes about awards, and anything else pertaining to the work. Ideally all this information should be identical in each MARC record, and any changes to one record (e.g., the addition of a new subject heading or a change in form of the author's name) should be made to all. This is a lot of work. In contrast, in an entity-relationship bibliographic database all this information would either be contained within the work record as attributes (e.g., a plot summary, notes about awards) or

linked to the work record by relationship links (e.g., the author's person entity record, the concept entity records). Any changes would be made only once, at the work level.

From the point of view of the user, too, there are important advantages to such a database structure. In the most common type of interfacing with a MARC database currently used, keyword searching, the user might receive hundreds of hits organized randomly when doing a search on *Gone with the Wind*. In a well-designed entity-relationship database the user might instead initially be presented only with work records, in this case possibly only two, one for the novel and the other for the film. From there the user could choose an expression (e.g., a recording, a French translation, or the original English-language expression). The user would then only see the few manifestation records associated with the chosen expression.

The first cataloging code to be explicitly based on FRBR and FRAD is *RDA: Resource Description and Access*, currently under development (see <http://www.rdaonline.org/>). Designed by the Joint Steering Committee for Development of RDA, it is intended as a replacement for AACR2, and is expected to be released in early 2010. As of this writing (2009) the structure of the code points toward its use in an entity-relationship database, containing instructions for recording attributes of each FRBR/FRAD entity as separate records, and instructions for linking these entities with relationship links. Although it is realized that RDA will first be implemented within a MARC environment, it is clear that its authors intend it to be used eventually within a FRBR-based entity-relationship environment. Although the database structure for this environment has not been designed yet, models within the larger database world exist, which should help development.

One of the driving forces behind the replacement of AACR2 with RDA is the changed environment in which libraries and other similar organizations find themselves at the beginning of the twenty-first century. One of the principal changes to this environment is the proliferation and wide availability of digital resources, both at individual institutions such as libraries and within the larger environment, including the World Wide Web. These digital resources are potentially subject to bibliographic control for the same reasons as physical resources are. And their proliferation has the potential to overwhelm traditional methods of bibliographic control. RDA is intended to address some of these problems, and to attract other communities, including the metadata communities, to use a common standard.

Metadata, a term coined about 1970, means data or information about other data. As such, all the techniques of bibliographic control discussed above produce metadata, since catalog records of all kinds contain data describing other data, i.e., works as embodied in a physical object such as a book. However, the common meaning of the term is data or information about digital objects.

Unlike traditional cataloging, which until recently exclusively described physical objects, and described them in a place physically separate from the objects themselves (the catalog), metadata is often attached directly to the digital object being described. This is possible because electronic metadata, itself digital, resides in the same place (e.g., the Internet, or a database) as the digital objects it describes.

This also makes possible the creation of metadata not only by professional catalogers (as was previous practice), but also by the creators of the objects themselves or their users. Indeed, the huge quantities of digital information resources demand at least some metadata creation by the creators and users of the resources. The nature of digital resources also opens the possibility of automatic harvesting of portions of the metadata from the object itself, with minimal human intervention. Because of all this a need was perceived for a metadata standard that was simpler than traditional cataloging standards. A workshop was hosted by OCLC in 1995 that gave rise to the "Dublin Core" (OCLC is located in Dublin, Ohio), a basic set of 15 elements that could be used for metadata creation. These included elements such as title, creator, subject, language, and date, which were easily understandable by anyone creating a digital object.

The Dublin Core is maintained by the Dublin Core Metadata Initiative (DCMI), which continues to refine the model and develop database architecture and modeling. DCMI's home page is <http://dublincore.org/>. One of its activities is a joint initiative with the creators of RDA. The DCMI/RDA Task Group, formed in April 2007, is charged with defining an RDA element vocabulary in order to make RDA's underlying bibliographic elements reusable in the "Semantic Web" (defined as a common framework that allows data to be shared and reused across applications), and citable with Uniform Resource Identifiers (URIs). Information about the Semantic Web is available at <http://www.w3.org/2001/sw/>. One of the hoped-for results of the DCMI/RDA Task Group is greater cooperation between the metadata and cataloging communities and broader use of RDA beyond traditional cataloging, including by the metadata communities. See information about the Task Group at <http://dublincore.org/dcmirdataskgroup/>.

All of these standards have been developed to facilitate the sharing of bibliographic data, so that data creators such as catalogers do not have to redo work that has already been done by others. Catalogers have long tried to organize themselves so that they could share cataloging, beginning with LC's catalog card sales and progressing to the use of each other's electronic copy through databases such as OCLC. However, the supply of reliable copy has not always been good, and a number of initiatives were attempted during the twentieth century to form alliances among cataloging agencies that followed a common standard and whose records could be used by others with little or no modification.

The most successful of these efforts was the Program for Cooperative Cataloging (PCC). Founded in 1995, the PCC built on successful existing programs for the creation of serial and name authority records. At the present time the PCC has four components: a program for the creation of name authority records called NACO; a program for the creation of subject authority records called SACO; a program for the creation of monographic bibliographic records called BIBCO; and a program for the creation of serial bibliographic records called CONSER. For information about the PCC, see <http://www.loc.gov/catdir/pcc/>. Participants in any of the PCC programs are given extensive training and their work may be subject to quality control by other PCC participants, ensuring a supply of high-quality cataloging data that others can use with confidence. Although much of the PCC's activity is hosted and supported by the Library of Congress, the Program is governed by its member institutions. In 2007 the 624 PCC member institutions contributed nearly 200,000 name and series authority records, about 3,000 subject authority records, over 22,000 serial records, and about 66,000 bibliographic records to the shared databases.

The beginning of the twenty-first century saw a great deal of thoughtful planning for the future of bibliographic control. In 2000 the Library of Congress sponsored the Bicentennial Conference on Bibliographic Control for the New Millennium, which produced an action plan for the Library. (The Papers are published in *Proceedings of the Bicentennial Conference on Bibliographic Control for the New Millennium* [Washington, DC Library of Congress Cataloging Distribution Service, 2001], also available at <http://www.loc.gov/catdir/bibcontrol/conference.html>. The action plan is available at <http://www.loc.gov/catdir/bibcontrol/actionplan.html>.) This was followed by three important and controversial white papers, one on the future of bibliographic services in the University of California system, another on the future of cataloging at Indiana University, and the third a paper on the future of bibliographic control in general, commissioned by the Library of Congress and written by Karen Calhoun. The publication details of these white papers were the following: University of California Libraries, Bibliographic Services Task Force, *Final Report, December 2005: Rethinking How We Provide Bibliographic Services for the University*, <http://libraries.universityofcalifornia.edu/sopag/BSTF/Final.pdf>; Jackie Byrd et al. *A White Paper on the Future of Cataloging at Indiana University*; January 15, 2006, http://www.iub.edu/~libtserv/pub/Future_of_Cataloging_White_Paper.pdf; and *The Changing Nature of the Catalog and its Integration with Other Discovery Tools* final report, March 17, 2006, <http://www.loc.gov/catdir/calhoun-report-final.pdf>, respectively. Fast on the heels of these publications, in November 2006, the Library of Congress convened the Working Group on the Future of Bibliographic Control. After broad, nationwide consultation, the Working Group produced its final report in January 2008 (*On the Record : Report of The Library of*

Congress Working Group on the Future of Bibliographic Control, January 9, 2008, <http://www.loc.gov/bibliographic-future/news/lcwg-ontherecord-jan08-final.pdf>). The Working Group, addressing the bibliographic control community in general and not just the Library of Congress, recommended that

1. The community increase the efficiency of its production through increased cooperation, including use of data from nontraditional sources (including publishers, foreign libraries, etc.).
2. Increase efforts to expose rare and unique materials currently "hidden" because of lack of adequate bibliographic control.
3. Position for the future by recognizing that the World Wide Web is both a technology platform and a platform for the delivery of standards and bibliographic data, and by recognizing that not only people, but also machines will interact with bibliographic data.
4. Incorporate user-supplied information such as social tagging into descriptions and work to realize the potential of the FRBR framework.
5. Strengthen the profession through education and measurements that will inform decision-making.

The Working Group concluded that

The future of bibliographic control will be collaborative, decentralized, international in scope, and Web-based. Its realization will occur in cooperation with the private sector, and with the active collaboration of library users. Data will be gathered from multiple sources; change will happen quickly; and bibliographic control will be dynamic, not static. (*On the Record*, p. 4.)

At a time of great change in the world of bibliographic control this seems as good a statement as any of what the future might bring.

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Bibliographical Society (London)

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Abstract

This entry sets out the principal aims of the Society, as recorded on its Web site, and traces how these have been pursued and achieved since its foundation in 1892, through its meetings, publications, through its Transactions (*The Library*), and since 1992, the awarding of financial help for bibliographical research. Bibliography has evolved, notably under French and German influence, into a world-wide discipline of the History of the Book, and the Society's leading members have played a major part in such ventures as the as yet uncompleted *Cambridge History of the Book in Britain*.

On its Web site, the Bibliographical Society sets out its objectives:

To promote and encourage study and research in the fields of:

Historical, analytical, descriptive, and textual bibliography, the history of printing, publishing, bookselling, book-binding, and collecting; to hold meetings at which papers are read and discussed; to print and publish a journal and books concerned with bibliography; to maintain a bibliographical library; from time to time to award a medal for services to bibliography.

To support bibliographical research by awarding grants and bursaries.

With the exception of the last, none of these objectives would have seemed alien to most members of the Society from its foundation in 1892 to the present time. Funds for bursaries and awards were raised in celebration of the Society's centenary in 1992. The earliest members were also a little unsure of the meaning of the word "bibliography," and there are in early issues of the *Transactions* papers which discussed what would now be considered "subject" bibliography. Two commemorative volumes have been published, on the jubilee and the centenary, 1942 and 1992. Notwithstanding its early concentration on foreign books, mainly of the incunable period and collaboration with the German-based Gesamtkatalog der Wiegendrucke, the Society soon focused on the definitive recording of British books, and upon the textual problems of the Elizabethan and Jacobean drama. The issue of the *Short-Title Catalogue (STC)* in 1926, was a milestone of the former, and W.W. Greg's *Bibliography of the English printed drama to the Restoration*, of the latter. *STC* appeared in a revised edition between 1976 and 1991. The Society also played a major part in the design and completion of the *Eighteenth Century Short-Title Catalogue*. Both the earlier projects involved research in, and publication of, several books of the records of the

Stationers' Company of London. The Society's concentration on pre-1640 English books was rudely interrupted by the exposure of Thomas J. Wise (a former President), but the exposure was the work of two future Presidents, John Carter and Graham Pollard, both—particularly Pollard—influential on the future direction of the Society. Ecclesiastical libraries have always been important sources of early books, and the *Cathedral Libraries Catalogue* begun in 1944, and long in gestation, was completed between 1984 and 1998. The editing and publication of such substantial works proved costly for a members' society, and the British Library offered welcome support for this and later works of scholarship, particularly those requiring extensive illustration. Keith Maslen's edition of the Bowyer ledgers was published in collaboration with the Bibliographical Society of America.

The Society's claim, also on the Web site, that it is the "senior learned society dealing with the study of the book and its history" might indeed be contested by the Edinburgh Bibliographical Society which was established in 1890.

The Society's objectives and achievements have been set out in volumes published on the occasions of its jubilee (1942) and its centenary (1992). *The Bibliographical Society, 1892–1942: Studies in Retrospect*, appeared in 1945, and was reprinted in 1949. The three-year delay was, understandably, caused by the conditions of war which had curtailed the Society's activities in many other ways. The book was edited by F.C. (later Sir Frank) Francis (President 1964), who from the relative security of the British Museum, had shouldered many of the Society's burdens—which included the Honorary Secretaryship and Editorship of *The Library*. *The Book Encompassed: Studies in Twentieth-Century Bibliography* was edited by Peter Davison (Honorary Editor of *The Library*, President 1992, and Gold Medallist 2003), and appeared more punctually. Both volumes, which differ widely in their appearance, are yet a continuing witness to the skills of Cambridge

University Press. Francis was uniquely qualified to write the historical introduction to the earlier volume. He detected a surprising uncertainty in the early objectives, which was perhaps mirrored in its first officials, and this was only resolved with the election in 1893 of A.W. Pollard of the British Museum as the Honorary Secretary of the Society, an office which he held solely until 1912, and jointly with R.B. McKerrow until 1934. The names of Pollard and McKerrow (both Gold Medallists in 1929) will recur in the ensuing entry. The strong connection with the British Museum was crucial to the development of the Society. The Department of Printed Books, under the direction of Panizzi, had become the greatest all-round historical collection, not only of British, but also of foreign books, and in particular of incunabula. And there was another, subtler, influence at work, that of a great museum with incomparable collections of artefacts. Thus it was natural that books should be studied, not only as texts, but as physical objects. The Society's earliest publications related to these foreign books. Despite the premature death in 1903 of Robert Proctor, a member since 1894, who had given the world the concept of "Proctor order" in arranging incunabula, the earliest British connections with the German "*Gesamtkatalog der Wiegendrucke*" were through the Museum and the Society; the Director of the Wiegendruckkommission, Dr. Konrad Haebler had been an Honorary Member since 1905. The Society has since then published both books and articles in *The Library* on fifteenth-century books. It is appropriate that the most recent (June 2008) issue of *The Library* should carry authoritative reviews of the 11th and final volume (on English incunabula) of the British Library's *Catalogue of Incunabula (BMC)*, and of the Bodleian Library's new *Catalogue of Books Printed in the Fifteenth Century*. The former review is by Bettina Wagner of the Bayerische Staatsbibliothek in Munich, who formerly worked on the Bodleian incunable catalog, and the latter by Richard Sharpe, Professor of Diplomatic at Oxford. He draws attention to the Bodleian catalog's concentration on the texts printed; a conscious move, very proper to a university library, away from that on printing houses, which was a legacy from Proctor. Two of the Society's Gold medalists, Konrad Haebler (1929), and Victor Scholderer (1951, and President 1946) were perhaps best known as incunabulists.

It was in a paper by A.W. Pollard, delivered in 1913, that the author described the work of the Society on English printers as "meagre and scrappy." This is a slightly dismissive judgement of what had so far appeared; Gordon Duff's *A Century of the English Book Trade* in 1905 (reprinted in 1948); the *Hand-Lists of Books printed by London Printers, 1501–1556*, of 1913 (which as Pollard writes in his Preface "were begun at my suggestion as long ago as 1894"); and the series of four Printers' Dictionaries which began in 1907, and were followed by others taking the coverage up to 1775, finishing in 1932. Their abiding

worth was recognized by their being reprinted by the Society in a single volume in 1977. They owed much to the archival investigations of H.R. Plomer (1856–1928), which I can personally testify, are still of value in this and related fields.

Pollard's sights were, however, by 1918, set upon a project which had at least been aired in the Society's earliest years, a "Short-Title Catalogue of English Books, 1501–1640." This owed a lot to the British Museum's own catalog of 1884. But by 1920, no bibliographer could be unaware, not only of collections of pre-1640 books in other British libraries, but of the increasing numbers moving westwards across the Atlantic. Nevertheless, the objective of Pollard and of his collaborator Gilbert R. Redgrave, was realized in the astonishingly brief period of eight years, and the "short-title catalog (STC)" of 1926 became the ancestor of a series taking the record up to 1800, and in which the Society has been, in various degrees, involved. It could do little more than bless the continuation 1641–1700 by Donald Wing of Yale University. Wing paid STC the compliment of imitating its style of entry closely, though making the obvious improvement of replacing the numeric location code with a more memorable alphabetic code, such as "LLP" instead of "L2," to signify Lambeth Palace Library. Nor did he allow himself to be deterred, as perhaps his predecessors had been, by the dramatic rise in printing output occasioned by the Civil War. Yet the revision of the 1475–1640 STC, undertaken in 1948 by F.S. Ferguson and W.A. Jackson, was always a Society project. The history of this project, which outlived both editors, and was brought to a triumphant conclusion in three volumes, 1976–1991, by Katharine F. Pantzer, originally Jackson's assistant at Harvard, has been told in the prefaces to the three volumes, of which the second (I–Z) was published first in 1976 (with an anonymous Preface by the present writer), volume 1 (A–H) in 1986, and volume 3 in 1991. The last contains several indexes, of which the first, of Printers and Publishers, encapsulates the unique knowledge of this part of the book trade which Dr. Pantzer had gained in the course of the revision, and largely, though not entirely, obviates the need for a revised Printers' Dictionary of the period. She was awarded the Society's Gold Medal in 1988. The Society remained the publisher, though the financial requirements of editing and publication proved to be far beyond the resources of a relatively small members' society, and occasioned several efforts of fundraising in Britain and the United States.

There was a determination, nevertheless, in the Society's ranks that something more than the benevolent neutrality (and war-induced impotence) that had been shown toward Donald Wing's enterprise, would have to be displayed, if a continuation to Wing's STC were called for. Preoccupation with the "New bibliography," and in particular with the textual problems of the Elizabethan and Jacobean drama (a subject which calls for extended discussion, below), had perhaps distracted attention from the

bibliography of the eighteenth and later centuries. However, in 1962, consideration was given to the possibility of an eighteenth-century short-title catalog. The Sub-Committee of the Society's Council appointed to consider it was chaired by the bibliographically omniscient President, Graham Pollard, and included Sir Frank Francis, and two of the Society's most knowledgeable *dix-huitièmistes*, L.W. Hanson and D.F. Foxon. The report they produced remained on the table until 1976, when a conference was called by the newly established British Library and the American Society for Eighteenth-Century Studies. Contributions to the conference by members of the Society, including the present writer, then Honorary Secretary, were prominent. In the end the *English Short-Title Catalogue* (ESTC), as it soon became known, came into being under the editorship of Robin Alston (President 1988 and Gold Medallist 1997), not in hard copy, but in electronic form, and to it have been added the contents of the Society's 1475–1640 volume and the 1641–1700 volume (under the auspices of the Modern Language Association). The ESTC is now run, and updated, by the British Library and ESTC (North America) at Riverside, California

The enumerative bibliography of early books was seen by W.W. Greg (President 1930, Gold Medallist 1935) as “one of the first tasks of bibliography” (*Studies in Retrospect*, 1945). He began this task very early in his membership of the Society, which he joined in 1898, with *A List of English Plays written before 1643 printed before 1700* (1900) and *A List of Masques, Pageants etc. supplementary to A List* (1902). Greg's single-minded devotion to the study of English drama had begun with his friendship at Cambridge with R.B. McKerrow, and came to a culmination only in the year of his death (1959) with the final volume of his *Bibliography of the English Printed Drama to the Restoration*. The first two books were the Society's earliest contribution to English literary studies, and Greg followed them with editions of *Henslowe's Diary* and *The Henslowe Papers* (1904–1908, not published by the Society). Greg and McKerrow were, in their scholarly examination of Elizabethan and Jacobean drama, joined by A.W. Pollard, whose interest had been aroused in the course of his museum duties, by a bound copy of the “Pavier Quartos” of “1619,” brought in for examination, and now in the Folger Library. Greg, in particular, challenged the reigning orthodoxy of Sir Sidney Lee on the subject of the unreliability of the Shakespeare quartos and First Folio. This formed the subject of Pollard's own *Shakespeare Folios and Quartos* of 1909, and his Sandars Lectures published in *The Library* from 1916, and his *Shakespeare's Fight with the Pirates* (1920).

F.P. Wilson's *Shakespeare and the New Bibliography* is by far the longest contribution to *Studies in Retrospect*, and solidly established the Society's claim to have “made a difference” to literary scholarship. Wilson saw the Society as “leader and inspirer of these studies,” “due in the

main to three of the outstanding members of the Society,” Pollard, Greg, and McKerrow.

The presence of these men in the British Museum from necessity or choice or both made that library and the neighboring restaurants—especially during the summer migration from America—the best centre for Elizabethan studies in the world.

The subheadings in Wilson's article are suggestive, as they underline the necessity of documentary evidence in addition to the study of the book as a material object: 1) copyright and the relations between author, publisher, and bookseller; 2) the interpretation of imprints; 3) entry or non-entry in the Stationers' Register; 4) licensing; and 5) piracy. These are topics which pre-date the Bibliographical Society, and are still under discussion. Robin Myers in her paper “Stationers' Company Bibliographers: the first 150 years: Ames to Arber” in *Pioneers in Bibliography* (1988) demonstrates that bookmen had for a long time been making use of the Company's records. The foundation stone for the investigation of the collateral, archival evidence called for by F.P. Wilson, was laid by Edward Arber (1836–1912). He was never, apparently, a member of the Society, but his *Transcription of the Registers of the Company of Stationers of London 1554–1640*, (1875–1895), in Robin Myers' words “heralded the ‘new bibliography’ of Pollard, Greg, Plomer, and others by giving scholars access to a large enough amount of the early records to enable them to work at a distance from Stationers' Hall.” Where Arber had led into early records, the Society followed, with *Records of the Court of the Stationers' Company, 1576–1602*, edited by Greg and E. Boswell (1930); *Records of the Court 1602–1640*, edited by William A. Jackson (1957); *The Loan Book of the Stationers' Company...1592–1692*, edited by W. Craig Ferguson (1989); and, most recently, *Index to the Court Books...1679–1717*, edited by Alison Shell and Alison Emblow (2007). Graham Pollard proposed an edition of “Stationers' Liber A,” but neither he nor D. F. McKenzie who took up the task were able to complete it. A photographic facsimile, originally prepared for Pollard, provided me with the names of “Brothers” of the Company—aliens who were engaged in the importation of books—for work on the “Latin Trade.” “Liber A” remains in prospect for publication.

Greg's magnificent four-volume *Bibliography of the English Printed Drama to the Restoration* (1939–1959) was completed in the year of his death, and reprinted by the Society in 1962. A summation of Greg's unparalleled scholarship over a period of 60 years, it is also a sustained example of quasi-facsimile transcription at its most elaborate. Ending his contribution to *Studies in Retrospect*, Greg presciently named two American scholars, Fredson Bowers and Charlton Hinman as providers of valuable bibliographical analysis. Of these, Hinman had already

given in *The Library* of 1940 a foretaste of his monumental *The Printing and Proof-reading of the First Folio of Shakespeare* (1963); Bowers (Gold Medallist 1969) was a frequent contributor to *The Library* (and to his own *Studies in Bibliography*) and speaker before the Society. Despite his differences with Greg over bibliographical description, he cherished a hope of continuing Greg's *Bibliography* up to 1700.

Hinman's great work was able to distinguish several different compositors at work in Jaggard's shop on the First Folio. It is thus the only begetter of a school of compositor analysis, directed largely upon the drama of the period. Bibliographical research can establish the nature and reliability of the copy underlying a printed text, but it is less good at emending a corrupt text. Or it can point out that differing texts may be equally valid, representing different stages of an author's intentions. Thus the recent Oxford *Complete Works* of Shakespeare (1986), edited by Stanley Wells and Gary Taylor, prints two versions of *King Lear*; prints the Folio version of *Hamlet*, but has an addendum of two and a half pages from the Quarto version (which appeared in the poet's lifetime); publishes the Folio *Othello*, which is 160 lines longer than the Quarto of 1622; and several other plays have briefer additions at the end, which may be perfectly authentic Shakespeare—who was not around to decide which version should go down to posterity. As for the actors and producers, they will do what they have been doing ever since at least 1600—act and produce whichever version they prefer, or have time for.

There is an ironic footnote to F.P. Wilson's words (above) about the society of friends who met at the British Museum from necessity or choice. For it was there that Pollard and McKerrow met and discussed the impact of *An Enquiry into the Nature of Certain Nineteenth Century Pamphlets* (1934) by John Carter and Graham Pollard. The book implied that Thomas James Wise had forged and sold some of the most sought-after literary pamphlets. Wise (President 1922) was seen as the Society's principal expert in the nineteenth century, a period which the Society had perhaps neglected. It was felt that the novelty and standard of bibliographical scholarship merited Gold Medals. Perhaps Wise did too; they felt an affection for him. Both Pollard and Carter became Presidents (1960 and 1968) and Gold Medallists (1969 and 1975). When Wise died in 1937, his Ashley Library was sold to the British Museum for £66,000. That A.W. Pollard's affection for him would have survived the discovery that it contained 89 of the 206 leaves stolen from the British Museum, mostly from the Garrick collection of plays, is unlikely. The discovery of the thefts was made in the course of cataloging the Ashley Library by David Foxon (President 1980, Gold Medallist 1984), and was published by the Society in 1959 as *Thomas J. Wise and the Pre-Restoration Drama*. The subject of a Presidential Address by Simon Nowell-Smith (President 1962), himself a

bibliographer and collector in Wise's "period," was "T.J. Wise as Bibliographer." It seems that Wise himself did not give a Presidential Address. In 1983, Nicolas Barker (President 1983, Gold Medallist 1999) published, with John Collins, *A Sequel to An Enquiry*, which showed that Wise, had an accomplice in the creation and marketing of the forgeries, Harry Buxton Forman.

In 1943, the Society and the Pilgrim Trust were asked to support a union catalog of pre-1700 books in the Anglican cathedrals of England and Wales, and in 1944 the catalog's creator, Miss Margaret Hands, began work at Worcester. The optimism so often found at the beginning of such schemes, fuelled (if that is the right word) by a certain naivety about what work in cathedral libraries is like, led to a far greater time-span of work than had originally been envisaged; so that with the exhaustion of the Pilgrim Trust's original grant, and the retirement of Miss Hands upon marriage, led to the lapsing of the catalog. Nevertheless, the handwritten slips remained accessible in the North Library of the British Museum. Six libraries remained uncataloged, among them three of the largest. Mrs. McLeod (as Miss Hands had become) returned to catalog Carlisle. Several other factors combined to its revival and ultimate publication. One was the existence, (in the case of Durham), or foundation of universities in or near, cathedral cities. Another was a provision in the British Library Act for assistance to be given to cataloging projects outside the British Library. The *Cathedral Libraries Catalogue* was published by the Society and the British Library in three volumes from 1984 to 1998. The Editor-in-Chief was (appropriately) Dr. David Shaw of the University of Kent at Canterbury (President 2002). It was also fitting that a French specialist should edit a catalog, the bulk of which contained books printed on the Continent of Europe before 1701.

The Society displayed a related concern for lesser, parochial, libraries, in its publication in 2004 of Michael Perkin's *Directory of the Parochial Libraries of the Church of England and the Church in Wales*, itself deriving from *The Parochial Libraries of the Church of England*, edited in 1959 by N.R. Ker (Gold Medallist 1975).

The centenary in 1992 coincided with the achievement of the Society's longest and most arduous tasks, STC. It also saw the maturing, if not the final completion of the *Cathedral Libraries Catalogue*. Another publication, *The Bowyer Ledgers*, edited by Keith Maslen and John Lancaster, published in 1991 in collaboration with the Bibliographical Society of America, had its origins among the desiderata of Graham Pollard's presidency, while *John Dee's Library Catalogue* (1990), edited by Julian Roberts (President 1986) and Andrew G. Watson (Gold Medallist 2001) had a gestation period of a mere 15 or 16 years.

The increasing financial strain of producing and distributing bibliographical works of quality, sometimes requiring illustration, has led the Society into collaboration

(as in the case of *The Bowyer Ledgers*, above). Collaboration has already been noted with the British Library over *The Cathedral Libraries Catalogue*, and the British Library also appears in the imprint of two recent publications which are generously illustrated, *Eloquent Witnesses: Bookbindings and their History*, (2004) edited by Mirjam M. Foot (President 2000), and *The Earliest Books of Canterbury Cathedral: Manuscripts and Fragments to c. 1200* (2008) by Richard Gameson. The Society has just announced its support for another collaborative venture in "Watermarks in English Fifteenth-Century Books," a project with strong international links. The Society also supported the conference "Collecting Revolution: the Historical Importance of the Thomason Tracts" (2008) in which several members read papers.

There now exist a great many outlets, both national and regional, for bibliographical research beyond the Society. Some of these were noted in *The Book Encompassed*; others are the Book Trade History Group, of which the late Peter Isaac (President 1994) was a founder, and the annual conferences organized by Robin Myers (President 1996) and others, whose proceedings have appeared since 1981 as the Publishing Pathways series. Particularly significant are two series, the *Cambridge History of Libraries in Britain and Ireland* (three volumes, 2006) and the ongoing *Cambridge History of the Book in Britain* (1999–, of which seven volumes are promised). If a personal example is permissible here, my Presidential Addresses of 1987–1988 appeared, not over the Society's imprint, but as a chapter "The Latin Trade" in volume 4 (2002) of the *Cambridge History of the Book in Britain*.

As the very earliest publications suggest, there has always been a powerful international concern. In 2000 the Society published *A Dictionary of Members of the Dublin Book Trade 1550–1800* by Mary Pollard. An even wider international concern dominates the reviews, in the "Recent Periodicals and Books" and "Books Received" sections of *The Library*. The most recent Gold Medallist, Dennis Rhodes (2007), is best known for his work on Italian books. Other recent honorands have been Bernhard Fabian (1999, also the Honorary Secretary for Germany), and Henri-Jean Martin (1994). The influence of the latter on British bibliography has been profound. As D.F. McKenzie somewhat mischievously noted in his contribution to *The Book Encompassed*, "'The Book' has still a ring of an imported phrase"—as in "L'Apparition du livre" or, more widely, in "L'Histoire du livre." Imported abstraction or not, it is now canonized in the title of the Cambridge series, or as one of the Society's objectives in, for example, the Society's "Publications Policy" in *The Library* for March 2008.

I now turn to the other objectives of the Society, as set out at the beginning of this entry.

Membership. After the uncertainty of the earliest years, the membership grew steadily, until the Council decided that the roll of members should be limited, as far as Great

Britain was concerned, to 300. The number of American members was 62 by 1894, and an American Secretary, E. D. North, was appointed. The limit upon numbers was dropped by 1919, and none has since been imposed. The Annual Report for 2006–2007 gave a total of 885 members. "Academics" form a far higher proportion of the membership than they did a century ago. The somewhat elastic requirement that a new member should be proposed by an existing member has now been dropped in favor of a simple statement of bibliographical interests. The original subscription of "one guinea" (£1.05) has risen (2008) to £33 for U.K. members and \$65 for Americans. If the impression was given early of a "gentlemen's club" this was soon dispelled by the election of women members, as was fitting and, indeed, inevitable for a society so closely linked to the profession of librarianship. Nevertheless, the Society had to wait until 1996 for its first woman President, Robin Myers. Since then, there have been two women Presidents, Mirjam Foot in 2000 and Elisabeth Leedham-Green in 2006. Katharine F. Pantzer, principal editor of the revised STC, was awarded a Gold Medal in 1988.

The Society's Officers are, a President, elected for a term of two years, Vice-Presidents, an Honorary Secretary, an Honorary Treasurer, and an Honorary Editor of *The Library*. The governing body is an elected Council. Something of the spread of the Society's influence may be gathered from the existence, in addition to an Honorary Secretary and Treasurer for America, of Secretaries for Japan, Germany, and Australia.

Meetings. There are normally six meetings during the "winter" season, which have for some time been held at University College, London, though the custom of holding the Annual Meeting at various other historic libraries in London has grown up. A summer meeting is held at such a library outside London. Two of the sessional meetings are "named" meetings; the Graham Pollard Memorial Lecture, devoted, if possible to one of Pollard's interests, and the endowed Homee and Phiroze Randeria Lecture. The latter, devoted to bookbinding, is a recent and welcome development for a Society which has been presided over by such eminent scholars of bookbinding as H.M. Nixon (1972), A.R.A. Hobson (1977), and Mirjam M. Foot (2000).

"*The Library.*" *The Library* was begun by J.Y.W. (later Sir John) MacAlister in 1889. He was then Honorary Secretary of the Library Association, and the first three series were published independently of the Society, though members, particularly A.W. Pollard who helped edit it, contributed to it. The "official organs" of the Society were then the *Transactions* and the *News Sheet*. The two journals were amalgamated in 1920, so that the second series of the *Transactions* was also the fourth series of *The Library*. The latter has so flourished that it is now (from 2000) in its seventh series. It is now appears quarterly, and is published for the Society by the Oxford

University Press. As it is an "Oxford journal," the full text from its foundation is available online. The details of this, and of all other publications, appear regularly in *The Library*.

The Society's library. This is perhaps the least perfectly realized of the Society's objectives. It has had a number of locations of limited accessibility; the former Rooms of the British Academy in Burlington Gardens, University College, London, Stationers' Hall, and most recently in the Senate House Library of London University. Borrowing from here is not possible, though the contents are accessible online, through the University of London Research Library Services catalog.

The Gold Medal. An endowment for a Gold Medal for services to bibliography was offered by Eustace Bosanquet in 1929. The amount was then sufficient for the award of five medals, which were, as they still are, awarded on an international basis. A post-war increase in the price of gold, and a decrease in the value of the fund, made it necessary for the medal to be struck in silver-gilt. The award is made on the recommendation of a special subcommittee of Council. The recipients since 1929 are listed on the Society's Web site.

Grants and bursaries. The impetus to raise an endowment for such awards was a feature of the Centenary celebrations of 1992, and is principally due to Barry Bloomfield (President 1990). After his death in 2002, his widow made a gift from his estate to fund an award for study in his own fields of interest, connected with the India Office Library, and modern literary bibliography. Major awards of up to £2000 are made annually on the recommendation of a subcommittee of the Council, and are advertised in the national press. In addition to other "named" awards, the Society, benefiting (in common with the Bibliographical Society of America) from the will of Katharine F. Pantzer Jr., who died in 2005, can award a fellowship of up to £4000 and a scholarship of up to £1500, named after her. Details of the awards made appear in *The Library*.

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Bibliographical Society of America (BSA)

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Abstract

The Bibliographical Society of America (BSA) is the oldest scholarly society in North America dedicated to the study of books and manuscripts as physical objects. It was organized in 1904 and incorporated in 1927 with the principal objectives of promoting bibliographical research and issuing bibliographical publications. These objectives have been and continue to be accomplished through a broad array of activities, including meetings, lectures, and fellowship programs, as well as the publishing of books and the *Papers of the Bibliographical Society of America* [PBSA], North America's leading bibliographical journal. The society is open to all those interested in bibliographical problems and projects, and its membership includes bibliographers, librarians, professors, students, and collectors worldwide. Libraries are welcome as institutional members.

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The body of this entry has been adapted from the presidential address delivered at the 100th annual meeting of the Society, 23 January 2004, and subsequently published as: Mayo, H. The Bibliographical Society of America at 100: Past and Future. PBSA **2004**, 98 (4), 425–448. Used by permission of the Bibliographical Society of America.

FOUNDING AND OBJECTIVES

The BSA was founded on October 18, 1904. It was one of a number of scholarly and professional societies organized in the Anglo-American world during the late nineteenth and early twentieth centuries, including the American Library Association (1876), the Library Association, Great Britain (1877), the Edinburgh Bibliographical Society (1890), and the Bibliographical Society, London (1892). Organizations such as these served to create and reinforce professional identity; through meetings, publications, and correspondence they promoted scholarly

communication; and they sought to organize knowledge in their fields, as well as, in most cases, codifying standards of scholarly investigation and professional conduct. In the United States, the late nineteenth and early twentieth centuries saw a kind of knowledge explosion, with the founding of research universities, such as Johns Hopkins (1876) and University of Chicago (1890), as well as the transformation of older colleges, such as Harvard and Yale, into similar institutions. These developments were accompanied by the formation of research libraries and by increased publication in all disciplines. In an age when publication meant print, and there were no union catalogs, making this abundance of information accessible to those who needed it was a priority for librarians and for learned societies. At a time when the American Historical Association and similar organizations in other disciplines formed committees on bibliography, and the American Library Association discussed creating a Bibliography Section, it is not surprising that there should have been a move to form a Bibliographical Society, reflecting a view that bibliography was a discipline with its own techniques, standards, and contributions to be made.

It is impossible to discuss the founding and the history of the BSA without giving some attention to its predecessor, the Bibliographical Society of Chicago. The individuals who formed the Chicago society were for the most part the same ones who were responsible for organizing the BSA 5 years later. These men and women, representatives of institutions such as the John Crerar Library, the Newberry Library, the Chicago Public Library, and the University of Chicago Library, were conscious that they were forming an organization that would differ deliberately from library clubs and the American Library Association on the one hand, and from book collectors' clubs, such as the Grolier Club and the Caxton Club, on the other. At the organizational meeting of the Chicago

society, Aksel Josephson of the John Crerar Library, convenor and chair of the organizing committee, remarked:

The object—the sole object—of the society should be bibliographical study and research. Our work should cover the whole range of the history of the book—printing, illustration and binding, publishing and bookselling, history and management of libraries, and last, but not least, bibliography proper, the registry of printed books and the recording of their contents. We wish to enlist the interest and cooperation of the bibliographer and the librarian, of the student of literature and literary history, of the private collector, if he is willing to make his library available to students, and of the printer and bookseller for whom his trade is something more than a means of making money.^[2]

These objectives are remarkably similar to those that still inform the work and character of the BSA. From the beginning, the founders intended that the creation of the Bibliographical Society of Chicago should lead to the formation of an American Bibliographical Society, a topic proposed at their first meeting and often discussed thereafter. To that end, they held frequent meetings, both in Chicago and in conjunction with conventions of the American Library Association. They began a journal—four volumes of the *Year-book of the Bibliographical Society of Chicago* appeared between 1900 and 1903—and they published two small monographs, all in an effort to establish a record of professional activity and national visibility. With the formation of the BSA, the Chicago society transformed itself into a chapter of the BSA and continued to hold local meetings until in 1912 it voted to dissolve itself and transfer its assets to the national society.

ORGANIZATION

At its organizational meeting, the BSA adopted a constitution which stated that “The name of this society shall be the Bibliographical Society of America” and that “The object of the society shall be to promote bibliographical research and to issue bibliographical publications.”^[3] Officers were elected, including: William Coolidge Lane, Harvard University Library, President; Herbert Putnam, Librarian of Congress, First Vice President; Reuben Gold Thwaites, Wisconsin State Historical Society, Second Vice President; Charles Alexander Nelson, Columbia University Library, Secretary; and Carl B. Roden, Chicago Public Library, Treasurer. Wilberforce Eames was named librarian, and a council of five members was chosen. In 1938, the office of Librarian was discontinued, and the position of Permanent Secretary, subsequently called Executive Secretary, was created to handle the ongoing administration of the Society’s business. At present, the BSA is governed by an elected council consisting of the officers (President, Vice President, Secretary, and Treasurer) and 12 councillors.

MEETINGS

In its early years, the BSA held general meetings twice a year, often in conjunction with conferences of the American Library Association, the American Historical Association, or other similar organizations, e.g., the American Association for the Advancement of Science, the American Historical Association, or the American Association of Law Libraries. One result was that meetings took place in various parts of the country or occasionally in Canada. Between 1904 and the end of 1941, the Society met in more than 35 different American cities in 22 states, from coast to coast, and in Ottawa, Toronto, and Montreal, Canada. The practice of meeting exclusively in the Northeast originated during World War II, and since 1960 all the official, annual meetings of the Society have been held in New York City.

Joint meetings with other scholarly and professional societies and meetings in various places produced programs reflecting bibliographical topics of local interest or the interests of the partner organization. For example, the 1908 conference in Richmond, with the American Historical Association, offered several papers on the bibliography of publications from or about the Confederate States of America; the 1911 meeting in Pasadena, with the American Library Association, heard a presentation on the lost history of Father Kino; the 1922 meeting in Ann Arbor focused on the materials for American history in libraries of the Great Lakes region; and the New Haven meeting of 1931 dealt with topics related to Connecticut printing history and to Yale University. On other occasions, the Society identified themes reflecting its own interests and organized panels to discuss them: for example, “Bibliography Today: Where Do We Stand”? (1959), “Bibliography and the Collecting of Historical Materials” (1964), “Bibliographical Techniques in the Ancient World” (1965), “Bibliographical Needs and Problems of Collectors, Librarians, and Booksellers” (1966), “Prospects for an Eighteenth-Century STC” (1977), and “Techniques of Shared Cataloging” (1981). Since the 1970s, the program at the annual meeting has usually consisted of a single address by an invited speaker. Throughout the history of the Society most of the papers presented at its meetings have subsequently been published in the *Papers of the Bibliographical Society of America*.

During its early decades the BSA relied on frequent meetings, meetings in various parts of the country, and joint meetings with kindred learned and professional societies to provide interest, variety, and broad programming appeal. After the practice of meeting annually in New York City had become well established, the Society instituted a regional or joint meetings policy, intended to encourage other organizations and institutions to host bibliographical gatherings in other parts of the country. A number of such meetings were held in the 1908s. More recent examples include “The History of Libraries in the

United States" (Philadelphia, April 2002), and, celebrating the Society's centennial, "Roughing It: Printing and the Press in the West" (St. Louis, October 2004). The Bibliographical Society of America also underwrote invitational conferences on the *Bibliography of American Literature* (BAL) (1992), on "Book Catalogues" (1995), and on "Marks in Book" (1997), the proceedings of which were published as special issues of *PBSA*. Since 2000, the Society has sponsored lectures or paper sessions at conferences of the American Printing History Association (APHA) and the Society for the History of Authorship, Reading, and Publishing (SHARP), at pre-conferences of the Rare Books and Manuscripts Section (RBMS), and at the St. Louis Conference on Manuscript Studies.

FELLOWSHIPS AND PRIZES

The Bibliographical Society of America funds several programs intended to promote bibliographical scholarship. A number of short-term fellowships of 1 or 2 months are awarded annually to support investigations of bibliographical topics, as well as research into the history of the book trades and publishing history. Eligible topics are defined as those concentrating on books and documents in any field, but focusing on the book or manuscript (the physical object) as historical evidence. The New Scholars Program funds early-career scholars who have been invited to deliver papers on bibliographical subjects at a forum immediately preceding the BSA annual meeting. The Society also awards three prizes: The William L. Mitchell Prize for Bibliography or Documentary Work on Early British Periodicals or Newspapers, the Justin G. Schiller Prize for Bibliographical Work on Pre-Twentieth-Century Children's Books, and the St. Louis Mercantile Library Prize in American Bibliography.

PUBLICATIONS

The publications sponsored by the Society include a periodical, monographs, and electronic publications. Funding for this activity central to the Society's mission has come primarily from endowed funds derived from bequests from George Watson Cole and Lathrop C. Harper, supplemented by grant funding in the case of some larger projects.

Periodical Publications

The publication of a bibliographical periodical was discussed at the founding meeting of the Society and recommended at the very first meeting of the Council. The journal itself came into being in 1906. The first number, printed in April 1906, was denominated *Bibliographical Society of America Proceedings and Papers Volume*

One Part One 1904–1905. The second number, *Volume One, Part Two* was printed in 1907 and covered the years 1906–1907. Also in 1907, the Society began publishing *The Bulletin of the Bibliographical Society of America*, which included proceedings of the Society's meetings, news, and notes, and listings of American bibliographical publications. After 1912, the *Bulletin* was discontinued and its contents were merged into the journal, which, starting with volume 4 (1909), was entitled *Papers of the Bibliographical Society of America*. Volume 100 of the *Papers* appeared in 2006. The objectives of the Society's periodical publications were well expressed by William Coolidge Lane, its first president, in the first issue of the *Bulletin*:

With this first number of a Bulletin, the BSA begins in a humble way the issue of a quarterly record of American bibliography. Whether it will prove useful, whether it is to succeed in bringing together the material it seeks, what it may eventually become, are all questions for the future. . . . Without constant help from a wide circle of correspondents, the Editors cannot make this bulletin what they wish it to be—a record of current bibliographical work in America, such a record as will be of value to all book lovers, book collectors, book workers, and book purveyors (librarians). . . . Any serious bibliographical work undertaken in America, as well as any such work relating to America undertaken abroad, is included in its scope. . . . The greater part of the titles recorded in this Bulletin will be of special bibliographies of various kinds, but works on the science and art of bibliography, works on manuscripts and public archives, accounts of library collections, both public and private, and the more important library catalogs, and contributions to the history of printing and book-selling will all find a place here.^[4]

This breadth of scope and purpose still characterize *PBSA*, which has published articles relating to all branches of bibliography and what is now called book history. In the words of the current guidelines for contributors,

Contributions to the *Papers* may deal with books and manuscripts in any field, but should involve consideration of the book or manuscript (the physical object) as historical evidence, whether for establishing a text or illuminating the history of book production, publication, distribution, or collection, or for other purposes. Studies of the printing, publishing, and allied trades are also welcome.^[5]

Between 1926 and 1951 the Society also published, at irregular intervals, 71 numbers of a *News Sheet* which printed announcements of and reports of meetings, lists of new members, notes and queries, and notices of bibliographical works published or in preparation. Lists of members were published at irregular intervals from 1905 to 1979, and yearly since 1982. From 1981 through 2006, the business documents of the Society, that is, the minutes of annual meetings and the annual auditor's reports, were

published in *PBSA*. Since 2007, these records have been printed in the annual list of members. Other business and administrative records exist in the Society's archives, formerly kept at the American Antiquarian Society and now hosted by the Grolier Club of New York City.

Monograph Publications

A complete list of the thirty-seven monographs published to date by the BSA may be found on the Society's Web site (<http://www.bibsocamer.org>). The Society's monograph publishing program was inaugurated in 1919 with the publication of the first *Census of Fifteenth-Century Books Owned in America*, edited by George Parker Winship. The second *Census of Incunabula in American Libraries* appeared in 1940, edited by Margaret B. Stillwell; the third *Census*, edited by Frederick R. Goff, in 1964; and a supplement to the third census in 1972. In 1980, the BSA granted permission to the British Library to keyboard the contents of Goff as the basis on which that library would develop its Incunabula Short-Title Catalogue, an electronic catalog that is now the most comprehensive listing of incunable editions and locations of copies. Other significant contributions to incunable studies have appeared as articles in *PBSA*.

Second in the series of the Society's monograph publications was the continuation in 1927, and the eventual completion in 1936 of Joseph Sabin's *Bibliotheca Americana: A Dictionary of Books Relating to America*. Work on this monumental compilation was first interrupted in 1881, with the death of Sabin himself. It was then taken up by Wilberforce Eames, who between 1884 and 1892 brought the alphabet from "Pennsylvania" to "Smith." After that, the project lapsed again until the mid-1920s, when the BSA, with funding from the Carnegie Corp., took on responsibility for the work. Between 1927 and 1929 parts 117–121 were completed under the supervision of Eames himself, and the remaining parts, through 172 and the end of the alphabet, were edited by R. W. G. Vail. The completion of Sabin's work was followed by the publication of a series of bibliographies of early American printing organized by state: Albert H. Allen, ed., *Arkansas Imprints, 1821–1876* (1947); Albert H. Allen, ed., *Dakota Imprints, 1858–1889* (1947); John Eliot Alden, ed., *Rhode Island Imprints, 1727–1800* (1949); and Lester Hargrett, *Oklahoma Imprints, 1835–1890* (1951). These grew out of the WPA-funded American Imprints Project of the Depression era, and were taken over by the Society after the death in 1944 of Douglas McMurtrie, who had been the director of that project. Other monographs in the area of American bibliography have included *A Bibliography of Oliver Wendell Holmes*, by Thomas F. Currier and Eleanor M. Tilton (1953); Roger P. Bristol's *Supplement to Charles Evans' American Bibliography* (1970); and Hazel A. Johnston's *Checklist of New London, Connecticut, Imprints, 1709–1800* (1978).

The Bibliographical Society of America's most significant contribution in the area of Americana has been the *Bibliography of American Literature [BAL]* published in nine volumes between 1955 and 1991. Begun by Jacob Blanck, who edited volumes 1–6, and completed after by Blanck's death by Michael Winship, the project was supported by funding from J. K. Lilly and the National Endowment for the Humanities. A comprehensive bibliography of the first editions of selected American literary authors, *BAL* pioneered in applying modern bibliographical principles and techniques to the study of nineteenth-century books and showed how analysis of their physical characteristics could help elucidate nineteenth-century printing and publishing history.^[6] In 1997, a digitized version of *BAL* was made available on CD-ROM or by subscription on the Web.

Some other areas represented in monographs published by the BSA are dictionaries of the book trades: C. Paul Christianson, *A Directory of London Stationers and Book Artisans 1300–1500* (1990); Sidney F. Huttner and Elizabeth S. Huttner, *A Register of Artists, Engravers, Booksellers, Bookbinders, Printers and Publishers in New York City, 1821–42* (1993); and editions of sources for printing and publishing history: Warren S. Tryon and William Charvat, eds., *The Cost Books of Ticknor and Fields* (1949), and K. I. D. Maslen and John Lancaster, eds., *The Bowyer Ledgers: The Printing Accounts of William Bowyer Father and Son Reproduced on Microfiche, with a Checklist of Bowyer Printing 1699–1977* (published jointly with the Bibliographical Society, London, 1991). Recent contributions have included titles as varied as: Kenneth E. Carpenter, *The Dissemination of "The Wealth of Nations" in French and in France 1776–1843* (2002); Brian Alderson and Felix de Marez Oyens, *Be Merry and Wise: Origins of Children's Book Publishing in England 1650–1850* (copublished with the Pierpont Morgan Library and the British Library, 2006); Milton McC. Gatch, *The Library of Leander van Ess and the Earliest American Collections of Reformation Pamphlets* (2007); and Andrea Krupp, *Bookcloth in England and America, 1823–50* (2008).

Electronic Publications

Since 2003, the Society has maintained Bibsite, a portion of its Web site that "functions as a service to bibliographers by offering a means for scholars to provide public access to accumulated bibliographical research material that may be useful to other researchers."^[7] Materials posted include supplements to published bibliographies, as well as tables of statistics, databases of images, and bibliographical listings deemed more suitable for online than for print publication. In other areas of electronic publication, the BSA has made the full text of the *Papers* available through ProQuest and is exploring the possibility of reissuing its back list of monographs as e-books.

From the date of its founding, the BSA's reason for existence has been to promote bibliographical research and to issue bibliographical publications. The Society has never promulgated a definition of bibliography, nor attempted to choose among the several applications of that term. Rather, the topics of research encouraged by the BSA and represented in its publications have included examples of every kind of bibliographical activity, as well as studies that build on bibliographical evidence to explore the context, whether literary or historical, in which books were produced and used. It expects to continue to promote, in whatever medium, work that will demonstrate the value of material evidence for the study of books and book history.

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Bibliography

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Abstract

The basic families of bibliography are distinguished, followed by an overview of the history of bibliography. Major works in the world of bibliography are cited in their contexts. The practices of assembling and searching bibliographical lists are summarized, and the last section, which focuses on physical bibliography, surveys the study of books as artifactual evidence.

BIBLIOGRAPHY IN GENERAL

Bibliography cites and studies books. The citing and compiling of citations into lists (i.e., bibliographies) are *reference* (or *enumerative*, or *systematic*) bibliography, the studies of printed artifacts are *physical* bibliography. The two activities go together.

Books, narrowly defined, are monographs printed on paper. There are millions of them, their numbers are growing, and they are much used. Books may also be defined broadly, to include other forms of written records: pamphlets, journals and their contents, maps, music, manuscripts, pictures, recordings, movies, texts of all kinds, tangible objects, online, or conceptual. Books are physical objects that exist because of their ideas. They are content as well as form, messages as well as media. The content can significantly determine the makeup and appearance of the object that readers are aware of. In turn, the object affects the way readers view the content. Bibliography deals with the content by citing and studying the physical sources. By specifying the physical evidence it locates the content; by suggesting the context of the evidence it reflects on the authority of the content.

Bibliography addresses the needs of readers by describing and prescribing. (Patrick Wilson's *Two Kinds of Power* explores the distinction.) Readers, however, still enjoy the freedom to use the citations as they please, selecting what they want, ignoring what they think they do not need, and reading into their selections whatever they wish. Bibliographical work is still validated by responsible citation and study of the written record, as informed by respect for readers and their intellectual freedom. The written record is implicitly historical: it deals with writings that now exist; it is also political in that it is designed for future use by readers.

Bibliographical citations are also transmitted informally and implicitly. They are passed on orally: indeed, personal communication is probably the most powerful but also the least controllable and measurable medium of

bibliography. The bedrock, however, is the citation, on paper or online, ideally formulated to be concise but sufficient, and based in physical evidence.

THE HISTORY OF BIBLIOGRAPHY

The Origins of Bibliography

The story of bibliography begins not in the West with Gutenberg's invention of printing around 1450. From the ancient Near East, three millennia earlier, archival inventories survive on cuneiform tablets. Early Egyptian lists are known about as well. The first famous bibliography is the *Pinakes* ("tablets"), conceived in the fourth century B.C.E. at the great library at Alexandria, which may have included the library of Aristotle, the mentor of Alexander the Great. Its contents were thought of less as an archive than as literature, and thus they were organized by the names of authors. The tablets disappeared when the library was destroyed, but later sources testify to their use for over a millennium as references to the known and lost writings of classical civilization.

Other bibliographies served other purposes. The Greek physician Galen (A.D. 129–199) prepared a list of his authentic works to help distinguish them from other works falsely attributed to him. In his *Retractiones* (A.D. 427), an aging St. Augustine cited his earlier writings in order to revisit them. The Venerable Bede concludes his ecclesiastical history (ca. 734) with a list of several dozen brief titles of his sources, beginning with books of the Bible, and ending with his other writings. In the book world around 985, probably in Baghdad, Muhammad ibn Abi Ya'qub Ishaq al-Nadim prepared a vast index, the *Fihrist al-'Ulum*, and cites writings that can often be traced back to the *Pinakes*.

One landmark above all was to affect all later bibliographical practice: St. Jerome's bio-bibliography (ca. 392) of writings by 135 authors, mostly Church Fathers, now

known as *De viris illustribus*. Jerome's goal was to justify his choice of sources so as to argue for the authority of his "Vulgate" Bible. His list, and its two notable supplements, by Gennadius of Marseilles, ca. 490, with 91 added names, and Isidore of Seville, ca. 620, with 33 more, were to inform Biblical exegesis over the following centuries. Several earlier bibliographical sources, like the *Pinakes*, were also author lists, but with Jerome the names of the authors invited readers to honor their names by critically evaluating their work.

Newly founded libraries often listed their holdings, which grew from a dozen or so volumes in the early Christian era to hundreds in the late middle ages. Citation practices were casual, and bibliography, inventory, and catalog were the same. In fact, the holdings were usually better recorded in the memories of readers. A famous catalog-poem of Alcuin (ca. 735–804), for instance, recites the holdings of his library at York in a mnemonic sequence that identifies the relative location of volumes on the shelf. From the fifteenth century also come several union lists of the manuscripts in Dutch and English libraries. The latter are valuable evidence of early holdings that predate the confiscations of Henry VIII.

The Rise of Modern Bibliography

The spread of printing after 1450 introduces a modern era in bibliography. If books were to circulate and flourish commercially, more was needed than word-of-mouth promotion. As the output of the press grew, the bibliographical record expanded, both in numbers and in kinds, for use by readers and purchasers, authors and printers, merchants and rulers. The lists generally fall into four bibliographical genres: commercial booktrade lists (booktrade bibliographies, publishers' and booksellers' catalogs), topical lists (subject bibliographies), advisory lists (bibliographies of prohibited or recommended writings, whether of political, religious, or social grounds), and catalogs of collections. The four categories overlap, perhaps not always in the minds of their original compilers or in the special interests of their sponsors, but as they were used in their day and over the course of history.

Commercial Lists: The very first printed list (ca. 1469) was a broadside issued by Peter Schoeffer, Gutenberg's successor, who sensed the value of listing the titles he had printed. As the book trade emerged, titles were promoted through catalogs. Beginning in 1564, citations of the titles from many publishers, exhibited at the semi-annual Easter and Michémas book fairs in Leipzig and Frankfurt, were collected and issued in lists known as *Messkataloge*. In time, these trade lists were to expand to become current national bibliographies of German books. The *Messkataloge* were succeeded by several extensive periodical lists: Wilhelm Heinsius's *Allgemeines Bücher-Lexikon* (1812–1894), Christian Gottlob Kayser's *Vollständiges Bücher-Lexikon* (1834–1912), *Hinrichs'*

Katalog (1857–1913), and others leading up to today's *Deutsche Nationalbibliographie* (begun 1921).

Trade lists were needed because the German book trade, like the country itself, was decentralized: publishers needed to share their markets. In other countries, where the trade was centered in one city (like Paris or London), current lists emerged later, but still on the initiative of the booktrade. Most lists were not so much national as cultural resources: in a time when Latin was giving way to local vernaculars, the language of potential purchasers was primary. The Netherlands book trade lists (Johannes van Abkoude's *Naamregister van de bekendste en meest ongebruik zynde Nederduitsche boeken*, begun in 1788, later replaced *Brinkman's Cumulative catalogus van boeken*) have enjoyed an especially long life. In Great Britain, no continuing lists date from the eighteenth century. Only in the mid-nineteenth were two competing firms to emerge to share the market: Samson & Low (*Publisher's Circular and Publisher and Bookseller*, begun in 1837) and Whitaker (*The Bookseller and Current Literature*, begun in 1858). The Norwegian *Norsk bogfortegnelse* dates from 1848, the Danish *Dansk bogfortegnelse* from 1851, the Swedish *Svensk bokhandels-tidning* from 1863. For the Russian booktrade, the St. Petersburg firm of A. F. Bazunov prepared a *Sistematicheskii katalog* beginning in 1869. A *Bibliographie de Belgique* was begun in 1875, with extensive overlap with the Brinkman lists from the Netherlands, since Flemish publishers in both countries shared their market. In the United States, the major early trade lists were the work of Orville A. Roorbach (*Bibliotheca americana*, 1852–1861) and James Kelly (*American Catalogue of Books*, 1866–1871). A continuing succession of American trade lists began with Frederick Leypoldt (later R.R. Bowker; *American Catalogue of Books*, begun 1876) and H.W. Wilson (*United States Catalog; with Cumulative Book Index*, begun 1898).

Over time, governments replaced the booktrade in sponsoring the national bibliography. The readership was now a civil polity rather than the booktrade's customers. The most famous example was the *Bibliographie de la France* (begun in 1811), long encumbered by the arbitrary decisions of functioning bureaucracies. Booksellers and readers thus often preferred booktrade lists like Otto Lorenz's *Catalogue général de la librairie française* (1867–1945), or later lists known as *Biblio* (now subsumed in a separate section of the *Bibliographie nationale française*). Other governments assumed responsibility for listings their country's publishing output, if often selectively. The most spectacular saga of a national bibliography is that of the Russian *Knizhnaia Letopis'*, begun in 1907 and issued continuously with few delays through a century of revolutions, invasions, and other tortuous events.

Topical Lists: Other early printed subject bibliographies cover medicine (Symphorien Champier's *Index*, 1506), law (Giovanni Nevizzano's *Inventarium*, 1522),

botany (Otto Brunfels' *Herbarum*, 1530), and many other subjects. These are landmarks in the history of the disciplines, but mostly for the intellectually curious. They deal with concepts and theories; the skills were to be learned not by reading books but through instruction and apprenticeship under master practitioners. The age of modern subject bibliography began with eighteenth century academic scholarship.

The most common subject lists were the early bibliographical *Acta*, lists in the spirit of St. Jerome that record the good deeds, not of the apostles of the church but of the apostles of learning, but still for critical study and veneration. The order was by authors' names, listed alphabetically or occasionally chronologically, rather than by subject subdivisions. Notable early lists are devoted to religious orders, beginning with Johannes Trithemius's *Carmelitiana bibliotheca* (1493). Later major works include Lucas Wadding's Franciscan *Scriptores ordinis minorvm* (1650) and Jacques Quétif's Dominican *Scriptores ordinis praedicatorum recensiti* (1719–1721), each of them later revised. The greatest of the genre is Augustin and Alois de Backer's vast *Bibliothèque des écrivains de la Compagnie de Jésus* (1835–1861, later revised by Carlos Sommervogel), still used to locate the early writings on the expansion of European settlement around the world from the vantage of the Jesuit missionaries who worked to convert the indigenous populations to Christianity.

Several early *Acta* celebrate the emerging national literatures. The compilers defined the criteria for inclusion; here again, the dividing lines were linguistic more often than political, since many national boundaries were not yet fixed. John Bale's *Illustrium maioris Britanniae scriptorum* (1548), for instance, follows a chronology that begins with the Biblical Seth (!) and ends up with Bale himself. Italian literature is covered in *La libreria* (1550) and *La seconda libreria* (1551), by Anton Francesco Doni, with the brief entries and quirky coverage that one would expect of this famously erratic poet. French bibliography begins with the *Premier volume de la Bibliothèque* of François Grudé de la Croix du Maine (1584) and its competitor, *La Bibliothèque* of Antoine du Verdier (1585). Each has titles the other missed. Other early *Acta* celebrate the hero-authors of regions and cities, among them Michele Poccianti's *Catalogvs scriptorum florentinorum* (1589) for Florence, Leone Allacci's *Apes Vrbanae* for Rome (1633), Louis Jacob de St. Charles' *Bibliographia Parisina* (1643, complemented by a *Bibliographia gallica*, 1651, for the rest of France), and for Oxford, Anthony à Wood's *Athenae Oxoniensis* (1691–92ff.).

Bibliographies before the nineteenth century were rarely devoted to individual authors, the famous exception being Erasmus's autobibliography at the end of his 1523 *Lucubrationum*, a forerunner of the lists that academics today prepare in applying for grants and promotion.

Lists of Recommended and Forbidden Books: The flood of printing in general, but Reformation and later the

Counter-Reformation religious tracts in particular, called for bibliographies of opposite kinds. Books recommended for the faithful have their model in the *Bibliotheca selecta* (1574) of the learned Jesuit Antonio Possevino (1534–1611). Faithful readers are not always easy to separate from eager or busy readers, whose needs were served by a vast array of recommended books, advisory and critical reading lists, and bibliographical "epitomes." The genre merges with prose works like Helen Haines *Living with Books* (1935 and 1950), long a mainstay of library school classes in book selection. All such works beg the criteria for inclusion and exclusion and ultimately the cause of intellectual freedom: readers are grateful for guidance, but they need to ask where it is coming from. The classic framing of the problem is in Lester Asheim's two famous essays, "Not Censorship but Selection," *Wilson Library Bulletin*, 28 (1953), 63–67, and "Selection and Censorship: A Re-appraisal," *Wilson Library Bulletin*, 58 (1983), 180–184.

More famous are the bibliographies of the opposite kind: ones that ban books. The famous example is the *Index librorum prohibitorum* of the Roman Catholic Church, begun in 1564, as fearful in its consequences as it was absurd in its execution. The set went through many editions before it was finally abolished in 1966. Listing the forbidden fruit in bibliographical citations was not a wise decision: forbidden fruit is always tastier. Political censors, in contrast, rarely publicized the apostates, preferring instead to destroy the copies and often their authors. This has left modern bibliographers with the hunt for Marprelate tracts and Mazarinades, pamphlets of the English Civil War and the American and French Revolution, booklets, diatribes, and broadsides, all of it crucial historical evidence for the study of the intellectual roots of political, social, and cultural change. The bibliography of pornography is still different. Sexually explicit material had been collected avidly, less by institutions than by a small and secretive world of private collectors, in which written citations are often privileged; and tastes in erotica have often been subjectively redefined. The genres of literature suppressed on sexual, social, political, and religious grounds is surveyed in the *Banned Books* series (1998; new eds., 2006).

Library Catalogs: The genre begins with the *Catalogus Graecorum librorum* (1575), covering 126 Greek manuscripts in the city library of Augsburg. The manuscripts had been presented to the city by the patrician Johann Jakob Fugger, and Hieronymus Wolf, his librarian, had prepared this catalog. A difference between public and private libraries then was irrelevant. Other notable early library catalogs include the *Ecloga Oxonio-Cantabrigiensis* (1600), a union list of the manuscripts in Oxford and Cambridge libraries compiled by Thomas James, who also prepared the first catalog of the Bodleian library (1605). In the third Bodleian catalog (1674), the librarian, Thomas Hyde, first suggested the need for consistency, anticipating the need for cataloging codes.

Over the nineteenth and twentieth centuries, many libraries published catalogs of their holdings. Among the great early American catalogs were those of the Astor Library in New York (1886–1888), and Charles Ammi Cutter's for the Boston Athenaeum (1874–1882). Also much respected are the catalogs of the two greatest libraries of Europe, the Bibliothèque Nationale in Paris (*Catalogue général*, 1900–1981), and the British Museum in London (1900–1905 and earlier, 1931–1954, and 1968–1979, superseded by the *British Library General Catalogue of Printed Books to 1975*, 1979–1987). The Library of Congress complemented them with its *Catalog of Books Represented by . . . Printed Cards* (1942–1946).

Universal Bibliography: The dream of one single bibliography, vast, comprehensive, and sufficient, is timeless. The first printed bibliography, Johann Trithemius's *Liber de scriptoribus ecclesiasticis* (1494), actually covers more than the writings of ecclesiastics: it nobly assumes nothing less than that all writings are the work of God, a vision of the wondrous totality of the intellectual universe. In truth, Trithemius's work is based mostly on the books in his monastery library at Sponheim. His work is still modest alongside Conrad Gessner's *Bibliotheca universalis* (1545–1555). Trithemius (1452–1516) was a learned scholar who looked inward (his best known other work is in cryptography), Gessner (1516–1565) was a brilliant polymath who looked outward to new fields involving the world at large, from natural history and geology to linguistics (in all of which fields he was historically important). Gessner's curiosity led him to end his work with a fourth volume, the famous "pandects," which provided subject access to the earlier volumes. Inevitably, his successors were lesser minds, who created selective abridgements of his work with shortened citations. Among Gessner's ambitious but sad successors is Francesco Marucelli (1625–1703), who copied out 111 volumes of citations to create his *Mare magnum*, a great bibliographical ocean still preserved but largely inaccessible in his Bibliotheca Marucelliana in Florence. Several other works have a national spin in their titles, although their purpose was not to record the nation's publications but to cite writings that were part of the national heritage, published anywhere: Christophorus Hendreich's *Pandectae Brandenburgicae* (1699; only A–B were completed) and Robert Watt's *Bibliotheca Britannica* (1824) come to mind. In the twentieth century, the world visions have been revived and begun to be implemented in the name of Universal Bibliographical Control.

Three Later Developments

Over the course of the nineteenth century, three innovations were to alter the world of bibliography profoundly: cataloging codes for libraries, serial lists of current writings, and the formal study of books as physical objects. All had precedents in earlier periods. All were justified by

emerging readerships in the new democratic societies; by a burgeoning book production made possible because of the readers as well as the Industrial Revolution; and by a proliferation of subject specialties that resulted from and in turn fostered to the new agenda of academic scholarship.

Library Cataloging Codes: (See *Cataloging*.) As libraries were established—in particular the publicly financed ones beginning in the nineteenth century, where costs needed to be measured—rules and uniform citation practices began to be developed. The goal was to provide for sharing bibliographical citation practices, and in time citations themselves, based on practices of compiling lists. Compilers of bibliographies were in turn influenced by cataloging codes, whose citations were easy to adapt and whose arbitrary practices saved the compilers many decisions.

The difference between cataloging and bibliography has been often proposed and continuously redefined over the years, and a firm relationship probably should not be fixed. The two obviously have much in common, not only in the material they describe but often also in the ways they describe it. They are still different in their objectives. Cataloging describes copies for all readers, bibliographies cover delimited literatures, and serve the needs of identified audiences of readers. Many writings have long fallen outside the scope of cataloging practices—periodical articles and many other analytics among them—and often particular communities of readers make best use of citations formulated with the familiar terms they use and in the structures they know. Ideally, cataloging data are based on autopsy of copies, but the content is frequently verified in bibliographies. Bibliographers too are expected to have examined the copies they cite, but today they are greatly helped by the way catalogs provide not only locations but also citations to adapt.

Serial Bibliographies of New Writings: Scholarly journals arose with the learned societies of the late seventeenth century, along with a few short-lived bibliographies. The *Acta* were still sufficient, especially with supplements. One of the most famous of them, Christian Gottlieb Jöcher's *Allgemeines Gelehrten-Lexikon* (1750–1751), for instance, had a supplement as late as 1897. A changing academia led to lists like Jeremias Reuss's *Repertorium commentationum a societatibus litterariis editarum* (1801–1821). Periodicals of all kinds called for indexing, but the indexes were particularly important to the proliferating fields of scholarship. Slowly the biographical focus gives way to subject classification, in the interests of providing a current awareness service to the growing scientific communities. Detailed indexes were needed in fields that were evolving, and occasional annotation of the entries in time led to today's abstracting services.

Periodical indexes for general libraries began with William F. Poole's *Index to Periodical Literature* (1853, new ed., 1891 with suppl. to 1907). In 1905, H.W. Wilson

began his indexes, beginning with the *Readers' Guide to Periodical Literature* (1905). The largest foreign counterpart is the *Bibliographie der deutschen Zeitschriften-literatur* (1896–1964) and counterpart *Bibliographie der fremdsprachigen Zeitschriften-literatur* (1911–1994),

Physical Bibliography: The study of books as physical objects has its roots in the work of the early printers and book craftsmen, who asked how they could make their books more attractive and easier to produce. Discerning collectors, antiquarian dealers, librarians, and inquisitive readers in time came to ask the same questions, particularly over the course of the nineteenth century. A crucial figure was the Cambridge University librarian Henry Bradshaw (1831–1886), who proposed a “natural history method” for studying the changing output of the early printers and rationalized the collational formulas that are the basis of descriptive bibliography. The founding of bibliographical societies around the turn of the century served to establish the new field, thanks in part to their journals and other publications. [See Bibliographical Society (London); Bibliographical Society of America. Their scholarship is discussed in the Section “Physical Bibliography”.]

THE WORLD OF BIBLIOGRAPHIES

Today's wealth of enumerative bibliographies ranges separate monographs in book form, often in multivolume sets, to pamphlets, articles, and handouts. Many lists are also now being posted online, where they can be easily updated, but also silently reconceived, renamed, or even deleted.

National Imprint Bibliographies: Retrospective

Most retrospective lists are censuses of known copies, but a few cite unrecorded the titles of works now lost. The bibliographies fit along an axis of place (whether defined by geographical borders, by language, or by the effective market for the book trade) and time (from the earliest imprints to the present). The genres and their contexts are detailed in Friedrich Domay's *Bibliographie der nationalen Bibliographien* (1987).

United States: Annals for the Colonial and early Federal years are recorded in Charles Evans's *American Bibliography* (1903–1959) and extended by Ralph R. Shaw and Richard H. Shoemaker in *American Bibliography* (1958–1963) and the *Checklist of American Imprints*, so far through 1846 (1964). The online *North American Imprints Project* will subsume the extant entries, minus Evans' chronicle of the press. The *Bibliography of American Imprints to 1901* (1993) is particularly strong for the early years, thanks to recent cataloging at the American Antiquarian Society.

Great Britain: The landmarks are the *Short-Title Catalogue... 1475–1640* (1926; 2nd Ed., 1976–1991, commonly called either “STC” or “Pollard and Redgrave,” for the guiding spirits behind the 1926 Ed.), and Donald M. Wing's *Short-Title Catalogue of Books... 1641–1700* (1945–1951; 2nd Ed., 1972–1998). These are now incorporated into the online *English Short-Title Catalogue*, which also subsumes the *Eighteenth Century Short Title Catalogue*, an ambitious online descriptive bibliography project. *The Nineteenth Century Short-Title Catalogue* (1984), in contrast, covers a considerably larger literature mostly by merging the card catalogs of several major British scholarly libraries. For the general literature of the later years and up to the highly selective *British National Bibliography* in 1950, booktrade lists are needed, along with the British Museum and other library catalogs. For regional writings, Harry G. Aldis's *List of Books printed in Scotland before 1700* (1916 and 1970) has brief citations, while Eiluned Rees's *Librae Walliae* (1987) cites Welsh books, 1546–1820, in fine detail.

Romance-Language Nations: No single French list covers the years before the *Bibliographie de la France* (1811) and its booktrade counterparts. Probably the most useful is still Alexandre Cioranescu's *Bibliographie de la littérature française du 16. [17 and 18.] siècle* (1959–1969). Italy similarly has no single sources, although the sixteenth century is being covered by the online “EDIT16” (*Censimento nazionale delle edizioni italiane del XVI secolo*), while the nineteenth is the basis for *CLIO: Catalogo dei libri italiani dell'Ottocento* (1991). For these and other areas, the British Museum—long seen as having the world's second-best collection of everything—prepared short-title catalogs for its holdings. That for France, 1470–1600, was the work of Henry Thomas (1924 and 1986), that for Italy the work of A.F. Johnson and others (1958), extended in Dennis E. Rhodes's *Short-Title Catalogue of Seventeenth-Century Italian Books* (1986).

Sketchy book-trade bibliographies cover Spain and Portugal, often their New World colonies. The basic historical work is Antonio Palau y Dulcet's vast and conspicuously stenographic *Manual del librero hispano-americano* (1948–1977). The heroic bibliographer of Latin America is José Toribio Medina. His *Biblioteca hispano-americana* (1898–1907) is useful, but the most impressive of his many works is the eight volume *La Imprenta in Mexico, 1539–1821* (1908–1912; the first volume, based on work by Joaquín García Icazbalceta, revised 1954, 1981). Medina also compiled lists for many other countries. His work is complemented by the work of other historical bibliographers, notably covering Cuba (Carlos Manuel Trelles y Govín, 1902–1926) and Haiti (Max Bissainthe, 1951 and 1973). There are also British Museum short-title catalogs by Henry Thomas, of Spanish (1921), and Portuguese books (1926) with a 2nd Ed., by Dennis E. Rhodes (1989, some with revised editions).

Germany and Adjacent Areas: The Leipzig and Frankfurt booktrade lists extended to cover much of the output of the German-speaking world, i.e., Austria, parts of Switzerland and of what now are many other central European nations. The two enormous "GV" sets (*Gesamtverzeichnis der deutschsprachigen Schrifttums, 1700–1910* and *1911–1965*) interfile the entries from the earlier lists of Heinsius, Kayser, Hinrichs, their successors, and supplements. The earlier periods are covered in the "VD" series: the *Verzeichnis der im deutschen Sprachbereich erschienenen Drucke des XVI. Jahrhunderts* (1983) and the online *Verzeichnis... des XVII. Jahrhunderts*. A.F. Johnson listed the British Museum's German books, 1455–1600 (1962); David A. Paisey prepared a supplement (1990), and a list for the years 1601–1700 (1994).

For the Low Countries, Wouter Nijhoff & M.E. Kronenberg's *Nederlandsche bibliographie* (1923–1961) covers the years 1500–1540. Later holdings in Belgian libraries are listed in Elly Cockx-Indestège and Geneviève Glorieux, *Belgica typographica, 1541–1600* (1968). A.F. Johnson and Victor Scholderer prepared a British Museum *Short-Title Catalogue of Books Printed in the Netherlands and of Dutch and Flemish Books Printed in Other Countries from 1470 to 1600* (1965), which was extended to 1620 by Anna E. C. Simoni (1990).

For Swedish imprints, Isak Collijn's *Sveriges bibliografi* covers the years to 1600 (1927–1938) and later (1942–1946), which Rolf du Rietz is extending in *Swedish Imprints, 1731–1833* (1977). For Denmark, Christian Walther Bruun's *Bibliotheca danica, 1482 til 1830* (1877–1931), was extended to cover the years 1831–1840 by H. Ehrencron-Müller (1943–1948). For Norway, Hjalmar Pettersen's *Bibliotheca norvegica* (1899–1924) covers the years 1643–1813.

Other Nations: The most heroic saga in all of bibliography is probably that of several generations of the family of Estreicher, librarians at the Jagiellonska Library in Krakow, who since 1872 have been compiling the *Bibliografia polska*, covering imprints up to 1900. Other notable lists from Eastern Europe include the lovely but uncompleted Czech *Knihopis českých a slovenských tisku* (1925–1948); Ioan Bianu's *Bibliografia romaneasca veche 1508–1830* (1903–1936); and the online Hungarian *Magyar Nemzeti Bibliográfia* data bases, covering early imprints from what is now Hungary as well as early editions in the Hungarian language printed elsewhere.

Other notable retrospective national lists include John A. Ferguson's *Bibliography of Australia, 1784–1900* (1941–1969), Austin Bagnall's *New Zealand National Bibliography to the Year 1960* (1970), Sidney Mendelssohn's older *South African Bibliography* (1910), and Marie Tremaine's *Bibliography of Canadian Imprints, 1751–1800* (1952, with a supplement by Sandra Alston and Patricia Lockhard Fleming, 1999), as well as Fleming's superb *Upper Canada Imprints, 1801–1820* (1988) and *Atlantic Canadian Imprints, 1801–1840* (both 1991).

National Imprint Bibliographies: Current

Ideally these should extend the retrospective lists. Usually, however, there are chronological gaps and different criteria for inclusion, the exception being the *Bibliographie Nationale Française*, a direct successor to the *Bibliographie de la France*. The *British National Bibliography* (begun 1950), one of the most successful recent national bibliographies, was a totally new project. It was the model for *Canadiana* (also begun 1950), the *Australian National Bibliography* (begun 1961), and the *New Zealand National Bibliography* (begun 1967)—all government supported. In Germany, the *Deutsche Nationalbibliographie* was established in Leipzig in 1921 as successor to national and trade lists that date back to the *Messkataloge*, but with many changes. During the Iron Curtain era, a *Deutsche Bibliographie* was issued out of Frankfurt in the West. National reunification led to a *Deutsche Nationalbibliographie* based on cooperative efforts.

The mid-twentieth century also saw official national bibliographies set up in Eastern Europe, serving the cause of ideological control along with the promotion of books and reading. The quality varied from the barely competent to the superb. It is not clear how much these lists are being weakened by a less rigid enforcement of copyright deposit laws now that publishing is no longer managed by the state. In most Third World countries, current national bibliographies have been meager, fostered, and sustained mostly by a weak local book trade working with a national library and with encouragement from UNESCO and friends abroad. For several decades beginning in the 1960s, the American Libraries Book Procurement Center at the Library of Congress managed a program for acquisitions of books from countries with counterpart currencies (PL-480), and cataloging them in an *Accessions List* series. Several countries with well developed booktrades have strong national bibliographies that use their national scripts, the Japanese *Nihon Zenkoku shoshi* being a good example. Recent titles are cited in Barbara L. Bell's *Annotated Guide to Current National Bibliographies* (1998). For the latest developments, the invaluable sources now are the *Reference Resources Europe* works maintained by the Italian publisher Casalini, annually in print (RREA, 1995) and online (RREO).

The United States has no national bibliography, aside from the Bowker and Wilson trade lists. It is generally assumed that there is very little of importance that is not in today's online union catalogues. New registrations at the Copyright Office in the Library of Congress have been listed in print since 1891. The data are often useful in bibliographical work, but the *Catalog of Copyright Entries* is often not well organized for use and hard to call a national bibliography. In 1948, the Bowker Co. began issuing *Books in Print* (a French counterpart, *Les Livres disponibles*, began in 1977, the German *Verzeichnis lieferbarer Bücher* in 1978), now accessible online.

Current Online Subject Bibliographies

Vast in their size and timely in their service to research, most current subject bibliographies are now online. (See the entry on “Online Database and Information Retrieval Services Industry,” p. 3963.) Constructed not as a sequence of entries (alphabetic, chronological, or classified) with indexes, the online sources are accessible through search terms, such as can be regularly updated to reflect new concepts and relationships. Some lists give entries only, others include abstracts. Many of the most respected of them grew out of sources that began in print, among them the MEDLINE/PubMed database (successor to the *Index medicus*, begun in 1879), WilsonWeb Library (incorporating many of the H.W. Wilson Co. library lists, including the *Readers Guide to Periodical Literature* (begun in 1905), *Chemical Abstracts* (begun in 1907), the Modern Language Association’s *Annual Bibliography* (growing out of the *American Bibliography*, begun in 1921), *Biological Abstracts* (begun in 1926), and the *International Bibliography of the Social Sciences* (begun in 1951).

The proliferating world of online bibliography is expanding in many imaginative directions. Services like *The Web of Science* (begun in 1961 as the *Science Citation Index*, later expanded to cover writings in the social sciences, arts, and humanities) document the spread of learning in footnotes and references. Vendors often produce several services, some of which they have taken over from earlier printed sources, others of which they have originated. *America: History and Life* has *Historical Abstracts* as a counterpart; in Lexis/Nexis, the former focuses on legal research, the latter on the news media. Some provide full texts, which still require bibliographical entries for access, others are built around search-term access in ways that imply that bibliographical authority is irrelevant.

Printed bibliographies have been either subsidized or justified by likely purchasers. Most current online subject bibliographies are rather different: as commercial businesses, they need to follow different economic rules as they negotiate operational decisions that will reconcile the demands of investors with the needs of their identified readers.

Other Bibliographies

Countless other lists cover narrowly defined subject areas, whose readers come to know their strengths and weaknesses. The bibliographies describe the literatures of subject areas large and small, of academic disciplines, and of topics within and between the disciplines and subject areas, as qualified by historical periods, geographical areas, and perspectives. They serve readers at all levels, from children and amateurs to specialized scholars, and they include citations in many languages. Often their

entries are classified in categories that reflect the structures of their readers’ fields of interest, annotations address the specific agenda of the discipline. Lists often include periodical articles and sections of larger works, chapters of books, essays in anthologies, poems and songs in collections, or individual maps in atlases—what bibliographers call “analytics” and which are outside the purview of library cataloging. Their scope is limited to the written record as it exists when the list is being compiled: future titles need to go into a supplement or a later edition. Many lists are now published online, although the linear layout is still usually that of the printed page. Among the printed and online genres are the following:

Bibliographical Guides: Bibliographies of bibliographies—lists that cite the lists that cite the sources—are of limited but occasional usefulness. The most extensive, now four decades old, is Theodore Besterman’s *World Bibliography of Bibliographies* (4th Ed., 1965–1966). It cites over 100,000 titles, out of a likely several million today. It is limited to lists published separately (in other words, bibliographies at the end of or as parts of other works are excluded). It can be very useful, particularly for its juxtapositions of lists that cover the same general topic but also for its totals of the number of entries cited in each list; but there is general consensus that bibliographies of bibliography are rarely a first place to look. Besterman himself devised his subject headings. They usually work, occasionally they are idiosyncratic, even counterintuitive. Alice E. Toomey’s supplement, *A World Bibliography of Bibliographies, 1964–1974: A List of Works Represented by Library of Congress Printed Catalog Cards* (1977), is arranged under Library of Congress subject headings, which are often no less counterintuitive. Besterman’s precursors are discussed in Archer Taylor’s *A History of Bibliographies of Bibliography* (1955). One step beyond such lists is Aksel G.S. Josephson’s *Bibliographies of Bibliographies Chronologically Arranged* (1901, with supplements to 1913). No successor to any of these works has ever appeared. Considering the magnitude of the task—the complexity of the genres, the sheer number of titles—the prospects of successors seem slim.

Bibliographical guidance is often easier to dig out of selective guides to reference sources. Most notably of these has been in the United States the *Guide to Reference Books* (11 eds., 1902–1996), long the work of a notable lineage of American reference librarians: Alice Bertha Kroeger, Isadore Gilbert Mudge, Constance Winchell, Eugene Sheehy, and Robert Balay. Their successor, the *Guide to Reference*, was recently published by the ALA in a Web-based version. Foreign counterparts include, for Great Britain, A.J. Walford’s *Guide to Reference Material* (1959; new eds, under different titles); for Germany, either Georg Schneider’s *Handbuch der Bibliographie* (1923; latest ed., 2005) or Wilhelm Totok and Rolf Weitzel, *Handbuch der bibliographischen Nachschlagewerke* (1954 and later eds.); and for France, Louise-Noëlle

Malclès's ancient but venerated *Les sources du travail bibliographique* (1950–1958). A selection of the most important new reference sources, many bibliographies among them, appears annually in *College and Research Libraries*, as well as in reviewing media like the *American Reference Books Annual* (1970, and as *ARBA online*); also in the H.W. Wilson *Bibliographical Index* (1937, now online at *Bibliographical Index Plus*).

Subject Lists, Monographic, and Analytic: These range from brief check-lists, often of ephemeral interest—their very existence is often best known by informal communication among specialists—over to monuments of scholarship like the multivolume Clarendon Press *Bibliography of British History* (1928–1970), the *New Cambridge Bibliography of English Literature* (1969–1977), along with T.H. Howard-Hill's *British Literary Bibliography* series (1966)—to single out a few major works. Several smaller lists serve also as basic guides to specialist reference librarians and as textbooks in historical methods courses for graduate students. Notable examples include the *Harvard Guide to American History* (Oscar Handlin, later Frank Freidel; 1954 and later eds.), and Vincent Duckles's *Music Reference and Research Materials* (1964, based on early syllabi, 1948–1957; 5th Ed., 1997). Monroe Nathan Work's *Bibliography of the Negro in America and Africa* (1928), maps out a literature that supports a richly expanding field of scholarship.

Among scholarly descriptive bibliographies, two landmarks are devoted to literary genres: W.W. Greg's *Bibliography of the English Printed Drama to the Restoration* (1939–1959) and David F. Foxon's *English Verse, 1901–1750* (1975). The output of historically significant presses is cited and discussed by Horace Hart (Oxford University Press, 1900, extended by Harry Carter, 1975), Philip Gaskell (John Baskerville, 1959; the Foulis Press, 1964), D. F. McKenzie (the early Cambridge Press, 1966), C. William Miller (Benjamin Franklin, 1974), William S. Peterson (Kelmscott Press, 1984), and Marcella Genz (Eragny Press, 2004).

Bio-Bibliography: Collected bio-bibliographies no longer predominate as in the days of the *Acta*, although several are still today among the mainstays of the bibliographical reference shelf. Many of the most respected of them cover national literatures. One thinks of Karl Goedeke's *Grundriss zur Geschichte der deutschen Dichtung aus den Quellen* for Germany (1859, reissued and extended; new Ed. in progress); the Maurist *Histoire littéraire de la France* (1733ff.), first of many French guides; Thomas Erslew's *Almindeligt forfatter-lexikon* (1843–1853) for Denmark, Jens Halvorsen's *Norsk Forfatter-Lexikon, 1814–1880* (1885–1908), succeeded by Holger Ehrencron-Müller's *Forfatterlexikon omfattende Danmark, Norge og Island indtil 1814* (1924–1935) for Norway, Bengt Ahlén's *Svenskt författarlexikon* (1942) for Sweden, and Innocencio Francisco da Silva's *Diccionario bibliografico portuguez*

(1858–1923)—the latter notable for its filing of entries by the author's *first* name (those who work extensively with Portuguese surnames will know why). Two other sets of *Acta* are mainstays of the reference shelf in fields where creativity is basic: Robert Eitner's *Quellenlexikon* (1900–1904), with citations of manuscripts printed editions of composers, and Ulrich Thieme and Felix Becker, *Allgemeine Lexikon der bildenden Künstler* (1900–1907; new Ed., 1983), for artists and their work. Appropriate to their celebratory function, most bio-bibliographies are printed; online lists have been slow to emerge.

Bibliographies devoted to one person emerged only over the last century, and are essentially of two kinds. Those devoted to writings *about* the person tend to have short entries, and are essentially of biographical interest. Writings *by* the person range from brief checklists, to superbly detailed descriptive bibliographies that are essential to textual scholarship. Among the many notable examples of the latter are those on Cotton Mather and his family (Thomas J. Holmes, 1931–1940), on Samuel Johnson (J.D. Fleeman and James McLaverty, 2000), on several eighteenth century authors by Allen Hazen, nineteenth century American authors by Joel Myerson, on twentieth century authors by Donald Gallup and Matthew J. Bruccoli, and others by William B. Todd.

Commercial Lists: Trade lists have largely been subsumed in national bibliographies, although publishers still issue lists to promote their titles. Many antiquarian booksellers now cite their offerings on the Internet, with citations are often models of descriptive bibliography and annotations (i.e., “blurbs”) of impressive historical scholarship. The laborious efforts are justified in the interests of finding customers, although scholars in general often learn to benefit from the record of the bibliographical facts and the lore behind the materials.

Library Publications: Library catalogs often function as bibliographies, even if their main goal is to organize and find items in the collection. Most library catalogs are now in union catalogs and merged on the Internet in the interest of document delivery. Most libraries also prepare finding aids (“pathfinders”) for work in the collections, selective bibliographies of a sort organized with a view to proposing search strategies for their readers. Exhibition catalogs, as they call attention to valuable or important works in the collections, often function as bibliographies. They work like dealers' catalogs in that the historical details in their annotations serve not to entice purchasers so much as to delight visitors.

Clearly, the most important of all bibliographies today are the library union catalogs. The great *National Union Catalog, pre-1956 Imprints* (1968–1980, known either as “NUC” or often for the name of its publisher, Mansell), in 685 volumes with a 69 volume supplement, grew out of the Library of Congress *Catalog of Printed Books* (1942–1946), in 167 volumes, with later supplements. It is updated but so far not entirely duplicated in the WorldCat

bibliographic database, maintained by OCLC (the Online Computer Library Center), to which over 60,000 member libraries contribute. (See the entry on “OCLC: A Worldwide Library Cooperative,” p. 3924.) Its over 88 million records cover books, serials, sound recordings, musical scores, maps, visual materials, mixed materials, and computer files. Recently, OCLC subsumed Research Library Information Network (the RLIN, maintained by the Research Library Group; not all RLIN bibliographical records are in WorldCat as of this writing, however). Online Computer Library Center also maintains close contact with the union catalogues in other countries and often records their holdings.

Incunabula: Books from Gutenberg’s day to 1501 (the “cradle” of printing) make up a much smaller but still very special bibliographical world of their own. The books are scarce, most of them large and beautiful. They testify to a world much different from ours today, so as to call for expertise of three kinds. The content is expressed either in a Latin that is usually corrupt or in vernaculars that were just beginning to be formed. The physical books call for a deep knowledge of analytical bibliography, particularly of type forms, since most printers needed to provide their own materials and adapt their skills. Finally, modern bibliographers need to know the bibliographical history, since older sources are still cited and very useful. The first major figure in this history is Georg Panzer, whose *Annales typographici* (1793–1803) are still useful for being arranged by imprint date. Ludwig Hain’s *Repertorium bibliographicum* (1826–1838) and its successors may not be held in high respect today, but scholars still consult them. More venerated is Robert Proctor, whose concept of “Proctor order” (titles are gathered first under country, then under city, then under date) is seen in the great catalog of the British Museum (begun in 1908 and finally completed in 2007). The next event was the *Gesamtkatalog der Wiegendrucke*, a unified guide begun in 1925 but still incomplete since the 1940s. Frederick Goff’s one volume *Incunabula in American Libraries* (1964) is still an indispensable starting point, although the “ISTC” project (now the *Illustrated Incunabula Short Title Catalogue*, and online now as “IISTC2”) promises to be the essential bibliographical record for incunabulists.

BIBLIOGRAPHICAL PRACTICE

Compiling Bibliographies

Enumerative bibliography involves *compilers* preparing *lists*, which contain *citations* (consisting of *entries* and, often, *annotations*) of written material, for the use of *readers*. Enumerative bibliography succeeds when the lists work the other way around: readers search the lists and find the citations. Readers are the unpredictable factor: they

often find what they need in unexpected places and they use it in ways that can rarely be anticipated.

A bibliography, as W. W. Greg proposed and Theodore Besterman famously recalled, must be based on “some guiding principle.” A transcript of citations becomes a bibliography when the principle becomes legitimized through use, although compilers commonly explain their decisions in their introduction. Admittedly, readers rarely read introductions: they impatiently turn instead to the citations. The introductions thus serve mostly to fix the list in the context of the literature. Rules for compilers follow conventions that are rarely specified but are widely understood and justified through use. The basic decisions involve:

Scope: Compilers make their topics manageable by defining their scope. All bibliographies include or exclude titles on grounds determined by the physical object or the intellectual content of the material being described. The obvious physical distinction separates books from other forms of recorded knowledge. Some forms are closely akin to books—pamphlets, government documents, and ephemera come to mind—and in lists usually fit comfortably alongside books. Continuations—serials, periodicals, journals, newspapers—usually work like books and rarely pose problems, although their component units (“analytics”) can be overwhelming in their profusion. Other forms—maps, printed music, and pictures—often benefit from separate listings, as do audiovisual materials—sound recordings, films, and videos—as well as electronic forms, so as to lead to hybrids like discography, filmography, videography, and Webliography. The less the documents look and work like printed books, generally the harder they are to fit into a bibliography, although readers are often best served by including them.

Citation Style: Bibliographical citation practices are spelled out in style manuals, which arose to provide consistent practices for scholarly journals. The many style manuals differ in details and have evolved over the years, but the most important today is arguably the *Chicago Manual of Style* (latest Ed., 2003), now compatible with the dissertation style long associated with Kate L. Turabian. The Modern Language Association prefers slightly different practices in its *Style Manual* (latest Ed., 2008) and *Handbook* (new Ed. expected, 2009), as do the British university presses at Oxford Horace Hart (latest Ed., 2005) and Cambridge (Judith Butcher, latest Ed., 2006). Scientific usage, most often prescribing authors’ given names as initials and the publication date before the title (once called “Harvard style”), is spelled out in manuals from the American Chemical Society (latest Ed., 2006), the American Psychological Association (latest supplement on electronic references, 2007), and the Council of Science Editors (latest Ed., 2006; formerly the Council of Biology Editors), among others. The International Organization for Standardization and the American National Standards Institute have also addressed

bibliographical style. Many publishers further specify their preferences in “house style” sheets. Cataloging codes can often inform bibliographical practice, although compilers commonly adapt the rules for the materials being cited, and with a view to the convenience and background of their selected readers.

Annotation: Compilers often find it important to define the aim, scope, or thesis of the writing being described; to identify the sources and context; to single out significant features; or to praise or incriminate the work (the former best done in understatement, the latter often by quoting the text). The goals of describing and evaluating are not as different as one might think. The writing style may be either conventional prose (to catch the reader’s attention) or “telegraphic” (busy readers, making quick decisions on whether or not to look at the writing, can usually do without the subject and often the predicate). Readers often benefit from comparing and contrasting entries, often done by annotating several entries together.

Organization: Most entry sequences follow one of three orders: alphabetical, chronological, or classified. Alphabetic lists are usually by main entry, most often the name of the author. The alphabet is not intrinsically intelligent but it is easy to search. Chronological lists suggest the growth of the literature, and reflect the ideal of *historia litteraria*. Classified lists display the literature under categories. Compilers are often stimulated by obvious juxtapositions but have second thoughts about titles that belong in more than one or no category. The idea of systematic bibliography is something of a counterpart to the systematic card catalogues in many libraries. Linear sequences usually ask for indexes, in printed lists as either internal cross-references or separate indexes, in computer lists through entry access.

Well designed bibliographies need to be clear, precise, and efficient. In the course of helping readers identify, tabulate, and explore, they are most effective when they lead readers think about the substance rather than the methodology, and to compare entries by moving from broad overview to fine structure.

Bibliographical Searching

Searching for specific citations is unlike subject searching, much like hunting is unlike farming. Readers still need to know the sources they work with, their scope, organization, and citation practices. But they also need to decide whether citations, once located, are actually what they are looking for: will any edition, or version, suffice; how specific must the citation be? Often the exact needs are determined only as the search progresses. Generally, searches lead to one of four outcomes: (1) success: the right citation has been located; (2) positive failure: the citation has been found but it is not what is needed; (3) negative success: the citation has not been

found, but it may be there; and (4) failure: the item has not been found, and it is certain that it is not there. Distinguishing between (3) and (4) is helpful in sizing up the bibliographical infrastructure of the literature. In general, the smaller and more transparent the list being searched, the more easily it can be determined that the result is failure rather than negative success. In many vast lists, it is simply not possible to guess where an item has been logically but ingeniously concealed. For this reason, bibliographical searching benefits from smaller lists and a knowledge of how they work.

The more important the search, the more time should be allotted to it. But many important ones turn out to be very brief: it is often the intellectual curiosity of the searcher that makes them time-consuming. Online searching is almost always faster than work with paper sources, if also less cardiovascular. But printed sources, laid out visually and deployed physically, ask to be searched for contexts. Locating entries is different from understanding them, so searching can be boring and routine or highly stimulating.

PHYSICAL BIBLIOGRAPHY

As nineteenth-century scholarship flourished and became increasingly methodical, the study of the artifactual evidence of bibliography became self-consciously analytical. Antiquarian booksellers and collectors had long known that some books were more desirable than others as physical objects, philologists and literary scholars had understood the importance of authenticity of literary writings, historians had long celebrated the bibliographical lore behind famous events, while librarians and private collectors had long taken special pride in their celebrated rarities. These groups, as they coalesced into bibliographical societies, stimulated each other in their dialogue and wrote up their findings in journals that aspired to the scholarship of academic disciplines. The goal was announced, boldly and provocatively, by W.W. Greg (in the Bibliographical Society’s 1945 *Studies in Retrospect*, p. 25), thus: “bibliography is the study of books as material objects, irrespective of their contents.” This study has come to be seen as several different activities.

Analytical Bibliography

The study of physical books entails an analysis of typography, paper, ink, “printing house practices” (i.e., layout and design, typesetting, imposition, and presswork), as well as illustration and binding. Philip Gaskell’s *New Introduction to Bibliography* (1972) is the standard overview, but much work has been done since his day, as synthesized in many writings and notably discussed in G. Thomas Tanselle’s annual essays in *Studies in Bibliography*. The graphic arts become important in evaluating the

working aesthetics of particular printers, traditions, and periods, while technology is now essential to the study of paper (e.g., the “Leningrad method,” also digitized watermark archives), ink (“PIXE,” i.e., particle-induced X-ray emission), layout (“fingerprinting”) and other evidence. Probably most important of all have been the digital images that make it possible to examine copies in distant locations side-by-side.

Evidence of tampering emerges out of a close study of the physical objects, making analytical bibliography essential to establishing their authenticity. The famous example is the legendary exposure of the forgeries of the highly respected bibliographer Thomas J. Wise, uncovered and written up by John Carter and Graham Pollard in their *Enquiry into the Nature of Certain Nineteenth Century Pamphlets* (1934).

Bibliographers recall Falconer Madan’s phrase, “the duplicity of duplicates,” and instinctively look for differences between copies that appear to be identical, and then seek to explain how and why the differences came about. In work with printed books of the hand-press era, they separate the differences and have conventional names for them. *Editions* are the basic units of production, that is, all the copies run off from the same printing surfaces. *Impressions* distinguish all the copies of a single press run. *Issues* involve changes overtly announced, for instance on title pages, and deal often with conditions of sale. *States* involve covert changes, made within a press run and not meant to be noticed, least of all mentioned on the title page. Often the levels of differences are hard to explain, or ambiguous, in which case the term *variant* is a useful recourse. (The conceptions are Anglo-American: terms used in continental Europe, like *Ausgabe*, *Auflage*, and *triage*, fit awkwardly into their hierarchy.)

Descriptive and Textual Bibliography

Descriptive bibliography is enumerative bibliography informed by analytical bibliography. The goal is to specify the exact particulars of the physical objects for scholarly use. Its rhetoric is ruled by conventions that provide for details that identify the important physical characteristics. Analytical bibliographers need to know the history of the materials and practices of printing and publication. Descriptive bibliographers will also know the grammar for formulating citations based on models that date from Henry Bradshaw in the nineteenth century, as later refined by W. W. Greg and codified in Fredson Bowers’ *Principles of Bibliographical Description* (1949). Enumerative citations are assumed to apply to all copies of a particular title; any differences are irrelevant for the intended readers.

Descriptive bibliographers may identify either a specific copy, with details on all of its relevant idiosyncrasies, or they may conceive of ideal copy (which, in Bowers’

conception, is “a book which is complete in all its leaves as it ultimately left the printer’s shop in perfect condition and in the complete state that he considered to represent the final and most perfect state of the book”). Citations in enumerative bibliographies are generally shorter, and their conciseness is assumed to be sufficient. Descriptive bibliographies explore physical details in order to allow readers reasons either to infer that the description is sufficient, or to record the insufficiencies.

Citations in descriptive bibliographies usually transcribe the title page and collate the gatherings. The ideal title-page transcription covers all its printed statements, often with type styles in “quasi-facsimile” presentation. The collation uses a grammar that records the gatherings by their signatures and the number of leaves in each gathering. A knowledge of early printing practices is essential, beginning with the basic practices of imposing the type within the form of the press, for purposes of accommodating sheets that were later folded once, twice, or three times (so as to produce folio, quarto, or octavo format). The directions of the paper’s chain and wire lines and the placement of the watermark are most often the crucial evidence. Changes during a press run were common. Leaves were added, removed, or cancelled, unsigned gatherings were added at the beginning, or interpolated. The early printing shop was constrained in its conditions—labor was usually cheap and materials were expensive—and the physical book needs to be explained in terms of how it was assembled.

The precise details of producing a physical book often explain its content. Textual bibliography is a search for authenticity of literary works based on a probing of the printed evidence. Its roots are in classical philology, Biblical studies, and modern editorial practice. Its calls on the practices of analytical bibliography to authors whose writings exist in variant printed editions, often in the absence of manuscript sources. Locating the crucial evidence requires a thorough familiarity with the text, a close reading of many copies in search of variants, and a knowledge of printing house practices, as well as an understanding of the authors and their working relationships with their printers, editors, and publishers. Contrary to what one might suspect, there are important differences in the texts not only of earlier authors of the “hand press era” (before about 1830) but also of many twentieth century authors as well.

Historical Bibliography

The written history of the artifacts that define our civilization begins as “book appreciation,” popular accounts of books and printing that recall the classic lore, of Laurens Janszoon Coster in Holland as a possible precursor of Gutenberg, of the Columbus letter and role of printing in the rapid spread of the news across Europe, of the *Depositio cornuti typographici* and Wayzgoose

revelry among printing apprentices and journeyman, of the dispersal of the 1640 *Bay Psalm Book* and the forging of the 1639 “Oath of the Freeman,” of Walt Whitman’s *Leaves of Grass* as a reminder of his work as a printer. The early craftsmen were heroes, their editions were works of art.

Bibliographers delight in these stories, and also in the vast profusion of other names, titles, and events they work with. They were rarely collected into historical narratives, however; before the twentieth century the historiography of bibliography was rather meager. In works like Karl Schottenloher’s *Das alte Buch* (1919, later eds. as *Bücher bewegten die Welt*), the account begins to be framed as cultural history. The *Annales* tradition of French academic scholarship, rich in charts, statistics, and maps, characterizes *L’Apparition du livre* (1958), begun by Lucien Febvre and completed by Henri-Jean Martin, as well as the later *Histoire de l’édition française* (1981–1985), to date the most lavish of several recent national histories of the book. Two complementary exhibitions in London in 1963 further expanded the agenda of historical bibliography. At Earl’s Court, a display on the history of the printing crafts and technology reflected a flourishing scholarship in the processes of book production, obvious tied to analytical bibliography. Two major periodicals emerged—the *Journal of the Printing Historical Society* (1965) and *Printing History* (1979)—along with syntheses based on the acts of production, such as Michael Giesecke’s *Der Buchdruck in der frühen Neuzeit* (1991) and Adrian Johns’s *The Nature of the Book* (1998). The second part of the 1963 exhibition, at the British Museum, was devoted to the first publications of the historic landmarks of Western thought, and led to the celebrated *Printing and the Mind of Man* catalogue (1967), along the way implying the crucial role of the antiquarian booktrade in preserving our cultural heritage. Two other works stand out in the rise of historical bibliography: Elizabeth Eisenstein’s *The Printing Press as an Agent of Change* (1979), which surveys the views of earlier writers who evaluated the impact of Gutenberg’s invention, and Robert Darnton’s study of the archival evidence of the publishers of the great eighteenth century *Encyclopédie* in *The Business of Enlightenment* (1979).

Are there significant differences between historical bibliography and the new fields of study called Print Culture and Book History? (See the entry, “History of the Book,” p. 2142.) If there are, they are subtle and often irrelevant. All of the families of bibliography benefit from being conceived with the needs of both readers and materials in mind. Alfred W. Pollard, one of the heroes from the last century, famously reflected these sentiments when he described bibliography as a “big umbrella.”

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Bibliometric Overview of Information Science

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Abstract

This entry presents an account of the core concerns of information science through such means as definitional sketches, identification of themes, historical notes, and bibliometric evidence, including a citation-based map of 121 prominent information scientists of the twentieth century. The attempt throughout is to give concrete and pithy descriptions, to provide numerous specific examples, and to take a critical view of certain received language and ideas in library and information science.

PROBLEMS OF TERMINOLOGY

“Information” and “science”—two formidable words joined. The combination has not gained wide understanding. Few persons can quickly associate it with a subject matter as they can geology with rocks or astronomy with stars. That may be because even expert definitions of information science (IS) resemble attempts to describe an elephant by describing the tent under which it is performing: some given in Zins,^[1] for example, could be parodied as “Information science is the science of data, information, knowledge, and messages.” Abstractions like this also cover, e.g., artificial intelligence, cognitive psychology, cognitive science, computer science, cybernetics, database management, informatics, and systems theory, as attested by *The Study of Information*,^[2] an interdisciplinary volume from a generation ago. One section of that large book resembles the present encyclopedia in being devoted to “library and information science”—L&IS—but this qualification, useful to insiders, is not readily intelligible to ordinary readers. In the popular view, librarians check out books and put them back in order on the shelves. So where is the science? It must involve something like memorizing the Dewey decimal system. Isn’t that what librarians mean by “information”? And hasn’t Google ended all that?

As it happens, even L&IS experts who would laugh at such notions have not clearly established their field for nonexperts. This entry attempts to do that through such means as definitional sketches, identification of themes, historical notes, and bibliometric evidence, including a citation-based map of information scientists. As an overview, it also points to entries in this encyclopedia that develop the histories of certain subfields more elaborately and systematically. It was written wholly independently of the ELIS entry on *Information science*, p. xx by Tefko Saracevic, but turns out to complement his quite well, arriving at similar conclusions through different means (See *Information Science*, p. 2570).

First, a quick commentary on librarianship. Traditional librarianship is not a science, nor is it usually based on science. It is a range of services that many intelligent persons can carry out intuitively. This is not to deny that librarians need coursework. It is merely to say that if “science” is taken to mean novel claims rigorously tested, then “library science,” which dates from the nineteenth century, is a misnomer; it really just means something like “library administration.” In Pierce Butler’s 1933 interpretation,^[3] it connotes a vague ethical stance, as when he recommends that librarians study “function” not “process.” Butler’s book, once considered classic, has been deservedly debunked by contemporary writers, not least his idea of science.^[4,5]

There are, of course, empirical studies of library operations that could be called “library science,” were the term fresh. These studies do reveal new, nonobvious facts about the world, and some of them have been made by librarians.^[6,7] But the activities most people associate with libraries are not defined by them, and libraries would not be markedly different if they had never been conducted. The bent of traditional librarianship is normative rather than positive. That is to say, librarians are not mainly concerned with *what is*, in the scientist’s sense of generalizable truths uncovered through measurement. They are mainly concerned with *what ought to be* in the politics of physical and intellectual access to texts. They are most at home with qualitative standards, such as codes, and ethical pronouncements, such as being for information literacy and against censorship. Library science in this sense is a policy science, not something more rigorous. Students entering library schools have probably gathered as much. They know they already possess the mindset required for professional life, and all they really need for marketability are socialization into the field and some technical skills.

What is gained, then, by tacking “library” onto “information science” to form L&IS? Principally, differentiation from the other information sciences as described by

Machlup and Mansfield^[2] or T.D. Wilson.^[8] Does L&IS belong in this company, or is “L&IS” just another overblown title for what librarians do? The answer is, yes, it belongs, and, no, it isn’t another name for librarianship. Although its various projects are far from being tightly cumulative, decades of evidence from what P. Wilson^[9] calls “bibliographical R&D” compel the conclusion that L&IS is real science and technology. Parts of L&IS are as mathematical as physics. Thousands of studies involve theorizing, measurement, the development and testing of hypotheses, experimentation and other respectable forms of data-gathering, the gradual improvement of explanatory models, and the engineering of real-world systems.

Among the information sciences, moreover, the domain of L&IS is unique. The discipline’s principal object of study is the age-old interface at which people communicate with bodies of related writings—broadly speaking, with literatures. At this interface, people seek to match their interests and questions with responses that would otherwise be hidden in unreadably large masses of text. At the same time, they want responses that meet the standards of their dialogues with other persons—standards of relevance, truth, novelty, timeliness and appropriate length. However, the literature side of the interface is mindless, and whatever responsiveness it has is built into it artificially through systems. Even when these systems include human intermediaries (such as reference librarians), they often function very imperfectly. It therefore makes sense to speak of the literature interface as a barrier that parts of L&IS try to reduce or remove.

L&IS DEFINED

In brief, L&IS consists of *research on literature-based answering*. Central to it are the properties of human questioners, the properties of various mediating systems (since literatures can’t talk), the properties of literatures themselves, and the properties of answers. These interrelated concerns define subfields of L&IS as a scientific and technical enterprise. Taking each in turn:

1. Questioners’ properties, both cognitive and sociocultural, imply what in the past were called user or usage studies and are now known as studies of information behavior. The latter title embeds literature-based answering in a broader context of behaviors, such as reliance on people rather than writings for answers. “User” connotes reliance on formal systems, and part of studying people’s relationship with writings has always been exploring reasons for their nonuse. However, millions of people still seek answers from writings, and how they express their needs through questions put to literature-based systems—for example, in Internet searches—remains a perennial topic of interest. So do the uses they make of information once

found. Many studies have been conducted of information seeking and use in particular groups, such as children, high school students, medical doctors, scientists, and humanists (See the entries on *Information behavior*, p. 2381; *Information behavior models*, p. 2392; *Information needs*, p. 2452; *Sense-making*, p. 4696; *Information searching and search models*, p. 2592; and numerous articles on the information behavior of various groups; *User-centered revolution, 1970-1995 [ELIS classic]*, p. 5461; and *User-centered revolution, 1995–2008*, p. 5496; among others.)

2. Properties of mediating systems—the systems that bring people and writings together—imply research on both verbal instruments and computer algorithms that serve to help people find what they want. The enterprise has been known for more than 50 years as information retrieval (IR), but it has far earlier roots. The verbal instruments have always included bibliographic metadata, such as descriptive and subject cataloging, classification and indexing schemes, and abstracts. The preestablished lists of authorized terms used in subject cataloging, classification, and indexing are called controlled vocabularies. Below these content-laden instruments are the content-neutral computer algorithms. Nowadays on the Web, the natural-language “keywords” by which people put their questions can be algorithmically matched with natural-language “keywords” in the full texts of documents, and the older mediating systems, such as controlled-vocabulary indexing or classification schemes, have been called into question, although they still have their staunch defenders (See numerous entries on information organization and description, such as *Classification theory*, p. 1045; *Descriptive cataloging principles*, p. 1481; *Metadata and digital information*, p. 3610; specific systems such as *Library of congress classification (LCC)*, p. 3383; and *Anglo-American cataloging rules (AACR)*, p. 99; and standards and protocols, such as *Encoded archival description (EAD)*, p. 1699; and *Resource description framework (RDF)*, p. 4539).
3. The properties of literatures imply the field of bibliometrics, which devises measures of the growth, connectivity, impact, scattering, and obsolescence of publications in various subject areas (See *Bibliometric research: history [ELIS classic]*, p. 546; *Citation analysis*, p. 1012; *Information scattering*, p. 2564; and *Webometrics*, p. 5634; among others). Contemporary extensions, glossed in Table 1, are called scientometrics, informetrics, and, most recently, webometrics. Research projects in bibliometrics and information retrieval have often been pursued without much contact, but one major exception involves the citation indexes published by Thomson Reuters. They are studied as retrieval tools in IR and are used to model literatures and investigate citers’ behavior in bibliometrics.

Table 1 Glosses on some overlapping subfields in IS.

Bibliometrics: The quantitative study of literatures. Measures countable properties across multiple related writings and looks for empirical regularities in structure. Can be considered a variety of cliometrics in that it typically deals with historical data that can change over time. May include data on usage of publications (e.g., in library collections). Units of analysis on which counts are made include documents (e.g., articles and books in subject areas), authors' *oeuvres*, and journals; also the publications of organizations or countries, or in particular languages. Can be either descriptive or evaluative in intent. Has its own theory and methods, but is related to such fields as content analysis, text mining, corpus linguistics, and stylometrics.

Scientometrics: Includes bibliometrics, especially as applied to scientific and technical literatures and to patents, but extends quantitative study to units of analysis other than publications, such as scientists and research organizations. May be a quantitative form of the sociology of science.

Webometrics: The quantitative study of Web pages and Web sites in such aspects as their growth and connectivity. Synonymous with cybermetrics, although the latter may be construed as dealing with the entire Internet rather than just the World Wide Web.

Informetrics: As currently defined, covers much of the quantitative side of IS, but focuses more on publications and information systems than on the psychology and sociology of information seekers. Oriented toward statistics and mathematical modeling.

4. The properties of answers, such as their relevance, accuracy, completeness, and concision, imply evaluative research on the output of information retrieval systems. Both before and after the advent of the computer, IR systems can be construed as hypotheses put forward by information scientists as to what will facilitate literature-based answering. A good part of the science of the field consists in testing how well these systems work—assessing their strengths and weaknesses and proposing improvements in the quest for artificially induced relevance (See *Information retrieval experimentation [ELIS classic]*, p. 2526; *SMART system: 1961–1976 [ELIS classic]*, p. 4770; *User-oriented and cognitive models of information retrieval*, p. 5521; *XML information retrieval*, p. 5700; *Web retrieval and mining*, p. 5615; and *Text REtrieval Conference (TREC)*, p. 5182; among others.) Some researchers are now devising systems that try to answer unforeseen questions directly rather than providing documents on a topic. Others are experimenting with algorithmic summarization of documents.
3. The algorithmists and evaluators of experimental computerized document retrieval systems belong to the Special Interest Group on Information Retrieval (SIGIR) within the Association of Computing Machinery, which publishes annual proceedings of the SIGIR conferences. Some of these researchers compete in the Text Retrieval Conference (TREC), an important annual contest staged by the (U.S.) National Institute of Standards for comparative evaluation of retrieval algorithms. Also for technical types, ACM and the Institute of Electrical and Electronics Engineers sponsor a Joint Conference on Digital Libraries, and IEEE by itself sponsors the Conference on Information Visualization.
4. Bibliometricians and kindred spirits have created ISSI, the International Society for Scientometrics and Informetrics. Their specialized journals are *Scientometrics* and the *Journal of Informetrics*.

There are also, of course, generalists whose interests cut across all these organizations and may extend to membership in the American Library Association or other librarians' groups. In Britain such interests meet in the Chartered Institute for Library and Information Professionals, which resulted from a merger of the [British] Library Association and the Institute for Information Scientists in 2002. International conferences intended to have cross-disciplinary appeal include Conceptions of Library and Information Science.

As noted, the phrase "L&IS" is not likely to evoke these definitions and details for most hearers or readers. It is true that libraries hold subsets of literatures and that librarians try to make them responsive to human inquiries. To certain initiates, therefore, libraries are the paradigm of the human–literature interface.^[10] But in practice this interface is not limited to libraries, nor is its scientific study limited to that context. Can the matter be cleared up by substitution of a more suitable word or phrase than L&IS? Not really; if the language provided a better name for the field, it would have been adopted by now.^[11] English in this case is lean in possibilities.

This four-part division has warrant in existing organizations, all with periodic conferences and journals. Repeating the order above:

1. The American Society for Information Science and Technology (ASIST) enrolls members who represent all four parts, but ASIST is now recognizably the home of the so-called cognitive wing of IR, who specialize in information behavior and advocate user-centered design. Among its publications are the *Journal of the Society (JASIST)* and the *Annual Review of Information Science and Technology*. An independent biennial conference called Information Seeking in Context is addressed to behavioral interests.
2. Persons concerned with linguistic aspects of indexing, classification, and metadata are members of ISKO, the International Society for Knowledge Organization. They publish a journal, *Knowledge Organization*.

Leaving “library” implicit, the field becomes just “information science” or IS.^[12] This name connotes “information” in at least two senses—as a synonym for textual content and as the presumed cognitive outcome of reading the texts. “Documentation,” its forerunner, connoted rather less. “Literature science”—meaning in White and McCain^[13] something like “literature response theory”—might suggest major parts of IS better than “library science,” but the other senses of “literature” bar its acceptance; relatively few people think first of subject literatures or linked Web pages as opposed to belles lettres when they encounter the word, and some humanists might deplore the conjunction. The phrase “and technology” is sometimes added to IS to evoke the field’s long-standing stake in engineered systems. All the other information sciences have distinctive names of their own (e.g., artificial intelligence), leaving IS to be principally understood as it is in names like the American Society for Information Science and Technology or the former Institute for Information Scientists in Britain.

MEDIATORS AND AUTOMATION

The founder of the latter organization, Jason Farradane, is also apparently the person who named IS as a field in 1953. He did so by articulating the concept of an “information scientist.”^[14] At least initially, however, he did not use the term in today’s sense of someone who does research on literature-based information systems and their users. He used it in the context of British laboratory work to name a scientist, such as a bench chemist, who is adept in searching the literature for materials pertinent to research projects—so adept that this becomes a full-time occupation. (Thus, one might also see terms like “information chemist” or “literature chemist”; the older “documentalist” had not really caught on.) Dyson and Farradane^[15] call this person “an expert *user* of all sources of information.”

The idea of persons who mediate between inquirers and literatures is certainly not original with Farradane;^[16] one obvious earlier instance of it is the reference librarian.^[17] Farradane’s information scientists, however, were supposed to have more substantive and technical expertise than the typical reference librarian. The same perceived shortcoming has beset librarianship for more than a century. For example, the Special Libraries Association broke away from the American Library Association in 1909 to signal its members’ more particular subject knowledge and more proactive services.^[18] For similar reasons (as well as a greater interest in microfilm technology), members of the American Documentation Institute left mainstream librarianship in 1937.^[19] Or, from the realm of theory, take Havelock et al.,^[20] a massive treatise on the role of persons who link others with potentially useful writings. In seeking to create a corps of such persons who could bring published educational research to school

teachers and administrators for practical application, Havelock modeled his linkers on agricultural extension agents. Librarians of any kind are not even mentioned.

As distinct from a librarian, the expert user of literatures on behalf of others gradually became an “information officer,” “information specialist,” or “information professional,” and Farradane himself evolved into an information scientist as the term is currently understood. At the heart of that understanding lies the idea of *automation* (See *Library automation: history*, p. 3326.) Even in the 1930s and 1940s, what is now called IS had begun its long-term project of automating the human–literature interface.^[21] One well-known godfather of this project is Vannevar Bush. Describing the design of the Memex, his imaginary retrieval device from the 1930s, Bush^[22] summarily dismissed the indexing schemes of librarians and documentalists, whom he also never consulted;^[23] instead, he foresaw that users would thematize their own collections of microfilmed documents with personal “associative trails.”^[21] The implicit tendency of IS, in other words, is to eliminate human intermediaries—the indexers, classifiers, catalogers, abstractors, librarians, and professional literature searchers who stand between textual resources and their non-specialized end users.^[24] Thus, information scientists in Farradane’s original sense have been increasingly marginalized by a line of researchers whose inclination is to substitute algorithmic for costlier manual processes wherever possible. (The process is sometimes explicitly called “disintermediation.”) This has led to the current situation in which the dominant symbol of the human–literature interface is not the traditional library—a room or building staffed by people who provide service with classified, cataloged, and indexed books and serials—but Google, which directly matches the natural language of users with the natural language of documents in cyberspace (For pre-Google antiquity, see *Internet search tools: history to 2000*, p. 2996).

While traditional libraries still have a place in the new order of things, there is much evidence that a profound change has indeed occurred.^[25] Many have seen it coming. For instance, describing “The New Generation” in his book *Digital Libraries*, the computer scientist William Arms writes (ch. 14):^[26]

In 1997, a Cornell student who was asked to find information in the library reportedly said, “Please can I use the Web? I don’t do libraries.” More recently, a faculty member from the University of California at Berkeley mused that the term “digital library” is becoming a tautology. For the students that she sees, the Internet is the library. In the future, will they think of Berkeley’s fine conventional libraries as physical substitutes for the real thing?

THE GOOGLE BOOM

Speaking of Google, it is interesting that its creators, Sergey Brin and Lawrence Page, have never been

members of the American Society for Information Science and Technology and are not usually described as information scientists in the “library” sense. (They were computer science students at Stanford University.) Yet their publications draw on ideas from IS. For example, the idea of algorithmically ranking documents by their suitability as answers (as Google does Web pages) was established in IS decades ago, notably in the work of Gerard Salton. The Saltonian tradition now lives in the proceedings of the Text Retrieval Conferences, one of which Brin and Page^[27] cite when they claim that TREC techniques do not scale up to handling the billions of pages on the Web. The key Google ranking algorithm PageRank, based on counts of links to particular Web pages, was influenced by the idea of citation analysis from bibliometrics, attributed in Page et al.^[28] to Eugene Garfield, the founder of citation databases in science and scholarship.

But more important than Brin and Page’s intellectual ancestry is their practical success in establishing a universal interface between inquirers and literatures in the widest sense. Their search engine has arguably had the greatest impact on libraries of any innovation in the past century. The old and the new are presently joined in such modules as Google Book Search (for retrieving passages from book texts in full), Google Scholar (for retrieving articles and other documents based on bibliographic citations), and OCLC’s Open WorldCat (for retrieving books held by local libraries in response to queries in Google and other search engines). Most notable is the use of Google’s main module—by worldwide nonspecialized publics—for answering reference questions and doing topical literature searches. These developments seem consistent with traditional library values even if they are not particularly auspicious for librarians.

During what might be called the Google boom, work recognizable as IS has become quite fashionable in academe, especially in computer science departments. Moreover, at this writing about 15 of America’s best library schools have morphed into “schools of information,” also known as “iSchools,” with computer science professors well represented on their faculties. In the past, with notable exceptions such as Donald Kraft (Louisiana State University) and Bruce Croft (University of Massachusetts at Amherst), computer scientists have been known to find the research problems of IS unappealingly messy, involving as they do both people and natural language as subject matter. But today the *de facto* technical vanguard of IS includes computer scientists at many elite institutions (for example, Ricardo Baeza-Yates at Yahoo! Research, Susan Dumais at Microsoft Research, Marti Hearst at UC Berkeley, Jon Kleinberg at Cornell, Christopher Manning at Stanford, and Simone Teufel at Cambridge). Most such researchers resemble Brin and Page in not being members of ASIST. Dillon^[29] similarly observes that “the term ‘information science’ has been taken on by philosophers and mathematicians who see themselves very much

distinct from the LIS domain...” The field is also now highly international, with numerous researchers from countries outside the traditional homes of IS in North America, Western Europe, and Russia.

One cause of the upturn in IS-related computer science was the digital libraries initiative of the 1990s. Funded in the United States and Britain by agencies that for years had largely ignored problems of the human–literature interface, this initiative made information scientists of persons who might enter a traditional library only to avoid the rain. The larger attraction was the transformative effect of the Internet and the Web on the world economy, which made new R&D on information systems not only intellectually stimulating but also potentially very lucrative. (Brin and Page are multibillionaires.)

Perhaps the foremost development in current IS is the explosion of interest in graph-theoretical work on dynamic networks—that is, the modeling of groups of entities as countable nodes and links whose counts can change over time.^[30–32] Quantitative network theory is abstract enough to be applicable to many different disciplines, but in IS it has been used to model—and visualize in color—such things as the papers connected by citation in the literatures of science and technology or bundles of hyperlinked pages across the entire Web. These are bibliometric (or webometric) applications. But network theory also turns up in IR—for instance, in the PageRank algorithm and the HITS algorithm,^[33] each employed in Web retrievals. The same methods and formulas can also effectively model interrelated persons, such as “invisible colleges” of communicating scientists or networks of coauthors. Interestingly, the PageRank measure, used to rank pages in Google, resembles an earlier measure, Bonacich centrality, used by sociologists to rank the centrality of people in social networks.^[34] Ranks based on network ties lead to automated recommendations of documents or people as possible sources of information. Google and the online bookseller Amazon.com have shown the relevance of such recommendations to librarianship.

There has long been a mathematical tradition in IS. In bibliometrics, for example, it began with S. C. Bradford and A. J. Lotka and continued with William Goffman and Manfred Kochen. The data typically involve power-law and lognormal distributions. In exploring and possibly exploiting such data today, algorithmically minded computer scientists are joined by physicists (e.g., Albert-László Barabási, Guido Caldarelli) and applied mathematicians (e.g., Mark E. J. Newman). In the past, quantifiers like these have occasionally taken positions in schools of L&IS, but the tendency now is for such persons to “do IS” on a variety of fronts outside the discipline.

It is necessary to mention these new information scientists because existing studies of IS seldom capture them. Existing studies^[35–37] characterize the discipline in terms of contributions to a limited range of home journals. However, the computer scientists and other researchers now

contributing to IS (using that term expansively) publish in conference proceedings, monographs, and journals of their own. No scholar as yet has assembled and analyzed their scattered works in the bibliographic databases ordinarily used to analyze IS as a field, such as Social Scisearch, Scopus, and Google Scholar. As a result, IS is currently defined in terms of past generations of canonical authors (mostly American or British), as opposed to the younger talents who are taking the field in new directions. This is not to say that the canonical figures no longer represent major subfields of IS or that continuity is lacking between old subfields and new—Zhao and Strotmann^[38,39] have made a start toward capturing the latter—merely that, in present research, brain and computer power is being upgraded with unforeseeable but probably dramatic results. Striking advances have occurred, for example, in the visualization of bibliometric data^[40,41] and in text mining,^[42] with implications for tomorrow's libraries. We are a long way from Pierce Butler.

A MAP OF IS

Several information scientists have visualized IS through author maps. White and McCain,^[36] for example, defined the field by mapping the 120 authors with the highest citation counts in 12 IS serials during 1972–1995. These computer-produced maps group authors algorithmically on the basis of cocitation. That is, the authors frequently cited together are placed relatively close together in “intellectual space.” Groups of proximate authors can usually be identified as subdisciplines or research specialties. The broadest groupings in such maps, corresponding to subdisciplines, are, first, authors mainly concerned with the design and evaluation of systems through which people seek answers from subject literatures, and, second, authors mainly concerned with the literatures that may provide those answers and whose quantitative properties are worth investigating in their own right. The first subdiscipline could be sweepingly characterized as “IR,” comprising authors who are, for example, algorithmic retrievalists, computer interface designers, specialists on indexing vocabularies, conductors of user studies, and systems evaluators. The second subdiscipline could be characterized as “Domain Analysis,” made up of authors who are, for example, bibliometricians, citationists, visualizers of scholarly and scientific fields, and researchers on disciplinary communication patterns.

An analysis of one such disciplinary map follows. The White and McCain^[36] data, with one author added, were remapped as a Pathfinder Network (PFNET) in White.^[43] A new configuration of that PFNET appears as Fig. 1. The two articles just cited give methodological and interpretive details, along with the mapped authors' full identities. (A fair number of these authors are referenced and indexed in this encyclopedia.) Here, it is enough to say

that Fig. 1 coherently organizes some major twentieth-century contributors to IS and suggests their degrees of influence. Quite a few of them, one must note, are now dead. Of those living, almost all have attained senior positions in their institutions, and many are retired or near retirement.

The map derives from a matrix in which raw cocitation counts for every pair of the 121 authors have been obtained from Social Scisearch. Most of the author pairs were cocited at least once during 1972–1995, but the PFNET algorithm links each author in the matrix only to that other author with whom he or she has the *highest* (or tied highest) cocitation count. For example, at lower left, Terry Winograd is linked only to Herbert Simon. This means that, of all Winograd's cocitation counts with the other 120 authors, his is highest with Simon. Nearby, William Paisley is linked to both Thomas J. Allen and Diana Crane. This means that Paisley has a tied highest count with both Allen and Crane. All other links are shorn away.

From the PFNET's radical simplifications, strong patterns emerge. To reinforce them, the size of each author's node has been made proportional to the number of other authors directly linked to it. The four authors dominating the linkages—stars in anyone's history of IS—are Gerard Salton, F. W. Lancaster, Eugene Garfield, and Derek de Solla Price. Salton has the most authors linked to him, followed by Garfield. Lancaster, however, is the most central author in the map. Cutting the link between him and Garfield would divide the authors into two subdisciplines of roughly equal size, the top one representing varieties of research in information retrieval and the bottom one representing varieties of domain-analytic research in scientometrics and the sociology of science. Derek Price, a polymath with doctorates in both physics and the history of science, is a key link in the latter.

Authors restricted to one position by PFNETs may in fact have published works in more than one specialty and even in both subdisciplines. An account of the multiple contributions of authors emerges from the factor analysis in White and McCain.^[36] That analysis nevertheless shows these authors' *main* specialties, as perceived by citers, in their highest factor loadings. Authors who load most highly on the same factors tend to be those explicitly linked in Fig. 1.^[43]

Salton and the authors around him are experimental retrievalists. Among them are Cyril Cleverdon and Michael Keen, leaders of the paradigm-setting projects on IR at the Cranfield Aeronautical College in England during the 1950s and 1960s. Researchers in the Cranfield tradition experiment with strategies of indexing and searching to improve scores of effectiveness in document retrieval. They design systems, run trials, and use human relevance judgments to assess the results. They also devise and justify measures by which system outputs can be evaluated (e.g., scores in precision and recall). Most have

Fig. 1 A map of 121 authors in IS, 1972–1995.

mathematical backgrounds, and virtually all are oriented toward statistics and algorithms. For many years their work was identified with “test-bed” collections—relatively small sets of topically constrained documents whose properties they knew well and on which their experiments were conducted. They did not usually evaluate retrievals from large commercial bibliographic databases such as those vended by Dialog or Thomson Reuters (See Salton’s own entry: *SMART system, 1961–1976*, p. 4770). In this tradition, moreover, the judges who assessed retrieved documents for relevance to queries were usually surrogates for end users, and there was little or no work on “real-world” users of systems. Largely pre-Web themselves, the Saltonians’ influence lives on in the Text Retrieval Conferences. TREC members base their research on much larger collections of documents than their forerunners but still resemble them in mindset.

Another group of retrievalists branches off to the left of the Salton group. In the so-called cognitive revolution in IR, which dates from the late 1970s, they increasingly reacted against the experimental retrievalists’ emphasis on systems in favor of a more user-oriented view. (Some of the authors shown around Salton—e.g., Don Swanson and Steven Harter—also did this.) The cognitive group might jointly be seen as “practical retrievalists.” Key transitional figures, maintaining a foot in both camps, are Tefko Saracevic, Nicholas Belkin, and Robert Oddy. Saracevic is linked to the philosopher Patrick Wilson and the psychologist Carlos Cuadra because all are noted for their work on relevance, often said to be the central notion in IS. The names around Belkin are identified with psychological aspects of user theory; around Marcia Bates, with users as online searchers; around Karen Markey, with users of online public access catalogs (OPACs) in libraries. The practical retrievalists are relatively nonquantitative in their approach, and much of their work involves users outside science and technology, such as public library patrons, students, and humanities scholars. Their work also casts doubts on the paradigm of IR that was initiated by the Cranfield team and furthered by experimentalists such as Salton, Keith van Rijsbergen, and Karen Sparck Jones.

The simplifying assumptions of early IR were that indexers describe documents with a fixed vocabulary, that users employ the same vocabulary in searching, and that the system brings both contentedly together when query terms and document terms match in topic. A major achievement of the cognitive group has been to establish that lay users seldom know or can tell the system exactly what they want, and learned users, though more sophisticated, do not robotically interact with a system or judge documents solely by topical match. Neither kind of user is much given to looking up indexing terms in thesauri or classification schedules to assist their searches. Both kinds flounder around exploratively, follow clues to diverse sources, and change their minds. Their search strategies

and relevance judgments are a creative process that goes well beyond the simplified input–output retrieval cycle of the textbooks.

The man who probably did most to popularize the simplified cycle was F. W. Lancaster, the quintessential information scientist between the Cranfield project (in which he participated) and the coming of the Internet. His book *Information Retrieval Systems*^[44] is the *locus classicus* of the paradigmatic diagram in which users’ “request profiles” and indexers’ “document profiles,” both based on controlled vocabulary, meet and sometimes match in a single system. Lancaster’s main factor loading is as an experimental retrievalist, but he was always more oriented toward everyday library practice and operational bibliographic systems than most of the Saltonians. For one thing, he led a large-scale evaluation of real-world document retrieval in the National Library of Medicine’s MEDLINE database; for another, he wrote textbooks on the complexities of actual indexing languages and actual Boolean searching in online systems such as Dialog. He taught a generation of librarians how to take a systems approach to evaluation^[45] and wrote voluminously on many other IS subjects.

It therefore seems fitting that the authors around Lancaster in Fig. 1 are themselves more diverse in their specialties than the authors around either Salton or Garfield. Most have their main factor loadings in general library systems (e.g., Allen Kent, Donald King, Robert Hayes, and Fred Kilgour); others have them in online retrieval (e.g., Martha Williams), OPACs (e.g., Michael Gorman), indexing theory (e.g., Derek Austen), user theory (e.g., Patrick Wilson—a bridging figure with the cognitive retrievalists), and even bibliometrics (e.g., Philip Morse), an area in which Lancaster also published. Many of the “Lancastrian” authors resemble him in being generalists who exhibit a wide range of interests across their publications (e.g., Michael Buckland).

In contrast to this mixed lot, the authors around Eugene Garfield all load most highly on citation analysis, the largest specialty in bibliometrics. Garfield founded the Institute for Scientific Information (ISI)—now Thomson Reuters—in Philadelphia in 1960. At ISI he and his staff developed citation indexes commercially as a new tool for retrieving documents, complementing subject indexes. (Lawyers and judges had long had Shepard’s citation indexes for discovering chains of precedent in legal proceedings, and one of Garfield’s motives for his indexes was to give scientists a way of tracking the chains of corrections, addenda, and retractions that affect the claims made in scientific papers; see p. 162).^[46] From the beginning, however, it was evident that ISI’s large-scale citation databases could be used for more than document retrieval. They could be used to operationalize the notion of scientific specialties as corpora of citation-linked writings—corpora whose composition changed over time, yielding mappable data for intellectual histories.^[41] The databases

could also be used to operationalize the notion of scientific impact or reputation, because they showed the varying citedness of individual papers, authors, journals, organizations, and countries.^[47]

Led by the prolific Garfield and the comparably influential Price, the citation analysts found many new applications of ISI data for descriptive or evaluative purposes. One of Garfield's contributions was the well-known journal impact factor, still widely used for assessing the prestige of journals, although various replacements have been proposed.^[48] Price virtually created the field of scientometrics by using citation data to study, e.g., author productivity (acknowledging Lotka as a forerunner), the growth of literatures, networks of scientific papers, invisible colleges, differentiation of the hard and soft sciences from the humanities, and cumulative advantage as a model of differences in scientific reputations. Among other innovators, Francis Narin, Mark Carpenter, and J. D. Frame did pioneering work on evaluative bibliometrics, notably on networks of journals that cite each other. Henk Moed and B. R. Martin are known for their uses of citation analysis in evaluating research teams at institutes and universities. Maurice Line gathered citation data to study the ageing (i.e., decline in use) of literatures; so did Belver Griffith. M. M. Kessler came up with the static associative measure called bibliographic coupling—the number of references documents share in their endnotes. Henry Small (Thomson Reuters's director of research) topped this with a dynamic associative measure, cocitation—the number of later papers that cite any particular pair of earlier ones. Howard White and Katherine McCain generalized Small's cocitation measure to authors' *oeuvres* and journals, respectively. Besides having uses in retrieval, bibliographic coupling and cocitation measures underlie the maps of science (such as Fig. 1) that have been appearing since the 1970s.

Linked to Price at right are B. C. Brookes's group of theoreticians who contributed significantly to the mathematical side of bibliometrics. Their work is concerned with fundamental processes of literature dynamics rather than with citation analyses of particular fields. Famous early students of these processes, all with distributions of bibliometric data named after them, are S. C. Bradford (connected to Brookes), A. J. Lotka (connected to Price), and George Zipf (connected to Herbert Simon at far left). Brookes himself, Ferdinand Leimkuhler, Robert Fairthorne, and Brian Vickery are all known for their work on "Bradford's law" (which pertains to regularities in the distribution of articles on a subject over journals). Leo Egghe, who was Brookes's doctoral student, is currently a leader in mathematical IS and the founding editor of the *Journal of Informetrics*.

From Price leftward, most of the authors represent disciplines other than IS. However, they share his interest in communication patterns in science and technology (which include citation networks and invisible colleges). Robert

Merton's group are largely identified with one of his specialties, the history and sociology of science. Merton, Harriet Zuckerman, and Thomas Kuhn (of paradigm fame) helped to legitimize citation analysis theoretically. Stephen and Jonathan Cole, Diana Crane, William Paisley, and Ronald Rice have all published citation analyses themselves, although their research topics are considerably broader. Herbert Simon (the Nobel laureate) and his group are sources of ideas imported into IS. Quantitative work by Simon and Zipf, for example, has been used in bibliometrics, and Claude Shannon's way of measuring "information" has had a diffuse influence.

TOO NARROW A VIEW?

As stated at the outset, many experts define IS at a high level of generality. This entry attempts to define IS more concretely by describing its center. It attempts to state the field's main scientific and technological concerns—literature-based answering, the human–literature interface—with many specific examples. When that is done, readers can assess not only what has been included but what has been excluded, and the exclusions can be judged. On grounds of clarity, that seems preferable to formulations of IS that imply anything and everything, from cloth books for preschoolers to the genetic code. (The same vague imperialism softens the field's name to "information studies.") Two earlier pieces by White and McCain^[36,49] took a similar line, and both have been criticized as leading to unduly narrow conceptions of IS. A bit more exposition thus seems called for, one that also extends earlier definitional themes.

Fig. 1 is a core-and-periphery model of IS; it depicts specialties as central authors surrounded by less central ones. It also depicts Lancaster's group as being the most central. Through Lancaster, the retrievalists above and scientometricians below are joined to a diverse group of generalists with applied interests in real-world libraries and information systems. However, if the center of the field is conceived more widely, the entire map of 121 authors can be taken as modeling the core of IS. On analogy with a target, it would be the bull's-eye in a set of concentric circles representing adjoining specialties and disciplines. (Something like an outer circle of authors now radiates left from Price.)

Does this mean, however, that just these 121 authors and no others fully characterize IS? Certainly not. First, they represent the period 1972–1995, and, as stated earlier, a whole new generation of information scientists has risen since then. (Mapping approximately the same intellectual space, Zhao and Strotmann^[38,39] show both new names and new specialties joining the older ones.) Second, while the 121 are an elite of sorts—they are the top citees in a set of 12 serials oriented toward IS and library automation—the cutoff was determined mainly by

computational and presentational limits. The elimination of lower-ranked contributors to IS or librarianship (or both) was not meant to deny them a place in the field or to impugn what they write about. It simply means that, across 12 representative serials, the work of certain authors has been the most prized by their citing colleagues. Revealing the nature of this work is an evidence-based way of bringing a field into focus.

Not seeing their own interests represented in Fig. 1, Danton^[50] and Webber^[51] questioned the set of serials from which the top authors were chosen. White and McCain^[36] acknowledged that the names they mapped were far from exhausting the field. A larger sample from the same or different serials would indeed add both authors and specialties. Areas such as library management and library education, for example, could be induced in Fig. 1 by expanding the pool of citees to include authors like Richard de Gennaro and Herbert S. White, both highly cited during 1972–1995 in library-oriented serials not among the original 12.

The subtext here, however, is that what appears on a citation map is never wholly value-free. It has a political dimension in which invidious comparisons are made. People who do not find themselves or their specialties on a map may feel slighted. Or they may fear that the maps will be used prejudicially, to rule out creativity in new directions.

In the latter vein, P. Wilson^[52] argued that IS is both messier and far richer than White and McCain's^[49] "restrictive" characterization of it as IR and bibliometrics, which is essentially repeated in Fig. 1. Cronin^[53] argued that the "exclusionary" maps in White and McCain^[36] may have revealed something of classical IS, but miss the many other contributory literatures being explored in the *Annual Review of Information Science and Technology* (ARIST), whose editor he had just become.

Obviously the White and McCain papers do not stifle creativity, or there would be no new literatures for ARIST to review. But in one sense Wilson and Cronin are correct: cocitation analysis drastically simplifies. The maps are high-altitude views of the consensus hidden in the bibliographic record. This consensus has been evolving over years or decades, and so the maps inherently look toward the past rather than the future. The best that can be said for them is that they provide a check on the overinclusive definitions of IS that many experts seem to favor. The *Online Dictionary for Library and Information Science*, for example, defines IS thus: "The systematic study and analysis of the sources, development, collection, organization, dissemination, evaluation, use, and management of information in all its forms, including the channels (formal and informal) and technology used in its communication." This phrasing covers all of the more than 500 sprawling, interdisciplinary ARIST chapters ever written, but also all of interpersonal communication, all of mass communication, all of education, and all of remote sensing (to go no further)—enormous areas of study that already have

plentiful researchers of their own. At the same time, it misses what is both central and unique to IS, namely the human–literature interface.

Another check on the nature of IS appears in Table 2, which shows the 20 ARIST chapters most highly cited in the Web of Science (WoS) and Google Scholar (GS) as of early 2008. Most of these chapter titles concisely imply what is now the human–computer–literature interface as an object of scientific study. The top 20 are taken from the entire run of ARIST, 1966–2007, and are a merger of the top 15 titles in each database. In each set of 15, 10 titles overlapped and 5 were unique. The unique chapters appear in Table 2 with abbreviations of their sources; the overlapping chapters are unmarked. The WoS counts reflect citations in the journal literatures covered by Thomson Reuters. The GS counts reflect many of the same citations but draw on a wider range of sources (e.g., conference proceedings, books) and so are usually higher. The WoS counts are higher for relatively old chapters.

The topics that come to the fore accord quite well with the divisions of IS given here. Information behavior studies are well represented. So is IR, in both its algorithmic and cognitive wings; so is the bibliometric study of literatures, including the recent emphasis on visualization. The one area not immediately apparent is the linguistic side of bibliography, as seen, for example, in discussions of subject indexing, classification, search strategies, metadata. That area is indeed present at the level of chapter titles in ARIST; it is just further down in the rankings.

Several titles in Table 2 imply that IS includes studies of communication between people. According to Webber,^[51] this is an area that White and McCain^[36] explicitly leave to other fields. More accurately, the latter paper claims that the *main* dialogue studied in IS is that between people and literature-based information systems. But interpersonal dialogues oriented toward that center have always been and will remain important topics in IS. For example, no one would rule out research on how reference librarians interact with their customers, or on how colleagues consult as a means of avoiding literature searches, or even on how people inform themselves when, for whatever reason, they have little or no access to publications of any kind. There are, however, countless other studies of interpersonal communication that address matters information scientists never will. Does this mean that all such studies are irrelevant to IS? Not if the right context is set up; IS borrows from other fields all the time. Yet it also seems likely that most would enter IS in a very limited context. They would be cited once or twice, rather than repeatedly.

The lesson to take away is that virtually all definitions of IS need elaboration with examples. The present account has advocated a way of getting examples that is distinctive to IS—by citation counts, using the ranking principle that is fundamental to both IR and bibliometrics. The ranked citation frequency distributions underlying both Fig. 1 and

Table 2 Major topics in IS as shown by the most-cited ARIST chapters, 1966–2007.

Year	Titles	Authors	WoS	GS
1986	Information needs and uses	B. Dervin, M. Nilan	317	383
1994	Relevance and information behavior	L. Schamber	144	212
1989	Bibliometrics	H. D. White, K. W. McCain	132	215
1968	Information needs and uses	W. J. Paisley	101	76
1987	Retrieval techniques	N. J. Belkin, W. B. Croft	92	189
2002	Scholarly communication and bibliometrics	C. L. Borgman, J. Furner	74	194
1996	Query expansion	E. N. Efthimiadis	63	161
1997	Evaluation of information retrieval systems	S. P. Harter, C. A. Hert	62	82
1985	Probability and fuzzy set applications to information retrieval (WoS)	A. Bookstein	59	59
1996	Social informatics of digital library use and infrastructure (WoS)	A. P. Bishop, S. L. Star	56	55
1980	The impacts of computer-mediated organization and interpersonnel communication (WoS)	R. E. Rice	54	20
1977	Bibliometrics (WoS)	F. Narin, J. Moll	53	40
1997	Visualization of literatures	H. D. White, K. W. McCain	52	63
1993	Browsing—A multidimensional framework	S. J. Chang, R. E. Rice	48	80
1991	Cognitive research in information science (WoS)	B. L. Allen	44	60
2003	Visualizing knowledge domains (GS)	K. Börner, C. Chen, K. W. Boyack	42	153
2001	Conceptual frameworks in information behavior (GS)	K. E. Pettigrew, R. Fidel, H. Bruce	40	64
1990	Information need and use studies (GS)	E. T. Hewins	38	70
1998	Cross-language information retrieval (GS)	D. W. Oard, A. Diekema	32	92
2002	Collaboratories (GS)	T. A. Finholt	23	112

Table 2 are highly typical of bibliometric data. They consist of a relatively small core of highly cited items, a larger number of decreasingly cited items, and a still longer tail of items with little or no citation. Ranking by citedness raises some items above a certain threshold, as if by balloting in an election. Those, in the judgment of all citing authors, are the items most relevant to the field. So how to prioritize one's examples for greatest relevance? Look to the cores.

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Bibliometric Research: History [ELIS Classic]

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Abstract

Hertzell marshals a vast amount of information on the origins and development of one of the core areas of information science research—bibliometrics, or, as it is also known, informetrics. The study of the statistical properties of the domain of recorded information is a large field with an extensive body of research results.

—*ELIS Classic*, from 1987

INTRODUCTION

The word “bibliometrics” first appeared in print in 1969 in Alan Pritchard’s article “Statistical Bibliography or Bibliometrics?” in the December issue of the *Journal of Documentation*.^[1] Pritchard’s article was the result of his judgment that the expression “statistical bibliography” should be replaced with a better term. He used “statistical bibliography” in his unpublished “Computers, Statistical Bibliography and Abstracting Services”^[2] and again in his *Statistical Bibliography: An Interim Bibliography*, published in May 1969.^[3] In December 1969, in “Statistical Bibliography or Bibliometrics?” he stated, “The term [statistical bibliography] is clumsy, not very descriptive, and can be confused with statistics itself or bibliographies on statistics.”^[1] As a result of the prompting of his friend, M.G. Kendall, Pritchard suggested that the word “BIBLIOMETRICS, i.e., the application of mathematics and statistical methods to books and other media of communication” be substituted for “statistical bibliography.”^[1]

In the same issue of *Journal of Documentation* appeared Robert A. Fairthorne’s classic article “Empirical Hyperbolic Distributions (Bradford–Zipf–Mandelbrot) for Bibliometric Description and Prediction,”^[4] in which the author used the word “bibliometric” and acknowledged Alan Pritchard as the donor of the term.^[4] Fairthorne, a close friend of Pritchard, admitted that a phrase in the article—“This term [bibliometrics] resuscitated by Alan Pritchard”^[4]—incorrectly suggested previous use, but in personal correspondence, he definitely verified that “Alan Pritchard *did* coin the word ‘Bibliometrics’.”^[5]

Because the relation between the terms “bibliometrics” and “statistical bibliography” has now been established, it seems imperative that a history of bibliometrics should begin with its predecessor, statistical bibliography and its components: statistics and bibliography.

BIBLIOGRAPHY

“Bibliography” was derived from two roots: *biblion*, book; and *graphos* from *graphein*, to write.^[6] Webster defined it as a “history of books, an account of manuscripts. . . and information illustrating the history of literature,” as well as “a list of an author’s writings; or the literature dealing with a certain subject or author.”^[6]

“In post-classical Greek times, when the word originated, it meant the writing or copying, i.e., the production of books; as late as the eighteenth century it was understood as the study of these ancient manuscript books.”^[7] Through the centuries, the meaning of “bibliography” has undergone a series of changes, some of which are considered here.

Monks, in copying manuscripts, also made lists of the books being copied; these lists, catalogs, or inventories are considered early bibliographies. At first, there were only limited numbers of lists of books or catalogs. Georg Schneider suggested this was because of lack of titles, limited need, and a limited area. He stated that, in the narrow sense, bibliography is a “study of lists of books” and further suggested that “true [i.e., modern] bibliography” began in 1564 when Georg Willer of Augsburg published his catalog of books, a listing for sale by him at the Frankfurt fair.^[8]

From individual listings, bibliography progressed to the attempt to produce a “world bibliography.” Konrad Gesner (1545) made the “first attempt to collect in one list all the scholarly publications of the world in bibliographic form,”^[8] resulting in his having been acclaimed the “Father of Bibliography,”^[8,9] but here, there is a difference of opinion. Archer Taylor claimed, “we may conveniently date bibliography from the activities of Johannes Trithem, a practical and theoretical bibliographer of the late fifteenth century,” but he agreed that “another man who was to display an even greater ability as a bibliographer” was Conrad Gesner (Murray acclaims “The

Bibliotheca of Conrad Gesner, a monument of human industry and one of the triumphs of bibliography.”^[9],^[10]

Between 1600 and 1700, bibliographies on particular subjects were published; these “are descriptive accounts of the literature of the subjects they deal with rather than catalogues of books.”^[9]

Taylor’s investigations led him to the conclusion that “By 1700 bibliography was a highly developed art. And it was more than that: It was a deliberate and conscious maintainer of an intellectual and learned tradition descending from the beginning of time. . . .”^[10] This tradition can be traced to the beginning of the sixth century with the founding by Cassiodorus of an Italian monastery, one of the rules of which was the service of God “by diligent study and carefully copying of texts,”^[11] and in the establishment in 529 of the Benedictine Order with its “very great emphasis on reading.”^[11]

The transition of meaning of bibliography was probably due to numerous reasons. These include the greater availability of books; rise of a middle class; development of “public” libraries; more people becoming literate; the passing of the Renaissance and advent of the Reformation; continued interest in humanism; the time of Galileo, Descartes, Kepler, and Newton; and the beginning of scientific progress.

By the eighteenth century in France, bibliography was “writing about books;”^[8] later, it was called “the science that deals with literary production”^[8] and finally, “the science of books.”^[8]

According to Thomas Hartwell Horne,

GENERAL BIBLIOGRAPHY. . . is, in strict language, a science; which consists in the knowledge of books, of their different editions and degree of rarity and curiosity, their real and reputed value, and the rank which they ought respectively to hold in a system of classification. General bibliography comprises works or catalogues, whose design is to give us a knowledge of every kind of book whatsoever. . . .^[12]

Bibliography is one of the oldest and yet one of the most modern of the sciences. It is old, because at all times scholars had lists of works of authors, catalogues of libraries, and other similar aids; it is modern, because it is only within a comparatively recent period that bibliography has been developed systematically.^[9]

In 1935, Oxford University Press published *The Beginnings of Systematic Bibliography* by Theodore Besterman. Besterman divided bibliography into two parts, “the enumeration and classification of books, and the comparative and historical study of their make-up.”^[13] His research indicated that “bibliographies started as biographies in which the writings of the subjects were referred to as facts in their lives.”^[13] Eventually this slant changed, with the emphasis on the writings becoming the more important.

Current bibliography may be said to be the result of demands of research, development of numerous journals, and the formation of many societies, literary and scientific.^[14] It can be concluded that the most important change in the meaning of bibliography was caused by change in its purpose, which at first was to preserve or record past items (lists or inventories), whereas its primary purpose now is to aid in dispensing knowledge (guides).^[14]

This supports E. Wyndham Hulme’s *Statistical Bibliography*, in which he defined bibliography as “the science of the organization of recorded knowledge.”^[15]

STATISTICS

“Statistics” was derived from the German “Statistik,” which came from the medieval Latin “statisticus,” which in turn was derived from the Latin “status” meaning state, position, standing (Latin for “to stand”).^[16]

Statistics

as a plural noun means collections or sets of facts that are related. . . . In practice, it is customary to restrict its meaning to facts that are numerical or can in some way be related to numbers. As a singular, collective noun, statistics means the science of collecting or selecting statistical facts, sorting and classifying them, and drawing from them whatever conclusions may lie buried among them.^[17]

In other words, “statistics” means facts or data of a numerical kind, assembled, classified, and tabulated to present information about a subject; originally, it referred to the physical, social, economic, intellectual, political, and industrial state of a country or its people as indicated in tables or numerical statements.

Yule and Kendall, in their *An Introduction to the Theory of Statistics*, first published in 1911, wrote that the now obsolete term “statist,” meaning a statesman or politician, was used as early as 1602 in Hamlet,^[18] and that the

earliest occurrence of the word “statistics” yet noted is in *The Elements of Universal Erudition* by Baron J.F. von Bielfeld (1770). One of its chapters is entitled “Statistics” and contains a definition of the subject as “The science that teaches us what is the political arrangement of all the modern states of the known world.”^[18]

Studies in the History of Statistical Method, by Helen Walker, asserted “The term “Statistik” occurs for what is probably the first time in the writings of Achenwall who is usually hailed as the father of statistical science.”^[19] His first statistical work appeared in 1748 and occurred in 1749 as the introduction to another of his works. The term “Statistik” was used in the preface.^[19] Helen Walker’s research led her to state that Achenwall and others “did

not devote themselves so much to enumeration and computation as to verbal descriptions of the political situation and of all facts of interest in their countries.”^[19]

Although the word did not appear until the eighteenth century, the rudiments of the subject, statistics, were found in very early ancient times and at first were only approximate counts. As early as 2000 B.C., there was a population census in Judea;^[20] in ancient Rome and Greece, the census was taken for real estate taxes; and in the Middle Ages, there were taxes, tithes, and land registers of various countries.^[20] As early as “762 Charlemagne ordered the detailed descriptions of church lands”^[21] in France, and by the first half of the ninth century, “the serfs and peasants being attached to the land were included in the land census.”^[21] Eventually, it became necessary for those in power, for their own protection, to know their military and financial standings and that of other powers. Thus,

In the beginning, statistics considered the most urgent need of the period, namely the knowledge of the state, and as its method comparison, without, however, possessing an exact sense of proportion nor a distinct consciousness of the necessity of measurement.^[20]

The gradual change in the meaning of statistics was a result of the era and the conditions of the time, starting with a listing of land ownership and progressing to a description of states, but at first, statistics was not an exact enumeration. Further development was due not only to the change from feudal or medieval system to the “modern state” but also to the need to know of the comparison status for an evaluation of power which necessitated more accurate counting.

Gradually, statistical facts became “public” knowledge, for as early as 1536–1544 the *Cosmographia* of Sebastian Muenster described the world, giving maps of known countries, history, organization, laws, customs “and in detail the chief cities with their wealth and trade.”^[20] This may be called “descriptive statistics.” Various other works followed; these included public laws, estimates of taxes, military strength, and commerce. In 1626, “the publication of the so-called *Respublicae Elzeviranae*,” which gave descriptions of single states written by distinguished statesmen of the period,^[20] was begun. In 1660, statistical studies were introduced into the curriculum of the University of Helmstedt, and from there, the giving of similar lectures spread to other areas.^[20]

It was during the “17th century [that] the games of hazard grew into prominence”—lotteries, probabilities in games of chance, and annuity life insurance,^[20] and this is thought to be the true beginning of inductive statistics, explained as follows by Walpole: “Any treatment of data leading to predictions or inferences concerning a large group of data is known as *inductive statistics*.”^[22] Based on the theory of probability, which had its beginning in

gambling or games of chance, inductive statistics projects or determines a possible or probable outcome.

History showed that Galileo was consulted for solutions to some problems on gambling, solved the problems, and wrote a paper concerning games of chance. Not long after in France, Blaise Pascal was approached by his friend Chavalier de Mere with similar questions.^[17] “Chevalier de Mere proposed to B. Pascal the fundamental “Problem of Points” to determine the probability which each player has, at any given stage of the game, of winning the game.”^[23] (See V. Sanford, who claimed this problem was in evidence as early as 1494.)^[24] Pascal shared the problem with his friend, Fermat. Both solved the problems, but by different methods. Pascal, as a result of his work, developed the theory of probability.^[17] In 1657, Huygens developed a treatise on probability which was later included in Jakob Bernoulli’s *Ars conjectandi*.^[23] Bernoulli, elaborating on the subject, made the innovative suggestion that the “ideas [of probability] might be applied to civil, moral, and economic affairs.”^[24]

Shortly after, Abraham de Moivre published *The Doctrine of Chances*, the outcome of which study led to the development of the normal curve of distribution.^[24] This same bell-shaped distribution is “often referred to as the *Gaussian distribution*, in honor of Gauss (1777–1855) who also derived its equation from a study of errors.”^[22] The ideas of probability also led to the further development of insurance which was based on “mortality.” During the seventeenth century, some investigators had used vital statistics to make predictions and draw some very interesting conclusions.^[20] The “first attempt to interpret mass biological phenomena and social behavior from numerical data—in this case, fairly crude figures of births and deaths in London from 1604 to 1661”—was in *Natural and Political Observations Made upon the Bills of Mortality*, by John Graunt of London in 1662.^[25]

John Graunt (1620–1674) was born in London and was a shopkeeper by trade.

The Bills of Mortality which attracted Graunt’s attention were issued weekly by the company of parish clerks and listed the number of deaths in each parish, the causes, and also an “Account of all the Burials and Christnings, hapning that Week.”^[25]

Impressed with Graunt’s work, Charles II fostered his membership in the Royal Society of London. The influence of Graunt’s work spread and soon affected “the gathering and study of vital statistics on the Continent.”^[25]

Thirty years later, Edmund Halley, of comet fame, at the request of the Royal Society, wrote the mortality rates report “An Estimate of the Degrees of the Mortality of Mankind, drawn from curious Tables of the Births and Funerals at the City of Breslaw; with an Attempt to ascertain the Prices of Annuities upon Lives.”^[20]

This was followed by “Some further Considerations on the Breslaw Bills of Mortality.” Together, the papers are the foundation for all later work on life expectancy, indispensable, of course, to the solvency of life-insurance companies.^[25]

“During the eighteenth century it [subject of probability] developed rapidly, and in the nineteenth it found application in the mathematical study of statistics.”^[24]

On the other hand, the approach of Gottfried Achenwall, the father of statistical science, was descriptive. In 1746 he began his statistical lectures and soon had some of his related writings published; in the introduction of one of these appeared for the first time the word “statistik.”

Up to this time the word had been merely suggested. . . by *statista*, one versed in the knowledge of the state, or by the adjective use, *rationes statisticae*, by Oldenburg, 1668, *bibliotheca statistica*, by Thurmann in 1701, and the *collegium statisticum* of Schmeitzel. Achenwall derives the word from the Italian, *ragione di stato*, practical politics, and *statista*, statesman.^[20]

He alleged the “final object [of statistik] is to gain political wisdom by means of knowledge of the various states” both internal and external.^[20]

In 1749, Achenwall’s work which later became *Reiche and Völker* was published.^[20] This covered “Spain, Portugal, France, Great Britain, the Netherlands, Russia, Denmark, and Sweden,” giving a careful picture of each, of land and peoples, in seven distinct groups of questions:

1. The literature and sources of information.
2. The state, its territory and the changes of the same.
3. The land, its climate, rivers, topography, divisions, abundance or scarcity of products.
4. The inhabitants, numbers and character.
5. The rights of the rulers, the estates, the nobility and the classes of the inhabitants.
6. The constitution of the court and the government, laws, and administration of churches, schools, and justice, industry, home and foreign commerce, currency, finances, debt, army and navy.
7. The interests of national life and politics, as well as the outlook for the future.^[20]

“The work found such general recognition that it was translated into all languages,” with the result that Achenwall’s concept of statistics in addition to the word was widely distributed and accepted.^[20]

Running parallel with Achenwall’s idea was the need for lists of “official statistics”—tables of vital statistics, census, and demographics. By 1782, the scope of the tables had been expanded considerably, and “the statistical details [were] collected in general outline tables.”^[20] The information was not only descriptive, it was exact enumeration.

The origin of the publication of details of official statistics has been attributed to Anton Friederich Büsching.^[20] He is also credited with the founding of *Das Magazin für Historiographie und Geographie*, claimed to be the first statistical periodical because of its statistics from many German and other countries.^[20] Büsching’s importance resulted from his interest in details and not in generalities as in Achenwall’s case, and this interest in details “led to a careful examination as to the completeness and correctness of the data, and promoted, by the scrutiny of their origin and arrangement, the progress of critical methods.”^[20]

Throughout the 1800s, numerous countries developed commissions, departments, or bureaus of statistics with publications of various reports and annuals. Undoubtedly, the developing spirit of nationalism, free trade movement, and world exhibitions were contributing factors to the ever-rising interest in statistics.^[23]

Adolph Quetelet, a Belgian statistician and sometimes referred to as the founder of modern statistics, “developed the conception of statistics as a general method of research applicable to any science of observation,”^[19] and his theory widened the application of statistics when he applied statistical methods to education and sociology. Quetelet, responsible for the First International Statistical Congress which was held in Brussels in 1853, was also “one of the first statisticians to demonstrate that statistical techniques derived in one area of research are also applicable in most other areas.”^[22]

By 1872, M. Haushofer by stating “statistics is a method and a science. . . designates statistics as an essentially methodical science,”^[20] and this was supported by August Meitzen, a German professor, who in 1886 evaluated statistics as “a method of scientific investigation by means of enumeration of objects and the numerical comparison of the results of such enumeration.”^[20] His concept of statistics was that it is a “science of method” based on counting plus a comparison of the results.

This information leads to the conclusion that statistics may be divided into two areas, descriptive and inductive, or inferential. Descriptive statistics is really a description or compilation of data in a form that is clear and usable, whereas in inductive statistics, data pertaining to a sample of a population are used to arrive at a probable conclusion or prediction concerning the whole. Blalock called this “generalizing on the basis of limited information.”^[26] The conclusions of inductive statistics, based on incomplete data, being uncertain or probable, depend on the theory of probability,^[22] and though the original meaning of statistics dealt with counting, the modern statistical method “deals more with the design, execution, data analysis, and interpretation of studies.”^[27]

Originating as the mathematical tool of the gambler, the science of probability has become fundamental in the

knowledge of the physicist, the biologist, the technologist, the industrialist, the businessman, and the philosopher.^[17]

It seems logical that the science of probability and statistics would also have been used by the librarian or the bibliographer and eventually applied to the field of bibliography. So, statistics, using the theory of probability (counting, analyzing, and interpreting) combined with bibliography (knowledge dispensers) became statistical bibliography, as Pritchard defined it.

STATISTICAL BIBLIOGRAPHY

In the papers using the expression “statistical bibliography,” there are only a few explanations of what is meant. Researchers claim E. Wyndham Hulme (1922) was the first to use the expression,^[15] and according to Alan Pritchard, from then until 1969, only two other authors, Charles F. Gosnell and L. Miles Raisig, used the phrase. Antecedent to Hulme was Cole and Eales’s use of “statistical analysis” in “The History of Comparative Anatomy, Part I (1917).”^[28] After Hulme, “statistical bibliography” was used by Gosnell in 1943 in his dissertation, “The Rate of Obsolescence in College Library Book Collections, as Determined by an Analysis of Three Select Lists of Books for College Libraries”^[29] and in his article of 1944, “Obsolescence of Books in College Libraries;”^[30] and by Raisig in 1962 in his “Statistical Bibliography in the Health Sciences.”^[31]

Hulme believed “statistical treatment must show the existence of phases of activity and retardation in each science and might even indicate approximately the period when its ultimate boundaries would be reached.”^[15] “Bibliographical statistics, employed with the requisite qualifications, are without question able to reveal the shape and period of such movements.”^[15]

Cole and Eales, calling their work a statistical analysis of the literature, graphically represented the “activities of comparative anatomists for a period of time.” As they stated,

In other words it seemed possible to reduce to geometrical form the activities of the corporate body of anatomical research, and the relative importance from time to time of each country and division of the subject.^[28]

Here we have tabulations, charted and analyzed as to the important periods in the development of anatomy study or progress.

Gosnell’s doctoral thesis, “The Rate of Obsolescence,” purports “to discover lines of trend or curves of distribution by means of which this rate of obsolescence may be expressed in mathematical form.”^[29] “The degree of such obsolescence may be discovered by statistical analysis.”^[29] His Chapter II, Statistical Bibliography, was

divided into several parts, the first of which was a definition.

In bibliography, which is the science of history and description of books major emphasis has always been qualitative. . . . Very little attention has been given to the significance per se of the number or bulk of publications in a group or series. *Statistical bibliography* implies emphasis on the quantitative aspect rather than the qualitative.^[29]

Using “three select lists of books for college libraries, the Shaw *List*, issued in 1931, the Mohrhardt *List*, 1937, and the Shaw *Supplement*, 1940,”^[29] Gosnell proceeded to make an analysis, developing a curve of obsolescence after first preparing tables of the distribution of imprint or publications dates. He also made the observation that “The curve of obsolescence in a sense represents the reverse of compound interest.”^[29]

In “Obsolescence of Books,” an article based on his thesis, Gosnell used two assumptions; the first suggests that principles of choice may be discovered by the documentary analysis of the list.^[30] (Here Gosnell is qualifying his use of the specific three lists.) “The second [under the section heading, Statistical Bibliography] is that mere masses of books (or titles) may be analyzed for certain characteristics without reference to their individual titles.”^[30] Here using “collections of books as populations,” he suggested that certain characteristics or trends be noted to make a reliable prediction of obsolescence.^[30]

Gosnell’s idea that “Books represent one of the higher forms of culture and the rate at which they are discarded and replaced may give some suggestion as to the rate of evolution of the general culture of which they form a part” seems to be a variation of the Hulme theme.^[30]

Raisig, claiming there was a “potential utility of statistical bibliography as a method of analyzing information needs,”^[31] stated that his article was “a review of investigative methods and results in the health sciences.”^[31] He gave the following as definition of “statistical bibliography:” “the assembling and interpretation of statistics relating to books and periodicals; it may be used in a variety of situations for an almost unlimited number of measurements.”^[31] He continued,

bibliographical statistics have been collected. . . for these [three] main purposes: to demonstrate historical movements, to determine the national or universal research use of books and journals, and to ascertain in many local situations the general use of books and journals.^[31]

“The citation analysis of the research usage of periodicals has yielded the greatest number of published results and the greatest variety of interpretations.”^[31] Raisig’s article leaned to a discussion of citation literature with particular critical emphasis on the Gross and Gross analysis (see the next section, Seminal Bibliometric Papers).

Glenn Wittig, in his extensive research, found several more users of “statistical bibliography:”^[32] H.H. Henkle in 1938 in the article “Periodical Literature of Biochemistry;”^[33] Herman H. Fussler in 1948 in his dissertation, “Characteristics of the Research Literature used by Chemists and Physicists in the Soviet Union,”^[34] which was also published in *Library Quarterly* in 1949,^[35] and Dale Barker in his dissertation of 1966, “Characteristics of the Scientific Literature cited by Chemists of the Soviet Union.”^[36]

Henkle’s paper used the expression “statistical bibliography” to report “the results of a study in which the methods of statistical bibliography were applied to an evaluation of the periodical literature of biochemistry.”^[33] Although he did not “define” statistical bibliography, he did state, “the bibliographies [he used] were analyzed statistically and a list of journals arranged in the order of the frequency with which they were cited.”^[33] He believed his research would help in the “problem of selecting periodicals for the library.”^[33] Henkle listed many papers of biomedical interest which have been patterned after the Gross and Gross method. His interest is a research study of citations in the biochemistry field and he made comparisons with the results of other scientists, concluding “one of the important facts shown by these bibliographical studies is the extent to which the journal literature demonstrates the interrelationships of the sciences.”^[33]

Fussler’s research, published as two papers in the *Library Quarterly*, examined the characteristics of the literature of chemistry and physics. Although Fussler wrote, “This study is a form of statistical bibliography,”^[35] he did not define statistical bibliography. However, he did make this explanatory remark:

A number of analyses of research literature have been made by listing the references contained in one or a group of important journals in the field to be surveyed. Various considerations suggested that the adoption of this technique or some modification of it would yield the most useful sample of the general research literature for chemistry and physics.^[35]

Dale Lockard Barker’s doctoral thesis, “Characteristics of the Scientific Literature,” was quite an ambitious endeavor. The objectives of his paper were:

to identify and describe in terms of selected characteristics, the scientific literature used by Soviet chemists and to determine in part the nature of that use. Specifically, the study sought a) to establish the outstanding properties of Soviet chemical literature; b) to provide greater insight into the characteristics of Western chemical literature as reflected in Soviet use; c) to extend our knowledge of some basic properties of world scientific literature without respect to its national origins, and; d) to determine patterns of literature used by Soviet chemists.^[36]

Although Barker did not define statistical bibliography, he described what it included. In the section headed Statistical Bibliography, the author pointed out that:

the knowledge of scientific literature afforded us by descriptive and historical studies has been augmented by a considerable body of statistical research. This has been directed toward various phases of scientific communication, but has sought principally to describe the characteristics of the literature available to scientists, to identify the literature required by them, or to determine how they use the literature.^[36]

“Statistical bibliography” was used by Pritchard when he wrote “Computers, Statistical Bibliography and Abstracting Services”^[2] and again in his *Statistical Bibliography: An Interim Bibliography*, which:

contains a 700 item bibliography of literature on statistical bibliography, arranged in author order. The areas covered are: citation studies, abstracts, journals studies, direct literature studies with additional relevant material on user surveys, the history and sociology of science and citation structures. The period covered is from 1881–1969.^[3]

Alan Pritchard’s definition in the introduction to *Statistical Bibliography* is:

The statistical analysis of the means of communication in order to illuminate the processes of communication, the factors which influence them and the inter-relationships between the history and sociology of a science and the literature of the science.^[3]

In December 1969, Pritchard’s “Statistical Bibliography or Bibliometrics,” where he cited his preference of terms, appeared in print.

About a year later, in September 1970, *Research in Librarianship* published Pritchard’s document, “Computers, Bibliometrics and Abstracting Services;”^[37] Pritchard said that it and his unpublished paper, “Computers, Statistical Bibliography and Abstracting Services,” “were very similar and for practical purposes you can take it that they were the same.”^[38]

“Bibliometrics” as a term was now accepted in print (Table 1).

BIBLIOMETRICS

Alan Pritchard, who first used the word “bibliometrics,” described it as the “application of mathematics and statistical methods to books and other media of communication.”^[1] This was paraphrased by Robert A. Fairthorne as “quantitative treatment of the properties of recorded discourse and behaviour appertaining to it.”^[4] In a later

Table 1 Chronological list—statistical bibliography to bibliometrics.

No.	Year	Author and title	Publication	Cites these works on	Is cited in these works ^a	Expression and location
1.	1917	Cole, F. J., and Eales, N. B. "The History of Comparative Anatomy Part 1. A statistical analysis of the literature"	<i>Science Progress</i> , Vol. 11, April 1917, pp. 578–596	—	2, 8, 9, 11, 12	Statistical analysis subtitle, p. 578
2.	1922	Hulme, E. Wyndham <i>Statistical Bibliography in Relation to the Growth of Modern Civilization</i>	Lectures, May 1922, Book: Butler and Tanner Grafton, London, 1923	1	7, 8, 9, 11, 12	Bibliographical statistics, p. 9 Statistical bibliography, preface, title, pp. 5, 21
3	1938	Henkle, H. H. "The Periodical Literature of Biochemistry"	<i>Bulletin of the Medical Library Assoc.</i> Vol. 27, 1938, pp. 139–147	—	7, 8, 9, 11	Statistical bibliography, pp. 139, 140 Statistical analysis p. 139
4.	1943	Gosnell, Chas. F. "The Rate of Obsolescence in College Library Book Collections as Determined by an Analysis of Three Select Lists of Books for College Libraries"	Dissertation: New York University; 1943	1, 2	11, 12	Statistical bibliography, p. 16 Statistical method, p. 158 Statistical analysis, p. 158
5.	1944	Gosnell, Chas. F. "Obsolescence of Books in College Libraries"	<i>College and Research Lib.</i> Vol. 5; March 1944; pp. 115–125	—	9, 11, 12	Statistical bibliography, pp. 115, 116
6.	1948	Fussler, Herman H. "Characteristics of the Research Literature Used by Chemists and Physicists in the United States"	Dissertation: University of Chicago, 1948; p. 115	—	11	Statistical bibliography, pp. 13, 240
7.	1949	Fussler, Herman H. "Characteristics of the Research Literature Used by Chemists and Physicists in the United States"	<i>Library Quarterly</i> , Vol. 19, 1949; pp. 19–35	2, 3	9, 11	Statistical analysis, p. 21 Statistical bibliography, p. 27
8.	1962	Raisig, L. Miles "Statistical Bibliography in the Health Sciences"	<i>Bulletin of the Medical Library Assoc.</i> , Vol. 50, July 1962; pp. 450–461	1, 2, 3	9, 11, 12, 14	Bibliographical statistics, p. 450 Statistical analysis, p. 450 Statistical bibliography, pp. 450, 451
9.	1966	Barker, Dale Lockard "Characteristics of the Scientific Literature Cited by Chemists of the Soviet Union"	Dissertation: University of Illinois, 1966, p. 297	1, 2, 3, 5, 7, 8	11	Statistical bibliography, p. 10, 17 Statistical analysis, p. 208 Bibliographic statistics, p. 99
10.	1968	Pritchard, Alan "Computers, Statistical Bibliography and Abstracting Services"	Unpublished: 1968	—	12	Statistical bibliography, title
11.	1969	Pritchard, Alan <i>Statistical Bibliography: An Interim Bibliography</i>	North-Western Polytechnic School of Librarianship, May 1969; 69 pages	1, 2, 3, 4, 5, 6, 7, 8, 9	12, 14	Statistical bibliography, title, abstract, introduction
12.	1969	Pritchard, Alan "Statistical Bibliography or Bibliometrics?"	<i>Journal of Documentation</i> , Vol. 25, December 1969; pp. 348–349	1, 2, 4, 5, 8, 10, 11		Statistical bibliography, p. 348 Bibliometrics, title, p. 349
13.	1969	Fairthorne, Robert A. "Empirical Hyperbolic Distributions for Bibliometric Description and Prediction"	<i>Journal of Documentation</i> , Vol. 25, December 1969; pp. 319–343			Bibliometrics, title, pp. 319, 325, 341
14.	1970	Pritchard, Alan "Computers, Bibliometrics and Abstracting Services"	<i>Research in Librarianship</i> , September 1970; pp. 94–99	8, 11		Bibliometrics, title, pp. 94, 95, 97

^aNumbers refer to number listing of articles in this table.

article, “Bibliometrics and Information Transfer,” Pritchard explained bibliometrics as the “‘metrology’ of the information transfer process and its purpose is analysis and control of the process.”^[39] He based his interpretation upon the fact that measurement is “the common theme through definitions and purposes of bibliometrics” and “the things that we are measuring when we carry out a bibliometric study are the process variables in the information transfer process.”^[39]

The *British Standard Glossary of Documentation of Terms* explained bibliometrics as the study of the use of documents and patterns of publication in which mathematical and statistical methods have been applied,^[40] which is basically the same as Pritchard’s original definition.

William Gray Potter, editor of the issue of *Library Trends* devoted to bibliometrics, followed suit with “Bibliometrics is, simply put, the study and measurement of the publication patterns of all forms of written communication and their authors.”^[41] In the same issue, Alvin M. Schrader said it even more simply, “Bibliometrics, [is] the scientific study of recorded discourse.”^[42]

Bibliometrics, called a quantitative science, is divided into two areas, descriptive and evaluative.

In one of these classes is included the study of the number of publications in a given field, or productivity of literature in the field for the purpose of comparing the amount of research in different countries, the amount produced during different periods, or the amount produced in different subdivisions of the field. This kind of study is made by a count of the papers, books and other writings in the field, or often by a count of those writings which have been abstracted in a specialized abstracting journal. The other...includes the study of the literature used by research workers in a given field. Such a study is often made by counting the references cited by a large number of research workers in their papers.^[43]

The two areas may also be divided as follows:

1. Productivity Count (descriptive)
 - a. Geographic (Countries)
 - b. Time periods (Eras)
 - c. Disciplines (Subjects)
2. Literature Usage Count (evaluative)
 - a. Reference
 - b. Citation^[43]

Nicholas and Ritchie divided the two groups as “those describing the characteristics or features of a literature [descriptive studies] and those examining the relationships formed between components of a literature [behavioral studies].”^[44] Although all the descriptive studies are not evaluations, all the evaluative analyses are first descriptive with the evaluative taking the data one step further, providing “data on the condition or character of the literature as a whole.”^[44]

Bibliometrics, the “science of recorded discourse”—which uses specific methodologies, mathematical and scientific, in its research—is a controlled study of communication. It is the body of a literature, a bibliography quantitatively or numerically or statistically analyzed—a statistical bibliography; a bibliography in which measurements are used to document and explain the regularity of communication phenomena.

Seminal Bibliometric Papers

For the development of a list of seminal bibliometric papers, two criteria were used: 1) did the author indicate the publication an original or; 2) did peer consensus indicate the paper “a first?”

Daniel O’Connor and Henry Voos, of the Graduate School of Library and Information Studies of Rutgers University, in the *Library Trends* 1981 Summer Issue, “Bibliometrics,” claimed “The scope of bibliometrics includes studying the relationship within a literature (e.g., citation studies) or describing a literature”^[45] focusing “on consistent patterns involving authors, monographs, journals, or subject/language.”^[45]

The paper by Cole and Eales was probably the first to give a description of a literature, using publication counts and utilizing graphic illustrations to them by year and country. “The History of Comparative Anatomy—A Statistical Analysis of the Literature”^[28] (1917), by F.J. Cole and Nellie B. Eales, has the qualifications that Hulme set forth for a statistical bibliography. It is considered a classic, being “one of the first papers based on significant statistical data.”^[46] Both Cole and Eales were scientists; F.J. Cole was a professor of zoology, and Nellie Eales was a museum curator.^[28]

Cole first attempted to “apply graphic methods to an historical study of anatomical museums” but “the number of such museums...was too small to admit of satisfactory treatment by statistical methods.”^[28] As a result, “a similar attempt on the literature of comparative anatomy” was made: “it seemed possible to reduce to geometrical form the activities of the corporate body of anatomical research, and the relative importance from time to time of each country and division of the subject.”^[28]

The report recorded publications (6,436) dealing with animal anatomy for the period 1543 to 1860,^[28] in chronological charts; the fluctuations shown were explained by miscellaneous influences. The authors admitted that no evaluation of papers was made before the counting; thus, a short paper counted the same as a lengthy one.^[28]

The Cole and Eales objectives were:

- 1) to represent by a curve the activities of comparative anatomists as a whole from the sixteenth century to 1860;
- 2) to detach from this general scheme and plot separately the performances of each European country;
- 3) to determine in a similar way which groups of animals and what

aspects of the subject engaged the attention of workers from time to time; 4) to trace the influence of contemporary events, public bodies and individuals on the history of anatomical thought.^[28]

A particularly interesting statement from the Cole and Eales publication is included here because of the noting of the occurrence by other scientists:

The steep decline after 1835 can only be explained as an admirable example of that rhythm which underlies all the activities of the living world. This primitive abhorrence of the fixed level, which finds its expression in advance or retreat, but never in stability, is just as characteristic of the work of a community as of the internal economy of the individual.^[28]

It would be very interesting to see an update of this paper from 1850 to check on the possible continuance of the Cole and Eales findings.

The second paper of importance is that of E. Wyndham Hulme;^[15] it too is an historical publication count and is considered “one of the first analytical accounts of the growth of the literature.”^[44]

Hulme used 13 annual issues of *The International Catalogue of Scientific Literature*, from 1901 to 1913, counting author entries for various subjects and graphing the information. Because of declines and advances evidenced in the chart he did a further analysis resulting in the tabulation of the “Number of Journals Indexed arranged by Countries”^[15] and listing of countries in order of total productivity of the number of journals indexed.^[15]

Wyndham Hulme wrote “Bibliography is the science which collects, preserves, describes and classifies.”^[15] He was an advocate of books being universally classified, then put in chronological order in each class, the result of which, he believed, “presents for each period a bibliographical counterpart of the corresponding growth of the activities of the human mind.”^[15] In other words, Hulme believed that the chronological order of classified books would show the growth or development of a subject science, or important movements in history.

The purpose of his paper was to “ascertain and illustrate by bibliographical data, various stages in the development of the mechanics of civilization.”^[15] “I deal with it [civilization] as an organic growth so far as this growth can be correlated with the recorded intellectual activities of the several periods.”^[15] He was not as concerned with numbers as with specialization, for he was certain a sign of subject division was a sign of growth. Hulme wished to emphasize that “phases of activity and retardation in each science” could be shown by statistical treatment and that the time a science would reach its boundaries might also be indicated.^[15] He gave three requirements for such statistics (which he believed were practically nonexistent):

1) the statistics must be international in scope and sufficiently extended for the purpose in view; 2) original work must be distinguished from educational literature; 3) the statistician must possess a competent knowledge of his subject matter.^[15]

Hulme also stated “increased activity in the library output of a science can invariably be associated with pre-existent causes,”^[15] concluding that declines and peaks are influenced by population change, political, and economic movements.^[15]

Cole and Eales said something of the same when they decided that an increase of anatomical publications from 1650 to 1700 and a decline from 1700 to 1750 were due to the number of anatomists being born between 1600 and 1650 followed by a birth decline, to the founding of important scientific societies from about 1652 to 1666, and to the beginning of periodical publications.^[28]

One item of note is the suggestion that a sharp decline after 1835 may have been due to “the rise of histology and embryology subsequent to the enunciation of the Cell Theory in 1838–9.”^[28] This sounds like Hulme’s idea mentioned earlier, that specialization shows growth.

Hulsey Cason and Marcella Lubotsky published a study, “The Influence and Dependence of Psychological Journals on Each Other,” in 1936.^[47] It was cited by Francis Narin in his study *Evaluative Bibliometrics*^[48] for its “Journal to Journal Cross Citation Influence for Journals and Fields.”^[48]

The purpose of the paper was “to secure a quantitative measure of the extent to which each psychological field influences and is influenced by each of the other psychological fields,”^[47] with the study being limited to journals published in the English language in 1933.^[47] The method used was a listing of 61 tentative journals in a survey letter sent to 54 psychologists; they received replies from 45, of which 39 were usable. Ultimately, only 28 journals were used; others were eliminated for various reasons. The specifically different references in the bibliographies, references, and footnotes of each article in each periodical were used.^[47]

For the 1933 part of each journal, we counted the number of references 1) to the same journal; 2) to each of the other journals listed in Table 1 [list of 28 journals]; and 3) to all other references including books, monographs, and journals not listed in Table 1.^[47]

Narin believed Cason and Lubotsky’s:

real advance lies in the idea of constructing a cross-citing network. They summarized their data by constructing a 28 × 28 element table of the percent of references from each of the most significant journals to the others, with a summarized count of references to other publications. This seems to be the first time that the idea of a cross-citing network appears in the literature.^[48]

The Cason and Lubotsky article should be mentioned even though the suggestions presented in it did not flourish.

In 1926 the *Journal of the Washington Academy of Sciences* printed the paper “Statistics—The Frequency Distribution of Scientific Productivity.”^[49] It was especially important because it developed a productivity formula which became known as Lotka’s Law.

Alfred J. Lotka, a statistician with the Metropolitan Life Insurance Company, thinking it “would be of interest to determine, if possible, the part which men of different calibre contribute to the progress of science,”^[49] developed a listing of A and B names (6891) from the *Chemical Abstracts Index* of 1907–1916 and the corresponding number of papers each produced. The same procedure, but using complete coverage, was applied to Auerbach’s *Geschichtstafeln der Physik* through the year 1900.^[49] From these data, Lotka formulated a general equation: “the relation . . . between the frequency y of persons making x contributions is $x^n y = \text{const.}$ ”^[49] He then found the value of the constant when $n = 2$; this ultimately became known as the inverse square law of scientific productivity, explained as follows:

In the cases examined it is found that the number of persons making 2 contributions is about one-fourth of those making one; the number making 3 contributions is about one-ninth, etc.; the number making n contributions is about $\frac{1}{n^2}$ of those making one; and the proportion, of all contributors, that make a single contribution, is about 60 per cent.^[49]

The results were publicized in June of 1926 and have had quite an impact on a number of investigations by stimulating further analysis, controversy and research. (See further discussion of Lotka’s Law in the next section.)

The major step of analyzing citations, as opposed to publications, was taken by Gross and Gross in 1927, when they discussed the purchase of journals for a chemical library in terms of a tabulation of citations from the *Journal of the American Chemical Society*.^[46]

Paul L.K. Gross and E.M. Gross, a husband and wife team, wrote a paper tackling the problem of colleges presenting “broad cultural education” without neglecting preparation for the increasing competitive demands of graduate schools. The Grosses were concerned about the preparation of graduates from small colleges who wanted to enter graduate competition and believed that some periodicals were more conducive to success than others in preparing students for advanced work.^[50] On the basis of the idea that lists or files of scientific periodicals were of utmost importance in solving such a problem, Gross and Gross “decided to tabulate the references in a single volume of the *Journal of the American Chemical Society*”

chosen “as the most representative of American chemistry.”^[50] The result was 3633 references for 247 different periodicals or journals.^[50] The tabulations were made for 5-year periods from 1871 to 1925 as found in the 1926 volume, and trends were traced from the tabulations. From these trends, need for specific periodicals was decided, which included not only specific subject journals but also some from related fields.^[50] “This is the first recorded study based on counting and analyzing citations, i.e., citation analysis”^[51] and has been a model for many investigations.

In late 1927, P.L.K. Gross wrote “Fundamental Science and War,”^[52] in which he claimed, “the process of laying this foundation [science progresses only after the foundation stones of pure science have been firmly laid] consists in searching out, correlating and classifying knowledge.”^[52] Gross again used citations to support his conclusions, this time as to the effect of war on the science of chemistry. In Gross’s words:

Consideration of the method of investigation [citation counts] here employed will show that we are concerned not merely with the quantity of work published during this period (1912–1923), but that in reality we are concerned only with the good work, the work which has survived and which has proved of value to the investigators who followed. The method, therefore, has a distinct advantage over any method which counts pages or number of papers published in various journals for its basis of comparison.^[52]

In other words, papers which are continually cited are the most valuable for researchers, according to Gross.

Samuel Clement Bradford, another pioneer of bibliometrics, should be considered for his special article “Sources of Information on Specific Subjects,”^[53] which is the first paper published on observations on scattering. This important paper contains Bradford’s law, which many scientists have used in research. Upon investigating “300 abstracting and indexing journals,”^[53] Bradford found that of 750,000 articles, “only 250,000 different articles are dealt with and 500,000 are missed.”^[53] This disturbed him greatly, true librarian that he was, and he believed repetition would be eliminated if there were a standard classification adopted internationally to bring references to the same subject together. This would be a cooperative endeavor.

Based on data collected by E. Lancaster Jones of the Science Library from the bibliographies of *Applied Geophysics* (1928–1931) and *Lubrication* (1931–1932 plus),^[53] a hypothesis was established: “to a considerable extent, the references are scattered throughout all periodicals with a frequency approximately related inversely to the scope.”^[53] Using this observation, Bradford proceeded to analyze his data to develop a means by which librarians could select the most usable periodicals. He found when the journals were divided into zones, each containing the

same number of articles as a nucleus, the relation of the number of journals was $1: n: n^2$.^[53] In his words:

the law of distribution of papers on a given subject in scientific periodicals may thus be stated: if scientific journals are arranged in order of decreasing productivity of articles on a given subject, they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups of zones containing the same number of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as $1: n: n^2$.^[53]

The next scientist to incite thought and controversy in the area of “bibliometrics” is George Kingsley Zipf. Zipf’s law is considered a bibliometric law and has been used in many bibliometric papers.

Zipf’s book *Psycho-Biology of Language*,^[54] published in 1935, has in its Preface the kernel of what later was called Zipf’s law.

If the number of different words occurring once in a given sample is taken as x , the number of different words occurring twice, three times, four times, n times, in the same sample, is respectively $\frac{1}{2^2}$, $\frac{1}{3^2}$, $\frac{1}{4^2}$, $\dots$, $\frac{1}{n^2}$ of x , up to, though not including, the few most frequently used words; that is, we find an unmistakable progression according to the inverse square, valid for well over 95% of all the different words used in the sample.^[54]

From this beginning, Zipf developed a formula, $ab^2 = k$, where a is the number of words occurring b times. He also concluded the “ $ab^2 = k$ relationship is valid only for the less frequently occurring words which, however, represent the greater part of the vocabulary in use, though not always a great majority of occurrences,”^[54] but “it is in the frequency distribution of the rarer words that we find the closest approximation to the $ab^2 = k$ relationship.”^[54]

It is important to note here that Zipf, in his book *Human Behavior and the Principle of Least Effort*,^[55] cited J.B. Estoup for word usage frequency by stating,

The first person (to my knowledge) to note the hyperbolic nature of the frequency of word usage was the French stenographer J.B. Estoup who made statistical studies of French, cf. his *Gammes Stenographiques*, Paris 4 ed., 1916 (have not seen his earlier editions).^[55]

Fussler’s paper, as noted earlier, is another classic in the history of bibliometrics^[35] and is composed of two parts: the first discusses “the importance of the literature of various subject fields to research in chemistry and physics,”^[35] and the second, “the temporal span of the literature, the principal forms of the literature, the national origins of the literature used in the United States, and some attention is devoted to the more important serial titles.”^[35] Because of various problems facing research

libraries, Fussler believed it important to do a study to find the “more fundamental characteristics of the literature used by research personnel of the United States in two related subject fields—chemistry and physics.”^[35]

He planned a modification of the technique of reference listing. Using the *Physical Review* and the *Journal of the American Chemical Society* as key journals of the individual disciplines, for the years 1899, 1919, and 1939, frequency lists of samples of cited titles were made, and lists of source journals were developed.^[35] The idea of using “key” journals to determine a frequency citation list which in turn gave a group of source journals was new,^[35] although Fussler admitted his general procedure, that of listing and analyzing references, was not new.^[35] Fussler’s study differed mainly in the method of selecting the source journals.^[48]

His investigations led him to conclude:

the distribution of literature, as revealed in the study, indicates that provision of a substantial proportion of the references in a research field is possible through a small number of journals if they are properly selected but that the provision of the entire necessary research literature for a field will require a very large number of titles, many of which will be needed elsewhere in a university or in a large research organization.^[35]

Because of the interrelationship of various disciplines, there is a “network of joint use of research materials”^[35] not necessarily based on the classification scheme.

One item of special note is Fussler’s comment about literature characteristics wherein he suggested that those of a particular sector of a discipline may differ noticeably from those of a whole field.^[35]

The first presentation of “impact factor” was in 1955 in “Citation Indexes for Science” by Eugene Garfield.^[56] Garfield was aroused by the quote of P. Thomasson and J. C. Stanley:

The uncritical citation of disputed data by a writer, whether it be deliberate or not, is a serious matter. Of course, knowingly propagandizing unsubstantiated claims is particularly abhorrent, but just as many naive students may be swayed by unfounded assertions presented by a writer who is unaware of the criticisms. Buried in scholarly journals, critical notes are increasingly likely to be overlooked with the passage of time, while the studies to which they pertain, having been reported more widely, are apt to be rediscovered.^[57]

Hoping to “eliminate the uncritical citation of fraudulent, incomplete, or obsolete data by making it possible for the conscientious scholar to be aware of criticisms of earlier papers,” Garfield developed a plan for “a citation index that offers a new approach to subject control of the literature of science. . . best described as an association-of-ideas index.”^[56] He concluded that a basic difficulty was

to build a subject index which included all possible synonyms, and that “bibliographic tools” were needed to help bridge the subject gap between source and receiver, authors and information-seeking scientists.^[56]

Garfield invented “a citation code for science.”^[56] This code was made up of two parts, “a serial number...to identify each periodical” and a “serial number, assigned to each article in a particular publication.”^[56] The citation index would have these characteristics:

A complete alphabetic listing of all periodicals covered, in addition to the code number for each periodical...would list in straight numerical order the code numbers for all the articles covered...code numbers representing articles that had referred to the article in question would be listed under each code number.^[56]

“The system would provide a complete listing, for the publications covered, of all the original articles that had referred to the article in question,” being especially “useful in historical research, when one is trying to evaluate the significance of a particular work and its impact on the literature and thinking of the period.”^[56] The influence of an article, Garfield named “its ‘impact factor’.”^[56]

Garfield’s “Citation Analysis as a Tool in Journal Evaluation,” subtitled, “journals can be ranked by frequency and impact of citations for science policy studies” appeared in 1972.^[58] Narin claimed it “is a milestone in the field”^[48] for this reason. “There are more data covering more citations to more journals in that one paper than there had been in all the scientific literature up to that time.”^[48] Problems, of course, exist: abbreviated titles standing for more than one journal title, changes in format of journals such as mergers or splits, and changes in journal titles for special issues.^[56] But Garfield claimed:

It is apparent...that a good multidisciplinary journal collection need contain no more than a few hundred titles. That is not to say that larger collections cannot be justified, but it does say something indisputable, in terms of cost and benefit, about how large a journal collection need be (or how small it can be) if it is to provide effective coverage of the literature most used by research scientists.^[56]

Using much data from his *Science Citation Index*, Garfield made numerous observations: “majority of all references cite relatively few journals,”^[56] “the average paper is cited only 1.7 times a year,”^[56] “predominance of a small group of journals in the citation network has been confirmed,”^[56] “half of all articles published cite at least one of the 25 most frequently cited journals at least once,”^[56] “predominance of cores of journals is ubiquitous,”^[56] and “most frequently cited journals...are (usually) most productive in terms of articles published.”^[56] All of this led him to state, “I can with confidence

generalize Bradford’s bibliographic law concerning the concentration and dispersion of the literature of individual disciplines and specialties.”^[56]

What about journals which rank low on a “times-cited” list? According to Garfield, although “citation frequency reflects a journal’s value and the use made of it,”^[56] low-ranking journals may also be used “for some purpose other than the communication of original research findings.”^[56]

In this article, Garfield also explained how his relative impact factor was determined:

by dividing the number of times a journal has been cited by the number of articles it has published during some specific period of time. The journal impact factor will thus reflect an average citation rate per published article.^[56]

In 1961, M.M. Kessler did a report on “bibliographic coupling” for MIT. This report, revised in 1962, was later published in *IEEE Transactions on Information Theory* of January 1963.^[59] The paper, “An Experimental Study of Bibliographic Coupling Between Technical Papers,” was described by Kessler as “one of several pilot studies designed to test an hypothesis.”^[59] Having been suggested three years earlier, the hypothesis was basically “that a number of scientific papers bear a meaningful relation to each other (they are coupled) when they have one or more references in common.”^[59]

In August 1962, Kessler sent his article “Bibliographic Coupling between Scientific Papers”^[60] to the publishers of *American Documentation*; it was printed in January 1965. In 1974, Bella Hass Weinberg reviewed the subject and referred to this paper by Kessler as “the classic paper in bibliographic coupling.”^[61]

Kessler stated that bibliographic coupling is “a new method for grouping technical and scientific papers,”^[59] with the essential facts of the method being:

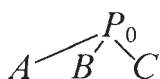
- A single item of reference used by two papers is called one unit of coupling between them.
- A number of papers constitute a related group, G_A , if each member of the group has at least one coupling unit to a given test paper P_0 .
- The coupling strength between P_0 and any member of G_A is measured by the number of coupling units (n) between them.^[62]

He also explained that:

This method was called “Bibliographic Coupling” because it originated in the hypothesis that the bibliography of technical papers is one way by which the author can indicate the intellectual environment within which he operates, and if two papers show similar bibliographies, there is an implied relation between them.^[62]

Based on the unit of coupling (a single item of reference used by two papers), two criteria of coupling, A and

B , are defined. Criterion A includes b) and c) in the foregoing list. An example of G_A would be:



where P_0 is the test paper, and A , B , and C are members of G_A .

Criterion B contains related group G_B if each member is connected with every other member by at least one coupling unit. An example of G_B would be:



where A , B , and C are members of G_B .^[60]

Although, at the time of his report, Kessler was further investigating his method, he listed five bibliographic coupling properties:

1. It is independent of words and language. All the processing is done in terms of numbers. We thus avoid all the difficulties of language, syntax and word habits.
2. No expert reading or judgment is required. Indeed, the text need not be available.
3. The group of papers associated with a given test paper extends into the past as well as the future.
4. The method does not produce a static classification or permanent index number for a given paper. The grouping will undergo changes that reflect the current usages and interests of the scientific community.
5. The member papers of a G_A may be considered as the "logical references" of P_0 . A population of papers, P_m may thus be produced in such a way that for each paper in P_m we substitute the members of its G_A for the actual references. (That is, replace the actual references of the paper by its logical references.) This population of papers may then be further processed according to Criterion A . The significance of this logic is being investigated.^[60]

To secure data, Kessler had a computer program written, processing 137,000 references obtained from 8,521 articles in 36 volumes of the *Physical Review*. Because of the overabundance of material, it was decided to use Volume 97 only, creating 265 G_{As} .^[60] The variance of the number of articles in each G_A was 0 to 27, with the variance of coupling units from 1 to 7.^[60] Bibliographic coupling, at the present time, is recognized as a technique "effective in identifying related papers,"^[48] but more analysis is needed to interpret the relationship.

Although the "epidemic theory" itself is not bibliometric, it can be in its application. Robert Kenneth Dikeman used the epidemic theory model in his

dissertation, "On the Relationship between the Epidemic Theory and the Bradford Law of Dispersion,"^[63] J.J. Hubert included it in his "Bibliometric Models for Journal Productivity,"^[64] and Dennis B. Worthen made a comparison of it in his "The Epidemic Process and the Contagion Model."^[65]

The original report, "A Generalization of the Theory of Epidemics: An Application to the Transmission of Ideas," by William Goffman and Vaun A. Newill,^[66] is included in this group of original idea papers because it is antecedent to a large portion of the bibliometric research of Goffman and his colleagues^[67-70] and can be considered fundamental.

Publicized ideas have been the forerunner of many scientific developments, and Goffman and Newill's innovative suggestion of the model of the theory of epidemics is really basic to the study of idea development. It is not a technique such as bibliometric coupling and cocitation which are used in the analysis of the structure of literature. The epidemic theory is a technique explaining the transmission of ideas by means of the literature. In other words, an "infectious disease epidemic" is compared to an "intellectual epidemic," where the germ or virus is analogous to an idea, the "case of disease" analogous to the "author of paper" or the "paper containing useful ideas," the susceptible person to the "reader of paper" or "all papers containing potentially useful ideas," "death or immunity" to "death or loss of interest," or "deletion or loss."^[66]

The purpose of this "epidemic theory report" was "to help to describe the publication activity within a given discipline"^[66] to determine the necessity for an information retrieval system.

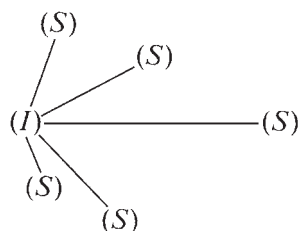
As explained by the authors, an epidemic process needs: "1) A specified population; [and] 2) An exposure to infectious material,"^[66] with the population divided into three categories at a given time:

- a) *Infectives*: Those members of the population who are host to the infectious material.
- b) *Susceptibles*: Those members of the population who can become infectives given effective contact with infectious material.
- c) *Removals*: Those members of the population who have been removed from circulation for one of a variety of reasons.^[66]

A possible example would be: If a third paper C cites papers A and B (which are then bibliographically coupled), it can be said that C was susceptible to the infectious material (idea) from infectives A and B , and because A and B are coupled, A could be considered a catalyst of B , and B the same of A . Example:



This analogy can also be applied to clusters of papers: an original paper is the infective, and papers that cite the original are susceptibles. For example:



Cluster of papers

One last note: If “in general, the epidemic process can be characterized as one of transition from one state...to another,”^[66] a scientific front and an epidemic are closely related, for a scientific front is also an indication of a change.”^{[66][65]}

The next article in the chronological arrangement of papers is that of Alan Pritchard who advocates the use of the new word “bibliometrics” in place of “statistical bibliography,” already mentioned in the first section.

Another innovative paper, this one on analysis of citations, was presented by Henry Small. Small proposed a new method of analyzing citations in 1973 in the first of a group of articles bearing on the subject cocitation. In this article, “Co-Citation in the Scientific Literature: A New Measure of the Relationship between Two Documents,”^[71] Small explained his subject as follows:

Bibliographic citations in scientific papers have been used by a variety of researchers to establish relationships among documents. Both direct citation—the citing of an earlier document by a new document—and bibliographic coupling—the sharing of one or more references by two documents—have received considerable attention. A related measure, which has been overlooked in earlier discussions, is co-citation. Unlike bibliographic coupling which links source documents, co-citation links cited documents and is, therefore, analogous to a measure of descriptor or word association. The purpose of this paper is to define this new kind of “coupling” and to distinguish it from bibliographic coupling, using an actual example from the literature of physics. Co-citation patterns are found to differ significantly from bibliographic coupling patterns, but to agree generally with patterns of direct citation.^[71]

Because “Co-citation is the frequency with which two items of earlier literature are cited together by the later literature,”^[71] the number of times that papers are cited together by a new or later document gives the strength of the cocitation. For comparison, bibliographic coupling, depending “on references contained in the coupled documents” is a set or permanent relation, whereas in the case of cocitation, “patterns change as the interests and intellectual patterns of the field change.”^[71]

Assuming that the main ideas and the experiments supporting them are in the frequently cited papers, then cocitation “can be used to map out in great detail the relationships between these key ideas.”^[71] Cocitation can also be used to depict a literature specialty core or cluster.^[71]

Small concluded:

The pattern of linkages among key papers established a structure or map for the specialty which may then be observed to change through time. Through the study of these changing structures, co-citation provides a tool for monitoring the development of scientific fields, and for assessing the degree of interrelationship among specialties.^[71]

The preceding information led to the listings found in Table 2. Historically, the Hulme paper was first in the presentation and application of the term “statistical bibliography.” Hulme cited the Cole and Eales publication which was the first to use a publication count by country. Gross and Gross, first to consider the structure of literature, used a citation count technique to make an evaluation. Fussler was the first to develop a different method of selecting source journals for data. Garfield was the first to use an “impact factor” in citation analysis. Kessler cited his paper as the introduction of bibliographic coupling. Goffman and Newill were the first to apply the theory of epidemics to the field of literature. Small introduced the technique of cocitation. Pritchard coined the word “bibliometrics.” The identification of the first papers of Bradford and Lotka to present their laws was easy; the identification of the first paper to present Zipf’s law required more searching; the law was found in the preface of one of his books.

Since the 1973 paper of Small, there does not seem to have been any basically new idea presented; the many publications since then are variations, applications and/or extensions of the original hypotheses, laws, or techniques.

Empirical Laws of Bibliometrics

One of the principal aims of Science is to trace, amidst the tangled complex of the external world, the operation of what are called “laws”—to interpret a multiplicity of natural phenomena in terms of a few fundamental principles.^[18]

Natural laws describe patterns which are regular and recurring. The scientific point of a law is twofold. First, a concrete statement of a law may give us the ability to better predict events or to shape our reactions to them. Second, a physical law may help in the development of theories which explains why a particular pattern occurs.^[72]

Table 2 Chronological list of seminal papers.

Year	Author(s)	Title	Historical significance
1917	Cole, F.J., and Nellie B. Eales	"History of Comparative Anatomy"	First publication count, by country, 1843–1860
1923	Hulme, E. Wyndham	<i>Statistical Bibliography in Relation to the Growth of Modern Civilization</i>	Term "statistical bibliography" first used
1926	Lotka, Alfred J.	"Frequency Distribution of Scientific Productivity"	Inverse square law, relation of authors to papers
1927	Gross, Paul L.K., and E.M. Gross	"College Libraries and Chemical Education"	Citation count technique
1934	Bradford, Samuel C.	"Sources of Information on Specific Subjects"	Scattering observations published
1935	Zipf, George K.	<i>Psycho-Biology of Language</i>	Word rank-frequency distribution
1949	Fussler, Herman H.	"Characteristics of the Research Literature used by Chemists and Physicists in the U.S."	First to use journal references to develop a core of journals in a field
1955	Garfield, Eugene	"Citation Indexes for Science"	Term "impact factor" first used
1963	Kessler, M.M.	"Bibliographic Coupling between Scientific Papers"	Introduced bibliographic coupling
1964	Goffman, William, and Vaun Newill	"Generalization of Epidemic Theory: An Application to the Transmission of Ideas"	Epidemic theory applied to literature growth
1969	Pritchard, Alan	"Statistical Bibliography or Bibliometrics?"	Word "bibliometrics" introduced
1973	Small, Henry	"Co-Citation in the Scientific Literature: A Measure of the Relationship between Two Documents"	Introduced cocitation

This was emphasized in the work of Pranas Zunde and John Gehl,^[73] where they wrote that it is important not only to describe the phenomena of a science but to try to establish tenets to explain and predict the phenomena.^[73]

Abraham Bookstein has set specifications for laws.

When a new law is proposed, it may be reasonable to demand of it, on intuitive grounds, that it remain true under a variety of circumstances differing from those in which it was discovered. Should it satisfy these demands, we may increase the validity of the law; if it does not, and yet we still wish to maintain the validity of the law, we ought to feel an obligation to explain the discrepancy.^[74]

Three regularities occur in bibliometrics to which have been given the name "law": Lotka's Law of Scientific Productivity (authors publishing in a certain discipline), Bradford's Law of Scattering (distribution of publications), and Zipf's Law of Word Occurrence (ranking of word frequency).^[75] Although claims have been made that the three laws are basically the same, one of their differences lies in the type of data. Lotka's law dealt with authors publishing and the number of papers published; Bradford observed the scattering of articles on specific subjects in various journals; Zipf counted frequencies of words. "Each of these distributions was empirically derived," and they "are similar to each other as special cases of a hyperbolic distribution."^[76] Although many and various proofs have been offered by important scientists supporting the theory of relatedness and similarity of these "laws,"^[4,77] the reader is advised to keep John Hubert's comment in mind: "literature" contains many models, and some are erroneously referred to as "laws" as if they predicted occurrences without error."^[78]

In this section, each law is analyzed from the viewpoint of its literature, and some of the literature of the three empirical laws explaining each one's importance is noted.

LOTKA'S LAW OF SCIENTIFIC PRODUCTIVITY

Alfred J. Lotka was a mathematician, supervisor of mathematical research in the Statistical Bureau of the Metropolitan Life Insurance Company from 1924 to 1933.^[79] It was during this time, 1926, that his definitive work, later called Lotka's law was produced.^[49] His investigation was a productivity analysis (described in the preceding section). Counting names and the number of publications listed for each, the coverage was for only *A* and *B* names in *Chemical Abstracts* for 1907 to 1916 and for Auerbach's *Geschichtstafeln der Physik* from its beginning through 1900.^[49] The data were tabulated and plotted, from which Lotka developed a "general formula for the relation. . . between the frequency *y* of persons making *x* contributions" as " $x^n y = \text{const.}$ "^[49]

Finding the value of the constant when $n = 2$, he observed that:

the number of persons making 2 contributions is about one-fourth of those making one; the number making 3 contributions is about one-ninth, etc.; the number making *n* contributions is about $\frac{1}{n^2}$ of those making one, and the proportion, of all contributors, that make a single contribution, is about 60 per cent.^[49]

Notice that Lotka's observation deals with the least number of productions.

Since the publication of Lotka's original article in 1926, much research has been done on author productivity in various subject fields. The publications arising from this research have come to be associated with Lotka's work and are often cited as proving or supporting his findings. However, a review of this literature reveals that Lotka's article was not cited until 1941, that his distribution was not termed "Lotka's law" until 1949, and that no attempts were made to test the applicability of Lotka's law to other disciplines until 1973.^[80]

In that year Murphy did his study of "Lotka's Law in the Humanities."^[81]

Larry J. Murphy chose for his work the first decade of the publication (on history of technology) *Technology and Culture*^[81] and found "the actual number of single authors" to be 130.^[81] He rounded off his numbers and plotted the results, leading him to conclude, without any statistical test for goodness of fit, that "The tabulation essentially verifies that Lotka's Law applies to this field within the humanities."^[81] There was an error in Murphy's graph which was noted and corrected in a letter to the editor.^[82]

In 1977 John J. Hubert, in a letter to the editor of the *Journal of the American Society for Information Science*, evaluated Murphy's work with the χ^2 goodness of fit test.^[83] His conclusion was, "By using an exact interpretation of the law and by applying a valid statistical test, it can be shown that this data does not follow Lotka's law."^[83] Russell C. Coile also did an evaluation of the Murphy results,^[84] and he too found that Lotka's law did not apply to the particular sample of authors.^[84]

Henry Voos, in 1974, measured the productivity of authors in the field of information science and compared his results with Lotka's observation.^[85] Using all the articles indexed in *Information Science Abstracts* from 1966 to 1970 for his data, he made a rank-frequency listing of all the authors and their articles by year.^[85] Voos "found that the relationship for information science seems to be $1/n^{3.5}$ instead of Lotka's $1/n^2$,"^[85] and instead of Lotka's 60% producing one paper, "in information science the figure tends to be 88% writing only one paper."^[85] The results of using the χ^2 test show "one can be more than 95% certain that the actual population fits the theoretical distribution."^[85]

Coile wrote a criticism of the Voos work, making suggestions and corrections.^[86] Voos responded with a revised chart, a promise for further research, and an apology.^[85]

Next to apply Lotka's law to various subjects was Alan Edward Schorr.^[87] He published his first application study in the fall of 1974 in conjunction with library science and used for data *Library Quarterly* and *College and Research Libraries* from 1963 to 1972.^[87] His analysis indicated that "It is clear that Lotka's Law does not apply to the field of library science, where four-fifths of all papers represent the only contribution of an individual."^[87] Schorr suggested:

for library science literature, scholarly production would follow an inverse quadruple power law ($\frac{1}{n^4}$) whereby for each 100 contributors of single articles, about 6 will contribute two articles, about 1 will contribute three articles, and almost no writers would provide four articles or more.^[87]

A scathing letter by Dean Tudor, chairman of the Library Arts Department of Ryerson Polytechnical Institute regarding Schorr's "Lotka's Law and Library Science" was soon received by the editor of *RQ*.^[88] Tudor called it "frivolous bagatelle occupying two pages of space that could be better put elsewhere,"^[88] but he did pose some interesting questions, including "is Lotka's Law still valid almost fifty years later?"^[88] Alan Schorr retaliated, but with a very carefully worded and explanatory letter.^[89]

In the spring of 1975, Schorr's "Lotka's Law and Map Librarianship,"^[90] based on his own map librarianship bibliography,^[91] was published. "Because it appears that the results do not support the inverse square law, a chi-square test was applied,"^[90] and conclusions were drawn that "Lotka's Law holds true for the field of map librarianship."^[90]

This time Russell Coile reacted to Schorr's work, writing "this conclusion is not true when the correct data is tested with an appropriate goodness-of-fit test"^[84] and suggested, after his own calculations were made, that "it would appear that Lotka's law does not apply to this field of map librarianship."^[84]

Schorr did one more test with Lotka's law, producing the paper "Lotka's law and the History of Legal Medicine,"^[92] the data being secured from *International Bibliography of the History of Legal Medicine*.^[93] Schorr found:

Authors with multiple contributions fall below the numbers expected by Lotka's Law (e.g., authors with two publications account for 18.1% of single author entries instead of 25%; authors with five publications comprise 1.8% instead of 4%)...The results do not support the inverse square law and thus Lotka's Law does not hold true for the history of legal medicine.^[92]

"To test for validity a chi-square test was applied... Lotka's Law is not applicable to this discipline."^[92]

T. Radhakrishnan and R. Kernizan reported their "experiment to verify the satisfaction of Lotka's law, with the papers published in the area of computer science,"^[94] in the article, "Lotka's Law and Computer Science Literature."

In a convenient machine-readable form we had with us the bibliographic details of the papers published during the years 1968 to 1972 in *Communications of the Association for Computing Machinery* (CACM) and in the *Journal of the ACM* (JACM).^[94]

It was decided to use this information in an attempt to verify Lotka's law. In their first experiment, the assumption was made that "an author publishes exclusively through one scientific journal," but it was found that this assumption was not valid. "From the chi-squared values it is clear that Lotka's original suggestion of x/n^2 does not apply very well. However, the prediction by x/n^3 is quite close."^[94] "In the second experiment we considered all the papers published by the authors irrespective of the journal."^[94] A random selection of authors was made using the cumulative author of *Computer and Control Abstracts* and was repeated with JACM. The deviation from Lotka's Law was high.^[94]

In the judgment of the authors:

1) Lotka's law, in its generalized form, seems applicable when we consider the publications of authors in one periodical; and 2) when we consider all the publications of the authors in various journals, the observed values deviate considerably from the predictions of the law. This may be due to the differences between pure and applied science.^[94]

They suggested further testing the law using "the service tapes such as Engineering Index, INSPEC, etc."^[94]

Two more papers testing the law in 1981 are here mentioned. K. Subramanyan did a study with library literature,^[95] and Valerie L. Richardson^[96] collected data from the "catalogue at State College of Victoria at Frankston."^[96] Subramanyan found that the pattern did not conform to Lotka's results and suggested more work be done.^[95]

Richardson stated that from her investigation, "It can be seen that the Frankston data do fit Lotka's law in its general form, but since the slope of the Frankston line is greater than 2, the data do not correspond to the inverse square law."^[96]

The compilation "Frequency Distributions of Scientific Performance: A Bibliography of Lotka's Law and Related Phenomena," by Jan Vlachy,^[97] although not a substantive work, is included here because of its excellence. This bibliography of 437 papers^[97] is international for it lists articles in English, from England, Canada, and the United States; and in Czech, Russian, Danish, French, and German. Lotka, Bradford, and Zipf are included as well as many other areas of bibliometrics. (An interesting note: Here was found the second reference to the Estoup book.)^[97]

Attention should be drawn to several items of importance: In Lotka's investigation, "Joint contributions have in all cases been credited to the senior author only,"^[49] whereas some of the studies counted each contributing author separately. This could make a difference in the resultant statistics. The number of names used may have influenced the outcome; Lotka use 6819 and 1325,^[49] other studies, many less; Murphy, for instance, used 130.

The time period is another variable that may have affected outcomes. Lotka's *Auerbach* data covered a complete history—and the data fit; his *Chemical Abstracts* statistics covered a 10-year period—and the data did not fit.^[49]

Miranda Lee Pao summed up the prevalent problems neatly:

Several studies have assumed the inverse square relation as the basis for testing. Others derived the value of the constant c from the percentage of single paper contributors. None of these assumptions can be traced back to Lotka.^[98]

Her deduction is well taken,

Therefore, a uniform method should be agreed upon by those attempting such a test. Comparison and generalization on author productivity may be possible only if compatible data are available and results are significant.^[98]

An added note about Lotka. At Johns Hopkins University at the invitation of the Department of Biometry and Vital Statistics, Alfred J. Lotka finished his book *Elements of Physical Biology*, started in 1902 and published in 1925.^[99] In the book, Lotka discussed the work of C.J. Willis, who developed a biological theory of age and area,^[100] and the extract following seems to be especially interesting.

Turning from the theoretical and debatable portion of Dr. Willis' contribution, to the factual material presented by him, we are confronted by a number of very remarkable relations. . . [The] ordinates represent the number of genera in the several natural families of plants and animals indicated, and the corresponding abscissae represent the number of species in each genus plotted. So. . . of the family Compositae 1143 genera were noted as follows:

446 genera of 1 species
140 genera of 2 species
97 genera of 3 species
43 genera of 4 species
55 genera of 5 species
etc.

...the monotypic genera, with one species each, are always the most numerous, commonly forming about one third of the whole group; the ditypics, with two species each, are next in frequency, genera with higher numbers of species becoming successively fewer. . . Perhaps more striking still is the relation established in figures 64, 65, and 66. [These figures are graphs wherein relations between number and size are plotted logarithmically.] The quantities plotted here are of the same character as in figure 63, [these are hyperbolic curves] but they are plotted on a double logarithmic scale, with the remarkable result that the graphs obtained are in close approximation straight lines. Thus if x denotes the number of species in a

genus, and y denotes the number of genera comprising x species, we have $\log x + a \log y - b = 0$ or

$$xy^a = \text{const.}$$

that is to say, the variables x and y are connected by a hyperbolic relation. It should be noted that this relation covers a wide variety of cases, including both plants and animals.^[99]

This seems very familiar when we realize Lotka's "general formula for the relation . . . between the frequency y of persons making x contributions is $x^ny = \text{const.}$ "^[49] and when his data are arranged as the Willis genera and species information.^[49]

Frequency of persons (Genera)	Contributions (Species)
3991	1
1059	2
493	3
287	4
184	5

Is it possible that Lotka's idea for his "productivity law" was suggested by Willis's investigations?

BRADFORD'S LAW OF SCATTERING

Part I

That Samuel Clement Bradford was a very determined and dedicated person is very evident in his writing. His thinking was undoubtedly influenced by Paul Otlet and LaFontaine, who organized the First International Conference on Bibliography held in Brussels in 1895.^[101] The theme of the conference was the need for international cooperation to develop a universal index which would recognize the requirement of a standard subject classification to be backed by a central universal library. This idea was staunchly supported by Bradford, as shown in the following.

In 1927 "Bibliography by Cooperation" appeared in *Library Association Record* (LAR). Here Bradford indicated his concern for the accelerating accumulation of "useful scientific and technical literature"^[102] and reiterated the need for "bibliographical work . . . [to] be brought together"^[102] by the use of one system of classification "as an index to all the papers that relate to a particular subject of study, no matter when they were written."^[102] Because "Every bureau indexes or abstracts papers that are done by other bureaux, and only a portion of the literature is covered,"^[102] he believed a universal classification system would eliminate repetition or classifying the same articles, use items not cataloged, and thereby save time, information, and money, and give better service.

He included in his paper a list of science subjects and the number of bibliographic references for each^[102] to alert readers as to what the Science Library, of which he was deputy keeper, was doing to develop into an "information service covering the whole field of Science and Technology."^[102] At that time, Bradford claimed the number of references assembled, covering many aspects of science and technology, as 1,212,700.^[102]

This article was followed by Bradford's "The Necessity for the Standardisation of Bibliographical Methods"^[103] in which Bradford explained the Science Library's method of classification and again stressed the need for cooperation. By the time of the introduction of the paper, a form of interlibrary loan already had been practiced for 2 years by the Science Library, with requests having been received from a number of other countries.^[103]

In 1934, Bradford's classic article^[53] containing his law was printed. Again he wrote about the number of articles abstracted and indexed by a number of abstracting and indexing journals showing his continued concern about wasted money and skills brought about by duplication of effort. He stated that "although the 300 abstracting and indexing journals notice 750,000 articles each year . . . only 250,000 different articles are dealt with and 500,000 are missed."^[53] His concern was shared by Ernest Lancaster-Jones, assistant keeper in the Science Museum. Consequently, "A statistical analysis was made of the references in two quarterly bibliographies compiled in the Science Library, i.e., the *Current Bibliography of Applied Geophysics* and the *Quarterly Bibliography of Lubrication*,"^[104] by Lancaster-Jones, a trained mathematician who also "had received recognition as an expert in applied geophysics."^[105] Bradford, using the data, evolved his "law."^[105]

The method Bradford used was this: For each of the two subjects, geophysics and lubrication, a table was made, listing "number of journals producing a corresponding given number of references"^[53] and each accumulation. (It seems natural that such a list of subjects and the number of references for each, plus a very limited budget and a sincere desire to give exceptionally good library service would cause an active and inquisitive mind, such as Bradford's, to wonder about the actual number of journals needed for coverage.)

One of Bradford's hypotheses was that

references are scattered throughout all periodicals with a frequency approximately related inversely to the scope. On this hypothesis, the aggregate of periodicals can be divided into classes according to relevance of scope to the subject concerned, but the more remote classes will, in the aggregate, produce as many references as the more related classes.^[53]

Observations of the tables evinced three "rough" zones or groupings which Bradford graded as "1) Those

producing more than 4 references a year; 2) Those producing more than 1 and not more than 4 a year; 3) Those producing 1 or less a year.”^[53] Bradford found

The groups thus produce about the same proportion of references in each case, and the number of constituents increases from group to group, by a multiplier which, though by no means constant, approximates fairly closely to the number 5, especially for the two larger groups.^[53]

From his data, Bradford constructed two graphs, plotting the logarithms of cumulated number of journals in relation to the cumulated number of references for each, geophysics and lubrication. He noted that “the later portion of each curve is remarkably close to a straight line,” and observed that

the aggregate of references in a given subject, apart from those produced by the first group of large producers, is proportional to the logarithm of number of sources concerned, when these are arranged in order of productivity.^[53]

With this observation in mind, Bradford constructed a second graph or diagram. This diagram he used to develop an algebraic relation, but only for the “straight” part of the curve noted originally.^[53] From this, he deduced his “law”:

Therefore, the law of distribution of papers on a given subject in scientific periodicals may thus be stated: if scientific journals are arranged in order of decreasing productivity of articles on a given subject they may be divided into a nucleus of periodicals more particularly devoted to the subject and several groups or zones containing the same number of articles as the nucleus, when the numbers of periodicals in the nucleus and succeeding zones will be as $1: n: n^2 \dots$ ^[53]

This was the first statement of what was later to be called the verbal part of Bradford’s Law. Usually referred to as Bradford’s Law of Distribution of Scattering, “sometimes this regularity is also called the law of dispersal of publications.”^[106]

Bradford came to the conclusion that

A standard classification must be adopted, so that references to the same subject would be brought together by the classification, irrespective of source or abstracting bureau, when, without increase of labour, a complete index to scientific literature would be achieved.^[53]

In a paper on abstracting and indexing periodicals, presented in 1937 at the ASLIB Proceedings 14th Conference, Bradford told that the details of the analysis “to determine the extent to which scientific papers are scattered in periodicals devoted to other subjects,”^[104] published in *Engineering* in 1934, were reprinted “in

Publication No. 1 of the British Society for International Bibliography, 1934,”^[104] and added, “Only the results need be quoted here.”^[104]

The law of scattering may thus be stated. If periodicals containing articles on the given subject are arranged in decreasing order of the number of such articles they contain and divided into a nucleus of journals more specifically devoted to the subject and zones of periodicals containing the same number of special articles as the nucleus, the numbers of journals in the nucleus and succeeding zones are as $1:N:N^2 \dots$ where N is about 5 or 6.^[104]

In his first article, Bradford used the value of 5.

In the discussion which followed his presentation, Bradford admitted:

The whole object of the elaborate statistical investigations reported in this paper is to prove beyond any question that quantities of important scientific papers are neither abstracted nor indexed. This is one of the main reasons why so much time and expense is being wasted in duplicating previous work. The other main reason is the adoption of archaic alphabetical methods of indexing, which hide the information and prevent it being found. The adoption of standard methods would go far to remove both these defects.^[104]

The International Federation for Documentation in 1946 published Bradford’s “Complete Documentation in Science and Technology,”^[107] which Bradford presented at the 16th Conference in Paris.^[107] Again, Bradford presented the statistics he used in “Sources of Information on Specific Subjects.” He repeated his description of the “law of distribution” as given in his previous papers and again supported the use of the Universal Decimal Classification. A synopsis of this paper was also printed in *Nature* of January 1947.^[108]

Two more of his publications are merely mentioned here: “Complete Documentation,”^[109] presented at the 1946 Royal Society Empire Scientific Conference when Bradford was president of the British Society for International Bibliography;^[109] and his book *Documentation*,^[110] first published in 1948. In both cases, Bradford used the same statistics he had used in his paper which first presented his law. The statistics were primarily used to support his ideas about cooperative, universal classification; the law was a natural outcome of Bradford’s desire to give added proof and credence to his unswerving conviction.

Part II

Bradford’s law has been the main topic of many articles in literature. A general sampling has been used here.

The discussions of Bradford's law take several directions: analysis of the law itself, attempts to refine it, comparison with other laws, and applications.

The first notable paper on Bradford's Law of Scattering was that of Brian C. Vickery.^[111] When results of an analysis of some 1600 periodical references, borrowed from various libraries by the Butterwick Research Laboratories Library, were compared with Bradford's work, an inconsistency was found.^[111] Vickery discovered that the law as Bradford stated it was not in total agreement with his algebraic expression.^[111] After methodically examining Bradford's algebraic analysis, Vickery proceeded with his own analysis, arriving at this conclusion.

We can...regard the theoretical distribution of papers on a given subject in scientific periodicals, as derived by Bradford, as fully corroborated by the distributions observed in the sample investigations. The rectilinear relation...incorrectly assumed by Bradford to be identical with his theoretically derived relation, fits only the upper portion of the observed curve. The theoretical relation itself, however, enables us to predict the whole curve.^[111]

The next paper to be noted is that of M.G. Kendall.^[112] Kendall's report is an analysis of 370 journals of 1763 references in operational research. For comparison, "1465 references to statistical methodology (covering the period 1925–39)"^[112] were used. Kendall suggested:

There is an obvious resemblance between this type of distribution and that of income. If we equate journals to persons and number of references to size of income we have the characteristic pattern in which a lot of people (journals) have a low income (few references) proceeding regularly to a few millionaires (journals with a large number of references).^[112]

Kendall supported the idea that the Bradford type of distribution is really a Zipf distribution,^[112] and he also provided "a more refined statistical explanation of the straight line observed by Bradford."^[113] (See page 35 of the Kendall article^[112] for Kendall's explanation.)

P.F. Cole in 1962 took "A New Look at Reference Scattering" whereby he plotted the cumulative fraction of references against the logarithm of the cumulative fraction of titles and the resultant slope he named "reference-scattering coefficient."^[113]

Cole gave three possible applications of the coefficient:

- For identifying those groups of references which, though of different sizes, are scattered to the same extent. This facilitates the establishment of further relationships between numbers of journal titles.
- As a criterion for detecting abnormalities in the results of literature usage surveys.
- As a concise means of expressing quantitatively the distribution of references among journal titles. The

extensive reporting in detail which is such a characteristic feature of literature usage surveys would then become entirely unnecessary. . . , which is probably the most important of the three, is self-explanatory.^[113]

Cole came to the conclusion that the reference-scattering coefficient "may be characteristic of the subject field"^[113] and found "A comparison of reference-scattering coefficients derived from data obtained in three published petroleum literature-usage surveys shows that the reference-count method gives untrustworthy results."^[113]

Ferdinand Leimkuhler did a further analysis of the Bradford law and concluded that

Bradford's "law of scattering" is the inverse function for the Bradford distribution, i.e. while the latter predicts the number of references for a given portion of the journals, the former speaks of the number of journals required to obtain a given portion of the references.^[114]

In a later paper (1980), Leimkuhler developed what he said was:

An exact, discrete formulation of Bradford's law describing the distribution of articles in journals (is derived) by showing that Bradford's law is a special case of the Zipf–Mandelbrot "rank frequency" law. A relatively simple method is presented for fitting the model to empirical data and estimating the number of journals and articles in a subject collection.^[115]

In 1981, Brookes did a criticism of Leimkuhler's exact formulation, where he wrote:

An elementary theorem of Shannon information theory shows that his [Leimkuhler] new function is applied to only 2.3% of the statistical information inherent in the bibliography he chooses and that Bradford's original simple formulation not only fits this segment but also the whole bibliography more closely than the new formulation. As every loss of statistical information can be measured, it can be shown that sophisticated mathematical techniques cannot compensate for the information they squander.^[116]

So I question Leimkuhler's present claim. More seriously, however, I question his methodology.^[116]

Brookes concluded:

The results of applying Bradford's law in its original form, i.e. applied to the ranked journals with the ranks marked on a logarithmic scale with the cumulative sums of papers as the ordinates, shows a better fit over any range than Leimkuhler's new function applied to the journals only.^[116]

Of course, Leimkuhler wrote an answer, making necessary corrections and adding, "I share Brookes' concern for empirical validity, but this concern should lead to more, not less, theoretical analysis."^[117]

In 1969 Brookes presented a paper, "Bradford's Law and the Bibliography of Science," in which he stated, "In the management of special libraries the bibliograph offers a check on the completeness of any allegedly complete bibliography—a check that has hitherto been missing."^[118] He made this claim on the basis of the application of Bradford's law in which he found, "All such bibliographs of periodical literature so far examined have either corroborated Bradford's law or else the discrepancies have been plausibly accounted for."^[118]

S. Naranan, in his "Bradford's Law of Bibliography of Science: An Interpretation,"^[119] called attention to the Brookes paper: "An interesting discussion of the law and its application in library systems is given by Brookes."^[119]

For the conclusion of his own paper, he wrote:

In summary, it is shown here that the essential features of Bradford's law of bibliography of scientific literature can be explained in terms of an underlying power law distribution of the number of articles in scientific journals. It is suggested that the law emerges as a natural consequence of exponential growth of scientific literature and journals at comparable rates. Such a model predicts a strong correlation between the age of a journal and the number of articles it carries. The proposed mechanism is likely to find wider application in many other fields of science.^[119]

Brookes responded with an interesting letter. He showed that Naranan's analysis, while not valid for Bradford, "(with suitable verbal amendments) provides a plausible model of Lotka's law."^[120]

This inverse square law of scientific authorship has hitherto been regarded as an inexplicable and useless statistical oddity. Naranan's model of it is therefore welcome. And, together with other measures of scientific productivity, Lotka's law has been applied by Dobrov and Korennoi in determining the optimum size of research institute in the USSR.^[120]

William Goffman and Thomas Morris applied Bradford's Law to library acquisitions.^[121] The authors stated,

Bradford's law should apply to the use of periodicals in a library as well as to the dispersion of articles among journals. These are both acquisitions processes; namely, processes of obtaining relevant items by means of selection.^[121]

Goffman and Morris summarized their findings in the following paragraph:

It has been shown that the distributions of both circulating periodicals and their users in a medical library seem to

obey Bradford's law. Hence, a smallest core of journals which must belong to the library's collection can be defined. This core should consist of the minimal nucleus of periodicals circulating in the library plus the minimal nuclei of journals devoted to the subjects of most interest to the library's nucleus of users. As the budget allows, successive zones of periodicals corresponding to circulation and user interest can be added. As a result, the library collection can be maintained in an orderly and viable state, thus providing its patrons with the most potentially usable materials for the funds at its disposal.^[121]

There was also a note of correspondence regarding the Goffman—Morris suggested "use of Bradford's law of dispersion as an aid to selection decision."^[122] A. Fasler of the Department of Research of Beckett and Colman of Norwich wrote, "this appears to be a most promising method."^[122] He added a warning, however, "Before it is possible to discontinue a journal subscription, it is necessary to make sure that such action will not cause great inconvenience."^[122]

In 1972 Elizabeth Wilkinson wrote "The Ambiguity of Bradford's Law."^[123] As Wilkinson pointed out, it is not necessary to completely understand an empirical law before using it.^[123] "Despite the limitations of our understanding of such laws, then, Bradford promises useful application in the design of more rational and economic information systems."^[123] She listed a number of scientists who have written papers about the Bradford law: "Vickery, Barrett, Leimkuhler, Brookes, Fairthorne, Goffman and Warren, and Naranan,"^[123] and added this observation, "Yet the most remarkable feature that emerges from a study of these papers is that no two of these contributors interpret the law in mathematically identical terms."^[123] She also remarked on the ambiguity of the law itself, for "Bradford formulated his law in two ways: firstly by means of a graph and secondly in words. But these two formulations can be shown not to be mathematically equivalent."^[123]

Vickery has pointed out the disparity between these two formulations. He showed that if n_m journals contribute a cumulative m papers, where n_m is larger than the nucleus, the verbal formulation is equivalent to the expression

$$n_m : n_{2m}n_m; n_{3m}n_{2m} : \dots :: 1 : a_m : a_m^2 : \dots$$

while the graphical formulation is equivalent to the expression^[123]

$$n_m : n_{2m} : n_{3m} : \dots :: 1 : b_m : b_m^2 : \dots$$

Wilkinson continued:

Leimkuhler has expressed the same relation in terms of the proportion of total productivity (papers)...contained

in the fraction. . . of journals. . . Brookes, on the other hand, has developed the graphical formulation of the law.^[123]

In summary then, the distribution of papers on a particular topic among contributing journals is expressed by

$R(n) = j \log (n/t + 1)$ for the verbal formulation, and
 $R(n) = k \log n/s$ for the graphical formulation.^[123]

the constants of these equations are not equal; i.e. $j \neq k$ and $t \neq s$. The verbal and graphical formulations are not, therefore, mathematically equivalent, nor do they converge for large n .^[123]

$R(n)$ is the cumulative total of papers published by the first n journals;
 n is the rank of a set of journals contributing papers on a particular topic constant;
 j, t, k, s are constants.^[123]

Commenting on "The Ambiguity of Bradford's Law" in Letters to the Editor, David A. Smith stated that it "showed clearly the empirical nature of Bradford's Law and the uncertainty about its derivation."^[124]

In 1973, *Library Trends* published an issue, "Analyses of Bibliographies," to which B.C. Brookes contributed the lengthy but excellent "Numerical Methods of Bibliographic Analysis."^[125] He listed five main objectives of numerical analyses,

based on the belief that quantification is a necessary component of the design of economic information systems and that measurement of the key processes of an information system is a necessary component of management control.^[125]

These are:

1. The design of more economic information systems and networks;
2. The improvement of the efficiencies of information-handling processes;
3. The identification and measurement of deficiencies in present bibliographical services;
4. The prediction of publishing trends; and
5. The discovery and elucidation of empirical laws which could form the basis for developing a theory of information science.^[125]

Most of the faults about the application of the technique [Bradford's Law to provide reliable estimates] that have been reported arise from lack of appreciation of the fact that the initiating data must be bibliographically well-defined in subject relevance and in period of publication and also be complete as far as they need to go. And the reliability of the estimates is naturally critically dependent on the precision of the initiating data.^[125]

Other areas in which Brookes believed the Bradford law to be evident and usable were: in relation to "items borrowed from a library;" "contributors to the discussions [at a conference], ranked according to the frequency of their questions or contributions;" "index terms assigned to documents; publication of books by publishers."^[125] Brookes also included a section on obsolescence^[125] which subject is mentioned in the next section.

In 1977, Wilson O. Aiyepoku of Nigeria, in an extensive "analysis of the periodical literature in geography for the whole world and for the USA, British Isles, France, and Germany,"^[126] found evidence "that data conforming with the verbal formulation of Bradford's distribution theory may not necessarily conform with its graphical representation and *vice versa*,"^[126] which is an agreement with other investigations mentioned earlier.

From here on, most of the papers regarding Bradford were surveys of literature pertaining to the law, refinements of the law, collection of data, and application of the Bradford distribution or reiteration of some previously noted facts.

I.M. Sengupta's study fostered

an extension of Bradford's law of scattering: that during phases of rapid and vigorous growth of knowledge in a scientific discipline, articles of interest to that discipline appear in increasing numbers in periodicals distant from that field.^[127]

Pope claimed "The area where the Bradford distribution has the greatest potential is in collections development, both in individual libraries and in library systems."^[128] A.B. Worthen's findings supported the statement that "Bradford's law of distribution can also be applied to the monograph-publisher relationship for a subject literature."^[129]

In 1977, Brookes contributed his "Theory of the Bradford Law"^[130] to the Bradford commemorative issue of the *Journal of Documentation*. In this superb paper, Brookes did a complete reevaluation of the Bradford Law and concluded, "Bradford was therefore a pioneer in social mathematics."^[130] Within the paper Brookes stated:

I describe how Bradford's law can be regarded as a particular example of an empirical law of social behaviour which pervades all social activities. Bradford, without knowing what he was doing in this respect, may have initiated a new branch of statistics—the statistics of individuality—which may also lead to an extension of fundamental mathematical ideas which would make mathematics more useful in the social sciences.

However, this paper will focus on the task of explaining Bradford's law in this wider context and on its applications to documentation.^[130]

The analysis of the Bradford law has hitherto been applied to theoretical models which are too static, too

deterministic and too physical. All Bradford data are derived by observing the *activities* of a set of sources over some appropriate period and by noting these activities, as measured in terms of the numbers of items each source accounts for in that time.

Thus, the Bradford law is concerned with:

- a. A finite set of active sources (*an ensemble*) whose activities are made manifest by the generation or consumption of a specified type of item.
- b. Observation of those activities over a specific *sampling* period.
- c. Items of some *homogeneous* kind which are discrete and countable.

One of the points that has so far escaped analysis is the fact that the statistical distributions of such an ensemble of activity must depend on relationships between the number of active sources, the range and intensity of their activities, and the period of observation which provides the sample data. All Bradford distributions are *samples* of some ongoing activity but, all too often, the sample data have been regarded as constituting a total population.^[130]

ZIPF'S LAW OF WORD OCCURRENCE

The third of the triumverate of bibliometric laws was that of George Kingsley Zipf. While studying linguistics at the University of Berlin,^[54] Zipf had an idea that “speech as a natural phenomena” is really “a series of communicative gestures” and after extensive research found that “the length of a word, far from being a random matter, is closely related to the frequency of its usage—the greater the frequency, the shorter the word.”^[54] He also discovered that

the distribution of words in English approximates with remarkable precision a harmonic series...an unmistakable progression according to the inverse square, valid for well over 95% of all the different words used in the sample.^[54]

Zipf wrote several books “on the theory and application of his principle of relative frequency in the structure and development of language.”^[131] In his first thesis, *Relative Frequency: A Determinant of Phonetic Change*, published in the Harvard Studies in Classical Philology in 1929,^[132] Zipf wrote:

Observing the speech of many hundreds of millions of people, we have demonstrated, in part actually, in part by induction, that the conspicuousness or intensity of any element of language is inversely proportionate to its frequency. Using X for frequency, and Y for conspicuousness (rank) we can express our thesis thus:

$$Y = \frac{n}{X} \quad \text{or} \quad XY = n$$

where n is some constant, the actual size or value of which need not be our immediate concern now.^[132]

This was undoubtedly the foundation on which his other works were based.

His next study, *The Psycho-Biology of Language*, he called “An Introduction to Dynamic Philology,” whose goal was to put language study on a par with exact sciences, by use of “statistical principles.”^[54]

The thesis, very briefly stated, is that the key to the explanation of all synchronic and diachronic language-phenomena has been found in a statistically established tendency to maintain equilibrium between size and frequency.^[131]

The “primary aim is the observation, measurement, and, as far as it is possible, the formulation into tentative laws of the underlying forces which impel and direct linguistic expression.”^[54]

Zipf recognized that there had been accurate investigative studies of language for about 100 years but “nothing has ever been found in the nature of speech in any of its manifestations which is not completely comprised in the statement that speech is but a form of human behavior.”^[54]

His method was “to analyze samples of the stream of speech of many languages into their component parts, [and]...study the frequency distributions of these parts.”^[54] By using data from three different languages (German, Chinese, and Latin) arranged in tables:

it is clear: 1) that the magnitude of words tends, on the whole, to stand in an inverse (not necessarily proportionate) relationship to the number of occurrences; and 2) that the number of different words (i.e. variety) seems to be ever larger as the frequency of occurrences becomes ever smaller.^[54]

Yet the significant feature in the diminution of variety which attends upon an increase in frequency of usage is the orderliness with which the one decreases as the other increases.^[54]

Zipf plotted his observations on double logarithmic paper and after drawing a line “approximately through the center of the points” developed:

the formula $ab^2 = k$ in which a represents the number of words of a given occurrence and b the number of occurrences. That is, the product of the number of words of a given occurrence, when multiplied by the square of their occurrences remains constant, for the great majority of the different words of the vocabulary in use, though not for those of highest frequency.^[54]

Of particularly important note was, “One has the feeling that the exponent of b may well differ with differences in the size of the bulk examined,”^[54] for “It is conceivable that an exponent of b which is larger than the square may represent the frequency distribution in bulks that may be viewed as incomplete discussions of a topic.”^[54]

About 14 years after Zipf’s *The Psycho-Biology of Language* (1935) was printed, his next book, *Human Behavior and the Principle of Least Effort* (1949) appeared.^[55] The purpose of this book, which was an introduction to human ecology, “is to establish the Principle of Least Effort as the primary principle that governs our entire individual and collective behavior of all sorts.”^[55] Zipf stated that, “An investigator who undertakes to propound any such primary scientific principal of human behavior must discharge three major obligations,” that is, have a large verifiable number of observations, be consistent, and have an understandable presentation.^[55] As to the observations:

we may claim in all modesty to have increased the number of our observations to such a point that they may be viewed as empiric natural laws...[for] by means of the accepted methods of the exact sciences, we have established an orderliness, or natural law, that governs human behavior.^[55]

What is the “Principle of Least Effort?” “In simplest terms, the Principle of Least Effort means, for example, that a person in solving his immediate problems will view these against the background of his probable future problems, as estimated by himself.”^[55] In other words, a person will tend “to minimize the probable average rate of his work-expenditure (over time), meaning use the least amount of effort.”^[55] “The connection between this principle and the rank-size law is by no means clear, and Zipf’s theoretical arguments now have at most only historical interest.”^[133]

In writing the chapter “On the Economy of Words,” Zipf applied his principle to speech development. Using Miles L. Hanley’s *Index of Words for James Joyce’s Ulysses*, he found in the rank frequency word distribution “a clearcut correlation” between r (rank) and f (frequency) of the words “in the sense that they approximate the simple equation of an equilateral hyperbola: $rx = C$.”^[55] This, he believed, gave “clear evidence of the existence of a vocabulary balance.”^[55]

More analysis showed

N number of different words of the same f -integral frequency of occurrence (under the conditions of the equation, $rx = C$) will be inversely proportionate to the square of their frequency (approximately)—or, stated somewhat more precisely in equation form, that $N(f^2 - 1/4) = C$.^[55]

This was sometimes considered Zipf’s second law and has been called his “weak” law.

Zipf, applying his “Principle of Least Effort” to many different areas of language and to other disciplines, cited many noted scientists, including Lotka, Davis, Willis, and Pareto, all of whom worked with distributions, but in various areas.^[55] Zipf’s very wordy, philosophical, and detailed explanations are beyond the scope of this paper.

One last observation by Zipf is noteworthy:

The greater the prestige of a person, the *ever greater* will be his power of attraction both for students and for grants of research money for the employment of technicians and for the purchase of expensive apparatus, with the result that his probable opportunities for making and reporting new “important” and “interesting” observations will tend to increase exponentially (i.e., “nothing succeeds like success”).^[55]

Many scientists have analyzed, refined, and evaluated Zipf’s endeavors, but Ronald E. Wyllys, who had made a special study of Zipf’s Law, called it “One of the most puzzling phenomena in bibliometrics”^[134] and noted:

that Zipf’s law only approximates the relationship between rank r and frequency f for any actual corpus. Zipf’s work shows that the approximation is much better for the middle ranks than for the very lowest and the very highest ranks, and his work with samples of various sizes suggests that the corpus should consist of at least 5000 words in order for the product rf to be reasonably constant, even in the middle ranks.^[134]

In Volume 2 of the *World of Mathematics*, the author called Zipf’s *Human Behavior and the Principle of Least Effort* a rather remarkable book; however, “that the law of least effort should be manifested everywhere in human conduct, as Zipf holds—indeed, “in all living process”—is difficult to believe.”^[25] Although Zipf offered much empirical data,

It does not show, as he claims, the existence of “natural social laws,” but, at best, only certain regularities. Brute empiricism is not yet science. Unless observed regularities can be brought into logical relation with other regularities previously observed, we remain at the level of description rather than explanation; and without explanation, we cannot attach much predictive weight to description.^[25]

Anatole Rapaport, in writing about the “Principle of Least Effort,” stated “His [Zipf’s] arguments are vague appeals to the recognition of the Principle in a great variety of situations simply on the basis of its plausibility. And even these appeals are often stretched far beyond ordinary credibility.”^[135] However, other serious researchers, Simon and Mandelbrot in particular, endeavoring to put Zipf’s investigations on a more scientific basis, have also done some very serious evaluating of his work.^[135]

Benoit Mandelbrot has published several studies of generalizations of Zipf's law [one of which is in French], dealing both with the question of whether the slope is -1 and with the deeper problem of explaining why the *rf* products should be relatively constant.^[134]

The purpose of Herbert A. Simon's paper, "On a Class of Skew Distribution Functions," published in 1955 was:

to analyze a class of distribution functions that appears in a wide range of empirical data—particularly data describing sociological, biological, and economic phenomena. Its appearance is so frequent, and the phenomena in which it appears so diverse, that one is led to the conjecture that if these phenomena have any property in common it can only be a similarity in the structure of the underlying probability mechanisms. The empirical distributions to which we shall refer specifically are: 1) distributions of words in prose samples by their frequency of occurrence; 2) distributions of scientists by number of papers published; 3) distributions by cities by population; 4) distributions of income by size; and 5) distributions of biological genera by number of species.^[77]

This paper included mathematical and technical explanations of a stochastic model primarily attributed to D.G. Champernowne^[77] and "the observed fit of the Yule distribution to a number of different sets of empirical data"^[77] including word frequency (Zipf). Simon's "Some Further Notes on a Class of Skew Distribution Functions," which is primarily in answer to a note written by Mandelbrot, followed in 1960.^[136] In Simon's words, "This note takes issue with a criticism by Dr. B. Mandelbrot of a certain stochastic model to explain word-frequency data."^[136]

Bruce M. Hill, a professor of statistics, was responsible for a group of papers regarding Zipf's law. Hill's first paper was "Zipf's Law and Prior Distributions for the Composition of a Population" (1970) in which he cited Willis for first noting the law and discussed the fact that the "theoretical models yielding such a law have been proposed by Yule and Simon."^[137] "Rank-Frequency Form of Zipf's Law" (December 1974), published next, "presents a theoretical derivation of the rank-frequency form of Zipf's law based on a Bose-Einstein form of the classical occupancy model."^[138] "Of course, other models have been formulated, and other approaches taken, in regard to justifying the Zipf (or Pareto) law, most notable those of Mandelbrot and Simon."^[138] Hill's next paper was "Stronger Forms of Zipf's Law" (March 1975), which is really an extension of his 1970 paper.^[139]

In September 1975, Sichel wrote "On a Distribution Law for Word Frequencies," for as he stated,

In the past, several attempts were made to represent word frequency counts by statistical distribution laws. Of the models suggested, none was singularly successful when applied to a variety of data over the entire length of the observed word distribution.^[140]

Therefore, Sichel developed a new model to which "twenty observed distributions quoted in the literature were fitted and the results look most encouraging."^[140]

Also in 1975, R.E. Wyllys presented a paper at the ASIS 38th Annual Meeting in which he included an excellent summation.

Inclined toward mysticism, Zipf not only leaped to the conclusion that the "true" slope of rank-frequency curves was -1 , but also claimed that this regular slope resulted from some fundamental force of nature. In the broad sense, this claim had to be correct; but Zipf variously described the force as that of the struggle between the "life tendency" and the "death tendency" or the "Force of Diversification" and the "Force of Unification," and finally as the "Principle of Least Effort," for none of which did he furnish an operable definition. However, in work summarized... Zipf did show that an astonishingly wide range of phenomena... exhibited distributional behavior that could be approximated by his "law."^[141]

Wyllys claimed his report and

study established that significant, detectable variations in rank-frequency curve slopes do exist, that they appear to have the potential for subject-field discrimination, and that they may perhaps also be usable for the identification of subfields of especially rapid development.^[141]

BRADFORD-ZIPF PHENOMENA

A number of researchers have attempted to explain the relation between the Bradford and the Zipf laws. One of the first papers to do so was "The Bibliography of Operational Research" by M.G. Kendall.^[112] Kendall suggested looking at Bradford's data through the eyes of a statistician and, contrary to Bradford, cumulate data from the bottom of the listing (see the sample chart given in Table 3). From this, he developed a relation which he reasoned indicated Bradford's Law would be true.^[112] According to his analysis, this would make the Bradford and Zipf laws almost equivalent.^[112] (See Kendall's paper for mathematical explanation.) Kendall called the results of Yz (see Table 3) a constant.

In 1967, Ferdinand Leimkuhler wrote his paper "The Bradford Distribution," in which he stated,

Bradford's "Law of Scattering" is the inverse function for the Bradford distribution, i.e., while the latter predicts the number of references for a given portion of the journals, the former speaks of the number of journals required to obtain a given portion of the references.^[114]

Leimkuhler also commented that "Kendall has suggested an alternative explanation of the linear approximation formula, in which he considers the number of titles with a

Table 3 Using Bradford's data from lubrication to illustrate the comparison of Bradford's and Kendall's methods.

Number of journals	Number of references		
<i>Bradford</i>			
<i>X</i>	<i>Y</i>	ΣX	ΣXY
1	22	1	22
1	18	2	40
1	15	3	55
2	13	5	81
2	10	7	101
1	9	8	110
3	8	11	134
3	7	14	155
1	6	15	161
7	5	22	196
2	4	24	204
13	3	37	243
25	2	62	293
102	1	164	395
<i>Kendall</i>			
<i>X</i>	<i>Y</i>	ΣX from bottom <i>up</i>	<i>YZ</i>
102	1	164	164
25	2	62	124
13	3	37	111
2	4	24	96
7	5	22	110
1	6	15	90
3	7	14	98
3	8	11	88
1	9	8	72
2	10	7	70
2	13	5	65
1	15	3	45
1	18	2	36
1	22	1	22

reference count greater than some given value"^[114] (column *Z* in Table 3). He showed his compliance with Kendall's mathematical manipulations by agreeing that "Thus Bradford's law and Zipf's law are essentially just two different ways of looking at the same thing."^[114]

Brookes, in one of the first of a group of papers, had this to say about the Leimkuhler paper:

Leimkuler's analysis therefore provided documentalists for the first time with a general formula which expresses the distribution of papers relevant to a given topic over the range of productive journals. Up to the present, information systems have tended to evolve, documentalists using their experience and making *ad hoc* adjustments to satisfy the demands for services made on the system. But the discovery and formulation of statistical laws of wide generality would enable documentalists to *design* information services. . .

Unfortunately, though Leimkuhler's formulation can be used theoretically without difficulty, it has some disadvantages for the practical documentalists.^[142]

An outstanding disadvantage was the need for tedious statistical computation;^[142] "the exasperation evoked by an attempted practical application of Leimkuhler's formulae [that] led the author of this paper to seek a simpler formulation of the Bradford distribution."^[142]

However, the near identity of Zipf's and Bradford's laws is not immediately obvious because, in practice, the most marked deviations of empirical data from the mathematical expectations of the Bradford law are likely to occur among the most productive journals of the nucleus. . . The Bradford law is not reliable in predicting the productivity of individual journals: it is a statistical law which relates only to large collections of journals or to major subsets of such collections.^[142]

Brookes then proceeded to develop the relationship " $R(n) = k \log n$,"^[142] which he believed was "an exact formulation of the distribution which satisfies the Bradford law."^[142]

The Groos Droop was also mentioned in this Brookes paper. "When empirical Bradford data are plotted in the expectation of yielding a straight line corresponding to $R(n) = k \log n$, the ideal straight line is attained only in part."^[142] Groos, after whom the droop is named, noticed when he plotted the Keenan-Atherton^[143] data according to Bradford that "the plotted points eventually form a curve which droops below the linear predictions of the Bradford law."^[142]

The upward curving bottom of the curve (of the bibliograph) represents the small nuclear zone of the most relevant journals. The upper end of the curve, usually termed the Groos Droop, represents the peripheral zone where relevant references are widely scattered among a great number of journals.^[144]

It has been suggested but not proven that the droop indicates that the data are incomplete.^[142] E.T. O'Neill, on the other hand, claimed "the pronounced droops have occurred most frequently in large and therefore presumably relatively complete sets of data."^[145]

In March 1969, "The Complete Bradford-Zipf 'Bibliograph' " by Brookes was published.^[146] This paper "summarizes the outcome of recent analyses of empirical data which have enabled the general form of the Bradford-Zipf distribution to be elucidated."^[146] Brookes explained "Bibliograph" as follows:

In general, the complete "bibliograph" has two components. . . an initial rising curve. . . running smoothly into. . . a straight line. . . Since a source, to be recognized and counted as a source, must contribute at least one item, it is possible to estimate the end-point. . . of the line. It has been shown that an estimate of the total number of *contributing* sources is given by the slope of the linearity.^[146]

The initial curvature indicates a situation in which restraints are imposed on the productivity of the contributing sources; the linearity indicates a true Zipf situation in which there are no restraints on productivity.^[146]

The complete “Bibliograph” was soon followed by two other papers by Brookes: “Bradford’s Law and the Bibliography of Science” and “Theory of the Bradford Law.” In “Bibliography of Science,” Brookes specified “the requirements for conformity with the law (Bradford-Zipf) in more general terms. . . .”

The Bradford-Zipf distribution can be expected to arise when selection is made of items, characterized by some common element, which are all equally open to selection for an equal period and subject to the “success-breeds-success” mechanism, but when selection of a most popular group is also, but to a weaker extent, subject to restriction. It is thus a general law of concentration over an unrestricted range of items on which is superimposed a weaker law of dispersion over a restricted range of the most frequently selected items.

The Bradford law remains empirical until it is better understood. But if it can be demonstrated to be widely applicable, reliable and useful in practical operations, there is no need to wait until the underlying theory is completely established.^[118]

Bradford’s law can be used to help in the designing of information systems, “in rationalizing library services, and in making more economic and fruitful use of the 29,000 scientific periodicals estimated to be the current production.”^[118]

Brookes gave as applications of Bradford’s law:

1. Use in computerized bibliographic search systems (Medlars).^[118]
2. “Management of special libraries.”^[118]
3. Discarding of “aged” periodicals (obsolescence).^[118]
4. “Planning of special library systems.”^[118]
5. “Subject bibliographies can be resolved or composed without difficulty.”^[118]

“Theory of the Bradford Law” was printed in the *Journal of Documentation* in 1977 and included in *Key Papers in Information Science*, published in 1980. In Brooke’s words, “In this paper I describe how Bradford’s law can be regarded as a particular example of an empirical law of social behavior which pervades all social activities.”^[147]

“The analysis of the Bradford law has hitherto been applied to theoretical models which are too static, too deterministic and too physical.”^[147] “All Bradford distributions are *samples* of some on-going activity but, all too often, the sample data have been regarded as constituting a total population.”^[147] “The law as Bradford formulated it is a hybrid.”^[147]

Brookes then concluded:

So as Zipf abandoned the use of ranks in favour of frequencies, whereas Bradford’s law can be expressed simply only in terms of ranks, I see no further reason to continue to use Zipf’s name descriptively in the context of Bradford’s law. When as many ambiguities surrounded the Zipf law as once surrounded the Bradford law, the use of Zipf’s name in the present context serves no useful purpose.^[147]

In 1969, M.K. Buckland and A. Hindle wrote a survey article, “Library Zipf” for the *Journal of Documentation*,^[148] in which they mention a publication by Kozachkov and Khursin who “propose a basic model, called the ‘hyperbolic ladder,’ and relate it, in particular, to work in linguistics by Zipf, in documentation by Bradford, and in the science of science by Lotka.”^[148]

According to Buckland and Hindle,

The earliest recognition that Bradford’s law of scattering was a form of Zipf’s law seems not to have come until a paper by Kendall in 1960—a conclusion since endorsed by Leimkuhler, Kozachkov and Khursin, and Brookes.^[148]

A number of letters resulted from Buckland and Hindle’s survey. Fairthorne claimed that the relation of the Bradford and Zipf Laws was suggested as early as 1953 and may have been referred to as early 1948 in a discussion of a paper by Vickery.^[149]

D.A. Smith also wrote a letter, not so much critical of the Buckland-Hindle article as critical of the theory discussed. He noted “Other authors have followed this well-worn path of references cited by Buckland and Hindle.”^[150]

The search for unifying principles is doubtless a worthwhile aim but will not justify the use of analytical techniques in libraries. Only attention to practical applications will do this and a study of the methods used in business management may well be of more value than the uncritical acceptance of ideas put forward by those who have a particular concern with theories of society.^[150]

Back came a reply from the authors of the original article. They apologized to Fairthorne for their oversight, but to Mr. Smith they addressed this,

We chose to stress Zipf mainly because, as we wrote, ‘In the field of libraries, where apparent manifestations of Zipf’s laws are evident, there is independent evidence that convenience is a dominant factor in determining library use. . . .’^[151]

In our own experience of attempting to apply the mathematical methods used in business management to practical problems in libraries, we have found that librarians

recognize well enough that mathematical predictions can only be estimates based on assumptions and require some check on their accuracy.^[151]

Brookes also wrote concerning Smith's letter:

Pareto's law [Smith seemed to be pushing for Pareto] does arise in documentation—in the data relating to the productivity of the periodicals in Bradford "nuclear" zones, where I interpret its occurrence as evidence of some control of publication. . . . Incidentally, Pareto has no monopoly of the distribution Mr. Smith claims for him and for economics. Biologists too have found applications of the same distribution in statistical taxonomy though they chose to refer to the same (Pareto) empirical distribution as the Willis distribution. And I am at present engaged in applying the Bradford-Zipf distribution to a problem in paleontology. . . .^[152]

My own view of empirical laws in documentation is that they provide us with prospects of making considerable economies in the running of special libraries and information services.^[152]

The use of the Bradford-Zipf relation was suggested by Stephen Bulick in the "interaction between book users and books available for use in a library."^[153] The author found:

the verbal formulation consistently produces a lower error percentage than the graphical and is, in fact, a good overall predictor. Book use, then, is a Bradford-Zipf phenomenon. . .

This offers support for the strategy of shortening loan periods for frequently circulated items. Other potential uses for a function that describes the distribution of book use over a collection might include core collection determination or the derivation of a marginal utility function describing the effect on total use of adding to a collection.^[153]

In October 1976, Abraham Bookstein's "The Bibliometric Distributions" was published.^[154] The premise of this paper was:

One of the more surprising findings in the information sciences is the recurrence of a small number of frequency distributions. In this paper, these distributions are described, and a point of view is adopted that allows us to understand them as being different versions of a single distribution. The empirical distributions are shown to be special cases of a single theoretic distribution.^[154]

All of these distributions are almost equivalent. . . . In each case we have a set of entities (for example, chemist, words) producing events (publications, occurrences) over some dimension of extension (time, length of text); and in each case the distribution describes the number of

occurrences of events over a fixed interval of that dimension. Under these conditions it is possible to describe the same distribution in at least four distinct ways: these modes of description are represented above by the distributions of Lotka, Zipf, Bradford, and Leimkuhler.^[154]

The four distinct ways are noted in Bookstein:

The four ways are: 1) One may rank the entities according to the values of the attribute, and express the value of the attribute as a function of the rank. This is the form the original expression of Zipf's law takes; 2) Conversely, we can define a unit of the attribute, and indicate how much the rank must increase if we are to gain an additional unit quantity of that attribute. Bradford chose to define his law in these terms; 3) The third form is to cumulate the attribute and indicate how many entities (e.g. what rank of journal) is needed to produce, collectively, a given amount of the attribute (e.g., a given number of articles). This is a form of Bradford's law as defined by Leimkuhler; 4) Finally, one can express, for any possible value of the attribute, how many entities take that value. This, of course, is the form taken by Lotka's law.^[155]

Other writers. . . have shown that Lotka's law and Bradford's law are different approximate descriptions of the same basic distribution, and that, at least for larger values of r , both agree with Zipf. . . . The distributions are approximately the same; it is only the entities and events that differ.^[154]

"Both Zipf's and Bradford's laws emphasize the higher-ranking entities. Lotka, on the other hand, begins with the low end."^[154]

An analysis then led Bookstein to conclude, "Thus the Bradford, Leimkuhler, and Lotka laws, which are virtually equivalent to each other, and also the Zipf law, are also special cases of the forms derived by Mandelbrot and Bookstein on theoretical grounds."^[154]

Citation Analysis

Since the inception of bibliometrics, citations have played a very important role in bibliometric research. At first, there were citation counts which were used to indicate importance of journals; these counts being statistical did not consider the quality of a work. Ultimately, the citations themselves were closely examined as indicated in many research papers. Citation analysis "is a method based on the principle that articles citing the same references also have much of their content in common," stated M. Osinga in "Some Fundamental Aspects of Information Science."^[156] Elliot Noma followed the same thinking, shown by the comment "The similarity between an article and the articles on its reference list is one of the cornerstones of citation analysis."^[157] The supposition that

articles and their references are related has led to many studies, including citation counts (Gross and Gross), impact factor (Garfield), bibliographic coupling (Kessler), cocitation (Small), and citation indexes.

In discussing citation study in his thesis, Dale Lockhard Barker noted there were “two principal types of citation studies. . . These are 1) studies bearing on productivity in all or part of science literature and; 2) those reflecting the use of all or part of the literature.”^[36] Studies based on entry counts in source materials are productivity studies.^[36] The source materials may be “major abstracting or indexing services, review journals, or comprehensive monographic bibliographies.”^[36] “The citations. . . are not to literature used but to literature published.”^[36] An example of such a study would be the work of Samuel Clement Bradford.

“The second type of citation study” was based on the literature used by an author.^[36] An example would be the citation count presented in the Gross and Gross paper.

Linda C. Smith, in her overview of citation analysis for the Bibliometrics Issue of *Library Trends*,^[158] explained the two kinds of citation: “A reference is the acknowledgment that one document gives to another; a citation is the acknowledgment that one document receives from another.”^[158] A relationship is implied between the cited document and the citing document, all or part. “Citation analysis is that area of bibliometrics which deals with the study of these relationships.”^[158]

Studies have found that reasons for citations are numerous and greatly varied. Ina Spiegel-Rosing discovered 13 different categories for use of references in *Science Studies*.^[159] Charles Oppenheim and Susan Renn list seven reasons for citations to some highly cited old papers:

- A. Historical background
- B. Description of other relevant work
- C. Supplying information or data, other than for comparison
- D. Supplying information or data for comparison
- E. Use of theoretical equation
- F. Use of methodology
- G. Theory or method not applicable or not the best one.^[160]

The amount of literature about citation analysis is truly extensive, if not actually overwhelming. It is evident that whenever a subject “grows” (research fronts), new views or facts are presented and more studies then are accomplished validating or questioning those views or facts. When the views are analyzed from different aspects, articles are written and printed, and following a logical sequence, usually a bibliography and/or index of the subject is then compiled, such as Pritchard’s *Statistical Bibliography: An Interim Report*, Pritchard and Wittig’s “Bibliometrics: A Bibliography and Index,” and Vlachy’s “Bibliography of Lotka’s Law and Related Phenomena.”

In the case of citation analysis, Garfield established and organized his extensive *Science Citation Index*; Renata Tagliacozzo wrote her “Citations and Citation Indexes: A Review;”^[161] and Hjerpe developed his report, “An Outline of Bibliometrics and Citation Analysis,”^[162] followed by “A Bibliography of Bibliometrics and Citation Indexing and Analysis.”^[163]

Some techniques using citation analysis are obsolescence, clustering, and citation indexes; information about these is given in the following subsections.

HALF-LIFE AND OBSOLESCENCE

When Gross and Gross determined what materials were vital for the maintenance of a dynamic college and library, they were projecting needs. The flip side of this positive thinking is what is no longer needed or of use. This can be interpreted as “obsolescence.” Obsolescence is the process whereby materials become no longer useful or reliable.^[29] Gosnell, whose dissertation was on obsolescence, stated “the causes of book mortality or obsolescence are many, varying from pure fad through extension of scientific knowledge, technological changes, to fundamental changes in our civilization.”^[30] The rate of obsolescence varies with the discipline. Books according to Gosnell “represent one of the higher forms of culture and the rate at which they are discarded and replaced may give some suggestion as to the rate of evolution of the general culture of which they form a part.”^[29]

In 1960 Robert E. Burton and R.W. Kebler wrote “The ‘Half-Life’ of some Scientific and Technical Literatures,”^[164] in which they compared the rate of obsolescence of scientific literature with that of radioactive substances.^[164] The authors noted upon their research “A short half-life, which is equivalent to rapid obsolescence, is the result of rapidly changing techniques or interest within a subject field.”^[164]

Half-life as explained by Maurice B. Line was “half the active life,”^[165] and this was usually interpreted “as meaning the time during which one-half of the currently active literature was published.”^[165]

The results of many of the half-life studies varied so greatly that they did not project a possible general application. There also were discrepancies as to meanings. This was Maurice Line’s explanation of the process. If the average number of articles in each journal remained constant, and the number of journals doubled, “the probability of citation is twice as great.”^[165] “The so-called ‘half-life’ of a literature is (therefore) compounded of its obsolescence rate and its growth rate.”^[165] Line then proceeded to develop mathematical expressions for determining a half-life corrected because of the two rates.”^[165]

In 1970, Brookes analyzed Line’s technique and concluded that it was “both questionable and impractical.”^[166] He stressed that the “rate of obsolescence is a

function of both the subject literature and of the local usage of that literature.”^[166] A much more accurate measure of obsolescence would be in “sampling the actual usage of the literature in the local library context”^[166] rather than using Line’s correction method. In other words, librarians interested in the obsolescence of holdings should make their own direct measurements. Brookes believed there had been sufficient theorizing; the time had come for proper testing of the basic assumptions which he was in the process of doing, which work, “relying mainly on citation analysis, is tedious but straightforward.”^[166]

The next paper to deal with obsolescence was that of Sandison, who stated “some aspects of the theoretical approaches and terminology need clarification.”^[167] The crux of the papers on this controversial subject was in two frequently observed facts,

first that, in any collection of citations and of items used in a library, the numbers decrease with the time since publication; and secondly that the numbers of items published and available for citation have increased year by year.^[167]

Age does not completely determine obsolescence; “it is possible for older literature to be in greater demand than newer.”^[167]

Michael K. Buckland—in posing an interesting question, “Are obsolescence and scattering related?”—explained obsolescence as the “relative decrease in use of material as it ages” and scattering as “extent to which the use of material tends to be concentrated in a few titles.”^[168] Results of research “were indicative but not conclusive.”^[168] Line, in Letters to the Editor, commented on Buckland’s hypothesis and claimed, “The reasons why scatter and obsolescence occur are numerous and complex, and vary from discipline to discipline.”^[169]

Sandison also wrote to the editor claiming Buckland fell into the same trap to which most citation analysis work has succumbed by “assuming that every citation can be treated as of equal weight as a parameter of a literature.”^[170] “But before further progress is possible in the interpretation of citation analysis, reliable data are required for the growth of the literature studied so that citation available per item can be calculated.”^[170]

Then, in 1973, J. Michael Brittain and Maurice B. Line coauthored “Sources of Citations and References for Analysis Purposes,”^[171] categorizing “the uses to which analysis of bibliographical references and citations can be put.”^[171] The authors identified five sources of references and citations and enumerated advantages and disadvantages of each. Included as one of the listed items was whether obsolescence patterns could be traced.

The “measurement of obsolescence” and “obsolescence, scatter, and growth” were sections in Brookes’s next publication.^[125] Brookes was truly interested in libraries, as was indicated in his observations of use of a library and in his remark “It is, however, simpler to

recognized that any literature ages at a uniform rate, but that some libraries, especially new ones, can hope to attract usage at a rate which exceeds the rate of obsolescence.”^[125]

Although there was some evidence of a positive correlation of scatter and obsolescence, it was not wholly convincing. “It may be so, although at the present time there is no general agreement on how scatter should be defined or measured.”^[125] Both scatter and obsolescence seem to be determined by the rate of growth; “the faster the rate of growth, the less is the scatter and the more rapid the obsolescence.”^[125]

Obsolescence has been the concern of librarians for some time because of overabundance of materials and lack of housing. However, interest in obsolescence was not imperative during the period of money availability which fostered more building and greater collections. Present lack of funds has made it necessary for librarians to reevaluate expenditures and has resulted in a recurrence of interest in purchasing and weeding practices. No doubt, this has aroused the attention of researchers again, but Maurice Line has emphasized, “no measure of journal use other than one derived from a local-use study is of any significant practical value to librarians.”^[172]

Kaye Gopen and Sigrid P. Milner accomplished an extensive study of obsolescence research in 1981^[173] and observed several interesting and important facts; there are many needs: much more investigation of the obsolescence hypothesis; agreement on definitions; proof of the “obsolescence concept” validity; and justification for costs acquired in making use studies. There are also problems: unfamiliarity of librarians with mathematical manipulations; controversial results of past research; and inherent local library “use peculiarities.”^[173]

CITATION INDEXES

Samuel Clement Bradford would be elated if he were to see Eugen Garfield’s work. Bradford, as stated earlier, advocated cooperation in indexing science articles for a universal index, and Garfield seems to have found a solution. In his “Citation Indexes in Sociological and Historical Research” of 1963,^[174] he reminded us that in his original paper of 1955, “Citation Indexes for Science,”^[56] he “proposed the compilation of comprehensive citation indexes primarily as an effective means of disseminating and/or retrieving scientific literature.”^[174] (“Citation Indexes for Science” is discussed in the section headed Seminal Bibliometric Papers.) His second paper was a review of his efforts since the first article appeared and was an emphasis on the fact that “Impact is not the same as importance or significance. There is no specific correlation between the number of papers published by an individual and the quality or importance of his work,”^[174]

although there have been indications that high publication rates usually go with high quality work.^[174]

Citation indexes have been called facilitators by Eugene Garfield; they facilitate personnel and fellowship evaluation, historical research, and computer programs.^[174] But what is a citation index?

A citation index is an ordered list of cited articles each of which is accompanied by a list of citing articles. The citing article is identified by a source citation, the cited article by a reference citation. The index is arranged by reference citations. Any source citation may subsequently become a reference citation.^[175]

“Arrangement by author is favored in the citation index and the source index because the research scientist usually approaches the literature first by author.”^[175] “A complete source index containing full source-article titles and certain additional data... is similar to an upgraded conventional author index covering all disciplines.”^[175] It was assumed that the source paper bibliographies were true indications of previous information; otherwise, the citation index would not be valid.^[175]

In his “Citation Indexing: A Natural Science Literature Retrieval System for the Social Sciences,”^[176] Garfield differentiated between the dissemination and retrieval of information. Information which was current was disseminated but information which had been stored was retrieved.^[176] The problems associated with both dissemination and retrieval, he believed, “are largely overcome by citation indexing.”^[176]

Since citation indexes deal with citations, it is important to explain the different kinds.

In an explicit citation, the source or citing document will identify the cited works by use of formal reference citations, which enable the reader to locate the document in question. In an implicit citation, one recognizes that some other work has been drawn upon or alluded to, but the citing author does not consider it important enough for a formal citation.^[176]

In other words, one is definite; the other is implied.

In the case of conventional indexes, it is necessary to use very highly trained indexers; in citation indexes, the author of a paper provides the indexing by providing the citations.^[176]

In another article, Garfield remarked that clearly visible linkages are “ordinarily provided by authors in the forms of explicit citations. Less clearly seen are implicit references.”^[177] However, in traditional indexing systems, treating each document as an independent unit “results in the loss of important informational links;”^[177] thus, by showing the linkages, citation indexes are more efficient.

In 1965, J.E. Terry, in a critical review of *Science Citation Index: An International Interdisciplinary Index to the Literature of Science*, reminded the reader that

“The whole concept of citation indexing in science should be regarded as still at an experimental stage,”^[178] a fact that Garfield supported by continually stating that improvements are constantly being made.

In his “Citation Indexing for Studying Science” of 1970,^[179] Garfield explained what the *Science Citation Index* does.

Basically...the SCI does two things. First, it tells what has been published. Each annual cumulation cites between 25 and 50 per cent of the 5–10 million papers and books estimated to have been published during the entire history of science. Second, because a citation indicates a relationship between a part or the whole of a cited paper and a part or the whole of the citing paper, the SCI tells how each brick in the edifice of science is linked to all the others.^[179]

“Important applications for the SCI have been found in three major areas: library and information science, history of science, and the sociology of science.”^[179] The first purpose of the SCI was as a retrieval tool which would be used in library and information science.^[179] In historical research, citation indexing aided in identifying “key events, their chronology, their interrelationships, and their relative importance.”^[179] In sociological processes, by means of citation networks, the papers that have had the most impact (most cited by others) can be recognized (The reader’s attention is called to item (15) of Conclusions, p. 33. “It is believed that citation analysis has been demonstrated to be a valid and valuable means of creating accurate historical descriptions of scientific fields, especially beyond the first quarter of the twentieth century when bibliographic citation had become well established as part of scientific publication.”^[180]). There are also different kinds of citation indexes: pertinent to one field or to one journal, or interdisciplinary.^[181]

There have been difficulties with citation indexes—costs, various spellings of authors’ names, authors with the same name, incorrect citing information, and other human errors—but Garfield believed the advantages far outweigh the disadvantages.^[179]

An excellent summary on citation indexes can be found in *On Documentation of Scientific Literature*:^[182]

A citation index consists of two different parts:

1. An index of all articles published in a selected group of periodicals in a given year (so-called sources index).
2. An index, arranged by author, of all articles cited in the articles of group (1) (so-called citation index).

The use of a citation index is: locating a known author in (2) and searching the sources, quoting his articles, in (1). If no author is known, a subject index is available leading to author names.^[182]

The same writer also listed three principal uses of citation indexes:

- (a) Searching for the history of an idea (patent).
- (b) Searching for the use and expansion of a certain method after its first publication.
- (c) Searching in multidisciplinary fields.^[182]

CLUSTERING

The topic “clustering” as part of citation analysis should not be overlooked. Mark P. Carpenter and Francis Narin reported their result of a cluster analysis in “Clustering of Scientific Journals”^[46] based on the *Journal Citation Index* (JCI) citations from 1,821 different journals.^[46]

The process [clustering process] used to divide sets of journals into subject areas has two underlying assumptions: first, that journals which deal with the same subject area will have similar journal referencing patterns; and second, that journals which deal with the same subject area will refer to each other.^[183]

The “first experiment using a new computer-based technique to identify clusters of highly interactive documents in science”^[183] was reported in Henry Small and Belver C. Griffith’s study “The Structure of Scientific Literatures I: Identifying and Graphing Specialties.” The paper was based on the idea that “scientific specialties” exhibiting “high levels of activity” will be represented by clusters.^[183] Clusters of cited documents are groups made evident by cocitation and cocitation strengths. Cocitation is the citing of two documents together creating a link, the strength of which is indicated by the number of times the pair is cited together.

Another important study undertaken by Small was based on the hypothesis that “highly cited and co-cited papers in a cluster is a concrete representation of the cognitive structure... that the authors of the highly cited papers constitute the elite, or ‘leading’ scientists of the specialty.”^[184] Small made three suggestions regarding clusters: 1) “. . . these reflect the social and cognitive structures of research specialties;”^[184] 2) “The authors of citing papers then comprise a subgroup of the current practitioners in the specialty;”^[184] and 3) “By using the same thresholds each year the growth of the specialty can be gauged in terms of the growth of the cluster.”^[184]

Sullivan, White, and Barboni did an evaluation study of citation analyses and agreed that citation analysis seemed to them to be a useful technique,^[185] but of Small’s three claims, the second and third were not supported by their data.^[185]

Trudi Bellardo also did an evaluation of the use of cocitations and made this summation:>

The primary utility of co-citation analysis is as a research tool for studying the sociology and history of science and

scientists. More specifically, co-citation analysis is a tool for understanding the specialty structure of science. The clusters of works which are connected by being co-cited are indirect indicators of the birth, growth, and death of scientific specialties and their social and cognitive structures.^[186]

Since

the observed relationships are in substance those which have been established by the collective efforts and perceptions of the community of publishing scientists. . . our task is to depict these relationships in ways that shed light on the structure of science,^[183]

wrote Small and Griffith. This, they believed, was accomplished by the clustering method.

CONCLUSION

The idea of chronological arrangement of periodicals to show trends is a very good theory, but because of the increasing number of bibliometric papers, any research concerning the theory should use technology in the gathering of data. Alan Pritchard listed 700 items in his interim bibliography of 1969,^[3] Roland Hjerpe cited 2032 items for bibliometrics and citation analysis as of 1979,^[163] and Pritchard stated in the introduction of his *Bibliometrics: A Bibliography and Index* that the literature at that writing (1981?) contained 5000–6000 items.^[187] This increase in the number of publications may have been due to the use of bibliometric techniques in various disciplines, to the many grants under which a number of studies have been accomplished, and to the greater interest in the theory of literature structure.

Studies have indicated that “bibliometric measures have been applied to evaluation of scientists, academic departments, and scientific publications.”^[48] Alan Pritchard and Glenn Wittig advised “some of the uses to which bibliometrics may be put are:”

1. The use as a visible sign of an underlying problem of social structure relating to individuals, e.g. sex differences, promotion policies, creativity.
2. The use for the evaluation of organisations—research sponsorship, government policies, standing in the academic community etc.
3. The use for the evaluation of countries, i.e. science policy studies, either looking at the situation within a country or comparing countries.
4. The use for the examination of the general growth and development of the social structure within a subject or discipline.
5. The use for evaluating individual journals or groups of journals, especially for acquisition decisions.
6. The use as raw data for operations research and other mathematical models.

7. The study of bibliometric distributions in their own right or as members of larger families which are of interest to social science generally.^[187]

Citation counts have been used to indicate linkages of papers as suggested by Henry Small,^[71] of individuals and their special fields mentioned by Broadus,^[188] and of institutions, programs, fields, and subfields as suggested by Narin.^[48] Citations are a valid measure of quality stated Lawani in his discussion regarding Nobel prize winners;^[189] “Derek de Solla Price of Yale [also argued] that citations are an accurate measure of individual quality.”^[190] Others believed that citations were not a true “measure of eminence.”^[188]

Several instances of valid practical applications of citation analysis have been cited by Wade, including a court case contesting the promotion of two men over a woman who had been denied tenure, and the National Science Foundation’s use of citation analysis to help determine the distribution of grants to chemistry departments.^[190]

Garfield used his *Citation Index* to point out key journals in disciplines,^[58] but Carlos Cuadra stressed that “no amount of quantitative or mechanical manipulation of texts, bibliographies, or other tools will enable one to identify the key contributions to information science.”^[191]

One of the most interesting studies was that in textiles, “The Examination of Research Trends by Analysis of Publication Numbers,”^[192] and although no clear-cut trend in total textile research could be concluded, basic research was decreasing; applied research (i.e., production and properties of yarns and fabrics) was increasing.^[192] It was hinted that such information could help channel careers.^[192] This examination was done for total research effort rather than interest in research significance, although it was recognized that counting publications did not indicate the importance of the research.

Wade also presented a possible use as volunteered by Morton V. Malin, “to identify the gaps in a country’s published research.”^[190]

Lawani had such strong feelings about scientists and their productivity being evaluated through citation analysis more and more, that he admonished scientists to “become familiar with the method of citation analysis” and the uses to which it is put “whether or not they consider the basis for such applications well-founded.”^[189]

These are isolated instances and do not have the practicality one would desire. As Nicholas Wade so aptly stated, “the impact of citation analysis on the scientific community cannot yet be assessed because all that has really been demonstrated so far is promise, not practicability.”^[190]

As applied to libraries, bibliometric analyses have been instrumental for book and periodical acquisitions, library use analysis, and weeding of obsolete materials. Carol Tenopir noted Bradford’s law had been shown “to apply to the items borrowed from a library, the users of a library,

contributors to a discussion at a conference, the index terms assigned to documents, and the publication of books by publishers.”^[193] Marcia Sprules informed us of an attempt of an academic library “to evaluate its periodical holdings in all disciplines” to identify candidates for cancellation.^[194]

Maurice Line wrote that “most studies of journal citations and library use are of little if any practical use to librarians...because of inadequate data collection and analysis.”^[195] On the other hand, Narin, in the foreword and summary of McAllister’s report, claimed “Citation analysis is steadily growing as a technique for analyzing scientific productivity.”^[196] Librarians, who were the first to use bibliometric procedures, were not primarily mathematicians or statisticians, nor were they bibliometricians.

Although Schmidmaier observed that “Bibliometrics has its...place in library science, bibliography and informatics,” he believed it needed promoting and that this should and “must begin with the popularization of the contents and teaching of basic knowledge,”^[197] which is a logical assumption.

Bibliometrics is the analysis of the structure of literature using various tools, counting, rank-frequency distributions, and citation analysis; and although the structure of literature is basic to all disciplines, it is particularly important in the area of information retrieval.

Hulme’s original idea was, in reality, a theory to show a possible trend or development in science by means of literature, but it was not a structure study. Gross and Gross, making a supposition about the structure of literature, developed a rank-frequency distribution from citation counts to indicate relative quality of journals; but this was a very primitive study of literature structure. Fussler’s study was an extension of the Gross and Gross idea. Kessler and Small developed excellent bibliometric tools for analyzing literature structure, and based on the same supposition as the Gross idea, these tools for studying relationships have far-reaching implications. No distinctly different technique has been produced since cocitation by Small in 1973, clustering and graphing being procedures using bibliographic coupling and cocitation. The many other articles since 1973 seem to be evaluations, applications, or analyses of investigative processes in attempts to describe more fully or support or duplicate previous research.

It seems evident that bibliometrics, which was first used in attempts to evaluate journals for collection development in libraries, has been recognized and expanded to the study of the structure of literature in the larger encompassing field of information science. At the present, it is composed of methods and techniques without a coordinating theory; but it seems possible that as more theoretical information is converted to fact, and behavioral patterns are established for the assessment and evaluation of the structural components of literature (i.e., authors, publications, words, and laws) and their relationships, the

more probable causal explanations will be evident and bibliometrics will be closer to being recognized universally as a science.

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Bibliothèque Nationale de France

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Abstract

With more than 10 million volumes and an annual increase of about 50,000, the Bibliothèque Nationale de France is one of the biggest libraries in the world. It is also one of the oldest and since the sixteenth century, it has been entrusted with the mission of collecting, cataloging, preserving, and providing access to the French print heritage. Although the library's history consists of several turning points, the last decade of the twentieth century has brought an unprecedented change in the life of the institution: new information technologies, new buildings, new collection management politics, and new services. More than ever, today the library is part of a national and international network of libraries and other cultural institutions whose goal is both to share the wealth of their resources and assert their identities.

A SHORT HISTORY OF THE PAST: FROM THE BIBLIOTHÈQUE ROYALE TO THE BIBLIOTHÈQUE NATIONALE

The Royal Library

The origin of what is now known as the Bibliothèque Nationale de France is the French kings' own private libraries. The most famous one is King Charles V (1364–1380) own collection, composed of 917 manuscripts and cataloged in 1343. In 1368, a specific space in the Louvre was built for this collection. Yet, according to the tradition, it was dispersed in 1380 after its owner's death. The first step to the creation of a royal library was made by Louis XI (1461–1483) who donated his private library to his heir. The new principle was respected by his followers. As the consequence of the advent of printing, the library expanded in the fifteenth century, and a 1622 inventory reports a volume of 4712 manuscripts and prints.

It is under François the First's reign (1515–1547) that a major decision was made to order any printers and booksellers to deposit copies of all books printed or sold in the kingdom. Although this law was not fully enforced in the beginning, the 1537 "Ordonnance de Montpellier" marks the birth of the legal deposit (*dépôt légal*) that remains one of the major missions of the Bibliothèque nationale de France to this day.

From the fifteenth to the seventeenth century, the library was housed in various royal palaces. Transferred from Paris to Amboise, from Amboise to Blois, from Blois to Fontainebleau, it was finally moved back to Paris at the end of the sixteenth century. In 1666, Colbert, Louis XIV Prime Minister, decided to move it into two of his own private residences located on rue Vivienne. In the following decades, that location was extended to the entire block on the rue Richelieu, rue des Petits-Champs and rue Colbert, where parts of the collection are still stored.

The constant expansion of the library in the seventeenth and eighteenth century was mainly due to a determined acquisition and gift policy. Nicolas Clément, librarian of the king in 1670, invented a classification based on 23 letters corresponding to subjects, from religion to literature, including history, arts, sciences, law, and foreign languages. It was used until 1996. The collections were enriched not only with books and manuscripts but also with medals and engravings, hence the creation by the Abbé Bignon, librarian of Louis XV, of the first departments in 1720: Manuscripts, Printed Books, Titles and Genealogy, Engraved Plates and Prints, and Medals and Stone Engravings. Parts of the collections were already open to scholars, but in 1720, the Abbé Bignon extended the access to the general public one day a week, from 11 A.M. to 1 P.M.

The French Revolution changed the contents and structure of the Library tremendously: around 250,000 books, 14,000 manuscripts and 80,000 engravings were confiscated from religious congregations and aristocratic families to be added to the collections, and a 1794 decree changed the Bibliothèque du Roi into the Bibliothèque Nationale.

The Bibliothèque Nationale Throughout the Nineteenth and Twentieth Century

Although its name was changed to Bibliothèque Impériale under Napoleon the First (1804–1815) and Napoleon the Third (1852–1870) and to Bibliothèque Royale under the Restoration (1814–1830) and the Monarchy of July (1830–1848), the library structure and mission kept developing in the same direction whatever the political system was.

The nineteenth century was for the Bibliothèque Nationale, as well as for many other great libraries worldwide, an important time of development in building and

cataloging. With the constant increase of the collections, the lack of space became one of the major issues in the middle of the nineteenth century. In 1862, Napoleon III commissioned the French architect Henry Labrousse (1801–1875) to renovate some of the original buildings, the Hôtel Tubeuf and the Galerie Mazarine, and to build new premises on the rue de Richelieu and rue des Petits-Champs. His most famous work for the library is the Printed Books Reading Room, inaugurated in 1868 and well known as an avant-garde masterpiece of cast-iron architecture.

At the same time, making inventories of the collections became a priority. Head librarians Joseph Naudet (1840–1852), Jules Taschereau (1852–1874), and Léopold Delisle (1874–1905) devoted most of their time and energy to cataloging. Catalogs of medical sciences and of French, British, Spanish and Portuguese, Asian, American, and Oceanic history were first compiled, followed in 1897 by Léopold Delisle's General Catalog of Printed Books (*Catalogue Général des Livres Imprimés*) that was continued throughout the twentieth century until the computerization of the catalog in the 1980s.

Expansions continued throughout the twentieth century, especially under the governance of Julien Cain from 1930 to 1964, to house current holdings as well as rare and precious pieces and to provide access to the public. A new catalog and reference room was built in 1935–1937, and a periodicals room in 1936; special departments (Engravings and Maps and Plans) were moved within the Richelieu block to free up space for the Printed Books Department; new departments were created to preserve and collect newly formed collections, such as oriental manuscripts and music and sound archives; decentralized annexes were created in Versailles in 1934, 1954, and 1971, in Sablé (200 km west of Paris) in 1980, and in Provins (east of Paris) in 1981.

Several laws and decrees managed to improve the legal deposit process and extended it to new materials. Since 1943, printers have the obligation to deposit in regional libraries copies of any material (books, periodicals, flyers, postcards, posters, etc.) printed in the country. The scope of the obligation was extended to imported books; photographic, cinematographic, and sound materials in 1925 and 1943; audiovisual items in 1975; and computer resources in 1992. In 1880, 12,414 prints were deposited; in 1993, the number reached 45,000 volumes.

With the computerization, the increasing readers demand, the growth of published material, and the pressure of new conservation requirements, among which is the urgent treatment of brittle and acid paper and the conservation of new media, the Bibliothèque Nationale had to face the issues of equipment, staff, and space at the dawn of the twenty-first century. A great debate in the 1980s finally ended with the decision by President François Mitterrand (1981–1995) to build a new library.

THE BIBLIOTHÈQUE NATIONALE DE FRANCE

History of the Project

The official launch of a new national library project dates back to the traditional Bastille Day presidential speech made by François Mitterrand in 1988, in which he announced “the construction and development of one of the, or maybe the largest and most modern library in the world.” The ambitious project was defined as such: “the role of this great library will be to cover every field of knowledge, to be accessible to all, to make use of the very latest data transmission technologies, to provide for remote document consultation, and to forge links with other European libraries.” A planning committee, the *Établissement Public de la Bibliothèque de France*, was commissioned for the planning for the new institution, including the international architectural contest, the construction schedule, and the collection and staff management. Although it was first planned to transfer into the new building only the collections printed after 1945, the final decision was made to transfer all prints into the new building, when the special departments would remain in the old site.

In April 1989, the location for the new building was chosen by the river Seine in a southeast area of Paris called Tolbiac. The international architectural contest was chaired by the American architect I. M. Pei. Four projects were selected by the jury and presented to the French President who finally chose the French architect Dominique Perrault on August 21, 1989. Dominique Perrault's project consists of four glass towers symbolizing four open books built on a wooden esplanade and surrounding a deep patio with a garden. On the east and west sides of the esplanade, two escalators provide access to entrance halls from which readers can reach either the reference library reading rooms on the upper level or the research library on the lower level. The project and its final result triggered and is still the topic of a great polemic, especially on the storage of books in glass towers.

On January 3, 1994, a decree merged the Bibliothèque Nationale and the *Établissement Public de la Bibliothèque de France* into a single institution, the Bibliothèque Nationale de France. The keys to the building were officially given by the architect on March 23, 1995, and the reference library was opened on December 20, 1996. After 2 years, during which most of the collections held on the Richelieu site were transferred to the new Tolbiac site, the research library was finally opened on October 8, 1998. A new site was also built by Dominique Perrault in Marne-la-Vallée (20 km east of Paris) for conservation, preservation, and restoration.

This great project presented an opportunity to modernize a century-old library that could not afford to miss the technological turn that revolutionized the information

world in the last decades of the twentieth century. It helped the library to improve its services to the public and to the national and international library community.

Mission and Organization

The Bibliothèque Nationale de France is in charge of five major national missions: acquiring and cataloging collections (through legal deposit, acquisitions, exchanges, gifts, and donations), preserving the collections (through preventive conservation, restoration, duplication), providing the public with access to the collections (inside the library within its 24 reading rooms as well as outside through the Digital Library and remote duplicated document delivery), highlighting the collections (through education and exhibitions programs, publishing, and other cultural activities), and last but not least, cooperating with national and international libraries and institutions (through conservation sharing, acquisition sharing, information and expertise sharing, and the creating of union catalogs).

As most cultural institutions in France, the Bibliothèque Nationale de France is a public institution. Both the President and General Director are named by the government, and most important decisions are made under the control both of the Ministry of Finances and of the Ministry of Cultural Affairs (Ministère de la Culture et de la Communication), more precisely of the Book and Library administration (Direction du Livre et de la Lecture). Funding is also mainly public: in 2001, the French state provided the library with a 105.8 million Euro budget, to which 23.7 million Euro from grants, donations, and internal resources were added. Yet, private funding is an essential and a major resource for the acquisition of special collections such as the manuscripts of Chateaubriant's *Mémoire d'Outre-tombe* bought in 2000 or of *Voyage au bout de la nuit* by Louis-Ferdinand Céline bought in 2001 for 11 million francs (1.67 million Euro).

Today, the Bibliothèque Nationale de France has more than 2800 employees. Three main directors rule the Library: the Staff Director, the Collection Director, and the Services and Networks Director. Furthermore, four delegates to the General Director are, respectively, in charge of a Development Office, a Bureau for International Affairs, a Bureau for Communication, and a Bureau for Cultural Activities. Two committees assist the President of the library with all administrative and scientific decisions. A financial service linked to the Ministry of Finance centralizes, distributes, and controls the resources and expenses of the establishment.

Although the collection was formerly divided according to the material type (prints, periodicals, audiovisual, photographs, etc.), it is now divided into four print collection departments based on disciplines (Philosophy, History, and Human Sciences; Law, Economics, and Political Sciences; Science and Technology; Art and Literature), one special department for Rare Books (Réserve

des livres rares), seven special departments based on material criteria and partly inherited from older departments (Manuscripts; Prints and Photographs; Maps and Plans; Coins and Medals; Music and Opera; Performing Arts; Audiovisual Collections) and two departments that are special libraries onto themselves with their own site (Bibliothèque-Musée de l'Opéra and Bibliothèque de l'Arsenal). A specific Department for Bibliographic Research is also under the supervision of the Collection Director.

Print and audiovisual collections were transferred to the Tolbiac site; the rest was left at their original sites.

Public and Collections

Tolbiac site

One of the key features of the new library site, also known as site François-Mitterrand, is opening its doors to the general public, when the Bibliothèque Nationale was traditionally for researchers only. Because it is not possible to provide the large number of people with access to the whole national print heritage, among which are rare, sometimes unique, and fragile pieces, the Tolbiac site is composed of two reading rooms levels: the upper level with a reference library open to any person over 16 and the lower level with a research library open to only authorized readers. Among the average 3000–3500 readers who come to the library everyday, about two thirds, mostly students, use the reference library and more than one third use the research library.

The reference library is composed of 10 thematic reading rooms providing 1700 seats. The 280,000 volumes of books and periodicals with an encyclopedic coverage of a first academic degree level are stored on open stacks and classified with the Dewey system as in many public libraries. Most of them are in French, but a wide range of foreign languages, such as English, German, Spanish, Italian, Portuguese, and also oriental languages is well represented. In every reading room, computers provide access to the library catalog (up to 8 million records), about 250 CD-ROMs and databases (bibliographic indexes, directories, dissertation abstracts, union catalogs, dictionaries, encyclopedias, etc.), a growing number of electronic periodicals, and the Internet. Admission to the research library is given only after an interview with a librarian who evaluates the needs of the user. Dealing with both of its missions of preserving and providing access with the national printed heritage, the Bibliothèque Nationale de France is considered a library of “last resort.” The collection of print materials is composed of 11 million volumes of books, among which 200,000 are kept in the Rare Books Department, and of about 350,000 periodicals titles, among which 32,000 are current ones. They have mostly entered the library through legal deposit and exchanges and are kept in closed stacks, either on the top

11 floors of the towers or on the basement level near the reading rooms. Every reading room of the research library also has open stacks holding about 330,000 volumes bought by librarians to compose the lower level open access reference library.

The library information system oversees the catalog and the documents and reading seats reservation system that is linked to an automated document delivery system made of 8 km of tracks and 150 delivery stations. Documents can be sent from any storage to any of the 14 reading rooms of the lower level in about 45 minutes.

Digitization has become an opportunity for libraries to duplicate and protect the original collection. Besides the 100,000 printed works and 300,000 fixed images that have been digitized, the library owns about 76,000 microforms and 950,000 microfiches that are substitutes for the documents.

The Department of Audiovisual Collections is the only special department on Tolbiac site. It covers all disciplines on audio, visual, and electronic material deposited by publishers. This collection of 50,000 multimedia documents, 900,000 sound recordings, and 90,000 video recordings is complementary to the Institut National de l'Audiovisuel (National Institute for Audiovisual) holdings that are also housed on the Tolbiac site and mainly consist of TV and radio legal deposit.

Richelieu site and the other libraries

Five special departments are still housed in the old Bibliothèque Nationale site, rue de Richelieu: Manuscripts (with a collection of 225,000 Western and Oriental volumes of manuscripts and xylographs), Engravings (with a collection of 12 million engravings, photographs, posters, and postcards), Maps and Plans (with a collection of 890,000 maps, atlases, reference documents, and globes), Coins and Medals (with a collection of 530,000 coins, medals, and antiques), Music (with a collection of 2 million music documents and recordings).

These departments are associated with other libraries that joined the national library. The Music Department is in charge not only of the collection housed in Richelieu but also of the Bibliothèque-Musée de l'Opéra housed in the Opéra Garnier building and composed of 130,000 prints and 240,000 special materials. The Bibliothèque de l'Arsenal (1 million prints and 120,000 special documents), which opened in 1797 and was originally composed of two precious encyclopedic collections owned by two members of the royal family, was annexed to the national library in 1934 and established as a department in 1977. It is well known among bibliophiles for its rare and precious editions and bindings. The Arsenal site also houses the Performing Arts Department (2.4 million objects and documents), which was created in 1976 after collector Auguste Rondel's donation and opened an annex in the Maison Jean Vilar in Avignon in 1979. A project for

the National Institute for the History of Art (Institut national d'histoire de l'art) composed of a reference and research library and of an academic research section has been in development since the late 1990s on the Richelieu site. It consists of the merging of three major art libraries (Bibliothèque d'Art et d'Archéologie, created after Jacques Doucet's private collection; Bibliothèque Centrale des Musées Nationaux, and Bibliothèque de l'École Nationale Supérieure des Beaux-Arts), providing free access to 550,000 volumes in the famous salle Labrousse. The École nationale des Chartes and its library, mainly specialized in medieval history, is also associated with the project. This institute is meant to be complementary with the Bibliothèque Nationale de France precious collection, which is being reorganized while the buildings and preservation conditions are being modernized. The former periodicals reading room of the Richelieu site, also called salle ovale, is meant to become in the coming years another reference library providing the large public with access to all the library digitized and microfilmed collections.

A LIBRARY FOR THE TWENTY-FIRST CENTURY

The Library on the Web

In the 1980s, the development of new information technologies enhanced a major evolution in the library world. Remote services are part of all contemporary libraries' missions and duties, especially those libraries with a national and international role. The new project for the French national library was an opportunity to define new missions, complementary to the traditional ones and based on technological progress. Twenty years later, the Bibliothèque Nationale de France has developed two major information tools that will continue to develop and grow: the Web site and the Digital Library.

The Bibliothèque Nationale de France Web site, <http://www.bnf.fr>, was created in 1996. It contains about 100,000 pages and provides information, services, and bibliographic products for the Internet public, the actual library's users, and the national and international community of librarians and publishers.

Information to the general audience mainly takes the form of a repertory of Internet resources called "Les Signets de la Bibliothèque Nationale de France" (the Bibliothèque Nationale de France Internet bookmarks) that are classified, enriched, and updated by specialized librarians. Service to the readers and researchers is based on the integrated information system that gives them the possibility to search in catalogs (BN-OPALE PLUS for printed material and BN-OPALINE for special collections), reserve a seat on Tolbiac site, order documents, or ask for duplication on various material (color or black and white photocopies, microfiches, microfilms, facsimiles,

slides, photographs, digitized images on CD-ROM or on disk, etc.). Information and services to the library and publisher community cover various activities: bibliographic standards (ISBD and ISSN recommendations, MARC formats); legal texts (legal deposit laws and decrees); bibliographic products (subject headings lists, catalogs, French National Bibliography online with the possibility to download records); and general information about the library (annual reports, legal deposit activity, and national and international cooperation and partnership).

In 2001, the Bibliothèque Nationale de France Web site was visited around 14,300 times every day by 11,700 different users (41% are located in France, 17% in Canada and the United States, 3.5% in Italy, and 38.5% in the rest of the world). An average number of 90,700 pages were looked at every day, mostly the catalogs and the Digital Library.

The Bibliothèque Nationale de France Digital Library, Gallica, was launched in 1997. It was reorganized in 2000 and includes in 2002 a free of right collection of 80,000 fixed images, several dozens hours of sound recordings, and more than 60,000 printed volumes. Most prints are digitized in image format, but all tables of contents can be accessed in text format as well as about 1250 documents, such as reference books, classical literature, and rare editions. In 2001, about 4500 Internet users entered Gallica every day, and 10 million pages were downloaded every month.

Gallica complements the virtual exhibitions and the Internet education programs also available on the Library's Web site. The Digital Library growth is based on 3-year digitization programs of 20,000 prints and 80,000 fixed images selected according to two major directions: completeness of the cultural heritage and encyclopedic library (new authors, dictionaries, and periodicals) and development of thematic projects such as Traveling (in France, in Africa, in Italy, etc.), Memories of the Bibliothèque Nationale de France (a selection of material of an outstanding research and art value), and special collections (illuminated manuscripts, incunabula, Philidor collection in partnership with the Library of Versailles, Gaignières collection in partnership with the Bodleian Library, Dunhuang collection in partnership with several foreign institutions coordinated by the Mellon Foundation).

National and International Cooperation and Partnership

Institutional and human networks based on expertise, financial resources, and documentation sharing are key priorities of the Bibliothèque Nationale de France.

Since 1994 a partnership policy based on long- or short-term programs has been created under the name of "réseau des pôles associés" (partner institutions network).

Every partner institution, mostly libraries or groups of libraries, signs an agreement with the national library displaying the cooperation patterns. In 2002, there are 64 «pôles associés», representing 71 institutions. Among them, 20 are city libraries, 18 are academic libraries, and 33 are research institutions, museums, or record offices.

Collecting and preserving the national heritage is one of the partnership's purposes: in 1996, agreements with 25 regional libraries and record offices were drawn up to reinforce the effectiveness of printer legal deposit and to enhance links between national and local copyright systems. Cross-control helps all partners to improve their collection depth.

Developing specialized collections of a high research level is a second purpose: seeking to ensure a comprehensive national coverage of the world's knowledge, the Bibliothèque Nationale de France shares its collection development policy with 39 libraries (23 located in Paris and its vicinity, 16 are spread out all over the country), mostly academic and research libraries that specialize in various disciplines or documents, from medieval art to biomedical engineering, from comics to posters. The library partly helps its partners financially.

Improving access to resources is the other action led by the Bibliothèque Nationale de France in cooperation with other libraries for the benefit of scholarship and research: The French Union Catalogue (Catalogue Collectif de France) was inaugurated on the Web in May 2001 and is composed of a National directory of libraries and document centers (Répertoire National des Bibliothèques et Centres de Documentation, RNB CD) providing detailed practical and technical information on more than 3500 French institutions and of 13 million bibliographic records from three major databases: the Bibliothèque Nationale de France's print collection catalog (BN-OPALE PLUS), the academic libraries union catalog (SUDOC), and a reservoir of bibliographic records resulting from a retrospective conversion program for handpress books held by city libraries. This recon program was also partly funded by the Bibliothèque Nationale de France.

Other services, such as shared digitization programs or remote document supply, are also developed.

Dealing on a large scale with most of librarianship issues, the Bibliothèque Nationale de France also shares resources and expertise with other similar institutions within international organizations. It is a member of various organizations promoting French language around the world and helping French-speaking countries to do so. Through a continuing professional education program, it provides French-speaking librarians from developing countries with training in particular domains of librarianship and in new fields of technology. An active cooperation network was also built in the past decades with French-speaking Canadian librarians, mostly from the Bibliothèque Nationale du Québec (BNQ) and the University of Laval to share information, documentation,

internships, and bibliographic records. Translating English-speaking library reference tools such as subject headings, ISBD, Dewey classification, and editing a French-speaking national libraries directory (Le Répertoire des Bibliothèques Nationales de la Francophonie) providing information on national libraries or equivalent institutions in not less than 43 countries, are some of the main actions led in that field of cooperation.

Before it was even built, the Bibliothèque Nationale de France had a mission to "forge links with other European libraries." Many collaborative projects are initiated by the Conference of European National Librarians (CENL) and funded by the European Commission. Among their programs, the Bibliothèque Nationale de France plays an active part in Biblink (Linking Publishers and National Bibliographic Services), Bibliotheca Universalis (a G-7 global information society pilot project), CD-BIB (National Libraries Project on CD-ROM), CoBRA (Computerized Bibliographic Record Actions), EROMM (European Register of Microform Masters), NEDLIB (Networked European Deposit Library), and RENARDUS (a project that aims at improving access to existing Internet-accessible services across Europe) and participates with various other organizations (The Ligue des Bibliothèques Européennes de Recherches, LIBER; the Consortium of European Research Libraries, CERL; the European Bureau of Library, Information, and Documentation Associations, EBLIDA) in actions promoting the interests of research libraries and academic users and mainly consisting in the making of shared catalogs and bibliographies.

Last, but not least, collaborating with libraries worldwide is another role of a national library. Within various specialized organizations, the Bibliothèque Nationale de France makes its contribution to international research on specific librarianship issues: computer files ISBD, permanent UniMARC, preservation and conservation within the IFLA, Russian and Mediterranean libraries projects in the UNESCO, bibliographic standards within the International Standardization Organization (ISO), and the International Standard Serial Number (ISSN), and on more specific collection issues within (e.g., the International Federation of Film Archives (FIAF)), the International Association for musical libraries (AIBM/IAML), or the International Council of Museums (ICOM).

The last decade of the twentieth century has been an important turn in the life of the French national library. The Tolbiac project played a pivotal role in the institution's growth and helped it to make up for lost time. The impact of new technologies in knowledge and collection management mainly consisted of the improvement of services, both inside the library and outside its physical frontiers. As any other national library, the Bibliothèque Nationale de France has now both dimensions of a keeper of the past and an initiator of innovating projects.

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Binding [*ELIS Classic*]

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Abstract

Lawrence Thompson has written extensively about bibliography and the history of books and printing. He contributed many articles to the first edition of *ELIS*, including this one on Binding. The binding of books is one of several book arts, as Thompson's discussion reveals.

—*ELIS Classic*, from 1969

INTRODUCTION

The binding of books is both a craft and an art. The forwarding of books (all the processes of binding before lettering and decoration) is a craft requiring a high degree of technical skill and a considerable fund of information about the materials and processes used in book production during all periods of history. Finishing (decoration of the cover in various styles) is an art in which some gifted binders of the past have attained substantial heights of achievement, comparable to artistic creativity in other media.

OVERVIEW

A binder's equipment and tools must be kept in an orderly manner, for a job can easily be ruined in a poorly organized shop. Minimum equipment consists of the bone folding stick (in constant use for many purposes), a pair of 6-inch scissors, a paste pot (earthenware is customary), a glue pot, which will hold about a pint, a glue brush (round, about 1 inch), a flat paint brush for the paste pot (about 1 1/2 inch), a cobbler's knife, a package of bookbinder's needles, a wooden sewing frame, a flat piece of marble or stone about 10 × 15 inches for doing any work which requires a firm surface (old toilet partitions are ideal), a lying press made of beechwood blocks and moved with wooden screws, a plough for cutting edges in the lying press, a backing hammer, a cheap board cutter, and, if possible, a standing press (in which to press books for drying, thus freeing the lying press for routine work in progress). A power cutter, two or three "finishing" presses, a tooling stove (for the finisher), an electrical paring machine, and a power-driven device for sharpening knives and shears are examples of other equipment that the more experienced hand binder may need.

When a binder receives a volume, his first task is collation, and if he deals with printed books from the fifteenth through the eighteenth centuries, he is likely to need to

know something about descriptive bibliography. Further, the folding of printed sheets is a process that requires meticulous care and competence in collation. If a book is to be rebound, it must be "pulled" (i.e., separate cover from text and remove old cords and tapes and the old glue, often a tedious process). If folds of old books are damaged, a "guard" (a narrow strip of paper used to repair a damaged fold, or to attach a plate or a single leaf) may be necessary. Special techniques are involved in guarding and mounting maps and folded sheets. A similar problem may arise in the case of pages of new books that are incorrectly printed. These pages must be cut out from the entire sheet, or "cancelled," and the corrected page supplied by the printer must be tipped in.

Before sewing, the pages of a book must be pressed firmly, both to expel air and to crease the folds of the sheets. If there is to be no edge-decoration or "rough-gilding," books may be trimmed before sewing. However, a book must be "cut in boards" if there is to be a smooth gilt edge, a marbled edge, gaufering, or a fore-edge painting (marbling is largely passé, gaufering and fore-edge painting are now essentially *tours de force*). Gilding smooth edges (see below) is a highly specialized technique, and application of gold leaf is a tedious and delicate operation.

There are various styles of sewing. Most primitive of these is stabbing, and the earliest codices were held together in this manner. In Western Europe and America small items were sold without covers and stab-stitched through the eighteenth century; and some modern American textbooks with wide inner margins are still sewn in this manner. With the rise of parchment as a writing material in the early Middle Ages, a much tougher material, which could be folded, was available. Threads could be put through holes in the folds. This process of sewing on raised thongs or cords goes back to the tenth century in northern Europe. Today large books (e.g., pulpit bibles) are generally the only works sewn in this manner, although imitation raised bands are commonly used to lend the illusion of luxury. Recessed thongs or cords were

first used in the sixteenth century as a step toward automation, since it is quicker and cheaper than raised-cord sewing (not for the aesthetic qualities of a smooth spine). “Two-sheets-on” sewing, a device in which each length of thread holds two sections instead of one, was used from the beginning of the seventeenth century until the latter part of the nineteenth, when sewing machines began to be used widely in commercial binderies. It is to be contrasted with the method of passing the thread continuously through all sections, from beginning to end, without a break. Oversewing (also called “overcasting” or “whipstitching”) was developed in the eighteenth century to hold heavy plate books together firmly. It is a method for making a series of sections, then sewing all along them. Oversewing machines are the mainstays of modern library binders. They have produced many an expendable book that has been circulated far more times than a hand-sewn book would have been used; but it has also resulted in the virtual destruction of many fine books sent out for rebinding by injudicious library binding assistants.

Regardless of the sewing method used, the sewn book must be “knocked-up” to be square at head and spine, and the expansion resulting from the sewing can be reduced by hammering along the back edges. The spine is glued with a thin hot glue (still preferable to the yet untested plastic product) diluted with some insecticide such as DDT, the book again “knocked-up” to round the spine, and the spine lined. Preparation of cover boards for the case requires exact measurements, lining-up (to prevent the pigmentation of the boards from showing through the end papers), marking the boards for sewing, and marking the boards for tapes.

End papers (sheets before and after the text of a book) may or may not be decorated. The classic type of decorated end papers is marbled, presumably originating in Japan in the twelfth century A.D., and reaching Europe via Persia and Turkey. By the end of the sixteenth century marbled paper was used in the Netherlands, and its use spread eastward and across the Channel in the next century. The oriental *serefsan* (gold-flecked) papers, used for end papers as well as texts, is a variation of marbling that has been given little attention, although *serefsan* has been used imaginatively by many oriental calligraphers and binders. “Dutch gilt” (or “Dutch flowered”) papers were produced in Germany and Italy in the eighteenth century, imported into the Netherlands, then exported to France and England. They were not marbled, rather printed by engraved rolls, wood-blocks, or incised metal. In the twentieth century, Douglas Cockerell^[1] and a few Parisian and Scandinavian binders (especially Ingeborg Börjesson) have produced marbled papers of distinction.

Commercial binders often use maps, engravings, or pertinent photographs (generally reproduced by offset) for end-paper illustration. A classic variation of the end-paper is the doublure or lining of silk, leather, or other material in lieu of end sheets. The Islamic doublure of the fifteenth century had a strong influence in Europe and was

well known on the continent beginning in the sixteenth century. Leather doublures were common in England and Western Europe from the latter part of the eighteenth century on (see Boyet, below). Most doublures are plain, although fairly elaborate borders are common. Since the first and last sections of a book are the weakest, and since elaborate doublures need added protection, leather hinges, either sewn in with the end papers or pasted down on the end papers, are usual in bindings with doublures. Linen hinges are often used for more common bindings.

Trimmed edges may be handled in different ways. In the middle ages each leaf was trimmed separately. In the sixteenth century the proliferation of books through printing required smooth trimming of edges. At this time we have the beginning of edge-painting (e.g., the Pilone Library; not fore-edge painting as yet, simply edge-painting), and gaufering (decoration of the edge with a tool on the gilded edge). In the middle of the seventeenth century the fore-edge painting (an image under a smooth gilt edge, visible only when fanned out) came into vogue. Floral, heraldic, and landscape themes were popular with fore-edge painters of the eighteenth and early nineteenth centuries. The art has become less popular in the twentieth century, but it is still practiced with vigor and imagination by such artists as the elder Joseph Ruzicka and Kenneth Hobson. Edge marbling was common in the eighteenth century, by the same method as the one used for marbling flat paper, by transfer via solution in muriatic acid, or by rollers. Sprinkling, most frequently with Venetian red, has been used in Europe since the sixteenth century and is still a characteristic of law books. “Rice marbling” is a similar process.

Traces of headbands may be found as early as the seventh or eighth century in the well-preserved Stonyhurst Gospel. The headband as we know it in modern books is in colored silk or thread. Beading shows at the bottom, and turned-in leather of the spine forms a hood. Sixteenth-century binders used this style, and it is still in vogue. In the nineteenth century the more sought-after hand binders used fine silks and elaborate patterns, and some quite handsome work was produced. Stuck-on headbands have been used since the sixteenth century, but the best hand binders of all periods have sewn them on to the spine.

Up to the nineteenth century most books were bound with “tight backs” (covering material attached firmly to the spine, or sandwiched between cover and spine when there are additional layers of material). “Hollow backs” permit leaves to throw up in the middle, and the outer spine is not folded or broken. Hollow backs began to be used widely in Europe at the end of the eighteenth century and became the order of the day after about 1820. “Spring backs,” “capable of retaining a firm situation” (patent granted to John and Joseph Williams, ca. 1799), are used in ledger bindings.

Leather was the primary covering material for books until the third decade of the nineteenth century, when

commercial publishers began to use cloth on a production-line basis. Goatskin, sheepskin, and calfskin have been the usual materials, although other sources of leather are known, ranging from weasel skin for a set of Lenin's collected works, to human skin (e.g., from Confederate soldiers, used by a Unionist Army surgeon to bind his texts and manuals, now in the College of Physicians and Surgeons in Philadelphia). Calf was popular in the sixteenth century, sheep in the seventeenth and eighteenth. Careless tanning methods have resulted in the virtually complete deterioration of hundreds of thousands of bindings. Straight-grained morocco was widely used in the eighteenth and early nineteenth centuries and is still in use today, since it does not show scratches and other damage as plainly as other leathers. Russian leather, originally prepared in and imported from Russia, is made from calf or cowhide; it was widely used in England, North America, and Western Europe since about 1730.

Embroidered covers were used for fine bindings in the Tudor and Stuart periods in England, possibly even as early as the late fourteenth century (Anne de Felbrigge's putative binding of her manuscript Psalter). Jeweled bindings, based on metal plates covered with enamel or with plaques in ivory or other metals, and in-laid with jewels, were the deluxe book covers in France and Germany from the sixth to the fourteenth centuries. In the twentieth century Sangorski and Sutcliffe and a few other hand binders have produced jeweled bindings, but tax laws and customs "finkishness" have discouraged hand binders from working in this area.

Clasps are a practical device for binders who use vellum, a material likely to curl in almost any climate. However, all books and leathers may curl, and clasps are practical for all types of bindings. Far Eastern and Islamic binders have used an ivory pin on a strong ribbon, to be inserted into a loop on the front cover. Some surviving Coptic bindings have a simple strap that can be fitted to the fore-edge of the front cover. Holes and pins were used in Europe until the fourteenth century, when metal clasps and catches began to be used. A significant key to bibliographic description is the position of clasps and catches: in the Low Countries and the Germanies the clasps were fitted to the bottom cover, the catch on the front cover. In France and England these positions were reversed.

Bosses were put on covers in the Middle Ages to save the decorations from wear and tear resulting from pushing over tables or shelves, or possibly from an overflow of sacramental wine (German student *Kommersbücher* of the nineteenth century were provided with bosses to elevate the covers a millimeter or so above the beer spilled on the *Stammtisch*). A related practical device was the chain, and *catenati* are still to be seen at Wimborne and Hereford. The length of chains ranged from three to five feet. Chains served less to prevent theft than to avoid abuse of books.

The earliest technique of finishing is blind tooling, impression of tools on leather (generally wet), without

use of gold or color. Coptic bindings of the seventh century show evidence of widened blind tooling. Blind tooling was always in use; and all surviving romanesque bindings of the twelfth and thirteenth centuries are in blind, with the exception of a French binding of the early thirteenth century on which there are traces of gold. Gothic bindings of the fifteenth and sixteenth centuries reveal much greater variety of stamps and rolls. A peculiar laborsaving technique developed at this time was the large panel stamp, a device that often provided a convenient medium for imaginative artistic expression. The panel stamp originated in the Netherlands and was used there throughout the fourteenth century, and during the fifteenth and first half of the sixteenth centuries it was used widely by binders all over Northern Europe. Impressions were almost invariably in blind. A related device was developed in commercial binderies of the late nineteenth century, the "butter stamp," which could be applied to the whole spine of a book and decorate it with one impression.

Related to the panel stamps as a decorative device is the supralibros, or superexlibris, stamped in the center of the front cover to indicate ownership. It was used in France from the sixteenth century on, and it spread from that country to the rest of Europe. Generally the supralibros is the armorial device of the owner, but it may also be a monogram or some other device indicating ownership. Unfortunately, some armorial bindings are forgeries, since a binder might retain the stamp and use it on books not belonging to the rightful owner of the device. When provenance lends value to a book, binders with a low level of scrupulousness have been tempted to make improper use of a supralibros stamp. The supralibros is generally tooled in gold leaf.

Blind tooling has had spurts of popularity with certain binders or schools (e.g., the "ecclesiastical" or "divinity" style in Victorian England), but after the middle of the sixteenth century it was largely restricted to cheap leather bindings on trade books. Another finishing technique, practiced mainly in Germany during the Gothic period, but still used occasionally, is *cuir ciselé* (also called *cuirbouilli*; German, *Lederschnitt*; incised leather). Under this method no elaborate dies were needed, for the leather was simply cut and then worked so that it stood out in relief.

Gold tooling *à petits fers* seems to have been a Moorish invention developed in Córdoba and was probably imported into Christendom via Naples in the late fifteenth century. Applying gold leaf with a hot tool was not a Venetian art, for binders in Venice simply followed the usual oriental manner of painting the impressions made by blind tooling. In any event, the art of gold tooling was used by Italian binders in the early sixteenth century and quickly spread to France. In both countries, bindings produced in this period show a high level of artistic achievement. Gold tooling did not spread to the Germanies and other parts of Europe until somewhat later. Much early

gold tooling was rather crude, but techniques improved gradually. Today virtually every design is drawn or tooled on thin paper, which is then positioned on the cover as a guide for the heated tools. It is said that the great English binder Roger Payne (1738–1797) first used paper patterns, and the accuracy of his tooling would tend to confirm this attribution. However, they did not come into common use until a generation after Payne's death, and we cannot safely give him certain credit for this invention.

Gold leaf is applied after the leather has been neatly smeared with glaire (or glair, white of egg). The dry leather is greased and covered with gold leaf, and the pressure of the hot tool causes the gold to adhere to the leather by the coagulation of the glaire. Pure egg white is generally altered with various other liquids, ranging from spirits of wine to vinegar, ammonia, salt, and camphor to avoid putridity. Today dried albumen is most generally used, since it works as well as fresh eggs and is far more convenient. Among oils used for binding, hog lard, palm oil, and Vaseline have been used. (But neither Vaseline nor any other mineral oil should ever be used for rubbing bindings.) Some soft unabrasive material such as flannel lightly sprinkled with olive oil should be used to clean off the leather after tooling.

"Smooth gilding" (in contrast to "rough gilding," see above) is an operation much like gold tooling and appeared on the European scene about the same time or a little later. It requires consummate patience and exactness of technique, and in large shops there are gilders who do nothing else. An essential step in edge-gilding is careful burnishing with an agate burnisher once the gilding is thoroughly dry. The purpose of gilding is protection of a book from the penetration of dust, and it is essential for the protection of fore-edge paintings.

There are devices other than tooling in gold or blind for decorating book covers, and we even have such bizarre examples of decoration as the Argentine *nonato* binding (skin from the foetus ["not born"] of an Argentine pampas calf, with hair left on). There are highly sophisticated uses of intarsia (inlay), a technique used as early as the 1560s by a French binder for achieving polychromistic effects with various colors of leather. In the twentieth century inlay has been used with grace and imagination by a number of master binders. Much "inlay" is actually "onlay," since the base leather is not cut, but rather impressed with the design and the impressions filled with cutout pieces of the desired color.

Certain other devices for decorating leather should be noted (these are mostly of British origin). "Tree calf" is a marbled calf on which the pattern resembles the trunk and branches of a tree, and the earliest example comes from England around 1775. Tree calf has not been used extensively in the twentieth century, perhaps, in part, because the marbling process is a cause of deterioration of leather. "Etruscan calf" received its name from the resemblance to the "black figure" pottery of the Etruscans with

contrasting shades or colors of the decoration. Most of the Etruscan bindings have a classical urn in the center surrounded by Greek palmated leaves and outer borders reminiscent of Hellenic entablature. They were popular in the quarter of a century on either side of 1800. "Landscape bindings," used in the same period, show landscapes on the covers, generally freehand drawing with India ink or acid, or possibly stenciled or otherwise printed, also come from this period.

"Illuminated bindings" originated in France and were popular in the mid-nineteenth century. They show designs in both gold and colors. Another process for showing designs in color is the "Sutherland tooling process," patented in 1896 by G.T. Bagguley of Newcastle-under-Tyne, and while it achieves rather striking effects, it is too delicate to be handled and is generally restricted to doublures. It was used originally on books bound for the Duchess of Sutherland. Richard Cosway (ca. 1747–1821), the noted British miniaturist, lent his name to "Cosway bindings," leather bindings with miniature paintings inserted in their covers. Actually Cosway bindings were introduced only in the beginning of the present century by Rivière and Son. A talented Miss Currie copied the miniatures, but the bindings were designed by Mr. Stonehouse.

Binding materials other than leather offer special problems to the finisher. Vellum cannot be tooled in blind or in gold with much success. Silk, actually too fragile for a practical binding, may be tooled, but care must be taken not to stain the material with glaire or to scorch it with a hot tool. Velvet can be decorated only with large tools, since it has such a deep pile. When unusual or exotic materials are used (e.g., tapa cloth for a James Michener book, snake skin for a Raymond Ditmars book), decoration should be restricted to pasted-on spine labels, since the natural design lends the desired effect.

Lettering is a late development, for in the Middle Ages and even into the sixteenth century, most books were shelved on their backs. The fore-edge may have been lettered, or a piece of vellum inscribed with the author and title was glued on the back (the upper side when the book was shelved with the fore-edge to the wall). Late in the sixteenth century the increased size of libraries required that books be shelved upright to economize on space, and the more elaborate decoration of spines suggested that the books could also be decorative household furnishing. In the first half of the sixteenth century gold-tooled spine lettering came from Italy and soon thereafter from Paris, then spread to England and the Continent. Tooled lettering did not become common until the latter part of the seventeenth century. Lettering was done with large individual tools (sometimes resulting in curious abbreviations), but in the late eighteenth century the typeholder and lettering pallet began to be used. About the same time printed paper labels were used widely, but commercial binders abandoned them when gold blocking on cloth came into general use in the 1830s.

Restoration and preservation of bindings is an entire discipline in itself. Such official or quasi-official agencies as the Institute for Restoration and Preservation of the Akademiia Nauk in Leningrad or the Istituto de Patologia del Libro in Rome, private investigators such as W.J. Barrow of Richmond, Virginia., libraries such as the New York Public Library (John Archer and H.M. Lydenberg), organizations such as the Library Binding Institute, and many individual binders have conducted productive studies in this area. The definitive manual on preservation and restoration is still lacking. At this point it is sufficient to issue a few caveats: Never attempt homemade restoration with miscellaneous adhesives and adhesive tapes. Never use any binder or restorer who is not recommended by one of the major rare book libraries. In general, do not rebind or attempt restoration unless the book is subject to further deterioration in its present condition. If a noble book suggests the need of a noble binding, consider a chemise inserted into a tastefully decorated slip case, leaving the book in its original state.

At this point a word about slip cases (sometimes called “thumb cases”), Solander cases, and chemises is in order. These devices are far and away the best means of preservation, for they do no injury to the book as it has been handed down through the years, and they also protect it from further damage and offer an opportunity to the binder to pay homage to a fine volume. Meticulous care must be exercised in measurement for slip cases, and it is essential that they be constructed to permit easy removal of fragile books. They may be in full leather, half leather, paper (plain or decorated), cloth, or most any other material. Leather spines—but not others—may have imitation raised bands. Leather and half-leather slip cases may be tooled in the same way as a leather binding. The Solander case, named for its inventor, Dr. Daniel Charles Solander, Anglo-Swedish naturalist on the staff of the British Museum in the 1760s and 1770s, differs from the slip case in that books are inserted from one end, not from the fore-edge. It may be covered in the same manner as a slip case and decorated if covered in a suitable material. A chemise, or a protective cover, lined with muslin or some other soft material, should be fitted over any book worthy of a slip case or Solander case before the case is designed. Slip cases or Solander cases are useful for vellum bindings, susceptible to curling even under the most careful temperature and humidity control.

HISTORY OF HAND BINDING

The history of bookbinding as we know it begins with the Roman diptych, two facing receptacles for wax tablets, or *pugillares* connected at the back with rings. Diptychs were made of ebony, boxwood, ivory, or some other hard material, and the outside covers were sometimes elaborately carved. The text proper was incised with a stylus on the

wax surface. There were also triptychs, including three *pugillares*, and some containing even more.

The codex form of the book is associated with the rise of Christianity. More specifically, the Coptic bindings from early Christian communities in Egypt reveal most of the basic characteristics of the binding of codices, and possible future discoveries may tell us much more than we know at present about the genesis of binding practices. Only fragments of the earliest bindings used by the Coptic Church in Egypt survive, but they are sufficient to tell us a great deal about the origins of the binding of the codex. Surviving examples of Coptic binding, mainly from the ninth, tenth, and eleventh centuries and quite fragmentary, show the full heritage of Hellenistic ornament in blind tooling, *cuir ciselé*, and even rudimentary *pointillé*—the basic styles of the previous 1000 years, and the basic techniques of the next millennium.

Greek art as well as Greek science owes much to the Christian Syrians and Egyptians, who were tutors of the Moslem invaders of the seventeenth century. The sophisticated Coptic leathercraft was picked up at once by the Mohammedans and taken to Sicily and Spain along with other skills inherited from the orient (e.g., papermaking, marbling, gold tooling). The full story of Europe’s artistic and intellectual legacies from Islam is still imperfectly known; but when it is told, the provenance of the technology and the artistic traditions of Western European binding will be much better understood.

Western Christendom had a tradition that went back to late Roman antiquity. In Europe as well as Africa the codex book was a necessary development, but techniques and decorative traditions were different. There were leather bindings on boards in the early Middle Ages, but we have few examples before the eleventh century. The Stonyhurst Gospel of the seventh or eighth century, with rudimentary blind tooling on leather or birch boards, and the Victor Codex at Fulda are well-known examples of medieval binding in the conventional manner in Europe. A very small group of decorated Carolingian leather bindings has survived.

As early as the seventh century there is an example of a jeweled binding, the Gospel for the Empress Theodelinda in Monza. The jeweled binding, with gold filigree, pearls, carved ivory, and enamel was frequently produced from the ninth through the twelfth centuries for emperors and secular and ecclesiastical dignitaries, but more as an act of piety than as a display of artistic skill. Noteworthy examples are the Codex Aureus (presented to St. Emmeran by Emperor Arnulf in the ninth century; now in the Bayerische Staatsbibliothek) and the lectionary from the Bamberg Cathedral (a gift of Henry II, also in the Bayerische Staatsbibliothek).

More important are the romanesque bindings of the twelfth and thirteenth centuries, of which some 200 survive. The stamps represented biblical characters such as David, Samson, and the Virgin, as well as themes from

classical mythology, such as centaurs and mermaids. A characteristic of the romanesque bindings is successive rectangular borders around a central square, rectangle, or circle. Romanesque bindings were produced in Germany, England, and France. There were two especially important shops in Paris in the neighborhood of the Sorbonne between 1135 and 1146.

Blind tooling, not only with individual dies but also with rolls and panel stamps (see above) reached a high level of artistic achievement in the fifteenth and sixteenth centuries when Gothic styles prevailed. Several unusual features of bindings during this period should be noted. Signed bindings [e.g., by the noted binderpriest, Johannes Rychenbach (Richenbach), chaplain of Geislingen] began to appear. Lettered inscriptions, such as a *Laus Deo* or an *Ave Maria*, on bindings suggest the rapidly developing concept of typographic printing. During the Gothic period we have quite elaborate inscriptions, giving even the full name and status of the binder and the year and the date when the work was completed.

The single stamps used in the Gothic period have been analyzed in meticulous detail by Ernst Kyriss,^[2] and thanks to his labors, styles and trends of this period are better known than any other before the Renaissance. Two major types of arrangement of the stamps can be identified. One is characterized by compartmentalization of the surface of the binding by means of lines, with the small stamps arranged within the compartments. The other type showed a large central panel surrounded by smaller stamps arranged in a geometric design. The octavo book, which became quite common in the early period of typographic printing (in contrast to the quarto and folio volumes of the manuscript period) were especially well adapted to the use of panel stamps (of necessity, relatively small). A large proportion of Gothic bindings are of monastic or of some other type of clerical provenance.

The late period of the Italian Renaissance was the source of the seminal traditions of modern hand binding. The Venetians had intimate contact with the Levant, before and after the fall of Constantinople in 1453; and the Neapolitans had equal intimacy with the Moors of Spain and North Africa. Both traditions were related, and undoubtedly both had their effects in Italy, with interlacing, reticulation, narrow fillets, cable patterns, and tiny roundels, which characterized Italian bindings of the late fifteenth century. The introduction of gold tooling to Italy (see above) was a major step forward. The vigor and imagination of Aldus Manutius as a manufacturer of books, regardless of how much or how little he personally innovated, cannot be overemphasized. He and his successors used every idea that drifted into Italy with full effect. The relationship of typographic design and the finishing of bindings in the Aldine tradition is especially obvious in the Aristotle of 1495 and the famous *Hypnerotomachia* of 1499, in which knobs and borders in the bindings have a striking similarity to the decorations on initial letters in the text.

The styles, which we know from Venice, are inseparable from the bindings commissioned or collected by Jean Grolier de Servin (1479–1565), French diplomat and bur-sar in Italy and friend of Aldus Manutius. Most of his some 3000 books, many bound in an apogee of the early Venetian style, with exquisite gold-tooling, went to his son-in-law, Méry de Vic, Seigneur d’Erménouville, but they were later dispersed, and those authentic items with the inscription, *Io. Grolierii et amicorum*, are special treasures of any collector or library lucky enough to acquire them. Grolier was addressed by Geoffroy Tory as “amateur de bonnes lettres, & de tous personnages sauans,” and some of his *amici* are listed in a famous quatrain:

Vatibus, historicis, addit calcaria; cunctos
Scriptores fovet, his fertque patrocinium.
Musurus, Stephanus Niger, atque Thylesius, Aldus
Lascaris, Arpinus, sunt mihi firma fides.

A successor of Jean Grolier in Italy was Thomas Mahieu (Maiolus), for whom bindings similar to Grolier’s were executed. Some 90 are known and identified. The styles are quite similar to those of Grolier’s bindings, with the characteristic interlaced strapwork, with impeccable gold tooling. In the same stylistic tradition are the so-called “Canevari bindings,” once ascribed to the papal physician, Demetrio Canevari. Actually these bindings were most probably ordered for books presented by Cardinal Alexander Farnese (son of Pier Luigi Farnese, duke of Parma and secretary to Pope Paul III) for his nephew, Alexander Farnese, about 1545–1547 as a reference collection. Regardless of genealogical and political problems, the “Maioli” and “Canevari” bindings are superb examples of finishing techniques of the sixteenth century.

The heritage of Marc Lauwrin, or Laurin, Seigneur de Watervliet, cannot be overlooked. Classicist, antiquarian, and patrician of Bruges, he has left two or three examples of work in the Grolier–Mahieu–Canevari style. In the Louvre there is a binding inscribed “Io. Grolierus M. Laurino D.D.”^[3] “M. Lavrini et amicorum” appears on his few surviving bindings.

A method of decoration used in Italy in the sixteenth century was a sort of cameo binding. Relief impressions, like ancient cameos, were produced by stamping leather with dies cut in intaglio. A noble example may be found in the British Museum’s Grenville Library: Celsus, *De Medicina* (Venice, 1497), inscribed by Grolier: “Est mei Io. Grolier Lugd. & amicorum.” The workmanship on the cameos is almost flawless. One of the Canevari (*vice*, Farnese) bindings has a superb cameo of Apollo driving a chariot hitched to two horses toward a crag on which Pegasus is perched, the whole oval cameo being encircled by the inscription:

ΟΡΘΩΣ ΚΑΙ ΜΗ ΛΟΞΩΣ

It is likely that some of the important surviving Italian bindings of the sixteenth century were produced in Lyon as well as in Venice and possibly Rome, Milan, and Naples. Toward the end of that century Italian binding deteriorated, along with other aspects of Italian art.

In France the Guild of St. Jean Latran, under the protection of the University and settled in its precincts, had a strong influence on the production and sale of books, not only in the Quartier de l'Université, but also throughout Paris and the rest of France. The guild was founded with a membership "en grant nombreur, riches et oppulenz" but it conservatively followed traditional styles, the Gothic in the fifteenth and early sixteenth centuries, the Italianate in the sixteenth. It was dissolved along with other Parisian guilds on March 17, 1791, although its influence had been almost nonexistent for over a century.

The early gold-tooled bindings of France date from the second decade of the sixteenth century [e.g., Thomas Linacre's copy of his translation into Latin of Galen's *Methodus Medendi* (Paris, 1519) presented to Henry VIII].—By the time of Francis I the influence of Italian binding traditions becomes obvious in France. A singularly fine example of this tradition is the binding of the *Vulgata* (Paris, 1538–1540; plate I in Marius-Michel,^[4] *La reliure française*), of which the main centerpiece is Italianate, yet the main design is Gallic. A binder for Francis I was Pierre Roffet, le Faucheur, "reliieur du Roy." Perhaps the most famous binder, illustrator, and printer of this period was Geoffroy Tory (ca. 1480–1533), educated in Italy and strongly influenced by Italian traditions. Tory was probably not a finisher, but he undoubtedly drew designs both for his illustrations and his bindings. It is doubtful that any other stationer of Western Europe in the sixteenth and seventeenth centuries conceived and produced work of comparable quality.

The bindings executed for Henri II and Diane de Poitiers bring into sharp focus the peculiar characteristics of French bookbinding (and French art in general) of the mid-sixteenth century. The crowned 'H' and the cipher of two 'D's' interlaced with the 'H,' surrounded by carefully arranged interlaced borders, is a high point of Renaissance art. The subtle contrasts of curved and angular forms, the intricate designs of the borders with interlaced fillets, and the suggestive devices and ciphers (H + D) of the king and his noble mistress are precursors of the baroque. There is a sharp contrast with the relative simplicity of the Grolier bindings. The collection of Henri II is largely preserved in the Bibliothèque Nationale; but that of Diane (Duchess of Valentinois after Henry succeeded his father in 1547) was dispersed, and only some 30–odd have been identified (Bauchart).

At the turn of the century a remarkable but short-lived dynasty of binders began with Nicolas Éve. He was binder in ordinary to Henri III and used the "semi" (strewn style, e.g., his binding of the 1581 Horace, an armorial panel surrounded by a field of fleurs de lis). Clovis Éve, possibly

the nephew of Nicolas, worked for later noble patrons, above all Marguerite de Valois, Queen of Henri IV, in essentially the same style. His typical design consisted of a field broken by a series of ovals, with flowers and sprigs of oak or pomegranate in the middle (the so-called style "à la fanfare"). Generally there would be borders of palm branches. The front cover usually shows a shield with three fleurs de lis. The legend, *EXPLICATA NON ELUDET*, is on the lower cover [e.g., the *Caesar* (Paris, 1564) in the British Museum, c. 19. a. 15].

In the early seventeenth century a still unidentified compatriot of Cyrano, "Le Gascon," produced some exceptionally fine work, tooled with singular care, in geometrical designs. His "pointillé" style (tool forms in dotted outline) was characteristic of his work. Some have identified Le Gascon with Florimond Badier, but the evidence is not convincing. Badier's name appears first in 1630, and he was accepted as a master in the Guild of St. Jean Latran in 1645. Many of Badier's bindings survive in the Bibliothèque Nationale. Another seventeenth-century French binder whose name should be noted is Macé Ruette, to whom the invention of marbled paper is often incorrectly attributed. Some of the great collectors of the day for whom French craftsmen worked are Henri IV, Jacques-Auguste de Thou, Nicolas Claude Fabri de Peiresc, and Sir Kenelm Digby.

The great French tradition of binding established in the Renaissance has endured to the present time, and even today Paris is still the world's most important center of fine binding. Only a few of the more important figures may be mentioned. Luc-Antoine Boyet (or Boyer), active from about 1680 until his death in 1733, used handsome dentelle borders (small contiguous stamps at the edge of the book cover, forming a lacy pattern) and may have introduced the decorated leather doublure (see below). His special patrons were the Marquise de Chamillart and Count Hoym. His son, Étienne, was binder and librarian of Prince Eugene in Vienna and also worked for Baron von Hohendorff. Probably a pupil of the Boyets was Augustin Duseuil, also a devotee of dentelle and doublure, but he was especially noted for his corner ornaments. Jean Charles Henri Lemonnier (d. 1782), binder for the Duke of Orléans, created some finely executed inlays in the style of *chinoiseries*. Antoine Michel Padeloup ("le jeune," 1685–1758) bound for Louis XV and the kings of Portugal. He used dentelle borders and inlay but also elaborate tooling such as feeding birds, not always in the best of taste, but technically well-nigh perfect. Mme. Pompadour was one of his best customers. Nicolas-Denis Derome ("le jeune," 1731–1788) was perhaps the greatest master of the *relieuse à dentelle*. His bindings are often identified by a small bird, but this method should be used with greatest care, since Derome le jeune and Dubisson also used a bird tool. Both Padeloup and Derome were members of families whose other members won distinction as finishers.

During the Romantic period Joseph Thouvenin (1790–1834), a student of the brothers Bozérien (binders for Napoleon, among others), was the best-known artist of the period. His technique was almost flawless, his ideas about decoration sensitive and pertinent to content. He was the master of the “cathedral” style, which used Gothic architectural motifs for cover decoration. G. Trautz, a German, married the daughter of the binder Antoine Bauzonnet (“master of the fillet” or “the Boyet of the nineteenth century”). He continued the historical trends of the Thouvenin school, and he produced singularly handsome bindings (often hard to open) for such noted collectors of the period as Baron Rothschild. They are signed Trautz–Bauzonnet. Toward the latter part of the century and into our own time we have such personalities as Chambolle, Duru, Cuzin, Gruel, Lortic, and Mercier, but they exhibited greater skill as forwarders than as finishers. There are signs of a renaissance of decorated bindings in France, and another Le Gascon, Padeloup, or Derome may well be serving apprenticeship today in some Parisian atelier.

After the great age of the Grolier and Mahieu binders, Italian binding suffered an eclipse from which it has never fully emerged. Italian binding of the seventeenth and later centuries has been strongly influenced by the French and, in general, has shown little originality. However, there are some young binders in Rome and Florence who are showing much promise.

Spain has always been a deviant country as a result of the Moorish domination, and her binding traditions reflect this situation. Arabic influence is revealed in the predominance of interlacing strapwork, rings, and dots, with a few supplementing stamps (some Islamic, some Christian in theme). The “mudéjar” style of medieval Spain has many imaginative features that represent a significant period of art history. Just as in Italy, Spanish binding styles from the *siglo de oro* on have been strongly influenced by the French. In Ibero-America there have been some outstanding shops in the twentieth century in São Paulo, Buenos Aires, Santiago de Chile, and Mexico City, mainly staffed by binders trained in Germany and France.

After the Gothic period at least one truly distinguished binder emerged in the Germanies, Jakob Krause (1531–1586). For the last twenty years of his life he was court binder in Dresden and created handsomely designed bindings in pigskin with decorated rolls and panels impressed in blind, a few gilded vellum bindings (a difficult art in every respect), and monumental decorated bindings on calf, the latter influenced by French and Venetian styles. His stamps (many cut in Augsburg, where he worked for a lustrum before settling in Dresden) were designed with fantasy and imagination, cut with flawless technology. Among his apprentices were Daniel Wachslar, Gregor Schenk the Younger, Urban Köblitz, Hans Hermann, and, perhaps the most competent, certainly the most famous, Caspar Meuser (d. 1593), successor of Krause as Saxon court binder. The latter’s son, Moritz, used tools in the

family stock for bindings for the Saxon archives. In April 1945 an air raid by the U.S. Air Force on Dresden destroyed a large proportion of the Krause bindings in the Japanisches Palais (home of the Königliche Sächsische Landesbibliothek).

It would be an error of omission not to mention Peter Flötner (ca. 1485–1546) of Ansbach and Nuremberg, whose remarkable wood-engravings are known from many sixteenth-century sources (e.g., *Spruchgedichte* of Hans Sachs). In addition to his contributions as an illustrator, he made plaquettes for German cameo bindings, not of the quality of those of the Italian school, but of considerable merit from the standpoint of imaginative design. In addition to Augsburg, Munich and Vienna were also major centers of the binding craft, for the kings and emperors were zealous to assemble libraries bound in the best contemporary styles.

In the seventeenth century there were remarkable naturalistic flower stamps (Praque, Gotha, Augsburg) and dentelle borders (Heidelberg). Far too little is known of eighteenth-century German bindings, and we need more detailed investigations of bindings for Frederick the Great (Kraft and Roch) and Goethe (Lehmann in Berlin). In the nineteenth century some of the ablest German binders emigrated, e.g., Trautz and Bradel to Paris, Zahn to the United States, Zaehnsdorf to London.

In the twentieth century German hand binding has attained new distinction. Best known abroad, perhaps, is Ignatz Wiemeler, whose stern insistence on the essentials of individual craftsmanship and basic elements of design is reflected in the work of numerous students. Otto Dorfner, theorist, teacher, and creative binder, has had a similar influence; and Paul Adam^[5] and Joseph Hoffmann belong in the same category as teachers and original artists. Fritz Helmuth Ehmcke (1978–1965), formerly professor in the Hochschule für bildende Künste in Munich, has had a strong influence on all aspects of German book arts. With F.W. Kleukens and G. Belwe he founded the Steglitzer Werkstatt. He has designed bindings, decorated papers and many typefaces in wide use. Franz Weisse (1878–1952), whose most productive years were spent as professor in the Kunstgewerkeschule in Elberfeld, was dedicated to the ideals of absolute simplicity in design. His relatively few bindings are among the best done in twentieth century Germany, but his influence in continental Europe is abiding. His home and his shop and most of his best work were destroyed one night in 1943 by an unprogrammed aerial raid. Despite the temporary setback of the period 1932–1945, hand binding and other arts, which advanced so rapidly in the Germanies from about 1890, are now on the rebound.

English binding reached no special distinction before the eighteenth century, although there are high points. The Gothic binding traditions of the Continent crossed the channel, and many engraved fillets and stamps comparable or similar to those in use in the Germanies and the Low

Countries reappeared in England. Few pictorial panels were used, but heraldic devices appear frequently.

In the latter part of the sixteenth century, England had such distinguished collectors as Lord Lumley, the Earl of Arundel, the Earl of Leicester, and Archbishop Cranmer, and the tradition has been continued to the present day. Many employed the best domestic and continental binders, and some of their collectanea have been preserved in the British Museum and a few other great English libraries. Such collections in the British Museum as the Harleian or that of the Rev. Mr. C.M. Crachecode, both intimately associated with the binding traditions of their period, explain in part the wealth of the museum in historical hand bindings.

Gold tooling is believed to have come to England in the work of Thomas Berthelet, or Bartlet, about 1540, a full half-century after gold tooling was used on the Continent. Berthelet showed some imagination, but the Italian influence is obvious in all of his work. Berthelet was also a printer, succeeding Richard Pynson in 1530 as royal printer. In Europe, England, and the Americas there was an intimate connection between the printing and the binding trades, and both were practiced in many of the major printing houses. The book business was monolithic in the sixteenth and seventeenth centuries: all processes, from type founding through retailing of the final product, were often done by one firm.

An Elizabethan collector often compared with Jean Grolier is Thomas Wotton, whose bindings are inscribed, "Thomae Wottoni et amicorum." His books were bound either in France, or by French craftsmen imported to England. Some of the work executed for Wotton is decorated only by a central armorial design, but others have considerably more elaborate devices, often decorated with strapwork resembling the designs of Grolier's binders. Through the Civil War and the Commonwealth, English binding, like English art (save literature) in general, was undistinguished. Samuel Mearne (d. 1683), binder for Charles II, and his son, Charles, produced rich and elaborately ornamented bindings, largely based on French models, but marred by heavy hands of relatively unskilled finishers. The Mearnes themselves were probably administrators of a book production firm, not binders.

In the eighteenth century English hand binding came into its own. There was James Edwards of Halifax, who invented transparent vellum bindings; John Whitaker, master of the Etruscan binding; and, above all, that eccentric genius, Roger Payne. Payne's remarkable tooling with delicate small dies, his almost unbelievable precision, and his exact gilding may have been partially inspired by indulgence in the Bacchic tradition. He inscribed his handsome binding for Barry's *Wines of the Ancients* with an amusing bit of doggerel:

Falernian gave Horace, Vergil fire,
And barley-wine my British muse inspire.

Payne designed and cut his own tools and did most of his own work, assisted by his brother, Thomas, and later by a partner named Weir. He bound for a few distinguished collectors, notably Rev. Cracherode, Lord Spencer, and Hon. Thomas Grenville (Lord Spencer's collections being largely preserved in the John Rylands Library in Manchester, the Cracherode and Grenville in the British Museum). Payne's use of straight-grain morocco (perhaps the first example among English binders and his "diced" russia ["diced" by ruling the leather in diagonal lines]) are characteristic features of his work. His meticulous tooling, much in pointillé, has never been excelled. He used heraldic devices as center panels on order from customers.

English and North American binding of the mid-nineteenth century and later is artistically unimportant, but much solid work was done by Francis Bedford (1799–1883) and his associates, Charles Lewis and John Clarke. They produced flawless forwarding, but their finishing was a weak imitation of Renaissance styles. Robert Rivière (1802–1882), scion of a family of French artists, taught himself binding and settled in London in 1840, where he bound for the royal family, the Duke of Devonshire, and other collectors, and restored the Domesday Book. His nephew, P. Calkin (Rivière and Son since 1880), carried on the business and did much solid but highly conservative work for British collectors. Joseph Zaehnsdorf (1816–1886) learned binding in Stuttgart and Vienna and settled in London in 1842. He attracted a substantial following among English collectors, and the reputation was maintained by his son, Joseph William (1853–1930), who continued a tradition of dignified but stolid finishing. He was court binder for Edward VII and George V. Francis Sangorski (1875–1912) and George Sutcliffe (1878–1943) formed a firm in 1901 in a Bloomsbury attic and have produced some usual inlaid and jeweled bindings (see above) along with much basic routine work with simple decorations. The Sangorski and Sutcliffe bindings of the *Rubāiyāt* of Omar Khayyām with the peacock design are particularly well known.

Thomas James Cobden-Sanderson (1840–1922), unhappy at the bar, took seriously the suggestion of Mrs. William Morris that he go into bookbinding, and he learned the rudiments of the craft in the shop of Roger de Coverly. Cobden-Sanderson shared the belief of William Morris that his age was one of pointless imitation, however skillful, of older styles (e.g., by Bedford, Rivière, and Zaehnsdorf). Imaginative and inventive, he did much to establish the concept of the innate quality of individual craftsmanship in contrast with mass production. While Cobden-Sanderson was certainly mistaken in many of his ideas about modern industrial tyranny, he did contribute a great deal to the craft by insisting on sound workmanship, the use of good materials, and originality in design. An apprentice at Cobden-Sanderson's Doves Bindery, Douglas Cockerell (1870–1945), put many of his master's ideals into practice, but Cockerell showed a vast fund of

common sense which was almost a closed book to Cobden-Sanderson.

In the United States, English traditions of hand binding have always been the major influence. When the Club Bindery (see Figs. 1, 2, and 3) was flourishing in New York around the turn of the century, both English and French craftsmen were on the staff. Some of the best binding in America has been done at the great printing houses which maintain extra-binding departments (e.g., The Cuneo Press with George Baer, or R.R. Donnelley and Sons with Harold Tribolet) and at certain libraries which maintain hand binders [e.g., Margaret Duprez Lahey at the Pierpont Morgan Library, Ferdinand Zach at Catholic University (see Fig. 4)]. German emigré binders, who have come to both hemispheres of the Americas since the 1930s, have also made a substantial contribution to the craft in the New World.

The medieval binding styles in the Low Countries were close to those of the Germans. In the seventeenth century one Magnus of Amsterdam was an exceptionally successful imitator of Le Gascon. John B. Smits of Haarlem and S.H. de Roos of Amsterdam executed some unusual designs around the turn of the century, and there are a number of promising young binders in Holland today. Among modern Belgian binders, René Laurent deserves special mention for the originality of his designs.

In Scandinavia styles were largely imitative up to the end of the nineteenth century, although there were occasional examples of superior workmanship and design, especially in Copenhagen. Hans Christian Lerche (1807–1876) was the founder of a Copenhagen hand-binding establishment, which his sons sold as late as 1921. D.L. Clément (d. 1877) catered to commercial publishers by using English cloth bindings, and when Immanuel Petersen (1836–1903), an accomplished gilder, took over his shop, both hand bindings of considerable originality in finishing and machine bindings were produced. Anker Kyser (1864–1939) started in Petersen's shop as a young gilder and developed rapidly in technical and professional skills. For most of the first part of the present century Kyser was the main personality in Danish bookbinding, skilled in forwarding technique and finishing, learned in the history of binding. His younger collaborators were Joakim Skovgaard, Hans Tegner, Johan Rohde, and, above all, Thorvald Bindsbøll. Around 1950 Henrik Park, a skilled and talented designer, became the heir to the Kyser establishment. Danish bookbinding in the twentieth century would have had a totally different tradition if August Sandgren (1893–1934) had not had a little shop in which he devoted all his energies to the ideal of individual craftsmanship, much in the tradition of Cobden-Sanderson and Marius Michel. His work is basically simple in



Fig. 1 From the Club Bindery.

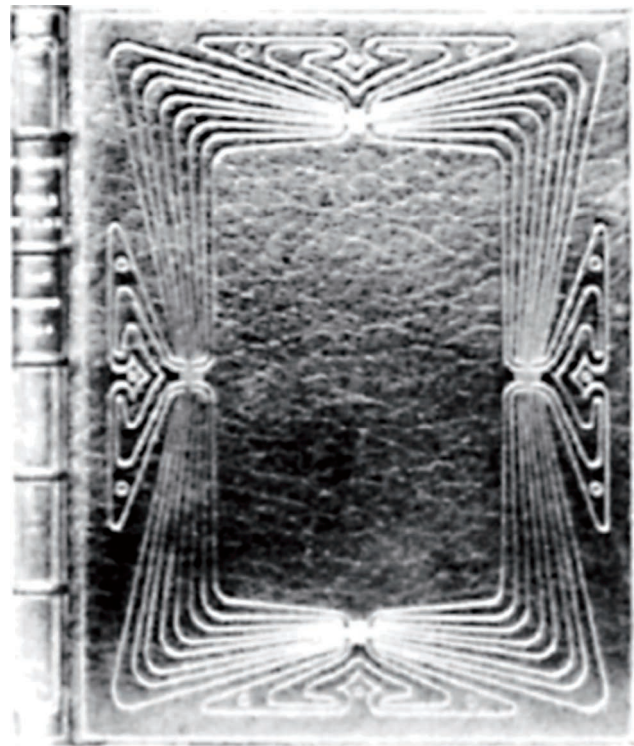


Fig. 2 "Salome," by Oscar Wilde, bound for Willis Vickery at Rowfant Bindery. Designed by Henri Hardy, and finished by Gaston Pilon. Cf. *Progressive Printer*, 19, 357 (1909).



Fig. 3 Anacreontis Teii Odae (Paris, Henricus Stephanus, 1554) (Club Bindery, 1898).

construction and design, but it represents the highest standards of personal achievement. His marbled papers and lithographic papers (with Axel Salgo) are exemplary.

In Sweden most bindings before 1850 were imitations of French, and, to some extent, of English and German styles. Johan Frederick Stangenberg, who flourished between 1821 and 1841, produced simple tooled bindings on long-grain leathers. After about 1850 there were a good many solid orthodox bindings by Gustaf Hedberg (also a historian of binding). During the 1920s and 1930s Akke Kumlien, master of most of the book arts, designed some publishers' bindings for P.A. Norstedt and söner, which have had an enduring influence in the Scandinavian book-making tradition. Two lady binders, Countess Eva Sparre and Greta Morssing, have produced work that is a major contribution to Swedish binding tradition.

The leading Norwegian bookbinder of modern times is M.M. Refsum, who established his firm in 1887. He worked closely with many outstanding Norwegian artists, notably Gerhard Munthe and his own son, Tor Refsum.

During the 1950s significant traveling exhibits of English, West German, Swedish, and Danish hand bookbindings were sponsored by the University of Kentucky Libraries. The viability of artistic inspiration in all four



Fig. 4 Binding of an edition of the Council of Trent, edited by Dr. S. Kuttner of Catholic University in 1942. The original manuscript is in the Pierpont Morgan Library Binding by Dr. Ferdinand Zach and presented by Catholic University to the Pope.

shows attracted considerable attention, and there is every reason to believe that some of the best book design and bookbinding will come from countries north of the Scheldt in the second half of the twentieth century.

CONCLUSION

Serious scholarship in the field of the history of bookbinding is largely a labor of love, and foundation support is rarely forthcoming. Nevertheless, scholars such as the late G.D. Hobson,^[6] Prosper Verheyden, Luc Indestege, Ernst Kyriss, and Ilse Schunke^[7] have made substantial contributions to the history of the book and to Western European cultural history with their investigations. The history of hand binding offers many opportunities for the bibliographer that have not been fully appreciated.

GLOSSARY

- Antique binding.** See Divinity binding.
Armenian bole. See Bole.

Basil.	Sheepskin, generally poorly tanned, used for inexpensive bindings.	Chevrotain.	Leather made from the skin of small guinea deer; also called cheveril.
Beating stone.	A stone set in a pan filled with sand, on which books are beaten to make the paper more compact.	Cloisonné.	Enamel intarsia between strips of metal placed on a porcelain or metal base.
Blind tooling.	Impression of tools on leather by hand, to form an engraved design, not to be painted or covered with gold leaf.	Cosway bindings.	Leather bindings with miniature paintings inserted in their covers; named for Richard Cosway (1742–1821), the English miniaturist, but who had nothing to do with the development of this style (an early twentieth-century fad).
Bole.	A reddish mineral (friable clay) similar to chalk used to prepare edges for gilding; also known as Armenian bole.	Cottage style.	Decoration associated with the Mearnes, characterized by the outline of a cottage gable on the cover.
Butter stamp.	Stamp applied to the whole spine of a book, decorating it with a single impression; generally cut for collected works of single authors and used widely by nineteenth-century edition binders.	Cropped.	A bound book, of which the edges have been trimmed radically, sometimes even cutting into the text, is said to be cropped.
Cameo binding.	A binding decorated with stamps cut intaglio (similar to a seal) and impressed on the center of the book as a medallion; background is generally painted in gold or colors; see also Plaque binding.	Cuirbouilli.	A design in relief on a leather cover, formed by modeling and hammering.
Cancel.	A corrected leaf, tipped in on the stub left from an incorrectly printed leaf which has been removed.	Cuir ciselé.	Decoration by incising the design into the leather; also known as <i>Lederschnitt</i> or incised leather.
Canevari binding.	Binding allegedly in the library of Demetrio Canevari (1539–1625), an Italian physician and collector of the sixteenth and early seventeenth century, whose books were probably those commissioned for binding by Cardinal Alexander Farnese for his nephew, Alexander Farnese, Duke of Parma, between 1545 and 1546; see also Farnese bindings.	Cumdach.	A box for a book in the shape of a casket, used in Ireland up into the eleventh century.
Case.	Simple cover of book, not yet covered with cloth or leather.	Cusped-edged stamp.	A stamp used in the south Germanies to provide the effect of a leaf design.
Catch stitch.	A stitch which fastens one section of a book to the other, also called chain stitch or kettle stitch.	Cut in boards.	A book whose edges are cut after the boards are laced on is said to be cut in boards.
Catenati.	Chained books.	Deckle edge.	Rough edge left on a sheet of paper in the manufacturing process.
Cathedral style.	The early nineteenth-century style which employed Gothic architectural motifs for decoration of covers.	Dentelle borders.	Small contiguous forms at the edge of a book cover (or doublure), forming a lacy pattern with ends pointing toward the center of the cover.
Chain stitch.	See Catch stitch.	Diaper design.	Repetition of lozenge forms at formal intervals.
Champlevé.	Embedding enamel in canals in metal plates used for book covers.	Diced.	Ruled leather, usually in crisscrossing diagonal lines to form diamonds.
Chemise.	Cover or jacket used to protect a binding, usually inserted in a slip case or a Solander case.	Diptych.	A Roman device for letter writing, consisting of two facing wooden tablets (or tablets of metal or ivory), of which the inner surfaces are covered with wax to be incised by a stylus.
Cheveril.	See Chevrotain.	Divinity binding.	Books covered in thick bevelled boards with Oxford corners, often with a heavily rounded spine and with Dutch marbled end papers; popular in the period from 1840 through 1870 in England; also known as ecclesiastical or monastic bindings.

Doublure.	Lining of leather, silk, or other material instead of customary end sheets; leather doublures are often decorated.	Forwarding.	Sewing and covering a book.
Ducali bindings.	Bindings for collections of official documents of the Venetian doges, often showing both occidental and oriental techniques in a single pattern.	French chalk.	A soft chalk used to remove grease spots.
Dutch flowered.	See Dutch gilt.	French shell.	Marbled papers with a conchological pattern popular in late eighteenth-century France.
Dutch gilt.	Papers decorated with wooden or metal blocks, or produced by engraved rolls; first produced in Germany and Italy, then imported into the Low Countries and exported from there to France and England (hence "Dutch").	Full-gilt.	An adjective applied to books of which all the edges are gilded.
Ecclesiastical bindings.	See Divinity bindings.	Gauffering.	Decorating a book edge with a tool over the gilt edge, often with elaborate designs.
End papers.	Sheets not forming part of the text pasted down inside of front and back covers; often decorated, sometimes illustrated (e.g., with maps or thematic illustrations in commercial books).	Girdle book.	A book whose binding had an extra protective cover, elongated so that one end could be attached to a belt or a girdle; common in Western Europe and Ethiopia; frequently used by wandering missionaries.
Etruscan bindings.	Decorated light brown or terra cotta covers with designs similar to the "black figure" pottery of the Etruscans.	Glaire.	White of egg, plus vinegar, water, and occasionally other substances, used to size tooled impressions on a leather cover (or, sometimes, cover of other material) or a smooth edge of a book, before gilding.
Extra binder.	A hand binder who uses the best manual techniques and the highest quality of material to satisfy orders for special work.	Gothic binding.	A style of decoration widely used in Western Europe in the fifteenth and sixteenth centuries, characterized by numerous stamps and rolls in blind.
Fanfare.	A cover design broken into a series of geometrically arranged ovals, bounded by fillets, and elaborately decorated with flowers, sprigs of oak, or pomegranates.	Grooved boards.	Boards cut out to receive slips of a book, or cover boards with grooved edges (characteristic of Greek bindings).
Farnese bindings.	Bindings with polychrome oval plaquettes, of which some 105 survive, originally the property of the papal physician Demetrio Canevari, or of Pier Luigi Canevari; see also Canevari bindings.	Guard.	A narrow strip of paper, used to repair a damaged fold, or to attach a plate or a single leaf.
Fillet.	A round finishing tool which makes an impression as it is rolled on a cover to form a running line or a series of designs on a book cover; also called a roll or a roulette.	Harleian style.	An English style of the eighteenth century, with a center of small dies in a lozenge form and a border decorated with a roulette; characteristic of the bindings of the Lords Harley, now mainly in the British Museum.
Finishing.	Decoration of a book after the boards have been covered.	Headband.	A band across the top edges of the book block, usually of silk, linen, or cotton (often in motley colors), and fitted to the contour of the back of the spine; see Tailband.
Fly-leaves.	All the leaves of an end-paper section.	Hollow backs.	Deceptively hollow construction affixed to the back of a book block before it is covered.
Fore-edge painting.	A painting on the fore-edge of a book visible only when the edge of the book is fanned out; generally covered by gold leaf when the book is solid (or not fanned out).	Imprint.	Place of publication, publisher or printer, and date; on last leaf of early printed books, in sixteenth century and thereafter generally on title-page.
		Incised leather.	See Cuir ciselé.
		Inlay.	Insertion of pieces of colored leather or other materials into incised patterns

	on a leather cover; often called intarsia; sometimes actually onlay, since pieces of colored leather are applied to blind-stamped patterns.	Onlay.	Pieces of colored leather or other material affixed over an outlined tool form, border, or panel; see also Inlay.
Intarsia.	See Inlay.	Overcasting.	A sewing process in which all the leaves of a section are bound together with thread.
Jansenist bindings.	French bindings of the second half of the seventeenth century, named for the highly orthodox Jansenists, and characterized by decorations only with blind-tooled lines.	Oversewing.	See Overcasting.
		Panel stamp.	A large stamp frequently pictorial, stamped in the middle of a cover of a book; common decoration of Gothic bindings.
Kettle-stitch.	See Catch stitch.	Plaquette binding.	Binding with medallions in the center of the cover as the main decoration; see also Cameo binding.
Knocking-up.	The process of squaring and making compact the back of the sections of a book.	Plough.	A wooden device into which a cutting edge is fitted to cut edges of a book in a lying press.
Kutch.	A container for a heavy piece of gold while it is being formed or beaten into thin pieces.	Pointillé.	Decoration of covers by tool forms in dotted outline (<i>fers pointillés</i>); used in seventeenth-century France by Le Gascon and his contemporaries.
Laid paper.	Paper manufactured in a mold in which heavy lines of wire are attached to the bottom, usually to form a pattern.	Polaire.	Book satchel used in medieval Ireland.
Landscape bindings.	Covers decorated with a watercolor of a landscape, frequent in England in the 1820s.	Pounce.	Adhesive used under gold or colors to make them stick firmly to the surface which they decorate.
Lederschnitt.	See Cuir ciselé.	Polyptych.	Three or more wooden tablets used for letter writing, with inner surfaces covered with wax to be incised by stylus; see Diptych.
Lozenge.	A tooled form in the shape of a diamond, or a square figure placed from one of its points; often gilded.	Provenance.	Record of previous ownership.
Lyonnais bindings.	Bindings of the sixteenth century with interlaced strapwork, often painted and with large cover ornaments, with a background filled in with dots; other French and Italian bindings from different localities show the same characteristic decoration.	Pugillares.	Tablets whitened to receive ink, or covered with wax to be engraved with a <i>stilus</i> ; also called <i>tabellae</i> ; Ovid, Am. i. 12, I.
Marbling.	A process by which oil colors are floated on size to form a design, then transferred to leather, paper, other covering material, or book-edges.	Pull.	To separate quires of a book from old cords and tapes and to remove the old glue.
Mosaic.	Inlaid designs on book covers; also called Intarsia or Inlay.	Raised bands.	Cords on the spine of a book over which the threads are passed.
Monastic bindings.	See Divinity bindings; also applied to any binding executed in a monastery.	Roan.	Sheepskin tanned in sumac.
Morocco.	Goatskins originally imported from Morocco, now mainly "Cape goat" (from South Africa), Niger (see <i>below</i>), and Turkish goatskin.	Roll.	See fillet.
Mudéjar style.	Strapwork design on a cover by medieval Spanish Moslem craftsmen who worked in Christian jurisdictions.	Romanesque bindings.	Bindings of the twelfth and thirteenth centuries richly decorated with single stamps, produced in England, Germany, and France.
Niger.	A "morocco" leather from the skin of small goats found in Nigeria and the Mediterranean coast of Africa.	Rough gilding.	Gilding of edges before a book is sewn.
Nonato bindings.	Covers in the skin of a foetus of a stillborn Argentine pampas calf, with the hair left on (<i>nonato</i> = not born).	Roulette.	See Fillet.
		Roundel.	A stamp forming a double ring, usually with a dot in the center.
		Russia.	Calf or cowhide originally imported from Russia, tanned with willow bark, dyed with sandalwood, and soaked in birch oil.

Saddle.	Part of book-sewing machine on which quires are placed so that folds may be directly below sewing needles and loopers.
Sawn-in.	The spine of a book is sawn in to provide a canal into which cords may be placed.
Semis (semée).	A cover design in which small stamps are located at regular intervals to form a design; originally a heraldic term.
Serefsan.	Gold-flecked paper from Persia or Turkey.
Slip case.	Book container opening at the front edge.
Solander case.	Book container opening at the top, so-called after Daniel Solander, a librarian in the British Museum, 1765–1782.
Spring backs.	Backs capable of retaining a firm position.
Sprinkled calf.	Speckled surfaces on calfskin produced by sprinkling of acid.
Sprinkled edge.	An edge sprinkled with gold, red ink, or other colors.
Stabbing.	Method of sewing books by which the inner edge of the entire book-block is perforated.
Stamp.	A tool-engraved intaglio to be impressed on a leather binding; impressed unheated in medieval and early modern times; today, impressed heated with an arming or blocking press.
Strapwork.	Interlaced double lines forming a geometrical pattern; a special characteristic of Grolier bindings.
Super-exlibris.	Panel stamp in center of front cover to indicate ownership.
Supralibros.	See Super-exlibris.
Sutherland tooling process.	A method of tooling in color on different materials used around 1900; name is from books bound for the Duchess of Sutherland by G.T. Bagguley of Newcastle-under-Tyne.
Tabellae.	See <i>Pugillares</i> .
Tailband.	A band on the tail edge of a book (opposite the head) usually of silk, linen, or cotton, and fitted to the contour of the book; see Headband.
Tree-calf.	Marbled calfskin with the pattern of the trunk and branches of a tree.
Triptych.	Hinged metal tables like the diptych, but with three tables instead of two.
Two-sheets-on sewing.	A method of sewing in which each length of thread holds two sections instead of one.

Vellum.	Thin scraped calfskin prepared with lime, not tanned.
Wire marks.	Marks left in a piece of paper by the wires in the bottom of the mold.

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Biological Information and Its Users

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Abstract

The purpose of this entry is to introduce the information science reader to the wide range of data and other resources that constitute “biological information.” Attention is paid to both paper and digital sources and the use of digital libraries and cyberinfrastructure for the creation, use, and reuse of information. The entry discusses various user communities and their needs, including scientists, educators and students, policy makers, and other secondary users. The entry concludes with challenges for data sharing, preservation, and access.

INTRODUCTION

The term “biological information” covers an enormous range of content, format, and uses. The creators and users of it are just as heterogeneous. The range of disciplines encompassed within the term “biology” is itself broad, including descriptive fields that rely on fieldwork and observation to those that are exclusively computer-based, or computationally intensive. Not surprisingly, the data generated from the results of scientific activity within these fields (which is what most biologists would call “biological information”) generates a variety of information formats and storage, from paper-based laboratory notebooks and anatomical drawings to petabytes of numeric data generated from high throughput screening, sensors, genomics, and proteomics. There is also a great deal of information generated by what might be termed the context of scientific practice. Information that can provide insight into the processes that generated scientific data may include grant reports, patent applications, correspondence, personnel records, and other texts and data that are not necessarily direct products of research practices. This does not even include medical information, which comes with a different and attendant set of users, privacy and other concerns, and legal ramifications. This encyclopedia piece, however, will focus on the realm of data products from the scientific research process and on contextualizing information from the conduct and organization of science within institutions.

For the information scientist, biological information presents fascinating challenges for understanding and facilitating information policy, organization, sharing, and access. This entry will first discuss some data-intensive current practices in biological research. Next, it will describe some of the variety of information that encompasses “biological information,” focusing on both the data products of scientific activity (this includes results of

experiments and analysis) and the documents that are created in the context of scientific research (correspondence, grant applications, and similar materials). Following that, the categories of users—scientists, educators, policy makers, and activists, will be discussed. Lastly, the entry will outline some challenges that exist for understanding biological information and its uses—highly collaborative environments, data-sharing and intellectual property regimes, proprietary formats. The conclusion will discuss potential challenges for information studies research and practice.

INFORMATION PRACTICES ACROSS THE BIOLOGICAL SCIENCES

The pedagogy of research in the biological sciences has been compared to an artisanal model.^[1] In universities around the world, junior students of the biological sciences trained with more senior scientists, then set up laboratories in other academic, independent, and government scientific institutions, often introduced through networks to their future employers. While scientists used various instruments, the primary mechanism for recording information was the laboratory notebook which contained drawings, handwritten notes, and served as a daily aide-memoire for the scientist. To some extent, this model of research training and scientific data gathering persists and continues to be taught in the science classroom, although many digital tools exist for capturing and storing data.

However, the biological sciences underwent radical changes in the latter half of the twentieth century and continue to change. The widespread use of information and communication technologies (ICTs) has made the biological sciences (indeed, all sciences) globalized and highly data intensive in nature. As a result, one emergent trend that has influenced the nature of biological

information is the advent of research teams can span countries and continents as expensive equipment is shared remotely and data sets analyzed in parallel. There have been efforts in numerous countries to develop information infrastructures that centralize data sharing and collection, standardize descriptive data (metadata), and make the use of remote tools more readily available. The emergent sciences of genomics (the study of genes), proteomics (the study of proteins), and chemical informatics (the study of molecular and submolecular entities in living systems) belong to this data-intensive category of science. Sensor-based biological arrays, from the particulate level to terrestrial grids, are producing terabytes of data on a daily basis. Examples include microorganism analysis,^[2] climate change, and land use.^[3] Systems such as the proposed Global Earth Observation System of Systems (GEOSS) integrates other information infrastructures to provide multidisciplinary perspectives on biological problems that are planetary in scale and scope of data.^[4]

A second important trend in the biological sciences that has been responsible for the generation of most of the data (and related and derivative information products) is the increase in the quantity and size of collaboration, often in response to emerging problems or even crisis situations (such as the SARS epidemic). Many researchers have noted that the need to gain access to instruments, unique data, and funding for increasingly complex projects requires the assemblage of individuals and teams with diverse skills.^[5] As many scientists become more and more highly specialized, these teams are necessary to solve complex problems. Teams can also minimize impact on politically, environmentally, and socially sensitive regions and areas. Governmental funding agencies such as the United States National Science Foundation (NSF) and funding programs in the European Union often require that collaborations be formed in order to use natural and data resources in efficient ways. Collaborations also cut across geographical and institutional boundaries. Non-profits, academic, government laboratories, and industries can work together to mobilize around problems and issues of mutual interest, hopefully with benefit to all concerned parties.

A third trend that has been instrumental in generating the explosion of biological data is the increasingly data-intensive nature of the biological sciences, aided by the introduction of information technologies with the capability to generate, manipulate, and store vast quantities of data at a high rate. Benoit^[6] notes that the collaboration of computer scientists and molecular biologists has generated an impressive collection of tools to manage data, conduct analyses, and present results that would not be possible without the integration of these disciplines. While the term bioinformatics has been reserved for the application of information technology, data mining, visualization, and other computational tools to questions in molecular biology, the other biological sciences (i.e., those whose

research purviews reside above the level of molecule, from the cell to whole systems) have also been aided by “informatics” and in turn have generated vast quantities of data. The resulting data (often the results of extremely intensive string manipulations^[6]) is stored in databases that may be local, publicly available, or commercial/proprietary.

The contribution of high performance computing to the scientific enterprise has been subsumed under the term “cyberinfrastructure” coined by the NSF to coordinate and further its sponsored research efforts in data acquisition, storage, management, and other Internet-based services around scientific information.^[7] In the United Kingdom and the rest of Europe, similar efforts are usually called e-Science.^[4] The term is meant to include the human resources needed to make the technical infrastructure function, but the discourse has tended to focus on a technologically deterministic vision for Web services in science.^[7,8] Cyberinfrastructure grants have proven to be technological drivers in furthering the computationally intensive sciences. Challenges include making data formats mutually intelligible, the creation and implementation of standards, and the creation of tools that make data resources potentially useful to multiple communities of experts and nonexperts. An important commonality across these cyberinfrastructure projects is the need for efficient storage and access to information.^[9] Many in the biological communities have relied on cyberinfrastructure projects to minimize bottlenecks to data sharing, since data derived in NSF-funded projects are generally considered open access and nonproprietary. Nevertheless, because cyberinfrastructure is built upon the current Internet, it has inherited all of the technical, legal, cultural, and policy problems of the Internet, including security, language barriers, intellectual property regimes, and others. However, cyberinfrastructure is not the only mechanism by which the biological sciences have been transformed. Traditional biological fields, such as anatomy, animal biology, and taxonomy, have also undergone dramatic changes, aided by the use of various kinds of technologies. Mapping technologies such as Geographical Information Systems (GIS), satellite imagery, and earth-based sensor networks allow scientists to use data that has changed the nature of these “traditional” biological disciplines.^[10,11] The ability to analyze legacy and archival data sets with new tools can yield insights into new problems. For example, analysis of tissue samples and doctors’ notes from the 1918 flu epidemic resulted in findings that an opportunistic bacterial infection may have been more responsible for the number of deaths, rather than the original flu virus itself,^[12] an important consideration for future pandemic planning.

New ICTs, increase in the size of collaborations, and data-intensive practices: these three trends, when taken together, probably account for the “information explosion” in the biological sciences more than any other factors. Collaboration across disciplines and informatics

together have made the biological sciences extremely data intensive. The former has enabled scientists to use equipment and resources in distant locations and answer increasingly complex problems with the help of colleagues with very different disciplinary interests. Informatics is entwined with this collaboration, since it implies the integration of biological sciences with computational power. Of course, policy initiatives and financial resources to back them can spur such efforts to greater success.

VARIETIES AND FORMATS OF INFORMATION

An early model by which biological information is organized is the UNISIST model, developed by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) and the International Council of Scientific Unions (ICSU), and more recently updated by Fjordback S ndergaard et al.^[13] In this model, three channels of information: tabular (or data), formal, and informal channels are defined, with three levels of information (primary, secondary, such as abstracting and indexing services, and tertiary, such as encyclopedias). This makes a good departure point, but is hardly complete.

Much biological data is still recorded on paper. Many researchers in the biological sciences still use bound laboratory notebooks in the conduct of their daily work. Paper notebooks may seem antiquated because they are not easy to search in or integrate data, but they are still prevalent and mainstream in science classrooms and many academic laboratories, which provide the fundamental education for scientists.^[14] Paper notebooks are a form of data capture that are easy to understand and use, transcend computer technology that breaks or becomes outdated, are fairly simple to maintain for short- and long-term use, and do not require any proprietary systems. They are also effective mechanisms for integrating printouts, drawings, spreadsheets, and other data formats.

Digital data, not surprisingly, is far more diverse in scope. Specialized instruments usually generate data files in proprietary formats; often, these data are further manipulated using computer-based analytical tools or integrated with other data formats. Common data formats, such as those from Microsoft and Adobe products are prevalent, but others are more specialized from manufacturers of scientific equipment. Other data, although technical, are in formats that have become standard in scientific fields: GIS, for example, generate data in a range of formats that are universally accepted and used by scientists. Still other data are often generated within and managed by "collaboratories,"^[15] closed groupware or collaborative systems that are built for or around a particular project or group that is heavily dependent on digital technologies.

These cover the general scope of primary resources in the biological sciences, but the data is analyzed and

synthesized into various formats for dissemination outside of the immediate laboratory or research group. The range of publication formats is also numerous, and the reliance on different kinds of materials varies greatly by discipline and by individual preference. For example, to circumvent publishers' embargos on current research and the high costs of publications, many scientific communities created their own systems for circulating preprints and obtaining comments. While these have been extremely successful in the physical sciences, there has been significantly less use of preprint or e-print servers in the biological sciences.^[16] Conference papers, conference posters, monographs, reference manuals, and publications in peer-reviewed journals are all important sources of biological information. Conferences and workshops will often maintain Web sites where publications from previous years can be found. In addition to general journals that may cover a wide range of scientific disciplines (such as *Nature*, one of its related journals, or *Science*), many scientists use more specialized peer-reviewed journals.

Although they may not be considered biological information per se, it is important to note another major category of documents that are important to the biological sciences: administrative materials. Scientists are responsible for obtaining grants and administering them, advising students, dealing with personnel matters, serving on peer review committees for journals and granting agencies, and depending on the status of the scientist, serving on conference and institutional, national, and other committees and boards. Many scientists may serve in multiple capacities as educators, consultants, researchers, and the like. In the context of these roles, scientists generate an enormous amount of information that may not be seen as important to the generation of biological knowledge, but are of incalculable value to other stakeholders with an interest in matters in the processes by which science is conducted.^[17]

INFORMATION AND DATA REPOSITORIES IN THE BIOLOGICAL SCIENCES

Data and other information in the biological sciences is, not surprisingly, stored in distinct and various locations, physical, virtual, and both. Laboratory notebooks and digital files tend to stay within the academic laboratories that created them, just as information in the commercial sector or government laboratories tend to stay within those institutions. In the latter case, digital data sets are not retained by the National Archives and Records Administration (NARA), but, in the best of circumstances, in the archives and records centers of these laboratories. More often, they are left in the custody of the scientists whose laboratories generated them.

Because their creators often consider these documents useless once they have been used for formal publications, they tend to be regarded without much interest for long-

term maintenance and preservation.^[17–19] There have been many institutional efforts to organize and contextualize data sets of long-term value as there has been some interest in repurposing them for other projects or having an easily accessible historical trail. Documents have been useful to historians and others with interest in scientific activity, so there is still interest in their long-term preservation. However, inactive documents and records often do not end up in archives of science for permanent retention, unless the director of the laboratory is extremely prominent. Even then, many archivists of science are reluctant to accept “raw” data, which is impossible to interpret without the aid of context in the form of the publications that resulted from them.^[17,20] Nevertheless, there are many archives of science around the world, often focused around specific individuals, institutions, disciplines or subdisciplines, or topics. These archives may include the personal and scientific papers of individuals and professional/academic societies, important instruments, and key artifacts. There are far too many to enumerate, but some interesting examples include the John C. Liebeskind Collection at the University of California at Los Angeles, the only history of pain collection in the world. BrightSparks, a resource for finding collections about Australian scientists serves as a pointer to the physical location of archival collections. Like the BrightSparks collection, there have been many efforts to make the finding aids of these collections available online, but digitizing the materials themselves is difficult and expensive, so few archival scientific collections are available online in their entirety.

Scientific publications are a crucial resource for obtaining peer-reviewed research results. Publicly funded and proprietary databases index and if necessary create abstracts for this literature, making it accessible to individual and institutional subscribers, and in the case of publicly funded databases, the broader public. Examples include the National Library of Medicine’s PubMed-Central, and proprietary databases from other commercial publishers such as the Web of Science. For reasons similar to the impetus for e-print and preprint repositories, there have been some institutional efforts to circumvent the traditional scientific publishing model, which many critics argue favors publishers at the expense of scientists and the institutions at which they work.^[21,22] These critics charge publishers with creating a model in which universities and similar institutions subsidize research publishing, and then in turn pay for subscription rights to journals and secondary databases. However, given the imprimatur these systems lend to individual scientists in establishing their professional reputations, there has been little leeway and few incentives for them to break away from this system.

There have been some efforts to create open access models for more immediate and free access to scientific publications. One example is the Public Library of Science, championed and cofounded by the former director of the

National Institutes of Health Harold E. Varmus in late 2003. In addition to being a repository for publications and references, the Public Library of Science also encompasses several peer-reviewed open access journals in the biological sciences on a market-driven model in which scientists pay for publication, peer review, and online archiving.

The digital libraries movement has probably been the most influential in making biological data and other information broadly accessible and usable, particularly to non-experts.^[23] The creation of digital libraries has been instrumental in allowing educators and other nonexpert communities with interest in scientific data to minimize problems associated with information overload, poor structure, and the variable quality of scientific information available on the World Wide Web.^[24] Resources in digital libraries are organized and maintained, usually around a focused topic, and can encompass a variety of information types and formats that can support searching, reuse, and other interesting reuses of data and other scientific documents.^[25]

USERS OF BIOLOGICAL INFORMATION

Most evidently, the primary users of biological information are biologists themselves. It is impossible to characterize the biological research community in any general way. It is international, multidisciplinary, and collaborative. Biological scientists receive academic training in academic settings, but may work in universities, the private sector, in government laboratories, for nonprofits and civil society, and even as independent scholars and researchers (although this limits the kind of work they can do). As noted earlier, scientists are trained in an apprentice-based model in which they conduct research with senior scientists, working on projects of interest to the principal investigator. These researchers can be funded through a number of mechanisms, including government and foundation grants. Researchers can be found in other kinds of institutions as well. Although there has been significantly less biological research being conducted in the private sector in recent years, researchers in pharmaceutical companies and other biotechnology firms generate data and related information and are dependent upon multiple publication streams for disseminating results and keeping up with the current research, just like their academic counterparts.

Lastly, government laboratories and independent organizations throughout the world also employ these researchers. In the United States, the federal government administers few biological laboratories of its own; the vast majority of its resources are disseminated in the form of grants to scientists in other institutions. Nevertheless, government laboratories often conduct research in topics that may be of little financial interest to the private sector, such as therapies for rare illnesses, or clinical research.

Of course, biologists also work in non-Western countries; their information needs and challenges are different and often fraught with difficulties. While their needs for information may be as great as their Western counterparts, many characteristics of their situations make finding that information more difficult. Subscriptions to journals and secondary databases are often prohibitively expensive, even for institutional libraries and consortia of libraries. Most of these databases are no longer published in paper format, which would be the most useful for situations with uncertain power supplies and limited Internet access. Scholarly communication at conferences and workshops is of great importance to the biological community as informal networks are important to all kinds of researchers; however, the costs of travel and often the difficulties of obtaining foreign visas make these options difficult in many situations and often marginalize scientific researchers outside main research centers.^[26,27] To give one concrete example, the American Association for the Advancement of Science (AAAS), a nonprofit organization in Washington, District of Columbia, has argued that U.S. travel policies have made it extremely difficult for Cuban scientists to enter the United States to conduct legitimate research or attend important conferences.^[28] These scientists, much like junior researchers and those at institutions that are considered less research oriented, are generally deemed peripheral to the core research networks; this in turn, further marginalizes their work and thus they find it harder to get and share important information.

There are other scholarly communities with interests in studying science from social science, behavioral, and humanistic perspectives. These transdisciplinary areas of scholarship are often grouped under terms like “science, technology, and society,” or “science studies”; these terms are used to denote research interests that generally focus on science as a practice and epistemology with methodologies drawn from the social and behavioral sciences and humanities. History of science is one obvious area in which researchers rely on documents and artifacts produced by and about scientists. Philosophers, anthropologists, and sociologists of science also use similar artifacts and documents, such as journal articles, to make and situate their claims about science itself.^[29] There are also other areas of research that may require use of biological information, such as bioethics. In general, there has not been much research into the specific ways in which this community uses biological (or for that matter, any) information, so it is difficult to state categorically what kinds of information are useful to this category of researchers. However, it is likely that their practices mirror those of other interdisciplinary fields in which attendance at workshops and conferences, collaborations with biological researchers and other scholars, and wide literature searching are important resources.^[30]

The introduction of digital libraries has been extremely useful for the educational community. There are a number

of reasons why educators have collaborated with computer scientists, biological scientists, and information scientists to create digital libraries. Although the biological sciences have been less affected than other scientific disciplines, concerns in the United States regarding the low interest of students in pursuing advanced degrees and subsequent careers in the sciences has led to new models of engaging students at younger ages. One way in which this challenge is being approached is through the use of real data to address real scientific problems and learn the processes of science as scientists themselves conduct it, one approach to what is often called “inquiry-based learning.”^[31,32] Much of the impetus to move toward more inquiry-based approaches for teaching science stemmed from the 1996 release of the National Science Education Standards (NSES) for grades K-12, which articulated numerous disconnects between classroom teaching and the ability of science students to connect their learning to science in the “real world.” Other studies have found that these problems persist in undergraduate science education. Furthermore, the sciences have found a decline in the number of women and underrepresented minorities in the sciences (though the biological sciences have again been less affected). Some reports have suggested that one way to engage these students might be through exposing them to real-world problems that can be addressed through scientific inquiry.^[33] Biological digital libraries have been used to support these efforts, since materials can easily be added to them to contextualize scientific data sets with age and level appropriate information.

However, researchers have noted that without “pedagogical alignment,” the potential of digital libraries to foster sophisticated inquiry cannot be fully realized. Instead, they serve as yet another “information silo” in which students conduct artificial projects and teachers then move on to other lessons. In short, the science curriculum and specific learning activities must align appropriately with the content and organization of the digital library itself.

More specifically for the biological sciences, research and implementation has suggested that participation in research is important for life science education,^[34] but that this is not necessarily feasible for all undergraduates in life science undergraduate programs. The use of biological data in the classroom and inquiry-based approaches may provide substitutes, however. Reading primary papers, designing “real-life experiments,” analyzing data, and reading primary papers have all been employed to further information competence and fluency, although this material can be enormously challenging to the undergraduate student.^[35,36]

Another important category of users is organizations and individuals involved in foundations, policy making, and advocacy (these communities are not necessarily the same, although there may be some overlap). Examples include data on disease prevalence, land use planning, and environmental information, though there are many others. These users may or may not have scientific training, but

may be working with others who do to get help in interpreting the literature. There is also an enormous range of “policy makers,” from local officials and planners^[37] to members of Congress, as well as scientists and bureaucrats within government agencies. Transgovernmental organizations are also significant users of scientific information. Relying on primary evidence is considered necessary to making science-based policy in environmental affairs, health care, new biomedical technologies, as well as many other areas of science and technology policy. These users are not likely to delve into the primary literature of biology, much less the primary data sources. Therefore, task forces and expert panels may be convened to assemble the state of the art on important topics; policy makers may also rely on information from the Congressional Research Service nongovernmental “think tanks,” some of which have partisan agendas and others that do not. In the United States, the National Research Council (NRC) and Institute of Medicine (IOM) are two quasi-governmental organizations that are tasked with providing expert opinion on various issues through the form of reports to the U.S. Congress and executive branch agencies; their reports are available to the public. Policy making, however, is both a political and a scientific process, and that complicates the ways in which it is used. Some argue that scientific information with policy implications is not useful when specifically targeted to this population; instead, synthesized consensus on such topics should be targeted to those who have the power to influence policy makers.^[38]

Another important group of users that rely on and even contribute to biological knowledge are interested amateurs. Some of them may be interested in data-driven approaches to social and political change. Again, these users represent a diverse set of interests, abilities, and needs. They may be geographically localized groups with an interest in environmental issues in their community,^[39] activist organizations that mobilize around a particular illness for personal, policy, and social change (AIDS activists are among the most well-known group, but there are many others),^[40] or global movements interested in effecting change on transnational issues. Individuals may be interested in obtaining the latest scientific information for personal knowledge. They may be involved in what is often called “citizen-science” for personal reasons; these users are often involved in research efforts in ornithology, biodiversity, and other observational fields.^[41,42] Many of the problems that plague other communities outside of the sciences persist: vast quantities of information that may or may not be valid, highly technical information, and few vetted pathways through that maze.

CHALLENGES AND CONCERNS

There are numerous open challenges to understanding the nature of biological information and making it useful. One

central issue for practice and research is the issue of data sharing. The National Institutes of Health, for example, argues that data sharing is necessary to develop new analytical tools, encourage supporting studies, enable interdisciplinary research, and prevent duplication of efforts. To this end, NSF and some other grantmaking agencies require a data-sharing plan in grant proposals. In spite of an ethos of information sharing, data sets in the sciences, even those with wide import and use, are often “siloeed” or not preserved in useful formats. There are many reasons for this—lack of time, resources, interest, and incentives for data sharing are all cited as barriers to true information exchange.^[43,44] This varies from scientific community to community, though there have been extensive calls for data sharing in the broader scientific literature. It is often argued by scientists themselves that most information sharing is done in the form of peer-reviewed workshop papers, conference presentations, journal articles, and informal networks; therefore, sharing “raw data” is not feasible, since it would require setting up a dedicated data repository, responding to many individual requests, and other mechanisms that may be time consuming.^[45] Committing long-term resources to the maintenance of data only seems feasible in fields that are highly data intensive and “cutting edge.”

The fields of genomics and protein chemistry have publicly available databases and extensive toolkits for data analysis (examples include GenBank and RefSeq); these efforts are usually developed and implemented by various branches of the federal government, such as the National Library of Medicine’s National Center for Biotechnology Information (NCBI). Data deposited to these databases is centrally maintained and curated. Many journals in molecular biology and related fields require submission of novel genetic or protein sequences before publication so that the accession number can appear in it. Europe and Japan have similar databases (EMBL and DNA Database of Japan, respectively), but work in collaboration with NCBI. Increasingly, many data are proprietary, as they are produced in the commercial sector, or in collaboration with commercial firms. The formal results of analyses of these data sets may be made public in publications, but the raw data is not made available for reuse.

Another concern is preservation and curation, not just of data, but also of the contextual information that is often of greater use to those outside of the biological communities. These are a complex set of concerns, both social and technical. Issues of digital preservation that haunt other arenas include problems with media, differing approaches, and metadata. These are issues that most laboratories do not routinely consider. Making information and data available to the scientific community requires appropriate architectures, integration of data formats, and agreements on the funding and labor required to maintain such systems.^[46]

But to make scientific information accessible to the nonscientist, even more challenges ensue. There is certainly interest in access to such data, since at least in the United States, data sets that are funded by public resources are expected to be made public in some format. Digital libraries have been one approach to mitigating the access problem, but these are designed for educational users, not activists or policy making. For the researcher who needs access to the material that is produced as a by-product of research, such as grant applications and letters, the problems may be one of too much information in too many places, all of it ephemeral, much of it not easily integrated with other data sources.^[47] Much of the work that has been done on mapping formal and informal communication networks, history of science, and similar fields was only possible with the preservation of letters and documents in archives, or at least in other accessible settings and conditions. However, much of the current practice of science is done online: in e-mail, word processors, and proprietary software or groupware. The transient nature of these systems requires more intensive preservation efforts than paper-based data sets, and if insufficient efforts are made to preserve this material, institutions end up creating what might be termed a “memory crisis”^[48] for contemporary science. This problem will only get worse, as the kinds of technologies that scientists use become less and less amenable to digital preservation. It is still an open question, though, as to what needs to be saved at all for future use.

CONCLUSIONS

In the research community, current focus is, not surprisingly, on the vast array of digital data being created and used, and a suite of pressing concerns with access, storage, analysis, and policy around it. But it is worth remembering that a significant amount of information is still generated on paper, in laboratories, by researchers and their students, and that this information is just as difficult to access. The ways in which these different kinds of information are generated are, not surprisingly, not always mutually exclusive. Furthermore, the kinds of information that are often of greatest interest to the nonexpert community is information that is increasingly difficult to access, or ephemeral. The users themselves are an extremely diverse group with differing needs; making biological information useful and accessible for all potential user groups is a daunting task and one that is probably impossible. Lastly, it is important to note that access to biological information is not just a set of technical problems; there are deep reasons of practice and policy that also shape storage, access, and use patterns. Most of these areas pose emerging questions of research and practice.

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Blind and Physically Disabled: Library Services

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Abstract

Library service for individuals who are blind or have a physical disability is an ever-expanding phenomenon, thanks to both the innovative spirit of the users and advances in technology. This entry discusses the 1931 establishment and subsequent growth of the National Library Service for the Blind and Physically Handicapped, Library of Congress. The importance of the network of cooperating agencies at the state and local levels and of the volunteers who support the program is also discussed. The entry presents the history of special-format reading materials in the United States. Specifically covered are the emergence of electronic braille and the development of digital audiobooks, both of which are accessible by smartphone.

INTRODUCTION

The path to providing quality library service to people who cannot read regular print with corrective lenses or who cannot handle printed materials because of a physical disability has experienced many advances, twists, and setbacks. The commitment and dedication of individuals and organizations and developments in braille and recording technology have combined to significantly improve access to written materials for all. The National Library Service for the Blind and Physically Handicapped (NLS)—a program of the Library of Congress—and its network of cooperating libraries have evolved from events dating back to the 1860s and are part of this expanding landscape. Together they form a unique organization of cooperative federal, state, and local programs that serve eligible residents of the United States and its territories and U.S. citizens living abroad.

This network, one of the oldest in the country, has its origins in the Act to Provide Books for the Blind—commonly called the Pratt–Smoot Act—which was signed into law in 1931. In the cooperative arrangement, NLS serves as the administrative agency responsible for selecting print books and magazines to be added to the national collections, for contracting with various entities to produce them in braille and audio formats, and for ensuring the availability of playback equipment. Cooperating libraries handle the daily interface with patrons; ensure that the books, magazines, and playback equipment are circulated to registered readers (see Fig. 1); and maintain necessary records on readership and inventory. This relationship between NLS and its affiliates is based on an informal agreement, which has been acceptable for the establishment of distribution centers (which now include regional libraries, subregional libraries, and advisory and outreach centers) since the program's inception.

Several other elements played vital roles in the effectiveness of the program: Free Matter postal legislation,

volunteers, the goodwill of authors and publishers, and later P.L.104-197 (known as the Chafee Amendment), which granted copyright permissions at no cost. The combination of these diverse elements made it possible for the program, in 2013, to serve more than 929,939 eligible readers. In that year, NLS circulated more than 24 million copies of the 217,896 titles included in its *Union Catalog*.

HISTORY

In the nineteenth century, library service for blind people was virtually nonexistent. In 1868, the Boston Public Library acquired a collection of books in an embossed format and began serving local residents. The Chicago Public Library followed in 1894, the New York State Library in 1895, the Library of Congress in 1897, and the Free Library of Philadelphia in 1899. Other collections were established, but most served only local populations. Several different systems of embossed formats were used by various library providers. Readers who learned one system could not necessarily read others. In addition, libraries could purchase only a few titles because of the high cost of production. These issues severely limited the ability of people who were blind to enjoy the same access to information as their sighted neighbors.

In 1917, the United States adopted the Revised Braille (known then as grade 1-1/2 braille) code as the standard for embossed materials. The system was invented in France in 1821 by Louis Braille, who used a military code as a model. The braille code is based on a six-dot cell, three rows high and two dots wide. Dots in the cell are raised according to the letters or numbers the dots represent (Fig. 2). Since its introduction, the code has been revised to accommodate changes in language and usage. Grade 1-1/2 braille integrates elements of the letter-for-



Fig. 1 A government worker teaches a blind veteran to use a digital talking-book player. Talking books enable individuals who are blind, are visually impaired, or have a physical disability that prevents handling print materials to access books and magazines. The National Library Service for the Blind and Physically Handicapped, Library of Congress, collections include bestsellers, biographies, and self-help materials.

letter transliteration of uncontracted braille and the abbreviated form of contracted braille. By 1925, the Library of Congress Reading Room for the Blind had expanded its readership from about 150 local readers to 2400 national patrons, and the collection had grown to 2400 volumes. Although improved, library service for blind people was still fairly sparse and the standard braille used today had not yet been adopted.

Recognizing the need for a centralized national library service, blind citizens and their advocates combined their efforts to acquire transcribed materials with coordinating economies of scale. Organizations serving blind individuals, including the American Foundation for the Blind in New York, the American Printing House for the Blind in Louisville, and the Braille Institute of America in Los Angeles, began to lobby Congress. In 1930, three bills addressing the issue were introduced in the House of Representatives and one in the Senate. The bills introduced by Congresswoman Ruth Pratt of New York and Senator Reed Smoot of Utah survived.

NETWORK OF COOPERATING LIBRARIES

The passage of the Act to Provide Books for the Blind (the Pratt–Smoot Act) and its signing into law on March 3, 1931, by President Herbert Hoover, created the first national free library service for people who were blind. The Act reads:

That there is hereby authorized to be appropriated annually to the Library of Congress, in addition to appropriations otherwise made to said Library, the sum of \$100,000, which sum shall be expended under the direction of the Librarian of Congress to provide books for the use of adult blind residents of the United States, including the several States, Territories, insular possessions, and the District of Columbia.

Braille Alphabet

The six dots of the braille cell are arranged and numbered:

```

1  ●  4
2  ●  5
3  ●  6

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The capital sign, dot 6, placed before a letter makes a capital letter.

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1  4
2  ●  5
3  ●  6

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The number sign, dots 3, 4, 5, 6, placed before the characters a through j, makes the numbers 1 through 0. For example: a preceded by the number sign is 1, b is 2, etc.

a	b	c	d	e	f	g	h	i	j
⠁	⠃	⠉	⠙	⠑	⠕	⠗	⠎	⠓	⠚
k	l	m	n	o	p	q	r	s	t
⠅	⠇	⠓	⠝	⠏	⠖	⠗	⠞	⠡	⠞
u	v	w	x	y	z	Capital Sign	Number Sign	Period	Comma
⠩	⠪	⠻	⠭	⠽	⠿	⠠	⠠	⠠	⠠

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1  ●  4
2  ●  5
3  ●  6

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National Library Service
for the Blind and
Physically Handicapped

LIBRARY OF CONGRESS



Fig. 2 The Braille cell, an arrangement of six dots, is the basic unit for reading and writing Braille. The image above shows the Braille code for the English alphabet.

The Pratt–Smoot Act also acknowledged the necessity of localized service:

The Librarian of Congress may arrange with such libraries as he may judge appropriate to serve as local or regional centers for the circulation of such books, under such conditions and regulations as he may prescribe. In the lending of such books preference at all times shall be given to the needs of blind persons who have been honorably discharged from the United States military or naval service. (Sec. 2)

The year the law was signed, 19 libraries from around the country, including the Library of Congress, circulated books in embossed formats. Two more joined the following year. These libraries, which formed the nucleus of the modern network of cooperating libraries, were called regional distribution centers.

In 1933 the Pratt–Smoot Act was amended to include books “published either in raised characters, or on sound reproduction records, or in any other form.” This change sparked an expansion of the network from 21 to 26 regional libraries by 1934. A second growth spurt began in 1950 and extended through 1976, ending with a total of 56 regional libraries.

During this latter period, the legislation received additional amendments. In 1952, the word “adult” was removed, permitting the braille and talking-book program to serve blind children; in 1962, a library of “musical scores, instructional texts, and other specialized materials” was established; and in 1966, Congress provided for the reading needs of “blind and other physically handicapped residents.” All of these changes were codified in Public Law 89–522 and approved on July 30, 1966.

With the growth in responsibility, the Library of Congress expanded the Service to the Blind project to Books for the Adult Blind. The unit became the Division of Books for the Adult Blind in 1943, later the Division for the Blind (1952), then the Division for the Blind and Physically Handicapped (1966), and finally the National Library Service for the Blind and Physically Handicapped (1978).

The 57th regional library was established in Bismarck, North Dakota, in 1995, leaving only Wyoming without its own special-format library. Wyoming’s patrons are served under contract by the Utah regional library. The network organized into four regions—the Midlands, North, South, and West—to facilitate interlibrary support, help librarians keep abreast of industry issues, and share information. Since 2009, two regional libraries in the Midlands have discontinued service. In each instance, however, a second regional library in the state assumed service for all eligible residents.

Subregional libraries: In the late 1960s, the concept of providing reading service through local entities emerged. Subregional libraries are extensions of the regional

libraries, although they typically are funded separately and may report to a different parent organization. The NLS annual report for fiscal year 1971 shows records that the network had four subregionals in Alabama, six in Kansas, and one in Nebraska. By the mid-1980s, these had been joined by 93 others for a total of 104. Since then, however, many subregionals have fallen victim to budget cuts. In July 2014, the network had 36 subregional libraries: 6 in the Midlands, 4 in the North, 23 in the South, and 3 in the West.

Advisory and outreach centers: The economic crisis that hit America starting in 2008 resulted in the constriction of the NLS network of cooperating libraries. As funding for public libraries decreased, many subregional libraries closed. In 2011, advisory and outreach centers were introduced to the network. Georgia and Kansas replaced their subregional libraries with advisory and outreach centers, which provide reader advisors to assist patrons with service issues and conduct outreach activities. Other states have followed suit and the network now includes a total of 15 advisory and outreach centers: 12 in the Midlands, 1 in the North, and 2 in the South.

Machine-lending agencies and multistate centers: When Congress authorized the Library of Congress to issue talking-book machines (TBMs) to eligible individuals for the purpose of reading, the agency established distribution centers. The centers were important to NLS’s ability to track machine placement. Today most regional libraries provide machine services to their patrons. Separate machine-lending agencies (MLAs) in Minnesota, North Dakota, and Ohio support regional libraries that do not loan playback equipment, and one in Wyoming provides playback equipment to eligible residents in the state who receive library service from Utah.

The current network is also supported by two warehouse facilities called multistate centers. The Multistate Center East (MSCE) in Cincinnati, Ohio, handles the storage and distribution needs of regional libraries east of the Mississippi River, including those in the territories of Puerto Rico, and the U.S. Virgin Islands. It manages the audio and braille foreign-language collection and, since the early 1980s, has conducted the network’s Quality Assurance Program to ensure the consistency and quality of locally produced audiobooks and magazines. The second facility, Multistate Center West, in Salt Lake City, Utah, serves libraries west of the Mississippi, including those in Alaska, Hawaii, and Guam. It also is the repository for special braille collections (Fig. 3) and for NLS playback equipment.

POPULATION SERVED

The free library service administered by NLS is available to any resident of the United States who is unable to read standard print because of blindness, visual impairment, or



Fig. 3 Print-Braille books from the National Library Service for the Blind and Physically Handicapped, Library of Congress, enable blind parents to share reading with their sighted children.

a physical disability that prevents holding a book or turning pages. Service is available on a temporary or long-term basis.

The majority of program users fit into one of two broad categories. First are individuals who are born blind, visually impaired, or with a physical limitation. Once individuals from this group learn about the program and apply for service, they may use it throughout their lives. The second group—the larger of the two—are individuals who become eligible later in life because of an age-related illness or disease. Arthritis, diabetes, glaucoma, and macular degeneration are the most common causes for eligibility. A subcategory of this group includes those who lose the ability to use print because of an accidental injury.

Currently, 69% of active readers in the program are 60 yr of age or older. The onset of a condition, later in life, that makes them eligible for the program has tended to make readers who are in their 1960s or older the primary users of this program. In fact, more than 3600 readers are more than 100 yr old.

It is important to note that veterans are given primary preference by law. As stated in Section 2 of An Act to Provide Books for the Adult Blind,

In the lending of such books preference shall at all times be given to the needs of blind persons who have been

honorably discharged from the United States military or naval service.

According to the Blinded Veterans Association, 7000 aging veterans become blind each year as a result of macular degeneration, retinitis pigmentosa, glaucoma, or diabetic retinopathy. In addition, approximately 13% of the wounded soldiers returning from the Middle East have sustained visual impairment of some type. The free library service that NLS provides assures that they will be able to continue to access the written word.

THE LIBRARY COLLECTION

The braille and talking-book collection of titles was established on the ideology that eligible readers should have access to the same type of materials found in public libraries for the sighted population. The collection emphasizes recreational and informational reading material. Among the nonfiction and fiction titles, including classics and bestsellers, patrons may select from a wide range of genres. Biographies, political commentaries, religion, and science titles may be found among the nonfiction offerings, while stories about mysteries, romances, science fiction, and westerns are popular fiction selections. Age-appropriate titles in similar categories are also available for younger readers. Though most of the offerings are English, the collection includes foreign-language materials, principally Spanish. The collection also offers subscriptions to popular magazines, selected for special format according to patron interest. The *NLS Collection Building Policy* explains that the interests of “the aged, the young, professional people, and other specific groups [are to be] reflected proportionally in the collections in relation to the overall readership served.”

As patron consideration is an important aspect of service, NLS is aided in its collection-building activities by a group that meets biennially. The National Collection Advisory Group includes patrons, librarians, and representatives of constituency organizations who gather information from their peers to recommend strategies for NLS to consider when making selections for the titles. Principles guiding selection are to ensure that titles are available to meet the interests of a population with broad and diverse interests, tastes, and reading levels. The *NLS Collection Building Policy* bases consideration of nonfiction titles on the following:

1. Broad trends in public interests, knowledge of developing theories and practices in the various subject areas, and availability of appropriate titles
2. Materials in areas of particular interest to readers, classic and standard materials, contemporary works, specialized works of interest to educated laymen, and works with potential informational reading reference

Annually, NLS seeks to add 3000 titles in audiobook format and about 500 titles in braille. Ratios of titles selected for audiobooks in each subject area are 60% fiction to 40% nonfiction, 70% current to 30% retrospective, and 80% adult to 20% juvenile. Braille, however, is selected based on cost: the larger and/or more complex the title, the higher the production costs. "For example: Stephen King's novel *11/22/63* contains 1576 transcribed pages in eleven volumes. NLS produced forty-three copies of 7,768 braille pages each, which cost \$23,300" (*The Future of Braille*, 2014).

MUSIC LIBRARY SERVICES

A special music collection for blind persons was authorized by Congress as part of the national free library program in 1962. The collection became the basis for the music program administered through the NLS Music Section. These services, extended to individuals with disabilities in 1966, are provided directly to eligible individuals from Washington, DC. In effect, the Music Section is the national music library for people who are blind and visually impaired or have a disability.

The collection offers braille, large-print, and recorded instructional materials about music and musicians. More than 30,000 titles in audio, braille, and large-print music scores, texts, and other instructional materials (in excess of 100,000 volumes) are available. Some materials are purchased from national and international commercial sources. Other items are selected and produced in audio and braille formats by NLS with the permission of composers, authors, and publishers. Some titles are developed solely for the NLS program. Patrons may also obtain free subscriptions to several magazines produced in audio, braille, and large print. Musical recordings intended solely for listening are not included in the music collection as they are readily available commercially and from public libraries.

BRAILLE AND TALKING BOOKS

Within 2 yr of the Pratt–Smoot Act becoming law, braille had become the standard for embossed reading materials in the United States. In 1931, the Division of Books for the Adult Blind selected 157 braille titles for the collection; and starting in 1934, the national program also offered sound recordings of books on 33-1/3 rotations per minute (rpm) rigid discs (records). The addition of talking books was especially well received because many individuals who were blind had never learned to read braille.

In 1935, the Works Progress Administration was allocated funding to build and repair record players for blind adults to read Library of Congress–produced recorded books. After World War II, Congress provided an

appropriation for the purchase of TBMs, which were distributed to regional libraries and MLAs for loan to eligible readers. By the mid-1960s, the Library of Congress began looking at ways to reduce the size and weight of the materials being handled by patrons, network library staffs, and the United States Postal Service (USPS). The first experiment slowed the speed of the 33-1/3 rpm record to 16-2/3 rpm, then to 8-1/3 rpm. Simultaneously, NLS began experimenting with providing books on magnetic tape. Initially, titles were produced on open-reel tape and loaned to readers who had access to open-reel tape players. While the tape technology proved effective, the open-reel format was inefficient. The experience, however, led NLS to the Phillips cassette, which was becoming the commercial recording industry standard. A C-90 Phillips cassette played for 45 min per side or 90 min overall at 1-7/8 inches per/second (ips).

NLS experimented with this format, at first reducing the play speed from 1-7/8 to 15/16 ips, which doubled the play time from 90 to 180 min. A second change was recording on four tracks instead of two, which added another 180 min. Unlike commercial cassettes that play for 1-1/2 hr, talking-book cassettes play for 6 hr. This format meant that readers needed to handle only a single cassette instead of four. The noncommercial speed prohibited talking books from being played on commercial machines, thereby ensuring copyright protection. The new format also qualified the books for Free Matter mailing.

TALKING-BOOK MACHINES

In 1947, the Library of Congress received its first appropriation for the purchase of special record players. From its introduction in 1935 through the transition to the cassette machine in 1971, the TBM was continuously modified to achieve peak performance. In the first decade, attention was given to the motor, pickup arm, and amplifier. In the 1950s, motor speeds began increasing to accommodate 33-1/3, 16-2/3 rpm, and, by 1965, 8-1/3 rpm. A lightweight model with a transistorized amplifier and plastic case was introduced in 1968. In the early 1970s, the TBM was further refined with an automatic cut-off switch, two-sided needle, and a detachable lid that held the speaker. The last model was joined by a cassette player and called the combination machine. It allowed patrons to play magazines on discs and audiobooks on cassettes, which were introduced in 1971.

Cassette machines debuted in two models: a playback-only and a record-and-play designed for students. The playback-only held a rechargeable nickel–cadmium battery and the latter used size C dry-cell batteries. Both operated at 1-7/8 and 15/16 ips. Cassette machines were produced to accommodate the four-track cassette beginning in 1974, and in 1976 an automatic shutoff, tape

motion sensor, and variable speed control were added. The 1980 model included a pitch restoration model that retained the pitch even at higher speeds. The Easy Machine, a cassette machine operated by two controls, was introduced to assist readers with low dexterity. The machine started and stopped with a sliding door and had a button to rewind the tape.

QUALITY IMPROVEMENTS

Recognizing that analog cassette tape would become obsolete by the early twenty-first century, NLS began exploring alternative formats for recorded books in the late 1980s. A review of the market at the time indicated that the recording and distribution of books and magazines should be moved from an analog to a digital environment and that the output of digital books required a format robust enough to stand up to the extensive handling and mailing that circulating machines and audiobooks between libraries and patrons entails.

By the mid-1990s, it was clear that digital technology would become the accepted medium. Digital recordings had emerged in several formats: digital audiotape (DAT), digital compact cassette (DCC), compact disc (CD), digital video disc (DVD), and mini discs (a smaller compact disc developed by Sony). Each of these applications utilized digital recordings, but all were susceptible to the same weaknesses as their analog counterparts. DAT and DCC relied on magnetic tape for storage, and CD and DVD encountered fragility problems not recognized at their inception. The NLS search for a durable medium led to flash memory. It was costly, but market research indicated that by 2008 the cost would drop enough to make the medium affordable.

Under the National Information Standards Organization (NISO), part of the American National Standards

Institute (ANSI), an international team of experts and interested parties released the ANSI/NISO Z39.86, the first standard for digital talking books, in 2002. With the NISO standard in hand and flash memory designated as the format, NLS selected a company to design a proprietary digital TBM, a cartridge, and a cartridge container. The design phase was completed and approved in the spring of 2007, and manufacturing began in 2008. NLS launched its digital talking-book system in 2009.

The transition from analog to digital service was well received by users of the NLS program. The digital talking-book system includes a player—available in two models, a flash-memory cartridge, and the cartridge container (Fig. 4). Patrons enjoy the higher-quality sound, easy navigation, and convenience of an incremental shutoff button in the basic machine. The advanced machine offers additional features such as chapter-to-chapter navigation. Both machines weigh less than the cassette player and are easier to carry. The larger buttons accommodate individuals who have dexterity challenges.

BRAILLE AND TALKING-BOOKS SERVICE TO GO

Prior to the emergence of the digital audiobook system, NLS launched the Braille and Audio Reading Download (BARD) Internet service. BARD offers patrons the ability to have their reading material in a matter of minutes as opposed to the week or two required for regular circulation activities. Books and magazines may be downloaded from BARD and played on NLS or authorized commercial players.

Interest in developing the BARD service was spawned by the success of Web-Braille, the first NLS exploration into providing online access to its collections. Established in 1999, Web-Braille, a password-protected website, allowed patrons to access thousands of complete e-braille books and magazines in contracted (formerly known as



Fig. 4 The digital talking-book system issued by the National Library Service for the Blind and Physically Handicapped, Library of Congress, provides an improved reading experience. Patrons may choose a basic player (left) or an advanced player (right). A single cartridge, circulated in a lightweight plastic container, will hold most books.

grade 2) braille. Books were added to the Web-Braille site after production in press-braille (paper) distribution to braille-lending libraries. Patrons received log-on IDs through their network libraries and then accessed the site to download braille books and magazines using braille-embossing hardware.

In 2006, NLS used Web-Braille as a working model, as several elements had emerged to create an environment for establishing an audiobook download website. First, Adaptive Multi-Rate Wideband Plus, an audio compression algorithm, had been selected as the best code-decode (codec) for ensuring high-quality human-voice recording for digital production. Second, a scheme for digital rights management to ensure copyright protection had been developed; and third, a compatible digital machine had been produced. Together they presented an opportunity for NLS to make the large collection of digital audio files it had amassed in preparation for the digital talking-book system available online.

In October 2006, NLS began testing the system's usability by launching its downloadable book pilot. A year later the pilot was expanded to the present BARD system. The password-protected website provides access to thousands of recorded and braille books and magazines, with weekly additions. In 2013, Web-Braille merged with BARD, and in 2014, network libraries were invited to submit their locally produced books and magazines for inclusion on BARD. More than 60,000 patrons are registered users of the website, which has more than 50,000 book titles and 94 magazine titles. Patrons may also download instructional music materials and some foreign-language books and magazines.

BARD Mobile: Always scanning the technological environment for opportunities to improve reading accessibility for individuals who cannot see to read regular print or handle printed materials, NLS turned its attention to smartphones. In September 2013, NLS successfully launched BARD Mobile, a software application that enables registered patrons to download audio and braille books and magazines from the BARD website using an iPhone, iPad, or iPod touch. All aspects of the app were designed and developed to ensure complete accessibility and a premium patron experience, including navigability and download speed. Users must register for access through their network libraries.

Audiobook readers are able to use the device's built-in speaker, and braille readers are able to read e-braille books, magazines, and music scores using a refreshable braille display connected via Bluetooth to their iOS devices. The new app increased the portability of the free library service and patrons expressed delight that it did not require special equipment; they can use the same type of devices as their sighted peers. About 5000 patrons signed up for BARD Mobile within the first week of release. In the first year, more than 10,000 users had registered for the app and registered 17,200 devices.

EQUIPMENT REPAIR AND THE ROLE OF VOLUNTEERS

Because talking-book equipment is loaned, users had to return broken or defective equipment to their MLAs and wait to receive replacements. At first, machines that needed repair were handled by centralized repair facilities, but that often left readers waiting for weeks or months to get them back. Consequently, the Division of Books for the Adult Blind changed its policy and required MLAs to replace broken machines immediately. This requirement ensured that the reader would quickly receive a replacement player, but it also created a backlog of machines needing service. Repair at the local level was sporadic, mostly because the staff did not have the necessary technical background or training. This ongoing problem was resolved in 1960 when the program, by then the Division for the Blind, formed a partnership with a volunteer organization whose members had both technical background and the time to devote to repairing the playback equipment.

Machine-repair volunteers: The Telephone Pioneers of America, formed by long-tenured or retired telephone company employees, was a nationwide organization looking for public service projects. In 1959, the Division and the Pioneers launched a pilot machine-repair project. The success of this project proved mutually beneficial, and the Pioneers adopted the TBM-repair program as a project on June 6, 1960. This group, which in 2008 changed its name to Pioneers—A Volunteer Network, has provided decades of significant community service by repairing TBMs. In 1989, the General Electric (GE) Elfun Society, a group of retired GE employees who were also looking for a community service project, joined the NLS volunteer machine-repair program. Its repair facilities are in Fort Wayne, Indiana; Louisville, Kentucky; Lynn, Massachusetts; Schenectady, New York; Cincinnati, Ohio; Philadelphia, Pennsylvania; and Salem, Virginia. In 2006, this organization changed its name to GE Volunteers. Together Pioneers and GE Volunteers have provided millions of dollars in service to the talking-book program, network libraries, and their patrons. More than 288 repair sites still operate around the country, a tribute to the dedication of the men and women who volunteer.

Other volunteers: Volunteers have played a crucial role in ensuring that individuals who are blind or have a physical disability gained and retained access to reading materials. Even before the national program was set in place, volunteers began organizing to provide hand-copied braille materials to blinded veterans after World War I. The formation of such organizations required a method for ensuring the quality of braille transcription. The Library of Congress and the American Red Cross collaborated to produce a manual to guide the sighted transcribers and to establish a certification program. This program operated under the American Red Cross until 1943, when it was transferred to the Library of Congress.

Many braille transcriber groups operate across the United States. Some network libraries have braille-transcription programs that are supported by these volunteers. Others contribute to the network library system by donating materials or handling special assignments. Braille transcribers and proofreaders still must be certified by NLS, now handled under contract with the National Federation of the Blind in Baltimore, Maryland. Their efforts are guided by the *English Braille American Edition* and *Braille Formats: Principles of Print to Braille Transcription*, under the watchful eyes of such groups as the Braille Authority of North America (BANA) and the National Braille Association (NBA). BANA's mission statement reads in part that it "publishes rules, interprets and renders opinions pertaining to braille in all existing and future code" (<http://www.brailleauthority.org>), while the NBA provides professional development and training for transcribers.

Most positions in the audiobook recording industry are held by paid professionals; however, some network libraries and volunteer studios engage the help of volunteers to narrate, monitor, and review audiobooks. Books narrated by volunteers must meet the standards of narration established by NLS. In addition, volunteer-produced books nominated to the NLS *Union Catalog* must pass inspection by the NLS Quality Assurance Program at the MSCE.

Countless other volunteers help maintain library service by performing a variety of functions, from greeting visitors to inspecting and shelving returned books. These individuals contribute numerous hours to ensuring that patrons have access to reading materials. The network of cooperating libraries recognizes their work through commendations, awards, and/or special events.

COPYRIGHT

Copyright protection became an issue when talking books were introduced to the Books for the Adult Blind. At the program's inception, only embossed books, which could be used by only a small percentage of the population, were provided. Publishers did not perceive this special embossed format as a threat to their profit margins. Recorded books, however, were produced in a commercial format, so anyone who had a phonograph could use them. To address this issue, the Library of Congress set controls on recorded books. First, Books for the Adult Blind secured permission from the copyright owner to publish recorded books. Then, every recorded book contained an announcement acknowledging copyright permission and noting that the format was for blind users only.

In spite of these safeguards, publishers became more reluctant to grant permission for the special-format publications as demand for talking books grew. By 1936, the Library of Congress could only add books published before 1880, most of which were already available in braille or had been read by patrons who came to the program after losing

their sight as adults. The Book Publisher's Bureau proposed that publishers grant permission for a nominal fee or at no cost to the Library of Congress, which became a clearinghouse for the special-format permissions. It tracked the number of permissions requested, the number granted, and the number of recordings made. The American Foundation for the Blind and the American Printing House for the Blind, which held government contracts to produce the books, labeled talking books "Solely for the Use of the Blind." They also ensured that this message was narrated, along with the name of the publisher.

Stakeholders felt that maintaining tight controls on TBMs was the key to copyright protection. TBMs were strategically placed in central locations because only one machine was provided for every six blind individuals in the United States. The Books for the Adult Blind program was required to track the location of the players and to issue regulations on their loan, maintenance, and repair.

This program worked for decades, although even with the controls in place it was a slow process. Then in 1996, at the request of representatives from organizations of individuals who are blind or who provided services to them, Senator John Chafee of Rhode Island introduced Legislative Branch Appropriations Bill, H.R. 3754, to amend Chapter 1, Title 7 of the U.S. Code as follows:

It is not an infringement of copyright for an authorized entity to reproduce or to distribute copies or phonorecords of a previously published, nondramatic literary work if such copies or phonorecords are reproduced or distributed in specialized formats exclusively for use by blind or other persons with disabilities.

P.L.104-197, signed by President William Jefferson Clinton, effectively removed the need to request copyright permission for any U.S. nondramatic work intended for production in braille or recorded format specifically for readers who are blind and visually impaired or have a physical disability.

In 2013, NLS met with commercial audio publishers to discuss acquisitions of commercially recorded audio titles. Hachette Book Group of New York, New York, agreed to provide NLS with audio files at no cost. The relationship marked a major benchmark in the NLS effort to provide an ever-increasing selection of audio and braille titles for program users. Other publishers joined, and as a result, NLS increased its annual audio title offerings from 2000 to 3000. It must be noted that while the audio files have been donated, NLS must cover the costs of duplication and distribution.

FREE MATTER MAIL FOR BLIND AND HANDICAPPED INDIVIDUALS

The Free Matter for the Blind and Handicapped mailing privilege offered by the USPS predates the legislation that

established NLS. Originally passed by Congress in 1904, it allowed public institutions serving blind individuals, public libraries, and blind readers to mail embossed materials free of charge. Two requirements for Free Matter mailing are noted in the *Domestic Mail Manual* Section 703.5, “Free Matter for the Blind and Other Handicapped Persons.” First, the material being mailed must be in a special format intended for blind users such as braille; sight-saving type (i.e., 14-point or larger); recorded materials on cassette, records, or compact discs; or descriptive videos with audio narration. Second, the recipient of the material must be eligible to receive (and return) materials as Free Matter. The criteria specified include being an NLS patron, being blind or having a physical disability that prevents using printed materials, and being an American citizen or resident of the United States or its territories.

Residents of the United States who are eligible for braille or talking-book service are a microcosm of the general population, representing every age, gender, and socioeconomic status. The only generalization that can be made about these individuals is that their most common problem is mobility. As a consequence of their disability, they do not drive. Therefore being able to receive and return library materials through the USPS affords them a considerable degree of freedom and independence.

Free Matter postal service is vital to NLS and the network of cooperating libraries as it supports postage-free book circulation. Libraries mail books, magazines, and playback equipment to patrons free of charge. Once readers complete a book, they merely return it to the mail stream, and it is returned to the appropriate library. Without the Free Matter mailing privilege, the NLS free library service would not be nearly as successful. For the past decade, the NLS network of cooperating libraries has circulated approximately 23 million books and magazines annually, and approximately 20 million books are returned. Additionally, an untold number of playback machines, catalogs, newsletters, and order forms travel between patrons and libraries. Postal service employees who process and deliver these materials have been honored by individual network libraries for the dedication and concern NLS patrons report.

DEVELOPMENTS IN THE FIELD OF BRAILLE

The technological landscape of the twenty-first century flourished with opportunities for accessible options. Yet Braille has remained the primary literacy tool for individuals who are blind or visually impaired. The tactile format enables these people to engage in their environment by gaining the fundamental skills that make literacy possible. Amidst all of the change, however, Braille seemed to be at a standstill. In June 2013, NLS partnered with Perkins of Watertown, Massachusetts, to convene a conference

exploring the status of braille, with a mind to shaping policies to expand and support this important literacy tool.

Called “The Future of Braille,” the braille summit drew more than 100 librarians, educators, producers, engineers, and others to the Perkins campus to discuss issues and to formulate recommendations. Their major concerns were reducing the high cost of braille production, acquiring better technology and more training for instructors, and the need to expand knowledge about the medium. Stakeholders also heard from a representative of the U.S. Department of Education, which had just released a Dear Colleague letter advising educators to include braille in the individual education plans of qualifying students; the National Braille Press Center for Braille Innovation and the Daisy Consortium Transforming Braille Group on their efforts to produce a low-cost braille display; and the Braille Authority of North America on its adoption of the Unified English Braille code, an update of the braille code that has a set of rules applicable across the English language.

Participants recommended that NLS provide a refreshable braille display at no cost to patrons, vary the quality and/or publication medium of books depending on their use and expected shelf life, and work with publishers to acquire source texts. They also asked NLS to expand the use of tactile graphics in its books and to build support for efforts to update braille technology, specifications, and methods for selection, production (including production on demand), and distribution of braille materials. These recommendations will serve as a guide as NLS develops policy to better serve its braille readers.

FROM READER TO LEADER

On March 26, 2012, NLS marked another milestone in its development. For the first time since its establishment, the organization would be led by one of its patrons. Karen Keninger, who had lost her sight at age seven, was appointed director of the National Library Service for the Blind and Physically Handicapped. From 2008 until her appointment, she had served as the director of the Iowa Department for the Blind, where she oversaw statewide vocational rehabilitation and independent living programs and library services. Prior to that—from 2000 to 2008—she had served as director of the Iowa Library for the Blind and Physically Handicapped, where she planned and implemented a new, in-house digital recording program with a state-of-the-art recording studio.

Taking the helm of NLS, Keninger set five priorities for the program: 1) maintain the highest quality standards for all NLS products; 2) enhance the reading experience for all NLS patrons by leveraging current and future technologies to improve the reading and delivery systems; 3) expand the scope and quantity of titles available in alternative formats through the NLS system; 4) take a leading

role in positioning braille as a viable, practical, and achievable literacy medium for all blind Americans; and 5) increase readership. Under her leadership, NLS has released the BARD Mobile app, engaged support from commercial publishers, held the first braille summit, and made digital audio materials produced by network libraries available on BARD.

CONCLUSION

Library service for eligible residents of the United States and its territories and for its citizens living abroad continues to expand as technology changes and new needs are identified. Within the NLS network, many libraries, both regional and subregional, offer services beyond those provided by the Library of Congress, such as large-print books and descriptive videos. Many also host community activities, such as summer reading programs for children and book discussion groups. They house recording studios that record books and magazines, normally of local significance, supplementing the NLS *Union Catalog*.

The development of library service to individuals who are blind, are visually impaired, or have a physical disability represents the combined efforts of many people, organizations, and institutions. Among these, the most important have been the readers. Their contributions have been evident from Louis Braille's use of a military code to create a tactile alphabet through contemporary demands for accessible technology, including braille displays and smartphone apps, to the rise of a patron to leadership of the national service. As noted in *That All May Read: Library Service for Blind and Physically Handicapped People*, "This history reflects the growing recognition that [people who are blind or have a physical disability] have the same interests, intellectual capacity, and ambitions as other members of society and the determination that they enjoy the same benefits."

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Bliss Bibliographic Classification First Edition [*ELIS Classic*]

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Abstract

Henry Evelyn Bliss was probably the greatest American contributor to the theory of the classification of library materials. The first edition of the classification scheme he developed is discussed here by a major British thinker in this area, Jack Mills. After some years of use, the scheme was extensively revised, under the Editorship of the same Jack Mills, and the resulting second edition of the Bliss Bibliographic Classification is discussed in the entry by that name.

—*ELIS Classic*, from 1969

INTRODUCTION

A substantial outline of the system of library classification^[1] known as the Bibliographic Classification (or Bliss Classification, or, simply, BC) was first published in 1935, and the full edition^[2] appeared in 1940–1953, making it the latest of the major general classifications for libraries to appear. It was the culmination of a life-long study of the problems of library classification by its author, Henry Evelyn Bliss (1870–1955). Bliss, who was associated for almost 50 years with the College of the City of New York, in fact, applied his system in an earlier form as long ago as 1908,^[3] when he reorganized the City College library. Subsequently, he undertook a very thorough investigation of the problems of organizing knowledge and the relevance to them of classification. He prepared the way for the publication of his full system using two works, both of them influential among librarians in the 1930s and 1940s, particularly in Great Britain. The first, *The Organization of Knowledge and the System of the Sciences*^[4] (described by John Dewey in its Introduction as a “monumental work”), appeared in 1929, and the second, *The Organization of Knowledge in Libraries*^[5] in 1933.

These two works set the scene for his classification in that they developed, after a thorough review of historical systems, both a comprehensive theoretical basis for the classification of knowledge and a set of pragmatic principles reflecting the functional requirements of documentary collections, the two combining to give the foundations of a bibliographic classification, i.e., one for documentary collections.

HISTORY

Extent of Use

Libraries began to adopt the BC as soon as the 1935 “System” appeared. By 1954, a year after the completion

of the full scheme, some 50 libraries had adopted it and the first issue of the *Bliss Classification Bulletin* appeared^[6] as a maintenance service for users. At first somewhat intermittent, it now appears regularly once a year; details of the service and of proposals for a new edition are given later in this entry. By 1967 more than 80 libraries had adopted the BC, and each year sees several more added to the total. These users are predominantly academic and learned libraries and government and special libraries. Most of them are in the British Commonwealth and only two are in the United States of America itself.^[7] In 1967 an abridged version of the scheme^[8] for use in schools was published by the (British) Schools Library Association.

Principles Underlying the BC

In the second edition of *The Organization of Knowledge in Libraries*, Bliss summarized the principles of classification for libraries under 32 headings. From these, five may be selected as of major significance in determining the characteristic features of the BC.

COLLOCATION

A library classification is a device for defining specific classes of information and for showing the relations existing between them. In this way it performs its basic function, which is to assist the retrieval of information from stores (libraries, bibliographies, indexes) by allowing a searcher first to locate a specific class in which relevant material is believed likely to be and then to make adjustments to the search (if necessary—and it usually is) by expanding or contracting the initial class according to whether too little relevant material or too much nonrelevant material is found in it. The second function is

achieved by *collocation*, i.e., bringing together in proximity those classes that are closely related.

Bliss attacked the alphabetical organization of information (which has been, throughout this century, the dominant form in American libraries) as serving adequately only the first function (of locating specific classes) when the needs of bibliographical searching make the second every bit as necessary. He argued that only systematic collocation could meet these needs and that this was the fundamental feature of a good classification, and it was only to be achieved by observance of certain basic principles governing the order of classes. The first of these was “consensus.”

CONSENSUS

Bliss believed that knowledge should be organized consistently with the “consensus of scientific and educational opinion,” since it is through the processes of science (in its broadest sense) and of education that we find that this organization is ultimately effected and its results systematized. This consensus, or agreement, he claimed, “is relatively stable and tends to become more so as theory and system become more definitely and permanently established in general and increasingly in detail.”^[5] The stability, Bliss argued, was a reflection of the fact that the system of knowledge was “correlative to the persistent order of nature.”

At its simplest, this notion was a conscious refinement of the basic assumption made, but never stated explicitly, by other major general classifications—the Decimal Classification, the Universal Decimal Classification (UDC), the Library of Congress, Colon—all based on the accepted “disciplines” of late-nineteenth-century Western society (although in the case of the Colon scheme, the framework of main classes and divisions reflecting this is its least significant feature). But Bliss went far beyond this almost intuitive assumption in his attempt to establish an acceptable consensus, which would at the same time display fundamental relations between classes with maximum efficiency.

This consensus is, to be sure, relative (to different viewpoints) and temporary. Bliss admitted this, but claimed for it an impressive weight of historical evidence, from the Stoic “triad” (logic, physics, ethics) to the more detailed structures of the nineteenth century philosophers, and particularly of Comte, Spencer, Ostwald, and Wundt.

GRADATION

A bibliographic classification must be presented as a serial or linear order, however complex the differences used to distinguish its classes. (At least, this is true of its use for the arrangements of documents on shelves and of entries

in a precoordinate index; it is not quite true of a classification used as an authority list or thesaurus for a post-coordinate index.) The two central relations underlying this serial order are subordination (of the special to the general) and coordination (of classes of the same rank, or order of division). While observing these two principles, Bliss recognized a further principle which seemed to incorporate elements of both. This was the principle of gradation in speciality:

A very important instance is that of the natural sciences arranged in order of *speciality*, each science being in one sense individual and coordinate with its fellow sciences, yet in another sense subordinate to that on which it is mainly dependent for concepts and principles and from which it is largely derived by specialization.^[4]

By this theory (advanced in various forms by a number of philosophers, particularly Comte, Spencer, and Ostwald) it is argued, for example, that physics, dealing as it does with the fundamental nature of matter and energy itself, is more “general” than chemistry, which studies organizations of matter and energy at a more specialized level. This “dependence” of chemistry on physics is seen in such critical areas as that of the theory of valency, in which the combining powers of chemical elements are explicable finally in terms of atomic structure.

It may be noted here that such a theory (which implies, for example, that all biological phenomena are ultimately explicable in terms of physics and chemistry) has obvious philosophical implications, as does the argument for consensus, which assumes that classes are correlative to a persistent order of an objectively verifiable, external nature. Bliss considered these implications at numerous points in his work, especially Chapter 10 of *The Organization of Knowledge and the System of the Sciences*.

Another interesting point is the close parallels that can be drawn between the order produced by gradation and that produced by applying the theory of integrative levels^[9] in which entities are organized in a sequence of increasing complexity, from fundamental particles to atoms, to molecular aggregates, to cells, and so forth.

ADAPTABILITY

The “adaptation of logical order to practical uses and to convenience thru collocation. . .” (*A Bibliographic Classification*, Vols. I–II. p. 23) recognizes the practical implications of the “relativity of knowledge and classes” and is another major principle in the BC. It takes the form of extensive provision for alternative locations and treatments, e.g., some technologies may be collocated with others in the technology class (U) or subordinated to the science that they largely reflect (as aeronautics, say, reflects aerodynamics); or, mineralogy may go with its

science crystallography, within chemistry, or under geochemistry, within geology; International law may go with international relations within political science or with law.

To implement this, extensive provision must be prepared in the notation for different decisions, and the BC provides this to a degree far excelling that of the other major schemes.

NOTATION

Bliss made valuable contributions to the theory and practice of notation, not least in his emphasis on notation being “correlative and subsidiary,” i.e., that it should not determine the display of relations achieved by the order of classes. In the BC, two principles of notation are particularly prominent. First, the use of “composite” notation to provide economically for the notational specification of different classes by recurrent concepts; this is the old principle of “divide like . . .” used by Dewey, and, while it is not taken as far as the provision of a fully faceted notation, it does allow notational synthesis on a scale comparable with that of the UDC. Second, the notation is quite the briefest of all the major schemes. Bliss considered brevity a major element in the acceptability of a notation and sought it for the BC in a number of ways.

The Classification

The basic sequence, its structure predominantly reflecting the principle of subordination of the general to the special and of gradation in speciality, is notably coherent and mnemonically clear:

Philosophy, Logic, Mathematics (i.e., “tool” studies, and Methodology)
 Physical sciences
 Physics
 Chemistry
 Astronomical systems and bodies
 Earth
 Biological sciences
 Botany
 Zoology
 Man: Human sciences and studies
 Physical anthropology (in widest sense)
 Social anthropology (in widest sense)
 Social sciences
 Arts

To put some flesh onto this skeleton, an amplification shows some of the additional features necessitated by the practical demands of a working bibliographic classification, including notation. The latter, it should be noted, does not necessarily reflect the relations (of subordination or coordination) between the classes.

This simple linear presentation (which, however, is quite essential to a bibliographic classification) does not fully display the care with which Bliss charted the complexities of the relations involved, and the consistency with which certain principles of subordination have been applied.

The principle of gradation clearly dominates the sequence down to class H, which introduces the human sciences and studies. It is then reflected somewhat differently in the placing of generalizing theoretical studies just ahead of the concrete activities they illuminate. For example, sociology, as the fundamental, generalizing study of society and social institutions, is located ahead of the special social sciences and studies in which particular aspects of human society—its religions, political, and economic structures and its technological and imaginative artifacts—are considered. Bliss firmly rejected the bifurcation of subjects into “abstract” and “concrete” and consistently locates the “abstract” studies (the philosophy and methodology) relating to a given activity with the associated concrete ones. Similarly, Bliss secures a valuable element of predictability by following an old, pragmatic indexing principle that is rarely explicitly stated—that of forming compound subjects, in which both general and special classes are reflected, by citing the special element first, e.g., physical chemistry under chemistry, biochemistry under biology, medical psychology under psychology, educational psychology under education. Generally speaking, such compounding follows a “retroactive” principle, whereby such compounds are located by citing first the “special” activity and then going “backwards” in the sequence to the preceding and more “general” class in order to cite the “general” viewpoint. In the human studies this principle tends to be obscured by the allowances made for consensus, e.g., in allowing the various aspects of a country’s history and description to be collected under that country (in classes M–O) rather than subordinating the place (the society) to the social activity (e.g., legal, political); or, in allowing the economic organization of particular industries to be subordinated to the class economics (T) rather than to place it with that industry in the neighboring useful arts class (U).

By and large, the “modulation” in the BC, whereby each major class leads onto the next in a manner clearly determined by adherence to the basic and consistent theory, as remarkably sustained when we remember the artificiality imposed on a classification by the need to linearize the multidimensional pattern of relations. Only in a few instances does the sequence raise a doubt as to why it is thus, and in these cases it is usually due to Bliss’s anxiety to provide a practical order agreeable to the current “consensus.” For example, education (J) is theoretically a special social science and should not precede sociology (J); Bliss argued that education, as the “training and development of mind and of mental abilities,” is inseparable from psychology and therefore placed it as a

bridge between education and sociology. The practical utility of this is indisputable and would seem to be a major reason for the adoption of the BC by nearly all the university Institutes of Education in the United Kingdom.

Another example of the very practical approach to collocation when the demands of theory are not overwhelming is in his interpretation of philology. Theoretically, language is the fundamental agent of social communication and by gradation should be collocated with sociology, and only its *application* to the “special” human activity of imaginative creation should be subsumed under literature. But there is a strong educational consensus manifested in the study and teaching of the two subjects to justify their collocation, and this Bliss does.

Class Q, social welfare, and so forth (previously called “applied social science”), is a composite class for which no accepted short name is available but which nevertheless collocates reasonably a number of broad social movements and problems (social pathology, women, socialism, internationalism, etc.) in which a number of special social sciences (politics, law, economics, etc.) intermingle.

One more example is the treatment of technology. By gradation, this should be regarded as a special social science (giving the “material culture” of society), and this is by and large how Bliss treats it. However, the demands of the literature obviously suggest collocation of some technologies with the science from which they spring, as in the case of electronics, nuclear engineering, much of chemical technology, and so forth. Bliss acknowledges this, and all these technologies are to be found with physics and chemistry in B and C, representing as they do what Bliss calls “the more scientific technologies.” However, we have noted already that alternatives are provided for some technologies.

Provision for Alternatives

Allowing some technologies to be collocated either with a “pure” science or with the useful arts class is typical of the regard for adjustability which makes the BC by far the most flexible of the major general schemes. This regard takes two forms: first, simple “alternative location,” in which a given class may be located in one of two (or more) different places but without any alteration of its *internal* arrangement; examples here are the moving of theology from Class P (religion) to AJ in order to collocate it with philosophy, or placing constitutional law in law instead of in political science (where Bliss prefers it).

The second feature of this regard for adjustability is in “alternative treatments,” which are more elaborate; they involve altering the internal structure of a class by varying its “citation order,” i.e., the order in which the elements of a compound class are cited (reflecting a different order of application of principles of division). A prominent example here is the rich provision under literature whereby the literature of a given language may be divided first by period

and then by form, or vice-versa; or, the literary texts may be kept separate from the works *about* literature and each major group then divided in various ways, of the division into texts and literary history may be made after prior division by period and/or form. A similar rich provision of alternatives is to be found under social–political history.

Notation

1. This uses predominantly capital letters A–Z; the number 1–9 (but not zero, which would conflict with the letter O) and lower-case letters a–z are used fairly often, as shown below. The comma is used extensively as a facet indicator and the hyphen is used as a phase indicator (i.e., linking elements derived from different subject areas rather than from different facets of the same class). Although Bliss unwisely introduced some ungainly symbols (&, %, and so forth) in the final volume of the BC these were used very rarely and have since been withdrawn (Table 1).

Table 1

1–9	Anterior numeral classes (for special collections of various kinds, e.g., 6, Periodicals) Class 2 here (Bibliology and libraries) is an alternative to its preferred position in Z.
A	Philosophy and general science (including Logic, Mathematics, Metrology, Statistics)
B	Physics (including special physical technology, e.g., Radio)
C	Chemistry (including Mineralogy, Chemical technology)
D	Astronomy, Geology, Geography (General and Physical)
E	Biology (including Paleontology, Biogeography)
F	Botany (including Bacteriology)
G	Zoology (including Zoogeography and Economic Zoology)
H	Anthropology (General and Physical) (including Medicine, Hygiene, Physical training, and recreation)
I	Psychology (including Psychiatry)
J	Education
K	Social sciences Sociology, Ethnology, Anthropogeography (including Travel and description in general)
L–O	Social–political history M Europe, N America, O Australia, Asia, Africa
P	Religion, Theology, Ethics
Q	Applied social sciences and ethics; Social welfare
R	Political science
S	Law
T	Economics
U	Arts in general, Useful arts (including the less scientific technologies)
V	Aesthetic arts, Recreative arts and pastimes
W–Y	Philology: language and literature W Non-Indo–European, X Indo–European, Y English
Z	Bibliology, Bibliography, Libraries

2. Bliss sought simplicity for his notation in two main ways: first, by using for the greater part symbols whose ordinal value are very widely known (i.e., Roman letters and Arabic numerals) with a minimum use of “arbitrary” symbols; second, by maximum brevity. This latter is secured by using a wide base for the radix fraction principle of division (effectively, 35 factors (1–9, A–Z) available for dividing any and every class); by careful allocation of the notation to the classes to reflect the weight of literature to be accommodated (although his assignment of notation to the physical sciences and technologies is somewhat small by this measure); and by the frequent and deliberate abandonment of “expressiveness” (i.e., the quality of conveying hierarchical relations by length of number). An extreme example of the last item would be Bliss’s use of a shorter number for a subclass than for the containing class where the weight of literature justified this (Table 2).

A third way in which Bliss sought easily grasped notation is his likened use of literal mnemonics where these are obtainable without sacrifice of desirable order; e.g., AL, Logic; AM, Mathematics; BD, Dynamics.

3. The hospitality of the notation (its ability to accommodate subdivisions wherever called for) is achieved by the radix fraction principle (cf. the arithmetical notation of the Library of Congress), by the deliberate refusal to seek expressiveness (so that growth is not inhibited by what the class number *looks* like), and by extensive use of the principle of faceted notation (i.e., using distinctive symbols to show the conjunction of different facets, thereby allowing the independent expansion of each facet). This latter is seen in the provision for “composite specification,” or “synthesis,” as it is perhaps better known.
4. Composite specification^[10] is achieved by a number *systematic schedules* (over 50, if the adaptations of particular schedules are counted as separate ones). Like the Auxiliary Tables of the UDC, which perform the same function, they are of two kinds—general (i.e., applicable to any class) and special (i.e., applicable only to a limited number of classes).
5. Of the former, *Schedule 1* provides for *form divisions*, using numerals, e.g., F1 dictionary of botany, F2 bibliography of botany. *Schedule 2* provides for *place divisions*, using lower-case letters, e.g., HOd hospitals in Europe, HOe hospitals in the U.K., HOed hospitals

in London. It should be noted, however, that in some classes (e.g., social–political history L–O) special provision is made for Place and Schedule 2 does not apply. Also, numerals may be used as an alternative to lower-case letters.

Schedule 3 provides for *language divisions*, using capital letters, e.g., XRY, M translations of Portuguese literature into English, XRY,P into Polish. Strictly speaking, this schedule is not general in that it is normally used only in conjunction with areas such as literature and philosophy, but theoretically it may be used to indicate the language of the document in any class. *Schedule 4* provides for *period divisions*, using capital letters, e.g., TU3A taxation in the ancient world, TUJ3N income tax in the nineteenth century. Again, in some classes (e.g., literature) special provision is made for period divisions, and these *Schedule 4* divisions do not apply.

6. Of the special systematic schedules, *Schedule 13* (for subdivision under any disease) is fairly typical. It includes, D diagnosis, ,e Etiology, ,n Therapeutics; these, added to the class number for a disease (e.g., HPSM epilepsy) give, say, HPSM,E etiology of epilepsy; HPSM,N therapy of epilepsy, and so on. In most cases, further detail may be obtained by drawing on the general tables, e.g., HN in therapeutics (general) and HNY is psychotherapy; the terminal “Y” may be added to the “N” from the systemic schedule to give HPSM,NY psychotherapy of epilepsy.
7. Some of the systematic schedules have extensive adaptations for particular needs, e.g., in Class J education one schedule has special adaptations for a number of different types of school. Or, in philology, schedules provide for division by linguistic factors (e.g., ,G grammar), by literary form (e.g., ,Q drama) and for arranging material under any given author; also, adaptations are made to allow fuller detail under the major literary languages.
8. If necessary, elements from several different systematic schedules can be added to a class-number. Confusion as to what schedule a given element comes from is avoided by following Bliss’s advice to introduce capitals from *Schedule 3* by the number “4” (from *Schedule 1*) and capitals from *Schedule 4* by the number “3” (from *Schedule 1*). *Schedule 1* and 2 cannot be confused since they use distinctive symbols (numbers and lower-case letters). This allows the letters from special systematic schedules to be added immediately after the comma (and sometimes even this comma may be dispensed with; e.g., MU social–political history of United Kingdom (U.K.); MUE economic history of U.K.).

Table 2

AZ	Physical science in general
B	Physics

As an example of what a sequence in a catalog or bibliography organized by BC looks like, using these various forms of composite specification, below is a selection

Table 3

UVP	Paper technology
UVP2	Bibliography
UVP3	History
UVP3K	18th century
UVP4e	United Kingdom
UVP4eK	18th century
UVP-UTT	<i>effect of Printing trade</i>
UVP,B	Research
UVP,C	Chemical/Physical studies
UVP,K	Manufacture of paper
UVP,R	Marketing
UVP,R,B	Research
UVPA	Rag papers
UVPI	Newsprint paper
UVPI,C	Chemical/Physical studies
UVPI,C,B	Research
UVPQ	Paper boards: Cardboard, etc.

of headings from Class UVP paper technology (for which a special Schedule 21 is available, as it is for all other industries in classes US–UW). This also demonstrates the *filing order* of the different symbols used in the BC notation (which is: 1–9; a–z; –; A–Z) (Table 3).

A–Z Index

Bliss provided an alphabetic relative index to the BC, printed conveniently in a separate volume and comparable in detail to the fullest relative indexes to the Dewey classification, containing about 45,000 subjects. While it is obviously the product of great care and industry, it suffers (as do the alphabetic indexes to the Library of Congress classification) from a failure to appreciate fully the dual role of the A–Z index, which is both a rapid key to the location of classes (using the *names* of subjects as entry) and as a complement to the systematic order in displaying relations between classes (i.e., indicating “distributed relatives”). Consequently, the direct alphabetic approach is constantly undermined by needless classification; for example, under the entry

Railroads, railways TNP : UHL

there are some 80 terms listed, each with its separate number(s), e.g., Accidents UHV; Transportation TNP. Yet all but four of these are subclasses of TNP or UHL (the economic and engineering aspects of railroads, respectively) and would be located very quickly by scanning the *systematic* display of them in the schedules or classified catalog. Moreover, not all of them are repeated under their direct alphabetic form (e.g., soils), so that a searcher for other contexts of these classes (e.g., other contexts of soils) would not find them.

To put the matter in another way, Bliss was unfortunately not aware of the substantial economies and

improved efficiency of access possible here by the use of chain procedure.

Weakness of the BC

The BC was largely the work of one man. Although Bliss received assistance from a number of librarians and subject specialists, the BC was overwhelmingly the product of his own exertions (even physically, in that the schedules are reproduced by photolithography from his own typescript). It is not surprising that there are some flaws of detail in the BC; what is surprising is that there are relatively so few.

The most serious weakness is undoubtedly the same one that marks every other general system apart from Colon, and that is the failure to observe strictly the fundamental rule of classification, which is to apply one principle of division only at a time and to exhaust it before applying another. The modern name for this is, of course, facet analysis, and it is rather sad that Bliss developed his great work just a little too soon to allow it to benefit from the rigorous methods of analysis and synthesis that Ranganathan was developing in his Colon classification. In a number of classes in the BC the facet analysis is clearly imperfect, e.g., in the systematic schedule 21 (applied to paper technology above) may be found (Table 4).

Although this reflects roughly the order in which a technology might operate, it produces an unhelpful mixing of technical and economic problem. The operations facet, for example, begins at ,E with the general technical operation of engineering, changes to a sequence of economic and business operations, is dropped to introduce another facet—that of product—and then returned to at ,R marketing, and so forth. The enumeration of terms such as deterioration, repair (under ,E) means that an implicit facet (processes and operations on agents of production) is being tied to a particular class (here, the agent, plant and machinery) when in fact it might easily occur in the

Table 4

,D	Materials, Raw or Crude Acquisition. . . . Import. . . . Properties. . . . ; Analysis, Testing, etc.
,E	Technology (general), Engineering, and Equipment Plant. . . . Power, Fuels; Machinery. . . . ; Deterioration, Repair
,F–,J	Business: Organization. . . . Management. . . . Personnel. . . . Safety. . . . Insurance. . . . Finances. . . .
,K–,N	Production: Manufacture. . . . Special methods. . . . Patents. . . .
,O–,Q	Products and By-products Properties. . . . Testing. . . . Substitutes. . . .
,R–,S	Markets. . . . Merchandising. . . .

literature compounded with other classes (e.g., deterioration of raw materials). Other classes belonging to this facet (processes and operations on agents of reproduction) are analysis and testing; these are enumerated under ,D and ,O—but not under ,E, say, or ,Q, where they might easily occur.

Lack of thorough facet analysis not only reduces the hospitality of the system but also introduces a lack of predictability for the indexers. Where would marketing personnel go—in ,R marketing or ,G personnel? Where would safety regulations for plant go—in, plant or ,H safety. Also, because of unnecessary repetition (as testing above) the economics in schedule display implicit in composite specification are not fully utilized.

Bliss's failure to appreciate fully the need for stringent facet analysis is also apparent in his discussions of, say, subordination. He tended to see this vital principle primarily as a problem of general-before-special sequence and of collocation between major areas (e.g., the subordination of psychology to anthropology). But every bit as important is the collocation *within* classes (large or small), which is determined largely by the citation order of facets, e.g., whether, in the subject of librarianship itself, college library cataloging is subordinated to the library service (college) or the library operation (cataloging). Consistency, to give predictability in searching, in this matter is very difficult without explicit recognition of facet structure.

However, this weakness in BC is one common to all the major "enumerative" systems, and, what is more significant, is the degree to which Bliss did in fact achieve consistent and thorough analysis. In many classes the demands of composite specification led to just this, e.g., the whole of the large philology class reflects it very clearly indeed.

A weakness of another kind in the BC is the lack of detail in certain class, notably some of the physical technologies. While it is rarely less detailed than the Decimal Classification of the Library of Congress (and the large synthetic element of BC must be remembered here since it greatly enlarges its range of specification), the BC falls well short of the UDC in these areas, despite its extensive provision for synthesis. However, this shortcoming is being remedied by the current program of the *BC Bulletin*.

Present Position

The BC is maintained via the *Bliss Classification Bulletin*.^[6] The first issues were edited by Bliss himself. On Bliss's death, in 1955, British librarians using his scheme cooperated to form the British Committee for the Bliss Classification, and Dr. D.J. Campbell took over the Hon. Editorship of the *Bulletin*, which the H.W. Wilson Company continued to publish and distribute free to all users of the scheme until the stocks of the present edition of the BC

were exhausted. In 1967 the H.W. Wilson Company handed over the publication of the *Bulletin* to the British Committee (which reconstituted itself as the Bliss Classification Association), vesting full copyright of the classification in them.

The BC is now (1968) out of print, although available in xerographic reprint form from University Microfilm, Inc. (313 North First Street, Ann Arbor, Michigan).

Meanwhile, the current program of the annual *BC Bulletin* is to provide, together with simple amendment by addition of recently developed terms, substantial revisions of complete classes, particularly in those areas of science and technology in which the BC has so far lacked detail. In issues of the *Bulletin* detailed schedules have appeared for such classes as electronics, oceanography, automatic control and control devices, nuclear reactor engineering, sound reproduction and recording, astronautics, microchemical analysis, physics and chemistry of the atmosphere, food preservation, operative surgery, child hygiene and care, gardening and fruitgrowing, solid state physics, physical and chemical metallurgy, printing, and so forth.

CONCLUSION

To their reader, most libraries serve primarily as self-service stores of information, in which the *order* of the material is the major index to its content. The efficiency of the day-to-day retrieval is closely affected by the quality of the collocation in that order. The same holds, though to a somewhat lesser degree, with library catalogs and bibliographies. On this score, the BC is without a doubt the best general classification we have. Not merely is its basic pattern superior, but the flexibility to special needs, which is one of its main features, ensures a particularly appropriate order if a local variant is called for. Moreover, the notation which maintains its order is of exceptional brevity and is often highly mnemonic, too. As a system for organizing catalogs and bibliographies, the relative lack of detail in some classes is a drawback, but this is now being remedied.

The main handicap to the wider use of the BC has been, on the one hand, the inertia inevitably associated with existing collections, in which the cost of changing systems is considerable, and, on the other, the administrative advantages enjoyed by the Decimal Classification and the Library of Congress by virtue of their facilities for centralized classification and substantial day-to-day maintenance. These are real disadvantages the BC offers for many kinds of libraries, and it is fitting to end with a categorical assertion by a former editor of the *BC Bulletin*, Dr. D.J. Campbell: "...it is the best scheme for any but very large general libraries, and for many special libraries, while it lends itself to the modifications which every special library needs."^[11]

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Bliss Bibliographic Classification Second Edition

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Abstract

This entry looks at the origins of the *Bliss Bibliographic Classification* 2nd edition and the theory on which it is built. The reasons for the decision to revise the classification are examined, as are the influences on classification theory of the mid-twentieth century. The process of revision and construction of schedules using facet analysis is described. The use of BC2 is considered along with some development work on thesaural and digital formats.

INTRODUCTION

The Bibliographic Classification of Henry Evelyn Bliss (BC1)^[1] was the last of the significant general classifications to appear, and was hailed by many as the best constructed and most scholarly of them all, “the fine flower of the enumerative period.”^[2] Despite that label, it included many facilities and devices for synthetic classification, what Bliss called “composite specification,” or the expression of complex subject content by the building of compound classmarks. Conceptually and structurally BC1 forms a bridge between the great enumerative library classifications of the nineteenth and early twentieth century, the Dewey Decimal Classification and the Library of Congress Classification, and the scientifically structured retrieval tools of the later twentieth century, such as Colon Classification.

BC1 was adopted by many academic and special libraries, particularly in the United Kingdom and the British Commonwealth, although it was not implemented anywhere in the United States, other than Bliss’s own library at the College of the City of New York, where it had originally been developed and tested. When the time came to produce a substantial revision of the classification it was BC1’s British user base which took up the task, and utilized the opportunity to make the 2nd edition a fully faceted classification scheme, the only general scheme of its kind other than Ranganathan’s own Colon Classification. The way in which faceted classification theory is married with the scholarly structure of Bliss’s original scheme is described below under the following heads:

Background and context of the 2nd edition.

The relationship of BC2 to the original Bibliographic Classification.

Facet analysis and information retrieval.

Structural principles of BC2.

The use of BC2 today and developments for the future.

BACKGROUND AND CONTEXT OF THE SECOND EDITION

Bliss was virtually the first theoretician of bibliographic classification, writing in the period immediately before Ranganathan, and establishing very many principles of knowledge organization that are still considered significant today. These include the need to relate documentary classification to the consensus of informed opinion about the nature and structure of subject fields (scientific or educational consensus), and the way in which the whole of knowledge can be reduced to linear order through philosophic or logical method (principles of general-before-special and gradation in specialty). Features of the original classification, its main class order, the presence of systematic and special auxiliaries, the use of systematic and literal mnemonics, the facility for synthesis, the flexibility of its alternative arrangements, and its inherent hospitality to new subjects, are all highly desirable features in a classification and are still so regarded today.

Nevertheless the classification, which was a long time in the gestation period, lacked any mechanism or financial support for the revision and maintenance so clearly required, even by the time of the publication of the final volumes. The first outline of the scheme had been published in 1910 (*Library Journal* 35(8), 351–358), and an abridged version in 1935 (*A System of Bibliographic Classification*; H. W. Wilson: New York). In the years immediately following the publication of BC1, updates and amendments were published in the *Bliss Classification Bulletin*, then under the editorship of H. E. Bliss himself, but after Bliss’s death in 1955 there were no obvious authorities appropriate to the intellectual work of maintenance, and the outlook for the long-term continuation of the system appeared bleak.

British librarians had long been supportive of the BC, and Bliss, in correspondence with a number of them during the period of its creation, acknowledged the part that

they had played in the development of the scheme. BC1 was warmly received in the United Kingdom, and its British advocates did much to promote its uptake both in the United Kingdom and overseas. In 1956 a new British Committee had been elected, and in 1960 Jack Mills became Chair of that Committee and Editor of the *Bliss Classification Bulletin*. In 1967 the Bliss Classification Association (BCA) was formed, again with Jack Mills at the helm, and, as at the time there were no users of BC1 in North America, H. W. Wilson, the publishers of the original scheme, passed all rights in the classification and the *Bulletin* to the BCA, who have remained the copyright holders ever since. The BCA also accepted responsibility for the maintenance of the scheme, and under the guidance of an executive committee, many small-scale revisions and amendments were published during the 1960s, via the medium of the *Bliss Classification Bulletin*.

By the late 1960s it was clear that this piecemeal revision (mainly consisting of the addition of new concepts) was not adequate for the continuation of BC as a viable system, and that more wide-ranging and more radical revision was required. A program was drawn up for such substantial revision, under the editorship of Jack Mills, and based at the School of Librarianship, Polytechnic (later University) of North London, work beginning on the revision in 1967. The revised classification was to be published by Butterworths in Great Britain as the *Bliss Bibliographic Classification 2nd Edition* (BC2), and although the original plan was for a single three-volume work, it was subsequently decided to publish in parts, each consisting of a discrete subject area. The first revised schedules appeared in 1977 (Introduction and Systematic Auxiliaries) and were closely followed by classes for Religion, Social Welfare, Psychology, Education, and Health Sciences. Since the 1970s further volumes have been published for Mathematics, Philosophy, Sociology, Politics, Law, Economics and Business, General Science and Physics, and most recently, the Fine Arts. Social welfare and Education are now in the 3rd edition. Current work is in the areas of Chemistry, Technology, and Music.

RELATIONSHIP OF BC2 TO THE ORIGINAL CLASSIFICATION

Since BC1 was in use in a number of libraries, the extent of the revision was a significant issue. A memorandum was prepared for consideration by the members of the BCA, and published in the *Bulletin* of 1969. Two aspects of the classification were in question: the level of detail in the vocabulary, and the internal structure of classes. It was felt that the vocabulary of BC2 should be at least equivalent to that of the Dewey Decimal Classification and the Library of Congress Classification. Since some specialist libraries used BC1 there was a potential need for a vocabulary comparable to the Universal Decimal Classification,

but this was not considered an achievable objective; there was an expectation that the facilities for synthesis would go some way toward implicit provision for complex topics.

Altering the structure of the classification was a greater problem since the consequences of such changes were more serious. It was agreed that Bliss had intuitively applied much of the new classification theory, and that the scheme largely met the requirements of a modern system. The overall order was excellent, and the internal facet structure was often correct; auxiliary schedules and other devices for synthesis allowed for the expression of complex subjects and the scheme was hence hospitable to new topics. However, it was also the case that in some classes the facet structure was inconsistent and the analysis imperfect. It was decided that, despite the undoubted inconvenience to users, correcting these faults would give the classification greater long-term stability, and reduce the need for frequent revision in the future.

The overall broad structure of the classification (much admired and generally agreed to be the best of any general scheme) would remain intact; new (particularly) scientific subjects, such as space science and cybernetics, were to be added at the appropriate place in the order, and the anterior numeral classes, previously used mainly as form classes, would accommodate a discrete classification of phenomena, allowing for the easier management of cross-disciplinary and interdisciplinary works. Bliss's provision of alternative locations would be built upon and extended, to allow, for example, the location of all technologies in Class U, and a unitary class for geography in Class D. The internal structure of classes was to be made consistent with the methods of faceted classification, which would import a degree of rigor in the analysis which was in parts lacking in BC1, and would ensure uniformity in the application of citation order, filing order, and the procedure for synthesizing classmarks. This process is described in detail below.

FACET ANALYSIS AND INFORMATION RETRIEVAL

Facet analysis was conceived by S. R. Ranganathan during the 1920s and 1930s, and formally disseminated in his works of classification theory,^[3] and the Colon Classification.^[4] While the Colon Classification was virtually never applied in Britain, Ranganathan's ideas profoundly influenced British librarians (The library of Christ's College Cambridge is a notable exception but in 2007 it is now almost completely replaced by the Library of Congress classification.) During the 1950s and 1960s much research and development work was carried out in the area of faceted classification and information retrieval, and many significant works in the field were published. The focus of most of this activity was the Classification

Research Group (CRG), founded in 1952, to which many of the leading lights of the age belonged, and which served as a forum for the discussion of these ideas. The CRG was committed to the concept of faceted classification as a unifying theory for information retrieval and the design of information retrieval tools, and in 1955 published what may be regarded as a manifesto for facet analysis.^[5]

During the 1960s work by the CRG on a new British general classification scheme funded by a grant from NATO^[6] failed to come to fruition, although much of the conceptual work can be discerned in the PRECIS system of indexing developed for the British National Bibliography by the principal researcher, Derek Austin.^[7] Nevertheless, the Group retained its interest in a general classification, and in 1963 held a conference to consider various aspects of this.^[8] Within this context the revision project of BC2 was seen as an ideal opportunity for the incorporation of many of the theoretical principles of the facet-analytical school in a large general classification. As a consequence BC2 became identified to some extent with the new general classification scheme long envisaged by the CRG, and embodying theoretical principles and structure in a way that no universal system of classification (with the exception of Colon Classification) had ever done before. While maintaining and preserving the central features of the original classification, and the general infrastructure of that system—the main class order, broad order within classes, literal notation, and principal mnemonics—the new schedules incorporated all the aspects of modern classificatory theory—rigorous and logical analysis into facets and their constituent arrays, the imposition of a consistent and predictable citation order via the medium of an inverted schedule, a theoretically limitless capacity for synthesizing compound subjects, and the use of a retroactive notation dispensing with the need for facet indicators and greatly simplifying the process of classmark construction.

Since the beginning of the BC2 project CRG meetings have provided a major forum for the discussion of draft schedules of BC2 and debate about the implementation of facet theory in them. Individual members of the CRG have also made a significant contribution to the creation of schedules, notably Eric Coates, Douglas Foskett, and Derek Langridge.

STRUCTURAL PRINCIPLES OF BC2

Main Class Order

In most of its particulars BC2 conforms to the model of a modern general classification scheme on the faceted pattern. The main features of a bibliographic classification scheme in general and those of BC2 in particular are set out in much greater detail in the introduction to BC2,^[9] but a resumé of the core principles is provided here.

It is often said of traditional library classifications, in contrast with automatically generated vocabularies, or with the recent phenomenon of social classification, that they are “top-down” classifications, since they are generated by dividing and subdividing knowledge as a whole. In all existing general schemes the primary step of division is into disciplines, or major subject fields, known as main classes.

The order of the main classes in BC2 follows that of Bliss’s original scheme; this has been widely regarded as the best and most helpful main class order of all the general systems of classification, based as it is on both philosophical principles and educational consensus (that is the perception of interdisciplinary and intersubject relations from the academic viewpoint, and reflecting academic study). The order follows a logical developmental sequence often regarded as consistent with integrative level theory.^[10] This was a scientific theory concerned with the basis of natural order, which was subsequently much used in the social sciences and as part of organization theory; it proposed that entities could be ordered in terms of a series of levels each of which was structurally dependent on the previous level. From a disciplinary point of view, physics, for example, should precede chemistry, since chemical substances were “dependent” on the forces and fundamental particles of physics; similarly chemistry should precede mineralogy and geology where the “simple” substances of the former are aggregated into more complex materials. Such a theory provides an excellent basis for the ordering of disciplines and produces an almost identical result to Bliss’s gradation in specialty order of main classes.

In comparison, BC2 starts with mathematics and the physical sciences, progressing through the biological sciences, with increasing complexity of organisms, to mankind, as represented by anthropology, medicine, and psychology. The study of society, sociology, is collocated with various aspects of human social activity, education, religion, politics, law, commerce and technology, and the whole is rounded off with the higher intellectual activities of man, music, the arts, and literature, culminating in bibliography and library science. In addition to the natural progression of this sequence, the order gives rise to natural academic groupings of subjects, the physical, and biological, sciences, medical sciences, social sciences, commerce and industry, and the arts.

Main Class Order in BC2

A–AL	Philosophy
AM–AX	Mathematics
AY	General science
B/D	Physical sciences
B	Physics
C	Chemistry
D	Astronomy and the earth sciences

(Continued)

Main Class Order in BC2 (Continued)

E/G	Biological sciences
E	General and microbiology
F	Botany
G	Zoology
H/I	Human sciences
HA	Anthropology
HB/HZ	Medicine
I	Psychology and psychiatry
J	Education
K	Sociology
L/O	Historical ancillaries and history
P	Religion
Q	Social welfare
R	Politics and administration
S	Law
T	Economics, business, management
U	Technology, industry, manufacturing
W	Fine arts: art, architecture, music
X/Y	Language and literature
Z	Bibliography

While BC2 shares with the other schemes this initial division into disciplines, subsequent organization of the subject proceeds on a very different basis from the traditional serial subdivision into smaller and more specific classes on more or less pragmatic grounds.

Facet Analysis and Fundamental Categories

A fundamental feature of a faceted classification is that its classes consist of individual concepts, rather like elementary particles in Chemistry, which are combined to express the more complicated subjects of actual documents, as elementary particles are combined to make molecules. Ranganathan himself compared the faceted classification to Meccano, an engineering toy consisting of individual struts, blocks, and wheels which can be combined to create simple machines; its modern equivalent is the Danish building block toy, Lego.

The internal structure of a class is determined by the process of facet analysis, or the allocation of the individual concepts to a set of categories or facets. The conventional definition of a *facet* is the total set of concepts, within a given class, produced by the application of one broad principle of division. Therefore, if a class such as agriculture is divided by the principle of *place*, concepts (or subclasses) such as England, Montana, Bolivia, uplands, forest, coastal regions, etc., are generated. This process can also be viewed as happening in the reverse manner, in that appropriate concepts are aggregated into facets labeled with the principles of division. For that reason, a faceted classification can be regarded as a “bottom-up” classification, that is, one in which individual concepts are grouped or categorized to build the classificatory structure from its component concepts.

Ranganathan identified five *fundamental categories* into which the concepts within a class would be sorted: personality, matter, energy, space, and time. In the Colon Classification these categories often have to do double duty, so that there may be two energy facets, or two (or three) personality facets, in a given subject. Work by the CRG in the 1960s made finer distinctions between categories, so that a set of 13 were eventually agreed on, as can be seen in the work of Vickery,^[11] Foskett,^[12] Langridge,^[13] Mills,^[14] and others. They form the basis of all analysis of concepts in BC2, and are as follows:

Thing: sometimes called **entity**, this is equivalent to Ranganathan’s personality category; it applies to the principal focus or object of interest of any discipline (plants in botany, substances in chemistry, nations in history).

Kind: this accommodates concepts in a genus–species relationship with **thing**, and contains general broad groupings of concepts (e.g., wind instruments, as **kind of thing** musical instruments) as well as specific subclasses (e.g., oboe as **kind of thing** wind instrument).

Part: constituents and subsystems of concepts in the **thing** category (e.g., **thing** vehicle has **parts** chassis, wheels, brakes; **thing** animal has **parts** legs, brain, skin). A separate **part** category only be considered legitimate if its members are in a part–whole relationship to all (or most) members of the **thing** category.

Material: this category is equivalent to Ranganathan’s matter category, and is represented by gross materials, constituents and elements; it is more fundamental than **part** (e.g., a **thing** house, has **parts** roof, walls, windows, basement, consisting of **materials** timber, brick, tiles, glass).

Property: properties and attributes of concepts in the **thing** category.

Process: the first of two energy, or activity categories, **process** refers to inherent and self-initiating actions within **things**—actions that “happen by themselves.” Examples are usually intransitive verbs (or noun equivalents), such as growth, change, disease, and flow.

Operation: these are actions which are performed on a **thing** by an external **agent**. Examples are usually transitive verbs, such as testing, building, mining, and harvesting.

Product: outcomes or results of processes within, or operations on, **things**; they usually occur as actual physical products in technologies; for example, food, drugs, or textiles in agriculture and horticulture.

By-product: another similar, self-explanatory, technological category.

Patient: the object acted on, when this is other than members of the **thing** or **entity** category, as is most usual. Instances are again largely technological; for example, in engineering, blanks (**patient**) may be stamped (**operation**) into components (**part**) for machines (**thing**).

Agent: the means by which **operations** are performed, **agents** may be either persons (or organizations of persons), or tools/equipment. Both categories of agents may occur simultaneously; for example, in medicine a surgeon (**person agent**) may excise tissue using a laser (**tool agent**).

Space: any region defined by political, administrative, physiographic, or other spatial properties (e.g., Hong Kong, Australasia, city, mountains, interior).

Time: any historical period, or concept defined by temporal properties (for example, Medieval, summer, nocturnal, permanent).

These 13 categories have been found to deal adequately with the vocabulary of a wide range of subjects, although it is usually the case that for a particular subject, only a smaller subset of categories is actually required. The complete range is probably only utilized within technological subjects, and modifications to the standard ones are found in some disciplines (notably the arts and humanities). When a particular *category* is identified within a subject, its members constitute a *facet* in that subject for example, the category of *things* or *entities* in zoology is known as the *organisms* facet, and the category of *processes* in pathology is the *disease* facet.

Organization within Facets

In the majority of subjects the number of concepts within a facet will be large, and some further means of organizing them must be found. This is done by identifying groups of concepts that share a particular defining attribute. For example, within sociology concepts in the persons facet may be divided into groups characterized by age (children, adolescents, old people), by gender (male, female), by ethnic origin (Afro-Caribbean, Caucasian, aboriginal), or indeed by a range of other properties. These groupings are called *arrays* and the defining attribute is called a *principle*, or *characteristic*, of *division*.

For example, in Class Q, Social Welfare, the facet "Persons in need" is organized into arrays by several principles of division, as shown in the (abridged) section below.

QG	Persons in need, Causes of need (Types of persons)
	(Defined by events, conditions)
QGN	Emergencies, disasters

QGN G	Victims, refugees
QGN J	Evacuees
QGO B	Prisoners of war (By social conditions)
QGP	Deprivation Poor Unemployed (Persons by age)
QL	Minors, children
QLV	Elderly, aged (Persons by disadvantage)
QMT	Physically disabled Blind

Order in Array

The sequence of the different arrays within a facet, and the sequence of the classes in individual arrays (order within array) are not usually based on any specific principles, although sometimes there are obvious orders to be employed (such as chronological, developmental, or spatial sequences). Ordinarily, order within arrays, and also between arrays, is not subject to any theoretical rules, but is decided pragmatically, as in this list of prisons from BC2 Class Q, which uses the degree of security as the basis of arrangement:

QQS K	Types of prisons
QQS M	Maximum security
N	Medium security
P	Minimum security, open prisons
R	With semiliberty (living in institution, working outside)
S	With restricted liberty (living at home, working at institution)

Order by degree of security in BC2 Class Q

Citation Order and the Combination of Concepts

A second fundamental characteristic of the faceted scheme, after its structural organization, is the system syntax, that is, the rules for combining basic concepts to express the content of documents, which is usually more complex. In any indexing or classification system that allows the building of classmarks or headings, the order in which concepts are combined is known as the citation order. In BC2 this is linked to the standard categories used to create the facets, and is known as standard citation order. A compound subject consisting of terms from more than one category combines them in the order of the standard categories as discussed above, that is, thing-kind-part-material-property-. . .-agent-place-time. For example:

Hospitals—emergency—fittings—procurement—UK
(thing) (kind) (part) (operation) (place)

The order of fundamental categories in the citation order is determined by Ranganathan's principle of decreasing concreteness, and also by the principle of dependency of succeeding facets. This proposes that a thing must exist in order for its kinds and parts to exist, and that an operation must have something to be performed on, and that an agent must have an action to be agent of.

In BC2 the structure does not require that all things are located in a single facet, or all operations, or all agents (a pure faceted structure). In practice the citation order can be introduced at any point. For example, in aeronautical engineering, the wing is part of the aircraft, but can itself have kinds for example, delta, and parts, for example, ailerons; likewise a process may have stages, or parts, for example, digestion has parts ingestion and peristalsis. The structure of BC2 can therefore become quite complex as this example shows:

HUH	Heart	=(Part)
HUH FP	(Treatment)	=(Part + op.)
HUH FV	Drug therapy	=(Part + op. + agent)
	(Disorders)	=(Part + process)
	(Physiology)	=(Part + process)
HUH	(Disorders of	=(Part + pro.1 + pro.2)
OX	heart physiology)	
HUH	Arrhythmia	=(Part + pro. + pro.
OXJ		+ kind)
HUH	(Drug therapy)	=(Part + pro. + pro.
OXJ FV		+ kind + op. + agent)

This example also demonstrates the practice in BC2 of incorporating many compounds into the facet structure to ensure that sought terms will appear in the schedule, and hence in the index.

Filing Order and Schedule Inversion

In addition to the organization of concepts into facets and arrays, and the order of concepts within the facet, it is also necessary to provide rules for the order of facets within the class as a whole. This order is known as the filing order, since it determines the linear sequence of classes on the library shelves or in the classified file.

In BC2 the filing order begins with the most abstract facet (time) and progresses toward the most concrete facet (thing). This concept of increasing concreteness produces an order of classes which looks natural and which appears to be intuitive to users. Because this is the inverse of the citation order, such a classification schedule is known as an inverted schedule.

J	Education	
J7	History of education	(Time)
J8	Education by place	(Place)
JE	Psychology of education	(Process)
JF	Educational performance	(Process)
JG	Students, pupils	(Patients)
JH	Teachers	(Agent)
JI	Teaching methods	(Operation)
JK	Curriculum	
JL/JV	Educands and educational institutions	(Thing/kind)

Inverted schedule in BC2 Class J

The principle of inversion is not essential to a faceted classification, but it makes the filing order much more logical when compound terms are added. We can see this in a very simple classification for history consisting of two facets (place and time) where the citation order is place-time:

History	
England	(Facet 1)
France	
Germany	
Fifteenth century	(Facet 2)
Sixteenth century	
Seventeenth century	

If some compound classes are now added, as will happen when the classification is applied to real documents, and the results filed, the following will occur:

History	
England	
Sixteenth century England	
France	
Fifteenth century France	
Germany	
Seventeenth century Germany	
Fifteenth century	
Sixteenth century	
Seventeenth century	

In this arrangement the specific classes of, for example, sixteenth century England and fifteenth century France, precede the general classes fifteenth century and sixteenth century. This is counterintuitive for the majority of readers who expect general classes to come before subdivisions of those classes, and, as the complexity of subjects is increased the confusion and illogicality of the filing order would also increase.

The situation can easily be remedied by inverting the facet order, so that the first cited facet files last:

History	
Fifteenth century	(Facet 2)
Sixteenth century	
Seventeenth century	

England	(Facet 1)
Sixteenth century	
France	
Fifteenth century	
Germany	
Seventeenth century	

It is not essential to invert the schedule, and in a digital environment where there is no linear ordering it may not offer any advantage, but where items are to be organized in a sequence it makes for a much more logical and natural arrangement. Because in BC2 the citation order is built into the schedule, this has the added advantage of making analysis and classmark building much easier for the classifier, since it is necessary only to combine the elements of a compound in the reverse order of their appearance in the schedule.

Notation

The original literal notation of BC1 has been preserved in the broad structure, since letter notations have several advantages. The notational base is large, and shorter classmarks can be achieved using letters. Because there are 26 letters, a two-character combination provides 26×26 classes (= 676) as opposed to 100 for numerals; at the four-character level, which is most often used for a broad arrangement of books, the difference is 456,976 to 10,000. Obviously a much greater depth of classification can be provided for within the same notational provision. Literal mnemonics, the creation of correspondences between letters in the terminology and letters in the notation, can also be used to advantage, for example, C for chemistry, CE for electrochemistry. As in BC1, the BC2 notation is nonexpressive and neither reflects the degree of hierarchy in the length of the notation, nor indicates the subordination of one class to another.

BTK	B	Bodies in gas flow
BTK	BBG	Control forces
		(parts)
BTK	D	Surfaces
	DR	Holes
		(types of bodies)
BTK	F	Streamlined bodies
	G	1-dimensional bodies
	H	2-dimensional bodies
	J	Manifolds
	L	Conduits, ducts
	N	Channels
	P	Closed conduits

In order to build compound classmarks BC1 uses the comma (to introduce auxiliary schedules peculiar to a subject), and the hyphen (to join classmarks between different classes). In BC2 the notation is used in a more sophisticated way to effect classmark synthesis without

the need for such facet indicators. This device, namely retroactive notation, is, like the citation order, incorporated into the schedule, and it further reinforces the mechanical process of classmark building.

The device operates by “reserving” blocks of notation under each class for the direct addition of any preceding classes. No facet indicators or linking devices are required, since notational conflict is avoided by the appropriate assignment of notation by the schedule compiler. The indexer simply adds together the notational codes for the constituent elements of his concept analysis; since this must be, by definition, done in the reverse of schedule that is, alphabetical order, this also serves to correct any errors in citation order made by the user.

Practical Classification in BC2

Classmark synthesis is achieved in BC2 by two methods. In most cases direct retroactive number building is used, as demonstrated in example 1 below. On occasion, where there is great pressure on the notation (because of the sheer size of the vocabulary), this may be eased by the introduction of an intercalator; this is a “peg” on which to hang synthesized numbers; an example of the use of the intercalator is given at example 2.

1. Normal retroactive building of classmarks within a main class involves the direct addition of notation for a previously scheduled term, dropping the main class letter from the added term.

B	Physics
B7H	Visualization and imaging
BAF	Energy interactions and forces
BF	Waves
BFT	Scattering
BJ	Magnetism
BM	Particles

All classes preceding BM can be directly added to that class, dropping the initial letter B.

BM7 H	Imaging of particles
BMF T	Scattering of particles

2. In some places, intercalators are employed to extend the capacity of the notation. In such cases, notation is added to a specified base letter, rather than directly. For example:

BB	Mechanics
BBB T	Kinetic energy
BDC	Velocity
BDM	Circular motion

BF	Waves, wave motion *Add to BFA letters A/DR following B
BFA BBT	Kinetic energy of waves
BFA DC	Velocity of waves
BFA DM	Circular motion of waves

Here previous classes are added to the intercalator A, rather than directly to the class BF. Use of the intercalator is always made explicit by instructions in the schedule, and should not be used other than in compliance with these.

THE USE OF BC2 TODAY AND DEVELOPMENTS FOR THE FUTURE

Although the scheme is envisaged as a general scheme suitable for large document collections, the take-up of BC2 has been largely among special libraries. The new scheme offers a level of detail in its terminology, and a capacity for synthesis that is particularly appropriate for collections of highly specialized documents, and in some disciplines there are no comparable indexing languages, either general or special. This is particularly true for Social welfare and related subjects where adoption of BC2 has been most widespread. Of recent times it has also been applied in a number of medium sized academic libraries in the University of Cambridge.^[15] It finds favor in these because of its sound theoretical principles, the visible logic and predictability of its structure, and the close match between its broad structure and the academic understanding of the constitution of subjects.

Most users of BC2 are new to the scheme, and BC1 libraries have not on the whole reclassified to the new edition, probably because the modification of the internal structure and the changes in notation would require both substantial reprocessing of stock and amendment of catalog records. The complexity of BC2 may also be seen as a disadvantage in an age when most UK librarians receive little formal education in cataloging. Over a period of time most BC1 libraries have now reclassified (or are in the process of reclassifying) to either the Library of Congress Classification or the Dewey Decimal Classification. The current emphasis on copy cataloging and the downloading of records in preference to local cataloging effects considerable savings for the majority of general libraries, making it difficult for schemes with a smaller user base to compete. Attempts in the 1970s to persuade the British National Bibliography to include BC2 classmarks were unsuccessful, and it is unlikely that this situation will change in the future.

BC2 also suffers from many of the same disadvantages as the original classification, and has been criticized on that basis. The lack of strong institutional and financial support for the scheme is a major shortcoming, and the

dependence on voluntary input from BC2 enthusiasts makes consistent and systematic maintenance and updating hard to achieve. The lack of salaried staff means that schedule production is a slow process, and this has been exacerbated by the need to reengineer the software that manages the physical generation of the schedules and alphabetical index.

To date, about two-thirds of the classification is published, and the remaining classes exist in draft format. Current plans are to disseminate these drafts on the Association's Website (<http://www.blissclassification.org.uk>) in the hope of providing for the gaps in the available classes, and attracting input from a wider constituency. It is also intended to produce in the near future an abridged version of the scheme (based in part on the unpublished classes) which may have greater appeal, particularly for small libraries, than the full classification, and will also address the problem of the missing subjects. Although completion of the scheme may as yet be some way off, where the necessary expertise is available, some classes (J, Education and Q, Social Welfare) have already been published in a 3rd edition.

BC2 in its inception was intended, like its predecessor, primarily as a bibliographic classification, and an organizing tool for print collections. Nevertheless the physical arrangement of books (and the related ordering of items in catalogs and bibliographies), important as this is, is not the only potential application of the system.

BC2 in a Digital World

There are numerous examples of applications of classifications and other conventional indexing languages to the organization of Web-based resources, and a number of schemes are used to arrange resources on managed sites, in the same way that those same schemes are used to order books on shelves. *EU telematics for research project DESIRE* surveyed the use of a number of existing library classifications for the management of Internet resources, particularly in managed hubs and portals. The results of their investigations can be viewed at <http://www.surfnet.nl/innovatie/desire1/deliver/WP3/D32-3.html>. However, more recent projects have begun to look at the knowledge structures embedded in classifications as tools for handling structural and semantic relations in searching and retrieval. It would appear that the highly structured, rigorously logical and predictable BC2, with its detailed vocabulary, and sophisticated semantic and syntactic relations, should be a frontline contender in any such enterprise. A project funded by the U.K. Arts & Humanities Research Council at University College London looked at the way faceted classification data can be structured and manipulated to deliver some degree of automatic indexing for digital resources.^[16] BC2 vocabularies provided the core subject terminologies, and the results were very encouraging. The regular structure of the classification lends itself

readily to incorporation in a database, where many of the relationships, including the facet status of a concept, can be recorded. This can allow the mapping of a document content analysis or a search query onto the database, and the automatic generation of structured strings using controlled vocabulary and with inbuilt citation order. It did, however, demonstrate that some features of the scheme (such as the alternative locations, the flexibility of the citation order, and the lack of facet indicators) must be sacrificed in order to achieve the regularity of structure that machine manipulation demands.^[17]

Thesaurus Format for BC2

As long ago as the 1980s the potential of BC2's faceted terminology as a source for a thesaurus had been realized and exploited. Jean Aitchison, known for her pioneering work on *Thesaurofacet*,^[18] had written about the process of converting BC2 to a thesaurus,^[19] and had developed a faceted thesaurus for international affairs from the BC2 Politics terminology.^[20] Current work on the classification is investigating the feasibility of publishing future volumes in the form of a joint classification and thesaurus, rather on the model of the *Thesaurofacet*. Music is a suitably straightforward vocabulary, of relatively modest size, and has been chosen as a trial class. To date the computer programs for the classification layout and alphabetical index generation have been extended to support the thesaurus format, and work has proceeded on guidelines for the form of entry of class headings to ensure that these can be converted to thesaurus entries with the minimum of human intervention and editing.^[21] Some difficulties occur as a result of the lack of vocabulary control in the classified structure, but otherwise trials of the software show that structural relationships are relatively straightforward to manage automatically, and that BC2 provides a sound basis for automatic thesaurus generation.^[22]

Influence of BC2 on Other Schemes

It is also clear that the major contribution of BC2 to date lies not so much in its adoption by individual institutions, as in the influence it has had on the development of classificatory theory, and the consequent impact of this on the other major schemes. Particularly this is true of the UDC. McIlwaine, I. and Williamson, N. *A feasibility study on the restructuring of the UDC into a full faceted classification system* International Society for Knowledge Organization Conference 1994 Copenhagen, examines the use of BC2 as a source of facet analytical structure and vocabulary for incorporation into new revisions of the UDC. This theme is further developed in McIlwaine, I. UDC centenary; the present state and future prospects. *Knowledge organization* **1995** 22(2), 64–69. Most other systems now regard some degree of facet structure as necessary in the development of new schedules, and the advantages in

retrieval performance of highly structured and logical systems on the model of BC2 can hardly be disregarded. The gradual spread of the faceted structure throughout an increasing number of retrieval languages must be due at least in some measure to the perceived superiority of this approach, and it seems likely that the published schedules of BC2 have provided a pattern for modern retrieval language construction that is now widely regarded as the archetype of the twenty-first century scheme.

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Boolean Algebras [ELIS Classic]

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Abstract

Boolean algebra, named after the 19th century mathematician and logician, George Boole, has contributed to many aspects of computer science and information science. In information science, Boolean logic forms the basis of most end-user search systems, from searches in online databases and catalogs, to uses of search engines in information seeking on the World Wide Web.

—ELIS Classic, from 1970

INTRODUCTION

In this entry attention is focused on mathematical models of proven utility in the area of information handling, namely, Boolean algebras. Following some general comments concerning mathematical models, particular examples of Boolean algebras, serving as motivation for the subsequent axiomatization, are presented. Some elementary theorems are cited, particularly the very important representation theorem that justifies, in some sense, the focusing of attention on a particular Boolean algebra, namely, the algebra of classes, and applications more directly related to the information sciences are given.

Running the risk of redundancy, attention will be called to an often-repeated observation, but one of extreme importance in applications of mathematics to physical problems. Referring to Fig. 1, it is important to realize that when one constructs a mathematical model as a representation of a physical phenomenon, one is abstracting and, as a consequence, the model formulated is doomed to imperfection. That is, one can never formally mirror the physical phenomenon, and must always be satisfied with an imperfect copy. However, following the initial commitment to a model, the logic that one appeals to dictates the resultant theorems derived within the framework of the model. Of course, the depth of the theorems realized is limited by the sophistication of the model as well as the ingenuity of those who attempt to formulate the propositions within it. After theorems are derived within the framework of the model, they are interpreted relative to the physical situation that motivated the model.

It is not necessary to go very deeply into mathematics before facing the necessity of examining, in some detail, this cycle and developing a feeling for its power as well as its limitations. By way of example, almost any student of calculus encounters, in one form or another, the following problem:

The deceleration of a ship in still water is proportional to its velocity. If the velocity is v_0 feet per second at the time

the power is shut off, show that the distance S the ship travels in the next t seconds is $S = (v_0/k)[1 - e^{-kt}]$ where k is the constant of proportionality.

HISTORY

The desired equation relating the distance traveled to the time is easily arrived at by means of the calculus. However, a close look at the solution reveals a few puzzling aspects. When does the ship stop? The conclusion is that it never stops. How far does it go? The conclusion is that it goes no further than v_0/k , that is, the distance it travels is bounded. Sympathy is due the beginning student of the calculus who is puzzled by these observations, but, too often, we neglect to focus our attention on the source of the puzzlement. It really has nothing to do with the limit process that plays such an integral role in analysis, nor must we drag poor Zeno into the picture. This disturbing conclusion is not the consequence of any faulty mathematics, but is more directly related to the naïveté of the original model. If we say that the deceleration of a ship in still water (an idealization in itself) is proportional only to its velocity, then the conclusion that asserts itself is that the ship never stops but only goes a finite distance.

The usual remedy applied in such cases as the ship problem is to construct a more sophisticated model, that is, a model that takes into account more of the phenomena observed. For example, in the ship problem, the assertion that the deceleration is proportional only to the velocity might be amended to include friction in some way, resulting in an equation of greater complexity, the formulation and solution of which require a more general mathematical model. We might extend the preceding model to look like Fig. 2.

The great power of mathematics lies in its ability to reflect several different phenomena at one time, and the theorems derived within the framework of a single

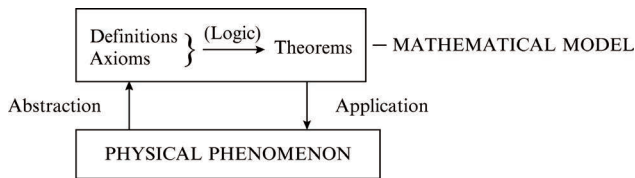


Fig. 1

axiomatization of these varied phenomena will, in turn, be applicable to each of them. However, the trade-off that exists between generalization and depth must constantly be kept in mind. That is, it should be remembered that it is difficult to prove deep theorems in very general models. But when axioms are added to the model, the phenomena which the model reflects begin to be delimited, and certainly one does not wish to undermine the real power of mathematics, that is, its ability to treat a variety of situations at the same time.

Examples

We now turn our attention to an examination of some of the particular examples of the model that is the principal concern of this entry, Boolean algebras. One must keep in mind that the common characteristics of these models are precisely those that will constitute the elements of our later axiomatization. To avoid infinite regress a certain level of sophistication on the part of the reader, if not actual mathematical experience, is assumed.

Example 1 (A finite algebra)

The system considered in this example consists of the two digits, 0 and 1, and two binary operations of multiplication, “ $\cdot$,” and addition, “ $+$.” The operations are defined by the multiplication and addition tables shown.

$\cdot$	0	1
0	0	0
1	0	1

Multiplication

$+$	0	1
0	0	1
1	1	1

Addition

If x , y , and z are any *variables* that are allowed to assume one of the two values 0 or 1, then the structure defined above has an algebra possessing (among others) the following properties:

$$x \cdot x = x \quad x + x = x \quad (1a)$$

$$x \cdot y = y \cdot x \quad x + y = y + x \quad (1b)$$

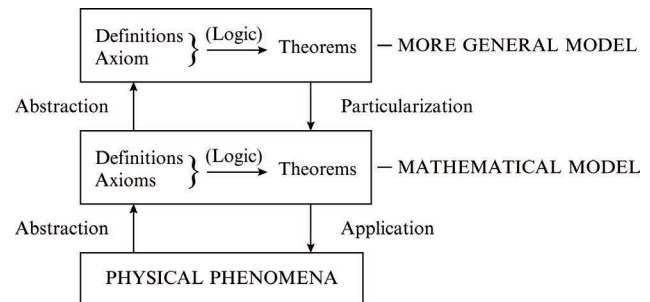


Fig. 2

$$x \cdot (y \cdot z) = (x \cdot y) \cdot z \quad x + (y + z) = (x + y) + z \quad (1c)$$

$$(x \cdot y) + x = x \quad (x + y) \cdot x = x \quad (1d)$$

$$x \cdot (y + z) = (x \cdot y) + (x \cdot z) \quad x + (y \cdot z) = (x + y) \cdot (y + z) \quad (1e)$$

Each of the above can be verified by a consideration of all the possible values of the variables.

If B is the collection consisting of the elements 0 and 1, and for each x in B x' is defined by $x' = 1$ if $x = 0$, and $x' = 0$ if $x = 1$, then

$$\begin{array}{lll} x \cdot x' = 0 & \text{and} & x + x' = 1 \\ 0 \cdot x = 0 & 1 \cdot x = x & \text{and} \quad 0 + x = x \quad 1 + x = x \end{array} \quad (1f)$$

We let $[B; \cdot, +, ']$ denote the system described in Example 1.

Example 2 (Algebra of propositions)

The elements in this example are *propositions*, that is, statements to which it is possible to assign one of the truth values “true” or “false.” Two propositions p and q are defined to be equal if and only if they have the *same* truth value. We consider the two logical binary operations of *conjunction* and *disjunction* as well as the unary (operating on a single proposition as contrasted with a binary operation, which operates on pairs of propositions) operation of *negation*. The conjunction of the propositions p and q is denoted by pq and is the proposition corresponding to that obtained by applying the logical connective “and.” The conjunction is defined to be true only if both p and q are true. Otherwise it is false. The disjunction of p and q , denoted by $p + q$, is the proposition corresponding to that obtained by applying the logical connective “or.” The proposition $p + q$ is false if and only if both p and q are false. The negation of p , denoted by $\bar{p}$, is the proposition having truth values opposite those of p . It corresponds to the logical statement, “It is false that p .”

All of the above can be summarized nicely by employing “truth tables” that give the truth values of compound statements, realized by applying the operations discussed to the truth values of the component propositions.

p	q	pq
T	T	T
T	F	F
F	T	F
F	F	F

Conjunction

p	q	$p + q$
T	T	T
T	F	T
F	T	T
F	F	F

Disjunction

p	$\bar{q}$
T	F
F	T

Negation

One can verify that, in view of the definitions above, if p , q , and r are any propositions, the following statements hold.

$$pp = p \quad p + p = p \quad (2a)$$

$$pq = qp \quad p + q = q + p \quad (2b)$$

$$p(qr) = (pq)r \quad p + (q + r) = (p + q) + r \quad (2c)$$

$$(pq) + p = p \quad (p + q)p = p \quad (2d)$$

$$p(q+r) = pq + pr \quad p+(qr) = (p+q)(q+r) \quad (2e)$$

$$p\bar{p} \text{ is always false and } p + \bar{p} \text{ is always true} \quad (2f)$$

Denoting $p\bar{p}$ by 0 and $p + \bar{p}$ by 1 we have

$$0q = 0 \quad 1q = q \quad 0 + q = q \quad 1 + q = q$$

(Note: It is easy to see that $p\bar{p} = q\bar{q}$ and $p+\bar{p} = q+\bar{q}$ for any propositions p and q .)

We illustrate the employment of the truth table technique in the verification of part of the assertion in Eqs. 2e, namely, that $p + (qr) = (p + q)(p + r)$.

p	q	r	qr	$p + qr$	$p + q$	$p + r$	$(p + q)(p + r)$
T	T	T	T	T	T	T	T
T	T	F	F	T	T	T	T
T	F	T	F	T	T	T	T
T	F	F	F	T	T	T	T
F	T	T	T	T	T	T	T
F	T	F	F	F	T	F	F
F	F	T	F	F	F	T	F
F	F	F	F	F	F	F	F

Since the columns headed “ $p + qr$ ” and “ $(p + q)(p + r)$ ” have identical entries the propositions $p + qr$ and $(p + q)(p + r)$ have the same truth value and are therefore equal.

The structure described in Example 2 is denoted in the sequel by $[\mathcal{O}; +, -]$.

Example 3 (Algebra of sets)

The term *set* is taken as undefined and used synonymously with class, aggregate, and collection. The objects that constitute a set E are called the *elements* of E . To denote the logical relation of “being an element of E ” we use the notation $x \in E$. This is read: “ x is an element of E .” The denial of this relation is symbolized by $x \notin E$.

The notation of $E = \{xP(x)\}$ denotes the set E consisting of all x for which the proposition $P(x)$ is true. When the set under consideration is finite, it is often denoted by a simple listing of its elements; thus, $E = \{a, b\}$ is the set consisting of the elements a and b .

If $A = \{xP(x)\}$ and there are no elements which satisfy the proposition $P(x)$, A is said to be the *empty set*. The empty (or *null*) set is denoted by ϕ .

If the sets E and F have the property that every element of E is an element of F , E is called a *subset* of F ; this is denoted by $E \subset F$. If the set E is a subset of F , but F is not a subset of E , then E is said to be a *proper subset* of F , or F *properly contains* E . The empty set ϕ is a subset of every set.

Two sets E and F are *equal*, written $E = F$, if and only if $E \subset F$ and $F \subset E$.

Given two sets E and F , we define the *union*, denoted by $E \cup F$, by the set equation

$$E \cup F = \{x | x \in E \text{ or } x \in F\}$$

Similarly, the *intersection* of E and F , denoted by $E \cap F$, is defined by

$$E \cap F = \{x | x \in E \text{ and } x \in F\}$$

In general, consideration centers on subsets of a fixed set often referred to as the *universal set*. In particular, if X is the universal set, we let $\mathcal{P}(X)$ denote the set of all subsets of X . The set $\mathcal{P}(X)$ is often called the *power set* of X . If $E \in \mathcal{P}(X)$, then the *complement* of E , denoted by E' , is defined as $E' = \{x \mid x \in X \text{ and } x \notin E\}$. If E and F are elements of $\mathcal{P}(X)$, that is, subsets of X , then the *difference* of the sets E and F , denoted by $E - F$, is the set defined by

$$E - F = \{x|x \in E \text{ and } x \notin F\}$$

It should be noted that $E - F = E \cap F'$.

It is often helpful to employ the schematics shown in Fig. 3 in visualizing the set-theoretic relations and operations defined above. The rectangular area represents the

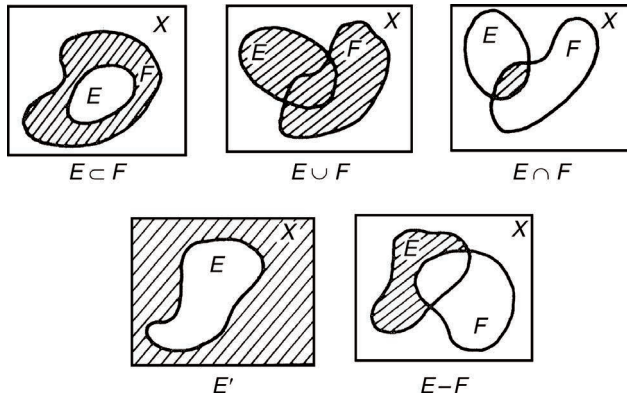


Fig. 3

universal set X ; subsets of X are denoted by areas within the rectangle.

Focusing our attention on a particular universal set X and its power set $\mathcal{P}(X)$, it is easy to verify the following properties (in no sense exhaustive) of the algebra of sets, where E, F , and G are arbitrary subsets of X .

$$E \cap E = E \quad E \cup E = E \quad (3a)$$

$$E \cap F = F \cap E \quad E \cup F = F \cup E \quad (3b)$$

$$E \cap (F \cap G) = (E \cap F) \cap G \quad E \cup (F \cup G) = (E \cup F) \cup G \quad (3c)$$

$$(E \cap F) \cup E = E \quad (E \cup F) \cap E = E \quad (3d)$$

$$E \cap (F \cup G) = (E \cap F) \cup (E \cap G) \\ E \cup (F \cap G) = (E \cup F) \cap (E \cup G) \quad (3e)$$

$$E \cap E' = \phi \quad E \cup E' = X \\ \phi \cap E = \phi \quad X \cap E = E \quad \phi \cup E = E \quad X \cup E = E \quad (3f)$$

In the sequel we denote the above algebra of sets by $[\mathcal{P}(X); \cap, \cup, ']$.

Axiomatization

In the preceding section we examined three structures possessing some common properties, namely, (1i), (2i), and (3i), where $i = 1, 2, 3, 4, 5, 6$. We abstract to construct the important mathematical (see Fig. 1) model called a *Boolean algebra*, named in honor of G. Boole who first studied it in 1847.^[1,2]

A *Boolean algebra* is a set B with two binary operations $\wedge$ (cap) and $\vee$ (cup) and a unary operation (complementation) satisfying the following axioms:

$$x \wedge x = x \quad \text{and} \quad x \vee x = x \quad (Ia)$$

$$x \wedge y = y \wedge x \quad \text{and} \quad x \vee y = y \vee x \quad (Ib)$$

$$x \wedge (y \wedge z) = (x \wedge y) \wedge z \quad \text{and} \quad x \vee (y \vee z) = (x \vee y) \vee z \quad (Ic)$$

$$(x \wedge y) \vee x = x \quad \text{and} \quad (x \vee y) \wedge x = x \quad (Id)$$

$$x \wedge (y \vee z) = (x \wedge y) \vee (x \wedge z) \quad \text{and} \\ x \vee (y \wedge z) = (x \vee y) \wedge (x \vee z) \quad (Ie)$$

B contains *distinct* elements 0 and 1 such that

$$x \wedge x' = 0 \quad \text{and} \quad x \vee x' = 1 \\ 0 \wedge x = 0 \quad 1 \wedge x = x \quad \text{and} \quad 0 \vee x = x \quad 1 \vee x = 1 \quad (If)$$

This is by no means the only axiomatization possible,^[3] but it is probably the one most commonly used.

To emphasize the relationship between the above axiomatization and the preceding particularizations

Boolean algebra	Example 1	Example 2	Example 3
B	set $\{0,1\}$	set $\mathcal{P}$ of all propositions	set $\mathcal{P}(X)$ of all subsets of a fixed set X
$\wedge$	$\cdot$	conjunction	intersection
$\vee$	$+$	disjunction	union
$'$	$'$	negation	complementation
0	0	$p\bar{p}$	empty set ϕ
1	1	$p + \bar{p}$	universal set X

(Examples 1, 2, and 3) we identify in tabular form the corresponding structural elements.

We now prove a particular theorem to illustrate the generation of results within the framework of the model and their subsequent application.

Theorem. If $(B; \wedge, \vee, ')$ is a Boolean algebra, then for any x and y in B we have

$$(i) x'' = x$$

$$(ii) (x \wedge y)' = x' \vee y'$$

Proof. First of all we prove that every element has only one complement. Suppose $\bar{x}$ is an element such that $x \wedge \bar{x} = 0$ and $x \vee \bar{x} = 1$. Then

$$\bar{x} = \bar{x} \wedge 1 = \bar{x} \wedge (x \vee x') = (\bar{x} \wedge x) \vee (\bar{x} \wedge x') \\ = 0 \vee (\bar{x} \wedge x') = \bar{x} \wedge x'$$

but

$$x' = x' \wedge 1 = x' \wedge (x \vee \bar{x}) = (x' \wedge x) \vee (x' \wedge \bar{x}) \\ = 0 \vee (x' \wedge \bar{x}) = (x' \wedge \bar{x})$$

and since $\bar{x} \wedge x' = x' \wedge \bar{x}$, we have $\bar{x} \wedge x'$. We then apply the preceding by demonstrating that $(x \wedge y) \wedge (x' \vee y') = 0$ and $(x \wedge y) \vee (x' \vee y') = 1$, so that $(x \wedge y)' = x' \vee y'$.

$$\begin{aligned} (x \wedge y) \wedge (x' \vee y') &= [(x \wedge y) \wedge x'] \vee [(x \wedge y) \wedge y'] \\ &= [(y \wedge x) \wedge x'] \vee [(x \wedge y) \wedge y'] \\ &= [y \wedge (x \wedge x')] \vee [x \wedge (y \wedge y')] \\ &= [y \wedge 0] \vee [x \wedge 0] = 0 \vee 0 = 0 \end{aligned}$$

$$\begin{aligned} (x \wedge y) \vee (x' \vee y') &= [(x \wedge y) \vee x'] \vee y' \\ &= [(x \vee x') \wedge (y \vee x')] \vee y' = [1 \wedge (y \vee x')] \vee y' \\ &= (y \vee x') \vee y' = (x' \vee y) \vee y' \\ &= x' \vee (y \vee y') = x' \vee 1 = 1 \end{aligned}$$

An interpretation (application) of this theorem in Example 2 yields the fact that the negation of the conjunction of two propositions is the disjunction of the negations of each of them. For example, "it is false that x is a positive integer and x is greater than or equal to 5" is logically equivalent to the proposition " x is not a positive integer or x is less than 5."

An interpretation of the above in Example 2 yields the set-theoretic equation

$$(E \cap F)' = E' \cup F'$$

that is, the complement of the intersection of two sets is equal to the union of their complements, as shown in Fig. 4.

We describe very briefly some of the more significant results and developments in the theory of Boolean algebras. For a comprehensive treatment of the subject, see Birkhoff^[3] and Halmos^[4] and their bibliographies.

Every Boolean algebra can be made into a ring with identity in which every element is multiplicatively idempotent; that is, $x^2 = x$ for every x . This is accomplished by defining addition and multiplication as follows

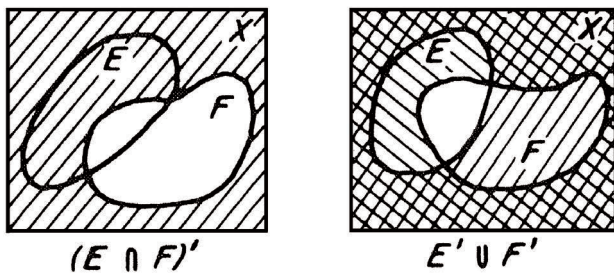


Fig. 4

$$x + y = (x \wedge y') \vee (x' \wedge y) \text{ and } xy = x \wedge y$$

Because rings are more familiar and more carefully studied many of the useful concepts can be translated into the context of Boolean algebras.

Conversely, if one starts with a ring with identity in which every element is idempotent (usually called a Boolean ring), defining $\wedge$ and $\vee$ by

$$x \wedge y = xy \quad x \vee y = x + y + xy$$

the Boolean ring is converted into a Boolean algebra.

Two Boolean algebras, B_1 and B_2 , are said to be *isomorphic* if there exists a function $h: B_1 \rightarrow B_2$ that maps B_1 onto B_2 in such a way that distinct elements of B_1 are mapped onto distinct elements of B_2 , and h preserves the operations; that is, $h(x \wedge y) = h(x) \wedge h(y)$; $h(x \vee y) = h(x) \vee h(y)$; and $h(x') = h(x)'$.

If X is a compact Hausdorff space, then the class of sets that are both open and closed forms a Boolean algebra. A topological space is totally disconnected if the only components (maximal connected sets) are points. There is a very important *representation theorem* in the theory of Boolean algebras, the Stone Representation Theorem (M.H. Stone^[5]). If B is a Boolean algebra, then a compact totally disconnected Hausdorff space S exists such that B is isomorphic to the Boolean algebra of all open-closed subsets of S .

An Application

We consider here one modest application of the preceding to switching theory. Switching theory is concerned with circuits composed of elements that can assume a finite number of discrete states, most commonly two states. These circuits are modeled as described earlier, and the models are analyzed. This is an idealization; the models neglect such characteristics as stability, temperature effects, and transition times. The theory of Boolean algebras has played an important role in the analysis of these models for circuits made of binary (two-state) devices.

A *switching function* is a rule by which the output of a composite circuit can be ascertained from the states of its components. If the variables x , y , and z denote switches and each switch can assume one of the states, open or closed (0 or 1), then the function $w = x \wedge y$ describes the output of a series circuit containing the switches x and y . Similarly, $t = x \vee y$ is a function describing a parallel circuit



Fig. 5

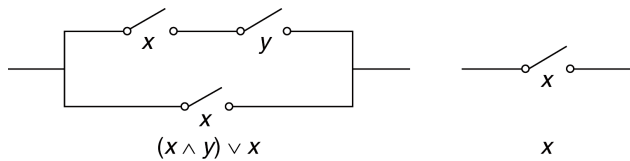


Fig. 6

containing the switches x and y . These components, along with the negation function (x' is a switch that is open whenever x is closed and closed whenever x is open), allow the construction and analysis of complex circuits. This analysis can be carried out by the use of truth tables, and the circuits can be indicated by a diagram, as shown in Fig. 5.

With this interpretation it is readily seen that the above is a Boolean algebra. For example, the verification of axiom (Id) involves the observation that the circuits in Fig. 6 are equivalent.

After observing that it is indeed a Boolean algebra, the machinery of that algebra may be used to synthesize circuits, consider questions of realizability, minimize circuitry, and so forth. We can only hint at the possible applications.^[6]

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Brazil: Library Science

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Abstract

This entry presents the history of Library Science in Brazil, from the creation of the first Library Science course in 1911, in the National Library, Rio de Janeiro, to the current courses offered today. The various levels of education for the professional librarian are described as well as the evolution of the profession from the early recognition of it as such through the twenty-first century including both undergraduate and graduate courses. It also focuses on the paradigmatic changes in information demands and discusses the professional job market highlighting the opportunities open to potential entrants.

INTRODUCTION

For many years in Brazil, Library Science as an avocation, had as its place in the library, which was mainly viewed from a static perspective as “a warehouse.” It was more for storing a collection rather than for exploiting it, and the more extensive it was, the more valuable it was perceived to be. For the profession to grow and broaden its functions, a radical change in its outlook was required. The result was a new trend toward an interest in facilitating access to the collections—which resulted in a growth in research and, in turn, a growth in knowledge.

The practice of the profession, at this time, was to find studious individuals, lovers of books and belles lettres, or historians—almost always highly cultured individuals—who would work with two main objectives: “to guard the collection zealously” and “to preserve it for the future.”

With the advent of the Industrial Revolution several events stand out that had world-wide influence for the practice of Library Science: increased production of the printed book; new scientific discoveries; the proliferation of scientific societies and the accompanying growth of scientific periodicals. These events brought about substantial changes leading to the information age and the changing role of the book keepers. Library professionals had to take on the responsibilities of acquiring, conserving, organizing, and distributing information and acquire the skills to do all of these.

DEVELOPMENT OF LIBRARY SCIENCE

There are several indispensable indicators for an area of study to be considered scientific: that it has developed theories, accompanied with practices that prove those theories; that there is a scientific infrastructure based on scientific societies, channels of communication, educational institutions and research; and most importantly, on qualified staff.

The formation of such staff represents a major component for the development of any field of study. For Library Science, it is achieved through courses at the undergraduate level in Latin American countries, and at the postgraduate level in Europe and in the United States.^[1]

In Brazil, courses of Library Science are offered mainly as undergraduate courses and postgraduate specializations, resulting in students having the legal right to the title “librarian” upon graduation. Graduate courses for master’s and doctorate degrees are completed in programs of various fields of study, with a major in Information Science.

The undergraduate and specialization courses result in the basic training needed to practice the profession. To become a professor or researcher, completion of a master’s or doctorate program is required and sometimes both.

Undergraduate Courses

In Brazil, the evolution of the professional course of Library Science is characterized by three distinct phases.^[2] The first one, from 1879 through 1929, followed the French traditions under the aegis of the National Library of Rio de Janeiro. The second, from 1929 through 1962, was based on American models, with the Mackenzie College, in São Paulo leading the way. The third, from 1962 until the present, begins with the establishment of the first official minimum curricula requirements (1962, revised in 1982) approved by the Federal Council of Education, and by the directives for curricula decreed in the Law of Directives and Educational Foundation (1996).

First phase

Library Science in Brazil, as a profession, closely follows the creation to the National Library. This library was formerly the Royal Library of Portugal, brought to Brazil by the Portuguese Crown, as it took refuge from the

invading French army in its more prosperous colony in 1808. Officially established in 1810, it was opened to the public in 1814. Headed by clerics in the early days, its first secular director was appointed in 1846. Subsequently, the directors began to voice their concern for the lack of qualified staff and, with the objective to ameliorate these circumstances, the first course of Library Science was created in 1911 within the National Library. The first group of students in 1915 studied four disciplines: Bibliography (subdivided into Administration of Libraries and Cataloging); Paleography and Diplomatics; Iconography and Numismatics. This course was later revised following the model of the *École Nationale de Chartes*, in Paris—the first school in the world (1821) for the formation of library professionals. In this phase, the predominance of general culture reigned to the detriment of Library Science practices.

Second phase

The second phase began with the pragmatic model of education for Library Science and the Elementary Course of Library Science, created in the late 1920s at the Mackenzie College of São Paulo. This school was soon followed by another, the Course of Library Science of the Department of Culture of the City of São Paulo, in 1936 directed by the city's Municipal Librarian Rubens Borba de Moraes. Both schools adopted the American model for the courses of Library Science, favoring its technical emphasis over the study of general humanities.

These two courses brought significant changes to the library scene limiting the term “Modern Libraries,” to those whose bookshelves and catalogs were open to the public with free access, in ample and comfortable installations, accommodation, with good illumination, and trained librarians to assist the readers.

In 1944, a new reform occurred in the National Library (see Fig. 1), incorporating changes in the Course of

Library Science, that de-emphasized the humanist and scholarly aspects and emphasized American technical practices. This change was brought about by Brazilian librarians who had studied for specializations in the United States. This reform and the creation of the Course of the Free School of Sociological Politics of São Paulo, with funding from the Rockefeller Foundation in 1940, opened up new opportunities for the field. Professionals from other Brazilian states that participated in these courses in Rio de Janeiro and São Paulo, upon returning to their homes, reorganized old libraries, created new ones and started new Library Science courses in their respective home states. For example, the Schools of Library Science of Bahia, of Belo Horizonte and Paraná, among others were founded soon afterwards.

Third phase

The proliferation of Library Science courses in the country—each one with a different grading system—started to cause concern among library professionals. This gave rise to a national movement with the goal to standardize education to improve the performance of the average Brazilian librarian. The first “Minimum Curriculum” for the course of Library Science was established by the Federal Council of Education (CFE), by means of a Resolution of November 16, 1962. Decree no. 326/62, authored by Council member, Josue Montello, presented the following basic characteristics:

1. *Course offerings:* History of the Book and Libraries; History of Literature; History of Art; Introduction to Historical and Social Studies; Evolution of Philosophical and Scientific Thought; Organization and Administration of Libraries: Cataloging and Classification; Bibliography and Reference; Documentation; Paleography.
2. The duration of the course changed from two to three academic years.



Fig. 1 The National Library of Brazil.

This act had the immediate consequence of elevating the profession to a “profession of superior level,” and was regulated by means of the Law no. 4.084/62 and Decree no. 56.725/65.

By this time there were 10 courses of Library Science in the country and by the end of 1969, eight new courses had been created. Between 1970 and 1977, 11 new additional courses were created. In the structure of their curricula, these courses followed the national model “Minimum Curriculum,” which began to be criticized for being overly bureaucratic and an impediment to timely changes in the curricular structure.

In 1971, the Brazilian Association of Education for Library Science and Documentation (ABEED) announced that it agreed that a revision of the curriculum was necessary. In 1980, the Secretariat of Higher Education of the Ministry of Education and Culture organized a task force, MEC/ABEED. A year later, they presented a proposal to the Federal Education Council for the restructuring of the Minimum Curriculum for Library Science courses.

The second minimum curriculum for undergraduate coursework in Library Science was approved in 1982. It established a minimum course duration of 4 years and maximum of 7. The new curriculum established core courses for Communication, Society, Economic and Political Studies of Contemporary Brazil, and Cultural History; Basic courses for Logic, Portuguese Language, a Modern Foreign Language, Methods and Techniques of Research and Professional Development courses in Applied Information for Library Science, Production of Knowledge Registers, Collection Development, Bibliographical Control of Knowledge, Dissemination of the Information, and Administration of Libraries.

All previous legislation concerning Library Science education was revoked by the new decree no. 9.394, passed on December 20, 1996. The new curriculum directives allowed for more flexibility with course structures addressing new issues relevant to Brazilian society.

Today there are 43 Library Science courses in the country following these curriculum directives; 70% are established in public institutions and 30% in private institutions. Library schools are mostly located in the South-eastern region (47%).

One of the newest courses in the country was established by the Federal University of Rio de Janeiro in July of 2005. This Course of Library Science and Management of Information Units (CBG) aims to produce library managers and administrators qualified to function in the twenty-first century, where flexibility, speed, autonomy, innovation, and competitiveness are the best words. This course, whose first group started in August, 2006, includes in its curricular package, the same disciplines of Library Science and Administration in the same proportion, but goes beyond the general matrix necessary to form professionals attuned to the demands of the current marketplace.

Graduate Courses

The creation of the Brazilian Institute of Bibliography and Documentation (IBBD) in 1954, had great importance for the formation of Library Science professionals in Brazil as it offered the first courses of graduate level study in the field.

Particularly noteworthy was their first Course in Scientific Documentation (CDC) for—initially—librarians, with the goal of enabling them to work with technical and scientific literature. This course trained innumerable librarians from Brazil and elsewhere in Latin America until the end of the 1960s. In the 1970s, the IBBB became part of the new Brazilian Institute of Science and Technical Information (IBICT) which, nevertheless, maintained the IBBB’s concern for access to information and interest in the formation of human resources in this area.

Strongly influenced by the international movement to create a new program, the first graduate course at the master’s level, entitled the Information Science Course was established in 1970 for IBICT. Until 2000 it was affiliated with the Federal University of Rio de Janeiro (UFRJ). During 2003–2006 it was affiliated with the Federal Fluminense University (UFF). Currently, it is renewing ties with the UFRJ, as part of the same University’s Center of the CBG—Center of Legal and Economic Sciences (CCJE).

According to Christovão,^[3] Brazil had no qualified individuals to teach at the master’s level in Information Science; consequently professors were imported from England and the United States by IBICT to teach the graduate level courses. Over time, as Brazilian students graduated and became qualified teachers and researchers, they obviated the need to import professors. Steadily they began to take over the advising of theses and dissertations and directing new lines of inquiry.

As of 2008, there are eight graduate programs of Information Sciences in Brazil and the discipline figures prominently in two others: in the Graduate Program in Communication, at the School of Communication of the University of São Paulo (ECA/USP), and in the Graduate Program in Communication and Information of the Federal University of Rio Grande do Sul (UFRGS).

THE JOB MARKET FOR LIBRARIANS

The accelerated transformations occurring world-wide have radically influenced work processes in all professions. Amongst other factors, the revolution in the world of microelectronics and telecommunications (CD-ROM, robots, Internet, email) and the shift from the industrial age to the information age has profoundly changed educational policies. This visible transformation of the labor market requires a new model for academic preparation, one that responds to the need for increasing professional competencies that can address unpredictable situations.^[4]

As the profession seeks to maintain relevancy and renewal, the teaching of Library Science, structured systematically, must continually identify the characteristics and conditions of the labor market and fields of research in relation to the profession of the librarian.

Historically, the labor market for librarians was limited, as Fontoura notes, to the preservation of information in the form of clay tablets, parchment scrolls, or papyrus sheets.^[5]

In Brazil, according to Stumpf,^[6] the librarian became an integral part of the work force after the creation of the first course for Library Science, in the National Library. From this point forward, the professional was absorbed by the budding labor market, and primarily by public service institutions.

In the 1960s with the recognition of the profession as being of “superior level” and the promulgation of Law 4.084/62 that regulated the profession, the market expanded with new opportunities. With this growth and expansion, however, arose many new avenues of research.

Studies on the Labor Market for Librarians

Among the many studies on the labor market for librarians expanding in the 1970s, that of Souza and Nastri^[7] stands out for its view that the major problem of the librarians’ labor market stems from the lack of any effective, serious national policy addressing or regulating the profession. Corroborating this position, Souza^[8] highlights the varying conditions and inequalities of working environments in Brazilian libraries that librarians face. An exit strategy for this situation came with planning and coordination at the national level of professionals, interested politicians, and appointees, which enabled and legitimized the performance of library professionals and enhanced their value in the eyes of the general public.

Again, referring to Souza and Nastri,^[7] the course curriculum for Library Science did not reflect a consensus about the type of professional the courses would turn out because too much emphasis was being given to technical practices. They also indicated that too many professors were out of touch and not keeping up with current research; the quality of students entering the undergraduate courses declined each year and seeming to lack enthusiasm for the course or even interest in it.

Other studies on the labor market of the librarian carried out in the 1990s emphasized the diversity of professional opportunities: documentation services, communication and information, culture and leisure, education, research, information, technology, planning, and policymaking. Mueller and Baptista^[9] analyzed the performance of Library Science students in the local market of the Federal District of Brasilia before and after graduation. The study by Tarapanoff^[10] sought to identify the profile of the information professional facing the challenges presented by the new technologies for interlibrary exchanges. Finally,

Maranhão^[11] researched the labor market of Rio de Janeiro with the intention of revising the Library Science curriculum prevalent in the 1980s. “Change” is the ever-present keyword in these analyses coupled with a call for adaptability during times of continual evolution. In the studies, the labor market described consists of several types of institutions with different foci. At the same time, they characterize the typical librarian as a professional who invests little in continuing education and seems unprepared to face the challenges presented by the evolution of technology and increasing globalization.

Tarapanoff^[10] argues that from the decade of 1990 there were many changes to the social and economic environments that impacted the strategies, structure, and the management of information centers or units. She observes that society is increasingly more dependent on information which she asserts will give rise to a broader labor market for the librarian and more recognition of the role libraries and library professionals play.

Although the dependence of society on information and of its ability to broaden the horizons of the librarian’s labor market, it is evident that this will only happen if the library professional is able to adjust to the new demands. To become a modern professional it is necessary to continuously adjust to new paradigms as they relate to the services and concepts of information. Courses for professional training must consider the dynamic, ongoing changes, injecting new content and practices into its programs to address these new situations.

Segmentation of the Labor Market for Librarians

While analyzing the labor market for librarians, Valentim^[12] was the first to identify three major sectors: the traditional information market; the “unoccupied” information market; and the “information-trends” market.

The first group—the traditional information market—represents the one most sought after by professionals and the one most highly recognized by society.

Within this sector, the public library is most familiar and attracts a great number of professionals. Unfortunately in Brazil, due to the dearth of school libraries, the public library tends to function more as a school library and this distorts the role its professionals perform. Consequently public library services may take a back seat to the school library services demanded by the users. Among the major public libraries in Brazil are the National Library located in Rio de Janeiro, the Municipal Library of Sao Paulo, the State Library of Rio Grande do Sul, and the State Library of Bahia.

School libraries represent another type of library in this first group. Most suffer from inadequate funding resulting in a myriad of deficiencies. On the whole, school libraries are staffed by persons with limited or no professional library training and users, not knowing the educational background of the attending person, may inappropriately

disparage the image of the librarian for inadequate rendering of services. Some private schools do have adequate libraries with trained personnel such as the American Schools in Rio de Janeiro and in Sao Paulo, Colégio de São Bento in Rio, as well as the many binational English language schools located in most major cities.

University or academic libraries also employ a great number of professionals. Although chronically underfunded, they stand out for having seemingly endless users that require efficient library products and services. Nearly all public universities and many private ones have one or more libraries for their students and faculty members. Some notable libraries with online services are at the University of Campinas, the Federal University of Rio de Janeiro, University of Sao Paulo, Federal University of Minas Gerais, University of Brasilia, and the Catholic Pontifical Universities in Rio de Janeiro, Sao Paulo, and Porto Alegre.

Also in this sector, specialized libraries include the libraries of research institutions, think tanks, or corporations, both private and public. These are almost exclusively located in metropolitan areas and attract a considerable number of professionals. It is worth noting that in the case of private companies, any financial turbulence directly impacts library funding, particularly staffing patterns and collection development. This instability demonstrates the questionable importance that entrepreneurs give to their information services. On the other hand, research institutions and think tanks, besides having better qualified staff (often with doctorates) than might be found in corporations, tend to value the services offered and usually invest heavily in resources for its library. Some of the outstanding specialized libraries are the Library of the Federal Senate in Brasilia, specializing in social sciences, law, and politics; the Pan American Health Organization Specialized Center BIREME offering medical and health information online and the Instituto Brasileiro de Informação em Ciência e Tecnologia in Brasilia which offers a wide variety of information resources in their library and online.

Cultural centers, which may also be considered as modern public libraries, are slightly different in that they usually function in partnership with another institution, and are located next to a museum, theater, auditorium, or cinema and often close to one or more of such facilities offering a variety of cultural activities for leisure and entertainment. However, although they are in larger urban centers where the demand for cultural activities is greater, these libraries tend to hire few professionals.

Archives and museums located in urban areas are also part of this sector and usually include a library space in their facilities; however, they also tend to hire few librarians.

The second sector, existing information markets but occupied by non-librarians, mainly pertains to school libraries. Few school library staff are trained librarians, in

spite of the constant vigilance of the Federal Council of Library Science and 15 regional councils which are authorized to levy fines on unqualified or undocumented practitioners and their employers.

Publishing houses and bookstores also hire very few Library Science professionals, although they could be very useful in this sector providing specialized expertise in cataloging and scientific editing for publishers and in bookstores, collection development, and publicity or public relations services. With the creation of the position of "literary consultant," this market sector is experiencing growth. The consultant is a type of reference librarian who provides clients with information on titles of specific interest.

Private companies, even those without a physical library, can use librarians as information purveyors or analysts, supplying relevant information to make the company more competitive in its business.

Internet service providers and Web-based purveyors represent another under-explored opportunity. They have the need to organize, process, and disseminate the information they manage—tasks that are basic to the profession. Databases are also fertile grounds that use few librarians tending to prefer systems analysts. Some of the major database content providers are SciELO, the Scientific Electronic Library Online covering a selected collection of Brazilian scientific journals; BIREME mentioned above and the IBICT online resources.

Librarians are finding that work as contractees or consultants is becoming an alternative to full-time, steady employment but this usually requires a great deal of experience, a recognized name, and the capital to invest in one's own business.

The third sector, that of, the "informational-trends" market, consists of a prospective market for librarians that demands performance based on the paradigm of access to information, when information is considered fundamental to the development of an organization.

The librarian who is prepared to offer excellent information services will have a place of prominence in this market; however, to act in this niche with quality and ability, the librarian must be sufficiently observant; act in an enterprising fashion; be flexible, dynamic, bold, a team player, pro-active and, mainly, to be future-oriented and interested in continuing education.^[12]

CONCLUSION

The evolution of Library Science in Brazil now points to a paradigm shift toward emphasizing ease of access to documents and the information contained within, and the abandonment of excessive concern with the conservation of collections. With this new focus, the discipline that has benefited enormously from the technologies of information and communication now requires a professional cadre

capable of addressing this new proposal: to give the right information to the right user at the right time to satisfy his/her informational needs.

It has become increasingly important that there exists a perfect harmony between the library schools and the marketplace. Schools need to provide students with the opportunity not only to learn about modern technologies related to information, but also to develop the management skills necessary to administer the full gamut of information resources, financial resources, material, and human resources. Library Science programs also need to consider the development of appropriate attitudes to manage the social responsibilities of the profession the student has chosen. In turn, the marketplace needs to monitor these abilities, ensuring that future professionals attain the levels of competency that the general public and the marketplace require.

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Brazil: Library Science—Distance Education

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Abstract

This study presents an innovative approach in the field of librarianship fostered by the Federal Council of Library Science and the Open University of Brazil (UAB) that encourage the implementation of a bachelor's degree in library science via distance education (DE).

The distribution of classroom courses in the country, concentrated primarily in the big cities, is described, emphasizing the need to expand the education of librarians to meet the demands of professional positions of information, especially in smaller cities and rural areas. It relates the first steps to implementing the DE course, which is supported by the Center for Higher Distance Education in Rio de Janeiro, an institution that has extensive experience in preparing materials for this type of education. The different stages for planning the development of tasks involving the preparation of teaching materials for DE are outlined. It also points out that the Federal University of Rio de Janeiro was selected, through public bidding, to take on this challenge, which is scheduled for implementation in December 2015, when simultaneously the UAB will launch the course via the public education institutions. The innovation that this initiative brings to the country can be summed up by the possibility of expanding access to information for Brazilian citizens and the opportunity to include a large proportion of the Brazilian population in higher education.

INTRODUCTION

Since the 1970s, new technological dynamics, coupled with the focus on flexibility and on the variety of organizations, stand up to mass production unleashing intensive information technologies, which are fast becoming key competitive strategies of the twenty-first century. Such an environment is characterized by great changes, in which scientific and technological knowledge constitutes the basic inputs of the organizations where the slogans are flexibility, speed, autonomy, innovation, and competitiveness.^[1]

In this context, the economy, previously based on land and capital, evolves to be based on knowledge, requiring the mastery of new knowledge bases and the ability to transform them into competitive advantage.

The society that emerges from this paradigm shift—alternatively called the Information or Knowledge Society—requires interdisciplinary collaboration and educational projects that meet the challenges of scientific and technological advances and justify their academic programs in a manner that guarantees a quality education compatible with the demands of the professional market.

Oliveira^[2] states that the resources of these emerging technologies are important tools in the Knowledge Society; however, it is pointed out that the partial integration of peripheral countries to the new economy—with unequal access to information and knowledge—sets insurmountable limits to underprivileged social segments to meet the challenges of the current technoeconomic context.

Studies by the Paulo Montenegro Institute (IPM)—a Brazilian nonprofit organization that develops and executes projects in education^[3]—show that even in the metropolitan regions of Brazil, where the potential access to educational resources is greater, literacy skills may still be insufficient. Data from the National Index of Functional Literacy (INAF) show that Brazil has advanced, especially in the early levels of literacy, but has failed to visibly progress in achieving full domain of literacy skills that are essential for full inclusion in a literate society. According to the IPM educators, much of this progress is due to universal access to primary and secondary schooling. They understand, however, that despite the progress, the difficulties that reach higher levels of literacy are increasingly acute for much of the population.

Other studies recorded by INAF show that the arrivals of new social strata to the higher educational stages come often accompanied by a lack of suitable conditions for these strata to reach the highest levels of literacy, thus reinforcing the need for a new quality of education. They also highlight that quality involves not only the amount of study hours or the increase of the amount of content taught, but also among other things the creation of new flexible models that allow any Brazilian to broaden their studies when desired at different stages of life.

In turn, the educator Arnaldo Niskier^[4] stresses that for many years the Brazilian educational system was centered on a classic paradigm, in which the physical structure of the school was recognized as the only place from which knowledge emanated. This conventional model of

education had a major drawback, which was translated into the homogeneous treatment of students while completely ignoring the learning pace of the individual student, resulting in losses both in the teaching and learning processes. In this learning process, there is a precondition for the existence of two parts, which should have complementary goals, that is, that one wants to learn and build new knowledge and the other wants to share and teach.^[5]

However, the interaction between these parties doesn't to occur linearly; such procedures should be designed not as a mere transmission and acquisition of knowledge, but rather as a joint construction of them, in which the party in charge of teaching assumes responsibility for the guidance and knowledge construction of the party interested in learning. This process is characterized as guided, social, and communicative, resulting in a shared knowledge that includes the active participation of students in the subject matter.

It is at this juncture that distance education, with its concept of open education, can be considered an innovation in terms of education, given the new, added components such as flexibility of programs, agility of administrative mechanisms, and fundamentally, the emphasis on student autonomy regarding the choice of location and hour of study.

From the perspective of Formiga,^[6] the modality of distance education, both as undergraduate and graduate studies, in different areas of knowledge, contributes to make available a pedagogical proposal, which aims not only to address theoretical and technical training but also to enhance the socialization of learners, which is essential to meet the needs of the current international educational scene.

Although Brazilian universities are offering undergraduate courses, specializations, and master's degrees in the classroom and by distance, thus enhancing higher education in the country, these institutions are mindful in maintaining the quality of this educational experience. It is precisely with this in mind that the Ministry of Education evaluates any course offerings. On the other hand, students envision the expansion of distance learning courses as a way to recover study time that was not completed, or an alternative to reconcile work and study simultaneously. Other points in favor of distance education are the convenience and easiness for those living far from large urban centers. Thus, the expansion of distance education occurs both by educational institutions and by students interested in this type of study.

The legislation regarding distance education in Brazil was first mentioned by Law No. 5.692, dated August 15, 1971, using correspondences, radio, and television on supplementary courses. However, the Law of Guidelines and Bases (LDB) dated December 20, 1996, allowed the higher education system to enlarge the visibility and applicability of this sort of education.

A new decree, No. 5,622, dated December 19, 2005, repealing the previous ones in some aspects, presents 37 articles with improvements to distance education.^[8] The changes made by this new decree promoted greater credibility to distance education, especially the issues of compulsory attendance to classrooms, not only to perform evaluations, but also to allow participation in internships and the defense of final papers. This measure leading to the creation of centers for distance education emphasized that the results of classroom tests should prevail over other evaluation results. Another relevant issue regarding this decree was the application of the National System of Higher Education Assessment to the Higher Distance Education movement.

Besides the rapid technological developments and the new act mentioned earlier, in 2005 the creation of UAB made possible the expanding and the strengthening of distance education. UAB was established, with ties to the Coordination of Improvement of Higher Education Personnel (CAPES). The goal was to broaden entry to higher education for people from all social classes with the ultimate result being a significant, positive impact on the workforce of the country.

Using the English model of their Open University, the creation of UAB was driven by the unfavorable educational environment existing in 2004, when only 11% of young people aged 18–24 had access to higher education in the classrooms. This low percentage led the government to create policies generating growth in the number of places available in higher education and thereby promote more opportunities for education in the country.

In order to combat this scenario and to improve the Brazilian workforce, the UAB was created by the Ministry of Culture with the mission of offering higher education courses and distance programs in partnership with public universities through consortia with both municipal and state governments.

UAB's project represented a landmark for Brazilian education given its purpose of expanding access to higher education and the training of teachers for basic education. It emphasizes the articulation of public institutions of higher learning with the centers for distance education designed to support, in a decentralized manner, educational and administrative activities.

For this purpose, the UAB system was created to unite public institutions of higher education that offer on-campus courses and distance education programs. These institutions, in addition to having a well-established university campus, must have confirmed experience in research and extension required for the successful implementation of distance learning initiatives.^[9]

This system was created to meet the unmet needs for higher education, especially for students who live in regions far from major urban centers. It supports the adoption and promotion of distance education through the use of ICT and various learning resources: printed material,

audio, video, multimedia, Internet, email, chats, forums, and videoconferences. Since 2007, this system is linked to the CAPES, Brazilian institution that plays a key role in the expansion and consolidation of higher education in the country.

Nonetheless, the usage of undergraduate distance education in Brazil could be stronger as the UAB system offers fewer than 100 bachelor degree programs, with an emphasis in management (80% of courses). Until further expansion of the program occurs, it is not possible to reach more conclusive results as to the effectiveness of the programs.^[9]

In parallel to the Brazilian educational scenario, one field of study, library science, is becoming an area of training professionals to manage the vast information generated worldwide, with the mission to promote optimal recovery in benefit of the society.^[10] This training has, so far, been grounded in classroom courses, heavily concentrated in the Southeast region of the country preparing professionals to work in larger cities but leaves mostly public library positions unoccupied, or occupied by laypersons, in smaller Brazilian cities.

In view of the arguments presented earlier, this study analyzes the implementation of the Bachelor in Library Science from a distance education perspective, which is an innovative alternative to meet existing demands in the professional labor market of Brazilian libraries.

Another justification for analyzing the initiative lies in the fact that the vast majority of actions undertaken so far in the implementation of distance learning in the field of librarianship cover postgraduate courses only. These situations have not produced the expected effect in the area, partly because of the small number of courses offered and, second, because almost all courses created involve costs that are beyond the ability to pay for most Brazilian professionals.

TRAINING IN THE AREA OF LIBRARIANSHIP

In Brazil, library science began when the first libraries were founded, arising from the religious orders of the Benedictines, Franciscans, and Jesuits. However, the true roots of the field of library science are attributed to the creation of the National Library (BN), which had its origins in the Royal Library brought to Brazil by the Portuguese royal court in 1808. Its official foundation occurred in 1810, and in the following year it was opened to researchers who obtained royal consent. In 1814, it was fully opened to the public.^[11]

While in Rio de Janeiro the development of the field of librarianship has been linked to the trajectory of BN, in São Paulo, it was influenced by the school library of the Mackenzie College. However, in both institutions, the pressing concern at the time was the need to resolve internal matters such as unprepared personnel managing these libraries much more than training staff to work in any kind of library.^[11]

The Federal Council of Library Science (CFB) considers that library science began as a field of study in Brazil in 1911, when Manuel Cicero Peregrino da Silva, director of the National Library, officiated the creation of the first librarianship course in Brazil. It was also the first such course in South America and the third in the world.^[11]

Until the early 1930s, Brazilian librarianship was under the strong influence of the French humanist model of the *École Nationale des Chartes*, a course founded in France in 1821, which was the first school in the world created for the education of personnel to work in libraries. When creating the Elementary Course of Library Science in 1929, the Mackenzie College in São Paulo initiated the most pragmatic course using American technical standards as a basis of instruction.^[12]

Based on the course taught at the Mackenzie College, in 1936 the first school of librarianship was established. It was initially part of the São Paulo Department of Culture and later was incorporated into the Free School of Sociology and Politics, also based in the city of São Paulo. This new school of librarianship focused heavily on the technical aspects of librarianship and strictly adhered to American principles as practiced at the course of Columbia College in the United States.

The 1940s saw the development of modern techniques of library science in Brazil and also witnessed the expansion of librarianship courses to other states. In the 1950s and 1960s, the creation of professional library associations in the country, as well as the completion of the first professional events and congresses in the field, created even more opportunities for relevant professional education and development. These events were promoted with the aim of bringing together librarians from throughout Brazil, in order to exchange experiences. They also gave rise to the creation of numerous libraries, particularly in federal agencies all the while encouraging further participation of candidates in professional courses. The various courses of librarianship in the country began to emerge in 1942 in several states, mainly linked to the federal universities, and by 1965, there were 14 official library science courses.

Since the enactment of the LDB, which repealed all previous legislation concerning undergraduate courses, professionals in the field of librarianship began discussions on the guidelines set out in the Act. The resulting document, "Curriculum Guidelines for Librarianship Courses," relaxed the curricular structure of training courses for librarians, being more directed to the needs of Brazilian society. Presently, the 43 existing courses in 2014 in the country follow these guidelines in establishing their curricula.

MODEL CLASSROOM TEACHING OF LIBRARY SCIENCE

The CFB indicates that the number of classroom-skilled library professionals working in Brazil is approximately

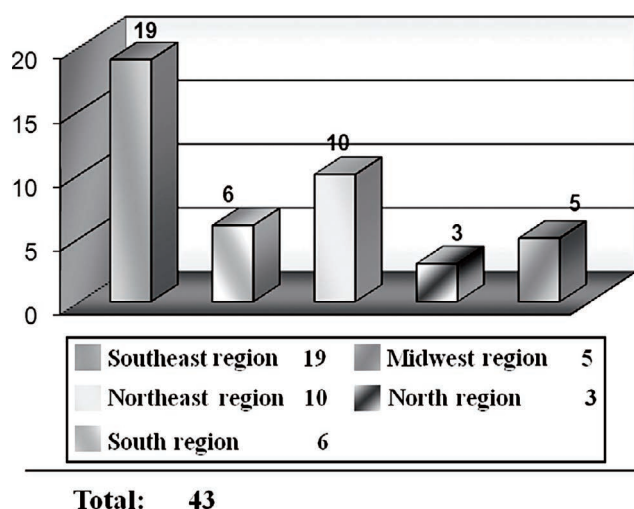


Fig. 1 Number of librarianship courses in Brazil.
Source: From Russo.^[1]

30,000 librarians. This data may be contrasted with the vast continental dimensions of the country and its population of over 200 million inhabitants, resulting in a scenario in which information is considered a vital asset (Fig. 1).^[13]

When analyzing the distribution of library science courses in Brazil, the following chart shows the highest incidence in the Southeast (44%), which is also the most economically developed region of the country.

Fig. 2 shows another aspect of the distribution of librarianship courses among Brazilian regions allowing the analysis of the relations between the number of courses and the size of Brazilian region.



Fig. 2 Librarianship courses in Brazil regions.
Source: From Russo.^[1]

In analyzing this distribution, the CFB highlights that the distribution of bachelors' training courses for librarianship is deficient in relation to the size of the country, especially with regard to the North and Midwest, which in geographical terms represent more than 50% of the national territory.^[13]

The data allow us to state categorically that the distribution of trained and qualified professionals in the country reflects the need to provide alternatives for the education of librarians to meet the significant social demand for effective information services.

Thus, considering the disparities exposed with current offerings for bachelor's degree courses in library science, the alternative methodology of distance education could serve to reverse the current scenario.

Library Science and Distance Education

The involvement of librarians with distance education dates back to the late nineteenth century, when, in 1888, American librarian Melvil Dewey invited professionals from the School of Librarianship in Albany, NY, to develop correspondence courses to update librarians in small American libraries.^[14]

In Brazil, distance education in library science has occurred more significantly during the last ten years, focusing on graduate-level courses. Such initiatives almost always aim at training professionals on current issues or topics in which their work activities require specific training. Many institutions are offering these courses, both in the public and private sectors, encouraging either recent graduates or more experienced librarians to embrace these opportunities for improvement or continuing education making use of one of the main facilities of distance education, which is the flexibility of time and place to study.

Libraries, in turn, are also making use of distance learning platforms to provide courses and training for users in various topics of interest such as information literacy, standards of scholarly work, access to databases, and many others, some of which already perform reference service through these virtual tools to promote real-time interaction with its users.

There are few studies analyzing the application of distance education in undergraduate courses in librarianship. Most of them present initiatives in disciplines where professors give classroom lectures complemented by distance learning sessions, which are used in virtual learning environments (AVAs). Among these environments, the most used is called Moodle, created in 2001 by Australian educator and computer scientist Martin Dougiamas, which allows open access. This software provides the instructor with tools for creating web-based courses with access control so that only enrolled students may have access to its content and facilities.

Even with the scenario described earlier, distance education in Brazil has been developing in various disciplines. Since 2006, the government has been providing greater incentives for the creation of numerous undergraduate courses in this mode by UAB.

The idea of creating an undergraduate degree in librarianship via distance education arose from the demand at the Open University in 2008. There was a great need to prepare library technical assistants to meet the needs of the classroom centers and libraries that were unable to service users taking their courses.

Motivated by this invitation and the opportunity to take higher inland education, the CFB, aware of the Brazilian library scenario and the lack of qualified personnel to develop products and services tailored to the needs of its actual and potential users, presented a counterproposal to the sponsoring agency suggesting the design of a distance course, not for the preparation of technical support personnel but instead for the training of full-fledged librarians. To support their stance, they used examples of international experiences in other countries based on current professional literature.

The acceptance of this counterproposal resulted in a partnership between the UAB and the CFB for the development of the pedagogical content of that course. This choice was considered due to the fact that the UAB system functions as the connector between higher educational institutions and state and local government in order to meet local demands for higher education. It was also reasoned at that time that the educational institutions that would be responsible for offering the courses in distance education would be exclusively public, federal, state, and municipal institutions called public institutions of higher education (IPES). This decision was based on the fact that these IPES that act with the support of classroom centers functioning as operational units with administrative and educational activities also provide the physical, technological, and educational infrastructure for the monitoring of distance courses.

Given this structure, various documents were drawn up by working groups of the two institutions involved including the pedagogical foundation to support universities that will offer training in distance education for librarianship. Using as a basis the studies of the Brazilian Association of Education in Information Science, the pedagogical design of the course was structured in eight different sections: Section 0, Basic Module; Section 1, Theoretical Foundations of Library and Information Science; Section 2, Organization and Representation of Information; Section 3, Resources and Information Services; Section 4, Policies and Management of Information Environments; Section 5, Information Technology and Communication; Section 6, Research in Library and Information Science; Section 7, Internships and Complementary Activities.

The proposal of the course curriculum covers a total of 2685 hr, distributed in eight distinct sections, lasting 4 yrs

or eight semesters. In the project, it is emphasized that “[...] the details of the school year and semester modules must be in accordance with current legislation, with the school regulations of the university and the proposed project submitted and approved by the UAB” (Reference,^[13] p. 22).

The counterpart of the institution that will offer the course must demonstrate the physical, material, and informational resources available as well as faculty members (teachers and tutors). For the latter, the weekly workload timetable, curricula, and other documents proving their competence to teach must also be presented.

The project also stipulates that tutors will play a fundamental role in the process and, therefore, should be described in detail by the proposing institution. They will be responsible for distance tutoring while mediating the learning process with those students geographically distant. Tutors will attend students at the classroom centers at reserved times. The tutor should therefore be well versed in the pedagogical course design; the teaching materials and the specific content under his/her responsibility, in order to answer questions, assist in individual and group activities and also participate in the evaluation process with teachers.

As for the administrative part, the IPES shall provide technical personnel to offer the support needed to complete the courses under their responsibility. This will include tasks emanated from the faculty members at the headquarters of the institution and also in the classroom centers. In these spaces, there will be technical support jobs for the provision of libraries, laboratories, maintenance of equipment, and physical facilities. This team should also operate in the academic department of the course, with the records and monitoring of enrollment and academic procedures, as well as providing academic support to tutors and teachers in classroom and distance activities.

The importance of the communication process is stressed in the project, insofar as the success of a distance course depends on the interaction between all participants in the process. In this sense, one should rely on an AVA, which should enable the following features: electronic mail, videoconferencing, discussion forum, chats, and other means of communication.

Also described in the pedagogical project is the curriculum content of the course, focusing on the sections previously mentioned, showing the options and objectives of each discipline.

After approval of this pedagogical project, CAPES launched in 2012 a Request-for-proposal (RFP) to select the Brazilian university that would manage the production of educational material to be offered by this course. Five institutions submitted proposals and the Federal University of Rio de Janeiro (UFRJ), through the Course of Library and Information Management Units (CBG), were selected to develop this innovative task.

The Notice 12/2012, which selected the UFRJ for managing the production of this course, also gave financial resources to select and train instructors for the content development of the many disciplines that make up the course curriculum. The Center for Distance Higher Education of Rio de Janeiro (CEDERJ) was chosen as UFRJ's partner institution in this project and is responsible for training the content developers, as well as for monitoring the production of the material to ensure consistency with the special characteristics of distance learning and teaching. With regard to expected results, the main points to be considered were 1) store the material developed by the project in a virtual repository, to be available to all IPES coordinators of the courses; 2) follow international standards to enable interoperability between different platforms; 3) prepare metadata that is compatible with international standards to enable the retrieval of information.

Thus, it was necessary to set up permanent teams to monitor and provide technical and operational support to the project. The following teams were created: 1) Technical Commission of Librarianship for Monitoring and Evaluation (CT) established by CAPES with the task of monitoring the management of the content development process of teaching materials, as well as other issues relating to the course offerings in library science under the UAB system. They act as an advisory committee. 2) Management Commission for the Production of Teaching Materials for the Library Science Course in Distance Education (CG) established by UFRJ, which is comprised of four members and two alternates, five of them are LS professors and one is a librarian from the CBG/UFRJ. Its function is to manage the operation of the project for production of teaching materials, monitoring the performance of all parties involved in the process. 3) Evaluation Commission of the Production of Teaching Materials for the Library Science Course in Distance Education (CA) established by UFRJ, being formed by two members nominated by the Technical Commission for Monitoring and Evaluation of Library Science, two members nominated by the Commission of Management of Production of Educational Materials of the course on librarianship, and a member of the distance education specialist, with experience in the production of educational materials for distance education. Its functions are to participate in the selection process of authors and readers, follow the process of production of teaching materials, and verify if the contents meet the guidelines of the pedagogical design of the course. This commission shall have a deliberative nature and includes CAPES participation in its decisions.

A summary of the key steps of the implementation process of the project of management of the distance education teaching materials for the course is presented here:

1. *Analysis and selection*: Selection of authors and readers and hiring technical staff; training of authors

and readers; signing the Declaration of Commitment; setting deadlines for delivering the materials and Deed of Assignment of Rights of Use for the teaching materials and support within the UAB system and in projects, programs, and courses of interest to the federal government.

2. *Design and development*: Creating and augmenting the virtual repository; preparation of teaching materials by subject (author); proofreading the teaching materials by subject (reader); preparation of instructional design and graphic design; CG and CA managing the preparation of teaching materials by subject, and validation of the material by CT.
3. *Certification and printing of course materials*: Registration of the teaching material produced in the International Standard Book Number, by the National Library Foundation Registration; production of matrices/electronic files for reproduction and control of the production of the material by CG.
4. *Delivery of material*: Recording of the materials developed; submission of materials to CAPES; sending interim and final reports on the progress of the project to CAPES/UAB.

It is important to note that the steps mentioned earlier will be followed to develop each of the disciplines, while seeking to meet the goals of the teaching and learning process and the guidelines of the educational program.

Besides the mandatory printed course material, supporting materials such as videos with the presentation of the course, tutorials, and programs of specific subjects for teachers, tutors, and students will also be produced.

After the design of the project, the team at UFRJ started actions aimed at developing a methodology for its implementation. These actions describe the path from design to development of this entry.

In order to maximize efforts, formal partnerships were made between UFRJ and the following institutions:

- Cederj—For advice on training and instructional design of the object of this public notice process;
- Jose Bonifacio University Foundation—To support the financial management of resources allocated to the project.

For the physical execution of the project, we sought a proper installation within the university campus at UFRJ, with the ultimate decision to occupy space at the Center for Distance Education (NEAD), a newly created center at UFRJ to provide the technological infrastructure and logistics for the development of distance learning courses at the university.

The development of this course material is scheduled to be completed by the end of 2015 or early 2016, when the subject content of the first four periods will be ready. At that point, CAPES will send out another tender for the

launching of the first official course in distance education for library science.

The preparation of this course content will result in a new, dynamic program of library science offered via distance education, which should meet the demands of the labor market in urban as well as rural areas. In this context, the expectations of the Brazilian government for the expansion of training opportunities at the university level should serve as a guiding point of this initiative.

CONCLUSIONS

The changes perceived in society, arising from the availability of vast amounts of information transmitted primarily by electronic networks, are omnipresent and causing a substantial impact on the socioeconomic, cultural, and educational environments of the world.

With regard to Brazil, concern about access to information and, hence, knowledge, on the part of its population also poses serious problems for the government, not only because of its territorial dimensions, but also because of persistent social inequalities observed in the regional development of the country.

The conventional educational model in effect throughout the entire country makes clear that the difficulties arising from this type of education will not be resolved in the short term, thus leaving a large part of the population on the sidelines of any formal educational activities.

In this context, the modality of distance education is considered a viable way to promote changes in an unfavorable environment leading to an education for many people who, for different reasons, have not had the chance to obtain one by traditional methods. This concept of teaching—more open, flexible, agile, dynamic, and autonomous—is being seen by the Brazilian government as a strategic tool to insert citizens into society, bringing improvements for their future and for the country in general.

In order to achieve this goal, UAB was created in 2005. Among its objectives is to offer degree courses in different fields of knowledge, expanding access to public higher education. In 2008, the discipline of library science was selected to create a new undergraduate course in this mode of teaching.

As mentioned in this study, the fact is that the choice of this area fell, first, on the issue of providing libraries to the Centers of Classroom Support (PAP), units that physically support the courses of UAB. However, negotiations with the CFB brought to light other demands of jobs for librarians, such as part of the labor market, which had professional posts in public and school libraries occupied by laypersons. Given this fact, those information units failed to provide the quality services for which librarians are trained and, thus, society lost out on that benefit.

We conclude that the provision of distance education courses in library science, with its more inclusive proposal, stands out as truly innovative, as it proposes to raise the bar for teaching in the area while increasing the possibilities for training professionals throughout the country with the goal of meeting the needs already identified.

One of the innovative aspects of this course lies in the initiative having been fulfilled by a partnership between a government agency, CAPES/UAB, and a professional union, the CFB, in order to conduct an educational course for professionals to work in the country's libraries, thereby solving the problem of a lack of qualified professionals in so many units of information such as documentation centers, special libraries, or public/academic libraries.

The increased supply of education in library science combined with opportunities for broader access to the course via distance education can lead to advantages for the candidates, such as saving time and resources, convenience of study, autonomy and flexibility in the tasks, and monitoring by tutors and more. This innovative characteristic of work and learning serves well as an enriching element of the educational process.

The incremental development of instructional materials and content produced for the course in distance education will also help classroom courses offered in the country, since this type of material has unique characteristics. They are written specifically for the student body, with the central aim of awakening their interest. The personal and conversational style facilitates active student participation in the learning process and eventual application of what is learned.

On the other hand, the production of teaching materials for courses in distance education presents major challenges to the team responsible for its preparation. The approach needs to be multidisciplinary, relying not only on experts in distance education but also on teachers responsible for the production of content, reviewers who are responsible for grammatical and editorial revisions, and experts in design and visual programming who create and develop graphic design and interactive content.

The strong presence of ICT in the teaching of library science courses via distance education, through the use of AVA, blogs, chats, wikis, and other collaborative writing tools, is considered an innovative approach in the area, a characteristic that may influence classroom courses. It is understood that ICT may serve primarily as a tool to streamline the interaction between the parties involved in the teaching process and the completion of tasks in order to build collective knowledge.

Increasing the number of library school graduates in the country, be it by classroom or distance education, serves well to promote greater visibility for the library science profession and also the body of work it encompasses.

Given these facts, the joint action by CAPES/UAB, the CFB and UFRJ will help significantly in overcoming the

obstacles described. The collective construction, with the overarching purpose to provide as many Brazilians as possible with access to higher education and of ensuring a better life, will also contribute to a stronger, economically sound country.

This effort established a new landmark in the field of library science, but its success will depend on the commitment of the sponsoring institutions, UAB and CFB, and also on the IPES. Through cooperation, this groundbreaking initiative will have the chance to reshape the library science area, and enrich its educational process bringing benefits to the Brazilian society.

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Brazil: Museums

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Abstract

This entry presents a history of the National Museum as an example of the challenges to Brazilian museums facing political objectives at different times. The New Museology is examined, as a landmark for the transformation of the institutions of memory, and an example of the ever-changing activities of the National Museum (Museu Nacional) in Rio de Janeiro. The text should be considered as a contribution to museological sciences encouraging reflections between professionals of different subspecialties in various museums.

INTRODUCTION

Brazil, one of the largest economies of the world, has a land mass covering more than half of South America, and a population of more than 190 million people. Since Pedro Alvares Cabral set foot on the continent in 1500, Brazil has produced a wide range of museums and libraries to serve its diverse population. Brazilian museums have been established and supported by royalties, politicians, bureaucrats, philanthropists, banks, universities, and wealthy families and individuals. The many unique museums found all over the country range from classical art collections in Sao Paulo to snakes and butterflies in the Amazon to creative folk arts depicting the utterly weird to daily life events on the outskirts of Rio de Janeiro. Libraries too have been founded and supported by a similar cast of characters. They are also wide ranging from the massive National Library on Rio Branco Avenue to a very petite one tucked away on a winding, uphill Rio road specializing in only *literatura de cordel* or “string literature” published only in Brazil (Fig. 1).

OVERVIEW

The idea of “museum,” as conceived today, was formed during the Renaissance and subsequent Age of Enlightenment, when the methods, systems, and scientific purposes characteristic of public museums were defined. From the eighteenth century, most notably with the French Revolution, when the concept of “national patrimony” became part of the ideological strategies of the modern European state, the museum would become a privileged space to protect the fragments that “materialize the collective inheritance of the nation.”^[1] It became a symbolic space to legitimize the State, reconciling historical continuity

with the creation of new spaces of memory. Portugal was not exempt from such developments, and colonial minister Martinho de Melo e Castro was instructed by Queen Maria I to require colonial administrators such as Brazilian vice-roy (from 1779 to 1790) Luis de Vasconcelos e Sousa, conde de Figueiro', to send back to Lisbon samples of local flora and fauna—even live animals^[2] and anything else representing the cultures of each colony, its mineral and agricultural potential, and the customs of its inhabitants for inclusion in Lisbon's royal museum, the Real Museu da Ajuda. The object of all this was the embellishment of the capital reflecting the scientific discoveries of the day. Within two decades, however, the capital would be moved from the old continent to the New World, together with the Museum, where it would become the Royal, and subsequently the National Museum, which is now part of the Federal University of Rio de Janeiro [MNRJ].

THE FIRST BRAZILIAN MUSEUM

According to Jose Lacerda de Araújo Feio, director of the National Museum, 1967–1971, the exact date of the inauguration of the House of Birds is unknown. It apparently opened even before the building to house it had been finished. Feio calculates that it started in 1783.^[3] For Maria Margaret Lopes, professor at the Universidade Estadual de Campinas, the Museum of Natural History opened in 1784, the same year in which Viceroy D. Luis de Vasconcelos e Sousa created the Cabinet of Natural History Studies and quite probably the Museum of Natural History as well.^[4] Luis de Vasconcelos e Sousa was succeeded as viceroy, 1790–1801, by Fernando José de Portugal e Castro, future third conde de Resende and second marquês de Aguiar, who was devoid of interest in the



Fig. 1 Map of Brazil.

Source: CIA The World Factbook.
<https://www.cia.gov/library/publications/the-world-factbook/geos/br.html>.

activities of the Museum of Natural History, and consequently, the establishment declined due to inattention and underfunding. In 1810, 20 years after its creation, the director, Francisco Xavier C. Caldeira, died and was replaced by Dr. Luiz Antonio da Costa Barradas. Sometime during 1811, the building was transformed into a workshop for diamond cutting, thus discouraging the collection of animals. On June 22, 1813, Fernando Jose de Portugal e Castro signed decree 20 of Prince Regent Dom João (1767–1826) giving an order “to extinguish the museum of this Court.” All the materials were summarily packed into two large boxes comprised of more than a 1000 bird skins, many insects, and some mammals.

The boxes and the furniture were given, for 1 yr’s safekeeping in a single room, to one Costa Barradas, presumably the father of the namesake Maranhão magistrate Joaquim da Costa Barradas, and the building was later razed.

In its place, a building for the Royal State Treasury was constructed, that later sheltered the National Treasury. In parallel to the decline of the Museum of Natural History, we pass now to an analysis of the situation in Europe as we identify the moment that would change the trajectory of Portugal and, consequently, of Brazil. The transference

of the Portuguese Court was a carefully planned endeavor. It was, without question, a strategic plan, conceived at the end of the eighteenth century, as an emergency solution that would save the Portuguese Crown during crisis situations. However, the transference only materialized when the threat became imminent to the integrity of the monarchy. The Prince Regent Dom João, the future King João VI, convinced that the Crown would only be guaranteed if he could preserve his possessions in the New World, whose vast natural resources were superior to those of Portugal, left Lisbon in November of 1807, with an entourage of some 15,000 courtiers and subjects.

The transference of the Lusitanian State structure to Brazil marked the end of the colonial period for Brazil.^[5] The city of choice was Rio de Janeiro, which was the principal port city and since 1763 the colony’s capital. Shortly after his arrival, Dom João, who intended to transform the region into the capital of the Portuguese monarchy, created a naval academy, a school of gunnery and fortification, a military archive, a gunpowder mill, the São João Theater, a government press, the Botanical Garden, the Academy of Fine Arts, the Chamber of Commerce, and the Royal Library, among others. On June 6, 1818, the Royal Museum was created,^[6] by the decree of

Dom João VI implemented by Interior Minister Thomas Antonio de Villanova Portugal. As a first step, a building was acquired from João Rodrigues Pereira de Almeida, created in 1828, barão de Ubá. Father Jose da Costa Azevedo (1818–1823) was appointed director.

He had previously been responsible for the Cabinet of Minerals and Physics, in the Military Academy. The Royal Museum, known from 1822 as the National Museum, represented, as did other institutions, a “transposition of European models to the tropics, demonstrating an alignment to the analogous initiatives in Europe.”^[1] The first collections of the Royal Museum were indigenous artifacts and natural products of the region. Dom João VI himself offered two octagonal display cases, containing 80 models of workshops of the professions most common at the end of the eighteenth century, made at the time on the instruction of his elder brother Prince Dom Jose, 1761–1788. One example is “a vase of gilt silver, crowned with coral representing the Emperor Constantine’s victory and consequent triumph of Christianity at the 312 battle of the Milvian Bridge; two keys; a carved Greek marble foot with sandal; one firearm of carved ivory from the Middle Ages and a fine collection of oil paintings”^[7] (Fig. 2).

As the monarchy strengthened in Brazil, so did the museum. With João VI’s return to Portugal, his elder son, Dom Pedro, became Prince Regent of Brazil and, as such, opened the Royal Museum to the public. In October of 1821, public visits to the Royal Museum began as decreed: “On Thursday of each week from ten in the morning until one in the afternoon, not being a holy day, to all persons, Foreign or National, who make worthy use of it for its knowledge and qualities.”^[8]

After this, the collections of the Royal Museum grew as the Brazilian kingdom became an empire with Prince Pedro now Emperor Dom Pedro I, advised by his chief minister Jose Bonifácio de Andrada e Silva to adopt a policy of encouraging visiting naturalists to donate artifacts and samples from the different regions of Brazil for the Museum.^[9] Analyzing the correspondence of the Imperial and National Museum from 1822, we can see that the work of identifying and researching materials and samples sought by the Imperial Government had been added to the activities and responsibilities of the museum staff. It also becomes evident that, from the second half of the nineteenth century, increasing requests for the Museum’s services points to a constant interaction between members of the Government and the administrators of the Museum. Gradually, the Imperial and National Museum became a vital resource center for the Empire (Fig. 3).

As the Imperial government explored Brazil’s natural wealth, and then with the second emperor Pedro II^[10] constantly encouraging scientific studies, the sciences in Brazil developed and grew throughout the nineteenth century. The Museum, with its scientific specialties—such as botany, zoology, geology, and ethnography—provided the



Fig. 2 Golden vase of silver donated by Dom João to the Royal Museum.



Fig. 3 Imperial and National Museum in Campo de Santana, Downtown, Rio de Janeiro.

foundation for great contributions to the natural sciences, heralded in the latter nineteenth century as fundamental to Brazil's progress. As the struggle for independence triumphed and internal cohesion was gradually secured, the Empire, despite its continued dependence on slave-based agriculture, joined the ranks of "civilized" countries. While in 1842, the Imperial and National Museum was recognized as Brazil's national museum, other museums were being created: the Emílio Goeldi Museum, for example, in Belém in 1861, or the Paulista Museum in São Paulo in 1890. The Goeldi Museum stands out as the largest museum of natural history in Northern Brazil. It, like the National Museum, is also dedicated to natural history. The concept of a museum for São Paulo dates back to the year of independence in 1822, but for various reasons, it was only in the Republican period that the institution was consolidated as a "place of memory,"^[12] being inaugurated in 1895. Over the next 100 years, it survived many modifications in its structure and eventually became a historical and university institution connected to the University of São Paulo. In 1946, the National Museum was affiliated with the University of Brazil (currently the Federal University of Rio de Janeiro) and has adapted to the teaching, research, and extension missions of the University. In this way, it was strengthened as an institution of natural and anthropological sciences in an academic environment.

NEW MUSEOLOGY

The science of museums, for many years, was related to the analysis of practices occurring in the various institutions. During the 1970s, discussions about the concepts of museums and patrimony led to the concept of Museology and, in turn, to "a social science that studies museum objects as a knowledge source" in the 1980s.^[13] In this way, the new concept of Museology adjusted to the New History^[14] that had departed from the factual narrative into an alliance with narratives of the oppressed, the disenfranchised, women, Indians, and new interpretations of daily life.

Additionally, we can link studies of Social Memory^[15] and its excellent argument on patrimony^[16] to the exigencies of the New Museology connecting the museum with its community. Throughout the twentieth century, there was a proliferation of diverse thematic museums in different regions of Brazil—some affiliated with universities; others with schools and communities. The museums, when being used as a "laboratory" of an educational institution, provided students the opportunity to improve their knowledge of preservation and scientific analysis through the collections on display and other primary resources. For example, we highlight the current National Museum, an institution that is being used for postgraduate extension courses, research, and education in the areas of

social anthropology, botany, and zoology, but facing the quandary of disconnection from education and research versus extension studies. Education and "elitist studies" done within the museum walls did not reach the community resulting in a dead end as far as outreach was concerned. At the turn of the twenty-first century, this changed with increasing activities directed toward schools and visitors to the museum's expositions. Not satisfied with short-term results, the institution's directors went outside its walls undertaking activities in the Boa Vista Park directly across the street. The anniversary of the institution's founding was chosen for the first such event, and this has continued each year ever since. Under large tents, minilaboratories, simulations, and exhibits are set up for geology, botany, and archaeology, along with presentations of vertebrates, invertebrates, or fossils: a new focus for the museum's activities and a great new interaction with the community. This gave the institution a new look changing it from a deposit for old objects into an educational laboratory presenting the results of research and education directly to the community. The Museum of Art in São Paulo (MASP) has taken outreach and continuing education seriously since the 1970s. Their educational services include children's art clubs, museum studies for students, and guided tours for school groups and adults. Through political maneuvers and policy changes, the museums of the New Museology^[18] have been transformed from places that rescued popular culture only to display it for the benefit of the privileged into vibrant institutions for the education of the entire populace.

Anthropological analysis suggests that museographic representations should be viewed as fact rather than fiction; thus, objects in museums play a strategic role in this process. Objects are seen as part of distant realities in space or time, establishing a delicate continuity that connects the visible with the invisible.^[19]

CONCLUSION

The first museum created in Brazil was established to keep, collect, and conduct research on the country's culture and its vast natural resources. As the years passed, the National Museum became an instrument in the Imperial regime's drive to establish, develop, and unify the nation. This drive extended into the present as many new museums were established in the late nineteenth and twentieth centuries highlighting the historical and artistic wealth of the nation such as the MASP, National Museum of Fine Arts in Rio, Historical Museum of the Republic, Museum of Modern Art, the State Pinacoteca in São Paulo, Casa do Pontal Museum, and Museum of Astronomy and Related Sciences, among many others. For the most part, the role of education in museums during the early nineteenth century, alas, did not last into the next century. Education, research, and public outreach suffered

inferior roles during the twentieth century with a few notable exceptions. These factors culminated in the estrangement of the institution and a lack of interaction between these three functions. According to the precepts of the New Museology, a change was required to present the National Museum's activities to the public, in order to stimulate reflection and appreciation as a tool for education. Finally, we look forward to the day when the daily work of museums will contribute to the integration of different professions: museum specialists, curators, historians, anthropologists, sociologists, biologists, archaeologists, librarians, and archivists. Beyond preserving objects, they must all develop studies that will enhance the knowledge base, updating and disseminating information about museum holdings, thus encouraging more reflection and thought about the resources they exhibit with a multidisciplinary outlook.

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British Library

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Abstract

The British Library holds one of the richest and most comprehensive collections of the world's knowledge. The collection is at the heart of the unparalleled range of services that are provided to national and international users in reading rooms and exhibition galleries and through document supply. The Library is active in its use of electronic services and digitization to provide effective and ever-wider access to its holdings. One of its main tasks is to collect, preserve, and provide access to the United Kingdom's National Published Archive. Significantly, new Legal Deposit regulations, which came into force in April 2013, extended this remit into the digital domain and conferred on the British Library (and the other UK legal deposit libraries) the right to receive a copy of every UK electronic publication including blogs, e-books, and the entire UK web domain.

INTRODUCTION

The British Library (BL) is the national library of the United Kingdom and one of the world's greatest libraries. It is also most emphatically a library for the world. It has its origins in the former Library of the British Museum and it holds one of the most comprehensive collections of the world's knowledge. Its collection can be said to contain both the memory of the nation and also the DNA of civilization. The collection is at the heart of the unparalleled range of services that the BL provides to national and international users in reading rooms and exhibition galleries and through document supply and bibliographic services. The Library is active in its use of electronic services and digitization to provide effective and ever-wider access to its holdings. One of its main tasks is to collect, preserve, and provide access to the United Kingdom's National Published Archive. Significantly, new Legal Deposit regulations, which came into force on April 6, 2013, extended this remit into the digital domain and conferred on the BL (and the other UK legal deposit libraries) the right to receive a copy of every UK electronic publication including blogs, e-books, and the entire UK web domain.

HISTORY, FOUNDATION, AND FUNDING

The British Library Act 1972^[1] established the BL as the "...national library for the United Kingdom... consisting of a comprehensive collection of books, manuscripts, periodicals, films and other recorded matter, whether printed or otherwise." The Act charged the British Library Board with managing the Library as "...a national centre for reference, study and bibliographical and other information services, in relation both to scientific and technological matters and to the humanities" and with making its

services available "... in particular to institutions of education and learning, other libraries and industry."

The BL commenced operations in July 1973. While this was the first time that the United Kingdom as a whole had formally had a national library, the creation of this new body amalgamated a number of existing library institutions—each having a national remit—into a single administrative unit. Of these existing institutions, arguably the most notable was the library of the British Museum.^[2,3]

The British Museum had been founded by Act of Parliament in 1753. Prompted by the decision of Sir Hans Sloane, the eminent physician and scientist, to bequeath his large collections of books, manuscripts, drawing, antiquities, and natural history specimens to the nation, the foundation collections of the British Museum Library also included the Harleian Manuscripts collected by Robert Harley, the first and Earl of Oxford and his son Edward, and the manuscripts collection of Sir Robert Bruce Cotton. The Cottonian collection included such treasures as the Lindisfarne Gospels, the Cotton Genesis, and two of the four surviving copies of Magna Carta. One phrase in the British Museum Act of 1753 has a permanent relevance: "For publick use to posterity."

Sir Anthony Panizzi is generally credited with making the British Museum Library the great treasure-house that it became in his lifetime. An Italian émigré and patriot, he held a succession of positions: first assistant librarian (1831–1837), then keeper of printed books (1837–1856), and finally principal librarian and director (1856–1866). He was knighted in 1869. He argued "I want a poor student to have the same means of indulging his learned curiosity, of following his rational pursuits, of consulting the same authorities, of fathoming the most intricate inquiry, as the richest man in the kingdom, as far as books go..." It was his aim "to bring together from all quarters

the useful, the elegant and the curious literature of every language; to unite with the best English Library in England, or the world, the best Russian library out of Russia. . . and so with every language from Italian to Icelandic, from Polish to Portuguese.” Panizzi enforced the system of legal deposit, organized the production of the new catalogue, and oversaw the construction of the famous Round Reading Room of 1857 in the quadrangle of the Museum building to a design by Smirke. The current strength of the BL’s collections derives in no small part from Panizzi’s legacy.

The catalyst for the passage of the British Library Act had been the 1969 Report of the National Library Committee.^[4] Chaired by Dr F.S. Dainton (later Lord Dainton), the Committee had been tasked with “the examination of the various National Libraries, and, in particular, to consider whether these institutions should be brought together into a unified framework.” The Committee concluded that in the interest of efficiency and effectiveness the institutions should be integrated into a new authority. The other institutions that were amalgamated into the new national library in 1973/1974 were the National Reference Library of Science and Invention, the National Lending Library for Science and Technology, the National Central Library, the British National Bibliography Ltd, and the Office for Scientific and Technical Information. (Subsequently, in 1982, the India Office Library and Records also joined the BL, followed by the British Institute of Recorded Sound, later renamed the National Sound Archive, in 1983.) It was the amalgamation of these component parts that defined the compass of the new national library. As the 1971 White Paper put it, “*The objective of the British Library will be to provide the best possible central library services for the United Kingdom*”.^[5]

With respect to the breadth of the BL’s mission, Dame Lynne Brindley (the Library’s former chief executive) has argued^[6] that, as a national library, the BL is effectively “... *in a class of one, and continues to be unique, particularly in its wide scope of activities and services.*” The value that the BL brings is essentially threefold:

- It is a critical resource for UK research, it is an integral component of the national research infrastructure, and it plays a correspondingly significant role in ensuring the research excellence of the UK.
- It underpins business and enterprise through its contribution to knowledge transfer, creativity, and innovation.
- It is a world-class cultural institution with a vital role as a holder of the national memory.

Thus, the BL occupies a prominent place in the intellectual and cultural life of the nation. It is an integral component of the research infrastructure and it plays a correspondingly significant role in ensuring the research excellence of the United Kingdom and in supporting

creativity and innovation. An independent economic impact study^[7] commissioned by the BL in 2003 suggested that the total value added to the UK economy by the Library each year was £363 million, or £4.40 for every £1 of public funding. An updated study undertaken in 2013 confirmed that the Library generates a net economic value of £419 million for its users and UK society as a whole. The study showed that the benefit cost ratio had increased to 4.9 from 4.4 in 2003 and, accounting for value placed on the Library internationally, the benefit cost ratio was 5.1.

The early history of the Library from its foundation, and thus from the first edition of this encyclopedia, was characterized by an ever-closer fusion of its constituent parts, developed through a number of different structures, each of which moved the Library forward.

Full integration was achieved and most symbolically demonstrated by the opening of the Library’s purpose-built premises at St. Pancras in London by Her Majesty Queen Elizabeth II in June 1998 (Fig. 1). The building, designed by Sir Colin St. John Wilson, now stands as a confident symbol of the importance of *all* libraries to the nation’s cultural, scientific, educational, and economic success in the twenty-first century. However, its construction was not without controversy.^[8] HRH The Prince of Wales described the new BL as looking “more like the assembly hall of an academy for secret police.” A campaign was mounted by the Regular Readers Group seeking to retain reader facilities in the British Museum, notably the Round Reading Room and North Library. A 1994 Parliamentary Select Committee described the building as “an edifice that resembles a Babylonian ziggurat seen through a fun-fair distorting mirror.” And inquiries by the National Audit Office in both 1990 and 1996 were highly critical of the project management of the construction of the building, which was significantly delayed due to technical problems with the book shelving, with cabling damaged during installation, with shortcomings in the fire protection systems, and remedial works. The building finally opened to readers’ acclaim in December 1996, and the knighthood conferred on St. John Wilson in the 1998 New Year’s Honours list for services to architecture can perhaps be seen as constituting the final word on the architecture of the BL building.

At St. Pancras, the Library was able to consolidate services from 18 different buildings around London, including the move from the historic Round Reading Room at the British Museum, thus bringing humanities researchers to join their peers from the scientific disciplines in 11 new reading rooms (with 1200 reader places) covering all fields of research.

The Board has adopted a two-site estates strategy based on its headquarters building at St. Pancras and a campus site in Boston Spa, Yorkshire. In line with this strategy, construction of the BL’s new state-of-the-art Centre for Conservation, to the rear of the St. Pancras building, completed in spring 2007.



Fig. 1 BL's headquarters in St. Pancras, London, is a sleek, modern complement to the Victorian Gothic railway station alongside.

Boston Spa promises to be the site of future expansion because it offers both space and relatively cheaper building costs and, at the time of writing, construction of a major new collection storage building was well under way. This low-oxygen, high-density storage unit will employ a fully automated storage and retrieval system and have a capacity for 260 km of storage (ca 7 million items). The Library's newspaper strategy, which addresses the future consolidation of the newspaper collections currently held in a separate newspaper library in North London, envisages the storage of newsprint in an additional newspaper storage facility, adopting a similar technological solution, at Boston Spa with access via digital and microfilm surrogates at St. Pancras. The Library employs broadly 2000 staff at its sites in London and Boston Spa.

The British Library Board has adopted a two-site estates strategy based on its headquarters building at St. Pancras and its campus site in Boston Spa, Yorkshire. In line with this strategy, construction of the BL's Centre for Conservation, to the rear of the St. Pancras building, completed in spring 2007. The center, which was officially opened by HRH The Princess Royal in October 2007, provides a world-leading facility for book conservation and state-of-the-art technical facilities for the preservation of the Library's recorded sound collection. A program of behind-the-scenes tours is an important adjunct to the work of the center, enabling members of the public to see: conservation techniques ranging from manuscript repair using sturgeon glue to the digital processing of archival sound recordings. The center also offers a national and international internship program, the aim of which is to give interns the opportunity to work with the Library's experienced staff to gain skills and also confidence in what they are doing.

Boston Spa promises to be the site of future expansion for the BL because it offers both space and relatively

cheaper building costs. During the last decade the Library has taken significant steps to improve the quality of its collection storage facilities for the ever-growing physical collection and the progressive concentration of the Library's collection. December 2009 saw the opening of a major new £26 million storage building for printed books at Boston Spa (and as a consequence the vacation of three leasehold outhouse storage buildings in London). This new storage facility at Boston Spa provides capacity for ca.7 million items (the equivalent of 262 linear kilometers of traditional shelving) in high density, preservation standard storage, with fully automated retrieval systems operating in a low-oxygen environment, and growth space for the next decade. This automated, high-bay, high-density solution is used frequently in warehouse management but rarely in archives and libraries, and its size and characteristics make it one of the most remarkable library buildings in the world. Collection moves of low-use stock into the new facility began in January 2009 and completed in early 2012.

At the time of writing, construction of another major new collection storage building also on the Boston Spa site—for newspapers—had just completed (Fig. 2). This new Newspaper Storage Building will hold the BL's newspaper collection in the best of archival conditions and permit the vacation of the Library's Colindale facility in North London, home of the newspaper collection since 1905. The new facility will store the equivalent of 33 linear shelf kilometers of newspaper content. Like the Additional Storage Building, the store has a fully automated retrieval system and full temperature and humidity control, and it will enable the BL's print newspaper collections to be kept in archival-standard conditions for the first time ever. Temperature in the storage void is held at a constant 14°C (+/- 1°C) and relative humidity at 52%.



Fig. 2 BL's new Newspaper Storage Building under construction at Boston Spa in 2014.

To eliminate fire risk, oxygen levels in the void are reduced to 14.9vol% by continuously introducing nitrogen. The construction of this new storage building is one element of the BL's newspaper strategy. Newspapers are an immensely rich source for research but they deteriorate quickly because of the poor quality of the paper they are printed on and it is crucial that they are properly preserved for future generations. The Library's ambition is to digitize the best of its historical collections, to open up the collections, and to make them much more widely accessible on the web.

The Library employs broadly 1600 staff at its sites in London and Boston Spa.

The Library's funding comes mainly from UK central government, through the vote of the Department for Culture, Media, and Sport. (At the time of writing the balance of the Library's incoming resources is annually in broad terms: grant-in-aid of £95 million, supplemented by the Library's trading income of £14 million, primarily from document supply services, and a further £15.6 million from donations, grants from foundations, and similar forms of support.)

STRATEGY AND USER COMMUNITIES

In September 2010, following a year of extensive research and consultation with stakeholders and experts from the fields of technology, information, publishing, libraries, the

media, learning, and research, the BL published its *2020 Vision*,^[9] setting out its priorities and aspirations for the next decade. The *Vision* highlighted what the Library considered was likely to be the key trends and opportunities over the next 10 years, indicating how the BL planned to take advantage of those opportunities to remain a great national library and a major hub of the global information network. And the *Vision* also provided a long-term perspective on where the information world and the Library was heading and the strong sense of direction that would be needed, particularly during the subsequent years of financial constraint.

The experts consulted by the Library provided a range of views on what the world of 2020 would look like. These predictions included the following:

- Technology will be in a constant state of beta—rapidly changing and, by 2020, resulting in a very different environment from today.
- The new generation of “digital natives” will enjoy wider access than ever to a huge range of online content in all formats; they will assume that *everything* is available on the web—an incorrect assumption, as even by 2020 a huge amount of legacy content will remain undigitized.
- The online landscape will increasingly resemble the *semantic web*—in which computers become capable of extracting, classifying, and analyzing data to create context from content.

- The business models underpinning scholarly publishing will change dramatically—more teaching, learning, and research will take place virtually and multi- and interdisciplinary research will continue to grow in importance.
- Knowledge institutions will need to reposition themselves, demonstrating the distinct value they add to the knowledge economy.

Our mission and 2020 Vision

Our mission: Advancing the world's knowledge

Our vision: In 2020, the BL will be a leading hub in the global information network, advancing knowledge through our collections, expertise, and partnerships, for the benefit of the economy and society and the enrichment of cultural life.

Our vision is supported by five key themes which set out the strategic priorities for the Library:

1. Guarantee access for future generations
2. Enable access for everyone who wants to do research
3. Support research communities in key areas for social and economic benefit
4. Enrich the cultural life of the nation
5. Lead and collaborate in growing the world's knowledge base

In February 2011, the Library published *Growing Knowledge: the British Library's Strategy 2011–2015*,^[10] which set out how the Library intended incrementally, to move toward delivering its 2020 Vision over the period. The strategy recognized that all five strategic priorities were valuable in that they would enable the Library to support a wide range of users, with varied needs; however, in a period of financial constraint, efforts would need to be focused on essential activities. Therefore, in its strategy, the Library attached greatest weight to those activities relating to its statutory remit to make accessible the nation's and the world's store house of recorded knowledge, both now and in the future. Thus, its key implementation priorities for the period were to

- Achieve regulations enabling implementation of the Legal Deposit Libraries Act 2003
- Manage the ingest and storage of voluntary and legal deposit content
- Develop the Library's digital infrastructure
- Open a state-of-the-art facility for storage of physical newspapers
- Develop selective collaborative stewardship arrangements to collect and connect to content
- Digitize up to 20 million pages from the Library's newspaper collection in partnership with brightsolid

- Establish, in partnership, at least one major new large-scale digitization initiative in addition to the newspaper digitization initiative
- Obtain agreements from publishers to provide access to licensed materials off-site through a range of models

The Library's users come from diverse backgrounds, span all disciplines, and have varied needs. The Library defines its broad audience communities as follows:

- Researchers
- Business people
- The library network
- Schools and young people
- The general public

The BL is a great historic institution, with a critical mass of its own and a vibrant international brand. However, it is not an island. In caring for and managing its collection, and in providing access, it seeks to work productively with a range of partners where there is a demonstrable mutual benefit. And the absence of a unitary governance, policy, and funding structure within government for library provision nationally places a particular onus on the libraries themselves to collaborate both within and across sectors. Some notable examples of collaborative projects led by the Library follow.

The UK Research Reserve (UKRR) is a collaborative distributed national research collection managed by a partnership between the higher education sector and the BL. It allows higher education libraries to deduplicate their journal holdings of a title if two copies are held by other UKRR members, ensuring continued access to low-use journals, while allowing libraries to release space to meet the changing needs of their users. With funding from the Higher Education Funding Council for England (HEFCE), it has the target of releasing 100 km of shelf space by 2015 and to date has achieved £37 m in savings through eliminating the need for duplicated storage in the system.

Electronic Theses Online Service (EThOS) is the national aggregation service for UK PhD theses, provided by the BL. It aims to transform the visibility and availability of this previously rarely used resource: It demonstrates the quality of UK research and supports the UK Government's open-access principle (see the following text) that publications resulting from publicly funded research should be made freely available for all researchers, providing opportunities for further research. Currently, EThOS contains 350,000 records relating to theses awarded by over 120 institutions; around 120,000 of these also provide access to the full text thesis, either via download from the EThOS database or via links to the institution's own repository. Of the remaining 250,000 records dating back to at least 1800, three quarters are available to be ordered for scanning through the EThOS digitization-on-demand facility.

The British Library's Business & Intellectual Property Centre (BIPC) provides access to world-class business and

intellectual property information and expertise under one roof. The Library's information resources—which include market research reports, up-to-the-minute company and financial information, and patent and trademark databases—effectively give small businesses access to the same quality and depth of resources as those of a large multinational. The information is supplemented by free or highly discounted workshops, one-to-one clinics, mentoring, and networking events all designed to inspire people and to teach them the skills they need to set up and run a business. Since it was set up in 2006, it has welcomed over 350,000 people through its doors and has helped to create over 2,700 businesses. Now, in a joint project with the UK Intellectual Property Office and six major English city public libraries, the Library is extending the successful BIPC model across the country by establishing a cobranded network with one-stop shop centers for small businesses and entrepreneurs in the city libraries of Birmingham, Leeds, Liverpool, Manchester, Newcastle, and Sheffield. Once up and running, the six centers will provide direct advice and guidance to over 25,000 people and will create over 500 businesses and 1,000 jobs each year.

COLLECTIONS AND SERVICES

The BL is unique among national libraries for the breadth and richness of its historic collections. The Library's collection is one of the largest in the world, holding over 150 million items in all known languages and formats, including books, journals, newspapers, magazines, sound and music recordings, patents, databases, maps, manuscripts, stamps, prints, drawings, and much more. Based on entries in catalogues, the Library's collection size^[11] is calculated as given in the following table:

Monographs	14,768,923
Serial titles	858,414
Manuscripts	370,396
Newspapers (titles)	52,000
India Office Records	413,801
Philatelic items	8,280,939
Cartographic items	4,574,521
Music scores	1,618,761
Sound disks	1,531,844
Sound tape items	256,867
Digital audio files	74,318
Videos	39,983
Digital video files	23,638
Prints and drawings	33,210
Photographs	323,039
Patents	68,634,309
Reports in microform	10,433,593
Theses	269,442
Total	112,505,998

In the field of arts and humanities, the BL holds the world's largest collections of western and oriental manuscripts (including substantial archives) and unrivalled collections of British printed books from 1476 to the present date, of European printed books from 1455 to date, and of Asian and African printed books dating back to the origin of printing in these areas. In addition the Library holds substantial collections of sound recordings of oral history and of recorded sound relating to English language and literature. The chief historic components of these collections are the library of the British Museum, collected since its foundation in 1753. Of special importance for arts and humanities are the collections that came with the India Office Library and Records (incorporated in 1982), ranging from the foundation of the East India Company in 1600 to Indian independence and with the British Institute of Recorded Sound (incorporated in 1983). Holdings include material over 3,000 years old (Chinese oracle bones), 310,000 manuscript volumes ranging from Leonardo da Vinci's Notebook to Harold Pinter's archives, *Magna Carta*, Lindisfarne Gospels, the first edition of the Canterbury Tales, Tyndale's translation of the New Testament, the most recently published British books, and the recording of Nelson Mandela's Rivonia trial speech.

The BL houses one of the foremost collections of scientific, technical, and medical literature in the western world. Its contemporary collection of modern scientific literature includes all subject areas and disciplines and includes materials in many formats including journals, research-level monographs, conference proceedings, reports, and electronic reference materials. The Library estimates that there are approximately 3.45 million volumes of print serials and monographs in the collection.

The Library's collections in the field of social sciences reflect the full history of official publishing in the United Kingdom and its constituent parts. The Library has 12,000 volumes of House of Commons sessional papers from the nineteenth and twentieth centuries, containing more than 185,000 parliamentary papers. There are 2400 volumes of UK parliamentary debates, all available on open shelves in the Social Sciences Reading Room. Government publications from across the world include records of legislatures, censuses, and other official statistics. The Library has all print communications from the United Nations, the European Union, and the Organisation for Economic Co-operation and Development as well as other intergovernmental bodies such as the World Bank. Collecting from around the world covers economic, political, social, and cultural development and includes many rare items. The Library's collections of trade literature and market research are among the most comprehensive in the world, including over 66 million patent specifications from across the world.

The BL's acquisitions budget in the year 2013–2014 on collection items (for material of research value) was £14.6

million. Research undertaken a few years back as part of the Research Support Libraries Group (RSLG) project underlined the critical importance of the BL's reference and document supply collections in underpinning the resources of the libraries of the higher education institutions of the United Kingdom. When the budgets for acquisitions in UK institutions were ranked against those in the United States, the BL's acquisitions spend was found to be on a par with the best U.S. research collections at Harvard and Yale. However, the highest ranking UK institutions not in receipt of legal deposit (Manchester, John Rylands) were ranked at the 83rd place and, more significantly, the last 85 places out of 221 were taken up by UK universities. The RSLG report^[12] observed:

"Researchers gain access to external hard copy resources in two ways: remotely via inter-library loan or document supply; and directly by visiting other institutions in person. Inter-library loan and document supply in the UK is deeply entrenched and effective.... The resources of the British Library are, we believe, one of the main reasons why UK universities are able to match, and in many cases exceed, the quality and scale of research undertaken within similar-sized universities in other parts of the world. Comparisons with North American universities, for example, show that only three UK libraries—the British Library and the university libraries at Oxford and Cambridge—acquire material on a scale comparable with the leading North American private or state universities. A large research intensive university in the UK typically acquires some 10,000 serials annually along with some 30,000 monographs—respectively about a quarter and a half of what the main Carnegie Research 1 universities in the USA, with which they would wish to be compared in the breadth and quality of their research, acquire."

Since then the information world has continued to change rapidly. Technology has improved, user expectations have increased, and publisher business models have changed. The BL's current content strategy, *From stored knowledge to smart knowledge*,^[13] has responded to the unprecedented scale of these changes and has adopted a number of key principles, the most relevant of which in this context are as follows:

- The UK's publications received through Legal Deposit will underpin content development.
- We will select content in terms of its research value.
- Connecting to content will become more important.
- We will continue to invest in heritage materials.
- We will conduct a strategic review of the acquisitions budget (in the context of changing levels of provision in the UK HE and public library sectors).
- The Library will continue to make the print-to-digital transition.
- We will add value to content through curation and encourage our users to add value through community.

- The Library will develop a "without walls" approach to access.

The importance attached by the Library to heritage acquisitions is reflected by the budget it has established for purchasing such items, equivalent in broad terms to about 10% of the Library's total grant-in-aid-derived acquisitions budget. This is supplemented by a number of BL trust funds, the largest of them in terms of endowment being the Shaw Fund, although, for an institution that has been going for 250 years, the Library does not have huge endowments. Heritage assets purchased by the Library in 2013–2014 were valued in aggregate at £2.7 million. In recent years, the Library has been fortunate to acquire a number of very significant acquisitions. Notable among these have been

- The literary archives of JG Ballard, Harold Pinter, Ted Hughes, and Mervyn Peake
- The photographic collections of William Fox Talbot and Fay Godwin
- The Dering Roll, the oldest extant English coat of arms, the Macclesfield Alphabet Book, a rare medieval *pattern* book, and an illuminated medieval prayer roll that once belonged to Henry VIII
- The seventh century St. Cuthbert Gospel, the oldest intact European book

The most essential task of national libraries, and the one that more than any other makes them what they are, is that they are responsible for acquiring, preserving, and making accessible the publications—of all kinds—of the country. Therefore, it follows that legal deposit—the objective of which is to build a collection of the national literature—must be of fundamental importance. New regulations (the Legal Deposit Libraries [Non-Print Works] Regulations 2013) came into force on April 6, 2013, giving the BL and the five other UK Legal Deposit Libraries (the National Library of Scotland, the National Library of Wales, Bodleian Libraries, Cambridge University Library, and Trinity College, Dublin) the right to receive a copy of every UK electronic publication. The Regulations enable the six libraries to collect, preserve, and provide long-term access to the increasing proportion of the nation's cultural and intellectual output that appears in digital form—including blogs, e-books, and the entire UK web domain. The Legal Deposit Libraries Act 2003 had established the principle that legal deposit needed to evolve to reflect the massive shift to digital forms of publishing: the 2013 Regulations finally made digital legal deposit a reality. This had been long sought by the legal deposit libraries, concerned there was a very real danger of a digital "black hole" opening up in the nation's memory, and was a tremendously important step forward, ensuring that the fullest possible record of life in the United Kingdom in the twenty-first century is collected and preserved for future generations of researchers.

On behalf of the Legal Deposit Libraries, the British Library is archiving copies of freely accessible UK websites and web pages from the open web, using an automated crawling or harvesting process. A “snapshot” of every website within scope, currently estimated at circa 4.8 million active sites, will be archived at least once a year. Some 200–500 websites within scope will be archived on a more frequent basis—such as quarterly, monthly, weekly, or even daily—in order to ensure that rapidly changing or updated content is archived adequately. Such websites will be selected by the Legal Deposit Libraries for their importance and research value, with the crawl frequency being adapted to the circumstances and nature of the content. And in addition, the Legal Deposit Libraries will crawl other selected websites in order to develop “special collections.” Perhaps four or five new collections will be developed each year for important events (which may involve crawling specific websites relatively frequently for a limited period) or important themes (which may involve crawling selected websites regularly over a longer period). By the end of March 2014, the BL had 140,000 E-journals available to access in its reading rooms and approximately 1.3 billion URLs were also available as a result of crawls of the .uk domain.

The Library’s new £15 m purpose-built Centre for Conservation, funded by Government, the Library, and through fundraising, hosts state-of-the-art conservation studios, a visitor center linked to the main exhibition galleries, public demonstrations and tours, and improved conservation treatments and skills for the current cohort and new training courses for future book conservators (including a new foundation degree in book conservation with a university partner).

The Library’s collection of reference materials, spanning four millennia and covering every written language, is one of the richest and the most comprehensive available to scholars. It is housed primarily in St. Pancras and serves the 11 reading rooms there (Figs. 3,4). Two other reading rooms are located in Boston Spa and in the newspaper collections building in North London. Access to the reading rooms is free—the Library welcomes everyone who wants to do research, whether for academic, personal, or commercial purposes—and, currently, Reader Passes are held by over 150,000 readers. While the reading rooms in St. Pancras are essentially interdisciplinary, they are broadly grouped into humanities on the one hand and science, technology, and business on the other. In addition, certain types of material—Manuscripts, Maps, Rare Books and Music, and Oriental and India Office Collections—each have a dedicated reading room. March 2006 saw the opening of the Library’s Business & IP Centre at St. Pancras. The Business & IP Centre is designed to support small and medium-sized enterprises and entrepreneurs from that first spark of inspiration to successfully launching and developing their business.

April 2014 saw the opening of the new British Library *Newsroom*, at St. Pancras. The *Newsroom* is an integrated news and media offering—as opposed to simply a newspaper reading room—combining print and microfilm news content (transferred from Colindale) with newly created Television News Recordings from the Library’s video server, with radio news, and importantly with web news collected under the Non-Print Legal Deposit Regulations introduced in 2013. The facilities of the Newsroom include

- More than 100 desks in a spacious and newly refurbished Reading Room at the heart of the BL at St. Pancras
- 40 digital microfilm viewers, offering excellent image quality and magnification, and swift, intuitive navigation—opening up microfilm to a new generation of researchers
- Microfilm of the 15 most highly used newspaper titles available instantly on open-access shelves in the Newsroom, the rest of the microfilmed archive—some 630,000 reels—available to order within 70 min
- Free access to digitized resources such as the British Newspaper Archive, which has 7.8 million scanned pages of historic newspapers, fully searchable by date, title, and keyword
- A public networking area for meeting, discussion, and collaborative research, including a large video wall displaying live news feeds and news-related Library content
- Access to the UK Web Archive, including 4.8 million archived UK domain websites, totalling more than a billion individual URLs
- The BL’s extensive collection of TV and radio broadcast news—including over 40,000 programs, and growing at a rate of 60 hr every day across 22 news channels

The Library’s reading room at Boston Spa was also refurbished during 2014 and now has facilities for news research broadly to match those at St. Pancras.

The Library’s document supply collection is housed mainly in Boston Spa and is used in university and public libraries and top research companies both in the United Kingdom and overseas (Fig. 5). In recent years, the majority of document requests have been met by photocopies, but increasingly, researchers are being given instant access to articles and papers in electronic form as the Library develops relationships with the publishers.

In 2013–2014 the number of items supplied/consulted remotely and onsite was 10.5 million.

For the general public, the Library’s building at St. Pancras provides modern facilities and galleries (Fig. 6). The centerpiece of the public space is the King’s Library, housed in a magnificent glass and bronze tower (Fig. 7). The 65,000 volumes of King George III’s collection were



Fig. 3 Humanities Reading Room, St. Pancras.

presented to the nation by George IV in 1823 and continue to be used by researchers every day.

Access to, and enjoyment of, the collection is also extended by a vigorous public program, both onsite and remote. At St. Pancras there is an exciting portfolio of free and charged public exhibitions, targeted at the broadest possible global audience, one that is notably diverse in culture, language, and styles of learning. The Sir John Ritblat Gallery of Treasures of the BL houses a permanent display of the jewels of the national collection. These include historic documents such as Magna Carta, icons of English literature including the Beowulf manuscript and the notebooks of the Brontës, and the sacred texts of the world's great religions. Imaginative access to a number of these, including the Lindisfarne Gospels, the Golden Haggadah, the Diamond Sutra, and Sultan Baybars' Qu'ran, is provided by Turning the Pages, a touch-screen system

developed by the Library to give visitors the opportunity to turn the pages of digital facsimiles, explore them in magnified detail, and hear or read about their production and meaning. In selecting items for exhibition, care of the collection is a paramount consideration; for example, the Library has recently introduced a rotation policy for its most iconic items, to ensure that they are rested for six months after an eighteen month period of display.

The Library plays host to two new major temporary exhibitions every year. Some recent notable examples include *Sacred: Discover what we share* (2007), which displayed some of the world's earliest and most important religious texts from the Jewish, Christian, and Muslim faiths, and *Taking Liberties: The struggle for Britain's freedoms and rights* (2008), which attracted some 100,000 visitors to see treasures including Magna Carta, the death warrant of Charles I, and the prison diary of suffragette

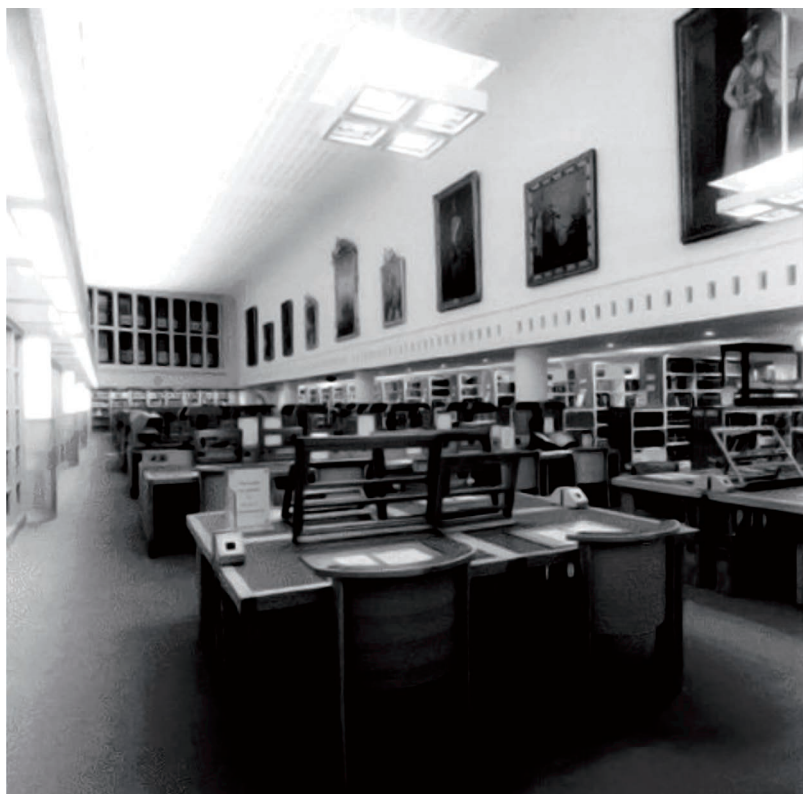


Fig. 4 Oriental and India Office Reading Room, St. Pancras.

Olive Wharry. Both of these exhibitions placed the visitor at the heart of current debates: in the former case exploring commonalities, crossovers, and contrasts between the three Abrahamic faiths and in the latter around rights and freedoms devolved government and free speech. Both of these exhibitions were accompanied by award-winning educational programs and enhanced by rich interactive displays. They are also accompanied by programs of public lectures, debates, readings, and performances, both in the building

and on the piazza, which bring new audiences to the Library, and raise awareness of its collection.

The Folio Society Gallery in the Library's Entrance Hall plays host to four special themed exhibitions each year and attracts audiences of around 180,000 visitors per annum. Examples include the following: *Poetry in Sound* (June 2013) celebrated the centenary of the birth composer Benjamin Britten, and *Beautiful Science* (February 2014) explored how the visualization of scientific data is crucial



Fig. 5 The British Library site at Boston Spa, Yorkshire, is the operational center for international document supply and bibliographic services.

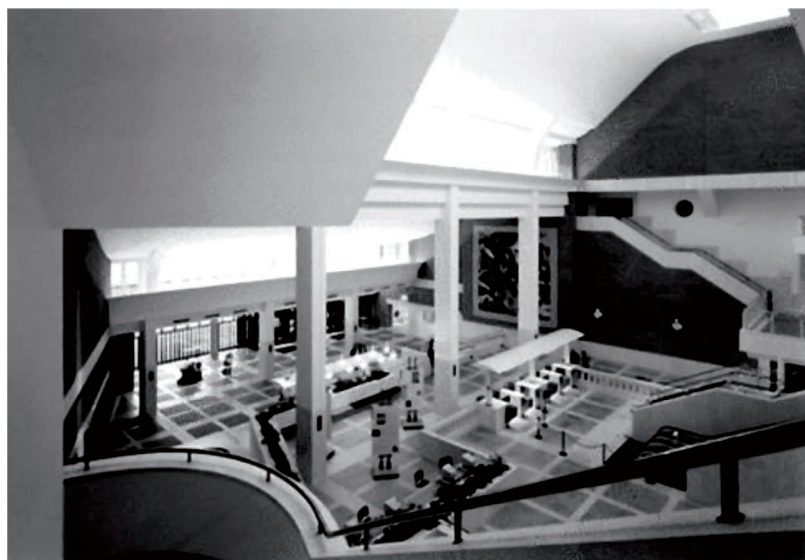


Fig. 6 The entrance hall of the Library's St. Pancras building.



Fig. 7 The tower of the King's Library, St. Pancras.

for making new discoveries and for communicating those discoveries effectively.

Other public spaces at St. Pancras include the Piazza, with sculptures by Sir Eduardo Paolozzi and Antony Gormley, and the conference center's auditorium and meeting rooms, which give the Library flexible space to mount events, conferences, and activities for a wide range of audiences.

Closely allied to the public program at St. Pancras is a program of regional outreach and cooperation with the UK public library network. Turning the Pages™ is included in the Library's complementary virtual learning environment, the Online Gallery, along with views of current and past exhibitions, and short research articles by our experts. The Library's learning program promotes the development of young people's research skills and engagement by schools and lifelong learning audiences with world culture and heritage. The Library's onsite program comprises workshops, exhibition activities, and major educational projects with schools, further education colleges, and youth and community learning groups, and public activities meet appropriate learning and access criteria.

Digitization has enabled significant numbers of collection items to be made available for a range of audiences—scholarly, school-based, commercial, or the wider public—by varying the routes into the material and the levels of interpretation provided. The Library's digitization programs, developed through a mixed approach of public and private sector funding, include major collaborations such as the International Dunhuang Project (IDP). This project is bringing together on the web a collection of thousands of Chinese manuscripts and early printed material that was dispersed a century ago from caves on the Silk Road trading route. The image bank, catalogue, and other resources promote in-depth study and establish a new paradigm for the fostering of knowledge in the digital environment by linking the collections and expertise of the BL to those of the National Library of China, the Bibliothèque nationale de France, the Institute of Oriental Studies, St. Petersburg, the National Museum, New Delhi, the Staatsbibliothek, Berlin, and other partners.

Unlike some other national libraries, the BL has not been allocated additional funding to enable it to undertake large-scale digitization. Therefore, while this has remained the case and in order to maintain the Library's core functions, the Board as a matter of policy has not allocated grant-in-aid funds toward digitization; instead, the Library has actively sought alternative forms of funding—for example, by charitable donation, sponsorship, or commercial partnership—to take this work forward on a project-by-project basis. The precise terms of funding and hence access necessarily differed between projects. Key initiatives that have significantly contributed to building critical mass include the following:

Nineteenth century books: In partnership with Microsoft, the BL commenced mass digitization of nineteenth

century out-of-copyright books with an initial focus on English Literature materials. The project digitized 65,000 titles in total (25 million pages) of nineteenth century philosophy, history, poetry, and literature.

Eighteenth and nineteenth century books: In June 2011, the BL and Google announced a partnership to digitize 250,000 out-of-copyright books (40 million pages) from the Library's collections. Selected by the BL and digitized by Google, both organizations are working in partnership to deliver this content free through Google Books (<http://books.google.co.uk>) and the BL's website (www.bl.uk). Google are to cover all digitization costs. This project is to digitize a huge range of printed books, pamphlets, and periodicals dated 1700–1870, the period that saw the French and Industrial Revolutions, the Battle of Trafalgar and the Crimean War, the invention of rail travel and of the telegraph, the beginning of UK income tax, and the end of slavery. It will include material in a variety of major European languages and will focus on books that are not yet freely available in digital form online.

Newspapers: In 2010, the Library announced a Public–Private Partnership initiative to digitize up to 40 million pages from the BL's national newspaper collection in partnership with brightsolid online publishing, the owner of online brands including findmypast.co.uk and Friends Reunited. This 10 year agreement is set to deliver the most significant mass digitization of newspapers the United Kingdom has ever seen, making large parts of this unparalleled resource available online for the first time. There are no direct digitization costs to the BL as brightsolid is to create a commercial offering and assume the associated financial risks. The resource will be available for free to users on-site at the BL and copies of all scanned materials will be deposited with the Library to be held in the national collection in perpetuity. The Library had previously made over 4 million digitized pages of pre-twentieth century newspapers—the output of a JISC-funded digitization program—available to UK Higher and Further Education Institutions.

Sound: Also in conjunction with the JISC, the BL has digitized portions of its substantial holdings of sound material amounting to 50,000 individual recordings and 7,500 hr of sound available (music, drama and literature, oral history, wildlife, and environmental sounds).

The national library of the United Kingdom is also most emphatically a library for the world. The British Library Board's international engagement strategy places a focus on collaboration and partnership, professional leadership and engagement, and cultural diplomacy. Under the terms

of the strategy, five key strands of international activity are being pursued: restoring and sustaining cultures, virtual reunification of collections, capacity building, strategic partnerships, and international professional leadership. The Library's priorities for international engagement at the current time place a focus both on India and China, and also on digital developments in its professional leadership activities. The Library has attracted £10m from the Lisbet Rausing Charitable Fund (now the Arcadia Fund) to administer an Endangered Archives Program, seeking to identify archival materials at risk in the developing world, to arrange their transfer to a safe archival haven in the country or region of origin, and to create surrogate copies for distribution by the Library. The Library continues to play its full part in the international professional bodies, including the International Federation of Library Associations (IFLA), the Conference of Directors of National Libraries (CDNL), and the Conference of European National Librarians (CENL).

Structure

Library policy and strategy is set by the British Library Board, which, under the terms of the British Library Act, comprises 13 members, under the leadership of a part-time nonexecutive chairman. In selecting members for the Board, the Act charges the Secretary of State with giving preference to "those who have knowledge and experience of library or university affairs, finance, industry, or administration". The chief executive is a member of the Board.

The Library is currently structured on the basis of four divisions: collections, operations, audiences, and finance. The directors of these divisions, together with the chief executive and the chief digital officer, form the executive leadership team of the Library, with responsibility for its day-to-day running.

Collections

The collections division is responsible for nurturing in-depth expertise and understanding of the collections and for developing policy for and managing the areas of collection development, description, and conservation. It is a major center of global excellence in collection expertise and management, uniting the Library's curatorial and conservation specialisms and also digital preservation.

Operations

The operations division is responsible for operating the services derived from the Library's collections. It is responsible for those services however they are delivered, whether in reading rooms or remotely through document supply. Divisional responsibilities also encompass IT delivery, human resources, and organizational development.

Audiences

The establishment of an audiences group reinforces both the importance of the Library's users at the heart of its strategy and also its commitment to understanding and reaching new audiences as well as serving its key constituencies. The division is responsible for the public profile of the Library, in its widest sense, and comprises the press office, public relations, exhibitions, publishing, and events, and senior staff head the marketing and communications activity to each of the Library's key audiences—researchers in higher education, business users, the library and information network, education, and the general public.

Finance

The finance division is responsible for not only the estates strategy of the Library but also the financial control of an annual spend, comprising both grant-in-aid and earned income, in the region of £120 million per annum, as well as corporate procurement, security and risk management, portfolio management, and corporate planning.

Outside the divisional structure, but within the executive leadership team, the chief digital officer is the most senior technology executive in the organization, tasked with influencing corporate strategy at the highest level to keep up the momentum and ambition of the Library's digital transformation, coordinating digital investment across the organization as a whole, setting consistent standards of architecture and metadata, and offering independent internal challenge and review.

CONCLUSION

The BL, in terms of its collections and the range of services that are derived from them, is the world's greatest research library. The Library is at one and the same time a world-class cultural institution with a vital role as holder of the national memory, a critical resource for UK research, an integral component of the national research infrastructure, and playing a correspondingly significant role in ensuring the research excellence of the United Kingdom, and it underpins business and enterprise through its contribution to knowledge transfer, creativity, and innovation. The digital information revolution has posed new challenges to the library profession and offered new opportunities. The BL is responding confidently to the new imperatives. Forty years ago the BL's founders sought to create a national library to serve the world. The Library is now achieving this in ways that its founders may not have envisaged but must certainly welcome.

FURTHER INFORMATION

The Library's website, www.bl.uk, gives details of services and collections and provides access to a wide range of digital resources.

The BL can be contacted at 96, Euston Road, London, NW1 2DB, United Kingdom.

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Business Informatics

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Abstract

The rapid changes in recent years demand constant evaluation and modification of education programs. The following contribution summarizes some aspects of current study programs in information systems (IS) and focuses on business informatics (BI). As a stream of IS, BI can be described as a method and model-centered approach focusing on business IS. The success of BI derives from the benefits that arise when business administration concepts are combined with computer science technologies and software engineering principles to form a coherent methodological approach. In addition, addressing the need for an innovative and cross-disciplinary study model to equip graduates with transformation skills we have developed a master's study program in BI. By discussing an example curriculum, this entry outlines the core elements of this program and gives direction for BI as a study domain.

INTRODUCTION

Many universities have offered various programs related to information systems (IS). However, the rapid changes in recent years demand constant evaluation and modification of education programs. Recent challenges include for instance the move toward programs, which are more applied and professionally orientated. The Bologna Declaration in Europe with its three-level study structure as well as the increasing pressure to ensure funding within most departments adds further pressure to many universities. Despite attempts being made to provide reference to curricula and guidelines, many universities and faculties struggle with the proper direction and design of the IS curricula.

Common reference curricula related to IS are, for example, the IS 2002: Curriculum Guidelines for Undergraduate Degree Programs in Information Systems; and the MSIS 2000: Model Curriculum and Guidelines for Graduate Degree Programs in Information Systems.^[1,2] Although proposed for many years, several discussions and disagreement exist on the content and direction of IS curricula and IS as a discipline. Recently a joint task force of the Association for Computing Machinery and Association of Information System is aiming at revising the IS 2002 undergraduate curriculum.^[3] At the same time we are experiencing decreasing enrolments in IS programs worldwide.^[4]

In order to summarize aspects of current study programs in IS we focus on business informatics (BI). This entry aims to illustrate differences between BI and traditional IS study programs.^[5] We structure the entry as following. First, we summarize the context of information technology (IT)- and IS-related study programs. Then we outline the main characteristics of BI. In addition, we provide a generic framework for IS study programs. Finally, we present an overview of an example study program in BI—the European M.Sc. in Business Informatics

at Dublin City University. We conclude the entry by outlining some key challenges of BI as a study domain.

CONTEXT OF IS STUDY PROGRAMS

One of the IS-related challenges at present is the increase in complexity and the growing interdependency between business aspects and IT. Organizational components like business strategy, rules, procedures, and processes, and the organization's application systems, including hardware, software, and databases, affect and influence each other. Any change in one of these components typically requires modifications in other components, whereas existing systems and structures often act as a constraint on organizations. As a consequence, the demand for graduates capable of analyzing complex information networks and project managers managing large IT projects is expected to increase. Therefore such subjects as application integration, enterprise architecture, information management, and business process management are increasingly important.^[6] In addition, claims that IT is no longer a source of strategic advantage, indicates the move from technology-orientated jobs to more business-orientated roles. Universities are expected to provide in addition to core knowledge of IS' design and implementation a broad business and real-world perspective.

Graduates should show strong analytical and critical thinking skills as well as interpersonal communication and team skills. A further necessary area of expertise for today's IT graduates is the International environment. In a decade that has seen the enlargement of the European Union and that globalized it, it is necessary for business and IT personnel to be competent to work in other countries and to work in multicultural teams. Graduates may need to understand how to manage geographically and

ethnically diverse teams. Therefore, students should gain practical experience of studying and working abroad, by which they will be exposed to the business culture of another country. Spending time in another country offers many advantages: a chance to acquire new skills, to participate in multicultural teams, and to experience the benefits of cultural diversity.

BI AND IS

Traditionally universities focused on management and business studies as well as computing, software engineering, and computer science. Computing and computer science (e.g., basic informatics) addresses technical and theoretical bases of IT and software systems. Business and management provide knowledge of the principal functions of management and focus on business operations and decision making (behavioral and organizational component). The combination of both disciplines, which includes technical and social components, is generally described as IS. Terms such as management information systems (MIS), business information systems (BIS), or information systems and management (ISM) are also common.

Besides these courses, over the last decades a growing number of universities, particularly in central and northern Europe, are offering undergraduate and postgraduate degrees in *business informatics*. The term seems well established in the German-speaking countries; however is often considered controversial. Indeed, BI stems from the literal translation of the German term “Wirtschaftsinformatik,” but there seems a controversy about the characteristics of BI. BI is sometimes assumed to be equal to the broad area of IS, though some indications exist that BI has a stronger emphasis on engineering principles and methods.^[7] In order to provide a foundation and to frame the subject in the IS discipline, in the following we outline the characteristics of BI.

Management-orientated IS programs sometimes lack consideration of a *methodological* combination of the theoretical work of computer science with a practical orientation toward designing systems and applications. This methodological focus is the area of BI, which complements traditional areas of IS that focus on *explaining* real-world scenarios. BI aims to engage constructively to develop solutions tailored to business problems. It takes an active role in aligning business strategy, corporate goals, business processes, and IT. The core element of BI is a methodological approach to describe, explain, predict, and design information and communication systems. It involves the development of terminologies, models, and architectures that are explicit and sharable.

BI can be characterized as

- Interdisciplinary.^[8]
- Focusing on business IS as socio-technical systems comprising both machines and humans.^[9–12]

- Concerning the inception, development, implementation, maintenance, and utilization of business IS.^[13,14]
- Describing the relationship between humans, business functions, information, and communication systems, and technology.^[15]

BI can be summarized as a socio-technological and business-orientated subject with *engineering* penetration.^[13] As a science discipline BI is categorized as

- Applied science that studies real-world phenomena.
- Formal science that creates and applies formal description methods and models.
- An engineering discipline that systematically designs and constructs information and communication systems.^[11]

The success of the subject derives from the benefits that arise when business administration concepts are integrated with computer science technologies and software engineering principles to form a coherent methodological approach. It centers on IS architectures and business processes and provides a systematic design and construction of organizational information and communication systems.

BI Subjects

In the following we present a framework for BI and IS for which we amalgamated prominent curriculum guidelines; an undergraduate and a graduate model curriculum predominantly referred to in the Anglophone area with one frequently referred reference curriculum in the German-speaking area.

- The model curriculum and guidelines for graduate degree programs in IS (*MSIS 2000*).^[1]
- The most recent version of the IS undergraduate model curriculum (*IS 2002*).^[2]
- The recommendation for BI at universities (*BI recommendation*).^[8]

The work of IS model curricula represent almost 30 years of experience in curriculum development. Started in the early 1970s by the Association for Computing Machinery (ACM) other organizations, including Data Processing Management Association/Association of Information Technology Professionals (DPMA/AITP), International Federation for Information Processing (IFIP), and Association for Information Systems (AIS), have aided model curriculum development. The IS 2002 model curriculum is the most recent version for an undergraduate IS curriculum, published by the ACM and AIS. IS 2002 includes detailed course descriptions and prescriptive advice on how to offer an IS undergraduate degree program. For our study we used the most recent version of the IS 2002

undergraduate curriculum, although the current version is currently reviewed by a joint ACM/AIS task force. The MSIS 2000 model curriculum was published by ACM and AIS as a guideline for master degree programs in IS. On a master's level, the curriculum is designed to accommodate students from a wide variety of backgrounds. It considers a set of interrelated building blocks including foundational skills, core subjects, integration subjects, and career tracks. Emphasizing on career development skills, the curriculum includes oral, written, and presentation skills; people and business skills; ethics and professionalism.

The model curricula are explicitly developed to include knowledge elements from three major computing disciplines: computer science, software engineering, and IS. It accumulates long experience in IS curriculum development and provides a coherent structure for a study program in IS. Thus these model curricula seem to be appropriate, even though the model curricula are primarily based on the educational system and degree structures common to the United States and Canada, with limited acceptance and use outside of this area. The two-level educational structures underlying the curricula proved to be of advantage, as many European universities are restructuring their study programs toward a two-phase curriculum with bachelor and master degrees.

The third curricula we used, the recommendation for BI, is issued by the German Society for Informatics and the Association of University Professors of Management, Germany. It is aimed at providing common directions for education in BI at universities. In contrast to the MSIS curriculum, which provides a detailed recommendation for a curriculum, the BI recommendation is intended as a guideline and is focused on key qualifications and core subjects to be taught. The BI recommendation is mainly orientated on a study program of nine semesters leading to a degree of "Diplom-Wirtschaftsinformatik" (diploma/master level in business informatics).

In order to cluster subjects and to provide a list of taught subjects, we customized the framework in an iterative process involving expert opinion from 10 academics from different countries. The structure follows the proposed curriculum building blocks in the MSIS curriculum. However, in order to accommodate particular subjects taught in some study programs, we added subject blocks of mathematics and logic, structural science, legislation, and economics, and business engineering, and included often taught business subjects, for example logistics, procurement, and supply chain management. The list of career electives and domain-specific subjects presented here illustrates just some of the possible topics. The framework is presented in Table 1.

Architectural Focus of BI

In contrast to IS, BI appears to have a stronger focus on mathematics, logic, and structural science.^[7] One reason

for this could be the focus on the *systematic* construction and the application of methodological principles, which are often stated as typical for BI study programs. Indeed, mathematical principles are perceived as essential in order to systematically construct, formalize, and analyze models and architectures of IS.^[16]

In this regard business informaticians are often described as IS architects (in the sense of engineers) who are actively and systematically analyzing and designing business IS. Central to this is the subject "Information System Architecture." IS Architecture describes IS through various models and refer to both a dynamic view in the form of processes and the specification of the overall structure, logical components, and the logical interrelationships of a system.^[17] The conceptual description of both views builds the methodological framework for understanding the alignment of software applications and information technologies, business processes, and the corporate strategy.^[18] One example of an important architectural framework for BI is ARIS—architecture of integrated information systems.^[19]

STUDY PROGRAM IN BI

In keeping with the points identified above, we outline an example of a BI study program, introduced at Dublin City University—the European M.Sc. in Business Informatics. As an example, we provide an overview of the program in order to give guidelines for similar programs in BI.

The central focus of the proposed curriculum for BI is to qualify individuals to lead IS-related transformations of business. This enables them to apply technological solutions and develop IS architectures to solve business problems of organizations. With this goal in mind the curriculum focuses on an engineering perspective and the integration of cultural studies. The program is intended for students who have achieved a primary degree in computing, computer science, software engineering, or a comparable discipline. The program is designed to be completed in one calendar year of full-time study and consists of two taught semesters followed by a third term consisting of a project of practical nature.

The curriculum has an emphasis on engineering principles, and includes a module on structural science, which encompasses management science, data engineering, and data mining. It also has a strong modeling component, and includes modules on IS architecture and business process management. The integrative perspective is provided by the supply chain management module. The program also covers the more traditional IS disciplines as in the strategic management of IT module. An overview of the general program structure is provided in Table 2.

In addition to the emphasis on engineering principles and core subjects of BI, the study program also supports the building of capabilities for managing transformations

Table 1 Study framework.

Informatics and fundamentals in engineering	Business and economics	IS	Integration and enterprise engineering	Informatics in action (representative)
<i>Information and Communication Technology</i> (hardware, software, networks, and communication technology) Programming and algorithms, data, and object structures <i>Mathematics and Logic</i> (analysis, linear algebra, numeric, logic) <i>Structural Science</i> (decision theory and methods for strategic decision making (e.g., risk analysis), statistics and quantitative models and methods, operations research, computational modeling and simulation)	Accounting and financing Marketing, production, procurement, logistics Organization, human resources, and corporate management Legislation and economics	<i>Fundamentals of Information Systems</i> (types of IS, IS industry, IS relevant legal frameworks, management, and IS) <i>Principles of Business Information Systems</i> (principles of functional and process orientation and industry solutions) <i>Data Engineering</i> (data modeling and management, knowledge engineering, and business intelligence) <i>System and Software Engineering</i> (analysis, modeling, and design) Managing data communication and networking <i>Information Management</i> (information, knowledge, and people, project, and change management, IS/IT policy, and strategy, ethics, and privacy)	Business Engineering and IS Architecture Integrating IS Functions, Processes and Data Integrating IS Technologies and Systems	Academia and research Academic and research libraries Biochemistry and molecular biology Consulting Consumer health information Customer relationship management Data warehousing Decision making e-Government information Electronic commerce Electronic publishing Environmental management Financing and banking Healthcare information Human factors Insurance management Knowledge management Library services Logistics Multimedia technologies Project management Techniques of IT consulting Technology management

Source: Helfert and Duncan.^[7]

by aiming to expand transferable skills. In essence, transferable skills are those skills that having been learned in one context can then be applied in another. Typically these skills are based on modern teaching, learning, and assessment methods, and include

- Guided independent study and activity, with specialist input when appropriate.
- Recent or current case studies.
- Essay and report writing.

- Collaborative group work and discussions.
- Presentation of findings to the group as a whole.

In the final semester, students work on a project of practical nature. The general objective of this project is to allow students to draw on the theoretical knowledge gained over the taught element and to apply it in a practical setting in an International environment. The project of a practical nature gives students the opportunity to demonstrate their ability to analyze problems in the field of BI and draw

Table 2 Curriculum overview.

Semester 1	• Research skills/Seminar topics • IS architecture • Structural science	• Business process management • Strategic management of IT • Business studies
Semester 2	• Supply chain management • Managing and working in an intercultural environment	• Sectoral applications of IS • Regulation in IS • Project management • Managing change
Summer	Dissertation/project of practical nature	

Source: From Helfert and Duncan.^[7]

conclusions according to scientific methods within a given timeframe.

SUMMARY AND CONCLUSION

This entry presented aspects of BI and illustrated a typical curriculum. We summarized some key requirements of IS graduates. In particular, graduates need a comprehensive understanding of behavioral aspects as well as software engineering, programming, and IT. Interpersonal and communication skills as well as problem solving and critical thinking capabilities are essential for any IS and BI graduate.

The example curriculum as outlined above comprises a balanced and interdisciplinary structure, which centers on engineering principles and focuses on transformation, models, and methods. The engineering penetration throughout the program is seen as one important characteristic, which differentiates this program from management-orientated IS degrees. In contrast to business administration programs, the production of information managers, often expected in practice, is not the objective of BI. As such BI can complement the management-orientated stream of the IS discipline.

In conclusion, the BI approach appears to us not only to be innovative with regard to its interdisciplinary character, but also the engineering perspective and the integration of cultural studies and practical experience in an international setting equip graduates with essential transformation capabilities. Indeed, the focus on engineering principles in BI could play an important role in future education programs.

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Business Information and Its Users

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Abstract

The complexity of business requires a wide array of multidisciplinary information sources to resolve business information needs. Users of business information are as varied as the discipline of business, ranging from business professionals to the lay person interested in investing to the business school student. Aspects of business touch the lives of everyone. For this reason, librarians in public, academic, and special libraries provide business information to their patrons. In order to make the most of business information, business information literacy is essential for librarians and nonbusiness professionals who seek and use business information. Business information literacy includes an understanding of business terminology as well as trends in business that have an impact on access to business information such as information overload, transparency, and the blurring of various components of business.

INTRODUCTION

Business, commercial activity involving the exchange of money for goods or services, is large and complex affecting all aspects of society. In 2006, there were approximately 26.8 million businesses in the United States. The complexity of business can be attributed to several factors: business events change at a rapid pace; business is closely tied to the economy; and business problems require multidisciplinary solutions.^[1] Business consists of industries that are comprised of companies that provide products and services. Business has changed over time; we have seen a decrease in manufacturing and an increase in service industries as well as an emphasis on communication, information, and computing technologies. Technological and social changes have had an impact on business. Davis and Meyer^[2] note that three factors, speed, connectivity, and intangibles, have resulted in a “new world” they refer to as “blur.” In this blur, there is no longer a clear distinction between a product and a service as products now incorporate services into their offerings. The integration of new technologies will continue to blur the distinctions of once separate components of business. A trend that has had an increasingly important impact on business is the demand from the public for transparency. To encourage transparency, new laws and regulations require that more and more information be made available to everyone who interacts with business. In addition, new technologies, such as blogs, are providing more internal information to those outside of an organization.

Management is another broad area closely related to business. Managerial activities include, among other

topics, the following: strategic planning, leadership, human resources, marketing, facilities management, financial management, and decision making. A variety of different types of sources provide management information, including books, videos, magazine, and journal articles.

Business information users run the widest gamut from those actively engaged in the business world to the layperson, from the entrepreneur to the student or professor in a business school. Each of these user groups has different characteristics, information needs, and information seeking behaviors. Librarians serving these various user groups in public, academic, and special libraries are called upon to provide them with business information. This entry focuses on business professionals whose various business activities relate directly to specific types of business information; business activities have influenced the forms of packaging of information to facilitate use. Business professionals include, among others, top executives, administrators, and managers. Many of the information needs and the sources used to resolve the business information needs of business professionals also apply at some level to all users of business information.

This entry will first discuss business information users and their needs. Understanding information behaviors is essential for librarians to provide appropriate library and information services. A discussion of different types of information used to resolve business information needs will be presented. A theme that will appear throughout this entry is the notion of the transparency of business activities. As will be noted, transparency is not new; however, recent events have resulted in efforts to increase transparency in business activities. Transparency has resulted in enhanced access to business information.

BUSINESS INFORMATION USERS AND THEIR NEEDS

The *Occupational Outlook Handbook* 2007–2008 (<http://www.bls.gov/OCO/>) lists a variety of managers including industrial production managers to medical and health services managers, education administrators, advertising, marketing, promotions, public relations, and sales managers. According to the *Handbook*, in 2006, administrative services managers held about 247,000 jobs; advertising, marketing, promotions, public relations, and sales managers held approximately 583,000 jobs; and financial managers held about 506,000 jobs. In addition there are related occupations that would also fall within the overall title of business professional, including, accountants and auditors, budget analysts, management analysts, and financial analysts. Every industry has its managers and for this reason, the education and training of managers varies. Business degrees at the undergraduate level or the Master of Business Administration (MBA) are common among business professionals. According to the National Center for Education Statistics (http://nces.ed.gov/programs/digest/d07/tables/dt07_290.asp), the number of degrees conferred in business in 2005–2006 was 318,042 at the bachelor level; 146,406 at the master level; and 1,711 at the doctoral level. The number of males and females were approximately equal at the bachelor's level; more males obtained the master's and doctoral degrees.

Common to business professionals is their tendency to focus on resolving the problem at hand as quickly as possible. Of major concern to the business end user is the ease of finding information, which of course means that business users will use the sources and channels most convenient to them, whether or not the sources are the most authoritative or current. However, accurate and timely information is essential for many business decisions and activities. In some cases, cost is not an issue; if critical information is needed, many business professionals will pay a premium to obtain the information in a timely fashion.

The information sources used by business professionals include informal and formal sources as well as verbal and written ones. Business professionals usually have access to “soft external information” that is available to them through personal contacts.^[3] A preference for interpersonal communication among business professionals has been well documented (pp. 194–203),^[4] (pp. 227–263).^[5,3] Business professionals often rely on a range of people for their information: customers, consultants, colleagues, experts, and product manufacturers. It is not uncommon for business professionals to call, send e-mail, or arrange an in-person meeting when seeking information. It is not surprising then that business professionals neither use the library as a primary channel for information nor are fee-based databases among the most consulted resources.

Much information about an organization is internal to the organization and is not found through computers, in books, or in online databases. Internal information may be available through internal systems or through the knowledge of employees and others affiliated with the organization. External business information sources form only a relatively small portion of sources used by business professionals.

Businesses carry out numerous activities that require information gathering. The extent to which information seeking activities are incorporated into the workplace will depend upon the resources available. Most businesses will engage in gathering competitive intelligence to some extent. Competitive intelligence involves the systematic process of gathering, organizing, analyzing, and managing data, information, and knowledge related to the environment in which a company operates. The overall objective is to convert the data, information, and knowledge into intelligence that will help a company gain a competitive advantage.

Businesses of all sizes need to understand their customers, both active and potential. The customer base is often referred to as the market. It is through research about the market that businesses of all types strive to understand the preferences and habits of actual and potential customers as well as factors that influence buying decisions.

Other common business activities include identifying companies for mergers or acquisition, planning to offer a new product or service, or expanding to a new segment of the market. More specific business tasks related to the organization itself also require information. For example, determining pay scales, selecting a new site location, completing background checks on potential clients or suppliers, compiling lists for mailings, performing a trademark search, negotiating a contract, identifying suppliers, or filling high-level positions.

One common approach to gathering important information for decision making is environmental scanning. Environmental scanning involves the assessment of the internal strengths and weaknesses of an organization in relation to the external opportunities and threats it faces. Through a variety of sources, interpersonal, print, electronic, and broadcast, business professionals uncover information about competitors, customers, economic conditions, trends, research, products, and legal issues.

Small business owners and entrepreneurs are similar to business professionals in their preference for informal oral sources of information. Young and Welsch concluded that this was due to the preference of the small business owner for customized and personalized sources of information (pp. 42–49).^[6] Franklin and Goodwin also found that small business owners relied on informal information sources that were convenient to use (p. 10).^[7]

Small businesses are a key component of business in the United States. Small businesses are defined as businesses with fewer than 500 employees. The U.S. Small

Business Administration (SBA) was founded in 1953 to assist small businesses through the provision of loans and counseling. Small businesses represent over 99% of all businesses and employ 45% of the private workforce. Of the total number of businesses, over 19 million are sole proprietorships. Like business professionals in large organizations, small business owners need information about competitors. The need for competitor information by small business owners is generally associated with the initial stages of starting a business to help determine location, pricing, and products and services to offer. Once established, small business owners focus on management information including operations, finance, and marketing unless business declines or an expansion is under consideration (pp. 42–49);^[6] (pp. 43–44).^[8]

Product information is essential to entrepreneurs since they need to know what other similar products are on the market and what is new or different about their product. Market data are also key for the entrepreneur to determine how big the market is for the product and where a potential customer would expect to purchase the product. Legal information will also be needed to resolve questions about copyright, intellectual property, trademarks, and patents.

Various information technologies have facilitated access to business information. New forms of information technology are being used to communicate with customers and employees. In person communication and the telephone have been supplemented by e-mail, instant messaging, and Weblogs. The cell phone has become ubiquitous and in addition to its use as a phone, cell phones often serve as a telephone directory or address book, provide Internet access, and include a camera.

The amount of information available in electronic format for free on the Web has greatly increased, including some resources such as patents and financial data that were previously more difficult to obtain and expensive. Information is being formatted to be accessible from mobile communication devices. Business professionals often rely on business portals which serve as a one-stop shop for business information. To facilitate access to information, Really Simple Syndication (RSS) may be used to feed information from news Web sites, Weblogs, and podcasts to end users of information on a regular basis without requiring the information seeker to initiate the activity. New search features are making it easier to access business information. For example, dynamic query suggestion tools may provide company names and ticker symbol suggestions that eliminate the need to look up this type of information before conducting a search. Visualization tools facilitate data analysis and decision making. Managers face information overload due to the nature of their work. “By virtue of their position, managers receive more information from more sources through more channels than almost anyone else in an organization” (p. 227).^[5]

Overall, the primary interest of most business information professionals in organizations of all sizes, as well as

those who are self-employed, lies in resolving information needs to assist in making decisions or resolving problems. These business professionals are not concerned with the process of information seeking but rather with the results. In fact, managers do not differentiate a discrete information seeking process but rather consider information seeking to be an integrated part of the decision making process (pp. 23–35).^[9] As with all information seekers, ease of access influences information seeking behaviors. Librarians working with business professionals will want to be proactive in providing information services and consider packaging information in ways that best meet the needs of business information users.

BUSINESS INFORMATION

In general, the types of information used to resolve many of the information needs described above include industry information, economic data, company information, financial data, contact information, demographic data, and legal information. Business information may be packaged in a variety of ways to meet the needs of business information users. Some business information sources have emerged from business activities themselves and are thus business specific; some sources of information are specialized or technical in nature and yet provide essential business information; some general reference tools have been adapted for use by business users; and some general information sources contain business information. Selected types of business information along with the types of sources that contain them will be described with some historical context when appropriate. Several books included in the section “For Further Information” will provide the reader with more comprehensive coverage of business information sources.

Business-Specific Sources

There is a wide range of industry information and due to the wide use of this type of information industry profiles have emerged. These industry profiles or surveys, available in print and electronic formats, provide prepackaged information about an industry including a description of the current environment; historical context of the industry; the industry structure; industry trends; key industry ratios and statistics; key players in the industry; an overview of products and services; related industry classification codes; and industry terminology.

Economic data and industry statistics are an important subset of industry information. The Economic Census dates back to the 1810 Decennial Census when questions on manufacturing were included with questions about the population. The 1905 Manufacturing Census was the first time an economic census was issued separately from the population census. In 1930, retail and wholesale trade

were added. The Economic Census was initiated in 1954 and is now issued every 5 years. In 2007, the Economic Census forms were sent to more than 4 million businesses. In keeping with the notion that different groups of users have different behaviors, the Economic Census has over 600 data-gathering forms for different industries. The Economic Census is mandated by law under Title 13 of the United States Code (sections 131, 191, and 224).

The Economic Census reports data using an industry classification. Recognizing the need to develop a standard industrial classification (SIC) system for all federal statistical agencies, developmental work was begun under the auspices of the U.S. Central Statistical Board, the predecessor of the Statistical Policy Office of Office of Management and Budget (OMB). The first SIC manual was issued in 1939 by the Interdepartmental Committee on Industrial Statistics which was established by the Central Statistical Board of the United States. The classification arose from the need to collect comparable data from a variety of agencies. The SIC included all industries that made up economic activity at that time. While revised periodically over the years, it was not until 1997 that the long-standing SIC was replaced with the North American Industry Classification System (NAICS) which was developed in conjunction with Mexico and Canada to provide comparable statistical data across the three countries. The NAICS recognizes a change in the focus of the economy from manufacturing to service and among other changes, created a new Information sector that includes establishments that create and disseminate information from a broad perspective. The new Information sector brings together various industries previously included in manufacturing, utilities and transportation, or the services sectors. Publishers of newspapers, books, and periodicals, and software, broadcasting and telecommunications producers and distributors, motion picture and sound recording industries, information services, libraries and archives, and data processing services are now part of this new Information sector.

Other data gathered to foster international comparability utilize the International Standard Industrial Classification (ISIC) maintained by the United Nations Statistical Office. The first version of the ISIC was issued in 1948 with periodic revisions over the years with a fourth revision approved by the United Nations Statistical Commission in March 2006.

An industry analysis would not be complete without statistics on shipments, payroll, and consumption. In order to understand the economic situation, one must utilize employment and labor statistics as well as other economic indicators. Statistical compilations aggregate useful statistics in one resource thus facilitating access. A statistical compendium compiles statistics on a given topic or generated by a particular agency or organization. The *Statistical Abstract of the United States* has been produced since 1878 by the U.S. Census Bureau and compiles statistics

gathered by a variety of government agencies, professional associations, and other entities.

Industries consist of companies and as such company information is an essential part of business information. Because of the need for company information, prepackaged company profiles have emerged as a new document type. While the content will vary somewhat depending on the producer of the company profile, most will include contact information, key officers in the company, information about the associated industry, identification of top competitors, company affiliation information (parent and subsidiary), sales figures, number of employees, year founded, and status of the company.

Company Web sites have become a very important part of company research. In many ways, the emergence of company Web sites has changed the panorama of business research. Web sites are available for entities of all types, including companies, associations, and government agencies. Company Web sites generally provide a range of information that may include contact information, company profiles, and biographical information in addition to information about products and services. The amount and type of information provided on the company Web site varies; large public companies often provide financial information along with detailed advertising campaigns, product information in the form of videos, and opportunities for customers to communicate with staff using blogs, e-mail, and chat.

Knowledge of a company's financial state is important for a variety of information needs, including merger and acquisitions as well as investment opportunities. It is in the area of financial data that the impact of transparency can be seen the most. The Securities Act of 1933 required the provision of significant information about securities that were offered for sale to the public and prohibited misrepresentations and fraud. One year later, the Securities Exchange Act of 1934 created the Securities and Exchange Commission (SEC) with oversight of all aspects of the securities industry, including brokerage firms and stock exchanges. The SEC was authorized to require periodic reporting by publicly held companies. Among the most common financial documents are annual reports and SEC filings such as the 10-K, 10-Q, and Prospectus. These public filings contain a wealth of company information including the nature of the business, history of the company, organizational structure, company auditor, balance sheets, and income statements. A complete list of SEC filings and forms can be found on the SEC's Web site. Annual reports and other SEC filings can be obtained directly from a company or obtained for a fee either online or through a courier. The SEC's EDGAR, the Electronic Data Gathering, Analysis and Retrieval system, now provides access to real time filings for those with access to the Internet. While EDGAR does not provide access to all SEC filings, it greatly facilitates access to financial data.

Research departments of major investment houses have staff members who track a variety of industries and public companies within those industries. The results are published in Investment Reports that include, for example, sales and earnings forecasts, market share projections, and research and development expenditures. The primary intent of these reports is to provide information for investment decisions; however, they are useful sources of industry and company information. Some concerns have been raised about possible bias in these reports. Over the years, newspapers have reported stories about brokerage firms that have been fined for touting stocks based on the interest of the firm rather than on the accuracy of the report or for abusive trading practices.

In 2001, the Enron scandal brought to light legal and ethical issues about the conduct of businesses and cost investors billions of dollars. It is considered by many to be the most profound crisis since the Great Depression of 1929 and resulted in more transparency in business activities.^[10] As a result of the Enron scandal, the Sarbanes-Oxley Act of 2002 was signed into law, introducing reforms for corporate responsibility, enhanced financial disclosures, and created the Public Company Accounting Oversight Board (PCAOB) to oversee the auditing role of accounting firms.

Financial filings are also available for nonprofits which are required to file an annual information return. The Form 990, Return of Organization Exempt from Income Tax or the Form 990-EZ (Short Form) is filed with the Internal Revenue Service. Regulations require nonprofits to make their three most recent filings available to the public. In addition, the Pension Protection Act of 2006 added a filing requirement for small nonprofits that were previously exempt from filing requirements. The purpose of the new filing requirement is to ensure transparency within the nonprofit sector.

Financial information for private companies, those companies whose securities are not sold to the public, is very difficult to obtain as there are no filing requirements. One alternative source of financial information or information related to finances for companies of all types is the company credit report. Credit reports have a long history, dating back to 1841 when the first credit service was created. Dun and Bradstreet (D&B) was established in 1841 by Lewis Tappan as the Mercantile Agency. Robert Dun assumed control over the agency in 1859 and renamed it R.G. Dun & Co. The Dun's Book was issued that same year with credit information for over 20,000 businesses. According to Hoover's company profile for Dun & Bradstreet (<http://access.hoovers.com>), there were over 1 million credit reports issued by 1886. R. G. Dun merged with its competitor firm John M. Bradstreet Company in 1933. The name Dun & Bradstreet was adopted in 1939. Credit reports help companies make sound credit decisions when dealing with other companies that are potential customers or suppliers.

Products and services are fundamental to businesses. Product catalogs are listings of companies' products, often with descriptions, pictures, measurements, and weights, properties, and other characteristics. Product catalogs are often available on company Web sites and are generally designed as a sales tool.

In addition to information about products and services, business professionals need information about those who purchase products or services. Off-the-shelf market research studies, prepared by market research firms, bring together market research data including sales, forecasts, market characteristics (e.g., age, income, preferences, and attitudes of consumers), new products, and competitor activities. Market research utilizes data gathered from focus groups, polls, and surveys. ACNielsen, founded in 1923 with a focus on industrial machinery, provides market research by tracking retail sales, brand loyalty, and demographics. Market research reports and data are used for general marketing activities as well as for competitive intelligence activities.

Advertising is the activity involved in bringing public attention to a product, service, or company. Advertising is available in a variety of formats: print, electronic, or broadcast (television or radio). Advertisements provide information on a company's products and services, including in many cases pricing. Advertisements also provide clues about popular products and their characteristics. For example, a review of advertisements for automobiles over time could illustrate new innovations and changing consumer tastes. Advertising may be difficult to monitor with the broad array of media through which companies advertise. There are companies, such as TNS Media Intelligence, that monitor advertising occurrences. Many company Web sites are good sources of advertising information, including current and historic advertising campaigns. In many cases, the main purpose of the company Web site is marketing so the Web site itself serves as advertising. Advertising is useful in competitive intelligence activities and is also used for price determination of new and existing products.

Specialized and Technical Nonbusiness Information

A patent is an often overlooked source of product information. A patent is a grant issued by the government giving inventors the right to exclude others from making, using, or selling the invention for 20 years. In return, the inventors fully disclose information about their invention to the public. There are three types of patents: utility patents which describe the way something works; design patents which describe the way something looks; and plant patents which are for a new variety of asexually reproduced plants. Patents are an excellent and detailed source of product information including graphics and images. They are also an important part of competitive

intelligence research and general company research. Patent research is essential for research and development so that time and money are not invested in an already existing product. A trademark is a word, name, or symbol that is used to distinguish a product or service from other products and services. Trademarks apply to logos, images, and sounds.

The role of the U.S. Patent and Trademark Office (USPTO), a federal agency founded in 1802 and currently located within the U.S. Department of Commerce, is to promote the progress of science by providing investors the exclusive rights to their inventions or discoveries for a limited period of time. (Article 1, Section 8 of the United States Constitution). In addition to reviewing patent and trademark applications, the USPTO disseminates information through freely available databases on its Web site. The Patent and Trademark Depository Library Program (PTDLP) began in 1871 when a federal statute (35 USC 12) first provided for the distribution of printed patents to libraries for use by the public. Now, all of the patent and trademark information is distributed to these libraries in a variety of formats including print, microform, and DVD. New rules have been and continue to be proposed by the USPTO to improve the efficiency of the patent process; a description of these rules and their status are available on the USPTO Web site. Patents were once available in print only through the PTDLP. Then commercial database services provided access to patents for a fee. Now patents are freely available on the USPTO Web site and through other Web sites. Patent offices in several other countries also offer access to patents through databases available on their Web sites, for example, the Canadian Intellectual Property Office (<http://www.cipo.ic.gc.ca/>), the European Patent Office (<http://www.epo.org/>), and the German Patent and Trademark Office (<http://www.dpma.de/>).

Laws and regulations are the rules and principles governing and regulating various activities. Laws and regulations impact the way companies do business so tracking them is critical to running a business. Legislative information may be of interest to businesses that want to monitor the status of Congressional bills that affect their activities. Proposed rules are of interest to many business information users; it is during the comment period that input can be given before a rule becomes final. Individual agencies that administer the law or regulation in question may also provide access to that information. More generally, the *Congressional Record*, first published in 1873, contains legislative regulations and is the official record of the United States Congress. In addition, The *Federal Register*, a daily publication that was first published on March 14, 1936, contains rules, proposed rules, and notices of Federal agencies and organizations, as well as executive orders and other presidential documents. The *Federal Register* is another example of an effort to provide transparency to the public. The role of the Federal Register has grown over the years and additional information has been added for

dissemination to the public. The *Code of Federal Regulations (CFR)* codifies the rules published in the *Federal Register*. Both the *Federal Register* and the CFR are available on the Internet for free.

Commonly Used General Reference Tools

Business professionals consult a variety of reference tools. There are encyclopedias, dictionaries, almanacs, etc. that focus specifically on business topics. Directories have emerged as a very important reference tool and business directories have evolved over the years to meet business information needs. While directories are listings of people or organizations that include contact information, the amount and type of information included in business directories varies greatly. Some directories may include only public companies or companies with earnings over a certain amount while other directories will include all types of companies, public, private, and nonprofit. Some directories provide contact information only and others will include additional company information such as financial information, detailed product information, historical information, and biographical information. Because people move from one organization to another and organizations may be acquired or go out of business, currency and accuracy is often an issue with directories. Many electronic directories offer field searching that is useful for identifying companies that meet certain characteristics.

General Information Sources

Organizations of all types provide news and press releases to announce business activities in a timely manner. Companies will provide up-to-date information about earnings; merger and acquisition activity; personnel changes; new product announcements; public offerings; and litigation. News releases from government agencies provide current information about economic indicators as well as results from economic and demographic surveys.

Newspapers are a major source of business information. Newspapers come in a variety of formats, covering different geographic areas, with broad or narrow focus. Business professionals are familiar with newspapers and look toward newspapers to answer many business questions. Daily newspapers, such as the *Washington Post*, *New York Times*, and the *Los Angeles Times* are staples for business collections. They provide news, company information, industry information, stock quotes and other financial data, biographical information, and statistics. Other newspapers with comprehensive coverage for a more targeted audience include those focused on a specific topic, such as finance, including the *Wall Street Journal*, the *Financial Times*, and the *Investor's Business Daily*. Other news publications focus on a particular industry, such as the *Cheese Market News* or *Autobeat*

Daily. In addition to national or international news coverage, regional newspapers are an often overlooked but important resource for business information. For information on private companies or people, regional newspapers can provide useful information that will not be found elsewhere.

Closely related to newspapers are business broadcasters on television or radio networks that focus on business news and business topics rather than on general news. These broadcasts are often associated with business portals that provide additional business information through blogs and videos. Business broadcasters provide one-stop shopping for business information and are therefore popular among business professionals.

Various types of magazines and journals are used by business professionals. Business magazines focus on business issues and include such titles as *Forbes*, *Fortune*, and *Business Week*. In addition to the news provided, these magazines also issue rankings such as the Forbes 500, the Fortune 500, or the Business Week's Global 1000. Trade journals are geared to a specific industry such as *Ward's AutoWorld*, *Food Processing Magazine*, or *Variety*. Popular magazines, such as *Time* and *Newsweek*, also provide useful business information as part of their more general coverage; discussions on issues and events in these popular magazines impact business. Some journals are peer-reviewed, also called refereed journals, and publish articles that have been assessed by scholars in the field. While these may be used less frequently among business professionals, they provide useful information. Probably the most popular among the academic journals is the *Harvard Business Review*. Other examples include the *American Economic Review*, a peer-reviewed journal generated by an association, and the *Monthly Labor Review*, a peer-reviewed government publication. These different types of magazines and journals are useful for different types of business information needs. Business magazines are important sources of information, providing news, company information, industry information, statistics, and biographical information. Both business and popular magazines may be read as part of environmental scanning programs to keep up on important trends and events. Business-related peer-reviewed journals are probably most useful for learning about management issues and new research findings.

Newsletters are periodic publications, usually relatively short and narrowly focused. Newsletters are typically underutilized in business research yet they may provide detailed and sophisticated coverage of industry news or subjects of interest to companies (e.g., employee benefits) or individuals (e.g., investment).

In general, monographs are not used heavily by business professionals for decision making and daily business operations. However, business books are an important part of management literature. Throughout the years, key figures have emerged in the area of management, a few of

which will be noted here. An early notable publication related to management is Frederick Winslow Taylor's work culminating in the publication of *The Principles of Scientific Management*.^[11] Taylor's work focused on the scientific approach of management based on work flow and procedures. Peter Drucker was a prolific author of more than 30 books on management issues and is known as the father of modern management. Among other important contributions to management, Drucker introduced the concepts of decentralized decision making and managing for the future in his book entitled *The Concept of the Corporation* which shaped management practice. He also introduced the concept of the knowledge worker and management by objectives.^[12] Michael Porter, one of the leading authorities on competitive strategy, is considered to be the father of the field of modern strategy.^[13] He is often included in lists of the world's most influential thinkers on management and competitiveness.

CONCLUSION

The world of business is broad and varied as is the information available to meet the needs of business information users. Business information is needed in almost every aspect of daily life so there is a wide range of business information users. This entry has focused on business professionals as business users; understanding the information behaviors of business professionals is necessary for librarians to provide suitable business information services. Many business activities are complex, information-intensive, and time-sensitive involving a range of types of information packaged in a variety of ways. Interpersonal communication is common among business professionals who often rely on colleagues, customers, and suppliers for information. Government information, statistics, and indicators are key to business professionals in their work. Increasingly more business information is available to the public due to government demands for more transparency in business operations. New information technologies have begun to blur the distinctions between products and services and have increased information overload. Katzer and Fletcher (p. 251)^[5] summarize the manager's information dilemma and challenge to librarians serving this user group:

... too much information, but not enough of the right information in the right format through the right channel at the right time.

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Business Literature: History [ELIS Classic]

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Abstract

One of the objectives of the information disciplines is to study the universe of recorded information—that is, to study the documentary products of domains of human activity—and to come to understand such bodies of literature as social and historical phenomena in and of themselves. Coman reviews the development of business from ancient times to the twentieth century, with particular attention to the history of the literatures of business and foreign trade.

—*ELIS Classic*, from 1970

INTRODUCTION

When the first caveman became a skilled manufacturer of arrowheads and traded them for a haunch of eohippus, the seeds of business were planted.

As the population increased, agriculture developed, civilization advanced, and villages arose that later became cities. There are no written records of very early business activities but archeologists have uncovered pottery and other artifacts that indicate trading contacts between the various settlements.

HISTORY

The Mediterranean and Asia Minor were not only the cradle of Western civilization, they were also the site at which the foundations of business were laid. The first business records were the cuneiform clay tablets found at the sites of cities in ancient Babylonia and Assyria. These date from about 2500 to 600 B.C. The tablets record contracts of sale, land titles, wills, trading ventures, lawsuits, and receipts and accounts.

The commercial activities of Babylon were codified in the *Code of Hammurabi* (ca. 2200 B.C.). This code of laws covers the relations between landlord and tenant, wages, the handling of herds and flocks, commercial contracts, wills, trading voyages, banking, and the treatment of slaves. Because it is so extensive, it supplies a large amount of information on the very active commercial life of this period.

The other seat of commercial activity was Egypt. Knowledge of manufacturing and commerce comes down to us from tomb and temple inscriptions, papyri, funerary models, and the writings of Greek authors. Most of these sources date from about 4000 B.C. to about A.D. 100. A Middle Kingdom papyrus describes the making of beer, and inscriptions on a Middle Kingdom tomb depict the making of perfume. Spinning and weaving are pictured

on the walls of Twelfth-Dynasty tombs at Beni Hansan and El Bersheh.

The Greek historian Herodotus traveled extensively in Egypt during the fifth century B.C. and mentions a number of manufacturing and commercial activities in his *History*. In the first century B.C. two other Greeks—the historian Diodorus in his *Historical Library* and Strabo in his *Geography*—make similar references to the commerce and industries of Egypt.

The Greeks and their predecessors, the Mycenaeans, early turned to the sea for their livelihood. The entire Greek peninsula is intersected by bays and inlets. The mountainous character of the country made communication by land difficult and reduced the available amount of arable land. In addition, numerous islands provided harbors of refuge for small vessels and natural sites for the establishment of trading posts. Therefore, it was most natural for the Greeks to become seafarers and traders.

The Greeks were quick to locate the routes of the caravans that brought silk from China; spices from India; and gold, ivory, and slaves from Africa. Early in their history, they established trading colonies at the Dardanelles and in what are now Syria, Lebanon, and Palestine.

Clay tablets discovered near Pylos, Greece, give some indication of the trade of the Mycenaeans. Although these tablets are largely tax receipts and records of military strength, they do indicate that the Mycenaeans were doing a lively trade around the eastern Mediterranean from 1500 to 1400 B.C. This trade consisted of exchanging olives, olive oil, figs, wine, perfumes, and pottery for grain and other foodstuffs, raw materials, and a few luxury items.

When the Dorians, the progenitors of the modern Greeks, took over about 1400 B.C., much of the manufacture and trade of fine pottery lapsed because the Dorians were a vigorous but ruder people, less civilized and less interested in artistic goods.

While the Greek economy was being rebuilt, the Phoenicians began to emerge as a commercial force. They probably were the branch of the Canaanites mentioned

repeatedly in the *Old Testament*; a seafaring people, they were centered around Tyre, Sidon, and Byblos in what is now Syria and Lebanon. Later, the Carthaginian branch extended its control to Sicily, Spain, and Cyprus—in fact, to the entire western Mediterranean. The seat of its power was Carthage, near the present city of Tunis, in Algeria. Despite various wars and invasions, the commercial and business operations of the Phoenicians flourished from about 1400 B.C. up to 146 B.C., when the Romans razed Carthage completely during the Third Punic War.

The first accounts of the activities of the Phoenicians occur in the Egyptian papyrus *Anastosi I* and the Amarana tablets from 1500 to 1400 B.C. The *Old Testament* describes the trade between Hiram I, King of Tyre, and King Solomon (1 Kings 9: 11; Ezek. 27), and Josephus mentions this same trade in his *Antiquities of the Jews* (xiv, 10, 6, and elsewhere). Herodotus makes numerous references to the seafaring and trading abilities of the Phoenicians in his *History*. Homer, in the *Iliad* (xxii, 744), speaks of the Phoenicians trading in Greek waters, and Xenophon, in his *Oeconomicus*, describes the skill of the Phoenicians as sailors and the high quality of their ships. Plato, in his *Republic* (lv, 435E), refers to the avariciousness of the Phoenicians and the hard bargains they drove.

The inhabitants of the towns on the Phoenician coast were occupied not only with trade but also with manufacturing. They had a monopoly on the production of a purple dye obtained from the gastropod *Murex*, and the manufacture of textiles and dyeing were important industries (Homer, *Iliad*, vi, 289). Metalwork in silver, gold, and electrum was also important (Homer, *Odyssey*, lv, 615 et seq.; xv, 458 et seq.). In addition, the Phoenicians were noted for their glass, and they mined iron and copper on the island of Cyprus.

During the Carthaginian period, which was the height of this civilization, the Phoenicians developed silver and copper mines in Spain and traded with the Britons for tin. The Greek writer Polemo records a special treaty regarding woven fabrics produced in Carthage that were a recognized luxury of the ancient world. In Sicily, Italy, and Greece, the Carthaginians sold black slaves, ivory, metals, precious stones, and all the products of central Africa that came to them by caravan.

The Phoenicians were the preeminent businessmen of the period from 1000 to 146 B.C. If they did not invent the alphabet and weights and measures, they improved these necessary adjuncts to business. They were the first to develop a system of accounts. Their skill and daring as seamen enabled them to be the first to venture into the Atlantic from the Mediterranean. In so doing they developed a regular trade with England and explored portions of the coast of western Africa. For a considerable length of time the Carthaginians completely controlled the trade of the western Mediterranean.

In addition to the works already cited, there are references to the business and commercial affairs of the Phoenicians

and Carthaginians in the writings of Polybius, Diodorus, Livy, Appian, Justin, and Strabo.

As the Greek civilization revived from the shock of the Dorian invasion, a lively trade began in the eastern Mediterranean that competed strongly with the Phoenicians. Athens became the center of commercial activity. In addition to the earlier exports of wine, olives, olive oil, and figs, the Athenians began to export objects of art. In addition, the Laurium mines supplied them with silver as a medium of exchange. Xenophon in his *Oeconomicus* throws much light on the commerce and industry of Athens. In one passage he states that the Assembly at Athens was composed of fullers, shoemakers, blacksmiths, farmers, merchants, and shopkeepers. He also refers to the litigious tendencies of the Greeks. There is also much material on economic activities in Plato's *Republic* and in Aristotle's *Politics*, his *Constitution of Athens* and his *Nicomachean Ethics*. Aristophanes in his plays makes caustic references to the workmen and commercial customs of the Athenians. Strabo also refers to Greek business.

The conquest of Greece, first by the Macedonians and then by the Romans, shattered Greek trade and practically destroyed the industry of the country. Greece was stripped of its artistic treasures, shipping came under the control of the Romans who took over the trade from the Far East, and pirates from Crete practically destroyed the local shipping.

The Romans were interested in conquest, administration, and public works. As a matter of fact, they looked down on trade and industry. They left trade in the hands of the Greeks and other foreigners, and industry was largely performed by slave labor under the direction of foreign overseers. Cicero in his letters (*Familiares*; *ad Atticum*; *ad Quintum*; and *ad Brutum*) throws some light on commercial and manufacturing activities, of which he speaks very grudgingly. Livy's *History of Rome*, Strabo's *Geography*, and Pliny's *Natural History* all contain references to business and commerce.

Agriculture did interest the Romans and was regarded as an honorable occupation. After the very early period, farming was based on the operation of large estates (latifundia system) worked by slaves under the direction of overseers. In order to keep track of this business, the Romans worked out a fairly complete accounting system. A highly romantic account of Roman agriculture is found in the *Eclogues* and *Georgics* of Vergil.

The break-up of the Roman Empire destroyed the peace and communications in the Mediterranean basin. This curtailed the large trade with the Far East. The importation of spices, perfumes, silks, ivory, precious stones, and pearls from India, Persia, and China amounted to 100 million sesterces (\$4 million) annually in the time of Pliny.

As the barbarian invaders took over, commercial activities were gradually acquired by the Italians, Provençals, and Catalans. The most active in this trade were the

Venetians, the Genoese, and the Florentines. It was largely a revival of the old trade in spices and luxury goods of the Far East. The development and extent of this trade is described in detail in W. Heyd's *Histoire du Commerce du Levant au Moyen Age* (Leipzig, 1885).

There are many references to the trade of these cities in the treaties and other records in their archives. Venice and Florence became very wealthy centers of manufacturing, trade, and shipping. The Venetians profited immensely from the Crusades; they furnished supplies, funds, and transportation to the Crusaders in return for trading rights in the conquered territories as well as cash payment for their services.

As a result of these activities, the Venetians, Florentines, and Genoese accumulated large financial resources and became the bankers of Europe during the thirteenth, fourteenth, and fifteenth centuries.

The invention of printing from movable type around 1450 made it possible to make information more readily available. The first book dealing with business was that by Lucca Paccioli, *Summa de Arithmetica, Geometrica et Proportionalta* (Venice, 1494), which had a section on double-entry bookkeeping. This method of accounting was soon dubbed the Italian system and spread very rapidly. Schools were established in Venice and merchants sent their sons there to be taught this method. Soon rival schools were set up in Antwerp and Augsburg, and later in London and Paris.

In the sixteenth and seventeenth centuries, commerce and industry arose in France, England, Holland, and Germany. This was the period of the demise of the feudal system, the coming to power of the merchants, and the freeing of the artisans from the control of their feudal masters.

An early work that describes commercial developments in Antwerp and Amsterdam is Ludovico Gucciardini's *Descrizione de Paesi Basse* (Antwerp, 1567). Sir Walter Raleigh wrote *Observations Touching on Trade and Commerce with Holland* about 1616. A work by John de Witt, which probably was the English translation of a French book by M. Delacourt, was *True Interest of Holland*, which appeared in 1667. The *Richesse de la Holland* was published anonymously in Amsterdam in 1678.

The records of treaties, suits, and business alliances of the powerful Fugger family provide insight into the operations of the Hanseatic League in the Baltic. A good résumé of this area and period can be found in Richard Ehrenberg's *Capital and Finance in the Age of the Renaissance: A Study of the Fuggers and their Connections* (New York, 1928?).

The stirrings of commercial life were very active in England at this time, and much light is thrown on commerce and industry through the various petitions, suits, and requests for charters that appear in *British State Papers—Domestic* and the records of the Privy Council, of the City of London, and of the various guilds.

Under the stimulus of developing trade, British merchants strove to improve and better control their operations. They were most interested in books that would be helpful to them. The earliest of these business books was Hugh Oldcastle's *A Profitable Treatyce: called the Instrument or Boke to learn to know the good order of keepyng of the famouse reconyng called in Latyn Dare and Habere and in Englyshe, Debtor and Creditor* (London, 1543). This was followed at a considerably later date by Richard Dafforne's *The Merchants Mirror: or directions for the perfect ordering and keeping of his accounts* (London, 1635). This book went through four printings and encouraged Dafforne to publish *The Apprentice's time enter-tainer accomptantly: or a methodical means to obtain the equisite art of accomptantship* (London, 1640). There is no record as to how this book was received by the apprentices but it did go through three editions.

The honors for popularity of books on accounting goes to George Fisher's *The Instructor: or young man's best companion. Containing... merchant's accompts, and a short and easy method of shop and book keeping* (Dublin, 1736). It took 31 printings to satisfy the demand.

Books on specialized accounting soon began to appear; the earliest of these was John Brown's *The Merchant's Avizo, very necessaire for their sonnes and servants when they first send them . . . to Spaine and Portugal* (London, 1589). Another popular book was one by Richard Hayes entitled *The Ship and Supercargo Bookkeeper* (London, 1731). There were other books on accounting for trade with British America, India, and for ships, banks, and estates. B. S. Yaney, et al., in *Accounting in England and Scotland: 1543 to 1800* (London, 1963) give a very full history of accounting and its literature.

The late seventeenth century and all of the eighteenth century was a period of ferment. Not only were commercial rivalries bitter between England, France, Holland, and Spain, but new methods and new products were coming onto the market. This caused serious dislocation of earlier industries and was also reflected in national policies. In England, an acrimonious controversy went on concerning the extent of governmental control, whether free trade or protection was best for the country, and what was best for the national interest. This debate went on to a lesser extent in other countries, but in France it was suppressed under the mercantilistic policies of Colbert under which the state closely controlled commercial and industrial activities. This period is described in part by Germain Martin's *La Grande Industrie en France sous Règne de Louis xiv* (Paris, 1898). A very comprehensive account of the state of industry and technology appearing in the latter part of the eighteenth century was the *Encyclopédie ou Dictionnaire des Sciences, des Arts et des Métiers* by Denis Diderot (Paris, 1751–1772; 17 vols.). An earlier French publication, *Dictionnaire Universel de Commerce* by Jules Savary des Brulons (Paris, 1723–1730), was of more interest to merchants. Malachy Postlewayt published

his *Universal Dictionary of Trade and Commerce* in London in 1751–1755; this was largely a translation of des Brulons's *Dictionnaire*.

There was a groping toward the development of economic theory from 1650 to 1750, especially in England. Publications, particularly tracts, appeared in increasing numbers. One of the earliest of these was *A Discourse of the Common Weal of Thys Realm of England* by Richard Hales (London, 1549). In 1581 Hales published in Cambridge an anonymous tract, *A Compendious or briefe examination of certayne ordinary complaints of diuerse of our countrymen in these our days: which although they are somewhat uniust & friuolous, yet are they all by way of dialogues thoroughly debated and discussed by W.S. Gentleman*. Hales held forth on the causes of poverty and the high cost of living, which he attributed to foreign trade and the debasement of the currency. He advocated restriction of the exportation of raw materials and of the importation of trifles (nonessential goods).

Gerald de Milynes (fl. 1568–1641), the assayer at the Royal Mint, was, as might be expected, very much concerned with monetary questions. His three books, *A Treatise on the Canker of England's Commonwealth* (London, 1601), *England's View in the Unmasking of Two Paradoxes* (London, 1603), and *Consuetudo* (London; several editions, the last in 1686), all dealt with monetary problems.

Edward Misselden (fl. 1608–1654) did battle with Hales, poking holes in his reasoning and conclusions in *Free Trade or the Means to make Trade Flourish* (London, 1621) and *Circle of Commerce* (London, 1629).

Thomas Mun (fl. 1571–1641) in his writings was an unconscious influence on Adam Smith in his works on foreign trade. These were *A Discourse on Trade from England unto East-Indies* (London, 1621) and *England's Treasure: by Forraign Trade: or the Ballance of our Forraign Trade is the Rule of our Treasure* (London, 1664), published after his death.

Nehemiah Grew (1641–1712), a British physician, pointed the way to the concept of utilitarianism and brought in ideas on consumption and distribution—in other words, he was the first to recognize the place of the consumer in economics and business. Grew's contribution was a tract, *The Meanes of a Most Ample Encrease of the Wealth and Strength of England in a Few Years Humbly represented to her Majestie in the Fifth Year of Her Reign* (London, 1707).

A highly acrimonious war was waged for a short period by two publications. The *Mercator: or Commerce Retrieved, Being Consideration on the State of British Trade* (London, 1713–1714) was one. This was a free trade sheet issued twice a week for a penny. Daniel Defoe was the editor. The opposition protectionist sheet, edited by Charles King, was *British Merchant: or Commerce Preserved; In Answer to the Mercator or Commerce Retrieved* (London, 1713–1714).

The English philosopher, Thomas Hobbes (1588–1679), held the theory that all human conduct is affected by environment, especially the drive for self-preservation. His books, *Leviathan* (London, 1651) and *De Cive* (London, 1651), influenced Mill and Bentham. The Frenchman François Quesnay (1694–1774) put forth the theory that agriculture was preeminent and land was the only source of wealth. His book, *Tableau Économique* (Versailles, 1758), epitomizes the theories of the Physiocrats. Bernard de Mandeville in his *Fable of the Bees: or Private Vices Public Benefits* (London, 1714–1729) espoused for the first time the notion that the self-interest of the individual is important to the economy.

Jeremy Bentham (1748–1832) was a leading exponent of utilitarianism, i.e., that happiness is the end of human existence. He had an influence on Mill, Adam Smith, and others. Sir James Steuart (1712–1780) was one of the first to begin to draw these strands of economic thinking together and the first to use the title “political economy” in his *An Inquiry into the Principles of Political Oeconomy: being an essay on the science of Domestic Policy in Free Nations in which are particularly Population, Trade, Industry, Money, Coin, Interest, Circulation, Banks, Exchange, Public Credit and Taxes* (London, 1767; 2 vols.). David Hume (1711–1776) added the theory of utilitarianism in international trade to the growing body of works on this subject. Mill and Ricardo were both indebted to Hume.

The time was ripe in the middle of the eighteenth century to weave all these strands of economic thought into a composite whole. Adam Smith (1723–1790) was familiar with these earlier writings and many of these men were his friends. His *An Inquiry into the Wealth of Nations and Causes of the Wealth of Nations* (London, 1776) laid the cornerstone of modern economics and became the bible of the supporters of *laissez faire*.

During this period, there were a number of articles on economics, trade, and commerce appearing in the *Philosophical Transactions of the Royal Society* (1665–). A publication of interest to businessmen was *The Annual Register* (London, 1758–), which carried much information on the political situation and the state of trade and industry in foreign countries. The Society for the Encouragement of Arts, Manufactures, and Commerce began publishing its *Transactions* in 1761. Other information of interest to businessmen was published in the *Journals of the House of Commons*, the *Journals of the House of Lords*, and the reports of committees made in response to petitions of businessmen or labor groups.

The forerunner of the British Board of Trade was formed as a committee of the Privy Council by Oliver Cromwell in 1660. This was designated as the Commission of Trade and Plantations. After being abolished in 1679, it was revived by William III in 1679 and was made a permanent body in 1786. Almost from the beginning, the Board of Trade compiled and published abstracts,

memoranda, tables, and charts relating to trade and industrial conditions in the United Kingdom, its colonies, and foreign countries. It now supervises trade accounts and provides monthly and annual data on shipping and navigation; labor, cotton, and emigration statistics; and foreign and colonial customs tariffs. The Board of Trade also provides individual businessmen with accurate information, and on occasion, confidential data. The *Board of Trade Journal* (1886–) provides businessmen with current trade information.

The first businessman to write on business and economic subjects was David Ricardo (1772–1823). After making a fortune in the stock market, Ricardo retired and devoted himself to studying the economy. He studied the actual operations of business and the economy and based his observations on firsthand knowledge. He established the principle that the amount of labor expended on a product determines its worth. His major publication was *Principles of Political Economy* (London, 1817).

One of the strongest advocates of the theory of utilitarianism was John Stuart Mill (1806–1873) of the Manchester School. His views were set forth in his books, *Essays on Some Unsettled Questions of Political Economy* (London, 1843) and *Principles of Political Economy* (London, 1848; 2 vols.).

The Frenchman Jean-Baptiste Say (1767–1832) must be included here, for in his *Cours complet d'économie politique pratique* (Paris, 1828–1829), Say was the first economist to stress the importance of the entrepreneur.

The Englishman Alfred Marshall (1842–1924) was the foremost economist of his time and was largely responsible for the development of modern economics. His *Principles of Economics* (London, 1890) went through many editions, and his *Industry and Trade* (London, 1919) and *Money, Credit and Commerce* (London, 1923) are highly respected works.

As the Industrial Revolution reached full flower in the 1880s, there was a divergence between the economic theorists and the businessmen. This was partly because the businessmen were busy transforming the economy and felt that many of the older precepts were outmoded, and partly because business was developing its own literature. Businessmen were relatively unaffected by the writings of the later economists, with two notable exceptions: Karl Marx's *Das Kapital* (Hamburg, 1867) and John Maynard Keynes's *The General Theory of Employment, Interest and Money* (London, 1936). The former laid the groundwork for the formation of labor unions and emphasized the class struggle; the latter became the handbook of the inflationists.

To return for a moment to the earlier period, there are some rather interesting accounts by travelers of economic conditions and commerce in England. Among these are Daniel Defoe's *A Tour through the Whole Island of Britain, divided into circuits or Journeys* (London, 1724–1727; 3 vols.); J. Campbell's *A Political Survey of Britain,*

being a series of reflections on the Situation, Lands, Inhabitants and Commerce of this Island (London, 1774; 4 vols.). Two foreign visitors recorded their observations in books. These were Erik T. Svedenstjerne, *Resa igenom en del af England och Scotland aren 1802 och 1803* (Stockholm, 1804) and F.A. Wendeborn, *Beitrag zur Kenntniss von Grossbritannien* (Lemgo, 1780). John Smith in his *Chronicum Rusticum: or Memoirs of Wool, Woollen Manufacture and Trade* (London, 1747?) reprinted a number of rare pamphlets on this subject.

What was perhaps the first biography of a businessman appeared in 1597. This was Thomas Deloney's *The Story of John Winchcombe, commonly called Jack of Newberry* (London, 1597). This biography of a woolen manufacturer and cloth merchant ran through many printings as it was extremely popular.

Up to this point, this entry has been concerned with developments in England and on the Continent, with no references to those in the United States. During the period 1750–1870 there was little indication in the United States of the wealth of information for the businessman that was to become available during the twentieth century.

Up until the Civil War, ships' captains and newspapers were the major sources of information aside from correspondence from agents and other businessmen. When they returned from voyages to all parts of the world, the captains had firsthand information on markets and economic and political conditions. The waterfront coffee-houses of Boston, New York, Baltimore, and Charleston were much frequented by businessmen and newspapermen. News from the interior of the United States was scanty and unreliable.

During the period 1700–1860 the businessman, depending on his locality, read the following newspapers: Boston had the *Boston Gazette* (1704–1754), a new *Boston Gazette* (1755–1836), and the *Evening Transcript* (1836–1960?); in Connecticut there was the *Hartford Courant* (1764–); Pennsylvania was served by the *United States Gazette* (1789–1847), which was absorbed by the *North American* (1830–); New York City was well supplied with newspapers, which included the *New York Gazette* (1725–1840), the *New York Herald* (1835–1964), the *New York Mercury* (1752–1783), the *New York Tribune* (1841–1964), and *The New York Times* (1851–). Perhaps the first newspaper directed to the businessman was the *Journal of Commerce and Commercial Bulletin*, founded in 1827 as the *Journal of Commerce* and in 1893 consolidated with the *Commercial Bulletin* (1865–).

In 1811 an attempt was made by Hezebiah Niles to provide a national news periodical. The *Niles Weekly Register* survived until 1849. Niles, its editor, strove for accuracy and gleaned his news from the captains of ships and merchants patronizing the Baltimore Coffee-House and the Merchants' Coffee House, also in Baltimore. He also reprinted articles from other newspapers; among those from which he drew material were the

Baltimore American and the *Commercial Advertiser* of New York. Niles published the full text of major laws, regulations, and important speeches, and he interviewed travelers. While his primary aim was to provide a weekly account of news and politics, the *Register* contained much commercial information of interest to the businessman. As an example, Niles warned businessmen that upon the conclusion of the War of 1812, their prosperity would collapse in the face of renewed competition from the British.

In the 1830s, 1840s, and 1850s, the United States was embarking on the Industrial Revolution. Factories were springing up all over the country, especially in New England and the Middle Atlantic states, and railroads were reaching out to the South and Middle West and later to the Far West.

Many issues of railroad stocks and bonds were being sold, especially in the 1870s, 1880s, and 1890s. It was most difficult to obtain information on the operations and finances of these companies. John Moody in 1870 undertook to publish a compilation of data on railroads; this appeared as *Moody's Manual of Railroad Securities*. For many years this was the only volume published each year. Eventually other volumes were added. Today, *Moody's Manual on Railroads* (renamed *Moody's Manual on Transportation* to include air and steamship lines, buses, and trucking); *Moody's Manual on Industrials*; *Moody's Manual on Public Utilities*; *Moody's Manual on Banks, Insurance Companies, Real Estate and Investment Trusts*; and *Moody's Manual on Governments and Municipals* are published annually. Moody was the first person to supply businessmen with accurate current information.

Credit was another troublesome factor to the businessman. This was particularly the case with wholesalers dealing with country storekeepers in the South and Middle West. In 1841, a young man in New York named Richard D. Dun undertook to supply merchants with credit information. In a large number of the smaller cities and towns, a merchant or banker whom he could trust would give him reliable information on the credit standing of individuals in their locality. R.G. Dun and Company soon had competition from the Bradstreet Company, which was formed by John M. Bradstreet in Cincinnati, Ohio, in 1849. At first, both these firms supplied credit information on a fee basis for each individual inquiry. This was later supplemented by *Dun's Reference Book*, which became, on the merger of the two firms in 1933, *Dun & Bradstreet Reference Book*. This volume supplies information on the type of business and capital resources of the firm or individual and gives some indication as to how promptly bills are paid. Originally issued annually, it is now kept up-to-date with bimonthly supplements. Dun & Bradstreet will, upon request, issue individual credit reports. To provide general information on credit, business conditions, and failures, Dun started *Dun's Review* in 1893. This publication has continued as *Dun's Review and Modern Industry*.

An earlier publication that is most useful to businessmen is the *Commercial and Financial Chronicle* (New York, 1865–). This periodical provides very complete stock, bond, and commodity quotations along with articles on national finance, business conditions, and foreign trade.

The businessman has always tried to obtain up-to-date information on matters affecting his operations. This includes data on economic conditions, business trends, new improvements in methods and technology, discoveries of natural resources, and recently enacted laws and regulations. In short, statistics are highly important to his business.

The British government was quick to recognize this need of the businessman for accurate information with its Board of Trade publications, including the *Board of Trade Journal*. Its Department of Overseas Trade for many years published detailed studies of various foreign countries and colonies. These publications are supplemented by the *Royal Statistical Society Journal* (London, 1838–); the *Economic Journal* (London, 1891–) of the Royal Economic Society; and the London School of Economics and Political Science's *Economica* (London, 1921–). Although much of the material in these latter publications is concerned with methodology and theory, they do contain a number of articles of interest to the businessman.

Publications in France and Germany of a similar nature are *Journal des Économistes* (Paris, 1841–1940); *Revue Économique* (Paris, 1950–); and *Finanz-Archiv* (Stuttgart, Tubingen, 1884–1943, 1948–).

In contrast to the interest of the British government in providing information for businessmen, the U.S. government, up until 1880, provided little assistance or information to business. The first census, in 1790, was little more than an enumeration of the inhabitants. It was not until the census of 1880 that useful data on business, manufacture, finance, agriculture, and foreign commerce became available. The utility of this publication was reduced by the delay in its issuance; the last volumes did not appear until almost 10 years after the census was taken. There were earlier publications on shipping and foreign trade, but businessmen needed the bringing together of data in the decennial censuses. The situation was much improved when the Bureau of the Census began to publish *The Statistical Abstract of the United States* (1878–). This brings together a large number of statistics from governmental and other sources.

The situation was improved with the establishment of the Department of Commerce and Labor in 1903. However, the Department of Commerce did not really begin to be effective until it became a separate organization with a secretary of cabinet rank in 1913. Publications on foreign and domestic commerce were issued at this time and a modest quantity of other information was supplied to businessmen.

The Department of Commerce truly became a help to business when it was reorganized by Herbert Hoover, who

was secretary of commerce from 1920 to 1927. A large number of reports, special studies, and periodicals began to be issued from that time on. Most notable of these is the *Survey of Current Business* (Washington, 1921–). This periodical with its *Weekly Supplement* supplies statistics from a wide variety of sources on every aspect of the economy, with pertinent comment.

With the establishment of the Federal Reserve System in 1915, much greater stability was given to the American banking structure. In that year the *Federal Reserve Bulletin* began to be issued and at a later date, the *Chartbook on Financial and Business Statistics* was issued on an annual basis. Another useful source for statistics is *Business Statistics*, published since the late 1940s by the U.S. Bureau of Foreign and Domestic Commerce. The Departments of Commerce and Labor and their various bureaus issue catalogs and checklists of their publications. The bulk of these are listed in the *United States Government Publications Monthly Catalog* of the U.S. Superintendent of Documents (Washington, D.C., 1895–).

Similar compilations of statistics are published in other countries, notably *Economic Trends* and the *Monthly Digest of Statistics* (Great Britain); the *Canadian Statistical Review*; *Economic Statistics* and the *Oriental Economist* (Japan); the *Monthly Abstract of Statistics* (India); and *Boletim Estatístico* (Rio de Janeiro, Brazil).

The advent of international organizations after World Wars I and II has resulted in the compilation of data on a worldwide basis. The League of Nations published annually the *Statistical Yearbook of the League of Nations* (Geneva, 1927–1945) and the *World Economic Survey* (Geneva, 1927–1945). These publications have been continued by the United Nations in its *Statistical Yearbook* (New York, 1948–), the *United Nations Monthly Bulletin of Statistics*, the *United Nations Economic Bulletin for Asia and the Far East*, and the *United Nations Economic Bulletin for Europe*; the two last-named periodicals appear quarterly.

Nongovernmental compilations of statistics and data on business are *Statesman's Year-book* (London, 1863–); *Whitaker's Almanac* (London, 1868–); *World Almanac and Book of Facts* (New York, 1885–); Standard and Poor's Corporation's *Trade and Securities Statistics* (New York, 1928–); and the National Industrial Conference Board's *The Economic Almanac* (New York, 1939–).

All the general periodicals directed toward the business reader, as well as trade publications, carry statistical and other data. The larger newspapers have much valuable information, especially the *London Times*, *The New York Times* and the *Wall Street Journal*. These three have the additional advantage of being thoroughly indexed.

The material contained in the publications listed dealing with statistics is of prime importance to businessmen and therefore has been discussed at some length.

Trade associations were formed in Great Britain early in the nineteenth century; these included associations of

the cotton spinners and the woolen manufacturers. Trade associations did not appear in the United States until 1870. In 1896, the National Association of Manufacturers was established by men in manufacturing and business. The objectives of this association are 1) promotion of the industrial interests of the United States; 2) fostering of the domestic and foreign commerce of the United States; 3) the betterment of relations between employers and employees; 4) protection of the individual rights of employers and employees; 5) the dissemination of information among the public with respect to the principles of individual liberty and the ownership of property; and 6) the support of legislation to these ends.

The National Association of Manufacturers and the individual trade associations were originally concerned with protecting their interests through lobbying for legislation favorable to them, particularly protective tariffs, and defeating legislation regarded as unfavorable to business. The number of trade associations has increased enormously and there are now not only trade associations for every industry but also for subdivisions of that industry and regional associations. As an example, there are 10 associations for the leather industry, ranging from the Tanners Council of America and the National Hide Association to the Last Manufacturers Association and the National Association of Slipper and Playshoe Manufacturers. Many of these associations put out publications containing news of the trade, statistics, remarks on the general state of the economy, and references to books and articles of interest to their members. The larger associations maintain research staffs that can help members with problems. Among these are the American Iron and Steel Institute, the Copper and Brass Research Organization, the American Petroleum Institute, and the National Association of Wool Manufacturers.

The chamber of commerce has flourished in the United States as nowhere else in the world. No town is too small to have this organization beating the drums on its special economic, commercial, and cultural advantages. These developed independently until 1912 when the Chamber of Commerce of the United States of America was formed with headquarters in Washington, D.C. Its membership was made up of local chambers of commerce and some trade associations. The constitution of the Chamber of Commerce of the United States of America proclaims its purposes to be (1) to study national problems and define current questions; (2) to ascertain the views of business and to determine what business feels is the best solution of national problems; and (3) to voice and explain the views of business to government and the public. The chamber is subdivided into a number of departments that do research and publish many useful reports on special subjects and national issues. These departments are agriculture, construction and civil development, domestic distribution, finance, foreign commerce, foreign policy, insurance, manufacture, transportation and communication, economic

research, education, and labor relations. The chamber publishes *Nation's Business* (Washington, D.C., 1912–).

In addition to the official publications of trade associations, there are magazines put out by commercial publishers as organs of general interest to the businessman or for specific industries. In the main, these periodicals have a broader scope and more complete coverage than do the publications of the trade associations. A very useful feature is their annual survey numbers, which sum up the state of the industry. The McGraw-Hill Book Company publishes the largest number of these trade magazines; one of general interest is *Business Week* (New York, 1929–). Other periodicals of general interest are *Nation's Business*, already mentioned, and the *U.S. News and World Report* (Washington, D.C., 1936–).

Many large companies publish magazines for their stockholders which supply information both on the operations of the company and on the industry as a whole. The larger brokerage firms put out large numbers of financial studies of firms and industries.

Schools of Business

As businesses grew in size and scope, thoughtful businessmen recognized the need for objective, scientific study of business and its operations. This thinking led to the establishment of schools of business in colleges and universities. The first of these was the Wharton School of Business at the University of Pennsylvania, which received its first students in 1881. This was followed by schools of business at the University of California and the University of Chicago in 1898. The Amos Tuck School of Administration and Finance was established at Dartmouth College in 1900, as were schools at the University of Wisconsin and New York University. The Harvard Graduate School of Business Administration came into being in 1908 and was the first to offer entirely graduate instruction. The Stanford Graduate School of Business opened its doors in 1924. Now there is scarcely a large educational institution that does not have a school of business.

This marriage between business and education has proved to be a happy one. It has provided the means to do competent and scientific research on the operations and methods of business without the pressure of day-to-day business operations and has trained a body of excellent business executives. Splendid reports, studies, and books are constantly being published by the faculties of schools of business; these are too numerous to be included. The librarians connected with the schools of business have been of immense assistance to business with their compilation and publication of bibliographies and checklists on all phases of business. A few of the excellent periodical publications of schools of business are the *Harvard Business Review* (Boston, 1922–); the *Journal of Business of the University of Chicago* (Chicago, 1928–); the *London and Cambridge Economic Services Report on Current*

Economic Conditions (London, 1923 – 1951); and the *Michigan Business Review* (Ann Arbor, Mich., 1949–).

Two institutions do business research independently of the academic world. These are the National Industrial Conference Board in New York and The Brookings Institution of Washington, D.C. The former is supported by firms and businessmen and supplies a large number of special reports, largely drawn from the experience of its members, to its membership. It publishes two periodicals, *The Conference Board Record* (New York, 1944–) and *The Conference Board Management Record* (New York, 1939–). The board also prepares the data for the *Economic Almanac* published by *Newsweek*. The Brookings Institution is engaged in long-range studies in depth dealing with the economy as a whole and also socioeconomic problems. The results of these studies appear at irregular intervals in the form of books. A foundation that is also on occasion concerned with research in business, with a slightly antibusiness bias, is the Twentieth Century Fund of New York.

Study of Scientific Management

After World War I, business increased greatly in scope and complexity and has continued to do so to the present day. From about 1915 on, there has been the tendency to break down business into its components, that is, finance, production, marketing, advertising and sales management, management, and personnel relations. This trend was given impetus by the studies in scientific management conducted in Europe and the United States by Oliver Sheldon (England), Henri Fayol (France), Frederick Winslow Taylor (United States), Henry Lawrence Gantt (United States), Frank B. and Lilian Gilbreth (United States), Mary Parker Follett (United States), and L. Urwick (England). This pioneering work has been continued in the United States by Wallace Clark, Harry Arthur Hopf, Ralph C. Davis, Leon P. Alford, Dexter S. Kimball, and Paul E. Holden.

Since the work of these men has been an important influence on business and industry throughout the world, it is only proper to list some of their books in this area. Frederick Winslow Taylor's books, *Shop Management* (New York, 1903) and *Principles of Scientific Management* (New York, 1911), started the trend to scientific management. Other important books in this field are Henry Lawrence Gantt's *Work, Wages and Profits* (New York, 1910) and his *Industrial Leadership* (New Haven, 1915); Harrington Emerson's *Twelve Principles of Efficiency* (New York, 1911); Frank B. Gilbreth's *Primer of Scientific Management* (New York, 1911) and his and Lilian M. Gilbreth's *Applied Motion Study* (New York, 1917). The work of these early pioneers is summarized in Frank Barkley Copley's *Frederick W. Taylor, Father of Scientific Management* (New York, 1923) and Leon P. Alford's *Henry Lawrence Gantt, Leader in Industry*

(New York, 1934). Oliver Sheldon in his *Philosophy of Management* (London, 1923) brought out the British aspects of scientific management, as did Henri Fayol in his *Industrial and General Administration* (Paris, 1920) for the French.

Later works in this field are the following: Paul E. Holden, Lounsbury Fish, and Hubert L. Smith, *Top Management, Organization and Control* (Stanford, California, 1948); A. Filippetti, *Industrial Management in Transition* (Homewood, Illinois, 1953); L. Urwick, ed., *The Golden Books of Management, An Historical Account of the Life and Work of Seventy Pioneers* (London, 1956); A. Rathe, ed., *Gantt on Management: Guidelines for Today's Executive* (New York, 1961). Other works in this important field are the following: W. B. Cornell, *Organization and Management in Industry and Business*, 4th ed. (New York, 1958); R. C. Davis, *Industrial Organization and Management* (New York, 1957); W. R. Spriegel and E. C. Davis, *Principles of Business Organization and Operation*, 3rd ed. (Englewood Cliffs, New Jersey, 1960). These books by no means exhaust the list of excellent books in this field and its subdivisions.

It was only natural that persons working in specific phases of business should join together in associations. Mechanical and civil engineers formed professional organizations at an early date. The first business professional group to organize were the accountants. The American Institute of Accountants was formed in 1887 and is now known as the American Institute of Certified Public Accountants. This American society was preceded by the Society of Accountants in Edinburgh (1854), similar societies in Glasgow (1855) and Aberdeen (1867), and the Institute of Accountants, formed in London in 1870. Scientific management was represented by the Taylor Society (1914), which in 1934 combined with the American Management Association (1923). The National Office Management Association (1919) has now changed its name to Administrative Management Society.

Other associations interested in improving business operations are the American Accounting Association (1916), the American Marketing Association (1915), and the National Association of Accountants (1919).

All these organizations publish periodicals and research collegiate schools of business, provide a most important body of business literature.

This treatment of business literature is already overlong; hence in the following list, references to the literature in specific fields of business are limited to those works that supply the greatest amount of information in the smallest compass.

Banking, Finance, and Investments

American Bankers Association. *Present Day Banking*; New York, 1954–1958; Vol. 6.

Bogen, J.I., et al. Eds. *Financial Handbook*, 3rd Ed.; New York, 1957.

Garcia, F.L.; Munn, G.G. *Encyclopedia of Banking and Finance*, 6th Ed.; New York, 1962.

Gerstenberg, C.W. *Financial Organization and Management*, 4th Ed.; Englewood Cliffs, NJ, 1959.

Jordon, D.F.; Dougall, H.E. *Investments*, 7th Ed.; Englewood Cliffs, NJ, 1960.

Prentice-Hall History of Money and Banking, Englewood Cliffs, NJ, 1962–1963; Vol. 18.

Real Estate and Insurance

Best's Insurance Reports (Fire and Marine) and (Casualty and Surety); New York, 1899–.

Dodge Statistical Service; New York, 1925?– (real estate).

Huebner, S.S.; Black, K. *Property Insurance*, 4th Ed.; New York, 1957.

Husband, W.H.; Anderson, F.R. *Real Estate*, 3rd Ed.; Homewood, IL, 1960.

The Insurance Almanac; New York, 1912–.

North, N.L.; Ring, A.A. *Real Estate Principles and Practices*, 5th Ed.; Englewood Cliffs, NJ, 1960.

Riegel, R.; Miller, J.S. *Insurance Principles and Practices*, 4th Ed.; Englewood Cliffs, NJ, 1959.

Spectator Insurance Yearbooks, Fire and Marine volume; Philadelphia, PA, 1928–.

Accounting

Barker, M., Ed., *Handbook of Modern Accounting Theory*; Englewood Cliffs, NJ, 1955.

Dickey, R.L. ed.; *Accountant's Cost Handbook*, 2nd Ed.; New York, 1960.

Lasser, J. K. *Handbook of Accounting Methods*, 2nd Ed.; New York, 1954.

Personnel and Industrial Relations

Aspley, J.C., Ed. *The Handbook of Employee Relations*; Chicago, IL, 1957.

Heyel, C., Ed. *The Foreman's Handbook*, 3rd Ed.; New York, 1955.

Yoder, D. et al., *Handbook of Personnel Management and Labor Relations*; New York, 1958.

Marketing, Sales Management, and Advertising

Aspley, J.C. Ed. *The Sales Manager's Handbook*, 8th Ed.; Chicago, IL, 1959.

Aspley, J.C. Ed. *The Sales Promotion Handbook*; Chicago, IL, 1954.

Barton, R. *Advertising Handbook*; Englewood Cliffs, NJ, 1950.

- Beckman, T.N. *Marketing*, 7th Ed.; New York, 1962.
- Canfield, B.R. *Sales Administration, Principles and Practices*, 4th Ed.; Englewood Cliffs, NJ, 1961.
- Hepner, H.W. *Modern Advertising, Practice and Principles*, 3rd Ed.; New York, 1956.
- Nystrom, P.H. Ed. *Marketing Handbook*; New York, 1948.
- Philips, C.F.; Duncan, D.J.; *Marketing Principles and Methods*, 3rd Ed.; Homewood, IL, 1960.

Public Relations

- Aspley, J.C.; Houten, L.L., Eds.; *The Dartnall Public Relations Handbook*, 3rd Ed.; Chicago, IL, 1961.
- Cutlip, S.M.; Center, A.H.; *Effective Public Relations*, 2nd Ed.; Englewood Cliffs, NJ, 1958.
- Lerley, P. Ed.; *Handbook of Public Relations*, 2nd Ed.; Englewood Cliffs, NJ, 1960.

FOREIGN TRADE

- Chamber of Commerce of the United States of America. *Foreign Commerce Handbook: Basic Information and Guide to Sources*, 14th Ed.; Washington, DC, 1960.
- Customs House Guide*; New York (issued annually with monthly supplements).
- Exporters' Encyclopedia*; New York (issued annually).

This is but a sampling of the books available, not to mention the many periodicals. For more detailed information on where to locate publications, see Coman.^[1]

The most pressing need of the businessman is for up-to-date information. This is most readily available in the newspapers, periodicals, and loose-leaf services. Fortunately, there are indexes that enable one to locate data in periodicals and other media. The three newspaper indexes have already been mentioned. Indexes to a broad range of publications are as follows: *Business Methods Index* (Ottawa, Canada, monthly); *Business Periodicals Index* (New York, monthly); *Applied Science and Technology Index* (New York, monthly); *Readers' Guide to Periodical Literature* (New York, monthly); *UNESCO International Bibliography of Economics* (Paris, monthly). More specialized indexes are as follows: *Index of Corporations* (Detroit, weekly); *Statistical Sources* (Detroit, monthly); *Management Index* (Ottawa, Canada, monthly); and *Accountants' Index* (New York, monthly).

The loose-leaf services that supply a stream of information daily are most popular in the United States. Commerce Clearing House, the Bureau of National Affairs, and Prentice-Hall (Englewood Cliffs, New Jersey) all have services on labor relations, taxation, and corporation law.

The tremendous amount of material being published creates a problem for the businessman as it becomes more

and more difficult for him to keep abreast of information vital to him. Various abstracting services have been devised to give the businessman a quick view of the literature in general. The most complete coverage is in *Economic Abstracts: A Semi-monthly Review of Abstracts on Economics, Finance, Trade and Industry, Management and Labour* (The Hague, 1953–). The coverage is extremely broad in that it includes abstracts of books, periodical articles, and reports of governments and international organizations published in Europe, North America, and Great Britain. The American Economic Association publishes the *Journal of Economic Abstracts* (Cambridge, Mass., 1963–), which tends to cover the more theoretical aspects of economics and business.

Specialized abstracting seems to be largely confined to personnel and industrial relations. These include *Issues & Ideas: Abstracts of the Current Literature in Management, Organization and Industrial Relations* (Chicago, 1954–); *Employment Relations Abstracts* (Detroit, 1950–); *Industrial and Labor Relations: Abstracts and Annotations of Current and Periodical Literature* (Ithaca, N.Y., 1948–1957); and *Management Abstracts* (Ann Arbor, Mich., 1955–).

One other publication, which should have been mentioned earlier, is *International Encyclopedia of the Social Sciences* (New York, 1968).

Reference has been made to the excellent bibliographies and other publications of the librarians in business libraries. This work was greatly encouraged when these librarians joined together in 1909 to form the Special Libraries Association. Various committees and chapters of this association have published many studies and very complete bibliographies on general and special subjects. The members have done much to increase the availability of business information.

Mechanization of business office operations began with the acceptance of the typewriter as a business tool in the 1890s; this was followed not too much later by the adding machine and the comptometer. Here progress rested until the advent of the computer. Now, in the larger firms, payroll and dividend checks, insurance claims, and much of the accounting for customers of banks and retail stores is done by computer. The military, the Bureau of the Census, and the Internal Revenue Service have gone heavily into the computerization of their activities. The various stock exchanges are striving to gain control of their paperwork through the use of computers.

There are still a number of problems, technical and especially economic, to be worked out before computerized retrieval of information works satisfactorily. The MEDLARS program for the retrieval of medical data and the current plans of NASA give promise of developing workable systems that will spread to other subject areas. There are two business-related computer information retrieval systems now in operation on a commercial basis. The *Standard Statistics Compustat Service*, Standard and Poor's Corporation, New York, supplies either magnetic

tapes or punched cards to subscribers. Fifty-one types of basic pertinent information, updated 10 to 12 times a year, are supplied on leading industrial and utility corporations. All this material is in machine-readable language.

The *Dun and Bradstreet Sales and Marketing Identification Service* is a roster of U.S. manufacturing and commercial establishments on magnetic tape of its IBM 1401 and 1410 systems. This computerized file of 300,000 firms provides the name, address, and up to 20 "identifiers" for each company. Information includes, in addition to the name and address, the name of the chief executive, the line of business, the Standard Industrial Classification (SIC), the number of employees, information on branches, etc., and for commercial subscribers, net worth and credit rating. Data is updated quarterly and is available on computer printouts, on 3 by 5 cards, or printed on tabulating cards.

Another useful but less sophisticated service is *Thomas Register of American Manufacturers*, *Thomas Micro-Catalog*. The complete catalogs of all the firms listed in *Thomas Register* are available on microfiche and each subscriber is given a microfiche reader.

The literature on computer operations falls into three parts: 1) the adaptation and utilization of computers in business; 2) the impact of the computer on business and personnel; and 3) the hardware and operation of the computer.

The following books are in the first category: C.C. Barnett, et al., *The Future of Computer Utility* (New York, 1967); Alexander Blanton, et al., *Computers and Small Manufacturers* (New York, 1967); J.R. Bright, *Automation and Management* (Boston, 1958); R.G. Canning, *Electronic Data Processing for Business and Industry* (New York, 1956); and R.L. Sisson and R.G. Canning, *A Manager's Guide to Computer Processing* (New York, 1967).

Books in the second group include the following: R.A. Brady, *Organization, Automation and Society* (Berkeley, California, 1961); J. McLaughlin, *Information Technology and Survival of the Firm* (Homewood, Illinois, 1966); and L. Ricco, *The Advance against Paperwork, Computers, Systems and Personnel* (Ann Arbor, Michigan, 1967).

Works in the third category, dealing with hardware and programming, are as follows: Gille Associates, Inc., *Data Processing Handbook* (Detroit, 1960; 13 vols.); Gille Associates, Inc., *Data Processing Equipment Encyclopedia: Electro-Mechanical Systems, Punched Card, Punched Tape, Related Systems* (Detroit, 1961; 2 vols.); E.M. Grabbe, et al., eds., *Handbook of Automation, Computation and Control* (New York, 1958–1960; 3 vols.); D.B. McCracken, H. Weiss, and T.H. Lee, *Programming Business Computers* (New York, 1959); J.G. Truxal, ed., *Control Engineer's Handbook* (New York, 1958); and J.R. Ziegler, *Time-Sharing Data Processing Systems* (Englewood Cliffs, New Jersey, 1967).

Application of computers to specific segments of business operations can be found in the following books:

R.H. Brown, *Office Automation: Integrated and Electronic Data Processing* (New York, 1958, plus extra sheets to update); R.H. Brown, *Office Automation Applications* (New York, 1959; 2 vols.); E.A. Johnson, *Accounting Systems in Modern Business* (New York, 1959).

The computer industry and its application are advancing so rapidly that a bibliography is obsolete almost as soon as it is published. A good bibliography, up to its date of publication, is C.P. Bourne's *Bibliography on Mechanization of Information Retrieval* (Menlo Park, California, 1958). The best and most current bibliography is the *International Bibliography of Automatic Control* (Brussels, 1962–), which appears monthly.

Periodicals are the best source of information on this ever-changing industry. Among these are *American Documentation* (Washington, D.C., 1937–); *IBM Journal of Research and Development* (New York, 1957–); *Information Processing Journal* (Cambridge, Massachusetts, 1962–); and *Progress in Automation* (New York, 1960–).

CONCLUSION

It is difficult to compress the very large body of excellent material published on business within the compass of this entry. Many worthwhile books and other publications have been omitted, as have certain topics. Among these are directories and the large mass of material published on particular industries.

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Canada: Libraries and Archives

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Abstract

Canada's libraries and archives have evolved from the first library in 1605 to become modern knowledge and cultural heritage institutions in the twenty-first century. Key developments in this evolution are outlined in this entry together with a profile of 13 major Canadian archives and libraries. The roles and issues of national library and archival associations and groups are examined as well as the development of professional education in Canada. It concludes with a discussion of a number of challenges and issues facing Canada's libraries and archives.

THE CANADIAN CONTEXT: AN INTRODUCTION

Canada's extensive geography, small but diverse population, federal system of government, and relatively late appreciation of the value of libraries and archives have all shaped how Canada's libraries and archives have developed. Canada is the second largest country in the world with an area of 9,984,670 km² with lengthy coastlines on the Atlantic Ocean to the east, the Arctic Ocean to the north, and the Pacific Ocean to the west. It has a population of 36.2 million largely concentrated in a ribbon close to its southern border with the United States with whom it shares close cultural and professional links. It has a G7 economy. Its diverse multicultural population now includes 4.3% aboriginal peoples and 22% who were born elsewhere with the largest number arriving from Asia and the Middle East. Its largest metropolitan area, Toronto, has more foreign-born residents than Canadian-born ones.

Canada has two official languages, English and French, but Chinese is the mother tongue of more than one million Canadians followed by Italian, German, and Polish. Algonquian languages including Cree and Ojibway together with Inuktitut are the largest language group for Canada's indigenous peoples. Canada's federal government and the Province of New Brunswick are officially bilingual (French and English); Québec is officially francophone and the remainder anglophone, but often services are available in both languages to serve substantial minorities. Canada's northernmost territory, Nunavut, created in 1999, has four official languages, Inuktitut, Inuinnaqtun, English, and French, and a population of some 29,000 occupying one-fifth the land mass of Canada. The 2011 census in fact lists over 100 maternal languages in the country. The Conference Board of Canada reported in 2013 that Canada ranked 8th out of 13 countries on the percentage of adults scoring low on adult literacy rates and that four out of 10 adults have literacy skills assessed as

too low to be fully competent in most jobs in a modern economy.^[1]

Canada is a federation formed in 1867 and now includes 10 provinces and three northern territories. The governments are based on British parliamentary traditions. The Government of Canada comprises the governor general as representative of HM the Queen of Canada, the Supreme Court, and Parliament with bicameral legislature: an elected House of Commons and an appointed Senate. Each of the provinces has one elected level of legislature, with a lieutenant governor representing the Crown and provincial courts. The "Constitution Act, 1982" and its predecessor, the "British North America Act 1867," divide responsibilities between the central or federal government and provincial governments. Features of the 1982 legislation include a Canadian Charter of Rights and Freedoms, provisions for the Rights of the Aboriginal Peoples of Canada, as well as a section on Equalization and Regional Disparities. The latter provisions address discrepancies among provinces with varying economies and resources. Libraries and archives are not specifically mentioned in the sets of powers ascribed to either the federal or the provincial governments. Education, however, which usually includes public libraries under its broad umbrella, is a provincial responsibility. Municipalities and school boards are created by provincial statute. All levels of government are responsible for their own administrative archives. Canada is generally acknowledged to be one of the most decentralized federations in the world.

THE FIRST NATIONS

The comments that follow reflect the imported European approach for the transmittal of authoritative knowledge across generations, emphasizing written records and print materials. There are other forms of library and archives embodied in the culture of Canada's First Nations. The

observation that “When an elder dies, a whole library burns” is simply attributed as an African proverb. It describes the reality of other oral cultures as their traditional continuity in both language and memory is disrupted by modern urban culture. Oral history programs have been earnest and well intentioned over the past century, but they have largely been sporadic, reflecting short-term research interests. Much has been lost. Recently, the power of the formal oral tradition has been renewed as the Supreme Court recognized the legitimacy of aboriginal oral traditions^[2] and a Truth and Reconciliation Commission has reached out to the indigenous victims of the residential school system to ensure their memories and their experience remain part of the national memory. The testimony and extensive documentation gathered by this Commission (2007–2015)^[3] is now preserved and becoming accessible at the newly established National Research Centre for Truth and Reconciliation hosted at the University of Manitoba.^[4]

NEW FRANCE 1605–1763

Archives and libraries have a long history in Canada beginning with the first French settlements in what is now eastern Canada. French territory grew to include the Ohio and Mississippi river valleys down through Louisiana to the Gulf of Mexico. Marc Lescarbot is credited with bringing a modest collection of books from France to what is now Annapolis Royal, Nova Scotia, then *Acadie*, in 1605. The *Collège des Jésuites* in Quebec City, established in 1635 to teach theology, classical studies, and sciences, had a library that included books from an earlier *Bibliothèque de la Mission Canadienne de Jésuites*. The extensive archives gathered by the *Séminaire de Québec*, dating from 1623 to 1800, are inscribed in UNESCO’s Memory of the World Register. A law library supported the *Conseil supérieur du Québec* and was located in the Intendant’s Palace in Quebec City. The Canadian archival tradition under the French regime included proposals for the appointment of a custodian of archives in 1724 and for a special archive building in 1731. When Canada became a British colony in 1763, French administrative state papers were returned to an uncertain fate in France, while the records required to support the judiciary, the church, and resident notaries were retained.

THE HUDSON’S BAY COMPANY, 1670–1870

The “Governor and Company of Adventurers of England trading into Hudson’s Bay” was incorporated by Royal Charter in 1670. This granted the company a monopoly on trading for furs in all the watershed draining into the Bay. In time, as trading posts were extended inland seeking supplies of beaver pelts, the Company’s lands encompassed the whole of the Northwest Territories, with settlements in the Red River Valley, and posts

scattered across the prairies, up through the Peace River Country, into the mountains and down to the mouth of the Columbia River. The Royal Charter included an obligation to search for the fabled Northwest Passage but also granted the company most of the rights of the Crown, including making and enforcing laws, alienating land, and the use of armed forces. These powers continued for 200 years, until in 1870, they were surrendered back to the Crown, and the territory became part of the new Canadian Confederation.

From its earliest days, the governors of the Company, based in London, instructed its factors to maintain a careful daily record of weather, trade, exploration, and peoples. Records were sent back to London annually and were scrutinized by the governors. The resulting documents constitute an extraordinarily detailed and continuous record of the administration of a major portion of Canada over two centuries, in effect the national archives for that region. These records are essential now for the study of environmental change and have been used for legal matters involving land ownership, borders, and sovereignty as well as its unique insights into people and culture. The Hudson’s Bay Company Archives were moved from London, United Kingdom, to Winnipeg in 1974 and then donated to the Government of Manitoba in 1994. The archives have received deserved international recognition being inscribed in the UNESCO Memory of the World Register.

BRITISH NORTH AMERICA 1763–1867

Governments in the various British colonies that eventually became Canada were increasingly publishing various official documents. The first press was established in Halifax, Nova Scotia, in 1752. The first issue of the *Halifax Gazette*, Canada’s earliest newspaper, appeared the same year. In 1779, Governor Frederick Haldimand established a bilingual subscription library at Quebec City supported by membership and annual fees as a way of “combating the ignorance of the populations and of encouraging good relations between the former French populations and the new British one.” What is now the Legislative Library of New Brunswick began when the Province of New Brunswick was created and separated from Nova Scotia in 1784. In 1787, the governor of Quebec, Lord Dorchester, appointed a commission to survey the archives of Quebec. The Legislative Council of Quebec passed an ordinance in 1790 “For the Better Preservation and Due Distribution of the Ancient French Records” to gather records concerning property and to improve access to them; Quebec Legislative Council. 30 Geo III. C8. Legislative libraries for the provinces of Upper and Lower Canada were established around 1792. Subscription libraries such as the Montreal Library were started in

1796 and the Niagara-on-the-Lake Public Library in Niagara in 1800 and at Kingston in 1804.

The development of libraries and archives in the British North American colonies prior to Confederation in 1867 was uneven, driven by different economic, administrative, social, linguistic, and educational factors. The period to the creation of Canada in 1867 witnessed waves of immigrants—from the United States and from England, Scotland, and Ireland. They brought with them increased levels of literacy and interest in books, newspapers, and other publications as well as a strong desire to better themselves in areas such as agriculture. Garrison libraries created by the large contingents of British troops stationed in Canada gave access to their collections to local residents by subscription. The libraries of legislatures in Upper Canada and Lower Canada were united in 1841 but in 1849 were destroyed when the Parliament buildings in Montreal were burned. Libraries in support of emerging medical and legal professions developed. There were also increasing levels of wealth as witnessed by the development of important private book collections. The precursors of free public libraries had their roots in a variety of community libraries. The first Mechanics' Institutes were organized in St. John's, Newfoundland, in 1827, Montreal in 1828, Toronto in 1830, and Halifax in 1831. The Atwater Library of the Montreal Mechanics' Institute is the oldest lending library in Canada. Member supported Mechanics' Institutes were located in most major population centers to provide libraries of "useful knowledge" in support of adult education including fiction, science, reference, essays, and travel accounts. Some of these received government grants in recognition of their strong support from the public. There were also school-district libraries in Nova Scotia, Ontario, and New Brunswick prior to Confederation. Association or social libraries were much in evidence. Canada's first learned society, the Literary and Historical Society of Quebec, was established in 1824 in Quebec City with a mandate to collect, preserve, and publish Canadian records. It received government support to locate and transcribe records and for publishing. Its library remains as both a research and tourist attraction.

Various governments were putting important parts of the information infrastructure in place—an "Act for the Protection of Copyright" in Lower Canada was passed in 1832 and required the deposit of a printed copy of books, charts, maps, or prints to secure copyright. In 1836, Newfoundland passed "An Act to prevent the mischief arising from the printing and publishing books, newspapers and papers of a like nature by persons unknown and to regulate the printing and publishing the same." In 1841, the United Canadas approved "An Act for the protection of Copyrights in this Province," which required the deposit of two copies of published materials with one of these copies destined for the Library of the Legislative Assembly. The year 1851 saw the first "Public Libraries and Mechanics'

Institute Act" passed by the government of the United Canadas followed shortly by the first "School Libraries' Act." In 1857, Nova Scotia appointed a records commissioner, the first provincial archivist. To support the new federal government, the Library of the Legislative Assembly, some 55,000 volumes, was moved by barge to Ottawa. By the time of Canada's Confederation in 1867, there were a number of types of libraries and archives in place in support of cultural, social, educational, and professional pursuits.

CANADA'S LIBRARIES AND ARCHIVES TO THE END OF WORLD WAR II

With Canadian Confederation in 1867, responsibility for education and, by extension, public libraries rested with the provinces. This period is one of building the library infrastructure in the provinces with very different patterns of support and development and an aspiration throughout for the establishment of a national library. At the same time, the federal government saw the need for the establishment of archival programs. The creation of Canada in 1867 with a federal government and provincial governments in place resulted in a significant scaling up of the role of the government in Canadian society. The federal Department of the Secretary of State became responsible for the keeping of "all State records and papers and papers not transferred to other Departments," and a keeper of the records was appointed. The Library of Parliament continued the functions that had earlier been put in place with the United Canadas in 1841, and legislative libraries were established in the new provinces of Ontario, Quebec, Nova Scotia, and New Brunswick. The Library of Parliament, serving the needs of federal Members of Parliament and senators, was housed in the new Parliament buildings in Ottawa in a magnificent octagonal structure designed by Thomas Fuller and Chilion Jones.

The Literary and Historical Society of Quebec had lobbied the federal government to establish a cultural archive to assist authors and others. In response, the government established an archives branch in the Department of Agriculture in 1872, and Douglas Brymner who is considered to be the first Dominion Archivist was hired. Brymner undertook to build collections and established programs to hand copy important archival materials related to the history of Canada in London and Paris. A survey and report in 1897 on the state of federal records drew attention to what the governor general described as the "most lamentable disregard for the archives of the Dominion." In response, the government consolidated responsibilities for administrative and cultural archives, and in 1904 Dr. Arthur Doughty (later Sir Arthur) was appointed Dominion Archivist and keeper of the records, a post he was to occupy for 31 years. He accelerated the program to copy Canadian records in Paris and London

and had extraordinary success in acquiring the original papers of former colonial officials documenting all aspects of the Canadian experience. The first purpose-built archives building was opened in 1907, and its exhibition rooms attracted a wide range of visitors. Doughty began the national documentary art and portrait collections, systematically worked to document the war effort (1914–1918), and added maps, photographs, pamphlets, posters, portraits, documentary art, film, and even historical artifacts to create a multimedia comprehensive record of the country. Through active programs of publication, teaching, and exhibitions, the Public Archives of Canada became an active cultural presence, encouraging the universities to study and teach Canadian history. In the 1920s, faculty from universities across the country gathered in the Archives' reading room, exploring the original record often for the first time and providing leadership to the modern historical profession. Doughty remains today the only federal public servant honored by an official statue in Ottawa.^[5] Several provinces followed the federal public-private model for their archives, with Ontario establishing its provincial archives in 1903 and with legislation confirming the Public Archives of Nova Scotia in 1929.

The Province of Ontario passed the "Act to Provide for the Establishment of Free Libraries" in 1882 following an investigation of Mechanics' Institutes in the province and set the pace for other jurisdictions to follow suit, which they did in British Columbia (1891 "Free Libraries Act"), Manitoba (1899 "Free Public Libraries Act"), Saskatchewan (1906), and Alberta (1907). The 1882 legislation in Ontario gave a framework for citizens to ask their municipal councils to establish and maintain public libraries. The Toronto Public Library (TPL) opened in 1884. A year later, Ontario went further with an amendment to this legislation designating Mechanics' Institutes as public libraries. By 1901, there were estimated to be over 130 public library boards in Ontario. As towns and cities across the country put their public library organizations in place, Andrew Carnegie, a Scottish-American philanthropist, began to support the construction of public library buildings. One hundred and twenty-five Canadian public libraries were constructed with Carnegie Foundation assistance, some \$2.5 million, between 1901 and 1925. Archives slowly advanced in several provinces, with a new provincial archives building opened in Nova Scotia in 1931.

In collaboration with the American Library Association, the Carnegie Corporation of New York also supported a major study of the library situation in Canada, *Libraries in Canada: A Study of Library Conditions and Needs*, which was published in 1933. This Commission of Enquiry was headed by John Ridington, the librarian at the University of British Columbia (UBC), together with George Locke, the chief librarian of the TPL, and Mary Black, chief librarian of the Fort William Public Library. Their report was the result of a nationwide study, which

saw every province of the country being visited in 1930 and interviews conducted with ministers, premiers of provinces, presidents and librarians of universities, public librarians, educators, and newspaper editors—a wide net was cast. The idea for such an examination of the state of libraries was born in meetings held by Canadian librarians attending American Library Association conferences in 1925 and the conference of 1927 that was held in Toronto. The Commission concluded after some 18 months of study that "though you can find books, there is no real library service, and nearly 80% of the people of Canada have nothing that could, by any stretch of the imagination, be called library service of any kind."^[6] They proposed the creation of a Dominion Library, a national library for the country, and a Dominion Librarian who would have "general charge" of the federal government's libraries whose collections should be cataloged under one common scheme. Among other duties, the Dominion Library was intended to be the recipient of the books deposited under the terms of the Copyright Act. The Commission recognized the very diverse nature of the provinces and their very different approaches to library development and support. They saw "five Canadas, each with differing backgrounds, conditions and outlooks" with only the provinces of Ontario and British Columbia recognizing "the principle that the library is an integral part of a people's welfare and educational programme." They set out some essential requirements for public library policy and legislation in the provinces and urged the formation of a national library association.^[7]

While the findings of the Commission were positively received, the harsh reality of the Depression made consideration of enhanced library development very difficult. As evidence of difficult times, in 1938 an Order in Council was passed by the federal government that authorized the destruction of materials that had been received for copyright registration purposes because there was insufficient storage space. The collection had previously been offered to the Library of Parliament and the Public Archives. In 1941, the Rockefeller Foundation of New York commissioned a study of the state of Canadian libraries, which was undertaken by Charles McCombs of the New York Public Library. He, like members of the 1930 Commission of Enquiry, visited libraries and archives in all parts of the country. He made observations about the state of libraries and archives and had a number of recommendations to make for the Rockefeller Foundation to guide them in making grants to Canadian projects. These included support for the newly organized Canadian Library Council, aid for the establishment of a National Central Library, as well as support for microphotography (equipment for microfilming newspapers, manuscripts, and archival materials), and a summary guide to the manuscript collections in Canadian libraries and archives.^[8] As World War II was ending, the new Canadian Library Council, with its national voice for libraries, submitted a brief to the federal Special

Committee on Reconstruction and Re-establishment that stressed the value of libraries for adult education and recommended the establishment of a Dominion Library Program “to guide, co-ordinate and encourage provincial, local and special efforts,”^[9] as well as national library services, library standards, and library consultation services. The notion of national library services included the establishment of a national library.

LIBRARY AND ARCHIVAL DEVELOPMENT TO THE TWENTY-FIRST CENTURY

There are a number of milestones in the post–World War II era when Canada’s archives and libraries came of age in a period of rapid economic expansion and cultural maturity. Vital leadership came with the federal government’s decision to name Dr. W. Kaye Lamb as Dominion Archivist in 1948 with responsibility for preparing the way for a national library. A Canadian Bibliographic Centre was established in 1950 under his direction, which began to assume national responsibilities for the preparation of a national bibliography and for the building of a national union catalog. The Royal Commission on Arts, Letters, and Sciences reported to the federal government in 1951 on their examination of national institutions and functions, which included a general survey of the arts, letters, and sciences. This was a landmark study and led to the strengthening of a number of federal institutions including the Public Archives of Canada and the establishment of a National Library in 1953. Dr. Lamb continued as Dominion Archivist but was also named as National Librarian. Legal deposit with the new National Library also began in 1953. The Archives addressed the government’s pressing need for effective records management and opened the first federal records center in 1956. In the provinces, the pace of change increased. The Saskatchewan Archives Act (1945) provided a model for archives control over the disposition of official records. Public library development was guided by the publication of the 1957 *Report on Provincial Library Service* in Ontario by Dr. William Stewart Wallace and then less than a decade later *Ontario Libraries: A Province-Wide Survey and Plan* by Francis R. St. John. “An Act Respecting Public Libraries” was passed in Quebec in 1959, as well as the establishment by statute of the Newfoundland Archives in 1959.

The expansion of universities and a growing interest in the study of Canada led to a number of influential studies at the national level. These included *The Humanities in Canada* by Watson Kirkconnell and A.S.P. Woodhouse (1947), *Resources of Canadian University Libraries for Research in the Humanities and Social Sciences* by Edwin E. Williams (1962), *Research in the Humanities and in the Social Sciences in Canada* by Bernard Ostry (1962), and F.E.L. Priestley’s *The Humanities in Canada; a Report Prepared for the Humanities Research Council of Canada*

(1964). *Resources of Canadian Academic and Research Libraries* was undertaken by Robert B. Downs for the Association of Universities and Colleges of Canada in 1967, reflecting the essential role of libraries in support of the academic mission. In 1975, Professor Tom Symons’ seminal *To Know Ourselves: The Report of the Commission on Canadian Studies* was published. Symons devoted a chapter to Canadian archives and the need for Canadians to be better aware of archival resources and the development of a national and regional plan to coordinate archival activity. The newly formed Social Sciences and Humanities Research Council carried forward Dr. Symons’ work with the influential 1980 report of their Consultative Group on Canadian Archives. These studies reflected the professionalization of library leadership and influence in national initiatives for a society seeking to understand its own culture and experience. More recently, the journal of the Association of Canadian Archivists, *Archivaria*, has been recognized as one of the leading international journals in the field. The writings of Hugh Taylor, Tom Nesmith, Terry Cook and Tom Delsey have advanced theory informed by practical experience. The InterPARES Project, led by Luciana Duranti has provided a productive research center for digital recordkeeping. The three volume *History of the Book in Canada* will stand as a celebration of its subject and the scholarship of a generation. (Eds: P.L. Fleming, Y. Lamonde, G. Gallichan, C. Gerson, J. Michon, and F.A. Black. University of Toronto Press, 2004–2006). Through the initiative of L’association des archivistes du Québec, the International Council of Archives and then UNESCO adopted the Universal Declaration on Archives, 2011. Two Canadians have served as President of the ICA: Jean-Pierre Wallot and Ian E. Wilson and Ingrid Parent served as President of the International Federation of Library Associations.

MAJOR LIBRARIES AND ARCHIVES

Library and Archives Canada/*Bibliothèque et Archives Canada*

Library and Archives Canada (LAC) is the country’s national library and national archives. This federal knowledge institution was created by the “Library and Archives of Canada Act” in 2004, amalgamating the former National Library and National Archives. This innovative integration resulted from the close collaboration between National Librarian Roch Carrier and National Archivist Ian E. Wilson. Parliament gave the new institution an ambitious mandate, seeking to ensure that the multimedia documentary heritage of Canada, from manuscript to print to electronic, is systematically acquired, preserved, and described and is as available as possible to all citizens. It strives to be “a source of enduring knowledge accessible to all, contributing to the cultural, social, and economic

advancement of Canada as a free and democratic society,”^[10] in the words of the legislative preamble. The vision was the creation of an integrated knowledge institution as a strategic response to the challenges of the twenty-first century. Ian E. Wilson was named the first librarian and archivist of Canada, responsible to the Minister of Canadian Heritage.

LAC incorporates all the functions of both a national library and a national archives, plus the portrait gallery of Canada and working in the context of the networks of libraries and archives serving communities throughout the country. Through consultation and coordination, the LAC is seeking to integrate holdings, services, description, and preservation to create a new type of comprehensive knowledge-based resource, relying increasingly on electronic means to deliver services. Coordinated acquisitions build on both legal deposit of print and electronic publications; the government recordkeeping programs; donations of the papers of prime ministers, artists, writers, and business and labor leaders; occasional purchases of Canadian documentary materials; agreements with broadcast media and filmmakers; and legal authority to preserve Canadian websites. The state of the art Preservation Centre in Gatineau, Quebec, across the river from Ottawa, opened in 1997 for the National Archives, provides a shared resource for secure storage and for conservation treatment. Nitrate photographic collections have now been accommodated in a new low temperature environment in a purpose-built building opened in 2011. And the extensive military service files of the twentieth century have been moved to a newly renovated secure storage building near the Preservation Centre.

The 2004 legislation and the ambitious vision for LAC remain to be realized. Financial pressures since 2009 have resulted in the loss of experienced staff, the reduction of the public exhibition programs, the cancellation of the building for the portrait gallery, the reduction of the interlibrary loan program, and the diminution of its international leadership role, together with service reductions and severe limitations on its website. The LAC’s budget was reduced by 10% between 2012 and 2015, eliminating some 215 staff positions. The Canadian Council of Archives (CCA), established in 1985, lost its funding base. The systematic digitization of significant Canadian content shifted to a consortium of research libraries through *Canadiana.org*. The LAC’s cataloging in publication program for Canadian imprints continues as do programs for reading and literacy for youth and persons with print disabilities. Information on its current policies and activities is available on its website: <http://www.collectionscanada.gc.ca>.

The reductions to LAC reflected a broader government policy closing or consolidating departmental libraries. In the period 2012–2014, departmental libraries serving Fisheries and Oceans Canada, Agriculture and Agri-food Canada, Environment Canada, Canada Immigration and

Citizenship, Canada Revenue Agency and Parks Canada, among others, were closed, or substantially constrained. Ministers explained that holdings were offered to others, often university libraries, before disposing of materials and the remainder “recycled in a ‘green way’.”^[11] It was expected that online services would be sufficient to replace professional library services. The full impact of these closures on research and on evidence-based governance has not yet been determined. For the first time in Canadian history, library and archives services became a partisan issue.

The changes alarmed the research community. Researchers and archivists came together in a unique Canadian Archives Summit in January 2014, with over 600 participating at the University of Toronto and across the country via live streaming. The Summit was intended as a creative participative process to engage allies and inform the two expert panels established by the Royal Society of Canada and the Council of Canadian Academies to study and make recommendations on the future of libraries and archives in Canada. Their reports were issued in November 2014 and February 2015, respectively. Both provided an eloquent and compelling defense of the continuing importance of memory institutions in a rapidly evolving content-rich, technology-enabled mobile society. Their reports stressed the changing context of information services encouraging leadership and collaboration in responding to the challenges and potential of digital technology coupled with public expectations for convenient access. Both were heavy laden with advice, with the Royal Society offering 70 specific recommendations to governments, institutions, and the professions. The Council of Canadian Academies discussed the available literature and drew on international initiatives to urge adaption to a digital environment, collaboration with others, and developing strong relationships with user communities. Both were thoughtful and strongly supportive but both were published in the final months of the then Conservative Government. Both provide useful inspiration and guidance for the future but neither organization launched an advocacy campaign and neither appears to have had a significant impact.

In both the library and archives communities, nationally and regionally, initiatives are increasingly led by consortia. Following the 2014 Canadian Archives Summit, a national working group continued the discussion, circulating a discussion paper *Canada’s Archives: A vision and areas of focus for 2015–2025*, and building on that, the institutions and associations formed the Steering Committee on Canada’s Archives (April 2016). The Canadian Association of Research Libraries (CARL) (www.carl-abrc.ca) has provided strong leadership in addressing the challenges of the digital era, supporting the Canadian Research Knowledge Network (www.crkn-rcdr.ca), providing university access to subscription-based scientific databases and the energetic *Canadiana.org* undertaking

large-scale digitization efforts are two such partnerships. As the federal government shifted resources to advance Open Government and establishing a public–private partnership, the Open Data Exchange (2015), CARL has effectively represented the library perspective.

Space permits examination of only a representative sampling of major Canadian libraries and archives. Many of these are examples of the increasing convergence that is occurring with knowledge and documentary heritage institutions and educational programs.

Bibliothèque et Archives nationales du Québec

Under the dynamic leadership of its first president, Lise Bissonnette, the *Bibliothèque et Archives nationales du Québec* (BAnQ) has been through a major process of transformation and development over the last decade. In 2006, a new provincial legislation took effect that created the BAnQ by combining the former *Bibliothèque nationale du Québec* (BNQ) and the *Archives nationales du Québec*. This had been preceded in 2002 with legislation that combined the functions of a national library (legal deposit, national bibliography, preservation of Quebec imprint materials, and other services) with the public service functions of the municipal library in Montreal. The public face of this institution was given an enormous profile with the opening of a major new building in 2005 for public services in Montreal. The building, called *la Grande Bibliothèque*, was the result of an international architectural competition and provides an impressive new flagship for library services.

Legal deposit of materials published in Quebec started with the creation of the BNQ and the passing of regulations for legal deposit, which took effect in January 1968. The *Règlement sur le dépôt légal* required the deposit of two copies of books, pamphlets, newspapers, periodicals, artists' books, and sheet music. In 1969, the "*Bibliographie du Québec*" started as the bibliographic record of everything that was published in the province. In 1992, legal deposit was extended to prints, posters, reproductions of works of art, postal cards, sound recordings, software, and microforms.

The BAnQ is located in a number of buildings throughout the province. A preservation center was inaugurated in 1997 in Montreal. The building houses technical services staff together with a number of vaults with stringent environmental controls to support the long-term preservation of one copy of Quebec imprint materials received under the legal deposit requirements of their legislation. Archival services are headquartered in Quebec City, in a beautifully renovated heritage building adjacent to the Université Laval campus, and in Montreal in another renovated heritage building. Regional services are provided through a network of centers located in nine major population areas in the province. BAnQ offers expert and effective leadership for libraries and archives throughout

Quebec and at the international level, especially in "La Francophonie."

The Provincial Archives of Quebec/Bureau des archives du Québec had been established in 1920. The BNQ had been created by the Province of Quebec in 1967. The BNQ inherited the collections and the building (*la bibliothèque Saint-Sulpice*) used to house the collections created by a religious order in 1915 and purchased by the Quebec government in 1941. The public library of the City of Montreal had been started in 1917 and included the Phileas Gagnon collection of Canadiana. The fusion of the collections and services of these diverse library and archival institutions has resulted in the creation of one organization dedicated to the acquisition, preservation and making known Quebec's published and archival heritage. For further information see the BAnQ's website at <http://www.banq.qc.ca>.

BAnQ and LAC have developed a close working relationship, respecting the national roles each performs. This was exemplified as they cohosted first the annual roundtable (CITRA) of the International Council on Archives in 2007 and then more than 3000 librarians attending the annual conference of the International Federation of Library Associations in 2008.

National Science Library Formerly the Canada Institute for Scientific and Technical Information (NRC-CISTI)/Institut Canadien de l'Information Scientifique et Technique (ICIST-CNRC)

The Canada Institute for Scientific and Technical Information (NRC-CISTI) has been recognized as Canada's National Science Library (NSL), as an integral part of the Knowledge Management Division in the National Research Council (NRC). It holds extensive print and electronic information resources in all areas of physical and life sciences, technology, engineering, and health sciences. Canada's NRC was founded in 1916 in the midst of World War I, and a librarian hired in 1917. Margaret Gill, the first chief librarian, was appointed in 1928 and through almost three decades of service developed the collections, the services, and the reputation as the basis for the NSL. The NRC Research Press started in 1929 and merged with CISTI in 1994 but in 2010 became a private company, Canadian Science Publishing.

Budget reductions and organizational changes have substantially impacted collections development and required new approaches to service delivery. While innovation and technology have always been major forces at NRC-NSL, these have been tested in the past few years. Working as a key partner with six other government's science libraries, NRC-NSL has helped establish a digital repository and coordinated acquisitions and has implemented both mobile services and a broad federated search system to facilitate public use. While headquartered in Ottawa in a purpose-built building opened in 1974, it

provides services across the country linked with installations of the NRC so that in Vancouver it is part of the NRC Institute for Fuel Cell Innovation and in St. John's, Newfoundland, with the NRC Institute for Ocean Technology.

Library of Parliament/*Bibliothèque du Parlement*

The Library of Parliament traces its roots to the legislative libraries established in the 1790s for Upper and Lower Canada (now the provinces of Ontario and Quebec) and the subsequent legislative library created in 1841 for the United Province of Canada. Moves of Parliament and its Library to different Canadian cities as well as fires in 1813 (fire started in York, now Toronto, by invading American troops in the War of 1812), 1849, and 1854 meant that many materials were lost or destroyed by the time the permanent home of the Library of Parliament in Ottawa was opened in 1876. The circular building is famous for its distinctive Victorian Gothic architecture with its flying buttresses, stone exterior, and ornamental ironwork. It was designed by architects Thomas Fuller and Chilion Jones with the active involvement of the first parliamentary librarian, Alpheus Todd. Fires continued to dog the Library with the Centre Block of the Parliament Buildings burning down in 1916 (with the miraculous exception of the Library that was separated by a fire corridor) and in 1952 when thousands of books were water damaged. The magnificent Victorian structure has recently reopened after a 4-yr restoration and expansion project.

For many years until the creation of the Canadian Bibliographic Centre in 1950 and the National Library of Canada in 1953, the Library of Parliament acquired collection materials in anticipation of a national library being established. Then when the National Library was established, over 250,000 volumes and a large collection of print newspapers were transferred from the Library of Parliament. The Library of Parliament served as a deposit for materials being registered for copyright purposes in Canada. The first legislation requiring deposit for copyright registration purposes was in 1832 with the then Legislative Library in Lower Canada. Then in 1841 copyright deposit was required with the Legislative Library of the United Province of Canada and confirmed in 1868 with the new Library of Parliament of Canada. The materials required for deposit included books, maps, charts, musical compositions, photographs, prints cuts, and engravings. This provision for copyright deposit remained in place until 1921 and then returned in 1931 until 1969. From 1885 to 1956, there were two equal administrative heads of the Library, an English-speaking parliamentary librarian and a French-speaking general librarian. This arrangement ended in 1956.

In a parallel with the development of substantial collections and in the absence of a national library, the Library of Parliament was open for use by the general public until 1961 when access became limited to

parliamentarians, the governor general of Canada (Canada's head of state), members of the Privy Council, justices of the Supreme Court, and members of the Press Gallery. Since that time, the focus has been on the development of collections and specialized research and reference services in support of the House of Commons and the Senate of Canada. It has an important rare book collection including a set of John James Audubon's *Birds of America* and early Canadian, British, French, and American imprints of note. The Librarian of Parliament is an officer of Parliament. The "Parliament of Canada Act" includes provisions for the appointment of the parliamentary librarian and an associate parliamentary librarian. This legislation dating from 1988 replaces a previous standalone "Library of Parliament Act" whose roots date back to 1802.

The Library has a wide range of responsibilities. Staff from the Library support the information and research needs of individual members of the House of Commons, senators, and parliamentary committees and groups. PARLMEDIA is an important media monitoring service, among many Web services provided to parliamentarians. The Library has an extensive publishing program that is made available to the public. The former Research Branch of the Library (now the Information and Document Resource Service) was an important initiative created by parliamentary Librarian Erik J. Spicer, parliamentary librarian from 1960 to 1994. There is also a position of parliamentary budget officer within the Library. The mandate of this office is to provide objective analysis to the Senate and to the House of Commons about the state of Canada's finances and trends in the national economy, to undertake research into the nation's finances and economy, and to provide estimates of the costs of proposals contained in legislation introduced by Members of Parliament. The Parliamentary Poet Laureate with eminent poets serving for 2-yr periods is part of the Library's responsibilities. In addition, the Library is responsible for educating the general public about the institution of Parliament and for giving orientations and tours to visitors to the Parliament Buildings in Ottawa.

Archives of Ontario/*Archives Publiques de l'Ontario*

The Archives of Ontario was established in 1903 as the Bureau of Archives. It preserves extensive collections for the study of the history and people of the Province of Ontario, Canada's largest province. Holdings include official records of the Ontario Government, and original source documentation on Loyalists, African-Canadian settlement, various cultural communities, provincial politics, and business and labor organizations, as well as key sources for genealogy and records relating to indigenous peoples. It also has a large collection of vital statistics materials largely now online. There are significant

collections of photographs (1,700,000), documentary art, architectural records (200,000), and cartographic records (40,000). Ontario Government records include land, court, and business registrations and the records of the Premiers of Ontario and many of their ministers. In terms of cultural archives, it holds records from some 2600 private individuals, businesses, clubs, and associations, the archives of large national businesses such as the T. Eaton department store chain and impressive architectural archives.

The Archives legislative mandate was renewed in 2006 with an emphasis on recordkeeping within the government. The Archives moved from downtown Toronto into its impressive new facility on the campus of York University in 2009. This has enabled a renewed public exhibition program and improvements to services for academic researchers and genealogists.

Bibliothèque de l'Université Laval

The University was founded by the *Séminaire de Québec* in 1852 that made its collection of some 15,000 volumes available to the new university. The two institutions continued to make their collections available together until the University moved in 1964 to its current campus at Sainte-Foy and the collections were separated. Collections exceed five million documents that include subscriptions to some 24,000 newspapers and serials of which almost 18,000 are electronic. There are 450 databases available on the Web. They have 20,000 sound recordings and 216,000 slides; 1.3 million microforms; 16,500 films, videos, and DVDs; more than 5,000 atlases; and 125,000 maps. More than half of the 2015–2016 collection budget of \$12.1 million (Canadian) is dedicated to the acquisition of electronic resources. The Library has been a pioneer in the digitization of materials and making digital resources available on the Web. It has worked in collaboration with the libraries at *Université de Montréal* and the *Université du Québec à Montréal* on an important project called *Érudit* (www.erudit.org). The consortium's mandate is to provide a digital platform to assist in the transition and free circulation of more than 150 scholarly social science and humanities journals available and to support the world of scholarly publishing in French. They are also partners in *Nos Racines/Our Roots*, a national project to digitize local and regional history materials. This project is carried out in partnership with the University of Calgary, Dalhousie University, and the University of Toronto. They have also been an early collaborator with LAC's Theses Canada program to produce electronic theses, which then form part of the Theses Canada Portal and the Networked Digital Library of Theses and Dissertations (NDLTD). Also in partnership with LAC has been Laval's ongoing development of *Répertoire de vedettes-matière* (RVM), which provides access to more than 200,000 French subject headings and their English equivalents and is used in libraries around the world.

Bibliothèques de l'Université de Montréal

The *Direction des bibliothèques* at the *Université de Montréal* is made up of some 18 libraries and one associated library. It has collections of over four million documents and serves a number of professional faculties in areas such as library and archival science, medicine, and law, as well as humanities, social sciences, and science to students in the French language. Special collections of note include the Collection Gilles-Blain of Jean Cocteau, the Collection Louis-Melzack, and the Collection Baby, which include important early Canadian materials.

McGill University Library

McGill College was incorporated in 1821 and included a library for the Medical School. It was not until 1843 that a Faculty of Arts was in place, and in 1855 a library for the college opened with slow growth of collections primarily through donations. In the 1890s, land was donated for a library by J.H.R. Molson and funds provided for a building as well as ongoing maintenance and salaries by Peter Redpath. With a new building came centralized ordering by the library and adoption of the Cutter classification scheme under the direction of Charles H. Gould, McGill's first full-time university librarian. By 1894 there were 54,000 volumes in the main library and departmental libraries and in 1898 some 90,000 volumes. By 1898 it had collections of an almost complete set of Canadian documents dating from 1840 and publications of five provinces. An early president of the American Library Association and friend of Charles Cutter and Melvil Dewey, Charles Gould promoted the idea of the annual conference of the American Library Association being held in Montreal. This took place in 1900 and brought many Canadian and American librarians together for the first time. Gould also pioneered the publication of McGill University Papers that were used for exchange purposes by the Library and as well promoted the research carried out within the University. He is also known for the establishment of a traveling libraries project in 1901 where small collections of special materials were made available to villages, towns, and rural areas where library services were unavailable.

Today, McGill University Library is known for the quality of its rare collections including a William Blake collection, the Lawrence Lande Canadiana Collection, a collection of Napoleon-related materials, the Redpath Tracts, a collection of some 20,000 British tracts and pamphlets, and the Osler Library of the History of Medicine. It has over six million items in its collections including almost one million electronic books and 38,000 electronic journals. It operates 13 branch libraries and several specialist collections open to the public. Like other university libraries, it is fostering the growth of electronic theses, digitizing increasing amounts of its analog collections,

and actively seeking ongoing financial resources for the library.

Toronto Public Library

Canada's largest public library system traces its roots to the York Mechanics' Institute founded in 1830 established "for the mutual improvement of its members in useful scientific knowledge. . . A library of reference and circulation will be formed." It now has some 100 branches and 11 million items in its collections. In 2015, the library recorded 18 million visits on site plus 31 million virtual visits. The significant progress of the TPL can be measured in some ways by the growth of its buildings as public spaces from a major building built in 1861 with a lecture theater, reading room, and music hall to the enormous support that Andrew Carnegie gave the TPL. In 1903, funds were received from Carnegie that paid for a new central library and three branches to be built. This was followed in later years by funds for another six branches for Toronto. In the greater Toronto area, Carnegie supported the construction of another 10 public libraries and one university library (Victoria College, University of Toronto). The Toronto Reference Library is a major landmark opened in 1977. Seventy percent of the city's population uses the library. The system now bills itself as "the world's busiest urban public library." (<http://www.torontopubliclibrary.ca/media/key-facts/>)

The TPL branches have research and reference libraries serving the whole city, district libraries serving large areas, and smaller neighborhood libraries. Examples of the research and reference libraries with extended hours for extensive research and reference would be the Toronto Reference Library and the North York Central Library. There are some 17 district branches in medium-sized buildings that normally have collections of more than 100,000 items and multilingual materials for the communities in the particular area. There are 78 TPL libraries designated as neighborhood branches with smaller collections. Some of the collections for which TPL is noted include the Osborne Collection of Early Children's Books; the Merrill Collection of Science Fiction, Speculation and Fantasy; and the Arthur Conan Doyle Collection, all of which are supported by their own friends' organizations. The Toronto Public Library Foundation raises funds for endowments and for particular initiatives such as the Toronto Dominion (TD) Summer Reading Program and Keep Toronto Reading Program. Collections in many languages serving a very diverse population and innovation in Web services such as the Virtual Reference Library/*Bibliothèque de Référence Virtuelle* and KidsSpace are hallmarks of this rapidly evolving institution.

The success and strong public support for the TPL is indicative of the essential role played by municipal public libraries across the country. Ontario, for example, decided in the 1980s not to build a provincial library but to link

more than 1000 public library branches as a provincial library network, reinforced by support services, electronic connections, and interlibrary loan. Impressive new public libraries have been built by progressive municipalities concerned about the quality of life and access to knowledge. These cities include Vancouver, Halifax, Winnipeg, Edmonton, Calgary, and, in 2020, Ottawa.

University of Alberta Libraries

The University of Alberta celebrated its 100th anniversary in 2008. Its library is the third largest research library collection in the country. The chief librarian has the responsibility of the University of Alberta Libraries, Museums and Collections Services, as well as the University of Alberta Archives and Records Management, the Bookstore, Printing and Duplicating Services, and the University of Alberta Press. The University of Alberta Libraries include the Bruce Peel Special Collections Library, the Data Library, and a Music Library. Collections of note in the special collections library include the papers of the legendary Mountie, Sam Steele, the Alberta Folklore and Local History Collection, a Dime Novel Collection, and the Pierre Ouyard Collection of some 300 fine bindings. There is also the Book and Record Depository (BARD). The BARD is a facility modeled on the Harvard Archives Depository, which opened in 1994 to house lesser used materials of the University and those of other institutions. With a capacity for 3.2 million books and almost 40 km of shelving, it is located in a former big-box store that was converted for collection storage purposes with constant temperature and humidity levels.

The University of Alberta Libraries has taken the lead in making regional publications available in digital form such as through the Peel's Prairie Provinces site, which makes available Bruce Peel's *Bibliography of the Prairie Provinces*, as well as the contents of many of the items from the bibliography and a wealth of other materials celebrating the history and culture of the Canadian Prairies.

University of British Columbia Library

The UBC Library has the second largest research library collection in Canada. It has more than 20 branches and divisions including the recently established UBC Okanagan Library. The main library was renovated with the addition of the Irving K. Barber Learning Center in 2009. The collections of special materials include the Wallace B. Chung and Madeleine H. Chung Collection of rare materials related to the discovery of British Columbia, the development of the Canadian Pacific Railway, and Chinese immigration to Canada. Its collections total more than 5.5 million volumes with some 260,000 e-books and more than 65,000 serial subscriptions. It has a number of important digital collections including its Bookplate

Collection, collections of photographs (Japanese–Canadian Photograph Collection, MacMillan Bloedel Photograph Collection, Peter B. Anderson Photograph collection, and the Rosetti Studios–Stanley Park Collection), and the UBC Historical Documents Collection, which includes copies of important records and publications documenting UBC’s history. It has established cIRcle, UBC’s information repository (www.circle.ubc.ca), which is an open-access repository for published and unpublished research, teaching, and other materials created by the UBC community.

University of Toronto Libraries

The University of Toronto Library houses the largest research library collection in Canada and third largest in North America after Harvard and Yale. The University of Toronto Library is made up of 44 libraries located on three university campuses. The Library dates from the opening of the University of King’s College in the former parliament buildings in Toronto in 1841. In 1849, the university was secularized and the name changed to the University of Toronto. In 1850 the Library had approximately 4500 volumes, and as of 2015, it had holdings of 12 million books and 160,000 serials, 5.4 million microforms, and 1.9 million CD-ROMs, computer files, manuscripts, cartographic materials, graphic materials, sound recordings, film and videos, and other materials with a collection budget of some \$31.8 million (Canadian). It has major partnerships with the U.S.-based Internet Archive and the Microsoft Corporation to digitize collection materials and was a founding member of the international Open Content Alliance. It has also scanned materials out of copyright from other institutions. It provides access to more than 28,000 full-text electronic journals, almost 900 indexes and abstracts, over 350,000 electronic books, and over 3000 electronic newspapers. The University of Toronto Archives and Records Management Services is a part of the Library. Its distinctive John P. Robarts Research Library for social sciences and humanities resources was originally designed by Mathers and Haldenby of Toronto and has recently been renovated to include a large Information Commons. It also houses the Thomas Fisher Rare Book Library, which includes major collections of Canadian holdings including the Northwest and the Arctic maps and atlases as well as Canadian poetry, fiction, and drama. The intention with the latter is to be comprehensive in all editions and translations as well as literary manuscripts from past and present icons of Canadian culture including Northrop Frye, Margaret Atwood, and Leonard Cohen.

Vancouver Public Library

The Vancouver Public Library (VPL) dates from 1869 with the start of the New London Mechanics Institute,

later renamed the Hastings Literary Institute. It is the third largest public library system in Canada. Over 10 million items are borrowed each year and a million reference requests answered. Its landmark central branch, Vancouver Library Square, opened in 1995 and was designed by architect Moshe Safdie. The Central Library succeeded an earlier Carnegie building opened in 1903 and a later building in 1957. The Vancouver Library Square building, which seats some 1200 patrons, includes retail space as well as a day care. The VPL has 22 branches. The VPL serves a diverse multilingual community. It maintains collections in languages other than English such as in Chinese, Farsi, German, Hindi, Italian, Japanese, Korean, Polish, Portuguese, Punjabi, Russian, Spanish, Tagalog, and Vietnamese. The use of the library as public space is important with library facilities being used for a wide variety of purposes. It has a number of innovative programs—One Book, One Vancouver, a citywide book club, is an example together with its leadership role in the AskAway program, a province-wide virtual reference service. It has a writer in residence and hosts the Vancouver’s Poet Laureate.

LIBRARY AND ARCHIVAL ASSOCIATIONS AND GROUPS

Canada has a wide range of national and provincial and territorial associations and groups who support libraries, archives, librarians, library technicians, and archivists. National associations and groups include the following:

Canadian Association of Research Libraries/ *Association des Bibliothèques de Recherche du Canada*

The CARL is a national association with institutional members made up of 27 major Canadian university libraries as well as LAC, the NRC’s National Science Library, and the Library of Parliament. Established in 1976, most of CARL’s member universities offer doctoral programs in both the arts and the sciences. Its Mission is “to increase the capacity of individual member libraries to be effective academic partners in support of research and scholarship at the national, regional and local levels.” It has a number of committees in place for copyright, effectiveness measures and statistics, government policies and legislation, and scholarly communication. It has working groups for data management, e-learning, and library education. CARL plays strong national leadership and advocacy roles in areas such as copyright, open access to digital resources, and digitizing cultural resources. *A Canadian Approach to Digital Copyright* was published in 2008 focusing on key copyright reform issues including fair dealing, damages and fair dealing, technological protection measures, and education use of

the Internet. It has been instrumental in obtaining financial support from the federal government for the indirect costs of research that its members provide in support of research undertaken at their university. In the absence of a national program for library statistics, it collects important data on collections, budgets, and expenditures from its members. CARL's Education Working Group has surveyed members to develop a set of national research priorities including how to move institutional repositories to become Trusted Digital Repositories, open access and the impact of new technologies on delivering library services, and the rationalization of print collections. They have also taken the lead in the LibQUAL Canada Project to assess the quality of services provided in CARL and other academic libraries. CARL has also taken an active leadership role in advancing cooperative initiatives for the systematic digitization of unique Canadian documentary content and in providing access to digital resources internationally through the Canadian Research Knowledge Network.

Canadian Federation of Library Associations (CFLA)/Federation Canadienne des Associations de Bibliothèques (FCAB), Formerly the Canadian Library Association/Association Canadienne des Bibliothèques

The Canadian Library Association (CLA) was a national voice and advocacy organization for the Canadian library community. Founded in 1946, it was dissolved in 2016. The Association replaced the earlier Canadian Library Council, which had been established with Carnegie Corporation and Rockefeller Foundation's financial support. Its first priority was to lobby for the establishment of a national library for Canada. CLA also continued work that the Canadian Library Council had begun to microfilm significant Canadian newspapers first with funding from the Rockefeller Foundation and later from other sources such as the Canada Council. The *Canadian Index to Periodicals and Documentary Films* later the *Canadian Periodical Index* and important directories and other publications followed. Over the past decade, increasingly active provincial and other library associations and declining membership resulted in the CLA being unable to continue as a viable organization.

After months of consultation, discussions, and recommendation, a proposal was presented in the fall of 2015 to dissolve the CLA, and in May 2016 the CFLA/FCAB was formally incorporated. The new organization represents eighteen Canadian member associations and will transition a number of the CLA's activities. The CFLA/FCAB brings together the provincial, territorial, and national associations across Canada and will focus on a unified and coordinated voice for the Canadian library community on both national and international issues. Its purpose is to advance library excellence, champion library values and

the value of libraries and to influence national and international public policy impacting libraries and their communities. Key priorities for the new organization include continuing the building of the new federation, copyright review, and international representation.

L'Association pour l'Avancement des Sciences et des Techniques de la Documentation (ASTED)

ASTED is the national association of French language librarians and libraries. It was founded in 1973 based on the earlier *Association canadienne des bibliothécaires de la langue française* and the *Association canadienne des bibliothèques catholiques*, established in 1943. Its mandate is to promote excellence in the services and personnel of libraries and information and documentation centers as well as to promote the interests of libraries to governments and to represent the interests of North American French library science. It has an advocacy role at the provincial level primarily with the Province of Quebec and at the federal level with the Government of Canada. Federally, it speaks on issues such as copyright and the Library Book Rate. It has two periodicals, *Documentation et bibliothèques* issued quarterly and *Nouvelles de l'ASTED* issued five times a year. It has an important annual conference and publishes a wide range of professional literature ranging from the French editions of AACRII and Dewey to a union catalog of serials in Quebec health libraries. It also provides ongoing professional development.

Provincial and Territorial Public Library Council (PTPLC)/Conseil Provincial et Territorial des Bibliothèques Publiques (CPTBP)

This Council is made up of the directors of public library services in Canada's provinces and territories. Established in 1978, it was formerly known as the Provincial and Territorial Library Directors Council (PTLDC). Given the diversity of provincial and territorial legislation and programs for libraries, the agencies represented on PTPLC vary in their mandates and responsibilities. The Council exists to provide a vehicle for sharing information on policy issues and development for public library services and to act collaboratively on national issues such as literacy, services to aboriginal communities, the library book rate, persons with disabilities, and resource sharing. It facilitates cross-jurisdictional initiatives and serves as a point of contact with national library organizations and the federal government. In 2005, the PTPLC commissioned a major examination of the role of public libraries called "Public libraries in the priorities of Canada: Acting on the assets and opportunities." The PTPLC reports to a committee of provincial and territorial deputy ministers responsible for public libraries and facilitates meetings of federal, provincial, and territorial ministers responsible for public libraries.

Canadian Urban Libraries Council (CULC)/ Conseil des Bibliothèques Urbaines du Canada (CBUC)

The CULC is a national organization of Canada's largest public library systems, serving more than 40% of Canada's population. Each system serves a city of more than 100,000 people. It was formerly called the Council of Administrators of Large Urban Public Libraries (CALUPL). The organization's mission is "To work collaboratively to build vibrant urban communities by strengthening the capacity of Canada's urban libraries." Its priority issues include social inclusion of new immigrants, established multicultural groups, and youth for which it has developed an Urban Library Social Inclusion Audit for the use its members, youth and civic engagement, organizational cultural changes, and technology. It is building an Urban Library New Immigrant Programs and Services Inventory. The CULC has an advocacy role on behalf of libraries in areas such as federal copyright reforms, open access, and service standards. CULC took over the administration of the former CLA's Library Materials Shipping Tool and leads the advocacy of e-books access and pricing issues.

CULC was instrumental in the establishment of LibraryNet, a program of the federal government, to provide public Internet access with a report called "Connecting Canadians." When LibraryNet was ending in 2004, CULC responded with "Sustaining Canada's Digital Capacity: An Urban Library Strategy to Sustain Socially Inclusive ICT Networks." It collects and publishes the *Canadian Public Library Statistics* and a separate *Branch Library Activity Statistics* on an annual basis. These provide important data on expenditures, revenue sources (provincial, municipal, others), collection budgets, size of collections, number of professionals and other staff, use of electronic resources, numbers of registered users, in-person visits, number of locations, and populations served for members of CULC and other library systems that are not members. While public libraries are the responsibility of Canadian municipalities, the Council provides a forum for the discussion of the issues facing large public libraries—literacy, digital literacy, resource sharing, equity of access through public Internet facilities, social cohesion, services to aboriginal peoples, and services and meeting the information needs of an increasingly multilingual and diverse population.

Canadian Council of Archives/Conseil Canadien des Archives

The CCA was founded in 1985 to encourage and facilitate the evolution of an archival system in Canada. A national organization, it has representation from provincial and territorial archival councils, LAC, the Association of Canadian Archivists (ACA), and the *Association des*

archivistes du Québec. The Council has a mandate to improve the administration and effectiveness and efficiency of the Canadian archival system and to identify national priorities. It has a number of Standing Committees and Working Groups for Standards, the Canadian Committee on Archival Description, Copyright, and Preservation. It had several funding programs supported by the federal government—including the Control of Holdings Program, the Professional Development and Training Program, the Special Projects Program, the Conservation Plan for Canadian Archival Records (CPCAR), and Preservation Management Program coupled with a training program. With support from the provincial councils, the CCA funded traveling archives advisors to encourage local institutions and their communities in preserving their archives. The CCA led the development of ArchivesCanada.ca as the national portal to access the holdings of more than 800 archives. This includes virtual exhibits, as well as digitized photographs, maps, and documents in projects supported by the former Archival Community Digitization Program. Federal funding for the CCA and the National Archival Development Program was canceled in 2012. With support from the archival community, the CCA has persevered and refocused and maintains the national database of archives holdings: <http://www.archivescanada.ca>.

More recently, the CCA has launched the ARCHIVESCANA Digital Preservation Service to provide memory institutions with an affordable digital preservation service maintained in an environment to ensure sustainability, long-term accessibility, usability, and authenticity of electronic records and digital information objects.

Steering Committee on Canada's Archives (SCCA)

Following the January 2014 *Canadian Archives Summit: Towards a New Blueprint for Canada's Recorded Memory*, organizers continued to develop the ideas and deliberations raised during the Summit though the annual meetings of the CCA, the ACA, and the *Association des archivistes du Québec* (AAQ). Building on the discussions over the summer of 2014, the ACA, AAQ, CCA, and the Council of Provincial and Territorial Archivists (CPTA) and LAC came together as a working group in September 2014 to develop a renewed vision and road map to guide the Canadian Archival System. A draft Strategy entitled *Canada's Archives: A vision and areas of focus for 2015–2025* was circulated for comment in the summer of 2015 with the final version of the Strategy launched at a national event in Ottawa that November. The SCCA was established to guide the implementation of the Strategy with representatives from each of the ACA, AAQ, CCA, CPTA, and LAC.

Association of Canadian Archivists (ACA)

The Association was established in 1975 and evolved from the Archives Section of the Canadian Historical Association. It has a number of standing committees such as education, membership, ethics, and public awareness. Special interest sections provide a forum for discussion in areas such as aboriginal archives, privacy and access, government records, municipal archives, technology and archives, personal archives, religious archives, sound and moving images, and university and college archives. It seeks to provide leadership, encourage awareness of archival activities, advocate on behalf of the needs of professional archivists, and communicate to further understanding and cooperation among members of the Canadian archival system and other information and culture-based professions. In addition to organizing a major annual conference, it publishes a newsletter, the *ACA Bulletin*, as well as *Archivaria* and monographs and occasional papers. Back issues of *Archivaria*, one of the leading English language archival journals in the world, are available online.

Association des archivistes du Québec/Association of Archivists of Québec (AAQ)

The Association was founded in 1967 and reflects the distinctive qualities of the archival discipline, history, and profession in Québec, Canada's francophone province. The AAQ represents more than 600 members: archivists, archival educators, and information specialists who work in both public and private sector organizations. The unique nature of the Québec archival practice marries both European archival theory and practices with the North American methodology and profession of records management.^[12] Joining management and conservation of historical archival documents with the document life cycle is reflected in both Québec archival discipline and the pedagogy developed and taught in the curricula used in university archival education programs. The Québec archival system is also characterized by its decentralization: archival records are managed and stored in the regions where they have been created.^[13]

The AAQ publishes a biannual publication *Archives*, established in 1969, which focuses on scholarly research and reflections on the theory and practices of the archival and information management professions in Québec.

Canadiana.org

Canadiana.org is a national not-for-profit organization that was established in 1978 with its initial funding coming from the Canada Council for the Arts. It was set up in response to concerns from librarians and scholars about the preservation of Canada's earliest printed heritage, as well as increased demands to have access to these

materials for research and study purposes for Canadian Studies programs. Since its establishment, it has completed several large projects to locate and film (to preservation standards set out the *Guidelines for Preservation Microfilming in Canadian Libraries*) and produce bibliographic descriptions of these materials. This national initiative has had the effect of pulling together Canada's early published materials, some unique, some deteriorating, from scattered collections in libraries and archives in Canada and abroad and making this content available through subscribing institutions. For the past 15 yrs, Canadiana.org has focused on shifting its method of access from microform to digital. With assistance from the Andrew W. Mellon Foundation and working in partnership with the then National Library of Canada and the libraries of the University of Toronto and Université Laval, it began its Early Canadiana Online project. With the support of its members, primarily research libraries and the Department of Canadian Heritage, it has completed a major digitization project, Canada in the Making, to make pre-1900 Canadian official publications available on the Internet. It successfully completed another multiyear digitization project, Early Canadian Periodicals to 1920. In 2008 Canadiana.org merged with AlouetteCanada.ca, a national collaborative initiative on the part of Canadian research libraries and LAC. AlouetteCanada.ca, in turn, had absorbed the work of the Canadian Initiative on Digital Libraries (CIDL), a collaborative effort to coordinate digitization projects and standards in Canada. Canadiana.org will be the focus of major projects to aggregate current digitized contents and to digitize Canada's rich cultural heritage including materials from libraries, archives, and museums. With the sustained support from the CARL and a contract with the LAC, Canadiana.org is embarking on an ambitious initiative. The Héritage Project is a 10-yr commitment to digitize and make accessible online some of Canada's most popular archival collections encompassing roughly 60 million pages of primary-source documents.

DEVELOPMENT OF CANADIAN LIBRARY AND ARCHIVAL EDUCATION

Formal library and archival education takes place at a wide range of institutions across Canada. The year 2004 marked the 100th anniversary of the first formal library education program in Canada. Prior to that time, librarians and archivists learned through experience or through attendance at courses in the United States. Charles H. Gould, the then university librarian at McGill University, laid the groundwork for early librarian education in Canada. He started with an in-house training course for staff, which was also open to outside applicants. This was followed with the first McGill University Library Summer School in 1904, which was directed to people that were

already in the workforce. There was a curriculum consisting of classification; cataloging; accessioning; shelving, charging, and ordering systems; reference work; and bibliography and included lectures, field trips, and special lectures including those delivered by Melvil Dewey and James Bain, the chief librarian of the TPL. Courses were in place from 1904 to 1911 and then in 1913 and 1914. Stimulated by the McGill experience, Ontario's Department of Education began to offer similar summer programs in 1911 in Toronto. The program in Montreal evolved to summer programs in 1927 at McGill accredited by the American Library Association then to a sessional graduate Bachelor of Library Science program at McGill University in 1930. In Toronto, a one-year academic program for university graduates leading to a Bachelor of Library Science at the Library School was jointly administered by the University of Toronto and the Ontario Department of Education and the Ontario College of Education in 1937. In 1937, the *École de bibliothéconomie* at the *Université de Montréal* was established for French language education. The University of Ottawa opened a bilingual French and English evening program for librarians in 1938 that evolved to offering a Bachelor of Library Science program in 1942.

Due to the rapid expansion of libraries in the 1960s, new graduate program library schools were created at the UBC (1961 School of Librarianship), University of Alberta (1965 School of Library Science), University of Western Ontario (1969 School of Library and Information Science), and Dalhousie University (1969 School of Library Service). The program at the University of Ottawa, *École de bibliothécaires/Library School*, closed in 1972. Carleton University began to offer a Canadian archives training course in 1959 that became a 6- to 8-week program at the Public Archives in 1969. Graduate librarian programs were accredited (and continue to be accredited) by the American Library Association. Over the last 50 years, these programs have evolved from offering Bachelor of Library Science (as a graduate degree program) to a 2-yr Master of Library Science degree program as well as doctoral programs. Changes to the programs and names of the various faculties reflect more specialization and the inclusion of other disciplines and a broader view of information management. The UBC introduced a Master of Archival Studies (MAS) program in 1981 as part of what became known as the School of Library, Archival, and Information Studies in 1984. They also introduced a First Nations concentration in 1998 and a Master of Arts in Children's Literature program in 1999. Today, the University of Toronto has a Faculty of Information with a Master of Information degree program, including eight areas of concentration together with a PhD program and a Master of Museum Studies program. Similarly, what is now the *École de bibliothéconomie et des sciences de l'information* at the *Université de Montréal* offers a Master of Information Science degree program, a doctoral program, and certificates in Archival

Studies and Digital Information Management. The program at the University of Western Ontario, now Western University, is combined with journalism as the Faculty of Information and Media Studies. The UBC was exploring a similar approach in January 2017. McGill University's program is now the School of Information Studies and offers areas of specialization in archival studies, knowledge management, and librarianship. The history department at the University of Manitoba established a master's degree program in archival studies in 1991. Finally, a new graduate program, the School of Information Studies, was launched at the University of Ottawa in 2009 as a bilingual program designed for students who want to work in the fields of archives, librarianship, and information centers.

The development of library technician programs mirrored the rapid expansion of libraries, graduate library programs, and the opening of community colleges across the country. In the late 1960s and early 1970s, library technician programs were opened at Red River Community College in 1962 in Winnipeg, Vancouver City College (now Langara College) in 1966, Southern Alberta Institute of Technology in Calgary in 1967, and Ryerson Polytechnical Institute in 1967 in Toronto. In Ontario a number of colleges of Applied Arts and Technology established programs at the same time. St. Clair College of Applied Arts and Technology and Seneca College of Applied Arts and Technology were the first in 1967. Core competencies were defined by the CLA in 1982 with their *Guidelines for the Training of Library Technicians*. There are currently programs in place in three Ontario community colleges down from a peak of eight institutions in the late 1980s, which reflect a number of closures of technician programs in the early 2000s. These colleges in Ontario were matched by a similar province-wide development of *Collèges d'enseignement général et professionnel* (CEGEPs) in the Province of Quebec intended for graduates of secondary schools. There are now some 48 CEGEPs in all regions of the province, primarily offering their courses in French with library technician programs in place in seven of these. The Nova Scotia Community College's program began in 1985. Core competencies for library technicians working in school libraries were defined in CLA's *Qualifications for Library Technicians Working in School Systems*. Library technician programs are also in place primarily to support the training of teacher-librarians at the University of Winnipeg, Lakehead University, Concordia University, Memorial University of Newfoundland's School of Continuing Education, and the University of New Brunswick's Library Assistant Program. Normally, these training programs are for 2 years.

THE CANADIAN LIBRARY AND ARCHIVAL LANDSCAPE: CHALLENGES AND ISSUES

Canada's archives and libraries share a range of issues and challenges. These include dealing with an increasingly

digital environment, preservation, access, description and resource discovery, and management of government information. The continuing issues are of standards development, copyright, resource sharing, national planning, and coordination; the revitalization and replenishment of their professional ranks; convergence; working collaboratively; serving both increasingly diverse multicultural populations and indigenous peoples; and providing services for people with disabilities. Canadian libraries have some challenges and issues that archives do not share in quite the same way. These include diminishing collection budgets to address the burgeoning number of electronic resources to be acquired (while at the same time witnessing increased numbers of analog materials) and services for people with disabilities and literacy. Archives with their unique multimedia collections place high emphasis on preservation of and access to all forms of documentation. Meanwhile, they must cope with the increasingly complex legal environment for the selection and preservation of official documents, legal discovery in class action litigation together with escalating freedom of information responsibilities, and the imperatives of copyright and privacy protection.

Digital

Canada's libraries and archives have been in the forefront of adapting to an increasingly digital environment. In the 1990s, Canada's federal government established an Information Highway Advisory Council that set the stage for a range of federal initiatives including digitization programs and LibraryNet and SchoolNet programs. The National Archives launched a multiyear initiative to digitize the key records of the 660,000 Canadians who served in World War I. The National Library established a pilot project in 1993–1994 to begin the acquisition of Canadian born-digital publications. Canadian publishers, particularly publishers at the federal and provincial governments, have made a major shift to producing their publications in digital formats. Canadian libraries and archives are actively engaged in digitizing parts of their collections. Some large digitization projects such as *Our Roots/Nos Racines*, which pulls together local histories and genealogical materials from across the country, were financially supported by the Department of Canadian Heritage. This same program has also supported the transfer to digital formats of important cultural resources from the National Film Board of Canada/*Office national du film du Canada*, and Canada's public broadcaster, CBC/Radio-Canada, LAC, BAnQ, and other research libraries have shifted resources to support digitization initiatives and have been active partners internationally to harvest and preserve significant websites. Canadians have been concerned about seeking to have a critical mass of Canadian digital content in order to provide a strong Canadian voice with the Canadian experience, culture, and heritage easily available on the Internet. Mass digitization on a national scale through

Canadiana.org supported by the CARL is advancing, with minimal assistance from the federal government. Libraries, archives, museums, broadcasters, publishers, and other stakeholders came together in 2006 to develop a cohesive Canadian Digital Information Strategy, which articulated a vision:

Canada's digital information assets are created, managed and preserved to ensure that a significant Canadian digital presence and record is available to present and future generations, and that Canada's position in a global digital information economy is enhanced.^[14]

Despite many efforts, this vision for a modern knowledge society and evidence-based decision-making has not been shared by the government. Libraries and archives are advancing this agenda through reallocation of their own limited resources. In June 2016, LAC announced the launch of the National Heritage Digitization Strategy, the objective of which is to reposition Canada and provide a cohesive path toward the digitization of Canadian memory institutions' collections by encouraging the long-term viability of documentary heritage records through quality standards-based efforts and ensuring a national plan of action will be in place (www.bac-lac.gc.ca/eng/about-us/Pages/national-heritage-digitization-strategy.aspx).

Public libraries and other institutions are concerned about a growing digital divide, between those Canadians who have easy access to computers and appropriate training and computer literacy skills and those who do not. Programs such as the Bill & Melinda Gates Foundation's Library Program's gifts of computer equipment, improving Internet access, and providing computer training facilities to public libraries across Canada have made a very large contribution to addressing the digital divide. Public, government, and university libraries are in the forefront in terms of offering digital services and collections.

Preservation

In terms of preservation, the CCA released a national strategy for archives in 1994, *The Preservation Strategy for Archives in Canada*. The National Archives established an expert national task force and released an alarming report in 1995 entitled *Fading Away* to raise awareness of the need to preserve the nation's audio-visual heritage in radio, television, film, and sound. In 1993, the then National Library working in collaboration with a national committee developed a national preservation strategy for libraries, *A National Strategy for Preservation in Canadian Libraries* and *Guidelines for Preservation Microfilming in Canadian Libraries* were developed and published. The mass deacidification program of LAC has treated more than a million items in their collections. LAC also moved forward on permanent paper standards adopted by the federal government, which has largely eliminated the use of inappropriate, acidic paper by Canadian print publishers. Generally, the interest and

support of preserving analog materials in paper, compact discs, tape, CD-ROMs, and other media has ebbed as digitization to ensure access has become prevalent at many custodial institutions. The LAC Preservation Centre and the new nitrate storage facility provide the best possible secure environments as do the many new library and archives buildings across the country. Several libraries have developed digital facilities meeting international standards for trusted digital repositories, but unique Canadian digital content and recordkeeping grows faster than the institutional capability. This remains a concern for institutions and the public who are coming to realize that their own digital legacy is transitory.

Access

In an environment where research is increasingly interdisciplinary and the point of access is via the Internet, researchers pay less attention to where their information needs are being met. “Access is the driver” has become a direction in many archival institutions, and while this is a natural sentiment in libraries to facilitate and support access to all collection materials, it has been less willingly embraced in many archival institutions where the training and practice has been to protect access in order to preserve materials. In Canadian libraries and other libraries, there is an increasing move to have open access for digital materials, particularly those that are publicly owned and non-exclusive licenses with private sector digitizing partners. The Simon Fraser University Library in partnership with the UBC hosts the development and provides support for the Public Knowledge Project’s open-source software for scholarly publishing and communication. CARL and its members have worked with Canada’s three federal research granting councils, first on endorsing open-access principles for the publication of scientific research (2010) and subsequently in encouraging the agencies to adopt an open-access policy on publications (2015). The intent is explicit: “The objective of this policy is to improve access to the results of Agency-funded research, and to increase the dissemination and exchange of research results” (http://www.science.gc.ca/eic/site/063.nsf/eng/h_F6765465.html). Similarly the three agencies adopted a *Statement of Principles on Digital Data Management*, requiring responsible stewardship with plans for metadata, preservation, and data sharing (http://www.science.gc.ca/eic/site/063.nsf/eng/h_83F7624E.html).

Archives and libraries are concerned about standards and best practices in digitization from analog and in creating born-digital materials to ensure long-term access. They are also concerned about integrity and authenticity of the originals and, given the Canadian context, how to see more materials online that speak to increasing multi-lingual and aboriginal audiences. To be truly useful, digital information resources have to be organized for seamless and more open access in a bilingual

environment. Access for archivists also speaks to access to information and privacy concerns with the large volumes of records of federal, provincial, and municipal governments. Equitable and ubiquitous access from wherever in the country is viewed as critical to the nation’s economic and cultural growth and innovation.

Description

The Canadian library community and, to some extent, the archives are implementing new standard for bibliographic description, *RDA: Resource Description and Access*, which is replacing the *Anglo-American Cataloging Rules 2nd Ed.* (AACR2). Description of published materials has been under review for some years by the Canadian Committee on Cataloguing, a national advisory committee and member of the Joint Steering Committee for Revision of AACR (JSC). The work of Dr. Tom Delsey, a Canadian, on the conceptual models Functional Requirements for Bibliographic Records (FRBR) and Functional Requirements and Numbering of Authority Records (FRNAR) prepared for the International Federation of Library Associations and Institutions (IFLA) have led the way for an overhaul of bibliographic description. He is also the editor of the new *Anglo-American Cataloging Rules 3rd Ed.* (AACR3), which has reassessed the fundamentals of bibliographic description. The AACR3 has been developed and is being implemented jointly by LAC, the Library of Congress, the British Library, and the National Library of Australia. Archival description in Canada is carried out under the “Rules for Archival Description (RAD)” developed and updated by the Canadian Committee on Archival Description (CCAD). The RAD was revised in October 2005 and the rule revisions took effect in 2007. In 2016, CCAD convened a meeting on The Future of RAD in Ottawa and reached a consensus regarding the future of archival descriptive standard in Canada and the possible revision or replacement of RAD (<http://archivescanada.ca/FutureOfRAD>).

Management of Government Information

The effective management of the administrative records of all levels of government, federal, provincial, territorial, and municipal, has become a major challenge across the country. Access to information and privacy protection coupled with public expectations and political commitments to accountability and transparency has provided incentive for all levels of government to improve their recordkeeping. As in the private sector, the stringent requirements for legal discovery in class action lawsuits have lent urgency. Most jurisdictions now recognize information and records as assets, which are formally the responsibility of all managers. The federal government in particular has had a number of major inquiries and auditors’ reports highlighting deficiencies in recordkeeping.

The Auditor General's Report of Fall 2014 concluded that LAC was not adequately fulfilling its responsibilities for acquiring, preserving, and providing access to government documentary heritage and had a considerable backlog of records for processing. A dedicated task force was put in place to assess and process 10 additional kilometers of archives so that they will be discoverable for users. Given the volume of government records being produced and the embrace of digital information and e-mails, government archives have been under significant pressure to put the infrastructure in place for improvements—guidelines, best practices, use of automated systems for the handling of electronic information, and more rigorous monitoring. The 2004 “Library and Archives of Canada Act” incorporated a number of new specific measures to strengthen the role of archivists in acquiring and describing Government of Canada records as well as identifying records at risk. To cope over the past two decades, the LAC pioneered risk-based functional analysis approach to the appraisal and selection of records. On a more positive note, governments have begun to make significant amounts of their published information and datasets available on the Internet to improve access by the public. The federal government is committed to the precepts of open data and in 2014 announced the formation of an Open Data Institute with the private sector.

Copyright

Canadian libraries and archives have taken a strong leadership and advocacy role as successive Canadian governments have moved to update and reform Canadian copyright legislation and to bring Canadian law into conformance with international copyright treaties. Acting collectively, library and archival groups have asserted views on the necessity of a balanced approach to copyright changes, which factors in users as a counterweight to creators. They also look to implement technology neutral approaches and technological protection measures and protection of educational use of the Internet. In 1986 Canada established the Public Lending Right Commission/*Commission du droit de prêt public*, which compensates registered authors on an annual basis for the use of their books (print format only) held in Canadian libraries. The advent of large digitization projects has put a renewed focus on securing copyright permissions and ensuring that copyright restrictions are respected. Libraries and archives in most Canadian jurisdictions operate under copying licenses from a number of copyright collectives.

In 2004, the Supreme Court of Canada clarified and expanded the scope of a “fair dealing” defense, seeking to balance the public interest with the rights of copyright holders (2004 SCC 13: *CCH Canadian Ltd vs the Law Society of Upper Canada*). The *Copyright Modernization Act* of 2012 recognized education as a permitted purpose, provided it is reasonable and fair. CARL is preparing to

participate in a Parliamentary review of the Act scheduled for 2017.

Resource Sharing

Equitable access by the public to collections held in libraries in Canada has been a public policy issue for many years. There is an assumption in Canada that the investment in building collections with public funds means that Canadians in principle should have access to these materials. This has manifested itself in many ways. The national union catalog maintained by LAC is one manifestation of this. With the creation of the National Library of Canada in the early 1950s, one of its first priorities was the microfilming of holdings of significant libraries across the country. Over the years, this has become a highly automated process but with the same purpose to permit library users in one library to have access via interlibrary loan to materials in other collections. Similarly, Archives Canada has brought access to the resources of participating Canadian archives and increased the ability of Canadians to know what had been collected and where it was available and possibly to seek access via interinstitutional loan. These national services and resources are bolstered by a series of agreements and provincial and regional union catalogs across the country. In 2017 LAC entered into an agreement with the Online Computer Library Center (OCLC), the massive international library cooperative, to move the Canadian National Union Catalogue to the OCLC database by the end of 2018. The Library Book Rate, a program of the Department of Canadian Heritage through Canada Post, subsidizes the transport of library materials from library to library. This is particularly important in rural and more remote parts of the country. A recent manifestation of this continued interest in resource sharing is the Resource Sharing Agreement agreed to by the Council of Prairie and Pacific University Libraries (COPPUL), the Ontario Council of University Libraries (OCUL), the *Conférence des recteurs et des principaux des universités du Québec* and the Council of Atlantic University Libraries/*Conseil des bibliothèques universitaires de l'Atlantique*. This permits students, faculty, and staff of Canadian universities standardized reciprocal interlibrary loan and document delivery privileges across Canada. Standards developments such as Z39.50 protocols and the Virtual Union Catalogue of Canada have all supported this sharing of resources.

National Planning and Coordination

Given the decentralized situation with respect to libraries and archives in Canada, it is important that there be planning and coordination mechanisms in place on a national level. The Canadian Digital Information Strategy, discussed earlier, was an important initiative of LAC in working nationally across different disciplines to achieve

a common purpose. Resource sharing is another area where coordination and leadership has been critical to cut across different types of libraries (public, university, college, school, special, government) and archives (government, private, university) to ensure equitable access to information holdings for Canadians. The CCA provides a mechanism for leadership and direction for Canadian archives. The Council on Access to Information for Print-Disabled Canadians was established to give advice, identify funding requirements monitor progress and make recommendations regarding the implementation of "Fulfilling the Promise: The Report of the Task Force on Access to Information for Print-Disabled Canadians." National library associations and groups provide leadership but are more fragmented and there is no coordinated program for library development. They come together to address contentious issues but are less engaged in working collaboratively in a proactive way to support critical research, develop public policy and plans on a national scale. The lack of national library and archival statistics gathering by Canada's national statistical agency, Statistics Canada, makes coordination and information gathering and policy development much more difficult.

Human Resources

Archives and libraries in Canada share major concerns about their workforces, which will be changing dramatically over the next few years. Libraries and archives witnessed great expansion in the 1970s and grew rapidly. The demographics of Canada's workforce in archives and libraries are such that there will be many leaving their professions over the next 5–10 yrs. The Cultural Human Resources Council, a federal body, has recently completed a "Training Gaps Analysis for Librarians and Library Technicians." Competencies and training for professional and non-professional staff in libraries and archives are evolving rapidly in response to the demands of a digital environment and the needs of an increasingly diverse Canadian public. The CLA's President's Council on the 8Rs (the Rs referring to recruitment, retirement, retention, rejuvenation, repatriation, reaccreditation, remuneration, and restructuring) has collaborated with CARL and the University of Alberta to analyze library staff trends over a decade from 2004 on and has informed workforce planning (the studies are available at <http://www.ls.ualberta.ca/8rs/reports.html>).

Convergence

With the dramatic growth in electronic resources, there is growing recognition that Canadian researchers and users of libraries and archives are increasingly unconcerned about whether it is archival or library materials that have been used to provide information or whether it is a library or an archives that has provided the information they require. Professional education and training at graduate

programs across the country reflect an increased emphasis on offering programs where students at the same faculty can specialize in archives or library studies or more generally for information as a discipline. Similarly, trainings at postsecondary institutions offering programs for technicians are blending both library and archival training. Joint exhibits with museums and galleries have become common, evidence of the recognition that Canadian governments are giving to an integrated approach to knowledge and our collective memory.

Working Collaboratively

In the past decade, collaboration has become the rule; not the exception. In the Canadian library world there are several approaches to collaboration. Consortia are well established with research libraries having a particularly close relationship in a number of regional consortia, the COPPUL, the OCUL, *Bureau de Coopération Interuniversitaire* (BCI) [formerly the *Conférence des recteurs et des principaux des universités du Québec* (CREPUQ)], and the Council of Atlantic University Libraries/*Conseil des bibliothèques universitaires de l'Atlantique* (CAUL/CBUA). The Partnership, which is the provincial and territorial library associations of Canada working together, offers programs and services to members of these associations. These include continuing education through the Education Institute, the Career Centre, and the electronic journal initiative, *Partnership: The Canadian Journal of Library and Information Practice and Research*. The Library Subcommittee of BCI supports cooperative collection development across the 17 French and English university libraries of Quebec, sharing cataloging resources and the development of the *Bibliothèque de recherche virtuelle québécoise* (BRVQ), the gathering of statistical data, and training and professional development. The Capital Smart Library/*la Bibliothèque de la Capitale* is a consortium of libraries, archives, and museums in the cities of Ottawa and Gatineau including the Ottawa Public Library, LAC, NRC-CISTI, and the libraries of Carleton University, the University of Ottawa, Algonquin College, and the Dominican University College as well as the Canadian Museum of History, the Canadian War Museum, and the National Gallery. All of these institutions' online catalogs have been added to the SmartLibrary Z39.50 gateway for federated searches to facilitate direct loans. Canada's archives have collaborated to establish ArchivesCanada as the search portal for access to fonds level description and increasingly to more detailed finding aids. The Toronto Public Library, the Regina Public Library, the Halifax Public Libraries, and the Vancouver Public Library have been working collaboratively on a joint project called Working Together: Library–Community Connections funded by the federal government. The project is seeking to develop better ways of serving socially excluded

communities and individuals who have not traditionally used library services. In Vancouver, the focus of the project is on the poor, in Toronto on immigrants, in Regina on indigenous peoples, and in Halifax on a socially disadvantaged community. For more than a decade, the Toronto–Dominion Bank has worked with the TPL, LAC, and, now, almost 2000 public libraries to offer the successful TD Summer Reading Club to engage school children in improving reading skills each summer.

Multilingual Services

Given the diversity of Canada's population and its multilingual and multicultural character, Canada's libraries have recognized for some years the importance of building collections and providing services that better respond to information needs.

Indigenous Services and Collections

The range of services provided to Canada's indigenous peoples and the kind of collections and information they need to access are very broad. In Nunavut, the only jurisdiction in Canada with a majority of the population being of indigenous descent, a consortium of the legislative, college, public, and court libraries has worked together on a common integrated library system to provide information in a shared Web-based public access catalog with Inuit syllabics. Many of Canada's indigenous peoples live on reserves where there are a variety of services provided. School libraries play a particularly strong role. Some First Nations' territories are in the remote parts of the country, with little access to books. In 2004, Honorable James Bartleman, then lieutenant governor of Ontario, issued a call for books. The public response was overwhelming and 850,000 quality used books were delivered to remote northern communities. This initiative has continued under his successors and is now the lieutenant governor's aboriginal literacy program (see <http://www.johnschofield.com/index.php/portfolio/lieutenant-governors-literacy-programs/>). Given the challenges provided by a strong oral tradition and insufficient numbers of published materials for and about indigenous peoples, there has been a major attempt both to stimulate publishing and to build libraries and library infrastructure in ways most relevant to First Nations peoples. Library education has been a concern, and for many years the National Library supported a program to send indigenous students to graduate library programs. Services to indigenous youth and adults living in urban settings are also a particular challenge.

Services for People with Disabilities

Roch Carrier, National Librarian of Canada from 1999 to 2004, established the Task Force on Access for Information for Print-Disabled Canadians. Their report, "Fulfilling the

Promise: the Report of the Task Force on Access to Information for Print-Disabled Canadians," made recommendations in a broad number of areas. In response to these recommendations, as well as the Federal Disability Agenda of the federal government, a number of significant achievements are being put in place including an Electronic Clearinghouse for Alternative Format Production. The pilot project for the Clearinghouse was supported by the Council on Access to Information for Print-Disabled Canadians (an advisory group to the Librarian and Archivist of Canada), the Canadian Publishers' Council, the Association of Canadian Publishers, *l'Association nationale des Éditeurs de Livres*, and leading Canadian alternative format producers with funding from Social Development Canada.

CONCLUSION

Libraries and archives in Canada have come of age in the digital era. While operating in a decentralized federation, Canada's libraries and archives and their various consortia, associations, and councils actively pursue opportunities to advance services and awareness. It is an exciting time: challenging but dynamic as technology and public expectations must be balanced with resources and capacity. New approaches thrive. The Public Service of Canada was recently encouraged to respond to this changing environment through collaboration, innovation, and courage.^[15] Librarians and archivists have been doing precisely this for some time.

APPENDIX: CHRONOLOGY

1. 1635—Collège des Jésuites organized the first university library in North America.
2. 1752—First press established in Halifax, Nova Scotia.
3. 1779—First bilingual subscription library established in Quebec City.
4. 1790—Ordinance "For the Better Preservation and Due Distribution of the Ancient French Records."
5. 1832—"Act for the Protection of Copyright" required deposit of printed books, charts, maps, and prints to secure copyright.
6. 1851—First Public Libraries and Mechanics' Institute Act passed by the Government of the United Canadas.
7. 1857—Appointment of Thomas B. Akins as Nova Scotia's Commissioner of Public Records.
8. 1867—Creation of the Canadian federation with the "British North America Act."
9. 1872—Appointment of Douglas Brymner and founding of the national archives.
10. 1876—Opening of the Library of Parliament building, Ottawa.
11. 1901—Ontario Library Association organized.

12. 1912—National archives detached from the federal Department of Agriculture and recognized by statute.
13. 1920—Provincial Archives of Quebec established and “Public Libraries Act” in Ontario revised.
14. 1923—“Canadian Catalogue of Books” started.
15. 1933—Carnegie Corporation supports a national study of library conditions and needs.
16. 1941—Rockefeller Foundation examines Canadian libraries.
17. 1943—Canadian Library Council incorporated.
18. 1946—Canadian Library Association formed.
19. 1948—W. Kaye Lamb appointed Dominion Archivist and given responsibility for preparing the way for a national library.
20. 1950—Canadian Bibliographic Centre established to compile a national catalog of the holdings of Canadian libraries and to publish bibliographies of current and retrospective Canadian publications.
21. 1951—Report of the Royal commission on National Development in the Arts, Letters, and Sciences 1949–1951 has a number of recommendations with respect to the archives and libraries.
22. 1952—“National Library Act” passed.
23. 1967—Opening of Public Archives National Library building in Ottawa.
24. 1967—Passage of “Bibliothèque nationale du Québec Act.”
25. 1975—Publication of *To Know Ourselves: the Report of the Commission on Canadian Studies*.
26. 1980—“Canadian Archives”—Report to the Social Sciences and Humanities Research Council of Canada.
27. 1985—Creation of the Canadian Council of Archives.
28. 1986—Creation of Public Lending Right Commission.
29. 1987—“National Archives of Canada Act.”
30. 2004—“Library and Archives of Canada Act” proclaimed merging the National Archives and National Library of Canada.
31. 2006—Establishment of the Bibliothèque et Archives nationales du Québec (BAnQ).
32. 2015—Final Report of the Truth and Reconciliation Commission of Canada: Honouring the truth, reconciling for the future.

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Canadian Heritage Information Network (CHIN)

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Abstract

A national center of museum excellence, the Canadian Heritage Information Network (CHIN) enables Canada's museums to engage audiences through the use of innovative technologies.

The Canadian Heritage Information Network (CHIN) supports an active network of more than 1350 not-for-profit member heritage institutions of all sizes and disciplines. Since 1972, this special operating agency of the Department of Canadian Heritage has been connecting museums with Canadians, enabling the creation, management, presentation, and preservation of digital heritage content for current and future generations.

To achieve this, CHIN pursues three strategies: mobilize and support collaborative networks of heritage institutions and research partners; provide skills development resources for heritage professionals; and support the development and presentation of digital heritage content.

Through its programs and online services, CHIN makes it possible for heritage professionals and volunteers to:

- interact and learn with colleagues through <http://www.pro.chin.gc.ca>;
- explore and share collection records through a growing online national inventory titled *Artefacts Canada*;
- reach and captivate their audiences, including youth, through virtualmuseum.ca—Canada's virtual national museum and the Department of Canadian Heritage's most popular online destination;
- engage teachers and students through the collaborative development of interactive online spaces and accompanying digital learning resources.

OVERVIEW

With the rapid development of new technologies, the heritage community is being presented with new and important opportunities. The Internet, more than just another medium, is a new environment in which heritage institutions have an active role to play. In order to adapt to and lead by example in this new domain, they must develop the necessary skills and abilities while making themselves relevant and meaningful to the world's online audiences.

In this regard, CHIN, in close collaboration with its members, is increasing the creation of Canadian online

content displaying the diversity of our heritage. As of today, more than 1350 Canadian heritage organizations are actively engaged in the network.

Through its professional Web site and related activities, CHIN helps to strengthen the knowledge and abilities of the Canadian heritage community with respect to the creation, presentation, management, and preservation of digital content. The CHIN site provides heritage professionals with easy access to extensive resources that draw from CHIN's own work and research as well as other centers of expertise around the world.

These online resources include:

- A national inventory of more than 3.5 million museum objects, including cultural and historical artifacts and natural science specimens.
- A forum in which heritage professionals and volunteers can learn, exchange knowledge and ideas, and collaborate.
- Bibliographies and data dictionaries.
- Research and reference tools.
- Publications on intellectual property, digital content, collections management, and standards.
- Courses on image digitization and automated collections management systems.
- Information on professional events and career opportunities.

In addition to its online services, CHIN works nationally and internationally, offering workshops, convening meetings on subjects of common interest to its membership, as well as sponsoring and attending conferences and events that provide opportunities for heritage professionals to increase their expertise. Underlying all of CHIN's activities is a continued, collaborative research program designed to advance our collective understanding of issues associated with new technologies and digital content, particularly in the areas of intellectual property and online audiences.

CHIN also represents the Canadian heritage community internationally in projects that facilitate access to

heritage information, and has been recognized for its work in developing standards for museum documentation. This work encompasses a broad range of information types and the technical protocols necessary for the exchange of information in a widely distributed environment.

CHIN's internationally recognized and most commonly accessed initiative, the Virtual Museum of Canada (VMC), showcases Canadian museums and their collections to a worldwide public audience. Through online exhibits, free games, and images, the VMC integrates art, culture, and heritage from Canadian museums. Designed in part to support classroom learning, it includes interactive lesson plans and learning resources for teachers and students. At the same time, anyone can access the site to learn about and explore the treasures of Canada's museums or browse listings of museums, events, and live exhibits across Canada.

CHIN also manages the international Bibliographic Database of the Conservation Information Network (BCIN), the Web's most complete bibliographic resource for the conservation, preservation, and restoration of cultural property. While previously part of CHIN's subscription-based research and reference resources, BCIN is now offered free-of-charge.

BACKGROUND

The 1970s: Founding of the National Inventory Programme

CHIN began as the National Inventory Programme (NIP) in 1972. It was created in response to the 1970 UNESCO Convention on Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property, of which Canada was an early signatory. The 1972 National Museums Policy proposed the creation of an inventory of the cultural and scientific collections held by public institutions in Canada. The mandate of NIP was to create a computerized national inventory of Canadian cultural and scientific collections, to facilitate the sharing of collections information, to conduct applied research and development on information management standards and technology, and to advise museums and the heritage community in these areas.^[1] Later policies extended the mandate to include other online resources.

The establishment of the National Inventory Programme resulted in the compilation of Canadian heritage information in three National Inventories—databases of humanities and natural science collections, as well as archeological sites. At first, museums sent their paper collections catalogs to CHIN for automation, but as technology advanced the National Inventories were maintained by the participating museums through dial-up access to CHIN's mainframe computer, with support from CHIN.

The National Inventories became an important resource, used for research, comparative cataloging, and exhibition planning, but also as a tool for individual institutions to manage their collections. CHIN also provided museums with the capability to share information through electronic mail long before the Internet made this a common practice.

In support of these activities, CHIN became active in the development and implementation of documentation standards, promoting the consistent documentation of museum information at the institutional and national level, and contributing to the development of international standards initiatives (Fig. 1).

The 1980s: Expansion of Services

In 1987, CHIN added the Conservation Information Network (CIN) and a series of other reference databases to its list of resources. CHIN's resources were offered by dial-up access, free of charge to Canadian heritage institutions, and as a subscription service to others. Beginning in the late 1980s, CHIN began to work with the Canadian heritage community to assess emerging technologies for disseminating museum information. Several projects involving CD-ROM and CD-I production were completed, providing valuable experience to all participants.

The 1990s: A New Mission

In 1995, CHIN engaged in a major review of its programs, in consultation with its client community. With the improvements in desktop technology and the advent of the Internet, CHIN and Canadian museums visualized an environment where museums would create rich public information resources which would be available electronically. CHIN developed a new mission to promote the development, presentation, and preservation of Canada's digital heritage content for current and future generations of Canadians.^[2]

In October 1995, all of CHIN's products and services, previously available only by dial-up access to CHIN contributors and subscribers, were launched on the Web. CHIN, working with the Canadian heritage community, also developed new collaborative products. CHIN's first virtual exhibition, "Christmas Traditions in France and Canada," released in 1995, served to bring museum content to new audiences while increasing the participants' experience in providing content for the Web.

Another new product that took advantage of the Internet to promote museums and reach new audiences was the Guide to Canadian Museums and Galleries. The Guide enabled museums to maintain their own institutional information in a searchable Internet directory—this was especially important for small museums that would not otherwise have had a presence on the Internet. CHIN also provided Internet accounts and training to museums as a

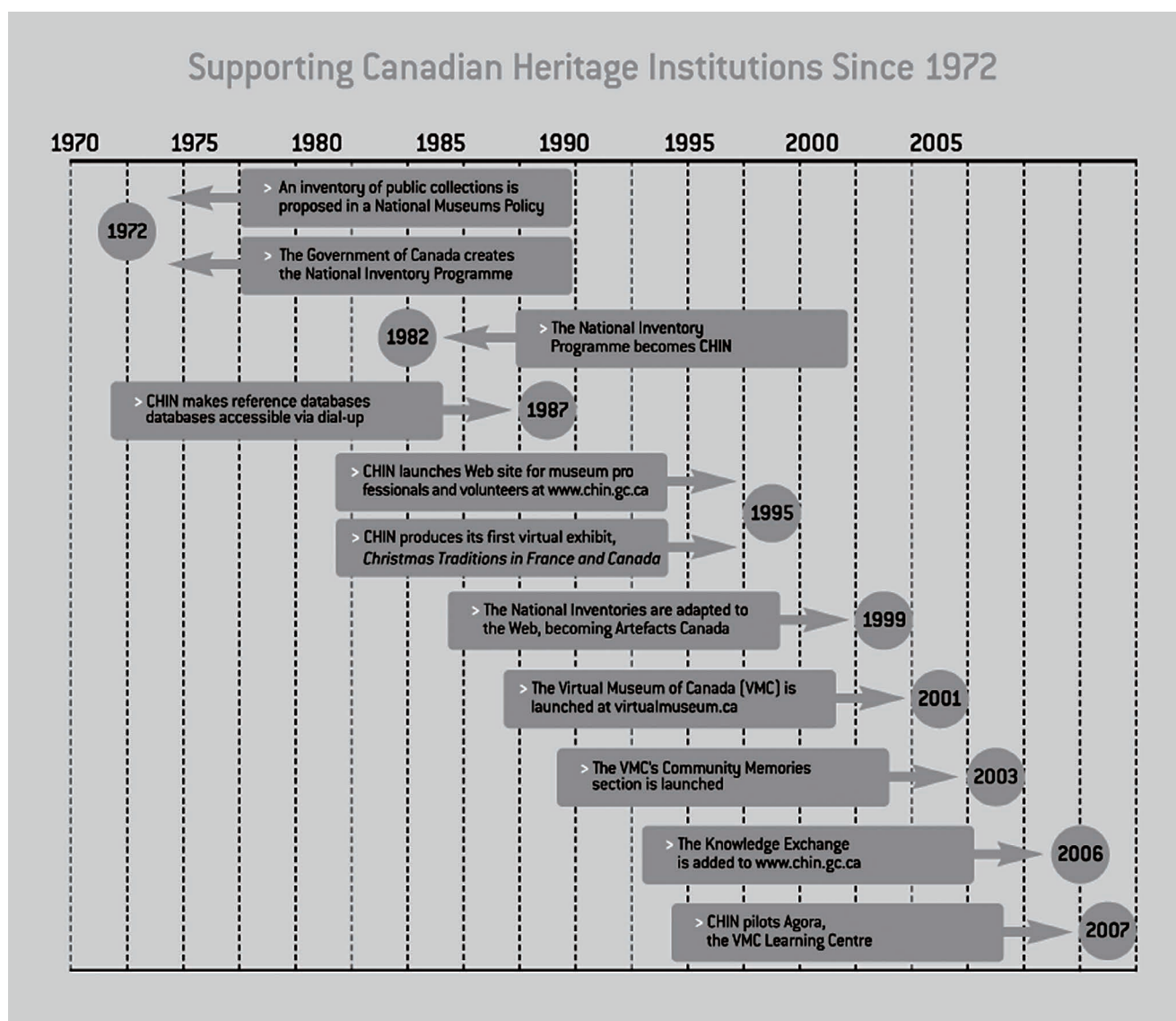


Fig. 1 A timeline of CHIN's most significant initiatives between 1972 and 2007.

means to participate in the Internet initiatives that were available, and to take advantage of the growing pool of resources for museums on the Web.

Also in 1995, as personal computers became more powerful and commercial collections management software became widely available, CHIN began assisting museums with the transition of their collections data from the CHIN mainframe to in-house collections management systems. This assistance included an assessment of a wide range of available software packages, conducted by CHIN and a team of museum professionals. The transition to in-house collections management software was accomplished by spring of 1998.

CHIN continued its participation in the development, promotion, and implementation of information standards, within the Canadian museums community and internationally. CHIN's participation in the Consortium for the

Computer Interchange of Museum Information (CIMI) and the International Committee for Documentation (CIDOC) of the International Council of Museums enabled the international community to benefit from the expertise of Canadian museums while yielding important results that could be applied to the interchange and management of museum information in Canada.

As museum information became more accessible on the Internet, CHIN began producing publications to address issues of copyright and protection of museum data and images on the Web. CHIN also began to provide information to museums on image digitization and collections management through a series of publications, online resources, and workshops.

In 1996, CHIN developed the Heritage Forum, a searchable online journal for heritage professionals with content contributed online by CHIN and users alike.

In 1999, the National Inventories were redesigned for the Web and renamed Artefacts Canada. Canadian museums contribute collections data and images to Artefacts Canada over the Web, and it has become a valuable professional resource.

The 2000s: Enriching the Virtual Experience

In 2004, following feedback from the Canadian heritage community, the Archaeological Sites section of Artefacts Canada was removed. Learning With Museums, launched in 2000, was developed by CHIN with the goal of enabling museums to promote their online educational materials to teachers and students.

In 2001, CHIN launched the VMC. CHIN works with the museum community in a collaborative effort to enable the creation, management, and presentation of digital content.

CHIN maintains two Web portals: the CHIN Web site at <http://www.chin.gc.ca>, which provides professional resources to the heritage community and the VMC at virtualmuseum.ca, which showcases Canadian museums and their collections to a worldwide public audience. CHIN also administers the Virtual Museum of Canada Investment Programs, which support museums in the creation of digital content for the VMC.

The museum information from the Guide was repurposed in the Find a Museum and Calendar of Events sections of the VMC. The rich resource that began as the National Inventories, which represents the results of nearly 40 years of collaboration between CHIN and the museum community, was also incorporated into the VMC—the Artefacts Canada collections records with images became part of the Virtual Museum of Canada Image Gallery. Learning With Museums was made part of the Virtual Museum of Canada Teachers' Centre.

Since the debut of the VMC, people from around the world have embraced this gateway to the exciting multimedia content created by Canadian museums. In its inaugural year, the VMC attracted almost 3 million visitors from more than 140 countries.

To coincide with the launch of the public-oriented VMC site in 2001, the focus of the CHIN Web site shifted to become exclusively a resource for heritage professionals. Artefacts Canada and the Heritage Forum remained on the CHIN site as professional resources, in addition to the publications, courses, and reference databases that CHIN offers.

PROGRAMS AND ACTIVITIES

Artefacts Canada

A growing national inventory, Artefacts Canada (also at <http://www.chin.gc.ca>) provides access to more than

3.5 million collection records from hundreds of museums, as well as more than 600,000 accompanying images. All images accompanying records are also accessible through the Virtual Museum of Canada's Image Gallery. The ongoing contributions of Canadian heritage institutions strengthen Artefacts Canada's value as a research and reference resource for the museum community, while increasing each participating museum's online profile through the VMC.

CHIN Web Site and the Knowledge Exchange

By providing heritage professionals with the means to share their collections and expertise, CHIN helps Canadian museums establish themselves as world leaders in the effective use of information and communication technologies.

CHIN members also access comprehensive products and services that address all aspects of the digital content process. Through its professional Web site and related activities, CHIN helps strengthen the knowledge and abilities of the Canadian heritage community with respect to the creation, presentation, management, and preservation of digital content. Welcoming nearly 4 million visits each year, the CHIN site at <http://www.chin.gc.ca> provides easy access to extensive resources that draw from CHIN's own work and research as well as other centres of expertise around the world.

In May 2006, CHIN launched the Knowledge Exchange, a new section of the CHIN Web site that fuels creativity, communication, and collaboration among heritage professionals by providing self-paced e-learning products, peer-to-peer online communities of practice, and engaging presentations by experts. On subjects ranging from collections management to intellectual property and other topics, the Knowledge Exchange provides museums with a wealth of knowledge on how they can better serve Canadians through emerging technologies. In 2009, the Knowledge Exchange section was expanded to include the entirety of CHIN's professional development resources. Rebranded as the Professional Exchange, the website can be freely accessed at <http://www.pro.chin.gc.ca>.

The VMC

For CHIN and its member institutions, the VMC is by far one of the network's proudest accomplishments. Administered by CHIN, Canada's national online museum brings a rich collection of engaging high-quality online content into Canada's homes, schools, and workplaces.

Through the VMC's digital content, heritage institutions can present their collections to a much wider audience than ever before, while showcasing their innovative use of digital technologies to the world. The Virtual Museum of Canada currently features over 500 online

exhibits that bring to life Canada's treasures and stories; nearly 600,000 images of museum objects; more than 140 interactive games for children of all ages; and detailed listings for nearly 3000 Canadian heritage institutions.

In 2007, the VMC began enabling museums to further engage Canada's educators and learners in active learning through a new pilot project entitled the Agora Research Initiative. Responding to the growing use of the Internet by educators and students, the VMC is adding innovative tools and content (in the form of texts, audio and video files, and animations) that enable teachers to create their own lesson plans and projects, interact with students online, and provide interactive learning experiences.

Virtual Museum of Canada Investment Program: Virtual Exhibits Component

CHIN supports the development of multimedia online exhibits, games, and learning resources to be showcased on the VMC. Under a competitive process, heritage organizations submit proposals to the Virtual Museum of Canada Investment Program to produce bilingual virtual exhibits, interactive games, and educational tools that engage diverse audiences through quality research and appealing presentation.

Proposals are reviewed by an Editorial Board composed of representatives from the museum community, as well as other sectors such as the publishing, education, library, and new media.

Virtual Museum of Canada Investment Program: Community Memories Component

The Community Memories Program helps smaller museums to engage and involve their communities in the sharing of their local history through simple technology. The range of possible subjects for a Community Memories exhibit is endless. Examples include a town's main industry, a historical event, traditional crafts, or a way of life. These productions allow communities to rediscover the people and events that shaped their past and present, bringing otherwise dispersed records into a coherent, engaging narrative. As well, these online exhibits provide Canadians from coast to coast with insight into the values and experiences that have shaped the country's collective identity. Museums with successful proposals are supplied with user-friendly software, and museums with five or fewer full-time employees also receive a standard investment.

Research

CHIN conducts research into how museums can best approach issues such as information management, digital technologies, intellectual property, and standards. It draws on this knowledge to provide research and reference

resources, as well as training opportunities for heritage professionals and volunteers, online and in-person.

CHIN is committed to staying on the leading edge of digital heritage research and technology that enhances public engagement and participation. Accordingly, it mobilizes and supports collaborative networks of heritage institutions and research partners, which leads to the publishing of original research. CHIN also works to improve heritage information management, maximize benefits for knowledge creators and distributors, and increase the ability of museums to capitalize on new business opportunities.

International Activities

CHIN works nationally and internationally, offering workshops, convening meetings on subjects of common interest to its membership, as well as sponsoring and attending conferences and events that provide opportunities for heritage professionals to increase their expertise. Underlying all of CHIN's activities is a continued, collaborative research program designed to advance our collective understanding of issues associated with new technologies and digital content, particularly in the areas of intellectual property and online audiences.

CHIN also represents the Canadian heritage community internationally in projects related to access to heritage information, and has been recognized for its work in developing standards for museum documentation. This work encompasses a broad range of information types and the technical protocols necessary for the exchange of information in a widely distributed environment.

Amongst other international initiatives, in recent years CHIN has taken a leading role in the digital Cultural Content Forum (dCCF), a partnership that brings together government agencies around the world that are dedicated to enabling heritage institutions in the fields of information and communications technologies.

MEMBERSHIP

CHIN and Canadian heritage institutions work together to strengthen our collective ability to create, present, and manage Canadian online content. This collaboration has resulted in the internationally valued Web site for heritage professionals at <http://www.pro.chin.gc.ca>, www.chin.gc.ca, and the highly successful VMC portal at virtualmuseum.ca.

Public, not-for-profit, Canadian museums and other heritage organizations are eligible to reap the many benefits of CHIN membership, including participation in the VMC. Membership is available at no cost to eligible institutions. Membership benefits include, but are not limited to:

- Extensive marketing support to heighten the collective profile of member institutions in schools and among

the domestic and international Web surfing public (e.g., billboard campaigns, press relations, online marketing, contests, search engine optimization).

- Access to CHIN's multifaceted expertise and ongoing technical support.
- Ability to have an important voice in shaping CHIN initiatives, and to participate in the development of programs.
- Presence on the VMC.

CONCLUSION

For over 35 years, CHIN has been an international leader in the enabling of heritage institutions to engage audiences through the use of innovative technologies. CHIN has a strong and privileged relationship with hundreds of heritage institutions and organizations across Canada, and around the world; and it actively nurtures its partnerships in an effort to leverage resources and expertise for the benefit of the Canadian and international heritage community.

CHIN will continue to work closely with the heritage community in the coming years to further enhance and enrich online communication, collaboration, creativity, and access to heritage information. As emergent technologies take hold of public use and interest, CHIN will continue to assist museums and heritage institutions in finding ways to take part in these new phenomena. For instance,

the growing use of iPods and other MP3 players as educational tools enables museums to reach both wider audiences and target demographic groups. We are presently offering presentations from technical experts, as well as step-by-step instructions for transforming heritage content into effective podcasts.

CHIN is also continuing to facilitate knowledge transfer among information and heritage experts. As our members take part in new digitization projects and the development of digitization standards for museums, CHIN will continue to support the transfer of this insight to all members so that their institutions can benefit from broader knowledge.

Finally, CHIN continues to support a cultural environment where museums can create rich public heritage experiences which integrate the virtual world with real-life exhibits and experiences. The organization's longstanding mission to promote the development, presentation, and preservation of Canada's digital heritage content for current and future generations of Canadians will remain a top priority.

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Canadian Library Association (CLA)

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Abstract

The Canadian Library Association/*association canadienne des bibliothèques* is a national, not-for-profit voluntary organization composed of librarians, information professionals, libraries, and information services. It is Canada's largest broad-based national organization focusing on and serving the Canadian library and information community through advocacy, continuing professional development, and the provision of direct products and services.

INTRODUCTION

The Canadian Library Association/*association canadienne des bibliothèques* (CLA) is a national, not-for-profit voluntary organization composed of librarians, information professionals, libraries, information services and suppliers to the library and information sector. It is Canada's largest broad-based national organization focusing on and serving the Canadian library and information (LIS) community. The Canadian Library Association was established in Hamilton, Ontario, Canada in 1946, and was incorporated in 1947.

Canadian Library Association's mission is to be the national voice of the LIS community and to build a stronger LIS community by providing services to its members. The Canadian Library Association provides a mix of tangible services such as continuing professional development, and intangible services such as building the Canadian LIS community by facilitating networking among members. While predominately English-language, CLA provides some services in French.

To assist in providing these services, the association has created five divisions based on type-of-library or role within the LIS community; 24 interest groups based on areas of practice; and numerous and ever-changing committees and task forces to undertake specific work. The five divisions are the Canadian Association of College and University Libraries, including the Canadian Technical and College Libraries section; the Canadian Association of Public Libraries, including the Canadian Association of Children's Librarians section; the Canadian Association of Special Libraries and Information Services, with chapters in Calgary, Edmonton, Manitoba, Ottawa, Toronto, and Atlantic Canada; the Canadian Library Trustees Association; and the Canadian Association for School Libraries.

ROLES AND ACTIVITIES

The Canadian Library Association has developed into a sectoral association, with activities combining the classic

roles of professional and trade associations. The strategic plan adopted in 2004 focused on advocacy and government relations, and continuing professional development, while maintaining direct member services and building a sense of community among practitioners. A new strategic plan is to be released in 2008.

As the major national association, CLA liaises extensively with other national library associations, including the *Association pour l'avancement des sciences et des techniques de la documentation* (ASTED), the Canadian Association of Research Libraries, and the Canadian Urban Libraries Council; other associations in related heritage fields such as the Canadian Museums Association and the Canadian Council of Archives; and with other national and international associations such as the American Library Association (ALA), the United Kingdom's Chartered Institute of Library and Information Professionals (CILIP), and the International Federation of Library Associations and Institutions.

As the main national voice of the Canadian LIS community, CLA advocates for and defends the core values of librarianship such as, for example access to information or freedom of expression. The Canadian Library Association advocates on policy issues that impact library users, including federal legislation on intellectual property rights, right to privacy, and other public policy debates.

The Canadian Library Association also advocates on behalf of libraries and librarianship themselves, particularly on federal programs that directly or indirectly provide funding for library services. Examples of this are the Government of Canada's Community Access Program and Canada Post's Library Book Rate.

In its role as a provider of continuing professional development, CLA holds Canada's largest national library conference, which is moved around the country to facilitate access by those with limited professional development funding. Not wishing to duplicate the conferences of Canada's provincial and regional library associations, CLA's conference is a high-level, "pinnacle" conference targeted at the leaders and senior management in the

Canadian LIS community. Also to advance the profession, CLA publishes a bimonthly magazine that provides in-depth exploration of topics in librarianship.

The Canadian Library Association has taken a leading role in fostering and disseminating research into human resources in LIS services, both by supporting a research project led by the University of Alberta's 8Rs Research Team, and by gaining funding from the Cultural Human Resources Council (a federally supported agency) for an analysis of the gaps between the sector's human resources needs and the training available. This work follows up on an earlier CHRC-funded study of human resources in the heritage community proposed by CLA, ASTED, the Canadian Museums Association, and the Canadian Council of Archives.

To help build the LIS community, CLA provides scholarships to attend library school, grants for research and education in library and information science, awards for excellence in literature for children and young adults, and awards for professional excellence and innovation in the field of library and information science.

The Canadian Library Association also provides direct services to libraries. Since 1996, CLA has administered funding under Young Canada Works in Heritage Institutions (part of the Government of Canada's Youth Employment Strategy) for summer student employment in libraries. Since 2005, CLA has hosted and administered the database of libraries eligible to access Canada Post's Library Book Rate, a set of reduced postal rates for interlibrary loan.

Along with the ALA and the CILIP, CLA copublishes the *Anglo-American Cataloguing Rules*; CLA is a member of the Committee of Principals, established in 1989 to oversee the development of the code. A new online version of the code called *RDA: Resource Description and Access* is under development for release in early 2009. Since 1993, CLA has been the exclusive Canadian distributor of all ALA Editions titles (selected titles were handled prior to that date); and CLA publishes or distributes other works.

GOVERNANCE

The Canadian Library Association is governed by a 12-person Executive Council, with six directly elected members, five division presidents sitting as voting members *ex officio*, and the Executive Director/Secretary serving as a nonvoting member *ex officio*. Each of the five divisions has its own executive boards.

EARLY HISTORY

The pre-establishment history of CLA and an account of the first 25 years could take an entry on its own. Readers

may wish to consult *The Morton Years: The Canadian Library Association, 1946–1971* by Elizabeth Hulse.^[1] and several articles by Basil Stuart-Stubbs published in *Feliciter* and on the CLA Web site.^[2–9] The program of activities developed in 1946 included assuming the duties of the Canadian Library Council, established in 1941. The council had an executive office in Ottawa, published the *Canadian Library Bulletin* and other publications, presented briefs to the government, began microfilming Canadian newspapers of historic importance, and coordinated a library clearinghouse.

In addition to these activities, the priorities outlined in 1946 for the CLA/*Association canadienne des bibliothèques* (the name was changed in 1969 to Canadian Library Association, but the original name was brought back in 2006) included the establishment of a national library for Canada and continuing the microfilming program.

As well, CLA established an indexing service for Canadian periodicals and documentary films (*Canadian Periodical Index*, subsequently sold), supported the publication of Canadian reference materials, developed a recommended salary scale for librarians, and created standards for libraries. A triumph of advocacy, the National Library of Canada was established by an Act of Parliament in 1953. *Feliciter*, the association's newsletter, began publication in 1956 and, following the cessation of the *Canadian Library Journal* in 1992, serves as the membership magazine. The driving force behind the successes of the first 22 years, Elizabeth Homer Morton, retired as executive secretary of CLA in 1968.

The 1970s–2000

A new constitution, adopted in 1973, provided a decisive role for representatives of the provincial library associations as full voting members of the CLA Council. Also in 1973, CLA formed five divisions to provide services on a type-of-library (academic, public, school, and special) or role (trustees) basis.

In 1989, following the CLA President's Commission on Organization (known as CLAPCO; 1987), CLA reorganized its governance. The bicameral structure (consisting of board and council) was replaced by a unicameral executive council. The position of second vice-president was eliminated, as were the provincial representatives, and the number of councillors was reduced from six to three. In 1991, the position of ASTED liaison (the chair of the CLA/ASTED Liaison Committee) was removed from the executive council and the committee disbanded.

Professional development, advocacy, library leadership, membership development, and fiscal development were the strategic priorities throughout the early 1990s. The major issues were nationwide reductions in funding to tax-supported libraries and the concomitant addition of electronic materials and revisions to the Copyright Act.

The Public Lending Right Commission, consisting of authors, librarians, and publishers, was established by the federal government in 1986 to administer a program of payments to Canadian authors for their eligible books cataloged in libraries across Canada. The Canadian Library Association is represented on the Commission.

Working with the federal government and ASTED, CLA organized the National Summit on Information Policy, in 1992, to allow Canada to maximize the benefits stemming from information resources, and, in 1995, CLA launched Library Advocacy Now! (LAN!) to train advocates and champions among the library community. In 2000, the CLA/LAN! Training Institute was established.

When Canada's Copyright Act was amended in 1988, amendments favorable to creators, specifically enabling the establishment of copyright collectives, were included. A "Phase II" set of amendments to address the concerns of users was promised immediately, but these amendments were not, in fact, introduced until 1996. Successful lobbying by the creator community resulted in reductions in the already limited library exceptions being passed in the current Copyright Act in 1997. The exceptions for libraries, archives, and museums went into effect in 1999 when the accompanying regulations were published.

The amendments to the Copyright Act passed in 1997 also established rules limiting "buying around" by libraries—importing a book from a distributor outside Canada when it is available in Canada through an exclusive distributor. The regulations governing book importation were also published in 1999.

OLAM (which originally stood for Online Account Management Service), purchased in 1987 to provide discounts to members on online database services, went into bankruptcy in 1999 and was dissolved in 2000.

Working with publishers, booksellers, and writers, CLA played a lead role in the Canadian Book Summit, held in 1999 to celebrate Canada's most successful cultural product: books.

As part of its work on copyright and in support of the continued public funding of libraries, CLA has had a watching brief on international trade initiatives: in 1998, on the Multilateral Agreement on Investment, and, since 1999, on the World Trade Organization and the World Intellectual Property Organization.

From 2000 On

The Canadian Library Association's advocacy work with the Canadian government has been impacted by government instability in the first years of the new century, with multiple federal elections and Ministerial shuffles since 2000.

In advocacy, work on "Phase III" amendments to the *Copyright Act*, which deal with copyright in a digital environment, continues. The CLA is a member of the Copyright Forum—14 national library, education,

academic, museum, and archive associations representing users' concerns.

With the financial support of a number of international partners, CLA took the lead to sponsor two analyses of the impact of international trade treaties on libraries.^[10,11]

Advocacy continues on both national policy issues such as intellectual property rights and right to privacy, and on funding for libraries and information services.

A joint conference with the American Library in Toronto in June 2003 was greatly impacted by incidents of Severe Acute Respiratory Syndrome (SARS) in the city. Using librarianship's core values of access to information and rational decision-making, CLA urged ALA not to relocate the conference. The American Library Association made the courageous decision to stay in Toronto, and no delegates were impacted by SARS.

The Canadian Library Association organized the second National Summit on Libraries and Literacy in 2006, to review progress since the first Summit in 1995, and to develop plans for future collaboration between libraries and adult literacy organizations.

To build the LIS community, CLA Presidents, and Executive Directors visit the universities and community colleges that teach library and information science or library technical studies, meeting the students and informing them of the role that CLA plays in the community and in their future working lives.

CURRENT TRENDS

The Canadian Library Association continues to be the national voice for the LIS community. It advances the profession through continuing professional development and the support of research; and builds community spirit through its divisions and interest groups.

The expected retirement of the "baby boom" generation of librarians within the next 10 years has put library human resources and succession planning at the top of the issues list for most libraries. The Canadian Library Association is leading efforts to publicize and operationalize the results of *The Future of Human Resources in Canadian Libraries*,^[12] which provides the Canadian LIS community with the data needed to create new approaches to human resource management.

A crisis in school librarianship continues, with teacher-librarians being reassigned to classrooms and a resulting loss of service in school libraries.

Like most other North American associations, a large number of CLA members joined between the late 1960s and the mid-1970s, and many of them will be retiring in the next 5–10 years. As well, many of this "baby boomer" cohort are in senior management positions and either do not have the time or have already served in senior positions within the association. The nature of volunteering has changed, and one of CLAs biggest challenges is to

adapt itself to the behaviors of potential new members so that they replace those retiring, and to encourage these new members to play an active role in CLA.

The implementation of leading-edge membership database, Web site content management software, and the collaborative tools of blogs and wikis form the operational strategy as CLA strives to serve the LIS community.

The Canadian Library Association/*Association canadienne des bibliothèques* can be reached at 328 Frank Street, Ottawa, ON K2P 0X8 Canada, or via its Web site: <http://www.cla.ca/>.

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Careers and Education in Archives and Records Management

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Abstract

Educators and trainers in the field of archives and records management face the challenge of providing for practitioners with widely varying educational backgrounds. At the same time, the professional environment has changed rapidly in recent years as well. Development of research programs is also crucial to the advancement of the profession and the survival of university-based professional education in the discipline. Competency standards for records management are discussed, including their appropriate role in training and education for practitioners. Examples of education and training programs from around the world are mentioned, although the coverage in this entry is not intended to be exhaustive. The role of professional associations as providers of training and in supporting and evaluating professional education programs is also addressed. The International Council on Archives Section for Archival Educators and Trainers provides a community of practice for educators and trainers. Its objectives and recent activities are described.

A wide and growing range of career choices is available to archivists and records managers. Traditional employers are national and regional archives, but there are many opportunities for specializing in aspects of the profession and the types of organizations served by the archives. Professionals with the necessary expertise required to manage digital services are in demand. Initiatives to support people of indigenous origin joining the profession and encouragement for the development of community archives are an area of growing interest.

INTRODUCTION

Education for the archives and records management profession is in tension between the need to provide an entry level qualification for new professionals and the need for generating a professional culture that is capable of finding a way forward through research while at the same time providing appropriately qualified educators for the next generation. Many countries do not have university-based programs and are reliant on short training programs for professional development, or sending prospective members of their profession overseas to gain qualifications or to further their education. At the same time, the profession must educate for a changing technological environment to ensure that sound strategies are developed for capturing, managing, and preserving born digital records. In a special issue of *Archival Science* dedicated to graduate archival education, Karsten Uhde noted: “never before in the history of archival systems has the daily work, the work material, and the whole job profile of the profession changed so quickly and radically as during the last 10–15 years.”^[1] Therefore, one of the current dominating interests in the profession is defining what knowledge and skills the recordkeeping professional needs, of which one manifestation is a drive to identify and document competencies for professional practice. Jeannette Bastian stated the dilemma of designing programs and developing curricula for a profession that must continue to preserve and

manage the record of the past while developing strategies to capture, manage, and preserve records created in rapidly changing and evolving new technologies:

Finding a balance between traditional archival subjects such as palaeography and new developments such as information management, insuring that students are prepared for an electronic information environment and promoting archival education as a professional discipline are all matters that deeply engage and also worry educators.^[2]

Tom Nesmith also explores the issues in designing curricula for a changing archival environment,^[3] while in the same issue Margaret Proctor cautions against a too-close alignment of curriculum with the shifting requirements of public policy and affirms the U.K. postgraduate programs’ strategy of

centr[ing] the educative process around the core elements of the profession—selection, preservation and provision of access; the many methods developed and developing for ensuring the effective performance of these functions; and, most importantly of all, the rationale for these functions, including the consequences for society if any aspect of them is neglected.^[4]

Nevertheless, archivists and records managers must have expertise in legislation pertaining to data protection and freedom of information legislation and the ethical issues

that arise when weighing freedom of access against protection of privacy.

While it is essential for a profession to know what it does, it must be able to validate that practice with a body of theory that is tested, confirmed, and extended through research. The tension between education for professional practice and research is an issue that preoccupies educators, most of whom constitute a small discipline interest hosted within larger university programs such as library and information science, computer science, or history. Nevertheless survival of programs within universities depends on the development of research programs that attract doctoral candidates and bring research grants to the university in order to provide the research expertise that will provide the necessary creative and investigative skills that will carry the profession forward. Furthermore, a doctoral degree is now the minimum requirement for appointment to a teaching post in professional education programs in universities. These programs must produce the next generation of professional educators.^[5] This is not a new concern: Ann Pederson^[6] pointed out the need to encourage archival research programs in universities in 1992, noting that among the barriers were low numbers of teaching programs and full-time professors in archival science; and Carol Couture reiterated the issue in 1996.^[7] In the same issue of *Archivaria*, Barbara Craig^[8] reviews Sir Hilary Jenkinson's thoughts on the need for focused archival education programs in his address at the inauguration of the first post-graduate course in England in 1947, noting that while his curriculum proposals are still relevant, education for research must be added to the archival education curriculum. In 2001, Carol Couture reported in *Archival Science*^[9] on a three-year research program investigating education and research in archival science, commencing with an extensive literature review, which was followed by a questionnaire sent out to educational institutions, national archives, and researchers. Responses from more than 70 different countries were received. By 2004 Sue McKemmish and Anne Gilliland were able to say

The past 15 years have seen unprecedented growth in the development of an archival research consciousness in the academy and in practice, as well as in scholarly awareness that the construct of *the archive*, and *recordkeeping* more generally, provides a rich locus for research and theorising. What has resulted is an unparalleled diversity of what is being studied and how.^[10]

Nevertheless, Richard Cox succinctly summarizes the enormous task facing relatively small archival education programs when he says:

it is difficult to imagine building doctoral programs, mentoring doctoral students, and guiding dissertation research if graduate educators have their time consumed

by teaching masters students, running workshops and supporting distance education.^[11]

EDUCATION AND TRAINING

University programs for archives and records management are found associated with several different disciplines. Traditionally, courses have been associated with either history or library and information science programs, but it is no longer unusual to find them associated with computer science and information systems programs, reflecting the profession's need for skills and knowledge to manage and preserve records that are born digital and to provide appropriate Internet services and access for users. In the United States and Canada, although courses are taught at master level, there are only a few entire programs dedicated to archival science. Most are courses offered within library science or history programs, or taught as optional courses. University level courses devoted to records management are relatively rare in North America. Jeannette Bastian and Elizabeth Yakel^[12] provide a description, based on comprehensive research, of both the availability of courses in archival science in the United States and Canada and what is being taught as "core" curriculum content for introductory archival courses. Two European institutions are dedicated entirely to the professional education of archivists for their respective national public service: The École Nationale des Chartes in Paris, France and the Archivschule in Marburg, Germany. In the United Kingdom archival education is positioned at master level, but all are full master programs dedicated to archives and/or records management, and applicants for the programs must complete a full year's appropriate work experience prior to commencement of their studies. Most European countries that have university-based archival education seat their programs at master level, but in Sweden and the Netherlands programs at both bachelor and master level are found, as is the case in China. Records management is included in the archival education programs taught in Scandinavia and the Netherlands. In Finland, the National Archives is a provider of education programs resulting in formal degrees, alongside university providers of archives and records management programs.^[13]

In South America university-based archival education programs are available in Argentina, Uruguay, and in Brazil. To promote cooperation among archival educators in South America, Red Iberoamericana de Enseñanza Archivística Universitaria was formed in 2000 as a permanent Committee of the ALA (Latin American Archives Association). RIBEAU translates as "Latin American Network of Archival University Training." The purpose of RIBEAU is to promote networking and to seek common solutions to Latin American problems in the field of archival education. In Argentina, archival education is the

subject of a debate between supporters of two types of degrees, on one hand, a specialized and independent course of archival education, and on the other hand, an integrated archival and library program. A third scenario considers a Professional level degree as a Librarian a pre-requisite for any archival training. In Peru the Archivo General de la Nación provides a training school that is not associated with a university and does not result in a formal degree.

In China, there is a strong tradition of archival education provided by a number of universities across the country, of which the Archives School at the Renmin University in Beijing is the largest. Programs range through vocational training courses, university-based courses at bachelor and master level, and doctoral degrees.

In Africa, university-based professional education for archivists is available in South Africa and at the Library and Archive School in Ibadan, Nigeria. An archival training program in French is also available in Dakar, Senegal. There is a strongly expressed need for assistance in developing capacity for archives and records management education in other African countries and in some countries of the Arabic-speaking world.

In Australia, university programs are also offered at both bachelor and master level, taking a recordkeeping continuum approach to archival science as described, for example, by Frank Upward and Sue McKemmish,^[14] integrating what the life-cycle model separates into records management and archives. The first archival education program offered entirely by distance education without any requirement for students to attend on-campus commenced in 1994 offered by Edith Cowan University in Australia.^[15,16] Caroline Williams reported on a survey of archival education programs at the International Congress on Archives in 2004,^[17] at which date there were already over 30 institutions providing courses by distance education in a wide range of models, ranging from paper-based correspondence courses to full online delivery.

Competency Standards

The development of a standard set of competencies for archivists has been the subject of much interest in the profession for more than a decade, accompanied by a debate about whether or not competency models are an appropriate basis for professional education programs in higher education institutions. Marian Hoy^[18] points out that there is no clear and universally accepted definition of competencies, but notes that:

The National Training Information Service (NTIS) of the Australian Government defined competency standards as follows: "Competency Standards describe the skills and knowledge required for a person to operate effectively in the workplace. The standards have been defined by industry, are nationally recognised and form the basis of

training for that specific industry. Standards contain descriptors of outcomes to be achieved and criteria for performance."

Thus they provide benchmarks for assessment of achievement in training programs and are also useful for classifying job descriptions according to the level of performance required. Margaret Crockett^[19] points out that competency standards also

Facilitate recognition of skills across national boundaries; enable workforce mobility; improve professional knowledge and practice; help implement ARM standards; provide benchmark[s] for non-professional stakeholders.

In Australia, the *Records and Archives Competency Standard*^[20] was first published in 1997, having been compiled with the active input of representatives from the Australian Society of Archivists and the Records Management Association of Australasia. Marian Hoy^[21] provides a useful comparison of competency frameworks as an appendix to her article, which explores the structure, uses, and issues surrounding the Australian competency standard.

The National Training Information Service (NTIS) manages the maintenance and revision program for the Standard, which in turn forms the basis of Training Packages for records management training programs available through Innovation and Business Skills Australia^[22] and provided by Technical and Further Education (TAFE) Colleges, which provide a nationally standardised system of vocational training and by other Registered Training Organizations. The NTIS maintains a system for assessing and registering trainers. Nevertheless, standards that document competencies are generally designed for and more suited as an evaluation tool for training than for education programs, which aim to provide a deeper and broader experience than the acquisition of a static set of skills.^[5] Therefore the Australian Society of Archivists and the Records Management Association of Australasia developed a *Statement of Professional Knowledge* (2006)^[23] as a basis for their work in accrediting and recognising university-based programs in archives and records management.

ARMA International's Education Development Group launched a project in 2005 to develop a set of competencies for records and information management professionals, which culminated in publication of the *Records and Information Management Core Competencies*^[24] in 2007. The ARMA International project is a sound exemplar for approaching the development of a competency standard. It brought together an expert panel to create a first draft of the competency model, which was then validated against other models, including those from Australia and Canada. The second draft was then subjected to a survey of 2000 volunteers from the ARMA membership to validate the panel's work and contribute to the final weighting structure.^[19]

In 2006, competencies for the archival profession were among the main topics for discussion at both the 7th European Conference on Archives in Warsaw and at the Society of Archivists (United Kingdom) annual conference. One outcome of the European conference was a resolution^[25] to:

- “Encourage the European Branch of the ICA (EURBICA) and the Section for Professional Associations of ICA (SPA) to carry out a feasibility study for a project to develop a European competency framework for the archival profession;
- “Recognize the need to develop and sustain professional standards through certification procedures for individuals, organizations, and education programs;
- “Underline the need to advance the creation and development of virtual educational tools for promotion of online training through the use of new technologies.”

The conference participants also resolved to “encourage the key educational institutions teaching archivists to:

- “Strengthen cooperation and common initiatives in order to increase the quality of archival education;
- “Improve tools for the assessment of the quality of archival education for accreditation.”

The Role of Professional Associations in Education and Training

The two peak professional bodies for records managers and archivists play an important role in supporting professional education and training, as do many of their national counterparts. The International Council on Archives (ICA)^[26] makes education and training one of its four strategic priorities, while ARMA International^[27] is itself a provider of training which includes online courses. Provision of the ARMA certification program is contracted to the Institute of Certified Records Managers (ICRM).^[28] Applicants receive the CRM designation by meeting both educational and work experience certification requirements established by the ICRM and by passing the required examinations. Two of the regional branches of ICA play an active role in the provision of training programs. EASTICA,^[29] the East Asian Regional Branch, in cooperation with the Hong Kong University runs four-week intensive courses (2003, 2004, 2007, 2008) leading to the award of a Postgraduate Certificate in Archival Studies. PARBICA,^[30] the Pacific Regional Branch, provides training in association with its regular conferences and has worked intensively since 1999 to encourage the development of a formal education program in the region. However, their initial plan to establish a distance education program at the University of the South Pacific stalled due to a lack of funding commitment by the university. PARBICA is now working with a wider focus, and aims to

provide a clearinghouse of information on educational opportunities for archivists in the region.

Some national professional associations also assess and accredit university-based courses within their national boundaries. The Society of Archivists (United Kingdom) does so, and provides a further program that mentors new graduates toward Registration over a minimum period of 3 years after graduation,^[31] but there is no further requirement for refreshing professional knowledge.^[32] The Australian Society of Archivists (ASA), Inc.^[33] and the Records Management Association of Australasia^[34] both have accreditation programs for university-based education programs. Graduation from a recognised program facilitates progress toward professional status in these two organizations. In the ASA, graduation from an accredited course shortens the route to professional membership, but is not an essential qualification. The Society of American Archivists (SAA) does not accredit programs, but provides a set of *Guidelines for a Graduate Program in Archival Studies* which the SAA considers “defines the minimum requirements for a graduate program in archival studies that is coherent, independent and based on core archival knowledge.”^[35] The Norwegian professional association Norsk Arkivråd^[36] plays an active role in encouraging the development of archives and records management education and itself provides training courses and sponsors workshops for those already working in the profession. The Finnish Association of Business Archivists provides training in records management,^[13] inspired by the American Certified Records Manager program sponsored by ARMA International. The German Association of Business Archivists^[37] is also a provider of records management training programs.

National professional associations in general provide some form of continuing professional development programs, yet few make active participation a condition of continuing professional status, although Margaret Crockett,^[32] for example, argues that this is one of the hallmarks of professionalism. The Records Management Association of Australasia requires professional members to submit an annual return as evidence of having met minimum requirements for participation in approved activities such as attendance at conferences and training courses, presentation of papers, or publications. A more rigorous approach to continuing professional development would require a system of accrediting either training providers or training courses to provide quality assurance, yet evaluation and endorsement of training programs is often seen as too difficult, or simply beyond the capacity of professional associations, although they are willing to undertake accreditation of university-based professional education programs.^[5]

There are also some scholarships funded by professional associations to encourage those studying for professional qualifications. These include ARMA International's Educational Foundation,^[38] the Association of Canadian Archivists Foundation,^[39] the Records Management

Association of Australasia^[40] and the Indigenous Special Interest Group of the Australian Society of Archivists' Loris Williams Scholarship, set up to support Aboriginal and Torres Strait Islander students in archives and records.^[41] Positive action for training archivists and records managers from ethnic minorities is an important development, particularly in countries where issues surrounding the past treatment of indigenous people is in the process of being addressed, or the proportion of recent immigrants is increasing.

ICA Section for Archival Educators and Trainers

The ICA Section for Archival Educators and Trainers (ICA-SAE)^[42] was formed after decisions taken at the 11th International Congress on Archives in Paris in 1988. In 1990 it succeeded the ICA Committee on Professional Training (ICA/CPT) which had been founded in 1979. It aims to provide professional support for educators and trainers worldwide and has more than 100 members spread across all continents. Its objectives are:

- To promote cooperation between archival training institutions and all those who are responsible for the education and training of archivists, and of other archives professionals.
- To assist in the development of archival research and the definition of standards, methods, and qualifications for archival education.
- To gather and disseminate information about programs of training institutions and other training activities and evaluate them.
- To cooperate with other bodies of the ICA in the preparation of training activities, training programs, and teaching for the various fields of archival work.

It has produced a range of publications and resources for teachers and trainers. Among the most notable are *What Students in Archival Science Learn. A Bibliography for Teachers*,^[43] a classified bibliography of resources in a wide range of languages. Jeannette Bastian and Elizabeth Yakel^[12] note that this work reports

on the frequency with which specific readings that were used and identified which archival education programs assigned a given reading. Unfortunately, there was no analysis of these usage patterns or implied interrelationships between programs. Still, this later work represents a significant snapshot of readings assigned in different archival courses.

More recently ICA-SAE has developed and published the *Train the Trainer Resource Pack*,^[44] which has been translated into Spanish, Bahasa Indonesia, Portuguese, and French, with translations into more languages proposed. The *Train the Trainer Resource Pack* is an

important means of increasing training skills among professional archivists and records managers. These training skills will enable sharing of professional knowledge and expertise more effectively in in-house training programs, courses for volunteers and in continuing professional development programs.

ICA-SAE works with educators around the globe to hold regional conferences, aiming to bring educators and trainers together to form regional networks, developing a community of practice through which knowledge is shared and capacity in education and training is increased. Since 1988, 17 international conferences have been held.

Providers of Education and Training

Many national archives provide in-house training for their own staff and those that have a legislative mandate to control and monitor recordkeeping standards in government usually also provide at least some basic training for records managers in government agencies. In some countries where there is little or no access to formal professional education, such training is crucial. However, few are able to cater for those in recordkeeping roles in nongovernment organizations. Some countries host training programs for archivists in other countries. Examples include the Les Stages Techniques Internationaux d'Archives, through which the Archives Nationales de France provides training programs for archivists in the francophone world; the Postgraduate Diploma course at the National Archives of India; the National Archives of Malaysia which provides training workshops and participates in exchange of archivists with other ASEAN countries; the Riksarkivet (National Archives) of Sweden in association with SIDA (the Swedish International Development Cooperation Agency) provides a course *Records Management in Service of Democracy* for archivists and records managers from African countries, followed up by visits by the course leaders to the participants in their own countries.^[45] Russian training expertise has also historically been available to former Soviet countries. Other national archives provide active support for courses and training activities offered through ICA Regional Branches, as for example support for PARBICA programs provided by the National Archives of Australia and Archives New Zealand.

The International Records Management Trust (IRMT) was established as a nonprofit organization in 1989 "to respond to widespread and progressive deterioration in recordkeeping in the developing countries."^[46] Its current goal is expressed as an aim to help "governments and organizations move to electronic environments by building trustworthy records management systems as a foundation for data integrity and management information systems."^[47] One of the three major foci of the Trust is the provision of education and training programs, provided through a network of international professionals.

It also undertakes research on the relationship between records management and governance and provides consultancy services, all of which inform the development of its training products. The IRMT's study materials can be downloaded and used without charge.^[48]

The ICA-SAE publishes a *Directory of Archival Education and Training Institutions*. The first edition was published in 1992 and the second edition in 2004.^[49] The Directory is incomplete for several reasons. The first is that the information gathering used a snowball technique, commencing with members of ICA-SAE at the time and depending on them to send the survey to organizations in which those members had contacts. The second reason is that submission of entries is entirely voluntary and dependent on providers completing and returning information to the editors. Thus there are gaps in the data for the francophone world, for Africa, South America, and for the United States. However, the SAA provides an online *Directory of Archival Education*^[50] which is kept up to date by education program providers. The ICA-SAE *Directory* also focused on university-based programs and only two providers of professional training courses outside formal university programs submitted an entry, yet the provision of short training courses is an important means of building capacity and improving professional skills in most countries, including those where university-based courses are available. Since the data were gathered for the last edition, new courses have begun in Japan, Switzerland, New Zealand, and South Korea, for example, and in Australia some courses have ceased and a new one has commenced. The Section therefore plans to revise the content and provide a facility for education and training providers to update their own entries online. Providers may submit a new or revised entry by contacting the ICA-SAE at <http://www.ica-sae.org>.

CAREER OPPORTUNITIES

Archivists and records managers have a wider range of career opportunities than ever before, and the options are growing. National, state, and regional archives remain the largest organizational employers of recordkeeping professionals in every country. National archives with a legislative mandate to play a key role in ensuring good governance and accountability have a strong role in the development of policy and standards for recordkeeping across the whole of government. They employ professionals who can research and develop jurisdiction-specific policies and standards for recordkeeping best practice, as well as developing and providing the advice, training and tools to assist compliance in government agencies' records management programs. Archival organizations now provide access to their services and collections via the World Wide Web and thus need recordkeeping professionals appropriately educated with the skills to manage the

provision of these digital services. As governments increasingly move toward providing public services via the Internet, professionals able to provide the necessary recordkeeping infrastructure that underpin e-government are in ever-increasing demand, along with expertise in data protection and privacy legislation. Large archival organizations provide opportunities for promotion through a structured career path as well as opportunities to gain wider professional expertise by moving across internal departments and services. The services of records managers are also in high demand in business and nonprofit organizations of all types. Records and information management professionals, with their systematic knowledge of organization-wide information structures, are well-qualified to take high-level positions as Chief Information Officers (CIOs). Qualified and experienced professionals who set up their own business as free-lance consultants or work for larger providers of professional consultancy services are in high demand to manage or undertake short to medium term projects that require professional expertise, or for filling temporary staffing shortages.

There is a wide range of other types of archives, as evidenced by the growing number of special interest sections of professional associations. In the International Council on Archives,^[51] these include: Notarial Records, Architectural Records, Business and Labour Archives, Archivists of International Organizations, Archives of Churches and Religious Denominations, Literature and Art Archives, Municipal Archives, Sports Archives, Archives of Parliaments and Political Parties, University and Research Institution Archives as well as a Section for Archival Educators and Trainers, and a Section for Records Management and Archival Professional Associations. Many national professional associations for archivists host similar sub-groups to cater for the sectoral interests of their members. For example, the SAA hosts a similar range and also includes groups focused on particular archival functions, such as Acquisition and Appraisal, Reference, Access and Outreach, and Preservation, together with a section on Museum Archives. Museums and galleries frequently contain archives to support and extend their collections and collectively employ a considerable number of archivists, although the majority of such collections are small and often have only one archivist, or part-time volunteers. Community archives are also increasingly in evidence. The United Kingdom provides a number of examples of these, where communities and immigrant groups work to develop collections that record their memory, their experience of arrival, settlement, community development, and traditions old and new.

The Australian Society of Archivists also has special interest groups covering the usual spread of special interests, but also caters for Electronic Records, for School Archives, and for Indigenous Issues (IISIG). The IISIG has been formed for professionals with Australian and Torres Strait Island indigenous heritage and professionals

who work with managing and providing access to records about indigenous people and the issues surrounding their treatment in the past. The Association of Canadian Archivists also has a Special Interest Section on Aboriginal Archives (SISAA).^[52] Archivists who work with film and sound archives and in broadcast television and radio have their own professional association and the international body is the Co-ordinating Council of Audiovisual Archives Associations (CCAAA).^[53] There are currently very large projects underway in a number of countries to manage the transfer of analog television and film archives to digital format in such a way as to ensure it is preserved and retrievable in the long-term.

And finally, but certainly not least, the role of educator or trainer for the recordkeeping professions is a particularly rewarding and stimulating career choice that requires sound academic achievement and well developed research, communication, and training skills.

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Careers and Education in Information Systems

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Abstract

This entry discusses the nature of information systems (IS) and the educational opportunities and careers in the information systems field within library and information science (LIS). The entry includes descriptions of the types of institutions that teach IS from a LIS point of view, standard curricula for B.A. and M.S. degrees, careers open to graduates from beginners to skilled professionals, and opportunities for continuing education. These educational possibilities are put in perspective by considering the nature of the IS industry with which professionals deal, the strategic use of IS in libraries, and the future directions of IS.

INTRODUCTION

Managing the vast stores of information and knowledge in libraries, in databases, and in knowledge repositories involves deep understanding of information systems (IS). This entry discusses the nature of IS and the educational opportunities and careers in the field.

University education in IS is centered principally in schools of business whose research objectives are to improve the application of IS in (usually profit-maximizing) organizations. Libraries are considered a specific field of application. IS studies in business schools and other departments such as computer science generally cover the fundamentals, but they do not emphasize the role of IS in library and information science (LIS). The uses of IS in LIS are taught principally in schools of information or informatics that emerged from schools of LIS. These schools usually offer full degrees or minors in IS specifically directed to libraries. Their emphasis is on the creation, processing, storing, and retrieval of information and knowledge.

A way of thinking about the use of computers in libraries is that it is similar to electronic commerce (e-commerce), the conducting of business over the Internet or over private networks. Many current library activities are forms of e-commerce. At the customer level, if you or I want a paper or a book or a question answered, we interact with the library in a way that is similar to e-commerce—ask for something and it is delivered electronically. On the supply side, libraries buy information electronically from JSTOR and other database providers such as LexisNexis, and obtain copies of books and journal articles from other libraries by e-order. E-mail is universal. All these activities depend on design and management of the IS behind them. In short, IS are at the core of how twenty-first century libraries really operate.

In keeping with the authors' backgrounds, this entry provides a view of IS in general. It covers the following topics:

- Differences among IS, computer science, computer engineering, and LIS.
- Education in IS: B.S., M.S., and Ph.D. level curricula.
- Schools of Information and Informatics.
- Training and continuing education.
- The IS industry (vendors, service providers, out-sourcers, internal IS groups, and consultants).
- Specializations and job categories in IS (including total employment nationally and internationally).
- Careers in IS (in internal groups in institutions; in external vendors; working with user groups; “verticals” such as health, communications, technology vendors, education; joint projects between firms, departments; and global teams).
- Professional associations in IS.
- Strategic use of IS.
- Future of IS.

INFORMATION SYSTEMS VS. LIBRARY AND INFORMATION SCIENCE VS. COMPUTER SCIENCE VS. COMPUTER ENGINEERING

While IS, LIS, computer science, and computer engineering are all concerned with managing information and knowledge, they are studied (and consider themselves) as different disciplines. In this subsection we consider the similarities and differences among them.

Library and Information Science (LIS) is defined in Prytherch^[1] as

the study and practice of professional methods in the use and exploitation of information, whether from an

institutional base or not, for the benefit of users. An umbrella term, abbreviated LIS, is used to cover terms such as library science, librarianship, information science, information work etc.

In terms of IS, LIS focuses on such areas as document and records management and knowledge.

Computer Science (also called computing science) involves studying the foundations of information and computation and their application in computers. It is also concerned with computer languages and computer software.

Computer Engineering (also called electronic and computer engineering) combines computer science and electrical engineering. It focuses on software design, computer hardware design, and the integration of hardware and software.

Information Systems (IS) involves the study of the “(1) acquisition, deployment, and management of information technology resources and services . . . and^[2] development, operation, and evolution of infrastructure and systems for use in organizational processes.”^[2] Information systems differ from computer science and computer engineering in that the latter two are concerned with the creation of hardware and software rather than with their organizational implications. Information systems as a whole is a superset of IS within LIS.

EDUCATION IN IS

Table 1 summarizes the educational enterprise in IS. Degrees in IS are available at the

- Undergraduate
- Masters
- Ph.D.

levels. Model curricula and accreditation are available in the United States at the bachelor's and M.S. levels. Ph.D. programs are not standardized in this way. The most recent model curricula are published respectively in Gorgone, Davis et al.^[2] for the undergraduate degree and in Gorgone, Gray et al.^[3] for the master degree.

In the United States, these degree programs are housed in

- Schools of Information and Schools of Informatics.
- Schools of Business.
- Schools and Departments of Computer Science.
- Schools of Liberal Arts.

Many, but not all of the Schools of Information and the Schools of Informatics are descendants of Schools of Library Science that changed their name and expanded their offerings and their faculty to include IS (see discussion below).

UNDERGRADUATE MODEL CURRICULUM

The undergraduate curriculum^[2] is based on the following image of the IS professional with a bachelor's degree:

1. Has a broad real-world perspective.
2. Has strong analytical and critical thinking skills.
3. Has interpersonal communication and team skills and strong ethical principles.
4. Designs and implements information technology solutions that enhance organizational performance.

The curriculum is directed to people studying in business administration programs but is tailorable to students studying in other disciplines such as LIS. Specifically, it contains:

1. General courses in IS suitable for all students regardless of their majors or minors.
2. Specialized information technology and application design courses for both majors and minors in IS.
3. Specialized application development, deployment, and project management courses for majors in IS.

The output desired for IS majors, is shown in Fig. 1.^[2] The course structure is shown in Table 2.

MSIS CURRICULUM

The M.S. model curriculum^[3] is directed to create graduates who are prepared to provide leadership in the IS field. M.S. graduates should have the same skills, knowledge,

Table 1 Information systems education.

Academic level	Model curriculum	Depts/schools in universities	Delivery of offerings
Undergraduate	IS2002 ^[2]	Schools of Business	Full time
M.S.	MSIS 2006 ^[3]	Schools of Business, Schools of Information	Full time, part time, remote via Internet or video
Ph.D.		Schools of Business, Schools of Information	Full time, part time, remote via Internet or video
Training and continuing education		Short courses, certificates	In class, on site, and remote (e.g., via the Internet)

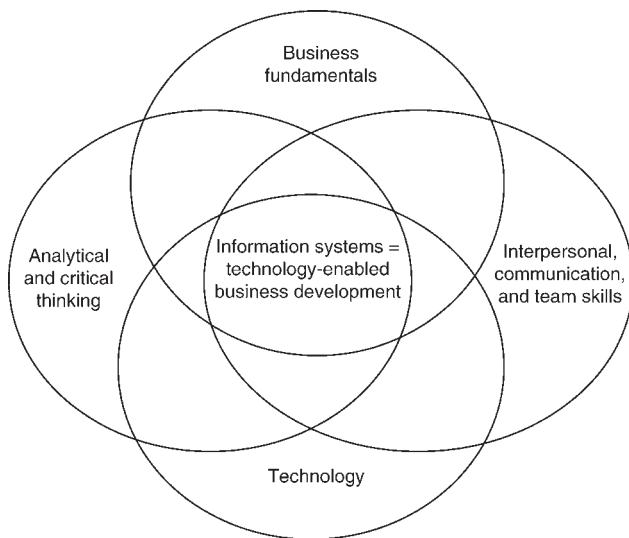


Fig. 1 High-level categorization of IS graduate exit characteristics.

and values as B.S. or B.A. graduates (Fig. 2^[3]) but at a higher level.

The M.S.I.S. course set recommended for IS professionals is listed in Table 3.

To be eligible to take these courses at the M.S. level, students are expected to have completed four prerequisite courses: two in IS:

- IS fundamentals
- Programming, Data, Files, and Object Structure

and a two-course sequence in business functions and processes.

All four prerequisite courses are usually already completed by students with an undergraduate degree in IS. However, students coming from other majors, such as LIS, may be required to take some or all of these prerequisites if they did not take them as undergraduates.

The M.S.I.S. program shown in Table 3 consists of 12 courses divided into three parts, each consisting of four courses.

- IS technology.
- Managing IS.
- A coherent sequence in a specialization area.

IS technology. The IS technology courses, shown in Table 4, focus on the broad range of technology-based topics that an M.S. student needs to know. Some topics appear in several courses because they are discussed from different viewpoints. The amount of time devoted to topics varies; for example, the discussion of human–computer interaction is extensive in the analysis, modeling, and design course because of the importance of the human factor in that subject.

Managing IS. No matter what the size of the organization, successful operation requires a working, and preferably highly efficient IS. IS management turns out to be one of the more complex problems organizations face. In libraries, as in most business organizations, IS are viewed as overhead that is necessary but whose costs should be minimized. Yet minimizing cost requires a trade-off with service.

Table 5 shows the suggested content of the management courses.

Specialization track. The purpose of the specialization track is to teach students about the specific field they want to work in and to provide field experience through a practicum. IS programs, given the need for economies of scale and the available skills of their faculty, usually can offer only three to five different specialization tracks. The tracks are usually technical, organizational, human factors, or tailored to specific industries that are prevalent in an area (e.g., software in Seattle, financial institutions in New York). Typically, the specialization tracks involve selection from among elective courses. Note that specialization tracks can be lockstep or custom tailored to individual students by mixing and matching electives.

In schools of information (see next subsection) that offer both library science and IS degrees, one of the specialization tracks is based on issues paramount in LIS (e.g., courses in databases, data retrieval, information issues, knowledge management, and more specialized

Table 2 IS2002 course structure for undergraduates.

Prerequisite	IS 2002.P0 Personal Productivity with IS Technology
Information systems fundamentals	IS 2002.1 Fundamentals of Information Systems
	IS 2002.2 Electronic Business Strategy, Architecture and Design
Information systems theory and practice	IS 2002.3 Information Systems Theory and Practice
Information technology	IS 2002.4 Information Technology Hardware and Software
	IS 2002.5 Programming, Data, File and Object Structures
	IS 2002.6 Networks and Telecommunications
Information systems development	IS 2002.7 Analysis and Logical Design
	IS 2002.8 Physical Design and Implementation with DBMS
	IS 2002.9 Physical Design and Implementation in Emerging Environments
Information systems deployment and management processes	IS 2002.10 Project Management and Practice

Source: Gorgone et al.^[2]

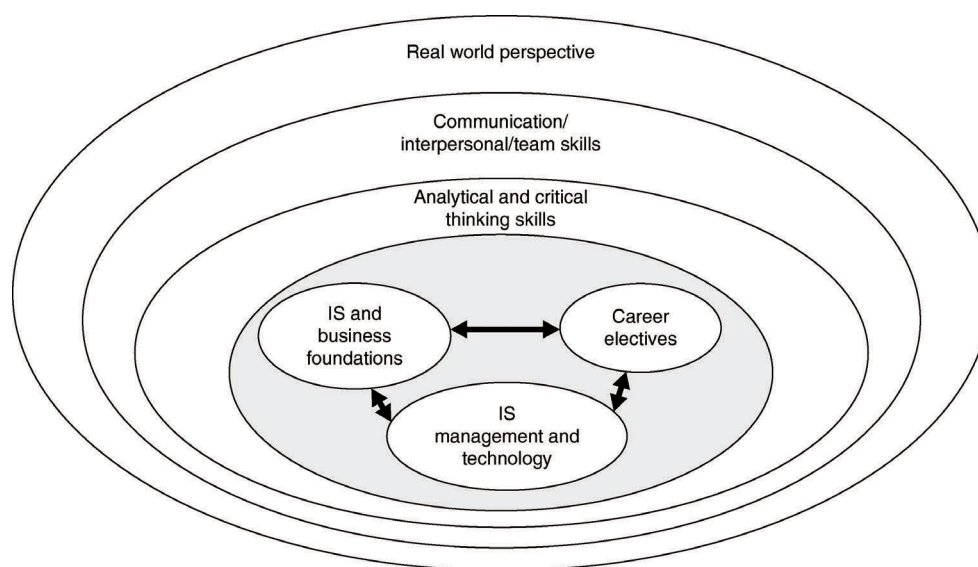


Fig. 2 M.S. level output model.

issues such as geographic IS). In M.S. programs located in schools that do not offer library science, the specialization track requires selection of appropriate electives.

The conclusion from this brief survey is that potential students and faculty with interests in both library science and IS should read school descriptions carefully if their interest spans the two disciplines.

TRAINING AND CONTINUING EDUCATION

Because of the rapid changes in information technology and software, even highly educated practitioners require updates to their skill sets. As a result, a large number of training offerings are available commercially or through universities. These offerings typically span from 3 to 5 days. Vendors offer courses at multiple locations on a weekly or monthly basis. Moreover, they produce online training (CDs, DVDs, and Internet accessible) for many software and hardware products, including the most popular ones produced by Microsoft, Oracle, and Cisco. These companies offer certifications that claim that the person who obtains them is qualified to install and maintain the

related products. Many information-related jobs call for such certifications, although the value of these certificates seems to be declining.^[4] Leading-edge libraries offer training for software that supports specialist areas such as geographic IS, statistical analysis systems, databases, and bibliographic systems. Information professionals who want to manage information departments and resources often attend one of the part-time, evening M.S. programs in IS available in most urban areas. Community colleges also offer courses and associate degree programs in IS.

THE IS INDUSTRY

Information systems pervade American organizations, including libraries. To create and service these organizations, a large number of

- Equipment manufacturers
- Software firms
- Service providers and outsourcers
- Internal IS organizations
- Consultant organizations

Table 3 M.S. courses.

IS technology	Managing IS	Specialization tracks
IT infrastructure	Project and change management Strategy and policy Implication of digitization Integrated capstone	Four courses in depth in a particular subject area including, where possible, a practicum course involving experience in an organization
Analysis, modeling, Design, including Human-Computer Interaction Enterprise Systems Emerging technologies and issues		

Table 4 Contents of the technology courses.

IT infrastructure	Analysis, modeling, and design	Data and data management	Emerging technologies and issues
IT architecture	Human–computer interaction	Information content	Data mining
Enterprise Information Infrastructure	Systems development methodologies	Distribution	Sourcing
Servers and Web services	Requirements determination	Process management	Web services and business processes
Layered network architecture	Team organization and communications	Data warehousing/data marts	Technology convergence
Internet protocols	Feasibility and risk analysis	Data mining	Security
Global WAN services	Design reviews	Managing storage area networks	Organizational intelligence
Enterprise network design	System development life cycle	Large systems (ERP)	Knowledge management
Wireless technologies	Conceptual and logical data modeling	E-commerce	Mobile computing
Network management	Database implementation	Content management	Ubiquitous computing
Server architectures	Data organization		
Storage management and networks	Software and systems metrics		
	Software package evaluation		

Source: Gorgone et al.^[3]

were created over the years. The stories of vast wealth accumulated by the founders of many of these organizations are part of the folklore. In this section we describe the role of each of these types of organizations and their relation to libraries.

Equipment (hardware) manufacturers. When computers first came on the scene commercially in the 1950s and 1960s, the focus was on building computers and peripheral equipment such as displays and printers. The

machines were large, horribly expensive, and designed for medium and large firms and government agencies that could afford them. Following the introduction of the IBM PC Model 51 in 1981, personal computing became generally available and is now pervasive.

The technology broadened so that it now includes telecommunications that allows computers to be networked together. Telecommunications, in turn, made it possible to connect to the Internet. Where previously connection

Table 5 Suggested content of the managing IS courses.

Project and change management	Implications of digitization	Policy and strategy	Capstone
Project life cycle	Ethics	Relationship between IS and the business	The enterprise as a system of integrated business processes
Project stakeholders	Privacy	IS and competitive position	Relationships with suppliers and customers
Project planning	Govt. regulations	Aligning IT goals and strategy	Strategic alignment of IT with the business
Software cost estimation	Globalization and sourcing	Creating IT values, vision, and mission	IT organization and governance
Work module design, assignment, version control	Intellectual property	IT strategic planning, infrastructure planning and budgeting	The value of IT
Role of repository, project library	Virtual work and telecommuting	IS implementation	Role of the CIO
Contingency planning	Implications of artificial intelligence	Inter-organizational systems	Sourcing
Reporting and controls	Security measures and planning	Outsourcing versus insourcing	Compliance
Testing and testing plans: alpha and beta	E-commerce	Globalization	Integrated enterprise architecture
Project Manager skills	Digital divide	Risk management	Platform choices
	IT workforce	Virtual organization	Impact of standards
			Vendor strategies

Source: Gorgone et al.^[3]

to the electric power grid was required, computer equipment is moving to wireless. Miniaturization led to ever less space being required and less heat generated.

Computer prices dropped from millions of dollars in 1960 to thousands today and computer user skills are nearing universality. The result is a computer-literate population that is accustomed to the digital life. The drop in costs made it possible for libraries and information repositories to use the technology to improve service and capabilities. However, recognize that while individual personal computers are cheap (prices under \$1000/unit for the hardware are common), the large number of individual units required, as well as the cost of servers, networking, and peripherals still makes the total cost of ownership considerable for an organization. The term servers, as used here, refers to dedicated computers that provide software and other services to computers on a network. In some arrangements, a server can also be used to do local computations.

Software firms. In the early years of computing, software was literally given away with the hardware, since programmers were few and programming computers was a highly complex, skilled art. By the early 1960s, firms sprang up that offered software commercially with different versions compatible with the major mainframe types. The software was high priced and was almost exclusively rented. That is, ownership did not pass to the purchaser. Rather, the software firm charged an initial price and then an annual maintenance fee, typically equal to 15% of the initial price. The result was lock-in. That is, once a particular piece of software was acquired, it became quite expensive to switch to another vendor. An annual maintenance fee was charged by the software firm to cover its cost of revising and updating the software as the hardware changed and additional features were added. For PCs, the policy is different in that its copies of software are cheap and it is possible to own the software. However, upgrades of the software must be purchased, often at or near the same price as the original. Maintenance requires separate contracts.

The range of software available expanded over the years. Typical office suites offer word processing, spreadsheets, presentation graphics, small databases, and more. Specialized software is required for large databases for data warehousing, for knowledge management and other subjects of interest to libraries.

The Internet is a separate issue. Software for access (i.e., browsers) is currently free, but hardware is required for connection. The major problems of the Internet deal with content. In addition to viruses, worms, spyware, and other “malware” directed toward ruining or interfering with content, spam is a major concern. Spam refers to unsolicited, unwanted advertising, most of it for dubious products. For libraries, be they public or in a corporation, access to pornography over the Internet needs to be avoided. Software to deal with these issues is available,

but it is not perfect. In fact, there is an arms race between providers and preventers of improper information, with one side or the other ahead at any particular time. Another content aspect is copyright protection where computer users want access to copyrighted material to which they are not entitled. Liability issues on copyright were still in contention when this entry was written in 2008.

Service providers and outsourcers. Libraries are faced with a classic “make or buy” problem. Although they can create their own computing environment, most purchase all or part of it from vendors such as catalog and database providers. Vendors include application service providers (ASPs) and outsourcers. ASPs provide computer-based services to customers over a network. A classic example is the Internet Service Provider (ISP) who offers connections to the Internet.

Outsourcers are contractors who perform computer work ranging from internal production to managing a firm’s operations to providing call centers. The movement of such work is called outsourcing and offshoring. Offshoring refers to contracting beyond the boundaries of the country whereas outsourcing usually refers to moving work domestically. Domestic outsourcing, of course, simply shifts jobs from an organization to a firm that specializes in some aspect of IS but still employs domestic workers. Although newspapers and magazines are filled with stories about moving jobs from high-wage western countries to low-wage countries such as India and China, only a small portion of IS jobs have moved overseas. For example, a 2008 survey shows that approximately 1.1% of IS jobs were offshored and that the trend is toward less offshoring and more domestic outsourcing in the future.^[5] Although small in percentage of jobs, offshore software outsourcing still involves large sums of money. For example, a study published in November 2007^[6] estimates revenues of near \$55 billion alone for India, China, Malaysia, and the Philippines.

A growing number of firms provide “Software As A Service.” That is, work is sent electronically to the ASP either over the Internet or on a private network. The ASP provides the computers and software that performs contracted tasks. The advantage is that the library does not need to perform that work internally at the cost of giving up some control over the work and how it is performed.

Internal IS organizations. Where a library system (usually with multiple locations) is a government service, their information operations may either be outsourced to a centralized information group that provides services to a number of government agencies or may be served by its own IS organization. Internal organizations, like those in businesses often have the advantage that they are part of the organization and know its needs. They can be more responsive in terms of both time and resources made available. This characterization assumes that the internal organization is not dysfunctional as internal IS operations

sometimes can be. With an internal IS function, the library system is locked into its organization. If the internal organization is dysfunctional, outsourcing is one way of attempting to resolve the dysfunctionality.

Consultant IS organizations. IS consultants are called in when a specific problem needs to be solved and the organization does not have the skills or the personnel needed within their internal organization. Consultants do not come cheap. They are experienced, quality people and operate in a high overhead environment since they need to cover not only their costs while employed by a client but also their costs when between engagements.

Hiring consultants is, in effect, renting knowledge. It is a speculation. It is not possible to predict whether the consultants' work will pay off. They are hired based on the reputation of their organization and people, their past success, and their potential. Knowledge rentals involve knowledge transfer from the consultant to the client. Even though consultants are temporary hires, some knowledge will stay after they leave. Some consultants offer training as part of their service. Although libraries seek their help in solving specific problems, it is wise to write the consulting contract to include knowledge transfer.

SPECIALIZATION AND JOB CATEGORIES IN IS

The United States Bureau of Labor Statistics (BLS) provides a classification and comprehensive description of information-related jobs and requirements, the number of persons (currently) employed in these jobs, and a forecast of the expected growth in the number of these jobs. The statistics presented in this section are from the 2008–2009 version of the *BLS Handbook*. Libraries typically keep only the latest annual version of the *BLS Handbook*. Thus, the data presented in Table 6 are, in some cases, obsolete in years beyond 2008. However, it is our experience that the categories and numbers change slowly. Thus, the categories and the data will remain indicative over the next several years.^[7]

Categories of taxonomies almost always overlap; job taxonomies are no different. The BLS does not directly classify jobs as information-related. The BLS classifications do not map one-to-one into the educational categories discussed previously. The differences, however, are not significant. BLS lists most information-related jobs in its professional occupations. However, some are included in the Business and Financial, Administrative, and Management occupation categories. Except for Computer Programmers and Librarians (both classified as professional), job growth through 2016 is predicted to be faster or much faster than average. Table 6 lists 11 BLS information-related categories that require at least a bachelor's degree along with a job description, current and expected employment figures; and median salary.

CAREERS IN IS

While the BLS classification provides a tool for understanding the current and future employment possibilities for the main groups of information-related jobs, a more direct description of jobs available to graduates of information programs can be inferred from job advertisements. A search of jobs advertised on Monster.com^[8] in eight major urban areas in the United States (within a radius of 50 mi from Los Angeles, San Francisco, Denver, Dallas, Chicago, New York, Philadelphia, and Atlanta), as of mid-July 2008 show a wide variety of job titles. Some of the titles vary by levels (e.g., Network Analyst and Network Manager), showing the natural career paths in many information-related jobs from entry level jobs (typically analysts and technicians) to senior positions (such as Manager or Chief Technology Officer). Job titles can be classified into domains (e.g., administrator, architect, analyst). Table 7 shows selected job titles by domain from the Monster.com search.

Table 8 maps the BLS occupational categories to job title domains and application areas (e.g., business systems, database, network). Salaries range from \$50,000 to well over \$100,000 with any specific job spanning a wide dollar amount depending on qualifications and experience. Jobs in the Information Technology field are classified into 12 different areas in Monster.com, including Computer/Network Security, Database Developer/Administrator, Enterprise Software, Information Technology/Software Development, Information Technology Project Management, Network/Server Administrator, Software/System Architect, Software/Web Developer, Systems Analysis, Telecommunications Administration/Management, and Usability. A search within these categories using a set of standard keywords for job titles provided the set of available jobs within the eight urban areas noted above. There is some overlap in available jobs using this method of search (see Table 9). While this table includes only a fraction of all jobs listed, it provides a fair distribution of jobs across different cities and job types. The highest paying jobs are more typically available in New York, Los Angeles, and San Francisco.

Within a traditional Information Systems department in a large organization, the normal hierarchy includes a senior manager (or Chief Information or Technology Officer); directors of the key IS functions, including database systems, systems development, systems maintenance, telecommunications and security, and user support. A typical career path for a specialist in database might lead from an entry level position to a database administration position, to a director of database systems, and then possibly to manager. IS managers need leadership and administration skills. They are typically experts in one of the department functions as the following discussion of career paths explains.

Table 6 BLS occupations in information fields.

Occupation	Job description	Employment 2006 and 2016	Salary median (2006) ^a (\$)
Computer Programmers	Write, test, and maintain the detailed instructions called programs that computers follow to perform their functions. Conceive, design, and test logical structures for solving problems by computer. With the help of other computer specialists, they figure out which instructions to use to make computers do specific tasks.	435,000 declining to 417,000	65,510
Computer and Information Scientists, Research	Work as theorists, researchers, or inventors. Their jobs are distinguished by the higher level of theoretical expertise and innovation they apply to complex problems and the creation or application of new technology. The areas of computer science research range from complex theory to hardware design to programming language design. They may work on design teams with electrical engineers and other specialists.	25,000 increasing to 31,000	93,950
Computer Software Engineers, Applications	Develop, create, and modify general computer applications software or specialized utility programs. Analyze user needs and develop software solutions. Design software or customize software for client use with the aim of optimizing operational efficiency. May analyze and design databases within an application area, working individually or coordinating database development as part of a team.	507,000 increasing to 733,000	79,780
Computer Software Engineers, Systems Software	Research, design, develop, and test operating systems-level software, compilers, and network distribution software for medical, industrial, military, communications, aerospace, business, scientific, and general computing applications. Set operational specifications, formulate and analyze software requirements. Apply principles and techniques of computer science, engineering, and mathematical analysis.	350,000 increasing to 449,000	85,370
Computer Systems Analysts	Solve computer problems and use computer technology to meet the needs of an organization. They may design and develop new computer systems by choosing and configuring hardware and software. They may also devise ways to apply existing systems' resources to additional tasks. Analysts who specialize in helping an organization select the proper system software and infrastructure are often called <i>system architects</i> . Analysts who specialize in developing and fine-tuning systems are often known as <i>systems designers</i> .	504,000 increasing to 650,000	69,760
Computer Specialists	Includes a variety of jobs such as Telecommunications Specialists, who focus on the interaction between computer and communications equipment; Webmasters, who are responsible for all technical aspects of a Web site, including performance issues such as speed of access, and for approving the content of the site; and Web Designers/Developers, who are responsible for day-to-day site creation and design.	136,000 increasing to 157,000	Not available
Database Administrators	Work with database management systems software and determine ways to organize and store data. They identify user needs and set up new computer databases. In many cases, database administrators must integrate data from outdated systems into a new system. They also test and coordinate modifications to the system when needed, and troubleshoot problems when they occur. An organization's database administrator ensures the performance of the system, understands the platform on which the database runs, and adds new users to the system.	119,000 increasing to 154,000	64,670
Network Systems and Data Communications Analysts	Design, test, and evaluate systems such as local area networks (LANs), wide area networks (WANs), the Internet, intranets, and other data communications systems. Network systems and data communications analysts perform network modeling, analysis, and planning, often requiring both hardware and software solutions. Analysts also may research related products and make necessary hardware and software recommendations.	262,000 increasing to 402,000	64,600
Computer and Information Systems Managers	Includes Chief Technology Officers, who evaluate the newest and most innovative technologies and determine how these can help their organizations; MIS/IT Directors, who manage computing resources for their organizations; and Project Managers, who develop requirements, budgets, and schedules for their firms' information technology projects.	264,000 increasing to 307,000	101,580

(Continued)

Table 6 BLS occupations in information fields. (*Continued*)

Occupation	Job description	Employment 2006 and 2016	Salary median (2006) ^a (\$)
Network and Computer Systems Administrators	Design, install, and support an organization's computer systems. They are responsible for LANs, WANs, network segments, and Internet and intranet systems. They work in a variety of environments, including professional offices, small businesses, government organizations, and large corporations. They maintain network hardware and software, analyze problems, and monitor networks to ensure their availability to system users. Administrators also may plan, coordinate, and implement network security measures.	309,000 increasing to 393,000	62,130
Librarians	Often called information professionals, increasingly combine traditional duties with tasks involving quickly changing technology. Help people find information and use it effectively for personal and professional purposes. Manage staff and develop and direct information programs and systems for the public and ensure that information is organized in a manner that meets users needs. Librarians with computer and IS skills can work as automated-systems librarians, planning and operating computer systems, and as information architects, designing information storage and retrieval systems and developing procedures for collecting, organizing, interpreting, and classifying information.	158,000 increasing to 164,000	49,060

^aNote that the data are based on 2006. Add at least a 3% annual increase for each year after 2006.

Source: *BLS Handbook*.^[7]

It is more likely that a career path would include lateral movement from one organization to another rather than lateral movement within organizations. For example, a database administrator may find a job at the same level in another company that may pay better or that will include use of a different database system, rather than move to a role in systems development in the same company. That is, people become specialized in their skills. Experience in particular technologies counts a great deal in developing a career path. Most job advertisements ask for specific experience. Specialization makes it difficult to begin a career in the IS field at other than the entry level. For example, a typical career can begin at a consulting firm that specializes in particular technologies. After gaining expertise in that technology, the next step might be to take a job in the organization that previously hired the individual as part of the consulting team to install its software system. Many IS jobs require certifications for using and applying specific technologies offered by companies such as Microsoft, Sun, and Cisco. Certification requires training but results in higher salaries, although the premium has been decreasing.^[4]

In small organizations, however, with only a small IS staff, each staff member is expected to have the skill needed to perform multiple functions. It is possible to move laterally and vertically back and forth between small and large organizations.

PROFESSIONAL ASSOCIATIONS

Whereas the American Library Association is the principal professional association for librarians, IS people

typically belong to one or both of the following two groups: The Association for Information Systems (AIS) and the Association for Computing Machinery (ACM). AIS consists almost exclusively of people who teach IS in universities and colleges whereas ACM (the much larger of the two associations) consists of both academics and practitioners with a focus on computer science rather than IS. AIS produces two electronic journals, *Communications of AIS (CAIS)* and the *Journal of AIS (JAIS)*. The flagship journal of ACM is *Communications of the ACM*. ACM also publishes a large number of specialty journals that deal with specific areas of computers and computer science.

STRATEGIC USE OF IS

The concept of strategic use of IS in libraries is used in two senses:

1. The creation of specific IS that provide a way of differentiating a library system from others.
2. A multiyear plan for operations into the future.

Differentiation. The goal of a strategic information system is to differentiate the organization by improving the organization's position. A strategic information system supports and shapes the organization's strategy, often leads to innovation in the way the organization conducts its work, creates new opportunities, or develops services based on information technology.^[9] In library systems, differentiation can be achieved by introducing new

Table 7 Job domains and job titles.

Job domain	Job titles
Administrator	Information Systems Administrator, Information Systems Database Administrator, Network Administrator, Senior Database Administrator, Systems Administrator
Analyst	Applications Systems Analyst, Business Analyst, Business Applications Analyst, Business Intelligence Data Analyst, Business Systems Analyst, Data Analyst, Help Desk Analyst, Information Security Analyst, Information Systems Analyst, Information Technology Analyst, Programmer Analyst, Quality Assurance Analyst, Senior Data Analyst, Senior Information Assurance Analyst, Senior Information Systems Analyst, Systems Analyst
Architect	Data Architect, Enterprise Architect, Information Architect, Information Systems Architect, Senior Information Architect, Software Architect, Web Information Architect
Auditor	Information Technology Auditor, Information Technology Senior Internal Auditor
Consultant	Business Systems Consultant, Implementation Consultant, Information Technology Consultant, Network Consultant, Senior Consultant Systems Domain, Storage Consultant
Designer	Application Designer, User Interface Designer, Web Designer
Developer	Application Developer, Database Developer, Information Technology Developer/Consultant, Senior Java Developer, Senior Software Developer, Senior Web Developer, Technical Developer, Web Developer, Web Developer/Image Librarian
Director	Director Clinical Information Systems, Director Information Systems, Director Information Technology, Global Information Technology Director, Information Technology Director
Engineer	Information Assurance System Engineer, Information Security Engineer, Information Security Network Engineer, Senior Engineer Information Systems, Senior Information Security Engineer, Senior Network Engineer, Senior Network Security Engineer, Software Engineer/Programmer, Systems Engineer, Technical Support Engineer
Librarian	Acquisitions and Collection Librarian, Corporate Librarian, Electronic Resources Librarian, Reference Librarian, Research Librarian, Technical Services Librarian
Manager	Information Security Manager, Information Services Manager, Information Systems Manager, Information Technology Manager, Manager Development, Manager Information Technology, Network Manager, Project Manager, Senior Information Security Manager, Senior Information Technology Project Manager, Senior Project Manager
Officer	Chief Technology Officer, Information Security Officer, Information Technology Disaster Recovery Officer
Professional	Information Technology Professional, System Administrator Professional
Programmer	Information Technology Programmer, Senior Application Programmer
Specialist	Application Specialist, Information Systems Specialist, Information Systems Support Specialist, Information Technology Specialist
Trainer	Business Application Trainer, Software Trainer, Web Product Support Specialist
Vice	Chief Solutions Specialist, Chief Technology Officer, VP Business Solutions, VP Information Systems Technology
President	
Writer	Report Writer, Senior Technical Writer, Technical Writer

Source: Monster.com^[8] and BNET Dictionary.^[9]

technologies (e.g., geographic IS, data warehouse), new services (e.g., adding an electronic data source), new analysis methods (e.g., data mining capabilities) and more.

Multiyear strategic planning. Library systems typically create their own multiyear strategic plan. A large number of such plans are found by using a search engine such as Google (e.g., Table 10 considers seven such plans). In examining these plans, the use of information technology is featured both for providing services and administrative support.

Whereas the strategic plans shown in Table 11 are concerned with the library system as a whole, IS departments also create their own strategic plan. To be effective, the department's and the system's plans should be aligned with one another. That is, they must be designed to achieve the same goals. However, in addition to supporting the system's goals, the department's work includes responsibilities that are unique to its operation, ranging from creating the needed infrastructure to

selecting new equipment and software to specifying personnel capabilities.

THE FUTURE OF INFORMATION SYSTEMS

Since the first commercial computer systems were installed in 1957, much changed in IS and even more changes can be expected. In this section, we present five of the many scenarios about the future of IS being discussed in 2008. The first four scenarios are based on a special issue on the IS Organization of the Future published in *Information Systems Management*.^[10]

1. *The future organization of the IS function.* As noted above, IS organizations tend to be hierarchical, with a Chief Information Officer (CIO) at the top reporting to a senior officer of the firm and supervising departments for technology, design, internal operations,

Table 8 Occupations, application areas, and job title domains.

Occupation	Application area	Job title domain
Computer and Information Systems Managers	Director	Applications Information Systems
	Manager	Information Technology
Computer Programmers	Internet/Web	Analyst Developer
	Software	Programmer
Computer Security Specialists	Information Systems	Administrator Analyst Director Specialist
	Information Technology Security/Data Security	
	Applications	Analyst Architect
	Business Systems	Consultant Developer Engineer Programmer
Computer Software Engineers, Applications	Software	Programmer
	Business Systems	Analyst Consultant Engineer
	Information Systems	Programmer/Analyst Specialist
	Information Technology	
Database Administrators	Database	Administrator Analyst Manager Programmer
	Information Systems	
	Information Systems Technology	Administrator Director Engineer Manager Specialist
Network and Computer Systems Administrators	Information Systems	Administrator Director Engineer Manager Specialist
	Information Technology	
	Network	
Network Systems and Data Communications Analysts	Information Systems	Administrator Consultant Engineer Manager Programmer Specialist
	Network	

Source: Monster.com.^[8]

Table 9 Number of available jobs by keyword in Monster.com.

	Atlanta	Chicago	Dallas	Denver	LA	NY	Phila.	SF	Total
Database	12	26	13	14	27	54	27	41	214
Librarian	4	7	5	2	8	22	6	4	58
Network	54	77	64	60	92	174	86	78	685
Programmer	35	84	56	36	122	225	105	62	725
Security	25	43	29	23	44	85	28	39	316
Software Engineer	75	72	45	54	202	157	85	346	1036
System Administrator	19	43	34	33	65	129	52	69	444
Systems Analyst	31	42	32	12	63	112	50	45	387
Total	255	394	278	234	623	958	439	684	3865

Note: LA = Los Angeles, NY = New York, Phila. = Philadelphia, SF = San Francisco.

Source: BNET Dictionary.^[9]

Table 10 Some library strategic systems plans.

Institution	Title
Emory University	An Overview of the Five Year Strategy for the Emory Libraries, 2007
MIT	MIT Libraries Strategic Plan 1999
New York State Library	2006–2007 Strategic Plan: Improving Library Services for All in the New Century
The Saskatchewan Multitype Library Board	Strategic Plan Update, 2003
U.S. Library of Congress	The Mission and Strategic Priorities of the Library of Congress FY 1997–2004
University of Wisconsin Libraries	Strategic Directions 2005–2007
Wisconsin Department of Public Instruction	Wisconsin Library Technology Strategic Plan, Updated 2007

Source: Google search on: strategic systems and libraries (Accessed August 2007).

computer security, and service to other departments and outsiders (such as through call centers). We use CIO to refer to the person in charge of information systems. The actual title may vary from one organization to another. With the trends to divesting many of these functions (e.g., through outsourcing and Software As A Service), the IS organization could well morph into a small group of technical and business experts managing the evolution of the organization's technology and a larger on-site group providing only maintenance-level services.^[11] However, in this case, IS career paths are not likely to change in that the same roles and functions are necessary for providing IS services by either insourcing or outsourcing.

2. *The IT talent challenge.* In response to the perceived trend to offshoring and as a result of the end of the stock market bubble in technology stocks in 2001, the number of students that chose to major in IS, computer science, and related fields has declined. That decline was starting to turn around in 2008. Nonetheless, the combination of a reduced demand for IS education at the college level and an aging baby boomer IS workforce results in concern for the

Table 11 Effects of changing technology on IS.

From	To	From	To
Standardization	Commoditization	Data management	Knowledge management
Technological continuity	Technology integration	User friendly	Usability standards
Proliferation of hardware types	Synergy among hardware types	Access security	Protection against terrorism

recruitment and retention of IS professionals because as the demand for professionals exceeds the supply, wages escalate.^[12] Therefore, IS becomes a valuable career with a long-term future.

3. *A move to Wi-Fi and telecommuting.*^[13] With the proliferation of portable technology (e.g., portable PCs, cell phones) and the continuing increase in the capabilities of these devices in a world without wiring, the current computer infrastructure is replaced by a wireless infrastructure that is able to provide large masses of data, information, and knowledge. Concomitant with the technology change, the workforce also becomes mobile and telecommuting^[14] is the dominant way people work. This virtual workforce is supported anytime, at anyplace, including library services. The combination of Wi-Fi and telecommuting makes it more likely that some IS professionals, particularly those involved in geographically dispersed projects do not have to move their home as their assignments change.

4. *Harnessing the Technology.*^[15] Table 11, shows how changing technology leads to changes in IS.

Note that in Table 11 as well as in each of the five scenarios, the focus is much more on technology and human factors than it is on the content being managed. The strength of people trained in both library science and IS is that they view issues in terms of content as well as technology.

5. *Carr's "IT Doesn't Matter" hypothesis.* In May 2003, the *Harvard Business Review* carried an article titled "IT Doesn't Matter" by Nicholas G. Carr.^[16] In this article and in a subsequent book,^[17] Carr argues that IS, like railroads and electric power, is an infrastructure technology that became a commodity. Initially strategic, IS is now a commodity, no longer offering advantage. Thus, something that everyone had would no longer matter as a way of distinguishing organizations from one another. Carried to its extreme, Carr's notion implies the death of organizational computing. Developments such as outsourcing and Software As A Service are viewed as omens of Carr's vision.

Which of these five alternative scenarios will play out in the years ahead? We expect that the predominating viewpoint will be some combination of these scenarios.

The foregoing represents visions of IS in general. When we turn to library IS, the future seems bright. These systems are coming into full flower compared to their role in business in general where IS are already in an advanced

state of maturity. The general coming shortage in people skilled in IS implies that people trained in library IS will continue to be in demand and, if their interests change, they will have the skills they need to be able to transfer their talents to many other applications.

One of the key trends in libraries is convergence, streamlining, and synergy. Instead of requiring users to go through multiple steps in research, including visiting library databases and online library catalogs, libraries are investigating ways to reduce the complexity of access such as federated search engines that combine databases, the online catalog, Web sites, and Open URL link resolvers (which provide links from non-full text citation/abstract databases to full text content). Libraries are also investigating innovative ways to market services and allow library users to match their tastes and research needs with library content in the Web 2.0^[18] environment. Examples include:

- Second generation catalogs with subject tag clouds and suggestions for similar reading.
- Podcasts.
- The use of social software such as blogs, Myspace, Facebook, and Second Life.

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Careers and Education in Library and Information Science

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Abstract

Preparation for professional careers in librarianship entails education at the master's level in many parts of the world. In North America, a degree from a program accredited by the American Library Association (ALA) is the credential preferred by most employers. While the content of library/information science education still includes traditional subjects such as reference, collection development, cataloging, and management, programs are including more courses on technology and electronic resources. Many programs are offering at least some of their courses online. Continuing learning is essential in order for librarians to adapt to rapidly changing information environments.

INTRODUCTION

Careers in librarianship may be pursued in a wide variety of settings, serve very diverse client groups, and entail quite different activities and responsibilities, ranging from storytelling to taxonomy design. There is commonality, however, which resides in the set of skills, knowledge, and attitudes that defines the profession. In much of the world, this foundation is acquired in graduate programs of library and information science. This entry deals primarily with careers and education in North America, although international developments are touched on briefly. Beginning with a general description of educational requirements, the discussion moves to the ongoing critiques of library and information science education, refers to resources on traditional and evolving career paths, and concludes with observations on trends in continuing education.

THE CONTEXT

According to the United States Bureau of Labor Statistics *Occupational Outlook Handbook*, there were about 158,000 librarians, 116,000 library assistants, and 121,000 library technicians employed in 2006. Growth in librarian positions from 2006 to 2016 is projected at 4%, but at 8% for assistants and technicians. The explanation given for the disparity is anticipated budget constraints, more work shifted to support staff, and sufficient increased enrollment in library education programs to replace retirees (<http://www.bls.gov/oco/ocos068.htm#emply>). Using the American Library Association's Library Fact Sheet 2, one can estimate that about 17% of librarians work in academic, 30% in public, 44% in school, and perhaps 10% in special libraries (<http://www.ala.org/ala/alalibrary/libraryfactsheet/alalibraryfactsheet2.cfm>).

The *Occupational Outlook Handbook* can be recommended as a fairly reliable brief introduction to the three types of library positions and the typical educational qualifications. It should be noted, however, that the profession would question the certainty with which some pronouncements are made, particularly in regard to library education curricula. Even on the requirement of a master's degree from a program accredited by the American Library Association (ALA) as a prerequisite to a professional career in librarianship, there no longer is total agreement.

Nevertheless, this discussion proceeds on the assumption that "Education for Library and Information Science," at least in the North American context, is generally understood to refer to master's degree programs accredited by the American Library Association (ALA), of which there are currently 50 in the United States and 7 in Canada (http://www.ala.org/ala/accreditation/lisdirb/lis_dir_2007-2008_re.pdf), and that "career" implies a professional level that rests on the accredited degree, or its equivalent. Since the late 1940s, the master's degree has been accepted as the basic qualification for a professional position as a librarian.^[1] "Library and Information Science" is typically shortened to LIS, and LIS education is understood to refer not only to programs that emphasize preparation for careers in library settings, but also for a broader range of information positions in industry and elsewhere. The latest *Library Journal* annual report on placements and salaries of 2006 LIS graduates states that 89.9% were placed in "some type of library agency." Employment outside of libraries, while still low, increased 37.4% over previous years.^[2]

The current LIS education landscape in North America is characterized briefly below. When speaking of professional qualifications it is useful to keep a few definitions in mind. A license to practice is issued by a government body, and should not be confused with certification, which

is recognition of an individual's qualifications granted by a professional organization. Accreditation, on the other hand, is given to an educational institution or program of study by an agency or professional association, based on the meeting of standards.

- A master's degree in library science (or library service or studies, or library and information science, etc.; usually designated as M.L.I.S. or M.L.S.) from a program accredited by the ALA is generally required for professional librarian positions in academic, government, and all but the smallest public libraries. According to the *Occupational Outlook Handbook*:

In addition to an M.L.S. degree, librarians in a special library, such as a law or corporate library, usually supplement their education with knowledge of the field in which they are specializing, sometimes earning a master's, doctoral, or professional degree in the subject. Areas of specialization include medicine, law, business, engineering, and the natural and social sciences. For example, a librarian working for a law firm may hold both library science and law degrees, while medical librarians should have a strong background in the sciences. In some jobs, knowledge of a foreign language is needed (<http://www.bls.gov/oco/ocos068.htm#empty>).

- Qualifications for school librarianship vary by state and are different in Canada. A master's degree in librarianship from a program accredited by the ALA or a master's degree with a specialty in school library media from an educational unit accredited by the National Council for the Accreditation of Teacher Education is held to be appropriate for U.S. school librarians. Many states also require school librarians to be licensed as teachers. Regulations for specific states may generally be found on their department of education Web sites.
- Most states and provinces have licensure requirements for public and/or school librarianship, generally based on educational credentials. At the municipal or county level, some U.S. governmental units may also apply Civil Service regulations for public library positions, usually involving examinations. In the case of small public libraries where staff is not required to hold the M.L.S. degree, some form of basic training may be mandated, usually under the auspices of the state library development agency.
- For other than school and small public library positions, most employers depend on ALA accreditation of the program where the candidate obtained the master's for assurance that the person has basic qualifications. ALA accreditation is based on standards first developed in 1951 and revised in 1972, 1992, and 2008. The ALA, in its turn, receives approval from the Council for Higher Education Accreditation. Standards

are designed to help programs to improve within parameters they themselves set. That is, each program declares its goals and objectives to suit its constituencies, and is judged on how well it achieves those goals and objectives. There is no single prescribed pattern that is expected or dictated by the Standards. Accreditation is granted by a committee of the ALA, based on self-studies and external review panel reports, for a period of up to 7 years. Standards are grouped under six headings: mission, goals, and objectives; curriculum; faculty; students; administration and financial support; and physical resources and facilities (http://www.ala.org/ala/educationcareers/education/accreditedprograms/standards/standards_2008.pdf).

- Curricula in ALA-accredited programs generally include courses on the organization of information, selection and acquisition of resources, assistance to users, application of relevant technologies, management, and what often are called "foundation" courses that deal with matters such as ethics, history, and service philosophy. Other offerings may include a range of courses on particular types of libraries, specific user groups, technical aspects of information technology, and evaluation and research methods.
- There has been a substantial shift in the delivery of M.L.I.S. programs from on-campus to the Internet. There is a consortium of schools, Web-based Information Science Education (WISE) that offer courses to each other's students on a space available basis (<http://www.wiseeducation.org>).
- Most programs strive to impart both theory and practical application, to introduce current issues and new technologies while continuing to cover the basics, and to allow for some level of specialization. Students are urged to get some practical experience prior to graduation, either through jobs, internships, or volunteer work.
- Most libraries prefer to hire M.L.I.S. graduates who have some experience and the specific skills required by the position to be filled. At the same time, there is an increasing interest in some institutions in hiring subject and technology experts who do not necessarily have an M.L.I.S.
- A large number of retirements were predicted some time ago, but it appears that there are not as many openings as anticipated. Some recent graduates are spending a long time searching for full time jobs, and are resorting to part time and temporary employment. This situation is especially likely to occur when the candidate limits the search to a specific location or particular preferred work environment.
- Descriptions of alternative careers (i.e., nonlibrary) for M.L.I.S. holders and advice on job searching are plentiful, both in print and online.

The above broad brush description of the current status of LIS education and employment of graduates in North

America masks the fact that technology for some time has been propelling change in libraries and concomitantly demanding new and different skills of librarians. It is difficult to tell how well recruitment into the profession, LIS education, job realignment, and hiring practices have responded to the changing scenario. There is evidence, however, that the profession has not been comfortable with the state of LIS education for some time.

CRITIQUES OF LIS EDUCATION FROM THE PROFESSION

There have always been complaints from librarians that educators pay too much attention to theory and not enough to practice, or conversely, that they teach technique to the neglect of theory and principles. The first formal program, launched at Columbia University by Melvil Dewey in 1886 was met with considerable suspicion, and the first graduate school to be established, by the University of Chicago in 1926, was not hailed as a necessary advancement in professional education.^[3] Primarily through the forum provided by the ALA, dialogue between practitioners and educators has continued over the years. Often the accreditation process has crystallized contentious issues, although external events, such as the increased demand for librarians after World War II, the Civil Rights and Great Society movements, and—more recently—the impact of computers and the Internet, also have stimulated discussion of the adequacy of LIS programs in producing graduates prepared to meet societal needs.

The strong postwar market for librarians, which spawned a dramatic increase in the number of accredited programs, came to a halt in the 1970s. From 1978 to 1994, 17 U.S. programs were closed.^[4] During that same period of retrenchment, more and more schools incorporated “information studies” or “information science” in their names and a noticeable number dropped the word library from the title. The closings, the incursion of information science (especially the hiring of faculty with doctorates in fields such as technology), the absorption of a number of independent programs into larger units in universities, and an increase in undergraduate majors in information created considerable anxiety about the direction of library education. One response was the first Congress on Professional Education (COPE), organized by ALA in 1999. Discussions revolved around the higher education context, core values, curriculum, and accreditation; a full report can be found at <http://www.ifla.org/VII/s23/bulletin/vol1-2.htm#4>. Two additional congresses were held, one on continuing education and the other on support staff. Some of the recommendations emanating from these meetings have been heeded, but it cannot be said that concerns have been laid to rest. Recently, an ALA presidential task force was appointed to consider the core curriculum, accreditation, and other contentious issues. A report is due in the summer of 2008.

Overlapping with the ALA congresses, a study of LIS education was carried out from 1998 to 2000, under the auspices of the Association for Library and Information Science Education (ALISE). Funded by the Kellogg Foundation, the project is known as Kellogg-ALISE Information Professions and Education Reform (KALIPER).^[5] The project identified trends that confirmed critics’ fears that LIS education was shifting attention and resources toward information as a major focus, but the researchers presented this finding in a positive light. At the same time, they reported that the traditional course content was still being offered, although compressed and not necessarily identified as a mandated core.

The most notable recent critique was spearheaded by Michael Gorman, 2005–2006 ALA President and Dean of Library Services at California State University-Fresno. He gave a keynote address at a conference of the European Association for Library and Information Education and Research (EUCLID) in 2003, the general thrust of which he repeated in other papers and speeches in the following years. The abstract from the EUCLID proceedings captures much of the continuing debate, and is therefore quoted at length:

This paper advances the idea that there is a crisis in library education. . . Among the problems seen are that library schools have become hosts to information science and information studies faculty and curricula. . . peripheral to professional library work. . . Many of the topics regarded as central to a library education by would-be employers are no longer central to, or even required by, today’s LIS curricula. Modern communications technology has led many library educators to concentrate on that technology and to dismiss anything about libraries that is not amenable to a technological solution. The gap between what is taught in many LIS schools and what is being practiced in libraries is wide and widening.^[6]

Gorman goes on to raise a number of other issues, such as the impending retirement of many librarians, the uneven geographical distribution of LIS programs across the United States, the loss of a number of prestigious library schools and the resulting “diminution of the research (in quality if not quantity) into library topics.” Gorman wants to see a required core curriculum taught in every school that reflects what goes on in libraries: collection development and acquisitions, cataloging, reference and library instruction, systems, management, and types of libraries. He claims not to understand why the accreditation process cannot assure this.

CRITIQUE OF LIS EDUCATION FROM WITHIN

While the KALIPER project concluded with a considerable amount of self-satisfaction, not all LIS educators are sanguine in the face of the changes of the last decades.

Expansion of course offerings with a focus on information technology and information science has made it more difficult to allow for concentration in medical, law, youth, and other specialized areas of librarianship. Courses such as the history of libraries and librarianship, reading, and outreach to underserved populations are not generally available. Florida State professor Wayne Wiegand, for example, makes a strong case for including reading studies and library-as-place in the curriculum.^[7,8] LIS educators are in agreement that they have failed to recruit students who reflect the population at large, have difficulty attracting minorities to the professoriate, and are not producing enough Ph.Ds. to replace the many faculty who will soon be retiring. Some even echo a number of Gorman's criticisms about curriculum and priorities.^[9,10] There is some unease about the rapidly increasing conversion of face-to-face courses to the online delivery mode. With few exceptions, master's degree programs are too short to prepare graduates who are as well qualified for today's complex library and information jobs as faculty would like. But the fear is that increasing the length of programs would cut into enrollments and therefore threaten program viability in cost-conscious higher education institutions.

IN RESPONSE TO THE CRITICS

The most serious criticism of the late 1990s concerned the perceived demise of the traditional core curriculum and the failure of the ALA's accreditation process to assure the profession that graduates of LIS master's programs are well prepared. The ALA's Office for Accreditation has acted upon the COPE I recommendation that it do a better job of preparing external review panels, by conducting training sessions in conjunction with ALISE and ALA conferences. The ALA's Committee on Accreditation (COA) has been increasingly rigorous in its reviews, and has continuously revised policies and procedures. The Office's Assistant Director, Renee McKinney, recently compared the ALA's 2005 draft of core competencies to the curricula of the LIS programs, and found that 94.6% had courses that included all of the eight that were identified in the draft (<http://www.ala.org/ala/accreditation/prp/prismreports.cfm>).

An earlier study by Karen Markey also identified five core courses, one each in organization, reference, foundations, and management, and one in either research or information technology. She concludes, "The curriculum remains strong in traditional coursework that seeks greater understanding of users, their information-seeking behavior, and the sources and services that libraries provide to users generally and to special populations."^[11] On the other hand, a 2006 content analysis of curricula found that there was a large number of elective courses, while the number of required courses was as low as two. The

four types of courses offered most frequently were organization of information, reference, introduction, and management.^[12]

In response to the fusillade delivered by Michael Gorman, almost the entire Fall 2005 issue of the *Journal of Education for Library and Information Science* was devoted to articles addressing his complaints. The most pointed is the paper by Carla Stoffle and Kim Leeder.^[13] Stoffle, as an academic library director with experience as a student of higher education, acting director of a library school, and member of ALA's Committee on Accreditation, takes a holistic view of the "crisis." Her main conclusion is that

many practitioners do not understand the goals of library education, the demands under which these programs operate, or the standards to which they are held. Practitioners want to dictate a curriculum based on their interests or the hiring needs of their particular libraries, without acknowledging the tremendous range of subject matter that these schools must address in only 36 to 42 hours of coursework.^[13]

OTHER PERSPECTIVES ON THE M.L.I.S.

Research libraries tend to be less concerned with the core curriculum than with qualifications that LIS graduates have obtained elsewhere during their education. Their stance is that foreign languages, area studies, and other specialized subject backgrounds are needed in research libraries, and that few M.L.I.S. holders have the necessary academic background. The Council on Library and Information Resources funds a postdoctoral fellowship at four libraries as a means of recruiting scholars to library work, bypassing the M.L.I.S. With a similar goal in mind, Yale offers a paid internship to Ph.D. students who have completed course work.

Other specialized LIS professional associations also have concerns about the products of ALA-accredited schools, and like to be involved in events such as the COPE series and to be represented on LIS schools' advisory bodies. They contribute by defining the competencies that their specialties require, providing internships, and teaching as adjuncts in LIS schools. The Special Libraries Association's (SLA) competencies document is frequently cited as a model (<http://www.sla.org/content/learn/comp2003/index.cfm>). It is divided into professional and personal competencies, with detailed descriptions of specific skills, and scenarios illustrating the application of professional competencies. The four major professional competencies which provide the framework for the skills lists are managing information organizations, managing information resources, managing information services, and applying information tools and technologies. While these skills are taught in LIS

education programs, SLA does not have a policy that states that the M.L.I.S. is the appropriate preparation for a career in special librarianship. Instead, the last policy statement (1992) on education expresses concern that many LIS programs do not provide an adequate range of courses. The full statement is not accessible electronically, and is probably seen as no longer necessary now that the competency document exists.

The Medical Library Association (MLA), through its Academy of Health Information Professionals, provides a credentialing system for librarians who can demonstrate that they have attained specific levels of education, experience, and professional achievement. An M.L.I.S. from an ALA-accredited program is suggested as the basic academic preparation, but an equivalent graduate degree is acceptable. The American Association of Law Libraries (AALL), like the MLA, lays out a list of competencies which “may be acquired through higher education such as library and information science programs, through continuing education, and through experience” (<http://www.aall.org/prodev/competencies.asp>). It is fair to conclude that for many kinds of special librarianship, the M.L.I.S. from a program accredited by ALA is merely one option for meeting entry level qualifications. SLA, MLA, and AALL all place great emphasis on the importance of continuing education and professional development.

MORE ON COMPETENCIES

In the curriculum section, the 1992 accreditation standards call for taking into account competency statements promulgated by professional associations devoted to the various specializations. At the time, few such statements existed, but since then the gap has been largely closed. As previously mentioned, the ALA developed a generalized draft in 2005. The Canadian Library Association has a somewhat whimsical all-purpose list, divided into personal and professional competencies (<http://www.cla.ca/infonation/skills.htm>). Some of the ALA divisions devoted to types of librarianship have their own specific statements, as do a number of the nonaffiliated specialized library/information professional associations. LIS educators are expected to be familiar with those that are relevant to the courses that they design. It must be recognized, however, that the term “competency” as used in these professional pronouncements does not mean what it does when it is used by specialists who apply sophisticated measurement tools to the determination of competencies. The lists produced by LIS professionals are more like best practices descriptions, and simply represent the consensus of a group of practitioners about the ideal behavior and performance of their peers.

LIS EDUCATION IN THE INTERNATIONAL ARENA

The International Federation of Library Associations and Institutions (IFLA) is one of the best sources of information about LIS education globally. A new edition of *World Guide to Library, Archive, and Information Science Education* was scheduled for publication in late 2007. The intention is to list professional education and university level training programs worldwide. Meanwhile, there is an online directory compiled by T. D. Wilson at <http://informationr.net/wl/>.

IFLA approved *Guidelines for Professional Library/Information Education* in 2000 (<http://www.ifla.org/VII/s23/bulletin/guidelines.htm>). The introduction states that while LIS education occurs at differing levels—technical, graduate and professional, and research and doctoral—the guidelines apply mainly to the graduate and professional level. It is recommended that programs should be part of a degree-granting institution at the tertiary (university) level. Recommendations are grouped under headings similar to those used in the ALA’s standards: curriculum, faculty, students, administration and financial support, and instructional resources and facilities.

In addition to IFLA publications, there are a number of English language publications that are regular sources of information about LIS education in various countries of the world, especially the journals *Education for Information*, *Journal of Education for Library and Information Science*, and *Libri*. In addition to ALISE and EUCLID, there are units in IFLA devoted to education and research. ALA conferences regularly attract LIS educators from abroad, and a wide array of international conferences also enable interaction among faculty from across the globe.

Perhaps the most significant development in LIS education at the international level was stimulated by the Bologna declaration in 1999, which calls for European countries to make their higher education programs more comparable and to initiate quality assurance efforts. For LIS, the likely outcome is that European preparation for library careers will look much more like that of the Anglo-American and some Asian countries. Eventually, it may be possible to tell whether librarians educated in one country have qualifications equivalent to those of another in which they want to work. Currently, it is difficult for employers in the United States, for example, to hire individuals who have received their training abroad. ALA states, however,

The master’s degree from a program accredited by the American Library Association (or from a master’s level program in library and information studies accredited or recognized by the appropriate national body of another country) is the appropriate professional degree for librarians

(<http://www.ala.org/ala/educationcareers/employment/foreigncredentialing/index.cfm>).

CAREERS

The ALA's Office on Human Resource Development and Recruitment has general information on careers (<http://www.librarycareers.org>). For a more wide ranging and current snapshot of the profession, see <http://www.liscareer.com>, which not only collects advice on career planning and job hunting, but has a list of links to a variety of job postings. A spate of books on careers in LIS has been published, reflecting not only the concern with recruitment, but also raising awareness of alternative career paths. Since the first edition of Betty-Carol Sellen's *What Else You Can Do with a Library Degree* in 1980, there have been numerous suggestions of nontraditional jobs that benefit from the knowledge and skills acquired through LIS education. Recent examples of books with sections on alternate careers are listed at the end of this entry. The contributors to the book edited by Shontz and Murray tell how they gained the specific knowledge and skills that their jobs require, which often are not in the domain of LIS education programs. Many of them also explain how they stay up to date and continue their professional development.

The best way to learn about specific requirements for positions is to read job announcements regularly. Even if educational preparation is not mentioned explicitly, one should be able to relate the stated qualifications to the kinds of courses and training that provide the background. Learning about what employers are looking for also gives one a sense of how the field is changing, and is one way for LIS educators to see where curricula need to be adjusted. The following are excerpts from recent announcements that illustrate the range of jobs and differing requirements. Not all require an ALA-accredited M.L.I.S., and most want individuals with the kinds of personal characteristics and talents that are inherent rather than learned in a professional degree program.

Categorization Analyst

- Understanding of linguistic ambiguity and a creative approach to problem-solving.
- A background in Linguistics, Library Science, Information Sciences, or related field is preferred.
- Must have a B.A./B.S. with 1+ years of experience, or an M.L.S./M.L.I.S./M.S.
- Excellent communication and organizational skills.

We are an innovative technology company in the business of structuring and organizing massive amounts of unstructured content.

Digital Services Librarian (Assistant Professor)

- Will collaborate with library faculty and the Dean's office in developing and producing digital projects, in

providing information services for students taking Web-based courses, and in the development of other Web-based applications.

- Will research, evaluate, test and recommend methods, standards, and software used in the creation of digital collections and their preservation; maintain best practice documentation for digital efforts; provide expertise to others in the creation of digital collections; and participate in grant-writing and training initiatives.
- Will collaborate with library faculty in providing reference service to distance education students and in developing tutorials and other Web-based services for off-campus and on-campus students.
- Will be expected to teach some information literacy courses and perform other duties as assigned.
- Required qualifications: Demonstrated digital project management skills; working knowledge of digital library technologies, standards, issues, and trends; ability to interact effectively with a broad range of employees within the Library, the University and in collaborative initiatives with other institutions; excellent written and oral communication skills; M.L.S. from an ALA-accredited program; a second master's degree or doctorate is required for tenure; excellent communication and interpersonal skills; demonstrated ability to work in a collegial environment.
- Desired qualifications: Demonstrated knowledge of digital conversion of materials; experience with MACHiNE Readable Cataloging (MARC) and Dublin Core; comprehension of relevant Internet delivery technologies for digital content; successful grant-writing activity.

Knowledge Systems Librarian/Taxonomist, Law

- Combination of knowledge and experience at the intersection of knowledge management (KM), law, and technology. . . . Must be able to interact effectively with attorneys and staff worldwide.
- KM Systems Librarian will maintain the quality of search results and contents and establish workflow procedures for vetting documents. Oversee workflow, reinforce and monitor data inclusion and indexing, and establish and maintain effective working relationships with all legal support departments firm wide. Develop and maintain taxonomies; both firm, office and practice group; and be able to integrate multiple language schemes. Work with Head of Technical Services to leverage Library Automation software and expand installations globally.
- Requirements: M.L.S. and/or JD (law degree) with proven expertise in building taxonomies. Must have solid IT skills including maintaining quality databases and an ability to troubleshoot difficulties with end user search and document indexing. . . . Working knowledge of European languages would be a distinct advantage.

Staff Training and Development Coordinator

- Work collaboratively with multiple constituents including Department Heads, managers, supervisors, and library staff members to design, develop, coordinate, market, and implement training and development programs that speak to the diverse needs of the staff.
- Track staff participation in training programs. . . assess effectiveness.
- Lead Library Education and Training Committee; run Library's New Employee Orientation program.
- Work with University resources (i.e., University Human Resources, the Ombudsman, EEO (Equal Employment Opportunity), Employee Health and Safety, and external organizations (i.e., PALINET, the Association of Research Libraries) to achieve results.
- Maintain and update the Library HR Web site.
- Required: Bachelor's degree required. A minimum of 5 years of previous experience as a training professional in an academic library or higher education setting required. Demonstrated ability to work effectively with a variety of people at all levels in the organization. Must have superior oral and written communication skills. Previous supervisory experience required.
- Preferred: Prior experience working with diversity programs and initiatives preferred. Master's degree in Human Resource Management, Organizational Development, or Adult Education preferred.
- Desirable: Certification as a HR Professional.

Principal Librarian to Lead the Youth Services Team

- Serve an extremely active and diverse community in an urban setting. The Youth Services Department Head supervises a staff of seven, including three full-time librarians. This position will also serve as a member of the Branch Management Team; designing branch services, developing branch objectives and activities, and recommending branch procedures. The ideal candidate will demonstrate enthusiasm; excellent organization and communication skills; the ability to lead a team and work as part of a team; a collaborative and inspiring disposition; strong desire to work with and within a diverse community; and demonstrated excellence in cross cultural competencies. Evenings and weekends are required with this 35 hr per week position.
- Requirements: A master's degree in Library or Information Science in a library program from a library school accredited by the State Board of Education. Two years of professional librarian experience.

Although the positions in the above examples are from a U.S. Northeast metropolitan area, they are not especially unusual, and do reflect today's LIS environment. The

Canadian Library Association' Web site has a page with hypothetical job descriptions, intended to give an idea of the range of positions and qualifications: <http://www.cla.ca/infonation/jobstuff.htm>.

Referring again to the excerpts from the above postings, it seems that technology expertise may not always trump management and people skills. Employers complain that LIS education gives short shrift to management, but most students resist taking courses in that area. LIS education program admissions decisions rest primarily on evidence that an individual is likely to succeed in graduate study. Admissions committees (or officers) cannot reject an otherwise well-qualified applicant merely because the applicant's motivation is confined to a lifelong love of books. The dissatisfaction that employers express with LIS curricula could at least in part be redirected to recruitment into the profession. It is well documented that most persons who decide to enter librarianship do so because they have worked in a library at some point and/or been encouraged by someone already in the field. The profession, therefore, tends toward replication rather than transformation.

CONTINUING EDUCATION

Referring again to the position announcement excerpts above, it becomes clear that very diverse skills and experience are needed across the spectrum of library/information careers, and that obtaining an M.L.I.S. may be only one step toward achieving career objectives. Other formal degree programs may actually be preferred, as in the case of the university library staff development position. All library/information personnel, however, need to participate in some form of ongoing learning, in response to continually changing technology, increasing client expectations, and pressure for accountability. Where the learning takes place can range from university classrooms, to professional conferences, to the workplace, to one's PC at home. A need may be met through offerings from a continuing education provider, workplace training, or by self-directed, informal learning.

Most LIS education programs are willing to have alumni return for additional courses as the need arises, and a few offer sixth year certificates. Some have professional development programs which range from occasional workshops, to series of webinars, to online credit-bearing courses, study tours, and other formats. Large library systems tend to have their own in-house professional development programs. There are regional consortia that play important roles in providing continuing education, and many vendors offer in-house training. The many LIS professional associations provide an increasingly diverse menu of learning opportunities, going well beyond the traditional publications and conference programs of the past. Many now regularly offer online

courses, and just about all have electronic discussion lists, podcasts, newsfeeds, and blogs that encourage members to share expertise. WebJunction is a portal and clearinghouse of professional development opportunities, which makes it possible to locate a resource to meet a learning need at the moment that it is required (<http://www.webjunction.org>).

For some specialized areas, there are annual institutes and symposia designed to impart the latest and best practices, such as the Northeast Document Conservation Center's School for Scanning and the University of Maryland's copyright symposia. There are too many leadership development institutes to list, and several annual conferences on information literacy. Internationally, a key provider is IFLA, which holds not only an annual conference with its numerous satellite events, but also has quite a few separate programs throughout the year in different parts of the world. IFLA has a section on Continuing Professional Development and Workplace Learning (CPDWL), which has developed guidelines for quality continuing education (<http://www.ifla.org/VII/s43/pub/cpdwl-qual-guide.pdf>), available in a number of languages. CPDWL has held seven conferences with published proceedings and is in the process of preparing a theme issue of *Library Management* devoted to professional development.

A recent addition to the array of professional development opportunities is the Certified Library Administrator program offered by the ALA's Allied Professional Association (APA). It is currently aimed at public library directors and is an effort to make up for the lack of management education so common among LIS graduates. Nine courses are available, of which four are required: Budget and Finance, Management of Technology, Organization and Personnel Administration, and Planning and Management of Buildings. The electives are: Current Issues, Marketing, Fundraising/Grantsmanship, Politics and Networking, and Serving Diverse Populations. The APA's Web site tracks the progress of individuals seeking certification—not many at this stage, but increasing (<http://www.ala-apa.org/>).

CONCLUSION

Is there a crisis in LIS education? Is there going to be a shortage of library/information professionals as more librarians retire? Or, will there be fewer entry level jobs for LIS graduates as more work is passed to nondegreed staff? Will the profession succeed in diversifying its ranks to better reflect changing demographics? Will LIS educators and employers reach a better understanding of each other? Can they agree on what a core curriculum should contain? Will the accreditation process remain much as it is now, or evolve in a new direction? Will the current 31 Ph.D. programs in LIS produce a new generation of

faculty members who are well suited to teaching and conducting research in the constantly shifting higher education environment? With 18 undergraduate, as well as Ph.D. and other master's programs sharing resources with M.L.I. S. programs, many of which are increasingly using labor-intensive online delivery, will quality be maintained? Many of these questions are not new, but recur over the years. Finding answers seems to be more critical today, as LIS education programs are challenged to survive criticism from within and without.

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Careers and Education in Records and Information Management

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Abstract

Careers in records management vary by organization and industry. There have been few educational-resources available other than ARMA conferences and meeting. While the career itself is interesting and challenging, the role of the records manager within organizations is often poorly understood or appreciated.

INTRODUCTION

Every type and size of organization needs records management. From the entrepreneur to the multinational, from government to nonprofit and NGOs, and from the accounting firm to the technology company, every organization needs to perform records management to find information again, to safeguard intellectual property, to comply with regulations, to be transparent, to lower costs, to serve customers better, and to respond to litigation, among other issues. The leaders of most organizations do not always understand the need for records management unless there are scandals like the British intelligence report on Iraq before the war began that nearly took down Tony Blair's government, seeing paper spread far and wide in the World Trade Center collapse, or hearing about a \$1.5 billion court fine against Morgan Stanley—in *Morgan Stanley v. Coleman*—for not being able to find e-mail backup tapes. Until recently, most leaders responded to these perceived risks with a hasty band-aid such as a change in procedures, a disaster recovery program, or a retention schedule. The number and severity of the scandals, from Bill Gates's e-mail in Microsoft's antitrust trial, to the deleted e-mails that brought down Arthur Andersen, from the large fines placed on broker-dealers for not managing their e-mail, to the \$38 million settlement in *UBS Warburg v. Zubulake* for not handing over e-mails for which the plaintiff had clear evidence, has convinced more leaders, mostly for-profit, that they need to have a complete program. Those same leaders are now seeking records managers with education and skills to run enterprise-wide programs that are now reporting to executives in accounting, legal, and information technology. This is in sharp contrast to a decade ago when records managers reported to a director of facilities and managed boxes in off-site storage and a few records rooms.

From late 1990s to now, executives and directors managing every type and size of organization in North

America have placed an increasing value on records management for finding information again for operations, disaster recovery and business continuity, and litigation response. Within those organizations generally there has also been recognition that the information technology products including, hardware, operating systems, and applications, purchased throughout the 1980s and 1990s to create, distribute, and store information actually do a poor job managing information by themselves. This increased value of records management and recognition of the current information technology situation has led to a higher value place on records managers, particularly those with the CRM (Certified Records Manager) designation. That dearth of qualified records managers has created an opportunity for professions, such as lawyers, to create retention schedules, and records management policies and procedures. This dearth has even created opportunities for library and information science to create and sell standardized taxonomies as the basis for a records retention schedule. Information technology vendors including Microsoft, Computer Associates, and EMC have created products to manage information on top of the other products these companies sell. Trade associations such as SNIA (Storage Networking Industry Association) and AIIM (Association of Imaging and Information Management, formerly the microfilm industry association) have created alliances or tried to merge with the association representing records managers, ARMA, International. These opportunistic services, products, and relationships have met with varying degrees of success depending upon the source's understanding of how complex the business objects in the records manager's portfolio are—as opposed to the cultural objects managed and studied by library science, archives, and information science. Until recently, those business objects were managed only by records managers, and were studied by the rare records manager with time for reflection.

RECORDS MANAGEMENT ASSOCIATED WITH RISK

The existence of the post of records manager, a records management program, and a perceived need for a records management consultant are currently based on the risk side of records management where in policies are inadequate, procedures are lacking, information technology that did not manage records was implemented *en masse*, and the employees created messes because they thought they “know technology” or that the technology was designed to manage information. The same activities that will correct these problems can, if understood by the creator, help the organization create a more secure computing environment, manage output, and aggregate information for innovation. If the creator does not understand these problems, the organization may get a set of groups of documents and the regulations that restrain their life. The education of the creator is key to the success or failure of the organization’s program. The selection of the creator is, however, entirely in the hands of employees who do not understand records management either, hence the hiring of preformed taxonomists and attorneys to create retention schedules. Other organizations seek out persons with experience and qualifications. More and more organizations are seeking out an individual with a CRM to perform all of the tasks to create and run a records management program.

DIVERSITY OF THE ROLE

Employees who perform records management are diverse. Any person who is responsible for managing some aspect of the life cycle of documents, records, content, or information inside an organization is performing records management. Thus, the mailroom supervisor who is capturing documents in the mailroom and the information technology (IT) director who sets the retention of e-mail in the personal mail boxes of end users to 30 days are managing records. Managing records does not mean managing only what ultimately get placed on a retention schedule, it means also ensuring that documents, content, and information that should not get placed on the retention schedule is managed (in this case, meaning formed properly and disposed of promptly).

What this means is that the titles for records managers are quite diverse. When ignorance of the existence of records management as a profession is added to that diversity, calling any organization and asking for “the records manager” can lead to some amusing circumstances. For example, in performing research for a project on organizational management and electronic records management the author made more than 150 calls to Fortune 500 and Forbes 300 companies, to identify the records manager for the study. At one Forbes 300 company the receptionist said she had worked for the company for more than

30 years and no one had ever asked that question. Only one call out of more than 150 produced the name of a person who was responsible for records management, but did not belong to ARMA.^[1] (As a result of this experience, I used the ARMA member list to enroll members.) At the same time, persons who are responsible for early phases of the records life cycle, particularly those who perform information capture through scanning documents may not identify themselves as records managers because of trade advertising and analysts that cast records managers and records management in a pejorative light. This author has interviewed employees at some of the largest Fortune 500 firms that performed records management through several phases of the life cycle, including both imaging and box storage, yet those employees eschewed the title “records manager” as some how lessening what they do. Some trade association publications characterize records managers as roadblocks to successful document management implementations. In an article, Steven Good fellow, the president of Access Systems, which is a records management consultancy, writes: “When the records manager is brought into the discussion, it may be viewed as an effort to stir up more dust thus clouding the solution seen by the department and/or IT. . . because they can’t speak in IT terms.”^[2] (This, of course, begs the question whether “IT” is a *lingua franca* or whether those who speak “IT” should learn to speak in the language of the employees of the organizations in which they are working.) This is a fairly typical characterization of a records manager and reflects the trade association’s need to portray the solution as requiring a “tool” rather than a practice or skill set. Underlying this is the problem that the “tools,” the electronic document management systems (EDMSs) and the content management systems (CMSs), are designed to solve a tactical departmental problem where as the practice of records management is focused on information management not only throughout the lifecycle of information, but also on an enterprise-wide basis. The perspectives are thus that of 10 ft off the ground versus the 50,000-ft level. The two perspectives are not incompatible; documents, whether electronic or hard copy, must be corralled into a repository to be branded and subsequently managed. Unfortunately, the products that corral the documents manage only a tiny portion of the life cycle and often are created without the ability to “preserve” documents either in a litigation or archives sense. In addition, the policies and procedures to manage documents beyond a very narrow definition of the capture phase, such as associating a document with a retention classification are also missing.

IT AND RM

This wound of tools managing one small portion of the life cycle versus the practice of managing the entire life cycle

that has existed for about 15 years is gradually healing as information technology loses its caché and as the companies that create the applications, such as Microsoft and IBM “discover” they have actually created problems that threaten the existence or at least the credibility of many organizations because of a failure to include the family planning to death certificate and document classification practices of records management. (For example, Arthur Andersen collapsed due to a lack of credibility because of the destruction and subsequent resurrection of e-mails. See Glater.^[3]) This has not yet brought together all records management practitioners into one, big, happy family yet, as the article quoted above indicates. Records management is considered by most of the application companies to be an application that manages documents after the documents have been “declared a record.” This relegation to less interesting phases of the life cycle has continued, so that some content management application companies have differentiated “retention management” from “records management,” where in retention management is differentiating ephemeral documents—and the purging of those documents—from those documents that would need to be kept for a long period of time. Thus, software applications companies understand the practice of records management as being the management of boxes of paper documents and electronic “records,” using the archivists’ understanding of a record as something that has passed beyond its active context to become “evidence” only.

The actual portfolio of activities performed by records managers is quite varied, so varied in fact, that it is difficult to describe what all records managers do other than to say we manage the life cycle of records through the employment of policies and procedures, classification systems, risk management, legal and business requirements, and the discovery phase of litigation management. What records managers understand as the life cycle of records includes everything from the family planning phase through a death certificate. The concept of “cradle to grave” management as espoused currently by the document and content management application companies is partly what led to jury penalties as high as \$38 million being applied when companies cannot pull out documents that should not have been created in the first place and that, in some instances, were deleted but resurrected because the document had not been properly destroyed. The planning phase includes creating policies, such as to whom information and the systems to create information ultimately belongs, procedures, such as ensuring that every document gets placed in an appropriate folder and does not float for eternity in the “Inbox” of an employee. The planning phase also includes a system of governance including a governance committee with enough authority to adjudicate issues, an audit program so that the organization knows whether employees are complying, a system of enforcement such as penalties for noncompliance and threats of law suit for egregious breach of policies and

procedures, and a training program that goes beyond using a software application to include why the records management program exists.

The creation phase can include everything from managing a mailroom and an imaging application there, to creating procedures to ensure the organization has draft, version, and copy or output control, to approving the purchase or intended use of a document, content, or records management application. Creation also includes limiting the content that can be placed in a document through e-mail etiquette and policies that forbid content such as pornography. No phase is hermetically sealed from other phases having created policies and procedures and introduced tools for one phase, the effects from all previous phases are felt throughout all subsequent phases. Organizations learning this currently through litigation say they are “dodging bullets” (personal conversation with general counsel of a multinational corporation) because they cannot find what they need to respond to subpoenas. Knowledge of how to write effective policies and procedures as well as how to provide training and change management are essential for implementing this phase.

RM AND LITIGATION

This leads to the question of what the records manager actually manages. There is neither “litigation phase” nor is there a limitation on what phase litigation can hit. Because of this threat, records managers now must address the management of any information captured within the organization whether that be photographs of employees dogs, internal e-mails that harass other employees, Internet caches that indicate what Web sites employees visited, in addition to those documents for which statutes, regulations, and agency bulletins as well as industry best practices and knowledge management needs. What the records manager actually manages bears little resemblance to ISO 15489 and the published definitions of archivists. Records managers are beholden to the definitions enunciated in law and the requirements of litigation—not the definitions of academic archivists. This extreme description of the “record” resembles nothing as closely as it does the current Euro-American studies of the “document” being performed by The Document Academy.^[4] I have managed chunks of concrete, tools for making corporate seals, and have advised on how to track property owned by the U.S. federal government to be used in prototype engines. Unlike inventory management and supply chain management where every token of a type is managed like every other token of a type, records management requires managing processes where every token becomes its own type, can be extracted from any business process, and brought into a business process addressing litigation.

This activity requires knowledge of each business process within the organization and what purpose those

business processes perform. This also includes understanding how and why employee create and use them. Knowledge of the method of capture or creation of nearly every document involved in those business processes is required in order to ensure adequate document controls and metadata are attached to each set of documents. Control to the level of whether, for example, comments are made on documents, whether Post-It® notes, comments, or red-lines may remain attached when the document becomes idle, or whether attachments must be stripped from e-mail when filed. Another term currently used for “document control” is “document management.” Document management is the phrase used to describe what activities are performed by information technology applications: EDMs and CMS. Imaging applications do not perform document control; they create a new copy of a document in another medium. While the companies that create these products would like to claim these products do not perform records management, the activities of document control are part of the early twentieth century historical foundation for records management.

RM AND DOCUMENT OR CONTENT MANAGEMENT

Document control is the practice of ensuring the “record” is created properly using various methods of management control. It may take decades to create the “record,” such as an engineering file documenting the creation of the Hoover Dam or a patient file documenting all services provided to a medical patient. The “record” may document an entire process like the creation of a single, complex document, or many different processes as with the example of the patient file. Many different skills are required to ensure appropriate controls are applied. Those skills, some of which are noted in the examples above, may require ethnographic skills to determine how the organization differentiates activities, analytical skills to determine what metadata are appropriate and what are not, managerial skills to manage change, and negotiation with upper-level executives to obtain appropriate funding for projects to implement document controls. For example, the author regularly interviews attorneys in law firms to uncover the logic of how they do their work and then negotiates with the same attorneys to help them create their own standardized list of “document types” and submatters (activities like environmental reviews for real estate deals). This requires knowledge of the technologies being used by the lawfirm, how they are implemented, and how to discuss what the attorneys do with administrators, including directors of IT, who believe the attorneys’ filing activities are either chaotic or so disparate that there can be no standardization. The records manager must also have an in-depth knowledge of security and privacy, litigation

facing the particular organization, quality controls, as well as how the organization views risk management.

Another aspect of this broader definition of “records” is the requirement of having detailed knowledge of the special content of each type of document. One university was astonished to discover the records manager knew where all the personally identifiable information was kept throughout the university and could recite the information from memory without having performed an expensive and time-consuming study. (Personal conversation with records manager of major state university.) Having worked with the documents and given extensive advice on all the university’s processes for so many years and with the disparate dimensions required of any records manager, this is surprising only to the nonrecords manager. Even records managers whose portfolio includes only boxes or tapes in storage will have extensive knowledge of the locations of different types of documents and requirements for managing those documents appropriately throughout the end of the lifecycle.

Knowledge of the varying simultaneous dimensions required to manage documents is often confusing even to employees managing the documents, while quite natural to the records manager. The most important dimension of documents within records management is Retrievalability. Documents, with the exception of the ejaculations of e-mail (which has its own set of problems), are rarely created and sent in one continuous action. Documents, even e-mails at times, are passed around, edited, approved, redrafted, abandoned, and picked up again. Being able to find the documents again is crucial to the smooth flow of business. After documents have been completed and “filed,” finding the document again can become a challenge, particularly if the person who “filed” the document is no longer with the department or even the organization. When there is a time limit on the time required to retrieve (and prepare and review) the document again, e.g., 30 days for a litigation subpoena, and there are thousands of such documents, an organization can find itself in dire straits with whom so ever needs or requires the documents. Precisely this situation held in *Morgan Stanley v. Coleman* where in Morgan Stanley kept finding more e-mail backup tapes and reporting them past the discovery phase of the trial. The judge was so exasperated with Morgan Stanley that he added a fine to the punitive damages that totaled nearly \$1.5 billion. This was subsequently reversed by a higher court, but not because of the amount of the fine. (The jury instructions were considered in appropriately framed. Again, this had nothing to do with the total damages.)

The next dimension in importance in records management is Accessibility. This dimension has a number of different components including speed of access, security, and privacy. Documents may be accessible, but getting hold of a specific document may take several days, many man-hours, and specialized equipment and software. Backup tapes are accessible, but depending upon the

number of tapes, how the tapes were created, and what is required, finding the specific document among thousands of backups can be a struggle. In the Morgan Stanley case, documents were accessible, but could not be retrieved and restored quickly enough to respond to the subpoena. The newly revised rules of evidence do not compel the production of new types of information.^[5] By using the term “electronically stored information” rather than “electronic documents,” “electronic records,” “electronic content,” “databases,” etc. the federal judiciary hoped to clarify what had been interpreted poorly by responsive organizations. Records managers are now beginning to be given responsibility for part of the production of electronically stored information and are working along side general counsel and information technology to create better environments for finding information again.

RM TITLES

The actual title “records manager” has usually made reference to “records,” “information,” or “documents.” Rather than appending “manager” to that, more and more organizations are raising their responsibility set of these employees by making them directors and vice presidents. Sometimes the title is “assistant deputy counsel” because the person has a law degree. In multinational corporations many records managers are the global directors of records and information management. Larger organizations may have more than one records manager with duties divided according to expertise. For example, one may be an executive in charge of the entire program with responsibilities for strategy and liaising with other departments, while another with extensive records retention experience may create an organization-wide retention schedule, yet another will have had experience in imaging or microfilm and be responsible for capture and long-term storage of documents. Research indicates that records managers work closely with legal, IT, and line-of-business managers both as an advisor and as a requestor of information. Far from being locked in a basement with boxes, records managers are now part of robust organizational networks.^[1]

RM EDUCATION

Until the past few years, records management was offered primarily as a community college course. Those courses were offered by practitioners with everything from a high school degree to a professional master’s degree to a doctoral degree. Course offerings would arise with the interests of an individual practitioner in association with a college or university and often ended with that practitioner’s absence. A college course or two would arise as the result of the efforts of a faculty member, but would also wane with the absence of that faculty member. There have been a few

baccalaureate degrees and minors offered, most notably at the College of Business and Public Administration at the University of North Dakota and the School of Information Science at the University of Tennessee at Knoxville. There was little effort put forth in creating an enduring program in part because the same faculty member could make additional monies through writing, consulting, and offering seminars. In other words, cooperation among faculty at different universities in creating a standardized course of study was not rewarded monetarily. Holding knowledge closely rewarded records management faculty monetarily. Faculty who did see themselves creating a course of study were few and created those courses at the baccalaureate level. However, as those faculty members’ careers waned, so did their programs—the same as at the community college level. In addition to this, the school in which records management was taught differed greatly in focus. At the University of North Dakota, records management is taught in the context of business. At the University of Tennessee, records management is taught in the context of library and information science. An occasional dissertation would appear on records management, but no graduate positions created. When records management was taught at the graduate level, it was taught in the context of a library and information science school, usually by an archivist. Some programs have begun offering certificates in records management in MLS (Master of Library Science) courses of study, essentially a minor in records management.

On a different front, the professional association for records managers, ARMA, International, did not have staff who understood enough about university education, like the need for recognition of the profession by deans, not just individual faculty, like the need for there to be a ready market for records management graduates, like companies recruiting for records management graduates on campus and a clear research agenda for the field, to have any impact on records management education. Yet most people who count themselves as records managers, both in the public (52%) and private (64%) sectors got their education in that field from ARMA.^[6]

Because no standardized course of graduate study arose, text books are all aimed at a very practical “how-to” level. Because university faculty, particularly graduate faculty, did not have practical experience and, until recently, the practitioners were primarily high school graduates, textbooks could not graduate much beyond a community college level. The content of textbooks in records management range from how to file^[7] to how to manage a file room.^[8–11] The very best textbook, best because of its scope, quality, and relevance to the field is the work of Robek et al.^[12] (Similar but not as extensive are books by Shepherd and Yeo^[13] and Penn et al.^[14]) Unfortunately, this book is no longer in print. Subsequent editions attempt to deal with electronic records and fail because the scope of the editions was limited and the electronic records dealt with were primarily images on optical disk, i.e., only a

fraction of the life cycle and of formats was dealt with in the text. No literature from archives was relevant to more than a tiny portion of the records life cycle, so no succor was found from that corner. Not until this author wrote *Domesticating Information: Managing Documents Inside the Organization*^[15] did a book dealing with records as business objects aimed at the graduate level exist. It is my hope that this book will be replaced by a much better graduate textbook, but so far, all candidates remain written at the community college level.

A number of courses of graduate study with some records management content have arisen. University of Pittsburgh, University of Michigan, University of Texas, University of North Carolina, and University of British Columbia are the longest running. However, there are no graduate programs in records management. The programs are combined with archives education as a specialty in schools of library and information science where the student would earn an MLS degree. To restate this bluntly, there are no courses of study in records management. Whether records management is a “discipline” or not is a nineteenth century argument that we will not address here. (I believe the same could be said of library science, information science, and archives studies that borrow the methods and trappings of social science, yet ask no grand questions, like the nature of the universe or why humanity is considered a privileged subject.) The courses of study are library studies courses with electives in archives and, usually, one course in records management being taught by an archivist or a practitioner with a CRM and, occasionally, an MLS. Conceiving of a doctoral degree at the present time is difficult as there are few graduate faculty with PhDs, sufficient knowledge of records management, and a CRM, to train a student appropriately. The courses of study where records management is included, “archives and records management,” have greatest emphasis on archives because the courses are taught primarily by archivists. Those courses of study emphasize a part of the life cycle most records managers never encounter: archiving for cultural purposes, i.e., handling information as a cultural object, rather than as a business object.

This difference between archives and records management is also what distinguishes records management from library and information science. Categorical statements about the subject of library science and information science declare the cultural and scientific purpose of information as *the* focus. Records management has an unembarrassed focus on business, including the business of government. Records management also focuses on the entire life cycle and the rules and governance necessary to domesticate information as thoroughly as possible. How scholars and culture will use information later is of relevance for only a tiny portion of information records managers manage.

ARMA has completed its core competencies. One of the purposes for creating the competencies is as a guide to

higher education to ensure that courses on records management include the knowledge and skills required to do the job. The competencies have been embraced enthusiastically by a number of different universities that teach records management including, Wayne State University, San Jose State University, University of North Carolina, and Indiana University. Some of these programs have distance learning courses also based on the competencies. ARMA has also developed a self-assessment tool so that members of the association can identify the gaps in their knowledge and skills for further education.

UNDERSTANDING THE ROLE OF RM HISTORICALLY

The history of records management has also not been well studied. Even records management textbooks trace the history of records management to the end of World War II (WWII) when U.S. archivists were drowning in documents sent to them by the many different agencies involved in the war. The historical record demonstrates that the basic concepts of records management—document control, life cycle management, and records retention—have been around for more than 5000 years.^[16] Modern records management in the United States arose when the concepts of “scientific management” that were developed on the shop floors of manufacturing in the late nineteenth century were brought into offices in the early part of the twentieth century.^[17] The term “records management” began to be used around the 1930s and was adopted by U.S. archivists immediately before and during WWII to describe what should be happening in the agencies so that the National Archives did not have to sort out the grains of wheat from the voluminous chaff. What the archivists appear to have added to the field after WWII is the term “records retention and disposition schedule” which had previously simply been called “transferring.”^[18]

Currently, few people with even a master’s degree are teaching records management in graduate courses. Many of those classes are non degree, distance learning only, because most classrooms cannot be filled by physically existing bodies more often than about every 5 years, except in very large markets like Houston and Los Angeles. The distance-learning methods range from the correspondence courses offered by Bill Benedon throughout the 1960s to online chat room courses like those at Wayne State University, and San Jose State University, to live video learning at Indiana University. Because of this dearth of education, the professional association for information managers, ARMA, along with its local chapters became one of the few sources of education in records management. Until a little more than a decade and a half ago, the educational sessions provided by the association and its chapters was on the latter half of the life cycle, because that was something nearly all members had in

common. This meant sessions on other parts of the life cycle had to be handled by special interest groups.

The lack of graduate education also led to the development of a certification, the CRM, which requires an application, 3 years of broadly based experience in records management, the passing of five multiple-choice tests, and one essay question. This certification has been in existence for more than 35 years and has become recognized in both the public and private sectors as a measure of professional knowledge. Currently, there are more than 800 CRMs world wide, this is up from 600 about 10 years ago. This is the only certification in records management, there are many seminars with examinations that offer a certificate. Those seminars do not require experience or an application other than a fee. The CRM is currently the only way to recognize general knowledge in records management.

CONCLUSION

The diversity of the work portfolios of records managers stems from the fact that records management is needed in every organization from aeronautics through government to zoos, from the part of the life cycle that is managed and the differences in types of information managed. Not all organizations have a records manager, and most suffer from that lack when information is not created appropriately, is found by persons that should not have access to it, cannot be found again, or is not destroyed properly. While an urban legend has records managers managing boxes of paper in a warehouse, they manage evidence rooms in law firms and police stations and even DNA samples and bio-authentication data (retinal scans, fingerprints, facial scans, etc.). More than the commonly held concept of documents, records managers manage logs, caches, whole databases, database outputs, copies, drafts, versions, etc. Records managers manage information about nuclear waste, municipalities, and medical patients. The information may require machines like electron microscopes, computers, and microfilm readers to access it. The information may be in a CAD (computer-aided design) program, a laboratory testing machine's memory, or at the phone company.

The problems a records manager deals with may arise through maliciousness, laziness, or lack of direction. Identifying the source of the problem is as important as managing the process of change to reach an optimal solution. The solution nearly always requires policies and procedures. Machines do not manage information, cannot judge the level of passion a change will create, nor create a judicious statement of how information must be handled under certain circumstances.

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Encyclopedia Edited By

John D. McDonald

and

Michael Levine-Clark



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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable.

Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

They acknowledge and thank the Taylor & Francis Group editors, Claire Miller and Rich O'Hanley, as well as Susan Lee, who passed away at the early stages of the preparation of this edition, and more recently, Alexandra Torres, who supported and kept the editors and authors on track over the course of the years of work on this edition of the encyclopedia.

The editors thank the authors who wrote and revised entries, and the huge number of reviewers who refereed the entries. Without their dedication, expertise, and willingness to share their knowledge with others, there would be no encyclopedia. They also wish to thank the Editorial Advisory Board for their advice, suggestions of topics and authors, their hours spent writing or reviewing for the final edition. They also wish to thank the previous editors, Marcia Bates and Mary Niles Maack, whose organization and structure for ELIS-3 provided an excellent blueprint for ELIS-4.



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Cataloging—Chartered

Chemistry—China

Circulation—College

Communication—
Corporate Art

Corporate Information—
Custody

Data—Dewey

Digital—Disaster

Document—Engineering



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Cataloging

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Abstract

Bibliographic control, the larger field of which cataloging is a part, is discussed in order to provide the context for cataloging. A major product of the process of cataloging, the catalog, is explained in order to underscore why cataloging is needed. The processes for completing original cataloging are delineated, followed by a brief look at cooperative and copy cataloging. Methods for encoding metadata records for online storage and display are outlined.

INTRODUCTION

The purpose of this entry is twofold: 1) to set the context in which cataloging takes place and 2) to introduce the basic concepts of cataloging. The discussion begins with an introduction to the realm of bibliographic control and a brief exploration of where cataloging fits within that realm. Catalogs are discussed in terms of their forms, functions, and components. An overview of the entire process of cataloging—descriptive cataloging, subject analysis, and authority control—is then given, followed by a look at cooperative and copy cataloging that make original cataloging of all materials for every collection unnecessary. Finally, there is mention of the formats of bibliographic records in catalogs and some emerging trends in the twenty-first century related to encoding and sharing bibliographic metadata.

BIBLIOGRAPHIC CONTROL

Cataloging is a subset of the larger field that is sometimes called *bibliographic control* or *information organization*, and it is helpful to view it in that context. Bibliographic control is defined by Elaine Svenonius as “the skill or art... of organizing knowledge (information) for retrieval.”^[1] Richard P. Smiraglia defines it as a process that encompasses “the creation, storage, manipulation, and retrieval of bibliographic data.”^[2] In other words, bibliographic control is the process of describing information resources and providing name, title, and subject access to the descriptions, resulting in records that serve as surrogates for the actual items of recorded information. These surrogate records (sometimes called *entries*, *bibliographic records*, or simply *metadata*) are then placed into information retrieval tools, where the records act as pointers to the actual information resources. The comprehensive descriptions found in the records provide users with

enough information to determine the potential value of the resources without actually having to view the items directly. Surrogate records are stored in a variety of retrieval tools including bibliographies, catalogs, indexes, finding aids, museum registers, bibliographic databases, and search engines.

The concept of bibliographic control is applied to all types of information resources including books, journal articles, corporate records, physical objects, digital images, and myriad other formats, and it includes both human-based and machine-derived metadata creation. While it includes activities such as bibliography, indexing, archival description, etc., the presence of the root word *biblio* suggests to some that bibliographic control focuses primarily on books, a resource type most commonly associated with libraries and library cataloging. Consequently, in recent years another phrase—*information organization* (or sometimes *organization of information*)—has been used increasingly to refer to the overarching concept of bibliographic control (i.e., describing all types of information resources for the purpose of retrieval). Arlene G. Taylor, in *The Organization of Information*, points out that “retrieval of information is dependent upon its having been organized.” She goes on to note that in addition to retrieval, the “organization of information also allows us to keep a usable record of human endeavors for posterity.”^[3]

In the universe of all knowledge, including knowledge that cannot necessarily be expressed verbally (e.g., music, and art), there is a certain amount of that knowledge that has been recorded in some way (e.g., written down, digitized, and painted). This subset is often referred to as the *bibliographic universe*. Taylor describes the bibliographic universe as “all instances of recorded knowledge,” and goes on to state, “Only the bibliographic universe can be controlled.”^[4] Such control is maintained through the use of retrieval tools in which each discrete information resource is represented by a surrogate record. Anyone

who has attempted to maintain a list of references to articles, a collection of books, or a set of bookmarks for web resources on a particular subject (or by a particular artist or author) has practiced bibliographic control over a very small part of the bibliographic universe. For such projects to succeed, it is necessary to decide what data elements to record about each resource; for example, it may be decided that creator(s), title, subject keywords, a standard identifier, and the location of the resource should be included in the description. The data elements that are recorded to describe a resource are referred to as *metadata*—a term that is often defined as “data about data,” but is more usefully understood as a set of important attributes of a resource that assist in finding, identifying, selecting, obtaining, and managing the resource. As the collection grows, so does the complexity of storing, managing, and retrieving needed information. When this occurs, the art and skills of organizing information become essential for the successful creation, maintenance, and use of the collection. In traditional library settings, the art and skills of bibliographic control are referred to as *cataloging*, and the result of these activities is a retrieval tool called a *catalog*.

CATALOGS

A catalog is an organized set of bibliographic records that represents the holdings of a particular collection and/or resources accessible in a particular location. It may be arranged by classification notation, alphabetically by names, titles, or subjects, and in various other ways. A collection may consist of any of several types of materials—books, periodicals, maps, coins, sound recordings, paintings, musical scores, to name just a few. Traditionally, the collection represented by a catalog has been located in one place or at least in different parts of the same institution. Increasingly, however, catalogs may represent the holdings of more than one library, as libraries form consortia or otherwise link their catalogs for the purposes of interlibrary sharing. (Such catalogs are sometimes called *union catalogs*.) In addition, catalogs may include surrogate records for resources that are not owned by the institution, but to which the library can provide access, including websites, online subscription databases, e-books, online journals, and digital library collections.

Why prepare catalogs? Catalogs are necessary whenever a collection of resources grows too large to be remembered item for item. A small private library or a classroom library has little need for a formal catalog; the user can recall each book, sound recording, map, or other such item by author, title, subject, the item's shape, its color, or its position on a particular shelf. When such a collection becomes a little larger, an informal arrangement, such as grouping the items by subject categories, provides access to them. When a collection becomes too large for such a simple approach, a formal record of the

collection is necessary. There are two major reasons to make such a formal record of larger collections: for retrieval and for inventory purposes. In addition to being unable to remember what is in a large collection for access purposes, it also becomes impossible for the owner to remember what has been acquired, lost, replaced, etc. A catalog can serve as a record of what is owned as well as a retrieval tool.

Forms of Catalogs

Historically, library catalogs have appeared in various forms. In ancient times, papyrus scrolls and clay tablets were all the rage, but in today's library the catalog primarily appears in one of four distinct formats: book catalogs, microform catalogs, card catalogs, and online public access catalogs (OPACs). While book, microform, and card catalogs are still used in many places around the world, the OPAC has become the most commonly used form of catalog in the Western world. Of these four forms of catalogs, the book catalog is the oldest. In its earliest appearances, the book catalog contained handwritten entries, but by the end of the nineteenth century, the printed book catalog was the most common form of catalog in Western libraries. Today, they are still used in some libraries that cannot or have chosen not to automate access to their collections and in other libraries for some parts of their collections. Because printed book catalogs were rather expensive to produce and quickly became outdated, they were gradually replaced by card catalogs.

Until the late twentieth century, the card catalog was the library catalog most often found around the world. In a card catalog, each information resource is represented by a set of standard 7.5×12.5 cm cards (roughly 3×5 in.), although in the beginning of the card era the size was not always standard. Multiple cards are prepared in order to represent the various access points needed in the catalog (i.e., a card for each author, a card for the title of the work, a card for each subject represented in the work, a card for a series, etc.). Cards were at first handwritten before the typewriter came into standard use. Typeset cards were available from the Library of Congress (LC) beginning in 1901. Later, cards were often prepared by photoreproduction of a printed or typed original. Cards are now most often computer-produced from machine-readable catalog records. The card catalog is still found in libraries throughout the world (it is sometimes difficult to remember that in some places, electricity is not always reliably present—making online catalogs impractical). In the United States, card catalogs can still be found in small libraries that cannot afford the software and equipment necessary to switch to an online catalog. They are also used in some larger libraries for specific parts of the collection, perhaps for older materials or special collections.

Microform catalogs became popular with the development of computer output microform (COM) in the

mid-to-late twentieth century. COM catalogs could be produced in either microfilm or microfiche. With this form of catalog, it was feasible to provide a completely integrated new catalog every 3 months or so, rather than providing supplements to be used with a main catalog as was needed with printed book catalogs. COM catalogs did require the use of microfiche or microfilm readers—bulky pieces of equipment that took up a great deal of space and were not portable. While COM catalogs were useful from the perspective of librarians, microform catalogs were not popular with users.

The online catalog, often referred to as an *OPAC*, has rapidly become the catalog of choice among librarians and users. The OPAC is usually one component of a larger automated system called an *integrated library system* (ILS)—a computer system that includes various modules to perform different functions in a library while sharing access to the same database. Other modules in the ILS may exist for cataloging, authority control, acquisitions, serials management, circulation, course reserves, and interlibrary loan functions. In the OPAC, the public interface to the ILS, bibliographic records stored in the ILS database are displayed on a screen in response to requests from users. Until the 1990s, such integrated systems were costly, and only very large libraries could afford them. Now, systems have been developed for use on every size computer and have become more affordable, including some that are available freely as open source software. In the beginning of the twenty-first century, as technology continues to progress, some difficulties associated with integrated library systems are becoming more evident. Often, the online catalog is negatively compared to web interfaces for popular online bookstores or to major Internet search engines, suggesting that catalogs are no longer a favored retrieval tool among users. In an attempt to satisfy users and create a more friendly search environment, new innovations in system design (i.e., the inclusion of meta-searching, faceted browsing, cover art, user tagging, tag clouds, and user reviews) are starting to appear in both OPACs and *discovery environments*, which are a user interfaces that work in coordination with the OPAC to provide alternate views of the metadata contained within. For example, a large set of results from a keywords search may be browsed using classification, creators, genre, subjects, dates, and various other facets as guideposts. Most recently, a number of library automation vendors have been offering new products, sometimes referred to as *library services platforms*, which go beyond the tradition ILS in their “engagement with electronic and digital content. In their own distinctive ways, these recently announced or delivered systems aim to break free of the models of automation centered mostly on print materials deeply embodied by the incumbent line of integrated library systems... to handle all the different forms of content.”^[5]

Functions of Catalogs

Catalogs, whatever their form, have four basic functions. The first is the *identifying* function. All retrieval tools aim at allowing a user, who has a citation or has a particular resource in mind, to match that known item with an entry in the tool—limited, of course, by the scope of the retrieval tool. The scope of a library catalog, for example, is often the items owned or made accessible by the institution; therefore, the user should be able to match or identify or find an entry for a known item that the library owns, or for an item to which the local institution can provide access.

The second function is the *collocating* or *gathering* function. Collocation is a means for bringing together in the catalog like and closely related entities; for example, resources about dinosaurs are grouped together under the subject heading *Dinosaurs*. The subject heading in this case acts as a gathering point for all resources about this topic. In many cases, a particular work is shown in relation to a larger group of connected works. For example, the bibliographic record for a play based upon Mark Twain’s *Huckleberry Finn* should be found with records for editions of *Huckleberry Finn*, which in turn can be found with records for other works of Mark Twain. The most common way of accomplishing collocation is through the process of *authority control*—using a unique character string (or some other form of identifier) to represent each name, work, or subject in order to achieve consistency within the catalog or other retrieval tool. If entries for *Huckleberry Finn* are sometimes found under *H* (for *Huckleberry Finn*) and sometimes under *A* (for *Adventures of Huckleberry Finn*) with no connecting references, collocation has not been accomplished.

The third function of catalogs is the *evaluating* or *selecting* function. This function allows a user to choose from among many different records the one that best seems to represent the information or specific physical resource desired. For example, a user looking for a particular edition of *Huckleberry Finn* should be able to select it from among several, if it is one of those listed in the catalog; or, given a choice between a spoken recording on a cassette tape or in the form of an MP3 file, a user could choose the one most appropriate for his or her circumstances, such as the resource that can be used with the equipment available to that user. It can be seen that the first three functions, first described by Charles A. Cutter as his “objects” of the catalog,^[6] are somewhat interdependent.

An additional function of a catalog is that of *locating* or *obtaining* resources, a function not always served by other bibliographic tools. One can tell from a library catalog whether the library contains a certain resource and, if so, where it is physically located. This is true even of union catalogs in the sense that the catalog identifies which libraries house particular items, although one may need more detail to know where in a particular library to find

an item. With many catalogs, the circulation system is linked, making it possible for the user to learn whether or not an item is available for use. Virtual locations of online resources are provided in catalogs through their uniform resource locators (URLs).

Components of Catalog Systems

Basically, there are three components comprising a whole catalog: a public access catalog, a shelflist, and an authority file or files. In printed catalogs, these are separate physical components. In online catalogs, the OPAC and shelflist are really different ways to search the same file; the authority file is actually a separate file. The public access catalog is the main component, giving access to bibliographic records via author, title, subject, or keyword. This is the catalog component readily available for the use of library patrons. Increasingly, OPACs include links to enhancements held outside the bibliographic records, such as online versions of the resource, tables of contents, and publisher blurbs and reviews.

A shelflist is a record of the holdings of a library; entries are arranged in the order of the items on the shelf—hence the name *shelflist*. With the cataloging of datasets, software, and web resources, for which there is often not a physical item to be placed on a shelf, the name is less descriptive. Records of a library's holdings for such entities may be placed in order by classification notation, acquisition number, or some other device. A shelflist record usually contains a record of ownership of numbers of copies and/or volumes held, as well as information about locations of copies, especially when a library is made up of several collections. Shelflists in print form have traditionally been kept in areas not accessible to the public. There have been notable exceptions to this, however, especially in situations where the areas in which materials are shelved (called *stacks*) are not open to the public. In these situations, browsing the shelflist can substitute for browsing in the stacks. Another change in the availability of shelflists has occurred with online catalogs. When classification is an access point in the catalog, the results of classification notation searches are displayed in shelflist (i.e., classification) order, essentially making the shelflist available to everyone. In addition, most online catalogs provide copy and location information at all access points.

Authority files contain records of the forms of names, titles, and subjects that have been chosen as the standardized forms to use as *authorized access points* (AAPs) in a catalog. An AAP is the exact string of characters used to represent an entity consistently. Authority records also contain lists of references made in the public catalog from unauthorized to authorized forms, so that users do not have to know the actual authorized forms of name, title, or subject in order to retrieve the needed information from

the catalog. Traditionally, authority files, like shelflists, have been kept in areas inaccessible to the public. Again, online catalogs have changed this. In some systems, authority files serve as indexes to the catalog.

Online catalogs usually contain all three of these components, but they are not always as distinctly separate as they are in printed catalogs. Authority files still are nonexistent in some online catalogs, and in others, they are unlinked files. Increasingly, however, links between the authority files and the bibliographic files are established so that the authority files may serve as the index(es) to the access points used in the catalog, and in some cases they serve to alert catalogers automatically to inconsistencies in the authority-controlled metadata. In addition, a number of other components have been added to online catalogs. Acquisitions and in-process records are available to the public in many systems, and circulation information is available in virtually every system.

CATALOGING

The means by which catalogs are prepared is through the process called *cataloging*. This process usually begins with descriptive cataloging, including access point choice and creation, and then moves into subject analysis. Additionally, authority control and the encoding of the metadata are mixed into the process.

Foundations of Twenty-First-Century Cataloging

In the early years of the twenty-first century, the international cataloging community has worked to create new standards and models to inform information organization activities. These included the design and elaboration of sound theoretical models to illustrate the bibliographic universe and its components, such as *Functional Requirements for Bibliographic Records* (FRBR) and *Functional Requirements for Authority Data* (FRAD), both developed by the International Federation of Library Associations and Institutions (IFLA). These efforts also included the formation of principles to guide the cataloging process, which resulted in the *Statement of International Cataloguing Principles* developed through a series of IFLA Meetings of Experts on an International Cataloging Code (IME ICC). More recently, these foundational documents supported the development of a new set of cataloging instructions: *RDA: Resource Description & Access* (RDA), an international cataloging standard grounded in Anglo-American cataloging traditions.

FRBR, published by IFLA in 1998, is a conceptual model of the various entities found in the bibliographic universe and the relationships among them.^[7] In other words, it is an entity-relationship model—an approach commonly used in modeling relational databases—which attempts to describe users' requirements for bibliographic

systems. The FRBR model is thus concerned with the entities found in the bibliographic universe and how those entities interact (i.e., the relationships among the entities). The bibliographic entities are broken into three groups in the FRBR model. Group 1 includes resource-based entities and the hierarchical levels represented in them. These include two abstract levels, *works* and *expressions*, and two concrete levels, *manifestations* and *items*. The first entity, *work*, exists only in the mind of its creator, but the second entity, *expression*, is the articulation of the work's ideas or concepts through spoken words, alphanumeric symbols, choreographic notation, musical notation, or some other method of communication. A *manifestation* is a physical embodiment of an expression of a work. It is a material object or electronic representation of the expressed work in the form of books, video recordings, web pages, sound recordings, paintings, and so on. An *item* is a single, specific instance of a manifestation; that is, it is the exact copy that is owned or accessed by a user. Group 2 represents those entities responsible for the establishment of group 1 entities. These include *persons*, *families*, and *corporate bodies*. These entities have several roles related to group 1 entities; for example, a person may create a work or help to realize an expression, a corporate body may produce a manifestation, or a family may own a particular item. The entity *family* is included in group 2, even though it is not found in the FRBR model, because it is discussed in FRBR's companion document, FRAD.^[8] Group 3 entities include subject entities described as *concepts*, *objects*, *places*, and *events*, as well as the group 1 and group 2 entities (which may also be used as subjects). The FRBR model presents ways to describe the entities with their attributes and also ways to relate various entities to each other. FRBR also reminds us that users want to find, identify, select, and obtain information in the resources that we catalog. A number of libraries and ILS vendors have experimented with systems that can make use of the FRBR model, and FRBR and FRAD are two foundations for the new set of descriptive cataloging guidelines, RDA. In 2016, a world-wide review of the FRBR-Library Reference Model (FRBR-LRM) began. The FRBR-LRM was developed to harmonize the separate "Functional Requirements" conceptual models into a single standard covering all aspects of bibliographic, subject, and authority metadata.^[9] At the time of this writing, significant changes in cataloging's underlying conceptual model are expected as a result of these revisions.

After a series of five meetings held between 2003 and 2007, the IME ICC disseminated in 2009 their *Statement of International Cataloguing Principles* (ICP). The purpose of the IME ICC meetings was to update the Paris Principles, which were agreed upon in 1961 and underlay all the major cataloging codes used throughout the world. The meetings' discussions were the basis for international agreement on an updated set of cataloging principles and a glossary of terminology. These principles emphasize convenience for users, stating, for example, that metadata

should be available in languages and scripts that users can read. In addition to discussing 10 basic objectives that guide the construction of cataloging codes (i.e., convenience, accuracy, standardization, etc.), the statement addresses six major principles related to entities, attributes, and relationships; functions of the catalog; bibliographic description; access points; authority records; and foundations for search capabilities. In 2015, IFLA's ICP was revised, and a world-wide review began in 2016. Some additions to the general principles are expected after the revisions are complete.^[10]

RDA, published in 2010, is a set of cataloging rules constructed by the RDA Steering Committee (RSC) to supersede the last version of *Anglo-American Cataloging Rules* (AACR). It is solidly based on FRBR, FRAD, and the IME ICC's *Statement of International Cataloguing Principles*. The goals of the RSC were to overcome the inconsistencies and inadequate structure of AACR and to provide rules for meaningful metadata for multiple types of resources that can be used by a wider audience than just the Anglo-American cataloging community. At the time of this writing, it appears that RDA is becoming an international standard for cataloging; it has been translated into Chinese, Finnish, French, German, Italian, and Spanish, and it has been adopted by over a dozen national libraries from around the world, with more expected to adopt it in the future. It is hoped that by providing a more all-encompassing set of rules for description and access, greater cooperation between libraries and other information communities may be developed.^[11] Whether this occurs or not is one of the main issues to be resolved in the realm of bibliographic control.

Encoding

Unless catalog cards are typed manually, encoding permeates the entire cataloging process. The results of each of the descriptive, subject, and authority processes are entered into a machine-readable form that is compatible with the online system in which the catalog record will be used. In the current cataloging environment, the most commonly used encoding standard is the MACHine-Readable Cataloging (MARC) bibliographic format, or in the case of authority records, the MARC authorities format. Increasingly other forms of encoding—often in the form of schemas established in the eXtensible Markup Language (XML)—are being found in integrated library systems, discovery environments, and library services platforms. At the time of this writing, a project to develop an alternative approach for sharing metadata, the Bibliographic Framework Initiative (BIBFRAME), is being headed by the Library of Congress.^[12]

Descriptive Cataloging

Descriptive cataloging is the phase of the cataloging process that is concerned with the identification and description of a resource, the recording of this information in the form of a cataloging record, the selection of name and title

access points the formation of AAPs for the names and titles, and the encoding of these data elements so that they will be machine-readable. Descriptive cataloging describes the makeup of a resource and identifies the persons or institutions responsible for the intellectual contents. Descriptive cataloging is concerned with both the carrier and the content of a resource, but does not address the topical contents of the resource, which are the province of subject cataloging.

Description

Identification and description are interrelated processes in descriptive cataloging. Identification consists of the choice of conventional elements, guided by a set of rules based on agreed-upon international standards. When the cataloger has properly identified the conventional elements, they are described in a catalog record in such a fashion that the description is unique and can be applied to no other entity in the collection. In other words, each resource should be distinguished from everything with which it could be confused. Elements considered essential for this purpose in describing physical resources are usually title, statement of responsibility, edition information, standard numbers, and publication, distribution, or production information. Physical description—extent and size of the resource—and series metadata are often essential to this purpose as well. Components essential for describing virtual resources (e.g., Internet documents) are title, statement of responsibility, version information (if present), date information, and location information (e.g., URL). In addition, the cataloger gives elements of description that may be helpful to a user in evaluating the potential use of the resource, such as whether it is illustrated, its intended audience, what equipment is needed to use it, any restrictions there may be on use, or its mode of access. Such descriptive metadata may be part of the conventional elements or may be contained within (sometimes extensive) notes in the catalog record.

Access

After describing a resource, the cataloger selects particular names and titles to be access points. Names of persons, families, and corporate bodies associated with the creation of a work are chosen according to the cataloging rules used. Title access points also are chosen—in addition to the obvious main title (called *title proper*) there may be alternative titles, variant titles, series titles, and titles of other works related in some way to the work being cataloged. The names and titles chosen are then formatted as AAPs, constructed in a form that will make them readily accessible in the catalog and will enhance collocation of related resources. This is done using cataloging instructions and through reference to the authority file (ensuring that the authorized form of name is used consistently), thus continuing the process of authority control.

In earlier cataloging practices, one access point was chosen as the *main entry* or *primary access point*. The main entry was typically the person or entity primarily responsible for the creation of a work. Because one access point was considered to be the main entry, the remaining access points were referred to as *added entries*. Both types of entries allowed for the retrieval of resources in the catalog, but the main entry had an additional function of identifying the work embodied in the resource being cataloged. A combination of main entry and title was the most common way of referring to a work in the realm of cataloging. In RDA, the terms *main entry* and *added entries* are not used, but the work-identification function of main entry is still needed. Catalogers require a consistent name for a work and the most logical one is the through the creation of an access point comprising the AAP for the principal (or first-named) creator along with the preferred title for the work (e.g., Shakespeare, William, 1564–1616. Hamlet).

Subject Analysis

The subject analysis process begins with determining the *aboutness* of the work, that is, what subject concepts are covered by the intellectual or artistic content of a work, and in the case of some creative works, the form or genre represented by the resource. Once these have been determined, the concepts are then translated into one or more forms of controlled vocabulary. Controlled vocabularies can take a verbal approach (i.e., subject headings or descriptors from a thesaurus) or a notational approach (i.e., symbols from a classification scheme) to subject representation. When taking a verbal approach, as many subject headings as are appropriate are chosen from a standard list to represent the topics of the work. Again, an authority file must be consulted if the works are to be properly collocated into the catalog with other works covering the same or related subject concepts. Verbal subject representation may take the form of single terms assigned individually to a work to represent a single concept, or it may take the form of strings of terms to represent multiple facets of a topic, if the controlled vocabulary allows this type of heading construction.

When using the notational approach, symbols from the classification scheme used by the library are assigned to the resource. Traditionally in the United States, classification serves both as a means for bringing an item in close proximity with other like items in the catalog and, in the case of tangible resources, as the first element of the *call number*, a device used to identify and locate a particular item on library shelves. The cataloger, therefore, must choose the one best place in the classification scheme for the item. In other parts of the world, however, or in nontraditional collections, more than one classification notation may be assigned to a resource to represent multiple topics or multiple aspects of subjects found in the content. These multiple classification numbers may be

used as searchable access points in the catalog, but with only one being chosen to represent the shelf location of the item.

Authority Control

Authority control is the result of the process of maintaining consistency in the verbal forms of names, titles, and subjects terms used to represent an entity, and the further process of showing the relationships that exist among those names, works, and subjects. It is accomplished through use of descriptive cataloging instructions (in the case of names and titles), use of a controlled vocabulary (for subject headings and descriptors), and reference to an authority file to create an authorized character string. An authority file is a group of records for the names, titles, or subjects chosen for use in a catalog. Each authority record in an authority file may contain, in addition to the form chosen for use as the AAP, a list of variant forms or terms that may be used as references. More recently, additional metadata elements reflecting attributes of persons, families, corporate bodies, and works have been added to authority records to provide more understanding of the entity being described in the record. Elements such as place and date associated with the entity, gender, field of activity, associated language, occupation, associated group, and the like provide greater context for the entity. A carefully prepared authority record also contains a list of sources consulted in the process of deciding upon the authorized form of name or term, the variant forms to use as references, and additional data elements to include. It is possible to practice authority control by letting the catalog itself serve as the authority file, that is, by assuming that the form of heading used in the catalog is correct. In larger catalogs, this has proved to be difficult, and it is very challenging to keep track of references without an authority file.

It is authority control that makes cataloging more than just a process of creating a series of bibliographic records to represent discrete works, because authority control allows the cataloger to create AAPs for names, titles, and subjects that show the relationships among the works cataloged. It means that the AAP for a particular name, when used in different records, is always consistent so that bibliographic records for all works by and about the same person or family, or emanating from the same corporate body, can be displayed together. An AAP for a work (formerly called a *uniform title*), which often consists of the name of the principal author followed by a standardized title, can be consistently presented so that bibliographic records for all editions, translations, sound or video recordings, adaptations, abridgements, etc., of a work can be displayed together. The subject heading or descriptor that is used to represent the same topic or concept in different works can be used in one form so that to the extent that works are identified as being about the same

subject concept, all such works can be displayed together collocated under the authorized subject term. Authority control of subject terminology also makes it possible to refer users from terms not used (e.g., Haplorhini) to those that are used (e.g., Monkeys), as well as from terms that are used (e.g., City dwellers) to broader terms (e.g., Persons) and/or narrower terms (e.g., Yuppies) and from terms that are used (e.g., Cooking) to other related terms that may be of interest (e.g., Gastronomy).

As we move more and more into the international arena, virtual authority control connecting national authority files with each other is becoming essential. Creators of catalogs in various countries using various languages need to be able to designate their own “authorized” forms of names, while at the same time recognizing variant names for the same person or other entity in other languages. International catalogs should not be required to use the English-language authorized forms, but should be able to link users to entities they seek, regardless of the language used in their searches.

Cooperative and Copy Cataloging

The process of cataloging described earlier is often referred to as *original cataloging*. Fortunately, it is not necessary for every information resource in every library to be cataloged originally in that library. Because libraries acquire copies of many of the same items, or decide to catalog the same online resources, their catalogers can share metadata by adapting a copy of the original cataloging created by another library for their own catalogs, a process commonly called *copy cataloging*.^[13] This is related to the idea of *cooperative cataloging*, the working together of independent institutions to share network memberships or to create cataloging that can be used by others.

In the United States, cooperative and copy cataloging efforts began in earnest in the early part of the twentieth century, when LC started selling its standard printed catalog cards to libraries in 1901. H. W. Wilson entered the field in the 1930s with simplified catalog cards for sale. A number of other companies created and sold catalog cards from the 1950s into the 1970s. In addition, LC book catalogs were available in large libraries, and methods were devised for photocopying entries from them for adaptation and use in local catalogs. With the development of the MARC format in the late 1960s, cooperative cataloging took a new turn. At first, the companies selling cards simply loaded LC’s MARC tapes into their computers and printed cards from them. But the beginning of bibliographic networks based on MARC not only changed the availability of cards but also introduced the truly cooperative availability of cataloging data. The first bibliographic network was OCLC—at first the Ohio College Library Center, but now OCLC Online Computer Library Center, Inc. Libraries can become members (either individually or

through regional networks) and contribute original cataloging to the system. Any member library then can use records found in the system contributed by LC, other national libraries, or other member libraries. At first, the OCLC cataloging system was used only for the production of cards. Once the appropriate technology became available, libraries realized that making changes to an online record is much easier than trying to adjust photocopies or preprinted cards. Now, most libraries simply download MARC records directly into their local online systems for use in their OPACs. In recent years, SkyRiver was created as an alternative to OCLC. In addition to OCLC and SkyRiver, smaller regional and local networks exist in large numbers.

The amount of original cataloging remaining after use of cooperative cataloging depends upon the type and size of library. The more specialized the library, the more original cataloging it has. Specialized collections can require a high percentage of original cataloging, even though the collection or library may be quite small. There is now increased interest in cataloging more of the unique materials (e.g., local history, digitized materials, rare foreign language resources, and genealogy materials) that local libraries may have in order to make these essentially hidden resources available to wider audiences.

In the mid-1990s, there was a movement toward outsourcing both original and copy cataloging in some libraries. Outsourcing involves contracting with vendors outside the library to do some of the cataloging (or occasionally all the cataloging) for the library. The move has both advantages and disadvantages, and much has been written on this subject.^[14,15]

In addition, vendors may provide metadata alongside the resources being sold or leased to libraries and other information institutions. In some cases, complete or nearly complete sets of records may be provided to the institution to be loaded directly into its catalog. Although it may be provided for individual resources, this type of service is more useful when dealing with large resources sets, particularly electronic resources (e.g., a collection of 5,000 streaming videos). The quality of such metadata, however, varies among vendors. Some catalog record sets may require little to no manipulation, but others may need to be enhanced or customized before being used by the institution.

FORMATS OF BIBLIOGRAPHIC RECORDS IN CATALOGS

In order for them to be displayed in retrieval tools, the surrogates created for each information resource must be encoded for machine processing or printing. The cataloging process, therefore, requires the encoding of the bibliographic records in the format of the system being used. Uniformity of display is very desirable so that patrons can

know how to read a record and where to expect to see certain metadata elements. In printed catalogs, the display of metadata was quite standard. Most libraries and card production sources followed the LC pattern, because LC-printed cards were so extensively used and because the order of elements devised by LC made a logical presentation of data. That order was codified by the various versions of the AACR.^[16]

Today, the vast majority of catalog records are created using one of the MARC formats. The first MARC format was developed at LC around 1965. The version used in the United States was, for many years, referred to as USMARC to distinguish it from the versions used in other countries (e.g., IBERMARC and danMARCAACR). The latest version, published in 1999, is called *MARC 21*. It is a “harmonization” of CAN/MARC and USMARC, and the name is meant to show that it is ready for the twenty-first century. Because many national versions of MARC exist, exchanging bibliographic data across international boundaries might be difficult, were it not for UNIMARC, created in 1977, which acts as a crosswalk or a translator between different versions of MARC and can be used as an encoding scheme itself. A general discussion of MARC and several other encoding standards can be found in Taylor and Joudrey’s *Organization of Information* and Joudrey, Taylor, and Miller’s *Introduction to Cataloging and Classification*.^[17,18]

MARC is not the only way to encode library metadata. In recent years, other approaches to encoding have been explored because some catalogers and information technologists have seen its limitations. A frequent criticism of MARC is its lack of interoperability with nonlibrary computer networks and systems. Not only does the MARC format limit the ability of libraries to interact with other forms of data, but also library metadata cannot easily be shared with other communities. The Library of Congress Working Group on the Future of Bibliographic Control stated that the library community needs to recognize that “the World Wide Web is both our technology platform and the appropriate platform for the delivery of our standards,” and “people are not the only users of the data we produce in the name of bibliographic control, but so too are machine applications that interact with those data in a variety of ways.”^[19] It is with these concerns in mind that libraries began exploring alternatives to the MARC format.

XML (ISO 8879) is a subset of the Standard Generalized Markup Language (SGML). In recent years, it has been used to store and share structured data on the World Wide Web. Like any markup language, XML is used to describe the various features and attributes found in documents, but unlike Hyper Text Markup Language (HTML)—which is also derived from SGML and is currently the language of the web—it is not focused on displaying text. Instead, XML focuses on identifying the various pieces or components of a text. For example,

HMTL allows users to manipulate the size and look of the text (using bold, larger font sizes, etc.); XML allows users to identify elements such as a document's title, its creator, relationships among the elements, what elements are required, etc. As the web has grown, HTML has been criticized because it is too simplistic to provide for many desirable applications. Some thought for a while that full support of SGML on the web was the answer. However, SGML is fairly complex and has features that make the programming involved complicated and lengthy. XML was developed as an answer to these problems. It is essentially a version of SGML that can be used on the web. Its components are the same: entities, elements, and attributes. XML is referred to as *extensible* because it allows its users to develop their own descriptive tags; it is very flexible and can be used to support many different types of web applications.

XML is touted by its developers as being just as easy to use on the web as HTML, but at the same time being as powerful as SGML.^[20] Although XML uses the same basic components as SGML, XML does not require a document type definition (DTD) or an XML schema. Schemas and DTDs are mechanisms used to define the elements and attributes used when describing documents. When attempting to consistently and fluidly share data of a particular type, in a particular community, or for a particular purpose, a defined set of tags and elements become essential for interoperability. In the library community, a MARCXML schema and DTD have been created in order to share MARC metadata with a wider community.^[21] Both mimic the content designation structure of the MARC21 bibliographic format, but encoding is in XML syntax. For example, instead of finding a title proper encoded as

```
245 14 $a The title is here / $c by
      Annie Author.
```

in the MARCXML schema, the title element would appear as:

```
<datafield tag="245" ind1="1" ind2="4">
  <subfield code="a">The title is here /
</subfield>
  <subfield code="c">by Annie Author.
</subfield>
</datafield>
```

Other XML-based approaches to library metadata include Metadata Object Description Schema, a schema for a bibliographic element set that uses natural language tags instead of the numerical MARC content designators;^[22] Metadata Authority Description Schema, a schema for an authority data element set that may be used to provide metadata about agents, events, and terms;^[23] and the Metadata Encoding & Transmission Standard, a schema for encoding descriptive, administrative, and structural metadata for digital library objects.^[24]

These approaches to encoding cataloging data, however, may not be sufficient for the type of sharing that is of interest and of concern at the time of this writing. Another project to develop a replacement for the MARC bibliographic format has been initiated by the Library of Congress. It is the aforementioned BIBFRAME, and it is meant to move cataloging data from the record structure found in the silos of traditional OPACs to the open linked data environment of the Semantic Web. This project, while still in early stages, has great potential to change the way resources are retrieved and connected.

CONCLUSION

Despite the changes in the field that have occurred over the past decade, cataloging will continue to evolve. Economics, developing technology, and the rapidly growing number of information resources in the bibliographic universe will guarantee this. Despite the current developments described earlier, the ways in which change will occur is not completely predestined. While many have tried to predict the trajectory of library cataloging throughout the centuries, many have gotten it wrong. In the 1904 edition of his *Rules for a Dictionary Catalog*, Charles Cutter stated that he could not “help thinking that the golden age of cataloging is over, and the difficulties and discussions which have furnished an innocent pleasure to so many will interest them no more. Another lost art.”^[25] In this particular case, Cutter was wrong, because more than a century later, many are still passionately discussing the difficulties and future directions of the art. While cataloging will change, what will remain constant is the desire of information institutions to maintain bibliographic control over their information resources for retrieval and historical purposes.

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Cataloging Cultural Objects (CCO)

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Abstract

The entry provides an overview of the data content standard, *Cataloging Cultural Objects* (CCO), developed by the Visual Resources Association (VRA), and published in 2006 by the American Library Association (ALA). CCO fills a gap in the array of descriptive standards by providing guidelines for visual resources curators, museum documentation specialists, archivists, librarians, or anyone engaged in the documentation of works of art and architecture, objects of material culture, and their images. The entry begins by placing CCO within the context of object and visual image cataloging and the broader framework of data content standards. Following the organization of the guide, which is divided into three parts, General Guidelines, Elements, and Authorities, it summarizes the main features of CCO. Finally, it evaluates CCO in terms of its suitability for use by the metadata communities that form its intended audience, and its sustainability.

INTRODUCTION

Cataloging Cultural Objects (CCO) is a data content standard for the description of art and cultural objects and their visual surrogates. CCO was developed by the Visual Resources Association (VRA) to provide guidance to visual resources curators, museum documentation specialists, librarians, archivists, and anyone engaged in describing works of art and architecture, objects of material culture, and their images. It was published in 2006 by the American Library Association (ALA).

The entry begins by placing CCO in the context of object and visual image cataloging, and within the broader framework of data content standards. Following the organization of the guide, which is divided into three parts—General Guidelines, Elements, and Authorities—it summarizes the main features of CCO. Finally, it evaluates CCO in terms of its suitability for use by the metadata communities that form its intended audience, and its sustainability.

HISTORICAL CONTEXT OF CCO

CCO was developed to answer the need for standards appropriate to the description of art and cultural works, as opposed to textual materials. (For a more in-depth discussion of the difference between a work in the bibliographic sense and a unique work of art or material culture, see the entry for “Work of Art.”) Data standards for the description of art and cultural objects have lagged considerably behind those used for textual materials. This can be ascribed partly to the fact that textual materials usually exist in multiples. When many libraries own a copy of the same publication,

shared cataloging becomes cost-effective, and this in turn leads to a demand for common data standards.

Long before the introduction of the computer, libraries had developed common cataloging rules, and were sharing bibliographic records through published union catalogs and catalog card distribution programs. The advent of computerization accelerated this process, leading to the development in the 1960s of Machine Readable Cataloging (MARC),^[1] a defined set of data elements that facilitated the exchange of bibliographic information and fostered the creation of modern online library catalogs and union catalogs such as Online Computer Library Center (OCLC) WorldCat.

Art and cultural objects are usually unique, which eliminates the greatest economic incentive for data standardization. As a result, museum guidelines for the documentation of objects were developed and implemented locally, and tailored to local needs, rather than based on a broader conceptual framework. The emergence of computing technology and the digital revolution kindled new interest in data standards. Although records for unique objects cannot be shared in the same way as records for copies of the same book, use of a common set of data elements and of controlled access points formulated according to agreed-upon rules facilitates other types of information sharing, such as the pooling of records in union catalogs or electronic catalogs raisonnés. Early efforts by the museum community to share collection information were hampered by incompatible formats and content,^[2] making it evident that standards were a prerequisite for meaningful data exchange and sharing.

The visual resources community has long been aware of the advantages of data sharing, since there is considerable overlap in the objects depicted in image collections.

Several projects tested the viability of pooling records for art images (p. 11);^[12] the disparities and inconsistencies in cataloging brought to light when records for the same work were aggregated provided convincing proof of the need for common data standards.

The museum and visual resources communities considered, but ultimately rejected, adoption of library data standards. There was a consensus that rules developed primarily for textual materials and/or material issued through a formal publication process could not provide adequate guidance for the description of unique objects. Unlike published works, objects are non-self-describing; the cataloger must supply most of the information required to document the object, so the emphasis in library cataloging rules on transcription of information appearing on the item, and the elaborate hierarchy of preferred sources of information was not applicable to object cataloging. Moreover, the physical characteristics of objects are far more varied than those of a book, and far more important for description and retrieval. One has only to consider the fact that a bibliographic record for a book routinely omits several pieces of information required for object cataloging—the object type (book), the support (paper), the medium (ink), and the technique (printing)—to realize that library cataloging rules are inadequate for object cataloging.

Early efforts to develop standards for object cataloging focused on data format definition. The International Committee for Documentation of the International Council of Museums (CIDOC) Conceptual Reference Model,^[3] and Categories for the Description of Works of Art (CDWA)^[4] represent attempts by the museum community to articulate conceptual frameworks for the description of objects. CIDOC covers all types of material collected by museums and related institutions,^[5] while CDWA is limited to “works of art, architecture, other material culture, groups and collections of works, and related images.”^[6] The Visual Resources Association’s VRA Core^[7] was influenced by CDWA, but it expanded on areas not initially covered by CDWA, eliminated most of the elements defined for administrative data needed for managing museum objects, and added elements needed to describe images.

These standards satisfied the need for an agreed-upon set of data elements. Still lacking was a standard for defining the content of the data elements. CCO is intended to supply the missing piece. Although CCO was developed by the VRA to complement VRA Core, it is intentionally data-format neutral, and can be applied within the framework of MARC, CDWA, CIDOC, Encoded Archival Description (EAD),^[8] or any other format designed for encoding cultural heritage information.

DEVELOPMENT OF CCO

Work on CCO formally began in 2001, with the formation of a five-person editorial team drawn from the VRA Data

Standards Committee and the Getty Standards Program.^[9] Primary funding was supplied by the Getty Foundation and the Digital Library Federation, supplemented by the Andrew W. Mellon Foundation. After reviewing and evaluating existing data content standards and practices, the team developed a conceptual structure for the publication. The first draft was subjected to extensive criticism and review by an advisory committee that included members of the visual resources, museum, library, and archives communities. A Web-based beta version of CCO was posted in November 2003; 35 experts conducted an additional formal review in 2004. The guidelines were published in 2006 by the ALA on behalf of the VRA.

ORGANIZATION OF CCO

CCO is organized in three sections: General Guidelines, Elements, and Authorities. These sections are preceded by an introduction that defines its purpose, audience, scope, and methodology, and followed by a select bibliography, glossary, and index. Throughout CCO, there are copious examples illustrating individual rules, as well as sample Work records and Authority records.

Part 1, General Guidelines

Part 1 of CCO provides a conceptual framework and general guidelines for the cataloging of cultural objects and their visual surrogates. Some of the topics covered in this section are applicable to any type of cataloging: for example, issues of minimal description, item- and collection-level cataloging, indexing depth and consistency, and the use of controlled vocabularies and authority files. Other issues pertain to the special characteristics of cultural material or to the environment in which object cataloging customarily takes place. These include the following.

What are you cataloging?

This question refers not to the identification of the object (is it a painting? a sculpture? a church?) but to the focus of the record:

Before beginning the task of descriptive cataloging, a cataloguer must ask a basic but potentially complex question: What am I cataloging? This question refers to the relationship between a work and its parts, and between a work and the images that represent it.^[10]

The item described may consist of a single object produced at a discrete point in time or one reworked over the years by several different hands. It may be a single work composed of many different parts, such as a building or an altarpiece. Or it may be multiple works within a series, a set, an archival group, or a collection. In each case, the

cataloger must determine the focus of the description, and decide how many records are needed. Separate records should be created whenever there is enough unique information pertaining to a part to warrant it.

Further complications arise when the item being described is an image of an object, and therefore at one remove from the object. The image may consist of a view of the entire work, a detail of the work, or several works:

... imagine a photograph intended to document an original two-dimensional painting (i.e., a photograph that contains the entire work and nothing more). ... Now imagine that the photographer had stepped back fifteen feet, expanded the perspective, and instead of a photograph of a painting, it becomes a photograph of a painting on a wall of a building with a sculpture in the foreground. The photograph is no longer a simple image of a single work; the photograph now represents a complex layer of information open to subjective interpretation (pp. 3–4).^[10]

Related works

Since many objects are physically complex, or related to other works, CCO discusses relationships between works in some detail. Related works are defined as “works that have an important conceptual relationship to each other” (p. 377).^[10] These relationships may be intrinsic or extrinsic. Intrinsic relationships take the form of whole-part relationships: for example, the relationship between a triptych and its component panels or between a building and the various rooms, the relationship between a collection and the individual items within it, or the relationship between a series and its individual members. CCO recommends recording all intrinsic relationships. Extrinsic relationships should be noted whenever possible, especially those that are not otherwise apparent in the description, for example, when one work is preparatory for or copied from another.

Relationship between the work and the image

An image has its own characteristics, such as the medium (photograph, slide, digital file), the angle or view at which it was taken, and the date of image capture. All of these need to be recorded, but kept distinct from the description of the work depicted. In order to make a clear distinction between a work and its visual surrogate, CCO recommends creating separate work and image records, and linking the records.

Database design

In Part 1 and throughout the publication, CCO offers a great deal of guidance on database design. It is tacitly assumed that users of CCO will have a significant role in either creating the database or influencing its design, since

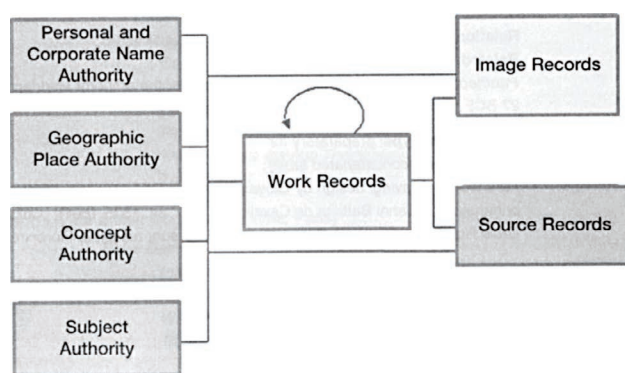


Fig. 1 Entity relationship diagram for CCO.

Source: From Baca.^[10] Fig. 1 (p. 20).

most visual resources collections and museum collections are managed using locally designed databases or customized versions of purchased or open source software. Although CCO may be applied in a variety of database settings, a relational database is recommended because of “the complexity of cultural information and the importance of Authority Records.” The entity relationship diagram reproduced here illustrates relationships between works, authorities, and images in a relational database implementation of CCO (Fig. 1).

Display and indexing

CCO makes a clear distinction between display data and indexing data. Its recommendations regarding the treatment of data for indexing purposes are similar to those made in library cataloging guidelines: for example, creator names that are presented in direct order in free text should be inverted for indexing purposes, and dates should be normalized to facilitate machine processing. Its discussion of display or free-text data illustrates a major difference between the cataloging environments of the object cataloger and the book cataloger. Since object catalogers must usually supply the description of the item being cataloged, rather than being obliged, as book catalogers are, to transcribe the information appearing on the item, they have much greater discretion about how to word the information. Moreover, the information in object records is more likely than the bibliographic records in a library catalog to be repurposed in multiple ways. CCO concentrates, therefore, not on giving rules for transcription but on providing guidance on recording display data in a form easily understood by the end user in a variety of different contexts, from slide labels to wall panels to Web sites.

Part 2, Elements

Part 2 describes the nine data areas that appear in Work and Image records.

- Entry 1: Object Naming (Work Type and Title)
- Entry 2: Creator Information
- Entry 3: Physical Characteristics
- Entry 4: Stylistic, Cultural, and Chronological Information
- Entry 5: Location and Geography
- Entry 6: Subject
- Entry 7: Class
- Entry 8: Description
- Entry 9: View Information

Each entry begins with a definition of the element and subelements covered in that entry, information on whether it is controlled, repeatable, or required, and a list of recommended sources of terminology. The bulk of each entry is devoted to cataloging rules. These rules, which are illustrated with numerous examples, cover syntax, suggested terminology for subelements in various media or subcategories, choice of singular versus plural (where relevant), capitalization, abbreviation, preferred language, and how to deal with ambiguity and uncertainty. The rules are followed by sections on presentation of the data (free text vs. controlled fields) and on the relationship between the work record and authority record. Each entry closes with sample work records and associated authority records.

Part 2: Entry 1, object naming

Object Naming includes two elements: Work Type and Title. Work Type identifies the work or works being cataloged and establishes the logical focus of the record. Work Type is usually based on physical form (e.g., statuette, hanging scroll, skyscraper), function (e.g., storage jar, presentation drawing, cathedral), medium or technique (e.g., engraving, watercolor, mosaic), or content (e.g., manuscript, sampler). Work Type, which is required, is recorded in a repeatable, controlled vocabulary field. In the case of multiple Work Types, one should be flagged as preferred. Work Type terms appear in the singular, unless the record describes a group of items, in which case the plural form is used.

The Title element comprises titles, identifying phrases, or names given to a work. Object titles take many forms: owner's titles (e.g., Wrigley Building), creator's titles (e.g., Hanging Spider), inscribed titles, titles referring to the owner, location, or history of the work (e.g., British Museum Harley 2788 or Bayeux Tapestry), and descriptive titles. Descriptive titles may refer to historical or religious subjects (e.g., Allegory of Music), works, places, or figures (e.g., Studies of a Female Nude); if the work is nonrepresentative, the title may simply repeat the work type (e.g., Silver Chocolate Pot). As the examples illustrate, CCO follows museum documentation practice rather than library cataloging rules by recommending the capitalization of all significant words in titles.

Unlike printed books and journal articles, many works of art or architecture are not self-describing. Catalogers must look for titles beyond the work; when no title can be found, the cataloger must construct one that indicates what the work is or what it depicts. CCO instructs catalogers to record all significant titles associated with the work, and to flag one title as preferred. A Title Type (e.g., preferred, inscribed, repository), taken from a controlled list, should be supplied for every title.

Part 2: Entry 2, creator information

Creator Information includes the name and role of every “individual, group of individuals, corporate body, cultural group, or other entity that contributed to creating, designing, producing, manufacturing, or altering the work.”^[15] An art or cultural work may be produced by multiple creators performing multiple roles, all of which should be recorded.

Creator names and roles are required. Since works of art signed by the artist are the exception rather than the rule, CCO makes provision for recording the source on which the attribution is based, and the degree of certainty (e.g., probable, doubtful, etc.) Possible sources include the work itself, stylistic analysis, traditional ascriptions, inventories, or other evidence. Former attributions should also be recorded, since art information is extremely fluid, and users may seek a work under a previous attribution.

CCO's instructions for recording information about unknown creators are based on art historical practice, which has developed an elaborate, nuanced terminology for unknown creators. Sometimes a work of art can be assigned to an anonymous creator, that is, “one whose hand is identified and whose oeuvre is established, but whose name is not known (for example, Master of The Dido Panels)” (p. 91).^[10] When no creator can be identified, but the style of the work suggests a relationship between the work and a known artist or group of artists, art historians express gradations of certainty by combining the known artist's name with a qualifier: “School of Rembrandt” or “Follower of Hokusai.” If the work cannot be associated with any known artist, it should be attributed to a nationality or a culture: “Unknown, French” or “Unknown, Maya.”

CCO recommends the use of standardized forms of creator names and roles. It provides a list of useful sources for names and role types as well as guidelines for formulating names for indexing and for display. For indexing purposes the inverted form of the name, followed by the role, is used. For displays, which in museum settings customarily contain brief biographical information about the creator, CCO recommends including the creator's name, nationality, birth and death dates, and role(s) in natural language order (e.g., sculpted by . . .).

Part 2: Entry 3, physical characteristics

Elements discussed in Physical Characteristics include Measurements, Materials and Techniques, State and Edition, and Additional Physical Characteristics, such as inscriptions and facture. CCO offers detailed guidance on recording the physical characteristics of the work types likely to be found in collections of art and cultural objects. Since these include paintings, drawings and watercolors, prints, sculpture and other three-dimensional works, books and manuscripts, furniture and architectural detail, ceramics and glass works, jewelry and utilitarian works, architecture, textiles and clothing, performance art and installations, film and video, and electronic and digital media, it is not surprising that Entry 3 is by far the longest entry in Part 2. The instructions in this entry are particularly helpful to library catalogers, who are unlikely to think of recording characteristics such as weight (for coins or megalithic monuments), size (for articles of clothing), or shape (for an oval painting). CCO recommends that the amount of detail be appropriate to an institution's needs: museums and other repositories that manage collections of physical objects will require more detailed descriptions than visual resources collections, which manage only the visual surrogates.

Measurement is a required element. Measurement types and units vary, depending on the nature of the object. CCO provides instructions on recording a bewildering variety of different types of measurement, including height and width, depth, diameter and circumference, shape, weight, volume and area, size, format, running time, scale, and structural dimensions. Measurements should be recorded in both a controlled field (to facilitate machine processing) and a user-friendly free-text display field. Here is an example for a carved gem:

Measurements display: 31 mm (1 1/8 inch) (diameter),
7.32 g (.2354 troy ounce)

Controlled fields:

Value: 31; Unit: mm; Type: diameter

Value: 7.32; Unit: gram; Type: weight (p. 113)^[10]

The Materials and Techniques element, which is also required, includes information about the creation processes (engraving, painting, photography), media (ink, oil paint), and support (paper, canvas, marble) of the work. The State and Edition element is used for works produced in multiples, such as prints (e.g., first of three states), or books (e.g., 2nd edition). The Additional Physical Characteristics element comprises features such as inscriptions and markings and facture. CCO briefly discusses condition and examination history and conservation history, but refers users to fuller treatment of these topics in Categories for the Description of Works of Art.

Part 2: Entry 4, stylistic, cultural, and chronological information

The data elements covered in Entry 4 have little in common with library descriptive cataloging standards. Style and culture have no real parallel in library cataloging, but are extremely important for cultural materials, since they provide a way to study a work in the context of other works created in the same style or in the same culture. The chronological information covered by CCO pertains to the creation, revision, and destruction of physical objects, while library cataloging focuses on the publication and copyright dates of manifestations of works.

CCO defines Style as the element that identifies “the named, defined style, historical or artistic period, movement, group, or school whose characteristics are represented in the work being cataloged” (p. 156).^[10] Stylistic terms may be based on a technique (Red-Figure) or on an artistic movement (Surrealist), or they may be related to a specific chronological period (Ming Dynasty, Renaissance). Culture is defined as the element that contains “the name of the culture, people, or nationality from which the work originated” (p. 157).^[10] Chronological information refers to “the date or range of dates associated with the creation, design, production, presentation, performance, construction, or alteration of the work or its components” (p. 157).^[10] A date may be a single point in time or a range as broad as several thousand years.

CCO offers guidance on the choice of terms for style and culture, and provides lists of controlled vocabularies. Considerable space is devoted to the syntax and presentation of dates, especially uncertain and approximate dates. Most objects do not bear a date; those by known artists can sometimes be dated by internal or external evidence, or at least assigned to a date during the artist's known years of activity. Dating for works by unknown artists is largely done through stylistic analysis; since some styles are associated with chronological periods occupying hundreds or thousands of years, date spans are necessarily very broad.

Part 2: Entry 5, location and geography

CCO defines the Location and Geography element as covering four different categories of location associated with art and cultural works: Current Location, Creation Location, Discovery Location, and Former Locations. (Topical location information is recorded in the Subject element, discussed in Entry 6.) The Current Location of an object may consist solely of a geographic place name, or a combination of the name of the owning institution and its geographic location, e.g., Florence (Italy), Galleria degli Uffizi. CCO instructs catalogers to treat the accession or inventory numbers which museums use to identify objects as Current Location information. Although it may seem superfluous to include Current Location information in a

repository's local catalog, it facilitates data exchange and retrieval in union catalogs or federated searches. If the Current Location is unknown, CCO instructs catalogers to record the last known location.

The Creation Location of a work is often unknown. Since users often search for material by this parameter, the geographic place, nationality, or culture elements in authority records for persons and corporate bodies associated with the work are often substituted for Creation Location in queries. Discovery Location becomes especially meaningful when little else is known about a work or its creation. Former Locations may refer to a work's ownership and collecting history, or be related to its exhibition, loan, conservation, or historical context. CCO also provides a list of published sources for place names, repositories, and buildings.

Part 2: Entry 6, subject

CCO defines the Subject element as "an identification, description, or interpretation of what is depicted in and by a work or image" (p. 207).^[10] This is not always easy to determine, and the difficulty is compounded by the fact that subject encompasses both what the work is about (its iconographical, narrative, thematic, or symbolic meaning), and what is actually depicted in the work (plants, animals, human figures, buildings, etc.) CCO recommends identifying both types of subject, at the level of detail appropriate to end users.

The universe of possible subjects is virtually unlimited. It may include "things, places, activities, abstract shapes, decorations, stories, and events from literature, mythology, religion, or history . . . [p]hilosophical, theoretical, symbolic, and allegorical themes and concepts" (p. 207),^[10] and human beings. The Subject element is required for all works. When a work is nonrepresentational, CCO suggests recording the form or function of the work as its subject; for example, the subject of a rug with no patterns or decoration would be "rug."

Subject information should be presented in two ways: as controlled indexing terms and as free-text description, which allows for interpretation as well as indicating ambiguity and uncertainty. A list of useful vocabularies, organized by type (e.g., event, fictional characters, plants, etc.) is provided, with the warning that subject indexing of art generally requires multiple vocabularies as well as locally supplied terms.

CCO recommends that the choice of singular or plural for subject terms reflect the number of entities depicted in the work: for example, if the work depicts one chair, the indexing term would be "chair," while "chairs" would be used for the depiction of several chairs. This is a departure from the practice of thesauri and controlled lists used in libraries, which customarily prefer the plural form of a common noun.

Part 2: Entry 7, class

The Class element is used to relate a specific work to other works with similar characteristics, such as "material, form, shape, function, region of origin, cultural context, or historical or stylistic period" (p. 235).^[10] It is generally based on the organizational scheme of a particular repository or collection, and is intended for local use only. The Class element bears a resemblance to library classification numbers, in that it facilitates browsing through groupings of similar works. But unlike library classification numbers, the Class element is not based on subject, and it is not used to arrange physical collections, but to facilitate conceptual browsing.

CCO recommends that Class terminology be less specific than the terminology used for the Object Name element, since Class is intended to place the work in a hierarchy. For example, the Class element for a Brewster chair would be "furniture," or, if greater specificity is required, "chairs." Plural terms are preferred, since classifications represent groups of similar items, rather than an individual item. The Class element is the only CCO element for which a free-text version is not recommended; if desired, the controlled terms may be concatenated for display purposes. For example, the hierarchy of classification for a painted Chinese screen could be displayed as Asian art, furniture, and paintings.

Part 2: Entry 8, description

The Description element is a note that elucidates the content and context of a work. It takes the form of a concise and coherent essay-like text that elaborates on the subject, function, or significance of the work, comments on information in the other elements, and records uncertain or disputed points. Although Description is a free-text note, consistent style, grammar, and sentence structure are recommended. CCO encourages brevity, and prescribes natural word order and complete sentences. Description can be treated as a separate element within the record, or attached to the relevant fields. In either case, CCO recommends adding the source of information (usually a bibliographic citation that comes from a source authority record) and the location within the source (usually a page number). Repositories of art and cultural objects may need additional notes about the physical description, condition, conservation, or provenance of the work. Some of these notes are inappropriate for public display and may be suppressed from public view.

Part 2: Entry 9, view information

The View Information element describes how an object is depicted in an image. View Information helps users, many of whom have access to a work only through a surrogate,

to understand the nature of the original. It also helps distinguish between different images of the same work. View Information appears only in the Image record, which is linked to the Work record for the object. The Image record also contains administrative and technical metadata such as the image control number, type (slide, photography, digital file), size or dimensions, format (Cibachrome, jpeg), source, and rights information. These fields are described briefly in Part 1, but CCO does not attempt to provide exhaustive coverage of this type of data.

View Description, Type, Subject, and Date are subelements of View Information. View Description, a free-text field, and View Type, a controlled vocabulary field, both describe the “spatial, chronological or contextual aspects of the work as captured in the image view” (p. 263).^[10] These aspects include the portion or extent of the work depicted in the image, the range or position (distant or close-up), the angle or perspective, whether the image depicts the interior or exterior of a built work, cardinal directions for built works, environment, or lighting, and positional attributes for three-dimensional works (e.g., a profile view of a face).

View Subject describes subject matter specific to an image, for example, the subject of an image depicting a close-up of the hands of the Mona Lisa would be “hands” or “female hands.” View Date includes any date or range of dates associated with the capture of the image, as opposed to the creation of the object, which is recorded in the Work record, or the generation of derivative images, which is treated as administrative data within the Image record. View Date information is particularly useful for works that have been damaged, lost, or altered, or for images taken during the production or creation of a work. Both subelements may be presented as free-text and as controlled fields.

Part 3, Authorities

Part 3 of CCO is devoted to authorities. CCO recommends using controlled vocabularies whenever possible, and documenting preferred terms and variants in authority files. The authorities should be linked to Work and Image records in order to facilitate cataloging, searching, and retrieval. Five different categories of authority are defined: source (a standardized bibliographic reference used for citing sources from which information is derived),^[11] personal and corporate name, geographic place, concept, and subject. This categorization differs in two respects from the way authorities are treated in the library data format, MARC. Within MARC, concept is subsumed under subject, instead of being treated as a separate category, and an authority record is created for a work whenever a controlled access point is needed for the work. In CCO, authority records are created in the source authority only for titles of secondary material; the Work record functions

as the equivalent of an authority record for the object described in it.

General characteristics of the entries on authority files

The organization of the entry on authorities follows the same model as the entries on the CCO elements. Each entry begins with a definition of the authority type, discusses its special characteristics, gives guidance on dealing with ambiguity and uncertainty, discusses how the information should be organized, lists required elements, and provides suggestions for sources of controlled vocabulary. The “Editorial Rules” that follow cover some of the topics covered by “Cataloging Rules” in Part 2, such as capitalization, abbreviation, and preferred language; but also include guidance on the choice of preferred term, the inclusion of additional information appropriate to the authority type, and the provision of links based on associative and hierarchical relationships to other entities documented in the authority files. Each entry ends with a discussion of data presentation issues, such as indexing and display, and sample authority records.

CCO prescribes much more detail in authority records than is customary in the library world, where the rule is to include only as much information as is needed to identify the entity being described. Like the recommendation to include contextual and critical information about the object in the work record, this reflects the tendency in museums and visual resources collections to use the catalog as a vehicle for outreach and for dissemination of scholarly research. By contrast, librarians make a sharp distinction between the roles of the cataloger, the bibliographer, and the literary critic or historian, with the catalog serving chiefly as a pointer to the works themselves and to other sources of information about them.

Personal and Corporate Name Authority: CCO recommends creating personal and corporate name authority records for persons and corporate bodies associated with works of art and cultural objects. The relationship may take the form of creative responsibility, patronage, or current or former ownership, or it may be a topical relationship, when a person is depicted in a work. Authority records should be made for unknown creators identified in the Creator element as “unknown [culture or nationality]”; however, qualifiers such as “workshop of” or “school of,” which denote an unknown creator associated with a known artist, should be recorded in the Work record instead of the authority record. CCO recommends using published sources for personal and corporate names, but provides guidance on how to formulate names not found in standard sources, and how to choose among variants when standard sources offer conflicting forms. Catalogers are instructed to record variant names, and two forms of the preferred name: one in natural order for display purposes, the other in inverted order for indexing. In addition

to documenting authorized name forms, authority records should provide biographical and historical information such as birth and death dates and places, life roles, culture, race, ethnicity, and gender for persons, and start and end dates, national affiliation, functions, and location for corporate bodies.

Geographic Place Authority: Geographic Place Authorities include physical features, such as islands, rivers, and mountains, and administrative geographic entities or inhabited places, such as states, ecclesiastical governing bodies, and cities. Terms may be very broad, denoting whole continents or general regions such as the Middle East, or very narrow, denoting a street address within a city or a trench within an archaeological dig. Both current and historical places, such as archaeological sites, deserted settlements, and former nations are represented; however, fictional places such as Oz or Narnia must be entered in the Subject Authority file.

A list is provided of authoritative sources for geographic names. CCO also provides guidance on formulating place names not found in standard sources, and choosing a preferred form among variants. In addition to preferred and variant forms of the names, CCO requires recording place type (e.g., river, county) and broader context information. Broader context information consists of the next level of geographic subdivision; the broader context for Burgundy would be France. A thesaurus structure is recommended for the file, in order to allow retrieval and display by geographic hierarchies; this is particularly useful for research on art and cultural objects, since it allows contextual study on various hierarchical levels.

Concept Authority: Terms in the Concept authority file contain information about generic concepts, as opposed to proper nouns or names. Concept terms are used to describe the work type, material, processes used in creating the work, style, period, culture, creator and life roles, physical attributes of the object, and abstractions such as theoretical and critical concerns, ideologies, attitudes, and social or cultural movements. These terms appear mainly in nonsubject fields, but could be used to index subject elements of a work, for example, when a painting contains a depiction of a bronze urn.

Subject Authority: The subject authority file should be reserved for

iconographical terminology, including proper names of literary, mythological, or religious characters or themes, historical events and themes, and any other terminology needed for subjects that falls outside the scope of the other three authorities

(p. 352). Terms from the other authority files may be used to index persons, corporate bodies, places, concepts, and objects depicted in works (Figs. 2 and 3).

ASSESSMENT OF CCO

Although CCO was developed by the VRA, it is aimed at and draws upon the expertise of numerous metadata communities in addition to visual resources professionals. Members of the visual resources and museum communities shared their understanding of the nature of the materials described, and their familiarity with existing descriptive practices. Librarians and archivists contributed their knowledge of their own communities' cataloging practices as well as insights derived from bibliographic and archival control: a principles-based approach to cataloging, the value of sharing data, and the importance of standardization and of controlled vocabularies. The confluence of these cataloging traditions makes CCO a more versatile guide, and optimizes its chances of being adopted as either a primary cataloging code or a complement to other codes.

CCO is likely to have the widest acceptance in the visual resources community, from which it originates, and which forms its core user group. The array of works covered by CCO—fine arts, cultural objects, works in the built environment—coincides with the works depicted in visual resources collections. Many of CCO's provisions reflect descriptive and organizational practices in visual resources cataloging, and the detailed guidance on database design reflects the do-it-yourself database environment in which most visual resources curators operate. Although individual descriptive practices in various visual resources collections may vary considerably, CCO might be the unifying tool the community needs to bring their descriptive practices closer together, foster best practices, and pave the way to a shared cataloging environment.

In the world of museum object documentation, there is an increasing awareness of the need for and advantages of conforming to standards. CCO draws heavily on descriptive practices in museums, and it is eminently suitable for use in a museum environment, though it would have to be supplemented by CDWA for certain types of administrative metadata. For museums electing to adopt a data content standard, CCO is the logical choice.

CCO will never become the main cataloging standard for the archives and library communities, since their collections contain too much material that falls outside its scope. But CCO could provide the necessary guidance for archivists faced with describing objects such as a writing tool, an article of clothing, or a coin, since *Describing Archives: A Content Standard* (DACS), the data content standard of the Society of American Archivists, deals chiefly with group- or collection-level cataloging, and focuses mainly on textual materials. Library catalogers faced with cataloging objects could also use CCO to complement AACR, the existing data content standard. Although CCO is not always compatible with AACR, it is seldom in open conflict with it. CCO does not dictate rules for formulating access points, leaving catalogers free

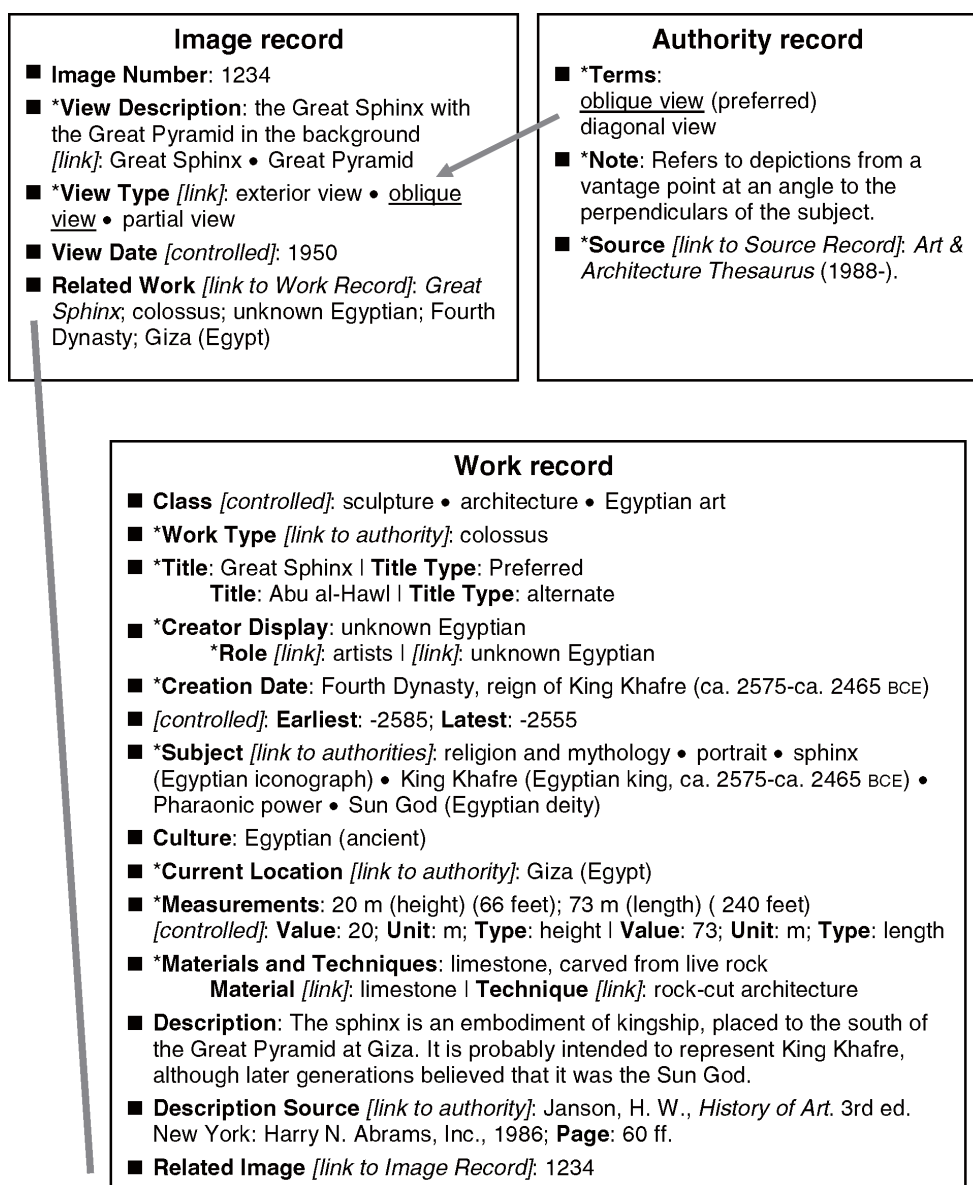


Fig. 2 Image record linked to Work and Authority records: Egyptian monument. Required and recommended elements are marked with an asterisk.

Source: From Baca.^[10] 276, Fig. 43.

to continue using AACR as their guide to formulating access points within object records, while incorporating the information recommended by CCO into free-text notes. The decision to remain format neutral means that CCO records can be accommodated in EAD, the data format used by archivists, and MARC, the data format used by librarians.

CCO's future prospects also depend on its sustainability. The VRA holds the copyright to CCO, and is responsible for supporting education and training in the use of the standard as well as its maintenance and dissemination. Even before its publication, the editorial team did yeoman's work publicizing the forthcoming standard, and

seeking comments; a section of the association's Web site was devoted to early drafts. After its release, VRA took a proactive role in arranging CCO-related presentations and workshops at conferences of the main professional organizations in the relevant metadata communities, publishing articles about the standard, and expanding the CCO Commons.^[12] This area of the VRA Web site provides online support in the form of sample records, brief summaries of the rules, FAQs, training tools and presentations, and links to crosswalks, related data standards, and vocabularies. In late December 2006, two new committees were formed to provide a more formal structure for sustaining the code. The CCO Standing Committee is charged with



Fig. 3 The Great Sphinx at Giza, Egypt, with the Great Pyramid in the background.

Source: © 2002 Maria Oldal.

maintenance and dissemination, and the CCO Advisory Committee advises on education and works with the Standing Committee to encourage the use of this standard.

CONCLUSION

CCO fills a long-standing gap in the array of data content standards. Previous standards were developed largely for cataloging textual material; consequently, they did not address basic issues of cataloging art and cultural works, or provide guidance on describing the special characteristics of specific object types. CCO provides detailed guidelines for description, access, and subject cataloging of art and cultural materials and their visual surrogates. Clearly written, well-organized, and illustrated with numerous examples, it can be read with profit even by those who simply wish to learn more about the description of these materials. For information professionals charged with

creating descriptions of art and cultural materials, CCO seems likely to play the same role for object cataloging as AACR has long played for book cataloging: their basic cataloging tool.

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Catalogs and Cataloging: History [ELIS Classic]

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Abstract

The catalog is the enduring means of access to information about the collection of a library. Without such information, use of a library would be limited to browsing the shelves in hopes of finding materials of interest. Hanson and Daily trace the development of catalogs from ancient times to the middle of the twentieth century. In parallel they also trace the history of cataloging rules and principles through the many codes of practice that have been developed over the years. The authors' speculation on what computerized catalogs *might* be like in the future, once developed, provides an interesting sidelight on the thinking of the era preceding the automation of catalogs.

—*ELIS Classic*, from 1970

INTRODUCTION

The story of catalogs and cataloging is only one phase of the broad panorama of library development. Traditionally the library has devoted its efforts to the acquisition, preservation, and promotion of graphic materials entailing the use of some system of bibliographic organization or control. Such organization is not unique to the library. History reveals the interrelationship between the activities of the bookseller, bibliographer, and librarian, all of whom sought to organize materials for effective location or retrieval. The methods employed are similar because they have a common goal, although they are inspired by relatively different purposes. Many attempts have been made to obtain some standardization of bibliographic entries among library catalogs, book trade publications, and published bibliographies. A substantial relationship exists between cataloging, designed to serve a definite library purpose, and bibliography, which has a more universal content and application. Cataloging in the United States has tended to be independent of book dealers' needs, while many European countries have coordinated bibliographic activities for centuries. Current efforts in international cataloging will no doubt serve to promote a closer working correlation of the two efforts. The Appendix lists the codes of cataloging rules in chronological order, their significance is the international character of standardization, still under way.

The library catalog is only one of the many forms of bibliography. It is generally defined as a list of books contained within a single library and is comprehensive rather than selective. In actual practice, although catalogs list the bulk of the monograph and at least part of the serial publications within a library, practices vary depending on

the particular library. Jennette Hitchcock,^[1] in a study conducted in 1939, estimated that subject headings could be omitted for four-fifths of the 90 different types of material. The results of her survey indicated that a significant number of libraries had followed this practice of omission. Librarians customarily tend to list only books in the catalog, influenced apparently by the traditional definition, although today library collections include a wide range of graphic materials. The reverence accorded the monograph perhaps was due in part to the dominance of the codex during the early periods; it was not seriously rivaled by other forms until the seventeenth century. The origin of learned societies as a result of the scholarly endeavors of the Renaissance led to the founding of the first scholarly periodicals in the 1660s. The increasing emphasis upon science encouraged the publication of serial publications, and by the eighteenth century they were the principal vehicles for the dissemination of scientific information. Other disciplines and agencies readily adopted the new form; this led to the proliferation of government documents, proceedings of Congresses, annual reports, and popular magazines evident during the nineteenth century and reaching an all-time high by the midpoint of the twentieth century. Libraries, with their roots planted in the humanistic spirit of the past, failed to respond sufficiently and rapidly enough to the growing variety and numbers of publications outside the realm of the monograph, and proved inadequate to fulfill the expected industrial and governmental needs that now tended to dominate the national scene. As a result, specialized groups became documentalists or information scientists in much the same way that librarianship and bibliography had separated years ago. The relationships were strong, but the methods and purposes varied to the point that each considered itself a separate discipline.

The movement to gain bibliographic control of serials has traditionally been of secondary concern to most librarians, although the efforts of Poole, Cutter, and Billings indicated a growing awareness, which has continued to develop since their time. The number of periodical indexes from the nineteenth to the twentieth centuries attested to their dominant position in the bibliographic structure, even though librarians were confident that less effort was necessary and that bibliographic accuracy could be sacrificed in favor of more rapid processing.

The influence of the bibliographer on library cataloging was apparent as the position of librarian was generally relegated to a scholar or a man of letters. The librarian sought to organize the materials in a manner suitable to his needs or those of his immediate associates, without particular regard for ease of accessibility—this would come during the later years when the library was eventually recognized as an educational tool. With the rise of a pragmatic philosophy of education there came the rise of the librarian schooled in the technical aspects of practical organization rather than in bibliographical theories. The preparation of the catalog by the late nineteenth and early twentieth centuries ceased to be an immediate undertaking of the library administrator and was relegated to practitioners who were dependent upon codes and traditions rather than results. The problem, however, shortly became a concern of the total library, for the rising costs of cataloging forced both administrators and catalogers to reexamine their methods and question the need for bibliographic detail, with the hope of relying more upon the other available bibliographic tools. A period of reevaluation and technological change has brought about an increasingly pragmatic approach that attempts to fulfill the needs of the versatile user while minimizing the expense of processing time and effort.

The process of cataloging, in its narrowest sense, is the compilation of headings and bibliographic descriptions for use in the catalog. This could, perhaps, be considered the work of a pragmatic bibliographer, although catalogers are beginning to find other ways of determining the amount and kind of bibliographic descriptions necessary. In a broad sense the process encompasses descriptive cataloging that may include, in addition to bibliographic descriptions, the choice and form of author headings and subject cataloging, which results in the assignment of classification numbers and subject headings. Catalogs may be distinguished as to purpose by such designations as public catalog, which serves the patron; official catalog, which serves the cataloging staff; and union catalog, which is a list of holdings of many libraries. Format or physical form is also used as a basis of describing the catalog with the most common being card, printed book, sheaf (slip with loose leaf binder), guard book (slips mounted in a special book), computer, and visible file. The arrangement of the catalog is a third consideration. The three most popular approaches are the

dictionary, which files authors, titles, subjects, and references in one alphabet; the divided catalog, which separates some of these headings; and the classified, which utilizes a systematic arrangement of subject entries supplemented by author, subject, and title indexes in alphabetical order. Other less frequently encountered variations are alphabetic-classed for subject headings, a combination of the alphabetic-classed and the dictionary catalog, and a number of single or combined arrangements of subject alphabetical and/or author and name catalogs. To this may be added a wide variety of variations of the divided dictionary catalog based on a horizontal (chronological) arrangement as well as vertical (type of entry) arrangement resulting in a separation of subject headings from author and/or title. Other combinations are possible with the printed book catalog serving as a supplement to the card catalog or vice versa. The correlation of shelf list and/or bibliographies with a printed book or card catalog present other possibilities.

The functions of the early catalog were comparatively simple, serving as an inventory list with progressive patterns of arrangement based on the order of accession, chronologically by date of publication or period of author. From these evolved a wide variety of approaches and an expansion of the inventory idea to include retrieval. The subject catalog, which employs a system of conceptual terms to depict the content of the material, has been the major outcome of centuries of development. The derivation of subject terms or headings may be dependent upon the title or content of the book and may be standardized through the use of a classification scheme or a specially prepared list. Cutter believed that

the ideal catalog would give under every subject its complete bibliography, not only mentioning all the monographs on the subject, but all works which in any way illustrate it, including all parts of books, magazine articles, and the best encyclopedias that treat of it; in short, the catalog would lay out just that course of reading which a man who thoroughly studied the subject, with a view not only to learn it, but to master the history of its treatment by others, would be obliged to pass through.^[2]

He continued by admonishing that “this can rarely be done because it is beyond the ability of librarians and the means of libraries.” In addition, in *Rules for a Dictionary Catalog*, Cutter contended that the purpose or objects of the catalog were as follows:^[3]

1. To enable a person to find a book of which either is known: author, title, or subject.
2. To show what the library has by a given author, subject, or in a given kind of literature.
3. To assist in the choice of a book: as to its edition (bibliographically) or as to its character (literary or topical).

These were restated in the *International Conference on Cataloguing Principles* of the International Federation of Library Associations as follows:^[4]

Functions of the catalog. The catalog should be an efficient instrument for ascertaining:

- 2.1 whether the library contains a particular book specified by
 - (a) its author and title, or
 - (b) if the author is not named in the book, its title alone, or
 - (c) if author and title are inappropriate or insufficient for identification, a suitable substitute for the title; and
- 2.2
 - (a) which works by a particular author and
 - (b) which editions of a particular work are in a library.

The inventory list functioned as a catalog and only later developed into a retrieval device that became probably the most highly organized part of an interrelated bibliographic network. The expanding number of points of access in the catalog indicates the comprehensive approach now possible. As subject terminology is perfected and mechanized methods are developed and applied, new dimensions will further expand the catalog until the spectrum of organized knowledge will rest upon a combination of the total bibliographic force, not just one phase.

The catalog serves as the key to the functions of a library and is a communicative device based upon a long process of social habits, designed to provide methodical and effectual access to graphic materials.^[5] Insight into the present practices can best be achieved by a survey of the catalogs of the past with particular attention to the developing forms and purposes that are reflected in our modern catalogs. Our major attention will be directed to the English-speaking countries, particularly Great Britain through the eighteenth century and the United States during the nineteenth and twentieth centuries.

AGE OF INVENTORY

Ancient Times

Primitive methods of bibliographical control have existed since the beginning of the first libraries. The original approaches were primitive, although Norris alleged that “the catalogs in use in the seventeenth century B.C. were very similar to those which are now in use in the twentieth century A.D.”^[6] The archeological excavations at Assurbanipal (1668–626 B.C.) revealed that bibliographic information was recorded on tablets that were similar to a press guide or a very rudimentary shelf list. These tablets served as a crude location device by recording title (occasionally

with opening words), number of tablets, number of lines, distinct subdivisions, and a location or classification symbol.^[7] A similar method was employed at Edfu (200–300 B.C.), where a list of books was reputed to have been engraved on the wall.

The Alexandria Library supposedly had an extensive catalog compiled by Callimachus in the form of *Pinakes* in 250 B.C. There is, however, some element of doubt whether this was actually a catalog of the Alexandrian Library or merely a bibliography compiled by the celebrated first cataloger. Norris suggested the possibility that Hermippus, an assistant to Callimachus, may have actually compiled the catalog in 220 B.C.^[6] It was described as a classified catalog complete in 120 books, but very few fragments exist.

Witty was able to trace only about five true fragments, which were in reality only quotations from the original. The other conjectured remnants were found to be “oblique references” by ancient authors to the bibliographical work of Callimachus.^[8] The term *Pinakes* (singular: *Panax*) was first used by the Greeks to indicate the tablets placed above the library press that served as a guide to its content and later denoted a catalog.^[8] The actual title was “Tables of those who were outstanding in every phase of culture and their writings—in 120 books.”^[8] The fragments reveal a newsy biobibliography of the works of the period with information more applicable for a biographical work than a catalog. Bibliographical information was comprised of a stoichiometric note (number of lines in text) and probably the first words of a work. The entries were subdivided by author or by chronological order.

The primal catalogs through the height of Greek civilization can be conjectured as quasiclassified with a broad subject and form arrangement that resembled an embryonic shelf list. The title concept was not firmly established so that opening words of text were of great importance and were always employed. The author was frequently cited without further reference, a practice that did not cause confusion in view of the paucity of works. As a result one of the most unique contributions of the Greeks may have been the first use of the author concept, for the traditional practice of the Orient has been under title.^[9] The Tripitaka, the source of Buddhist scriptures, was organized only by title.

The Roman period was marked by scanty information regarding catalogs and cataloging. Public and private libraries were common during this period, depending largely upon the works of the Greeks, which were the foundation of Roman culture. Rolls were generally separated by Latin and Greek with general subject divisions used within both categories, and probably an attempt was made to retain all the works of a single author together under the relevant subjects. Two varieties of catalogs, the classified and the bibliographical lists, were prevalent with the former based on shelf arrangement and the latter seeking continuity through authors. Both ordinarily included

titles and/or first lines, number of lines in work, and frequently appended biographical information. It was clear that the Romans continued the precedence as established by Callimachus adding nothing new to the art.^[7] The beginnings of Christianity brought little change to the Roman conceptions of the library for the first seven centuries, except the addition of new works, and works of the church fathers supplementing or even supplanting the authors and philosophers of Greece and Rome.^[10] Gradually, however, public or temple libraries began to decline, especially after the third century when Christianity became the state religion. In A.D. 336 with Constantinople now the center of the Roman empire, the libraries of Rome were rivaled by the collections assembled by a succession of emperors who as a whole supported libraries and scholarship until the conquest by the Turks in 1453. The great libraries of the empire slowly were dispersed or suffered the ravages of neglect. Few extant accounts actually depict the dispersal of the manuscripts and the razing of the temple structures.

Middle Ages: Early Period (Fifth Through Eleventh Centuries)

The fall of Rome in the sixth century brought about a decline in scholarship with the deliberate destruction and dispersion of the public or temple libraries as well as many private collections. The next 10 centuries for the libraries of the Western world would be characterized by small collections of surprisingly similar manuscripts in the many monasteries established in this period. The austere life of the monastic orders was not entirely new; the tradition existed among the Essenes during the early days of the Christian period. The place of books in the monastery was important, for monks were admonished to read, meditate, and copy for the glory of the afterlife. One of the outstanding monastic clerics to whom libraries owe a debt was Cassiodorus,^[11] who after serving in public life retired and founded a monastery at Vivarium in Benevento (southern Italy). His respect for learning was clearly reflected in his famous *Institutiones*, which served as a scholarly model for the many orders and furnished an annotated guide to what he considered valuable.

These monasteries were the major instruments of education, such as it was, and were the primary vehicles in the preservation and production of books. The need for library catalogs, however, was limited during this early period, with efforts directed only toward an inventory record. One of the most elementary type was a list of books given by Gregory to the church of Saint Clements. It consisted of a marble tablet inscribed with an introduction or prayer and a few treasured Biblical works.^[12] The poetical catalog composed by Alcuin of York in the eighth century was a unique form that was in reality a list of famous authors or a bibliography, although it was reputed by some to be a catalog of the York monastery. Another simple listing of

this period was Saint Augustine's *De Trinitate*. This was merely a list of works transcribed on the final flyleaf of a book.^[9] Emperor Louis the Pious (814–840) actuated the compilation of catalogs when he decreed that monasteries and cathedrals should make a list of all the books they possessed.^[13] These early catalogs or inventory lists were thus fashioned by the immediate need for a list of material possessions. The books were generally arranged not by author but by the importance of the work, with precedence given to the Bible and other religious works and with secular works placed last. In addition, these terse lists were not indicative of the full contents of the works included, because it was common practice during this period to bind several works by the same author, or treatises by various authors but on similar subjects, within one cover as an economy measure. Thus a small collection of 10 volumes may actually contain nearly double this number of distinct works. The purpose of the list was to identify the book rather than analyze the contents of the physical volumes. Fortunately, Armarians realized the value of a more complete analysis of at least the distinct works. Several catalogs of the ninth century provided a listing of the works within each volume and the "number of volumes or rolls in which each work was contained."^[9]

One outstanding literary work, *The Myriobiblion*, is indicative of the bibliographic contribution of the period. It was compiled ca. A.D. 842–848 by Photius, patriarch of Constantinople. It bore a strong resemblance to the *Pinakes* of Callimachus and was a primitive but interesting review of approximately 280 works of the period with bibliographic, biographic, and critical information.^[14] The Upper Rhineland monastery at Lorsch in the tenth century produced a more typical catalog in the following order: liturgical works, the Testaments, theological and patristic works, lives of the saints, and last poetry, with a few of the classic authors.^[13] Catalog production between the ninth and eleventh centuries was surprisingly active. Gottlieb listed 24 catalogs from the ninth century, 17 from the tenth, and 30 from the eleventh.^[15]

The period of the early monastic and cathedral library catalogs may be characterized as a period of rudimentary methods. The earliest catalogs were crude lists, frequently inscriptions, without apparent order or sequence, which later became parchment inventories placed near the book presses and further expanded into more distinctive works as the library grew. The manuscripts were arranged, or classified, by broad subjects. The most common order was: archives, scriptural texts and commentaries, constitutions, council and synodal proceedings, homilies and epistles of the fathers, lectionaries, and legends of martyrdom with secular literature frequently placed in a subsection divided by the seven liberal arts: grammar, rhetoric, logic, arithmetic, geometry, music, and astronomy.^[13] This arrangement reflected a utilitarian as well as a philosophical aspect. As long as the collections were small the divisions were simple. Frequently, secondary arrangements

were by order of acquisition or size. The widely varying catalogs of the early Christian period were most nearly like the modern shelf list and provided an inventory designed to facilitate record keeping while showing the location of the work.

Middle Ages: Late Period (Twelfth Through Fourteenth Centuries)

Twelfth century

Catalog arrangement of this century continued in the same casual manner. The extant portion of the 1158 catalog of the monastery at Prüfening indicated a chronological sequence for all books that were grouped after the Biblical works. The compiler was foresighted enough to provide space for the collection of later acquisitions.^[13]

The Christchurch catalog, 1170, was the first to use a system of reference letters placed both within the catalog and the books.^[16] The Lincoln Cathedral Library Catalog of ca. 1200 continued the practice of including opening words as well as the title and added another feature, an introduction.^[6]

Although only a few catalogs have been discussed, the twelfth century was characterized by a large number produced on the continent with Gottlieb listing 62 examples.^[15] The typical catalog, however, remained an inventory list compiled with a general lack of system on a two-column parchment page. The broad subject arrangement was the accepted pattern with titles generally subarranged in chronological order rather than alphabetical by author. Author's names served primarily as a means of identification with little attention given to form and accuracy. The information listed was extremely brief, composed of author's name and short title, frequently with the opening words of the work and occasional statements concerning physical conditions, color, or number of items in the volume. The addition of the beginning words of the text was necessary to aid in distinguishing anonymous works and works with identical or similar titles. As a whole the information included was so vague that it offered little aid outside the context of the individual library.

Thirteenth century

The thirteenth century found a continuation of the shelf or press arrangement with short titles and opening words. The Glastonbury catalog of 1247^[6] employed a unique and remarkable classification. Books that were by obscure authors but yet valuable for subject information were placed under the subject. Those by well-known writers were placed under the author. This system, in effect, was an attempt to select an entry that would best serve the needs of the user. The beginnings of union catalogs can be traced to the *Registrum Librorum Angliae*, 1250–1296,

which was an unfinished attempt to record the holdings of 183 English monastic libraries.

The earliest information regarding the libraries of the universities came to light in the catalog of the Sorbonne at the University of Paris in 1289. It contained over 1017 Latin titles but only four in French, arranged by 10 major divisions: the seven liberal arts (or the trivium and quadrivium) plus theology, medicine, and law. Authors were arranged alphabetically within each division followed by the title and the beginning words of the text.^[7]

Fourteenth century

The fourteenth century provided an abundance of examples although few new innovations. Subject arrangement was common; five of the seven catalogs described by Norris had this arrangement. The catalog of Christchurch, Canterbury, 1313–1331, was considered to be the first to adapt an alphabetical order under at least one subject heading, theology. In addition a system of press marks was present as well as an inept attempt to list the works of each volume.^[6]

The Exeter Cathedral Library catalog of 1327 was an author catalog with only one subject heading. It listed the value of each book, as it was probably intended only for the inventory of church property.

The catalog of the Saint Martin's Priory at Dover of 1389 had an unusual three-part arrangement by location number. The first section was intended for the use of the librarian, consisting of a tabular shelf list; the second was a duplicate of the shelf list with enumeration of the individual works bound within each volume; and third was a crude alphabetical-analytical index designed to indicate the location of an individual treatise in a volume.^[17] The addition of the author index to this inventory list added the dimension of a true catalog, which was not evident in many of the examples up to this time. The catalog of the Leicester Abbey in 1394 exhibited a similar characteristic with a double catalog of authors and subjects.^[13]

The catalog of the Library of Meaux Abbey, 1396, was arranged by the location of the bookshelves, which were scattered about the abbey. It did have a more distinct feature, however, in its introductory remarks concerning the origins of the catalog; these were later to become an interesting addition to book catalogs as late as the nineteenth century.

The catalogs of the fourteenth century were the familiar inventory lists arranged by broad subjects with books assigned to a designated or fixed location on the shelves. In effect this was merely the classification of shelf space within the presses, which were marked as to content. This concept encouraged the use of press marks, which could readily be added to the books as an aid in reshelving. Each individual library devised a unique mark generally relying upon alphabetic characters and upon Roman and Arabic numbers. The Dover (1389) and Durham (1391) catalogs

established the practice of recording the “opening words of the second leaf of each book,” which was to become an almost universal method in the next few centuries.^[16]

Modern Period

The fifteenth and sixteenth centuries were a period of sweeping sociological, economic, and cultural changes that reverberated throughout the whole social structure. The Reformation shifted the power from the old universal church to a wider range of authorities with secular organizations assuming more responsibility in many of the nations. In England, the decline of the monastic orders tended to shift the collections of books to the private, college, and university libraries, which was impelled by the suppression of the monasteries during the reign of Henry VIII, 1536–1539. The collegiate libraries were to suffer some of the same harassment in 1549 from the Commissioners of Edward VI, who sought to root out “superstitious literature.” In spite of these difficulties the influence of the Renaissance on scholars, who were nurtured within the academic community, caused them to emphasize the collection and preservation of books as the mark of gentlemen and valuable assets for a nation. The beginning and rapid development of printing from movable type assured a wide distribution of multiple identical copies of a work, a technological advance hitherto unknown to the world. The expensive manuscript books with parchment pages, beautiful and unique, ceased to be the primary form of communication. Printed books were the beginning of a revolution with which bibliographic organization had to keep pace. No longer would the written word be controlled by a central authority that closely guarded the use and distribution of ideas. The existing few and soon numerous libraries, though still in monasteries, cathedrals, universities, and private palaces, began to acquire universality. The stagnation of the preceding centuries ended. The private libraries of the past had represented a broad range of tastes, but were limited in number due to the cost and paucity of the manuscript codices. The church had reluctantly retained the works of the ancients, primarily as a method of education rather than for their contribution to Christian ethics. The university libraries and expanding private libraries began to seek a wide representation of works and assumed the role of conveyors of human knowledge rather than the preserver of a few standard works. Leaders such as Naude and Dury recognized the value in retaining all types of works as the tools of the scholars and the links to the past. The printers and booksellers, albeit with large economic motivation, provided the substance of libraries as well as forging a major link in the bibliographic chain through the efforts of such giants as Maunsell. As the libraries developed, the methods of bibliographic organization slowly evolved despite poor communication, a lack of clear objectives and functions, minimal economic resources, traditionalism,

and the relegation of library usage to a selected few. By the end of the sixteenth century the dawn of the new era was at hand and blossomed fully in the next three centuries.

Fifteenth century

The beginning of the century brought the *Catalogus Scriptorum Ecclesiae* by John Boston, a monk at Bury Saint Edmunds. Apparently he intended to continue the *Registrum* of the previous century, as identical code numbers were employed in both.^[18] He increased the list of authors' names from 85 to 700 and included additional libraries as well as biographical information.^[17]

The catalog of the private library of Amplonius Ratinek de Berka, 1410–1412, which was later given to the University of Erfurt, represented one of the more carefully classified catalogs of the period. Arrangement was by broad subjects such as grammar, poetry, logic, rhetoric, mathematics, natural philosophy, metaphysics, moral philosophy, medicine, law, and theology, with the contents of each volume fully listed and frequently extending to 10 or more items.^[19]

The collegiate catalog of Peterhouse Library, Cambridge, 1418, was arranged by the traditional subjects and indicated two distinct collections, one for reference, which consisted of chained books, and one for lending to the “fellows.” Its unique feature lay in the use of the last word of the second folio in addition to the widely accepted practice of indicating the first words. This pattern was also followed by the Cambridge University Library catalog of 1424.^[6]

The Vatican Library catalog of 1481 depicted the accepted practice of placing the books in bookcases by broad subject arrangement. The catalog was simply an inventory device to show the locations of the materials within the bookcases of the Latin, the Greek, and the Inner libraries, and the Bibliotheca Pontificia.^[10]

The most outstanding catalog of this century was that of the Saint Augustine's Library of Canterbury, 1497. It was comprised of three parts: first, a location list indicating in tabular form the exact place where the books were located and/or the name of the borrower; second, an unfinished alphabetical listing of all books in the library with a reference to the page number of the catalog where the full entries and the press marks could be found; and third, the main section of the catalog.^[6] The latter was a model of uniformity with the general title or that of the first treatise, the name of the donor, the contents (titles) of other works in the volume, the traditional first words of the second work, and the press mark.^[17]

The alphabetical approach with its problem of inter-filing was more common on the Continent than in England during this period. Several catalogs that originated in Austria and Germany revealed the efforts to achieve more logical points of access to the shelf arrangement. An alphabetical catchword index to the shelf list was formulated at

an Austrian monastery at Aggsback; a list of authors, subject designations, and catch title anonymous works were employed as special indexes to the catalog at Melk Monastery in 1483; and dictionary-type catalogs with a multiple-entry approach through author and title catchword were reported at the monasteries of Rebendorf at Eichstaett and Aegidian at Nürnburg.^[20]

The most obvious change during the fifteenth century was a break in the traditional bibliographic organization both within and outside the libraries. Generally, the university catalogs were not as well developed as those of the monasteries. The subject arrangement of the inventory was still the dominant order, but the finding list concept was slowly evolving through the addition of author indexes. Extent of description remained fairly constant with bibliographic comments at a minimum, but exceptions were evident in the Durham Catalog of 1416 which had such information as value, size, doubtful authorship, stolen books, and location.^[6] Thompson reported that the earliest entry of the pages in a work appeared in 1465.^[13] Press marks were used to some extent as in the fourteenth century while the use of the last word as well as the first of each treatise was an innovation. The Saint Augustine Catalog was perhaps the most outstanding product, with its analysis of the parts of volumes through the use of rather advanced cross references, which were given the status of entries.^[18]

Before leaving this century some attention should be given to an important approach devised by Johann Tritheim, who began his bibliographic career with the reorganizing and cataloging of the German monastic library at Sponheim. While engaged in this undertaking, he apparently realized the value of a bibliography of ecclesiastical writers, which he completed in 1494. The *Liber de scriptoribus ecclesiasticis* enumerated 277 works, recorded about 7000 books, and reflected a considerable amount of investigation.^[19] The inclusion of an alphabetical index of authors, arranged by their Christian names, was appended to facilitate the use of the chronological arrangement and established a principle that was to continue as a bibliographical method for many centuries to come.^[19] Thus recognition of multiple access to books was clearly emerging as standard bibliographic procedure with the finding list theory becoming a recognized element within the catalog.

Sixteenth century

The sixteenth century found a continuation of the concept of the inventory device. Some catalogs, such as Saint Martin's Priory of Dover, had gone beyond this by developing shelf lists and analytics. The value of analyzing each part of the physical volume was evident in many catalogs but was by no means universally accepted.

The entry had little resemblance to that of the modern catalog with only title and first words and perhaps last

words of each work. This, however, was to be modified somewhat during this century and substantially during the next as the printed book became relatively commonplace. Catalog production shifted from monasteries to collegiate and private collectors. The century was truly productive with some of the most positive influences for the catalog attributed to Gesner, Trifflerus, and Maunsell. Their efforts stimulated a systematic approach rather than the individualistic methods of the past.

Only two monastic catalogs are of particular value during this century. First, the Syon catalog of 1526 was important because it was the first English catalog to incorporate the idea of Tritheim by including an alphabetical index of authors. It utilized a subject arrangement within the main section with letters of the alphabet denoting subjects. These were then combined with Arabic numbers, which represented accession numbers, to form a complete press mark. Donors and opening words of the second work in the volume are recorded as well as the traditional abbreviated entry. The second was the 1558 catalog of the library of the Bretton Monastery, which was the first to include in the entry the names of editors and translators.

One of the greatest contributions of this century, however, was made by Konrad Gesner, who in 1545 issued the first volume of a comprehensive international bibliographical dictionary entitled *Bibliotheca Universalis*. The work was divided into several distinct parts. First, the main section was comprised of a listing of all the Latin, Greek, and Hebrew authors that were known to the compiler. The arrangement was by the author's Christian name with an added "summary list" of author's names in inverted order.^[19] The second volume was the *Pandectarum*, in which the works of the first volume were rearranged under 21 subject headings that were more extensive than ordinarily found in a typical library catalog up to this point; this represented a marked improvement. The scheme, however, gives the "...impression that it was drawn up empirically and then forced into a pseudo-logical system."^[19] The use of copious subdivisions and an alphabetical index of headings were features that were truly remarkable. As an added bit of information for the book collector, Gesner provided instructions for arranging books in a library. He suggested that books be divided by size and then by some order on the shelves. A catalog of books in shelf order and an alphabetical author index were considered sufficient, although a record by accession number with acquisition and value was also contributory. In addition to these suggestions he pointed out that his *Bibliotheca* could be readily used as a catalog to any library by the addition of press marks.

Additional support for a logically organized library catalog was expounded in 1560 in a manual published in Augsburg by Florian Trefflerus, a Benedictine monk. He stressed the value of a catalog and suggested that five catalogs were desirable: first, one arranged alphabetically by the name of the author; second, one arranged in classed

order or shelf list order; third, one serving as a subject index to the various contents of all books; fourth, an alphabetical index to the third; and fifth, one intended to list books held in reserve because of age or condition. He suggested a shelf mark comprised of a letter designation for size, color, and subject. The first two were represented by abbreviations, but the subject scheme was delineated by the first 17 letters of the alphabet.^[6]

The last provocative work of this century was done by Andrew Maunsell, a London bookseller who in 1595 compiled a bibliography of books published in English. He adopted new methods and shunned the examples of “the learned men that have written Latine Catalogues.”^[21] A dictionary arrangement was followed with a single alphabet of authors, limited added entries such as translators, and subject words. Individual entries were arranged alphabetically by author’s surname rather than the Christian name, and the anonymous works were entered under title, subject, or sometimes both if it would facilitate location. When subject was used it was as a “see” reference to the main entry. This practice was continued in library catalogs and encouraged the custom of distinguishing the main entry. All Bibles or books of the Bible were listed together under the designation Bible to facilitate their location and no doubt influenced later use of uniform headings. The form of entry had a completeness of description lacking in most earlier library catalogs. It was composed of author’s names, translator if present, sufficient name of printer or bookseller, imprint date, and type of format.

It is readily seen that this century witnessed great strides in bibliographical organization, with two of the most important contributions emanating from outside the library itself. The two library catalogs described were significant since they incorporated some of the concepts that were later suggested by Trefferus, Gesner, and Maunsell. Gesner and Trefferus clearly championed the need for several points of access through multiple indexes. Maunsell’s direct and simple approach to the problems of entry word, arrangement, anonymous works, and completeness of description would have a decided influence upon the codes of the succeeding centuries. As the century closed it was clear that a recognition of the need for uniformity and a systematic approach to catalogs and cataloging would soon be a reality rather than just the vague promise of a few erudite bibliographers.

AGE OF THE FINDING LIST

Modern Period

Seventeenth century

The dawn of the seventeenth century found a continued lack of understanding regarding the nature and purpose of library cataloging. The familiar concepts persisted with

shelf arrangement designed for administrative reasons rather than the needs of the patrons. The classification by size as well as subject gained in popularity. The finding list idea, however, was clearly established with author indexes widely advocated. The development of the printed catalog was a highlight of this century. The old manuscript catalog had been laboriously produced while the new lists lent themselves to extensive production if the need should arise.

The number of libraries continued to increase, but cataloging methods changed only slightly although there seemed to be some standardization during the first quarter of the century.^[23] The gulf between the medieval and the modern methods of cataloging could be discerned in the precocious instructions given by Naude, Dury, Baillet, and the Bodleian Catalogue of 1674. The first general library catalog that served primarily as a finding list was the Bodleian Catalogue of 1620. The combined efforts of Thomas James and Sir Thomas Bodley produced a catalog that was arranged by the author’s surnames and catchword titles for anonymous works. The functions of the catalog had finally come to the forefront, although it was in an unintentional manner. Bibliographers would continue to extend the points of access that would be valuable to students and scholars. The major philosophical issues involved in catalog construction were in the offing and only in the nineteenth century were they explored more fully.

The Bodleian catalogs were one of the dominant influences of the seventeenth century and would continue to affect all succeeding study of cataloging procedures. The principal figure behind the reorganization of the Oxford University Library was Sir Thomas Bodley, a retired English diplomat, who dominated the cataloging efforts of Thomas James, the first librarian. The initial printed catalog of 1605 was primarily a shelf list of printed books and manuscripts. The arrangement was typical of the sixteenth century, with groupings by the four academic disciplines of theology, medicine, law, and art. Size separated the books further with the folios chained to the reading desks and the quartos and octavos shelved in special locked cases. Individual entries were listed under subjects, alphabetically by the author when known. Anonymous and pseudonymous works were placed under the most significant word of the title or else under the first word. The entry was somewhat more complete, with author’s name in natural order, title, place, date, size, and location, but lacking edition. To the main catalog was appended an alphabetical index of authors and lists of commentators. The original intent was to print the contents of a single shelf on one page, which would allow extra pages to be used as shelf guides. Recent additions were to be included within an appendix.^[6]

In 1613 an alphabetical author catalog was compiled in manuscript form. It was never printed but rather formed the draft for the second catalog.

The 1620 catalog was a milestone in catalog arrangement, as it used a single sequence of authors' surnames (Christian name first), with anonymous works placed under the first or most striking word of the title. This in effect was our modern dictionary catalog in its embryonic stages without the benefit of uniform subject headings. The idea here, as in other earlier catalogs, was to provide a single entry for each book with the author considered the most logical approach. The anonymous works had created serious problems in other catalogs. Entries for them frequently were made under title, under form heading, or under the most striking word of the title. This catalog utilized the latter method, not in the sense of a systematic coverage of subject information but rather as an attempt to establish some assemblage of materials lacking authors by subject words or forms that might be remembered by the catalog user. The titles of the ancient works had never been a unique form of identification and even at this time were considered of doubtful value in their natural order. The catchword seemed to be the logical way to supplement the author list by serving to group materials of a like nature (form or subject) rather than to scatter them by title. Other practices were separation of author's name from title, books by several authors entered under each name, cross references used, and initial or pseudonym constituted an anonymous work.

The last Bodleian catalog of the century was issued in 1674 under the direction of Thomas Hyde; it kept the alphabetical sequence of authors with catch titles for anonymous works as well as making provisions for the assembling of literary units. The preface contained a number of rules that were the most innovative cataloging procedures formulated until the middle of the nineteenth century. Many of the rules had been previously followed in the earlier Bodleian catalogs, but now the rules for main entry clearly supported three continuing concepts. First, the literary unit principle was expressed by the fact that only one form of the author's name was selected for use in the catalog. Second, an assumed name with cross references was used if the author's name was not given. Translations were entered under original author. Finally, anonymous works were entered in one of four ways: 1) under selected form headings for widely used works, 2) under place or edition for less used works, 3) under biography referred to for biography, and 4) under the most striking or subject word of title.^[6] The recognition and assemblage of authors known by different names, under a single form, constituted the first principle of modern cataloging.^[22]

The catalog of the Lumley collection, compiled by Anthony Alcock in 1609, was a typical private library compilation. It was comprised basically of a classed catalog of 2500 printed books and 400 manuscripts that were arranged within eight classes ranging from theology to music, to which was appended an alphabetical index of authors.^[23]

The catalog of the Sion College Library, 1650, was one of the early dictionary catalogs with names of authors and

subjects filed in a single alphabet. Subject headings and authors' surnames were printed in italics, while guide letters were placed at the top of each column of a two-column page with press marks indicating press, shelf, and order of books on the shelf. The general practice of a single entry per book prevailed, with entry either under author or under subject for anonymous works, as used in the Bodleian Catalogue of 1620.^[6]

In addition to the catalogs cited, the status of cataloging was depicted through the contribution of five authors of the period. Gabriel Naude included valuable hints to the librarian regarding the catalog in his *Instructions*. . .^[24] He commented on the desirability of the catalog and suggested the compilation of two: the first, arranged according to classes (morals, sciences, and devotion) and the faculties (theology, physics, law, mathematics, humanities, etc.) with subdivisions; and the second, an alphabetical author catalog.^[24] He pointed out the need for a miscellaneous class, criticized the single access of some catalogs, and exalted the superiority of the systematic arrangement over the fixed location.

John Dury, a protestant clergyman and later Royal Librarian, in 1650 published in England a small pamphlet devoted to library economy. He contended that "the proper charge then of the Honorarie Librarie Keeper in an Universitie should bee thought upon, and the end of the Imploiment in my conception, is to keep the publick stock of learning which is in Books and Manuscripts, to increas it, and to propose it to others in the waie which may bee most useful unto all. . ."^[25] A catalog was the first step. It should be divided by sciences (subject or classes) and languages. He concluded that space on the shelves and in the printed catalog should allow for the "increase of number" and that a reference to the location of the book on the shelves be included. He spoke of the printed catalog as though it were commonplace and called for an annual supplement compiled for use in the library and "made common to those that are abroad," through printing every 3 years. He suggested other methods such as acquisition by exchange, faculty opinions in selection and cataloging, and the selective cataloging of doubtful publications through the use of an alphabetical author catalog with notes regarding subject. Treflerus in 1560 had suggested a similar list but limited it to books that had been superseded or that were worn.

Adrien Barillet, a French librarian and teacher, achieved two distinctions in the field of cataloging: first, the compilation of a catalog in 1682 of the library of Chretien-Francois de Lamoignon with an alphabetical subject index; and second, the formulation of a set of rules for the multientry, alphabetical catalog (subjects and titles for anonymous works). He advocated the use of major subject categories for shelf arrangement that could be further subdivided by chronological, geographic, or more minute subjects; upheld extensive use of cross references; lamented the traditional single-dimensional approach of

the present shelf arrangements as being too restrictive; championed the subject index as the key to the collection through a multidimensional approach; supported the need for an alphabetical index of authors' surnames; and differentiated between the entry of biographical works under specific name or subject.^[20] In general, his remarks exhibited a firm grasp of the value of the catalog for the location of all materials of the library.

Near the end of the century another provocative publication appeared on the construction of the library catalog. The author was a Danish book collector by the name of Frederic de Rostgaard. His somewhat complicated arrangement of a double page, divided into columns, which designated size and the chronological arrangement of entries within each column with accession number and a letter to designate the subject, provided a varying approach to the grouping of books. He also included instructions for an alphabetical index of subjects and authors arranged by surname with reference to size, accession number, and subject.

The seventeenth century was one of growth, experimentation, and expression. The catalog had progressed to the finding-list stage, but still was beset by an absence of universally accepted principles although the many manuals indicated a more systematic attempt. Cross references were now accepted practice and analytical entries were used, especially in the alphabetical subject catalogs as suggested by Baillet. The imprint was now a standard item of the catalog entry, although still limited to place and date. That the subject arrangement was becoming much more refined was due in part to the publication of Bacon's system of classification of human knowledge. The classification that had been used for centuries in the catalogs seemed necessitated by the shelf arrangement rather than by a proven need for a classified catalog forming a systematic arrangement of subjects to provide access to collections. Classification continued to play a more important role as knowledge became more systematized. The value of the subject and author indexes as a means of expanding the approach to the single-dimension shelf arrangement was recognized and discussed by the theorists of the period, but they continued to remain as adjuncts rather than an essential part of the catalog. The use of catchword titles for anonymous works added a limited subject dimension to the catalog, which would progress beyond its original intent. The use of the surname had largely replaced the archaic practice of entry by Christian name, although some vestige of the former remained with the Christian name frequently recorded before the surname. The question of arrangement was still in doubt, with a full range of possibilities. For example, the catalog of the Norwich City Library of 1658–1883 illustrated the shifting trends in concepts of arrangement. The initial catalog followed the subject method but shifted to the author approach in the eighteenth century, then adopted the division by language and size, and finally returned again to the author catalog in

the nineteenth century.^[6] In addition to the question of arrangement, the use of the original language of the book for title, the treatment and analysis of composite works, indication of size, inclusion of eminent printer with date and place, designation of first edition or best edition, assemblage of different editions of every author together in chronological order, and designation of the value of the book were all problems that confronted the cataloger of the century according to Humphrey Wanley, an assistant librarian at the Bodleian.^[6] Many problems would be answered only to be replaced by more perplexing ones brought on by an expanding society; however, the question of arrangement would persist to the present day. The cataloging process slowly developed from the evolutionary examples and rudimentary codes of this century to the more theoretical and logical efforts of the eighteenth and nineteenth centuries.

Eighteenth century

The eighteenth century was a time of stabilization rather than one of innovation. The expanding university and private collections, augmented by a few municipal libraries, grew in size but only slightly in organizational methods. The French code of 1791, which was the first national code, represented the only major contribution of the century toward a solidification of cataloging procedures. The arrangement of the catalog was still dominantly by subject or by size, with the author approach gaining since the publication of the Bodleian of 1620. The spread of new ideas was slow as each individual library approached the preparation of a catalog greatly restricted by local conditions and attitudes. The printed catalog that became so abundant after the seventeenth century did allow for a distribution of examples highly susceptible to the apprenticeship status of the early bibliographers, who were ordinarily not too concerned with theory.

The inventory or shelf list approach had slowly yielded to a more erudite product, the catalog, although the persistent concern for books on the shelves, not the indexing of knowledge, inhibited the process. Some of the methods of classification developed beyond the simple arrangements of the past and expanded the major classes and subdivisions. The Philadelphia Library Company of 1789 exploited the suggestion of Naude, Baillet, and Dury by classifying under three major divisions and 31 classes, which were then subdivided by size. The purely artificial arrangement by size was frequently used during the seventeenth and eighteenth centuries in accord with the suggestions of Gesner and Rostgaard, and perpetuated the major concern for shelf arrangement. Size is still utilized today as a secondary shelf arrangement, although the storage libraries have recognized its value as well as the accession number approach.

The increased information included in the entry was evident in the catalog of the Friends' Library of 1708,

which added place of birth and residence, time and place of death, edition information, and number of sheets in work. Although it was primarily an alphabetical catalog arranged by authors' surnames, a few subject and form divisions as well as titles for anonymous work were included.^[6]

The fourth Bodleian Catalogue of 1738 continued the tradition of the alphabetical arrangement by author and catch title for anonymous titles subarranged in chronological order. The addition of the name of the printer indicated that one of the problems suggested by Wanley had been solved.

The catalog of the Sion College Library departed from its former alphabetical arrangement of 1650 and was reissued in classified order in 1724.^[6] The artificial scheme was similar to many of the period, which was simply a designation of letters to represent not necessarily subjects, but rather book presses and their contents.

Compilers frequently contended that a catalog by shelf order was most suitable, as missing items could be readily detected and the donors could more quickly determine which presses needed books.^[6] The latter reason was legitimate at that time and was reflected in the later library laws of Great Britain and in such American catalogs as that of Harvard, 1723.

The Chetham catalog of 1791 attempted to utilize a "judicious and scientific" arrangement under the divisions of theology, law, history, sciences and arts, and humanistic literature, which could in turn be subdivided as necessary. The lack of an index badly hampered its use until 1826, when some relief was afforded through the addition of an author index, which gave the title of anonymous works.^[6]

Harvard College had the distinction of issuing the first printed library catalog in America in 1723. Its expressed purpose was not for the improved use of library facilities, but rather as a solicitation device to be circulated "to friends abroad." The catalog served as an inventory and was arranged by size with subdivision by author and catchword titles for anonymous works, although the later editions were in alphabetical order.

Twenty years later, in 1743, Yale produced an excellent catalog composed of three parts: a manuscript shelf list, an alphabetical list of authors, and a classified guide or index for student reading that was divided by approximately 23 major classes with appropriate subdivisions. Books were listed under as many as five subjects in order to bring out the various contents of the volume.^[26]

Generally, the catalogs produced in America during the eighteenth century favored the size or author arrangement or a combination of both, with only three out of approximately 24 relying upon the subject approach. Of these, only the Philadelphia Library Company Catalogue of 1789, with its three divisions and 31 classes that were subarranged by size, and the Harvard catalog of 1790, with its 64 classes that chose subarrangement by author, are of particular significance. The use of the index was

slowly evolving as a valuable asset and was frequently found in the American catalogs. The catalogs of the Philadelphia Association Library Company of 1765 and the Library Company of Philadelphia, 1770, frequently made entries under the first or substantive word of the title in addition to the author,^[26] which would later develop into accepted practice. The information contained in the entry was approximately the same as the British successors. In spite of the unique innovations that have been described, the early American catalogs as a whole could be characterized as rudimentary devices primarily serving as an inventory or index, arranged in a single sequence with generally only a single entry for each work.

Near the end of the century the French revolutionary government confiscated a large number of books and manuscripts from a countless number of institutional and private libraries. The code of 1791 was formulated to provide simple but comprehensive rules for organization, beginning with the assembling and numbering of the books and continuing through the mailing of the completed cards to Paris. Playing cards or slips of paper were suggested as a format, which was the first mention of such an approach in any code. The completed code was to contain an accession number, title exactly as recorded in the book unless extremely long, imprint (place, printer, date), size, and other exceptional features. The author's name, as it appeared on the title page or elsewhere in the work, or a word that was most indicative of the subject if anonymous, was underlined for emphasis. Cards were then arranged alphabetically and fastened together by a thread through the lower left-hand corner. The name of the parish or district was recorded at the bottom of the card. A copy was then made on ordinary paper for retention within the district, and the cards were forwarded to Paris. It was reported in 1794 that approximately one million cards had been compiled as a record for roughly three million volumes.^[27]

The close of the century witnessed few new innovations in cataloging procedures. Author, size, and subject or a combination of any two dominated the arrangements with preference to author and size. A chronological subarrangement rather than alphabetical by title was frequently used in the author catalogs, although the size of the collection dictated the practice in this regard. Completeness of description varied, with the catalog of the Friends' Library being the first to use the number of sheets. Analytical entries continued to gain in popularity, as shown in the Yale catalog of 1743 and in the catalogs of the two society libraries of Philadelphia in 1765 and 1770. The inverted form of the author's name was now a reality, in spite of the use of the possessive form by some of the less progressive libraries.

Nineteenth century

At the beginning of the nineteenth century some vestige of the old inventory concept still persisted. Generally, the

catalog was considered a finding list but occasionally was further refined to include the newest Bodleian concept of assembling literary units together. The purpose of the catalog had evolved through two distinct phases: first, the inventory or content of shelves, which was prevalent in the monastic period; second, the finding list, which began with the author indexes and attained recognition with the alphabetical catalog of the Bodleian in 1620. In addition, Akers^[22] acknowledged a third state, that of assembling literary units, which was originally expressed and practiced in the Bodleian Catalogue of 1674. Akers further contended that the stage demanded a highly developed instrumentation with differentiation between author, subject, and title entries, with main entry determined by authorship, and with the finding list function assigned to secondary entries in the event that the main entries were inadequate for quick location of the book.^[22] The catchword title continued to be used throughout this century, but was dominated by Edwards's statement that "of necessity such catalogues must deal rather with the phraseology of title pages than with the subject of book."^[28] As a result of strict adherence to this and the idea of only one entry per book, the development of subject headings was retarded. Cutter very philosophically avowed that after the introduction of the title entries for anonymous books,

...the next step was to make the title-entries not merely for anonymous books but for all which had any good word in the title from which to refer, the object being to provide a means by which anyone who had heard of the book could easily find it.^[2]

Apparently catch titles were considered as an adjuvant means of grouping materials on certain subjects together, and were used by at least 19 catalogs in the United States between 1815 and 1854.^[2] It should be pointed out that Cutter, in 1876, codified the practice of entry by author, subject, title, and form and refuted the notion that "a catalogue must of necessity confine itself to titles only of books."^[2]

This was a century of codes, with 15 major works originating in Great Britain, France, and the United States, not to mention the individual rules as expounded in the introductions of countless catalogs. The number of catalogs produced during the first three-fourths of this century numbered over 1000 (including supplements) in the United States alone. This was the age of the printed book catalog, which was to continue until the waning years of the century, largely replaced by the card catalog in the early twentieth century only to be revived later.

Our discussion for this century will be directed mainly toward the American catalog and the codes developed by the British Museum, Jewett, and Cutter.

Considerable attention was devoted during this century and the early years of the twentieth to the relative merits of the alphabetical author, the dictionary, the classified, and

the alphabetical-classified catalogs. The alphabetical author catalog consisted primarily of the surnames of the authors while anonymous titles were entered by one of the Bodleian code suggestions. Only one entry per book was considered necessary, although deviations from this occurred quite early in the Philadelphia Association Library Company catalog. The dictionary catalog evolved from the author catalog and is an alphabetical sequence of duplicate entries for authors, titles, subjects, and forms. Frequently the name is used in a narrow sense to apply only to a single alphabetical sequence, while in the broadest connotation it indicates the mere alphabetical arrangement of several separate files. The main distinction lies in the arrangement of specific subjects that are in alphabetical rather than systematic order.

The classified catalog is limited to subjects that are arranged in a systematic order so that related objects are grouped together or in close proximity. The subject-arranged catalogs discussed up to this point were habitually arranged in an unsystematic order so the value of a subject, author, and title index was readily seen although not always present at the preliminary stages. Just when the true classed catalog developed is open to debate, since the early subject arranged shelf lists were pseudoclassified. The assumption that the classified catalog developed before the alphabetical is misleading, for without the modern classification schemes and indexes of the twentieth-century classified catalog, it would fall far short in achieving the usability of the dictionary form.^[29] The early works of Gesner, Naude, Dury, and later Brunet were instrumental in an attempt to systematize the approach to knowledge in the library catalog. The lack of suitable classification schemes retarded the full use of the classified catalog, but the nineteenth century brought some alleviation. For the sake of clarity, the term classed catalog rather than subject arrangement or subject catalog will be used in the discussion of the nineteenth and twentieth centuries. The term subject catalog in its broadest sense does not refer to the arrangement, but rather to the inclusion of subject entries.

The alphabetico-classed catalog, which became popular during the middle of the nineteenth century, was basically a merger of the best points of the dictionary and classed catalogs. Cutter indicated that "...the subjects are grouped in broad classes with numerous alphabetical subdivisions."^[3] This definition was somewhat limited and has been expanded by Shera to include two possible arrangements: first, major divisions in alphabetical order with subdivisions classified in an "appropriate manner," or second, classified order for major divisions with subdivisions in alphabetical sequences.^[30] The catalog of the New York Public Library was strongly influenced by the alphabetico-classed concept, although recent subject headings tend toward greater specificity.

In addition, the combined catalog mentioned by Cutter was composed first of a classified catalog and second of a

dictionary catalog, with author and anonymous-title entries, subject entries, other title entries, and subject references to classed catalog.^[2] This approach would be similar to the combined use of a dictionary catalog and shelf list.

In the early part of the century, the popularity of the alphabetical catalog continued despite the fact that the classified catalog was developing into a sophisticated device with systematic classification schemes and author and/or subject indexes. In 1810 (2nd ed., 1820), Jacques-Charles Brunet published a classified bibliography or *catalogue raisonné* of books for booksellers and private bibliophiles; it consisted of an alphabetical author index with full entry to which was appended a classified abbreviated entry catalog or “*table en forme de catalogue raisonné*.”^[29] The latter was devoid of a separate index, although it did have a brief summary outline that provided a cumbersome but nonetheless systematic access.

The *Catalogue of Printed Books* of the Society of Antiquaries of London, 1816, was reputed to be the first true dictionary catalog; it used the duplicate entry approach within a single alphabet, including catchword or subject word for anonymous works as well as for those the authors of which were known.^[31] This practice, however, was followed to a limited extent in the Philadelphia Association Library Company Catalogue of 1765. Eight years later, Robert Watt issued the *Bibliotheca Britannica*, a two-part bibliography with one alphabetical sequence for authors and a second for subjects. His deviation from the phraseology of the title page as the only source of subject headings was to have a profound effect on indexing methods, ultimately producing a dictionary arrangement.^[29] Panizzi acknowledged the influence of R. Watt’s work on his proposed plan, but pointed out that insufficient information had been given “to the titles of books or to the index.”^[32]

As the purpose of the catalog became more clearly defined, libraries began to reintroduce the classified catalog, which incorporated such refinements as systematic classification schemes devised by Bacon, Horne, Brunet, and others. Indexes were not considered an essential part and were comprised primarily of authors, although the Providence Athenaeum catalog of 1837 included editors and translators.^[2] Thus new means of access were evolving through the index, which served to provide added entries for the book catalog.

At the same time supporters of the alphabetical arrangement sought to improve the subject approach. The Andover Theological Seminary catalog, compiled by O.A. Taylor in 1838, was one of the best alphabetical catalogs of the period and was based on the German practice that provided for two separate alphabetical catalogs arranged by author and by subject. He managed to complete the author section but never finished the systematic index.^[26] Taylor was aided by Charles Jewett, a student, who would later adapt his example at Brown University.

The subject index of 1843 to the author catalog of Brown was to serve as an alphabetical and a pseudoclassed index and was comprised of a single sequence of subjects or catchwords, broad subject entries, and specific entries.^[26] Although Jewett only infrequently deviated from the phraseology of the title page, the departure from the traditional concept of Panizzi and Edwards was significant enough to foster a movement that would in time free the subject index from the restraint of title terminology. “The way was now open for the compilation of a full dictionary catalog.”^[26] Three years later a similar catalog was issued by the Linonian Society of Yale, using a single alphabet with author, title, and subject word.^[2]

Another form of alphabetical catalog, issued in 1844 by the New York Mercantile Company, was comprised of an author catalog with an alphabetically classified index. The index was divided into 69 subjects arranged in alphabetical order, with individuals works listed beneath each heading in a similar arrangement.^[26]

The first half of the nineteenth century was characterized by a variety of combinations of arrangements and indexes. The first major group was comprised of catalogs that were arranged primarily by subject or classified order. The most elementary form was by broad classes or subjects in a shelf list order, with works subarranged by accession and chronologically by imprint date, title, or author. An extension of this was close classification with classes or divisions subdivided into more minute facets by a systematic scheme. Both were considered indexes with single or variant combinations of author, title, or subject as optional features, but their presence became commonplace as librarians recognized the need for a multidimensional approach and stopped arguing about whether the patrons sought material primarily by author or subject. The classified approach was considered more difficult to use, which was true until the development of classification schemes and indexes. The problem of looking in two places, however, always will tend to be somewhat of a disadvantage of this arrangement.

The second broad group of catalogs had a primary arrangement in alphabetical order. They were in many cases indexes to a secondary classified order, but the major emphasis was placed upon the ready accessibility of an alphabetical, rather than a systematic, approach. In other words, both were complementary to one another, with a classified system being rather limited without an alphabetical index and the alphabetical system badly limited because of extreme dependency upon the occurrence of letters. Some of the most common types of arrangements in alphabetical order were: subject list or combinations of subject, author, and title to a classified catalog; subject list with works listed beneath each heading with possible indexes for author and/or title; classes with subdivisions in alphabetical order or classified order; and author list with appended subject list in alphabetical or classed order. Some of the more sophisticated types actually developed

shortly after the turn of the century. It is easily seen that the distinctions are not always too clear. The recognition of the value of each type of arrangement precipitated some rather unusual combinations, which testify to the ingenuity of American bibliographers and librarians. The emergence of the dictionary catalog unquestionably demonstrates the growing influence of the public library in American society. The development of a new form, the card catalog, seemed to parallel the new arrangement during the second half of this century.

In 1853 in an introduction to a classified catalog compiled by Ezra Abbot for the Cambridge High School, the changing concepts of authorship were reflected in the placing of anonymous works under the first word of the title if not an article or preposition, societies under name, periodicals under title, and collections under editor.^[33]

The continuing effort to utilize the key words of the title as a source of information slowly led toward the development of the dictionary catalog. In 1854, Sampson Low issued an *Index to the Titles* for the *British Catalogue of Books Published in 1854*. The former classified index with its 34 classes was now arranged in one alphabetical sequence. This new “concordance of titles,” which supposedly presented the “author’s own definition” of his book, was concerned not with subject information but rather with a more ready location device for the booksellers.^[2] The idea was further developed in 1856 by Crestadoro, a former assistant to Low.

Frederick Poole, in 1854, compiled a dictionary catalog at the Boston Mercantile Library with a single sequence of authors, titles, and subjects. The use of subject words rather than independent subject headings continued the obedience to wording of the titles. The catalog was limited to a single line for each work and was one of the first condensed catalogs produced as an answer to the overwhelming costs of the comprehensive printed form. The lack of cross references was unfortunate, as the related subject words were further obscured just as failure to provide for multiple subjects of composite works further limited the subject value. The catalog continued the tradition as employed in Poole’s *Index to Periodical Literature*, which was first begun at Yale for the libraries of the Linonian and Brothers’ Society in 1848.

After leaving the Smithsonian, Jewett became librarian at the Boston Public Library in 1857 and 1 year later issued a catalog for the Lower Hall; it continued the title entry idea with synonymous words scattered but strengthened it with a wider variety of subject words employing duplicate entries to bring out the various aspects of polytopical books. It also included cross references, which were considered the “greatest improvement of all,” from many subjects to others that were of a similar nature.^[2] The authors’ names were placed first under the headings, thus allowing for easy alphabetical arrangement and greater importance for subject emphasis. Jewett thus “...took the first steps, somewhat wavering steps, it is

true, in a different direction.”^[2] He recognized the informational purpose as well as the need for a specific citation and sought to bring about some distinction between subject and title entries. “The idea was not thoroughly carried out, but it had been conceived.”^[2] The prominence of the subject idea continued to develop in the later Bates Hall Index and its supplements. The dictionary catalog was now an immature but accepted method; however, the idea of specific entry was still in a formative stage though regimented by the title page.

Ezra Abbott entered the catalog scene once again in 1861 by embarking upon an alphabetico-classed card catalog for the Harvard University library, where cards had formed a “private card supplement” since 1833.^[34] This practice was not entirely new, as libraries for years had maintained files of “slips” which were integrated into supplements or new editions of the printed or manuscript catalog and served the staff as a supplementary list. Their use was not an American innovation, as they were employed by Abbe Rozier in 1775 for the compilation of an index of publications of the Paris Academie des Sciences; again in 1791 as described in the French code; then by the Society of Telegraph Engineers in London in 1820; and continuously since 1827 by the Trinity College in Dublin.^[35] The British Museum used an 11- by 4-inch slip, which formed the basis for a sheaf catalog begun in 1841.^[35] The first catalog designed for public use within the United States was reputed to be at the Philadelphia Library Company in 1857.^[36] Bates Hall at Boston Public Library instituted a public Card Catalog in 1871 with two rods across the top of each drawer to hold the cards securely.^[35] The University of Rochester was reported to have used them temporarily as early as 1846.^[2] In addition to the use of cards, the Harvard Catalog was the first time a librarian had undertaken a subject catalog that would include true subject headings for each book that were derived from the content of the book rather than the words of the title.^[26] The subjects would not be scattered by accident of alphabet but rather would be grouped together under a common form. To Abbot, the most logical approach was to compile two separate catalogs or indexes, one for authors and one for subjects. The former would follow the usual pattern and be primarily intended as a finding list for determining the availability of a particular book. The second would be made up of subjects, arranged in alphabetical order, which were subdivided by various aspects in a second alphabetical sequence, thus allowing for some of the advantage of the classified catalog. In addition to entries for books, analytical entries for academy proceedings and periodicals were included. He reasoned that none of the three approaches presently used were feasible: first, the closely classified catalog required a knowledge of a complex classification scheme; second, the broadly classed catalog tended to be too general an approach; and third, the dictionary scattered materials in every part of the catalog.^[26] Abbot’s efforts were to have a

decided effect upon the cataloging procedures, particularly upon the extensive application of cards. His suggested subject arrangement was not widely accepted, although it was in part adopted for the dictionary catalog with its many subdivisions, which became a part of the latter. Cutter commented that Abbot's system was "...best adopted for the thorough investigation of comprehensive subjects"; while the dictionary catalog was for "finding quickly what relates to a person, a place or other specific topic."^[2]

The dictionary and classified catalogs were collocated in 1874 by J. Schwartz at the New York Apprentices Library;^[37] he believed that the "abstract" information or "objects," which must be "viewed in their relations to other objects, or as parts," can best be located by the classified catalog, while "concrete" information or "objects," which "may be viewed as complete" in themselves, can best be located by the dictionary catalog. Thus the information supplied by both was equally valuable but "...both methods cannot be united without doing violence to the principles on which each is based." The ideal catalog could be obtained by the acceptance of "both as co-ordinate parts of one whole." The results were first a classified catalog of all books (imprints omitted) arranged by 24 classes, 216 possible divisions, and about 2000 subdivisions. This was prefixed by a synopsis of the classification scheme to facilitate ready location within each class. The second part was an alphabetical listing: authors and anonymous title entries with individual works subarranged alphabetically by title (complete with imprint); titles that do not clearly indicate subjects or topics "whether stated in title or only implied" followed by a list of all books thereon; class headings used as references to classified; and cross references. The subject headings adapted were frequently in inverted order with the noun or substantive first, then followed by an adjective. The catalog exemplified an attempt to use the best of both, but entailed a considerable effort to compile. The twentieth century would find a similar procedure being used with reference cards placed in the dictionary card catalog that directed the user to the shelf list for general and voluminous classes of information. This approach has never been extensively employed and certainly has great possibility for allowing more selective inclusion in the dictionary catalog while utilizing the ever-present shelf list as a systematic access.

The catalog of the Boston Athenaeum of 1874 was a monumental product of this period and embodied the most advanced thinking of Charles Cutter, who is most clearly identified with the dictionary catalog. The catalog was begun in 1856, the year that Poole assumed the post of librarian, and continued in various stages of development until Cutter became librarian in 1868. Cutter was visibly displeased with the preceding efforts, as he sought to achieve high standards with complete and carefully constructed entries. Author headings were meticulously

established with full names and identity of authors of anonymous works if possible; otherwise they were entered under the first word of the title. Unique subject headings were employed without regard to phraseology of the title, which had become accepted, if not universal, practice by this time. Contents notes were added for each collected work with analytics made for these under author, title, and subject as well as entries for periodical articles and society publications. This was a tremendous feat, but he considered the catalog to be the key to the library collection. At the other end of the spectrum during this same year, Poole published a finding list at the Chicago Public Library that was simply a reproduction of the shelf list with brief bibliographic information. The popularity of such abbreviated lists persisted throughout the remainder of the century. The Boston Athenaeum catalog became the model of the period, with its dictionary arrangement by author, title, and subject with form occasionally denoted by references. The acceptance of the dictionary catalog was then almost universal within the United States, although a few classed catalogs were produced.

In addition to the publication of Cutter's *Rules* in 1876, four other events occurred that were to have an effect upon cataloging. First, the founding of the American Library Association (ALA) united and concentrated efforts in the direction of cataloging with discussion and activities centering around the advantages and disadvantages of the card or book catalog, the merits of the dictionary or classified catalog, analytic indexing of periodicals, indexes for government publications, potential use of bibliographies, and other issues concerning bibliographic organization. Maddox concluded that the most widely discussed library topics of the period, 1876–1885, were classification and cataloging.^[38] The second was the publication of the Dewey Decimal Classification with subject index by the young Amherst librarian. This scheme was designed for a classified catalog and supplied a long-awaited standard index to subjects that would tend to solve one of its major disadvantages. Librarians quickly recognized the value of the scheme, utilizing it first for the classified catalog and later primarily as a shelf arrangement for the dictionary catalog. The third was the planned publication of the *American Library Journal*, which was to serve as "a periodical supplement" to the 1876 Report.^[39] In addition, the editors solicited copies of catalog cards or slips to be used as examples of methods and catalogs in the many libraries and hinted at possible cooperative cataloging ventures by the *Journal* through the "printing of accurate titles of new books in such a way that they can be used for the card catalogs of libraries."^[39] And the fourth was the founding of the Library Bureau, which both standardized the dimensions of the catalog card and later was one of the first organizations to offer printed catalog cards for sale.

The catalog of the Brooklyn Mercantile Library, 1880, was based on the alphabetico-classed concept which

attempted to bring some semblance of order to the subject headings rather than scattering them throughout the dictionary catalog. It occurred at a period when the book catalog was beginning to wane and at a time when the Boston Athenaeum catalog overshadowed other contributions. S. B. Noyes, the compiler, sought a systematic approach to authors, titles, and subjects within a single alphabet by forming certain general classes or class lists, such as BIOGRAPHY (individual subjects), COUNTRIES (alphabetical arrangement), or FICTION (alphabetically by author and title), within the general alphabetical sequence. Specific headings were then grouped primarily under 30 such class lists, which were interspersed among authors, titles, and cross references in traditional alphabetical order. Topics that were too fragmentary, complex, or many-sided would be placed in the general alphabet rather than under the general classes for easy location. Analytics for collections, miscellaneous essays, and some periodical articles were included. The purpose of the catalog was aptly described by Noyes:

The catalogue is designed to secure as far as possible, in one alphabet, an index to authors, titles, class headings, subject class headings, specific subjects and subheads, so that the inquirer may at once be directed to what he is in search of.^[40]

Although it was well received, Cutter criticized the catalog as a “mixture of partial dictionary and incomplete classification. . . .”^[2] The user must know the degree of comprehensiveness of subject, which was generally a varying process as clearly pointed out by Oliver Lilley^[41] in the next century. Cutter further contended that with such classes the arrangement was a “return to the dictionary plan by specific entry,” and certain important classes were lacking which had for instance been used as subjects for a separately published class list for the Lower Hall at Boston Public Library. He conceded that perhaps this irregular selection of classes might “correspond to the public’s unsystematic association of ideas” with the reader possibly looking “in the right place at first” and avoiding extensive use of cross references. He concluded that: “Never the less it may prove a most successful catalogue.”^[2] Nearly 80 years later the comment was made that “its (alphabetico-classed) possibilities have never been adequately explored.”^[30]

The Index-Catalogue of the Library of the Surgeon-General’s Office, 1880–1895, compiled under the direction of John S. Billings, was another monumental product of the period, requiring over 20 years to complete. The title, “index-catalog,” was used to denote the inclusion of books and periodicals. The consistent use of specific headings, which were independent of title words, and a systematic employment of aspect subheadings, which were separated by brackets rather than dashes, were outstanding features of this 16 volume classic.^[29]

Centralized cataloging or the preparation of catalogs or cards by a centralized agency or library for distribution to other libraries was first suggested shortly after the middle of the century by William D. Cooley, an English geographer, and Charles Jewett, through the use of stereotyped plates. Photographic techniques were suggested in 1835 by Albert Blor^[42] and again at the Librarians Conference in 1877 by Henry Stevens, who speculated that centrally produced cards might include a photographically reduced title page for each entry.^[43] F. Max Müller, former librarian at the Bodleian, had suggested the use of printed slips that could be distributed with each book in an article in the *Times* (London) of March 1876. He contended that national libraries should assume the responsibility for cataloging publications produced within their borders and pointed out the desirability of requesting each author to compose a “proper slip of his own book.” He also proposed that printed slips could be used to maintain three or four kinds of catalogs such as alphabetical by authors, chronological, local, and classified by subject.^[44] Similar proposals regarding the use of printed slips had been made by Otis Robinson, librarian at the University of Rochester, 2 years previously, and in 1876 by Justin Winsor, the librarian of Harvard.^[44] The first successful, but short-lived, attempt was by *Publishers’ Weekly* in the form of slips that could be cut apart and pasted on cards. This was followed by a similar venture in 1887 by the American Library Association, which sought to supply cards. The Rudolph Indexing Company in 1893 planned to supply cards for over 100,000 volumes, but this failed to materialize.^[45] The Library Bureau issued cards from 1893 through 1896 until the project was shifted to the American Library Association Publication Section, where it was quickly dropped, although efforts continued through the production of cards for serials and composite books. As the century ended, plans were in the offing to expand the publication of cards by the American Library Association but in July 1898, the Library of Congress began to print catalog cards for American copy-righted books. A short time later cards were exchanged with two or three large libraries, which were also printing catalog cards at that time. A printed card service has been available to all libraries since 1901. Failure of the early attempts at cooperative cataloging was largely attributed to the inability of librarians to accept such a radical innovation; failure of cards to conform to individual practices such as author headings, size of card, and bibliographic information; and the long delays in shipment.^[45]

The early catalogs had occasionally utilized a supplementary alphabetical subject index, which was the forerunner of our present subject lists. After the freeing of subject words from the phraseology of the title, librarians quickly became conscious of the lack of uniformity among the subject headings selected by the various catalogs. The dictionary catalog made the problem even more acute, as now the subject headings were words that would be

suggestive of content, not the title. It was soon observed that they must utilize a syndetic structure to be effective in covering the many possible approaches by the user. A committee was established in 1879 by the American Library Association to study the problem of an index to subject headings that would serve as an appendix to Cutter's *Rules*. Cutter, the chairman, reported 2 years later that an impasse had been reached as "we can't agree."^[46] The efforts of the committee continued with numerous reports and membership changes attesting to the difficulties. In 1895 the project culminated in the publication of the *List of Subject Headings for Use in the Dictionary Catalogue*. The work was a composite listing of terms used by several large catalogs and other sources which had been carefully screened and was complete with "see" and "see also" references. It was considered a standard list for all types of libraries and found wide acceptance in three editions until the final issue in 1911, when it was largely replaced by the Library of Congress list of subject headings, which was issued in parts between 1909 and 1914. The popularity of the latter was assured by the widespread use of printed catalog cards. Its failure to include references until 1943 was a decided drawback, although supplements were a distinct asset in keeping up to date on new terminology.

Three other important bibliographic tools, which would affect catalogs, were issued during this period. The first was the third edition of *Poole's Index to Periodicals Literature*, which extended coverage to 1882. The second was the *A.L.A. Index* of 1893, which was designed to index collections and composite works and free the catalog of innumerable analytics for this type of material. The third was the *Catalog of the A.L.A. Library, 1893*, which was to serve as a selection aid, cataloging guide, and printed catalog. It is interesting to note that all three of these have continued to be issued, although under different names and publishers, until the present time.

Codes: British Museum. Before the merging of the Royal Library with the Cottonian, Harleian, and Sloan collections in 1753, early individual cataloging attempts were as a whole poorly planned and executed. In 1759 the trustees expressed the desirability of a catalog and further suggested in 1807 that a separate alphabetical catalog for each collection be compiled as well as a general classed catalog.^[6] These efforts culminated in the issuance of seven volumes between 1813 and 1819, during the tenure of Sir Henry H. Baber as Keeper of Printed Books.

The current emphasis on scientific classification was skillfully presented by Thomas H. Horne, who submitted his *Outline for the Classification of the Library* in 1825 to the trustees, who engaged Horne temporarily to accomplish such a catalog at the British Museum. Although the project came to an impasse, this proposal and his *Observations on the Manner in Which Titles of Books are to be Entered and Classed* were valuable additions to cataloging

literature. The latter contained a few rules which pertained to bibliographic descriptions such as content notes, forms of authors' names, and the need for several indexes to the classified catalog.

The work on the classified catalog begun by Horne was suspended in 1834, at which time Mr. Baber proposed a plan for an alphabetical author catalog based on 16 rules that provided for uniform cataloging slips, entry under author if it appeared any place in the work, form of name taken from title page, anonymous works placed under "prominent or leading word" with name of possible author inserted at end of titles in brackets, pseudonymous works cataloged under pseudonym with real name inserted after title in brackets, entry under editor for collected works, and translations entered under original author.^[47] In addition he proposed that Panizzi, an impetuous Italian political refugee, should be given the task of editing the new work. The proposal was rejected and then followed by committee studies in 1834 and 1836, during which time the arguments for the classified and alphabetical catalogs were vehemently expressed with few concrete results. In 1837 Panizzi was appointed the Keeper of the Printed Books in spite of strenuous objections. The work on the new catalog was authorized by the trustees in 1838 with a projected completion data of 1840, but with the stipulation that each letter of the alphabet was to be published individually instead of the original "shelf by shelf" plan of Baber and Panizzi.^[6]

The so-called "Ninety-one Rules" employed in the compilation of this catalog were not the work of Panizzi alone but were accomplished by the unique method of having Edward Edwards, J.W. Jones, J.H. Parry, and Thomas Watts compile codes, which were then studied and criticized. The resultant code was thus formulated by the effort of five men who carefully collaborated to express the best in cataloging philosophy of the period. It was approved by the Board of Trustees in 1839 and published 2 years later.^[6] The final product consisted of 91 rather than the originally suggested 79 rules and was decidedly inferior because of the meddling of the trustees.^[48] Work on the catalog, however, was not progressing as smoothly with the first volume so marred by omissions that the printing was suspended in 1841, although the manuscript project continued. A rash of criticisms and investigations in 1847 ensued, with Panizzi defending the "Ninety-one Rules," but now questioning the feasibility of a printed catalog for such a large library. In 1849 a guard book catalog was devised with the entries copied on slips that were formed into a 150-volume catalog by 1851.^[6]

The influence of Panizzi may have been overemphasized, although his impact upon modern cataloging was decisive. An assessment of his contribution is obscured somewhat by the fact that the "Ninety-one Rules" were a product of collaboration, although the testimony before the commissions was assumed to be an expression of his

ideas. He was a fervent supporter of the author catalog, contending that this was the most natural approach by the user. An “index of matter” or title subject words, which were severely limited by the admonition that only the title page was to serve as a source, was appended. The authority of the title page was accepted as a means of attaining a consistent catalog in the typical tradition of the Bodleian Catalogue in 1674. The practice of using abbreviated references which guided the user to the main entry was considered a feasible method of gaining space in the book catalog and set a precedent that would be followed by future librarians even after the advent of the card catalog and the unit card should have negated such a concept. The treatment of anonymous works was a major concern and indicated Panizzi’s feeling that the catalog must be more than a quickly prepared finding list. He sought to separate anonymous works into corporate bodies and form heading groups where possible, still leaving room for those entries that could only be called miscellaneous. The first were arranged in alphabetical order under the name of the country or place “from which they derive their denomination or for want of such denomination, under the name of the place from whence their acts are issued.”^[32] Organizations such as academies, universities, and learned societies were entered under the form heading ACADEMIES, and were subarranged by continent and then country. The second group was designed to place special types of material where form was apparently considered essential under such headings as PERIODICAL PUBLICATIONS, EPHEMERIDES, CATALOGUES, LITURGIES, and BIBLE. The final group was comprised of miscellaneous publications that lacked authors and were not covered in the other categories. They were listed in order of preference as possible alternatives: 1) enter under person if referred to in title, 2) enter under place if referred to in title, 3) enter under substantive if lacking both person or place, and 4) enter under first word if not substantive in title.

This elaborate structure clearly reflected the problem of anonymous publications, which included corporate and miscellaneous works lacking the name of a personal author on the title page. The rules were frequently divergent from Panizzi’s opinions as revealed in the testimony by his preference for the first word that was not an article or a preposition rather than the first substantive,^[32] by his belief that the reader was expected to know the title of the book just as readily as the author,^[32] by his objection to class headings asserting that the most desirable situation would allow every title in its place without any other heading than “its own fixed and certain heading” with fewer titles under each entry,^[32] and by his contention that a cataloger must take the title as it occurs rather than forming it to suit his convenience.^[32] Many of his opponents advocated entry under the subject word rather than the first important word. One of the major contributions of the “Ninety-one Rules” was the concept of placing

corporate bodies under the country or place, although the names were derived from the title and could be construed to have the quality of a subject rather than a corporate author. The system of form headings was a secondary approach relegating special types of works to a consistent location which supposedly made them more accessible than a wide variety of non-descript titles. This approach persisted in British cataloging practices to the twentieth century and was evident in all of the codes including the 1967 Anglo-American code. The reluctance to utilize the conventional title as an entry was evinced by the final group of miscellaneous anonymous work, although it was not indicative of Panizzi’s philosophy.

The “Ninety-one Rules” were a monumental achievement, as they represented the first attempt to codify the rules for the compilation of an author catalog with logical guides for cross references. Many of the basic concepts originated from the Bodleian and other leading libraries. The “Ninety-one Rules” were to form a basis for future codes and had a particular effect upon librarianship in the English-speaking countries.

Codes: Jewett, 1853. The first distinct code of cataloging rules issued in the United States was compiled by Charles C. Jewett, librarian of the Smithsonian Institution. Jewett sought primarily to provide a set of uniform rules established on principles, and supplemented by explanations and examples. The “principal object” of the rules was to secure uniformity; however, he cautioned that even the most elaborate rules were inadequate to “provide for every case of difficulty which may occur.”^[49] About one-third of the publication was devoted to a description of an ingenious system that had originally been proposed in 1850 at a meeting of the American Association for the Advancement of Science in New Haven and again at the Librarians Conference of 1853. Jewett’s plan was truly remarkable for its day as it called for the compilation of a code of rules, the submission of catalog entries by individual libraries according to these rules, stereotyping of each single entry, and the production of catalogs according to demand by simply interfiling and printing. The project failed, however, as it was too far advanced for the period to achieve widespread support as well as being hampered by technical problems that developed in the material used for the stereotype plates. The advantages described by the author were: elimination of duplicate effort, source of location for books, useful bibliographic information, guide for exchange, increased uniformity, possible American bibliography, and a future universal bibliography. The possible list of American literature embodied the concept that was later used in the Library of Congress printed catalogs. He pointed out that copyright books were required by law to be deposited at the Smithsonian and that these could be listed in monthly bulletins, annual lists, and quinquennial catalogs that would form a record of American publications.

He asserted that a catalog was a list of titles of books that a library contained and was generally not expected to give any further information “than the author gives or ought to give in the title page, and the publisher, in the imprint, or colophon; except the designation of form which is almost universally added.”^[49] He admonished that

...the catalog is designed to show what books are contained in a particular collection, and nothing more. Persons in want of further information, are expected to seek for it in bibliographical dictionaries, literary histories, or similar works.^[49]

The alphabetical catalog according to Jewett was the best type and he supported this with many of the arguments previously advanced by Panizzi. He proposed an alphabetical rather than a classified index as it was considered easier to use.

The rules themselves are basically those formulated by Panizzi but with a few changes such as the simplified treatment of anonymous works. The corporate concept was more clearly established in Rule 23 that placed all corporate bodies in one category and provided that they be entered under the name of the body. Cross references were to be made from “any important substantive or adjective, to the principal word.”^[49] U.S. government publications were to be placed under *United States*. To secure uniformity, anonymous works were to be entered under the first word of the title which was not an article with cross references made from other words that might be sought. The librarian would be relieved of problems and the reader would no longer have to search in two places for a book. “Any rule for selecting the most prominent word of a title, or for entering a book under the name of its subject, would be found fatal to uniformity...”^[49] Pseudonymous works were to be placed under the assumed name followed by *pseud* but were not considered pseudonymous if the author had “...published any edition, continuation, or supplement under his name.”^[49]

The contribution of this small pamphlet should not be underestimated. The plea for uniformity would prove to be somewhat idealistic although the suggested rules were widely accepted, exerting a strong influence on future development of catalogs and codes.

Codes: Crestadoro, 1856. Four years after the publication of Jewett’s rules, Andres Crestadoro issued an informative pamphlet^[50] that advocated an extension of the subject word concept. He objected to the classified catalog because of its dependence upon an artificial arrangement and suggested a detailed entry catalog arranged by accession number that would be supplemented by a rather comprehensive alphabetical index of authors and subjects. He believed that the cataloger should add the author, subject, and “nature” or form of each book to the index even though the title failed to yield this information. An

extensive system of cross references was proposed to overcome the lack of standardized terminology by referring from as many terms of the title as necessary, by connecting synonymous terms, and by interrelating class headings with subordinate or “partially synonymous” terms. Title terminology was always preferred with supplied information, only as a last resort supplied by the cataloger. This would scatter similar subjects in several locations, although at least a recognition of the need for a subject approach was expounded.

Codes: Cutter, 1876. The most comprehensive rules formulated during this century were by Charles Cutter. They were issued as part two of the Bureau of Education Report *Public Libraries in the United States...*^[2] The rules evinced the influence of Panizzi, Jewett, Perkins, Abbot, Poole, and other leading librarians of the century. The first edition was issued in 1876 and was continued through a fourth in 1904 that Cutter suggested was actually unnecessary in view of the success of Library of Congress cataloging.^[3] The rules covered the full range of cataloging procedures including a section of definitions; another on entry (where to enter) that contained subsections pertaining to authors, title, subject, and form catalogs as well as analysis; a section on style (how to enter) which included aspects of descriptive cataloging such as headings, body of card, collation, contents, notes, capitalization, and punctuation; and other minor sections pertaining to other catalogs and cataloging of special materials. Some of the major points regarding entry were: entry under personal or corporate author or substitute for it, bodies of men considered as authors, corporate bodies under name, anonymous works entered under title including periodicals, entry under original title for anonymous works when variant titles appear in successive volumes, specific subject heading rather than inclusive class, and subject entry under words expressing content of book rather than under terminology of title.

The rules were the epitome of the cataloging “art” of the period and were complete with copious notes which discussed the problems and suggested possible alternatives. Cutter’s pragmatic approach was based primarily upon three principles. First, was the principle of convenience and habit of the user. System and simplicity should be sacrificed when strict adherence to rules and uniformity create practices which are at odds with the “general and deeply rooted” habits of the public.^[3] Second, was the principle of specific and consistent subject entries. Each term used was to be applicable to innumerable books as it was derived from the content and not the title. It should consist of a specific heading, not the class, to which it was subordinate. To this was added the syndetic structure to connect related and synonymous terms.^[3] Third, the catalog was more than a mere finding list “for a given book by an author’s name” and should facilitate the location of all books of an author by placing them together in one place.^[3]

The rules for the subject catalog represented the first attempt at such a codification and were to serve as the basis of American subject cataloging practices until the present day. Although they were designed to establish principles and practices with alternative solutions, they reflected the occasional uncertainty of the author and are marred by inconsistencies that still haunt cataloging theoreticians today. The Vatican code of 1931 was the only other completed codification of rules for the subject catalog and included one section on general principles and forms and a second on specific areas of application.

Many of the problems of the present dictionary subject catalog may be attributed in part to the context in which Cutter compiled his rules. The book catalog was still the dominant tool although the card catalog was gaining stature and was recognized by his last edition of the *Rules* as the way of the future. The *Rules* were compiled for a book catalog, dependent upon the main entry concept, and were designed for the relatively small popular library with a collection of information sources in the traditionally monographic format rather than the highly specialized texts in varying forms, and promulgated the developing concept of subject analysis that was generally regarded as a convenience rather than a necessity.^[41] The lack of direction that has persisted in the subject catalog may be attributed in part to the unquestioning adherence to Cutter's *Rules* and a failure to expand the few principles that were presented. Similar issues were still visible in the twentieth century when Frarey enumerated the eight major problems of the subject catalog: the principle of specific entry, terminology, form and structure of headings, choice among alternatives (place or subject), confusion of title and entry, size and complexity, reference structure, and maintenance.^[51] Without a doubt, little progress had been made since the days of Cutter except the addition of a new obstacle, the size of the subject catalog that aims at thorough analysis.

The *Rules* as a whole proved to be a valuable addition to library literature and provided a codification of policies so badly needed by American libraries. Many of the issues raised by Cutter were to become the subject of intense debates in the next century. On the negative side the rules supplied a refuge for tradition and tended to reduce cataloging to a routine rather than make it the application of principles. Akers commented that since the 1876 issuance of the *Rules* "...there has been no further development in principles although an enormous amount of work has been done in amplifying, codifying, and clarifying rules, which has contributed to a needed uniformity of practice."^[22]

The nineteenth century had been productive years in catalogs and in cataloging procedures. The beginning of the century found both the classified and alphabetical author catalog in use with a variety of subject arrangements and indexes. Panizzi and Jewett both proclaimed the author catalog the most usable and reasonable form.

The newly developing author catalogs eventually evolved into the dictionary form when subject headings were recognized as independent forms and no longer dependent upon the phraseology of the title page. In 1876 Poole reported that "the plan of the catalogue with references under authors and subjects, in one alphabetical arrangement, is the one which is now most universally used and is preferable to the classified plan."^[52] By 1893 catalog arrangement was still divergent with the single alphabetical order for authors and subject dominating, although some libraries still separated authors and subjects in two distinct parts with the latter in dictionary-classified or alphabetic-classified order. In Europe the classified catalog tended to be more popular, although the subject catalog was never strongly advocated in Great Britain during this century. The Germanic countries tended to develop comprehensive catalogs divided into an alphabetical catalog of authors and anonymous titles and a separate subject catalog or "schlagwortkatalog" that was arranged alphabetically by subject or catchword or the "systematischer katalog" arranged in classified order (logically or alphabetically) by subject.

The form of the catalog was manuscript or printed book at the beginning of the century. The use of slip catalogs, which were maintained originally only for preparation of the printed catalog, slowly began to evolve beyond their original intent. Cards had originally been suggested and used by French libraries in the eighteenth century, but failed to achieve widespread application until expanding book production and changing concepts of bibliographic organization stimulated the need for increased flexibility. Slip catalogs were frequently only accessible to librarians, but the Boston Public Library and the Philadelphia Library Company opened their slip catalogs to public use during the 1850s,^[53] while the former introduced a public card catalog in 1871. By 1893, Lane reported that the card catalog (43 reported) was the dominant form and was conceded a necessity although it infrequently served as a supplement for the printed book (13 reported). He also found that "most libraries still employ a running hand, generally preferring an upright and round to a slanted or angular one."^[54] He reported that the typewriter was now being used by over 40 libraries and that printed cards from the Library Bureau were used by three. He ascertained that catalog cabinet drawers were generally designed for one instead of two rows of cards, which were divided in size between 12.5 × 7.5 cm. (U.S. Postal Card) and 12.5 × 5 cm. although other unusual sizes were in use.

The need for the catalog was now recognized with the subject cataloging evolving from the shelf inventories, to the anonymous title, to the subject word, and eventually the subject heading as advocated by Jewett, Abbot, and Cutter. Lane found a consensus that every book should have an author or title entry and that most should have subject cards. Out of 191 libraries surveyed, 171 reported subject catalogs in one form or another.^[54] Subject

headings were still a matter of catalog's choice and varied widely, but the subject approach to books aided by the syndetic structure was firmly established and awaited further development.

The form of author or title entry progressed considerably during the century. Anonymous works were originally treated by intricate form headings, subject or place entries, or a host of alternatives. Jewett and Cutter advocated the separation of corporate bodies from the anonymous category and established a simple and logical framework. By the end of the century corporate bodies tended to be entered primarily by first word of title or place depending upon the inclusion of the name within the title or whether it was a local British or American group.^[54]

Varying opinions continued to govern pseudonyms at both the beginning and the end of the century.

The entry of descriptive elements had continued to increase. In the book catalog there are wide variations depending upon whether the entry was subject, author, or title as abbreviated forms were used to economize printing space. Lane determined this practice was still present in 1893 even though cards were now widely accepted.^[54]

Throughout the eighteenth century the title page continued to be the basis for the description, with brackets later used to indicate supplied information. The publisher or printer was recognized as an important part of the imprint early in the century. The use of size continued to be standard procedure although methods varied somewhat. Inclusive paging began during the early years and was widely accepted by the end of the century. Editors, translators, and now artists were all recognized as essential parts of the bibliographic description.

By 1893 Lane discerned that libraries tended to agree on the following: diminishing use of capital letters but no uniform practice, Arabic rather than Roman numerals, compound names under last part for English and first part for others, English and French names under prefix, and periodicals under title unless too generic. The use of contents notes evolved more fully during this century and were widely used during the last quarter. Analytics also developed more widespread use as bibliographers sought to increase the usability of the catalog and included periodicals and society publications as in the Harvard card catalog of 1861 and in the Boston Athenaeum Catalog of 1874.

Codes were accepted during this century as the guides for cataloging compilation rather than the individualistic ideas that had dominated. Panizzi, Jewett, and Cutter were the major leaders of the century with Cutter's influence still dominating today's scene. Lane found that the majority of libraries used Cutter, with infrequent or supplemental use of codes by Linderfelt, Library School Rules (Dewey), and ALA.^[54]

The nineteenth century was a period of prodigious growth in cataloging procedures and codification. This

was the era of numerous catalogs beginning with initiatory inventories and finding lists and culminating in the monumental printed dictionary catalogs. American cataloging had passed through a pioneer period while Europeans experienced stabilization. The lack of rules for the construction of catalogs during the early years stimulated local ingenuity, and techniques were crude with uniformity at a minimum. The situation was greatly improved by mid-century, and codes have become a standard part of the cataloging process. The freedom from restraint during this century had nurtured innovative and conflicting ideas, pragmatic and idealistic approaches, and enhanced interest by bibliographers and scholars who slowly began to recognize the necessity for at least some semblance of bibliographic organization. Cataloging activities ceased to be the major concern of the administrators and were relegated to trained practitioners. The differentiation in staff assignments became more pronounced. Cataloging could be considered the first recognized specialization within libraries with Harvard establishing a distinct department devoted to this endeavor in 1859.^[48] Personnel training and recruitment, however, were largely based on expediency for Poole suggested that "there are ladies in the eastern cities who have had much experience in cataloging, and who devote themselves to this speciality. . . ."^[52] The opening of the Columbia School of Library Economy in 1887 assisted development by supplying personnel with previous technical training.

AGE OF SOVEREIGNTY AND SCRUTINY

Modern Period

Twentieth century

The cataloging activities of the twentieth century may be divided into two distinct periods: first, a period of traditionalism which extended approximately to 1941; and second, a period of reevaluation and rebirth.

The survey of cataloging practices by Lane in 1893 was followed by a similar report in the opening years of the new century. He attempted to review some of the then current cataloging tendencies that faced the profession. He began by pointing out that the catalog had been a simple author list but now every library needed as perfect a subject catalog as possible. The debate over the relationship between subject bibliography and subject catalog persisted intermittently when Raynard Swank renewed the discussion in the 1940s. American librarians such as J.C.M. Hanson tended to seek wide coverage for the subject catalog while the European librarians frequently relied heavily upon subject lists. Lane was further concerned by the growing size of the catalog and suggested that certain sections of the catalog could be printed, that selected lists could be compiled for use by the general reader, and that

existing bibliographies could be checked to denote library holdings and to provide for omission of older imprints by libraries attempting to compile a subject catalog. He maintained that classification was used basically as a shelf arrangement, was designed primarily for the popular library, and had contributed little to the subject catalog. He pointed out the values and problems of certain enriching devices of the catalog such as subject headings, annotations, and analytics. He concluded that the card catalog was here to stay although national libraries still relied upon the printed catalog, and that codes tended to “become longer the oftener they are revised,” although the object was to seek simplicity and uniformity with specific instructions for more cases. Lane expressed hope for international uniformity in bibliographic matters and card publication by foreign governments, and he contended that the catalog was a finding list and not a bibliographic dictionary, but expressed the need for cooperation and centralization and described some of the cooperative projects such as printed cards and local union lists of periodicals.^[55]

Two events that were to have a decided effect occurred during the early part of the twentieth century. The reorganization of the Library of Congress revitalized its cataloging department with an influx of qualified personnel such as James Christian Meinert Hanson and Charles Martel who later became leaders in the field of cataloging and classification. The second was the appointment of a committee by ALA in 1901 under the chairmanship of Hanson to revise the old 1883 catalog rules so that they were in accord with those of Library of Congress. A draft or advanced copy was issued a short time later and circulated for comments and criticisms. At the same time the Library Association (Great Britain) was also in the process of revising their cataloging rules and it occurred to Dewey that this was an opportune time to establish some uniformity among the English-speaking countries of the world. A committee was formed and in 1908 the code was completed and published in two separate editions although there were only eight rules upon which agreement could not be achieved. Within the United States the reconciliation of the rules with Library of Congress was not as complete as hoped for; the codification of their practices was still in the developmental stage and efforts had to be continued in this direction.^[56]

Cooperative cataloging, which is defined as the compilation of catalog cards through a joint effort by a number of libraries in an effort to reduce duplication of operations,^[57] continued during this century. The Library of Congress began the printing of catalog cards submitted by other government libraries in 1902, and this was further extended to include several large libraries outside the government structure in 1910. By 1932 the Cooperative Cataloging Committee of the ALA had opened an office at the Library of Congress with a subsidy from the General Education Board. Two years later the Cooperative Cataloging and Classification Service became a division of the

library and by 1941 it was largely absorbed by the Descriptive Cataloging Division.^[58] Efforts at cooperative cataloging were never as intense as those directed toward centralization, which would afford more concentration of staff and tools, maximum standardization of procedures and codification of rules, and substantially improved supervision and administration.

The dictionary form of the catalog continued to dominate the scene with some exceptions such as the 1903 Classed Catalog of the Carnegie Library of Pittsburgh, which was compiled by Margaret Mann and was to be remembered not only for its arrangement but also for its printed format. The debate over the relative merits of the classified and dictionary catalog continued although the issue was largely closed in the United States. In 1905 Fletcher intimated that the dictionary catalog

...has the character of a superstition in so far as it is accepted and religiously carried out on grounds that are traditional, rather than on intelligent conviction that it meets present needs and is good for the future needs for which we must make provisions.

He warned that changes had occurred in the size of libraries, methods of administration, and the attitude toward the library patron that must be considered in catalog construction, and he suggested that the subject catalog be supplemented by the shelf list, bibliographies, reading lists, and indexes.^[59] Rider later renewed the discussion, contending that librarians lacked imagination in approaching the problem of bibliographic organization and should examine such alternatives to the dictionary catalog as the classified catalog, microphotography, book catalogs, and smaller-sized catalog cards. He contended that a philosophy of the catalog was necessary and cited Hanson and Mudge as believing the catalog was an end in itself while Richardson and Currier believed it existed only to put the reader in contact with the library's holdings. He criticized the bibliographic method of cataloging as practiced by the Library of Congress, which was slavishly adhered to by the majority of the libraries in the U.S.^[60] Interest in the classified catalog was somewhat stimulated at an institute on subject analysis of library materials in 1953 when Harry Dewey and Kanardy Taylor supported its excellence. Dewey succinctly outlined the ease of converting the dictionary catalog to the classified.^[61] Kanardy Taylor contended that the alphabetical was best for public use while the classified was more adaptable to scientific research and concluded by agreeing with Gjelsness who contended in 1931 that “perhaps we have gone too far in accepting a standard product and applying it to all purposes” and called for a “universal re-evaluation.”^[62]

Continued interest in the classified catalog in a few special libraries, the mounting pressures for improved bibliographic organization, experimentation with new approaches

to classification, and the recognition of the underdeveloped potential of the classified catalog precipitated the publication of a manual in 1956 that sought to depict the functions, characteristics, and necessary procedures.^[30] Although well done, this manual failed to stimulate the production of classified catalogs, as a survey made in 1962 listed only 16 classified catalogs in use in the United States and Canada.^[63] Today exemplary classified catalogs are found at John Crerar, the Engineering Societies Library of New York, and Boston University Library, and the National Library of Canada. Some libraries did produce duplicate shelf lists, which were used as adjuncts to the dictionary catalog, but further development of the classified catalog in the United States must await another era.

Advocates of the dictionary catalog attempted to facilitate more rapid use and maintenance in the 1940s by separating the subject and form entries and the author and title entries into two distinct files, although other combinations were possible. The separation was reputed to alleviate searching by the user and to make filing by library personnel considerably easier. A number of college and university libraries, such as the University of Denver, adopted the divided catalog but interest was limited with only 24 divided catalogs found out of 457 academic libraries surveyed with the majority of them developing between 1938–1947.^[64] Later the discussion shifted from the author-subject division of the catalog to the horizontal division by date of publication as large research libraries sought to devise a solution to the problem of the mass of entries under some headings.

Size became a topic of discussion as book production soared. The major virtue of the card catalog soon became a detriment as catalogers continued insertion of added entries in the form of analytics, numerous subject headings, title cards, series cards, and catch-titles as well as a host of references for both authors and subjects. Each new edition of the subject lists tended to multiply the number of references until librarians began to question their use. The traditional form of descriptive cataloging continued to necessitate the inclusion of items that some librarians thought should have been relegated to biographical and bibliographic sources outside the catalog.

Library administrators began to bewail high cataloging costs while catalogers struggled to evaluate their methods. As a whole, cataloging departments of the early twentieth century were poorly organized and administered, regimented by tradition rather than by objective analysis of the situation, and dependent upon Library of Congress cataloging practices. To complicate matters the number of catalogs also increased with duplicate cards filed in official, departmental, and union catalogs being maintained at unknown expense. Library of Congress cataloging policies continued to expand with supplementary rules or decisions printed on cards after 1911. Numerous special publications such as a guide for cataloging periodicals

issued in 1918^[65] and another for serials in 1919^[66] were characteristic of the growing complex of rules. The ever increasing arrearage at the Library of Congress, which was due in part to the mass of rules, precipitated an extensive study by Joeckel in 1940.^[67] The survey clearly indicated that the proliferation of rules must be arrested and the present body reduced and simplified. This was followed by further studies during this decade which evinced the desired simplification of cataloging procedures and would reach its climax in the revision of the code a few years later. Librarians were beginning to demand that the principles of cataloging be recognized rather than attempting to provide rules for every situation.

Outside the Library of Congress the use of centrally prepared catalog cards was clearly a time saver, but the constant rechecking and adherence to minutia tended to keep the cataloging costs at a high level. In an effort to counteract the growing size of the card catalog, selective and simplified cataloging were suggested as possible solutions. Selective cataloging was suggested by Dury in 1649 and was thoroughly discussed by Van Hoesen in 1928.^[68] Selective cataloging is an attempt to limit the number of catalog entries by designating library materials for varying degrees according to their potential use. Generally full cataloging is accorded reference works while at the other end of the scale pamphlets or government documents are usually completely excluded from the cataloging process. The economic feasibility of this method was recognized although the cataloger was required to be aware of the users' methods and demands. Simplified cataloging denotes an effort to omit or greatly simplify elements of the catalog card that are not considered essential. It is intended to achieve economy by an abbreviated entry, less effort for verification of author's name, fewer added entries, or similar steps that are not considered essential in a small public library or a childrens' collection. The Library of Congress instituted cataloging categories in 1947 and limited cataloging in 1951. Both are examples of selective and simplified cataloging as certain types of materials were relegated to full bibliographic description while others were described less fully. Added entries were made only after a careful scrutiny of their potential value. In spite of the objection by some catalogers that every book in the library should be subject to the same rules, all libraries practice some form of simplified or selective cataloging. Some innovations are the omission of subject entries for older works, limited use of added entries, and simplified entry for materials in storage. The widespread use of printed cards by commercial companies such as H.W. Wilson and *Library Journal* attest to the acceptance of simplified cataloging by public and school libraries.

The use of the card catalog was also a subject of discussion and represented an attempt to utilize empirical research in offering a more logical approach to one of Cutter's basic principles, the user. Early studies were primarily discussions of inadequacy, complexity, and organization

of catalogs based on traditional impressions and theories of the user and his approach to the catalog.^[69] During the 1930s the studies began to become more concerned with the user's point of view and continued to develop in outlook and method. A survey of 27 catalog use studies completed between 1930–1956 revealed some shortcomings in methodology and tended to relate only to the quantitative use of the catalog. Some of the more significant findings were: catalog used by 50–60% of all library users; nonspecialist tends to use catalog more than specialist; subject catalog infrequently used to find all material in library; English language material of recent date most widely sought; author, title, call number, and subject heading most widely used information; problem of use stems largely from lack of understanding and application of principle of specific entry, preferences for subject or place, and inability to deal with obsolete terminology; subject catalog considered effective about 70% of the time; need for better instruction in use of catalog; and possible modification into a more selective tool as some evidence supports dispensability in present form.^[69]

Active revision of the 1908 code began in 1930 with the appointment of a committee on code revision by the ALA. The preliminary edition of the revised code was issued in 1941 and was divided into two sections: the first dealt with form of entry and heading, and the second was concerned with the description of the book. The code was received with a rash of complaints, largely due to the elaborate rules suggested in part two, which was dropped in the final publication of the second edition. It was immediately apparent that a reevaluation or reappraisal of cataloging policies was needed. This call for reevaluation marked the end of the traditional period and the beginning of the new.

In 1941 the “crisis in cataloging” was succinctly depicted by Andrew D. Osborn who called for an end to the slavish adherence to codes that tended to obscure reasons and principles and maintained that cataloging was an art that was based upon a few simple rules. He continued by discussing the four types of cataloging: legalist theory (an expanding complexity of rules); perfectionism (effort to catalog a book once and for all); bibliographic (cataloging molded into a branch of descriptive bibliography); and pragmatic theory (rules and decisions serving a practical purpose). He soundly condemned the continuance of the three tradition-bound methods and called for recognition of a need for the pragmatic cataloger. He contended that card catalogs frequently failed to achieve their goals because of meaningless practices, a need for three distinct grades of cataloging with the standard less detailed than advocated by the 1908 code, simplified rules even a necessity for the Library of Congress, self-cataloging methods advisable for little-used materials, high quality for essential items but little for nonessential, practical interpretation of any point, and a review of the treatment of serials, documents, and nondocuments to determine cataloging

needs. He concluded that the classical period was drawing to a close and that the change could be largely attributed to extreme systematization and standardization that had resulted from too much work.^[70]

Five years later the report of Herman Henkle on descriptive cataloging by the Library of Congress clearly reflected the changing concepts and sought to develop functions and techniques.^[71] The functions were aimed at presenting an accurate description of each book that would indicate its relationship to other editions and issues as well as entries for other books. The new rules, which were published in 1949, attempted to carry out the proposals of the study with brevity and simplicity.^[72] They were intended as an adjunct to the *ALA Cataloging Rules for Author and Title Entries*, which were finally issued the same year. In spite of the years of discussion and the interest shown in the new codes, they tended to produce only a change in details, with the *ALA Rules* in particular tending to ignore the discussion, rather than reflecting it.^[56] In any event, the period of discussion regarding the codes of 1949 tended to focus concern on the need to reevaluate the function of the catalog, to adapt time-saving methods within the cataloging department, to cope with mass acquisition, and to search for new approaches that would ensure a less pronounced growth of the card catalog.

Within a few years after the appearance of the “twin codes” a movement for the simplification of author and title entries was afoot. The need for guiding principles was examined by Seymour Lubetzky in his study of 1953 that has exerted a major influence upon the actions of the resulting committees.^[73] As in the case of the 1908 code, the activities of the special committees appointed by the ALA were coordinated with a similar committee of the Library Association (Great Britain) and was further augmented by a committee of the Canada Library Association. International cooperation was afforded through the International Conference on Cataloging Principles, Paris, 1961.^[4] The results of the conference were encouraging as a relatively uniform consensus of opinion resulted in a statement of principles pertaining to the function and structure of the catalog and to the choice, form, and structure of entries. These principles clearly reflected the influence of Lubetzky's critique as well as his unfinished draft of 1960^[74] and were accepted by the Catalog Code Revision Committee in 1962. The Paris Principles “were seriously questioned by the large research libraries who were alarmed by the possible extensive recataloging as a result of their retrospective application.” The Library of Congress conducted a detailed study of the “theoretical merits” of the statement and attempted to ascertain the proportion of change required in the retrospective application of the rules in its card catalog.^[75] The results, as expected, provided support for the contention that the large research libraries were unable to accept the radical changes because of the heavy costs of revising the many

catalog entries. The so called “Miami Compromise,” which agreed to certain exceptions regarding the retention of the archaic entry under place rather than name of the corporate body, was approved and incorporated into the code Rules 98 and 99. The Library of Congress accepted the code only as it affects new author headings by adopting the practice of superimposition that allows the new rules to apply only in establishing entries not previously used while reverting to the old rules for all entries presently established in the catalog. As a whole the rules were a significant improvement for they were based upon a set of principles that freed them from some of the rigidity of the past. The inclusion of the rules for descriptive cataloging and for special material provided a single volume rather than the multiple works of the past.

Centralized cataloging became a primary concern during this century. Printed card production was largely limited to a few large public libraries and the Library of Congress. The card distribution service of the latter soon became recognized as a valuable asset with many libraries making extensive use of the somewhat limited number of available cards. In 1938 H.W. Wilson began the printing of catalog cards that were designed primarily for the needs of public and school libraries. The cards followed a simplified system, aimed at providing less bibliographic detail for the more popular titles with annotations and analytics adding another dimension for reading guidance.

The growing need for cataloging information and the dissatisfaction with the present services stimulated the movement for cataloging or processing centers that were occasionally established within large public libraries with small units contracting for services, or at the state level through the efforts of the state library commission, or at the regional level through an association of libraries.

Georgia was the first state library to initiate the distribution of printed cards in 1944. In the following years a number of similar centers were established as were commercial enterprises offering a variety of cataloging services. The major problems of availability and the delay in supplying cards stimulated a large amount of discussion which resulted in a number of cooperative plans such as the one suggested by Ralph Ellsworth in 1948 to assure the availability of printed cards for all books that were acquired by the Library of Congress and cooperating libraries.^[76] In 1953 the Library of Congress inaugurated the All-The-Book Plan in an effort to increase the number of titles for which printed cards were available. The library hoped to solicit prepublication copies of current American imprints from the publishers so that cards would be produced as soon as possible. The Library of Congress order numbers were also supplied to the publishers who placed them on the verso of the title page to assure ready accessibility in ordering cards. The services were further improved in 1959 when R.W. Bowker Co. agreed to lend to the Library of Congress review copies received by them for listing in *Library Journal* and *Publishers' Weekly* in

exchange for cataloging information, which would be included in the latter. Wholesale book dealers and commercial processing centers such as Alanar cooperated by lending copies that were not readily available.^[77] Through this program the bulk of the trade books now had printed catalog cards available. It was estimated that in 1965 Dewey numbers were available in 80% of all Library of Congress printed cards because of this expanded coverage.^[77]

The Library Service Act of 1956 with its state plans and federal funds added further impetus to the development of centers such as the Southwest Missouri Library Services, Inc. in 1957. The trend was apparent for by 1965–1966 there were 63 identified cooperative processing centers in 41 states.^[78]

School libraries enjoyed a similar interest with centralized processing, utilized as early as 1917 in one instance although by 1961 such services had expanded to include at least 3% of the elementary and 2% of the secondary schools.^[79] The National Defense Act and the Elementary and Secondary Education Act of 1965 yielded increased book budgets that in turn actuated the need for cataloging services. Centralized centers for school libraries began to develop as did commercial services ranging from the *Library Journal* kits to complete processing. The charges for standard cataloging by the commercial centers in 1967 varied from \$0.60 to \$1.90, with custom or special cataloging costs much higher.^[80] Card production at the centers and within individual libraries had developed extensively from the early heliotype method mentioned by Cutter in 1876.^[2] A study completed in 1965 outlined the following methods of card procurement or production: purchase, manual typing, stencil duplication (postcard size), fluid duplication, stencil duplication (full size), offset, addressing machine (fiber or metal stencil), automatic typewriter, Diazo duplication, electrostatic copying (Xerox, etc.), defusion transfer copying, and projection photocopying.^[81] To this list may be added the newest computer-produced cards, which are generated by individual libraries as well as being available commercially from the Catalogue Card Corporation of America. Efforts of college and university libraries have been devoted primarily toward improving the program at the Library of Congress although Colorado embarked upon a state processing center. Junior and small 4-year colleges frequently use commercial services in addition to the Library of Congress while infrequently relying upon the state and regional centers.

The Cataloging-in-Source experiment was the revival of a movement that was suggested and attempted during the nineteenth century and was designed to provide a copy of each catalog card within the book itself. The project was conducted by the Library of Congress between June 1958 and February 1959, with over 157 publishers cooperating through the provision of proof copies for 1203 publications.^[42] The plan was well conceived but was

hampered by a variety of factors such as a lack of cooperation by many publishers (only a little over 50% of those originally contacted actually participated) and dissatisfaction with the interrupted production schedules. Some reservations were also evident at the Library of Congress when the projected increases in staff and facilities were questioned in the light of the possible results. The results were well received by the libraries although an extensive consumer reaction survey failed to provide sufficient "clear cut evidence" of possible savings and of utilization of the information. The cataloging information contained in the *Publishers' Weekly* and SACAP, an acquisition and cataloging service instituted by Bro-Dart that would provide paper offset masters suitable for producing a sufficient number of catalog cards, were suggested as more economical methods of obtaining similar results. The project passed into oblivion with the following:

In light of the experience gained through the experiment, it is concluded that neither a full nor a partial Cataloging-in-Source Program is desirable. The *Publishers' Weekly* and SACAP programs have suggested methods by which the potential promise of Cataloging-in-Source might be realized in a much more economical way. There should be no further experiments with Cataloging-in-Source. If the new programs fail to meet their objectives, further experiments should be conducted along the lines these programs have laid down.^[42]

The Cards-with-Books-Program of 1961 was another attempt by the Library of Congress to get cards into the hands of librarians as quickly as possible. The major thrust of the program was to encourage publishers and book wholesalers to supply printed cards with their publications. Special arrangements were made at the Library of Congress to facilitate this operation and by 1967 over 96 wholesale distributors and publishers were annually distributing almost 10 million cards (about two million sets).^[82] Many were still hesitant, however, in spite of the fact that libraries purchase approximately 80–85% of all current American trade books through wholesale book distributors and card sales at the Library of Congress indicate that about 80% of all cards sold are for current American imprints.^[83]

Generally Library of Congress printed cards are available for only about 50% of the research library acquisitions with availability directly related to the acquisition and cataloging efforts of the Library of Congress and the cooperating libraries. The development of the Area Studies programs and the passage of PL 480 created an increased need for catalog cards in a wide variety of foreign languages that were simply beyond the capabilities of most cataloging departments. In 1962 a concerted effort was made to improve the availability of such cards by the Library of Congress adding several language sections to its descriptive cataloging division, with cooperative copy being supplied by large libraries such as Princeton, and

data sheets being compiled by personnel in the country of origin of each publication. A major step toward the systematization of centralized cataloging at the national and international level occurred in 1965 with the passage of the Higher Education Act, Title II-C. The Library of Congress was provided funds in 1966 to embark upon an unprecedented program of worldwide acquisition and centralized national cataloging aimed at alleviating the pressing needs of the research libraries.^[82] The resulting National Program of Acquisitions and Cataloging, known in Europe as the Shared Cataloging Program, was to expedite acquisition through a carefully formulated plan of blanket orders and purchase arrangements. Cataloging operations were accelerated through the use of entries from national bibliographies that provide an international aspect although adjustments were made so that entries complied with existing standards. By the end of the first year of operations nine overseas offices were providing publications from 21 countries with cataloging information from 17 foreign sources.^[82] Catalog cards for over 150,000 publications were supplied to over 92 cooperating libraries in America within the first 12 months of its existence.^[82] The impact of the program will be widely felt by the cooperating libraries as a preliminary analysis of the availability of cards for foreign titles indicated a record high of 73% opposed to the former 50% expectancy while the total number of all titles processed at the Library of Congress rose 20%.^[82] The magnitude of the cataloging operation at the Library of Congress is clearly shown by a reported sale of over 74 million printed cards to approximately 20,000 libraries throughout the world by the Card Division in 1967.^[82]

Centralized cataloging operations were not confined to printed cards only, for in 1965 the Library of Congress published the first reports pertaining to a proposed plan for issuing cataloging information on magnetic tape. The first tapes for this experiment in Machine Readable Cataloging Data (MARC) were issued in November, 1966, to 16 participating libraries and resulted in over 16,000 records for current English-language monographs being provided by the end of the fiscal year.^[82] The results were carefully studied and a more highly developed standardized format was put into operational distribution under the MARC II designation.

Centralized cataloging has experienced tremendous growth during this century. The problems of individualism, time, and limited availability have tended to inhibit the universal acceptance although the situation improved considerably during the last decades. After over 100 years the visionary ideas of Jewett were nearing fruition.

The early 1930s witnessed the establishment of a number of local and regional union catalogs within the United States. The availability of personnel through the Work Project Administration exerted a strong influence upon their proliferation but the ensuing years proved difficult for many of them to endure because of soaring maintenance costs.

Three bibliographic centers at Philadelphia, Denver, and Seattle today attest to the feasibility of the concept. The major reason for the survival of the latter two was probably the establishment of a broad base of regional membership held together by a strong moral belief in the cooperative idea as well as a definite need for such a service within an area rather sparsely populated and without extensive state library collections.^[84]

The most notable union catalog is the National Union Catalog that was established in 1901 at the Library of Congress to provide a listing of governmental libraries in Washington and important libraries outside the city. The reciprocal exchange of cards soon became a reality and depository catalogs were established in many of the major libraries. The growth of the catalog continued and by 1926 it contained more than two million entries. From 1927 to 1932 a grant from John D. Rockefeller, Jr. financed the "Project B" program that was designed to expand the catalog to contain the location of all important reference books in American libraries. After 25 years of administration the Card Division was relieved of the Union Catalog project in 1932 when it was established as a separate unit. Continued efforts by librarians, particularly those working through the ALA, focused attention upon the venture which in turn led to increased financial support so necessary for expansion. The official name, National Union Catalog, was adopted in 1948 and by 1964 over 15 million cards represented approximately eight million titles and editions.^[85]

The pressing problem of maintaining the depository catalogs within the specially selected libraries and the need for wider distribution of cataloging information necessitated a more economical and feasible approach. The most logical solution lay in the revival of the book catalog that had continued as a standard in many national libraries in spite of abandonment by others. A *Catalog of Books Represented by Library of Congress Printed Cards Issued to July 31, 1942* was published in 1942–1946 in 167 volumes and was followed by a series of supplements for both authors and subjects. In 1956 the catalog was expanded to include the holdings of the National Union Catalog and the next issue was given a new title to reflect this increased coverage. The movement to encompass an extended retrospective period led to the publication of *The National Union Catalog, 1952, 1955 Imprints...* and the most recent, *The National Union Catalog, Pre-1956 Imprints*, that is presently being published by Mansell Information Publishing Ltd. (England), and will contain over 16 million cards. Thus the whole spectrum of the National Union Catalog will now be available through the use of the printed book catalog.

The success of the Library of Congress book catalogs and the advent of electronic hardware had a decided effect upon the return of the book catalog. In 1953 the Lamont Library at Harvard produced a printed catalog that was designed for wide distribution to students and faculty.

The catalog was produced by a photo-offset lithographic process such as used by the Library of Congress catalogs, only each of the 40,000 titles were retyped, generally one line per title, in a classified order that was supplemented by an author index of approximately 60 pages and an index of the classification.

The Library and Information Service of Western Australia compiled a classified nonfiction book catalog in 1965 containing approximately 67,000 titles. The classified section was comprised of two volumes arranged by the Dewey Decimal System while the subject index was compiled from the Library of Congress subject headings that were carefully formulated into relative index entries. The entries were typed on strips that were then printed by a photolithographic process. Future revisions are planned by positioning new entries among the original strips.^[86]

A variety of other printing techniques are presently used with varying degrees of success depending upon the desired results and the amount of economic support. The linotype slugs method, used by H.W. Wilson, can be revised simply by interfiling new slugs and removing obsolete ones. It is expensive but is especially well adapted to the cumulative indexing scheme.

The shingled card technique with offset is inexpensive and especially adaptable for the smaller operation. The process entails the photographing of overlapping cards arranged like shingles, preparation of an offset plate from a reduced negative, and final printing. The sequential camera is a refinement of this technique and consists of a special camera capable of photographing only a part of the catalog card as it is placed before the lens. This method was used successfully in 1959 by the National Library of Medicine for the production of its *Current List of Medical Literature*.

The early Library of Congress catalogs utilized a photo-offset process based upon a photographically reduced negative produced by assembling cards immediately after one another in columns. Later a special card was printed which eliminated the blank spaces at the bottom, thus expanding the contents of each page considerably. Another offset process that utilizes microfilm and electrostatic or xerographic reproductions for plate composition has been extensively used by G.K. Hall since 1959 for the reprinting of a wide variety of library catalogs for commercial distribution.

One of the first catalogs produced by tabulating machines was that of the King County Public Library, Seattle, in 1951 and issued on expendable IBM paper. The Los Angeles County Public Library employed a similar approach but went further and prepared multilith masters which were then used to print two extensive and carefully compiled catalogs in 1952 and 1954. The first was a four-volume children's catalog divided into separate alphabets for authors, titles, and subjects and an adult catalog of 37 volumes that was divided into separate alphabets for authors (8 volumes), titles (6 volumes), conventional

subjects (18 volumes), fiction subjects (four volumes), and foreign books (one volume).^[87]

The New York State Catalog of 1956–1960 was designed principally for interlibrary loan and was a single line entry checklist of books and ephemeral material in three broad subjects issued in separate parts. The catalog was produced by the use of a tabulating machine and photo-offset printing.

The Baltimore County Public Library Book Catalog, issued in 1965, was a completely computerized product containing approximately 55,000 titles with bimonthly and annual supplements. The shelf list was arranged in alphabetical order, then edited, and key punched on cards that were later transferred to magnetic tape for storage. The computer organized printout resulted in a divided catalog for authors, titles, and subjects. Simplified cataloging procedures were used as the main emphasis was a finding list rather than a bibliographic tool. Added entries were held to a minimum although no limit was placed on the number of subject headings.^[88]

One computer-produced catalog appeared at Stanford University in 1966 with the first issue of an annual catalog containing about 25,000 titles arranged in a three-part format: author and title, subject, and shelf list. The source of information was the basic Library of Congress cards, which were keypunched and then converted to magnetic tape. The catalog sought to provide “. . . something more than reproductions of unit catalog cards” and rejected both the traditional main entry concept and unit card in an effort to gain space.^[89] The final printouts were photographically reduced and placed on offset masters for printing.

The contemporary book catalog made tremendous strides in the last two decades of its revitalization. Generally production of the book catalogs falls into three categories. First, the photo-offset method based on the production of a photographically reduced negative by shingling or grouping individual cards, by a sequential camera, or by the use of microfilm and electrostatic printing. Second, tabulating machines with punched cards or tape equipment are used to produce printouts or multilith masters. The former may be used as copy for the photo-offset while the latter is immediately available for printing. Third, the computer now is capable of organizing information for catalog production which results in printouts for immediate use or for the production of photo-offset masters. Two other categories should be mentioned although they are an advance beyond the book catalog. First, the use of some form of microprint, suggested by Fremont Rider as early as 1940. Limited production of catalogs that utilize some form of microprint is available although accessibility has hampered extensive use. Another use is in such index-machines as Filmores, Flip, Fosdic, Media, Minicard, Rapid Selector, Verac, and Walnut.^[90] Second, the futuristic computer-stored catalog as depicted by many current experiments may eventually

become economically feasible. Presently the computer input necessary to produce a book catalog could readily be adapted to direct user access and several libraries are making provisions for on-line, real-time terminal inquiries.^[91]

Catalogs and cataloging will continue as in the past to vary considerably from one library to another depending upon needs, former practices, personnel, and financial resources. History clearly indicates that new methods are not unique to this century. A review of some of the so-called recent innovations reveals our debt to the past. The KWIC Index is nothing more than the old subject word concept which was revered by Edwards and criticized by Cutter. The finding list or limited entry catalog was used and strongly supported over 100 years ago by Poole. Arrangement of books in order of accession was practiced even in the most ancient libraries. The use of broad rather than close classification was employed for years. Size classification, so useful in storage libraries, was suggested hundreds of years ago by Gesner. The past can play an important role in future development if new practices are based upon a rational approach stemming from empirical research rather than tradition. The failure to define the functions of the catalog has created a framework of mythology regarding the needs of the users that was further promulgated by Cutter and accepted verbatim by catalogers as gospel. The method used to determine these potential needs during the time of Cutter has never been clearly enumerated although his philosophy has prevailed for almost 100 years and before that was adumbrated by the Bodleian and British Museum Rules which enounced dogma in the same authoritative tones. At that time, however, the position of the library was decidedly different from today as literacy was low and only the gentry had access to printed materials. As the libraries grew and assumed a prominent place in the educational structure, the catalog retained the nineteenth century rules for construction of the printed book catalog while slowly being filled with twentieth century acquisitions. The problem of determining the needs of the user is characterized by an infinite number of variables that are changing every day as the demands of society are modified. The few trends, which are discernible from extant studies, are difficult to translate into action that will fulfill all the needs at reasonable cost. The solution seems to lie in the formulation of catalog-centered criteria, as suggested by Taube, that would provide evaluation based on size, compilation and maintenance costs, amount of appropriate and relevant material, number of access points, extent of information about each item, inclusion of many types of information for various purposes, and a low rate of growth.^[41] These must then be assigned values with regard to the individual library in order to provide a statement of reasonable and attainable functions that can be interpreted into specific goals. The next step is the formulation of methods complete with suitable alternatives. These, however, are not an

end in themselves but serve to carry out the specific goals and more inclusive functions.

It is impossible to foresee the many possible forms and methods which will characterize the catalog of the future because of the infinite variations existing from one library to another. General trends, however, may be conjectured upon the basis of events of the past although levels and extent of applications will vary widely.

The most advanced form of the catalog of the foreseeable future will be the computerized catalog so aptly depicted by Swanson.^[92,93] This catalog will consider 11 performance goals: user dialogues (programmed interrogation), aids to browsing, user-indexed library, access to in-depth information, wheat and chaff identification, national "network" of libraries, national network of bibliographic tools, instant information, remote interrogation and delivery, active dissemination, and quality control over library services (improved feedback).^[92] The basic system would be comprised of two-way communication with a computer-stored catalog such as the National Union Catalog through the use of a console that would permit the user to progress from simple bibliographic or limited subject information through a series of heuristic steps to the actual text. Many of the more specialized works such as periodical articles could be obtained as printouts while the contents of monographs could be examined through a display of the table of contents or indexes by a type of cathode ray tube while the final examination would be dependent upon an actual physical perusal. The plan devotes sufficient attention to all of the performance goals. The cost, based on National Union Catalog size and use, is estimated at about \$50 per minute, clearly prohibitive, with the primary problem created by the disproportionately large amount of information storage to that which is actually used.^[93] The only solution seems to lie in the development of equipment that could economically surmount this problem and the utilization of more complex operations pertaining to subjects rather than simple descriptive searches involving the specific author, title, etc.^[93] The potential use of the computer in providing access to technical reports, government documents, periodical articles, and other highly specialized information has been clearly demonstrated and may be the most economically feasible area of immediate development. The failure of the present subject catalog to go beyond a cursory analysis could be greatly improved through such an application. Libraries will continue to seek wider coverage and will no doubt strengthen their positions through a more thorough subject analysis rather than by concentrating on the traditional monographic sources. Research libraries may find it feasible to store bibliographic information for all sources within the computer and produce printed catalogs only for the monographic materials that will be sought by a large number of users, while the computer information would be available for serious researchers desiring comprehensive searches. The inclusion of actual

textual materials would be limited primarily to the units of a more manageable length rather than attempting to convert to total text storage for extensive monographic material.

A more immediate and universal application of the computer will be the production of book catalogs and catalog cards. As costs are reduced wider application will result in increased regional and national cooperation with catalogs being produced from state or regional union lists in much the same way as from the National Union Catalog. Wide distribution of cataloging information will in turn stimulate more sophisticated methods of card reproduction for those who seek to retain the card catalog.

Aside from the computer, less sweeping but significant changes will probably take place in the immediate future and would be more generally applicable to a large number of libraries. It seems likely that the book catalog will slowly become the dominant manual system with the card catalog serving as a supplement analogous to the old slip catalogs. The dichotomy of expanding the catalog beyond the monograph and limiting it to a reasonable size will continue as a major source of debate. Where computers are available the problem will be a question of input and storage, while both systems will strive to provide more information organized in such a way that the whole file must not be searched for each request. Horizontal division by date will allow older materials to be printed in a separate sequence, and the use of bibliographies will continue to prove useful. The use of the shelf list (conventional or printed) will serve as a source for large blocks of information that can readily be connected by references. The classified catalog will continue to gain new converts like the National Library of Canada where the Library of Congress system is applied. Centrally produced subject indexes for the classified catalog would greatly add to this movement, with several now available through G.K. Hall from such libraries as Boston University and John Crerar although much more needs to be done in this area. Classification will continue to rise above the shelf-location status that it was originally accorded in the United States and serve as a flexible subject device within the catalog. The use of the shelf list will be expanded, serving as a basis for computerization and as an expanded approach to subjects in the manual systems. Terminology will be of primary concern in all types of catalogs with emphasis given to logical development by specialists. Classified subject lists, as suggested by Mostecky,^[94] and thesauri will be prepared to replace the outmoded subject lists with complex and unsuitable terminology set in an illogical syndetic structure. Careful studies, such as those done by Daily, Lilley, and Pettus, all accentuate the need for a more realistic approach to the place of subject headings, descriptors, or indexing terms within the subject catalog. The intellectual process of converting a remote concept into a possible subject heading will be guided by improved lists with heuristic qualities rather than the chance inclusion of

references. The present subject lists have been used to some extent as supplementary guides to the public catalog, but will be eventually replaced by the new lists that will convert the users' concepts into catalog access points. The use of references within the catalog itself could be dropped with the lists serving as the first step to the subject approach. Libraries will continue to expand in-depth subject analysis within the manual systems. Analytics and wider coverage could be accomplished by separate indexes and bibliographies and by improvement of existing sources using a greater degree of more cooperative methods. The service basis approach by H.W. Wilson is indicative of the feasibility and economy of such action. Professional organizations have and should continue to make advances in this direction. Every possible effort should be made to extend cooperative indexing to its fullest potential so that it is available in usable formats, with reduced duplication and increased accessibility to the largest number of possible users. Professional organizations and the federal government will play an active role in such improvements with national planning developing far beyond present levels. Continued centralized efforts such as MEDLAR and MARC will be joined by a host of preparation centers to extend bibliographic control that is much less than popularly supposed. Use of centralized services and decentralized centers will combine a variety of approaches to produce and disseminate the guides to graphic materials. Regional cataloging centers will expand operations with the aid of centrally produced copy. Less deviation will be found between cataloging methods of the various libraries particularly in the areas of descriptive cataloging with a more pragmatic approach overcoming the traditionalism of the past. Major problems of the past will become minor ones of the future with the functions of the catalog clearly placed in a context of simplicity and usefulness.

The literary unit and main entry principle will undergo intensive study that will result in a restatement of their function within the context of the card catalog. The main entry and unit-card concepts have both been eliminated from the computerized catalog, resulting in a substantial saving of space. The literary unit principle will be carried out logically by added entries that may again be accorded new prominence particularly within the computerized catalog. The verification process of the old methods will be modified to meet with a minimum amount of effort. The catalog will perform as a finding list rather than a bio-bibliographical tool which seemed so desirable during the early part of the twentieth century.

Other minor innovations will include a return to the use of guide cards rather than typing subject headings on each card, photographic reproduction of title pages that could be reduced for inclusion on catalog cards or left full size and placed in a loose-leaf binder serving as a supplement, sequential arrangement of books on shelves, and achievement of the original intentions of the *Anglo-*

American Rules with names gaining precedence over locations. In regard to the arrangement of books, it is interesting to note that Dewey originally intended to provide classification numbers that would bring out other subjects of the book and suggested a sequential arrangement of books on the shelves rather than alphabetically by author.

The cataloging operation of the future will be based first upon a succinct statement of functions formulated in the light of needs; second, upon research, reevaluation, and experimentation that constantly provide alternative solutions and new methods; third, upon ideas, concepts, and machinery originating outside the library itself which will aid in the organizational process; fourth, upon professional personnel who plan, direct, develop, and evaluate the program and rely upon technicians who utilize the existing centralized services in the mechanical preparation of a catalog within a planned framework; and fifth, upon the combined cooperative effort of the professional, scholarly, and governmental units which benefit from increased bibliographic accessibility.

The twentieth century may be characterized as a period of growth and development of productivity. The emerging subject catalog developed within the context of the printed book catalog and retained many of the constraints until a new age of librarians began to rise above the technological phases of catalog production. Subject lists developed largely from existing library practices with the profession originating the quest in this direction only to be supplanted by the rather singular effort of the Library of Congress. The fate of the classified catalog was sealed in the United States when the Library of Congress adopted the dictionary catalog that resulted in the issuing of printed unit cards that set the pattern for the whole nation. Research was at a minimum with the appeal to authority exerting an over-powering influence. Catalogers followed the edict of Cutter and debated only his alternative suggestions. The lack of empirical research permitted the catalog to develop with regard only to the book although a secondary effort was given to the periodical indexes, which strangely enough seemed to be outside the realm of the cataloger. The rules employed in the construction of the book catalog were perpetuated in such outmoded practices as the main entry. The card catalog eventually faltered under the weight of the increased number of books being printed with book budgets stretching its size far beyond original expectations. The newly formed administrative librarian, who had only recently relinquished the task of catalog construction to the practitioners, began to complain about the costs of processing. Catalogers sought to evaluate their own procedures but were hampered by traditional functions, outlooks, and methods. The codes continued to grow with each edition until finally the discontents of the 1940s brought some simplification first within the realm of descriptive cataloging that by 1967 had been expanded to include more logical approaches to author headings.

Traditionalism and economic expediency once again caused some attrition but progress was made.

Cooperative and centralized cataloging were given impetus with expanding resources and federal funds largely responsible for their growth because the astute foresight of many librarians focused attention in this area.

The coming of the computer served to answer the immediate needs of the seeker of specialized information and is now being applied to conventional library situations with varying degrees of success. Its place in future development is apparent and is dependent upon pecuniary resources and logical applications.

By mid-century the subject catalog was the subject of considerable debate. User studies have failed to provide concrete answers for all situations but generally have indicated trends that aided in selecting methods. The role of the subject catalog, though generally recognized, has undergone more intensive study with its components, such as subject headings and the syndetic structure, receiving considerable attention. The results have been rewarding in a limited degree with some understanding gained through analytic studies of subject terminology and a burgeoning number of special subject lists or thesauri. Libraries, like other social institutions, have failed to keep up with new innovations and as a whole have retained old methods or hastily accepted practices that lead to unendurable problems. The subject catalog will continue to demand major emphasis during the remainder of the century that hopefully will be marked by scientifically sound experimentation and rational development.

CONCLUSION

The unfolding of the story of catalogs and cataloging has indicated general trends, which may be succinctly summarized. The ancient period was a time of crude inventory lists that served only as a listing of property rather than an index to the library. The contributions of Callimachus to the cataloging field were typical of the early bibliographic endeavors that were prepared by scholars in order to preserve a record of the leading literary works of the period. This method was characteristic of the attempts of the ancient civilizations that sought to perpetuate the culture for ensuing generations. The concept of authorship and title was confusing, with listings frequently a combination of author names, titles, and/or first lines although the Greeks were probably responsible for the use of the author in reference to individual works. Chronology or order of accession were the primary orders of arrangement. The rise of Christianity shifted the centers of learning to the monasteries where the codex was used and reproduced for distribution to other religious houses. Books were an exceedingly valuable commodity which necessitated a record of the holdings of each collection. Slowly the lists began to reflect a utilitarian aspect with

books arranged not by the old chronological approach but by order of importance to the user that in turn led to broad subject and form arrangements persisting for many centuries and later forming the basis for the more systematic classification schemes. As these lists lacked author or subject, and title indexes, they were not catalogs in the modern sense of the word but rather resembled our shelf list in character and use.

In the thirteenth century the first union catalog was attempted and college and university libraries, which were to exert such an influence on later development, began to assemble comprehensive collections.

The fourteenth century brought the inclusion of an author index appended to an inventory list that could conceivably be designated as a true catalog.

The fifteenth century with the invention of movable metal type brought a new need for bibliographic organization with leaders such as Trithem who appended an index of authors to his chronologically arranged bibliography of ecclesiastical writers and exhibited a concept of the main and added entry which was further developed by Gesner, Trefferus, Maunsell, and Sir Thomas Bodley.

The sixteenth century was marked by a number of leading bibliographies produced by Gesner and Maunsell who were joined by Trefferus in providing information on the construction of catalogs. Two astute bibliographers suggested that a bibliography could be pressed into service as a substitute for the catalog. Maunsell's use of the author's surname was indicative of the changing concepts regarding names. The addition of supplementary indexes was clearly emerging with the number of access points going far beyond the original inventory list and catalogs beginning to assume the retrieval function.

The seventeenth century brought the Bodleian catalogs. The author arrangement of the influential issue of 1620 advanced the concept of entry with considerable attention to the determination of the form of main entry and an expression of the literary unit principle. An early form of the dictionary catalog with authors and subjects filed in a single alphabet appeared although the single entry (author or title for anonymous) was the rule of the day. A number of codes of instructions by Naude, Dury, and Baillet indicated that interest in the catalog was increasing with methods taking on a few primitive signs of standardization.

The eighteenth century found a national cataloging project in France using cards as a basis of the catalog as well as a national cataloging code. Bibliographical description slowly increased and was assuming more of its modern aspects.

The nineteenth century was the high point of cataloging with a number of important codes produced, beginning with the British Museum and reaching a zenith in Cutter's *Rules* of 1876. Catalogs steadily developed under the concept of the subject word particularly within Germany and America as the single entry idea expanded beyond

conventional application. The card catalog became more commonplace after 1860 and assumed a variety of arrangements reflecting a number of divergent opinions. The subject catalog was the major contribution of the era and was employed first in America by Jewett. Cutter was to provide the definitive work with the publication of his *Rules* in 1876, which were to serve for years as authoritative and final. The problem of catalog arrangement was still a controversial issue at this time and was never satisfactorily resolved, although, elements of the classified printed book catalog were readily adopted to the dictionary card form. The emergence of centralized cataloging at the Library of Congress, which was based upon a dictionary catalog, terminated serious debate and elevated the technological aspects of its catalog to a paramount place with little regard for its philosophical advantages over the classified systems.^[41] Classification became not a tool of the catalog but rather a location symbol. The catalog was dependent upon an alphabetical order which was supported by a syndetic structure, serving as a systematic guide to subject terminology. Subject headings and cross references, however, grew not by design but rather by chance until the burgeoning size of the catalog brought forth a deluge of criticism against Cutter's answer to the classified catalog. The lack of an acceptable classification scheme no doubt influenced the rapid growth of the dictionary catalog, which came under close scrutiny during the twentieth century. The overemphasis on rules and a preoccupation with monographs in libraries stymied innovation to such an extent that seekers of specialized information and extraordinary services turned first to the documentalist and then to the information scientists. The mid-fifties produced a number of studies pertaining to the classified catalog, approaches and needs of the user, cost analysis, catalog division, book catalogs, and the relationship of bibliographies to the catalog. All of these reflected the failure to adequately study the fundamental design and purpose of the alphabetical subject catalog in card form.^[41] By the end of the nineteenth century the pattern of catalog construction was well defined with subject headings, main entry, literary unit principle, dictionary catalog, classification, unit cards, added entries, and adequate bibliographical descriptions all well-developed elements. Cooperative cataloging was in its beginning stage with the first efforts directed toward an early type of cataloging-in-source, which advocated slips with the books.

The twentieth century brought an expansion of cooperative and centralized cataloging, three new cataloging codes for the English speaking world, numerous subject lists, and a general reevaluation of the cataloging process beginning with the descriptive phase. The junglelike growth in the size of library collections forced many librarians to seek simplified methods as well as expanding cooperative and centralized services.

Substantial sums of money have been used since the intervention of the federal government into the field of

scientific information with primary efforts directed toward retrieval of specialized information but later expanding to encompass services of more immediate value to public and research libraries. The National Program of Acquisitions and Cataloging Program is one example of the concerted effort which will result in a more comprehensive coverage of printed cards for foreign titles and will stimulate international cooperation in bibliographic control.

Continued technological advancements such as the electric typewriter, electrostatic copying, telefacsimile transmission, and computers will expedite cataloging activities.

The present and future hold great promise for the development of catalogs into a more useful, more functional, and more comprehensive tool through the formulation of attainable goals, continued experimentation, empirical research, and cooperative effort. So far there is no indication that the need for catalogs will ever diminish or be replaced.

APPENDIX LIST OF CODES OF CATALOGING RULES

- 1791 *Instruction pour procéder a la confection du catalogue de chacune des bibliotheques sur lesquelles les Directoires ont dû ou doivent incessamment apposer les scelles* Imprimerie nationale, Paris, 1791.
- 1841 *The British Museum code of ninety-one rules*, adopted by the Trustees in 1839.
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Censorship and Content Regulation of the Internet

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Abstract

Censorship is defined as the intervention by a third party between the free exchange of a willing sender and a willing receiver of information; typically, censorship is repressive in that both sender and receiver do not want the intervention. Censorship of the Internet began clumsily from when it was made publicly available. Then governments were trying to reconcile the new medium with existing rules on traditional media. Since then, there have been two other overlapping and parallel waves of attempts to censor Internet content. Today's censorship of the Internet is more nuanced. Governments in general do not accept the argument that the Internet is difficult to censor. Among the methods used are simple denial of access to the Internet, passing punitive laws that would deter others when those who are caught are prosecuted, and using blocking technology. The most acceptable face of such censorship would be for the protection of minors and through filtering of the Internet. Censorship of the Internet will continue to exist because of the cultural differences that exist.

INTRODUCTION

For many years after it was introduced to the public, it was held as a self-evident truth that the Internet could not be censored or regulated. The sentiment was first pronounced by John Gilmore in 1993, before the Internet became widely available to the public, the "Net treats censorship as damage and routes around it."^[1] It was reiterated by John Perry Barlow in his Declaration of Cyberspace that governments have no place in cyberspace.^[2]

One of the reasons is that the Internet has a diffused packet-switching architecture that was absent any visible central governing body that regulated it on a daily operational basis. It seemed designed to evade government control. If there was a slogan then, it would have been "information wants to be free."^[3]

Scholars such as David Johnson and David Post argued that the Internet could not be governed by existing legal regimes because it crossed borders.^[4] The U.S. government under President Bill Clinton declared a hands-off approach to Internet communication and e-commerce because of its "decentralized nature and... tradition of bottom-up governance."^[5]

The Internet has come a long way. As at November 2007, there were an estimated 1.3 billion users, almost 20% of all inhabitants on the planet, and the number is still rising.^[6] The evidence is overwhelming today that neither the architecture nor the lack of a visible central governing body necessarily means the Internet is beyond government control.^[7,8] The Final Report of the Working Group on Internet Governance shows that there is a need for a central body to at least coordinate the Internet for it to function.^[9] This is the Internet Corporation for Assigned Names and Numbers (ICANN). While ICANN cannot be accused of

censorship, the fact that it is located in the United States gave rise to the issue of what happens when the United States is at war with another country. What happens to the Internet in the other country? Before the war in Iraq, the operators of the Iraqi domain name .IQ, who were based in Texas, were arrested and charged with unauthorized sale of computer parts to fund terrorist groups. The operators were eventually convicted in 2005 and 2007.^[10]

It was at the World Summit on the Information Society (WSIS) in Tunis to discuss the Report of the Working Group on Internet Governance (WGIG) that it was agreed by all the countries present, including the United States, that the country code top level domain (ccTLD) system would be managed only by the country themselves. In the case of the .AF domain name for Afghanistan, the private individual who held the right to operate it signed his right away to the new government in 2004.^[11] The WSIS Declaration in Tunis implicitly recognizes the sovereignty of national government over the Internet. The long arm of national laws can reach into the realm of Web site content; it is possible, within limits, for governments to control the Internet.^[12]

Another group that has shown interest in gaining some measure of control over the Internet is the private sector. If information ever wanted to be free, the providers did not. Increasingly, content is being copyrighted. Government regulation is necessary to balance the rights of individual to privacy and fair use of information with the desires of the private corporation.

DEFINITION OF CENSORSHIP

A working definition of censorship by this author is: the intervention by a third party between the free exchange of

a willing sender and a willing receiver of information; typically, censorship is repressive in that both sender and receiver do not want the intervention.

There are a few points to note about the above definition. First, the definition of censorship is independent of the party. This is in contrast to the position in some countries, such as the United States under the First Amendment to its Constitution, the government shall “pass no law” abridging content. This means that in the United States and in countries that have similar phrasing in their constitutions, the governments cannot, subject to qualifications by the courts, censor content. Business, however, is not subject to the same restrictions placed on government.

An example of such a divide would be, say, a song with lyrics calling the police “pigs.” In many countries, such lyrics would be banned by law because they encourage the flouting of law and order. In the United States, however, such lyrics would be allowed but business may refuse to carry the music and other groups may encourage boycott of the singer of the song.

Second, it excludes such acts as editing, which seeks to improve the meaning and clarity of the message. The definition may or may not include gatekeeping functions, such as which messages should appear and in what order. In those instances, it is not always clear if there are legitimate grounds for gatekeeping or if it is censorship—in the sense of intervention with the primary intent of blocking the transmission and reception of the information.

Third, the definition includes what is sometimes called “pre-censorship.” As practiced on traditional print and broadcast media, censorship involves the removal or deletion of forbidden material. With the Internet, it is often not possible to remove or delete material from a Web site. Instead, the most frequently used method is to deny, block, or filter access. To distinguish the act of removal, some call such denial of access “precensorship.” The distinction, however, is not helpful and in fact disguises the fact that censorship is at its most egregious when the content is blocked even before it sees the light of day.

Sometimes, what may be censorship to one person is to another perfectly legitimate, perhaps even backed up by law. For example, the European Union lists as grounds for restricting information that are “potentially harmful or illegal contents or can be misused as a vehicle for criminal activities” the following:

- National security (instructions on bomb-making, illegal drug production, terrorist activities).
- Protection of minors (abusive forms of marketing, violence, pornography).
- Protection of human dignity (incitement to racial hatred or racial discrimination).
- Economic security (fraud, instructions on pirating credit cards).
- Information security (malicious hacking).

- Protection of privacy (unauthorized communication of personal data, electronic harassment).
- Protection of reputation (libel, unlawful comparative advertising).
- Intellectual property (unauthorized distribution of copyrighted works, e.g., software or music).^[13]

That list includes restricting information that violates privacy, reputation, and intellectual property rights. In general, most countries around the world would consider the restrictions acceptable and be legal under law. The United States, because of its First Amendment, would be an outlier in this regard. For example, hate speech, such as the denial of the Holocaust, is allowed under the United States and the government would not be able to censor them on the Internet. In practice, however, there would be pressure from business and civil society exerted on the hosts to remove such offensive material. Often, such pressure can be effective.

HISTORY

Early Days

Since the diffusion of the Internet to the public, three overlapping and parallel “waves” of attempts to regulate Internet content may be discerned. The waves reflect the attempts of national governments and international agencies to wrestle with the Internet. In the first wave, from 1994 to 1997 in the early days of the Internet, the approach was to attempt to fit the Internet into the same mold as traditional mass media. That is, governments used legislation and existent executive powers and resources that most closely resembled that part of the Internet to regulate it. If that part of the Internet functioned like a newspaper, then newspaper laws applied; if another part functioned as a broadcasting station, then broadcast rules applied. This “functional approach” to regulating the Internet is understandable because lawyers and judges are trained to use precedents and analogies in their arguments.

In South Korea, the offline rules pertaining to national security were imported to apply to the Internet.^[14] Under the National Security Law, any publication that praised North Korea would be banned. So when one page of the massive Geocities Web site praised the North Korean leader Kim Il Sung, South Korea blocked access to the entire Geocities site.^[15] After a hailstorm of international criticism that followed that incident, South Korea removed that block and has not attempted a similar move.

When Singapore made Internet access publicly available, it was the first country in the world to develop a code of practice for Web site owners in 1996 but also the first to have an official government Web site (<http://www.sg>). It was, however, the code of practice that drew worldwide attention, because it was the first Internet-specific

legislation aimed at regulating content. The code empowered the authorities to block for residential users some 100 mostly pornographic sites using a proxy server; experts said the proxy server could block up to 300 sites after which the user would notice the slowed access. The code also licensed Web site owners, in line with Singapore rules that require licensing of all who publish any periodicals. The license would be revoked if the terms for them were breached. In a nod that recognized the uniqueness of the Internet, licenses were automatically issued—that is one was given a license when one operated a Web site.^[16] Why was this fiction of an automatic “class license” created when it is well-nigh possible to just have a law that criminalized the breach of the rules in the code? Functionally, the Singapore regulators were treating the Internet as a traditional mass medium: anyone who ran a mass medium in Singapore had to have a license.

Meanwhile in the West, governments were attempting to apply rules to the Internet to combat credit card fraud, pornography, etc concerning the Net, as was reported in the news then. It was as if Prometheus had brought back fire and all that the media covered were people getting burned by it. One incident that marked this feverish pitch was the *Time* magazine cover story of July 3, 1995, in which the magazine said that more than 80% of the images posted on Usenet newsgroups were pornographic.^[17] The study was later discredited.

Inevitably, there was pressure on politicians “to do something.” Laws were passed hastily. In the United States, the U.S. Supreme Court struck down a part of the Communications Decency Act in 1997.^[18] Across the Atlantic, a similar fate befell a comparable law in France. In 1996, the French Constitutional Council struck down provisions of a new Telecommunications Law that empowered the Conseil Supérieur de la Télématique to make recommendations on what types of content was permissible.^[14]

In short, between 1995 and 1996, it looked as if the Internet would never be regulated. Countries that were trying to regulate it were either failing before the courts or failing in practice. Singapore was giving it a shot but in essence, it was not really doing much. Laws in the United States and France were being struck down. In the conceptual space, scholars such as Post and Johnson suggested that the Internet needed a new legal regime and the United States said that it was taking a more hands-off approach to regulation.

Latter Days

Law enforcement, however, was not taking a similar approach. Australia, which had probably the soundest Internet policies at that time, conducted a sweep for consumer fraud in 1996. No new Internet laws were passed for the sweep. Instead, the consumer protection agency relied on existent laws. Since then, a number of countries,

including the United States, have joined Australia in conducting such annual sweeps under an umbrella organization called International Consumer Protection and Enforcement Network (ICPEN).^[19]

Similar sweeps have also been mounted against child pornography. Cyber libertarians say the Net is ungovernable because effective regulation requires international cooperation and such cooperation is difficult to come by. For example, what is a crime in one country may not be a crime in another. There is one offence that virtually all countries can agree upon—the use of children for pornography. (Japan had to pass child porn laws in May 1999 to be in line with international norms; until then, the Japanese drew no distinction between porn of children and adults.^[20]) In a sweep called Operation Cathedral, police in 14 countries in the OECD cooperated to crack several child-porn rings.^[21] Today, child porn is an area that police patrol.

On the legislative front, with direct regulation failing before constitutional challenges, attention turned toward self-regulation. It appeared that a prevalent notion was that self-regulation was *the only* way to regulate the Internet. In 1998, the Internet Law and Policy Forum, an independent and loose association formed mainly of lawyers, initiated an effort to look at self-regulation. Its Web site carried a bibliography that appeared to signal the start of a serious study on the subject of self-regulation.^[22] Unfortunately, the study appeared to have been stuck at that starting line of 1998.

From 2000

Around the turn of the millennium, two trends toward regulation were discernable: self-regulation and direct regulation. The Internet industry has been reluctant to self-regulate. The U.S. Federal Trades Commission, after giving several one-year deadlines for the industry to regulate the privacy of children using the Net, passed the Children Online Privacy Protection Act in 2000.^[23] In Australia, the Internet Industry Association emerged with a code of practice after five fruitless years when the Federal government passed a law that, among other things, compelled the development of the code.^[24] The Federal law has forced some sites to move from Australia.^[25]

In Europe, there has been some movement toward self-regulation. Internet Service Providers' associations have often developed codes to minimize their own liability as well as to self-regulate some aspects of business. This contrasts with the United States, which is suspicious of codes, and Asia, which lacks cohesive industry associations. The movement toward self-regulation in Europe has been aided by the work of the Bertelsmann Foundation.^[26]

In 1999, the Foundation, started by one of the world's largest book publishing houses, brought together a group of experts to address the issue of content filtering. The Internet Content Rating Association (ICRA) filtering

platform based on platform for Internet content selection (PICS) was launched a year later. ICRA, an effort with which the author was involved, aimed to empower parents with simple tools to filter contents of Web sites while addressing the charge of censorship. American civil libertarian groups such as the American Civil Liberties Union (ACLU) and the Center for Democracy and Technology (CDT) were among various bodies consulted during the development of the platform. ICRA's idea was simple: Web sites were to tag every page; users were then to decide what content they would allow. Although it did succeed in creating a filter that was acceptable for the most part by civil libertarians because tagging was not compulsory, ICRA did not succeed in getting the tool to be incorporated into Web browsers. An attempt to develop a plug-in failed. The result was that it was never in use. In February 2007, ICRA relaunched itself as the Family Online Safety Institute (FOSI).^[27]

The Western European experiment in self-regulation is commendable but appears to have blunted by the reality that it is limited in practice. Nevertheless, Western Europe may well play a significant leadership role in the laws and policies of regulating the Internet. There are several reasons for this.

In general, many Western European countries acknowledge some degree of censorship of some media content. This position more closely resembles the situation in many parts of the world where censorship is present, varying only in degree.

On the other hand, many European countries also protect free expression under Article 10 of the Council of Europe's convention on human rights, more formally known as the Convention for the Protection of Human Rights and Fundamental Freedoms.^[28] This protection resembles the U.S. First Amendment as well the culture of Internet users. In short, Europe has checks and balances on the competing interests of censorship and free expression.

Against this backdrop, there have been surprising developments in the Western European countries. In 2000, a French court ordered the Internet search-engine Yahoo to block French users from accessing a section of the site that auctioned Nazi memorabilia.^[29] Although Yahoo initially objected, it later banned the sale of Nazi and hate-related material on its site.^[30] To be sure, there are peculiarities in the case. First, Yahoo had used a French domain name—yahoo.fr. That gave the French a jurisdictional toehold on Yahoo. Second, Yahoo was targeting the French users through its advertising. So when Yahoo said it had no way to filter out users the judge was unconvinced: if French users could be directed to a French version of Yahoo, surely Yahoo could filter its users to deny them access to Nazi memorabilia. The information on which the judge based the findings had been given by a panel of experts that included Internet-pioneer Vinton

Cerf. The experts, however, did not agree with the conclusion of the judge on ideological (the Internet should be free) and pragmatic (the filtering was only about 70% effective anyway) grounds. The ideological ground is impossible to explain away. But the pragmatic ground reflects a deficient understanding of the purpose of censorship—it is not meant to be 100% effective.

This is a form of what economists call the “Nirvana fallacy”—something is not worth doing if it does not achieve perfect results. For example, an argument often made against censorship is that on the Internet, a user can always make an international phone call anyway. The argument misses the point. It has never been possible to reliably block anything, even at customs. The persistent will always find a way around the censors. The censor's goal is achieved if it is difficult for *most* users to access the material.

The French approach may be used in other countries. Korea has reportedly ordered its Internet service providers to block access to Korean-language pornographic sites hosted overseas that do not restrict access with an age-verification process.^[31]

A major case regarding blocking access to the Internet is the dispute between Antigua and the United States over Internet gambling. In 2003, Antigua filed a formal complaint against United States with the World Trade Organization (WTO), arguing that the United States' restricting online gambling violated obligations that it had made in 1994 regarding international trade. The United States argued that it was blocking access to online gambling sites on moral grounds. In 2004, the WTO ruled in favor of tiny Antigua. The United States appealed and lost in 2005.^[32] On December 2007, after long debates and many delays, the WTO finally ruled that Antigua won compensation of US\$21 million per year from the United States. However, the United States continued to refuse to comply and at the time of writing, Antigua has threatened to abrogate all its intellectual property treaties with the United States and open itself to allow piracy of movies and music on the island.^[33]

ARGUMENTS AGAINST CENSORSHIP

Problems of Internet Censorship

Even with traditional media, censorship has never been 100% effective 100% of the time. With the Internet, it is even more difficult to censor.

The root of the problem for censors is that the Internet combines characteristics of the newspaper, telephone, the radio, the television, and the computer. Each of these inventions alone has contributed to an increase in the transmission and reception of information. Combined, they offer a surfeit of information for censors.

Second, the reach of the Internet ranges the spectrum from one-to-one (e-mail)—which is usually uncensored—to one-to-many (Web sites) and many-to-many (Usenet groups)—which tends to attract some form of censorship. No technology before has had such a combination of reach. E-mail is generally viewed in most countries as private communication, an “e” version of regular mail. But it is possible to conduct mass mailings and some discussion groups are conducted through such mailings. In short, e-mail, a private communication medium, has the potential to be a mass medium.

Theoretically, there is no reason that e-mail cannot be read and censored. It just takes a lot of work. Opening and reading e-mail, however, may well be the most effective means of turning users away and killing the growth of the Internet. In 1994, through a misunderstanding of a high-level official request, Internet accounts of an access provider in Singapore were scanned for .GIF files. Of 80,000 files scanned, five were found pornographic by Singapore standards and the users were warned. Although no non-GIF file was opened, users nevertheless were irate. Many expressed grave reservations about security and privacy on the system. In the end, the access provider had to assure its users that no such scanning will occur in the future.^[16]

Third, there is the problem of regulatory paradigm. By combining the traits of traditional communication media and blurring their boundaries, the Internet poses the question of who is to regulate the content and by what standards even domestically.

Should the Internet be treated as a postal service because it has e-mail? Or would the capabilities of Internet Relay Chat and voice-telephony make it a telecommunication service? Then does the presence of electronic newspapers make it a print medium? Or should the availability of radio and television stations make it a broadcast medium? Should its use of the computer mean that the computer model of regulations applies?

In practice, regulators bypass these questions by treating the Internet based on its functions. That is, a Web-based newspaper is likely to be treated as a newspaper, an online radio station as a radio station. It means that there is no single regulatory paradigm. Such an approach, however, is not sustainable in the long run because it magnifies the regulatory problem of convergence where different rules and standards apply to convergent products and services. For example, is a news Web site that combines a newspaper with television news to be treated as a newspaper or a television station?

The fourth problem in Internet censorship is that the computer culture celebrates maximum (and sometimes anarchistic) freedom, not censorship. The early Internet operated with a loose, informal consensus. It arose from universally accepted technical protocols for carrying on electronic conversation from remote locations and times, and it gave birth to common language, culture, and norms.

No matter how system administrators at individual sites may restrict access to objectionable materials, savvy users can overcome the hurdles. Sites that are banned in one country are quickly relocated in another. Sites that are blocked are bypassed through anonymizing proxies. Ways and means to bypass censorship are published online.^[34]

Fifth, the Internet highlights a major legal issue in global interconnectivity: which censorship standard applies? The issue extends beyond the classic “what is pornography” debate as first highlighted in a U.S. case where a bulletin board service (BBS) operator in California was convicted of delivering pornography to a resident in Tennessee.^[35]

The Internet offers a myriad of material on subjects such as drug culture, bomb-making, murder, and anti-Semitism. Material that is illegal in one country and punishable with a heavy sentence may be wholly legal in another part of the world.

Germany’s case of the Neo-Nazis frames the problem best. In January 1996, the German phone company Deutsche Telekom blocked users of its computer network from accessing the Web site of Ernst Zündel, a German-born activist living in Toronto, Canada, suspected of distributing Neo-Nazi and anti-Semitic material over the Internet.^[36] Given the history of Germany, such a response is perhaps understandable.

However, in the United States several prestigious universities offered to mirror Zündel’s site.^[36] Similarly, when Germany tried to block access to a magazine called *Radikal*, 47 other sites all over the world mirrored the *Radikal* site.^[37] Enforcement of this German law outside of Germany is practically impossible. Any attempt at censorship therefore also has to consider the international dimension.

Finally, the process of regulation tends to proceed piecemeal and almost always lags behind changes in technology. Censorship of any new medium today is most likely to come into play after the objectionable material has been sent. Until then, censors would not be aware of the possibility of circumvention or violation. In the interim, before the passage of any regulation, there is the gray area.

METHODS OF CENSORSHIP

Access Control

Negroponte has said that bits and bytes do not stop at borders.^[38] Authoritarian regimes, however, can stop them. A 2001 study of the Internet in China and Cuba illustrated this point: the Internet does not automatically disempower authoritarian governments.^[39] In Myanmar, modems, even those built into laptops, have to be licensed. Those who use unlicensed modems have been jailed.^[40]

Slightly less draconian is the use of centralized access, typically through some form of state control. A number of states in the Middle East—such as Syria, Iran, and Iraq—use this approach. The fear of being caught accessing unauthorized material is the deterrent. However, the limited means of access discourages competition, which inhibits the diffusion of the Net.^[41]

China regulates access in another way: by compelling Internet subscribers to register with the police.^[42] Those who use the cybercafes have to show some identification before being able to access the Net. Lest the idea appear too wild, a similar notion of registering users has been proposed by Robert Cailliau,^[43] the codeveloper of the World Wide Web with Tim Berners-Lee.

In Singapore, Internet access providers have to use proxy servers to block 100 “high-traffic” pornographic sites for home subscription plans.^[44] The process of having to look up the blacklist does slow down access a little.^[45] Such centralized controls have limited capabilities: at most, several hundred pornographic sites can be blocked in the face of hundreds of thousands others.

To block these hundreds of thousands of sites, companies have sprung up to offer regularly updated blacklists of pornographic sites. The names of these sites are then blocked from user access. Such a family-friendly Internet access plan is increasingly available throughout the world. However, because of the costs of installing and maintaining the list, subscribers have to pay more for such plans.

Passing Laws

A common misperception is that if there are no new rules for the Internet, it means the Internet is not regulated. This perception is misplaced because in the United States, Internet users have been convicted for violating pre-Internet state laws concerning pornography.^[14]

In South Korea, a government official was quoted in the 1990s as saying: “A South Korean who meets by chance a North Korean on Internet had better report to the police within seven days.”^[14] South Korean security police in the 1990s have tracked down users who, in online debates, expressed opinions that could “benefit the enemy.”^[14] Such actions are authorized by the National Security Law. According to a civil rights activist, Kim Young Sik, president of the South Korean Civil Union Against Censorship, users have had their access restricted because of comments that were deemed to be in violation of the National Security Laws.^[45]

How successfully existent laws can be applied to the Internet depends on how well an analogy can be drawn to the Internet. In Singapore, for example, Web sites of religious and political organizations, as well as online newspapers produced locally, have to be registered.^[46] Although the law appears novel, it is essentially an adaptation of existing media laws in Singapore.

As regulators understand the Internet better, they have attempted to pass legislation to regulate content. However, passing Internet-specific laws does not necessarily imply a censorial intent. In many countries, it is necessary to pass Internet-specific laws because the medium is new. For example, without Internet-specific laws recognizing electronic evidence, it would be impossible to conduct e-commerce.^[47]

That laws in the United States and France were struck down because they conflict with freedom of expression does not mean that it is not legally possible to censor the Internet. What it means is that legislators cannot simply rush the laws for political expedience. Initially, perhaps because the medium is so new, the laws appear not to have been well-thought out.

In the European Union, soon after publication of the EU paper on “Illegal and Harmful Content on the Internet,”^[48] Internet service providers were, for a time, fearful of possible legislation that would make them liable for content for which they had not originated. Since then, Internet-specific immunity provisions have been written in a range of countries—Germany, United States, Singapore, India, Bermuda, France, Australia—so that intermediaries who do not originate content would not be held liable.^[49] The immunity for intermediaries is an example where laws need not be restrictive of the Internet.

Using Technology

Laws, however, are blunt instruments for what is essentially a delicate task of picking and choosing content to be removed. Inevitably, the very technology that has enabled the spread of the information has been used to censor. However, the result has been mixed at best.

Probably the first program to censor the Internet was developed by medical researcher Richard DePew in 1993. Annoyed by anonymous messages on the Usenet groups he read, he developed a program he called Automated Retroactive Minimal Moderation (ARMM) to delete them. The program failed at first. Several versions later, when it succeeded, it affected the workings of other connected computers.^[50]

Many Usenet readers disagreed with DePew’s deletions because it deprived them of the messages. Since then, DePew has stopped using ARMM. Instead, he has developed a program called a bincancel-bot, which removes inappropriately placed binary files from Usenet groups. Such binary files tend to be large, usually contain either programs or images, and are often off-topic. This time, there was a more muted reaction.^[51]

A similar “cancelbot” was first used spam sent by law firm, Canter and Siegel, who in 1994 sent to more than 1000 Usenet groups off-topic advertisements hawking their legal services. A 25-year-old Norwegian programmer, Arnt Gulbrandsen, developed a cancelbot that hunted down and deleted messages sent by the firm.^[52] However,

there is room for abuse. In September 1996, a computer user in the United States sent an unauthorized cancelbot to remove 25,000 messages from the Usenet.^[53]

As might be expected, there are software circumvention tools to defeat censorship; they may be successful in varying degree, depending inversely on how earnest the censors are. It is a cat-and-mouse game. For example, China's censorship has become more sophisticated. In 2002, on a visit to Shanghai, the author saw that Google's search results were blocked for the actual site but not for the cached version. So it was easy to bypass the censorship. But a later year, access through the cache was also blocked.

Anonymising programs and proxies make it difficult for the censor to trace the user and thereby may be able to defeat a block. Tor and Psiphon software allow users to access the Internet through a computer with uncensored access. As might also be expected, there are sites giving advice on how to beat the censors.

Filtering^[54]

Of all the technological means to censor the Internet, the most widespread is filtering by the end-user. The goal of filtering is to empower parents to block undesirable content to children, the only group for which censorship is internationally accepted. One category of filtering software resides in the user's computer. Much in the same way as antivirus software, such filtering programs require regular updates for sites to be added. Another category of filters resides in the server and is a service provided by the Internet service provider; users subscribe to the service, usually on a monthly basis. Filtering software programs have been endorsed, at one time or another, by industry and governments in Europe, Australia, and the United States.

Such programs have improved in sophistication. Initially, some of the software blocked off sites merely for having words such as "breast" on its pages. There were concerns by civil libertarians that this meant blocking educational or medical sites. Today's filtering programs are more context sensitive. Nevertheless, they still suffer from two inherent limitations of such programs. First, filters have to balance the need to be accurate with the comprehensiveness of the filter. The more comprehensive the filter (the more offensive words it recognizes), the less accurate it will be in parsing context. The second limitation is that the filter software needs to be updated frequently.

TRENDS

A few years ago, it was easier to discern the trends: overall, the Internet would make countries freer.^[55] After the September 11, 2001 attack, however, security has become

a more important part of network policy. The freewheeling Internet has become less freewheeling.

Governments often point to a historical or cultural basis for censorship. In the classic case, Germany has had its memory-searing record of anti-Semitism. Singapore had a history of race riots in mid-1960s. South Korea has its fear of the North Korean invasion. And so the bias toward security and censorship, instead of openness, has a basis in historical events.

Some form of censorship, perhaps better phrased as content regulation, of the Internet is here to stay. The question is the degree and the form of censorship. In some ways, censorship of the Internet is more severe than censorship of traditional media. In the digital world, one either receives the content or not at all; a garbled message is usually unreadable. In the analog world, one may receive the content partially. A garbled message may be partially readable; a printed copy may be smudged or covered over but parts may be readable. Also, online censorship is often through a blocking mechanism, which is prior restraint. Legal doctrine views this as a more severe form of censorship than restriction after publication.

There are several areas where censorship is on the rise. A developing area of censorship is copyright. The early use of copyright was indeed for censorship. There is very little debate on this issue as rights are being extended by rights-holders, at the expense of society at large.^[56]

U.S. companies such as Yahoo and Google face the question of the extent to which they should respect the laws of a foreign land when that law clashes with a fundamental value such as free expression. In Yahoo's case, the company has swung from ignoring the French government to being wholly compliant to the Chinese government's request for the name of a journalist, who was subsequently sentenced to 10 years imprisonment for disseminating "state secrets." Ironically, Yahoo was not legally bound to do so.^[57] The European Union has issued a declaration urging companies that do business in repressive countries to develop a code of conduct to "put limits on the activities of companies in repressive countries."^[58] Yahoo, Google, Microsoft, and a few others did attempt such a code but at Yahoo, it was rejected by the shareholders.^[59] Reporters Without Borders in 2005 got 35 investment firms to sign a "Joint investor statement on freedom of expression and the Internet" and to "monitor the activities of Internet sector companies in repressive countries."^[60] It is however, difficult to see how such a code would be implemented because it would mean disobeying the laws of a land that the business operates in censorship and trade.

CONCLUSION

Censorship tends to be more tolerated in times of crisis and war. At the time of writing, the war on terrorism in

Iraq, Afghanistan, and around the world was still raging. A greater degree of censorship and other retrenchment of civil liberties may therefore be expected. Temporarily, at least, the freedom and anarchy that the Internet vanguard had hoped for is likely to be curtailed from the West.

The future of freedom on the Net, however, is bright. Freedom House's study of Net freedom concludes that the large number of users alone will make it hard for governments to censor, and that thereby creates more space for public debate. Free speech has either won or will win any battle censors may put up over the Internet.

As the Internet has developed, it is also clear where the boundaries are for censorship. The one area that virtually all countries agree to censor is materials that go to the young. The United States has gone so far as to impose laws, such as the Children Online Privacy Protection Act, that have closed down Web sites. Other areas that developed countries are prepared to see regulated are child pornography and representations to consumers that spill over to become consumer fraud.

Apart from these areas, censorship laws become murky and harder to defend. Many people accept that countries do have a right to their own cultural identity. And certainly history plays a part. But not every one agrees how that culture and history should be treated. Hence the debate over censorship will continue. Especially on the Internet.

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Center for Research Libraries

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Abstract

The Center for Research Libraries fosters and advances scholarly inquiry through cost-effective, cooperative programs that provide reliable access through traditional and electronic means to unique and unusual collections of library materials in all appropriate formats, international in scope, and comprehensive in disciplines.

INTRODUCTION

The Center for Research Libraries (CRL) is an international consortium of university, college, and independent research libraries. The CRL supports original research and inspired teaching in the humanities, sciences, and social sciences by preserving and making available to scholars a wealth of rare and uncommon primary source materials from all world regions.

CRL

History

The CRL was founded in 1949 as the Midwest Interlibrary Center by ten Midwestern research universities. The founding institutions were the University of Chicago, the Illinois Institute of Technology, the University of Illinois, the State University of Iowa, Indiana University, the University of Kansas, Michigan State College, the University of Minnesota, Northwestern University, and Purdue University. It arose following a decade of study and planning for a regional cooperative deposit library. As originally conceived, the CRL was to serve four programmatic purposes: cooperative storage of little-used materials, cooperative acquisitions, coordination of collecting policies, and centralized cataloging. Of these four functions, centralized cataloging and coordination of collecting policies proved unworkable at that time. The founding planners pursued, rather, the creation of a consortium whose role would be to develop and maintain a corpus of scholarly research materials, assembled cooperatively through deposits and purchases and to make those materials available to consortium members.

Construction of the storage and processing facility was completed in 1951, and the CRL opened in that year. In the ensuing half century, the consortium has grown to include more than 210 research universities and libraries

from North America. In 2005, the University of Hong Kong became the CRL's first global member. Since then, the Max Planck Institute for Human Development in Germany and Nalanda University in India have joined as global members. The CRL now maintains a centralized collection facility and a corpus of research materials consisting of more than five million volumes and microform volume equivalents.

The need among academic libraries for cooperative solutions to acquisition and storage problems in the mid-twentieth century became, if anything, more pressing with the passage of time. In his article about the CRL in the first edition of the *Encyclopedia of Library and Information Science*, Ray Boylan stated that as "knowledge (and the publications containing it) has grown, researchers have had to become more specialized in order to master it."^[1] Despite such adaptive behavior on the part of scholars, individual academic libraries were scarcely able to purchase, catalog, store, preserve, and make available all of the materials necessary to meet the specialized research needs of faculty and students. In the intervening years, the growth of scholarly resources has only accelerated. At the same time, the scope of scholarly inquiry has been enlarged as well, through the introduction of new disciplines and fields of study. The late-twentieth-century revolution in digital technology also expanded the array of media through which scholarly communications are transacted, thus raising the prospective costs of comprehensive collecting in those disciplines to higher levels while competing with the need to provide electronic access to resources. As the need has grown, so have the services, collections, and programs the CRL offers.

Global Resources Collaborations

To address the changing realities of humanities and social science research, the CRL has formed strategic partnerships with other organizations whose goals align with the CRL's mission. Through these partnerships, the CRL

brings new expertise and resources to bear on its efforts to digitize, preserve, and provide access to published materials in four major domains.

Partnerships

Global Resources Agriculture Partnership—Project Ceres: The CRL works with the U.S. Agricultural Information Network and the Agriculture Network Information Center to support the ongoing preservation and digitization of historical collections in the field of agriculture. The CRL provides funding to libraries to digitize and commit to preserving print materials essential to the study of the history and economics of agriculture.

Global Resources Law Partnership: The CRL works with the Law Library Microform Consortium (LLMC) to expand access to legal and governmental primary source documents serving the research interests of the CRL's diverse library community. The CRL and LLMC identify, preserve, and provide digital access to important at-risk primary source documents in law and government from the United States and other national jurisdictions.

Global Resources Partnership in Science, Technology, and Engineering: In 2012, the CRL and the Linda Hall Library (LHL) of Science, Engineering, and Technology formed a strategic partnership to preserve, further develop, and provide access to historical research collections in the fields of science, technology, and engineering. The partnership builds upon the rich holdings of print serials in those fields assembled by the two institutions during the past six decades. The combined holdings of the two institutions constitute a premier library of global science. The CRL and LHL are pooling resources to promote the visibility of these collections worldwide, making them available electronically and through traditional interlibrary loan (ILL) and document delivery to researchers through the CRL libraries.

News: Access to news in its many forms requires coordination and participation of a variety of stakeholders. As one of the foremost news collections in North America and the world, the CRL works to systematically identify critical collections; establish consensus on preservation, archiving, and digitization needs; and negotiate licenses and partnerships to obtain access to materials available electronically. The CRL's partnership with Readex on the World Newspaper Archive supports the library community's efforts to preserve and provide persistent electronic access to historical newspapers from around the globe. Through its work with the International Coalition on Newspapers (ICON), the CRL partners with major news repositories around the world to preserve and improve access to historical news collections. ICON places increasing emphasis on assessment of sustainable digital news repositories, and the ICON database of newspapers is the most comprehensive source of information on digitized newspapers in trustworthy repositories.

Additionally, the CRL represents the interests of its members to obtain favorable terms of access to historical (digitized) and current (born-digital) news sources. The CRL establishes relationships with media organizations (such as the New York Times), commercial providers, and academic partners to ensure the persistence and accessibility of these resources.

Global Resources Programs

AFRINUL: The Cooperative African Newspapers Project seeks to enhance the utilization of newspapers as a source of information about Africa. The project has developed the African Newspapers Union List (AFRINUL), a centralized electronic database of holdings information for newspapers (all formats and all languages) published in sub-Saharan Africa.

CAMP: The Cooperative Africana Materials Project (CAMP) acquires, preserves, and maintains microform and digital collections of unique, rare, and bulky or voluminous Africana research materials for its members. CAMP emphasizes original preservation of newspapers, journals, government publications, archives, and the personal papers of scholars and government leaders.

CIFNAL: Collaborative Initiative for French Language Collections (CIFNAL), the Collaborative Initiative for French Language Collections, was founded in 2006 to promote and facilitate the cooperative exchange of ideas and resources between Francophone and North American research libraries. CIFNAL seeks to improve access to French and French-language resources through licensing, digitization, and institutional connections.

GNARP: The German–North American Resources Partnership (GNARP) supports the acquisition, sharing, and use of German-language materials among North American libraries and the fostering of closer collaboration with German research libraries.

HRADP: The Human Rights Archives and Documentation Program (HRADP) facilitates efforts by institutions to identify, preserve, and provide access to human rights–related archives and documentation by collecting and sharing information about the nature and status of at-risk materials and providing other technical, communications, and financial support for preserving and maintaining those materials.

ICON: ICON is a multi-institutional effort to promote the accessibility and preservation of international newspaper collections by gathering and providing data on physical and digital collections of newspapers from all world regions. The program supports the ICON Database of International Newspapers and conducts assessments of major newspaper digitization initiatives.

LAMP: LAMP (formerly known as the Latin American Microform Project) acquires, preserves, and maintains microform and digital collections of unique, rare, and bulky or voluminous Latin American research materials

for its members. LAMP emphasizes original preservation, either through microfilming or digitization, of newspapers, journals, archives, and ephemeral material from Latin America and the Caribbean.

LARRP: The Latin Americanist Research Resources Project (LARRP) is a cooperative initiative that seeks to improve access to the array of research resources published in Latin America. LARRP supports collaborative projects that increase free and open access to information in support of learning and scholarship in Latin American studies and cultivates relationships within the academic library community.

MEMP: The Middle East Materials Project (MEMP) acquires, preserves, and maintains microform and digital collections of unique, rare, and bulky or voluminous research materials pertaining to the field of Middle Eastern studies for its members. MEMP emphasizes original preservation, either through microfilming or digitization, of newspapers, pamphlets, and ephemeral material from or about the Middle East and the Arab world.

PAN: The CRL sponsors the Print Archive Network Forum (PAN), a biannual meeting held in conjunction with ALA conferences, to share information, expertise, and best practices about strategic management of print archive programs. PAN invites libraries and consortia of all sizes to participate.

SAMP: The South Asia Materials Project (SAMP) acquires, preserves, and maintains microform and digital collections of unique, rare, and bulky or voluminous research materials in South Asian studies for its members. SAMP emphasizes original preservation, either through microfilming or digitization, of newspapers, journals, official publications, monographs, and ephemera in all languages of South Asia.

SEAM: The Southeast Asia Materials Project (SEAM) acquires, preserves, and maintains microform and digital collections of unique, rare, and bulky or voluminous research materials in Southeast Asian studies for its members. SEAM emphasizes original preservation, either through microfilming or digitization, of newspapers, archives, manuscripts, journals, and ephemera relating to all countries of Southeast Asia.

SEEMP: The Slavic and East European Materials Project (SEEMP) acquires, preserves, and maintains microform and digital collections of unique, rare, and bulky or voluminous research materials pertaining to the field of Slavic and East European studies for its members. SEEMP emphasizes original preservation, either through microfilming or digitization, of newspapers, journals, books, archives, pamphlets, and other relevant materials from the region.

TRAIL: Technical Report Archive and Image Library (TRAIL) works to ensure preservation, discoverability, and persistent open access to government technical publications regardless of form or format. TRAIL identifies, acquires, catalogs, digitizes, and provides persistent and free access to historical collections of federally funded

technical research reports held by research libraries and other organizations.

The Collection

The CRL holds more than five million newspapers, journals, dissertations, archives, government publications, and other traditional and digital resources for research and teaching. Holdings include such diverse materials as 800,000 doctoral dissertations from outside the United States and Canada (including those of Albert Einstein, Dag Hammarskjöld, and other Nobel Laureates), some of the earliest African-American newspapers, and several human rights-related archives. Emphasis is on materials produced outside the United States, and the CRL has special strength in publications and archives from developing nations.

Resource Sharing

The CRL is committed to fast, accurate delivery of materials and digital content for faculty and student research. ILL provides a mechanism for access to CRL materials by members. One of the most important CRL ILL features is unlimited access to important research materials with extended loan periods: patrons from member libraries can make an unlimited number of requests, request any amount of material to be sent, and are allowed to use the CRL materials for as long as necessary. (The CRL will recall an item only if another patron from a member library requests the material.) The lengthy loan period is possible because the CRL collects material that is rarely used at single institutions. On-demand digitization of fragile and rare material, if possible after assessing condition, is also a service the CRL provides. The CRL staff has worked to improve discoverability of its tangible and digital resources by creating cross-links to the CRL OPAC and web-based collection guides from various open-access web resources developed by the CRL and its affiliates.

Cooperative Collection Development

Since its earliest days, cooperative collection development was accomplished in two ways: through the CRL's deposit service and through the CRL's purchase programs. Initially, many of the CRL's original members deposited material that was rarely used in their own libraries (Fig. 1). The depositing library gained shelf space in their own stacks for the acquisition of new materials. These deposits formed the core of many of the CRL's collections. The deposit program remains an important service for both the individual member library and for the larger community as the CRL continues to receive titles for its JSTOR print archives (JSTOR was the Andrew W. Mellon

Foundation's acronym for the "Journal Storage" Project). The CRL/JSTOR Print Archive Project provides assurance to the CRL members and to the library community that paper copy of all JSTOR titles will be available as an archive. More information about the CRL/JSTOR Print Archive Project is available at <https://www.crl.edu/archiving-preservation/print-archives/crl-administered/jstor>.

The second part of the CRL's cooperative collection program is its purchase programs. Material is purchased in four ways: subscriptions, demand purchases, purchase proposals, and shared purchases. From the CRL's inception, certain classes of materials had been identified as material the CRL should collect. Selected titles in these classes are acquired through subscriptions. In fact, when the CRL opened for business in 1951, it began with entering subscriptions to 40 newspapers. Along with the newspaper subscriptions, the CRL maintains subscriptions to

various rarely held serial titles, such as the *Asian Journal of Chemistry*.

The Demand Purchase Program works with the classes of materials the CRL specifically collects: newspapers, foreign doctoral dissertations, and archival records. Each year, a percentage of the collection budget is set aside to purchase-on-demand materials in these classes if a patron from a member library so requests and the CRL does not presently own them. One example concerned a researcher studying the Berlin Airlift. Relevant material from Public Record Office files had recently been micropublished. The researcher was able to request the CRL to purchase this archival material using its Demand Purchase Program. The patron's library did not have to spend money and time on purchasing, cataloging, and storing the material. Other member libraries also benefited from the CRL's

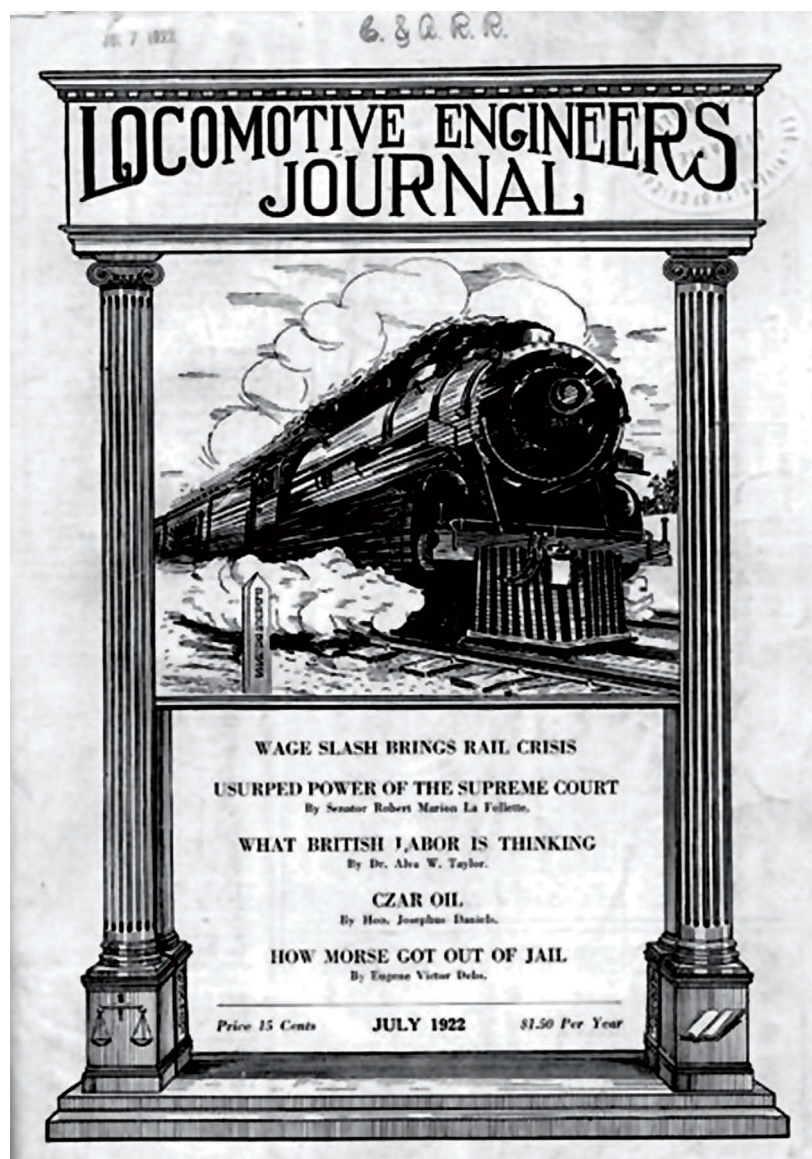


Fig. 1 Cover of *Locomotive Engineers Journal*, July 1922, Vol. 52.

acquisitions of this material, as they did not need to purchase the material for their own library.

A portion of each year's budget is set aside for the Purchase Proposal Program. Each year, representatives from member libraries propose titles for purchase through this program. If the proposals meet the specified criteria, the item is balloted. The criteria can be found at <https://www.crl.edu/collections/cooperative-collection-building/purchase-proposal-program>. Member libraries then rank items on the ballot and the CRL purchases as many of the approved titles as possible with the year's available pool of money. Many of the major microform sets the CRL owns were acquired through this program. Recent acquisitions of material through this program include "Church Missionary Society Archive. Section III: Central Records, Parts 12–22", "La Dépêche algérienne: journal politique quotidien (1885–1943)", and "Qing gong nei wu fu zou xiao dang."

How to Use CRL

As mentioned earlier, the use of the CRL's collections by patrons at its member institutions is free and unrestricted. As the CRL's collections are rarely held and used at any single institution, a researcher can often have the luxury of loan periods lasting years. The use of the CRL's collections, for those not affiliated with a CRL member institution, is provided on a cost recovery basis and subject to certain limitations. For more information, read the nonmember loan policies found at <https://www.crl.edu/services/borrowing/non-member-lending>.

The CRL's online public access catalog (<http://catalog.crl.edu/>) contains more than 1,300,000 records. However, many of the materials held by the CRL are uncataloged. Presently, the CRL is working to provide more access to these collections and more information can be found in the section "Other Collections" here: <https://www.crl.edu/collections/crl-collecting-areas>.

CONCLUSION

The CRL was founded at a time when individual university libraries realized they could not be self-sufficient. Time has shown that cooperative collection development and resource sharing remains essential for academic libraries. The CRL aims to realize a shared network of traditional and digital resources for scholarly research and teaching and to develop and manage these resources strategically for the benefit of the academic and independent research libraries community.

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Charleston Conference

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Abstract

This entry covers the history, founding, evolution, structure, values, and future directions of the Charleston Conference held annually in Charleston, South Carolina.

HISTORY AND FOUNDING

The Charleston Conference was begun in 1980 by Katina Strauch who was the then newly hired Head of Acquisitions at the College of Charleston's Robert S. Small Library. At that time the library had a small materials budget (\$150,000) for all material acquisitions. The library also had no travel budget and little knowledge of acquisitions processing. However, the Library staff was a young, energetic, and innovative group. The Head of Special Collections at the time, Dr. Ralph Melnick, was planning an Antiquarian Book Fair, and the Head of Reference, Cerise Oberman-Soroka, was already running a highly successful conference for reference librarians on approaches to bibliographic instruction. The College also had hired a new continuing education director, Sue Sommer. Sue, Ralph, and Cerise encouraged Katina to start a conference connected with the Antiquarian Book Fair focused on acquisition of rare and out of print materials. Accordingly, the first Charleston Conference's speakers included, among others, Jake Chernofsky, Editor of *AB Bookman's Weekly for the specialist book world*, Bob Barrows from Arno Press, and Paul Koda, Rare Books Librarian, University of North Carolina (UNC)-Chapel Hill. There were approximately 25 attendees including Mike Markwith (Blackwell's), Corrie Marsh (Georgetown), John Ryland (Hampden-Sydney College), Bill Schenck (UNC-Chapel Hill), and Tom Leonhardt (Duke University). Several of the papers from that first meeting were published by Jake Chernofsky in *AB Bookman's Weekly*.

After the first Conference, word spread. Since there were no other conferences like this for acquisitions personnel, there was no need for organized publicity, just word of mouth. So a grassroots gathering of a handful of acquisitions librarians has grown over the ensuing three decades to over 1500 attendees in 2012. The timeline as created for the Conference's 25th anniversary is included at the end of this essay.

GUIDING TENETS AND EVOLUTION OVER TIME

Originally held in the spring and spanning two days, the Conference was moved to the first or second week of November because academic acquisitions librarians normally are too consumed by their local institution's budgetary issues in late spring. Based on attendees' recommendations, it was also lengthened a half day into Saturday, which allowed attendees to drink in the appeal of historic Charleston as a venue and to offer additional sessions to an audience of broader professional scope.

After the Conference was several years old and its attendance was growing, Katina felt the need to initiate more frequent communication with past attendees. Accordingly, and with the help of Steve Johnson, Head of Acquisitions at Clemson University who had his own beer lover's newsletter and helped with the layout, Katina and her husband Bruce launched *Against the Grain: Linking Publishers, Vendors, and Librarians* in March 1989. Originally conceived as a four-page mimeographed handout for Conference attendees only, *ATG* grew quickly.

The first issue was 10 pages long instead of four, and *ATG* issues now comprise a minimum of 88 pages. The first issues of *ATG* were distributed by Ballen Booksellers International and Alfred Jaeger, Inc. with help from Ambassador Books, Inc. Ads were not initially intended for the publication, but *Against the Grain* began to get requests for ad space. Edna Laughrey, former Head of Acquisitions at the University of Michigan, volunteered and became *ATG*'s first ads manager. Thus, Katina began to involve willing Conference attendees in increasing the reach of the Conference to the library and publishing world. Word of the Conference continued to spread, and attendance continued to grow.

The program for the first decade of Charleston Conferences was a series of consecutive plenary talks by a handful of speakers. However, in the 1990s, as the online, networked world began to expand, topics were too diverse to fit into a series of plenary talks given over only two and one-half days. Traditional lines of demarcation between

the operations inside libraries have blurred and continue to blur, and the Charleston Conference has been able to stay not only current but be on the cutting edge of factors influencing change in information's allied professions.

The Conference is an organic, living organization. As such, Conference organizers began to plan concurrent presentation sessions to complement the generally broader-scope plenary presentations. These concurrent sessions tended to be subject or process focused and allowed more attendees to present their research findings to the professional information community. The 2015 Charleston Conference included over 300 such concurrent sessions.

Over time the original focus of the Conference on acquisitions applications in academic libraries has broadened to encompass a full range of ideas, problems, and opportunities faced by scholarly publishers, vendors, and libraries and the advancement, sharing, and preservation of knowledge. Topics such as copyright and compliance, standards, communication, digital rights, networking, technology advances, budgets, and archiving are germane to everyone in the information profession.

When Katina began the Conference, she had two caveats. First, she did not want concurrent sessions; she wanted everyone to hear the same paper at the same time and react to its content as a community. Second, she did not want exhibits as she felt the Conference should be about ideas and not become a commercial venue. Also, as a newly minted acquisitions librarian from an unknown academic library, she wanted to create a venue that wasn't just for the "big guys" and already-well-known librarians. She didn't want to exclude them, of course, but she wanted to be mindful of the little, insignificant guys, many coming from small academic institutions. The Conference has held true to the original attendee-inclusive objectives for thirty-six years.

Although as concurrent sessions became a necessity given the explosion of the virtual world and the growth of attendance, the Charleston Conference still gives opportunities for presentations, open questions, friendly repartee, and continued discussion to players from all types of academic libraries, interested public and special libraries, scholarly publishers, vendors and aggregators, consultants, students, etc. Unknown participants are frequently given special consideration when they are identified. A third caveat—Katina wanted to preserve informality, giving the opportunity for give and take during plenary. Microphones are opened to the audience after each plenary presentation, and anyone wishing to comment or question is encouraged to do so. The only requirement to speak is to first identify oneself.

Regarding the introduction of commercial exhibits, in 1999, after attending conferences with exhibits of all sorts of products, the organizers decided to trial a focused Vendor Showcase. This allowed companies with products of direct application and interest to collection developers, acquisitions librarians, serials librarians, digital services librarians, etc. to showcase their products for librarians to

see firsthand, unencumbered by multiple products less applicable to the relevant information professional in attendance. The now successful Vendor Showcase is held prior to the main conference on Wednesday for an eight-hour period and does not conflict with programming on Thursday, Friday, and Saturday. The exhibits are kept simple; tables may be shared by more than one related vendor/publisher. The physical structure and short duration for the Vendor Showcase attains the informal feeling so characteristic of Charleston Conferences overall. Vendors do not have to staff exhibit booths during Conference presentations of interest to them. They are encouraged to send their most knowledgeable representatives to answer questions from Conference attendees and to interact openly in other sessions and social activities. A smorgasbord of refreshments set up in the middle of the Vendor Showcase area also adds to its pleasant and informal atmosphere.

ORGANIZATIONAL ISSUES AND DETAILS

As previously noted, a grassroots gathering of a handful of acquisitions librarians in 1980 grew to 1800 in 2015 and includes a mix of publishers, vendors, aggregators, consultants, students, and librarians. Spread over two and one-half days in early November—late Wednesday afternoon through mid-afternoon Saturday—broad, often controversial, topics of interest to the world of information professionals are explored in plenary sessions, which are interspersed with multiple concurrent "breakout" focused sessions exploring the practical, the novel, or the clever application to instruction and research. Speakers are drawn not only from the information professions of publishing, academic/public/research/government librarianship, vendors of information tools, and technology gurus but from the corporate world of the broader service industry sector, such as Google or Amazon. Prominent speakers, known for both their professional acumen and their presentation skills, are solicited, and expert panels providing opposing or complementary viewpoints are convened and are deftly moderated. A multisection, printed program offers not only the daily program schedule and a précis of each presentation but also the bios of all presenters and a list of those attendees who have preregistered along with their contact information.

The program itself is a feat of organization and information. The program is produced in hardcopy and in digital form available via the Conference website. When recently surveyed, attendees continue to want a printed program in addition to the online. Attendees can manage their own online Conference calendar. The Conference online program serves as a retrospective repository of sorts where presenters may add their slides postconference in addition to the abstracts of all presentations already available prior to the Conference. Recordings of all plenary sessions (when permitted by speakers) are made available free of charge on the Conference website as well.

Cognizant of travel budgets across academic libraries, online registration begins in early June before the end of most institutions' fiscal year. "Early bird" registration generally closes in early September, and regular registration generally is open through mid-October. On-site registration is possible but is not encouraged. The Conference secures blocks of rooms in several hotels—mostly those close to Marion Square in downtown Charleston. Shuttle buses are available between Conference hotels and venues on a limited schedule. The Charleston Area Convention and Visitors Bureau assists planners with hotel and restaurant information, and vendors can seek their assistance in planning ancillary entertainment.

The Francis Marion Hotel has served as the Conference's anchor hotel since the College of Charleston repurposed its adjoining Lightsey Center in 2001 where the Conference had been based for several years. Prior to the Lightsey Center, the Charleston Conference was held in several College of Charleston venues depending on availability and space required—a student commons room on campus, in the Education Center, and in the Sottile Theatre. Since relocating to the Francis Marion Hotel, which is too small to accommodate the entire Conference, the Conference has used several hotels and College of Charleston buildings in addition to the Francis Marion—the historic Embassy Suites hotel in downtown Charleston (the site of the old Citadel), the downtown Hampton Inn, the Marlene and Nathan Addlestone Library of the College of Charleston, the School of Sciences and Mathematics Building of the College of Charleston, and most recently the Marriott Courtyard (once a Holiday Inn). The Gaillard Center in downtown Charleston was renovated in 2015 and holds 1800 attendees. There are several additional hotels in the works in downtown Charleston, so the Conference planners are optimistic that downtown Charleston will continue to be a viable location for the Charleston Conferences.

The fact that the Charleston Conference is *not* sponsored by a professional association, such as ALA or AHA, contributes to its uniqueness. That no professional or corporate entity drives its focus gives Conference organizers the freedom to expand to where the action is, to predict where it will be, and nimbly go there first. Program design is in the hands of a small, unpaid leadership group providing continuity and structure. This contrasts positively against the design of programs for many professional association conferences where volunteer organizers come and go, and topics may be planned years in advance at a time when they are relevant, but relevance may have changed. Charleston Conference planners are able to put a program together with a shorter lead time; thus the programs offer immediate appeal and current relevance.

Regarding the Conference structure, seasoned attendees know what to expect of the day and when—lending calm to an otherwise frenetic schedule of presentations and associated activities. For those new to the Conference, a few "old-timers" serve as mentors to newbies by answering

their questions emailed prior to the Conference and are also available for additional guidance during the Conference, staffing an information table near the registration area. The use of mentors was brokered by Pam Censer, then at the University of Florida, and Susan Campbell of York College, who suggested it. The mentors welcome first timers and orient them as needed. Mentors also serve a "concierge" function for all attendees by interpreting local maps, giving directions, suggesting restaurants, and advising on transportation choices. Being available for immediate problem-solving assistance adds to their overall usefulness.

THE CONFERENCE PROGRAM

Each year's Conference is organized around a catchy theme, which drives the content of the plenary sessions and many of the concurrent sessions.

Included here is a list of all of the conference themes:

- 2016: Roll With the Times or the Times Roll Over You
- 2015: Where Do We Go From Here
- 2014: The Importance of Being Earnest
- 2013: Too Much is Not Enough (tentative)
- 2012: Accentuate the Positive
- 2011: Something's Gotta Give!
- 2010: Anything Goes
- 2009: Necessity is the Mother of Invention
- 2008: The Best of Times, The Worst of Times
- 2007: What Tangled Webs We Weave
- 2006: Unintended Consequences
- 2005: Things Are Seldom What They Seem
- 2004: All the World's A Serial
- 2003: Games People Play
- 2002: Two Faces Have I: One For Books and One for Bytes
- 2001: The Trends They Are A'Changing
- 2000: Is Bigger Better?
- 1999: And the Beat Goes On
- 1998: We Want More For Less
- 1997: Learning From Our Mistakes
- 1996: Money Talks
- 1995: Still Crazy After All These Words
- 1994: The Savage Marketplace
- 1993: Bubble, Bubble Toil and Trouble
- 1992: The Medium is the Message
- 1991: And I Am Right, And You Are Right, Too-Loo-Ra-Lay
- 1990: The Pure and Simple Truth (each session of this conference was prefaced with a quotation from Oscar Wilde)
- 1989: Remembrance of Things Past
- 1988: Questioning Assumptions
- 1987: Plus Ça Change
- 1986: External Influences on Acquisitions and Collection Development

- 1985: More Than You Ever Wanted to Know About Finance
- 1984: Old Problems, New Solutions
- 1983: Collection Development in the 1980s
- 1982: Charleston Conference did not take place. (Katina's daughter Ileana was born.)
- 1980, 1981: no overlying themes yet

Invited speakers deliver plenary presentations in the Carolina Ballroom of the Francis Marion Hotel. These approximately 45-minute presentations are simultaneously transmitted for viewing to large audiences gathered in several other ballrooms and large meeting rooms across the Conference venues. Each venue has at least one moderator who interacts via microphone with a counterpart in the Carolina Ballroom allowing those remote from the physical speaker to feel intimately involved in “the action.” Courtesy reigns in the Francis Marion ballroom even though contrarian views are encouraged. In 2015, plenary sessions were held in the Performance Hall of the Gaillard Center, which meant that all attendees were together in one venue.

Each year brings presentations of current interest, yet annual reprises of certain themes engender great audience anticipation. Recent favorites have been a panel discussion on recent—or anticipated—legislation and current court cases that affect the information landscape and a point-counterpoint debate on the future of the information industry. Speakers chosen as panelists speak to the multiple facets of a hot topic, recently the advance in technology and user acceptance of e-books. Individual plenary presentations may be delivered by prominent information professionals or by individuals prominent in advancing fields that impact the information professions.

Concurrent, smaller-audience, breakout sessions are more loosely organized, but several thematic tracks are offered for those interested in zeroing in on one facet of the information spectrum. Tracks such as budget/fundraising/allocation formulae, end users/use statistics/usability studies, management, and technology offer broadly targeted presentations. Individuals seeking to present choose the track where they feel their presentation would best fit, and Conference program organizers select from them to develop a balanced program. Location of the breakout session rooms across multiple venues is done differently from other conferences where a specialized group may hear presentations in the same room or two for the duration of the conference.

Theme tracks are less important in room choice than the size of the audience anticipated to attend. Room sizes at the several Conference venues vary widely and accommodate from 15 to 800.

The Charleston Conference is a dynamic community. Organizers welcome suggestions and ideas for innovations. Fast Tech Talks give companies a chance to showcase a product or service. Innovation Sessions allow participants to discuss or brainstorm new approaches. Poster Sessions give presenters the opportunity to display

information regarding their department or library. Preconferences are designed to delve deeply into a subject when there is insufficient time during a plenary or concurrent session and the topic is deemed by the organizers to be important. Juried Product Development Forums allow companies to discuss possible future products, ideas, or innovations with a small group of interested librarians. Dine-Arounds on Friday nights give attendees an opportunity to meet each other and try out the culinary fare in a nearby restaurant. Each of these program innovations was suggested by conference attendees or members of the Charleston Conference planning group.

Concurrent presentations at midday, termed “Lively Lunches,” allow attendees not to break their trend of concentration but to eat lunch in the meeting rooms during lunch-time presentations. With so many restaurants offering takeout in the immediate vicinity of Charleston's Marion Square, the Lively Lunches allow attendees to select their own fare with only a 30-minute recess. Over the past several years with more restaurant choices in the vicinity, more time has been allowed for attendees to get lunch and return to the sessions.

Breakout and Lively Lunch program choices are so varied that attendees must make their choices in advance. The sessions are kept small, and the number of concurrent sessions/Lively Lunches offered increases with the increasing number of Conference attendees. Questions are always encouraged in all sessions; microphones are also provided there as necessary. Members of the audience are encouraged to chime in with questions or to add their own experience/opinion. Often there is much give-and-take between presenter and audience to the benefit of all assembled. Most breakout sessions attract at least seven attendees, and some require extra chairs for forty or more. Sessions expected to draw the biggest crowd are scheduled in the larger conference rooms in the Francis Marion or the Marriott Courtyard—hotels located around the edge of Marion Square. Some sessions are held in the College of Charleston's Addlestone Library, which offers an opportunity to explore that lovely building opened in January 2005. Sessions have also been held in the College's School of Sciences and Mathematics Building across the street from Addlestone. Prior to 2001, the College of Charleston's Lightsey Center served as a venue. In 2015, many breakout rooms were made available at the opening of the Gaillard Center four blocks away.

The Gala Reception buffet on Thursday evening is included in the registration fee and has been held in various locations about town, for example, the South Carolina Aquarium, the Old Exchange & Provost Dungeon, the College of Charleston School of Sciences and Mathematics Courtyard, the William Blacklock House, and Rivers Green of the College of Charleston. A particularly memorable event was an oyster roast held at the city's Visitor Center. The city's stamp is continually intertwined into the culture of the Conference. For those attendees whose employers do not reimburse meals, this Conference does not send them back home hungry!

Late Wednesday afternoon's Juried Product Development Forum presentations, for which a limited number of noncorporate conference attendees may register in advance, allow vendors to test the market for a product or procedure in the development stage before introducing it to the market. Vendor submissions are reviewed by an anonymous panel, and the successful applicants must demonstrate that their product/process has been developed to the point where it can be judged; they cannot simply look to bounce an idea off the participant group. As a result, an interested and knowledgeable audience provides feedback in time for a revision, improvement, or extension.

The Conference's commitment to a responsive culture is demonstrated by a postconference Rump Session held on Saturday afternoon to immediately review the past days' events. All attendees are invited, and thinking begins for the next year's Conference. Conference critiques are requested from all registrants and are analyzed for their suggestions. Thus, the planning cycle begins anew.

CONFERENCE ADMINISTRATION

The Charleston Conference has several important working groups. The local arrangements group handles registrations, hotel logistics, communicates with registrants, and the like. This working group consists of three key people who keep everything in order. The Charleston Conference content planning group selects keynote speakers and concurrent session presentations. This group consists of librarians, publishers, and vendors from many areas. Members of the planning group stay involved as long as they are able. Additional members of the planning group are added every year. The Conference planners like continuity.

There is a primary leader of the Conference planning group. The first primary contact was Judy Webster, Head of Acquisitions at the University of Tennessee, who unfortunately passed away too early. The next primary contact was Rosann Bazirjian who was at Penn State University at the time and is now Dean of Libraries at UNC-Greensboro. Rosann has recently retired. The current primary program contact is Beth Bernhardt also at UNC-Greensboro.

Several key individuals contribute to the overall success of the Charleston Conference. Leah Hinds is the primary contact for the Conference overall. Leah oversees registration and is the Associate Director of the Charleston Conference. Leah works with Beth Bernhardt and the Conference planning group on the content of the program. Leah also manages the Conference website <http://charlestonlibraryconference.com> and *Against the Grain* website the-grain.com, contacts potential advertisers and sponsors, and manages the publication of the Conference Proceedings by Purdue University Press.

Toni Nix handles the Vendor Showcase and *Against the Grain* advertising. Sharna Williams coordinates all registrations and manages the Juried Product Development Forums. Regina Semko retired as previous long-time registrar of the Conference. Regina was with the Conference for over ten years and saw many changes over her tenure with the Conference. And, of course, the founder, Katina Strauch, continues to be both behind and at front and center in the scene! Katina is now Assistant Dean for Technical Services and Collection Development at the Addlestone Library.

The content planning group at present, numbering over sixteen members and chaired by Beth Bernhardt for the past six years, consists of librarians, publishers, vendors, and consultants. The primary organization and content of the plenary sessions is decided by this group. Proposals for concurrent sessions are submitted online and a small group makes selections, at times consulting specific members of the content planning group. Members of the content planning group are mindful of the content and evaluations of both the plenary sessions and the concurrent sessions. The content planning group holds several regular conference calls during the year.

The Conference design offers opportunities for corporate sponsors, some of whom underwrite a morning or afternoon coffee break or the Southern—ham and biscuit—breakfast on Saturday. They often invite groups of their customers for dinner on Friday evening.

For those attendees not being feted by a vendor or publisher on Friday evening, the Conference sponsors group dinners, called Dine-Arounds, at several local restaurants with a sign-up sheet at the information booth. Those dinner groups meet in the Francis Marion lobby and are guided on a walk to their chosen restaurant. Dine-Arounds underscore that sense of community among Conference attendees, which is promoted by its very structure in a city famed for Southern hospitality. In the same spirit of community and friendliness, the Conference feted long-time attendees at its 25th anniversary in 2005 with a booklet featuring the career biographies of 50 individuals from all walks of the information profession who had influenced this Conference's long-term success.

Organizing committee members audit some of the breakout sessions and may report in *Against the Grain*, a publication emanating from the Conference, but not limited to Conference reporting. *Against the Grain* is mailed bimonthly to all Conference registrants for the year following a Conference and is available via www.against-the-grain.com/. For many years, Ramune Kubilius has managed the reports from Charleston Conferences for *Against the Grain*.

LEGACY AND PUBLICATIONS

Papers from the Charleston Conferences have always been considered worthy of publication and sharing. As

noted earlier, several of the papers from the very first Charleston Conference were published in *AB Bookman's Weekly*.

Beginning in 1983, Scott Bullard, editor of *Library Acquisitions: Practice and Theory* published by Pergamon Press, began to publish many of the papers from the Charleston Conferences. *Against the Grain* published the proceedings in 2000 and Greenwood Publishing Group/Libraries Unlimited published the proceedings from 2001 to 2009. In 2009 the Conference entered into an agreement with Purdue University Press to publish the future proceedings. Purdue University Press is also publishing a Charleston Insights monograph series building on important issues and trends from the Conferences. The first Charleston Insights monograph published in 2012 was by copyright guru Lolly N. Gasaway of UNC-Chapel Hill entitled *Copyright Questions and Answers for Information Professionals*. More volumes from the Charleston Insights are in the works.

In 1997, Mario Casalini, President of Casalini Libri in Fiesole, Italy, approached Katina about starting a conference like Charleston in Italy. The Fiesole Collection Development Retreats were begun in April, 1999, and many of the presentations are freely available at <http://libraries.casalini.it/retreat/>.

In 2006, ABC-Clio began the annual Vicky Speck ABC-Clio Leadership Award. Vicky Speck edited many Charleston Conference proceedings with Rosann Bazirjian before her untimely death. Recipients of the Vicky Speck Award to date have been Anthony Watkinson, Jack Montgomery, Beth Bernhardt, Heather Miller, Eleanor Cook, Glenda Alvin, Ramune Kubilius, Leah Hinds, and Tony Horava.

Several companies give scholarships to help attendees defray the cost of attending the Conference. EBSCO, Harrassowitz Verlag, Swets, and IGI Global are among those frequent donors.

VALUES

The Charleston Conference's unique appeal lies in its relatively small size, broad-to-specific mix of presentation topics; close interactions between library-related professionals, scholarly publishers, aggregators, and vendors; no exhibits conflicting with sessions; compact venue; overall aura of informality; and a structure that fosters a "complete immersion" experience.

The Charleston Conference sticks to the set of values that the organizers consider essential to its operation. The atmosphere must be informal and welcoming so that people can say what they think. Allow *humor* and *levity*. Ly said, "many a truth is said in jest." Humor goes a long way to create a lively and friendly atmosphere. The programming must be *flexible*, allowing time for last-minute, timely additions to the program. The structure must be *dynamic* so that changes can be made to the structure of the programming frequently. It is important to *surprise* attendees with

innovative programming. Avoid *groupthink*; peer review is good and necessary, but we all have a tendency to reward/accept what is the conventional wisdom. Acknowledge that new and *good ideas can come from anywhere* and that a library technical assistant or a "low person on the totem pole" can have just as valid an idea or concept as the CEO or Library Dean. When sessions are suggested, evaluate the idea and work with the presenter to make his or her point in a way that will increase its understandability to the audience. *Try not to turn down ideas out of hand*. Remember—*everyone has a good idea*. Take chances with programming, plenary or concurrent. Try what other conferences won't do or can't do. Do not be overly bureaucratic. Be positive and smile at all times. The Conference founder tries to be *impartial*. Remember—"Nothing will ever be attempted if all possible objections must first be overcome" (Samuel Johnson, 1709–1784).

The added charm of the Charleston, South Carolina, setting featuring fine, moderately priced restaurants, obvious and extensive historical significance, and artistic and recreational opportunities plus sheer physical beauty buoys the Conference's appeal and contributes to its success. The vision and vigilant guidance of a single individual, Katina Strauch, aided by a coterie of hard-working assistants, has served to keep the Conference high on the desiderata list of most librarians—both in the United States and international.

THE FUTURE

The Charleston Conference began as an idea nurtured by a group of librarians, publishers, and vendors. It continues to be nurtured by those same categories of individuals who love books, libraries, information, and knowledge. What is certain is that it will continue to evolve. Long may it continue.

Editor's note: Many people have helped with this history of the Charleston Conference. Special thanks are extended to Julie Arnheim, Shirley Davidson, Leah Hinds, and Mike Markwith along with Katina Strauch, Charleston Conference Founder.

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Chartered Institute of Library and Information Professionals (CILIP)

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Abstract

The Chartered Institute of Library and Information Professionals (CILIP) is the leading professional body for librarians, information specialists, and knowledge managers in the United Kingdom. It has members both in the UK and in approximately 100 countries throughout the world. Its members work in all sectors, including business and industry, science and technology, further and higher education, schools, local and central government, the health service, the voluntary sector, national and public libraries. CILIP was formed in April 2002 as a result of the unification of the Library Association (founded in 1877) and the Institute of Information Scientists. CILIP is the only body in the United Kingdom to accredit university courses in library and information studies, and its Royal Charter empowers it to award Chartered professional status to Members who fulfill its professional criteria.

CILIP is governed by a Council and an Executive Board, supported by a number of special Committees, Panels, and Boards. It provides a full range of services to its members, details of which can be found on its web site at <http://www.cilip.org.uk>. In 2008 CILIP included approximately 21,000 members and offered its services to approximately 15,000 people engaged in library and information work who are regular customers of CILIP Enterprises.

INTRODUCTION

The Chartered Institute of Library and Information Professionals (CILIP) is the leading professional body for librarians, information specialists, and knowledge managers in the United Kingdom. It has approximately 21,000 members, both in the United Kingdom and in around 100 countries. Its Members work in all sectors, including business and industry, science and technology, further and higher education, schools, local and central government, the health service, the voluntary sector, national and public libraries. CILIP was formed in April 2002 as a result of the unification of the Library Association and the Institute of Information Scientists.

CILIP's goals are to position the profession at the heart of the information revolution; develop and enhance the role and skills of all its Members; present and champion those skills, together with new ones that will be acquired through continuing professional development; and ensure that individuals, enterprises, and not-for-profit organizations have ready and timely access to the information they need.

CILIP is the only body in the United Kingdom to accredit university courses in library and information studies, and its Royal Charter empowers it to award Chartered professional status to Members who fulfil its professional criteria.

CILIP is governed by a Council and an Executive Board, supported by a number of special Committees, Panels, and

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MISSION

CILIP's mission is to

- Set, maintain, monitor, and promote standards of excellence in the creation, management, exploitation, and sharing of information and knowledge resources.
- Support the principle of equality of access to information, ideas, and works of the imagination, which it affirms is fundamental to a thriving economy, democracy, culture, and civilization.
- Enable its Members to achieve and maintain the highest professional standards in all aspects of delivering an information service, both for the professional and the public good.

GOVERNANCE

All aspects of CILIP's work are governed by its Council, supported by Committees, Panels, and Boards drawn from the Members of CILIP, usually through a process of annual elections. Members can also make their voice heard through the Annual General Meeting when the

annual report and accounts of CILIP are presented for scrutiny by the Membership at large.

In this process of governance and accountability, the Honorary Officers have an important part to play. The President of CILIP is elected annually by the Membership at large with the President, President-Elect, and Past President forming three of the six Honorary Officers. The Honorary Treasurer is also elected by the Membership at large, while the Chairs of Council and of the Executive Board are elected by the Council at the first meeting of the year.

CILIP plays a major role in the formulation of policy and development of service delivery across the library and information domain. To assist with this, CILIP has created a range of Advisory Panels covering specific areas of policy, representing key sectoral interests, and providing a locus for consideration of particular aspects of professional activity.

CILIP is a democratically accountable Membership body, and this process of democratic governance is mirrored by CILIP's Branches and Groups, which also hold elections to their various offices and Committees.

Council, Executive Board, Committees

CILIP's governing body is its Council, composed of representatives of Branches and Groups, a number of Councillors elected nationally, and the Honorary Officers of the organization. CILIP is a registered charity and Councillors are the Trustees of the charity.

The Council meets three or four times every year to decide on major issues of policy and resource allocation, scrutinize the work of its various Committees, and review the Regulations that govern the ways in which CILIP conducts its business. As a Chartered Institute, CILIP has a Royal Charter and associated Byelaws that are subject to approval by the Privy Council. These set a broad framework within which the details of rules and procedures are determined by the Council.

In between meetings of the Council, matters of policy and resource allocation and the overall management of CILIP are dealt with by the Executive Board, which also has responsibility for the organization's equal opportunities' policy and practice. The Executive Board reports to the Council on matters affecting general policy, legal and parliamentary business, on developments proposed in the work of the Institute, and on business not assigned to other Standing Committees, and acts on behalf of the Council, in an executive capacity, in matters of urgency.

In addition, there are three broad areas of Committee work to cover in detail the various activities of CILIP:

1. First, at the heart of any professional body are processes of professional development and standards of professional practice. In this area, the Committee

structure covers activities such as the accreditation of courses in librarianship and information science, the framework of qualifications awarded by CILIP, the code of professional conduct, the work of Branches and Groups, and other matters related to the profession.

2. Second, there are the areas of ethics, discipline, and professional conduct, which are also covered by the Committee structure.
3. Finally, there is CILIP's portfolio of Enterprises, which generates more than half of the income used to fund the organization. To oversee these income-generating activities, CILIP has an Enterprise Board, and also an Editorial Board to advise the Editor of CILIP's monthly professional magazine, *Update*.

CILIP's Committees and subordinate Panels include the following.

Policy Development Committee

To formulate and develop an effective program of Library and Information Services (LIS) policy at the national and international levels and to promote good practice in policy implementation. Its Panels include:

Youth and Schools' Panel: To advise Council, develop policy, and promote good practice in relation to LIS to young people.

Post 16 Learning Panel: To advise Council, develop policy, and promote good practice pertaining to LIS as they relate to Post 16 Learning.

Public Libraries' Panel: To advise Council, develop policy, and promote good practice in relation to the Public Library Service.

Workplace and Information Services' Panel: To advise Council, develop policy, and promote good practice in relation to LIS in the "workplace" sector and in relation to the work of independent information specialists.

International Panel: To oversee the international work of CILIP, including the implementation of its international policy and the conduct of international relations.

Preservation and Conservation Panel: To formulate policy and initiate action on issues of preservation, conservation, security, and heritage whether written, visual, printed, spoken, or electronic.

Freedom of Information Panel: To examine the emerging statutory and regulatory framework relating to access to information in the United Kingdom and Europe and to advise CILIP on how to promote the best interests of the public and users, and how to maximize opportunities for CILIP members and the LIS profession in this area.

Professional Development Committee

To formulate policies, initiate action, and monitor performance in matters relating to the qualifications framework and structure (including Chartered status and all aspects of the scheme for Continuing Professional Development) and to the framework of Course Accreditation. Its Boards include:

Chartership Board: To manage all matters relating to applications for admission to Chartered Membership and Fellowship of CILIP (excluding Honorary Fellowships); to establish and maintain standards for approved training programs, submissions for Chartered Membership, and submissions for Fellowships; to assess training programs designed to fulfil the requirements for admission to the Register; to assess applications for Chartered Membership and make decisions on their acceptability; to assess applications for Fellowship and make decisions on their acceptability; to advise the Professional Development Committee on any matters relating to admission to the Register of Chartered Members, including the regulations governing the award of Chartered Membership and Fellowship; to establish and maintain a program of Continuing Professional Development for Chartered Members; to establish and maintain a program of certification of Affiliate Members.

Accreditation Board: To manage all matters relating to applications for approval of courses for the purpose of admission to the Register; to apply the Procedures for the Accreditation of Courses as approved by Council; to assess courses submitted for approval and make decisions on their acceptability; to conduct such enquiry as may be necessary to determine the suitability of overseas qualifications for approval; to advise the Professional Development Committee on any matters relating to the approval of courses, including the regulations governing their acceptability.

Professional Practice Committee

To formulate policies, initiate action, and monitor performance in matters pertaining to Branches and Groups, issues of ethics and standards including the Code of Professional Conduct, membership recruitment, and in matters relating directly to personal members including membership benefits. Its subordinate panels include:

Ethics Panel: To develop the Code of Conduct and Code of Professional Practice for CILIP and to deal with any matters related to the ethics of the library and information profession.

Membership Recruitment and Retention Panel: To develop and oversee strategies for Member recruitment

and retention including market research into Membership satisfaction and the development of Membership benefits.

CILIP Enterprise Board

To oversee the affairs of CILIP's Enterprises in such a way that professional concerns are supported while achieving maximum income generation. Its subordinate bodies include:

Facet Publishing Advisory Panel: Provides a sounding board and guidance for the publishing team, particularly in relation to the publishing program, ensuring that it is of a high standard and reflects the needs of the information community.

Training and Development Panel: Provides a sounding board and guidance for the development of CILIP's training and development function, ensuring that it reflects the needs of CILIP members and their employers, and the wider information community.

Update Editorial Board: Communicates the views of members to the Editor to ensure that members of CILIP receive a relevant and high-quality magazine, which is in touch with issues of concern and relevance to the profession.

Umbrella Planning Sub-Committee: Works with the Conference Department, to help plan a biennial conference that both reflects the current training needs and interests of members and provides an effective meeting and networking opportunity for all CILIP members.

BRANCHES AND GROUPS

CILIP has 12 branches, one for each of the English regions plus CILIP in Scotland, CILIP Cymru for Wales, and CILIP Ireland. All CILIP Members are automatically assigned to one of the 12 Branches and can choose whether they wish it to be based on their home or work address. All Branches receive a central grant from CILIP to allow them to produce regular newsletters and arrange meetings for their Members.

In addition, CILIP has over 20 special interest groups. Membership of two groups is included in the CILIP subscription, and Members may join others for a nominal fee. CILIP's special interest groups include:

Affiliated Members: A special category of CILIP Membership for paraprofessional and other library and information workers, whose National Committee runs special events and publishes a newsletter.

Branch and Mobile Libraries' Group: For staff working in smaller libraries in all types of public library

service, and particularly those working on or with mobile libraries.

Career Development Group: Encourages Members to involve themselves in all aspects of professional activity and is committed to giving a voice to newer Members of the library and information profession.

Cataloging and Indexing Group: Unites Members engaged or interested in the organization and retrieval of information and in the planning, production, maintenance, and exploitation of library catalogs, bibliographies, and indexes.

Colleges of Further and Higher Education Group: Promotes the role of LIS, and of the profession, in further education, higher education, and sixth form colleges.

Community Services Group: Under the banner “information, equality, opportunity”, the Group promotes equal access for all communities to LIS, and combats disadvantage.

Diversity Group: Newly formed in 2003, the Group promotes and celebrates diversity within the library and information profession.

Education Librarians' Group: Concerned with the provision of library and information services to all involved in education as a profession, or the study of education.

Government Libraries' Group: Represents the professional interests of library and information workers in Government Departments, Agencies, Parliamentary and National LIS.

Health Libraries' Group: Unites all those working or interested in LIS for medical, nursing, and allied health professions, for people with disabilities and health problems, the housebound and those in residential care, and for carers and patients in hospital.

Industrial and Commercial Libraries' Group: Represents library and information workers in a wide range of commercial and industrial workplaces, and those acting as independent consultants. Also includes an Aerospace and Defence Librarians' Sub-Group.

Information Services' Group: Supports Members' interests in the provision of information services by promoting activities that improve the effectiveness of information provision to all sectors of society.

International Library and Information Group: Unites Members worldwide who have a strong interest in international work, fostering good international relations, encouraging closer understanding and contributing to the development of library and information services overseas.

Library and Information History Group: Aims to raise awareness of library and information heritage within and beyond the profession, frequently through activities with an international flavour.

Library and Information Research Group: Promotes the value of information research and links research with practice.

Local Studies' Group: Improves public and professional awareness of local studies' library and information services and the valuable role they play within their community.

Multimedia Information and Technology Group: Aims to unite Members engaged or interested in multimedia information and technology developments within the profession, enabling communication and promotion of professional interests.

Patent and Trade Mark Group: Acts as a collective voice for Members involved in patent and trade mark searching and other related information matters in dealing with Government and other official bodies, both nationally and internationally.

Personnel, Training, and Education Group: Provides a focal point for study and discussion of every aspect of personnel work (including training) relating to staff in library and information services and to professional education.

Prison Libraries' Group: Unites Members concerned with the provision of library and information services to penal establishments and serves as a focus for staff who could otherwise feel isolated owing to the nature of their working environment.

Public Libraries' Group: Concerned with all aspects of public librarianship, including standards, staffing, service delivery and promotion, with Membership open to all interested in the work of public libraries.

Publicity and Public Relations Group: Demonstrates to the library and information profession that continuous and planned public relations is essential in every type of library and information service.

Rare Books' Group: Unites library and information workers responsible for collections of rare books, manuscripts, and special materials with other interested individuals.

Retired Members' Guild: Enables retired library and information workers to keep in touch with each other, participate in activities, and assist CILIP in promoting library and information services.

School Libraries' Group: Promotes school libraries and school library services as being essential to all areas of the curriculum, to enable the exploitation of a wide range of resources, develop pupils' information skills, encourage the reading habit and support equal opportunities and multicultural education.

The UK Online User Group (UKOLUG): Advancing the effective use of electronic information resources. The national user group for online, CD-ROM, and Internet searchers, aiming to act as a user forum and also as a consumer group to represent users' interests within the information industry.

University, College, and Research Group: Concerned with the interests of library and information specialists in national, research, university, and other higher-education libraries, including playing a significant part in continuing professional development.

Youth Libraries' Group: Works independently and with other professional organizations to preserve and influence the provision of quality literature, LIS for children and young people in public libraries, and school library services.

MEMBERSHIP

To make sure that every level of our profession is represented, CILIP offers a number of different categories of membership:

Chartered: Member CLIP (MCLIP)—Chartered Members who have met the standards for admission to the professional register through demonstration of professional competence. Fellow CLIP (FCLIP)—Fellowship is awarded for achievement and contribution to the profession.

Associate: For members who are eligible to Charter (i.e., have undertaken an accredited course or have met work requirements).

Honorary Fellow: For persons who, in the opinion of Council, have rendered distinguished service in promoting the objects of the Institute. Nominations may be made by members, Branches, Groups, or committees and subcommittees of Council.

Student Member: For people in full or part-time education on an accredited course in library and information science in the United Kingdom, and graduate trainees on pre-postgraduate experience.

Affiliated Member: Any person working in a post within a LIS or information service that does not require professional qualifications.

Supporting Member: For people interested in LIS.

Overseas Member: For any person in the above categories but resident overseas.

Institutional Membership: For organizations working in or interested in the library and information field.

Suppliers' Network: For members of the library and information supply industry, to develop a closer dialog and program of joint action.

PROFESSIONAL EDUCATION AND QUALIFICATIONS

CILIP currently accredits undergraduate and postgraduate library and information courses in universities throughout the United Kingdom. Courses accredited range from first degrees to postexperience courses, where candidates are

expected to have previous library and information experience at a professional level. Courses come in all forms—full- and part-time, face-to-face or distance learning—and often in combination with other subjects such as business or health information, art history, or languages. All are regularly reaccredited by CILIP's experts, to ensure that they remain up-to-date, relevant to today's issues, and effectively delivered.

In addition, there are courses leading to para-professional/vocational qualifications that are designed to assess levels of competence in a current job. They are designed to improve practitioners' chances of employment and promotion by honing their skills and helping them demonstrate their commitment to the profession. They provide a combination of practical experience and theoretical knowledge and can help candidates find their first job in library and information work.

Chartered Membership

Chartered Membership is the first level of professional qualification awarded by CILIP. Most Members gain Chartered Membership 2 or 3 yr after graduating. It is open to any Member who fulfils the requirements of the Byelaws and complies with the regulations laid down by Council. These include holding academic qualifications in librarianship and information management that are approved by CILIP, having been in Membership for a minimum of 1 yr and having had a period of practical professional experience on which to base an application for Chartered Membership.

The award of Chartered Membership is based on evidence of continuing professional development in practice and on the ability to learn from experience. It is not a re-examination of the theoretical knowledge acquired on an information studies' course. Candidates seek to demonstrate how that knowledge has been applied and what has been learned as an outcome of that application. Gaining Chartered Membership provides concrete evidence of professional development and progression since the completion of academic studies.

Application for Chartered Membership is made through submission of a two-part application. The first part is a form on which candidates must provide information about the knowledge and skills they have developed since gaining their information studies qualification. The second part is a portfolio of evidence of continuing professional development. There are two routes to Chartered Membership. One requires completion of a period of supervised training, the other a period of self-directed continuing professional development.

1. Route A: One-year full-time equivalent work experience following a CILIP-approved training and development program supervised by a Chartered Member. Qualifications required: CILIP accredited degree.

2. Route B: Two-year full-time equivalent work experience without direct supervision following a Personal Development Plan. Qualifications required: CILIP accredited or other approved qualification.

The achievement carries with it the right to the designation Chartered Member of the Chartered Institute of Library and Information Professionals and the right to the use of the postnominal letters MCLIP.

Fellowship

Fellowship is the highest professional qualification available to Members of the Chartered Institute of Library and Information Professionals. It is open to any Corporate Member who has been on the Register and in professional practice for at least 5 yr. full-time or its equivalent. Professional practice includes any aspect of librarianship of information work. Fellowship signifies that a Chartered Member has developed the potential identified by that award and has applied an increasing level of professionalism both through personal professional practice and the contribution made to the profession at large.

Candidates for Fellowship have to demonstrate that they have built on the potential identified by the award of Chartered Membership, through developing the ability to carry out demanding tasks and handle complex professional issues and by making a contribution to all or part of the profession. At this level, the selection of material for submission is of considerable significance. Work presented for the award of Fellowship will almost invariably contain an element of originality, demonstrating intellectual and professional development.

Occasionally, a Member who has not become a Chartered Member may be allowed to make an application for direct admission to Fellowship. Such a candidate must demonstrate that the level required for Chartered Membership has been achieved by some other means (for example, by an equivalent qualification gained in another country).

The achievement carries with it the right to the designation Chartered Fellow of the Chartered Institute of Library and Information Professionals and the right to the use of the postnominal letters FCLIP.

Framework of Qualifications

The CILIP Corporate Plan 2002–2005 stated that CILIP must

provide Members with the means to ensure that their expertise is recognised by the wider community, and to enable them to extend that expertise, so that they can remain abreast of new developments and compete effectively in the employment marketplace. It can do this by ensuring that CILIP's framework of academic and professional qualifications remain rigorous and credible, by

providing new forms of access that recognise paraprofessional roles and nonconventional routes to qualification . . .

Consequently, CILIP has been developing a new Framework of Qualifications, which it is committed to implementing by March 2005. The Framework is based on research and analysis of the skills and competences needed by staff working in LIS in the 21st century, and it will allow for multientry points and progression routes, catering for differing portfolios of experience and qualifications.

The Qualifications Framework introduces a Certification Scheme for Affiliated Members and a Revalidation Scheme for Chartered Members. The Corporate Plan also articulates the need for CILIP's current Body of Professional Knowledge to be reviewed and updated. Following discussion within both the Accreditation and Chartership Boards, and the Skills and Competencies Steering Group (now called the Framework of Qualifications Steering Group), it was agreed that this work would be undertaken in several stages.

A think tank of representatives of the sector has been meeting to undertake a preliminary investigation. This will be developed and refined through further consultation and debate among a wider stakeholder group, including representatives from outside the library and information sector. The work has been undertaken by a joint working group, under the direction of CILIP's Chartership and Accreditation Boards. The final document will provide a crucial underpinning to the work of designing and developing new Regulations for Chartered Membership, including Fellowship, and also to the review of the Accreditation procedures for assessing programs of academic study in the discipline.

Additionally, CILIP is taking forward various initiatives to support work on its Equalities agenda; this includes investigation of a bursary scheme information and library staff from minority ethnic groups to enable study for professional and paraprofessional qualifications.

Overseas Qualifications

CILIP has a reciprocal agreement with The American Library Association and The Australian Library Association, which means that academic qualifications accredited by those bodies are recognized in the United Kingdom. This allows graduates holding American or Australian bachelor's and master's degrees in library and information studies to apply for posts asking for qualified librarians and information professionals in the United Kingdom.

Qualifications from European Union member states are also recognized in the United Kingdom, provided they have been assessed as being at the degree level or its equivalent.

Other qualifications are individually checked and inquirers should contact the Qualifications section at CILIP.

All inquirers whose qualifications are accepted by CILIP are eligible to register to Charter with CILIP.

ETHICAL PRINCIPLES AND CODE OF PROFESSIONAL PRACTICE

CILIP has drawn up guidelines to provide a framework to help library and information professionals, who are Members of CILIP, to manage the responsibilities and sensitivities that figure prominently in their work. There is a statement of Ethical Principles and a more extended Code of Professional Practice, which applies these principles to the different groups and professionals to which its Members must relate. The Code also makes some additional points with regard to professional behavior. Given the diversity of the information profession, it is inevitable that not every statement in the Code of Professional Practice will be equally applicable to every Member of CILIP. However, the Ethical Principles ought to command more general support, even though some Members may not feel the force of each one of them to the same extent in their day-to-day experience. The Principles and Code assume that respect for duly enacted and duly enforced law is a fundamental responsibility for everybody. However, the Principles and Code may provide additional guidance where there appears to be a conflict of responsibilities.

By the terms of its Royal Charter, CILIP has a responsibility to “the public good.” It is therefore anticipated that its Ethical Principles and Code of Professional Practice may be of interest well beyond the immediate limits of the Membership of CILIP, both to those whose work bears close comparison with that of CILIP Members and to those who may, from time to time, want a clear statement of our ethical principles and what we consider to be good professional practice.

Associated with these Principles and Code, there is a growing collection of practical examples, illustrating how information professionals and others can use the Principles and Code to help them cope with the ethical dilemmas they may face. In further support of the Principles and Code, CILIP has established an Ethics Panel of experienced members of the profession, and they and the professional staff of CILIP are available to Members who may need additional help in resolving ethical issues. In those instances where there appears to have been a significant breach of the Code of Professional Practice, this may be a matter for the CILIP Disciplinary Committee. According to the Regulations, the Disciplinary Committee is required to have regard to the Code of Professional Conduct in its work.

SERVICES TO MEMBERS AND OTHERS

CILIP provides a comprehensive range of services to its Members, with the overall aim of helping them remain

both informed and employable. In addition, CILIP Enterprises, the Institute’s revenue generating arm, provides services to all who require them, usually with discounts for CILIP Members. Further details of all these services can be found on CILIP’s website—<http://www.cilip.org.uk>.

CILIP’s direct services to Members include:

Qualifications and Professional Development

- Assessment and accreditation of undergraduate and postgraduate university courses in information and library studies.
- Advice on academic study and professional qualifications in library and information work.
- Chartership—full support from expert CILIP staff throughout the process of becoming professionally qualified.

Information and Advice

- Dedicated enquiry service for members’ personal queries—including free searching of selected commercial databases.
- CILIP *Daily News*, *Weekly Information World*, and *International News Bulletin*—member-only e-mail news and current awareness services, delivered direct to CILIP Members’ desktops (on-line sign-up required).
- Confidential one-to-one advice and guidance on professional issues and personal development.

News and Comment

- *Library & Information Update*—CILIP’s monthly magazine, including in-depth coverage of professional and industry news and features (also available separately on subscription).
- *Library & Information Gazette*—CILIP’s fortnightly tabloid newspaper with Institute-related news, views, comment, and approximately 12 pages of jobs (available to CILIP members only).

Networking and Further Support

- Free membership of the appropriate regional CILIP Branch and two special interest groups (further groups can be joined at nominal charge).
- Exclusive use of CILIP’s Information Centre, which includes a library, e-mail and Internet facilities, meeting area, and Members’ lounge (available to guests when accompanied by a CILIP Member).
- Libex International Library and Information Job Exchange—Clearinghouse for U.K. CILIP members interested in arranging job exchanges with library and information professionals in other countries.

- Discounts on other CILIP products and services listed below, plus a growing range of exclusive bonus benefits—details are available at <http://www.cilip.org.uk>.

Details of all other services available from CILIP (usually available to nonmembers for a charge and to Members at a discount) are also given on its website, <http://www.cilip.org.uk>. Services include:

Library and Information Update (including Buyers' Guide supplement)

- *Library and Information Update*—A monthly magazine with in-depth articles and news on current library and information issues, supplied automatically to Members and available to others on subscription.
- *Update Buyers' Guide*—Quarterly supplement to *Library and Information Update* listing library and information service suppliers' products and services. Also available on-line.

LIS Jobnet

- On-line summary of currently available jobs on offer, available through the CILIP website (details also mailed exclusively to CILIP members in *Library & Information Gazette*).

Facet Publishing

- CILIP's own publishing house, widely regarded as the best source of quality, timely, and useful books for library and information professionals worldwide. Details of available titles and sample chapters are accessible via the CILIP web site, and CILIP Members enjoy a 20% discount on all titles.

INFOmatch

- CILIP's in-house recruitment consultancy, offering services to recruiters, and jobseekers. Covers permanent, temporary, and contract employment. Infomatch services are open to all, but the consultancy also offers special job search advice services to CILIP members.

CILIP Training and Development

- Comprehensive program of training workshops and executive briefings, provided both in-house and on-site. Sessions are usually open to all, but CILIP Members enjoy discounts of up to 30% on course fees.

CILIP Conferences

- CILIP's in-house conference management service, creating tailor-made events for CILIP organizations and outside clients.

CILIP Consultancy Services

- Specialist library and information consultancy with a track record in a wide range of projects and disciplines.

CONCLUSIONS

Vesting Day on April 1, 2002 saw the birth of CILIP, but the new organization will not be fully grown for some time after this. An action plan was mapped out for the transitional period to December 2004 during which a number of important elements of the new organization were being put in place:

- A new structure of qualifications.
- New arrangements for regional Branches in England.
- A new code of conduct and ethics.
- New arrangements for Special Interest Groups.
- A new subscription framework.
- A new web site.

For some time, CILIP will continue to be a "work in progress"—in consultation with the Membership—while at the same time providing a full range of products and services for CILIP Members and the wider library and information community. For up-to-date information on CILIP and its activities, readers are advised to revisit its website regularly—<http://www.cilip.org.uk>.

Chemistry Literature and Its Users *[ELIS Classic]*

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Abstract

The chemical literature is large and varied, crossing many other scientific disciplines. It includes review sources, which summarize past work done in a particular field and are excellent background reading; primary literature, such as research articles in journals; indices and abstracts, which help one to find review and primary documents; catalogs for books, chemicals, and equipment; and handbooks, which present values for physical and chemical properties and the references that report them. There are many nonkeyword access points to all of the various types of literature. Names, formulae, structures, sequences, and other unique identifiers help chemists to locate compounds, while substructure, reaction, and sequence searching are powerful tools for finding structurally similar substances and their reactivity.

INTRODUCTION TO CHEMISTRY AND THE CHEMICAL LITERATURE

Chemistry has been described as “the central science,” in part because it has close links to all other sciences. Mathematics is used to describe some physical phenomena, and a basic knowledge of physics is necessary to understand how chemicals behave and why reactions occur. Chemistry takes place in biological systems, fuels transportation devices, and produces cleaning products, medicines, and personal adornments, such as cosmetics and jewelry. Anyone who has baked a cake, lit a candle, or thrown salt on a driveway to melt ice in the winter has set a chemical process in motion.

Chemistry has traditionally been broken into five subdisciplines: organic chemistry, inorganic chemistry, physical chemistry, biological chemistry, and analytical chemistry. Organic chemists are concerned with the synthesis, reactions, and properties of compounds containing carbon. Inorganic chemistry is a vast field; some of the many substances studied by inorganic chemists are elements, compounds or salts containing no carbon, alloys, glasses, ceramics, and substances that combine metals with organic molecules (coordination compounds). Physical chemists study the underlying physical processes involved in chemical behavior, while biochemists look at the chemistry that occurs in biological systems. Analytical chemistry is used, to some extent, by all of the above groups; it involves the characterization of chemical substances and the study of the structure of matter. Although undergraduate-level chemistry still tends to be divided along these lines, chemical research is becoming increasingly interdisciplinary, such that other subcategories and “overlap categories” (theoretical chemistry, medicinal chemistry, polymer chemistry, organometallic chemistry, environmental chemistry, nanochemistry, energy research, etc.) are becoming the norm, rather than exceptions.

Researchers in each subdiscipline ask different types of questions and seek different kinds of information, but all have certain things in common. They are all concerned with chemical substances or processes, whether they perform reactions using them in the lab or model them on a computer. In order to locate information successfully, chemists must understand the structure of the chemical literature, be familiar with its unique access points, and make use of specialized search techniques.

STRUCTURE OF THE CHEMICAL LITERATURE

Primary Literature

Like the literature of most disciplines, the chemical literature is divided into two basic categories, primary and secondary sources. As a general rule, primary sources contain the results of original research, as well as experimental procedures. Since chemists are constantly seeking to build on the work of others without reproducing it from scratch, they are avid readers. Bench chemists, or chemists who work with chemicals in a laboratory, rely on the primary literature to get recipes and instructions for running reactions, and all experimental and theoretical chemists read to stay up-to-date with recent advances in their fields. Commonly used primary documents include: journal articles that describe new research, monographs that consist of collections of original articles, patents, governmental and industrial technical reports, preprints, and some Web sites. Chemists also share information about their research at conferences; however, these meetings do not always result in published conference proceedings. For example, the largest chemistry meetings, the American Chemical Society National Meetings, publish abstracts for talks or posters but have no formal conference proceedings. In recent years, the American Chemical Society

has begun recording and making available online a subset of the talks presented at the meetings, and individual divisions of the society might publish their papers presented at the meetings in serial publications or as *ACS Symposium Series* volumes. Researchers looking for more detailed information from a paper or poster presented at a meeting for which conference proceedings are not available can always try contacting the author directly to get a copy of the material.

Journal articles

The bulk of the primary literature in chemistry is published either as journal articles in peer-reviewed publications or as patents. Academic chemists try to publish in prominent journals with high impact factors or that are central publications in their fields. They tend to publish two different kinds of primary articles describing their research: communications, or letters, which are short pieces intended rapidly to introduce important findings, and articles, which are longer pieces that present more details than communications. Chemists turn to the journal literature for general or specific instructions for a particular reaction, programming code for a simulation, methods of preparing substances, etc. They can use a variety of secondary sources to identify research articles of interest in the journal literature, many of which are discussed later in this entry.

Patents

Not all important chemical research, however, is published in the journal literature. Chemistry is not only an academic discipline; it also has a strong industrial sector. While chemists at companies with large research and development groups do publish in the journal literature, important advances by companies are more frequently *patented*. This gives the company the right to exclude others from using the patented invention for the term of the patent, which is, for example, 20 years in the United States. Patents will only protect the invention in the countries in which they are filed; therefore, if a chemist wants her invention protected in the United States, China, and Japan, she must file her patent with the patent offices in each of these countries. There are several overarching intellectual property organizations, including the European Patent Office, a regional patent office whose patents protect inventions in most European countries, and the World Intellectual Property Organization (WIPO), which administers the Patent Cooperation Treaty (PCT). This treaty allows an inventor to file a single patent application with WIPO and use it to apply for protection within any member country.^[1] Patents for the same invention filed in different countries constitute a *patent family* and contain roughly the same information. Therefore, if a scientist locates a useful patent in a language that he does not read,

it can be helpful to search for that patent's family and see if it contains an "equivalent" patent in a known language.

Chemists file utility patents that protect substances themselves (drugs, agricultural agents, polymers, etc.), methods of producing substances, and scientific instruments or equipment. Within the patent, the scientist must prove that the invention described is novel, useful, and nonobvious. He or she must also present instructions so that someone skilled in the art would be able to reproduce the results. Therefore, in addition to being legal documents, patents are very important scientific documents, presenting the same kinds of recipes and instructions that the journal articles do. It is important to note that a large percentage of the chemistry published in the patent literature is not published in any other place, and so it is wise to consider searching both patents and journal articles when performing an exhaustive search on a subject. Chemists can identify useful patents using the search features on the individual patent offices' Web sites,^[2,3] or by using proprietary resources like the Derwent World Patents' Index, available through the Derwent Innovations Index, or CAS's SciFinder product.^[4]

Publication of primary data

In the early 2010s, many government funding agencies began requiring grant awardees to make the products of their research freely available to any who wanted to benefit from them. Initially, their attention focused on open access journal articles, but this was quickly followed by open data. At the time of this writing, many U.S. government agencies require chemists to include in their grant proposals a *data management plan* describing how data resulting from the project will be preserved and made accessible to other researchers. Whenever possible, the chemists are being asked to make their data available through open access repositories, either at their home institutions or through external entities like FigShare.^[5] Chemists may also choose to deposit data in domain data repositories, such as the Protein Databank and the Cambridge Crystallographic Data Centre, which are discussed further later in this entry. The purpose of this requirement is to allow other scientists to use and benefit from the data gathered from publicly funded projects. Many data repositories supply the data sets with digital object identifiers (DOIs), which others can use to cite the data in their work. Calriviate Analytics tracks citations to data using the Data Citation Index, and this activity may encourage chemists to take citations to data, as well as to articles, into account when evaluating academics for promotion and tenure, although it is still too early to tell.

Secondary Literature

Secondary sources do not directly report research results; instead, they serve as a "key" to the primary literature, and

chemists use them to locate the original research that they require. They can be divided into four further categories. *Review sources* and *handbooks* are edited by experts in the field and aim to supply the most reliable information in their areas. Chemical information professionals occasionally refer to these two categories of literature as the “tertiary literature” to distinguish them from the other two categories, *indexing and abstracting services* and *catalogs*, which are much less judgmental. These resources allow researchers to locate primary documents on a subject of interest but offer little indication of the quality of the information retrieved.

When approaching a new project, a chemist will usually seek background information on the subject, in order to hone the idea and determine which experiments or models to use. A piece of review literature generally serves as an excellent introduction to a subject; an experienced scientist has summarized the literature written in this area and provided an extensive bibliography of primary documents and additional reviews. Once the chemist enters the lab, he or she tends to rely on the primary literature, located using appropriate indexing and abstracting sources, as well as catalogs, to find procedures, suggestions, and even substances or equipment that help to move a project from stage to stage. Handbooks can be invaluable sources of quick information and, most importantly, properties and reactions of compounds. In fact, when searching for properties, it is always best to start with a handbook, which will include both the value of the property and the primary literature reference in which it was reported. The following sections more completely describe each type of secondary or tertiary resource and introduce some of the most important sources of each type.

Review Sources

Review sources in chemistry can be divided into three basic categories: encyclopedias, treatises, and review articles in journals. All are helpful to a scientist attempting to find general or background information on a subject of interest. Of the three categories, encyclopedias tend to treat the most general subjects, while the topics of review articles can be extremely specialized. The problem with review sources, as a category of information, is that they are out-of-date as soon as they are published. Therefore, it is very important to pay attention to the publication date of the source and to supplement an older review with searches of the recent primary literature.

Encyclopedias

Encyclopedias are usually multivolume sets that deal with a fairly broad subject. Some examples of chemistry encyclopedias include the *Encyclopedia of Analytical Chemistry*,^[6] the *Encyclopedia of Chemical Physics and Physical*

Chemistry,^[7] the *Encyclopedia of Inorganic Chemistry*,^[8] the *Encyclopedia of Inorganic and Bioinorganic Chemistry*,^[9] and the *Encyclopedia of Reagents for Organic Synthesis* (EROS).^[10,11] Encyclopedias serve a dual purpose; a scientist can get an overview of a very broad subject by reading large sections at a time, or he or she can pick up quick information and definitions by using the indices and tables of contents. For example, EROS has in-depth articles about various reagents used to synthesize organic molecules. However, using the online edition, a chemist can search for a particular transformation and be taken directly to the point of the article at which this transformation is discussed. Encyclopedias in the field of chemistry are published in both print and electronic formats, with parity between the two formats becoming increasingly rare. It is a monumental undertaking to publish a complete, new edition of an encyclopedia, meaning that they get updated in their entirety rather infrequently. Leveraging the speed of Web-based publishing, publishers can update articles as needed, and many have begun selling “annual updates” to customers who choose to purchase an electronic encyclopedia outright rather than licensing it through an annual subscription. Electronic editions of encyclopedias tend to be much more expensive than their print counterparts.

One of the most important encyclopedias in any area of chemistry is the *Kirk-Othmer Encyclopedia of Chemical Technology*,^[12,13] which is a great starting point in a search for information on a broad or general area of chemistry or chemical engineering. Many articles are about commonly used chemicals and classes of substance and contain information about their production, physical and chemical properties, biological activity, and natural occurrence. Because of *Kirk-Othmer*’s emphasis on chemical technology, many of the articles dealing with chemicals also include information on economic aspects, industrial uses, and safety or hazards associated with the chemical, the first of which can be extremely difficult to find elsewhere.^[13] In addition to pieces about chemicals, *Kirk-Othmer* also contains articles describing chemical processes and pathways, techniques, and instrumentation. It is available in two formats; the fifth print edition, consisting of 26 volumes, began publication in 2004 and was completed in 2007. It is organized alphabetically by concept, with subject and contributor indices. The electronic edition, which contains the same information as the print, can be browsed alphabetically by article title or searched by keywords in any field of the record. It has options that allow the user to search a specific field of the record or limit to articles in a specific subject area or written during a particular time period.

Treatises and review articles

Treatises can range from enormous, multivolume sets, such as *Organic Syntheses*^[14] and *Methods in*

Enzymology,^[15] to short monographs on a subject, like the books in the Oxford University Press *Practical Approach* series. All are written or edited by experts in the field of the volume, and all provide the reader with information that is slightly more specific than that found in an encyclopedia but is still general enough to be understood by someone new to the area. The print editions of the larger sets, including *Comprehensive Organic Functional Group Transformations 1* and *2*^[16,17] and *Comprehensive Organometallic Chemistry 1, 2, and 3*,^[18–20] tend to be kept in library reference collections, although many libraries are now purchasing these types of tools in electronic format, due to the superior searchability and ease of access of that format. As with encyclopedias, the electronic editions tend to be much more expensive than print editions. Comprehensive sets are updated regularly but infrequently, with each updated edition picking up the review of the literature where the previous one stopped. The topics of the sets tend to be fairly broad, and the individual volumes frequently deal with a single subject or a set of subjects in a reasonable amount of detail.

One of the most impressive treatises is the enormous *Houben-Weyl Methoden der Organischen Chemie*, or *Houben-Weyl Methods of Organic Chemistry*, published by Georg Thieme Verlag.^[21] This resource aims to present a comprehensive set of methods of synthesizing compounds and classes of compounds. The first edition was created in 1909, by Theodor Weyl, and it reviews literature dating back as far as 1834.^[22] The current series consists of 183 volumes. In 2000, Thieme decided to extend and update Houben-Weyl with a 48-volume series called *Science of Synthesis*,^[23] released almost simultaneously in print and database format between 2000 and 2008. Mindful of the datedness of review-type publications, Thieme began releasing periodic “Knowledge Updates” to the original 48-volume set; these volumes are aimed at updating information encapsulated in the original set and adding topics not originally included. *Science of Synthesis* can be searched online via its native interface, but articles from it and from its parent series are also referenced in *Chemical Abstracts*, making it easy for chemists to be drawn to information of interest. The online edition features the ability to search by structure or reaction for molecular transformations, as well as detailed text search capabilities. The previous volumes of *Houben-Weyl* are also available online through the *Science of Synthesis* interface, although the search features are not as advanced.

For background information on a more specific subject, chemists tend to turn to books in their library collections. Chemistry books appear in both print and electronic formats, and, at the time of this writing, libraries tend to select one or the other on a case-by-case basis. Chemistry e-books are sold either as individual items or as part of e-book packages, and some publishers allow libraries to pick the purchase option that they prefer, while others use

a single option. Libraries choosing an e-book package get access to all books published that year in the chosen subject area. Some monographs have records in *Chemical Abstracts*, but most can be more efficiently located through a search of the local library catalog, a union catalog, such as OCLC’s WorldCat,^[24] or an e-book aggregator or publisher platform. Monographs can also be discovered by word of mouth, and scientists will frequently recommend books to one another. Many chemistry books are described as “textbooks,” as opposed to “books of original articles”; some of them are actually textbooks, in the traditional sense of the word, but many are simply treatises written by a single author, which provide excellent background information.

The most specific type of review literature is the review article, found either in journals or in books of original articles. Review articles in journals are submitted and undergo the same peer review process as experimental articles. They can be submitted either to journals that publish only review articles, such as *Chemical Reviews*, or journals that publish all kinds of scholarly articles, such as *Science*. Scientists can identify review articles on a subject of interest using indexing and abstracting services, all of which include an option to limit document or treatment types to review articles. The reviews in books do not always undergo as strenuous a review process as those in journals, but they have been requested and edited by the volume editor. It can be more difficult to locate these, as book indexing in indexing and abstracting services is not always consistent or detailed. However, most recent library catalog records include table of contents information in their notes fields; so, a keyword search across all fields in a local catalog will frequently locate books containing an article of interest.

Indexing and Abstracting Services

Indexing and abstracting services in chemistry are not fundamentally different from their counterparts in other disciplines, although they frequently have access points that are unique to chemistry. The most comprehensive index to the literature of chemistry is the gargantuan *Chemical Abstracts*,^[25] produced by Chemical Abstracts Service (CAS), a division of the American Chemical Society. This resource covers all areas of chemistry and currently indexes chemistry articles from thousands of scholarly journals, as well as books, book chapters, patents from 63 different patent-issuing authorities, dissertations, reports, preprints, and Web sites.^[26] The *Web of Science*^[27] provides access to both topical information and citation data for all areas of science and technology, including chemistry. In addition to *Chemical Abstracts* and the *Web of Science*, researchers in specific chemical disciplines use other indexing and abstracting services, as well. Physical chemists may use *Inspec*,^[28] which indexes over 3500 journals in the areas of physics and electronics

and contains information dating back to 1896.^[29] Biochemists prefer information from *PubMed* or *MEDLINE*^[30] and other resources from the *National Center for Biotechnology Information (NCBI)*^[31]; and some inorganic and materials chemists find useful references with the electronic version of *Engineering Index*, *El Compendex*, which dates back to 1884 and contains information on all engineering disciplines.^[32]

Chemical Abstracts

No discussion of the chemical literature would be complete without a look into *Chemical Abstracts*, one of the world's largest indexing and abstracting publications. *Chemical Abstracts* began publication in 1907. Prior to its inception, several other sources, including *Comptes Rendus*, *Bulletin de la Société Chimique de France*, *Index Medicus*, *Engineering Index*, and *Chemisches Zentralblatt*, provided abstracts of American and international chemical literature; American chemistry was highlighted in the *Review of American Chemical Research*, *Chemical Abstracts'* direct precursor, which began publication in 1895 and became a part of the *Journal of the American Chemical Society* two years later.^[33] For a long time, *Chemical Abstracts* relied on volunteer abstractors to write abstracts for journal articles; currently, they take author abstracts and enhance them, making them more informative and easily searchable. Like many other indexing and abstracting services, *Chemical Abstracts* uses a thesaurus of index terms, as well as supplemental, descriptive terms. Its print indices included the Author Index, General Subject Index, Formula Index, Chemical Substance Index, Patent Index, and Ring Index, as well as the Index Guide, which provides searchers with supplemental terms on which to search, and the Registry Handbook, which lists CAS Registry Numbers[®] of newly published substances and substance names.

Chemical Abstracts is currently accessible online via the STN or SciFinder^[4] interfaces. Information professionals in companies and the government prefer the command-line driven STN interface, which allows for superior query generation and great specificity of search options. End user chemists and most academic librarians use the more "intuitive" SciFinder interface, which seamlessly links the CAS Registry database with the Chemical Abstracts and MEDLINE abstract databases, as well as a reaction database called CASREACT. Therefore, a researcher can perform a search for a compound in the Registry, click a single button to get all references that contain preparations of that compound, and then click another button to be taken to all reactions that appear in those references. In addition to these four main databases, SciFinder also incorporates a commercial availability source called CHEMCATS and a regulated chemicals listing called CHEMLIST. These are linked from the compound listings in the Registry, although they can be

accessed by clicking on a chemical structure or CAS Registry Number (see pp. 37–38) from any database in the system.

Chemical Abstracts is most chemists' first stop for information since its literature coverage is so extensive and it handles compounds and reactions better than any other article database. SciFinder was one of the first of the major science and engineering resources to introduce the analyze feature, allowing users to get some "demo-graphics" of a large answer set, such as publication years, prolific authors and institutions, or substances used in the papers; this feature is now standard in many resources, but it still offers chemists the ability to easily refine their queries.

Web of Science

The Web of Science, available from Clarivate Analytics, is a unique database. Its core collection indexes scientific journal literature from over 12,000 sources.^[34] The original electronic database dates back to 1945, but the previous owners, Thompson-Reuters, expanded this coverage with a supplemental back file extending back to 1900. The Web of Science allows topic, author, and institution searching, with a wide range of refinements available. A topic search of the database searches the titles of articles, their abstracts, when available, and author- and indexer-generated keywords. Results can be analyzed according to any category in the articles' records, refined by keyword or other limits, and exported into a usable format for the scientist.

The true power of the Web of Science, however, lies in its ability to perform cited reference searches. While many databases and search systems, such as SciFinder, can link from an article to those that cited it for a limited portion of their coverage, the Web of Science lets users perform a true cited reference search across the entire breadth of the database.^[35] Although each Web of Science record links directly to the articles that cite it correctly, the most comprehensive way of searching for citing references in Web of Science is to use the cited reference search interface. Authors will frequently make mistakes in their bibliographies: citing an incorrect volume number, making a typing error in the page number, inverting the issue number and page numbers, etc. A cited reference search will retrieve all of these variants and allow the user to select those that he or she thinks refer to the original document. By entering the name of the first author, the standard Web of Science abbreviation for the journal title, and the year of publication, the user retrieves a list of documents that match these three criteria. From this list, users can easily see the correct variant (it links to the Web of Science record for the article itself) and can select the other variants that they think actually cite the article of interest.

Another advantage to the Web of Science is the many options that it offers for citation analysis. A researcher can

generate a citation report on any list of results generated through Web of Science searching. While the most common use of the citation report is to determine an author's h-index, one can also look at the citation metrics for a cluster of articles on a topic or published by a journal. The core collection also links to the *Journal Citation Reports (JCR)*,^[36] so, researchers can immediately view basic impact metrics for any article in a result set and can link across to the full JCR in order to view more journal metrics and compare the title with others.

Chemists use citation searching in a very similar manner to other scientists. It is frequently employed by tenure and promotion committees to demonstrate the impact that the scientist has had on his or her field of science. This is frequently done by generating a citation report for that author's publications to locate his or her h-index or by examining the Impact Factors of the journals in which he or she has published. However, it can also be used in more creative ways. If a chemist is having difficulty with a literature search, it can be helpful to perform a cited reference search on one article that is highly relevant to the matter at hand. This will indicate the uses that other researchers have made of that information and can yield some results that a simple keyword search might miss. In addition, the multidisciplinary nature of the resource allows a user to see the applications of chemistry research in other areas of study.

Inspec and Compendex

Inspec's topics lie in the areas of physics, physical chemistry, and electrical and computer engineering, as well as some information science. As a result, it can be quite helpful for chemists examining the physical aspects of a project. One particular boon for chemists using this service is the chemical indexing field, which was first added to the Inspec data structure in 1987.^[37] The chemical indexing claims that it does not include organic compounds, although small molecules like methane and ethane can actually be located, as can fullerenes, which are large, spherical "organic" molecules. The structure of "formulae" in the database is truly unique, and users should refer to the help files for exact formatting. However, in addition to having the chemical's formula, it also includes a list of every element that makes up the chemical or system. Formulae and elements are tagged with indicators of their roles in the paper, which include element, binary, system, adsorbate, and surface. The last two roles make the database very useful for physical chemists interested in systems in which a small molecule or atom interacts with a surface. For these reasons, Inspec is probably the most "chemical friendly" of the databases whose primary focus is not chemistry.

Compendex, which is primarily *Engineering Index* online, employs more traditional keyword searching, supplemented by author and controlled vocabulary

indices. It is strong in materials science; it has good coverage in the areas of nanochemistry and materials chemistry, both organic and inorganic; and it also contains useful information for polymer scientists, fuels chemists, and energy researchers. It does not have any specific chemical search capabilities and thus is most frequently recommended for research topic or author name queries that overlap its fields of study.

MEDLINE, the NCBI resources, and the Protein Data Bank

The information in the National Library of Medicine's (NLM) MEDLINE database currently dates back to approximately 1946 and is devoted to all areas of medicine, including clinical medicine, nursing, medicinal chemistry, biochemistry, and pharmaceuticals. The NLM provides the MEDLINE database free of charge through an interface called PubMed, and it is also available via many different vendors' platforms including CAS's SciFinder and through the Web of Science.

MEDLINE is obviously of great use to biochemists, particularly those interested in studying the chemistry of biological systems or drug development, and many such scientists will turn to PubMed before searching in any other resources. MEDLINE, like *Chemical Abstracts*, is thesaurus driven, and the Medical Subject Headings (MeSH) thesaurus can be viewed online. Many of the subject headings are accompanied by subheadings or aspects, which can be searched on their own; some of the ones that are most useful to chemists are "chemistry," "biochemistry," "isolation and purification," and other similar terms. CAS Registry Numbers were added to MEDLINE records in 1985, and a search in this field will retrieve information written since that date. However, the CAS Registry Number and substance indexing in MEDLINE is not nearly as exhaustive as that in *Chemical Abstracts*.

The other NCBI resources are mainly used by biochemists and molecular biologists. The tools are organized on the NCBI Web site^[31] according to the type of information that they search, including Chemicals & Bioassays, DNA & RNA, Domains & Structures, Proteins, and Literature, and they represent an interesting mix of secondary search tools and deposition databases for experimental data. The literature database PubMed is a true indexing and abstracting service, incorporating MEDLINE records, as well as non-MEDLINE articles that come from MEDLINE-indexed journals, while the other resources are varied and include deposition and curated databases of substances, sequences, gene information, and diseases. Some examples of molecular and substance databases offered through NCBI are Nucleotide, Protein, Structure, Gene, Genome, and PubChem. These sequence data, three-dimensional structures, entire genomes, and small molecules deposited by scientists, as well as references to

these entities in the literature. Additionally, some of the databases, such as Gene, contain summary information prepared by curators to supplement data deposited by submitters, as well as links to additional information resources. The NCBI resources all link seamlessly to one another and to PubMed, making it easy for a searcher to move from one to another. For example, with a few clicks, a researcher can search for articles dealing with a genetic disease, learn about the gene that controls it, link to nucleotides connected to that gene, and end with the three-dimensional structures of the proteins coded by those nucleotides.

Catalogs

Chemists use several different types of catalogs as they search for information. Library catalogs are extremely valuable for determining the holdings of a local library, as well as for locating treatises and review sources. Union catalogs, like WorldCat,^[24,38] can assist chemists who want to examine a broader spectrum of books and periodicals. Most searching in catalogs parallels that done in other disciplines; researchers use title and author searches to locate known items and use keyword searches, as well as the occasional subject heading search, to find items on a topic of interest.

In addition to catalogs of books, however, chemists require other types of catalogs. Since bench chemists are performing reactions and studying substances, they need to purchase chemicals and equipment in order to do their research. There are several popular chemical catalogs, including CHEMCATS, available via links from the Registry file in SciFinder; the Aldrich, Sigma, and Fluka catalogs, which can be obtained by request from the companies or accessed online through their combined catalog^[39]; *ChemSources USA*^[40] and *ChemSources International*^[41]; the PerkinElmer Available Chemicals Exchange (ChemACX)^[42]; ChemExper^[43] and e-Molecules,^[44] free sources that harvest information from many different online catalogs. There are an equal number of equipment catalogs, and glassware and equipment can also frequently be obtained from the Thomas Register,^[45] most conveniently searched online.

Many chemical catalogs provide, in addition to the availability, quantity, and price of the catalog, some basic physical properties. The Sigma-Aldrich online catalog is one of the best catalogs in this regard, including such properties as melting point, boiling point, density, and solubility, as well as links to pdf images of the infrared, Raman, and nuclear magnetic resonance spectra of many substances. This catalog also goes one step further, referencing the compound's location in important handbooks, such as the Beilstein Handbook of Organic Chemistry and the Merck Index.

Chemical companies also provide another useful piece of information for every substance that they sell. Called

Safety Data Sheets (SDS), formerly Materials Safety Data Sheets, these information sources are designed to inform scientists of the hazards involved in working with the compounds that they describe. To do this, they include physical and chemical properties of the substance; its chemical reactivity; information on safe storage, transportation, and disposal techniques; appropriate first aid information; and other useful information to ensure safe use and handling of the substance. The companies are required by law to disclose this information for each substance that they sell, and OSHA regulations require that chemists know the location of the SDS for each substance that they use in the lab. The Internet has become a common location for safety data sheets, and most companies link to the SDS for each substance from its catalog entry. One of the easiest methods of finding SDSs is through a simple Google search for the name of the company that supplied the substance and the term "safety data sheet." A chemist can use any SDS in order to find general safety and hazards information about a substance, but, to fulfill the regulatory requirements, they must keep a copy of the SDS from their specific supplier on file.

Handbooks

Finding physical and chemical properties of substances using indexing and abstracting sources can be like searching for a needle in a haystack. Abstracts are infrequently written to include statements like, "The following physical properties of the new compound are presented in this paper," and index terms, while they may indicate that properties of substances are included, do not always tell which properties of each compound are present. Presenting different properties in an easily read manner is the job of handbooks, a category that includes general and specific handbooks, spectral atlases, and crystallography collections and that falls into the "tertiary" classification of literature. A good handbook will be edited by someone knowledgeable in the field and should include the best possible values for each property presented. In addition to the value of the property, a reference to the primary document from which the value was obtained should be given. This allows a chemist to refer to the conditions of the original experiment and can help to explain inconsistencies in the reported values of properties. Handbooks tend to deal with a particular class or category of compounds; for example, the *The Merck Index*,^[46,47] now owned by the Royal Society of Chemistry, covers only drugs, biologicals, and agricultural agents. However, some handbooks, like the *CRC Handbook of Chemistry and Physics*^[48] and the *International Critical Tables*^[49] include a wide variety of compound types.

It is important to note that no handbook is exhaustive. They generally contain a limited universe of compounds (the largest handbook discussed here, Reaxys,^[50] presents only about 26 million of the more than 100 million

compounds reported in the CAS Registry), and not every compound has all properties covered by the handbook. There are several reasons for this. In order for a property to appear in a handbook, it must first be published somewhere in the literature. The editor of the handbook must locate it and decide to include it in the book. If one of these steps does not occur, it may be necessary for the scientist to rely on his or her own experimentally determined values for a given property.

In the online environment, several companies have made an effort to compile collections of handbooks that are simultaneously searchable. One of the most comprehensive of these collections is the Knovel Engineering and Scientific Online Reference Books.^[51] The Knovel collection includes many classic chemical handbooks, also available in print format, including Yaws' *Thermophysical Properties of Chemicals and Hydrocarbons*,^[52] and *The International Critical Tables*,^[49] as well as other information sources, such as *DIPPR Project 801 Database*,^[53] which lists constant and temperature-dependent properties for chemical substances. When accessing handbooks and databases through Knovel, however, it is very important to check the edition of the handbook being presented. Publishers will occasionally make older editions available through Knovel, while keeping the newest edition for distribution in print only or on their own online platform. Also, as publishers make and leave agreements with Knovel, books may be added or removed from the platform.

Reaxys

Reaxys is an interesting, hybrid handbook/indexing and abstracting source. It has as its basis two important and historic print sources, the *Beilstein Handbuch der Organischen Chemie*^[54] and the *Gmelin Handbuch der Anorganischen Chemie*,^[55] as well as the Elsevier Patent Chemistry Database. The data from the three seed sources have been completely integrated and are now being updated as a seamless whole, but it is important to understand the historic antecedents of the database in order to get a sense of its strengths and weaknesses.

Beilstein. The *Beilstein Handbuch der Organischen Chemie*, or the *Beilstein Handbook of Organic Chemistry*, is an enormous work that was, for a long time, the work of one individual. Friedrich Konrad Beilstein, a Russian chemist of German descent, decided to create a comprehensive handbook of all organic chemicals, their properties, and their reactions, and he edited the first (1881), second (1885), and third (1906) editions himself, before his death in 1906.^[56] The work of compiling the data then fell to the German Chemical Society, the Beilstein Institute, and, most recently, Elsevier, which incorporated the data into Reaxys. References to the literature date back to the 1770s, making it also one of the oldest secondary or

tertiary sources in chemistry. Although the first through fourth editions in print are published in German, the online text available through Reaxys has mostly been translated and is accessible even to non-German speakers. The handbook volumes do have some narrative information that is not included in Reaxys; however, a savvy searcher should be able to find most desired information by referring to the many references to the primary literature found in the compounds' records.

Gmelin. The *Gmelin Handbuch der Anorganischen Chemie*, or *Gmelin Handbook of Inorganic Chemistry*,^[55] is the inorganic/organometallic version of Beilstein. Named after Leopold Gmelin, who edited the first edition of the work in 1817,^[57] it was published by the Gmelin Institute for some time, before the data were purchased by Elsevier Science. Gmelin reviewed the literature from 1772 to the present and is incorporated in the Reaxys database. Although the series was begun with printed, German-language books, some of which may still be available from used book dealers, the print version is no longer being updated. Unlike Beilstein, which focused on compounds and is organized by substance, Gmelin focused on elements and the substances that they form. Such substances can include the pure elements, glasses, ceramics, organometallic substances, alloys, polymers, dopants, solid solutions, and isotopes. In the print version, substances were organized by key elements within them, with a set of volumes for each element, which contained all of the information both about the element and about its compounds and alloys. The handbook included reaction information, as well as hundreds of physical and chemical properties.

Searching Reaxys. At the time of this writing, Reaxys is most effectively used to find information about substances, their properties, and their reactions, and the substance and reaction information derives from a few hundred journals. Although Elsevier has added title and abstract-level references to articles from over 16,000 journals to Reaxys' "Literature" search context, these articles are not deep indexed for substance and reaction information. Chemists can search for known substances using a substance identifier (discussed below) in order to find physical and chemical properties or reactions. However, one of Reaxys' strengths is its structure search interface, which allows users to locate reactions of interest using a partial or complete reaction search (see Reaction Searching), as well as to profile substances by substructure or by properties, entering possible values or ranges of values for a list of properties and retrieving all substances that meet these criteria. It is also fairly easy to search for structures and property values simultaneously or to limit structure search results to only those substances for which a particular property is reported. Special mention should be made of Reaxys' unique way of describing

organometallic substances and “coordination compounds,” both of which are frequently difficult to locate using a structure or formula. A special code, called a “ligand formula” allows a chemist to search for the metals and the types of organic structures that are bound to them. This way, a variety of coordination compounds with the same basic connections and components can be retrieved.

Spectral atlases and crystallography collections

Spectra and crystal structures are frequently desired properties of compounds that serve similar purposes. *Spectroscopy* and *spectrometry* of substances falls into the realm of analytical chemistry. Broadly stated, when taking a spectrum of a substance, a researcher exposes that chemical to particular wavelengths of radiation and records the absorbances, reflections, vibrations, or bond breaking that occurs. The results are presented in a graph that indicates characteristic peaks or absorbances, which can be interpreted by a scientist to arrive at a structure for the compound. There are several kinds of spectra that are commonly used by chemists. Mass spectra are taken when a compound is hit with radiation and decomposes into fragments in an instrument called a mass spectrometer. The mass spectrometer measures and records the molecular weights of these fragments, and a knowledgeable scientist can deduce the composition of the parent compound from the size of the fragments. To obtain a nuclear magnetic resonance (NMR) spectrum, a chemist places a sample in an instrument that generates a strong magnetic field around it. He or she then obtains a graph, indicating the vibrations of and interactions between its atoms. Infrared (IR) and ultraviolet-visible (UV-VIS) spectra both indicate the wavelengths of light absorbed by a particular substance on a sloped graph.

Many scientists desire a graphical spectrum to compare to one that they have been taken themselves, and there are a number of free and proprietary print and online spectral atlases, including BioRad's KnowItAll products,^[58] the *Sadtler Handbook of Proton NMR Spectra*,^[59] the Aldrich NMR and IR/Raman sets^[60,61] (also available, free of charge, through the online Aldrich/Sigma/Fluka catalog), the NIST Chemistry Web Book,^[62] and the SDBS: Spectral Database of Organic Compounds^[63] from the National Institute of Advanced Industrial Science and Technology (AIST) in Japan. These resources have varying levels of quality and varying numbers of compounds, but all provide the user with graphical spectra. However, not all substances have spectral information available in this format. There are several handbooks that compile spectral lines, giving the wavelengths at which peaks occur, including the *CRC Atlas of Spectral Data and Physical Constants*^[64] and the *Handbook of Ultraviolet and Visible Spectra of Organic Compounds*.^[65] Other resources, like Reaxys, simply refer to articles in the literature that report spectra. CAS Registry

database on SciFinder (Scholar) has a mixture of spectral information; it links to graphical spectra collections from Wiley, BioRad, and AIST for many substances, provides literature references where others' spectra can be found, and, for some substances, has no spectral information at all.

A *crystal structure* of a substance uses X-rays to determine its structure unambiguously, including exact bond lengths and angles. A crystal structure of an organic, inorganic, or organometallic substance can prove the identity of a substance. However, crystal structures can also be used to determine the average bond length of a certain type of bond, as well as the differences in angle between three specific atoms in different types of substance. A crystal structure of a protein, in addition to providing bond lengths and angles, can indicate the way in which the protein folds. When searching for crystal structures, a scientist is generally looking for the exact distances and angles between all atoms in the substance. Therefore, he or she will want to download the “coordinates,” the location in space of all atoms present, in the .cif file format. The Cambridge Crystallographic Data Centre,^[66] a registered charity in the United Kingdom, curates a repository of small-molecule crystal structures that can be downloaded by individuals free of charge or searched through the Cambridge Structural Database (CSD).^[67] Inorganic compounds and substances can be found in the Inorganic Crystal Structure Database (ICSD),^[68] a proprietary database produced by FIZ Karlsruhe, while proteins are deposited in the RCSB Protein Data Bank (PDB),^[69] managed by Rutgers and UCSD and based on the Rutgers campus. While individuals are welcome to deposit their crystal structures in a structural database on their own initiative, some primary journal publishers go so far as to request that authors including crystal structures in their publications deposit their data with one of the three repositories. Although these three tools have robust search and retrieval engines, it is important to note that they contain curated versions of researcher-deposited crystal structures and therefore cross the line from secondary to primary literature. All three systems will permit interested parties to download the crystal structure information files (.cif) of substances in the database, which can then be used in crystal structure visualization or manipulation programs.

IDENTIFYING SUBSTANCES FOR INFORMATION RETRIEVAL

One of the greatest challenges to a searcher unfamiliar with chemistry or chemical information is navigating the multitude of unique access points to the literature. In addition to performing successful topic searches, a researcher will be called upon to find information about chemicals, which have many different forms of identification. The following sections describe various identifiers that can be used when searching for chemicals, times at which they

are particularly helpful, and general strengths and weaknesses of each type.

Ambiguous Chemical Identifiers

Of the many ways of identifying compounds, relatively few are completely unambiguous, one-to-one identifiers. Ambiguous identifiers, or those that are not one-to-one, abound and include chemical names, formulae, molecular weights, and various physical properties. This section discusses two of the most important ambiguous identifiers: chemical names and formulae.

Chemical names

Chemical nomenclature is frequently an art, rather than a science. Names are difficult identifiers to use in information retrieval because they are infrequently one-to-one identifiers for substances. There are two official systems of nomenclature that are widely used: the *IUPAC* system, which employs rules developed by the International Union of Pure and Applied Chemistry, and the *CAS* system, with rules made by the Chemical Abstract Service. One of these two systems is usually required when naming substances in a journal article; however, frequently used chemicals are generally given at least one common name, also called a *trivial name*, and substances that are commercially available often have at least one *trade name*, as well. In late 2015, the CAS Registry database showed 134 systematic, trivial, and trade names for the compound commonly known as aspirin.^[70] This creates a many-to-one problem for information retrieval; there are many possible names for a single compound, and a searcher who wishes to locate chemicals by name must hope that the name variant that he or she has is the same as the one found in the index of a reference book or the electronic record in a database. A further problem arises because, in electronic information sources, the chemical name field is a “string” field, in which one must exactly match the input search string to an identical string in the chemical name field of a record. No typing errors are tolerated, and the databases do not have a “did you mean” feature since the alteration of a single character could indicate a completely different substance. For example, the substances “ethanol” and “ethanal” are two completely different molecules. For this reason, if one is having difficulty locating a substance by its chemical name, the best approach is usually to locate the name in a resource with an extensive synonym list and find the molecular formula or CAS Registry Number, which can then be used in the original resource to obtain the desired information.

Chemical formulae

A chemical formula describes the number or ratio of atoms of each type present in a substance. There are three general types of formula. The *molecular formula* is the

formula most frequently used both by chemists and in information retrieval. A molecular formula lists the symbol for each atom in the substance, found by consulting the periodic table, followed by the number of that type of atom that appears in the substance. The formulae are written using a convention called *Hill Order*, which provides some degree of standardization. The first step in constructing a Hill Order formula for any substance is to group all like atoms together, ignoring functional groups or units. For organic compounds, defined as substances containing one or more carbon atoms, the atomic symbols are then ordered as follows: carbon, hydrogen, and all other atoms in alphabetical order. For example, the molecular formula for 4-aminobutanoic acid, which contains four carbon atoms, two oxygen atoms, nine hydrogen atoms, and a nitrogen atom is written $C_4H_9NO_2$. For inorganic substances, defined as substances containing no carbon atoms, all atomic symbols appear in alphabetical order. For example, the molecular formula for sodium chloride, which contains one sodium atom and one chlorine atom, would be written as $ClNa$, not $NaCl$.

The other two types of formula, empirical formula and structural formula, are used very infrequently in information retrieval. The **empirical formula** gives the ratio between the different types of atom found in a substance. The molecular formula of glucose is $C_6H_{12}O_6$; so, its empirical formula is CH_2O . The **structural formula** is written to give some inkling as to the connectivity of the atoms in the molecule. For example, 4-aminobutanoic acid, $C_4H_9NO_2$, has the following structure (Fig. 1).

The structural formula for this substance would then be either $COOH-CH_2-CH_2-NH_2$ or $CO_2H-CH_2-CH_2-CH_2-NH_2$. While empirical formula information can be used in some advanced search systems, such as the Registry file on STN, to search for compounds that have a given ratio of atom types, the use of structural formula has mostly been replaced by chemical structure searching in online resources, although some biochemists will still write out a structural formula instead of drawing a structure for simple molecules.

Searching by molecular formula presents the opposite kind of problem to that experienced when searching by chemical name. Since a molecular formula gives no indication of the connectivity of the various atoms in the molecule, it is very easy to find many molecules with the

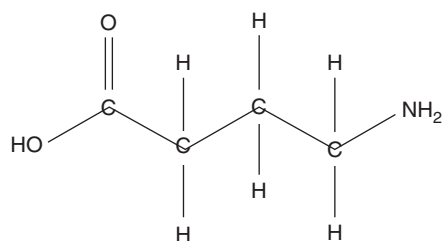


Fig. 1 Structure of 4-aminobutanoic acid.

same formula. However, most resources present the names or structures alongside the list of formulae in the book index or electronic search results, making it easier for a searcher to select the correct substance from the list. Another method of surmounting this problem is by selecting a different identifier by which to search.

Unambiguous Chemical Identifiers

It is preferable, although not always possible, to use an unambiguous identifier when searching for a substance. The three most commonly used one-to-one identifiers are chemical structure, sequence, and CAS Registry Number, although there are others. A relatively new identifier, the InChI, is a unique, text-based string that can be used with Web search engines, such as Google, but is most commonly used by database providers behind the scenes to link information sources that contain the same substances. Spectra, discussed earlier, serve as the fingerprints of chemicals, presenting a graph with characteristic peaks that enable chemists to determine the exact structure of the substance in question. Each identifier has its drawbacks in information retrieval, yet the use of each will generally retrieve a single substance.

Chemical structures

Structure is the least ambiguous identifier most commonly used for small, organic, or organometallic compounds. A substance's structure is akin to its photo ID; it shows not only the types and numbers of atoms that make up the substance, but also how they are connected. The structure of dicyclohexyl methanone ($C_{13}H_{22}O$) appears below (Fig. 2), using normal conventions for drawing organic compounds. Carbon atoms appear as line termini, and hydrogen atoms are understood.

At present, most chemistry databases and electronic resources have some form of structure search capability, generally provided through the means of a Java plug-in, a non-Java editor, or, in a few cases, specialized client software. Such resources allow a user to draw a structure of choice and then search for either exact matches or for larger molecules that contain the structural elements as drawn. The tools available vary from resource to resource; free resources tend to offer only basic search options, while resources like Reaxys, which rely heavily on structure searching, allow the user to construct extremely

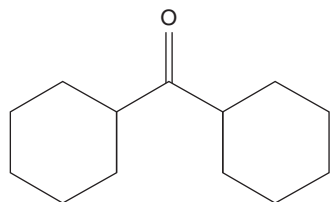


Fig. 2 Structure of dicyclohexyl methanone.

complex queries. Although it is not possible to search for structures in most print reference works, it is easy to count the atoms in a structure, generate the substance's molecular formula, and look it up in a formula index.

Sequences

Many biological chemists study very large molecules called proteins and nucleotides. These are, essentially, polymers consisting of many smaller units. The components of proteins are amino acids, while nucleotides are composed of bases. Because the sequence of the component amino acids (also called *residues*) or bases is very important to the function of the biomolecule, a molecular formula is not a good way to describe its composition. Biochemists use identifiers called sequences to describe the order of the component pieces. Each component is given a letter code. The letters are then strung together in the order in which the segments appear in the biomolecule. Resources that contain proteins or nucleotides generally allow sequence searching, and many let researchers locate sequentially similar substances using an algorithm like BLAST, described later in the article.

CAS Registry Numbers®

The Chemical Abstract Service assigns a unique, one-to-one identifier, called the *CAS Registry Number* (*CAS RN*), to each compound published in the literature. CAS RNs are formatted in the following manner, where X, Y, and Z represent any of the digits 0–9:

XXXXXXX-YY-Z

The first set of digits (X) is arbitrarily sized but has at least two digits. The second set (Y) contains two digits, and the third set (Z), or the check digit, is a single digit. CAS RNs are helpful because they aim to be completely unambiguous. They can be difficult to search because few people memorize them, and therefore, a source must be used to determine the CAS RN for each substance. In addition, since they are unique identifiers, a CAS RN search will not retrieve compounds that are structurally identical but contain one or more element with a higher or lower number of neutrons than usual, called an isotope. At times, it is important to exclude these “isotopically labeled” compounds, but, since their formation and general behavior is usually identical to their unlabeled counterparts, useful information can be missed if they are omitted. Although most resources have a CAS RN index or search function, these numbers are proprietary, and database providers must request permission from CAS to use them in their products.

InChIs™

An *InChI*™, or an *International Chemical Identifier*, can be described as IUPAC's version of the CAS Registry

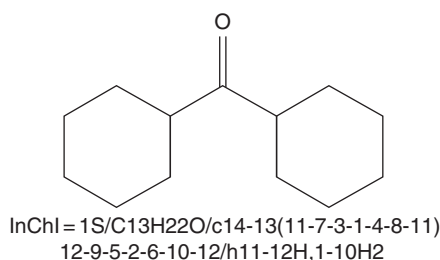


Fig. 3 Structure and InChI for dicyclohexyl methanone. The first set of characters refers to the InChI standard being used, the second set is the molecular formula, the third set tells how the molecular backbone is connected, and the fourth set indicates the locations of hydrogen atoms.

Number, only with structural information built in.^[71] IUPAC defines an InChI™ as “a non-proprietary identifier for chemical substances that can be used in printed and electronic data sources thus enabling easier linking of diverse data compilations.”^[71] InChI strings are generated using free software provided by IUPAC, and two free drawing programs, ACD’s ChemSketch and the PubChem Server Side Structure Editor, can both generate InChIs from structures. InChIs appear as a long text string and can therefore be used for searching the Web, as well as text-based databases and search engines. Below are the structure and corresponding InChI for dicyclohexyl methanone (Fig. 3):

InChI=1S/C13H22O/c14-13(11-7-3-1-4-8-11)12-9-5-2-6-10-12/h11-12H,1-10H2

InChIs carry all of the advantages of CAS RNs, as well as the added advantage that database providers do not have to request permission to use them in their records. As was previously mentioned, they are most likely to be used as linkers by information providers, but it is possible to use them within those databases that include them in the substances’ records.

SEARCHING FOR SUBSTANCES IN THE CHEMICAL LITERATURE

Specialized Search Techniques

Chemical names, molecular formulae, and CAS Registry Numbers can all be used to retrieve information about chemicals. In online sources, the use of structure and sequence are also prevalent. However, there are other specialized search techniques that can be used to locate substances, their properties, and their reactions in electronic resources. Substructure searching and sequence similarity searching, using algorithms such as BLAST, can be used to locate substances that are similar in composition. Reaction search techniques can be used to find all ways of executing a particular reaction, to learn the best way to perform a reaction with a specific reactant and product,

and to find out exactly what will happen when two substances react.

Substructure searching

Frequently, chemists will want to search the literature, not for specific structures, but for structures that resemble a substance of interest. For example, assume that a scientist has discovered that some natural products have been found to have anticancer activity, which can be traced to a certain portion of their structure. He would like to figure out how to make that structural segment in the lab and is writing a grant application to fund this research; so, he wants to locate many examples of substances containing that fragment that also exhibit anticancer activity. Another example of the utility of substructure searching is a scientist who tries and fails to make a new substance. She can search for papers that report the synthesis of structurally similar substances and then apply the techniques to her own system.

Substructure searching, simply put, is a truncation search for a molecule. The searcher draws the portion of the structure that interests him or her, and the database retrieves all molecules that contain that structural fragment. In general terms, the query substructure can be thought of as a template that is superimposed over all substances in the database. A substance is retrieved as part of the hit set only if all atoms and bonds in the template exactly match atoms and bonds found in that substance.

In Fig. 4, the searcher input the boxed substructure in the center and retrieved the three structures surrounding it. Note that, when performing a substructure search, hydrogen atoms must be drawn; they are no longer understood. This substructure, therefore, contains nine “free sites,” places where atoms, in this case carbon, chemically must form additional bonds. Any kind of atom or group can be attached to each of these sites. In Fig. 4, the substructure query is bold in each of the three retrieved substances, and the additional substituents appear in a lighter color. If the searcher wanted to be more specific about the type of substance retrieved, he or she would need to place additional restrictions on these free sites. For examples, the chemist could specify that atoms attached must not be part of a ring; that only nonhydrogen atom attachments are allowed; or that only carbon, nitrogen, or oxygen can attach at a particular site.

Reaction searching

Since many chemists seek to make new compounds or study the reactivity of known compounds, it is logical to assume that searching for particular reactions is a valuable tool. Reaction searching is most frequently used by chemists attempting to synthesize novel compounds or seeking new and improved methods of making known substances. For example, a chemist may wish to convert one

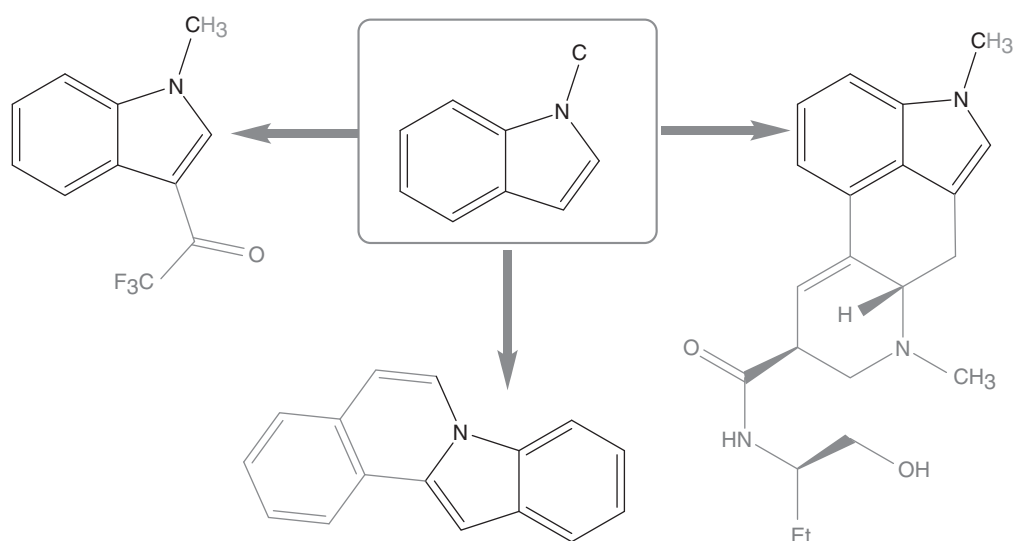


Fig. 4 A sample substructure and possible results obtained when using it to search. Note that the substructure is highlighted in black in each of the search results.

compound into another, but he may not know the proper reagents or conditions to apply to make this reaction happen. Another chemist may want to synthesize a compound without having a particular starting material in mind. Still another might be interested in all types of reactions performed by a given class, or type, of compound.

Many databases allow both partial and complete reaction searching using either exact structures or substructures. The chemist who wishes to use a particular reactant to make a product will perform a *complete reaction* search (Fig. 5A), drawing both the starting material and the product into the search engine. The chemist exploring possible methods of synthesizing a compound, who does not care which starting materials they use, will instead use a *partial reaction* search (Fig. 5B), drawing only the product, labeling it as such, and indicating by means of a hash mark the bond that is to be formed in the course of the reaction.

There are many reaction databases available, and each has different methods of search available to users. Some of the more common reaction databases are the CASREACT database from CAS and the reaction module on Reaxys.

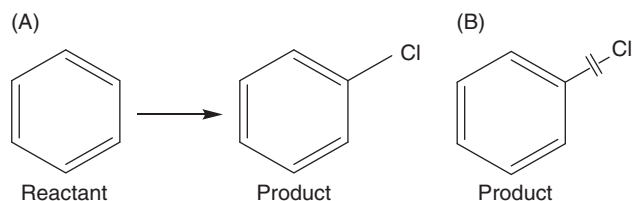


Fig. 5 (A) A complete reaction search, in which a chlorine atom is added to a benzene molecule. (B) A partial reaction search intended to locate all possible methods of adding the chlorine to the benzene ring.

In recent years, reaction databases have begun adding synthesis planning options to their search interface. For example, from a substance search in SciFinder, one can click on the structure and select an option to “Synthesize this...” Reaxys offers a more sophisticated synthesis planner that allows you to explore various routes of making a molecule in question. Starting with the target, researchers can click on the “Synthesize” links to retrieve a list of potential reactions that result in that product, from which they can choose their desired preparation. As they work backwards, the synthesis planner constructs a tree-like reaction scheme, indicating the chosen reactants and reagents for each step, and generates a list of references in which the protocols can be located. InfoChem’s *IC_{SYNTH}* product will also allow chemists to generate potential synthetic routes to a target molecule.^[72]

Sequence searching and BLAST

Frequently, scientists will want to locate proteins or nucleic acids that have sequences similar to a sequence of interest. If a biological chemist is studying a human protein that has never been studied, it might be helpful for him to see whether there are any similar proteins in other organisms that have been more extensively researched. Searching for sequentially similar proteins or nucleic acids in different organisms can also give indications of evolutionary relationships between species. Frequently, locating intensely studied proteins or nucleic acids with similar sequence can help a researcher determine the putative identity and function of a given substance. The best method for accomplishing these goals is to perform some kind of similarity search in a database of sequences.

“**BLAST**” stands for “Basic Local Alignment Search Tool,” and it is one of the most common methods of

locating sequentially similar proteins or nucleic acids. The BLAST algorithm is complex, but it basically looks for sequences in a database, or **subject** sequences, that have a small sequence fragment that is identical or highly similar to one found in a query sequence. Starting at this sequence fragment, the system then works outward in both directions, comparing each nucleotide or amino acid of the query sequence to those in each subject sequence in the database. It then determines the length of the “matching” section between the query and each subject sequence and assigns each subject a score, based on the length of the similar section and the closeness of the match, and presents the results in order of score, from most to least similar. Advanced searchers can adjust the parameters of a search to be more or less sensitive, allowing retrieval of more or less disparate sequences. BLAST searching is frequently used to identify similar sequences in different organisms, often with an eye to discovering evolutionary patterns or functional similarities.^[73]

CONCLUSIONS

The literature of chemistry is as varied as the types of research that chemists perform, and is likely to become more so as chemical research becomes increasingly multidisciplinary. Chemists are avid readers, partly driven by the need to experiment efficiently because their research is so expensive. As a result, the chemists frequently desire or need to do their own searches, evaluate their results, and immediately modify or refine their searches, requiring a large degree of autonomy and strong searching skills. Occasionally, particularly in industry, they will ask an information professional to perform searches for them, evaluate the results, and request modifications. However, many academic chemists have a decent familiarity with their literature and, while they will occasionally require assistance framing searches, they often wish to be taught rather than spoon fed. Many of the tools, particularly the SciFinder and SciFinder Scholar interfaces, are aimed at end user searchers. With appropriate instruction in the specialized search techniques and entry points to the resources, chemists can be efficient searchers and find most of what they need to do their research.

Chemists should be taught to use review sources, including encyclopedias, treatises, and review articles, for background research, before proceeding to the primary literature in journals, books, and patents. Indices, abstracts, and catalogs will assist them in identifying good primary research on which to build, as well as chemicals and equipment. Handbooks can supply quick values for properties and references to the literature in which they were reported. All resources can be searched with unique access points, including chemical name, formula, structure, sequence, and CAS Registry Number, and many

allow specialized searching, such as substructure searches, reaction searches, and BLAST.

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Chemoinformatics

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Abstract

The entry summarizes the principal tools in modern chemoinformatics systems, principally in the pharmaceutical industry. These tools enable molecules to be selected for biological testing as potential drugs, and include methods for searching databases of two-dimensional and three-dimensional chemical structures, and for predicting the properties of molecules from their structures.

INTRODUCTION

Information systems in chemistry have a long history, first in printed and then in computerized form, and the great bulk of the world's chemical information is now available on the scientist's desktop.^[1] Much of this information is textual (e.g., the full-text of a journal article) or numeric (e.g., a molecule's boiling point) in nature, but there is an additional data type that distinguishes chemical information systems from those designed for more general use: the structures of chemical molecules, normally in the form of a two-dimensional (2D) structure diagram but increasingly also in three-dimensional (3D) form. Molecules (and their reactions and properties) lie at the heart of chemistry and this has spurred the development of systems for the representation of structures, not just as images but in a form that will enable sophisticated processing to be carried out on them. The focus on the structure is the principal distinguishing feature of chemical information systems, in much the same way as biological and geographic information systems highlight the importance of biological sequences and of cartographic information, respectively.

Computer-based systems for the manipulation of structural information started to be developed in the early 1960s, most notably the establishment of the Chemical Abstracts Service Registry System to record all the molecules that are reported in the world's scientific literature.^[2] Systems such as this focused on tools for rapid and effective database searching; at the same time, scientists, principally in the pharmaceutical industry, were developing computer systems for modeling individual molecules so that they could be displayed interactively and their properties, shapes, and reactions computed from their two-dimensional (2D) or three-dimensional (3D) structures. These two areas of research developed strongly over the next two decades,^[3,4] with the establishment of chemoinformatics—"the application of informatics methods to solve chemical problems"^[4]—as a distinct discipline being driven in part by the need to integrate these two approaches to the manipulation of structural

information. This need has been strengthened by technological developments (specifically, the techniques of combinatorial chemistry and high-throughput biological screening) that have brought about an increase by at least two orders of magnitude in the volumes of data that need to be processed in chemical research and development. Chemistry is by no means unique in needing to assimilate and to rationalize vast bodies of data, and informatics tools are thus being increasingly developed and applied in many subject domains. Here, we summarize the components of modern chemoinformatics systems, describing the main techniques that are used to search databases of chemical structures and to correlate the biological properties of molecules with their structures. Much of the discussion relates to the pharmaceutical industry since that is where many of the developments have taken place to support the discovery of new drugs; however, the techniques are increasingly being applied in many areas of chemistry, such as structure elucidation, reaction prediction, and synthesis design. The entry focuses on methods for searching chemical databases, with brief accounts of some of the other approaches that are used to support drug-discovery programs; more detailed accounts of chemoinformatics are provided in the textbooks by Gasteiger and Engels^[4] and by Leach and Gillet,^[5] and in the standard reference work edited by Gasteiger.^[6]

SEARCHING DATABASES OF 2D STRUCTURES

Search lies at the heart of any type of information system, and methods for searching chemical databases have been studied now for over four decades. These methods can be divided into two broad classes: those that are used with databases of 2D structures, where molecules are represented by conventional chemical structure diagrams; and those that are used with databases of 3D structures, where molecules are represented by sets of atomic coordinates in 3D space. This entry deals with the first group of methods although, as we shall see in the following entry,

many of the techniques are also applicable in the 3D context.

Representation and Structure Searching

The two most important types of representation that have been used to describe a chemical structure in machine-readable form are the *line notation* and the *connection table*. A line notation encodes the structure of a molecule in a text string, in which individual symbols encode atoms or groups of atoms, with the bonds linking these atoms normally implicit in the ordering (which is subject to strict preference rules). Line notations were widely used in the 1960s and 1970s, with the Wiswesser Line Notation in particular forming the basis for both corporate and public chemical information systems.^[7] The most popular current line notation is the SMILES (Simplified Molecular Input Line Entry Specification) notation, a compact text string that can be used for the input of chemical structures and for *structure search*. Structure search is one of the principal types of database search (the others are described later in this entry)

and involves scanning a database for the record associated with a specific molecule. Such searches are typically carried out to retrieve data associated with that molecule, e.g., how it can be synthesized or its solubility. This is the chemical equivalent of a known-item search, e.g., looking for an ISBN in a library catalog to see if a copy of a book is available for loan or scanning a telephone directory to get a person's telephone number, and can be effected using conventional computer techniques such as string matching or hash coding. However, line notations are far less suitable for the other types of chemical searching, which require an explicit and detailed description of the pattern of bonds in a molecule to enable effective searches to be carried out. This information is encoded in a connection table, which can be regarded as a *chemical graph*, in which the nodes and edges of a graph represent the atoms and bonds, respectively, of a molecule. The hydrogen atoms are normally excluded from a connection table since their presence can be deduced from simple considerations of atomic valency. An example of a structure diagram and the corresponding chemical name, connection table, and SMILES are shown in Fig. 1.

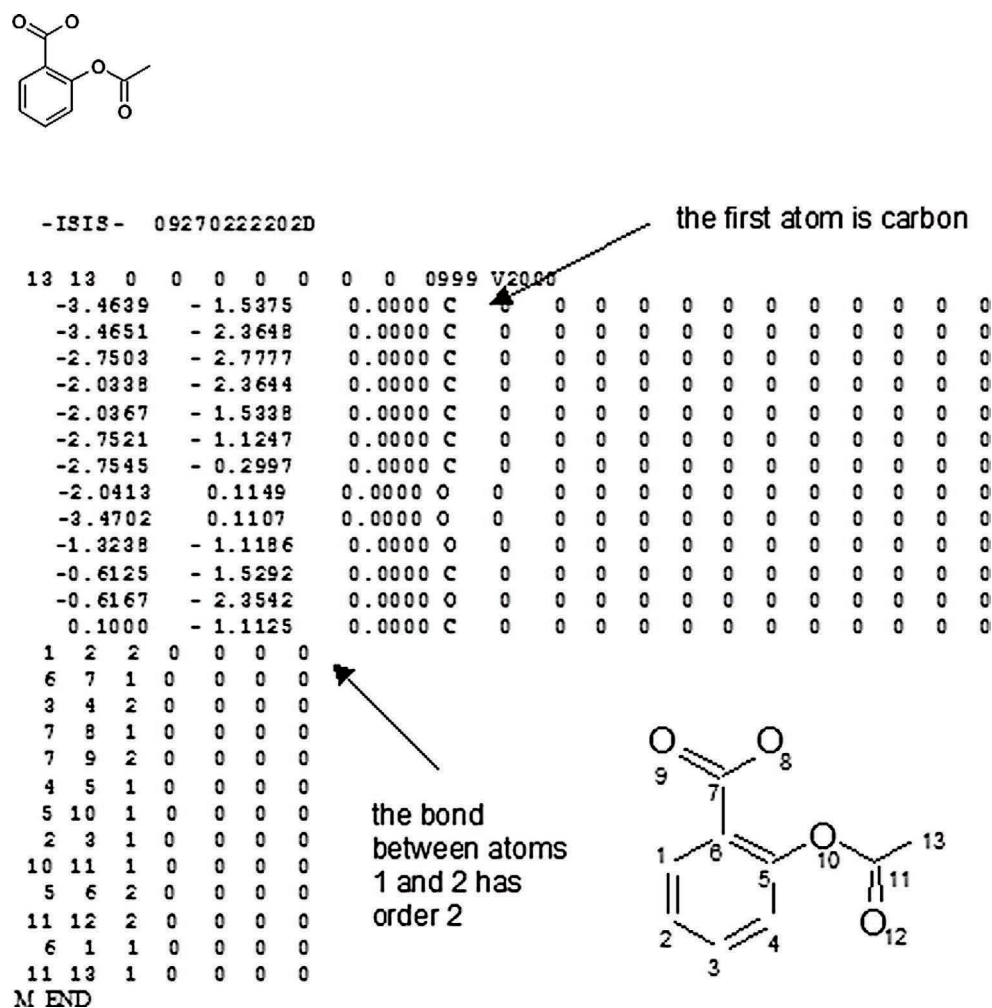


Fig. 1 Example of (A) a structure diagram, (B) systematic nomenclature, (C) connection table in MDL format (see URL <http://www.mdli.com>), and (D) SMILES for a molecule.

Substructure Searching

The availability of the graph-based, connection-table representation means that chemical database applications can make use of algorithms originally developed for the matching of graphs, in particular the use of a subgraph isomorphism algorithm to carry out *substructure searching*.^[8] This involves scanning a database for all of those molecules that contain a user-defined partial structure, e.g., all of the molecules that contain the four linked rings that characterize a steroid. This is the chemical equivalent of a Boolean text search, e.g., looking for all documents satisfying the logical constraint (chemical AND database* AND search*), and requires rapid access not just to the entire structure of a molecule but also to all of its constituent parts. An example of a substructure search is shown in Fig. 2.

A subgraph isomorphism algorithm checks whether a query graph is contained within another graph, and such an algorithm hence provides a simple and direct way of carrying out a substructure search given a set of connection-tables. However, while this is an effective search procedure, it is a very inefficient one, since subgraph isomorphism, like many graph algorithms, has an expected time complexity that is a factorial function of the numbers of nodes in the two graphs that are being compared. The computational requirements are lessened, when compared to graphs in general, because chemical graphs are small (typical organic molecules contain 20–30 nonhydrogen atoms); are of low complexity (since each atom is bonded to only a very few other atoms, the exact number depending on its valence state); and have node and edge labels (i.e., the atom and bond types) that can be used to constrain the number of graph matches that need to be considered. Even so, substructure searching of large chemical databases using subgraph isomorphism would be totally infeasible if it had not proved possible to provide an initial, *screening* search that eliminates the great bulk of a database from the time-consuming subgraph search.

Screening is based on the idea that a database-molecule cannot possibly contain the sought query moiety unless that molecule contains all of the fragment substructures that are contained in the query. Only if each and every one of these fragments is present is it worth carrying out the subgraph search to determine whether they are joined together in exactly the same way as they are in the query. A range of types of fragment can be algorithmically generated from a molecule's connection table. One simple approach is to use common rings and functional groups so that, e.g., a molecule might be characterized in chemically meaningful terms as containing a phenyl ring, an acid amide group, and a methyl group (in much the same way as a paper in an academic journal might be characterized by some number of keywords). More commonly, the fragments are small atom-, bond-, or ring-centered substructures; for example, a molecule might be characterized

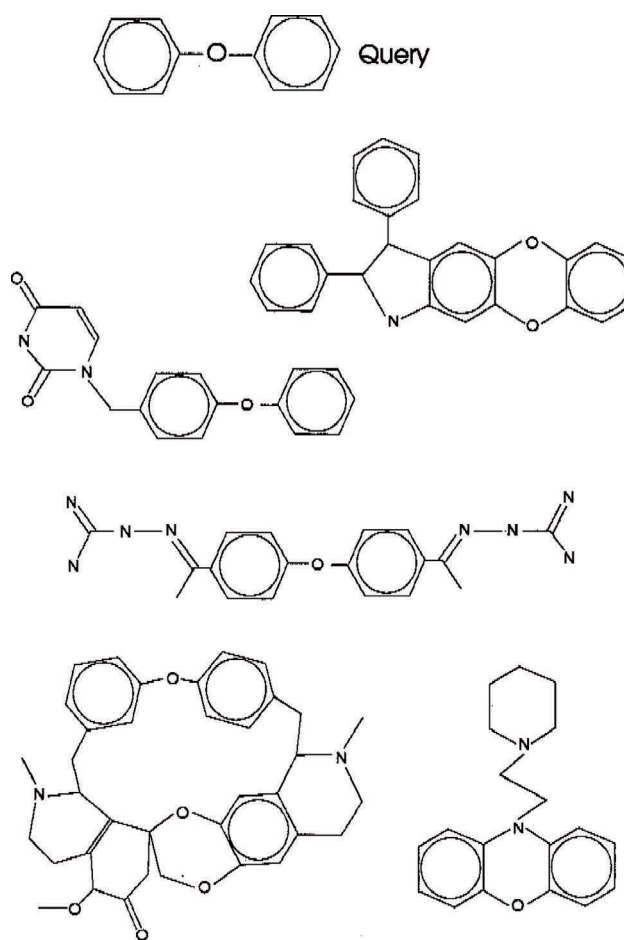


Fig. 2 Example of a 2D substructure search. The search is for the diphenyl ether query substructure at the top of the figure, below which are shown five of the hits resulting from a search of the National Cancer Institute database of molecules that have been tested in the U.S. government anticancer program (see URL <http://dtp.nci.nih.gov/>). This database is also used for the search outputs shown in Figs. 3 and 4.

by *augmented atoms*, where an augmented atom is an atom together with the atoms that are bonded directly to it, or by a chain of four atoms and the three bonds that link these atoms together.

The presence or absence of such fragments (either in a query or in a database molecule) is encoded in a *fingerprint* or *bit-string*. A fingerprint is a binary vector where each of the bits (or groups of bits in some cases) is set to one to indicate that a particular fragment (or fragments) is present in the connection table describing a molecule. A screen search is then carried out by comparing the bit-string describing the query with the bit-string describing a database molecule; only if a logical intersection (Boolean AND) of the two fingerprints confirms that all the specified query fragments are indeed present will the detailed and time-consuming subgraph isomorphism match be carried out for that database molecule. An effective screening system will ensure that less than 1% of the database

molecules need to undergo this second-level search. Other approaches to 2D substructure searching have been described,^[9] but the fragment-screening approach continues to be by far the most common; moreover, fingerprints are used not just for 2D substructure searching but also for many other applications in chemoinformatics, as discussed below.

Similarity Searching

The advent of the Web has meant that Boolean searching, although used for many years by library and information specialists, is now used far less than the alternative best-match or ranked-output approaches that characterize Web search engines. The chemical equivalent of this approach to database access is called *similarity searching*.^[10] Here, a user enters a complete molecule, which is normally referred to as the *reference* or *target* structure, and the similarity is computed between this reference structure and each of the database molecules. The database molecules are then ranked in order of decreasing similarity and the most similar, the *nearest neighbors*, presented to the user as the output from the search.

The basis for similarity searching is the Similar Property Principle, which states that molecules that are structurally similar are likely to have similar properties. Thus, if a biologically active molecule is used as the reference structure then its nearest neighbors are also likely to be active (in much the same way as a Google search based on the keywords from a known relevant document is likely to identify further relevant documents). This is clearly a simple way to search a database but it will only be effective if an appropriate measure of intermolecular similarity is used. There is a large, growing literature on chemical similarity,^[11] but current systems are overwhelmingly based on the use of fingerprint-based measures of structural similarity. In a substructure search, two fingerprints are compared to determine if one is contained within the other; in a similarity search, two fingerprints are compared

to determine how many bits (normally the bits that are switched on) are in common. The number of common bits represents the number of common fragments and generally after a normalization stage to give a value between zero and unity, the overall degree of resemblance of the two molecules whose fingerprints are being compared. This simple approach has proved to be very popular, enabling the identification of biologically active molecules in chemical databases at minimal computational cost and often more effectively than other, more complex types of similarity measure.^[12] An example of a fingerprint-based similarity search is shown in Fig. 3.

Patent and Reaction Searching

There is another type of 2D structure that is of particular importance in industrial research and development, and this is a molecule in a chemical patent. Patents in chemistry resemble those in other fields in describing novel entities and their uses (in this case chemical molecules and some sort of useful property), but they differ in the way that the molecules are described. Specifically, whilst individual, specific molecules are generally included in a patent, either as a name or as a structure diagram, there may also be one or more *generic*, or *Markush*, structures. A generic structure is a high-level description not of a single molecule but of a whole class of molecules that possess common structural features; for example, there may be a range of different substituents possible at a single position on an invariant central ring system, or there may be limits on the numbers and types of atoms allowed in a heterocycle.^[13] A single generic structure may represent many thousands, or even millions, of individual specific molecules, and is included in a patent so that the originating company can claim patent protection for all of the molecules implied by the high-level description, without the need to describe (or even, in most cases, to synthesize and test) the individual molecules. Fragment-screening and graph-matching procedures analogous to those

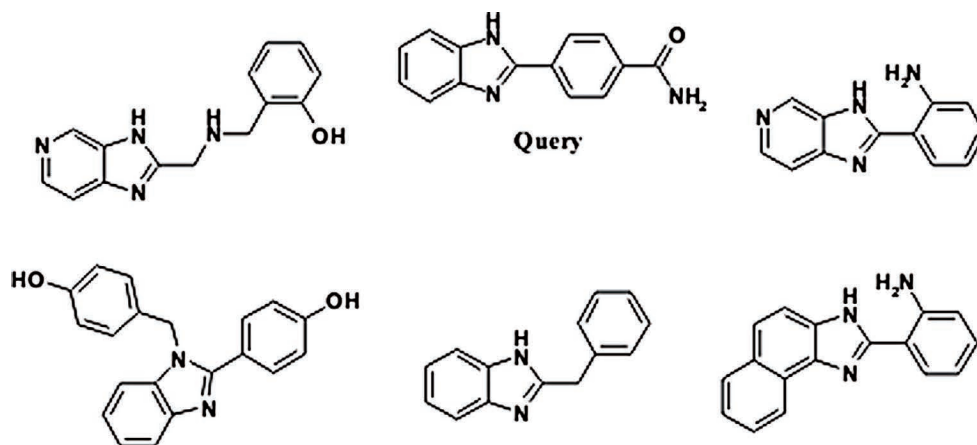


Fig. 3 Example of a fingerprint-based 2D similarity search, showing a query molecule and five of its nearest neighbors.

described above have been developed for patent databases; however, it can still be difficult to describe precisely some types of patent and to carry out searches that are as effective as those possible on databases of conventional, fully defined molecules.^[14]

Finally in this entry, it is appropriate to mention search techniques for databases of chemical reactions. Here, a database record consists not of a single molecule but of two, linked sets of molecules, i.e., the sets of reactants and products; in addition, there may also be reagents or catalysts that are necessary for the reaction to proceed in high yield. Some types of query that a user might wish to pose to a reactions database, e.g., all syntheses of a specific molecule or how to convert one molecule to another, can be achieved using simple modifications of conventional structure searching procedures. However, an effective reactions database also needs to be able to represent and to search not just the molecules that are involved in a reaction but also their constituent *reaction sites*, i.e., the parts of the reactants and products where the substructural change engendered by the reaction has taken place.^[15] For example, a user might wish to retrieve all reactions involving the combination of two acid groups to form a heterocycle, i.e., a form of substructure searching that will again involve simple modifications of conventional fingerprint and graph-match algorithms. In addition, however, this sort of search will require effective algorithms to recognize the substructural differences between the reactants and products, and hence the location of the reaction sites, and then the ability to link together information about both the reacting molecules and the reaction sites. For example, a user might wish to retrieve all reactions involving the combination of two acid groups to form a heterocycle (as previously) whilst also specifying that another acid group elsewhere remains unchanged during the reaction. Systems providing such comprehensive retrieval capabilities are now well established,^[16] and facilities can also be provided for reaction similarity searching.

SEARCHING DATABASES OF 3D STRUCTURES

Systems for structure and 2D substructure searching were available for both corporate and public databases by the early 1980s but a decade was to pass before techniques were developed for the effective processing of 3D structures.^[17] Indeed, even today, 3D searching systems are restricted to corporate environments where the file-sizes are much less than the large public databases available from Chemical Abstracts Service (at <http://www.cas.org>) and from Beilstein (at <http://www.beilstein.com>).

The principal source of experimental data on the 3D structures of small molecules is the Cambridge Structural Database (at <http://www.ccdc.cam.ac.uk/>), which contains atomic coordinate data for approximately 400K molecules for which an x-ray crystal structure determination has

been carried out.^[18] X-ray techniques are constantly evolving but this number is less than 2% of the number of molecules for which the 2D structure is known; accordingly, if 3D searches need to be carried out, computational, rather than experimental, techniques must be used to generate the requisite atomic coordinate data. Molecular modeling provides a range of tools that can be used to generate 3D structures, using sophisticated approaches such as quantum mechanics, molecular dynamics, and molecular mechanics,^[19] but these are too slow if structures need to be generated for hundreds of thousands or millions of molecules. Instead, *structure generation* programs have been developed that can rapidly generate reasonably accurate sets of atomic coordinates from a 2D connection table.^[20] The set of coordinates for a molecule can then be used to compute the distances between all pairs of (nonhydrogen) atoms. These distances form the basis for a 3D chemical graph, in which the nodes and edges of the graph characterize the atoms and interatomic distances, respectively (as against the atoms and bonds in a 2D chemical graph).

Substructure Searching

A *pharmacophore*, or *pharmacophoric pattern*, is the geometric arrangement of features in a molecule that interacts with a biological receptor and that allows a molecule to exhibit the desired biological activity. Potentially bioactive molecules can hence be identified by searching a database for all those molecules containing a query pharmacophore, this typically consisting of a small numbers of atoms and associated interatomic distances. An example of a pharmacophore is shown in the upper part of Fig. 4. Such patterns are derived from analysis of sets of known bioactive molecules to identify the geometric features that they have in common.^[21] The 3D graph for a molecule is more complex than the corresponding 2D graph since there are far more edges present (each atom is separated by a distance from every other atom in the molecule but is only bonded to some small number of other atoms) but the fact that a graph representation is available means that we can again apply the screening and subgraph isomorphism approaches described previously.

The condition for a subgraph match in 3D substructure searching is now not that atoms are bonded together in the correct way but that they are separated by the correct distances, normally to within some small level of tolerance such as ± 0.5 Å, and a subgraph isomorphism algorithm can be modified to handle such data. The screens that are used are based on interatomic distance ranges, e.g., a bit in a fingerprint might be set to denote the presence of an oxygen and a nitrogen atom separated by 3.5–5.0 Å. The lower portion of Fig. 4 illustrates some of the molecules retrieved in the search for the pattern in the upper portion of the figure, and demonstrates the wide range of types of molecule that contain the query

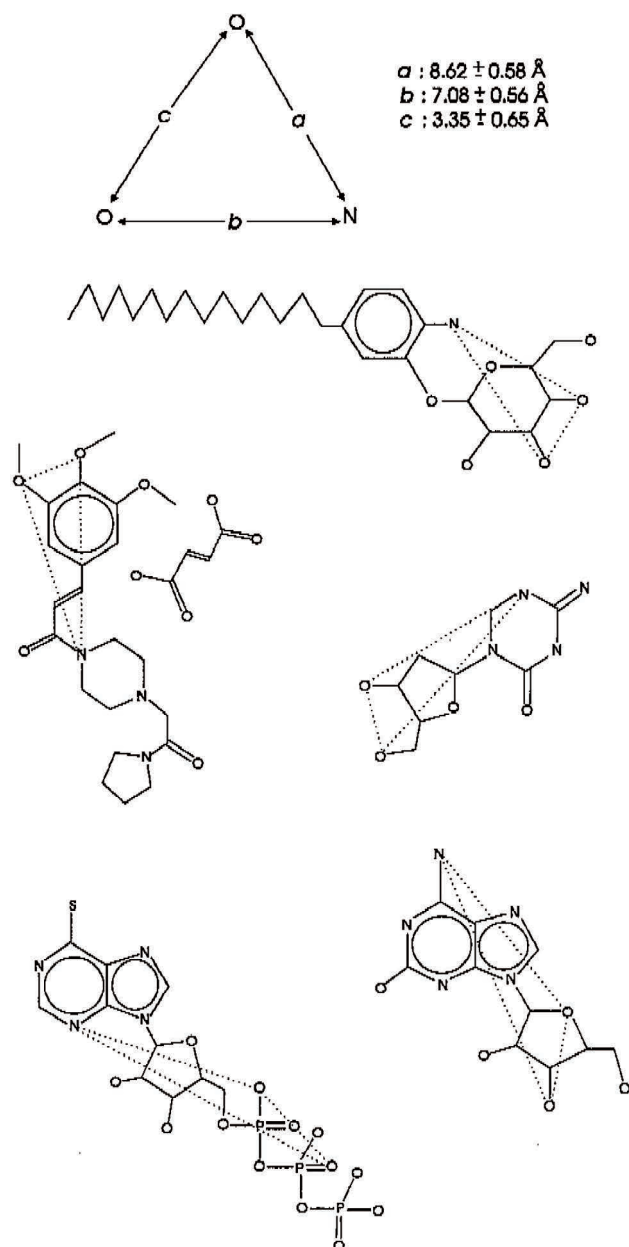


Fig. 4 Typical hit structures for the antileukemic pharmacophore shown at the top of the page, with the presence of the pharmacophore in the retrieved molecules shown by dotted lines.

Source: From Zee-Cheng and Cheng.^[22]

pharmacophore. Thus the structures retrieved from a 3D substructure search are typically far more diverse than those retrieved from the corresponding 2D search. The former is hence well equipped to identify novel structural classes that might not be covered by existing chemical patents, a commercially important capability that is increasingly referred to as *scaffold hopping*.^[23]

The use of a graph in which the distance between a pair of atoms is fixed is not generally correct, since most molecules are *flexible*, i.e., they can adopt a large number of

different conformations, which vary both in shape and in energetic stability. Different conformations can result in different sets of interatomic distances, and a 3D substructure search of a database of rigid molecules may thus fail to retrieve many of them containing the query pharmacophore if each molecule is represented by a single, low-energy conformation. One way to overcome this problem is to store multiple conformations in the database for each molecule, with the conformations chosen to encompass the entire range of energetically feasible shapes that the molecule can adopt; there are many ways in which such a conformational analysis can be carried out.^[19] The distance-based screening and subgraph isomorphism searches are then applied to all of the conformations describing each of the database-molecules. An alternative approach, more precise but also potentially much more time consuming, carries out a conformational analysis during the execution of the search, with the screening and subgraph-isomorphism stages being used to minimize the numbers of molecules and numbers of conformations that need to be explored by the conformation-analysis routine. This approach also requires the use of a different type of graph. Whereas the edges in a graph for rigid 3D searching encode interatomic distances, the edges for flexible 3D searching encode distance-ranges, the lower- and upper-bounds of which correspond to the minimum- and maximum-possible distances between each pair of atoms. The resulting graph encompasses all possible geometrically feasible shapes that the molecule can adopt; the final conformational analysis then checks whether hits that are geometrically feasible are also energetically feasible.^[24]

Similarity Searching and Docking

Pharmacophore searching is now well established, although a flexible search for a broadly defined 3D pattern can be extremely time consuming unless other information can be used to constrain the search. Similarity searching in 3D is less well established. As noted previously, similarity measures based on fingerprints are used in nearly all 2D similarity searching systems, but there is still much debate as to how similarity in 3D should be quantified. Approaches based on comparing sets of interatomic distances (and more complex distance functions), the shapes of molecular surfaces, and surrounding electrostatic fields, *inter alia*, have all been discussed in the literature.^[25] Thus far, however, it is not clear that any one approach is consistently superior to the others or, indeed, that the increased (in some cases massively increased) computational load results in searches that are more effective than similarity searches based on conventional 2D fingerprints.^[10,11]

There is, however, one type of 3D search that is very widely used: *docking*. Similarity searching seeks database-molecules that are structurally similar to the reference structure; docking seeks database-molecules that are structurally *complementary* to the binding-site of a protein, i.e.,

that part of a protein that is involved in a biochemical pathway that a molecule needs to modify if it is to function as a drug. The need for complementarity arises from the so-called *lock-and-key* theory of drug action, which assumes that a molecule is likely to be able to act as a drug if it fits into a binding-site in much the same way as a key fits into a lock. A docking search hence requires that we know the 3D structure of the protein, information that is increasingly available from studies using x-ray crystallography and NMR (nuclear magnetic resonance) spectroscopy: the Protein Data Bank (at <http://www.wwpdb.org/>) is the principal repository of such data.^[26] The first program for docking was described by Kuntz et al.,^[27] whose DOCK program was based on complementarity of shape, as encoded in sphere-like descriptions of the shapes of the binding-site and the database-molecules. This basic approach has since been much extended, with enhancements including the use of chemical complementarity (e.g., areas of positive charge fit best with areas of negative charge) and the inclusion of algorithms that permit the docking of flexible molecules (although it is not generally possible, as yet, to allow for flexibility in the protein).^[28]

COMPUTER-AIDED DRUG DISCOVERY

This final entry describes the use of chemoinformatics to support drug discovery since the pharmaceutical industry has been, thus far, chemoinformatics' principal application domain. However, it is also being increasingly used in related specialty areas, e.g., the agrochemical and biotechnology industries, and is applicable in principle to any area of chemistry where there is need to identify molecules with particular types of property. We focus here on three applications: *quantitative structure–activity relationships*, *molecular diversity analysis*, and *ADMET prediction*. All of these, and the searching methods described thus far, can be considered as examples of *virtual* (or *in silico*) *screening*.^[29,30] Even with the significant developments that have taken place in the speed of biological screening, this is still the most time consuming and most expensive part of the discovery stage of pharmaceutical research (although the costs of this stage are far outweighed by the costs of the subsequent development and clinical stages). The cost-effectiveness of drug discovery will hence be maximized if molecules with a low probability of activity can be eliminated at as early a stage as possible from the discovery process; virtual screening is one of the most important tools available to achieve this end.

Quantitative Structure–Activity Relationships

Thus far, we have focused on the searching capabilities of modern chemoinformatics systems. Of equal importance is their ability to correlate structural information with the biological properties of molecules, which in the case of

pharmaceutical research is normally some sort of therapeutic property, e.g. lowering a person's blood pressure. Biological experiments are time consuming and expensive, even at the *in vitro* level, and hence an effective method for predicting a molecule's properties from its 2D or 3D structure can help to enhance research productivity by focusing experimental studies on those few molecules that are predicted to exhibit the desired activity. The basic methodology is to take some number of molecules for which the necessary biological data are available, and then to use this *training-set* to develop a mathematical model relating the experimental measurements to structural descriptors. If a statistically significant relationship can be derived, then it can be used to predict the property values for previously untested molecules in the *test-set*, and hence to identify those worthy of further, more detailed study. This is analogous to the use of known relevant documents to compute weights that can then be used in a relevance-feedback text search.

The development of what came to be called quantitative structure–activity relationships (QSAR) derives in large part from the pioneering work of Hansch and his collaborators.^[31,32] Hansch analysis, as the approach has come to be called, involves the use of multivariate statistical methods, such as multiple regression or partial least-squares, to correlate molecular physicochemical properties (such as the octanol/water partition coefficient or the molar refractivity that are relatively easy to compute or measure) with quantitative biological data (that are much more difficult to measure). The approach is still widely used but does have two principal limitations: it can only be applied to small sets of structurally similar molecules, typically groups that have a common central ring system and that differ just by the nature of the substituents on this central scaffold; and it is based on the correlation of physicochemical properties computed from the structure, rather than the structure itself (which can be used to compute a very wide range of types of descriptor^[33]). The latter limitation is addressed in the widely used CoMFA (for Comparative Molecular Field Analysis) approach to QSAR, where 3D variables describing the shape and the electrostatic charge of molecules are correlated with biological activity. CoMFA (and related approaches) is now the standard method for the analysis of small datasets but is still restricted to structurally related sets of molecules.^[34] With developments in high-throughput biological testing, there are now large amounts of biological data for massive, structurally diverse sets of molecules, and this data explosion is currently driving the application of machine-learning techniques (such as support vector machines, neural networks, and naive Bayesian classifiers) to chemoinformatics datasets.^[35]

Molecular Diversity Analysis

The virtual screening methods described thus far can be used if some molecules have already been tested, e.g., a

similarity search if just one active is available or a docking search if the 3D structure of the biological receptor is known. If no such information is available then molecular diversity analysis is used to select molecules for testing. The Similar Property Principle means that molecules with similar structures are expected to have similar biological activities, and hence a virtual screening model is likely to have significant predictive power only if the molecules selected for inclusion in the training set are as structurally disparate as possible. The selection of such structurally disparate sets of molecules for biological testing is effected using the techniques of molecular diversity analysis.^[36,37]

There are many ways in which a diverse set of molecules can be identified: we will illustrate the approach by cluster-based selection, which is perhaps the best established of the methods.^[38] In the present context, cluster analysis involves partitioning a database into groups (or clusters) so that the molecules within each of the clusters are strongly similar to each other but dissimilar to the molecules in the other clusters. The similarities are normally computed using 2D fingerprints (as described for 2D similarity searching) and a clustering method then applied to the sets of intermolecular structural similarity values to derive the clusters. There are many different clustering methods that can be used, with the Jarvis-Patrick and Ward methods being the most common for chemical applications. Once the database has been clustered, one molecule (normally that closest to the centre) is drawn from each cluster in turn, with the expectation that the resulting set of selected molecules will have only a limited degree of similarity. If one of the molecules that has been selected proves to be biologically active when tested, then the other molecules in its parent cluster are also candidates for testing.

ADMET Prediction

Thus far, we have focused on the use of structural information in drug discovery. However, the fact that a molecule contains the correct substructural features is not sufficient for it to be a useful drug when administered to a patient. In particular, it is vital that it has an appropriate profile of pharmacokinetic properties and that it is not toxic: for example, molecules that are rapidly metabolized in the body will be unable to exhibit the desired therapeutic activity. Historically, ADMET (standing for absorption, distribution, metabolism, excretion, and toxicity) testing was carried out once a potential drug molecule had been identified. However, it became clear that this meant that a lot of time was spent optimizing the structures of molecules that subsequently proved to be unsuitable and ADMET testing is increasingly being carried out in parallel with chemical and biological screening. In addition, in just the same way as QSAR is used to direct a research program by predicting the biological

activity of molecules that are being considered for synthesis (or acquisition) and testing, so there is much current interest in the development of ADMET methods that could predict the pharmacokinetic and toxicity behavior of molecules.

A very simple approach involves analyzing simple physical properties of successful drugs to enable an assessment to be made of the *drug-likeness* of a molecule. There is now considerable evidence that properties such as the molecular weight, the octanol/water partition coefficient, the numbers of heteroatoms, and the degree of conformational flexibility provide an effective basis for screening out large numbers of molecules that cannot possibly be effective drugs.^[39] More sophisticated approaches have adopted the statistical techniques that are used in QSAR to obtain correlations between substructural descriptors or physicochemical properties and important characteristics such as intestinal permeability and absorption, oral bioavailability, aqueous solubility, interactions with cytochrome P450s, and toxic side-effects.^[40,41]

CONCLUSIONS

The discovery of novel drugs is costly, time consuming, and scientifically demanding. The productivity of drug research is maximized if attention can be focused on just those few molecules that have a high a priori probability of success, and chemoinformatics provides a range of tools to support this aim. The brief introduction here has focused on the methods that are available for searching and for processing databases of 2D and 3D chemical structures, summarizing methods for structure, substructure and similarity searching, docking, quantitative structure–activity relationships, molecular diversity analysis, and the prediction of the pharmacokinetic and toxicity characteristics of molecules.

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Children and Information Technology

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Abstract

This entry presents research on the complex topic of children and information technology. Covered are children aged 0–18. Information technology has changed significantly over the last few years as has the research covered by Library and Information Science. This entry includes a brief overview of research between the years 1995 and 2009 and more in-depth coverage of the years 2010–2014. Children have increased using information technologies in every aspect of their lives to play, learn, communicate, and participate in online ecologies. A multidisciplinary perspective is taken to show that children are engaged participants, connected continuously using many technologies, including mobile devices such as smartphones and tablets, and creative content developers, but who still are plagued with poor understanding of how to effectively use retrieval systems. The technological, psychosocial, ethical, security, and legal issues children encounter while online are also presented.

INTRODUCTION

Children and information technology is a very broad topic, thereby requiring broad coverage. For the ease of the reader, the term “children” will be used to indicate both children [ages 0–11] and young adults [ages 12–17]. This entry does not include discussion on young adults between the ages of 18 and 26. The term “information technology” is defined broadly as “any electronic format designed to help people access information.”^[1] This definition allows us to include any textual, audio, video, image, or virtual media, including the Internet and World Wide Web, as well as mobile technologies such as smartphones and tablets. The popular perception is that children are “digital natives” who are adept at using information and communication technologies.^[2] This population of children represents the first group who have grown up with technologies such as computers, mobile devices, and social media interwoven into many aspects of their lives. The research, as will be outlined within this entry, is beginning to paint a picture of children as engaged, connected, creative users, not just consumers of information technologies, but who are still plagued with issues of information illiteracy and poor understanding of how to use retrieval systems effectively.

Along with technology use are the psychosocial, ethical, security, and legal issues that children face daily as they interact in the new information ecologies or “networked publics”^[3] of the Web, and particularly, social media. As we learn more about how children are using, and are users of, information technology, it is important to remember that children will still go through the same experimental, explorative process of play, communication, and emotional and psychosocial development as

children always have, and to them information technology is a necessity in many of their social worlds.

This entry does not seek to provide a comprehensive review of all of the literature, but rather will synthesize our understandings of children’s use of information technology and to present important research areas being explored in Library and Information Science. As some of the research is multidisciplinary, guided by theories and studies within the fields of Education and Communication, this entry will include studies from those fields as relevant to understanding the complex relationship between children and information technology and to explore sociocultural issues not fully addressed in library and information science literature. Furthermore, as previous editions have provided coverage of earlier research, this entry will include only a brief summary of research conducted prior to 2010. For earlier research, refer to previous editions of this entry.^[4–6]

OVERVIEW

Children globally have unprecedented levels of access to information technology, whether through the use of computers located in their homes, schools, libraries, or other locations, or through their cell and smartphones or other mobile devices. For example, China has invested significant effort to add information and communication technologies (ICTs) to schools. In 2007, 270,000 elementary and secondary schools in central and western regions added facilities with ICTs, with the majority of these facilities connected to the Internet for the first time.^[7] Schools in remote rural areas, however, in 2008 remained largely unconnected.^[8] The International Telecommunication

Union has estimated the worldwide population of digital natives as 363 million or 5.2% of the world's population of 7 billion in 2012. They define digital native as the population of networked youth, aged 15–24, with 5 or more years of online experience. This estimate equates to 30% of the world's youth population as digital natives. Digital natives, however, still represent a minority among the world's youth due to low Internet usage rates in developing countries. The total population of digital natives varies between countries, from 0.1% in Timor-Leste to a high of 14% in Iceland; median population of digital natives in Belarus and Syria with 5.5 and 5.4, respectively. Notably, the populations with the highest proportions of digital natives are all high-income or upper-middle-income countries with very high overall levels of Internet penetration, including Iceland, New Zealand, Republic of Korea, and the United States (19).^[9]

Other studies focused on the U.S. children reveal that information technology use begins at a very early age. A 2013 study conducted by the Common Sense Media group found that U.S. children aged 8 and under spend an average of 1 hour and 55 minutes a day with screen media, an increase of 21 minutes spent in 2011. Screen time measured included watching TV, playing video games, using a computer, and using mobile devices such as smartphones and tablets (15).^[10] Further telling is that in 2011 only 8% of children aged 8 and under had access to and used tablets, while in 2013 this figure increased to 40%, with many of the children having access to their own tablets, not having to share it with other members of the family. Smartphone ownership within the family has also increased from 41% in 2011 to 63% in 2013. Use of mobile devices has also increased for this age group and begins at a young age, with 38% of children of age 2 and under using a mobile device for any media activity, compared with 10% in 2011. Among 2- to 4-year-olds, the rate increased from 39% in 2011 to 80% in 2013; and among 5–8-year-olds, from 52% to 83% in the past 2 years (20).^[10] Older children (ages 12–17) have been the focus of multiple large-scale studies. For example, a 2012 joint Berkman Center for Internet & Society at Harvard (Berkman) and the Pew Research Center (Pew) study found that 78% of U.S. teens (ages 12–17) own a cell phone, with half of those phones being smartphones. This figure is an increase over 2011, in which only 23% owned smartphones. One in four teens or 23% own a tablet; three in four or 74% say they primarily access the Internet on cell phones, tablets, and other mobile devices. Thirty-four percent of teen girls aged 14–17 report that they mostly go online using their cell phone, compared to 24% of boys in the same age range. Fifty-five percent of teen girls who own smartphones report they access the Internet mostly from their phone (2).^[11] It is also important to note that a digital access divide still exists among teens from lower-income households. Teens in lower-income and lower-education households are “still somewhat less likely to

use the Internet in any capacity”; however, the income and education level of parents does not affect the likelihood that teens in these families own cell or smartphones (7).^[11] Increased access to information technologies provides children, especially older youth, with opportunities to learn, play, create, socialize, and participate in civic life at unprecedented levels than earlier populations of youth.

AREAS OF RESEARCH

Research Prior to 1995 (years of each section based on years that correspond to earlier editions of this entry).

There is a rich history of research on children's use of information technology, with the majority of the research focusing on older children (middle and high school students of ages 11–17), and much of the research employing small, nonrepresentative samples. Research prior to 1995 (when more widespread use of the Internet and World Wide Web began) focused on children's use of electronic resources, such as online public access catalogs (OPACs), databases, and CD-ROM software in libraries and school media centers. This body of research on children's use of electronic resources “reflected the pragmatic concerns of librarians and educators who saw a need to train students in the effective use of these new information resources” (2).^[12] Much of the research during the 1980s and prior to the Internet use provided descriptive data on which schools provided access to electronic resources, and the effect (whether positive or negative) using these new electronic sources had on children's information retrieval abilities. It examined the role that system design, search skills such as formulating Boolean searches, and the use of synonyms, truncation, and controlled vocabularies had on children's abilities to find information in electronic resources. Research did not focus on children's information seeking behaviors and the cognitive, physical, emotional, etc. factors that might affect retrieval.^[12] The reader is referred to Cool^[12] and to an earlier edition of this entry^[4] for further coverage of the research conducted in the 1980s and prior to 1995.

Research 1995 through 2004

Research conducted between the years 1995 and 2004 continued to explore children's use of electronic media, but it also began to examine 1) how children were using the new technologies of the Internet and World Wide Web, search engines, and digital libraries (for a comprehensive look at children and the Web during this time span, see Large^[13]); 2) other information technology devices such as electronic books (e-books) and PDAs; 3) collaboration between children and technology designers; 4) use of computers in libraries and schools; 5) the impact Internet access and use had on children's use of the public library; and 6) use of new technologies to reenergize old

practices (blogs, e-books, literature circles). Also investigated were older children's selection criteria of Web pages and the factors considered when librarians design Web pages for use by children. Refer to the 2003 and 2005 editions of this topic^[4,5] for more in-depth descriptions of the research conducted during 1995–2004.

It is also important to note that beginning in 2001, several large-scale national surveys within the United States as well as in Canada were conducted to learn more about children's online activities while they use the Internet. The Pew Research Institute's American Life Project^[14] conducted numerous surveys using both nationally sampled, random digit dialing telephone surveys as well as focus groups with children and their parents. Other groups, such as Environics Research Group, the U.S. Department of Education, Grunwald Associates with cooperation of the Public Broadcasting Service, also conducted large studies on youth's online activities in the United States and Canada. The results of these surveys served as our main source of nationally representative, generalizable findings on what activities children engaged in while online, locations of access,^[15,16] attitudes of parents and children,^[17] and youth's educational and recreational uses for information technologies (included teachers' perspectives as well).^[18] These earlier studies helped us develop a more complete view of what children were doing online, the activities they engaged in, and their attitudes, opinions, and purposes for using the Internet. Findings indicated that 1) children viewed themselves as tech-savvy, especially more than their parents and/or teachers; 2) the Internet played a pivotal role in children's lives and they both rely on it and value its use; and 3) children used the Internet for communication with friends, to surf for fun, and for recreational and educational purposes. These studies did not, however, reveal any findings about children's information seeking processes, problems encountered while searching and using search engines, nor the effect cognitive, developmental, physical, or emotional variables can have on children's search success.

Research 2005 through 2009

Research conducted in 2005 through 2009 continued with and expanded upon the research emphases of prior years (information seeking processes and factors that affect retrieval of digital resources, the role that children can play in collaborative design of systems for children, i.e., digital libraries, search engines, Web pages, and children's online activities). Information seeking success can be influenced by many cognitive, developmental, and system factors. Previous research findings indicate that children in all age groups encounter a range of difficulties while searching for information due to 1) a lack of understanding about how the system works; 2) limited search and semantic skills; 3) the system's use of an inappropriate controlled vocabulary to describe the resources;

4) resources were not current, not age-appropriate or contained incomplete or low-quality information; and 5) systems were not designed for children and included features that distracted children and/or made navigation confusing and inefficient. During 2005 through 2009, research continued to help us understand children's search processes, the factors that impact children's success while seeking information, and their seeking within specific contexts (OPACs, databases, the Internet using search engines, and digital libraries). Beginning in 2005, two new areas of research appeared in the literature on children's information seeking. These areas included the effect of affective variables such as emotion on information seeking outcomes and the multicultural use of information technologies, mostly in the context of digital libraries. While affective variables are not new to studies conducted in the fields of psychology, computer science, education, or cognitive science, affective variables have not been emphasized as a research area in information science until recent years. Bilal^[19] explains that children "need to possess not only adequate information-seeking skills but also intelligent affective strategies that will help them cope with its [information technology's] complexity" (198).

Also of importance, during the years of 2005–2009, we saw a radical shift in how children interact with information technology. Instead of just being passive users of information technologies such as library OPACs and the Internet to locate information, children, especially older children, became very active content creators, designers, teachers, and participants in social networking, gaming, and virtual environments. This "shift" opened up new areas of research, as well as presented many pragmatic, ethical, and safety-related issues for children, their parents, and practitioners and libraries. While our understanding of children's use of the Internet is informed by the areas of research outlined earlier (use of electronic and multimedia resources, their information-seeking activities, the problems they encounter when using systems, and the cognitive, affective, physical, and developmental factors that can impact their system use and retrieval activities), examining children's use of the Internet is a very complex issue that requires us to not just look at their use through a traditional information-seeking and system use lens but rather, we need to look broader at the activities and environments they engage within, the social issues that are becoming more prevalent with universal Internet access such as cyberbullying, privacy, and safety. New areas of exploration during this time period were related to 1) the use of social networking sites, such as MySpace and Facebook;^[20] 2) content creation on blogs and social sharing sites such as YouTube;^[21] 3) social issues of cyberbullying, identity, privacy, and safety;^[22–24] and 4) information technologies used for communicative purposes, including cell phones, email, and texting.^[20,25] Refer to the 2010 edition of this topic for more on the research conducted during 2005 through 2009.^[6]

Research 2010 through 2014

The research emphases that had begun in earlier years became even more important in 2010 through 2014 as more researchers focused on the “digital native” or “digital youth” and understanding more about their information behaviors, information literacy, online participatory activities, and the impact the information technologies had on their intellectual and psychosocial development. Much of the research during this time period is on older children, or teens, with scant research focused on younger children. While traditional research areas of information behavior and information retrieval continue to help build understanding of the digital youth, much of the research during this time period focused on youth’s use of and participation in online ecologies, such as social networking and collaborative sites. Research of youth within this context has explored their frequency and motivation of use, psychosocial issues such as identity development, privacy and safety issues, and the potential benefits and drawbacks of participating in online environments. This section will outline the research areas prevalent during this time period with examples of research that contribute to our understanding of children and information technology.

Information behavior

Research on the information behaviors (IBs) of children can help us better understand today’s digital youth. Wilson defines IB as “the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use.”^[26] Information behavior can be purposive, having a specific goal in mind, and may be engaged in as part of a person’s everyday information activities. Several models have been proposed throughout the years to portray the iterative, interactive, dynamic processes humans engage in when browsing or seeking information to meet an information need. (Refer to Fisher et al.^[27] for discussion on information behavior models.) The research conducted between 2010 and 2014 included various contexts and frameworks for understanding information behavior of youth, including for example, studies based on the everyday life information seeking (ELIS) framework, the creating behavior of youth as an additional aspect of IB,^[28,29] health information seeking,^[30–35] information behaviors of specific populations^[36,37] who examined the understudied population of Latino youth in poor California communities, and studies concerned with information retrieval factors.

Everyday life information seeking

The everyday life information seeking (ELIS) framework was proposed by Savolainen and has been adapted by other researchers. The ELIS framework describes an individual’s daily life information activities and the role

information plays in decision making. Furthermore, it proposes that the individual habits we form when monitoring daily events and seeking information, as well as the sources and channels we use to find information, are based on values, attitudes, and interests learned in sociocultural contexts.^[38] A chapter by Abbas and Agosto,^[39] in Behesti and Large’s recent book on the information behavior of the digital generation,^[40] outlines research in youth’s ELIS and describes how ELIS is useful in understanding digital youth. Synthesis of the research to date on youth’s ELIS found:

- Youth search for information for various purposes (problem solving, coping, entertainment, self-development).
- Youth prefer to use informal human channels first, such as family and friends and use various information technologies to communicate with friends and family.^[41,42]
- Youth use the Internet to find information related to various everyday information needs, for entertainment, and to participate in social networks.^[39]

What ELIS research has not uncovered is whether or not youth are using information technologies such as cell and smartphones and social network sites to find information. Many of the ELIS studies outlined in this entry took place prior to large-scale adoption of information technologies by youth but the research has illustrated how this framework can be very useful for understanding digital youth.

Creating behavior

The most prevalent models of information behavior include the recognition of an information need and the process an individual follows to satisfy that need. What is generally not explored is the complex creation process undertaken by youth when they use found information to develop new information or products. Online environments afford youth many opportunities to create information products such as YouTube videos, websites, social media posts, online photos posted on sharing tools (e.g., Flickr, Snapchat, Instagram). Youth creating behavior, then, would seem to be a necessary aspect of understanding their information behaviors; however, few studies to date have explored this component of information behavior. Harlan et al.^[29] and Koh^[28] have proposed that creating behavior be included in information behavior models. Harlan asserts that “the affordances of social media—ease of use, ubiquitous access, and communal nature—have made creating and sharing content an appealing process for teens.” (p. 569) She also links creating behavior to learning and information literacy. Her research explored how teens experience using information to learn as they engage in online communities. Koh examined older children’s information creating behaviors while participating in an online community using the programming tool Scratch. Her findings indicate that creating behavior

includes 1) the development of content, 2) organization, and 3) presentation of information. Furthermore, the findings illustrate the complex processes youth engage in when creating content in online, collaborative environments, including 1) visualizing (using visual tools and multimedia to communicate their ideas); 2) remixing (building on or adding to the original information or projects of others and then sharing the product with others); and 3) tinkering (iterative design process youth engage in while creating). Youth also felt a sense of empowerment as they contributed to the Scratch community and took on new, more responsible roles. Koh's study also shows how youth seek and evaluate information from multiple sources to determine their accuracy and how they demonstrated an understanding of the relationships connecting the various sources they used.

Health information seeking

Health information seeking by youth has increased in recent years. Fox and Jones in 2009^[43] found that 28% of older youth (12–17) have used the Internet to look for health-related information. In 2010, Purcell and Lenhart^[44] reported that of the 93% of the U.S. youth (aged 12–17) who went online, 31% had searched for health information. Furthermore, a multidisciplinary literature review between the years 2000 and 2012^[31] examined 82 articles on teen's health information seeking and found that 57% of teen health information behavior studies were focused on specific topics such as sexual health, mental health, nutrition and eating issues, and those related to alcohol, drugs, and tobacco; 43% covered more general health topics. The majority of the studies included online resources as the context of the study, with 47% focused only on online resources and 36.5% including both online and other types of resources. The review also found that the number of studies focused on teen health information seeking increased beginning in 2011. Health information behavior studies have examined many aspects of youth information behavior including 1) the information coping strategies and online activities of young people,^[30,34,35] 2) searching for nutrition-related information,^[45] 3) using text messaging and other information technologies to assess adolescents' health information needs,^[32,46] 4) the issue of trust as a factor in user-centered design of systems promoting sexual health in African-American youth,^[33] 5) the use of social media to find health information,^[47,48] and ELIS as a way to understand the "coming-out-process" of gay youth.^[49]

Information retrieval

Information retrieval studies are concerned with the seeking or retrieval process of information behavior. The studies include models of information seeking/seekers, search processes, barriers to retrieval, and factors to consider in retrieval system design. Research during 2010 through

2014 continued to explore children's web searching and technoliteracy;^[50–54] roles that youth of all ages display while seeking information;^[55,56] and innovative ways to increase precision and recall in systems designed for children.^[57] As noted earlier, children encounter many issues when searching for information using information technologies. Today's digital youth are no exception. Research has shown this to still be an issue in children's information seeking. For example, Spink and colleagues studied web searching of 4- and 5-year-olds and discovered that young children use search engines to both search and browse for information. Young children are also capable of complex web searches, could evaluate sources for relevance to their query, and engaged in successive, collaborative search behaviors like those of adults. Their technoliteracy was measured as competent as they proficiently used the mouse, cursor, and keyboard to effectively navigate the websites. The children did, however, exhibit issues while constructing queries related to spelling and word acquisition.^[50] Behesti, Large, and Tam's study of transaction search logs from a Canadian history web portal designed for children showed that children preferred to browse using the topic taxonomy feature, followed second by the alphabetical word search (combined 83%), rather than search using key words or the advanced search feature.^[53] Bilal and Ellis^[51] and Bilal^[52] took a different approach as they compared the performance of five search engines, two being specifically designed for children, and found that the engines designed for children did not perform as high as, based on relevance of documents retrieved, the larger engines. The child-centric engines did, however, retrieve higher precision results on partially relevant results. The results of the studies illustrate that children continue to encounter many barriers when searching for information on the Internet such as using advanced features of engines that enable them to filter results, the ability to formulate effective search strategies and to interpret and evaluate the results retrieved, and possessing adequate reading skills (189).^[52]

Teachers also provide a valuable perspective on children's information literacy and technological fluency. A survey of Advanced Placement (AP) and National Writing Project (NWP) teachers revealed that teens' research habits are changing in the digital age. The study findings indicate that 75% of AP and NWP teachers report that while the Internet and search tools have had a mostly positive effect on students' research habits, 87% said these technologies are creating an "easily distracted generation with short attention spans," and 64% say "today's digital technologies 'do more to distract students than to help them academically'" (2).^[58] Some of the positive effects include access to a "greater depth and breadth of information on topics that interest them," engaging multimedia formats, and that many become self-reliant searchers. Teachers are, however, concerned with increasing dependence on search engines, the difficulty children have on judging reliable,

quality information, increasing distractions, poor time management skills, and the general level of literacy of children (2).^[58] Furthermore, the teachers report that the Internet has changed the nature of research. To children, research means “Googling,” in which the student no longer engages in a slow, intellectual process of discovery, but rather is concerned with quickly finding just enough information to complete the assignment (3).^[58]

Teachers also noted many barriers to incorporating information technologies into their classrooms, such as policies restricting use of cell/smartphones in school, Internet filters on school computers, and provisions in a school’s acceptable use policy (5).^[58] In a related report from the Berkman Center for Internet & Society at Harvard University (Berman Center), youth report similar observations. Youth reported a wide variety of school policies related to laptop use, phones, iPads, and other mobile devices and how the policies served as barriers to access. An interesting finding was that youth mentioned being frustrated with school initiatives to provide them with new tablets for academic purposes when they would have preferred laptops instead.^[59]

While most information retrieval studies of children take place in schools, libraries, or in laboratory settings, Foss and colleagues^[55,56] studied children of ages 7, 9, 11, and 14–17 in their homes. The goal of their study was to understand how children search the Internet in their homes and to uncover potential triggers to searching, search rules, emotional and social factors encountered, and how they handle multistep, complex search tasks. Their study developed a framework of seven search roles children can be characterized by including 1) Power (awareness of sources to use and ability to use advanced search features); 2) Developing (limited knowledge of search tools, unable to plan searches or to verbalize their search process, and use a variety of search approaches); 3) Distracted (tendency to drift easily off task, and to encounter information not related to the task); 4) Nonmotivated (compliant with directions to search but generally do not choose searching or the computer as an activity); 5) Domain-specific (use search abilities to gather information on specific topics of interest); 6) Visual (a desire to retrieve information from visual sources, like pictures or videos); and 7) Rule-bound (displayed constrained searching patterns, repeating the same steps each time).^[55] Younger children (ages 7, 9, 11) displayed different roles than adolescents. For example, there was an absence of Distracted Searchers in adolescents, while an additional role emerged for adolescents, that of Social Searcher, whose main use of the computer was driven by social factors such as communicating with friends using social networking sites. The other notable difference between younger children and adolescents was that Power searchers were more advanced in their searching than younger children (178–179).^[56] These studies illustrate that children do not all search the same, in fact they take on a variety of different roles when

searching. Gossen and Nurnberger^[60] note that one of the current problems in IR research for children is that researchers view children as a consistent user group. Furthermore, researchers do not consider that children of different age groups may require different solutions that influence the design of information systems. The studies outlined here, as well as earlier studies by Bilal and other researchers,^[5,6] illustrate how children’s abilities differ from adult searchers, their ideas of research and how to find useful information are changing, and that age and cognitive abilities are factors that still require further exploration.

Internet Use: Social Networking

During 2010 through 2014 the use of the Internet increased with an estimated 95% of teens in 2012 reporting they go online. Eight in ten online teens have used some form of social media (19).^[61] Online environments have changed the way that people seek information, interact with others, contribute to participatory cultures, create, learn, and play. LIS research on the Internet during this time period continued to focus on the pragmatic, ethical, legal, and literacy issues related to use of the Internet and social networking sites. Research of youth in social networking sites has explored their frequency and motivation of use, information technologies used to go online, psychosocial issues such as identity development and privacy and safety issues, and the potential benefits and drawbacks of participating in online environments. Anttiroiko and Savolainen^[62] defined Social Network Sites (SNS) as “profile-based hosted services that allow people to create and maintain networks of friends and contacts based on general social interests” (p. 89). Examples of the most popular SNS currently are Facebook and Twitter, though use of SNS continues to change as new different, subject-specific, or media-specific sites appear. For example, Instagram and Snapchat are becoming favorite sites among older children. These new SNS allow teens to post images and/or short videos that can be instantly shared with friends, without requiring the content development and upkeep of a Facebook profile page. The sites allow teens to communicate quickly and easily with their friends, without the drama or time investment of Facebook.

Compared with adults, U.S. teens are heavy users of SNS. In 2012, 77% of online teens reported they have a Facebook account (81% reported using social media), and 24% of them used Twitter, while 67% of adults used social media and 16% used Twitter.^[61] Research related to SNS use by children has also continued to increase. A multidisciplinary literature review conducted by Agosto and Abbas in 2012, including studies focusing on youth between the ages of 12 and 18, showed that 38 studies were published between the years 2006 and 2011. Their study concluded:

The burgeoning body of literature paints a multifaceted picture of youth people's SNS practices, and the major issues that surround their participation in social networking communities. For the most part, the kinds of activities taking place in SNS are the same kinds of activities that took place offline among previous generations of young people. The difference is not so much the kinds of activities that are occurring online, but the *amount, frequency, and semipublic nature* of these activities (pp. 123–124).^[63]

This conclusion is supported by other researchers such as Boyd,^[64,65] and Livingstone and Brake.^[66] Agosto and Abbas outline major themes in the literature including:

- Motivation (social interaction/communication,^[41,42,64,65,67–75] relationship building and maintenance,^[41,42,68–71,76–79] emotional support,^[68–70,80] convenience^[41,42,71,81]).
- Benefits (identity exploration and formation,^[64,65,68–70,78,80,82–87] technological literacy,^[67,70,77,80,86,88,89] educational support/formal learning,^[73,86,85,90] positive self-esteem^[41,76,91]).
- Harms (privacy risks,^[67,92–95] security risks^[41,67,92,94–101]).

These themes have been reflected by the large-scale studies conducted on this topic between 2010 and 2014. More recent studies are outlined briefly as follows.

Bullying in a Networked Era:^[102] As part of the Kinder and Braver World Project at the Berkman Center for Internet & Society at Harvard University (Berkman Center), this report provides a multidisciplinary literature review of academic research on the topic of bullying. The review focuses on research published between 2008 and 2012 but includes some important earlier studies as well. The study captures both offline and online bullying and is guided by two questions, “What is bullying?” and “What can be done about bullying?” A companion to this report is an overview of state antibullying legislation and other related laws in the United States.^[103] This report provides an overview of existing and pending antibullying state legislation, as well as specifics of how the laws define and address bullying, cyberbullying in multiple contexts, and procedures for reporting and prosecuting offenses.

Teens and Technology 2013:^[111] This report, a collaborative effort by the Pew Research Center's Internet and American Life Project and the Berkman Center, describes cell and smartphone adoption among teens and how using cell or smartphones has afforded them 24/7 mobile access to the Internet. See Overview section for key findings.

Social Media, Social Life: How Teens View their Digital Lives:^[104] This Common Sense Media research study gives another glimpse into teens and their use of social media. Their study complements other studies

conducted by Pew and the Berkman Center. Key findings include:

- Nine out of 10 or 90% of 13–17-year-olds have used some form of social media.
- Seventy-five percent have a profile on a social media site; 22% have a Twitter account.
- For the vast majority of teens, social media and other forms of digital communication are a daily part of life. Sixty-eight percent text every day; 51% visit social media sites daily; 34% visit their social media site several times a day; 11% receive tweets at least once a day.
- One in four (23%) are “heavy” social media users and use at least two different types of social media every day (9).
- Most teens prefer face-to-face communication. About 49% prefer in person communication with friends. Texting is their next favorite (33%), followed by social media (7%), talking on the phone (4%), and tweeting (1%). They prefer in person communication for various reasons, mostly because it is fun (38%) and they can understand what people mean better (29%) (11).
- Some teens wish they could disconnect more often and that others would too. Forty-one percent said they were “addicted” to their phones; 43% strongly or somewhat agree and wish they could unplug sometimes. The teens who reported they are most interested in unplugging are the ones who either are not using social networking or who have had a bad experience online (2).

Teens, Social Media, and Privacy:^[61] This report, a collaborative effort by the Pew Research Center's Internet and American Life Project and the Berkman Center, provides up-to-date research on teen's (ages 12–17) use of social media, their sharing and privacy practices, and impressions of online privacy. Some key findings include:

- Teens are sharing more information about themselves on social media than they did in the past; 91% post photos of themselves, 71% post their school name, 71% post their city or town, 53% post their email address, and 20% post their cell phone number. These figures differ across age, with older teens (14–17) sharing more content than younger teens.
- The typical teen Facebook user has 300 friends, while the typical teen Twitter user has 79 followers. Older teens tend to be friends with a variety of people than younger teens, with most of their friends being people they know.
- Teens are losing interest in Facebook and reported a dislike of the adult presence, people sharing excessively, and the stressful drama in many of the posts as

reasons. They continue using Facebook because it is an essential part of teen socializing.

- 60% of teens keep their profiles private and say they can confidently manage their privacy online.
- Teens use multiple measures to maintain their reputations online and to manage their networks, including for example, deleting people from their friends/followers list, pruning their profile content, posting false information such as fake name, age, or location.
- Teens did not report a high level of concern about third-party access to their data, only 9% reported they were “very concerned.”
- Teens reported more positive experiences than negative experiences (2–7).

Where Teens Seek Online Privacy Advice:^[105] This report, a collaborative effort by the Pew Research Center’s Internet and American Life Project and the Berkman Center, sought to determine the resources teens used to learn about protecting their online privacy. Some key findings include:

- Teens (ages 12–17) in the United States care about their online privacy and take steps to manage access to their online social media spaces.
- Many teens report relying on themselves for learning about online privacy measures; however, the majority of teens (70%) found themselves asking for outside advice at one point
 - 42% asked a friend or peer for advice
 - 41% asked a parent
 - 37% asked a sibling or cousin
 - 13% used a website for advice
 - 9% asked a teacher
 - 3% have gone to some other source
- Younger teens (12–13) are more likely to seek out advice than older teens.
- Girls are also more likely to seek out advice than boys.
- White teens from high-income and high-education households are more likely to turn to parents for advice.
- Teens who have sought advice take similar measures to protect their online presence as do those who have not sought advice.

It is evident from the research that social networking sites figure prominently and are an essential part of children’s lives. The data show that almost all teens have used social media at some point, many use more than one site, and may visit the site more than once a day. Teens are, however, becoming less enthusiastic about using some social media, such as Facebook, and wish they could disconnect at times and that others would do so also. Children feel that they do a good job of managing their online profiles and employ various measures to keep their information private, though at the same time, they are not worried about third-party access to their personal data.

Digital Media, New Literacies, Digital Youth

A related research area which serves to help us better understand children and information technology is that of digital media use and new literacies from the fields of education and communication. While a bit out of scope for this entry, what we are learning from studies in this area is informing research and practice, specifically in public and school libraries. To study the “digital native” or “digital youth,” Ito and colleagues undertook a ground breaking study to explore the social and cultural influences of new media practices on today’s youth, and to determine how digital media are changing the way young people learn, play, socialize, and participate in civic life. Their 3-year multiproject study funded by the MacArthur Foundation included a comprehensive ethnographic study of 700 youth. The researchers developed a framework of “genres of participation” that helped to describe different levels of commitment of youth engagement with new media such as social networking sites, YouTube, or chatrooms.^[72,106] According to Ito and colleagues, “Instead of looking to rigid categories that are defined by formal properties, genres of participation are a way of identifying, in an interpretive way, a set of social, cultural, and technological characteristics that participants recognize as defining a set of practices” (16).^[72] Ito and colleagues’ genres of participation include:

- *Friendship-driven* genres of participation, the dominant and mainstream practices of youth as they go about their day-to-day negotiations with friends and peers in various contexts, such as school, religious groups, school sports, and other local activity groups. Facebook is an example of an online context for friendship-driven genres of participation.
- *Interest-driven* genres of participation put specialized activities, interests, or niche and marginalized identities first. Interest-driven practices of youth are described by young people as “the domain of the geeks, freaks, musicians, artists, and dorks, who are identified as smart, different, or creative, and who generally exist at the margins of teen social worlds” (13).^[72] Interest-driven genres of participation are driven by a young person’s interests in hobbies, finding information on specific topics, and in their desire to be seen as an “expert” in their particular interest. Relationships are formed on this premise, rather than for social or interaction interests as seen in the friendship-driven genre.

Ito and colleagues also determined that young people engage with media at different levels of commitment: “1) they ‘hang out’ with friends in social spaces such as Facebook and MySpace; 2) they ‘mess around’ or tinker with digital media, making simple videos, playing online games, or posting pictures in Flickr; and 3) they ‘geek out’ in online groups that facilitate exploration of their core interests” (9).^[3,72]

This typology of engagement by digital youth is called HOMAGO and is the basis for the connected learning philosophy [website], and the pedagogical framework for emerging interactive learning spaces in libraries and museums called Learning Labs and Makerspaces.

Dresang's Radical Change Theory may provide the bridge that is needed to explore the issues associated with digital youth's media use and ELIS. Dresang and Koh^[107] suggest using Radical Change Theory as a framework for understanding more about how digital youth think and seek information, perceive themselves and others, and access information and seek community. They explain that Radical Change theory is "based on the digital age principles of interactivity, connectivity, and access. This theory provides a promising theoretical framework for explaining contemporary changes in information behavior and resources as well as for serving as a guide for investigative studies and professional practice." (27) The typology^[108] includes three facets:

1. *Interactivity* refers to the dynamic, nonlinear, and nonsequential learning and information behavior in the digital age.
2. *Connectivity* is the sense of community and development of online social worlds that have emerged from young people's changing perspectives and expanded associations.
3. *Access* is described as breaking down the longstanding information and access barriers and giving young people access to a wider diversity of formerly largely inaccessible opinions.

Building on Dresang's earlier typology and incorporating findings from new media studies,^[72,106,107,109–111] Dresang and Koh extended the theory to identify three types of information behavior of digital age youth. The three types include:

1. Type One: Changing forms of seeking information and learning (or how youth seek information and learn)
 - a. obtaining information from a variety of sources
 - b. multitasking
 - c. preference for graphic and visual information
 - d. seeking information nonlinearly and nonsequentially
 - e. developing self-defined and controlled paths
2. Type Two: Changing perspectives (or how youth perceive themselves and others)
 - a. expressing opinions for themselves
 - b. portraying flexible and multiple identities
 - c. encountering information from various perspectives
3. Type Three: Changing boundaries (or how they access information and seek community)
 - a. obtaining instant access to a wide array of information

- b. seeking, sharing, and creating information collaboratively
- c. forming new types of social networks
- d. participating in community engagement (29).^[107]

An outcome of the digital media, new literacies, and connected learning initiatives that is directly related to LIS and to libraries specifically is the integration of technologies into interactive learning spaces, such as Learning Labs or Makerspaces, to facilitate STEM learning. Little research has been done on the efficacy and usefulness of these spaces and while the literature itself is proliferating almost as quickly as these new spaces themselves, it focuses mainly on: 1) history and models of Makerspaces/Learning Labs;^[112,113] 2) case studies or informal reports of how specific libraries or museums developed their Makerspace or Learning Lab;^[114–116] 3) advice and resources for how to start a Makerspace or Learning Lab;^[117,118] and 4) models and technology suggested for use and sample projects.^[119] The limited research literature relates to surveying libraries in the United States and seven other countries about the presence of Makerspaces in their organization or their plans to develop one in the future; issues related to funding, programming, and the top technologies used by library Makerspaces^[120] and a study by Koh and Abbas about the competencies needed by library and information professionals who work in Learning Labs or Makerspaces in U.S. libraries or museums.^[121]

CONCLUSIONS

The research focused on children and information technology shows a picture of children as digital youth who are engaged, connected, creative users, not just consumers of information technologies, but who still encounter many issues when searching for information using information technologies. Information behavior and retrieval studies provide us with a better understanding of how children use information technology to search for information they need for activities and decision making within their everyday lives, to create within collaborative environments, and the roles children display while searching online. Research has also found that social networking sites have become even more essential in the daily, digital lives of children, thereby requiring more research into the socio-cultural, psychosocial, ethical, legal, and pragmatic issues faced by youth as they use these information and communication technologies to engage with others. As we learn more about how children interact with information technology, and within digital ecologies, it is important to remember that children are still children who will still go through the same experimental, explorative process of play, communication, and emotional and psychosocial

development as children always have, and to them information technology is a necessity in many of their social worlds.

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Children's Literature

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Abstract

“Children’s Literature” describes literary works written for children and young adults. The entry uses a genre approach to organize the literature and focuses on historical and contemporary English language and to a lesser degree international children’s literature that has been translated into English.

INTRODUCTION

The adults concerned about the books children read—parents, educators, authors, editors, critics, though not the children—define “literature” using demarcations based on quality, genre, and even format. The poet Walter de la Mare’s comment that “only the rarest kind of best in anything can be good enough for the young” (cited in Silvey, p. 121),^[1] exemplifies the emphasis on literary quality in books for children, as do most literary awards such as the Newbery and Caldecott Medals. Instructions for the awards committees state that popularity is not a consideration. In terms of genre, “literature” is often restricted to imaginative writing. Although occasionally the Newbery Medal has been awarded for informational books and biographies, not until 1990 and 2001 did the National Council of Teachers of English and the American Library Association (ALA), respectively, establish awards for informational books and biographies for children. Concepts of formats that can be considered literature have also changed over time. Two graphic novels, a format that was formerly labeled “subliterature,” were recognized for the first time in 2007 by two ALA awards.

Childhood too is a relative concept. The age of responsibility, when childhood is considered to be at an end, has risen since the beginnings of the industrial revolution, while the age at which children are considered capable of comprehending complex issues, from sexuality to social problems, has fluctuated across both time and place. The trend since the 1960s has been to introduce complex issues to children at younger ages than in the nineteenth and early twentieth centuries, but serious social issues are more likely to be introduced in European than American children’s books for elementary school age children.^[2]

This entry will use Rebecca Lukens’s definition of children’s literature in *A Critical Handbook of Children’s Literature*: “...the body of writing that exists because of inherent imaginative and artistic qualities” (p. 3).^[3] Lukens emphasizes the importance of pleasure the author aspires to evoke in the implied reader, the child; the

understanding the work is likely to engender through the “exploration of the human condition”; and the form literature provides for the reader to make meaning of the fragmented experiences of life (pp. 4–6). Children’s literature will refer to literature written for an audience from the youngest child to age 14, the limitation set for the Newbery Medal, but each section of the entry will also discuss literature written for young adults, which refers to literature that considers the perspectives and interests of young people between ages 11 and 18. After a brief history of children’s literature, the entry will discuss various genres of children’s and young adult literature; international and multicultural children’s literature; and nonbook media, and will list literary awards and some of the major organizations devoted to children’s literature.

HISTORY OF CHILDREN'S LITERATURE

The history of children’s literature in the sense the term is used today, is no more than 250 years old. Social, economic, and technological factors contributed to its development in the industrializing England of the eighteenth century. Similar developments took place elsewhere in Europe and North America in the nineteenth century and in East Asia in the late nineteenth, early twentieth centuries. Children’s literature in Latin America, Africa, and much of Asia has been developing since the middle of the twentieth century. The costs of paper, printing, and distribution, as well as standard of living affect the extent to which a country or region can afford to create books for children.

For most of human history, children and adults shared the orally transmitted stories passed on within communities for the purpose of acculturating, instructing, and entertaining them in both secular and sacred matters. Some recorded fables and books of prayer, however, did become available to children and were used for their education. Manuscripts of Aesop’s fables, for instance, were used throughout Western Europe in the Middle Ages to teach

Greek and Latin, rhetoric and grammar, as well as ethical behavior to a small minority of children.^[4,5] The majority of children, however, continued to be educated through sacred and secular oral narratives; drama; poetry and nursery rhymes; and visual representations.

The democratization of literacy and the slow evolution of material published expressly for children began with the development of the printing press by Gutenberg in the mid-1400s. One of the first English printed books, published in 1484, William Caxton's *Aesop's Fables*, however, was not meant for children alone, but rather for ordinary people of all ages, "for to shewe to all maner of folk what maner of thing they ought to ensyeew and folowe" (p. 9).^[5] The books published in the following few centuries for children were didactic, meant for their spiritual and social edification, with little regard to the pleasures of reading. The hornbook (see Fig. 1), published

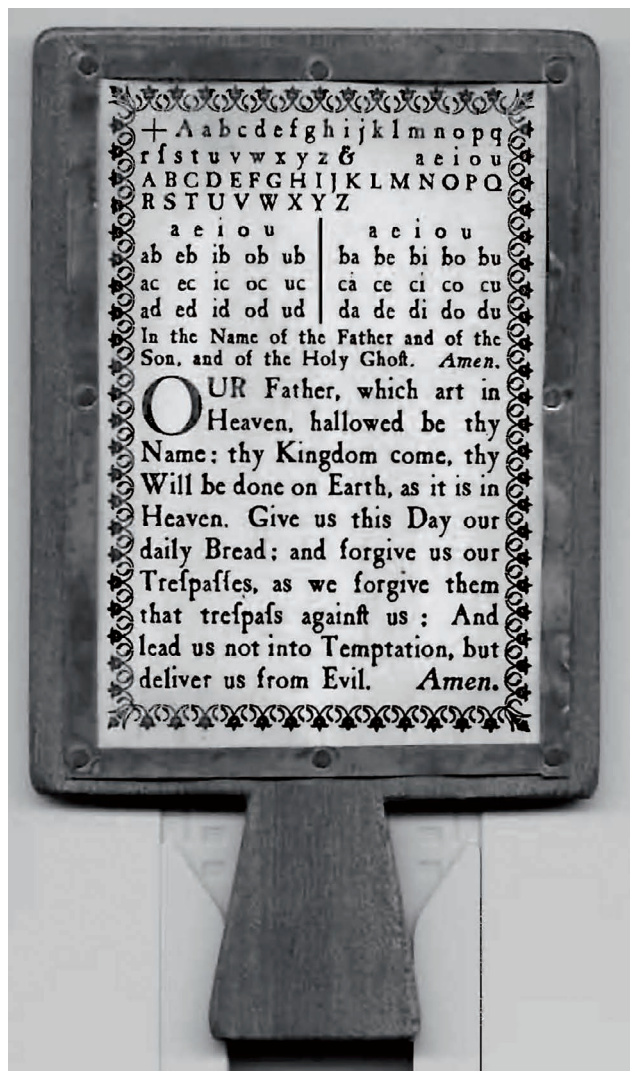


Fig. 1 Facsimile/replica of a Horn Book—printed by Otto Miller at Thomas Todd printing shop on Beacon Hill for the Horn Book, Inc. With permission.

between the sixteenth and mid-eighteenth centuries, consisted of the alphabet and a syllabary, as well as the Lord's Prayer. The battledore, a trifold piece of cardboard, which largely replaced the hornbook in the middle of the eighteenth century as paper became less expensive, included not only the alphabet and a syllabary, but also single words with woodcut images accompanying them and a brief verse or Biblical quotation. Grammars, books of manners, and religious tracts designed to induce children to lead virtuous, Christian lives, were the staple of seventeenth century English publishing. Much of this material was meant for the schoolroom, but some books, such as James Janeway's *A Token for Children, an Exact Account of the Conversion, Holy and Exemplary Lives of and Joyful Deaths of Several Young Children*, (1671–1672), were intended for children's leisure reading. Aesop's fables continued to be used as well, as one of the more entertaining ways of teaching, and were frequently republished with new morals. John Locke in 1703 first emphasized the importance of using Aesop with illustrations specifically meant for children to help them understand the meanings of the words and to entice them to a love of reading.^[5]

During the late seventeenth and early eighteenth centuries, folk and fairy tales became popular adult literature and influenced children's literature. The 12 volume *Arabian Nights Entertainment* or *One Thousand and One Nights* (*Mille et une Nuits*), known as *Alf layla wa layla* in Arabic, translated into French by Antoine Galland between 1704 and 1712, and into English between 1705 and 1716, was one of the most influential sources. This compilation of oral and written tales included philosophical, romantic, and even pornographic stories. "Aladdin," "Ali Baba and the Forty Thieves," and "Sinbad" as well as the frame story of Scheherazade have been most frequently retold for children. The stories influenced European writers, such as the German Wilhelm Hauff, to create their own "Oriental" stories. Even more influential were the artfully retold folk tales and literary fairy tales written by French upper class women, and some men such as Charles Perrault, who used them as a safe form of protest against both Louis the XIV's excessive taxation and the social conditions of marriage for women.^[6,7] Charles Perrault's 1697 *Histoire ou Contes du Temps Passé* popularly known as *Contes de ma Mère l'Ois* [Tales of My Mother Goose], translated into English in 1729, and Jeanne Marie le Prince de Beaumont's "La Belle et la Bête" (1756), translated into English in 1761 as "Beauty and the Beast," have remained popular as children's literature and were the sources of Disney's film adaptations. The popular title of Perrault's fairy tales collection, "Mother Goose," however, has been attached to nursery rhymes, rather than fairy tales, ever since John Newbery published *Mother Goose's Melody or Sonnets for the Cradle* (1765).

To obtain imaginative literature, seventeenth and eighteenth century children adopted adult books as their own.

The three most influential and popular of these were John Bunyan's *The Pilgrim's Progress* (1678), a Christian allegory with an adventurous plot; Daniel Defoe's *Robinson Crusoe* (1719), a celebration of middle class self-reliance; and Jonathan Swift's *Gulliver's Travels* (1726), a political and philosophical satire with a fantasy setting.^[5]

The chapbook was the main source of imaginative literature for children of the eighteenth century. Door-to-door peddlers, or chapmen, carried a variety of inexpensive wares, including these cheaply made folded paper books whose front page served as the cover and whose stories often ended where the paper had to be cut. Chapbooks, with their legends; medieval romances, including those of King Arthur; fairy tales, including stories from the Arabian Nights and Perrault; lurid true crime stories; jokes; and recipes, stimulated the imaginations of children such as the poet William Wordsworth, who had to read them surreptitiously because they were considered low class.^[8,9]

Active publishing for children began with John Newbery, a book publisher whose sideline of selling patent medicines allowed him to finance his venture into publishing for the children of the newly rising middle class. Newbery's *A Little Pretty Pocketbook* (1744), a small attractive illustrated book, is often credited with having been the first book for children. It was based on John Locke's educational philosophy of enticing children to learn through entertainment.^[5] (A facsimile of the first American edition of the book is available through the Library of Congress at http://lcweb2.loc.gov/cgi-bin/ampage?collId=rbc3&fileName=rbc0001_2003juv05880page.db.) Newbery's books include numerous editions of Aesop; the first comprehensive book of nursery rhymes, *Mother Goose's Melody* (1765); a series of informational books for children entitled *The Circle of Sciences* (1746–1748); and a didactic fictional book designed to improve children's morals, *The History of Little Goody Two-Shoes; Otherwise called, Mrs. Margery Two-Shoes* (1765), which some have attributed to Oliver Goldsmith.^[5]

It was not until the 1820s, after Jacob and Wilhelm Grimm's *Kinder-und-Hausmärchen* (1812), the first comprehensive collection of folktales, was translated from German into English as *German Popular Stories* (1823), with high quality engraved illustrations by George Cruikshank, that folk and fairy tales became accepted as literature for children in England. In Germany, these folktales became popular once the Grimms, seeing the success of their book in its illustrated English translation, had their brother Ludwig Emil Grimm add illustrations, and began to edit their collection to make the stories more readable for children. The Grimms also edited the fairy tales to suit German parents' expectations for teaching their children the virtues society considered important: obedience, hard work, orderliness, cleanliness, and piety.^[10] The Grimms' collection has been translated into more than 100 languages and the stories have entered the written as well as oral tradition of numerous countries throughout the world.

Many of the English-speaking world's stories, such as the familiar versions of "Hansel and Gretel" and "Rumpelstiltskin," now considered part of our heritage, were first introduced through the Grimms' fairy tales. Even more importantly, the Grimms inspired people all over the world to collect and retell their own folktales for children. Joseph Jacobs's *English Fairy Tales* (1898) has been particularly influential for English-speaking children's literature.

Throughout the nineteenth century, the debate continued over what constitutes good literature for children. Moral purpose remained important and imaginative literature began to be an important vehicle for inculcating positive values. Much of the literature of the beginning of the nineteenth century was didactic with thin storylines and characters whose only function was to demonstrate correct behavior, but by the second half of the nineteenth century imaginative literature began to have strong plots and memorable characters.

The literary fairy tale's popularity, begun in France in the seventeenth and eighteenth centuries, was greatly enhanced in the nineteenth century by the Danish Hans Christian Andersen and German writers such as E.T.A. Hoffmann, the author of "Nussknacker und Mauskönig" (1816) [*The Nutcracker and the Mouse King*, 1817]. Andersen, the author of *Eventyr, fortalte for børn* (1835–1842) [translated by Mary Howitt as *Wonderful Stories for Children*, 1846] used a lively, conversational style as well as memorable imagery to develop his themes through literary fairy tales such as "The Ugly Duckling" and "The Little Mermaid." Fantasy classics, such as James Barrie's *Peter Pan* (1906), best known for its stage version, and L. Frank Baum's *The Wonderful Wizard of Oz* (1900), elaborated on the tradition of literary fairy tales.

The nineteenth century also saw the birth of modern high fantasy with heroes fighting evil powers, often of mythic proportions, in the publication of George MacDonald's *The Princess and the Goblin* (1872) and *The Princess and Curdie* (1882). Although MacDonald had a moral agenda, he allowed children to discover his themes rather than stating them explicitly.^[11] By contrast, the primary purpose of Lewis Carroll's (pseudonym for Charles Dodgson) fantasy novels, *Alice's Adventures in Wonderland* (1865) and *Through the Looking Glass* (1872), was to give pleasure rather than to teach a moral. It is Carroll's playfulness, and to some extent subversive conspiracy between adult author and child reader against "the grown-ups," which marks a turning point in children's literature.^[12,13] While the subversiveness is minimal—in the end, Alice turns the cards upside down and returns to the ordered world of her family and school—most children's books, since *Alice*, have been taking the child's perspective, even as the child protagonist grows and ultimately resolves inner as well as external conflicts without the author resorting to providing explicit morals.

The last quarter of the nineteenth century and the first quarter of the twentieth century also saw the beginnings of another type of modern fantasy in which personified animals and toys explore themes of concern to children. Carlo Collodi's (pseudonym of Carlo Lorenzini) Italian classic, *Le avventure di Pinocchio* (1883), translated into English as *The Adventures of Pinocchio* (1892), follows a puppet's exploration of what it means to be human. Kenneth Grahame's animal characters, Rat, Mole, and Toad, in *The Wind in the Willows* (1908), explore friendships in an idyllic setting, while Rudyard Kipling's *The Jungle Book* (1894) and its sequel transport European and American children to "exotic" settings.

Fiction for children, especially the adventure novel, with its possible if not always plausible plots, was another development of the nineteenth century. Juvenile nineteenth century fiction was largely didactic, designed to inculcate duty, honor, kindness to the less fortunate, and decent treatment of animals, as in Anna Sewall's *Black Beauty* (1877).

Although fewer of the nineteenth and early twentieth century works of fiction for children have stood the test of time compared to fantasy, several of this era's books have become classics and continue to be read or remain a part of our culture through their film adaptations. Many children, for instance, are familiar with one of *Robinson Crusoe's* numerous offshoots, *The Swiss Family Robinson* (1814) [*Der Schweizerische Robinson* (1812–1813)] by the Swiss author Johann D. Wyss, through the Disney film, and some early twentieth century books, such as *Pollyanna* (1913) by Eleanor Porter, might have been forgotten, had it not been for their film versions.

Boys' adventures and domestic novels for girls dominated the market and children's reading. Boys' adventures were produced in both England and the United States, while girls' domestic novels tended to be more popular in America.^[14] Mark Twain's *The Adventures of Tom Sawyer* (1876), loosely based on the author's pre-Civil War era childhood experiences in Hannibal, MO, represents one of the most outstanding examples of the boy's adventure genre. It started a trend of adventure books about boys who get into scrapes, but are good at heart.^[15] *Huckleberry Finn*, (1885), with its social satire and complex themes continued the genre but took it to much greater heights, while avoiding didacticism. By contrast, Horatio Alger's *Ragged Dick; or Street Life in New York with the Boot Blacks* (1867) exemplified the didactic rags-to-riches urban adventure story.

Among the English adventure novels, the school adventures of Thomas Hughes' *Tom Brown's School Days* (1857) started a spate of British public (i.e., private) school-life stories; Robert Louis Stevenson's books, such as *Treasure Island* (1883), captured its readers through exciting plots, colorful characters, and exotic settings; and British author G. A. Henty's historical fiction, such as *With Clive in India* (1884), introduced historical fiction

and brought the countries of the British Empire into the homes of English and American children.

Louisa May Alcott's *Little Women*, (1868), which was the first of a series of books about Meg, Jo, Amy and their offspring (Beth having died in the first book), was one of the best of the domestic novels. Alcott's independent-minded girls and their strong mother can be seen as early feminists. Other girls' domestic series which were popular in the late nineteenth and early twentieth centuries, such as Margaret Sidney's (pseudonym for Harriet Lothrop, 1844–1924) immensely popular *Five Little Peppers and How they Grew* (1881), are known today mainly by their titles.

The redeeming power of the innocence of childhood, often combined with the idea of nature's restorative power, whether in its wilder state or in the cultivated garden, was a dominant theme of many of the most popular books of the late nineteenth, early twentieth centuries. Several of the best, with their strong plots, appealing characters, and a sense of place, continue to be published, read, and adapted to film and television. Swiss author Johanna Spyri's *Heidi* (1880, translated into English in 1884), set in the Swiss Alps, and English/American author Frances Hodgson Burnett's *The Secret Garden* (1911), set in an English garden on a country estate, epitomize the above themes. Canadian author L. M. Montgomery's *Anne of Green Gables* (1908) and its sequels, too, attained their popularity from their independent-minded yet innocent and loving protagonist, as well as from their picturesque and nostalgic setting.

Finally, the turn of the twentieth century saw in Edith Nesbit's books of realistic family fiction the introduction of a strong child narrator whose concerns are those of children rather than of adults. The children respond with intelligence, wit, and shrewd insight into the world of the adults, while continuing to maintain their innocence (p. 104).^[13] Nesbit's *The Railway Children* (1906) is still read and translated into other languages. The family adventure reached classic heights in Arthur Ransome's books of the Walker family's camping and sailing adventures in England's Lake District, starting with *Swallows and Amazons* (1930).

History of Illustration in Children's Books

Illustration has been used worldwide to convey information and tell stories throughout human history, from cave paintings to fourth century Chinese scrolls illustrating moral lessons of the Buddha, to medieval European stained glass windows, and Indian storytelling cloths used by village storytellers in India.

In illustrated books, although the text is dominant, the pictures capture significant moments in the narrative, often adding to characterization or setting. Book illustration in medieval Europe was primarily religious in nature and included illuminated manuscripts of The Bible as well

as prayer books such as the Duc de Berry's renowned "Book of Hours," *Les très riches heures* [The Very Rich Hours, often referred to as Book of Hours], (ca. 1424 A.D.) (See <http://www.ibiblio.org/wm/rh/>).

Woodblock printing made it possible to illustrate early printed books. William Caxton's 1484 *Aesop's Fables*, for instance, featured a picture of Aesop. Moravian minister John Amos Comenius's 1658 *Orbis Sensualium Pictus* [The World in Pictures] (see <http://www.mhs.ox.ac.uk/gatt/tower/catalog.asp?CN=40>), a picture encyclopedia, is often considered the first fully illustrated book for children. Comenius used illustrations to clarify and expand upon the text. It was not until the middle of the eighteenth century, however, that high quality illustrations began to be used in children's books, when John Newbery commissioned woodcut artists to illustrate his children's books. One of the finest among the late eighteenth–early nineteenth century woodcut artists, Thomas Bewick, was in much demand by the newly developing children's publishing trade throughout England, as was his brother John.^[5]

The development of metal engraving techniques in the late eighteenth and early nineteenth centuries made it possible to create more realistic images than those made with woodcuts. The mystical English poet William Blake illustrated his books using copper engraving and watercolors. George Cruikshank's illustrations for the Grimms' *German Popular Stories* (1823), translated by Edgar Taylor, provided detail and characterization unavailable in earlier illustrated books. Color began to be used in early nineteenth century alphabet books and nursery rhymes, although the colors had to be added by hand, often using child labor. By the 1860s and 1870s color printing using both woodblock and lithographic techniques, developed by the printer Edmund Evans, allowed artists such as Walter Crane, Randolph Caldecott, and Kate Greenaway to create full-color illustrated books.^[5] Some of the most enduring nineteenth century illustrations for children's books were by newspaper caricaturists and illustrators, such as John Tenniel, who immortalized the look of Alice and the other characters in Lewis Carroll's *Alice's Adventures in Wonderland* (1865) and *Through the Looking Glass* (1872), and the German Wilhelm Busch, creator of *Max und Moritz* (1865).

The turn of the twentieth century is often referred to as "The Golden Age of illustration." British illustrator Ernest H. Shepard created memorable characters for the *Wind in the Willows* (1908) by Kenneth Grahame (as well as for *Winnie-the-Pooh* (1926) and *The House at Pooh Corner* (1928) by A. A. Milne). French illustrator Maurice Boutet de Monvel with his delicate designs and colors influenced American children's illustrators.^[16] Arthur Rackham, a prolific illustrator from Britain, used strong lines and patches of light and shadows in his illustrations for children's books, including *The Fairy Tales of the Brothers Grimm* (1900), James Barrie's *Peter Pan in Kensington Garden* (1906), and *Mother Goose* (1913). Danish-born Kay Nielsen (*East of the Sun and West of*

the Moon, 1914 by Peter Asbjørnsen and Jorgen Moe) and French-born Edmund Dulac (*The Sleeping Beauty and Other Fairy Tales*, 1910 by Arthur Quiller-Couch) illustrated books in England for children and adults using delicate lines and romantic representations of palaces and clothes in an Art Nouveau style. American illustrator Howard Pyle retold and illustrated in black and white the legends of King Arthur and of Robin Hood at the end of the nineteenth century, while N.C. Wyeth created dramatic scenes in oil colors for adventure books such as *Treasure Island* (1911) by Robert Louis Stevenson. Although the ascendancy of picture books in wealthier countries seems to have supplanted illustrated books for children, illustrators of novels have continued to memorialize incidents and characters. A few of the illustrators who have created memorable characters using line drawings and halftones include Ilona Wikland (Pippi Longstocking); Pauline Baynes (Narnia series); Garth Williams (Little House series and Wilbur); Alan Tiegreen (Ramona Quimby); and Timothy Ering (Despereaux). Both Jerry Pinkney in *Tales of Uncle Remus* (1987) by Julius Lester and Barry Moser in *Jump!* (1986) by Van Dyke Parks and Malcolm Jones have provided new images for B'r'er Rabbit, and Moser has also created a new look for Alice.

PICTURE BOOKS

Definitions

The modern picture book format is a recent phenomenon, having been developed in the 1870s by British illustrators Kate Greenaway (1846–1901) and Randolph Caldecott (1845–1886). Greenaway's full-color illustrations for books such as *Under the Window* (1879), which consisted of original verse by Greenaway, depicted children playing in pastoral settings wearing light, airy clothes. Greenaway influenced both the depiction of children in picture books and children's fashions in the late nineteenth–early twentieth centuries.^[14] It was Caldecott, however, who created the first genuine picture books by providing characterization and setting as well as action-filled narrative through illustrations for each event in a nursery rhyme or story. He divided the text into 32 page segments, creating a parallel narrative through illustrations. Caldecott's skilled use of line to create dynamic images as well as his humorous interpretation of characters and events such as those for *Hey Diddle Diddle* (1883) (see Fig. 2) make his books classics. Beatrix Potter brought picture books to new heights by creating total unity between text and illustrations. She used expressive anthropomorphized animals, spare, naturalistic details, and plenty of white space to allow children to give scope to their imaginations, as in *The Tale of Peter Rabbit* (1901/1902), the picture book from the era that children most often continue to ask for.^[17]



Fig. 2 From *Hey Diddle Diddle and Baby Bunting* by Randolph Caldecott. London: Frederick Warne, n.d. original edition London: Routledge, 1883.

The two narratives of a picture book, textual and pictorial, encompass a wide range of interrelationships. The text may consist of one or two words or up to a long paragraph, usually written at a child's listening vocabulary level, but above his or her reading level, while the pictures may be simple, to match the single words or phrases meant for toddlers as in *Max's First Word* (1979) by Rosemary Wells, or they may be complex, adding a new dimension to the text. The parallel narratives of picture books—words and pictures—usually tell the same story, as in Tomie de Paola's *Strega Nona* (1975), with the pictures supporting every step of Big Anthony's misadventure. Frequently, however, the picture and text are even more integrated, neither being complete without the other, as in *Where the Wild Things Are* (1963) by Maurice Sendak and in *Officer Buckle and Gloria* (1995) by Peggy Rathmann, in which the pictures create dramatic irony. Sometimes the pictures are sufficient with few or no words, as in the case of *Tuesday* (1991) by David Wiesner. Generally, however, the complex relationship between image and text distinguishes picture books and creates the total reading/listening experience.

The Text of Picture Books

The traditional audience for picture books, children ages preschool through 7, is usually not expected to read the

text but rather to look at the illustrations while listening to the story, responding to both the verbal narrative and the pictures. The best of children's book authors do not speak down to their audience, but, like Kevin Henkes, the author/illustrator of Caldecott Medal and Honor winning books, they choose their words for effect, not for simplicity. In *Kitten's First Full Moon* (2004) Henkes describes Kitten's fall using carefully selected words and phrases of varied lengths: "But Kitten only tumbled-/ bumping her nose and banging her ear/ and pinching her tail./ Poor Kitten!" The phrase "Poor Kitten" serves as a refrain, giving the text rhythm. There are, however, picture books that are deliberately written with the child as beginning reader in mind, most notably Dr. Seuss's *Cat in the Hat* (1957); the Theodore Geisel Award honors those writers who are able to create varied and interesting language while adhering to a limited vocabulary.

Styles of Illustration in Picture Books

The primary function of the illustrations is to heighten emotional response through the use of color, line, shape, layout, texture, scale and point of view. Throughout the twentieth century, picture book artists experimented with the picture book format, while advances in technology also influenced picture book styles. Because of the cost



Fig. 3 From *YO! YES?* by Chris Raschka. Copyright © 1993 by Chris Raschka. Reprinted by permission of Orchard Books, an imprint of Scholastic Inc.

of full-color illustration before the 1960s, artists had to be creative to achieve their effects with few colors. Artists created award-winning picture books entirely in black and white, focusing on line, shape, and layout, as did Wanda Gág in *Millions of Cats* (1928); monochrome pictures of sepia or blue, as did Robert McCloskey in *Make Way for Ducklings* (1941) and *Blueberries for Sal* (1948); or with a few flat colors, as did Jean de Brunhoff in *Histoire de Babar, le petit éléphant* [*The Story of Babar*, 1931]; and H. A. Rey in *Curious George* (1941). The development of photographic offset printing eliminated the older, more tedious method, and the 1980s and 1990s brought further sophistication in color printing through the use of computers. Since the beginning of the 1980s there has been a trend toward more painterly oil and acrylic illustrations, such as Paul Zelinsky's images for *Rumpelstiltskin* (1986) with its shimmering scenes of golden straw. Artists, however, continue to use all of the earlier styles in combination with newer techniques. Mo Willems, for instance, used a few deft lines in *Don't Let the Pigeon Drive the Bus* (2003) to create Pigeon's expressions ranging from wheedling to sly to furious, and line work combined with touches of watercolor continues to be widely used, as for instance by artists Betsy Lewin in *Click, Clack, Moo: Cows That Type* by Doreen Cronin (2000) and Chris Raschka in *Yo! Yes?* (1993) (See Fig. 3). Increasingly, artists use computers to develop complex combinations of materials. Once electronic books become more accessible to the general public, artists are likely to take advantage of the computer's

capabilities for nonlinear sequencing with multiple linkages between scenes and actions.^[18]

Picture book artists use a wide range of art styles, some developing a signature style, others matching the style of a specific book to its subject, theme, or setting. Jerry Pinkney always uses an impressionistic style, as in Pat McKissack's *Goin' Someplace Special* (2001). Bryan Pinkney typically uses flowing lines and deep colors in scratchboard for subjects from folktales to biographies such as *Duke Ellington: The Piano Prince and His Orchestra* (1998) by Andrea Davis Pinkney. Cubist styles are reflected in some works of illustrators, including Christopher Myers's in *Harlem: A Poem* (1997) by Walter Dean Myers. Mixed media, combining collage and other media, such as paint in picture book illustration, pioneered by Ezra Jack Keats (*The Snowy Day*, 1962) and Leo Lionni (*Inch by Inch*, 1960), is used by many artists. Bryan Collier in *Uptown* (2000), for instance, created a tapestry of shapes and textures to depict Harlem (see Fig. 4). The influence of cartoon art is also apparent in many picture books, as for instance Ian Falconer's *Olivia* (2000) and Eric Rohmann's *My Friend Rabbit* (2002) (see Fig. 5).

Wordless Picture Books

Wordless picture books, which used to be an exception in picture book format, are increasing in numbers. These books rely entirely on the sequence of illustrations for their narratives. Some wordless books are designed to help young children interpret the visually told story through

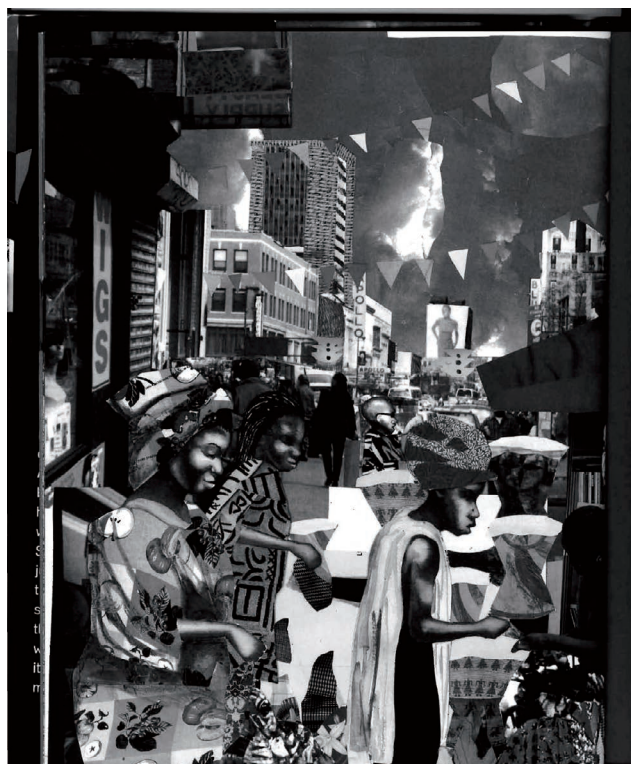


Fig. 4 Illustration from *Uptown* by Bryan Collier. Copyright 2000 by Bryan Collier. Reprinted by permission of Henry Holt and Company.

carefully constructed sequences showing scenes of familiar actions, as in Australian author/illustrator Jan Ormerod's *Sunshine* (1981). Alexandra Day's *Good Dog Carl* (1985), a story about a Rottweiler and the toddler he baby-sits, is more fanciful and leaves greater leeway for interpretation by young readers. More sophisticated wordless books for somewhat older audiences include Jeannie

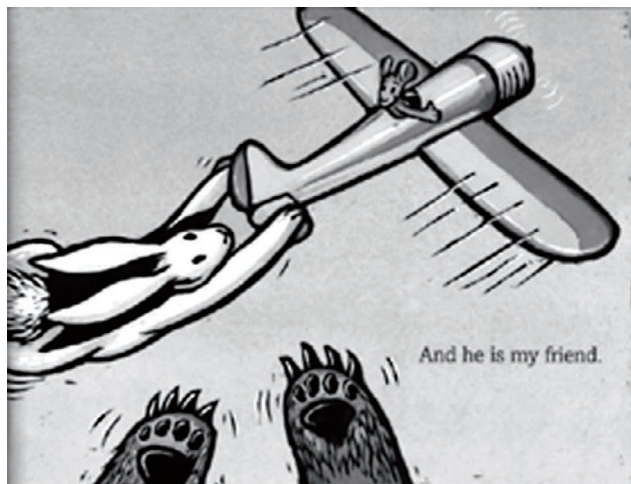


Fig. 5 Illustration from *My Friend Rabbit* by Eric Rohmann. Copyright 2002 by Eric Rohmann. Reprinted by permission of Henry Holt and Company.

Baker's *Home* (2004), which shows the passage of time in a city neighborhood; Mitsumasa Anno's *Anno's Journey* (1978), which is replete with cultural and historical allusions; David Wiesner's *Free Fall* (1988), an explorations of the boundaries between dream and reality; and Brian Selznick's *The Invention of Hugo Cabret* (2007), a 533 page historical fiction told through several hundred pages of images interspersed with some text. Other artist-storytellers who have told complex stories in wordless picture books include Russian artist Nikolai Popov in an antiwar book *Why?* (1996), and Belgian-born artist Gabrielle Vincent in *A Day a Dog* (1999), about a dog's quest for home.

Specialized Types of Picture Books: Alphabet Books, Counting Books, Concept Books, Engineered Books, and Graphic Novels

Traditionally alphabet books have introduced preschool children to the shapes and sounds of letters. Kate Greenaway's *A Apple Pie: An Old Fashioned Alphabet Book* (1886) has one concept for each letter. Well conceived alphabet books help develop phonemic awareness as children learn to hear and associate the sounds with the letters as well as the words (usually initial sounds) in which they appear as in Helen Oxenbury's *ABC of Things* (1972). Many alphabet books, however, go beyond direct representation to introduce new words and concepts, play with language, and stimulate visual perception and imagination. *Antics!* (1992) by Cathi Hepworth plays with language—An Einstein-like chemist ant illustrates “Brilliant”; *Animalia* (1986) by Graeme Base and *Alphabet City* (1995) by Stephen T. Johnson, evoke close observation; and Chris Van Allsburg stimulates the imagination as readers try to guess what fate may have befallen each letter of the alphabet, in *The Z Was Zapped: A Play in Twenty-Six Acts* (1987) (see Fig. 6).

Counting books may introduce the counting sequence and show a one-to-one correspondence between the numeral and the number of objects on the page, or they may cluster the images into groupings to match numbers, as does Anno's *Counting Book* (1975). Like alphabet books, counting books can be playful and stimulating. For instance, Czech artist Kveta Pacovska shows numbers doing acrobatic contortions in *One, Five, Many* (1990), and Bruce McMillan introduces fractions through photographs of children eating in *Eating Fractions* (1991).

Concept books introduce preschoolers to single concepts: (e.g. opposites, colors or shapes). Photographer Tana Hoban focused mostly on this genre, stimulating children to discover specific concepts and to look closely at the world around them, with books such as *Is it Larger, Is it Smaller* (1985) and *Shapes, Shapes, Shapes* (1986). Other award winning artists who create concept books include Donald Crews, Lois Ehlert, and Steve Jenkins.



Fig. 6 Illustration from *The Z was Zapped* by Chris Van Allsburg. Copyright © 1987 by Chris Van Allsburg. Reprinted by permission of Houghton Mifflin Company. All rights reserved.

Engineered books, books with tactile, three-dimensional, or moveable parts, have a long history. The first lift-the-flap book designed for children was Robert Sayer's *Harlequinade* (1765). Victorian engineered books included dial-turnable scenes as well as pop-up scenes. Lothar Moggendorfer in Germany created intricate pop-ups at the end of the nineteenth century. Due to the economic hardship of WWI and the Great Depression, the market for these elaborate books disappeared.^[19] Simpler engineered books, however, such as Dorothy Kunhardt's *Pat the Bunny* (1940) with fuzzy inserts and Eric Hill's *Where's Spot* (1980) with open-the-flap surprises continue to be enjoyed. Sophisticated engineered books are making a revival. Robert Sabuda's three-dimensional pop-ups and movable parts have greatly developed paper engineering, as in an adaptation of Baum's *The Wizard of Oz* (2000). Other contemporary pop-up artists of children's books include David Carter, Jan Pienkowsky, and Matthew Reinhart.^[20,21]

Influenced by both Western style comic books and by Japanese manga, graphic novels are book-length, self-contained works. Despite the term "novel," graphic novels represent every genre of literature, though they are best known for fantasy hero stories. Most graphic novels are written for young adults and adults. Many of the works

produced in graphic novel form are intellectually and emotionally challenging, as are Art Spiegelman's *Maus: A Survivor's Tale* (1986) and Marjane Satrapi's autobiographical *Persepolis* (2003), which captures a child's point of view about life in Iran before and during the 1979 revolution. Her theme, the use of ironic humor, and the haunting black and white images suggest a young adult and adult audience. Even when not emotionally challenging, the themes focus on young adult concerns such as romance or finding values to live by, as in *Garage Band* (2007) by Italian author/artist Gipi. Reading the text and pictures in a highly interactive way and interpreting the visual symbols are also sophisticated literacy skills.^[21,22] Graphic novels for young adults also include adaptations of classics, as, for instance, Peter Kuper's version of Franz Kafka's *Metamorphosis* (2003) and Stephane Heuet's adaptation of Marcel Proust's *Remembrance of Things Past: Combray* (2001).

Graphic novels for younger children include *The Greek Myths* (1991) by Marcia Williams; popular children's series such as Raina Telgemeier's adaptation of *The Babysitters Club* (2006) by Ann Martin; original modern fantasy such as Newbery Honor-winning writer Jennifer Holm's and artist-brother Matthew Holm's *Babymouse: Queen of the World* (2005) and other titles in the series; and biographies/autobiographies such as Michael Foreman's *War Boy: A Country Childhood* (1989) and Siena Cherson Siegel's account of her days at the Juilliard School in *To Dance: A Memoir* (2006).

Trends in Picture Books

Many picture books are for an older audience than the traditional preschool through 7 year old, or they are for multiple audiences of older and younger readers, because of their complex formats and allusions to other texts and visuals with which younger readers may be unfamiliar, as well as their use of sophisticated language. David Wiesner's *The Three Pigs* (2001), for instance, can be enjoyed on different levels by various ages; the youngest would likely enjoy seeing the pigs get away from the wolf while older children might understand the idea of moving in and out of stories and would be more likely to recognize the allusions. The dual audience for English author and illustrator Anthony Browne's *Willy the Dreamer* (1998) is distinct: while the daydreams of Willy, a chimp, about what he will do when he grows up are readily accessible to a young audience, the visual allusions are meant for adults familiar with both popular culture—Elvis Presley—and modern artists—René Magritte. Other picture books with sophisticated explorations of time and space include *The Red Book* (2004) by Barbara Lehman; *Black and White* (1990) by David Macaulay; and *Flotsam* (2006) by David Wiesner. Jon Scieszka's *The Stinky Cheese Man* (1992), illustrated by Lane Smith, is a book of fractured fairy tales, playing with the conventions of

story structure as well as a book's accustomed format. Australian author Margaret Wild's and illustrator Ann Spudvilas's *Woolvs in the Sitee* (2007) is a psychological exploration of fear. Frequently, picture books introduce subjects that require a sense of history or of social conditions usually considered beyond the cognitive and emotional level of preschool through first grade. Books like these include Peter Sis's *The Tree of Life: A Book Depicting the Life of Charles Darwin, Naturalist, Geologist, and Thinker* (2003); Emily Arnold McCully's *Bobbin Girl* (1996); Japanese author/illustrator Toshi Maruki's *Hiroshima No Pika* (1982); and Mary Williams's *Brothers in Hope: The Story of the Lost Boys of Sudan* (2005) illustrated by Gregory Christie.

For major English language picture book awards, see "Awards."

POETRY

Poetry for children differs from poetry for adults only in degree, not in kind—poets who write with children in mind select their words carefully, calling on the reader's/listener's emotional memory through description and imagery and creating sensory experiences through rhythm and devices of sound: rhyme, alliteration, onomatopoeia, etc. Children's poems focus on experiences and concepts of concern to children, from daily events like dealing with homework to questions about friendship, family, adult authority, and death. Delight in the immediate—the feel of mud, the taste of chocolate, the way it feels to swerve on a skateboard—are all likely themes in poems for children, as are emotions ranging from sibling rivalry to joy at a parent's return at the end of the day. Narrative poems might tell of humorous or dramatic events, or they might be biographical. Though children prefer humorous and accessible poems, they respond to a wide range of poetry if they hear or read it without being required to analyze it. Children can develop a love of poetry early in life.

If children are lucky enough to have heard lullabies, nursery rhymes, and folk songs, to have played to the accompaniment of street and game chants, then they come to the forms of poetry with a firm grasp of its bare bones—rhyme, rhythm, meter, and the *singingness* of language (p. 89).^[23]

The traditional nursery rhymes, or Mother Goose rhymes, are children's first poems. Even infants respond to the strong beat and predictable rhymes. Collections of nursery rhymes abound, their illustrations ranging from personified animals, as in Iona Opie's and Rosemary Wells's *My Very First Mother Goose* (1996) to contemporary urban settings, as in Nina Crews's *Neighborhood Mother Goose* (2004).

William Blake, the author of *Songs of Innocence* (1789) and of *Songs of Experience* (1794) whose poems "The Lamb" and "The Tyger" are frequently included in anthologies of poetry for children, was one of the first poets who wrote for children, though only his *For Children: The Gates of Paradise* (1793) explicitly stated the audience.^[24] Sir Isaac Watts, however, was better known in his own lifetime and throughout the nineteenth century. His gently didactic verses in *Divine Songs for Children* (1715) were a staple in homes and schools. During the eighteenth and most of the nineteenth centuries children also heard or read poems meant for an adult audience. These included folk ballads about Robin Hood. The chief form of poetry written deliberately for children was moral verse, which used rhythm and rhyme to help them remember lessons.^[5] Some of these verses, such as "Mary's Lamb" by Sarah Josepha Hale (1830) have passed into folklore. "A Visit from Saint Nicholas" by Clement Moore (1823) was one of the few poems for children that was written primarily for enjoyment during this era. Published as a book with Thomas Nast's illustrations in 1860, it influenced American images of Christmas^[13] and continues to be popular in many picture book versions. Other nineteenth and early twentieth century narrative poems republished as picture books include Robert Browning's *The Pied Piper of Hamelin* (1889), illustrated by Kate Greenaway (<http://www.indiana.edu/~librcsd/etext/piper/cover.html>) as well as by more recent illustrators; Henry Wadsworth Longfellow's "Paul Revere's Ride" (1860), illustrated by Christopher Bing (2001); and Alfred Noyes's "The Highwayman" (1902), illustrated by Charles Keeping (1981). Contemporary poets sometimes use narrative poems for biographies and informational books. Bobbi Katz celebrated American history through poems of varied styles to fit each topic in *We the People* (2000); Marilyn Nelson wrote *Carver: A Life in Poems* (2001) as well as *A Wreath for Emmett Till* (2005); and Carmen T. Bernier-Grand portrayed Frida Kahlo in *Frida: Viva la vida! Long Live Life!* (2007).

Edward Lear's verses were perhaps first in a long line of English language nonsense poetry, designed to amuse through imaginative juxtaposition of incongruities and through language play. Many of Lear's limericks are included in children's anthologies, and his "The Owl and the Pussycat" (1870) has appeared frequently as a picture book, including one by James Marshall. Laura Richards was one of the first Americans to publish nonsense verse: her "Eletelephony" in *Tirra Litra: Rhymes Old and New* (1932) is a classic. Poets throughout the twentieth century who have played with nonsense verse for children as well as adults include Dylan Thomas, John Ciardi, and Theodore Roethke. Some contemporary practitioners of the art include X. J. Kennedy (*Exploding Gravy: Poems to Make You Laugh*, 2002); Dennis Lee (*Alligator Pie*, 1974), J. Patrick Lewis (*July is a Mad Mosquito*, 1994), and Jack Prelutsky (*Scranimals*, 2002). Where nonsense

verse ends and humorous poetry begins is hard to determine. Well known poets such as David McCord, Russell Hoban, Karla Kuskin, and Douglas Florian continue to play with the English language—"Just when you think you know the boa/ there's moa and moa, and moa, and moa." (from *Beast Feast*, 1994 by Douglas Florian). Shel Silverstein's (*Where the Sidewalk Ends*, 1974) great popularity rested on his ability to make everyday experiences, from watching TV to taking out the garbage, seem hilarious. These and other poets also look at serious topics from a humorous angle. Jane Yolen's "Homework" (from Michael Hearn's *Breakfast, Books, and Dreams*, 1981) pokes light-hearted fun at excuses, and Eve Merriam's socially ironic poems combine wordplay and social commentary on topics ranging from alienation in a technological world to war.

While children respond most readily to humorous and narrative poems in the early years, even the youngest can respond to the musicality of lyrical poetry, such as that of two early poets who wrote for children: Christina Rossetti, *Sing Song: A Nursery Rhyme Book* (1871) and Robert Louis Stevenson, *A Child's Garden of Verses* (1885). By the middle elementary grades children also appreciate lyrical poetry in which the author speaks of personal experiences without nostalgia or condescension. The reader is invited to see through the poet's eyes the familiar in a new way, as in Aileen Fisher's and Valerie Worth's nature observations and Patricia Hubbell's vision of the modern world: "Concrete mixers are urban elephants/their trunks are raising a city" from *8 A.M. Shadows* (1965). The reader might realize that the poet has put words to a familiar experience: Lillian Morrison, who has specialized in sports poetry, captures the moment of "flow" when the player becomes one with his or her activity in "The Sidewalk Racer or On the Skateboard" (*The Sidewalk Racer*, 1977); Myra Cohn Livingston describes a child's fear in "The Dark" (*Worlds I know and Other Poems*, 1985); and Eloise Greenfield tells about things an urban child delights in, from the gushing of a fire hydrant, a "flying pool," to cuddling in her mother's arms in "Honey, I Love" (*Honey, I Love and Other Love Poems*, 1977).

Concrete poems wittily represent the meaning of the words through the layout of the text. In *Flicker Flash* (1999), poet Joan Graham laid the words out in the form of the subject of the poem: for instance, a birthday cake. J. Patrick Lewis's *Doodle Dandies* (1998), Paul Janeczko's *A Poke in the I: A Collection of Concrete Poems* (2001), illustrated by Chris Raschka, and John Grandits' *Blue Lipstick* (2007) offer a variety of concrete poems for children and young adults.

Poetry for young adults, in keeping with their need for identity development, often uses a first person perspective to speak of love and loneliness, doubts, and dreams. Paul Janeczko writes of being a young teen in his working class neighborhood in *Brickyard Summer* (1989), and Gary Soto in *Neighborhood Odes* (1992) shares both universal

experiences of love and longing, and those more specific to his experience as a Latino teen. Mel Glenn in *Class Dismissed!* (1982) and Nikki Grimes in *Bronx Masquerade* (2002) use a first person perspective to express young people's hurts and hopes.

Sources for identifying outstanding poets for children include anthologies by Catherine Clinton, Beatrice Schenk de Reniers, Stephen Dunning, Donald Hall, Lee Bennett Hopkins, X. J. Kennedy, Paul Janeczko, Nancy Larrick, Bruce Lansky, Myra Cohn Livingston, Lilian Moore, Naomi Shihab Nye, Jack Prelutsky, and Michael Rosen, as well as the National Council of Teachers of English Award for Poetry for Children, <http://www.ncte.org>.

TRADITIONAL LITERATURE

Storytelling seems to be integral to the human experience. Traditional stories were used to educate and acculturate children and adults to the mores and values of their society as well as to entertain and to express a group's hopes and wishes. Charles Perrault's eight fairy tales artfully retold in *Histoire ou Contes du Temps Passé* (1697), established the popular notion that folktales are for young people. The idea was solidified with Jacob and Wilhelm Grimm's retelling of German folktales in *Kinder-und-Hausmärchen* (1812). Today children throughout the world learn the traditional stories of their culture as well as those of other cultures through books, though storytelling continues to survive.^[25]

In many countries traditional literature represents the bulk of publishing for children; even in countries with a large children's publishing industry, such as Australia, Japan, the United Kingdom, the United States, and Western European countries, a large proportion of picture books are retellings of fables, folktales, myths, and legends. The influence of traditional stories in every culture goes beyond the publishing of traditional literature: original stories too, whether in picture books or in fiction and fantasy for older readers, as well as in film and even advertising, draw on the structures, themes, and characters of traditional stories.^[17,26]

Traditional literature published for children tends to fall into the categories of fables, folktales, myths and legends. Fables are didactic stories. They are brief and often use animal characters to teach ethical lessons that help hold society together. In the most familiar of fables, the Aesop fables, the morals are usually stated at the end. Though less well-known in the West, the fables of India, the Panchatantra and Jataka, are becoming available through picture book versions. Because of the brevity of Aesop's fables, collections of fables are particularly enjoyable and have been reissued with different artists' interpretations, such as those of Jerry Pinkney (2000); Tom Paxton with Robert Rayevsky's illustrations (1988); and Lisbeth Zwerger (1989). Reinterpretations or

humorous modern versions include Leo Lionni's *Frederick* (1967); Arnold Lobel's *Fables* (1980); and Toni and Slade Morrison's *The Ant or the Grasshopper?* (2003), illustrated by Pascal Lemaitre. Two collections of Panchatantra tales retold for children include Gloria Kamen's *Ringdoves* (1988) and Asha Upadhyay's *Tales from India* (1971). Demi in *Buddha Stories* (1997) and Jeanne M. Lee in *I Once Was a Monkey: Stories Buddha Told* (1999) have produced collections of the Jataka tales. For a collection of international fables, see *Feathers and Tails: Animal Fables from Around the World* (1992) retold by David Kherdian.

Folktales serve a variety of functions, from teaching lessons to entertainment. Folktales are about ordinary people and anthropomorphized animals, and include a range of story types. Fairy tales or wonder tales delight listeners and readers with their courageous and often kind heroes who achieve extraordinary goals through perseverance and the good sense to listen to wise advice offered by magical helpers. Fairy tale heroes who win through patience and kindness characterize the hundreds of worldwide variants of kind-and-unkind sisters and related Cinderella stories, many of which have been retold in picture book format. A few of these are *Yeh-Shen: A Cinderella Story from China* by Ai-Ling Louie (1982); the Korean *Kongi and Potgi* by Oki Han (1996); *The Irish Cinderlad* by Shirley Climo (1996); and the Russian *Baba Yaga and Vasilisa the Brave* by Marianna Mayer (1994). The equally ubiquitous questing hero, who wins the prize through courage, perseverance, and usually magical help, is featured in stories such as *Song Bird* (1999) from Africa by Tololwa Mollel; *Inch Boy* (1986) from Japan by Junko Morimoto; and *The Black Bull of Norway* (2001) from Scotland by Charlotte Huck.

"Pourquoi" or "why" tales, which purport to explain how a custom, plant, or other observed phenomenon came to be, often used to teach children how they should behave, and cumulative or chain stories, characterized by events repeating themselves in longer and longer chains, are especially popular with children. Native American stories are rich in pourquoi tales such as Gayle Ross's *How Turtle's Back Was Cracked* (1995). Pourquoi tales are also told in Africa, as in Ashley Bryan's "How the Crab Got his Shell" in the collection *Turtle Knows Your Name* (1989). "The Gingerbread Boy," with its many picture book variants such as *The Pancake Boy* (1988) by Lorinda Cauley, is a cumulative tale, as is *Too Much Talk* from Ghana, retold by Angela Medearis (1995). Humorous tales, whether of numbskulls or of tricksters, are told for entertainment, as negative exemplars, or as a way to express a group's belief in the possibility of survival against the odds. Some popular numbskulls and tricksters include the Appalachian Jacks, most famously collected by Richard Chase in *The Jack Tales* (1943) and more recently retold by Gail Haley in *Mountain Jack* (1992); the West African and Caribbean Ananse as in *Ananse and*

the Lizard: A West African Tale (2002) by Pat Cummings, and *First Palm Trees: An Anancy Spiderman Story* (1997) by James Berry; the Native American Coyote (or Rabbit or Iktomi or Raven, depending on the region) as in *Ma'ii and Cousin Horned Toad* by Shonto Begay (1992); the Puerto Rican Juan Bobo as in *Juan Bobo* (2000) by Marisa Montes; the Goha from Arab-speaking countries as in *Goha, the Wise Fool* (2005) by Denys Johnson-Davies; and The Hodja from Turkey as in *Watermelons, Walnuts, and the Wisdom of Allah and Other Tales of the Hoca* (1967, 1991) by Barbara Walker. Though some popular tall tales are not true folktales, they are nevertheless part of American lore. Steven Kellogg's retellings with amusing illustrations include *Paul Bunyan* (1984) and *Pecos Bill* (1986). In *Cut from the Same Cloth* (1993) Robert San Souci retells tall tales about American women, some historic, others folkloric. Illustrated collections of international folktales and collections of specific countries, regions, or ethnic groups abound. Some of the resources for identifying the best of these collections include professional textbooks listed under "Bibliography," while individual stories in collections can be found through Margaret Reade MacDonald's *The Storyteller's Sourcebook: A Subject, Title and Motif Index to Folklore Collections for Children, 1983–1999* (2001), Joseph Sprug's *Index to Fairy Tales* (1994), as well as this index's earlier editions by Norma O. Ireland and by Mary Huse Eastman.

Every culture has its myths, stories that give concrete expression to their belief systems. Best known in the West are the Greek and Roman myths. The D'Aulaires' *Book of Greek Myths* (1962) and Alikì's *The Gods and Goddesses of Olympus* (1994) introduce 8–11 year olds to the Greek pantheon, while William Russell retells the stories in a lively collection *Classic Myths to Read Aloud* (1989) with pronunciations and explanations of common words derived from the myths. Less known are the Norse myths, which have been retold by authors such as Kevin Crossley-Holland in *Axe-Age, Wolf-Age: A Selection of Norse Myths* (1985) and Mary Pope Osborne in *Favorite Norse Myths* (1996). Native American myths have been retold in several collections by Joseph Bruchac, including in a science activities book by Michael Caduto, *Keepers of the Earth: Native American Stories and Environmental Activities for Children* (1989; 1999). John Bierhorst, a folklorist, has retold North, Central, and South American myths for children in books such as *The Mythology of Mexico and Central America* (1990). Chinese-Canadian artist Song Nan Zhang has retold Chinese myths of origins in *Five Heavenly Emperors* (1994), and English-Indian author Debjani Chatterjee has retold the Hindu myths in *The Elephant-Headed God* (1989). Virginia Hamilton's *In the Beginning: Creation Stories from Around the World* (1988), and Steven Zeitlin's *The Four Corners of the Sky: Creation Stories and Cosmologies from Around the World* (2000) are two of many international collections of myths. Bible stories have been retold by outstanding authors such

as Miriam Chaikin, Tomie de Paola, Peter Dickinson, Erik Kimmel, Julius Lester, Jan Mark, Geraldine McCaughrean, and Martin Waddell.

Legends are told as history, whether of the exploits of a group's hero, of important events in the history of the group itself, or of a symbolic animal, plant, landmark, or object of importance to the group.^[27] Legendary heroes embody the ideals of their societies. Children's books about legendary heroes include *The Epic of Gilgamesh* (2003) by Geraldine McCaughrean; *Black Ships Before Troy: The Story of the Iliad* (1993) by Rosemary Sutcliff; *The Adventures of Odysseus* by Neil Philip (1996); *Sundiata: Lion King of Mali* (1992), as well as *Golem* (1996) by David Wisniewski; *John Henry* (1994) by Julius Lester; and *The Magical Monkey King: Mischief in Heaven: Classic Chinese Tales* (2002) by Ji-Li Jiang. Legends of places and plants in North America are retold in Joseph Bruchac's *Between Earth and Sky: Legends of Native American Sacred Places* (1996).

Traditional literature offers an introduction to cultures around the world. Whether retold by people from the tales' culture of origin or someone outside the culture, authors and artists should treat the material with respect, avoid trivializing it, research the background of the story, credit their sources, and indicate in what way they may have altered it from its traditional origins according to storytellers Betsy Hearne^[28] and Joseph Bruchac.^[29]

REALISTIC FICTION

Fiction, though presenting imaginary characters and situations, can be realistic. The author creates a world which is simpler than real life, but the events, characters, and settings are within the realm of the possible in the natural world, even if at times they stretch the reader's credulity. Two subcategories of realistic fiction are Contemporary Fiction and Historical Fiction.

Contemporary Fiction

Contemporary fiction deals with characters who live contemporaneously with the author and the author's initial readers. In 1868, when Louisa May Alcott's *Little Women* was published, her readers were familiar with the events, the language, and the concerns of the characters. In the same way, today's contemporary fiction has relevant themes for today's young readers, as well as realistic plots, characters, settings, and dialogue. Dialogue that includes the latest in slang may date the work; outstanding contemporary fiction, however, transcends through theme, plot, and characterization, the limitations imposed by language, while adding, over time, a historical element the author did not originally intend. By minimizing setting and avoiding the most up-to-date slang, some contemporary fiction maintains its currency for 30 or 40 years, as have

Beverly Cleary's early books which were written in the 1950s and 1960s (*Ramona the Pest*, 1968).

Two of the major changes since the nineteenth century have been the degree of social realism and the tone authors use. Themes of personal development or coming of age and relationships within the family, with peers, and within the larger society continue to dominate children's fiction, but children's problems and the perspectives presented tend to be more complex and diverse than in early twentieth century fiction. While in British author Arthur Ransome's *Swallows and Amazons* (1930) the children develop their skills and demonstrate their ingenuity and courage during a sailing adventure in the idyllic setting of the Lake District in England, the skill and courage the protagonist of *The Wanderer* (2000) by Sharon Creech demonstrates as she sails with her adoptive family across the Atlantic must be matched by her courage in search of her identity. The family that meant a safe haven for children in earlier fiction, as in Eleanor Estes's *The Moffats* (1941), today may be the source of conflict. Parents remarry and children and stepparents may not get along, as in *My War with Goggle-Eyes* (1989) by British author Anne Fine; children may be abandoned by one or both parents, as in *A Catalogue of the Universe* (1985) by New Zealander Margaret Mahy, or dumped on a frail grandparent, as in *The Same Stuff as Stars* (2002) by Katherine Paterson; or a child may have to deal with abuse, as in *What Jamie Saw* (1995) by Carolyn Coman and in *I Hadn't Meant to Tell You This* (1994) by Jacqueline Woodson. Other themes of social realism include teens struggling with drug addiction, as in *A Hero Ain't Nothin' But a Sandwich* (1973) by Alice Childress, and *Smack* (1998) by British writer Melvin Burgess; AIDS, as in *Eagle Kite* (1995) by Paula Fox; homelessness, as in *Stone Cold* (1993) by British author Robert Swindell; coming to terms with homosexuality, as in *Deliver Us from Evie* (1994) by M. E. Kerr; and illegal immigration, as in *Ask Me No Questions* (2006) by Marina Budhos—in short, the issues of concern to adults and young people at the time of writing. In spite of the serious tone and subject of many of these books, however, the underlying themes are personal growth, the redeeming power of caring for others, and hope.

Humorous treatments of families and their struggles or of children and their peers continue to play an important part in engaging children with life issues. Barbara Park's *Junie B. Jones* series and British author Hilary McKay's Casson family series, starting with *Saffy's Angel* (2002), have children consider everything from learning to fit in at school to searching for one's identity; Canadian Polly Horvath's ever-optimistic hero's misadventures make children laugh in *Everything on a Waffle* (2001); a teen whom everyone else has given up on finds self-respect and a sense of purpose as a foster child in a riotously creative family in *Surviving the Applewhites* (2002) by Stephanie Tolan; and a child's yearning for a mother is poignantly

and humorously told in *The Higher Power of Lucky* (2006) by Susan Patron. Humor has also lightened the tone in books dealing with serious social issues, such as fear of homelessness in *Money Hungry* (2001) by Sharon Flake, and protecting the environment in *Hoot* (2003) by Carl Hiassen.

Adventure and survival in nature also continue as important subjects of fiction. Wilderness adventures, such as *Hatchet* (1987) by Gary Paulsen, provide children a chance to vicariously test their ingenuity and mastery of their environment, as do urban adventures, such as Cornelia Funke's magic realistic adventure *The Thief Lord* (2002) set in Venice. Urban adventures, however, can also have much more serious themes, as in *The Planet of Junior Brown* (1971) by Virginia Hamilton, in which Junior Brown is introduced to the world of squatter children in New York City.

Besides increased social realism and a more serious tone, point of view has become more complex since the 1960s. Young adult author Paul Zindel pioneered the telling of a story from multiple or unusual perspectives in *The Pigman* (1968).^[30] Since then authors have frequently used the technique, especially in books for young adults, as in *Nothing But the Truth* (1991) by Avi in which an unreliable narrator tells us about his "unfair" treatment by a teacher; in *Monster* (1999) by Walter Dean Myers, in which a teen arrested for acting as an accessory to a robbery ending in murder examines himself through a pretend camera lens; and in Virginia Walter's *Making Up Megaboy* (1998), which shows the reactions of the parents, only friend, the media, classmates, the victim's widow, and, finally, the young perpetrator to a deadly shooting.

Historical Fiction

In historical fiction authors set the action in the past, usually after doing research, in order to create an authentic setting, with the characters' concerns and language fitting the era depicted. Historical fiction, like contemporary fiction, is realistic. It too sheds light not only on the era in which it is set but also on contemporary times, as the stories frequently deal with issues of concern at the time of writing. Katherine Paterson's *Lyddie* (1991), set in a textile factory town in the 1830s, for instance, explores the issue of child labor which is still relevant in some parts of the world. Besides introducing a historic era, the authors usually explore universal themes such as the quest for personal identity or questions of honor, loyalty, friendship, and death. There is almost no limit to the historic settings that authors have attempted to evoke for young people, but certain eras are particularly well represented, as for instance the European Middle Ages in the books of Karen Cushman, Eric Haugaard, and British author Rosemary Sutcliff. The American Civil War and slavery are also frequently explored as in Patricia Beatty's *Charley*

Skedaddle (1987) and *Turn Homeward, Hannahlee* (1984); Sharon Draper's *Copper Sun* (2006); Paul Fleischmann's *Bull Run* (1993); Joyce Hansen's *Which Way Freedom* (1986); and Maureen Stack Sappey's *Letters from Vinnie* (1996). World War II and its aftermath can be seen from multiple perspectives. Many of the books have been translated from other languages. Settings include: Denmark (Bjarne Reuter's *The Boys from St. Petri*, 1994); Germany (Peter Härtling's *Crutches*, 1988); Greece (Alki Zei's *Petros' War*, 1974); Japan and Korea (Yoko Kawashima Watkins's *So Far from the Bamboo Grove*, 1986); Korea (Linda Sue Park's *When my Name Was Keoko*, 2002); Netherlands (Els Pelgrom's *The Winter When Time Was Frozen*, 1980); the United Kingdom (Nina Bawden's *Carrie's War*, 1973); and the United States (Mary Downing Hahn's *Stepping on the Cracks*, 1991 and Patricia Rielly Giff's *Lily's Crossing*, 1997). The Holocaust and its context have been treated by many European and American authors including in titles such as *Daniel Half Human and the Good Nazi* by David Chotjewitz and *Friedrich* (1970) by Hans Peter Richter, both set in Germany; *Run, Boy, Run* (2003) by Uri Orlev, set in Poland; and *Upon the Head of the Goat* (1981) by Aranka Siegal (1981) as well as *Marika* (2002) by Andrea Cheng, both set in Hungary.

The Civil Rights era has been portrayed in books such as *The Watsons Go to Birmingham, 1963*, (1995) by Christopher Curtis, which begins with the humorous interactions of an African American family and their journey South, but turns serious during the trip, with sibling rivalry and teasing replaced by siblings helping each other survive emotionally. The Great Depression has been frequently depicted from various perspectives: *Esperanza Rising* (2000) by Pam Munoz Ryan, from a Mexican-American immigrant farm worker perspective; *Out of the Dust* (1997) by Karen Hesse from an Oklahoma farm girl's perspective; and *Bud, Not Buddy*, (1999) by Christopher Curtis from an African American perspective. Successful works of historical fiction have believable characters, vivid and accurate settings, and plausible plots.

MODERN FANTASY

Fantasy is one of the most enduring forms of children's literature. Only poetry and the genre's closest forebears, the traditional folk-fairy tales, legends, and myths have persisted longer, and for some of the same reasons. By transcending specific geographic settings and symbolically representing ideas, authors have been able to speak to audiences across both time and space.

Modern fantasy contrasts with its folkloric antecedents by its complexity, highly developed themes, and carefully crafted characters, many of whom are, in spite of the fantasy element, recognizable young people in search of identity, friendships, and values to live by. It was Tolkien

who articulated the essential quality a fantasy writer must strive for if the reader is to achieve “willing suspension of disbelief.” Tolkien called for consistency based on the “laws” set up for the imagined world and for treating the magic seriously, not as something to explain away or to smirk at.^[31]

Some of the typical categories of fantasy include literary fairy tales, which are halfway between traditional folktales and modern fantasy; high fantasy or quest fantasy; animal fantasy; toy fantasy; enchanted journeys and alternative worlds; supernatural and time-shift fantasy; and science fiction.

Contemporary authors of literary fairy tales for children include the American novelists Robin McKinley (*Beauty*, 1978 and *Rose Daughter*, 1997—both a reenvisioning of Jeanne-Marie Leprince de Beaumont's 1757 classic “Beauty and the Beast”); Gail Carson Levine (*Ella Enchanted*, 1997—a psychological exploration of the Cinderella figure); Donna Napoli (*The Magic Circle*, 1993—a look at the witch's perspective in Hansel and Gretel); and Jane Yolen who is sometimes referred to as the American Hans Christian Andersen. Literary fairy tales continue to draw on traditional fairy tale characters such as elves, dragons, princesses, wizards and witches, etc. as do works of high fantasy, also referred to as quest fantasy.

The high fantasy genre whose heroes begin life inauspiciously but prove their nobility through valor, perseverance, and the willingness to fight against the forces of evil—begun by George MacDonald in the nineteenth century—continues strong in the twenty-first century. The international popularity of the Harry Potter series by J. K. Rowling, starting with *Harry Potter and the Philosopher's Stone* (1997, i.e., *The Sorcerer's Stone*) has rekindled interest in the genre, partly because though the evil is of mythic proportions, Harry is a less-than-perfect, seemingly ordinary boy who defeats the embodiment of evil by relinquishing the temptations of power, choosing through love to save his companions and ultimately the world. With a few exceptions, high fantasy with its complex plots, often strange secondary-world settings, literary allusions, and symbolism is generally more accessible and of greater interest to upper elementary students through adults than to younger readers. A few of the American award-winning writers of high fantasy include Lloyd Alexander whose Welsh mythology-inspired Prydain series (beginning with *The Book of Three*, 1964) presents adventurous male and female heroes as well as humorous secondary characters; British-born Susan Cooper (*The Dark is Rising* series, starting with *Oversea, Under Stone*, 1965, in which contemporary children protect the land as they communicate with Arthurian heroes); Ursula Le Guin whose *Earthsea* series (*A Wizard of Earthsea*, 1968) begins with a 12-year old boy wizard and ends six volumes later with a young adult female hero in *Tehanu* (1990); and Robin McKinley who has created strong female heroes in books such as *The Blue Sword* (1982).

A few of the many great British fantasy writers since the mid-twentieth century include C. S. Lewis (*The Chronicles of Narnia* series, starting with *The Lion, the Witch and the Wardrobe*, 1950, a Christian allegory in which four ordinary children must choose between Aslan, the good king of Narnia and the evil white witch); Diana Wynne Jones (*The “Chrestomanci”* series, 1977–2005 about a young boy magician, his sisters, and their schooling); and Philip Pullman (*Northern Lights*, 1995, i.e., *The Golden Compass* and the rest of His Dark Materials series), whose male and female protagonists explore complex issues of belief, the uses of technology, and issues of power). International writers of high fantasy whose works have been translated into English include German author Michael Ende (*Die Unendliche Geschichte*, 1979, i.e., *The Neverending Story*, 1983); Italian author Silvana De Mari (*L'Ultimo Elfo*, 2004, i.e., *The Last Dragon*, 2006); and Japanese author Miyuki Miyabe (*Bureibu sutori*, 2003, i.e., *Brave Story*, 2007).

Animal fantasy has dominated picture books since Beatrix Potter first dressed Peter Rabbit in a blue jacket and gave him a sense of adventure. Because preschoolers readily identify with the animal protagonist, authors/illustrators can focus on universal feelings and can have animals do more extreme and more dangerous activities than would be realistic for young children. This last consideration is also true for the animal fantasies written for early elementary age children, such as Beverly Cleary's *The Mouse and the Motorcycle* (1965). Most animal fantasy is for younger readers, but some, because of their complexity and literary allusions, are more likely to appeal to middle and upper elementary age students than to younger children: *Mrs. Frisby and the Rats of NIMH* by Robert O'Brien (1971); *Watership Down* (1972) by Richard Adams; *Redwall* (1987) and its series by Brian Jacques; and *The Amazing Maurice and His Educated Rodents*, (2001), by Terry Pratchett.

Since Carlo Collodi's Pinocchio first strove to become human in 1883, toys in children's books have been talking about their feelings, making friendships, and discussing philosophical questions of what it means to be loved (*The Velveteen Rabbit*, 1922 by Margery Williams Bianco); how to be a friend (*Winnie-the-Pooh*, 1926 and *The House at Pooh Corner*, 1928 by A. A. Milne); and whether it is better to take your chances with life or to be the perfect manufactured object (*Alexander and the Wind-up Mouse*, 1969 by Leo Lionni). While books about toys are usually written for younger children, books such as Russell Hoban's *The Mouse and His Child* (1967), replete with social commentary, appeal to somewhat older children.

Alice's Adventures in Wonderland (1865), with its combination of playfulness and satire, set a high mark for journeys to a parallel universe. In some books it is the children of this world who find a way to the alternative world, as in *The Phantom Tollbooth* (1961) by Norton Juster; *Coraline* (2002) by Neil Gaiman; and *Dangerous*

Spaces (1991) by Margaret Mahy. In other stories it is the inhabitants of the parallel world who slip into our world, as in *The Borrowers* (1952) by Mary Norton and in *Moorchild* (1996) by Eloise McGraw. Or, the story takes place entirely in what Tolkien called a secondary world, as in Diana Wynne Jones's *Cart and Cwiddler* (1975) and the rest of the Dalemark quartet and Terry Pratchett's *Wee Free Men* (2003) and all of the books in the Discworld series.

Time slip/time travel is often a device for introducing historical eras or to help a protagonist get in touch with people in the past in order to understand their perspectives or to understand themselves better, as in *Playing Beatie Bow* (1980) by Australian author Ruth Park, who takes a modern-day girl back to her grandmother's days in late nineteenth century Sidney, and *The Ultimate Game* (2000) by Christian Lehmann, in which three boys discover that war is not a game. Other time slips include *Tom's Midnight Garden* (1958) by British author Philippa Pearce; *Building Blocks* (1984) by Cynthia Voigt; *The Devil's Arithmetic* (1988) by Jane Yolen; and *If I Should Die Before I Wake* (1994) by Han Nolan.

Many children and young adults like tales of haunting, horror, and the supernatural in both traditional literature and in modern fantasy, as the popularity of Stephen King with adolescents attests. Tales of the supernatural for elementary school age children include: *The Improbable Cat* (2004) by Allan Ahlberg; *The Children of Green Knowe* (1954) and its sequels by Lucy Boston; *The Ghost of Thomas Kempe* (1973) by Penelope Lively; *The Ghost Drum* (1987) by Susan Price; *Whispers in the Graveyard* (1994) by Theresa Breslin; as well as the humorous spoof of the genre, *Bunnicula* (1979) by Deborah and James Howe.

Some fantasy works are hard to classify. A few of these include modern classics such as Natalie Babbitt's philosophical *Tuck Everlasting* (1975) with its exploration of death and the cycle of life; Roald Dahl's *James and the Giant Peach* (1961) and *Charlie and the Chocolate Factory* (1964); Alan Garner's *The Owl Service* (1967); and Geraldine McCaughrean's *A Pack of Lies* (1988).

Science fiction, while less generally popular with children than fantasy, has its enthusiastic followers.^[14] Jules Verne (*Vingt Mille Lieues sous le Mers* 1870, i.e., *20,000 Leagues Under the Sea*) and H. G. Wells (*The Time Machine*, 1895) introduced the genre. Since its inception, science fiction, though based on scientific and technological concepts, is speculative rather than accurate, dealing with technological possibilities as well as their social ramifications. Madeline L'Engle in *A Wrinkle in Time* (1962) with its contemporary settings and technological dystopia explores the concept of free will within the contexts of both a totalitarian government and Christian theology. Other works of science fiction address issues such as the meaning of civilization (*The Green Book*, 1981 by Jill Paton Walsh); the uses and abuses of cloning people

(*House of the Scorpion*, 2003 by Nancy Farmer and *Galax-Arena*, 1992 by Gillian Rubinstein); and what it would mean if we could eliminate pain, sorrow and even the memories of painful history from our lives (*The Giver*, 1993 by Lois Lowry). Other authors who have written science fiction for children and young adults include Monica Hughes, Andre Norton, Kenneth Oppel and William Sleator.

INFORMATIONAL BOOKS AND BIOGRAPHIES

Although children's informational books are not a new genre—John Newbery published many informational books, including the series *The Newtonian System of Philosophy* (1761) by “Tom Telescope,” changes in attitudes toward children and changes in publishing technology have fueled a dramatic increase in engaging, quality informational books for children.

Changes in attitudes toward children involved viewing them as capable of responding to the inherent interest of factual material without the need for a thin story veneer, formerly thought essential in order to fascinate young readers. The use of a story line to introduce informational material, however, does remain common for preschoolers through first or second grade, and research suggests that the emotional involvement with the story characters helps these children remember the information.^[32] One of the most successful among informational books with a story line is the *Magic School Bus* series by Joanna Cole, illustrated by Bruce Degan, in which the author and illustrator make use of fantasy by having the magic school bus explore a wide range of scientific concepts from the inner world of the circulatory system to the eye of a hurricane. Most outstanding authors of informational books, however, have chosen to eschew fictionalizing even for younger children in favor of using an engaging style. They involve readers by stimulating their thinking through demonstrating the process of research, asking provocative questions, and leaving unanswered questions for children to ponder and dream about researching in the future. Vivid photographs, diagrams, and images extend the information. Jean Fritz, in a series of biographies for 2–4th graders about American Revolutionary War figures (*And Then What Happened Paul Revere?* 1973) pioneered the use of a lively, informal style of writing while adhering to strictly documented information and presenting a balanced view of her subjects, flaws included, in order to help her readers realize that they too can strive to be great. When Fritz chose accuracy over idealized models, she broke new ground in writing biography for children. Judith St. George (*So You Want to be President*, 2000) and Kathleen Krull (*Lives of the Musicians: Good Times, Bad Times, and What the Neighbors Thought*, 1993) have continued in the same vein.

Writing informational books for children is challenging, as another outstanding writer, Russell Freedman

(*Lincoln: A Photobiography*, 1987 and numerous other award winning books) has written,

I welcome the discipline of a book such as that [history or biography] imposes on the author. It is something like writing a sonnet: your words must fit within a certain format, and every word counts . . . The art lies in the selection and arrangement of documented facts, in the closely observed and painstakingly constructed narrative, and in the imposition on those facts of the author's unique sensibility. It requires a feat of imagination as well as diligent research to make the past live again for the reader. (p. 25)^[33]

Imagination and diligent research are certainly the hallmarks of the best of informational books, along with the advantage of high quality photographic reproduction at affordable prices. Freedman, for instance, specializes in using reproductions of archival photographs, letters, diaries, and other primary documents to enhance readers' understanding of his subjects.

Similar to biography and history, the presentation of science for children has also undergone a major change, the field having particularly benefited from technological developments. Children's books feature photographs from the field, as well as electron microscopic, satellite, and fiber-optic images. As with biography and history, ideas about what constitute good science informational books for children have changed in the last quarter of the twentieth century. Newer children's science books focus on the processes of science as well as on science concepts and discoveries, thus involving readers in the painstaking but exciting work of scientific research. Patricia Lauber's *The News About Dinosaurs* (1989) is an example of this approach: she presents the reader with established scientific information about dinosaurs, then shows how, because of new research evidence, these beliefs had to be reevaluated. Similarly, Susan Quinlan involves the readers in both science concepts and processes as she presents 12 rain forest ecology mysteries in *The Case of the Monkeys that Fell from the Trees* (2003), and Sy Montgomery and Nic Bishop document the work of field scientists in books such as *Quest for the Tree Kangaroo: An Expedition to the Cloud Forest of New Guinea* (2006).

Even before children are ready to think formally about hypothesis testing, trade books introduce them to the scientific method, involving them in observation and classification. Following the lead of Milicent Selsam, a science teacher and writer during the 1950s and 1960s whose works stimulated preschool and early elementary school age children to observe their world and to develop hypotheses about their observations, science writers/artists such as Jim Arnosky (*Crinkleroot* nature series) and Steve Jenkins (*What Do you Do with a Tail Like This?* 2003), engage children through biological and visual puzzles. Others have young children consider factorials (Masaichiro and Mitumasa Anno in *Anno's Mysterious*

Multiplying Jar, 1983) and very large numbers (David Schwartz in *How Much is a Million?* 1985). Informational books also deal with other topics. For instance, they play with language (Fred Gwynne, *A Chocolate Moose for Dinner*, 1976); make grammar and punctuation lessons fun (Lynne Truss's *Eats, Shoots, and Leaves: Why Commas Really Do Matter*, 2006, which is based on her book for adults, *Eats, Shoots, and Leaves: The Zero Tolerance Approach to Punctuation*); or explain to children a range of personal experiences.

It is impossible here to convey the variety of informational books and biographies available to children and young adults; however, the following recommended book lists provide a beginning for exploring the many outstanding authors and illustrators, and their works.

- "Best Science Books for Children" named annually by *Science Books and Films* a publication of the American Association for the Advancement of Science
- "Notable Trade Books for Young People" by the National Council for the Social Studies/ Children's Book Council. This extensive list is published every May in the association's journal *Social Education*, or order directly from Children's Book Council. Also at NCSS: <http://www.ncss.org/resources/notable/>
- "Outstanding Science Trade Books for Students K-12" by National Science Teachers Association, Children's Book Council. This extensive list is published every March in the association's journal *Science and Children*, or order directly from Children's Book Council. Also at NSTA: <http://www.nsta.org/publications/ostb/>

See also "Awards" for major informational book and science trade book awards.

INTERNATIONAL CHILDREN'S LITERATURE

International books are defined as having been written in another country for the readers of that country, and then imported and made available either in the original language or in translation. The nineteenth and early twentieth centuries produced classics that readers in many countries consider their own, regardless of the books' origins: The Grimms' and Hans Christian Andersen's fairy tales; *Alice's Adventures in Wonderland*; *Pinocchio*; Jules Verne's books; *Heidi*; *Tom Sawyer*; *The Wonderful Wizard of Oz*; *Winnie the Pooh*; *The Story of Babar*; and *Pippi Longstocking*. With the exception of such classics, however, relatively few children's books are truly international, the worldwide success of English author J. K. Rowling's Harry Potter (1998–2007) series being a rare exception. Furthermore, children in English-speaking countries are exposed to few translated books, with imports representing 1% of the total output of children's books per year as compared with Germany or Japan,

where translated books represent around 30% of children's publishing.^[2] Reading international books, however, is important as they give children a more balanced view of their world than do the news and commercial films, open a window to the lives of children whose experiences are different from theirs, and connect children to each other through shared readings.^[2]

Because children's books from Australia, Great Britain, Canada, the United States and New Zealand are more readily available than translated books, this section will focus on translated books. (For awards from English-speaking countries, see "Awards" section).

In spite of the challenges, it is possible to identify books that were first published in non-English speaking countries. Awards lists highlight authors and illustrators who are known in many countries. The most important award for international literature is the Hans Christian Andersen Award given by the International Board on Books for Young People (IBBY, <http://www.ibby.org/index.php?id=273>). Margaret Mahy of New Zealand (2006), whose works range from picture books to young adult fiction and fantasy, represents the breadth and quality of writing of the winners. Some of the other recipients who are known worldwide include Finnish author Tove Jansson, who created the Moomintroll family, Swedish author Astrid Lindgren with her irrepressible Pippi Longstocking, and Irish author Martin Waddell, who has written many tender picture books such as *Can't You Sleep Little Bear?* (1988) as well as retellings of legends and contemporary fiction. The award is an excellent way to become acquainted with writers and illustrators from other countries such as Brazilian authors Lygia Bojunga Nunes and Ana Maria Machado; Japanese illustrator Sukeichi Akaba; Norwegian author Tormod Haugen and French illustrator Tomi Ungerer. (Six Americans have also received the award.) The works of most of the awards recipients are available in English.

The Mildred L. Batchelder Award (<http://www.ala.org>) is an important resource for outstanding translated books available in the United States. While earlier winners of the Batchelder award tended to be translations from Germanic-speaking countries—Denmark, Germany, Netherlands, Norway, Sweden^[34]—in more recent years awards have gone to Brazilian, French, Israeli, Italian, Japanese, Spanish, and Turkish authors as well.

The Batchelder Award books have included all genres, but they are especially rich in historical fiction. The stories have been set in Renaissance Italy in *The Apprentice* (1993) by Pilar Molina Llorente; Napoleonic era Germany in *Innocent Soldier* (2005) by Josef Holub; and 1950s Syria in *Hand Full of Stars* (1990) by Rafik Schami. Most frequently represented, however, has been the time period just before, during and right after World War II, including the Holocaust, making the Batchelder Award winners a good source for studying this historic era from multiple perspectives (specific titles are discussed in the section on "Fiction.").

Batchelder winners also include lighthearted books and books set in the present. Some genres and topics include works of contemporary fiction such as the serious yet also humorous exploration of friendship and its healing power in *The Friends* (1996) by Japanese author Kazumi Yumoto; fantasy, such as *Rabbit Island* (1978) by Swiss author Jörg Steiner, an allegory of freedom; and science fiction, such as *Konrad* (1977) by popular Austrian author Christine Nöstlinger about what it means to be human.

Some of the best ways to identify high quality children's books that were first published in another country which are available in the United States are through the three annotated bibliographies sponsored by the United States Board on Books for Youth (USBBY): Carl Tomlinson, *Children's Books from Other Countries* (1998); Susan Stan, *The World Through Children's Books* (2002); and Doris Gebel, *Crossing Boundaries with Children's Books* (2006). (See "Bibliography"). Other international children's book awards are also listed under "Awards."

The following are additional sources for discovering international authors/illustrators and their works:

- Books available in English in the United States: USBBY's "Outstanding International Books" annual list, posted at <http://www.usbby.org>.
- The "IBBY Honour List," published biennially at the IBBY Web site (under Activities) at <http://www.ibby.org/>, lists the best written, illustrated, and translated book of each member nation.
- IBBY's journal, *Bookbird*, provides insight into the national children's literatures of different countries.
- *White Ravens*, an annual annotated list of international books compiled at the International Youth Library (Internationale Jugend Bibliothek) in Munich available at the International Children's Digital Library (<http://www.icdlbooks.org/servlet/WhiteRavens>).
- The International Children's Digital Library <http://www.icdlbooks.org/index.shtml>, full text digitized children's books in their original languages.

LITERATURE REPRESENTING DIVERSE PERSPECTIVES

Readers need to encounter both windows showing the lives of others and mirrors reflecting themselves.^[35] Literature written by and about nonmainstream groups is essential to accomplishing this. This entry will focus primarily on multicultural books, that is, books of underrepresented ethnic groups, but will also discuss children's literature that deals with disabilities and alternative sexual orientation.

Multicultural Books

For multicultural literature to be successful, authors must be able to portray the culture of the ethnic group

authentically, based on familiarity with the cultural nuances, whether through intimate personal experience or through intensive research.^[36] While most librarians and other educators agree that books presenting diverse perspectives are important, building a multicultural collection continues to be a challenge. The Cooperative Children's Book Center (CCBC) at the University of Wisconsin, Madison, reported in 2007 that of the approximately 5000 children's trade books published annually in the United States, five percent (5%) of the books had significant African American or African content, 2.9% having been created by African American authors or illustrators. The numbers were even smaller for other nonmainstream ethnic groups, with 1.3% of the books having Native American content and only 0.4% having been created by Native American authors or illustrators.^[37]

The Coretta Scott King Award (<http://www.ala.org>) has been instrumental in highlighting the works of outstanding African American authors and illustrators. Themes range from the universal to the culturally specific. Recurrent themes include developing relationships and a positive self concept, as in picture books by Eloise Greenfield (*Nathaniel Talking*, 1988, illustrator Jan Spivey Gilchrist) and Angela Johnson (*When I am Old With You*, 1990, illustrator David Soman); a sense of history and pride in the accomplishments of famous and unsung African Americans, as in the books of Tonya Bolden, James Haskins, and Patricia and Frederick McKissack; and realistic portrayals of the struggles of contemporary young people, as in the works of Sharon Draper, Sharon Flake, Walter Dean Myers, and Jacqueline Woodson. The illustrators who have received the award include, among many others, artists mentioned in earlier sections, such as Gregory Christie, Bryan Collier, Floyd Cooper, Leo and Diane Dillon, Christopher Myers, Brian Pinkney, and Jerry Pinkney. For an extensive annotated bibliography, see Rand and Parker's *Black Books Galore* (in "Bibliography").

While most of the approximately 2.2% of children's books representing Asian Americans are folktales, there are many authors and illustrators who portray Asian American experiences realistically, although Chinese or Japanese Americans are best represented among both authors and subjects.^[38] Striking a balance between striving for acceptance by the mainstream culture through assimilation and maintaining ethnic identity have been dominant themes in contemporary and historical fiction as in many of Laurence Yep's books, such as *Child of the Owl* (1971); Gene Luen Yang's *American-Born Chinese* (2006); Cynthia Kadohata's *Kira, Kira* (2004); An Na's *A Step from Heaven* (2001); Tanuja Hidier Desai's *Born Confused* (2002); and the picture books *Apple Pie 4th of July* (2002) by Janet Wong, and *Halmoni and the Picnic* (1993) by Sook Nyul Choi. Many books also celebrate cultural heritage, as in Kam Mak's *My Chinatown: One Year in Poems* (2002), Grace Lin's *Year of the Dog*

(2006), and Madhur Jaffrey's *Seasons of Splendor* (1985). The Asian Pacific American Award for Literature (<http://www.apalaweb.org/awards/>) honors authors and illustrators who portray Asian or Asian-American culture authentically.

Latino/Latina authors and illustrators portray the diversity of experiences in Latin American countries and U.S. Latino communities. George Ancona's, Monica Brown and Raul Colon's, and Carmen Lomas Garza's informational picture books document both daily lives and the lives of famous people; the narrative poetry of Carmen T. Bernier-Grand and Margarita Engle celebrate historical and contemporary figures while the lyric poems of Francis X. Alarcon, Juan Felipe Herrera, Pat Mora, and Gary Soto give voice to children's experiences; and Francisco Jimenez, Pam Muñoz Ryan, and Victor Martinez portray through autobiography and fiction the importance of family and the challenges of being poor and an immigrant. While much of Latino/Latina children's literature is specific to Mexican American experiences, Alma Flor Ada and Lulu Delacre are two of the authors who also portray Cuban and Puerto Rican culture and folklore. Three awards that recognize outstanding Latino books include The Pura Belpré Award (<http://www.ala.org>), the Americas Award (<http://www.uwm.edu/Dept/CLACS/aa/index.html>), and the Tomás Rivera Award (<http://www.education.txstate.edu/departments/Tomas-Rivera-Book-Award-Project-Link.html>)

Until recently most children's books about Native Americans were written by non-Native writers. Even when well-meant, these books' themes, characterizations, details of everyday life, and values were and often still are inauthentic.^[39] Increasingly, there are children's books in all genres created by American Indian writers and illustrators. Besides retelling traditional legends and myths, Joseph Bruchac (Abenaki) for instance, has written picture books (*Fox Song*, 1993), fiction (*The Heart of a Chief*, 1998), and modern fantasy (*Skeleton Man*, 2001). Other authors, such as National Book Award winner Sherman Alexie (Spokane/Coeur d'Alene) and Cynthia Leitich Smith (Muscogee) show the lives of contemporary Native Americans through realistic fiction while Louise Erdrich (Ojibwe) and Tim Tingle (Choctaw) have provided Native American perspectives on historic eras and events through historical fiction. Sources for authentically written/illustrated books about Native American experiences include: The online catalog of Oyate, <http://www.oyate.org>, a non-profit Native American organization; *A Broken Flute: The Native American Experience in Books for Children* (2005) by Doris Seale and Beverly Slapin (See "Bibliography"); and the American Indian Youth Literature Award <http://aila.library.sd.gov/News/2008youthlit/index.htm>. (See "Awards").

Finding books representing Middle Eastern Americans or Muslims is a particular challenge, but children's books written by Middle Eastern Americans are beginning to

appear. Naomi Shihab Nye has written about Palestinian Americans' experiences visiting family in Palestine in picture books such as *Sitti's Secret* (1994) and in contemporary fiction such as *Habibi* (1997) and has translated Arabic poetry for young people. Nye's books of poetry and anthologies express hope for a peaceful world. Other writers describe refugee experiences, as do Ibtisam Barakat in *Tasting the Sky* (2007); Deborah Ellis, a Canadian author, in *The Breadwinner* (2000) and its sequels; and Rukhsana Khan in a picture book, *The Roses in my Carpets* (1998).

For reviews of current multicultural books, see:

MultiCultural Review, the official publication of EMIERT, the Ethnic and MultiCultural Information Exchange Round Table of the ALA. <http://mcreview.com/>

For annotated bibliographies, see "Bibliography"

Books about Children with Special Needs

In the nineteenth century children with disabilities were presented in children's books as exemplars of virtue, often acquired by the child after developing the disability. Sentimental and unrealistic presentations continued in the twentieth century though a few children's books did present children with disabilities realistically, focusing on not only their struggles but their strengths. *Johnny Tremain* (1943) by Esther Forbes is an early example. The Schneider Family Award of the ALA (<http://www.ala.org>), begun in 2004, was established in order to recognize books of literary/artistic quality that present the disability experience, whether of the protagonist or of the family. Disabilities can be physical, mental, or emotional, such as Cynthia Lord's *Rules* (2006) about an autistic boy and his older sister, Pam Muñoz Ryan's *Becoming Naomi León* (2004) about a Mexican American girl and her learning disabled brother, and Pete Seeger and Paul DuBois Jacobs's *The Deaf Musicians*. Another excellent resource, especially for younger children, their families, and teachers is a 300 item bibliography compiled by Crystal and Kaiser (2007) (see "Bibliography").

Books Featuring Gay, Lesbian, or Transgendered Characters

Few picture books for children feature homosexual protagonists or same-sex parents. Of the few, Justin Richardson and Peter Parnall's *And Tango Makes Three*, a picture book account of two male penguins in a New York City Zoo raising a penguin chick, is one of the best picture books on the topic of same-sex households. There are far more well-written young adult books with gay or lesbian characters by writers like Nancy Garden, Julie Peters, Alex Sanchez, and Ellen Wittlinger. The best of the books feature characters who are not defined solely by their sexual identity. The "Stonewall Award," listed in

ALA-Awards (<http://www.ala.org>) recognizes children's books dealing with gay/lesbian/transgendered issues.

NONPRINT MEDIA

Children's literature has long been tied to toys, decorative objects, and other products, such as children's dishes and linens, the best known of which may be those depicting Beatrix Potter's characters. While most of these products are commercial ventures, libraries have made good use of the puppets and dolls that have been created from literary characters, such as Madeline, The Cat in the Hat, and The Wild Things, to generate interest in the books.

The new forms of media that changes in technology have made possible have added to rather than supplanted books as a source of children's literary experiences. Besides original films meant for children, children's classics, such as *Little Women*; *Heidi*; *Pinocchio*; and *The Secret Garden* have been adapted to film, most several times, in both live action and animation, and are available through videotapes/DVDs and Web-based film sources. One of the films made from a children's book that has achieved classic status in its own right is *The Wizard of Oz* (Dir: Fleming, 1939). A few of the many more recent award-winning children's books with film adaptations include *Bridge to Terabithia* by Katherine Paterson; *Charlie and the Chocolate Factory* by Roald Dahl; *Ella Enchanted* by Gail Carson Levine; the *Harry Potter* series by J. K. Rowling; *Holes* by Louis Sachar; *The Polar Express* and *Jumanji* by Chris Van Allsburg; *A Wrinkle in Time* by Madeline L'Engle; and many of Dr. Seuss's books, including his *How the Grinch Stole Christmas*. Some children's books, such as *Anne of Green Gables* by L. M. Montgomery; *Carrie's War* by Nina Bawden; *Sarah, Plain and Tall* and its Sequels by Patricia MacLachlan; and *Konrad* by Christine Nöstlinger have been made directly into television movies. The International Movie Database, <http://www.imdb.com> is a good source for identifying different productions of these films.

Besides commercial film and television, several producers have used film/video to recreate picture books, as close to the original as possible. These productions preserve the original text and art, adding animation or iconography, music, narration, and sound effects. These formats are available in school and public libraries and are meant primarily for preschool and elementary age children. Weston Woods Studios pioneered the format and set the standard for painstaking effort to make possible for classroom sharing the literary and visual delights of a picture book. The Andrew Carnegie Medal (<http://www.ala.org>) honors the producers of an outstanding children's video. Award-winning videos range from iconographic images of picture books such as Mordecai Gerstein's *The Man who Walked Between the Towers* (2005), produced by Michael Sporn and Paul Gagne, to live action such as

Jump in Free Style (2007), produced by Kevin Lafferty, directed by P. Hoen. Children's videos are reviewed in *School Library Journal* and *Booklist*.

Audiobooks have moved with the technology from vinyl records to cassette tapes to compact discs and have gained a far wider audience, as adults and young adults have begun to listen to audiobooks. High quality children's and young adult books are available in audio format. Because the quality of narration is important, audiobooks are reviewed in such professional journals as *Horn Book Magazine*, *School Library Journal*, *Booklist* and *VOYA* (*Voice of Youth Advocates*). Three major awards for audiobooks are: the Audie Award (<http://www.hbook.com/resources/awards/default.asp>), the *Audiobook Hall of Fame* (<http://www.hbook.com/resources/awards/default.asp>) and the Odyssey Award from Association for Library Services to Children (ALSC) and Young Adult Library Services Association (YALSA) divisions of ALA (<http://www.ala.org>). Award-winning audiobooks may be read by a full cast, as in *Knuffle Bunny* (2006) which was read by author Mo Willems and his family, but more often are narrated by a single narrator with occasional musical accompaniment as in 2008 Odyssey Award winning *Jazz* (2007) by Walter Dean Myers.

Electronic books, also referred to as e-books or digital books, are becoming increasingly important for reference work for high school students and adults, but children's trade books, while available in digital form since the mid-1990s, have not yet become widely popular. Nevertheless CD-ROM and online digital versions exist and are reviewed in *School Library Journal*. The best of the e-books take advantage of computer animation and use it to enhance the text and allow children to interact with the medium, as is the case with David Macaulay's *The New Way Things Work*, Version 3.2 (DK, 2007). Most electronic books, even the better ones, however, make limited use of the technology. The potential for great changes to the delivery method of picture books and novels is only beginning to be realized, but picture book artists, such as Jean Gralley, are excited about the possibilities of "lifting the book off the page" and onto portable, rollable, back-lit and searchable e-paper which will have the advantages of both the book and digital technology.^[18]

Another use of electronic texts, accessibility from anywhere, is already a reality. Besides digital archives of historical children's books from university and national libraries, The International Children's Digital Library (<http://www.icdlbooks.org/>) is a growing collection of electronic texts which allows readers to access full-text books from a wide range of countries. Most of the books are in-copyright books that authors and publishers have made available to children worldwide, but the digital library also includes historic nineteenth and early twentieth century books.

Computer games with sophisticated graphics which allow multiple players to interact in virtual environments

have become a major form of "literature" as players become creators of realistic contemporary or futuristic worlds as in *Sims 2*. The realistic visuals allow players to better immerse themselves in the worlds they are exploring, while the roles they build allow them to look at the ramifications of the decisions they make within the game.^[40]

CHILDREN'S LITERATURE AWARDS, ORGANIZATIONS, AND COLLECTIONS

Children's literature research collections have burgeoned nationally and internationally since the mid-twentieth century, when an ALA survey identified 153 collections in the United States and Canada. In 1995, there were over 300 American collections, and 119 collections internationally. National libraries have comprehensive collections, and their catalogs can be accessed online. The International Federation of Library Associations (IFLA) provides links to National Library Catalogues (<http://www.ifla.org/VI/2/p2/national-libraries.htm#U>). Two of the oldest international research collections include the International Youth Library in Munich (<http://www.ijb.de/>) and the International Institute for Children's Literature, Osaka (<http://www.iiclo.or.jp/english/english.htm>). For other major collections and research centers identified by country, see the International Children's Literature Research Society's Web page (<http://www.irscl.com/>). Besides links to collections, the society's Web page also lists journals of children's literature.

The following Awards list identifies organizations and their children's book awards. Because of space limitations it is not possible to identify all national awards; the list was therefore limited to English Language and major international awards. The Database of Award Winning Children's Literature compiled by Lisa R. Bartle provides access to award winning books by author, title, and subject (<http://www.dawcl.com/>).

International Awards:

Swedish Arts Council

The Astrid Lindgren Memorial Award.

(http://www.alma.se/default_a.aspx?id=247&epslanguage=EN) : Given for a *body of works*,

living authors, illustrators, storytellers and promoters of reading are eligible. Annual, started 2002.

International Board on Books for Young People. (<http://www.ibby.org/> see Activities)

Hans Christian Andersen Award: for a *body of works* (total contribution to children's literature) by an internationally acclaimed author; total work by international illustrator (two different awards). Every 2 years, started 1956.

International Reading Association (<http://www.ira.org>)

Children's and Young Adult's Book Awards for author's first or second publication. Fiction and nonfiction

for primary, intermediate, and young adult readers. (Annual, since 1975)

U.S. Awards:

American Institute of Physics. (<http://www.aip.org/aip/writing/winchild.html>)

Science Writing Award—Children (Annual since 1988) by the ALA—Association for Library Services to Children (<http://www.ala.org/ala/alsc/awardsscholarships/awardsscholarships.cfm>)

Andrew Carnegie Medal for Excellence in *Children's Videos*. Annual, started 1991.

Caldecott Medal: for best *illustrated picture book* by U.S. illustrator (citizen or resident). Annual, started 1938.

Laura Ingalls Wilder Award: for a *body of works* by U. S. author or illustrator. Every 3 years, started 1954.

Mildred L. Batchelder Award: Given by the ALA to the U.S. publisher of the *best-translated book* of the previous year, which had been originally published in another language. Annual, started 1968.

Newbery Medal: for best *written children's book* by U.S. author (citizen or resident). Annual, started 1922.

Odyssey Award for *audiobooks*. Annual, started 2008.

Pura Belpré Award given jointly with REFORMA for a *Latino/Latina author and illustrator*. Annual, started 1996.

Robert F. Sibert *Informational Book* Medal: Annual, started 2001.

Schneider Family Book Award for authors or illustrators of outstanding books that depict the *disability experience* for grade school, middle school, teens. Annual, started 2007.

Theodore Seuss Geisel Award for most outstanding *beginning reader trade books for authors and illustrators*. Annual, started 2004.

American Library Association Ethnic and MultiCultural Information Exchange Round Table (<http://www.ala.org/ala/emiert/corettascottkingbookaward/corettascott.cfm>)

Coretta Scott King Award and Honor books: best written text by an *African American writer*, best picture book by an *African American illustrator*. Annual, started 1970.

Asian/Pacific American Library Association an ALA Affiliate (<http://www.apalaweb.org/awards/awards.htm>)

Asian Pacific American Awards for Literature. Children's categories include authors and illustrators of an outstanding book of fiction or nonfiction that is related to *Asian/Pacific Heritage*, not necessarily by someone of that heritage. Annual, started 2004.

Boston Globe-Horn Book Awards (<http://www.hbook.com/bghb/>)

Picture book, Fiction, Nonfiction category by *The Boston Globe* and *Horn Book Magazine*. Annual, started 1967.

Center for Latin American and Caribbean Studies. University of Wisconsin, Madison

The Americas Award. (<http://www.uwm.edu/Dept/CLACS/aa/index.html>)

U.S. works of fiction, poetry, folklore, or selected non-fiction (from picture books to works for young adults) published in the previous year in English or Spanish that authentically and engagingly portray *Latin America*, the *Caribbean*, or *Latinos in the United States*. Annual, started 1993.

Jane Addams Peace Association (<http://home.igc.org/~japa/index.html>) and Women's International League for Peace and Freedom (WILPF).

Jane Addams Children's Book Awards

The award is given for "children's books published the preceding year that effectively *promote the cause of peace, social justice, world community and the equality of the sexes and all races* as well as meeting conventional standards for excellence." Annual, started 1953.

National Council of Teachers of English (<http://www.ncte.org>)

Award for Excellence in Poetry: Every 3 years, started 1977

Orbis Pictus Award: For an outstanding *informational book* (including biography) of the previous year. Annual, started 1990.

Texas State University College of Education. (<http://www.education.txstate.edu/departments/Tomas-Rivera-Book-Award-Project-Link.html>)

Tomas Rivera Mexican American Children's Book Award. Honors authors and illustrators who create literature that depicts the *Mexican American* experience. Annual, started 1995.

The Horn Book Magazine Web page (<http://www.hbook.com/resources/awards/default.asp>) lists a wide variety of national and international children's media awards, including the *National Book Award*; *The Golden Kite Award*; the *Audie* for Audiobooks, the *Audiobook Hall of Fame* and the *Will Eisner Award* for comic books and graphic novels.

British Awards:

Chartered Institute of Library and Information Professionals (CILIP) <http://www.carnegiegreenaway.org.uk/home/index.php>

Carnegie Award to the *author* of best children's book first published in the United Kingdom (or copublished within three months) the previous year. Annual, started 1937.

Kate Greenaway Award to the *illustrator* of the best children's book first published in the United Kingdom (or co-published within three months) the previous year. Annual, started 1955.

Australian Awards:

Children's Book Council of Australia, in the categories of *older readers, younger readers, early childhood, picture book* and *informational book*. Annual. <http://cbca.org.au/>

Canadian Awards:

Canadian Council for the Arts, Governor General's Literary Awards: in seven categories, including

Children's literature (text) and Children's literature (illustration) <http://www.canadacouncil.ca/prizes/ggla/>

Canadian Library Association <http://www.cla.ca> "CLA at Work"-Awards-Book Awards

Book of the Year for Children Award for *text*. Annual, started 1947

Amelia Frances Howard-Gibbon Award for *Illustrator*. Annual, started 1971

Young Adult Canadian Book Award. Annual, started 1981.

New Zealand Awards:

Library and Information Association of New Zealand <http://library.christchurch.org.nz/Kids/LiteraryPrizes/> EstherGlen/

Esther Glenn Award for the most distinguished contribution to *children's and young adult* literature. Annual, started 1945.

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Children's Services in Libraries

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Abstract

Children's services in libraries began at the end of the nineteenth century in the United States and were well institutionalized by the 1950s. Service to children birth to age 12 or 14 is now understood to be a standard element of public library operations. This entry looks at the nature of those services, the education and work of children's librarians, and some emerging challenges and issues. The focus is on contemporary services to children in the United States. However, a brief discussion of international approaches to the field is also provided.

INTRODUCTION

On a typical day, more than a third of the people who enter an American public library are children under the age of 14. They arrive in strollers and on skateboards. They come to hear stories; find a book to read; get help with homework; play games; make things; borrow a device, such as an iPad or e-reader; or use the computers. The lucky ones find a glorious space especially designed to appeal to young people with professional librarians available to help them meet their needs that day. All of them will find a basic level of service that is an affirmation of the vision of the women who developed the concept more than 100 years ago.

This entry will outline the historical development of library service to children and describe how it is implemented today. It will look at the role of the children's librarian in providing that service and discuss some of the more urgent challenges facing them today—the increasing diversity of their clientele, rapidly changing information and communication technology, and the pressure to document the outcomes of their services. Finally, it will look briefly at some of the international dimensions of library service to children.

HISTORY

Children were not welcome in the first public libraries in the United States. The philanthropists and civic leaders who established these institutions in the early 1800s intended to provide uplifting literature to adults who were unable to purchase their own books. They also wanted to help newly arrived immigrants assimilate to the American way of life. Children, with their dirty hands and noisy behaviors, were specifically prohibited from using these early public libraries.

The situation began to change after the publication in 1876 of a study of the “history, condition, and management” of public libraries by the U.S. Bureau of Education. One of the contributors to that study, William I. Fletcher, argued that public libraries should change their policies limiting access to children. He based his argument on the need to develop a taste for refined reading early in life, writing,

If there is any truth in the idea that the public library is not merely a storehouse for the supply of the wants of the reading public, but also and especially an educational institution which shall create wants where they do not exist, then the library ought to bring its influence to bear on the young as early as possible.^[1]

Fletcher's message was consistent with other ideas beginning to circulate at that time about the need to reach children early in their lives in order to influence the kind of adults they would become. John Dewey's ideas about education and G. Stanley Hall's theories of child psychology began to influence other fields. The new specialists in library services to children, the first children's librarians, were convinced that young people who were exposed to the best in fine, uplifting literature would grow up to become fine, uplifted adults. Betsy Hearne and Christine Jenkins describe their approach as a kind of visionary quest in which the “grail was not just information or even knowledge but the enrichment of experience through whole reading, the kind of reading that engulfs the heart as well as engaging the head and ultimately shapes a lifetime.”^[2]

By the end of the nineteenth century, libraries across the country had begun to open their doors to children. Administrators began to recognize the need for specialist staff—children's librarians—who would provide services for this new clientele. Some remarkable women answered the call and defined those services with such passion and

force that they left an indelible imprint that has lasted for more than 100 years.

Among the pioneering children's librarians were Frances Jenkins Olcott, the first head of the children's department of the Carnegie Library of Pittsburgh, Caroline Hewins at the Hartford Public Library, and Anne Carroll Moore, supervisor of children's services at the New York Public Library from 1906 until 1941. Moore deserves special mention for her role in defining and institutionalizing public library services for children.

Anne Carroll Moore believed that the library should be an inviting and gracious environment for children. To this end, she created children's rooms that were warm and welcoming with books displayed on low, open shelving. She established circulation policies that did not discriminate against young library patrons. She provided rigorous training for the young women who worked under her supervision. She searched out the best books for children at a time when few existed except for a few nineteenth century classics and then encouraged publishers to establish separate children's divisions. She encouraged authors and illustrators to create new books for children, and then she reviewed those books for some of the most influential publications of the day. Her opinions were never tepid, and not everyone in the children's literature community appreciated her hegemony over the field. However, her contributions to the early development of children's librarianship are unrivaled.^[3]

The pioneering children's librarians took their message about the importance of libraries in forming children's reading interests to the annual meetings of the American Library Association (ALA). Their voices were heard; and by the end of the 1920s, even the smallest public libraries stocked books for children and provided some of the services that were becoming standard, such as summer reading and storytelling programs. Andrew Carnegie did his part by including designated space for children in his massive public library building program.^[4] The events of the Great Depression of the 1930s and World War II put further development of children's services on hold. However, the post-War years proved to be boom times for American families and for public library services to children.

Many innovations in those services were institutionalized during the last half century. An explosion in children's book publishing led to a new focus on evaluating books, systematically developing collections, and promoting the books with children through techniques such as booktalking and merchandising. Preschool story hours introduced 3- and 4-year-olds to the experience of listening to stories in a group. A new awareness of poverty and racial inequities in the 1960s led to outreach efforts and nontraditional programming designed to appeal to populations who had not been library users in the past.

Taxpayer revolts in the 1980s resulted in a movement for accountability in local government operations;

children's librarians responded with the development of output measures.^[5] The rise of the Internet generated apocalyptic talk about the death of the library; children's librarians responded with programs to teach children and their families how to use information and communication technology more effectively. There was national concern about children's poor reading skills; children's librarians responded with a research-based program designed to educate parents in techniques to prepare their young children to learn to read.^[6]

Today's library, in response to concerns about preparing children for the future, has expanded services to support learning in science, technology, engineering, art, and math. Many libraries are incorporating Makerspaces, where a variety of tools (anything from sewing machines to 3D printers) are available for children and families to learn, share knowledge, and make things. Libraries are also sites for community gardens and summer lunch programs. In fact, the majority of programs in public libraries are geared for youth and the demand for these programs continues to grow.^[7]

A Pew Internet study states that "70% of parents report their child visited a public library in the last 12 months and 55% say their child has his/her own library card."^[8] The report also points out that adults who have children or grandchildren are more likely than other adults to use the library themselves. A vast majority of parents hold the opinion that access to the library is important for their children. The remainder of this entry will examine how children's services in libraries are organized and will explore current issues in the field. Finally, it will look briefly at children's services at international libraries.

CONTEMPORARY LIBRARY SERVICES TO CHILDREN

Implementing Children's Services within the Public Library

Library service to children has evolved into a distinct specialization within the profession. In most public libraries, these services are provided through a designated department or division. In large libraries, these departments are ordinarily headed by a manager or coordinator of children's services who provides training and general oversight for service to children. In smaller libraries, an individual children's librarian may be responsible for the work.

A few public library systems have moved away from specialist designations for children's and adult reference librarians in favor of a more generalist approach. In these situations, all public service librarians are presumed to be able to serve the needs of children, as well as teenagers and adults. A children's services coordinator or manager

may be on staff to organize programming and train all staff in some of the skills needed to serve children well.

Service to children is almost always provided in a special space within the library. Lower shelving and child-sized furniture are the basic elements in a separate children's room or the children's wing in a library with an open floor plan. However, most of these open floor plans use other features such as color, wall decorations, toys, games, fish tanks, and puppet stages as indicators that this part of the library is meant for young patrons. Computers have become a standard feature in children's areas everywhere. Some are especially designed for the youngest patrons, loaded with educational software and games.

Two recent trends in library spaces for children are worth mentioning. One is the creation of "destination" sites, designed as exciting discovery centers for children.

These libraries use elaborate decorative elements and interactive installations to lure children and families to spend time there. One of the most striking of these new approaches is the *ImaginOn*, a collaborative venture of the Charlotte–Mecklenburg Public Library and the Children's Theater of Charlotte in North Carolina (Fig. 1). Opened in 2005, this 102,000 ft² building is filled with dynamic modules intended to "bring stories to life through extraordinary experiences that challenge, inspire, and excite young minds."^[9] The Phoenix Public Library employed a designer with a background in children's museum work to create custom installations in its picture book areas. These installations encourage young children to develop small motor skills, phonemic awareness, and letter awareness in a developmentally appropriate and child-friendly environment.

The second significant trend in library facilities for children is the Family Place Movement.^[10] Family Place Libraries is a joint initiative of the Middle Country Public Library in New York and Libraries for the Future. It is

now a nationwide network that includes 435 librarians from 25 states. Family Place Libraries aim to help parents and caregivers become more intentional, informed, and active participants in their young children's development. A key component of their program is a specially designed space within the library where parents can gather with their young children to play, learn, and observe. These spaces have collections of toys, music, and parenting materials in addition to the usual books for preschool children.

Range of Services

The overarching goals of contemporary library services to children are to promote reading and literacy and to ensure that children have access to information in all formats. These goals are achieved through a wide range of services. Collection development is the foundation for most of those services.

With more than 5000 juvenile titles published in the United States each year, it becomes critical to select the most appropriate books for any particular library collection. Children's librarians in large library systems may have access to review copies that they can evaluate firsthand. Most, however, rely on reviews in sources such as *School Library Journal*, *Booklist*, *Kirkus Reviews*, and *The Horn Book*. They make their decisions based on budget, community needs, judgments about quality, and other standards, all codified in a collection development policy. Knowledge of the collection—and the broader field of children's literature—is a fundamental part of the children's librarian's toolkit.

After books are added to the collection, they are typically organized on the shelves according to format and genre. Picture books are housed in low shelving designed to accommodate large formats. Nonfiction and fiction



Fig. 1 Interior of the Spangler Library, *ImaginOn*, Charlotte, North Carolina.

are separated, and there may be special sections for easy-to-read primer, ABC and other concept books, folk and fairy tales, and parenting materials. CDs and videos (DVDs) are also standard materials in children's collections today.

Since reading promotion is the *raison d'être* for the book collection, children's librarians promote the books in a variety of ways. They create book displays and book lists to highlight segments of the collection. They work one-on-one with patrons in the library, providing expert readers' advisory and reference services. They promote specific books to groups such as school classes—an activity known as booktalking. They mount summer reading programs designed to motivate children to read during the months when they are not in school.

Storytelling is another basic service provided in almost all public libraries. Originally, as conceived by Anne Carroll Moore at the New York Public Library in the early 1900s, this was exclusively the telling of traditional folktales to audience of school-aged boys and girls. While some librarians still practice the traditional art of storytelling, it is much less common than story hours for preschool children.

The preschool story hour was popularized in the years after World War II when the baby boom was impacting communities—and libraries—in all parts of the country. As originally conceived, it catered to 3- and 4-year-olds who were developmentally ready to participate in a brief group experience away from their parents and caregivers. In a period of about half an hour, the children's librarians would present a variety of picture books, flannel board stories, finger plays, and nursery rhymes or songs. While the traditional preschool story hour is still a staple in many public libraries, it has evolved into a broad menu of programs for young children—lapsit programs for infants, toddler storytimes for 2-year-olds, and family storytimes designed for the broadest possible age range. Increasingly, the use of technology is being incorporated into storytimes and it is now considered good practice to include parents and caregivers in library programs for young children. In fact, parent education is now an integral part of much early childhood programming in libraries.

In addition to programs in which librarians and other storytellers read or tell stories to children, there are also planned ongoing programs in which children are encouraged to read aloud, a practice that helps to develop reading fluency. Grandparents and Books is one such program. Older adults are trained in techniques for engaging children in literacy and literacy-oriented activities, including having the children read to them. The grandparents then volunteer to be available to the children after school in the library reading rooms.^[11] Literacy dogs are another recent innovation in library programming. Children are invited to read aloud to specially trained dogs. Reluctant or less fluent readers apparently find the patient animals to be perfect listeners. There are programs using specially trained therapy dogs as reading partners for children at

many public libraries. One good example is R.E.A.D. (Reading Education Assistance Dogs) at the Salt Lake City Public Library.^[12]

Besides storytelling, children's librarians typically provide other kinds of programming: puppet and magic shows, visits from Seeing Eye dogs and snake handlers, cooking and sign language classes, and much, much more. Makerspaces are becoming commonplace in libraries. Makerspaces provide space and tools for creativity, knowledge sharing, and collaboration. While they are often thought of as providing access to technology such as 3D printers, special software, and electronic devices, in fact they can provide a wide variety of learning and creative opportunities. Makerspaces can be a place to learn to fix a bicycle, knit, solder, code, or otherwise make things depending on the needs and interests of the community.

Community gardens are another increasingly popular library program. Community gardens serve a variety of educational and recreational needs and are being used in libraries with children of all ages. In addition to teaching gardening skills, they foster nutritional and environment literacies, and teach plant identification. The garden experience connects quite naturally to books and other information sources provided by the library.

Another recent innovation is summer meal programs in public libraries. Often partnering with the U.S. Department of Agriculture, these programs help to ensure that young people in low-income areas have access to healthy food during summer vacation from school. Summer meal programs introduce the library to often underserved populations to the resources the library offers, build community partnership, and provide opportunities for positive youth development.^[13]

Many of the programs provided by the public library are not held in the building itself but are taken out into the community into a variety of venues from schools to recreation centers to parks and playgrounds. This kind of outreach is intended to extend the library's sphere of influence, to enhance the library's visibility, and to make services available to children who might not be able to physically get to the library itself. Children's librarians also work to develop strategic partnerships with other child-serving leaders and organizations in their community. Almost all children's librarians maintain some kind of relationship with the schools in their communities. They may invite school classes to visit the library or go into classrooms themselves to promote library services and reading.

In spite of this emphasis on programming, the heart of library service to children is still one-on-one readers' advisory and reference work. Children's librarians bring their specialized knowledge of their collection together with their understanding of children to advise young people as well as their parents, caregivers, and teachers about books to read for pleasure, information, and enlightenment. Queries range for a mother's request for a book to help

her 3-year-old adjust to the death of a grandparent to a 12-year-old's pleas for a book as good as the last Harry Potter to a fifth-grade teacher's need for good fiction titles to supplement the American History curriculum.

Reference services for children are often related to homework needs. While school libraries are the best first resource for homework, their hours are often limited. Furthermore, not all schools provide adequate libraries. The public library fills the gap. Many public libraries allocate special resources to provide homework help during after-school hours.^[14] These can be as modest as a special shelf of homework-oriented reference books or as elaborate as well-equipped Homework Centers staffed with aides or tutors especially trained to assist young people with their homework needs. These homework services are particularly appreciated by families in which parents are not fluent in English or familiar with the American school system and by working parents who have limited time to spend with their kids on school nights. Homeschool families also make extensive use of public library facilities.

As electronic resources have become increasingly useful resources for children's homework needs, librarians have also begun offering instruction in the information literacy skills needed to navigate the Internet effectively. They may offer this instruction informally, as part of their reference interview, or more formally through classes and workshops.^[15]

Children's Librarians

In 1905, in a report to the ALA, Frances Jenkins Olcott described the ideal applicant to the newly established training school for children's librarians at the Carnegie Library of Pittsburgh:

Sympathy with and respect for children, strength of character, a genial nature, a pleasing personality, an instinct for reading character, adaptability, and last but not least, a strong sense of humor. Her home training and education should have given her a love and knowledge of books, a fund of general information, a quick and accurate mind. These qualities are difficult to find combined in one person.^[16]

It is no longer assumed that the ideal children's librarian is female, but many of the desirable characteristics described more than 100 years ago are relevant today, and they are still difficult to find combined in one person. However, perhaps in keeping with newer thinking in human resources management, we tend to think today in terms of competencies rather than personal traits. The Association for Library Service to Children (ALSC) has developed and maintained a comprehensive outline of the competencies that children's librarians are expected to demonstrate on the job. The most recent edition of this document was released in 2015.^[17] The competencies are

grouped into seven broad categories: commitment to client group; reference and user services; programming skills; knowledge, curation, and management of materials; outreach and advocacy; administrative and management skills; and professionalism and professional development.

Outstanding Library Services to Children, a publication sponsored by ALSC, provides useful guidance for achieving and maintaining those competencies. The author makes clear that nobody is expected to have mastered all of the competencies before starting his or her first job and that most children's librarians will be more proficient in some areas than others. They acknowledge the extremely broad range of knowledge and skills required to do the job well, calling children's librarians, "the original multitaskers of the library world."^[18]

A master's degree from an ALA-accredited graduate school is the standard educational requirement for children's librarians. In addition to the core curriculum that prepares all professional librarians, they typically take courses related to children's literature, collection development, and children's programming. In many master's degree programs, there is an emphasis on customer service, understanding the user group, and management. The integration of technology into LIS education has furthered the inclusion of technology tools into course content including a variety of media and applications.^[19]

The Laura Bush 21st Century Librarian Program of the federal Institute of Museum and Library Services (IMLS) has provided resources to help libraries and graduate schools of library science fund the development of new information professionals, including youth librarians. Grants have provided scholarship funds for both master's and doctoral students, helping to meet the need for children's librarians and faculty to teach them.

Children's librarians are supported in their efforts to serve children and in their own professional development by various professional associations. The primary national organization is the ALSC, a division of the ALA. State library associations usually have a division or section devoted to children's services as well and often provide an entry point for professional involvement by novice children's librarians. Some children's librarians also participate in related professional associations such as the International Literacy Association or the National Association of the Education of Young Children.

Issues

IT is significant that library service to children has continued to evolve over more than 100 years since it began. Some of the core values and service that were identified by the early leaders in the field remain at the heart of the specialization today. However, society has undergone major changes in the last century, and the rate of change continues to increase. Children's librarians are struggling to redefine and reinvent the services they offer in a

turbulent environment. This section will outline some of the issues that are currently driving calls for innovation in the field—specifically, changing notions of childhood; the increasing cultural, ethnic, and racial diversity of the populations served by public libraries; technological imperatives; and the demand for demonstrable outcomes of services.

The founding mothers of library services to children had few doubts about the clientele they served. Their patrons were school-age children. While some of the great early illustrators such as Randolph Caldecott and Kate Greenaway had produced picture books for young children, there was not yet a well-defined preschool market for publishing or for public library services. Adolescence had yet to be identified as a distinct developmental stage, and childhood for middle- and upper-class children extended at least into the early teens. Working-class children were usually expected to take on adult responsibilities by the age of 13 or 14.

As many historians and sociologists of childhood have demonstrated, however, childhood is a malleable social construct.^[20] By the beginning of the twenty-first century, American childhood had contracted. Adolescence was occurring both physically and socially at an earlier age, and children as young as 8, 9, and 10—“tweens”—were taking on the characteristics of teens in training.^[21] At the same time, discoveries in cognitive science made it clear that the earlier years of human life, from birth to age four, are enormously important developmentally. Many children's librarians have responded to this shift in our understanding of the span of childhood by shifting their priorities away from the older middle school child in favor of working with parents and caregivers of very young children. The ALSC continues to define its clientele as children from birth to age 14, while the Young Adult Library Services Association, a sister division of ALA, claims the age group from 12 to 18. Public libraries are not consistent in their classification of service population by age, and presumably, young people between the ages of 12 and 14 will gravitate to the area of the library in which they fell most comfortable.

Whatever their age, twenty-first-century children live in a world that would be almost unrecognizable to Anne Carroll Moore and her peers. Two dramatic changes in American society have a particular impact on children and on the services provided for them by public libraries. One is the ever-increasing racial and ethnic diversity in our country as well as changing attitudes toward this diversity. The other is the impact of new and emerging communications and information technologies.

The changing ethnic and racial composition of the United States has been well documented. In 2014, only 52% of children in the United States were non-Hispanic White. Non-Hispanic Black children were 14% of the population; Asians, 5%; and Hispanic, 24%. Immigration

patterns and differential birth rates do much to explain the shifts, and some states—such as California—show more dramatic changes. There, the 2014 statistics show that only 26% of the children were non-Hispanic White. Non-Hispanic Black children were 5% of the population. About 52% of California children are Hispanic; 11% are Asian.^[22] Understandably, library patrons are also increasingly diverse.

The increasing diversity of the children using public libraries impacts both collections and the services provided for them. Many communities now find it appropriate to stock books, videos, and recordings in languages other than English. The International Children's Digital Library has filled a gap for some libraries by seeking out and digitizing books in languages that are more difficult to find in the United States, such as Farsi, Croatian, or Maori.^[23] Collections of children's books in languages other than English are particularly important resources in immigrant communities. These collections enable parents to share books with their children in their mother tongue and often serve as tangible evidence that the public library is a welcoming and relevant institution in their adopted country.

The increasing diversity of library patrons has highlighted some staffing and recruitment needs. Bilingual librarians are in great demand, as are those from diverse racial and ethnic backgrounds. Unfortunately, the library profession has traditionally attracted White females. Demographic statistics for the total library workforce are somewhat elusive, but ALA estimates that about 73% of credentialed librarians in 2010 were White.^[24] There have been numerous efforts to recruit more diverse students to library school through such efforts as the ALA Spectrum Scholarships. For the academic year 2013–2014, approximately 67% of students graduating from ALA-approved master's degree programs were White and approximately 77% were female.^[25]

The rapid proliferation of digital information and communication technologies has generated other kinds of challenges for the traditionally book-oriented field of children's librarianship. The children being served in public libraries today have grown up with computers and the Internet. IT has affected the way they learn and play. However, disparities caused by income gaps have created what has become known as the digital divide. Discussion about the digital divide includes concerns about access to computers as well as access to broadband (continuous high-speed connection to the Internet). The Children's Partnership reports that

Compared to their peers in households with annual incomes over \$75,000, children in households with annual incomes less than \$15,000 are

- 1/2 as likely to have a computer at home
- 1/3 as likely to have the Internet at home
- 1/7 as likely to have broadband at home^[26]

Public libraries have responded aggressively to help bridge the digital divide. Public access to the computers and to the Internet is now a standard service in libraries across the country. Because of the provisions of the Children's Internet Protection Act, many libraries have installed filtering software on computers in their children's areas.^[27] This restriction has been a source of conflict for many children's librarians who are torn between their advocacy for children's intellectual freedom rights and their desire to protect children from exposure to pornography and other harmful matters.

It is not unusual to see three or four children crowded around each computer in the children's area while the book stacks stand as empty as ghost towns. Many librarians applaud this development, citing in particular the welcome sight of boys returning to the library. Some are concerned, however, that children seem to be using the Internet primarily to access games sites rather than for informational purposes. In any case, the seamless integration of computers into the service plan and general operation of library service to children has not yet been fully accomplished. Computers still feel like add-ons in many children's libraries (Fig. 2).

There are some promising developments, however. Libraries that offer after-school homework assistance have found that computers are a natural learning tool. Some libraries have made an effort to offer tutorials in information literacy skills to parents and children. Many libraries are integrating games of all types into library programming.

The third issue of interest in contemporary library service to children is the pressure to document demonstrable outcomes. Funding sources ranging from granting agencies to local governments are asking for evidence that the services libraries provide make a difference in the lives of children and families. No longer satisfied with simple

output measures such as circulation and reference counts that tell "how many" or "how much," they now want answers to the question, "so what?" The kind of research necessary for conducting good outcomes evaluation studies is rigorous and often expensive. Eliza Dresang, Melissa Gross, and Leslie Edmonds Holt have produced a good how-to-do-it manual based on their own IMLS-funded work at the St. Louis Public Library, but doing this work still requires more commitment and expertise than most public libraries can command.^[28] Some library systems have contacted with academic partners to do outcomes evaluation of specific grant-funded projects, but the resulting studies have not been generalizable to other libraries.

INTERNATIONAL DIMENSIONS

Service to children has tended to be included as an element of public library services in countries around the world. In most respects, this service has followed the American model with an emphasis on books and reading. The Standing Committee on Libraries for Children and Young Adults of the International Federation of Library Associations and Institutions (IFLA) has published guidelines for children's services that advocate the kind of outreach, networking, collection development, and programming that are institutionalized in most American libraries. The IFLA document cites the United Nations' "Convention on the rights of the Child" as an underlying statement of principles that should guide library services.^[29]

Of course, countries vary in their funding base, opportunities for professional education, and local community values and practices. Scandinavian libraries, for example, have a tradition of partnering with local cultural



Fig. 2 Computer stations in the children's room of the Central Library, Minneapolis, Minnesota.

institutions and of furthering what they call “children’s culture,” including such manifestations as children’s theater and musical performances. In some cases, they have also pioneered effective technological innovations. The Interactive Children’s Library of the Aarhus Public Libraries in Denmark is designed especially to attract children through applications of digital technology. The Children’s Community Libraries in Singapore are also known for their integration of technology with book collection in English, Chinese, Malay, and Tamil in well-designed modern facilities. The children’s library of the Bibliotheca Alexandrina on the site of the original ancient Library of Alexandria in Egypt, limited to children over the age of seven, is a beautiful section in the iconic new building offering many of the services we have come to expect in a contemporary public library. Interestingly, children are not permitted in the adult department of the library there. Websites for each of the libraries mentioned include some information in English. Public libraries in Croatia have responded to the lack of early childhood education offerings in their country by creating special playrooms for children from birth through six, the age at which they are able to enroll in school. Many libraries employ people with dual degrees in library science and early childhood education to provide formal programming in the playrooms (Fig. 3).

In some developing countries, library services to children are provided as often through nonprofit organizations and volunteer initiatives as through government-funded public libraries. An interesting example is the Banco del Libro in Caracas, Venezuela. This volunteer effort begun by a group of women more than 49 years ago was instrumental in developing the first library network and the first bookmobile service in that country. The Banco del Libro went on to form a children’s literature examination center, the first children’s book publisher, and the first specialized children’s bookstore in Venezuela.^[30]

Public libraries in African countries struggle to find funding for services to children. They are also hampered by the lack of material in local languages since there is little or no publishing or trade of children’s books in sub-Saharan Africa. Almost all efforts to put books into the hands of children are supported by international nongovernmental organizations such as the British Book Aid or the Canadian CODE. These groups work with local individuals and institutions to produce children’s books in local languages. The results are often didactic and fall well below the quality standards of Western publishing houses, but they do meet some important local needs.

Another interesting example is the Lubuto Project that is currently operating in Zambia. The Lubuto libraries began as an individual voluntary initiative on the part of one American librarian living in Lusaka. She began by volunteering to read to street children made homeless by the loss of parents to AIDS at Fountain of Hope, an agency providing services for that overwhelmingly needy population. This led to a temporary library housed in an abandoned shipping container. The project celebrated its 10th anniversary in 2015 and has received grant funds to build their fifth library.^[31]

CONCLUSION

Library service to children has evolved from the first specialization within library services in the United States to a well-institutionalized practice. Its proponents have redefined its mission and extended its parameters while retaining the original values exemplified by the motto, “the right book for the right child.” Some aspects of the service—summer reading programs, preschool story hours, and individualized reading guidance—are near universal elements of public library service. Emerging



Fig. 3 Playroom, Medvescak Public Library, Zagreb, Croatia.

services such as promotion of early childhood literacy through education of parents and caregivers, after-school homework assistance, and the provision of Internet access have achieved wide acceptance in the field. Children's librarians network actively and form partnerships with other community organizations in their efforts to advocate for children more generally.

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China: Libraries, Archives, and Museums

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Abstract

This entry examines the challenges and the path of library development in China, with emphasis being given to the twentieth century when new library institutions and practices were first introduced. In just over 100 years Chinese libraries and librarianship have evolved from ancient royal depositories to modern information centers. This entry discusses the underlying political and social changes and examines the contributions of important leaders who have promoted China's library development. An overview of some of the important archives and repositories in the country is presented.

INTRODUCTION

The largest of all of the Asian countries, China (Zhongguo) occupies nearly the entire East Asian land area. It extends for about 3,100 miles (5,000 km) from east to west and 3,400 from north to south, covering an area of about 3,696,100 square miles (9,572,900 square km). In size China is almost as large as the entire continent of Europe. China's land frontier is approximately 12,400 miles in length and its coastline is about 8,700 miles. The country is bounded by Mongolia to the north; Russia and North Korea to the northeast; the Yellow Sea and the East China Sea to the east; the South China Sea to the southeast; Vietnam, Laos, Myanmar (Burma), India, Bhutan, and Nepal to the south; Pakistan to the southwest; and Afghanistan, Tajikistan, Kyrgyzstan, and Kazakhstan to the west. China also faces South Korea and Japan, across the Yellow Sea, and the Philippines, beyond the South China Sea (see Fig. 1, Map).

China has the largest population of any country in the world, 1,330,044,544 (July 2008 est.). Similar to other large countries, China is multiethnic. The Han people comprise 91.5% of the majority group in China, while the remaining minorities the Zhuang, Manchu, Hui, Miao, Uyghur, Tujia, Yi, Mongol, Tibetan, Buyi, Dong, Yao, Korean, and other nationalities comprise 8.5%. The Han group speaks Chinese and most of the minorities speak other languages.^[1]

History

Until the mid-nineteenth century, China was the dominant power in East Asia. Chinese Confucian teachings, along with institutions and practices, were introduced into Japan,

Korea, and Vietnam. The Chinese system of education, based upon the Chinese classics, was reverently followed and mastered by scholars in these countries.

In China the earliest known documents were those carved on tortoise shells and animal bones. The collection and preservation of such documents can be traced back to as early as the Shang Dynasty (1600–1100 B.C.) when royal archives or libraries were first maintained. China had an imperial library in each dynasty throughout her long history, from the Shang to the Qing (1644–1911 A.D.) dynasties. The imperial libraries served as depositories of national literature and archival documents and were for the use of the imperial family, high officials, and noted scholars. These libraries were not opened to the public. The keeper of the library was little more than protector of this private collection; there was no known formal training for librarianship.

China's traditional libraries experienced remarkable development during the Tang Dynasty (618–906 A.D.) and Song Dynasty (960–1279 A.D.) when block printing became popular and movable type printing was invented. During this time there was a much wider diffusion of printed materials and both official and private collections blossomed. From the tenth century onward, printed versions of the classics and other writings were more readily available, and the door was opened for education for greater numbers—especially those training for governmental service. China's libraries were then composed of royal collections, academic and private collections, and cloister or temple collections. Access to these volumes was mainly restricted to nobles and scholars.

Not until the nineteenth century was the importance of libraries recognized in the context of developing a modern educational system for China. Following the defeat of China in the Sino-Japanese War of 1894–1895, political



Fig. 1 Map of China.

Source: CIA World Fact Book.^[1]

leaders and intellectuals realized the need to modernize and improve the educational system in order for China to prosper and be strong. The Reform Movement of 1898 was launched and part of the proposed reform plank was educational reform following Western practices. Among the Chinese intellectuals advocating a new model of librarianship was Wang Kang Nian. In 1896, he wrote that

The key to revitalize China lies in education. Education depends on the ability to master new knowledge and the mastering of new knowledge can only be accomplished through the establishment of schools, study, societies, and libraries. . . Every Western library collects tens of thousands of books in all languages and herein lays the key to a prosperous China.^[2]

Libraries were now linked directly to China's education and overall development.

The founding of the Republic in 1912 brought an end to the institutions and practices of the imperial system, and China began the difficult and long process of economic, intellectual, and political change. New knowledge was diffused to the population and the use of a Chinese phonetic alphabet was introduced. Following the May 4 Movement in 1919, books and periodicals in the colloquial language were published. Soon translated works of Peter Kropotkin and other foreign writers were in high demand among Chinese intellectuals. Libraries to meet the demands and needs of the new era were now faced with changing conditions and new challenges.

Beginning in the 1920s, four main types of Chinese libraries developed: public libraries, college libraries,

society libraries, and special libraries. Of the four, college or academic libraries held the best collections of Chinese and foreign books. These new academic libraries began to use the latest organizational and cataloging systems; their library facilities and equipment were also of higher quality than those of the public libraries.

The Republican period on mainland China (1912–1949) witnessed the beginnings of the introduction of modern librarianship, albeit repeatedly curtailed by civil and international conflicts. Beginning with the founding of the People's Republic of China (PRC) in 1949, and especially following the initiation of the “opening and reform” policy in the early 1980s, library development greatly accelerated.

Modern Librarianship in China

By the mid-nineteenth century, Chinese sovereignty was severely compromised as a result of the “unequal treaties” following China's defeat by Britain in the first Opium War (1839–1842). The economic, cultural, and political penetration and exploitation of China by the Western and Japanese powers and the decline of the Qing (Manchu) Dynasty (1644–1911) over the next half-century contributed to the instability of the nation. Although the Manchu governing class had introduced some reforms at the end of the nineteenth century, popular uprisings from the mid century on—from the Taiping Rebellion (1850–1864) to the Boxer Rebellion (1900)—demonstrated that all was not well. The traditional Confucian order of guarding

against any contact between the Chinese and foreigners (who were regarded as barbarians) eventually gave way to trade with the West, missionary endeavors, introduction of Western technologies and political institutions. The influx of foreign educators and the enrollment of Chinese students in Western colleges provided external political and cultural stimuli for change. As a result of the Western and Japanese intrusions in Chinese affairs beginning in the 1840s, many traditional Chinese institutions were shaken, including the closed-access model of Chinese libraries carried over from ancient times.

The beginnings of modern Chinese librarianship can be traced to the Public Library Movement (1840–1926), with its interest in following developments in European, American, and Japanese library systems. Many Chinese intellectuals recognized that it was essential to modernize and improve education for China to prosper and be strong, and some of these reformers recognized the potential role of libraries. Liang Qi-Chao, scholar, literary journalist, and political figure, emphasized the importance of establishing libraries to spread culture and train talented people; he introduced into China the term library, “tushuguan,” from Japan.^[3] This new term appeared for the first time in 1896 in *Current Affairs Newspaper*, which Liang Qi-Chao edited. Later Liang traveled to the United States and visited public, university, and national libraries in Boston, New York, and Washington, District of Columbia in the early twentieth century. He quickly discerned that public libraries were necessary for public education. What impressed him most was the open-shelf arrangement of American college libraries. He also became convinced that libraries were linked directly to America’s educational and economic development.

The Public Library Movement (*Gong Gong Tushuguan Yundong*)

The Public Library Movement marked an end of Chinese feudal society and the beginnings of great changes and reform, socially and politically. European, American, and Japanese library systems played a predominant role during this period.

During 1917–1926, the Chinese public library movement was at its height. Two primary factors contributed to this: 1) the Literary Revolution and Renaissance Movement, which occurred during 1917 when “pei hua” or the colloquial language was introduced as a medium of literary expression; and 2) the May 4th Movement of 1919 which unleashed the New Culture Movement in China by challenging aspects of traditional culture that dominated the lives of the Chinese for more than 2000 years. Confucianism was repudiated, setting the stage for dramatic cultural changes.^[4]

Influenced by the West, the Mass Education Movement of 1920 had the goal of teaching illiterates to read and write using 1000 characters. Such initiatives had

important implications for the development of public libraries. It should be noted that at this time the majority of public libraries were maintained by the educational budget of local districts and were under the control of the provincial commissioners of education. The majority of reading rooms had noncirculating materials. Imposition of a small fee even for in-house use of library materials was common in many public libraries, mainly to keep away vagrants. By the mid-1920s the traditional idea of charging fees for admission gradually was being discarded, but borrowing books for home use was not yet widely accepted. It was in the free public libraries that newly published works on various subjects were made available as well as copies of Chinese classics. Children’s reading rooms were also maintained in these libraries, though they were still in their infancy in China. Often preexisting buildings (such as old palaces, former academies, and abandoned temples) were turned over by the authorities to be used free of charge as libraries and reading rooms.

The Public Library Movement, 1840–1926, evolved into the Modern Library Movement (*Xin Tushuguan Yundong*), 1911—to the present, which not only advocated for more public libraries, but also promoted the development of college and university libraries, and special libraries. At this time special libraries were most prevalent in major cities such as Beijing, Shanghai, and Guangzhou (formerly known as Canton) and were founded mainly to provide information for government organizations and bureaus in China. The Modern Library Movement (also called the New Library Movement) sought to eradicate traditional library practices, promoted Western librarianship throughout China, introduced Western library science and technology, and raised the social standing of Chinese librarians.^[5]

Library Science

At the beginning of the Chinese Republic in 1912, many reformers realized the need to replace the traditional practices of Chinese library administration. Since many Chinese intellectuals were influenced to some extent by Japanese culture and science before the Revolution of 1911, Japanese library science was the first foreign model introduced into China. In 1910 Xie Yun-Cang translated *Library Education* which was authored by a Japanese scholar and published by Fengtian Press; this was the first book about library science published in China.^[6] After Shen Zhu Rong returned from the United States in 1917 (discussed in the “American Influences” entry) and launched the Modern Library Movement, the emphasis on foreign library science shifted from Japan to the United States. Between 1919 and 1949, many articles were translated into Chinese that dealt with “American Public Libraries” and “American Librarianship.” Even lectures on the Library of Congress (LC) Classification, Dewey

Decimal Classification (DDC), Brown Subject Classification, and Cutter's Expansive Classification were translated and published by Chinese librarians. Thus the concept of an American-type library administration prevailed and later spread throughout China.

Prior to 1900 there were no card catalogs in China, only book catalogs. After the introduction of both Japanese and Western library science, card catalogs became popular. The Library of the North China Branch of the Royal Asiatic Society had catalog cards with Dewey classification numbers. Cutter's author numbers and index entries were in usage as early as 1908. The Boone Library (founded by Mary Elizabeth Wood in 1910, in Wuchang, now a district of the city of Wuhan, Hubei province) and Beijing libraries began using card catalogs in 1918. After the 1920s the majority of Chinese libraries adopted the card catalog system. Beijing Library as early as 1936 began to print and issue cards for the use of all libraries in China.

Sun Yu Xiu was the first person to introduce the DDC system into China. Sun said, "It is the most important and popular classification among all the classifications in English."^[7] Introduction of the DDC precipitated major changes in the development of modern Chinese classification system. Soon it was found that DDC was not adequate for Chinese works; the Chinese Si Ku classification or fourfold scheme was eventually merged into the DDC system: the four Chinese schemes included the following categories of works:

1. The six classics, lexicography, philology.
2. Philosophy, military science, mathematics, and divination.
3. History, anecdotes, state documents, and miscellaneous writings.
4. Poetry, eulogies, and treaties.

Shen Zhu Rong and Hu Qing Sheng led the way to combine the class heading of both Si Ku and DDC. The Boone Library published Shen and Hu "Modified Dewey Decimal Classification" in 1927. This had a great impact on all of the succeeding Chinese classifications. At the time, DDC was classified into the following 10 categories: General Works, Philosophy, Religion, Sociology, Philology, Natural Science, Useful Arts, Fine Arts, Literature, History and its many subdivisions, together with the fourfold Chinese classification. This led to several changes in the development of modern Chinese classification: 1) supplemented DDC to suit the headings for Chinese libraries; 2) mixed the class headings of both Si Ku and DDC; and 3) used DDC as a basis for class headings with additional new class headings according to the subject of the Chinese publications.

It can be seen that Anglo-American library science indeed had a strong impact influencing Chinese librarianship. But some technical functions could be adopted and others could not. For example, China could not completely

replicate America's classification system to their own library's system, since China had its own set of traditions and books that often could not coincide with those introduced from abroad. Therefore, modification and adaptation were the result of such encounters.

American influence

Let us examine the specific impact and role that America had on Chinese librarianship in modern times, exemplified by the work of Mary Elizabeth Wood and Arthur E. Bostwick. Mary Elizabeth Wood (1861–1931) came from a family of missionaries. She, herself, was later named a lay missionary of the American church. In 1899 Miss Wood visited her brother who was a missionary in Wuchang, China. At his suggestion Wood stayed on to take charge of an elementary English class in the small, missionary-run Boone College. While working as a teacher she became aware of the inadequate library facilities and collected donations (which she used along with her own funds) to open the independent Boone Library in Wuchang in 1910. The Library was opened to the public as well as students from Boone College. Here Miss Wood advocated the Western practice of open access to the stacks, which set a precedent in Chinese librarianship. In order to attract users to the library and to introduce American librarianship, Miss Wood conducted lectures in the Boone Library. Realizing that training of young professionals was essential to the development of Chinese librarianship, she financially assisted Shen Zhu Rong and Hu Qing Sheng to go to the United States and study library science. Miss Wood sowed the seeds for the rise of the Chinese Modern Library Movement by promoting professional training for Chinese librarians.

Shen Zhu Rong and Hu Qing Sheng, the two students who went abroad to study in 1914 and 1917, returned only to find that the knowledge they gained would be applicable primarily to foreign libraries and could not be completely adopted in Chinese libraries. Therefore, it became imperative that a Chinese institution of library education to train librarians be established. Shen Zhu Rong and Hu Qing Sheng worked with Miss Wood to found the Department of Library Science of Boone College in 1920. This was the first institute for modern library education in China. The institute, which became the Boone Library School was accredited as a college by the Ministry of Education in 1930, and became the premier institution for the training of librarians in China. The School was financially supported by American funding during 1920–1949; for example, American churches contributed \$8,000 annually and the American government returned each year \$13,500 of the Indemnities Fund of 1900 (Boxer Rebellion). It was through the determined efforts of Miss Wood that a campaign was launched to persuade the American government to return the indemnities of 1900 in order that the money could be used to

advance Chinese librarianship. Through two trips to the United States Miss Wood and her supporters succeeded in persuading the American government to return all the indemnities of 1900, allowing some of the funds for Chinese libraries.

In 1924 Miss Wood prevailed upon the American Library Association (ALA) to help her Chinese colleagues establish a national library association in China. She also invited Dr. Arthur E. Bostwick, Director of the St. Louis Public Library, to visit China and lecture on the philosophy and practices of American libraries. Dr. Bostwick arrived in Shanghai in 1925 and visited more than 50 libraries in China where he lectured and also presented films on American librarianship. He was so successful in advocating American library philosophy and practices such as open-access that many librarians in China wanted to emulate the American way of operating libraries. Bostwick's visit coincided with the founding of the Library Association of China (LAC) by the Beijing Library in 1925.

With the growth of the Modern Library Movement in the early 1920s, there was a growing need for coordination. The Chinese Association for the Advancement of Education (CAAE) (*Zhonghua Jiaoyu Chujinhui*) proposed in 1923 to establish local library associations. By 1924 a number of provincial and local library associations developed, with Beijing Library Association being the primary one. These local associations paved the way for the establishment of a national library association. In April 1925, the national LAC, *Zhongguo Tushuguan Xuehui*, was founded to welcome the visit of Dr. Arthur E. Bostwick. During its existence, the accomplishments of the LAC included providing services to academic and public libraries, publishing a series of reference works and two periodicals, and encouraging library cooperation on the national and international levels. In 1927, the LAC was one of the founders of the International Federation of Library Associations (IFLA). From its inception this association of Chinese librarians became the leading force in the Modern Library Movement or New Library Movement. Its aim was to encourage research in library science, to develop Chinese librarianship, and to strive for the cooperation of the libraries. Through the efforts of LAC the development of Chinese librarianship evolved from the promotion of American librarianship to the reformulation of Chinese librarianship.

The period 1925–1937 witnessed the beginning of Chinese national political consolidation and economic and social reconstruction. In the 1930s the national government at Nanjing under Chiang Kai-shek launched a program to make the library an indispensable agency in the construction of new China. Notwithstanding insufficient funds to further the movement, Chinese libraries continued to develop. According to a survey conducted by the LAC in 1935, there were 933 public libraries and 1002 popular libraries in China, as compared to 1922 when there were only 51 public libraries and 239 free

public libraries.^[8] Popular libraries were the result of the mass education movement beginning in the 1920s. They pushed these institutions to a new level and laid the foundation for further developments. Instead of just being a storehouse for the preservation of books, popular libraries began to serve the general public. Under the second Chinese library law (1915) on public libraries there were two sets of regulations: 1) regulations regarding governing popular libraries—these libraries were small, containing a few thousand books and a few reference books, including popular books, magazines, and current newspapers for everyone; and 2) regulations that libraries be established in all provinces and every administrative district—public libraries in this category would emphasize more the academic materials. These rules led to the growth and reorganization of public libraries.

Subsequent political events and discords had an adverse affect upon library development in China. For example, during the Sino-Japanese conflict of 1937–1945, the National Library of Peiping (*Guoli Peiping Tushuguan*) received very few books from foreign countries. During the years when much of Eastern China fell under Japanese occupation, limited foreign materials were collected in the cities of Chongqing and Kunming. After 1941 when the Japanese occupied major coastal ports, the importation of books and periodicals from abroad became scarce.

The founding of the People's Republic of China (PRC) and the Cold War

When the PRC was founded in 1949 the new government faced many challenges. China was in a state of chaos, economically, politically, and socially. Much of the country's industry, educational facilities, and social base were destroyed during the years of Japanese aggression (1937–1945) and during the civil war in China (1947–1949). The new government immediately set up plans for national, social, and economic reconstruction. Libraries and library service were to play a critical role in the reconstruction of China during this period. To assist in national development, China adopted Russia's experiences, theories, and principles for the construction of a socialist model of library service. The goals of the library were to be aligned with the following principle:

The main tasks of the People's Government in its cultural and educational work are to elevate the cultural standard of the people, train personnel for national construction, eradicate all feudalist comprador-type and Fascist thinking, and foster thoughts of service.

Thus libraries were to serve as providers of ideological doctrine and work related information.

With the establishment of the new government under Mao Zedong, China turned toward the Soviet Union and

Eastern European countries for assistance in building a productive socialist state. During this time many non-Eastern bloc countries, including the United States, adopted an embargo against China. Meanwhile the National Library's acquisition of Western materials diminished greatly and its mission was realigned, following Soviet library principles which were "to serve politics, production, workers, peasants, soldiers, and scientific studies."

As early as June 1949, Mao Zedong declared,

All Chinese without exception must lean either to the side of imperialism or to the side of socialism. Sitting on the fence will not do. Internationally, we belong to the side of the anti-imperialist front headed by the Soviet Union, and so we can turn only to this side for genuine and friendly help, not to the side of the imperialist front.^[9]

This principle was implemented on February 14, 1950 with the Treaty of Friendship, Alliance, and Mutual Aid between the People's Republic of China and the USSR. Mao's "lean to one side" policy reinforced the importance of Soviet influences on librarianship in China. As the national economy was gradually restored, the Ministry of Culture took steps to restructure the libraries, and promulgated a new slogan of "serving the readers by every means." All types of libraries, especially public libraries, promoted book circulation by providing recommended book lists to readers and book exhibits.

Libraries were replenished with new revolutionary publications which were placed alongside the classical works of Marx, Engels, Lenin, Stalin, and Mao Zedong. The government also banned books that opposed the policies and ideology of the Chinese Communist Party, including works that referred to capitalism (particularly to American life), feudalism, idealism, imperialism, and individualism. Throughout the country, libraries were required to inventory their historical works and to identify and remove all "reactionary" publications, including "Fascist," pornographic, and factitious types of literature. Collection development was closely tied to the various political objectives; when a policy was declared, books, relating to the policy were purchased and those with opposing viewpoints were banned.

During the early 1950s libraries developed rapidly throughout China. Chinese officials were interested in establishing an effective library system and sought to learn the operations and practices of librarianship from the Soviet Union. At this time many works on library sciences written by Soviet specialists and librarians were translated into Chinese. These works were collected in 1957 and published as *Translations on Library Science*. The Chinese also adopted many of the technical aspects of Soviet librarianship; for example, the new classification scheme was based on the four main classes of the 1955 Soviet Classification Model: 1) Marxism-Leninism; 2) social sciences; 3) natural sciences; and 4) generalia.

During the 1950s, examples of the most successful newly created libraries were the rural and labor libraries. The slogan, "Culture going to the mountains and the countryside," was used everywhere to foster Marxist education and the popularization of socialist culture. The Government threw open the library doors to readers; no longer was there admission charged, unlike the republican period when users were charged a fee. Under the new government, the masses were the ruling class and libraries were organized to serve the workers and peasants.

During the First Five-Year Plan, 1953–1957, there was a great push for the rapid development of the national economy. This was the time of the 1956 "March toward the Sciences" movement. There was a surge in the rural areas to establish commune libraries. These commune libraries grew; they were administered by local Party committees and run by local people. The materials were acquired through municipal libraries or donations and carried directly to users at work sites. Realizing the importance of education and culture, a major literacy campaign was undertaken during the 1950s. Schools attached to reading rooms in communes and work places taught literacy skills. During these years there was seen also a surge in the growth of labor union libraries. By the end of 1956, it was reported rural reading rooms reached 182,960 and it was these reading rooms that enabled the laborers and peasants to study the current events and policies during the agricultural cooperation period, to elevate their ideological awareness and the standard of their scientific knowledge and production techniques. The libraries for the workers were established to help increase productivity by making more science materials available. After the 1960s there was progress in conducting research on users' needs and demands to further improve scientific scholarship.

Various government ministries held administrative control over libraries:

- The public library system, which included the national, provincial, municipal, county, and cultural center libraries were under the Ministry of Culture.
- College and university libraries were under the Ministry of Education.
- Elementary and secondary school libraries were under the Ministry of Education.
- Trade union libraries were under the Trade Union.
- Special libraries were under appropriate government agencies.

It should be noted that this administrative structure was also based upon the Soviet system.

Beginning in 1952, as a result of the Cold War, China secured few Western language materials, due to the strained relations between China and Western countries. It was difficult to find channels through which to purchase Western language books, except through third parties such

as India, because of the strict embargo act imposed upon China by the United States and many of its allies. By the latter half of 1953 the great majority of foreign books acquired in China were from the Soviet Union and East European countries; these works were acquired not only through purchase, but also through bilateral exchange agreements. Through 1957, Soviet materials relating to science and industry were translated in great quantities; these Chinese translations of Russian works amounted to 38% of the total number of publications issued in China.^[10] Other books and periodicals were acquired, by purchase, gift, or exchange, from the Soviet Union and distributed to libraries, where they contributed to the development of Russian language collections, including those in the National Library of China's (NLC) collection.

For China, the decade of the 1960s was one of domestic unrest and foreign conflicts. This was the period of waning relationship with the Soviet Union. In the early 1960s, the Soviet Union withdrew all scientific and technical assistance to China, including library development aid. The ability of China to purchase and/or acquire on exchange the necessary Soviet scientific publications was largely curtailed. In an attempt to rectify this problem, China looked toward Japan and Western Europe for materials in advanced science and technology. Meanwhile, China also began a movement toward self-reliance; the populace was discouraged from reading foreign literature, and access to new scientific and technological developments from abroad was restricted.

The Cultural Revolution and recovery

During the decade between 1966 and 1976 the leaders of the Cultural Revolution sought to eradicate old thoughts, old culture, old customs, and old habits of the bourgeois classes of China's past. Many libraries in China were closed and some destroyed. All educational and cultural activities came to a grinding halt. Meanwhile, the West continued to impose an embargo on relations with China. During this time the progress of modern librarianship was interrupted.

After the Cultural Revolution, beginning in the late 1970s, Chinese librarianship recovered and began to adapt many of the new Western ideas and practices of library science and technology. Libraries in China were rebuilt, transformed, modernized, and began to play a key role in national development. After the introduction of economic reforms and the opening up of China in the 1980s, Chinese libraries developed rapidly. Chinese students enrolled in American and other Western library schools, and some also attended special seminars for practicing Chinese librarians in China. Those seminars held in China included some sponsored by national and provincial library organizations. For example, the National Library had organized many seminars across the country to stimulate library development; the Institute of Scientific and Technological

Information of China (ISTIC) sent information specialists to lecture to library and information science students in universities and colleges; in 1978, a national conference was held in Nanjing for libraries with significant classical collections to discuss the 1982 preparation of the National Union Catalog of Ancient Classical Books project—this led to special training classes held in Sichuan province to coordinate the project.

By 1979 China reestablished interaction with the West, including diplomatic relations with the United States. To facilitate China's quest to gain access to Western knowledge, an agreement was signed between the United States and China in August 1979. The Implementing Accord for Cultural Exchanges between the governments of the United States and China provided for the LC to send a full set of U.S. government documents to China's National Library of Beijing (*Guoli Beijing Tushuguan*) beginning January 1, 1980. In return the National Library agreed to send in exchange to the LC a comparable number of Chinese publications. For the first year, LC sent 20,000 publications to Beijing and received only 800 publications from the National Library. A year later, in 1981, the National Library of Beijing raised its number to 13,000 publications. The issue of equivalent content was also raised by LC, for Chinese titles included a wide selection, from scientific treatises to children's books. In 1995 LC urgently requested only Chinese government publications. Since China owned and controlled the country's publication activities, everything it published was classified as a government publication.^[11] Other exchange agreements with foreign nations provided an avenue for further acquisition of much needed scientific and technical information.

LIBRARY AND INFORMATION SYSTEMS AND SERVICES

Legislation

As early as 1909, the first library law in China was enacted by the Ministry of Education. According to this law, the aim of the library was to preserve Chinese classics, to disseminate knowledge, to provide research facilities, and to collect materials for the free use of the public. No one was permitted to check books out of the library. There were two kinds of materials in the library—rare editions for safe keeping in the library and ordinary publications for general reading. The rare items included those editions published in the Sung and Yuan dynasties and permission to use them was required by the library authority. Books classified for general reading were government and private publications. Regarding foreign publications, the library was not allowed to obtain foreign books for fear it would contain ideas distasteful to the Emperor, known as "Son-of-Heaven." The library law of 1909 applied not only to the national library, but also to libraries at provincial

capitals and county and district libraries. The national library was called the Metropolitan Library. The second Chinese library law on public libraries, Regulations Governing Popular Libraries in 1915, elaborated and specified that public libraries should collect popular books for the general public. This became the turning point in Chinese library history, that is, libraries became more democratic and were expected to provide education for everyone; they not only served provincial and other administrative units, but also public and private schools.

Later in 1916, the Ministry of Education requested that all publishers deposit a copy of their publications in the Metropolitan Library. It also mandated that every library in the provinces, counties, and districts be encouraged to collect books and manuscripts pertaining to the history and culture of their respective locality. The official deposit law was revised in 1926 when it required that every publisher should submit four copies of each new publication to the provincial department of education. These publications were to be distributed to the Metropolitan Library, the National Bureau of Compilation and Translation, the provincial library, and the local county library. Through the years, many rules and regulations concerning libraries have been issued: for example, three of the most important were the National Book Coordination Act of 1957, relating to fostering library service in China; the *Summary Report of Library Work*, 1980, encouraging governments at all levels to develop libraries and expand their services as part of their national planning; and the *Report Pertaining to the Improvement and Enhancement of Library Work*, 1987, from the Ministry of Culture and other ministries, urging the coordination of libraries, reform of library management, and adoption of modern technology. Since 1987 there have been many sets of regulations for special libraries in the development of science and technology to advance economic progress. In 2008, the first standard for the construction of public libraries was issued by the Ministry of Culture. The Ministry and the Library Society of China (LSC) are striving to draft legislation on libraries for the People's Congress, China's highest legislative body. The regulations that have been approved through the years have served the administrative management and smooth operations of libraries well.

National Library of China (*Zhongguo Guojia Tushuguan*)

In 1929 the Chinese Ministry of Education recommended that the Beijing Library and the Metropolitan Library be amalgamated under one management to form a National Library. The two libraries were reorganized under the name of the National Library of Peiping (NLP). Although the National Library functioned mainly as a reference library, it was open to all classes of readers, and in 1929 loan services were offered to libraries and individuals.

At that time the NLP also expanded its services as a center of bibliographical information, both nationally and internationally, and it served as a National Information Center for China. The years 1929 to 1935 were one of growth and development in the foreign language collection. During this time 68,479 volumes of foreign language materials were acquired through purchase, gift, and exchange. A total of 39,113 volumes (representing 57% of the total acquisitions) of foreign language materials were purchased. Approximately 40% of the collection acquired was for natural and applied science materials. Political upheavals and crises had a definite impact upon China's library modernization. The affect of procuring foreign collections was an example. During the Sino-Japanese conflict of 1937–1945, the NLP received few books from foreign countries. Beijing came under Japanese occupation and the library transferred part of its resources to Chongqing and Kunming. At that time, the policy of the NLP was to maintain and manage the various reference collections in Beijing, while the Chongqing and Kunming offices were responsible for the continued collection of Chinese and foreign materials. In the early part of the war, foreign language materials could still be obtained through Hong Kong and then shipped inland. There was, however, the problem that the National Library had no permanent library facilities in Chongqing and Kunming and the two cities were subjected to Japanese bombardments, resulting in the transfer of a portion of the collection to the countryside and another portion to various universities. Later in the war, especially after 1941, with Japanese occupation of all the coastal areas, books and periodicals from abroad became scarcer and their acquisition was finally suspended. After the Japanese surrender in 1945, part of the library's collection at Chongqing and Kunming was shipped to Beijing, but the number of volumes was not large.

From 1945 until the early years following the establishment of the PRC in 1949, the NLP received a considerable number of Chinese and foreign materials which had been held by the Japanese supported puppet government of Wang Qingwei. This was especially true of Japanese language materials that numbered in the tens of thousands. During World War II, though the Japanese had burned many Chinese library collections, the Japanese collection at the National Library remained intact. In 1949, the National Library had a total holdings of 1,400,000 volumes of books and journals of which 292,162 volumes consisted of foreign language materials; this represented approximately 21% of the total collection.

In March 1950 the PRC changed the name of the National Library of Peiping to the National Library of Beijing. Beginning in 1978, when the PRC embarked on a reform policy, the national library began a major drive to modernize its facilities, equipment, functions, personnel, and organization. The goal of the government was to create one of the world's foremost national libraries. In 1988

after a new building was opened, the State Council approved a name change from National Library of Beijing to the National Library of China. (NLC—*Zhongguo Guojia Tushuguan*).

Following the establishment of relations with the United States and other foreign countries, beginning in the 1970s, the national library's collections increased rapidly. The Library found it could no longer accommodate all the incoming materials. In March 1975, after a proposal from Premier Zhou Enlai, the State Council approved the building of a completely new National Library adjacent to the Purple Bamboo Park in Beijing, in an area where many colleges and research institutes were located. The building plans were to reflect China's large population, long history, rich cultural heritage, and many nationalities. Construction of the new library building began on November 18, 1983, an undertaking involving more than 5000 workers. Completed on July 1, 1987 the new building is one of the largest libraries in the world. It has a total of 170,000 m² of floor space, which can accommodate 30 reading rooms with a seating capacity of more than 3,000 and the capability of receiving 7,000–8,000 readers per day. The old library continues to serve as a branch library for books published before 1949.

As the most noted library in China (under the Ministry of Culture) the NLC has the largest collection of Chinese books in the world; through legal deposit, it continues to comprehensively collect all books currently published in China. As of 2007, the NLC's collection consisted of the following: 6,379,096 Chinese books; 3,410,844 foreign books; 50,283 Chinese periodicals; and 43,407 foreign periodicals. It ranked fifth among national libraries in the world. The Library holds a rich collection of 270,000 volumes of rare books [rare books include the volumes of the Song (960–1279 A.D.) and Yuan Dynasties (1271–1368 A.D.) as well as volumes of rare books and manuscripts of notable authors]; 1,600,000 volumes of general ancient books [ancient books consist mainly of thread-bound books after Qianlong Emperor in the Qing Dynasty (1644–1911) and some collections in the Yuan and Ming Dynasties (1368–1644 A.D.)]; and 35,000 pieces of the scripted turtle shells and animal bones from the Yin-Shang Dynasty, ca. 1600–1046 century B.C. In addition, the NLC has the largest collection of foreign language publications in China. Similar to national libraries throughout the world, NLC serves as a depository library for UN publications; NLC also collects publications of other international organizations and foreign governments. It also acquires numerous microforms and AV materials, hundreds of CD-ROM databases, and more than 8000 titles of electronic publications. Like other national libraries, NLC represents an important cultural institution in China, for it has promoted exchanges and cooperation with libraries and cultural institutions all over the world. It has publications exchange relations with more than 1000 libraries and academic institutions in more than 120 countries and regions of the globe.

The NLC is not only a national repository of Chinese and international publications, but also a national bibliographic center, a national center of library information networks, and a library research and development center. In addition to serving the central government, research institutions, academic institutions, business, and the general public, the NLC plays a leading role in standardization, digitization, and networking efforts in China. With the use of modern technology, various kinds of bibliographical databases and subject databases were being created and improved. These include:

- The China National Bibliography Retrospective Databases (1949–1987), created by NLC and other cooperating libraries.
- The China National Bibliographical Databases (1988 to date) created by NLC.
- The China National Bibliographical Database (comprised of the two databases above).

In addition, the Online Computer Library Center (OCLC) becomes a center for creating, processing, and distributing bibliographical records, providing MARC records of Chinese books to scholars throughout the world. The NLC will add its bibliographic records to the OCLC WorldCat database, by developing software to convert the format of its records. It was expected that some 1.5 million records will be sent to OCLC by 2008. (<http://www.oclc.org/news/releases/20085.htm>). The Library will continue to add records beyond 2008 once the format has been converted. Through these activities, the NLC forms the center of a system covering the entire country. Administratively the NLC is under the PRC Ministry of Culture, which also supervises all public libraries—including provincial, municipal, county, and cultural center libraries.

Similar to libraries in the West, NLC divides its reference services along subject specializations: Social Sciences Reference Service, Sci-Tech Reference Service, Legal Information Reference Service, Abstracts and Indexes Reading Room, and Information Service. There is also a Newspaper Clipping Center and a Document Supply Center that provides subject research, document delivery, and photocopying service. NLC also has two main electronic reading rooms, the largest of their kind in China. These rooms were opened to the public in March 1995, which provided electronic information access services to readers—resources include CD-ROMs (as of 2005, there were 22,429 CDs) on various subjects, multimedia CD-ROMS, CD-ROM bibliographic databases, Web-databases, and over 10,000 full-text e-journals in Chinese or English. The users can phone, write, or visit in person. Service to the users includes training on the Internet, CD-ROM retrieval, and Web page design. The CD-ROM network in the electronic rooms is connected to all major information networks in China: 1) the network of exchange data of the People's Liberation Army (PLA); 2)

by wireless with the network of the Ministry of Posts and Telecommunications; and Military Medicine Academy; and 3) by phone with more than 10 institutions' network such as Nankai University Library at Tianjin, Life Science Institute of Beijing University, Zhejiang University, Zhejiang Industry University, Shanghai Huadong University of Science and Engineering, Xi'an Institute of Foreign Language, Ningbo Science and Information Technology Institution, and many more. These connections provide information exchange with all major institutions in China, the Internet, and remote access services for users around the world. With the Gigabit Ethernet library-wide network and an Internet service system open 24 hr a day all year, NLC is able to provide electronic information services, such as Internet Navigation, Full-Text Books Online, and OPAC Access. The NLC has become a center of network information resources. Furthermore, with the advanced Gigabit Ethernet technology developed in February 1999 and the opening of NLC Web site, the library has become a major network resource center connecting with high speed 100 MB leased lines to the State Council, Peking University, and Tsinghua University and also connecting ChinaNet, CERNet (China Education and Research Network), CSTNet (China Science and Technology Network), Beijing Cable TV Network, the National Cable TV Network, and CNC (China Netcom).^[12]

While the NLC adapted many modern library concepts and practices from the West, it also strove to utilize these practices to maintain the cultural heritage of China by preserving the great books of the past. The Library has maintained China's rich culture by preserving the books of the past, including works from the royal collection of the Southern Song Dynasty of the twelfth century as well as the Dunhuang manuscripts, the valuable Zhao Cheng Zang (the collection of Buddhist Scriptures preserved in Zhao Cheng County, Shanxi Province), the monumental Yong Le Da Dian (the Yong Le Encyclopedia), and the multivolume Si Ku Quan Shu (Complete Collection of Four Categories of Literature), all regarded as unique copies in the world. Along with the rare books and special collection, NLC maintained about 2,000,000 volumes of thread-bound books. Emphasis is placed on preservation and conservation of the library's exceptionally rich cultural heritage; staff members are engaged in restoration and conservation of rare books, applying traditional rare book conservation techniques and modern microfilming technology.

Since 1995, NLC has been keeping up with the latest development in digital libraries. In 1998, the Ministry of Culture approved a new building project "China National Digital Library." The project proposal of NLC Phase II and the National Digital Library of China Project was completed in November 2001. *The Feasibility Study Report on the National Library of China Phase II and National Digital Library of China Project* was approved by the State Planning Commission in 2003; 12.23 billion Renminbi (RMB) was distributed to NLC for the project;

in 2003, the RMB exchange rate was 8.3 to US\$1. Construction was completed in June 2008 and the Library was opened to the public on September 9, 2008. The National Digital Library of China has developed newer models of services, has become a center of Internet knowledge, and a base for information service without limitations of space and time. NLC provides unlimited digital resources, such as digital television, handheld mobile electronic reader for walk-in readers, E-government network, special area and equipment for the visually impaired, satellites, CDs, etc. Architecturally, the new building represents ideas of the past, present, and future: more open reading rooms, free access to publications, spacious reading areas, quiet areas for research, and modern exhibition and instruction areas.

The new library can accommodate an average of 8000 readers per day, with a collection capacity of 12–14 million volumes. The total floor space amounts to 80,538 m² and 2,900 seats. The total area of the National Library including both old and new buildings is 250,000 m², ranking it third among the world's national libraries.^[13]

Academic and Research Libraries

In the 1950s China's educational system, which had been modeled after the Western educational institutions, was reoriented toward using Soviet teaching techniques, curricula, textbooks, and materials. Beginning in the 1950s, higher education came under new directives, with its primary goal being the socialist reconstruction of China. Foreign policy, too, dictated China's educational practices and orientation; the Soviet "model" was widely adopted. Translations from Russian works on library science flourished and Soviet librarians were invited to visit China to consult and give lectures. Academic libraries were called on to engage in national development, subject to the same ideological and political constraints and requirements as other institutions. For example, purchase of Russian books exceeded those of other Western publications during the 1950s. However, a severe setback occurred during the Cultural Revolution (1966–1976) when all university libraries were isolated from the outside world. Foreign acquisitions ceased, creating a 10-year hiatus in book and periodical acquisition.

When universities and colleges finally reopened in 1978, academic libraries recovered and adapted many of the new Western ideas and practices of library science and technology. After the introduction of economic reforms and the opening of China in the 1980s, Chinese libraries developed rapidly. Academic libraries in China were rebuilt, transformed, and modernized and began to play a key role in national development. In the twenty-first century, many Chinese colleges and universities have the best-organized and finest collections. Examples of the development of academic libraries can be seen in Peking University Library (PUL) and Tsinghua University Library.

Peking University Library (PUL)

PUL was first established in 1902, under the name of Capital College Book Storage; at that time it had a core collection of 78,500 volumes. After the revolution of 1911, the present name was adopted. (Peking University kept the name Peking, because of its historic past. It was founded over 100 years ago and was the cradle of the 1919 May 4th Movement.) The reorganization of Chinese colleges and universities was initiated in the 1950s, following the founding of the PRC; PUL absorbed the Yenching University Library as well as collections from other universities. In 1998 when the construction of the new library building was completed, PUL became the largest academic library in Asia, with over 51,000 m², 4,000 seats in its reading rooms. By 2002, the centennial anniversary of PUL, the library contained approximately 6.5 million items and was ranked as the largest of any university collection in China. Its holdings included works in the fields of liberal arts, natural sciences, applied sciences, and social sciences. In addition to 2,700,000 volumes in Chinese, the library also holds 900,000 volumes in foreign languages as well as CD-ROMs, microforms, AV materials, and databases for many disciplines. PUL has been steadily developing its collection, with an increase of 80,000 items annually and it maintains exchange relationships with more than 500 foreign libraries, schools, and research institutes.

With a history of more than 100 years of collection development, PUL's Chinese rare book collection is ranked first among academic libraries in China. Among its treasures are 1,500,000 traditional thread-bound books. In addition, the PUL holds 56,000 copies of Chinese rubbings from inscriptions on ancient bronzes and stone tablets. These rubbings are very important for the study of ancient characters, calligraphy, and fine arts (Fig. 2).

On the cutting edge of technology, PUL operates the UNICORN-integrated automation system that includes an online public access catalog (OPAC), as well as modules for the acquisitions, circulation, reference, serials control, acquisitions, etc. In 1998, the headquarters of the China Academic Library Information System (CALIS) was established at the PUL. CALIS is a nationwide academic library consortium with members throughout 27 provinces, cities, and autonomous regions in China. Funded primarily by the Chinese government, its purpose is to digitize resources and develop an information service network in order to serve multiple resource-sharing functions among the participating libraries; these functions include online searching, interlibrary loan, document delivery, and coordinated acquisitions and cataloging.^[14]

Tsinghua University Library

Tsinghua University Library was founded in 1912 in Beijing, 1 year after the university was built. In 1928 the

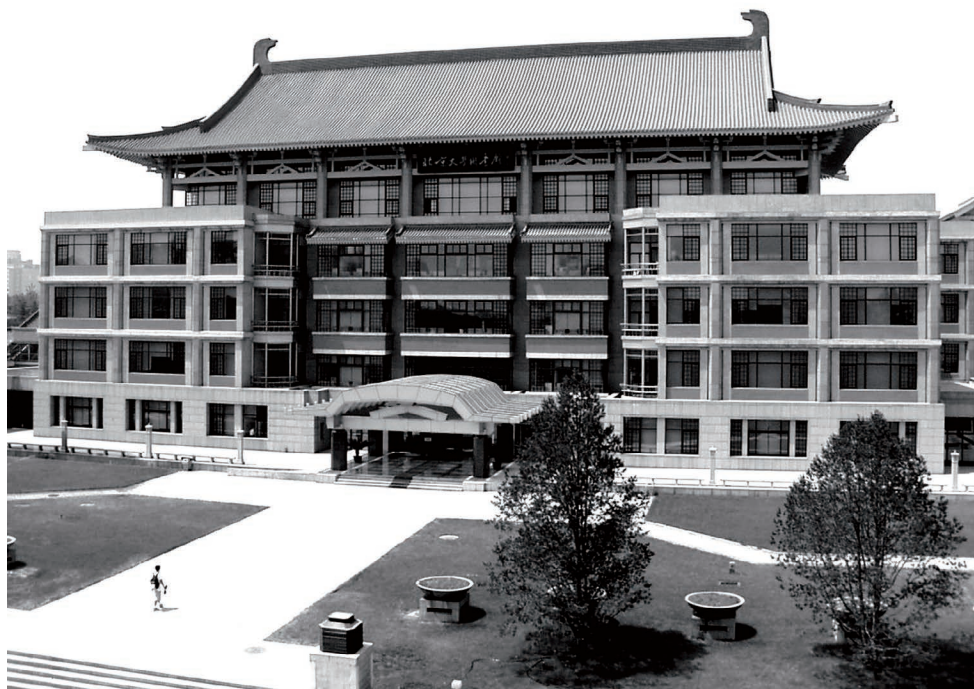


Fig. 2 Peking University Library, Beijing.

Tsinghua School became the National Tsinghua University. Between 1928 and 1935 the Tsinghua University Library expanded rapidly. In 1931 the collection held 300,000 volumes and the library building was 7,700 m², with 700 seats. During the Sino-Japanese War (1937–1945) the University moved to Kunming. In 1938 Tsinghua University merged with Peking University and Nankai University to become the Southwest Associated University. The Tsinghua Library shipped 23,000 volumes to the new university. During the move, 10,000 volumes which were temporarily stored in Chongqing were damaged by Japanese bombings, and only 3,000 volumes were saved. In Beijing, the library building became a Japanese military hospital. By 1946, the collection returned to the original campus in Beijing, but the Library had lost 175,000 volumes during the war. After the PRC was established in 1949, there was restructuring which included a reexamination of its collection development policy to support the University's mission of education and research. While there was a strong focus on engineering materials, the library also collected literary works and other subjects in the humanities. The library's collection had grown to 1.35 million volumes by 1966. During the Cultural Revolution period, 1966–1976, the budget of the Library was cut deeply. However, with the help of faculty members, students, and librarians the majority of the library collection survived that tumultuous period. The collection since 1978 grew rapidly reaching 2.5 million volumes by 1990 (Fig. 3).

When the new library was built in 1991, a new stage in library development began. Since then, Tsinghua University Library has made substantial progress in automation and networking. The new library has a floor space of 39,000 m² and more than 2,500 seats for patrons. The Library maintains a rich collections of 3,923,000 volumes (books and journals) which cover the humanities, social

sciences, and management, but there is primary emphasis on the natural sciences, engineering, and technology. The printed collections contain: 300,000 thread-bound ancient books; over 4,000 current serials and more than 400,000 bound periodicals; over 30,000 Tsinghua University dissertations and theses; and 70,000 microforms. In addition the library has special collections of antiques and rubbings from inscriptions on ancient bronzes and stone tablets; it also contains manuscripts and videotapes donated by faculty members, staff, alumni, and others.

An advanced information infrastructure has been established. The CD-ROM network provides students and faculty with the literature and information searching services via the campus network. An increasing number of electronic resources and virtual resources have been made available in the library or online. Tsinghua University's virtual library is a network of information databases including approximately 42,000 full-text e-journals; over 350 electronic databases; more than 920,000 e-books; more than 35,000 multimedia collections (not including online databases and Internet resources). The system supports the university's goal of becoming a world-class institution.

Tsinghua University Information Network Engineering Research Center was established in June 1994 as an engineering research entity that includes Computer Science and Communication. The center has completed "Sample Project of CERNET (China Education and Research Network)" which was undertaken jointly by Tsinghua and nine other well-known Chinese universities. The first CERNET in China to adopt the TCP/IP system structure was also established here; its aim was to provide a common communication platform for information exchange, scientific computing, and international networking for China's universities and schools. The center served as an important base for the state computer and Internet technology research.



Fig. 3 Tsinghua University Library, Beijing.

Subject librarian system. Tsinghua University Library has a Reference and Information Service Desk at the main hall of the new building in order to provide assistance and advice to individual library patrons. In addition to helping the faculty and students make better use of library resources, the librarians have also attempted to strengthen ties between library and academic departments through "Subject Librarian System," which was begun in 1998. Since then, every academic department has appointed a departmental library coordinator to keep the library apprised of the needs of the department. The subject librarians have academic credentials related to the discipline of the department which they serve. The responsibilities of the subject librarians include:

- Offering training programs to new faculty and new students in March and September of each year.
- Conducting customized workshops on library utilization for their department.
- Introducing new information resources and new services to their department.
- Collecting and introducing useful Web resources for their department.
- Soliciting information in regard to the needs of their department for journals, books, electronic resources, and services of library.

Public Libraries

The public libraries of cities, counties or districts, and villages are all supervised by the Ministry of Culture. They play an important role by enabling Chinese citizens to obtain cultural and educational information as well as meeting the needs of economic construction and scientific research. Some function as research libraries. Organizationally, public libraries are under the Ministry of Culture and are not centrally controlled except for the NLC. They are mainly self-governed and self-financed through the Bureau of Culture of their respective governmental level. At the local level, this consists of provincial regulations characterized by regulations of the operations and organization of libraries in cities, counties, towns, and villages.

For the year 2005, Tables 1–3 provide an example of the number of public libraries and the size of their collections and staff. Table 1 gives the total number of libraries, staff, and collection at the national, provincial, municipal, and counties level in China. Tables 2 and 3 provide examples of major municipal and autonomous regions/

Table 1 Chinese public libraries 2005.

Categories	Number of libraries	Staff	Collection
National	1	1,372	25,050,000
Provincial	38	7,706	143,555,000
Municipal	338	12,704	120,548,000
Counties	2385	28,641	191,407,000

Source: From Ref.^[49]

Table 2 Major Chinese municipal public libraries 2005.

Municipality	Number of libraries	Staff	Collection
Beijing	25	1219	11,214,000
Chongqing	43	755	7,675,000
Dalian, Liaoning	12	461	4,675,000
Ningbo, Zhejiang	12	228	2,641,000
Shenzhen	8	444	4,464,000
Tianjin	32	1057	8,694,000
Qingdao, Shandong	13	267	3,294,000
Xiamen, Fujian	8	153	1,925,000

Source: From Ref.^[49]

provincial libraries with the number of libraries, staff, and collection.

Official statistics for township and village libraries (rural libraries) do not exist; however, scattered evidence seems to indicate that this particular class of libraries expanded greatly. In Hunan Province, the number of township and village libraries grew from 1,800 in 1985 to 14,000 in 1997.^[15] Starting in the 1980s with the surge of economic reforms, public libraries at all levels regarded economic development as the main feature in their work. For example, in rural libraries, public libraries collected and published works on the production technology of planting to be sent out to peasants. These public libraries delivered books by bookmobile or mobile book store and set up service points for circulating books.

Shanghai Library

Established in 1952, the Shanghai Library is the second largest public library in China, next to the NLC. In 1995 the Shanghai Library merged with the Institute of Scientific and Technical Information of Shanghai (ISTIS) (*Shanghai Kexue Jishu Qingbao Yanjiusuo*). In 1996, the

Table 3 Major Chinese autonomous regions/provincial public libraries 2005.

Location	Number of libraries	Staff	Collection
Anhui	88	1217	8,474,000
Fujian	84	1110	12,735,000
Guangdong	129	3252	31,194,000
Hebei	153	1690	13,071,000
Heilongjiang	96	1669	12,910,000
Henan	136	2742	14,292,000
Hunan	120	1963	16,665,000
Inner Mongolia	110	1776	7,435,000
Jiangsu	103	2363	31,785,000
Liaoning	126	2888	23,256,000
Shaanxi	111	1691	8,870,000
Shandong	145	2690	27,464,000
Sichuan	141	1869	20,023,000
Tibet	4	62	421,000
Qinghai	43	365	3,242,000
Xinjiang	96	951	8,174,000
Yunnan	149	1661	13,709,000

Source: From Ref.^[49]

new institution moved to its new quarters on Huai Hai Zhong Lu. It is now a comprehensive research library as well as a public library. The Shanghai Library together with the ISTIS has holdings of approximately 51 million items. The location covers 3.1 hectares of land, with a floor space of 83,000 m². The architectural design comprises of two towers connected by a glassed-in-walkway; the taller tower is for sci-tech holdings, the other for social sciences and humanities. Within the social sciences-humanities building is a glass-enclosed atrium crisscrossed by escalators leading to different floors (Fig. 4).

The merger of the Shanghai Library and the ISTIS has established the Library as a center of information resources, an information clearinghouse, and as a center for lifelong literacy. After reorganizations, a new three-dimensional model of services has emerged:

1. Service to the general public—The Library's public services include, reading and lending, reference service, public lectures, exhibitions, and cultural meetings. The policy is to have the Library open to everyone (people outside the city can get a temporary pass with an ID card) and open everyday. The Library maintains 21 local branch public libraries (they share the same circulation system and overall resources). The Shanghai Library has a municipal network of four-level public libraries: 33 district libraries, 215 community/township public libraries, and thousands of local/village reading rooms. In addition, the Shanghai Library serves as a coordinator among all kinds of

libraries and information services in the city; there is a consortium of 60 research libraries. This is an indication of the role of the Library's mission to reach out to the people.

2. Service to the research community—Reference service for the city's social and industrial development is provided by both the Shanghai Library and ISTIS. With the Institute's over 100 specialists in various scientific and technical subjects, the Library has organized information research think tank projects for the industrial and technical community.
3. Service to the city government and legislature—Since 2001, the Library has successfully served the city government and legislature, by producing bulletins in two series: General and Technology. This enriched service has been well received because of the information on city development, comments from noted experts, and new trends in world economy and technology. Since the service was so well received, the government has assigned the Library numerous research projects.

The library's mission is to pursue excellence through service. The library has a user-centered policy and sponsors outreach activities to the public. Through their combined collections, the Shanghai Public Library and the ISTIS respond to the educational, social, and industrial needs of the city. The historical documents in the collection include 100,000 manuscripts and letters, approximately 5,400 local records dated before 1949, 18,000 titles of



Fig. 4 Shanghai Library, Shanghai.

genealogical files (342 family names), 150,000 pieces of epigraphs and rubbings, and 1.7 million ancient books (25,000 titles amounting to 170,000 volumes are rare editions). There are more than 50,000 letters, diaries, inscriptions, pictures, and rare documents from famous people of the late Qing Dynasty; and many of these items are being digitized. Materials in the collection range from ancient artifacts, such as those described above, to the latest technical reports, patent files, sound and video recordings, and digital databases. As many as 1 million books are displayed in its 25 reading rooms and open stacks.

With the twenty-first century being the information era, Shanghai Library is giving priority to the building of a digital library. Nine digital reference services have been established: Shanghai Classical Pictures, Shanghai Classical Texts, Music Station, Ancient and Rare Books, Books of the Republic of China (1911–1949), Database of Index of Papers presented at Chinese Professional Conferences, Chinese Newspapers and Periodicals, Foreign Periodicals, and Science and Technology Garden.

School Libraries

After 1949, the development of school libraries became a priority of the Chinese government. School libraries together with academic libraries were under the Ministry of Education (from 1985 to 1998 called the State Commission of Education). Between 1949 and 1965, the number of school libraries multiplied in every province, region, and municipality. In 1989, the State Commission of Education held a national conference on school libraries and a Preparatory Committee for the National Association of Primary and Secondary School Libraries was formed to oversee their development at the local level. In 1991 the Committee issued an official document, *Regulations on School Libraries*. Since then, each province has issued its own provincial rules in accordance to its specific local conditions.

In addition to libraries managed by cultural and educational departments of the central and local governments, there were libraries and reading rooms for children run by Trade Unions. It was estimated that in 1989, there were more than 200 children's libraries or reading rooms established by neighborhood service centers in Beijing, Tianjin, and Shanghai. Also book dealers had set up private libraries, reading rooms, and lending deposit stations to provide an important service to children living in rural areas, in the expectation that the Ministry of Culture and other departments would provide support to these new libraries and help train librarians. Taken as a whole, the development of the school libraries was uneven. There were great differences in areas, given the economic, cultural, and educational level of developments. Over 80% of those schools that had libraries were chiefly located in large and medium-sized cities along the coast. In the economically backward areas of the West, with a low level of education

70% of the schools had not yet established any libraries. This uneven distribution of service was one of the major problems in the growth of school libraries in China.

In China there are also primary and high schools belonging to universities. In May 2007, author visited Xibei University (Xian) Elementary School library and interviewed Headmistress Sun Shu Min. At Xibei University (Xian), there is a provincial university primary school with 1600 students whose families are members of the faculty and staff of the university; others from the province who wish to enter were tested and carefully selected. According to Sun Shu Min, the school's goal was to emphasize reading ability. Each month there was a contest to see which class read the most books, and a prize was awarded to the winning group. On each of the four floors of the school there was a reading corner where students could sit and read various children's magazines. Other incentives to encourage reading are the regular reading discussion groups and parent–teacher conferences. Since 2000, an electronic room was also being used for classes; it was there students learned to use the computers. The annual library budget was approximately 20,000–30,000 yuan in 2007, emphasizing the purchase of electronic books. There was an audiovisual room which included a television set, videos, a language lab, and other facilities. However, the library had no set hours and there was only a part-time staff member to maintain the collection.

Special Libraries

Prior to 1949, research in China was mainly conducted in universities. After the establishment of the new government, it reorganized scientific research according to the Soviet system, which meant that the sole function of universities was teaching. From then on, research was to be carried out in specialized units such as the Chinese Academy of the Sciences (*Zhongguo Kexueyuan*) and Chinese Academy of the Social Sciences (CASS) (*Zhongguo Shehui Kexueyuan*). To support research, special libraries were set up under the jurisdiction of the government agencies and institutions: libraries of the Academy of Sciences (natural sciences) and libraries in the respective research institutions under the academies. There were also libraries in the various ministries or commissions of the government such as the ministries of geology, medicine, agriculture, and industry as well as their numerous branches. As examples of such libraries, two of the research units of the Academy of Social Sciences Library will be discussed: the Institute of Law Library (ILL) and the Institute of West Asian and African Studies Library.

Chinese Academy of Social Sciences (CASS) Library Center for Documentation and Information

In May 2007, the author visited the Chinese Academy of Social Sciences Library and interviewed Jiang Ying,

Deputy Director of the library. The CASS was founded in 1977; prior to that time, CASS evolved from the Research Division of Academic Information, Department of Philosophy and Social Sciences under the Chinese Academy of Sciences in the late 1950s. The Division was later named Division of Academic Materials. From the Division, the Institute of Information of the CASS was founded in 1977. In October 1985, the Center for Documentation and Information (CDI) emerged as a result of the amalgamation of the Institute of Information and the Materials Division. In 1994 the Chinese Academy of Social Sciences Library (CASS Library) (*Zhongguo Shehui Kexueyuan Tushuguan*) was founded. A new library building was constructed in 2002, covering an area of 18,000 m². The CDI (*Wenxian Qingbao Zhongxin*) is a part of the CASS Library.

The CASS Library has not only applied the most advanced computer and network technologies for researchers in the institutes but also for other scholars. However, the CASS Library is not open to the general public. The library collects, catalogs, shelves, and loans primary documents for researchers in the humanities and social sciences. The emphasis is on collecting in the areas of economics, sociology, and international studies. The collection is almost evenly divided between Chinese and English language materials. The CASS Library has approximately 5,000,000 items; this includes 2.4 million volumes (journals and books), covering all areas of the humanities and social sciences in more than 40 languages. Other items in the collection include:

- Thread-bound ancient books 650,000 vols.
- Paperback books 880,000 vols.
- Foreign books 410,000 vols.
- Academic degrees theses 100,000 vols.
- Bound-volumes of newspapers and periodicals 300,000 vols.

In the early 2000s, the collection consisted of 1800 Chinese and 900 foreign language periodicals, in addition to 1780 literary journals published from 1919 to 1949.

A series of CD and online databases are also available; they include: Bibliographic Database of CASS and Database of Citations of the Humanities and Social Sciences in China; Full-Text Database of the People's Daily for over 50 years; Full-Text Database of Duplicated Newspapers and Journals of the Renmin University of China; Gale's (United States) Database of Full Texts and Abstracts in the Social Sciences, and 13 other databases of OCLC. The budget has grown to accommodate the need for electronic resources. In 2007, the budget for electronic resources was 2,000,000 yuan as compared with 8,000,000 yuan for books. CASS actively engages in exchanges with institutions and academic organizations in Russia, United States, Great Britain, France, Germany, Holland, Finland, Japan, R.O. Korea, Vietnam, Israel, Taiwan, Hong Kong, and Macao. Annually foreign books acquired through

exchanges account for 20% of the total acquisition of foreign books.

Institute of Law Library (ILL) of the CASS

In May 2007, the author visited the ILL of the CASS and interviewed Zhang Qun of the Institute of Law. Established in 1958, the ILL (*Faxue Yanjiusuo Tushuguan*) of the CASS is considered the preeminent law library in China. The Library's collection was mainly acquired from three sources:

1. Tsinghua University in 1958 when universities were restructured.
2. The Legal Bureau of the State Council and the Legal Press in 1959.
3. Donations of nationally and internationally famous jurists.

After 1959 the Library has grown through purchase, exchange, and donations, becoming the largest and most comprehensive legal library in China.

In 2007 the total area of the Library was approximately 1127 m². Eight hundred thirty-five square meters were used for Chinese books, books in western languages, Japanese books, ancient books, journals, and newspapers. The reading rooms occupied 210 m², including separate reading rooms for newspapers (Chinese and foreign languages), reference books, Chinese data, electronic data, and catalogs.

The law collection includes theories of law and various branches of legal sciences. The main emphasis is on legal history, laws and regulations from various countries, and international and domestic literature on every aspect of law. At the end of 2001, the library's holdings contained 385,000 titles; of the 177,000 Chinese books, there were 38,227 ancient legal books and documents, of which 2,795 were rare and solely existing copies. In addition, the library holds over 60,000 foreign language works, including books in English, Japanese, Russian, French, German, and many other languages.

In this foreign language collection there are a large number of modern Japanese legal texts and materials on human rights in English. The library also has 25,000 journals (17,000 in Chinese and 8,000 in foreign languages). The collection also includes 24,193 pages of English books on microfilm, as well as 110,000 Chinese newspaper clippings on law. In 2006, the budget was 600,000 yuan, which was mostly spent on printed books. Few foreign books were purchased because of the high inflationary rates. Even the purchase of e-journals became difficult, therefore, the CASS database network was utilized.

The library provides various services to the legislative, administrative, and judicial sections of the state, the legal practitioners and law school professors, and students, but it does not offer interlibrary lending services. There were

eight professional staff in the library, five had library science degrees, and three had law degrees.

Institute of West Asian and African Studies Library of the CASS

The Institute of West Asian and African Studies Library (IWAASL) (*Xiyafeizhou Yanjiusuo Tushuguan*) of the CASS, established in 1981, is considered the best library in African collections in China. In May 2007, the author visited the IWAASL of the CASS and interviewed Chen Hong, Librarian and Chen Yulai, Deputy Director of the Center of Southern African Studies of IWAAS. There are more than 20,000 books, one-half relating to the Middle East and the other half to Africa. The library subscribes to over 100 Chinese journals, as well as more than 100 English and a few French language journals. Most of the budget is spent on foreign journals (70%), with few books purchased from overseas. The remaining 30% is for Chinese newspapers and some Chinese books. The library subscribes to no overseas newspapers, due to high costs. The budget was little more than 300,000 yuan in 2007.

Ms. Cheng Hong, librarian of the IWAASL, created several magazine and book databases for IWAASL:

- The Chinese academic journal database, which is an index for articles relating to the Middle East and African studies.
- The database for Western language magazine articles on Middle East and African studies, began in 1983, which includes indexing and some abstracts.
- Full-text databases for Chinese articles began somewhere between 1990 and 2001.
- The book database which includes abstracts of books published in China and abroad on the Middle East and African Studies.

The CASS database network contains other works not found in the IWAASL. The Institute has a separate room with compact shelving for the 20,000 plus collection. The materials are shelved in two sections, Africa and the Middle East, with half of the materials in Chinese in each area.

Digital Library Collections and Services

During the past decade, the information infrastructure of China has expanded greatly. According to the China Internet Network Information Center (CNNIC) Survey, June 30, 2007, there were 162,000,000 Internet users and 1,311,600 Web sites. A majority of the Internet users live in the capital and coastal cities, which is where the major universities and scientific research institutions and industries are located; these cities are also centers of research and development activities. With increased access to the Internet, the development of digital libraries in China has become a priority and a significant component in the

national information infrastructure. Digital libraries in China are defined as

research institutions where computer specialists and content service providers focus on technology improvements for digitizing, organizing, distributing, preserving, retrieving, and searching data, or as projects with practical applications designed to create digital collections or provide digital library services.

After the 1996 IFLA Conference held in Beijing, the first national level digital library project in China, the National Pilot Digital Library Project (NPDLP) was initiated in 1997 by the Ministry of Culture and the State Planning Commission. The NPDLP included the NLC and five large public libraries (the Shanghai Library, Liaoning Library, Nanjing Library, Zhongshan Library, and Shenzhen Library). The project's aim was to experiment a digital system of collaboration and resource sharing with participants. Since 1998 many additional research and development projects related to digital libraries have been launched by universities (under the Ministry of Education) and by the science and technology research institutes and the Chinese Academy of Sciences.^[16]

Chinese National Science Digital Library (CNSDL)

The CNSDL began in 2001 and was part of the Knowledge Innovation Project of the Chinese Academy of Sciences. The primary goal of CNSDL was to build a national information resources and management system that would provide a document delivery and interlibrary loan service system accessible from every scientist's desktop in China. CNSDL has also constructed several Chinese scientific literature databases with more than 1 million records, covering major topics in chemistry, biology, physics, mechanics, optics, mathematics, astronomy, geography, and computer science. CNSDL provided more than 10,000 full-text foreign scientific magazine and other virtual reference services.^[17]

China National Knowledge Infrastructure (CNKI)

Established in 1996, the CNKI is a significant national e-publishing project in China. This project was founded by Tsinghua University that developed the Tsinghua Tongfang Knowledge Network Technology Company. The CNKI full-text databases reach out not only inside China, but also globally, covering resources such as journals, newspapers, dissertations, proceedings, yearbooks, reference works, and others. CNKI has been a great encouragement for Chinese libraries to digitize as well as to aid researchers. As of 2006, the CNKI academic databases have served more than 5500 universities, public libraries, and other research institutions.^[18]

World Digital Library (WDL)

Developments in digitization are progressing in China. On November 2008, the LC signed an agreement with the NLC to collaborate in developing the WDL, which included: to provide content to the WDL in such areas as the development of the Chinese-language interface; to set up international working groups to plan the project; and to establish an advisory committee of leading scholars to suggest major collections relating to the Chinese culture and history in the WDL. Signing took place between Zhan Furui, General Director, NLC and James Billington, Librarian of the Library of Congress. The goal is to digitize important primary Chinese materials, including manuscripts, maps, rare books, musical scores, recordings, films, prints, photographs, architectural drawings, and many more; to provide important resources on the Internet to scholars; and to promote international understanding.

The background to the WDL began in October, 2007, when the LC and other institutions around the world, in collaboration with the United Nations Educational, Scientific and Cultural Organization (UNESCO) presented a prototype of the future WDL. Major institutions participating in the WDL included Brazil, Egypt, Iraq, Israel, Russia, Serbia, and Sweden; also included were the U.S. National Archives and Records Administration, the John Carter Brown Library, and the libraries of Brown and Yale Universities. The project is to be launched in April 2009.^[19]

Peking University Library (PUL) Providing Virtual Reference

PUL has been in the forefront of the development of a modern digital library. When the library launched its virtual reference service in 2002, it adopted OCLC's QuestionPoint, a collaborative reference system using technology that can handle the complexities of the Chinese language and easy to use. Question Point allows libraries to reach out to patrons, instead of waiting for the patrons to come to the library to ask questions. PUL has a well-trained reference staff and has developed clear guidelines and effective implementation plans. Question Point has an interface that enables libraries to offer online reference services locally and to refer questions to libraries locally, regionally, or globally.

Since 1998, PUL Library has served as the administrator of the CALIS, which includes over 60 academic libraries as members; these members collaborate within China to share cataloging information and library resources. In 2007, collaboration in digital reference service was limited, since only five CALIS members used Question Point; these libraries included Peking University, Tsinghua University, Shanghai Jiaotong University, Sun Yat-Sen University, and Beihang University. In the future CALIS

would like to plan its own collaborative digital reference system for academic libraries in China.^[20]

Digital library projects in China continue to be developed. The concept of a digital library was first introduced in China at the IFLA Conference in 1996, which was held in Beijing. China has made much progress, but more remains to be accomplished.

Library and Information Science Education

Formal library training in China began in 1920 when a program was set up at Boone College, jointly founded by Mary Elizabeth Wood, Shen Zhu Rong, and Hu Qing Sheng. However prior to 1949, the development of library education was limited, due in part to the turbulent political situation. With the establishment of the PRC the entire concept of library service changed. The new government sponsored a great expansion of libraries as well as reconstruction of facilities that had been destroyed during the Japanese occupation and the civil war. The number of libraries grew from 400 in 1950 to more than 33,000 in 1958. To meet the growing demand for library personnel in the 1950s a new library education system was set up following the Soviet principle of dividing libraries and information services into two separate systems where by library study was a part of *literary* study and information science was regarded as the study of *science*. This separation between library and information science later turned out to be impractical.

The Department of Library Science at Peking University was created in 1949 and 3 years later the Boone library school was absorbed by Wuhan University, where it became a department of library science. At first Wuhan and Beijing both operated junior college level programs that offered high school graduates 2 years of professional training; later the programs were extended to become 4-year college degrees. However, in the 1960s the Cultural Revolution disrupted China's educational programs and formal education was halted. Universities did not resume regular instructions until the late 1970s.

College-level library education also became an important component in the library and information education system in China. Wuhan and Peking universities both had two divisions: one specializing in the humanities and social sciences and the other in science and technology. Students could enroll in a 4-year college program with a bachelor's degree and a 2- or 3-year certificate programs. Graduates of this degree program spent equal time in professional training and in other courses, such as liberal arts, social science, law, or computer science offered by other departments.

Beginning in the early 1980s, the entire political/education ideology in China shifted to a more pragmatic and open policy. Economic reform to further modernization became the rallying cry of the 1980s, and it soon became apparent that well qualified librarians and information

specialists were urgently needed. In 1979, the first 3-year master's program was created at the Departments of Library Science at Wuhan and Peking. In 2007 there were 18 institutions offering master's degree—9 were accredited to grant M.A. degrees in library science and the other 9 eligible to grant an M.S. degree in information science. Entrance exams were required for graduate education and general higher education. Students spent approximately one-third of the total course hours in internship and conducting research projects, and about the same number of hours in writing a thesis during the third year.

Since 1984, there have been other graduate programs which required only 2 years of course work and no thesis. Between the years 1978 and 1993 there have been approximately 700 graduates, primarily in the master's program. As of 1986, 18 of the government-recognized comprehensive universities had library and information programs, with more than 2000 new students enrolled annually. In 1989, there were 50 institutions that had developed departments with specialized programs for formal library and information courses.

The rapid growth of information industry has challenged educational institutions to update their curriculum and expand their teaching programs to meet new needs. In 1991, Ph.D. programs were first introduced at Wuhan and Peking universities and the following year the Department of Library Science at Peking University changed its name to Department of Information Management. The 3-year doctoral program at Peking University consists of coursework and a dissertation. In 2007, there were four institutions offering Ph.D. degrees: Peking University and the Chinese Academy of Sciences were qualified to confer the Ph.D. in library science, while Wuhan and Nanjing Universities were allowed to grant the degree in information science.

Informal education has developed rapidly and provided opportunities to deliver library and information education in remote regions such as Xinjiang and Inner Mongolia. These programs were offered to adults who had no formal degrees but worked in the library and information fields. Three types of programs were available: correspondence programs, television programs, and in-service training. The Ministry of Culture and the Ministry of Education declared that upon completion of the required courses, students could earn a college diploma or certification. The programs differed little from the formal 3-year certification education.

Night and "Spare-time" Schools, Workshops, and Seminars organized in metropolitan areas offer library education to tens of thousands of experienced library workers who lack formal education, but wish to take advantage of the opportunity to gain the basic knowledge of the library profession. The NLC set up the Sparetime Workers' College and Nanjing Normal College set up the Night College of Library Science. Conferences, workshops, and seminars were organized within libraries and others were held

jointly with the China Society of Library Science (CSLS). This has resulted in a great improvement in the quality of personnel.

Professional Associations

The LAC founded in 1925 was an important force for library reform during the 1920s and 1930s. In 1949, LAC moved with the Nationalist government to Taiwan and was inactive until November 1953 when it was reconstituted in Taipei.

In China there were no professional societies for 30 years. It was only until the "opening up" of China in the late 1970s did various professional societies reemerge. In 1979 The China Society for Library Science (CSLS), *Zhongguo Tushuguan Xuehui*, was established. Soon after international and bilaterally organized seminars were presented in China: a UNESCO-sponsored seminar was held in Beijing on the topic of automation and how to access databases. Seminars were organized by the CSLS with international agencies. International viewpoints were exchanged and discussed.

Though China was one of the founding members of IFLA (1927) it was not active in IFLA for many years due to war, political unrest, and the Taiwan issues. Slowly as China regained its membership in UNESCO, CSLS returned to IFLA in 1981.

As of 2000 the CSLS had 10,000 individual members and 47 institutional members. The CSLS is an affiliate institution of the NLC and a national association on librarianship under the joint leadership of the China Association for Science and Technology (CAST) (*Zhongguo Kexue Jishu Xuehui*) and the Ministry of Civil Affairs. Its functions as a liaison between the Government and librarians; it also has the status of a national nongovernmental and nonprofit organization. CSLS is a member of the China Association for Science and Technology and a consultative body of UNESCO. The CSLS guidelines and policies as set up by the state are to promote and contribute to the development of librarianship for the purpose of modernization. Its principle responsibilities as stated in the Constitution are to promote library science research; in addition the society has conducted seminars and training classes on particular topics. General membership meetings are held every 5 years.

A core national library journal sponsored by the CSLS and the NLC is the *Journal of Library Science in China*, JLSC (former name was the *Bulletin of the China Society for Library Science*, 1979–1990). JLSC presents the theoretical and practical results of research and development by professionals, professors, and students in the field. Since the establishment of CSLS, the number of professional journals has been growing. More than 50% of library and information journals published in China originate from library societies at the national, provincial, and municipal levels.

The English name of CSLS was changed in 2005 to the LSC. Annual meetings are conducted. At the 2007 annual conference in Lanzhou, Gansu Province, China, LSC invited members from the ALA and Chinese American Librarians Association (CALA), an affiliate of ALA, to participate. The main theme of the conference was “The Library: New Environment, New Changes and New Development.” Barbara Ford, former president of ALA, Director of the Mortenson Center for International Library Programs at the University of Illinois at Urbana-Champaign participated in the seminars. More than 50 presentations were conducted and over 20 discussion panels were conducted. Approximately 300 attendees from all over China came to the conference. The forums were very successful and the speakers were all well-known in their fields; it provided a learning exchange with Sino-American librarians.

After China’s return to IFLA in 1981, its activity with IFLA has promoted programs beyond its national boundaries. International exchanges, cooperation, and relationships with foreign library associations have all developed. In 1996, the 62nd IFLA General Conference was held in Beijing. The theme of the conference was the Challenge of Change: Libraries and Economic Development. The IFLA Conference gave librarians all over the world an excellent chance to exchange ideas and explore librarianship in China.

Other significant organizations for information professionals include the China Society for Scientific and Technical Information (CSSTI) (*Zhongguo Kexue Jishu Qingbao Xuehui*) and the Chinese Archives Association (CAA) (*Zhongguo Dang’an Xuehui*). The CSSTI was founded in 1964 and was a part of the CAST. CSSTI was a nongovernmental organization of science and technology professionals and its mission was to promote the development of information science and its services; to serve science, technology, and economic construction in China; to edit and publish information in books and periodicals, and to strengthen international academic exchanges.

ARCHIVES AND ARCHIVAL SCIENCE

The responsibility and overall direction of archival work in China reside in the State Archives Bureau (SAB) (*Guojia Tanganju*) which was established in 1954 under the State Council, the highest executive organ of the PRC. The main principles of archival work in China are to administer national records, to protect the safety of the records, and to facilitate the work of the state by making archival documents available. In other words, the role of the archives is to serve the priorities of the state. The main emphasis in Chinese archival study is on the dissemination of select documents centered on historical themes considered by archivists and historians to be significant in Chinese history.

Legislation

In 1987, the Archives Law was adopted by the Standing Committee of the National People’s Congress and enacted on January 1, 1988. It defined the establishment of archival administration and records department, the collection, utilization, and protection of archives. The Archives Law of the PRC allowed, but did not require, that records in state archives be opened to researchers 30 years after their dates of origin. Economic, scientific, technical, and cultural records may be opened earlier. Records that are highly confidential may be restricted up to 50 years or longer. The law also requires that records must first be processed, arranged, and described before they may be opened for consultation. The function of the SAB is to outline broad archival policies and principles for the entire nation, and to work in consultation with each national-level ministry to devise and institute archival management, records management, and records disposition guidelines for use by archival repositories at every level. Below the National SAB are archives bureaus at the provincial, municipal, and county levels.

Chinese Archival Classification

The Chinese Archival Classification (CAC) together with the Chinese Thesaurus for Archives and the Cataloging Guidelines for Archival Descriptions were first published in 1987 under the auspices of the SAB; a second edition appeared in 1997. Because classification schemes based primarily on subjects are not considered suitable for archives, the administrative structure of the government is used as the basis for archival classification schedules. The CAC has been adopted by archival institutions at all levels in China.

Archive Management Bureaus and Archival Repositories

It was reported in 1992 that there were more than 3400 archive management bureaus and more than 3500 archival repositories in China. What ties all these diverse entities together is the role of the SAB in Beijing and archives bureaus of the provincial and local governments. The role of the SAB is to create general archival policies and principles for the entire country, and in consultation with each national-level ministry to disseminate archives management, records management, and guidance for disposition of records for archives bureaus or archival repositories at all levels. The provincial level archives are responsible for the acquisition and preservation of local records. They function and receive guidance from the SAB. The SAB not only implements regulations and archival records management, but staff members go out to provincial archive bureaus to review, offer advice, and offer suggestions in improving local applications. Archival

repositories differ from archival management: the latter is concerned with policy management and the former with care and service. There are two kinds of repositories, comprehensive archives and specialized archives. Each performs at different levels, be it national, provincial, or local. A comprehensive repository houses all kinds of records from different units in a geographic area and a specialized repository is limited to keeping records in a special medium, for example, motions pictures, photos, audio and video recordings.

National Archives

The national archives in China are The First Historical Archives (in Beijing) and Second Historical Archives (in Nanjing). They are directly under the SAB. The Central Archives (in Beijing) contains contemporary records and those relating to Communist party history, and is directly subordinate to the State Council.^[21]

In May 2007, author visited the first Historical Archives of China in Beijing and interviewed Zou Ailian, Director. The First Historical Archives in Beijing was established in 1925 and was also known as the Ming-Qing Archives or the Palace Museum Archives; it was the most important historical archives in China for the pre-1912 period. The collection consists of records of the central governments of the Ming (1368–1644 A.D.) and Qing (1644–1911 A.D.) dynasties; it holds over 10,000,000 items (jian). Published reports estimate that more than 317,000 items in the First Archives collection were from the Manchu (Qing dynasty). There were at least 10 catalogs for different types of Manchu documents which have been made available to researchers. They contain valuable research materials on military affairs and relations with Mongolia, Tibet, and Xinjiang. The Archives have been used heavily by Chinese and foreign scholars. An extremely useful guide was published by the archives under the title *Collection of the First Historical Archives of China*, 1985 (*Zhongguo Diyi Lishi Dang'An Guan Guancang Dang'Angaishu*). Scanning, microfilming, and photocopying are available.^[22] There were 14 Divisions, 170 full-time staff, and 100 part-time employees in 2007. The Archives, since 1975, is housed in a modern building; 10% of its records are digitized. It is under the SAB.

The Second Historical Archives of China (SHAC) in Nanjing was the first archive to be established after the founding of the PRC. It is also under the administration of the SAB. The collection consists of original records of the previous central governments and their subordinate organs (Republic of China, during the 1912–1949 period). The Second Historical Archives was formally opened to scholarly inquiry in 1980; it now has state-of-the-art storage facilities, preservation programs, cataloging systems, and retrieval capacities. SHAC has five departments: 1) Archive Processing and Cataloging Department; 2) the Conservation Department; 3) the Public Services

Department; 4) the Technical Department; 5) the Computing Center; and 6) the Compilation Department. The aim of the SHAC is to collect, arrange, catalog, preserve, compile, and facilitate the use of the holdings of the Archives. The Archives are equipped with microfilming, photocopying, and computer technologies. Various types of finding aids are available. The SHAC has led the way in redefining the nature of a state archive by extending their holdings well beyond those of formal government bodies; the SHAC collection now includes papers of Republican-era institutions such as the private industrial companies, banks, and educational institutions that had been nationalized either during the Guomindang period or the early years of the PRC. By the end of 2000, the records of the Republican governments (and their subordinate organs during the 1912–1949) were estimated to comprise 1,800,000 files in more than 900 classes (Fig. 5).

The bulk of the holdings in the SHAC is made up of official documents; also included are photographs, medals, seals, currencies, postal stamps, trade marks, geographical handbooks, paintings, and calligraphy. These items are useful for historical research and verification of historical artifacts. Since SHAC was opened to the public in 1980, it has been used by approximately 300,000 researchers who have consulted more than 1 million files; these users are from China and abroad (Taiwan, Hong Kong, the United States, Japan, the United Kingdom, France, the Netherlands, and Germany). To make records more accessible to the public, the SHAC staff have published more than 50 different compilations of primary sources. The SHAC also publishes the journal *Republic Archives* relating to historical sources held at the archives.^[23]

Provincial Archives

The archives of provinces, autonomous regions, and municipalities take their directions from the respective provincial, regional, or municipal governments. While the SAB offers advice, it does not manage or administer the local archives. An example is the Sichuan Provincial Archives (*Sichuan Sheng Dang'an Quan*). In May 2007, author visited Sichuan Provincial Archives in Chengdu and interviewed Feng Shaocheng, Director of Circulation. The Sichuan Provincial Archives was established in 1966, but it was dispersed during the Cultural Revolution; it resumed activities in 1979 and moved into a new building in 1988. The total collection consists of approximately 1.3 million files, making it one of the largest provincial archives in China. The emphasis is on the Qing Dynasty, the Republican and contemporary periods as it relates to Sichuan. All of the documents of the Qing Dynasty are on microfilm, but as of 2007 documents from the Republican and contemporary periods had not yet been microfilmed. The Sichuan Provincial Archives does not collect any new materials on Chongqing (in 1990, Chongqing became a separate administrative district directly under the national



Fig. 5 The Second Historical Archives of China, Nanjing.

government of China, therefore, is no longer part of Sichuan) or any separate files on warlords and military matters. The Ba-xian county archives during the Qing period (1644–1912) are the most comprehensive collection of its kind of any county in the country, and records of the Sichuan Railway Protection Movement of 1911 archives are considered especially valuable. Select official documents of the former province of Xikang during the Republican period (1930s–1940s) are also available. (Xikang was merged with Sichuan following the founding of the PRC in 1949.) Also available are a limited collection of Western language files, including 136 files of documents of the French Consulate in Chengdu from 1908 to 1949 and the 872 files of English language documents of the Chongqing office of the Chinese Maritime Customs Service, 1891–1949. Sichuan Provincial Archives has published a very comprehensive 759 page guide to its collection. The majority of visitors are professors and graduate students from Sichuan. Some of the archival documents have been locally scanned and it may take several years more to digitize all the materials. It was agreed that to preserve the archives, digitization was the answer and they were moving in that direction. The Archives hoped to integrate all the archives into a national system. There was a card catalog which was organized by topics.

Religious Archives

A special repository which should be mentioned is **The Archives on the History of Christianity in China** at the Hong Kong Baptist University Library, Hong Kong.

The Archives was established in 1996 to serve as a research center in Asia for scholars. The collection covers both primary and secondary English and Chinese language source materials concerning Chinese Christians, missionaries stationed in China, church history, and other materials pertaining to the history of Christianity in China. There are over 3,400 volumes of correspondences, diaries, manuscripts, monographs, and serials, as well as over 31,000 microform items. The extensive microform collection was a result of the generosity of a 3-year \$120,000 grant from the Henry Luce Foundation. There are hundreds of biographies and memoirs in the Archives. For the period between 1950 and 1970 there were newspaper clippings on the history and development of religions in China. In addition, a digitization project on *China through the Eyes of CIM (China Inland Mission) Missionaries* database was completed. The database includes 225 lantern slide and glass plate negative images of portraits, landscapes, scenery, and architecture in China as well as photos documenting the socioeconomic activities of the Chinese from the 1900s to the 1930s.^[24]

China's Archival Education

Since 1949 Chinese archival education has been regulated by the state. There are archival training programs in secondary schools, colleges, postgraduate institutions, as well as in-service training, adult education, correspondence courses, and television courses. In 1992 there were approximately three dozen Chinese institutions of higher learning offering archival education courses, with a full-time faculty of 500 and over 7000 students enrolled. Sixty

secondary schools offered archival service training and in 1992 there was a total enrolment of more than 1000 students at that level. In-service training from the provincial level to the Archival Administrators' Education Centre in Beijing offers courses to thousands of mid-level and higher-level archivists. The SAB, the Ministry of Education, and the Chinese Archives Society were all involved in archival education.

China People's University

At the China People's University (Renmin Daxue), the Archives College, a teaching and research center, was established in November 1952; since then Renmin has been the leader in China's archival education. Located in the western suburbs of Beijing, the College was designed to train professionals engaged in archival work. It also trained faculty to teach archival science. The Archives College has a faculty of 54, including 30 professors and associate professors. The 4-year undergraduate curriculum offers majors in three areas: archival science, administration of scientific and technical work, and archival preservation. The 3-year graduate studies program offers concentrations in archival science and in the history of Chinese archival systems. A 2-year certificate program of specialized education is awarded to majors in archival science and in document administration. Not until 1994 did the college develop a doctoral program in historical document science, including archival science. In the 40 year period from 1952 to 1992, a total 4489 graduate students completed their archival training, and many of these alumni have become well-known scholars and leaders in the archival profession. Students from other countries have studied at People's University and professional archivists and educators from Russia, Canada, and the United States have taught there.

Professional Associations

Founded in 1981, the CAA (*Zhongguo Dang'an Xuehui*), is a professional organization of Chinese archivists, and is a member of the China Association for Science and Technology. There are branch associations at the provincial level and in local districts. The headquarters of the CAA is in the SAB; its leadership is drawn from the national archival management system and from academics of archival science in universities. The society encourages research in archival preservation, the history of archival management, and archival management education. The CAA has as its goals:

1) to encourage archival academic exchanges with foreign archive institutions, learned societies, and individual archivists; 2) to raise the academic level of members; 3) to spread archival knowledge among members; and 4) to make known Chinese developments and achievements in archive academic research at home and abroad. Examples

of some of the special committees work include: records management, editing and publishing of historical documents, automation, microfilming and reproduction, and conservation. CAA also publishes two professional journals: the bimonthly *Archives Work* and the quarterly *Historic Archives*.^[25]

Chinese archives have undergone major changes, especially since the PRC Archive Law in the 1980s. The Archive Law states that archives should be opened to researchers and to citizens. The range of services as well as the scope and variety of uses for archives has been slowly expanding. Researchers particularly engaged in early twentieth century history from 1900 to 1949 will find increasing opportunities to gain access to the original documents. As China's modernization accelerates, electronic comprehensive cataloging of archival holdings is being explored; it will soon be possible to use online finding aids to locate materials in any Chinese archives that are pertinent to pre-1949 Chinese history.

MUSEUMS AND MUSEOLOGY

Modern Chinese museums appear in a remarkable diversity with regard to size, function, form, and content. The majority of them are public museums administered as facilities of the state, province, municipality, or district, while private museums are operated under different rules. Their focuses frequently evolve around the following subjects: history, religion, ethnicity, cultural relics, science and technology, arts and crafts, famous people, sports, and paleontology and archaeology. They encompass most ordinary types ranging from aviation to natural history museums, in addition to unique ones such as those on modern Chinese revolutionary history, traditional Chinese medicine, historical salt /mining industry, ancient astronomical instruments, and silk and tea industries.^[26]

Since the past two decades, China has been rebuilding and expanding existing museums, as well as updating exhibition facilities and constructing new ones. While only less than 30 museums were visible in major cities when PRC came into existence in 1949, 480 museums were recorded in the 1950s, and a rapid flourishing of museums concurrent with the rise of market-based economy was observed in the last decade of the twentieth century. The number reached 1357 in 1999, and a total of 1722 public museums of all varieties were operating in 2008.^[27] The list is estimated to have more than 2300 when nongovernmental museums are also being included.^[28] It appears that only a mere 300 are related to subjects in scientific studies, and most were established after the turn of the twenty-first century.^[29]

Of all the Chinese museums, approximately 120 currently located in the capital city constitute the highest concentration in a single city. Among them are some of the most popular ones scattering along the western section

of the east–west oriented Chang'an Street. The Palace Museum in the Forbidden City, now commonly known as the “former Palace,” as well as its 1,000,000 pieces of artifacts in the collection, represents a complete ancient palatial complex dating back to 1420. The walled complex of 720,000 m² was the seat of a succession of Ming and Qing imperial houses until the last emperor Pu Yi was expelled in 1924.^[30] The Palace Museum in the Forbidden City along with the Shenyang Palace Museum in Liaoning Province^[31,32] are important sources for understanding the life and history of the Qing imperial house.

Near the Palace Museum of Beijing is the Chinese National Museum in a structure composed of two separate units: the Museum of the Chinese Revolution and the Museum of Chinese History. The former is designed to interpret the modern history of China with a focus on the Communist Party. The latter had been expanded from its predecessor, the Beijing History Museum originally built in 1912. The items in the collection include the fossils of Chinese *homo erectus*, Neolithic potteries, bronzes and ceramic wares from dynastic periods, in addition to a rare bronze human sculpture marked with acupuncture points.^[33] Besides the Palace Museum in the Forbidden City, the Museum of Chinese History with its 300,000 items in its collection has only two rivals in terms of the size of their collections: the Tianjin Natural History Museum of Hebei Province and the Nanjing Museum (formerly National Central Museum) of Jiangsu Province.^[34]

The new version of the Beijing Capital Museum farther west inaugurated in 2006 is regarded as one of China's leading museums to exemplify elements of a modernized institution. The architectural complex of outstanding design is built to accommodate a maximum of 2000 visitors for exhibitions, educational activities, and conferences requiring multilanguage interpretation services. In the galleries, special exhibitions such as “Ancient Calligraphy,” “Stories of the Capital City,” and “Treasures of Peking Opera” complement permanent installations to recount the history and cultural aspects of Beijing city, with topics ranging from its Paleolithic beginnings to the recent past. These are designed to reflect the goal of the museum that stresses integration of collection, exhibition, restoration, and research into education.^[35]

Apart from museums dedicated mainly to China's past, the China Science & Technology Museum located near the northern section of the 3rd Ring Road is a national institution to demonstrate that China is abreast with rest of the world in an increasingly globalizing world of technology. Its programs are carried out through permanent and short-term exhibitions, onsite activities, and shows at a domed-shaped Astro-vision film theater, which is one of the largest worldwide. In the museum complex constructed in 1988 and expanded in 2000, exhibits of different fields of modern science introduce the basics of mechanics, electromagnetism, heat, acoustics, optics, air and space, energy, transportation, mechanics, material

science, environmental science, nuclear technology, and information technology. The return capsule of Shenzhou No. 1 spaceship and its parachute are also displayed to explain the science of astronautics. Others are presentations on ancient Chinese technology (astronomy, compass, gunpowder, bronze metallurgy, papermaking, and printing) to document China's scientific inventiveness and technological preeminence in the past. Prior to 1999, the museum was one of the few in the country to have encapsulated training-based education programs and experiment-based displays.^[36]

The new building of the Chinese Science and Technology Museum located in the Olympic Green just north of the National Stadium (nicknamed “Bird Nest”) is built with government investment. As one of the auxiliary facilities of the 2008 Olympics, this new facility has debuted with an exhibit on scientific and technical innovations of ancient China, and is anticipated to be in full operation during 2009. It will be a milestone to follow two other supersized hands-on interactive museums: Shanghai Science and Technology Museum (2001) and Guangdong Science and Technology Museum (2008). Concurrent with the opening of the Summer Olympics is the inauguration of the Beijing Jingcheng Olympic Education Museum in the northeastern section of the city, sponsored by a private educational organization in commemoration of the 2008 game.^[37]

Among the 30 museums in Beijing showcasing materials associated with scientific studies, the Beijing Museum of Natural History in an area south of the Tiananmen Square is one of the old national museums founded in the 1960s. Its reputation is built upon rare specimens displayed in four specialized sections (paleontology, zoology, botany, and anthropology), domestic and foreign traveling exhibits, award-winning museum projects, and research projects collaborated with international teams, museum publications, and its museum association.

The museums in the capital city encompass the oldest and the newest aspects of human existence. The Beijing Museum of World Art at the Millennium Monument is the first in China to have focused on diverse artistic aspects known in world history and modern societies. The museum emerged onto the international art map in 2002 when an electronic display entitled “Salvador Dali: A Journey Into Fantasy” was held in its digital gallery. Its exhibitions cover a wide spectrum of subjects and media pertaining to a convergence of art and technology, including different forms of digital imageries facilitated with links to the World Wide Web.^[38] Aside from having become a window through which art and technology communicate in a contemporary global setting, the Beijing World Art Museum also has pioneered in incorporating enterprise-style management into its operation system, which appears atypical at traditional Chinese museums.^[39]

Less well known in the city is the Arthur M. Sackler Museum of Art and Archaeology on the campus of Peking

University in northwestern Beijing, an institution characterized by its modern concepts in artifact display and conservation. As an affiliate of the Department of the Archaeology at a university similar to its peers at the Northwest University, Sichuan University, and Shandong University, its hands-on projects in laboratories and archaeological sites are major educational resources for scholarly research and a training ground for new-generation archaeologists and museologists. The Sackler Museum of Beijing opened in 1992 and is accessible to general public.^[40]

Away from the capital city are local-based museums of different nature, administered by state, provincial, municipal, regional, or private organizations. One of the prominent museums in the south is the Nanjing Museum (formerly National Central Museum) of Jiangsu Province. In 1933, it was conceived as a national institute and the prototype of modernized Chinese museums when Mr. Tsai Yuan-Pei (Cai Yuanpei), the head of the national academy, proposed to construct a public museum complex to address distinct themes pertaining to culture, technology, and natural science. The museum was eventually established as an organization to exclusively house collections of works of art and artifacts acquired through purchase, archaeological excavation, and exchange, as well as to engage in research and conservation of these materials. Incorporated into its large artifact collections are also important archaeological finds taken from sites in nearby regions, including the Neolithic jades from Liangzhu cultural area. The Nanjing museum is famous for having actively published periodicals and research materials, conducted educational programs and archaeological excavations, and hosted special exhibitions from foreign collections in addition to organizing exhibitions to travel internationally.^[41] The museum also serves as the headquarter of regional cultural organizations, including the Association of Jiangsu, Institute of Archaeology of Jiangsu, and the Association of Folk Culture of Jiangsu.^[42]

An additional sophisticated museum in the same province is the internationally renowned Shanghai Museum. It is the base for a collection of 120,000 pieces of ancient Chinese art works and archaeological materials. Displayed in separate exhibition halls are some of the finest and rare specimens ever created in Chinese history. Aiming to conserve, display, and promote aspects of cultural diversity,^[43] the essentials of a modernized museum can be discerned in its featured exhibitions and research facilities, educational, visiting, and exchange programs, along with eleven galleries, three special temporary exhibition halls, its superb conservation department, library, gift shop, coffee shop, cafeteria, and a multimedia meeting room equipped with translation services. The innovated museum building of 1997, which symbolizes traditional Chinese understanding of the universe: the circular heaven above and the square earth beneath, attests to the changing

taste from the norm of old socialistic aesthetics.^[44] The museum operates with 85% government funding in conjunction with donations from private sectors.^[45]

Rich collections of historical relics and archaeological materials also have become highlights at the major provincial or district museums, such as the Shaanxi Historical Museum, Hubei Provincial Museum, Zhejiang provincial Museum, Yunnan Provincial Museum, and the Ordos Museum in Inner Mongolia. Nevertheless, one of the most unique forms of museums in China are those with exhibition halls constructed at archaeological sites that have been designated as protected cultural areas. Among them, the Museum of Banpo Neolithic Site in Xi'an City, the Terracotta Warriors' Museum of the First Emperor of Qin in Shaanxi Province, Dunhuang Cave Museum in Gansu Province, the Sanxingdui and Jinsha Museums in Sichuan Province, and the Yinxu Museum in Henan province rank among the top tourist attractions. Many of these have been incorporated into the UNESCO list of World Cultural Heritage sites.

In addition to exhibitions, activities such as research projects, seminars, and conferences also are parts of the fabric of Chinese museums. The results of these works are made available to the public through museum publications. The Chinese museum literature shows a long list of research reports and monographs, along with preeminent professional journals such as "Party History Research Data (*Dangshi Yenjiu Ziliao*)," "Journal of National Museum of Chinese History (*Zhongguo Lishi Wenwu*)," and "Palace Museum Journal (*Gugong Bowuyuan Yuankan*)." Others are popular magazines edited by professionals at the Geological Museum of China, Beijing Planetarium, and the China Science and Technology Museum, to name a few. They enjoy equal fame with "The Great Nature (*Daziran*)" of the Beijing Museum of Natural History, a favorite magazine for young readers nationwide. The illustrated monthly "The Forbidden City (*Zijincheng*)" of the Palace Museum is also one of the popular magazines on cultural history and art.

Additional museum periodicals with sections dedicated to museum studies include the "Southeast Culture (*Dongnan Wenhua*)" of the Nanjing Museum and "Relics of Yunnan" (*Yunnan Wenwu*)" of Yunnan Provincial Museum. These in conjunctions with relevant works from non-museum publications, such as "Beijing Relics and Museology (*Beijing Wenbo*)," "Chinese Museums (*Zhongguo Bowuguan*)," "Newsletter of the Chinese Society of Museums (*Zhongguo Bowuguan Tongxun*)," and "News Letter of the Chinese Association of Natural Science Museum (*Zhongguo Ziran Bowuguan Xiehui Tongxun*)" have contributed significantly to the field of museology. The last two belong to the Chinese Society of Museums (*Zhongguo Bowuguan Xuehui*) and the Chinese Association of Natural Science Museums (*Zhongguo Ziran Kexue Bowuguan Xiehui*), respectively, both of which are members of the International Council of

Museums (ICOM). The former also is the largest museum association in the country for organizations related to cultural and historical studies. As an affiliate of the State Administration of Cultural Heritage (*Guojia Wenwuju*), it has been the driving force in organizing workshops and conferences on topics pertaining to museum studies and authentication, collection, and assessment of artifacts. Besides its professional journal “Chinese Museum (*Zongguo Bowuguan*)” and other publications on the subject of museology, “The Annals of China Museum (*Zhongguo Bowuguan Zhi*)” published in 1995 is a compendium of the history of Chinese museums. Currently, the Chinese Society of Museums is collaborating with two other institutions to compile a revised edition of this book. It also will be the organizer of the 22nd General Conference of ICOM, to be held in Shanghai in 2010.

The general outlook of Chinese museums underwent obvious transformation during the past decade due to forces of globalization. The government endorses exchanges of display materials between museums and encourages exhibits of legal nongovernmental collections from domestic and international sources. Frequent blockbuster shows at major museums and corporate-operated exhibition facilities in large cities encourage competition and open-mindedness not known previously, while a free-admission policy introduced at the country’s public museums in 2008 assists in promoting appreciation of China’s national heritage. The negative side of an explosive rise of museums is that shortage of trained museum professionals and training programs in museum studies has become a key issue in the history of twenty-first century Chinese museums.^[46]

Although the exhibition narratives in state-sponsored museums remain to serve the interest of the Party and to dutifully fulfill their roles in the realms of education and social service, changes in the exhibition practices have altered the progression course of Chinese museums. Unique concepts such as virtual museums and “ecomuseum”^[47] have been introduced into the country as novelties; some of the new government funded science museums, frequently mammoth in sizes with multitheaters and being positioned in close proximity to shopping arcades, are morphed into market-based enterprises. In the meantime, private art museums have become profit-generating engines in disguise for artists, collectors, and urban-developers.

CONCLUSION

This study has documented the development of modern librarianship, archives, and museum studies in China. It was not until the nineteenth and twentieth centuries that the transformation of libraries, archives, and museums was initiated, and China began the long process of change; new institutions, values, and techniques were gradually introduced, through self development and foreign

influences. Successive waves of internal and foreign conflicts and influences assisted and hindered cultural developments. Under the PRC, library reforms patterned on Soviet practices were implemented in the 1950s. Following the social upheavals of the Cultural Revolution, Chinese library development resumed, beginning in the early 1980s. In the twenty-first century era of globalization, information and digital techniques have significantly advanced and expanded the role of libraries, archives, and museum services in China. Digital libraries have become an important priority, as well as a significant component in the national information infrastructure. New museums have been built also to showcase China’s ancient and recent past, together with changes in exhibition practices. Archives are opening up to researchers and citizens, and with the expansion of online finding aids, location of archival holdings will be easily found.

In November 2008, the U.S. Institute of Museum and Library Services (IMLS) and the Ministry of Culture of the PRC signed an agreement on the *Partnership for Cultural Exchange* between museum, library, archive, and information services at the LC. The agreement is to share in library and museum services, including education in museums, application of new technologies, and the availability of online information in libraries and museums. A part of the agreement is to establish cultural exchange between American and Chinese librarians. Professor Paula Kaufman, University Librarian and Dean of Libraries at the University of Illinois at Urbana-Champaign, and Dr. Zhan Furui, Director of the NLC and President of the LSC signed the *Think Globally, Act Globally* agreement. This is a 2-year IMLS project with additional support from the LSC. Chinese librarians, library educators, managers of library technology will be introduced to American public library service. U.S. librarians in turn will work with the Chinese librarians to identify Chinese information resources that could be made publicly available through an online portal developed by the team. Training will be in the United States as well as in China. CALA is included as a project partner. In addition IMLS is supporting training for the care of collections—both parties will exchange and disseminate information to promote best practices in the care of collections held in museums, libraries, and archives.^[48]

With new technologies ever developing, it makes it easier to share China’s cultural heritages; but that alone is not enough. It is critical that we must continually engage in dialog and exchange to further build understanding and cooperation among our global counterpart scholars, archivists, librarians, and museum professionals.

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APPENDIX

Table A1 Chronology of Major Dates in Chinese History, Libraries, Archives, and Museums

16–11 B.C.	Shang Dynasty—documents carved on tortoise shells and animal bones.
221–206 B.C.	The Qin Dynasty unified China and established China's first central Government.
16 B.C.–1911 A.D.	Imperial libraries served as depositories of national literature and archival documents.
105 A.D.	Cai Lun invented paper.
618–906 A.D.	Tang Dynasty—Printing was invented, beginning with wooden blocks.
960–1279 A.D.	Song Dynasty—Movable types invented; printed books became available in China.
1644–1911	Qing Dynasty (Manchus).
1839–1842	Opium War, concluded with the signing of the Treaty of Nanjing and China's forced opening to the West.
1840–1926	Public Library Movement.
1850–1864	Taiping Rebellion.
1894–1895	Sino-Japanese War.
1898	Hundred Days Reform.
1899–1900	The Boxer Rebellion.
1909	The Ministry of Education promulgated the first library law in China for public libraries: to preserve Chinese classics, to disseminate knowledge, to provide research facilities, and to collect materials for the public to use freely; also to establish the Metropolitan Library (National Library) and other provincial, county, and district libraries.
1910	Xie Yun-Cang translated from Japanese, <i>Library Education</i> , first book on library science published in China.
1910	Mary Elizabeth Wood founded the Boone Library, to serve as a public library, Wuchang, China.
1911	Overthrow of the Qing Dynasty.
1911 to the Present	Modern Library Movement.
1912	On January 1, the Republic of China was declared with Sun Yat-sen as provincial president. Yuan Shikai, a Manchu general, was elected President.
1916	Legal deposit was established.
1919	May 4th Movement, cultural and intellectual revolution.
1920	Mass Education Movement.

(Continued)

Table A1 Chronology of Major Dates in Chinese History, Libraries, Archives, and Museums (Continued)

1920	First library school, the Boone Library School in Wuchang, China, founded by Mary Elizabeth Wood, together with Shen Zhu Rong and Hu Qing Sheng.
1921	Founding of the Chinese Communist Party.
1922	Chinese National Association for the Advancement of Education founded; a division on Library Education was formed.
1924	China Foundation for the Promotion of Education and Culture was established; administered a portion of Boxer remission indemnity funds to be used for public library developments in China.
1925	The national Library Association of China (<i>Zhongguo Tushuguanh Xuehui</i>) founded.
1925	The Palace Museum, Beijing, founded. China's largest museum. Listed by UNESCO as a World Cultural Heritage Site in 1987.
1925	First Historical Archives of China (Beijing) established—Ming-Qing archives.
1933	Nanjing museum established—a national institute of historical and cultural interests; includes many cultural relics, paintings, calligraphies, and ancient books.
1937	Marco Polo Bridge incident commences Japan's invasion of China.
1945	Japan surrenders. Civil war continues between the Communists and the Nationalist government.
1949	On October 1, Mao Zedong proclaims the founding of the People's Republic of China (PRC).
1950	Treaty of Friendship, Alliance and Mutual Aid between the PRC and the Soviet Union.
1953–1957	China's First Five Year Plan.
1954	State Archives Bureau (<i>Guojia Tanganju</i>) established.
1957	The National Book Coordination Act.
1957	Russian library works translated into Chinese and published as <i>Translations on Library Science</i> .
1958	The Great Leap Forward.
1961	Beginning of the Sino-Soviet Conflict.
1964	China Society for Scientific and Technical Information (CSSTI) founded.
1966–1976	The Cultural Revolution.
1978	Deng Xiaoping launches "opening and reform" policy.
1979	The China Society for Library Science, CSLS (<i>Zhongguo Tushuguan Xuehui</i>) was established in China.
1979	United States and the PRC formally establish diplomatic relations.
1980	Summary Report of Library Work, encouraging governments at all levels to develop libraries and expand their services.
1980	Second Historical Archives (Nanjing) opened—documents relating to the 1912–1949 period.
1981	Chinese Archives Association (<i>Zhongguo Dang'an Xuehui</i>) founded.

(Continued)

Table A1 Chronology of Major Dates in Chinese History, Libraries, Archives, and Museums (*Continued*)

1987	Report Pertaining to the Improvement and Enhancement of Library Work, issued by the Ministry of Culture and other ministries, urging for the coordination of libraries, reform of library management, and adoption of modern technology.
1987	Dedication of the new library building, National Library of China, Beijing.
1991	Journal of Library Science in China (former name Bulletin of the China Society for Library Science). Core leading national journal in library and information science. Jointly sponsored by the China Society for Library Science and the National Library of China, under the auspices of the Ministry of Culture.
1996	Sixty-second International Federation of Library Associations and Institutions (IFLA) General Conference held in Beijing.
1996	China National Knowledge Infrastructure (CNKI). Founded by Tsinghua University and Tongfang Knowledge Network Technology Company; full-text database created to integrate important resources in China, to be disseminated in China and globally.
2005	China Society for Library Science (CSLS) name changed to the Library Society of China.
2008	Opening of the National Digital Library, National Library of China, Beijing.
2008	Signing of the agreement between the Library of Congress and the National Library of China to develop the World Digital Library project.
2008	Olympic Games held in Beijing.
2008	Opening of the Guangdong Science and Technology Museum, Guangzhou, world's largest science and technology museum.

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Abstract

Circulation services in public libraries are pivotal to the success of library services. The circulation desk is where library service typically begins and ends for library patrons (users). Patrons come into the library and ask for directions at the circulation desk, to apply for library membership in the form of a library card, and to learn library policy information regarding circulation of materials, computer use, programming confirmations, and more. After receiving reference services from the librarian, patrons go back to the circulation desk to check out materials, pay fines, learn of library programs, and status of requests.

Throughout the history of public libraries in America, circulation areas have been in tune with the technological trends of the day. From due date cards to keypunch operating machines to self-check-out modalities, circulation desks have always been and continue to be the focal point for library patrons to learn the value of the library.

INTRODUCTION

“Circulation services” is the term used to describe many of the most important, yet oftentimes invisible activities of today’s libraries. Circulation services include all activities that are involved in the making of library books, journals, and other materials directly available to the people who need them. Public, school, special, and academic circulation services can be defined as the full cycle of a user borrowing library material and subsequently returning it within a designated time frame. This borrowing cycle has a history alongside the existence of libraries, and even with the advent of technology in library services during these contemporary times, the borrowing cycle continues to be the impetus for library circulation services today.

Circulation in American libraries has been documented since 1856.^[1] Library book circulation over the decades has been relatively stable with an average of 11 books checked out per American public library borrower per year.^[2] With the accessibility of books, films, recordings, videos, CDs, DVDs, software, and audiovisual products in both print and electronic formats, circulation of library materials amongst the reading public has increased (mainly due to electronic borrowing privileges), while physical library visits have decreased.^[2]

It should be taken into account that what was defined as a “public library” or an “academic library” during the nineteenth century may differ from what we define as a public or academic library today. Thus circulation statistics of yesteryear may include public use from libraries that we now consider as school or special libraries. For example, subscription libraries were considered public

libraries during the nineteenth century.^[1] Subscription libraries are considered special libraries today. In the case of academic libraries, when a group of learned men pooled their books together to create a library upon which Yale University was founded, such collaboration attests to what was once perhaps a social library that quickly evolved into an academic library.

Another aspect of circulation services that should be taken into consideration is the circulation of juvenile materials. During the nineteenth century, juvenile materials were not as readily available in public libraries (nor in academic libraries) as they are today. During that time, adult materials counted for a large percentage of public library circulation, whereas today, juvenile borrowing typically counts for a significant proportion of circulation statistics in public libraries. Children’s literature collections are frequently available in academic libraries where the institution offers majors in education, library science, and other related disciplines. Some academic libraries, like University of North Carolina at Chapel Hill and Kent State University, offer extensive specialized collections in picture books. Specialized collections such as these are circulated by adults, as opposed to high circulation rates being attributed to children in public libraries. This increase in juvenile literature circulation correlates with the increase of the publication of children’s literature.

In recent years, there continues to be a rise in the circulation of young adult literature, multicultural materials, and audiovisual mediums such as DVDs, language videos, audiobooks, and electronic books (e-books). This rise in audiovisual circulation speaks of an increase of equitable access to a variety of information in popular

formats, thus libraries can reach broader and more diverse audiences with different learning styles and informational needs. More and more libraries are taking this option to the next level by offering streaming video and e-book services, bypassing the need to download, a feature optimally set for the burgeoning set of smartphone-using patrons. Finally, free online classes (aka MOOCs: Massively Open Online Classes) are being “circulated” through public library catalogs through such vendors as Coursera, Input, Universal Class, Khan Academy, and others.^[3]

Digital technology continues to inspire an evolution in circulation services and practices in libraries of all kinds. Self-service automated systems for users and graphical interfaces for facilitating circulation services by library staffers continue to grow and improve as technological innovations emerge. Staffers and users alike experience new learning opportunities as technology impacts circulation of library materials on-site, in remote storage facilities (physically and in the cloud), and virtually online.

Overall, with staffers continuing to learn new technologies and to employ vital customer service to diverse populations, circulation services remain an important and vital mainstay of library services for all types of libraries.

ETHICS

The privacy of patron library records reaches into the issue of intellectual freedom. As part of the first amendment’s assertion for freedom of expression, libraries hold library records to be confidential because what is checked in and checked out illustrates a patron’s intellectual and personal interests. A library record is like a record of one’s thoughts, ideas, and curiosities. These records must be respected and protected. Staffers are held to the highest form of professional confidentiality and integrity when interacting with and maintaining library borrower records. Even in this age of the US PATRIOT ACT and the Foreign Intelligence Surveillance Act of 1978 Amendments Act of 2008 (FISA), librarians have been uncompromising stalwarts in respecting the privacy of patron records and even insisting that the U.S. Federal Government do so as well.

Librarians’ enforcement of Sections 215 and 505 of the PATRIOT ACT, amendments that have been made to the law to preserve confidentiality of library borrower records echo the professional standards of the American Library Association’s Code of Ethics.^[4] Many academic and public library administrations have also enacted policies, guidelines, and best practices for librarians and circulation staff to follow in the event of legal requests for private patron information.

CIRCULATION DESK

The circulation and reference desks are the two focal service points in a library. At its most basic, the circulation

desk is the location within the building where library users borrow (check-out) materials, renew, and return (check-in) borrowed materials. The circulation desk is mostly staffed by paraprofessionals (library assistants, library technicians, clerks, and, in some cases, volunteers) as opposed to the reference desk which is mostly staffed by librarians, assistant librarians, and library trainees.

As the initial entry and exit point for library users, the circulation desk serves three primary functions: 1) facilitating user information needs, 2) collecting and filtering library materials, and 3) facilitating user-centric information needs such as processing library card applications, library card renewals, paying fines, and handling borrowing privileges. Another set of functions involves the collections. As borrowed material is returned, or as material used in-house is gathered up, the circulation desk serves as a collection point and a filtering point. It is at the circulation desk that any damaged or mutilated returned items, or any item returned with missing parts (i.e., cases, discs, and pamphlets that make up many audiovisual items), will be first noticed. From the circulation desk, items are then sent on to the appropriate area depending on whether the items are to be re-shelved or sent to the processing room for repair or de-accessioning if the item is damaged.

A third set of functions served at the circulation desk rises from the fact that the circulation desk is usually the first point for anyone entering a library and is the last point before leaving the library. Because of this important position, the circulation desk itself should be clean, clear of clutter, and inviting. The circulation desk staff, then, is responsible for greeting people, being inviting, and having knowledge of the library’s policies and procedures as well as a basic knowledge of locations of materials (sometimes known as simple reference). Upon entering the library, users, in many cases, will come to the circulation desk first and then be directed further into the library to confer with the librarian(s). In short, the circulation desk is the touchstone for user experience in most libraries.

The circulation desk is a locus of technology in many libraries. Check-in and check-out terminals, cash registers, camera equipment for library cards that carry photos; sometimes photocopying machines, faxes, and public telephones are found at or near the circulation desk and, in any case, tend to be under the purview of the circulation desk staff.

Libraries may designate various names to the circulation desk such as “Information Desk,” or “Information.” Libraries will typically have dominant signage that indicates the location of the circulation desk as the initial point of contact for library users.

The circulation desk may be the most important location in a library, at the very least equal in importance to the reference desk. Whereas the reference desk is where users learn and access the content of the library, the circulation desk is the contact point between the library, as a whole, and the wider community outside the library.

KINDS OF CIRCULATION

Circulation is the movement of library materials usually from within the building out into the service community of a library and back again. Library users are the prime catalysts of this movement; it is the users' information wants and needs that cause books and materials to go out of the library, and thus the user is responsible for returning the material. This output–input process is commonly known as checkout (also known as “charge” and “borrow”) and check-in (also called “discharge” and “return”). This culminates the most basic understanding of what it means to circulate library materials.

Typically, not all items and materials in a library are allowed to circulate. Materials that do not circulate are typically referred to as the reference collection or non-circulating collection. Reference materials can be checked out in special circumstances based on the borrower's needs and at the librarian's discretion. Reference materials typically are borrowed overnight, two days, sometimes as long as a week, in public libraries. In academic libraries, reference materials can be checked out for an extended amount of time for faculty and/or course use.

Circulation can take many forms, depending on the kind of library, the service community, how technologically advanced the library's systems are, and the size of the library's circulating collection. Aside from charging and discharging materials, if a borrower returns material past the due date, a fine is typically incurred on a daily basis until the material is returned. In public library systems, this fining schedule will often have a capitalizing limit whereas after a certain amount of fines are accrued, the entire cost of the material is charged to the patron instead. In this situation, upon return of the late material a patron either returns the material and pays the maximum capped fine or does not return the material (the item is lost) and instead pays the cost of the material for purposes of item replacement.

If a patron's borrower record illustrates a pattern of lost and/or missing materials along with unpaid fines, his/her record can be blocked from further circulation activities until the record is expunged either by payment, return of materials, or some other arrangement coordinated with the library administration. In school and academic libraries, lost library item costs can be added to a student's financial record and can block administrative services such as the release of grades and transcripts. Similar sanctions can occur in special libraries and archives.

At a basic level, in most libraries users may borrow up to a set limit of items from the circulating collections—fiction and nonfiction books, audiovisual material including DVDs, videos and audiobooks, and magazines (in print and electronic formats), and can hold items for a set period of time (two weeks, four weeks, seven days, overnight, etc.) before returning them. These set limits and time periods, known as borrowing privileges, differ from

library to library. If a library has a small collection, the maximum number of items that can be borrowed might be less than in a library with a larger collection. By the same token, the time period a person may place a request on an item (also known as putting an item “on hold”) may be shorter, creating a quicker turnaround time ensuring the item will be available more often. Items that are in high demand may have shorter due dates for the same reason. Multimedia items, such as DVDs, videos, music CDs, gaming, and software discs, might have shorter due dates based on the premise that these items do not take as long to listen to, or view, or use as the time it may take to read a book. To meet the demand of largely requested titles or items, librarians may keep multiple copies of an item “on reserve” for patron use in-house. Reserves are commonly offered in academic libraries to accommodate instructors who want textbooks or other materials available for class review.

Another kind of circulation involving technology involves the use of a library's website and downloadable material. In this kind of circulation, the library user enters his/her library card number (or some other acceptable code) and downloads a digital file containing an entire book, music, or video, onto his/her computer, tablet, or handheld device. Once downloaded, the file can be read or viewed by the user. After the established due date is reached, libraries commonly enact digital rights management to cue the file to automatically disappear from the user's library account. Libraries comply with legalities associated with digital rights management (DRM) to enact the ethical return of digital data and files to the library collection. Digital rights management technologies serve to control copyright protection so that users cannot copy, sell, or inappropriately possess library materials. It is DRM technology that is in play when electronic library materials are “returned” (via disappearance in user's account) to the library's holdings.

The option to stream books, music, and video is beginning to appear on many libraries' websites. As technology improves, vendors marketing products proliferate, and the availability of platforms (smartphones, advanced e-readers, tablets, laptops, PCs) to access these features spreads, patrons are able to bypass the standard check-out/check-in paradigm.^[5] The nature of streaming is immediate and temporary (while the patron is actively using the item), so it does not resemble the typical circulation transaction. Still, accessing these services requires a library card number to be entered for the transaction to occur and the patron's library card needs to be in good standing regarding the amount of overdue fines, late books, or lost item fees exactly as in traditional circulation transactions involving print items. Vendors such as Overdrive, Freegal, Hoopla, Indieflx, Zinio, and Smithsonian Global Sound for Libraries are just some examples of companies offering streaming features on library websites.

As streaming technology and accessibility improves, libraries are in a unique position to consider content creation as another service to the community. One of the strengths of libraries is the ability to collect and preserve the history and culture of a community. The library collects knowledge of local relevance to the community and, in many cases, is the only source for such information.^[6] How this local content creation is circulated, and what impact it will have on circulation overall, will pose an interesting question for library administration to consider.

The kind of community the library serves can have an effect on circulation. A special library in a law firm or business or an academic library catering to a specific population might have a very different circulation policy than a public library serving a broad and diverse geographic community. A library with more funding, and thus able to buy larger collections and replace items more easily may have more generous borrowing privileges than a library with less funding.

In certain special libraries, because of the population served, circulation, if tracked at all, is considered the number of items taken from the shelves and used in-house as there is no need to take material from the library. In academic libraries, faculty are sometimes given the privilege of checking out materials for extended periods of time, and can place course textbooks and articles on reserve at the circulation desk for student reference use. Nowadays, academic libraries also circulate materials via electronic delivery methods, whereby scholarly articles can be retrieved via interlibrary loan (ILL) and with delivery notices sent by email to students and faculty alike. Such documents are typically delivered in PDF format on the library's secured website, whereupon entering one's login information, a patron can locate and download the requested materials.

The value of circulation, no matter the various kinds it can take in various locations around the world, is a symbol of a library's relevancy and connection to its community.

USER COMMUNITIES

"User community" is a term used to identify any group of library users based on a wide variety of defining terms. Defining terms of a user community can be based on demographics of any kind, whether age, gender, culture, education, profession, socioeconomic status, ethnicity, geographic region, or nationality.

Each user group would have specific information needs that would differ from other user groups, but might not necessarily be completely exclusive or removed from the information needs of other groups. The age levels and reading levels of books; types of circulating collections, reference works, and fiction and nonfiction; the availability and diversity of multimedia; borrowing privileges; and many policies and procedures are dependent upon the user

groups that a library serves. It is the duty and responsibility of administrative librarians, reference librarians, and library staff to be knowledgeable of, sensitive to, and accommodating of the user groups within their service community.

User groups based on age are lapsit, toddler, preschool, school age, high school, teen, home-schooled, young adult, adult, and seniors.

User groups based on culture, nationality, or ethnicity may include immigrants, as well as communities identifying with a specific heritage, language, or history.

User groups based on socioeconomic status could be centered on income levels: urban, suburban, rural communities, home-ownership, homelessness, transience, and migrancy.

User groups based on civic status include immigrants, travelers, court-appointed volunteers, recovery outpatients, patrons of varying mobilities, and prisoners.

User groups based on educational criteria would be concerned with level of schooling, groups working in the field of education, people with college, and graduate degrees.

User groups are unique and specific to their communities, often comprising an admixture of citizens cross-pollinating in multiple groups at one time. Thus all library communities are diverse and must strive to create library collections that can be inviting for users to circulate materials amongst one another with the circulation desk and staff as a friendly interface.

STAFFING

Paraprofessionals are typically the staffers of the circulation desk in public libraries. Paraprofessionals usually possess a high school diploma (or equivalent) as the minimum educational requirement for working at the circulation desk. Paraprofessional staffers go by various titles, but common titles are "Library Assistant" or "Library Technician." Competencies for library assistants include excellent organizational skills, ethical proficiency in mathematical skills, being detail-oriented and technologically savvy, being culturally competent with high-quality customer service skills, and performing entry-level reference services. Through years of experience, library assistants/technicians become very proficient with their knowledge of literature, technology, the community, and library trends. Library assistantship is a common gateway through which paraprofessionals become professional librarians, initially seeking their bachelor's degree in higher education and ultimately earning the master's degree in library science to qualify as a professional librarian.

Paraprofessionals are a vital part of the library staff as they work to control the circulation flow of the library.

Library users check out books at the circulation desk, thus good customer service skills are vital for the successful library assistant. Paraprofessionals also enforce library policy making sure that patrons pay fines as well as ensuring ethical practices with the processing of monies from collected fines and other fees.

Library assistants also work to maintain the order of the library collection. In larger public library systems, paraprofessionals may package and log in new materials for the collection, and they may frequently serve as the primary shelveers of new and circulated materials. A lead paraprofessional may, at times, serve as the librarian in the absence of one. In smaller libraries such as in rural locations, a paraprofessional may be the librarian for his/her location, often running the entire library with a few volunteers.

Paraprofessional training and skill development tends to be an internal function of the library or library system. In larger systems, there is usually a staff training office (most likely within the Human Resources Office) that schedules training sessions, workshops, and professional development opportunities such as webinars, conferences, and guest speakers. In smaller systems or libraries, training may be hands-on, at the circulation desk, during the workday as the new staff member “shadows” the experienced staff members. The efficacy of the latter and financial challenges posed by the former is an ongoing conversation in librarianship.^[7,8]

In best case scenarios, paraprofessionals are encouraged and supported by librarians and library administrators to continue their education through professional development activities. Such activities may include attendance to staff meetings, conferences, technology workshops, and community seminars. Paraprofessionals may also join paraprofessional library divisions within their state library associations. For example, the Nebraska Library Association has a Paraprofessional Section, and the Georgia Library Association has a Paraprofessional Division. Across cultural lines, paraprofessionals are also welcome constituents to ethnic library groups such as REFORMA (The National Association to Promote Library and Information Services to Latinos and the Spanish-Speaking), APALA (Asian Pacific Library Association), and the Black Caucus of the ALA (BCALA).

STACK MANAGEMENT

Stack management, also known as collection maintenance, is that aspect of any library system or unit concerning the care, handling, shelving and storing, and accessibility of library materials, on-site and beyond.

There is a dearth of current discussion on issues relating to stack management in libraries today.^[9] But perusing the written record going back 15 years and further reveals some basic concepts of stack management that remain relevant to this day.

There are five divisions to the process of stacks management also known as collection maintenance.^[10,11] The five divisions are storage and shelving systems (to hold and protect a wide variety of unique materials), housekeeping routines (cleaning stacks and vacuuming books; knowing and reacting to specific material needs and environmental conditions), general care and handling practices (broad set of activities that protect materials that are handled, proper techniques to handling materials and how material should be shelved and stored), care and handling routines in processing (proper techniques in handling items throughout the journey of processing, borrowing, charging, and storing the item repeatedly, during its life in the library), and collection improvement activities (noting when and how to best screen and identify damaged and problematic materials within the circulation cycle and the processing stream). These divisions hold for libraries across the profession whether public, academic, or special.

The primary responsibility for maintaining a robust stacks management program and implementing collection maintenance activities rests primarily with circulation staff. In many situations, responsibility during acquisition, cataloging, shelf preparation, and binding will lie with technical processing staff. Cleaning and buildings staff might well play a role in housekeeping functions or when the literal nuts and bolts of the shelving systems to be used are discussed and established. And, as in so many systems or programs, the role of library administration is to ensure that clear, firm policies are established, disseminated, and accessible and that priorities are set, known, and supported.^[12]

In recent years, stack management has evolved to include the relocation of print collections to digital format and/or to off-site locations. Print collections are becoming smaller in many libraries due to the changing focus of the library from a collection storage facility to a more inclusive space for community interaction and exchange.^[13] With the shift of the foci on libraries from artifacts to community building, some libraries blend collection maintenance and stack management routines into one circulation department. Large systems such as university libraries may opt to separate the stacks management functions from the circulation department to promote better efficiencies in getting the material in question back to the shelves and made available in a more timely fashion.^[14] Many large public library systems also have a separate stacks section removed from the functions of the circulation department while at the same time allowing a blending of both routines on the branch or unit level as needed (author's observation, 2014).

The digital age has also delivered new formats for books that affect the circulation and management of library stacks and collections. E-books (as well as e-magazines and e-audiobooks) can now be checked out and loaned and renewed online via in-house electronic circulation systems, mobile applications, and library websites with digital

platforms such as Overdrive, OneClickdigital, and Bookshare, without library patrons needing to be physically at a library circulation desk.^[15,16] Facilitating circulation of e-books and managing their circulation records often falls within the professional purview of library circulation managers and clerks.

Earlier challenges for making e-books accessible from the publisher to the reader have been progressively met. With e-book access having progressed due to the work of librarians, stakeholders, and the ALA Digital Content Working Group (DCWG), the challenge now is to make e-book lending a satisfactory user experience for library patrons by incorporating emerging trends such as e-book subscription models, self-published authors, and the online availability of e-book retailers such as Amazon and Netflix. All these trends shape reader expectations requiring the knowledge base of librarians and circulation staff to constantly change to meet user information needs.^[17]

With the increased availability of print, audiovisual, and electronic resources on the Internet and through databases, and the trend toward virtual reference, the need for physical stacks and collections is changing dramatically with an increase in library collections being moved to digital records and/or remote storage locations in order to afford more physical space for human interaction within library walls. Remote services and management of customer knowledge and patron usage patterns continue to grow in importance in this online, mobile, virtual world era. The policies and procedures, the theories and applications, for the future of stack management and collection maintenance are even now being discussed, formulated, and written.^[18]

TECHNOLOGY

Since the formal professionalization of librarianship in 1876, technology in libraries has continuously evolved to employ the latest technology of the times. During the nineteenth century, books were checked out using a hand-written ledger system, where librarians would write down a user's due date as a line item action for each title borrowed. Technology quickly evolved where systems for circulation services were comprised of permanent card systems and metal plate systems by the early twentieth century.

With the card system, a permanent identifying card was generated for every book acquired for the library collection. The card was kept in the book, and then removed from the book when borrowed. This system is still employed today in some rural public libraries, school libraries, and academic libraries for in-house reserve materials. The metal plate system was considered an improvement over the card system because the user's information was permanently embossed on a metal plate, allowing for a decrease in error when recording borrower information. With the plate

system library staffers were also able to automatically set due dates on library cards.

In the late 1940s, early efforts at using new data processing techniques revolved around the idea of batch processing using key punch cards. These new systems were fast and dependable, could produce overdue notices on demand, and did not require any filing. Some of the drawbacks to the batch processing system were lack of a user database, and lack of inventory control of collections. Most batching processes took hours to complete, so would occur overnight in many public and academic library systems. The batch would process information about materials checked out, but not record information about materials still on the shelves. This made the quality of expanded circulation services, such as book reserves and interlibrary loan, cumbersome and unreliable, as books were hard to locate in the library, since there was no consistent inventory record. Not offering much improvement on older circulation technologies like the ledger and metal plate systems (in terms of keeping record of whole collection management schemes), batch processing was eventually superseded by computer online systems during the later half of the twentieth century.

Subsequently by the 1970s, circulation services in both public and academic library systems were incorporating bar code readers, scanners, and laser technology, to process check-ins, checkouts, holds, reserves, and interlibrary loan requests, as well as modernizing inventory storage records into the form of digitized data. Radio-frequency identification methods (RFID) allow for library users to manage their own check-out processes with the use of wireless technology that scans a microchip embedded in a user's library card and also tagged within the library material to be borrowed. Self check-out machines read the information on the library card and connect that information with the borrowed material via a radio signal, creating a transaction record that is logged in the library catalog. RFID technology can also assist library circulation staff with the book handling process of returned items with systems that automatically read returned items from the book drop, processes the check-in procedure on a user's library record and sends the library item to the appropriate bin for re-shelving.^[18] Along with ILS, RFID, and graphics-oriented interfaces for managing borrowing processes at the circulation desk, technology continues to impact circulation services by incorporating self-service automated developments for public and academic libraries.

Newer advances in technology appearing at the circulation desk include cash registers networked to the check-in and check-out terminals and RFID terminals that allow library users to check out material themselves by placing the item on a scanning plate or waving a light wand over the item's barcode. This produces a receipt with information on which items were checked out, how many items were checked out, and due dates. It is the responsibility in most libraries for the circulation desk staff to

assist library users with this new technology and to come to the aid of the user when technical glitches occur.

In more recent years, innovations in web development allow library users to access their library accounts via the Internet to renew materials, manage requests, and pay fines. Users can now access their library accounts from library websites via their personal computer, laptop, tablet, or cell phone. Library users can also borrow technologies to use in the library and to check out to use at home. Some technologies that are now circulated in libraries include computer laptops, headphones, calculators, voice recorders, CDs, DVDS, gaming items, and digital cameras.

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Citation Analysis

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Abstract

References *from* publications are at the same time citations *to* other publications. This entry introduces some of the practical uses of citation data in science and scholarship. At the individual level, citations identify and permit the retrieval of specific editions of works while also suggesting their subject matter, authority, and age. Through citation indexes, retrievals may include not only the earlier items referred to by a given work but also the later items that cite that given work in turn. Counts of citations received over time, and measures derived from them, reveal the varying impacts of works, authors, journals, organizations, and countries. This has obvious implications for the evaluation of, e.g., library collections, academics, research teams, and science policies. When treated as linkages between pairs of publications, references and citations reveal intellectual ties. Several kinds of links have been defined, such as cocitation, bibliographic coupling, and intercitation. In the aggregate, these links form networks that compactly suggest the intellectual histories of research specialties and disciplines, especially when the networks are visualized through mapping software. Citation analysis is not without critics, who have long pointed out imperfections in the data or in analytical techniques. However, the criticisms have generally been met by strong counterarguments from proponents.

INTRODUCTION

In specialties with literatures, citations link earlier and later work. They denote unique writings and connote concepts associated with those writings. They reveal the citer's intellectual sources in preparing a new text and enable readers to retrieve them. In Derek Price's useful distinction,^[1] further discussed in Wouters,^[2] a work's *references*, made in its footnotes or endnotes, are "outgoing mail" that it sends to older works. A work's *citations*, in contrast, are "incoming mail" that it receives from newer works. It is common, however, to refer to both as "citations" and let the context indicate whether they are incoming or outgoing.

Such linkages may be interesting even at the level of individual documents. In general, however, more interesting patterns emerge when citations from many sources are analyzed in the aggregate. Then one can learn such things as a field's most highly cited authors or works (intellectual bestsellers, so to speak), the primary influences on a particular author's body of writings, and authors or works that are repeatedly cited together over time, indicating that in the eyes of citers they are highly related. Researchers use the latter sort of information to investigate the intellectual structure of learned specialties and disciplines. Citation analysis along these lines is a major part of bibliometrics, the subdiscipline of library and information science (L&IS) devoted to the quantitative study of literatures.^[3] It is also the form of L&IS research most widely adopted by other fields—in part because citation analysts have long used visualization techniques to make relationships in their data easier to grasp.^[4–6]

Entries complementing the present one are McVeigh's "Citation Indexing and the Web of Science" (p. XXXX), Bar-Ilan's "Informetrics" (p. XXXX), and Brooks' "Citer Motivations" (p. XXXX). This entry focuses on research in which citation counts come into play as raw data. It draws examples from the Web of Science (WoS), because of that system's historical importance in revealing the possibilities and problems of citation-based bibliometrics, especially in the journal-oriented sciences. Examples are also drawn from the WoS citation databases on the Dialog Classic retrieval system, because its software could quickly retrieve and display bibliometric data in useful formats not seen elsewhere. Dialog was retired by ProQuest, its parent company, in 2013.

The WoS continues to be a major resource, but after decades of being the only widely regarded source of citation data, it now has formidable competition from Elsevier's Scopus, Google Scholar (GS), and Microsoft Academic. WoS and Scopus can themselves generate reports for subscribers with routine bibliometric questions, while a free system called Publish or Perish^[7] does the same for GS and Microsoft Academic. Nevertheless, many studies can be carried out only by downloading records from these services and analyzing or visualizing them with external software, such as the Sci2 toolset,^[8] CiteSpace,^[9] or VOSviewer.^[10]

Specific citation analyses are matters of practical concern, since they are often published as evidence for knowledge claims and are sometimes used in making consequential decisions. They have been brought to bear on national scientific and technical policies, evaluations of

organizations to determine funding, and academic tenure and promotion cases. They are used to map literatures, reveal networks of citers and citees, and assess the impacts of organizations, authors, journals, and individual works. They also have uses in library collection evaluation. Historically, citation data have come largely from journal articles, but other document types, such as books, conference papers, dissertations, and patents, are increasingly mined as well.

Bibliometrically speaking, however, publications are no longer judged solely by the citations they have received. Shared document repositories (e.g., arXiv), reference managers (e.g., Mendeley), and social media (e.g., Twitter) have led to alternative measures, which are called “altmetrics,” to differentiate them from citation-based measures. Altmetrics include counts of the times that publications have been viewed in or downloaded from repositories, bookmarked or shared in reference managers, mentioned or discussed in social media, and, in the case of books, formally reviewed. Another altmetric for books is the number of libraries that hold them in union catalogs such as WorldCat.^[11] Yet none of these measures is likely to replace citation measures; instead, the best of them complement citations as indicators of reader interest in publications and perhaps as raw data for measures of greater complexity.

Many citation analyses require readers to know statistics or mathematics. This entry points to reviews of that research but presents ideas, resources, and analytic techniques at a basic qualitative level. Zhao and Strotmann^[12] covers some of the same topics in greater technical detail.

CITATIONS AS VERBAL OBJECTS

Both citers and bibliographers briefly describe written works, but they have different aims. Citers adduce other writings in the context of a new work of some creativity—a work for which authorship and a byline are claimed (or claimable). More particularly, they adduce works to support a line of discourse—e.g., as evidence, background, example, or proof. By contrast, when bibliographers make entries in a catalog, bibliography, or abstracting service, they merely register or subject-index works without developing new lines of thought; they are not arguing and documenting a point. Typically, they are not considered authors and do not get bylines.

The distinction between citers and bibliographers bears on collection evaluation. Librarians often evaluate their holdings by checking them against bibliographers’ products, such as *Resources for College Libraries*. However, some librarians draw samples of citers’ products—that is, the works cited in books, articles, and dissertations.^[13] Every item in these checklists has already proved useful in real research, and the librarian can ask, “Could my library have supported that research by providing this

title?” Alternatively, if the sample consists of citations by local authors, the librarian can ask, “Which of the titles in my collection does the home team most heavily use?”

Citations show the *editions* of the works the citer referred to—the copies of a text made from a particular master. The routine fields of conventional citations (e.g., author, title, journal, date, and pagination) function jointly to identify editions. The author and title by themselves name a work but not the specific version of the work’s text—the edition—that was consulted. While many published works exist in only one edition, there is a permanent possibility of more than one, and since they may vary in quality (to the point of having different evidentiary or aesthetic value), we want a means of telling different texts of the same work apart, even if we never actually retrieve more than one. Conventional citations have just enough data to disambiguate in this fashion. They lead to “known item” retrievals in bibliographic databases and library catalogs, which typically use editions as their units of analysis.

More abstractly, citations represent written works as to *authority*, *age*, *subject matter*, and *form of knowledge*. The last is the author’s orientation toward the subject matter—e.g., scientific, technical, historical, or personal.^[14] *Authority* is rendered, first, by naming whoever is responsible for the content of the work, and, second, by naming whoever released that particular version of it to the world—respectively, the author(s) and the publisher, both of whom exercise editorial quality control over content. *Age* is implied by publication date. *Subject* and *form of knowledge* are rendered through the content and style of the title (and possibly subtitle). They may also be rendered by a name connected with the publisher—e.g., the title of the journal or monographic series in which the work appears.

The four kinds of information are not always present. This may result from citers’ carelessness or from defects in the works themselves, as when they lack a publication date or have unrevealing titles. Less often, it results from convention, such as the journal *Science*’s policy of omitting titles from citations to save space. Ideally, however, citations communicate all four, and the ideal is frequently realized in practice.

At the level of a self-contained citation, the four are simply qualitative variables whose values have both explicit and implicit meanings. Explicit meanings are those that any educated reader might receive without special knowledge of the field in which the citation is made. Implicit meanings are those accessible to a field’s insiders through their knowledge of reputations, technical vocabulary, rhetorical styles, and the like. To insiders, a citation can connote subject matter not explicit in the title of the work. Such connotations are part of a field’s intellectual history, as doctoral students come to know it. In information science, for example, one might happen on this citation:

Bradford, S. C. (1934). Sources of information on specific subjects. *Engineering* 137 (3550): 85–86.

From the opaque title, outsiders could not guess that this paper is the origin of Bradford's law of scattering, a pillar of modern bibliometrics. Bibliometricians, on the other hand, might be surprised that the paper is cited at all, since the findings it announced have long been a staple of their thought. As a result, Bradford now goes relatively uncited—a phenomenon the sociologist of science Robert K. Merton termed “obliteration by incorporation.”^[15]

CITATION COUNTS

Talk of relative citedness leads to the notion of citation counts, by which individual citations enter into larger structures of meaning. These structures are the main subject of this entry.

Many published writings are never cited. But many others are drawn into citation networks that preserve information about the history of learned specialties and disciplines. A natural metric in these networks is how frequently authors have cited specific earlier publications. This measure resembles figures on book sales, journal subscriptions, and visits or links to web pages. Like them, it is not a gauge of absolute worth; quality and popularity are not identical.^[16] But when properly used, citation counts are a reasonably valid indicator of reputation in any field, granting that reputations may be increased by controversy.

The counts are metadata that emerge as citations to works accumulate in files. Until 1960, when Eugene Garfield founded the Institute for Scientific Information (ISI) in Philadelphia, there were no such files. *Shepard's Citation Index*, one of Garfield's influences, had enabled the legal profession to trace precedent decisions in court cases since 1873, but *Shepard's* was not regarded as a bibliometric tool. It was only when ISI created the *Science Citation Index*, the *Social Sciences Citation Index*, and the *Arts and Humanities Citation Index* for purposes of document retrieval that analysts could exploit them further as large-scale databases from which to mine statistics on learned literatures.^[17,18] The three previously mentioned ISI tools, which started as printed publications, were moved online as, respectively, Scisearch, Social Scisearch, and Arts and Humanities Search. In 1992, ISI was taken over by a new owner, Thomson Reuters, but the same databases remained available on the Internet, in time marketed jointly as the WoS. At this writing, WoS is offered by a Thomson Reuters spin-off called Clarivate Analytics.

The WoS indexes, described in McVeigh (p. XXX), are designed for “forward citation retrieval”—that is, they allow searchers to look up an earlier work and find the later documents that cite it. (When a later work is used to

find an earlier one, it is called “backward citation retrieval” or “footnote chasing.”) For example, a forward retrieval on Arthur C. Danto's 1964 article *The Artworld* in *Arts and Humanities Search* leads to (among other things) *Farewell to Danto and Goodman*, a 1998 article by Joseph Margolis in the *British Journal of Aesthetics*. All such later articles add up to the earlier work's citation count, or rather to its WoS count—a qualification necessary for two reasons.

First, while the citations in WoS may be *to* works of any sort, they are primarily drawn *from* articles and other types of publications that appear in journals. (Some WoS journal files date from as early as 1900.) WoS now also offers an index to citations from scholarly books (from 2005 on) and another to citations from conference proceedings (from 1990 on), but these require separate subscriptions, and many millions of older works are not covered. Second, WoS bases its coverage of contemporary journals, books, and proceedings in part on their international citedness: publications with citation counts below a threshold are not indexed and cannot contribute to the counts. This citedness policy also tends to favor inclusion of publications in English, the international language of science, and publications from countries dominant in scientific research, e.g., the United States and the United Kingdom.

The most widely used alternatives to WoS are Scopus and GS, both dating from 2004. Scopus, another high-quality subscription service, indexes current materials, especially scientific journals, even more broadly than WoS, but its retrospective coverage at this writing goes back only to 1996. Like WoS, its editorial selection policies determine what it will cover. Also like WoS, it has sought in recent years to improve its indexing of citations from books and proceedings, but again with the same careful selectivity. GS is different: it simply crawls the web, extracts citations from accessible documents regardless of their origin or language, and makes them and their counts available everywhere without charge. GS is increasingly used in serious bibliometrics—for example, in Bensman et al.^[19] Its counts for all sorts of works frequently exceed those in WoS and Scopus,^[20] although in some fields and periods, the latter two have better coverage of the literatures. The policies behind GS data gathering are opaque, and it has been faulted for unreliable data.^[21] But data from the other two major services may require cleaning as well.^[22] Ideally, researchers would combine vetted citations from all of the services (omitting duplicates) to arrive at counts.

MICROLEVEL DATA

The counts of a publication's outgoing references and incoming citations are not the same. For example, Stephen P. Harter's 1992 article “Psychological Relevance and

Information Science” makes *references* to 49 older works (a fixed count). At this writing, it has *citations* from more than 200 newer works in WoS (a changing count). Disciplines vary in the average number of references in their articles and in the average number of citations those articles receive in the years after publication. The latter sets a standard for what a *high* citation rate would be within a discipline, which can be compared in turn with rates in other disciplines. Harter’s article is highly cited in the relatively small field of L&IS, but not in science as a whole.

Table 1 displays what is actually counted. It is a lightly edited bibliographic record from *Arts and Humanities Citation Index* in WoS (in an old-fashioned, space-saving format). It identifies both a 1993 article by Russ Pottle and the publications he cites. His work is thus a “source” article in WoS—that is, a source of the “cited references” in the CR field.

These highly abbreviated CR strings are sufficient to identify works. In Pottle’s case, there are 14, as shown in the NR (number of references) field. Among them are an article by Nina Baym and a book by Ann Douglas, two older works to which Pottle’s is now related. (Either could retrieve Pottle if entered into a Cited Reference search in

WoS.) The citation frequency for any work is obtained by counting the CR strings that identify it in source (SO) publications. For example, occurrences of “Baym N, 1979, PMLA, V94, P909” are counted to get a total for the Baym article, and occurrences of “Douglas A, 1977, *Feminization Am Cult*” are counted to get a total for the Douglas book.

Baym and Douglas are sole authors, but who gets credit for a citation when coauthors are involved? In WoS databases, citations formerly accrued only to the first author, because CR strings identify no one else. Now, coauthors receive credit along with first authors in WoS, just as they do in Scopus. But in downloaded WoS data, one still sees only the CR strings. If one nevertheless identifies all the coauthors, there are two major ways of crediting them: either all get full credit for the citation (their counts all go up by one) or all share equal fractions of credit (e.g., three coauthors get a third of a credit each). Besides affecting authors’ citation records, this choice determines who appears in author maps.^[23–25]

The CR strings themselves can be split into additional variables that are countable across the database. For instance, a count for Herman Melville as a cited author can be obtained from occurrences of “Melville H”; a count for *Publications of the Modern Language Association* as a cited journal by occurrences of “PMLA.” A count for items published in a cited year—say, 1979—is obtained from occurrences of “1979,” as seen in the Baym and Jubak articles in Table 1. Counts of items published in a cited year are used in half-life statistics, described later.

For entities above the level of individual works, such as authors and journals, citation counts may be incremented by how frequently their names occur in the CR strings, or by how many source publications cite them. For example, Melville’s count could go up by *three* because three of his works appear in Pottle’s references, or by *one* because one more source publication—Pottle’s article—cites him. Scopus and WoS display counts of both kinds. GS simply counts citations to individual works and then totals them for authors.

What the citation databases do *not* count are the times a later work refers to an earlier one in its body text—instances of *op.*, *cit.*, and *ibid.*, as it were. Systems do not yet exist for routine analysis of that kind. For example, no matter how many references Margolis may make to “The Artworld” within his text, it is his “Farewell” article that is counted, and so the citation count for “The Artworld” increases only by one. But with greater computer power, frequencies of internal references may in time be captured as an indicator of the importance of works to the citer.^[26]

Fields other than the CR field can be analyzed in WoS records. Given data like those in Table 1, analysts can learn the number of items published by particular authors (AU) and source journals (SO). Institutional affiliations and geographic data for authors can be mined from the “reprint author” (RP) field. (Records for newer articles

Table 1 Source article record from Web of Science with tagged fields

AU	Pottle, R
TI	The Monkey before the Whale, Signifyin(g) and Melville’s ‘Mardi’
SO	Journal of Narrative Technique
LA	English
DT	Article
RP	Pottle, R (Reprint Author), Louisiana State Univ, Baton Rouge, LA 70803, USA
CR	Baym N, 1979, PMLA, V94, P909, DOI 10.2307/461973 Beaver H, 1984, H Melville Reassessm Davis Merrell, 1960, Lett H Melville Davis Merrell R., 1952, Melvilles Mardi Char Douglas Ann, 1977, <i>Feminization Am Cult</i> Durer CS, 1986, <i>Romanticism Past Pre</i> , V10, P45 Gates HJ, <i>Signifying Monkey Th</i> Giltrow J, 1980, <i>Am Lit</i> , V52, P18, DOI 10.2307/2925185 Jubak J, 1979, <i>Genre</i> , V9, P121 Melville H, <i>Moby Dick</i> Melville H, <i>Typee</i> Melville H, <i>Mardi</i> Samson John, 1989, <i>White Lies Melvilles</i> Saussure FD, 1989, <i>Course General Lingu</i>
NR	14
PY	1993
VL	23
IS	3
BP	36
EP	53
PG	18
SC	Literature

give affiliations and geographic data separately in a field tagged C1.) While these data may need extensive cleaning, they are obviously useful in evaluating institutions and countries. One can also get totals of items by language (LA), publication year (PY), and document type (DT). The subject category (SC) field characterizes not individual articles but the journals in which they appear. The SC assigned to the belletristic *Journal of Narrative Technique* in Table 1, for instance, is “Literature.” (Some journals are assigned to more than one subject category.) The full SC scheme in WoS covers most of the sciences, social sciences, and humanities and allows literatures to be broken out by disciplines and subdisciplines.

HOMONYMS AND ALLONYMS

An introduction to citation analysis must warn about the errors caused by homonyms and allonyms. These occur in the strings of text that designate articles, books, journals, authors, organizations, and other entities.^[27] They must be dealt with if the citation counts for any entity are to be accurate. No current software solves the problems entirely; checking is always necessary, and data cleaning may well be.

A *homonym* is a name that is the same for two or more different cited entities. In L&IS, for instance, the string “Wilson P” denotes at least two authors (Patrick Wilson and Pauline Wilson). Homonyms require disambiguation. If the right disambiguator does it—someone who can interpret contextual clues correctly—this may be simple enough. For others, it may be difficult or even impossible. The homonym problem is made worse by the abbreviations in citation databases that nullify disambiguations inherent in natural language. At this writing, WoS has a module for disambiguating abbreviated authors’ names, while Scopus, a newer system, permits retrievals on full names. However, full names, too, can be homonymic.

An *allonym* is one of two or more different names for the same cited entity, such as “Jones KS” and “Sparck Jones K” when both denote the information scientist Karen Sparck Jones, or “Am Lit” and “AL” when both denote the journal *American Literature*.^[27] Allonyms require conflation. This may require as much insider’s knowledge as disambiguating homonyms. To assign accurate counts to certain information scientists, for example, one must know that the name Derek de Solla Price takes many forms in citations, or that Karen Markey is also cited as Karen Drabenstott. If serials have appeared under more than one title, or books in more than one edition, one must decide whether their allonymic citation counts should be conflated or kept separate.

Citers often inadvertently create allonyms by getting names wrong or by misnumbering journal volumes, pages, and years of publication. (These are called “citation variants” in WoS; the broader “allonym” includes both

erroneous and nonerroneous variants.) While such errors may be too singular to affect counts much, inconsistent data entry in all the citation databases can affect counts greatly. WoS has reconciled different versions of the same journal name in the SO field of its records for source articles, but it has not done so in the abbreviated journal names or book titles that appear in the CR strings. Clean sets of older *Journal Citation Reports (JCR)* data are available for comparison studies.^[28,29]

Both homonymic and allonymic problems can beset the same name. For example, the American founder of cocitation analysis, Henry Small, has published under bylines both with and without his middle initial. He is thus cited as both “Small H” and “Small HG.” Since both counts are sizable, these allonyms should be conflated. But other Smalls with the same initials also contribute to the counts, and their homonymic names need to be disambiguated from “the right Small’s.” In the case of Chinese, Japanese, and Korean researchers, name problems are severe.

MEASURES DERIVED FROM COUNTS

Citation counts are the basis of some important summary statistics, such as impact factors for journals and the h-index for authors (see also McVeigh, p. xxxx; Bar-Ilan, p. xxxx). Handbooks from Sweden’s Karolinska Institute^[30,31] describe in detail many of the indexes that can be derived from counts. Further introductions will be found in books by Harzing^[7] and Moed^[32] and in reviews by Mingers and Leydesdorff^[33] and Waltman.^[34] Several indexes are quite controversial; critics challenge their validity for evaluating authors, organizations, and journals.

Journal statistics. As part of WoS, *JCR* provides statistical data like those in Table 2. Such reports are available for journals in the natural and social sciences (not the arts and humanities). They are pegged to individual *JCR* years, e.g., 2013. The “Total Cites” column tells how many citations went in the *JCR* year to all articles published in that journal in a specific year. These numbers have obvious interest for journal editors and also for library serials managers as they decide how to allocate subscription money.

Table 2 ranks by “Journal Impact Factor” some well-known journals in the subject category “Information Science and Library Science” in *JCR* year 2013. The impact factor, which varies from year to year, adjusts journal citation counts by the number of items published, so as to counteract the effects of journal size and age. To compute it, all citations to a journal’s articles in the two years before the *JCR* year are divided by the number of articles the journal published in the same two years. A factor of 1 means that the articles of those two years averaged one citation each. In Table 2, the impact factors for *JCR* year 2013 are based on citations to articles published during 2011 and 2012. At the

Table 2 Ten L&IS journals ranked by impact factors in *JCR* year 2013

Full journal title	Total cites	Journal impact factor	Immediacy index	Cited half-life	Citing half-life
<i>Journal of Informetrics</i>	1152	3.58	0.6	3.2	6.4
<i>Scientometrics</i>	5129	2.274	0.329	6.5	8.1
<i>Journal of the American Society for Information Science and Technology</i>	5125	2.23	0.29	6.6	8.1
<i>Online Information Review</i>	558	1.443	0.042	4.8	8.2
<i>Library & Information Science Research</i>	562	1.384	0.056	7	8.7
<i>College & Research Libraries</i>	528	1.333	0.182	9	7.7
<i>Journal of Information Science</i>	937	1.087	0.117	7.2	8.2
<i>Information Processing & Management</i>	1836	1.069	0.236	8.3	7.8
<i>Journal of Documentation</i>	1046	1.035	0.195	>10.0	9.4
<i>Library Quarterly</i>	291	0.861	0.143	>10.0	>10.0

top, the *Journal of Informetrics* articles averaged almost 3.6 citations each; at the bottom, the *Library Quarterly* articles averaged less than 1 each. (In the hard sciences, one sees much larger impact factors than those of Table 2.)

Researchers know that it is important to publish in good journals, and impact factors are one measure of this. However, such factors do not necessarily indicate the quality of *individual papers* in the journals.^[35] Much of a journal's citation impact depends on a relatively small number of highly cited contributions that the "average" paper may scarcely resemble. Thus, a paper being evaluated (e.g., in a tenure case) should also be judged on other grounds, such as its own citation count and comments from peers.

The "Immediacy Index" is an indicator of how fast-moving a field is—how quickly articles in a journal are cited. To obtain the index, all citations to a journal's articles in the *JCR* year are divided by the number of the articles the journal published in that year. In Table 2, the 2013 immediacy index for *Scientometrics* reflects a faster-moving research field than the one represented by, say, the *Journal of Documentation*.

The "Cited Half-life" of a journal is the median age of the articles in it that are cited in a *JCR* year. Article age is measured from year of publication. In Table 2, half of the articles in the *Journal of Informetrics* that were cited in 2013 were no more than 3.2 yr old. The half-lives of the other journals indicate that citers were drawing on somewhat older materials. Bibliometricians have done considerable work on how publications age (or "obsolesce") in terms of citedness^[36]—a process relatively fast in many sciences and relatively slow in the humanities and the softer social sciences.

Whereas cited half-life pertains to the citations a journal receives, *JCR* also provides data on the references the journal sends out. This is called its "Citing Half-life," and it is the median age of publications that appear in the bibliographies of its articles. Again, contributors to the *Journal of Informetrics* tend to cite newer materials than do contributors to comparable journals.

JCR creates a web page for each journal it covers. The page displays graphs of the journal's half-life trends over

time, its citing and cited relationships with other journals, and the raw counts from which the Table 2 statistics were calculated.

The WoS subject categories define fields in which journals can be compared. One can rank journals by any of the indexes in Table 2 (plus several others) and also alphabetize them by title. It is possible as well to obtain those indexes for aggregates of journals representing entire WoS subject areas. For example, by clicking on the "Categories by Rank" button, one can compare "International Relations" with "Law" in terms of the median impact factors of journals in the two disciplines.

Since 2007, *JCR* has made available two other measures of impact called eigenfactor metrics.^[37] A journal's "Eigenfactor Score" starts with a count of all citations it has received from other journals in the five years preceding the *JCR* year. Then the other journals are weighted by how many citations *they themselves* have received, so that citations from highly cited journals raise the eigenfactor score more than do those from less-cited journals. The second measure, derived from a journal's eigenfactor score, is the "Article Influence Score." It summarizes, in a single value, the influence of all the articles in a journal over the five years since their publication. A score of 1 indicates that the articles have had average influence. Scores above 1 indicate influence above average, as is desirable; scores below 1, the reverse.

Scopus has its own "CiteScore" metrics of journal quality, including the "SCImago Journal Rank" and the "Source Normalized Impact for Paper," as noted in its downloadable guide. GS has also instituted some quality measures for journals under a "Metrics" link and explained how publications qualify for GS indexing under an "Inclusion" link.

Author statistics. Within appropriate domains, authors' raw citation counts always have human interest. They range in order of magnitude from 1 to 10 for obscure scribblers to more than 10,000 for world eminences such as Noam Chomsky and Michel Foucault.

A summary measure for authors that caught on quickly is the "H-Index."^[38] When an author's publications are

ranked high to low by their citedness, h is the lowest number of publications that have received at least that many citations. For example, an h -index of 20 means that a scientist has published 20 papers that have been cited at least 20 times each. The index is intended to capture career achievement by balancing the productivity of authors (their publication counts) with the reception of their work (their citation counts). It should be used to compare authors only within their fields, since disciplines vary in size and citing norms. Errors in counts attributable to homonyms and allonyms must be corrected; otherwise, the h -index can be very inaccurate.

The h -index is now automatically calculated by Scopus, WoS, and (for GS and Microsoft Academic data) Publish or Perish. As with impact factors, the strengths and weaknesses of this index have received critical scrutiny, and alternative measures have been devised to supplement it.^[39] One is the “G-Index,”^[40] which is the last rank at which the author’s *cumulative* citation count is at least the square of the rank. For example, moving down the ranks, the g -index = 10 when the total citations to an author’s top 10 papers equal or exceed 10^2 (i.e., 100), but not 11^2 (i.e., 121). The g -index takes into account the actual number of citations received at the top end, thus complementing the h -index, which is blind to this.

Organizational and national statistics. Increasingly, policy-makers consider bibliometric data as evidence in deciding how to allocate funds to scientific and scholarly organizations. Given past funding as input, organizational outputs can be assessed qualitatively by experts. They can also be assessed quantitatively through indicators such as counts of research publications and patents, and of their citations over time. In the hurly-burly of politics, where money and prestige are at stake, opinions on bibliometric indicators run from enthusiastic acceptance to litigious rejection.

The unit of analysis here is not individual authors but the organizations themselves. The Centre for Science and Technology Studies at Leiden University in the Netherlands is a world leader in research of this kind. The Centre’s former director, Anthony van Raan, notes that disciplines and specialties can be compared at the national level and across universities, faculties, and institutes. In his view, the studies most relevant for policy-makers are those that examine “the real ‘workfloor’ of research practice: departments, research groups and programs within universities and large institutes” (p. 21).^[41]

To learn a research unit’s international scientific influence, several ratios from WoS data are brought to bear. For example, to determine the impact of a German institute in medical research, van Raan’s team obtained 1) its mean citation rate per publication over a multiyear period (with self-citations removed) and for the same period 2) the mean citation rate of all papers published in all journals in the subject fields relevant to the institute. Dividing 1) by 2) gives the original “Crown Indicator,” a

measure of the institute’s internationally standardized citation impact in the Western world. If the ratio is around 1 (0.8 to 1.2), the program is average. A ratio of 0.5–0.8 indicates the program is below standard (less than 0.5 would be far below). Conversely, a ratio above 1.2 suggests distinction; above 1.5, high distinction. The German institute scored above 1.5, and the analysts could apply the same ratio to other programs in the institute to learn which contributed most to the excellence of its output. The Centre is engaged in ongoing improvement of the crown indicator, and a new one has been proposed.^[42]

Bibliometrics may yield insights for academics and policy-makers even when data are at the highest levels of aggregation. For example, Sylvan Katz^[43] compares nations within the world science system and finds that the number of papers they publish (“production”) and the citations those papers receive (“recognition”) have a very strong power-law relationship that is constant over time and independent of system size and nationality. This means that both production and recognition in science are inherently nonlinear or skewed, with small minorities of researchers producing disproportionately high numbers of papers and receiving disproportionately high numbers of citations. Science evolves this way naturally; its systems at all levels—regional, sectoral, national, and international—are “self-organizing” and “self-similar.” A major policy implication of this finding is that governmental attempts to change a nation’s science system through reallocations of funding are not likely to be simple or quick.

Other introductions to policy-related citation research in this vein are Leydesdorff^[44] and Lundberg.^[45]

INTERDOCUMENTARY RELATIONS

Citation analysts are not limited to counting attributes of documents taken singly. They can analyze counts of attributes taken jointly—for example, attributes of both citing and cited documents. It is in pairwise relations that analysis of citations may attain its greatest interest (see also Bar-Ilan, p XXXX). A nonexhaustive view of possibilities may be gained by looking at the two records in Table 3. (The Dialog Classic tags in them—CS, GL, and JN—are a bit clearer for present purposes than their analogs in WoS.) Table 3 shows the simplest pairwise link—direct citation, in which one document cites another. From that link, more complex structures can be created, such as the following.

The titles (TI) of citing and cited documents can be searched for coinciding vocabulary that suggests thematic connections. (No title words coincide in the records in Table 3, but the relations sketched here presume large pools of such records.) Data from the author (AU) field can reveal citer–citee patterns, including those of self-citation. The organizations that other organizations cite can be learned through corporate source (CS) data, which name

Table 3 Pairwise relations can be computed from raw data such as these

Cited document	Citing document
TI- The Artworld	TI- Farewell to Danto and Goodman
AU- Danto AC	AU- Margolis J
CS- Columbia Univ, New York NY	CS- Temple Univ, Philadelphia PA
GL- USA	GL- USA
JN- Journal of Philosophy, V62, N19, P571-84	JN- British Journal of Aesthetics, V38, N4, P353-74
PY- 1964	PY- 1998
DT- Article	DT- Article
SC- Philosophy	SC- Philosophy
LA- English	LA- English

authors' employers. The global locations (GL) of those employers permit similar analyses to be performed country to country. Journal names (JN) that a particular journal cites or is cited by—again including self-citations—are a standard bibliometric measure of influence. Publication year (PY) data, which are separable into cited and citing years, have multiple uses—for example, in WoS and Scopus statistics on authors and journals and in studies of document obsolescence. The PY variable can be combined with other variables in Table 3 to demonstrate chronological trends.

The last three fields suggest analyses parallel to those already described. In what proportion does each document type (DT) cite itself and other document types? What is the corresponding breakdown for languages (LA)? And finally, from what subject categories (SC) does a given research area receive citations, and to what SCs does it send them? SC data resemble those in import–export tables that quantify international flows of trade. They show the disciplines from which a field is importing ideas and the disciplines to which it is exporting them.

Intercitation. In studying intellectual connections, one can look at how members of a closed set cite each other. For example, among a set of aestheticians, how frequently does Margolis cite Danto or Danto cite Margolis over time? This is a rough measure of influence in the broadest sense. At this writing, Margolis has cited Danto in 11 articles, and Danto has cited Margolis in one. The citer–cited relation is asymmetric: A's citations to B need not be the same as B's to A.

Analysis of pairwise counts for a closed set of citers and citees—say, 20 philosophers in aesthetics—is a form of network analysis,^[46] and the methods available for studying social networks are perfectly adapted to it. With network software such as UCINET, identical techniques can be used to analyze the social ties, interpersonal communications, and citation ties of Danto, Margolis, and other aestheticians. If the nodes representing papers in citation networks are numerous, the researcher needs

software capable of analyzing and visualizing very large matrices. Pajek, which may be downloaded free, is one solution.

Intercitation is also of interest at the level of journals. Over some time period, for example, how many articles in the *Journal of Documentation* cite those in the *Journal of Information Science*, and vice versa? (This may bear on subscription decisions by serials managers in libraries.) Studies of intercitation among journals include Leydesdorff^[28,29] and Morris and McCain.^[47]

Bibliographic coupling. Originally proposed by M. M. Kessler,^[48] this measure is a count of the references that two publications make in common. (“Co-references” some call them.) Thus, if Paper A and Paper B cite two of the same other works, they are said to have a bibliographic coupling strength of 2. (Margolis's “Farewell” article and Danto's “Indiscernibility and perception: A reply to Joseph Margolis” have a strength of 2 because both refer to the same two books by Danto.) The fact that papers share one or two references may mean little substantively, but as their bibliographic coupling strength increases, so does the probability that they have similar content.

Bibliographic coupling is used in the Related Records module of WoS (see McVeigh, p. XXX). If one retrieves a publication of interest and wants to retrieve others like it, the “Related Records” button on its individual web page will call up other writings whose bibliographic coupling strength with the seed is at least 1. Unfortunately, such a low threshold retrieves many publications with no obvious ties to the seed. Moreover, the retrievals are based on only one seed at a time. To study *networks* of papers that are bibliographically coupled at a respectable strength, one must download records and use other software.

Cocitation. Whereas bibliographic coupling links *citing* documents, cocitation links *cited* documents. Bibliographic coupling is a static measure, because the references shared by two citing documents will not change. Cocitation, in contrast, is dynamic. It occurs whenever a later work cites any two earlier works in its footnotes or endnotes. Clearly, repetitions of the same pairing can occur in other later works indefinitely. Rousseau^[49] has a useful discussion of cocitation counts, bibliographic coupling counts, and their elaborations.

Cocitation is a symmetric relation; A's count with B is the same as B's with A. As with bibliographic coupling, a cocitation strength of 1 or 2 may mean little, but repeated cocitation of the same two works (especially if done by different citers) predicts high relatedness. In expository writings, the connection will usually be on grounds of subject matter, method (e.g., quantitative vs. qualitative), and form of knowledge. When dissimilar imaginative works such as *Moby Dick* and *Huckleberry Finn* are frequently cocited, the connections will be on deeper levels of inferred themes and meanings.

Even so, two works cocited in the same publication may have nothing to do with each other. This problem

has recently been addressed by weighting the tie between any two cocited works by the width of the narrowest text window in which the tie occurs—the narrower the window, the higher the weight. In other words, the more closely two works are cocited in body text, the likelier they are to be intelligibly connected. Text windows of course require access to digital documents in full, not just their reference lists. In Liu and Chen,^[50] which builds on Gipp and Beel^[51] and Callahan et al.,^[52] four degrees of cocitation proximity are weighted high to low: within the same sentence > within the same paragraph > within the same section > within the same article. The conclusion is that cocitations at *sentence* level preserve “the most important structural components in the traditional cocitation network” while reducing the size of the data set 20-fold (pp. 509–510). They are thus a more efficient unit of analysis than the far commoner but looser cocitation ties at article level.

Cocitation as a measure was independently introduced by Henry Small^[53] in America and Irina Marshakova^[54] in Russia. Both focused principally on pairs of scientific *papers* as their unit of analysis. Small soon collaborated with Belver C. Griffith et al.^[55] to develop algorithmic maps of science based on papers cocited above specific thresholds. Much subsequent work has continued to use papers to define scientific specialties. The early results are described in Garfield;^[17] more contemporary results, in the four reviews mentioned earlier.^[3–6]

With Griffith, Howard D. White^[56] introduced maps based on cocited *authors*. The data here are counts of the times any two authors are cited together in later publications, regardless of which of their works are involved. Put differently, they are counts of the times authors' oeuvres have been cocited. Karl Erik Rosengren^[57] anticipated this line of thought in Sweden by studying how frequently famous literary authors (e.g., Ibsen and Tolstoy) were “co-mentioned” in book reviews.

Cocited authors should not be confused with coauthors. Danto and Margolis, for example, have never coauthored anything, yet Arts and Humanities Search on Dialog Classic showed various items from their oeuvres cocited in 64 articles. Like papers, highly connected oeuvres tend to share subject matter or research methods or both. Once authors as oeuvres are connected, the analyst can also explore possible ties between the same authors as persons—for example, as mentor and student, coworkers, or intellectual opponents. Social facts like these often help to explain the groupings in author maps and heighten the interest of the maps to a field's insiders.

Katherine McCain began the cocitation analysis of *journals*.^[58,59] Her maps at this higher level of aggregation are based on how frequently any two journals are cited together, regardless of what in them is cited. Cocitation groups journals not on the basis of the superficial similarities perceived by indexers, but on conjoined use by researchers. Analysis can be limited to a specific

field or expanded to uncover supporting disciplines and related topic areas. It is therefore relevant to serials management and information retrieval.

Illustrating several of the possibilities, McCain has used journal cocitation mapping to study interrelationships in the literatures of genetics, economics, and aquatic sciences/fisheries. In the genetics and fisheries studies, visualization of the cocitation data demonstrated the existence of a basic-to-applied continuum of journals representing major themes in research and development. The genetics and economics studies combined cocitation data with intercitation data to identify, map, and cluster journals central to fields.^[13]

Cocitation analysis can be broadened to include *organizations* and even *countries*. Whatever the unit of analysis, algorithmically produced cocitation maps are usually quite intelligible. The same is true of maps based on bibliographic coupling. Zhao and Strotmann,^[60] for example, mapped a set of information scientists using their cocitation counts and their bibliographic coupling counts from 1996 to 2005 as separate indicators of relatedness. Both metrics proved informative and complemented each other. In another study involving many thousands of biomedical articles from 2004 to 2008, Boyack and Klavans^[61] found that an enhanced form of bibliographic coupling outperformed cocitation and direct citation in identifying clusters of documents at research fronts.

A cocitation map. Fig. 1 is a map of cocited information scientists. It was generated in 2004 by entering the name of a seed author, here Marcia J. Bates, into a web-based system called AuthorMap. This system was developed by a Drexel University team to visualize cocitation data instantly on the fly. At the time, AuthorMap was connected to Social Scisearch on Dialog Classic, and in the first step it retrieved the 24 other authors most highly cocited with the seed. In the second, it put these authors into a 25 × 25 matrix and retrieved the cocitation count of every unique pair. In the third, it used the Pathfinder Network (PFNET) algorithm to draw links reflecting only the *highest* cocitation counts among the 25 authors.

PFNETs are fully connected networks that simplify intellectual structure to its most salient aspects. The numbers above the links in Fig. 1 are cocitation counts. While Bates (lower center) is cocited with everyone in the map, her *highest* cocitation count is with Nicholas Belkin. Similarly, the highest counts for Carol Fenichel, Christine Borgman, Raya Fidel, and Karen Markey are with Bates. The same principle holds throughout the map—for example, the highest count for Amanda Spink (upper right) is not with Bates but with Tefko Saracevic. In this manner, the PFNET algorithm creates groupings that anyone familiar with information science can interpret.

Briefly, the central group around Belkin, which includes Bates and Saracevic, consists of authors associated with “the cognitive turn” in information science, which dates from the late 1970s. This group's goal has

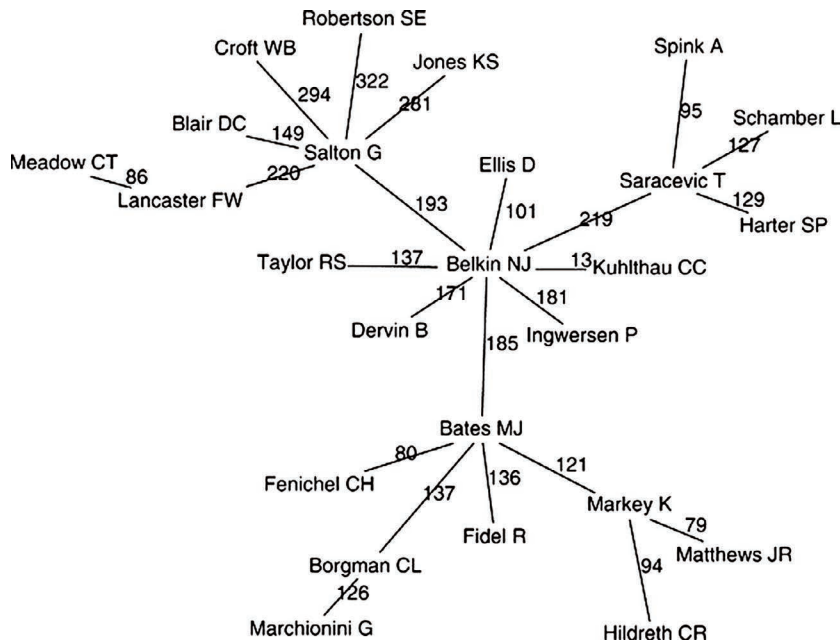


Fig. 1 PFNET of top 25 names in Marcia J. Bates' citation image, with cocitation counts.

been to redirect research emphasis from systems to users, construed both psychologically and sociologically. Belkin, for instance, has explored the effects of ignorance (under the name "anomalous state of knowledge") on attempts to specify information needs to a retrieval system. Saracevic and the authors around him are keen on elucidating the notion of relevance in judging documents. Bates' group often study particular classes of persons (e.g., children, college students, humanities scholars) who seek answers from library catalogs or bibliographic databases in natural settings. The focus is on how users actually behave as they search online and what in system design helps or hinders their progress.

The cognitivists were reacting against the relatively impersonal tradition typified by the authors around Gerard Salton (upper left). Whether experimenting with retrieval from small testbeds of documents or appraising systems such as Medline, the latter group tends to stress algorithms, indexing vocabularies, and quantitative evaluations with formal measures like recall and precision. In their research, people function mainly as judges of system output and remain invisible otherwise.

Note, however, that the relationships of these cocitees are not so much adversarial as complementary. All seek to fill gaps in information retrieval theory and practice. Salton (symbolizing systems) and Belkin (symbolizing users) are here directly linked, and the entire field as mapped is ultimately generated from Bates' name. The cocitation metric and PFNET algorithm pack a great deal of historical information into a comprehensible whole.

Images, identities, and recitation. Fig. 1 is based on the top 25 names in Bates' "citation image." This term is defined in White^[27,62] as a rank-ordered list of the authors with whom a seed author is cocited. Citation images are

created by citers in general and give "the field's-eye view" of the seed author as it has developed across multiple publications.

The citers who create a seed's image can themselves be ranked by the number of publications in which they have cocited anything by the seed with anything by others. Given this fact, White^[27,62] calls them "citation image-makers."

Just as works and authors can be characterized by the number of citations they have received, they can be characterized by the number of *unique authors* who have cited them. The result is a new way of looking at impact. In the case of a work, do its citations come from many different authors or from relatively few authors who cite it again and again? A work with many different citers would seem to have had greater impact, in the sense that it has attracted more people's attention. Citer counts can thus reveal the intellectual *reach* of a seed author, which mere counts of citations obscure. In studies of American and British L&IS^[63] and then of nine fields in the natural and social sciences,^[64] Ajiferuke and colleagues used cited authors (rather than works) as seeds and counts of their unique citers as an impact measure. Although citation counts and citer counts were significantly correlated, the rankings of seeds they produce were not identical, and the differences were greater in the social sciences than in the natural sciences.

Another way to study a seed author is to obtain the author's "citation identity." As defined in White,^[27] this is not the field's-eye view, but that of the seed author. It is a list of the author's own citees, rank-ordered by frequency of citation over time. As the seed author's publications grow, some names will be cited more than once, and a fraction of these will be cited many times. These

Table 4 Names cited at least 10 times in Margolis's citation identity

Rank No.	Items	Term
1	48	MARGOLIS J
2	28	PUTNAM H
3	28	QUINE WV
4	25	GADAMER HG
5	22	RORTY R
6	20	DAVIDSON D
7	19	KUHN TS
8	18	GOODMAN N
9	16	DERRIDA J
10	15	CHOMSKY N
11	14	FOUCAULT M
12	13	DENNETT DC
13	13	HABERMAS J
14	12	DUMMETT M
15	12	WITTGENSTEIN L
16	11	DANTO AC
17	10	BEARDSLEY MC
18	10	POPPER KR
19	10	STRAWSON PF

Rank: S1/1-85 Field: CA= File(s): 439. (Rank fields found in 77 records—510 unique terms).

heavily *recited* names are compact clues to an author's intellectual history. Almost always, the top name on the list will be the seed author's own: self-citation is ubiquitous in science and scholarship. Self-citation is no more egotistical than bylines are; it is the way in which authors bind their oeuvres into wholes, a task for which they are uniquely qualified.

We have seen that citations connect the philosophers A. C. Danto and Joseph Margolis. Danto's citation identity shows that he cites quite sparsely in his many journal publications. His single citation to Margolis came in response to the "Farewell" article in Table 3. Margolis, whose identity appears in Table 4, is much more prolific in his recitations. Names he cites 10 or more times reveal him to be a generalist of modern philosophy; aesthetics (represented in the identity by, e.g., Goodman, Danto, and Beardsley) is only one of his interests.

Until late 2013, citation images, image-makers, and identities were readily obtainable with the Rank command on the Dialog Classic system.^[62] Table 4 was made by forming the set of Margolis's 77 publications in Arts and Humanities Search (File 439) on Dialog and then entering a command that ranked his citees high to low. WoS has some useful modules for analyzing citations, but, unlike Dialog, not for obtaining images, identities, or cocitation counts of any sort. Nor do Scopus, GS, or Microsoft Academic. (The tools named in^[8-10] enable bibliometric map-pers to extract cocitation counts from downloaded data.)

Historiographs. Eugene Garfield and a programming team have patented a free, web-based tool called HistCite that makes "historiographs" possible.^[65] These show networks of citing and cited papers that define a specialty or

that descend from the influential work of a predecessor. Analysts choose the specialty (e.g., Digital Libraries) or the predecessor (e.g., M. M. Kessler) to investigate. The term "historiograph" indicates that the data, drawn from the WoS, can be graphed as a time-ordered cascade of papers whose linkages are pertinent to the history of a line of research. Certain papers stand out in historiographs because they have numerous links to or from other papers, suggesting a high degree of intellectual interest.

Although HistCite has its own graphics module, Fig. 2 is a diagram of HistCite data made with Pajek software. It shows a subset of the network of papers that descend from the original paper on bibliographic coupling.^[48] The downward-pointing arrows mean "cited by"—that is, the foundational work, labeled Kessler-MM-1963b, was cited by Garfield-E-1963, which in turn was cited by Garfield-E-1964 and so on. The chain Weinberg-BH-1974, Smith-LC-1981, and Liu-MX-1993 are literature reviews.

HistCite diagrams reveal not only direct citation links between papers but also indirect links—that is, connections through intermediary papers. In Fig. 2, the link between Brooks-TA-1985 and Chakrabarti-S-1999 (lower left) is not direct but runs through Lui-MX-1993 and Savoy-J-1997. Were this a chain of influence in the development of an idea, it might interest intellectual historians. Serious large-scale investigation of such chains will require computerized analysis of the full texts in which citations are embedded, but that is increasingly a possibility.

Long before HistCite, an important early historiograph appeared in a study that Garfield and two ISI colleagues made in 1964 on classic research in genetics. As reproduced in Garfield,^[66] the hand-drawn historiograph shows 40 interlinked papers keyed to major events in the development of DNA theory from 1820 to 1962. The baseline for the ISI study was a narrative history of this development, Isaac Asimov's 1963 book *The Genetic Code*. The ISI citation analysis independently corroborated Asimov's conclusions at many points. It also turned up intellectual connections he had missed but that enriched his history.

Through HistCite, existing data on many networks of papers are also freely available on the web. The linked HistCite Guide explains the pertinent variables and the algorithmic mode of visualization. New analyses may be conducted on data downloaded from WoS.

Recently, van Eck and Waltman^[67] have introduced another free tool for analyzing and visualizing citation-linked chains of WoS documents. Called CitNetExplorer, it can interrelate papers historically, cluster them by topic, and reveal papers new to the user for retrieval.

Documents by the millions. Klavans and Boyack^[68] is a succinct history of attempts to make citation-based subject classifications more accurate. At the same time, it captures the gradual transition to "big data" in the visualization of scientific and scholarly knowledge. Researchers today can map data sets involving millions of documents (e.g.,

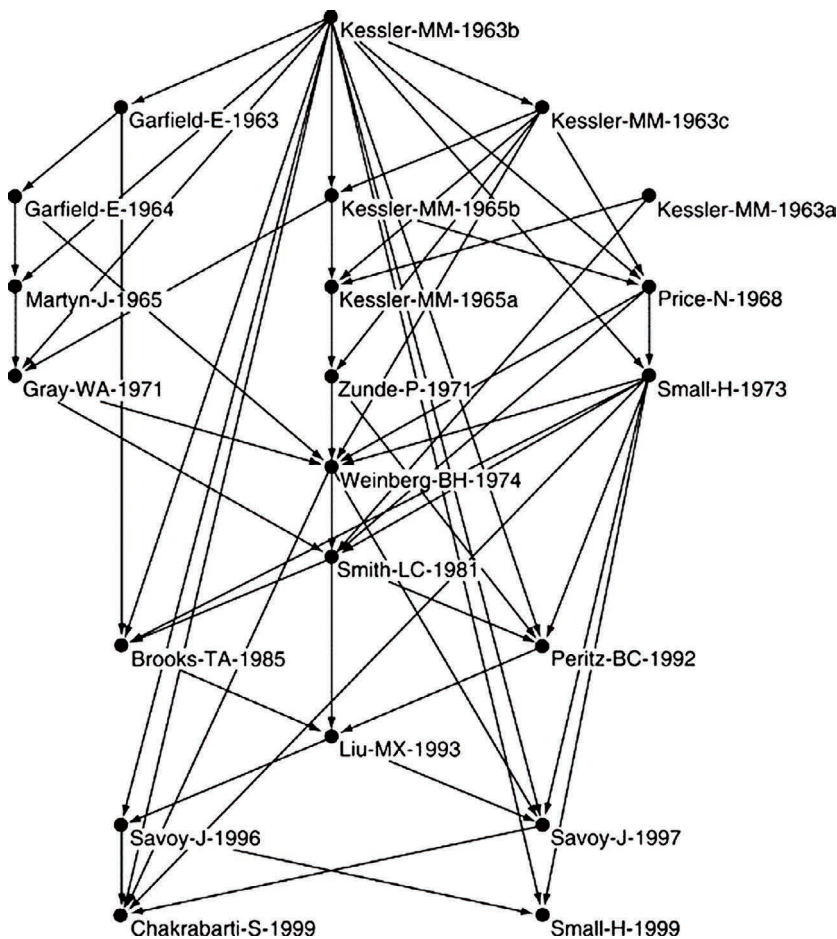


Fig. 2 Histogram of papers descending from Kessler's paper on bibliographic coupling.

Waltman & van Eck^[69]). Some of their achievements are on colorful display in two large, handsome atlases by Katy Börner.^[70,71] The best-known visualization at present is perhaps Klavans and Boyack's beautiful map of the interconnectivity of all science.^[72] Originally drawn from 7.2 million papers in more than 16,000 journals covered by WoS and Scopus during 2001–2005, it has since been extensively updated.^[73] It depicts a network in which the nodes represent *groups of journals*, and the links represent intercitation among the groups. Strong intercitation connotes highly shared literatures and thus defines disciplines (e.g., physics) or specialties (e.g., brain research) for color-coding. Weaker intercitation connotes literatures shared *across* fields; fields with considerable sharing (e.g., physics and mathematics) are adjacent in the network, while fields with little or no sharing (e.g., brain research and earth sciences) are apart. The network also serves as a base map against which aspects of particular disciplines or specialties (e.g., funding) may be highlighted and compared.

CONTENT, CONTEXT, AND IMPACT

Can we finally say what citation counts mean? This question has long been debated—especially whether citation

counts can be taken as indicators of quality. That is what the persistent calls for “a theory of citing” are all about.

The root of the problem is that counts treat citations as identical units, when clearly they are not. First, as pointed out in Cronin,^[74] counts hide the fact that citations refer to writings at different levels of granularity, from entire oeuvres down through individual works, passages, and sentences to single words and numbers. Second, counts mask the disciplinary provenance, subject matter, and genre of citing works. Third, they also mask the varying functions of citations in context. There are differences between identifying one's theoretical tradition, adopting a method, suggesting background readings, acknowledging a mistake, nailing down a quote, and so on. Fourth, counts may be increased by negative citations that reflect adversely on what is cited. Fifth, counts often merge self-citations with citations to other authors. Sixth, counts fail to discriminate between citations that are essential to a new text and citations that could be dropped from it without loss. Seventh, counts may include citations to works the citers have not even read. Eighth, works that citers typically leave uncited—reference books, popularizations, technical manuals, and the like—cannot accumulate counts and so be recognized. Worse, omissions of this sort may occur with important substantive works—works that

should be cited. Ninth, counts are unrevealing as to citers' deeper intentions: Are they simply crediting intellectual predecessors? Symbolizing concepts? Marshaling everything relevant to their topic? Showing off their erudition? Summoning authorities to persuade readers of their own credibility? Inflating the citation counts of cronies from whom they expect the same?

This multipronged critique requires that citations be analyzed as to their contexts and content—their implicit as well as explicit meanings. It requires that citations be categorized in various ways and then recounted. In what is called “citation content analysis,” researchers extract *explicit* phrases from the text surrounding citations in multiple documents. They are looking for stable meanings that emerge as the phrases pile up.^[75] Ding et al.^[76] describes techniques that are emerging in this long-standing area of interest, since, in some fields at least, citations mark passages whose rhetorical significance is algorithmically detectable.^[77] One possible goal is simply to improve citation indexing, such as giving text-based clues as to *why* writings were cited and at what level of granularity. A more immediate goal is to discover linked knowledge claims in citing documents by extracting phrases from the sentences in which citations are made. Information scientists have begun to use such micro data to automatically summarize individual texts and to produce literature reviews across texts (Small–Elkiss et al.^[78–80]).

In another line of inquiry called “citation context analysis,” researchers must discover the *implicit* relations between citing and cited texts, such as what citations accomplish and the motives behind them.^[77,81] Studies of this sort traditionally require extensive reading and inference by human judges. Two examples: Garfield^[17] reproduces an early set of 15 inferred citer motives; among them are crediting related work, identifying methods and equipment, providing background information, and substantiating claims. Another influential work, by Moravcsik and Murugesan,^[82] calls for decisions such as whether the cited work is essential to the citer's new argument and whether the citer's attitude toward the cited work is positive or negative. Despite the growth of automated analyses, findings from older, labor-intensive studies like these have not lost their relevance (see, e.g., Baird,^[18] White,^[77] and Small–Nicolaisen^[83–87]). Some conclusions to be drawn from reviews of citation analysis are as follows:

- Relatively few citations are negative, and negation is also judged inconsistently across studies; it comes in many degrees of severity. (“Smith is wrong” is clearly a negative citation, but what about “Smith only partially covers my topic”?) Moreover, the negative citers may themselves be wrong. Even if they are not, to criticize something is by no means necessarily to destroy it. Controversies are frequently worthwhile; indeed they are a major driver of science and scholarship.
- While relatively many citations are indeed “perfunctory,”^[82] this does not mean they are useless. They do things like ritualistically invoking a pioneer, providing background reading, or mentioning distantly related work. Their opposites, which Moravcsik and Murugesan^[82] call “organic,” identify writings to which the new writing is directly indebted. These, too, are numerous. A possible predictor of organically related writings is multiple references to them in the same text.^[26,88] Another is an author's relatively heavy recitation of them over time.^[27]
- Works may be repeatedly cited because they symbolize concepts.^[75] For example, chemists can allude either to “hydrogen scattering factors” or to “Stewart et al.” and mean the same thing. Occasionally, a paper comes to stand for more than one concept,^[89,90] and full-length books may stand for many.^[91] When citations are inconsistent in what they connote—an unpublished study has shown this to be the case for citations to Wittgenstein's *Philosophical Investigations*—citors are referring to different passages or interpreting the same passages differently.
- Self-citations are no less legitimate in function than other kinds.^[27,92] If evaluators see self-citations as a problem, existing software can remove them from counts. For some measures (e.g., eigenfactor scores), removal is automatic.
- Authors may sometimes cite items without checking or even reading them. Clerical errors can be traced to the blind copying of flawed secondary sources.^[87] More seriously, cited works may be misrepresented as to content.^[93] But imperfections like these should not detract from the many millions of citations that function properly.
- The supposed norm in science and scholarship that “all relevant materials should be cited” means that authors should pay known intellectual debts and not suppress contrary evidence. In practice, authors do not take “all relevant materials” literally. If they did, lists of references would be too long for journals to accommodate. For example, no foundational work could ever be, in Merton's sense, incorporated and obliterated. To discredit citation counts, MacRoberts and MacRoberts^[94] claim that relevant materials are grossly undercounted, arguing that authors cite only about 30% of them. But this percentage depends wholly on the MacRobertses' own relevance judgments, for which they offer no supporting data. By second-guessing what authors *should* have cited, one can arrive at any percentage whatever.
- Social constructivists, for example, the MacRobertses,^[95] assert that the true motive of citers is to borrow prestige for their own texts from big-name authorities and to ingratiate themselves with editors, referees, and colleagues who can return favors. This is a bald form of the “persuasion hypothesis,”^[96,97] which holds that

authors cite to persuade others to accept their works. Undoubtedly, authors want to be persuasive—how could they not?—and cite others to achieve that goal. But are they trying to manipulate readers underhandedly, or are they simply giving proper credit? The latter view—called “the reward hypothesis”—is associated with Merton and his school of sociologists of science. Where statistical evidence has been gathered, it supports the Mertonians rather than the constructivists.^[87,98] In fact, the constructivists rarely present hard evidence; their case is closer to satirical folklore. The most trustworthy critics of citation analysis are those who have actually done it.

The issue, once again, is how seriously to take citation counts as indicators of quality.^[99] Cautionary examples include Gregor Mendel, whose now-famous work in genetics was relatively little cited until years after his death, and Arthur Jensen, who is highly cited but whose writings on race and IQ many academics deplore because of their implications for American education. With regard to Mendel, there are indeed cases of delayed recognition in science—van Raan has called them “Sleeping Beauties”^[100]—but they are rare. According to Glänzel and Garfield (p. 8),^[101] “Nearly all significant research is well cited within the first three to five years of publication.” Jensen is a somewhat ironic case in point: his foes quickly and repeatedly attacked his research to keep it from influencing policy-makers. But no one has been swayed simply by his citation rate. As Garfield (p. 652)^[102] puts it, with Jensen in mind, “Not all high impact science is great science.”

The word *impact*, in both the cognitive and social sense, is the best name for what citation counts measure. Work deemed bad for one reason or another may still have high impact. Conversely, good or even excellent work may have little or no impact, at least for a while. However, cases like Mendel’s and Jensen’s are exceptional. The trick for interpreters of citation counts is not to lose sight of the norm: high citation impact is frequently correlated with high marks on other scales, such as a favorable peer review^[103,104] and receipt of prizes and awards.^[99] As citationists themselves point out, counts should be compared only within disciplines and checked against other measures, but they are no less informative for that.

They are in some ways like election results. Delving below vote totals, one finds that voters differ in their affiliations and demographics, that different issues motivate them, that not all are equally well-informed, that ballots contain mistakes, that ballots may be fraudulent, and so on. Nevertheless, vote totals by themselves determine the central fact in all political battles—who wins and who loses. Citation counts, too, can be broken down in many interesting ways, but none is more interesting than what they reveal as aggregates—the current standing of works, authors, journals, and organizations in the battle for attention.

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Citation Indexes and the *Web of Science*

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Abstract

The *Web of Science*, an online database of bibliographic information produced by Thomson Reuters—draws its real value from the scholarly citation index at its core. By indexing the cited references from each paper as a separate part of the bibliographic data, a citation index creates a pathway by which a paper can be linked backward in time to the body of work that preceded it, as well as linked forward in time to its scholarly descendants. This entry provides a brief history of the development of the citation index, its core functionalities, and the way these unique data are provided to users through the *Web of Science*.

INTRODUCTION

In 1997, the Institute for Scientific Information (ISI[®], now part of Thomson Reuters) released the *Web of Science*, an online database of bibliographic information. It currently contains records from more than 13,000 journal titles spanning nearly 110 years of published information in the physical, chemical, natural, and applied sciences, all aspects of the social sciences, as well as the leading scholarly publications in arts and humanities. The library and scholarly communities immediately recognized that the hyperlink and search capabilities of the Internet could simplify the retrieval and navigation of scholarly information. The origin of the *Web of Science* and its real power, however, lay in an older and more radical innovation in information—the scholarly citation index. A citation index is a specific type of bibliographic and bibliometric database that has a specific structure and functionality. In this entry, I will outline the fundamental concepts of the citation index as well as describe how the *Web of Science* uses the key insights of citation indexing to offer both simple and powerful tools for the retrieval, navigation, management, and analysis of scholarly literature.

The primary uses of the *Web of Science* center on its structure as a citation index, containing an extensive, selective index of source materials, and an index of cited references. A simple topic or author search will present a user with a set of articles. The record for each article contains a list of the works referenced by the author, giving a look backward in time to important, relevant materials. It also contains a link to works published subsequently that reference the earlier article, giving a look forward in time to how the earlier article was interpreted by the scholarly community. Because citation searching retrieves articles based on relationships created by scholarly authors, it does not require subject vocabulary. It is possible to research an area that has emerging and complex terminology, without having to search on all that

vocabulary. Citation searching can also bypass ambiguous terms that are shared among several fields. Finally, the cited reference index, which allows a user to search all references in the database, enables a thorough analysis of citations, even if the cited materials are not part of the source database.

THE REVOLUTIONARY IDEA OF CITATION INDEXING

Among the most fundamental activities in research are collecting and comprehending the current knowledge. Thus the practice of citing prior literature is closely bound to the practice of scholarship itself. For the author, the list of cited references assembles a body of prior works within which the context of the current report can be considered. It is a way to acknowledge the shoulders of the giants on which you stand, either to climb higher, or to identify the point from which you depart. For the reader, pursuing the cited materials is a way to begin a guided exploration of the literature, to deepen understanding of the current work, and to inform the process of intellectual critique that allows the creation of the next scholarly work.

Eugene Garfield realized that the references created in the process of scholarship could construct a unique bridge between the creator of information, the author, and the consumer of information, the reader.^[1] Cited references were highly informed connections between scholarly works created by the scholars themselves, that could provide an authoritative statement of relevance. These connections were already available in each article, but could only point backward in time. The key insight underlying the citation index is that, when collected across many papers, cited references can connect an earlier work to many subsequent works, reframing the paper in terms, not of its origin, but of its consequences. If the cited references in a paper are descriptors added by the author, the citations to a

paper are descriptors added by later scholars that can indicate the developed meaning of the work.^[1,2]

At the time of writing a paper, there is no way for the author to anticipate fully the later development of the ideas or methods contained in his/her current description. By codifying the retrospective sweep of each work, and by linking many later works to the original work they all cite, a citation index creates a pathway by which a paper can be linked forward in time to its descendants. Through this, the community of publishing authors became what Garfield called “an army of indexers” providing information about their own and others’ works, and far exceeding the productivity, capacity, and expertise of any group of subject indexers. In a more modern parlance, citing authors are tagging each prior work by relating it to their own paper. Garfield’s goal was to create a new method of document collection and indexing that would harness this highly informed tagging to improve information retrieval. His solution was to create a citation index.

WHAT IS A CITATION INDEX?

In its simplest sense, a citation index is a structured list of all the cited references from a defined collection of original source materials^[3,4] and organized so that each cited reference can be associated with the article(s) that cite it. A citation index for a single article would thus be a list of cited references and the information about the article in which they appeared. A citation index for a journal would then be a list of all the substantive texts (exclusive of marginalia, advertisement, and similar content), along with the cited references that appeared in these texts.

Immediately, the complexity becomes apparent, as several articles in a journal could cite the important prior work. This shared citation, indicative of a topical relationship among the works, would be visible in the citation index in a way that is difficult to capture by reviewing the reference lists of each article individually.

A true citation index has two aspects—a defined source index and a standardized/unified cited reference index (Fig. 1).

The defined source index is a fully described set of materials from which cited references will be compiled. It can be a list of articles that is collected by subject and timespan, or a list of journals or other materials from which articles are drawn. In all cases, the content must be clearly defined bibliographically and temporally. Without clear definition of the source materials, the meaning of the citations themselves becomes unclear and they are of limited use. Selecting a random set of articles across subjects and across time results in a collection having no clear meaning and very limited utility.

The standardized cited reference index is the set of cited references that appear in the source material. The cited references are not harvested as they are presented in the journal, as journals will vary in the information and format they require for each cited reference. Rather, in the construction of the index, data elements from the references are standardized to allow like citations to be collected, or unified.^[5] Citation unification allows all articles that cite the same reference to be collected, thus visualizing the relationship among them that is implied by the reference. The functionality of a true citation index depends on these two interconnected databases and will be discussed in detail below.

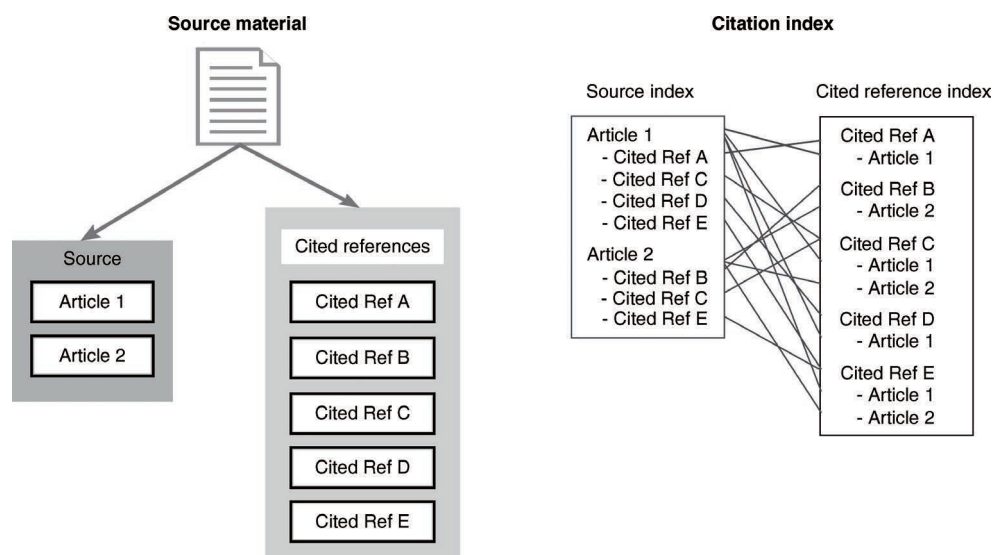


Fig. 1 Creation and structure of a citation index. A citation index is derived from a two-part indexing of source materials. Bibliographic entries are created for each source item; cited references are captured into a separate index where identical references are unified. The resulting two-part structure is the basic architecture of a citation index.

In 1963, the first robust, multidisciplinary implementation of a citation index was published commercially as the *Science Citation Index* (SCI). The first printing used a source index created from 613 scientific, technical, and medical journals and all substantive materials published in those journals in the year 1961. The cited reference index contained more than 1.4 million cited references. The intricate methodology needed to navigate the several print indexes^[3] did not prevent information scientists' recognizing the unique utility and great potential of the SCI, not only for retrieving an exhaustive (if exhausting) list of articles relevant to a subject, but also for navigating, mapping, and evaluating the research literature.^[2,4,6-9]

THE FUNCTIONS OF CITED REFERENCES IN CITATION INDEXES

The conceptual and practical applications of the scholarly citation index as envisioned by Garfield in the 1950s waited more than 40 years for a technological advance that would radically transform their use. When the maturing Internet met the "hyperlinked, relational database" that underlay the ISI citation indexes, the potential of Garfield's novel concept was finally realized. In 1997, ISI[®] (now a part of Thomson Reuters) released the first version of the *Web of Science*, containing the *Science Citation Index-Expanded*, the *Social Science Citation Index*, and the *Arts & Humanities Citation Index* in a single interface. When the citation indexes were mounted as a fully searchable, hyperlinked, relational database, the real power of the citation indexes was suddenly very simple to use.

Before describing the *Web of Science* product, it is necessary to describe the key functions of a citation index. A true citation index attaches three functions to cited references as an aspect of the scholarly literature: cited reference capture, cited reference linking, and cited reference searching, each being dependent on the effective implementation of the one prior to it.

Cited Reference Capture

Cited reference capture is the inclusion of the cited references as an aspect of the bibliographic data for each source article in the source index. An increasing number of bibliographic resources, such as databases, aggregators, and institutional or subject-specific archives, provide cited references as part of the data associated with each article. In addition, many publishers, in moving to electronic access to journals, freely provide not only table of contents of issues, but also the abstracts and cited references of articles, making much of this information readily available. The cited references provide additional information about the content of the indexed item in that they sketch the context in which the author is placing his/her work.

Besides this subtlety of indexing or cataloging, the presence of cited references allows a citation index to echo a critical aspect of how researchers interact with the literature when they review the full text: author, title, abstract, and a perusal of the cited references allow a more informed decision about the importance of obtaining the full text for close reading.

Cited Reference Linking

The most basic and most important function of a cited reference is allowing the reader to locate the particular works cited and to expand his/her knowledge of the subject area, as well as, in some sense, to retrace the intellectual or methodological path taken by the author. Cited reference linking was a natural extension of capturing and providing access to cited reference lists. A cited reference is, by its nature, a link to the prior literature, even in a print journal or in the print SCI. In electronic resources, this link can be made literal, functional, and immediately navigable, thereby expanding the role of cited reference capture in online information resources, both bibliographic and full text. The creation of a navigable link to the citing works allows a scholar to view not just the antecedents of a work, but its descendants. Citation linking allows each article to collect a continuously evolving set of user-generated commentary in the form of citation acknowledgment.

Cited reference linking is limited by three things: availability of content, correctness of cited references, and effectiveness of linking methodology.

Cited reference linking is first limited by the content of the resource in which the link exists. If the material being cited is not resident in, or is not available to, the resource, no functional link can be created. Publishers will often provide links to/from only those materials that are also resident on their sites. Bibliographic databases can link from an article record to another article record in their holdings, or suggest a link to an external source. However, the number of links to an article (the citation count) that can be assembled and navigated will be determined by the publication sources from which these citations were captured. If the cited reference was not captured, or the source item is not available, no link can be made. For example, if a specific book is not indexed as a source item, and its cited references are not captured, the book will not appear as a citing item for any record in the database, nor will there be a bibliographic record for the book that can collect all the citations to the book. Because the importance and volume of books in scholarly communication will vary somewhat by subject area, the absence of these links will affect scholarship and bibliometrics in some fields more than others. Scholarly books are less prominent in the physical, biomedical, and applied sciences than in the social sciences or the humanities, but their role in the latter fields can be critical to fully understanding the current research.

Secondly, cited reference linking is limited by the correctness of the bibliographic data in the cited reference itself. Many studies have examined the occurrence of citation errors in the primary literature as well as in citation indexes and speculated about their source.^[10–13] The advent of online journals both enabled and, in some ways, complicated cited reference linking. While the online form of a journal can support a live link to cited works, the relatively new and still-evolving bibliographic metadata associated with electronic materials create some confusion among authors as to the correct citation. The familiar data elements of author, source title, volume, page, and year (and possibly other elements) have given way to article numbers, electronic pagination, summary-versus-complete versions of a text, preprint versus published versions, HTML, PDF or print versions, and so on. Some electronic journals eschew volume or issue numbers, pagination or article numbers, leaving authors with a host of numbers they can attach to a reference in an effort to link their reader to a prior work. This leads to an increasing diversity of ways a given work is cited and hinders the creation of links. The Digital Object Identifier (DOI) foundation (<http://www.doi.org>) offered a solution that seemed simple and powerful, given that it originated in an online publishing environment for the use of online publications. The DOI is a unique and permanent identification of a document. It is associated with the document itself, not its electronic location, so it can be used to create a links to any and all places where the document might reside, such as a journal Web site, an online repository, an author Web site, etc.^[14] The advantage of the DOI is that it is machine-readable and designed for an electronic, Web-based navigation. This is also something of a disadvantage in that the DOI is not human-readable. A single character error in a DOI is both fatal and undetectable in the way a similar error in a journal title is not. It is not often that a citation to the *British Medical Journal* would go unnoticed and uncorrected, nor would it usually prevent a reader from seeking out the article in the *British Medical Journal*.

The third and most problematic limitation on cited reference linking has to do with the linking methodology. How robust is the system in overcoming citation errors and in its ability to locate the correct material even when the cited reference provided is incorrect? A reference to an incorrect author, or some error in source, or page, or DOI results in a citation that is not linked to the source item, and so is not visible in the Cited By links on that source item. When cited reference linking is the only way to retrieve citing articles, an incorrect reference is a lost reference.

Cited Reference Searching

Direct search within the cited references is the most powerful (and possibly the least utilized) function of cited references, as it requires a true citation index to be most

effective. Often it is assumed that cited reference indexing and cited reference linking are all that is required for a citation index, but there are important differences. A cited reference search operates on the structured, standardized data in the cited reference index, independently of the source index. The separate index of cited references is the critical distinction between a citation index and a bibliographic resource with linked cited references, but lacking a searchable cited reference index. Cited reference searching allows the feature of cited reference capture to break through the limitations of cited reference linking. To find materials that have cited an item in a bibliographic resource that lacks a cited reference index, you can locate the source item and navigate to the linked cited references, but you will have no way to find the items when citation or linking was imperfect. An incorrect citation to this article can only be found if you happen across the misciting article and peruse its reference list and recognize the unlinked, but familiar cited work. This is, ironically, no different from the problem of finding such citing works prior to the creation of the SCI, when even the most rigorous literature review could not identify all citing works.

Further, cited reference searching is a way to overcome the inevitable incompleteness of any individual source index. A citation index, through cited reference search, can collect all materials in the source index that cite a work, even if the work itself is outside the source coverage. For a bibliographic database without cited reference searching, comprehensive coverage is indispensable for citation analysis, as effective analysis is limited to those works that are in the source index. However, no matter how monumental the coverage, it will be insufficient if the item of importance to the searcher is not a source item. No matter how large the source index, cited references can only be collected to other items in the source index. With cited reference searching, the boundary around the coverage is less fixed. The searchable cited references provide pointers to external sources, which are then available to collect and to quantify.

Cited reference searching becomes more critical for scholarship in fields where the complete source materials cannot possibly be covered. In the natural sciences, citations to GenBank or the arXiv preprint server form an important part of the literature. In the social sciences, cited materials can include not just journal articles, books, and conference proceedings, but additionally demographic and census data, government reports, newspapers, and other ephemera, and a complex array of grey literature source materials. Even more problematic is scholarship in the arts and humanities, where materials cited can include original works of art, specific performances, primary and historical works, and a host of multimedia online resources. These works are critical for scholars, and so are critical for scholarly communication, but they usually defy indexing as source materials.

The enabling reach of cited reference searching reveals a logic to the selective development of a source index. Although Garfield meditated on the possibility of achieving H.G. Wells' vision of a "World Brain" of all knowledge,^[4] and despite the incomprehensible enormity of the Internet, no perfect, comprehensive, all-inclusive resource is on the immediate horizon. However, repeated works have confirmed Bradford's law that 80% of scholarly references are to 20% of source journals. This logic underlies the selection of source materials for the earliest productions of the *Science Citation Index*, as well as the current expansion of the Thomson Reuters indexes to include journals that publish more nationally and regionally relevant scholarship.^[15,16] Knowing that the source literature providing the citations has been studied and selected for both quality and representational breadth provides the user confidence in the value of the citations.

THE WEB OF SCIENCE AS A CITATION INDEX

Content

The *Web of Science* has, as its backbone, a suite of citation indexes spanning more than 100 years of published literature in a wide array of subject areas. The *Science Citation Index-Expanded* contains the *Century of Science* back file, and so indexes both source materials and cited references back to the year 1900. The *Social Science Citation Index* currently begins in 1956, but a *Century of Social Science* file back to 1900 is in preparation. The *Arts & Humanities Citation Index* includes materials back to 1975. The source index for these databases includes nearly 41 million items from more than 13,000 titles. The citation index includes 600 million indexed cited references, which resolve to approximately 155 million unified cited references. In the years since its first release, the *Web of Science* has added other data sources to expand the citation index. These include *Index Chemicus* (from 1993 to the present), *Current Chemical Reactions* (with an expanded file back to 1850), and, in fall 2008, the *Conference Proceedings Citation Index* with 10 years of published papers from scientific and scholarly meetings. The content of the *Web of Science* is updated weekly with between 20,000 and 60,000 new source records and up to 1 million cited references.

Source Records and Searching

The *Web of Science* was redesigned in 2007 to allow a deeper integration with the other databases in the *ISI Web of Knowledge* platform. The enhancement retained all the key functionality of the *Web of Science* interface, with improved navigation to the most-used features, additional functionality, and a more streamlined search process. The source index can be searched by topic (a combined search

field that includes article title, author keywords, *KeyWords Plus*[®], and complete author abstract), article title, author (individual author or collective, corporate, or group author), publication name, year published, address word, language, or indexed document type. The interface allows a simple text string entry, but more experienced searchers can use Boolean logic either within a search field or to combine multiple fields to create intricate and precise searches. The Advanced Search option supports command-line searching that is familiar to many information professionals. Specialized searches for specific chemical structures are enabled using a plug-in. Both General Search and Advanced Search allow the user to limit searches to specific databases and/or time intervals (such as latest week, or 2 weeks, year to date, or just the past 5 years).

Several features in the search page provide assistance and information for users who may be unfamiliar with searching structured data. Search Aids are activated by a link located to the right of the search box when an appropriate field is selected. The Search Aid will provide access to the index terms in that field, collected across the entire database, and will allow users to add precise, specific terms to their search with a click. The Author Finder tool guides the user through a series of search steps to facilitate locating the works of an individual author. Author searching was further enhanced by the addition of the Distinct Author Sets feature, which uses advanced bibliographic analyses across the entire *Web of Science* citation indexes to cluster source items that are likely written by the same author.

Cited Reference Searching

Cited reference searching is a two-step process. Because the very strength of cited reference searching lies in the ability to surface unlinked, imperfect citations or citations to materials not included in the source index, some flexibility in the search terms is important. First, the user enters one or a combination of the following elements: cited author, cited work, and cited year. Understanding that cited references can be presented in various ways (for example, author names with or without a first initial, variations in the abbreviation of the title of the cited work, etc.) suggests the use of truncation and wildcards to retrieve the errant cited references. The user is then presented with a list of records from the cited reference index that match the criteria. Selecting items from that list according to one's understanding of the variations in citation allows a more complete retrieval of citing articles. Finishing the search will then display a list of the citing articles.

For example, R.J. Charlson wrote an influential paper on global warming, published in the journal *Science*.^[17] Searching for Cited Author = Charlson and Cited Work = Science retrieves a large number of variants for this

search, some of which clearly show errors in cited author, cited volume, or cited page (Fig. 2). To date, 1242 citing articles are linked to this record, but an additional 42 citing articles can only be retrieved using cited reference searching. This is a simple cited reference search, where the goal is to retrieve all items citing a known article. Cited reference searches using author only can be used (with care) to collect all articles citing any of the author's papers. Using Advanced Search (or the Search History page), one can combine that cited reference search with an author search using the Boolean operator NOT. This will give a list of articles citing Charlson's work but for which Charlson was NOT an author, i.e., a count of citing articles that excludes the author's citations to his own work.

Cited reference searching in the print SCI was meticulous work, cycling from the source indexes to the cited reference indexes and back, pulling multiple volumes off

the shelf of imposing orange volumes. Although moving this activity into an online environment made it easy, cited reference searching still requires some effort on the part of the user. Clicking a link in the *Web of Science* or in other electronic resources is so easy that it distracts most users from any other method of locating citing articles. Even the most powerful linking methodologies and the most extensive coverage of source materials will have missing links and lost references, blind spots, and gaps. Thorough scholarship still requires a thorough search.

Search Results and Results Navigation

The results list from any search is not a flat list of records, the end point of a search, but a functional list of items that can be a starting point for a greater understanding of the network of literature available. Lists of results may be sorted by latest date (most current records presented first),

Cited Author	Cited work	Cited Year	Cited Volume	Cited Page	# of citing papers	Link to source record
CHARLSON	SCIENCE		255	423	1	
CHARLSON	SCIENCE	1992	255	423	2	
CHARLSON R	SCIENCE	1992	255	6423	1	
CHARLSON RJ	SCIENCE	1992	255		1	
CHARLSON RJ	SCIENCE	1992	255	254	3	
CHARLSON RJ	SCIENCE	1992	255	422	23	
CHARLSON RJ	SCIENCE	1992	255	423	1242	View Record
CHARLSON RJ	SCIENCE	1992	255	424	1	
CHARLSON RJ	SCIENCE	1992	255	425	1	
CHARLSON RJ	SCIENCE	1992	255	2423	1	
CHARLSON RJ	SCIENCE	1992	225	423	2	
CHARLSON RJ	SCIENCE	1992	43	152	3	
CHARLSON RJ	SCIENCE	1992	25	423	1	
CHARLSON RJ	SCIENCE	1992	25	426	3	

Fig. 2 Cited Reference variants. Citation variants for the search Cited Author = Charlson and Cited Work = SCIENCE. A total of 43 cited references for this author and work were retrieved. The 14 references above represent those that are likely to be citations to the same article. The cited reference in bold represents the item where cited reference linking was successful. In these results, 1242 citing articles are linked to this source, representing 96% of the citing articles.

times cited, relevance, first author, source title, or publication year. The sort options facilitate the navigation of large and small results lists, rather like shaking a box of cereal to get the prize to float to the top.

The Refine feature allows the user to manipulate the set of results to eliminate or to focus on records that contain some item of particular interest. Refine will display the count of records within the set of results according to subject area (the index categories, or *Journal Citation Reports* categories), document type, author (from all authors, not just the first author), source title, publication year, institution, language, or country/territory. The various Refine options can be used singly or in combination. For example, using Refine by document type = Review and by publication year = 2007 or 2008 will winnow your results set to display only review articles from the past 2 years.

The Analyze feature uses the same data elements as Refine, but allows the user to characterize the set of retrieved records as a whole entity. While also supporting the same kind of filtering as Refine, this view of the data allows bibliographic analysis of a search set, by displaying not just numbers of records according to the selected field, but the percentage of records in the results set that contain this element (Fig. 3). For example, a search on Topic = “global warming” retrieves 8037 records (as of this writing); analyzing this group by publication year shows the emergence of the specific term in 1975. No other papers using the term appeared until 1981, but fewer than 10 papers per year were published through the remainder of the 1980s. The number increased to 40 papers in 1989, then jumped to 151 in 1990. The term, and presumably, the more general field of the study of climate change had a steady increase in publication activity through the 1990s, and early part of the new millennium. In the year 2007, more than 940 papers using the term were published, a number likely to be equaled or exceeded in the year 2008.

Users can also highlight the institutions, journals, and authors that have made the greatest contribution to the literature. Result sets of up to 100,000 records can be navigated using Refine and Analyze.

The Citation Report creates a rapid overview of several bibliographic analyses for any results set (up to 10,000 records). It includes graphical display of the number of items in each publication year, as well as the number of citations in each year. Basic bibliometric data are created for the set, such as the sum of all times cited, a link to all the citing items (with or without citing articles that are, themselves, part of the results set), the average number of citations per item, as well as the emerging metric, the h-index.^[18] It displays the list of results, as well as the citations per year for each (Fig. 4). The analyses in the Citation Report can be printed or e-mailed or the data can be exported as a delimited file.

The Bibliographic Full Record

Although the manipulation and review of large sets of results is an important aspect of information retrieval, the *Web of Science* is first and foremost a database of bibliographic records, connected and navigable by citations. Each record in the *Web of Science* contains all basic bibliographic and Thomson Reuters' indexing metadata, but the record has evolved from its early form as a flat bibliographic entry in the *Science Citation Index* to an information node that is linked to a wide array of internal and external resources (Fig. 5). A simple and powerful use of the Internet enables a user to link directly from the *Web of Science* bibliographic record to the full-text record in journals for which the library holds an electronic subscription. However powerful the bibliographic data, scholars require the full text to fully comprehend and use an article.

Full records also include a link to the captured cited references as well as to the citing articles—through the Times Cited (and Cited By) links. This allows the immediate collection of the citing articles as a results list. There is a deceptiveness to this simple retrieval. The citing articles are obviously related to the work at hand, but they will also be subtly related to one another. For example, an article describing a specific method or technique in biochemistry can be cited by other works in various experimental systems. The citing articles may share no keywords or title words, but their common use of the original technique means that each is likely to add some incremental insight to the method, including caveats or modifications that may be of great use to other, later scientists seeking to replicate or apply the method.

Cited Reference and Cited By links can be enabled even in resources that are not citation indexes. However, *Related Records*[®]—another feature available on each bibliographic full record—is a higher order function built on the cited reference index itself. *Related Records*[®] uses a method called bibliographic coupling,^[19,20] in which the cited references in the starting document are used to retrieve all other materials that share at least one of those cited references. A citation index is derived from the insight that the list of cited references in each article functions as a set of bibliographic descriptors provided by the author; therefore, if two authors cite several identical references, it suggests that the source items are related. These relationships might not be revealed from standard topic searching, nor are the articles necessarily directly connected by citation linking. Because the cited references are available at the time of indexing, *Related Records*[®] can be linked long before any later citing papers appear. This allows a record to expand into a broader literature immediately upon indexing while the development of a citing article context is still evolving. Enabling the retrieval of relevant articles through these more subtle relationships was one of the first goals in creating the citation index.^[1]

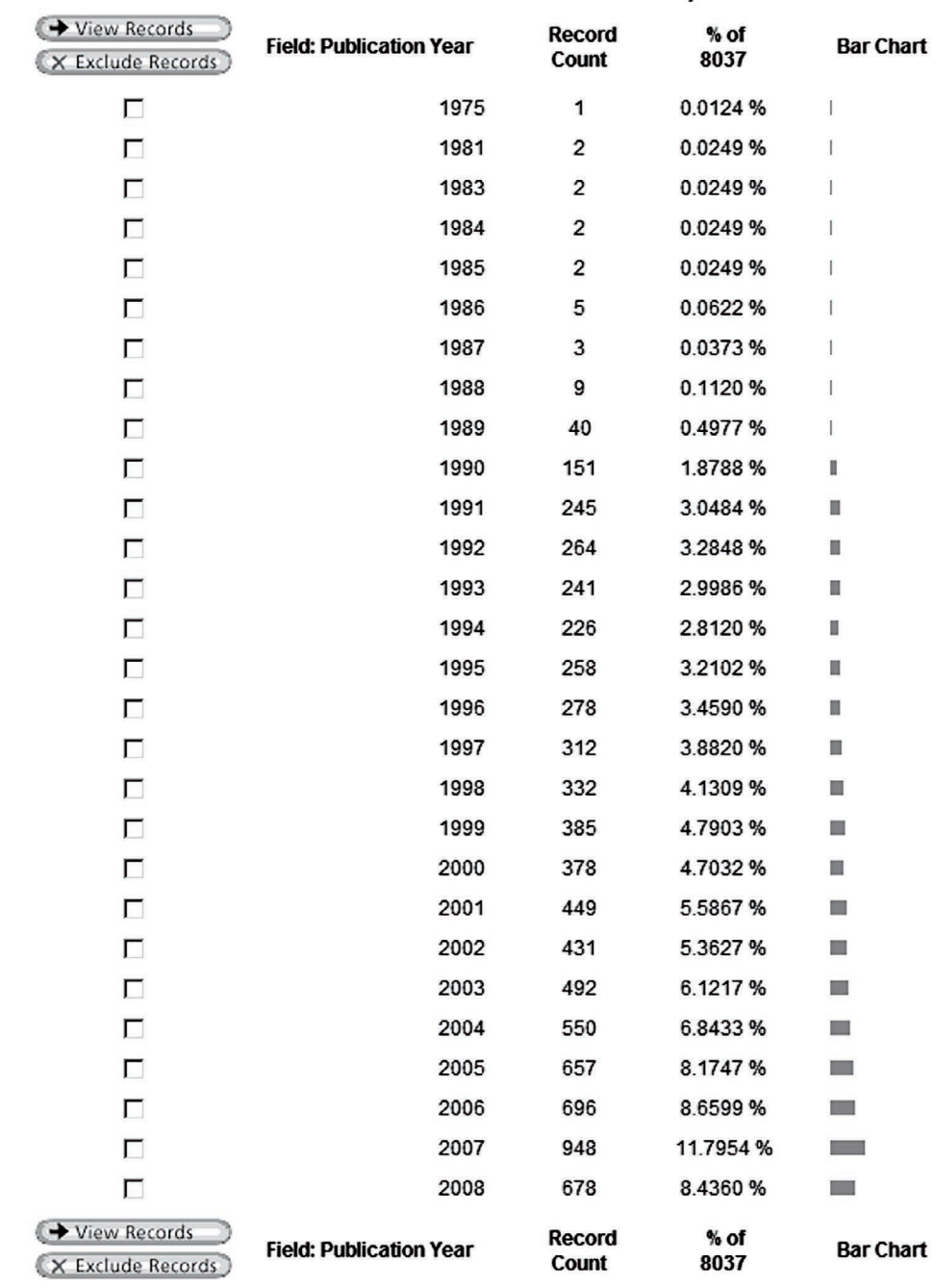


Fig. 3 Section of the Analyze Results screen. The search Topic = “global warming” retrieved 8037 records; the figure shows the results analyzed by publication year. Selecting a publication year and using View Records filters the results.

In 2008, a long-awaited feature was added—in a beta version—to the full records in *Web of Science*. The Citation Map creates a visual representation of the cited references and/or the citing articles that are connected to the starting record. The feature was recently reviewed by Simboli^[21] and will not be discussed in detail here. Visual display of citation relationships is complicated when the number of citation links is very large, and of limited use when the number

of citations links is very small. The *Web of Science* dataset is rich, deep and densely linked, and presents challenges to visualization methods that are as large as the potential benefits. Robust visualization can reveal elusive connections among sets of articles, such as many articles in a set of results citing a single item that is, itself, not in the results set. It might also be desirable for some users to navigate through a visual map of the citation space in a field or arrayed around the works

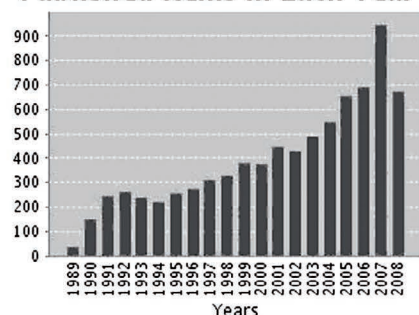
Citation Report

Topic=("global warming")

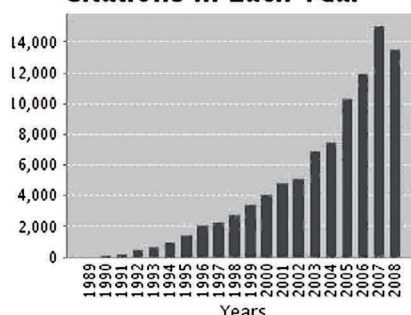
Timespan=All Years. Databases=SCI-EXPANDED, SSCI, A&HCI, IC, CCR-EXPANDED [back to 1840].

This report reflects citations to source items indexed within Web of Science. Perform a Cited Reference Search to include citations to items not indexed within Web of Science.

Published Items in Each Year

The latest 20 years are displayed.
View a graph with all years.

Citations in Each Year

The latest 20 years are displayed.
View a graph with all years.

Results found: 8,037

Sum of the Times Cited [?]: 94,377

View Citing Articles

View without self-citations

Average Citations per Item [?]: 11.74

h-index [?]: 112

Results: 8,037

Page 1 of 804 Go

Sort by: Times Cited

Use the checkboxes to remove individual items from this Citation Report or restrict to items processed between 1900-1914 and 2008 Go

- ☐ 1. Title: Ecological responses to recent climate change
Author(s): Walther GR, Post E, Convey P, et al.
Source: *NATURE* Volume: 416 Issue: 6879 Pages: 389-395 Published: MAR 28 2002
- ☐ 2. Title: DECADEAL ATMOSPHERE-OCEAN VARIATIONS IN THE PACIFIC
Author(s): TRENBERTH KE, HURRELL JW
Source: *CLIMATE DYNAMICS* Volume: 9 Issue: 6 Pages: 303-319 Published: MAR 1994

	2004	2005	2006	2007	2008	Total	Average Citations per Year
1	7505	10326	11935	15046	13594	94,377	2775.79
2	112	146	176	196	175	897	128.14
3	72	66	67	59	50	821	54.73

Fig. 4 Section of the Citation Report. Citation Report on the 8037 records retrieved using a topic search for “global warming.” The default ranking is in descending order by times cited to allow identification of the h-index core, i.e., the set of articles with a citation count greater than or equal to the value of the h-index. Data from Citation Report can be saved to a delimited file to allow customized analyses.

of an individual author. The irregular density and complexity of the citation network underlying the *Web of Science* makes this an ambitious goal. The Citation Map feature is an initial step, allowing references to be organized, color-coded, and in other ways, made to reveal patterns and trends.

Additional Features and Services

Additional features of the *Web of Science*, while enhancing the access to and manipulation of bibliographic records and data, are less directly related to the fundamental concept of a citation index and will be mentioned only briefly here. Record exporting has been made more accessible through a quick export. This allows users to bypass the Marked List to export records with a minimum, standard set of data elements or with a complete set of tagged data. Users also have access to the Web version of the popular bibliographic management tool, *EndNote* as part of the *ISI Web of Knowledge* platform, allowing them to store a library of references that is accessible via any computer. *ResearcherID* offers a new

way to develop, view, and manage the record of one's own publications, and uses the analytical tools from *Web of Science* to reveal patterns within the collection of articles that cite one's own work. An ever-improving set of customizations, alerts, saved searches, and personal journal lists in the *ISI Web of Knowledge* platform embed the information in the *Web of Science* within the ways scholars use information.

CONCLUSION

The 11 years since the first release of the *Web of Science* have seen sweeping changes in almost every aspect of scientific communication and publishing, as well as in the interrelated fields of library and information sciences, information management, retrieval, and use. As the needs and practices of researchers change, the functionality, content, and interface of the *Web of Science* continue to evolve, but the critical insight and immense usefulness of citation indexing and cited reference searching remain at the very heart of the product.

Ecological responses to recent climate change

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Author(s): Walther GR, Post E, Convey P, Menzel A, Parmesan C, Beebee TJC, Fromentin JM, Hoegh-Guldberg O, Bairlein F

Source: NATURE **Volume:** 416 **Issue:** 6879 **Pages:** 389-395 **Published:** MAR 28 2002

Times Cited: 897 **References:** 97 [Citation Map](#) *beta*

Abstract: There is now ample evidence of the ecological impacts of recent climate change, from polar terrestrial to tropical marine environments. The responses of both flora and fauna span an array of ecosystems and organizational hierarchies, from the species to the community levels. Despite continued uncertainty as to community and ecosystem trajectories under global change, our review exposes a coherent pattern of ecological change across systems. Although we are only at an early stage in the projected trends of global warming, ecological responses to recent climate change are already clearly visible.

Document Type: Review

Language: English

KeyWords Plus: ECOSYSTEM RESPONSE; SOUTHERN-OCEAN; SEA; VARIABILITY; PHENOLOGY; MIGRATION; RED; CONSEQUENCES; DETERMINISM; TEMPERATURE

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Subject Category: Multidisciplinary Sciences

IDS Number: 534UX

ISSN: 0028-0836

[<< Back to results list](#)

Record 1 of 8,037

Output Record

Step 1:

- ☐ Authors, Title, Source
- ☐ plus Abstract
- ☒ Full Record
- ☐ plus Cited Reference

Step 2:

[How do I export to bibliographic management software?]

[Print](#)
[E-mail](#)
[Add to Marked List](#)
[Save to EndNote® Web](#)
[Save to EndNote®, RefMan, ProCite](#)
[Save to other Reference Software](#)
[Save](#)

Fig. 5 Section of a bibliographic full record. An example article full record from the *Web of Science* shows the bibliographic metadata, link to publisher full text, cited references and times cited links, *Related Records*[®], and Citation Map features. Quick export and *EndNote Web* export are also visible.

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Citer Motivations [ELIS Classic]

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Abstract

Much informetric research is based on the analysis of the citations that authors make to the publications of other scholars and researchers, whose work they have used in their own articles and books. If such measures are to be useful for understanding scientific recognition and the ways in which scientific results build on earlier work, then an understanding of the motivations of the people doing the citing can be helpful in evaluating the validity of the research based on the citation analysis.

—*ELIS Classic*, from 1988

INTRODUCTION

Citations are one of the hallmarks of scholarly writing. They reside in one text, and point to other texts that the author wants to bring to the attention of his reader. Why would an author want to do that? The study of citer motives begins with this question.

Citations are examples of unobtrusive or nonreactive social science measures.^[1] Unobtrusive measures are physical evidences of activity that exist independently of their source: the private act of authorship produces citations that are public objects available for scrutiny and analysis. As with many of these unobtrusive measures, it is difficult to ascertain in any given application what social or psychological construct the citation counts are measuring.

Many people consider citations as positive evidences of scholarly opinions. In this view, heavily cited works enjoy the attention of scholars while uncited works suffer their neglect. This is a naive correlation of citation activity and scholarly opinion. It assumes that there are identifiable citer motives that govern the behavior of scholars. This article surveys attempts to catalog what those citer motives might be.

Citations have *prima facie* validity because it is plausible to consider them as measures of scholarly eminence, intellectual worth, or subject value. Many of the univariate models of citer motivations surveyed below portray a citation as a signal that the writer was influenced by the material cited. The *prima facie* validity of citation analysis is reinforced by several credible studies that report correlations among highly cited individuals and other measures of scientific achievement. Both Narin^[2] and Myers^[3] report strong correlations among frequently cited authors and other independent measures of eminence. Virgo found citation analysis to be a consistent and accurate predictor of important scientific papers; better on the average than the individual scientist's judgment which "is a reasonable conclusion if one considers that citations actually reflect a

consensus of a large group of readers as compared to the evaluation of a single individual" (p. 423).^[4]

When citations are considered as artifacts of the psychological state of an individual writer, they are less credible. There are many possible motives driving citation behavior that have nothing to do with scholarliness, intellectual worth, or subject value. Self-citation, collusive arrangements among researchers, and even universal condemnation among peers are examples. As Ravetz succinctly put it, "by appropriate nuance of mention, one can under-cite without actually stealing results, or overcite with the effect of inflating the value of the property of a colleague" (p. 257).^[5]

There have been two lines of attack on the validity of citation analysis; both involve citer motives. The first is that citer motives have not been studied empirically, and therefore exist only as objects of speculation. Thorne^[6] and Bavelas^[7] are vociferous critics of citation analysis who follow this tack. Advocates of citation analysis have responded to such criticisms by developing citer motivation models, each with a certain *prima facie* validity or special application. Many citer motives have been suggested from simple univariate models to complex multivariate taxonomies. These models are reviewed below.

The second line of attack on citation analysis was suggested by Martyn.^[8] He speculated that two or more citers may not be targeting the same informational unit in a mutually cited paper. Martyn broadly defined informational units as simple propositions, computer bits, or any other feasible unit. Consequently, linking two authors together based on shared citations may be spurious: each was targeting different informational units in the cited paper. While Martyn intended this caveat to pertain only to bibliographic coupling, he nevertheless added another dimension to the citer motivation problem. It appears to be quite possible that authors perceive cited papers as harboring several information units, and at the same time, they may employ complex motives in targeting those informational units. About a decade later, Small^[9] made

the contradictory observation that scholars regard cited papers as representing a single concept, which would be only one information unit as defined by Martyn. Furthermore, Small suggested that authors are uniformly motivated when they cite such a paper. He used content analysis to examine the text surrounding individual citations, and found textual regularities suggesting that certain works act as shared symbols. In his view, citations act as symbols of single concepts. This implies that many scholars share the same motives when they cite works that stand for shared symbols in their fields. Both lines of attack on citation analysis are unresolved at this time. As can be seen below, there are many candidate citer motivation taxonomies and the one, or several, most appropriate models have yet to be articulated. The Martyn/Small confrontation is similarly unresolved.

Content analysis^[10] has been the major tool used in deducing citer motivations. This approach quantitatively analyzes texts for signs, symbols, or messages. The validity of this approach, and therefore the validity of the resultant citer motivation taxonomies based on content analysis, is premised on a consistent classification procedure: different people should code the text in the same way. Consistent text coding is not easy, and few researchers who categorize citations are as candid as Stigler and Friedland about the pitfalls of using a content analytic approach:

Usually a citation is easy to classify. ... Often, however, the classification taxes one's casuistical skill. Consider Hicks's review article on Patinkin, which begins by stating: "The main things I have learned from [the book] are not what the author meant to teach me. ..." It is not complimentary to be told that one did not understand his own message; it is complimentary for an economist to be able to teach Sir John anything—so the passage is classified as neutral. Although there is no ambiguously correct classification, we believe the classification has been fairly consistent. (p. 489)^[11]

These comments illustrate several liabilities of the content analytic approach. Stigler and Friedland^[11] used a simple univariate citer motivation model with categories of "favorable," "unfavorable," and "neutral." The citation under examination did not easily fit into either "favorable" or "unfavorable," so they compromised and called it "neutral." This suggests that their results may be method bound. Several of the following models used in content analytic experiments also find a disconcertingly high percentage of neutral or perfunctory references. These results probably illustrate the limitations of the citation taxonomies employed. Stigler and Friedland^[11] were also struggling with an apparently mixed citation motive since they considered Hicks to be both complimentary and critical simultaneously. Many of the following models fail to recognize that authors may be motivated by a complex psychological state when they cite other works. Finally, it is worth speculating that much enlightenment about these matters might be gained by interviewing authors

themselves about their citation behavior. Historically, however, the approach of content analysis has been favored over any other. Given the problems inherent in a content analytic approach described above, future researchers may be prompted to try other, more fruitful approaches.

UNIVARIATE MODELS OF CITER MOTIVATIONS

A univariate model of citer motivations attempts to represent the psychological state of a citer along one dimension such as favorable-neutral-unfavorable. Many early citer motivation models are of such a simple nature. They can be roughly grouped into categories such as:

SCIENTISTS ALL ACT THE SAME

Price^[12] postulated an average conscientiousness, and Martino^[13] a scholarly custom of citer motivations. Many people agree with Whitley^[14] that scientists cite anything and everything they consider important.

RULES OF BIBLIOGRAPHY

Creager and Harmon^[15] suggested that the arduous task of compiling a list of references will tend to inhibit authors from including irrelevant citations. Kaplan^[16] felt that some rules of bibliography were passed informally from teacher to student.

NEED FOR CURRENCY

Both Bavelas^[7] and Line and Sandison^[17] suggested that scholars cite to show an awareness of the important work in their field, or to show up-to-dateness.

In the last decade, a new discipline, the social studies of science, has also produced several citer motivation models. These motives relate to a scientist's need to claim new intellectual territory,^[12] to recognize intellectual property rights,^[16] or to provide a form of "income" in terms of status.^[5] Gilbert^[18] considered citations as elements of the rhetoric of argumentation. He portrayed an author as struggling to present his best case to his reader, and as using references as tools of persuasion.

Citations have also aided sociologists and historians of science in tracing the development of intellectual models or paradigms. Fleck^[19] described the establishment and transmission of ideas within a scientific community, and categorized the active use of cited material as forming part of the "thought collective" of a group of scientists. The passive use of cited material denoted information less useful in a paradigm. Dolman and Bodewitz^[20] used

Fleck's active/passive categories to calibrate how papers have become accepted, or in their jargon, "sedimented." With the passage of time, the increasing number of active-type citations shows that an idea has become sedimented.

MULTIVARIATE MODELS OF CITER MOTIVATIONS

A number of researchers have offered complex multivariate taxonomies of citer motivations. Several have specific subject application.

GARFIELD'S TAXONOMY

Eugene Garfield^[21] commented on the difficulty of automatic indexing for several reasons including the many citer motives authors may use. He offered the following list of citer motives.

1. Paying homage to pioneers
2. Giving credit for related work (homage to peers)
3. Identifying methodology, equipment, etc.
4. Providing background reading
5. Correcting one's own work
6. Correcting the work of others
7. Criticizing previous work
8. Substantiating claims
9. Alerting readers to forthcoming work
10. Providing leads to poorly disseminated, poorly indexed, or uncited work
11. Authenticating data and classes of fact—physical constants, etc.
12. Identifying original publications in which an idea or concept was discussed
13. Identifying original publication or other work describing an eponymic concept or term (e.g., Hodgkin's disease, Pareto's law, Friedel-Crafts reaction, etc.)
14. Disclaiming work or ideas of others (negative claims)
15. Disputing priority claims of others (negative homage)

LIPETZ'S CITATION RELATIONSHIPS IN SCIENCE LITERATURE

Ben-Ami Lipetz^[22] sought to improve citation indexing by using codes to indicate the precise relationship of the citing work to the cited reference. His model was the legal citation indexes that provide information that a later case affirms, refutes, and so on, an earlier case. The following taxonomy was developed by examining articles in physics.

Group One. Original scientific contribution or intent of citing paper.

1. Description of observed phenomena
2. Data transformation
3. Explanation
4. Hypothesis or theory
5. Calculation from theory
6. Prediction
7. Definition or notation
8. Statement of experimental technique

Group Two. Contribution of citing paper other than original scientific contribution.

9. Review article
10. Bibliography
11. Data cumulation

Group Three. Identity or continuity relationship of citing paper to cited paper.

12. One or more authors in common
13. Same text
14. Abstract or condensation
15. Erratum
16. Continuation
17. Precursor
18. Inclusion

Group Four. Disposition of the scientific contribution of the cited paper in the citing paper.

19. Noted only
20. Distinguished
21. Reviewed or compared
22. Applied
23. Improved or modified
24. Replaced
25. Changed the precision (plus or minus)
26. Changed the scope of applicability (plus or minus)
27. Questioned
28. Affirmed
29. Refuted

HODGES'S TAXONOMY

Theodora Hodges^[23] evaluated the potential of citations indexing for bibliographical control, and produced the following elaborate taxonomy. The entries have been abbreviated here; her dissertation provides extensive discussion of each category.

Evidential references: Writings which are cited later in other writings as providing evidence for what those later writings are themselves contending. . .

Corroborative references: . . . A corroborative reference is to parallel rather than to sequentially related work.

General informational references: References made for the purpose of providing general information cast a very wide net. . . . The apparently dissimilar writings juxtaposed by having referred to the same work or works as general background information may contain a common element. . . .

Specific information references: . . . The class of writings they lead to is neither so wide nor so heterogeneous [as general informational references].

Historical references: . . . From a subset of either general or specific background references. . . .

Documentary references: . . . Those in which the documents referred to are of such specific content in themselves that works citing them are likely to have something in common. . . .

Sibling references: . . . The term “sibling” is attached to references which are to other pieces of the same series of experiments, experiments which should be of interest as a set simply because they were so planned.

Methodological references: Forward links from writing cited in explanation of the methods used are undoubtedly of interest to those working directly on whatever method is cited. . . .

Oppositional references: References which mention opposing explanations for the same observed phenomena as are explained in the citing paper are probably very important links to helpful writings.

Corrective references: There can be no doubt at all that references which point out work which is corrected are important as forward links.

Clarificational references: A clarificational reference helps an author delineate his position: he does not usually in the course of making such a reference, add anything to the exposition of the work he is using.

Logical references: The relationship of a paper to that or those which it cites as logically antecedent to itself is thus very close, so close that a man interested in a paper cannot afford not to know how its implications are further developed. . . .

Expositional references: Most people interested in a given work are concerned with understanding it, and can be expected to find works devoted to furthering the general understanding of that work helpful.

Illustrative references: Illustrative references are seldom of any more than rhetorical importance in the development of the ideas in any one: they serve the same function, though at a more superficial level, as clarificational references.

PERITZ'S SOCIAL SCIENCE TAXONOMY

Bluma Peritz^[24] streamlined Hodge's unwieldy taxonomy down to eight categories, and applied it to five social

science journals. Peritz also noted how her categories related to those of Hodges's.

Setting the stage for the present study. . . Citations to previous work which leads up to the research questions asked in the present investigation. Hodges calls this group “evidential.”

Background information. . . Citations which document basic data. . . or support factual information. . . . Hodges distinguishes between general and specific information but this distinction did not seem to be workable, or relevant, in practice.

Methodological. . . Citations describing some aspect of the methods used. . . .

Comparative. . . Citations to other studies with which the present one is being compared. (Hodges speaks about “corroborative” citations; some of her “oppositional” and “corrective” citations, would also fit into this category.)

Argumental, speculative, hypothetical. . . Citations made in supporting the formulation of new hypotheses and conjectures. . . No such category appears in Hodges's classification.

Documentary. . . Citations which refer to the sources of raw data. . . . This category includes also most of what Hodges calls “sibling” citations. . . .

Historical. . . citations made while retracing the history of the subject. . . .

Casual. . . Citations not directly tied to the issue at hand. . . .

Peritz reported enthusiasm for the content analytic approach. Her comments reflected unintentionally on the Martyn/Small controversy (p. 308).^[24]

The classifying procedure itself is easy to carry out, even without in-depth knowledge of the field; a general understanding of the paper's main message is sufficient. In most cases the text surrounding the citation provides unequivocal clues for its classification.

FROST'S CITATION CLASSIFICATION FOR LITERARY RESEARCH

Carolyn Frost^[25] proposed the following taxonomy for literary research. She applied it to a small sample of works in German literature.

- A. Documentation of primary sources—references to literary texts, letters, etc.
 1. To support an opinion or factual statement on the specific literary author(s) discussed in the citing work;
 2. To support an opinion outside the central topic of the citing work; or
 3. To support a factual statement outside the central topic of the citing work.

- B. Documentation of secondary sources—references to previous scholarship.
1. Independent of approval or disapproval of the citing author.
 - a. To acknowledge the pioneering work of other scholars;
 - b. To indicate the state of present research, a range of opinions, or prevailing views on a topic; or
 - c. To discuss the meaning of a term or refer to a work in which a given term or symbol first appears.
 2. Representing the approval of the cited scholar.
 - a. To support an opinion of the citing author;
 - b. To support a factual statement of the citing author;
 - c. To take an idea a step further; or
 - d. To acknowledge intellectual indebtedness.
 3. Representing the disapproval of the citing author.
 - a. To disagree with an opinion of the cited author;
 - b. To disagree with a factual statement of the cited scholar; or
 - c. By expressing a mixed opinion.
- C. Documentation of sources either primary or secondary.
1. To refer to further reading; or
 2. To provide bibliographic information on a specific edition.

CITATION CATEGORIES OF MORAVCSIK AND MURUGESAN

This multivariate citer motivation taxonomy was refined by Moravcsik and Murugesan^[26] in a series of papers, and represents a model from the social studies of science field.

Conceptual references: If a concept or theory of the cited paper is used directly or indirectly in the citing paper in order to lay foundations to build on it or to contribute to the citing paper, then the citation is a conceptual one.

Operational references: When a concept or theory is referred to as a tool. . .[or] when it borrows mathematical or physical techniques, results, references, or conclusions from the cited paper.

Organic references: . . . Those [papers] from which concepts or theories are taken to lay the foundations of the citing paper, or papers from which certain results (including numerical ones) are taken to develop the ideas in the citing paper, or papers which help to better understand certain concepts in the citing paper.

Perfunctory references: . . . Those [papers] which describe alternative approaches are not utilized in the citing paper. . . references which are used to indicate the fact that a certain method employed is routine in the literature, and references which merely contribute to the chronological context of the citing paper.

Evolutionary references: . . . [The paper] provides a concept or theory to build on, or a mathematical technique to use, or results of an analysis which is used in the development of the citing paper, or notation used in the citing paper.

Juxtapositional references: . . . [The paper] refers to alternative approaches. . . [and] refers to other analysis used in the citing paper only to make comparisons, refers to other works which may help to clarify some ideas but do not contribute to the development of the citing paper, or refers to a paper only for references given in the latter.

Confirmative references: A reference is confirmative if the author of the citing paper considers the paper referred to as correct.

Negational references: . . . The author of the citing paper is not certain about the correctness of the cited paper.

This has been an influential taxonomy. Dolman and Bodewitz^[20] compared their active and passive categories to the conceptual and operational categories listed above, and Ruff^[27] used the perfunctory and organic categories to analyze papers citing the life work of Istvan Kovacs, a theoretical molecular spectroscopist. It also directly influenced the work of Chubin and Moitra.

CITATION CATEGORIES OF CHUBIN AND MOITRA

This taxonomy also originates in the social studies of science. Chubin and Moitra^[28] were unhappy with the high percentage of perfunctory references reported by Moravcsik and Murugesan, and wished to redefine their taxonomy into mutually exclusive categories.

Affirmative Citations

Essential Citations

Basic citations. If the referenced paper is declared central to the reported research. . .

Subsidiary citations. If a specific method, tool, or mathematical result is not directly connected to the subject of the paper. . .

Supplementary Citations

Additional citations. When the referenced paper contains an independent supportive observation (idea or finding). . .

Perfunctory. . . . Papers referred to as related to the reported research without additional comment.

Negational Citations

Partial. . . This paper is erroneous in part. . .

Total. . . The paper is completely wrong. . .

VALIDATION OF CITER MOTIVATION MODELS

Little work has been done toward validating the citer motivation taxonomies enumerated above. One reason has been the lack of rationalization of the numerous categories that overlap, or leave gaps, in the multivariate

taxonomies. A second reason is that certain taxonomies may be more appropriately applied in certain subject fields than others. Both of these problems present large challenges to future researchers.

Brooks^[29] attempted a general rationalization of the citer motivation models presented above with the following categories: currency, negative credit, operational information, persuasiveness, positive credit, reader alert, and social consensus. He interviewed 26 authors who assessed each reference they gave in a recently published paper, and described their motives by using one or more of these scales. Persuasiveness was one of the most popular motives.

In a follow-up study, Brooks^[30] explored complex interactions among these seven motives, and found they could be reduced to five: (1) persuasiveness; (2) negative credit; (3) currency, positive credit, and social consensus; (4) reader alert; and (5) operational information. A finer analysis of positive and negative citations showed they were often correlated. In other words, when an author gave a negative reference, he often associated it with a countervailing positive credit, currency, or social consensus reference. Brooks considered this to be empirical evidence of the hypothesis of MacRoberts and MacRoberts^[31] that scholars dissemble when giving negative references.

CITATION CONTEXT ANALYSIS

Small's contention that citations are concept symbols is an area of active research interest. There is the possibility that advances in related fields such as rhetoric and semiotics will contribute tools to analyze the conceptual use of citations. Concept analysis has firm philosophical support from the study of science:

Cognition is the most socially conditioned activity of man, and knowledge is the paramount social creation. The very structure of language presents a compelling philosophy characteristic of that community, and even a single word can represent a complex theory. . . . This social character inherent in the very nature of scientific activity is not without its substantive consequences. Words which formerly were simple terms become slogans; sentences which once were simple statements become calls to battle. This completely alters their socio-cognitive value. They no longer influence the mind through their logical meaning—indeed, they often act against it—but rather they acquire a magical power and exert a mental influence simply by being used. . . . Whenever such a term is found in a scientific text, it is not examined logically, but immediately makes either enemies or friends. (p. 42)^[19]

Small^[9] found that all of the mostly highly cited papers in chemistry were used uniformly, as based on his content analysis of their textual settings. For example, one of these, the most highly cited paper in all of science:

Lowry, O.H.; Rosebrough, N.J.; Farr, A.L.; and Randall, R.J. Protein Measurement with the Folin phenol reagent, *J. Biol. Chem.* 193: 265, 1951.

was used in all cases to refer to a certain protein determination method. Small concluded that scholars who cite Lowry et al. in their text were placing a commonly understood symbol that other scholars would immediately recognize as the concept of protein determination. In this way scholars share concepts, and use citations to represent those concepts.

Two recent developments have complicated the relationship between a citation and its conceptual use. For example, a citation's conceptual meaning may change with time. Small^[32] found a paper that in its early history was symbolic of a unique collagen type. Later, after contradictory evidence emerged, its symbolic function changed to that of a controversial hypothesis. This implies that the conceptual use of a citation may evolve throughout its lifetime. Cozens^[33] introduced a further complication that the same citation can have more than one conceptual meaning at any given time. She found that two different groups of scholars were referring to the same paper—in each case treating the paper as the symbol of one concept—but the groups did not agree as to which symbol the paper represented. She called this phenomenon a split citation identity.

CONCLUSION

This survey has illustrated that to inquire why authors give citations is to pose a complex question that cannot be answered satisfactorily at this time. Univariate models of citer motivations lack credibility, and multivariate models suffer a lack of coordination in scope and purpose. Major future challenges to researchers in this field are to rationalize the multivariate citer motivations taxonomies, and to develop the study of the conceptual use of citations. Advances in both of these areas will probably require the application of social science methodologies other than content analysis.

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Classification Theory

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Abstract

In the library and information sciences, classification theories are used primarily for knowledge organization, either in a manual or in a machine environment. In this context, classification theories have usually been developed initially as a support for specific knowledge organization classification systems, although the theories and the systems have influenced and re-influenced each other in particular ways throughout their lives. This entry discusses theories for knowledge organization classifications using examples from a number of classification systems, but no one system is discussed at length. Instead, the entry is organized into sections that deal first with classificatory issues in general and then with theories of content, theories of structure, and theories of notation for knowledge organization classifications.

INTRODUCTION

Theories of how knowledge organization classifications should be created, developed, structured, used, and communicated to others underlie the systems themselves. To classify means to put things into meaningful groups. Things can be physical objects, ideas, events, or anything else that human beings can perceive or imagine, and a meaningful group can be formed using any characteristic or combination of characteristics of the things. Groups can be considered to be permanent or they can be considered temporary responses to a need of the moment. These groups of things can then be combined and arranged to make a knowledge organization classification system. A knowledge organization classification is a structured plan that ideally shows all the groups that have been created and their relationship(s) to each other.

GENERAL ISSUES IN CLASSIFICATION

Knowledge organization classification theories and the systems they give rise to are cultural artifacts that directly reflect the cultural concerns and contexts in which they are developed. This cultural dependence means that no knowledge organization theory or system can be useful for every time and in every place because knowledge organization theories and systems for one time and place will be unsuitable or irrelevant for another. For example, different countries have different educational systems, and a knowledge organization classification for education in one country is not helpful for education in another country. The same constraint applies to different times in the same place—education in the nineteenth century was very different from education in the twenty-first century. This cultural component in classifications of all kinds also means that each knowledge organization classification

will need adjustments in order to accommodate both new content and also the diverse ways human beings have devised to record and to communicate information and knowledge. For example, the modern phenomenon of electronic information technology has meant, among other things, that the existence of the new tools, the characteristics of electronic retrieval, and the kinds of electronic information objects computers can make available have had to be accommodated by knowledge organization classification theories and systems.

It follows, too, that the study of knowledge organization classification theories and systems is transdisciplinary. Classificatory issues are important intellectual components of every field, and classification literatures can be found in databases and other finding aids for every topic or field of study. For example, classification is an important activity in biology and other scientific fields, statistics and other mathematical areas, sociology and other social science areas, and music and other arts and humanities areas. Numerous publications exist on classificatory issues in every field. For example, Vickery^[1] provided Appendix A, “Historical Aspects of the Classification of Science” (pp. 147–180), which includes some representative classifications of science (pp. 174–180). Veltman^[2] examined knowledge organization in the visual arts. Douglas and Hull^[3] and Ellen and Reason^[4] provide essays on a wide variety of classification topics in the social sciences. Classificatory activities in all fields are driven by the theories that are appropriate for that purpose, topic, time, and/or place.

Groups of things can have many different purposes, and a knowledge organization classification may contain groups of things that may not seem intuitively related to each other. For example, suppose we grouped together a painter’s easel, a cow, a lunar landing pod, and the map of a journey we plan to take. All those things have “legs,” either literally or figuratively. This group could belong in

a knowledge organization system the purpose of which was to gather and organize the literal and figurative meanings of words relating to the human body. It would not, however, belong in a knowledge organization classification the purpose of which was to group objects that have been created by human beings because a cow is not a human creation. It follows that creating a group or class for one purpose entails omitting things that do not fit into that class. Classifying thus simultaneously creates two major groups: 1) a group of things that all belong to a particular larger group and 2) another group of things that do not belong to that larger group. Normally, the group of things that are omitted is larger than the group of things that are included because the omitted group includes everything in the world that does not belong in the included group (e.g., the group of all things that do not have legs).

For human beings, classifying is a cognitive imperative; infants begin to group things as soon as they are born. Perhaps the most basic tool we use for grouping is natural language, either spoken or written. A natural language is a language that has evolved over time and that people use in their daily lives. If we say something is a “chair,” that word gathers all the things that could be called chairs and omits from that group all the things that could not be called chairs. A number of complications arise from natural language, however. One complication is that words can be used both literally and figuratively as in the example of things with legs given above, and another complication is that each group needs to have a name or a label that describes what belongs in the group. Thus, the problems of language recur throughout all the levels of every classification system.

This discussion implies that one result of creating a knowledge organization classification system is to provide a context in which to understand the intended meaning of a particular word. By saying that a cow belongs to a group of things that have legs helps us to understand which of the possible meanings of the words cow and leg is intended. Other implications are that the relationship(s) of all the things in the knowledge organization classification needs to be shown in some way in the groups and in their names, that the relationship(s) among the groups themselves will need a name, and that the knowledge organization classification itself will need to have an appropriate inclusive name. Knowledge organization systems for the whole world of knowledge are called general or universal knowledge organization systems, and knowledge organization systems for a smaller part of the world of knowledge (e.g., astrophysics) are usually called special classifications.

Traditionally, the groups in a classification system should be “mutually exclusive” and “jointly exhaustive.” The criterion of mutual exclusivity applies throughout the classification system. It means: 1) that a certain named thing should occur in only one class and 2) that the class

in which the thing occurs should have no overlapping content within itself. The criterion of joint exhaustivity means that each class in the classification system and the entire classification itself should contain all and only those things that are appropriate to the classes and to the entire system. Nothing relevant should be omitted, and nothing irrelevant should be included. Taken together, mutual exclusivity and joint exhaustivity mean that the classification system should contain all and only the appropriate things for each class and for the classification as a whole, and that there should be no overlap of content among the various classes.

These criteria create a number of problems, especially when they are considered in relation to the problems of natural languages. It is probable that no knowledge organization classification system completely meets both criteria. Suppose we have a knowledge organization classification for “physical objects that people have created.” One major class in this system might be called Furniture and another major class might be called Vehicles. One of the requirements of the criterion of mutual exclusivity is that only kinds of furniture should be in Furniture and only kinds of vehicles should be in Vehicles. The problem then arises of things people have created that could legitimately belong to either major class. Where should a wheelchair or a baby’s stroller be placed? These objects belong in the classification system because they have been created by human beings, but both of them function both as furniture and as vehicles. On the criterion of joint exhaustivity we can also anticipate problems. What will happen when a new kind of furniture or a new kind of vehicle is invented? Before airplanes were invented, we had no name for this kind of vehicle, and it could not have been included in a knowledge organization classification for objects people have created. Yet, as soon as machines that could fly were invented, a knowledge organization classification for things that people have created that did not include these flying machines was immediately out of date. For this reason, knowledge organization classifications need to be updated regularly. The ability to include new things in the appropriate place in a knowledge organization classification is called hospitality.

Organizations

The International Society of Knowledge Organization (ISKO) (<http://www.isko.org/>) has active chapters in Asia (China and India), Europe (France, Germany, Austria and Switzerland, Italy, Poland, Spain, and the United Kingdom), and North America and South America. International conferences are held every two years, and these conference proceedings are published. ISKO’s official quarterly journal is *Knowledge Organization*. The Special Interest Group for Classification Research (SIG/CR) of the American Society for Information Science and Technology (ASIST) holds a yearly workshop during the annual

conference of its parent organization (<http://www.asis.org/SIG/cr.html>). Regional chapters have been formed in the continental United States and Taipei. The proceedings of the yearly workshops are published as *Advances in Classification Research*. These two organizations deal with classificatory activities and debates in all fields and are two of the major sources of information about classificatory issues.

Terminology

In this field, the same term can be used in different ways. For example, the person who creates a classification system is a “classificationist” or a “classifier,” but “classifier” can also be used for the person who applies an existing knowledge organization classification. “Classed” or “classified” can be used interchangeably, as in “classed catalog” or “classified catalog.” These differences mirror preferences in the culture or discipline of the writer.

“Theory” as used in this field is not testable or replicable in the strict scientific sense. These theories are not subject, for example, to double blind experiments or similar kinds of empirical validation. The theories presented here are not susceptible to statements of truth or falsity. Instead, writers on classification consider a certain theory better or worse, more useful or less useful, than other theories for various reasons. Theories necessarily contain assumptions and discussions about what would be better or worse in a particular situation, and they attempt to establish classificatory principles that will achieve better results than other possible principles would achieve. These issues in relation to classificatory cognition and behavior are discussed in Lange.^[5] Often, classification theorists combine their own theories and principles with those of others, either consciously or unconsciously.

“Document” is a generic term for a container of information objects. The container can be in any form or format, for example, in a book, on a Web page, in an architectural drawing, from a piece of music, or in any other way in which people record information and knowledge in order to remember it and to communicate it to others. This inclusive perspective on recorded knowledge allows us to reveal the pervasiveness of classification in human life, language, and culture. It generalizes discussions of theories and issues in knowledge organization classification and other kinds of information work in order to emphasize they are not restricted to one medium of information exchange.

“Warrant” is a term that in this field means the justification and rationale for important types of decisions about a knowledge organization classification theory and the systems to which it gives rise. For example, the cultural dependence of a knowledge organization classification is called its cultural warrant. In the knowledge organization literature, a number of kinds of warrant have been identified, such as literary warrant, user warrant, institutional warrant, and ethical warrant. The different kinds of warrant

individually or in combination seek to provide a consistent theoretical foundation for decision-making about the various elements of a knowledge organization classification.

Scope and Perspective

Given the ubiquity and importance of classificatory activities in human language and interaction, it is important to set out the scope of any discussion of classification theory. This entry deals primarily with bibliographic library knowledge organization classification theories and their assumptions, principles, and elements. Bibliographic library knowledge organization classification theories and systems have been developed for whole documents, not for parts of documents. Historically, these kinds of classifications were developed as knowledge organization classifications for collections of books in libraries and were primarily used for shelving and in some cases for catalog arrangement in specific library catalogs, union catalogs, or bibliographies. The knowledge organization classification theories developed for these purposes were often used as the basis for particular classification systems and were adapted and modified by other theorists for their own purposes. At the same time, other accessing methods, such as indexing (see also Indexing), addressed the content of parts of documents. In cases of both whole and partial document accessing methods, the original theories assumed manual, nonelectronic accessing capabilities. More recently, both bibliographic library knowledge organization classifications and indexing theories and methods are being adapted for electronic purposes in information retrieval applications, both for whole documents and for parts of documents, and other theories are being developed solely for electronic media. Thus, to obtain a complete view of issues of document analysis and access over time, this entry should be read in conjunction with related entries in *ELIS*, including those on specific classificationists and on specific systems (see also the Table of Contents).

Structure of This Entry

After this introduction, the entry is organized in six parts. First, three theoretical planes of work for knowledge organization classification are identified. Next, background and foundations for current knowledge organization theories and systems in the library and information sciences are briefly described. Using the three planes of work previously identified, theories of: 1) how to decide on the appropriate sources for the content of a knowledge organization classification system; 2) how to structure knowledge organization systems; and 3) how and what kind of notations to provide for the systems are discussed. Like all systems of organization, the one adopted for this entry is artificial, the boundaries between the concepts are not rigid, and the issues that arise are not mutually exclusive.

For that reason, a final section bringing together all the theories is provided.

BIBLIOGRAPHIC LIBRARY KNOWLEDGE ORGANIZATION CLASSIFICATION

Three Theoretical Planes of Work

S.R. Ranganathan suggested that classificatory work could be divided into three planes: the idea plane, the verbal plane, and the notational plane. Each of these elements has been theoretically examined and developed extensively in the literature. The idea plane is the conceptual basis for a knowledge organization classification system, including appropriate considerations of its purpose, its warrant, its content and its structure. The idea plane deals with the foundations of knowledge organization and theoretically governs all the decisions that go into the development of a knowledge organization classification.

The verbal plane comprises the words that are used to describe concepts in the schedules of a knowledge organization classification. The verbal plane instantiates the principles of the idea plane and helps to express and demonstrate the relationship(s) between and among concepts in the knowledge organization classification. If the system has an alphabetic index, the verbal plane provides complementary access to the schedules using terms from the schedules and synonyms for them that might be looked up by a user trying to find the place for a topic in the schedules. Two kinds of indexes for this purpose are the relative index, invented by Melvil Dewey, and the chain index, invented by S.R. Ranganathan.

The notational plane requires decisions to be made about the coding that stands for the place of the concepts in the system. Once the sources of content and the structural principles have been chosen for a classification system, a notation is usually provided for helping to identify the order in which documents have been organized by the knowledge organization classification. Notation is a code that stands in place of the name of a class and ideally facilitates use of the classification: 1) by demonstrating the position of the class in the system and 2) by showing the relationship(s) of the class to other classes. A notation is assigned to each class and subclass in the system, and the documents in these classes are then uniquely identified by their separate notations. Notation can be visible to the information seeker, as in a library where users can browse open stacks using the notation to find materials that have the same general topic and that are physically located near each other. Alternatively, notation can be invisible to the information seeker, but still used to organize information for display in an electronic environment (e.g., on a Web page or in an electronic library catalog). A number of different kinds of notation have been developed based on different principles (e.g., expressive, faceted, retroactive),

and the characteristics of each kind are considered when choosing one for a particular classification system.

Background and Foundations

In the library and information sciences, knowledge organization classification theories and the systems that have been based on them have a long history. Usually, Aristotle (384–322 BCE) and Sir Francis Bacon (1561–1626) are credited with being among the historically important figures who have influenced knowledge organization classification theory in library and information sciences fields, but modern authors have more directly shaped the theories and systems we use today. For example, Melvil Dewey (1851–1931), Henry Evelyn Bliss (1870–1955), James Duff Brown (1862–1914), Paul Otlet (1868–1944), Henri La Fontaine (1854–1943), Charles Martel (1869–1945), and Shiyali Ramamrita Ranganathan (1892–1972) have all been influential. In this field, classification is also known as taxonomy or ontology, although with somewhat different meanings (see also Taxonomy and Ontology). In general, the purpose of library and information sciences knowledge organization classification systems is to organize recorded knowledge so that it can be accessed and acquired for use. Two kinds of these knowledge organization systems are usually recognized: general systems for organizing and accessing documents for the whole world of recorded knowledge and special systems for organizing and accessing documents for a particular area of recorded knowledge (e.g., biology or information studies). Knowledge organization classification systems, then, are tools initially for organizing and subsequently for retrieving information and knowledge for any kind of purpose in any kind of information container. Knowledge organization classification theories provide the conceptual bases of the systems and help govern which concepts are included and what principles of organization manifest themselves in the systems.

The foundations of most current knowledge organization classification theories and systems were established in the late nineteenth century. The *Dewey Decimal Classification* (DDC), the *Subject Classification* (SC), the *Universal Decimal Classification* (UDC), and the *Library of Congress Classification* (LCC) as well as less influential systems (e.g., the *Expansive Classification* (EC)) were all initiated before the beginning of the twentieth century. Further, two of the most influential classificationists, Henry Evelyn Bliss, who created the *Bibliographic Classification* (BC), and S.R. Ranganathan, who created the *Colon Classification* (CC), were born and began their education during the nineteenth century. Dates for the first editions of these systems were: DDC, 1876, Melvil Dewey; SC, James Duff Brown, 1908; UDC, Paul Otlet and Henri La Fontaine, 1899; LCC, Charles Martel, 1898; EC, Charles Ammi Cutter, 1891. Later, BC, Henry Evelyn Bliss 1940; CC, S.R. Ranganathan, 1933.

Except for UDC and LCC, each of these systems began as a library classification for open stack libraries where library users were able to browse the shelves, and each, including UDC and LCC, added to the store of knowledge organization classification theories, classificatory devices, and common practices for bibliographic classification systems. The foundation of these systems in nineteenth century thought has greatly influenced their development, but the evolution of these knowledge organization theories and systems has been neither entirely cumulative nor entirely linear. Instead, each has tried to address various theoretical and practical issues that arise in creating, maintaining, and using knowledge organization classification systems, initially in libraries that collected physical objects and now also including venues that collect virtual objects.

Originally, knowledge organization classifications were enumerative and precoordinated. An enumerative classification is one in which all the classes are decided upon in advance and are then arranged in an appropriate overall order. In an enumerative knowledge organization classification, all of the classes and subclasses of the system were enumerated in the printed schedules that ideally showed both the classes themselves and their relationship(s) to other classes. An enumerative knowledge organization classification is difficult to keep up to date because the pace of knowledge creation and change means they must be continually expanded to accommodate new concepts and ideas. At the same time, however, a knowledge organization classification must in addition continue to accommodate concepts that are of historical interest, although not currently considered valid. For example, chemists no longer study alchemy, but the literatures of alchemy from earlier times must still be enumerated in the schedules because scholars continue to study them. Similarly, many of the early knowledge organization classifications have now expanded their frames of reference and are applying their theories and principles to the wider realm of knowledge organization classification as retrieval devices for electronic information objects.

These kinds of systems are also precoordinated. That is, the document is analyzed to determine its “aboutness,” the result of that analysis is translated into the notation of the classification system, and document retrieval takes place using the notation for the document. The overall purpose of these systems is to help people find information that they can use for whatever purpose they had in seeking it. In a precoordinated knowledge organization classification, searching must be carried out in the order of the classes in the classification. For example, if we enumerate four classes for cats and give these classes a notation

Acats
ABcats—kinds
ABC cats—kinds—domestic
ABD cats—kinds—wild

we must then search for wild cats using the notational sequence ABD for cats—kinds—wild, and not a notational sequence AD for cats—wild because the notation AD will have a different meaning. Currently, we have replaced the theory of enumerative classifications with the theory of faceted classifications in which all the classes do not have to be enumerated in detail at the time of the creation of the classification. Similarly, the theory of precoordinated searching has been replaced with post-coordinated searching in which notational elements can be combined at will at the time of the search electronically. Discussions of these evolutionary changes appear throughout this entry.

Theories for the Basis of Knowledge Organization Classification Systems

Three major theories have emerged to describe the best place to start in creating a knowledge organization system: 1) the theory of literary warrant; 2) the theory of scientific and educational consensus; and 3) the theory of phenomenon based knowledge organization classifications. These theories deal with issues of where the sources for the content of a knowledge organization classification should be found. The theories themselves are not mutually exclusive, and elements from more than one theory can be seen in different knowledge organization systems. In addition, it is necessary to remember that the various theories were used to create knowledge organization systems. It is not useful or appropriate to divorce the theories from the knowledge organization classifications they were used to create.

The theory of literary warrant

The theory of literary warrant was developed by English librarian E.W. Hulme in his 1911–1912 essay “Principles of Book Classification.” He wrote that the name of a class should rest upon a

purely literary warrant. . . . A class heading is warranted only when a literature in book form has been shown to exist, and the test of the validity of a heading is the degree of accuracy with which it describes the area of subject-matter common to the class.^[6]

Here, Hulme implied that we need to classify existing books, not the more numerous potential books that could be written. In this, he relied on his view that putting things (books) in groups (classes) does not imply anything about how these groups should be arranged. He rejected the idea that the arrangement of the groups should be based on philosophical theories about the order of nature or the order of science. Instead, for Hulme, the purpose of book arrangements was to expedite locating the literature of interest, and the arrangement of groups

of books should be based on the contemporaneous common understanding of where books could be found. Classification in Hulme's view was not designed to educate library users, but to help them find books that they wanted to read.

Two conclusions followed from these views. First, Hulme suggested that each library would probably need its own classification system, just as each library had its own collection of holdings. The holdings in a particular library reflected the needs and interests of its users, who presumably supported the collection policies of the library, and their needs and interests should, therefore, drive the arrangement of the groups of books, both on the shelf and in the catalog. To Hulme, then, debates about classification did not entail debates about whether or not a classified arrangement was better or worse than an alphabetical one. By divorcing ideas about which groups to form from ideas about which arrangement of the groups to use, Hulme rejected theories of knowledge organization classification that relied upon philosophical or scientific theories about how knowledge should be arranged. Instead, Hulme espoused basing the knowledge organization classification upon the actual books the library had acquired or was likely to acquire in the future.

Second, Hulme demonstrated that, by examining the actual number of documents that were produced during different eras, we would be able to follow changes that had taken place in the development of what he called "civilization." The number of documents in each group would, Hulme believed, show the extent of the literature that existed in that knowledge area in that time and in that place, and, in consequence, show what people in that era were interested in. For example, using statistics of patented inventions and their applications in England between 1449 and 1921, he charted the course of the Industrial Revolution.^[7] This kind of statistical method of using bibliographic output as a way to understanding an age was the beginning of the development of what is now called bibliometrics.^[8]

Hulme's ideas were confined to classification of books in libraries because at the time he wrote books were the most prevalent library collections. Subsequently, a number of different kinds of warrant have been identified (e.g., terminological warrant, institutional warrant, user warrant, cultural warrant), and the theory of literary warrant has been extended to include these different warrants as foundations for grouping documents by means of knowledge organization classification systems. Similarly, during the twentieth century, libraries collected many kinds of documents other than books, and the theory of literary warrant was expanded to include those other kinds of documents (e.g., video recordings, music recordings, journals, research reports).

It is usually thought that development of LCC was based on the idea of literary warrant, even though Hulme did not publish his "Principles" until after the beginning of

LCC in 1898. Nevertheless, the idea that the rationale for a knowledge organization classification system resides chiefly in the content of the materials it seeks to describe is still an influential and useful theory. Regardless of any other rationale that is put forward, a warrant in what is being classified is fundamental. Clearly, if the purpose of the knowledge organization classification is to organize architectural drawings, the characteristics of the architectural drawings to be classified must be taken into account. In that case, the system would be based on "architectural drawing warrant." Further, it is clear that any system can have more than one warrant. All classification systems are embedded in cultural warrant and they can each have other kinds of warrants too.^[9,10]

The theory of scientific and educational consensus

The theory of scientific and educational consensus was put forward by H.E. Bliss initially in a 1910 essay "A Modern Classification for Libraries with Simple Notation, Mnemonics and Alternatives" and later in *The Organization of Knowledge and The System of the Sciences* (1929) and in *The Organization of Knowledge and the Subject-Approach to Books* (1933). He also summarized his ideas briefly in an essay "The System of the Sciences and the Organization of Knowledge" (1935).^[11-14] Bliss' idea was that a classification system should be based primarily on what he called the "scientific and educational consensus." He maintained that bibliographic knowledge organization classifications

should be organized in consistency with the *scientific and educational consensus*, which is *relatively stable* and tends to become more so as theory and system become more definitely established in general and increasingly in detail^[15]

To Bliss, the term "science," which is derived from the Latin "scientia," meant "knowledge in general." He believed that, over time, human beings would grow toward increasing agreement about the answers to fundamental questions that were asked not only in science but also in every other area of human enquiry (e.g., religion, aesthetics, and sociology). Further, he believed that this increasing consensus was mirrored in the way educational institutions organized themselves to pass recorded knowledge to future generations efficiently and effectively. The implication of the consensus idea was that classification systems for knowledge organization should be based on the consensual foundations that knowledgeable people used to organize their own studies and those of the educational institutions they established. Bliss gleaned and justified his ideas through his extensive and widely admired scholarly and theoretical studies of the philosophy of science,^[16] and he summarized his conclusions in five synoptic tables that showed the correspondences

between The Order of Nature, The Developmental Order of Knowledge, The Pedagogic Order, Logical Order, and [Order] by Speciality.^[17]

According to Bliss, only this consensual kind of knowledge organization classification would be appropriate for libraries because they collected materials that people would require for their studies in every area. He believed that expert advice on this consensus would assist the classificationist in developing an appropriate way of classifying every area of recorded knowledge, but he also understood that consensus was not yet complete. For that reason, he believed that a knowledge organization classification should provide alternative placements for topics about which there was still some level of disagreement or for libraries that needed to collect a particular group of documents in one place rather than scattering them throughout the classification. Bliss believed that alternative locations of topics within a knowledge organization classification were necessary in order to provide for the variety of purposes and interests that library patrons brought to their researches. The correlation of these views with the theory of scientific and educational consensus required that another principle, that of maximal efficiency, be added to the theory of consensus. Maximal efficiency meant that a knowledge organization classification should be designed so that both those who agreed with the common consensus and those who did not would find their views and/or purposes reflected in the schedules of the classification, depending on the library that was using the system. In turn, the search for maximal efficiency required two other principles to be established, those of subordination and collocation.^[18] These two structural principles are discussed below in the section on theories of structure for knowledge organization classification.

Bliss' contribution to theories of knowledge organization classification was highly influential for later theorists, but the first edition of his BC was not widely used or particularly well-regarded in the United States. Nevertheless, BC was the basis for the second edition (BC2) which is now considered the most theoretically advanced knowledge organization classification. Bliss' work has been related to the later work of Ranganathan on facet theory and facet analysis,^[19] and his various principles can also be usefully compared and contrasted with Ranganathan's Five Laws of Library Science (see also S.R. Ranganathan).

The theory of phenomenon-based knowledge organization

The theories of literary warrant and consensus were recognized as important and potentially influential when they were first enunciated, but phenomenon-based knowledge organization classification was little known when it was first developed and is only now gaining some prominence. Literary warrant and consensus both implied that the world

of recorded knowledge should be initially subdivided roughly on the prevailing academic disciplines, which are also sometimes called "forms" of knowledge (e.g., science, humanities, and social sciences). DDC, UDC, LCC, and BC first subdivided the world of knowledge along those lines, but the theory of phenomenon-based classification did not require an initial subdivision by academic disciplines or by the forms of knowledge.

The theory of phenomenon-based knowledge organization classification was enunciated and attempted by James Duff Brown, who developed what he called a "one-place" classification system in SC. Brown initially subdivided SC into five main groups: generalia, matter and force, life, mind, and record. The subdivisions of these main classes correspond somewhat to the forms of knowledge as instantiated in the academic disciplines, but Brown believed

there is not the slightest difficulty in working out a complete scheme from any basis, nor does it matter much into what main divisions specific subjects are put, provided always they are kept together on the shelves.^[20]

He did not, then, subscribe whole-heartedly to either the theory of literary warrant or to the theory of consensus. Instead, Brown believed that literature on "concrete" subjects (which he did not define) should be kept together on the shelves so that library patrons could find materials of interest at the same place. Using the example of the Rose, he wrote that the Rose could be treated from many different standpoints such as

Biological, Botanical, Horticultural, Historical, Geographic, Ethical, Decorative, Legal, Emblematical, Bibliographical, Poetical, Musical, Sociological, and so on to any extent.^[21]

In SC, Rose would be at one place in the classification, qualified by these various standpoints from which the subject Rose could be viewed. In that way, people interested in all aspects of the Rose would find all the literature on the Rose together because, using the special devices of SC's notation, all the books on the Rose would be gathered together on the shelves. Brown thus provided the theoretical rationale and a practical example for discussion of phenomenon-based knowledge organization classification. SC was used in the Clerkenwell Public Library in North London where Brown was chief librarian and was regarded as particularly suitable for public libraries in Great Britain.

The phenomenon basis for classification has not been widely accepted, and no completely phenomenon-based scheme has been tried. Special "phenomenon classes," however, have been included in two modern classification systems, the Broad System of Ordering (BSO) and BC2. In these two knowledge organization classifications, the

phenomenon class acts as a place where grouping on the basis of some phenomenon can occur if desired. That is, all the materials that can be said to focus on one phenomenon can be gathered together, even though these materials would normally be scattered throughout the classification. All materials on “logic,” for example, can be brought together in one place in the classification instead of being scattered in various disciplines such as philosophy, computer science, and mathematics. If desired, more than one phenomenon class can be established for any particular collection of documents.

The idea of basing knowledge organization classifications on phenomena is considered to be particularly useful in developing systems that can deal effectively with multidisciplinary and/or multi-format documents because the phenomenon idea corresponds to a similar trend in educational institutions, where departments are now often organized on the basis of a phenomenon (e.g., information studies, women’s studies, Canadian studies). Langridge believes, however, that “primary division by phenomena is not possible throughout a general scheme,”^[22] even though it has not been tried. One problem is that no accepted definition of “phenomenon” exists for use in knowledge organization classification. Clearly, if one intends the word to be taken in a sense broad enough to be useful, then academic disciplines, forms, and formats must also be considered to be phenomena. If only material phenomena (e.g., the Rose) are considered, however, the Langridge’s assertion seems correct. Nevertheless, the phenomenon idea may take its place in classification theory along with literary warrant and consensus as one possible basis for the content of a classification system. Phenomenon-based groupings within classification systems founded on literary warrant and/or consensus demonstrate that a single classification system can effectively use more than one principle of grouping in the same system.

The relationships among these three theories for the sources of content for a knowledge organization classification are relatively complex. Literary warrant uses the topic of documents as the basis for developing a knowledge organization classification. Consensus, likewise, considers the topics of documents, but then extends the idea of literary warrant to include the position the authors take about these topics. It posits that authors will increasingly adopt the same point of view toward the topics. Clearly, too, the idea of consensus implies that many documents will be created based on consensual ideas. It follows that more and more documents will presumably be published validating this consensus. The idea of basing at least part of a system on a phenomenon of particular interest in a particular library includes not only the content of the documents themselves, their authors, and their topics, but also extends these other two theories to include the needs of the users of libraries that may have important special collections that should be kept together.

Three Types of Structure for Knowledge Organization Classification Systems

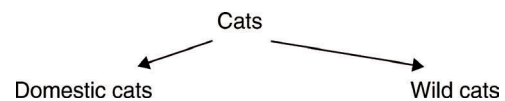
We have concentrated on theories relating to the content of a knowledge organization classification. Like natural language, however, knowledge organization classifications have a structure by which the content is organized. The most common structure for classification systems is a hierarchical arrangement with classes and their various levels of subclasses. Another structural principle for classification systems is faceted subdivision, which was introduced into library classification by S.R. Ranganathan in the first edition of CC in 1933. More recently, the biological theory of integrative levels was investigated by the British Classification Research Group (CRG) for structuring a knowledge organization classification. The CRG’s work was not successful, but the Italian Chapter of ISKO has begun investigating the theory of integrative levels more fully.

Hierarchical structure

No one definition of hierarchy is commonly accepted, but all definitions include the notion of different levels of a thing.^[23] That is, one level in a hierarchy is subdivided to create lower levels, and different kinds of levels are given names to distinguish them from each other and to show their relationships. For example, in the hierarchical downward sequence

Mammals
Mammals—Cats
Mammals—Cats—Domestic cats

Cats is subordinate to Mammals and superordinate to Domestic cats. These hierarchical vertically linked concepts are called chains. If Cats were subdivided into Domestic cats and Wild cats, those two subordinate classes of cats are considered to be coordinate with each other.



Such horizontally related coordinate classes are called arrays.

These technical terms apply to the same concepts in different relationships to each other. In the chain

Mammals
Cats
Domestic cats
Angora cats

Domestic cats is subordinate to Cats and superordinate to Angora cats. In addition, subdivision of hierarchies can be based on equally valid but conceptually quite different principles. For example,

Mammals
Cats
Domestic cats

is subdivided by kind, that is, cats are a kind of mammal, and domestic cats are a kind of cat. Equally, however, mammals could be subdivided by preferred foods, for example,

Mammals
 Carnivores
 Cats
 or
 Mammals
 Herbivores
 Cows

Similarly, things can be subdivided by function, by materials, by time, by place, or by a multitude of other characteristics of division. A characteristic of division is the concept used to create the subdivisions of a group. Clearly, the first subdivision of the whole class will have an influential effect on subsequent choices. In our example of subdivisions of mammals, the first subdivision (whether by kind or by choice of food) governs the kinds of subdivisions that can appropriately come lower in the hierarchy. The choice of subdivision principles depends on the overall purpose of the knowledge organization classification system and on the content appropriate to each class.

The idea of hierarchical levels is apparently present in all cultures,^[24] and until the work of S.R. Ranganathan beginning in the 1920s, classification systems for knowledge organization were all hierarchically structured. That kind of structure was not questioned. For example, Melvil Dewey assumed a hierarchical structure and developed his classification system in such a way that the structure was more important than the content. He wrote

In all the work, philosophical theory and accuracy have been made to yield to practical usefulness. The impossibility of making a satisfactory classification of all knowledge... has been appreciated from the beginning, and nothing of the kind attempted. Theoretical harmony and exactness has been repeatedly sacrificed to the practical requirements of the library... Theoretically, the division of every subject into just [ten] heads is absurd.^[25]

In this passage, Dewey asserts that the structure of DDC is absurd because subdivision of every class and subclass into tens cannot be justified on any theoretical basis, but the structure is nevertheless more important than its content because it improved library practice. He advocated and adopted this kind of decimal subdivision because it was practical and he ignored issues of theoretical elegance or accuracy. Dewey's position on this issue is very strong—not even inaccurate names for content should stand in the way of the practicality of the structure of his classification system for arranging books on shelves and surrogate records for these books in catalogs.

Various criteria have been developed for the hierarchies of knowledge organization classification systems. In the principle of maximal efficiency, Bliss, for example,

provided two similar criteria, “gradation in speciality” and “subordination.” Gradation in speciality meant that basic classes, particularly in the sciences, should lead to their derivatives. For example, chemistry should lead to chemical technology. Subordination meant that special subjects should be subordinate to general subjects. For example, Platonic philosophy should be subordinate to philosophy in general. In addition, writers usually mention that subdivision in a hierarchy should be well-modulated and big leaps in subordination should be avoided. For example, mammals should not jump down suddenly from mammals in general to Angora kittens with no intervening hierarchical steps. In general, these criteria are applied to knowledge organization classifications in which the schedules of the system were printed and established in the hierarchical order required by the creator of the system. These kinds of systems are enumerative and precoordinated knowledge organization classification systems, as discussed above.

Facet structure

A facet is a group formed by the consistent application of only one characteristic of division at a time. Ideally, a facet contains all the terms that could reasonably be used when we want to subdivide by a certain characteristic. Each element in a facet is called a focus (plural foci). For example, in subdividing furniture by the materials facet, we might include wood, plastic, and metal, but not cobwebs, which cannot be a focus of the materials facet for Furniture because cobwebs are not used to make furniture. Similarly, in subdividing Furniture by kinds, we might include tables, chairs, lamps, and beds, but not automobiles because automobiles are not a kind of furniture. If we want to subdivide more deeply to another hierarchical level, we can use a subfacet of the original facet. For example, if Furniture is subdivided by kind to produce Chairs, Chairs can also be subdivided by kind to produce a list of kinds of chairs (e.g., dining room chair, kitchen chair, rocking chair, armchair, and lounge chair) or by material to produce a list of all the materials chairs are commonly made of (e.g., metal, plastic, wood). In contrast, we would not subdivide furniture into such groups as “metal chairs” or “plastic lamps” because more than one characteristic of division is operating at each level.

S.R. Ranganathan, who began his career as a mathematician, became university librarian at the University of Madras in India, and was subsequently sent to England to study library science in 1924. While he was in London, he began to develop the idea of faceted structures for knowledge organization classification. He postulated that there were five fundamental categories that could be used to state notationally the content of documents, both books, and other kinds of texts like journal entries. The five fundamental categories were assumed to be personality, matter, energy, space, and time. These five facets were established in his famous “facet formula” PMEST. The

Personality facet was the basic idea, entity, or concept of the document. The Matter facet dealt with the substances, properties, or materials involved. The Energy facet was the processes, operations, or activities involved. The Space facet included nations, geographic features, etc., as appropriate. The Time facet included periods, dates, seasons, etc., as appropriate. The issues raised by these five facets have generated considerable discussion in the literatures of the library and information sciences. It is important to note that the five fundamental categories were postulated, that is, not proven.

Ranganathan's principles of analytico-synthetic classification were supported by these five fundamental categories. In analytico-synthetic classification, unlike enumerative classification, the content of a document was to be analyzed into separate concepts that each was assumed to belong to one of the five fundamental categories. These individual concepts would then be given the appropriate notational element, and these notational elements were then synthesized into a notational statement that expressed the subject of the document. In general, the schedules of an analytico-synthetic knowledge organization classification are much shorter than the schedules of an enumerative classification because all possible combinations of notation do not have to be enumerated and listed in the schedules. On the journey back to India in 1925, Ranganathan began work on the CC, which was first published in 1933.

The theory of facet analysis was primarily a theory of structure for creating a notational statement by combining separate notational elements that, when joined together, would express the subjects of documents. The facet structure is often discussed, however, as if it were the opposite of hierarchical structure. Faceted knowledge organization classification can include hierarchical structures such as hierarchical levels of sub-facets, and the two kinds of structure are not mutually exclusive. A faceted knowledge organization classification is, however, fundamentally unlike an enumerative structure because a faceted structure does not require all possible combinations to be established in the classification schedules. Instead, a faceted classification establishes facets and their foci and then allows notational combinations from the facets and foci to be formed in order to state the subject of a document. It is also sometimes stated that faceted classification shows the relationships between the elements present in a document and stated in a notation. This assertion is invalid because the five fundamental categories do not stand in a constant relationship with each other within different documents. For example, if we have two documents about "the influence of the moon on the tides," one may emphasize the phenomenon of gravitational force (Energy facet) and the other may emphasize the tidal response (Materials facet) to gravitational force. In this case, the notation for both documents will be the same, but the content of the documents is quite different.

Ranganathan's contribution was to apply the principles of mathematical set theory to concepts as a way of making

a classificatory structure predictable, rational, and economical. Like the other knowledge organization classifications we have discussed, CC had main classes based on academic disciplines as the forms of knowledge. In CC, these were called basic classes. Each basic class had a standard facet formula for its own content that was a variation on the PMEST formula. In addition, it became clear that documents often contained more than five conceptual elements that corresponded exactly to the five fundamental facets. For this reason, Ranganathan extended the facet formula in practice in such a way that more than one occurrence of various facets could be used in what were called rounds and levels of notation.

Ranganathan's basic ideas were brought to Great Britain in 1951 in a textbook called *The Fundamentals of Library Classification* by B.I. Palmer and A.J. Wells.^[26] Before that publication, Ranganathan's ideas were known in Great Britain, but his explanations of technical terms were considered obscure. For example, Ranganathan did not use the term "facet" in the present meaning of the term until the third edition of CC in 1950. Before that, Ranganathan used the terms "standard unit," "sequence," or "train of characteristics" for what he later called a "facet." In his *Prolegomena to Library Classification*, for example, he wrote

Complete Division of a universe is the process of extending division of that universe on the basis of a sequence of characteristics until no multiple group is left.^[27]

Further, his mathematical background suggested terms such as postulates, rules, laws, and formulae to him, and he brought those terms into knowledge organization classification theory. These kinds of terms added to the difficulty others sometimes encountered in understanding his ideas and how they could be applied in knowledge organization theories and systems for the library and information sciences. Palmer and Wells' textbook clarified Ranganathan's vocabulary and concepts for English classificationists, classifiers, and students.

In consequence, Ranganathan's ideas rapidly caught on, and in 1955 the CRG in England published a manifesto called "The Need for a Faceted Classification as the Basis of All Methods of Information Retrieval."^[28] The members of the CRG had analyzed the theory, principles, and practices of existing knowledge organization classifications and found that they were inadequate for the tasks for which they had been designed. The CRG extolled the theory of facet analysis and the analytico-synthetic facet method as the only method that would be adequate for the increasing number of documents that were being published, many of them on highly detailed, multidisciplinary, and specialized topics. The members of the CRG created a number of special knowledge organization classifications using Ranganathan's principles, and a manual on how to make faceted systems was published.^[29]

Despite the group's admiration for Ranganathan's work, however, they disagreed with his postulation of only five fundamental categories. The CRG extended the idea of fundamental categories to include other categories that seemed necessary for the particular classificatory domain they were considering. For example, Vickery's classification for soil science had nine facets, and D.J. Foskett's classification for container manufacture had four facets and one set of common subdivisions (both classifications are in Vickery^[30]). These differences may have arisen from the work of CRG's members in special libraries and bibliographic venues.

Ranganathan himself disagreed with the CRG's emphasis on special knowledge organization systems for domains smaller than the whole universe of knowledge because he saw the world of knowledge as a unitary circular structure, as expressed in the acronym APUPA. The center of the world of knowledge was the Umbra, surrounded by concentric circles of Penumbra and Alien areas that were increasingly farther away from the center. The CRG, too, realized that special domains could not entirely be separated from the rest of the world of knowledge. They saw their special knowledge organization classifications as consisting of a core area of knowledge surrounded by fringe topics that were related to the core in some particular way. For example, a knowledge organization for a special area of knowledge would also need to accommodate educational, legal, and ethical issues for that area, and the CRG also recognized that these fringe areas were actually complete core fields of study in themselves.

The CRG's research during this period was highly fruitful. After their work on the North Atlantic Treaty Organization (NATO) grant was over, as discussed below, the Group produced LISA (Library and Information Science Abstracts) knowledge organization classification, their most successful scheme. In addition, Derek Austin began work on Preserved Context Indexing System (PRECIS), and Jack Mills began work on BC2. Although BC2 is not yet finished, it is generally considered to be the most theoretically sophisticated modern knowledge organization classification. It is based on the research the CRG conducted under the NATO grant and it uses the analytico-synthetic theory of facet analysis and retroactive notation, which was developed as in part as a result of the CRG's work on a general scheme. BC2 is regarded as a fully-faceted scheme in the sense that each main class uses facet theories and principles exclusively in its development. The Introduction to BC2 is probably the most comprehensive discussion of facet theory, principles, and methods outside Ranganathan's own writings,^[31] and an exposition of BC2's principles appears in Mills.^[32]

Facet analysis and faceted classification theories have been highly influential in the revision of the major general classification schemes such as DDC, UDC, and LCC. Currently, research is being conducted on revising UDC on

the basis of work carried out for BC2.^[33] Further, facet theories, principles, and methods are considered particularly effective for Web-based classification and information retrieval, and interest in elements of facet theories and principles are increasing in computer science, in other technical areas, and for relatively untrained computer users (discussion and examples can be found at Denton).^[34] Ranganathan's theoretical work on structural issues in knowledge organization is generally seen as the most fruitful and highly-regarded knowledge organization work in the twentieth century. The influence of facet theory and the CRG's work has been brought up to date in a current entry with the same title as the CRG's original paper on faceted classification and in a special issue of the journal *Axiomathes*.^[35]

Theory of integrative levels

In 1962, NATO gave the Library Association £5000 (about \$14,000) to develop a new general classification system for scientific documents. The Library Association approached the CRG for this work, and the group began to create this new system. For the new system, the CRG planned to use facet analysis as the basic structural principle and method, and they decided to use the theory of integrative levels to design how the classes would be formed. The theory of integrative levels is a biological theory about how individual cells combine into different organisms.^[36,37] This theory meshed neatly with facet theory because it appeared to be a special case of an analytico-synthetic method worked out for the biological sciences. The CRG was unable, however, to create a knowledge organization classification system based on the theory of integrative levels, and the NATO grant was not renewed when the Group reapplied in 1969.

The theory of integrative levels was based on a series of Laws of the Levels and Rules of Explanation. As described by the CRG, the theory of integrative levels maintains

that the world of things evolves from the simple towards the complex by an accumulation of properties, and that, at a succession of levels, these aggregations reach new degrees of complexity and become new wholes, with individual and unique identities. Each whole is greater than the sum of its parts, and ceases to possess its identity if broken down again. It acts as a unit, and the units at each level can engage in processes characteristic of that level; an influence acting on one part of the unit affects the whole unit, even though other parts may continue to function as before.^[38]

The description of the CRG's examination of integrative levels and the conclusions it reached are presented in their report *Classification and Information Control*.^[39] A number of problems arose, among which were their efforts to

find appropriate levels with which to analyze the ideas that human beings created and worked with (which the CRG termed “mentefacts”) and also the physical creations of human beings (e.g., works of art). Further, the group realized that a general knowledge organization classification for documents would need to classify documents about certain things, not the things themselves. This situation became known as “the Chinese plate syndrome,” which the CRG used to draw the distinction between classifying books about Chinese plates and classifying the Chinese plates themselves.^[40]

The CRG was not able to resolve the problems they faced, and they abandoned the theory of integrative levels when the NATO grant ran out was not renewed. Nevertheless, the theory of integrative levels remained intriguing and became the basis for Dahlberg’s Information Coding Classification (ICC).^[41] More recently, the Italian chapter of ISKO (<http://www.iskoi.org/>) has embarked on a series of investigations into the theory of integrative levels and has begun developing the Integrative Levels Classification (ILC).^[42] These investigations appear to be fruitful new directions in research on the structure(s) of knowledge organization classification.

Notation for a Knowledge Organization Classification System

Notation is used in many fields as a way of coding and communicating complex ideas, such as music, dance, and mathematics.^[43] All the knowledge organization classification issues we have discussed have implications for notational systems. There is general agreement that the notation is the final step in creating a knowledge organization classification. Once a notation is in place, the system is considered to be frozen. At that point, it is more difficult (but not impossible) to make a system hospitable by adding new concepts at the right places. Notational development is important for knowledge organization classification because the notation shows the position of the concept in the schedules and that concept’s relationship(s) to other concepts. Notation thus allows individual documents and related groups of documents to be retrieved. In theory, notation is a device that describes the structure and content of a knowledge organization system without using words. Ranganathan aspired to create an “artificial classificatory language”^[44] that would systematize and regularize notation.

Discussions of desiderata for notation have included a number of characteristics, for example, it should be pure (use only numbers or only letters); it should be mixed (letters, numbers and/or other symbols); it should be expressive (show the hierarchical level of the concept in the system); it should be mnemonic (suggest its own meaning in some way); it should be short (for memorability); and it should be pronounceable. Clearly, all of these characteristics cannot occur together. For example, an

expressive notation that shows a hierarchical depth of 15 levels of subdivision cannot also be short and will probably not also be memorable or pronounceable. A useful chart showing how various kinds of notations work and how they compare with each other in length appears in A. C. Foskett’s *The Subject Approach to Information*.^[45] Detail about the CRG’s research into notation appears in Vickery.^[46]

Although Dewey probably did not invent the decimal notation that DDC uses, he popularized it and demonstrated its usefulness in bringing books on like topics together on the shelves. Before DDC, books were usually arranged on shelves in broad classes with an ordinal call number that was based on the book’s accession number. That practice was called a fixed place notation and meant that books on the same topic would not be shelved in proximity to one another unless they had been acquired at the same time. One argument in favor of fixed place notations was that a library patron could learn where a favorite book was placed and find it immediately because it was always shelved in the same place. That characteristic was helpful at a time when much indoor lighting used candlelight, or, at most, oil or gas lights. The idea that decimal notation was superior to fixed place notation spread quickly at least in part because of Dewey’s charismatic personality and tireless promotion of DDC. As interest in Ranganathan’s ideas became established, faceted classification structures created a renewed interest in notation because an analytico-synthetic faceted system depended on being able to notate separate content elements to express the subject of a document. This development meant that two new issues had to be addressed concurrently when creating a notational system for a faceted classification: citation order and facet indicators.

Citation order

A citation order for the separate elements of a faceted notation needed to be established. Citation order is the sequence in which notational elements are set down in a complete notation. The analytico-synthetic method meant that the subject of the document was analyzed into its parts, each of which was given its own notation. Once these notational elements were identified for the document, they had to be synthesized in a standard predictable order. The requirements of information retrieval meant that these stand-alone notational elements could not be combined randomly. If random order were used, it would not be possible to predict what each notational element meant in the notation as a whole and accurate retrieval could not occur. For this reason, a standard notational sequence had to be established.

Ranganathan’s PMEST facet formula specified the citation order in which notational elements needed to be combined for CC. Other faceted classifications, for example, those developed by the CRG, have different citation

orders based on the requirements of knowledge organization classifications. The group did, however, develop what they called a “standard” citation order that could be established for each class. The CRG’s standard citation order was class, thing (purpose), kind, part, property, process, operation, agent, space and time. This standard citation order added detail and flexibility to Ranganathan’s PMEST facet formula. In the CRG’s version, thing (purpose) corresponded to personality; kind, part and property were included in material; and process, operation and agent were included in energy. Space and time always stand at the end of a notation and are included in every faceted classification system and in most enumerative ones. Time is usually the last element because it is considered to be a more abstract concept than space and has no universal referent.

Citation order did not pose a similarly difficult problem for non-faceted enumerative notations because the schedules of that kind of system did not allow the flexibility of combining notational elements at will. The device of combining notational elements was not entirely new with faceted systems, however. For example, the second edition of DDC (1885) allowed one to subdivide certain topics geographically by adding numbers from the 900 class to the notation for the topic. The topics that could be subdivided in this way were shown in Table 1 of the second edition. Similarly, UDC, which was based on the fifth edition of DDC, provided from the beginning seven auxiliary tables for this kind of notational synthesis, six of which are still included in the UDC schedules today. Individual schedules in LCC also have tables for combining notations. SC had an auxiliary table, the categorical table, which provided about 900 “standpoints” by which any topic in the schedules could be modified. In addition, SC allowed both intra- and inter-facet notational synthesis, that is, synthesis within one facet and between different facets. The rationale for this kind of notational synthesis in enumerative systems is that the use of auxiliary tables meant that every possible combination does not have to be printed in the schedules. Further, there is usually some choice about when to use the auxiliary tables (except in LCC). Thus, in enumerative knowledge organization systems notational synthesis is seen as device to provide economy in the schedules and a citation order is built into the schedules, but in faceted systems notational synthesis is a fundamental principle that is driven by the theory of analytico-synthetic classification. In this case, citation order must be explicitly decided and rationalized by the classificationist.

Facet indicators

As we have seen, at the advent of Ranganathan’s analytico-synthetic method in classification, the level of analysis of an information object changed from notation summarizing the whole information object to notation expressing different elements that would, when combined, describe the

intellectual characteristics of the document. Thus, in addition to requiring a citation order, analytico-synthetic theory, principles, and practices required facet indicators. Facet indicators are punctuation marks or other symbols that show where the synthesized notation is divided into its separate facets. Facet indicators are required so that separate notational elements may be used in information retrieval. Without an indication of where a new facet begins: 1) one cannot search for an instance of a notational element and 2) one cannot add digits to the notation for that facet when required by the demands of hospitality. In the first edition of CC, Ranganathan used the colon as a facet indicator between the notation for each of the facets. Later, different punctuation marks were inserted at the beginning of each facet. For example, the topic “Classification of theses by the LCC classification system in Canadian university libraries in 1978” would be notated 234;494:51;M98.72’N78 where 2 was the basic class for library science; 34 was the personality facet for university libraries ; 494 was the matter facet for theses ; :51M98 was the energy facet for classification by LCC ;.72 was the space facet for Canada; and ‘N78 was the time facet for 1978.

Like citation order, facet indicators had been used before Ranganathan’s views were known, but in a somewhat different way and without a theoretical basis. UDC used what were essentially facet indicators from the beginning, although they were called “signs of association.” UDC has, however, no prescribed citation order, and it is thus possible to arrange notational elements in the way that is most useful for a particular situation. It should be remembered, too, that the UDC was not created as a knowledge organization classification for books on shelves, so that the problems created by differing citation orders are not as prominent as they are for a knowledge organization system for shelving. For example, notation for the topic “A thesis in French on the classification of books on education in Canada in 1979, written from the economics point of view” would be notated 025.4:37.003.1(71)“1979”(043) = 40 but could be written in a different order if required. 025.4 stands for BC; :37 means in relation to education; .003.1 means from the economic point of view; “1979” means the date; (043) means thesis; and = 40 means in French. UDC has undergone many revisions since its beginning, and the meanings of these signs of association have changed periodically. Nevertheless, the influence of UDC on other classificationists and classification systems has been strong. The most comprehensive work on the origins and development of UDC is Rayward.^[47] A shorter treatment appears in McIlwaine.^[48]

As we can see from these examples, facet indicators create lengthy and complex notations. Although they were necessary to implement the theory of faceted classification, these indicators produced notations that were considered too complex to be easily understood and too long to

be given to documents, especially for the spines of books. These issues were particularly important in an era when library classifications were used primarily to organize books on shelves (except for UDC).

The CRG undertook a number of experiments on notation, and probably the most successful was retroactive notation. Retroactive notation has been used in a number of schemes, principally in BC2. Retroactive notation does not need facet indicators, and it can be either numerical (0–9) or alphabetical. It mechanizes notational synthesis because the citation order is built into the classification schedules. In a retroactive notation, the order of the schedules is from general to specific (moving from the beginning of the schedules to the end), but the notation is applied from the specific to the general (moving from the end of the schedules to the beginning). When devising a retroactive notation, only letters in the alphabet that come after the initial letter of the notation are used. For example, the topic “a program of training for the advertising of public utilities” might have the notation ttvstwrw or ttv stw rw. We can see that the first notational element (ttv), which comes at the end of the schedules, is followed by the notational element (stw). In this example, s is closer to the beginning of the alphabet than its immediately preceding letter (v). Therefore, s begins a new facet. Similarly, in the next notational element (rw), r is closer to the beginning of the alphabet than its immediately preceding letter (w). Therefore, r begins a new facet. Retroactive notation can thus be checked by referring to alphabetical order and this kind of checking is a quick and easy procedure for computers to do. It creates a shorter notation because no facet indicators are needed, but devising the schedules is difficult. This example was developed from Barbara Kyle’s classification for the social sciences in Kyle.^[49] Retroactive notation has, however, been suggested as appropriate for computer applications because of the power of computers to analyze long strings text and a suggested system that uses some of the characteristics of retroactive notation has been developed.^[50]

CONCLUSION: THE THEORIES BROUGHT TOGETHER

Ranganathan believed that knowledge organization classification had three planes: the idea plane (the overall conception of the system); the verbal plane (the schedules and index of the system); and the notational plane (the way the concepts in the schedules were expressed in notation). The separation of topics in this entry into content, structure, and notation is roughly analogous to Ranganathan’s three planes of work. As we have seen, from their beginnings in the late nineteenth century to the present, knowledge organization classification systems have undergone major shifts in all three planes. The

initial enumerative classifications (e.g., DDC, LCC, UDC, SC) can be thought of as “universe of knowledge” classifications. That is, they began with the whole universe of knowledge and subdivided it from the top down in successive steps to create classes and subclasses at various levels of hierarchical depth. Once the schedules were arranged in the desired order, a notation was applied. As theoretical development proceeded through Ranganathan and the CRG, this top-down universe of knowledge classification systems was partially transformed into bottom-up “universe of concepts” classification systems. Wilson distinguished between universe of knowledge classifications and universe of concepts classifications in Wilson.^[51] That is, within each class and subclass, the most important concepts were identified first and their facets and subfacets were then established. On the basis of Ranganathan’s theory of analytico-synthetic classification theories, principles and methods, concepts were identified in documents, and notation was assigned to each concept. These notational elements were then synthesized in the correct citation order that had been established for the knowledge organization classification. The development of BC2 is described in Mills.^[52]

BC2 is the best example of this kind of classificatory thought, but all the major classification theories and systems have been revised to a greater or lesser extent on the basis of facet theory and its extensions. Library and information knowledge organization classification theories and systems have influenced and re-influenced each other throughout their evolutionary histories. In a rough chronological sequence, DDC was the basis for UDC, which was influential in the development of CC. Facet theory and method moved through all the systems and came to their highest point of development in BC2. Facet theory and method have then retroactively influenced DDC, UDC, and CC. CC has influenced all the others in both theoretical and practical ways, and they have all influenced the various revisions of CC. This analysis is based on Cockshutt.^[53] Thus, despite the differences in concept, application, and history of the various knowledge organization classifications, they share with each other important theoretical developments that have occurred throughout their lives. In addition, it must be remembered that all the theories and systems that have been discussed are constrained by the cultural warrants of their times and places because “classification systems are intellectual, and fundamentally also political, constructs: they represent, and impose, a view of the world at a certain time and in a certain environment.”^[54]

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Clinical Decision-Support Systems

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Abstract

Clinical decision-support systems (CDSS) apply best-known medical knowledge to patient data for the purpose of generating case-specific decision-support advice. CDSS forms the cornerstone of health informatics research and practice. It is an embedded concept in almost all major clinical information systems and plays an instrumental role in helping health care achieve its ultimate goal: providing high-quality patient care while, at the same time, assuring patient safety and reducing costs. This entry introduces the concept of clinical decision support from early generation artificial intelligence-based systems to the evolution of modern systems based on evidence-based clinical guidelines. The discussion also includes the key technological considerations of CDSS and the barriers inhibiting its widespread adoption and effective use.

INTRODUCTION

The notion that artificial intelligence (AI) might one day rival the decision-making capability of human brain sparked the first generation of computerized clinical decision-support systems (CDSS) developed from the 1960s into the 1980s.^[1,2] However, years of trials and frustrations convinced AI enthusiasts that the enormous variations in patient care cannot be reduced to systematic decision making to render qualitative medical treatments.^[3] These limitations became even more apparent with the increasing awareness that patient care outcomes are also subject to other factors including quality- and value-of-life judgments, economic and psychosocial considerations, and social well-being of the patient as a whole. This brought a disappointing close to the first chapter in the use of computers to aid in medical decision-making.^[4]

The story did not end there. Computerized clinical information systems proliferate throughout health care organizations today, significantly reducing the costs to acquire and store patient data. These changes, however, have invited new challenges, including an explosion of patient information that far exceeds any practitioner's capability of processing such data.^[5] This situation is further compounded by a wellspring of medical knowledge resulting from the "evidence-based medicine" (EBM) movement over the past 20 years that has revolutionized the way medicine is practiced. EBM requires physicians to rely less on their own experience and more on the current best evidence in making decisions about the care of individual patients.^[6] Unfortunately, "current best evidence" is a temporal concept that may become outdated rapidly as medical research advances or the mechanisms causing diseases change (e.g., new varieties of flu virus).

Further, the U.S. health care system has been criticized for its high costs, low efficiency, poor quality, and unacceptable rates of preventable medical errors. In 2007, \$2.2 trillion or 16.3% of national gross domestic product (GDP) was spent on health care in the United States,^[7] while this number was only 8.7% on average in other industrialized countries, based on 2006 data.^[8] Despite the twofold higher health care expenditure, the quality of care provided in the United States ranks last among major industrialized countries.^[9] As a result, 31% of Americans rated the U.S. health care system as "poor" in 2008.^[10] Further, the landmark 2001 report published by the Institute of Medicine, *To Err is Human: Building a Safer Health System*, showed that preventable medical errors in the U.S. health care system cost a total of 44,000–98,000 patient lives and \$17–29 billion a year.^[11] In response to these challenges, regulatory bodies and payer systems are actively establishing new regulations and incentive policies to assure health care institutions operate optimally. Joint Commission on the Accreditation of Healthcare Organizations (JCAHO, <http://www.jointcommission.org/>), for example, publishes *Comprehensive Accreditation Manual for Hospitals* every year articulating a wide range of accreditation criteria on facility operation, care provision, and patient safety. Similarly, the National Committee for Quality Assurance (<http://www.ncqa.org>) specifies a comprehensive set of measures for monitoring patient care performance through its annual publication *The Healthcare Effectiveness Data and Information Set (HEDIS)*. While these may help to address the problems in U.S. health care, they also add a new layer of complexity to the already chaotic clinical workspace. This is the reason the medical community is embracing more than ever the idea of using computer systems to aid in medical decision making.

CLINICAL DECISION-SUPPORT SYSTEMS

Broadly speaking, a decision-support system is an interactive, flexible, and adaptable computer-based information system developed specifically for supporting the solution of a nonstructured management problem for improved decision making. It utilizes data, provides an easy-to-use interface, and allows for the decision maker's own insights.^[12] Google Maps™ (<http://maps.google.com>) provides a good example. The site applies intelligent algorithms to geographic data to provide “optimal” routes for traveling from location A to location B while, at the same time, allowing the travel planner to manually intervene in the process, such as creating a more preferred route with click-and-drag options.

Likewise, in the health care arena, clinical decision-support systems provide clinicians, staff, patients, and other individuals with knowledge and specific, individualized information, intelligently filtered and presented at appropriate times, to enhance clinical performance and patient outcomes. It encompasses a variety of tools and interventions such as computerized alerts and reminders, clinical guidelines, order sets, patient data reports and dashboards, documentation templates, and diagnostic support.^[13] The essential component of CDSS is *inference engine*, which applies the knowledge stored in a knowledge base to patient data to derive case-specific recommendations. CDSS is usually interfaced with, or as a part of, other clinical information systems such as electronic health records (EHR) or computerized provider order entry (CPOE) systems. For example, every full-fledged commercial EHR system provides certain types of electronic templates for managing chronic disease conditions. These templates offer individualized treatment and lifestyle change advice based on clinical guidelines and patient data.

With its capability of generating decision-support alerts warning against drug–drug interactions and drug–allergy interactions, CDSS is being increasingly mandated by regulatory bodies and advocacy groups such as JACHO, the Leapfrog Group for Patient Safety (Leapfrog, <http://www.leapfroggroup.org/>), and the Certification Commission for Healthcare Information Technology (CCHIT, <http://www.cchit.org/>). The JACHO accreditation manual has a dedicated Management of Information section clearly specifying the data requirements for enabling clinical decision support. Leapfrog, a voluntary group of large employers that ranks hospitals based on their quality and safety performance, has specific requirements to evaluate whether a hospital is equipped with CPOE decision-support systems capable of warning against drug interaction, allergy, and overdose. CCHIT, a recognized certification body (RCB), incorporates the clinical decision-support provision as a key component of its clinical information system certification process.

History of Clinical Decision Support

Started in the 1960s, the initial objective of introducing computers into medical practice was very clear: to provide doctors with decision aids using AI-based medical diagnostic reasoning. The enthusiasm was primarily spurred by the capability of computers to solve complex decision models in real time. This stream of research eventually developed into a dedicated discipline, Artificial Intelligence in Medicine (AIM), with wide appeal and broad consensus for optimism. In 1970, Schwartz announced in the *New England Journal of Medicine* that clinical computing would likely be commonplace in the “not too distant future.”^[14] *DXplain*, shown in Fig. 1, is a representative example of the early generation diagnostic tool. Developed at the Massachusetts General Hospital, *DXplain* uses a modified form of Bayesian logic to produce a ranked list of possible diagnoses based on symptom manifestations. Table 1 lists several other influential systems developed during this time period. For a comprehensive bibliography of these early generation CDSS systems, readers can refer to Miller 1994.^[15]

Unfortunately, the plethora of clinical computing, as predicted by many, never occurred. A large number of AI-based diagnostic reasoning systems were developed and tested, but most was not adopted in practice. A plausible reason accounting for this failure is that the AI-based diagnostic reasoning “functioned more like the ‘Greek Oracle’ rather than permitting a more flexible, interactive approach” (p. 4).^[2] A “decision-making,” rather than a “decision-supporting” structure, was perceived by physicians as a threat to clinician autonomy.^[2] Moreover, most of these early generation systems were stand-alone, self-contained applications. They were not integrated with other computerized systems supporting hospital operation and patient data management, which were not readily available at the time. As a result, the decision-support advice generated by these early generation CDSS was often inaccurate or irrelevant. For example, Berner et al. (1994) tested four diagnostic systems and found that the proportion of correct diagnoses ranged from 0.52 to 0.71, and the mean proportion of relevant diagnoses ranged from 0.19 to 0.37.^[16] This level of performance made the adoption of such systems for treating real patients unrealistic. Another major reason accounting for the failure of early generation CDSS was the lack of financial returns. The dominant pay-for-service model—reimbursement was determined based on what was done rather than how well it was done—provided little incentives for medical practices to invest in expensive computer-based decision-support technology.

New Generation of Guideline-Based CDSS

The use of computerized clinical information systems to support hospital operation as well as clinical activities

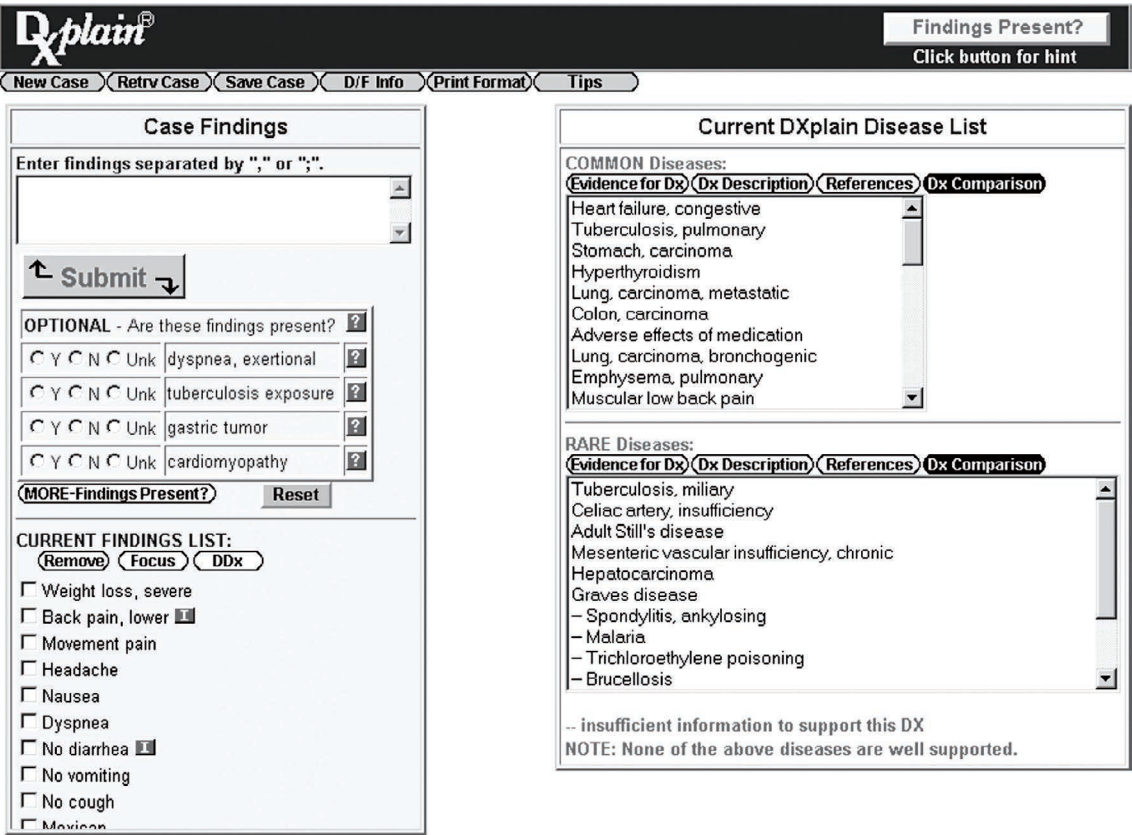


Fig. 1 DXplain: A representative early generation clinical decision-support system.
Source: MGH Laboratory of Computer Science, <http://dxplain.org>.

Table 1 Examples of early generation clinical decision-support systems.

De Dombal	1972	Developed at the Leeds University, United Kingdom, De Dombal is a clinical decision-support tool that uses naive Bayesian approach to provide automated reasoning under uncertainty for diagnosing acute abdominal pain and recommending the need for surgery.
INTERNIST I	1974	INTERNIST I is a rule-based expert system for solving complex diagnostic problems in general internal medicine. It was developed at the University of Pittsburgh and later commercialized under the brand name Quick Medical Reference (QMR).
MYCIN	1976	MYCIN is a rule-based expert system developed at Stanford University. It was used to diagnose and recommend treatments for certain blood infections and other infectious diseases.
DXplain	1984	Developed at Massachusetts General Hospital, DXplain uses a modified form of Bayesian logic to produce a ranked list of diagnoses that might explain or be associated with the clinical manifestations.

started to flourish in the early 1990s. Besides the significant technological breakthroughs, including the availability of enterprise-level database management systems (DBMS) and health data standards such as ICD and HL7, new legislation and advocacy by federal funding agencies also played a key role. International Statistical Classification of Diseases: Standard diagnostic classification developed by the World Health Organization (WHO) for its member states to report mortality and morbidity statistics. In the United States, ICD-9-CM (ICD 9th Revision, Clinical Modification) is widely used to codify diagnostic data for administrative (such as billing) purposes. <http://www.cdc.gov/nchs/dataawh/ftp/ftpICD9/ftpICD9.htm>. Health Level Seven (HL7) is an all-volunteer, not-for-profit organization. It oversees the development of international health data exchange standards. <http://www.hl7.org>. Financial investments to implement large-scale health IT systems were made by the Agency for Healthcare Research and Quality (AHRQ, <http://healthit.ahrq.gov>), Health Resources and Services Administration (HRSA, <http://www.hrsa.gov/healthit/>), and many other foundations and private funding sources. Insurance companies have also been actively engaged. They either

funded health IT directly, or provided financial incentives to medical practices for adopting information technology. The purpose was to reduce administrative costs in processing paper-based claims, thereby improving the quality and timeliness of health data submitted by medical facilities.

This provides a platform warranting the rise of a new generation of CDSS. Fewer of these new generation systems remain as stand-alones because of the need to provide clinicians with a unified interface to access all patient data and all clinical functionalities. Instead, CDSS often appears as modules embedded in other computerized systems, such as EHR and CPOE. Compared with their AI-based ancestors, these new generation systems represent a new class of CDSS—evidence-adaptive decision support—that provides decision aids with a knowledge base constructed from, and continually adapting to, new evidence based on research and practice, i.e., EBM. EBM is the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients (6). It distills scientific evidence from the systematic analysis of medical literature using statistical or data mining approaches.^[17] These systems are primarily used to help improve the coherence of preventive care and chronic disease management guidelines. A significant portion of clinical decision support is also provided using rather primitive database look-up rules. For example, dosage levels may be suggested based on patient age and body mass index (BMI), or prompts may appear for medication interactions based on commercially available medication lexicons, or reminders for vaccines based on well-specified childhood or adulthood vaccination schedules. The rationale behind these CDSS systems is simple: the majority of quality care problems and patient safety issues are due to human omissions, rather than lack of medical knowledge. Hence, CDSS should focus on “reminding” clinicians to avoid potential omissions instead of providing direct diagnostic aids by assuming clinicians are unable to solve a problem. As shown by Garg et al. 2005, such passive reminding systems are far more effective than proactive diagnostic systems.^[18]

In 2006, the American Medical Informatics Association (AMIA) published *Roadmap for National Action on Clinical Decision Support*, which identifies three key objectives for CDSS research and practice: 1) Best Knowledge Available When Needed; 2) High Adoption and Effective Use; and 3) Continuous Improvement of Knowledge and CDS Methods.^[19] Objective 1 of the AMIA CDS Roadmap suggests that providing clinical decision support should be based on up-to-date medical knowledge and should occur “as part of clinician workflow” and “at the time and location of decision-making” (p. 765).^[20] Objectives 2 and 3 are related to medical knowledge engineering and the implementation and user resistance barriers of CDSS, which is discussed in detail in the following two sections.

Guideline Ontologies for Effective Medical Knowledge Engineering

The up-to-date medical knowledge implemented in CDSS is primarily derived from evidence-based clinical guidelines. AHRQ’s National Guideline Clearinghouse (<http://www.guideline.gov>) is the principal resource for the latest guidelines spanning a wide variety of disease areas. However, these clinical guidelines are usually disseminated as unstructured, narrative documents that often lack sufficient detail for computing. For example, a very simple guideline for breast cancer screening recommends “screening mammography, with or without clinical breast examination, every 1–2 years for women aged 40 and older.” U.S. Preventive Services Task Force, Screening for breast cancer, Recommendations and rationale. <http://www.ahrq.gov/clinic/3rduspstf/breastCancer/brcanrr.htm>. To convert this guideline into a computable form, “screening mammography,” “women,” and “age” all need to be rigorously defined with standard medical terminology, shown in Fig. 2. The location of the corresponding patient data elements and how to retrieve them must also be specified. Oftentimes, this task is not trivial. For example, “mammography” may be stored in a laboratory information system (LIS) that does not communicate with the CDSS, or the terminology representing “mammography” in the LIS may not conform to the terminology used in the CDSS.

Arden Syntax, a procedural language for representing medical logics, was introduced in 1989 to enable effective and standard-based computation of medical knowledge. It soon became a standard of the American Society for Testing and Materials (ASTM) and was later adopted by HL7. Arden Syntax provides a specification for encoding medical logic as individual rule-based procedures, also known as Medical Logic Modules (MLMs). Each MLM contains sufficient computational detail and data requirements to make a single medical decision. For example, the following MLM code determines when to issue the alert, “Consider impaired kidney function” based on the most recent creatinine level and blood urea nitrogen (BUN) test results:

```
data:
  last_creat := read last { "Creatinine
level" };
  last_BUN := read last { "BUN level" };
;;
logic:
  if last_creat < 1.5 or last_BUN > 30
  then alert_text := "Consider impaired
kidney function.";
  conclude true;
  end if;
;;
```

Arden Syntax, however, is not suitable for representing comprehensive guidelines. Each MLM represents a discrete

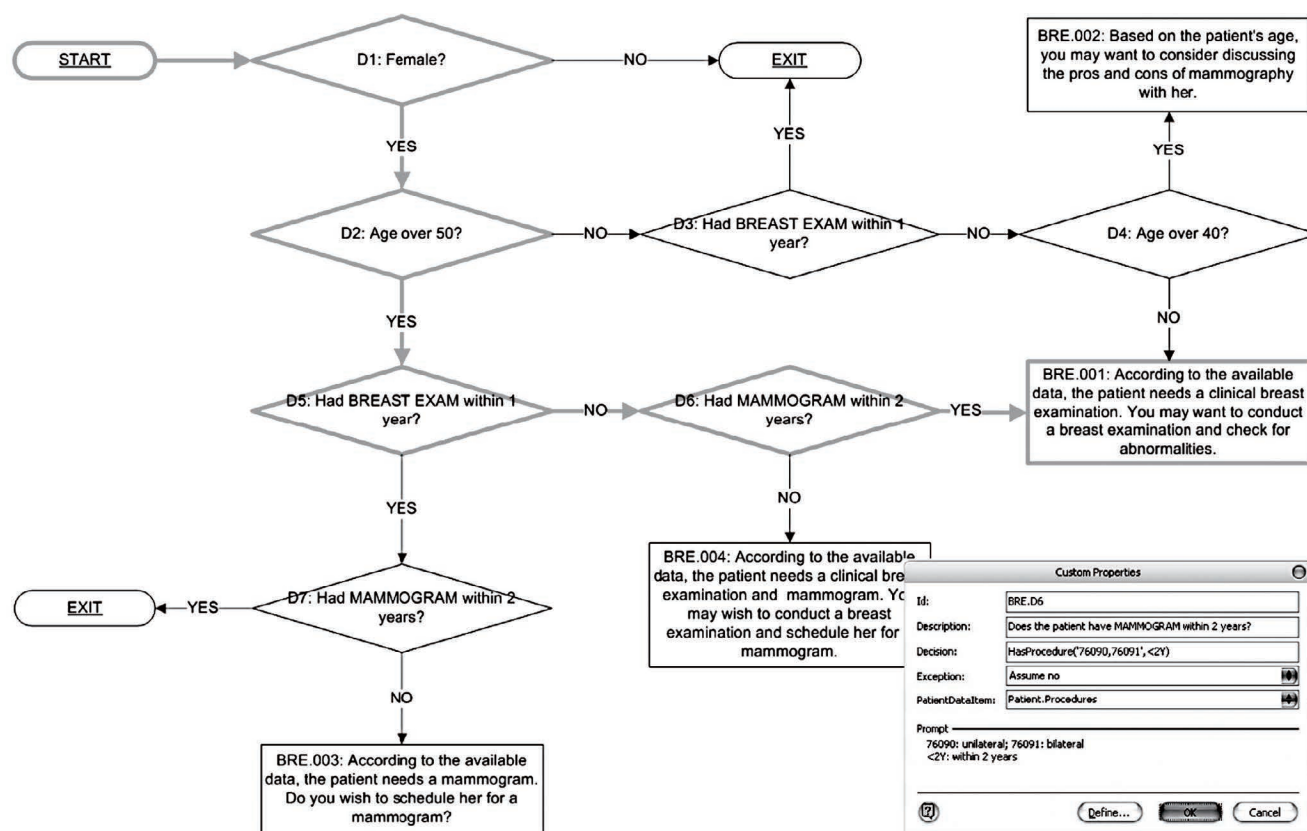


Fig. 2 A computerized clinical guideline flowchart.

decision-making logic, like the example above, and could easily become unmanageable as guidelines become more complex. This limitation has led to the development of several ontology-based guideline representation models.

A guideline representation ontology is a specification of elements that constitute evidence-based guidelines. It represents the elements by specifying their attributes and defining the relationships that hold them together. For example, a guideline may represent a set of medical decisions and actions (attributes) and a set of rules (relationships) that link the evaluation of a decision criterion to a set of further steps to be taken. A rigorously defined computational ontology provides considerable promise of producing computable representations that can be visualized, edited, executed, and shared using CDSS. Several ontology-based guideline representation models have been developed over the past 20 years. The influential ones include Asbru (<http://www.asgaard.tuwien.ac.at>), EON (<http://www.smi.stanford.edu/projects/eon/>), GLIF (Guideline Interchange Format, <http://www.glif.org>), and SAGE (Sharable Active Guideline Environment, <http://sage.wherever.org>), developed in the United States; and GUIDE (http://www.labmedinfo.org/research/dsg/decision_support.htm), PRODIGY (<http://www.prodigy.nhs.uk>) and PROforma (<http://www.acl.icnet.uk/lab/proforma.html>), developed in Europe. Some models, such as GLIF and SAGE, aim to achieve a general, interchangeable

format.^[21] Others, such as PRODIGY, focus on representing guidelines in specific disease areas.^[22]

Barriers to Implementing and Using Clinical Decision Support

Clinician time is the most precious resource in a medical practice. Average time for seeing each outpatient visit is less than 20 min.^[23,24] Considering other administrative time loss, the amount of time for accomplishing the actual work—examining patients, reviewing historical data, making judgments, and documenting new findings and performing treatments—is extremely limited. Any innovations that slow things down are bound to fail.

Unfortunately, very few CDSS systems benefit time efficiency. In fact, most require extra clinician time to enter patient data and review and act upon decision-support prompts. Managing complex chronic disease conditions such as diabetes, for example, is very time-consuming and often distracts clinicians from the main focus of a patient visit.^[25] As a result, the actual efficacy and effectiveness achieved by new generation CDSS are still mixed.^[17,26,27] Overriding or ignoring computer-generated decision-support advice is common,^[28] and many CDSS systems are abandoned altogether.^[29]

Patient data codification

A fundamental barrier in CDSS adoption is the need for patient data codification. All patient data must be properly codified, according to certain standard taxonomies, in order to be computed in the inference engine of a CDSS. However, picking a right code is a mechanical, time-consuming process that generally keeps clinicians away from focusing on the content of clinical documentation. The codified patient data also risks losing the narrative, story-telling nature that used to be conveyed in free-text patient notes. Moreover, numerous competing and conflicting taxonomies exist for historical reasons. ICD-9-CM, for example, is widely used in the United States to prepare diagnosis-based billing claims. Nevertheless, many clinical observations and findings are intermediate disease stages that are not necessarily “diagnoses,” and hence cannot be meaningfully represented using ICD-9-CM.^[30,31] To address this issue, new observation-oriented clinical data taxonomies, such as SNOMED-CT, have been proposed. Systematized Nomenclature of Medicine-Clinical Terms (SNOMED-CT): A clinical terminology that provides unique meanings and formal logic-based definitions for diseases, clinical findings, and procedures. <http://www.ihtsdo.org/snomed-ct/>. The National Library of Medicine also maintains the Unified Medical Language System (UMLS, <http://www.nlm.nih.gov/research/umls/>), a meta-thesaurus for translating terminologies across different medical vocabularies whenever compatible.

System interoperability

Another significant barrier inhibiting CDSS adoption is the system interoperability issue. In order to generate case-specific advice, CDSS must have access to complete and up-to-date patient data. While computerized clinical systems are now commonly used to manage a variety of patient information, many of these systems do not readily talk to each other. Creating one-to-one data exchange interfaces is possible, but can be very costly and difficult to maintain as systems constantly upgrade. Enabling patient data sharing across health care settings is further challenged by the lack of regional health data exchange networks. Personal Health Records (PHR), that allows all care providers to upload patient data to a common repository, have shown some promise as a solution to the issue. Google Health™ (<http://www.google.com/health/>) and Microsoft HealthVault™ (<http://www.healthvault.com>) are examples of PHRs that are currently being tested in the field.

Other contextual factors

Lastly, there are many other concerns in using CDSS beyond technological considerations. CDSS introduces a radical impact on patient care delivery and, in particular,

can be detrimental to the quality of point-of-care physician communication if not used properly. Using computers in front of patients and the resulting loss of eye contact is considered rude and often listed among common reasons causing user resistance.^[32] The threat to clinical autonomy is also an enduring issue for physicians. Many new-generation CDSS systems are now associated with certain evaluative mechanisms to “score” clinician performance. This unpleasant characteristic could further erode user acceptance. As Anderson et al. 1994 commented, “despite the fact that they are technologically sound, more than half of medical information systems fail because of user and staff resistance” (p. 1).^[33] These contextual human factors must be taken into account when implementing CDSS in real practice.

Case Study: The Clinical Reminder System

The clinical reminder system (CRS) was jointly developed by the H. John Heinz III School of Public Policy and Management at Carnegie Mellon University and the Western Pennsylvania Hospital (WPH). Since February 2002, CRS has been deployed in two WPH medical practices treating real patients.

CRS uses evidence-based clinical guidelines to support the management of four chronic health conditions (asthma, diabetes, hypertension, and hyperlipidemia), and five preventive care procedures (breast cancer, cervical cancer, influenza, pneumonia, and steroid-induced osteoporosis). A guideline representation model built upon existing ontologies (e.g., GLIF) was implemented in CRS for enabling structured acquisition and automated execution of evidence-based guidelines. Fig. 2 shows a sample visual representation encoded in this model. These visual representations, with embedded medical decision-making logic (shown at the bottom right corner in Fig. 2), are stored in XML files that theoretically can be shared with other CDSS systems if they implement the same underlying guideline representation model.

In order to generate case-specific reminders, CRS stores and manages comprehensive patient information, such as patient descriptors, symptoms, and orders. Standard medical vocabularies are used whenever possible. For example, ICD-9-CM is used in CRS for encoding diagnoses, CPT4 for procedural treatments, and the National Drug Code (NDC) for medication prescriptions. Current Procedural Terminology: A directory of descriptive terms and identifying codes for reporting medical services and procedures under public and private health insurance programs. CPT4, its 4th edition, is the most widely adopted version in the United States. <http://www.ama-assn.org/ama/pub/category/3113.html>. National Drug Code Directory: A directory that lists universal product identifier for human drugs. Its current edition is limited to prescription drugs and insulin products. <http://www.fda.gov/cder/ndc/>. CRS also retrieves patient data from many

Fig. 3 The main workspace of the clinical reminder system.

other hospital information systems, most in real time. The clinic staff use CRS to manage appointments, patient check-in and check-out, and record vital signs. The residents and attending physicians use CRS to document clinical observations, prescribe medication and laboratory test orders, and generate reminders to aid in their decision making. The reminders usually take the form of recommended actions to have certain tests performed, to receive vaccinations, or to discuss the pros and cons of alternative treatments. The main workspace of CRS is shown in Fig. 3, where residents and attending physicians can act upon the reminders by selecting “Performed,” “Deferred,” “Not Compliant,” among several other possible responses.

A series of research studies were conducted to examine the user adoption and acceptance of CRS. Periodical user satisfaction surveys showed that while CRS was rated “satisfactory” on all interface-related items, it received very poor user evaluation on system-related items as indicated by the survey comment, “the system is ineffective in helping me complete my work quickly.” Follow-up semi-structure interviews were conducted to investigate the issue. The results revealed several challenges to overcome, including iterative advisories (“the same reminder was generated time and time again”), cumbersome data entry (“it is too difficult and takes too

long to enter data”), workflow disruption (“slowed down my work”), solicitation for one single system (“we should have only one system to access all information needed”), disrupted physician–patient communication (“my patient felt upset when I used my computer”), and lack of guidance in the application workflow (“I don’t know where to start”). These problems are primarily associated with the sociotechnical integration issues when clinicians try to incorporate CRS into their routine clinical practice.^[34]

CONCLUSION

This entry introduces the concept, history, and key considerations and barriers to providing computerized decision support to clinicians, with a particular focus on systems that provide prompts based on evidence-based clinical guidelines. This stream of CDSS has become increasingly popular and viewed as a key solution to addressing the quality and safety problems of the U.S. health care system. Cutting-edge research is also being conducted to explore the efficacy and applicability of more sophisticated decision models particularly those accommodating decision making under uncertainty. Readers who wish to develop a full spectrum of knowledge of CDSS may refer to the OpenClinical

Project (<http://www.openclinical.org/dss.html>) or Berner's textbook *Clinical Decision Support Systems: Theory and Practice*.^[35] Practitioners interested in the design, development, and implementation of CDSS may refer to the CDSS Implementer's Guide developed by the Healthcare Information and Management Systems Society.^[36]

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College Libraries

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Abstract

College libraries, through a combination of forces have made unprecedented strides in the development of access to information resources and in offering services to help students and faculty make greater use of these resources. In so doing, college libraries have become more critical to the success of the host institution. They are now poised to build on the advancements of the past 30 years to respond to the environmental changes and user expectations and to meet the challenges of being even more integral to the academic program.

INTRODUCTION

For this entry, “college libraries” includes the libraries in the 527 institutions classified as either Baccalaureate Colleges-Liberal Arts or Baccalaureate Colleges-General in the 2000 Carnegie Classification.^[1] A sampling of the 527 institutions using data from the 2000 edition of *Peterson's Guide*^[2] indicates that the average enrollment of this group is 1239 students. The libraries of these institutions average about 182,000 volumes. The averages are deceiving because the collection sizes range from 50,000 volumes to well over a million, and enrollment ranges between 98 to more than 4000 students. Therefore, neither size of collections, and thus probably neither facilities nor staff size, nor size of student body can neatly define the group. The definition of the category as having primarily or exclusively 4-year undergraduate programs is the one characteristic that the institutions share.

BACKGROUND

The history of college libraries is documented through the early 1960s in Richard Harwell's article in the earlier edition of this encyclopedia.^[3] Harwell focused largely on the development of college library buildings and collections with particular attention to special collections. However, stimulated by such publications as Daniel Gore's “zero growth,”^[4] Evan Farber's “university-library syndrome,”^[5-7] A.P. Marshall's “librarians as educators,”^[8] and William Moffett's “life and redemption this side of ARL,”^[9] in the 1970s and early 1980s, college librarians began to broaden their activities. Although the specifics of each article are important, and in fact could be the subject on a separate essay, what is especially important here is that, together, they signal the recognition of college libraries' potential to play an important role in the education of undergraduates. Since their writing, the

messages of these entries have been given substance and texture in the development of library programs.

It is important to understand the changing nature of higher education over these 30 years. As Edward Holley has indicated, the early 1970s were a time of great pessimism in higher education. Support for higher education had declined in the federal and state governments since the 1950s and 1960s, and high inflation in the economy and a sharply declining birth rate all made the future of higher education look bleak.^[10] In contrast, by the end of the millennium, inflation had declined, enrollment had increased, and a broadened social role had very much changed the ethos of higher education.^[11] As a result, the challenges faced by undergraduate libraries changed over the 30-year period. Libraries that had to make do with fewer resources in the 1960s, by the 1990s had increasing resources but faced increasing user expectations for access to information resources.

To reflect the shifting challenges in college libraries, the rest of this entry addresses six areas: the use of information technology; collection development; interlibrary loan; bibliographic instruction/information literacy; changes in assessment and accreditation standards; and library management, structure, and staffing. There are a number of other topics that might have been treated, but it is the author's judgment that these six are not only the most critical and most central to the recent developments in college libraries, but will likely be the central and critical issues in the near future.

DEVELOPMENT OF INFORMATION TECHNOLOGY

Despite the beginnings of the application of data processing in business and in large academic libraries, none of the four articles by Farber, Gore, Marshall, and Moffett mentions the potential of computer technology in

college libraries, nor is there much written on computers in college libraries in the early to mid-1960s. Although some visionaries may have seen the coming importance of computer technology in college libraries, in practice computers were of little concern for college librarians. For example, the 1974 edition of the venerable *The Administration of the College Library* by Guy Lyle, almost a textbook for college librarians, although it does discuss the potential use of computers in acquisitions, cataloging, and circulation in college libraries, it is very tentative about its role.^[12] Typical of Lyle's attitude is the conclusion to the section on circulation, where he writes:

It must be said, of course, that few college libraries, and then only the very large ones have fully automated their circulation services. . . . At what stage it is practical to make the conversion from manual or semi-automated circulation systems to a fully automated system. . . . has not yet been clearly settled.^[12]

If Farber and others had written their articles in the 1990s, they would have been compelled to discuss computer technology's impact on their topics. In fact, Farber later did so in an article discussed below.^[13] The absence of discussion of computers in college libraries in the 1960s is not a reflection on college librarian's lack of foresight but rather indicates the rapidity of change in the status of computer technology over the next 30 years. Some would say technology has been *the* critical issue and will continue to be in the future.

College libraries have generally not been leaders in the implementation of new technologies because of the equipment and labor costs of implementation and the rapid obsolescence of experimental technologies. On the other hand, college libraries have rapidly embraced technologies when standardized and relatively easy-to-implement services and products became available. Perhaps the best example is the implementation of OCLC, originally the Ohio College Library Center, and now the Online Computer Library Center. It began operations in Ohio in 1971 and spread nationally beginning a year later.^[14,15] The impetus for OCLC's development came from the large academic libraries in Ohio that funded its early development.^[16] Once the service was well established and began to spread beyond Ohio, college libraries were quick to embrace it. In recognition of the difficulty colleges had in paying for the implementation of OCLC, the W.K. Kellogg Foundation provided 302 college libraries grants to support the purchase of equipment, training, and a portion of the operational costs for a few years. OCLC is central to library operations, and almost all college libraries are members of OCLC, usually through a regional or state network.

The implementation of OCLC in college libraries had a profound and almost immediate impact on technical operations of the library (e.g., cataloging, acquisitions,

and interlibrary loan). OCLC's services replaced many manual processes within libraries' technical operations. As a result, there were changes in work assignments and the organization of technical operations within college libraries.^[17,18] However, the implementation of OCLC in college libraries was almost totally invisible to library users and had very limited impact on other parts of the library (e.g., circulation, reference).

A similar pattern of development occurred in the next major stages of technology's use in college libraries: electronic databases and library automation systems. University libraries typically began their library automation efforts by building their own systems, whereas most college libraries waited until commercial systems that could be installed and operated with modest technical support became available. Although many colleges did use CD-ROM databases and a few even networked the databases, it was not until services such as Silver Platter and First Search became available over the Internet that use of electronic databases became common and have now almost entirely replaced the use of print indexes.

Unlike the implementation of OCLC, which largely affected only technical operations of the library, online library systems or, later, the provision of online databases had a profound impact throughout the college library.^[19] The combination of integrated systems and the provision of patron access to the technology both united the organization and fundamentally expanded the role of the library. The use of the integrated system by all departments created an entity in which the entire staff had a vested interest. Because the system is the working tool for all activities, the quality of the system and information it provides is of paramount interest to all members of the library staff. Furthermore, the library staff must now work more closely with a variety of external groups to make the system work effectively. Most obvious are the technical staff who operate the system such as computer center staff, vendor, and/or consortia support staff. The other major external group is library users. The uniqueness of local system configurations, the rapidity of change and the inherent difficulties in understanding how the systems operate have increased the instructional and reference support role of librarians.

Computer technology, including OCLC, local systems, on-line bibliographic databases, and online full texts, has had a significant impact on college library budgets. First and foremost has been building and maintaining the computer infrastructure. Although some of the costs may have been absorbed by the computing services budget, these new expenses have doubtless had an impact on the library's budget through competition with computing services for campus funding. Beyond the infrastructure support, college libraries have also had to absorb the costs of purchasing the content of indexes, online journals or electronic books. Although the annual costs of purchasing the content may replace or at least reduce the costs of building

new space and maintaining print collections, budgeting for electronic resources will continue to be a challenge to college libraries.

Technology has extended its replacement of print resources well beyond indexes and now is on an accelerating pace to replace print periodicals and is making significant inroads in providing electronic books. That electronic texts will replace many print books is not debatable any more; the question now is how quickly and to what degree.

College libraries now face competition from commercial enterprises that offer “libraries” of electronic resources, for a fee, directly to students. Carol Ann Hughes of Questia, one of these commercial enterprises, talks about the “new competitive space,”^[20] pointing out that academic libraries no longer have the exclusive role as the gatherer and supplier of information. If college librarians are to be effective in supporting students’ information needs, they must go well beyond providing space and collections. College libraries must provide, to use the business language of the day, added value to their collections and facilities. Such added value includes reference and instructional services both within the library’s facilities and over the network, which are tailored to the unique needs of course assignments. Convincing the college community of the value of such activities remains the single most important challenge to college libraries. This is not new; it is the perennial challenge of college librarianship now made imperative by the real competition of commercial enterprises such as Questia. [The Questia service is a commercial activity, begun in 1999, which plans to sell access to “libraries of full-text of books and periodicals directly to students at an annual or monthly rate.” More details are available at QuestiaSM—The Revolutionary Online Research Service. Questia Media: n.p.; <http://www.questia.com/what.html> (accessed January 20, 2001).] In so doing, college librarians will demonstrate to administrators their unique contributions to the academic program through curriculum-related collection building, development of enhanced methods for accessing information resources, teaching the use of information resources, and providing personal assistance. The impact of such activities is to enhance the teaching and learning process.

COLLECTION DEVELOPMENT

Collection development in college libraries had long been ignored in the overall collection development literature.^[21] In 1991, Joanne Schneider Hill and her coauthors produced the first book devoted to collection development in college libraries. In their introduction, they noted the strong belief that collection development activity was the same regardless of the size of the library.^[22] Therefore, it was assumed that articles and books about university collection development were applicable to smaller libraries

as well. However, beginning in the late 1970s, perceptions began to change. In her essay, “Collection Development in College and University Libraries: A Comparison,”^[23] Mary Casserly thoroughly vitiate that notion. Her point that college and university libraries are different is consistent with Farber’s university library syndrome concept. The differences fall into two main categories: purpose and organization. The development of college library collections is highly focused on meeting the immediate needs of undergraduates and only secondarily are other audiences and the long-term future taken into account. This focus is illustrated in a sample collection development policy included in ACRL’s CLIP Note #11 on this topic:

...the major responsibility and top priority of the library lies with the teaching programs at the undergraduate level. The library endeavors to serve the needs of the faculty either by purchasing (if the materials can also be used by the student body) or by securing through interlibrary loan those resources needed for faculty study and research. Although at a much lower priority, the library services the entire college community through the purchase of recreational, cultural and general information materials.^[24]

The second difference is in the organizational structure that supports collection development. University libraries often have a separate unit that is responsible for collection development even when there is a broad based liaison relationship of librarians with faculty. The separate unit is seen as critical in managing large budgets and in proactively seeking out material to develop the collection to meet the current and future research needs of faculty and graduate students. In college libraries, there may be one staff member such as the director or an acquisitions or collection development librarian who is responsible for authorizing purchases. However, other librarians, particularly those who work in reference or public services, share responsibilities for developing the collection.

Although the idea that collection development in college libraries should focus on supporting the needs of undergraduates is a broadly shared one, there has been controversy over how the idea might be interpreted and implemented. William Miller and Stephen Rockwood, in a 1979 article, proposed that collection development should be carefully tied to the level of bibliographic instruction activity because that activity is an excellent indicator of library use.^[25] However, Evan Farber, an active supporter of bibliographic instruction, claimed that such a narrow basis for collection development was inappropriate on several counts. It is politically problematic because it makes bibliographic instruction an arbiter of budget allocations and thus appears punitive. More importantly, it focuses “support of the curriculum” too narrowly.^[26] Farber pointed out that bibliographic instruction is not an end in itself. Rather, like all aspects of the library’s program, including collection

development, bibliographic instruction is just one way, albeit a critical way, for the library to support the academic program. There are ways in which the library's collection can support the curriculum without the presence of instruction within a department or major program. Farber pointed to the need to support the curriculum as the basic focus of collection development in college libraries.

Throughout much of the twentieth century, college librarians have explored the notion of a core collection. Hardesty and Mark in "searching for the Holy Grail," reviewed the history of the various attempts to create core lists of titles that were considered to be the most important for or best suited to an undergraduate library. However, their review of overlap studies revealed that college library collections have not developed as though there were such a thing as a core collection. Rather, the overlap studies of consortial groups of libraries found that large portions of college library collections, even in the smallest libraries, were unique.^[27]

As electronic resources developed, college librarians looked to them as a boon for college libraries: they would greatly enhance the availability of resources and "level the playing field" for college libraries relative to university libraries.^[28] However, as the availability of electronic resources has developed, the playing field has not been as level as was hoped because of the high costs, even when there are small library pricing plans. Although there is no doubt that electronic resources have improved access across campus, they are not cheap. In fact, electronic versions of periodical indexes and journals are likely to be more expensive than the print versions or may be an added cost to a required print subscription. Despite that expense, college libraries have acquired electronic resources to improve services and access. To mitigate the high costs of electronic resources, college libraries have either joined state networks (e.g., Galileo, ILLINET),^[29] OhioLink, or formed their own consortia (e.g., PALNI^[30]) to make joint purchases. Although there is no doubt these joint purchases reduce the out-of-pocket costs to individual libraries, such joint purchases add administrative overhead costs such as participation in consortial governance, the group selection processes for databases, and the management of group license agreements and budgeting.^[31]

The development of electronic journal collections has created new entities—block purchases—for college libraries to consider in their collection development. Although many journal titles in electronic format are available individually, publishers have often packaged their periodicals in bundles that require purchase of the entire bundle. These discounted packages greatly benefit large academic and public libraries, but for most college libraries, they are often beyond their financial means, unless purchased consortially. Furthermore, all parts of the package are not items needed to support an undergraduate curriculum.

INTERLIBRARY LOAN

Interlibrary loan may seem a minor service of college libraries and, therefore, undeserving of a separate section. However, those who work in college libraries know that, as a result of a changed view of collection management, as well as economic and technological developments, interlibrary loan is now a central service in college libraries.

Daniel Gore and others foreshadowed the changed view in a 1975 collection of papers entitled *Farewell to Alexandria: Solutions to Space, Growth, and Performance Problems of Libraries*.^[32] Throughout the essays, but particularly in Gore's essay of the same title,^[33] the idea is presented that if libraries would continue to grow exponentially as they had in the previous three decades, costs of major space and building needs and their attendant costs would be prohibitive. Instead, libraries and their users needed to develop a new view of the role of libraries. That new view was of college library collections as working collections designed to meet the immediate needs of the curriculum,^[34] with the complimentary development of services that provide access to those materials, which are occasionally needed. Therefore, the role of interlibrary loan became more important in college libraries. College libraries, whether they subscribed to Gore's "zero-growth" concept or not, were forced to curtail their purchasing because of the inflation in the cost of library materials in the 1970s and 1980s, especially periodicals,^[35] and the cost of construction. Concurrently, college librarians came to realize that their libraries could better serve patrons with a smaller carefully selected collection.^[36] Also, as Karen Liston Newsome pointed out, improved bibliographic access and the automated request systems through such services as OCLC greatly facilitated increased use of interlibrary loan.^[37] In the early 1990s, the availability of electronic databases led to an increase in the use of interlibrary loan.^[38] Together, the change in the focus of collection development, the growing costs of library materials, and the application of technology to interlibrary loan, increased the use of interlibrary loan in college libraries.

This increase in the use of interlibrary loan is dramatically illustrated in data from a group of Midwest liberal arts colleges.^[39] Over a 20-year period, 1977–1997, lending increased 980%, and borrowing increased 703% (Table 1).

Table 1 Interlibrary loan activity in a selected group of Midwest liberal arts colleges.

	1977– 1978	1982– 1983	1987– 1988	1992– 1993	1997– 1998
Lent	557	840	1798	2696	6025
Borrowed	852	1001	2101	2622	6844

Although the volume of interlibrary loans borrowed by this group grew dramatically, the number of items lent increased more rapidly. Other reports^[40] also showed that college libraries were lending at least as many items as they borrowed and in many cases more. College libraries had become full partners in the national interlibrary loan system, and not as some had predicted, raiders of the collections of larger libraries.

User-initiated interlibrary loan has moved from a possibility to a reality. OCLC's FirstSearch now provides users of their databases with the capacity to initiate an interlibrary loan through the OCLC system.^[41] Furthermore, in consortia such as OhioLink, the users can request items directly from member libraries without making the request personally to a local library staff member. This practice has significantly increased the volume of interlibrary borrowing while reducing the volume of material processed through the traditional OCLC system.^[42] User-initiated interlibrary loan request are another example of how technology can increase access while reducing unit costs. At the same time, by making requests for loans so easy, the volume of requests may increase and intensifies the need for library users to be more effective and thoughtful users. Some, if not many, college reference librarians have regarded their interactions with students about interlibrary loan requests as "teachable moments" (i.e., occasions to talk over with students their requests). Although such encounters obviate the rapid access and lower cost that technology can provide, the elimination of individual consultation increases the importance of teaching students to evaluate resources and effectively use the local collection before the self-initiated interlibrary loan events occur.^[43]

BIBLIOGRAPHIC INSTRUCTION/INFORMATION LITERACY

Perhaps the most significant programmatic change in college libraries has been the development and main streaming of instructional programs. Such programs take many forms, but they all share a common focus: providing students with skills that both help them complete assignments in their courses more effectively and help prepare them for a life of self-directed learning. Such goals serve both the practical short-term needs of students and the long-term goals of an undergraduate education.

Mark Tucker has provided a history of instruction in academic libraries prior to the early 1960s.^[44] In that history, Tucker focuses primarily on developments in university libraries. The one exception was the Library-College movement, which began in 1928 and continued into the late 1960s. The history of the concept was told in 1966 in the last major publication on the idea.^[45] The Library-College idea was to integrate the library into the curriculum so that the library becomes the college,

melding classroom teachers and librarianship.^[46] The concept questions the traditional structure of college personnel by requiring staffing with individuals who do not have the background and training of traditional graduate and professional education. Because of this incongruity, the concept only gained a temporary foothold in a few institutions where the administration could mold the structure of the faculty and the library to approximate what is needed to realize the concept. The idea never survived beyond the few initial implementation efforts.

Despite the failure of the Library-College movement to change the relationships of teaching faculty and librarians, the movement did introduce a new idea to the library profession. Patricia B. Knapp, without mentioning the Library-College concept or the name Louis Shores, the movement's foremost promoter, used the exploration of "methods of developing more vital relationships between the library and college teaching"^[47] in her Monteith College project in the early 1960s. Knapp's contributions were cut short by her untimely death in 1972.^[48] Nevertheless, her work had a significant impact on the development of bibliographic instruction in college libraries by demonstrating the effectiveness of course-related and course-integrated approaches.

At about the time of the Monteith College experiment, another institution, Earlham College, was beginning to experiment with the concept of course-related instruction. Evan Ira Farber was appointed college librarian at Earlham in 1962 and almost immediately recognized the need for instruction to help students with their course assignments.^[49] As Thomas Cottle described the institution in the early 1970s, Earlham gave unusual attention to a range of general education goals, which included preparation for a life of self-directed learning.^[50] In this fertile ground, Farber developed a program that would become a model^[51-53] that continues to this day.^[54] Patricia Breivik writing about the Earlham program says:

Basic to this entire program—to its integration, its structure and its extensiveness—is a close working relationship between librarians and teaching faculty in planning and implementing library instruction.^[55]

This model of close working relationships between librarians and teaching faculty was recognized by librarians such as Breivik as key to the successful incorporation of the library into the academic program, and many sought to explore means to overcome the inherent barriers that the Library-College concept had not overcome. In response, Earlham conducted a number of workshops from the early 1970s to 1995—workshops that gave librarians and faculty an opportunity to examine the Earlham model and to explore how they might build these critical working relationships in their own institutions.^[56]

The decade of the 1970s was the golden age of bibliographic instruction in college libraries. In addition to

Earlham's developing program, the Council on Library Resources (CLR) funded 51 projects (36 of them with assistance from the National Endowment for the Humanities) in an effort to support "experimental endeavors to improve the relationship between libraries and faculty."^[57] The 51 institutions were predominantly undergraduate institutions, and 35 of those were small liberal arts colleges. This infusion of funding into experiments in library programming designed to enhance the role of libraries in academic programs generated a smorgasbord of examples on which college librarians feasted over the next decade. A bibliography of the publications describing the outcomes of these projects is available in Nancy Gwinn's 1980 review of the CLR programs.^[57]

With the increased availability of electronic resources and on-line tools for massaging information, new ideas changed the scope of instruction. Lori Arp^[58] and Loanne Snaveley and Natasha Cooper^[59] have reviewed the semantics, the conceptual dimensions, and the politics of the shift. Over the course of the twentieth century, the terms orientation, library instruction, bibliographic instruction, and information literacy have been used. In succession, the proponents of each new term have claimed the new term is more encompassing and better frames the concept of teaching the use of information resources in relation to the other aspects of the liberal arts. In each case, the new concept is seen as encompassing all previous concepts. For example, bibliographic instruction was seen as including the former content of library instruction, while adding the notion that the instruction should be focused on a broader set of ideas than just how to use a particular library. The scope of the enterprise has been conceptualized in still broader terms, and the responsibilities of librarians have expanded. Jeremy J. Shapiro and Shelley K. Hughes define this expanded scope when they wrote that:

... information literacy should in fact be conceived more broadly as a new liberal art that extends from knowing how to use computers and access information to critical reflection on the nature of information itself, its technical infrastructure, and its social, cultural and even philosophical context and impact—as essential to the mental framework of the educated information-age citizen as the trivium of basic liberal arts (grammar, logic and rhetoric) was to the educated person in medieval society.^[60]

The implication is that information literacy is not just the responsibility of librarians; it is the responsibility of the entire faculty and the institution.

In response to this change in the concept in the 1990s, the Andrew Mellon Foundation began awarding grants to colleges that, as the CLR grants of the 1970s did, bring librarians, faculty, and the new partner, instructional technologists—those who focus on the application of technology to educational activities—together to develop model programs.^[61]

Despite the changing terminology and the expanded scope driven by technology, the critical dynamic remains the working relationship of librarians and classroom faculty. Evan Farber points to this similarity in "Plus Ça Change..."^[13]

COLLEGE LIBRARY STANDARDS AND CHANGES IN ASSESSMENT AND ACCREDITATION PROCESSES

College library standards were first promulgated in 1959 by the Association of College and Research Libraries for the purpose of providing "...a guide for the evaluation of libraries in American colleges and universities which emphasize four-year undergraduate instruction..."^[62] During the 41 years since then, there have been four revisions, in 1975, 1986, 1995, and 2000. The standards have continued to provide a guide for evaluation despite the changes in the assumptions on which they were founded and the resultant changes in content. The changes in standards can help one understand the changing assumptions about what is most important in assessing a library's quality.

The 1959 standards are in the form of a series of prescriptive statements on the appropriate characteristics of a college library. These are grouped in seven categories: functions, structure and government, budget, staff, collections, building, quality of service and its evaluation, and interlibrary cooperation. The statements of characteristics were written in general terms; for example, in the statement on collections: "The collections should meet the full curricular needs of undergraduate students and should be easily accessible to them."^[62] There were only a few quantitative measures such as staff work space (125 square feet per person) and collection size (minimum of 50,000 volumes and 10,000 volumes for each 200 additional students over 600).^[62]

Not until 1975 did a new set of standards appear.^[63] Although "should" was changed to "shall" and there were other minor changes in language, the major changes were the addition of "commentary" and quantitative standards. Organized under eight categories (objectives, collections, organization of materials, staff, delivery of service, facilities, administration and budget) each standard has appended "a brief explanatory exegesis...citing the reasons for its inclusion and providing suggestions and comments upon its implementation."^[63] This "commentary" appears to be a reaction to the vagueness of the 1959 standards. The intention of the authors seemed to be to provide some guidance about implementation through specific suggestions.

The second major change was the addition of quantitative measures for collection, staff, building, and budget size. In each case, a formulaic approach was developed that took into account the size of the institution and the

scope of the curriculum. By using these formulas, it was deemed possible to provide some objective evidence of library quality and minimum. It was further hoped that by providing a basis for comparison among college libraries, poorly supported libraries would have the data to argue for enhanced resources. In fact, the writers went so far as to assign grades (A, B, C, D, and unacceptable) to various levels of achievement for each quantitative standard.^[63]

The 1986 and 1995 revisions of the standards^[64,65] resulted in little substantial change, despite serious questions raised by Ray Carpenter^[67] who analyzed how well—actually how poorly—libraries performed relative to the standards, and despite a growing body of literature that pointed to performance measures as a more appropriate mechanism for assessing the quality of libraries. Nevertheless, the formulas for collections, staffing, building, and budget were left the same. Revisions in the language of the standards and the commentaries were updated in the 1986 edition to better account for nonprint collections and services and networking and cooperative activities, but the overall structure was left intact.^[64]

The introduction to the 1995 standards noted the rapid changes in technology and acknowledged that although more technological developments would have significant impact on library operations, it “will take about thirty years” for libraries to really respond to advances in technology.^[65] Thus, they left it to the next generation of revisors to incorporate technology into the standards.

Even before the 1995 standards were written, Ronald Leach had called for academic librarians to focus more on outcomes as an indicator of quality in academic libraries.^[67] The increasing recognition of outcomes as an indicator of quality led the Association of College and Research Libraries to establish a Task Force on Academic Library Outcomes Assessment in 1998. In its report, the task force went to some length to distinguish among inputs, outputs, and outcomes. With these three different ways of looking at library performance in mind, the task force concluded:

...that standards should be based on evidence of normative practice or...programmatic success as determined by the measurement of outcomes. ...Wherever possible, inputs should be related to and support desired outcomes, rather than vice-versa.^[68]

One recommendation of that report was that ACRL should revise its library standards; as a result, the College Library Section's Standards Committee took the initiative to write the first ACRL set of standards that used the tripartite concepts of inputs, outputs, and outcomes as the paradigm. The 2000 edition of the Standards for College Libraries^[69] has sections not unlike the earlier editions, but it also has newly titled sections that reflect a focus on services and activities (e.g., instruction, and access). The 2000 edition includes a series of “should” statements, not

unlike those of the 1959 standards, but each of these statements is followed by a series of questions that give definition and specificity to the “should.” In the 2000 standards, the quantitative standards were removed, and a new section was added on “Planning, Assessment and Outcomes Assessment.” The new standards do not reject input measurements as part of the assessment process. Rather, they suggest a combination of measures. One measure is based on ratios that take into account an institution's size (e.g., acquisitions expenditures per student). A second measure examines outputs and outcomes.

The ACRL Standards are the principal means by which librarians have measured quality in college libraries, but for the regional accrediting agencies, the quality of college libraries is measured through a set of standards that are less specific and placed in the context of the larger institution. Despite the differences, according to Paul Coleman and Ada D. Jarred's analysis, the assessment criteria for libraries in five regional accrediting associations' standard focused on issues similar to those in the 1986 Standards for College Libraries, although the ACRL Standards are more quantitative.^[70]

As Coleman and Jarred acknowledge, the accreditation standards go beyond the measurement of inputs to focus on output measures. It appears that in the 2000 revision of the Standards, ACRL was trying to catch up with the regional accrediting associations' emphasis on output and outcome assessment.

As this entry was being written, some accrediting agencies were in the process of revising their criteria for accreditation. The changes continued to move further in the direction of outcomes by framing the criteria in student learning. As Jane Wellmen, senior associate of the Institute for Higher Education Policy, pointed out, “Learning outcomes assessments have been a long time coming and are, in many ways, a welcome and necessary change.”^[71] However in over emphasizing them at the expense of basic measures of resources available (e.g., size of faculty, size of library collection, and amount of time spent in class), Wellmen fears that assessment of learning outcomes that best serves the internal development of the institution is too narrow a gauge of quality for the external world of the larger society. Through input measures an institution is better able to demonstrate the resources that are needed to strengthen the institution. Furthermore, not everything in an institution should be viewed through the lens of student outcomes. For example, it would be futile to try to assess the quality of a library facility through the level of student learning because of the indirectness of the connection between student performance and quality of facilities and the number of mitigating factors such as number of library assignments and the quality of information literacy program.

In the fall of 2000, the Accreditation Review Project of the Commission on Colleges, an arm of the Southern Association of Colleges and Schools (SACS) illustrates

another problematic trend in library assessment. In an effort to create a performance assessment statement that encompass all types of service deployment—traditional building based library and virtual electronic collections—the standards statement is written in the most general terms. In the draft “Principles and Requirements for Accreditation” issued in September 2000 for membership comment, the criteria for library services are stated as follows:

Core Requirement Related to Learning Resources

The institution provides and supports student and faculty access and user privileges to adequate learning and information resources which are consistent with the degrees offered and are sufficient to support all educational, research and public service programs (*Core Requirement#9*).^[72]

This statement is not only vague but begs the question of what is a quality library. Furthermore, the statement lacks any interest in the college library’s educational role beyond supplying sufficient resources. The efforts to measure effectiveness in outcomes and to describe adequacy in the most general terms—sufficiency to meet program needs—tend to confuse those interested in understanding the characteristics of a quality college library.

LIBRARY MANAGEMENT, STRUCTURE, AND STAFF CHANGES

A number of factors have had and will continue to have a profound impact on the staffing of college libraries: the changing nature of assessment and accreditation, economics, the increased use of technology, the declining supply of librarians, and the expanding mission of libraries. This impact is evident at every level of the college library staff—student employees, paraprofessionals, librarians, and library managers—as well as the organization as a whole.

A series of articles have appeared on the roles, responsibilities, and management of student employees^[73–75] and paraprofessionals.^[76] The increased sophistication in their work is the result of the increased use of technology and the shift in work tasks of librarians to instructional programming and management of technology. These articles identify the increasing complexity of their work and the resultant need for more training.

Although many aspects of college library organization have gotten considerable attention, the relationship between computing and the library has probably gotten more attention than any other. In an early article, Guskin et al. concluded the library is the appropriate part of the academic institution to take on the responsibility for helping institutions use microcomputers and their applications software effectively in their educational programs.^[77]

That was a prescient comment, and a number of libraries followed that advice. But most did not, and the relationships between the two units varied greatly. In 1997, Larry Hardesty studied the variety of organizational relationships between computing and the library which developed in the absence of any consensus about the college library’s role vis-a-vis computing. He concluded:

Libraries and computer centers face similar challenges. . . . Nevertheless, no organizational structure will solve all, or even most, of these challenges. . . . We must define carefully the problems we seek to solve and consider individual and group differences before hastening to solutions that may prove to be only temporarily fashionable.^[78]

Hardesty’s conclusion that situational factors should dictate organizational structure is a wise one. It suggests that the preferred structure should not be some imposed ideal but rather the one that best addresses the library’s needs.

The challenges of adequately preparing leaders for college libraries has been a concern of the profession,^[79] and in response, under the leadership of Larry Hardesty, the Association of College & Research Libraries’ College Library Section has conducted the College Library Directors Mentor Program since 1992.^[80] This program provides each newly appointed novice director with a mentor, an experienced college library director, with whom she or he could consult; after a few months all first-year directors—15 or so a year—attend a workshop that explores commonly faced issues and approaches to addressing them. This program has become increasingly important as young and less experienced librarians become directors to fill the increasing number of open leadership positions caused by retirements.

CONCLUSION

College libraries, through a combination of forces have made unprecedented strides in the development of access to information resources and in offering services to help students and faculty make greater use of these resources. In so doing, college libraries have become more critical to the success of the host institution. They are now poised to build on the advancements of the past 30 years to respond to the environmental changes and user expectations and to meet the challenges of being even more integral to the academic program.

The authors of the 1995 Standards for College Libraries, beginning to feel the impact of technology, indicated that it would be 30 years before the full impact of technology would be realized in the operation and use of college libraries. What was more likely is that in the 1990s college libraries entered a new world in which *change* is permanent. College libraries will be constantly

adapting to changes in technology, curriculum, economic health of the host institutions, and to the nature of the profession. One doesn't even know if "library" as we know it today will still exist on college campuses. The new forms of competition developed by commercial interests and delivered over the internet could supplant the concept of the library as a physical space and a source of expert advice in using information resources. The ultimate challenge for college libraries is to deliver, at a high level of quality, those services and facilities that are unique and cannot be provided by others. To do that, the following is needed:

1. An adequately trained staff who not only know the traditional technical skills of librarianship but are also effective teachers and collaborators with classroom faculty and other academic professionals.
2. An effective alliance of computing services and the library so that adequate technology can be deployed.
3. A strong program of information literacy/bibliographic instruction that assists students in effectively using information resources for course work and provides them with the skills and attitudes to be effective life-long learners.
4. A balanced approach to collection development and programs of access that maximize the availability of needed information resources within a constrained budget.
5. An active program that both markets the library's services to the community and listens and responds to community needs.

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Communication and Communication Studies

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Abstract

The focal purpose of this entry is to lay out the contours, within historical contexts, of the structural arrangements and intellectual foci of the various areas of study and emphases in institutions of higher education generally clustered under the much used and abused term “communication.” Because communication studies has been a presence in the academy for less than 60 years, and because it has evolved in the midst of an exploding and rapidly changing communication environment, there are necessarily multiple and competing stories to be told. This entry attempts to focus both on convergences and divergences. The entry reviews in turn: different meanings for the word “communication” and how and when the term came into popular usage; the two primary historical lineages out of which communication studies has emerged—speech communication and mass communication; the forces leading to institutionalization, including the exploding emergence of mass media. The entry examines the phases in which communication studies became institutionalized and how supporting structures of organizations and journals have handled seemingly overwhelming diversity. The entry concludes with a discussion of how communication studies necessarily holds within its core a series of contradictions that are in essence symptom and cause of both centralities and dispersions, struggles and successes.

INTRODUCTION

Communication is a much used and abused term. In everyday parlance, it most often refers to humans sharing experiences, ideas, and feelings with each other via some kind of verbal or nonverbal symbolic language, including words, gestures, body language, tonality, and nonverbal expressions. Sometimes this sharing is done in person; sometimes over an increasingly wide variety of mediated means, across stretches of time and space. Sometimes the sharing is one person to one; sometimes one to many; sometimes many to many.^[1–3]

Much emphasis is placed in our society on improving communication. At one and the same time it is felt that improved communication will make each of us more successful at persuading others; and simultaneously help us get along better with each other within and between families, groups, organizations, and nations. Good communication is expected to help us to be better informed and more knowledgeable, increase both human happiness and effectiveness, and facilitate justice, democracy, and peace. Communication is assumed to be a fundamental and essential social process.^[2,4] Much is asked of a phenomenon about which there are, when one digs below the surfaces, an extraordinary number of differing and competing definitions, theories and expectations of what role communication does, could, or should play in human affairs.^[2,5–14]

It is not known who first used the word “communication.” The term itself is visibly identifiable in a variety of forms in biblical and philosophic writings in the fourteenth century. But, before that in the first century B.C., the ancient Greeks focused on concerns for effective communication with their emphases on rhetoric and oratory. Throughout the ages, tales focusing in some way on communication have appeared in literature, folklore, poetry, and religious treatises. One famous example is Persian Omar Khayyam’s Rubaiyat in which concerns for communication between leaders and the people are a frequent focus. Another is the Anansi myth, a generative base for numerous tales that originated in West Africa and spread via imposed slavery and diasporic immigration of African communities throughout the globe.^[15–19]

It is fair to say that communication has been a fundamental concern for the human species since antiquity.^[16,19] Yet, the appearance of institutionalized emphases labeled communication via academic courses and programs did not begin to appear until the late 1930s and 1940s. The appearance of these emphases emerged from a convergence of long journeys from disparate origins with sometimes incommensurate understandings. Major players in the story have journeyed from such diverse fields as anthropology, education, engineering, literature, family life, linguistics, literature, government, philosophy, political science, psychology, rhetoric, semantics, semiotics, sociology, and written and oral

composition.^[5,15–17,20–25] The result has become an array of institutional arrangements that still, despite some 70-plus years of development, appears chaotic both to outside and inside observers.

The story of communication must be told in a way that allows this chaos to remain apparent while making some sense of what must be called an extraordinary revolution in scholarly attention—a revolution that moved us from a time when no academic unit admitted to focusing on communication to a time when communication has become virtually everyone's concern with emphases on communication spread throughout virtually every academic institution. At the same time, the story must be told in a way that allows not only the divergences and differences to show but centralities as well. Particularly important is the centrality of what for many in communication studies, including most of the notable founders, is more than merely an intellectual focus but a passion for and a vision of what difference it would make to look at humans and their institutions, cultures, communities, nations, and societies through a new kind of lens. This lens, a communication lens, focuses not on separate habit-driven entities, as the common conception of human beings and their collectivities comes to us from psychology, sociology, and anthropology, but on how these entities use communication to forge the human experience in the constantly changing and often chaotic conditions that constitute the contexts within which humans live.^[8,14,27–29]

Finally, because communication studies, as a relatively recent arrival on the academic scene, has struggled with self-definition and with self-defense in often rigid academic hierarchies, there has been an extraordinary self-consciousness in the field resulting in a plethora of self-examining articles.^[5,7,9,11,12,14,27,30] The literature is large, disparate, and incomplete.^[5,20] References in this entry must be understood as illustrative rather than comprehensive. This entry limits specific details to the U.S. context although the available histories suggest that the impelling forces and consequences have been much the same worldwide except for how specific cultural environments have changed qualitative emphases in each national, regional, and cultural context.^[5,15,17,22–24] Brief examples will be given of these differences but the story as told here applies primarily to the United States.

The presentation of the varying stories of communication and communication studies is presented below in six sections: 1) meanings for the word “communication” and how these anchor on a common core but also vary markedly; 2) two primary institutions that became the sites of communication studies—speech and mass communication; 3) the exploding emergence of media; 4) the phases of the institutionalization; 5) structures for handling the diversity; 6) communication studies and its productive tensions.

The narrative is organized around a presentation that examines: 1) how emerging societal attentions to something

called communication, particularly as sparked by the exploding diffusion of mass media, led to two streams of communication studies, one based in ancient humanistic studies of rhetoric; the other focusing on the scientific study of media; 2) how these different streams have moved toward each other while retaining their historical characters; and 3) how communication studies in general manages the necessary diversities of attention imposed by the fact that communication—the phenomena of interest—always occurs in particular contexts with distinctive attributes.

Meanings for the Word “Communication”

Purpose in this section is to examine the emergence of the term “communication” and how it was put on policy and popular agendas, and ultimately, academic agendas. The second purpose is to survey the various definitions applied to the term, focusing on both a common core while exhibiting the many divergences.

While the species has addressed concerns about communication since ancient times, early systematic attentions were limited to the study and practice of rhetoric as artful oratory in public and institutional settings.^[5,15–17,26] Below the surfaces of these systematic attentions there were the ruminations of poets, storytellers, and religious leaders capturing what they saw as wisdoms for understanding essential struggles of human existence—the problems of getting along even within relatively homogenous enclaves and temporally and geographically confined boundaries.^[18,19] The varying uses of the term communication as we know them today did not begin to emerge until advances in technology permitted mass production of messages and the transmission of these messages across time and space. The term first drew large-scale attention in policy debates and in popular imagination. These attentions were impelled by the exploding diffusion of mass media in the first half of the twentieth century as well as by the increased struggles to gain public space in which to be heard by diverse populations worldwide. It was these attentions and events that made the institutionalization of academic studies in communication possible.^[5,16,17,20,26,31]

Most definitions of communication have a common core although this common core goes beyond the “sharing” focus that dominates popular usage. Definitions focus on sharing but also relaying, transmitting, imparting, or exchanging in some way a message or messages of some kind via some means from one or more entities to one or more other entities in some context. The entities to which this core definition of communication has been applied have included not only human beings and their various collectivities and symbolic artifacts, but also other living animals as well as nonliving entities such as radio systems and railroads.^[1–3,5,20,23]

The last point deserves special emphasis because, in fact, the emergence of communication as a term in the

English language between the late 1700s and the late 1970s was as likely to focus on communication as linkages between humans as to refer to connecting passages, sea channels, railroads, electrical transmissions, and other technological and natural avenues that permitted movement across space and time.^[5,20] When the term referred to human communication, it was as likely to imply a view of humans as transmitting senders and receivers as it was to focus on humans relating, sharing, or exchanging with each other. Further, it was as likely to refer to communication as instrumental manipulation and persuasion as it was to engendering mutual understandings. It was rarely used to refer to something now called intrapersonal communication—self communicating with oneself across time and space.^[8,14],28]

Some observers suggest that the tensions between these branches of emphasis still mark communication studies today.^[5,11,12,20] Some have argued that the U.S. emphasis on instrumental communication that dominated communication studies from the 1950s through 1980s was an unconsciously adopted preference for meanings that reflected the instrumental ideologies that had dominated the very character of U.S. expansion.^[10,13,20,23] Some have charged that this hidden hegemony is one cause of why histories of communication study and its emphases vary sometimes quite markedly between portraits emphasizing instrumental values and those emphasizing humanistic values. These issues remain among the many enduring debates in communication studies. In particular, there remain concerns about whether or not conceptualizing human beings as if they are transmitters and receivers is useful for understanding the role communication plays in the human condition.

When the core definitions above are applied specifically to human communication, on the surface at least the definitions seem to have much in common. One simple and common definition of communication is “how people use messages to exchange meaning.”^[1] From this simple core, one finds a large variety of definitions that bring in more and more aspects of the phenomena as the definers see it. Two typical more complex definitions might read as follows: how people use messages to generate meaning within and across contexts, cultures, channels, and media; or, the processes by which people inform, persuade, manage, relate to, and influence via channels and media through contexts and culture.^[2,3]

As will be shown below, within these seemingly congruent definitions, those doing communication studies have launched upon a dizzying array of topics, theories, models, and approaches. Most of the differences are accountable in terms of how different researchers have chosen to focus on different goals, contexts, levels of analysis, and so on. We find, for example, different scholars defining communication in ways useful to the study of communication: 1) at different levels of social analysis, e.g., interpersonally, intergenerationally,

cross-culturally, internationally; 2) in different content or knowledge domain applications, e.g., health, politics, democracy, marriage; 3) in terms of the goals they see communication serving, e.g., persuasion, negotiation, dialogue; or, 4) in terms of how communication serves and impacts different socially defined groups, for example, women, minorities, disabled, gays, and lesbians. These are but examples for the differences are many.^[3,5,32–34] The differences can be seen as details on which the study of communication must be based. Yet, communication studies must also bracket the differences in order to look at communicative essences.

It is important to note, however, there are more subtle variations that mark attempts to define communication. Various authors have identified these in different ways and many different words are used for the relaying, transmitting, imparting, sharing, or exchanging that seems central to all definitions. To illustrate these variations, consider the word relaying. Cutting across the differences, it can be said that definitions of communication and implementations of these definitions focus on communication as: 1) behavior: the act of relaying; 2) codes: the languages and symbolic systems used in the relaying; 3) information: the contents that are being relayed; 4) message: the package in which the contents are wrapped so they can be relayed; 5) means: the channel, media, or system through which the message is relayed; 6) skills and techniques: the relaying practices and procedures; 7) process: the steps involved in the relaying across time-space; 8) meanings: interpretations of the message as understood by those involved in the relaying; and 9) outcomes: impacts of the relaying, often an assessment of whether the relaying was successful.^[5]

These subtle differences in definitional emphasis make a great deal of difference when it comes to understanding what is being addressed. Take, for example, the difference between a definition that focuses on communication as process versus one focusing on it as outcome. For the latter, communication is an end point, it comes after the relaying. For the former, it is the very process of relaying itself. As another example, compare a definition focusing on information with an external authoritative representation of message content versus one focusing on meanings where interpretation occurs within a person or cultural context. The mischief caused by these differences is, understandably, the subject of enduring debates in communication studies.

Two Primary Institutions—Speech and Mass Communication

As will be shown below, communication as a focus of study eventually spread into every nook and cranny of the academy. However, the history of the institutionalization of communication studies has been essentially the story of two major emerging structural arrangements. One focus

has become today's emphases on mass communication, broadcasting, and journalism; media studies; advertising and public relations; communication and information technology; and communication law, policy, and economics. The other focus has become emphases on speech, rhetoric, debate, argumentation, and oral interpretation; communication codes; interpersonal and intercultural communication; group, organizational, network communication, and, sometimes, speech and hearing science. These basic categories of attention in the two root structures can be found in varying combinations across academic units. The two root structures are themselves most often referred to as mass communication and speech communication.^[9,16,17,21,23,25,31,35]

In today's academia, many units still reflect these historical divisions, although rarely as cleanly as suggested above. Further, when one sees a unit named simply communication, that unit will usually be reflective of one or the other of these lineages. Sometimes one finds a comprehensive or unified unit that cuts across the lineages. In the United States, these are more likely to be found at second tier and teaching-oriented institutions. In top tier universities, the lineages often remain divided even to the extent that sometimes the media-oriented unit will be located in a social sciences college while the speech-oriented unit will be in a college of humanities. When one looks at the two major journeys that constituted the advance of communication studies—that of mass and speech communication—it becomes possible to understand why to this date the histories of the field and descriptions of its emphases show great diversity and competing narratives.

The mass communication journey involved the introduction of new, modern emphases on artifacts with relatively recent introductions—newspapers, radio, film, telephones, television, digital games, and the Internet. In a relatively short span of time, new media units were introduced from one end of the country to the other in academia first with a focus on skills trainings and not long after in order to understand the rise and role of media in people's lives and society at large.^[5,17,23,26]

In contrast, the speech communication journey arose from its ancient legacy focusing on rhetoric, dialogue, discussion, argumentation, and oratory. It involved absorbing into traditionally anchored and agreed upon discourses entirely new emphases, focusing, for example on: fostering long distance romantic partnerships, improving intercultural communication for transnational corporations, managing organizational knowledge production and memory. The rise of newer media such as e-mail, video-conferencing, and virtual worlds began to blur the lines between what was traditionally seen as in person versus mediated communication. Speech-oriented units quickly turned their attentions to these developments.^[5,16,20,21]

Today, as the media landscape of society still rapidly changes, communication-labeled units in the academy

continue to evolve. Some disappear. Some reappear. Some combine, voluntarily or by administrative mandate. Most find ways to collaborate and share resources. Most acknowledge that despite their different origins, today they have common interests.

Other important polarities have stood as barriers between the two root structures. These are reviewed below. For purposes here, the important point is that during the first 30 years of the formal emergence of institutionalized academic units carrying the communication label, the two emergent institutional forms—mass and speech communication—evolved in relative isolation and sometimes mutual ignorance, even though many of the same forces were impacting both.

Given these divergent paths, it is small wonder that these isolated journeys resulted in competing narratives of communication studies—what it is, where it came from, and why. Amid rapidly changing conditions, there has been little time for building historical consciousness.^[5,16,20] Historical descriptions are still sparse and incomplete. Even on fundamentals such as the identification of the presumed founding heroes, the histories tell different stories. In the arena of studies now identified as mass communication, an often named founder is Wilbur Schramm;^[5,17,25] in studies now identified as speech communication, Kenneth Burke.^[5,16] When one adds to the mix founding heroes in communication studies in other parts of the world, different heroes are eulogized.^[5,22–25] In Canadian communication studies, for example, they point to Harold Innis and Marshall McLuhan; in Europe, again as examples, Raymond Williams or Jurgen Habermas. Each arena within communication studies has developed its own isolated history, often presented as “the” history. Founding fathers have only recently been identified as shared across these terrains.

Comprehensive histories only began to emerge in the late 1990s and early 2000s.^[5,20] Communication studies must still realistically, then, be seen as a meeting place where diverse roads have converged out of a plethora of different and rapidly changing labels, sponsorships, leadership goals, and resistances.^[5] There are agreements on central visions and important debates. Even now, however, these can be hard to see through a sea of competing, sometimes contesting details.

Unlike many older traditional fields—e.g., library science, mathematics, philosophy—communication as a field of study exploded onto the scene in our recent modern era, an era characterized by rapidly diffusing media technologies; the uses and abuses of these media for propaganda, publicity, and play; two devastating world wars; the fall of colonial powers; the rise of populist movements; and increasing global connectivity. Simultaneously, there occurred a rising interest in using the emerging social sciences as scholarly approaches to understanding humans and their societies. Part of this surge of interest involved a concern for using the increasing body of social science

knowledge to create better individuals, citizens, and societies. Better was variously defined in terms of values within specific cultural and political-economic contexts. The confluence of these forces meant that governmental agencies and educators worldwide were increasingly concerned about both the potentials of media for what they defined as positive change (e.g., education, literacy, modernization) as well as negative (e.g., injurious propaganda, the spreading of base values, the potentials of mob rule). They turned to the academy for help.^[5,15–17,26,31]

At the same time, an intellectual ferment was brewing that did not fully erupt to impact communication studies in the United States until the 1980s but accounts for some of the differences in how communication is defined, studied, and historicized. This ferment involved collisions between scientific and humanistic ways of conducting scholarship focused on humans and their societies. There were two important trajectories here. One was that studies of media were being introduced in the United States primarily as scientific study while studies of speech had been traditionally anchored in the humanities. During the institutionalizing process, speech-oriented units had no choice but to absorb the social sciences.^[5,16] But, speech communication units were more likely to retain the humanistic traditions as well. This proved over the years another source of debates as the emerging institutional streams were forced to pay attention to each other.

Simultaneously, philosophic thinking about humans and their societies was burgeoning, riding on the surge of interest in the writings of such thinkers as Cooley, Darwin, Dewey, Freud, Marx, Mead, Simmel, Park, and Weber.^[523,25] Most of these writings directly addressed communication-pertinent topics and were fertile sources of ideas about communicating drawn on heavily, but quite differently, in the writings of the various founders of the emerging communication units. These philosophic writings are seen by some as part of a worldwide thrust of attention away from focusing only on individual humans and human collectivities as static entities toward focusing on communication as a lens for examining and understanding human conditions and the communicative forces that constrain or enable human life. In this framework, communication is seen as explanatory of how humans and their collectivities become, rigidify, and/or change.^[8,14,27–29]

Uses of these writers' works were sometimes anchored in stereotypical positivistic or instrumental orientations, focused especially on using scholarship to change people and societies for the better. Others focused on stereotypical humanistic or romanticist orientations, focusing on understanding and nurturing creativity, expressiveness, and human fulfillment. Numerous debates emerged within and between the social sciences and the humanities. In general, because of their differing lineages, United States, speech-oriented communication studies was more open to these debates while media-oriented studies were less so.

In contrast, in Europe and Canada, as examples of regional differences, there was earlier and far more robust attention to these differences.^[22–24] Ultimately by the mid-1980s, these debates became a top agenda item in both mass and speech communication units for at least the next decade—a period sometimes labeled as a time of “ferment in the field.”^[5,9] The debates still continue today, albeit in a more quiescent form.

The Exploding Emergence of Media

There is essential agreement about the importance in the histories of communication studies of the spread of the media and the impacts of this spread on personal, political, economic, and other societal arrangements. Media made it possible to communicate faster across time and space and reach geographically disparate populations. Further, messages came to have a more durable presence in material form. This explosion of changes led to governmental and policy attentions and, hence, academic attention. In the context of the current speed of the diffusion of the Internet, it is difficult to remember that each of the mass media diffused at speeds considered astonishing in their times. This was as true for books, newspapers, telephones, and radios as it has been for televisions, videotape recorders, personal computers, and Internet use.

Gutenberg's invention of the printing press around 1440 is seen by many as the first small step in the rise of mass media. The period between its invention and the 1800s was marked primarily by small scale uses serving the needs of religious and educated elite. By 1800, further technological advances introduced by the industrial revolution made large and inexpensive runs possible both for religious and secular works. In the early 1800s, one found massive runs of Bibles both in the United States and Europe. In 1836, Dicken's *Pickwick Papers* became the first wildly popular novel, a business enterprise unto itself with attached theatrical performances, bootleg copies, and merchandizing.^[5,17,19,26,31,36]

As the book became a tool of mass communication, newspapers were moving forward on their own fast-moving course, showing the same movement from elitist defined contents and formats to more popularized approaches incorporating illustrations, games, comics, and news of popular culture and celebrities. The first newspapers are said to have been circulated in both the United States and Europe in the late 1600s and early 1700s. By the early 1850s, there were some 2500; by the late 1800s, some 11,000. A downward trend in newspaper circulation is attributed to the impact of electronic media. Newspapers have been responding, however, with increases in their online presences.^[5,17,19,22,23,31,37]

The same story of rapid diffusion is documented for radio and television. Licensed commercial radio began in the early 1900s with the first radio stations being introduced in the 1920s in the United States and Europe.

Today, there are some 12,000 radio stations—commercial and noncommercial in the United States alone. Television broadcasting with a regular schedule was introduced by a station in New York City in 1931. By 1960, roughly 9 of 10 households in the United States owned at least one television, and as of the late 1990s, there were some 219 million television sets in U.S. homes. Riding on these developments was the spread of advertising and public relations as massive enterprises. The first advertising agency as such opened in 1850. U.S. Census figures reported more than 11,000 advertising agencies in the United States and at least half that number of firms specializing in public relations.^[5,17,19,38–40]

The speed of the spread of Internet use is even more startling. The worldwide infrastructure as we know it today first became available for public use in the early 1990s with the development of graphic interfaces and the World Wide Web. Current penetration to the U.S. population is more than 70%; Europe 48%; Oceania/Australia 59%; globally 22% (more than 1.5 billion users).^[41]

The astounding growth and diffusion of all media technologies has had extraordinary impacts on the social fabrics of societies already changing rapidly because of the impacts of the industrial revolution. The growth in the entrepreneurial working class meant, for example, more leisure time for many, leading to clamoring for more diversions to fill that time. The rise of mass production of products and services coupled with the use of advertising and public relations as dissemination tools spread in rapid succession of all manner of changes in the distribution of goods and services, and impacts on lifestyles. Those with more flexible incomes clamored for products. Those with reading literacy reached for newspapers, books, and magazines, and, of course, eventually all media. The projection that some media would disappear during these evolving conditions is only in part true. Particular technologies have disappeared but the differential needs they serve varied audiences remain. If anything, the brunt of evidence suggests complementarities between media technologies rather than competitions.^[18,19,28]

One major phenomena that must be emphasized as characteristic of the growth of mass media is that for first time media did not demand reading literacy as defined by elites. In general, media formerly controlled by and serving elites became mass-based. Citizens worldwide began to get access to pictures of their worlds formerly hidden from their views. They learned, for example, of misdeeds of their own leaders not reported locally; or how ordinary citizens lived in other parts of the world. Some media observers worried about an era of rising expectations that could not be met in a realistic (in one framing of the critique) or brutal (in another) reality. Others foretold how ordinary citizens would seize media for their own purposes as, for example, Bolivian miners' unions did as early as the 1950s. Others were deeply worried about the impact of media, such as film and radio on ordinary

citizens, particularly children. Others were concerned with the need to educate populations with a new kind of literacy—media literacy.^[5,15–17,20–22,31,35,42]

These polarizing concerns between potentially positive and negative communication impacts got entangled in growing arguments about who gets to decide what is positive and what is negative. Lack of consensus mirrors the now documented truism that media developments as envisioned by those controlling media technology rarely turn out as expected. This has been particularly so as the media have evolved from elites communicating with elites, to elites communicating to the masses, to masses communicating with each other, to masses organizing and communicating back at elites.

As we look broadly at historical media developments, the same expectations of communication and its potential impacts in society have been repeated for each successive media development. But the debate is not new. Even in the very early years of rhetoric in ancient Greece, there were discussions on the ethics of using persuasive manipulation. The debate centered on whether these approaches to communicating were necessary as an antidote to ignorance and mob rule, or abuses of power and intrusions upon the sanctity of human consciousnesses.^[5,16]

The Phases of Institutionalization

Most histories of the rise of communication studies have essential agreement on the phases of events. In the very earliest period—prior to the institutionalizing of communication-named units—the teaching of rhetoric was fairly well established. Rhetoric was part of the first curriculum at Harvard in 1636. By the end of the 1700s, it was well established in most of the Ivy League. An emphasis on rhetoric spread throughout the country. However, as more institutions were established, this emphasis slowly evolved to focusing primarily on the practical skills of discussion, speaking, and oratory. Increasingly these courses were usually located in departments focusing on English. By 1910, the academics focused on teaching speech and were large enough in numbers that they founded their own association.

While attention to media studies does not have this long history, the same practice emphasis characterized early developments. As the media were introduced and began to diffuse to mass circulations, it was not long before academic courses focusing on media skills began to appear. The earliest known course in journalism was introduced at the University of Leipzig in 1671. In the United States, in the 1860s, Southern Civil War leader Robert E. Lee introduced journalism training to assist postwar reconstruction at what is now the University of Washington and Lee. The University of Missouri introduced journalism training in 1878. The Wharton School started a business journalism school in the early 1900s.^[5,17,22,23]

The same growth patterns ensued for each media development in turn. The first instruction in advertising was offered at New York University in 1905. Less than 30 years after Edison's invention, cinema studies courses followed in both Europe and the United States by 1920. Courses in radio broadcasting also began to appear in the 1920s and early 1930s. The first master's degree in radio broadcasting was offered in the United States in 1931 at the University of Wisconsin.^[5,17,31]

These early attentions to communication education did not include the term "communication" in their names and almost all focused on practical training. While in general, speech training was located in departments of English and journalism training was either located there or in new separate units, it is really impossible to generalize where these units were placed in academic structures. Until attention to media began to coalesce in a consciousness of media as part of a communication revolution, the spread had a capricious character.^[5]

It was when the mass media exhibited widespread diffusion and potentially negative impacts on society that attentions were directed to studying these impacts in the hopes of understanding and abating them. In the 1930s and 1940s, most of these attentions were manifested in the development of temporary centers, institutes, and programs. Columbia University, for example, established an office of radio research, launched a readability laboratory, and subsequently established a bureau of applied social research which specialized for a period in studying communication problems. Princeton University, with Rockefeller funding, established a center for monitoring short-wave broadcasting during WWII. The Chicago School introduced an interdisciplinary course focusing on communication and propaganda that eventually led to an interdisciplinary center. Ohio State University's Bureau of Educational Research launched the Payne Fund studies on the impacts of film on children with funding from the Motion Picture Research Council.^[5,17,31]

From the 1940s on, new programs, centers, and projects began to emerge at what has been estimated as at least one per year.^[5] Audience research was introduced into already established journalism units, for example, at the University of Minnesota in 1944 and University of Iowa in 1946. Speech focused units began to add social scientists to their faculties and introduce social science focused courses.^[5,16,21]

In the 1940s, units with the communication label began to appear. The first unit to specifically use the communication label was a communication research center at the University of North Carolina, emerging out of speech and theater. The Institute of Communication Research with a media focus was established at the University of Illinois as was the University of Iowa's communication research center, also with a media focus.^[5,17]

By the 1950s, the label communication was popular both in academic and governmental circles as well as

public imagination. The first mention of communication studies as an academic enterprise in *Webster's Dictionary* was in 1951. The first college identified as such was established at Michigan State University in 1955. The first doctorate was awarded under the communication label in 1956. Courses and institutes in higher education that focused on something they specifically called communication increased from the early entrees in the 1950s to explosive developments of the 1960s and 1970s. Most of the early developments occurred at the Big 10 universities of the Midwest. Exceptions to this were the robust communication-labeled units at the University of Pennsylvania, the University of Washington, and Stanford. Later, communication-labeled units diffused virtually everywhere except, notably, in the Ivy League. Despite the fact that Ivy League institutions were among the first to promote communication research initiatives, they have not incorporated communication studies into their formalized curricular hierarchies.^[5,17]

As the growth of communication studies marched on, the various media focused units—journalism, radio, advertising, film, and television—began to change their names to incorporate the "communication" word. Programs merged and coalesced into schools and colleges of mass communication. Likewise, units coming from the speech communication trajectory began to change their names.

The growth statistics on the introduction of departments, schools, and colleges were remarkable. In less than 50 years, by 2006, some 1300 colleges and universities in the United States had communication focused programs or departments. In 2005–2006, according to the Chronicle for Higher Education, 81,661 degrees were awarded in communication at the bachelor's, master's, or doctoral level—about 5.2% of all degrees conferred. This number rose from 14,794 in 1967–1968 (1.8% of all degrees).^[43]

With continued growth, there were challenges. Primary among these were the impacts of academic cutbacks in the 1980s and resulting pressures on the different communication-focused programs for retrenchment. This involved mandates for mergers and elimination of duplications. This also led to many attempts by communication scholars to show internal coherencies in communication studies with its emphasis on communication as fundamental process. These efforts continue today.

Further, communication suffered and continues to do so in many locales from being seen as academically inferior, in many minds tarnished by its legacies in practical training. Some have seen this as a result of academic elitism and erroneous stereotyping of communication studies as merely a field that focuses on practice and not a discipline that focuses on basic research and theory development.^[5] Yet, at the same time, communication skills and understandings have increasingly been documented as among the skills and understandings college educated graduates need.^[4] Further, students continue to seek out

higher education courses in communication, both for media or speech emphases. Popular sentiment has supported this trajectory. One sample indicator of the place of communication in public consciousness is that as of November 11, 2008, there were more than 649 million Google hits to Web pages dated 2008 with the word “communication” in them and more than 140,000 titles dated 2008 with the “communication” word in them in Google scholar.

Structures for Handling the Diversity

Space prevents any attempt to show the numerous ways in which those involved in the study of communication have partitioned and organized their topics of interest. There are some basic large categories of attention most easily discerned by examining texts developed for introductory courses. These are listed in the first paragraph of the section “Two Primary Institutions—Speech and Mass Communication.” However, from textbook to textbook these can markedly disagree, not so much in the specific details but in the ways in which the categories are organized.

For the most part the categories for organizing curricula and attentions in communication studies capture some basic enduring nouns into which the communication terrain has been divided. What is missing are the many ways in which different researchers, academic units, organizations, and journals have parlayed their interests into specialized contexts, cultures, and domains. Looking across category schemes, we find divisions emphasizing, for example: societally important foci of attention (e.g., health, political communication, marriage, peace); communication processes (e.g., sense-making, dialogue, leadership); goals (e.g., persuading, informing, educating); audiences (e.g., women, men, children, parents, minorities). The list goes on.

The diversity shows most clearly by examining Tables 1–3, profiles of the three largest comprehensive organizations that have emerged over the years to support communication studies with annual conferences and journal production. These three organizations, as well as a number of equally robust but more specialized organizations, have grown from relative isolation over a 50-plus year period to their current formations. Each has a distinctive character arising from its own historical lineage. Each has exploded in growth in short periods of time and has robust conferences and supports a roster of journals. Each over the years has converged more and more onto common interests while retaining their distinctions, providing room for the diversities of interests of their members, and simultaneously setting aside a significant portion of attentions to communication in the broadest and most widely applicable sense.^[1,2,5,32–34]

Today, the three most comprehensive organizations that attract members from the United States are, in order of historical emergence: the National Communication

Association (NCA), the International Communication Association (ICA), and the International Association of Media and Communication Research (IAMCR).^[32–34] There are important organizations with more specialized foci that are not being highlighted here. In the U.S. context, examples include the Association for Education in Journalism and Mass Communication, the Broadcast Educators Association, and the American Association for Public Opinion Research. Each has robust membership and conference attendance. Each supports one or more journals. There are as well numerous communication studies associations in virtually every country and region of the world, each exhibiting the same essential core foci on communication as fundamental process and each exhibiting differences arising from their unique historical lineages and current cultural and political-economic interests.^[5,17,22,23]

The importance of focusing only on the three most comprehensive organizations which today attract substantial U.S. membership is to examine them as exemplars of how the structures that support communication studies focus on core interests in communication while simultaneously handling the diversity in contexts, cultures, domains, and environments that are the locales where essential communication processes play out their roles and impacts. Tables 1–3 profile each organization’s history, current membership composition, and current emphases as displayed in subgroup category names and journal titles. It is in these lists that one gets a glimpse of both the core of communication studies and its parts.

In 2008, ICA (Table 2), for example, had a special interest group focusing on game studies, a recent emergence, while at the same time its journals covered a broad spectrum of communication interests. One special interest group in ICA focuses on communication and history, a reflection of how ICA, strongly anchored in emphases on social scientific studies, is admitting more and more humanities based interests into its roster. For NCA (Table 1), one of the most recent divisions to be added focuses on spiritual communication, a reflection of a general societal turn to interests not usually covered by normative studies of how people use media and messages. National Communication Association’s journals also reflect a broad spectrum of interests—both humanistic and scientific—and retain as well the organization’s focal origins on communication education. International Association of Media and Communication Research’s (Table 3) subgroups reflect its historical lineage and cover a number of special foci more likely to be catapulted into membership attentions by the historically international character of the organization. In 2008, working groups were listed, for example, for diaspora and communication, Islam and media, as well as for emerging media foci common to all three organizations—e.g., the digital divide, comic art, and popular culture.

Table 1 Profile of the National Communication Association.

Main organization	Subgroup structures as of 2008
National Communication Association	<i>Divisions</i>
http://www.natcom.org	African American Communication and Culture
Founded 1914	American Studies
<i>Former names</i>	Applied Communication
Speech Communication Association	Argumentation and Forensics
National Association of Academic Teachers of Public Speaking	Communication and Aging
<i>Current mission statement</i>	Communication and the Future
...a scholarly society that works to enhance the research, teaching, and service provided by its members on topics of both intellectual and social significance	Communication and Law
...the oldest and largest national association	Communication Apprehension and Competence
promoting communication scholarship and education	Communication Assessment
...promotes study, criticism, research, teaching, and application of the artistic, humanistic, and scientific principles of communication	Communication Ethics
<i>2008 statistics</i>	Communication and Social Cognition
7700+ members	Communication as Social Construction
<i>Home locations of members</i>	Critical and Cultural Studies
20+ countries, mostly United States	Environmental Communication
<i>Conference attendance</i>	Ethnography Division
4000+ attendees at typical annual conference	Experiential Learning in Communication
an estimated 4000+ presentations	Family Communication
in 1000+ programs	Feminist and Women's Studies
<i>Conference sites</i>	Freedom of Expression
2008, San Diego	Gay, Lesbian, Bisexual, Transgender and Queer Communication
2007, Chicago	Group Communication
2006, San Antonio	Health Communication
2005, Boston	Human Communication and Technology
2004, Chicago	Instructional Development
*4 regional U.S. associations—eastern, southern, western, central, sponsor own annual meetings and journals	International and Intercultural Communication
<i>Journals available to members</i>	Interpersonal Communication
Communication & Critical/Cultural Studies	Language and Social Interaction
Communication Education	Latino/Latina Communication Studies
Communication Monographs	Mass Communication
Communication Teacher	Nonverbal
Critical Studies in Media Communication	Organizational Communication
Journal of Applied Communication	Peace and Conflict
Journal of International & Intercultural Communication	Performance Studies
Quarterly Journal of Speech	Political Communication
The Review of Communication	Public Address
Text & Performance Quarterly	Public Relations
	Rhetorical and Communication Theory
	Semiotics and Communication
	Spiritual Communication
	Theater
	Training and Development
	Visual Communication
	<i>Sections</i>
	Communication Centers
	Community College
	Elementary and Secondary Education
	Emeritus/Retired Members
	Master's Education
	Student
	Undergraduate College and University

In each of these organizations, the subgroups and journals represent the presence of discourse communities substantial enough in size that they have parlayed for themselves a share of convention and journal resources. Each is, as well, a trace of the many different topics and

emphases brought to bear on teaching and research foci. Throughout academic units focusing on communication studies in the United States and throughout the world, the same play between the past and the present, the center and the peripheries can be observed.

Table 2 Profile of the International Communication Association

Main organization	Subgroup structures as of 2008
International Communication Association http://www.icahdq.org	<i>Divisions</i>
Founded 1950	Communication and Technology
<i>Former names</i>	Communication, Law, and Policy
National Society for the Study of Communication	Ethnicity and Race in Communication
<i>Mission statement</i>	Feminist Scholarship
...aims to advance the scholarly study of human communication by encouraging and facilitating excellence in academic research worldwide. The purposes of the Association are: (1) to provide an international forum to enable the development, conduct, and critical evaluation of communication research; (2) to sustain a program of high quality scholarly publication and knowledge exchange; (3) to facilitate inclusiveness and debate among scholars from diverse national and cultural backgrounds and from multidisciplinary perspectives on communication-related issues; and (4) to promote a wider public interest in, and visibility of, the theories, methods, findings and applications generated by research in communication and allied fields.	Global Communication and Social Change
<i>2008 statistics</i>	Health Communication
*4000p members	Information Systems
<i>Home locations of members (estimates for 2008)</i>	Instructional/Development Communication
*66% from the United States; 34% from other countries	Intercultural Communication
<i>Conference attendance</i>	Interpersonal Communication
*2100p attendees at 2008 annual conference	Journalism Studies
representing 51 nations	Language and Social Interaction
an estimated 1800p presentations	Mass Communication
464 different sessions	Organizational Communication
<i>Conference sites</i>	Philosophy of Communication
2008, Montreal	Political Communication
2007, San Francisco	Popular Communication
2006, Dresden	Public Relations
2005, New York City	Visual Communication Studies
2004, New Orleans	<i>Interest groups</i>
<i>Journals available to members</i>	Children, Adolescents and the Media
Communication Theory	Communication and History
Communication, Culture ... Critique	Game Studies
Journal of Computer-Mediated Communication	Gay, Lesbian, Bisexual and Transgender Studies
Human Communication Research	Intergroup Communication
Journal of Communication	

In essence, across the many diversities can be found a core concern for researching, theory building, and applying through practice understandings of communication as a fundamental and universal process by which humans somehow transmit, exchange, or share meanings. While, for example, in the big three organizations each subgroup may have its own emphasis, the boundaries between them

have not been impermeable. Subgroups within and between the organizations regularly come together in journals and conventions to intermingle and produce collaborative work that recognizes core interests in communication. As a bottom line, it is fair to describe communication studies as an academic force that has continuously encouraged unity amid its essential diversity.

Table 3 Profile of the International Association of Media and Communication Research.

Main organization	Subgroup structures as of 2008
International Association of Media & Communication Research http://www.iamcr.org Founded 1957 with UNESCO support <i>Former names</i> International Association of Mass Communication Research <i>Mission statement</i> ...worldwide professional organization in the field of media and communication research ...promotes global inclusiveness and excellence within the best traditions of critical research in the field ...supports the public presence of the field of communication research *promotes and supports the input of media and communication researchers in local, national, and global agendas <i>2008 statistics</i> 1601 individual and institutional members <i>Home locations of members (estimates for 2008)</i> Africa, 18.4% Asia, 15.6% Europe, 35.6% Latin American and Caribbean, 9.7% Middle East, 3.7% North America, 23.3% Oceania, 4.8% South East Asia, 2.3% <i>Conferences attendance</i> 950+ attendees at 2008 annual conference, representing 82+ nations presenting an estimated 1100+ papers, in some 300+ sessions <i>Conference sites</i> 2008, Stockholm 2007, Paris 2006, Cairo 2005, Taipei 2004, Porto Alegre <i>Journals available to members</i> International Communication Gazette New Media & Society Global Media & Communication	<i>Sections</i> Audience Communication Policy and Technology Community Communication Emerging Scholars Network Gender and Communication History International Communication Journalism Research and Education Law Media and Sport Media Education Research Mediated Communication, Public Opinion and Society Participatory Communication Research Political Communication Research Political Economy <i>Working groups</i> Comic Art Communication and HIV/AIDS Diaspora and Media Digital Divide Environment, Science, and Risk Communication Ethics of Society and Ethics of Communication European Public Broadcasting Policies Global Media Policy Islam and Media Media Production Analysis Media, Religion and Culture Popular Culture Post-Socialist and Post-Authoritarian

Communication Studies and Its Productive Tensions

Communication studies as a terrain of academic focus was welcomed into the academy on the tail of the explosive

spread of mass media and the interest, particularly by government and policy makers, to apply the tools of social sciences to studying, understanding, and curbing negative effects from the media as well as promoting positive ones. Yet, from the beginning the forces that put the

“communication” word on the map harbored contradictions within them.

These contradictions are many. In terms of historical lineages, communication studies attached itself to two established teaching missions: one focused on training media practitioners; the other focused on training citizens and leaders for oratory and discussion in public forums. This introduced immediate contradictions between practice and scholarship, one that remains today. As science was emphasized more and more as an appropriate form for study, the humanities way of knowing the world collided with the scientific way.

These two historical polarizations in many ways were simply surface symptoms of a host of other contradictions that have beset communication studies. Those studying communication disagree about: how to know the world, what to do with the knowledge, how to handle differences, and what to call deviance and what not; whether the role of leadership is to control, correct, and persuade, or facilitate and engender opportunity; how best to understand others and even whether the understanding is worth the effort; whether communication and, in particular, media damages us and our societies, or helps; whether communication is something that might be used to make the world a better place; whether this very idea can be considered ethical or impositional.^[5,10–15]

These tensions and many more can be seen galloping through discourses in more traditional fields of study, both in the humanities and the social sciences. They can also be seen galloping through media news reports on our TV screens and in our newspapers.^[28,34] Yet, it can be argued that communication studies is more impacted because these tensions, if resolvable, must be resolved in communication.^[8,28] Add to this the fact that increasingly our lives are structured and patterned within landscapes of electronic communication that now seem to be making the old distinctions between mediated versus non-mediated irrelevant. These converging forces put communication studies in the center of a hurricane. The subjects of communication studies are what make the hurricane whirl. But, communication studies, like all other centers of academic attention, is whirling along as well.

Both insiders and outsiders look at communication studies and what appears to be a chaotic jumble of incoherent interests and emphases and ask: How can this be a discipline or it is merely a field? Is this even a field, or merely a meeting place? Is this a specialty requiring a discipline or a phenomenon that is now everyone’s business? Debates on these issues continue and are expected to do so for some time.

Yet, despite these disagreements, an examination of communication studies shows that it keeps trying to hold onto the vision of many of its founding fathers—that there is a communicative way of looking at the world and that worldview provides special strengths. Some see this

strength as growing out of communication studies as the practical discipline where one studies how humans use communication to make and unmake and remake their worlds. Others see this as a distinction between the nouns that are the specialized foci of most of the social sciences and humanities, and the verbs of communicating that forge the linkages between peoples across time and space. Some see communication studies’ continuing efforts to retain this core and vision as its special strength and potential greatest contribution. In this sense, the contradictions and chaos that seem to give communication studies an incoherent face can be seen as symptom and cause of both its centralities and its dispersions, its weaknesses and its strengths.

CONCLUSION

The goal of this entry has been to describe the historical emergence and current states of attentions to communication as a phenomenon of academic study; and, to describe the various academic formations today nested under the term communication studies. Because communication studies has been a presence in the academy for less than 60 years, and because it has evolved in the midst of an exploding and rapidly changing communication environment, there are necessarily multiple and competing stories to be told. This entry has attempted to focus both on convergences and divergences across these stories. The entry has reviewed in turn: different meanings for the word “communication” and how and when the term came into popular usage; the two primary historical lineages out of which communication studies has emerged—speech and mass communication; the forces leading to institutionalization and the exploding emergence of the media. The entry has examined the phases in which communication studies became institutionalized and how it has handled its diversity with supporting structures of organizations and journals. The entry concluded with a discussion of how communication studies necessarily holds within its core a series of contradiction that are in essence both symptom and cause of its centralities and its dispersions, strengths, and weaknesses.

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Communication Policy: United States

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Abstract

This piece examines the impact that competition will have in determining communication policies and goals. It makes the case that, in a regulated environment in which communication technologies were regulated according to a different basis—common carriage, first amendment rights, and public interest standards—it was possible to meet a variety of communication goals. Each technology fostered a different goal. Given convergence, and the deregulation of the communication policy environment, such flexibility is no longer viable. One approach serves all. The result has been that, more than ever before, policy goals must be traded off, one against the other.

INTRODUCTION

The U.S. communication regime reflects the pattern of economic relationships that exist among and between key players as well as the public policy goals and corresponding rules that govern them. For years, the goals and rules of the system and the balance among interested parties were generally accepted and relatively stable. Typically, industry leaders have been the driving forces in developing and promoting communication technologies, competing among themselves for primacy. At certain periods, however, the government has intervened, crafting a new set of communication policies to bring private sector players more in line with public sector needs.

Today the existing set of arrangements is once again being called into question, as technological and socioeconomic developments give rise to new possibilities, new players, and new types of problems. In particular, deregulatory communication policies have shifted more decisions to the market at the same time that technological advances have generated new opportunities in all realms of life. Some applaud these developments, seeing in them new possibilities for innovation and growth. Others fear that if decisions about new technologies are made solely in the marketplace, important social, cultural, and political opportunities might be lost. The contest will continue to be played out in Congress and the courts over issues ranging from telecommunications reform to those having to do with intellectual property rights, privacy, and networking security.

Information-based networks will serve to coordinate economic and political activities in a knowledge-based global economy. The market choices, institutions, and policies that govern them will determine not only the nature of society and the performance of the economy, but also how wealth and power are distributed. For a discussion of the role of institutions in determining economic outcomes, see North.^[1]

Whatever the institutional choices made, they will have far-reaching consequences, for in an increasingly networked society, what is at stake in crafting communication policy is the system of property rights itself. The outcome is not predetermined, nor will it necessarily be efficient. Instead, these new institutional arrangements will evolve over time in response to pressures from economic and political actors who want to restructure the rules of the game in their favor.^[2] Policy outcomes will also be irreversible, at least in the short and medium terms, for once a decision is made, technology tends to become firmly fixed on a given trajectory. This pattern is especially evident with networked information technologies, which require vast amounts of capital and social investment.

Periods of rapid technological advances such as we are witnessing today therefore provide a rare opportunity to reassess the nature of communication policy goals and the mechanisms designed to achieve them. With this opportunity in mind, this entry examines the extent to which today's deregulatory, competitive policy can be expected to meet the wide range of goals that have traditionally been associated with U.S. communication policy and/or new goals that might be required in an increasingly networked environment. First, it lays out the challenges entailed in establishing communication policy goals. Second, it examines the historical goals that have driven U.S. communication policy to date. Next, the entry considers the technological advances and associated social and economic changes that have led to efforts to restructure the telecommunications infrastructure along more competitive lines. Finally, it considers the goals that will be favored in a more market-oriented environment and identifies some new tensions among goals that are likely to emerge as a result.

The entry contends that communication policy based on a strategy of competition alone will not suffice in a networked information society. Given the enhanced role

of communication and information in all realms of life, even greater trade-offs among policy goals are likely. Far from reconciling competing communication goals, the shift in decision making from the political arena to the marketplace will serve to obscure these trade-offs, leading to the emergence of new and perhaps more thorny issues over the long run. To resolve these issues, the government must play a delicate balancing act, employing as it has so successfully done in the past a variety of roles and policy mechanisms.

CRAFTING COMMUNICATION POLICY

Goal setting provides a unique opportunity for policy makers to change course in response to technological advances and changing social and economic circumstances. Rarely, however, do politicians seize such an opportunity, given the dangers and difficulties involved. More often than not, policy goals are instead established and implemented in the context and course of “politics as usual.” When goal setting does take place formally, it usually occurs within the context of major organizational and structural changes.

In the case of communication policy, the effects are likely to be especially far-reaching, because communication is the basis for all interactions and one of the means for organizing society. Given the central role of communications, policy making in this area is generally coupled to other important policy areas. Thus, for example, political concerns about freedom of speech and the free flow of information may easily come into conflict with defense-related concerns, as has recently happened with respect to encryption policy. Similarly, in cases involving pornography or violent media content, concerns about cultural norms and values must be balanced against First Amendment rights.

In crafting communication policy, decision makers must also be sensitive to the importance of three interrelated sectors of the economy—transportation, communications, and information. Mirroring the role of communications in society, these industries are significant, and not just because of their contribution to trade and gross national product. Communication- and information-based goods and services are both intermediary goods and end products, so the impact of policies that affect their costs, availability, and use reverberate across all industry sectors as well as throughout the economy as a whole.

Consideration needs to be given not only to the impact of policy on these key industry sectors, but also on the competitive relationships among communication- and information-related industries. When industry players are able to translate their economic power into political leverage, as is often the case, the problem of sorting out these relationships is greatly compounded. Because political leverage is often distributed unevenly, some industry players

are likely to be favored over others, with little regard for broader public policy goals.

Technology also complicates matters greatly. Because communication is both dependent on as well as mediated by a technology-based infrastructure, decision makers have to craft communication policies with technologies and their distinct characteristics and capabilities in mind. Technologies, however, are very difficult to fathom. Not only are technologies highly complex; they are constantly changing. Crafting sound communication policies therefore requires considerable vision as well as technical expertise.

Even when communication policies are well designed to take technologies into account, they are highly subject to unintended consequences and events. Technology advances, for example, can easily undermine the assumptions on which policy is based. One need only consider, for instance, what can happen to policies designed to affect market structure. Technology advances can alter the rules of the game by affecting economies of scale and scope, the availability of product substitutes, and the costs of production. By providing new opportunities and challenging conventional ways of thinking, technology advances place new demands on the system, creating the need to reassess and reconsider basic communication-related goals.

The U.S. experience in setting communication policy goals reflects the magnitude of the challenges involved. Legislative mandates laying out specific goals have been rare. Once the major guidelines have been established, U.S. communication policy strategies have been derived incrementally over time through a process of administrative and judicial interpretation. This incremental approach only succeeded, however, as long as social and economic conditions were relatively stable and there was a broad consensus on related goals. As described below, in periods of major crisis or upheaval, such as the shift from an agrarian to an industrial society or from a peacetime to a wartime economy, new sets of rules designed to solve new challenges and accommodate new players became imperative.

COMMUNICATION GOALS: AN HISTORICAL PERSPECTIVE

Examining the U.S. communication policy regime from an historical perspective, a number of major communication policy goals can be identified. Established in the context of major social and economic changes—oftentimes brought about by technological advances—these goals were broadly conceived. Recognizing the link between communication and the social and economic orders, policy makers viewed communication as a means and not just as an end in and of itself. In pursuit of these goals, the government adopted a variety of roles and a broad range of policy mechanisms

Table 1 Goals, roles, and policy mechanisms.

Goals	Government Roles				
	Broker	Regulator	Educator	Promoter	Market maker
Achieving democracy	Newspaper exchange	First Amendment		Postal roads; mail subsidies	Intellectual property
National integration	Public school movement	Rate regulator	Extension service; libraries	RFD; land grants; Express Mail	
Efficient interconnection	REA	Common carriage rate regulator		Rate averaging	Antitrust legislation
Cultural concerns	Voluntary constraints	Spectrum licensing must-carry	Educational TV	Public Broadcasting	Ownership rules
Defense and security	Standards industry broker	Censorship; wiretapping		R&D; roads; ARPANET	Procurement policies

that were designed not only to take advantage of new technologies, but also to serve the needs as they were perceived by both key stakeholders and the nation as a whole. These goals, government roles, and policy mechanisms are depicted in Table 1, and they are briefly described and discussed below.

Securing Democracy by Promoting Information Access

Some of the most far-reaching and enduring communication policy goals were established at the time of the nation's birth in the context of a political revolution and a total revision of governmental affairs. These goals reflected the Founding Fathers' preoccupation with establishing a democracy and the importance they attributed to communication and information in securing it.

Occurring at the height of the Enlightenment, the American Revolution was a battleground of ideas. The dissemination of these ideas, and the revolutionary fervor accompanying them, was linked to print technology and the emergence of new channels of communication, such as the religious and merchant networks associated with the growth of discursive literacy. In nineteenth century England, for example, not only did the number of newspapers and periodicals grow by a factor of 10; equally important, journals were distributed more widely—beyond cities to small towns and villages in which a single copy might be read and discussed by a number of persons.^[3]

In the U.S. colonies, for example, newspapers and pamphlets served as the primary vehicle for public protest and revolt, providing a network of political communication that was crucial to revolutionary activities. Thus it was that with the onset of the revolution, printers—functioning as editors and publishers—generated and controlled the flow of public information. In fact, it was in their shops that many political accounts and ideas were exchanged, and although they had strongly opposed British control of the press, they were equally prepared—during the Revolution—to suppress dissenting opinions.^[4,5]

No one appreciated the power of the pen more fully than the Founding Fathers—the architects and ideologists

of the revolution. Fearful of misinterpretation, they excluded journalists from the Constitutional Convention. Seeking to build support for the Constitution, Alexander Hamilton and James Madison disguised themselves as the columnist Publius, and wrote *The Federalist Papers*, a series of newspaper articles, on its behalf. In the new nation, however, in which competing interests were institutionalized and balanced against one another, open communication was to be the rule.

Distrusting government as much as they valued information, the Founding Fathers looked to the federal government to play a minimalist role. To promote the free and independent flow of communication, they relied for the most part on prohibitions against government interference in content, as well as on subsidies and targeted economic incentives. At the same time, however, the government was authorized to use its postal authority to promote information. For these purposes, the Founding Fathers incorporated three clauses into the Constitution. These provisions guaranteed freedom of speech, assembly, and the press, and authorized the federal government to protect intellectual property and to establish a system of postal roads. Designed with print technologies in mind, this approach provided adequate for an agrarian society, in which people who had dealings with one another were in close proximity and the costs of producing and distributing information were well within individual reach.

The first amendment

The First Amendment to the Constitution, covering freedom of speech, religion, assembly, petition, and the press, forbade Congress from any actions abridging those freedoms. The amendment gave American newspapers a degree of liberty unknown elsewhere. Applied most fully to print media, it has consistently meant private ownership, freedom from prior restraints, virtually no content controls, and relatively limited liability for the consequences of a message. Except during times of war and social stress, this value included the right to criticize government vigorously. Viewed as a centerpiece of American government, major cases involving its applicability did

not arise until after World War I with the introduction of the “clear and present danger” standard. Subsequent Court interpretations have ranged from a strict absolutist view, which interprets the First Amendment literally, to a more restrictive view, which allows for exceptions in cases such as obscenity, libel, and national security. The Court has generally adopted an intermediary stance between these two positions; however, while consistently holding that freedom of speech is not absolute, it has defined exceptions very narrowly.

The protection of intellectual property

Article 1, section 8 of the Constitution authorizes the federal government to grant intellectual property protection. Its express purpose was “To Promote the progress of the Exclusive Right to their respective Writings and Discoveries.” Generally speaking, there are four different forms of intellectual property protection—copyright, patents, trademarks, and trade secrets—each with its own set of rights and obligations. Of these, the copyright regime is the one that has until recently been most closely associated with communications policy.

Like the free flow of information, the promotion of sciences and the useful arts was closely linked to democracy; a democratic polity was viewed as a prerequisite for advancement in applied science, while technological achievements were expected to provide the physical means of achieving the democratic objectives of political, social, and economic equality.^[6,7] To assure that intellectual property protection would play this dual role, the Founding Fathers made it a statutory right granted not as a reward per se but rather as an incentive to achieve a specific public policy goal. James Madison—the principal author of the intellectual property clause—was aware of the monopolistic connotations of such a governmentally granted, exclusive right. He distinguished the American system of intellectual property rights from previous ones that he believed were more pernicious. To avoid the evil of monopoly, Madison intended that the exclusive right afforded by copyright be narrowly circumscribed; owned by “many” and “granted for only” limited period of time (p. 84).^[7]

Although the rights granted under the first Copyright Act of 1790 corresponded to the capabilities of the printing press, the law has been extended over time to incorporate new technologies.

Establishing postal roads

Like its constitutional counterparts, Article 1, section 8, paragraph 7, which authorizes Congress to establish a system of postal roads, was intended to assure that all citizens in the burgeoning democracy had access to a broad range of information. The writers of the Constitution were acutely aware that building a nation would

require a national communication infrastructure, and the development and evolution of the postal system was designed to serve this end. Setting aside factional differences, Federalists and Republicans rallied behind a postal policy to encourage newspaper circulation. Favoring the exchange of political and business information over interpersonal transactions, Congress set postal rates several times higher for letters than for newspapers. The distribution of news was also encouraged through postage-free exchanges among newspaper editors. In 1936, the Post Office also inaugurated postal express services to speed the flow of market information.^[8]

PROMOTING NATIONAL INTEGRATION BY SUPPORTING MASS MEDIA AND EDUCATION

The situation facing policy makers in the post-Civil War period was radically different from that which had confronted the Founding Fathers a century before. No longer unified around a set of revolutionary goals, the nation was coming apart at the seams. Pressing problems included the reconciliation of the North and South, the integration of the western territories, urbanization, the absorption of new immigrants, and the shift from agriculture to industrialization.

Like the Founding Fathers, post-Civil War decision makers turned to communications policies for answers. Instead of focusing on ways for people to exercise their individual differences and choices, however, they began to view communication from a more organic perspective—as a means of socializing individuals and integrating them into specialized roles within a larger community. Such a radical change in approach is understandable, given the prevailing intellectual and political thinking of the day. Support came from the Progressive movement as well as from the burgeoning field of sociology, which stressed the role of communication.^[9] These groups looked to the media not only to enhance public understanding but also to improve society. As the philosopher John Dewey described, “The duty of the present is the socializing of intelligence—the realizing of its bearing upon the social practice.”^[10]

Support for the mass media

In keeping with this perspective, in the late 1800s the federal government extended its postal subsidies to the newly emerging mass media. Taking advantage of technology advance and advertiser financing, publishers launched a new media genre—low-cost magazines that were geared to a mass, middle-class audience. Magazines such as *The Saturday Evening Post* and *The Ladies' Home Journal* provided a mechanism, by which mass retailers—advertising brand name consumer goods—could reach out to the public.^[11]

Given the country's expansion westward, the mass media were considered essential to the development of a national market. Moreover, because the mass media could breach the social and economic cleavages that beset the nation, many hoped it would foster a sense of national identity as well as the peaceful resolution of differences.^[12] Members of the influential Progressive Movement were especially hopeful in this regard. To assure widespread access to magazines, the government—in 1890—inaugurated the Rural Free Delivery (RFD) Program. The targets of the RFD subsidies were the underserved, remote, high-cost rural areas. Although costly, rural free delivery helped to improve access. Over the next four decades, the distribution of periodicals increased 20 times faster than the population at large.^[13]

The public school movement

Nowhere was the new communication philosophy embraced more enthusiastically than in the realm of public education. Whereas in the early years of the republic education was regarded as a private affair—provided for the benefit of the well-to-do and the professional classes—in the post-Civil War era it was considered a matter of national survival.^[14] Looking to education to unite the nation and preserve its social and economic integrity, politicians and educators joined together in a public school crusade. By educating American youth in public schools, they hoped to inculcate a common set of patriotic, Protestant, and republican values.^[15,16] Moreover, they believed such schools would socialize the growing number of people from so many different backgrounds for increasingly differentiated economic roles.

To perform this function, public schools were structured in accordance with business principles. Vocational education and guidance were introduced as part of the educational curriculum. Assuming that the majority of Americans would be working at industrial jobs, educators believed that vocational education would serve not only the best interests of individuals, but also society.^[17,18]

Public libraries were likewise targeted for support. In rural areas, book deposit stations were set up in grange halls, neighborhood stores, fire stations, and women's clubs. In cities, libraries and adult education programs were set up to provide a haven for working class immigrants.^[19]

Agricultural extension

In its educational efforts, the government also reached out to farmers, who bore much of the brunt of the socioeconomic changes taking place. Describing this situation, Wayne Rasmussen notes,

The revolution generated by the Civil War catapulted the nation's farmers not only into a world of complex social and economic forces that were too volatile and powerful

for individual farmers to confront by themselves. It seemed that the appearance of more complex and productive tools intended to guarantee the farmer's survival had made that survival more complex.^[20]

To help them adjust to changes in the economy, the government began to develop and transfer modern technology to agriculture. It thus initiated the Agricultural Extension Service in 1914. As provided under the Smith-Lever Act, the U.S. Department of Agriculture and the land grant agricultural colleges were charged with establishing partnerships between university extension and experiment stations, and between country extension agencies and country farm bureaus. Within a few decades, an elaborate network of public and private partners had achieved its goal of farm modernization.^[20]

Land grant colleges and industrial education

Universities were also overhauled to keep pace with social and economic changes. The land grant colleges, provided for under the Morrill Act of 1762, played a critical role in this regard. Under this law, land was provided to the states, the proceeds of which were to be used to teach agronomy and mechanical arts. Subsequent legislation provided federal support for research and the operation of land-grant colleges. Designed to meet the role of an industrial economy, these universities were called on to expand beyond the traditional role of training gentlemen as preachers, lawyers, and doctors. Democratic and populist in origin, they were open to children of all backgrounds. Moreover, unlike traditional colleges, they were not isolated in their communities. Through their agricultural experiment stations and their service bureaus, their activities were designed to foster economic development in the states.^[21]

The impact of the Morrill Act was clearly evident in the field of engineering. Before its passage, state legislatures had been reluctant to invest in technical education. By 1886, there were 110 schools of engineering.^[22]

Promoting Universal Efficient Interconnection via Regulation

To meet the needs of a rapidly expanding and increasingly complex industrial economy, large-scale, integrated networks, as well as a more activist federal policy, were called for. Although new technologies—such as the railroads, the telegraph, and the telephone—emerged to accommodate the needs of an industrial economy, acting on its own, the market could neither generate the financing nor promote the economic coordination necessary for their ubiquitous deployment and diffusion.

The public was also much less inclined to provide unquestioned support for business. Middle class reformers describing themselves as “progressives” opposed the

concentration of economic power. They called on government to control corporate abuses and reduce the negative impacts of rapid industrialization and urbanization. Farmers and others living in the West accused big business, especially the oil companies and railroads, of price gouging. In addition, labor—emerging as a movement in its own right—became increasingly critical of business.

This decline in the support of business reflected the economic uncertainty of the time. The exceptional growth that had characterized the period from the end of the Civil War to the turn of the century was accompanied by fierce competition. Growth in economic activity gave rise to overproduction, which led in turn to three severe economic downturns (from 1873 to 1877, 1885 to 1887, and 1893 to 1897). In this economic climate, the rate of business failure was exceedingly high. To survive, businesses employed whatever measures they could, including cartels and other pooling arrangements, predatory pricing, or direct control through horizontal mergers.^[23]

Seeking a more stable economic environment, business and political reformers alike called for a new transportation and communication policy regime. In developing a new strategy, the federal government drew on the concept of a public service company, which in England dated back to the fourteenth century.^[24] As the term was applied in the United States, public service companies were those whose products or services were considered essential to a community's well-being and way of life. Given their importance, these companies were required to provide services to everyone on a nondiscriminatory basis, while government was called on to assure compliance.

United States policy makers adopted this model for regulating the rapidly growing and increasingly powerful transportation and communication industries, which fit neatly into its framework. Embedded first in the Interstate Commerce Act of 1887 and later in the Communications Act of 1934, this regulatory solution allowed businesses to operate in the private sector while providing some social control over the single-mindedness of the market. Facilitating inter- and intraindustry coordination—even, when necessary, at the expense of monopoly—it promoted network interoperability, economic viability, and universal service at the time in which the communication infrastructure was becoming ever more important to the American way of life.

The railroads and the interstate commerce commission

Because of its high fixed costs, fluctuating demand, scale of operations, and need for coordination and specialized engineering skills, the railroad industry was from its inception prone to exceptionally high transaction costs. After numerous failed efforts by companies to jointly develop standards, coordinate operations, stabilize prices, and rationalize the industry, railroad industry magnates

began to merge their operations, frenetically buying up their customers and competitors. In their efforts to establish greater market stability, the railroad companies alternated their strategies between two extremes—cutthroat competition or pooling and price fixing. Because the economic stakes and uncertainties were so high, neither strategy proved successful. Cutthroat competition was ruinous for all, but cooperative agreements were untenable without some mechanism for enforcement.^[25]

Railroad companies' competitive machinations quickly spilled over into the political arena, giving rise to demands for reform. Most vocal in calling for reform were small business owners and farmers in the West who had been forced by the railroad companies to subsidize the discounted rates offered to the large eastern industrialists. An increasingly disgruntled and activist labor force soon joined these voices.

Under mounting pressure, the government established the Interstate Commerce Commission in 1887 to regulate the railroads to assure just and reasonable rates.

Regulating the telegraph

Requiring large-scale technologies and national interconnection, the telegraph—like the railroads—posed questions about the industry's structure and its relationship to government. Although the federal government had provided \$30,000 for the construction of the first telegraph lines in the United States, it was reluctant to play a more active role. The post office, already burdened by deficits, was disinclined to assume responsibility for the Washington D.C./Baltimore line, which appeared to have only limited commercial value.

Absent government involvement, telegraph firms strung wires between towns of any commercial consequence. With dozens of companies competing, however, customers were wont to secure rapid, reliable transmission. Under these circumstances, businesses preferred dealing with a few reliable national firms. Happy to oblige, Western Union absorbed its competitors, obtaining a near monopoly.^[26] Concerned lest a single national telegraph abuse its power, the government opted once again for a common carrier system. In 1866, Congress granted monopoly privileges to Western Union in return for its promise to provide "services like a common carrier, namely to all comers without discrimination." In 1893, the U.S. Supreme Court ratified the telegraph's status as a common carrier, and Congress legislated it in the Communications Act of 1934.

Regulating the telephone

The history of the telephone industry followed a similar pattern. By 1902, 451 out of 1,200 cities had two or more phone companies. As with the telegraph, business users found competition burdensome. At the same time, cities and states increasingly expected telephone providers to

operate for the public's convenience. Responding to a serious movement for government ownership, AT&T mounted a public campaign, arguing that telephony was a natural monopoly and regulation was the only way to reduce "wasteful competition" and assure universal service. As Theodore Vail, AT&T's chief operating officer, described his vision of the telephone industry in the annual report of 1910,

The position of the Bell system is well known.... The telephone system should be universal, interdependent, and interconnected, affording opportunity for any other subscriber of any other exchange...annihilating time or distance by use of electrical transmission.

Congress was amenable. It gave the Interstate Commerce Commission regulatory authority over the Bell system in 1910 and shifted jurisdiction to the Federal Communications Commission (FCC) in 1934 with the passage of the Communications Act.

Managing Cultural Concerns

Electronically based media presented government with a novel dilemma, which threatened to pit public concerns about media impacts against the constitutional guarantee of First Amendment rights. Early in American history, political thinkers and policy makers had looked to the newspapers to enlighten and empower the public. With the advent of popular electronic media such as film and broadcasting, however, concerns about cultural values and negative impacts came to the fore.

Electronic media were considered different in a number of respects. Capable of reaching a mass audience on a simultaneous basis, film, radio, and television broadcasting appeared inordinately influential. At the same time, their commercial nature and dependence on advertising raised concerns lest these media demean culture and stifle political discussion by appealing to humanity's lowest common denominator. Because these media transmitted content directly into the home, listeners and viewers seemed powerless in defending against unsolicited messages.

As Secretary of Commerce Herbert Hoover described the situation with respect to radio:

Radio has passed from the field of an adventure to that of a public utility. Nor among the utilities is there one whose activities may yet come more closely to the life of each and every one of our citizens, nor which holds out greater possibilities of future influence, nor which is of more potential public concern. Here is an agency that has reached deep into family life. We can protect the home by preventing the entry of printed matter destructive to its ideals but we must double guard the radio.^[27]

The fear that mass media would unduly influence the public was fueled by their use of propaganda during the

Second World War. Although propaganda had proved critical to the military effort, it appeared more sinister in the postwar period. People were concerned lest the media's manipulative techniques be used against them. In fact, in his best-selling book *The Hidden Persuaders*, Vance Packard had accused advertisers of cynically using propaganda to manipulate American consumers.^[28]

Postwar scholars and social critics reinforced these worries. Bemoaning the public's reaction to the media's "pseudo-environments," Walter Lippman called for the replacement of journalists by social scientists who, he claimed, would organize and interpret events more objectively.^[29] At the same time, social psychologists—such as David Riesman in his book *The Lonely Crowd*—began to link the mass media and mass opinion to negative social and political outcomes.^[9]

In addressing these concerns about content, the government was limited by the First Amendment. By leveraging its ownership of the public airways and allocating them according to "public interest criteria," however, the government was able to pursue a number of content-related policy goals within the bounds of the Constitution.

Voluntary censorship

Voluntary private censorship was the preferred means of influencing media content. With voluntary censorship, not only could the government achieve its public interest goals; industrywide standards also allowed media providers to appease the public without being competitively disadvantaged. Responding to its critics and the threat of government intervention, the motion picture industry was the first media provider to set voluntary content standards through the National Board of Censorship of Motion Pictures. Movie critics were concerned lest films lead to the vulgarization of daily life. As Michael M. Davis of the Russell Sage Foundation argued in 1912, "recreation within the modern city has become a matter of public concern; laissez faire, in recreation as in industry, can no longer be the policy of the state." Responding, local governments began to employ ordinances, such as those pertaining to Sunday blue laws, safety, and community morals, to censor content and when deemed necessary to shut theaters down (p. 44).^[9]

When faced with the prospect of regulation, broadcasters followed suit. Thus, as soon as the Federal Radio Commission made its intention known to scrutinize broadcast content in allocating renewal license, the National Association of Broadcasters (NAB) wasted no time in developing an industry code of standards. Similarly, the first NAB television code was adopted in 1951 shortly after Senator William Benton threatened to establish a national citizen's advisory board that would oversee programming and submit an annual report to Congress assessing the extent to which broadcasting served the public interest.^[30]

Although voluntary in nature private sector content standards have proved problematic. Indeed, over the years broadcasters have often been chastised for “self-censorship.” Critics claim that because broadcasters must appeal to a broad advertising base, they avoid controversy by diluting their programming. Voluntary content standards have also been challenged on both antitrust and First Amendment grounds. In 1979, for example, the court—in *Writers Guild of America, West, v. ABC*—questioned whether the government had unduly pressed the NAB to voluntarily agree to a one-hour evening segment of programming for “family viewing.” When the Justice Department challenged the code on antitrust grounds, the NAB abandoned its standards altogether.^[31]

Spectrum licensing

When voluntary standards have not sufficed, the government has leveraged its ownership of the public airwaves to force broadcasters to operate stations in accordance with “the public interest, convenience, and necessity,” as provided for in the Communications Act of 1934. Such a proactive regulatory structure was considered justified, given the chaotic situation in the early days of broadcasting and the industry’s reliance on a limited public spectrum. Policy makers and industry representatives alike believed that without some means of allocating the public spectrum the airwaves would become so overcrowded and interference so rife broadcasting would be precluded. Thus it was, for example, that broadcasters aligned in 1922 to form the NAB, with the express purpose of promoting radio regulation. Commenting on the public mood of the time, Secretary of Commerce Herbert Hoover described the situation as “one of the few instances that I know of when the whole country is earnestly praying for more regulation.”^[32]

Accordingly, broadcasters have been required to provide among other things local content, news and public affairs programming (with adequate and unbiased coverage given to controversial issues), and educational fare for children, as well as equal time for the use of stations by political candidates. While restraining the FCC from actions considered excessive, the courts have generally sanctioned the broadcast regulatory regime on the grounds that spectrum—being scarce—needed to be rationed.

Setting the tone for the future in the landmark case *Red Lion Broadcasting Co. v. FCC*, the Supreme Court considered the constitutionality of the Fairness Doctrine:

Broadcast frequencies constitute a scarce resource whose use could be regulated and rationalized only by Government. Without Government control, the medium would be of little use because of the cacophony of competing voices, none of which could be clearly and predictably heard. [Thus] Every licensee who is fortunate in obtaining

a license is assumed to operate in the public interest and has assumed the obligation of presenting important public questions fairly and without bias.^[48]

Must carry rules

The availability of spectrum was not an issue, however, when the FCC issued the *Cable Television Report and Order* in 1972, laying out comprehensive rules for the cable industry. In the late 1960s, small cable operators were joined by larger systems that aimed to greatly expand their markets. In response, broadcasters pressured Congress to restrict cable. The FCC reluctantly issued a series of rulings that had the cumulative effect of restricting cable development.

Under the *Cable Television Report and Order* in 1972, cable systems were freed to expand to the top 100 markets, but as a quid pro quo they were subject to “must carry rules” requiring operators to provide channels for educational institutions, municipal governments, and public access. Moreover, to assure the viability of free television and the availability of community programming, cable operators had to carry local broadcasting companies’ signals.

Cable posed a potential threat to the FCC’s vision of a localized television system, because if cable operators began to import distant signals into local markets, they might drive local stations out of business. This danger only became apparent as cable began to grow and expand into major markets.

Public broadcasting

Although public interest regulation helped to limit some of the negative aspects of broadcasting, it did little to foster high-quality content. For such purposes, a more direct and concerted effort was required. In the United States, in which government ownership of the media was not an option, a hybrid system of public broadcasting was devised. To preserve the system’s integrity, Congress devised a decentralized structure, which placed the individual stations at its center.^[34] In addition, it set up the Corporation for Public Broadcasting (CPB) with the dual purpose of developing a nationwide broadcasting system and acting as a buffer between broadcasters and government. The corporation itself was prohibited from owning and operating any broadcast or cable organization, interconnection system or facility, program production house, or public telecom organization; nor could CPB produce, schedule, or distribute programs to the public.^[35] At the same time, however, Congress maintained tight reigns on funding through the annual appropriations process.

Communications for National Security and Defense

Communication goals have evolved not only in response to changing social and economic needs. At times, they

have been radically reoriented to meet the exigencies of war. In most countries, reordering priorities for defense purposes was relatively easy. Owned and operated by the government, these companies were designed to serve the state's needs. In contrast, in the United States, in which the First Amendment precludes government interference, establishing a communication system to support national defense has been more problematic. To minimize the tension between defense and other communication-related goals, the government has involved itself in communications-related activities only on a sporadic and/or indirect basis.

This pattern was set at the time of the U.S. involvement in the First World War. In the autumn of 1918, for example, Congress directed the postmaster general to assume operation of the nation's telephone and telegraph companies. Under the post office's management, the telegraph and telephone systems worked smoothly, although rates increased. Shortly after the government took control, however, the war ended and Congress restored the wires to the private sector.^[36]

World War II and the Cold War that followed led to a much more compelling and pervasive preoccupation about national security. Although the government consistently turned to the private sector to promote its defense-related goals, an increased emphasis on national defense and security sometimes collided with those of free speech and a free market.

Limits on speech

Speech first became an issue during wartime with the passage of state and federal sedition laws, which were premised on the notion that speech could undermine the war effort. Early on, convictions were common because courts applied a "reasonable tendency" test. Later, justices began to fashion a standard that was more protective of free speech—the "clear and present danger" test, which cut off speech only if it posed an imminent and substantial danger to some vital interest.^[37] On rare occasions during peacetime, the government sought to enjoin the press from publishing information whose disclosure might undermine national security.

The government's attempt to invoke national security to stop publication of the *Pentagon Papers* failed when the Supreme Court, acknowledging that national security was sufficient reason to impose prior restraint on publication, ruled that in this instance the government had failed to show that anything more than embarrassment would result. In effect, the door was left ajar. Where atomic secrets have been involved, the government has been better positioned to justify a prior restraint. In 1970, for example, the government obtained a district court injunction that stopped publication of an article by *The Progressive* magazine, which depicted the making of a hydrogen bomb.

Promoting defense technology

Communication and information technologies have generally been high on the list of technologies meriting government promotion. Recognizing the defense potential of radio, for example, the government played a critical role in its development. The U.S. Navy, in cooperation with AT&T, not only helped to develop the emerging technology, it also spearheaded the corporate–government alliance to consolidate and centralize radio during and after World War II. The Wilson administration's goal was to challenge British domination of international communication and to protect U.S. military and commercial interests. After failing to get Congress to pass legislation that would make wartime government control of wireless permanent, the administration pursued a different strategy. In 1919, British Marconi was the only company negotiating with General Electric to buy exclusive right to the Alexanderson alternator, a high-powered radio transmitter used for transoceanic work during the war. Through a series of delicate negotiations, the government stepped in and served as the midwife to the birth of the Radio Corporation of America. RCA, with GE as the major stockholder, bought out Marconi (which had been controlled by the British), thus assuring America a powerful position in world communication (p. 70).^[9]

The military's role in developing the computer and other advanced communication technologies was also critical, even if indirect and behind the scenes. The government not only subsidized the early research and development of satellites, computers, and semiconductor chips, it also used its procurement powers to assure that these industries had stable, guaranteed markets.^[38,39]

Securing the infrastructure

The government's ability to balance government and free market interests was greatly aided by the existence of a government-regulated telephone monopoly, which was renowned for quality and research in all communications fields. As the only company supplying end-to-end telecommunications service to the Defense Communication Agency, AT&T was directly involved in formulating national security telecommunications specifications and requirements and in making adequate provisions governing robustness, ubiquity, and restorability. Nonetheless, believing AT&T's centralized, hierarchical structure to be vulnerable to attack, government researchers at the Advanced Research Project Agency developed a packet-switched network based on a decentralized architecture. By 1971, the ARPAnet—precursor to the Internet—linked defense scientists and engineers at 16 university-based nodes. To ensure their seamless and transparent interconnection, the Defense Department also sponsored two key networking standards: the transmission control protocol (TCP) and the Internet protocol (IP).

TRANSITION TO A COMPETITIVE ENVIRONMENT

As this short history illustrates, despite periods of upheaval and change, the U.S. communication policy regime—like the Constitution in which it is grounded—has proven to be quite flexible and stable over time. Old rules survived even as new ones were added. Multiple goals coexisted—even when they competed with one another—because each goal was associated with a particular communication technology having unique technical characteristics and imperatives as well as its own set of industry players. Thus, for example, First Amendment goals have generally been associated with print technologies, whereas universal service goals have been more closely linked to telephony and the transportation infrastructure. If—as was sometimes the case—the boundaries among technologies began to blur, policy makers intervened to reinforce the lines of demarcation.

Today, however, achieving flexibility in this way is increasingly problematic. Not only have new technologies been developed that do not fit neatly into old categories; with the convergence of print, carrier, and broadcasting technologies, old categories themselves no longer apply.

In light of such convergence, pressures have mounted to create a more level playing field and to establish a uniform regulatory regime based on market competition. As early as 1962, for example, a number of regulatory economists began to question the public utility concept. Together their work—if it did not give rise to the new deregulatory climate—served at least to legitimate it. As Roger Noll has described:

Economists generally entered the study of regulation with the naïve view that regulatory institutions were set up for the purpose of rectifying market failures. Unfortunately, and almost without exception, the early empirical studies—those commencing in the late 1950s and continuing into the 1970s—found the effects of regulation correlated poorly with the stated goals of regulation. By the early 1970s, the overwhelming majority of economists had reached consensus on two points. First, economic regulation did not succeed in protecting consumers against monopolies and indeed often served to create monopolies out of workable competitive industries or to protect monopolies against new firms seeking to challenge their position. Second in circumstances where market failures were of enduring importance (such as environmental protection) traditional standard-setting regulation was usually a far less effective remedy than the use of markets and incentives.^[40]

At the same time regulators, impressed by the potential of new technology to reduce costs and increase capacity, were also willing to experiment with competition. As former FCC Commissioner Nicholas Johnson commented on the occasion of the FCC's decision to approve MCI's application to establish long-distance service:

On this occasion three Commissioners are urging a perpetuation of more Government regulation of business, and four want to experiment with the market forces of American free private enterprise as an alternative to regulation. No one has ever suggested that Government regulation is a panacea for men's ills. It is a last resort: a patchwork remedy for the failings and special cases of the marketplace....I am not satisfied with the job the FCC has been doing. And I am still looking, at this juncture, for ways to add a little salt and pepper of competition to the rather tasteless stew of regulatory protection that this commission and Bell have cooked up.^[41]

Equally important, the growing importance of telecommunications and media-related industries within the economy changed the way communications came to be conceived. Instead of being perceived as a means to an end, communication was viewed increasingly as a commodity much like any other, to be bought and sold in the marketplace. In the process, the public interest came to be measured not by the quality of social and economic life, but rather by the state of the media industry and consumer demand.^[42]

Tensions and discrepancies within the old system first manifested themselves in the case of cable—a hybrid technology—but it was not long before they emerged in more traditional arenas such as telephony and broadcasting. Early attempts to address these tensions within the old regulatory framework were short-lived.

Fitting Cable into the Regulatory Regime

The inherent tension in broadcast regulation—between First Amendment rights and the public interest standard—became increasingly apparent with the advent of cable television, which did not fit well in either category. With its multiplicity of channels, cable was, moreover, the first technology to defy the long-held belief in scarcity.

Cable was originally intended to enhance television signals in communities located in areas outside good broadcasting reception. At first, the FCC ignored CATV, viewing it as an auxiliary to broadcasting. Seeking to avoid the administrative burden of regulating another industry, the FCC pointed out that CATV was neither a common carrier (because the subscriber did not determine the nature of the signal being carried) nor a form of broadcasting (because signal transmission was completely by wire). Thus, what attention the FCC did pay to CATV in the early years was centered on possible interference or problems for the broadcast sector. For a history of the FCC and the regulation of cable see.^[43]

The situation changed in the late 1960s, however, when cable operators sought to expand their markets by importing broadcast signals. Under pressure from broadcasters, the FCC issued rulings curtailing cable growth. Then in 1972 the FCC reversed itself, allowing cable to expand on the condition that it provided community

programming and adhere to must carry rules. Two factors served to stimulate industry's growth. First, the rise of pay-cable services such as Home Box Office revealed an extensive latent demand for alternative programming. Second and more important in the long run, cable programming became linked to satellite. Communication satellites created reliable and economically feasible distribution networks, while the availability of new and specialized programming stimulated nationwide demand.

As cable's fortunes improved and programming became available, operators characterized the industry as analogous to newspapers rather than broadcasting.^[44] On this basis, they called for deregulation and full First Amendment rights (See, e.g., Shapiro).^[45] Because spectrum scarcity had been used to justify broadcast regulation, cable's multichannel capacity lent credibility to its demands. As characterized by Laurence Tribe:^[46]

The clear failure of the 'technological scarcity argument' as applied to cable television amounts to an invitation to reconsider the tension between the Supreme Court's radically divergent approaches to the print and electronic media. Indeed, since the scarcity argument makes little sense as a basis for distinguishing newspapers from television even in the late 1960s and early 1970s, such reconsideration seems long overdue.

Seeking to rectify the situation, Congress passed the Cable Communications Policy Act of 1984, deregulating the cable industry. Nevertheless, considerable confusion about the nature of cable was embodied in the act itself. Cities lost the authority to regulate subscribers' rates and much of their discretion over franchise renewal. The act also prohibited the regulation of cable as a common carrier or public utility. At the same time, however, cities were allowed to charge franchise fees and require public access channels and other kinds of programming. The outcome represented as a compromise between the cities, which wanted to continue to charge franchise fees, and the cable operators, who wanted to facilitate the franchise-renewal process, but the compromise sidestepped the issue of the First Amendment.

Thus, the issue of cable regulation, and its relationship to the First Amendment, did not disappear. In fact, given rising cable prices and increased concentration, Congress reregulated the industry in 1992 under the Cable Television Consumer Protection and Competition Act. The new law reinstated rules for common carriage and rate of return regulation. In addition, it prohibited exclusive franchise agreements between cable and municipalities as well as affiliations between cable programmers and cable operators.

Subsequent court cases also failed to resolve the question of how cable should be handled from a regulatory perspective. In fact, while acknowledging that scarcity was no longer a problem, the courts—in the cases of

Turner I, Turner II, and Denver Area—upheld the must carry rules.^[47] Looking at the cable industry's structure and noting Congress' concerns about over-the-air broadcasting, the Court departed from a traditional doctrinaire interpretation of the First Amendment. As one critic of the decision characterized it:

In *Denver Area Educational Telecommunications Inc. v. FCC*, the plurality assiduously managed not only to avoid defining the First Amendment status of cable within fairly well-established boundaries, but seemed to grope at a new ad hoc constitutional approach somewhere between intermediate and strict scrutiny.^[48]

Instead it argued that First Amendment cases must be decided on a case-by-case basis and with reference to the context involved. Only by looking at the context, said the Court, is it possible to balance the vendor's First Amendment rights to provide information against the user's First Amendment right to access it.^[49]

Tensions in the Telecom Regime

As in the case of cable, technology advances helped to undermine the long-standing common carrier regime. Given the convergence of information and communication technologies, there was no longer a clear distinction between what constituted a monopoly (and hence regulated) service and what constituted a competitive service to be provided in the market. Convergence also gave rise to a new network architecture, in which intelligence was dispersed. As a result, the network could more easily be unbundled, allowing users to purchase, and new providers to offer, separate portions of it. Barriers to entry were also reduced, given technology advances that increased performance but greatly reduced costs.

Economic developments also generated incentives for new entrants. As information came to play a greater and more strategic role in business, large users sought alternative ways to meet their telecommunication needs. In some cases they set up their own internal networks. In others, they simply bypassed the Bell system, purchasing services in lower-priced, unregulated markets. Equally important from a political perspective, business users joined forces with burgeoning new service providers to press for greater competition.

In light of these developments, policy makers were more receptive to the idea of competition. In 1959, the FCC took a first step toward breaking up the Bell system with its "above 890" decision. This decision liberalized the licensing of private microwave systems, allowing the newly created Microwave Communications, Inc. (MCI) to offer a new product—discount private line service. With the subsequent Carterphone decision in 1969, the FCC opened the customer-premises market. Finally, with its Execunet decisions in 1976 and 1978 requiring AT&T to

connect to MCI, the FCC struck a final blow to the 100-year-old AT&T monopoly.

In 1982, AT&T entered into a consent decree with the Justice Department, following a decade-long antitrust suit. A modified final judgement (MFJ) went into effect in 1984, clarifying and expanding the terms of the 1982 consent decree. The basic premise of this divestiture was that the Bell system's competitive markets should be separated from their noncompetitive markets to prevent unfair monopoly abuses. Accordingly, AT&T was broken into eight companies, the reorganized AT&T and several regional holding companies. The Bell system's 22 local telephone companies were separated from the parent company, and grouped into seven regional Bell holding companies (RBOCs), which were prohibited from the three lines of businesses deemed competitive and therefore assigned to AT&T. These were designing and manufacturing telecommunications networks and customer premises equipment, providing information services (such as electronic yellow pages), and providing long-distance service.

While the MFJ settled the Department of Justice's antitrust suit, it could not resolve the tension between the goals of efficiency and competition that are inherent in any telecom regulatory policy. As Noll has emphasized,

Pending regulatory issues reflect an enduring characteristic of telecommunications policy; neither the pricing nor the structural issue has even been or is likely to be resolved. The telecommunications system is not, and never was, broken. Rather, its underlying technical and economic characteristics create an enduring policy dilemma. One can regulate prices and structure to encourage maximum feasible competition, or to promote an integrated monopoly. What is infeasible is a 'neutral' formulaic policy regarding prices and structure that will assure the right mix of monopoly and competition. The current policy agenda continues the futile search for better regulatory instruments, and also includes rear guard actions by the people who lost the last time around—who are not, and probably cannot be convinced that deregulated competition is the best policy (p. 233).^[39]

No sooner had the parties agreed to the MFJ when these issues re-emerged in the waiver process, the triennial review, and in public policy debates about how open the telephone network should be.

In this context, the FCC—eager to promote competition in the local exchange—devised a plan allowing RBOCs to enter new markets in exchange for opening their networks. To assure compliance, the local telephone companies had to make their basic network services (referred to as basic service elements) available in a uniform and nondiscriminatory fashion. Subsequently, in 1987 the ban against providing information services was amended, and then in 1991—following continued challenges by the RBOCs in court—all information service restrictions were eliminated. In an effort to promote innovation and greater competition

in the cable market, the FCC also established video dial tone rules that allowed local exchange companies to provide video services on a common carrier platform. None of the telephone companies saw it in their interest to pursue this option, however. Like cable companies, they wanted to be released from the yoke of regulation and to be brought within the First Amendment regime.

Efforts to Deregulate Broadcasting

Broadcasting had long been a target for deregulation. Challenges to the broadcast regulatory framework first got underway during President Carter's administration, when FCC chairman Charles Ferris initiated a deregulatory policy much in keeping with the administration's overall policy on deregulation. These efforts only achieved their full momentum, however, during the Reagan years, when Chairmen Mark Fowler and Dennis Patrick set out to revamp the entire regulatory structure, substituting marketplace constraints in place of regulatory controls.^[50]

Citing past FCC failures, opponents claimed that regulation was inappropriate for achieving broadcast policy goals, and at times counterproductive, as in the case of the FCC's efforts to constrain cable TV. Regulatory critics argued, moreover, that with the development of high-capacity cable scarcity no longer justified government intervention. Deregulation, they argued, was also more in keeping with First Amendment principles. Industry players echoed this claim, although they were much more pragmatic than principled in their enthusiasm, generally favoring only those measures that were economically advantageous.

To bring about a more competitive media market, the FCC began to undo the elaborate structure of rules and regulations that had been set up over the years.^[51] Thus the FCC eliminated most advertising constraints as well as rules requiring broadcasters to devote a given amount of time to different classes of nonentertainment programming—even fair use. At the same time, the agency relaxed a number of ownership rules.

Despite these changes, tensions persisted in broadcasting. Although broadcasters favored deregulation, they wanted to maintain the benefits, particularly access to free spectrum and the congressional favor that the public interest regime had afforded. Moreover, broadcasters could anticipate an even greater need for congressional support in the future, given the emergence of new technologies competing for spectrum. Relying heavily on broadcasters for financial and political advantages, members of Congress were also unwilling to unravel the public interest regime, thus there occurred the anomalous situation in which the FCC refused to enforce the Fairness Doctrine while key members of Congress championed it and promised to codify it at the first opportunity. As described by Le Duc, "At the moment, then, the broadcast deregulation has reached an impasse, Congress refuses to release the

commission from its obligation to regulate American broadcast service, while the agency refuses to discharge this obligation with any more diligence or dedication than absolutely required by law.”^[52]

THE TELECOMMUNICATIONS ACT OF 1996

Despite these tensions and mounting pressure for reform, efforts to fundamentally restructure the regulatory regime lacked an overriding vision and a set of guiding principles. Without such vision, reformers were unable to generate a broad political consensus in support of their efforts.^[53] As a result, reform proposals typically fell victim to the hassling and squabbles of the legislative process and to Congress’ reluctance to offend powerful interests. In the absence of legislative guidelines and in the face of rapid technology advance, decisions about communication policy were often regulated to the courts. It was only when Vice-President Gore successfully captured the unique potential of the Internet in his vision of a national information infrastructure (NII) that a groundswell for reform emerged.

The Internet Vision

The rapid rise of the Internet provided a unique opportunity as well as the necessary momentum to generate a new vision of communication policy for the future. Providing a digital platform for all forms of electronic communication, the Internet defied the technology and industry boundaries that had sustained three distinct regulatory regimes.

From a regulatory perspective, the most promising feature of the Internet was its open architecture and decentralized organizational structure. Viewed in these terms, the Internet could be best described as a very loosely coupled “network of networks.” Given common interfaces, networks on the Internet can be interconnected while they are at the same time operated and managed independently of one another, thus control is decentralized and horizontally structured. Given a common suite of protocols, interconnection is seamless, allowing traffic to flow easily and to be exchanged across disparate networks and applications. As described by the Computer Science and Telecommunications Board:

Most users of the Internet see it through experiencing its applications, most obviously the World Wide Web, but also the ubiquitous electronic mail, remote login, file transfer, and other applications. But from the perspective of Internet designers, the essence of the Internet is not the applications, but rather the more basic functionality that makes the Internet a suitable place for those applications to operate. The structure of the Internet reflects two major design objectives: first, to support as many sorts of applications as possible, and second, to operate over as many sorts of network infrastructures as possible.^[54]

According to this vision, in an Internet environment public policy goals could be achieved with minimal government interference (for this perspective, see McKnight).^[55] For example, with nonpropriety, widely available interfaces, interconnection and access would not be a problem, thus fostering competition and innovation. Moreover, diffusion would be rapid and widespread, given low costs and positive externalities resulting from shared provisioning and usage. Consumers also would be empowered. Because interoperability allows applications and intelligence to be unbundled and extended outward, individuals could control the provisioning and use of networks and applications.

When the Democrats came to power, Vice-President Gore incorporated this vision in the administration’s NII initiative, which was launched in September 1993. The initiative emphasized the hope of achieving broad-based social, economic, and political goals in the context of a competitive environment. The key principles included the need to: (1) encourage private investment, (2) promote and protect competition, (3) provide for open access to networks, (4) avoid the creation of a society of haves and have-nots, and (5) encourage network flexibility.^[56]

The NII initiative was intended not only to foster an open network architecture but also to provide a more open communication policy-making process. To support this process, the president established the Advisory Council on the National Information Infrastructure, which comprised 37 members—two-thirds from business and the remainder from the nonprofit sector, organized labor, and state and local government.^[57] Even more unprecedented, the government took advantage of the Internet itself to include the broader public in the debate.

The NII initiative served as a catalyst to bring together public interest groups and citizens who shared a common vision of a public-oriented infrastructure. In October 1993, they created the Telecommunications Round Table, a peak organization to lobby on behalf of their goals. Inspired by the Internet and the range of possibilities that it allowed, they called for a NII that would provide support for universal access, two-way communication, active and participatory public debate, competition and diversity of information, an equitable workplace, privacy protection, network security, and democratic policy making. While favoring market solutions, the coalition wanted proof of competition and consumer choice, as well as assurances that there would be no redlining, before government took steps to deregulate the industry. Equally important, they advocated that 20% of the bandwidth of the NII be reserved for public use as a public “right of way” (p. 328).^[57]

The national debate on the NII engendered enough momentum to break the congressional logjam, which had dashed all previous efforts at reform. Once the center of action shifted to Congress, however, the public interest groups generating this momentum had very little impact on the final legislative outcome.

The Missed Opportunity

Although the Communications Act of 1996 was generally welcomed as being long overdue, none of the parties to it was totally satisfied with the results. Arrived at through intense congressional lobbying, the law that was eventually adopted represented a carefully crafted compromise rather than a blueprint for the future. Concerned primarily that technology advance deprive them of some strategic competitive advantage, most key players ultimately preferred retrenchment to reform. A major opportunity was lost as a result.

Defeat in the 103rd Congress

In 1993, three bills relating to industry restructuring were introduced in Congress: the Brooks–Dingell bill (H.R. 3626), the Markey–Fields bill (H.R. 3636), and a companion bill in the Senate, the Hollings–Danforth bill (S 1822). Focusing primarily on industry deregulation, the Brooks–Dingell bill was the most narrow and permissive. As originally written, the bill called for a three-stage process of entry by which the local telephone companies could enter into long-distance services. Under pressure from the RBOCs, however the bill was modified to allow local telephone companies to seek authorization to enter long-distance from the Justice Department and the FCC on the same day the law took effect.

Strongly influenced by both the administration and increasingly vocal public interest coalition, the Markey–Fields bill went much further. Stressing the importance of an open network, the bill had much more stringent conditions for telephone company entry into other markets. According to the bill, local exchange carriers could enter other markets, but only after they had sufficiently opened up the local loop to competition. Telephone companies were also authorized to provide video services, but on a common carrier basis. In addition, the bill required the FCC to study the costs and benefits of the telephone companies providing an open network platform. At the same time, the Markey bill mandated open interfaces for set-top boxes and outlined steps to achieve social and economic goals, such as the provision of services to schools, health care centers, and libraries. In the summer of 1994, the House passed a somewhat watered-down version of H.R. 3636 by an overwhelming vote of 420 to 4, while the Senate moved to take up the companion bill, S 1822.

As fate would have it, a number of events intervened to bring Senate passage to an abrupt halt. The coalition supporting the legislation began to disintegrate in committee when Senator Daniel Inouye amended it, attaching S. 2195, which required carriers to allocate up to 20% of their capacity to noncommercial information suppliers in exchange for using public rights of way. This amendment was strongly opposed by industry players, who

successfully lobbied to reduce reserved bandwidth to 5%. The public interest coalition was similarly riled when Senator James Exxon introduced an amendment requiring the FCC to monitor and censor the Internet for pornographic materials. The final blow to the legislation, however, came when the RBOCs withdrew their support, protesting a provision that denied them access to competitive markets absent “actual and demonstrable” facilities-based competition. Unwilling to compromise on this point and faced with increasing Republican opposition, Senator Hollings, chairman of the Senate Commerce Committee and sponsor of the bill, allowed it to die in committee.^[57]

Retreat in the 104th Congress

In the November 1994 elections, Republicans returned to Congress with a mandate calling for deregulation. In keeping with the mood of the country, the leadership wanted to take immediate steps to deregulate the cable industry and greatly relax the limits on broadcast station ownership. Disagreements among industry players and concerns about a presidential veto made them more cautious,^[58] however. Although most members of industry were staunch supporters of deregulation and greater competition, they strongly disagreed about how best to achieve these goals. Long-distance carriers and cable operators, for example, called for more stringent prohibitions on local phone companies, while the RBOCs argued that competition was being impeded by MFJ restrictions. Broadcasters in turn contended that for competition to survive they needed free spectrum.

Faced with such difficult choices, the Republicans looked to industry to help them write reform legislation. With this objective in mind, they invited top industry CEOs to Washington to find out precisely what they wanted to incorporate in a bill.^[58] Hustling and jockeying for advantage continued right up to the end of the congressional debate. In the last six months before passage, for example, the top three long-distance companies contributed \$2.1 million in political campaign funds to member of Congress, while the seven regional Bells gave \$2.3 million.^[59] Not surprisingly in light of the outcome, the RBOCs favored the Republicans with their contributions, the long-distance carriers the Democrats. As reported in *Business Week*, changes in political fortunes had a significant impact on the flow of campaign funds. When the Democrats controlled the Congress, the money from political action committees was evenly divided between parties. In contrast, after the elections, the Republicans received \$1,267,122 while the Democrats received only \$473,289. Similarly, Congressmen who had the greatest political leverage in the telecom debate—such as Senator Larry Pressler, chairman of the Senate Commerce Committee—received the larger shares.”^[60]

The Legislative Outcome: Winners and Losers

Despite congressional gridlock over the budget, Republicans and Democrats joined together to pass the telecommunications reform legislation in early February 1996 by a vote of 414 to 16 in the House, and 91 to 5 in the Senate. On February 8, President Clinton, having originally threatened to veto the bill for being too lax, signed it into law. The stated purpose of the new legislation was to promote deregulation and competition. Hailed as a major step forward, the reform bill was essentially a well-honed bipartisan political compromise, providing some concessions to just about all. Sorely missing from the law, however, was an overriding vision of the role of communications in society and a clear set of principles linking deregulation and competition to a larger set of social and economic goals.

The stakeholder group that could perhaps be most pleased with the outcome was the RBOCs. Eager to enter the competitive fray, the RBOCs boycotted the previous Democratic-sponsored legislation on the grounds that it was too restrictive. The Republic legislation went much further in meeting their needs. According to the law, local telephone companies no longer had to prove the actual existence of facilities-based competition before entering competitive markets. Instead, they only need to gain approval of the FCC and state regulators based on a somewhat vague set of criteria outlined in the legislation.

For cable companies, there was also much to boast about. Four years previously, the FCC had ordered them to cut their rates by up to 17%. Under the 1996 act, all cable rates were to be deregulated after 3 years. In small communities, regulation ended immediately. With greater cash flow, cable companies could compete more easily in telephone company markets, and some companies were already upgrading their systems to provide phone service as well as consolidating their businesses to establish a better geographic fit with the telephone company markets.^[60]

The fate of the broadcasters under the new law was less certain. On the positive side, the law relaxed the previous cross-ownership rules, allowing broadcasters to own as many stations as they wanted as long as they did not exceed 35% of the U.S. market. Broadcasters failed, however, to eliminate a legislative provision requiring them to equip television sets with devices to block violent or sexual programs. Nor did broadcaster receive a clear mandate for free spectrum, as they had wished. Last-minute opposition from Senator Dole led to the postponement of this decision.

Nor did the long-distance companies fare as well as they had hoped. From their point of view, the longer RBOCs could be restrained from providing long-distance services the better. Given the status quo, long-distance carriers could gradually gain access to local exchange markets while local operating companies would still be

precluded from entering long-distance markets. The new legislation, which provided less stringent criteria for determining competition in the local loop, was thus generally viewed as a major setback.^[61] On the other hand, with the opening of the local loop to competition, long-distance carriers gained an opportunity not only to enter this lucrative market but also to bypass local exchange carriers by providing end-to-end services.

Society at large was perhaps the real loser in telecom reform. The primary focus of the bill was limited to deregulation and competition. Even when measured solely in terms of this narrow set of goals, however, the new legislation was sorely lacking. In contrast to the Markey bill, which had sought to promote open, two-way access, the Telecommunications Act eliminated most of the explicit requirements for interconnection and open interfaces. Instead of addressing the issue of competition head-on, it postponed the debate, delegating the thorny problems entailed in determining what constitutes "competition" to the FCC and the Department of Justice.^[62] Thus, for example, the law required the FCC to write no fewer than 80 rules determining how the transition to competition would take place and how the costs and benefits among industry players would be distributed.^[63,64]

Social considerations were not totally absent from the new legislation. For example, the act mandated the delivery of advanced telecommunications services to rural schools, libraries, and health care facilities at rates that are discounted to assure affordable access and use of such services. While reiterating the goal of universal service, however, the act charted a new course for achieving it. In contrast to earlier efforts, which relied almost exclusively on price averaging and other subsidies, the new legislation sought to achieve the goal of universal service—"to the extent technically feasible and economically reasonable"—in the context of a competitive market environment. The act also called for restrictions on content. It required television equipment providers to embed technological filtering devices—V-chips—into all new television sets, and Internet providers to monitor and censor content on the Web in order to prevent juveniles from accessing pornography.

The passage of telecom reform legislation in the United States was heralded as a major step forward in bringing communication policy into line with technology advances. Amidst the high-minded congratulatory statements and general sighs of relief, a few dissident voices could be heard. Focusing on the lack of competitive safeguards, these skeptics were concerned lest the law provide the means and incentives for the communications industry to reintegrate itself along vertical lines. Perhaps the most disturbing and prescient in this regard was the assessment of Judge Harold H. Green, who had overseen the 1984 consent decree governing the breakup of AT&T. As he confided

I'm a little concerned [whether] there are sufficient safeguards against the kinds of mergers and acquisitions that might give some small group of companies or individuals a strong hold over U.S. markets... I'd hate to see the AT&T monopoly be reconstituted in some form. It would be like I'd wasted the past 18 years.^[65]

Recent events and speculations about the future suggest that Judge Green's concerns were not without foundation.

COMPETITION IN RETROSPECT

The 1996 Telecom Act aimed to achieve a level playing field among industry players so that the market rather than government might effectively set the basis for interconnection among competing providers. The law, however, has proven much easier to write than to implement. Instead of promoting competition among communication services as was intended, it has led instead to a rash of mergers and the industry's reintegration. Equally discouraging, the promise of new, interindustry competition has dwindled as providers have begun to fully comprehend the costs and risks entailed in invading each other's markets.^[66] Not surprisingly under the circumstances, many consumers are now paying more for their phone and cable services than they did prior to the Act.^[67,68]

Nor has the Communications Act led to the deregulation of the communications industry or the demise of the FCC as so many of its proponents had hoped. To the contrary, in its effort to establish competition, the FCC had found it necessary to "reregulate," thus it had become more embroiled than ever in creating an elaborate set of detailed prescriptions to govern competition among the converging communication industries.^[69]

The problems entailed in implementing the 1996 act have been exacerbated not only by the high stakes involved and the complex and controversial nature of the issues, but also by the fact that the act itself left so much unresolved. To fulfill its mission, for example, the FCC was charged with carrying out three interrelated tasks: setting access charges, establishing the rule for interconnection, and establishing a mechanism for meeting universal service requirements. To meet the legislative requirement for nondiscriminatory access and pricing, in each case the FCC had to establish a means of determining real costs. The bane of all past regulatory proceedings, determining costs is anything but an exact science, and thus it has always been done in a somewhat arbitrary fashion. The problem of pricing is especially challenging in the case of universal service, given both the historical ties between pricing and universal service and the inherent tension between competition and universal service goals.

Given the uncertainties entailed in working out these issues, the FCC encountered political maneuverings and judicial litigation at every turn.^[70] No sooner had the Act

been passed, for example, when AT&T petitioned the FCC to bar the Bell companies from sharing market data with their out-of-region long-distance companies. Ameritech complained that Time-Warner's Home Box Office had refused voice and video on the Internet, competitive access providers complained that the RBOCs were holding up negotiations on access charges, and the Bell Companies contended that their competitors were using the regulatory process to block their entry into the long-distance market.^[63]

Disappointed by the FCC's performance, many have chastised the agency for overstepping its authority. Challenging the FCC's carrier interconnection order in court, for example, the states have claimed that the FCC lacks the authority to establish interim proxy prices or to prescribe the pricing methodologies that they might use. Politicians have similarly gotten involved, threatening to pass legislation constraining the FCC's future actions. By far the most outspoken legislator has been Senator John McCain, chairman of the Senate Commerce Committee. Proposing legislation to limit the FCC's role in determining antitrust cases, McCain has criticized the FCC in the following terms:

a majority of this Commission places too little confidence in competition and way too much in regulation. It tends to ignore the demands of making orderly, efficient, and fair decisions on the matters before it, preferring to pursue issues that are within neither their expertise nor their jurisdiction. It has shown a distressing tendency toward inconsistent and ad hoc decision-making, and toward picking and choosing which parts of the law it will choose to follow.^[71]

Market realities have also served to undermine the basic assumptions underlying the telecom act. Thus, for example, the act was based on the premise that the local loop was the only remaining network bottleneck. Today, however, with convergence and the development of Internet-based e-commerce, new bottlenecks have appeared. By integrating infrastructure services and applications, providers can benefit not only from economies of scale and scope, but also from the many positive externalities associated with networked technologies. Equally important, integrated networks command higher service prices because businesses need a seamless networking platform to link their operations. In addition, by offering an integrated platform, providers can gain a first-mover advantage using the network as a barrier to entry. Offering a wide range of business services, they can also position themselves best to collect and make optimal use of transactional data. Perhaps the best example continues to be Microsoft. Building upon the Internet, Microsoft has pieced together an entire suite of business applications, ranging from accounting to procurement.^[72]

Not surprisingly, network providers are scurrying to take advantage of these opportunities. Mergers and

acquisitions in information technology, communication, and media industries jumped 97% in 1997, to \$488 billion.^[73] Nor are Internet companies immune to these developments. In fact, given the lack of barriers to market entry, they are far more inclined to engage in mergers and acquisitions than established lower tech companies. As noted by one consulting firm, for the top 25 Internet companies, the average number of years before significant merger and acquisition activity take place is 6 years, as compared to 72 years for the top 50 U.S. companies.^[74]

This kind of integration will not be limited to large-scale infrastructure industries. As described by Hof

That could prove all the more true thanks to a rapidly emerging new class of net middlemen in a wide range of consumer and industrial markets. Online, with few limitations of time and geography, these new market makers can quickly generate a virtuous loop of buyers and sellers whose very presence attracts yet more buyers and sellers. For this reason, they're expected to dominate many industries from chemical suppliers to rolled steel.^[75]

Equally disturbing, where competition among providers has been rampant, it has had major unintended consequences. Thus, for example, network providers competing to be the first to fiber the country have generated a major glut in capacity. According to one source, these companies spent \$90 billion to lay approximately 39 million miles of fiber optic cable, of which only 2.6% is in use. Not surprisingly, many of these companies are verging on bankruptcy.^[76] The failure of these companies has taken a major toll on related industries, such as equipment manufacturers, venture capital, and the stock market.^[77] As the author notes:

Nearly every technology sector is linked with telecom: phone companies buy networking equipment to route Internet traffic, computer servers to offer Web hosting, software to dish up services, and fiber-optic gear to transport bits of information. Last year, spending on communications gear in the U.S. totaled \$124 billion, or 12% of business spending on equipment and software, according to the Commerce Department. Moreover, it accounted for one-quarter of the rise in business spending (p. 102).^[77]

The impact on the economy as a whole has yet to be measured. Estimates are that the recession generated by the collapse of the high-tech sector may not show signs of recovery till late 2002.

THE MARKET AS MEDIATOR

Much of the criticism of the Telecom Act of 1996 has been directed at the problems and side effects associated with its implementation. Over the long term, however, even more serious problems are likely to emerge, which

cannot be mediated within the framework of a competitive marketplace. The market works best to allocate resources when such resources are fungible; that is to say, when their values can be reduced to an equivalency or common denominator. Notwithstanding recent efforts by policy makers and industry stakeholders to characterize communication as a commodity, communication resources are highly problematic in this regard. For example, harking back to former Chairman Fowler's comparison of television and toasters, the present chairman of the FCC—William Powell—recently analogized the “digital divide” to the inequities associated with car buying.

One need only consider, for instance, the multifaceted nature of communication. Communication resources serve not only to meet consumer needs but also social and economic goals, which are much more difficult to measure adequately. Often the prices consumers are willing to pay for communication as a commodity diverge significantly from its social and economic value. Declining public support for the First Amendment provides a case in point. Notwithstanding the First Amendment's central role in the U.S. political system, a growing number of Americans now believe that the media has “too much freedom.” A recent survey conducted by the First Amendment Center found, for example, that 39% of the respondents believed the First Amendment “goes too far in guaranteeing rights, compared with slightly more than 22% last year.”^[79] Imagine how much less support there would be if consumers were called upon to pay for this freedom directly!

Compounding the problem of measurement is the fact that the value of communication is not constant. To the contrary, it is highly dependent on time and circumstances. As the survey of U.S. communication goals clearly illustrates, the priorities that policy makers give to certain communication goals and the way in which they seek to implement them are highly contingent on historical conditions and the social and economic problems that loom large at the time. Thus just as the Founding Fathers' reluctance to involve government in media affairs is traceable to their experiences during the Revolutionary War, so too the government's willingness to take a more proactive approach in the latter half of the 1800s can be attributed in part to the perceived need to heal the wounds left by the Civil War.

We should expect no less today. As our social and economic circumstances change, new tensions and problems that call for communication-related policy responses are likely to emerge. Certainly, for example, the rise of Web-based networked commerce will provide a major stimulus in this respect. With the convergence of networks, markets, and firms, issues that were at one time clearly situated in the realm of economic policy will become enmeshed with those in the realm of communications.^[79] Already a number of privacy issues are emerging that span these two realms. According to one recent industry-sponsored study, new privacy rules will cost industry

between \$9 billion to \$36 billion.^[80] Other likely candidates include issues related to taxation, licensing, property rights, and antitrust. Crosscutting issues in the area of defense and security are also likely, given the decentralized nature of the Internet and the ability to circumvent traditional lines of authority.

Globalization will also present new policy problems and choices. As the World Trade Organization conflict over audiovisual content makes clear, the task of valuing communication resources and making trade-offs among communication-related goals is greatly exacerbated by cross-cultural differences. Whereas U.S. policy makers consider audiovisual materials to be commodities that should be freely traded, Canadians and French policy makers view them as a cultural heritage to be protected and supported by government. Even when there is general agreement among countries with respect to goals, policy makers may interpret goals differently and/or choose alternative ways of implementing them. Whereas in the United States, for example, antitrust decisions are typically determined based on the potential harm to consumers, in Europe they are decided based on the potential harm to competitors.

In a capitalist society, the market mechanism will always play an important role in sorting out communication policy issues. As the history of U.S. communication policy makes clear, however, the market is only one among several policy tools that government can call upon to implement its goals. In fact, by employing different policy mechanisms in the past, the government was able to avoid making difficult trade-offs among competing goals; freedom of expression, ubiquitous infrastructure deployment, and education could all be accommodated. Conflicts among policy goals are likely to be even greater in the future, given the enhanced role of communications and information in all respects of life. To resolve emergent communication issues while taking full responsibility for our choices, we cannot simply defer to the marketplace. In addition to its role as "market maker," government must—depending on the circumstances—continue to play the supporting roles of broker, educator, regulatory, and promoter.

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Community Informatics

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Abstract

Community informatics is an emerging field focusing primarily on the interaction between local communities and information technologies and a more particular focus within social informatics. It is rooted in library practice, most notably the outreach that led to information and referral (I&R) services, as well as other innovative practices, for example the community technology center and the community network, aimed at strengthening communities faced with the digital era and its attendant disruptions and opportunities. Community informatics research and teaching is carried out at a growing number of library/information schools and elsewhere, as appropriate to this interdisciplinary endeavor.

Community informatics is an emerging field that encompasses both study and practice, although the focus here is on the former. Loader (2000, cited in Keeble)^[1] has described it as navigating the interaction between *transformation* as expressed in information technology and *continuity* as expressed in a local, historical community. This is a specification of Kling's definition of the field of social informatics, of which community informatics is a part: "the interdisciplinary study of the design, uses and consequences of information technologies that takes into account their interaction with institutional and cultural contexts."^[2] While social informatics historically most often concerned itself with business and government settings, community informatics looks at a third realm of social activity, the community. The concept of community and the tensions within that concept, set in the context of the nascent information society, are the basis for the core ideas of community informatics. Community informatics practitioners can be found in public libraries, community technology centers, community networks, and in an increasing range of community and economic development activities, employed in the private, public, or non-profit sectors. Researchers come from the disciplines of library and information science, communications, community development, computer science, informatics, sociology, urban and regional planning, and other fields. Fortunately, the discussion in this encyclopedia entry is informed by the fact that one author (Durrance) comes to community informatics through library practice and scholarship, and the other through community practice and study of the digitization of society, or social informatics (for example, see Williams).^[3] This allows the entry to trace multiple paths that have led to a single, if fuzzy-bounded, interdisciplinary field. By all accounts,

however, the starting point is very much the local, historical community.

COMMUNITY AS THE BASIS FOR COMMUNITY INFORMATICS

Most scholars have defined information technology very concretely as a particular, if evolving, set of digital tools and applications. But defining and understanding community is a challenge that has productively engaged more than a century of scholars. With the last major wave of U. S. migration from country to city, the fate of community within the metropolis occupied a generation of scholars, who themselves referenced the scholarship of those who had earlier grappled with the meaning of the European migration to the cities. The earlier discourse was very much driven by the ideas of Marx, Tönnies, and Durkheim, while the Chicago School (including among others Frazier, Mead, Park, and Wirth) was the most influential in the United States.

Community is variously defined in the social sciences and has been examined in many of its guises in community informatics literature. Most often, it refers to a population living within certain geographic boundaries (geographic community), and this gives rise to a local history and culture which is the context for whatever else happens. This definition is bolstered by the fact that planning and funds flows are channeled according to those boundaries and political battles are often fought within these jurisdictions. This can be seen during the 1980s when various cities implemented community technology projects. (For a comparison of four cities, see Guthrie).^[4]

But there can be communities within these geographic communities, as for instance the communities of interest that contended—homeless and their allies, and local business and real estate interests—within Santa Monica's Public Electronic Network.^[5] Or Bishop et al.'s^[6] work on a Web tool for local African-American women working on health issues. And there are communities with a particular geographic, historical origin that are now spread across large or small distances. Diasporic communities have taken to the Internet to maintain close ties with people far away, for example Trinidadians.^[7] And one's community may be spread across a single metropolis, as in Wellman.^[8] Wellman, in fact, later proposed^[9] and then tempered his assessment^[10] that every individual with their ties now represents a distinct personal community, more or less place-based.

Benjamin^[11] used a recursive definition of community—"people living in a geospatial area who define themselves as part of a community"—in order to analyze why some telecenters succeed and others fail to attract local involvement. This definition has a history in ethnography and acknowledges that communities are quite often self-identified or socially identified.

Human activity itself has been theorized as taking place in communities.^[12] Rheingold documented the arrival of the virtual community^[13] and the cell phone based social network.^[14] Rheingold's online or phone based communities interact in particular ways with the local, the historical community. Online discussion lists, games, and other social computing phenomena have generated interesting work that enriches and is enriched by community informatics per se.

There are tensions and overlaps between these various communities. The field of community informatics, by studying the interaction between transformation and continuity, between information technology and local community, is building up a picture of how the social, historical places we live in are evolving as we move from the industrial age to the information age, with particular attention to social and digital inequalities. Moreover, it has done this very much based on practice, both inside and beyond libraries.

ROOTS OF THE FIELD OUTSIDE THE LIBRARY: THE SOCIAL INFORMATICS PERSPECTIVE

Setting aside for the moment the important role of libraries and library scholars in community informatics, several other interrelated but distinct social trends have also given rise to and continue to shape the field. These can be summed up as the network society, the hacker ethic, and the digital divide.

For some time now the network society has been unfolding on and in local communities. What does this term mean? It means that today society is characterized

by networks rather than organizations; flexible production with a flexible workforce; an economy that is globally coordinated in real (or chosen, as with e-mail) time. A new space has been identified that contrasts with the space of place, that is, the geographic communities where we live and breathe. This new space is the space of flows that is based on digital tools and systems; in other words, the sum total of all the communications and transportation flows that link the global, mobile, network of human networks.^[15] The world's economies, east and west, adopted digital technologies even as they experienced the economic crises of the 1960s and 1970s; what has resulted is spaces of place that are threatened, because they are mostly bypassed, by the space of flows. In the industrialized countries, one can think for example of Rust Belt, United States or vast stretches of the North of England as thus threatened. Other spaces of place, Silicon Valley, for example, have certainly not been bypassed, and yet even there the space of flows has left toxic dumps for the space of place to cope with.

Faced with this, local governments responded with digital initiatives of their own. Among many: In 1989, Santa Monica, California, offered its residents free online discussion lists, accessible in public libraries or from home, and access to city officials, as mentioned above.^[16] In 2000, Lagrange, Georgia, offered its entire population free cable Internet.^[17]

An interesting reflection in academia of this space of place-space of flows or network-communities tension was the 1996 colloquium that became the edited volume *High Technology and Low Income Communities*.^[18] This arose from a dialogue between two mutually exclusive groups in urban planning at MIT, one focused on opportunities for Information and Communication Technology (ICT) and the other on low-income communities. They recruited Manuel Castells to the event and produced a proceedings volume that discussed, but did not name, community informatics.

On the heels of early experimentation, the second social trend that has given rise to community informatics is the discourse and the activity around the concept of the digital divide. This emerged in the mid 1990s as a popular phrase for the gap between people who access and use information technology and those who do not.^[19] In the United States, the Department of Commerce was an early implementer of both research and policy on this. The department launched a (continuing) series of survey reports on individuals' access to and use of computers and later the Internet and other particular tools such as cell phones.

In the realm of practice, the same agency within the Department of Commerce began more than a decade of annual rounds of grantmaking (Telecommunications and Information Infrastructure Assistance Program (TIAP), later the Technology Opportunities Program, or TOP) to organizations in local communities to support their community technology projects. The Department of Commerce

initiative was rooted in the economic imperative to develop a market for computers and for e-business and to develop a skilled workforce via education and public provision of information technology. Such experiments as TOP were echoed by private and other public funders, including technology companies and even the National Science Foundation, which helped Playing to Win launch the nationwide Community Technology Centers Network. One could certainly say that the dot-com technology bubble fueled the digital divide discourse in the United States, with corporations supporting local and national projects.

A third social trend giving rise to community informatics can be summed up as the hacker ethic, which took hold as computers and software became a hobby and a profession. In contrast to the media's definition of hacker as thief, the hacker ethic is the practice of building computers and writing code for the fun of it, for the creativity of it, and for the community-building. This is what^[20] calls "the spirit of the information age." The hacker ethic expressed itself in the origins of the personal computer out of the milieu of the Homebrew Computer Club and in the production of Linux and other such software. It also expressed itself in projects where hackers joined up with others to produce tools such as:

- PLATO, where by 1972 hackers and teachers were writing online courses for all levels of students.^[21]
- Berkeley Community Memory, the public terminals established in 1973 that provided an online bulletin board for all passers by.^[22]
- Community technology centers such as Playing to Win, opened in 1983 by math teacher Antonia Stone in a Harlem housing project,^[58] and
- Freenets or community networks such as the Cleveland Free-net, which began life in 1984 as St. Silicon's Hospital and Information Dispensary, an online communications tool for doctors and patients.^[23]

The community network and community technology center phenomena each grew into international movements, with associations, publications, and annual conferences for practitioners. Community technology projects emerged out of the grassroots—as in Toledo, Ohio^[24–27] and inner-city Wilmington, North Carolina^[28]—and blossomed in both virtual and actual space. Community network developers soon connected with librarians and library scholars, for reasons given below.

ROOTS OF THE FIELD WITHIN LIBRARIES

Urban social unrest provided the backdrop for librarians developing new approaches to service that resulted in the creation of early community information services. The riots of the late 1960s marked the beginning of change in the nation's urban libraries. The decay of the inner city

had resulted in a mismatch between the services that agencies such as public libraries offered in the mid-1960s and the needs of a changing population. Librarians had traditionally used library circulation figures to measure their effectiveness in the community. As the middle class left the nation's major cities, urban libraries suffered a drastic drop in circulation. At the same time researchers found that, "citizens are uninformed about public and private resources, facilities, rights, and programs. . . and frustrated in their attempts to get information required for everyday problem solving" (p. 20).^[29]

By the early 1970s, the federal government had provided funding for both the development of information and referral (I&R) services and a series of educational programs and guides aimed at helping professionals gain skills in developing I&R services.^[30–32] The federal government's active fostering of the development of I&R services by various institutions drew in both practitioners and academics, including a group of pioneering urban libraries and a small cadre of LIS (library and information science) researchers.^[29,33,34]

Academics who focused on community information in the 1970s worked with practitioners through associations and consultancies, analyzed practice, contributed articles and reports, made public presentations and developed academic curricula in the established LIS programs at Syracuse University, the University of Maryland, Drexel University, and the Community Specialist Program at the University of Toledo.

Clara Jones, then Director of the Detroit Public Library and its first African-American leader, argued at the time that:

The welfare of the public library is inextricably interwoven with the destiny of the city, the financial dilemma of libraries being one manifestation of characteristic urban ills. Although we are a predominantly urban nation, there is widespread indifference or resignation to the desperate plight of cities. . . It seems increasingly evident that we can no longer depend solely on the traditional cornerstone of public library service to adults—reference work, reading guidance, and programming—to stimulate sufficient interest and satisfy a broad enough range of needs (pp. 85–86).^[35]

The purpose of I&R was to provide a link between a person with a need and the resources in the community that would meet that need. To accomplish this, pioneering I&R staff created community information files, provided information about community services, and engaged in active question negotiation. Information and referral services, considered essential to avoid fruitless agency ping-pong—people seeking services bouncing from one office to the next in an environment where social services by hundreds of agencies and nonprofit organizations were delivering social services. Information and referral work was considered by many to be a radical departure from standard public library services.

At their outset, I&R services were also confusing and lacked definition.^[33] The Alliance for Information & Referral Services in 1973 defined I&R and outlined a set of activities including: file development, simple and complex information giving, actively helping clients make contact with a resource (referral), working with the client to overcome obstacles (advocacy), and assuring that clients actually reached the appropriate resources (follow-up); some of these were divergent from traditional library practice. In the late 1970s, Childers conducted a benchmark study of I&R in public libraries and found that while public libraries in his study embraced the information role, for the most part they did not engage in referral and follow-up.^[33]

In spite of the limitations in adopting the I&R model in the 1970s, library engagement in the community-focused information services discussed above laid the groundwork for the public library's community-focused roles in the digital age and the beginnings of academic response to community problems.

By the 1990s, librarians and library scholars were ready to join forces with the grassroots activists, local government staffers, foundations and other nonprofits, and businesses who were experimenting with technology in communities. A particular series of three conferences helped to catalyze the community networking movement. The Ties that Bind conferences (1994, 1995, 1996) were sponsored by Apple Computer's Library of Tomorrow Project and the Morino Foundation. They brought together a wide range of individuals and groups to foster community networking.^[36] The encompassing goals of these conferences were:

to provide information and case studies on the types of community networks that have proven viable, including economic, collaborative, and technical models; to help individuals representing schools, non-profits, foundations, businesses, media, and government agencies realize how community networking can be used as a tool to help advance the goals and needs of the community; to understand the importance of community networking in the formation and effective use of the National Information Infrastructure; to understand the emerging context – the social, economic, technical political, and sustainability issues which characterize the challenges and potentials for Community Networking.^[37]

These conferences, led by Steve Cisler of the Apple Library of Tomorrow, resulted in the creation of the Association for Community Networking and strongly influenced the encompassing thought processes that resulted in the development of the community informatics framework.

A major study funded by Institute of Museum and Library Services (IMLS) and conducted in 1999–2000 by Durrance & Pettigrew found that community information provision had undergone major change as a result of Internet adoption by libraries. They found increased use of networked community information, a variety of

digitization projects, a strong Internet presence, adoption of digital reference, increased collaboration between libraries and other community organizations, and, as a result of these innovations, increased visibility and community support.^[38,39]

One noteworthy example of library-community information projects is the Tallahassee FreeNet (TFN), Florida's oldest community network. It was started in 1993 by faculty from the Florida State University super-computer center. Quickly the LeRoy Collins Leon County Public Library became an operating partner and the TFN became one of the nation's first library-university community networking projects. Tallahassee FreeNet's mission statement reflected the aims of all the early collaborative community networks:

TFN is more than an operator of an information system. It is the agent guiding Tallahassee and to some extent Florida, into the Information Age. Therefore, it is further the mission of TFN to precipitate community cooperation that is the basis for having community-wide electronic communication.^[40]

University Contributions

During the 1990s, a number of universities, armed with excess computing power and aware of the digital disparities between the universities and communities, worked with local agencies to form community networks. Several of the long-lived projects among these are worth noting:

1. The Community Networking Initiative (later joined with the Alliance for Community Technology) at the University of Michigan School of Information and Library Studies, now School of Information. The University of Michigan Community Networking Initiative (UM-CNI) began with support from the W. K. Kellogg Foundation in 1994. This project enabled faculty and students to take a leadership role in Internet-based community networking (see, for example, Durrance).^[41] A collaborative venture involving the UM-CNI, the Flint Public Library, the Mideastern Michigan Library Cooperative, the Library of Michigan, and the Apple Library of Tomorrow Program created in 1995 the Flint Community Networking Initiative, a model public library Internet training laboratory featuring an extensive training program first for staff and later for community members—especially teens—and an ongoing community-focused Internet presence in Flint. Today the Alliance for Community Technology carries out a variety of teaching, research, and service projects.
2. PrairieNet and the Community Informatics Initiative at the University of Illinois at Urbana-Champaign Graduate School of Library and Information Science. PrairieNet, a partnership between the university and

local community members and nonprofit organizations, was founded in 1993. It seeks to:

promote equity of access to computer resources for everyone in the community; facilitate information and resource sharing in support of community development efforts; empower individuals by teaching computer skills and providing access to the Internet; and strengthen community organizations by assisting them with access and the sharing of information.^[42]

The Community Informatics Institute focuses on research and teaching, especially through Prairienet and its other community partnerships, among them the East St. Louis Action Research Project and the Puerto Rican Cultural Center in Chicago.^[43,44]

3. Blacksburg Electronic Village at the Virginia Polytechnic Institute and State University. This program is connected to researchers in architecture and design (and later information architecture) as well as human-computer interaction. This collaboration included the Town of Blacksburg and a major communication company in order to bring high-speed Internet and social computing to the community. Planning began in 1991; the Blacksburg Electronic Village became operational in 1993. It has been an international model for networked community through its innovative collaboration and citizen involvement.^[45]

EMERGENCE OF COMMUNITY INFORMATICS AS A UNIFYING CONCEPT

Allowing for the caveats summed up by Stoecker,^[46] a loose network of scholars can today be seen to comprise a core of community informatics research. The scaffolding of the field features two processes that have contributed to drawing together scholars via conferences, proceedings volumes, and at least one journal. The first of these two processes is the series of seven Dimensions in Advanced Computing (DIAC) conferences sponsored by Computer Programmers (later Professionals) for Social Responsibility since 1987; this has generated both proceedings volumes and edited books (most recently Day and Schuler^[47] and Schuler and Day).^[48] Dimensions in Advanced Computing's organizer Doug Schuler, a cofounder of Seattle Community Network, launched an undergraduate program in community informatics and authored *New Community Networks: Wired for Change*.^[49]

The second process has been anchored in the north of England, where Brian Loader and others have generated a flow of edited and authored volumes,^[1,50-55] several conferences, and the quarterly journal *Information, Communication and Society* (since 1998), all while guiding several community technology projects.

Other integrative processes are: 1) the work of^[56] defining community informatics and bringing particular

attention to work in Australia, Canada, and elsewhere; 2) the annual Community Informatics Research Network meetings; 3) the broader biennial Conference on Communities and Technologies; 4) the also more broad but still highly useful conferences of the Association for Internet Research (annual since 2000) and 5) the journals *First Monday* (launched 1996), *The Information Society* (1981), *Journal of Computer Mediated Communication* (1995), *New Media and Society* (1999), and the *Journal of Community Informatics* (2004).

NEW DIRECTIONS

As technology has evolved, converged, and diffused, the binary concept of the digital divide has revealed itself as containing multiple digital *inequalities* bearing deeper analysis. (For a recent example see Mossberger).^[57] Four trends are worth noting: datasets, globalization, a turn towards theory, and a recent expansion of community informatics curriculum in library information science schools.

First, academic and policy researchers have produced hundreds of case studies, and the color and texture of these continue to be highly valuable. The multitude of studied and not-yet-studied community informatics projects and practices and the need for research to guide policy present scholars with an opportunity to standardize our approach to case studies and to collect and analyze larger datasets. This will allow us to generalize and confirm trends in communities. Second, related to this, is the imperative to study community technology as a global phenomenon rather than a national one. The search for community development through technology, for community sustainability in the digital age, is turning up lessons in one part of the world that others cannot afford to ignore.

Third, as researchers turn increasingly to theorizing as well as describing, our work on communities can be usefully placed alongside the work of others on the informatics of our government, education, and business sectors. A number of theoretical concepts and frameworks are already proving powerful in this regard: information use, community inquiry, civic intelligence, social networks and social capital,^[59] and the public sphere among them. These summations will help community informatics and others scholars to revisit and update our conceptions of the Information Society, which first took shape with very little actual data from the localities where we all live.

A fourth trend is not within the research but relies on it: the expansion of community informatics and community information in the curricula of the library and information science schools. The iSchools conferences are playing a role here; offering sessions focusing on community informatics. Today courses in this area are taught at the graduate level at 7 of the 57 library and information science programs in the United States and Canada. It is expected that Gurstein such efforts will grow, in and beyond the LIS programs.

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Complexity and Self-Organization

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Abstract

This entry introduces some of the main concepts and methods of the science studying complex, self-organizing systems, and networks, in a nontechnical manner. Complexity cannot be strictly defined, only situated in between order and disorder. A complex system is typically modeled as a collection of interacting agents, representing components as diverse as people, cells, or molecules. Because of the nonlinearity of the interactions, the overall system evolution is to an important degree unpredictable and uncontrollable. However, the system tends to self-organize, in the sense that local interactions eventually produce global coordination and synergy. The resulting structure can in many cases be modeled as a network, with stabilized interactions functioning as links connecting the agents. Such complex, self-organized networks typically exhibit the properties of clustering, being scale-free, and forming a small world. These ideas have obvious applications in information science when studying networks of authors and their publications.

INTRODUCTION

A new paradigm for scientific inquiry has been emerging: complexity. Classical science, as exemplified by Newtonian mechanics, is essentially reductionist: it reduces all complex phenomena to their simplest components, and then tries to describe these components in a complete, objective, and deterministic manner.^[1,2] The philosophy of complexity is that this is in general impossible: complex systems, such as organisms, societies, or the Internet, have properties—emergent properties—that cannot be reduced to the mere properties of their parts. Moreover, the behavior of these systems has aspects that are intrinsically unpredictable and uncontrollable, and cannot be described in any complete manner. At best, we can find certain statistical regularities in their quantitative features, or understand their qualitative behavior through metaphors, models, and computer simulations.

While these observations are mostly negative, emphasizing the traditional qualities that complex systems lack, these systems also have a number of surprisingly positive features, such as flexibility, autonomy, and robustness, that traditional mechanistic systems lack. These qualities can all be seen as aspects of the process of self-organization that typifies complex systems: these systems spontaneously organize themselves so as to better cope with various internal and external perturbations and conflicts. This allows them to evolve and adapt to a constantly changing environment.

Processes of self-organization literally create order out of disorder.^[1] They are responsible for most of the patterns, structures, and orderly arrangements that we find in the natural world, and many of those in the realms of mind, society, and culture. The aim of information science

can be seen as finding or creating such patterns in the immense amount of data that we are confronted with. Initially, patterns used to organize information were simple and orderly, such as “flat” databases in which items were ordered alphabetically by author’s name or title, or hierarchically organized subject indices where each item was assigned to a fixed category. Present-day information systems, such as the World Wide Web, are much less orderly, and may appear chaotic in comparison. Yet, being a result of self-organization, the Web possesses a nontrivial structure that potentially makes information retrieval much more efficient. This structure and others have recently been investigated in the science of networks, which can be seen as part of the sciences of complexity and self-organization.

The concept of self-organization was first proposed by the cyberneticist W. Ross Ashby^[3] in the 1940s and developed among others by his colleague Heinz von Foerster.^[4] During the 1960s and 1970s, the idea was picked up by physicists and chemists studying phase transitions and other phenomena of spontaneous ordering of molecules and particles. These include Ilya Prigogine,^[1] who received a Nobel Prize for his investigation of self-organizing “dissipative structures,” and Hermann Haken,^[5] who dubbed his approach “synergetics.” In the 1980s, this tradition cross-fertilized with the emerging mathematics of nonlinear dynamics and chaos, producing an investigation of complex systems that is mostly quantitative, mathematical, and practiced by physicists. However, the same period saw the appearance of a parallel tradition of “complex adaptive systems,”^[6] associated with the newly founded Santa Fe Institute for the sciences of complexity, that is closer in spirit to the cybernetic roots of the field. Building on the work of John Holland, Stuart Kauffman,

Robert Axelrod, Brian Arthur, and other SFI associates, this approach is more qualitative and rooted in computer simulation. It took its inspiration more from biology and the social sciences than from physics and chemistry, thus helping to create the new disciplines of *artificial life* and *social simulation*. The remainder of this entry will mostly focus on this second, simulation-based tradition, because it is most applicable to the intrinsically social and cognitive processes that produce the systems studied by information science. Although the other, mathematical tradition sometimes uses the term “complex systems” to characterize itself, the labels of “nonlinear systems” or “chaos theory” seem more appropriate, given that this tradition is still rooted in the Newtonian assumption that apparently complex behavior can be reduced to simple, deterministic dynamics—an assumption which may be applicable to the weather, but not to the evolution of a real-world social system. Extending both traditions, the turn of the century witnessed a surging popularity of research into complex networks. This was inspired mostly by the growth of the World Wide Web and the models proposed by Watts and Strogatz,^[7] and Barabasi and Albert.^[8]

At present, the “science of complexity” taken as whole is still little more than a collection of exemplars, methods, and metaphors for modeling complex, self-organizing systems. However, while it still lacks integrated theoretical foundations, it has developed a number of widely applicable, fundamental concepts and paradigms that help us to better understand both the challenges and opportunities of complex systems. This entry will try to introduce the most important of these concepts in a simple and coherent manner, with an emphasis on the ones that may help us to understand the organization of networks of information sources.

COMPLEX SYSTEMS

There is no generally accepted definition of complexity.^[9] different authors have proposed dozens of measures or conceptions, none of which captures all the intuitive aspects of the concept, while they are applicable only to a very limited type of phenomena, such as binary strings or genomes. For example, the best-known measure, “Kolmogorov complexity,” which is the basis of algorithmic information theory, defines the complexity of a string of characters as the length of the shortest program that can generate that string. However, this implies that random strings are maximally complex, since they allow no description shorter than the string itself. This contradicts our intuition that random systems are not truly complex. A number of more complex variations on this definition have been proposed to tackle this issue, but they still suffer from the fact that they are only applicable to strings, not to real-world systems. Moreover, it has been proven that

the “shortest possible” description is in general uncomputable, implying that we can never be sure that we really have determined the true complexity of a string.

In spite of these fundamental problems in formalizing the notion of complexity, there are a number of more intuitive features of complex systems that appear again and again in the different attempts to characterize the domain.^[2] One that is more or less universally accepted is that complexity must be situated *in between order and disorder*: complex systems are neither regular and predictable (like the rigid, “frozen” arrangement of molecules in a crystal), nor random and chaotic (like the ever-changing configuration of molecules in a gas). They exhibit a mixture of both dimensions, being roughly predictable in some aspects, surprising and unpredictable in others. This intermediate position, balancing between rigidity and turbulence, is sometimes called the “edge of chaos.” A number of theorists have proposed that this precarious balance is precisely what is necessary for adaptation, self-organization, and life to occur, and that complex systems tend to spontaneously evolve toward this “edge.”^[6]

Another fundamental feature is that complex systems consist of many (or at least several) parts that are connected via their interactions. Their components are both *distinct* and *connected*, both autonomous and to some degree mutually dependent. Complete dependence would imply order, like in a crystal where the state of one molecule determines the state of all the others. Complete independence would imply disorder, like in a gas where the state of one molecule gives you no information whatsoever about the state of the other molecules.

The components of a complex system are most commonly modeled as *agents*, i.e., individual systems that act upon their environment in response to the events they experience. Examples of agents are people, firms, animals, cells, and molecules. The number of agents in the system is in general not fixed as agents can multiply or “die.” Usually, agents are implicitly assumed to be goal-directed: their actions aim to maximize their individual “fitness,” “utility,” or “preference.” When no specific goal can be distinguished, their activity still follows a simple cause-and-effect or condition–action logic: an agent will react to a specific condition perceived in the environment by producing an appropriate action. The causal relation or rule connecting condition and action, while initially fixed for a given type of agent, can in some cases change, by learning or evolutionary variation.

The environmental conditions to which an agent reacts are normally affected by other agents’ activity. Therefore, an action by one agent will in general trigger further actions by one or more other agents, possibly setting in motion an extended chain of activity that propagates from agent to agent across the system. Such interactions are initially *local*: they start out affecting only the agents in the immediate neighborhood of the initial actor. However, their consequences are often *global*, affecting the system

of agents as a whole, like a ripple produced by a pebble that locally disturbs the surface of the water, but then widens to encompass the whole pond.

Nonlinearity

The spreading of a wave is not a complex phenomenon, though, because its propagation is perfectly regular and predictable, and its strength diminishes as its reach widens. Processes in complex systems, on the other hand, are often *nonlinear*: their effects are not proportional to their causes. When the effects are larger than the causes, we may say that there is an amplification or *positive feedback*: initially small perturbations reinforce themselves so as to become ever more intense. An example is the spread of a disease, where a single infection may eventually turn into a global pandemic. Another example is the chain reaction that leads to a nuclear explosion. When the effects are smaller than the causes, there is a dampening or *negative feedback*: perturbations are gradually suppressed, until the system returns to its equilibrium state.

Interactions with positive feedback are very *sensitive to their initial conditions*: a change in that condition may be so small that it is intrinsically undetectable, yet result in a drastically altered outcome. This is called the *butterfly effect* after the observation that, because of the nonlinearity of the system of equations governing the weather, the flapping of the wings of a butterfly in Tokyo may cause a hurricane in New York. The nonobservability of the initial perturbations means that the outcome is *in principle* unpredictable, even if the dynamics of the system were perfectly deterministic: no weather monitoring system can be so accurate that it senses all the movements of butterfly wings. This explains why weather forecasts cannot be truly reliable, especially for the longer term. Positive feedback will amplify small, random fluctuations into wild, unpredictable swings, making the overall behavior of the system chaotic. An illustration can be found in the erratic up-and-down movements of quotations on the stock exchange.

In spite of the omnipresence of fluctuations, most systems around us appear relatively stable and predictable. This is due to the presence of negative feedback, which suppresses the effects of such fluctuations. However, while negative feedback makes a system more predictable, it also makes it less controllable: if we try to change the state of such a system, we may find that our changes are counteracted, and that whatever we do the system always returns to its own “preferred” equilibrium state. Examples can be found in social systems where attempts from leaders or governments to change the behavior often are actively resisted so that they eventually come to nothing.

The dynamics of complex systems typically exhibits a combination of positive and negative feedbacks, so that certain changes are amplified and others dampened. This

makes the system’s overall behavior both unpredictable and uncontrollable. Moreover, such systems are normally open, which means that they exchange matter, energy and/or information with their wider environment. For example, an economy or ecosystem is dependent on the climate, and the amount of sunlight, rain, and heat that it produces. These in-going and out-going flows make the dynamics even more complicated, since we cannot know every external event that may affect the system. For example, a thriving economy or ecosystem may suddenly collapse because of the invasion by a foreign pest. Furthermore, the input of energy (such as sunlight) tends to feed amplification processes, so that they never reach the equilibrium that would otherwise follow the exhaustion of resources.

Modeling Complex Systems

For the above reasons, traditional deterministic models (such as systems of partial differential equations) of truly complex systems are in general impracticable,^[10] if not in principle uncomputable.^[11] In nonlinear systems, simplifying the model by using approximations is dangerous as well. The common way to approximate the effect of complex interactions by reducing it to the “mean field” (i.e., the average effect of many discrete actions performed by independent agents) can actually lead to fundamental errors. For example, a differential equation representing the “mean field” effect may predict that a certain perturbation will die out because it is too small, while a computer simulation of the individual agents finds that its effect is amplified by positive feedback until it dominates the system.^[12]

Because of these intrinsic difficulties with mathematical models, complexity researchers typically prefer computer simulations, which, while of course being approximations as well, are easier to manipulate, so that more different factors and variations of the model can be explored. Here, the system’s evolution is traced step-by-step by iteratively applying the rules that govern the agents’ interactions, thus generating the subsequent states of the system. Such simulations typically include a generator of random variations, to represent the effect of unpredictable perturbations. A typical setting is inspired by the Darwinian mechanism of natural selection, in which the rules that determine an agent’s behavior are randomly “mutated” and sometimes recombined with the rules of another agent, after which the “fittest” or best performing agents or rules are selected to carry on, while the others are eliminated. To explore the possible behaviors of the system, many different “runs”—with different initial conditions or random variations during the process—of the simulation are performed. The main variable values for each run are collected. These results are then analyzed statistically to discover recurring trends.

This sometimes produces very robust results, in the sense that all runs, however different in their initial

behavior, eventually appear to converge to the same type of stable pattern. In the majority of cases, the outcomes can be classified into a relatively small number of distinct categories. This provides the researchers with a qualitative picture of the most likely results—and hopefully an insight into the factors that promote one outcome rather than another one. It is only exceptionally that no clear pattern can be discerned in the outcomes of the different simulation runs. The reason that complex systems in spite of their intrinsic unpredictability tend to settle into a relatively small set of recognizable behaviors is their inherent tendency to *self-organize*.

SELF-ORGANIZATION

Self-organization can be defined as the spontaneous emergence of global structure out of local interactions. “Spontaneous” means that no internal or external agent is in control of the process: for a large enough system, any individual agent can be eliminated or replaced without damaging the resulting structure. The process is truly *collective*, i.e., *parallel* and *distributed* over all the agents. This makes the resulting organization intrinsically *robust* and resistant to damage and perturbations.

As noted, the components or agents of a complex system initially interact only locally, i.e., with their immediate neighbors. The actions of remote agents are initially independent of each other: there is no correlation between the activity in one region and the activity in another one. However, because all components are directly or indirectly connected, changes propagate so that faraway regions eventually are influenced by what happens here and now. Because of the complex interplay of positive and negative feedbacks, this remote influence is very difficult to predict and may initially appear chaotic.

To explain the appearance of organization, we need to make one further assumption, namely that the outcome of interactions is not arbitrary, but exhibits a “preference” for certain situations over others. The principle is analogous to *natural selection*: certain configurations are intrinsically “fitter” than others, and therefore will be preferentially retained and/or multiplied during the system’s evolution. When the agents are goal-directed, the origin of this preference is obvious: an agent will prefer an outcome that brings it closer to its goals. For example, in a market a firm will prefer the outcome that brings it more profit. In an ecosystem, an animal will prefer an outcome that brings it more food or that reduces its risk of being attacked by a predator. But even inanimate, physical objects, such as molecules or stones, have an in-built “preference,” namely for the state that minimizes their potential energy. Thus, a stone “prefers” the stable state at the foot of a hill to an unstable state on the top. Here, “preference” simply means that the unstable state will sooner or later be abandoned, while the stable one will be retained.

Coevolution and Synergy

Given such a preference, it is clear why an individual agent tends to “organize” itself so as to settle down in its preferred situation. The problem is that what is best for one agent is in general not best for the other agents. For example, more profit for a firm generally means less profit for its competitors, and an animal safe from attack by a predator means a predator that goes hungry. However, interaction is in general not a *zero-sum game*: a gain by one party does not necessarily imply an equivalent loss by the other party. In most cases, an outcome is possible in which both parties to some degree gain. For example, a firm may increase its profits by developing a more efficient technology, which it then licenses to its competitors, so that they too become more productive. In that case, we may say that the interaction exhibits *synergy*: the outcome is positive for all parties; all involved agents “prefer” the outcome to the situation without the interaction.

In general, such a collective solution is still a compromise, in the sense that not all agents can maximally realize their preferences. Not all the stones can end up in the same, lowest spot at the bottom of the hill, but they can all end up much lower than they were, by reducing the irregular hill to an even plain. Such a compromise reduces the tension or “conflict” between competing agents. (Such conflict would otherwise lead to instability as every action of the one triggers a counteraction by the other.) In that sense, we may say that the agents have *mutually adapted*; they have *coordinated* their actions so as to minimize friction and maximize synergy.

The achievement of this stable, synergetic state is in general a process of trial-and-error or variation-and-selection. Because agents are independent and interact locally, and because the dynamics of the system is unpredictable, they in general do not know what the effect of their actions on the other agents will be. They can only try out actions because they appear plausible, or even choose them at random, and note which ones bring them closer to their goals. Those actions can then be maintained or repeated, while the others are abandoned. This is the fundamental dynamics of natural selection. The main difference with traditional Darwinian evolution is that trial-and-error happens simultaneously on different sides: the agents *coevolve*, the one adapting to the other, until they mutually “fit.”

From Local to Global Organization

To shift from local coordination to global organization, we just need to note that all interactions between all agents in the complex system will tend toward such a coherent, stable state, until they are all mutually adapted. This process generally accelerates because of a positive feedback. The reason is that if two or more agents have reached a mutually fit state, this defines a stable assembly to which

other agents can now adapt, by trying to “fit” into the assembly as well. The larger the assembly, the more “niches” it has in which other agents can fit. The more agents join the assembly, the larger it becomes, and the more niches it provides for even more agents to join. Thus, the assembly may grow exponentially until it encompasses the global system.

This growth is typically faster when the agents are identical (e.g., molecules of the same substance) or similar (e.g., individuals from the same species), because the solution found by one agent will then suit the other agents as well, so that minimal further trial-and-error is needed once a good arrangement is locally found. This typically happens in processes of physical self-organization, such as crystallization, magnetization, or the emergence of coherent light in a laser.^[5] When the agents are all different (e.g., species in an ecosystem), each in turn needs to explore in order to find its unique niche in an environment that continues to evolve, resulting in a much less explosive development.

In the case of identical agents, the global structure that emerges is typically uniform or regular, because the arrangement that is optimal for one agent is also the one optimal for the other agents. As a result, they all tend to settle into the same configuration. An example is a crystal, where all molecules are arranged at regular intervals and in the same orientation. In this case, self-organization produces a perfectly ordered pattern. In cases where the agents are diverse, like in an ecosystem or a market, the resulting structure is much more complex and unpredictable.

Global Dynamics

If we now consider the system as a whole—rather than the agents individually—we may note that the system too undergoes a process of variation. This can be seen as an exploration by the system of different regions of its state space, thus following an intricate trajectory. (The state space of the system is merely the Cartesian product of the state spaces of all its components.) Self-organization then means that the system reaches an *attractor*, i.e., a part of the state space that it can enter but not leave. In that sense, an attractor is a region “preferred” by the global dynamics: states surrounding the attractor (the attractor *basin*) are unstable and will eventually be left and replaced by states inside the attractor.

A nonlinear system has in general a multitude of attractors, each corresponding to a particular self-organized configuration. If the system starts out in a basin state, it will necessarily end up in the corresponding attractor, so that the long-term behavior can in principle be predicted (assuming we know what the attractor is, which is generally not the case). However, if it starts out in a state in between basins, it still has a “choice” about which basin and therefore which attractor it ends up in,

and this will depend on unpredictable fluctuations. An attractor generally does not consist of a single state, but of a subspace of states in between which the system continues to move. The self-organized configuration, while more stable than the configuration before self-organization, is therefore in general not static but full of ongoing activity.

Self-organization can be accelerated by augmenting the initial variation that makes the system explore its state space: the more different states it visits, the sooner it will reach a state that belongs to an attractor. The simplest way to increase such variation is to subject the system to random perturbations, i.e., “noise.” For example, if you shake a pot filled with beans, the beans will explore a variety of configurations, while tending to settle into the one that is most stable, i.e., where the beans are packed most densely near the bottom of the pot. Thus, shaking will normally reduce the volume taken in by the beans. This principle was called “order from noise” by the cyberneticist von Foerster^[4] and “order through fluctuations” by the thermodynamicist Prigogine.^[1]

Emergence

The pattern formed by the stabilized interactions, mutual “fittings,” or “bonds” between the agents determines a purposeful or functional structure. Its function is to minimize friction between the agents, and thus maximize their collective “fitness,” “preference,” or “utility.” Therefore, we may call the resulting pattern “organization”: the agents are organized or coordinated in their actions so as to maximize their synergy.^[5] However, such organization by definition imposes a *constraint* on the agents: they have lost the freedom to visit states outside the attractor, i.e., states with a lower fitness or higher friction. They have to obey new “rules,” determining which actions are allowed, and which are not. They have lost some of their autonomy. The resulting mutual dependency has turned the collection of initially independent agents into an organization, i.e., a cohesive whole that is more than the sum of its parts. The goal of this “superagent” is to maximize overall synergy rather than individual utility. In a sense, the agents have turned from selfish individualists into conscientious cooperators. They have become subordinated (or “enslaved” in the terminology of Haken)^[5] to the regulations of the collective.

This whole has *emergent* properties, i.e., properties that cannot be reduced to the properties of its parts. For example, a cell has the property of being alive, while the molecules that constitute it lack that property; gold has the properties of being shiny, malleable, and yellow, but these properties do not exist for individual gold atoms.^[2] Rather than the parts individually, emergent properties characterize the pattern of interactions or relations between them. They typically include global or “holistic” aspects, such as robustness, synergy, coherence, symmetry, and function.

Different attractor regimes imply different properties for the system obeying that regime. For example, a circulating convection current may rotate clockwise or counterclockwise. Since it cannot be a priori predicted which attractor the system will end up in, the emergent properties of the whole cannot be derived from the properties of its parts alone. Once the attractor regime has stabilized, the behavior of the parts is rather regulated or constrained by the properties of the higher-level whole. This is called *downward causation*. For example, the correspondence between DNA triplets and amino acids in the genetic code is not determined by the chemical properties of the molecules that constitute DNA, but by evolutionary history producing a particular mechanism for “reading” DNA triplets in living cells. A random variation of that history might well have produced a different mechanism and therefore a different code. The languages that different people speak are not determined by the neurophysiology of their brain, but by the self-organization of shared lexicons and grammatical rules within a community of communicating individuals.

While the self-organized whole is intrinsically stable, it is still flexible enough to cope with outside perturbations. These perturbations may push the system out of its attractor, but as long as the deviation is not too large, the system will automatically return to the same attractor. In the worst case, the system is pushed into a different basin but that will merely make it end up in a different attractor. In that sense, a self-organizing system is intrinsically *adaptive*: it maintains its basic organization in spite of continuing changes in its environment. As noted, perturbations may even make the system more robust, by helping it to discover a more stable organization.

COMPLEX NETWORKS

The structure emerging from self-organization can often be represented as a network. Initially, agents interact more or less randomly with whatever other agents happen to pass in their neighborhood. Because of natural selection, however, some of these interactions will be preferentially retained, because they are synergetic. Such a preferentially stabilized interaction may be called a bond, relationship, or *link*. A link couples or connects two agents, in the sense that linked agents preferentially interact with each other. The different links turn the assembly of agents into a *network*. Within the network, the agents can now be seen as *nodes* where different links come together. Perhaps the most intuitive example is a social network, which links people on the basis of friendship, trust, or collaboration. Other well-known examples are the Internet, which connects computers via communication links, and the Web, which connects documents via hyperlinks. A more abstract example is the biochemical network that connects

the molecules that react with each other within a cell in order to produce further molecules.

It is easy to define an abstract mathematical network. You just need a set N consisting of nodes n_i , and then select any subset L of links from the set of all possible connections between two nodes:

$$L = \{(n_i, n_j)\} \subset N \times N$$

However, complexity researchers have observed that “natural” (i.e., self-organized rather than artificially designed) or “complex” networks tend to exhibit a number of specific features: they are *scale-free*, *small-world*, and *clustering*. These features are defined statistically: certain configurations of links appear with a much higher probability than chance. We will here try to explain these particular link distributions from the dynamics of self-organization of a network.

Random Networks

Let us assume that we start with a collection N of independent agents (future nodes of the network) that initially interact randomly, thus creating random links. This produces a *random network*, i.e., a network where the links have been selected by chance from the set $N \times N$ of all possible connections. Random networks have been extensively studied in mathematics. They exhibit the phenomenon of *percolation*: when links between randomly chosen nodes are added one by one, larger and larger subsets of N become connected into cohesive subnetworks. When more links are added, subnetworks will become connected to each other, defining a larger connected subset. When a certain threshold is passed, all subsets become connected so that there is now just a single connected network. It is said that the network *percolates*: imagine the links as tubes and a liquid being injected into one of the nodes; when the network percolates, the liquid will spread throughout the whole system, because any node is now directly or indirectly connected to any other node by an uninterrupted path or chain of links. Whatever happens in one node of the network can now in principle propagate to every other node in the network.

Small-World Networks

The maximum length of the shortest path connecting two nodes in a connected network is called the *diameter* of the network. If the diameter is small relative to the number of nodes, the network is said to be a *small-world network*. The notion derives from the “it’s a small world” phenomenon in social networks: two people encountering each other will often find that they have one or more acquaintances in common. Studies of social networks have indicated that it is in general possible to find a short sequence

of friend-of-a-friend links connecting two people. It has been estimated that on the scale of the world as a whole, two randomly chosen individuals are unlikely to be more than six such links removed from each other (“six degrees of separation”).

Whereas random networks have the small-world property, the opposite applies to regular networks. An example of such a network is a two-dimensional lattice or grid, where each node is connected to its four direct neighbors (left-right-up-down), each of which is connected to its four neighbors, and so on. In a square grid of $100,000 \times 100,000 = 10$ billion nodes, the nodes at the opposite ends of a diagonal are 200,000 links apart. This is the diameter of the network. Compare this to the distance of a mere six links that apparently characterizes the world social network with its nearly 10 billion nodes! Regular networks, where nodes are linked according to strict, repetitive rules rather than random connections, are typically large-world networks. This means that a change in one node will normally take a very long time to propagate to the rest of the network. As a result, the network will be slow to react to perturbations or innovations.

We may conclude that complex networks are not regular. But they are not random either: their linking patterns do obey certain regularities, albeit not strictly. In fact, it has been shown that a regular network can easily be turned into a small-world network by adding a small number of randomly chosen links to the otherwise strictly constrained links.^[7] These random links by definition do not care about the “distances” within the regular grid: e.g., they may directly connect nodes that are otherwise 100,000 links apart. Such random links create “worm-holes” or “shortcuts” between otherwise remote regions, thus bringing them suddenly within easy reach. As a result, a small number of random links added to a regular network spectacularly decreases the shortest path length between nodes.

Clustering

One of the nonrandom features that characterize complex networks is *clustering*. Clustering means that when A is linked to B, and B to C, then the probability is high (or at least much higher than could be expected in a random network) that A is also linked to C. In other words, two randomly chosen connections of B have a much higher than chance probability of being connected themselves.

The origin of this can best be explained by considering social networks. Here, the clustering property can be formulated as “the friends of my friends are (likely to be) my friends.” In other words, friends tend to form a cluster or community in which everyone knows everyone. The reason is simple: when you regularly encounter your friends, you are likely to encounter their friends as well. More generally, if an agent A frequently interacts with an agent B, and B interacts with C, then the probability is high that

A will sooner or later interact with C as well. If A and B have some similarity in aims that helps them to find synergy, and the same applies to B and C, then A and C are likely to discover a synergetic relationship as well.

Scale-Free Networks

A less intuitive feature of complex networks is that their distribution of links tends to follow a *power law*.^[8] There are many nodes with few links, and few nodes with many links. More precisely, the number of nodes N with a given degree (i.e., number of links) K is proportional to a (negative) power of that degree:

$$N(K) \sim K^{-a}$$

(The values of the exponent a tend to vary between 1 and 3.) A network that obeys a power law is called *scale-free*. When $a = 1$, N is inversely proportional to K : in other words, as the number of links goes up, the number of nodes with that number of links goes down proportionally.

This property has been established empirically, by counting the number of links in various networks, such as the Web or social networks. It turns out that a few nodes have an inordinate amount of links. They function as the *hubs* of the network, the central “cross-roads” where many different connections come together. The most common nodes, on the other hand, have just a few links. This means that nodes are strongly differentiated: something that happens to a hub will have a disproportionately large influence on the rest of the network, while something that happens to an ordinary node may have little or no consequences. This has great practical implications: an innovation or perturbation that appears in a hub (e.g., a central network server, a high-visibility Web page, or a person who is known by many) may change the whole network in a short time, because it is immediately propagated far and wide. By identifying the hubs in a network, it becomes easier to manipulate its dynamics, for good or for bad. Obvious applications are the spread of computer viruses, contagious diseases, new ideas, or fashions.

Whereas clustering tends to increase distances in a network, by creating locally connected clusters that have few links outside the cluster, the presence of hubs has the opposite effect. Because hubs have a very large number of links they are likely to link into many different clusters, thus acting as shortcuts that reduce the distance between the clusters. But this also means that removing a hub may break the connections between otherwise remote regions of the network. This is a danger especially in communication networks such as the Internet, where the failure of a small number of hubs may split up the network into separate “islands” that no longer communicate with each other. Similar dangers exist in ecosystems where the disappearance of one or more key species—i.e., “hubs” on which

many other species depend—may lead to a complete breakdown of the system.

Barabasi and Albert^[8] have proposed a theoretical explanation for power-law distributions based on the mechanism of *preferential attachment*: new nodes joining the network preferentially establish links with nodes that already have a large number of links. They have shown that when the probability of linking to a node is exactly proportional to the number of links of that node the resulting network obeys a power law with $a = 3$.

For a more general scenario for the self-organization of a complex network, consider a collection of agents that initially only interact locally with those that happen to pass in their neighborhood. Some of these interactions will be stabilized into enduring links. Once they have some links, the locality principle entails that agents are more likely to forge links with the “friends of their friends” than with randomly chosen others, thus promoting clustering. But agents that already have a high number of links also have many “friends of friends” (i.e., nodes two links away) and therefore they will be more likely to develop additional links within this two-step neighborhood or cluster. The more links an agent has, the larger its neighborhood, and therefore the larger the probability that it will receive even more links from within this neighborhood. Similarly, the larger the cluster, the more likely it is to receive random links from outside, thus extending the neighborhood outwards and linking it into other clusters. This determines a positive feedback, which leads to an explosive growth in the number of links. The agents that happen to be in the center of such a quickly growing cluster will become the hubs of the network.

APPLICATION TO KNOWLEDGE NETWORKS

Having reviewed key concepts typifying complex, self-organizing systems, and networks, we will sketch some possible applications of these ideas in the area of information science. Information science focuses on the knowledge that is available in the documents that are available in libraries and databases across the world. These documents are typically produced by authors or researchers who investigate a domain, building further on the results of other authors, and publishing their results in new papers or books that refer to these used sources. This knowledge producing system can be viewed as a very complex network, formed by the researchers, the concepts they use and the publications they produce. All the “nodes” of the network are linked directly or indirectly, by relations such as citation, collaboration, or information exchange. This complex system is intrinsically self-organizing: no individual or organization is in charge, or can decide in which direction knowledge should develop. Novel, globally available knowledge emerges out of the spontaneous, local interactions between the individual agents.

By applying the concepts and methods from the domain of complexity, we may hope to better understand the development and structure of this network. We can view it as a complex, adaptive system that generates new patterns (knowledge) through the complex, nonlinear interactions between multitudes of autonomous agents (individual scientists and organizations). This system has the structure of a heterogeneous network (Fig. 1), consisting of three basic types of nodes:^[13] agents, i.e., the individuals or organizations who actively process and produce knowledge, containers, i.e., the documents, databases, or journals in which the produced knowledge is stored and made available to other agents, and concepts, i.e., the abstract elements of knowledge itself, which are typically represented as keywords.

There already exists some preliminary work on subnetworks of this encompassing network, such as collaboration networks between authors^[14] or citation networks between documents. This research has found that they possess typical features of complex networks, such as being scale-free and small-world. For example, citation

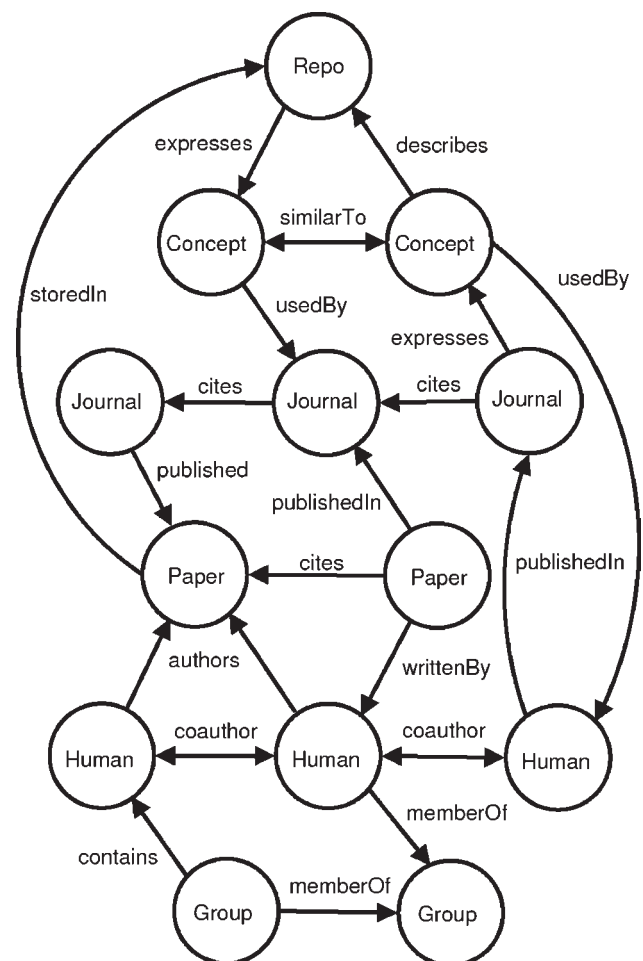


Fig. 1 heterogeneous knowledge network, containing authors, concepts, and documents.

networks typically contain a small number of hubs (“citation classics”) with very many links, while most publications only gather a few citations. Some of the most successful recent methods for information retrieval, such as the PageRank algorithm underlying the Google search engine, or the HITS method developed by Kleinberg,^[15] implicitly use this network structure to identify the “hubs” of a hypertext network.

More interesting even than the static analysis of existing networks is the modeling of their evolution. We may assume that an information network will self-organize through the propagation of information between nodes across links, creating new links and nodes in the process. For example, assume that information is transferred from paper A to researcher B. After reading the paper, B may decide to get some more information linked to paper A, e.g., by contacting A’s author, or reading some of A’s references. These in turn may refer B to other authors or papers relevant for B’s interests, and so on. Some of these additional sources may turn out to be particularly important for B’s research, inspiring B to develop a new concept, published in the form of one or more papers. This process will create links (e.g., B may start collaborating with another author, or refer in new papers to papers discovered in this way) and nodes (e.g., new papers, new concepts, new journals). Such links and nodes will tend to cluster around a small number of “hubs”—thus defining a new “community” of related authors, documents, and ideas.

The emergence of a new scientific domain is a good example of the self-organization of such a community of knowledge,^[16] where people from initially diverse backgrounds find each other around a common interest, which gradually coalesces into a new paradigm. This process could be observed by mapping the network of authors, publications and keywords in a particular domain at regular intervals (e.g., every 2–5 years), and analyzing it in terms of clustering, hubs, average distances, etc. The change of these features over time may show processes of self-organization taking place. A good theory of the self-organization of knowledge communities would propose a number of processes and parameters that allow us to predict where, when, and how such self-organization is most likely to take place. Such a theory would help us to find not only the presently most authoritative concepts, publications, or authors (hubs), but those that are likely to become so in the future. This would provide a very powerful instrument to uncover emerging trends and to direct attention and investment toward the most promising people, ideas, and information sources.

CONCLUSION

The science studying complex, self-organizing systems and networks is still in its infancy. Yet, it already provides

us with a powerful new perspective and a number of promising conceptual and modeling tools for understanding the complex phenomena that surround us, including organisms, the Internet, ecosystems, markets, and communities.

On the one hand, the complexity perspective reminds us to be modest in our aims: many phenomena in nature and society are simply too complex to be analyzed in the traditional scientific manner. Openness and nonlinearity make a complex system in principle unpredictable and uncontrollable: the tiniest internal or external perturbations can be amplified into global changes. Therefore, we will never be able to capture it in a complete and deterministic model. Still, agent-based computer simulations can help us to get an insight into the qualitative dynamics of the system, and to classify and delimit the likely scenarios for its further evolution.

On the other hand, the complexity perspective gives us new reasons for optimism: while we cannot truly control a complex system, it tends to self-organize to a state where it regulates itself. This state tends to increase the utility or fitness of the system’s active components or agents, by coordinating their interactions so as to maximize synergy. The resulting organization is distributed over all the agents and their interactions, and thus much more robust and flexible than any centralized design. Moreover, it determines a number of emergent, global properties that cannot be reduced to the properties of the individual components. By understanding the underlying mechanisms, we may be able to facilitate and stimulate such self-organization, or to drive it in one direction rather than another.

One of the most recent applications of the complexity perspective is the analysis of complex networks, such as the World Wide Web, and the nonlinear processes that generate them. This has led to the identification of common statistical features of such networks: small-world, clustering, and scale-free link distributions. These notions promise a wealth of applications in the analysis of information networks, potentially helping us with the organization, management, retrieval, and discovery of relevant knowledge within masses of ill-structured and continuously changing data.

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Computer-Mediated Communication (CMC)

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Abstract

Computer-mediated communication (CMC) is a field that studies the use of computers and related technologies as a means of facilitating human communication. With the decrease in cost of computer-based systems, use as a communication and collaboration medium has increased dramatically. Applications have been developed for businesses, educational institutions, and governmental agencies to meet the demand of emerging environments, and to enhance personal use of social networks. Scholarly research in the area of CMC has mirrored this growth. This entry first provides a description of CMCs, including areas in which computers have been used to facilitate collaboration, automation, and management. The second section categorizes both synchronous and asynchronous applications of CMC conferencing and communication technology by breaking applications down between task-specific and non-task specific areas of application within interpersonal, group, and mass communication venues. The remainder of this entry explores academic research in the area of CMC.

INTRODUCTION

The term *computer-mediated communication* or CMC was developed to represent the use of computers as a means of facilitating human communication. Computer-based systems have gained momentum as a communication and collaboration medium. Computer-assisted communications takes on a greater role in society as the cost of technology declines, as the communications infrastructure grows (e.g., the World Wide Web), as the cost of face-to-face meetings increases, and as social pressure to communicate and network with others more efficiently increases. Applications have been developed for businesses, educational institutions, and governmental agencies to meet their increasing demand for networked communication capability and for personal use to enhance social networks. Scholarly research in the area of CMC has mirrored this growth. The study of the impact of computers on human communications and information flow has resulted in a large collection of practical and theoretical papers. This growth has also fueled newer research streams as the number of uses for computers as an instrument of human communications continues to increase. A scholarly journal devoted to CMC (the *Journal of Computer-Mediated Communication*) has been created.

This entry will first provide a description of CMCs, including areas in which computers have been used to facilitate collaboration, automation, and management. Next it provides a framework for classifying various types of CMC and discusses each portion of the framework in terms of both example applications and research topics.

DESCRIPTION OF CMC

CMC has been described in various ways by academics and practitioners. Although some would describe CMC as virtually all computer uses that employ a user interface or involve the manipulation of data, this description may not include data or information flow between two or more people. Thus, computer applications such as statistical analysis programs, remote-sensing systems, and financial modeling programs would fit within this concept.^[1] A narrower view holds that CMC only encompasses those applications that directly assist human communication. That the term includes the word, “mediate,” implies reliance upon a third party or entity to enhance the information flow between two or more people. This entity adds something to the communication that helps improve (or at least provides the opportunity to do so) the efficiency and/or effectiveness of information flow. The addition of elements to aid information flow is what distinguishes CMC from ordinary telephone conversations, FAX communications, and electronic broadcasts (such as “webinars,” which are unidirectional). An example of an element that a computer might provide to enhance communications is the storage and presentation of large amounts of data, which is beyond the capability of human short-term memory to store. From this perspective, CMC encompasses not just the communication itself, but the entire process by which people create and exchange information using electronic systems and the extent to which computers assist the communications by adding some element of facilitation.

CMC can further be described according to its function. CMC is utilized in such diverse areas as teaching and learning, in social networking (for both personal and professional reasons), for dissemination and/or control of information, and for entertainment of various kinds. The methods by which each of these functions are accomplished provide additional ways of classifying a particular CMC system. Systems may require synchronous communications or allow sharing of information asynchronously; systems may provide for unidirectional communications or they may allow interactive participation; systems may provide for either small or large numbers of simultaneous participants; and systems may provide elaborate interfaces in very controlled circumstances or they may allow very informal settings that utilize simple interfaces.

This entry will discuss CMC first in terms of function as described above; next, it will provide some descriptions of systems currently in use and discuss how these systems achieve these functions; finally, we will present the various categories of research both by discipline and by topical area and journal publication. This entry is not meant to be all inclusive of every system that might be classified as a CMC, but to provide a broad taxonomy of current systems such that future systems might be understood and classified using these criteria.

There are several characteristics of CMC that can be used for classification. If communications between people occurs in real time (i.e., if one person must hear what another is saying at the time it is said), this is called synchronous communications. Conversely, if the speaker leaves a message for the receiver, which can be retrieved at a later time, this is termed asynchronous communications. Whether a message is unidirectional or bidirectional also provides us with a classificatory characteristic. Directionality can be further subdivided into active and passive components depending upon whether the receiver is expected to interact with the speaker with more than just a verbal response, as by engaging in a business transaction, for example. The complexity of the system from both the designer's point of view and the user's point of view (so-called user friendliness) is another feature used to classify systems. Finally, the degree of control exercised when the system is used can also be used to classify systems. As we discuss each example, we will use these categories to describe them.

CMC scholarship covers a wide range of applications. This is due in part to the number of potential applications for this technology and in part to the number of fields it spans. The term CMC has been used to describe research in diverse areas such as from electronic messaging,^[2] office automation,^[3] distributed decision-making,^[4] electronic boardrooms,^[5] teleconferencing, informatics,^[1] computer-supported cooperative work or CSCW, decision support systems and group support systems or GDSS,^[6] and computer-assisted instruction or CAI.^[1,7]

In general, CMC systems can be broken into three distinct areas based on application. These areas are conferencing, informatics, and CAI. While each area has unique characteristics, elements common to all CMC include communication, computers, and information exchange. Rather than attempt to describe each individual area fitting within CMC, this entry concentrates on the commonalities shared by CMC applications. The first section develops a general understanding of the primary divisions within CMC by discussing conferencing and communication, informatics, and CAI.^[8] The second section categorizes both synchronous and asynchronous applications of CMC conferencing and communication technology by breaking applications down between task-specific and non-task specific areas of application in interpersonal, group, and mass communication venues. The remainder of this entry explores academic research in the area of CMC.

PRIMARY FUNCTIONS OF CMC

Teaching and Learning

CMCs are used in several distance education scenarios. Lectures can be prerecorded and broadcast to students all at once or provided on a file server to allow asynchronous use. Lectures can also be broadcast live and can allow for either active or passive audience participation. Technology is available that allows for storage of recorded lectures and for notifying students when new lecture content is available using RSS (Really Simple Syndication) feeds. Live lectures can be uni- or bidirectional so that students can either sit passively and listen, or they can respond with questions and/or supplemental content while the lecture is broadcast. Lectures such as these are not limited to a single instructor or class, but might include several instructors located in various places broadcasting to several classrooms also located in various places. For example, a class on human resources might be enriched if some or all of the lectures were broadcast from several locations throughout the world so that students can get a better taste of the international climate and cross-cultural issues. A lecturer in Chicago might teach a local class and be piped into classrooms in New York, Los Angeles, London, Capetown, and Singapore, and be joined by lecturers in each of these locations.

Classroom-assistance programs have been developed to facilitate communications between instructors and students. Initially designed to replace the teacher's grade book, systems such as Axio, Blackboard, and others have evolved into a system that allows not just (near) real-time delivery of grades, but also for content storage and delivery to enhance learning and improve efficiency. Students can electronically complete assignments and upload them to the class repository (usually hosted by a Web server),

download and view assignments and other information pertinent to the class, and communicate with each other either synchronously or asynchronously. The idea behind these systems is to free time for both students and instructors that might otherwise be devoted to administrative tasks so that the time can be used more effectively for learning.

Classroom participation programs have also been developed and are currently being studied for their effectiveness. These systems were developed to provide real-time feedback to the instructor so that changes and assessment of learning can be made while class is conducted. Students are provided with electronic devices with which they can interact with a central recording unit when prompted by the instructor. An instructor can present a question regarding material covered in the class and allow the students to enter their answer using these electronic devices. Answers can be recorded and assessed immediately so that both the instructor and the students may become aware of learning progress. The instructor can then decide whether to repeat information not well understood or continue on to additional topics for information that has been assimilated.

Computer labs and computer simulation is another method by which teachers can transfer information to students. Prewritten lab exercises can be performed by students either in a live lab or asynchronously outside of class time so that students can see and learn the topics by performing exercises designed to provide new information to the students. This type of instruction is especially suitable for software training. Computer simulations are similar to see-and-perform lab exercises, except that the student is now required to prepare a simulation environment and then let the computer perform the actual steps. Simulations are beneficial when large amounts of data must be created and analyzed in a short period of time.

Conferencing and Collaboration

A primary use of CMC has been to facilitate direct human communication through conferencing and collaboration applications. To understand the differences in these two types of applications, we can divide them into task-related and non-task related scenarios. When people meet to accomplish specific tasks, we can categorize this as collaboration. Task-related communication systems therefore imply that such systems are designed to help participants concentrate on specific goal completion with human communication as a necessary link in the process. On the other hand, when people meet to discuss agenda items for which there is no immediate result (except perhaps plans to act in the future), we can categorize this as conferencing.

Several types of computer applications have been designed to support group conferencing and collaboration. These include instant messaging, chat rooms, text messaging, blogging, wikis, GDSS systems, groupware, and audio

and video teleconferencing. Table 1 provides a framework to categorize these systems based on whether they are primarily used for conferencing or collaboration and whether they are used synchronously or asynchronously.

Many of these systems have gained widespread acceptance and use in both personal and business settings. Instant messaging, blogging, and wikis are all examples. On the other hand, systems such as GDSS have received an enormous amount of attention in the scientific literature (e.g., Nunamaker)^[9] but have largely been used in business settings.

The term group decision support systems or GDSS has been used to describe a particular area within CMC, specifically developed from the need to support organizational decision-making processes which are being implemented by more than an individual. Unlike the non-task specific CMC applications, GDSS are generally used to facilitate a particular task. As such, GDSS can be described as an interactive computer-based system used to support collective decision making. The term *group support systems* is often associated with GDSS, but focuses specifically on processes within the group. However, a GDSS may also include provisions for collaboration from outside the group and for information management.

Generally, decision makers utilize data and models within a GDSS to communicate and solve problems. However, researchers have classified a variety of applications as GDSS ranging from systems to facilitate electronic meetings to systems to support complex decision processes.^[10]

The simplistic GDSS may consist of no more than a personal computer and voting pads combination. In this arrangement questions are answered with a simple yes and no. The results are tabulated real time and the results are displayed graphically. In more complex GDSS implementations, anonymously entered data can be displayed and options such as data consolidation, statistical analysis, voting tabulation, ranking, and agenda planning exist.

Other GDSS systems have been developed to support an organizational paradigm of computing. In this view, the GDSS integrates data from corporate transaction processing systems and decision support systems and uses this information to demonstrate various outcomes.

GDSSs have been developed for use in several different environments. Among these are decision rooms, local networks, and remote networks. In the decision room scenario, a traditional conference center is equipped with computerized aids. This allows both the advantages of face-to-face communication and electronic interaction to

Table 1 Group application classifications.

	Synchronous	Asynchronous
Conferencing	Instant messaging, chat rooms, audio and video teleconferencing	Text messaging, blogging, and wikis
Collaboration	GDSS	Groupware

be enjoyed. A networked GDSS is designed to allow participants to interact remotely. Using their own computers, communication and access to data and decision support tools is enabled. Such systems allow collaborators to be located within the same building or to be geographically dispersed.

GDSS applications enjoy several benefits, among these are anonymity, extension of group memory, parallel task completion, and democratization of decision making.

Researchers report anonymity enhances group member participation by reducing inhibition.^[10] Groups working anonymously produce greater numbers of solution clarifications, critical comments, questions about solutions, and total comments. In addition, members were more likely to be critical of ideas, to ask questions about new ideas, and to clarify or add to ideas. Anonymity acts as a buffer between people, disassociating them from their comments. This reduces behavioral constraints on group members and allows them to contribute more freely to the group discussion.^[11]

The efficiency of group work is also improved by a GDSS through the structuring of team member interactions. Resulting time savings allows a greater focus on its task performance and problem solving activities.^[12] Parallel entry also provides an increase in group efficiency. Members do not need to wait for someone to finish speaking before beginning the entry of additional information.^[13]

GDSS tools can also enhance group memory. Retaining group memory has been a traditional barrier in face-to-face interaction and often results in information loss. Features of GDSSs such as electronic information capturing and display have been specifically designed to reduce information loss. A single garrulous person cannot raise his or her voice to dominate a meeting when GDSS is used. GDSS tends to democratize the process giving members the same opportunity to express their ideas through their terminal.

GDSS applications are not without shortcomings. The use of GDSS tends to reduce face-to-face interpersonal communication and increase social distances between members. In addition, the technology used to implement a GDSS can make meetings more complicated, particularly to the facilitator.

A variety of commercial products have been developed in the area of GDSS. Among these are *VisionQuest*, an electronic meeting support software supporting anonymous brainstorming, voting, allocation, and meeting documentation. Like most GDSS products, it runs in a variety of environments and requires that network software already be in place. Other tools include Autotel Information System's *Clarity* which provides a permanent record of the group's interactions; *CM/1* by Corporate Memory Systems—a graphical meeting map combining a hypertext interface with an object-oriented database to allow groups to collaborate and organize ideas during brainstorming sessions; *Group Systems V* by Ventana, an electronic

meeting software that captures anonymous text-based ideas and displays the results in a shared screen environment; and *OptionFinder* from Option Technologies, an interactive GDSS that allows each meeting participant to vote using a numeric keypad attached to a PC then collects, calculates, and graphically displays results in real time.

Newer products that can be classified as GDSS systems include IBM's Sametime, Microsoft NetMeeting, and Citrix's GoToMyPC. These systems allow users to interact via a public or private computer network using audio, video, file sharing, Web page sharing, voting, and other functions depending on the setup at each individual computer. A server is used to run the software and host the meeting. Each participant can then log into the meeting using a Web browser. Users can share their desktops and even allow another group participant to take control. This is especially helpful in which technical support is needed or in which users can utilize a common screen to share ideas, yet are geographically dispersed.

Dissemination and Control of Information

Two aspects of information sharing among people that can have separate meanings but are many times interactive because of social agendas are the dissemination of information and the control of information. Dissemination can range from *freely available* as one would find in a public library to *strictly controlled*, as might be the case for government classified documents. Information control is easier when less information is available for dissemination, but as the volume of information grows, one technique used to protect it is through selective release. To accomplish this, an organization can simply filter the available information so that only those topics considered public by the organization are disseminated. This is especially prevalent when persuasion of the information receiver is the goal, such as in marketing/sales situations, politics, and fund raising activities. It is also prevalent when protecting confidential or proprietary information, or when misleading the information receiver is the goal (e.g., Gup).^[14]

While these concepts are not new, the use of computers to store and disseminate data and information has brought with it an increased ability to disseminate voluminous amounts of data and to control what is disseminated. The Internet and the World Wide Web have proven to be a nearly universally available conduit for information sharing for which search engines have been developed so that interested researchers can find answers to just about any question that has an answer. The other half of this complex maze of information is the information providers who make both old and new information available in electronic form and post it in Web sites on the Internet. Users can easily formulate a simple query regarding an item of interest and submit it to a search engine that will return a

myriad of related Web sites that are relevant to the query. These search engines are free to the user, but for this access, the user is subjected to advertising, which is not free, thus turning the search engine into a (hugely) profitable business.

Additional methods for dissemination of information are Web logs (blogs), wikis, and other commercial Web sites, especially those devoted to news and weather and to special interest groups such as professional organizations and political action committees. Commercial Web sites are usually devoted to advertising by providing company, product, and service information, but may be transaction-enabled so that consumers can make purchases directly online. Other forms of information disseminated electronically via the World Wide Web include legal (e.g., LegalZoom.com) and medical information (e.g., WebMD.com), government information such as governmental activities and welfare benefits, and information disseminated from professional societies, religious groups, lobbyists, and political organizers and terrorist organizations.

The mediating effect of the computer is seen first in the ability to store massive amounts of information in diverse places, as in blogs, wikis, and Web sites and second in the ability to quickly search through this information and retrieve only that which is relevant to the question.

Informatics

Informatics dates back to 1957 when Karl Steinbuch published a paper that dealt with automatic information processing. Since that time it has been defined and redefined so that it is now often confused with other disciplines such as computer science and cognitive science. For the purpose of this discourse, we focus solely on the automation of information processing as it deals with CMCs. In that sense informatics can be described as the treatment of data and information by computers to present it in such a way as to be understood and used by humans. It works like this: humans determine that certain raw facts must be stored for later use and so these facts are entered into an electronic database for storage onto electronic, magnetic, or optical media. When later retrieved, the data is processed by the computer (according to preprogrammed human instructions) and is presented in usable format as information. As the science of data storage and treatment grows, so does the ability for computers to do more of the work by picking the details that must be stored, organizing them in certain ways to eliminate repetition, and to search through available data banks to obtain only that which is necessary to solve a particular problem or perform a task.

As an example, consider a patient's medical record. The care providers can enter patient data into an electronic medical record so that it can be reviewed at a later date by a doctor who might diagnose or treat a condition, but must be cognizant of a previous history, which might add to or in some way affect the outcome of current treatment. As

more information is programmed into the computer, some decisions can be made by the computer itself, such as warning the doctor of possible drug interactions. Providing just-in-time information to the care giver is a highly desirable goal because it can improve the efficiency of medical care—improve its effectiveness and reduce its cost.^[15,16] As knowledge workers extract information on the factors that lead a physician to a certain diagnosis and a course of treatment, and program this knowledge into a computer, expert systems are created that allow the less knowledgeable care giver to analyze and perform actions that were previously left to the more educated ones. The effects of this are to push more and more of care and treatment responsibilities to the lower end of the care giver spectrum such that nurses, physician's assistants, and midwives are now relied upon for care that has become "routine" but which used to require in-patient care.^[17]

Computer-Supported Cooperative Work

The study of people working together using computerized technology is the focus of computer supported cooperative (or collaborative) work or CSCW. While this area can be classified under the umbrella of CMC, the goal of researchers in this area is to develop better ways to use computer technology to further enhance the group work process. Key concerns include trying to better understand the role time and location play in the process. The focus of CSCW is the social interaction of people, not technology. Typical topics in CSCW research include e-mail, shared applications, databases, hypertext, and other technical developments that improve a participants' awareness of other users and their activities. Like CMC in general, CSCW can be divided into synchronous and asynchronous domains. The term *Groupware* is used to refer to the technology used by individuals wishing to collaborate on a project. CSCW on the other hand refers to the field that studies human use of that technology.

APPLICATION VENUES

A second way of classifying CMC is to view how applications are used in various communication venues. In general these venues are: interpersonal, group, and mass communication.

Interpersonal

CMC systems developed specifically for communication support between two individuals or within a very small group are classified as interpersonal. Interpersonal communication systems can be synchronous or asynchronous with text, audio, and video based-communication being passed between system users. Synchronous communications operate in a real-time or near real-time atmosphere.

Text-based chat, video chat, and voice communication have all been implemented using computer technologies to facilitate synchronous interpersonal communication. Asynchronous systems generally are based on stored text, audio, or video files. One of the most common asynchronous interpersonal communication systems is e-mail, but other applications are gaining popularity with video, text, and audio implementations. These applications involve digitally storing information then transmitting them to the receiver who can listen to or view the message at his/her leisure.

Text-based chat and messaging

Chat and messaging systems provide a synchronous, text-based way to communicate with people all over the world. Most real-time chat systems rely on the Internet as a transmission medium. In general terms, Internet relay chat (IRC) systems consist of various separate networks of chat servers or machines that allow users to connect. Once connected to a server, text-based communication can begin. Besides providing a means for interpersonal communication, chat systems are often used to enable communication between larger groups of people. The largest chat networks at this time are EFnet, IRCnet, QuakeNet, and Undernet. In most applications, the user will run a program called the client and connect to a server on one of the nets. The server relays information to and from other servers on the same net. Some of the best-known client programs include mIRC which runs in a windows environment, X-chat runs under Mac's OS X, and ircII which runs on Linux systems. A client connected to a chat network has the option of joining one or more channels. These channels are used to categorize and separate conversations by topics. Chat networks may have several thousand channels available at any time and the user can generally initiate a new channel. Conversations may be public (everyone in the channel will see the typed messages) or they may be private (communication is between only invited people) depending on the way in which the channel was created.

IRC chat is currently declining in use largely due to the popularity of instant messenger software systems. Providers such as Yahoo, Microsoft, and AOL all have provided software focused on allowing users connected to the Internet via computer or mobile device to send and receive text messages in real time. Additionally, other features such as webcam use, file transfers, and message storage have added to the sophistication and desirability of these applications.

Video conferencing

Interpersonal video conferencing facilitates synchronous communication using video and audio. Like many CMC tools, this communication method can save time and

reduce travel costs. Video conferencing software currently offers everything from compressed low-bandwidth images on desktop PCs with messenger software to full-motion, broadcast quality video. Frequent users may utilize private line video conferencing and less frequent users may opt for standard Internet access. Video conferencing can be either one-way or two-way interactive and provide a multimedia mix of voice and graphics in addition to video. Personal video conferencing is focused on one-on-one, person-to-person interaction. Other applications of video conferencing might be directed toward larger groups of people. One of the best-known video conferencing software packages is Polycom. Instant messenger softwares such as Yahoo!Messenger also allow video conferencing.

Voice communication

Audio conferencing programs digitize speech as the user speaks and sends the digital data over the Internet or other transmission media. Often this is called voice over IP or VOIP. In order to match sound quality comparable to regular telephone service, most audio communication applications compress sound information before transmitting. In full duplex conversations, sender and receiver can speak and hear the other person simultaneously. In half duplex applications, only one person can speak at a time.

Various commercial products have been developed to support audio CMC applications. Currently, cable television companies market Internet phones and applications such as Skype provide VOIP services for users via their computers. Messenger software also incorporates VOIP services.

The main disadvantage with VOIP communication applications is that most offer proprietary compression schemes, which make compatibility across applications difficult. Internet bottlenecks and transmission interruptions can also slow the natural cadence of communication as well.

E-mail

Electronic mail or e-mail provides a means of sending text-based messages over a communications channel. E-mail is similar to regular mail with an added advantage—speed. E-mail allows both the sender and receiver to asynchronously communicate at convenient times.

Asynchronous voice and video

Developed as an extension to e-mail software, asynchronous voice and video applications have become more popular. Digitized voice and video files are transmitted as attachments to email and viewed or heard at a time convenient to the receiver. Some messenger software allows asynchronous messages to be sent to off-line users.

Groups

CMC systems have also been developed specifically to support communication within groups. Like the interpersonal systems, group CMC has been developed to support both synchronous and asynchronous modes of communication. Text, audio, and video formats can be used to facilitate the exchange of information between system users. In terms of synchronous communication, chat systems, real-time video systems, networked meeting systems, multiple user dialog systems, and group collaboration systems have all been implemented. Asynchronous applications such as discussion boards, blogs, and electronic mailing list software have also been developed.

Chat systems

Most text-based chat systems were designed to support synchronous communication within groups. The same applications used to support interpersonal communication are also used to support groups over the Internet or other computer networks.

Real-time video

Several real-time video conferencing software packages are currently available. Some of these have been developed for use in educational settings. Of these, Polycom is one of the best known and most widely used. Polycom allows users to hold desktop video conferences using the Internet as a transmission channel.

Networked meeting software

Networked meeting software generally refers to a package which supports synchronous collaboration tools like group chats, shared whiteboards, multiuser editors, Web slide shows, or and shared applications running simultaneously on the Internet or other network. A number of these platforms have emerged in both the business and education arenas.

Multiple user dialog

A variety of multiuser environments have become available to support real-time group communication and collaboration over computer networks. Multiple User Dialogs or MUDs and related systems such as Object-Oriented MUDs or MOOs were derived from systems developed by the gaming community in the 1970s and 1980s. Many of the original MUDs have been extended to provide real-time conferencing and collaborative environments. Sometimes called text-based virtual realities, these multiuser environments can be used to facilitate group interaction. MUDs are generally text-based sites that allow people to connect to the same place at the same time. Unlike

conventional chat rooms, they allow program manipulation and interaction through supporting software. In other words, the decision of one user can impact the perceived environment of another user. Synchronous communication is usually a component of the system.

When logged onto a MUD, an individual types rather than talks, reads rather than listens, and manipulates programs to describe themselves and the current state of the virtual environment. Resulting descriptions are generally text-based and in real time.

Recent advances in Internet bandwidth and software sophistication have enabled these same concepts to be enhanced with 3-D graphics and additional features such as voice. Gaming and social software systems such as World of Warcraft (WOW) and Second Life have added avatar capability to give users an appearance and facilitate communication more closely emulating real-world interpersonal communication.

Groupware and collaboration

Groupware encompasses a wide set of technologies used to support interpersonal and group collaboration. Groupware ranges from e-mail to Electronic Meeting Systems (EMS) to workflow collaboration tools. Generally speaking, groupware provides tools to solve *collaboration-oriented* business problems. The general concept driving groupware is the intent to foster collaboration and interpersonal productivity. This is accomplished through the technical automation and enhancement of a variety of tasks. Some groupware applications seek to integrate the functionality of e-mail with other technologies such as calendar/scheduling software. Others integrate group work processes, workflows, and meetings.^[18]

Newsgroups and blogs

Unlike the related asynchronous interpersonal CMC technology, e-mail, newsgroups facilitate group asynchronous communication. Rather than receiving messages directly, newsgroup messages are posted to groups. These groups are organized into topic headings. The user can decide which topics are of interest and choose which messages to view or download. An early newsgroup system was called the Usenet. Usenet was an international forum where asynchronous discussions on myriad topics are constantly taking place. Usenet discussion was been described as liberating because of its anonymous nature. As in many applications of CMC, participants are judged on their words, rather than on outward appearance, age, or gender.

Newsgroups have declined in popularity over time until they have almost become a relic of early Internet use. Their functionality has largely been replaced with Blogs and discussion boards which provide much of the same functionality.

Electronic mailing lists

Like newsgroups, electronic mailing lists are an asynchronous group communication technology. Mailing lists use e-mail technology to disseminate information and facilitate discussion. In many mailing list systems, a user subscribes to a list. After acceptance, copies of every message sent to the group will be routed to each member on the list. If the list is moderated each message will be reviewed by a moderator prior to being disseminated to each member. Most mailing lists will have three email addresses. These are:

- The Subscription e-mail: To subscribe to the list.
- The List e-mail: To send messages to the list.
- The Administrator/Moderator e-mail: To contact the administrator or moderator of the list.

Mailing lists fall into two categories, manual and automatic. Manual lists are generally moderated or controlled by a particular person. This person accepts, rejects, or edits message contents. Automatic lists are not generally moderated. Instead computer programs called robots are used for administration. Two common robots are LIST-SERV and Majordomo. Other types of mailing lists allow readers to read messages but not send new messages.

Social networking software

Like groupware, social networking software provides communication capabilities suited to group communication situations. However, beyond group communication, social networking also allows participants to engage in individual discussions and mass communication within a shared environment. In general, social networking focuses on the construction and development of like-minded online communities and provides a variety of Web-enabled ways for users to interact. Social networking is currently used by millions of people in both work settings and in their personal lives. Some of the most common social networking sites are MySpace, Facebook, Bebo, Orkut, Second Life (a virtual 3-D social network), and Cyworld (also 3-D).

Mass

CMC systems have also been developed specifically for mass communication. This means computer systems facilitate one-to-many communication in either a synchronous or asynchronous mode.

Text

Technologies such as mailing lists, newsgroups, and Web sites have been implemented to effectively allow one-to-many communication. This is particularly true of

mediated newsgroups, Blogs, and mailing lists where a single individual is able to communicate to an audience which cannot be limited.

Audio

Systems have been developed to present real-time audio over the Internet and other networks. Users with conventional multimedia personal computers, a network connection, and the appropriate software are able to listen to real-time sound broadcasts. The term podcasts has been used as a descriptor.

Video

One-to-many video applications operate over the Internet and other networks. Multicast provides one-to-many and many-to-many network delivery services. Sometimes called video casting, vidcasts, video podcasts, video streaming has become a very important Internet application. Web sites such as YouTube and iTunes have provided infrastructure that has allowed video casting to become commonplace.

CMC RESEARCH

CMC research has been found in a multitude of disciplines including communications and journalism, library science, engineering and computer science, business, criminology and forensics, knowledge and operations management, education, psychology, including cognitive science, sociology and anthropology, law and ethics, and both human and veterinary medicine. Research is not limited to each single discipline, however, and the norm is more multidisciplinary. As examples, engineering teams with medicine to discover new ways of treating and detecting disease and communicating these techniques to both engineers and physicians; computer science may team with anthropology to discover new ways to analyze ancient texts.

The range of research is also quite broad. Research may be focused entirely on hardware improvement so that data and information can be shared much more quickly than before. (As an example, consider that a 10 GB connection that stretches across the United States is fast enough to transmit an entire 24-volume encyclopedia from Los Angeles before the first bit is received in New York.) Research is also focused on software improvements to allow organizations to do more with the hardware that they have. (In fact software development often creates a need for further hardware improvement because newer software usually requires more powerful processing than was previously available.)

As research helps humankind to improve the sharing of information and to solve intractable problems, much of the problem solving is turned over to the computer because of

its ability to store massive amounts of data and recall it quickly and to process massive numbers of calculations in a short period of time. Thus, this type of research is *auto-catalytic* in nature—bigger and more powerful machines allow us to solve more problems, and this in turn provides even more problems to solve. This germinates the need for bigger and better machines, and the cycle is repeated.

The other end of the research spectrum focuses on the user. Such questions as the perceived value of an information system, the perceived success of an installed information system, and how well a user is able to interact with a system (so-called human–computer interaction) are some of areas which have received a lot of attention.

Additional topical areas fall in between the devices and the programs and the users, and include group work and interactions, individual work, performance and productivity enhancement, software that supports social networking, religion and cross cultural issues, security, cyber and information warfare, comparisons of different communications techniques, and entertainment.

Techniques used to accomplish CMC are also studied. Most people are familiar with instant messaging, chat rooms, electronic mail, blogging, and wikis and these areas have received attention in the literature. Newer techniques include VoIP, which provides telephone service over the Internet instead of the legacy telephone circuits, text messaging and other forms of communications using cellular and satellite technology, and audio and video conferencing using tools suitable for Internet transmission. One reason that the move from the legacy telephone circuit to the Internet infrastructure gets so much attention from both researchers and practitioners is that the older telephone systems utilize a method known as circuit switching, while the Internet uses a different technique born of data communications technologies called packet switching. With circuit switching, a physical line is held during the course of a phone call; with packet switching, a communications message is divided into chunks called packets and each is sent autonomously to the receiver. The need to tie up a single physical line is eliminated with packet switching and alternate routes may be used when sending the packets. This technology brings both advantages and disadvantages and so much effort is devoted to analyzing and improving upon the technique.

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Computer-Supported Cooperative Work (CSCW)

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Abstract

In this entry, we consider various definitions for computer-supported cooperative work (CSCW) and related terms, and we draw outlines around the large scope covered by CSCW. Subsequently, we consider the main challenges that have impeded us from realizing the great promise of CSCW and we identify some factors that could help CSCW succeed. We review the current state of practice for CSCW, along with some promising technologies. We close with our outlook for CSCW.

Few contest the claim that modern information technology, supported by computers and communications, contributes to a dramatic improvement in productivity and effectiveness among individuals engaged in a wide range of tasks. Computer-supported cooperative work (CSCW) aims to provide similar improvements for “multiple individuals working together in a conscious way in the same production process or in different but related production processes.”^[1] If achieved, this aim, which has proven elusive during the relatively few years since the term CSCW was coined in 1984, promises to multiply our productivity, perhaps by more than the square of the number of users, as compared against the productivity improvements that personal computers provide to each of us as individuals.

In this entry, we consider various definitions for CSCW and related terms, and we draw outlines around the large scope covered by CSCW. Subsequently, we consider the main challenges that have impeded us from realizing the great promise of CSCW and we identify some factors that could help CSCW succeed. We review the current state of practice for CSCW, along with some promising technologies. We close with our outlook for CSCW.

DEFINITIONS

The term CSCW first appeared in 1984 to identify an interdisciplinary workshop organized by Irene Greif and Paul Cashman at MIT in August of that year for invited researchers to consider how computers might be used more effectively to support people in their various work arrangements. A second, open workshop on CSCW followed in December 1986, attracting 300 people. Since then, an international CSCW workshop^[2] has been held every 2 years starting in 1988. Because CSCW is such a new area of investigation, one might expect significant controversy and fluidity regarding its definition and focus. Surveys of the CSCW literature support this expectation.

Most observers seem to agree that CSCW, an emerging interdisciplinary field, entails some combination of computing and social science. For example, Greif^[3] suggests that CSCW is an interdisciplinary endeavor encompassing artificial intelligence, computer science, psychology, sociology, organizational theory, and anthropology. Similarly, Paul Dourish^[4] sees CSCW as a highly diverse discipline involving psychology, sociology, anthropology, network communication, distributed systems, user-interface design, and usability. Beyond agreement on the interdisciplinary nature of CSCW, opinions vary widely about a detailed definition and an exact focus for the field.

CSCW researchers seem to adopt one of two main viewpoints. One viewpoint is technology-centric, placing an emphasis on devising ways to design computer technology to better support people working together. For example, Greif^[1] defines CSCW as a distinct and identifiable research field focused on the role of the computer in support of group work. A second viewpoint is work-centric, placing an emphasis on understanding work processes with an aim to better design computer systems so as to support group work. For example, Suchman^[5] defines CSCW as “the design of computer-based technologies with explicit concern for the socially organized practices of their intended users.” Similarly, Bannon and Schmidt^[6] believe that “CSCW should be conceived as an endeavor to understand the nature of cooperative work as a foundation to designing information systems to support the work.” In a subsequent article, Schmidt and Bannon^[7] restate their position, and identify several important questions, listed below, which they believe CSCW researchers must answer.

1. What characteristics distinguish cooperative work from individual work, and what support requirements derive from those characteristics?
2. Why do people work together, and how can computers be applied to address the requirements arising from the specific reasons?

3. How can coordination requirements arising during cooperative work be accomplished more easily using computer technology?
4. What do the identified requirements imply for the development of system architectures and services?

The main emphasis of researchers holding the work-centric viewpoint is to understand cooperative work so as to design computer systems to better support cooperative work. The main emphasis of researchers holding the technology-centric viewpoint is to design computer systems to better support the requirements of cooperative work. Further, as Mahling^[8] observes, some social scientists also work in the field of CSCW.

Typically, social scientists working in the field of CSCW aim to describe and analyze the behavior that they see as people work together: focusing purely on description, not prescription. On the other hand, work-centric and technology-centric CSCW researchers aim to create computer systems that address the requirements of cooperative work groups. As such, these researchers hope that the social scientists, through their studies, will prescribe the requirements for successful CSCW systems. To date, this expectation remains unrealized, but much energy has been expended as CSCW researchers work to understand and reconcile these different views. The outlooks suggested by Suchman and by Bannon and Schmidt indicate that some researchers are attempting to work across the gap between description and prescription. In fact, some consensus appears to be building among researchers that CSCW is fundamentally a design-oriented research area. Under this view, the main focus of CSCW should be toward the design of systems that embody a deep understanding of the nature of cooperative work, and its forms and practices. As we will outline in a bit, the current scope of cooperative work, in terms of forms and practices, proves so large that the challenge for CSCW researchers may be overwhelming. First, though, we need to provide some explanation about the many confusing terms and concepts surrounding the field of CSCW.

SELECTED TERMS

Due to its broad scope and relative youth, the field of CSCW encompasses a wide array of specific and sometimes confusing terms. In this section, we introduce and attempt to distinguish among some of the more common terms. People often use *groupware*^[9] as a catchy term to refer to CSCW. More specifically, we can think of groupware as computer software and related computer networks that enable collections of people to work cooperatively. Groupware might include application-sharing programs, videoconferencing software, software for tracking document changes, electronic-mail software, and software to support the collaborative viewing of Web pages. *Workflow*^[10] is another term

often used to refer to CSCW. Workflow deals with the specific issues surrounding movement of transactions through a set of people who must act together to complete some required work. In this sense, workflow is a more specific term than groupware; however, workflow software typically supports formal work processes, and so is often excluded from the scope of groupware, which is usually considered to be software that supports less formal forms of collaboration. *Team computing*, a term coined at Xerox PARC,^[11] refers to collaborative systems to support group meetings. In general, such meetings are envisioned to occur in face-to-face settings. More recently and more conventionally, another term, *electronic meetings*,^[12] has been used to describe group meetings enhanced through the use of computers, networks, and software. A less common term, *media spaces*,^[13] occasionally appears in discussions of CSCW. The intent of media spaces is to provide a virtual meeting space where distributed collaborators can congregate electronically, meet informally, and gain all the advantages of collaborators who work together within the same physical location.

KEY DIMENSIONS OF CSCW

As indicated in the brief discussion of definitions and selected terms, CSCW involves a broad, multidimensional scope. Here we aim to distinguish some of the important dimensions inherent in CSCW, and to clarify the essential features that must be supported by CSCW systems. Table 1 lists 10 key dimensions of the complex design space for CSCW; for each dimension the table indicates two extreme design points. One important dichotomy facing designers of CSCW technology occurs along the *time* dimension: is there a requirement to support cooperative work that occurs simultaneously (synchronously) or separately (asynchronously) or both? Another decision relates

Table 1 Ten key dimensions in the CSCW design space.

Dimension	Extreme design points
Time	Fully simultaneous vs. fully disjoint
Space	All collocated vs. fully distributed participants
Group size	Small team vs. mass audience
Interaction style	Assigned workflow vs. ad hoc
Context	Single vs. unlimited collaborations per participant
Infrastructure	Fully homogeneous vs. fully heterogeneous
Collaborator mobility	All in fixed locations vs. all mobile
Privacy	Assigned by authority vs. controlled by participant
Participant selection	Assigned by authority vs. free for all
Extensibility	None vs. all functionality defined by participants

to *space*: must the individual collaborators be physically located at the same site, such as a room or an auditorium? Of course, a more complicated requirement might also exist for multiple, physically distant, sites of collocated collaborators to be brought together virtually. A third important dimension is *group size*: must the system support a small team, a department, an enterprise, or a mass audience? A fourth dimension must consider *interaction style*: does the group require support for planned or impromptu interactions or both? A fifth dimension covers *context*: do group members participate in many distinct collaborations or do they tend to participate in only one or few? A sixth dimension relates to *infrastructure*: will the group permit the deployment of homogeneous computing platforms tailored to collaboration or must the CSCW system operate across already deployed, heterogeneous computing systems? A seventh dimension defines *collaborator mobility*: will the collaborators remain at fixed locations or will some or all of the collaborators move among locations? An eighth dimension considers the degree of *privacy*: how much information can be made available about the collaborators and who should control the release of information? A ninth dimension considers *participant selection*: must the group's participants be assigned by existing group members or by some external authority or can participants self-select or search for additional participants from a larger population? A tenth dimension covers *extensibility*: does the CSCW system define the complete functionality available to collaborators or can the collaborators extend the functionality to support changing needs? These 10 dimensions provide a rich design space through which the developers of CSCW technology must navigate. Despite such richness, CSCW researchers have been able to focus on some essential features that CSCW systems must provide.

Essential Features in CSCW Systems

Much of the CSCW research literature focuses on providing collaborators with tools to support *articulation work*:^[7] establishing and evolving organizational structure, plans and schedules, standard operating procedures, and conceptual schemes for classifying and indexing information objects. In other words, CSCW aims to support the overhead that arises when work is conducted among distributed, independent agents. Articulation work includes two important threads: construction and management of a common, shared information space and workflow management. In the past, designers of workflow systems automated written procedures as maintained by each target organization, which in all cases turned out to be a fictional, idealized version of the real work process. Now, CSCW researchers understand that most work situations entail a continuous renegotiation of task descriptions and allocations. Further, researchers understand that collaborative communication must allow for ambiguity in

the negotiation processes surrounding articulation work. To support articulation work, CSCW researchers investigate essential design features in five main areas: communication, configuration, coordination, information access, and interaction. Table 2 indicates some of the specific features encompassed by each of these areas. We discuss these features further below.

Communication

Successful negotiation on issues related to organization, planning, and control requires provision of an effective system for communication among the individuals involved. For this reason, human-to-human communication is one of the key features needed for CSCW. Previous research^[14] suggests that audio is the most important channel for successful communication. Some CSCW researchers^[15,16] have investigated the effectiveness of conference calls, or open-loop multiparty audio channels. Other researchers^[17] have shown the value of shared audio channels even when a group of workers is physically collocated. The importance of collaborating around data or documents is also well established. For this reason, a group audio channel is sometimes augmented with a separate distribution channel for sharing views of a document and for highlighting on the document. More sophisticated communication systems integrate audio and data distribution channels together with video channels to compose a form of multimedia conferencing. Whether communicating live (synchronously) or in playback mode (asynchronously), humans can benefit from such multimedia channels.

For live communication, multimedia transmissions often stream data among multiple points in some form of videoconferencing arrangement so that all parties can simultaneously see and hear each other, along with any relevant documents. Satisfactory video viewing usually requires a rate of at least 15 frames/sec. Typically, multimedia communication includes an associated audio channel that requires reasonably tight synchronization with the video, within at least 200 msec. These factors place a

Table 2 Five CSCW design areas and some key design features in each.

Design area	Key features
Communication	Asynchronous, audio, data, private, shared, structured, synchronous, text, unstructured, video
Configuration	Adaptation, composition, evolution, extension
Coordination	Access control, concurrency, consistency, delegation, scheduling, versioning
Information access	Distribution, filtering, retrieval, structure
Interaction	Attention management, awareness, context management, relationship establishment and maintenance

premium on the quality of service (QoS) provided by the underlying data transmission channels. For this reason, much of the research^[18] related to networking for CSCW has investigated techniques to provide the necessary QoS transmission characteristics. Currently, the required QoS can usually be arranged by configuring a conference topology to support multiparty communications at transmission bandwidths (typically ranging up to 2.0 Mbps) provided by H.320-compliant products. Bandwidth requirements for satisfactory multimedia conferencing vary depending upon the configuration of the devices at conference endpoints—a minimal conferencing arrangement typically requires around 300 Kbps. Unfortunately, most collaborators must use the more ubiquitous Internet, which does not provide built-in mechanisms to request and achieve specific targets for QoS. For this reason, much network research^[19] related to CSCW has focused on establishing QoS for multiparty transmissions on the Internet.

In the absence of either multimedia conferencing support or audio communication channels, successful collaboration can still be conducted through the use of text-based interaction systems, known variously as chat (instant-messaging) applications or chat rooms. Text-based chat applications can also provide private channels for a subset of collaborators to hold side conversations outside the purview of the main proceedings. As chat applications become more sophisticated, they can also provide a convenient means to distribute documents, data, and images related to a collaborative session. Beyond free-flowing text-based chat applications, CSCW researchers have developed and assessed a number of techniques for enforcing structure on the dialog and interactions associated with a collaborative session. Such systems, which include newsgroups, dialog-threading applications, and indexed electronic-mail lists, have proven useful in limited ways. Studies^[20,21] have shown that the rather fixed capabilities provided by most of these systems can sometimes impede their effectiveness as a collaboration tool.

Due to the growing role of globalization in the workplace, CSCW researchers have begun to investigate how to facilitate cross-cultural communications, which must bridge differences in natural languages and social norms. Setlock and colleagues^[22] investigated the influence of cultural differences among teams, comprising American and Chinese members who work synchronously, either face-to-face or through computers, to solve two tasks. The teams worked in English. The study compares teams, consisting of all Americans, all Chinese, and a mix of Americans and Chinese, with respect to several factors (e.g., communication style, quality of interaction, persuasion, and task performance). Yamashita and Ishida^[23] considered effects of machine translation on teams, consisting of Chinese, Japanese, and Korea members, who worked through instant-messaging software to agree on an ordering of 10 figures. The study compared working with the aid of machine-translation software against collaborating

in a common second language (English). The area of cross-cultural and cross-lingual collaboration is due for increased study.

Configuration

Whether supporting small or large groups, CSCW systems have proven difficult to setup and configure. The scope of such systems is large, covering several layers of system and application software and many points in a distributed topology, both within the network and at network end points. Though relatively few CSCW researchers^[24] have chosen to investigate these issues, we suspect that the viability of CSCW systems depends in some large measure on the ease with which collaborative sessions can be established. A number of researchers^[25–29] have investigated the difficult problems associated with: (1) extending the capabilities of CSCW systems after deployment; (2) automating adaptation to changes in available resources for transmission and display of data; (3) composing CSCW systems from a range of supporting components; and (4) evolving system components to suit the changing needs of collaborators. Research surrounding the configuration of CSCW systems has not yet received the attention it warrants. Successful adoption of CSCW technology will certainly require an ease of configuration that at least equals and tracks the ease with which desktop computer software can be configured.

Coordination

Much of the communication associated with CSCW is used to coordinate work among the disparate, independent parties engaged in a collaborative endeavor. For this reason, CSCW researchers investigate features and mechanisms to help groups coordinate their activities. A major aspect of group coordination involves scheduling, whether of people, processes, or resources. While some CSCW researchers^[30] have investigated techniques to more tightly integrate calendaring software with other aspects of collaboration, such as document distribution, situation awareness, and personnel location tracking, more of the research to date has focused on process or workflow scheduling and coordination. For example, Glance et al.^[31] investigated process-structure grammars as a means to introduce flexibility into workflow languages. Such grammars describe the relationships among documents and tasks, and use constraints to express soft dependencies, rather than the hard dependencies more often introduced with process-flow languages. Similar goals motivate related research^[32] by Paul Dourish and colleagues. Other researchers^[33] focus on mechanisms that permit coordination policies to be established and changed as collaboration unfolds. CSCW researchers should also be interested in techniques for expressing, catching, and handling exceptions during the processing of workflows.

The need for such techniques arises because to date implementing workflow procedures has proven brittle. Researchers must also take interest in the issues surrounding delegation of authority and work within a workflow. Such techniques are often used by people in day-to-day work but are usually not supported well in automated workflow systems.

Aside from coordinating direct activities among people, CSCW requires mechanisms to coordinate indirect activities as individuals asynchronously access and update shared documents, files, objects, and other resources. The needed mechanisms include: control of access and concurrency and maintenance of versioning and consistency. A number of researchers have investigated concurrency control techniques. For example, Prakash^[34] has uncovered a range of concerns that arise when providing concurrency control for concurrent editing applications. These concerns include: (1) ensuring adequate response time for shared edit operations; (2) maintaining consistency of results under simultaneous updates; (3) providing adequate capabilities for a per-user “Undo” feature; and (4) ensuring effective awareness of the activities of others engaged in editing the same files. Adopting a formal approach, Ressel and colleagues^[35] use a transformation-oriented scheme to represent and reason about concurrency and “Undo” operators, as used within group editors. In a more general look at the relevant issues, Munson^[36] and Dewan^[37] discuss the larger design space, encompassing a framework for consistency control in synchronous, shared-access applications.

Achieving effective concurrency and consistency control in information sharing applications requires two underlying foundations: access-control policies and versioning policies. Access-control policies establish the ground rules under which various users may access shared information objects. Versioning policies define the ground rules under which different versions of the same object may be combined into a single, consistent copy. In a typical desktop computer, a small set of standard access-control policies is applied to each directory and file that a user creates. Should the user need to extend access to various groups for particular objects, the access-control policies can become quite difficult to establish, understand, and verify. This is one aspect of the problem that faces designers of access-control policies for CSCW. As discussed by Keith Edwards^[38] another aspect of this difficult problem is that access-control policies must be changeable during run-time as the requirements of a collaboration change.

While most access-control policies seek to enforce consistency by limiting access to a single user at once, many collaborative activities, such as joint authoring of documents, proceed more efficiently when multiple users can access the same information simultaneously. In such cases, consistency among independent, concurrent updates becomes a key concern. In an attempt to provide an

effective system for coauthoring of documents, Rees and colleagues^[39] describe a mechanism that separates proposed changes to a shared document space from the orthogonal issues of concurrency control and repository management. Specifically, as a collaborator updates a copy of a shared document, the updates are recorded in change proposals that track information the collaborator expects to revise and that record consistency relationships that must be maintained. Once recorded, change proposals can themselves be treated as shared documents. At an appropriate point, multiple versions of shared documents can be combined and residual inconsistencies can be raised for case-by-case consideration. The area of concurrency and consistency control within multiuser distributed systems remains fertile territory for research, whether applied to CSCW or other relevant applications.

Information Access

All collaborations require access to information in two classes: subject-matter information and collaboration-support information. Subject-matter information includes the data, images, video clips, spreadsheets, and Web pages that contain content related to the subject being discussed in a collaborative session. Collaboration-support information encompasses overhead data, such as session transcripts (which can include all media types: audio, video, text, images, and interaction events) of previous discussions and agreements about plans, procedures, and schedules for the work. CSCW requires the ability to structure, retrieve, distribute, filter, and index information in both classes, whatever the media type. CSCW researchers, as well as researchers in the related fields of information management and digital libraries, work on all of these techniques.

Vannevar Bush^[40] provided one of the earliest discussions of automated structuring and retrieval of information when he outlined the possibility of the *memex*, an associative memory enabling the retrieval of information encoded on microfilm, and permitting people to construct an associative web of trails through the information. The ideas behind Bush’s *memex* foreshadowed several later developments, such as the World Wide Web, publish-subscribe tuple spaces,^[41] and globally accessible persistent storage. These later developments (discussed in subsequent sections of this entry) seem poised to provide CSCW with a tremendous increase in capabilities to structure and access information. For example, hypertext, a direct descendant of Bush’s *memex*, possesses some significant strengths exploited early on by researchers of Web-based systems for collaboration^[42–45] and later adopted in several commercial products, such as Netscape Collabra™, WebMeeting™, and eAuditorium™. Unfortunately, as discussed by Jeff Conklin,^[46] hypertext has two significant drawbacks as an information access technique. First, users often experience disorientation while navigating

through hypertext, finding it difficult to identify their current place in the information, such as their route to the current page and routes to return to previous pages. Second, users who structure information as hypertext often report a significant cognitive burden associated with creating, naming, and tracking a large number of hyperlinks. For these reasons, information structuring and access remain important research topics.

Information distribution provides one possible alternative to information retrieval. Information distribution aims to automatically promulgate relevant information to people who might be interested. Such capabilities can be very handy for disseminating information in collaborative sessions. In general, information dissemination systems require some means of description, coupled with mechanisms for matching and delivery. Information subscribers must be able to indicate the characteristics of information they would find interesting and producers must be able to indicate the essential characteristics intrinsic to the information that they create. With these characteristics properly expressed, a computer program can identify matches between subscriber needs and producer data. Once matches are made, distribution can be carried out through a messaging system.

The key issues in information distribution surround description techniques. As discussed by Thomas Malone and colleagues,^[47] semistructured messages enable computers to process automatically a much wider range of information than would be possible with free-form text messages alone. In addition, semistructured messages enable people to communicate nonroutine information, which would be impossible within the confines of rigidly structured messages. Malone points out that much of the processing that people already undertake reflects a set of semistructured messages, so even if no automated processing is anticipated, people can benefit from having an available set of semistructured message templates to help them formulate messages that contain all relevant information for particular tasks. Further, by adopting a set of semistructured message templates, automated systems could be adopted and incrementally enhanced more easily over time. Malone and colleagues also illustrate that semistructured message templates can be arranged in a type hierarchy that can then be supported with a consistent set of display-oriented editors to help people construct messages. Semistructured messages seem particularly appropriate for collaborative systems because both computers and people can create, read, interpret, and act on the same messages. Semistructured messages foreshadow the later development of the eXtensible Markup Language (XML), a means to specify computer-interpretable messages that can also be read by people.

While semistructured messages work well for text data, much of the information associated with collaborative systems exists in the form of image, video, and audio information. Such rich, but unstructured, information presents

significant problems with respect to access. The key problems revolve around indexing multimedia information so that people can access it through filters and queries. Some researchers^[48] investigate techniques that employ speech-recognition technology to create text transcripts from audio streams. Once an unstructured text database exists, additional technologies can be applied to create multiple indices that identify people, places, dates, and topics included within the data. Using this approach, an audio stream, or repository of audio streams, can be indexed for retrieval or filtering. Some researchers^[49] consider audio and video together. Video presents new challenges associated with automatically dividing video clips into scenes or segments. While the audio indexing techniques can help in this process, other techniques can also be applied. For example, if an audio-video stream comes with an associated closed-caption text stream, then information can be extracted directly using topic and subject identification techniques. Other techniques can be applied directly to the video frames in an attempt to identify scene changes. Further, some researchers^[50,51] attempt to look inside video frames to identify objects and to extract text, for example on trucks, buildings, and street signs. While analysis and indexing of multimedia streams is typically tackled off-line, some researchers^[52] are attempting to perform a rough level of filtering in real-time. The challenging problems surrounding automated indexing of multimedia data continue as targets for active research; however, progress along these lines promises to boost substantially the capabilities of CSCW systems that include video and audio conferencing.

Interaction

CSCW must include support for people-to-people interaction at a distance: maintaining awareness of the state and activities of others, managing attention and context when a collaborator becomes involved simultaneously in multiple distinct collaborative sessions, and building and maintaining relationships among people who meet infrequently, if ever. These problems might be among the most difficult that CSCW researchers must address. Still, some progress can be discerned.

An important focus of interaction research deals with awareness at a distance. In order to stimulate ad hoc discussions or to coordinate work, collaborators working in distinct locations must maintain some awareness about the availability and progress of others. This can also extend to awareness about the state of collaborators in multiple, distinct collaborative sessions. The issue is further complicated by the fact that people seem averse to allowing others to peak into their personal space or activities. In a sense, there appears to be a fine line between maintaining awareness and allowing unwanted intrusions. Hudson and Smith^[53] have considered associated tradeoffs. Several researchers^[54,55] investigate video-based techniques that

can reduce the problem of intrusiveness, while simultaneously facilitating ad hoc interactions among distributed groups. Nomura and colleagues^[56] experiment with techniques to provide peripheral awareness through shared workspaces. Others^[57–59] propose mechanisms to provide awareness within the context of application sharing and groupware systems. Some researchers^[60] even imagine that desktop computers can be used successfully for impromptu interactions. Taking a less constrained view, Tollmar and colleagues^[61] have designed and experimented with several techniques intended to enhance social awareness within the work place. Awareness in CSCW systems remains an important and fertile area for research.

Another difficult challenge for CSCW researchers involves development of techniques to effectively manage the attention of collaborators, especially when individuals may become involved in multiple, but separate, collaborative sessions at the same time. Belotti and Bly^[62] examined the problem of context management in an environment where people move among physical locations to engage in various collaborations. Fitzpatrick and her colleagues^[63] studied the problem for virtual collaborations; specifically, they investigated the issues that arose as a group of system administrators collaborated remotely with each other and with system users to identify and solve problems with the configuration of computer systems. Results from the study influenced the design of Orbit,^[64] a research system to support desktop collaboration where the user engages simultaneously in multiple collaborative contexts. Other researchers attempt to solve the problem of context management through the use of various metaphors, such as “virtual places” and “virtual spaces”^[65] and “team rooms.”^[66] Even in a physical workspace, many people find it difficult to manage multiple working contexts, as well as to manage their own time and attention. Computer systems bring the possibility for people to engage in many more activities at once. Aiding people to effectively manage these more numerous contexts remains a challenging research issue.

CSCW researchers must also address a subtler problem: how can people find appropriate collaborators and then build and maintain effective relationships without much physical contact? These issues will become increasingly important as business interactions move more and more to the digital realm, which can reduce the inconvenience, cost, and other inefficiencies associated with physical travel to face-to-face meetings. One typical problem confronting people, even within the same organization, is to find appropriate experts to answer a specific question or problem, or to apply a particular body of knowledge. For this reason, several researchers^[67–69] have investigated systems to facilitate finding knowledge and expertise through a social network. Other researchers^[70–72] have explored the use of collaborative filtering systems, which do not necessarily include information about the expertise of the participants but which can be applied on a large

scale, such as the World Wide Web (the Web). Since the Web encompasses millions of users, some researchers attempt to leverage typical behaviors among Web users to help connect them to possible collaborators without incurring additional cognitive overhead. For example, Payton and colleagues^[73] devised a novel way for people to discover potential collaborators based on comparisons among individual patterns of Web browsing, which are typically logged by a computer. After converting logs of Web accesses into graphs associated with each user, a matching program can measure similarities and differences and then bring people into contact through electronic mail. Included within this research are several mechanisms intended to protect individual privacy, a concern that might be raised by potential users when a computer system is applied to passively monitor their activities. Even in some face-to-face situations, such as large conferences or meetings, electronic systems can be used to help stimulate new collaborations. For example, Borovoy and colleagues^[74] developed “Meme Tags,” wearable devices with displays that enable conference attendees to electronically share succinct ideas or opinions. Based on the shared information, conference attendees could form into groups with similar interests. Behind the scenes, a server system monitors and collects information about tag exchanges and then reflects the information back to conference attendees in “Community Mirrors,” which are publicly visible displays that present real-time views of the unfolding dynamics within a community. Similar ideas have been used within cyberspace to permit groups of individuals with related interests to form and interact from among millions of undifferentiated participants. Usenet^[75] pioneered in 1979 by Jim Ellis, provides one of the earliest examples. Usenet enables the creation of newsgroups focused on particular topics. Individual users can discover the existence of such groups, subscribe to those of interest, and then participate in asynchronous conversations through threaded, text postings. The more popular newsgroups sustain interactions among hundreds or thousands of users. Newsgroups continued in popularity as tens of millions of users moved onto the Internet during the 1990s. In fact, newsgroups have helped to form the ocean of Internet users into smaller collections of folks with similar interests. From these smaller collections, some individuals form and sustain deeper connections, a human art which can require additional assistance in the digital domain.

Establishing, developing, and maintaining human relationships typically relies on:^[13] (1) informal social contact; (2) chance encounters in hallways; (3) chats before and after formal meetings; (4) discovery of shared interests; (5) feelings of community; and (6) implicit knowledge of the state of others. While many of these factors occur naturally among collocated people, some researchers^[76] have observed that social responsibility and commitment appear to diminish when people do not meet face-to-face.

For this reason, CSCW researchers often attempt to recreate these relationship-building factors when people must interact at a distance. We have surveyed much of the relevant research already. A few CSCW researchers^[77,78] have focused specifically on building relationships with significant depth and trust while working at a distance. Research surrounding these topics will increase in importance as work becomes more reliant on digital interaction at a distance.

CSCW CHALLENGES

To derive the greatest benefit from CSCW, the supporting technology must infiltrate as widely as possible throughout the populace. CSCW researchers have conducted studies that support this assertion. For example, Steve Whittaker,^[79] in a study of users of Lotus Notes, a technology intended to support asynchronous collaboration, found that both conversations and the creation of group archives proved more successful with large numbers of diverse participants, as compared against small, more homogeneous, project teams. Similarly, Whittaker reports that a large database of material was more likely to be used and extended than a small database. Further, the presence of a moderator was found to inhibit rather than enhance discussions. In other words, Whittaker's study suggests that the larger and more diverse the population of participants and the more free-flowing the conversations, the more effective the results.

What factors inhibit the widespread adoption of CSCW technology? First, CSCW technology generally relies on a big stack of computer and network technology, operating systems and protocols, data formats and user-interface devices. The dissemination of such capabilities, while growing at a rapid pace, is far from ubiquitous, and even where these technologies have penetrated, the systems, protocols, formats, and software is far from homogeneous. We can safely observe that the telephone handset appears to be ubiquitous, while the networked desktop computer is far less so. Some progress can be discerned regarding de facto standardization of desktop computer systems and software, as well as the adoption of standards associated with the World Wide Web. Even so, these technical underpinnings on which CSCW depends continue to evolve. Further, there exists little penetration of the systems, and associated networking QoS required, to support effective videoconferencing. These facts suggest that to some large degree the pace of progress in CSCW depends upon, and must be tied directly to, those supporting technologies that achieve near ubiquitous adoption. On the other hand, as selected technologies evolve over time to become ubiquitous, the degrees of freedom available to CSCW researchers and designers also diminish.

Even assuming that the necessary networking and computing technologies achieve complete penetration throughout society, the deployment of CSCW may still be retarded by

various administrative and policy decisions, which paradoxically may in part be taken in reaction to the depth of penetration of the technologies themselves. For example, as more people gain access to the Internet the potential increases for various unwanted intrusions, eavesdropping, information theft, and denial-of-service attacks. To limit the effects of such incursions, network managers have deployed security firewalls. Such firewalls are typically configured to impede the free flow of communication among nodes on the Internet. These restrictions attempt to turn a physically ubiquitous system of nodes into logically partitioned and protected enclaves of nodes, and thus interfere with the ability of people to collaborate—especially when the potential collaborators exist within separate administrative domains.

Beyond the need for widespread adoption of the necessary underlying technology, CSCW can suffer from Grudin's inequality,^[20] which states: those who devote the time and effort to capture and record the articulation work associated with collaboration, may not be the ones who benefit most from the results. This same issue appears again, but on a larger scale associated with knowledge management, in a panel discussion held at the 1998 conference on CSCW, where participants considered the question: "can an organization shape its culture so that people will network and share expertise, making knowledge explicit whenever possible, rather than just whenever convenient?" In this case, an entire organization stands to benefit from the time invested by its individual members, while the members themselves might not gain directly from the time they invest.

Another impediment to progress in CSCW concerns a general inability to measure progress within the field. In hardware-related fields progress can be measured easily along many relevant dimensions, such as component density, execution speed, power consumption, and heat dissipation. To date progress in software-related fields has proven less amenable to quantification. A compounding factor, identified by Whittaker,^[79] is that user perceptions about the effectiveness of CSCW technology often do not match the effectiveness as measured by an unbiased, outside observer. This finding implies that measuring progress in the field of CSCW cannot rely solely on surveying the experiences of users. For this reason, large companies often spend substantial resources to set up human-factors laboratories where users can be observed and recorded while using specific technologies and where the observations and recordings can be studied to glean information about the effectiveness and efficiency of various software features. Understandably, because CSCW encompasses a complex and multifaceted research domain, measuring progress will remain difficult. Some researchers^[80] have proposed a framework intended to encompass the important dimensions along which progress can be measured, and have provided some examples^[81,82] showing how to apply the framework.

While conducting research and measuring progress in CSCW appears challenging enough, we must also consider the fact that the underlying technology on which CSCW builds continues to change at an alarming rate. Because CSCW builds on a wide range of software and networking technologies, significant advances in those fields can challenge the assumptions on which CSCW applications are constructed. In fact, CSCW applications live at the end of a long food chain of technologies, and so must adapt to any changes that arise. Further, several technologies within the food chain can change simultaneously, making it difficult for CSCW researchers and developers to track and understand the significance of the changes, let alone adapt to them. Even if CSCW researchers could adapt fast enough to technological changes, there still remains the problem of understanding and evaluating the effectiveness of the adaptations. By the time researchers gain an understanding, the underlying technologies have typically moved on again. This cycle poses quite a challenge to CSCW. Even worse, the adoption of new technologies and CSCW applications by people and organizations inevitably leads to changes in the way people work, as well as in the assumptions that people make about what should be possible or expected from CSCW in any given circumstance. For example, Olson and Teasley^[76] discuss how working arrangements among a team changed to become more loosely coupled when the team was forced to work virtually at a distance. Similarly, Malone^[83] predicts a shift in the organizational structure of corporations as they come to depend on computer-mediated coordination technologies. This coevolution between CSCW technology and the reaction of people and organizations to the technology appears even more challenging when we consider the fact that evolution along each dimension operates on different timescales. While technology evolves quickly, people and organizations tend to resist change, or to change fairly slowly, perhaps even at a generational pace. This mismatch in the pace of change adds to the difficulty CSCW researchers face when they attempt to assess progress in the field.

CSCW SUCCESS FACTORS

Given the challenges facing the field of CSCW, can we identify some keys to success? First, success depends on the degree to which CSCW technology becomes ubiquitously deployed throughout society. This implies that CSCW researchers must target their innovations and developments to ride on underlying technologies that appear poised for widespread adoption by a substantial portion of the population. Past examples of such technologies include telephones (in 1999 the Federal Communications Commission estimated that about 94% of Americans had telephones) and televisions (Nielsen Media Research-NTI reported that sometime between

1980 and 1985, televisions penetrated 98% of U.S. households). Potential future examples include the World Wide Web, which connects millions of desktop computers together, and to information and communication services. To date, World Wide Web technology has penetrated to between 50% and 70% of the population in industrialized nations, depending on the specific country, as reported in a study, "Truly a World Wide Web: Globe Going Digital," conducted by the Pew Global Attitudes project, released in May 2006. That study reported that the percentage of Americans with online access increased from about 64% in 2002 to 70% in 2005, while Internet usage by the world's two most populous countries lags: only 38% of Chinese and 14% of Indians used the Internet in 2005. While not certain, desktop computers and the Web seem likely candidates for near ubiquitous deployment.

Second, CSCW researchers must focus their efforts to understand and account for the characteristics of cooperative work. Some researchers have already contributed in this way. For example, Ehrlich^[9] reports themes from research about group work. Communication among groups is generally ad hoc, informal, and unplanned, which implies that CSCW researchers should develop techniques that can support such interactions in the digital world. Group members also need to maintain awareness about the availability of others to communicate, and about the state of joint work, which implies that CSCW researchers should seek to improve our ability to accomplish these tasks when working through computers and across networks. Further, issues related to sharing information often hinge on subtle notions of anonymity, which suggests the CSCW researchers should continue to experiment with mechanisms to manage the release of personal information in cooperative settings. In another contribution, Schmidt and Bannon^[7] suggest some guidelines to consider when designing systems to support cooperative ensembles. Cooperative ensembles: (1) exist as large assemblies or as groups embedded within larger assemblies (which implies that CSCW researchers should focus on techniques that scale); (2) often emerge to handle a particular situation, then dissolve (which implies that CSCW researchers should explore techniques that ease the burden of establishing collaborative sessions); (3) exhibit continuously changing membership, or membership that cannot be determined (which implies the CSCW researchers should investigate techniques for finding and forming effective subsets from larger populations); and (4) often intersect (which implies that CSCW researchers should develop techniques to manage multiple collaborative contexts, including mechanisms to control the dissemination of information in accordance with policies that might conflict). MacKay^[13] highlights another key to success when she identifies the importance of mechanisms that enable people to control who can see or hear them at any time, and to know when someone is seeing or hearing them. MacKay also discusses a critical issue surrounding

interaction and interruption. Specifically, individuals desire to determine the intention of any proposed connection or interaction, and to avoid communications that might disturb their work. These observations imply that CSCW researchers could focus productively on mechanisms to automate the initiation and management of interactions.

A third key to success for CSCW relates to automated support for coordinating group activities. While CSCW researchers are now convinced that most workflow and coordination processes demand continuous negotiation among participants and entail liberal application of techniques to handle unanticipated exceptions, the work of coordination remains largely a domain where only people add value. While selected CSCW researchers investigate automated, language-based support for flexible workflow processes and for negotiation and coordination, this territory remains wide open. Will agent-based coordination systems really work effectively? Can constraint-based languages be applied to achieve flexible information and transaction flow? Can automated methods support coordination among people, or are the problems too hard? Finding the right balance between automated support and human responsibility could improve the prospects for CSCW technology to go beyond communication to include coordination.

CURRENT PRACTICE OF CSCW

While some technologies appear promising as foundations for advances in CSCW, it should prove instructive to consider the current state of the practice. The typical collaborative session today consists of a telephone conference where collaborators discuss content, which might include faxed documents or perhaps some shared electronic documents, such as presentation slides or word-processing files that might be supported by change tracking capabilities. In some advanced situations, a collaborative activity that extends beyond particular real-time sessions might also be supported by a Web site, with one person elected as the editor. Usually, files to be added to the Web site would be sent by electronic mail to the editor. This typical collaborative session leverages a ubiquitous technology, the telephone network, which also happens to provide one of the most important channels, audio, for quickly conveying information among people and for conducting the real-time interactive dialog that helps to coordinate understanding and consensus building among participants. Typical collaborative sessions might also exploit the telephone network to distribute paper documents through facsimile machines. This permits discussions to center around shared documents, but relies on the use of the audio channel to ensure that all participants focus their attention on the same locations within a document. Increasingly, electronic mail is replacing the facsimile as

a mechanism to distribute documents, and the documents usually adopt a widely available format, such as Adobe portable document format or Microsoft Word™ format, which also provides change-tracking capability, along with PowerPoint™ format for shared viewgraphs. These techniques help, particularly the change-tracking capability, which can be useful when several people wish to propose amendments to shared documents. Even in this case, either the document must be distributed serially to ensure all changes are recorded, or the collaborators are left to ponder changes independently proposed on various copies of the document. No clear advantage exists for either approach because it can be somewhat difficult to follow documents marked up with proposed changes. Notice that the use of electronic mail to distribute electronic documents still relies on the audio channel to coordinate the focus and attention of all participants during a collaborative session.

Some technologies aimed at improving the state of the practice have failed as yet to provide much help. For example, application-sharing systems exist (e.g., Microsoft's NetMeeting™) that provide a means to visually indicate focus on electronic documents, that support simultaneous markup of electronic documents among a group of users, and that also include audio and video conferencing capabilities. Yet, these systems are not in widespread use. Why? Few widely agreed standards exist. The systems prove difficult to configure and use. They require support for a level of network QoS that is not widely available. Videoconferencing systems, such as the roll-around stations and room-based systems available from PictureTel and Polycom, have failed to achieve ubiquity as well. Why? Such systems tend to be expensive; thus, they are deployed selectively and must be scheduled and shared. This limits their applicability for spontaneous collaboration. Further, such systems require specialized support for network QoS, usually provided through H.320-compliant dial-up lines. The Internet, while more widely deployed, does not provide the necessary support for guaranteed QoS. Systems (such as Lotus Notes) that support asynchronous collaboration can be used to disseminate documents and discussions and to trigger alerts when various events occur. Such systems have not achieved wide usage. Why? The litany of reasons should be familiar by now: lack of widely agreed standards; difficult to configure, deploy, and use; expensive to buy and maintain. A similar story can be told for collaboration servers, such as Collabra and TeamWare, another form of collaboration technology available today, but not widely used.

While the current state of the practice in CSCW appears rather primitive and the landscape of more advanced technical solutions appears strewn with failures, some technologies promise to better support CSCW in practice. For example, the Web, with a growing infiltration in society and an increasing base of widely agreed

technical standards, looms as a mass medium that can likely be exploited for collaborative purposes. In fact, as the Web's inventor, Tim Berners-Lee, has often observed,^[84] collaborative software development provided the original motivation behind the Web. Of course, Mr. Berners-Lee has also rued the fact that at its current state of development the Web appears to be a mass medium more suited for TV-like distribution of multimedia. Despite its current state, Mr. Berners-Lee and many other researchers^[85] and developers continue to seek mechanisms to improve the Web's support for collaboration. Great potential exists for CSCW on the Web because ubiquitous availability provides a crucial key to success.

Another significant development for CSCW appears to be the growing role of distributed, collaborative software development, as fostered by the "Open Source" movement.^[86] Of particular interest is SourceForge (<http://www.sourceforge.net>), a Web site that provides services to open-source software development projects distributed around the globe. SourceForge provides hosted projects with Web-based tools for collaborative software development, a project Web server, tools for software maintenance and bug tracking, mailing lists and discussion forums, databases and compile farms, software release services, and advertising. SourceForge users have the option to mix-and-match these tools, and are free to design and contribute tools that might enhance collaboration. As of May 2007, SourceForge hosted over 150,000 open-source development projects and more than 1.6 million registered users. These figures represent a fivefold increase over 5 years. We might conclude that SourceForge employs Web technology in a form intended to realize the original motivation cited by Mr. Berners-Lee: collaborative software development.

What can we conclude from our examination of the current state of the practice in CSCW? The successful CSCW technologies appear to share some traits: ubiquitously available, easy to understand, easy to set up and use, few administrative constraints, reasonable technical requirements, and affordable prices. The unsuccessful CSCW technologies fail with respect to one or more of these traits. The expansion of users on the Web seems likely to continue, perhaps achieving near ubiquity at some future date. Such ubiquity would provide a key foundation to improve computer-mediated collaboration at a distance. SourceForge provides an early glimpse of what might become possible. While current practice appears quite limited, growth in Internet-based communication suggests that we are living near the dawn of effective CSCW. A number of technologies seem particularly promising.

PROMISING CSCW TECHNOLOGIES

If we look a bit beyond the horizon of today's widely deployed systems, we can identify a few technologies that

exhibit significant promise with regard to CSCW. One suite of technologies might enable us to divide the general Internet up into virtual communities inside which we can securely conduct collaborative sessions, both in real-time and across time. Such technologies can replace the current firewalls, which divide the Internet up along administrative boundaries, with virtual enclaves, which might divide the Internet up, on demand, along the lines of function or context. Already elements of such technologies are commercially available. For example, Microsoft Windows ships with networking technology that enables users to form virtual private networks, which use encryption to establish confidential, virtual Internets on top of the physical Internet. Other commercial products, such as VMware and the XenServer, permit a single desktop computer to be divided into virtual operating systems, which provide multiple, separate contexts for users or to divide Web servers into segregated enclaves so that a single physical Web server can appear as multiple, logically distinct Web servers. Desktop, network, Web server—these assets form the ingredients needed to support collaborative sessions among distributed users across organizations, and the ability to "virtualize" each of these assets in order to support multiple but separate contexts already exists in the commercial market. What remains to be developed are: (1) techniques for connecting these distinct virtual assets into unified virtual enclaves, each consisting of virtual desktops, a virtual network, and virtual servers; and (2) mechanisms to quickly establish virtual enclaves and to support mobility among the virtual desktops and virtual servers. Some networking researchers^[87] have already investigated techniques for composing virtual enclaves, while other networking researchers^[88] have refined technology that can allow virtual networks to be established simply and on demand. Recent research^[89] promises to deliver on-demand allocation of optical communications paths, which should support virtual networks and provide sufficient QoS to support a wide-range of multimedia channels to support collaboration. At the forefront of current research, grid software available as part of the Globus software distribution^[90] is being developed to allow collaborators from multiple administrative domains to contribute resources into a virtual organization hidden from unauthorized members.

Above the networking and operating system layers, technologies for the Web are evolving in interesting ways that also promise to support improved CSCW. We previously mentioned the advantage of the XML for describing the syntax and content of information in a form both readable by people and interpretable by computers. XML^[91] seems likely to become the standard language for defining information objects exchanged among computers. Future evolutions of XML^[85] promise to annotate information objects with semantic tags that can enable intelligent interpretation on the part of supporting software applications. CSCW researchers and developers should be

able to build safely on this base. Early examples of what might be possible exist in the form of community-based Web sites, such as MySpace (with its 182 million users) and Facebook (which has 23 million members), and Web sites aimed at establishing and extending business networks, such as LinkedIn (11 million users).

XML does not include a means to describe the behavior associated with various objects, except in the form of references to programs that can implement services associated with the object. The ability to express behavior directly in a form that can be transferred between computers seems to have an important place in future automated systems. At present, candidates for this role include portable scripting languages, such as Python, RubyScript, TclScript, and network programming languages, such as C# and Java. Some researchers^[27] have used Java to implement Habanero, a combined synchronous-asynchronous collaborative system that shows how the power of mobile programs can be applied to bring unprecedented interoperability, function, and performance to CSCW.

While XML and Java suggest how metadata and behavior can be described for dissemination among a network of computers, other technologies promise to provide new mechanisms to accomplish the distribution. Already, industry is busy working on notification services and publish-subscribe (pub-sub) technology that will facilitate the distribution of events and notifications to all people who have an interest. These pub-sub technologies, such as Web-Services Notification and JXTA, build on research conducted by David Gelertner,^[41] who investigated the applicability of “tuple spaces” as a means for efficient, large-scale coordination among many distributed processes.

Gelertner, a creative and visionary computer scientist, also investigates^[92] techniques for organizing multimedia experiences, so-called lifestreams, into a readily accessible form. Such technology would serve admirably to enhance the ability of collaborators to locate relevant information. Earlier, we discussed other research along these lines, such as Rough’n’Ready^[48] and Informedia,^[49] when we considered the importance of access to raw multimedia recordings of collaborative sessions. While this class of research has not yet matured to the point of widespread commercial availability, CSCW developers should be poised to make effective use of the technology.

As outlined earlier, existing technology for videoconferencing has failed to achieve widespread acceptance, probably due to expense, configuration complexity, and requirements for guaranteed QoS from the network. Despite the seeming failure of this technology, some researchers continue to investigate the possibility for radical advancements in multimedia conferencing. For example, Jaron Lanier^[93] advocates tele-immersion, a technology that aims to facilitate live multimedia interaction. The goal of Lanier and colleagues is to exploit computers, sensors, display technology, and networks to enable remotely distributed collaborators to hold virtual meetings with the same degree

of quality as if they were collocated. Similarly, Rick Stephens and colleagues^[94] have developed software to integrate large numbers of multimedia devices with high-speed networking channels to provide various sizes of Access Grid, aimed at enhancing remote collaboration across administrative domains. Success along these lines would prove invaluable to enhance the power and effectiveness of CSCW.

Not to be overlooked is research intended to exploit and enhance familiar modes of interaction as a basis to support human collaboration. For example, Paul Luff and colleagues^[95] are devising techniques that enable paper to become an input device for selecting functions, and fulfilling roles now played by computer mouse devices and graphics tablets. As another example, technology for creating digital paper^[96] and thin, flexible displays^[97] promises to enable the use of paper-like devices to load and exhibit information, which could provide significant improvements over current forms of visualization, freeing mobile collaborators from reliance on bulky, expensive, power-hungry displays. Companies (such as E Ink and Universal Display Corporation) are already developing some products along these lines. More work will be required to integrate paper-based input modalities along with digital paper or flexible displays in order to provide mobile collaborators with the ability to interact conveniently while consuming little power. CSCW developers and researchers would be well advised to increase their investigation of techniques that can exploit familiar human interaction devices, such as whiteboards, walls, tape, paper pads, markers, and pens, while simultaneously crossing the boundary between the physical and digital worlds. Examples of promising lines of research include the Easy Living^[98] and Sentient Computing^[99] projects, the Mixed Reality Architecture,^[100] and Microsoft’s “Surface”^[101] interactive table. Finding effective methods to bridge the gap between people and computers promises to yield great improvement in the interaction of groups.

OUTLOOK FOR CSCW

CSCW has become a hot technology and seems likely to remain so for the foreseeable future. The information age, and related exigencies associated with increasing globalization and specialization in our modern society, impels an ongoing transformation in the organization of work. Work is becoming more information-based, relying on computers and communications, and increasingly involves the activities of teams, often across organizational boundaries and time zones. Usually, people work on multiple teams, where the team composition changes depending upon the context, subject, and business arrangements. In this demanding environment, organizations and people naturally seek to employ any technology that can help get the job done better, faster, and cheaper. These factors presage

difficult, long-term problems whose solutions hold immense potential to benefit companies, individuals, nations, and society. Today we stand only 25 years into what might be a 50-year endeavor to research, develop, deploy, and refine effective, efficient and affordable technology for CSCW. CSCW might encompass the greatest challenges facing information technology researchers and developers, but CSCW also promises to deliver the greatest benefits that computer, network, and software technologies have to offer mankind. The central question guiding the CSCW field can be stated simply. How can computing systems enhance cooperative work without unduly constraining human collaborative processes? The question has no simple answer.

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Conservation and Preservation of Museum Objects

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Abstract

This entry describes the history and evolution of the field of conservation of culturally valued materials found in museum collections. Significant steps in the evolution of museum conservation in the twentieth century include the introduction of chemists to a field previously dominated by artists and craftsmen, and a redefinition to include the prevention of damage through environmental management rather than only through activities designed to restore already damaged works. Professionalization of the field coincides with the introduction of standards and codes of practice, membership organizations, and scholarly publications. A description is included of the historical development of these standards and codes, which are generally referred to as conservation ethics. A final section examines the professional emphasis on textual, graphic, and photographic documentation used to monitor conditions and practices, and the way in which conservation activities and records have moved from behind the scenes to become part of the museum information accessible to the public.

INTRODUCTION

Conservation professionals are those whose activities are devoted to the preservation of cultural heritage for the future. Since conservation is also a term applied to the protection of biodiversity, cultural heritage specialists often distinguish their field by applying the limiting phrase of “art conservation,” perhaps more accurately termed cultural conservation as the field encompasses a broad range of specialties including natural history specimens, archives, and books. This larger purview is often described using the term preservation, notably when referring to the activities used to conserve and protect archives and books. While museums are not the only employers of conservators, who may work for universities, libraries, government agencies, research institutes, and in the private sector, museums constitute an important employer because of the significance of the collections they hold. As social institutions of cultural memory and transmission, museums are involved in the interpretation, presentation, and preservation of cultural materials (or of culturally valued natural science materials and living collections), and museum conservators contribute to all of these efforts. The evolution of museum conservation is always tied to the practice of restoration, the act of returning damaged objects to an apparently unimpaired or even improved state. Restoration has a narrower focus than conservation and one that is tied to presentation value. The complete emphasis on presentation without regard for preservation or accurate interpretation has been emphatically rejected in the modern definition of conservation.

(See “Conservation and Preservation of Library and Archival Materials,” p. 1250.)

The role of the museum conservator began at the very end of the nineteenth century, however restoration practices were always conducted on valued objects. Since museums are not static and their role continues to evolve, the museum conservator has shifted emphasis by contributing to presentation, then to research and preservation, and finally to both technical and contextual interpretation of museum objects, while continuing to work in all of these areas.

It will be illustrated how museum conservators are currently contributing to public engagement with collections; however, the development of museum conservation and its access by the public were not synchronous. The period when museums hired their first conservators occurred between 1900 and 1940, with an emphasis in those early years on either ancient collections whose condition was challenged by the transfer from an archaeological to a museum climate, or paintings, which had a high monetary value and were the focus of considerable art historical investigation. Publications by this early generation did provide some access by nonspecialists to information about the field of museum conservation. However the field was more successfully promoted by world-changing events such as the emergency transport of paintings from British museums into underground railroad stations and quarry caves during World War I and II,^[1,2] and the international recovery efforts of museum and library collections following flooding of the Arno River in Florence in the 1960s. Both events, reported in the popular press,

captured public sentiment about the significance of these collections and the importance of their preservation.^[3–5]

Conservation has joined all museum functions that are witnessing a shift in public access and interpretation resulting from the use of information technology. Until recently, conservators examined and documented museum objects, and carried out procedures designed to enhance their stability and appearance, and this documentation was shared with professional colleagues. The nature of this documentation, which has been standardized and codified through professional consensus, has been revised to include didactic and even entertaining components for public access. As museums increasingly recognize the fascination with technical clues and transformative treatments and seek content for Web sites, blogs, and online community platforms, museum conservators have sought to use these tools to engage the public about the value and interpretation of objects.

HISTORY OF THE MUSEUM CONSERVATION FIELD

The terms restoration and conservation have a long and richly debated history, with philosophical underpinnings that are the subject of numerous books and articles.^[6–8]

Restoration is recognized as a longstanding undertaking encompassing repairs made to extend the serviceable life of objects and buildings and the aesthetic life of sculptures and paintings. In terms of museum objects, the origins of restoration are frequently cited as when Italian Renaissance sculptors recarved and augmented Classical stone statuary,^[9,10] and artists retouched and revarnished earlier important paintings, all to permit display.^[11] It is important to point out that artists' materials had historically been applied to significant collections of all types with a goal toward an acceptable display appearance, without a prior understanding about how such materials might behave upon aging or interaction with collections. Once the term conservation was adapted in the late nineteenth century, it was held in opposition to restoration. Paul Coremans, an analytical chemist whose early pioneering work in conservation included founding Brussels' Institute Royal du Patrimoine Artistique, considered it "essential to differentiate between conservation and restoration."^[12,13] It was recognized in the late twentieth century that these terms cannot be easily separated: "[conservation] revolves around research, the understanding and long term preservation of the materials of which the object is made, and [restoration] relates to their enhancement."^[14] As decisions are made about the steps necessary for the preservation and public access of museum objects, all of these activities are considered under the modern rubric of conservation.^[15]

The nineteenth century was something of a florescence in the founding of museums, each with workshops and

studios dedicated to the preparation and maintenance of collections for display. It was not until the beginning of the twentieth century that conservation facilities were founded. Conservation facilities in museums were distinguished by the hiring of chemists who worked alongside existing staff including craftsmen skilled in areas such as sculpture, painting, cabinetry, model making, and taxidermy.^[16,17] Even museums founded in the seventeenth century such as the Ashmolean in Oxford, England employed sculptors, watchmakers, and portrait painters to care for the collections until the 1950s, when the first conservators were hired.^[18] Activities carried out by "repairers" in 1856 at the Victoria and Albert Museum, and preparators at American museums as recently as 1976, included "duties involving the handling of museum specimens or art objects for a variety of purposes including exhibitions, research and teaching; [and to] assist the Curators in the maintenance of collections." Preparators were supervised by Senior Museum Preparators, who

perform preservation and restoration, including the cleaning of specimens for exhibition; sort, arrange, and integrate specimens or art objects into classification or storage systems; condition and install works of art; and assemble and re-file specimens or art objects, including checking material returned from loan for possible damage.^[16,19]

Museum Conservation Laboratories

The world's oldest scientific museum laboratory, no longer called a workshop or studio, is the Chemical Laboratories of the Royal Museums of Berlin, founded on April 1, 1888, and renamed in 1975 the Friedrich Rathgen Laboratory after its founder.^[20]

Rathgen's primary contributions to conservation were in the area of archaeological materials, including a publication in 1898 of *Die Konservierung von Altertumsfunden*, translated into *Preservation of Antiquities* in 1905.^[20,21] Archaeological materials were also the focus of Gustav Rosenberg (1878–1941) the first conservator at the National Museum of Denmark whose tenure extended from 1895 to 1940.^[22] An even broader emphasis on research and preservation was pursued in the Department for Scientific and Industrial Research, founded in 1919 at the British Museum, with chemist Dr. Alexander Scott at the lead.^[21,23] Dr. Scott was succeeded at the British Museum by Harold Plenderleith in 1924. Plenderleith is well known for his book *The Conservation of Antiquities and Works of Art, Treatment, Repair, and Restoration*, which was published in 1956, and represents what many consider to be the first attempt to codify a conservation approach to a broad range of museum materials. It is lauded for its emphasis on object examination, scientific methods, and the inclusion of case studies.^[24] Another

conservation pioneer is Alfred Lucas, a British analytical chemist with a strong background in forensic science, who in 1923 became a consultant to the Egyptian Department of Antiquities in Cairo, working both with excavations and with collections at the Egyptian Museum.^[25]

In the United States, the appointment of Edward W. Forbes as director of the Fogg Art Museum at Harvard in 1909 initiated an emphasis on technical examination of artists' materials that is a mainstay of modern museum conservation. Forbes also believed that the diagnosis and treatment of artworks should rely on the same rigorous academic training afforded to other fields at Harvard.^[26] Forbes' assembly of a set of over 1400 western and oriental pigments for use as reference materials remains familiar to most contemporary conservators as a model for approaching comparative analysis.^[27] Forbes' tenure at the Fogg Art Museum culminated in the creation in 1928 of the Technical Department, with George Leslie Stout as its first conservator.^[26] While Stout was an art historian by training, he hired chemistry student John Rutherford Gettens and radiography expert John Burroughs in what was in 1931 to become the Department for Conservation and Technical Research.^[26] These men are lauded with playing a "crucial role in the early professionalization of the discipline through the introduction of innovative conservation techniques and through the development of systematized methods for examination, analysis, and documentation."^[28]

The 1930s and 1940s saw the foundation of conservation laboratories in many museums, including the Louvre Museum, the Walters Art Museum, the Boston Museum of Fine Arts, and the Metropolitan Museum of Art.^[29] The emphases on thorough examination and investigation of both collections, and materials used in conservation processes, along with careful documentation of observations and activities, are critical components of a modern museum conservation approach.

While chemistry and craft persist as important aspects of responsible conservation, there is a debate between scientific and humanistic approaches to cultural preservation that continues to rage. Art historians specializing in paintings have been the most outspoken about the potential of scientific methods to overshadow aesthetic judgments necessary for the conservation process.^[30,31] This controversy extended to sculpture when the cleaning methods for Michelangelo's *David* were debated in the American press.^[33] The concerns pit the value of scientific methods against the value of changes wrought by time, function, and cultural use, overlooking the nuanced decision making that actually occurs between these positions.

A humanistic approach persists alongside science and requires that conservators consider culturally varied standards and intentions for what it means to preserve, and that they work collaboratively with artists, community members, and other stakeholders to foster communication on these issues. For example, a revised approach to the

conservation of indigenous cultural objects and human remains involves a negotiation of context and values, since conducting research and performing treatments may alter the object or its cultural meanings.^[33–36] A committee of American conservators proposed a commentary to the Guidelines for Practice, accepted in 1997, which revised decision making for the preventive care of certain cultural objects. This commentary recognizes that deterioration may be the culturally appropriate intention for some objects:

Special cultural or contextual considerations may influence preventive conservation measures taken for a specific cultural property (e.g., sacred, contemporary, conceptual). In some cases a decision to allow deterioration to occur by avoiding certain preservation practices may be appropriate. Such decisions should be made only in collaboration with appropriate individuals connected with the cultural property.^[37]

This concept has since been accepted into national and international charters governing museum work.

CONSERVATION ETHICS

The evolution of conservation from a field of artisanal skills toward a profession that integrates technical studies and scientific research resulted in the acknowledged need for standards, responsibility, and transparency. The first such standard developed in 1931 is the Charter of Athens, devoted to "the Restoration of Historic Monuments." This code of behavior was adopted by international participants to the First International Congress of Architects and Technicians of Historic Monuments, meeting in Athens. The Charter of Athens advocated for the open critical review of restoration procedures, reliance on scientific methods, and legislative measures for the prevention of damage as a first step rather than interventions to address damage. It also stressed respect for the original materials of the monument, and collaboration with relevant experts.^[38] Like the Charter of Athens, the 1964 Charter of Venice also focused on monuments and not museum collections, and this document extends preservation beyond the monument to include the site. The Venice Charter values the physical changes wrought by all periods of use, further endorses use of scientific materials and methods, and argues against falsification by promoting restorations which are harmonious but distinguishable. This charter advocates publication of conservation work.^[39]

The first set of ethical principles applicable to conservation work in the museum was drafted in 1960 by a Committee of Ethical Standards and Procedures of the International Institute for Conservation–American Group. The resulting document adopted in 1963 is known as the "Report of the Murray Pease Committee: I.I.C. American

Group Standards of Practice and Professional Relations for Conservators,” known thereafter as the Murray Pease Report. Pease, the committee chairman and a conservator at the Metropolitan Museum of Art, considered the report to outline “. . . objective procedural requirements for the proper conduct of professional work by members of I.I.C.-A.G.”^[40] By outlining sound business practices, client confidentiality, and avoidance of conflict of interest for monetary rewards, the Pease report acknowledges the role of conservators working for private clients as well as museums. Important principles introduced in the Venice Charter are incorporated into the Pease report, including not working beyond your knowledge, not modifying known qualities of the original work to be conserved, clearly documenting sample sites and condition before carrying out any sampling or treatment, and full documentation of treatment.^[40] In 1967 the I.I.C.-A.G. membership adopted a Code of Ethics proposed by the Committee of Ethical Standards, and this document along with the Murray Pease Report are the foundation documents for the Code of Ethics and Guidelines for Practice followed by professional members of the American Institute for Conservation today.^[41]

Core concepts of ethics and guidelines continue to be reviewed and updated by committee members of the American Institute for Conservation (née I.I.C.-A.G.).^[42]

Roughly every 10 years since the adoption of the Murray Pease report, the contents and language of these documents have been revisited by the American conservation community. Increased professional specialization and the founding of graduate education for conservation in the United States prompted a review of the core documents in 1977. In 1986, the concept of reversibility was challenged. The obligation to render reversible all interventions applied as part of a conservation treatment had developed as an ethical standard in opposition to past treatments, where intractable and damaging methods and materials had been used routinely in restoration. In the 1990s a more nuanced approach to reversibility was adopted, stressing the selection of materials and methods which will not themselves age poorly or result in deterioration, compromise research potential or cultural viability, or inhibit future treatment steps. So critical is this concept that it took another 10 years of debate and discussion before the AIC membership would revise their ethics and guidelines to reflect this principle.^[42]

A second fundamental change in the professional practice of conservation, also reflected in ethical codes of conduct, has been a shift from physical interventions carried out on cultural property to management of the environment surrounding the property in order to reduce risk. These two approaches are referred to as interventive conservation versus preventive (or preventative) conservation, the latter drawn from medical terminology of preventive care. The maturation of preventive conservation as an approach has been supported by the increased

emphasis on doing no harm and respecting cultural norms, as well as on a considerable body of research conducted from the 1960s to present, which proves the benefits to collections of environmental control. This significant shift in assessment and practice was incorporated into the language of the Code of Ethics and Guidelines for Practice in the 1990s. In 1994, based on the recognition that the application of ethical conduct is varied and evolutionary for different specialties within the conservation field, Commentaries to the Guidelines for Practice were proposed by an Ethics and Standard Committee of the American Institute for Conservation and were adopted by the membership.^[43]

The European Confederation of Conservator-Restorers' Organization (ECCO) was founded in Belgium in 1991 with the aim to “. . . develop and promote, on a practical, scientific and cultural level, the profession of Conservator-Restorer of Cultural Property.”^[44] The organization adopted Professional Guidelines in 2002, in which the Conservator-Restorer's role is described as contributing “. . . to the perception, appreciation and understanding of cultural heritage in respect of its environmental context and its significance and physical properties.” These Guidelines reflect current shifts in the profession by defining the Conservator-Restorer, diagnostic examination of cultural heritage, preventive conservation, conservation (direct action on cultural heritage), restoration (direct action carried out with the “. . . aim of facilitating its perception, appreciation and understanding.”), and documentation.^[45] As is the case with the American document, the ECCO Guidelines outline ethical conduct in compliance with legal and environmental principles and collegial behavior.

DOCUMENTATION AND PUBLIC ACCESS

Increasingly professional practices in the twentieth century include museum conservators sharing their work with each other and with the public. Before this stage, museum staff often kept diaries or logs about collections care activities. In chronicling conservation history at one of the earliest museums in North America, the Smithsonian Institution, the authors indicate that

archival evidence for collections care is scant until the curatorial annual reports begin in 1881. Records from the next three decades are replete with references to care of collections and exhibition including annual reports with summaries of daily activities, diaries, letters, and other documents (p. 185).^[16]

The first publicly accessible venue for routine museum conservation reporting is the museum annual report. Evidence for collections care can be found in Annual Reports authored by the Ashmolean Museum's Keeper Arthur

Evans beginning in 1896.^[18] In many other institutions including the Metropolitan Museum of Art, the Philadelphia Museum of Art, and the Brooklyn Museum, conservation staff begins reporting activities involving analysis, equipment purchases, and treatments in annual reports in the 1950s.^[46–48]

In addition to annual reports, many early museum conservation laboratories are rich repositories of correspondence from the first quarter of the twentieth century documenting exchanges about conservation challenges, methods and materials.^[49,50] This trend toward outreach and exchange provides a marked contrast to what was previously a field with jealously guarded workshop practices, undocumented, and designed to result in invisible and transformative reconstructions completed in restoration studios.^[9]

The increased professionalization of conservation has also included the development of written, graphic, and photographic documentation as standard components of museum work, as well as the development of peer reviewed journals for the publication of conservation research and practice, and organizations dedicated to professional conservation standards. Conservation documentation in the 1930s continued to take the form of diary entries, index cards, and written reports, where remarks and treatment steps were recorded, sometimes accompanied by drawing and photographs. The first professional publication in English, *Technical Studies in the Field of Fine Arts*, was published by the Fogg Art Museum at Harvard beginning in 1932.^[28] The year 1950 saw the founding in London of the International Institute for the Conservation of Museum Objects, now called the International Institute for the Conservation of Historic and Artistic Works (IIC), and this organization began publishing the journal *Studies in Conservation* in 1952.^[51,52] Beginning in 1958, countries began to form regional groups that abided by the aims and objectives of the IIC, which include excellence in professional practice in the preservation of cultural heritage and the promotion of knowledge, practice, and standards. The United Kingdom and the United States were two of the earliest regional groups of IIC, and seven other countries and regions currently maintain chapters.^[53]

The IIC-American Group had its first meeting in 1960, and this group, now known as the American Institute for Conservation of Historic and Artistic Works, meets annually and publishes the peer reviewed quarterly *Journal of the American Institute for Conservation*. In 1946, the International Council of Museums (ICOM) was founded in agreement with UNESCO, and 20 years later a Committee for Conservation was created that actively participates in triennial meetings and publications.^[54] The International Centre for the Study of the Preservation and Restoration of Cultural Property was established in Rome in 1959, and it is known by the acronym ICCROM. Focusing on both museums and monuments, it offers publications, research meetings, seminars, and training based on

interdisciplinary collaboration involving scientists, conservators, restorers, archaeologists, art historians, curators, architects, engineers, and city planners.^[55]

Perhaps the most dramatic change to the practice of conservation documentation occurred when typed, handwritten, or printed documents and film based images were superseded in the 1970s by digital technology which became the infrastructure of all museum operations.^[56,57] Many museum conservation laboratories are believed to have switched to a digital format for their text documents by the 1980s, and digital imaging followed later with best practices documents created only this year.^[58,59] The incorporation of conservation records into a museum's digital collections management database is the subject of a major initiative by the Andrew W. Mellon Foundation which in 2008 launched the Mellon Conservation Documentation Survey, encouraging participation by "all who document objects, analysis, treatments and other processes in museum, library, or archive conservation and science departments, or who use such documentation in their work."^[60] The survey results, which will be available at the end of 2008, will establish priorities for preservation through digitization of museum conservation archives, as well as explore how to take advantage of broadening access to these records by scholars and the museum public.^[61] This could result in 100 years of diaries, logs, papers, and photographs being digitized and made Web accessible to varied audiences.

While conservation documentation has not heretofore been produced for public access, and is in fact considered confidential when it refers to privately held collections, the museum-going public has had a sustained interest in conservation, evidenced by exhibitions dedicated to the exposure of fakes *The Art of the Fake: Egyptian Forgeries from the Kelsey Museum of Archaeology*, An Internet Public Library exhibition of selected Egyptian artifacts—both real and fake, *Unearthing The Truth: Egypt's Pagan And Coptic Sculpture*, Brooklyn Museum, opening February 2009, *Fake?, The Art of Deception*, British Museum, September 30, 1990, *Fakes and Forgeries*, Minneapolis Institute of Arts, July 11–September 29, 1973, to the study of technology *Gian Lorenzo Bernini: Sketches in Clay*, Fogg Art Museum, February 28, 1998, *Gifts for the Gods: Images from Egyptian Temples*, The Metropolitan Museum of Art, October 16, 2007–February 18, 2008, *Rembrandt/Not Rembrandt in the Metropolitan Museum of Art. Aspects of Connoisseurship*, October 10, 1996, and to the process of conserving works in a museum collection. *Star-Spangled banner, The Preservation Project*, National Museum of American History, 1998–present. Conservation in public institutions has experienced a shift from activities conducted behind the scenes, with records intended only for museum staff, to an activity designed for public exploration. The Smithsonian National Museum of American History created a visible laboratory behind glass walls in 1998 to permit visitors to observe the ongoing

examination and conservation of the Star Spangled Banner, the flag that inspired America's national anthem. Additional staff for this project included educational and interpretive specialists and an exhibitions curator, unusual staffing for a conservation project, and one which won awards for public relations and exhibition.^[62]

Another pioneer in this effort to make conservation public is the Lunder Conservation Center at the Smithsonian American Art Museum and National Portrait Gallery, which includes multiple laboratories with different specialties separated from the public by glass viewing walls. Elaborate didactics in front of each laboratory include videos and text panels about completed and ongoing projects. In June 2008, conservators at the Lunder Center began posting details of conservation treatments on Twitter,^[63] a free Web-based short messaging service designed for use with mobile devices.^[64]

Though no survey exists to provide a precise number, dozens of museum Web sites now feature videos, daily diaries, and blogs about conservation. A search on the Brooklyn Museum Web site produced 2020 locations with the term conservation. The Museum has a blog under the heading of "Community," to which conservators contribute along with other museum staff, and where the public is encouraged to comment and inquire about activities. Postings describe reattaching paint on a delicate nineteenth century watercolor by Frances Flora Palmer, inviting the public to look through the microscope to compare the condition of paint before and after treatment. Another set of postings show the reuniting of the portrait and mummy of a first century A.D. Roman citizen of Egypt, separated by museum conservators in 1939.^[65]

This public aspect of conservation has culminated in a Wikipedia article entitled Conservation–Restoration, with a majority of its postings added in 2008. The use of the term Restoration aligns the site with cultural heritage preservation rather than wildlife management, the subject of another Wikipedia entry entitled Conservation. The Conservation–Restoration article received minor editorial attention until 2006, since when it has been edited 445 times, with 307 of these edits occurring between October 2007 and October 2008.^[66] In April 2008, the Publications Committee of the American Institute for Conservation recognized the audience impact and outreach potential of an article in Wikipedia, and took on the project to expand the site and increase accuracy. This expansion has included the addition of sections on ethics, the history of the profession, professional specializations, training, and links to organizations and journals, bringing the field of conservation more fully into the public domain.

CONCLUSION

Conservation is a field whose professional activities are devoted to the preservation of cultural heritage for the

future. An understanding of the foci on ethical practice, documentation, balancing humanism and science, and public outreach in the field of museum conservation make sense when viewed in the context of the profession's beginnings and its historical achievements. The evolution of the field to include the introduction of science to a craft-based activity explains the need to develop standards and formalized ethical practices. As a profession that contributes to both the interpretation and preservation of tangible and intangible values in cultural objects, conservators are intimately tied to the museum function of memory transmission. Conservation records grew from an informal form of note-keeping, to an internally valuable report on museum accomplishment, to part of the story that assists the public in appreciating and understanding collections.

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Controlled Vocabularies for Art, Architecture, and Material Culture

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Abstract

There are a number of controlled vocabularies that can be used for describing and enhancing access to information resources relating to art, architecture, and material culture. These data value standards are essential for the description of movable art works, built works, and objects of material culture, as well as their visual and digital surrogates. Local, collection-specific authority files for museum and visual resource collections also play a key role in describing collection materials and providing access points for a wide range of users, both internal and external to the particular organization. So-called *folksonomies*, which are the result of *social tagging*, are not true controlled vocabularies but can be useful in providing additional access points.

INTRODUCTION

The simplest way to define vocabularies is to say that they are groupings of terms or names; vocabularies are said to be *controlled* if they are limited to a particular domain or set of concepts, and to designate a preferred form for each concept, person, or entity represented. Controlled vocabularies are organized collections of words, phrases, and/or names structured to show the relationships between terms and concepts. Authority files and thesauri are types of controlled vocabularies, but a simple *picklist* (a feature that allows users to select terms from a preset list) can also be controlled. An *authority file* is a type of controlled vocabulary that serves as a source of standardized forms of names, terms, or titles. Authority files normally include references or links from variant forms (terms or names that are equivalent to the preferred term or name) to preferred forms or “headings.” For example, in the Library of Congress Name Authority File, the name form “Ovile Master” links to the preferred form “Bulgarini, Bartolomeo” for the fourteenth-century Italian artist whose hand has been variously identified with the “Master of the Ovile Madonna,” “Ugolino Lorenzetti,” and “Bartolommeo Bulgarini,” which are all considered to be variants or synonyms for the preferred name form. Authority files, originally designed to regulate usage in library catalogs, also provide additional access points, thus potentially increasing both the precision and recall of many searches. A *thesaurus* is a type of controlled vocabulary in which each entry or record is restricted to a single meaning (unlike a dictionary). It is further characterized by relationships explicitly expressed in the structure of the vocabulary. Relationships include equivalence relationships (between synonyms in a single record), hierarchical

relationships (whole/part, genus/species, and instance between records), and associative relationships (other types of relationships between records, not hierarchical). Hierarchical and associative relationships are semantic; equivalence relationships are lexical. For example, in the *Art & Architecture Thesaurus* (AAT), a “gisant” is a type of funerary sculpture (genus/species relationship); a “predella” is the decorated base of a large altarpiece (whole/part); “firedogs,” “andirons,” and “chenets” all refer to the same type of device used to support logs in a fireplace (equivalence relationship); and “arriccio” (a type of plaster used in the creation of frescoes) is conceptually rather than hierarchically related to “fresco,” a specific type of painting (associative relationship). Associative relationships can also be used to distinguish terms from one another; for example, “rhyta” are drinking vessels held over the head. In the AAT, the record for “rhyta” is linked (conceptually and electronically) to the records for “Sturzbechers” and “stirrup cups,” which are different types of vessels but, like rhyta, rest on their side when not in use. “National Gallery of Art” and “Tate Modern” as narrower terms of “art museums” are an example of an instance relationship in a thesaurus (in this case, dealing with corporate bodies such as museums and other cultural institutions).

Controlled vocabularies can be powerful tools for describing and enhancing access to collections of any kind. They can range from a simple alphabetical list of approved terms to a complex, carefully structured thesaurus, including broader and narrower concepts, related concepts, and any number of equivalent or near-equivalent terms or names denoting the same concept, as shown in the examples discussed. In information science, controlled vocabularies are often referred to as *data value standards*,

since they provide the specific terms, names, and other data values that are used to populate *data structures* or metadata schemas such as MARC (Machine-Readable Cataloging), MODS (Metadata Object Description Schema), Dublin Core, LIDO (Lightweight Information Describing Objects), EAD (Encoded Archival Description), and others.

The cataloging rules that are used to guide the way that data values are entered into data structures are often (and, for many people, confusingly) referred to as *data content standards*—*Resource Description and Access* (RDA), *Describing Objects: A Content Standard* (DACS), and *Cataloging Cultural Objects* (CCO) are examples of data content standards for bibliographic materials, archival collections, and unique cultural objects, respectively. For a chart that clearly outlines the types of data standards, with examples, see Gilliland.^[1]

CONTROLLED VOCABULARIES FOR ART AND ARCHITECTURE

In the areas of art, architecture, and material culture, there are several vocabulary tools that have been specifically designed for describing these types of collections, such as the AAT. Other vocabularies have been developed for other types of materials but can also be applied to art and architecture, such as the *Library of Congress Subject Headings* (LCSH) and the *Thesaurus for Geographic Materials* (TGM), also maintained by the Library of Congress.

Controlled vocabularies have three main uses. They can be used as sources of standard terminology for descriptive cataloging and other forms of documentation; as knowledge bases or lookup tools for discovering the meaning of a particular term or a term for a particular concept or object, or a description of a particular individual or corporate body in the case of a name authority file; and as online searching assistants that can enhance both precision and recall in querying databases that can have multiple data values representing the same concepts, objects, or persons.

EXAMPLES OF USES OF CONTROLLED VOCABULARIES

As sources of terminology for catalog records and other forms of documentation: In a catalog record for a painting in a museum's collection or an image in a photographic archive, the following database fields or metadata elements should be populated with values from appropriate controlled vocabularies: object type, creator name, materials/techniques, creation location, subject matter, and so on. See the cataloging examples provided on the

Categories for the Description of Works of Art (CDWA) website: http://www.getty.edu/research/publications/electronic_publications/cdwa/examples.html, which indicate which fields in a database record should be populated with values from a controlled vocabulary.

As knowledge bases or lookup tools: A user wishes to know what “trompe-l'oeil” means; he or she does a search in the AAT on that term (or on a right-truncated version of the term, in the event of being unsure of the exact spelling) and retrieves a record with the scope note that begins “French term meaning ‘deceive the eye,’ applied to images so realistic that they may fool the viewer into thinking that the represented objects, scenes, textures, or points of view are real rather than images.” If a controlled vocabulary has carefully constructed hierarchical relationships and scope notes, users can even find terms for concepts for which they do not know the word. In her article “Indexing and Access for Digital Libraries and the Internet: Human, Database, and Domain Factors,” Marcia J. Bates^[2] discusses the issues associated with the fact that many users are essentially trying to describe something they do not know or for which they have knowledge gaps, while indexers know what they are describing and use specific terminology in the process of purportedly providing access points for specific materials. The use of carefully structured thesauri and other vocabularies that link both specific and more generic terms, and even “right” and “wrong” (but frequently used) terms, can go a long way toward bridging the gap between indexers and end-users. For example, in the AAT, users can navigate down the Visual Works hierarchy from “sculpture” to “funerary sculpture” to “ushabti,” or they can enter a key word search for “Egyptian and tombs” on the scope notes and also find the record for “ushabti” (with eight variant spellings), the small sculptures that the ancient Egyptians buried with their dead to accompany them in the afterlife. Or a user may have come across the name “Beggartstaff Brothers” and wants to know who these artists were. A search in the *Union List of Artist Names* (ULAN) reveals that this was the pseudonym adopted by brothers-in-law William Nicholson and James Pryde (each a well-known artist in his own right) while they were collaborating in the 1890s as poster artists. The ULAN record also has links to the individual records for each artist.

As online searching assistants: An Italian searcher wishes to know if the Getty Museum has any works by the artist designated in the scholarly literature and exhibition catalogs in the Italian language as “Gherardo delle Notti.” He enters this name in the Getty search engine and retrieves works by “Gerrit van Honthorst,” the name used in non-Italian-language publications and institutions to designate this Dutch artist who was active in Italy during the first half of the seventeenth century. This is because the ULAN, with all the variant names for this artist clustered together in a single record, is being used

as an intermediary between the searcher and the resources being searched. Similarly, a user can search on “desk” and retrieve a “cartonnier” in the Getty’s collection, even though the word “desk” does not appear on the web page for that object. This is because the power of the AAT hierarchy is being used to assist the searcher who is using a more generic, nonexpert term for a very specific object. Bates^[3] discusses the power of faceted searching (made possible by faceted thesauri like the AAT) in “Speculations on Browsing, Directed Searching, and Linking in Relation to the Bradford Distribution.”

Vocabularies in the realm of art, architecture, and material culture may contain personal names (e.g., *Leonardo da Vinci*), corporate names (*Richard Meier & Partners*), object names (*squat lekythoi*), iconographic subjects (*Hercules and the Nemean Lion*), geographic names (*Luxor, Qina governorate, Upper Egypt*), proper names of built works (*Hagia Sophia*), and so on. They can take a variety of forms. *Alphabetical lists* of approved terms or names are often used in local applications to ensure consistency and accuracy. In a controlled list, all terms should be equal in specificity and should not have overlapping meanings. *Subject headings* are terms and phrases, usually arranged in an alphabetical order, that can be combined to express compound concepts (e.g., *Triptychs—Italy—Florence—Congresses*). A *taxonomy* is an orderly classification system for a defined domain, with hierarchical relationships (e.g., *Flagellation of Christ, Passion of Christ, New Testament, Bible*, in an ascending hierarchical order). A *thesaurus* is a structured vocabulary that explicitly includes the semantic relationships between and among terms and concepts. As indicated earlier, the types of relationships in a thesaurus are “equivalence” (*still life = natura morta*), “hierarchical” (a *gisant* is a type of *effigy*, which is a type of *funerary sculpture*), and “associative” (a *charterhouse* or *chartreuse* is a type of building associated with the *Carthusian* monastic order). Any one of these types of controlled vocabularies can be used as an *authority file*—that is, a vocabulary that is used to enforce consistency by providing standardized forms of names, terms, titles, and so on. Authority files not only regulate usage, but also provide additional access points for users who may be searching on nonpreferred forms of names or terms. For example, in the *Union List of Artist Names* (ULAN), “Schiavone, Andrea” is the preferred name form for a Dalmatian artist active in Italy during the sixteenth century, but searchers can also enter queries on variant forms as diverse as “Medulić, Andrija” and “Andrea Meldolla.”

“UNCONTROLLED” VOCABULARIES AND FOLKSONOMIES FOR VISUAL WORKS

The phenomenon known as *social tagging* (also referred to as *collaborative tagging*, *social classification*, *social*

indexing, *mob indexing*, and *folk categorization*) that is prevalent on image websites such as Flickr (<https://www.flickr.com/>) and museum websites such as the Brooklyn Museum (<http://www.brooklynmuseum.org/opencollection/collections/>) is the decentralized method by which individuals and groups create, manage, and share terms, names, and so on (called “tags”) to annotate and categorize digital resources in an online “social” environment. Another example of social tagging for artworks is the Public Catalog Foundation’s “Your Paintings” tagging application (<http://tagger.thepcf.org.uk/>).

A folksonomy, which is simply an assemblage of concepts represented by tags, is the result of social tagging. It should be noted that in spite of the “onomy” at the end of the word, a folksonomy is not a taxonomy, which is an orderly, structured classification that explicitly expresses the relationships, usually hierarchical, between and among the things being classified.

Social tagging and other forms of user-generated metadata such as “crowdsourcing” are a trend in online resources that is garnering considerable attention and interest. If unstructured, nonstandardized terminology created by social tagging and other forms of user-generated metadata is linked to more highly structured, standard thesauri and vocabulary tools, the potential for enhanced end-user access is significantly increased.

COLLECTION-SPECIFIC LOCAL VOCABULARIES

Many museums and other collecting institutions have learned that merely taking terms from a published controlled vocabulary such as the Library of Congress authorities, the AAT, or ICONCLASS and using them to populate descriptive records for objects in their collections is not enough. They may find that they need to supplement these sources with scholarly or other specialized terms that are out of scope for discipline-specific vocabularies, or too specific for the level of indexing supported by more general vocabularies. Or they may use nonexpert, generic, or even erroneous terms or misspellings that cannot be found in a published, standard vocabulary tool to enhance access to collections for a wide range of users. The National Gallery of Art in Washington, DC allows users to browse its collections by using controlled lists of object types and artists’ nationalities. The Getty Museum uses collection-specific thesauri of both object types and subject matter to enable users to familiarize themselves with the works in its collections, both on the Web and in the touchscreen kiosk system in its galleries. In a collection-specific thesaurus aimed at enhancing access to nonexpert users and museum visitors, a term as unscientific as “bottles and pots” can be used to lead users to more specific types of vessels with names that would be known only to experts. While this type of “folk

classification” is not legitimate for a published, standard authority such as the AAT or LCSH, it is extremely useful in a local thesaurus, where it can be linked to the more accurate expert terminology as well.

CONTROLLED VOCABULARIES EXPRESSED AS LINKED OPEN DATA

Linked Open Data (LOD) are data created according to the best practices for publishing and interlinking structured data using the Resource Description Framework (RDF) syntaxes and made publically available on the Web; see <http://linkeddata.org/>. The Virtual International Authority File (VIAF), the Getty vocabularies, and the Library of Congress Thesaurus for Graphic Materials (TGM) are examples of controlled vocabularies that are made available as Linked Open Data in addition to their familiar formats as web lookup tools. Controlled vocabularies expressed as LOD can enable meaningful machine-generated linking, thus greatly enhancing the research potential of the online environment and enabling users to easily access related resources that they otherwise might never have found. Formats for expressing vocabulary data as LOD include RDF and JavaScript Object Notation (JSON). As of this writing, Bibliographic Framework (BIBFRAME) is the emerging data model for expressing bibliographic records using Linked Open Data.

CONCLUSION

The three main ways by which users attempt to find information online are browsing, directed searching, and following links.

For online collections of art, architecture, and material culture, all three of these methods can be extremely powerful. Museums can use their collection-specific thesauri and descriptive cataloging records to enable users who are unfamiliar with their collections to browse by object type, creation place, chronological period, subject matter, and so on. As shown in the examples discussed, directed searching can be significantly enhanced via both the terms and the hierarchical relationships in controlled vocabularies. Likewise, controlled vocabularies can be used to lead users to other materials of interest via links from one specific term or name to another. Many of the debates that are currently taking place among information professionals about how the library profession can modernize itself, compete with commercial search engines like Google, and ultimately not only survive but re-create itself center on authority control rather than on item-level description. The 2008 final report of the Library of Congress Working Group on the Future of Bibliographic Control (<http://www.loc.gov/bibliographic-future/news/lcwg-ontherecord-jan08-final.pdf>) also stresses the need

for increased focus on authority files and controlled vocabularies in a collaborative model among different institutions and communities, and the potential value of mapping values from different controlled vocabularies.

Controlled vocabularies, combined with less structured data values such as those generated by social tagging, may very well be one of the key elements in the future of access to the constantly growing body of online resources. Since the mission of museums, archives, and other collecting and memory institutions is not merely to collect and preserve, but also to provide access to what they collect, the use of controlled vocabularies to describe and lead users to their collections should be as essential as the use of security systems and climate control to protect and preserve those collections.

SPECIFIC VOCABULARY TOOLS

Following is a list of published vocabulary tools that can be used to describe and provide access to materials relating to the visual arts, architecture, and material culture:

Art & Architecture Thesaurus® (AAT)

<http://www.getty.edu/research/tools/vocabularies/aat/>

A structured vocabulary that contains terminology and other information related to art, architecture, and related disciplines. Updated monthly.

Cultural Objects Name Authority® (CONA)

<http://www.getty.edu/research/tools/vocabularies/cona/>

A structured vocabulary comprising unique numeric identifiers and brief records for works of art, architecture, and material culture. As of this writing, CONA is in pilot release phase.

Getty Thesaurus of Geographic Names® (TGN)

<http://www.getty.edu/research/tools/vocabularies/tgn/>

A structured vocabulary containing names and other information about geographic places, focusing on but not limited to places important to art, architecture, and related disciplines. Web version updated twice monthly.

ICONCLASS

<http://www.iconclass.nl>

A classification system for iconographic research and documentation of images. *ICONCLASS* is a collection of definitions of objects, persons, events, situations, and abstract ideas that can be represented in the visual arts. The system is organized in 10 broad divisions within which subjects are ordered hierarchically. Although

ICONCLASS is primarily a classification system, the textual correlates of the alphanumeric classification codes can be used to describe and/or index visual materials, as can the associated key words be.

Also available in print:

van de Waal, H. *ICONCLASS: An Iconographic Classification System*, 9 Vols., completed and edited by L.D. Couprie with E. Tholen, G. Vellekoop. Amsterdam, the Netherlands/New York: North-Holland Pub. Co., 1973–1983.

Library of Congress Name Authority

<http://authorities.loc.gov/>

A controlled vocabulary consisting of records for names and titles of works established by the Library of Congress and cooperating libraries. Updated daily.

Library of Congress Subject Headings

<http://authorities.loc.gov/>

A structured vocabulary designed to represent the subject and form of the books, serials, and other materials in the Library of Congress collections, with the purpose of providing subject access points to the bibliographic records contained in the Library of Congress catalogs. More broadly, LCSH is used as a tool for subject indexing of library catalogs and other materials (including visual materials). Updated daily.

English Heritage Thesauri

<http://thesaurus.english-heritage.org.uk/>

A set of thesauri developed by the National Monuments Record Center, English Heritage Project (officially known as Historic Buildings and Monuments Commission for England). The thesauri include Monument Types, Archaeological Objects, Building Materials, Defence of Britain, Components, Maritime Place Names, Maritime Craft Type, Maritime Cargo, Evidence Thesaurus, Archaeological Sciences, and a Historic Aircraft Types thesaurus.

Subject Index for the Visual Arts

Glass, E., comp. *A Subject Index for the Visual Arts*. London: H. M. Stationery Office, 1969.

A structured vocabulary used for subject access to materials in the Print Room of the Victoria & Albert Museum, London.

Thesaurus for Graphic Materials (TGM)

<http://id.loc.gov/vocabulary/graphicMaterials.html>

A thesaurus of terms that describe the subjects and the work types of graphic materials.

Union List of Artist Names® (ULAN)

www.getty.edu/research/conducting_research/vocabularies/ulan/

A structured vocabulary containing names and other information on artists, architects, and other creators of art and architecture. Web version updated twice monthly.

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Corporate Archives

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Abstract

Over 300 North American businesses support archival programs as part of their corporate structure. This entry provides an overview regarding the rationale for these archival programs, their organizational structure, the services they provide to the business, a sampling of internal marketing initiatives, and a description of the records contained in these collections. The entry also explores the differences between the work of corporate archivists and others in the profession.

While academic libraries, historical, and cultural agencies have collected voluminous records relating to the political, literary, and social history of North America, few repositories have included business collections as focal points of their acquisitions strategy. Certainly, institutions like the Baker Library and Eleutherian Mills at Harvard University, the Eleuthesian Mill Historical Society, the Minnesota Historical Society, and the Hartman Advertising Collection at Duke University have acquired very significant collections that partly fill the void, but the vast majority of American business records have been ignored by the major academic research centers. Consequently, the prime responsibility for preserving business records has fallen to the businesses themselves.

Corporations supporting internal archival programs tend to fall into three major groups: financial services companies including banks and insurance firms; consumer goods and services units; and technology-driven enterprises like. Representing the first group are companies like Aetna, Nationwide, State Farm, AIG, and Allstate from the insurance sector while Wells Fargo, American Express, Scotiabank, J.P. Morgan Chase, Royal Bank of Canada, and the New York Stock Exchange provide a wide range of financial services. Well-known consumer product companies include Ford Motor Company, Procter and Gamble, McDonald's, Walt Disney, Kraft, Coca-Cola, Eli Lilly, NBC, Williams Sonoma, Levi Strauss, UPS, and Gap. Technology-driven firms like IBM, Microsoft, and Hewlett-Packard also maintain their own collections.

Less than 10% of the Society of American Archivists 5000+ institutional and individual members manage business records, but business archivists have been an important component of the profession from the beginning. The Firestone Tire and Rubber Company formed one of the earliest corporate archives in 1943,^[1] just 7 years after the formation of SAA itself, and Firestone's archivist, William Overman, later became president of the society in 1957–1958. Since that time, there has been a steady increase in the number of companies supporting an archival

program growing from 133 business archives in 1969^[2] to nearly 350 in early 2008.^[3]

The single-most compelling reason for companies to create an archives is an anniversary of some note. As businesses reach significant milestones, documentation is required to provide historical context and to define those qualities and characteristics that separate one firm from another. Regardless of size or scope, anniversaries generate interest in creating a book, pamphlet, audiovisual production, exhibit, or some combination of those programs. The anniversary creates a unique opportunity for the organization to focus on its history and to allocate resources for the collection, organization, and utilization of its historical resources.

As these historic dates approach, many corporations realize that the records required to support commemorative programming are not easily found. Most likely, they are scattered throughout the business, disorganized, and stored in less than optimal conditions. The anniversary provides the catalyst to begin segregating these records and determining whether they offer a longer value proposition than the celebration of the anniversary itself.

A second driver for corporate archives, frequently connected to the first, is the CEO initiative. While corporations are normally forward-looking and disinclined to consider history as a relevant element in strategic thinking, senior managers want their legacy to be preserved and to become imbedded in the corporate culture. As leaders approach the end of their term in office, they become much more reflective on their accomplishments and much more inclined to take positive steps to see that those achievements are institutionalized. The CEO archival mandate is more common in family run enterprises but such initiatives can occur in businesses of any size. An archives stands as a visible reminder to both internal and external audiences of the legacy that has been established.

Litigation support and the recognition of an information gap are the other factors that can influence the foundation of an archives. In order to protect trademarks and

other forms of intellectual property, corporations must have detailed files that document the creation and utilization of their advertising concepts and campaigns, packaging, technology, and marketing initiatives. In many instances, an archives charged with the collection and management of these materials offers the best low-cost option for protecting these assets.

Similarly, an archives provides a unique resource for the business that other information management specialists do not provide. The archivist looks across the entire spectrum of records being generated by the parent body and determines which materials have long-term value to the ongoing work of the business. In most cases the total volume of retained records is no more than 2–3% of all records generated, but the retention of those materials will define what future generations know about the organization and can help to educate new managers, agencies, and suppliers about the core principles that define the brands and programs they direct.

Once a decision has been made to create an archives, the placement of that function within the business becomes the next critical decision. Most corporate archives reside within one of four areas: the public relations or communications function; the office of the general counsel, the corporate secretary's office or some administrative placement such as the president's office. All of those scenarios can work well as long as the decision-making ladder is relatively short. If the archives has easy access to senior management for resources, allocation, a specific organizational structure is less relevant.

Still, there are some positives and negatives to be considered in any of these arrangements. The communications placement may be the most symbiotic as both archivists and public relations professionals respect and appreciate the power of information. The communications function has a broad view of the organization and provides enhanced visibility for an archival program. The principal drawback to this linkage is that the public relations activities are often ranked lower than other functional areas and frequently receive lesser funding. Ties to the General Counsel or to the Corporate Secretary's office place the archives in areas that are well regarded and operate from positions of strength. Funding for programs is easier to obtain and access to senior management is streamlined. The potential negative in this placement is that the archives can be easily neglected because of critical business priorities facing the functional leadership. The most dangerous positioning is the administrative one. This situation usually occurs if a President or Chairman has made a unilateral decision to create an archives to preserve the history of a specific administration or when the archives is dumped into a general administrative area that handles nonessential business activities. In this scenario, the archives is the likely victim in a change of executive leadership or a financial slowdown that necessitates a prioritization of resource allocation.

Corporate archivists will often create a wide array of tools to help them attain greater visibility in the corporation and to better define their role. One of the most important documents for a corporate archives is a mission or policy statement, distributed company-wide, that defines the responsibilities of the department and provides the authorization for the archives to collect records from individual business units. Such documents may detail the specific functions of the archives, may identify records considered to be archival, and may even outline the specific processes for transferring records to the archives.

The creation of a broad-based, cross-functional advisory board to help the archivist define the institution's collecting canons can broaden the client base of the archives and develop an in-house support system for its mission. By holding regular meetings of this group, the archivist ensures that the collection represents the company's key functions while creating a group of auxiliary archivists with a vested interest in securing important records from their respective functions.

Many archivists place a high priority on outreach programming to extend the influence of their institutions to external audiences, attracting new researchers to their collections and generating a broader support base for their activities. In the corporate world, outreach is also critically important, and the overall objectives are similar, but the tactics and execution are internally directed. Unlike academic programs where the value of preserving historical documentation is clearly understood or government repositories where retention is mandated, corporate archives exist in an environment that focuses on the future and pays little more than lip service to the past. To succeed over the long term, the corporate archives must be relevant to the business and be able to justify the costs of the program.

One of the most natural alliances is with the public relations team as the archives is a tremendous resource for the generation of media coverage of the business. The archives can provide the historic background data, photographs, film, and video that add depth and color to the new releases and media stories that shape the image of the business to the outside world. The archives provides content to in-house magazines, newsletters, annual reports, social responsibility, and citizenship publications that communications groups produce and distribute. Additionally, the archivist can become an adjunct member of the public relations department by authoring features on heritage and serving as a company spokesperson on historical issues.

During an anniversary celebration, the archives becomes even more critical as it serves as the primary resource for the publications that will inevitably mark the event. Books, magazines, case studies, timelines, brochures, and pamphlets signal important milestones in organizational growth and development and create special opportunities for the archives to shine in the corporate spotlight. During these

moments of historical focus, the relevance of the archival program is obvious. It is in the nonanniversary years that a program must have a broader organizational impact to sustain itself.

Technology offers new possibilities to make archival materials more accessible to broader audiences. The emergence of digital technology allows users access to thousands of images, documents, and audiovisual materials via intranet sites. With a few clicks of a keyboard, materials that had been held in a single geography can be shared with associates in hundreds of locations in high-resolution formats, resulting in cost-savings that can be calculated and communicated to the management. Similar techniques are used throughout the archival profession, but the business archives application has a robust revenue stream that establishes a clear return on investment (ROI), a calculation that every business recognizes and appreciates. Many business operations rely on a network of agencies and suppliers to provide them with high-resolution photography files for commercial applications at costs that frequently exceed \$100 per unit. The existence of the archives removes these middlemen and concentrates the collection and preservation of images at a single contact point, supplying materials through the organization in a cost-efficient manner. In addition to the information sharing, many corporate archives license their images to third parties for commercial application. These licensing programs generate thousands of dollars that can reduce, if not totally offset, the costs of maintaining an archives.

The Internet also provides business with an interactive communications tools to reach out to important constituencies: consumers, stakeholders, students, the media, regulators, and nongovernmental organizations. A section of the site devoted to Heritage can provide a large volume of useful information to individuals and groups interested in the historical and cultural impact of the firm. By placing this data in one convenient location, the business connects with key audiences while gaining some cost-savings through the reduction of personnel handling consumer inquiries.

The use of blogs as a social media tool offers new opportunities for corporate archivists to engage proactively, using rich content from their collections on the Web. Rather than relying on traditional media outlets to publish positive stories on the history of the business, archival bloggers can post stories and commentary on a schedule of their choice and can interact with groups and organizations that would not normally receive information directly from the business. With over 100 million blogs in existence, an archival blog may be one of the easiest methods of delivering historical information through nontraditional outlets.

Exhibitions are excellent tools to enhance the archival presence, signal the importance of history to the organization, and create an experience that helps shape the corporate culture. Most corporate archives use them, in one

form or another, to create an atmosphere that encourages the study of the past to inform the future. The size and scope of these exhibits can vary from small window and case displays near the archives entrance, to more robust lobby displays greeting visitors to the business, to free-standing museums open to the general public, but the archivist administering these share one strategic objective. The exhibit makes history and the archives come alive for the people reviewing it, providing an overt rationale for the larger program.

Within the marketing arena, the archives can play a pivotal role in helping managers understand business and brand basics. By securing a representative collection of advertising, promotional, packaging, and product files, the archives can document the strategies, positioning, and philosophies that have marked both successful and unsuccessful programs. Management can then repurpose the best practices into contemporary executions that will resonate with consumers. Conversely, by understanding why projects failed, there is a stronger likelihood that a new generation of management will not make the same mistakes.

As noted earlier, one of the reasons businesses choose to establish archives is their critical role in litigation. Trademarks, patents, designs, copyrights, and other forms of intellectual property uniquely define the corporation and represent its most valuable assets. By maintaining records of the development, implementation, and continued use of those elements, the corporation secures its unique standing in the marketplace and ensures its long-term viability.

The archives serves as a powerful resource in this arena. The scope of the collection itself can frequently discourage frivolous lawsuits from ever being filed, but the more quantitative value is established when records maintained by the firm form the basis for a successful legal action. All of the costs associated with the creation and maintenance of the archival program could be recovered with a single piece of litigation.

The human resources function represents yet another client for archival services. Employee orientation presentations, training programs, department briefings, and retiree organization all benefit from an in-house historical department that can supply materials that underscore the company's mission statement and reinforce those values that shape the corporate culture. Frequently, the archivists play a pivotal role in such activities, while the films, photos, music, videos, and artifacts from the archives add depth and color to the presentations.

The types of records collected by corporate archivists are similar to those collected by any other repository that collects institutional documentation, but the volume of records generated by business and the sensitivity of certain categories of records (personnel, financial, research, and development) requires rigorous appraisal criteria. The nature of the business itself and the frequency of use are

the two primary criteria that determine the volume of materials collected and the hierarchy assigned to them. A financial services company will tend to collect records with fiscal content more heavily than a consumer goods company that will focus more energy against identifying and securing marketing and advertising files. Not only are those records more indicative of the functions of the respective businesses, they also are the records used most frequently by business units.

Conversely, corporations generally will not retain certain record types as part of the archives if they have high litigation potential. Federal and state regulations mandate the retention of specific personnel, technical, and financial data, but at the expiration of the required life cycle, these materials will be destroyed unless there is a more compelling historical reason to retain them. In an era when class action lawsuits can yield millions of dollars in settlements, corporations will not run the risk of preserving records of tangential research value.

Most corporate collections will include records from the senior executives of the organization. The papers and working files of the Chairman of the Board of Directors, the President, the Chief Financial Officer, and the Corporate Secretary's office will provide a strong overview of the events and issues that characterized each administration. Functional records from Finance, Legal, Human Resources, Technical, Public Relations, Community Affairs, and Administration provide the detailed documentation of the operations of the enterprise that will comprise the historical record and allow for interpretation and repurposing in the future.

In developing an organizational scheme for the records, corporate archivists look at the work product from each group and establish record groups that document their activities. For instance, a record group titled Marketing would contain data relating to the advertising, promotion, and packaging of goods and services. A Human Resources record group would contain data on the workforce, policies and procedures, training information, and employee benefits. The record groups will vary in size and importance depending on the focus of the business, but they should reveal the essential activities of the parent body.

The collections will also hold extensive audiovisual collections, clippings files, small library collections, and reference files, as well as the records of predecessor or merged companies that may have their own unique records structure. Many archives will also function as the corporate museum and will preserve extensive collections of artifacts encompassing packaging, awards, promotional items, premiums, and a host of advertising and marketing samples, ranging from small signs and posters to large pieces of equipment.

The biggest differences between the work of corporate archivists and others in the professional falls into three areas: descriptive practices, access policies, and the institutional approach to reference and research. While most

archives are interested in fully describing their collections and making them available as broadly as possible, corporate programs have a very different vision. Their clients and users are the employees, suppliers, and business partners of their host institution. Their mandate does not extend to any third parties beyond that limited definition.

Many corporate archives have sophisticated information management and digital asset management systems that allow them to share detailed information about their holdings internally and externally, but they seldom report or contribute to national databases that make similar information available to researchers around the world. The corporate archivist does not seek or encourage the external researcher who would certainly materialize if holdings were more widely reported. Similarly, the descriptive tools used by the archivists are designed for internal use and frequently are based on proprietary software developed by the business itself.

Most business archives limit access to the collections to employees and designated partners. They do not solicit or cultivate scholarly research nor do they feel obligated to share their resources with the general public. The corporation provides all of the funding for the program and determines how the collection will be used. Equal access is not a concept utilized in the corporate environment.

The archives receives funding because it provides a unique set of services that the business could not secure from any other source. It is intellectual capital that is as important as trade secrets or patents. Consequently, there is a reluctance to share this collateral with others by opening the doors of their historical vaults to the outside world. From the corporate perspective, there is little to be gained and a very serious downside to releasing materials to third parties who do not have a vested interest in the business.

Reference and research also look considerably different from academic models. In academic settings, researchers travel to the host institution, request the desired records, study the documents, and formulate their conclusions. Reference specialists respond to written and oral inquiries in a structured fashion that normally requires the researcher to wait several days, if not weeks, before receiving a formal reply.

In business, the archivist processes the records, prepares finding aids for them, and then assumes all of the research and reference responsibilities. As to the subject matter expert, there is an expectation that the archivist will search through the records to expeditiously retrieve the requested information and deliver it to the client. Researchers seldom visit the archives and even less often volunteer to go through the materials themselves. There is the further expectation that the requested information will be provided in a time-sensitive fashion measured in minutes and hours rather than days and weeks. Businesses operate on cycles that require speed and efficiency to produce financial results that benefit their shareowners.

Archivists operating in that environment must mimic those qualities if they are to be successful.

Salaries for business archivists tend to be higher than those of other archival practitioners. The mean salary for academic archivists hovers around \$50,000, while government archivists earn about \$3000 more. The mean salary in the business arena exceeds \$61,000, with manager salaries approaching \$70,000.^[4] Additionally, compensation packages in corporations frequently include annual bonuses and stock options not reflected in the salary figures. Total compensation in the corporate sector can easily exceed \$100,000 per year.

While the compensation levels for the corporate archivist are appealing, this segment of the profession is the most unstable. The continued existence of the program totally depends on the financial health of the parent organization. In years of strong earnings and profitability, the archives will prosper and enjoy management support, but in an economic downturn, the first targets of downsizing are those functions considered overhead. Unfortunately, archival programs can be consigned into this category, resulting in reduced, outsourced, or discontinued programs. Some of the major business archives programs in the United States including those at Firestone, United Technologies, Arco, Bank of America, and Polaroid disappeared in retrenchment initiatives.

The number of business archives in North America will probably continue to grow though not as rapidly as

programs in the nonprofit sector. For current information about business archives, the best resource is the Web site of the Business Archives Section of the Society of American Archivists (<http://www.archivists.org/saagroups/bas>). This site includes member's profiles, news and announcements, information on section initiatives, and technical guidance on issues of concern to the group. Dr. Gregory Hunter, a professor at Long Island University, maintains the "Directory of Corporate Archives in the United States and Canada" at his Web site (hunterinformation.com), and Dr. Hunter also posts the notes of the Corporate Archives Forum there. The CAF is an informal group of about a dozen business archivists from large companies who have met annually since 1998 to discuss issues of mutual interest and to share best practices. Additionally, the Society of American Archivists sponsors a workshop on Establishing and Managing a Business Archives on an annual basis.

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Corporate Art Collections

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Abstract

What propels a for-profit corporation to collect and invest in the collection management of an art collection, to buy original works of art to display, care for, and store? What are the benefits of placing art in the workplace? What does the future hold for corporate art collecting? The term “corporate art collection” has become a generic, catchall phrase that often encompasses the art collecting activities of law and accounting firms, small companies, government, cities, port authority, transit, and other types of organizations. The purpose of this entry, however, is to discuss art collecting activity conducted within corporate business workplaces specifically. Does a corporate art collection reveal a corporation’s viewpoints, long-term goals and aspirations, and culture? And what are the philosophical concerns of mingling art and commerce in the presentation of art in a corporate setting? This entry seeks to address such questions and provide a cursory history of corporate art collecting in the United States and abroad.

INTRODUCTION

The notion that to place art in the workplace is simply *decorative* is to take a simplistic viewpoint. Corporations buy artworks to fill many needs: to fill blank walls, to improve a *workplace* environment, to enhance their *image* (internally, externally, or both), to support the local art community, to make a social statement, and to demonstrate their company values.^[1] While most companies do not purchase art for financial gain, some track the current market value of their collections for insurance and other purposes. For many corporations, *accessibility* and image are key elements in the contemporary world of corporate art collecting.

An emphasis on contemporary art seems to be a trend in corporate art collecting, the currently high-paced—and priced—art marketplace notwithstanding. Popular amongst companies with a *global* presence, is to collect art with an international focus, reflecting their workforce, or reflect a *regional* art focus in specific locations. Corporations today are particularly savvy in finding new ways of utilizing their art collection for *marketing*, advertising, and *commissioning* artwork to promote their company’s image and products.

Every corporate art collection, from its origins, to its objects, to its operations, is unique. There currently remain very few books and articles written on the subject of corporate art collecting. While the *Directory of Corporate Art Collections* profiles over 1000 collections, and some companies promote their art collections and attendant activities online and in print, much remains hidden and private in regard to how corporate art collections are formed, managed, and maintained. This entry aims to illuminate the world of corporate art collecting.

HISTORY

The collaboration between art and business dates back to Renaissance Italy and in more recent years has become a common partnership.^[2] In earliest examples, financial institutions were leaders in terms of corporations collecting art; presenting art in the workplace demonstrated to their clients the sophistication and wealth of their institution, as well as the path of portfolio investment. Deutsche Bank, one of the largest corporate art collections in the world at present, has over 50,000 objects in their collection, housed in over 1000 locations. Regardless of institution type, the history of each corporate art collection can provide a fascinating glimpse into the history and culture of a company. Many corporate art collections were willed into being by notable CEOs with personal interest in art and art collections of their own, and a vision for wanting to bring art—and the appreciation of culture that comes with art—into their corporate culture. Others begin their art collecting activity by forming grassroots committees of interested executives and employees.

In the United States, in late nineteenth and early part of the twentieth century, art was explicitly used for marketing: railroads such as Union Pacific and Santa Fe would use art as a publicity medium to encourage travel and to publicize themselves.^[3] Abbott Laboratories began their collection in 1930, the Anheuser-Busch collection dates back to the late 1890s, and what is generally regarded as the first modern-day corporate art collection is the International Business Machines (IBM) collection of contemporary American art, begun in 1939.^[4] Image making continued to drive art collections that began in the 1960s and the 1970s, with a large number of collection facilities being created in Japan. The 1980s witnessed a significant

rise in corporate art collection activity, particularly in the United States and Britain. By the 1990s, as a result of an economic recession, some corporate art collections disbanded or were sold, leading many to consider corporate art collecting as a mere phenomenon of the times. In fact, the sheer number of corporations collecting art on an ongoing basis far outweighed the few collections that were dismantled. Today, corporate art collecting is now an “established segment of the art world, with its own corps of professionals and specialists, its own philosophies and standards of ethics, and its own professional organizations” (Fig. 1).^[3]

In Europe, with more general, broad-based government support to museums and artists, culture is more widely considered a part of life. With this intrinsic way of thinking, European corporate art collections have been innovators in terms of collecting activity, commissions, and corporate-supported artist projects. The Deutsche Bank art collection was essentially founded on a friendship. Herbert Zapp, a former bank board member, lent his chauffeured limousine to the artist Joseph Beuys while Zapp drove an accompanying security car, en route to a Beuys exhibition, and they became friends. Another board

member, Hermann J. Abs, years previously, had introduced Beuys to the bank. Together Abs and Zapp shaped the bank’s art policy in the 1970s, and jointly initiated a significant acquisition of a comprehensive series of Beuys drawings for the Deutsche Bank art collection.^[5]

In addition to placing art in the workplace, some corporations have designated spaces solely dedicated to displaying their collections in corporate art museums, galleries, and sculpture gardens. The first corporate art museum was founded by Josiah Wedgwood & Sons Ltd. in 1906 in Barlaston, Stoke-on-Trent, and other corporate art museums and galleries began to proliferate in the 1920s.^[6] By the 1990s the corporate art museum model was challenged. Occidental Petroleum Corporation’s Armand Hammer Museum of Art and Cultural Center in Los Angeles was created in the late 1990s, which brought about lawsuit from dissident stockholders challenging the right of Chairman Armand Hammer and the Occidental Petroleum Corporation to finance a museum housing the chairman’s private collection of artworks. The lawsuit further charged that the museum had no tangential connection to the company and offered no stockholder benefit. While a settlement was reached, the ruling was in line “with long-time corporate beliefs and practices in the United States and other countries” that spaces can be created if the facilities are in the best interest of the company, “on the grounds that it is in the company’s best interests—meaning good for business and public relations.”^[6]

PROMOTING CULTURE

Although internal and external publicity varies amongst them, corporate art collections typically exhort the role they play in promoting arts and culture in their respective workplaces. They have many reasons to do so: In addition to directly supporting artists through tangible object acquisitions, their collections also can be considered a valued intangible asset for the public relations of a corporation that supports a professional and inspiring environment for employees and the public. Regardless of intent, a corporate art collection serves as an ongoing visual reminder of the value of inspiration, creativity, and innovation, and the corporation’s support of such values. That said, there are numerous philosophical issues surrounding the intermingling of art and commerce, as companies that delve into art collecting, art sponsorship, and other modes of engagement, can “convert cultural capital into economic capital, in sometimes politically pernicious forms.”^[7]

Responses in a 2001 survey of 32 companies by the Business Committee for the Arts (BCA) and the International Association for Professional Art Advisors (IAPAA) assert that art in the work environment fosters elements essential to a company’s success. The survey found that 78% of respondents believe that art in the workplace



Fig. 1 Microsoft Redmond Campus installation view of Bean Finneran, *Orange Cone*, 2006, fired ceramic and glazes, 20 × 20 × 14 in.

Source: Photo copyright of Adam L. Weintraub.

reduces stress, while 64% believe it increases creativity and productivity. Another 67% believe it enhances morale, while 77% agree that it “broadens employee appreciation of diversity and encourages discussions, and expression of opinions.”^[8]

ACQUIRING ART

Corporations acquire artwork for their collections in a number of ways. In fact, there is a constellation of entities that can be involved in any one corporate art program. Some companies employ in-house curators, who work with decision-makers in their company and outside resources—such as art galleries, artists, auction houses, and print publishers—to select works of art. Other companies outsource art advisors to recommend artworks to a decision-making committee or individual within the company. Depending on the project, an in-house art curator or an outsourced art advisor can work with architects, landscape architects, contractors, lighting designers, and building occupants to determine an art installation plan, proper lighting, and architectural opportunities for special art placement.

The type of art purchased on behalf of a corporation is as varied as the companies amassing them. Some corporate art collections purchase and commission art tied to their products or marketing campaigns, while others collect and commission artworks intended as visual counterpoints to the workplace environment. Most corporate art collections have a mission or vision statement to guide their collecting activity and programming. Ultimately, corporations that collect and display art in their facilities are stating, either overtly or subtly, that they support culture within and without the workplace walls.

For artwork acquisitions, regardless of purchase decisions made by committee or by those considered subject-matter expert(s), such decisions require research, timing, and negotiation. In most cases a rigorous initial selection process is undertaken. Corporate art curators and art advisors can consult numerous sources: art fairs, museum exhibitions, art journals, newspapers, magazines, artist monographs, art galleries, exhibition catalogs, juried exhibitions, and artist studio visits. When a work of art is purchased, items such as shipping, framing, digital image, accession number, provenance, artist and exhibition articles, artist curriculum vitae, gallery announcements, and condition reporting are just a few of the items that go into the typical processing of an artwork as an asset into a corporate art collection.

Those that purchase the artwork, in addition to keeping in mind the project’s budget, building installation plan, hanging or placement requirements, have many other variables to consider when deciding upon what to buy. The famous dictum to “buy what you love” is a good rule of thumb. However, the purchaser’s (or decision-maker(s)) taste and aesthetic is a factor, as well as, content of the

piece, media, style, artist, size, installation requirements, price, and expected maintenance. Further, it is the job of the procurer to examine the strengths and weaknesses of an existing art collection and how a new acquisition would fit within that collection. Other items that a purchaser will likely weigh are authenticity, historical significance, provenance, practicality, region, and ethnicity of artist.

When a project’s scope is assessed, the individual(s) determining artwork purchases can look to the primary art marketplace: art galleries, artist studios, rental/sales galleries, and to the trade commercial art procurers, or, to the secondary art marketplace: auction houses and consignment art galleries. In addition to filling their buildings with artworks, many companies also commission artists to create site-specific works in designated locations within their facilities. Commissioned work gives the company an opportunity to have an iconic, unique piece of art to both support artists and to enhance their image. In a recent example, BMW commissioned Icelandic artist Olafur Eliasson, an artist concerned with tangible topics such as civilization, technology, and nature, as well as renewable energies, and ephemeral works, to design the 16th BMW Art Car, to be added to the BMW Art Car Collection.^[9] Eliasson’s work, an H2R BMW metal car frame covered in 2 tons of frozen water and lit from within, is a sharp visual commentary intended to raise awareness to automotive industry practices and their effects on global warming. His work, which initially may seem an indictment of the automotive industry, ultimately aligns with BMW’s values for their product, which is to provide sustained mobility based a regenerative fuel source.

While modern day media may obsess upon corporate art collections that have been disbanded or sold, corporate art collecting comprises a large segment of the art marketplace—some attribute up to 30% of sales worldwide toward this specific market—however it is difficult to fully assess as many dealings are kept secret.^[7] For artists interested in their work being added to a corporate art collection, F. David Fowler, managing partner for KPMG Peat Marwick, who works with the art advisors for their corporate art collection, states:

The key to being included in a corporate collection is no different from being in an outstanding private collection: you have to be known, have a good gallery. A typical corporate art curator or art advisor gets invitations to every gallery opening in town, every exhibition and show, but it is tough. . . I wish we could do more with local artists but budgetary constraints limit us.^[4]

ART AS INVESTMENT

While there have been certain art collections that have applied an art as investment philosophy to their collecting

activity, by and large, most corporations do not buy art for investment. While artwork typically appreciates in value rather than depreciates, and corporate executives may find satisfaction in that fact, corporations that are in the position to begin or support a corporate art program typically have a product or products that bring in significant profit, so looking to an art collection as a potential money-making investment is not typical. One challenge to a corporate art program is to demonstrate, particularly in a tenuous situation, such as a company merger, executive shuffle, bankruptcy, or buyout, that the collection's value is equally high, if not higher in intangible value to employees, customers, and visitors that interact with the art collection on a daily basis.

For a publicly held company, another concern is how a corporation's art collection is viewed amongst its stockholders. While it has been demonstrated in studies such as BCAs aforementioned survey in 2001, and in other sources, that art in a workplace environment improves productivity and employee satisfaction, stockholders may question putting company profits toward such a program. Conversely, stockholders may appreciate that artworks are a part of a company they have invested their hard-earned money in: The company invests in benefiting employee quality of life and the art community.

COLLECTION MANAGEMENT

As we have by now well established, every corporate art collection is different. So is how they are managed: One particularly large corporate art collection can have 10 different curators with various content specialties, and a smaller art collection could be overseen by a director in lieu of a curator. Corporate art collection management has been humorously described as a cross between being air traffic controller and the director of an art museum. When corporate art collections begin, collection management can sometimes be an afterthought. However, when a corporate art collection grows to a certain size, it becomes abundantly clear that professional collection management is required. Benchmarking survey data from similar-size art museums and corporate art collections can demonstrate strengths and weaknesses in a corporate art collection program assessment.

Important items in collection management that a corporate art collection typically requires are collection management database to store and track data; climate-controlled art storage facility; de-accessioning (*to sell or otherwise dispose of an item in a collection*) of objects; conservation; image library; art research and reference library; appraisal and inventory survey of collection; and maintenance schedule for cleaning select works, such as outdoor sculpture. Unlike a museum collection, which may house up to 90–95% of its holdings in storage at any given time, a corporate art collection is usually the



Fig. 2 View of Microsoft Art Collection storage vault.
Source: Photo courtesy of Microsoft Art Collection.

opposite ratio, and the works are typically rotated within buildings owned by the company (Fig. 2).

A corporate art collection might be housed within any number of teams or departments. These can range from Human Resources, to Real Estate, to Legal, to the Executive Office, depending on how a particular company's divisional structure is arranged. Furthermore, every corporate art collection budget is unique. For a growing company, an artwork budget might be set by a metric, or measurement, involving square footage. For others, it may depend on the desire of the CEO.

ALTERNATIVE MODES OF COLLECTING

Corporations also instigate other types of involvement with artists beyond the corporate art collecting model. For art collections that become a valued and invaluable part of a stable company, many companies utilize their collections in targeted marketing campaigns, advertisements for products, and commissioning artists to literally make a mark on their products. Examples of this are seen in commissioned works for Illy Espresso company and wine labels for Baron Rothschild wineries. New forms of corporate sponsorship will continue to emerge and set trends, as the worlds of marketing and advertising, art and commerce converge.

Corporate Mentality, a book by Swedish artist Aleksandra Mir, documents the myriad ways in which artists interact with corporations and how they consider them rich subject matter in producing object-based and performative artworks. In one example of art meeting

commerce, Mir interviews Martina Westin, Manager of Communications of The Absolut Company in Stockholm. Remarks Westin:

The artists that collaborate with us are given complete artistic freedom. . . we don't buy art, but look for a relationship in which we ask artists to interpret our (vodka) bottle. In that, they are free to do whatever they like but . . . since many of the art works are advertised, some policies and laws apply, such as no cars, no children and no pornography. That way freedom of expression may be limited, but our parameters are clearly stipulated from the very beginning when we brief the artist and he/she accepts or enters the collaboration. . . Maurizio Cattelan's rat in the bottle. . . I tell you, I have worked in the food industry for many years, and rats in conjunction with food is the ultimate no-no. But here we felt that the artistic freedom and the integrity of the artist is important, so we approved it.^[10]

Created in 1984, Fondation Cartier Pour l'art Contemporain, in Jouy-en-Josas, France, has a unique program that is a separate division of Cartier International Paris. Their foundation, historically the first corporate foundation in France, provides studio, living, and exhibition space for artists-in-residence, as well as a conference and meeting center, library, restaurants, sculpture garden, and an exhibition hall. Other corporate art collections innovate through programs training employees to lead art tours, inviting artists to speak, presenting films, offering art-related book discussions, and developing partnerships with community organizations and more.

Umeå Energi, located in northern Sweden, produces, distributes, and sells electricity, heating, and cooling. Collaborating with Umeå's College of Art, they work with students to create various art projects that are featured in differing formats for company use. Mir's interview with Anette Mångsén discusses their "Power Flower" project. States Mångsén:

Power Flower is a sponsorship arrangement that . . . is an example of how art can be used for more than just adornment. The agreement. . . also gave us the right to use the Power Flower theme in our advertising, in our information activities for schools, on our Web site. . . on T-shirts, and as a screensaver, etc. This is how sponsoring works. It should involve mutual giving and taking, in which both parties are winners. . . a sponsorship agreement is just like any other business arrangement. By means of artistic expressions. . . we can demonstrate that Umeå Energi is more than electrons and incinerators, and that we are people with warmth, feelings, and a sense of humour. Employees also benefit from seeing art in their everyday lives. We spend a large proportion of our working hours at work, and it is important to have various forms of stimulation. Art is enriching, and it liberates the senses.^[10]

Another interesting model is the collaboration of BMW KulturKommunikation unit and the BMW Art Car

Collection. Christiane Zentgraf, head of, Corporate Affairs, in Munich, Germany, states:

The BMW Group has been actively engaged in the field of culture for over a quarter of a century, both regionally and internationally. Over the course of time, BMW's experience with art led to the realization that a discursive engagement with art and culture, if it is used in the right way, can be employed as an outstanding medium of communication. Art and culture are highly sensitive fields. Our primary focus is not on financial transactions or the cash value of goods, but rather the long-term interaction of partners who are interested in getting to know and understand each other and each other's worlds, exchanging ideas, and realizing joint projections that will, of course, need to be financed. The widely quoted motto, "Do good and talk about it," is not BMW's policy. BMW believes in "doing good and letting others talk about it."

The BMW Art Car Collection began in 1975 as a result of the spontaneous request of French auctioneer and racing driver Hervé Poulain to his friend Alexander Calder to design a BMW racing car. The idea "sparked enthusiasm in both Calder and BMW," and started the impetus for additional art cars by artists such as Roy Lichtenstein, Frank Stella, Andy Warhol, Jenny Holzer, and Robert Rauschenberg. Zentgraf further states: "The artists find themselves in the world of automobiles; BMW is critically received in the world of art."^[10]

CHALLENGES AND CONCERNS

Some corporate art collections strategically aim through their artwork acquisitions to challenge the viewer. Others are tied to the initial vision of a CEO, such as Lloyd Cotsen's textile and folk art collection at Neutrogena (today housed in a wing of the International Museum of Folk Art in Santa Fe). Regardless of acquisition focus, by and large, those purchasing works for corporate art collections do consider sensitivity to subject matter, in light of the fact that employees are paid to be at a workplace vs. an individual willingly experiencing a boundary-breaking art exhibition. Many corporate art collections, such as Microsoft's, while pushing certain envelopes, often, do avoid artworks with overt nudity, political and religious content. Works of art with challenging media, such as materials that are highly light-sensitive, hazardous, or sculptural works with dangerous shapes must also be considered prior to being placed in a workplace setting.

As a corporate art collection grows, the overall value of the art collection can appreciate to the point that a specialized fine art insurance policy is required. In larger businesses with offices worldwide, it can be a challenge, however, to demonstrate the level of risk a company is exposing itself to if the company is large enough to deem such a specialized policy irrelevant. Many corporate art

collections are difficult to formally survey and appraise, as artworks can be installed far and wide depending on the corporation's size and their art collection's overall program and scope. Finally, there are a number of legal concerns that a properly managed corporate art collection must consider, such as loaning objects to art museums and institutions; rights to reproduce images of works in the collection in various formats (print, online) and for various uses (education, commercial/advertising, product packaging); and bill of sale for purchasing artworks from primary and secondary art marketplace sources.

CORPORATE SPONSORSHIP AND PATRONAGE

With the seemingly gradual reduction of governmental funding, particularly in the United States, arts institutions increasingly turn to corporations and other sources for short- and long-term support. Through arts sponsorships, corporations gain new audiences and new platforms to market themselves, which has “become a well-known and beneficial marketing tool.”^[11] Deutsche Bank is a major sponsor of the Frieze Art Fair in London, and also operates a space—the Deutsche Guggenheim—an outpost in the Guggenheim Museum's global network on the ground floor of the Deutsche Bank building in Berlin. Corporations can also make an impact in rural areas or small- to medium-sized cities, such as Microsoft's campus in Fargo, North Dakota, if they are acquiring and placing art and can directly impact a regional art market, from individual artists to art galleries and collaborations with local art museums.

Corporations that support the arts, not just in corporate art collecting, but through sponsorship and other innovative programs, have often been compared to the Medicis:

Why don't more people buy art? The benefits are considerable: offices have to be decorated anyway; it pleases and motivates the workforce; it enables a company to project a positive image and to act like a Medici, sponsoring artists; and not least, careful buying can prove a profitable investment.^[11]

See Fig. 3 for an illustration. With some companies their art collection is an integral part of the culture of the company, yet for others, there is also the drive to affiliate themselves with artists to market their products in new ways. Takashi Murakami's collaboration with Louis Vuitton on their monogram handbags demonstrates that boundaries between art and the commercial sphere can easily blur. Aforementioned Olafur Eliasson also created a light piece for Louis Vuitton stores, and, almost defensively, states:

It is about a principle that art should not be exclusive. Art doesn't have to polarize itself into a critical, quite

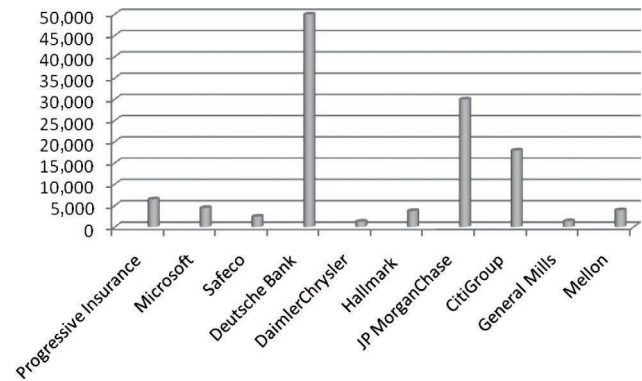


Fig. 3 Select corporate art collection sizes in object totals, August 2007.

predictable role of being oppositional. To think that a museum is a free space and a Louis Vuitton window is not is problematic.^[12]

When LACMA opened its 60,000 ft annex, the Broad Contemporary Art Museum, in February 2008, real estate financier Eli Broad gave the museum \$50 million for construction, and limited access to his foundation's art collection as well as his personal one. This hybrid arrangement, of which there are a few other examples, presents the viewer with a potentially confusing presentation of a museum within a museum. Finally, corporate executives with a passion for art have long held posts on museum boards and advisory committees, not only for their ability to donate to the institution, but also for their access to others with similar interests and pocketbooks.

EVOLUTION OF THE WORKPLACE

The corporate workplace is rapidly evolving, as evidenced at Microsoft, with more employees working remotely and the proliferation of open plan workstations, which decrease the overall amount of available wall space to hang artworks. For those that maintain an office, many employees no longer adhere to a 9 A.M. to 5 P.M. work schedule; some utilize their office spaces 24/7. In addition to these developments, many companies choose to “brand” their interiors with company logos, products, awards, and advertising campaigns. As a result, placing art in the dynamic setting that is today's workplace requires nimbleness and open attitude to change.

In a workplace environment, artworks are subject to a variety of variables not found in a more controlled art museum setting. Fluctuations in light, temperature, and humidity, which vary depending on the heating and cooling system activity in an office building (on weekends such systems are typically powered down) must be considered regarding art installations. Other elements, such as mail carts, construction projects to retrofit interiors, painting

crews, furniture moves, all must be considered and planned for prior to art placement. Furthermore, most corporations do not have the level of security one might find in a museum setting. Corporations with art collections can counterbalance security concerns by security-mounting artworks and educating employees through programs and signage about appropriate behavior with regard to looking at art.

Due to the proliferation of technology in the workplace, placing art within such a context can strike a powerful visual counterpoint against a field of varying devices. In such a setting, art can humanize the environment, make a statement, and enhance a company's overall image. In the United States, one way corporations evaluate themselves and each other and how employees evaluate them, is through the Fortune Magazine's "Best Places to Work" survey. A company-sanctioned art program can attract future employees and retain existing work force, as a corporate art program can overtly or subtly demonstrate the environment of the corporation and how the company treats its employees.

CONCLUSION AND LOOKING FORWARD

There have been gradual and significant changes to the world of corporate art collecting. Many companies that are expanding are expanding their art programs as well, and new companies continue to start their own art collections. The often more conservative art collecting programs in the 1960s and 1970s, leading up to the extravagant purchasing in the 1980s—and wholesale selling of certain art collections during economic downturns—led to today's cautious, yet carefully optimistic and predominant viewpoint of corporate art collecting reflecting the values of a company. Corporate art collecting is now an established entity in the art world, with a variety of professional organizations to support specialists in the field.

As corporate art collections grow, some companies will consider establishing a nonprofit foundation to protect their collections from oftentimes tumultuous business cycles and executive turnover in a company.

One interesting model has emerged from Hallmark Cards, Inc.: After having built a museum-worthy photography collection, the company donated it in 2006 to the Nelson-Atkins Museum of Art for posterity and to enhance the museum's photography collection holdings. At the same time, the Hallmark Art Collection continues its collecting activity in other media.

While corporate art collecting remains an often secretive activity, employees, customers, and guests at a company have the rewarding opportunity to see and be surrounded by original art. A company's art collection is a reflection of the company and can provide an outsider with a different viewpoint and perception of a corporation. Ultimately, a well-managed and well-cared for corporate

art collection not only enhances a workplace setting, it also supports the art community as a whole.

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Corporate Information Centers

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Abstract

Information has become the lifeblood of the global economy. Corporate information centers (CICs), often called special libraries, leverage this force as they provide services to meet the specialized needs of a company, organization, or group. The CICs are typically staffed by library and information professionals, "...information resource experts dedicated to putting knowledge to work to attain the goals of their organizations." They provide information support to decision makers, researchers, and administrative and technical personnel.

INTRODUCTION

Information has become the lifeblood of the global economy. Corporate information centers (CICs), often called special libraries, leverage this force as they provide services to meet the specialized needs of a company, organization, or group. The CICs are typically staffed by library and information professionals, "...information resource experts dedicated to putting knowledge to work to attain the goals of their organizations."^[1] They provide information support to decision makers, researchers, and administrative and technical personnel.

A CIC provides both specialized services and a targeted collection of the information resources most needed by the organization's personnel. Since these people are generally inundated with information, do they really need the CIC? As Leigh Buchanan notes, "...the kudzulike spread of information—information that's readily accessible yet often inaccurate, confusing, and more than slightly irrelevant—has actually increased the need for librarians."^[2] The staff of the CIC helps to solve this problem. They review the world of resources available, and then identify those that are accurate and applicable to their organization.

SUBJECT AND SERVICE SPECIALIZATION

Subject Specialization

Because the corporate information center serves a unique clientele, the staff is able to build both subject and service specialties. Obviously, the subject specialty reflects the goals of the parent organization. For example, the library in a textile company will have information resources—both print and electronic—that relate to aspects of the textile industry. They will have resources that cover the

hard sciences, like chemistry as well as those on color, durability, and manufacturing processes.

How can we consider this textile company a specialized subject area, when it includes so many disciplines? The answer is that the information resources selected from these many disciplines all relate to textiles. Another way to look at it is to consider the disciplines that are not covered in this library. Do they have print materials related to music or resources in psychiatric medicine? Does the collection cover history and philosophy? Do they include general dictionaries or only dictionaries pertinent to the textile industry? Only resources related to the industry are included. The smaller world inside a larger universe is characteristic of a corporate information center. Fig. 1 pictures some of the areas in the Nike Design Library.

Service Specialization

Public libraries, which are funded by tax dollars, often assess their value by the size of their collections. These libraries are serving every citizen, providing content for every interest, and covering every subject imaginable. In this arena, collection is king.

The goal of the corporate information center, however, is to provide pinpoint access to exact information in the shortest time possible. In the language of corporations, the corporate information center is a key player in building competitive edge. The corporate information center client values its collection, but values its services more. Figs. 2 and 3 show work areas next to information areas at Deutsche Bank.

The focus on the organization's subject area enables the staff of the corporate information center to provide services that are unique, or at least tailored, to their customer base. A company's information center, for example, may provide an alerting (current awareness) service in a very narrow area for a small number of employees in a small department.

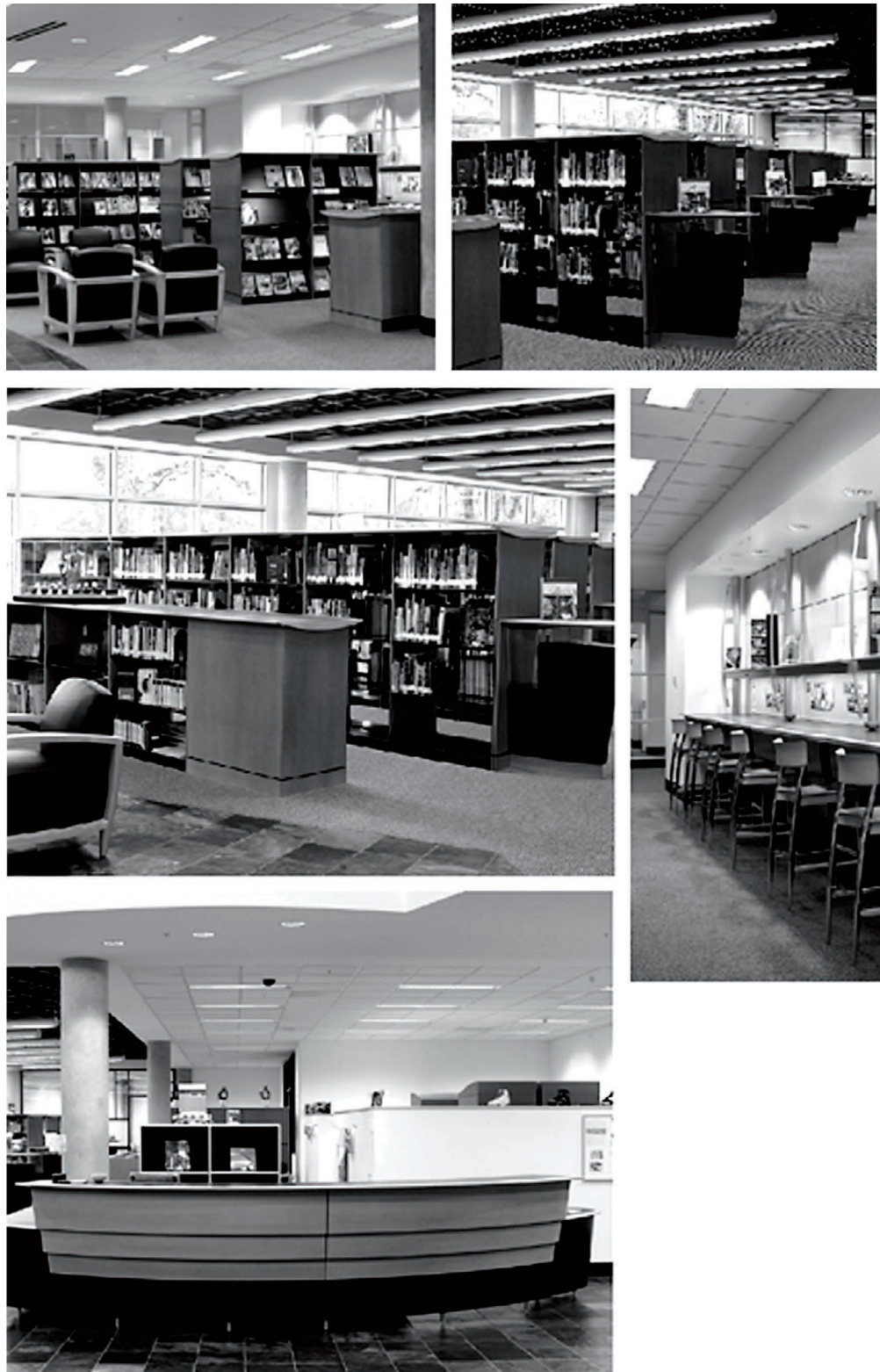


Fig. 1 Areas of the Nike Design Library.

Imagine the library in an information technology company that specializes in enterprise-wide networking. The end users have the skills and knowledge to manipulate any database in existence, but they do not have the time or

training to identify which commercial databases are the best for their specific information needs. As the information landscape of their industry changes, their corporate information center may identify new or different state of



Fig. 2 Book cabinets in a work area at Deutsche Bank allow easy access to information.

the art resources on a daily basis, and provide that information to the end users in the same tight time frame. In a large law firm, the corporate information center may provide an indexing service for depositions. In cases that include hundreds of thousands of documents, this service is worth its weight in gold to associate and partner alike. In these examples, the library provides a service that frees the end users to do what they do best. Figs. 4–10 show parts of the CIC at Deutsche Bank.

Are There Also More General CIC Services?

The CIC general services include reference, document delivery, research, electronic resource management, and internal information consulting. The collections of information include both external and internal materials. They may be traditional print collections such as books, journals and reports, or other specialized media; and objects such as images, material samples, or microscope slides. Collections may also be virtual, such as networked resources or databases. The corporate information center staff works with executives and managers to support decision making, strategic planning, and market research initiatives. They



Fig. 3 Employees share an alerting area at Deutsche Bank.



Fig. 4 A computer work area at Deutsche Bank.

work with technical personnel to support scientific research and development, engineering, and manufacturing. The CICs also provide industry data, benchmarking, statistics, and other information to support administrative personnel in the areas of human resources, financial planning, quality assurance, and public relations.

How Many Special Libraries Are There?

Statistics provided in The Bowker Annual, Library Trade and Book Almanac, 2000, indicate that there are 9691 special libraries in the United States. This figure includes corporate, medical, law, religious libraries, but not special libraries in public, academic, armed forces, or government libraries.

QUALIFICATIONS AND ONGOING PROFESSIONAL DEVELOPMENT

How Is the CIC Staffed? What Are the Staff Qualifications?

The range of staffing for a corporate information center can vary widely based on the role of the center, the demand for



Fig. 5 Storage units.



Fig. 6 Information storage.

its services, and the budget allocated to the function. The professional degree for this field is a master's degree, offered in the area of library or information science, and requiring one or two years of postgraduate education. Ongoing professional development is essential to ensure that the staff remains conversant with developing products and technology. The company itself, information vendors, and professional associations provide advanced training in the field. Depending on their needs, most experienced information professionals belong to the Special Libraries Association (SLA), American Society for Information Science (ASIS), the Medical Library Association (MLA), the American Association of Law Librarians (AALL), or other professional societies.

USERS AND SERVICES

Who Uses a CIC?

The intended user base of a corporate information center is typically defined by the CIC's mission statement or by its functional position in the organization. The CIC may serve



Fig. 7 A storage wall in the Information Center.

a narrow or broad constituency. In some cases, the CIC may be intended to serve only a subset of a company. For example, it may be a technical resource used only by research scientists within a larger corporation, or a business library serving only management and executive personnel. Alternatively, the CIC may serve an entire division, business unit, department, or other organizational segment. It may be chartered to serve the entire organization, or even to serve the external customers of an organization. As an example, a pharmaceutical company's CIC may support scientists, marketing, and administrative personnel, and may also provide some information services directly to consumers of the company's products.

What Services Are Provided by the CIC?

Because a corporate information center's service offerings vary widely according to its purpose within the organization, there is no set suite of services provided by all CICs. Major areas of service may include reference, research, current awareness, collection management, information resource management, document delivery, and information consulting.



Fig. 8 An employee at work.



Fig. 9 A specially designed information cabinet.

Reference

Reference service, in a nutshell, means answering questions. The questions answered through reference services may be simple lookups of facts, dates, names, addresses, or definitions. Many libraries define reference service to include primarily quick-turnaround, limited-scope, and relatively easy-to-answer questions. But sometimes reference questions may be complex, open-ended, and even unanswerable, and the staff's response can include a range of options for further pursuit of the question. In a corporate information center the reference service can be viewed as the cornerstone for all other services, because it measures the pulse of the organization's ongoing information needs. In the course of meeting these changing needs, the staff continues to develop its complement of internal and external resources. Needs identified through the reference process subsequently influence the CIC's planning and priority setting in collection development, service offerings, planning, and staffing.

Research

Research services include literature searching, primary research, and synthesis of information. A literature search is a comprehensive review of electronic and print information resources. The goal of the search is to compile a focused set of references or documents pertinent to a specific topic. Primary research extends beyond a review of written or published data, and involves the gathering, interpretation, and synthesis of



Fig. 10 A work area at Deutsche Bank.

information directly from people such as industry experts, researchers, or authors. Primary research is especially significant for supporting functions such as competitive intelligence or market research, which are unique to each company. Information synthesis and reporting are the refined end products of literature searches and primary research. Benchmarking of products or companies is an example of this process, in which literature searches and primary interviews are used to compile data and information. This information is studied, organized, and presented with comparisons, conclusions, or recommendations for action.

Current Awareness

The information center's current awareness services provide ongoing updates of targeted information to users interested in following a specific topic, company, or technology. Current awareness may be topic-specific, such as a monthly update of new developments in the telecommunications industry, or it may be resource-specific, such as a monthly table of contents from a specific journal title. Current awareness services may be compiled and distributed directly by the corporate information center staff or set up through external vendors.

Collection Management

Corporate information centers may manage collections of internal or external documents or information. The collections may be physical, as in a print book or journal collection, or virtual as in an electronic document management or intranet system. Examples of internal collections include patents, technical reports, policies and procedures, scientific data, or organizational records. External collections can include externally published books, journals, reports, conference proceedings, audiovisuals, and standards. A formal collection development policy or statement of scope often

drives collection management. These tools define the types of materials and topical areas collected, and they are useful in making decisions about how to allocate acquisitions resources to collect and organize the most important materials for the organization. Collection management includes acquisitions, cataloging, indexing, development of finding tools, and circulation. In addition to providing tools for users to locate collection materials, the corporate information center staff interacts directly with users to help them locate the specific materials or information they need.

Information Resource Management

An extension of collection management, information resource management includes the planning, purchase, implementation, and administration of intranets; content licensing, intranet subscription services; or other electronic or networked resources. Management of content licensing and intranet subscription services, in particular, enables the CIC to help control the cost of information access across the organization. Successful implementation of these services requires effective teaming between the CIC, information technology, communications, and purchasing. A teamwork approach ensures that there is less duplication of effort within the company, and less duplication of purchased resources.

Document Delivery

While a collection management effort strives to maintain key materials and frequently used documents in-house, there is always a need to quickly and cost effectively obtain materials from outside the organization. Document delivery services are designed to purchase or borrow books, photocopies, journal articles, and other resources from publishers, vendors, and other libraries. These services can be very effective in obtaining both print and electronic materials and provide good backup to the information center.

Information Consulting

Consulting services offered by the CIC may include information audits, information mapping, and project information support. Information audits can be used to identify an organization's information needs, gaps, and processes; they also serve as a basis for better information resource allocation, process improvement, and communication. Information mapping can be used to identify, document, and provide pointers to an organization's internal data and information resources, which would otherwise be underused or hidden. Project information support makes an information professional available to support new initiatives or task teams, and in many CICs it is standard practice to assign an information specialist to these teams as they begin their work. This staff member can provide

topical background information, ongoing current awareness, and research specific questions that come up in the course of the initiative.

IMPACT AND STRATEGIC POSITIONING

How Does the Corporate Information Center Impact the Organization?

In addition to its primary role of access to information, the CIC can introduce new technologies to the organization; research and highlight industry measures of total quality; perform needs assessments and information audits, facilitate focus groups and design surveys, and map information in the organization to identify critical resources. All of these roles rely on the CIC's strategic positioning within the organization.

A CIC must be flexible, responsive to change, and able to extend and tailor services to provide what the organization needs before the need actually arises. These organizational needs must continually be identified and verified through frequent communication and feedback with users and organizational leaders. If the information center has the best collection in the world on large widgets, but the company has changed its strategic direction to small widgets, that collection is of little use to the company.

What Are the Corporate Information Center's Costs and Benefits to an Organization?

In addition to providing the information needed to support organizational functions, CIC services can save both money and productive time. King Research, Inc., funded by a research grant from the Special Libraries Association, compiled data from 23 studies of special library users and services, and four national surveys of scientists, engineers, and other professionals. This study reported, "it would cost these parent organizations about 2.9 times more for their professionals to obtain information from other sources than it now costs to run the library."^[3] Savings of this kind are obviously important to all organizations that watch their bottom line.

Productive time is a "soft savings," that is, one that does not usually register on the company's balance sheet. One channel for loss of productive time is the inclination of a company's professional and technical employees to "surf the Net" for the information they need to do their jobs. "Most professionals with internet access on their desktop computers don't know the most efficient way to conduct a search. Further, employees are too often satisfied with finding any information on a subject—not necessarily the best data or most significant source. Top-notch librarians, however, know how to find primary sources and judge information. . . ."^[4]

Where Does a Corporate Information Center Fit Within Its Organization?

The CIC may report to information systems, human resources, records management, facilities, business planning, or a general corporate services function. The organizational placement of a corporate information center may define or reflect its overall purpose. Placement within information systems is appropriate for an organization in which the most valuable information resources are available chiefly through electronic means such as Internet, intranet, internal databases, or networking. This type of corporate information center is effective in an organization with an employee population skilled in using computer-based resources, and in an industry that relies chiefly on current rather than historical information.

A corporate information center placed within the human resources department is likely to be found in organizations that strongly associate access to information with employee development and organizational learning. A library in this setting may be expected to provide information resources to meet both the business and personal needs of employees. To support organizational learning, this library may be involved with knowledge management initiatives or other organization-wide projects to capture and redeploy employee expertise.

A CIC placed within an organization's records management setting may be more closely identified with the organization's internal information. This type of library can add value to the management of records and document management systems, especially by contributing its expertise in understanding the interface between people and information systems, and by putting into place tools to help people locate information more easily.

An information center placed within the business-planning segment indicates that the organization recognizes the value of information to the business and strategic planning function. A library in this setting is likely to provide services to management and executives, sometimes to the exclusion of the general employee population.

Finally, placement within the general services organization of a company indicates recognition that library services are needed by the organization as a whole, just as accounting and procurement may reside in this general services structure. This placement may free a library to design a wider range of services based on varied needs across the organization, but may also limit it by keeping it perennially in the crosshairs of ongoing hunts to control costs.

Is there an ideal setting for the corporate library or information center? Probably not, since placement depends on the needs of the organization, the perceptions of the company's decision makers, and the abilities of the CIC to prove that the resources and services it can provide are valuable. In reality, most corporate information

centers exhibit characteristics related to all of these settings. CICs continue to change and recreate themselves, including moving from one organizational reporting structure to another, as their companies themselves continue to restructure and reorganize to meet the changing business environments.

Budget

Budgets for corporate information centers typically include line items for personnel, information resources, and general costs. Personnel costs include the cost of employee benefits and training. Information resource costs include the costs of materials purchased centrally for any library collections or directly for the company employees, commercial database fees, and annual fees for internet subscriptions or networked electronic resources. General costs included in a library's budget may include internal services such as information technology support, reproduction, phone, workstation, and facilities costs. In general, corporate libraries must justify costs on an annual basis, at budget planning, and at approval time. They must gain the approval and support of the management of the library's primary user bases, who often share in the cost to retain the corporate information center.

Many libraries are funded through chargeback or assessment to these user groups each year, often on an overall basis linked to user and service statistics, or on a transactional basis throughout the year. It is easier for special libraries to justify their budgets if they consistently assess user needs, design services to meet these needs, and communicate their value.

One challenge to a library's budget activities is the rising cost of information resources. Journal subscription costs in particular, whether print or electronic, provide a good example of the difficulty of controlling costs. Journals that focus on a specific industry segment or scientific field often rise most dramatically in cost, but are also those most needed by companies that work in these specific industries or scientific areas. It is prudent for the manager of the information center to clearly delineate the cost of these expensive resources and the customers who use them the most often.

COMMUNICATIONS

Good communication is central to the success of a corporate information center. In a business setting, information is primarily used to make decisions and, therefore, must be shared, rather than added to a collection on a shelf. A variety of communication skills are used many times every day, and it is expected that professional staff will have these skills when they begin the job.

Advanced listening skills are an absolute requirement in this setting, since the staff will be required to interpret

the actual needs of the customer, rather than relying on the customer's knowledge. Customers from human resources (HR), for example, can be expected to know a great deal about HR, but may not be up to date about marketing. They may have heard a marketing information resource mentioned, and assume that since they are interested in marketing job positions, that same resource will work for them. The staff uses the reference interview process, including active listening, to identify the actual information that is needed.

The staff of the CIC is also required to be able to communicate effectively, in speech and in writing, to customers from the lowest to highest position in the organization. Communications with the manager of a technical department, for example, may include a quick précis of research techniques and technical jargon, which demonstrate that the librarian speaks his language. Communication with the chief executive officer (CEO), on the other hand, must be brief and well focused, as the CEO will probably have less time, and be more interested in bottom-line issues. In communications like this, the information specialist must take into consideration two points: what is the listener's past knowledge of the subject (are they familiar with the topic? are their perceptions based on misinformation?); and what information does the audience actually need to make a decision (statistics? anecdotal evidence? trends over time?) Keeping these ideas in the forefront will ensure that the communication is on point.

Does the prevalence of electronic messaging and e-mail indicate that written communication skills are no longer important in a corporate setting? The use of these vehicles actually makes clear and effective written communication more difficult. It is quite easy to take a wrong tone in an e-mail. Once that e-mail is delivered, the tone speaks for itself, with no in-person speaker to clarify the intent or modify the message. It is easy to eliminate the use of all capitals, which is effectively screaming at the customer, but not as easy to detect when a comment might be interpreted as sarcastic rather than as humorous. Careful editing is required for good writing, and is especially important for electronic communication.

The need for excellent communication skills becomes even more important with the growth of a global economy. Professional staff can no longer assume that every customer will speak American English. Requests for research or other services may come from foreign subsidiaries, customers from abroad, or from people who work in the same building who are not native speakers.

In a diversified corporate setting, it is easy to find yourself with a customer who is exceedingly difficult to understand, and who has trouble understanding in return. How can this problem be handled without insulting the customer? The first rule, of course, is not to speak louder, under the assumption that the problem is one of intelligence rather than of translation. In instances where the

customer is providing data, it is imperative that the staff ask the customer to write the information; in this way, numbers will not be misunderstood, which can lead to disastrous results!

STRATEGIC PLANNING

The corporate information center must align its goals and objectives with those of the parent organization and reflect these goals in its own strategic plan.

The term strategic plan sounds ominously complex, but it simply means outlining where the special library is going, and how it will get there. The plan identifies the goals and objectives of the library, and the actual steps required to reach them.

As an example, a company's five-year strategic plan calls for entering a new market, which will require that the whole company shift its focus toward a new material or process. To help the company achieve this goal, the CIC must allocate a portion of its budget to cover more resources to support this initiative, and to add or develop staff to specialize in those areas. In theory this is not difficult; it simply requires moving funds from one pot to another.

In practice, however, the company has many goals, and some seem to be in conflict with others. Imagine that in the example above, the director of Marketing requests the CIC to increase support to his department next year. How can library funds and staff be allocated in this situation? The answer can be found in the company's strategic plan, which prioritizes its various initiatives. If the company's strategic plan calls for increasing allocations to product development by 10%, over the previous year's allocation of 5%, the library must shift its focus to increase resources and services related to product development. The CIC's strategic plan is, therefore, based on the organization's upper tier plan. Each request for services or resources should be considered and balanced in light of the CIC's strategic plan. In this case, the additional 5% allocated to product development cannot be allocated to other needs. When other groups request library services to support their initiatives, the strategic plan provides the basis for the allocation decision, and the explanation to the unhappy marketing director, who may not see more research into customer attitudes.

BUILDING COMPETITIVE EDGE

Understanding Competitive Edge

In the for-profit sector, time to market is everything. Time to market is the difference between a profitable product and an unprofitable one. Time to market is money.

A good example of this concept lies in over-the-counter pharmaceuticals. Name an over-the-counter product that reduces fever quickly. Most of us will name the same one, because it was the first on the market to make that unique

or specific claim. Once a product has worked for them, the average consumer is likely to buy it again. Voila! This way lies profit.

How can the corporate information center help to improve time to market and, therefore, help the organization be increase profitability? One of the best ways to understand the corporate information center's role in building competitive edge is to imagine a Slinky, the creeping toy loved by children far and wide. The rings of the toy can be pulled apart, leaving wide spaces between the coiled wires, or they can be pushed together, so that the coils are all touching. The extended Slinky, with wide open spaces, represents the infinite amount of information that can be found on almost any topic. The contracted Slinky, with every ring tightly closed, represents the goal of the CIC—targeted information located in the shortest amount of time possible.

But in a real time-to-market scenario, the end user may not even have time to ask the library for help. Outstanding corporate information centers are successful because they proactively provide the right information before anyone thinks of asking for it. They understand the organization's goals, they know their subject matter, and they deliver unique service with a smile.

Customer Intimacy

Customer intimacy is increasingly important to companies doing business in the global economy. Ongoing globalization of industries causes upheaval, realignment, and repositioning of industry players. In many industries, a company may be competing fiercely with its competitors in some arenas, yet partnering with them in others. With lines between competitors blurring, the company—customer relationship becomes even more critical. Companies must not only be responsive to their customers in a reactive way, but also proactively anticipate customer needs and provide solutions to their problems. Communication and information are foundations of this relationship. Corporate information centers must create this same relationship with their customers through expertise, effective information services, participation in knowledge management and competitive intelligence initiatives, and effective teaming with key organizational functions.

Challenges for the Future

Corporations will continue to fight the battle of information overload. For every decision that is made, there is a need for information. Sometimes not too much information is needed, since the CEO is not writing a journal article. At other times, lots of information is needed for the people in the research department, who are. And most times, there is a need for every possible choice of volume or specificity in between. Information overload will remain a challenge for

the CIC. How can it continue to identify the absolutely relevant and accurate information, as the marketplace is continually flooded with everything else?

As the information industry continues to refine a pricing model, the CIC will be more strategic than ever, since it is the first line of defense against models that are too extreme. As pricing models change, CICs may need to change the way they budget and charge for services. Since budgets follow costs, that is, the next year's budget is based on this year's costs, considerable strategic planning skills will be needed to anticipate these changes. Those who are not able to anticipate accurately will find themselves lagging behind an entire budget cycle, which can affect the information center's ability to function.

Some corporations may see a centralized information center as an anachronism, since they view it as a place rather than a service. These organizations may want to employ information professionals in other venues, for example, in knowledge management, competitive intelligence, or market research functions. This change in the information professional's role will be both a challenge and an opportunity.

CONCLUSION

Finally, information vendors, including established publishers and brand-new entrants to the information markets,

are grappling amongst themselves for market share and role definition. As part of their response to this instability, some vendors are attempting to subsume the role of the corporate information center. In an attempt to maintain market share, they are trying to be all things to all organizations by providing outsourced services. Maintaining the role definition of the CIC will be crucial in meeting this challenge.

Notwithstanding these challenges, corporate information centers remain exciting and dynamic organizations. They are positioned to make a difference to their company and to the future of the profession.

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Corporate Records Management

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Abstract

Records management is the discipline used by corporations to ensure management principles are systematically applied to the recorded information created, received, and used in the normal course of business operations. The corporate records management program uses established records management methods and practices to reduce costs associated with recordkeeping, provide efficient access to and retrieval of business information, help to protect information critical to the business, and overall bring recognized value to the corporation. Corporations deal with increasingly complex recordkeeping requirements due to the continued growth of electronic records as well as legal and compliance issues. Corporations face records management issues that government entities may not as they comply with international laws and regulations, civil litigation and the impact of electronic discovery, and mergers and acquisitions.

INTRODUCTION

Corporations are legal entities established to provide goods or services in order to make a profit. In addition to managing the core operations that make the goods or provide the services, corporations also employ various management techniques (disciplines) to more efficiently manage the business and to control the costs associated with doing business. Using financial management, human resources management and other related disciplines serve to make operations more effective and efficient, thus adding to profits, the so-called “bottom line.”

One of these management disciplines is records management—the systematic analysis and control of the creation, receipt, maintenance, use, and disposition of recorded information. Corporations establish records management programs (RMP) to manage all records (considered to be “information assets”) in all stored formats—paper-based, photographic, or digital storage. Employing records management techniques helps to lower the cost of doing business by controlling the growth of records maintained and by facilitating efficient access to recorded information needed for business decisions.

Corporations create, receive, and maintain a considerable amount of recorded information as they document what they intend to do (writing policies and plans) and how they intend to do it (developing procedures). As work activities are completed, corporations document the results of work activities, in the form of reports, meeting minutes, training presentations, photographs, charts, tabulated data, etc. The resulting recorded information must be properly managed to be of any benefit to the corporation.

The corporate RMP is responsible for managing the recorded information.

Records management activities help to make corporate operations more efficient by supporting both internal operations and by helping to meet external recordkeeping requirements and expectations.

Internal requirements include being accountable to an executive function or to a governing board, and if publicly traded, to shareholders. This is done in part by providing proof, in the form of records, that work activities were completed and completed correctly.

External requirements (in the form of laws or statutes) are those imposed by government legislative bodies or by government agencies (in the form of rules and regulations). Conducting business is a privilege, rather than a right.^[1] This privilege is conferred and controlled by one or more government agencies, and thus businesses often must comply with multiple requirements. These regulations often impose recordkeeping requirements on many business activities to make sure that there will be proof that the corporation complied with the appropriate requirement.

Corporations also operate within a larger social environment and the corporation may wish to present a positive image of the corporation to the public, establish good relations, or meet societal expectations as a “good corporate citizen.”^[2]

Records management supports the goals of cost savings and compliance by managing recorded information, regardless of the storage medium (paper, photographic, or electronic), from the time the records are created or received, until they are dispositioned. This concept of

“cradle-to-grave” management is called the records “life cycle” and is a fundamental tenet of the discipline.

Records management is also practiced in other types of organizations in addition to public and private enterprises. Government agencies at the local, state and national level, nonprofit organizations, universities and cultural institutions, all create and maintain records as one result of their operations.

The same principles of the record management discipline apply and many of the same methods are used. Records management in government agencies differs most significantly in the granting of access to many of the records maintained. The government agencies presume that outside parties (generally speaking, the public) have some rights to access government records, as the government conducts activities on behalf of its citizenry.

At the U.S. federal level the Freedom of Information Act (FOIA) codifies this right to access.^[3] States also grant similar rights to access records maintained by state and local agencies. In California, for example, the California Public Records Act, states that most records maintained are accessible by the public, delineates which records are not, and provides requirements for producing public records when requested.^[4]

Private and publicly traded companies do not have to comply with FOIA, and therefore, do not need to provide the public access to their records. Indeed, as records are considered a corporate asset, and often of a proprietary nature, corporations spend considerable effort protecting records and information from unauthorized access.

A comprehensive corporate RMP has five broad elements.^[5] These include:

- Records retention: determining how long to keep records.
- Compliance: ensuring that the corporation is aware of external recordkeeping requirements and complies with them.
- Active records management: arranging, organizing, and storing current or frequently referenced records to promote efficient retrieval and use.
- Inactive records management: identifying records that are no longer frequently used and transferring them out of an expensive office or work environment to low-cost warehouse storage or transferring them offline to tape or other cost-effective electronic storage.
- Vital records management: protecting records critical to support ongoing operations to ensure that they are available to respond to an emergency or disaster.

RECORDS RETENTION

As mentioned earlier, records retention is the activity of determining the value of a record to the corporation and assigning a timeframe (retention period) for maintaining it.

Records retention has been called “. . .the defining responsibility of records management as a business discipline.”^[5]

A key part of the corporate RMP is the “records retention schedule”—a list of each grouping or collection of records (called a “records series”), the time period the records series must be maintained (the retention period), and the assignment of business unit (e.g., department, division, section) responsible for the records series.

Records retention schedules can be developed using one of several methods and can be presented in several formats. The important point for purposes of this discussion is that the retention schedule is a policy document that states the corporation’s intent to maintain its records for certain time periods.

Determining the appropriate timeframe for keeping a records series involves analysis of the business (or “operating”) need to maintain the record and any pertinent legal requirements. These two considerations are applied to each record series in establishing the retention period. Once the records series meets the retention period, the records are either destroyed, or retained in an archive, if they have been identified as having historical significance.

This process of deciding how long to keep a record series is called “appraisal” as it involves determining the “value” of the records to the organization, and at what point the records no longer have value.

There is a risk management component to this decision-making process. There is a risk to both keeping the record indefinitely and to not keeping it. As records are created and maintained by organizations in order to support their position or to defend against allegations, deciding how long to keep records is very important.

The risk to maintain the record involves determining the cost of maintenance (physical storage space, equipment and supplies, as well as computer disk storage), personnel (to maintain files and ensure digital records are protected), and if the organization is involved in litigation or a government investigation or audit, the cost to find and retrieve relevant information.

The amount of risk in not maintaining a set of records indefinitely (in other words, putting a finite retention period in place) involves determining the costs that might be incurred if the organization decides after destroying the records that it now requires the information and has to recreate it, or if the records have been destroyed in error and are relevant to litigation or investigation, and therefore, should have been maintained.

Another aspect of risk management as a part of records management is the identification and protection of “vital records.” Vital records are those that contain information that is critical to ensuring the continued important operations of a corporation, and protecting its rights and assets, in the event of an emergency or a disaster. Frequently, the vital records are identified as such on the records retention schedule so that the business unit assigned responsibility

can ensure that they are protected and available to respond to the emergency or disaster. The records management function within the corporation works with the business recovery or disaster response function in planning for, and responding to, emergencies.

Records retention schedules must be customized specifically for a corporation. There are no “generic” records retention schedules that can be used as is. Although companies may produce many similar-type records, especially for those functions such as accounting or human resources management that all organizations have, the differences in industries, geographic locations, legal jurisdictions, and especially the corporate culture are all factors in determining how long the individual corporation is prepared to maintain records, or conversely at what point in time they are comfortable with the decision to destroy records deemed obsolete.

Legal Environment and Compliance

The legal environment in which a corporation does business influences all aspects of record keeping within the corporation. Laws and regulations can dictate the types of records an organization creates, the format in which records are kept, what access is permitted, how long the organization is obligated to retain records or how an organization may dispose of their records. Compliance with record keeping requirements helps companies avoid fines and penalties as well as reduces risks and liability during litigation, audits, or government investigations.

Corporations are governed by multiple and various jurisdictions. In the United States, companies are regulated by the states in which they incorporate, the federal government, and, if public, by the SEC. Local or regional jurisdictions may also regulate company actions. Multinational corporations have to abide by the laws and regulations of not only their “home” country but each country or territory in which they conduct business.

Key laws driving corporate compliance include anti-trust and competition laws, insider trading and securities laws, privacy and data protection laws, environmental and occupational health regulations, labor laws, and tax and revenue laws.

In addition, many industries have specific laws regulating their activities. For example, financial institutions are governed by legal controls regulating money laundering (Bank Secrecy Act) and the sharing and use of customer credit information (Fair Credit Reporting Act). Other highly regulated industries include health, energy, food, securities, and telecommunications.

Publicly traded companies follow rules and regulations laid out by the U.S. Securities & Exchange Commission (SEC). In response to the corporate finance and reporting scandals of the 1990s, the U.S. federal government passed the Sarbanes–Oxley Act of 2002 which applies to all publicly traded companies and which is

regulated by the SEC. The purpose of the Sarbanes–Oxley Act is to ensure the boards of directors of publicly held companies take responsibility for both receiving accurate information about the company’s finances and reporting accurately on those finances to the public.^[6] To demonstrate compliance, organizations develop internal guidelines, processes, reports, and other sorts of documentation that require appropriate management, retention and disposition.

U.S. laws cover not only business activities that take place within the country but also business conducted outside of the country. The U.S. Department of Justice oversees the Foreign Corrupt Practices Act (FCPA). The FCPA makes it unlawful to bribe foreign government officials to obtain or retain business. Signed into law in 1977, the FCPA requires publicly traded companies “. . .to maintain records that accurately and fairly represent the company’s transactions. . . . requires these companies to have adequate systems of internal accounting controls.”^[7] Anti-bribery provisions of the FCPA make it unlawful for a U.S. person to make a payment to a foreign official for the purpose of obtaining or retaining business for or with, or directing business to, any person.

Multinational corporations must take into consideration the laws and regulations of each country in which they conduct business. A U.S.-based records retention schedule cannot simply be applied to international offices as other country’s laws may contradict U.S. law. Efforts to apply a single retention period to common business records across countries may result in keeping records longer than necessary or not long enough, both costly to the organization in terms of legal risk and operational efficiencies.

For example, privacy regulations vary across countries and every company doing business that crosses borders must be aware of the regulations and laws pertaining to information privacy. The European Union (EU) has stringent rules governing how corporations can use, retain, and store personal data. The European Directive on Data Privacy of October, 1998, governs both how information is collected and retained within the European community as well as how that information may be transferred from the EU to other countries. Data can be transferred to countries outside of the EU if there is a guarantee of “adequate” protection. The U.S. Department of Commerce, with the European Commission, developed a “safe harbor” framework for U.S. companies to comply with the EU directive. Companies certified to the safe harbor are recognized by EU organizations as providing “adequate” privacy protection, as defined by the Directive.^[8]

How an organization meets its compliance obligations varies and usually multiple parties, including legal, finance, information technology, and records management are involved in corporate governance. Detailed knowledge of the organizations’ records as provided by the RMP plays a key role in corporate compliance programs.

Litigation, legal holds, and discovery

Business conflicts and disputes are part of the cost of doing business for corporations. Regardless of the type of products or services provided, every company is at risk of being involved in a legal action. Antitrust actions, workers compensation claims, breach of contract, product liability, and other claims and lawsuits share in common the importance and necessity of business information as material evidence to prove or disprove their case. Company records may support or be harmful to the company's position. The corporate RMP is a component of the company's larger preventive law strategy.^[9]

The RMP helps to reduce the legal risks facing an organization through the systematic retention and disposition of records. Retaining information that may be needed in defense of potential legal actions protects the organization while disposing of information no longer required by the company can reduce the risks and costs of legal discovery. Doing so systematically, in the normal course of business, protects the organization from accusations of deliberate destruction or arbitrary decision-making. Effective information management practices also protect the corporation during litigation. Well-organized physical, photographic, and digital records facilitate the identification, access, and retrieval of information that may be needed for a legal action.

In the event of, or in anticipation of, litigation, corporations have a duty to preserve relevant information. A legal hold or preservation notice is a common communication method used by corporations to ensure that records are not inadvertently or deliberately destroyed. The duty to preserve supersedes the records retention policies that mandate the destruction of records that have reached the assigned retention period. Depending upon the legal action, the duty to preserve information can be limited to specific records, individuals, and departments, or can cover all records across the entire enterprise. "The duty to preserve includes an obligation to identify, locate, and maintain information that is relevant to specific, predictable, and identifiable litigation."^[10]

RMP procedures describe the process for suspending normal records and information destruction (i.e., enforcing a "legal hold" on the destruction of obsolete records). Because legal holds are an exception to the records retention policy, when the need for the hold no longer exists, the legal hold is lifted. At that time, the corporation can return to "business as usual" in terms of records disposition, and process for destruction any records which have met the assigned retention periods.

Discovery is the fact-finding process that takes place after a lawsuit is filed and before the trial, in order to allow the parties in a case to prepare for settlement or trial.^[11] With the explosion in the amount of electronic information stored, the cost of electronic discovery, or "e-discovery," is significant.

In December 2006, amendments to the U.S. Federal Rules of Civil Procedure (FRCP) went into effect, which have a direct impact on how organizations respond to litigation and discovery requests. The amendments address the growing burden to organizations in terms of time, effort, and cost to respond to e-discovery requests during litigation. The FRCP amendments provide guidance for the handling of electronically stored information (ESI) during litigation. How organizations will address the impact of the guidelines remains to be seen as the risk of litigation and e-discovery is different for every organization.

ACTIVE RECORDS MANAGEMENT

Active records management involves the organization and retrieval of records that are referenced frequently within the organization to support specific business activities. Components include the methods used to organize active records, the documentation and processes supporting the methods, and the selection of appropriate housing or storage for the records. The purpose is to ensure that records are safe, available, and accessible when needed.

A filing system is the primary method used to organize active records. An organization can have both paper-based and computer-based filing systems. Filing system elements include file plans, procedures, and access controls. The file plan outlines the way the records are organized and is often closely linked to the records retention schedule. There are different types of filing arrangements which can be employed by the organization, both simple and complex, all of which are a variation on an alphabetic or numeric arrangement. Classification schemes are used within the file plan to group related materials together. Indexing techniques are employed to provide additional access points to the records. The corporate RMP brings standardization and uniformity to the methods used so that filing systems are consistent across the corporation yet flexible enough to accommodate different types of records, can provide the security and confidentiality required, and are maintained and updated regularly.

The housing of active records is important to the corporation for several reasons. One is to ensure ready access to, and quick retrieval of, the records most needed to conduct daily business. Second is to manage equipment costs and use office space in the most efficient manner available. A third reason is to make sure that vital and confidential records are safe and secure, protecting the organization from loss or unauthorized access.

Corporations select equipment that facilitates retrieval at the most efficient cost. Office space is expensive; minimizing the records equipment footprint is one way to keep costs down. This is done by selecting specialized equipment for the type of physical records being organized, such as using shelving designed to fit tapes rather than shelving for standard file folders.

The format of the record influences where it is housed and how it is accessed. Employing imaging systems to digitize paper records to make the records more readily available to employees is a common corporate practice. Records that are frequently accessed by multiple people across the organization are good candidates for imaging. Records management will play a role in the imaging program to help ensure that the imaging process is documented and meets standards, to determine if or for how long the paper records shall be kept after digitization, the levels of indexing required to aid in retrieval, appropriate security controls, and that retention rules are applied to the digitized records.

Document management systems are deployed to store and help manage digitized and electronic active records. Features such as check in/check out capabilities, version control, and flexible security models, provide greater control over electronic documents than simply housing the documents on a shared drive or an employee's computer drive.

Enterprise content management (ECM) systems provide the organization with the ability to manage all digital content, whether Web sites, images, documents, video files, audio files, photographs, or multimedia in one repository. ECM systems are attractive to corporations because they offer "one stop shopping" to solve a number of requirements for the management of digital content.

Electronic Records Management

The amount of information created and maintained in electronic format increases each year in volume and importance. Records management concepts and methodologies apply to all record formats, but there are special challenges in the management and control of machine readable or electronic records. A component of the overall RMP, electronic records management requires close partnership between the information technology and records management groups to ensure the rules are applied effectively to the data within the systems and applications.

One issue with managing electronic information is the sheer volume of records of which only a small portion may be official business records. Contributing to the volume is the ease with which duplicate information can proliferate. Although duplication occurs with physical (hardcopy) records, the issue is greatly magnified in electronic form. The same electronic record can reside on numerous employee hard drives, in shared drives, in e-mail systems, content and document management systems, stored on optical disk, be backed up to tape or other storage medium, and then be printed and eventually stored. The challenge is in managing all these copies, consistently applying retention, controlling access, and facilitating retrieval.

Just as with physical records, file arrangements, standard naming conventions, metadata, classification, and

taxonomy schemes improve access by providing systematic organization to the electronic information. For large stores of electronic information, the manual application of classification—human beings assigning records to categories—is labor-intensive and not economically feasible for organizations. Organizations may invest in search engines or automated classification tools to facilitate information retrieval.

The electronic record is dependent upon the hardware and software upon which it is created and therefore is vulnerable to factors such as system obsolescence, storage media instability, data migration, and potential data loss. The obsolescence of systems and applications may make long-term retention of electronic records impractical due to costs associated with the continued need to migrate data from one generation of software or system to the next.

Electronic Messaging

Electronic communication is the favored method of communication for corporate employees. The physical interoffice memorandum and carefully crafted letters to and from outside parties are a small percentage of corporate mail.

Electronic mail (e-mail) is an important method of communication and information transfer for corporations. The use of e-mail continues to grow each year. In 2005, the average user produced 75 e-mails per day; in 2008 that figure rose to 156 e-mails per day, according to the Radicati Group, a computer and technology market research firm.^[12] Using the figures provided by the Radicati Group, an organization with 5,000 employees is processing 780,000 e-mails per day. Managing all of this e-mail presents a major challenge to organizations.

Initially, corporations and professional records and information management organizations viewed e-mail messages as casual, transitory means of communication and not as records. Managing e-mail focused on limiting the volume of e-mail message stored due to the high cost of storage and hardware limitations associated with storing e-mails. However, it is now standard practice for corporations to treat any e-mail message as a potential record. As a record, the e-mail message needs to be managed systematically similar to other corporate records, according to business, regulatory and litigation requirements.

Corporations employ a variety of methods to manage e-mail. Methods include the imposition of quotas or mailbox size limitations; automatic deletion of user mailbox contents after a specified period of time; archiving systems that store e-mails declared a record by users; storage systems that store all e-mails created or received by an organization, removing the employee from the decision-making; and personal archives where the employee determines what e-mails should be archived and when, storing the archives on designated drives.

Instant messaging, voice over IP, and unified messaging are other electronic communication methods used by corporations. Unified messaging combines voice mail, faxes, and e-mails into one mailbox. This is attractive to organizations as it allows employees to access voice mail from the e-mail system and e-mail from the telephone. From a records management perspective, it represents more records to be managed and protected.

Electronic communications ultimately are managed depending on the regulatory climate, business needs, and organizational culture of the corporation. For example, financial industries are regulated by the SEC and the National Association of Securities Dealers and therefore may have stricter controls than a nonregulated business.

Electronic Records Management Systems

The technology of records management has evolved from systems supporting the organization and retrieval of paper-based records to focusing on the management of electronic records. The value of electronic records management systems (ERM) is in their ability to manage retention and disposition of physical and electronic records. As discussed earlier, the volume of electronic records makes a manual application of retention schedules much too labor-intensive and time-consuming to be economically viable. Automated means to track electronic records, apply disposition rules, and apply legal holds during litigation are important to the overall management of corporate records.

The electronic records management systems themselves must be accurate and trustworthy. Trustworthiness means that an information system, whether computer- or paper-based, is accountable and can produce reliable and authentic information and records.

According to the Gartner group, records management systems have become key components of content management systems.^[13] The records management software market has consolidated as large technology companies acquired smaller companies with stand-alone records management products. Now, many records management products are integrated into electronic content management systems (ECM) as part of an overall suite of products that may include Web content management, document management, and workflow. This integration can be beneficial to the corporation as they look for strong return on investment when purchasing technology solutions.

Since the late 1990s, the U.S. Department of Defense (DoD) records management standard, *DoD 5015.2-STD Design Criteria for Electronic Records Management Software Applications* (DoD 5015.2), has served as the industry benchmark for records management software standards.^[14] Although developed specifically for software vendors who want to sell their products to federal agencies, it is used by government and private companies alike. Compliance with the standard or obtaining DoD

5015.2 certification is a prerequisite for many companies when selecting records management software products.

The *Model Requirements for Management of Electronic Records* (MoReq) is a European standard for electronic records management systems developed for the European community. It is also used as a benchmarking tool for corporations looking to implement ERM systems.^[15]

INACTIVE RECORDS MANAGEMENT

Inactive records management involves the storage and protection of records that are no longer accessed on a frequent basis but are still necessary to the organization due to legal, audit, or other retention requirements. Ensuring the reliable retrieval of records when needed or to ensure appropriate disposal when obsolete is a key element of inactive records management strategy.

An inactive records storage program can achieve considerable cost savings per year by moving physical records out of expensive office space and into lower cost storage warehouses, achieving economies of space and equipment.

An element of inactive records management is to determine the most effective long-term storage mechanism. Determining whether to convert physical records to a micrographic or digital format for storage purposes will depend on the retention period, level of access expected, and cost-effectiveness. If the costs to store the records to the end of their life cycle are less than the cost to convert the paper to another format, then there is no reason to convert. Paper records that are stored due to space limitations with frequent access may be candidates for digitization. While the cost to store a container of records (usually a cubic-foot box) is low, the costs to retrieve, deliver, and refile boxes increase the overall cost of storage significantly. In this case, it may be cost-effective to digitize the records for access and retrieval purposes. Microfilm is a good technology for records that must be retained for a long time and are infrequently accessed. The small format requires less space than the paper records and so cost savings may be gained.

Organizations may elect to store and manage inactive records themselves or outsource the activities to vendors specializing in records storage (commercial records centers). If the latter, the role of the records management department is to manage the vendor relationship and ensure quality of service to the organization.

Corporations interested in preserving the history of their business may establish a corporate archive to provide evidence and information of their organization's functions, policies, procedures, origins, operations, products, and services. Corporate archives can incorporate documents, photographs, films, publications, and ephemera as well as objects that capture the history and development of

an organization. Preserving the records of company presidents and other policy-making offices can offer valuable insight into the reasons for corporate actions. Records management and archives may be fully integrated or separate functions that work closely together. The business archive complements records management by assuring the preservation of documents of long-term management, legal, fiscal, communications, and marketing value.

VITAL RECORDS

A vital record is any recorded information that is identified as essential for the continuation or survival of the organization if a disaster strikes.^[16] A vital records protection program is a key component of a corporate RMP with the purpose of ensuring the organization identifies and protects those records critical to the organization in the event of disaster. Vital records protection is often integrated into the corporation's overall business continuity or disaster recovery program. This ensures the information critical to the business is identified, protected, and available when disaster strikes.

Determining whether a record is vital is done through an appraisal process, typically as part of the development of the record retention schedule. The cost of protecting the records must always be weighed against the cost of reconstructing them and to other direct monetary losses, such as revenue, assets, and productivity if the records are destroyed prematurely. The point is to protect the information contained in the records rather than the records themselves, although the evidential value of the record is also considered and should be protected if necessary.^[17]

In addition to identifying the vital records, the program determines the method of protection. Disasters can come in many forms and with varying degrees of severity. There are natural hazards such as fire, water, mildew, light, dust, insects, rodents, and acids; human hazards such as theft, loss, unauthorized access; and disasters such as earthquakes, hurricanes, and explosions. Likewise, the methods of protection can vary. An assessment to identify the types of disaster an organization might incur must be considered when determining protection needs.

The vital records program is a form of insurance for the corporation, making certain that the information needed to respond to an emergency is available. It is therefore important that the type of disaster be weighed against the likelihood of these disasters, and the consequences to the organization if they occur. Methods of protection are dependent upon the type of disaster and level of severity. Three accepted methods of protection are

- Duplication and dispersal.
- On-site storage and vaulting.
- Remote storage and vaulting.

Operating procedures cover the use of records in daily activities, in emergencies, and after disasters. A vital records master list provides the organization with a complete list of all vital records, the business group responsible for protecting the records, the method of protection, the importance of the record, and frequency of taking protective measures.

MERGERS, ACQUISITIONS, AND DIVESTITURES

When a corporation decides to merge with or acquire another company, the motivation may be to reduce competition, diversify, or revive a business. Merging companies face enormous challenges as the successful integration of information, technology, equipment, and corporate culture is critical to meeting the business objectives driving the consolidation.

The role of records management in a merger or acquisition is multifaceted. Records management will provide support and assist in the overall integration of information assets, including records and data collections (physical and electronic) and systems. For certain industries, such as healthcare and finance, there are state and federal regulations to be considered regarding the management of information during a merger.

If both entities have established RMPs, then the integration of records management functions requires review and analysis. Issues to consider include whether to change record retention periods (a potentially huge and costly undertaking for large mergers), whether to incorporate the acquired organization's retention schedule or leave separate schedules, whether to integrate records management databases and systems, identifying staffing requirements, services offered, and whether to consolidate inactive records storage.

A third facet involves managing the records created during the merger itself. This includes due diligence records, contracts, and financial records among others. The due diligence phase of an acquisition is when the organization is still determining whether the deal is beneficial to both parties. Due diligence is information-intensive and very dependent upon data, documents and evidentiary records. It is also highly confidential and in many cases the records management group will not be involved until this phase is over and the records are no longer restricted.

When a company sells off a part of the business or a joint venture between organizations ends, there are very similar records management considerations. Instead of dealing with how information assets and systems will be integrated, now the questions involve how to deal with the records of, and related to, the departing organization. The legal obligations and liabilities of the organization will help to determine the proper division or sharing of information assets. The fact that a business unit or business

asset is transferred to a new owner does not exempt the original owner from responsibility nor from the need to retain the records associated with the unit or asset as required by law.

Dissolution of a company does not end its obligations to retain records. Statutes of limitations apply and the corporation can still be exposed to lawsuits. The Corporate Secretary is usually responsible for the books and records including following legal requirements for the retention of information after the dissolution.

Most relevant to the records management discussion is that ownership of the records and recordkeeping responsibilities are clearly defined and documented.

RECORDS MANAGEMENT PLACEMENT WITHIN THE CORPORATION

The records management function provides services across the corporation, supporting all departments, and working closely with other corporate support departments such as audit, finance, information technology, human resources, legal, risk management, security, and tax. Its placement in the corporation varies and depends on many different factors, including size and type of organization, management structure, organizational culture, and regulatory environment. The one constant is that there is no single place in the corporation where records management always lives.

Traditionally, it was common to find records management placed within the administrative services or operations area of the organization. The records management function was considered a “back office” operation and the perception of records managers as clerical staff (file clerks) rather than information professionals persisted for many years. More recently, due to the proliferation of electronic information and increased regulatory environment, the records management function may be placed within the information technology, audit or legal/compliance departments.

The challenge is that regardless of the placement within the corporation, records management is a non-revenue generating function. Records personnel must build collaborative relationships with key corporate support departments as well as direct relationships with the lines of business in order to implement, maintain, and grow the corporate RMP.

STANDARDS

Standards provide a means for which corporations can measure a service or a product against a set of guidelines. There are many standards incorporated into the workplace, several of which relate to records and information management. Not all corporations follow all standards;

rather corporations follow standards that best support their business activities.

The International Standards Organization (ISO), issues standards covering a wide variety of subjects; standards issued by this body carry an authority that comes with obtaining consensus from many countries. ISO 15489:2001 is the international standard on records management.^[18] Praised by the records management profession upon its release, it has the potential to serve as the model for RMP regardless of industries or geographic location. The U.S. National Archives and Records Administration based its approach to records management on the standard. ISO 15489 is a voluntary standard, so compliance is a business decision each organization makes depending upon their needs. This makes it difficult to measure the impact of the standard on corporate RMP.

The ISO 9000 Quality Assurance series of standards cover quality management systems in the manufacturing and service industries. Being compliant with the standards is important for certain industries—certification is required in order to do business in Europe for the manufacturers of telecommunications equipment and medical equipment. Other corporations may use the standards as a benchmarking tool without going through the accreditation process, which can be costly. Although not a “records management” standard per se, there are many records requirements in the standards. The activities that comprise the field of records management form the foundation for successful compliance with the records requirements of the standards.^[19]

RECORDS MANAGEMENT AUDIT

By law, publicly traded corporations must submit to external audits for verification that their financial records and statements are accurate and the company has fairly reported its financial condition. Corporations also conduct internal audits, carried out by employees of the corporation, to evaluate financial and operational controls over processes, records, and systems. The internal audit group usually reports back to a corporate audit committee or governance board with authority to enforce change. Information audits can be conducted against the RMP or be used to gauge employee and organizational compliance with the RMP.

Audits may be conducted by an internal audit group or outside consultants. Regardless, the audit should be an independent and objective review of the RMP with clearly defined standards so that the purpose, scope and measures of success are agreed to by all parties. Factors such as company size, geographic location(s), and workloads may impact the scope of the audit, dictating whether the audit covers the entire organization, focuses on a single business unit, or covers only a sample of records created since the last audit.

The RMP audit may be used to measure how well the records management function is serving the corporation; assess whether the corporation is in compliance with the RMP policies, procedures and processes; or identify gaps and areas of improvement with the organization and the RMP. It may be used as a method of benchmarking the RMP so that future reviews of the program are measured against the initial audit. The audit findings can serve as a roadmap for the RMP and provide a link back to the overall strategic goals of the corporation.

CONCLUSION

The purpose of a corporate RMP is to support the overall goals and objectives of the corporation. The program achieves this by bringing recordkeeping efficiencies into the organization, controlling costs associated with recordkeeping, and ensuring that information is readily available to support business functions. While the specifics of a program vary depending on a number of factors discussed in this entry, a comprehensive RMP includes the core elements of record retention, compliance, active records management, inactive records management, and vital records management.

By retaining only those records required for legal, regulatory, and business need, the company can reduce storage costs, improve access and retrieval, and reduce time and effort to reconstruct information in the event of disaster. Compliance with the laws and regulations governing records helps companies avoid fines and penalties as well as reduces risks and liability during litigation and audits.

Although records management practices were initially developed to better manage records within the U.S. federal government, businesses long ago recognized the value of these practices and began adapting them to the corporate environment.^[20] Corporate records management practices continue to evolve to better support the corporation by adopting appropriate technologies, by monitoring and responding to new and changing legal and regulatory requirements, and by evaluating the impact of these changes on information management.

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Credibility and Cognitive Authority of Information

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Abstract

This entry defines the concepts of information credibility and cognitive authority, introduces the key terms and dimensions of each, and discusses major theoretical frameworks tested and proposed in library and information science (LIS) and related fields. It also lays out the fundamental notions of credibility and cognitive authority in historical contexts to trace the evolution of the understanding and enhancement of the two concepts. This entry contends that the assessment of information credibility and cognitive authority is a ubiquitous human activity given that people constantly make decisions and selections based on values of information in a variety of information seeking and use contexts. It further contends that information credibility and cognitive authority assessment can be seen as an ongoing and iterative process rather than a discrete information evaluation event. The judgments made in assessment processes are highly subjective given their dependence on individuals' accumulated beliefs, existing knowledge, and prior experiences. The conclusion of this entry suggests the need for more research by emphasizing the contributions that credibility and cognitive authority research can make to the field of LIS.

INTRODUCTION

This entry traces the evolution of the concepts of credibility and cognitive authority in library and information science (LIS) and other related fields including communication, human-computer interaction, and psychology. It provides definitions for information credibility and cognitive authority. It also introduces multiple dimensions as well as theoretical frameworks explaining the process of assessing credibility and cognitive authority, concluding by discussing the significance of the two concepts and calling for further research in the area.

Historically, credibility and cognitive authority of information were considered as criteria for making relevance judgments in LIS. Due to the recent growth of the Internet and concomitant evolution of information, communication, and publishing mechanisms, LIS researchers and practitioners have increasingly recognized the importance of understanding credibility and cognitive authority as a research agenda in its own right. Today people have access to a wider range of information resources than ever before, and as a result, face greater challenges in evaluating the usefulness of information with which they interact. Given the popularity of various self-published resources in which the source of information is vague and uncertain, the assessment of information credibility and cognitive authority has become a ubiquitous human activity.

In this entry, credibility and cognitive authority are considered as closely related yet different concepts. Most definitions of credibility revolve around the concept of believability of information.^[1] This entry uses the term *cognitive authority*, coined by Patrick Wilson to differentiate it from administrative authority.^[2] Unlike a person in

administrative authority, the world's leading authority in a domain area has no power to command. Experts perceived as not only credible or worthy of belief but also influential in other people's thinking are termed cognitive authorities. Those people or information sources considered to be credible serve as the potential pool of cognitive authorities. That is, cognitive authority is one of the principal aspects of information credibility.

CREDIBILITY DEFINITIONS AND ORIGINS

Definitions

Credibility is an intuitive and complex concept.^[3] Rather than having one clear definition, credibility has been defined along with dozens of other related concepts such as believability, trustworthiness, fairness, accuracy, trustfulness, factuality, completeness, precision, freedom from bias, objectivity, depth, and informativeness. Most credibility researchers agree that credibility assessment results from simultaneously evaluating multiple dimensions. Among these, two key dimensions are identified: trustworthiness and expertise.^[4] Trustworthiness is a core dimension in credibility assessment that captures the perceived goodness and morality of the source.^[5] The perception that a source is fair, unbiased, and truthful contributes to the trustworthiness of information. Trustworthiness is, however, not a synonym for credibility because people also must recognize expertise in order to deem information credible. Expertise reflects perceived knowledge, skill, and experience of the source.^[5] Expertise is likewise an important factor given its close relationship to people's

perceptions of a source's ability to provide information that is both accurate and valid.

Trustworthiness and expertise are not always perceived together. An expert with the title of doctor or professor might have a reputation of being knowledgeable in a certain area but still might not be considered trustworthy for the tendency to unreliability or bias. A person may think of a friend as being honest and trustworthy in general, but the advice that the friend gives is not necessarily considered credible for the friend's lack of expertise. The most credible information is found in those perceived to have high levels of trustworthiness and expertise.

Credibility does not reside in an information object, source, or person, although the characteristics of the foregoing can serve as the bases for people's assessment. It is people who ultimately make judgments of information credibility. People who have their own experience, knowledge, and beliefs are likely to make their own credibility judgments. Many studies show, in fact, that judgments of credibility are highly subjective assessment processes. In this entry, credibility is defined as people's assessment of whether information is trustworthy based on their own expertise and knowledge.

Historical Development

The fields of communication and LIS are both concerned with the credibility assessment of information and sources. Credibility research, however, has evolved in fundamentally different ways, with each field having its own origins, approaches, and goals for the study of credibility over the past five decades. Some researchers believe that scholarly interest in credibility dates back to Aristotle's examination of *ethos* (appeal based on character), *pathos* (appeal based on emotion), and *logos* (appeal based on logic or reason).^[6] Aristotle's notion of credibility focused mainly on the characteristics of *ethos*, which is "the communicator's ability to inspire confidence and belief in what was being said" (pp. 422–423).^[3]

Scholarly examination of credibility began in the twentieth century when psychologists investigated persuasion as a part of the propaganda efforts during the World Wars. A series of landmark studies were conducted by the Yale Group which defined credibility as a receiver-based construct and suggested that credibility is determined by an audience's acceptance of a speaker.^[4] In the 1950s, mass media professionals took an interest in the notion of credibility when television became popular and subscription rates for newspapers began to decline. Professional news organizations' examination of perceived credibility of newspapers versus television then grew into the study of *media credibility* which to this day remains an established research area in the field of communication.

Credibility research began much more recently in LIS as compared to the communication field. This does not mean that LIS researchers and practitioners had no concerns

about credibility assessment in the past. Rather, LIS research into human judgments of information centered on the notion of relevance. Relevance is often seen as playing a significant, underlying, and yet elusive role for various information activities such as acquiring, organizing, storing, preserving, searching, communicating, interacting with, and using information.^[7] The history of relevance started with the first libraries as library users were concerned about the problem of finding information *relevant* to them.^[7] However, the notion of relevance remained hidden and implicit until Vickery's presentations at the 1958 International Conference on Scientific Information.^[8] Since then, relevance has been studied extensively in terms of frameworks for defining relevance dimensions, forms of document representation affecting relevance judgment, subjectivity of relevance judgment, and identification of criteria adopted by users in judging relevance.

While the majority of relevance research has discussed relevance in terms of its topical aspect, which concerns itself with whether or not the topic of a search query matches the topic of a document, alternative notions have been suggested. For instance, utility, which is entirely subjective and based on personal judgment, is proposed as a measure of information retrieval effectiveness.^[9] Relevance and utility are not the same concepts. Until the 1980s, relevance was viewed as judgments concerned with aboutness, pertinence, or topical-relatedness. Utility was considered a broad concept involving not only topic-relatedness but also quality, novelty, importance, credibility, and other evaluations. In the 1990s, a substantial body of empirical studies on relevance criteria was conducted, producing studies which consistently revealed that people use much more diverse criteria than mere topicality in making relevance judgments. The criteria identified in these user-centered relevance studies include credibility, authority, completeness, depth, currency, accuracy, quality, effectiveness, belief, and clarity.^[10]

In LIS, as in other related fields, the emergence and proliferation of information technology, the Internet in particular, provided the impetus for improved and more formal understanding of the notion of credibility. Empirical studies showed that people became more concerned about quality, credibility, and authority of information as they gain awareness of the fact that the Web lacks quality control mechanisms in contrast to traditional information retrieval systems.^[11] Further, when looking for information, people rely on multiple information resources and may even seek to verify across different resources given the availability and accessibility of various types of digital media and forms of information.^[12] The two fields—LIS and communication—that have studied credibility from different perspectives and presumptions because of historical origins have drawn closer together than ever before as both fields have paid more attention to the significance of studying credibility and authority assessment in the contemporary digital information landscape.

TPOLOGY OF CREDIBILITY

Communication researchers have traditionally drawn distinctions between source credibility, message credibility, and media credibility. *Source credibility* usually refers to “judgments made by a perceiver concerning the believability of a communicator” (pp. 130–131).^[13] Numerous empirical studies have investigated the dimensions of source credibility from the perspectives of message recipients and identified those factors that might influence audience perceptions of trustworthiness and expertise. These factors include dynamism, composure, sociability, qualification, reliability, animation, poise, and good-naturedness.^[14] A meta-analysis of 114 credibility studies revealed that source expertise is a stronger influence on persuasion than other source characteristics given that the expertise dimension of source credibility is more objective than other dimensions and consequently easier to assess.^[15]

Message credibility examines how message characteristics such as content, structure, language, and presentation can impact perceptions of the believability of information. But the distinction between message credibility and source credibility is not always clear. Credible sources are likely to produce credible messages, and credible messages are likely to be seen as originating from credible sources. When people have strong interest and involvement, message characteristics become more influential than source characteristics because they are motivated to scrutinize message content. In some situations in which little information is available about the source of a message, people tend to turn to message cues in making credibility judgments.^[16] Researchers have examined the influence of various factors such as message comprehensibility, number of arguments, incentives, fear appeals, one-sided versus two-sided messages, repetition, and presentation style on people’s message credibility assessments.^[14]

Media credibility focuses on the relative credibility of various media channels through which a message is sent. Media credibility studies typically ask which medium people would believe if they received conflicting reports on the same news story from different media such as radio, television, magazines, and newspapers.^[17] This question aimed to discover people’s perceptions of the relative credibility of different news media. Previous studies suggest that media credibility is strongly related to the frequency with which people use a particular medium. In them, people judge their preferred medium as being the most credible.

In recent years, media credibility studies have attempted to compare people’s perceptions of traditionally-delivered information sources (newspapers, magazines, brochures, etc.) and their online counterparts (online newspapers, online news magazines, online political Web sites, etc.). The popularity and unique characteristics of the Web as a medium led to studying *Web credibility* as a distinct notion. Credibility researchers

have proceeded to note the following characteristics of the Web: lack of filtering mechanisms, form inclusive of interaction techniques and interface attributes, source ambiguity, and infancy as a medium.^[18]

Computer credibility impacts the field of human-computer interaction (HCI) when computers act as knowledge repositories, instruct users, report measures, report on work performance, report on their own state, run simulations, and help in the rendering of virtual environments. Computer credibility assessment relies on simultaneous evaluation of four types of credibility: presumed credibility, reputed credibility, surface credibility, and experienced credibility.^[11] *Presumed credibility* refers to the extent to which people believe information because of general assumptions in their mind. Sometimes people make assumptions based on stereotypes rather than on truth, and these assumptions and stereotypes all contribute to credibility perceptions. *Reputed credibility* describes the extent to which people believe information because of what third parties—other people, media, or institutions—have reported. These reports may come in the form of endorsements, awards, or referrals. *Surface credibility* derives from simple inspection. People make credibility judgments based on first impressions of surface traits such as of book covers, the visual designs of software, interface designs, and the information architecture of Web sites. *Experienced credibility* refers to the extent to which people believe information based on their first-hand experience. It may prove to be the most powerful form of credibility because it derives from people’s interaction with others or with systems over an extended period of time.

Some credibility researchers who consider the processes of social endorsement to be crucial in credibility construction have proposed several variants of credibility including conferred credibility, tabulated credibility, and emergent credibility.^[6] *Conferred credibility* indicates that people sometimes recognize credibility not based on a real source of information but on other sources’ positive reputation, all of which helps alleviate skepticism. For instance, Google might confer its credibility on sponsored links in the search results page because most people are unaware of the sponsorship model and consider such links equivalent to Google’s results. *Tabulated credibility* refers to the assessments people make based on peer ratings of an individual, organization, or product. The availability of aggregated ratings from other people may widen the range of social input on which people can rely in judging credibility. *Emergent credibility* arises from a pool of resources, such as Wikipedia, wikis, social networking sites, and other applications created by individuals. These forms of credibility suggest that people are not isolated evaluators of credibility as well as that social engagements and interactions must be considered in understanding credibility construction and assessment.

AUTHORITY

Authority has been defined and discussed in many different forms across numerous disciplines, including philosophy, education, psychology, political science, law, religion, and LIS. Authority is related to those areas of competence or applicability over which it is exercised. Having authority is different from being an expert because authority is a relationship involving at least two people. A person can be an expert even though others may not realize or recognize the fact. No individual by himself or herself can be an authority. All authority is “a relation among a bearer, a subject, a field, in virtue of a particular quality, attribute, and context” ^[19], p. 77]. In other words, authority is limited to spheres. A person can speak with authority within one sphere, but with no authority on questions outside that sphere.

Many researchers agree on the two broad categories of authority: epistemic authority and deontic authority. The former corresponds to being an authority and the latter to being in authority.^[19] As an example of epistemic authority, when people say, “He is an authority on Hegel,” they mean that he is superior to others within a field in light of knowledge about Hegel. Deontic authority takes the forms of imperial authority as exercised by a state through its government and its various organs, paternalistic authority as exercised by parents over their children, and operative authority as vested in any designated leader or office. In place of epistemic authority and deontic authority, cognitive authority and administrative authority can be used as alternative terms in distinguishing more clearly these two different types of authority.^[2]

COGNITIVE AUTHORITY

Definitions

Cognitive authority is a kind of influence.^[2] Those who are cognitive authorities profoundly influence others’ thoughts. People who are not cognitive authorities may still exert an influence in the world. What distinguishes people who are cognitive authorities from those who are not is that the formers’ influence is recognized in some official manner. Cognitive authority is a matter of degree; thus the weight that a cognitive authority’s words carry for others might vary. Even though it is possible for an absolute cognitive authority in a given sphere to have an answer to virtually all of the questions within the area, people in general tend to take the opinions and advice of others with different degrees of seriousness. Cognitive authorities are those people whose opinions and advice are taken more seriously with more weight being placed on their words than on the words of others.^[2]

Two bases for cognitive authority need to be recognized: being an expert and being reputable.^[2] To qualify

as an expert, a person should show evidence of knowledge, skill, experience, training, and education. Because knowledge and skill are difficult to test directly, evidence in terms of occupational roles or advanced degrees often must provide support for claims to expert status. However, not all experts necessarily possess outstanding competence. Experience and education may provide evidence of basic qualifications but still be insufficient in providing a high degree of expertise. To be an outstanding expert, a person must have a reputation for that expertise. In addition, established cognitive authorities can transfer authority to other people. When reputation among peers is unknown, special groups of people already considered to be knowledgeable can be turned to. For instance, individual A believes individual B because individual A believes group C, and group C says that individual B can be believed. This rule—that one can trust those who are trusted by those one trusts^[2]—constitutes a central feature of cognitive authority.

Bases for Assessing Cognitive Authority

When people acquire influence from cognitive authorities, there should be an answer for the question “What makes you think so?” Whatever the reasons for thinking that certain others deserve cognitive authority, it is not for the reason that people always directly test the authorities’ knowledge. Rather, people often cite indirect tests that serve as the bases of cognitive authority judgments. Not only individuals are recognized as cognitive authorities: books, journals, newspapers, manuscripts, and films are all possible sources of knowledge and opinion though they give rise to the same kind of questions about cognitive authority: which works can be taken seriously?; how much weight can be given to what the texts say? When people have sufficient knowledge of certain topics, they can claim directly against what they already know. However, most texts discuss topics people do not know enough about to apply the direct test. This is because people look for information and consult texts to find what they do not know.^[20] Therefore, people apply various indirect tests for recognizing the cognitive authority of a text, including personal authority, institutional authority, textual type authority, and intrinsic plausibility.^[2]

The first apparent basis for recognizing a text’s cognitive authority is the cognitive authority of its author. People will trust a text written by an individual or group of individuals whom they trust. The tests of personal cognitive authority are based on present reputation and accomplishments. Recognition of personal authority does not automatically transfer to past or future work. An established reputation is insufficient to establish the current authority of old texts.

Another kind of test is associated with the publisher and publication history. A publishing house can acquire a kind of cognitive authority if it is considered to be good at

publishing high-quality work. Thus, publications by a publishing house people respect constitute a kind of personal recommendation. A journal can exert authority, too, which transfers to the articles it publishes. Other institutional endorsements are also used as tests of authority. For instance, sponsorship by a learned society or a professional organization serve as the basis of institutional authority, as could publication by a government agency. Then again, published reviews furnish a special indirect test. If a reviewer has cognitive authority then his or her review itself constitutes a personal recommendation.

The third kind of test, that of text type, is based on the text itself separate from its author or publisher. For instance, reference works such as dictionaries and encyclopedias do not draw attention to their compilers as people often do not know who the authors or editors are. Standard reference works tend to be revised frequently and may be considered as institutions in their own right.

Finally, the test of intrinsic plausibility is always available. Reading a few words or sentences of the text may be sufficient for people to decide whether or not to continue reading the entire text. Such rapid assessment is not entirely based on intrinsic plausibility, but does constitute a major part. If people find that a work represents a school of thought they reject or has a style of research they think worthless, they become discouraged from continuing to read the work. Although people do not always reject what they see as being in conflict with their prior beliefs and cognitive positions, they cannot avoid assessing the text's contents as plausible or implausible and accordingly bestowing or withholding cognitive authority.

THE PROCESS OF ASSESSING CREDIBILITY AND COGNITIVE AUTHORITY

Several theoretical frameworks suggest that the assessment of credibility and cognitive authority needs to be understood as a process rather than a discrete evaluative event. Most of these frameworks and models are developed in the context of Internet use and Web searching. Rieh's Model of Judgment of Information Quality and Cognitive Authority was proposed based on an empirical study conducted in the context of Web searching.^[11] Her model captures the point at which people make predictive judgments about which Web site contains credible information and then follows through to include evaluative judgments by which they express preferences for information encountered. When people open a Web browser, they take the first action based on a predictive judgment that must be made before a new page is introduced. The selection of a certain Web site is based on people's knowledge and experience, recommendations from others, or other characteristics of information objects or sources. Once people open a new Web page, they make an evaluative judgment in terms of how good the information is, how useful the information is, how

trustworthy the information is, how accurate the information is, and so on. The reasons underlying such judgments are based on certain characteristics of information objects and sources. If people find that evaluative judgments of the information do not match the expectations of the earlier predictive judgments, they might return to a previous page or decide to start with a new page. By iterating the process, people can reach a point at which their predictive judgments and evaluative judgments match and they will proceed to use that information.^[21]

Wathen and Burkell's model of credibility assessment, developed by synthesizing the literature in the field, also proposes that the assessment of credibility of online information is iterative.^[22] Upon entering a Web site on the first level of evaluation, people rate the credibility of the medium in question based on surface characteristics such as appearance, interface design, download speed, interactivity, and organization of information. Once the site passes people's credibility criteria in the initial evaluation, they then move to the next level of evaluation. Should the site fail the first evaluation, people are likely to leave the site to seek others. On the second level of evaluation, people consider the credibility of the source and the message, evaluating source expertise, competence, trustworthiness, and credentials. The message is evaluated in terms of content, relevance, currency, accuracy, and tailoring. On the third level of the evaluative process, the interaction of message presentation and content can be assessed with respect to people's cognitive states. Wathen and Burkell point out that, given the limitless number of possible interactions among contextual and intervening variables, credibility assessment becomes quite complex and difficult to predict.

Fogg's Prominence-Interpretation Theory grew out of a series of research projects conducted at the Stanford Web Credibility Research Lab.^[23] Fogg's theory describes the credibility assessment process from the point at which people notice something of interest in a Web site to the point at which they make their judgment. This theory states that two events need to occur for people to make credibility assessments on the Web: they notice element(s) in a Web site (prominence), and make judgments about what has been noticed (interpretation). If people do not notice the element, it would not have any impact on their credibility assessment of the site. Fogg's theory proposed five factors affecting prominence: involvement (motivation and ability to scrutinize Web site content), topic of the Web site, task of the user, experience of the user, and individual differences in users. Interpretation, the theory's second component, involves people's judgments about a Web site element in terms of being good or bad. Various factors relate to interpretation, including assumptions (culture, past experiences, heuristics, etc.), skills/knowledge (level of competency in the site's subject matter), and context (environment, expectations, situational norms, etc.). This process of prominence and interpretation can occur more than once because new aspects of the site can

be continually noted and interpreted in the process of making credibility assessments on the Web.

A number of credibility researchers have observed that people do not always engage fully in the cognitive effort of making analytical judgments of content messages and sources. Rather, people often rely on mental shortcuts to judgmental rules (or heuristics), which have evolved as generalizations in their knowledge base and have thus been refined through the course of their experience.^[24] People are often unaware of the role of heuristics in influencing their judgments, which can result in their accepting a message as credible without first attributing the specific reasons for their acceptance. Cues that trigger heuristics can either be embedded in a message or internally located within people's cognition.^[25]

Sundar's research team at the Media Effects Research Laboratory at Pennsylvania State University identified four broad affordances in digital media capable of cueing cognitive heuristics pertinent to making credibility assessments: modality (M), agency (A), interactivity (I), and navigability (N).^[26] The modality affordance, which often appears in the multimedia in digital devices, is the most structural (that is, tied to structure rather than to content) and apparent on an interface and accordingly triggers heuristics related to realism, novelty, and coolness, among factors. The agency affordance relates to identification of the source. Depending on who or what is perceived as a source, cognitive heuristics are triggered and in turn affect the information's perceived credibility. The interactivity affordance of digital media provides cues related to interaction, activity, choice, control, and responsiveness. Finally, the navigability affordance has dual abilities: hyperlinks on a Web site may trigger heuristics given that easily navigable sites have perceived credibility, and words on the hyperlink trigger different heuristics more closely related to the nature of the content. These four affordances are all structural features that help explain the perceived credibility of digital media beyond content characteristics. The affordances are associated with first impressions of surface-level characteristics of Web sites, which are capable of amplifying or diminishing content effects on credibility. The core idea of Sundar's model is that, while cues and heuristics do not guarantee success, they likely appeal to many individuals striving to cope with the deluge of information.

Hilligoss and Rieh's credibility framework also considers heuristics as an important component of credibility assessment.^[27] The results of an empirical study about people's credibility assessment in a variety of everyday life information-seeking contexts identified three distinct levels of credibility judgments: construct, heuristics, and interaction. The construct level involves defining the notion of credibility that influences people's judgments. The heuristics level pertains to general rules of thumb for credibility assessment, applicable to a variety of general information seeking situations. The interaction level refers to credibility judgments in which particular sources or

content cues are characterized. These three levels of credibility assessment are interlinked; for instance, people's constructions of credibility influence the kind of heuristics used in selecting a Web site in which people begin a search. Credibility heuristics can influence the ways in which people pay attention to certain characteristics of information and sources. As people gain more experience with a certain source of information, credibility heuristics can be changed or extended. Should a heuristic prove consistent over time, then it becomes a construct of credibility in people's minds. Their model additionally demonstrates that context is a factor importantly influencing all three levels of credibility assessment. The context is the social, relational, and dynamic frames surrounding people's information-seeking processes, creating boundaries around the information-seeking activity or the credibility judgment itself. The context of credibility judgments can either guide the selection of resources or limit judgment applicability.

CONCLUSION

This entry intends to raise awareness about notions of information credibility and cognitive authority in the field of LIS as well as to encourage additional research work in this area. The entry defines two concepts, introduces key terms and dimensions, and discusses major theories and models proposed and tested in LIS and related fields. It also lays out the foundations of credibility and cognitive authority in historical contexts in order to illustrate the importance of understanding and enhancing these concepts as foci of research and practice.

Assessment of credibility and cognitive authority is a ubiquitous human activity, given that people constantly make decisions and selections based on the value of information in a variety of school, work, and everyday life contexts. Further, credibility and cognitive authority assessment can be seen as an ongoing and iterative process rather than a discrete evaluation event. The judgments made in assessment processes are highly dependent upon people's accumulated beliefs, existing knowledge, and prior experiences. While information objects, sources, and media often provide clues and bases for assessment, it is eventually people who make assessment with respect to their information seeking goals and motivations.

Credibility and cognitive authority have long been significant concepts for both researchers and practitioners in LIS and communication fields. Theoretical developments and applications are still emerging and evolving given changing information and communication technology environments. Previous credibility research has looked at people as information consumers while holding rather narrow views of information activities, for example, by focusing on seeking, reading, receiving, and watching. Today, more people are engaging in a broad range of information

activities, such as creating and mediating content while actively utilizing new and diverse information technology tools and applications. Further empirical studies need to be conducted to investigate new kinds of research problems that reflect dynamic and complex information seeking and use contexts. Additional broad and multidisciplinary theoretical frameworks need to be constructed to represent a variety of human information behaviors beyond information seeking and retrieving. Creative and insightful inquiries from researchers and practitioners into credibility and cognitive authority in the LIS field would lead to efficient systems and programs that will eventually help people become more effective information users.

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Croatia: Libraries, Archives, and Museums

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Abstract

This entry provides a short historical overview of the oldest writing systems, manuscripts, and books in Croatia. It describes the emergence of the first libraries, archives, and museums from the ninth to the twentieth centuries followed by a description of the present-day situation in the information professions, including legislation regulating the field, the most important libraries, archives and museums, professional associations, professional education, and continuing professional training. The conclusion discusses examples of present-day cooperation between information institutions.

INTRODUCTION

The Republic of Croatia is located in the south-east of Europe. It shares borders with Slovenia to the west, Hungary to the north, and Serbia, Bosnia, and Herzegovina and Montenegro to the east and south-east. The Adriatic Sea forms its southern border with Italy (see Fig. 1). Croatia covers an area of 56,538 km² and has a population of 4,491,543 (July 2008 est.).

According to its geographical position Croatia is a southeastern and Mediterranean country. Its location has had a significant impact on its historical development. From the ninth to the end of the eleventh century it was an independent principedom and kingdom. In 1102 it formed a union with Hungary. Starting in 1527, rulers from the House of Habsburg also became kings of Croatia. As the result of Turkish invasions in the fifteenth century, its geographic holdings were diminished both in the south and in the west. From 1409 until 1797, the coastal area along the Adriatic Sea fell under the administration of the Republic of Venice. Dubrovnik enjoyed a special status, first as an independent commune, and as the Republic of Ragusa from the fifteenth century onward. Despite attempts to unify Croatian lands after the fall of the Republic of Venice in 1797, Northern Croatia still remained in a state union with Hungary, while Dalmatia became a province to the Emperor of Austria, except for the short period between 1806 and 1814, when along with Istria it fell under the French administration, first as part of the Kingdom of Italy and after 1809 as part of the Provinces of Illyria. A stronger movement toward unification arose in the 1830s during the national revival movement. In 1918, Croatian lands were partly unified when Croatia entered the union of the Kingdom of Serbs, Croats, and

Slovenes (as of 1929 the Kingdom of Yugoslavia), and were finally fully unified only after World War II when Istria joined in as part of the Federal People's Republic of Yugoslavia (FPRY). Following the dissolution of Yugoslavia in 1991, Croatia became an independent internationally recognized state in 1992.

LITERACY, BOOKS, AND LIBRARIES

Historical Overview

The political division of Croatian lands determined their affiliation to different cultures. The coastal part of Croatia was under the strong influence of the Mediterranean cultural heritage, while northern Croatia was characterized by central European culture. Croats arrived to their present homeland as illiterate in the seventh century. In the ninth century they converted to Christianity and first wrote in the Latin language and in the Latin script. This language and script appears both on stone monuments and in the correspondence between princes, kings, and bishops with popes and other rulers of that time.^[1] From the eleventh century in the southwestern regions of Croatia two other indigenous scripts were used along with Latin: the Glagolitic alphabet and the Croatian Cyrillic alphabet (bosančica). These were used to record texts in the Old Slavic and the national Croatian languages. The oldest preserved Glagolitic texts written on stone monuments date from the eleventh century. One of the most famous is the Valun Tablet named after the place on the island of Cres where it was found, containing bilingual inscriptions in Croatian and Latin. The Croatian text is written in Glagolitic script and the Latin in Carolingian script. The



Fig. 1 Map of Croatia.

Source: *CIA World Factbook*. <http://www.cia.gov/library/publications/the-world-factbook/geos/hr.html>.

Baška Tablet dating from 1100 also carries great significance for Croatian cultural history. It is a stone monument inscribed in the Glagolitic script which was discovered in Baška on the island of Krk and in it, a Croatian name is mentioned for the very first time. From the river Una in the north to Boka Kotorska in the south, the Croatian Cyrillic alphabet was used, a variant of the Cyrillic alphabet originating from tenth century Bulgaria. The parallel use of the Glagolitic and Cyrillic alphabets is evidenced by stone epigraphs dating from the twelfth century and Glagolitic manuscripts in which dates, names of authors and transcribers, prayers and similar addenda which scribes or the owners of the manuscripts entered in the Cyrillic alphabet are found.^[2]

Numerous legal and private documents were written in Glagolitic such as laws, town statutes, minutes of town councils, monastery rules and registers, and liturgical books such as the richly illustrated Missal of Prince Novak from 1368 and the Missal of Hrvoje Vukčić Hrvatinčić dating from the beginning of the fifteenth century. Many handwritten books in the Glagolitic were translations or adaptations of Italian and French works (theological manuals, sermons, etc.). Translated from Czech and adapted to Croatian language was the famous *Lucidarius*, a type of medieval encyclopaedia in which all the knowledge of the time was gathered.^[3]

Croatian incunabula were also printed in Glagolitic. The first Croatian printed book is the Missal from 1483. Since the place of printing is not indicated in the colophon, it is supposed that the Missal was printed in Venice

even though some experts attempted to prove that it was created in a domestic printing house of which no direct information has been preserved. The first known printing house in Croatia was established in Senj at the end of the fifteenth century. It is known that at least seven books were printed there in Glagolitic in the period from 1494 to 1508. The Glagolitic script was used for recording the Croatian language until the sixteenth century when the Latin script prevailed, yet in some parts of the country Glagolitic remained in the liturgy until the beginning of the twentieth century.

Literacy, education, book production, and the establishment of libraries were closely connected to monasteries with scriptoria and libraries founded by members of individual church orders from the ninth century onward. Benedictine monks came to Croatia at the invitation of the Prince Trpimir. Their monasteries were the most important cultural centers from the ninth to the thirteenth centuries. Beautifully illustrated medieval manuscripts were created in Benedictine scriptoria, such as the *Evangelium Vekenegae* dating to approximately 1075 (today kept in the Bodleian Library in Oxford) and the *Evangelium Traguriense* from the first half of the thirteenth century (today kept in the treasury of the Trogir Cathedral). Monastery library collections were modest—at the end of the eleventh century they had between 10 and 50 codices. These codices were purchased or acquired as donations from distinguished and wealthy individuals.^[4]

In the thirteenth century new monastic orders arrived in the country. The first Franciscan monasteries were established in the first half of the thirteenth century in Zagreb, Varaždin, Zadar, Šibenik, and Dubrovnik. In the thirteenth and fourteenth centuries Dominican monasteries became important centers of culture. Books and schools were especially important to the Dominicans as a means of fighting against heresy and educating young members of their order. Schools were organized in several Dominican monasteries, and in 1553 in Zadar the Dominicans founded “general studies.” Laymen and members of the order alike were awarded the baccalaureate after completion of the program.

In addition to monastery libraries, diocese libraries also existed in the Middle Ages. The diocese library in Split is considered to be the oldest library in Croatia. In the Middle Ages there was also a scriptorium along with the library. Some of the manuscripts from the oldest period of the library have been preserved to this day in the treasury of the Split Cathedral of which the most famous is the Greek–Latin *Evangelium* known under the name *Evangelium Spalatense*. Historically it was believed that this manuscript originated in the seventh or eighth century, probably from the scriptorium of the diocese, but recent paleographic analysis confirms that it dates from the fifth or sixth century.^[5] The inventories of the Zagreb Diocese Metropolitan Library founded at the end of the eleventh century have been preserved through to the

present, and confirm that the library was well managed. The oldest inventory dates from 1394 and contained several codices from the eleventh century. In the preserved inventories of a later date, books were organized according to a systematic order. Care of the library was usually entrusted to a member of the monastery or chapter community. The Episcopal provision from 1348 established that funds gathered from monetary fines collected in disputes between priests were to be used for renewing library materials.^[6]

The private libraries of writers and scholars of the fifteenth and sixteenth centuries were largely created in Split, Dubrovnik, Zadar, and Hvar—the literary centers of the time. The manuscript catalog of the library of the humanist and poet Marko Marulić (1450–1524), which he himself assembled, has been preserved. The catalog contains 148 volumes of religious works, works of humanists and classical writers.^[7]

In the seventeenth century Jesuits arrived in Croatia and founded ecclesiastical schools (gymnasias) in larger towns: Dubrovnik, Rijeka, Varaždin, Požega, and Zagreb. According to the rules of the order each school had to also have a library. From the library of the Zagreb Jesuit Collegium, founded in 1607, the future Library of the University of Zagreb would develop, known today as the National and University Library. Besides religious orders, noblemen and scholars also possessed libraries. After the execution of the Croatian poet and nobleman Nikola Šubić Zrinski (1620–1664), his library, containing works of classical and contemporary authors, was taken to Austria, but was repurchased in 1892 for the University Library in Zagreb. The systematic catalog of that library dating from 1662 has been preserved.^[8] Partially preserved is the library of the poet, scholar, and librarian of the seminary library in Split, Jerolim Kavanjin (1643–1714).^[9] One of the richest and most valuable private libraries is the library of the Garanjin-Fanfogna family in Trogir, founded at the end of the eighteenth century, which besides manuscripts and books also contains family and other archival records some of which date from as far back as the twelfth century. The first manuscript catalog of the library was composed in 1796.^[10]

At the end of the eighteenth and beginning of the nineteenth century, so-called reading rooms appeared in various towns. These were establishments primarily intended not only for entertainment, dances, and social gatherings, but also reading. Often they were called casinos. So from 1775 in Šibenik there was the Società del Casino, and from 1806 a casino in Rijeka. The first reading room which actually contained the word “reading” in its name was the Gabinetto di lettura, or Druxba od scenja, founded in Zadar in 1807.^[11] Those reading rooms, as well as numerous others newly established in various towns and villages during the period of the National Revival (1835–1849), were called Illyrian. After the ban of the name Illyrian in 1843, they were called public

reading rooms, and were focal points for the spread of ideas of revival. The National Revival strived toward the unification of South Slavs and thought to accomplish that goal by developing a common popular language as a strong tool for raising national awareness. The leader of the movement was Ljudevit Gaj (1809–1872), the reformer of the Croatian orthography (1830), and publisher of *Novine Hrvatske* (Croatian Newspapers) (1835). Public reading rooms appeared to be political organizations participating in the fight for language, national identity, and freedom. Yet the majority of them also had a library which, at least partly, performed some of the present-day library functions. Public reading rooms operated until 1849 when their work was banned.^[12]

Twentieth Century Library Development

Public libraries in today’s sense of the word were established only at the beginning of the twentieth century, when the idea of the need for popular education appeared. Students of the Zagreb University played an important role in transmitting that idea and encouraged the opening of libraries. In 1903, as part of the Croatian Writers Society, the main administration for the establishment of public libraries was founded. In 1906 the Croatian Society for Popular Education in Zagreb, founded for the purpose of performing tasks of establishing, supporting, and monitoring public libraries, joined in those efforts. Because there was still no special legislation which would ensure the continuous financing of libraries, and thus enable them to operate unhindered, libraries were established through donations gathered from individuals. Consequently, they often occupied modest spaces, in community houses, parish houses, town halls, schools, houses or even inns, without anyone looking after them on a regular basis. For that reason they were often short-term efforts and quickly disappeared.^[13]

The situation was similar in libraries in the Kingdom of Yugoslavia. In 1937 Josip Badalić (1888–1985), the librarian of the University Library in Zagreb, wrote the following:

In the field of our public education, public librarianship [in Yugoslavia] seems to have the role of Cinderella. This is entirely true not only in the case of public librarianship, but unfortunately also in the case of state librarianship and all the way to the highest positioned university librarianship. The main reason for this is the inexistence of legislation in the field of our national librarianship. . .^[14]

Despite efforts to promote public library development, the first Library Act would not be passed until 1960.

In World War II many libraries were destroyed. Especially devastating was the loss of the library of the Gymnasium in Zadar, destroyed by bombarding in 1943, because that library used to receive legal deposits from

Dalmatia. Many libraries were also destroyed in the 1991–1995 war. Data confirms that around 200 libraries of all types, including those containing valuable heritage material, were damaged or destroyed.^[15]

Legislation

The current Library Act was adopted in 1997 and amended in 2000. The Act established within the Ministry of Culture an expert advisory body known as the Croatian Library Council. The council is charged with issuing recommendations on all important matters in the field of librarianship. The Library Act also regulates the establishment and maintenance of libraries, the organization and functioning of the library system, the delivery of legal deposits, and the conservation of book heritage.

A special chapter of the Library Act regulates the operation of the National and University Library as the center of the Croatian library system. In addition the Act prescribes that each municipality in the country must establish a public library, or contract a library in another municipality, to perform library services for its citizens. The general operation of libraries is financed by local authorities, but the Ministry of Culture assists in acquiring material, and in securing and equipping adequate library facilities. Libraries must meet the standards stipulating minimum requirements for library operation. Besides standards there are also ordinances which provide detailed descriptions of individual methods and procedures which libraries have a duty to perform.

National and University Library

The National and University Library in Zagreb (Fig. 2) is the largest library in the country, and at the same time performs the function of the national library and the central library of the University of Zagreb. This library was established in 1607 as the library of the Jesuit Gymnasium (Collegium), later the Academy. After the dissolution of the Jesuit order in 1776, it became the library of the Academy of Science (the School of Law, Philosophy and Theology). It enriched its collection primarily through donations. One of the most significant was the personal library of Adam Baltazar Krčelić, a clergyman and historian from Zagreb, who in 1777 left in his last will and testament 757 volumes of books and 50 manuscripts, under the conditions that they be open to the public, which was realized only in 1818. When the University of Zagreb was founded in 1874, it became the University Library.

In the beginning of the nineteenth century, the university library had already begun to perform the function of the national library. In 1837 it acquired the right to legal deposits from northern Croatia. In 1856 it received a permanent donation for the acquisition of books. First located in the building of the university, it moved to a building specially constructed for that purpose in 1913 which it shared with the State Archives. In 1919 it acquired the right to legal deposits from the whole territory of Yugoslavia. In 1943 it was administratively separated from the University and changed its official name to the Croatian National and University Library. After World War II it



Fig. 2 The National and University Library in Zagreb. Photograph: Damir Fabijanić.

was once again named the University Library, although it also performs the function of a national library. By virtue of a federal regulation in 1947, it became the central library of the Republic of Croatia, and after 1945 it again received legal deposits from the whole territory of Yugoslavia. Pursuant to the Library Act from 1960, it changed its name to the National and University Library and began performing the task of coordinating the acquisition of foreign literature for libraries in the country, providing expert assistance to other libraries and creating union catalogs.

In 1995 the library moved in a new building covering an area of 45,000 m². Besides its general collection containing 2.5 million volumes, it also has special collections: a collection of manuscripts and old books, a collection of prints (founded in 1919), a collection of geographical maps and atlases (founded in 1945), and a collection of music and audio materials (founded in 1943). It has 1100 seats for reading and approximately 18,000 users benefit from its services each year. It receives legal deposits, develops and organizes the national collection, develops the national current and retrospective bibliography, and cares for the protection of book heritage. In cooperation with the University Computing Centre SRCE, it harvests national digital publications which it deposits in the Digital Archives of Croatian Web Publications. It also includes the Librarianship Institute whose task is to develop the Croatian library system and librarianship in general. In the year 2001, it initiated a project under the name Digitised Heritage. So far 555 items of various formats (books, music sheets, drawings, graphics, and maps) have been digitized and may be accessed via the Web site of the Library (<http://www.nsk.hr>).

Academic, Research, and Special Libraries

Until the 1970s the University of Zagreb was the only university in Croatia. Today, with its 50,000 students, it is the largest. It was only in 1973 that the University in Rijeka was founded, followed in 1974 by the University in Split and in 1975 the University in Osijek. The newest universities were established in Zadar (2002), Dubrovnik (2003), and Pula (2006).

The universities were for the most part decentralized and consisted of several faculties and schools of higher education in different locations. These circumstances contributed to the emergence of numerous faculty, departmental, seminary, and other libraries at certain faculties; some of them having a very long tradition. The library of the Zagreb Faculty of Law was established back in 1906, the library at the Faculty of Engineering in 1926, at the Faculty of Economics in 1920, and at the Faculty of Veterinary Medicine in 1922. At the Faculty of Philosophy, the largest constituent part of the University of Zagreb, the oldest library is that of the Slavic seminary founded in 1906. The oldest medical library is the library of the School of Public Health and the Institute of Public Health

in Zagreb, established in 1927. That library served the students and professors of the Medical School as the only expert medical library until the Central Medical Library was established in 1947.

In the second half of the twentieth century academic libraries faced many problems: the lack of funds for acquisition of foreign titles (especially journals), inadequate and sparsely equipped facilities, the absence of union catalogs, lack of or informal cooperation between libraries, and the lack of understanding of the need and importance of libraries on the part of the administration. The collection of the National and University Library was mostly oriented toward humanities and could not meet the needs of the university community. In the 1960s a university professor of chemistry, Božo Težak (1907–1980), used the International Permanent Exhibition of Publications ISIP, an exhibiting institution founded in 1951, and developed the Referral Centre of the University as a center for dissemination of scientific and technical information.

At that time the number of special libraries belonging to companies, factories, industrial centers, and scientific institutes also grew. In the 1970s there was a tendency to transform special libraries into information documentation centers that could provide scientific information to assist in the development of the economy. At the level of the Yugoslavian state the System of Scientific and Technical Information project was initiated with the purpose of enabling libraries to provide relevant information. As part of the project, technical equipping of libraries also began. In the 1980s first the National and University Library was automated and gradually other libraries followed suit.

In 1991 the Ministry of Science and Technology initiated CARNet (Croatian Academic and Research Network), first as a project, and as of 1995, as an institution whose purpose is to assist institutions in the field of science and higher education, in adopting and applying information and communication technologies and disseminating knowledge. Today CARNet gathers 238 university institutions and scientific institutes in 37 Croatian cities. In 1994 the Ministry initiated a project intended for academic libraries, called Scientific Information System, whose purpose was to enable access to information sources to users of academic libraries. As part of that project, academic libraries were equipped with computers and connected to the Internet, and training for librarians was organized.

Public and School Libraries

Between 1945 and 1990 numerous public libraries were opened. In 1950 the first children's library with a reading room was opened as a department of the City Library in Zagreb. There, for the first time, open access to collections was introduced. In 1963 the first record collection in the country was opened in that library. In the 1970s the first network of public libraries was established in Zagreb.

Only a few new purpose built facilities were constructed for libraries, for example the City Library in Karlovac got its own building in 1976. It was only after the 1990s that a more significant number of existing buildings and facilities were adapted for city libraries such as the city libraries in Zadar (1999), Šibenik (2005), and Virovitica (2007). Today there are 256 libraries operating.^[16] The majority of public libraries are connected to the Internet and have their own Web pages.

Primary and secondary schools are obligated to establish libraries by law. The adoption of the Library Act in 1997, requiring school librarians to acquire professional qualifications, constituted a significant step toward professionalizing librarianship. There are 1347 libraries of primary and secondary schools in Croatia which are members of CARNet and have Internet access (<http://www.carnet.hr>).

Church Libraries

Monasteries, parishes, and churches possess very valuable collections of heritage material, of which very little is known because many of them are not organized. Consequently, they are not available to the public. The Regulation of the Croatian Conference of Bishops on church libraries from 2000 prescribes that older and more valuable books are to be deposited in the central diocese library or religious province library, which should facilitate the cataloging of heritage material and its final inclusion in the national registry of cultural heritage.

Professional Associations

The Croatian Library Association was founded in 1940 by a small group of librarians from the University Library in Zagreb. Today the association is organized as an umbrella organization of 16 regional library associations with a total of 1400 members. The goals of the Association are described in the Statute adopted in 2002 and include publication of professional literature, organization of conferences and other forms of continuing professional training, proposal of relevant legislation, representation of interests of library service users, promotion of literacy, and care for cultural and book heritage (<http://www.hkdrustvo.hr/hr/statut/>).

The Association is the most important publisher of library science literature in the country. Between 1966, when it published its first title, and 2006, the Association published 95 titles. It is also the publisher of the oldest professional journal *Vjesnik bibliotekara Hrvatske* (1950–). As of 1999, it organizes Days of Special Libraries, an annual meeting of librarians of special and academic libraries. Beginning in 2001 it has organized the annual Round Table on Free Access to Information; these sessions are primarily intended for public librarians. Together with 17 NGOs, the Association participated in

the drafting of the Act on the Right to Information Access, which was adopted in 2003. The association has awarded the Kukuljević Charter, the highest professional acknowledgment, since 1968 and the Eva Verona Award for the best young librarian since 1998.

Library and Information Science Education

Until the 1960s there was no formal schooling available for librarians and professional knowledge was acquired by passing a librarianship examination. Regulations issued in 1928 required that librarians of the University Library must pass the librarianship examination. In 1931 the same requirements were extended to include all librarians in state libraries.^[17] The acquisition of professional knowledge through taking professional examinations would continue, even after the introduction of university librarianship studies. The examinations were no longer required after the Library Act of 1997.

The first university program for librarians started in 1961 as postgraduate studies in librarianship, documentation, and information sciences under the Faculty of Science. As of 1970 the studies were connected directly to the University of Zagreb. The opening of that study program significantly contributed to professionalizing librarianship and helped create a core group of formally educated librarians for all types of libraries but with an emphasis on university libraries. The program finally closed down at the beginning of the 1990s. In 1977 a graduate program in library studies was opened at the Faculty of Philosophy in Zagreb. At first this was a 2-year supplementary study program, but from 1986 onward it was constituted as a 4-year program in Information Science for librarians, archivists, and museology experts. Beginning in 1998 library science could be studied at the University of Osijek, and as of 2003 also at the University of Zadar. Postgraduate studies in information sciences for archivists, librarians, museology experts, and IT experts were started in 1994 at the Faculty of Philosophy in Zagreb. Following the Bologna educational reform the program was revised in 2005, and is now held as a 3-year doctoral study program.

In 2002 the National and University Library, the Libraries of the City of Zagreb, the Department of Information Sciences of the Faculty of Philosophy in Zagreb, and the Croatian Library Association founded the Centre for Continuing Training of Librarians. Annually it organizes an average of 60 one-day courses for more than 1000 librarians (<http://www.nsk.hr/CSSU/>).

ARCHIVES

Historical Overview

The tradition of keeping documents, both in monasteries' and municipal archives, is most pronounced in the



Fig. 3 The chest of privileges of the Kingdom of Croatia, Dalmatia, and Slavonia (*Privilegia regni*) 1643.

coastal region of Croatia (Dubrovnik, Dalmatia, and Istria). The statutes of coastal communes provide numerous stipulations on keeping documents. The Split Statute, from 1312, obligates the municipality of Split to keep records about documents, indicating their quantity and the year of origin; it also specifies the location where they are to be kept and the criteria for access. In northern Croatia, an old tradition of keeping archival records is evident in the chapters which, as “*loca credibilia*”, played a role equal to public notaries in the coastal region. Even though *Archivum Regni* was mentioned in documents as early as in the sixteenth century, it was not until 1643 that the Croatian Parliament passed a stipulation on making a chest (*Cista—Archivum privilegiorum Regni*) for keeping the most important state documents (Fig. 3).

Besides the Kingdom Archives, every county and every free royal town had their own archives where this material was kept. In the times of the Empress Maria Theresa, a reform of archives management was undertaken, and the archival material was processed and the first lists of material compiled. Nikola Škrlec (1729–1799), a royal protonotary, played an important role in these activities. In the first half of the nineteenth century, in the times of the National Revival, the most important cultural institutions were established including the National Museum (1846) and the State Archives (1849).^[18]

A modern archive service was established after 1945: it establishes practices for the care for current records, the creation of a network of archives and drafting modern legislation on archives. Bernard Stulli (1915–1985), director of the Central State Archives, initiated the making of modern information retrieval tools, started a project on keeping records of material located outside the archive, and supported systematic education of archivists, thus playing a particularly important role in the modernization of archive service.

Legislation

Archive services are regulated by the 1997 Act on Archival Material and Archives and amendments to this Act from the year 2000. The Act covers public and private archival material, and records located in records governmental departments before being forwarded to archives. Public archival material is imprescriptible. The Act stipulates the obligations of the creator and the records owner in regard to the process of appraisal, transfer to archives, and the use of archival material. Since all archival material is a part of cultural heritage, the Act stipulates the obligations of all creators and also regulates the circulation of archival material of private origin. Besides legal acts, subordinate legislation, i.e., ordinances, also regulate particular procedures, e.g., the use of archival material, keeping registers in archives, etc.^[19]

The archive service consists of the network of state archives and the statutory possibility of establishing specialized (university, party, church, etc.), city and municipal archives. It falls under the purview of the Department of Archival Activities, Directorate for the Protection of Cultural Heritage, in the Ministry of Culture. Advisory and professional tasks are performed by the Croatian Archival Council as an advisory body to the Minister of Culture. There are 12,680 archival fonds and collections, kept in 14 state archives and 11 collecting centers. In addition, there are 187 other institutions (libraries, museums, religious communities, institutes) where archival material is kept.^[20]

Croatian State Archives

The *Croatian State Archives* originates from the *Archivum Regni*, which dates from 1643. After 1849 it is known by the name of the Royal Regional Archives, acting as an auxiliary office of the Royal Government of Croatia, Slavonia, and Dalmatia. Then in 1870 the Parliament adopted the Legal Article on the Organisation of the State Archives and the Instruction on the use of documents of the State Archives; these two measures established the status of the archive, regulated the use of documents, and stipulated the concentration of archival collections in one location. In 1923 it separated from the state administration, and in 1945 it officially became the Central State Archives. Following the independence of the Republic of Croatia, it became the *Croatian State Archives* (<http://www.arhiv.hr>).

The Croatian State Archives includes

- The Department for Protection and Processing of the Archival Records.
- The Croatian Film Archives.
- The Department for Information and Communication.
- The Central Laboratory for Photography, Micrography and Reprography.

- The Laboratory for Conservation and Restoration.
- The Deposit of the Archbishopric of Zagreb.

The Croatian State Archives keep archival material that originated from the region of northern Croatia (Banska Croatia or the Kingdom of Croatia, Dalmatia, and Slavonia) in the period prior to 1918, and the material resulting from the work of regional and central state bodies of Croatia, covering the period after 1918. Due to specific historical circumstances, material for some parts of Croatia, which is also of importance for the entire county, is kept in the State Archives in Zadar, the State Archives in Rijeka and the State Archives in Dubrovnik.

The *State Archives in Zadar*, dating to the thirteenth century, holds the records of the Municipality of Zadar. In the course of the nineteenth century this archive collected also material from the municipal archives of Dalmatia. The Zadar Archives also keeps material important for the history of the Republic of Venice and for the history of Dalmatia as an Austrian crown province in the period from 1797 until 1918, as well as the material of the Napoleon Administration in the period from 1806 until 1814.^[21]

The *State Archives in Dubrovnik* (<http://www.dad.hr>) contains material originating from the activities of the Dubrovnik municipality since the thirteenth century, and material of the Republic of Ragusa from the beginning of the fifteenth century to the dissolution of the Republic in 1808. The Archives in Dubrovnik has a wider significance for the historical study of the Balkans and the Mediterranean, from the fourteenth century until the fall of the Republic of Ragusa in 1808.^[22]

The *State Archives in Rijeka* (<http://www.riarhiv.hr>) and *in Pazin* (<http://dapa.hr>) contain material for the wider area of Istria and the Croatian Primorje, starting from the Middle Ages with particular strength in materials from the nineteenth and first decades of the twentieth century.^[23]

Other State Archives in Croatia have been established in Bjelovar, Gospić, Karlovac, Križevci, Štrigova, Osijek, Sisak, Slavonski Brod, Split, Šibenik, Varaždin, Vukovar, and Zagreb with the task of collecting and keeping local archival material.

Digital records are received by the archives only rarely. The Croatian State Archives systematically digitizes material of particular archive holdings and collections. Registers of births, marriages, and deaths are digitized, and so is the Croatian Glagolitic heritage located in Croatia and abroad; the collection of cartography and the Cadastre are currently being digitized as well. In 2007 the National Archival Information System (ARHiNET), a Web-based system for description and management of archives was introduced. Digital archival records, digital images of archives, and finding aids have been made available online (<http://arhinet.arhiv.hr>). The system has also been used by the members of the government and public administration, as well as by other

organizations, for providing records schedules to archival institutions.

National Film Archives

The Croatian National Film Archives (*Hrvatska kinoteka*) was established pursuant to the *Cinematography Act* of 1976, operating within the Croatian State Archives since 1979. The film collection includes preserved films produced by Croatian cinematography in the period from 1904 until 2009, and foreign films distributed in Croatia in the period from 1895 until 2009. In addition to films, the Archives also keeps scripts, film photographs, posters, books and magazines, clippings, and video and audio recordings. The Film Archives has a total of 9296 titles of Croatian and foreign films.^[24]

Specialized Archives

The *Croatian Academy of Sciences and Arts Archives* keeps the Glagolitic and Cyrillic manuscripts, a collection of Oriental manuscripts and the manuscript heritage of writers, playwrights, and musicians, as well as archival fonds and collections significant to the history of theatre.^[25] *Religious communities* have rich archival material in episcopal, chapter and monastery archives. Some church archives are located in the state archives deposit (as for example, the Archives of the Zagreb Arch/Bishopric and the Archives of the Zadar Archbishopric).^[26] *Archives of political parties* for the period prior to the Croatian independence (1991) are kept in state archives. After the period of socialism, political parties establish and maintain their own archives.

Publishing and Professional Associations

Archival periodical *Vjestnik Kraljevskog Zemaljskoga arkiva* has been published since 1898, and since 1953 under the name of *Arhivski vjesnik*. Archival journals are published also in Rijeka, Pazin, Osijek, and Split. The first textbooks on archivistics were published after 1945, while foreign professional literature used in education of archivists has been systematically translated since 1991. Professional education of archivists was introduced in the second half of the twentieth century, when persons employed in the archives were first required to pass professional examination. Archivists could enroll in a postgraduate university program in Zadar (1971–1975), or at the University of Zagreb (1961–1992), where a program for graduate students was also established in 1986.

The Croatian Archivist Association was founded in 1954, with the aim to stimulate and promote education and professional training, organize professional and scientific conferences, issue professional publications, and establish professional standards.^[27]

MUSEUMS

History

Prior to the establishment of the first public museum in 1820, collections were established by patricians, intellectuals, and clergy. These were collections of curiosities, encyclopedic museums, or collections of natural history specimens or man-made objects, armory, paintings, treasury, sculptures, etc.^[28] The Archaeological Museum in Split which was established in 1820 moved the following year to the first purpose built museum in Croatia. In the course of the nineteenth century, the general Central-European movement for preservation and promotion of national cultural heritage national museums had a strong influence in Croatia, and the cities Zadar, Osijek, Dubrovnik, and Zagreb established museums open to the public. The efforts of many learned and other societies led to a series of initiatives aimed at founding regional and municipal museums specializing mainly in history, natural science, and art. By the end of the century, fine arts museums (galleries) and museums of arts and crafts were established, and at the beginning of the twentieth century ethnographic museums were opened.^[29]

Many specialized museums were founded in the first half of the twentieth century; examples include a museum of the history of education and pedagogy, museums and collections of medical and agricultural studies, as well as museums devoted to important persons.^[30]

In the second half of the twentieth century, an effort was made to enlarge the museum network by establishing many regional, local and town museums, enacting new legislation, setting up professional associations, and expanding museums' exhibiting and publishing activities. The growth of specialized museums/permanent exhibitions devoted to the World War II and the Partisan movement was evident. In the 1970s the Museum of Medieval Croatian Culture in Split and the Museum of the Ecclesiastical Art in Zadar were opened as the tangible national investments in culture.

Following the war (1991–1995), the museums and their holdings had to be restored.^[31] Great efforts were made to erect new museum buildings, to reorganize museum management and curatorship, to modernize and improve permanent exhibits, to strengthen international exhibiting program, and to implement IC technology.

Legislation and Organization

Museum activity is governed by the Museum Act (1998) and by several ordinances.^[32] As cultural assets, museum holdings and documentation are covered under those ordinances which address the protection of cultural assets. The ordinances provide guidelines on museum documentation, access to museum collections and records, the

maintenance of the museum register, requirements for joining the museum network, professional and technical standards, and the qualifications required for museum staff. The Museum Network was created on the principle of professional competence and flexibility. As a result, it has established unique standards and norms and supported partnerships between museums and other local regional and national heritage and cultural institutions with the aim of pursuing joint projects. The Network also strengthens intermuseum cooperation by encouraging the exchange of services and activities. It is based on two main criteria: the type of a museum and the level of regional responsibility.^[33]

Information and documentation concerning Croatian museums is collected by the Museum Documentation Centre (MDC) established in 1955. The MDC (<http://www.mdc.hr>) is the central information, documentation, and communication point for the Croatian museum network; it keeps the Register of museums, galleries, and collections. The Register is a record of "musealized heritage" and contains information about all museum institutions in Croatia, regardless of their legal or administrative status. In 2006, according to the Register, there were 219 museums with 1428 collections and 617 documentation holdings,^[34] and about 6 million objects; in addition, about 130 church collections and a large number of private collections throughout the country.

General museums are classified as national or regional, local, and town (municipal). The number of national museums is small, and the predominance of national archaeological museums is evident with one third of all museums are archaeological museums. The best known are the Museum of Croatian Archaeological Monuments and the Archaeological Museum in Split, and archaeological museums in Zadar, Pula, Naron, and Osijek. The state makes efforts to support various types of museums, such as a sports museum, a museum of ecclesiastical art, the Croatian history museum, the Croatian naïve art museum, the Old Village in Kumrovec (the birth-place of Josip Broz Tito). Technical (science) and natural history museums are funded by local authorities such as the City of Zagreb.

The famous fine arts museums are the Strossmayer Gallery of Old Masters (Italian Renaissance and Baroque paintings, along with the works of German, Dutch, Flemish, and French artists), the Mimara Museum encompassing three millennia of arts and crafts from various cultures and civilizations, and the Ivan Meštrović Foundation in Split, Zagreb, and Otavice housed in the Meštrović family houses and studios containing sculptures, drawings, and the sculptor's personal archive. The national gallery of art, known as the Modern Gallery in Zagreb, contains works of nineteenth and twentieth centuries' artists.

New museum buildings in Croatia include the Museum of Contemporary Art, the Museum of Evolution and the

Site of Pre-historic Man "Hušnjakovo", and the Archaeological Museum on the Narona Site. Other buildings and sites have been modernized, such as the Science and Technology Site of Nikola Tesla and the Memorial Site in Jasenovac. The computerization of the Croatian museum network started in 2004.^[35] The locally produced *M++ system* has been used by all museums and up to the beginning of 2009 around 1,000,000 museum objects have been recorded and processed. For the time being they are accessible at the local site, but the network will be implemented in the near future. Today 60% of Croatian museums have their own Web site, and a great number of CD-ROMs promoting their holdings were produced. Museum Web site addresses are available at <http://www.mdc.hr>.

Publishing, Staff, and Professional Association

Museum publishing of catalogs, guides, annual reports, monographs, journals and books, and professional journals is an important way of communicating museum knowledge to a wide range of audiences in Croatia. These include *Muzeologija* (1953–) and *Informatica Museologica* (1970–), and *Vijesti muzealaca i konzervatora* (1952–). The total number of museum professional staff is 907. The structure of museum employees is extremely traditional; there is a great lack of PR and marketing experts, and ICT experts. Museum professional associations are organized at the regional and national levels. The national association is the Croatian Museum Association.

CONCLUSION

Apart from the university education organized as a common study program for all three professions, there are also other examples of professional cooperation. Since 1997 the archival, librarianship, and museology professions organize regular AKM annual seminars (Archives, Libraries, Museums) whose goal is to develop cooperation among professions and exchange expertise.

In 2006 the National Programme for the Digitisation of Archival, Library and Museum Records was developed and adopted. This program provides for the development of a referral center or service for assistance. It also monitors digitization projects and supports the creation of a Web reference portal with information and data on digitization projects in progress.

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CrossRef Publisher Linking Network

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Abstract

CrossRef, the cross-publisher linking network and platform for other collaborative technologies and its services will be outlined in this entry. The impact it has had to date on various segments of the information industry and how it has progressed from a small DOI Registration Agency to a robust platform for publisher collaboration with tens of millions DOIs deposited in its system. CrossRef developments and new services will also be discussed, as will placing CrossRef as part of a larger trend in resource discovery toward virtual integration of distributed resources.

INTRODUCTION

This entry provides an overview of CrossRef, a cross-publisher linking network and platform for other collaborative technologies. It discusses CrossRef's mission and history, as well as how the system works, and the impact it has had to date on various segments of the information industry. A final section looks at recent CrossRef developments. The entry concludes by situating CrossRef as part of a larger trend in resource discovery toward virtual integration of distributed resources.

CROSSREF'S MISSION

CrossRef is a nonprofit membership association, founded and directed by publishers. Its mission is to enable easy identification and use of trustworthy electronic content by promoting the cooperative development and application of a sustainable infrastructure for online content. CrossRef operates a cross-publisher citation linking system, and is an official Digital Object Identifier (DOI) registration agency, appointed by the International DOI Foundation (or IDF).^[1] A look at the history of CrossRef helps explain these core functions of the organization.

CROSSREF'S HISTORY

CrossRef was incorporated in January of 2000 as a cooperative venture among 12 of the world's leading scholarly publishers, both commercial and not-for-profit, with a mandate to provide cross-publisher reference linking throughout the online journal literature. The founding members were Academic Press, the American Association for the Advancement of Science (publisher of *Science*), the American Institute of Physics, the Association for Computing Machinery, Blackwell Science, Elsevier

Science, the Institute of Electrical and Electronics Engineers, Kluwer Academic Publishers, Nature Publishing Group, Oxford University Press, Springer-Verlag, and John Wiley & Sons. Start-up funds for CrossRef were provided as loans from eight of the original publishers, all of which were paid off in full in 2007.

When the CrossRef service went live in June of 2000, it supported reference links in roughly 1100 journals from a member base of 33 publishers, using a beta system called the "DOI-X prototype."^[2] CrossRef became an official DOI registration agency in September 2000 and was the first such agency, authorized by the IDF to allocate DOI prefixes and register DOIs. To date, CrossRef is the most robust implementation of the DOI model.

Although CrossRef got underway with a specific focus on linking electronic journal articles in the scientific, technical, and medical (STM) arena, it has since branched out to cover DOI-based linking of all authoritative scholarly and professional literature online, regardless of genre or discipline, with a broader mission of improving resource discovery through collective initiatives.

The Importance of Cross-Publisher Linking

Among the visitors to the Frankfurt Book Fair in October of 1999 who witnessed a demonstration of the DOI-X project were several representatives from STM publishing. Recognizing that a DOI-based lookup system for citations could enable a cross-publisher article-level linking system for serials, they took the unprecedented step of joining together in an independent association.

Linking at the article-level benefits both scholars and publishers. References are how authors make explicit the links between their work and previously published scholarship. Making a citation immediately actionable, so that it links to the cited document in a matter of a click or two, is a powerful enhancement to efficiency and functionality in online research, but not if it is bounded by digital

collections defined by publisher. From the researcher perspective, neither the publisher's identity, nor even that of the journal in many instances, is considered a significant identifying feature of the published work, as opposed to who wrote it and when.

Hence, automated linking is mainly useful from a research perspective if it works across publications, across publishers, and is truly comprehensive. The usefulness of the system is directly proportional to the robustness of its coverage, and CrossRef paves the way for a truly robust, comprehensive network of connected publications.

Citation linking of this kind also offers advantages to serials publishers, because it drives readers to their publications and their Web sites. By allowing readers to connect to their content from outside resources and locations, they not only serve their subscribed user-base better, but at the same time they create opportunities for article- or chapter-based sales, whether through document delivery services, hosting intermediaries, or their own pay-per-view mechanisms.

CROSSREF TODAY

Let us look at how far the CrossRef initiative has progressed. As of October 2008, the network includes 619 publishers, 21,212 journals, and over 33 million DOIs, including 3 million DOIs for non-journal content such as books and conference proceedings, at varying levels of granularity. The CrossRef system is adding about 14,000 new DOIs every day. Many of these DOIs point to backfile, historical content, as publishers digitize archival material; roughly 400,000 CrossRef DOIs point to seventeenth, eighteenth, and nineteenth century publications. Another source for the steep growth is the addition of new content types. Publishers who have been registering journal content for some time now register DOIs for other resources, and new members who may not publish journals at all are joining to register books, proceedings, datasets, dissertations, grey literature, standards, and other scholarly materials.

The state of the CrossRef endeavor can also be measured by its impact on the research experience. Researchers are currently using the system at a rate of about 19 million DOI clicks per month. Roughly 5 million DOIs per month are retrieved from the system, which gives some indication of the number of DOI-based links being created. In addition to the 619 publishers who participate as members, there are roughly 3500 other participating organizations, including libraries, database publishers, full-text aggregators, software vendors, and journal hosting/linking platforms. These "affiliates" access the CrossRef database of DOIs and metadata on a regular basis to facilitate linking through their own products.

THE DOI^[3]

The DOI syntax is a National Information Standard Organization (NISO) standard.^[4] A DOI is an alphanumeric name for a digital content entity, such as a book, journal article, chapter, image, etc. The DOI is paired with the object's electronic address, or URL, in a central directory that can be readily updated, and is published in place of the URL to prevent links from breaking, while allowing the content to move as needed. The CrossRef system makes updating the URL in the central DOI directory very easy. Since CrossRef publishers have been updating their records reliably so far, reports of nonworking DOIs are rare, even with millions of DOIs being resolved each month.

Let us take a closer look at a DOI, in Fig. 1. The DOI is made up of two components, a prefix and a suffix, separated by a forward slash. The prefix is assigned to the content owner by a DOI registration agency like CrossRef. All DOI prefixes begin with "10" (to distinguish the DOI from other implementations of the Handle System®),^[5] followed by a four-digit string. The prefix in this example is "10.1006." The suffix has a very flexible syntax and is composed by the publisher according to their internal content management needs, with the main restriction being that the suffix must be unique within a prefix.

Once a DOI is assigned to a digital entity, it continues to identify that entity regardless of ownership. While publishers assign DOIs using their own prefix(es), control of individual DOIs can be readily transferred. For example, if ownership of a journal passes from Publisher X to Publisher Y, control over the DOIs for articles in that journal will be given to Publisher Y, who can then update the metadata and URLs for those DOIs. Publisher X will continue to assign DOIs using their existing prefix. Therefore, the prefix of a DOI does not reliably identify the publisher. At the same time, because the DOI never changes in these cases, it means that all the links to that content that have already been published still function. Hence, one key insight of the DOI system is persistence; the other is "actionability." Like the URL itself, one click on a properly implemented DOI gets the user to the location of the content they want.

The DOI remains unique and persistent throughout changes in ownership and location of the content, but it need not be transparently meaningful or descriptive. Rather, descriptive information belongs in the metadata

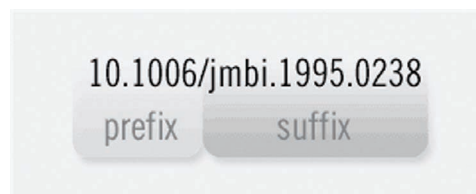


Fig. 1 Sample DOI, illustrating prefix and suffix.

associated with each DOI when it is registered in the CrossRef system. Actionable, persistent identifiers like the DOI add value to publications because they enable new functionality and work reliably in the Web environment. The identifier strings themselves can be opaque if they are associated with descriptive metadata in the registration process, and, in any event, mainly being interpreted and processed by computers. At the same time, registering an identifier along with descriptive metadata lays the groundwork for constructing other automated services around the content being identified.

HOW CROSSREF WORKS

Publishers use automated (i.e., batch) processes to deposit metadata records into the CrossRef metadata database (MDDb). Each deposited record must include minimal bibliographic information, a DOI, and a current URL. The descriptive metadata includes journal title, ISSN, first author, year, volume, issue, and page number. Depositing metadata with CrossRef involves creating an XML file formatted according to a schema. A sample CrossRef metadata record with both journal-level and article-level metadata and identifiers is shown in Fig. 2.

When publishers deposit records, they automatically enable others to link to their content, because other publishers, librarians, and intermediaries can then retrieve from CrossRef the DOIs that link to that content. After a metadata record is deposited, CrossRef registers each DOI-URL pair in the central DOI directory, an implementation of the Handle System. Thus, when a user clicks on the DOI, it is resolved through the Handle System and not the CrossRef system.

In a separate process, the publisher submits the citations contained in each registered work as queries to the MDDb in order to retrieve any matching DOIs. This way, the publisher can, as part of its electronic production process, add outbound hyperlinks to any of an article's citations that point to entities already registered in the CrossRef system. CrossRef can also accept DOIs as input and return metadata as output. Fig. 3 provides an overview of the workflow for reference linking.

Non-XML interfaces for depositing and querying are now also available. A manual Web deposit form allows publishers to type in requested metadata on a record-by-record basis, and a simple text query form allows publishers and other users to cut and paste groups of references in order to retrieve matching DOIs. These services have helped make the CrossRef system readily accessible

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Fig. 2 Abbreviated example of journal-level and article-level metadata record in CrossRef.

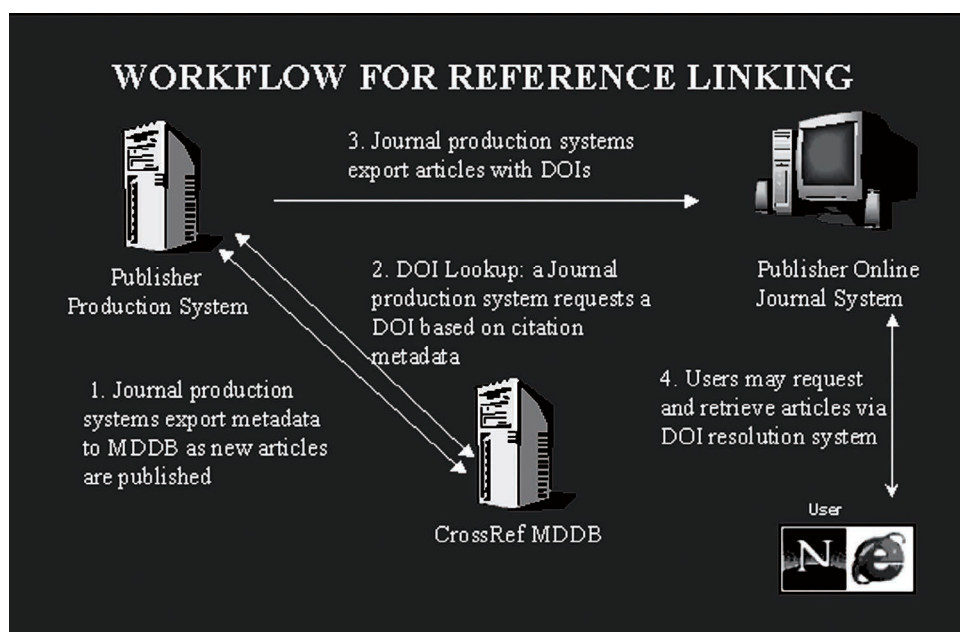


Fig. 3 Workflow for reference linking.

to smaller content providers, including those with limited resources and technical expertise.

When metadata and DOIs are deposited with CrossRef, publishers must have active response pages in place so that they can accept incoming links. As soon as a given deposit goes through, other users of the system will be able to retrieve the DOI in question and create links using that DOI. A minimal response page consists of a full bibliographic citation and some mechanism via which the user can gain access to the

full text. Access to proprietary content is controlled by the publisher; most publishers take users to an abstract page and permit authenticated users to go directly to the full text. If the full text is available at no charge, all users can view it immediately. Many publishers also present unauthenticated users with pay-per-view options.

Fig. 4 shows a user clicking on a CrossRef DOI in Journal 1 and connecting to a response page at the Web site of Journal 2.

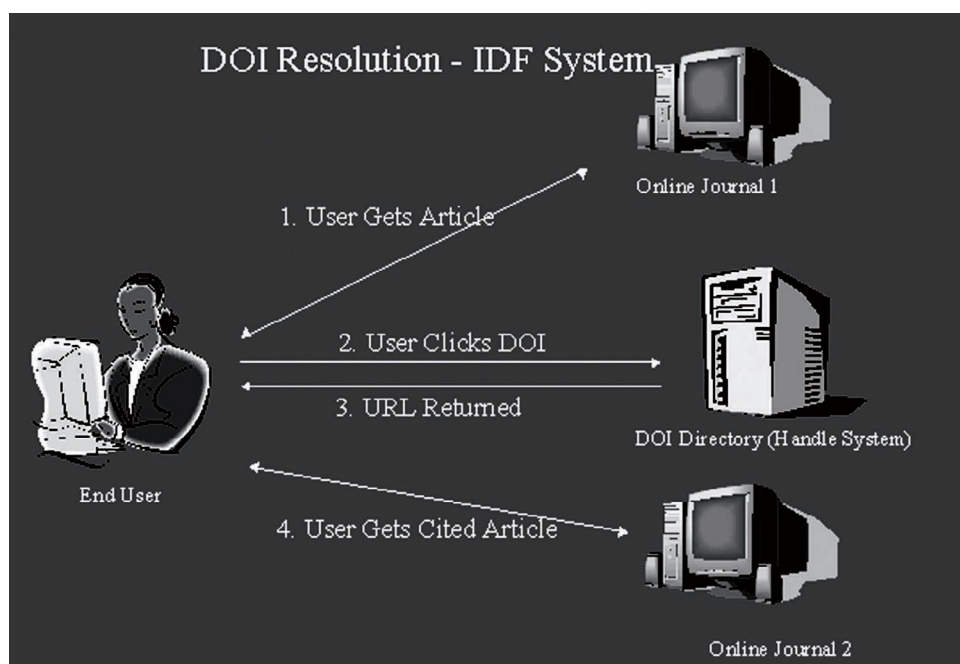


Fig. 4 DOI resolution from the end-user perspective.

In sum, CrossRef provides a database of DOIs and metadata that supports DOI lookup. If you know the DOI for a piece of content, that is all you need to know in order to locate it persistently, not unlike a homing device. If a publisher changes the location of the content, it need only update the URL in one place.

CROSSREF'S IMPACT

Let us look now to how CrossRef impacts the various communities in the information arena.

Impact on Publishers

The current system of Internet addressing made widespread linking possible several years ago. Yet cross-publisher linking remained a largely onerous and error-prone endeavor for scholarly publishers until CrossRef was formed. Before CrossRef, in order to link with one another, publishers had to enter into numerous bilateral agreements and stay on top of several publisher-specific, algorithmic linking schemes. Any change in the online location of a piece of linked content meant that previously published links to that content became obsolete.

With CrossRef, publishers have both a technology and a business infrastructure for persistent linking. On the business side, the publisher (or other interested party) signs one agreement with CrossRef and gains the right to link to all other participating publishers. With 619 dues-paying members, nearly 200,000 bilateral agreements ($1/2N(N - 1)$) would have otherwise been needed to enable the same network of connections. Hence, a linking network on this scale could never have arisen without an organizational infrastructure like CrossRef. Publishers also benefit from being part of a collaborative platform for ongoing development of shared technologies, while maintaining control over their own business practices and how their content is accessed.

On the technology side, CrossRef addresses the error-proneness of links by use of the DOI, as described above. CrossRef is the only DOI registration agency with a DOI lookup and retrieval service. For a publisher with content registered in the CrossRef database, this means that over 3500 participating organizations—other publishers, A&I databases, aggregators, and libraries—will be able to link automatically to their response pages. For electronic books such as reference works, CrossRef facilitates internal linking of components and references, as well as providing durable hyperlinks from citations to any other participating publishers' material. Assigning DOIs to book chapters gives publishers a head start in repurposing content for course-packs, for derivative works requiring a subset or reordering of the original components, and for e-commerce at the chapter level.

Impact on Libraries

With CrossRef functioning as intended, DOIs are now widely distributed by publishers as a standard part of bibliographic metadata. Libraries and their patrons regularly encounter DOIs in the primary and secondary publications that they access. DOIs are good for libraries in the same way that they are good for the research process. Namely, they make linking reliable at any level of granularity possible. In the same way that links drive readers to publisher content, libraries may also see increased usage of acquired electronic resources as an additional benefit.

Most researchers access content through the institutions with which they are affiliated. For the user working in an institutional context, it is not always appropriate to be directed to publisher's online version of a research article. For instance, the institution may not subscribe directly to the e-journal but may still be able to offer the user access to the desired article through an aggregated database or through print holdings. In addition, the library may wish to provide a range of navigational options beyond what is available at the publisher's Web site.

The OpenURL is a mechanism for transporting metadata and identifiers describing a publication, for the purpose of context-sensitive linking. The OpenURL standard has been NISO accredited (ANSI/NISO Z39.88) since 2004.^[6] A "link resolver" is a system for linking within an institutional context that can interpret incoming OpenURLs, take the local holdings and access privileges of that institution into account, and display links to appropriate resources. A link resolver allows the library to provide a range of library-configured links and services, including links to the full text, a local catalog to check print holdings, document delivery or ILL services, databases, search engines, etc.

The DOI and the OpenURL work together in several ways. First, the DOI directory itself, where link resolution occurs in the CrossRef platform, is OpenURL-enabled. This means that it can recognize a user with access to a local resolver. When such a user clicks on a DOI, the CrossRef system redirects that DOI back to the user's local resolver, and it allows the DOI to be used as a key to pull metadata out of the CrossRef database, metadata that is needed to create the OpenURL targeting the local resolver. As a result, the institutional user clicking on a DOI is directed to appropriate resources.

By using the CrossRef DOI system to identify their content, publishers in effect make their products OpenURL aware. Since DOIs facilitate linking and data management processes for publishers, many publishers are beginning to require that the DOI be used as the primary linking mechanism to full text. Link resolvers can use the CrossRef system to retrieve the DOI, if the DOI is not already available from the source (i.e., citing) document.

As we have seen, static URLs are not a persistent linking mechanism. If a URL is published as a link and the content it points to is moved, then that link will no longer

function. DOIs address this problem. An OpenURL link that contains a DOI is similarly persistent. OpenURLs without DOIs can function persistently only if the relevant metadata is updated within the institution's link resolver. This process is greatly streamlined via access to the CrossRef system, because CrossRef provides a single source for linking reliably to a multitude of publishers without the need to track varied metadata-based linking schemes. In short, link resolvers benefit from using the DOI when linking to publisher-designated resources is appropriate, and as a way to obtain needed metadata.

Impact on Intermediaries

CrossRef encourages its publisher members to distribute DOIs as part of the standard bibliographic metadata that they provide to database publishers, aggregators, vendors, and other intermediaries. These intermediaries can also come directly to CrossRef for a way to identify, acquire, and capture DOIs for records that do not currently contain DOIs as provided directly by the primary publisher.

Like primary publishers, intermediaries join CrossRef to create links to all CrossRef member publishers without signing bilateral linking agreements or having to track publishers' individual linking schemes. They can then also offer their customers links to the full-text content of some primary publishers who do not authorize any other type of linking relationship. In addition to the efficiencies of centralized linking agreements and the enhanced utility of indexes that link reliably to full-text resources, some intermediaries offer CrossRef implementation as part of their journal hosting services, and others integrate their own software into the CrossRef system.

Impact on Researchers

Clearly, researchers want the content that they read online to be linked. It is much more efficient to navigate a body of research at the citation level. When the researcher takes on the author role, linking can be viewed as a way of garnering additional exposure. Including outbound hyperlinks adds valuable functionality to online publications, and inbound linking increases readership and citations. Although the CrossRef linking infrastructure has not been actively promoted to the end user, researchers are increasingly aware of DOIs, and CrossRef now offers several free points of access for researchers to retrieve DOIs. Many scholars and scientists now add DOI links to their own authored works, whether journal articles or newer communication formats such as blogs.

BEYOND CITATION LINKING

The CrossRef network is currently expanding not only in terms of content coverage—to different genres and levels

of granularity—but also in terms of functionality. Some of the latest key developments are described here.

Cited-by Linking formerly Forward Linking is a way of tracking citations to a given publication as they occur. In addition to using CrossRef to create outbound links from their references, CrossRef member publishers can now retrieve “cited-by” links—links to other articles that cite their content. An optional tool is offered to CrossRef members, enabling them to display “cited-by” links in the primary content that they publish. This is a natural extension of the CrossRef linking network, and helps provide a better online reading environment for researchers and scholars. As part of the same functionality, CrossRef also offers a “match-alert” feature that saves users from having to query CrossRef repeatedly to find DOIs for citations that do not initially return a match. If the publisher chooses to enable this, then the system automatically sends an e-mail containing the matched results when the relevant content is registered in CrossRef.

CrossCheck powered by iThenticate^[7] is a new initiative from CrossRef to help the scholarly publishers verify the originality of submitted manuscripts. The need of a plagiarism tool was identified as a top priority by CrossRef members in 2006 and as a result CrossRef researched the best plagiarism tools on the market to provide a solution for the CrossRef members. CrossCheck is really two products, a database of scholarly publications and a Web-based tool to check an authored work against that database. The Web-based tool can be used in the editorial process to identify matching text but it cannot, on its own, identify plagiarism. A human has to look at the matching text and use their best judgment to identify if plagiarism has occurred or not.

CrossRef Metadata Services formerly CrossRef Web Services is an optional service for publishers who would like CrossRef to disseminate metadata on their behalf. This can be useful to streamline the Web crawling carried out by search engines and others, in order to optimize the functionality of their indexes. It consists of a suite of tools to enable authorized partners to collect metadata from multiple publishers, using a variety of metadata gathering implementations such as Open Archives Initiative Protocol for Metadata Harvesting (OAI-PMH). Standard terms of use are provided for search engines, libraries, and other partners to use the metadata available from CrossRef Metadata Services.

CONCLUSION

CrossRef is about reducing friction in the means of discovering and accessing scholarly content online. Perhaps the key insight of the CrossRef initiative is that it allows publishers to create collectively the experience of integrated electronic resources for the scholarly community,

without in fact requiring aggregation of anything but the most minimal metadata.

CrossRef is representative of a trend toward “distributed integration”^[8] of information resources that will continue to progress as publishers take advantage of yet other ways, such as the Open Archives Initiative,^[9] to expose metadata about their information products on the Web for harvesting, search, and e-commerce applications. From the end-user perspective, the outcome is a more highly integrated body of research literature, even if such integration is merely virtual. As the automated tools for exposing and harvesting metadata, classifying content, and performing intelligent search continue to be refined/improved, this trend will no doubt advance.

Interlinking of resources across publisher platforms, as in CrossRef, is a prime example of distributed integration in electronic publishing. Both content providers and content consumers benefit from initiatives that use metadata and identifier registration to enable virtual integration of scholarly literature online.

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Cultural Memory

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Abstract

Cultural memory is a term used to describe interpretations of the past created by a group to address contemporary concerns. Cultural memory is transmitted to other individuals in forms such as commemorations, rituals, monuments, oral traditions, museum exhibits, books, and films. Groups or nations create and transmit cultural memory primarily to promote unity, identity, or some other political or cultural ideal. The term traces its origins to anthropology, but sociologists developed its theoretical framework. Since the 1980s, a number of academic disciplines have embraced cultural memory studies as a valuable tool of inquiry. Although it is a popular field of research, critics contend that a number of methodological issues need to be resolved. The term has entered the popular lexicon to describe how the works of a contemporary generation utilizes the traditions of a previous generation.

INTRODUCTION

Cultural memory is a term used to describe interpretations of the past shared by a group of individuals. The need to address contemporary concerns, such as preserving group identity or sustaining support for a political ideal, influences the creation and content of cultural memory. Thus cultural memory represents a reconstructed past that serves the present needs of a group. Individuals that construct, support, or preserve cultural memory usually share nationality, religion, ethnicity, politics, or some other cultural identifier, and many times these individuals did not live through the event being remembered. A group's cultural memory is reinforced and transmitted to other individuals in forms such as commemorations, rituals, monuments, oral traditions, museum exhibits, books, and films.

Scholars in fields as diverse as history, religious studies, literature, folklore, art, anthropology, sociology, and mass communications have devoted considerable research and texts to the significance of cultural memory to their respective fields. The term cultural memory has also entered the popular lexicon. It is sometimes used to describe how activities such as cooking, composing popular music, and graffiti reflect aspects of a culture's past traditions.

HISTORICAL CONTEXT AND TERMINOLOGY

Although the term "cultural memory" was not coined until the 1980s, its theoretical framework came to light during the upheaval that occurred in the humanities following the devastation caused by World War I. In an attempt to understand the ethnic, social, and political dynamics that led to the conflict, scholars sought new methods for

analyzing the inner ethnic relationships and international relations of nations. From this scholarship emerged new ideas about memory distinct from its Freudian conception as created and existing purely in the minds of individuals. The scholar most frequently cited as forming these ideas into a usable theory is French sociologist Maurice Halbwachs (1877–1945). His book *Les cadres sociaux de la memoire* (The Social Frameworks of Memory), published in 1925, theorized that individuals reconstruct memories of the past only within a social context. Through day-to-day communication individuals possessing shared concerns for the present form memories of the past "collectively" that supports the needs of the group. He labeled this type of memory "collective memory." To support his theory, he demonstrated how different classes of French society (working, old wealth, new wealth, etc.) collectively possessed contrasting interpretations of French history.^[1,2]

Halbwachs' ideas influenced scholars in the ensuing decades, but none had quite the impact on the development of cultural memory theory as French historian Pierre Nora. His *Lieux de Memoire* series (Realms of Memory), first volume published in 1984, solicited essays from a number of French historians that identified and examined historic and cultural sites that represented collective memories. For example, contributor Edouard Pommier demonstrated how during the late 1600s King Louis XIV employed decorative arts in the Palace of Versailles to link his reign with heroic legends of antiquity. In the process, the King hoped to fuse French history with myth to create an idealized vision of the French past that would support his administration.^[3] This essay and others in the volumes for the first time placed collective memory into a broad historical context, thus establishing it as a characteristic of modernity (the era beginning in Western Europe in the 1600s that embraced science and reason as the tools to

propel civilization toward an ever-evolving state of progress). Nora contended that modernity and its emphasis on nation-building and industrialization had created a divide between peoples' personal experiences and their relationships to the past, especially when it came to identifying with a national or cultural ideal. Thus, a need arose for producing "external sites of memory" such as monuments and museums to preserve links between individuals and tradition. According to Nora, this "memory crisis" was further exasperated in the twentieth century with the ascendancy of popular culture and emergence of postmodernity (generally referring to the era following World War II; proponents of the term rejected the notion that civilization was in a state of continuous progress). Popular culture, such as television shows, popular music, and films, increasingly defined the shared traditions of groups, thus creating an even greater need to locate ways to preserve national and cultural traditions.^[1] Nora's work had enormous influence on the potential applications of collective memory theory, leading a new generation of scholars into the field of cultural memory studies the following decade.

However, the term "collective memory" did not sit well in all disciplines. While sociologists naturally gravitated to the term in their work, scholars in other disciplines, especially historians, developed alternative terminology that better reflected their methodological framework. They employed terms like public memory, social memory, popular memory, heritage phenomenon, patriotic culture, cultural amnesia, and myth to describe what are at their core Halbwachs' original conception of collective memory. This different vocabulary had more to do with the type of research being conducted and enhancements of definition rather than a major break with the sociological foundation of collective memory.

Perhaps the most widely used memory term in academia and popular culture is "cultural memory." A frequently cited definition of the term emerged from the field of anthropology by German Egyptologists Jan and Aleida Assmann. In Jan Assmann's book *Kultur und Gedächtnis* (Culture and Memory), published in 1988, he expanded on Halbwachs' work by locating two primary modes of collective memory. Assmann defined "communicative memory" as the day-to-day communication of individuals that expresses shared viewpoints about the past. This memory has no fixed place in time and thus lasts only a few generations. "Cultural memory" is when these "communicative memories" are turned into "objectified culture," such as monuments, texts, and museums. Only then do the memories become fixed in time, become distanced from everyday communication, and achieve power.^[4] To illustrate the differences between these two types of memory, imagine an American family who shares and discusses its memories of President Franklin Roosevelt's New Deal programs of the 1930s. Aspects of these memories may shift over time as some details gain or fade in importance

and the generation who lived through the era dies off. At this point, these memories would be defined as communicative. But if the family creates a text or commemoration that reconstructs its memories of the New Deal, and if this text or commemoration becomes accessible to the public, it becomes a cultural memory that can be shared with other Americans.

CHARACTERISTICS OF CULTURAL MEMORY

Defining the Group

An interesting aspect of cultural memory is that there is no formula for determining the makeup of a group who shares or creates a cultural memory. This is not to say that cultural memories do not frequently form along cultural indicators such as ethnicity and class. But it would be an oversimplification to point to this as one of its defining characteristics. Cultural memories can exist and be produced in units as small as ethnic minorities, created by the bureaucracy of a nation, or shared across lines of class and nationality. In fact, in the late 1990s the Getty Institute initiated a "Global Cultural Memory" project to "create a collective archive of digital information (text, images, and, in future, sound and video) that documents both everyday and singular events, lifestyles, and achievements that have influenced the most recent 50 years of cultural memory."^[5] It is hard to imagine an application of cultural memory that could have a farther reach.

Age is one important indicator for understanding why one group may find an aspect of the past important for commemoration while another group may choose a different past. Psychologists Schuman, Rieger, and Scott conducted studies in 1989 and 1992 that sampled 1410 Americans over 18 years old. Participants were asked to name past public events that they deemed as important to their lives. The study found that events that occurred when participants were in their late teens or early twenties appeared to receive the largest positive response. Thus, for an event like the assassination of President John F. Kennedy, people who were in their twenties when the event occurred found it to be more significant to their lives than people who were in their fifties (Fig. 1). This suggested that people of the most affected generation would likely support commemorations, museums, movies, etc. that showcase the event more than earlier or later generations. The study is also significant for the number of people who recalled significant events that occurred well before they were born. In the case of the Depression of the 1930s, 10% of participants deemed the event as important to their lives even though they were not born until 29 years after the event occurred (Fig. 2). For these respondents, such is the strength of the cultural memory of the Depression that had been transmitted to them by family, texts, the media, and other sources.

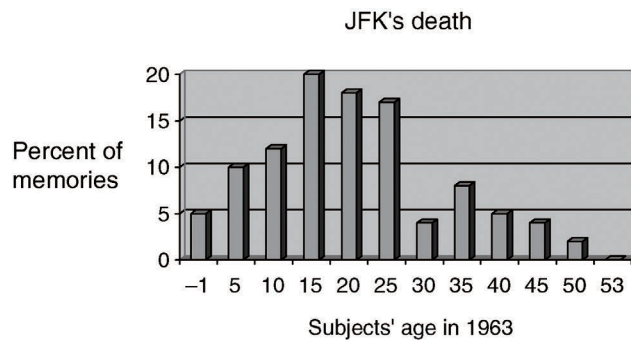


Fig. 1 John F. Kennedy's death.

Source: From Schuman and Rieger, C.^[21]

Considering that many cultural memories form out of a need to establish group identity and unity, ethnicity is an important indicator. A study by Roy Rozenzweig and David Thelen, published in 1998, revealed how black and white Americans possessed very different views of U.S. history. When asked to list past events that had been important to their lives, a majority of black participants listed the Civil Rights Movement first and slavery as second. In contrast, white participants listed World War II first and the Vietnam War second (Table 1). This survey helped explain why the cultural memory of nations is so often contested. Various interest groups possess strong opinions as to what aspects of a nation's past are worth commemorating. When the preservation of that past is in jeopardy or not supported by the nation's leaders or other groups, conflict almost certainly ensues.

While interest groups form their own cultural memories of the past, nations often use cultural memory to promote particular policies. The majority of scholarly texts that focus on this aspect of cultural memory deal with contemporary issues, but scholars have been successful in demonstrating that manipulations of cultural memory by nations existed already in antiquity. Jan Assmann argued that the leaders of the ancient Egyptian Middle Kingdom (2040–1650 B.C.E.) used cultural memories of the leaders of the preceding First Intermediate Period (2150–2040 B.C.E.) to help establish their authority over

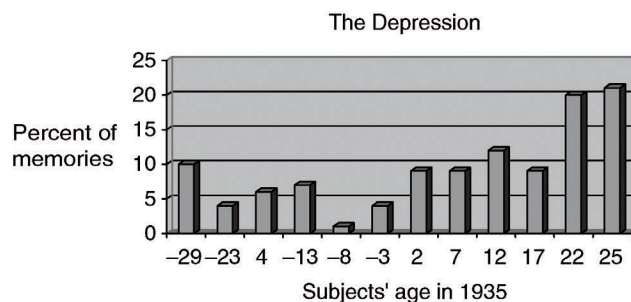


Fig. 2 The depression.

Source: From Schuman and Rieger, C.^[21]

Table 1 Significant U.S. historical events: Black and white Americans.

Event	Black	White
Civil rights	30 (22.4%)	9 (5.4%)
Slavery	15 (11.2)	2 (1.2)
World War II	9 (6.7)	21 (12.5)
Martin Luther King's assassination	6 (4.5)	0
Assassinations of 1960s	6 (4.5)	1 (.6)
Vietnam	6 (4.5)	19 (11.3)
John F. Kennedy's assassination	2 (1.5)	14 (8.3)
Gulf War	2 (1.5)	9 (5.4)

Source: From Rosenzweig and Thelen.^[20]

the Egyptian people. The First Intermediate Period was a time of extreme chaos and uncertainty in Egypt. With its enemies defeated by the time of the Middle Kingdom, the new rulers needed to preserve the memories of the earlier period to demonstrate that “only the [current] pharaoh could restore order and balance in a world out of joint and threatening to fly apart.”^[6] Assmann used surviving texts from the Middle Kingdom that evoked these disturbing memories to support his theory that cultural memory is not unique to modernity.

To cite a contemporary example, American historian John Bodnar employed the rubric of public memory to examine how the battles surrounding the monuments and museums commemorating the social and political upheaval of Vietnam War/Civil Rights era America paralleled the turmoil of the 1960s itself. He viewed public memory as an “intersection of official and vernacular cultural expressions.” Official culture represented the goals and beliefs of national leaders seeking unity, while vernacular culture represented the localized beliefs of various specialized interests.^[7] Together they competed to form a public memory of the past that could be widely accepted yet serve the interests of each group. The tendency of a nation to manipulate the past as propaganda to support its agenda and the efforts of minority groups to contest this reconstruction of the past by asserting its positions is a recurring theme in the literature produced by historians exploring cultural memory.

Impressively, some cultural memories have the ability to reach across generational and ethnic lines with little contestation within a nation. A good example is the American cultural memory of the Holocaust. Although a minority of Americans was personally affected by the atrocities against Jews carried out in Adolf Hitler's Germany during the 1930s and 1940s, America possesses a number of museums devoted to the genocide, and dramatic portrayals in film and television have persisted in popularity. As historians Peter Novick and Michael Morgan have observed, the rise of a Holocaust consciousness in Jewish Americans, which occurred decades after the event actually happened, stemmed from a need to provide unity in the Jewish American community in light of declining religiosity and increasing assimilation. The Holocaust also provided

Jewish Americans a link with Israel. But in America, the story of the Holocaust was created somewhat uniquely from stories generated in Israel. American museums embraced a “universalist definition” of the Holocaust that linked Jewish victims with those of other ethnicities and nationalities killed by German sponsored pogroms during World War II. Some even went as far to link the genocide with other atrocities such as the “killing fields” of Cambodia during the 1970s or the slaughter of Armenians by Turkish soldiers during World War I, thereby removing anti-Semitism from its central place in the narrative (a fact that incensed many Jewish scholars). Scholars opine that America embraced this definition because it would better resonate with the nation’s diverse population, address the societal need for tolerance, and perhaps even deflect attention from America’s own history of racism.^[8,9] The embedment of the Holocaust into the American consciousness has been very successful. Regardless of class, ethnicity, or religion, many Americans possess a shared knowledge of the event through museums like the National Holocaust Museum and Museum of Tolerance, films such as *Schindler’s List*, and popular books like the *Diary of Anne Frank*.

Representations

As described above, representations of cultural memory may be found in museums, archives, monuments, commemorations, film, and books, and historians have made good use of this primary source material to explore how groups reconstruct the past. But representations of cultural memory can take many forms and many other disciplines have used cultural memory theory to good effect. Anthropologists found cultural memory theory to be an effective way to investigate non-Western cultures. Rejecting the use of nineteenth century colonial records to understand such cultures, anthropologists turned to observations of indigenous people “in the field” and recognized how cultural memory was deeply embedded in contemporary traditions. Utilizing this approach revealed that historical interpretations of the past existed in these cultures in a non-linear fashion, distinct from the linear properties of history in the West. For example, Levi-Strauss observed Australian aborigines performing historical or commemorative rites that recreated the sacred and beneficial atmosphere of mythical times to recall the traditions of their ancestors.^[10] Rather than a simple reenactment of the past, the aborigines viewed these rites as allowing the past and the present to coexist simultaneously. These rites, which can be interpreted as cultural memories, served to reinforce identity and support social needs.

In literary criticism, scholars have used cultural memory theory to locate meaning in fictional characters. A critique of Paule Marshall’s novel *Praisesong for the Widow* by Susan Rogers invokes cultural memory theory to analyze the book’s protagonist Avey Johnson. A woman of African

American and Caribbean heritage, Johnson becomes obsessed with reconnecting with her African ancestors’ history of bondage in the Americas. In her essay, Rogers explored how the author portrays Johnson’s body as “a site of cultural expression and memory.” Feeling detached from life and in denial of her heritage, Johnson struggles to find her true identity during an ocean cruise eventually rediscovering a sense of heritage in one of the oldest forms of cultural memory—the dance.^[11]

Art historians have long recognized that artworks transmit the culture of the past to contemporary societies. Before Halbwachs developed his theory of collective memory, German art historian Aby Warburg (1866–1929) used anthropological methods to deconstruct art works and reveal connections between an artist’s work and its social and historical contexts. Unlike many of his contemporaries, he rejected the analysis of art based purely on aesthetic principles. But he also warned against expecting too many insights into the artist’s world by just looking at his or her artwork. For Warburg, all culture transmitted through art was mediated in some respect and “artistic style is a most treacherous key for ascertaining political and social developments.”^[12]

The interdisciplinary fields of American Studies and Cultural Studies have embraced cultural memory theory as a method of investigation. Popular culture provides much of the source material for these fields to explore the lives of ordinary citizens. Hip Hop music, Tom Cruise movies, graffiti at the Beatles’ Abbey Road recording studio, and the *X-Files* science fiction TV show have all been used as source material for uncovering cultural memories.

In journalism, cultural memory as a term is sometimes used in articles and reviews. A kind of jazz may invoke a cultural memory of the big band era of the 1930s. A particular dish may produce the cultural memory of an ethnic cooking tradition. Even commemorative journalism that reports on observations of historic events draws on cultural memory theory. The meaning of cultural memory as originally defined by Assmann has likely been misused by some in the media. Nonetheless it has found wide-spread acceptance as a descriptor of the ethereal mnemonic qualities of things that pass from generation to generation.

Social Relevance

As these examples illustrate, the need to address contemporary concerns influences the creation and transmission of cultural memory. Thus, scholarly investigation of cultural memory possesses significant implications for the present. According to one critique, it appeals to scholars because it “turns academics into concerned citizens who share the burdens of contemporary memory crises.”^[13] Or as historian John Gillis explained, it locates “usable pasts capable of serving the heterogeneity of new groups that

[have] become active on the national and international stage: racial and sexual minorities, women, youth, and dozens of new nations and ethnic groups aspiring to sovereign status.”^[14] Through an examination of how groups reconstruct the past, the core issues that divide and unite people can be revealed.

The preservation of the Lorraine Motel in Memphis, Tennessee, site of the 1968 assassination of Civil Rights leader Martin Luther King, Jr., shows how cultural memories expose divisions in society and influences the urban landscape. The assassination was so shameful to the city of Memphis that it took 20 years before major efforts went forward to turn the Lorraine into a museum. But even then, city residents possessed strong opinions about whether this cultural memory deserved recognition, and opinions were divided along mostly racial lines. Most blacks felt that a museum at the Lorraine would help heal societal wounds caused by the city’s history of racial discrimination and uplift the black community by recalling its role in the national Civil Rights movement. In contrast, most whites felt that the museum would only reignite the racial unrest of the 1960s. Some also felt that King’s legacy was not worth remembering because of his opposition to the Vietnam War and his stances on economic equality (seen by some as an obvious reference to Communism).^[15] In sharp contrast to the ease at which Holocaust museums found a foothold in America, Civil Rights museums have met resistance. The National Civil Rights Museum at the Lorraine eventually opened in the early 1990s and helped revitalize a section of downtown Memphis. An examination of the cultural memory conflict that occurred in the city during the museum’s development proved to be an effective way for understanding the city’s unresolved racial issues.

The social relevance of cultural memory is not a uniquely Western phenomenon. According to historian Gyanendra Pandey, beginning in the 1980s in India, a right-wing Hindu movement waged an effort to establish a national Hindu culture in the nation. Naturally, the movement focused on reconstructing history and memory to achieve its goals. The movement reclaimed national sites by tearing down historic mosques, built monuments to its leaders, and produced a widely distributed pamphlet that featured a “new” history of India that highlighted the heroic contributions of Hindus to the nation.^[16] In modern China, Ban Wang sees the occurrence of a “dialectic tension between memory and history” to form a contemporary national memory. On one hand, the traumatic memories of imperialism that were used to justify the creation of an authoritarian state in China are being subdued to accommodate the economic benefits of the nation’s movement into the global marketplace. But on the other, nostalgia combined with a critique of modernization attempts to hold enthusiasm for a Chinese global economy in check. Thus, according to Wang, history and cultural memory in China are in transition as current

discussions about the direction of the nation create a need to reform cultural memories of the past.^[17] Both of these examples underscore how present political or societal needs influence the reconstruction of the past in nations around the globe.

CRITICISMS OF CULTURAL MEMORY STUDIES

Since the 1980s, cultural memory studies have produced a flood of academic manuscripts and popular cultural references. However, a number of scholars have raised their voices to express concern about the inherent problems with drawing precise conclusions from cultural memory studies. One such concern is that too little attention is paid to how cultural or collective memory is different from individual memory and that scholars sometimes misapply psychoanalytical tools developed for understanding individual memory to the shared memories of groups. Terms familiar to discourse on individual memory such as “trauma” and “amnesia” are frequently used in conjunction with cultural memory theory, but questions persist if these same terms can be properly applied collectively rather than individually (p. 186).^[2] Take for example the memories created by natural disaster such as Hurricane Katrina, which hit the United States in 2005. An individual who lived through the event may experience mental trauma. This individual might repress memories or manipulate them to deal with the trauma. These memories may even change over time as the temporal distance increases from the event. At the same time, other population samples of the United States, who are concerned by the disaster’s implications for national image, may be said to have also experienced trauma from the event. But is the trauma experienced by the individual and the population sample the same? Can we accurately interpret the trauma experienced by the United States as a whole? To some scholars, cultural memory studies too frequently fail to make this distinction and treat the shared memories of groups the same as the memory of an individual. They believe that more work needs to be done on how collectives truly manage to remember and forget.

The lack of understanding of how groups receive and internalize specific representations of cultural memory is another major concern for critics of cultural memory theory. Cultural memories, as represented by monuments, museums, etc., tell us much about the people who created them, but little is known about how these memories move from monument to individuals and eventually groups. Individuals invariably bring their own interpretations of the past with them as they encounter a museum exhibit or historical film. The effect of this interplay on cultural memory is rarely addressed. Receivers of cultural memories do express opinions in newspaper editorials and other sources that provide access to the thoughts of these receptors, but even these sources are mediated by editors and do

not present an unmediated representation. Wulf Kansteiner suggests that one solution to this problem would be to look at why some memories never succeed in becoming a part of a public consciousness. An example he cites is the commemoration of America's involvement in the Korean War. "The Forgotten War," as it is sometimes called, finally received some attention during the 2000s with street names and memorials in cities across the nation paying respect to the soldiers who participated. But this was after memorials for veterans of the Vietnam War, which ended two decades after the conclusion of the Korean War, had already appeared. For Kansteiner, examining why some events fail to become part of cultural memory may be as illuminating as looking at the ones that succeed.^[2]

According to some critics, the similarities and distinctions between the reconstruction of the past that occurs during the formation and transmission of cultural memory and the scholarly process of producing historical texts and media needs to be explored further. Groups create cultural memory by manipulating viewpoints about the past to address contemporary concerns. The biases and current interests of historians naturally influence the subject matter and interpretation of historic persons and events found in their work. Indeed historiography is full of examples of multiple changing perspectives on historical events. This leads to the question as to what are the true distinctions between cultural memory and history. Is it simply the academic status of history that distinguishes it from the building of museums and monuments? Are not the public historians who build the collections in museums or develop historic sites deemed as professionals?^[1] The cultural memory versus history debate remains unresolved.

Some scholars have also noted how the majority of cultural memory studies focus on controversial historical events and contestation. Volumes have been produced on memory conflicts regarding the Holocaust, American Civil War, French Revolution, and post-World War II Germany. The more divisive a history, the more reconstruction of cultural memory appears to come into play. However, in cases where remembrance has provoked little controversy, memory studies are typically silent. The Lorraine Motel represents a site of contentious memory, thus its preservation has been analyzed. But most likely a nineteenth century Victorian house in Memphis preserved for its architectural beauty will receive little attention in regards to the cultural memory that it represents. Psychologist Barry Schwartz argued that cultural memory studies begin to ring hollow unless

...there is something to be mystified, some injustice or atrocity to be concealed. . . . In every culture and in every age we see exclusion and bias, but as the work of civil rights, multiculturalism, and inclusion continues, it becomes more difficult to squeeze out insights from [cultural memory] analysis.^[18]

According to Schwartz, cultural memory studies could conceivably reach a point where it runs out of source material for study.

CONCLUSION

Despite criticisms of cultural memory theory, the use of the term cultural memory in academia and popular culture shows no sign of abating. The term persists as a way to identify reconstructions of the past created by groups or nations. Cultural memory is transmitted to other individuals in forms such as commemorations, rituals, monuments, oral traditions, museum exhibits, books, and films. Thus these forms supply the primary source material for scholars to investigate the implications and significance of cultural memory creation and transmission. The term traces its origins to anthropology, but sociologists developed its theoretical framework. Since the 1980s, a number of diverse academic disciplines have embraced cultural memory studies as a valuable tool of inquiry.

There are three main characteristics of cultural memory. First, diverse groups create and share cultural memories. There is no formula for defining the size, age ranges, ethnicity, or nationality of groups that may create or possess a cultural memory. Cultural memories frequently form along such cultural indicators, but there are examples of cultural memories that transcend this pattern. Scholars have located examples of cultural memory creation in cultures across the globe in both antiquity and modern times.

Second, representations of cultural memory occur in many forms allowing many academic disciplines to apply cultural memory theory. Historians, in their work, emphasize cultural memories transmitted through commemorations, monuments, and museums. Cultural memory may also be located in forms such as religious practices, visual arts, literature, dance, and music. Although the term is used by the popular media in a slightly different context than it is in academia, it is sometimes used by journalists to describe how a generation utilizes the traditions of a previous generation.

Third, cultural memory is created to address contemporary concerns. Thus, cultural memory studies possess social relevance because it contributes to an interpretation of national culture and reveals the core issues that divide and unite contemporary populations. Cultural memory influences preservation initiatives that affect the built environment and underscores the challenges faced by nations as they strive for continuity during times of change. As a result, contestations between groups and nations over representations and manipulations of cultural memory are a core aspect of cultural memory literature.

Critics contend that a number of methodological issues need to be addressed before cultural memory theory can emerge as a reliable tool of inquiry. Scholars sometimes

misapply psychoanalytical tools developed for understanding individual memory to the collective memories of groups. How groups process and receive reconstructions of cultural memories has not been fully explored. Some scholars are troubled by the relationship between cultural memory studies and historical research. And, the study of cultural memory tends to focus primarily on contentious events.

The number of articles discussing cultural memory has declined since the 1990s. However, commemorations, monuments, and other interpretations of the terrorist attacks of September 11, 2001 will undoubtedly provide fertile ground for cultural memory studies for decades to come. Also, the continued development of Africa, Asia, and the Middle East will likely involve reassessing the past and the creation and transmission of cultural memory. The wide-spread use of the internet potentially provides a new platform representing cultural memory. E-mails, blogs, and videos posted by various groups on YouTube could prove to be key representations of cultural memories for scholars in the future.

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Curating Archaeological Artifacts

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Abstract

Archaeological artifacts, collections, and associated records represent arguably the most important resource for documenting the entirety of the human career. Their integrity and value, however, depend on appropriate management and curation. This entry provides a brief survey of standards and generally accepted practices for the documentation, acquisition, cataloging, care, use, and interpretation of curated archaeological collections as well as a summary of metadata standards and current ethical issues confronting archaeological curators.

INTRODUCTION

Archaeological collections represent a primary form of cultural heritage and one of the major sources of evidence regarding the human career. The value and integrity of these collections depends on appropriate curation, management, and care; this entry briefly summarizes key curatorial concerns, and addresses current trends and ethical issues relating to curatorial practice in archaeology.

Various definitions have been offered, but for our purposes, archaeology (the spelling with “ae” is generally preferred, but some U.S. federal sources prefer the spelling “archeology,” and some scholars in classical archaeology continue to use the diphthong “æ”) may be defined as the study of human behavior from its material correlates and physical residues. This definition places material objects—and information relating to these objects—at the center of archaeology as a scholarly enterprise. This emphasis on materiality need not limit the kinds of questions archaeologists address, but does frame the nature of the evidence on which archaeological research is based. Technically, at least, archaeologists do not actually study the past. Instead they study evidence of all kinds that has survived from the past into the present or from the present that may be more broadly applicable, in order to make inferences about the past. More than a fine distinction, this fact informs most guidelines regarding the proper management and curation of archaeological collections.

Archaeological sites are fragile, finite, and non-renewable resources. Rates of site loss and looting are alarming. The trade in antiquities is difficult to quantify, with estimates ranging from \$300 million to more than \$6 billion annually.^[1] While rates of site loss and destruction are equally difficult to quantify, Heritage Action in the United Kingdom has estimated that between 1975 and 2015 more than 12,268,252 artifacts have been removed from sites in England and Wales alone by metal detectorists,^[2] and Elizabeth Stone, a specialist in the

archaeology of southern Iraq, has documented looting activities in southern Iraq between 2003 and 2007, larger in areal extent than all archaeological excavations ever conducted in the region combined. More recent research by Brodie and Contreras used Google Earth to identify looted areas at a single site in Jordan totaling more than 74,000 m².^[3]

While new archaeological sites are being created constantly by living societies, those from any past period or society are both limited in number and subject to destruction or damage from a wide range of natural and human-induced processes. Even the act of archaeological excavation is inherently destructive, and hence archaeologists focus much attention on preserving, in situ, undisturbed archaeological material and in maximizing the information that may be gained from artifacts, collections, or samples already excavated. Most professional archaeological organizations have explicit, and all have implicit, ethical frameworks requiring that archaeologists work to minimize damage to the archaeological record.^[4] Most archaeologists view that obligation as relating primarily to the preservation of intact sites or cultural resources, but equally important is the preservation of collections resulting from past research, and the maintenance of information relating to those collections that gives them meaning and significance. Properly curated, older collections can continually address new questions and be examined using new instrumentation and methods.^[5]

CURATING ARCHAEOLOGICAL ARTIFACTS

The number of archaeological objects held in the world’s museums and repositories is unknown, but the scale is enormous. Individual sites may produce tens of thousands of discrete, uniquely cataloged artifacts or objects, and the number of already-recorded sites is considerable, with an unknown number yet to be discovered. Japan has already

recorded more than 440,000 archaeological sites within its borders, Denmark's *Kulturhistoriske Centralregister* has recorded more than 150,000 archaeological sites, with a schedule of 55,000 monuments (not including buildings), and New Mexico, USA, currently lists more than 100,000 recorded sites in its automated ARMS site registration system.^[6] The U.S. Department of the Interior estimates its 2014 holdings at more than 44.9 million objects,^[7] and this includes neither associated archival records (more than 122 million items relating to all scholarly disciplines, with the proportion dedicated to archaeology as yet unknown) nor major holdings administered by other arms of the federal government (e.g., the Department of Defense through, among others, the U.S. Army Corps of Engineers, or the Department of Agriculture through the U.S. Forest Service).

STANDARDS

Currently there are few standards for the curation of archaeological collections, and no generally recognized standard for the recording or interchange of information regarding archaeological collections. The irony of this situation is that archaeology has been concerned since its inception with creating order and meaning from the complex and often jumbled remains of the past that survive to the present day. In order to do so, archaeology depends upon *context*, the spatial, cultural, environmental, and temporal associations between objects. Probably the most important form of context is *provenience*, or the physical context in which an object was found. Objects without provenience have limited archaeological value, and many archaeological journals prohibit the first publication of such materials. These prohibitions reflect two concerns: (1) that validating objects recovered from looted or unknown contexts may lead to further site destruction and (2) that the inclusion of objects from unknown contexts may introduce either fakes or misattributed items into the scholarly literature in ways difficult to later remedy, biasing interpretations and creating false foundations on which later scholarship relies. Provenience, etymologically from the same root, generally refers to the chain of custody and goodness of title for objects or collections. The terms are sometimes confused, particularly by scholars in different disciplines that emphasize one concept at the expense of the other: Art historians privileging provenance will sometimes treat provenience as a subset of provenance; archaeologists privileging provenience will sometimes treat provenance as a special, postexcavation case of provenience. Both concepts are crucial for managing archaeological collections, with provenience being central to the utility of objects in making archaeological inferences and provenance being central to assessing claims for restitution, repatriation, and return of objects.

Probably the most broadly applied standard for managing archaeological collections in the United States is a set of federal regulations that govern the management of federally owned or administered archaeological materials, 36CFR79,^[8] promulgated in 1990. They mandate levels of intellectual, environmental, and physical control over collections and related documentation, but for the most part these levels of control aren't clearly specified but instead must minimally correspond to changing professional standards within museums. In the United Kingdom the equivalent, and in most respects more detailed, set of guidelines is *Standards in the Museum Care of Collections: Archaeological Collections* originally prepared by the Museums & Galleries Commission.^[9]

PROJECT DESIGN AND RECORDS

Management and curation of archaeological collections actually begins prior to fieldwork. The design of field projects plays a major role in determining the long-term research value of archaeological collections. Since archaeological collections include not only artifacts and other cultural material but also a range of environmental and lithostratigraphic materials, potentially including the soils, sediments, or matrix within which objects were recovered, all collections ultimately reflect sampling. Sampling in this sense assumes at least two forms: (1) sampling strategies determining which areas are surveyed, studied, or excavated and (2) recovery strategies determining what kinds of materials and samples are retained from those areas sampled. Since the absence of certain categories of material in a curated collection may represent either their absence from in situ deposits or a field decision not to collect those classes of material, documentation of the research design and data recovery plan is critical for understanding the material record.^[10]

All archaeological projects generate collections, although in some cases the collections comprise only documents, photographs and records. Different kinds of survey or excavation projects employ a variety of techniques for recording the horizontal and vertical locations as well as the associations of objects, samples or measurements; this information is linked to objects by recording contextual information on the artifact, on the bag or other container housing the object or objects, or by assigning objects or groups of objects from the same context a lot number keyed to contextual information in project records, as well as by paper or electronic field notes and forms. Records also document how objects were consolidated or cleaned in the field, if applicable. Often, objects are assigned field numbers that link the object to its context and associated records; this represents a preliminary labeling system separate from identifiers used by the museum or repository.

ACQUISITIONS AND ACCESSIONS

Objects being considered for acquisition by an institution are generally examined relative to formal acquisition policies defining the kinds of material held by that institution. In some cases this is framed by the interests of the staff or stakeholders, in others by formal collecting plans or acquisition policies, and in others by the institution's mission statement or by legal mandate (e.g., governmental repositories). These policies also specify who within an organization has the authority to accept objects and who has authority or responsibility for different aspects of the acquisition process and subsequent management of the collection, and specify the conditions under which objects are accepted.^[11] Usually, institutions will not acquire objects for which they cannot receive good title, which they do not expect to retain, or for which they cannot provide adequate care (although in some cases institutions may accession objects for which nominal title is retained by the government). For museums and repositories, at least, ultimate authority for acquisitions rests with the governing authority, as it is legally responsible for the institution's actions.

If objects are determined to be appropriate for acquisition, the next step is *accessioning*, which establishes legal custody and ownership of objects or collections, and documents the means by which an institution acquired the material. Depending on what kinds of information accompany the collection, it may also be the first step in establishing intellectual control over the material. While procedures vary widely, each accession generally represents one or more objects, including a whole collection from an archaeological project, from a single source, acquired by a single means of acquisition or transfer of title, and accepted on a single date. Accessioning establishes custody and title for one or more objects and is usually distinct from *cataloging*, which identifies each individual object and provides descriptive detail based on curatorial expertise. In larger institutions, at least, the registrar records accessions while the curators catalog objects. Some recording systems treat the accession and catalog number as identical, others use separate catalog and accession numbers, and some employ a hybrid system in which parts of the same numeric sequence convey accession and catalog information. Usually accession and/or catalog numbers are written on or affixed to the object. In some large museums the accession and catalog numbers are affixed to objects as barcodes or electronic tags, changing the mechanics of the registration process but not its underlying logic.

CATALOGING

Cataloging requires the identification and classification of an object and reflects the professional expertise and background of the curator. A variety of descriptive schemes

and terminologies may be employed, and different archaeologists may employ differing cultural–historical frameworks, functional typologies, or nomenclatural standards.

Multiple standards for collections documentation have been proposed, and even institutions adopting one or another standard often modify the standard to better suit their individual needs. Probably the most widespread is the CIDOC International Core Standard for Archaeological Objects, developed by the Archaeological Sites Working group of the International Committee for Documentation (CIDOC) through the International Council of Museums.^[12] For the most part, such standards define the kinds of information to be recorded, but not the terminology or classificatory frameworks to be employed. For the United Kingdom, Collections Trust UK provides an excellent outline of the registration and documentation process, along with links to resources for terminologies or lexicons for archaeological objects.^[13] While useful for a given region, such resources are not for the most part transportable to other regions without substantial modification. Commonly employed terminologies include the Nomenclature for Museum Cataloguing (a revision of the Chenhall system)^[14] and the Getty's Art and Architecture Thesaurus,^[15] although neither is considered fully satisfactory by most archaeological curators. As there is no accepted standard within the discipline, the choice of terminology or lexicon is in some respects less critical than the consistent application of whatever set of terms is adopted, particularly now that most collections cataloging involves the creation of electronic records that facilitate synonymies and the cross-indexing of terms. Consistency benefits search and retrieval within an institution, and supports emerging efforts to allow searches across the collections data of multiple institutions.

Cataloging also involves identifying whence objects come. In addition to intrasite provenience information, it is also necessary to uniquely identify the site and geographic location from which objects originate. Unique site designations are normally provided by governmental agencies or ministries (in the United States by the state historic preservation officer or state archaeologist), but geographic names require some external authority or lexicon. Commonly used geographic authorities include the Geographic Names Information System for the United States and the Getty Thesaurus of Geographic Names for global place names.

METADATA STANDARDS

Metadata, or data about data, documenting the structure, format, and content of data fields or information, represents a crucial concern in establishing accessible and meaningful intellectual control over collections. Metadata standards in archaeology have not yet achieved their initial promise of allowing relatively source-transparent

searches across multiple datasets. In part, this reflects the proliferation of metadata standards, and in part, a paucity of systematic application of existing standards. Most archaeological metadata is built on the Dublin Core, an ANSI (Z39.85-2001) and ISO (15836) approved standard widely used for resource recovery, with extensions to handle data of particular concern to archaeologists (see also ISO 21127, the ISO implementation of the CIDOC Conceptual Reference Model (CRM), which relates specifically to cultural heritage information).^[16] In theory the Dublin Core represents the basal data used by a variety of disciplines, with discipline-specific extensions developed to meet the needs of specific communities of users. In practice the Dublin Core is generally mapped on to a subset of existing datasets that correspond to the Dublin Core elements. CIDOC, for example, provides mapping of the Dublin Core elements to the CIDOC CRM. The Darwin Core, a metadata standard paralleling the Dublin Core but aimed primarily at natural history and systematics or biological taxonomic collections, emphasizes georeferencing of objects rather than standardized place names.^[17] In theory such metadata allow collaborations, gateways, and interoperable search platforms, but this promise has yet to be realized. For the most part, such searches remain limited to within either individual data archives such as The Digital Archaeological Record (DAR) or the Chaco Research Archive^[18] or within archaeological data publishing initiatives such as Open Context or the Comparative Archaeology Database (CADB).^[19]

STORAGE AND CARE

Once cataloged, the curator and/or collections manager becomes responsible for the storage and care of the object. The logic by which storage areas are organized varies by institution, and may be based on catalog number, geographical area, or type of object. Certain classes of objects may be stored together because they share a need for specific environmental profiles (e.g., low relative humidity) or to reflect sensitivities of key stakeholders (e.g., human remains being stored separately from other collections). The creation and maintenance of appropriate storage conditions is a complex process of monitoring and controlling (or ameliorating) a variety of environmental parameters, while providing appropriate levels of physical security and access to the collections.^[20]

There is, unfortunately, no ideal temperature or humidity for all objects; each kind of material has separate ideal environmental conditions, and in the case of compound or complex artifacts there may be contradictory ideal conditions for the constituent materials making up a single object. A hafted axe comprising a wooden handle, sinew lashings, organic glues or mastics, and a metal bit might be stored at low humidity to protect the metal from corrosion, but at the expense of the wood. Conversely, higher

humidity might maintain the dimensional stability of more hygroscopic materials like wood, but at the expense of the metal. And the ultimate goal is not merely preserving the constituent materials but the integrity of the artifact as a whole, and the ways they are combined to form that complex artifact.

For the most part, however, constancy in environments is crucial, and shorter-term variations in environment are more damaging than longer-term changes.^[21] For museum collections absolute humidity is less relevant than relative humidity, since hygroscopic materials are affected by whether their ambient environments have little moisture relative to their capacity to hold moisture, in which case they absorb moisture from objects, or are nearer their maximum capacity for moisture, in which case they tend to release moisture into objects. This capacity is, in part, a function of temperature. From the standpoint of dimensional stability and direct damage, most objects are less sensitive to temperature changes than to humidity, although temperature and humidity are generally linked, and both natural processes of decay and the likelihood of pest infestations are accelerated at higher temperatures. Temperature and humidity levels are generally monitored using either analog thermohygrographs or multichannel digital data loggers. Other sources of environmental damage are airborne particulates and light, especially in the high-energy ultraviolet wavelengths. Light damage is cumulative, and bright lights for shorter durations do not generally cause greater damage than longer exposure to dim lights. Light levels are generally controlled by limiting the foot-candles of light to which objects are exposed, both by moderating lighting in display areas and by storing collections in closed cabinets, by sealing windows and by using ultraviolet filters on all light sources. Light levels are normally measured with a direct-reading UV light meter or less accurately with a visible light meter that estimates UV levels.

Pests are another threat to the integrity of collections and associated documentation; one (probably apocryphal) story from the American midcontinent describes rodents eating the labels off every bag from an entire archaeological field season, leaving the bags intact but with no record of their source or contents. Insects, particularly dermestid beetles, are also a significant and persistent threat to organic materials. Prevention is the preferred approach; most chemical treatments generally cause as many problems as they solve.^[22] For insects, thermal treatment (freezing either at very low temperature or for a period longer than the life cycle of the pest) is a commonly employed treatment strategy, and anoxic environments can be used in some cases. In the past, a variety of hazardous materials including arsenic, strychnine, and mercury were used to treat for pests and to prevent mold or mildew; these treatments have resulted in some older collections now being classed as biohazards requiring special storage, handling, and disposal protocols. Treatments of any kind,

whether to control for pests or to conserve and stabilize objects should be documented as part of the permanent record as they may inform subsequent management decisions or influence analytical testing.

Objects are also subject to physical damage, and a series of protocols on handling objects are available, varying in detail but similar in general form and practice.^[23] Padding and supports for objects may be needed and can be constructed from nonacidic closed-cell foam or similar conservation-grade materials; all materials, containers, and cabinets should be inert and nonacidic.

In recent years, many institutions have adopted care policies that incorporate the concerns of descendant communities. The Museum of Indian Arts and Culture in Santa Fe, New Mexico, does not fully seal cases containing kachina dolls to allow them to “breathe,” the Milwaukee Public Museum allows certain objects to be wrapped and bundled with tobacco or other ritually potent plants, and the storage facilities for the National Museum of the American Indian, part of the Smithsonian Institution, include a smoking room for the blessing of material objects by native groups. Such policies often require a compromise between museological and traditional approaches to care, and if adopted should be developed in close consultation with appropriate communities.

The physical security of collections should generally be provided by an overlapping combination of physical security (e.g., locks), electronic security (e.g., alarms or cameras), and human security (e.g., either guards or supervision by collections staff), although the degree of physical security is often contingent on both the available resources and the perceived level of threat.

ACCESS AND USE

Along with stewardship, one of the primary obligations of curators is to provide access to the collections for scholars and interested individuals or groups.^[24] Stewardship and access require a balance, however, as increasing levels of access put objects at increasing levels of risk of all kinds. The movement and handling of objects increases the risk of physical damage, theft, variation in microenvironments, accumulated light damage, infestation, and generally increased wear and tear on objects. But at the same time, increased use adds to the value and intellectual potential of objects; since archaeological collections include both objects and their associated information, research adds to the collection by increasing the information associated with objects, and by clarifying the relations between objects. Access to collections is also crucial for consultation with descendant communities or other stakeholders with specific links to collections, as well as allowing opportunities for traditional forms of care including purification rites. Collections may also be loaned for study or other appropriate purposes. Past practice allowed a wide

range of loan conditions, but more recent practice generally requires that loans be for a period of 1 year or less (although loans may be annually renewable) and that the borrower be an institution rather than an individual comply with all conditions set by the lending institution, and provide a standard facility report to ensure that appropriate storage conditions can be provided. For research loans, most institutions require a copy of resulting publications or studies, and most museums and repositories loan only to institutions. Policies governing appropriate access, use, and loans should be listed in collections management policies or other documents approved by the institution’s governing authority. As both usage of the web and acceptance of applicable metadata standards increases, access policies will need to address web-based access and attendant issues of fair use and copyright.

INTERPRETATION

One of the primary differences between museums and repositories is that museums have an explicit educational and interpretive mandate. As a result, curators may be involved in a range of exhibitions and interpretive programs. Exhibition or program design and museum-based informal science education are separate fields, each with their own journals, infrastructure, training, and guidelines for professional practice. Curators generally serve as content experts as part of design teams, although in smaller institutions curators may be asked to simultaneously serve in all of these roles. Programmatic use of collections must balance the preservation and protection of the objects and documents against the mission-defined value of public understanding and instruction. While allowing visitors to confront and be engaged by authentic objects is an important role of museums, in many programmatic contexts replicas may be equally effective as ancient artifacts and constitute a more appropriate option.

Museums play an important role in influencing how the public perceives cultures both extant and extinct, and potentially in reifying or rectifying stereotypical or naïve assumptions about past lifeways.^[25] Interpreting the past is a complex enterprise, however, in which perceptions are an amalgam formed from at least three complex constellations of elements: (1) the past itself; (2) the viewpoints, attitudes, and assumptions of the curator selecting and interpreting the representations of the past; and (3) the viewpoints, attitudes, and assumptions of the visitor.^[26] The ways in which these elements relate to one another is better documented than understood, and because the curator occupies a privileged position in influencing the ways in which the past is represented—and thus the ways in which the past intrudes into and influences the present—he or she must be particularly sensitive to the ways that their own biases and agendas influence the selection of objects, topics, and the narratives through which the past

is presented and represented. Curators influence representations both by the objects or topics they select and by those they do not, as well as by how effectively they communicate concepts and information to visitors with different backgrounds, interests, and preferred learning modalities. Archaeological objects may be easier to present and interpret for visual learners, for example, whereas auditory and kinetic/tactile learners may face additional challenges in apprehending the core messages a given exhibition seeks to communicate.

In the past, exhibitions or programs were often designed as vehicles for curators to showcase artifacts and refine public sensibilities. Current best practices in museums call for program design beginning with a clearly defined set of take-home messages and with the didactic, pedagogical, and aesthetic design of the subsequent exhibition or program crafted specifically to communicate and reinforce these messages. Evaluation of the effectiveness of selected strategies is often necessary and usually results in both an iterative process of correcting weaknesses in the initial program design and ultimately in more robust and effective programs. Exhibit design thus includes not only aesthetic and pedagogical dimensions, but significant logistical, political, social, and ethical dimensions as well.

ETHICAL ISSUES

Curators of archaeological collections face a number of other ethical dilemmas. Some are common to all disciplines—making hard choices between competing needs or priorities in the face of limited resources, or choosing among optimal environments for storing complex artifacts made of multiple materials, each with a different optimal environment. Others are unique to archaeology, with five being worthy of mention here: (1) the so-called curation crisis; (2) orphaned collections; (3) deaccessioning and disposition of archaeological objects; (4) looting and the acceptance of unprovenienced antiquities; and (5) repatriation and restitution of objects or collections.

The enormous scale of archaeological collections worldwide is not mirrored in the availability of resources to maintain and properly curate them, nor to protect and document unrecorded or unexcavated sites. This has resulted in a “curation crisis,” in which an increasing number of museums and repositories lack adequate space or staff to care for new collections irrespective of their importance or value, while others process new collections at the expense of bringing older collections up to acceptable standards of care and curation.^[27] As stewards of cultural heritage, archaeological curators must assess whether they and the institution they represent can afford collections the necessary levels of care to ensure their integrity and security for years to come, and to meet new standards over time.

Not all archaeological collections are housed in institutions providing permanent care and support of objects. Many academic institutions generate significant archaeological collections over the professional lives of individual faculty members, but in many instances there is no mechanism in place to ensure adequate curation after the retirement or death of an individual. In other cases, institutions holding collections, but not viewing curation as central to their mission, decide at some point that the costs of curation are unacceptably high, or the unit caring for collections is disbanded due to the vagaries of institutional funding or vision. All result in “orphaned” collections carrying with them not only the logistical and facility costs to institutions willing to offer them a permanent home, but also significant curatorial staff time to bring them to acceptable standards.^[28] Recognizing this problem, some granting agencies and academic departments are requiring that curation arrangements be included in cultural resource project and academic research designs alike, and that necessary costs be included in project budgets.

All artifacts are not equally valuable in documenting the human past, and many scholars feel that only a portion of certain kinds of mass-produced or commonly encountered objects need to be preserved. Bricks from a historic site may reveal significant manufacturing and architectural information, but it is questionable whether every brick needs to be curated in perpetuity. Similarly, fire-cracked rock from prehistoric sites, or certain categories of undecorated body sherds from sites producing millions of such sherds in large-scale excavations, may reveal information that can be preserved from subsets of the mass of material encountered within a site. In some instances these issues are addressed through the project data recovery plan, which determines what kinds and quantities of objects are transferred to the museum or repository. In other cases, the issues must be addressed by the collecting institution, either by initially accepting only parts of a larger collection—in which case the status and future of the remaining parts of the collection are at best uncertain—or by selectively removing objects later in time. The pitfall of such removal is that innovative scholarship and future technical capabilities may transform categories of objects currently of little analytical or scholarly value into crucial pieces of evidence and accurately scrying the future is difficult for most students of the past.

Deaccessioning is the formal process by which an institution removes an object or objects from its collection. Most institutions have formal processes for deaccessioning requiring review and approval from multiple levels of authority—often more rigorous than those required to accession an object—and specific restrictions on the disposition of objects once deaccessioned. Many museums have policies allowing the sale of deaccessioned objects if the proceeds are used exclusively to acquire other objects for the collection (both as an ethical practice and because within the United States, museums are able to

treat collections as nonfinancial assets excluded from capitalization if such practices are followed),^[29] but the sale of antiquities is viewed as problematic by many within the discipline. In most cases, transfers to or exchanges with another peer institution are preferred methods of disposition. British museums have traditionally resisted deaccessioning of material, and in many parts of the world deaccessioning requires approval from appropriate governmental agencies or ministries. Within the United States, there are currently (July 2015) no guidelines under 36 CFR Part 79 to allow federal agencies or museums to deaccession and dispose of collections deemed of insufficient archaeological significance to warrant the continuation of permanent curation, although draft deaccessioning rules have been proposed by the National Park Service on multiple occasions.

Objects from looted contexts or otherwise lacking provenience generally have limited value for systematic research, but may nevertheless be works of considerable aesthetic or cultural merit. And in some instances, inherent qualities of the object may confer considerable scholarly importance on objects despite their uncertain pedigree. Site destruction in Iraq from 2003 to 2008 uncovered large numbers of cuneiform tablets whose contents have remarkable epigraphic and historical significance even if their original context cannot be reliably determined. Most archaeological organizations counsel against work with unprovenienced objects and forbid the first publication either of such objects or of research based on them, but this means that much information may be lost first through the loss of archaeological provenience, then again from loss of what information the resulting artifacts might offer. Some scholars find it difficult to reconcile that loss of information with their ethical obligations of stewardship, and question whether the validation of such finds by scholarly study will really increase rates of site destruction and looting, or further commercialize antiquities.^[30] Such questions admit to no easy answers, although most professional organizations eschew unprovenienced objects for another reason as well—in the absence of detailed provenience data, it is easy for fakes or misattributed objects to mislead the unwary and jeopardize the integrity of future work based upon the shaky foundations offered by unprovenienced antiquities. Some institutions—primarily a few larger art museums—have expressed little concern for whether or not an object is from looted contexts or even whether their purchase of such objects may spur further looting. In their view, the aesthetic merit of the object outweighs both its questionable pedigree and the consequences resulting from its acquisition. Such approaches are generally condemned by scholarly and professional organizations as unethical and inappropriate.

While accessioning of collections involves an assertion of title by the museum, title actually represents a bundle of rights that have increasingly unraveled in past decades. Under the provisions of the Native American Graves

Protection and Repatriation Act of 1990 (NAGPRA), recognized tribes and native corporations may claim objects from museums if they fall within one of four defined categories: (1) human remains; (2) associated and unassociated funerary objects; (3) sacred objects; and (4) objects of cultural patrimony.^[31] While museums may have held custody of these objects for a century or more, NAGPRA specified that museums did not receive good title to these objects because they were either inalienable or communally owned, and hence not subject to transfer of title by any individual. While NAGPRA has led to the return of many items from museums and repositories, it has also increased communication between repositories and native tribes, and spurred cooperative agreements between museums and descendant communities.

Claims by nation-states for objects looted from sites within their statutory boundaries have also increased in recent years, in part due to more aggressive cultural patrimony policies in source countries and the increased role of antiquities in nationalist ideologies and in part due to evolving legal standards for the applicability of the National Stolen Property Act (NSPA) of 1934 (as amended) to looted antiquities.^[32] Under the so-called McClain doctrine (based on the 1979 case *United States v McClain*), foreign governments may invoke the NSPA if the objects were looted after the passage of an unambiguous and generally enforced cultural patrimony law in the country of origin vesting ownership of all antiquities in the state. Prior to this, the legal standing of either individuals or governments relative to unprovenienced artifacts was unclear, as in the absence of provenience information the harmed party having standing to bring suit was difficult or impossible to establish. While these details are specific to the United States, similar problems can be cited from most other developed nations; Britain continues to wrestle with Greece's demand for the return of the Elgin marbles, France with the return of a range of ethnographic objects to Native peoples, and Germany with claims for the return of the Amarna bust of Nefertiti to Egypt.

CONCLUSION

One reason that archaeological collections are the object of such contention is that they are building blocks for national and community identities, constructs that are themselves used to construct charters for present beliefs and legitimization of ideologies through the authority that rooting them in long-standing tradition confers. "The past is full of life, eager to irritate us, provoke and insult us, tempt us to destroy or repaint it," the Czech novelist Milan Kundera once wrote, adding "the only reason people want to be masters of the future is to change the past. They are fighting for access to the laboratories where photographs are retouched and biographies and histories rewritten."^[33] Archaeological collections remain the clearest and most

immediate record of worldwide cultural achievement and social change over the broad sweep of the human career. The legal, ethical, and procedural outlook of curators of archaeological collections has changed significantly over the last decade, and there is little reason to believe that the decades to come will be any less dynamic and demanding for the stewards of the past.

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Curating Natural History Collections

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Abstract

Natural history collections are composed of objects of natural origin, most often of biological or mineral nature. These collections include organismal collections (like plant, insect, and animal collections) as well as anthropological and geological collections. Curating such collections requires establishing the longevity of the objects while maintaining their scientific utility. Maximum scientific utility is ensured by preserving with as little modification as possible the object, protecting the object against degradative processes, and managing the object information in an unambiguous and easy-to-retrieve way. While many specialists may be involved in curating larger, more active natural history collections, smaller collections are often managed by only one or two people. The goal of most natural history collections is to create and maintain a scientifically-useful research resource. The uses to which collections are put include educational, artistic, and scientific purposes. Several specific examples are given of how specimens have been used as unique informational resources for scientific research.

INTRODUCTION

The term “Natural History” refers to the study of all things natural, especially as it relates to the history of our planet and the lifestyles, features, and habits of animals and other organisms living on it. Natural history collections are those containing objects meant to assist natural historians, geologists, anthropologists, and biologists determine patterns through time. For the biologist this includes determining what species exist, where they existed, what their form is, and to the extent indicated by their form, what their habits are. For the geologist this might include describing the material composition of naturally-produced mineralized or earthen bodies, such as rocks or continents, and how these have been formed and changed through time.

Natural history collections include collections of natural, as opposed to manmade, objects. Typical objects in organismal collections include the bodies, body parts, or natural products thereof, of once living individuals. These individuals may be of literally any living species of plant or animal and are more often referred to as “specimens” (Fig. 1). Most natural history collections specialize in one natural, evolutionary group of organisms, or another, called taxa. Thus, we have herbaria, specializing in plant taxa, entomological collections specializing in insect taxa, vertebrate collections specializing in vertebrate taxa (such as birds, mammals, reptiles, fish), etc. Different taxa lend themselves to different subjects of study and different methods of research, and this, coupled with the sheer numbers of species, necessitates professional specialization on some subset of living creatures, and explains the reason for natural history collection specialization.

Anthropological collections are a special type of organismal collection because the objects contained in these collections are often only from one or relatively few species (humans, or recent prehuman primate species), and often include significant holdings of nonbody objects (such as tools, clothes, or pottery).

Another common deviation from the rule of taxonomic specialization are paleontological collections, which tend to include diverse groups of organisms from many different taxa (i.e., plants, insects, invertebrates, and vertebrates), but which are united by their fossilized form. The mineralized form determines the kind of research that can be done on fossils, and the preservational needs of the objects in the collection. Thus, paleontology’s departure from other natural history collections is caused by practical considerations—fossilized objects have shared physical features, and therefore break off naturally as objects with similar management needs.

Despite primarily being defined by the kinds of their objects, natural history collections also tend to have shared missions, goals, management needs, professionals, and activities. The mission in particular is somewhat distinctive from that of other types of collections. The mission of natural history collections is to ensure the long-term persistence of data-rich specimens specifically to facilitate future scientific studies. Given that the ultimate goal of natural history collections is to support the “current and anticipated needs of biological and/or geological science,” the standard activities, and practices conducted in these collections may change through time as different technologies become available, and different scientific questions become of interest.

The orientation toward repeatable science also leads to the critical importance of data associated with natural

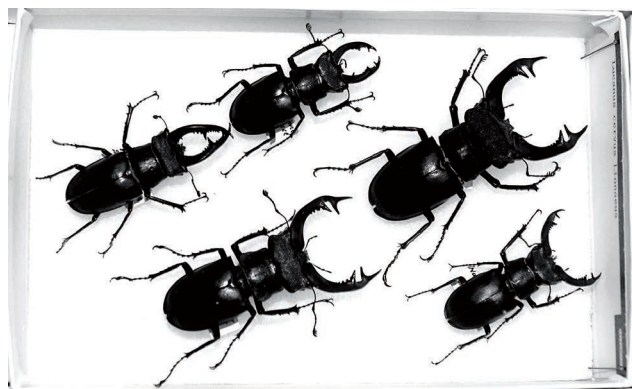


Fig. 1 Sample natural history collection objects. A series of European stag beetles, *Lucanus cervus*, illustrates how animal specimens are often housed dry in unit trays with labels affixed. **Source:** Photo courtesy of James Liebherr, Cornell University Insect Collection.

history specimens. Since most natural history research involves fine-scaled measurement and placement of objects geographically or temporally, when and where an object was collected is critical contextual information, and is critical for the utility of a given specimen for most scientific studies. In the end, nearly as much time can be spent gathering and managing the data associated with physical specimens as is spent acquiring and managing the specimens themselves.

The following discussion is broken into three sections, each designed to add complementary perspective on what natural history collection are and how they function. The first part describes natural history collections from the perspective of bringing a new object into the collection and following it through the various activities involved in formally incorporating it into the collection. Part II views collections from a more human, managerial point of view, considering who works in collections and what their respective roles are. Finally, Part III reviews a small series of published scientific studies that together demonstrate how natural history collections are used to contribute to our understanding of the natural world. These examples hopefully serve to emphasize how science guides the fundamental principles behind the development and maintenance of natural history collections.

These discussions are structured around my experience curating organismal, specifically vertebrate, collections. However, it is important to acknowledge that different types of collection have their own specific traditions, needs, and practices.

CURATING COLLECTIONS I: THE SPECIMEN POINT OF VIEW

Below we explore the multifaceted activities that comprise curating a natural history collection. One of the most

tangible ways to understand what is involved in curating natural history collections is to follow a specimen through the process of collection, identification, preparation (the preliminary act of preservation), accession, cataloging, installation, long-term conservation, monitoring, and preservation, as well as administration of a specimen for use.

Collecting and Preparing

The “specimen” to which natural history curators constantly refer is typically the body, or body part, of an individual (Fig. 2). Occasionally, it may be a product of an individual (such as a bird’s nest), the product of a group of individuals (such as a bees’ nest), or be multi-individual (such as a clutch of eggs or a colonial organism), or any of a number of other, nonorganic, natural objects (crystals and rocks, for instance). For the purposes of this discussion we will imagine the body of a single individual organism.

The methods used to collect individuals depend on the type of organism. Collecting may involve simply picking or digging the individual up (as in fossils, plants, or some insects), or trapping (insects, fish, reptiles), netting (fish, birds, and bats), shooting (birds and mammals), or



Fig. 2 A natural history collection’s type specimen. These three images are from one individual alcohol-preserved *Synodontis acanthoperca*, CU 89005 (this new species of catfish has no common name).

Source: Photo courtesy of Thomas Vigliotta, Cornell University Museum of Vertebrates.

salvaging (finding dead) the specimen. Collecting is done to minimize damage to the specimen, and to maximize data collected with the specimen. Data can include: (1) minimally, when and where the specimen was collected; (2) the immediate habitat and social environment the specimen was collected in; and (3) any potentially relevant information that is present at the time of collection that will not be ascertainable from the specimen directly later on. The color of living tissues is a good example of a feature that often changes shortly after death, and is often impractical or impossible to preserve. Audio or video recordings, photographs, or notes can capture this associated specimen data.

For some organisms, preparation can happen at the time of collection (plants, insects, fish), in other organisms preparation may be labor intensive, in which case it is more efficient to separate the process of collection from the process of preparation.

For any given taxa, several “preparation types” are possible. Dry-preserved and fluid-preserved preparations are the most common. The basic principle behind dry preservation techniques is facilitating dehydration of the internal parts of the organism to retain the appearance of the external features. Thus, plant specimens can be dried to preserve vegetative patterns. Animal specimens may need to have their internal parts removed before being dried to preserve the exoskeleton, skin, and fur or feathers. Drying prevents bacteria-driven rot or decay, and hinders molding, which allows the external features—often already dry—to remain unmodified and available for study (Fig. 3).

Alternatively, specimens can be preserved in fluid. Fluid preparations prevent decay either by “fixing” or chemically altering the tissue so that it is un-degradable by bacteria (i.e., formalin fixation), or, again, by dehydrating the specimen by removing the water while still keeping it in fluid (alcohol preservation, usually ethanol or isopropanol). These preparations are ideal for

organisms with moist or thin skins (fish, reptiles and amphibians, and many aquatic invertebrates) and have the added benefit of keeping the internal organs, tissues, and structures intact. Fluid preservations often compromise the external appearance by wetting structures (feathers and fur) and colors of integument are often lost or modified.

The primary goal of all preparation techniques is to establish the longevity of the specimen and specific targeted features (determined by the method of preservation). Further efforts are made to standardize as much as possible the posture or shape of the individual to maximize information retrieval and ease of storage, and minimize likelihood of handling damage. Care is taken to minimize physical and chemical manipulation of the specimen with the goal of reducing the risk of removing or destroying potentially useful information.

Accessioning, Cataloging, and Installing

Once a specimen has been prepared, the next phase of curation is the management and long-term preservation of the collection objects and their data. Accessioning is the first step in the formal admittance of the specimen to the collection. Accessioning is a paper or computer-based process whereby a group of specimens entering the collection are recognized as a group united by their origin. The origin of the specimens may be as official as a collecting event or expedition in which a group of people travel to a specific place to collect a set of specimens, or as informal as the contents of a wildlife rehabilitator’s freezer. Each accession is given a unique identifier, and correspondences, contact information, any associated specimen data, any applicable permits, etc. are held in a folder for each accession.

Determination, or identification and characterization, of a specimen is attempted before cataloging. In some cases this is a trivially easy task, as specimens coming into collections are often representatives of common and/or



Fig. 3 Dry specimens with external features preserved. Here four *Euplectes ardens* specimens from the Cornell University Museum of Vertebrates are seen as they are in the collection, with plumage and external morphology available for study.

Source: Photo courtesy of Kim Bostwick, Cornell University Museum of Vertebrates.

easy to identify species. However, in some cases, especially in non-vertebrate groups of animals, determining the species identity of a specimen can be difficult, time consuming, and/or impossible. In these cases, the collectors and/or collection staff do their best to make as exact an identification as possible. Redeterminations can be done later when more information is available, or when an expert in a given group is available to examine the specimens.

Cataloging each of the individual specimens in an accession is the next step and achieves multiple critical functions. It results in the assignment of a unique, institution and collection-specific identifier (often a number) that will be used to identify the specimen for the rest of its term in the collection. Cataloging also results in the capture and standardization of the specimen data in a way that allows rapid and efficient generation of labels, reports, loan forms, etc. for any future activity related to that specimen. Once cataloged, a specimen may finally be considered a “curated” specimen of the collection.

Once cataloged, the specimen is ready to be installed into the collection itself. Collections are organized by species, with more closely related species being located near one another, or alternatively, alphabetically by species names according to major taxonomic groups. Within species, specimens are usually organized according to subspecies, and/or geographic locality of the specimen, and/or date information (Fig. 3). The practical reason for arrangement by species is size/preparation uniformity, and the nature of human inquiry that often seeks direct comparison of closely related things.

Long-Term Care: Housing and Monitoring

Once installed into the collection, specimen curation involves protecting the specimens from the degradative effects of their environments. Long-term care starts with the housing circumstances of the specimens. The building and rooms where the specimens are housed are literally and figuratively the building blocks upon which good curation rests. Ideally, the building will be designed or chosen as the first line of defense to protect the collections from light, water, excessive humidity and temperature fluctuations, and pests (usually insect, fungal, or rodent). This usually amounts to a tightly enclosed space with few windows, physically barricaded from any noncollection spaces (such as offices or hallways), with environmental controls.

Of perhaps equal or greater concern than the rooms in which specimens are housed, is the museum cabinetry or furniture into which specimens are placed. This furniture is chosen to further mitigate the same destructive forces the room is; light, humidity fluctuation, and pests, and to additionally protect from airborne dust particles and physical damage from exposure. Thus, in the case of dry specimens, cabinetry is sealed tightly against dermestid beetles

(a family of carpet beetles). In the case of fluid specimens, the specimens are housed in jars filled to their sealed tops with alcohol.

Inside cases, the materials directly surrounding the specimens are also critically important: buffered papers, archival ink, and inert building materials are used to minimize specimen deterioration. Acidic and basic materials can chemically alter the sensitive organic compounds of most organisms and are generally avoided.

Once a stable environment is established, from the materials touching the specimen most immediately, through to the rooms housing the collection, the last curatorial task is monitoring. Routine examination of specimens is required to ensure that the protective measures have not been compromised and to keep chaotic forces from reducing the high level of order that a specimen collection represents into disarray and deterioration.

Administering the Use of Specimens

Natural history collections exist to be used, and often use is the single greatest source of damage to collections. Thus, the goal of longevity and the mission of supporting research and education must be balanced.

Use has become more and more about using the data associated with the collections. Information requests use the data gathered in the database, and are strengthened by having specimens to “voucher,” or verify by proxy, their legitimacy.

Other uses involve the direct examination of specimens for research. Some research aspires to describe patterns of diversity, and simply involves examining specimens visually, or with simple measuring devices such as calipers, spectrophotometers, etc. Other research requires “destructive sampling.” In these cases use of the specimen involves a procedure that will irreversibly alter the specimen. This may be dissection of a fluid-preserved specimen, or a subsampling of tissues, such as skin or feathers. For destructive sampling, the value of the specimen as determined by its uniqueness or commonness, or overall physical or data quality, is weighted against the value or significance of the use (research vs. teaching), and against how destructive the procedure will be. Severely destructive sampling of a valuable specimen requires a more stringent justification than minor sampling of a common or data-less specimen. Whether or not to allow destructive sampling is a judgment usually made on a case-by-case basis by the collection’s curator.

Data and Database Management

Increasingly, database management has become an important part of specimen curation. Individual collections manage their own data using either off-the-shelf generic database software or software customized for use by natural history collections. These databases allow the creation

of electronic collection management tools for creating reports, labels, and for answering specimen queries quickly and efficiently. Collections can also make their specimen data, or some subset of it, available over the internet for general queries regarding collection holdings or data associated with specimens. Several initiatives are allowing the federation of collections data from numerous institutions. This allows the specimen data from multiple institutions to be searchable from a single portal, and mapping tools are increasingly being used to visualize geographic ranges using data from the collective natural history collection's holdings.

CURATING COLLECTIONS II: THE ADMINISTRATIVE POINT OF VIEW

Another useful way to break down these and other activities related to curating natural history collections is to consider each of the professionals, amateurs, and students who complete the tasks described above. The discussion that follows describes one commonly conceived division of the titles and divisions of responsibilities used in natural history collections (that most familiar to me), but it is important to be aware that other institutions may have different titles for the same roles, or a different breakdown of how duties are divided and shared. Nonetheless, natural history collections may have any of a number of the following people associated with them: curators, collection managers, collectors, preparators, archivists, conservators, student assistants, and volunteers. Alternatively, curation may be done by one or very few people. Either way, between them, these people strive ensure the above described curatorial activities are being done, and being done well.

Curator

Given that natural history collections are developed as a resource for scientists, the highest administrative role within a natural history collection is held by the curator. The curator is most often a scientist who uses specimens in his or her own research, has experience in scientific collections, and also has a broad and deep knowledge about the diversity and biology of the taxa held in the collection he or she is responsible for. Because the practice of science changes so rapidly, a curator must be in touch with how specimens are likely to be used, and a practicing scientist is in the best position for maintaining the appropriate perspective for guiding curatorial decisions and practices.

Like all professionals in natural history collections, the curator typically performs many activities. These can be organized into several sets of tasks. I here consider these as fulfilling each of 4 roles, that of: (1) a professional

“taxologist”; (2) a practicing scientist; (3) an educator; and (4) an administrator.

In the role of the taxologist, the curator acts as the knowledgeable specialist about the various biological features and diversity of the group of plants or animals in the collection curated. As such, he or she is best equipped to strategize about collections growth, selecting the species and specimens of greatest interest for addition to the collection. The curator's active place in the larger scientific community allows him or her the social and opportunity-driven resources to “acquire” such specimens. Once acquired, judgment for “identifying” and “organizing” the specimens using the most up to date information is critical.

As a practicing scientist the curator has a unique perspective on what specimen features are important to preserve to maintain a specimen's scientific usefulness. For instance, in Ornithology, the depth of the bill is a common measure oftentimes used to distinguish among species or populations of birds. Thus, the curator will make sure newly trained preparators pay special attention to make the correct alignment of the mandibles and ensure complete closure of the mouth during specimen preparation.

The educational and administrative roles of a curator involve less direct interaction with the collections themselves. In their educational roles, curators often give talks or seminars, guide tours, or otherwise host activities meant to promote not only knowledge in different biological areas but also the value of collections themselves. This may or may not involve the production of exhibits.

In addition to overseeing the other members of the curatorial team, one of the primarily administrative ways in which a curator curates his or her natural history collection may be through grant writing and planning to enhance the environment the specimens are housed in, or expand the collections themselves. This can include everything from reorganization of the collection according to modern ideas about organismal relationships, to the purchase of new specimen cabinetry, to planning new collection building solutions, or the funding and arrangement of a major collecting expedition.

Finally, the last major administrative contribution of the curator is the negotiation of the terms of use of specimens. Keeping in mind that the mission of the collection is to serve science, and use always entails the risk of specimen damage, immediate and future use needs must be balanced by judging potential specimen damage or consumption against scientific merit of a given project, and the rarity or uniqueness of the specimen in question.

Collection Manager

The Collection Manager is the central figure in the day-to-day and hands-on aspects of the collections. His or her duties include technical, for lack of a better word “custodial,” managerial, and educational roles.

On a daily basis a collection manager will be accessioning specimens, preparing them, cataloging them for installation into the collection, and/or overseeing student or volunteer assistants completing these activities. He or she will also be monitoring and ordering curatorial materials necessary for running the collection.

The collection manager has a suite of more irregular duties as well. For instance, collecting tends to occur in sporadic bouts, since it must be conducted outside the office and usually requires some planning. There are meta-specimen responsibilities as well such as making sure the collection labels are accurate, and also verifying the long-term protective measures being taken, in the collection are effective. The collection manager usually removes specimens from the collections to display for visiting classes, or to fill out and mail the loans approved by the curator.

Finally, one major and increasingly complex role assumed by the collection manager is the management of the various permits needed to maintain a functional collection and to allow legal collection and transport of the plants and/or animals of interest. Depending on the types of organisms held in the collection, this may indeed be a significant sink of time and energy.

Specialists: Collectors, Preparators, Archivists, and Conservators

Occasionally individuals are associated with natural history collections whose sole role is to collect and prepare new specimens for addition to the collection. These are often loose arrangements or affiliations of mutual benefit to the collecting/preparing individuals and the institution in which they deposit their materials. The donating individuals get an institutional affiliation, and the recipient collection gets new specimens for little cost. This arrangement was more common historically when large-scale collecting was more commonplace and full-time collecting was a viable profession.

Additionally, some larger museums, when they house many individual natural history collections, hire professional archivists or conservators whose job it is to research the practices and materials used within collections. Their goal is to make knowledge-based recommendations that will increase the longevity of the collection's specimens.

Assistants: Students, Interns, and Volunteers

Much of the work involved with curating collections is interesting and, with a little training, entirely doable by novices. This means that student trainees, interns, and volunteers can and do contribute significantly to the hands-on work done to curate natural history collections. From typing and printing labels, to preparing, installing, and even cataloging specimens, these collections assistants often account for a significant proportion of the

curatorial man-hours required to maintain a well-curated natural history collection.

CURATING COLLECTIONS III: USES, SIGNIFICANCE, AND VALUE

As time has passed the primary uses, significance, and value of natural history collections has expanded. In some cases, collections are still working tirelessly on the original goals of natural history collections; documenting the diversity of species on the planet, where they live, and what they look like. For instance, Fig. 2 shows the “holotype,” or the original species-name-bearing individual of *Synodontis acanthoperca* on which the species' original description was wholly or partially based. Botanical and invertebrate collections in particular still occupy this unique, critical role in the foundation-building tasks of alpha taxonomic descriptions and inventories.

In all organismal natural history collections now—including the relatively more well-known vertebrate groups, like birds and mammals—data and specimens are being used in new ways for ecological and evolutionary studies asking new kinds of questions. Below is a small set of published scientific studies using, in this case, bird skins, in nontraditional ways. These examples illustrate new uses of natural history collection specimens.

Using Specimens for Research: Documenting Changes in . . . Reproductive Physiology

When Peregrine Falcons' numbers were crashing in the 1950s, there were anecdotal observations of crushed eggs being found in nests, but it was difficult to know the significance of these observations. In 1968, a paper was published in *Science* describing the results of a study comparing the eggshell widths of 1729 birds' eggs.^[1] The eggs, held in 39 different natural history collections, were collected across nearly 80 years of time, from six different species from all over the United States. For 57 years, the average weight and shell width of Peregrine Falcons in California were constant, then, between 1947 and 1952, eggshell weights dropped precipitously by 18.9%. Similar patterns were found in Osprey eggs, Bald Eagle eggs, and Peregrines from other parts of the United States. Where Peregrines had already been extirpated in the East, egg shells “had become” up to 26% thinner. Documentation of this dramatic change, and being able to pin it down to a very specific time period, was critical in pinning down the cause of the problem; the use of chlorinated hydrocarbons like DDT became widespread in the United States in 1946. This study became a classic example of how natural history specimens could contribute to our understanding of how animals were changing, and why.

Population Structure

A recent study of the federally endangered Marbled Murrelet used a method called age-ratio analysis to determine how the proportion of juvenile to adult birds varied from year to year.^[2] Juveniles have different plumages from adults, and analysis of 170 Marbled Murrelet specimens collected off the coast of California between 1892 and 1922 indicated proportionally more young birds than adults. This information allowed inference of what the rates of reproduction and adult survivorship were around the turn of the century. The researchers discovered that the rates of adult survivorship are the same now as they were then. However, the rates of reproduction have dropped eight to nine fold; the relative number of young individuals have decreased dramatically in these birds, and this is likely responsible for the declining populations of Marbled Murrelets.

Trophic Level of a Predator

The relative proportion of Carbon and Nitrogen isotopes in feathers can tell us about what a bird was eating at the time it was growing its feathers, and therefore how “high” it feeds on the food chain. Another study on Marbled Murrelets using isotopes extracted from the feathers of museum specimens has shown that historically, young Murrelets were able to exist as higher-level predators in their environments then they can now.^[3] Now they appear to be subsisting more on smaller prey items than on the sardine fishes they used to flourish on, before overfishing caused dramatic declines in sardine and other small fishes.

Symmetry and Ecological Stress

In animals where the right and left sides are mirror images of each other, like ourselves, high levels of symmetry are achieved and maintained throughout development. However, in more stressful developmental circumstances, we are more likely to have small deviations from perfect symmetry. In this way, one might determine if a group of animals is “stressed” by carefully measuring the degree of symmetry of its individuals. One study compared the lengths of the right and left leg bones in 133 specimens of six species of birds collected in an unbroken, undisturbed forest in Kenya between 1934 and 1948, with the same species netted and measured in the same forest plots in 1996–1998, after the forest had become highly fragmented and degraded. The contemporary birds in the most degraded plots of forest were four to seven times less symmetrical than their 1940s counterparts from museums, indicating although the species were still surviving in these forests, they may well be living life on “the edge.”^[4]

Genetic Diversity

A suite of studies have been published using DNA extracted from the toes of natural history specimens to determine the genetic diversity of bird populations decades ago and compare them with populations today.^[5,6] Prairie Chickens in particular have been the subjects of studies that have shown allelic diversity is dropping in these populations, approaching levels reached by Heath Hens prior to their extinction.^[7] These studies have further shown that genetic studies of modern populations alone cannot always accurately infer historical levels of diversity.^[8]

Ecological Niche during Speciation

Not all studies of natural history specimens focus on changes being wrought by man and occurring in the last century. Insight to far more general processes, such as speciation, can be obtained from specimens as well. This is highlighted in a study where museum specimen data for mammals, birds, and butterflies was used to examine sister-species pairs for patterns of similarity.^[9] “Sister species” are species who are each other’s closest relatives. As each other’s closest relatives, sister species tell us something about what changed when speciation happened. One model of speciation suggests that species become adapted to different environments and that is what causes or drives speciation. If this is true, we would expect the habitats of sister species to be demonstrably different in some ecological factor. Using sophisticated artificial intelligence algorithms, with detailed mapping of environmental parameters and massive amounts of specimen data drawn from multiple natural history collections, scientists were able to show that most often, sister species lived in environments that were completely co-habitable to one another, with no sign of ecological separation. Using this result they concluded in many circumstances it is simply vicariance—or being physically separated by a barrier for some period of time—and nonadaptive forces that drive speciation in many species.

CONCLUSIONS

Natural history collections are as diverse as the natural objects curated in them, but share the function and goal of advancing scientific research. The curatorial traditions and practices within any given collection are determined by the nature of the objects curated, and guided by the research questions likely to be asked. A diversity of professionals can share the various curatorial duties, or in the case of small or less-active collections, a single person may aspire to manage the collections. In any case, the value of collections’ objects tend to increase with time as they become increasingly rare vouchers of individuals from places and times that have changed or ceased to exist.

The examples discussed in Part III serve to highlight the diversity of ways in which even one type of collection (bird dry skins) are being used for science. Any type of natural history collection could generate an equal list of diverse and important scientific uses. It is worth noting that for most of these studies, the specimens used were collected decades before DNA, or stable isotopes, fluctuating asymmetry, etc., were discovered as research tools, and decades before pesticides or habitat changes like overfishing existed to have their effects studied. Thus, no framework for asking the questions answered in these studies existed at the time the specimens were collected. This highlights the unique value of natural history collections as archives of information, and this in turn guides the principles and practices therein.

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Custody and Chain of Custody

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Abstract

Custody, the holding of records and objects in archives and museums for security and preservation reasons, has been a fundamental principle of collections management in those institutions. Having an unbroken chain of custody, that is, being able to accurately identify all the individuals and organizations that have owned these items since they were created, has been considered as an essential evidence of the authenticity of the object and supports the legality of its transfer from one owner to the next. However, legal custody does not necessarily imply legal ownership. In the late twentieth century, the usefulness of custody as a management principle has been challenged in museums by repatriation claims and in archival collections by replevin and the need to both preserve the authenticity and integrity of electronic records and to guarantee access to both paper and electronic records over time.

INTRODUCTION

Custody, the act of holding archival records and museum artifacts for purposes of preservation and security, has long been an important principle in the collection management practices of both archives and museums. Traditional definitions of custody combine physical possession with the assumption of appropriate care of those collections. Having custody of an object also implies controlling access to it. Public museums and archives typically operate under the mandate that their collections are held in trust for the public good. The rationale for maintaining such public collections of objects and documents is to preserve the authentic evidence of the cultural and artistic diversity of human endeavor and to protect those materials from damage or loss. Access to these collections is considered a public benefit, an attitude that museum historians trace to the Enlightenment. However, in some collections, preservation and access can be seen as mutually incompatible goals, as even careful handling can place fragile materials at risk. Such tensions can result in restricted access, although such restrictions can also be based on other considerations, such as the terms of the donor agreement or institutional policy on access to intellectually rather than physically sensitive materials.

With the increasing professionalism of museums and archives, codes of ethics have been developed that support standard practices of collection, acquisition, preservation, and interpretation. Awareness of these codes of ethics and their application in collections holding cultural heritage materials is critical to a consideration of custody as they reflect changing attitudes toward their validity of claims to cultural property, particularly that owned by indigenous, colonized, or conquered peoples. Writing on this change of focus, Brown notes that prior to the late 1980s “museum curators, archivists, and anthropologists had

rarely worried about whether the information they collected and managed should be treated as someone else’s property.”^[1]

One widely cited ethics code that deals with the acquisition and care of collections is that of the International Council of Museums (ICOM), which notes that “Museums that maintain collections hold them in trust for the benefit of society and its development.” The commentary on this ethical standard specifically states that collections should not be acquired without an assurance of valid title or otherwise illegally acquired. Section 2.3 additionally establishes the value of securing and maintaining provenance information, noting that “Due diligence in this regard should establish the full history of the item from discovery or production.”^[2]

The ICOM Code of Ethics additionally identifies international legislation designed to protect cultural heritage materials, including the 1970 United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property. With over 100 signatories, this legislation and its associated national implementations, such as the U.S. Convention on Cultural Property Implementation Act of 1983, form the basis for the international control of import restrictions of cultural objects. While much of the international legislation related to establishing ownership and custody of collections brought into museums and archives deals with art objects, natural history collections are also covered by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), passed in 1973 and implemented in the United States through the U.S. Endangered Species Act. CITES protects species threatened by international trade by requiring permits issued by the source country for the export of CITES-listed species.

Within the museum community, provenance research documents an object's chain of custody, accounting for the complete history of ownership of the object prior to its arrival at the museum. Anthropological collections use the term *provenience* to define the object's specific geographic location of origin; natural history collections use the term *locality* to identify the specific geographic location where the organism was collected. Documentation can take the form of field notes, photographs, site plans, collection permits, correspondence with donors and dealers, bills of sale or deeds of gift or conservation notes, all of which may be housed separately from the objects, often in the institution's archives or registrar's files. Within the archival community, the term *provenance*, or the *respect des fonds*, refers to the principle that records of different origins are to be kept separate in order to preserve their different contexts.

Once in the custody of the museum, it was assumed that the object would be protected against any further undocumented alteration or damage. The goal of museum provenance research was to identify those previous owners and confirm the circumstances of the transfer of ownership.

In many cases, identification of that sequence of owners substantiates the identity of the object itself, by locating it in specific historical times and places. A study of an object's provenance can also be used to invalidate the claims of a museum's ownership of the item, if sufficient evidence can be found to indicate that the object was obtained illegally. Since the 1998 report of the Association of Art Museum Directors Task Force on the Spoliation of Art during the Nazi Era, modern art museum provenance research has been primarily focused on the restitution of artworks confiscated during the Nazi Era (1933–1945).^[3] This interest in provenance research, with its emphasis on identifying gaps in the chain of custody or items that have passed through the hands of “red-flag” dealers, those who were known to have been in collusion with the Nazis, has resulted in an increase of publicly available information about the provenance of artworks. Many museums have contributed extensive provenance information to the collaborative Nazi-Era Provenance Internet Portal Project sponsored by the American Association of Museums.^[4]

The validity of American museums' stewardship of objects of cultural patrimony of Native Americans was addressed by the 1990 U.S. law, the Native American Graves Protection and Repatriation Act (NAGPRA). The purpose of this act was to protect Indian burial sites from further looting and provides a legal mechanism by which descendants of culturally affiliated tribes could request the return of human remains and sacred objects from the collections of federally funded U.S. museums. The ongoing debate has focused on the potential loss of access to these objects for scientific study versus the return of illegally obtained objects, many considered sacred or communal

property and therefore not transferable outside the tribe. However, the number of objects actually repatriated has been less than what critics of the law feared, with many tribes choosing to leave these objects in the custody of the museums, although sometimes imposing more specific requirements on their storage, limiting public access to these objects, and restricting their use in exhibitions.^[5]

CUSTODIAL HISTORY AND POST-CUSTODIAL APPROACHES

Donors to both archives and museums often believe that their contributions will be maintained in perpetuity under controlled circumstances, reinforcing the assumption that such custody confers lasting value on the object or collection of documents. The term “museum quality” implies that these specific items are recognized as highly representative, particularly fine examples, or otherwise worthy of special distinction and care because of their association with notable individuals or organizations. In the archives community, the term *custodial history* is used to describe the record of the list of successive organizations or individuals who have held these materials since their creation and can refer to both physical and intellectual possession. Institutional archives, including governmental records, are those records identified as having lasting value to provide accountability for the organization's actions toward the community it serves or for evidence of the business process or transactions, but are not in active use by the creators of the records. The practice of moving these records from the creating offices into the archives frees space for the records documenting current activities, and assures the safety and continuing availability of those materials designated as archival by protecting them against damage and unconsidered dispersal. Historical theories of custody in archives are based on the writings of European and British archivists responsible for limited numbers of decentralized governmental records dealing with land ownership and taxation based on property rights. However, with an increasing quantity of the business processes of organizations created and maintained electronically, a post-custodial theory of archives has emerged.

Recognizing the ephemeral nature of electronic records, post-custodial archivists believe that they cannot wait for the deposit of the records as delivered by the creating agency, but must be proactive, becoming involved with the agency from the earliest stages of records creation, ideally even before the record is created, in order to advise on which records are to be maintained permanently and to determine how best to capture the context in which the records were created and used. Solutions posed by the post-custodialists include leaving the records identified as having archival value in the offices and computer systems of the creating agencies rather than transferring them into the separate physical custody of the

archives. The significant difference of post-custodial theory is that the responsibility of the archivist is imbedded in the ongoing management of the records of the organization rather than being an external custodian of records housed in a centralized repository to which they are delivered by the creator. Opponents to this distributed custody approach argue that this practice is counter to the traditional responsibilities of archivists and could lead to unauthorized removal or alteration of the records. Supporters of this approach state that it is impossible to maintain electronic records outside of the social and software context of the creating business practice. Post-custodial theories of archives management require a more proactive involvement of archivists in the design of information systems and their deployment and maintenance through institutional retention policies.

In these professions in which the term custody is employed, there is an expectation that objects held in custody will be protected and preserved for the common good, but not necessarily owned by the museum or archives. The lack of physicality of electronic records presents additional preservation concerns as well as the ongoing management of intellectual property.

CUSTODY AS APPLIED TO MUSEUMS

Museums often refer to their responsibility for objects in their collection as stewardship, which implies the preventative care of custody as well as the responsibility for holding the materials in trust for the public good. The American Association of Museum's 2000 Code of Ethics contains the following statement on the acquisition and retention of collections.

The distinctive character of museum ethics derives from the ownership, care, and use of objects, specimens, and living collections representing the world's natural and cultural common wealth. This stewardship of collections entails the highest public trust and carries with it the presumption of rightful ownership, permanence, care, documentation, accessibility, and responsible disposal.^[6]

The apparent permanence of the museum's custody contributes significantly to the public trust in museums. This trust can be undermined by a lack of public understanding of the process of deaccessioning, when a museum chooses to reverse its original decision to accept an object into its permanent collection. While refinements are made in a museum's collecting policy, as well as the inability of individual museums to adequately care for certain types of collections do present legitimate reasons to deaccession items, the process of deaccessioning often provokes negative public comment, which can damage the museum's position as an organization deserving of the public trust. Removal of an object from the museum's custody is seen

as devaluing that object and, by association, the donor.^[7] Some commentators identify the increase in media and public concern about museum deaccessioning practices, beginning with the highly publicized deaccessions from the Metropolitan Museum in New York in the 1970s, with an increased demand for "access to records documenting the history of ownership of museum collections [which] also grew as the right of museums to continue to have custody over certain objects was challenged."^[8]

Ideally, the legal status of the transfer of ownership and its implications for the legality of ownership are documented in carefully written and retained donor agreements and accession records. While museum curators, directors, and boards may be involved in the acquisition of museum objects and subsequently generate records pertaining to that transaction, those records are typically maintained by the museum's registrar.^[9] As these records may be added to, and amended over, the lifetime of the object in the museum and may even outlast the object itself, these collection records are considered continuously current and often remain in curatorial or departmental offices rather than being removed to the separate custody and control of the museum's archives.

CHALLENGES TO CUSTODY IN MUSEUMS: REPATRIATION REQUESTS

In the United States in the late twentieth century, a growing number of Native Americans had been approaching museums, requesting the removal of objects of cultural significance and human remains from museum exhibitions and research collections and petitioning for the return of these materials to the custody of the associated tribes. Many of these materials were collected a century earlier in the belief that these tribal communities were in decline and would require an accelerated mode of collecting similar to that of salvage archaeology in which extreme measures are taken to collect in bulk when a cultural landscape is in immediate danger of destruction. The apparent need for speed, the market value of these objects of material culture, and the lingering belief that these indigenous peoples were uncivilized and primitive led to abuses that further threatened the continuation of these communities. Passed in 1990, the NAGPRA covers all U.S. museums receiving federal funds, with the Smithsonian Institution's United States National Museum of the American Indian covered under an equivalent legislation, the 1989 National Museum of the American Indian Act. The highly structured process of repatriation mandated by NAGPRA, which puts the burden of discovering documentation on the holding museum rather than the claimants, recognizes that legal custody does not necessarily imply legal ownership. While the law was intended to provide for the repatriation of material acquired by museums in the recent past, the most contested application of the law was the

disposition of the skeleton discovered in Kennewick, Washington, in 1996, now dated to be over 9000 years old. A number of local tribes claimed the skeleton for reburial, stating that they were descendants of tribes that had occupied the area in the past, and were countered by a group of anthropologists and archaeologists who wished to maintain the skeleton's availability for continued scientific study.^[10,11]

While there is a formal process of U.S. law governing the return of human remains and sacred objects to the tribal descendants, there are not similarly clear or well-defined laws addressing the return of antiquities, even when there is strong evidence that they had been illegally acquired. Arguments that the preservation of cultural treasures taken as the spoils of war was better handled by the conquering nation date back to the Napoleonic campaigns, although many of the objects exhibited in the Louvre were returned to the countries from which they were despoiled under the terms of the 1815 Congress of Vienna. The international agreement that forms the basis for modern repatriation requests of objects of cultural patrimony is the 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property.^[12]

Demands for the return of the "Elgin Marbles," marble sculptures removed from the Parthenon in Athens, Greece, between 1799 and 1803 by Thomas Bruce, seventh earl of Elgin while he was the British ambassador to Constantinople and then sold to the British Museum in 1816, are the most highly publicized of these international museum custody battles. Preservation was one of the justifications for the removal of these artifacts from their original locations and Elgin's removal of these sculptural elements can be seen as an early example of salvage archaeology. Although Elgin had paid for the privilege of removing the sculpture through negotiations with the local Ottoman occupying force, popular outcry addressing the cultural dislocation began almost immediately with their arrival in London with satirical references in several poems by English poet Lord Byron.

While the number of claims for the return of cultural property is increasing, particularly in the area of antiquities, some have been resolved to the satisfaction of the claimants, such as the return of such objects as the Euphronios Krater. Negotiations were concluded in 2006 for the Metropolitan Museum's return of this sixth century BC bowl signed by the Greek painter Euphronios to the Republic of Italy in 2008 as part of its cultural heritage. As noted in a recent overview of cultural property laws, "The debate is over not only who owns the past, but in whose hands the stewardship of cultural heritage should lie."^[13] Some archaeologists claim that more restrictive import and export laws will make the black market less profitable and stem the tide of cultural heritage items from artifact-rich but resource-poor nations.

CUSTODY AS APPLIED TO ARCHIVES

Historical theories of custody in archives are based on the writings of European and British archivists responsible for decentralized governmental records dealing with land ownership and taxation based on property rights. Both the 1898 publication of a practical manual on the care of archives by three Dutch archivists and the 1922 *Manual of Archive Administration* by British archivist Hilary Jenkinson address the difficulties of maintaining the authenticity of archival collections accumulated in a number of locations without a formally documented transfer of custody. Jenkinson worked his entire professional career in the Public Records Office in London, the repository for governmental records extending back into the medieval period, and established for the purpose of centralizing British governmental records. Jenkinson "connected authenticity with continuous custody of archives by their creator and its legitimate successors. The argument is that the creating body has an interest in preserving its records free from any tampering that would affect their authenticity, of being what they seem to be."^[14]

In his 1954 *Modern Archives: Principles and Techniques*, based on his experience in the United States National Archives, American archivist Theodore Schellenberg rejected the concept of continuous custody required by Jenkinson on the basis of the complexity of the process of the production of modern records and the impracticability of guaranteeing an unbroken line of continuous custody when records were produced by a number of different divisions of an organization in different locations. Nonetheless, Schellenberg believed that once records had crossed the threshold of the archives, they needed to stay in the custody of the archives in order to guarantee their integrity following their arrival.

With the proliferation of paper records and the technological complexity of electronic records, American archivist F. Gerald Ham recommended a post-custodial approach in his 1981 "Archival Strategies for the Post-Custodial Era," in which the archivist's role was less than that of a keeper concerned with the physical custody of records and more a proactive manager of records, taking on advisory responsibilities toward the creators of records. Both Canadian and Australian archivists have explored various aspects of post-custodial theories as applied to the records of business and government, wanting to assure both access and accountability for local records of government and business.

Physical custody of electronic records is a meaningless concept without the maintenance of the supporting environment of software and business practice, hence the development of a theory of distributed custody, in which records may remain with the creating agency, but with guidance provided by archivists as to their disposition and long-term maintenance. Various post-custodial

theories providing solutions to the problems of custody of archival records in electronic form include distributed custody, or leaving those records in the hands of their creators, with the archives providing guidance on their management and serving as a last resort.^[15] (For an extended discussion of how the inter-relation of custody and access was applied to the archival records of the Virgin Islands.)^[16] New skills for the archivists now include digital curation, which requires that archivists take responsibility for maintaining both the context and content of digital information, focusing “not just on preserving digital entities but on keeping them functional, supporting their continuous annotation and maintaining their fitness for purpose.”^[17]

Control of records, regardless of their form, is a means of protecting them and the basis for assurances of continuing authenticity. Post-custodial approaches do not mean a noncustodial approach. Archivists administering records held in distributed custody would continue to “guarantee the long-term preservation of ongoing social, cultural, historical, or symbolic value.”^[18]

CHALLENGES TO CUSTODY IN ARCHIVES: REPLEVIN REQUESTS

Although issues of contested custody in museums are more immediately newsworthy, particularly when they involve looted art or antiquities of dubious provenance, there are equivalent cases in archives that are no less significant. Two cases can be used to illustrate the use of replevin as a technique to challenge an archive’s custody of documents. Replevin is defined in the Society of American Archivists’ online *Glossary of Archival and Records Terminology* as “an action to recover property that has been improperly or illegally taken” and notes that it is a technique frequently employed to describe efforts to recover public records that are in private hands.

In December of 1955, a suit was brought against the Minnesota Historical Society contesting the ownership of a previously unknown collection of field notes compiled by William Clark substantiating details of the events of the Lewis and Clark Expedition between December 1803 and April 1805. In addition to the family in whose possession the documents had been discovered, the claimants in the suit included the United States, based on the notion that Thomas Jefferson, who had initiated the expedition, had requested that the records of the expedition be submitted to the government. However, historically, the federal government had not previously claimed any of the other Lewis and Clark expedition papers, many of which were held in private and public collections, or indeed any records of government-sponsored expeditions. There was considerable opposition to this, particularly from those collections, who were concerned that “the government’s claim to Clark’s ‘Field Notes’ posed a threat to any

privately owned historical documents.”^[19] The court ruled in October 1955 that the government could not sustain the burden of proof in establishing its claim; therefore, the field notes were private papers rather than public documents. Following the ruling, the family sold them to a private collector, who in turn donated them to Yale University. A scholarly edition of the papers, *The Field Notes of Captain William Clark, 1803–1805*, edited with an introduction and notes by E.S. Osgood, was published in 1964. This edition includes facsimiles of the original pages, allaying the fears that the information in the papers would become unavailable, if the papers had gone into a private collection.

A replevin case in which the reverse ruling was made in an appeal was the 1975–1977 case of the legal briefs dated 1767 and 1768 signed by William Hooper of North Carolina, considered to be one of the rarest of the 56 signers of the Declaration of Independence. Shortly after these items had been offered for sale by autograph collector B.C. West, he was informed that “the state of North Carolina claimed his two Hoopers on the grounds that title to any paper that had once been a public record remains with the state.”^[20] A 1977 ruling on the ownership of the Hooper documents granted custody of those documents to the state of North Carolina. While much discussed at the time, particularly by manuscript collectors, this case did not set a precedent for replevin and similar state documents were offered at subsequent public auctions and not requested by the state. Nonetheless, organizations such as the Manuscript Society have issued policies on the custody of abandoned or discarded government documents which support the rights of individual rights of ownership when the person can demonstrate legal title. This debate continues in the United States over the ownership and accessibility of presidential papers.

Another case of contested custody in archival collections deals with the acquisition of the Stanton Glantz Research Files of the Brown and Williamson Tobacco Corporation, established at the University of California, San Francisco, Library and Center for Knowledge Management in 1994, which provided public access to copies of internal documents from the tobacco company’s files which had been given anonymously to Glantz, a cardiologist and tobacco-control activist at the University of California, San Francisco (UCSF). This collection, the basis for the research in the 1996 publication, *The Cigarette Papers*, was the subject of a lawsuit in which the Brown and Williamson Tobacco Corporation sought to remove the material from the University of California library that indicated that the tobacco industry had suppressed research on tobacco addiction and its health risks. The ruling of the San Francisco Superior Court allowed the release of the documents on the Internet, stating, “the public has the right to know.”^[21,22]

That government offices, particularly at times of political unrest, are not the most reliable of stewards has been

proven so again and again, in such cases as the South African Truth and Reconciliation Commission, established in 1995, to investigate the destruction of records created during the period of apartheid.^[23] Similar efforts in Argentina, Brazil, Chile, El Salvador and Guatemala have attempted to gain access to public records dealing with the rights of individuals under previous regimes. The release of previously secret files such as those maintained by the Stasi, the Ministerium für Staatssicherheit, the official secret police of East Germany raises questions as to the potential for social and personal harm caused by the availability of these records.

CONCLUSION

Museums and archives have traditionally taken custody of cultural objects and records of lasting value as a means of fulfilling their obligation to preserve the past for the future. In both types of institutions, contextual information is required in order to give meaning to the objects, including maintaining and enhancing information on the identity and use of the items as well as information on the circumstances of their acquisition through ongoing scholarship and exhibitions. Modern theories of cultural property have challenged the retention of some cultural items by these institutions, most notably NAGPRA, the U.S. law passed in 1990. The application of this legislation has resulted in the repatriation of many objects of cultural patrimony to those identified as lineal descendants. Additional legislation such as the CITES controls the transportation of animals and plants across international borders in order to help protect endangered species and their often equally endangered habitats. Provenance research applied to the return of works of art looted during the Nazi Era heightened social responsibility as chronicled in Lynn Nicholas, *The Rape of Europa: The Fate of Europe's Treasures in the Third Reich and the Second World War*, New York: A.A. Knopf, 1994. Although successful claims have been made for the return of antiquities from museums to the current governments of the original creators, these repatriations have not gone uncontested. Some critics argue that such actions will diminish the research collections held in modern museums, which exist to provide a critical mass of cultural material for valid comparative scholarship.

Parallel to the reasoning that museums give value to objects selected for their collections, some archival theorists argue that records held in the custody of archives retain their authenticity which would not be the case if they were left in the hands of their creators. Critics of this approach argue that the records may well have been tampered with prior to their deposit in the archives and therefore may not represent the full truth of business transactions. Post-custodial theories of archival management have been developed to deal with the custody of

governmental and business electronic records which require maintaining a surrounding environment of software and business practice.

Determining the custody of an object or document is an essential responsibility of museums and archives. Responsible stewards of collections should begin by determining the deceptively simple fact of ownership of collections under their care.

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Data and Data Quality

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Abstract

This entry presents a definition of data and their quality dimensions as the basis for a survey of data quality management and improvement techniques, with special attention to data published on the Internet. Several factors have contributed to making improved data quality an urgent priority. These factors include “data quality disasters” such as the Year 2000 Presidential Election, corporate reporting, and homeland security, and the stunning growth in data volumes, and recognition of the importance of data to the modern organization. This entry does not treat issues of database system quality, such as system reliability, accessibility, and usability, or related issues such as data security.

THE NATURE OF DATA

Of the triumvirate of concepts *data*, *information*, and *knowledge* at the conceptual foundations of the information age, data is by consensus regarded as the most basic. Like the other two, however, the concept of data is not well understood. Although it is basic, the notion of data is surprisingly multifaceted and complex. One reason for this is that the word is used in so many different ways in conversation. For example, one hears comments such as the following:

1. The data on this graph prove my point.
2. The data point is six.
3. See, here are the data we need.
4. I cannot get the data out of the database.
5. When you get some data like that, you know it is time to do something drastic.
6. The data misled us because they were wrong.

Some of these uses of the word treat data as tangible measurements, as in comments 1 and 2. In other uses, the term seems less tangible, but is a motivator for action, as in comments 3 and 5. Some uses seem to treat data as something abstract or conceptual, as in comment 2, and others seem to deal more with physical representations for data, as in comments 1 and 4. In some cases data are treated as factual, and in others, like comment 6, the data may not be correct. This variety of uses of the word data raises many questions about what data are, and how we should understand the term.

A thorough treatment of data quality must be based on a clear understanding of the meaning of the term data. In

developing this understanding in this section, we first explore the data life-cycle, the sequence of phases through which data pass as they progress from creation to storage and use. Data’s life-cycle model is, in effect, a formal way of looking at “the social life of information.”^[1] The life-cycle model helps account for the different uses of the term data because, at different stages in their life, data change in subtle ways. Based on the lifecycle, we consider definitions of data and select the definition that encompasses the most critical features and advances our objective of quality assessment, control, and improvement.

The Data Life Cycle

As noted, the data life cycle is the sequence of activities that create and populate a *data bank* in which data are stored, find and extract data from a data bank, and manipulate and use extracted data (Fig. 1).^[2] The data life cycle includes the following activities:

1. *Defining a model*—The portion of the real world to be described by the data is defined, and the detailed mechanism of description is specified. This involves defining entity types, their attributes, and attribute domains, all discussed further below.
2. *Implementing the model*—An empty data bank, or physical data repository, is created. In a small organization, the data bank may be a sheet of paper, and implementing the model may involve laying out columns for recording data. For electronic databases, the model must be described in the language of the database management system.

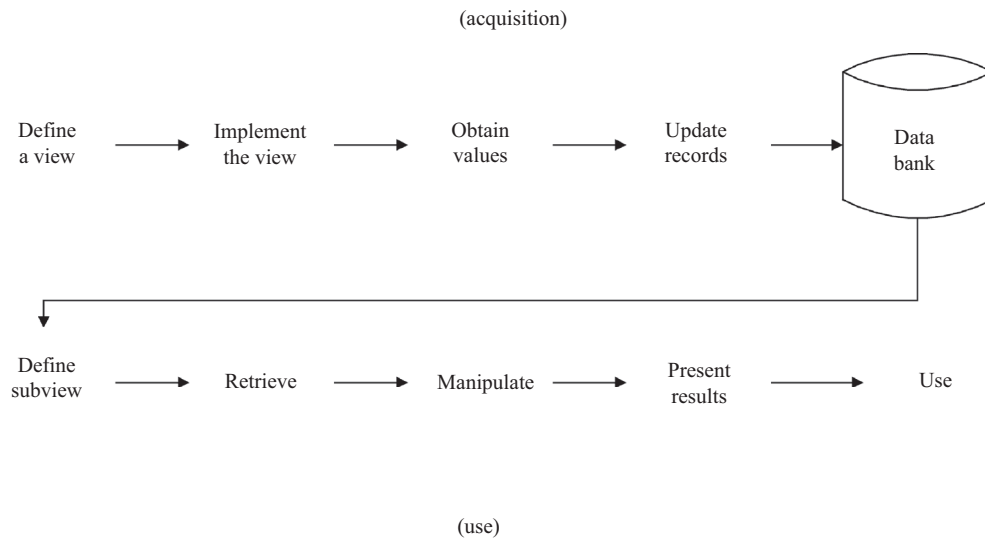


Fig. 1 The data life cycle. (© Navesink Consulting Group.)

3. *Obtaining values*—Data values are collected for the part of the world modeled in the data bank. Common ways of obtaining data values are measuring, surveying, observing, and copying another source. Poor data values are a principal issue in data quality and are discussed throughout this entry.
4. *Storing values*—Data values are recorded in the data bank according to the conventions established in the data model.

The result of these *data acquisition* activities is data stored in a data bank. Subsequent *data usage* activities put the data to use in the following ways.

5. *Define a view*—Typically a data customer or application requires only a subset of the data available in a database. A *view* describes the portion of the data to be used. By convention, in quality management, we call those who use data, products, or services *customers*. Technologists often refer to the same people as *users*.
6. *Retrieve*—Data (values) of interest are retrieved from the data bank.
7. *Manipulate*—Data are processed in one or more of four principal ways: classification, analysis, manipulation, and synthesis. This step is sometimes bypassed when the sole intention is to present data to a customer.
8. *Present results*—The data are formatted (graphed, listed, etc.) and given to the customer. The appropriate form of presentation depends on many factors, including the results of retrieval and presentation, the presentation medium, and the customer. (People need one form of presentation, application software, another.)
9. *Use*—Data may be used on presentation to the customer.

This simplified version of the model does not include activities to access the quality of data and make adjustments. (The reader interested in such details should see Levitin).^[2]

Criteria for a Definition of Data

The data life cycle suggests that data must be defined in a way that will account for the fundamental operations of defining models and views, collecting and updating values, storing, retrieving, and manipulating data, and presenting data and using them for a variety of purposes. The following criteria are also important in a good definition of data.^[3]

- *Clarity and simplicity*—This criterion holds for any good definition.
- *Nonreliance on the term information*—This criterion avoids circular definitions.
- *Agreement with common usage*—We want to understand the term data, not to create a new meaning for a common term.
- *Inclusion of conceptual and representational aspects of data*—Both are too important to leave out.
- *Wide applicability*—The definition should include data as diverse as meter readings and the contents of databases and document information systems.
- *Suggestive of quality dimensions*—The definition should lead to practical data quality improvements.

Data Defined

Many definitions of data have been suggested in the literature; the one that best meets the criteria discussed in the

previous section is based on the classic definition of the term accepted in the database community. (For an in-depth discussion see Whitmore).^[4] This definition is really a collection of definitions of several related terms.

A *conceptual model* or a *data model* is an abstract description of some part of the world, called the *universe* or *enterprise*, that associates, or maps, objects in the world to abstract objects in the model, called *entities*. The portion of the world modeled may include both physical and abstract objects. Characteristics of the modeled real-world objects and relationships between them are captured in the model as attributes. An *attribute* is a property of an object that can assume values from a set called the *domain* of the attribute. There are no restrictions on the elements of a domain; they may be numbers, strings, entities, sets of entities and so forth. An entity is said to have an attribute when the attribute applies to the entity. Entities in a conceptual model that share a set of attributes are grouped together as an entity type.

To illustrate these definitions, consider two conceptual models used to define the reader. Consider first the conceptual model employed by his/her employer. The entities in this conceptual model consist of all past or present employees. The attributes of interest include name, employee ID, status, department, and so forth. Each attribute has well-defined domains of permissible values, for example, the domain for the attribute department includes all departments (Human Resource, Finance, Operations, etc.) of the employer's organization (note that the domain may change as the organization changes). Besides indicating the properties of entities, attributes may be used as entity identifiers. For example, this conceptual model might use the Employee ID attribute as an entity identifier.

Within this framework, we define a *datum* or *data item*, as a triple $\langle e, a, v \rangle$, where e is an entity in a conceptual model, a is an attribute of entity e , and v is a value from the domain of attribute a . A datum asserts that entity e has value v for attribute a . *Data* are the members of any collection of data items. Returning to the example, a datum in the collection is $\langle \text{John Doe, Department, "Legal"} \rangle$, indicating that the department assigned to the employee John Doe is "Legal."

Note that the Internal Revenue Service (IRS) may also take an interest in the reader. The conceptual model it uses may overlap the employer's. For example, both include Name. But the employer's model may not include Year 2000 dividend income. Likewise the IRS's model need not include Department.

To complete this characterization of data, the mechanism of data representation must be included. A *data representation* is a set of rules for recording data triples on some medium. A *data recording* is a physical object interpretable (via a data representation) as a listing of data items. Representation of data values is accomplished via a *format*, or convention for recording data values using *symbols*, or representational elements. Publications data

might be recorded in a paper index, a card catalog, or a computer database. A typical mechanism places all data values for a particular entity together in a *record* consisting of a *field* for every attribute in which the value for the attribute is stored. In many cases, the representations for values in fields will follow traditional formats. For example, author attribute values are typically recorded in a "last-name-first" format using the Roman alphabet.

This definition of data satisfies the criteria discussed in the section above in the following ways:

- The definition is set in the context of conceptual modeling, so it accounts for the data life-cycle activities of defining models and views. It also matches the standard conceptual foundations in the database literature.^[5]
- The definition distinguishes data values, attributes, and entities, which are necessary to make sense of the data life-cycle operations of defining a model, of collecting and updating values, and of storing, retrieving, manipulating, and presenting data.
- The definition is simple; if necessary, it can be stated in precise mathematical terms so it is clear.
- The definition does not mention information, so information can be defined in terms of data without circularity.
- This definition of data accords with everyday uses of the word. For example, a water meter reading can be understood as a recording, using a certain data representation, of the value of an attribute (WaterConsumption) of an entity (the CUSTOMER).
- This definition accounts for both the conceptual and representational aspects of data.
- This approach is applicable in all studies of data in systems, including database systems, document information systems, and manual data systems.
- This definition of data lends itself to the study of all salient quality dimensions of data, as we will discuss below.

In summary, the ordered triple view of data meets all requirements for an adequate definition of data, and provides the necessary basis for a thorough consideration of data quality.

QUALITY AND QUALITY CONTROL

The most basic idea in quality is to "create and keep a customer."^[6] One collection of data that satisfies customer needs better than a second collection is of higher quality. It follows that the most important measure of quality is customer satisfaction and that a key component of any good approach to quality is determining who the customers are and understanding their needs. Although this is simple in principle, it is complicated enormously by a

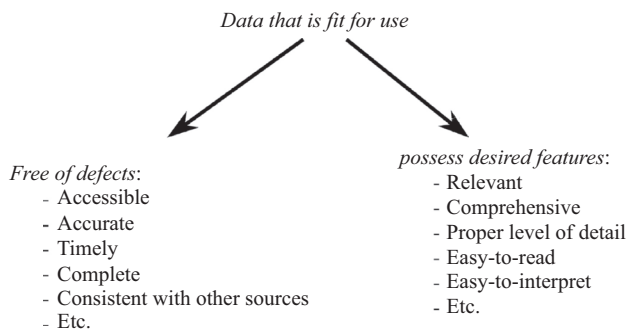


Fig. 2 Data quality defined. Data are of high quality if they are fit for their intended uses (by customers) in operations, decision making, and planning (after Juran). (© Navesink Consulting Group.)

dynamic world: customer needs change continuously, new competitors enter the market, new offerings appear, and so forth. And data customers can have a stunning array of needs. A simplifying notion is that of “fitness for use,” as illustrated in Fig. 2, below.

Although data quality must ultimately be defined by the data’s customers, several characteristics stand out as important to most customers. These characteristics are called *data quality dimensions*. Given the definition of data above, quality dimensions can be classified according to three major quality concerns: quality of a conceptual model, quality of data values, and quality of data representation;^[7] alternative approaches developed by Massachusetts Institute of Technology’s (MIT) Total Data Quality Management Research Program can be found in.^[8–10] Finally, one can also take the point of view that customers should not be required to separate their requirements of data from those of database systems and that data quality dimensions should be viewed as a subset of all requirements. (See Redman^[7] for a comprehensive list of dimensions).

Quality of a Conceptual Model

A *conceptual model* provides a framework for a data set by specifying entity classes, their attributes, and attribute domains. In addition, various constraints, often called *business rules*, can be included in the model. Quality dimensions of a conceptual model can be grouped into six categories: content, scope, level of detail, composition, consistency, and reaction to change. (This grouping follows Levitin and Redman;^[11] see Flavin^[12] and Fidel^[13] for alternative views. See also Brackett^[14] for an in-depth discussion of a good data modeling practice).

Content

This category includes characteristics of the facts represented by the data. The most important of them is

relevance: the degree to which a model’s components are pertinent for the intended applications. Although the importance of data relevance seems obvious, lack of relevance has been singled out by several authors as among the most important issues in data quality.^[15,16] Another concern is that all model components have *unambiguous definitions*. The necessity and difficulty of achieving clear definitions is discussed by Brackett,^[14] Kent,^[17] and Thompson.^[18] The lack of clear definitions continues to plague many important databases (see Sy^[16] and Gardner^[19]). Finally, the *obtainability of values* for entities and attributes must be considered. Obtainability of values can meet various obstacles. For example, including gender information in a database may be illegal because it may lead to job discrimination. Obtaining blood types for all employees or citizens may not be affordable.

Scope

This characteristic involves the breadth of coverage of a model. A model should be both *comprehensive* and *essential*. In other words, a model must be broad enough to satisfy all the needs of its intended customers but not include unnecessary information. In practice, identifying the needs of even a single customer poses serious challenges for a data modeler. Integrating different sets of requirements to allow data sharing by several customers or applications as required for modern database management systems adds additional issues and difficulties.

There are several reasons for choosing a model broader than the one minimally necessary. First, the designer must usually create a model to accommodate both current and future applications. Second, redundancy can be introduced as a way to check data values. For example, a census form may ask for both the number of children in a household and a list of their names. Third redundancy speeds up some queries. For example, even though the number of employees in a DEPARTMENT can be calculated by checking the department attribute of all EMPLOYEES, it will be available more quickly as the value of the (redundant) attribute Number Of Employees. Unless justified for one of these reasons, the expense of obtaining, storing, and maintaining unnecessary data should be avoided.

Level of Detail

Choosing the proper level of detail for a conceptual model has two aspects. The first is exemplified by the choice of size of geographic regions for recording sales. Data might be recorded for a city, a county, a state, and so forth. This characteristic is called *attribute granularity*. Lower levels of granularity provide more detail and the opportunity of keeping more data (e.g., subtotals) for finding and correcting errors. On the other hand, a lower level of granularity leads to a larger volume of data. Detailed data may be harder to obtain and usually increase costs.

Customers may also be annoyed when presented with data more detailed than needed.^[20]

The other aspect of level of detail is called *domain precision*, the measurement or classification detail used in defining an attribute's domain. For example, measurements in inches are more precise than measurements in feet. Similarly, having 20 distinct values in a color attribute's domain is more precise than having 7. (See a realistic example in Sy and Robbin's^[16] discussion of the Standard Industrial Classification).

Composition

This characteristic concerns the structuring or grouping of facts represented by data. Each entity type of data model should be *natural*; that is, it should be a natural grouping of natural attributes with natural domains. This requirement can be met if each entity type has a sensible counterpart in the part of the world being modeled, and each attribute captures a single fact about entities and their relationships. Such an attribute typically represents some property (e.g., the gender of an employee) or it used for identification (e.g., the Social Security number of an employee). Unnatural "multifactor" attributes are often introduced to satisfy outdated implementation constraints. For example, an attribute may be defined to hold a code for both age bracket and gender in an effort to save storage space. Date^[21] discusses other examples and their consequences. Although multifactor attributes should be avoided, some well-established classification schemes incorporate secondary information. For example, room numbering schemes often code the floor into the number. It is hard to call this familiar scheme unnatural. (Things have a tendency to become natural when we get used to them.) Secondary facts may also be incorporated into values for redundancy and security.

In a well-composed conceptual model, each type must have a mechanism for distinguishing individual entities. This requirement, called *occurrence identifiability*, is often incorporated into the definition of an entity type. Usually, occurrence identification is accomplished with a *primary key*, one or more attributes whose value(s) uniquely identify individuals. For example, Social Security Number can serve as a primary key for an EMPLOYEE entity type.

A good model should also promote *homogeneous* types. This means that each attribute should apply to all individuals of the type. This does not preclude using values for "none," "exists but unknown," or even "existence is unknown" (each of these may apply, e.g., to Telephone Number).

Consistency

There are two aspects of this quality dimension. The first is *semantic consistency*, which requires consistency of definitions among related components of a model.

Problems often arise with definitions from different databases. For example, Whitmore^[22] cites a serious discrepancy in oil import figures reported by the U.S. Bureau of the Census and the Department of Energy caused by the differing definitions of "petroleum," "U.S.," and "month." Sy and Robbin^[16] discuss many examples of problems with U.S. government data. The second aspect of consistency is *structural consistency*, which requires consistency in combining a model's components. For examples, such commonly used attributes as Person Name, Address, Date, and Time Of Day should have the same structure across all entity types. Tasker^[23] has suggested standard structures for such attributes.

Reaction to Change

A conceptual model provides a framework for representing information about a part of the world, but both the world and customers' requirements change over time. A good model *must accommodate change*. We classify changes into four categories: addition or deletion of an entity (e.g., hiring or firing an employee), changing a value (e.g., changing a salary), changing a domain (e.g., introducing a new car model), and introducing a new attribute or entity type. The first two kinds of changes, called *updates*, are routinely performed in any computer-based database management or document information system without any change in the underlying model; the other two require changes in the model.

Most authors mention "flexibility" as the only design characteristic for accommodating change. In practice, changing a model is usually a serious and expensive task and the ability to accommodate change without redesign is an important practical need. We define a model's *robustness* as its ability to reflect changes in the world and its customer's requirement without design changes. The first step toward design robustness is to select attributes that will not change or whose changes can be easily accommodated. For example, Social Security Number is a more robust identifier of people in the United States than a Name (even if a name's uniqueness could be guaranteed) because it is easier for a person to change names than social security numbers. Another avenue to robustness is to anticipate changes and provide for them in the original design. For example, a company that currently produces sweaters with sizes "small," "medium," and "large" may produce other sizes in the future. No matter how robust a model may be, some design changes will have to be made eventually. A model's *flexibility* is its capacity to change to meet unanticipated demands. A good model is flexible as well as robust.

Quality Dimensions of Data Values

We group dimensions of data quality involving data *values* into four categories: accuracy, currency, completeness, and consistency.

Accuracy

The *accuracy* of a datum $\langle e, a, v \rangle$ is the degree of closeness of v to some value v' in the domain of attribute a considered correct for the entity e . Sometimes v' is referred to as the *standard*. If the value v is identical to the correct value v' , the datum is said to be *accurate* or *correct*. To illustrate, consider an EMPLOYEE entity identified by the Employee Number 314159, and the attribute Year Of Birth. If the value of Year Of Birth for employee 314159 is the year the employee was born, the datum is correct.

Accuracy is most easily measured in terms of inaccuracy. Inaccuracy for a single datum may be computed as the absolute difference between the correct value v' and datum's value v . For the example above, inaccuracy may be quantified as the absolute difference between the year of birth v' and the value v for the attribute Year Of Birth. The (in)accuracy of a database can be measured in two ways. *Field (in)accuracy* is the fraction of triples in the database with (in)correct data values. *Record (in)accuracy* is the fraction of entities in the database whose records are error-free; that is, the fraction of all entities in the database all of whose attributes have correct data values. Records are usually composed of several fields, so record accuracy is much lower than field accuracy. Furthermore, errors in different fields may be unimportant or disastrous. These last two observations suggest caution when judging database quality on the basis of error rate.^[24]

Accuracy and correctness are not as simple as they seem, especially when it comes to evaluation. It is often difficult to determine the standard. Sometimes there is not an obvious single correct value for an attribute, as is often the case in spelling, especially names. Sometimes the correct value is undefined, as when an entity identifier is wrong. In the example above, there may be no correct value for Year Of Birth if there is no employee 314159. It may also be difficult to quantify inaccuracy, even if the correct value is known, because the attribute in question may resist quantification, as do label, category, and description data. In summary, measuring data inaccuracy is often not easy when it is possible, and it is not always possible.

Currency

The ordered triple definition of data treats data as snapshots of part of the world. Most objects change with time, introducing opportunities for data to become incorrect or inaccurate. A datum is *current* or *up-to-date* at time t if it is correct at time t , and *out-of-date* at time t if it is incorrect at t but was correct at some time before t . Currency may be quantified by measuring how far out-of-date a value is. Database currency can be measured as the fraction of out-of-date triples in the database. As an example, suppose the annual salary of an EMPLOYEE can only

change at the start of a calendar year, and that some employee's salary was \$36,000 in 1992, \$39,000 in 1993, and \$43,000 in 1994. If during 1994 a datum shows the salary as \$43,000, it is up-to-date; if it shows \$36,000, it is two years out-of-date; if it shows \$42,000, it is simply incorrect.

Completeness and Duplication

The degree to which a data collection has values for all attributes of all entities that are supposed to have values is its *completeness*. A data collection may be incomplete because of missing values in the triples present or because some triples are missing entirely. In the case of missing values, the completeness of a single datum may be measured by whether or not it has a required value; a completeness measure for an entire data collection is then the fraction of triples in the collection with missing values. When a triple is missing a value, a special "null" value may be assigned for it. The meaning of null is different, depending on whether the attribute is mandatory, optional, or inapplicable. For mandatory attributes, the null value means value unknown. For optional attributes, the null value may mean that the attribute applies but we lack its value, or that the attribute does not apply, or that we do not know whether the attribute applies. For an inapplicable attribute, like Name Of Spouse for an unmarried person, the null value signifies that the attribute does not apply. In theory, these cases could be distinguished with different kinds of null values; in practice, having even one kind of null value causes problems for database systems.^[25,26]

A data collection may also be incomplete because some triples that should be included are missing. Missing record incompleteness can be measured by finding the fraction of records missing from the data collection.

Consistency and Integrity

Data are said to be *consistent* with respect to a set of conceptual model constraints if they satisfy all the constraints in the set.^[27] One measure of the consistency of a datum is a binary indication (Yes or No) of whether the datum satisfies all constraints. A measure for an entire data collection is then the fraction of inconsistent triples in the collection. Correct data must be consistent. The converse statement (consistent data are correct) need not be true. Said differently, consistency is necessary but not sufficient for correctness. Nevertheless, it is important to distinguish consistency as a special dimension because checking consistency is usually much easier and cheaper than checking corrections. Data integrity is sometimes used as a synonym for consistency, but sometimes it means data accuracy or correctness and, sometimes, security and concurrency control in database management systems.^[28–30]

Quality Dimensions of Data Representation

From a customer's perspective, the most important data representation issue is the means chosen to represent data values by symbols on a recording medium, called the *format*. The following are the four major formats.^[31]

- *String formats* represent values by character strings over some alphabet, including alphanumeric strings, and bitstrings. This category includes numeric coding schemes, most computer storage mechanisms, and most textual representations of data.
- *Positional/marking formats* specify values by marking a particular spot on a recording medium. This category includes coding sheets used in questionnaires and graphical methods.^[32–35]
- *Icon formats* use pictorial symbols to represent values.
- *Color formats* represent data values by colors.

The first two formats are the most widely used, but there are several applications in which the last two appear as well.^[36]

The most important quality dimension of a format is its *appropriateness*, both for meeting customer needs and using the recording medium effectively. Customers deal with representations of data, not data triples themselves, and their needs are of primary importance. They depend on two factors: the type of customer (human, mechanical, optical, etc.), and the task the customer is to perform (communication, analysis, storage, etc.). Reliable and convenient use of recording media is obviously of practical importance.

A format should result in a correct interpretation of values represented; that is, the format should be unambiguous. For example, a format representing three ratings with the digits 1, 2, and 3 is more ambiguous (to a human) than the one using the strings “worst,” “average,” and “best.” Ambiguity may also arise when a format does not specify a unit of measurement for quantitative data. Special care is needed with icon and color formats because there is not wide agreement about their meaning.

A third quality dimension of formats is *universality* or *portability*, which is the degree to which a format can be used by a wide range of customers. In this respect, specifying numbers with words of a natural language is inferior to using Arabic digits. Similarly, representing telephone numbers without area codes is inferior to including area codes. When using a color format, colors must be chosen bearing in mind that color-blind people can distinguish some colors but not others.

A good format must also be sufficiently *precise*, which means that there must be distinct representations for any two values in an attribute's domain. For example, formats for quantitative data must provide means for specifying numbers as precisely as required. A fifth

quality dimension is *flexibility*, which is the ability of a format to accommodate changes in the domain of values represented. This issue has arisen in many information systems struggling to adapt to real-world change.^[36,37] A sixth quality of a good format is its *ability to represent null values*. A good format should represent null values in a way clearly understood by customers; Celko^[36] retells the tale of the motorist who got thousands of traffic tickets because his license plate read “none.” Finally, a format should *make efficient use of the recording medium*.

DATA QUALITY MANAGEMENT

Over the last several decades, any number of quality techniques have been developed and applied. The greatest penetration has occurred in the manufacturing sector, where any number of industries now produce far better products at far lower cost. The service sector has begun to apply quality techniques, also with good success. And some organizations have begun to extend quality techniques to data.

Perhaps the most important lesson learned is that, more than anything else, an organization's leadership dictates the quality of its products, services, and data. While technical excellence is important, consistent, sustained management effort is essential.

Quality Systems

The totality of an organization's efforts that bear on quality define its quality system. Thus, the quality system includes leadership, management, and the application of tools to understand customer needs, measure quality, find and fix defects, and so forth. And while literally thousands of techniques have been tried, all support one of three basic quality management philosophies:

- So-called *first-generation* philosophy and techniques provide quality through inspection and rework of final products, hopefully, before they are passed on to customers.
- So-called *second-generation* philosophy and techniques provide quality by minimizing root causes of defects in the processes that produce final products. Here the term *process* means the sequence of work activities that produce and deliver products or services to customers.
- So-called *third-generation* philosophy and techniques aim to design processes so that defects cannot be produced.

Each of these approaches is discussed briefly in the following sections.

First Generation: Inspection and Rework

In this approach to quality, a product or service is inspected for conformance to needs before delivery to a customer. Products or services that fail inspection are either reworked or discarded. In the simplest case, everything is inspected, but more sophisticated acceptance sampling procedures can reduce inspection costs.^[38]

The strength of this approach is that it usually improves outgoing quality. Its major drawbacks are that inspections are often difficult and expensive, and reworking or discarding products or services is always expensive. Further, process quality levels tend not to improve beyond a limiting level. Inspection and rework is the first step that an organization takes to achieve quality.

Second Generation: Process Quality Management

The fundamental tenet of process quality management is that process performance can be made predictable within limits. A process operating within expected limits is in a state of *statistical control*. For such processes, statistical and other methods can identify process weaknesses and then changes can be made to improve process performance. For example, suppose a process for collecting and filling service orders is measured and found to be out of control. After study, several problems with ill-defined procedures are identified and eliminated. The process then operates in a state of statistical control with an average error rate of 0.1%. Further study of the process then reveals error-prone activities that can be improved, thereby reducing its average error rate to 0.05%. The net results of these activities are that: 1) they make the output of the process predictable and known and 2) they produce measurable improvements in process performance. (For a fuller account of this approach see Ishikawa,^[39] Wadsworth).^[40,41]

Process quality management requires some investment, but as processes are brought under control and improved, total costs go down (inspecting and reworking defects is simply much more expensive than preventing them). Furthermore, process quality management can produce sustainable quality improvements as necessary to satisfy customer needs.

Third Generation: Process Design

This approach attempts to make large improvements quickly by designing or redesigning a process from scratch rather than letting it evolve through process quality management. This goal can be reached by making the process simpler and less error-prone, often by incorporating higher technology in both the process and its design.^[42] A third-generation philosophy and supporting techniques are required to meet 6σ (six-sigma) quality

levels; today, symbolic of world-class quality (6σ equates to 3.4 defects per million).

Combining Quality Management Approaches

All three approaches to quality management discussed above have proven effective in countless instances, especially in manufacturing settings. The two process-based approaches are more advanced and more effective than inspection and rework for the following reasons:

- Defects are expensive to find and fix; detecting and removing a defect can cost up to 10 times as much as preventing it.
- Defects that customers find have a direct impact on customer satisfaction, the ultimate measure of quality.
- Experience has shown that world-class quality levels cannot be achieved solely through inspection and rework.

Despite their weaknesses, inspection and rework have their place alongside process quality management and process design, and mature quality systems combine all three approaches. For example, an organization may have carefully designed a process to minimize errors and may be managing it actively to steadily improve and optimize its performance. Nevertheless, a bad product or service may still find its way to a customer, where it must be replaced or fixed. A mechanism for inspection and rework may thus need to be present in even the most sophisticated environments.

Although quality approaches have been pioneered in manufacturing enterprises, they have also been effective in service industries.^[43] And experience confirms that they work for data as well. More specifically, experience confirms that the first two approaches work well. (See English,^[44] Loshin^[45] and Redman^[46] for examples). The next subsection reviews specific methods for applying these three general approaches to data quality.

QUALITY CONTROL APPROACHES APPLIED TO DATA

While all dimensions of data quality are important (at least to some customers), in this section, we focus only on data accuracy. It is important to all customers and is a good vehicle for illustrating the application of quality approaches to data.

First-Generation: Error Detection and Correction

The most prevalent method for controlling and improving data accuracy is to detect and correct inaccurate values. The simplest procedure is to compare data values to the world and fix those that are wrong. For example, consider

an employee database containing data on work and home addresses. It is common for the administrators of such databases to survey employees regularly to verify and correct their addresses. Depending on how cooperative employees are (and whether or not the address verification and correction form reaches them), this procedure can work very well. It is costly, however, and yields no sustained improvement in data quality over time; after a survey, the accuracy of data will deteriorate steadily until the next survey is done.

A second technique, called *database bashing*, is also used frequently when data values are stored in two or more databases. Corresponding values in the databases are compared, and when a disagreement is detected, an investigation finds the correct value, and the databases are fixed. This technique has several advantages over comparing all values to the real world. It is easier to manage and tends to cost less, especially when the databases can be compared using a computer, but, like all techniques based on inspection and rework, it does not yield sustained quality improvement.

A third technique, called *data editing*, involves computerized checking of data values against constraints. These constraints may be simple or sophisticated and typically involve the following:

- *Checks of a single field.* For example, a field whose domain is {0, 1, 2, ..., 10} may have its values checked against this set.
- *Checks of several fields.* The checked fields could be in a single record or in several records. For example, a field recording the Number Of Employees of a DEPARTMENT might be checked by examining the department field of all EMPLOYEE records and counting the EMPLOYEES in the DEPARTMENT.
- *Probabilistic field checks.* For example, a record with a gender field value of female and a height field value of 78 in. is unlikely.

Such constraints are often called business rules. See Ross^[47] for further details. Once a record is found to be in error, further investigation locates and corrects the offending field(s). This technique may be used in the data life cycle during the activities of storing data values, retrieving data values, and manipulating data values, or as part of special data cleanup activities.

Data editing is popular because it is (apparently) computationally cheap. It is often difficult to generate an effective and complete list of edits, however.^[14,48] Once errors are found, it is still expensive to investigate and correct them. Finally, data editing provides no lasting quality improvements.

In summary, inspection and rework methods are not very effective for improving data quality because they are conducted downstream of data-value creation, usually either during a storage activity or during usage activities

of the data life cycle. Although these methods result in short-term data quality improvements to specific data values, they cannot provide lasting improvements because they do not attack the sources of errors.

Second-Generation: Prevent Errors at Their Sources

An alternative to error detection and correction is to focus on processes that create data values. Conceptually, this is simple. As in manufacturing, one must first achieve a state of statistical control. Errors are then reduced by identifying where and how they occur and changing the process to prevent them. Improvements made this way require more effort than inspection and rework but are sustainable and, therefore, cheaper in the long run.

But there are many practical problems. One problem stems from the fact that data move around the organization so quickly. Data created to satisfy a customer's order one day are used to manage inventory, to track sales, to plan next year's marketing campaign, and so forth, the next day. Data customers are harried in doing their current jobs, be it managing inventory, tracking sales, or planning next year's marketing campaign. When confronted with inaccurate data, they are simply more inclined to correct them or compensate for poor quality in some other way, than they are to seek out the sources of incorrect data.

That said, many organizations have made substantial improvements. And they have lowered costs and sped up their business processes and decision-making (error detection and correction takes time and costs money) as a result. Ten "best practices" have been observed.^[7] These are summarized as follows.

1. Senior management recognizes the importance of high-quality data and has mobilized the organization to improve. And they have focused data quality efforts on the most important data.
2. The organization holds those who create data responsible for the quality of data they create. This includes both internal and external data sources.
3. The organization identifies and actively manages its most important data suppliers.
4. The organization identifies and actively manages its most important internal business processes.
5. The organization recognizes "social issues" around data (such as that noted above) and actively manages data. It attaches value (often monetary) to data.
6. The organization understands "the most important needs of the most important customers." Data quality efforts are thus focused on the most important data.
7. The organization measures data quality levels. Measurement can be difficult. After all, data do not have physical properties such as size, weight, and impedance. Fortunately, good measurement information

can often be obtained cheaply. One simple method piggybacks process measurement on data-editing activities: failed edits can be classified and counted, and these measurements used for quality control and improvement. AT&T has developed a useful technique called *data tracking*^[49] for better process measurement and error detection and localization. Data tracking follows data through a process to determine where data are corrupted. Subsequent investigation identifies the root cause(s) of errors and removes them.

8. Statistical control of data sources is achieved. Control implies that data quality levels will be predictable into the future. And controlled processes are more easily improved.
9. Organizations with the best data are good at defining and conducting improvement projects that get to the root causes of error and eliminate (or at least mitigate) them.
10. Organizations with the best data set and meet aggressive targets for improvement. Indeed, they focus less on actual quality levels than on the rate of improvement.

Third Generation: Process Design for Data Quality

The third data quality improvement approach is to design or redesign processes to minimize errors. This approach is usually initially more expensive than either inspection and rework or process quality management, but, when successful, it yields large gains in a short time and may be cheaper than either one in the long run. Typically, process design introduces new information technologies. For example, an automatic bar-code reader may be introduced into a process because it reads product codes faster and more accurately than a person can.

Limited experience in designing processes confirms that the following ideas^[7] can work well:

1. Replace humans with automation in repetitive tasks in which people are likely to make errors, such as data input, data transcription or reformatting, and data searching. More generally, automating well-defined tasks and processes yields gains in speed, productivity, and quality. Conversely, automating poorly defined tasks and processes rarely works.
2. Design processes to optimize end-to-end performance, not the performance of subprocesses.
3. Capture data as close as possible to its original source. Minimize duplication, data transcription, data transformation, and redundant data storage.
4. Employ a “just-in-time” philosophy to data creation.
5. Design data editing and handling of exceptions into the process.

6. Employ simple data codes and extensive, easy-to-access data dictionaries.
7. Data quality measurement should be designed into processes that create data from the beginning. This provides nonintrusive mechanisms that can be used for quality improvement and control, especially when measurement can be built into the software that supports a process.

Process design for data quality is a promising area for further work in the future.

DATA QUALITY AND THE INTERNET

Even a casual glance confirms that the importance of data, and, hence, data quality, has grown enormously over the past decades. Many factors are involved, including the transition to the information economy, the tremendous gains in all sorts of information technologies, and the thirst for ever-more detail to support decision makers. As the importance of data has grown, so too has the need for data quality. And there is no end in sight.

The Internet, thus, is the latest in this series of technological advances and social changes. As this is written (summer 2001) the Internet is just beginning to change the data quality landscape. While the impact will evolve as the Internet evolves, a few points about data quality and the Internet are pertinent.

The first observation is that the Internet creates new data customers. Organizations are publishing data on the Internet that they had previously held as proprietary. Those who view these data almost certainly have different needs than internal customers. They have not been trained on how to interpret data, making clear definition and ease of interpretation more important. They are not familiar with the nuances inherent in the data and could be more easily misled, making accuracy more important. Their native language may be different, making dimensions associated with data presentation more important. Perhaps most importantly, they have different needs and they themselves are different. Some, such as those seeking medical advice relevant to a particular condition, may be focused and discerning but not technically sophisticated. Some, such as college students desiring to complete a report, may be technically advanced but in a hurry and not too careful about what they accept as fact, and so forth.

The second change involves the use of the Internet to conduct business operations. Supply chain management is a good but, by no means, only example. Supply chain management involves using the Internet to order goods and services, arrange and make payment, coordinate deliveries, and so forth. Without the Internet, organizations spend an enormous amount of time and money on supply chain management. Supply chain management works

reasonably well, and the Internet offers the opportunity to do so at far lower cost. But only if the data are of high quality.

Third, the Internet makes things possible that are currently not. We do not wish to enter the debate about whether or not “the Internet changes everything.” See Porter^[50] for a compelling, though not proven, viewpoint that it does not. But it does appear that opportunities to replace standard or commodity products and services with products and services tailored specifically to the individual may indeed become realities. Certainly health care providers are beginning to talk about drugs formulated specifically for individual patients. “Markets of size one” form part of the hope of customer resource management, and so forth. All share the following characteristics:

- They require vast quantities of individual-specific data.
- The impact of poor data is much greater.

CONCLUSION

To summarize, data quality is a subject of primary importance in the twenty-first century. Many factors, including the Internet appear to be making high-quality data more important than ever. Improvement must be based on preventing errors at their sources.

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Deaf and Hearing Impaired: Communication in Service Contexts [*ELIS Classic*]

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Abstract

From the author's text: "This article provides insights on deafness, deaf and hearing-impaired people, the varied means of communication they use, and basic communications skills useful in communicating with deaf patrons. Suggestions for further reading and study are given, as are sources of in-depth information about deafness and related subjects. Minor modifications to the manner in which one converses can facilitate communication with people with various degrees of hearing impairment, enhance the level of mutual comfort of library personnel and deaf patrons alike, and lead to more productive interaction. Such accommodations can and do represent a significant step toward making libraries accessible to hearing-impaired and deaf people."

—*ELIS Classic*, from 1995

INTRODUCTION

Ideally, libraries should be accessible to all potential users without regard to any disabling condition. As depositories of information, libraries constitute a key institution of democratic societies, yet people with hearing impairments often discover that communication difficulties can be a serious barrier to their using the library to its full potential.

Librarians typically communicate with people of diverse backgrounds and characteristics. Inevitably, some of these people will be deaf or hearing impaired. According to a 1974 study at the Deafness Research and Training Center at New York University, approximately 7 percent of the population is hearing impaired, and slightly under 1% is profoundly deaf.^[1] Another writer estimates that approximately 14% of the population is affected to some degree by hearing loss, including that caused by aging.^[2] Hearing impairment is the single most prevalent chronic disability in the United States.^[1]

The Americans with Disabilities Act of 1990 mandates that public accommodations, including libraries, must strive to provide auxiliary aids and services to clients and consumers without charge. Such aids and services appropriate for deaf and hearing-impaired clients include qualified interpreters, notetakers, written materials, telephone communication devices for the deaf (TDDs), assistive listening devices, and closed or open captioning.^[3]

Unusually large numbers of deaf and hearing-impaired people live and attend colleges and universities in Rochester, New York, and Washington, D.C. A number of libraries in these areas, particularly the collegiate libraries of Rochester Institute of Technology (RIT), (which is the

host institution to the National Technical Institute for the Deaf) (NTID) and Gallaudet University (in Washington), have addressed the communication needs of hearing-impaired people in various ways.

For example, at RIT there is a reference librarian specializing in services to deaf and hearing-impaired students and offering specialized training to other librarians in meeting the needs of these patrons. The coordinator of the staff resource center of the NTID serves all NTID faculty and staff, including those who happen to be deaf or hearing impaired. Both have developed sign language proficiency. The former offers instruction in the use of the RIT library for deaf students, provides library orientation tours in sign language, writes and distributes informational and public relations flyers about library services available to deaf patrons, and teaches weekly sign language classes for other RIT reference librarians. Three TDDs are available in this library, including one available for student use, thus making the library accessible by telephone for deaf patrons. An extensive collection of books and information about deafness is maintained.^[4] In the greater Rochester community, several public libraries have also made themselves accessible to deaf patrons through the provision of TDDs.

Aside from the offerings of these few libraries, however, relatively little is available in the way of skilled personnel or adapted facilities to meet the needs of deaf and hearing-impaired patrons. Librarians in general still tend to be unprepared to cope with the special and varied communication needs of these patrons or to promote action toward making their facilities accessible to them. In spite of the prevalence of hearing loss in this country

that disability still remains a serious barrier to communication in the use of libraries. [Generally speaking, that] barrier is a 2-way obstacle—people in the hearing world do not communicate with those in the non-hearing world, and vice versa.^[2]

This article provides insights on deafness, deaf and hearing-impaired people, the varied means of communication they use, and basic communications skills useful in communicating with deaf patrons. Suggestions for further reading and study are given, as are sources of in-depth information about deafness and related subjects.

Minor modifications to the manner in which one converses can facilitate communication with people with various degrees of hearing impairment, enhance the level of mutual comfort of library personnel and deaf patrons alike, and lead to more productive interaction. Such accommodations can and do represent a significant step toward making libraries accessible to hearing-impaired and deaf people.

BACKGROUND

Terminology

Hearing impairment is the most general term used to describe all types and degrees of hearing defects, ranging from slight loss to profound deafness.

“Deaf” individuals can discern no meaning in perceivable sounds. Additionally, the capitalized word *Deaf* is used by some authors to refer to profoundly deaf people whose community and culture are based on both common experiences (such as attending institutions or programs for deaf students) and a common language, American Sign Language (ASL).

“Hard-of-hearing” describes individuals whose sense of hearing, while deficient, is still somewhat functional. They can comprehend speech to some extent with or without a hearing aid, and generally depend on speechreading, facial expression, and gestures (sometimes including sign language) to supplement what they do hear.

Additional communication and cultural characteristics of both groups are discussed later in this entry.

Deafness and Deaf People

Over the course of their lifetimes, millions of Americans live with some degree of hearing loss. *Congenitally deaf* people (those who are born with profound deafness) are in the minority, but still comprise many thousands of individuals. Significantly larger numbers are *adventitiously deaf*, having lost part or all of their hearing later in life, at any time from infancy onward. *Prelingual deafness* describes the loss of hearing before the acquisition of language, usually before 3 years of age. *Postlingual deafness* describes hearing loss occurring after (often long after) language acquisition.

A number of different factors determine the impact of deafness or hearing loss on the individual. These include the type and severity of the loss, the age of onset of hearing loss, and whether the loss is sudden or gradual. Schooling, life experiences, personality, and communication preferences are other determinants of an individual's adjustment to deafness and the communication style and skills developed.

Causes of hearing loss are diverse. Common etiologies include genetics, illness, trauma, exposure to excessively loud sounds over a period of time, and gradual deterioration due to aging.

Severity of hearing loss may range from a slight and correctable loss to profound deafness, in which case the individual literally cannot hear any sound. Moreover, there are different types of hearing loss, such as middle ear problems, or nerve deterioration or damage. Hearing impairment will usually entail greater difficulty in detecting certain frequencies than others within the spectrum of audible sound. For example, if someone has difficulty hearing high frequencies (as opposed to low or midrange frequencies), the sound of the final “s” that forms the plural of many words is often entirely missed.

Modern hearing aids can be adjusted to some extent to compensate for uneven hearing loss over the range of audible frequencies, particularly when the severity of loss is minimal. In such cases, hearing with an aid may be close to normal. However, when the hearing loss is severe, even a powerful aid may not be able to compensate evenly for losses that are distributed across the entire audible frequency spectrum. The result is that sounds are distorted and therefore harder to recognize and distinguish. The greater the severity of loss, the less effective a hearing aid is in helping an individual receive and understand information through sound alone, and the more the individual must rely on alternative strategies. Speechreading, manual communication, gestures, writing, or combinations of these methods are examples of such strategies used in communication between deaf and hearing people.

The age at which an individual experiences hearing loss or becomes deaf has a great impact on language acquisition and intellectual development. Language is ordinarily acquired through the frequent and repeated exposure to speech, usually beginning in infancy. An individual who learns speech and language patterns through such early exposure will normally retain and continue to use them even if his or her hearing deteriorates later in life. On the other hand, developing speaking skills is infinitely harder and slower for someone born deaf. Without intervention, the deaf child

must grow up not only unable to speak but denied even a concept of language, that indispensable instrument of thinking and reasoning. . .not only unable to communicate with others, he cannot even communicate with himself.^[5]

It is extremely difficult to learn to produce sounds that one has never heard and that may also be difficult or impossible to read from a speaker's lips. An individual who is born with moderate hearing loss or who experiences such loss early in life will hear imperfectly, which often results in corresponding difficulties with English because of the lack of a language-based frame of reference.

In contrast to blindness, deafness is most commonly an invisible handicap. However, there are common signs and symptoms indicating that a person may have a hearing loss.

Look for these signals when the person

- Asks to have things repeated often
- Does not react to loud noise
- Does not always respond when spoken to, or responds inappropriately
- Misunderstands conversation
- Has trouble hearing in group settings
- Complains that people are mumbling
- Has difficulty hearing women's or children's voice, but can hear deeper tones, such as men's voices
- Must be close to the person speaking
- Speaks too loudly or softly in conversation
- Strains to hear
- Ignores sounds coming from behind
- Has nasal speech or less distinct articulation
- Turns head towards the person when speaking^[6]

Communication Modes

Adding to the diversity previously described are disparate communication modes, strategies, and preferences. In the United States and elsewhere, communication methodology has been hotly debated among both deaf and hearing people for over a century. Even today, educators, doctors, and other professionals; parents; and deaf people themselves still argue over whether deaf children should be encouraged and taught to communicate orally (i.e., through speech and speechreading only), in ASL, in signed English, or through a combination of methods.

In describing the disparate communication strategies used by Deaf and hard-of-hearing people, respectively, certain generalizations may be made.

Deaf people, particularly those who are prelingually deaf and/or are born to deaf parents, rely primarily on vision, although some may use residual hearing to supplement their communication. Members of this group:

- Communicate through sign language and/or speechreading
- Use sign language interpreters
- Use Telecommunication Devices for the Deaf (TDDs) and Telephone Relay Services
- Use visual signaling devices for doorbell, telephone, sounds of baby crying, etc.

- Sometimes use specially trained "hearing dogs"
- Use closed-caption decoders for television viewing
- Generally are members of the Deaf culture.

Hearing impaired people rely primarily on hearing supplemented by amplification, and use their vision to supplement their communication. Members of this group:

- Generally do not use sign language
- Generally do not use interpreters
- Generally do not use TDDs or Telephone Relay Services
- Communicate using amplification and through speechreading
- Use hearing aids
- Use Assistive Listening Devices, such as induction loops, FM and infrared systems, and telephone speech and hearing amplifiers
- Use visual signaling devices
- Generally are not members of the Deaf culture.

There are some areas of overlap in the communication strategies used by these two groups.^[3] Obviously, there is no typical deaf person; there is tremendous diversity among people with any degree of hearing loss.

Misconceptions about Deafness and Deaf People

Misconceptions about deaf people are common among hearing people who have little or no direct contact with deaf individuals. The same is true about the various means used by deaf people to communicate among themselves and with their hearing counterparts.

For example, good speech is not necessarily an indication that a hearing-impaired speaker can also hear well. People who lose their hearing later in life may speak almost perfectly, in spite of profound deafness. Late-deafened adults lose the ability to monitor their own speech, which usually results in deterioration of speech quality. Sometimes this deterioration leads others to suspect a speech impairment rather than the deafness that actually causes it.

A common first question asked of deaf people is, "Can you lipread?" Although most deaf people do get information through observing lip movements, skill, experience, and comfort in speechreading vary tremendously. Very few deaf people develop sufficient speechreading skill for it to become their primary means of understanding others; often they will depend more or less exclusively on other means of communication because of great difficulty with speechreading. Some deaf individuals do learn to speechread so well that hearing people may be unaware of, or forget, their deafness.

Wearing a hearing aid does not necessarily imply that the wearer can "hear" in the sense of understanding speech

as a hearing counterpart would. In cases of severe impairment, wearing a hearing aid may be of little value beyond alerting the wearer to environmental sounds that are in themselves unintelligible.

COMMUNICATION WITH DEAF PEOPLE

Speaking and Facial Expression

Although speaking louder to a deaf or hard-of-hearing person is a natural inclination, this rarely, if ever, enhances comprehension. A profoundly deaf person will still hear nothing, no matter how loudly a message is spoken. Additionally, a hearing aid wearer may experience both distortion and pain when shouting or abnormally loud speech is amplified.

Leaning forward or speaking into a deaf person's ear are also counterproductive, if natural, responses to the person's deafness. When this occurs, speechreading becomes harder or impossible for the deaf person, because of the difficulty experienced in focusing on the speaker's mouth. As Wright points out, the speechreader must at all costs keep his or her line of vision to the other's face.^[5]

The use of facial expression appropriate to the tone and content of the message is of considerable help in communicating with deaf people. Speakers whose facial expression, gestures, and animation supplement spoken messages appropriately will generally be much more readily understood than those who do not provide these additional message clues.

Facial expressions are also crucial in conveying the intensity of a message. Particularly for deaf people who rely heavily on sign language, they modify both signed and spoken messages in a manner analogous to the way adjectives and adverbs modify spoken English for hearing people. Whether the speaker is mildly amused, delighted, perplexed, or angry, his or her thoughts might be expressed in essentially the same signs (with some variations in pace and intensity), but facial expressions are what convey the mood being expressed.

Overcoming any personal or cultural biases that inhibit the expression of feeling through facial expression and body language will convey the intended weight and meaning of a message to deaf patrons much more effectively.

Speechreading

Lipreading entails deciphering verbal messages through watching lip movements. Speechreading, on the other hand, not only encompasses lipreading, its most important component, but also incorporates many other visual clues that assist in understanding the spoken message. Such clues include facial expression, gestures, pantomime, rate of delivery, and eye contact. Even hearing people develop

and use some speechreading ability, often unconsciously, especially when background noise interferes with hearing.

People with hearing impairments vary greatly in their ability to speechread, even when other factors, including educational level attained, are essentially equal. Words and concepts must obviously be part of an individual's vocabulary and experience to be recognized through speechreading. Thus, a deaf individual who has never heard the patterns of spoken English will most likely find it difficult or impossible to speechread.

David Wright, a deaf Oxford University graduate, explains how complex lipreading is, even under ideal conditions

Lipreading is not simply a physical operation in which the eye has learned to interpret for the ear; it is also an intellectual exercise. Lipreading is ninety percent guesswork, because while most vowels are easily distinguished, many consonants are not, since those are often produced by nearly identical lip movements. This means that in effect a great number of words and syllables which are distinct in sound appear to the eye as like as peas. The alternatives can be so many that it may take a lipreader a few seconds to make the choice while he runs the various possibilities through his mind.^[5]

A missed key word can make an entire sentence incomprehensible to a speechreader. Words used out of context, as when a speaker changes the topic of his communication suddenly, are usually difficult to recognize. Stuttering and accents interfere with speechreading, as do poor lighting and visual interferences and distractions, including but not limited to bushy moustaches, objects in the mouth, or people or objects moving in the background.

Fortunately, the typical library, characterized by good lighting (i.e., bright, indirect, and uniform) and relatively few visual, tactile, or auditory distractions, is conducive to speechreading.

Although some deaf people speechread remarkably well in spite of the difficulties mentioned, it is important not to assume that every hearing-impaired person can speechread well enough so as not to require other supplemental means of communication.

Sign Language

The use of gestures is a natural communication channel for many people, particularly within and across certain cultures, and is as old as humankind. Deaf people have long communicated with one another through gestures and signs of their own invention. In various countries, some of these sign systems have become formalized into languages.

The | French | Abbé Charles Michel de l'Epeé convinced himself that gestures and signs were the natural language or "mother tongue" of the deaf-born, and therefore set out

to construct and codify a sign language based on the natural signs' that he had learned from his own pupils.^[5]

American Sign Language stems from this French sign language, as well as from a native American sign language. As is true in the cases of other modern languages, ASL continues to evolve.

Particularly over the past thirty years, linguistic studies have shown that ASL has a complex, systematic syntax of its own that differs dramatically from that of English. Moreover, the order in which concepts are signed and the ways in which they are modified are considerably different.

Just as the tone of voice in articulate speech modifies the sense of a word, the meaning of a particular sign can be modified by an expressive variation of gesture while making it.^[5]

In recent years, ASL has been recognized as a language in its own right. Many deaf people, as well as organizations such as the National Association of the Deaf, have become increasingly assertive in advocating ASL as both their language of choice and of instruction.

American Sign Language is a purely visual/gestural language, and thus has no written form. However, in the 1950s and 1960, William Stokoe, a Cornell University researcher, originated a system of symbols that accurately describe the finger, hand, face, and body movements that constitute ASL. His efforts, combined with the general recognition of ASL as a distinct language, have resulted in the publication of various dictionaries and instructional material on ASL. This in turn has led to greater standardization of ASL throughout the United States.

Many Deaf people and their advocates, notably organizations such as the National Association of the Deaf, have become increasingly assertive in advocating ASL as their language of choice in both social and instructional settings.

Fingerspelling

Simple, distinct handshapes are used in fingerspelling to represent the letters of the alphabet, as well as the digits 0 through 9. Letters are formed one after another to spell out words; slight pauses separate words from each other. Many of the letters of the alphabet are obvious in their manual representations.

Fingerspelling is most frequently used to supplement sign language, as when no sign for a particular concept exists, or when greater clarity or emphasis is desired in conveying a word or name. Because the number of letters and digits is tiny compared to the number of distinct signs, fingerspelling can be learned much more rapidly than sign language.

Simultaneous Communication and Total Communication

The use of *manual communication* (including both ASL components and fingerspelling) along with *oral communication* (speech and speechreading) is called *simultaneous communication*. This approach to communication (both to and among deaf people) tends to follow more closely the syntax and word order of English.

Total communication involves using everything at one's disposal to communicate, including simultaneous communication as just described, plus gestures and mime. Deaf people who normally use only ASL when communicating among themselves sometimes attempt to use speech as well as a word order more closely resembling that of English when communicating with hearing people.

Learning Sign Language

For those interested in developing or enhancing sign language skills, sign classes are offered by many schools, colleges, and universities, as well as by organizations serving the deaf community. The Monroe County Association for Hearing Impaired People in Rochester, New York, is one such organization. Many bookstores offer books on sign language (including fingerspelling), pictorial dictionaries, manuals that explain sign usage and word order, and collections of specialized signs.

As is true in learning any other new language, extensive practice is necessary to develop proficiency in manual communication. Interaction with a knowledgeable instructor and with deaf people is far preferable to self-instruction, because motion, mime, facial expression, intensity, and other visual clues, such important components of sign language communication, are best learned from this interaction.

However, even the use of fingerspelling alone can make a tremendous, positive difference in communicating basic information to a deaf person. So can learning and using a few signs relevant to the messages most often conveyed. This is all the more true if one is careful to verify the correctness of the signs used before using them routinely. Any appropriate communication adaptations, such as fingerspelling, the use of basic signs, or writing, help convey to a deaf person one's willingness and desire to communicate.

If asked, many deaf people will gladly provide helpful feedback to someone who is learning sign language. In communities with large concentrations of deaf people, it may be possible to find a professional (for example, a certified interpreter or teacher of sign language) who could evaluate one's skills more formally and provide feedback on appropriate or inappropriate communication strategies.

Writing to Communicate

Writing is one of the best ways to get a message across to a deaf person, especially when speech does not seem to be conveying the desired message. Writing information is particularly helpful when the message is detailed or when accuracy is essential. Brevity and simplicity often facilitate this means of communication, particularly in communicating with an individual whose proficiency in English is not well developed. Writing only the essential words of one's message may prove to be entirely sufficient.

Because ASL word order is so different from that of English, individuals whose primary language is ASL encounter some of the same difficulties with English as do others for whom English is a second language. Since qualifiers other than tenses, adjectives, and adverbs (e.g., facial expression, and rate of delivery) are used to modify ASL messages, the writing of deaf individuals sometimes exhibits errors somewhat comparable to writing errors of other nonnative users of English.

Questioning and paraphrasing by both the hearing and deaf persons can help clarify the intent and meaning of a written message when necessary.

OPTIMIZING CONDITIONS FOR GOOD COMMUNICATION

Managing the Communication Environment

Good lighting, appropriate position, unobstructed vision, and minimal distractions are essential to optimal speechreading. Although a resourceful and assertive hearing-impaired individual will try to position himself so as to optimize his own understanding, a speaker can also do much to optimize that communication. Many of the suggestions that follow are effective regardless of the hearing-impaired person's preferred communication mode.

Whenever possible, the speaker should

- Position herself so that the main source of light shines directly on her own face. Backlighting, which silhouettes the speaker's face, makes speechreading difficult or impossible.
- Position himself so that his face is at the same or a slightly higher level than that of the hearing-impaired person, rather than the other way around. This facilitates speechreading.
- Maintain eye contact. As difficult as this may be in some cultures, eye contact is of great importance in communicating with hearing impaired people. As Wright puts it:

The divining of people's moods and intentions from their eyes is so much easier (since it makes less intellectual demand) than the reading of their actual words.^[5]

Avoid noisy backgrounds or locations where there is a lot of motion that can be distracting. Move to a quieter spot if necessary.^[6]

General Suggestions for Interactive Communication

An individual's deafness, communication skills, and preferences remain invisible until he begins to communicate. The manner in which a deaf person initiates communication with a hearing person provides clues as to how he or she prefers to communicate in that situation. This might, for example, be through speech, a written note, gestures, or a signed message. Communication occurs through many channels other than just speech or sign language. Gestures, mime, facial expression, writing, and even drawing can be used to communicate. The less a person hears, the more important visual aids become in facilitating understanding.

It is best to respond using whatever communication techniques seem most appropriate at the moment and are within the speaker's current repertoire. Through experience and practice, and with background information of the kind presented here, hearing people may develop the ability to recognize and adapt skillfully to the diverse communication needs and preferences of hearing-impaired people.

The following tips will help in communicating with these patrons.

Initiating Communication

- Always get the hearing-impaired person's attention before starting any communication. This may be accomplished by moving into the other's line of sight, by touching him or her gently on the arm or shoulder, or by using other means that seem appropriate under the circumstances. Try not to startle the person.
- Establish and maintain eye contact.
- "Face the person directly. Stand still to communicate from a reasonably close, yet comfortable, distance."^[6]
- "Ask how you can facilitate communication. People appreciate being asked. You may be doing everything just fine, or your listener may need for you to talk slower, slightly louder, or make some other adjustment. By asking how to help, you show your desire to communicate clearly."^[6]

Adapting Your Communication to the Needs of the Hearing-Impaired Person

- Speak in a normal tone of voice. Don't speak loudly; doing so may embarrass the other person by drawing attention to his or her disability, and it usually does not enhance comprehension.

- Enunciate words distinctly, but without exaggeration. Exaggeration changes the appearance of speech on the lips to the point where words may actually become harder to recognize. Try not to mumble.
“Articulate: move your lips as well as the best new seaster on television.”^[6]
- Speak at a moderate, uniform rate, and with normal rhythm. Slow down delivery only enough to be able to enunciate clearly. Extremely slow or excessively rapid speech may be harder to speechread.
- Paraphrase messages when appropriate. If one or two repetitions of a word, phrase, or sentence do not seem to be conveying the message, try synonyms. Emphasize the key words in the message, as through repetition or by fingerspelling or writing these words.
- Use any gestures (or mime) that seem appropriate in helping to convey the desired message or meaning. If necessary, demonstrate an action or outline the shape of an object being discussed. For example, opening one’s hands as one would open a book both conveys a clear meaning and is actually the sign for “book.”
“Give other clues to clarify miscommunication.”^[6]
- Minimize behaviors that make speechreading more difficult, such as gum chewing, eating, or covering the mouth in any way while speaking. Also minimize head or body movements, unless they reinforce a spoken message.
- “Ask for feedback to know [whether or not] the person is understanding the conversation. Do [whatever else] you can to further enhance communication.”^[6]
- In a session where many new terms are being used, provide the new vocabulary in written form prior to the session.
- Make use of visual aids as much as possible. Be sure they can be seen clearly from all points in the room.
- Repeat questions or statements from the audience before answering or commenting.
- Depending on the format of the program, provide special seating for persons with hearing loss, so that they can see the speaker’s face and read captions.^[2]

Because of the diverse nature of hearing loss and that of the social, language, and educational experiences of people with hearing impairments, there are marked differences in communication preferences from one deaf person to another. Even though any proficiency in sign language on the part of a hearing person demonstrates caring and commitment to communicating, not every deaf person necessarily knows sign language or appreciates its use. Some deaf people still prefer to rely on speech and speechreading, especially if they themselves are not proficient in the use of sign communication.

Particularly after one has developed a repertoire of communication skills, asking deaf patrons which communication mode or modes they prefer is appropriate and will be appreciated.

CONCLUSION

As this article demonstrates, there are many straightforward, common sense things one can do to facilitate communication with hearing-impaired people. The desire to communicate and the willingness to adapt one’s communication to the needs of the individual deaf person, combined with patience and empathy, are more important than extensive sign language training. Positive experiences in communicating with deaf individuals will more often than not quickly enhance one’s comfort level in such situations, as well as that of one’s listeners.

All the topics in this article are discussed extensively in published works, including books and journals. The bibliography lists recent works, as well as several classics, under several headings: Services for Deaf and Hearing Impaired Library Patrons, Deafness, Communication, and Sign Language. Organizational sources of further information and of relevant services are listed.

Demonstrating Empathy with the Listener

- “Be patient if your listener seems slow to respond. The person may just need a little time to piece together what was heard or seen. This is the processing time needed to use two senses (sight and hearing) to receive communication. Impatience may show on your face and could create tension for your listener, which only makes further communication more difficult.”^[6]
- “Stay positive and relaxed. If you appear frustrated or anxious, the person with a hearing loss will find it more difficult to continue the conversation or (to) give you the feedback you need to make sure you are communicating effectively.”^[6]
- If using an interpreter, talk *to* the hearing impaired person, not about him or her. Remember that the communication is with the hearing impaired person, not with the interpreter. Again, maintain eye contact with the former.

Facilitating Group Communication

- Aid deaf and hearing impaired persons, when applicable, with an outline, summary, script or printout, prior to a meeting.

NOTE

This article is an adaptation of.^[7]

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Decision Sciences

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Abstract

This entry provides a description of the vast area of decision sciences from an operations research/management science (OR/MS) perspective. This means that the focus is on how quantitative models can be used for improving the quality of decisions. After describing and explaining a general conceptual approach to quantitative decision modeling, some important, commonly used decision models and methods are considered in more detail. The list includes both deterministic models such as linear programming (LP), integer programming (IP), and economic lot sizing, as well as stochastic models for safety stock decisions in inventory management. Various generalizations are also discussed together with brief comments and references to other important decision modeling approaches such as game theory, multiple criteria decision making (MCDM), queuing, and simulation.

INTRODUCTION

“Decision sciences” represents a broad area of research with a common focus on advancing the understanding of decision making processes and improving the quality of decisions, organizational as well as individual. Essentially all types of decisions fall within the realms of the field, but an emphasis is placed on various types of business-related decisions or decisions with an economic dimension. From a methodological perspective, the field contains both behavioral and quantitative modeling research. The former is often closely related to organization theory and psychology, while the latter to a large extent is synonymous with operations research/management sciences (OR/MS), and closely relates to economics, applied mathematics, and statistics. In this entry we restrict our attention to the quantitative modeling (OR/MS) area of decision sciences. The motivation is twofold: first of all, it is arguably the largest area; second, this is where our own backgrounds lie as authors.

Decision sciences research from an OR/MS perspective is usually concerned with improving the quality of decisions. This is done by describing the decision problem in a quantitative model of the real system, then use this model to generate decision alternatives and choose the best among these candidate solutions. The challenges are to model the dynamics and constraints of the underlying system with an appropriate level of detail, and to determine what criteria should be used in assessing what is the best decision. After some reflection most people find this structure intuitively appealing because it fits well with how they make their own decisions (if they are forced to dissect the situation). A set of constraints limits the choices you have and defines the possible alternatives. You then choose between these feasible alternatives

according to some objective function that reflects what your goal is with the decision. In the entry on “Examples of Common Decision Models and Applications,” we will look at several classical models and methods that illustrate variations of this basic model structure. For the remainder of this entry we will take a closer look at the general approach for quantitative decision modeling sketched above. We will then reflect on the past development, and the future opportunities and challenges of the field.

The general approach when using quantitative models is illustrated in Fig. 1. The goal is to find good decisions for some real system. This is very difficult in many situations. Therefore we can choose to replace the real system by a quantitative model. The model seldom provides a complete description of reality, instead it serves as an approximate, simplified version of the real system. However, an advantage is that the quantitative model quite often can be optimized, that is, we can find the best decisions for the simplified version of the real system. In some cases we cannot find the optimal decisions but still some good ones, for example, by using simulation to evaluate some reasonable alternatives. Because the quantitative model does not take all aspects of the real system into account, decisions that are optimal for the model may not be optimal for the real system. However, presuming the model is a valid description of reality, it should capture the essence of the real system at an appropriate level of detail. Decisions obtained from a validated model can be expected to work well also for the real system. Thus if the model is valid, the model decisions can be implemented in the real system with good results. It is often quite difficult to design the quantitative model at the right level of detail. If the model is too simple, it may provide a poor approximation of the real system (i.e., the model has poor validity), and it may be dangerous to use the model as a basis

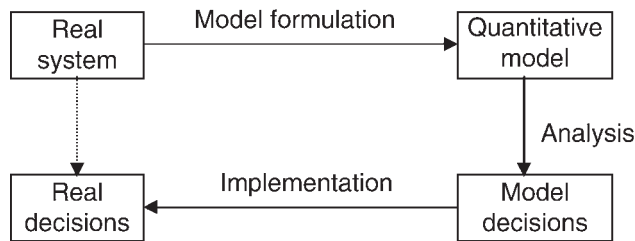


Fig. 1 Using quantitative models to improve the decision quality.

for generating decisions to be implemented in the real system. On the other hand, if the quantitative model is too complex it may be too difficult to analyze. Thus, it becomes quite useless as a tool for helping the decision maker to make better decisions.

The approach to use quantitative models to analyze and describe reality is a cornerstone in modern science and dates back to the dawn of our civilization. However, the birth of the OR/MS field, with its focus on modeling complex decisions, is often attributed to military activities during World War II. The war effort induced an urgent need to make vital decisions about allocation of scarce resources at a scale never seen before. The U.S. and British military services turned to a large number of mathematicians and other scientists to do research on these decision problems, and to develop scientific methods to help solve them. After the war, the success of these efforts spurred an interest to apply the same approaches to decisions in industry and business. The dissemination was fueled by the fast industrial development following the war, and the fact that many consultants and industry people had come in contact with OR/MS methods during their military service. The fast growth of the OR/MS research field after World War II can also be attributed to the groundbreaking research achievements in OR/MS techniques that attracted talented people into the new field. A stellar example is the Simplex method for solving linear programming (LP) problems, originating with George B. Dantzig in 1947, see Dantzig.^[1] Other important areas where much progress was done early on were dynamic programming, queuing theory, and inventory theory.

Since the early days in the 1940s, the progress of the OR/MS field of decision sciences has been closely connected to the development of the computer and information technology. The revolution in computational power due to the emergence of the digital computer, and later on the emergence of the personal computer, has made it possible to model and solve increasingly complex decision problems. Another important enabler for the development of the field is the tremendous advances in information technology, not least in recent years. Access to an almost infinite amount of information at the press of a button, propels the opportunities for quantitative models to help decision makers evaluate information and decision

alternatives. Hence, the need for quantitative decision models, embedded in user-friendly decision support systems, continues to increase as the tide of information keeps overwhelming the decision makers. From a research perspective, easy access to new and more detailed information in combination with increased computational power creates new interesting challenges and promises an interesting future for the OR/MS area of decision sciences.

Important professional associations, which among other things host some of the most influential conferences and journals in the field, include INFORMS (<http://www.informs.org>), Decision Sciences Institute (<http://www.decisionsciences.org>), and EURO (<http://www.euro-online.org>).

EXAMPLES OF COMMON DECISION MODELS AND APPLICATIONS

In this entry we will look closer at some commonly used quantitative decision models. The ambition is to illustrate how the general model building approach discussed above can be applied in different contexts. The models chosen are classical examples but represent a small sample of the entire field, and should not be construed as an exhaustive representation. For specific examples of OR/MS decision models applied in the library and information sciences area we refer to Kraft.^[2]

Deterministic Models

A deterministic model is characterized by the absence of randomness, meaning that all input values are known with certainty (i.e., correspond to a single outcome with probability 1). A model that incorporates randomness belongs to the class of stochastic models (see the entry on “Stochastic Models”). To exemplify, consider a decision where the customer demand during next week is an important input parameter. If the demand is known to be 50 units it is deterministic. If there is a probability of 0.5 that the demand will be 25 and a probability of 0.5 that it will be 75, the demand is stochastic (or random) with a mean of 50. The advantage of deterministic models over stochastic ones is that they are generally easier to solve, thus, larger problems may be dealt with. Clearly, in most real systems there is some uncertainty present. However, in many situations this uncertainty may be low enough for a deterministic model to be an appropriate approximation. In other situations, the inherent uncertainty may be critical for the decision and must be incorporated into the model, the choice should then fall on a stochastic model.

In this entry we will consider three types of deterministic models: LP models, integer programming (IP) models, and the economic lot sizing model. Examples of stochastic models are found in the “Stochastic Models” entry.

LP models

Linear programming is perhaps the most well known and most widely used decision sciences method to date. It was originally developed by George Dantzig in late 1940s, who proposed the so-called Simplex method for solving large-scale general linear programs. As the name suggests, an LP model is restricted to linear relationships between the decision variables. Programming is, in this case, synonymous with planning, thus LP can be thought of as linear planning.

Generally speaking, an LP model consists of a linear objective function to be maximized or minimized, and a set of linear constraints that limit the decision alternatives. The objective function is a linear equation of the involved decision variables and should reflect how the decision variables impact the overall decision objective. The constraints are also linear equations of the decision variables, describing logical relationships between these variables and how they consume various types of limited resources. Because of its flexibility, the LP approach has been applied to almost any decision situation conceivable, including production planning, scheduling of personnel, investment planning, marketing, logistics, supply chain management, military strategy and tactics, agricultural planning, etc. The most common type of LP application concerns decision problems of allocating limited resources to a number of competing activities in the best possible way (as defined by the objective function). To make the discussion more concrete consider the following example of a classic product mix decision problem.

A production manager who wants to maximize profits is faced with the decision problem of how much to produce of two products A and B during the upcoming planning period. The production process involves three different machines (resources). The times (resource units) to produce a batch of product A and B, respectively, in each of the machines are specified in Table 1. One can also find the available capacity for each of the machines there, and the profit associated with each batch of product A and B sold. Demand is high so we can assume that everything that is produced can also be sold. A restriction is that previous order commitments require that at least 20 batches of product B are produced.

To formulate this decision problem as an LP, the first step is to define the decision variables, which in this case are the amounts of products A and B to be produced.

Table 1 Input data for the product mix example.

Resource	Production time per batch		Available capacity
	Product A	Product B	
1	3 hr	—	150 hr
2	1 hr	2 hr	140 hr
3	2 hr	2 hr	160 hr
Profit per batch	\$1500	\$2000	

X_A = number of batches to produce of product A

X_B = number of batches to produce of product B

Given these decision variables, the goal to maximize total profits (Z) translates into the objective function: $\text{Max } Z = 1500X_A + 2000X_B$.

Turning to the constraints that limit the amount of product A and B that can be produced, the capacity constraints for resource 1, 2, and 3 can be expressed mathematically as:

- (1) $3X_A \leq 150$ (limited capacity in resource 1)
- (2) $1X_A + 2X_B \leq 140$ (limited capacity in resource 2)
- (3) $2X_A + 2X_B \leq 160$ (limited capacity in resource 3)

Similarly, the constraint that at least 20 batches of product B must be produced can be expressed as:

- (4) $X_B \geq 20$ (produce at least 20 batches of product B)

Adding the non-negativity constraints, $X_A \geq 0$ and $X_B \geq 0$ (assuring that the model solution does not suggest negative production) renders the complete LP model of the product mix problem

$\text{Max } Z = 1500X_A + 2000X_B$ (objective function : maximize total profits)

Subject to

- (1) $3X_A + \quad \leq 150$ (limited capacity in resource 1)
- (2) $1X_A + 2X_B \leq 140$ (limited capacity in resource 2)
- (3) $2X_A + 2X_B \leq 160$ (limited capacity in resource 3)
- (4) $X_B \geq 20$ (produce at least 20 batches of product B)
- (5) $X_A, X_B \geq 0$ (non – negativity constraint)

Note that due to constraint^[4], the constraint $X_B \geq 0$ is redundant in this formulation and it is included solely for reasons of completeness.

After formulating the decision model, the challenge is to solve it and determine the optimal decisions. For the current example with only two decision variables the problem can be solved graphically as illustrated in Fig. 2.

Scrutinizing the graphical representation in Fig. 2, the bold lines labeled (1)–(4) correspond to constraints (1)–(4) above when satisfied to equality. The gray shaded area corresponds to the feasible region, where all the constraints are satisfied (including the non-negativity constraint $X_A \geq 0$). The optimal decision must satisfy all the constraints, hence the feasible region defines all decision alternatives of interest. The optimal solution is the feasible solution that maximizes the objective function. The dashed line in Fig. 2 represents the slope (or level) of the objective function, $Z = 1500X_A + 2000X_B$. To maximize Z , we increase X_A and X_B , which corresponds to parallel-shifting

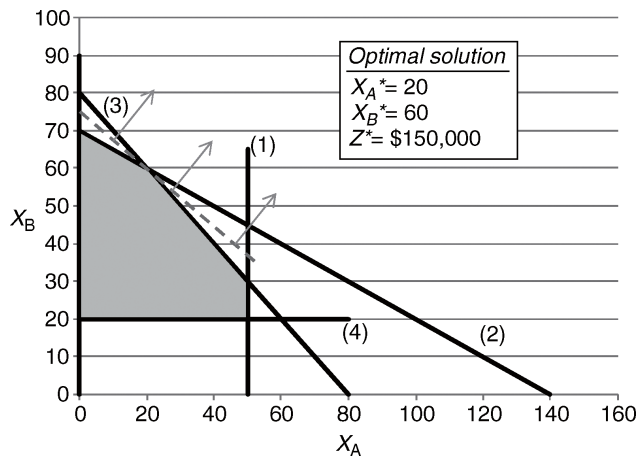


Fig. 2 Graphical solution of the product mix decision problem.

the dashed line in the directions of the arrows depicted in Fig. 2 (mathematically the arrows represent the gradient to the objective function). The optimal solution is the last point on the dashed line which belongs to the feasible region. From Fig. 2 we can see that this corresponds to the corner point of the feasible region where constraint (2) and (3) intersect. Solving the linear equation system defined by constraints (2) and (3) (or by inspecting the graph), the optimal solution $X_A^* = 20$, $X_B^* = 60$ is found. The corresponding objective function value is $Z^* = 150,000$. Hence, the optimal decision obtained from the LP model is to produce 20 batches of product A and 60 batches of product B, which renders a total profit of \$150,000.

Clearly, LP problems of practical interest are considerably larger than the small example studied here (often including thousands or even millions of variables and constraints), which prohibits a graphical solution technique. Instead, these large-scale problems can be solved using, for example, an efficient algebraic technique called the Simplex method. This method utilizes the fact that an optimal solution to an LP problem is always found in a corner point to the feasible region (a consequence of the linearity of all equations). In principle, the method searches through the set of feasible corner point solutions in a structured fashion until a set of optimality conditions are fulfilled, and the optimal solution is found. More details about the Simplex method and other aspects of LP, such as duality and sensitivity analysis can be found in basic OR/MS textbooks such as Hillier.^[3] For more theoretical treatment of the subject one can turn to books like Dantzig^[4-6] and Vanderbei.^[7]

IP models

One limitation with LP models is that the decision variables must be continuous. Hence, it is just a coincidence that the optimal solution to the product mix example above turned out to be in full batches ($X_A^* = 20$, $X_B^* =$

60) rather than fractional. If integer restrictions of the decision variables are added to an LP model, it transforms into an Integer Programming (IP) model. If some variables are allowed to be continuous while others are integer, the model is often referred to as a Mixed Integer Programming (MIP) model.

Solving a problem which contains integer variables is much more difficult than solving a LP model. The reason is that there is no longer a guarantee that an optimal solution is found in a feasible corner point solution. As a result, the number of candidate solutions to investigate increases tremendously. To avoid complete enumeration, which would severely restrict the size of the problems worth considering, much research has gone into finding good solution methods for various kinds of IP problems. One common solution approach is the family of Branch and Bound algorithms. The underlying principle with Branch and Bound is to divide a difficult problem into subproblems that are easier to solve, and then use these subproblems to bound the optimal solution. The subproblems may, for example, be linear programs. For more details about Branch and Bound techniques and other solution approaches for IP models one can turn to, for example, Wolsey.^[8] For a more general introduction to IP models, including examples of formulated problems^[3] is an excellent starting point.

A special case of integer-valued decision variables are binary variables, which are restricted to be either 0 or 1. The binary variables are important in decision modeling because they can be used to describe Yes/No decisions, either or alternatives, fixed charges and stepwise changes. They can also be used for representing general integer variables.

To exemplify the use of binary variables, we return to the product mix example in the “LP Models” entry. After further analysis it turns out that there is a fixed charge of \$1000 associated with starting up production of product A. This start up cost is due to necessary configuration of machinery and special material handling equipment that needs to be acquired in case product A is produced. To incorporate this feature into the decision model, an additional decision variable is needed together with new constraints and a modified objective function.

Definition of the additional (auxiliary) decision variable:

$$y_A = \begin{cases} 1 & \text{if product A is produced} \\ 0 & \text{if product A is not produced} \end{cases}$$

The modified objective function (maximize total profits) that includes the fixed charge associated with producing product A becomes

$$\text{Max } Z = 1500X_A + 2000X_B - 1000y_A$$

The new constraints must assure that y_A is binary and that the contingent decision to produce A or not (modeled by y_A), is aligned with the original decision of how much to produce of A (modeled by X_A). For the formulation, we

define the parameter M to be a very large number, larger than the highest possible production of product A.

- (6) $X_A - My_A \leq 0$ (X_A positive only if $y_A = 1$)
 (7) y_A is binary

The complete formulation of the fixed charge product mix decision problem now amounts to the following MIP model.

$$\text{Max } Z = 1500X_A + 2000X_B - 1000y_A \text{ (maximize total profits)}$$

Subject to

- (1) $3X_A + \dots \leq 150$ (limited capacity in resource 1)
 (2) $1X_A + 2X_B \leq 140$ (limited capacity in resource 2)
 (3) $2X_A + 2X_B \leq 160$ (limited capacity in resource 3)
 (4) $X_B \geq 20$ (produce at least 20 batches of product B)
 (5) $X_A, X_B \geq 0$ (non-negativity constraint)
 (6) $X_A - My_A \leq 0$ (X_A positive only if $y_A = 1$)
 (7) y_A is binary

The versatility of IP models means that they can be used to describe almost any kind of deterministic decision situation with a single objective. Their usefulness in practical applications may however be limited by the computational effort involved in solving large size problems. Still, the situation is continuously improving thanks to increased computer capacity and better solution algorithms. One of the most widely used software packages for solution of large-scale IP (and LP) models is CPLEX, a product sold and developed by the company ILOG.

It may be worth noting that when dealing with reasonably large integer variables it is usually an acceptable approximation to use an LP model and then round the solution to integers (although there is no guarantee that the rounded solution is feasible). However, in case of binary variables this approach is generally not feasible.

Economic lot sizing

Let us now consider a simple nonlinear decision model that has been around for a long time but still is very important in production and inventory management, the so-called classical economic order quantity (EOQ) model.

Consider an inventory location that replenishes its stock of an item from an external supplier. The problem is to determine a suitable batch quantity, that is, to decide on the size of a replenishment order. This decision is mainly affected by two costs. First there is usually a fixed "ordering cost" associated with each replenishment (independent of the batch size). This cost can be due to administrative costs associated with the handling of orders and to costs for transportation and materials handling. The other important cost that needs to be considered is a "holding cost" per unit and time unit. The holding cost includes an opportunity cost for capital tied up in inventory, but may also include other costs that increase with the inventory on hand.

Our simple model assumes that the known demand is constant and continuous. Furthermore, the batch quantity is not changed over time, the whole batch quantity is delivered at the same time, and no shortages are allowed. We shall use the following notation:

- h = holding cost per unit and time unit,
 A = ordering or setup cost,
 d = demand per time unit,
 Q = batch quantity,
 C = costs per time unit.

Clearly, a batch should arrive and be placed in stock just as the previous batch is depleted. The development of the inventory level can therefore be illustrated as in Fig. 3.

We wish to determine the optimal batch quantity Q^* . The relevant costs to consider in the decision model are therefore the costs that vary with the batch quantity Q . We get

$$C = \frac{Q}{2}h + \frac{d}{Q}A$$

The first term represents the holding costs, which we obtain as the average stock, $Q/2$, multiplied by the holding cost h . The average number of orders per unit of time is d/Q , and multiplying by the ordering cost A , renders the ordering costs per unit time in the second term.

It is easy to optimize the cost function. We just set the derivative with respect to Q equal to zero (as one can show that C is a convex function).

$$\frac{dC}{dQ} = \frac{h}{2} - \frac{d}{Q^2}A = 0$$

Solving for Q we get the EOQ:

$$Q^* = \sqrt{\frac{2Ad}{h}}$$

This result was first derived by Harris in Harris^[9] There is also a well-known early paper by Wilson, Wilson,^[10] providing the same result.

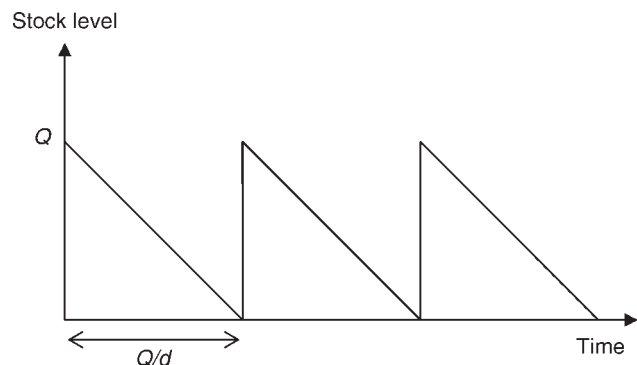


Fig. 3 Development of inventory level over time.

As we have discussed in the introduction, it is common to use decision rules that are based on certain simplified assumptions also in settings where these assumptions are not really satisfied. For example, in practice it is common to use the classical lot size formula also in case of stationary stochastic demand. The constant demand d is then usually replaced by the demand forecast. It can be shown that this approximation, in general, works quite well. The considered simple lot size formula has been implemented in an enormous number of inventory control systems. There are also many related models, see, for example, Axsäter.^[11]

Stochastic Models

In many situations, the inherent uncertainty or randomness of decision input information is the main obstacle for making good decisions. Intuitively understanding the consequences of random behavior on the system performance is difficult for most people, including decision makers. This emphasizes the need for quantitative decision models that explicitly incorporate randomness and evaluates its consequences. Describing uncertainty and randomness mathematically involves the use of probability theory and stochastic variables. To make the discussion more concrete and to illustrate the usefulness of stochastic decision models, we will in this entry look closer at the classical newsvendor model, which is the foundation on which many stochastic inventory models are built.

Before turning to the newsvendor model, it is worth emphasizing that the complexity associated with stochastic behavior often prohibits the use of detailed analytical models. In these situations computer-based simulation models may be very useful for evaluating different decision alternatives and analyzing the dynamics of complicated stochastic systems. Particularly, modern discrete event simulation software packages with graphical interface represent a flexible and easy to use decision support tool. For further details on simulation modeling and the use of modern discrete event simulation software, one can turn to Law^[12] and Laguna.^[13] The latter also provides an introduction to analytical modeling of simple queuing systems (see also Hillier),^[3] which represents another important area in stochastic decision modeling.

The newsvendor model

In this entry we consider the classical newsvendor model. In its original form, the problem deals with a newsvendor who can buy copies of a newspaper in the morning for a certain price, and sell them during the day for a higher price. The stochastic demand during the day is known through its probability distribution. The newsvendor is not paid anything for unsold copies of the newspaper.

We shall deal with a slightly more general formulation of the problem and introduce the following notation:

X = stochastic period demand,

$f(x)$ = density of the stochastic period demand,

$F(x)$ = cumulative distribution function of the stochastic period demand, that is, the probability that the demand X is less than or equal to x ,

S = ordered amount,

c_o = overage cost, that is, the cost per unit for inventory remaining at the end of the period,

c_u = underage cost, that is, the cost per unit for unmet period demand.

Let us for a moment go back to the newsvendor interpretation of the problem. The period length is then one day. Assume that the newsvendor pays 25 cents for a copy of the newspaper and sells them for 75 cents during the day. We then have $c_o = 25$, and $c_u = 75 - 25 = 50$. Note that c_u in this case corresponds to the opportunity costs for lost sales.

For a certain demand X the costs are:

$$C(X) = (S - X)c_o \quad \text{if } X \leq S$$

$$C(X) = (X - S)c_u \quad \text{if } X > S$$

Using this we can express the expected costs $C = E\{C(X)\}$ as

$$C = c_o \int_0^S (S - x)f(x)dx + c_u \int_S^\infty (x - S)f(x)dx$$

It is relatively easy to show that the expected costs are minimized when S is chosen so that

$$F(S) = \frac{c_u}{c_o + c_u}$$

This means that the optimal S can be obtained from a very simple decision rule,

$$S = F^{-1}\left(\frac{c_u}{c_o + c_u}\right)$$

The newsvendor model has many important applications, especially when considering ordering and capacity decisions regarding products with a short selling season or product life cycle, for example, in the fashion industry. The model is also closely related to many multiperiod inventory models dealing with an infinite horizon. Assume that there are many periods and associated replenishment opportunities. The overage cost in a period is then the cost to carry a unit in stock to the next period, that is, a holding cost. Similarly, the underage cost can be interpreted as the cost for letting a customer wait to the next period, that is, a backorder cost. For overviews of different types of stochastic inventory models see, for example, Axsäter^[11] and Silver.^[14]

Other Types of Decision Models

So far we have considered two types of decision models, deterministic and stochastic models. For both types of models we have assumed a single decision maker who wants to find the best decision for a considered system as a whole. However, there may also be situations where there are several decision makers interacting (competing or cooperating). If the behavior and responses of these different decision makers are important to understand in order to make good quality decisions, the dynamics need to be incorporated into the quantitative decision model. To analyze game situations where there are several decision makers with different goals, different types of game theoretic models can be used. Such situations are very common in practice.

Let us return to the newsvendor model in “The Newsvendor Model” entry. In this model we only studied a single decision maker. However, it is quite natural to extend the model to include two decision makers. We let the newsvendor have the same role as in “The Newsvendor Model” section. But the newsvendor now buys the newspapers from a supplier with a certain production cost per unit. The supplier can choose the price he wants to charge the newsvendor. In this setting both the supplier and the newsvendor want to maximize their individual profits. What decisions should be taken by the two players? Will the resulting entry be optimal for the system as a whole? It turns out that the answer to the latter question is no. However, if we change the considered “wholesale-price contract” to a “buyback contract” where the supplier pays the newsvendor for left over inventory a coordinated solution may be reached. This means that it is possible to instigate a pricing and contract mechanism so that we can let the supplier and the newsvendor optimize their individual profits and still get a solution that is optimal for the system as a whole.

We refer to Cachon^[15] and Chen^[16] for recent overviews of the literature on coordination and contracts in such systems.

An underlying assumption for all the models we have considered in this entry is that there is a single, well-defined objective for each decision maker, for example, maximizing profits, minimizing costs, etc. However, in many situations the decision maker can be faced with several different objectives that may not be aligned, or may even be in direct conflict. For example, the objective to retain the current workforce may not be aligned with maximizing profits, the objective to maximize environmental friendliness may conflict with an objective to minimize costs, etc. Modeling and analysis of decision problems with multiple (conflicting) objectives is the focus of the multiple criteria decision making (MCDM) area. A basic question when approaching these problems is whether there is a clear order of priority between different objectives or not. An associated question is how to

translate different objectives into a common scale. Monetary terms may not always be the best choice. For more about MCDM one can turn to, for example, Bouyssou.^[17]

CONCLUSIONS

In this entry we have provided a description of the broad area of decision sciences from a quantitative modeling (OR/MS) perspective. An overarching objective with most research in this field is to use quantitative models to improve the quality of decisions. This means that the model is viewed as a tool for helping decision makers to generate, evaluate, and choose good decision alternatives. With this as a starting point, we have explained the conceptual approach underlying the use of quantitative decision modeling. We have also illustrated this general approach by considering some commonly used deterministic and stochastic decision models in more detail. The model types we have discussed include LP, IP, economic lot sizing, and the newsvendor model. We have also briefly commented on extensions and other modeling approaches such as game theory, MCDM, queuing, and simulation.

Looking at the development of the field in recent years, one can conclude that it is in many ways linked to the development and wide spread use of information technology and computers. With the increasing access to vast amounts of information, there is a growing potential for making better decisions that capture the value hidden in the information flow. This accentuates the need for quantitative decision models and decision support systems to help the decision makers sort, evaluate, and process input information into concrete decision alternatives. The increasing amounts of information also suggests more complex and large size models to evaluate, which can be done thanks to the fast development in computer technology, and more efficient solution methods. Altogether one can conclude that this paints a bright and interesting future for the field. However, an important challenge, in order for quantitative decision modeling to reach its full potential, is to bridge the gap between the complex quantitative model and the decision maker. The foundations for those bridges are carefully designed software packages, and easy to use decision support tools.

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Decision Support Systems

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Abstract

Decision support systems (DSSs) are defined as interactive computer-based systems that aid users in judgment and choice activities. The entry focuses on the core module of DSSs, notably one that directly supports modeling decision problems and identifies best alternatives. It introduces three components of decisions: decision alternatives, preferences, and uncertainty. It presents fundamental components of a DSS: the database management system, the model-base management system, and the dialog generation and management system. It discusses an emergent class of decision-analytic DSSs, based on the sound foundations of probability theory and decision theory. Finally, it reviews issues related to user interfaces to DSSs.

INTRODUCTION

Making decisions concerning complex systems (e.g., the management of organizational operations, industrial processes, or investment portfolios; the command and control of military units; the control of nuclear power plants) often strains our cognitive capabilities. Even though individual interactions among a system's variables may be well understood, predicting how the system will react to an external manipulation such as a policy decision is often difficult. What will be, for example the effect of introducing the third shift on a factory floor? One might expect that this will increase the plant's output by roughly 50%. Factors such as additional wages, machine wear, maintenance breaks, raw material usage, supply logistics, and future demand also need to be considered, however, because they will all affect the total financial outcome of this decision. Many variables are involved in complex and often subtle interdependencies, and predicting the total outcome may be daunting.

There is a substantial amount of empirical evidence that human intuitive judgment and decision making can be far from optimal, and it deteriorates even further with complexity and stress. In many situations, the quality of decisions is important; therefore, aiding the deficiencies of human judgment and decision making has been a major focus of science throughout history. Disciplines such as statistics, economics, and operations research developed various methods for making rational choices. More recently, these methods, often enhanced by various techniques originating from information science, cognitive psychology, and artificial intelligence, have been

implemented in the form of computer programs, either as stand-alone tools or as integrated computing environments for complex decision making. Such environments are often given the common name of *decision support systems* (DSSs). The concept of DSS is extremely broad, and its definitions vary, depending on the author's point of view. To avoid exclusion of any of the existing types of DSSs, we define them roughly as interactive computer-based systems that aid users in judgment and choice activities. Another name sometimes used as a synonym for DSS is *knowledge-based systems*, which refers to their attempt to formalize domain knowledge so that it is amenable to mechanized reasoning.

Decision support systems are gaining an increased popularity in various domains, including business, engineering, the military, and medicine. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of an unaided human decision maker, and in which precision and optimality are of importance. Decision support systems can aid human cognitive deficiencies by integrating various sources of information, providing intelligent access to relevant knowledge, and aiding the process of structuring decisions. They can also support choice among well-defined alternatives and build on formal approaches, such as the methods of engineering economics, operations research, statistics, and decision theory. They can also employ artificial intelligence methods to heuristically address problems that are intractable by formal techniques. Proper application of decision-making tools increases productivity, efficiency, and effectiveness, and gives many businesses a comparative advantage over their

competitors, allowing them to make optimal choices for technological processes and their parameters, planning business operations, logistics, or investments.

Although it is difficult to overestimate the importance of various computer-based tools that are relevant to decision making (e.g., databases, planning software, spreadsheets), this entry focuses primarily on the core of a DSS, the part that directly supports modeling decision problems and identifies best alternatives. We briefly discuss the characteristics of decision problems and how decision making can be supported by computer programs. We then cover various components of DSSs and the role that they play in decision support. We also introduce an emergent class of *normative systems* (i.e., DSSs based on sound theoretical principles), and in particular, decision-analytic DSSs. Finally, we review issues related to user interfaces to DSSs and stress the importance of user interfaces to the ultimate quality of decisions aided by computer programs.

DECISIONS AND DECISION MODELING

Types of Decisions

A simple view of decision making is that it is a problem of choice among several alternatives. A somewhat more sophisticated view includes the process of constructing the alternatives (i.e., given a problem statement, developing a list of choice options). A complete picture includes a search for opportunities for decisions (i.e., discovering that there is a decision to be made). A manager of a company may face a choice in which the options are clear (e.g., the choice of a supplier from among all existing suppliers). She may also face a well-defined problem for which she designs creative decision options (e.g., how to market a new product so that the profits are maximized). Finally, she may work in a less reactive fashion, and view decision problems as opportunities that have to be discovered by studying the operations of her company and its surrounding environment (e.g., how can she make the production process more efficient). There is much anecdotal and some empirical evidence that structuring decision problems and identifying creative decision alternatives determine the ultimate quality of decisions. Decision support systems aim mainly at this broadest type of decision making, and in addition to supporting choice, they aid in modeling and analyzing systems (e.g., as complex organizations), identifying decision opportunities, and structuring decision problems.

Human Judgment and Decision Making

Theoretical studies on rational decision making, notably that in the context of probability theory and decision theory, have been accompanied by empirical research on whether human behavior complies with the theory. It has

been rather convincingly demonstrated in numerous empirical studies that human judgment and decision making are based on intuitive strategies, as opposed to theoretically sound reasoning rules. These intuitive strategies, referred to as *judgmental heuristics* in the context of decision making, help us in reducing the cognitive load, but alas at the expense of optimal decision making. Effectively, our unaided judgment and choice exhibit systematic violations of probability axioms (referred to as *biases*). Formal discussion of the most important research results, along with experimental data, can be found in an anthology edited by Kahneman et al.^[1] Dawes^[2] provided an accessible introduction to what is known about people's decision-making performance.

One might hope that people who have achieved expertise in a domain will not be subject to judgmental biases and will approach optimality in decision making. Although empirical evidence shows that experts indeed are more accurate than novices, within their area of expertise, it also shows that they also are liable to the same judgmental biases as novices, and demonstrate apparent errors and inconsistencies in their judgment. Professionals such as practicing physicians use essentially the same judgmental heuristics and are prone to the same biases, although the degree of departure from the normatively prescribed judgment seems to decrease with experience. In addition to laboratory evidence, there are several studies of expert performance in realistic settings, showing that it is inferior even to simple linear models (an informal review of the available evidence and pointers to literature can be found in the book by Dawes).^[2] For example, predictions of future violent behavior of psychiatric patients made by a panel of psychiatrists who had access to patient records and interviewed the patients were found to be inferior to a simple model that included only the past incidence of violent behavior. Predictions of marriage counselors concerning marital happiness were shown to be inferior to a simple model that just subtracted the rate of fighting from the rate of sexual intercourse (again, the marriage counselors had access to all data, including interviews with the couples). Studies yielding similar results were conducted with bank loan officers, physicians, university admission committees, and so on.

Modeling Decisions

The superiority of even simple linear models over human intuitive judgment suggests that one way to improve the quality of decisions is to decompose a decision problem into simpler components that are well defined and well understood. Studying a complex system built out of such components can be subsequently aided by a formal, theoretically sound technique. The process of decomposing and formalizing a problem is often called modeling. Modeling amounts to finding an abstract representation of a real-world system that simplifies and assumes as much

as possible about the system, and while retaining the system's essential relationships, omits unnecessary detail. Building a model of a decision problem, as opposed to reasoning about a problem in a holistic way, allows for applying scientific knowledge that can be transferred across problems and often across domains. It allows for analyzing, explaining, and arguing about a decision problem.

The desire to improve human decision making provided motivation for the development of various modeling tools in disciplines of economics, operations research, decision theory, decision analysis, and statistics. In each modeling tool, knowledge about a system is represented by means of algebraic, logical, or statistical variables. Interactions among these variables are expressed by equations or logical rules, possibly enhanced with an explicit representation of uncertainty. When the functional form of an interaction is unknown, it is sometimes described in purely probabilistic terms (e.g., by a conditional probability distribution). Once a model has been formulated, various mathematical methods can be used to analyze it. Decision making under certainty has been addressed by economic and operations research methods, such as cash flow analysis, break-even analysis, scenario analysis, mathematical programming, inventory techniques, and various optimization algorithms for scheduling and logistics. Decision making under uncertainty enhances the above methods with statistical approaches, such as reliability analysis, simulation, and statistical decision making. Most of these methods have made it into college curricula and can be found in management textbooks. Due to space constraints, we do not discuss their details further.

Components of Decision Models

Although a model mathematically consists of variables and a specification of interactions among them, from the point of view of decision making, a model and its variables represent the following three components: (1) a measure of preferences over decision objectives; (2) available decision options; and (3) a measure of uncertainty over variables influencing the decision and the outcomes.

Preference is widely viewed as the most important concept in decision making. Outcomes of a decision process are not all equally attractive, and it is crucial for a decision maker to examine these outcomes in terms of their desirability. Preferences can be ordinal (e.g., more income is preferred to less income), but it is convenient and often necessary to represent them as numerical quantities, especially if the outcome of the decision process consists of multiple attributes that need to be compared on a common scale. Even when they consist of just a single attribute but the choice is made under uncertainty, expressing preferences numerically allows for trade-offs between desirability and risk.

The second component of decision problems is available decision options. Often these options can be enumerated (e.g., a list of possible suppliers), but sometimes they are continuous values of specified policy variables (e.g., the amount of raw material to be kept in stock). Listing the available decision options is an important element of model structuring.

The third element of decision models is uncertainty. Uncertainty is one of the most inherent and most prevalent properties of knowledge, originating from incompleteness of information, imprecision, and model approximations made for the sake of simplicity. It would not be an exaggeration to state that real-world decisions not involving uncertainty either do not exist or belong to a truly limited class. As Benjamin Franklin expressed it in 1789 in a letter to his friend M. Le Roy, "in this world nothing can said to be certain, except death and taxes" (Bigelow.^[3]).

Decision making under uncertainty can be viewed as a deliberation—determining what action should be taken that will maximize the expected gain. Due to uncertainty, there is no guarantee that the result of the action will be the one intended, and the best one can hope for is to maximize the chance of a desirable outcome. The process rests on the assumption that a good decision is one that results from a good decision-making process that considers all important factors and is explicit about decision alternatives, preferences, and uncertainty.

It is important to distinguish between good decisions and good outcomes. By a stroke of good luck, a poor decision can lead to a very good outcome. Similarly, a very good decision can be followed by a bad outcome. Supporting decisions means supporting the decision-making process so that better decisions are made. Better decisions can be expected to lead to better outcomes.

DECISION SUPPORT SYSTEMS

Decision support systems are interactive, computer-based systems that aid users in judgment and choice activities. They provide data storage and retrieval, but enhance the traditional information access and retrieval functions with support for model building and model-based reasoning. They support framing, modeling, and problem solving.

Typical application areas of DSSs are management and planning in business, health care, the military, and any area in which management will encounter complex decision situations. Decision support systems are typically used for strategic and tactical decisions faced by upper-level management—decisions with a reasonably low frequency and high potential consequences—in which the time taken for thinking through and modeling the problem pays off generously in the long run.

There are three fundamental components of DSSs:^[3]

- *Database management system (DBMS)*. A DBMS serves as a data bank for the DSS. It stores large quantities of data that are relevant to the class of problems for which the DSS has been designed and provides logical data structures (as opposed to the physical data structures) with which the users interact. A DBMS separates the users from the physical aspects of the database structure and processing. It should also be capable of informing the user of the types of data that are available and how to gain access to them.
- *Model-base management system (MBMS)*. The role of MBMS is analogous to that of a DBMS. Its primary function is providing independence between specific models that are used in a DSS from the applications that use them. The purpose of an MBMS is to transform data from the DBMS into information that is useful in decision making. Because many problems that the user of a DSS will cope with may be unstructured, the MBMS should also be capable of assisting the user in model building.
- *Dialog generation and management system (DGMS)*. The main product of an interaction with a DSS is insight. Because their users are often managers who are not computer trained, DSSs need to be equipped with intuitive and easy-to-use interfaces. These interfaces aid in model building, but also in interaction with the model, such as gaining insight and recommendations from it. The primary responsibility of a DGMS is to enhance the ability of the system user to use and benefit from the DSS. In the remainder of this entry, we use the broader term user interface rather than DGMS.

Although various DSSs exist, the above three components can be found in many DSS architectures and play a prominent role in their structure. Interaction among them is shown in Fig. 1.

Essentially, the user interacts with the DSS through the DGMS. This communicates with the DBMS and MBMS, which screen the user and the user interface from the physical details of the model base and database implementation.

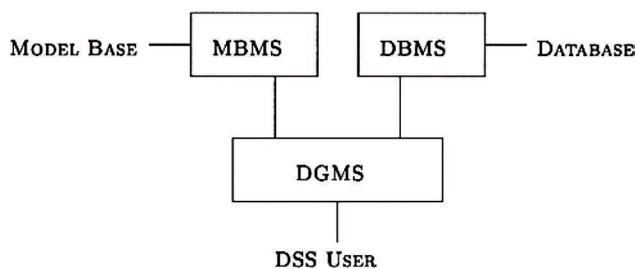


Fig. 1 The architecture of a DSS.

Source: From Sage.^[4]

NORMATIVE SYSTEMS

Normative and Descriptive Approaches

Whether one trusts the quality of human intuitive reasoning strategies has a profound impact on one's view of the philosophical and technical foundations of DSSs. There are two distinct approaches to supporting decision making. The first aims at building support procedures or systems that imitate human experts. The most prominent member of this class of DSSs are *expert systems*, computer programs based on rules elicited from human domain experts that imitate reasoning of a human expert in a given domain. Expert systems are often capable of supporting decision making in that domain at a level comparable to human experts. Although they are flexible and often able to address complex decision problems, they are based on intuitive human reasoning and lack soundness and formal guarantees with respect to the theoretical reliability of their results. The danger of the expert system approach, increasingly appreciated by DSS builders, is that along with imitating human thinking and its efficient heuristic principles, we may also imitate its undesirable flaws.^[5]

The second approach is based on the assumption that the most reliable method of dealing with complex decisions is through a small set of normatively sound principles of how decisions should be made. Although heuristic methods and ad hoc reasoning schemes that imitate human cognition may in many domains perform well, most decision makers will be reluctant to rely on them whenever the cost of making an error is high. To give an extreme example, few people would choose to fly airplanes built using heuristic principles over airplanes built using the laws of aerodynamics enhanced with probabilistic reliability analysis. Application of formal methods in DSSs makes these systems philosophically distinct from those based on ad hoc heuristic artificial intelligence methods, such as rule-based systems. The goal of a DSS, according to this view, is to support unaided human intuition, just as the goal of using a calculator is to aid human's limited capacity for mental arithmetic.

Decision-Analytic DSSs

An emergent class of DSSs known as *decision-analytic DSSs* applies the principles of decision theory, probability theory, and decision analysis to their decision models. Decision theory is an axiomatic theory of decision making that is built on a small set of axioms of rational decision making. It expresses uncertainty in terms of probabilities and preferences in terms of utilities. These are combined using the operation of mathematical expectation. The attractiveness of probability theory, as a formalism for handling uncertainty in DSSs, lies in its soundness and its guarantees concerning long-term performance. Probability

theory is often viewed as the gold standard for rationality in reasoning under uncertainty. Following its axioms offers protection from some elementary inconsistencies. Their violation, however, can be demonstrated to lead to sure losses.^[6] Decision analysis is the art and science of applying decision theory to real-world problems. It includes a wealth of techniques for model construction, such as methods for elicitation of model structure and probability distributions that allow minimization of human bias, methods for checking the sensitivity of a model to imprecision in the data, computing the value of obtaining additional information, and presentation of results (see, e.g., von Winterfeldt^[7] for a basic review of the available techniques). These methods have been under continuous scrutiny by psychologists working in the domain of behavioral decision theory and have proven to cope reasonably well with the dangers related to human judgmental biases.

Normative systems are usually based on graphical probabilistic models, which are representations of the joint probability distribution over a model's variables in terms of directed graphs. Directed graphs, such as the one in Fig. 2, are known as Bayesian networks (BNs) or causal networks.^[8] Bayesian networks offer a compact representation of joint probability distributions and are capable of

practical representation of large models, consisting of tens or hundreds of variables. Bayesian networks can be easily extended with decision and value variables for modeling decision problems. The former denote variables that are under the decision maker's control and can be directly manipulated, and the latter encode users' preferences over various outcomes of the decision process. Such amended graphs are known as *influence diagrams*.^[9] Both the structure and the numerical probability distributions in a BN can be elicited from a human expert and are a reflection of the expert's subjective view of a real-world system. If available, scientific knowledge about the system, both in terms of the structure and frequency data, can be easily incorporated in the model. Once a model has been created, it is optimized using formal decision-theoretic algorithms. Decision analysis is based on the empirically tested paradigm that people are able to reliably store and retrieve their personal beliefs about uncertainty and preferences for different outcomes, but are much less reliable in aggregating these fragments into a global inference. Although human experts are excellent in structuring a problem, determining the components that are relevant to it and providing local estimates of probabilities and preferences, they are not reliable in combining many simple factors into an optimal decision. The role of a decision-analytic

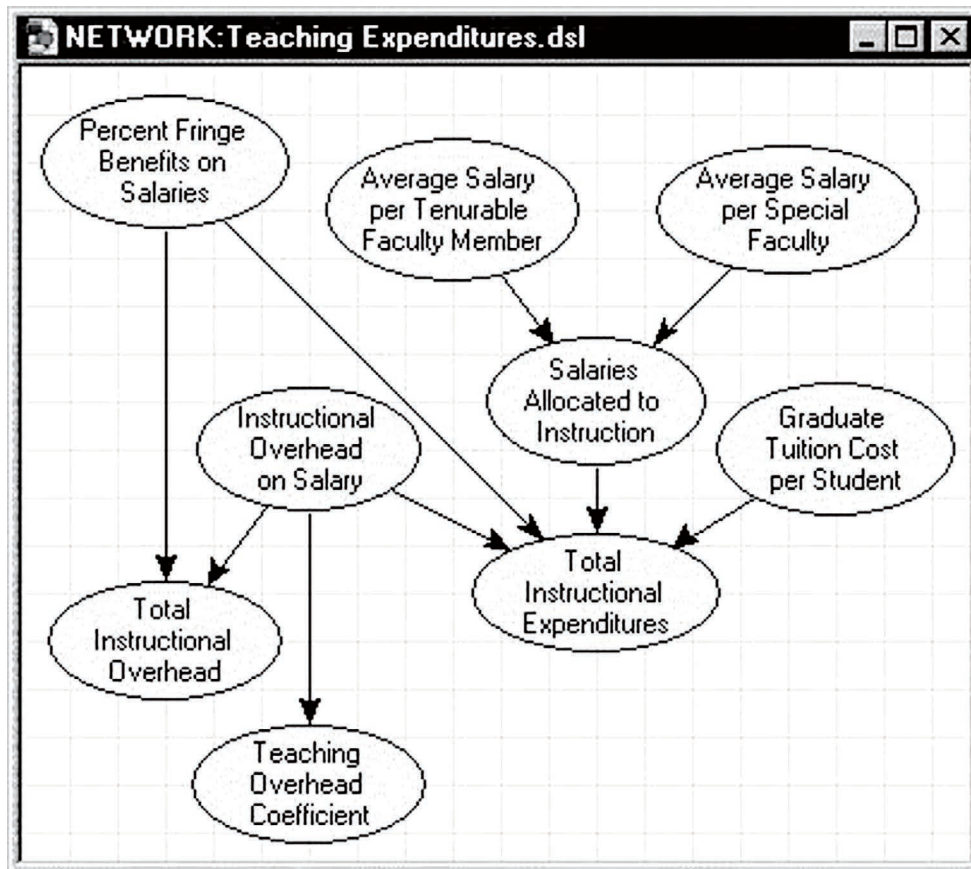


Fig. 2 Example of a BN modeling teaching expenditures in university operations.

DSS is to support them in their weaknesses using the formal and theoretically sound principles of statistics.

The approach taken by decision analysis is compatible with that of DSSs. The goal of decision analysis is to provide insight into a decision. This insight, consisting of the analysis of all relevant factors, their uncertainty, and the critical nature of some assumptions, is even more important than the actual recommendation.

Decision-analytic DSSs have been successfully applied to practical systems in medicine, business, and engineering. Some examples of applications are described in a special issue of *Communications of the ACM* on practical applications of decision-theoretic methods (Vol. 38, No. 3, March 1995). We encourage the readers to experiment with GeNIe,^[10] a development system for decision-analytic DSSs developed at the Decision Systems Laboratory, University of Pittsburgh, available at <http://genie.sis.pitt.edu/>. As these systems tend to naturally evolve into three not necessarily distinct classes, it may be interesting to compare their structure and architectural organization.

- *Systems with static domain models.* In this class of systems, a probabilistic domain is represented by a typically large network encoding the domain's structure and its numerical parameters. The network comprising the domain model is normally built by decision analysts and domain experts. An example might be a medical diagnostic system covering a certain class of disorders. Queries in such a system are answered by assigning values to those nodes of the network that constitute the observations for a particular case and propagating the impact of the observation through the network to find the probability distribution of some selected nodes of interest (e.g., nodes that represent diseases). Such a network can, on a case-by-case basis, be extended with decision nodes and value nodes to support decisions. Systems with static domain models are conceptually similar to rule-based expert systems covering an area of expertise.
- *Systems with customized decision models.* The main idea behind this approach is automatic generation of a graphical decision model on a per-case basis in an interactive effort between the DSS and the decision maker. The DSS has domain expertise in a certain area and plays the role of a decision analyst. During this interaction, the program creates a customized influence diagram, which is later used for generating advice. The main motivation for this approach is the premise that every decision is unique and needs to be looked at individually; an influence diagram needs to be tailored to individual needs.^[11]
- *Systems capable of learning a model from data.* The third class of systems employs computer-intensive statistical methods for learning models from data.^[12–16] Whenever there are sufficient data available, the

systems can literally learn a graphical model from these data. This model can be subsequently used to support decisions within the same domain.

The first two approaches are suited for slightly different applications. The customized model generation approach is an attempt to automate the most laborious part of decision making, structuring a problem, so far done with significant assistance from trained decision analysts. A session with the program that assists the decision maker in building an influence diagram is laborious. This makes the customized model generation approach particularly suitable for decision problems that are infrequent and serious enough to be treated individually. Because in the static domain model approach, an existing domain model needs to be customized by the case data only, the decision-making cycle is rather short. This makes it particularly suitable for those decisions that are highly repetitive and need to be made under time constraints.

A practical system can combine the three approaches. A static domain model can be slightly customized for a case that needs individual treatment. Once completed, a customized model can be blended into the large static model. Learning systems can support both the static and the customized model approach. However, the learning process can be greatly enhanced by prior knowledge from domain experts or by a prior model.

Equation-Based and Mixed Systems

In many business and engineering problems, interactions among model variables can be described by equations that, when solved simultaneously, can be used to predict the effect of decisions on the system, and hence support decision making. One special type of simultaneous equation model is known as the structural equation model (SEM), which has been a popular method of representing systems in econometrics. An equation is structural if it describes a unique, independent causal mechanism acting in the system. Structural equations are based on expert knowledge of the system combined with theoretical considerations. Structural equations allow for a natural, modular description of a system—each equation represents its individual component, a separable and independent mechanism acting in the system—yet, the main advantage of having a structural model is, as explicated by Simon,^[17] that it includes causal information and aids predictions of the effects of external interventions. In addition, the causal structure of a SEM can be represented graphically,^[17] which allows for combining them with decision-analytic graphical models in practical systems.^[17,18]

Structural equation models offer significant advantages for policy making. Often a decision maker confronted with a complex system needs to decide not only the values of policy variables, but also which variables should be

manipulated. A change in the set of policy variables has a profound impact on the structure of the problem and on how their values will propagate through the system. The user chooses which variables are policy variables and which are determined within the model. A change in the SEMs or the set of policy variables can be reflected by a rapid restructuring of the model and predictions involving this new structure.^[19]

Our long-term project, the Environment for Strategic Planning (ESP),^[20] is based on a hybrid graphical modeling tool that combines SEMs with decision-analytic principles. The ESP is capable of representing both discrete and continuous variables involved in deterministic and probabilistic relationships. The powerful features of SEMs allow the ESP to act as a graphical spreadsheet integrating numerical and symbolic methods, and allowing the independent variables to be selected at will without having to reformulate the model each time. This provides an immense flexibility that is not afforded by ordinary spreadsheets in evaluating alternate policy options.

USER INTERFACES TO DSSs

Although the quality and reliability of modeling tools and the internal architectures of DSSs are important, the most crucial aspect of DSSs is, by far, their user interface. Systems with user interfaces that are cumbersome or unclear or that require unusual skills are rarely useful and accepted in practice. The most important result of a session with a DSS is insight into the decision problem. In addition, when the system is based on normative principles, it can play a tutoring role; one might hope that users will learn the domain model and how to reason with it over time, and improve their own thinking.

A good user interface to DSSs should support model construction and model analysis, reasoning about the problem structure in addition to numerical calculations, and both choice and optimization of decision variables. We discuss these in the following sections.

Support for Model Construction and Model Analysis

User interface is the vehicle for both model construction (or model choice) and for investigating the results. Even if a system is based on a theoretically sound reasoning scheme, its recommendations will only be as good as the model on which they are based. Furthermore, even if the model is a very good approximation of reality and its recommendations are correct, they will not be followed if they are not understood. Without understanding, the users may accept or reject a system's advice for the wrong reasons and the combined decision-making performance may deteriorate even below unaided performance.^[21]

A good user interface should make the model on which the system's reasoning is based transparent to the user.

Modeling is rarely a one-shot process, and good models are usually refined and enhanced as their users gather practical experiences with the system recommendations. It is important to strike a careful balance between precision and modeling efforts; some parts of a model need to be very precise, whereas others do not. A good user interface should include tools for examining the model and identifying its most sensitive parts, which can be subsequently elaborated on. Systems employed in practice will need their models refined, and a good user interface should make it easy to access, examine, and refine its models. Some pointers to work on support for building decision-analytic systems can be found in.^[22–25]

Support for Reasoning About the Problem Structure in Addition to Numerical Calculations

Although numerical calculations are important in decision support, reasoning about the problem structure is even more important. Often when the system and its model are complex, it is insightful for the decision maker to realize how the system variables are interrelated. This is helpful not only in designing creative decision options, but also in understanding how a policy decision will affect the objective.

Graphical models, such as those used in decision analysis or in equation-based and hybrid systems, are particularly suitable for reasoning about structure. Under certain assumptions, a directed graphical model can be given a causal interpretation. This is especially convenient in situations where the DSS autonomically suggests decision options; given a causal interpretation of its model, it is capable of predicting effects of interventions. A causal graph facilitates building an effective user interface. The system can refer to causal interactions during its dialogue with the user, which is known to enhance user insight.^[26]

Support for Both Choice and Optimization of Decision Variables

Many DSSs have an inflexible structure in the sense that the variables that will be manipulated are determined at the model-building stage. This is not very suitable for planning of the strategic type when the object of the decision-making process is identifying both the objectives and the methods of achieving them. For example, changing policy variables in a spreadsheet-based model often requires that the entire spreadsheet be rebuilt. If there is no support for that, few users will consider it as an option. This closes the world of possibilities for flexible reframing of a decision problem in the exploratory process of searching for opportunities. Support for both choice and optimization of decision variables should be an inherent part of DSSs.

Graphical Interface

Insight into a model can be increased greatly at the user interface level by a diagram representing the interactions among its components (e.g., a drawing of a graph on which a model is based, such as in Fig. 2). This graph is a qualitative, structural explanation of how information flows from the independent variables to the dependent variables of interest. Because models may become very large, it is convenient to structure them into submodels, groups of variables that form a subsystem of the modeled system.^[2,7] Such submodels can be again shown graphically with interactions among them, increasing simplicity and clarity of the interface. Fig. 3 shows a submodel-level view of a model developed in our ESP project. Note that the graph in Fig. 2 is an expanded version of the *Teaching Expenditures* submodel in Fig. 3. The user can navigate through the hierarchy of the entire model in her quest for insight, opening and closing submodels on demand. Some pointers to work on user interfaces of decision-analytic systems can be found in Wang,^[25] Druzdel^[27,28] and Wiecha.^[29]

CONCLUSION

Decision support systems are powerful tools integrating scientific methods for supporting complex decisions with techniques developed in information science and are gaining an increased popularity in many domains. They are especially valuable in situations in which the amount of available information is prohibitive for the intuition of

an unaided human decision maker, and in which precision and optimality are of importance. Decision support systems aid human cognitive deficiencies by integrating various sources of information, providing intelligent access to relevant knowledge, aiding the process of structuring, and optimizing decisions.

Normative DSSs offer a theoretically correct and appealing way of handling uncertainty and preferences in decision problems. They are based on carefully studied empirical principles underlying the discipline of decision analysis, and they have been successfully applied in many practical systems. We believe that they offer several attractive features that are likely to prevail in the long run as far as the technical developments are concerned.

Because DSSs do not replace humans but rather augment their limited capacity to deal with complex problems, their user interfaces are critical. The user interface determines whether a DSS will be used at all and, if so, whether the ultimate quality of decisions will be higher than that of an unaided decision maker.

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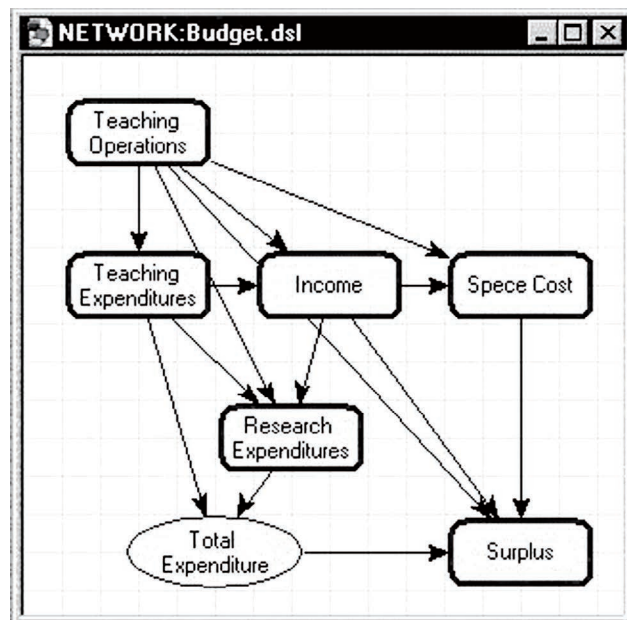


Fig. 3 A submodel-level view of a decision model.

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Demand-Driven Acquisition/Patron-Driven Acquisition

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Abstract

Demand-driven acquisition (DDA), also commonly referred to as patron-driven acquisition (PDA), is a process used by libraries to provide a large pool of content to their users while only paying for portions of that content at the point of use. Typically, records for that content are displayed in the library's catalog or discovery system, and when patrons find those records and access that content, a purchase or temporary lease of that particular title is triggered. DDA has most commonly been used for e-books, but it has been used for other formats as well.

INTRODUCTION

Demand-driven acquisition (DDA) is an overarching term for a number of different models that libraries can use to provide content to their users and pay for that content at the point of use. Patron-driven acquisition (PDA) is often used synonymously with DDA but, for the purposes of this article, is considered to be a broader term. PDA in this broader sense refers to something that libraries have always done—respond to the suggestions of their users. In this sense, a librarian purchasing a book because of a patron request or adjusting an approval plan because of an analysis of usage is practicing PDA. DDA is a subset of PDA in which those patron-driven decisions are pushed to the point of demand; when a patron needs a book (or some other type of resource), the library acquires that content for her, ideally in an unmediated way.^[1]

There are a number of different models for DDA, which are described in the following sections, but all allow libraries to provide a larger pool of content to their users than would be possible under traditional models. Instead of acquiring books that may or may not ever be used, a library can provide access to a broader “consideration pool” of titles and pay for only those that get used.

RATIONALE FOR DDA

DDA solves a supply and demand issue for libraries: there are far more books published than even the best funded libraries can purchase, and of the books purchased by libraries, many get little or no use. The *Library and Book Trade Almanac* reports that in 2014, 200,768 titles were published in the United States alone.^[2] The International Publishers Association (IPA) has an even higher figure for 2013, with 304,912 titles (including new editions of previously published works) published in the United States. The IPA reports a figure of 444,000 for China and 184,000 for the United Kingdom. Many other countries

publish more than 50,000 titles a year, and even relatively small countries such as Slovenia publish more than 3,000 volumes.^[3] Even the biggest libraries can afford to purchase only a fraction of this annual publishing output. Librarians traditionally have done the best they could to build collections that made sense for local curricular and research needs but have always needed to make choices about which books to purchase. Meanwhile, numerous studies have shown that large portions of academic library monograph collections do not get used.^[4] DDA allows libraries to provide access to a wider range of this massive publishing output by reallocating some of the funds that would traditionally be spent on these unused titles.

DDA can be used to broaden the collection by providing access to more titles, from more publishers, across a wider range of subjects. If libraries do not need to make a decision about what book to buy until the point of use, they can give their users a larger choice of titles. In theory, a library could provide access to many more titles, while spending the same amount of money as in the past, thus creating a broader and deeper collection.

DDA can also be used to save money. A library could decide to select the same number of titles as it used to under traditional acquisition models, but instead of buying them, make them available for potential use and purchase. Assuming similar usage patterns, not all of these titles would be used and the library would spend less overall on monographs.

In reality, libraries have used DDA both to save money and to broaden the collection. They have provided access to more titles than they would have purchased in the past but have spent less overall.^[5]

DEVELOPMENT OF DDA

An early version of DDA was developed by the Colorado Alliance of Research Libraries, which ran a consortial-level DDA program for netLibrary e-books from 1999 to

2005. Participating libraries loaded records for e-books into their catalogs, and the consortium agreed with netLibrary to allow one free use of any book in the consideration pool, with purchase on the second use. The consortium paid 155% of list price to share purchased titles across the entire group. In theory, having a purchase happen only on a second use meant that titles with limited demand would not be acquired, but in practice, the consortium found that many books with just two very brief uses were purchased. Ultimately, because of the low threshold for purchase, this model proved unsustainable.^[6]

A more enduring model of DDA was developed by Ebooks Corporation, which eventually became known as Ebooks Library (EBL), based on conversations with Alison Sutherland, a librarian at Curtin University in Australia, in 2001 and Jens Vigen, from CERN, in 2002. Sutherland approached Ebooks Corporation with the idea of purchasing e-books on demand. Vigen followed up a year later with the concept of pay-per-view rental access for e-books as an alternative to interlibrary loan (ILL). Out of these conversations, EBL launched in 2004 with a model that paired a 5-min free browsing period in the e-book, with paid short-term loans (STLs), and purchasing after multiple paid uses.^[7] With this model, libraries did not buy books with very little use, because these uses either triggered a relatively cheap STL or if they were short enough, led only to a free browse of the book. Ultimately, this model proved successful, and e-book aggregators such as ebrary and EBSCO (which subsumed the netLibrary brand) adopted it as well.

DDA was used by a relatively small number of libraries in its early years, with a big uptake around 2010–2012. Ingram, through the MyiLibrary e-books aggregator and Coutts approval vendor, set up its four initial DDA programs in 2008. By the end of 2009, Ingram managed 17 programs. In 2010, 17 more were added, including their first consortial DDA program. DDA expanded dramatically in 2011, with 31 new programs, including the first program to include DDA for print. In 2012, Ingram added 39 programs.^[8] Meanwhile, YBP Library Services, the other major academic library approval vendor, began the development of DDA services with aggregator partners in 2010. Many of these customers had already worked with aggregators directly and approached YBP for assistance in integrating this new method of collection development into their existing acquisitions workflow. In 2011, YBP implemented 63 DDA programs for customers with either EBL or ebrary. In 2012, YBP expanded to include EBSCO and added 63 more DDA programs, some of which used all three e-book aggregators.^[9]

COMMON THEMES OF DDA

There are many different models of DDA, but all of them allow purchase of content at the point of use. Most

programs have some aspect of free discovery, which allows users to discover whether content is worthwhile before triggering a purchase. In some programs, there is an option to pay for temporary access, allowing payment based on a brief usage of the material. And all programs have an ultimate option to purchase content, generally after passing through the free discovery and temporary paid access stages.

Free discovery works in different ways but is intended to prevent unintended purchase of content that might not actually be relevant to the user. In some cases, this free discovery period is time based, with usage under 5 or 10 min being free. In others, it is based on usage of some portion of the book, with the front or back matter free, for example. Another model allows for the first or second usage to be entirely free but triggers a purchase after the second or third usage. With this last option, there could still be multiple “accidental” uses of material that is not truly relevant to the user.

Temporary access, most commonly offered in the form of an STL, allows the library to pay for access for a day, a week, or some other brief period, based on the assumption that in many cases a patron will use a book once or twice and that then the library will never have demand for that particular title again. Rather than paying list price for a book that may never be used again, a library can provide immediate and temporary access for a fraction of list price. Libraries can generally choose how many STLs to offer, with the understanding that a higher number of STLs will mean a greater emphasis on access to content and less on ownership.

In all cases, there is an option to purchase content through DDA, though in relatively few cases a library can implement DDA with only STLs. For some libraries, the goal of the program is to use patron input to build a permanent collection. For others, the goal is to provide as wide a range of content to the user as possible, and ownership is less important. Libraries that wish to emphasize collection building will likely want to trigger purchase sooner in the process (and some do away entirely with STLs, purchasing on the first use).

DDA MODELS

Broadly speaking, there are four basic models for DDA, with wide variation within them. None of these are perfect, and there are risks and rewards for each. *Demand-Driven Acquisition of Monographs: A Recommended Practice of the National Information Standards Organization* provides a detailed overview of these models, with some exploration of how they might fit into the goals of a particular library choosing to implement DDA.^[10]

The oldest model, used originally by netLibrary with the Colorado Alliance of Research Libraries, is relatively simple in concept. The first several uses of an item are free

and then the next use triggers a purchase. For the Colorado Alliance, this was one free use with a purchase on the second. Ebrary and MyiLibrary both used this netLibrary model when they first adopted DDA. Though easier to implement, this model can lead to purchase of content that may not be needed, since presumably a patron could spend one second looking at a book and that would count toward purchase.

There are several examples of the risks involved with the netLibrary model, one of which occurred with the Colorado Alliance program. In this example, there was an assignment related to bananas in a geography class at the University of Colorado Boulder. Students searched within netLibrary and found e-books, whether relevant or not, that mentioned the word “banana.” Because the program committed the Colorado Alliance to purchase books on the second use, regardless of length, the Alliance quickly purchased all of the books in netLibrary’s collection with the word “banana.”^[11] It is worth noting that a free discovery period would have prevented this from happening. The University of Iowa, one of the early adopters of DDA with ebrary in 2009–2010, reported rapidly overspending their budget when using a similar model but with ten uses of any length before a purchase was triggered. After just a few months, Iowa had to cut back the number of titles in their consideration pool dramatically.^[12]

A more complex model is the one developed by EBL and eventually adopted by ebrary and others. This model involves the free discovery period of 5 min (10 min for ebrary), STLs, and a purchase. Libraries can configure these as they wish, using more or fewer STLs before purchase. A library wishing to emphasize access can have more STLs, while one wishing to emphasize purchase can have fewer. The book will be purchased after that number of STLs has been surpassed. Doug Way and Julie Garrison showed that in early implementations of this model, it was cheaper overall to have more STLs prior to purchase.^[13]

After wide adoption of the EBL model by libraries, publishers became concerned about the impact of STLs on their revenue. With multiple STLs before purchase, many libraries were paying for a small number of STLs of e-books but never purchasing these titles. Overall, publishers saw declining sales and responded in 2014 and 2015 with increases in the prices charged for STLs. A few publishers also pulled front list titles from STL programs.^[14] It is likely that other publishers quietly pulled content from DDA programs entirely. At this point, it is unclear what the full impact of this change will be.

ProQuest Ebooks (which includes EBL, ebrary, and MyiLibrary) has recently introduced a rent-to-own model, called “Access-to-Own,” in which STLs count toward purchase. The model was developed to address the concerns about STL costs and provides a trade-off of sorts: in return for accepting higher STL rates, libraries benefit by being able to apply those STL fees toward the purchase cost. Publishers benefit by having higher STL costs for

titles with low use and an easier path to a sale of the book for higher-use titles.^[15]

A different model, used by several publishers on their own platforms, is evidence-based acquisition (EBA), also known as evidence-based selection (EBS). Under EBA, a library commits a certain amount of money to a publisher and agrees to buy content from that publisher at the end of the year based on an evaluation of usage data. The publisher then makes available some agreed-upon amount of content for the library’s patrons to choose from throughout the year. EBA allows a publisher to offer DDA without having to develop the infrastructure that the more complex aggregator-based models require.^[16]

There are risks and rewards for both publishers and libraries under EBA. Because EBA relies on a library to guarantee a certain amount of money to a publisher up front, a library runs the risk of having to purchase unused or little used content at the end of the year. On the other hand, publishers run the risk of libraries gaining access to a large amount of heavily used material for a relatively low price. Negotiating a reasonable price and mix of content up front is important for both partners in such a program.^[16]

DDA FOR VIDEO

Most DDA programs thus far have involved e-books, but an increasing number of vendors are offering DDA for streaming video. Alexander Street offers both an EBA version and one in which purchases are triggered at the point of use.^[17] Kanopy also has a DDA model and reports that more than 1500 institutions have adopted it globally.^[18] DDA has allowed libraries to expand their video collections dramatically.

DDA FOR PRINT MONOGRAPHS

Some libraries have developed DDA programs for print monographs, often in conjunction with an e-book DDA program. The University of Vermont developed a print-only DDA program in 2007 in which they loaded records from three major publishers into their catalog, allowing patrons to identify unowned books and then request a purchase. They expanded this program to include e-books in 2011.^[19] Though DDA for print is less common than it is for e-books, other libraries, such as the University of Arizona, have implemented DDA programs that combine e-books and print books.^[20]

DDA for print monographs (or any other tangible formats) is complicated by the fact that the materials selected will not be immediately available to the user. Print DDA programs require clear messaging to the user that the content is not available for immediate use and may take some time to be delivered. Further, because it has to be

delivered to the user, it is crucial to gather accurate data about the patron. DDA for print also requires development of forms that can be populated with bibliographic data about the item being ordered. Once data about the patron and item have been gathered, the library must order the book, determine a reasonable shipping time and process, and then deliver the item to the patron. While it is not as easy to implement, print DDA has been successful in the relatively small number of libraries with it in place.

CONSORTIAL DDA

Libraries often use consortia to negotiate substantial discounts for bulk purchasing, and based on that success, many have tried to build consortial DDA plans. The earliest, as noted previously, was the netLibrary plan for the Colorado Alliance of Research Libraries. A more recent success has been a program with EBL for the Orbis Cascade Alliance. Developed in 2010, this program uses a multiplier model to provide shared access to e-books across the consortium. While STLs are charged at the same rate as they would be for a single institution, the cost of purchasing the e-book is calculated at five times the list price and the consortium then shares perpetual access rights.^[21] The multiplier model has become common across many consortia. One of the consortia using this model, the Colorado Alliance of Research Libraries, has questioned whether shared ownership makes sense for DDA. Early data from the Colorado Alliance project suggest that by some measures it would have been cheaper for libraries to do DDA on their own.^[6] The Colorado Alliance experience points to an essential contradiction in consortial DDA programs: while consortial purchasing relies on a group purchase of shared content to lower overall pricing and is thus geared toward ownership of the same content across the group, DDA is predicated upon purchase based on use, and use of a given title is often not the same across institutions.

Novanet, a consortium in Nova Scotia, developed a DDA program in 2011 that uses a different model in which the consortium purchases shared access to the e-book for list price but pays for another copy of the e-book after reaching a certain threshold of usage.^[22] This model solves the problem that the Colorado Alliance faced, in which the consortium paid a multiplier for e-books that ultimately had very little subsequent use. In the Novanet model, only higher-use books trigger a multiplier on the list price.

THE CONSIDERATION POOL

In all DDA programs, there must be a consideration pool, a set of titles available for potential discovery and purchase. Libraries can choose to carefully curate the titles

available in the consideration pool or can open it very broadly. Decisions about the size and scope of the consideration pool are linked both to financial pressures and the vision of the library about the type of collection DDA is intended to support.

With a smaller consideration pool, a library has less risk of overspending a budget. Some libraries have opted to limit the pool by publisher, by publication year, or by subject. The pool can be limited on the front end, as titles are published, or later on as libraries choose to remove them from view.

Similarly, libraries might choose to limit the scope of a consideration pool out of concerns for quality or curricular match. In this case, some of the same criteria might be employed but for a different purpose. Libraries opting to limit the size of the pool for quality reasons might leave older books in the pool but would be careful to include only books that match other predetermined needs. Some libraries using YBP or Coutts to manage DDA do so because of the capabilities those companies have to profile for academically relevant books.

Other libraries have taken a much broader approach to profiling and have embraced a philosophy that users know best what they need. At the extreme end of this viewpoint, a library might make all titles available in a consideration pool, whether academically relevant or not, with the assumption that in some cases popular material can serve a scholarly purpose. More likely, libraries with a broad approach to the consideration pool will consider a wider range of subjects than they would have under a traditional speculative purchasing program. For example, a library at a university without an architecture program would typically buy a handful of architecture books to support art history but would ignore most books on this topic. With DDA, this same library might choose to make available a wide range of architecture books for the same purpose.

In reality, most libraries have needs to both limit and expand the consideration pool. They will want to expand it to include subjects that were not traditionally purchased at their institutions but will need to consistently or periodically reshape the pool to exclude content for budgetary purposes.

RISKS

There are some significant risks for both libraries and publishers with DDA. With traditional purchasing, libraries knew that books that they acquired would be there in perpetuity for their patrons. They did not have to worry about titles going out of print because they were securely on their shelves. With DDA, while libraries do not have to expend scarce resources on purchasing titles that may not be in use and overall have more titles available to their users than would have been possible traditionally, they run the risk of those titles no longer being available at the

point of need. Publishers occasionally either pull content in whole or in part from e-book aggregators or change prices enough that libraries need to remove some titles from the consideration pool, making them unavailable to users at the point of need.

The risk of DDA for publishers has already become clear and resulted in the rising costs of STLs. Concurrent with the rise of DDA and STLs, publishers have seen sales of books to academic libraries decrease, making it possible that some types of books may be too risky to publish.^[23] While this decline in monograph sales to academic libraries has been linked to increasing adoption of DDA and STLs, it has also been coincidental to general declines in purchasing power for libraries. Nonetheless, the predictability that library sales traditionally gave to publishers is gone, and DDA is at least partially responsible.

PRESERVATION

While there is risk inherent in DDA, there is opportunity as well. Traditionally, academic libraries have concentrated purchasing at the point of publication, with only moderate addition of older titles to the collection. Because of the relatively small print runs of scholarly monographs, once these copies sold to libraries and then the title went out of print, it was hard to find older books for purchase. DDA allows libraries to extend the point of purchase well past the point of publication, but to do so requires that those titles still be available for purchase.

As consideration pools grow and become ever more important means of providing access to content, it is essential that libraries be confident that the not-yet-purchased content will still be there at some point in the future. Tools such as Portico and CLOCKSS preserve content but are geared toward providing libraries with access to the material that they have already paid for, not the content they might someday wish to pay for. A long-term preservation solution might help mitigate risk for libraries and publishers. Libraries would have the confidence that content would be available whenever their users needed it and publishers might be able to rely on sales far into the future.

INTERLIBRARY LOAN

Libraries have traditionally used ILL to provide patrons with temporary access to materials not in the collection. ILL was cheaper for libraries than purchasing a book or was the only way of supplying a book that was out of print. ILL allows libraries to share resources widely and means that low-use titles do not need to be acquired by every library. Some of the earliest examples of DDA occurred when libraries began purchasing titles requested

through ILL, either because purchasing those titles was cheaper than ILL or because they met some criteria to be added to the collection.^[24] This function is largely for print monographs or other tangible materials.

On the e-book side, STLs can serve much the same function as ILL, providing temporary access to materials not in a library's collection. Publishers were willing to experiment with STLs at least in part because of this potential to serve an ILL-like function while providing some additional revenue.^[23] Unlike ILL, which is staff intensive and does not provide a user with instant access to requested material, STLs could provide a better patron experience than ILL of an e-book.^[25]

CONCLUSION

DDA is a means of providing access to content that libraries purchase at the point of use. By linking purchase to demand, DDA allows libraries to provide access to far more content than was possible traditionally. While mostly used for e-books, DDA has been used for print monographs and for streaming video as well. It is closely linked to ILL purchasing and could replace some aspects of ILL.

DDA has been around since 1999 but was first widely adopted around 2010. Since then, the models have been evolving as publishers and libraries get used to the cost structures and the risks. Though the models will likely continue to shift, DDA as a concept appears to be here to stay. Libraries and publishers need to work together to make sure that it is sustainable for both parties.

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Denmark: Libraries, Archives, and Museums

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Abstract

The authors provide an overview of the modern development of libraries, archives, and museums in Denmark. Topics covered include: National, public, academic, special and school libraries as well as the Danish Agency for Libraries and Media, the State Archives, regional archives, university archives, the Heritage Agency of Denmark, and three major types museums: natural history, art, and cultural heritage. The legal framework for these institutions is detailed. The authors also describe the role of professional associations and the development and professional education in these three fields. Finally, recent trends and issues are discussed with a focus on digital projects.

INTRODUCTION—FACTS ABOUT DENMARK

Denmark (Fig. 1) is a northern European state and part of the Scandinavian cultural community. The country has been an independent kingdom for more than 1000 years with variable frontiers. Since 1920, the frontiers have been permanent with an area of 43,094 km². The population in 2006 was 5,427,459. The capital is Copenhagen.

Denmark is a fertile low-lying country, which for the most part is cultivated. Agriculture was the dominant trade until about 1850 when industrialization began. Today, the majority of the population live in towns and are employed in industry, commerce, and service. Denmark's gross national product is one of the highest per capita in the world, as is its rate of taxation. Its social and healthcare system is publicly funded, and education is free all the way to the highest university level.

The Danish constitution is based on the Constitution of the Kingdom of Denmark, most recently revised in 1953. It goes back to the Constitution of 1849, which ended a constitution of absolute monarchy introduced in 1660. In 1849, a parliament with two chambers was introduced. Today, Denmark has a one-chamber parliament and a multiparty system. Since 1972, it has been a member of the European Community, and since 1992, of the European Union.

LIBRARY AND INFORMATION SYSTEMS AND SERVICES

The First Libraries and Absolute Monarchy

As in other European countries, the earliest libraries were established in monasteries in the Middle Ages. Later,

libraries were set up at the cathedral schools which from about 1100 were established in connection with a number of cathedrals, where priests were also educated till the University of Copenhagen was founded in 1479 and with it the first Danish university library. The first Danish book had been printed in 1482.

Ten years before the absolute monarchy was introduced in Denmark, King Frederic the Third had started building up a library and cabinet of curiosities. These collections formed the basis of those in The Royal Library, The National Museum, and the Danish National Gallery. In 1697, legal deposit of all printed material was introduced. The Enlightenment in the 1700s left distinct traces in Denmark. In 1775, P.F. Suhm, professor at the University of Copenhagen, opened his library of 100,000 volumes to the public. Twenty years later, the Royal Library opened its collections to the public. Government archives suggest definite moves toward systematic registration as the country became more centralized under the absolute monarchy. The Royal Cabinet of Curiosities became the Royal Art Museum in 1842 and included art as well as other museum objects.

General compulsory education was introduced in 1814 where the country, following the national bankruptcy of the previously year, started to expand in relation to education and culture. Today, the Folkeskole's (municipal primary and lower-secondary school) educational program runs for 9 years.

Democracy and public libraries

The absolute monarchy was abolished peacefully in 1849, and the royal collections went to the state. Art was separated and the Danish National Gallery established. Several



Fig. 1 Map of Denmark.

Source: CIA World Factbook (<https://www.cia.gov/library/publications/the-world-factbook/geos/da.html>).

art-historical collections were gathered together in what is today The National Museum. One of these collections was the collection of antiquities, which was made publicly available in 1819. Around this time, the first public libraries were established on the initiative of enlightened citizens, often organized in associations.

With the emergence of the labor movement in 1870 came a movement in favor of public enlightenment. This resulted in reading societies in the towns that built up libraries. In 1882, the State began awarding grants to chapbook collections. In 1900, A.S. Steenberg published a book on the organization and design of libraries. The book was based on his studies of English and American free public libraries. This book became the basis for the subsequent structure of a modern library system. In 1909, the State established an office for the support of library initiatives with Steenberg as its leader, and in the same year, the Royal Library's chief librarian, H.O. Lange, published his ideas of a coherent library system based on regional libraries. In 1920, the first act on public libraries was passed, based on these thoughts, and in that same year, the Book Collection Office became the State Inspectorate of Public Libraries with Thomas Døssing as director and driving force of the systematic development of public libraries all over the country.

A librarian training course was established in 1918 as a mixture of practice and theory. The Royal Library School was established in 1956. In 1999, the school gained university status and the previous education programs were

replaced by bachelor's and master's programs and the possibility of Ph.D. studies.

The Royal Library (Fig. 2), the University Library and the libraries at the Technical College of Denmark and the Royal Veterinary and Agricultural University were the only academic libraries until 1902 when the State and University Library in Aarhus was founded to serve the public outside the capital. In 1928, Aarhus University was founded, and the State and University Library (Fig. 3) became its library. During the last third of the twentieth century, a number of universities and university colleges were established, and the national museum collections were supplemented by professionally run art and cultural-historical-museums in many towns.

The welfare state and the expansion of public libraries

During the interwar and postwar periods, public libraries followed the classical model with the loan of books and the administration of reading rooms as central activities. The task was to establish libraries wherever the need arose and make sure that they were run professionally. In this period, many public libraries became a driving force in study circle activities. With the 1964 amendment to the law, public libraries were made mandatory in all municipalities; cultural activity was included in the legislation, and libraries geared up to meet the educational boom that arrived with prosperity and the baby boom. In 1970, a municipal reform resulted in merging the small rural districts. This provided the basis for a sustained professionalization of the public libraries. In 1983, the responsibility for local public library service was entrusted to the municipalities. At the same time, the financing of public libraries changed from government subsidy to block grants with the municipalities' free right of disposal as a basic principle.

The last major wave of change arrived with IT development. The first initiatives within cataloging came around 1970 with OPAC (Online Public Access Catalog) as their goal. The breakthrough of the Internet in the mid-1990s brought with it a challenge to change all libraries into hybrid libraries. Home pages and Internet access for the public appeared in the latter half of the 1990s. It became obligatory with the Act regarding library services in 2000 that established free access to a Web-based National Union Catalog and mandated broad media access through public libraries.

Throughout the twentieth century, the public library system was consolidated with regional libraries in the counties, libraries in all municipalities, and more branches in larger towns. But many libraries were still owned by associations, and only with the revision of the library act in 1964 was municipal library service made obligatory. In 1983, full responsibility for the local public library was



Fig. 2 The Royal Library in Copenhagen.
Source: Photo by Mette Udesen.



Fig. 3 State and University Library in Aarhus.
Source: Photo by Martin Lund.

transferred to the municipality. But from the beginning of the century the State maintained a firm involvement in the development of the libraries.

Legislation

Library activities have been regulated by legislation since 1920; the law is changed at regular intervals. The latest act dates from the 2000, Act regarding library services (I 78, 2000) (English version: <http://www.bs.dk/publikationer/english/act/index.htm>). The Act addresses public libraries, regional libraries, government libraries, and government obligations. The stated objective of library service is to “promote information, education, and cultural activity.” The means are making books and other relevant media available, including Internet access. The public library is open and available to everyone for the loan of materials. All services are free. Public libraries must cooperate with school libraries, which are obligatory in municipal schools and are run as part of the school activity. All municipalities are obliged to provide library service for both children and adults. The State is responsible for the national bibliography and for the union catalog, which is made available via the Internet. The State also pays for regional library service. Together with the State and University Library, the regional libraries are a “superstructure” for the public libraries and handle a number of tasks in relation to procurement of materials, advice, and competency development in the libraries.

The law provides a legal framework that deals with the way libraries should perform their tasks in the information society. It emphasizes that there are media other than print and defines the conditions for giving access to the Internet. For state libraries, including university libraries, a condition for receiving subsidies is that they must participate in interlibrary loan cooperation free of charge.

Legal deposit was introduced in 1697. In 1998, the act on legal deposit was changed so that the deposit obligation included not only printed material but also other media, such as e-publications, videograms, databases, film, and radio and TV broadcasts. The 2005 revision of the law includes harvesting the Danish part of the Internet. Legal deposit of printed material is shared between the two national libraries, the Royal Library and the State and University Library. The latter is responsible for the National Newspaper Collection, radio and TV programs, and film produced with a right to public viewing.

Public Lending Right Remuneration is distributed as a culture subsidy to Danish authors whose works are available at public and school libraries. Public Lending Right Remuneration has been paid out since 1946; Denmark was the first country in the world to introduce this subsidy scheme. The principles are stated in the Act on Public Lending Right Remuneration.

The legal framework for the school library can be seen in The Folkeskole (2) where it is determined that a school

library must be established in every Folkeskole and that these must function as pedagogical service centers.

National Library and Information Services

The Danish Agency for Libraries and Media, which operates under the Ministry of Culture, is the central government organ for libraries and media. The Agency handles a number of administrative tasks related to the libraries, including administration of the Act regarding library services. Likewise, it deals with development tasks in association with the libraries' activities and administers a number of subsidies within the library area.

The Agency was founded in 1920 as the State Inspectorate of Public Libraries with tasks related to the public libraries. In 1986, it merged with The Office of the National Librarian, thereby being allocated coordinating tasks regarding the research libraries. In 1997 this office gained status as an agency entitled Danish National Library Authority. In 2008 the Agency merged with The Danish Agency for Media and gained its present name.

The Danish Agency for Libraries and Media, performs tasks that in other countries might belong to the national library. It is responsible for

- The national bibliography.
- Standards, including cataloging rules etc.
- National bibliographic databases, DanBib and Bibliotek.dk (library.dk).
- The national distribution scheme for interlibrary lending.
- Financing the regional library service.
- Handling performance contracts with 16 regional libraries, which in 2010 will be reduced to six.

The regional libraries act as central repositories for materials, advise smaller libraries and are responsible for professional development.

The Danish Agency for Libraries and Media, is secretariat for Denmark's Electronic Research Library, which is a collaboration between more than 200 special and academic libraries and handles licenses for e-resources to Danish educational and university libraries. The division of work between the Agency and the libraries means that the agency is responsible for the infrastructure, while the municipalities and research and education institutions are responsible for the actual running of the libraries. Central to the infrastructure is the union database, DanBib, which started in 1994 and registers all Danish library records. DanBib forms the basis of bibliotek.dk, the libraries' common public portal that opened in 2000. There one can search for and request any titles in a Danish library. Projects are in progress concerning the establishment of a common data well with bibliotek.dk and databases with e-resources for the purpose of establishing integrated search.

The Agency is responsible for coordinating library collaboration and ensuring national development of the libraries. This happens via subsidies for development projects and professional development. The Danish Agency for Libraries and Media has entered into a contract with Danish Bibliographic Center, a limited company owned mainly by the Danish state and municipalities, for the preparation of the national bibliography and the running of DanBib and bibliotek.dk. The Royal Library in Copenhagen and The Danish State and University Library in Aarhus both have status as national libraries, the State and University Library also being part of the infrastructure for the public libraries. As such, they are responsible for legal deposit and Netarkivet.dk that contains the Danish part of the Internet, harvested by Web crawlers. So far the Net Archive can only be used for research.

ACADEMIC AND RESEARCH LIBRARIES

Universities

Following a recent reform of Danish universities which also included the merger of some independent research institutions there are today eight Danish universities. The largest universities by far are

- Copenhagen University (est. 1479) with an academic staff of about 3500.
- Aarhus University (est. 1928) with an academic staff of about 2000.
- The Technical University of Denmark (est. 1829) is the third largest.

These three universities have stronger research profiles, than the smaller schools. The University of Southern Denmark (est. 1966), the University of Aalborg (est. 1974), the Roskilde University (est. 1972), and The Copenhagen Business School (est. 1917) are medium-sized universities while the eighth university, IT University of Copenhagen (est. 2003), is a very small university (Fig. 3).

Universities are the primary institutions for higher education in Denmark, and all of them, except IT University, have an independent research library, which the school funds and manages. In the case of Aarhus and Copenhagen universities, the libraries have an independent role, since the two national libraries also function as university libraries.

In the recent reforms of the Danish educational sector, also included the vocational educations at college/high school level. A large number of schools for engineers, nurses, teachers, and pedagogues were merged into eight university colleges. The largest of these have close to 10,000 students. The largest of these colleges have roughly the same number of students as the medium-sized universities. The students and teachers at the university

colleges were originally supported by small libraries connected to the particular education but following the mergers new and larger library organizations are being established at the different university colleges.

Special Libraries

A number of academic libraries are regulated by the Act regarding Library Services. The act specifies that the libraries participate in the general interlibrary loan cooperation and are freely accessible to the public; doing so is a prerequisite to receiving a grant for the library. The Danish Agency for Libraries and Media each year publishes a list of those libraries regulated by the Act.

There are a large number of small academic libraries. The Danish library statistic collects data from 169 academic libraries; 42 of these participate in general interlibrary loan cooperation. Of these 42 libraries, 16 are large academic libraries that provide more detailed statistics. The universities have a total of 122 departmental libraries, e.g., libraries in law and medicine.

The loan of printed materials continues to play a central role in library activities. The library.dk service and the underlying interlibrary loan cooperation are important in that regard. Downloads from subscription-based electronic journals have replaced printed materials as the most important activity for the larger research libraries. In 2006, the 16 largest libraries had 2.8 million loans of books and other printed materials and 8.2 million downloads from electronic journals. That means that two out of every three loans are now electronic.

Library roles and tasks

Academic libraries are expanding the traditional role of information provision to include new services to support activities at the parent institution. In its strategy for library development, The Danish Agency for Libraries and Media identifies five major functions of academic libraries.

The most important task is still providing information through building print collections and purchasing subscriptions to electronic journals and databases. A second activity is the creation of new interfaces to the global Web of knowledge for both students and researchers. At present, efforts are focused on integrated search, i.e., creating seamless access to the many different information resources and delivering accurate search results.

The 2003 act on universities emphasized the export and mediation of knowledge from universities. Subsequently, this has become a third major task for academic libraries. An important activity is the registration of research and the operation of current research information systems (CRIS). This role is expanding into the fourth major activity—the support for a coherent e-framework for education and research at the parent institution. There is increased focus on IT systems for supporting learning and

research. This can include systems for e-learning and handling of scientific primary data. The fifth and final task is development of information literacy skills.

Digital Library Collections and Services

Denmark's Electronic Research Library (DEFF) plays an important role in regard to the build-up of the libraries' digital collections. Among other things, it functions as a national framework for consortia buying electronic journals and databases. The DEFF-secretariat handles negotiations with vendors and administers practical aspects of the subscriptions. Denmark's Electronic Research Library supported the development of the national access system that allows all students and researchers to have remote access to electronic journals.

Denmark's Electronic Research Library provides the infrastructure for both consolidation and development of library services, and it supports the increasing consolidation of library systems and the joint development of common CRIS systems. It also support more specific projects, e.g., in information literacy. The SWIM tutorial at Aalborg University Library (<http://www.aub.aau.dk/swim2/1024/start.html>) and the library test (<http://www.librarytest.dk/>) developed by The Royal library are examples of such projects.

In addition to its own Web site <http://www.deff.dk>, DEFF has supported the development of the national science portal <http://www.videnskab.dk> and the national research database <http://www.forskningsdatabasen.dk/>.

PUBLIC LIBRARIES

The Danish public library system is regulated by the Act regarding library services, which is a framework law that obligates all municipalities to run a public library that offers both children and adults free and equal access to Danish libraries' materials. Public libraries must cooperate with school libraries. All major research and special libraries participate in the interlibrary loan cooperation free of charge.

The common database, bibliotek.dk, and a transport scheme financed by the State form the basis of extensive ILL (interlibrary loans) activity. All public libraries are to be run by professionally qualified staff. The law obliges the libraries to provide free access to all types of media, including the Internet. Public libraries together produce a number of national, Web-based services, e.g., Biblioteksvagten.dk/Ask-a-librarian, Litteratursiden.dk, SpørgOlivia (Ask Olivia).

In 2007, the Danish municipal structure was changed from 275 to 98 municipalities, which led to the merging of many public libraries. One hundred and thirty-six branches were closed that year culminating a decade of closures of almost 500 out of more than 1000 libraries. In

2007, there were 550 public libraries. The closures are seen as part of a restructuring of the libraries to accommodate the needs of the knowledge society. The remaining libraries are extending their opening hours and services, and work is going on to find alternatives to the small local branch, e.g., cooperation with school libraries, self-service branches, flexible mobile libraries, and delivery of library materials. The total budget for public libraries is 2.75 billion krone DKK (Danish crowns), which means a per capita expenditure of 502 DKK per year (2007) (Fig. 4).

There is a decrease in the loan of traditional library materials, but an increase in the use of new digital services. The average loan figure per citizen is 13 (2007). The government's strategy for the development of public libraries features three main tracks:

- Continuous development of digital services.
- Changing the physical library from storehouse to a learning, meeting, and experience space.
- Innovative thinking in terms of outreach library service.

One example of a new digital service is the loan of music files from home via the library that clears the use with the rights owners. All recorded Danish music is digitized and forms part of this agreement together with a large part of foreign music.

Outreach library service is partly Web-based and partly directed toward various target groups. Kindergarten libraries and targeted early initiatives concerning children in ghettos in the shape of bookstart programs are examples.

SCHOOL LIBRARIES

School libraries are obligatory in the Folkeskole where they have status as pedagogical service centers. Thus, they are integrated into the school and are run by teachers who have supplemented their training with a school librarian course (diploma program). The school library makes available all types of educational materials for teaching and provides books and other materials for the pupils' leisure reading. There are 1929 school libraries, and most pupils use them; 75% of pupils visit the library at least once a week. The school library forms a central part of the school's learning environment and acts as the school's innovative, mediatory, and pedagogical learning center. It supports the aims of the Folkeskole and contributes to realizing the school's fundamental values, learning targets, and action lines.

There is no statutory requirement for libraries in secondary schools. About 75% of the nearly 250 secondary schools, however, do have a library with instruction in information literacy as a central feature. Upper-secondary school libraries support the pupils' learning environment



Fig. 4 Interior of children's library at Hjoerring Public Library.
Source: Photo Fjord and Bosch by Laura Stamer.

and study competence, and studies show that traditional library service is heading toward a new form of learning and knowledge center. Focus is directed at interdisciplinarity, and many places are working intensively on introducing a new project culture. In 2007, the upper secondary schools were changed from being county institutions to private institutions. Beginning in 2009, these schools will be included in Denmark's Electronic Research Library.

School libraries are supported by 16 government centers for educational services. These centers offer information on and loan of educational materials, pedagogical advice, and guidance to teachers, assistance with the production of educational materials, and educational programs, such as instruction in IT application.

Library and Information Science Education

The Royal School of Library and Information Science (<http://www.db.dk/english>) was established in Copenhagen in 1956 as a professional school with 4-year educational programs. In 1973, a branch was established in Aalborg in Jutland. Until the late 1960s, research and academic libraries offered a program for library assistant, which then became a 4-year education program at research and academic libraries. In the mid-1980s, the two programs merged into one.

In 1999, the school became an institution of higher education with bachelor's, master's, and Ph.D. programs (3 + 2 + 3) and a diploma program which consists of a 1-year advanced level program following a bachelor's degree. The school also offers a number of diploma and

master's programs. Prior to the school's change to university status, an assessment was carried out according to American Library Association Standards for accreditation of Master's Programmes in Library and Information Studies with a very gratifying result.

A research evaluation, carried out by five recognized international and national researchers in 1999 concluded that the school's research was at the highest level. The school employs about 100 researchers with a broad spectrum of research fields. It has made its mark internationally through research within information retrieval, domain analysis, and knowledge organization. Several Danish universities have conducted information scientific research projects and established educational programs bordering on information science.

The educational programs at the Royal School of Library and Information Science are directed at tasks in both public and research libraries, public administration, organization, and private businesses. Students trained at the school are increasingly being employed in all types of knowledge-based institutions. Both the classical library services and the rapidly growing digital services play an ever-increasing role: organization, mediation, and sharing of knowledge are of fundamental importance to society's economic and cultural development and cohesion. About half of the school's graduates are employed outside the library sector. The school has close to 1000 students, about 200 in Aalborg, and 800 in Copenhagen.

The Royal School of Library and Information Science has a Department of Continuing Education and Consultancy, which is responsible for continuing education and

deals with advice and development tasks. The Department of Continuing Education and Consultancy is visited annually by about 5000 course participants and arranges about 300 courses a year.

Associations

The association, “Danmarks Folkebiblioteksforening,” was founded in 1905 and was merged with the Danish Library Association in 1920. The aim of the association was to further the library cause in Denmark, and for more than 50 years it represented all library interests in the country. Today, the association membership includes local authorities responsible for cultural affairs and institutions as well as personal members, primarily among library staff. It lobbies for the continuous development of public libraries and publishes the journal *Danmarks Biblioteker* (<http://www.dbf.dk/Default.aspx?ID=4126>).

In 1969, library employees broke away from the association and formed The Danish Union of Librarians, which represents the interests of professionally trained librarians. Today, the union has 5500 members and publishes the journal *Bibliotekspressen* (<http://www.bf.dk/Service/English.aspx>).

Research libraries broke away in 1978 and formed the Danish Association of Research Librarians, a professional organization for research libraries and their employees (<http://www.dfd.dk/uk.php>).

The Municipal School Library Association dates from 1919 and organizes municipalities and their politicians with particular interest in school libraries, <http://www.ksbf.dk/page/foreningen.html> while school librarians have their own association, the Association of School Librarians (<http://www.emu.dk/gsk/skolebib/>).

Danish public library directors are organized into the Association of Library Directors, <http://www.bibliotekslederforeningen.dk/>, while the libraries’ clerical staff and library assistants are organized in HKstate (http://www.hk.dk/stat/landssammenslutninger/statslige_biblioteker_og_arkiver) and HK Municipal Library Committee (<http://www.hkkommunal.dk/sw30576.asp>). These associations’ homepages are only available in Danish.

Since 1989, all of the Danish associations have collaborated in the Library Umbrella, just as most of them are members of the European library associations, EBLIDA (European Bureau of Library, Information and Documentation Associations), and IFLA (International Federation of Library Associations).

ARCHIVES AND ARCHIVAL SCIENCE

Legislation

The Danish Archives Act regulates preservation and disposal of public records, the public archives’ activities, and

the public’s access to records. It states that public archives must:

- Ensure the preservation of records of historical value or that serve as documentation of conditions of important administrative or legal importance to citizens or authorities.
- Guarantee the possibility of disposing of non-preservation-worthy public records in cooperation with those authorities affected by the law.
- Make records available to citizens and authorities, including for research purposes.
- Instruct citizens and authorities in the use of records.
- Do research and spread the knowledge about research results.

The Danish Archives Act is administered by the State Archives, a government agency under the Ministry of Culture that determines the detailed rules for preservation and disposal of public records. Municipalities and regions may choose to establish their own archives for the preservation of their records. The State Archives are obliged to cooperate with these regional or local archives. Government authorities must transfer their records before they are 30 years old. Special rules apply to digital records.

The Archives Act defines the rules for accessibility to public records. Public records are normally freely available when they are 20 years old. Records that contain information about an individual’s private, personal, or financial, situation are only available after 75 years. There are a number of regulations about accessibility to specific types of records. In special cases, authorities transferring records can, in cooperation with the State Archives, determine accessibility deadlines for specific archive groups. The Act states that it is possible to seek access to records that are not immediately accessible. In such cases, the State Archives, possibly in collaboration with the relevant public authorities, decide whether special permission may be granted. The State Archives can collect and make available private records from individuals, associations, organizations, and companies. In such cases, agreements must be made on accessibility between the transferring party and the State Archives.

National, Regional, and Local Archives

“The State Archives,” consists of the Danish National Archives, the Regional Archives of Zealand, Regional Archives of Funen, Regional Archives of Southern Jutland, Regional Archives of Northern Jutland, the Danish Data Archives, and Danish Business Archives. The State Archives altogether employ about 300 people.

The Danish National Archive in Copenhagen is the central administration’s archive and collects and stores records from all Danish central authorities—ministries,

government agencies, and the armed forces—and from private individuals and organizations. The National Archive contains about 168,000 shelf meters of records that are made available to the public in the reading rooms of the State Archives. The reading rooms have about 17,000 visitors each year, principally genealogists, researchers, and students.

The public archives in Denmark are quite professionalized, partly because they are administered under the authority of the State Archives. The State Archives' dual function as an agency for the administration of the Archives Act and as a cultural institution for the preservation, accessibility, and mediation of records has proved to be effective. As opposed to many other national archives, the State Archives no longer have a backlog. With the prospect of new, climate-regulated stacks that can accommodate the entire collection a volume of almost 400,000 shelf meters, the State Archives find themselves in an extremely favorable situation.

Denmark also has a number of "Regional Archives" that collect and store records from public regional authorities, primarily regions, and municipalities. These include:

- The Regional Archives of Zealand, Lolland-Falster, and Bornholm are also situated in Copenhagen.
- The Regional Archives of Zealand contain about 69,000 shelf meters of records and are visited by about 18,000 people each year in their reading rooms.
- The Regional Archives of Funen in Odense collect and store records from public regional authorities, primarily regions, and municipalities.
- The Regional Archives of Funen contain about 20,000 shelf meters of records and annually welcome about 9000 visitors to their reading rooms.
- The Regional Archives of Southern Jutland in Aabenraa collect and store records from public regional authorities, primarily regions, and municipalities.
- The Regional Archives of Southern Jutland contain about 18,000 shelf meters of records and have about 4000 visitors each year in their reading rooms.
- The Regional Archives of Northern Jutland in Viborg collect and store records from public regional authorities, primarily regions, and municipalities.
- The Regional Archives of Northern Jutland contain about 62,000 shelf meters of records and about 11,500 visit the reading rooms each year. Here you also find the State Archives' Filming Centre, which does microfilming and digitization of the records kept in the State Archives.

The Danish National Business Archives is a research institution that collects and preserves important historical source material about the development of Danish business life and makes it available to the public. The Business Archives also act as archive for Aarhus municipality. They contain about 50,000 shelf meters of records and

about 3500 visitors find their way each year to the reading rooms.

Danish Data Archives in Odense collect, preserve, and deliver digital research data from social science, medical science, and history. Quantitative research data in the form of questionnaires make up most of the collection. Danish Data Archives' material is available via search catalog on their homepage. The State Archives' collections are searchable via the database DAISY, which is available online. Digital historical data in the shape of archiving versions are available via the database SOFIA.

Separate from the State Archives are a number of municipal archives. Among the largest are Copenhagen City Archives, Aalborg Municipal Archives, Vejle Town-historical and Municipal Archives, and Frederiksberg Municipal Archives. State archives typically offer search in special databases. Finally, there is DANPA, Denmark's National Private Archive Database where one can search registrations of private archives from most large archives in Denmark.

College and University Archives

The archives of Danish institutions of higher education are to be found in the State Archives. The archives of Copenhagen University, Technical University of Denmark, and the Aarhus University School of Education are placed in the Danish National Archive. The archives of Aarhus University and Aalborg University are placed in the Regional Archives of Northern Jutland, those of the University of Southern Denmark in the Regional Archives of Funen and Roskilde University archives in the Regional Archives of Zealand.

The State Media Collection, part of the State and University Library, collects, preserves, and mediates Danish TV and radio broadcasts, commercials and sound recordings from parliamentary debates, news bulletin manuscripts and Danish video releases. Researchers (including journalists) and students/lecturers at institutions of higher education can borrow the TV and radio broadcasts. Everyone can use the audiovisual collections in the library, even the legal deposit material, since they cannot be loaned to other libraries or to private individuals.

According to the Film Act, the Danish Film Institute is obliged to ensure the preservation of films and documentation material about films, to collect film and TV literature, to do research and to make the collections available to the public. The archives of the Film Institute hold more than 30,000 titles and contain all kinds of films shown in Danish cinemas from the beginning of the history of film in 1896 to the most recent films that are legally deposited with the archives. The film archives work actively for preventative preservation, conservation, and digital preservation/conversion. The Institute's films are available online in the database "Danmarks Nationalfilmografi."

DR Archives and Research is part of Denmark's Radio and contain archives and library. Apart from servicing the employees at DR, it sells archival and research services to external stakeholders. DR Archives and Research does not lend from its archival collections with TV broadcasts, but it is possible via the country's libraries—for research purposes—to use TV materials.

DRs Radio Archives file and maintain the broadcasts that must be preserved for posterity. The radio broadcasts go back to the 1930s and cover recent Danish history politically, socially, and in societal terms. Add to this radio dramas, montages, and recitals. There is no public access to the collections of radio broadcasts, but it is possible to buy individual broadcasts. Radio materials from the State Media Collection can be used for research purposes.

Other Archives and Repositories

The Labor Movement's Library and Archives in Copenhagen contain a large collection of archival material concerning the history of the labor movement in Denmark. The Danish Emigration Archives in Aalborg are The National Collection of records on the history of emigration in Denmark. The Map and Land Registry Agency contains previously valid cadastral maps, cadastral protocols, and registered cadastral cases, including surveying information. The collections cover the period from 1844 to the present. For information on Greenland and the Faroe Islands, see National Museum of Greenland and Archives and the Faroese National Archives.

Digital Archival Collections and Finding Aids

Cf. the Archives Act, the State Archives collect, store, and make available Danish authorities' digital records. Development of search tools for the digital collections is undergoing a tremendous process of change. The database SOFIA, which contains the authorities' digital archival version, as of 2008 was only available in the reading rooms of the State Archives. An online solution is expected to be implemented soon.

Archival Science as a Discipline and Profession

Archivistics, as profession and discipline, has emerged in Denmark mainly under the auspices of the State Archives and to a lesser extent the municipal archives. The State Archives employ about 200 archivists, providing a professional archive environment. Extensive Nordic collaboration is going on with expert seminars, Nordic Archives Academy, exchange of staff and the Nordic Archive Days. The central publication relating to archives and archivistics in the North is *Nordisk Arkivnyt*, published four times a year.

Education for archivists and records managers

Denmark has no actual archivist training course. However, Aalborg University, together with Aalborg Municipal Archives, has established a training program in information administration that includes courses such as archive theory, databases and communication, and a final project. The program, first offered in 2008, runs for two semesters. A student enrolled both terms can earn 60 points European Credit Transfer and Accumulation System. In addition, the State Archives offer a number of internal courses for their archive professional staff.

Professional associations

There are four major associations related to archives and archivistics.

1. *The Organization Danish Archives (ODA)* works to increase public awareness of the importance of Danish Archives and also attempts to promote collaboration, coordination and other kinds of activities that can enhance Denmark's archival cultural heritage.
2. *Forum for Knowledge, Information, Documentation, and Archives (VIDA)* is an association whose aim is to encourage rational archival organization, particularly in the corporate sector. Here companies, organizations, and individuals are gathered together, who have journalizing, electronic document management as areas of responsibility, occupation, or interest.
3. *The Archives Association* arranges functions open to anyone interested in archive professional issues, or who just has a general historical interest. There are 6–8 functions a year.
4. *The Association of Local Archives (SLA in Danish)* brings together people with archival interests in Denmark in a common endeavor to heighten the quality in the work with preservation of the cultural heritage. The association has more than 400 members, distributed on 13 districts that each covers one of the former counties. Members of the association profit from each other's experiences and expertise and from the development work carried out by SLA's committee.

Electronic Records as Archival Documents

The Archives Acts does not differentiate between electronic/digital records and paper records. The State Archives thus have the obligation of collecting, storing, and making available all records whatever the medium and format. The State Archives have collected electronic/digital records since the early 1970s.

In order to preserve and make available electronic/digital records, the State Archives conducted a large conversion project during the past few years where electronic/

digital records of older formats are recorded on DVD in a searchable format. The project ended in 2008, and from now on focus will be placed on accessibility of the collection of electronic/digital records.

Preservation

The State Archives do not perform actual conservation of its collections. For the purpose of conservation, a professional consultant is employed who monitors the collections and decides which records should be conserved. The conservation process is outsourced to The Royal Library's Preservation Department.

The State Archives are in the process of introducing climate control regulations for all new stacks, to ensure that a stable, low temperature and stable, low, relative humidity will inhibit the deterioration paper records. In addition, the State Archives stores the majority of its collection in acid-free, bar-coded boxes.

Conservation and preservation of digital records take place as mentioned above in a special format and structure conversion project.

MUSEUMS AND MUSEOLOGY

Introduction—The Danish Museum Sector

The Danish museum sector covers a broad and varied spectrum of institutions and subjects. The major institutions share the same legal framework—The Danish Museum Act—and receive funding or subsidies from the Ministry of Culture. Almost 100 museums cover cultural history, another 35 focus on art, and three specialize in natural history (geology, zoology, and botany).

The number of visitors at Danish museums has been stable for the past 10 years, totaling approximately 10 million visitors a year. In 2006, the state-owned and state-subsidized museums introduced free access for people under age 18. At the National museum and “Statens Museum for Kunst—The Danish National Gallery,” free access is also given to adults. Since 2006, there has been a 2% yearly increase in the number of visitors. In 2007, the total number was 10.8 million. That is the equivalent of two museum visits a year per inhabitant in Denmark.

Total public spending on the museum sector is approximately DKK 1.1260 million a year, of which the State's share is DKK 716 million (2006). There are eight state-owned museums that are fully funded by the central government, and 123 others that are approved by the State and receive partial funding.

The state-subsidized museums are owned by local authorities, by independent institutions or by an association whose objective is to run the museum. These three forms of ownership are equally prevalent. The central government's share of funding for state-subsidized

museums is approximately 35% of their total expenses. There are 19 state-subsidized museums that receive extra State funding, because they have special research and/or dissemination activities. Some of these museums also handle tasks at the national level.

Legal Framework

The state-owned and state-recognized museums are regulated by the Museum Act, passed in 2001.

According to the law, the general purpose of the museums is to safeguard Denmark's cultural and natural heritage and secure access to and knowledge about this heritage and its interaction with the world around us. The purpose is realized through the five key function that constitute the tasks of the museum: collecting, registering, preserving, researching, and disseminating information. The act identified three types of museums: 1) natural history museums; 2) art museums; and 3) cultural history museums. The 2006 revision of the act introduced free access for children and made some changes related to the reform of the Danish municipalities.

Heritage Agency of Denmark

This agency promotes collaboration between museums and supports the development of individual museums. It makes recommendations to the Minister of Culture about which museums are to be recognized by the State and thus eligible for state subsidies. It also administers state subsidies for these museums. Other tasks include listing buildings of national significance and the protection of ancient sites and monuments, and of the archaeological excavations undertaken by Danish museums. The Heritage Agency also administers various funds for which both state-owned and state-subsidized museums can apply annually. Such state grants provide support for research projects, study trips, purchases, publication of books.

In addition to the Heritage Agency, certain museums have special roles in regard to other museums. The National Museum of Denmark, “Statens Museum for Kunst—the Danish National Gallery” and the Danish Museum of Natural History are the principal museums for cultural history, history of art, and natural history, respectively. These three museums have a special status and offer expert advice to other museums in Denmark.

Museums of Art

There are three state-owned art museums. The Danish national “Statens Museum for Kunst—the Danish National Gallery,” is according to the museum law, given has the responsibility of illustrating Danish and foreign visual arts, primarily from the western world after 1300 A. D. The museum's collections constitute almost 9000 paintings and sculptures, more than 240,000 works of art on

paper as well as more than 2600 plaster casts of figures from ancient times, the Middle Ages, and the Renaissance. The major part of the museum's older collections comes from the art collections of Danish kings.

The two other State art museums are the Ordrupgaard Collection and the Hirschsprungske Collection. The former is named after the village of Ordrupgaard, which lies just outside Copenhagen. Its collection features nineteenth-century French and Danish art, including works by important Romantic, Realist, and Impressionist painters. The Hirschsprungske Collection owes its name to Pauline and Heinrich Hirschsprung, who donated their comprehensive collection of nineteenth-century Danish art to the Danish State in 1902.

Among the 35 art museums are the ARoS (formerly Aarhus Art museum), which was established in 1859 and opened in a new building in 2004. It offers Denmark's largest art collection outside Copenhagen and has notable collections of Danish art that span 300 years as well as exhibitions of contemporary international art. The Ny Carlsberg Glyptotek in Copenhagen is one of Denmark's most popular museums. It houses more than 10,000 works divided into two principal collections. One is devoted to the Mediterranean cradle of Western culture and the other to Danish and French art from the nineteenth and twentieth centuries.

Outside Copenhagen are two museums of twentieth-century art. The Arken Museum of Modern Art, which was opened in 1996, collects Danish, Nordic, and international art with special emphasis on work from 1990 to the present. The Louisiana Museum of Modern Art offers a collection of more than 3000 works, produced primarily after 1945, that concentrates on more compact groups of works and artists.

Cultural History Museums

The Museum Act states: "The cultural history museums illustrate change, variation, and continuity in the living conditions of human beings from prehistoric times to the present." The National Museum of Denmark is the country's principal cultural history museum. Its responsibility is to illustrate Denmark's culture and the interdependence of all the world's cultures.

In addition to exhibitions of Denmark from prehistory through the Middle Ages and the Renaissance to modern times, the museum houses exhibitions from the ancient cultures of Greece, Italy, the Near East, and Egypt. It is also in charge of some of the archaeological investigations that the Museum Act specifies as important in securing the cultural and natural heritage.

Denmark has three additional cultural history museums. The Danish Defence Museum has two exhibitions: The Royal Danish Arsenal Museum, which exhibits the development of small arms and edged weapons during the last 500 years, and the Royal Danish Naval Museum,

which presents naval models and marine paintings. The Defence Museum also exhibits historic warships, which include the frigate, Peder Skram, the last Danish submarine, Sælen, and the fast attack boat, Sehested.

The Danish Agriculture Museum illustrates farming and the life of farming families from the Late Stone Age through the agricultural reforms that took place from the late eighteenth century to the present day. The collection contains approximately 70,000 items, some of which are extremely large. The museum's buildings extend over approximately 24,000 m², including 8000 m² of exhibition space.

The Danish Museum of Hunting and Forestry is one of the largest of its kind in Europe. With 3000 m² of exhibition space, the museum presents the history of hunting and forestry in Denmark from the Stone Age to the present day.

Danish history from the Stone Age and Iron Age can be experienced at several other places. The Prehistoric Museum, Moesgaard, near Aarhus in Jutland, offers a wealth of relics from prehistoric Denmark to the Viking Age, including a large collection of runic stones. On the border between museums and experience centers, Hjemsted Oltidspark in southern Jutland and Lejre Experimental Centre near Roskilde, are worth mentioning.

Natural History Museums

The natural history museums illustrate nature, its development, contemporary environment, and the way it's related to human beings. In 2004, four institutions were merged to create The Natural History Museum, which is responsible for maintaining and building up natural history collections, for carrying out research in the natural sciences, and for presenting the current state of knowledge about natural history to the general public. The four merged institutions, the Botanic Garden, the Botanical Museum and Library, the Geological Museum, and the Zoological Museum, are now a department of the University of Copenhagen. The museum's exhibitions play an important role in teaching and public outreach.

The Ministry of Culture grants subsidies to four natural history museums. The Natural History Museum in Aarhus, the second largest of its kind in Denmark in both size and exhibition area, contains more than 5000 different species of animals from all over the world. Svendborg Zoological Museum (naturama) focuses on mammals and birds whereas the Mid-South Jutland Museum exhibits primarily fossils collected in the Gram Clay Pits (Gram Lergrav), which have fossils as much as 8 million years old. The Fur Museum contains a unique collection of 54 million-year-old fossils.

Digital Museum Exhibits and Services

The Heritage Agency coordinates registration of the museum's collections. The cataloging system Regin was

made available to the museums in 2003, and the data are presented on the Internet at <http://www.kulturarv.dk/mussam>. With this service, it is possible to get an overview and search the collections of the cultural heritage museums.

A similar service is available for the arts museums. The central register of works of art in Danish museums and collections was founded in 1985 and went online in 1996. The register holds information on approximately 39,000 works by Danish and international artists. It is available at: <http://www.kulturarv.dk/kid/Forside.do>. In addition, there is the possibility of searching for museums and institutions by geography, subject, or collection at: <http://www.dmol.dk/engelsk/start.asp>.

A 2006 ministerial report recommended an increased focus on digital mediation and increased cooperation and knowledge sharing, and it proposed a specific focus on mediation for children in a digital environment. It also highlighted some of the many services and projects developed by the museums themselves. A good example is <http://www.kongedragter.dk/> where it is possible to study the clothing of Danish monarchs. At Zoom Ordrupgaard (<http://www.zoomo.dk>) the public can experience close ups of pictures, compare pictures, and get tips on analyzing them. Another example of digital mediation is <http://www.absalon.nu>, which is a collaboration between the local library, archive, and museum presenting the history of Copenhagen on the Web. At <http://www.tilbygningen.dk> (the annex), audiences can experience a virtual addition to Thorvaldsens Museum and take a trip around the collections. The museums are continuously developing new digital exhibitions and services, frequently with funding from the Kulturnet Danmark funding pool. One such example is <http://www.vildmedwillumsen.dk>.

Another kind of service presented by Danish institutions in arts, design, and architecture is a joint portal <http://www.arkade.dk>, which offers a collection of links, the possibility of cross-searching the institution's catalogs and access to other digital information resources.

Two initiatives seem to hold interesting prospects for future mediation. One is <http://www.emuseum.dk> where the museum's collections and mediation is directly linked to teaching. The other is <http://www.danskkulturarv.dk> which is a pilot project that attempts to show how digitization and, in particular, mediation can be cross-institutional and bridge the traditional division between archives, libraries, museums, and other institutions, such as the Danish Broadcasting Cooperation.

Museology as a Discipline and Profession

The universities have a long history of offering education in museology as subjects in arts history and ethnography, but there was no coherent education specifically focused on museology until 1977 when it was established as an interdisciplinary, optional course at the Department of Art

History at Aarhus University. In 2001, museology was offered as a supplementary program at the University of Aarhus, and in 2002, museology was integrated in the B.A. program at the University of Copenhagen. In 2005, a master in museology was established at the University of Aarhus. The latter program is divided into four modules: international museum theories and methods, organizational museum theories and methods, museum communication, and finally a master's project. Additional teaching study in museology is offered at the University of Roskilde and at The Royal School of Library and Information Science.

Training for curatorship and museum administration

For a number of years, The Museumshøjskolen (a folk high school) was an important center for the development of museology in Denmark. The school offered further education to employees at Danish museums. In 2006, the Museumshøjskolen was merged with the Association of Danish Museums, which offers a number of shorter courses as well as further education. For example, the training in museum administration and management is offered at the diploma level.

The School of Conservation, part of The Royal Danish Academy of Fine Arts, was established in 1973. The education as conservator is a 3 year bachelor degree followed by 2 years of graduate studies. After 5 years of study, the student earns the degree Cand.Scient.Cons. The school also offers a 3 year research program (Ph.D.).

Professional associations for curators and museum administrators

The Association of Danish Museums, which covers almost all Danish museums, organizes a number of different subject-based informal networks. One of these is a museology researcher's network, which has evolved into a more permanent organization with regular meetings.

Key contemporary issues—preservation, access, educational role

The growing importance of museology as a profession, the Museum Act of 2001 and the establishment of the National Heritage Agency all signal a new and more visible profile for Danish museums. The Danish reform of municipalities and counties has entailed new funding structures, and some mergers in the museum sector. These issues have dominated the debate for the past few years.

These developments have also served as a catalyst for a debate on the concept and functions of the museum. There is a growing emphasis on the educational and interpretive role of the museum in relation to the other four functions (collecting, registering, preserving, researching). Mediation is seen as increasingly important as the museums try

to contribute to other societal goals, such as education, tourism, social inclusion, and economic development. This has sparked a debate on whether museums risk becoming mere entertainment, like the Tivoli amusements, or whether, according to new theories of learning, entertainment, and education can be combined in innovative ways. At the same time, digital development challenges the traditional concept of museums as dependent on collections and highlights the possibilities of cross-institutional cooperation.

CONCLUSION

Danish libraries, museums, and archives are highly advanced and are undergoing rapid transformation as a result of the knowledge society's new standards for hybrid institutions. Although the library, archives, and museum sectors are formally separated and each has its central state agency, the fundamental objectives, and conditions for the institutions are similar.

All knowledge and culture institutions are facing a radical digital challenge that has to do with the materials and services of the institutions, their service to the users, their organization, and expertise.

For a number of years, work has been going on locally as well as centrally concerning cooperative digital projects between the three types of institution. Nationally, work has centered around an adaptation of search systems to make it possible to search in all collections at the same time. Locally, focus has been on the work with joint Web presentations with local history subjects or themes of common interest.

The Danish Ministry of Culture is preparing a national strategy for digitization of cultural heritage materials. The existing interim report reveals the desire for interdisciplinary presentation of digital cultural heritage based on user needs. It also points out that consolidated solutions for preservation and mediation will reduce costs in connection with digitization and stresses the need for a consolidated data warehouse. Finally, functional division of labor with a few centers of expertise is contemplated.

Confronted by new challenges libraries, archives, and museums are all moving toward a realignment of their

institutional culture, going from a collection orientation to a user-centered orientation. The need for this can be most clearly observed in work with children and young adults. Particularly in libraries and museums, there have been increased efforts to establish new modes for communication and interaction based on Web 2.0, inclusion, and active participation. The importance of keeping the interest of children and young as users of cultural institutions is underscored by an increasing political understanding of the importance of culture- and knowledge-institutions in increasing social cohesion and stimulating collective innovation.

WEB LINKS

- Danish Agency for Libraries and Media. Available at <http://www.bs.dk/default.aspx?lang=en>
- Nordic Public Libraries in the Knowledge society. Available at <http://www.bs.dk/publikationer/english/nnpl/index.htm>
- Act Regarding Library Services. Available at <http://www.bs.dk/publikationer/english/act/index.htm>
- Danish library policy. Available at http://www.bs.dk/publikationer/english/library_policy/index.htm
- Danish library statistics. Available at Statistics:<http://www.bs.dk/publikationer/english/statistics/2006/index.htm>
- Svane-Mikkelsen, J. *The Library System in Denmark*; Royal School of Library and Information Science: Copenhagen, Denmark, 1997. Extracts available at <http://www.bibliotekshistorie.dk/sektion14.lasso?-database=bibdan.docs2&-layout=document&-response=sektion14.lasso&refID=263&-search&-token.level=2>
- Heritage Agency of Denmark. Available at http://www.kulturarv.dk/english/about_us/index.jsp
- Museum Act. Available at <http://www.kum.dk/sw4497.asp>
- The Danish State Archives. Available at http://www.sa.dk/content/us/about_us
- Danish Archives Act. Available at http://www.kum.dk/graphics/kum/English%20website/Legislation/Promulgation_of_the_Danish_Archives_Act.pdf

Descriptive Cataloging Principles

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Abstract

This entry explains the international standard that guides bibliographic description, the International Standard Bibliographic Description (ISBD) that contains the principles of descriptive cataloging. The standard will be analyzed by giving its definition, purposes, principles, and objectives; and by explaining its structure, uses, and acceptance around the world. Its need will be justified by providing a short history of the background and evolution of the publication, ending with the current version of the consolidated ISBD that integrates the description of all types of resources that had been covered by specialized ISBDs.

INTRODUCTION

Bibliographic description is done in order to identify and retrieve resources. The descriptive part of a bibliographic record represents a substitution for the resource, a kind of surrogate. It helps general users identify and select resources, but it is especially useful for librarians, because it allows them to perform many collection development tasks without needing to recall volumes from the stacks. In addition, it is useful for library inventory. Bibliographic descriptions also can be adapted to meet the needs of specific types of users.

To standardize means to bring conformity with “something established by authority, custom or general consent.”^[1] The International Standard Bibliographic Description (ISBD) is the international standard approved by IFLA for bibliographic description.

The International Standard Bibliographic Description (ISBD) was recommended by the ISBD Review Group, and approved by the Standing Committee of the IFLA Cataloguing Section. Preliminary consolidated ed.; München: Saur, 2007. This work is cited as “ISBD, 2007” hereafter in this text. Per the IFLA Web page (<http://www.ifla.org/III/index.htm>, accessed November 2007): “The International Federation of Library Associations and Institutions (IFLA) is the leading international body representing the interests of library and information services and their users.”

The ISBD is the standard that determines the data elements to be recorded or transcribed in a specific sequence as the basis of the description of the resource being cataloged. In addition, it employs prescribed punctuation as a means of recognizing and displaying these data elements and making them understandable independently of the language of the description.

PURPOSE

The ISBD *aims* to

- “make records from different sources interchangeable, so that records produced in one country can be easily accepted in library catalogs or other bibliographic lists in any other country” (*ISBD*, 2007; 0-1). It has furthered cooperative activities and projects such as interlibrary loan, shared catalogs, and networks at national and international levels. Given the huge number of cooperative projects, a high level of standardization is needed to be effective.
- “assist in the interpretation of records across language barriers, so that records produced for users of one language can be interpreted by users of other languages” (*ISBD*, 2007; 0-1). This supposes a *lingua franca* among librarians.
- “assist in the conversion of bibliographic records to electronic form;
- “enhance interoperability with other content standards” (*ISBD*, 2007; 0-1).

It is important to highlight that the ISBD is addressed to national bibliographic agencies that have the responsibility to contribute to Universal Bibliographic Control (UBC). UBC is the IFLA’s program for promotion of a world-wide system for the control and exchange for bibliographic information. “National bibliographic agencies are called on to accept responsibility of creating the definitive record for each resource issued in that country. It is therefore recommended that descriptions prepared by them contain all the mandatory elements set out in the ISBD insofar as the information is applicable to the resource being described” (*ISBD*, 2007; 0-2); that is why

the ISBD establishes if the element is mandatory, optional, or conditional, to accomplish the objective that the description aims to identify the resource. Although intended for national bibliographic agencies, the ISBD application is also recommended for libraries that share bibliographic data with others because normalization improves cooperation.

Originally the development of the ISBDs was pushed by the automation of bibliographic control as well as the economic necessity of sharing cataloging. Nevertheless, the ISBD is independent of any specific electronic format for information. It is useful and applicable for bibliographic descriptions of all kinds of bibliographic resources in any kind of catalog, whether Online Public Access Catalogs or catalogs less technologically advanced.^[2]

The intention and objective of the International Federation of Library Associations and Institutions (IFLA) have always been to support the continuing development of library activities, and at the same time to help all countries to incorporate such developments. "IFLA is the global voice of the library and information profession . . . help libraries and information services to fulfil their purposes and to shape responses to the needs of clients in a rapidly changing global environment." (In IFLA Web site: <http://www.ifla.org/III/index.htm> (accessed October 2007)). Therefore, a standard from IFLA such as the ISBD must take into account all library situations.

The previous statement, in conjunction with the need for the standard, cannot be better explained than with the director of the IFLA International Office for UBC, Dorothy Anderson's words in 1974, which in spite of the passage of time are still current:

In a world which is unevenly composed of over-privileged and under-privileged countries, where economic resources rest unequally and what in one country seems commonplace—computers, typewriters, copying machines—in another may seem a far distant and impossible dream, yet the objective of international standards rests firm with or without computer. All countries can participate as the component parts of a world wide UBC system if their contribution follows patterns and standards that are universal; and equally can receive.^[3]

Today all kinds of resources coexist with direct access resources: books, printed serials, etc. sharing space with remote-access resources. Description, as made traditionally, provides basic and brief information of resources to enable identification of the document, to select or disregard it, and to give access to electronic resources through links.

That is why the ISBD is the agreed-upon standard, on which the descriptive portion of the bibliographic record should be based. This consensus is reflected in the Statement of International Cataloging Principles that is being developed through a series of regional IFLA Meetings of Experts on an International Cataloging Code (IME ICC) (http://www.d-nb.de/standardisierung/pdf/imeicc-statement_principles-2008.pdf).

The ISBDs have guided the work of national cataloging committees in updating their codes to promote internationally accepted practices. This is a point underscored by the compilations of practices by various rules that were prepared for these IFLA Meetings of Experts on an International Cataloging Code. (IME ICC Web page, available at http://www.d-nb.de/standardisierung/afs/imeicc_index.htm (accessed October 2007). http://www.d-nb.de/news/pdf/code_comp_2003_europe_2.pdf (accessed October 2007) and http://www.loc.gov/loc/ifla/imeicc/source/code-comparisons_final-summary.pdf (accessed October 2007)). From these overviews, the general impression is overall compliance and considerable harmony among the national codes and with IFLA's recommended stipulations in the ISBDs. From the regional meetings we know

- Europe has the greatest number of cataloging codes in use, and one of them is AACR2.^[4]

Regarding the ISBD, it was acknowledged as a great achievement of international standardization for descriptive cataloging that requires the transcription of identifying information from the item at hand to create the standardized areas of description and ISBD goes on to state the basic elements to include in such descriptions, the order of those elements, and the prescribed punctuation, so the resulting records are understandable worldwide, regardless of language or script.

For IME ICC1, rule makers in Europe were asked to compare their codes and 18 reports on their cataloging codes were received. In their overviews were two questions related to ISBD acceptance and the general outcome was that all codes were based on ISBD.

Results of rule comparisons on ISBD from First IFLA Meeting of Experts on an International Cataloging Code, Frankfurt, Germany, July 28–30, 2003. (Web site, available at http://www.d-nb.de/standardisierung/pdf/code_comp_2003_europe_2.pdf (accessed October 2007)). From the 18 responses 15 were affirmative, and from the three left it can be deduced also to be based on ISBD, although the libraries did not answer in the same way, resulting in a wrong interpretation on the comparison. This can be deduced by the second answer to 2.2: KBRSM (Lithuania), did not answer to the question 2.1, but in the answer to the 2.2 (http://www.d-nb.de/standardisierung/pdf/code_lithuania.pdf) it was confirmed "Our rules of description are based fully on ISBD. No different rules are applied." Also KSB (Sweden) recognizes, in the same document page 1 when citing their code (http://www.d-nb.de/standardisierung/pdf/code_comp_2003_europe_2.pdf) that the code is translation of AACR2, which is the first one in recognizing it. And finally the last code not cited in the question 2.1, is the RAK (Germany) in which question 2.2 (http://www.d-nb.de/standardisierung/pdf/code_rak.pdf) says: "The cataloging code RAK is principally based on ISBD

for rules for description. RAK-WB was based on ISBD (M) edition 1974. For the special codes of RAK, other ISBDs were partly, but not thoroughly used.”

- The IME ICC for South America was structured a little differently from the European meeting. Unlike Europe, where there are several rule-making bodies and different cataloging rules, Latin American and Caribbean countries typically follow the *Anglo-American Cataloguing Rules* or the Spanish rules, *Reglas de catalogación*. These codes were already compared in IME ICC1 and their basis on ISBD was confirmed.^[5]
- “The Middle East has no rule making bodies and the countries typically follow the *Anglo-American Cataloguing Rules*.”^[6]
- From IME ICC for Asia reports, it is known that “China, Japan, and Korea have a history of rule making bodies . . . Many other countries in Asia follow the *Anglo-American Cataloguing Rules* or have a local set of rules based on AACR2.”^[7] So they recognized their rules are based on and consistent with ISBD.
- From IME ICC for Africa, of 29 countries, there were 19 responses. Twelve responded that they apply the ISBD directly while the rest apply codes already revised which were based on ISBD, such as AACR2 and AFNOR rules.
- International Standards used in Sub-Sahara Africa. In *Fifth IFLA Meeting of Experts on an International Cataloguing Code*, Pretoria, Durban, South Africa, August 14–15, 2007. Available at http://www.imeicc5.com/download/InternStand_Sub-SaharaAfrica.doc (accessed October 2007).

The IME ICCs have been very useful for the ISBD revision work, as there have been many suggestions to be considered in the future. Suggestions have come from the recognition of the different languages and scripts and also “cultural” patterns of publications that will be taken into account in the continued revision, and that will help to improve the ISBD and its interpretation.

OBJECTIVES AND PRINCIPLES

In order to know and understand this document language that is the ISBD, it is necessary to keep in mind the underlying objectives and principles.

The objectives are to assist in finding, identifying, selecting, and acquiring a resource, and to assist in navigating among resources. But to explain more in-depth the actual consolidated ISBD, it is necessary to address the objectives that guided its development (*ISBD*, 2007; vii–viii):

- “To prepare a consolidated, updated ISBD from the specialized ISBDs in order to meet the needs of catalogers and other users of bibliographic information.”—

here has been added cataloger’s convenience to stress that not only the final user is concerned, but also that catalogers represent a large part of users with special needs to carry out their tasks, and this must be taken into account.

- “To provide consistent stipulations for the description of all types of resources to the extent that uniformity is possible, and specific stipulations for specific types of resources as required to describe those resources.” This objective represents the practical application of what has been called the Principle of integration by which the description of all types or resources must be based in one set of rules in a uniform manner.

Uniformity in describing bibliographic entities, irrespective of the medium in which they are embodied, is desirable for several reasons: it serves the objectives of the catalog, particularly the collocating objective; it serves user convenience in providing a common interface to bibliographic information; and it serves the principle of parsimony in achieving economy of expression. . . . Early in the 1970s reaction set in, and a swing began away from specialization and toward integration.^[8]

The principles are

- “The primary purpose of the ISBD is to provide the stipulations for compatible descriptive cataloging worldwide in order to aid the international exchange of bibliographic records throughout the international library and information community (e.g., including producers and publishers).” This is the principle of standardization. It supposes the most important achievement of the twentieth century, the IFLA *lingua franca* between libraries that is ISBD, necessary for communication and cooperative projects. The specific “goal of reducing bibliographic effort so that one item need be described only once worldwide necessarily assumes adherence to a uniform level of description . . .”^[9]
- “Different levels of cataloging will be accommodated, including those needed by national bibliographic agencies, national bibliographies, universities, and other research collections.” Although intended largely for national libraries or national bibliographic agencies, it is also addressed to university and research libraries, and can be used by other types of libraries and collections that have a wider choice and do not have the same responsibility of describing the national output or of sharing records. The ISBD aims to standardize the description and to be useful for all kinds of bibliographic communities at different levels of compliance. The standardization admits levels of degree. The international exchange of bibliographic information requires and takes benefits from maximum standardization of bibliographic description, but it could be considered excessive in some situations in which it is in conflict with the principle of user convenience. That is the

reason why the standardization must be flexible to adapt to the users of different types of libraries and also to local culture and script situations.

- “The descriptive elements needed to identify and select a resource are to be specified.”—This means that the description should include the elements that are significant to allow these actions and objectives. The principle requires a bibliographic description to be full enough to meet the objectives of a system for organizing information and, at the same time, allows other data elements to be optional. This principle could be considered sometimes to be against the principle of representation of the prescribed source that was the common practice of strict adherence to the title page until the revolution that represented the ideas of Lubetzky. He defended the logic of working having in mind the objectives that would determine the description:

our practice represents the result of an effort to preserve the integrity of the title-page and an inability to do so. Such effort may be justified in the cataloging of early books, where a difference in the title-page reflects a difference of edition, or in the cataloging of rare books, where the title-page has an interest of its own. It serves no purpose in the cataloging of modern books . . . In the cataloging of modern books the aim of the cataloger should be not to point out the differences of the title-pages but the identity of the books under them, so when a reader has reference to a given issue which may not be available he could safely be served by any other issue of the same edition.^[10]

This principle supposes a limit to a standardization that could be excessive. It is a practical action that reduces the needs for identification and selection of resources, and it was Cutter “one of the first to face the problem of necessary versus unnecessary data elements. He viewed appropriate fullness of description as a variable, depending on local needs and circumstances, such as library size . . . to the present day, but is becoming less useful as global cataloging renders distinctions based on library size irrelevant.”^[9]

- “The set of elements of information rather than their display or use in a specific automated system will provide the focus.” This principle represents the evolution of ISBD and the change of objectives since the beginning. It represents an intention of ensuring the interoperability with other systems’ displays. ISBD has been adapted to the current time, where many display formats coexist, usually locally developed. Some of them are suited to local users’ habits as it is the labeled display that is the most common and clear display for general end users in one language. ISBD, in addition to presenting an internationally understandable display, has introduced the necessary changes to allow consistency in other displays.

- “Cost effective practices must be considered in developing the stipulations.” This is the principle of economy by which, when there are alternative ways of achieving a goal, the less complicated one and the one requiring less time and effort will be preferred.

Although not specifically mentioned as a principle, the whole ISBD is a contribution to a principle of representation. “The distinctive feature of the ISBDs—that is, that the descriptive information is taken from the item itself in the form in which it is presented in that item—has been recognized as the most economical and more certain way of ensuring compatibility in bibliographic recording.”^[11] This representation principle does not necessarily mean transcription that is only required in area 1 with phrases such as “in the form in which it appears on the prescribed source of information,” or in area 2 or in area 6 including information not found on the prescribed source in square brackets (see section General Structure of ISBD for explanation of areas). The rest of the areas leave the cataloger the possibility of selection of elements in order to better achieve this representative description. At the same time it is necessary to ensure the accuracy of description and “to prevent idiosyncratic descriptions,” just in case this principle of representation if “carried too far would result in bibliographic descriptions that individually are correct but when taken collectively are inconsistent. It would go against the principle of user convenience . . .”^[12] If the information that is going to be transcribed could result in ambiguous, unintelligible, or incorrect data, this assessment must be explained and corrected, within brackets depending on the kind of information, to identify the resource clearly.

BASIS FOR DESCRIPTION: SOURCES OF INFORMATION

The data elements can be found in different places on a particular resource and can take different forms. Therefore, to reach consistency in description requires prescribing exactly where the elements can be taken from. Accurate description depends on the order of preference of sources of information on the resource, which means agreement on the specification of locations where an entity can represent itself.

The determination of sources varies depending on the type of material, but there are common characteristics for the determination: comprehensiveness, proximity, and persistence. This is clearly established in ISBD 0.4.1 Basis of the description: “For all types of material the resource itself constitutes the basis of the description” but specifically the criteria to determine a source of information is cited in 0.4.2.1 of ISBD. Although this stipulation is related to printed resources, it can be extrapolated to all: “The selection of the source to be treated as title-page

substitute is determined by considering which source has the fullest information, with preference given to a source that is part of the resource over sources outside the resource.” There is more reliability to internal sources than external ones that could be separated, modified, or lost. When use of internal sources is not possible, these criteria of persistence guide us to choose sources permanently associated with the resource.

Depending on the types of resources, with different physical characteristics, the sources will be different. In addition, the same works or content can be published in different physical formats, for example an e-book that is also in a format of a printed text, or can be published in more than one physical medium as kits or sharing characteristics of more than one, for example serially issued maps in electronic form. To solve this situation better and to accomplish one of the basic purposes of the ISBD, that is to facilitate record exchange, the ISBD urges national bibliographic agencies and libraries participating in networks to create separate bibliographic descriptions for works issued in multiple formats. Other libraries may select a single-record approach if they wish to do so.

Therefore, “the ISBD is applied to describe manifestations, by means of description of the item in hand as an exemplar of the entire manifestation, using *Functional Requirements for Bibliographic Records (FRBR) terminology*” (ISBD, 2007; viii). That conforms to the recommendation of the Statement of International Cataloging Principles:

2.1.1. Bibliographic records should typically reflect manifestations. These manifestations may embody a collection of works, an individual work, or a component part of a work.

Manifestations may appear in one or more physical units.

In general, a separate bibliographic record should be created for each physical format (manifestation).^[13]

GENERAL STRUCTURE OF ISBD

The ISBD is structured in eight areas with different kinds of content and with different interrelated data elements sequentially ordered. This arrangement corresponds to the order of relative importance of information that usually follows the order presented in the main sources of information. Its origin is the traditional organization that was found in the main resources at that time, books, and this was the order in which the information is presented on the title-page. The structure was accepted and standardized internationally because there was not much difference in such information in international practices, as many conferences on Universal Bibliographic Control would demonstrate. It was also accepted and adapted to other types or resources, as the publication patterns are common for the

majority of types of resources. The intention of arrangement of information following the patterns usually appearing in the resources is also for the users’ convenience, as it is the order in which they are accustomed to finding them. But at one time following the strict order of presentation on the main source, the transcription of the title page was expanded and was no longer helpful for the order of the catalog. Seymour Lubetzky well expressed that, “The problem with strict adherence to title-page sanctity in the organization of a bibliographic description is that it does not make for helpful order within a catalog. A well-arranged or integrated catalog requires that similar data elements appear in similar locations in bibliographic records.”^[14] This is accomplished with the logical and relative importance structure of the ISBD with the following areas:

Area 1—Title and statement of responsibility area

This area covers several data elements:

Title proper:

This consists of

the title of the resource in the form in which it appears on the prescribed sources of information for the title and statement of responsibility area. It includes alternative titles and the conjunction linking an alternative title with the first part of the title proper.

It can consist of a common title and a dependent title when a section, supplement, part, etc., has a title or designation insufficient to identify it without the inclusion of the common title or the title of the main resource.

(ISBD, 2007; 1.1-1.)

There are many stipulations to standardize the form of recording the title proper, or the selection of title proper when two or more titles appear on the prescribed source of information or when there is more than one prescribed source of information, about resources with two or more works with a collective title, or without a collective title, about resources that are part of another resource.

General material designation:

“The purpose of the general material designation is to indicate, in general terms and at an early point in the description, the class of material to which the resource belongs” (ISBD, 2007; 1.2-1). But to decide the class of material it is necessary to speak about the medium in which the manifestation is published, which is very important for organizing the collection. It is necessary to say whether it is computer-readable, microform, printed, etc.; and it is also necessary to indicate the way of perception by the user, tactile, three-dimensional form, etc.; and content characteristics, such as music or cartographic. An attempt has been made to address all these characteristics

with a common terminology used by the final user to categorize the resources, and much investigation on it is being made nowadays.

Parallel title:

“A parallel title consists of a title in another language and/or script than the title proper and presented as an equivalent of the title proper on the prescribed source(s) of information” (*ISBD*, 2007; 1.3-1).

Other title information:

“Other title information consists of a word or phrase, or a group of characters, appearing in conjunction with and subordinate to the title proper, parallel title(s) or titles of individual works contained in the resource” (*ISBD*, 2007; 1.4-1).

Statement of responsibility:

“A statement of responsibility consists of name(s), phrase(s), or group(s) of characters relating to the identification and/or function of any persons or corporate bodies responsible for or contributing to the creation or realisation of the intellectual or artistic content of a work contained in the resource described” (*ISBD*, 2007; 1.5-1). This information helps in the identification of the responsible entities of the work or expression, and at the same time reflects the relationship of those entities with the work or expression.

There has always been criticism against repetition of the author's name in the statement of responsibility in addition to its access point as the principal entry, but already in 1943 there were authors who defended that. “They maintain that a knowledge of the usage of the author's name on the title-page is sometimes helpful in the identification.”^[15] This reason continues to be equally important nowadays, because some usage forms are not clear enough to avoid the wrong attribution by the cataloger, in spite of the normalization of access points today which tends to accept the usage of authors. This mistake could not be mended without an accurate transcription of the statement of responsibility of the work as it appears in the resource.

Elaine Svenonius speaks about controlled versus uncontrolled vocabulary, the latter being “those that are derived as-is from documents containing information,” and the former “those that are assigned” and are controlled access points. “The dual representation serves to facilitate two different approaches to information: a keyword approach useful for identification and finding and a controlled-vocabulary approach required for collocation.”^[16]

The *ISBD* deals both with one statement of responsibility and with more than one statement of responsibility.

All these elements from area 1 are addressed in *ISBD* with its casuistry and stipulations relative to a transcription from sources of information for each element are given.

Area 2—Edition area

The edition statement is necessary for identification of the manifestation of a work. As said in the definition of the area “An edition includes all copies of a resource produced from substantially the same original input and issued by the same agency or group of agencies or a person. An edition may be identified by an edition statement on the resource or by information provided by the publisher” (*ISBD*, 2007; 2-1). We have to take into account the distinct publication patterns among countries in deciding when we have a real edition statement and not a reprint of the edition.

The edition area consists of the following data elements: the edition statement; the parallel edition statement, statements of responsibility relating to the edition; the additional edition statement and finally the statements of responsibility following an additional edition statement.

Area 3—Material or type of resource-specific area

This area is specific for particular classes of materials devoted to recording information that it is not possible to give in other areas because the data elements are different. Specifically it is to record information on the special music format; or mathematical data on scales, projection and coordinates and equinox for cartographic resources; and the numbering and dates of coverage of serials. As is explained above, nowadays there are resources that share characteristics from more than one type of resource, as for example a map serially issued, so this area is repeatable to allow giving the different data elements for specific resources.

Area 4—Publication, production, distribution, etc. area

The term “publication, production or distribution” is intended to cover all types of publication, production, distribution, issuing and release activities connected with resources (*ISBD*, 2007; 4-1).

In this area, with the issuing activities are recorded those data elements referring to activities of the process of physical manufacturing of the resource that can be developed by a different or by the same entity; in the last case only one statement is given. This area represents the integration of the common responsibilities of publication and of printing resources with financial and administrative responsibilities. But beyond, the activities of production include responsibilities of organization of the resource, fixing the data, and creative aspects, which are more common within electronic resources, motion pictures and sound recordings processes; and activities on making available the resource, i.e. its distribution.

The information recorded in this area has been related to, and considered representative of, the reputation of the resource, as the editor or producer is a guarantee of the physical quality of the resource and “the name of a

professional or scientific organization is an endorsement of the authenticity of the subject treatment.”^[15]

Therefore the data elements provided in this area to identify the entity that carries out this function are place of publication, production and/or distribution; name of publisher, producer and/or distributor; the statement of function of a distributor if required; date of publication, production and/or distribution; if printing information is given it is also necessary to give the place of printing, manufacture or engraving, the name of the printer, manufacturer or engraver and/or other printing information, followed by the date of printing or manufacture.

For those data elements the ISBD provides stipulations for cases when the information is in the resource and for cases when it is not in the resource. Stipulations for resources published in multiple issues or parts, or stipulations for procedures when there are irregularities in dates are given, because this information is very important for identification and selection.

Area 5—Physical description area

This area is reserved to describe the physical carrier of the resource, that is, to describe the copy in hand that we have as representative of the manifestation. But if for any reason these physical characteristics have been modified by any circumstances, the physical description continues referring to the manifestation that can be accessed not only in the collection of the library but also in other libraries or bookshops, etc., and the special peculiarities of the item in the collection should be explained in notes.

The detailed physical description has always been criticized as not necessary and less economic, but it is important information for library activities such as storage, circulation, and conservation.

In this area the data elements given are:

The specific material designation and extent: The specific format that belongs to the medium has been categorized in the GMD (General Material Designation) but here it is possible to use the more specific term best suited to the users. For this data element it is necessary to give stipulations when the resource is in one physical unit or when it is in more than one, or when it is a multimedia resource or kit. If the physical carriers can be counted, the number of units is given with the specific term for the carrier. It is followed by the extent, that is, the number of pieces it is composed of or the playing time. Extent-specific stipulations are given for specific types of resources.

Other data elements refer to other physical characteristics related to the method of production, illustrations, color, material from which the resource is made, etc. details that are not related to dimensions, which is the next data element defined, very useful for the management of space in the stacks, and can be used to help finding a resource being sought.

Finally an accompanying material statement can be added when appropriate. It represents a separate physical unit independent of the main carrier, and that is published

jointly with the resource as part of the manifestation but with a secondary role to the main work.

Area 6—Series area

“The series area is used when the resource being described belongs to a larger bibliographic resource: series, subseries or multipart monographic resource” (ISBD, 2007; 6-1). It represents the granularity in description. The resource as a whole could be described with the title of the series and the specific title proper of parts could be given in a contents note, or each part could be described by its title proper giving the “common title” of the work to which it belongs in the series statement in area 6. This convertibility is why this area and area 1 are so related, having almost the same data elements:

Title proper of series, subseries, or multipart monographic resource; parallel title of series, subseries, or multipart monographic resource; other title information of series, subseries, or multipart monographic resource; statements of responsibility relating to series, subseries, or multipart monographic resource. Because the resources belonging to series or subseries can be continuing resources, the data element of International Standard Serial Number of series or subseries is added. Finally the numbering of the separate resources within the series, subseries, or multipart monographic resource is included.

Area 7—Note area

The note area contains any descriptive information that has not been given in other areas of the description but that is considered to be important to users of bibliographic records. Notes qualify and amplify the description in areas 1–6 and can deal with any aspect of a resource. Notes may also give the bibliographic history of the resource and indicate relationships to other resources. (ISBD, 2007; 7-1.)

Most of the notes are optional and their use depends on the depth of description the library wants to make. But some of them are mandatory because they are fundamental for user access to the resource. An example would be the notes that specify the method of access to electronic resources. When the resource is direct access, the system requirements are specified, and when it is remote access the mode of access is specified, if possible providing the link. Another very important note for librarians looking for consistency in description is the one that specifies where exactly the title proper information has been taken from when the source is different from the prescribed source of information.

The notes are organized according to the ISBD areas, but in addition there can be other interesting notes not related to these areas but to description, bibliographic history, attribution of the work or expression, etc.

Area 8—Resource identifier and terms of availability area

A resource identifier is any number or alphanumeric designation associated with a resource according to an international standard, such as an International Standard

Book Number (ISBN) or an International Standard Serial Number (ISSN), or a designation assigned by a publisher. (*ISBD*, 2007; 8-1.)

The area is repeatable because one resource can have more than one identifier. For example in the case of multipart resources, each part can have its own identifier, and the whole resource can have another identifier.

In this area the following data elements are recorded when available: The resource identifier transcribed preceded, as appropriate, by letters that identify the standard; the key title assigned by the ISSN Network when the resource that is being described is a continuing resource; the terms of availability and/or price. When the identifier or the terms of availability or price need supplementary information, qualifications are given.

HISTORY AND RECENT DEVELOPMENT OF THE ISBD

Historically catalogs were lists of information to find a book in collections that essentially consisted of such types of resources. That is why the title page was used as the basis for cataloging, and the description of other types of materials had to fit into the book patterns.

Because the most important thing for finding a resource was to provide information on the author, the cataloger then gave more attention to find the authorship. The cataloging rules until the beginning of the twentieth century were mainly stipulations related to authorship. The other part of the cataloging was the description, but it was considered less important. First it was necessary to find, then it was possible to identify if the resource found was meeting the requirements that were looked for. As collections were growing, the identification needs were more important. This identification was only possible by means of the description of the resource. At this time the card catalog was considered a necessary intermediate tool. The rules for description had been influenced by the bibliographers who were developing their techniques for the description of older books, where the description should be as accurate as possible with close transcription of the title page from top to bottom. This exaggerated reverence for the title page did not allow catalogers to use a commonsense approach to late nineteenth century and twentieth century printed books.

Seymour Lubetzky was a figure who influenced many at this time presenting a

systematic approach, which took its departure from the assumption that before describing a book it is necessary first to be aware of the objectives that description is to serve. Only then is it clear what is and what is not to be included in a bibliographic record. . . . Basically their import was that a bibliographic description served first to identify a book and, secondly, to characterize its contents.

Data elements on a title page that did not further either of these objectives were to be excluded. . . . On the other hand, data elements that did not appear on a title page, yet were necessary to meet one or the other of the stated objectives of description, were to be included in a bibliographic record.^[17]

At this time, in the 1950s there was an unprecedented boom in book production. Trying to find a centralized solution to world bibliographic control, “UNESCO’s work was more realistically directed, based on two fundamental criteria, the first, concern for fundamental study and research, the second, reliance on national activities: ‘it is unrealistic to think progress in bibliographic control at the international level can be achieved even if national conditions are ignored. . . .’”^[18]

In 1958 the Symposium of National Libraries in Europe held in Vienna settled the basis for defining the role of the national library and its contribution to national bibliographic control by means of developing the current national bibliography.

According to the self-criticism environment on cataloging practices in the library community, IFLA (formerly International Federation of Library Associations) organized the International Conference on Cataloging Principles, in Paris in 1961. Preparatory to this conference, an examination of the problems relating to bibliographic control through the analysis of national cataloging codes was made. The conference supposed a landmark that had as a result an international agreement that influenced the cataloging codes world wide until today. But the principles accepted were again focused or centered mainly on access points, revealing the main concern at this time was not on description as the differences between countries were not considered important.

Eva Verona, Yugoslav librarian well known internationally for her work and her chairmanship of various IFLA committees and working groups, recognized this lack in her comments on the principles:

It might be argued that the list of elements specifying a particular book as given in section 2.1, and amplified in section 3.2 and section 6.4, is not complete. A complete list should necessarily include those particulars which enable the user of the alphabetical catalog to distinguish various editions of the same work. . . . It is thus made quite clear that the Statement is aware of the importance of such particulars in the alphabetical catalog. The fact that those particulars are not mentioned in section 2.1 in connection with the first basic function of the alphabetical catalog may be accounted for by the limitation of the Statement to problems concerning the choice and form of elements determining the order of entries.^[19]

But three things changed minds in 1960s: One was shared cataloging projects on a large scale; the other, the arrival of the computer.

As long as libraries were using computers solely for processing their own records there was no problem, but as soon as they began to exchange machine-readable records and tried to use those received from other agencies in their systems, the need for standardization became clear. Computers demand standards: standards for electronic storage and transmission, standards for the formats within which the data would be recorded and (to some extent) for the data content itself. The third factor was, oddly, a by-product of the International Conference on Cataloging Principles... the agreed text of the principles accompanied by full examples to illustrate them. Originally, the examples showed an embarrassing variety of descriptive practice beneath the agreed headings. ...^[20]

Work was started to prepare the second major cataloging conference of the period, the International Meeting of Cataloging Experts held in Copenhagen in 1969 at which was established the basis toward creating a system for the international exchange of information: The standard bibliographic description of each publication developed and distributed by a national agency in the country of origin of the publication, which will be responsible for creating records in such standardized conditions. The effectiveness of the system was dependent on the maximum standardization of the bibliographic description.

The study of the rules in use until that time revealed that there was sufficient similarity in the descriptive part of the catalog record as all the stipulations on description were to transcribe the title page. The main goal was, and continues to be, to offer consistency when sharing bibliographic information:

Under the title Universal Bibliographic Control (UBC) IFLA is proposing that UNESCO adopts as a major policy objective the promotion of a world-wide system for the control and exchange for bibliographic information. The purpose of the system is to make universally and promptly available, in a form which is internationally acceptable, basic bibliographic data on all publications issued in all countries.^[21]

In the promulgation of the UBC program three international organizations have played a major part: IFLA; the UNESCO General Information Programme (PGI); and the International Organization for Standardization (ISO). The international office for UBC was created, and it gave support at a variety of levels to projects directed toward its development. In so doing it has provided support to IFLA working groups and to experts engaged in particular bibliographic projects. Nowadays it has been supplanted by ICABS IFLA-CDNL Alliance for Bibliographic Standards. (ICAB's Web page, available at <http://www.ifla.org/VI/7/icabs.htm> (accessed October 2007). The National Library of Australia, the Library of Congress, The British Library, the Koninklijke Bibliotheek, and Die Deutsche Bibliothek have agreed to participate in a joint alliance together with the Biblioteca Nacional de Portugal, IFLA and CDNL to assure ongoing coordination, communication

and support for key activities in the areas of bibliographic and resource control for all types of resources and related format and protocol standards.)

Its objectives at that time were not much different from objectives today (related above):

1. The interchange of bibliographic records.
2. Interpretation of records from foreign sources and ability to identify the parts of the record, independent of the language and script.
3. Conversion of manual records to electronic form.

There were three methods to achieve these: definition of elements, organization into a structure in eight areas, and identification of each element by a symbol of punctuation.

IFLA's special contribution to the concept of UBC is its firm belief that every country can become a component part of the UBC system, that each has a contribution to make. It accepts that contributions may vary considerably in quantity between developed and developing countries ...^[22]

Among the requirements to achieve UBC there were the establishment of the national bibliographic agency in charge of preparing the authoritative bibliographic record for each new publication issued in the country and collected in national bibliographies; the record's acceptance at an international level; and also an international standard for creating the bibliographic records. That standard must take into account: (1) its contents: the elements to be included in the authoritative record; the order of those elements; the means of distinguishing the elements and their functions; and (2) its physical form; compatibility of machine-readable records; standardization of catalog cards.

The basic premise for establishing UBC has been set out thus: that the comprehensive bibliographic record of a publication is made once in a country of its origin, in accordance with international standards which are applicable in both manual and mechanized systems; and that record is then available speedily, in a physical form which is also internationally acceptable.

The detailed elements that make up that comprehensive and authoritative bibliographic record include all the information about the publication which may be required to fulfill any of the functions of library or information services. The selection of these elements and the way in which they are presented have evolved from careful work of experts. ... there are still areas of national bibliographic traditions evolving from language and culture.^[23]

This is mainly the reason why the ISBD was designed primarily for national bibliographic agencies that are responsible for creating descriptions with all the defined mandatory elements, as was explicitly said in the introduction. But this practice is also recommended for libraries that exchange bibliographic records. Other libraries can use the ISBD, and it is recommended that they do, but

they can adapt it to their needs, selecting the elements to be described. The reason is that the ISBDs were intended to serve as a principal component of IFLA's program to promote UBC.

The first of the ISBDs to be published was the International Standard Bibliographic Description for Monographic Publications (ISBD(M)), which appeared in 1971, with a revised text published in 1974 as the "first standard edition." It was clearly based on traditional descriptions of monographs found on printed catalog cards. Other ISBDs subsequently appeared for specific types of resources: ISBD(S) for serials was also published in 1974; ISBD(CM) for cartographic materials and ISBD(NBM) for non-book materials were both first published in 1977; ISBD(A) for older monographic publications (antiquarian) and ISBD(PM) for printed music first editions were published in 1980; and the ISBD(CF) for computer files, first edition, was published in 1990. Along the way, the need was felt for a general framework to which all the ISBDs would conform, resulting in production of the ISBD(G) published in 1977; the primary utility of the ISBD(G) was that of ensuring harmony among the other ISBDs. For article-level publications, *Guidelines for the application of the ISBDs to the description of component parts* was issued in 1988. For a more detailed introduction to the ISBDs, see Byrum.^[24]

It was necessary to normalize the description of each type of material, but today the borders are not so clear.

At the IFLA World Congress in Brussels, held in August 1977, the Standing Committee of the IFLA Section on Cataloging made important new decisions in relation to IFLA's program of ISBDs. It was decided that all ISBD texts would be fixed to a life of five years, after which revision would be considered for all texts or for particular texts.

More pragmatically, they have been revised as the need has arisen, to implement general applicable changes or by the evolution of library materials, such as those that resulted in publication of the ISBD for electronic resources and, more recently, the ISBD for serials and other continuing resources.

Although some ISBDs have been developed or revised to meet particular needs, there have been two overall revision projects affecting the entire family of ISBDs.

First General Review Project

Consequent to the decision taken in 1977, mentioned above, the initial overall revision resulted in the creation of the ISBD Review Committee, which first met in August 1981.

The committee established three major objectives for the first general review project:

1. To harmonize provisions, achieving increased consistency.

2. To improve examples.
3. To make the provisions more applicable to catalogers working with materials published in non-roman scripts.

In addition, two narrower objectives motivated this particular revision effort:

1. To review the use of the equals sign (as its use in bibliographic descriptions had been the source of some controversy).
2. To remove coverage of machine-readable materials from the ISBD for nonbook materials.^[25]

By the early 1990s the revised edition of the ISBDs had been published:

- The standard for monographic publications ISBD(M) previously revised in 1978, was revised again in 1987.
- Cartographic materials ISBD(CM) was revised in 1987.
- Nonbook materials ISBD(NBM) was revised in 1987.
- Serials ISBD(S) was revised in 1988.
- Printed music ISBD(PM) was revised in 1989.
- ISBD(G) was revised in 1992.
- In addition, a separate ISBD was published for computer files (1990), which, due to the rapid advances in technology, was soon superseded by creation of an ISBD for electronic resources (1997). (The entire list of ISBDs is available at <http://www.ifla.org/VI/3/nd1/isbdlist.htm>, (accessed October 2007).

Second General Review Project

In the early 1990s, the section on cataloging in cooperation with other sections set up the Study Group on the Functional Requirements for Bibliographic Records (FRBR). One immediate consequence of this development was the decision to suspend most revision work on the ISBDs while the FRBR Study Group pursued its charge to "recommend a basic level of functionality and basic data requirements for records created by national bibliographic agencies." This decision resulted in the permanent suspension of a project to identify the components of a "Concise ISBD(M)," because it was expected that FRBR's findings would, in effect, provide such a baseline. In 1998, the FRBR Study Group published its final report,^[26] and the ISBD Review Group was reconstituted to initiate a full-scale review of the ISBDs in order to implement FRBR's recommendations for a basic level national bibliographic record^[27] and ensure conformity between the provisions of the ISBDs and FRBR's data requirements.

To facilitate the work of national bibliographic agencies of preparing the definitive description containing the mandatory elements, the ISBDs designate as "optional" those data elements that are not mandatory when applicable or as "conditional" those data elements that are needed in certain

circumstances but may otherwise be considered optional. Therefore, the main task in pursuing the second general review entailed a close look at the ISBD data elements that were now mandatory in order to ensure that no element that was mandatory in FRBR was optional in the ISBDs.

Another important task was consideration of the adaptation of ISBD terminology to FRBR's terms "work," "expression," "manifestation," and "item" to determine if they should be introduced in place of terms such as "publication" or "item." The Review Group concluded that it was essential for IFLA to clarify the relationship between the ISBDs and the FRBR model. The group encountered difficulties in trying to achieve that alignment, in large part because the terms used in FRBR were defined in the context of an entity-relationship model conceived at a higher level of abstraction than the stipulations for the ISBDs. While the entities defined in the FRBR model are clearly based on the elements forming an ISBD description,^[28] the relationships are too complex to be conveyed through a simple substitution of terminology. Taking into consideration Patrick Le Boeuf's advice at the Frankfurt IME ICC (International Meeting of Experts on an International Cataloging Code) in his paper on "Brave new FRBR world":^[29] "FRBR terminology should not be merely incorporated such as it stands into the ISBDs and cataloging rules, but [these] should keep their own specific terminology, and provide accurate definitions showing how each term in this specific terminology is conceptually related to the FRBR terminology." The Review Group thus decided that the development of a table to detail the relationship of each of the elements specified in the ISBDs to its corresponding entity, attribute or relationship as defined in the FRBR model, would satisfy the need to make clear that the ISBDs and FRBR themselves enjoy a harmonious relationship.^[30]

Nevertheless, the ISBD Review Group did decide to introduce some changes in terminology, beginning with the recently revised ISBD(G). Among them is the use of the term "resource" rather than "item" or "publication." This decision was taken because the use of the term "item" in the ISBD was different from the term "item" as used in FRBR, and it is difficult not to confuse them.

Some of the ISBDs (G, M, CR, ER, CM, and A) went through this revision process, but the process was interrupted before being finished, as work on the consolidated ISBD began.

Reasons for a Consolidated ISBD

There had been seven specialized ISBDs, plus the General ISBD. These ISBDs have been revised and published at various times, with no method for incorporating changes made in newer texts that affect all the ISBDs into the older texts. For example, when it was decided to incorporate decisions on which data elements should remain mandatory in the ISBDs based on those required in FRBR, these

changes were incorporated into the ISBD(M) and the ISBD(CR) that were issued in 2002, and the ISBD(G) in 2004 although they applied to all of the ISBDs.

In addition to this situation, publications that show characteristics of more than one format require the application of stipulations from more than one ISBD. Because the ISBDs themselves had some inconsistencies, this brought major difficulties that caused the ISBD Review Group to decide in 2003 that consolidation of the ISBDs was feasible, and work was started on preparing a definitive text.

The work received ICABS support for a first merger of the text of the seven ISBDs. Project money was also granted by the IFLA Professional Committee.

A "final" version was sent to the IFLA Cataloging Section's Standing Committee, which voted for acceptance before the end of March of 2007. The consolidated ISBD replaces the specialized ISBDs.

In the integration of information from all types of resources, agreement was reached on the general outline to be followed for each area. In addition, it was decided to recommend that:

- The structure should be changed to a new structure of areas where general stipulations that apply to all types of resources are given first, followed by exceptions or additional stipulations that are needed for specific types of resources.
- Present stipulations should fit into the new structure; therefore, the order of stipulations has also been modified to make the text more logical and consistent.
- Some changes should be made to generalize wording and to match wording as much as possible, also taking into account the stipulations that were considered mandatory, conditional, or optional in the already-revised ISBDs.
- The GMD should be moved from after the title proper to another location.
- Further changes to stipulations can be made at a later stage.^[31]

The focus has been on the set of elements of information rather than their display, and looking for interoperability with other systems and display formats, the punctuation has been slightly changed. Although the importance that ISBD punctuation has had in the past and continues to have in the context of different languages and scripts is recognized, the presentation of information is a secondary objective. In local catalogs the labeled display is now the most common and clear display for many users, that is why punctuation is not as essential as before but continues being recommended for international understanding.

CONCLUSION

The UBC concept continues to provide a foundation for the international and national organization of the creation

of bibliographic data. "Among the characteristics of a national bibliography are that it provides a current, timely, comprehensive, and authoritative list of all titles published in a country, it provides a record of their existence, and it identifies them unambiguously."^[32] The ISBD helps in providing authoritative bibliographic records, but the ISBD has spread far beyond because in the management process of our collections it is easy and cheap to copy bibliographic records or download them from other databases and use them with scarcely a need to make changes. For this reason and because the process of reviewing the ISBD will continue to keep it updated to take account of new developments, the ISBD will continue to be the standard for definition elements and descriptive content of bibliographic records.

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Design Science in the Information Sciences

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Abstract

Design is a core professional responsibility in the information professions as in others. It may be local and idiosyncratic, or it may be the focus of a major research project. Design researchers have argued that there are fundamental design problems and design solutions that cross scale and domain boundaries; if this is so, then design science, the study of design, should build knowledge both about particular domains and also about what is true across domains. This entry examines design science in several fields to indicate where it might inform design in the library and information sciences. It concludes with two examples from the information sciences, one a design science study of vocabulary design and one a design research project, in which the research consisted of design of an information retrieval system.

INTRODUCTION

Design is a central professional task in the library and information science (LIS). Patrick Wilson wrote in 1996 that information science inhabits two fields, engineering research and development (R&D) and social/behavioral/humanistic studies. In R&D, Wilson included both the design of material technologies for information retrieval and the design of intellectual technologies such as metadata systems and strategies for searching information retrieval systems. Thirty years earlier, Herbert Simon, in his influential *Sciences of the Artificial*,^[1] wrote that design is the core responsibility in all professions. Simon defined design as taking a problematic situation and transforming it into a desirable situation. Management decision-making, strategic planning, psychotherapy, and other nonmaterial problem-solving are thus included as design work, along with material design such as engineering, sculpture, and architecture.

Design science is the study of the work of design—how designers make decisions, use tools, manage problems, and think about their work, and what the characteristics of that work are. Research methods include interviews, surveys, ethnographic techniques, introspection, and philosophical investigations. One area of design science has been referred to as “design research” (or sometimes “design science” or “design science research”); this refers to the practice of design in which novel and important design is undertaken for the combined purposes of creation of the artifact and contribution to the professional knowledge base of the field.^[2]

Design is under-theorized in the library and information sciences. On the R&D side of the disciplines, there is a well-developed line of research in which information retrieval design is treated as an experimental science (thanks in large part to the efforts of Gerard Salton). However, there is little or no theory about the work of design

itself. The social science side of LIS has concentrated on users of information systems—information-seeking behavior, user satisfaction, search behaviors of experts and novices, sociotechnical studies of digital library use, etc. Although the understanding of the technical differences between information retrieval (IR) systems is important to understanding differences in user behavior, the characteristics of IR systems has rarely been an independent variable in research. Nor has the social science tradition in LIS often studied the processes by which technical systems are designed. The presence of both research traditions within the field could provide a “home field advantage” over disciplines where a social understanding of technical systems requires either importing ideas from outside the domain proper or the importing of social scientists themselves. Use of design science as a social science approach could create interesting connections between the social science and engineering sides of the discipline, as well as adding a dimension to the study of how information and social systems interact. Conceptualizing the sum of the design work undertaken in our field as “design research” could add dimensions interesting from both social science and technical design standpoints.

Buchanan^[3] notes that each of the fields that have studied their own design work has tended to regard it “as an applied version of its own knowledge, methods, and principles” (1995a, p. 18). The various literatures have had little cross-boundary interaction; the notable exceptions are Simon (artificial intelligence) and Alexander (architecture). There is a growing belief, however, that there are similarities in design problems and solutions that cross domains, and some research to determine whether that is in fact the case.^[4] Thomas and Carroll argue that design is a way of looking at a problem and is therefore not exclusive to a particular kind of problem; they found that “activities as diverse as software design, architectural design, naming, and letter-writing appear to have much in common.”^[5] Nigel Cross, who has

written extensively about design methodology and design theory, also asserts that design is at least partially independent of the profession in which it is undertaken and that there exists a form of knowledge which is a “designerly way of knowing.” In 1982, Cross^[6] called for the construction of a way of conversing about design that is domain independent. It is in this spirit that this entry will draw attention to several strands of literatures from various disciplines. The goal is to highlight themes and approaches that may be of use to researchers or practitioners interested in applying them in the library and information sciences.

In everyday conversation, “design” is often equated with “style”—extra, nonfunctional aspects of a product that make it attractive or fashionable or characteristic of a particular approach; this is not the meaning used here. Design in this entry refers to the professional or research activity that results in a plan for a product or service that will be or could be instantiated in the world to solve a problem. Designing often includes the actual creation of the product or service, but as Schon notes,^[4] designers often create blueprints or sketches or combinations of functions which someone else will turn into a building or landscape or software code. In some fields the distinction between design and making is theoretically important, with design as an intellectually different activity from that of instantiating the design.

Design takes place in a range of professions and a range of venues. Buchanan,^[7] for instance, divides the “design professions” into four general groups: 1) those that design symbolic and visual communications (graphics, books and magazines, film, computer display, etc.); 2) those that design material objects (clothing, tools, instruments, machinery); 3) those that design activities and organized services (management functions of logistics, decision making, strategic planning); and 4) those that design systems or environments (systems engineering, software design, architecture, and urban planning). Information professionals and researchers work in all four of these categories.

Two assumptions underlie this entry. The first is that there is indeed some “designerly way of knowing” that crosses disciplinary and professional boundaries. The second is that every design context is different, with unique interactions between context and process. The uncertainty in design is a constant in design theory. After an exploration of this core concept, the following seven sections address additional aspects of design work that seem to be independent of the particular physical or intellectual artifact being designed. An example of design science and an example of design research in library and information science are then described.

UNCERTAINTY

That design practice is inherently uncertain because it involves changing potential into actuality is a key factor

addressed by most design theories. In this entry, it is given pride of place, discussed first and then pervading discussion of other aspects of design.

Historically, two responses have been made to uncertainty, attempts to remove it from design or acknowledgment of it as an inherent part of the creative process. The first, in part a reaction to an earlier tendency to romanticize inspiration and individual creativity, was to find objective and rational techniques that would remove uncertainty and allow the development of methods that would give reliable results. The second, in part a reaction to the rationalists, was to acknowledge that uncertainty is not removable and to embrace it as a part of the creative process. The first philosophy can be traced back to the logical positivists, the second to the constructivism of John Dewey and Charles Sanders Peirce.

The movement to develop design techniques that removed the mysterious, inexact, intuitive component and make design more like science began in the early twentieth century. The term “design science” itself is a direct descendent of this attempt, though it is also used today by those who reject the desirability of objective, rationalist methodologies. The architect and urban planner Le Corbusier was a pioneer in developing Modern Architecture theory for the building of spaces; he began his work during the First World War, when the traditional European city was showing the destructive effects of the Industrial Revolution. Believing that improving living spaces would allow people themselves to improve, he sought techniques that would create both harmony and efficiency in the built environment. Harmony could be achieved by the application of Leonardo da Vinci’s golden ratio which based building proportions on the proportions of the human body and by the incorporation of concepts about the mathematical order of the universe. Uncertainty was addressed with techniques based on the objective, rational industrial management ideas of F. W. Taylor and Henry Ford. “The use of the house consists of a regular sequence of definite functions. The regular sequence of these functions is a traffic phenomenon. To render that traffic exact, economical and rapid is the key effort of modern architectural science” (Le Corbusier, cited by Cross).^[8]

Like Le Corbusier, Buckminster Fuller believed that design of buildings and spaces based on rational principles rather than aesthetic inspiration would solve many contemporary problems. He is thought to have originated the term “design science,” which he defined as “effective application of the principles of science to the conscious design of our total environment in order to help make the Earth’s finite resources meet the needs of all humanity without disrupting the ecological processes of the planet.”^[9] He declared the years between 1965 and 1975 the Design Science Decade, and urged a retooling for schools of architecture around the world, to use scientific methods to “measure, observe, and improve solutions until

solutions are developed that will work not just once, but over and over, and in a variety of situations.”^[10]

The architect Christopher Alexander^[11] also sought to develop systematic design methods that would give reliable outcomes; he explored the use of logic and mathematics, and later computers, to analyze the uncertainty out of design problems. While he saw a role for intuition, he argued that many had made a fetish of it, and that too much emphasis on intuition and artistry prevented the designer from asking reasonable questions and employing systematic processes. The increasing complexity of design problems required rational methods. A design problem “has requirements which have to be met and there are interactions between the requirements, which makes the requirements hard to meet. . . . Each of the issues interacts with several of the others . . . [In large design problems], each issue is itself a vast problem; and the pattern of interactions is vastly complicated.”

In his 1964 book *Notes on the Synthesis of Form*, Alexander^[12] asserts that most design problems are so complex that the designer cannot see the solution. Therefore, the architectural designer should start by listing all of the requirements and their interactions with each other. Once this is done, the requirements can be broken down into subrequirements; the solutions for each of the subrequirements will then be easier to determine, and from the set of solutions to the subrequirements, the final form can be synthesized. Thus the process is to apply the logic of analysis first, to determine all the parts of the whole, followed by applying the logic of synthesis to combine the solutions. In *A Pattern Language*,^[13] Alexander and five coauthors systematically analyze common problems in design and then describe the core of the solution to each problem, providing patterns that can be combined and recombined to solve architectural problems ranging from the level of climbing plants, doors, windows, and duct space through the level of rooms and foundations to entire buildings, towns, and the distribution of towns. Over time, as his ideas and others of the rationalist approach became more widely accepted, Alexander came to feel that just as people had made a fetish of individual intuition in design, so they were now making a fetish of a rationalistic methods. Disavowing what he described as a “painful and drawn-out misunderstanding” of his work, he disassociated himself from the use of method for its own sake, which he felt had become desiccated, dried up, and senseless.

Herbert Simon is the most-quoted and most influential rationalist, objectivist theorist today. In his 1969 book *The Sciences of the Artificial*,^[14] he argues that design is a process of decomposition; the problem is defined, alternatives are generated, and the alternatives are tested against an array of requirements and constraints, often in nested series of cycles. Much like Alexander, he argued in “The Structure of Ill-Structured Problems,”^[15] written for the artificial intelligence community, that large, ill-structured

problems can be broken down into smaller problems which are structured and therefore solvable.

In the reaction against the rational approach and attempts to decompose messy problems into solvable ones, one of the most influential writers has been Horst Rittel. He began developing the concept of “wicked problems” in the mid-1960s. Rittel took the phrase from Karl Popper, but used it differently. Wicked problems are ill-defined, and Rittel denies that they can be analyzed into smaller, well-structured problems. Published in an urban policy journal, Rittel and Webber’s “Dilemmas in a General Theory of Planning”^[16] defined wicked problems as those which are ill-defined, messy, circular, and aggressive. “Tame” problems are definable and separable and may have solutions that are findable; in addition, it can be determined whether or not the problem has been solved. Chess, puzzle-solving, and math are examples of tame problems. With wicked problems, “one of the most intractable problems is that of defining the problem (of knowing what distinguishes an observed condition from a desired condition) and of locating problems (finding where in the complex causal networks the trouble really lies). In turn, and equally intractable, is the problem of identifying the actions that might effectively narrow the gap between what-is and what-ought-to-be.”^[17] Rittel and Webber list ten distinguishing properties of wicked problems:

1. There is no definitive formulation of a wicked problem.
2. Wicked problems have no stopping rule.
3. Solutions to wicked problems are not true-or-false, but good-or-bad.
4. There is no immediate and no ultimate test of a solution to a wicked problem.
5. Every solution to a wicked problem is a “one-shot operation”; because there is no opportunity to learn by trial-and-error, every attempt counts significantly.
6. Wicked problems do not have an enumerable (or an exhaustively describable) set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan.
7. Every wicked problem is essentially unique.
8. Every wicked problem can be considered to be a symptom of another problem.
9. The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determines the nature of the problem’s resolution.
10. The planner has no right to be wrong.

Today many design theorists see the unexpected as the source of, or opportunity for, creativity. Donald Schon, a philosopher who developed an epistemology of professional practice, accused rationalist theories of being radically incomplete. He studied six different professions for his 1983 book, *The Reflective Practitioner*.^[4] architecture,

clinical psychology, engineering, scientists designing equipment to test their hypotheses, city planning, and management. Like Simon, he saw design as the core of professional practice, but when he actually studied professionals at work he found that they were not carrying out series of logical transformations until the problems were solvable, but rather making and remaking entire design structures. Well-formed problem-solving of the sort advocated by Simon occurred only in later stages, after the design structure had stabilized. In the early stages, he found very fluid activities which often resulted in surprise and learning. A second problem that Schon found with the rationalist tradition was that it could not account for this kind of learning, which often results in reframing the problem itself. The third problem was that Simon and others tend to regard rational decision as a process that occurs within the mind of an individual; Schon observed, to the contrary, that designing is almost always a social process, with constraints and affordances arising from colleagues, the customer or imagined user, funding agencies, management structures, designers of the technologies the designer uses, distributors of materials, and so on.

Other researchers have supported the idea that the presence of the unexpected benefits design as well as creating problems. Bucciarelli,^[4] writing of product engineering, found that uncertainty actually allowed participants to exercise their creativity, that a variation untried before or challenging an assumption or constraint took engineers into unknown areas, where outcomes were unpredictable. Organizational war stories and jokes about Murphy's law reflect a design culture's realization that in design there is always disorder, chance, the creative, surprise—the unknown. Gasser,^[18] in a forum on management as design, wrote that

randomness is a natural consequence of engagement with the world. The more engaged an actor is, the more apparent randomness, uniqueness, or 'situatedness' he or she experiences. To be engaged in a present experience means to be able to differentiate that present experience from another—to experience its uniqueness, its lack of pattern with respect to other situations. . . . Deliberate injection of randomness can be a powerful tool for analysis and even for improving efficiency of certain activities and processes.

PROBLEM SETTING

Simon's^[15] argument that design problems which are ill-defined in the beginning can be broken down into smaller well-defined problems is undermined by many authors' descriptions of the problem-setting process. Rittel and Webber begin defining wicked problems with the characteristic that "there is no definitive formulation" of the

problem. Others argue that it is not just wicked problems for which this is true, but that in fact all true design shares this characteristic. Lave,^[19] writing of problem-solving in general, argues that problems are generated in relation to the particular setting within which the practitioner is working, and that problem solvers choose "whether to have a problem or not, and the specification of what constitutes the problem." Even in an engineering firm where the task is to design to client specifications, Bucciarelli asserts, they are negotiating the nature of the problem with the specifications themselves, with the suppliers of materials, with the nature of the tools they have available, and with others on the design team, and of course with the clients.

There is a large literature on client or user participation in design and the difficulties in such collaboration. Many authors of works on information systems have discussed the problem of obtaining useful information from potential users about what the problem is and what the solution should be—much of users' knowledge is tacit, and they lack the design and technical knowledge to understand the kind of information that designers need; designers, on the other hand, often lack thorough understanding of users' work and workflow despite time spent in requirements elicitation.^[20] Thus the negotiation about what the artifact will be has many dimensions and generally goes through many iterations; it is frequently the case that users and designers think they agree, only to discover later that words had disguised the tacit understandings of each side and that in fact they were operating under very different assumptions. In addition, design projects are often set in motion by the supervisors of those who will actually use the artifact to accomplish their work, which adds additional layers of definition which affect the understanding of the need the project addresses.

Boland^[21] stresses the impact of language on problem definition; writing of business managers as designers, he says "Good designers are aware of their own vocabulary and what it does to their work. . . . How we describe what a manager is and what he should do, what a problem is and how it should be approached, and what a good and true course of action is and how it is to be achieved, are all dependent upon our vocabulary." Schon^[22] similarly argues that "When we set the problem, we select what we will treat as the 'things' of the situation, we set the boundaries of our attention to it, and we impose upon it a coherence" 1983, p. 39.

One of the sources of uncertainty at the stage of problem definition is constraints—how needs will be ascertained, with whom, how they will be understood and then translated into design concepts, what materials and processes are both available and judged appropriate, which outcomes are required and which are secondary. The definition of constraints contributes to how a design problem is defined and therefore to how it is solved. Vincenti^[23] studied events in the history of aeronautical

engineering; he asserts that although most of the work is done at the lower levels of design, the top level of problem definition, which is where the problems are primarily conceptual and unstructured, is where knowledge growth occurs in engineering.

CONVERSATIONS WITH MATERIALS

Some of the uncertainty of design results from the interaction between designer and the materials of design. Wagner^[24] says that architects “meander” between seeing specifications and fixed elements of a solution precisely, and seeing them as partial and preliminary, still in formation. Schon^[4] calls this a “conversation with the materials” of design, in which the designer makes a move and the materials “talk back.” The designer then adapts as she sees how the materials respond to her, and they in turn respond to her adaptation. Keller and Keller^[25] in an essay titled “Thinking with Iron,” describe the way that a blacksmith takes an action with the fire and metal and the iron responds; the blacksmith then responds to that result, undoing the action or deciding what next action the response has made appropriate. Through this conversation, the design emerges. Although the blacksmith has begun with a general plan, the specific actions and the plan itself become fluid and may change as his actions change the situation.

Often the early conversations are carried out in “virtual reality.”^[4] Rather than jumping directly into the creation, designers often test their ideas using sketches, computer graphics programs, conversations, and other substitutes for the actual materials. As noted above, it is critical that the virtual medium be sufficiently indeterminate to allow surprises to occur, for the designer to learn from the actions he takes. Art historian Rudolf Arnheim quotes Goldschmidt as describing sketching as a dialectic process. Sketches are not just a representation on paper of the images in the designer’s mind; rather, they are an oscillation of arguments and the responses of the sketch, in which the sketch supplies essential new food for the arguments.^[26]

Another representation of this process is as experiments testing hypotheses, each of which is evaluated for fit and misfit, and changes the context in which the next hypothesis and test will be carried out.^[27] Similarly, Wagner^[24] describes this oscillation as the underpinning “for the passage from possibility to actuality which is the work of design.”

Rationalist theorists of design have described such tests as running a maze, with the assumption that although many trials may be dead ends, eventually the correct path will be found and design will proceed. Schon, however, asserts that a designer can never make a move which has exactly the intended results, and that her knowledge about what is possible and desirable evolves as the materials of

the situation talk back to her. It is as though the process of running the maze *changes* the maze.

CONSTRAINTS

Constraints enable the definition of a problem and the range of solutions, and also limit them. Standards, codes (such as construction codes), consideration of “best practices,” textbooks, and other formal sources of professional knowledge provide guidance. Current consensus about good design stimulates and provides direction to creative ideas. Codes are interpreted and conformed to in different ways; relationships between stakeholders are defined and redefined as the design situation evolves. Experience with a standard can be fed back into the system and the standard be rewritten.

Other constraints arise from the specifications for a project, as noted above. Time and money also influence design decisions. Organizational culture about how projects should be carried out may determine the approaches at both unconscious and conscious levels.

The materials of design, both the tools and the “raw material” also provide opportunities and limitations. Architects work explicitly with the constraints provided by land, soil type, and climate conditions. Schon^[28] quotes an instructor in a school of architecture as advising a student to “let the land generate some sub-ideas” (p. 89). Reciprocal transformations between the designer and the field of constraints give shape to a design project.

TOOLS

Traditionally, the tools of design have often been ignored or seen simplistically as enabling or imposing limitations on the process. However, theorists in sociotechnical studies emphasize the importance of paying serious scholarly attention to *all* of the elements of a research (or design) situation if we are to eventually understand the process. Clarke and Fujimura^[29] explore the idea of “the right tool for the job.” Griesemer^[30] in that volume makes the point that the tools the scientist understands to be appropriate shape the problem as well as the solution. Collopy^[31] notes that an important difference between expert and novice designers is that novices do not fully understand the control that they could have over the design environment itself. Experts have learned how to design tools that help them to think of things that they would not normally; tools are tools for thought as well as for material actions. Wagner^[24] describes ways in which design labs are often constructively cluttered, filled with toys, gadgets, interesting shapes, all tossed around somewhat arbitrarily; unfamiliar juxtapositions of objects can give rise to creative leaps, juxtaposing ideas about the artifact in ways that give new direction.

Schon^[4] gives special attention to the tools that create what he calls virtual worlds—these include maquettes, scale models, rehearsals, improvisations, computer simulations, and so on. He identifies this process in architectural design studies where sketching is the basis for communication between student and instructor and also in the relationship between a psychologist and patient where transference and counter-transference serve as a substitute for firsthand experience, a virtual world which represents the patient's other relationships and which can be analyzed to understand the meanings and effects of action. Boland and Collopy^[32] describe an architect's model as a tool for thinking, a stimulus and a way to explore ideas, not as a representation of a future reality. They argue that in management, models are taken too seriously, as a kind of compressed truth, and urge managers to break loose from "decision attitudes" and foster instead "design attitudes."

Henderson^[33] found in an ethnographic study of industrial engineers that use of computer graphics in design often could not accommodate uncertainty, and too quickly drove the engineer to settle on an approach. Therefore engineers often mixed paper practices with their electronic practices to protect the cognitive spaces where creativity took place. Creative design work is based, she found, on unarticulated knowledge, often visual in format; and this knowledge is recalcitrant to incorporation into computer graphic systems. Attfield et al.^[34] note similar phenomena, and add that uncertainty is particularly important during the early stages of the design process. Boland and Collopy^[32] as well describe an architect shaping his design ideas with his hands and materials, and using software only much later. The value of virtual worlds is in their malleability; when they remove uncertainty prematurely, they limit the range of potential problem solutions.

DESIGN FAILURE

One of the consequences of the presence of the unexpected, of course, is failure. According to David Pye (cited by Petroski,^[35]) there is always compromise in design.

The requirements for design conflict and cannot be reconciled. All designs for devices are in some degree failures, either because they flout one or another of the requirements or because they are compromises, and compromise implies a degree of failure. . . . All designs for use are arbitrary. The designer or his client has to choose in what degree and where there shall be failure. . . . It is quite impossible for any design to be 'the logical outcome of the requirements,' simply because, the requirements being in conflict, their logical outcome is an impossibility (pp. 217–218).

And, somewhat paradoxically, failure is a major contributor to the reduction of the unexpected. Henry

Petroski,^[35] writing about structural engineering, points out that all possible uses of a structure under all possible conditions can never be anticipated. Structural engineering is hypothesizing, testing one's expectations of how things will work. Engineering design is revising, analyzing by questioning the behaviors of the parts under the imagined conditions of use, discovering problem areas, redesigning, and then analyzing the new design. Prototyping is one method of hypothesizing, allowing the designer to "fail early," and without consequence. The process continues until the designer can imagine no possible way in which the structure can fail under the anticipated use. But the uncertainty is always present. The less like the past the future is, the less likely that the engineer's hypotheses will be correct; and the object itself changes the future. Although an incorrect hypothesis may hold for a long time without discovery under certain conditions, if those conditions are no longer met, the conditions under which the hypothesis fails may be revealed.

"The well prepared engineer can and does build beyond experience."^[36] Copying structures which have stood the test of time is engineering work that holds no distinction; Petroski compares engineers with artists: "just as the great writers are those who have given us unique and daring experiments that have worked, so it is that the great engineers are those who have given us their daring and unique structural experiments that have stood the test of time."^[37] An engineer designing beyond his knowledge or ability is violating ethical principles, with potentially catastrophic results; but "failure in innovation should be no more opprobrious to the engineer who has prepared himself as well as he could for his attempt to build a longer bridge than to a pole vaulter who fails to make a record vault after practicing his event and using his pole to its capacity."^[35]

Although failure of an engineered structure can be tragic in its consequences, it is also an important component of the growth of knowledge. Structural failure, not success, improves the safety of future generations of a design. A failed structure is a counterexample to the engineer's hypothesis and shows what cannot be done; a structure that stands without incident often conceals whatever lessons it might hold for the next generation of engineers. For these reasons, Petroski argues that design literature needs to incorporate descriptions of failures.

DESIGN AS INTELLECTUAL WORK

This entry is based on the premise that the literature of design from other disciplines is relevant to the library and information sciences. Words frequently used in descriptions of a "designerly way of thinking" are creativity, fluidity, rationality, intuition, emotion, reflection, confidence, and taste. While these characteristics certainly apply in other kinds of work as well, in the practice of

design they take on a unique character in relation to pervasive uncertainty.

Before discussing the elements of design thinking that are thought to be common across boundaries, it may be useful to consider what does not cross the boundaries. In Schon's 1983 study^[38] of six professions, he identified four areas where each had unique elements: (1) the media, languages, and repertoires [of action] that practitioners use to describe reality and conduct experiments; (2) the appreciative systems [values] they bring to problem setting, to the evaluation of inquiry, and to reflective conversation; (3) the overarching theories by which they make sense of phenomena; and (4) the role frames within which they set their tasks. These more stable elements of the situation give the practitioner relatively solid references from which she can work to address the unknowns of the design; they provide a base for reflection in action. It is in the constantly evolving confrontation with uncertainty, ironically, that designers have most in common.

Creativity has been described in this entry as being the necessary response to conditions of uncertainty. It is required in the initial work of setting a problem out of a fluid problem space. And, as Lave^[39] says, one does not have a problem without a sense of a resolution space as well. David Kelley, founder of the widely recognized design firm IDEO, emphasizes that successful design depends on being open to multiple possibilities and being ready "to take risks in a creative leap into possibilities that are not yet defined and whose consequences are not yet visible."^[40]

Wagner^[24] similarly describes an architect's ability to perceive "the novel within the familiar, to discover relations between seemingly incongruent objects and notions, to relate the unrelatable." She describes designing as an informal, fluent process, simultaneously focusing on floating concepts, preliminary specifications, and contradiction and constraints. The process she describes is closely related to Schon's^[4] description of the path from initial idea to final design as unpredictable, emerging out of a conversation in which the materials "talk back" in response to each decision made by the designer.

This fluidity in thinking, closely related to creativity, is important in the intellectual work in design. A designer must be able to keep seeing a problem from new perspectives, avoiding filters that make everything conform to that filter. Designers must first look as broadly as they can at the universe of possible solutions; then they can feel more comfortable narrowing. It is important that hypotheses be formulated, tested, discarded, and revised; understanding of the problem, the tools, and the materials of the situation changes as the three interact.

It is often stressed that designers need to be able to live with pervasive uncertainty. "The typical design situation requires doing something that you don't yet know how to do."^[41] In addition, it is never possible to be certain that one has done it in the best possible way; there may always

be a new, better solution that one stopped just before reaching.

Rationality was the central concern of designers early in this century, and is certainly not dismissed by contemporary theorists. Intuition is fed by experience. Solid disciplinary knowledge is a prerequisite to meaningful creativity. If one does not understand the formal properties of the tools and materials, then there is no basis for the deeper insights that can come from failures. *The Structural Engineer*,^[42] the official journal of the British Institution of Structural Engineers, defines structural engineering as "the science and art of designing and making. ..." Petroski argues that design is first articulated by the engineer as artist, and then analyzed by the engineer as scientist.

Intuition is another dimension of the work of design. "Creative leaps" can be based on intuition about what will work, the sense of a resolution space, as can be the hypotheses tested in building models.

Emotion in design takes various forms. Designers have been compared to athletes; they want to design the best thing they possibly can. There are no professional rewards for copying existing designs, although that work is likely to solve problems safely. Kelley,^[43] says "the designer has a passion for doing something that fits somebody's needs, but that is not just a simple fix. The designer has a dream that goes beyond what exists, rather than fixing what exists. ... there is a satisfaction in addressing problems at a deep level." Surprise is a frequent emotion in good design, because of the indeterminacy of the work. At times commitment to an organization or a social goal is a strong motivator, and an additional source of satisfaction in success. A sense of play is emphasized in some design organizations, because it opens up new approaches which might not be considered otherwise. Design teams often keep an assortment of gadgets around to stimulate play and exploration that can lead to innovative work.^[44]

Taking a risk in design means making a decision to create something that is not proven to be what is needed to solve that problem. Kelley asserts that even the most flexible people are uncomfortable with this kind of risk taking, but learn to live with that discomfort. Emotion, if it takes the form of commitments to particular ways of doing things or avoidance of uncertainty, will constrict design work.

Design requires confidence, the ability to make a creative leap and follow a path which doesn't yet exist. According to Kelley, a good designer creates beyond what the problem calls for, to create a solution that fits in a deeper situational or social sense. Kelley sees the designer's approach to a problem situation as dramatically different from that of an engineer, whose solution is based on mathematics and certainty. "A good problem in design is one for which you aren't sure that there is a right answer."^[45]

Related to confidence is a designer's ability to tell when she's got something that's good, an inner gyroscope that allows her to evaluate her own work.

DESIGN RESEARCH

"Design research" is a term used in some fields for design that is undertaken for the explicit purpose of extending the knowledge base; it may be instantiated to solve a particular problem, or its purpose may be proof of concept, demonstrating that a particular solution is possible. Design is considered research rather than practice on the basis of its greater novelty and difficulty, its significance to a research community, there being a serious question about how to solve it and its being "rigorously defined, formally represented, coherent, and internally consistent."^[2] Hevner et al.^[2] broaden the requirement of significance in information systems work to include social analysis of the design in use, with information provided to managers about the best deployment of the artifact. Design research takes place primarily in corporate laboratories and universities, thus having some characteristic differences from design in the field, notably in problem definition and constraints.

In a corporation, design is a strategic competency;^[46] a good problem is one that will contribute to the trajectory of the company's competitive strength. Teece et al.^[47] argue that a firm's previous investments and the repertoire of routines it has established create its current position, and that the current position is the primary constraint determining the paths available ahead. Learning tends to be local, and opportunities in the neighborhood of a firm's prior research are the paths most available. A company's history thus shapes and constrains its problem definition, and even what is recognized as a problem. A research culture develops that defines the optimum amount of novelty, and the levels of difficulty and uncertainty that are acceptable. Research cultures change over time, as may be seen in the fact that since the 1990s, U.S. R&D programs have shortened their focus, de-emphasizing basic research, and companies have favored design problems with a clear line-of-sight to market.^[48]

In universities, disciplinary value systems dominate, shaping and sometimes overriding the goals of university administrations.^[49] Disciplinary value systems emphasize theory and original contributions to knowledge. The significance of research questions is defined by the discipline, embodied in scholarly journals' decisions about what is important enough to publish and what is not. Problem setting is always influenced by the tension between the need to produce new knowledge and the risks of working outside the established disciplinary boundaries.^[20,50] This tension is passed on by dissertation committees and tenure committees taking seriously their responsibility to socialize new members into the academic culture. Weedman,^[49]

in a study of a design research project, found that students and junior faculty were advised away from problems that lay outside disciplinary boundaries.

The national emphasis on direct applicability has affected university design research as well as corporate laboratories. In the 1980s and 1990s, federal funding for basic research decreased, generating attempts to make "theory" more "relevant" in several disciplines. Addressing computer science and engineering (CS&E) in 1992, for instance, the National Research Council called for these disciplines to focus on "substantive research problems in the context of their application in and relevance to other domains."^[51] They urged collaborative projects between researchers in CS&E and client disciplines who would be the users of the designed artifact. Recognizing the tension between the scholarly requirements of a discipline and the practical requirements of users, the NRC anticipated that CS&E could "thus be framed simultaneously as a discipline with its own deep intellectual traditions, as well as one that is applicable to other problem domains. CS&E [could] thus be an engine of progress and conceptual change in these other domains, even as they contribute[d] to the identification of new areas of [scholarly] inquiry" (p. 65). This approach turned out to be fraught with problems, as the incentive structures of both the design and the client disciplines worked against mutual problem definition.^[20,49]

A special section in *MIS Quarterly* in 1999^[52] made similar recommendations, framing the tension as rigor vs. relevance. Overemphasis on rigor was seen as posing a danger of irrelevance, because of the need to formalize the problem, removing considerable sources of uncertainty present in design in the field. Several authors argued for the importance of combining relevance and rigor: rigor provided by building on the research knowledge base and relevance provided by selecting problems that would lead to the design of artifacts for specific situations. Benbasat and Zmud^[53] asserted a symbiotic relationship between researchers and information systems practitioners: "Theories and models are judged on their predictive power for guiding practitioners, the quality of theories are enhanced by testing and revising them with data from the world of practice, and the cues and insights offered by practitioners are assessed through rigorous examination across a variety of contexts." They note that much of the perceived irrelevance of research to the field may be the result of the way it is reported; to be useful, research reports must be shaped for the needs and concerns and rhetorical styles of the different audiences. Hevner et al.^[2] define design science problems as dual problems requiring dual reports, one scholarly for other researchers and one for business managers who need to understand the role of information systems and specific features in achieving their company's goals. The research problem is defined as a problem in the field as well as a disciplinary problem.

Not all researchers perceive an opposition between relevance and rigor; Lyytinen,^[54] for instance, wrote that many authors seemed to believe that there is a law that reads “rigor will always replace relevance if there are no powers to stop it.” He argued for more reflectiveness about the concept of relevance and the assumption made by many that relevance means rigor watered down or simplified, something that can be read and learned in an afternoon. He notes that relevance does not preclude research reports from being difficult, theoretical, and challenging, thus resolving the double vision of dual problem definitions.

There are also constraints unique to design research. Researchers in professional schools are often expected to fulfill obligations to the field for which they are preparing their students at the same time that they adhere to norms of the academic discipline. Practitioners or the clients for design projects often believe that design done as research is not relevant to actual needs in the field. Research may be perceived as too far in advance of practice to be applicable in “the real world” or as lagging behind practice, starting from scratch to develop proof of concept for something that has been done in the field (perhaps on a smaller scale) already. Formalized, mess-free designs often cannot be instantiated in actual work sites, or the cutting-edge theoretical problems that researchers need to address may not be perceived as problems in the field. An inability to satisfy both sets of constraints can lead to great frustration in a design research project.^[49]

Another set of constraints unique to design research is the relationship between standards and novelty. Design research requires novelty, yet a design must be standards compliant if it is to be built and used. Codified knowledge represents virtuoso performances within established boundaries; formal standards such as those issued by the American National Standards Institute cannot anticipate all future design situations. Bucciarelli^[55] writes that “a code is a historical statement based on experience and testing, but mostly on experience. Design is design of the new and the untried, the unexperienced, the ahistorical.” The constraints of university research require that design be novel, and therefore often outside established boundaries. Yet if it is to be used, a system needs to conform to the constraints created by technical standards. Goals to design an interesting research system that is also standards compliant must meet sometimes antithetical constraints.

DESIGN SCIENCE IN THE LIBRARY AND INFORMATION SCIENCES

Two examples suggest ways in which design science might be incorporated into the library and information sciences. One is a study of designers of controlled vocabularies for local use in image collections; the other is an ongoing design research project using probabilistic information retrieval systems.

Design Science: Local Vocabularies for Image Collections

In LIS, design work related to knowledge organization is carried out simultaneously at multiple levels—in the devising of national standards for design such as the National Information Standards Organization (NISO) *Guidelines for the Construction, Format, and Management of Monolingual Thesauri*, in the maintenance of major vocabularies such as the Library of Congress’ *Thesaurus for Graphic Materials*, in the design of vocabularies intended to be diffused widely such as the *Art & Architecture Thesaurus*, and at the local level in the creation of descriptors or classification systems for individual collections of materials.

This study^[56] consisted of a survey of individuals who had created or worked with locally designed vocabularies for image collections, and interviews with the respondents who had participated in the creation of a vocabulary. In the interviews, open-ended questions were asked in order to elicit description of the process—the work—of vocabulary design. Transcripts of the interviews were then coded and analyzed to ascertain whether or not concepts taken from design literature such as those discussed in this entry were applicable to design in this area of library and information science. The 2004 report was based on the first six interviews to be conducted. The sites included a collection of urban photographs, a historical site containing many objects as well as photographs, a collection of illustrated medieval manuscripts, a collection of magazine photographs illustrating mid-twentieth century culture, the photograph collection of a medical research center, and the visual resources collection of a university art department.

Uncertainty was pervasive in the work of vocabulary design. The uncertainty of language is said to plague information retrieval, with its synonyms, homonyms, nuances, and context-dependent meanings; Morville,^[57] for instance, calls language “the questionable foundation upon which information retrieval is built.” However, it was not language that caused the most uncertainty for the respondents. In information retrieval, language creates relationships between documents—identifying shared attributes that will aggregate some images and discriminate them from others. It was the relationships themselves about which the vocabulary designers rarely felt comfortable. The establishment of these relationships, though informed by the discipline or setting of the collection and the anticipated needs of users of the collection, was still, ultimately, a creative act by the designer, for which there was no ultimate test of correctness. The most uncertainty of all was felt about the breadth and specificity of the relationships—how broadly the aggregating attribute should be defined, whether the images it would bring together would constitute the most useful grouping, whether the entities that could be brought into that

relationship should be. The designers reported that it was these relationships, not the words used to express them, that were the source of the worst uncertainty in their vocabulary design.

Conversations with the materials of design did occur. Most frequently they took the form of arranging and rearranging terms to see the relationships which resulted. Adding a new image to those previously included in a category often changed the earlier the relationship, requiring different configurations to accommodate new possibilities. Even using terms that were well established in the domain did not solve the problem of which relationships to create and which to leave invisible; an established term would create one relationship, but then some items would need to be disaggregated because they differed in some critical dimension. Designers often considered the effects of using one term or set of terms to express relationships, then changed the terms and relationships to see what the result was. Creation of a new term could affect the scope of the first. "You have to be willing to mess with things." One respondent said that he designed vocabularies in the same way that he baked bread, through experimentation—"I try things and then respond in accordance with what's happening."

There are, of course, various constraints on the work of vocabulary design. The existence of standardized structures is one constraint; one designer compared a sense of structure to a painter's understanding of oil and canvas, and said that if one didn't fully understand the nature of structure, the designer could be "misled by content." Time and money were common constraints that shaped the final vocabulary. The size of one of the older vocabularies was determined by the computer available for use and the size of its memory. In an art history library, the decision about whether a vocabulary should capture literal objects in an image or their symbolic meaning was determined by the fact that the actual indexing would be done by students who had taken not more than one art history class. User warrant, literary warrant, and the warrant of standard vocabularies such as the *Art & Architecture Thesaurus* are other forms of constraint that influence design work.

Problem setting was influenced by these constraints and other factors. In no case was the problem that gave rise to the creation of a vocabulary simply the need to provide intellectual access to the image collection, even when that was given as the initial problem statement. In the case of the urban photographs, providing intellectual access was first described as "trimming down" the descriptive terms assigned by the photojournalists, despite their unsuitability for information retrieval; this turned out to mean bringing consistency to the terms while preserving them as part of the intellectual whole of the photographs and their descriptions, to be followed by the design of an independent vocabulary for information retrieval when the collection was merged with others. In the case of the illustrated manuscripts, the general goal of providing

intellectual access turned out at its core to mean relating the illustrations to the part of the story they depicted, so that different versions of the same work could be compared by a professor and his graduate students whose research centered on this one work. The vocabulary would be useful for others doing the same kind of research, but not for individuals studying the work in different ways. An initial problem description of designing a vocabulary in one situation turned into "find something you can do NOW," bypassing the content management vocabulary for the Web site which had run more than a year beyond its deadline. For the historic site, the problem was defined both as providing computer access so that users could find things on their own, and as bringing together the materials that were all related to the same story. Doing good in the world was another problem definition that emerged well into an interview.

The designers interviewed were employed as librarians, metadata specialists, curators, or in other positions; vocabulary design was only one of many responsibilities. All said that they saw the design work as different in nature from other parts of their jobs. They saw it as requiring more creativity, making something that hadn't existed before. Some of the creativity was in the act of putting oneself in the minds who would be using the images. One designer captured the role of constraint in novelty when he commented that "when you understand your audience you can be creative." The importance of seeing things (in images) in relation to one another was strongly emphasized. They cited an intuitive dimension, a sense of how things should go together and of when a relationship wasn't right. Emotion was also present in the work, sometimes unexpectedly, as in the discovery of slave records in the historical site. There was an emotional connection with design work that took the form of curiosity about "how things could be brought together into a structure." Enjoyment of "pulling things apart and putting them back together" was important to one of the designers. Emotion was also cited as a negative factor; one's response to images could get in the way of subject analysis.

Themes taken from the study of design in other professions provided a useful frame in this study for exploring design practice in the library and information sciences. Discussions of uncertainty, problem setting, the conversation with materials, and other concepts provided a different set of insights into vocabulary design than is gained from other research approaches.

Design research: Cheshire

The development of the Cheshire information retrieval system, begun in 1990, is an ongoing design research project. Cheshire was developed by Ray Larson at the University of California, Berkeley. I interviewed him in 2007, again with the goal of determining whether concepts from the design literature of other disciplines would be

echoed in descriptions of design work in the library and information sciences. The initial question was very broad; “tell me about the history of Cheshire—how it started, how it changed and why, why you made the decisions you did.” The questions that followed focused on the actual work performed by Larson; what kinds of things he did, how he made decisions, and so on.

The history of Cheshire over 17 years illustrates many ways that uncertainty, problem setting, conversations with materials, constraints, the role of tools, and failure play out in design research in LIS. In a large project of long duration, none of these factors come into play only once. They interweave in various ways throughout the life of the project.

Problem setting is required at many stages of design research—in the development of Cheshire, the initial problem was redefined to take advantage of opportunities, in response to the tools available, to accommodate the unexpected, and to address subparts of the problem more specifically.

Larson began defining the problem during his dissertation work, a computer performance evaluation of the UC systemwide library catalog, when one of his findings was that users experienced subject searching as very difficult, often learning to avoid it as much as possible. At this time, the commercial search engines were entirely Boolean. Ranked retrieval appeared as the alternative to explore; William Cooper, with whom Larson had studied, argued that ranked retrieval was the optimum way to do subject searches, and W. E. Maron, with whom Larson had also studied, argued that probability theory provided the best foundation for ranked retrieval. There were two major theoretical approaches for providing relevance ranking of results, neither of which had been instantiated in full working systems because of their computational requirements. The first was that of W. E. Maron and J. L. Kuhns, who had published “On relevance, probabilistic indexing, and information retrieval” in *Journal of the ACM* in 1960,^[58] and the second was the vector space model, Gerard Salton’s SMART system.^[59] Although Larson initially framed the problem as a need for probabilistic retrieval for subject searching, none of the computers available could carry out the computationally intense procedures; the early experiments leading to Cheshire, then, were carried out with the vector space model.

Because of his dissertation work and the availability of the library’s records, Larson began with the MARC (Machine Readable Cataloging) format, but in a graduate class that gave his students the opportunity to build an IR system from the ground up, Larson and the students realized that the MARC format imposed too many constraints and that a more generalized markup language was needed. This led, after investigation, to a new subproblem, conversion to SGML (Standard Generalized Markup Language), and the system designed in the class became the first Cheshire.

The problem definition shifted again—back to probability theory as the design model—when Larson joined a multimillion dollar research project on data management in the earth sciences that made state-of-the-art computers available to the investigators. Cheshire then became Cheshire II.

The chance to build probability algorithms into a working system exposed a set of unanticipated problems—the formal results differed from the way that code actually behaved. Problem definition shifted to address differences between the model and the instantiation. Then the problem definition changed again and became how to incorporate the relevance feedback on which the probability model depends. The solution was to employ logistic regression on samples of documents for which human relevance judgments had been made, to determine which of their characteristics would predict that someone would judge the document to be relevant. The statistics from this sample are then used as the basis for the relevance ranking in the rest of the database.

Cheshire3, developed together with investigators in England, will be the next generation. A part of the problem set for Cheshire3 is to have it search multiple collections and determine the best one in which to carry out a given query; this problem definition is made possible by the fact that many of England’s archival databases use Cheshire II search engines, allowing them to be used as test sites.

Larson describes his work process as starting with a vision of what he would like to have the system be able to do, and then discovering “all the little details” that are needed to make it happen. Conversations with materials often led to increasingly complex and convoluted code, until suddenly Larson would see a different way of solving the particular subproblem that would be more direct. The module would then be rebuilt. The process of creating Cheshire II contained many of these long conversations and sudden insights.

Larson described the path between “I’d like it to do this” and the point where the search engine *does* “this” as “a combination of pondering, visualization, imagining, and ‘how could one...?’” The questions are “what data do I need to give it so it can do this? How do I get that data and how would I need to process it in order to make the outcomes be what I want them to be?”

Fluidity is the greatest when something is partially working. At that point there is design room for experimentation. Things can be tried to see what happens, then dropped or modified. The history of the conversations with materials can be traced in what Larson refers to as an “archeology of code.” Some unused appendixes couldn’t be removed because of shared variables, so they were left. Other obsolete pieces were left because it takes longer to remove code than it does to write it in the first place. So working code exists in layers over, and intertwined with, old code. A designer works down through that archeology

when the addition of a new feature involves rewriting a dozen or more modules, because making one sort of change at the top level often requires that you change other things that interact with it layers down. Having written the largest share of code himself, Larson speaks of his intimate relationship with it, knowing not just where everything is but how its particular form is the result of design paths begun and abandoned, unanticipated modifications and their unanticipated results on existing code, fixes, and then fixes to fixes.

The material with which the designer conducts a conversation is not, Larson stressed, the code itself. The conversation occurs when he runs the program and looks at the data that results, and the “back talk” is the appearance of needless duplications or errors in the way that the data comes out. The designer isn’t having a conversation with the underlying algorithms per se; but he has to find where in the code the problem is located to try to fix it. Finding out if he has indeed fixed it requires another conversation.

Intuition and insights are part of the intellectual work of this kind of design. Sudden insights sometimes occur after a fruitless struggle with a problem that seems impossibly difficult, or doable but not in any reasonable amount of time; it’s not unusual to wake up in the middle of the night with “oh!—wait a minute, wait a minute!—I can do it *that way!*”

As other designers have described fluidity of thinking and the importance of unexpected juxtapositions, Larson has found that when a problem or approach seems insoluble, it’s instructive to “turn it on its side or turn it on its head or turn it around completely, turn it backwards, and see what happens.” And very often the different perspective makes visible (or discoverable) a better way of doing it.

An example is the design problem of including functionality for geographic retrieval in Cheshire3. Study of searchers shows that they scan through all the possible items until they find the one that would serve their purposes, which would be impossible in a large-scale system. R-trees in computer science are used for searching regions, but would have been “horrendously” complex to implement in the system. Larson describes spending a great deal of work on how to incorporate R-trees before asking what *else* could be done. Software developed within another Berkeley research project, Berkeley DB, gives access to the underlying index structure of a database. The techniques of Berkeley DB plus some middle-of-the-night inspirations led to a method that will in effect create R-trees but with the technique of creative scanning of the indexes. This turned out to be a solution that works accurately and very quickly.

Larson describes design as a cognitive process, with no emotional input except a desire to avoid approaches that have failed to work in the past. Emotions do accompany the cognitive process, however. Negative emotions are most often evoked not by the problem itself, but by

technical limitations or some other external factor. The frustration is not a productive part of the design process; rather, it’s a sign that it’s time to do something else for awhile. Positive emotions are feelings of accomplishment evoked by the sudden insights into solutions, the satisfaction of something working the way that it was expected to, and the elation that follows a middle-of-the-night insight, when “you can’t wait to get up and go in to try it out and see if it works.”

Standards are constraints that both enable and limit design work. The value of working with standards is that it’s possible to build for the existing infrastructure. Because of its use of XML, Cheshire can search any database that has an XML structure. Use of a standard may permit unexpected novel results as well. The Z39.50 protocol is an information retrieval standard used to extract data from different collections and build an index of the combined elements; any database that supports Z39.50 for querying or SRW (Search/Retrieve Webservice) and SRU (Search/Retrieve via URL) protocols can be harvested. When Z39.50 was built, it included common operators such as the “equal to” relationship, “greater than” or “less than,” truncation, and so on. One of the operators was named “relevance.” Some investigation revealed that no one had used that operator anywhere. What it does is direct the server to do relevance matching. This obscure operator allows Cheshire to search any server built on its model and direct it to rank the results for relevance.

Standards also provide the basis for the status quo; and as knowledge progresses, it diverges from the status quo. Forward-looking standards cannot anticipate all directions of development. Thus there is always a tension between infrastructure and change. Design research, because of its inherent novelty, puts pressure, small or large, on standards. The result in the short term is a proliferation of work-arounds, such as ways to bypass the preset record formats established by servers or by the Z39.50 protocols and request other formats. In the long term, standards change.

Problem setting is often affected by factors external to the project itself. The initial ability to do probabilistic retrieval, for instance, came from funding for a project focused on technology for global change research. Sometimes it comes from another interest of a researcher that can be blended into the design project; data mining capabilities were built into Cheshire3 as a result of one of the researchers’ interests in that area. Development of the UTF-8 encoding scheme for Unicode made it possible create cross-language retrieval. That led to the need for various tools, usually open source, to be incorporated, for example, a snowball stemmer that can be given a training data set that configures it for a particular language and from it create a stemmer for that language. Cheshire now has stemmers for all major European languages.

Problem setting in a university, as discussed above, has to respond to the norm of knowledge generation. When

ranked retrieval systems existed only as algorithms in the 1960s, Gerard Salton framed the field of information retrieval as an experimental science. The problem definition of Cheshire, Cheshire II, and Cheshire3 as practical application of theory in production environments resulted in both relevance and rigor as defined by the discipline,^[2] in both socially useful artifacts and articles reporting the theory and experimental research, comparing the base algorithms to other well-known information retrieval algorithms in terms of the standard measures of precision and recall.

This long-term design research project, then, does illustrate a “designerly way of knowing” in common with other forms of design. While primarily cognitive, there are elements of creativity, inspiration, and emotion. The conversation with materials plays an important role in the final form of the artifact, as does response to the fertile mix of challenges and constraints.

CONCLUSION

Although design is an important part of professional and research practice in the library and information sciences, it is at present undertheorized. Schools of LIS teach Web design, thesaurus design, management, public services, system analysis, interface design, XML, and other classes that have a strong design component. Our social science traditions provide strengths in understanding the use of systems, their integration into work life, and how users evaluate results; these traditions could usefully be expanded to study design as professional practice.

There are two potential benefits to studying our own design. One is that it may give rise to increased knowledge of and thereby improvement of design practice. Boland and Collopy^[32] write that the awareness of one’s own profession’s design practices enables discussion across professional boundaries, which can lead to new insights and “design attitude.” The other is the value of knowing for its own sake; the design that we do is important work, and understanding it is interesting. The review provided here of the “designerly way of knowing” in the information sciences indicates that there is a great deal of interest that could be done.

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Dewey Decimal Classification (DDC)

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Abstract

This entry discusses the Dewey Decimal Classification's value proposition as a general knowledge organization system in terms of basic design, history, ongoing development, translations, mappings, applications, and research. The authors conclude with prospects for use of the DDC inside and outside of libraries.

INTRODUCTION

The Dewey Decimal Classification (DDC)^[1] system is a general knowledge organization system that is continuously revised to keep pace with knowledge. The DDC is used around the world in 138 countries; over 60 of these countries also use Dewey to organize their national bibliographies. Over the lifetime of the system, the DDC has been translated into more than 30 languages.

The system has value because of its well-defined categories, well-developed hierarchies, rich network of relationships among topics, worldwide use, and language-independent representation of concepts. The existence of interoperable translations, mappings to other subject schemes, and the large amount of categorized content already associated with the system also contribute to Dewey's value proposition.

BASIC DESIGN

Structure and Notation

The DDC structures knowledge by disciplines or fields of study in a general-to-specific arrangement in well-developed hierarchies. At the top level, the DDC includes 10 main classes:

000	Computer science, information and general works
100	Philosophy and psychology
200	Religion
300	Social sciences
400	Language
500	Science
600	Technology
700	Arts and recreation
800	Literature
900	History and geography

Each main class is divided into 10 divisions, and each division is divided into 10 sections (some numbers in the divisions and sections have not been used—these are marked as “Unassigned”):

500	Science
510	Mathematics
510	Mathematics
511	General principles of mathematics
512	Algebra
513	Arithmetic
514	Topology
515	Analysis
516	Geometry
517	[Unassigned]
518	Numerical analysis
519	Probabilities and applied mathematics
520	Astronomy
530	Physics
540	Chemistry
550	Earth sciences and geology
560	Fossils and prehistoric life
570	Life sciences; biology
580	Plants (botany)
590	Animals (zoology)

The top-levels of the DDC—the main classes, divisions, and sections—are known collectively as the “DDC Summaries.”

Arabic numerals treated like decimal fractions are used to represent each class in the DDC. In other words, main class 500 Science is really .5 Science. The main class, divisions, and sections are usually represented as three digits (extra zeros are added as needed). A decimal point (a punctuation device without mathematical significance) follows the third digit in a DDC number, after which division of the class continues by specific enumeration and/or notational synthesis. For example, 006 Special computer methods is divided into six subclasses: 006.3 Artificial intelligence, 006.4 Computer pattern recognition,

006.5 Digital audio, 006.6 Computer graphics, 006.7 Multimedia systems, and 006.8 Virtual reality. All but the last are further subdivided. In addition, each of these classes (including the last) can be further extended by general notational synthesis rules as well as instructions in specific classes.

Classes 000–999 are known collectively as “the schedules”; there are also six auxiliary tables (Tables 1 through 6) that support notational synthesis:

Table 1	Standard subdivisions
Table 1	Standard subdivisions
Table 2	Geographic areas, historical periods, persons
Table 3	Subdivisions for the arts, for individual literatures, for specific literary forms
Table 4	Subdivisions of individual languages and language families
Table 5	Ethnic and national groups
Table 6	Languages

Notation in tables is represented in the print edition with an em dash followed by the number, e.g., —624 Sudan is the Table 2 number for the country of Sudan. In the Relative Index in the print edition, and throughout the current Web version, the same number is represented by T2—624. The prefix for the table number and the em dash are removed when the notation is appended to another number (see the section “Notational Synthesis”).

The schedules and tables also include some numbers enclosed in square brackets and parentheses. Numbers in square brackets are not in current use. Numbers in parentheses are optional numbers—alternate notation for a concept. Optional numbers are provided to give emphasis to a topic not given preferred treatment in the standard notation.^[2] For example, Library and Archives Canada routinely prefaces the notation for American literature in English and French literature with “C” to represent Canadian literature, e.g., C813.6 is the optional number for 21st century Canadian fiction in English; 813.6 is the standard number for the same concept.

Accompanying the schedules and tables are the Manual and the Relative Index. The Manual provides extended discussions on choices among related numbers, and on classification in complicated areas of the tables and schedules. The Manual was first published in 1982 as a supplement to DDC 19;^[3] it was fully integrated into the system with the publication of DDC 20.^[4]

The DDC is indexed by a unique tool known as the “Relative Index.” The index is so named because it shows the relationship between subjects and the disciplines (or in some cases, the various aspects within disciplines) in which they appear. For example, the Relative Index entries for Garlic are as follows:

Garlic	641.3526
Garlic—botany	584.33
Garlic—cooking	641.6526
Garlic—food	641.3526
Garlic—garden crop	635.26
Garlic—pharmacology	615.32433

Within 641 food and drink, garlic appears in food (641.3526), and cooking (641.6526). Garlic also appears in botany (584); as a garden crop in agriculture (635.26); and in a subfield of medicine, pharmacology (615.32433). The interdisciplinary number for garlic is the one that appears opposite the unsubdivided entry for garlic (641.3526).

The Relative Index has been a feature of the DDC since the first edition of the system, and is considered one of Melvil Dewey’s unique contributions. Miksa^[5] traces the history of the Relative Index through the 22 full editions of the DDC with special attention to its nature as a conceptual indexing system, the conceptual contexts provided by Relative Index, and its treatment of concepts resident in internal tables. Green^[6] investigates the explicit and implicit relationships between Relative Index terms and topics in the schedules and tables.

Classes, Hierarchies, and Relationships

Each class in the DDC is defined by its position in a hierarchy, notes within the class, and a rich network of relationships with other classes. Relationships may be explicitly stated within the class itself, within other classes, and inherited through hierarchical relationships.

Entries in the schedules and tables have two main components—a DDC number and a heading (caption) describing the number. The entry may also contain notes that further describe the class, provide instruction for notational synthesis, or define its relationships with other classes.

796.932 Cross-country skiing
Including biathlon
Class here Nordic combination, Nordic skiing
For jumping, see 796.933

Hierarchy in the DDC is expressed through structure and notation. The DDC organizes knowledge first by discipline and then by subject in a hierarchical structure in which topics progress from the general to the specific. Each of the classes subordinate to the 10 main classes needs to be considered in terms of the hierarchy. Notes with “hierarchical force” regarding the nature of a class at any point in the hierarchy also apply to subordinate classes and to referenced classes.

The hierarchy is largely expressed through the notation. For a class within a given hierarchy, the next broader topic

will generally be represented by a number one digit shorter, and subordinate topics will generally be one digit longer. Coordinate topics are usually represented by the same number of digits. For example, here are several specific ice and snow sports shown in the context of their complete hierarchy.

700	Arts and recreation
790	Recreational and performing arts
796	Athletic and outdoor sports and games
796.9	Ice and snow sports
796.91	Ice skating
796.92	Snowshoeing
796.93	Skiing and snowboarding

The classes 796.91, 796.92, and 796.93 are coordinate classes—they are directly subordinate to class 796.9 Ice and snow sports, which in turn is subordinate to section 796 Athletic and outdoor sports and games. Section 796 is part of division 790 Recreational and performing arts, which is part of main class 700 Arts and recreation.

General Rules for Classifying with the DDC

The general rules for classifying with Dewey are set forth in the introduction to the DDC.^[7] Additional instructions are found in the beginning of Tables 1 through 6 (in the electronic version, the instructions can be found in the “0” record associated with each table, e.g., T1—0), in individual schedule and table records, and in the Manual notes associated with selected entries.

Since Dewey was originally developed to order physical materials, the instructions are geared toward the selection of a single number to represent any document-like object. The rules for choice of a single number also facilitate sharing of Dewey numbers among users, e.g., through bibliographic cooperatives such as Online Computer Library Center’s (OCLC’s) WorldCat. In the electronic environment, additional full and partial numbers may be assigned for access (see the section “Applications and Research”).

The guiding principle is to classify a topic within its disciplinary context. For topics scattered across the DDC, an interdisciplinary number is often identified. Within a discipline, a comprehensive number might be identified if there are aspects of a topic further developed in the discipline. For example, holidays may be examined from the perspectives of customs, law, religion, etc. The numbers for holidays will vary from each of these perspectives, e.g., 394.26 (Holidays—customs), 344.091 (Holidays—law), and 203.6 (Holidays—religion). The class 394.26 is designated the interdisciplinary number for holidays. It is also the comprehensive number for holidays in customs—there is a substantial development for holidays under

394.26 for secular and religious holidays, plus provision in 394.25 for Carnival and Mardi Gras.

Notational Synthesis

The DDC schedules enumerate only a fraction of the possible numbers that can be used to represent concepts. Often, a number must be synthesized (built) to express a particular concept. Numbers can be synthesized using notation in Tables 1 through 6, notation from other parts of the schedules, or notation from add tables that appear in the schedules. Any number can be extended by notation from Table 1, known collectively as “standard subdivisions,” unless there are instructions to the contrary.

Number building from the Tables 2 through 6, other parts of the schedules, and add tables can only be initiated upon instruction.

Here are some examples of notational synthesis in Dewey:

<i>Journal of Topology</i>	514.05
(514 Topology + notation 05 Serial publications from Table 1)	
The Internet in Africa	004.678096
(004.678 Internet + notation 09 Geographic treatment from Table 1 + notation 6 Africa from Table 2)	
Medical journalism	070.44961
(070.449 Journalism in specific subjects + notation 61 from 610 Medicine and health [it is a convention in Dewey to drop the final zero after the decimal point])	
Elementary mathematics curricula	372.7043
(372.7 Elementary education in mathematics + notation 043 Curricula from the add table under 372.3–372.8 Elementary education in specific subjects)	

HISTORY

The DDC was conceived by Melvil Dewey in 1873 and first published in 1876.^[8] Dewey developed the system as an economical alternative to the practice of organizing books first in broad categories, then by a fixed location within each category representing a physical shelf location. There were no relationships built within the categories except for order of acquisition. Dewey decided to use decimal numbers to represent the subject of books—under his system, books would be numbered according to their subject content instead of physical location. The system gets its name from Dewey’s surname plus the decimal element in its design. Wiegand,^[9] Comaromi,^[10] and Miksa^[11] discuss the early history of the DDC and influences on Melvil Dewey in his development of the system; Comaromi and Miksa also discuss the development and

features of subsequent editions of the DDC through DDC 18 and DDC 21, respectively.

Editions

The system is published in full and abridged editions, and in electronic and print versions. The DDC databases associated with the full and abridged editions are also available to licensees as an XML data file.

DDC 22, the latest English-language full edition of the DDC, was published in print in 2003;^[12] Abridged Edition 14, an abridged version of the full edition, was published the following year.^[13] The current full edition database contains nearly 27,000 numbers enumerated in the schedules, plus more than 13,000 additional synthesized numbers in the index. There are over 9000 table numbers listed in Tables 1 through 6; an additional 600 synthesized table numbers are included in the index.^[14] As mentioned previously, additional notation beyond that explicitly provided in the schedules, tables, and index can be synthesized to reflect a particular aspect of a topic.

The abridged edition is a logical truncation of the notational and structural hierarchy of the corresponding full edition. It is much smaller than the full edition—in print, it is one volume instead of four, and is aimed at collections of 20,000 titles or less. It also contains fewer tables than the full edition—Tables 1 through 4 instead of Tables 1 through 6. There are still opportunities for notational synthesis, but they are more limited than the full edition provisions for number building. The current abridged edition database contains nearly 5000 numbers enumerated in the schedules, plus an additional 400 synthesized numbers in the index. There are over 500 table numbers listed in Tables 1 through 4, plus nine additional synthesized table numbers in the index.^[15]

Electronic Versions of the DDC

The conversion of DDC to electronic form began in 1979 with the use of a computer-based photocomposition system to produce DDC 19. Five years later in 1984, Forest Press commissioned Inforonics, Inc., to develop a database and online system to support the continuing development and publication of the DDC.^[16] The project and resulting system become known as the Editorial Support System, or ESS. John Finni, the chief programmer from Inforonics, and Peter Paulson, the executive director of Forest Press from 1985 to 1998, envisioned that DDC data would also be used in classifier-assistance tools and in end-user retrieval systems. In 1989, the ESS was used by the Dewey editorial team to produce DDC 20. Electronic Dewey was released by OCLC Forest Press 4 years later. Electronic Dewey marked the start of classifier access to machine-readable classification data. The software ran on a personal computer and provided access to

the schedules, tables, Relative Index, and Manual of DDC 20 on CD-ROM. For schedule numbers, Electronic Dewey also provided up to five frequently used Library of Congress subject headings (LCSH) and a sample bibliographic record for the most frequently occurring heading.

A new Microsoft Windows®-based version of the software, Dewey for Windows, was released in mid-1996 at the same time as the publication of DDC 21. Dewey for Windows was based on the DDC 21 database and included significant enhancements to the user interface.^[17] The Windows version included statistically mapped LCSH and selected LC SH editorially mapped to DDC numbers. Dewey for Windows was issued annually through 2001.

In June 2000, WebDewey, a Web-based version of DDC 21, was released by OCLC as part of the Cooperative Online Resources Catalog (CORC) system. The CORC project grew out of the work of OCLC researchers to develop automated tools for finding, harvesting, and classifying electronic resources. In 2002, WebDewey and Abridged WebDewey, the latter a Web-based version of Abridged 13, became available in the OCLC Connexion cataloging service. These services replaced Electronic Dewey and Dewey for Windows.

The latest full and abridged versions of the DDC are available in the Connexion service. WebDewey and Abridged WebDewey incorporate all changes to the print editions, plus additional index terms and built numbers, and many other enhancements.

WebDewey features^[18] include:

- Regular database updates incorporating the latest changes to the DDC (new developments, new built numbers, and additional electronic index terms).
- Updated mappings to DDC 22 from the OCLC publication, *People, Places & Things*.^[19]
- Thousands of LCSH that have been statistically mapped to Dewey numbers from records in WorldCat or intellectually mapped to Dewey numbers by the DDC editors.
- Thousands of Relative Index terms and built numbers not available in print.
- Links from mapped LCSH to the LCSH authority records.
- Selected mappings from Medical Subject Headings (MeSH).

Abridged WebDewey features^[20] include:

- All content from Abridged Edition 14, including regular updates.
- LCSH that have been intellectually mapped to Dewey numbers by DDC editors, including mappings from the OCLC publication, *Subject Headings for Children*.^[21]
- Links from mapped LCSH to the LCSH authority records.

- Mappings between abridged Dewey numbers and subject headings from H.W. Wilson's *Sears List of Subject Headings*.^[22]

One by-product of the development of the DDC Web-based versions was the generation of a suite of XML representations of DDC data. The XML representations are used by OCLC in products and services and distributed to translation partners, research partners, and other licensed users. The proprietary XML representations are scheduled to be replaced by ones based on the MARC 21 formats for Classification and Authority data. The conversion is being undertaken in conjunction with the development of a new version of the ESS. In the new ESS, the record format used for schedule, table, and Manual data will be based on an enhanced version of the MARC 21 Format for Classification Data. The record format used for Relative Index headings and for mapped headings from other vocabularies will be based on an enhanced version of the MARC 21 Format for Authority Data. The MARC 21 representations of the files will also be available in XML.

Emerging data models for representing knowledge organizations schemes, e.g., Simple Knowledge Organization System (SKOS), may provide new opportunities for publishing, linking, and sharing classification data on the Web. Panzer^[23,24] identifies several issues that must be addressed before the DDC can be transformed fully into a Web information resource, including the design of Uniform Resource Identifiers and modeling DDC in SKOS.

DEVELOPMENT

Since July 29, 1988, OCLC has owned all copyright rights in the DDC and funds the ongoing development of the system. The Dewey editorial office has been headquartered at the Library of Congress since 1923, and is physically located in the Dewey Section.^[25] Dewey numbers have been assigned to works cataloged by the Library of Congress since 1930; classifiers in the Dewey Section are the primary assigners of Dewey numbers at the Library of Congress. Having the editorial office in close proximity to a key user group assists the editors in detecting emerging topics and shifts in viewpoints and terminology.

The DDC is continuously developed and updated by an editor in chief and four assistant editors. The editors study the distribution of topics in WorldCat to determine literary warrant (the existence of a certain level of literature on a topic) for updates—they also monitor the subject literature, news feeds, and other information resources, plus consult with users.

All changes to the DDC are reviewed by the Decimal Classification Editorial Policy Committee (EPC), a

10-member international advisory board whose main function is to advise the DDC editors and OCLC on matters relating to changes, innovation, and the general development of the DDC. The committee is a joint committee of the American Library Association and OCLC and has been in continuous existence in its present form since the early 1950s. Current EPC members represent academic, national, public, school, and special libraries and come from Australia, Canada, South Africa, the United Kingdom, and the United States. In addition, current translation partners serve as corresponding members of EPC—they receive all draft proposals for comment at the same time as EPC members.

TRANSLATIONS

Over the life of the system, the DDC has been translated into over 30 languages. Translation activities and international use prior to acquisition of Forest Press by OCLC in 1988 are summarized in Downing and Yelland^[26] and Holley;^[27] later activities are discussed by Chan and Mitchell,^[28] Beall and Couture-Lafleur,^[29] Knutsen,^[30] Heiner-Freiling,^[31] and Beall.^[32] Since 1988, authorized translations of the full and abridged editions of the DDC have been published in the following languages: Arabic, French, German, Greek, Hebrew, Icelandic, Italian, Norwegian, Russian, Spanish, Turkish, and Vietnamese. MelvilClass, the German counterpart to WebDewey, is an up-to-date version of the German translation of DDC 22. Other Web versions are currently under study. Current versions of the top-level summaries of the DDC have been translated into Arabic, Chinese, Czech, French, German, Hebrew, Italian, Norwegian, Portuguese, Russian, Spanish, Swedish, and Vietnamese. A project is under way in South Africa to translate the DDC Summaries into the ten official languages of South Africa besides English.

OCLC enters into agreements with recognized bibliographic agencies around the world to produce localized representations of the DDC in which classes remain interoperable with the English-language edition on which the translation is based. Translations are localized with examples and terminology appropriate to the country/language group, and are often supplemented by interoperable expansions (e.g., a deeper representation of a geographic area than found in the English-language full edition).

The following example illustrates the principle of interoperable expansions. The German translation of Table 2 contains expansions for several areas; the expansion for—43551 Regierungsbezirk Köln is shown below. The English-language version of the development for —43551 Regierungsbezirk Köln is a logical abridgment of the German version. In the English-language version of Table 2, only the categories shown in bold are listed.

—43551	Regierungsbezirk Köln
—435511	Aachen
—435512	Kreise Aachen, Heinsberg, Düren, Euskirchen
—4355122	Kreis Aachen
—4355124	Kreis Heinsberg
—4355126	Kreis Düren
—4355128	Kreis Euskirchen
—435513	Rhein-Erft-Kreis
—435514	Köln
—435515	Leverkusen
—435516	Rheinisch-Bergischer-Kreis, Oberbergischer Kreis
—4355163	Rheinisch-Bergischer-Kreis
—4355167	Oberbergischer Kreis
—435518	Bonn
—435519	Rhein-Sieg-Kreis

Research projects are under way on models for mixed Norwegian-English and Swedish-English translations of the DDC,^[33] and on multilingual presentations of the DDC.^[34]

Translations enrich the terminological base of the DDC, and extend the specificity of the system in the form of interoperable expansions and additional synthesized numbers. Translations also spur additional categorized content being associated with the DDC.^[35] Translation partners bring a rich diversity of viewpoint to the DDC that often results in improvements to the English-language standard edition.^[36]

MAPPINGS

Mappings between Dewey and other knowledge organization systems enrich the vocabulary associated with DDC numbers, and permit the use of the DDC as a switching system. Current services plus a host of research projects make use of such mappings for a variety of applications.

The electronic versions of the DDC contain selected mappings between Dewey numbers and three standard subject headings lists—LCSH, MeSH, and H.W. Wilson's *Sears List of Subject Headings*. The last represents the longest continuous mapping between the DDC and a subject heading systems. Dewey numbers first appeared in the 4th Ed. of *Sears* in 1939.^[37] They were dropped in the 9th Ed. of *Sears*,^[38] reappeared again in the 11th Ed.,^[39] and have continued through the 19th Ed.^[40] The mappings between abridged Dewey numbers and *Sears* headings are created at H.W. Wilson under an agreement with OCLC, and are included in various products and services offered by OCLC and H.W. Wilson.

The Dewey editors have long consulted LCSH and MeSH as sources of terminology for the DDC; terminology from both systems is also mapped to the DDC. The OCLC publications *Subject Headings for Children and People, Places & Things* are lists of LC subject headings with corresponding DDC numbers. The publications function as tools for end users and catalogers and supply

vocabulary for the DDC database. Both include subject heading-DDC number pairs statistically derived from WorldCat. Vizine-Goetz^[41] describes the general processes used to map LCSH terminology, including statistical mapping. Ongoing access to LCSH mappings is through WebDewey services.

In 2008, the Dewey editors began a project to map DDC numbers to the BISAC (Book Industry Standards and Communications) subject headings.^[42] The project is part of OCLC's Next Generation Cataloging pilot, which captures publisher and vendor metadata and enhances it for the mutual benefit of library and publishing industry partners.^[43] The mappings are used to add Dewey numbers to publisher metadata records that contain BISAC codes, and BISAC subject headings to bibliographic records that contain DDC numbers.

Translation partners and other groups are also linking general terminology lists with the DDC.—> In the CrissCross project, headings from Schlagwortnormdatei (SWD), the German subject heading authority file, are being mapped to Dewey numbers (to date, 58,000 headings have been mapped).^[44] At the Italian National Central Library in Florence, work is under way to map Dewey numbers to Nuovo Soggettario, the Italian subject heading list.^[45,46] The Spanish translation of *Sears List of Subject Headings* also includes mapped Dewey numbers.^[47]

There are also concordances being developed between Dewey and other classification systems. The Library of Congress's Classification Web system includes statistical correlations among LCSH, Library of Congress Classification (LCC), and DDC based on the co-occurrence of the three in Library of Congress bibliographic records. The National Library of Sweden has developed a mapping between Sveriges Allmänna Biblioteksförning (SAB), the Swedish classification system, and the DDC as part of an exploration to consider a Swedish translation of the DDC.^[48]

Several concordances between the Universal Decimal Classification (UDC) and the DDC have been developed. For example, the Czech National Library has built a concordance between UDC and DDC for the purposes of collection assessment.^[49] McIlwaine and Mitchell are experimenting with a concordance between the Class 2 Religion in the UDC and 200 Religion in the DDC as a method of presenting a chronological/regional view of religion in the DDC similar to the updated one found in the UDC.^[50]

APPLICATIONS AND RESEARCH

The DDC is perhaps most familiar to users as the classification portion (Arabic numerals punctuated by a decimal point after the first three digits) of a call number used to label physical objects in libraries. The classification

portion of a call number is one manifestation of Dewey; the underlying DDC data and associated terminologies are used for a variety of applications beyond physical shelf location.

The first and most well-known research effort to incorporate DDC data into an end user retrieval system was the DDC Online Project led by Markey.^[51] Markey's team built an experimental online catalog, Dewey Online Catalog (DOC), that included data from the DDC schedules and Relative Index. The DOC system provided new subject searching capabilities not available in online catalogs, e.g., subject indexes enriched with terminology from the DDC schedules and Relative Index, and features to broaden or narrow searches using the DDC hierarchy. Other notable research projects that use DDC-based search strategies are the Renardus Service^[52] and the High Level Thesaurus (HILT) project.^[53]

The Renardus project developed a pilot Web-based service that enabled searching and browsing of subject gateway services from Denmark, Finland, Germany, the Netherlands, Sweden, and the United Kingdom. To enable browsing across the gateways, the local classification systems used in the gateways were mapped to a common classification system that could function as a switching language and browsing structure. The DDC was chosen as the common scheme. The project developed a mapping tool that allowed the participating gateways to specify the level of match between the local scheme and DDC.

Like Renardus, the HILT project is investigating and developing solutions for subject searching and browsing across multiple schemes and information environments. The DDC is used as a central spine to which collection descriptions are mapped. In the HILT II pilot service, user queries are matched to DDC captions, Relative Index terms, and mapped terminology; DDC caption hierarchies are displayed in search results to provide context for matched terms. When a user selects a result, the service returns a list of collections to search.

These systems are exceptional in their integration of DDC data into the search process. As Markey notes, "To this day, the only way in which most online catalog users experience classification online is through their OPACs shelflist browsing capability."^[54] Even so, the value of classification-based browsing has not gone unnoticed by users and developers of online catalogs. Many online catalog redesign projects include a requirement for a virtual shelf-browsing feature.

The approval of additional MARC 21 fields for DDC numbers in the bibliographic format may provide new opportunities for using DDC data in end-user and classifier systems. The 083 field (Additional DDC Number) can be used to code additional DDC numbers, including internal and external table numbers, for subject access.^[55] The 085 field (Synthesized Classification Number Components) traces the components of a synthesized number. Beall^[56] gives several examples of 083 and 085 fields and

discusses how the data can help libraries make full use of the DDC for retrieval.

Liu^[57] investigated the feasibility of decomposing DDC synthesized numbers in the 700s. He concludes that synthesized numbers can be decomposed automatically in all DDC classes and suggests that bibliographic records could be enhanced with additional indexing vocabulary based on the component parts of a number. Following Lui, Reiner^[58] is developing software to decompose DDC numbers assigned by the German National Library. The German National Library began assigning Dewey numbers to resources in its collection in 2004. The goal of this research is to develop software to automatically assign class numbers. It remains to be seen whether the MARC 085 field will stimulate new investigations into decomposition and automated number assignment.

The Library of Congress is employing a semi-automated approach for DDC number assignment. The "AutoDewey" software takes advantage of places where the LCC and DDC schedules for literature are similar enough to facilitate mapping between the two schemes. The software suggests DDC numbers based on the LCC number chosen by the cataloger for the work in hand.^[59] Where one-to-one mapping is possible, AutoDewey assigns DDC numbers automatically, based on the LCC number. When direct mapping is not possible, the cataloger must often choose a literary form (poetry, drama, and fiction); when the literary periods of LCC and DDC do not match, the cataloger must also choose a literary period. Almost 2400 DDC numbers were assigned in 2007 using AutoDewey, and 5105 numbers were assigned in 2008. The software was developed by the Library of Congress.

OCLC has taken a different approach with the beta service Classify.^[60] The service provides summaries of classification data (DDC, LCC, and NLM) for FRBR-based groups of WorldCat records. All summaries include the most frequently used number based on holdings and the most recently assigned class number based on OCLC record number; many also include Dewey edition information. The service supports the assignment of classification numbers for books, DVDs, CDs, and many other types of materials. Classification data is accessible through a user interface and a Web service.

Previously, in the research phase of the CORC project, OCLC introduced tools to help users assign DDC class numbers. The tools, now available in Connexion, consist of software that automatically generates DDC numbers for Web resources and a feature to apply authority control to Dewey numbers. Despite attempts to optimize the content of classification records for automated classification using the Scorpion software, fully automatic classification remains an unrealized goal.^[61,62]

The DDC is also being used for collection analysis and assessment. In the WorldCat Collection Analysis service, DDC numbers are mapped to the OCLC conspectus to enable libraries using multiple classification schemes to

analyze their collections as a whole.^[63] At the British Library, the DDC has been used in a pilot project to assess the library's collections in support of higher education in the United Kingdom.^[64]

CONCLUSION

A rich set of tools is critical for knowledge representation and access in an information environment in which information flows freely in all formats across national and linguistic boundaries. Knowledge organization systems such as the DDC have a yet-to-be-fully-exploited role to play in the current and future environment. The Dewey Decimal Classification—with its well-defined categories, well-developed hierarchies, rich network of relationships among topics, worldwide use, language-independent representation of concepts, interoperable translations, and mappings to other subject schemes, plus the large amount of categorized content already associated with the system—holds promise in a variety of applications beyond its familiar role as a shelf location device. The success of Dewey as a tool in current and future environments will depend on ubiquitous and convenient availability of the system in a variety of formats for experimentation and use, continued (direct and automatic) application of Dewey numbers to content, aggressive association of the system with a wide variety of terminological resources, and continuous updating and development of the system by the editorial team in partnership with the worldwide community of Dewey users.

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Digital Content Licensing

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Abstract

Content licensing primarily concerns the licensing of property, and impacts legal rights under diverse bodies of local, national, foreign, and international law. Besides copyright law, content licensing may concern, depending upon the jurisdiction, the author or creator's "moral rights," "neighbor rights," lender's rights, defamation, privacy, publicity, pornography and obscenity, international trade, exports and technology transfer, privacy, trademark, commercial codes, and employment law, etc. Commercial or contract law enters in as well in connection with such issues as formation, interpretation, warranties, and remedies for breach. Choice of law and choice of forum are issues as well in our present global marketplace. Thus, content licensing is a complex legal subject necessitating review of the applicable law both creating intellectual property rights and governing contractual agreements and licensing.

INTRODUCTION

Content licensing primarily concerns the licensing of property, which itself consists of certain legal rights. Besides copyright law, content licensing takes place within the context of rights and obligations stemming from an array of local, national, foreign, and international laws. Such law may concern author or creator's "moral rights," "neighbor rights," lender's rights, defamation, privacy, publicity, pornography and obscenity, international trade, exports and technology transfer, privacy, trademark, commercial codes, and employment and contract law, etc.

To understand content licensing, copyright and other law must be juxtaposed with the law governing the formation, interpretation, warranties, and remedy for breach of contract. The issues are complicated by choice of applicable commercial law. While it is always prudent to consult an attorney with respect to negotiating, drafting, and litigating any contract, this is especially true with respect to the technical field of copyright law. Consequently, the topics and issues discussed in this entry are for informational purposes only and should not be relied upon in lieu of consultation with competent legal counsel.

WHAT IS A LICENSE?

A license is a contract, not necessarily in writing, in which one party (the licensor) transfers rights to use certain property to a user (the licensee) for some limited period of time or until some event. A permanent transfer of rights is an assignment or sale, even when the licensor retains other related rights (e.g., the transfer of rights to publish in print but not in any electronic medium). With respect to

intellectual property, a licensor may, but need not be, the creator, or even the owner, of the work being transferred.

By entering into license agreements, the parties seek to establish a mutually beneficial relationship in which they exchange certain promises or consideration (payment), set forth their respective rights and obligations, and provide for redress in the event of breach (i.e., a failure of one or more of the parties to meet their obligations). Besides license to use property for a given term, the licensee may seek certain warranties (guarantees) from the licensor, that the person has title or the rights to the content being licensed, and that additional payments or liability to third parties will not result from licensee's use of the property. As used in this entry, content licensing refers to license agreements affecting informational content and the software necessary to access that content.

One principal difference between licensing content and purchasing information in a print publication is that the "first sale" doctrine generally does not apply.^[1] The first sale doctrine cuts off the right of owners to seek additional remuneration each time a work is subsequently sold or lent to another.^[2]

WHAT RIGHTS MAY BE ADDRESSED IN A LICENSE AGREEMENT?

Although it may be said that all property consist of rights, in the case of intellectual property (^[2] at 813) such property owes its existence to rights enumerated in the law, and often by statute. The right to license intellectual property interests may potentially originate in the law of copyright, neighboring rights, moral rights, and electronic rights, etc. Several of these respective sources of

intellectual property rights frequently addressed in content licensing agreements are considered below.

Copyright Law

In the United States, such rights are found in Title 17 of the United States Code (USC) § 106 and include rights to:

1. Reproduction;
2. Adaptation (or “derivative works”);
3. Distribution (including “sale or other transfer of ownership, or by rental, lease, or lending”);
4. Public performance (limited to “literary, musical, dramatic, and choreographic works, pantomimes, and motion pictures and other audiovisual works”);
5. Public display (limited to “literary, musical, dramatic, and choreographic works, pantomimes, and pictorial, graphic, or sculptural works, including the individual images of a motion picture or other audiovisual work”); and
6. Digital audio transmission (limited to sound recordings).

In addition, 17 USC § 201 (c), sets forth rights of publishers of “collective works” in relation to the rights of contributing authors. Specifically, publishers of collective works have the right to publish contributed articles in “revisions” of the original collected work (e.g., a second edition of the same encyclopedia) and in any “later collective work in the same series” (e.g., a subsequent reprint of an article in the *same* journal). In the European Union, the EU Database Directive provides protections for publishers of databases.^[3]

Enumerated rights, such as those expressed in U.S. federal copyright law, form the basis for property rights assigned pursuant to licensing agreements. Similar rights may also be found in the common law of the various U.S. states and the law of foreign nations. Each of these rights may serve as the basis for an assignable property right and may further be limited in seemingly infinite variations by terms set forth in the licensing agreement (by time, jurisdiction, medium, types of uses, etc.).

Neighboring Rights

Besides copyright law, additional rights affecting licensing agreements stem from other law, including state law and the laws of foreign nations. For instance, many civil law jurisdictions such as France (and California, alone among U.S. jurisdictions), provide for neighboring rights (*droit de suite*), or rights designed to compensate artists for subsequent resale and reproduction of their works (traditionally, the law presumed that the reproduction rights to the works of fine artists had been transferred to the buyer of that painting, sculpture, etc., whereas the rights to literary works had not).^[4] In California, *droit de suite* is

applied through the California Resale Royalties Act.^[5] The Berne Convention, which was adopted by the United States in 1989, recognizes *droit de suite*. Unlike many other rights protected by the treaty, *droit de suite* requires that an author’s country recognizes the right. In addition the convention’s provision recognizing the right may not be “self-executing” under U.S. law (i.e., applicable without enabling legislation).^[6]

As a result of neighboring rights, licensees often seek express warranties in licensing agreements whereby the licensor warrants that the person not only has the right to lease or title to the licensed property, but that licensed use (or acquisition) of such property by the licensee (or purchaser) will not result in liability as the result of neighboring rights that any third (noncontracting) party may have. In addition, licensees often require an indemnification clause in the agreement whereby the licensor agrees to fully compensate the licensee as a result of liability to third parties.

Moral Rights

In many countries, under the Berne Convention, and to some extent in the United States, but only with respect to visual artists, there is a distinctive category of rights known as “moral rights” or *le droit moral*. This bundle of rights varies by legal jurisdiction, but can generally be enumerated:

1. Attribution or paternity (including the rights to be identified as the author, free from false attribution, and to publish anonymously or pseudonymously);
2. Integrity (to prevent derogatory substantive changes to the work);
3. Disclosure (or nondisclosure), reconsideration, and withdrawal (from circulation); and
4. Association (or disassociation of the work from products or institutions distasteful to the author or artist).^[7]

In many jurisdictions, moral rights are noneconomic rights. Whether or not such rights in property can be alienated, waived, or can survive their authors and creators depends upon the law of the jurisdiction being applied. The Berne Convention recognizes rights of attribution and integrity, but it leaves it up to signatory members how to protect such rights. Furthermore, the convention does not require such rights to be inalienable, “unwaivable,” or to survive the death of the author or creator.^[8] Under the convention, foreign authors and artists enjoy the same rights as native citizens in nations adhering to the convention.

Under the U.S. Visual Artists Rights Acts of 1990, now 17 USC § 106A, moral rights are addressed with respect to “visual art,” but only with respect to rights of attribution and integrity. In addition to U.S. federal law, several states have adopted moral rights, but to the extent such rights

concern the attribution and integrity rights of visual artists, state law is preempted by the federal statute.^[9]

France and Germany each represent yet two different conceptions of moral rights (in addition to the U.S. viewpoint). In France, moral rights are separate from economic rights, and consequently, cannot be alienated, and have no set term.^[10] In Germany, the duality of rights (economic and moral) is not recognized. Rather the approach is to prohibit the complete assignment or transfer of rights, and the term of the rights is set by statute.^[11]

The impact of moral rights on licensing agreements, to some extent, depends upon whether such rights may be waived, assigned, or limited under applicable law. Regardless of the validity of such limitations, however, licensees seek warranties that the licensor has not infringed upon any third party's rights and that the intended use per the agreement will not infringe upon such rights. In addition, the licensor may seek similar assurances that the licensee will not infringe upon any third party's moral rights (e.g., by removing attribution information, etc.). Per an indemnification clause, each party may also seek compensation for any liability resulting from infringements by the other.

E-Rights

With the development of the Internet and other information technologies, some have questioned whether "e-rights" constituted a new class of rights. While the U. S. Supreme Court decision in *New York Times v. Tasini* found that e-rights (in that case rights to republish the work of freelance journalists in a searchable database) do not automatically vest with print publishers, a closer reading reveals the real issue decided by the Court. That issue was whether, in that instance, the electronic database constituted a revision of the earlier collective, print work (which would favor the publisher, as an exception to infringement for "collective works" under 17 USC § 201 (c)), or a new work (which would favor the freelance journalists). Under 17 USC § 201(c), publishers of "collective works" acquire the right to reproduce and distribute a "particular collective work, any revision of that collective work, and any later collective work in the same series." The Supreme Court found that the database, which included many collective works (and not just a digital version of the original collective work), and provided access to each freelance article individually and separately, was indeed a new work.^[12] Thus, under *Tasini*, the issue is not whether e-rights are distinctive, but whether a database is considered a "revision," or falls within another exception for publishers of previous collective works under 17 USC § 201(c).

The Second, Ninth, and Eleventh Circuits have followed *Tasini*'s lead in utilizing traditional copyright analysis to determine rights in e-content. For example, in

Faulkner v. National Geographic Enterprises, Inc.,^[13] plaintiff authors sued National Geographic when it published a compilation of all previous issues in CD-ROM format, through which the original content appeared in its original context, albeit in a different medium. Like the *Tasini* court, the Second Circuit focused on whether the CD-ROM constituted a compilation, or a revision of a compilation, within the meaning of § 201(c) of the Copyright Act. Because the CD-ROM presented the "underlying works . . . in the same context as they were presented . . . in the original versions," which had not been the case in *Tasini*, the Second Circuit held that the CD-ROM was a "privileged revision" (^[13] at 38). In similar litigation also involving National Geographic, the Eleventh Circuit very recently reached the same result using a § 201(c) analysis.^[14] The Ninth Circuit looked to §§ 101 and 106 of the Copyright Code in *Perfect 10 v. Amazon.com*, which involved slightly different, but similar, issues arising out of thumbnail images and redirected access to copyrighted images through Google's Image Search feature.^[15] Using traditional analysis, the court found that thumbnail images were "fair use." Thus, these post-*Tasini* courts have not treated e-rights as separate or distinct, but have continued to apply traditional copyright analysis.

E-rights, to the extent that they represent rights in media created by new technologies, serve as a reminder of the importance of carefully identifying (with the assistance of competent legal counsel) what rights are subject to a licensing or assignment agreement. Careful attention needs to be given to new and unforeseen media that may result from new technologies. It follows that the greater the breadth of rights being licensed or assigned, the greater the compensation that may be expected. To assure the rights are being discretely bargained for, and thus do not include non-enumerated rights, each right or use should be identified with corresponding consideration, and a statement as to who holds the unnamed rights (including rights in any new media) should be included (^[7] at 103–104).

APPLICATION OF COMMERCIAL LAW

In addition to law governing the creation of intellectual property rights (such as copyright), licensing transactions are governed by commercial law (i.e., law governing contracts). Other law may apply as well, such as consumer protection statutes, labor relations codes, professional codes of conduct, bankruptcy and debtor–creditor law, and trade law. Because it is generally in the interest of commercial transactions to promote predictability and uniformity, uniform and model commercial codes are important as sources for law governing licensing transactions.

What Law Applies

In the United States, state law largely governs contract and commercial law through a series of uniform acts known as the Uniform Commercial Code (UCC), promulgated by the National Conference of Commissioners of Uniform State Laws (NCCUSL). For transactions involving “computer information,” a special uniform or model act was prepared in 1999, known as the Uniform Computer Information Transactions Act (UCITA). Amendments to UCITA were introduced and considered in 2000 and 2001; in 2002, NCCUSL approved the final revisions and amendments to UCITA and recommended it for enactment in all the states.^[16] As of summer 2007, only Maryland and Virginia have adopted the act.^[17] UCITA is controversial, and Iowa, North Carolina, West Virginia, Idaho, Vermont, and New York have passed or introduced legislation refusing to apply UCITA to contracts with their citizens.^[18] In addition, a committee of the ABA has recommended that UCITA be rewritten.^[19] In spite of UCITA’s widespread rejection, given the need for a uniform law and the impact of the UCC, not only in the United States, but also on commercial codes throughout the world, UCITA (or its progeny) may yet become an important source for the construction and interpretation of digital licensing agreements throughout the world. If nothing else, UCITA represents an important effort to address the multitude of issues pertaining to content licensing and computer information transactions.

To the extent that a U.S. state has not adopted UCITA, then often UCC Article 2 applies. In varying degrees, state courts in Connecticut, Kansas, Massachusetts, Georgia (applying Michigan law), Nebraska, New York, and Tennessee have applied UCC Article 2 to computer software licenses. Likewise, federal courts in California, Florida, New Hampshire, New Jersey, and Pennsylvania have interpreted the laws of their respective states to apply UCC Article 2, and federal courts in Michigan and Kansas have applied Illinois and Wisconsin UCC law, respectively.^[20] Because many software licenses involve the licensing of both goods (the software product) and services (technical, customer support, and client-specific programming), many courts weigh whether the services or the goods predominate.^[21] The question of whether software has been designed as a service (to which UCC Article 2 has been found not to apply)^[22] or whether it is a product customized for a particular user or includes installation and other services (to which the UCC has been applied)^[23] is one that requires careful weighing of all the pertinent facts. In addition to UCC Article 2, Article 2A, governing leases, has been adopted in 49 states and the District of Columbia. The sole state yet to adopt Article 2A is Louisiana, which has also declined to adopt Article 2.^[24] Because of the similarity of leases to licenses in terms of transfers of rights or use and possession, but not ownership, one may speculate that UCC Article 2A will become

the dominant law governing content licensing agreements (assuming UCITA is not widely adopted).

In August of 2002, proposals to amend Articles 2 and 2A of the UCC to exclude “information” from the definition of “goods” were submitted to the NCCUSL.^[25] Such a definition of “goods” would mean that neither Article 2 nor 2A would apply to most information transactions. Somewhat surprisingly given the historical resistance of UCC Article 2 to amendment, the proposed changes were adopted in 2003. Currently, in defining “goods,” Articles 2 and 2A both specify that “[t]he term does not include information.”^[26] The Official Comment to Article 2 acknowledges, however, that transactions often include both goods *and* information, and that it will ultimately be up to courts to determine whether, and to what extent, Article 2 should apply.^[27] As of summer 2007, Oklahoma is the only state that has incorporated this change into its commercial code.^[28]

At present there is no treaty or convention expressly addressing computer information transactions in the same manner as UCITA. The European Union’s EC Legal Advisory Board has expressed considerable hesitation and reluctance to fashion their own law after UCITA. Principally, concern has been expressed over whether UCITA, even if adopted, will be done so on a uniform basis because of some of its controversial provisions and approach: acceptance of click-wrap agreements (via electronic agents), choice of law, focus on software (rather than other forms of intellectual property), and the acceptance of denial of access and electronic self-help as remedies for breach.^[29]

The UNCITRAL Model Law on Electronic Commerce addresses admissibility of electronic documents, electronic signatures, and “data messages” pertaining to the sale of goods, but not on the licensing of copyright. Another law that may apply is the Convention on Contracts for the International Sale of Goods (CCISG) (however, unlike the UCC, the convention does not apply to “goods purchased for consumer purposes” meaning for “personal, family, or household use”).^[30] In addition, the European Directive on Unfair Terms in Consumer Contracts,^[31] the European Data Directive,^[32] and the European Directive on Legal Protection of Databases may also apply.^[33]

Writing Requirement and Requirements of Formation

Under UCITA § 201, the licensing of digital rights for transactions involving payment of \$5000 or more generally requires written agreement. With respect to transfers in ownership, U.S. federal copyright law under 17 USC § 204(a) requires written contracts. UCITA § 201 provides for exceptions to the written requirement, which exceptions are common to commercial contract law. Generally, no writing is needed when

1. The contract term is one year or less;
2. Performance has been tendered and accepted;
3. Such agreement has been admitted under oath;
4. Written confirmation of a contract is received between merchants and no objection is made within a reasonable time.

In addition to the requirement that certain contracts be in writing, there are other requirements to the formation of a valid license agreement:

1. Parties intent and basis for remedy;^[34]
2. Agreement as to material terms;^[35]
3. When applicable, a valid offer and acceptance.^[36]

Official Comment 5 of UCITA § 202 clarifies that if there is disagreement as to the “scope” of the license, there is no contract.

Because of the utilization of “shrink-wrap” and “click-wrap” agreements” (i.e., agreements that are accepted by clicking “yes” on prompted display of a license agreement as part of the loading or use of software or a computer service), UCITA devotes considerable attention to the use of “electronic agents” to manifest acceptance of an agreement. Sections 107, 112, 207, and 208, recognize shrink- or click-wrap agreements. Click-wrap agreements are recognized through electronic agents, which are defined under § 102(a)(27) as “a computer program, or electronic or other automated means, used independently to initiate an action, or to respond to electronic messages or performances, on the person’s behalf without review or action by an individual at the time of the action or response to the message or performance.” In other words, it is possible to manifest assent or acceptance of an agreement through automated means without written signature. An example of acceptance by electronic agent is found in Official Comment 4 of UCITA § 206: “Officer dials the telephone information system using the company credit card. A computerized voice states: ‘If you would like us to dial your number, press “1”; there will be an additional charge of \$1.00. . . .’”

Shrink-wrap or click-wrap agreements are permitted under UCITA §§ 112, 113, 208, and 209 under the following conditions:

1. The parties had reason to know at the outset that terms would be proposed for later agreement.
2. There is an opportunity to review the terms before assent is given (this may be after payment is tendered).
3. There will be assent involving acts or inaction taken with reason to know that it will create an inference of assent.
4. If the party does not assent, it has a right to a return and refund of any price paid, which right is cost free in a mass-market case.

5. In a mass-market case, the terms are produced and assented to at or before the time of initial use of the software.

Notwithstanding the validity of shrink-wrap and click-wrap agreements or acceptance by electronic agents, UCITA § 206(a) does grant courts discretion to fashion a remedy where the acceptance resulted from “fraud, electronic mistake, or the like.”

Some state consumer protection statutes may differ from UCITA in terms of their signature or record-keeping requirements. UCITA does not alter these requirements, but rather provides states the latitude to specify which such statutes are to prevail over UCITA provisions in case of a conflict.^[37] State consumer laws enjoy special status (for preempting terms of licensing agreements) under UCITA.

Other laws may also recognize shrink- or click-wrap agreements. While UCC § 2-204(1) provides that “a contract for sale of goods may be made in any manner sufficient to show agreement, including . . . conduct by both parties which recognizes the existence of such a contract. . . ,” U.S. courts are divided as to whether shrink-wrap agreements are enforceable.^[38] UCC § 2A-204(1), governing leases, contains an almost identical provision to Article 2. The CCISG permits electronic agreements (without a writing) unless one of the contracting states specifically mandates a writing requirement by excluding the applicable provision of the convention.^[39]

Finally, although yet to be ratified by any country, the Hague Convention for Choice of Court Agreements (CCCA), provides a liberal standard of contract formation: “by any . . . means of communication which renders information accessible so as to be usable for subsequent reference.”^[40] Under this standard, almost any “click-” or “shrink-wrap agreement” concluded pursuant to the law of a signatory nation would be enforceable.^[41] However, the CCCA exempts contracts entered into for personal or household purposes (^[41] at Art. 2(1)).

Enforceability of Contractual Terms against a Fundamental Public Policy or Conflicting with Other Law

The Eighth, Ninth, and Federal circuits have recently looked at the enforceability of “no reverse engineering” clauses included in shrink-wrap or click-wrap agreements. Faced with claims that such terms violate public policy in that they prohibit fair use, courts have generally held that those who agree to such license terms are bound by them.^[42] Courts have also rejected the argument that “no reverse engineering” clauses are preempted by the Copyright Act, finding that the mutual assent and consideration required by a contract claim provide an “extra element” that makes the right asserted qualitatively different from

the rights protected under the Copyright Act.^[43] Absent a license term that prohibits it, however, the Ninth Circuit has held that reverse engineering constitutes fair use, privileged under § 107, when “there is good reason for studying or examining the unprotected aspects of a copyrighted computer program.”^[44]

Under UCITA, a license agreement (or other contract) in which any term “violates a fundamental public policy” may result in the court finding that the contract is unenforceable or limiting enforcement to the remainder of the contract.^[45] In Official Comment 3 to UCITA § 105, a “shrink-wrap license” prohibiting the licensee from ever criticizing the software is seen as problematic. On the other hand it is expressly noted that such a provision might be accepted in a negotiated license where the license pertained to software in the early stages of development, which had not been released to the general marketplace.^[46] In addition, courts may refuse to enforce or limit the enforcement of contracts or terms that are unconscionable (generally, terms that are very “one-sided”).^[47]

Besides considering public policy, UCITA provides for the preemption of federal law and state consumer protection statutes.^[48] Other state law does not preempt private license agreements (unless explicitly considered by the state when it enacts UCITA). This is important because copyright and other rights contained in state law, which may be broader than federal copyright law, consequently do not preempt contractual agreements under UCITA.

Of particular concern is whether licensors of digital content can extend their rights that would otherwise be limited with respect to applicable federal copyright law (state law, except for consumer law, is granted a lesser standing to preempt terms of the license agreement under UCITA § 105). The act attempts to balance a fundamental policy of contract law to enforce contractual agreements with “public interest in assuring that information in the public domain is free for all to use from the public domain and in providing access to information for public purposes such as education, research, and fair comment.”^[49] Having said this, there is no question that UCITA fundamentally advocates the enforceability of license agreements. “[I]t is clear that limitations on the information property rights of owners that may exist in a copyright regime, where rights are good against third parties, may be inappropriate in a contractual setting where the courts should be reluctant to set aside terms of a contract.”^[50] Indeed, courts are particularly reluctant to set aside negotiated (as opposed to “mass-market,” “shrink-” or “clip-wrap”) agreements.^[51]

With respect to “mass-market” transactions, Official Comment 3 of UCITA § 105 suggests that license terms prohibiting the making of multiple copies, use of information for commercial purposes, limiting the number of authorized users, or modification of the software or content are generally enforceable.^[52] However, terms in a “mass-market” agreement that “prohibit persons from

observing the visible operations or visible characteristics of software and using the observations to develop noninfringing commercial products, that prohibit quotation of limited material for purposes of education or criticism, or that preclude a nonprofit library licensee from making an archival (backup) copy would ordinarily be invalid in the absence of a showing of significant commercial need.”^[53] Additional provisions are suggested for the circumvention of technical measures protecting copyright for purposes of checking security and to provide for the “interoperability of computer programs.” Finally, “to the extent that Congress has established policies on fair use, those can be taken into consideration under [UCITA § 105].”^[54] Consequently, policy articulated in the legislative history of the fair use provisions of 17 USC § 107 may have bearing on the enforceability of terms in license agreements that otherwise restrict the application of “fair use.”

Like UCITA, UCC Article 2 has a section addressing “unconscionable contracts.”^[55] It does not, however, have a specific section addressing conflict with fundamental public policies or consumer protection statutes. However, the UCC does not necessarily restrict claims of aggrieved parties to breach of contract under the UCC. For example, it is possible to bring a claim for breach of warranty under the UCC in the same action as claims based upon violation of a consumer protection statute provided that the consumer protection claim is not simply a restatement of the breach of warranty claim.^[56] Likewise, UCC Article 2A, governing leasing, and now adopted in 49 states, addresses consumer protection statutes but does not conflict with “fundamental public policy.”^[57] Article 2A also addresses “unconscionable” leases and terms.^[58] The CCISG, unless otherwise noted therein, expressly does not address the “validity of the contract or any of its provisions. . . .”^[59] Consequently, enforceability of terms that may be in violation of a fundamental public policy or unconscionable is a matter to be determined under national or local law pursuant to choice of law rules.

Choice of Law and Forum

Choice of law and forum matter because the outcome of a particular dispute may rest on the discrepancies of the law between jurisdictions. Under UCITA § 109, the law governing any agreement is generally the law selected by the parties per the agreement. However, this does not apply to “consumer contracts” (i.e., between a licensed merchant and consumer) to the extent that this would affect the application of any state law (such as consumer law) pursuant to choice of law rules under UCITA (assuming the absence of agreement as to choice of law).

If the parties have not specified what law applies by agreement, then the law of the licensor’s jurisdiction applies if the contract called for electronic delivery of the product or information, and the law of the licensee’s

jurisdiction applies if a delivery was designated by a tangible medium. In any other instance, the law of the jurisdiction with the “most significant relationship to the transaction applies.” As a final caveat, for an international transaction in which choice of law has not been determined per the agreement, the law of a jurisdiction outside the United States only applies if a party located in the United States would have “substantially similar protections and rights” to those found under UCITA. As indicated in Official Comment 5, this does not mean “merely that the foreign law is different,” but rather the “differences must be substantial and adverse.” Under UCITA § 110, choice of forum, the place where litigation of a dispute will take place, is also left up to the parties unless the choice is “unreasonable and unjust.” Official Comment 3 indicates:

“Terms may be unreasonable in that they have no commercial purpose or justification . . . and their impact may be unjust if the term unfairly harms the other party. . . . On the other hand, an agreed choice of forum based on a valid commercial purpose is not invalid simply because it adversely affects one party, even if bargaining power was unequal.”

In essence valid commercial purposes, such as a party’s location, will justify choice of a particular forum.

For those states that do not adopt NCCUSL’s recently changed definition of “goods,” which now excludes “information” (see ^[25] and accompanying text), UCC Article 2 applies Article 1, § 1-301, to determine choice of law for digital content agreements. Like UCITA, the UCC distinguishes consumer from other types of transactions, but otherwise gives deference to the choice of the parties regardless of whether the jurisdiction selected has a “reasonable relation” to the transaction. However, for consumer transactions, the selected jurisdiction must bear a “reasonable relation” to the transaction, and may not deprive a consumer of any protection under their applicable consumer protection law. Regardless of whether the transaction is a consumer transaction, per § 1-301, a choice of law clause is “not effective to the extent that application of the law of the State or country designated would be contrary to a fundamental policy of the State or country” whose law would otherwise apply.

In the absence of UCITA, and once again assuming that “information” is not excluded from the definition of “goods,” UCC Article 2A may become the preferred uniform law for interpreting content licenses. Under Article 2A, choice of law and forum clauses for consumer leases are limited:

1. If the law chosen by the parties to a consumer lease is that of a jurisdiction other than a jurisdiction in which the lessee resides at the time the lease agreement becomes enforceable or within 30 days thereafter or

in which the goods are to be used, the choice is not enforceable.

2. If the judicial forum chosen by the parties to a consumer lease is a forum that would not otherwise have jurisdiction over the lessee, the choice is not enforceable.^[60]

Consequently, under either UCC Article 2 or 2A, applicable consumer law of the party who is a consumer will generally always apply. Indeed, under Article 2A, the law of the party who is a consumer will always apply.

Although only applying to commercial (and not consumer) transactions, the CCISG, applies if both of the parties (which must be in different countries) are located in contracting states (to the CCISG), or if the law of a contracting state applies through choice of law rules.^[61] Having said this, parties may, per the agreement, elect out of the application of the convention.^[62] Since the convention neither applies to consumer transactions nor addresses the validity or enforceability of contractual terms,^[63] choice of law rules of the jurisdiction where the dispute is adjudicated have to be applied for many issues relating to international transactions. For U.S. courts, choice of law questions are increasingly decided based upon “significant relationship” of the jurisdiction to the transaction (even if the UCC is not considered). Certain factual contacts are weighed to determine if such a relationship exists:

- The place of contracting;
- The place of negotiation of the contract;
- The place of performance;
- The location of the subject matter of the contract; and
- The domicile, residence, nationality, place of incorporation, and place of business of the parties.^[64]

In addition several policy considerations are weighed:

- Maintenance of interstate and international order;
- Relevant policies and government interests of the forum;
- Relevant policies of other interested states;
- Relevant interests of those states in the determination of the particular issue;
- Protection of justified expectations (of the parties);
- Basic policies underlying the particular field of law;
- Certainty, predictability and uniformity of result;
- Simplification of the judicial task; and
- Application of the better rule of law.^[65]

For EU countries, the issue of choice of law is governed by the Convention on the Law Applicable to Contract Obligations (adopted in 1960), which generally honors the choice of the contracting parties.^[66] If no choice has been made by the parties, the law of the country “most closely connected” which usually defaults to the domicile or place of business of the party “who is to effect the

performance” (i.e., deliver the licensed product) (^[66] at Art. 4). Once again, certain exceptions are made for consumer contracts (defined as pertaining to goods or services outside of the buyer’s profession (^[66] at Art. 5).

Warranties

Warranties are additional promises made by the parties, usually pertaining to ownership of/or rights to the property being licensed, capacity to contract, outstanding claims for infringement, etc. Warranties may be specified by contract, but there are always certain warranties addressed in the applicable governing law on contracts. Under UCITA § 401(a), a licensor, who is “a merchant regularly dealing in information of the kind warrants that the information will be delivered free of the rightful claim of any third person by way of infringement or misappropriation. . . .” For other licensors (although also applying to merchants who deal in information), the warranty is limited: “no person holds a rightful claim to, or interest in, the information which arose from an act or omission of the licensor, other than a claim by way of infringement or misappropriation, which will interfere with the licensee’s enjoyment of its interest. . . .”^[67] Additional warranties (that the information is not in the public domain and that no other party shares in rights to the information) are made in the event that an exclusive license is granted.^[68] Warranties are not made with respect to the infringement of rights pertaining to collective administration (e.g., rights obtained through collective bargaining), or with respect to compulsory rights (certain limitations on copyright under U.S. law).^[69] Neither do UCITA’s § 401 warranties apply to informational rights arising under foreign law (unless the contract expressly provides for warranties under the laws of other countries *and* the rights originate in countries “under a treaty or international convention to which the country and the United States are signatories”).^[70]

The warranties set forth in UCITA § 401 can be waived or modified by agreement, but only if by “specific language or by circumstances that give the licensee reason to know that the licensor does not warrant that competing claims do not exist or that the licensor purports to grant only the rights it may have.”^[71] In an electronic or automated transaction, the language has to be “conspicuous.”^[72] Merchants have the option of “quitclaiming” rights without any warranty.^[73]

UCITA also applies for express warranties (additional promises made by the licensor)^[74] and, with respect to software, an implied warranty of merchantability (i.e., “fit for the ordinary purpose for which programs of that description are used”).^[75]

For content licensing agreements, a key issue is always whether there is a warranty as to the accuracy of information. UCITA § 404 distinguishes between licensors who are merchants “in a special relationship of reliance with a

licensee,” who collect and compile previously non-published information, and other kinds of licensors (editors or “conduits” for informational content). Essentially, the former are required to exercise “reasonable care.” In determining whether a “special relationship of reliance” exists, several requirements are articulated in the Official Comments to § 404, which comments attempt to capture doctrines already set forth in U.S. case law:

- Licensor possesses “unique or specialized expertise;”
- Licensor is in a “position of confidence and trust with the licensee such that reliance on the inaccurate information is justified;”
- Licensor is in the business of providing the type of information that is the subject of the transaction;
- Information is personally tailored to the needs of the licensee.^[76]

In addition, to the UCITA warranties for accuracy, other duties may be imposed on professionals (lawyers, physicians, etc.) based upon the law of the respective jurisdictions of their practice. The exclusion from warranty under § 404(b)(1) is for “published informational content,” which is “informational content made available to the public as a whole or to a range of subscribers on a standardized, not a personally tailored, basis.”^[77] The policy behind this exclusion is discussed on Official Comment 3. b. Regardless of UCITA or the UCC, claims brought against information and news services have been made under negligence rather than contractual warranty theory, and courts have found First Amendment reasons for not imposing liability.^[78]

Published informational content is the subject matter of general commerce in ideas, political, economic, entertainment or the like, whose distribution engages fundamental public policy interests in supporting and not chilling this distribution by creating liability risks. This Act treats published informational content that is computer information analogously to print newspapers or books which are not exposed to contractual liability risks based on mere inaccuracy; treating the computer informational content differently would reject the wisdom of prior law. Creating greater liability risk in contract would place an undue burden on the free flow of information. Once again, UCITA attempts to capture existing law as defined in the courts.^[79]

In addition to warranties concerning noninfringement, express warranties, and accuracy of information, UCITA also addresses implied warranties for compatibility with computer systems dependent upon whether the licensor “has reason to know any particular purpose for which the computer information is required. . . .”^[80]

Like UCITA, both UCC Articles 2 and 2A provide for warranties from infringement, express warranties and implied warranties of merchantability. Instead of providing for an implied warranty addressing system integration,

UCC Articles 2 and 2A each have an implied warranty for a “particular purpose.”^[81] However, there is a material difference with respect to UCC Articles 2 and 2A pertaining to warranties from infringement. Generally, Article 2 just warrants “rightful” title, and freedom from security interests, encumbrances, and liens.^[82] Article 2A, pertaining to leases grants freedom from interference with enjoyment (otherwise known as “the warranty of quiet enjoyment”) resulting from “a claim to or interest in the goods not attributable to the lessee’s own act or omission. . . .”^[83] The distinction is that “quiet enjoyment” includes the right to *use* and possess property without infringing upon third parties, whereas good title only refers to infringement as a result of the transfer of ownership (e.g., a transfer of title to a car may legitimately transfer ownership without guaranteeing that the car may be driven on state roads). This is a clear instance in which UCC Article 2A favors licensees. One can imagine litigation over whether Article 2A should apply to a transaction because the licensee argues that a particular use of the licensed information is covered under § 2A-211’s warranty of enjoyment. Like UCC Article 2, the CCISG requires transfer of good title (for intellectual property this warranty is limited to infringements of which the licensor knew or should have known),^[84] but there is no reference to a warranty for quiet enjoyment.

Like UCC Article 2A, UCITA warrants the “enjoyment” of the licensee’s interest from competing interests or claims “which arose from an act or omission of the licensor. . . .”^[85] Merchants who “regularly deal[] in information” have an unrestricted warranty of delivery that is free of third party claims for infringement or misappropriation (i.e., the infringement does not have to result from acts or omissions of the licensor). However, this higher standard for certain merchants does not encompass warranties of quiet enjoyment (which, for such merchants, still requires acts or omissions on their part).^[86]

However, since UCITA does not limit the warranty on merchants who “regularly deal[] in information” to their infringements resulting from *their own acts and omissions*, it provides better protection in some instances for licensees than Article 2A, but without explicit reference to enjoyment. Consequently, whether UCITA, the CCISG, UCC Article 2, or UCC Article 2A applies can have significant impact on the outcome of a dispute.

To illustrate this difference, imagine that a business subscribes to a database of fine art images from a commercial vendor who regularly sells databases of images from art museums and galleries. The license agreement says nothing about permissible uses of the images, and the initial subscription or access to images does not constitute infringement. The subscribing business uses an image as a background for the Web pages of its Web site. The owner of the image, a museum, informs the subscribing business that it is infringing on the museum’s rights by using the image on its Web site. Apparently, the museum had

licensed the images to the database vendor for educational purposes only, and the vendor was expressly obligated under its agreement with the museum to place a statement as to the educational limitation in any sublicense agreements, such as the one with the business (but failed to do so). The subscribing business to the database seeks redress from the database vendor for breach of implied warranty. Under UCITA § 401(b) and UCC § 2A-211(a), the database vendor may be held in breach of his warranty for quiet enjoyment. However, under both UCC § 2-312 and the CCISG Article 42, the database vendor is only in breach if it does not have good title, and it is unclear in this instance whether the database vendor’s failure to notify the subscribing business of any limitations for “educational purpose” constitutes failure of good title, especially since there are other permissible uses for the database. Since this section of UCC Article 2 has been applied to software,^[87] a legitimate issue is raised as to the potential for disparate treatment under the different uniform laws. This disparity may lead to “forum shopping” and greater use of contractual provisions that select the applicable law.

Remedies—Electronic Self-Help and Denial of Access

Although UCITA generally avoids functioning as a consumer protection statute, it does, in its final draft, completely ban the licensor’s use of electronic disabling devices or “self-help.”^[88] Termination of access for access contracts is permissible upon “material breach” of the agreement or “if the agreement so provides” without any other limitation under UCITA.^[89] Other remedies are available under UCITA including damages, cancellation, withholding payments, discontinuing access (for access contracts), repossession of all copies of the licensed information, etc.^[90]

UCITA’s use of electronic “self-help” (in early drafts where it was permitted) is really a reflection of UCC Article 9, pertaining to secured transactions, specifically the repossession of collateral.^[91] However, no analogous provision exists in UCC Article 2 or 2A or the CCISG. The propriety of such action is uncertain under case law. For example, a Minnesota case on the subject discusses claims (or counterclaims) against those invoking electronic deactivation of software; the court basically found that deactivation was appropriate because it comported with license terms to which the parties had agreed.^[92] In another case (although unpublished), claims based upon breach of warranty and the Computer Fraud and Abuse Act (CFAA)^[93] survived a summary judgment motion to dismiss.^[94] Subsequent case law ruled that the CFAA applies not just to hackers but to computer manufacturers as well.^[95] In yet another instance, a “drop dead” software device was found “void as a matter of public policy.”^[96]

Without the blessing of a uniform law such as UCITA, utilization of electronic self-help remedies such software deactivation and “drop dead” devices may subject licensors to liability. Even with UCITA, a significant legal issue is raised as to whether federal statutes such as CFAA or state or federal consumer protection statutes are superseded by UCITA with respect to electronic self-help.

As a kind of self-help remedy, termination of access, as provided for under UCITA § 814, does not have the same stringent requirements for exercise as electronic measures embedded in software under UCITA § 816. However, even the exercise of this remedy may be problematic if it conflicts with federal statutes or state consumer law.^[97] Nonetheless, the apparent greater latitude available for the termination of access remedy may propel vendors into exclusively providing content via online services.

CONCLUSION

Content licensing is a complex legal subject necessitating review of the applicable law both creating intellectual property rights and governing contractual agreements and licensing. In addition, consumer protection and other law may impact the transaction. Because of the nature of information transactions to involve a wide array of jurisdictions, choice of law has to be carefully considered with respect to international, foreign, and domestic (both state and federal) law. To add yet an additional layer of complexity, UCITA, a uniform law governing computer information transactions has evoked widespread opposition, and significant disharmony among jurisdictions. Nonetheless, UCC Articles 2 and 2A (and potentially, on a limited basis, the CCISG) may, on an increasing basis, fill some of the void left by UCITA. This is especially true of Article 2A, governing leases, assuming UCITA fails and that states decline to redefine their codifications of Article 2A to exclude information transactions.

Principal among the issues addressed by the various commercial codes and conventions are issues of formation, unenforceability, warranties, and available remedies in the event of breach. Particularly noteworthy (and worthy of scrutiny) are the attempts of such uniform laws to resolve issues surrounding shrink-wrap, click-wrap, mass-market transactions, and the validity of provisions conflicting with copyright law (including the interest of the public in “fair use”); other state and foreign intellectual property rights (which may be broader than, for instance, U.S. federal law); and state consumer laws. In addition, the enforceability and desirability of choice of law and forum provisions, the scope and validity of both implied and explicit warranties, and the potential for abuse and disruption potentially caused by remedies such as denial of access and electronic self-help through means such as disabling devices in software need to be resolved.

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Digital Divide and Inclusion

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Abstract

The term “digital divide” is used to describe unequal access to computers, the Internet, and online information, whether among individuals, communities, or countries. Originally targeted at issues of physical access, such as whether people had a computer or Internet account at home, the concept is increasingly used to incorporate related issues, such as whether people have the skills and knowledge required to make effective use of digital media and information. A variety of initiatives have been taken within the United States and internationally to try to combat the digital divide.

INTRODUCTION

The term “digital divide” refers to the gap between those with access to computers, the Internet, and online information and those who lack such access. The digital divide has been discussed in relation to income group, race, ethnicity, age, gender, and language status among people within a community or country. Used internationally, it is often used to refer to gaps between countries that overall have greater access to information and communication technology (ICT) and countries with lesser access.

The term was originally used to refer to inequality in physical access, as represented by ownership of a home computer or having broadband Internet access. Soon thereafter, the term began to include other factors that enabled them to effectively use new technology, such as skills, knowledge, and social support.

This article will introduce the origin of the term in the 1990s and examine how the concept has evolved since it first emerged. It will review key facts about inequality in access to ICT, both within the United States and internationally, and discuss important individuals, organizations, and initiatives that have responded to this inequality.

HISTORICAL CONTEXT

Though the online communication dates back to the late 1960s, the Internet first became widely popular following the introduction of World Wide Web browsers in the 1990s. With this growing popularity, both officials and activists became increasingly concerned about the consequences of unequal access to ICT. In the mid-1990s, journalists and government officials in the United States began to describe this unequal access as a “digital divide.” *New York Times* writer Gary Andrew Poole used the term in

several articles in late 1995 and early 1996,^[1] and then both Al Gore and Bill Clinton used it in a speech in Knoxville, Tennessee.^[2] That same year, sociologist Manuel Castells published the first of three volumes on the information age.^[3] Castells’ three-volume work laid out the most compelling analysis to date of the critical role of information technology access and use in generating wealth, power, and knowledge in the current era.

Beginning in the mid-1990s, the term was used regularly by Clinton administration officials, especially by Larry Irving, Assistant Secretary of Commerce and Director of the National Telecommunications and Information Administration (NTIA). The NTIA published national studies in 1995, 1998, 1999, 2000, 2002, 2004, 2007, 2010, 2011, 2013, and 2014 that attempted to measure technological inequality in the thorough analysis of U.S. census data on computer ownership and Internet access as differentiated by race/ethnicity, income, gender, employment status, disability status, and urban/rural location.^[4] These research efforts were backed by policy initiatives, including the E-Rate program, which has provided funding to assist Internet connectivity in schools and libraries since 1996, the Federal Community Technology Centers Program, which provided substantial funding for local technology training and access in fiscal years 2000 and 2001, and later the National Broadband Plan, which aimed to use stimulus funds to bring broadband connectivity and technology education to underserved populations, particularly in rural areas in 2009–2010.

Just as steps were being taken to address the digital divide in the United States, international leaders and organizations became increasingly concerned about a global digital divide between rich and poor countries. The Group of 8 (G8) formed a Digital Opportunity Task Force in 2000 that brought together teams from government, the private sector, and nonprofit organizations in developed

and developing countries to identify ways to spread the benefits of the digital revolution more broadly.^[5] The following year, the United Nations Information and Communication Technologies Task Force was launched with a similar mission.^[6] The U.N. task force, still in existence today, organizes awareness programs, develops stakeholder networks, assists countries and regional groups with strategy development, supports broadened international participation in policy development, works to improve Internet connectivity around the world, and promotes efforts to support local content and application creation.

CONCEPTIONS OF THE DIGITAL DIVIDE

Early conceptions of the digital divide focused on a binary distinction between those who had and did not have access to ICT as indicated by availability of an Internet-connected computer. However, these conceptions soon came under criticism on several levels. First, since people access and use ICT in a wide variety of locations and contexts, the notion of a binary divide, rather than a complex continuum, was portrayed as simplistic, and one that could lead to failure to recognize the diverse ways that different individuals and groups do connect to digital information. Second, ICT access does not have a one-way relationship causal to individual and social development, but rather two-way; higher levels of development enable more ICT access, and ICT access can enhance developmental processes. Finally, the focus on physical access to technology was seen as too narrow since there are many other factors, such as language and literacy ability, computer skills, suitability of online content, and availability of instruction or social support that enable or constrain meaningful ICT use; any efforts to overcome inequity related to technology thus need to take these broader factors into account, rather than merely supplying additional hardware.^[7,8]

Today, there is broad recognition that the digital divide must be understood as incorporating a broad range of variables. A number of models have been developed to portray the factors involved in meaningful technology access and use, such as the one by Warschauer seen in Fig. 1.^[9]

Finally, some prominent individuals and groups have downplayed the notion of a digital divide. Michael Powell, chairman of the U.S. Federal Communications Commission from 2001 to 2004, compared the digital divide to a “Mercedes divide,” suggesting that ICT represented a consumer product that people could purchase or not depending on their wealth and desire and that government had little interest in promoting equitable ICT access.^[10] This view was echoed by the U.S. Heritage Foundation, which claimed that the free market will rapidly erase any digital divide in the United States and that government action would thus be counterproductive.^[11]

MEASURING THE U.S. DIVIDE

A variety of approaches have been developed for measuring the digital divide, both within and across countries. Within the United States, the early standards on this issue were largely set by the NTIA, whose national reports were broadly seen as the authoritative source of information on the topic. The reports were based on the Current Population Surveys (CPS) of about 50,000 U.S. households conducted by the Bureau of Labor Statistics and the U.S. Census Bureau. The CPS collect general demographic data on a monthly basis and supplement that with specialized data at different times; supplemental data on computer and Internet access were collected on six occasions between 1994 and 2003 and formed the basis of the NTIA reports.^[12]

The 1995 NTIA report focused on the question of whether U.S. households had either 1) a computer (i.e., *computer access*) or 2) a computer, a modem, and subscription to an online service (i.e., *Internet access*).^[13] Computer and Internet access were then compared by

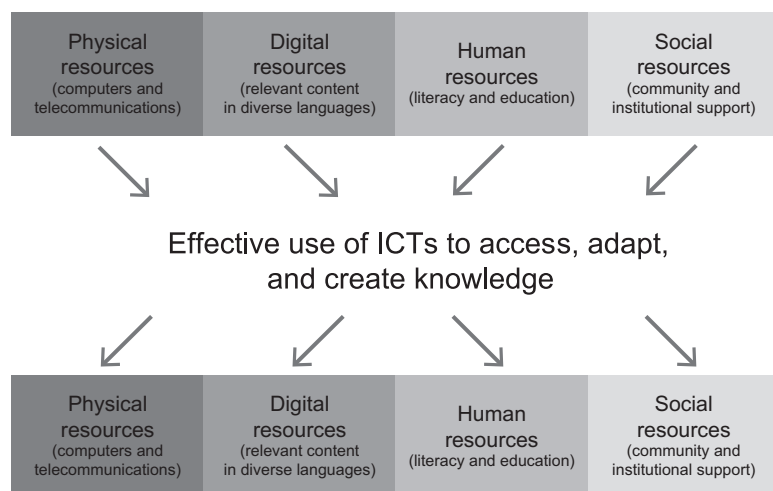


Fig. 1 A model of factors affecting technology access and use.

geographic region and by the income, race, age, and educational attainment of the head of household. The 1998^[14] and 1999^[15] reports used a similar methodology, though the latter also added an additional variable of having an e-mail account (i.e., *e-mail access*).

The 2000 NTIA report continued to include comparative household data, but also included for the first time data on individual use, again compared by demographic variables. This shift represented an emerging recognition that any true measure of the digital divide needed to account for not only whether one had physical access to the technology but also whether one actually used it. Also for the first time, the 2000 NTIA report included the category of disabled status, thus drawing attention to an important dimension of the digital divide.^[16]

As home computer and Internet access continued to expand, the NTIA further de-emphasized household access and instead discussed individual use in more detail. For example, the 2002 report compared different types of Internet use (e.g., finding health information, finding financial information, entertainment-oriented activity) by the gender, age, race, and income of users; began to investigate who had broadband access to the Internet (though differentiated only by urban/rural location); examined types of computer use at work by the occupation of the user; compared amount of Internet and e-mail use at work by occupation and by gender; looked at whether diverse groups of children used computers at home, school, and other locations; and examined Internet use among particular categories of the disabled (e.g., blind, deaf, difficulty walking).^[17] The 2004 report indicated Internet use in relationship to broadband access and other demographic factors (e.g., gender, race/ethnicity, employment, income, education, age, and particular types of disabilities).^[18]

Beginning in 2013, the U.S. Census Bureau collected data on ownership of computers, smartphones, and other devices, as well as Internet access and type (e.g., broadband, dial-up, fiber optic), and has since provided these data on a yearly basis at the national, state, and, in some cases, city-specific level.^[19] These census data have revealed smaller gaps across race in terms of Internet use on smartphones.

Other groups have collected a range of data on Internet use that is helpful for understanding technology and equity. The most important of these groups is the Pew Research Center's Internet & American Life Project, which conducts random digit-dial telephone surveys on a wide variety of topics related to Internet use. Topics addressed by the Pew project include home broadband adoption, the use of the Internet for particular kinds of pursuits (election news and activity, health information), typologies of Internet users, and uses of the Internet by particular demographic groups (see Table 1).^[20] Data from NTIA, Pew, and others thus presents the following overview of the digital divide in the United States in relationship to particular demographic groups.

Table 1 Demographics of U.S. Internet users

	Use the Internet (%)
Total adults	88
Women	86
Men	89
Age	
18–29	99
30–49	96
50–64	87
65+	64
Race	
Caucasian, non-Hispanic	88
African-American, non-Hispanic	85
Hispanic	88
Geography	
Urban	89
Suburban	90
Rural	81
Household income	
Less than \$30,000/yr	79
\$30,000–\$49,999	90
\$50,000–\$74,999	95
\$75,000+	98
Educational attainment	
Less than high school graduate	68
High school graduate	81
Some college	94
College +	98

Source: Pew Research Group, Internet/Broadband Fact Sheet. <http://www.pewinternet.org/fact-sheet/internet-broadband/> (accessed May 22, 2017).

Gender: Differential computer and Internet access by gender had disappeared in the United States by 1997, and women and men continue to access the Internet to about the same degree. However, women receive only 18.2% of the computer science bachelor's degrees in the United States and encompass only 24.5% of professionals in information technology industries.^[21,22] These facts have led many groups to be concerned about the types of early experiences girls have with technology and whether these experiences are helping them develop the skills, knowledge, and attitudes to become leaders in technology-oriented careers.

Race/ethnicity: The race/ethnicity gap in Internet use has lessened over time, but it is unclear exactly how much. According to the most recent published U.S. Census Bureau information, 82.5% of Caucasian and 89.9% of Asian individuals live in a house with at least some Internet access, whereas only 71.1% of Hispanic and 67.3% of African-American households had an Internet connection.^[23] Pew Internet reports much smaller gaps, with a similar proportion of Caucasian (88%), African-American (85%), and Hispanic (88%) adults using the Internet, which could be due to the more recent dates of the data gathered (Pew in 2016 vs. Census surveys in 2013), or differences in methodology, with the Census data based on in-person visits to households and the Pew data

based on telephone surveys.^[20] In addition to different rates of Internet access, there appear to be differences in how different racial groups make use of digital media and the Internet, with African-Americans and Latinos disproportionate uses of social media and video streaming sites and Caucasians and Asians reporting more frequent use of the Internet for interest-driven content production practices.^[24–26]

Age: While the gap in Internet use between older and younger Americans is declining, age continues to be an important factor in the digital divide, with only 64% of U.S. seniors aged 65 or older using the Internet.^[20] Research suggests that income, cognitive ability, and the availability of relatives to help with technology are all factors correlated with whether and how seniors access the Internet.^[27]

Geography: Urban and suburban residents access the Internet to equal degrees. The gap between them and rural users has lessened in recent years and appears to be due in part to lesser access to broadband in rural U.S. areas; however, initiatives such as the Broadband Technology Opportunities Program have targeted these populations for increased broadband connectivity and education.^[28] Most recent data indicate that 81% of the rural population has broadband access compared to 89% of the urban population.^[29]

Income: Though all income groups have expanded their access to the Internet in recent years, income remains a major factor, with only 79% of those with household incomes under \$30,000 using the Internet compared to 98% of those with household incomes over \$75,000.^[20] Differences in quality of use are likely as well, due to the higher likelihood among families of having up-to-date computers, multiple computers, and broadband Internet connections than low-income families.

Education: Educational attainment is one of the most prominent factors of the digital divide, with 68% of those with less than a high school diploma or less education using the Internet and 98% of college graduates using the Internet.^[30] Differences in types of usage are also strongly correlated with education, with college graduates far more likely than others to use the Internet to enhance their productivity or manage digital content.^[31]

Disability: Disability status is also strongly correlated with Internet use, with only 62.5% of people with disabilities using the Internet.^[23] Limited mobility, limited income, and the high cost of specialized adaptive technology are all barriers toward people with disabilities using computers. Inconsistent implementation of accessibility standards in the design of online content also makes it difficult for people with certain disabilities, such as visual impairment, to make effective use of the Internet.

MEASURING THE INTERNATIONAL DIVIDE

Assessments of the international digital divide are usually made at the level of countries, or groups of countries,

Table 2 World Internet usage

Region	Percent of population using the Internet (%)	Usage growth, 2000–2016 (%)
Africa	28.7.3	7,488.8
Asia	45.6	1,515.2
Europe	73.9	485.2
Middle East	57.4	4,207.4
North America	89.0	196.1
Latin America/Caribbean	61.5	2,029.4
Oceania/Australia	73.3	261.4
World total	50.1	918.3

Source: Internet World Stats. Internet Usage Statistics. <http://www.internetworldstats.com/stats.htm> (accessed January, 2017).

rather than individuals. Indicators that are taken into account include the number of computers, Internet subscribers, or Internet users as a percentage of the population. Countries are then often aggregated by either region or continent for comparison purposes. For example, as seen in Table 2, dramatic differences exist between regions of the world in Internet penetration. Though regions with the least Internet access are expanding the fastest rate, it will still take a long time for them to catch up.

The international digital divide is also reflected in production of Internet content. An earlier study demonstrated that Internet domains are overwhelmingly concentrated in certain countries (e.g., the United States, Germany, and United Kingdom) and in major cities within those countries; follow-up studies have not been conducted to show how these trends may have changed over time.^[32]

The International Telecommunications Union (ITU) has attempted to develop a more complete measure of the international divide using a wide variety of indicators measuring network infrastructure (e.g., international Internet bandwidth), individual use (e.g., Internet users per 100 inhabitants), individual access (e.g., broadband subscribers per 100 inhabitants), and skills that enable computer and Internet use (e.g., adult literacy rates). It then brings this data together into an ICT Development Index (IDI) and groups countries based on this index into high, upper, medium, and lower levels. The ITU study found a huge gap between these different levels, with the divide steadily increasing further between the high and low extremes from 2001 to 2004. In 2004, the divide between high- and low-IDI countries began to decrease, suggesting the beginning of a small catch-up effect in overcoming the international digital divide. By 2007, IDIs had increased across all countries, and the gap between high- and low-IDI countries had slightly decreased, only to widen again in the subsequent 2011 reports.^[33,34] However, the gaps between developed and developing countries are now decreasing once again according to the groups' most recent report.^[35]

Researchers have also investigated the social, economic, and political factors that tend to correlate with the digital divide internationally. Studies suggest that general developmental level, amount of political openness and democracy, mass education, the presence of a sizeable service sector in the economy, and flexible telecommunication policy are all factors that correlate with Internet diffusion in particular countries.^[36,37]

The availability of mobile Internet connections has also contributed to increased Internet access and use. Some 95% of the global population lives within reach of mobile-cellular signal.^[35] However, the cost of mobile connectivity remains high in developing nations and is a major barrier to mobile phone ownership.^[35] Whereas about 80% of the world's population is using mobile phones, this falls to less than 60% in large developing economies such as Bangladesh, India, Indonesia, and Pakistan.^[35]

THE EDUCATIONAL DIVIDE

A good deal of attention on the digital divide has focused on the role of schools. Within the United States, for example, the National Center for Educational Statistics has carried out national studies since 1998 measuring Internet and computer access in public schools throughout the country. Though gaps between the number of Internet-connected computers in high-person of color (POC) schools (i.e., with 50% or more of their students being racial or ethnic minorities) and low-POC schools (i.e., with fewer than 6% of their students being racial or ethnic minorities) steadily fell from 1998 to 2002, it remained steady thereafter (see Fig. 2). In 2005, a study indicated that there were 3.0 students per Internet-connected computer in low-POC schools and 4.1 students per such computers in high-minority schools.^[38] More recent figures in 2009 suggest that on average there are 1.7 students per computer that can be brought into the classroom (such as via a shared laptop cart), with a slightly lower ratio in schools with less than 35% of students on free or reduced-price lunch (1.5 students per computer) and slightly higher in schools serving 50% or more students eligible for free or reduced-price lunch (1.8 students per computer).^[39] Though current data is not available, the widespread diffusion of low-cost Chromebooks is likely bringing these numbers down further. The digital divide in schools goes beyond the availability of computers and extends to how technology is used. African-Americans, Hispanics, and low-income students have been shown to disproportionately use computers for drills, remediation, and vocational education, whereas Caucasians, Asians, and high-income students more frequently use computers for advanced simulations and research.^[40] These differences are due to a number of factors, including the different levels of background, skill, and knowledge that

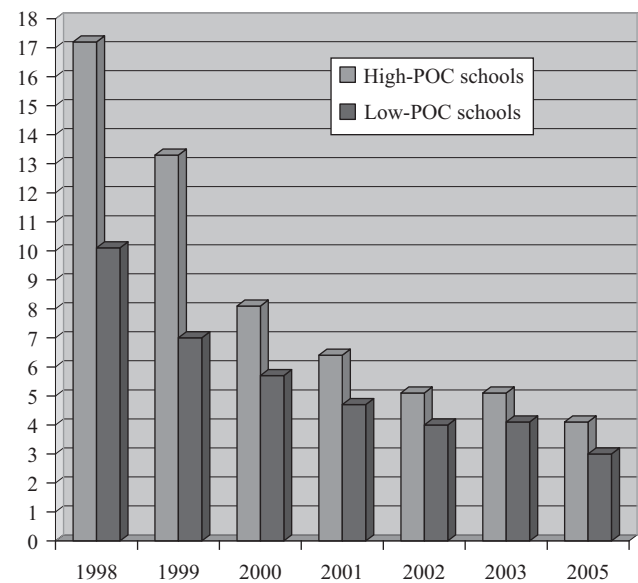


Fig. 2 Number of Internet-connected computers per student in high-POC and low-POC U.S. K-12 schools, 1998–2005.

Source: Wells et al.^[38]

students have; the differential amounts of technology they have at home (that may help them prepare for more advanced uses at school); and the different levels of skill and experience among teachers in low-income versus high-income neighborhood schools.^[39]

On the international level, little data exists as to the number of computers or Internet connections in schools around the world; however, obvious differences in these measures exist between developed and developing countries. Many developing countries think of schools as a critically important arena for overcoming the digital divide and are thus making efforts to outfit schools with computers and Internet access.

Schools have been a major focus for overcoming the digital divide. In the United States, the federal program known as E-Rate has made use of the Universal Service fee charged to telecommunication companies to distribute funds for schools and libraries to obtain affordable telecommunications and Internet access. Renewed in 2014 as the E-Rate Modernization Order, this program has expanded its goals to include provision of high-speed broadband, particularly Wi-Fi, in schools and libraries.^[41] Internationally, a number of countries, including Portugal, Peru, Uruguay, and Thailand, have carried out widespread distribution of individual laptops or tablets to children to attempt to increase technology access and educational equity.^[42–45] A number of prominent programs in this regard have been organized by the U.S.-based One Laptop Per Child (OLPC) program.^[46] Though OLPC extended computer access to the poor in a number of countries, it has also been criticized by some who believe that developing countries have more pressing educational priorities

than making large-scale investments in laptop computers for individual students, lack the infrastructure for basic utilities let alone Internet access, and too often do not have the resources to include teacher professional development and ongoing technological support for such initiatives.^[47] Research to date suggests that widespread distribution of computers to students without efforts to integrate their use into instruction fails to raise reading or mathematics test scores^[48] but may bring some more general cognitive benefits.^[42,49]

ADDRESSING THE DIGITAL DIVIDE

A number of programs have been put in place for addressing the digital divide. At the infrastructural level, programs have been launched to reduce the cost of computers or Internet connectivity for low-income citizens, for example, through providing free municipal wireless access. Other programs, such as the aforementioned OLPC initiative, seek to develop special versions of hardware or software that are both lower in cost and more suitable for use among the urban and rural poor.

As regards content, advocacy groups work to create online materials that reflect the economic or social needs (e.g., information about health care for low-income residents in the United States or local crop prices for rural farmers in India) and are available in multiple languages and dialects and at reading levels suitable for mass access. The development of technologies that enable self-publishing and collective content creation (e.g., wikis, blogs, and social media) has also enabled advocacy groups to work with underserved populations to promote inclusive participation in digital media production and to generate community-relevant educational materials.

As regards human capital development, initiatives have focused on making computers and the Internet more affordable to schools and for developing curricular and pedagogical approaches that ensure that all students have equal access to advanced forms of learning with new technology.

Finally, as regards social support, a number of governmental and nongovernmental organizations have promoted the availability of online population- and community-targeted resources for digital literacy education and to boost participation in digital media.^[50] Additionally, populations previously underrepresented in digital access and use have more and more been able to participate via mobile devices.^[51–53] However, some argue that lack of cultural capital means that—like computers and the Internet—access to mobile broadband alone is not enough to bridge the digital divide.^[53]

A number of grassroots groups attempt to coordinate information and organize, aimed at tackling the digital divide. Among these is the Digital Inclusion Network,^[54] which includes discussion lists, blogs, and event

announcements for educators, activists, policy makers, and others concerned with technology and social inclusion. Additionally, the Digital Media + Learning Central blog publishes case studies, articles, blogs, and educational resources promoting digital inclusion and ICT equity among global communities.^[55] A growing information and communications technologies for development (ICT4D) or development informatics community currently explores strategies for implementing information technologies as a means for spurring national development (e.g., see).^[56]

CONCLUSION

In the 1990s, governments and organizations around the world became concerned about unequal access to new technologies, whether among individuals or nations. Labeling this unequal access a *digital divide* helped draw attention to the issue. Since that time, the concept has broadened to address not only physical access to computers and the Internet but also the kinds of knowledge, skills, online content, and social support necessary to make such access meaningful. In that sense, there is not one digital divide but many, and diverse efforts on many fronts are needed to overcome them.

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Digital Humanities

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Abstract

Digital humanities is a recent and rapidly evolving field. It includes the range of activities and projects associated with the use of digital technologies for humanities research. Its roots lie in the 1960s with early work on digital texts and text corpora. With the emergence of desktop computing, use of computers for humanities research expanded in the 1980s, followed by the development of standards and the rapid growth of digital research projects and academic centers. In the 1990s, the rise of the World Wide Web made digital forms of publication increasingly common, and placed new emphasis on the value of networked information and online patterns of usage. The modern field of digital humanities has multiple forms of institutional presence, and embraces a range of characteristic methods, questions, and topics including information modeling, pattern discovery, standardization, and metadata.

INTRODUCTION

The field of digital humanities is a recent and rapidly moving target. There are several reasons for this: first, the fact that both of its putative two “sides” (humanities and digital technology) are themselves evolving swiftly, responding to cultural pressures and also to their own inner developmental logic. But in addition, their relationship is evolving. As digital technology moves into essential scholarly systems such as libraries, research and instructional tools, and methods of communication, the institutional juxtaposition of digital technology to the humanities disciplines has shifted. Where three decades ago, the technological infrastructure was housed and managed with visible and impressive separateness (and rarely used by humanists), it is now pervasive and unremarkable. Digital technology is no longer positioned as “science” or as “machine” but rather as media, as access, as enhanced modes of instruction, as a medium of collaboration.

The desktop revolution has made all of this possible by making digital technology cheap, user-friendly, and appealing to consumers. The ubiquitous connectivity of the Internet has also introduced new types of interaction and new participants in the humanities discourse. But this prompts an important question: how is digital humanities distinguishable from the routine (and expanding) use of desktop computing technology and the Internet for ordinary workday tasks? How does it differ from publications and research by nontraditional scholars and the general public? Is one doing digital humanities when one uses a word processor, or uses Flickr, or registers for an online seminar? If there is a clear difference, then it should be possible to describe—for funding agencies, for university administrations, and even ultimately for professional assessment—where that difference lies. It now appears

that digital humanities together with its various cognates is emerging as a distinct field of study – as suggested by the rise of departments, professorships and national funding programs using “digital humanities,” “humanities computing,” “humanities informatics,” and similar terms. If digital humanities, together with its various cognates, is to be considered an emerging field of study, then how can we most usefully characterize it and identify its boundaries?

This entry begins by providing a definition of digital humanities and a brief history, followed by a discussion of digital humanities in its institutional contexts, its relationship with digital libraries and finally, a short introduction to characteristic methodologies.

DEFINITION

Digital humanities can be understood both as a field in its own right and as a way of identifying digital research and project development efforts in specific humanities fields. More broadly, it also refers to any digital activity that furthers research in the humanities, or assists in the scholarly activities of its practitioners. Some of these activities may operate outside of any particular humanities field: for example, digital publishing or digital libraries.

As a discrete field, digital humanities studies the intersection of humanities ideas and digital methods, with the goal of understanding how the use of digital technologies and approaches alters the practice of humanities scholarship. In this sense it is concerned with studying the emergence of scholarly disciplines and communicative practices at a time when those are in flux, under the influence of rapid technological, institutional, and cultural change.

As a way of identifying digital interests and efforts within traditional humanities fields, the term “digital humanities” identifies, in general terms, any kind of critical engagement with digital tools and methods in a humanities context. This includes the creation of digital editions and digital text or image collections, and the creation and use of digital tools for the investigation and analysis of humanities research materials. It also includes the aggregation and arrangement of digital resources and tools in order to present humanities material to students, and other forms of broader dissemination. Finally, the term can be used to refer to tools, processes, and projects that expand access to the source materials of scholarship and teaching such as primary source texts, images, representations of artifacts, objects of study, and secondary source materials. In many cases, these expanded forms of access closely resemble their traditional counterparts, albeit with improvements of speed, accessibility, scope, and flexibility of use. These aspects of digital humanities can be expressed through conventional publication. But humanities researchers, accustomed to studying discursive modes, have also begun to seek experimental ways of embodying their work in new forms of digital publication. Examples include journals like *Vectors* and experiments with new models of scholarly publication such as *Hypertext in American Studies*, supported by *American Quarterly* and the Center for History and New Media.^[1,2]

It is useful to identify what we mean by “critical engagement” with digital tools a little more precisely. When an experimental digital tool first enters humanities practice, its methods of operation require significant user knowledge and are also subjected to critical scrutiny. However, as digital tools enter the realm of routine utilities, and develop surfaces that permit shallow rather than deep configuration, they become optimized for the most common uses. This optimization limits opportunities for critical engagement, by limiting access to information about their internal processes. In effect, as they become normalized and predictable, they become more like black boxes. This evolution mirrors the development of consumer tools in other technological areas. For example, automotive technology initially required the driver to have a detailed working knowledge of engines and to perform all configurations and repairs, thereby permitting the expert user to optimize the vehicle’s behavior (but also permitting mistakes and disasters). Modern vehicles allow the knowledgeable driver to make improvements and repairs, but do not assume this as a common practice. We can envision that the cars of the near future will be extremely high function, but only within the limits of the standard design, with no user-serviceable systems at all. Different digital humanities tools are at different stages in this evolution. Systems for authoring and publishing XML documents are just starting to enter the second phase, permitting but not requiring user configuration and expertise, whereas word processing systems have been at this

stage for over a decade. Some kinds of digital scholarly tools will probably never reach this point, but will always require significant levels of intervention from the responsible (and necessarily expert) user.

The question is whether this kind of engagement is, *ipso facto*, meaningful in a critical sense—in the sense of yielding important levels of disciplinary insight into methodology and process—or whether it merely seems meaningful at this incunabular stage of digital tool development because of the novelty of these processes. It is useful to recall in this context the intellectual significance Douglas Engelbart attached in the early 1960s to what we now regard as commonplace editorial functions like copying and pasting. The full description of the copy/paste process is worth quoting in full for its reminder of the historical distance traversed: “Adding one more light-pen pointing to what it took to delete an arbitrary string of symbols, Joe could direct the computer to move that string from where it was to insert it at a new point which his light pen designated. Again it would disappear instantaneously from where it had been, but now the modified display would show the old text to have been spread apart just enough at the indicated point to hold this string. The text would all still look as neat as if freshly retyped. With similar types of keyset and light-pen operations, Joe could change paragraph break points, transpose two arbitrary symbol strings (words, sentences, paragraphs, etc., or fragments thereof), readjust margins of arbitrary sections of text—essentially being able to affect immediately any of the changes that a proofreader might want to designate with his special marks, only here the proofreader is always looking at clean text as if it had been instantaneously retyped after each designation had been made.”^[3] Similarly, the use of online reference sources and journals is now taken for granted in humanities scholarship. The immediacy and comprehensiveness of these sources arguably has had a transformative effect on humanities research, but it would be harder to argue that it now has a significant effect on the intellectual or methodological content of that research.

There may thus be a critical window during which new tools expose their methodological significance to us, before they respond to the pressure toward commodification and the seamless interface required for general use. This would suggest that as digital humanities becomes established as a field, it will embrace both humanists for whom the use of digital tools is central to their regular research practice, and those for whom the exploration of tools and their impact on research methodology is itself of critical interest.

John Unsworth has suggested a definition which addresses this question from a different angle: digital humanities involves activities “in which the computer is used as tool for modeling humanities data and our understanding of it, and that activity is entirely distinct from using the computer when it models the typewriter, or the

telephone, or the phonograph, or any of the many other things it can be.”^[4] This formulation usefully relocates the idea of “meaningful engagement” away from the tool itself and onto the modeling activity the tool enables. It is not a question, in other words, of whether the tool itself resembles a modern automobile, but rather of whether our use of it resembles our use of the automobile: of whether we are capable of taking it apart and reassembling it as a spacecraft or a work of art. Tools and methods that look unscholarly or purely utilitarian at one point may over time be appropriated for scholarship in unanticipated ways; for instance, we are now beginning to see techniques from social networking sites such as del.icio.us and Flickr being incorporated into the design of scholarly digital publications. Examples include the experiment in folksonomic museum cataloging being undertaken at <http://www.steve.museum>, the ThoughtMesh project, and also the work of the NINES project.^[5,6]

The term “digital humanities” has emerged at least partly as a gesture of inclusion and an attempt to define a broader domain than was suggested by earlier terms such as “humanities computing.” But there are also several closely related fields which, though they share methods, interests, and populations with the digital humanities, can nonetheless be usefully distinguished from it. One of these is the field of new media (also, media studies), which contextualizes an interest in the digital within a broader set of concerns about media more generally. New media often combines a more strongly theoretical approach with a practical interest in multimedia production, and the field also engages more directly with domains like the visual arts and the performing arts. A second neighboring field is digital libraries,^[7] which sets shared interests (in meta-data, digital representation, and humanities content) within the context of library science issues such as information retrieval, knowledge representation, classification and cataloging methods. Digital libraries approaches are also framed by institutional priorities such as long-term sustainability, scalability, standard work flows, and cost-effectiveness.

HISTORY

Computing in the humanities began as a specialized practice which required access to scarce equipment. It was originally practiced by individual scholars who used it to perform their own research on literary or historical questions, and who published their disciplinary results in conventional venues. Subsequently, humanities computing became less concerned with the purely technical aspects of digitizing and analyzing digitized materials, and focused more on the preparation and representation of text collections and other objects of study. As this knowledge left the exclusive province of researchers and became a component of scholarly infrastructure like the library,

digital humanities has moved on to grapple with the social and collaborative aspects of computing, while continuing to explore aspects of text representation and text analysis. As it has matured, digital humanities has evolved from “humanities computing” which was defined by its reliance on and interaction with a computer to “digital humanities” which is concerned more broadly with media and methods in a digital context.

The earliest known use of technology to advance a discipline in the humanities was in 1949, when Father Roberto Busa approached IBM for help in creating a print concordance of the works of Thomas Aquinas and related texts.^[8–10] This was characteristic of early humanities computing, which replicated well-understood existing scholarly technologies such as concordances and dictionaries, but made their preparation faster, more accurate, and less tedious. There were no standards specifying how to encode a text for machine processing, which programming language to use, or even which hardware. Concordance programs had to be developed from the ground up, and although methodology was published and shared, the specifics of each implementation were unique.

Early humanities computing focused on indexing and analyzing texts, as the limitations of computers in the 1960s privileged character-based data. Early digitized text collections were usually small, and were not designed to be read online or disseminated electronically. Instead they represented a data set for processing: one step in the process of preparing a particular scholarly product. However, it was a natural progression to apply quantitative analysis to these data sets of literary and historical texts. This also fit into the data processing paradigm of computing that was prevalent at the time. Apart from Father Busa’s corpus of Aquinas, which took decades to be completed, most early humanities computing projects were applied to individual texts, and addressed specialized problems, for a single researcher. (In 1967, *Computers and the Humanities* listed 120 such projects under the category “Literature.”^[11]) Their results were published in conventional venues, books, and journals, and the “computerized” materials were not easily reusable by other scholars. Examples of this kind of processing were indexes, stylistic analysis, bibliographic compilations, and authorship studies.

By the late 1960s, we begin to see the appearance of journals and newsletters that document computer projects in the humanities (for example *Computers and the Humanities*, first published in 1966) followed soon thereafter by the founding of conferences and professional organizations (for example, the Association for Literary and Linguistic Computing was founded in 1973, and the Association for Computers and the Humanities was founded in 1978) that provided venues for sharing information, providing support, and creating the beginnings of a disciplinary identity. This increased sense of professional interconnection reflected important changes in the

scale and collaborative nature of digital projects. As computers became more standardized, centralized computer facilities appeared on campuses which allowed broader access and it became possible to acquire programs and materials created elsewhere. This made it feasible to justify paying for the development of larger corpora by pointing out the value of shared access to materials that could not be created for the use of a single researcher. Projects like the *Thesaurus Linguae Graecae* were initially funded by private donors, and were concerned from the outset with justifying the basis on which they selected texts and the ways in which they encoded them, so as to be acceptable to their destined audience in classics.^[12,13] Although not exclusively, work sprang from the disciplines with the most preexisting scholarly apparatus and with well-defined corpora of manageable size: religious studies, classics, Old English, and linguistics. Such disciplines were early users of computational tools to mediate their interaction with textual materials, partly because these tools reproduced and enhanced the utility of traditional research tools such as concordances and critical apparatus and perhaps partly because these fields are more hospitable to quantitative and empirical approaches to textual study. As computational tools elicited stronger mathematical forms of quantitative analysis, methodological disagreements (which had already separated the more philologically oriented field of Old English from the more critically oriented field of English literature) became more acute, alienating more traditional humanists from humanities computing.^[14]

Computerized texts also made it possible to print editions, concordances, and dictionaries more accurately and more efficiently. In the 1970s, with the development of corpora and the ability to output to typesetting equipment, it was possible to avoid rekeying texts with difficult formatting and unfamiliar character sets.^[15] Individual scholars and professional organizations like the Society for Biblical Literature developed specialized knowledge about fonts and typesetting, which was a digital extension of the scholarly apparatus they already applied to their discipline. Computerized texts could be repurposed, and used not only for generating indexes, but also for whole-sale printing of new editions.

In the early 1980s, this emerging emphasis on large-scale shared corpora and text processing tools was joined by a complementary trend: the emergence of desktop computing, with the introduction of the IBM PC (1981) and the Apple Macintosh (1984). The introduction of the graphical user interface helped to broaden the scope of humanities computing by making it possible to show images and display non-ASCII character sets. Specialized knowledge was no longer necessary to interact with a computer—word processing, and somewhat later e-mail, became part of the daily work of every scholar. The term “computing humanist” began to shift: from describing any scholar using a computer to perform research in the

humanities, to referring solely to those creating technology for the use of their colleagues in the humanities, or themselves exploring applications of technology in the humanities. As more scholars had access to computing, efforts were made to bring existing searching and analysis tools to the desktop [for example, tools like MicroOCP (Micro-OCP User Manual, Oxford University Computing Service: Oxford, 1988) and Conc (<http://www.sil.org/computing/conc/>)] as well as specialized word processing and textual editing software, targeted at the scholar, that mimicked the production of scholarly print editions.^[16] These tools did not form the mainstream of scholarly computing: they tended to be very specialized, with non-standard formats and user interfaces, and were difficult to share between different hardware and software platforms. However, by broadening the accessibility of scholarly computing, they helped to create an environment in which digital humanities methods could be discussed not merely as a novelty but as an emerging set of shared methods and practices. At the same time, they revealed a set of new opportunities and challenges. The overhead of having to prepare one’s own text for analysis, the difficulty of finding texts prepared by others, and the challenges of dealing with idiosyncratic markup systems were a substantial obstacle to scholars whose primary interest lay with the text and not with the digital methods themselves. On the other hand, the knowledge that scholars could make use of digital texts and other information at their desk, as they did conventional reference material, coupled with the graphical user interface, opened new horizons for translating conventional scholarly publication into richly linked, multimedia hypertexts.

In response to these limitations and challenges, two important developments emerged in the late 1980s and became more firmly entrenched in the 1990s. First, leading computing humanists who had been writing software and performing analyses on digitized texts, and who were aware of the lost opportunities and wasted effort due to the widely varying encodings applied to digital texts, gathered in Poughkeepsie, New York in 1987 to call for a standard encoding scheme for scholarly documents. This turned into the Text Encoding Initiative (TEI), which issued its first draft set of *Guidelines for Electronic Text Encoding and Interchange* in 1990, with the first major release in 1993. The guidelines were based on SGML, an emerging international standard, and have since evolved into one of the most influential components of digital humanities work. The process of developing the TEI Guidelines, and their application in specific projects, brought a wider range of humanities scholars into the field of humanities computing and opened up opportunities for digital text representation and analysis that went beyond the purely quantitative early approaches. It also raised issues of the relationship between language and its representation in text giving rise (perhaps for the first time) to theoretical questions about digital text itself, which contributed

importantly to the emergence of humanities computing as a research field rather than a way of getting things done.^[17–20] At roughly the same time as the development of the TEI *Guidelines*, other standards for humanities text encoding and metadata (such as EAD in the mid-1990s, to be followed by METS (Metadata Encoding and Transmission Standard) and related standards in the early 2000s) laid the groundwork for large-scale text digitization projects based on SGML and designed on a platform-independent and interoperable basis. Early examples include the Women Writers Project, the Victorian Women Writers Project, the Perseus Project, the Oxford Text Archive, the Canterbury Tales Project, the Piers Plowman Archive.

The other development was the dissemination of the work of Douglas Engelbart at Stanford and the writings of Ted Nelson on hypertext and hypertextual structures of information, and their application to knowledge work.^[21,22] Hypertext arose as a research area in Computer Science, and was implemented in several commercial and widely available software applications that ran on personal computers, the best known of which were Hypercard (Apple, 1987), SuperCard (Silicon Beach Software, 1989), and Guide (Owl, 1987). These applications allowed technical neophytes to create small, interlinked systems that could be used by their students and their colleagues. The parallelism of hypertextual structures with the literary theories of intertextuality and deconstruction resonated with scholars and instructors, and encouraged experiments in building self-contained hypertexts around particular areas of study: for example, Context 32, which turned into the Victorian Web (<http://www.victorianweb.org/>), and the Shakespeare Project developed by Larry Friedlander at Stanford University. The emergence of image and early multimedia capability on personal computers also permitted the use of non-textual materials. Projects like the IRIS Intermedia project at Brown University and the Perseus Project at Harvard University created multimedia digital content that could be used by other scholars and students. Several such projects are described in Delany.^[23] Although there was still no standardization of formats or software, humanities computing was now concerned not only with databases and textual analysis, but also digital dissemination and publication.

The World Wide Web, which was introduced in 1989, but whose potential became evident with the release of the Mosaic browser (1993), allowed all humanists with an Internet connection to be computing humanists by providing access to searchable corpora that were seamlessly linked to other relevant work. The WWW might be said to have made hypertext so common that it became invisible. Although the underlying structures and the linking mechanisms of the WWW were less powerful than what was available on desktops and in research software, they had several important effects: scholars, authors, and software developers were able to rely on a uniform infrastructure that allowed them to focus their efforts on their own

materials and presentation, the WWW's reliance on standards encouraged the development of standards in other areas, and the ability to link easily across Web sites and topic areas introduced the concept of collaboration as a scholarly tool.

The 1990s and the early part of the twenty-first century have seen both consolidation and further advances in all these tools and methods: a mixture of advanced experiments in desktop hypertext, scholarly editing, large corpus building and the increasing development and adoption of standards and guidelines such as SGML (which became XML in 1997),^[24] TEI,^[25] METS, and EAD,^[26] and the technologies that are based on them. At the same time, literary and media theorists have begun to engage with digital humanities projects, and have generated an increased awareness of digital art which tests the tropes of digital rhetoric. This has brought to the forefront a new research domain, the problematization of digital methods and systems. Heretofore, theoretical concerns had been situated in traditional disciplinary issues of scholarly editing, and analysis. Starting in the 1990s, media theory and critical theory find themselves sharing concerns.^[27–29] Finally, there has been a rise in international collaboration and the development of very large-scale digital infrastructure for humanities research.^[30]

INSTITUTIONAL LOCATIONS

What is suggested but not fully revealed in this history, as the field of humanities computing and digital humanities takes shape, is the important role of institutional location and funding models. Digital humanities projects find an institutional home in a variety of different contexts, and it is often these contexts that determine their scale, research agenda, personnel, and practical outcomes. For this reason, classification of digital humanities projects and work models can be a useful way of understanding the terrain. One such classification was developed in 2003 by Willard McCarty and Matthew Kirschenbaum and published by the Association for Literary and Linguistic Computing.^[31] This was repeated and expanded by the Centernet classification.^[32] It emphasizes the functional role of the various institutional centers: whether they provide teaching, research, collegial support, or technical support, or several of these in combination.

This classification leaves out some important sites of digital humanities activity (for instance, digital publication projects and individual research projects), and it also elides some useful distinctions. The category of “library-based units,” for example, includes both large-scale digitization efforts located within libraries, library units focused on managing electronic resources for patrons, and library projects with a more specific scholarly focus. This is not a failing in the classification itself but an expression of its intended purpose: to create a classificatory matrix that can

accommodate all humanities computing projects. But for purposes of understanding the broad outlines of the field and its evolution over time, we suggest an alternative classification that illuminates the most significant types of projects and takes into account the kind of intellectual product that motivates their design and activity. Naturally a given entity may occupy multiple spaces in this classification. The significant terms in this classification might be as follows:

- Digital library projects and centers which undertake the digitization of library collections on a large scale.
- Faculty support centers in which the goal is to enable humanities faculty (typically nontechnical or at least technically not self-sufficient) to use digital humanities technologies and approaches in teaching and/or research. Examples include the Institute for Advanced Technology in the Humanities (<http://www.iath.virginia.edu/>), HUMLAB (<http://www.humlab.umu.se/>), Maryland Institute for Technology in the Humanities (<http://www.mith2.umd.edu/>), Oxford University Computing Services (<http://www.oucs.ox.ac.uk/>), and the Scholarly Technology Group (<http://www.stg.brown.edu/>).
- Digital humanities research units in which central questions in digital humanities and its constitutive fields (human-computer interaction, digitization standards and practices, text encoding theory, new media theory, etc.) are pursued as the central activity; publications, projects, and funding initiatives emerge from this agenda. Examples include the Center for Research in Digital Humanities (<http://cdrh.unl.edu/>), CTB at the Royal Dutch Academy (<http://www.kantl.be/ctb/>), SpecLab (<http://www.speculativecomputing.org/>), STG, Women Writers Project (<http://www.wwp.brown.edu/>), and the Center for History and New Media (<http://chnm.gmu.edu/>).
- Digital humanities programs and departments in which digital humanities is the subject being taught (and where research is conducted as part of that effort). Examples include the Centre for Computing in the Humanities at King's College, London (<http://www.kcl.ac.uk/cch/>); English and Film Studies at University of Alberta (<http://www.arts.ualberta.ca/efs/research/dhrc.php>); TextTechnologie Department at Bielefeld, Germany (<http://coli.lili.uni-bielefeld.de/>).
- Digital publication projects, organized around the creation of a specific digital publication (often a scholarly edition or thematic research collection). Examples include NINES (<http://www.nines.org/>), WWP, and the Walt Whitman Archive (<http://www.whitmanarchive.org/>).

Some important relationships between these terms deserve closer attention. First, there are developmental processes by which one type of group will evolve into another.

Digital humanities research units, as they mature, may begin to resemble academic departments, particularly because the personnel they attract are already hybrids: technologists with advanced degrees in humanities fields or humanities faculty on a temporary detour from standard teaching jobs. This process in some cases results in a formal institutional transformation (for instance, the Centre for Computing in the Humanities at King's College London was converted from a support center into an academic department in 2006), and sometimes produces a group in which personnel occupy a dual role (for example, the senior staff of the Maryland Institute for Technology in the Humanities at the University of Maryland and at the Institute for Advanced Technology in the Humanities at the University of Virginia hold faculty positions). Digital publication projects may evolve into digital humanities research units, by attracting personnel for whom the research problems attendant upon the publication become an interest in themselves and provide an agenda that extends beyond the bounds of the original publication. Examples include the Women Writers Project at Brown University, which was originally founded to create digital anthologies of early women's writing but has evolved into a digital humanities research group; and the Walt Whitman Archive, which began as an electronic edition of Whitman's writings but similarly has gained critical mass in digital humanities research more generally. It now undertakes significant research on metadata usage and text encoding standards and has become the nucleus of a Center for Research in the Digital Humanities at the University of Nebraska. The reverse is also the case: research units and faculty support units often engender digital publication projects by providing support and impetus for faculty to undertake scholarly publication in digital modes. Finally, digital library centers often produce digital publication projects focusing on individual collections or authors of particular significance. Examples include the Robert Graves Diary at the University of Victoria (<http://graves.uvic.ca/>), the Chymistry of Isaac Newton at Indiana University (<http://webapp1.dlib.indiana.edu/newton/>), the New York Public Library's Digital Schomburg collection (http://digital.nypl.org/schomburg/images_aa19/), and numerous others.

There are also important structural alliances arising between entities in this list. Digital library centers and faculty support centers often find themselves in complementary (or potentially competing) roles in responding to faculty needs for digital materials. Depending on where digital services first arise in a given institution, facilities such as digital course reserves, digitization services, and support for digital publications or scholarly digital projects based on library collections may fall within the purview of either type of group. A clear mutual articulation of responsibility can be crucial in avoiding duplication, gaps in service, and territorial disputes. Along different lines, digital publication projects and faculty support centers

often depend on digital library centers for essential infrastructure, both technical and intellectual: metadata, cataloging, and digitization services, long-term archiving and digital repository management, and expertise in rights management and best practices.

DIGITAL HUMANITIES FROM A LIBRARY PERSPECTIVE

Thus far, we have been considering the field of digital humanities more or less as it considers itself. But from the perspective of the library community, the field presents a few specific faces of particular significance.

First of all, a very large proportion of large-scale digitization efforts in North America are being undertaken in libraries, or in partnership with libraries. The library community and in particular the academic library community are thus the places where attention is being paid to ways of making the resulting collections usable in a digital humanities context. Digital library staff are typically those charged with developing and implementing best practices for the use of metadata standards, and with producing and maintaining interfaces that permit these collections to be used effectively by readers. Already, experimentally, this use may include the ability to build new projects that draw and recombine materials from large digital collections, together with project-specific commentary or more specialized interface tools. And as we have already observed, a substantial number of digital humanities projects actually arise within libraries, arising either from faculty interests or from specific library collections (or both).

More importantly, though, libraries play a crucial role in the larger life cycle of the digital humanities. As we noted earlier, digital humanities tools and methods are constantly evolving from early experimental forms into routinized practices; as this happens, the kinds of support and implementation they require undergo significant changes. A digital tool or process in the incipient stages is initially adopted experimentally by a few adventurous practitioners; the required tools are installed as prototypes on a development server and programmers explore configurations, make optimizations, and work closely with faculty to develop cutting-edge projects that innovate both technically and intellectually. The results are often published as demonstrations of the potentially transformative effect the tool in question will have on humanities research. These activities typically take place within a digital humanities research group or faculty support center: groups devoted to small-scale, custom approaches that need not operate at scale to be effective as investigations. However, once the process in question is working smoothly and no longer requires attention (or poses interesting problems), such groups need to move on: their funding and institutional mandate require them to tackle new tools and processes, not to maintain well-established

projects at a production level, or to undertake their long-term preservation. As projects and processes enter a mature phase of active operation, a new set of needs arise: for the articulation of best practices, for cost-effective methods of executing work processes consistently and at scale, for anticipation of future needs such as forward migration of data, and for the provision of sustainable approaches to preservation and long-term access. These needs are entirely consonant with the traditional mission of libraries and it is in digital library centers that these needs are now typically being met. Because the library community is already primed to be aware of the importance of standards and best practices, they have led the digital humanities world in advocating, developing, adopting, and documenting standards and best practices in all areas of digitization.

Among these standards and practices a few of the most significant deserve specific mention:

- Metadata standards and specifically METS,^[33] MODS (Metadata Object Description Schema),^[34] EAD (Encoded Archival Description), the various name authority formats (MADS,^[35] etc.), and controlled vocabularies which form the basis for large-scale data management and retrieval. While these are typically not used directly by digital humanities projects, they provide an infrastructure on which many digital humanities projects rely at some point in their life cycle: for instance, when they enter a digital repository, or when they draw on digital materials from a digital library collection.
- Digitization methods such as digital imaging, OCR, automated scanning and markup technologies. Advances in this area are often driven by digital library needs, which are on a larger scale than other typical digital humanities projects.
- Aggregation and federation of data to permit cross-collection searching and other forms of functionality such as metadata harvesting. These are complicated infrastructural systems that can only be implemented by libraries, but they can be (and increasingly are) used by digital humanities projects and activities.
- Intellectual property rights management, and reciprocally the issues surrounding digital publication and the licensing of research materials such as online journals. Libraries have traditionally acted as institutional agents in these realms and continue to do so in the digital arena; additionally, however, as libraries play an increasing role as publishers of digital information, they also play a potentially transformative (or disruptive) role in the publication ecology and its cost structures.^[30]
- Information retrieval and knowledge representation, as these affect the design and implementation of large-scale systems for aggregating, processing, and using digital information in scholarly research. The field of

information science is merging into library science, specifically on the terrain of digital research materials. While these issues are by no means limited to the humanities, humanities data poses distinctive challenges and research requirements.

Finally, the rise of digital humanities activity and the increased resources that are being devoted to digital humanities projects mean that sustainability and long-term preservation of digital resources are rapidly becoming far from academic. Libraries are typically the place where digital repositories are being developed and housed, and the library world is the institutional space where issues of long-term archiving, metadata management, and forward migration are being tackled.

CHARACTERISTIC METHODS, PRACTICES, AND QUESTIONS

Modularity

The idea of a modular toolset or “scholar’s workbench” has preoccupied the digital humanities community for decades^[36] and has led to an interest in identifying the essential intellectual components of humanities scholarship and research. In a November 1995 posting to Humanist, Willard McCarty called for “a basic set of primitives” and a corresponding set of “component-packages”; “It seems to me that the most broadly useful invention would be a set of components the ‘garden-variety’ humanist could assemble quickly into a process.” (Humanist 9.301 <http://www.digitalhumanities.org/humanist/Archives/Virginia/v09/0278.html>.) Perhaps in recognition of the tendency noted earlier—by which methods and tools become “black-boxed” as they attain routine status—modularity of design has become an important paradigm for the digital humanities at a fundamental level. Its corollary is the concept of the application programming interface: the exposure of processes, of inputs and outputs, so that modules can be developed independent of one another and assembled by the practitioner in whatever combinations suit the task at hand. Its underlying logic is that of the open source, in which a published specification and open architecture permit extension and experimentation without artificial dependency or limitation.

For digital humanists, this modularity has two important goals. The first is, practically, to be able to model or represent these components in a combinatorial way in the digital arena; in other words, rather than prepackaging them in arbitrary and immutable combinations, to provide more granular or elemental tools which can then be used in whatever combinations scholars need. The second, more theoretically, is to be able to work on the difficult task of modeling these primitives themselves

digitally: not so much with the intention of producing tools, but rather of understanding the activities themselves more deeply.

The first goal has been tackled by digital humanities software developers. Willard McCarty gives as a notable example, the case of the Tübingen System of Text Processing Programs (TUSTEP),^[37] which provides for a sequenced set of tasks which are taken as fundamental to certain types of digital text processing: “capture, retrieval, collation, analysis, sorting, rule-based manipulation and output in digital or printed form.”^[38] But as he points out, the second goal is more challenging; mapping functional modularity onto the “functional primitives of scholarship” is not straightforward and in fact they do not correspond directly. These functional primitives actually turn out to require a different kind of modularization from what is in evidence in current tools. John Unsworth suggests what these might be: “discovering, annotating, comparing, referring, sampling, illustrating, representing.”^[4] Unsworth explicitly proposes these as a basis for a “useful tool-building exercise in humanities computing.” But as his subsequent discussion makes clear, the tools that arise to serve these needs are not focused in any simple way on sequencing these tasks or fulfilling them through a direct, modular implementation. On the contrary, he presents complex interfaces that integrate these functions as essential but not necessarily separable dimensions. In other words, modularity operates usefully at a conceptual level to help us understand the activities being supported or modeled, but at the level of implementation the units of modularization may be quite different.

Representation

Digital humanities as a field is deeply concerned with questions of representation, particularly as these impinge both on the digital representation “under the hood,” and on the way source material is offered for use to the reader. These questions sometimes loom as large theoretical problems. For instance, through what kinds of information structures can a digital object represent a material object or a time-based object? How do we measure the adequacy of a representation: through qualities like visual fidelity, or informational richness, or retrievability, or tractability to analysis?^[39,40] Does the form of the digital representation itself even matter, as long as its effects for the reader are serviceable? From another angle, the questions are methodological. What are the appropriate or strategically useful levels of granularity at which to represent data? What are the appropriate descriptive vocabularies and what are their characteristics? What is the strategically appropriate balance between, as Willard McCarty puts it, the “complexity and ambiguity” of the cultural source material, and the “mechanically rigorous” demands of computational form?^[41]

We can usefully identify several distinct (and often complementary) approaches to the representation of digital humanities information.

The first of these is modeling, which McCarty describes as the “performative” building of “hypothetical constructs” (p. 53)^[41] through which we can “make new knowledge” (p. 71),^[41] a process of “purposeful simplification” (p. 52).^[41] Modeling is thus an intellectual process which is not necessarily or even primarily digital, but which digital research methods bring to the fore. In this respect modeling recapitulates the relationship of critical engagement with the method that we observed earlier. McCarty notes the “mediating role and ternary relationship modeling establishes between the knower and known: the directed, vector-like engagement of the inquirer’s attention, through the model he or she has made to the object of study, and the model’s consequent function as an artificial agent of perception and instrument of thought” (p. 38).^[41] One measure of success here is the sophistication of the questions the model permits us to entertain, and its horizon of usefulness. Do we exhaust its intellectual potential and its ability to sustain questions immediately or over a longer period of time? Another measure is the range of different kinds of questions the model permits. Digital modeling technologies are typically those that permit complex data representation: databases, XML structures like TEI, METS, or SVG, metadata of various sorts, and data formats that represent spatial information such as GIS or CAD.

An opposed, or at least complementary approach, is what we might term the “facsimile”: representations that seek to reproduce the source more and more exactly according to some metric of fidelity. These metrics include, for instance, exactness of color duplication, granularity of visual detail, or fineness of sampling rate. Typically facsimiles appeal directly to some human sense: most frequently sight or sound, but we can imagine others becoming relevant with the advent of different output technologies catering to other senses. The measure of success for a facsimile is typically a level of accuracy, exactness of duplication, or sensory indistinguishability, rather than function. More precisely, the facsimile’s accuracy supports high function in the human brain through the human analytic processes that it enables, rather than functionality within the digital system.^[42]

The most common examples of facsimile approaches to digital representation are found in digital library collections that have been digitized as page images, often with metadata but without a corresponding transcription (either for reasons of cost or of transcriptional difficulty). In these cases, the facsimile simply offers an affordable way of providing basic access to rare or otherwise inaccessible materials for which transcription would be prohibitively expensive. However, for some projects the facsimile carries specific methodological merit as a way of representing visual (or other non-textual) information that

cannot yet be usefully modeled. The most vivid examples are the archives of visual artists such as William Blake or Dante Gabriel Rossetti, both of whom have prompted digital publications that not only rely on high-quality facsimile representations but also argue the limitations of modeling.^[42]

These arguments also reflect an increasing interest in the materiality of media and in particular of the source materials that are the objects of scholarly research. The modeling approach involves the complete absorption and transfiguration of the source’s informational content into a representation that is oriented toward some specific research problem. The facsimile approach suggests instead that there is an irreducible and resistant “thingness” to texts and artifacts that requires a more direct sensory interaction. The digital representation necessarily intervenes in this interaction (through sampling and the other reductions that take place in digitization) but it may do so to enhance some dimensions while it reduces in others. A good example is the work that has been done at the University of Kentucky’s *Electronic Beowulf*,^[43] where images of the damaged manuscript have been digitally processed so as to reconstruct damaged pages and make visible letters that could not otherwise be read. Processes such as digital flattening of folded or crumpled pages too brittle to be moved,^[44] or magnification and special lighting to reveal nearly invisible marks, suggest the ways in which a researcher’s apprehension of the material text itself is oddly more immediate and vivid—in some dimensions—when digitally mediated.

A third predominant form of digital representation is metadata, and in this category we can usefully also include the more traditional scholarly domain of commentary and contextualization. In an important sense, metadata is a more structured form of commentary: a way of formalizing our knowledge about an object and associating it with that object in a durable way. Under this informational rubric there is considerable variety. Some types of metadata are embedded within the digital object itself, such as EXIF or XMP data in a digital image file, or the TEI header in a TEI document. Other kinds stand outside the digital object and serve to catalog, manage, or situate it within a larger collection, or to manage information about some dimension of its content. Examples include METS, MODS, and the numerous formal standards for authority control. As the uses of metadata change with the growing importance of aggregation and cross-collection functionality, metadata is increasingly being managed apart from the digital object, pointing to it rather than being embedded within it, so that the distinction between embedded and independent metadata is less clear and less important.

Metadata plays a crucial role in the digital humanities, and particularly in projects and research tools in which scale is a critical component. For individual digital projects (such as a scholarly exploration of a single poem, or a multimedia installation, or an edition of a single text) the

need for metadata is minimal, and is focused on the requirement that such digital objects should carry with them basic information about their creation and status as publications, much as a book carries a title page and publication information. Best practice suggests that such objects should also carry further information about their preparation: the editorial principles that guided their creation, the relevant digitization standards, and methods of capture. This information, while not always strictly necessary for a reader, is probably useful for most critical readers. It serves the role of the discussion of methods that accompanies scholarly editions, and also serves the crucial purpose of facilitating future support or archiving of the digital object by an IT support group or a digital repository. Indeed, as soon as the object finds its way into institutional structures like these, it no longer functions in isolation but has to take its place in collections (increasingly large ones) in which its effective functioning will depend greatly on what kinds of metadata it carries or has added to it as part of its acquisition.

This transition illustrates an important tension in how metadata functions within the digital ecology. To the extent that the digital humanities domain aspires toward effects of scale (interinstitutional collaboration, large-scale aggregation of resources, cross-collection searching, reliable retrieval, analysis) it anticipates the value of metadata and invests significant resources in creating it, typically through partnerships with libraries or organizations devoted to creating standards and metadata aggregations (e.g., OAI). At the same time, as digital humanities reaches the scholarly desktop and no longer requires large-scale funding or groups of people to implement digital humanities projects, digital humanities activities resemble individual monographic publications, but without the publication infrastructure through which metadata in the print world has traditionally been supplied. In addition, the structure and even the medium of many digital humanities projects and publications leaves little space for metadata. For this reason, many of the digital scholarly products of the current era find themselves in publication (via the Web) without the levels of formal metadata control that were commonplace in print.

Pattern Discovery and Visualization

There has been increased interest in a new breed of text analysis tools which emphasize dynamic manipulation and pattern discovery rather than hypothesis testing and scientific approaches.^[45–49] The value of interactive systems was recognized much earlier; see for example Ben Shneiderman's 1983 discussion of "direct manipulation" which he defined as systems whose key features are "visibility of the object of interest; rapid, reversible, incremental actions; and replacement of complex command language syntax by direct manipulation of the object of interest."^[50] In the same vein, John Bradley contrasts what

he calls the "deterministic-transformational" approach to text analysis with approaches that consider "the effect of the machine on the development of a critic's *mental model* of the text" (187, emphasis in the original). McCarty, commenting on this entry, observes further that "Criticism is ... poorly supported by batch-orientated software, which being a 'black box' is by nature peripheral to what the scholar actually does" (219).

This emphasis on text analysis has led to significant research efforts in two directions: first, a resurgence of interest in large data sets that will permit meaningful literary text analysis, but with some differences from earlier corpus-building approaches: whole texts rather than samples; texts that are of significance to scholarship; markup used to represent genres and textual structures. And second, there has been a strong interest in developing tools that draw on data mining technologies drawn from the sciences and financial analysis to permit very large-scale pattern discovery. Currently the most prominent example of humanities data mining is the MONK Project (<http://www.monkproject.org>). These efforts are still nascent, but they offer significant potential to respond to real scholarly needs in the humanities rather than overlaying scientific investigative techniques onto literary content.

In concert with the development of the back end software and substantial corpora for analysis, visualization tools are also emerging as a crucial component of modern text analysis, but they have also arisen on their own as part of the fascination with Web 2.0 styles of graphical display and aggregations of data. From a digital humanities perspective, visualization tools fit well with the prevailing interest in modeling, since they provide ways of creating visual analogues to the representational models operating within the data itself, or within the researcher's own mind. Digital humanities visualization tools draw techniques from a wide array of sources: knowledge management tools, mapping, social networking tools, medical and scientific imaging, and virtual reality tools.

Future Trends

The developmental tendencies for the digital humanities field seem to run both toward increased disciplinary consolidation (through the emergence of departments, faculty, and degree programs) and also, ironically, toward disciplinary dispersal as digital techniques penetrate the humanities more and more broadly. It is thus difficult to predict whether in 20 years the field will have created very clear boundaries for itself, or on the contrary will simply have become synonymous with "the humanities" and perhaps have disappeared altogether. However, beyond its impact on the practice of traditional humanities disciplines, perhaps the clearest indication of its influence is the emergence of new humanities fields in which digital media are themselves the focus of attention. We have already mentioned new media studies, the study (as Janet

Murray puts it in her introduction to the *New Media Reader*) of “the computer as an expressive medium.” Adjoining this field are two others of note: first, game studies, which takes the same approach but with a close focus on computer games and the expressive logic of the game form. The second is digital aesthetics, not yet perhaps a field but certainly a research domain, again attending to the expressive potential of the digital realm but with an emphasis on specifically aesthetic questions and problems. These three fields which represent visible nodes in an intellectual continuum that is still in the process of coagulating, all take the computer itself, and the digitally networked systems that arise from it and depend on it, as having pervasive cultural significance—not because of their novelty, but because of the distinctiveness of the intervention they are making in our cultural and intellectual habits. The complex relationship between digital information and human cognition, which could be characterized as augmentative, complementary, frictional, or mutually antagonistic seems to reveal problems and questions of deep and lasting significance which we need new tools and approaches to study. Digital humanities may prove to be the durable locus of that study, or it may turn out to be a temporary phase through which these studies are passing on their way to a more tightly defined disciplinary focus.

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Digital Humanities and Academic Libraries

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Abstract

This entry opens by defining and outlining digital humanities as an academic enterprise and exploring the intellectual and institutional connections between digital humanities and libraries. Through an examination of the major publications on the subject, the theory and concepts of digital humanities as a field of inquiry are explored, and how those theories and concepts are possibly mapped to academic library traditional collections and services. The majority of the narrative is then dedicated to focusing on the nature of the work being done in these areas by academic libraries and librarians and the issues and challenges they encounter surfacing in that work.

INTRODUCTION

“[O]f all scholarly pursuits,” the literary scholar Stephen Ramsey relates, “Digital Humanities most clearly represents the spirit that animated the ancient foundations at Alexandria, Pergamum, and Memphis, the great monastic libraries of the Middle Ages, and even the first research libraries of the German Enlightenment.” For Ramsey, digital humanities (DH) “is obsessed with varieties of representation, the organization of knowledge, the technology of communication and dissemination, and the production of useful tools for scholarly inquiry.” These sentiments underline an enduring connection between DH work and librarians, accenting a shared investment in information organization, discovery and access, outreach, and collection development. Indeed, sites of DH research, Ramsey contends, enable “scholars to act more like librarians, and . . . librarians to act more like scholars.”^[1]

Ramsey’s remarks highlight a growing consensus among librarians and DH scholars about the place of the library in DH, and DH in libraries. With expertise in metadata, knowledge of digital collections, and familiarity with the operational side of digital projects—whether sourcing, preparing, and manipulating data; digitization and analysis of text, moving images, or other audiovisual material, information architecture, and user experience; or instruction about tools and techniques—librarians have played an important role in promoting and integrating DH in universities.^[2] At the same time, librarians have also generated DH scholarship, such as leading the large Text Encoding Initiative (TEI), and data and text mining projects, which, inter alia, helps efface and complicate the implied division of labor that often surfaces between librarians and digital humanists.^[3] That librarians are integral participants in conversations about DH as digital humanists is a perspective embraced by many working in the field.^[4]

And while DH labs and centers have been well established and based in libraries (such as the Center for Digital Research in the Humanities at the University of Nebraska), more libraries have begun to investigate different ways of initiating or formalizing their work in DH and are considering the place of the library in the institutional development of DH programs in universities and the attendant difficulties inherent in establishing infrastructure and support for library-led DH initiatives.^[5] But the opportunities offered and the questions raised by this relationship are manifold, and all parties—librarians, professors, and administrators—also understand how indispensable collaboration is in fostering and sustaining successfully digitally oriented research endeavors in the humanities and social sciences.^[6]

This entry opens by defining and outlining DH as an academic enterprise and exploring the intellectual and institutional connections between DH and libraries. The majority of the narrative is dedicated to focusing on the nature of the work being done in these areas by libraries and librarians, by librarians working with academic faculty, and the issues and challenges they encounter surfacing in that work.

DIGITAL HUMANITIES

One of the principal problems for anyone interested in DH is the vexed question of definition. Whether made capacious or narrowly drawn, definitions for DH often reflect the research interests and work of persons proffering definitions. At a talk in 2010, Johanna Drucker, observed in jest that the heterogeneous nature of DH—filled with librarians, information scientists, and scholars working in disparate fields of the humanities—resembled the variegated extraterrestrial crowd at the Mos Eisley Cantina

from the original *Star Wars* film.^[7] And, to be sure, this heterogeneity is reflected in the Whitman's sampler of methodological approaches employed by numerous scholars from the various fields doing original work in the DH: network analysis, algorithmic criticism (topic modeling, word frequency analysis, large-scale text analysis), preparation and analysis of linguistic corpora, digital media archeology, spatial humanities (geo-analysis), data visualization, instructional design and pedagogy, and locating and assembling humanities data sets—to name only a few.

In view of this, when venturing a definition, a more functionalist approach that examines scholarly activities or modalities related to DH is probably most appropriate. For Josh Honn, a Digital Scholarship Librarian at Northwestern University, the work that shapes what is classed as DH falls into five, nonmutually exclusive categories:

1. Scholarship presented in digital form(s)
2. Scholarship enabled by digital methods and tools
3. Scholarship about digital technology and culture
4. Scholarship building and experimenting with digital technology
5. Scholarship critical of its own digitalness^[8]

What Honn means by each speaks (in a disciplinary manner) ecumenically to DH's computational, experimental, cultural, and deeply self-reflexive humanist academic origins. Beginning with Father Roberto Busa's enlistment of IBM in 1949 to help develop the *Index Thomisticus* (often adduced as the first DH project), DH work has been characterized by the engagement of information technology and methods, questions, and content culled from diverse scholarly fields and a concomitant reflection on the use of that technology in that engagement.

By this reckoning, DH is not so much a distinct, intellectually autonomous disciplinary field, but rather as John Unsworth contends, "a method of reasoning."^[9] What this means for librarians is that DH librarianship does not necessarily have to be tethered to the kind of single subject specialization associated with subject librarianship (expressed most frequently by additional disciplinary degrees). Instead, DH furnishes powerful digital tools and interdisciplinary methodologies to gather data, analyze them in ways previously unused/underused in humanities research (for instance, network analysis), and take the results thereof to draw novel conclusions and pose original research questions. This understanding of DH, with its accent on critical, interdisciplinary openness, affords librarians greater purchase, both intellectually and procedurally, in skilling up for, participating in, or overseeing DH enterprises—whether as extensions of library-focused work (using DH methods for collections analysis), as collaborations with disciplinary faculty (procuring data for research), or building digital projects.

LIBRARIES AND DH: THEORY AND PRACTICE

Theory

The current scholarship on DH and libraries theoretically and conceptually places libraries within the DH more as collaborative entities and having a greater role in faculty scholarship endeavors. As the title of the 2015 Association of College and Research Libraries (ACRL) publication *Digital Humanities in the Library: Challenges and Opportunities for Subject Specialists* suggests, DH and libraries has now in great part wrested with subject librarians and collections specialists. In collaboration with other campus entities (mainly faculty, but also grad students), libraries and librarians can offer "partner relationships, becoming embedded in the mission-critical aspects of higher education—research, teaching, and learning—and infusing librarians particular expertise, collections and values into new types of research. . ." (Forward, X).^[10] This ACRL publication does well to combine many of the "core" publications on libraries and DH that came before it—especially Issue 53 of the *Journal of Library Administration*, the Association of Research Libraries (ARL) SPEC Kit 326, and the Ithaka report on *Sustaining the Digital Humanities: Host Institution Support Beyond the Start-Up Phase*—by giving an overview of the state of scholarship in the field as pertains to libraries, while simultaneously demonstrating best-case scenarios and real-world solutions to DH-generated problems. Most recently, *Laying the Foundation: Digital Humanities in Academic Libraries* does well illustrating how "librarians are critical partners in DH instruction and inquiry and that libraries are essential for publishing, preserving, and making accessible digital scholarship" (xii). Along the 2016 SPEC Kit 350 on *Supporting Digital Scholarship*, these publications (among many others) form a core of titles around which to explore three areas of theoretical encounters: 1) how libraries enact and engage DH, 2) how libraries understand and relate to DH, and 3) how libraries can sustain, foster, and facilitate DH.

How libraries enact and engage DH

The first to appear of the "core" publications on the subject was the 2011 ARL SPEC Kit 326: *Digital Humanities*, which was made to answer the question of whether and which libraries offered centers or services that support DH work. Its stated purpose was "to provide a snapshot of research library experiences in these centers. . . and the benefits and challenges of hosting them" (p. 10). By way of survey, the SPEC Kit identifies major trends of libraries supporting DH and estimates levels of project staffing, services and support, hardware and software, (the range of) service users, actual project workspace, funding sources, policies and procedures, sustainability (through project preservation), partnerships, and whether these

efforts were undergoing assessment. The survey recognizes the relative prevalence of “bricks and mortar” DH centers (as opposed to a more general digital scholarship center) and how great the overall effort of a library team (with other units such as metadata and preservation units) being involved is. The remainder of the SPEC Kit delineates findings from the survey instrument, and then provides representative documents (mostly screen captures) attached to the DH-related units who responded. Especially useful are the conclusions that libraries are most useful (and are considered that way by scholars) at the starting and ending phases of a DH project because they provide knowledge of various information technologies and collections, and because libraries have knowledge of metadata and preservation.

In 2016, ACRL released another SPEC Kit (350) on *Supporting Digital Scholarship* that surveyed and updated much of the same terrain as the earlier publication. That these volumes bore a remarkable similarity in content yet were branded differently could serve an informal index of how ACRL envisions how libraries enact and engage DH. Using Abby Smith Rumsey’s definition for digital scholarship, this SPEC Kit understands library engagement as the “use of digital evidence and method, digital authoring, digital publishing, digital curation and preservation, and digital use and reuse of scholarship.”^[11] For librarians, what this engagement includes are varied activities and support services within the library, such as digitizing and reformatting analog media, metadata creation, building digital collections and exhibits, digital publishing support, database support, software development, interface design, and consulting on geospatial information (GIS) and digital mapping projects, doing text encoding and analysis. Indeed, the move toward “digital scholarship” elicits questions about what, if anything, is distinctive about “digital humanities” librarianship. *Supporting Digital Scholarship* does not discuss or acknowledge a distinction (nor does it use “digital humanities” in its executive summary). Given the list of duties detailed in the report, an emphasis on generating original scholarship, or acting as research partners, is comparatively not stressed.^[12] Whatever “digital scholarship” is for libraries engaging in DH, it remains undetermined whether the term functions as simply rebranding, implies a discrete set of duties that principally accent service and support, or extends librarians’ work in DH to other disciplines as library-led scholarship.

How libraries understand and relate to DH

In 2013, the *Journal of Library Administration* devoted an entire issue to addressing the nexus of DH and libraries—what was currently being done and what the future was. Chris Alen Sula’s article on *Digital Humanities and Libraries: A Conceptual Model* for the first time presents

a “cultural informatics model of libraries and digital humanities, and (situates) DH work with the user-centered paradigm of library and information science.”^[13] By doing so, Sula conjoins DH and libraries and how the two can be operationalized through collaboration—both within the library (between library units) and across campus. This model places emphasis on relevancy rather than sustainability, which is a slight departure from the scholarship on the subject previously. Potential collaboration between DH scholars and librarians then “offer(s) an important opportunity to provide renewed support for the humanities and to bring library resources across the board up to speed with digital scholarship for the 21st century.” Others within the *JAL* issue pick up the mantle of collaboration: Jennifer Vinopal and Monica McComick suggest that “New models for librarian-scholar collaboration include much more librarian engagement with the entire research process than ever before,” including “grant-seeking, project planning, data collection and organization, and metadata creation,” as well as “data analysis and visualization, content dissemination, and long-term archiving.”^[14] And this range of work is reflected in the multi-institution survey results from librarians reporting about the variety of work they do published the 2016 ACRL SPEC Kit on digital scholarship:

- (90–95%) making digital collections, creating metadata, and offering data curation and management support
- (85%) creating exhibits and project planning
- (81%) GIS and digital mapping
- (79%) digitization
- (76%) digital publishing
- (72%) project management
- (38%) developing DS software^[12]

How libraries can sustain, foster, and facilitate DH

The Ithaka report on *Sustaining the Digital Humanities: Host Institution Support Beyond the Start-Up Phase* combines the theoretical with the practical, demonstrates what libraries are doing with DH, and points out possible success scenarios for the future—in part answering the mythic question of “If I/we build it will they come?”^[15] Though the study focused on a small but tidy group of ARL institutions that had established DH “centers” within their libraries, many other administrators, librarians, and scholars were interviewed around questions having to do with sustainability, investment in resources, and expected outcomes. For libraries, the report is important for its insistence on institutional (“top level”) support from university administrations and provides several frameworks for gap analysis surveys to be done on campuses. Once it has been decided upon whether to start a DH center, and the answer is “to build,” then there is a practical road map

in the section on “Success Factors and Examples of Good Practice” by keeping the following in mind while visualizing and operationalizing a DH center:

1. Knit deep partnerships among campus units (library, IT, digital labs).
2. Rationalize support and manage faculty expectations.
3. Figure out how to use scale solutions, without overly limiting the creativity and research aims of project leaders.
4. Clearly communicate pathways and expectations to faculty.
5. Measure and communicate impact.

The report goes beyond previous theoretical models and suggests the “Comprehensive System” for creating the DH center through

1. A clear starting point for any faculty or staff developing digital projects
2. An “intake” process that allows an important screening process
3. Regular communication among those units on campus with human or infrastructure capacity to share
4. Establishment of measures for success
5. Bring(ing) in new partners to the digital life cycle to support dissemination activities
6. Documentation that spells out the process to all faculty and staff members

The Ithaka report is heavy on institutional collaboration for the success of a DH unit, as are most of the advisory takeaways from the scholarship on the subject. So in answer to the question “If I/We build it will they come?” the answer is, “Only if you build it in partnerships and collaboration with other campus entities.”

The subtext of the Ithaka report also suggests an emphasis on new skills and ways approaching the profession for librarians of the twenty-first century. Preceding Ithaka was a 2012 report released by Research Libraries United Kingdom (RLUK) that broadly redefined roles for subject librarians.^[16] Entitled *Re-skilling for Research*, the report accented the growing importance of equipping academic and research librarians with a large swath of technical skills associated with data analysis and curation, in addition to further training in grant writing and soliciting funding for projects. The recommendations in *Re-skilling* for subject and liaison librarians in academic and research institutions conclude by emphasizing how these librarians have effectively created and curated metadata in the past, and will be required to do more of the same in the future.^[16] Librarians must evince “knowledge to advocate, and advise on, the use of metadata,” as well as possess “[s]kills to develop metadata schema, and advise on discipline/subject standards and practices, for individual research projects.” This emphasis on training is also

outlined by Alix Keener in her study of DH scholars and academic librarians within the Center for Institutional Cooperation (CIC) network of institutions, where she urges “libraries . . . [to] address internal issues, such as training and re-skilling librarians as necessary,” in order to help “make the library an active and equal partner in research.”^[17]

Practice

Owing to its relative, more formalized newness in libraries, steps for practical implementation of library-led DH initiatives have only recently begun to be discussed. As a template based on their own experiences, Katie Gibson, Marcus Ladd, and Jenny Presnell have outlined a tiered commitment level description of how librarians can start building DH capacity through outreach, instruction, and self-education:

- *Low commitment*: connect with graduate students, explore other DH sites and projects, and learn about institutional technological infrastructure, preservation formats and standards, and altmetrics.
- *Moderate commitment*: host DH symposium with external participants, collaborate on designing curriculum for courses, provide workshops, and seek opportunities to learn DH tools and how to code.
- *Intensive commitment*: build new DH projects with materials sourced from library’s unique holdings.^[18]

As indicated, skilling up for DH work (learning code, tools, methodologies, data manipulation, different application programming interfaces [APIs]) composes an essential component at all stages, and beyond self-paced websites (e.g., Codecademy) or MOOCs, options are limited for professional development—and are often pitched to those already working in allied, tech-heavy areas. Some institutions have developed in-house initiatives designed to equip subject librarians the “hard” technological skills often needed for DH projects. For instance, informed by *Re-skilling for Research*’s conclusions about the future import of DH, the humanities and history librarians at Columbia University formed the Developing Librarian Project, a 2 yr hands-on effort to learn-by-doing that required them to design and build a digital project ab initio. But, explains Miriam Posner, the coordinator and core faculty in Digital Humanities Program at the University of California, Los Angeles, “much of the discussion about building a DH-friendly library environment leans too hard on individual librarians, without taking into account the set of institutional supports, incentives, and rewards that will allow DH to flourish in a sustained way.”^[19] In addition to these concerns, Posner emphasizes several practical problems library-based DH work can encounter, and ones that might stymie any level of commitment investment; these include limited training

opportunities, “lack of support for librarian-conceived initiatives,” innumerable tasks with limited time, “lack of authority to marshal the appropriate resources,” “inflexible infrastructure,” “lack of incentive,” concerns working with faculty, “diffusion of effort,” and “lack of a real institutional commitment.” By drawing attention to these issues, Posner urges consideration not only of the substance of DH library work but also how necessary the material conditions and institutional commitments are to enable and sustain its possibility.

For librarians just beginning to establish or build out DH work in the library, more sensitive, existential, and political questions surface concerning their role in that work. If there are librarians doing DH work, asks Dot Porter, the curator for Digital Research Services at the University of Pennsylvania, then “what the heck is a DH academic?”^[20] In high-level discussions of DH in the library, there is often an implied division invoked between “librarians” and “DH scholars/academics” and an argument for understanding the role of “librarians as digital sherpas” or for separating out the work of the “DH skilled-librarians” from “DH academics.”^[21] And, to be sure, such a perspective is in consonant with the traditional service orientation of library work, which accents librarians’ role in providing critical and often necessary support and guidance for DH projects. Without library expertise, for instance, in furnishing metadata or sourcing data sets, DH projects that rely on these indispensable library services would most likely flounder or stall. But as Alix Keener explains, while “scholars appreciate the specialized expertise of librarians” (such as metadata and special collections work), librarians at the same time should “take a more active stance in utilizing current library resources or vocalizing their needs for other resources.”^[17]

All the same, as Trevor Muñoz, assistant dean for Digital Humanities Research at the University of Maryland Libraries, contends, “[d]igital humanities in libraries isn’t a service and libraries will be more successful at generating engagement with digital humanities if they focus on helping librarians lead their own DH initiatives and projects.”^[4] While these two approaches are not mutually exclusive, they do suggest the charged valence that often slots digital humanists working in the library into a category that is distinct from colleagues stationed in other campus units. “It doesn’t make sense to measure the digital humanist-ness of someone,” Porter advances, “based on their current post (especially as digital humanists tend to be fairly fluid, moving between posts inside and outside of the library).” And to militate against these concerns, Bethany Nowvickie, director of the Digital Library Federation and director of Digital Research and Scholarship at the University of Virginia Library, proposes embracing a collaborative model that emphasizes independence and parity, the “Skunk Works.” Taken from a Lockheed-Martin working group, the term skunk works “describes a small and nimble technical team, deliberately and self-

consciously and (yes) quite unfairly freed from much of the surrounding bureaucracy of the larger organization in which it finds itself.”^[22] For building DH projects that involve participants across university units (including the library), skunk works are premised on marking out inventive spaces for digital humanists—irrespective of job title—to collaborate as research and development peers in generating original research. As Harriet Green argues, only by “engaging in radical collaborations and pursuing new reconfigurations of library engagement and services, librarians can become even more embedded in the research workflow and engage researchers as partners.”^[23]

With these practical—and at times abstract—considerations informing the library environment for DH work, the operational side for the library resembles the recommendations of the tiered commitment model outlined by Gibson, Ladd, and Presnell. Working from those recommendations and expanding its scope, a more generic set of terms to group the elements described can be divined that characterizes the broad areas of work DH librarians do: instruction, consultation and collaboration, and collection. While many librarians do work in these areas (in the case of the subject specialists, usually all four), these terms take on a special, practically oriented valence when used in a DH context.

Instruction

For many librarians, instruction often entails teaching information literacy, or providing demonstrations of print and electronic resources or discovery systems, like the library catalog. While this variety of teaching falls within the purview of librarians whose work might encompass DH, instruction for DH librarians frequently emphasizes two ways that extend traditional library teaching: pedagogical collaboration with teaching faculty and leading workshops and boot camps.^[24] Ideally, informing instruction in these settings is a holistic understanding of digital pedagogy that helps facilitate digital literacy, that is, as Anita Say Chan and Harriet Green explain, these are pedagogical approaches that “connect digital tools to research practices linked to course content.”^[25]

Library-led curriculum support in DH can range from working with instructors to developing assignments that introduce DH tools and methods, making available data sets for analysis (whether sourced from the library’s own collection or available elsewhere), or leading sessions that introduce tools or being an embedded presence providing specific assistance for DH class projects. Successful pedagogical collaborations between librarians and teaching faculty, Zoe Borovsky and Elizabeth McAulay argue, usually involve making “subject matter . . . the central concern of the course rather than digital methodology.”^[26] In other words, these collaborations can help cultivate digital literacy (for instance, evaluating different digital tools and methods) from grounding in and speaking

through disciplinary knowledge. Another common area of instruction for DH librarians are workshops or boot camps, which pivot around introducing DH tools and methods in a manner often similar to information literacy sessions, albeit without the disciplinary focus. There are efforts to explore to use the unique affordances of library instruction to teach DH through information and data literacy principles, as well as disciplinary expectations, but much of the teaching remains tool focused.^[27] Whether course based or workshop introduced, Adeline Koh has identified four general types of projects best suited to library-led DH instruction: digital mapping, text analysis, multimedia websites/online exhibits, and Wikipedia editing.^[28] These types of projects can both complement disciplinary instruction as well as serve as a single session in a workshops series. In all instances, library-led DH instruction incorporates traditional elements of library pedagogy (information literacy, one-shot sessions) but entails greater collaboration and co-presence with teaching faculty.

Consultation and collaboration

Like instruction, consultation for DH librarians builds upon the principles of the reference interview and an understanding of information seeking behavior but is also frequently augmented by counsel, partnership/collaboration on grant writing, research data management, technical advice, and project management. With its stress on collaboration, DH consultations in the library can (or in some cases are designed to) become equal partnerships on projects or initiatives. Elizabeth Lorang and Kathleen A. Johnson particularize elements that can be read as project consultation that evolves into (or is in its conception) a successful DH collaboration.^[29] Their inventory of requirements includes articulating clearly the project's research question and the scholarly conversation being entered, researching other projects with similar research aims or methodologies, defining the scope of the project, developing a communication plan, investigating issues regarding intellectual property, developing a project work plan and a data management plan, providing regular assessment of project development, and documenting project work (among several others).

Much has already been discussed here about collaboration—both as intralibrary initiatives that take advantage of existing collections and services and also between faculty and librarians. Collaboration between faculty and librarians arises in part because of a fundamental shift in the world of academic publishing, which has made academics turn to libraries as partners in their endeavors. Open-access publishing has created new methods of disseminating scholarship, and libraries have now found themselves in the middle of this new and challenging landscape, at least in part due to the rise of institutional repositories (which are often administered by academic libraries).

Many institutions have mandated open-access scholarship and simultaneously mandated that libraries become repositories for data and the publications that arise from research. A “Research Data Management Plan” became mandatory for the National Institutes of Science Education and Research grants in 2013 and the mandate became a requirement for the National Endowment for the Humanities shortly thereafter, which was important for those doing DH projects. When scholars turned to libraries for help with managing, housing, and providing access to data, and even with publishing research, the open-access movement began to take shape within libraries. So we must now add to the role of an academic library (in addition to the traditional roles of acquisition, organization, and preservation of information) the roles of curation and publishing. This is significant to DH practitioners when they realize that libraries have long been the curators and preservationists for digital collections, understand digital publishing issues, and serve as natural collaborators for DH projects. In addition to the roles of acquiring, curating, and disseminating DH projects, subject librarians can also be the natural collaborating partners for the teaching of workshops and instruction sessions for combining digital collections with the DH project management (see the *Instruction* part of this article). The list of DH projects that have academic libraries as their center abound: ARC (NINES, 18th Connect, MESA, and others, now centered at Texas A&M: <http://idhmc.tamu.edu/arcgrant/>), the Text Creation Partnership (centered at the University of Michigan: <http://www.textcreationpartnership.org/tcp-texts/>), to name but a few.

Collections

Traditional collection management responsibilities, such as purchasing monographs or databases, building subject-specific collection strength, or even negotiating with vendors, are situated in an expanded field when considering DH in a library context. Evaluating what constitutes of the components of what is collected, what formats—or how many, and how they are made accessible, uniquely DH collection practices are broadened to include to what can be termed, in this context, humanities data, whether these data are textual or audiovisual, but always in a digital form. Like traditional collection management, the way in which these data are accessed, stored, and made discoverable are paramount questions, but they are also ones made more complicated when curating with born-digital materials.

For Miriam Posner, the idea of humanities data is “a necessary contradiction.”^[30] Indeed, humanities scholars often find it difficult to reimagine books, photographs, and film, among other formats (including born-digital ones, like websites), as agglomerations of discrete data points. But when rendered digitally (or already digital), the possibilities of analysis at scale, or working with metadata

about a text (whether descriptive, technical, or administrative metadata), are opened in ways not previously countenanced. With this in mind, Devin Higgins and Thomas Padilla define humanities data as “organized difference presented in a form amenable to computation [and] put into the service of humanistic inquiry.”^[31] For instance, a scholar could use the API of the Digital Public Library of America to retrieve, en masse, a subset of bibliographic metadata in JSON for a distant reading project. The metadata harvested and transformed constitute humanities data sets, drawn from a larger universe of humanities data, and formatted for computational analysis. Because of its unique affordances, that humanities data are available digitally is what enables novel forms of analysis.

Humanities data, like research data or other data available digitally, requires curation. Julia Flanders and Trevor Muñoz describe the principal purpose of humanities data curation as “ensur[ing] that the representations of objects of study in the humanities functions effectively as data.”^[32] What they mean by this is that humanities data curation maintains data for computational analysis and keeps it interoperable across systems and format migration “while still retaining provenance and complex layers of meaning.” Often questions of curation fall outside the ambit of collections, but recognizing humanities data unique characteristics, such as the features of scholarly editions, text with markup (like TEI), textual corpora (and the fonds thereof), or other annotated data accompanying analysis, can afford a better perspective on how these data are collected and used.

For libraries, the challenges of working with humanities data can be complex. While there are manifold online repositories (the Internet Archive and HathiTrust, among many others), the rationale for libraries to collect one variety of humanities data over another can be a confusing proposition. In many instances, humanities data are digital versions of analog material (and by being rendered digital are thus freighted with additional metadata in order to be made available for the possibility of computational analysis), and this can generate concerns about collection duplication, and item reproduction. If an item is made available in one digital format, is there argument it should be available in another? And, if so, what copyright issues will need to be addressed in producing an additional digital access copy for computational analysis? For librarians thinking about DH in their collection management decisions, addressing the unique affordances of humanities data will be an intellectual and operational challenge, but a necessary one for fostering DH scholarship at their institutions.

CONCLUSION

“Libraries and digital humanities have the same goals. Stop asking if the library has a role, or what it is, and start

getting involved in digital projects that are already happening. Advocate for new expanded roles and responsibilities to be able to do this. Become producers/creators in collaboration with scholars rather than servants to them.”

In his article from *In the Library With a Lead Pipe*, Micah Vandergrift, echoing Matthew Kirschenbaum’s “What Is Digital Humanities and What’s it Doing in English Departments,” gets to the point quickly that DH is something that libraries have in a less unified form been doing for quite some time, though they may have been calling it something else (digitization projects, metadata, curation of digital projects, etc.).^[33] Libraries that have actually named DH units in order to keep up with the prevailing parlance of academia are reimagining already existing services and collections, leveraging their knowledge of metadata and familiarity with digital project management, while adding to that existing knowledge and resource base the sourcing, preparing, and manipulation of data, and analysis of digitized text, image, and audio for both themselves as a campus unit and for the patrons they serve. Most of these DH units are based around the following areas: collections (to build and/or enhance collections amenable to computational analysis, enable new modes of discovery and access to collections, acquire and/or condition data to support pursuit of DH research questions), collaboration (to partner on DH research, develop tools, convene events, symposia, and colloquia), consultation (to aid with text analysis, network analysis, image analysis, visualization, digital preservation, data curation, grant application process), and instruction (in method, tool, and technique lectures and workshops). As libraries reskill and transition to new ways of supporting patron teaching and research, they also find themselves in new roles because of the changing landscape of academic publishing—and because of repositories, librarians find themselves at the nexus of curation, consultation, and collaboration in the publication of research. So whether or not scholars agree on what DH means and what forms it takes (or should take), the practice of DH looks to remain core to the mission of academic libraries well into the future.

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Digital Images

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Abstract

Although the technologies that underpin digital imaging have been in development for a surprisingly long time, recent developments in computing and networking technologies mean that digital images have recently become the dominant means to create and share photographic material. The Library and Archive sector were early adopters of these technologies, with many and various digitization projects being undertaken to produce digital images of important holdings, which is now an expected practice across the heritage sector. Best practice guidelines have been produced to provide technical and managerial recommendations for those wishing to undertake digitization projects. However, due to the increase in digital images in general society, the information professional also has role in educating industry and the public regarding issues in the long-term preservation of this medium, and we are now at a juncture where cultural and heritage institutions have to explore how best to interact with the general public effectively via digital images.

INTRODUCTION

Images are an integral part of human history, culture, and society. From daubing on rocks, to inventing printing and photographic techniques, humans have continually improved the technology available that enables them to create, share, and disseminate visual information. The way we produce, manipulate, disseminate, and comment on visual imagery has changed considerably since the closing parts of the last millennium. Recent developments in digital imaging, personal computing, and networking technologies have led to an exponential increase in image-based material, from both the personal and public sectors. Digital images are now the dominant, and pervasive, medium used to create, display, and share photographic images, and photographic reproductions of objects and artifacts. The library, archive, museum, and cultural sector were quick to embrace these technologies to increase access to collections through digitization: creating digital representations, usually images, of holdings, predominantly for distribution via the Internet. Various guidelines and recommendations are now in place to ensure best practice in creating digital image surrogates for memory institutions, although concerns regarding benchmarking, quality, management, and long-term preservation remain. Questions regarding use and usefulness are also being raised: does the evidence of use match the investment required to create such representations? Additionally, the pervasive use of digital imaging technology by the general public presents novel and immediate concerns for information professionals.

THE HISTORY OF DIGITAL IMAGES

Visual imagery is a powerful communicator, and the development of digital imaging technologies is tied to the development of communications technology, itself dependent on complex relationships between various scientific discoveries and the culture that encouraged them. Digital photography did not just materialize in the late twentieth century: scientists and technologists had been working for over a hundred years to understand how to use the power of electricity to communicate across long distances and how to use automated computational power to carry out mathematical analysis, eventually finding ways of capturing, distributing, then storing and processing digital information, including images. In turn, the growth in information communications technologies has led to the increased production and use of digital images in all areas of life and culture in the developed world.

Shortly after the first telegraph message was sent in 1837 (2 years before the “discovery” of photography), inventors aimed to transmit drawings via this new technology, with a working system in operation by 1851.^[1] By the mid-1860s, the Victorian world possessed the understanding and the means to enable an image to be scanned in, distributed, and reproduced electronically, in a precursor to facsimile, or fax, technology. Photographic images were first sent by fax in the 1890s, and by the late 1900s, with the discovery of silicon’s conductive properties, technological advances meant automated light-sensitive scanning was available. By using such optical technology to analyze an image broken up into discreet sections, or pixels, and by sending these encoded signals over the

wire, digital scanning, encoding, and reproduction of photographs was possible. This was established in 1920 with the Bartlane system, named after its British inventors, H. G. Bartholomew and M. L. MacFarlane. Many early transatlantic news images appeared in newspapers after being delivered via this system, cutting down transmission time from a week (the time it took a ship to cross from the United States to the United Kingdom) to a couple of hours. By the 1930s, the transmission of images by digital fax was commonplace, with many commercial news organizations owning scanners and networks throughout the world, yet although the digital fax converted images into digital signals by breaking them into refined units, and expressing these units numerically, it was missing vital elements of image processing and electronic storage: digital representations could be created, distributed, then printed, but computing technologies did not yet exist to store or manipulate them.

It was over 35 years later that computers could be powerful enough to store or manipulate digital image representations: in 1957, a drum scanner was used to input image data into a SEAC 1500 word memory computer.^[2] Advances in computing and digital imaging technologies were many and varied in the Cold War years (NASA invested large sums to investigate the use of digital image technologies as a means of defense). However, it was not until the 1980s when the falling costs of computer components, and rising storage and processing capacities of computers, meant that access to computational power became more commonplace, allowing (and requiring) research and development to be carried out on the intricacies of picture-generating software and systems. By the close of the twentieth century, most basic, affordable personal computing systems were able to handle standard full-color images and were capable of running sophisticated photo-manipulation software that allowed digital manipulation that rivaled the accuracy and resolution of traditional photographic darkrooms.^[3] Image capture peripheral devices also became increasingly available (scanners, digital cameras, mobile phones incorporating digital camera technology, printers) in cheaper and smaller incarnations, encouraging users to abandon traditional film-based photographic technology.

Alongside these developments, engineers and computer scientists were also busy constructing networks that would allow computers to source and exchange information. The Internet, and its subset, the World Wide Web, is the perfect vehicle for the distribution of both professional and user-created digital content: having a reliable, and fast, networked environment that can act as a way to share, disseminate, and view digital information has encouraged the creation of both digital versions of analogue material (through digitization) and digital-born media. The role of the Internet in encouraging the uptake of digital image technology should not be underestimated, and digital images of artifacts, objects, people, and places are often

the central focus of information available online. Various online communities now exist around image-sharing sites, including the photo-sharing site Flickr.com, the lifestyle imagery site Pinterest.com, the photo-sharing and -filtering site Instagram.com, and the image-based blog site Tumblr.com.

The history of digital imaging is rooted in the Victorian era but was only toward the end of the twentieth century that it has existed as a practical technology, due to converging developments in communications technology and the networked environment, increased access to cheaper and faster computers, and the lowering cost and improving performance of the peripherals that create digital images, all encouraging the production and use of digital images, by both individuals and institutions. This has been followed by a corresponding rise in user expectations regarding the quality and amount of digital image information that should be able to be produced by desktop machines, or be available online. The recent rapid uptake of digital imaging, and the growing provision of services and online tools, means it appears to be, and functions as, a new medium, changing the information environment and creating new concerns for those working in the information professions.

DIGITAL IMAGE FUNDAMENTALS

There are two distinct classes of digital images: vector graphics (which use a series of geometric drawing commands, such as lines, curves, or shapes and solid or graduated color, to represent an image), and bitmap or raster images (where an image is broken into a grid by the capture device, with the light value (lightness, darkness or color) of each piece of the grid—an individual pixel—recorded individually. The term *raster* stems from the Latin, to rake). Bitmaps are relatively easy to implement, and, within limits, work for any image: they can record just about any conceivable image or view of a scene since any image can be broken up into a grid, and as far as the human eye is concerned, if that grid is small enough we see it as a continuous tone image. Vector graphics are predominantly used in graphic design, and computer-aided design systems for engineering and architecture: neither bitmap or vector graphics methods are better than the other: they simply have different functions and uses. Digitization projects and cultural and heritage institutions will be most likely to produce and deal with bitmapped images, although as Digital Humanities techniques become more widespread, images are also increasingly used alongside other types and formats of data such as marked up text, large textual repositories, or geographically encoded data (see Schreibman et al.^[4] for an overview of different commonly used approaches to information generated from the digitization process).

The term “pixel” has been used to describe the individual points of a bitmapped image since the 1960s, being an

abbreviated form of “picture element.” Each pixel contains complete information about a particular point of an image, detailing the color (hue, lightness, and saturation) and place of the individual pixel within the grid. From a mathematical point of view, this array is merely a collection of numbers that may be transformed and manipulated in a wide variety of ways. Such an array is called a *bitmap*—a representation of the image data that parallels the manner in which it is stored in computer memory. Bitmap image pixels are generally square, but pixel size is variable depending on the size of the grid chosen to display or output them. The number of pixels in a given area is described as the *resolution* of the image. The amount of color information stored for each individual pixel is determined by *bit depth* (Fig. 1).

Resolution is usually denoted by a measurement such as pixels, or points per inch (ppi: measuring the number of pixels in an image within a linear one-inch space), dots per inch (dpi: measuring the number of individual dots of ink a printer can produce), or lines per inch (lpi: used to denote how close together lines are in halftone printing, the method commonly used in newspapers and magazines where images are represented by a series of dots of different size and density). The terms are often used interchangeably when talking about image resolution, dpi being the most common, and conventionally understood to cover different media. (For cameras, resolution is stated differently. Rather than the number of pixels in an inch, the resolution given is usually the maximum resolution a digital sensor at the back of the camera can achieve, normally expressed as the absolute number of pixels in the grid, rounded up to one decimal place.) The topic of resolution can be confusing because it isn’t fixed and immutable. If you change the size of a digital image without changing the number of pixels within it, you change its resolution: the size of the grid has changed without changing the individual elements within it. Interpolation—the term given to the mathematical creation of missing data—is often used to create new pixels to insert into, or choose which pixels to delete from, a resized image, in order to maintain image resolution and to ensure that the image does not become visibly disrupted, or pixelated. The ideal resolution at which to capture or store an image depends on the purpose of the image: resolution for online display, for example, is much lower than that needed for print or archival purposes. Digitization guidelines (see section “Use of Digital Images in the Library and Archive Sector”) provide guidance in this area (Fig. 2).

Bit depth describes the number of bits of memory that are available to describe the color of each pixel of the image. The greater number of bits assigned to each pixel, the greater number of colors the image can have. The simplest type of image, black and white, sometimes referred to as a binary image, has a bit depth of 1, as each pixel is either black or white (0 or 1). Grayscale images are 8 bit—capable of describing 256 difference shades of gray.



Fig. 1 A digital image of a Mediaeval stained glass window. At the viewing resolution, pixels cannot normally be seen, but when magnified, such as the lower section featuring the devil’s eye, the underlying matrix containing pixels of individual color become apparent. Being able to see pixels within an image under normal viewing conditions is termed “pixelation.”

24-bit and 32-bit colors are capable of describing millions of different permutations of color information for each pixel. 48-bit color is capable of describing billions of different colors (more than the human eye can discern, and only used for specialist systems). The amount of color information created, sampled, or stored regarding an image depends on the image’s purpose: for some images, such as representations of black and white newspapers, color brings little to the image, whereas for others, such as images of mediaeval manuscripts, color may hold intrinsic information regarding the object. Digitization guidelines provide guidance regarding the bit depth suitable for different media (Fig. 3).

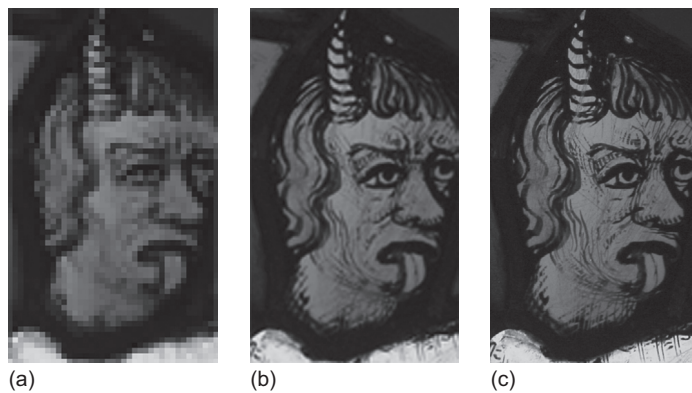


Fig. 2 A section of an image of a Mediaeval stained glass window captured at different resolutions. (A) At 30 pixels per inch, the size of the pixels is above the threshold of human vision, and the image is pixelated. (B) At 72 dots per inch, the image is suitable for online display, and we see it as a continuous tone image, but some detail is lacking. (C) At 300 dots per inch, the level of detail captured makes the image a more accurate representation of the object.

Creating accurate representations of objects and artifacts using digital imaging technologies requires attention to detail: photographing objects at high resolution and normally, now, at full color (over the past few years, the sector has moved away from scanning, and black and white capture, as Digital SLR cameras and the cost of data storage have come down in cost). However, the more samples captured, and the more detailed the color information captured, the larger the file size of a resulting digital image. There is a payoff between representing detail and the ability to manipulate, display, and disseminate images efficiently. Smaller file sizes are required, for example, for delivery via the Internet. Compression techniques are often used to reduce the number of bytes

required to represent a data set: some techniques are designed to store information efficiently, while others store the data set accurately. Lossless compression ensures that an image viewed and decompressed will be identical to its state before being compressed (but although the image is stored accurately, it is difficult to reduce the file size significantly using lossless compression). Lossy techniques eliminate information from the pre-compressed state, the amount of detail discarded can usually be adjusted to change as little of the visible detail in an image as possible. Lossy compression can achieve significant storage savings and is ideal for creating images for display on the Internet; however, once the information is gone, the original image cannot be recreated. It is important to use lossless



Fig. 3 A section of an image of a Mediaeval stained glass window captured at different bit depth. The top section is bitonal, being only black and white, and although the resulting file size is small, much of the detail is lost. The middle section demonstrates the same image section in grayscale: 256 different shades of gray, which is much more effective in capturing detail. The final section, in 24-bit color, contains much more information, demonstrating that the provision of color information can be important when providing images of originals that rely on vivid color themselves.

compression for images that are to be stored long term, such as master files resulting from digitization projects, to ensure that all information possible is preserved for future use.

Further information and introductions to the basic infrastructure of digital images specifically targeted for librarians and information professionals are available,^[5–10] with many digitization projects using the Library of Congress “Technical Standards for Digital Conversion of Text and Graphic Materials” as a base.^[11] The Jisc Digital Media service (formerly the Technical Advisory Service for Images) provides many up-to-date online guides to digital imaging at <http://www.jiscdigitalmedia.ac.uk/>. A detailed introduction to the fundamental physics, mathematics, and perceptual phenomena behind digital images, covering optics, electronics, photography, and semiconductor technology is also available.^[12]

IMAGE FILE FORMATS

Image formats are files that store any type of persistent graphical data (as opposed to text, spreadsheet, or numerical information) that is intended for eventual rendering and display. There are now over one hundred image formats in existence^[13] and that number continues to grow: different applications use different types of data in different ways to satisfy different user needs. A cultural and heritage digitization project will mostly work on creating two-dimensional representations of artifacts and documents, or bitmap graphics, and use commonly available formats to facilitate interoperability and information exchange of digital image data. Using recommended, commonly available, documented formats also ensures that the information should be accessible when technology advances, and formats change and become obsolete. File formats can be converted from one to another. This can be useful if the organization of the data stream is incompatible with the requirements of a particular device or application, or if the original format is not one suited for, say, online delivery, long-term storage, or interoperability.

Although there are many different image file formats, most work in a broadly similar way. Most typical data sets consist of a linear list of data values, commonly referred to as a data stream. The entire data stream makes up the file. The difference between individual image files formats lies in the details: what type of data is stored, if it is compressed, and how it is encoded. A typical structure of an image data stream may be: File Signature (declaring which format the data are stored in), Image Header (containing technical information that describes the image, such as pixel dimensions, image height and width, and bit depth), perhaps a Color Palette (a means of storing color information effectively), then the individual pixel color data (the major part of a data stream for a bitmapped

image, storing individual pixel color values, usually in display order: this is the part of the file that can be compressed), and finally a File Closing Marker (marking the end of the data stream, and so the end of the file). Disruption to this datastream generally means that the file cannot be read at all.

The most popular image formats that an information professional may come across are GIF, PNG, JPEG, and TIFF. GIF, PNG, and JPEG files are commonly used to save images that need to be compressed in order to be delivered easily across a network, such as the Internet. GIF files have a limited color palette and use a compression algorithm that is suited to compressing areas of the same color, meaning they are suitable for logos, graphics, and buttons. The PNG format is becoming more popular for this purpose: it was designed to improve the GIF specification and to avoid any of the licensing issues that plagued GIF toward the close of the last century. JPEG is actually a method of file compression specifically designed to cope with complexity of photographic images, and the file format developed to incorporate this technique is now the most common format for storage and interchange of digital photographs, although it is a very lossy format. TIFF files are one of the most useful formats for the capture, storage, and exchange of high-quality digital image data. Since the early 1990s, TIFF has been embraced as an archival digital image format by the library and archive community and is now also in common use as an output format from professional-level digital cameras. It is recommended that the capture of archival and library material is done “once for all purposes”: creating a high-resolution TIFF file of an object will allow lower resolution and compressed image files in different formats to be generated from the master file, while creating a digital surrogate for long-term preservation and access, and limiting the handling of the object experiences.^[14] However, many digitization studios are now also maintaining the RAW files that come directly from a Digital SLR sensor, allowing further tonal adjustments at a later stage, although these can be very large. In addition, there is a growing interest in the JPEG2000 format, which allows more sophisticated image compression and storage possibilities than either existing JPEG or TIFF. Again, digitization guidelines can provide guidance in this area, and the recommendations and documentation on a working group on the use of JPEG2000 in the heritage sector are also available at <http://wiki.opf-labs.org/display/JP2/Home>.

USE OF DIGITAL IMAGES IN THE LIBRARY AND ARCHIVE SECTOR

The Information, Culture, and Heritage sectors were quick to embrace the potential of imaging technologies as they became available, primarily to facilitate access to items in collections by providing them in electronic format,

allowing a broader audience to use and appreciate the objects. Additionally, collections can be enhanced through the provision of digital representations: gaps in collections can be filled or material that has been geographically dispersed between institutions (such as manuscript material) can be virtually reunited. Early projects believed that digitization of artifacts could also be a form of preservation: this is only the case when the medium of the original is deteriorating, as digital information and media have relatively short life spans themselves; but digitization can also be perceived as a form of preservation when access to the original is restricted and users directed to the digital version of the artifact to reduce the stress of repeated handling on an object. Digitization projects often raise the profile of an institution, showcasing their collections, allowing detailed research to be undertaken, and encouraging outside funding to invest in their infrastructure.^[15]

Many early projects, coming from a long tradition of microfilming, showed initial interests in digitizing text, with the hope the Optical Character Recognition technologies would be able to convert the images into moveable type. In the 1980s, small-scale, in-house projects of limited scope and interest were undertaken, but toward the end of the decade large-scale projects were launched, including pilot projects aiming to investigate the appropriation of digital technologies to the handling of large volumes of information, such as those carried out at the Library of Congress, Cornell University (both the United States), and the Archivo General de Indias (in Spain), sometimes in partnership with commercial computing companies.^[10] The 1990s were termed the “decade of digitization”^[7] as the lowering costs of equipment and storage, and the increased networking possibilities, encouraged most institutions to create digital representations of at least some of their holdings themselves for online display. This was also fostered by many funding opportunities arising around the Millennium, such as that provided by the New Opportunities Fund in the United Kingdom, specifically for the purposes of digitization. Growing user expectations encouraged libraries, museums, and archives to provide images (and related records and metadata) of their material online. Since then, digitization efforts for individual institutions have slowed somewhat, as funding becomes harder to come by, and questions have been raised regarding the costs of digitization and the resulting benefits to institutions. It is all very well to provide images of a medieval manuscript in glorious full color, at great cost, online, but if only three or four scholars in the world are actually interested in looking at it in any great detail, could the money be spent in other ways that are more beneficial to the institution? Questions are now being asked about how we understand value and worth of digitized content.^[16,17] In the early twenty-first century, digital imaging activities have moved beyond digitization of the treasures held in special collections in libraries and archives, back to large-scale commercial partnerships for mass digitization of more general collections to

enable (and experiment with) information searching and retrieval. Industry partners (such as Google or Microsoft) pay for the digitization, getting access to the information in return, and such digitization projects promise to make information available to all via the Internet. However, there is consternation in the publishing industry and the library world regarding issues such as copyright, licensing, and information quality, unanswered questions about technical and managerial procedures, and a fear that such large-scale commercial digitization has a potential to misrepresent, or even damage, the world’s cultural heritage.^[18] We are also only beginning to understand use and usage of large-scale digitized content.^[19] It is now difficult to remember a time when institutions did not provide digital representations of the important materials held in their collection: a recent survey of 1400 European galleries, libraries, archives, and museums showed that 87% of them now have a digital collection,^[20] a rise of 4% since 2012. However, far from everything is available online: on average at time of writing, 17% of collections are digitized across Europe, with further plans to digitize another 52% of institutional holdings across the sector.

Producing digital image versions of holdings through digitization has become an industry in itself, and there is much research devoted to producing guides to best practice in undertaking the digitization of library and archive material. Many early projects were, in effect, experimental case studies, exploring the best way in which to appropriate digital imaging technologies for the Library and information sector. Nowadays, however, guidelines are in place covering all aspects of the digitization process: creating a digital image of an object is just one step in a long chain of procedures that enable digital access to an object, including collections management, object selection, preservation issues, copyright and rights management, technical issues, managing the digital workflow, quality assurance, production of metadata and associated records to allow searching and retrieval, delivering images to users, usability testing, accessibility legislation, and beyond.^[6–8,15]

The need for technical digitization guidelines was highlighted by early projects in the library and archive sector. Given that technologies, standards, and recommendations are constantly changing, the best place to find up-to-date recommendations regarding the technical aspects of digitization is from the online documentation provided by trusted and well-known institutions, such as the frequently updated “Library of Congress Technical Standards for Digital Conversion of Text and Graphic Materials”:^[11] those produced by national bodies such as the U.S. National Archives and Records Association;^[14] those produced by University Libraries, such as the guides available at the California Digital Library (www.cdlib.org/) and the standards advocated by the Digital Library Federation (www.diglib.org/); guides to good practice created and pointed to by the United Kingdom’s Digital

Curation Centre (<http://www.dcc.ac.uk/>); and resources produced by the Jisc Digital Media service (<http://www.jiscdigitalmedia.ac.uk/>), which remains a comprehensive source for all aspects of digitization and digital imaging. Most guides and recommendations are meant to be informative rather than prescriptive, and many cover areas such as management, workflow, delivery, and quality control, as well as providing an insight into up-to-date technical specifications for the production of digital images.

However, although there has been much investment into digital imaging in the Library and Archive sector, there still remain unresolved issues regarding both technical and usability aspects. Benchmarking image quality is difficult as the human visual system varies from operator to operator, and likewise, color management and fidelity is difficult to quantify and manage. Questions still remain about the long-term preservation of digital image files and the resources required to maintain digital image collections in the long term.^[21] The searching and retrieval of digital images is still computationally complex: most systems require adequate metadata regarding the content and provenance of images to be provided, and this can be costly. Evidence of value and levels of use of digitized resources is also scant.^[10,16,17] There are also benefits and opportunities that remain to be explored in using digitized collections further, via “crowdsourcing” of labor to help sort, tag, identify, label, and transcribe images:^[22] how we can best use all this digital image information, now we have it, remains a large issue.

PERSONAL DIGITAL IMAGE COLLECTIONS AND THE LIBRARIAN

Due to the pervasive nature of digital imaging technologies, and the ease with which images can be taken, manipulated, and shared, personal photography has now become vastly more popular than it ever was, and been transformed from a private to a community experience. The online storage and organization of personal digital image collections, often made available to the general public, and made more searchable through the use of tagging, metadata, and online (and mobile phone based) sharing platforms, has been one of the success stories of Web 2.0 (the growing online phenomenon of websites that are community driven, service based, with high-level tools that also harness the collective intelligence of large groups of users). Online services such as Yahoo/Flickr, Google/Picasa, Photobucket, Instagram, Tumblr, Pinterest, and Facebook host hundreds of millions of photographs posted by millions of users. An expanding service industry is growing alongside the user-generated content, providing, for example, online services for ordering digital prints, and facilities for digital photographers to sell or license their images for advertising purposes. Such industries are

undermining traditional photography manufacturers and photo-stock agencies.

Yet users seem to know little about how to archive, preserve, or maintain their personal image data despite photographic industry initiatives such as “Save my Memories.”^[23] Concerns about digital preservation are not only limited to institutional requirements: a child born today may be the most photographed of any generation, but without careful consideration of how these image files are stored, the chances of them being able to see their baby photos in 20 or 30 years are slim. Home computers tend to be seldom backed up or maintained beyond their short lifespan: digital images are emailed and shared online, but seldom printed and stored in archival conditions, meaning loss of the hardware they are stored on means permanent loss of the images themselves. Further research is needed into how digital imaging technology has transformed user habits, and although the industry has started to provide advice for users regarding the long-term preservation and access to their data,^[23] there is increasing concern from the information profession regarding the potential loss of decades of digital images, and any personal digital data, for future use, never mind future generations.^[24–26] To that end, the Library of Congress has recently established a “Personal Archiving” section to give advice to the public about “Preserving your Digital Memories,”^[27] using digital outreach methods to reach as wide an audience as possible to highlight these issues, such as regular guest blog posts in sites that have a large audience.^[28] In the United Kingdom, the Digital Preservation Coalition recently reported on “Personal Digital Archiving,” providing advice for both individuals and information professionals on how to tackle this growing issue.^[29] Other public engagement initiatives undertaken by information professionals, such as the Society of Georgia Archivists’ “Everyday Digital Archives” campaign,^[30] provide a model as to how institutions can inform, educate, and help the general public in both understanding the need for personal archiving of photographic (and other) data, but also how to do so, to ensure their digital photographs are available for future generations. With the rise of social media and image-sharing sites such as Flickr and Instagram, it is also important that people understand issues of privacy and ownership of digital content, and the information community can have an advocacy role in encouraging engagement with the like of the Creative Commons framework^[31] to increase the information literacy^[32] of a wider audience in these increasingly complex areas.

The pervasive nature of digital imaging technologies in the developed world has also led to recent changes in news coverage as the general public can now capture an immediate and personal response to subjects and events that would traditionally be covered by news agencies, often before traditional media outlets are aware of the incident or able to dispatch reporters. This can aid police in their investigations, and calls for the public to submit such

eyewitness material are now commonplace (as is the creation of user-generated video and pictures that counteract official records of events and happening). User generation of digital content is set to become ever more common, and important, blurring the distinction between professional and amateur, democratizing news reporting, and providing historical and judicial evidence. The maintenance and preservation of such digital material for future users, historians, and investigators is the responsibility of the professionals within the media and information environment, and the library and archive sector have role and opportunity in educating the public and media regarding the importance of preserving this information for future generations.

CONCLUSION

Digital imaging technologies, and related advanced in Internet technologies, have changed the way we produce and disseminate visual information, leading to an exponential increase in visual material available in recent years. The Library and Information sector has, through trial and error, developed best practice procedures for the creation of digital image representations of documents and artifacts, and many institutions have undertaken digitization projects to increase access to their holdings. Although successful projects have been undertaken, delivering much image-based content to the user, questions remain regarding the cost, long-term viability, and usefulness of digitized collections. Additionally, the role of the librarian and information professional does not stop at the institution's door: issues regarding the preservation of digital information created by general society, including digital images, are becoming increasingly pressing.

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FURTHER READING

A variety of both online and print material exists specifically for the Information professional wishing to know more about digital imaging, and undertaken digitization projects. Print materials such as Besser and Trant,^[5] Kenney and Reiger,^[6] Lee,^[7] Besser,^[9] Terras^[10] are good starting points for those wishing to know more about the technical underpinnings of image files and formats, with a much more detailed account available in Graham^[12] (although this may be a little too technical for those starting out). Online materials, such as Cornell University Library,^[8] Besser,^[9] Library of Congress^[11] and the resources available at the Jisc Digital Media service (<http://www.jiscdigitalmedia.ac.uk/>), also provide good resources regarding all aspects of imaging for the LIS sector. Management issues are dealt with in Lee,^[7] Hughes,^[15] van Horik^[21] raises interesting issues about longevity of digital images and image surrogates and Hughes^[16] covers issues on the impact of digitized content, and what we know of its use. Outreach and public engagement by the sector regarding personal archiving of digital photography collections is covered in Save My Memories,^[23] Library of Congress,^[27] Society of Georgia Archivists,^[30] Public Libraries Online,^[28] Redwine,^[29] and Creative Commons.^[31]

Digital Millennium Copyright Act of 1998

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Abstract

The Digital Millennium Copyright Act (DMCA) was the most important amendment to U.S. copyright law during the 1990s. Unlike other amendments that altered small but important pieces of the copyright law, the DMCA created an entirely new form of protection that will have wide-ranging effects and has even caused some to suggest it could be the death of copyright. The DMCA was passed by the U.S. Congress and signed by President Clinton in 1998. It amended the U.S. Code, primarily Title 17 of the U.S. Code, part of the federal law that deals with copyright law. The DMCA includes a cluster of discrete copyright-related issues that were combined in one substantial piece of legislation. It covers a wide range of topics, including limiting Internet service provider (ISP) liability, the scope of exclusive rights in ephemeral sound recordings, and protecting boat hull designs. One of the most important sections—the circumvention prohibition—forbids circumvention of technological measures that prevent access to a work.

INTRODUCTION

The Digital Millennium Copyright Act (DMCA) was the most important amendment to U.S. copyright law during the 1990s. Unlike other amendments that altered small but important pieces of the copyright law,^[1] the DMCA created an entirely new form of protection that will have wide-ranging effects and has even caused some to suggest it could be the death of copyright.^[2–4]

The DMCA was passed by the U.S. Congress and signed by President Clinton in 1998.^[5] It amended the U.S. Code, primarily Title 17 of the U.S. Code, part of the federal law that deals with copyright law.^[6] The text of the DMCA and the copyright laws is available online at the Library of Congress Copyright Office.^[7] The DMCA includes a cluster of discrete copyright-related issues that were combined in one substantial piece of legislation. It covers a wide range of topics, including limiting Internet service provider (ISP) liability,^[8] the scope of exclusive rights in ephemeral sound recordings,^[9] and protecting boat hull designs.^[10] One of the most important sections—the circumvention prohibition—forbids circumvention of technological measures that prevent access to a work.^[11] The Act is 58 pages long and divided into five topical sections, or titles. Each title of the DMCA has its own background, history, and implications, and each title is discussed separately below. Two important topics that were in early versions of the bills that became the DMCA, database legislation and parallel import legislation, were excluded from the final version.

TITLE I. WORLD INTELLECTUAL PROPERTY ORGANIZATION TREATIES IMPLEMENTATION

Title I of the DMCA is the enabling legislation for two World Intellectual Property Organization (WIPO) treaties

that were drafted in 1996.^[12] The WIPO is an intergovernmental organization under the United Nations umbrella. It is based in Geneva, Switzerland, and is responsible for the administration of various multilateral intellectual property treaties, including the Berne Convention.^[13] There are over 150 WIPO member states that take part in negotiations on a broad array of intellectual property topics, from protection of folklore to database protection.

There is no such thing as international copyright law. Therefore, once a copyright treaty is finalized, each member state that wants to join that treaty must ratify it and amend its own national laws to conform to the substantive and procedural terms of the treaty. This means that each nation must pass “enabling legislation” to amend its national copyright laws.

Under the U.S. Constitution, the President can negotiate a treaty. However, the President needs the Senate to reject, approve, or conditionally approve a treaty. After two-thirds of the Senate ratifies a treaty, the President deposits it with the originating organization, in this case WIPO. Ideally, the implementing legislation, which goes through both the House and the Senate, should be completed prior to depositing the treaty.

For the same treaty, one jurisdiction might have only minor amendments, while another jurisdiction joining the same treaty might have to rewrite large portions of its copyright laws to conform to the new instrument. It is important to remember that these treaties serve to establish minimum standards, and, as discussed below, countries may amend their national laws to protect copyrights well beyond the terms of the treaty.

The two treaties enabled by the DMCA are the WIPO Copyright Treaty (WCT)^[14] and the WIPO Performances and Phonographs Treaty (WPPT).^[15] The WCT implemented several relatively noncontroversial legal

requirements, including recognizing that authors have the right to control the distribution of their works (with first sale exceptions being determined on a national basis), providing for exclusive rental rights for certain types of works, and increasing the term of protection for photographic works to 50 years.^[16] The WPPT covered the rights of performers and music producers in their creations. These issues had already been largely addressed in U.S. copyright law.

Title I of the DMCA amends the copyright law to include a section prohibiting circumvention of access controls.^[17] Access controls are technological locks that prevent users from copying the underlying digital information. For example, CDs do not have any access controls, and hence can easily be copied. DVDs, on the other hand, have access controls that prevent the user from skipping certain portions of the introductory content and copying the disc. This section of the DMCA also includes a section that prevents tampering with copyright management information, such as digital identifiers of the title of the work, the author of the work, and relevant licensing terms.^[18] It also includes civil and criminal penalties for violations of the copyright management information tampering provisions and the anticircumvention provisions. The maximum penalty on the criminal conspiracy charge is 5 years of imprisonment and a \$500,000 fine;^[19] the maximum penalty for each of the civil charges is 5 years of imprisonment and a \$250,000 fine.^[20]

Anticircumvention

The most important section of the WCT, from the perspective of U.S. copyright law, is Article 11, the rationale for the important anticircumvention provisions of the DMCA.

Article 11 states:

Contracting Parties shall provide adequate legal protection and effective legal remedies against the circumvention of effective technological measures that are used by authors in connection with the exercise of their rights under this Treaty or the Berne Convention and that restrict acts, in respect of their works, which are not authorized by the authors concerned or permitted by law.^[14]

Article 18 of the WPPT includes virtually the same language.^[15] Although some have suggested that existing U.S. law was sufficient to meet the requirements of Article 11,^[21] industries concerned with the distribution of their digital content lobbied for a new form of protection in U.S. law.^[22] This protection is based not on copyright (i.e., the right to copy), but on the right of access (i.e., the right to read, view, or experience the work in the first place).^[23,24]

Access rights

Section 1201(1)(a) of the copyright law as added by the DMCA states: “No person shall circumvent a

technological measure that effectively controls access to a work protected under this title.”^[25] A technological measure “[e]ffectively controls access to a work . . . if the measure, in the ordinary course of its operation, requires the application of information, or a process or a treatment, with the authority of the copyright owner, to gain access to the work.”^[26] In other words, if the copyright owner or representative has supplied a mathematical formula or code to make a video readable by the video-playing machine, the work is effectively controlled. There is the potential for substantial litigation about the word “effectively,” because some types of encryption, whether pig Latin or a simple mathematical transposition, are arguably ineffective, even though they are required in the ordinary course of operation. If, and only if, access to the work is “effectively controlled” does the second phrase, “circumvent a technical measure,” become relevant. “Circumvent a technological measure . . . means to descramble a scrambled work, to decrypt an encrypted work, or otherwise avoid, bypass, remove, deactivate, or impair a technological measure, without authority of the copyright owner.”^[27] Thus, if a user circumvents an effective access control, regardless of intent, there has been a violation of this section. Notice that this section requires that the work be “protected under this title.” It is possible that this clause will be used by courts in the future to limit the scope of the DMCA to only those works that are currently protected by copyright.

There are a few narrow exceptions to the anticircumvention provisions, notably for law enforcement, reverse engineering, and encryption research.^[28] For example, reverse engineering of software is permitted if certain conditions are met and if the sole purpose of the circumvention is to achieve interoperability.^[29] The exception for nonprofit libraries, archives, and educational institutions permits access “to make a good faith determination of whether to acquire a copy of the work.”^[30] There is also a triennial rule-making mechanism, discussed below, that can result in additional exceptions.

It is important that the technological measure control “access,” not “copying.” Even though the DMCA amends the copyright law, the anticircumvention provisions of the DMCA, sometimes called paracopyright,^[31] are fundamentally different from the rest of the copyright law. Copyright is a constitutionally mandated legal balance between the interests of creators of protected works and society. The U.S. Constitution states: “Congress shall have the power . . . [t]o promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries.”^[32] This is achieved by granting creators specific exclusive rights to control certain aspects of their work for a limited time, after which the work becomes part of the public domain, and the exclusive rights cease to exist. In contrast to the balance between the incentive to create and the benefit to society found in copyright law,

the anticircumvention provisions have no such balance. If a technological measure effectively controls access to a work, there is no time period after which there is a right to decrypt it or any fair use right that trumps the anticircumvention provisions.^[33]

Access controls prevent the user from using the work, including viewing it. Copy controls prevent the user, who can view the work, from copying it. The important distinction is that the DMCA permits circumvention of a measure that prevents copying, but not circumvention of a measure that prevents access. It states “[n]othing in this section shall affect rights, remedies, limitations, or defenses to copyright infringement, including fair use, under this title.”^[34] If you can legitimately gain access, then you can still exercise your fair use rights and other rights embodied in traditional copyright law. However, because you cannot copy what you cannot access, and content providers know access controls cannot be circumvented, there is great incentive for content providers to use technological measures to limit access, thereby preventing potential copiers from ever reaching the work. To restore the balance of copyright law to the access rights, scholars opposed to the DMCA have proposed expanding fair use to include access rights or creating a new right of access.^[24] For other articles discussing the relationship between the DMCA and public interest concerns, see Cohen^[35] and Samuelson.^[36] For a different perspective, see Ginsburg.^[37]

Device trafficking

Along with the prohibition of circumvention in most cases, one cannot “manufacture, import, offer to the public, provide, or otherwise traffic” in devices or methods if they are primarily designed or produced to circumvent; they have only limited commercially significant purpose or use other than to circumvent; or they are marketed for use in circumventing.^[38] Additionally, users cannot avoid, bypass, remove, deactivate, or otherwise impair a technological measure that effectively protects a right of a copyright owner under Title 17. Finally, they cannot traffic in devices that bypass technological measures.^[39] Together, these device trafficking prohibitions are much like prohibiting the sale of lock-picking tools if those tools have no other purpose. However, most prohibitions against lock-picking tools require the owner to have some level of intent to use them in an illegal way. To the extent that fair use is extended to access rights, there will need to be legal mechanisms that permit the distribution of devices to facilitate legitimate circumvention. Otherwise, only the technological elite will be able to avail themselves of these access rights. Both device trafficking sections require that the works be “protected under this title,” suggesting that perhaps devices that are designed in large part to circumvent access controls blocking access to public domain works or uses are permissible.

“Particular Class” Rule Making

The DMCA also requires the Librarian of Congress to conduct rule making 2 years after enactment, and every 3 years thereafter, to define “particular classes” to exclude from the anticircumvention provisions.^[40] The rules can only permit circumvention of access to a defined class of works by all users, rather than permit access by the type of use or user. This means that the rule making would have to justify permitting access to the least favorable user, e.g., a direct competitor or consumer in the marketplace, rather than permitting access exclusively to researchers or for educational purposes. The narrow constraints of the rule-making framework minimize the potential for them to ameliorate the more socially detrimental aspects of the DMCA. The first rule making defined only two exempted classes, lists of blocked Web sites and literary works rendered unusable due to inoperative control devices.^[41] More recent rule making has created exceptions that permit circumvention in other cases, such as circumventing DVD copy protection systems to create clip reels, circumventing digital locks in cell phones that prevent the user from changing carriers, and circumventing the access controls on e-books if there is no version that permits them to be read aloud.^[42]

The scope of the rule making is limited by the DMCA to address anticircumvention, not device trafficking. By excluding devices from the scope of the review, even if an access right is recommended, each individual exercising that right would need to achieve the technological sophistication to circumvent the controls without the assistance of a distributed device, an extremely unlikely scenario.

Section 104 Report

The anticircumvention and antitrafficking sections of the DMCA did not become effective until 2 years after passage of the Act. The DMCA also required the drafting of a report that addressed the relationship between the DMCA and parts of the copyright law, notably section 109,^[43] the first sale doctrine, and section 117,^[44] the section that permits the making of archival copies of computer programs. The Librarian of Congress, based on the recommendations of the Register of Copyrights and the Assistant Secretary of Commerce, issued the report in 2001.^[45]

The report addresses three proposals: creation of a “digital first sale doctrine,” creation of an exemption for the making of certain temporary incidental copies, and the expansion of the archival copying exemption for computer programs in section 117 of the Act.^[45] The comments related to the first sale doctrine discuss whether the societal benefits of the first sale doctrine should be carried over into the digital realm, where the “loan” of a digital work is really the making of a copy and the concurrent deletion of

the original.^[45] The concern of opponents is that this would lead to widespread piracy and destruction of the market for the legitimate original if the originals are not deleted.^[45] This is a particular concern for digital works, because, unlike analog works, there is no degradation of quality when a copy is copied.

There is substantial scholarship on trusted systems,^[46–49] systems that automatically delete the original when sending the copy. In light of the infancy of such systems, the report concluded, “Given the relative infancy of digital rights management, it is premature to consider any legislative change at this time. Should this practice become widespread, it could have serious consequences for the operation of the first sale doctrine, although the ultimate effect on consumers is unclear.”^[50] An additional concern was the effect of anticircumvention legislation on the creation of archival copies of software.^[50] The report addressed that point as well, stating:

The library community has raised concerns about how the current marketing of works in digital form affects libraries with regard to five specifically enumerated categories: interlibrary loans, off-site accessibility, archiving/preservation, availability of works, and use of donated copies. Most of these issues arise from terms and conditions of use, and costs of license agreements. One arises because, when the library has only online access to the work, it lacks a physical copy of the copyrighted work that can be transferred.

These issues arise from existing business models and are therefore subject to market forces. We are in the early stages of electronic commerce. We hope and expect that the marketplace will respond to the various concerns of customers in the library community. However, these issues may require further consideration at some point in the future. Libraries serve a vital function in society, and we will continue to work with the library and publishing communities on ways to ensure the continuation of library functions that are critical to our national interest.^[50]

Cases

Several cases have dealt with the issues raised by anticircumvention provisions of the DMCA. One recent District Court opinion rejected the argument that there was a fair use right to access.^[35] The most important cases attempt to invalidate the anticircumvention sections on Constitutional grounds and are discussed in the following sections.

Two important types of challenges to the anticircumvention provisions of the DMCA are likely. The first challenge will be claims that by preventing circumvention of access controls when the underlying works are partially or completely in the public domain, the DMCA oversteps the authority granted by Congress in

the Patent and Copyright Clause of the U.S. Constitution. The intent of the Patent and Copyright Clause is to create an incentive for creators to create; thereby subsequently benefiting all of society after the limited term of the exclusive rights comes to an end. Since the term of protection for public domain works has expired, Congress may lack the authority to protect them further.^[34,51,52] Because Congress is only granted the power to secure exclusive rights for a limited time, the anticircumvention provisions arguably exceed the scope of the powers of Congress by permitting the encryption of public domain material without a right of circumvention. It is possible that the DMCA could survive this Constitutional challenge, either because a court determines it does not exceed the scope of that clause or because the DMCA is considered within the scope of Congressional power under another Constitutional clause, such as the Commerce Clause.^[53]

The second challenge will be that the DMCA is unconstitutional, because it is in conflict with the First Amendment. The success of Constitutional challenges to the DMCA will largely hinge on the level of scrutiny the court applies. Even if a court decides that the prevention of copyright piracy is an “important or substantial governmental interest,”^[54,55] the DMCA could be declared unconstitutional, because the DMCA cannot “burden substantially more speech than necessary.”^[55] The court would then have to determine if less restrictive means could reach the same end, such as preventing copying, but not blocking access. Whether the court would consider the technological feasibility of the alternatives as of the time of passage of the DMCA or as of the time of lawsuit raises interesting issues and, if the latter, suggests that subsequent attacks on the DMCA might be successful, even if earlier ones failed. What follows is a discussion of several recent cases that touch on the relationship between the First Amendment and the DMCA.

DeCSS case (*MPAA v. Corley*)

DVD discs include a content scrambling system (CSS).^[56] DVD players include chips that permit them to play DVDs that use the CSS. Without “decoding” the DVDs, the content on them is not viewable. A program was written, called DeCSS, which makes DVDs playable on devices other than licensed DVD players, including computers running the Linux operating system. To achieve this goal, the program decrypts the CSS on the DVD and uses the information to make the content on the DVD viewable on unlicensed players that lack the special chip.^[57] Although DVDs can be copied without breaking the CSS, so long as the CSS is not circumvented, the content cannot be viewed, except on licensed players. The CSS is a type of access control.

The DeCSS case arose when an online magazine posted the DeCSS program and hyperlinked to other sites that posted the DeCSS program.^[58] There are two issues in

the DeCSS case: whether, under the DMCA, Web sites can be liable for posting the code to decrypt the DVDs; and whether Web sites can be liable for knowingly linking to sites that post the code to decrypt the DVDs. The Web sites raised constitutional First Amendment concerns, because a limitation on posting programs or linking to programs limits the ability of the Web site owner to communicate, and hence free speech.

To address these questions, the court determined that CSS was “effective” and that decrypting CSS to play DVDs on unlicensed players, such as computers running Linux, was not within the interoperability exception.^[58] In addressing the free speech issue, the court applied the O’Brien test, because the DMCA targeted functional speech, rather than expressive speech, and the speech limitation was considered content neutral, meaning that it did not attempt to discriminate against certain types of content.^[58] The court upheld the constitutionality of the DMCA in both the posting and linking scenarios. It found that in the context of the DMCA, there was an “important or substantial governmental interest” and that the DMCA avoided burdening substantially more speech that is necessary to further the government’s legitimate interests.^[58] In the context of linking, it upheld the District Court’s linking test that found that limiting some acceptable speech was Constitutionally acceptable, even though the alternative of limiting less speech and tolerating some decryption would have reduced the burden on speech, but at the cost of the potential for widespread piracy.^[58]

Felten case (*Felten v. RIAA*)

Professor Edward Felten of the Computer Science Department at Princeton University researched music samples distributed by the Secure Digital Music Initiative (SDMI).^[59] These samples included watermarks that could be detected by players or recorders to prevent duplication. The challenge was to remove the watermarks without overly degrading the sound quality.^[60] After Professor Felten’s group achieved this goal, they wanted to present their results. In a complicated set of facts, SDMI and others suggested that presenting their results might violate the licensing agreement Professor Felten had agreed to prior to receiving the samples or might violate the DMCA, because their research could help others defeat the watermarking system, which was already in public use outside the challenge.^[60] Professor Felten sued to be able to present his results. After initially not presenting their results, his research team did so at a subsequent conference, with the permission of SDMI and others. After presenting his results at a conference, but arguing that there was still a controversy because future research would be chilled, a court determined that the issue was moot, because there was no continuing controversy.^[61] Along with threat of DMCA and breach of contract claims, the Felten litigation team raised First Amendment

free speech claims, suggesting that the DMCA was being used to censor discussions about encryption research.^[62]

The Felten case highlights two important effects of the DMCA: the potential chilling effect of such broad legislation and the role of contracts in potentially preventing access to both copyright-protected and public domain content. Professor Felten received e-mail that suggested he might face liability if he presented his paper. Even though he subsequently presented it, the threat of liability might stifle research in the encryption and computer security areas. The concern is that this would be detrimental to the U.S. economy, because there would then be reliance on systems that are not secure. The counter to this argument is that the process of encrypting content and unauthorized decryption will lead to a great deal of wasted effort spent trying to encrypt and decrypt content and that it is better that those efforts be spent in other areas. This argument is put forth along with the suggestion that the exemptions within the DMCA are sufficient for research in these areas.^[63]

The Felten case is also different from the DeCSS case in that Professor Felten agreed to contractual terms prior to receiving the SDMI samples. Contracts, particularly nonnegotiable shrinkwrap or clickwrap licenses, are the legal equivalents of the technological access controls in the DMCA. If a nonnegotiable clickwrap agreement is a contract, then the agreeing party will be bound by the terms of the contract. Although there are certain exceptions, the drafters of these licenses to circumvent the balance in copyright law by eliminating the acquirer’s first sale and fair use rights, just the way access controls can technologically prevent exercise of first sale and fair use rights.

The 104 Report addressed this point:

On the other hand, the movement at the state level toward resolving questions as to the enforceability of non-negotiated contracts coupled with legally-protected technological measures that give right holders the technological capability of imposing contractual provisions unilaterally increases the possibility that right holders, rather than Congress, will determine the landscape of consumer privileges in the future. Although market forces may well prevent right holders from unreasonably limiting consumer privileges, it is possible that at some point in the future a case could be made for statutory change.^[64]

The Court dismissed the case as moot after the RIAA promised not to sue Professor Felten for publicly presenting his research.^[65]

Sklyarov case (*U.S. v. ElcomSoft*)

The third important DMCA case is the case of the Russian programmer, Dmitry Sklyarov, who was arrested in the United States while attending a conference on

e-books.^[66,67] The Sklyarov case was notable, because it was a criminal prosecution, unlike the other two cases, which were civil cases for monetary damages. Dmitry Sklyarov works for ElcomSoft, a Russian company that creates and sells software that circumvents access controls on e-books. This is a legal product in Russia but not in the United States, due to the DMCA. After a substantial period of detention in the United States, Sklyarov was released in late 2001 on the condition that he testifies against his employer, ElcomSoft.^[68] A U.S. jury subsequently cleared ElcomSoft on all charges.^[69]

Arguably, the Sklyarov scenario is precisely the reason the DMCA was passed, but it also highlights the complexity of enforcing laws in an area where the laws and norms vary widely from country to country. In fact, the European equivalent of the DMCA has numerous provisions that differ substantially from the DMCA.^[70] Given that circumvention of access controls and distribution of software devices that circumvent access controls are facilitated by Internet access, issues of jurisdiction and enforcement of judgments are likely to become more important in the coming decades.

Lexmark case (*Lexmark Int'l v. Static Control Components, Inc.*)

Lexmark sold laser printers and toner cartridges. The toner cartridges had a chip in them that enabled them to work with their printers. Competitors could not sell replacement toner cartridges because without the chip, the printer would not operate. The defendant manufactured chips that would enable non-Lexmark toner cartridges to work with Lexmark printers. Lexmark sued, claiming a DMCA violation and won at the District Court.^[71] The Court of Appeals subsequently reversed the District Court's opinion.^[72] The case is notable because it prevented the scope of the DMCA from expanding into a realm where interoperability and competition would be hampered by permitting manufacturers to use the DMCA to block competition in areas approaching patent law. For a related case regarding garage door openers, see *Chamberlain v. Skylink*.^[73]

DVDCopy case (*321 Studios v. Metro-Goldwyn-Mayer Studios, Inc.*)

DVDCopy, produced by 321 Studios, was software that permitted users to copy their DVDs. 321 Studios was sued because the software circumvented the access controls on the DVD. Even though the end users could do what the software permitted them to do, the District Court held that 321 Studios was still liable for selling the tool that permitted the end user to decrypt the DVD.^[74] This case highlights that even if tech-savvy end users can legally do certain things, those who lack the savvy will not be able to take advantage of the rights that they do have. In

addition, 321 Studios made certain constitutional arguments that the court largely rejected.

Bnetd case (*Davidson & Associates v. Jung*)

Blizzard created Battle.net as a server-based application that would permit players of Blizzard games to find each other online players and play online.^[75] Among other things, it checked to see if the user's copy of the software was legal. Bnetd.org was designed to serve the same purpose as Battle.net, but lacked some features, such as the authentication of the user's copy of the software. When Blizzard sued bnetd, part of bnetd's defense relied on analogizing to the Lexmark Case. The court rejected that analogy, suggesting that the difference between the two is that the acquisition of the printer provides access to the relevant programs, while in the bnetd case, no one ever gets access to the Battle.net code, so the DMCA does apply. In addition, the court stated that the interoperability exception did not apply, suggesting that the lack of a check that the user's software was legal made a substantial difference.

TITLE II. ONLINE COPYRIGHT INFRINGEMENT LIABILITY LIMITATION

Title II of the DMCA addresses the twin concerns of content providers and ISPs.^[76] Prior to the DMCA, content providers were concerned that, without the threat of liability, ISPs would facilitate the distribution of pirated digital content. ISPs were concerned that they would be liable for money damages for infringing copyrights by distributing or hosting protected content. Because copyright law grants creators exclusive display and performance rights, ISPs might be directly, contributorily, or vicariously infringing the owner's rights. The ISPs were particularly concerned, because the person who actually posted the content would probably not be as well off as the ISP, would be harder to trace, and might be a more sympathetic defendant, leaving the ISP to become the primary defendant in online copyright suits.

A compromise was struck wherein Title 17 of the U.S. Code, the copyright law, was amended by adding a new section 512. It set forth that ISPs would not be liable for hosting or transmitting content so long as they had registered contact information, had no actual knowledge of copyright infringements, and cooperated with processes to disable access and limit the harm to the copyright owner following a valid notification of a violation.^[77] Section 512 is extraordinarily detailed. It lays out an elaborate roadmap for ISPs wishing to avoid liability for caching, storage, and transmission of protected works.

In the Napster case, dealing with whether the decentralized file sharing service that did not host any information itself could be found liable for secondary

copyright infringement, one of the issues in the Napster case was whether Napster could invoke this liability limitation.^[78] Napster was a service in which a server indexed music files on users' computers and facilitated users copying files from other users' personal computers. Napster was not an intermediary in the copying of files. Although the Napster model could be used to distribute public domain content, most of the content distributed via Napster was protected content.^[78] On appeal, the court suggested that this section of the DMCA was intended to provide relief to vicarious infringers in some contexts but did not opine on whether such an analysis would include Napster.^[78] Other cases have confirmed that companies like Amazon^[79] and eBay^[80] are able to take advantage of this limitation. The issue of whether search engines, such as Google, are able to take advantage of section 512 is currently being litigated.^[81]

More recently, the major case law has involved service provider liability for repeat infringement by users.^[82]

TITLE III. COMPUTER MAINTENANCE AND REPAIR COPYRIGHT EXEMPTION

This section, also known by its short title, the "Computer Maintenance Competition Assurance Act" amends section 117 of the copyright law to overrule a case that held that if software was licensed and a service company came to maintain the computer, by turning the computer on, the party servicing the computer was creating an illegal copy of the program in the memory of the computer.^[83] This section permits the making of a copy in the memory of the computer if the purpose of the use is to repair or maintain the hardware.^[84] This section does not apply to software to the extent that the exemption does not apply if the copy is made when the software is "not necessary for that machine to be activated."^[85]

TITLE IV. MISCELLANEOUS PROVISIONS

Title IV amends various parts of the copyright law to address issues related to distance education, libraries, and ephemeral recordings, among other things. Due to the concerns of educators, the DMCA required the Register of Copyrights to issue a report on how to promote distance education through digital technologies.^[86] After an intense 6 mo review, the report suggested nine changes:

1. Clarify the meaning of transmission to include both digital and analog.
2. Expand coverage of rights to the extent technologically necessary.
3. Emphasize the concept of mediated instruction. Ensure that the performance or display is analogous to the type of performance or display that would take

place in a live classroom setting, rather than a substitute for the original.

4. Eliminate the requirement of a physical classroom, but substitute the requirement of official enrollment to limit abuses of distance education.
5. Add new safeguards to counteract new risks, such as using technological measures to control unauthorized use and educating students and faculty on copyright law.
6. Maintain existing standards of eligibility.
7. Expand categories of works covered.
8. Require use of lawful copies.
9. Add new ephemeral recording exemption.^[86]

Section 404 of the DMCA updates the library exemption, section 108 of the copyright law,^[87] to meet current archival needs and standards. This section permits archives to make three copies of archival works, one as the master, one as the archival copy, and one as the use copy. Additionally, the copy no longer has to be a facsimile, but it can reform the content. Libraries cannot distribute digital content in the same way that they are permitted to distribute the analog facsimiles. Although print works could become damaged or stolen, existing section 108 did not address the library's needs when the digital format was unreadable. This section of the DMCA added that archival copies could be made when the format became obsolete. Obsolete is defined as "if the machine or device necessary to render perceptible a work stored in that format is no longer manufactured, or is no longer reasonably available in the commercial marketplace."^[88] Finally, if no notice of copyright appears on the work, the library can state that the work "may be protected by copyright."^[89]

Sections 402 and 405 of the DMCA address the issue of ephemeral recordings and reconcile previous copyright legislation and the anticircumvention provisions with the need for broadcast organizations to make ephemeral copies of their programming. Another section defined the scope of exclusive rights in sound recordings as they pertain to ephemeral recordings.^[90]

TITLE V. PROTECTION OF CERTAIN ORIGINAL DESIGNS

Title V, also known by its short title, "Vessel Hull Design Protection Act," protects boat hull designs for 10 yr.^[91] There is a long and contentious history of protection of boat hull designs.^[92] Boat hull designs, like digitized music, can be very hard to create and very easy to copy. In the context of boat hulls, they are copied through the use of plug molds. To qualify for protection, the design has to be registered, and notice of protection would be required.^[93] The section includes exceptions for educational uses, independent creation, and liability for resellers if there was no notice of protection.^[94]

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Digital Object Identifier (DOI®) System

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Abstract

The Digital Object Identifier (DOI®) System is a managed system for persistent identification of content on digital networks. It can be used to identify physical, digital, or abstract entities. The identifiers (DOI names) resolve to data specified by the registrant, and use an extensible metadata model to associate descriptive and other elements of data with the DOI name. The DOI system is implemented through a federation of registration agencies, under policies and common infrastructure provided by the International DOI Foundation which developed and controls the system. The DOI system has been developed and implemented in a range of publishing applications since 2000; by early 2009 over 40 million DOIs had been assigned. The DOI system provides identifiers which are persistent, unique, resolvable, and interoperable and so useful for management of content on digital networks in automated and controlled ways.

IDENTIFIER CONCEPTS

An identifier is a concise means of referencing something. The term “identifier” can mean several different things:

- A “string,” typically a number or name, denoting a specific entity (the referent of the identifier string). For example, the identifier ISBN 978-0-00-721331-3 denotes the book “Francis Crick” by Matt Ridley.
- A “specification,” which prescribes how such strings are constructed. For example, the ISO standard ISO 2108:2005^[1] is the current specification of the ISBN numbering system; but having that standard alone will not enable someone to construct and register a new valid ISBN.
- A “scheme,” which implements such a specification. For example, the ISBN International Agency^[2] implements the ISBN standard in an implemented scheme, by assigning ISBN prefixes to publishers, registering specific ISBNs (strings); providing rules on use of the ISBN (such as the incorporation of the ISBN as a bar code on the cover of a book). Typically, such schemes provide a managed registry of the identifiers within their control, in order to offer a related service.

Some important concepts relating to identifiers are “uniqueness,” “resolution,” “interoperability,” and “persistence.”

Uniqueness is the requirement that one string denotes one and only one entity (the “referent”). Note that the converse is not a logical consequence: it is not necessary that an entity have only one identifier. For example, a book may have an ISBN and also an LCCN. An identifier scheme may even allow multiple identifiers for one entity, though usually these are deprecated.

Resolution is the process in which an identifier is the input to a service to receive in return a specific output of

one or more pieces of current information related to the identified entity. For example, a bar code ISBN in a bookshop is scanned by a bar code reader and resolves to some point of sale information, such as title and price. Note that resolution depends on a particular application: while a bar code in a bookshop may resolve to price, the same bar code in a warehouse application might resolve to current stock number, or pallet position. Another familiar example of resolution is the Internet Domain Name System (DNS) which resolves a domain name address (URL) to a file residing on a specific host server machine.

Interoperability denotes the ability to use an identifier in services outside the direct control of the issuing assigner: identifiers assigned in one context may be encountered in another place or time without consulting the assigner. This requires that the assumptions made on assignment will be made known in some way. For example, a customer may order a book from a bookseller or a library system by quoting its ISBN, without consulting the publisher who assigned the number.

Persistence is the requirement that once assigned, an identifier denotes the same referent indefinitely. For example, ISBNs, once assigned, are managed so as to reference the same book always (and are not reassigned). Persistence can be considered to be “interoperability with the future.”

The management of content on digital networks requires identifiers to be persistent, unique, resolvable, and interoperable. As an example, URLs do not identify content but a file location: using them as a substitute for such identifiers is not sustainable for reliable automation. The content may be removed (“404 not found”), or changed (not being the same as the user anticipated, or the user being unaware of such change). There have been a number of efforts to address the need for such reliable identifiers, notable among them URN^[3] and

URI^[4] specifications; however these do not of themselves provide an implemented managed scheme and registry for specific content sector applications. Such full schemes require more: a model for identifiers and their management; shared, standards-based, persistent identifier management infrastructure; support for adoption of persistent identifiers and services, and a plan for sustainable shared identifier infrastructure.^[5,6] The Digital Object Identifier (DOI®) system is such a managed system for persistent identification of content on digital networks, using a federation of registries following a common specification.

The uncapitalized term “digital object identifier” may be used nonspecifically to describe a number of varied technologies concerned with the identification of entities in a digital environment. The capitalized term “Digital Object Identifier” refers to one specific system defined and managed by the International DOI Foundation,^[7] which provides an infrastructure for persistent unique identification of entities (here termed “objects”) on digital networks deployed in a number of content-related applications.

DOI SYSTEM: OUTLINE

DOI is an acronym for Digital Object Identifier. The DOI system provides for unique identification, persistence, resolution, metadata, and semantic interoperability of content entities (“objects”). Information about an object can change over time, including where to find it, but its DOI name will not change.

The DOI system brings together

- A syntax specification, defining the construction of a string (a DOI name)
- A resolution component, providing the mechanism to resolve the DOI name to data specified by the registrant
- A metadata component, defining an extensible model for associating descriptive and other elements of data with the DOI name
- A social infrastructure, defining the full implementation through policies and shared technical infrastructure in a federation of registration agencies

More detail on each of these aspects is given later in this entry.

The DOI system operates through a tiered structure:

- The International DOI Foundation is the umbrella organization defining the rules and operation of the system. It is a non-profit member-funded organization.
- Registration agencies are all members of the International DOI Foundation, and have a contractual

arrangement with the Foundation including a license to operate the DOI system. They provide defined services in specific sectors or applications. DOI registration is normally only a part of the service such an organization offers, since assignment of an identifier is usually done for the purpose of a specific initial service or application. An example is the CrossRef registration agency,^[8] which provides services to publishers for linking reference citations in articles based on DOI-identified articles. Registration agencies may collaborate, or remain relatively autonomous.

- DOI names are registered by clients via a registration agency (e.g., in the case of the CrossRef agency, individual publishers are clients using the CrossRef service). Part of this process may be undertaken by the registration agency, as part of its service offering. If a suitable registration agency cannot be found for a certain sector, the International DOI Foundation will seek to appoint one.

DOI is a registered trademark of the International DOI Foundation, Inc. (abbreviated to IDF). The preferred usage, to avoid ambiguity, is with a qualifier to refer to either specific components of the DOI system (e.g., “DOI name”: the string that specifies a unique referent within the DOI system); or the system as a whole (“DOI system”: the functional deployment of DOI names as the application of identifiers in computer-sensible form through assignment, resolution, referent description, administration, etc.).

SCOPE

The term “Digital Object Identifier” is construed as “digital identifier of an object,” rather than “identifier of a digital object”: the objects identified by DOI names may be of any form—digital, physical, or abstract—as all these forms may be necessary parts of a content management system. The DOI system is an abstract framework which does not specify a particular context of its application, but is designed with the aim of working over the Internet.^[9]

A DOI name is permanently assigned to an object, to provide a persistent link to current information about that object, including where it, or information about it, can be found. The principal focus of assignment is to content-related entities; that term is not precisely defined but is exemplified by text documents; data sets; sound carriers; books; photographs; serials; audio, video, and audiovisual recordings; software; abstract works; artwork, etc., and related entities in their management, for example, licenses or parties. A DOI name is not intended as a replacement for other identifier schemes, such as those of ISO TC46/SC9^[10] ISBN, ISSN, ISAN, ISRC, etc., or other

commonly recognized identifiers: if an object is already identified with another identifier string, the character string of the other identifier may be integrated into the DOI name syntax, and/or carried in DOI metadata, for use in DOI applications.

A DOI name may be assigned to any object whenever there is a functional need to distinguish it as a separate entity. Registration agencies may specify more constrained rules for the assignment of DOI names to objects for DOI-related services (e.g., a given registration agency may restrict its activities to one type of content or one type of service).

SYNTAX

A DOI name is the string that specifies a unique object (the referent) within the DOI system. The DOI syntax (standardized as ANSI/NISO Z39.84-2005)^[11] prescribes the form and sequence of characters comprising any DOI name. The DOI syntax is made up of a “prefix” element and a “suffix” element separated by a forward slash. There is no defined limit on the length of the DOI name, or of its prefix or its suffix elements. The DOI name is case-insensitive and may incorporate any printable characters from the Unicode Standard.

- Example: a DOI name with the prefix element “10.1000” and the suffix element “123456”: 10.1000/123456

The combination of a unique prefix element (assigned to a particular DOI registrant) and a unique suffix element (provided by that registrant) is unique, and so allows the decentralized allocation of DOI numbers. The DOI name is an opaque string for the purposes of the DOI system: no definitive information should be inferred from the specific character string of a DOI name. In particular, the inclusion in a DOI name of any registrant code allocated to a specific organization does not provide evidence of the ownership of rights or current management responsibility of any intellectual property in the referent. Such information can be asserted in the associated DOI metadata.

The DOI prefix has two components: a “Directory” indicator followed by a “Registrant” code, separated by a full stop (period) (e.g., 10.1000). The directory indicator is always “10” and distinguishes the entire set of character strings (prefix and suffix) as DOIs within the wider Handle System[®] used for resolution. The registrant code is a unique alphanumeric string assigned to an organization that wishes to register DOI names (four digit numeric codes are currently used though this is not a compulsory syntax). The registrant code is assigned through a DOI registration agency, and a registrant may have multiple-registrant codes. Once a DOI name is assigned the string should not be changed, regardless of any changes in the ownership or

management of the referent object; if an object is withdrawn from digital access, its DOI name should still resolve to some appropriate message to this effect.

The DOI suffix may be a sequential number, or it may incorporate an identifier generated from or based on another system used by the registrant (e.g., ISBN, ISSN, ISTC). In such cases, the existing system may specify its own preferred construction for such a suffix:

- Example: a DOI suffix using an ISSN: 10.1038/issn.0028-0836.

When displayed on screen or in print, a DOI name is normally preceded by a lowercase “doi”: unless the context clearly indicates that a DOI name is implied.

- Example: the DOI name 10.1006/jmbi.1998.2354 is displayed as doi:10.1006/jmbi.1998.2354.

The use of lowercase string “doi” follows the specification for representation as a URI (as for e.g., “ftp:” and “http:”).

DOI names may be represented in other forms in certain contexts. For example, when displayed in Web browsers the DOI name itself may be attached to the address for an appropriate proxy server (e.g., <http://dx.doi.org/> resolves DOIs in the context of Web browsers using the Handle System resolution technology) to enable resolution of the DOI name via a standard Web hyperlink.

- Example: the DOI name 10.1006/jmbi.1998.2354 would be made an active link as <http://dx.doi.org/10.1006/jmbi.1998.2354>.

DOI names so represented in a URL and transported by the HTTP protocol are constrained to follow standard IETF guidelines for URI representations. The syntax for URIs is more restrictive than the syntax for DOIs; some characters are reserved and will need encoding (the NISO Z39.84 DOI syntax standard provides more detail). Certain client or server software may be able to handle DOIs using native handle resolution technology (where doi:10.1006/jmbi.1998.2354 would be understood by the browser and automatically resolved without the addition of the proxy server address). DOI names may also be represented in other schemes, for example, in the info URI schema^[12,13] as info:doi/10.1006/jmbi.1998.2354.

RESOLUTION

A DOI name can, within the DOI system, be resolved to values of one or more types of data relating to the object identified by that DOI name, such as a URL, an e-mail address, other identifiers, and descriptive metadata (or any additional types defined extensibly by the registration agency). Resolution is the process of submitting a specific

DOI name to the DOI system (e.g., by clicking on a DOI in a Web browser) and receiving in return the associated values held in the DOI resolution record for one or more of those types of data relating to the object identified by that DOI name. Since the referent objects referred to by DOI names may be of various types (including abstractions as “works,” physical “manifestations,” performances), they may or may not be directly accessible in the form of a digital file or other manifestation; hence the resolution may or may not return an instance of the object.

The initial implementation of DOI system was that of persistent naming: a single redirection from a DOI name to a digital location (URL) of the entity (Fig. 1).

A significant DOI function is the capability for multiple resolution, that is, delivering more than one value back from a resolution request. The values are grouped into defined types, which can form the basis of services (Fig. 2). An example of current usage of this facility is resolution to a specific local copy of an article, determined by combining the resolution result (several URLs) and local information about the user’s location (from the user’s browser application).

Objects (identified by DOI names) which have common behavior (defined by metadata) can be grouped, using DOI application profiles; these application profiles can in turn be associated with one or more services applicable to that group of DOI names (see Fig. 3).

The Handle System,^[14] the resolution component used in the DOI system, is a general-purpose distributed

information system designed to provide an efficient, extensible, and secure global name service for use on networks such as the Internet. The Handle System includes an open set of protocols, a namespace, and a reference implementation of the protocols. The DOI system is one implementation of the Handle System; hence a DOI name is a “Handle.” DOI names are distinguished from other handles by additional “metadata” and “policy.” The Handle System enables entities to be assigned first-class names, independent of domain names and other location-specific information, which can then be resolved (redirected) to appropriate locations: since the resolution destination is managed and can be changed, this provides a tool for persistence, avoiding “404 not found” and similar problems with URLs. The Handle System is used in a variety of applications such as the Content Object Repository Discovery and Resolution Architecture (CORDRA) of the U.S. Department of Defense (DoD) Advanced Distributed Learning initiative; The Library of Congress National Digital Library Program; and applications in grid computing and advanced future Internet architectures. The Handle System also includes several features not currently used in the DOI system, such as trusted resolution using public key infrastructure.

The Handle System is part of a wider Digital Object Architecture;^[15] that architecture specifically deals only with digital objects with identifiers (Handles). There is no conflict in these two views, since any non-digital entity may be reified (or represented) as a corresponding digital object for the purposes of digital object management

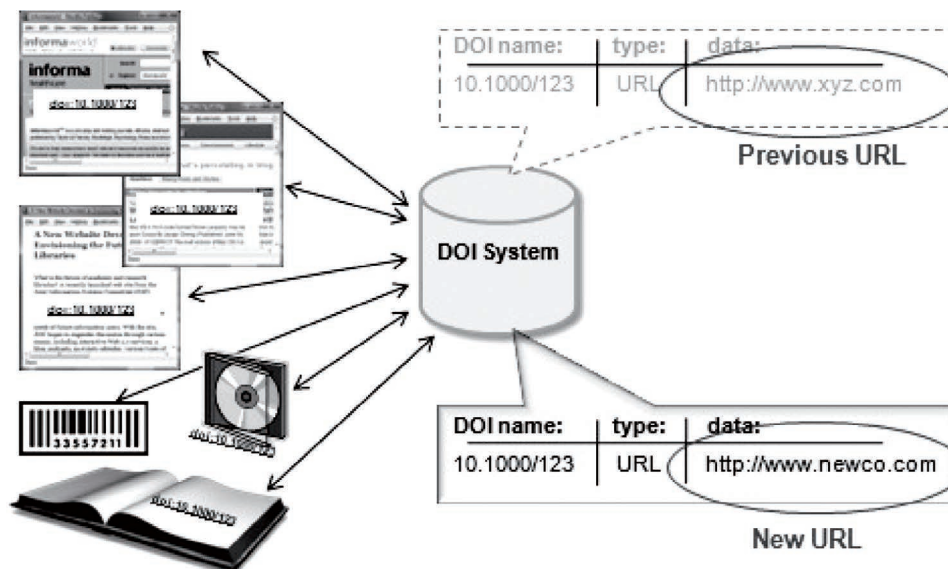


Fig. 1 The role of the DOI system as a persistent identifier. A DOI name (10.1000/123) has been assigned to a content entity; the DOI system provides resolution from that name to a current URL. When the content, previously at URL xyz.com, is moved to a new URL newco.com, a single change in the DOI directory is made: all instances of the DOI name identifying that content (even if already recorded in print, as bookmarks, etc.) will resolve to the new URL, without the user having to take any action or be aware of the change. Note that the DOI name is persistent, i.e., remains unchanged.

Source: From International DOI Foundation.

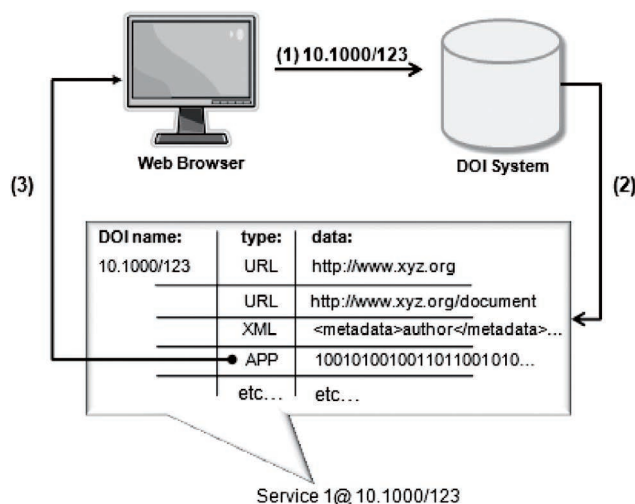


Fig. 2 Multiple resolution. A Web browser is running an application “Service 1.” That service resolves DOI name 10.1000/123 to the DOI system (1) where it finds four values within the relevant DOI record (2): here, two are of the type URL, one is XML, and one is a conjectural application. Service 1 selects one of these results (in this case, the APP value) on the basis of combining information provided in the resolution result and the local application.

Source: From International DOI Foundation.

(though some care is needed in the definition of such objects and how they relate to non-digital entities).

METADATA

The object associated with a DOI name is described unambiguously by DOI metadata, based on an extensible data model to support interoperability between DOI applications. Assignment of a DOI name requires the registrant to record metadata describing the object to which the DOI name is being assigned. The metadata describes the object to the degree that is necessary to distinguish it as a separate entity within the DOI system.

A minimum set of such metadata, the DOI kernel, is specified by the IDF. This includes elements such as “other identifier(s) commonly referencing the same referent (e.g., ISBN, ISRC),” and the name by which the referent is usually known (e.g., title). This minimum kernel may be enhanced by registration agencies through the development of specific application profiles with metadata elements appropriate to a particular application or set of applications. The IDF also specifies the template for the exchange of metadata between DOI registration agencies to support their service requirements, and specifies a Data Dictionary as the repository for all data elements and allowed values used in DOI metadata specifications.

The basis of the metadata scheme and extensions used in the DOI system is the index (interoperability of data in

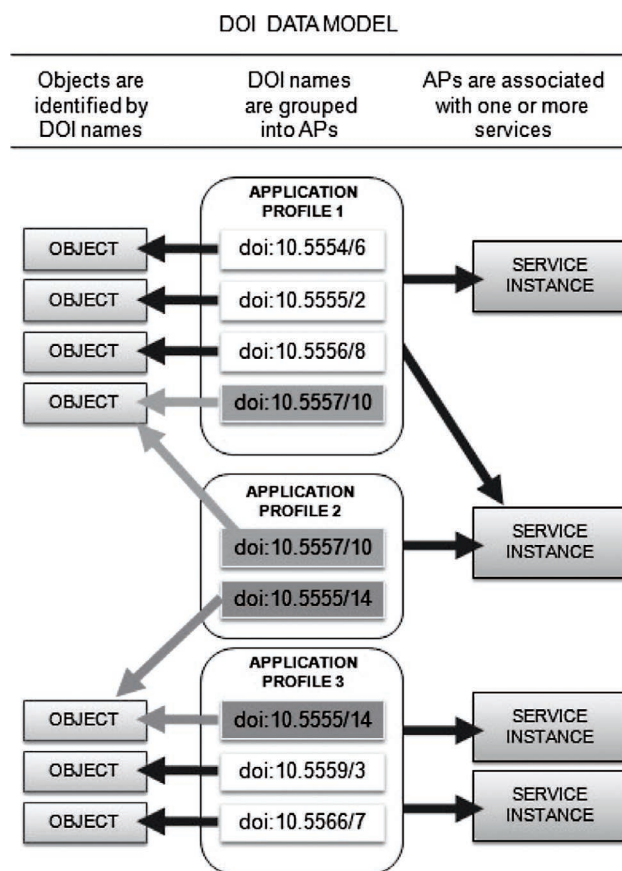


Fig. 3 DOI data model: the Application Profile Framework. DOI names (identifying the entities on the left) are grouped into application profiles. Any single DOI name can be a member of multiple application profiles (e.g., DOI 10.5557/10 is shown here in two). Each application profile can similarly be associated with one or more services: each service can be made available in multiple ways. This makes it possible to make a new service applicable to many DOI names, simply by adding that service to the relevant application profile(s).

Source: From International DOI Foundation.

e-commerce systems) project.^[16] This contextual ontology approach to interoperability is shared by a number of significant content sector activities.^[17,18] This allows the use of a variety of existing metadata schemes with DOI names in a common framework.

The use of these tools for DOI metadata has been limited in initial applications, but more applications are emerging as the sophistication of content management on digital networks and the need for interoperability increases.

SOCIAL INFRASTRUCTURE

DOI names are intended to be persistent identifiers: no time limit for the existence of a DOI name is assumed in any assignment, service, or DOI application. A DOI name and its referent are unaffected by changes in the rights associated with the referent, or changes in the

management responsibility of the referent object. Since such persistence requires a social infrastructure, policies as well as technical infrastructure need to be defined and implemented. The IDF develops and implements policies such as rules for transfer of management responsibility between registration agencies, requirements placed on registration agencies for maintenance of records, default resolution services, and technical infrastructure resilience. These are codified in a formal agreement between the IDF and each of the registration agencies.

The DOI system is not a means of archival preservation of identified entities; it does not store the identified objects themselves; nor does the central DOI Directory store comprehensive metadata (only pointers to the registration agency or other source of such data). The system provides a means to continue interoperability through exchange of meaningful information about identified entities through at minimum persistence of the DOI name and a description of the referent.

HISTORY

The DOI system was the result of a publishing industry initiative in the late 1990s, which recognized the need to uniquely and unambiguously identify content entities, rather than refer to them by locations, and commissioned a study to specify an appropriate technical solution, selected if possible from one or more existing technologies rather than developing a new system. The International DOI Foundation was incorporated in 1998 to develop the system; where possible, existing technologies and standards were adopted for the implementation of the DOI system. The first DOI registration agency began in 2000; by early 2009 around 40 million DOI names had been assigned through eight registration agencies. The most widely known application of the DOI system is the CrossRef cross-publisher citation linking service which allows a researcher link from a reference citation directly to the cited content on another publisher's platform, subject to the target publisher's access control practices. Other applications include government documentation, books, and data; further applications are under development.

The development of the DOI system has proceeded through three parallel tracks:

- An initial implementation of persistent naming: a single redirection from a DOI name to a digital location (URL) of the entity or information about it.
- The development of more sophisticated means of management such as contextual resolution, where the result of a redirection is also a function of some additional information such as local holdings information.
- Collaboration with other standards activities in the further development of tools for managing entities in a digital environment.

The DOI System is a Draft International Standard of ISO, it is expected that the final standard will be published in late 2009 or 2010.

RELATED ACTIVITIES

The DOI system is associated with two independent technical activities which it has used as components of DOI implementations: the Handle System and the series of contextual ontology initiatives derived from the indecs project. Each is used in other non-DOI applications (an aim of the International DOI Foundation was to use existing solutions where available and proven to be useful). Either of these components could be replaced in the DOI system by other technologies offering similar features in the future if necessary.

The International DOI Foundation, particularly through its registration agency CrossRef, has also been closely involved in the development of the OpenURL, a mechanism for transporting metadata and identifiers describing a publication for the purpose of context-sensitive linking. The DOI system is now widely implemented using OpenURL by many libraries: further information on this topic is available from the Crossref Web site. The use of open URL was the first widespread example of more sophisticated means of content management through contextual resolution.

The expertise of the International DOI Foundation in issues such as resolution and semantic interoperability has also led to some IDF members being active participants in discussions of further identifier scheme development such as the International Standard Text Code (ISTC) numbering system for the identification of textual works, and identifiers for parties (persons and organizations), and licenses.

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Digital Preservation

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INTRODUCTION

Digital preservation can be viewed as a set of strategies or methods used for preserving information in a certain format and also as a means for preserving information using digital systems. In the first usage, digital preservation is one aspect of preservation writ large, a companion to preservation practices for paper, film, and all the other media of art and expression that libraries collect. In the second usage, digital preservation is closely linked to digitization, the reformatting processes used to create digital surrogates for works that were issued in various nondigital formats. Most professional bodies are careful to make a distinction between digitization as a method of reformatting, and digital preservation, the ensuing process and relevant technologies for keeping the resulting digital content viable over time.

The Association of Library Collections and Technical Services defines digital preservation in process-oriented terms, as the “policies, strategies and actions that ensure access to digital content over time,” focusing on digital collections as objects that require preservation effort and in turn, describing the work that must be done to maintain them.^[1] Libraries have also recognized that digitization and digital libraries can serve as valuable preservation methods themselves. Just as printed books serve to preserve information, but also require libraries to provide preservation support and conservation intervention to keep them usable and available, digital objects can preserve information, provided they are supported by the right systems and practices, and use appropriate technologies to realize the library’s preservation goals.

FRAMEWORKS AND METHODOLOGIES

Digital preservation has developed rapidly, the internet and digital tools themselves providing a platform for the exchange of ideas among practitioners and researchers in libraries and a variety of allied sectors. Even though particular efforts of government or economic boundaries on philanthropy have led to many digital preservation projects, platforms, and technologies that have a strong national or regional association, there are certain frameworks and methodologies that are shared across the globe. These frameworks serve an important role in digital preservation, guiding the development of particular

technologies in the present while also preparing libraries to move from one specific system to another as technologies develop and supersede one another.

The Open Archival Information System Reference Model

The Open Archival Information System Reference Model (OAIS) has achieved near-universal acceptance as the canonical model of a digital preservation system.^[2] The OAIS describes three zones of activity relevant to digital preservation. Although the core of the OAIS addresses management of the archive itself, the framing activities of submission and dissemination are important preservation concepts in the OAIS. In particular, the dissemination activities are coupled to a Designated Community, and the use-cases associated with the Designated Community have a reciprocal effect on the way that the OAIS framework is implemented.

In the OAIS model, preservation begins when Submission Information Packages (SIP) are taken into the archive in a process called Ingest. Ingest associates preservation metadata with the SIP to create an Archival Information Package (AIP). This set of data and metadata is often referred to as a Digital Object among digital preservation practitioners. The core of the OAIS, Management, has two streams of activity. One, roughly analogous to systems administration or core IT activities, is Administration. This set of activities provides archival storage of the AIP, through storage and database maintenance, backup and redundancy measures, and protection of the archive against disasters or threats. The other, Preservation Planning, includes the data management and reporting operations that are necessary to monitor the status of the archive and determine when preservation actions are required, as well as to take in materials from producers and prepare them for the archives as AIPs, and then distribute them to consumers, a process called Dissemination. This involves querying the archive for results sets describing the archive’s contents, and then ordering a Dissemination Information Package (DIP), consisting of some derivative form of the AIP intended for end-users. The DIP could be identical to the AIP, or it could contain alternate versions of the AIP content, perhaps a lower-resolution copy for faster transmission over the network or a version in an alternate file format, when the original format is obsolete.

Deposit Systems for Electronic Publications

Although the OAIS has been accepted as the common reference framework for the digital preservation community in its widest sense, embracing not just libraries, but archives, museums, research centers, and more, the Deposit Systems for Electronic Publications (DSEP) deserves some attention for libraries, specifically.^[3] This model was developed by the Networked European Deposit Library (NEDLIB), one of the host archives for the Portico and JSTOR projects, and reflects an integration of library-specific practice into the OAIS model. Of particular note is the inclusion of numerous sources and recipients for a variety of bibliographic metadata, including publishers and external bibliographic utilities, as well as the relationships mapped between internal preservation functions.

Trustworthy Repositories

The OAIS model is central to ongoing efforts to develop audit and certification processes for trustworthy digital archives. These efforts were initiated in response to an RLG-OCLC report, “Trusted Digital Repositories: Attributes and Responsibilities,” published in 2002.^[4] The audit process couples an assessment of OAIS compatibility with a broader institutional assessment intended to ascertain whether a digital preservation effort has addressed all of the potential hazards in preserving materials, has sufficient technical capability to execute its plans, and has the financial resources and institutional resilience needed to remain in business and capable of responding to future developments. Two prominent efforts that have emerged from the trustworthy repositories: the Trusted Repositories Audit Checklist (TRAC), the related ISO/DIS 16363 standard, and the Trusted Digital Repositories Checklist (TDR).

Program Development

There is an ongoing effort to educate practitioners, so that digital preservation efforts can commence in a variety of institutional contexts. These programs use a variety of frameworks to help practitioners perform needs assessments in order to select appropriate technologies and process changes to advance their digital preservation goals. Where TRAC and related efforts tend to be used for large scale assessments of entire institutions, these program development models can be applied at a small scale, within a single department or subprogram. They share the OAIS reference model as a point of agreement, however, and can be seen as a system of needs assessment aimed toward fuller or improved OAIS compatibility, that might in turn be evaluated or audited through TRAC or TDR.

The longest-standing development program is the Digital Preservation Management (DPM) Workshop, started by Anne R. Kenney and Nancy Y. McGovern with support

from the National Endowment for the Humanities and hosted at Cornell University (2003–2006), the ICPSR (2007–2012), and now at MIT Libraries since 2012.^[5] The DPM model is often described as “Five stages and the Three-legged stool,” for its framework of three categories of activity—policy and planning, technological infrastructure, and content and use—and five stages of program development within them.^[6]

- Acknowledge: Understanding that digital preservation is a local concern
- Act: Initiating digital preservation projects
- Consolidate: Segueing from projects to programs
- Institutionalize: Incorporating the larger environment
- Externalize: Embracing inter-institutional collaboration and dependency

These concepts influence a set of activities hosted by the Library of Congress Office for Strategic Initiatives and funded by the National Digital Information Infrastructure and Preservation Program (NDIIPP). The National Digital Stewardship Alliance (NDSA) and the Digital Preservation Outreach and Education (DPOE) program both promote progressive frameworks, with the assumption that libraries were starting with little or no digital preservation capacity. The NDSA describes four levels of competency in each of five functional areas: (1) storage and geographic location; (2) file fixity and data integrity; (3) information security; (4) metadata; and (5) file formats. The DPOE identifies six core areas of digital preservation activity and trains practitioners to identify, select, store, protect, manage, and provide digital content to their designated communities.

METHODOLOGIES

Digital preservation efforts employ a variety of technical methods to ensure that the data stored in an archive can be rendered in the ways that are useful to the Designated Community. These methods respond to two broad classes of preservation problems: (1) obsolescence and (2) damage. Damage includes any number of events that cause data loss, through failures of media or computing systems; errors in transmission, synchronization, or duplication of data; deliberate sabotage; or a myriad of other possible accidents.

In instances of obsolescence, the bitstream itself may be undamaged, even though the digital object cannot be rendered on a particular system. This is frequently attributed to the changes in the prevailing technologies in use. Examples include the release of a new application software that lacks compatibility with files produced by older versions, file formats that cease to be supported or developed, or broader shifts within an industry or other group from one preferred technology to another.

Bit Preservation

The baseline for all digital preservation efforts is maintaining data integrity. Bit preservation, also referred to as refreshing, uses a variety of approaches to ensure that data are unaltered across time. This includes the maintenance of multiple copies of data so that they can be compared for discrepancies and the periodic copying of data from one physical storage medium to another, to avoid data loss from damaged or decaying media. Bit preservation is usually tested by mathematical derivatives, called checksums or hashes, which can be computed against a particular set of data to show if any bits have changed. A variety of algorithms can be used to compute fixity indicators, but all have in common the property of generating a different value if any bit in the data has altered. Fixity tools do not themselves provide a way to correct damaged data, a process called error-correction. Comparing fixity indicators over time allows digital preservation managers to determine when data were altered and which copies are intact and should be used as the canonical version of the data going forward.

Emulation

Emulation consists in creating a virtual computing system that offers the necessary and significant functions required to execute code from one platform on a different, generally newer and more powerful, platform. Universal Turing machine theory and Moore's law make emulation both possible and practical. All discreet computing systems are logically equivalent, that is, they all perform the same set of logical operations that were initially defined by Alan Turing in his paper "*On Computable Numbers, with an Application to the Entscheidungsproblem*."^[7] This logical equivalency has a valuable practical outcome. Intel founder Gordon Moore observed that improvements in manufacturing were enabling manufacturers to improve the complexity or circuit density of their chips "at a rate of roughly a factor of two per year," effectively doubling the processing power.^[8] Because computer systems have been rapidly increasing in computational power, more recent computers can not only perform every function of an earlier system, as a matter of logical equivalency, but they can also perform those functions at roughly the same speed of the original system.

Emulation has been subjected to some criticism for its apparent complexity, since modeling a physical computer in software is a nontrivial task, and can be more laborious than defining a crosswalk between two formats and writing code to replicate that translation, the strategy used in migration. This potential complexity has been offset in practice by the widespread value derived from emulators. Testing and prototyping of systems and networks in software is much less expensive than doing the same work in hardware for instance, and, because a single emulator can often be reused for many applications, the initial cost of development can be spread over many uses. Emulation has been widely adopted in some areas of digital

preservation, especially for multimedia and interactive systems, such as games and computer art. In these instances, the nature of the work itself requires complex code execution and may also have an important esthetic dimension that could be lost by migration to an alternate format or design.

Migration

Migration addresses the problem of obsolescence by converting from one format or encoding to another. This could mean a change from one file type to another (e.g., migrating an image from TIFF to JPEG2000) or from one method of encoding data to another (e.g., from ASCII text to UTF-8), or both. Migration can be seen as the digital preservation instance of a preservation practice called reformatting, where obsolete or damaged media or formats are transcribed onto or translated into contemporary formats. This approach has the benefit of allowing for easy integration of the resource's informational content into the libraries' current systems and processes. The core disadvantages of migration, as with all reformatting strategies, is that the new format may differ from the original format in ways that preclude certain uses of the information or require additional metadata creation and management to document provenance and significant differences. For many file types or encodings, however, migration is a widely used and easy-to-implement approach to keeping information available.

Forensics and Conservation

In some instances, digital preservation relies on the maintenance of original systems, especially original hardware, to render data. Digital forensics primarily deals with the recovery of data from damaged or obsolete systems, usually by creating a bit-perfect replica of stored data, so that the copy can be examined or altered without risking change to the original. Because the systems in question may be obsolete, digital forensics intersects with conservation through the maintenance of older computing hardware as a means to keep data available. In addition, conservation of computing hardware is done for reasons of material culture preservation, to make the tools and technology of different eras available in present-day curatorial programs or research efforts. Maintaining and repairing these computing systems, as well as the specific knowledge required to use them, mirrors the practices of other branches of conservation practiced in libraries, archives, and museums.

DIGITIZATION

In the late twentieth and early twenty-first century, libraries often centered digital preservation activities around digital libraries created by digitization of their physical resources: (1) books; (2) journals; (3) photographs; and

(4) recorded sound, video, and motion pictures. This focus on digitization as a type of preservation reformatting led to an ongoing emphasis on the creation of high quality digital objects, often referred to as preservation masters. A number of projects exist to promulgate standards for digitization, specifying resolution and bit depth requirements for various media types and desirable formats for storing digital information. In general, these standards emphasized digitization that captures more data than the human eye or ear can perceive, and storing data in file formats that are uncompressed and not encumbered by any proprietary or for cost licenses. These digitization projects tend to be driven by highly specific selection criteria and focus on creating a high-fidelity surrogate of the original items, serving a dual purpose of creating a high-quality preservation master while improving access to library collections, often through curated presentations of materials accompanied by secondary scholarship or other contextual information to create a specific collection in the context of a digital library.

In counterpoint to this approach, a large-scale digitization initiative (LSDI) converts a massive quantity of information into digital forms. Several LSDIs for library print collections were started in the first part of the twenty-first century. The Google Books Project and the Internet Archive's digitization efforts are the largest of these, and were the primary impetus for the creation of the HathiTrust, an organization that operates a preservation repository for the output of LSDI projects and works with its member libraries to develop digital library services and collection management projects built around this corpus of materials. Other LSDI projects are notable, as well, including Microsoft's Live Search and the Million Books Project and, arguably, publisher efforts to convert their catalogs to e-book formats.

BORN-DIGITAL WORKS

Despite the early emphasis on digitization, the largest groups of digital materials in libraries are "born-digital" works. These have no direct analog source, and are often created through entirely digital production processes. The best practice that has emerged for these materials is to accept them as they come to the repository and retain their original format, and then to normalize, migrate, or emulate data and systems to allow access as needed.

Electronic Publications

E-journal preservation is probably the most active area of born-digital preservation, especially when it is combined with e-publications as a whole, including serials, monographs, and published datasets. Libraries subscribe to a large amount of digital content, and have launched cooperative projects to ensure that this content remains available in the future. Although the process and technology

differs between these efforts, they share the common features of a present-day intake mechanism to build an archive, based on an agreement between the publisher and a third-party repository that, in turn, manages permissions based on the subscription profiles of libraries, and provides authorized libraries with post-cancellation access (PCA) to the archive in response to certain trigger events, usually the cessation of business by a publisher or the end of publisher support for a particular title.

Two of the most extensive and long-standing digital preservation efforts have their roots in the e-journal preservation challenge. The oldest of these is called LOCKSS, an acronym for "Lots of Copies Keeps Stuff Safe." This project was started at Stanford University by Victoria Reich and David Rosenthal and has developed into a series of related projects that rely on a peer-to-peer network of many devices to compare multiple instances of a given work and then repair any damage detected. LOCKSS was initially an e-journal preservation effort, but has developed a wider range of services under the auspices of the LOCKSS alliance, including controlled and private LOCKSS systems that allow for the management of a variety of digital content. Portico was also started as an e-journal preservation service, focusing on the content in JSTOR, but has quickly grown by expanding the scope of publishers involved and the types of content maintained in the service. Portico uses a different technical infrastructure than LOCKSS, relying on a smaller number of copies of the entire archive in geographically separated data centers. These mirrors of the archives are in turn monitored for integrity and completeness on a regular cycle.

Institutional Repositories

Institutional repositories have been developed as a way to preserve a variety of born-digital materials, including pre- and post-prints, working papers, student work, ports, datasets, and gray literature. These systems perform the administrative tasks of identifying and documenting works, keeping digital objects organized, and placing objects into reliable storage systems. DSpace, EPrints, BePress, and OPUS were all developed in the late 1990s or early 2000s in close alignment with the Open Access movement, as a way to provide unrestricted online access to peer-reviewed scholarly research. In terms of the OAIS model, these systems control the Ingest, archival management, and dissemination of information. To provide a complete digital preservation solution, they must be connected to reliable archival storage and supported by ongoing preservation management efforts.

Digital art and multimedia works have presented a particular challenge for born-digital preservation, because artworks may be closely tied to obsolescent computing platforms and multimedia works may combine elements with vastly different risks and requirements for preservation. Many preservation efforts in this area focus

on metadata creation to document the as-built state of the work, with the assumption that this will facilitate preservation efforts in the future. Emulation has received substantial attention for this reason, as well, since sufficiently detailed documentation of the system alongside maintenance of its component parts can allow for its emulation on a later computing platform.

Web archiving projects collect websites available over the internet for later access. These efforts face difficulties similar to collecting multimedia work, since the web provides a disparate set of born-digital materials, but the standardizing pressure of network protocols, the HTML specifications, and related technologies mitigates the risks somewhat. Two major difficulties for web archiving are deciding how far to follow hyperlinks in the interest of creating a useful archive, and problems in collecting dynamically generated web pages, since content that is created on the fly from a database or content management system has no single, fixed form that can be treated as a definitive copy of record.

Data management includes elements that align with born-digital preservation, as well. These include the promulgation of standards and the best practices for creating and managing data, which entails making choices about the format and encoding of data and their related rendering software, as well as the creation of metadata that will be needed for the future interpretation and reuse of data. Data management plans are often required by research-funding agencies, and this has led to the creation of tools to assist in data management planning and helped to align data management with related efforts such as institutional repository development.

DIGITAL CURATION AND DIGITAL STEWARDSHIP

The terms “digital curation” and “digital stewardship” have become strongly associated with digital preservation. These ideas place digital preservation within a larger context of selection and appraisal of materials and of providing access to them. These practices are implicit in many digital preservation models, and explicit in others. The OAIS reference model, for example, uses the concept of a Designated Community that receives a DIP as a way of framing access to the archive, and the first two stages of the DPOE model are “identify” and “select,” which focus on determining what content is appropriate for the archive.

The digital curation movement builds on this, however, to encompass many ways of understanding the way technology is used and interpreted in a variety of contexts and to create and manage data in such a way that they can be reused in future research. The Digital Curation Centre, for example, describes eleven steps in their digital curation life cycle,^[9] while the University of North Carolina, Chapel Hill, School of Information and Library Science’s

DigCCurr project proposed 39 elements of “knowledge and competency” in their matrix of digital curation.^[10]

Digital preservation and the core practices associated with it—safe storage, migration, and emulation of data and systems, and forensic and conservation practices—exist as key subsidiary elements of these digital curation models. Digital curation, in turn, is an overarching set of activities that comprise the whole life cycle of materials in libraries and archives, predicated on their continued availability due to sound preservation efforts.

CONCLUSION

Digital Preservation, to borrow the definition of the American Library Association, “combines policies, strategies and actions to ensure access to reformatted and born digital content regardless of the challenges of media failure and technological change.” At present, this area of librarianship is enacted through numerous tools addressed to specific technical issues and a variety of widely accepted frameworks for evaluating preservation efforts and outcomes. In counterpoint to this maturity though, digital preservation efforts are always engaged in adaptation to developments in technology.

Computers and computing have been active fields for decades and if one counts from Turing’s papers, the centenary of digital computing is just a few decades away. In that time, many technologies have proven stable and reliable, but others have been short-lived and problematic from a preservation viewpoint. As of this writing, the text and image data that make up the bulk of library and archive collections are supported by formats and encoding that have been stable for multiple decades, as has digital audio preservation. Video, datasets, and 3-D models all present preservation challenges, however, as do the processes for preserving systems and interactive works, like social media, video games, and websites.

Libraries have adopted, developed, and now depend upon a wide range of technologies, making digital preservation an intrinsic part of library science. Although digital preservation emerged from the problems associated with novel technologies prone to obsolescence, there is substantial evidence of libraries’ success and capability in resolving digital preservation problems, shown by the wide acceptance of certain technologies and frameworks.

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Diplomatics

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Abstract

This entry presents the science of diplomatics, briefly describing its history, its theoretical content, and its methodology. Comparing classic diplomatics with modern diplomatics, it discusses the concepts of authenticity, originality, and record. Then, it outlines the building blocks of the diplomatic body of knowledge, that is, the context, the act, the persons, the procedure, the documentary form, and the archival bond and comments on the process of diplomatic criticism and on the usefulness of diplomatics as a discipline.

INTRODUCTION

Diplomatics is a science that was developed in France in the seventeenth century for the purpose of ascertaining the provenance and authenticity of records that attested to patrimonial rights and later grew into a legal, historical, and philological discipline, as it came to be used by lawyers to resolve disputes, by historians to interpret records, and by editors to publish medieval deeds and charters. Its name comes from the Latin term *diploma*—derived from the Greek words διπλω, meaning I fold, and διπλωμα, meaning doubled or folded—which was used in ancient Rome to refer to documents written on two tablets attached with a hinge and later to any recorded deed, and it means “about records.” However, over the centuries, its focus has expanded from its original concern with medieval deeds to an all-encompassing study of any document produced in the usual and ordinary course of activity as a means for it and a residue of it.

This entry briefly outlines the history of diplomatics; presents its purpose, object, and fundamental tenets, including the concepts of record, authenticity, and originality; describes the concepts that constitute the building blocks of diplomatic analysis, including those of person, procedure, and form; and discusses diplomatic methodology and its usefulness. In the process, classic and modern diplomatics will be constantly compared to show their relationship and interplay.

THE HISTORY OF DIPLOMATICS

The history of diplomatics is directly linked to the so-called “diplomatic wars” (*bella diplomatica*), judicial controversies over political or religious claims based on records of disputed origin, which, in the seventeenth century, especially in Germany and France, assumed a

doctrinal character and prepared the ground for a scientific debate between the Benedictines of the Congregation of Saint-Maur in France and the Jesuits organized by Jean Bolland in a scientific society in Antwerp (Bollandists). In 1675, the second volume of the *Acta Sanctorum*, an analysis of the lives of saints published in several tomes by the Bollandists, was released, with an introduction by Daniel Van Papenbroeck, which outlined the general principles and methods for assessing the authenticity of medieval records. In the text, the author, applying his analysis to the records of Frankish kings, declared a diploma issued by Dagobert I to be a forgery, thereby discrediting all Merovingian diplomas, on which most patrimonial rights of the French Benedictines rested.

The Benedictines answered Van Papenbroeck 6 yr later, in 1681, with a treatise in six parts written by Dom Jean Mabillon and called *De Re Diplomatica Libri VI* [¹, p. 37]. The treatise analyzed about 200 documents by comparing the material support, seals, ink, script, punctuation, abbreviations, formulas, discourse, types of subscriptions, etc. and, on the basis of this study, established a method of criticism of records whose validity was recognized throughout Europe. Several works followed Mabillon’s and contributed to a further development of the discipline. Among them, the most notable are the *Nouveau traité de diplomatique* by Rene Prosper Tassin and Charles Toustain, published in Paris between 1750 and 1765, which, by comparing records of different geographical origin, on one hand, demonstrated the validity of diplomatics across contexts and, on the other hand, gave origin to the idea of a special diplomatics for records of the same provenance, and *Beitrag zur Diplomatik I-VIII*, by Theodor von Sickel, in *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften*, published in Vienna between 1861 and 1882, which linked the assessment of the authenticity of records to the analysis of their procedure of creation. Although mostly regarded as an

auxiliary science of history since the middle of the nineteenth century, diplomatics was included in the body of knowledge required for archivists since the first half of that century in all European archival programs of education and later on in all programs influenced by the European tradition in other continents. As a consequence, diplomatics concepts and methodology became in most parts of the world an integral part of archival science and of the intellectual armor of the archival profession [²], pp. 3–5].

THE OBJECT OF DIPLOMATICS

When discussing diplomatics, it is useful to distinguish “classic diplomatics” from “modern diplomatics,” the reason being that these two branches of the discipline do not represent a natural evolution of the latter from the former, but exist in parallel and focus on different objects of study. Classic diplomatics uses the concepts and methodologies developed by diplomatists living between the seventeenth and the twentieth centuries and studies medieval charters, instruments, and deeds; modern diplomatics has adapted, elaborated, and developed the core concepts and methodology of classic diplomatics in order to study modern and contemporary records of all types. Among the key distinctions between the two branches of the discipline are the concept of record and that of diplomatics. According to classic diplomatics, a record is a document (i.e., information affixed to a medium) that constitutes “the written evidence of a fact having a juridical nature, compiled in compliance with determined forms, which are meant to provide it with full faith and credit” [³], p. 18]. Therefore, classic diplomatics only studies documents that are meant to have legal consequences and therefore require specific documentary forms and is defined as the knowledge of the formal rules that apply to legal records [⁴], p. 1; [⁵], p. 32; [⁶], p. 4]. According to modern diplomatics, a record is a document created (i.e., made or received and set aside for action or reference) in the course of activity as an instrument and by-product of it [⁷], p. 604; [⁸], p. 667]. Therefore, modern diplomatics is concerned with all documents that are created in the course of affairs of any kind and is defined as “the discipline which studies the genesis, forms, and transmission” of records and “their relationship with the facts represented in them and with their creator in order to identify, evaluate, and communicate their true nature” [¹], p. 45; [⁹], p. 28].

THE APPROACH AND PURPOSE OF DIPLOMATICS

Although the primary focus of both classic and modern diplomatics is to assess the trustworthiness of records, the former establishes it retrospectively, looking at

records issued several centuries ago, while the latter is concerned not only with establishing the trustworthiness of existing records but also with ensuring the trustworthiness of records that have yet to be created, thereby taking a prospective approach as well as a retrospective one. Additionally, classic diplomatics identifies trustworthiness with authenticity, while modern diplomatics distinguishes several aspects of trustworthiness. To classic diplomatists, trustworthy records are authentic records, that is, documents “written according to the practice of the time and place indicated in the text, and signed with the name(s) of the person(s) competent to create them” [¹¹], p. 46]. This is far too simplistic a concept for the variety of records that modern diplomatics aims to evaluate and the time span of their creation (from the sixteenth to the twenty-first century), especially in consideration of the fact that its concern is the entire life cycle of records, from creation to permanent preservation. Thus, modern diplomatics defines and assesses four aspects of trustworthiness: reliability, authenticity, accuracy, and authentication.

Reliability

Reliability is the trustworthiness of a record content and is defined as the trustworthiness of a record as a statement of fact. It is assessed on the basis of the *completeness* of the record, that is, the presence of all the formal elements required by the administrative–legal system for that specific record to be capable of achieving the purposes for which it was generated and of the *controls exercised on the process of creation* of the record, among which are included those exercised on the author of the record, who must be the person competent, that is, having the authority and the capacity, to issue it. The reliability of a record is the exclusive responsibility of its creator, that is, of the person or organization that made or received it and maintained it with its other records.

Authenticity

Authenticity is the trustworthiness of a record as a record and is defined as the fact that a record has not been tampered with or corrupted, either accidentally or maliciously. An authentic record is one that preserves the same *identity* it had when first generated and can be presumed or proven to have maintained its *integrity* over time. The identity of a record is constituted of those characteristics that, together, distinguish it from any other record (e.g., the names of its author and its addressee, the date of its compilation, its title, its classification code, or its register number) and is assessed on the basis of the formal elements on the face of the record and/or its attributes, as expressed, for example, in a register entry or as metadata. The integrity of a record is linked to its ability to convey the message it was intended to communicate when

generated. Thus, it does not matter if the ink is fading, the medium (i.e., the material support) is falling apart, or the bit stream is not the same as in the first manifestation of the record, as long as the content is readable and is the same as it was originally intended, the medium does not have missing parts, or the manifestation we see on the computer screen is the same as it was the first time the record was saved. The integrity of a record is inferred not only from its appearance, which might be deceiving in the case of good forgeries, but also from the circumstances of its maintenance and preservation: An unbroken chain of responsible and legitimate custody is considered an insurance of integrity till proof to the contrary. The authenticity of a record is a movable responsibility, as it shifts from the creator, who needs to guarantee it for as long as the record is in its custody, to the preserver, who guarantees it for as long as the record exists.

Accuracy

Accuracy is the trustworthiness of the data (i.e., the smallest meaningful indivisible piece of information) within a record and is defined as their truthfulness, exactness, precision, or completeness and usually presumed for reliable records as well as for authentic records. However, in the digital environment, it is necessary to consider and assess accuracy as a separate quality of a record because of the easiness with which data can be corrupted during transmission across space (between persons and/or systems) and time (when digital systems are upgraded or records are migrated to a new system). Consequently, accuracy also is a shifting responsibility that moves over time from the creator to the preserver.

Authentication

Traditionally, the most trustworthy records are those that are declared to be so by a person who is given such responsibility in a formal way. Authentication is defined as a declaration of authenticity made by a competent officer and consists of a statement or an element, such as a seal, a stamp, or a symbol, added to the record after its completion. It is not to be identified with authenticity—which is a quality of the record that accompanies it for as long as it exists—in that it only guarantees that a record is authentic at one specific moment in time, when the declaration is made or the element is affixed.

STATUS OF TRANSMISSION

Although it is a general assumption that an original record is a trustworthy record, simply because it presents all the possible elements that allow for an assessment of trustworthiness, it is obvious to all diplomatists, classic and modern, that originality has no relationship with

trustworthiness. Rather, it is one of three possible statuses of transmission of a record, that is, it relates to the degree of perfection of a record. An *original record* is the first record generated in a complete form that is capable of reaching the consequences wanted by its author. Thus, an original has the qualities of *primitiveness*, *completeness*, and *effectiveness*. With records that are meant for transmission across space, the original is the document received by the addressee, while with records that are only intended to be transmitted through time (i.e., internal records), the original is the document kept by the author. In the digital environment, the original is the first manifestation of either the received record or the saved record, depending on whether we have an external or an internal record. We have multiple originals when the same record is issued at the same time to multiple recipients, such as a contract (e.g., indenture), a treaty, an invitation, or a directive.

The other two possible statuses of transmission are the *draft* and the *copy*. A draft is a document prepared for purposes of correction and is meant to be provisional, temporary. A draft may have various levels of completion, but it is never an effective or a legal document, and, if kept, it is intended to stay with the author; thus it may be transmitted through time but not across space. If a draft is electronically circulated, the document received by each recipient is an original as to “status of transmission”—having been communicated to an addressee in the intended status of completion and having been the first capable of reaching its purpose of being examined by the person receiving it—and it is a draft only as to content, therefore as type of document (e.g., an ISO draft standard circulated for comments to the ISO members). A copy is a reproduction of another document, which may be an original, a draft, or another copy. Classic diplomatists study the sequence of copies over time to assess the probability of trustworthiness of a text that has been transmitted through the centuries by copying it. The most trustworthy copy is the copy in the form of the original, which is identical to the original in all respects, including holographic signatures, if required, but is issued after the original. Equally trustworthy is the authentic copy, which is declared to conform to the original by an official entrusted with such responsibility. Imitative copies (e.g., photocopies) reproduce both the form and the content of the record; simple copies only transcribe the record content; and inserts (also called *vidimus* or *inspeximus*) are original records containing a copy of another record or a part of it. The study of copies, their process of creation, and their trustworthiness is becoming increasingly relevant in the digital environment as we will no longer have originals on which to assess the authority of records.^[10]

THE BUILDING BLOCKS OF DIPLOMATICS

Diplomatics saw the documentary world as a system and built a system to understand and explain it. Early

diplomatists rationalized, formalized, and universalized document creation by identifying within it the relevant elements, extending their relevance in time and space, eliminating their particularities, and relating the elements to each other and to their ultimate purpose. These elements are building blocks that have an inherent order: in fact, they can be analyzed in sequence from the general to the specific, following a natural method of inquiry [¹¹, p. 107].

The building blocks used by classic diplomatists were the *juridical system*, which is the context of records creation; the *act*, which is the reason for records creation; the *persons*, which are the agents; the *procedures*, which guide the actions and determine their documentary residue; the *documentary form*, which reflects the act and allows it to reach its purpose; and the *archival bond*, which reveals the relationship of a record with all the other records in the same aggregation.

THE CONTEXT OF RECORDS CREATION

As a consequence of its definition of record, classic diplomatics identified the *juridical system* as the only relevant context of records creation and defined it as a social group organized according to shared principles and values that allow it to establish and recognize a body of rules and to give institutions the power to enforce them. Thus, a juridical system is constituted of a community, its institutions, and its legal system. The legal system comprises positive law and all the other conceptions of binding law (e.g., natural law, ethics, custom) that are held by a community.

Modern diplomatics, having extended the concept of record, has redefined the context of records creation as the framework of action in which the record participates and has identified five relevant contexts, proceeding from the general to the specific. They are 1) the juridical-administrative context, that is, the legal and organizational system in which the record-creating body belongs, as indicated by laws, regulations, etc.; 2) the provenancial context, that is, the record-creating body, its mandate, structure, and functions, as indicated in organizational charts, annual reports, the classification scheme, etc.; 3) the procedural context, that is, the business procedure in the course of which the record is created, which, in the modern environment, is often integrated with documentary procedures, as indicated by workflow rules, codes of administrative procedure, classification schemes, etc.; 4) the documentary context, that is, the archival fonds to which the record belongs and its internal structure, as indicated by classification schemes, record inventories, indexes, registers, etc.; and 5) the technological context, that is, the characteristics of the technical components of the record system in which the record is created [¹¹, p. 18].

ACTS

An act is defined as an exercise of will that aims to produce determined effects. Acts are distinguished in mere acts and transaction. Whereas a mere act is an act whose purpose is the accomplishment of the act itself, a transaction is an act that aims to create, modify, maintain, or extinguish relationships between two or more physical or corporate persons. Some acts, especially transactions, occur in writing, thereby resulting in records. Classic diplomatics categorizes those records according to their relationship with the acts that caused their creation. It calls *notitia* a record that was meant to provide evidence of an act that came into existence and was complete before being manifested in writing, while it calls *charta* a record that was meant to put the act into being and was therefore the essence and substance of the act. In modern English, we call the former *probative* records and the latter *dispositive* records. Examples of probative records are certificates, registrations, transcripts, and receipts. Examples of dispositive records are contracts, grants, applications, and money orders. These types of records have all in common the fact that their existence and written form are required by the juridical-administrative system within which they are created, and therefore they are all legal records. They do encompass all the types of documents that classic diplomatics defines as records.

However, modern diplomatics has a much broader focus, and its object of inquiry—what it calls records—is constituted not only of documents whose written form is required, but also of documents whose existence is not required by the juridical-administrative system and the written form of which is discretionary. These nonlegal records can be distinguished in two categories: *supporting* records, whose function is to support the activity in which they take part, and *narrative* records, whose function is one of free-form communication of information. While both categories of records participate in some kind of act, neither is able to provide evidence of such act by itself or to carry it out. Examples of supporting documents are teaching notes and maps, and examples of narrative documents are informal correspondence, discretionary reports, and accounts of events. In the digital environment, two additional categories of records have been identified: *instructive* records and *enabling* records. The former indicate the form in which external data are to be presented (e.g., regulations, manuals of procedure, instructions for filling out forms), and the latter enable performance of artworks (e.g., software patches), execution of business transactions (e.g., interacting business applications), conduct of experiments (e.g., workflows generated and used to carry out the experiment of which it is instrument, by-product, and residue), or analysis of observational data (e.g., interpreting software). The salient characteristic of these two categories of digital records is that the record as it is stored differs from the record as it is manifested on the computer screen [¹⁰, pp. 49–52].

PERSONS

In diplomatics, as well as in law, persons are the subjects of rights and duties, that is, they are entities recognized by the juridical system as capable of acting. This means not only that a person in a given juridical system may not be considered a person in another one but also that the same entity in the same juridical system may be a person with respect to a type of act and not a person with respect to another (e.g., in the past, women have been persons in regard to being paid for a job, but non-persons in regard to owning real estate). Persons can be *physical*, that is, individual human beings, or *juridical*, that is, collections of human beings (e.g., an organization, a committee) or successions of human beings (e.g., a position, a title).

Classic diplomatics posits that, for a record to come into existence, three persons are necessary: the author, the writer, and the addressee. The *author* is the person having the competence (i.e., the authority and the capacity) of issuing a record, which is made by it, in its name, or by its order (e.g., the testator in a last will, the university in a letter of appointment of a professor, the king in a proclamation). The *writer* is the person competent for the articulation of the discourse in the record. It might be the same as the author or may not, as is the case when the author is an abstract entity, such as a corporation. The *addressee* is the person for whom the record is intended in its documentary form. It may coincide with the recipient of the record and may not, as is the case when a second original of a letter of appointment whose addressee is the appointed person is sent to the financial office responsible for paying the salary, which is therefore the recipient.

Modern diplomatics, which tends to focus on aggregations of records, rather than on individual items, identifies a fourth person necessary to the existence of a record, the *creator*, that is, the person in whose fonds or archives a record exists as an item or as part of a file and/or a series. In the digital environment, it is important to identify a fifth person, the *originator*, that is, the person responsible for the electronic account or space in which the record is generated or from which the record is sent ^[12], pp. 51–52]. Persons are the primary diplomatic criterion for determining the public or private nature of a record. Thus, a record is *public* if issued by a public person, that is, a physical or juridical person who, by performing functions considered to be public by the juridical system in which the person acts, is invested with the exercise of some form of sovereignty. A record is *private* when its author is a person “deprived” of public function. In situations in which the wills of a public person and a private person meet in the same record (e.g., a contract between a government and a contractor, or an income tax return), the record acquires the nature of the person who dictates the form and the procedure of creation of the record.

PROCEDURE

A procedure is the formal sequence of steps or phases whereby a transaction is carried out. It is different from a process, which is the series of motions by which a person prepares to carry out the acts involved in a procedure. In relation to each record, classic diplomatics identifies two distinct types of procedures: the procedure governing the act and the procedure governing its documentation. The first type is further distinguished in two categories: the procedures that are the initiative of the persons who carry them out and the procedures that result from an external initiative. The procedures included in the former category consist only of the decisional moment, the *iussio*, while those included in the latter begin with the *petition* to the authority or request to accomplish some action and proceed with the *intercession*, or recommendation of persons close to the authority; the *intervention*, or permission of the persons who are affected by the consequences of the requested action; and the *iussio*, or command to create the record enacting the act or providing evidence of it. After the procedure controlling the action is concluded, the procedure controlling the production of the related documentation begins. Its phases are the *compilation of the draft*; the *preparation of the fair copy*; the unabridged or abridged *registration*; the *validation* through signatures or affixing of stamps, seals, etc.; the *computation of the taxes* for the issuing of the record; and the *delivery* of the record.

Modern diplomatics, having moved the focus of study from medieval to modern and contemporary records, has observed an increasing integration of the procedures for acting and the procedures for creating the record, as over time the acts have begun to be carried out by writing records, and indeed several records for each procedure, not just one, as it used to be. Thus, modern diplomatists have identified for each procedure six typical integrated phases. They are the *initiative*, constituted by the acts that initiate a procedure and producing records such as applications and claims; the *inquiry*, consisting of the collection of the information necessary to evaluate the situation and producing records such as surveys and estimates; the *consultation*, consisting of the collection of opinion and advice based on the information accumulated and producing records such as minutes and discussion papers; the *deliberation*, or final decision-making, resulting in records such as appointments or contracts; the *deliberation control*, exercised by a person different from the author of the record embodying the transaction on the substance and form of the deliberation and the form of the record resulting from it; and the *execution*, constituted by all the actions that give formal character to the transaction and resulting in the final record of the transaction, plus letters of transmissions, registrations, etc. ^[11], pp. 115–119; ^[9], pp. 47–63]. In the digital environment, the same fundamental structure has to date proven to be valid and easy to embed in a workflow.

DOCUMENTARY FORM

Form is the whole of the rules of representation by which an act is documented or a message is conveyed in writing. It comprises all those characteristics of a record that can be separated from the determination of the particular subjects, persons, or places the record is about. The fundamental idea of the early diplomatists was that all records are similar enough that it is possible to conceive of one typical ideal documentary form, a template, which encompasses all the possible characteristics of a record, and which can be used to analyze existing records for the purpose of determining their nature, provenance, and trustworthiness. Thus, they built this ideal documentary form as follows. First they distinguished the formal characteristics that determine the appearance of the record and make it effective from those that represent the articulation of the discourse and make the record complete. They called the former extrinsic elements and the latter intrinsic elements. Classic diplomatics has continued over the past three centuries in this tradition, and modern diplomatics has only introduced a few new elements; therefore, the formal elements of the record are presented here in their logical sequence, with some reflection on their variations over time as appropriate.

Extrinsic Elements of Form

The extrinsic elements of form are the medium, the script, the language, the special signs, the seals, and the annotations. The *medium* is the physical carrier of the record, of which diplomatists study the material, the way it is prepared, the watermark, the shape and size, the edging, rulings, etc. With modern records and the increasing standardization of supporting media, this element has lost importance as it is no longer itself imbued with meaning and a key factor in the assessment of the authority and authenticity of the record. Furthermore, in the digital environment, the medium is no longer to be considered part of the record, although it is still necessary to its existence, as a record that is not affixed to a medium does not exist.

The *script* is not analyzed paleographically, but in terms of layout, paragraphing, punctuation, abbreviations, or initialisms. The *language* is studied in terms of the style, formulas, and tenor of the discourse. *Special signs* are symbols identifying the persons involved with the record, like logos, heraldic images, mottos, stamps, or drawings, and are key to the identification of the record provenance. *Seals* are examined as to their material, size, shape, typology, legend, and the method of affixing or appending them, and they are also indicators of the origin of the record and of its authority.

Annotations are additions made to the record after its completion. They can be distinguished in three types: the annotations that are added to the record at the conclusion

of the procedure generating the record itself, those added to the record in the course of the procedure in which it participates after its creation, and those added to the record in the course of recordkeeping activities. The annotations of the first type, added during the execution phase of the integrated business and documentary procedure, include the mention of the registration of the record in a register or book, with identification of the latter and of the relevant page and date, and the authentication of the record, of signatures on the record, of the identity of persons participating in the issuing of the record, or of the act referred to in the record, such as an oath of office. The annotations of the second type, added in the course of handling the matter in which the record participates, include mention of the decision made or further actions to be carried out, dates of hearings or readings, and locutions such as “urgent” or “bring forward.” The annotations of the third type, added in the course of managing the record, include a registry number, a classification code, and the endorsement of docket-style folded records. In the digital environment, the latter also include the record profile, that is, the metadata schema that is attached to the record for the purposes of declaring and maintaining its identity and protecting its integrity.

Intrinsic Elements of Form

The study of a large number of records of different times and provenance has shown that the intrinsic elements of form, those that are meant to convey the action or message and its context, do not appear in a simple sequence, even if an ordered one, but tend to gather in groups, to be in some relation of subordination to each other, thereby forming sections, each of which comprises several of them [6], p. 527]. Thus, it is fair to say that all records present an ideal structure and an ideal substructure, which is constituted of three sections, each of which has a clear purpose. The first section is called *protocol* and contains the administrative context of the action, that is, the place, date, and subject of the record, and the persons who have participated in its creation; the second section is called *text* and contains the action or message, including its motivation, circumstances, or conditions; and the third section is called *eschatocol* and contains the validation of the record, including the mention of the means used to validate it, the signature of the author, and those of witnesses and countersigners.

The elements that follow will be identified by the English version of their name, except for the few that only exist in medieval records and have retained their Latin name. Classic diplomatists, however, tend to use exclusively the Latin name of the formal elements of records. Thus, for the elements that existed in medieval records, the English name will be accompanied in brackets by its Latin version, as given by the *Encyclopaedia Britannica*^[13].

The intrinsic elements that usually appear in the protocol of a record are the *entitling*, or letterhead, comprising the name, title, capacity, and address of the physical or juridical person issuing the record or of which the author of the document is an agent; the *title* of the record; the *topical date*, that is, the place where the record was issued; the *chronological date* (*actum*, for the date of the act, and *datum*, for the date of the record); the *invocation*, that is, the mention of the entity in whose name the act is made (e.g., God, the Republic, the People, the Law); the *superscription* (*intitulatio*), that is, the name of the author of the record and/or the act; the *inscription* (*inscriptio*), that is, the name of the addressee of the record and/or the act; the *salutation* (*salutatio*), which is usually a formula of greeting; the *subject*, that is, a statement signifying what the record is about; the *formula perpetuitatis*, which is a sentence declaring that the rights given by the record are valid forever (*in perpetuum, ad perpetuam rei memoriam, pp.*); and the *apprecatio*, that is, a prayer for the realization of the content of the record (*feliciter, amen*).

The intrinsic elements that usually appear in the text are the *preamble* (*arenga*), which expresses the ideal motivation of the act or the principles inspiring the message; the *notification* (*promulgatio*), a formula stating that the record is communicated to all those concerned, who therefore must be aware of it; the *exposition* (*narratio*), which explains the concrete circumstances and motivation for the creation of the record; the *disposition* (*dispositio*), that is, the act or message that the record is intended to carry out or convey; and various *clauses* expressing the obligation of those concerned to respect the will of the author (*of injunction*), the prohibition to violate the act or oppose it (*of prohibition*), the obligation to respect the act notwithstanding other orders or decisions contrary to it (*of derogation*), situations or conditions that constitute exceptions (*of exception*), the obligation to respect the act for one's heirs or successors (*of obligation*), the consent to give up a right or a claim (*of renunciation*), a threat of punishment should the act be violated (*of warning* or *sanctio*), or the promise of a prize (*promissory*). Sometimes the *apprecatio* concludes the text, or begins the eschatocol.

The intrinsic elements that usually appear in the eschatocol are the *corroboration* (*corroboratio*), a clause that states the means used to validate the record (e.g., "signed and sealed," or "I have hereunto set my Hand and Seal of Office"), normally followed by the topical and chronological date; the *complimentary clause*, which is a brief formula expressing respect (e.g., "Yours truly"); the *attestation* (*subscriptio*), that is, the subscription of those who took part in the issuing of the record (author, writer, countersigner) or of witnesses to the enactment or to the subscription; the *qualification of signature*, that is, the mention of the title and capacity of each signer; and the *secretarial notes*, such as initials of the secretary, indication of enclosures, or indication of additional recipients of the record.

ARCHIVAL BOND

The concept of archival bond is unknown to classic diplomatics because of its focus on medieval records, the main characteristic of which was the fact that each incorporated the entire act as carried out through the acting procedure and the subsequent documentary procedure. The focus of modern diplomatics on modern records meant that one of its main concerns had to be the interrelationship that each modern record has with the previous and subsequent records that participate in the same act and/or integrated business and documentary procedure. This interrelationship, following archival theory, was by modern diplomats called the archival bond and was configured as an incremental network of relationships that links all the records of the same file and/or the same series and the same archival fonds. The archival bond is *originary*, that is, it exists from the moment a record is created; *necessary*, that is, there is no record without it; and *determined*, that is, uniquely defined by the function of the record in the business activity in which it participates. Besides determining the whole structure of the archival fonds, the archival bond is the primary identifier of each modern record and is usually made explicit by a classification code. While in a traditional paper environment the archival bond is implicit in the physical location of the record in the aggregation in which it belongs, in the digital environment it must be made explicit and expressed among the metadata; otherwise, according to the archival postulate that a record is made up of a document and the whole of its relationship, we are unable not only to identify the record but to have a record altogether [¹², pp. 53–54].

DIPLOMATIC CRITICISM

The structure of diplomatic analysis, or criticism, as it is called by classic diplomatists, is rigorous and systematic and may proceed from the general to the specific or vice versa, depending on the available information. The early diplomatists first separated the record from the world and then put them into relation trying to understand the world through the record. Thus, they began analyzing the formal elements of the records, and, from the results of such analysis, they reached conclusions about procedures, persons, acts, and contexts. They firmly believed in the possibility of discovering a consistent, underlying truth about the nature of a record and of the act producing it through the use of a scientific method for analyzing its various components.

The diplomatic analysis of the elements of a record is a process of abstraction and systematization, the aim of which is to identify the essential attributes of a record and make them transportable to different historical and documentary contexts. By decontextualizing and generalizing the essential attributes of a record, the original

diplomatists were able to recognize and evaluate records created over several centuries and across different juridical systems. The overarching thesis of contemporary archival diplomatics is that it will enable archivists to recognize and identify electronic records created in a variety of administrative contexts and in different hardware and software environments [¹⁴], p. 209].

Indeed, modern diplomatics has gone much further than that: Using its century-old understanding of the nature of records and of their necessary characteristics, it has attempted to design record-making and recordkeeping systems and to determine at the outset the documentary form of the records resulting from specific acts. This proactive stance is still experimental and it has mostly been developed in the course of two research endeavors called “The UBC Project” and InterPARES [¹⁴], p. 199]. However, irrespective of its success as a designing instrument, diplomatics remains a fundamental component of the intellectual armor of every record professional.

Diplomatics has long been recognized as a formative discipline, which develops analytical ability by making explicit the set of principles by which a record is created, and its form is shaped by defining its elements by their meaning and function, their order, and their consequences and by naming them in a consistent and meaningful way. In addition, it enables record professionals to work with a heuristic device, a diagnostic tool for establishing the meaning of the phenomenon under investigation, thereby making possible the understanding of unprecedented manifestations of records, the assessment of the trustworthiness of records that come to us at the end of several reproduction processes (in this regard, it is complementary to Digital Records Forensics [¹⁵]), and the identification of what needs to be protected and how to ensure that a trace of our actions will be carried into the future. Finally, the capacity of diplomatic analysis to uncover the interrelationships of records focusing on context over content and on purpose over use makes of it the most useful instrument for carrying out all archival functions, from appraisal to arrangement and description and from preservation to communication.

CONCLUSION

This entry has outlined the origin, purpose, object, and content of a three-century-old science, diplomatics, which has been used by several disciplines—such as jurisprudence, philology, history, and archival science—primarily, as an instrument of inquiry, a tool for analysis, but which has a substantial body of knowledge of its own, especially in its conceptualization of the record, and should be studied on its own merit by all those who either manage records or use them as sources.

The discussion of the concepts has been carried out comparing the perspective of classic and modern

diplomatics. The reason is that modern diplomatics does not replace classic diplomatics but adapts and elaborates the same body of core knowledge to make it applicable to modern records. Thus, we have two branches of one science that coexist and are equally important. While classic diplomatists, being persons of our times, need to gain an understanding of contemporary records by accepting modern diplomatics, modern diplomatists could never grasp the depth of diplomatic concepts without learning first classic diplomatics. The profound understanding of the nature of records that both classic and modern diplomatics provide is a vital component of the intellectual armor of every record professional and, like in Europe, it should be an integral part the curricula of graduate education for all records, archives, and information specialists.

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Disaster Planning and Recovery for Cultural Institutions

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Abstract

Disaster planning is the ongoing process by which cultural institutions (libraries, museums, archives, etc.) seek to prevent loss of collections using data gathered to identify and mitigate risks; prepare and revise the written Disaster Plan; and train staff in response procedures.

This entry briefly discusses disasters of the last few decades, which have led to today's understanding of disaster planning. The majority of the text discusses the major components of a disaster plan and the requisite steps for achieving an effective plan.

DISASTER-DRIVEN: HOW DISASTERS HAVE LED TO IMPROVEMENTS IN DISASTER PLANNING

Disasters to repositories of cultural materials (libraries, museums, etc.) have always happened. Acts of nature and of man have taken their toll ever since man assembled the first collection—each loss resulted in an irreplaceable loss of cultural memory.

Thus, it is surprising that it was not until the mid-twentieth century that disaster planning and prevention efforts by libraries and other cultural institutions gained momentum.

The beginnings of modern disaster planning for cultural institutions can be traced to the 1966 flooding of Florence, Italy when the Arno River rose 22 ft, covering millions of books, manuscripts, and works of art in water, mud, oil, and sewage in numerous libraries, churches, archives, and rare bookshops. Conservators from all over the world sped to aid these institutions. The Florence flood heightened awareness of the incalculable loss that major disasters can inflict upon the world's cultural legacy and the enormous resources needed to recover from them.

In the months and years following the Florence flood, much was learned about how to effectively treat wet materials. For example, when the disaster first happened, freezing was not accepted nor was there sufficient technical support to use it as a means of preventing mold growth and stabilizing the materials. But by the 1990s freezing most materials, to buy time, had become the first step in recovering water damaged collections. Through the cooperative efforts of conservators, and many others from all over the world, major improvements to conserving and restoring wet objects were made. British conservator Peter

Waters (later head of the Library of Congress' Preservation Office), who worked on-site in Italy, drew on his experiences in his *Procedures for Salvage of Water Damaged Library Materials*,^[1] a preservation resource which is still highly regarded today. Hilda Bohem's 1978 work, *Disaster Prevention and Disaster Preparedness*^[2] was the first to describe the elements of a disaster plan and how an institution might organize the work to achieve it.

A few examples of some of the advances in response and recovery that have come out of experiencing disasters follow.

Water Damage

While the Florence flood taught much about cleaning and air drying wet materials, in the late 1970s, speculation began on how to dry large quantities of objects more efficiently. Options for drying treatments that would not distort the materials, especially when large quantities were involved, were extremely limited. However, following the Stanford University Library Flood, in 1979, vacuum freeze-drying was used for the first time and eventually became the preferred method to dry paper, especially for books printed on coated paper. Although the vacuum freeze-drying process is still undergoing refinement, there is no doubt that it has saved numerous collections from irretrievable loss. Other mass drying methods such as freeze-drying (done with heat) and dehumidification are used to a lesser extent.

In 2000, the European Space Agency (ESA) began to offer satellite images of environmental disasters in Europe adding a new source of information on the extent of damage from natural disasters.^[3] In 2002, the waters of the

Elbe rose to record highs affecting primarily Germany, Austria, and the Czech Republic. Early warnings allowed for evacuation of some cultural artifacts in Prague and Dresden^[4] but, “in general the water was just too high for all materials to be moved... a number of libraries, archives, and art museums had their basements and ground floor completely flooded. . . It is estimated that one million volumes were under water, 800,000 in the Czech Republic alone and the majority of them are lost.”^[5] The Elbe River rose to record high level’s again in Northern Germany in 2006.

Earthquakes

Understanding how to withstand sudden and unpredictable earthquake damage to buildings which house collections is a significant challenge to cultural stewards, architects, engineers, geologists, contractors, and first responders (personnel trained to react to emergencies such as: firemen, police, and facilities staff).

In earthquake-prone California, the California State Library recommended seismic safety standards for library shelving due, in part, to the effects of the 1971 San Fernando earthquake (6.6 on the Richter scale) which included the collapse of a hospital which had just been built as “earthquake resistant.”^[6]

In 1989, an earthquake of 6.9 was centered near the Loma Prieta peak in the Santa Cruz, California mountains, approximately 14 km (9 mi) northeast of Santa Cruz and 96 km (60 mi) south-southeast of San Francisco.^[7] The unbraced stacks of the University of California campus library located there collapsed. In 1990 and again in 1991,

other southern California cultural institutions whose stacks and storage areas were seismically braced proved that the bracing standards needed improvement (see Fig. 1).^[8] [See also Library Stacks and Shelving, created by Earl Siems and Linda Demmers and provided through the Libris Design Project (<http://www.librisdesign.org>), <http://www.librisdesign.org/docs/ShelvingforLibraries.pdf> (accessed May 2008).] Subsequently new standards were adopted by the *Uniform Building Code-California Additions*.

The fact that properly braced shelving can survive was borne out in the earthquake that devastated the California State University, Northridge, January 1994. Even though 600,000 books required reshelving, this process was less costly in terms of time and money than replacing broken shelving as had been the case following the San Fernando quake. While anticipated damage to structural concrete, drywall and nonstructural ceiling tiles occurred, the Northridge calamity provided an unexpected education on steel frame buildings. Construction with steel framing to withstand earthquakes did not work in this case. The four-story high girders in the library’s wings cracked at the 4 ft thick steel base fastened to the foundation. Microform storage units also proved dangerous, resulting in the cabinets shifting and falling over and the self-locking drawers opening from the force of the ground swell. This led to new recommendations on seismic retrofitting to fasten cabinets to walls and each other.

Fires

Similar to seismic and structural guidelines, fire safety is also covered by a variety of building codes^[9] and the



Fig. 1 Failed seismic bracing.

National Fire Protection Association.^[10] Concern for having fire codes rose to a panic level in the nineteenth century following the Chicago Fire and other tragedies and ultimately led to improved codes for building materials.

Fire resulting from defective electrical, heating, or photocopying machines, arson, construction, lightening, and other causes is still a prime threat to all cultural institutions; as is the combustion level of historic buildings. For many years there were debates about the destructive power and incinerating effects of fire and heat versus, the damaging effects of water used to arrest the spread of fire and the accompanying smoke damage.

The fire detection and suppression industry, however, has adhered to rigorous standards and in doing so has made strides to improve the precision and timeliness of detecting fires and alerting potential victims and responders. Most of this progress is a result of new technology such as fine mist sprayers. Advances in technology have also led to fewer instances of indiscriminate and inadvertent release of water from sprinkler systems, and the availability of a number of choices for water delivery. When appropriate fire suppression is employed, results can be positive as illustrated by the Historic Fourth Ward School Museum fire on February, 2008 in Virginia City, Nevada. In that case, the 20 year old sprinkler system saved the building and minimized damage to the collection.^[11]

The Los Angeles Central Library arson fire of 1986 also demonstrated the importance of fire detection and suppression. An effective smoke alarm system and evacuation procedures saved staff and patrons. However, the lack of a sprinkler system and fire doors, combined with an open flue-like stacks configuration of the old Carnegie building resulted in \$18 million worth of damage and destruction to the collection (400,000 books burned and 500,000 were damaged by heat and smoke).

In 1988, the damages from a fire at the Academy of Sciences Library in Leningrad, Russia surpassed those of the Los Angeles Public Library. Again, 400,000 books were destroyed by fire but an additional 2–3 million were damaged by heat and smoke, and 1 million items were damp and wet. In this case, the library had no disaster plan or, it seems, any other type of preparation. While at first the authorities tried to suppress information and minimize reports of damage, eventually, they invited consultants from the Los Angeles Library fire and other countries for advisement.

An article in the 1991 *Book and Paper Group Annual* reports on the progress of the recovery and the many techniques tried and some promising new techniques developed.^[12]

Useful Tool: Barclay Ogden's 2004 publication, *Collection Preservation in Library Building Design*, does an excellent job of incorporating preservation and disaster concerns in building design and interior space intended to minimize risk and harm.^[13]

Civil Unrest, Armed Conflicts

Three sets of international treaties form the framework for protecting cultural heritage in time of war and its aftermath. These are The Hague Conventions of 1899 and 1907; the Geneva Convention of 1949 and its two Protocols; and the Hague Convention of 1954 and its two Protocols. Together, they respond to four threats to cultural heritage: deliberate attack, incidental damage, pilage, and outright theft.^[14]

Museums, libraries, and archives are particularly vulnerable in times of armed conflict. With the culminating recognition that cultural property was entitled to protection from outright acts of war and associated risks, a treaty to address the protection of both moveable and immovable cultural property was realized in "The 1954 Hague Convention on the Protection of Cultural Property in the Event of Armed Conflict" developed under the auspices of the United Nations Educational Scientific and Cultural Organization (UNESCO). This convention was strengthened in 1999 with the issuing of the "Second Protocol" particularly in the recognition of explicit crimes in relation to breaches of cultural protection and permanent institutional arrangements including meetings and an elected Committee. Moreover, the International Committee of the Blue Shield was established in 1996 to work to protect the world's cultural heritage threatened by wars and natural disasters, and its constituent "civil" organizations have standing advisory roles in relation to The Hague's Committee. In addition to The Hague Convention, other international conventions address terrorism and the illicit traffic of cultural property. Sadly, the world continues to witness the threat to institutions from civil wars, ethnic conflicts, and terrorism as demonstrated in Iraq, Croatia, Bosnia, and elsewhere.

Avoiding all disasters is impossible because there will always be hurricanes, floods, fires, and wars. However, being prepared with a plan is crucial to ensuring optimal response. Disaster planning today goes beyond the preparations that individual institutions make, and includes collaborative planning on local, regional, national, or even international levels as The Hague Convention advises. A significant event can serve as the catalyst for developing cooperative emergency preparedness networks. Such was the case in the devastating Los Angeles Central Library fire in 1986 that inspired formation of the Inland Empire Libraries Disaster Response Network in southern California, which in turn led to similar networks in California and elsewhere. Similarly, the Heritage Emergency National Task Force—Alliance for Response^[15] initiative builds partnerships in cities across the United States between cultural heritage stewards and first responders to help emerging networks become cooperative models. The Task Force's "Lessons Applied"^[16] initiative assists members with developing and implementing projects to address issues raised by hurricane Katrina in 2005, and provide tools useful for disaster planning.

Since Italy's 1966 flood, the concept of disaster planning has broadened to include all stages of planning and preparation. Cultural stewards are making better use of expertise and practices from other industries and occupations, and more cooperation is in evidence between those responsible for heritage collections and emergency management professionals. In addition, professional recovery services with experience in libraries, archives, and museums are more widely available as well as national and international preservation initiatives and collaborations have increased.^[17]

ACHIEVING A DISASTER PLAN AND A PREPARED STAFF

It is a common axiom that disasters only occur on holidays, evenings, and weekends and one might add "when under construction." This refinement of the Murphy's Law adage should be firmly in mind when preparing the disaster plan and when training staff.

The purpose of this section is to highlight important preliminary steps in disaster preparedness, such as risk assessment and mitigation, collections assessment, and setting collections priorities. We also discuss several basic components of a typical disaster plan, such as: packing out instructions; insurance considerations; staff training; response actions; salvaging, building concerns and the like from other countries.

The goal of a disaster response strategy is to plan for and ensure the protection and/or salvaging of collections. A well-conceived disaster plan replaces chaos with thoughtful, deliberate response and recovery guidelines. In doing so, it increases the speed and efficiency of response, while minimizing damage, saving money, and decreasing the amount of time service is disrupted. While institutions always hope such a plan will never be necessary, advance preparation for a disaster is an inexpensive form of insurance when compared with the daunting challenge of salvaging and—if even possible—replacing huge segments of the collection.

While a written disaster plan is important, the need to familiarize staff with these guidelines, and train them in response tactics cannot be stressed enough. When disasters strike, time is critical; therefore having both a plan of action and first responders who are trained and prepared to jump into action is much more efficient than trying to bring them up to speed while dealing with threats to the collections.

Whatever the size or manifestation of a disaster, keepers of cultural heritage have learned that no institution is immune. They have also learned that emergencies of any size may result in the disruption of services, as well as a loss to cultural memory. Most importantly, experiences have taught that preparation, by way of an organized and coordinated response strategy, is essential.

The first activity in developing a plan is to gather information on an institution's current risks.

Useful Tools: dPlan, a free online disaster writing template is posted on the Northeast Document Conservation Center (NEDCC) Web-site (<http://www.dplan.org/aboutdplan.asp>):

Enter information about the institution using the comprehensive fill-in-the-blank template. The template guides the writer through the steps necessary for effective disaster planning. Once completed, dPlan generates a printed disaster plan specific to the institution. The resulting plan contains contact information for staff and key personnel, preventive maintenance checklists, salvage techniques, and much more. dPlan can be updated continuously to reflect the changes that occur.^[18]

Conservation OnLine (CoOL) is a great tool for all areas of preservation and conservation. Its "Disaster Planning and Response" section has good examples of disaster plans that can be used as models. <http://palimpsest.stanford.edu/bytopic/disasters/>.^[19]

Assessment of Risks

Before an institution can successfully articulate preventive measures, the hazards and/or situations that are potentially damaging to collections must be identified.

As mentioned earlier, emergency situations often result from a combination of forces including natural and/or man-made threats, faulty mechanical systems, weakened physical storage structures, and the collections themselves (such as nitrate negatives). The most effective method of minimizing or, even better, eliminating these risks is through a comprehensive risk survey. This important first step in long-term planning and preventive maintenance includes close examination of geographic, climatic, structural, and interior hazards that pose potential threats to cultural collections. For example, is the building susceptible to damage from natural disasters such as hurricanes, tornadoes, or earthquakes? Or, is it located in a flood plain? Does the structure have a flat roof or a very old roof? Basically, the comprehensive risk assessment requires a thorough survey of both the exterior of the storage facility as well as the interior's structural and nonstructural elements.

When surveying the interior of the building note the availability and location of fire suppression systems, alarm systems, water sources and the condition of plumbing. Consider past events. Where have there been problems in the past and what caused them? Is there a bathroom with constant plumbing problems or a leaky air conditioner? Shelving for the collections is also important and must be examined for location and stability.

Ultimately, the risk assessment seeks to provide the best possible picture of exactly what hazards may threaten the storage facility, and the collections they house.

Prevention/Mitigation

Once the data has been collected and analyzed, strategies to mitigate the potential risks need to be mapped out. Some hazards may be minimized or prevented by the facilities staff doing regular building inspection (e.g., clean leaves from gutters and check drainage around building in fall and spring). Certain “fixes” may require more labor-intensive or costly strategies (such as a new roof or a new heating, ventilation, air conditioning (HVAC) system). If, however, “all improvements cannot be undertaken at once, make a schedule and follow it.”^[20] In the meantime, list the actions that should be taken when there is a threat (i.e., when a storm is predicted put plastic sheeting over objects and shelving areas where the roof is known to leak). Regular inspections will catch new problems before they become hazardous.

Preparation Activities

The purpose of this set of activities is to gather information which results in documentation, instructions, policies and procedures, and assigning responsibilities; each of which become part of the Disaster Plan.

Assessing collections assets and setting priorities

If the entire building was under water and everything in it was wet, what assets should be saved first? This is one eye-opening approach to establishing salvage priorities.

When responding to disasters, working quickly will lessen damage; therefore, immediate access to information that articulates what item(s) or collection(s) to salvage first is critical to a successful recovery. Determining collection salvage priorities during the Preparation phase can save valuable time during an emergency situation.

Normally, priority for salvage is given to those records and collections that are not backed up elsewhere and (1) have information needed to either establish or continue operations, including administrative records necessary to pay staff, responders, and vendors; (2) have the highest value; and (3) assist in fulfilling the requirements of the insurance company in order to file a claim. Early determination of salvage priorities save valuable time during an emergency situation and should therefore should be done early in the Preparation process.

What is the emphasis of the collection? What is the greatest current need to support the institution’s programs? How difficult is the material to replace and/or how costly? What type of formats are included in the collections, and to what are they most vulnerable? Can the material be frozen? Can it be air-dried? Knowledge of this information may change its priority on the list. Being aware of the vulnerability of the collections’ format is important, and may result in moving some collections to a higher priority. An excellent document to both assist

with prioritizing and to place in the disaster plan is “Salvage at a Glance” by Betty Walsh.^[21]

The highest priority collections will be the first items packed out if they are damaged or the threat of damage is imminent. If these items are not in immediate danger, or are impossible or too dangerous to reach, then the next highest priority would become the focus for salvage. Consider the circumstances and limiting factors (time, access to materials, availability of resources, etc.) which may require deviations from the plan.

In large institutions, especially libraries, priorities are usually assessed by groups of materials or subject classification rather than item-by-item. Individual items which have extremely high value might, however, be listed separately. One thing is certain: running around a building during the crisis, gathering an item here and there is an inefficient way to salvage any collection.

Instead, salvage priorities should be documented and added to the Disaster Plan. In addition, the location of high priority items and/or collections should be clearly marked on the Floor Maps used by staff and other rescue workers.

Pack-out instructions

What will be the packing techniques to remove items from the building safely? Having just determined the salvage priorities, this is an opportune time to proceed with developing instructions on how to safely pack-out the different formats, whether wet or dry. Will there be a staging area to transport the material to or will the wet items be so delicate that they must be packed in place rather than handled a second time? With large-scale book disasters, packing books into boxes often happens right in the book stack aisles where the only sorting is between wet and dry. Other times a staging area is set up and the books are brought to it on book carts where they are sorted by wet, damp, and dry; might have freezer paper placed around every other or every one; and where more precise inventory control can be carried out. These instructions are added to the Disaster Plan.

Staff training

Staff training has already been mentioned a few times in this entry and its importance cannot be overstated. Clarifying roles and responsibilities and periodically practicing salvage techniques gives staff confidence and teaches success. Training can also reveal weaknesses in the Disaster Plan. Are there gaps in resources, for example? Does communication and coordination need improvement? Do staff members know the chain of command and have copies of contact lists? Do they even know where to find a copy of the Disaster Plan?

Training exercises should be as realistic as possible. Wet materials are extremely fragile so all staff should be given hands-on experience with carrying and packing all

the major formats collected by the institution. Libraries, which regularly deaccession books, can provide a ready resource for experimentation and training. Deaccessioned items can be wet in order to train staff in the proper way to remove materials from a shelf and how to box them. This exercise can be paired with having each staff member take a wet book and learning to air-dry it.

One way to teach damage assessment is to design a scenario that simulates wet and/or fire damaged material in storage areas. This can be signaled easily with crepe paper streamers (e.g. black crepe for burned; blue for wet books). Have the assessment teams take pictures, mark damage on the floor maps and estimate the number of damaged items.

Other exercises may be done sitting around a table and describing a situation and walking it through with the Disaster Plan.

It is good to work with local emergency responders involving them in drills and training whenever possible. Making them aware of the salvage priorities as well as walking them through the building is also a good preparation step.

Useful Tools: *The California Preservation Program has a Web site with several useful documents in the section on "Emergencies Preparedness and Response." In addition to an elaborate tabletop exercise there is a "fill-in-the-blank" disaster plan workbook and templates* (<http://calpreservation.org/disasters/index.html>).^[22]

Supplies, suppliers, service vendors, and consultants

The Preparation phase is a great time to purchase and distribute supplies to have on hand to aid in immediate response for small and moderate disasters, and to also list the response supplies and equipment in the building. Compile contact lists of suppliers and vendors in the surrounding area who would be able to provide the amount of supplies necessary to respond to any large size disaster. Another important contact list to generate is for disaster services vendors as well as recovery and conservation experts. These lists of in-house supplies and equipment, suppliers and vendors, and potential consultants are invaluable components of the Disaster Plan. The locations of in-house supplies should be clearly marked on the Floor Maps.

Useful Tool: *A useful Web site to consult for supplies, suppliers, and experts is The Disaster Mitigation Planning Assistance Web site* (<http://matrix.msu.edu/~disaster/>).^[23]

Finances

Procedures on accessing funds and finances should be added to the Disaster Plan. One of the many roadblocks that can slow down recovery is how does the institution pay for what is needed? While an important part of being prepared is to buy and store supplies before they are needed the amounts are limited by the building's capacity

to store them. In most cases, the supplies in storage would be expended quickly in a major disaster. Another example: workers must be fed regularly and take-out restaurants are unlikely to accept institutional purchase orders. Thus, the cash on hand at the institution on an average day should be taken into consideration. Are there institutional credit cards and, if so, who is authorized to use them? Can purchase order information be set up with local vendors ahead of an event? If staff members pay for something related to the recovery, how quickly can they be reimbursed?

Insurance

Another area that must be investigated during the Planning or Preparation Phase is the insurance policy. Find out how the institution contents are insured and learn the policy's exclusions. Meet with the risk manager and/or insurance representative to review coverage and discuss the documentation required to file a claim. What is the replacement cost per book or per object? What documentation does the insurer require in order for the institution to begin salvage efforts immediately without waiting for a company representative? For rare and valuable items a special policy, often called a "fine arts" insurance policy, covers each piece individually against all risks. This list must be updated annually and the items should be given a high salvage priority.

Once the information is gathered, develop a document for the Disaster Plan that succinctly gives instructions on how to file a claim. In addition, the contact information for the insurance company is added to the appropriate contact list in the Disaster Action Plan. Claim forms and instructions can become one of the plan's appendices.

Note about FEMA: Federal Emergency Management Association funds are difficult to get. It pays, therefore, to file as soon as possible, document everything and take extensive pictures.

Chain of command, communication, and contact information

There are many steps needed to achieve a successful recovery from a disaster. The most important may be in the assigning of responsibilities and ensuring those duties are clearly understood and practiced *before* an emergency occurs. Setting up a clear chain of command and reporting relationships that are understood by all staff is particularly essential.

In the Planning and Preparation phases, staff members' roles during disaster response and recovery should be clearly defined and extensive training implemented in order to teach them how to fulfill their responsibilities. The Appendix lists many of the tasks that need to be assigned for a successful response and recovery. It pays to assign each responsibility to the appropriate staff

member. For example, a cataloger might be assigned to maintain inventory control, and track the materials either moved to other sites or sent to commercial drying companies. Once these roles are assigned, the next step is to put the information in writing and compile the contact lists that are needed for the Response section of the Disaster Plan.

Upper management level staffs, together with certain additions such as the facilities manager, preservation specialist, personnel representative, and budget/finance person oversee the entire Response and Recovery phases. Once called to report to the Command Center (a group of individual staff members who have been assigned key responsibilities in responding to disaster) each member assumes his or her role as operations director, recovery coordinator, risk management/insurance, finance person, personnel, public relations and communications, facilities, disaster coordinator, etc (see Appendix).

The next level of staff consists of the individuals who have been designated and trained to deal with a disaster of any type. This group is often called the “Disaster Response Team” or “Disaster Action Team” and may include some members of the Command Center Team as well as department heads and supervisors. The primary purpose of this group is to deal with the day-to-day issues of getting the work done, such as leading work teams in packing out, monitoring supplies, inventory control, and training other staff members and volunteers in proper salvage procedures.

Remaining staff make up the disaster work teams, or if physically unable to do the packing out duties, they help with inventory control, phone calls, refreshments, screening volunteers, etc.

Useful Tool: *The Council of State Archivists (CoSA) has developed a “Pocket Response Plan (PReP)” one side of which is an Emergency Communication Directory, with contact information for staff, first responders, emergency services, utilities, vendors and suppliers, disaster teams, etc. The other side contains an Emergency Response and Checklist for Collections Recovery that lists actions that should be taken in the first 24–72 hr following a disaster.*^[24]

Management issues

To manage a disaster response and recovery operation effectively requires access to a variety of ways to communicate including cell phones, walkie-talkies, e-mail, and even people to serve as “runners.” While remaining on-site is the best option for the Command Center Team to manage the operations and may also be the best psychologically for the staff, it can be a problem if electricity is not available. Ideally, several areas within the building will have been planned to become the designated Command Center, and hopefully one of them is actually accessible and has electricity. If this is not possible, the institution should consider renting a modular unit with a

generator parked near the building or space in a nearby building.

Other areas that should be identified before they are needed are those areas in the building that could serve as staging areas to triage materials and properly pack items being sent out of the building.

Among the many other duties, someone, on the Command Center Team should have responsibility for keeping staff informed of progress, perhaps with briefings at the beginning of shifts or as staff exit and enter the operation. Even if it is only a series of handwritten notes posted and updated regularly, it will reduce the sense of isolation that staff feel when working “in the trenches.”

A brief description of the responsibilities, along with contact information for the person assigned to them, should be documented and added to the Response section of the Disaster Plan. Any contact list should list all the ways each person (staff, vendor, suppliers, custodians, safety, etc.) can be reached, including on evenings, weekends, and holidays.

Another vital contact list is the “First Response Emergency Contact List.” As any staff member might be the person who discovers an emergency situation; he or she needs to know how to respond. A brief set of instructions to ensure the staff member’s safety and a short list of whom to call to report the problem needs to be assembled. These instructions should be given to every staff member, and posted by every work phone. To be truly effective this document will need to be reviewed and updated on a regular basis and, similarly, staff members should be reminded of its existence every few months.

After identifying the nature of the emergency, the person who discovers it should be able to determine what type of emergency responder is needed. In other words, is this something that may easily be handled by custodial staff, or should they call either the fire or police departments? The next step should be for the staff person to contact their supervisor, the building manager, the director or whomever protocol dictates. In some circumstances, it might require staff to evacuate the building. Fig. 2 is an example of a first responder instruction sheet as used by the University of California Riverside. (For another approach, see CalPreservation’s website.^[25])

Security

When assessing risks it is important to evaluate the current status of security and determine what extra measures are needed both before an emergency and during disaster response and recovery. This is especially true of areas that store high value items.

During the Response and Recovery, the building and collections will need to be secured from unauthorized entry. Volunteers and workers should be screened and proper documentation filed. Media and crowds may need to be controlled. Is there adequate key or access card control?

REPORTING AN EMERGENCY

The following is a list of the 4 calls the person discovering an emergency situation must make. If you are the first person on the scene, determine the nature of the emergency and make the appropriate calls. Ensure your own safety first!

1 st Call:	For FIRE - PEOPLE PROBLEMS-POLICE WATER OR ELECTRICAL Emergency (Day) Evenings/Weekends	
2 nd Call:	Library Administration (Day) Evenings/Weekends	
3 rd Call:	PEOPLE PROBLEMS, Circulation Dept. BUILDING DAMAGE, Facilities Manager (Day) Evenings/Weekends Cell Phone COLLECTION DAMAGE, Preservation Librarian Evenings/Weekends Cell Phone	
4 th Call:	Your Immediate Supervisor (Day) Evenings/Weekends Cell Phone	

Note: In some emergencies you may need to locate a single line phone or use a cell phone to make the necessary calls or send runners. Refer to page_____ in the Disaster Plan for the list of single line phones and their locations.

Fig. 2 Reporting an emergency.

Are there alarms and are they monitored by an entity outside the building? Are there security personnel patrolling, even when the building is closed? Are the items tagged in some way to set off an alarm if taken from the building without authorization? The findings should be analyzed and developed into an action plan and filed in the Disaster Plan.

Floor maps

Almost all facilities, which are open to the public, have the “You Are Here” floor maps. These usually show the main features of the interior of the building such as rooms, stairs, elevators, emergency exits, restrooms, etc.

A disaster response and recovery floor map should have all of this and much more, and because of this should probably not be posted publicly. This “emergency map” should be an accurate representation of storage areas (for example, book storage areas should accurately reflect the number of ranges of book stacks), the location of disaster supplies, and as already mentioned, the priorities of the various collections as well as the location of fire alarms and extinguishers; The maps should also note the location of water cutoff valves to the building and electrical panels. It also makes sense to include projected area for the Command Center and potential sites for the staging areas for triage and pack out.

The detailed floor map prepared in the Preparation phase has many uses when an emergency is discovered. First, it is used to direct fire, police, and custodial personnel to the correct location. (Library of Congress call numbers and other classification systems usually mean nothing to non-library personnel.) Second, these maps are used by staff doing assessment of damage. And third, when damaged areas are correctly marked on an accurate map it is easy to visualize the extent of the affected areas and start planning for response and recovery.

Response Actions

In order to respond efficiently, the Response section of a Disaster Plan contains information and actions needed to respond to an emergency situation in order to lessen the effects, as well as protect property and save lives. It also includes actions necessary to evacuate or retrieve collections and property from damaged areas and “first-aid” measures to stabilize collections.

Useful Tool: “The Detailed Building and Site Assessment,” available on the National Center for Preservation Technology & Training Web site, is a “three-page form that may be used to make a more intensive survey of damaged properties after natural or manmade disasters. The form requires some knowledge of architectural

history and survey techniques in order to produce the most accurate results. It is intended for use by preservation professionals.”^[26]

Damage assessment

Keep in mind that when cultural collections are damaged or at risk of damage, time is of the essence. In fact, the first 48–72 hours, following a disaster are usually considered the most critical for the long-term viability of the collections. Depending upon the size, extent, and type of the disaster, access to the storage environment may not be possible. While the inability to see the condition of the collections can be very stressful, it is vital to refrain from entering the damaged areas until the fire marshal, police, or other official has declared it safe to do so. Regardless of the collections’ value, the safety of staff and patrons safety should never be compromised. As this may be the only “slow” period before the staff is immersed in the recovery process, it makes sense to start preparing. For example, is the area that was planned to become the base of operations for the Command Center still usable? If not, what else is available that has electrical power and access to phones and computers? Call all members of the Command Center Team to meet and start the planning. If safety personnel can estimate the approximate time the area will be accessible, this would be the time to inform staff who are on-site and not part of the Command Center to go home and wait to be called or to report back at a specified time. Contact should also be made with staff not on the premises to alert them as to when they might be needed. Review the Disaster Plan and Salvage Priorities, and assemble in-house disaster supplies.

Once the building or storage area has been declared safe to enter, proceed with caution. Assessors should enter in pairs, rather than alone, wearing protective clothing, footwear, and carry a means of communication such as a cellular phone or walkie-talkie. Document the damage with pictures and/or videos. Take copies of the floor maps to mark the damage to help visualize the scope of the disaster as described in the Floor Map section. Not only will photographic documentation assist in determining treatment needs, but it also fulfills requirements for insurance coverage and FEMA. Remember “even things which seem insignificant now may prove to be very important as you negotiate with insurance adjusters” (SOLINET, “Actions for the first day after”).^[27]

In some situations, only a limited number of persons may be allowed entry into the building or must be escorted by police or fire safety personnel. Whatever the case, the goal of the assessment is to determine the scope of the damage. Where exactly is the damaged area? Is it confined to one particular area? Has it affected the floor below or above? Estimate how many items are damaged and/or threatened. Are there different formats involved? In a disaster, a quick response is critical and valuable time

may have already been lost during the time the building was inaccessible. Time lost may increase the likelihood of a mold outbreak. Therefore, the damage assessment must be as efficient and timely as possible.

Assessors should note additional hazards or areas that need to be stabilized. “It is essential that whatever damage there is to collections be limited at this time.”^[28] If possible, “create an inventory of found items, dislodged architectural features, decorative fragments, furnishings, collections. **DO NOT THROW AWAY MATERIALS AT WILL.** Many items may prove salvageable as the restoration and rehabilitation projects proceed.”^[29] Assessment of the disaster site will yield useful information for determining whether additional, external, assistance is required. It also allows staff to obtain a more realistic sense of what additional supplies may be required and for what purpose. Visual documentations will inform the decisions that are to follow. Other questions for consideration include: whether or not recovery can be done in-house with staff; whether wet materials should be shipped off-site to a commercial freezer or be sent immediately to a vacuum freeze-drying facility or some other process; whether a consultant will be necessary; whether to use a commercial disaster recovery firm; whether to store dry materials out of the building? Keep in mind that even with this preliminary data the salvage plan may need to be revised during the actual salvaging process so it should be as flexible as possible.

Once the damage assessment has been completed, and the area declared safe to work in, the next step should focus on salvaging and/or retrieving those resources fundamental to the mission and operation of the organization. In other words, what collections and other resources are needed, and what steps need to be taken to have the facility operational again? Of course, resources will vary dependent upon the facility, extent of the damage, and availability of responders.

As the immediate threat of a disaster begins to dissipate, the first thought is to begin the salvage process as quickly as possible. While a fast response time is vital be aware that “during this phase, many historic structures and properties are needlessly lost and damaged through hasty clean-up procedures.”^[30] Therefore, the need to proceed with care and caution—and yes, patience—cannot be stressed enough.

Salvage

Starting with the highest level priority that is accessible, carefully transport materials to the staging/triage areas where, while keeping some type of inventory control (with barcodes or numbers, etc), items are sorted by their condition (wet, damp, dry) and packed using the instructions written during the Preparation phase. During a large disaster is not the time to decide whether an individual item needs to be kept or discarded. Those decisions can be made when the items are returned to the building after

drying. Materials with any sign of mold should be isolated from other items as soon as possible.

Recovery Phase

After the damaged and threatened assets have been moved from the building, either to a freezer or drying facility or, if dry, to store in another part of the building or off-site, it is time to prepare the building for their return and reopening to the public. Documentation regarding actions to take after an emergency, in order to rehabilitate the materials, building and storage areas, and return to full operations should be in the Disaster Plan.

Building concerns

Before the materials are returned to the building, several issues must be addressed. First, the facility must be declared ready for occupancy. Did the after-the-disaster building assessment include examining and addressing the building's structure, such as walls and the roof? Are there holes in the physical structure of the facility, for example, which may place the already damaged collections at further risk?

Is the Heating, Ventilation, Air Conditioning (HVAC) system fully operational? Has it been examined by a qualified technician? Have the vents and air ducts been checked for mold and/or soot? Do the filters need replacing? Is the security system operational? Have the facility's fire detection and extinguishing systems been thoroughly examined and reset by the fire department, and determined to be working at full capacity?

The conditions of the storage areas are equally important. Having salvaged, cleaned and stabilized the collections it would be counterproductive to place them in an unclean or unsafe storage environment. Therefore, before relocating the materials "check every shelf, drawer and surrounding floors and areas" to be sure that the requisite cleaning has actually been completed.^[31] If yes, are all surfaces completely dry? If left unchecked, excess moisture in the environment may result in mold growth; therefore, double-checking to make certain that the area is completely dry will save both time and the health of the collections and staff.

Returning collections to the building

If accurate inventory control was maintained during the removal of items from the building then the staff should know the location of each item. This provides an opportunity to return things to the building in a logical manner and reintegrate them into the rest of the collection. If not, the result can be chaos.

If possible, the dried and/or restored items should be unpacked in an isolated area with ample space for the material to be spread out for examination, sorted by

format and later, put into a logical order for return to storage or display. This makes it easier to maintain accurate records of materials and the decisions made about them. This organized, systematic approach allows trained staff and consultants to assess material for specialized conservation treatment, withdrawal, replacement, or repair. What can be repaired in-house? Which need a conservation specialist? Are there items that are damaged beyond repair? Should they be discarded? Another reason for the items to be isolated before reshelving is that an insurance claim settlement cannot be completed until loss-evaluation is completed.

Once the treatment needs are determined, the remaining materials can be returned to permanent shelving/storage. However, even after the materials are returned to their permanent location, spot-checks for mold should continue to be done regularly for at least 6 months.

Debriefing, revision, and more training

Every disaster plan needs to be established according to the needs and demands of the institution that it is meant to serve. In addition, it is very important that the disaster plan cover all types of disasters, big and small, with clear instruction on what needs to be done. The plan must be reviewed frequently so that any necessary changes and updates can be made.

Throughout the disaster, debriefing sessions should be held so as not to lose any information that will help improve future response. The Command Center Team should have a simple list that can help them to make a final assessment of how well (or not) they responded to and dealt with the disaster. How did staff perform? In what areas could they benefit from more training? Were supplies adequate? What about communication and cooperation between departments, divisions, and outside help? Was record keeping accurate? How efficiently were things handled? What were the unexpected problems and their solutions?

CONCLUSION

The topics discussed in this entry deal with some of the most important factors to consider when charting a plan of action for preparing for and responding to threats to our cultural heritage. Even though the hope is that we will never have a need to use the disaster plan, it pays to be prepared. Making sure that information is accurate and current, staff trained, and emergency supplies readily available will place us in a far stronger and more prepared position to respond to a disaster—should it happen!

Every cultural institution needs a Disaster Plan that is subject to continual review and revision. The most effective plans cover every likely contingency and

involve as many of staff as possible in the planning and training phase. A well-informed and well-trained staff can help with every step from planning and preparation to rapid response. A plan written by one or two specialists soon becomes a dusty, forgotten plan; a plan produced and practiced by an entire institution is the strongest defense against incalculable damage and irretrievable loss.

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APPENDIX:

RESPONSIBILITIES FOR DISASTER RESPONSE AND RECOVERY

There are many responsibilities that must be assigned to a group or specific staff to make a successful response and recovery. Doing this in the Preparation stage of disaster planning and making sure everyone is clear on their assignments will eliminate lost time. It is recommended that each person have two backup people trained in the performance of the same duties.

Management

- Responsible for overall management of recovery and salvage operation (often a team of upper management personnel called the Command Center)
- Determines the kind of salvage necessary based upon assessment and collection priorities
- Determines when to begin salvage after consulting emergency personnel and Facilities Management
- Determines the type and level of preservation response
- Determines timetable for recovery
- Receives reports and analyzes progress; makes adjustments accordingly
- Designates treatment area(s)
- Decides on restoration of services
- Secures information needed to establish replacement costs for damaged or destroyed

Communications

- Notifies and assembles the members of the Command Center Team
- Notifies with staff workers who have been trained in packing our procedures (often called the Disaster Action Team)

- Receives reports from Team members
- Communicates with the other members of the staff keeping them informed of the status of the recovery progress
- Responsible for public relations with media and is the only person to officially speak for the institution
- Interacts with the organization to which the entity reports
- Works with emergency responders (Fire, Police, custodial staff)
- Tells library staff and volunteers where to report on the advice of the Disaster Response Director
- Contacts Insurance Company or Risk Manager and fills out required forms.

Personnel Issues

- Provides up-to-date information on how to reach staff members
- Deals with union contract issues
- Health, safety, and comfort (physical and emotional) concerns
- Screens volunteers

Assessment and Documentation

- Ensures proper documentation of damage (pictures, video, etc.) to building, furniture, and collections
- Estimates the type and extent of the damage
- Reviews the collections priorities list and confirms or adjusts it based upon the assessment of damage
- Estimates number of personnel needed to complete the work and how long clean up will take
- Evaluates and recommends whether or not recovery can be done in house with staff; will involve shipping material off-site to a commercial freezer of a vacuum freeze drying process; the need to bring in consultant(s); use a commercial disaster recovery firm; storage of dry materials out of the building; decision to store wet materials in a freezer or send immediately for vacuum freezing drying
- Identifies locations for storing materials out of building if a commercial disaster recovery firm is not going to be used
- Formulates logistics for packing out and moving materials out of the building if a commercial disaster recovery firm is not going to be used
- Keeps inventory control of items being removed, discarded, etc.
- Records all major decisions and a chronology of events
- Keep records of materials moved to other sites

Security

- Secures and protect the building's contents

Financial Issues

Figures the monetary impact of all decisions
Arranges for funds necessary to buy supplies, equipment, food, etc.

Salvage Operations

Trains and supervises work teams in proper packing and personal safety
Schedules and deploys work teams
Prepares regular reports on work team progress for the Command Center
Transportation and relocation activities
Arrangements for removing books from site
Arrangements for equipment and supplies
Responsible for handling and treatment of materials from the time they are removed until they are reshelfed

Supplies and Equipment

Contacting outside agencies for services and supplies
Responsible for ordering, delivery, and dispersal of sufficient quantities of the right materials for packing out
Responsible for ordering, delivery, and dispersal of sufficient quantities of food, water, and other comfort items for the workers
Transportation of supplies and materials and the movement of damaged collections

Building Issues

All issues leading up to the eventual restoration of the building to normal
Organizes the orderly return of materials to approved shelving
Identification of locations for response and recovery activities
Supervises in-house cleaning and drying

Recovery Operations

Works with appropriate bibliographers and serves as liaison to cataloging and acquisitions to record destroyed items and to arrange for replacement copies
Prepares report for the Command Center, including photographic record, on the rehabilitation process and unsalvageable materials
Acknowledges and thanks people who have participated in the recovery
Rewrites the disaster plan in light of lessons learned

User Issues

Where can we refer our users until we can open again?

Can we establish some basic services for users in some part of the building or nearby?

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Document Information Systems

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Abstract

From characteristics of information, documents and document information systems (document IS), motives to use document IS are described. A few cases are presented.

The functional aspects of document IS are described, derived from ISO standard 15489 on records management and the Sarbanes–Oxley law, and made operational in MoReq and DoD standard 5015.2. Explicit attention is given to related subjects from a viewpoint of document management: information sharing (workflow, knowledge management), and interoperability of Information and Communication Technology (ICT) tools; authenticity because of the possible evidential value of documents; and digital longevity because of the possible long-time function of archival documents.

The technical aspects answer functional demands; important information science standards, and standard components for 12 characteristics of document IS are described, among others ODMA, the XML family, OAIS, and metadata schemes.

The design methodological aspects answer functional demands and technical possibilities. Models are introduced and the way of working of, e.g., a digitization project is described.

INTRODUCTION

In the past, information was scarce and precious. (Information denotes in this entry an entity from the series data-information-knowledge-wisdom. Information should be recorded, have meaning, and be able to change a person's knowledge: "Information is a body of data on a semantic level.") Information was a matter to be preserved carefully. But today people are drowning in information.^[1] All civilized people are "dataholics." Everyone has to cope with the information overload. And still users are thirstier for information and knowledge than ever; one cannot afford to be ill informed. Information is rated ever higher, "the fourth production factor, the essence of economy, and the fundament of human culture."

Information is a strange commodity. Information can easily be multiplied and spread once it is generated. Information does not vanish when it is being used. Information can be reused and inserted in new documents, without glue, seam, or welding. Information is not an object, but a representation of an existing or intended reality.

Documents contain information. (Due to Information and Communication Technology (ICT), the word document is not used for hardcopies only. A document is defined as "any object which has the purpose, or to which the purpose is given, to serve for the perusal of the data of which it is the carrier." The object may be a book, report, journal article, form, contract, letter, etc.; the data carrier may be paper, CD-ROM disk, microfiche, etc.) The information in documents is ill-structured; its semantics

depends upon a context. Ill-structured information is more difficult to handle for a computer than well-structured data, but it has become feasible. So, there are document information systems (document IS) to keep document information for all those documents that need to be read if necessary, to support our memory, and to serve as witnesses of transactions, and perhaps even to give evidence of today's circumstances in a distant future. The two seemingly conflicting views, information overload and information requirements at the same time, are resolved by document IS to handle, consult, share, draw attention, store, reuse, and discard information—the tasks of librarians, archivists, record managers, document managers, and knowledge managers. (A document IS is defined simply as an information system of which the data is of document nature. The database of a document IS contains references to documents, and it may contain (parts of) documents in the form of texts and/or document images.)

Former ideals of the paperless office have vanished. Paper books, documents, reports, and records have their advantages: they are common, cheap, easy to use, and legally accepted. Electronic documents have other advantages. They can bring savings in the document sector—the economic motive. Without ICT support, control of the mass of electronic documents is impracticable—the manageability motive. Documents have moving pictures and sometimes sounds, or spreadsheets and dynamic links—the presentation motive. Organizations face increasing quality requirements of their products and services, and thus have increased quality needs of document

information and information retrieval facilities—the quality motive. Documents are open to support collaborative authoring, and they can be used everywhere and at all times—the usability motive. These and others motives call for document IS.

If someone still thinks a document IS is a luxury, one may recommend trying to do without. A nasty example of what that means was seen after the destruction of the World Trade Center on September 11, 2001. The memory of many organizations in the Towers had been destroyed. They had to try to reconstruct their organization's transactions and assets when much of the paper was gone, the servers that stored all electronic information were gone, and many employees did not survive either. Resulting ideas on the value of document management have been described by Cox et al.^[2]

This entry starts with a few cases. Then, in the section on the functional requirements for document IS, ISO standard 15489 and the Sarbanes–Oxley law are presented, two firmly established foundations, as well as the resulting software requirements in MoReq and the DoD 5015.2-STD. Explicit attention is given to related subjects from a viewpoint of document management: information sharing (workflow, knowledge management) and interoperability of ICT tools; authenticity because of the possible evidential value of documents; and digital longevity because of the possible long-time function of archival documents. Then, in the section on the technical aspects answering the functional demands, standards, and standard components of document IS are discussed. Examples are the Open Document Management API (ODMA) for information interchange between applications; the eXtensible Markup Language (XML) syntactical data model family; the Reference Model for an Open Archival Information System (OAIS) for preservation of digital information objects that have to be kept for a long-term; metadata schemes for information retrieval; and others. The section on design methodology, as an answer to functional and technical demands, focuses primarily on models of documents, information, users, and usage; and on design questions in, for example, a digitization project.

A FEW CASES

From a few practical cases the highlights are concisely presented.

1. A medium-sized industrial firm wanted to reduce the costs of document information handling (No increase in the number of document managers anymore). The organization wanted to control the design process: each phase of the project needed approval. The functions this firm wanted were common to document management software: they were equivalent to the Model Requirements for the management of

electronic records (MoReq) scheme. The document usage and working time spent on documents were thoroughly investigated. A classification structure was designed. The economic aspects of the document IS were carefully studied. Part of the process was outsourced, for which a request for proposal was written. Business Process Redesign was postponed.

2. A consultancy firm wanted to facilitate reuse of its projects reports by other team members. The needs and wants of the organization were investigated; they were to make reports easily accessible, draw attention to relevant items, ensure security of the report, and guarantee that expertise of consultants is maintained in case of job hopping. It required the prescription of a standard for the reports of the consultants, which took several iterations. The document IS was to be made available in an intranet; it is an internal Web application.

In the design phase, the setup and tools were demonstrated, and in a short course the ICT and the corresponding procedures were discussed. The consultants have been encouraged to share experiences. The document IS was a start to knowledge management, which was indeed one of the purposes of the project.

3. A ministry has an investigation service for environmental frauds. In the research stages, a wide range of information sources is used and produced. The document IS should improve the level of document management support, make the status of each process clear, and guard time limits. The main technical requirements were control of documents, folders, and user's rights; control of descriptors for information retrieval; control of the applications accessing the document repository; compatibility with the software already in use; and document data conversion. This is quite a list, but even more effort was needed to bring around the change of work: the employees had to change profoundly their way of working with documents; the records management unit had to change from routine "information handling" to "organizing document management."
4. A Royal Library, having its own collection but also responsible for preservation of all publications of the country, wanted to renew its information infrastructure. The data structures and software should enable interoperability for services and data from its own collection, its national task for publications and other collections. The infrastructure encompasses XML as an information structure, Web services based on XML and the eXtensible Stylesheet Language (XSL) and the HyperText Transfer protocol (http), facilities for query languages, the use of a standard metadata scheme (Extended Dublin Core), Digital Object Identifiers, and the use of the redirect facility OpenURL.

5. A University wanted to build trusted digital repositories. What technology exists to ensure trust? One answer is: make XML containers, store the original bitstream, zero or more bitstreams in a converted format (!), and the metadata in an XML container, use a digital signature and use a persistent identifier. For harvesting the Open Archives Initiative–Protocol for Metadata Harvesting (OAI–PMH) was used. The use of open standards is stressed. Other organizations, among others a city archive and an institute for historical information, came to the same setup as the University.

In all these cases expertise is needed both from document management, information retrieval, collection management, and knowledge management and from the ICT domain.

The cases differ with respect to the problems, the goals, the project plan, and the type and size of costs and benefits. That is on purpose. There is a wealth of problems in practice. Many cases could be added. Due to their differences, it is no use to write a cookbook. However, functional and technical requirements and design issues can be discerned and best practices and guidelines can be given.

FUNCTIONAL ASPECTS OF DOCUMENT IS

Procedures

Document IS starts by proper document management procedures.

The ISO standard for records management, ISO standard 15489, describes “best practices” for records management. The standard is partly based on the older Australian AS 4390 standard. It states economic and legal reasons for records management, strategies, and operational guidelines for best practices; and actions to be taken: management, responsibilities, education (!), control, ICT infrastructure, records ingest, metadata, access, and security. This influential standard is in a way the best thing that happened to records management for a century.

Another way to draw attention to records management procedures is the U.S. Sarbanes–Oxley Act, in effect since 2002. This Act, often abbreviated as the SOX Act, has a profound impact by its legal character. U.S. businesses legally need to manage, control, and preserve their information. Every company has to control the management and procedures of information and management, the executive control of the records management program, and the technical environment of their records. It is considered to be a crime to delete information with the purpose to obstruct inquiries into proper management.

Of course, ISO standard 15489 and Sarbanes–Oxley did not come out of the blue. They reflect a modern view

on centuries of filing and archival practices and proper business management practices. But currently, ISO standard 15489 and Sarbanes–Oxley are a concrete-based foundation of document IS.

Software

Document management has close relations to other requirements. It makes no sense to file and archive documents if you cannot find them, so retrieval must be supported. It makes no sense to store documents if someone else cannot access them (if that person had the right to access it); this leads to the demand of information sharing, workflow management, knowledge management through groupware, and also the important demand of technical interoperability. For these functions, separate software exists, that may be connected to document management software.

One can distinguish the following types of software applications:

- Document management software, emphasizing document capture, control tools, folder management, version management, and security facilities.
- Information storage and retrieval software, with metadata bases and elaborate ranking.
- Library document management, with retrieval and loan facilities.
- Workflow management, with business process building facilities, document routing, item status facilities, and time control.
- Information sharing and knowledge management packages; groupware.

Records Management Software Functions

The “Model requirements for the management of electronic records” (MoReq) is a “standard” used all over Europe.^[3] In the United States, the U.S. Department of Defense (DoD) 5015.2-STD is used.^[4] The National Archives and Records Administration (NARA) endorsed this DoD standard to all federal agencies. Both MoReq and DoD 5015.2 state the functionality for applications for electronic records management. Records management has a wide scope. All kinds of people create, receive, and retrieve records as part of their daily work, and they need all kind of operations. That work is supported by records managers and archivists and by the records management application. As a consequence of the many types of operations, the functionality is extended.

Operations, demands, and facilities have been prescribed for functions such as process control, security, classified marking and declassification, retention and disposal, retrieval and rendering records, administrative functions such as changing and deleting records, metadata

requirements, and nonfunctional requirements such as performance, system availability, and legislative requirements.

Interoperability

All kinds of organizations face the demand of interoperability. There is a mass-document information exchange between governmental levels; between businesses for reasons of e-commerce; and for common catalogs like Picture Australia.^[5] Picture Australia offers an online portal with search facilities to find digital photos that are not owned by themselves but stored in repositories all over Australia. With a click on a thumbnail you get the whole photo. Picture Australia is an archive without an own collection, all photos reside at the participating organizations. That is an extreme example of interoperability!

The demand on interoperability is a response to the trend to globalization, enabled by ICT. Networked organizations have developed; loosely coupled, seemingly independent organizations without much common authority. Memory organizations like archives, libraries, and museums, and businesses form electronic networked organizations, as well as businesses that collaborate via electronic documents. They share electronic information, exchange information, and reuse each other's information. Interoperability has become an enormous important aspect of document IS.

The participating organizations may be more or less alike, partly colleagues and partly competitors, with horizontal connections, characterized by common or mutual information use. In other cases suppliers and customers of information can be discerned, with vertical connections. The cooperation is based on information exchange. Establishing functional requirements for common document IS for a networked organization consisting of memory institutions (or businesses) without much common authority is difficult for the following reasons:

- There is a problem (for instance, poor service, poor coordination, high costs of the end product, long delivery times of products or services), but the fact that there is a problem does not by itself lead to collaboration.
- The necessary conceptual and empirical model of the new situation at business level is not shaped.
- As a consequence, at employee level it cannot be predicted how the new situation will work out, so that no one can tell senior staff and personnel exactly how their work is going to change. This leads to organizational fuzz.
- It takes time to realize good cooperation with another organization (do not underestimate the *time* needed to realize good cooperation between organizations).
- Insufficient knowledge of ICT issues for common use of document IS.

Authenticity

For document information, three types of values can be distinguished:

- Informational value: the document describes an existing or intended reality.
- Evidential value: the document is a witness of a decision or a transaction.
- Cultural-historical value: the document describes a historical reality.

Most people have for documents only the informational value in mind and realize their evidential, legal value only if they need proof. The evidential value must not be neglected! A document can have evidential value only if it is authentic (if the document is what it purports to be). The content, structure, layout, context, and (if applicable) behavior of the document must be proven to be identical to what it was like in the past.

Authenticity is for an electronic record in a document information system a more difficult item than for a paper record. The fact that a bitstream has to be rendered in order to be readable brings about the questions: what do we mean by authenticity in this case and how to realize authenticity of digital documents.

International Research on Permanent Authentic Records in Electronic Systems (InterPARES) is the major initiative to bring the concept of authenticity applicable to our electronic era.^[6] The InterPARES 1 project resulted, among others, in terms of assessment of authenticity. To assess the authenticity of an electronic record, the InterPARES report states the preserver must be able to establish its *identity*, i.e., the attributes of the record that uniquely characterize it and distinguish it from other records; and demonstrate its *integrity*, i.e., the record is complete, whole, sound and uncorrupted. Next to an overview of the custody—who kept this record and how—this means that the records need a quality check before they are transferred to the document information system where they will be kept, and the records must be maintained after transfer.

Gladney and Bennett studied the authenticity and trustworthiness and genuineness for derivatives for digital objects and transformed text, and also for a broader domain: analog signals, performances, artifacts, and natural entities.^[7] As a result of this work they propose the definition: something is an authentic copy if it is a *sufficiently faithful* derivative with true *provenance*.

Authenticity should be either 1 or 0; a document is either authentic or it is not. The finding of Gladney and Bennett (*sufficiently faithful*) is not at ease with the demand of either 1 or 0.

Hedström and Lampe investigated the result of various forms of preservation (migration and emulation) of Chuckie egg, a game.^[8] The game has been migrated and

emulated and users played the original and a preserved game. As a result, the game is supposed to be authentic if there is no longer a difference in playing the original and the preserved game, although the software is different! So, evidently, for a given user group a *test* can tell the authenticity of a digital object upon change in the ICT infrastructure.

OAIS states that an information object in a document IS will be preserved for a designated community. The designated community must be defined in order to predict what the document should be used for. So, the community and the foreseen use define the measures to keep the document authentic and this defines the test setup to decide whether the document is still authentic in the future.

Next to the demand to describe the designated community, OAIS defines a Preservation Description Metadata scheme with four types of metadata: reference information, context information, provenance information, and fixity information. The reference information is meant to define the identity, the provenance information must provide the demanded true provenance (custody!), and the fixity information must indicate the data integrity. That could function as a solution for the demands that InterPARES disclosed.

Digital Longevity

Due to the urge of ICT innovation, the life time of digital information objects that are represented by bitstreams that have to be rendered, is small. The average maximum life time of a digital information object, a program, or digital document, may be 5 years. In sharp contrast to the short life time of digital objects, an archive demands many of its information objects, digital or no, to have lifetimes that may easily exceed a century.

The changes in ICT within the time of even one generation are such that within a few generations we can foresee a big “Byte out of history” from our times.^[9] Content, structure, lay-out, context, and/or behavior of digital information objects are at risk by the urge of ICT innovations.

In order to preserve electronic records, the refreshing strategy will periodically be necessary: all data on a medium are transferred to fresh media so that the bits are “square and fair” at a new copy of the same type of medium. If the medium is becoming obsolete, the data will be transferred to a more modern type of medium, the strategy of migration. A study of ICT standards, the building blocks of our digital information objects, in time, shows that they are aging fast. The data format and application type get obsolete, too. In that case, the bit stream is “converted” to a more modern standard, data type, or application type (in computer science the term porting is used for this strategy). In cases like this, an audit is necessary to be able to ensure that the result conforms to archival demands.

In the emulation strategy, a new computer system “behaves” like an old one. The Universal Virtual Computer (UVC) emulator, based on a minimal and future-proof computer instruction set, has been developed by Van der Hoeven.^[10] Kol showed, that it takes a computer scientist no more than two hours to express an existing data format to a future-proof instruction set (in UVC terms: a logical data schema) that can be executed in a distant future.^[11] This seems to be a solution to ensure longevity for digital records in the very long run.

TECHNICAL ASPECTS OF DOCUMENT IS: STANDARDS AND STANDARD COMPONENTS

The technical aspects for document IS start from functional requirements of document IS, that have been stated in ISO standard 15489 and Sarbanes–Oxley; to which demands for search and retrieval, sharing information, and possible long-time storage have been added.

The hardware for a document IS is well known from other ICT applications: servers, storage device, monitors, scanning equipment, storage media readers and burners, printers, and telecom. For software, there is a growing number of (information science) standards and standard components for document IS. Some important ones are discussed here.

Storage Media

It has long been recognized that standards for exchangeable data carriers are indispensable. The ISO standard 9660 for CD-Rom and ISO standard 11560 for a common type of Worm disk were the first well known standardized media. From a standardization viewpoint, storage media standardization is a success story. There is a list of some 150 standards for data storage on the Web site for Interchangeable Media for Mass Computer Storage.^[12] They enable ubiquitous media use!

Software Selection

The choice depends on the type of support that is needed, of course. Overviews for package selection containing detailed descriptions help to draw a short-list.

Tailor-made adjustments to software are often needed. Reasons for those demands can be summarized as: we are different, we know better, we cannot wait, and we want to be on our own. These reasons have been put forward for 20 years now. Although additions and adjustments can be useful and necessary, a warning is in place to be careful with them. Every addition carries the burdens of increasing ICT service costs, continuing difficulties to upgrade existing software, and making work procedures more rigid.

ODMA

The ODMA^[13] enables applications to interface seamlessly with a document management client. ODMA offers the support to create, edit, revise, and manage documents. ODMA is very successful, to be judged from the fact that most document management packages are ODMA compliant. ODMA's website^[13] also gives a list of ODMA-compliant packages.

Persistent Identifiers

A persistent identifier is a unique label that is assigned to an information object and that identifies and locates that object forever. By using persistent identifiers, one hopes to avoid dead links (http code 404) and related problems. But it is also avoided that, in order to make electronic documents accessible, someone must maintain the data locations or update the references upon every change. Instead, indirect links to the resources are maintained using a persistent identifier on the one side that is coupled to an updatable reference to the location on the other side. The principle of persistent identifier is based on the redirect principle: the persistent identifier is sent to a resolver that “knows” the address of the demanded document. The Digital Object Identifier (DOI) system is an example of a persistent identifier mechanism. An example of a DOI is the Web address doi:10.1177/0165551504045850. If recognized as a link, in Microsoft Word® or PowerPoint® the cursor is drawn over the identifier, the window shows <http://dx.doi.org/10.1177/0165551504045850>. dx/doi/org indicates a “resolver,” the DOI naming authority [in this case identified by 1177, which knows what Uniform Resource Locator (URL) is indicated by 0165551504045850] returns the useable URL and the result of these actions is that the Web page with the current URL is sent to the requestor.

XML Syntactic Data Model Family

The Office Document Architecture (ODA, ISO standard 8613) was never used much. The Standard Generalized Markup Language (SGML, ISO standard 8879) was more popular from 1990 by publishers and by constructors of complex technical equipment (medical photo cameras, airplane engines). The XML is a data model that is an advanced version of SGML that is commonly used, especially for Web-based document IS. XML itself describes the syntactic data model, the Document Type Definition (DTD) or XML Schema describes the “grammar” of the XML syntactic data model, the Extensible Stylesheet Language (XSL) or rather the XSL Transformations (XSLT) describes the lay-out structure, XPath enables to navigate through XML documents, and XQuery is a query language for XML collections. W3Schools Online Web Tutorials are an introduction into all XML family members.^[14]

OAIS

The Reference Model for an OAIS^[15] is ISO standard 14721. OAIS is used by many digital archives that are meant for long-term preservation of digital information objects. OAIS contains important principles. It gives a high-level overview of the handling of the bitstream and the metadata of the bitstream upon ingest, keeping, and consumer request; and allows the description of a workflow for object handling in the archive. OAIS distinguishes the Submission Information Package (SIP) from the Archival Information Packages (AIP) and the Dissemination Information Package (DIP): the information object submitted to the archive by an author may be repackaged by the archive for keeping purposes and it may be tailored to the user's demands upon request! Moreover, OAIS demands to define a “designated community” for which the information objects are kept, influencing which documents shall be kept, and what should be possible with the document in the future, influencing how it shall be kept and preserved, as a result of the (sometimes anticipated) demands of future “consumers” (users)!

OAI-PMH and OAI-ORE

The OAI-PMH is a protocol to harvest metadata of other institutions.^[16] Especially in the document sector, collaboration is necessary; no one organization can afford to use solely its own documents. So, it may become useful to share repositories. Organizations that are willing to give access to parts of their documents or their collections can implement software to handle OAI-PMH requests. They become data providers. A service provider acts as data publisher having a harvester, an application that handles OAI-PMH requests like “listRecords” to get the metadata, builds a database with metadata of the data providers and offers that to the companies that collaborate or top the general public. The original exemplar of the latter is Picture Australia.^[5] A follow-up standard exists: the Open Archives Initiative-Object Reuse and Exchange (OAI-ORE) standard. OAI-ORE is more ambitious than OAI-PMH; it is meant to describe tools for richer services, even Web 2.0-like services, based on digital objects in distributed repositories.

Metadata

The access structure to document information is another main reason for the use of ICT. On the one hand, the flood of documents leads to ever-increasing demands on sophisticated tools to separate the necessary from the unwanted documents. On the other hand, and not less important, increasing quality requirements of the company lead to increasing needs for information retrieval. We refer to situations like “We have had a similar situation before, how did we react to it?” In the past, if the pertinent

documents could not be found quickly they were not searched for at all. Such a question would be answered from memory, and not always precisely. The enhanced quality that is required nowadays by every business and government body is precisely the reason that these questions have to be answered correctly from the relevant documents.

It may be necessary to find the pertinent documents, but the possibilities of finding a document needle in the information universe haystack are poor. Reuse of information objects is furthered by the intrinsic interoperability in standard metadata sets. The following standard metadata tag libraries are often used.

- a. Dublin Core, “DC”, ISO standard 15836, is the best known metadata element set.^[17] It consists of 15 elements. The Qualified Dublin Core, DCQ, adds to DC the possibility to use refinement to the metadata elements, encoding schemes, and extra metadata fields from a small expansion list. Dublin Core is a common tool in digital libraries.
- b. The General International Standard Archival Description [ISAD(G)] was developed in the archival world.^[18] It contains 26 fields, of which reference, title, archive creator, date, size, and level of description (record, record group, collection, etc.) are obligatory. Next to it is the International Standard Archival Authority Record for Corporate Bodies, persons, and Families [ISAAR (CPF)], describing persons and organizations.
- c. The Encoded Archival Description (EAD) is the successor of ISAD(G) for electronic collections.^[19] Like Dublin Core, it has the form of an XML tag library. An EAD record consists of three parts: <eadheader> describes the archival description or finding aid, <frontmatter> describes information that could have been stated on a title page of the electronic record, and <archdesc> contains the archival description itself.
- d. Metadata for records, ISO standard 23081, is a metadata scheme for “document management” records. As of mid-2007 only part 1, principles, has been published; the other parts, more explanatory and providing practical guidelines, will follow. The standard prescribes metadata on the description and the accessibility of records, about the business rules and the business processes, and metadata about records management processes. This metadata element set indeed corresponds to ISO standard 15489 for records management. It is likely to become important.
- e. OAIS describes electronic information packages. The information packages have metadata for packaging information: content information about the content information object, i.e., bitstream, as well as the associated representation information needed to make the bitstream understandable; as well as Preservation Description Information (PDI). The PDI encompasses: reference, the identifier of the bitstream; provenance,

the source of the bitstream, who had custody, and its history; context, stating for instance how this bitstream relates to other ones (e.g., “reply”); and the fixity, that makes alteration in the bitstream perceivable. The OAIS metadata add well to the original Dublin Core.

- f. PREservation Metadata: Implementation Strategies (PREMIS) is meant for digital objects. The PREMIS data dictionary^[20] contains the information a repository uses to support the preservation process of the digital objects. The viability, renderability, understandability, authenticity, and identity of digital objects must be protected on preservation; also digital provenance and relations between digital objects should be preserved. PREMIS builds upon OAIS and uses XML Schema.

Content Representation

Both classification and thesauri are used in the content representation section of the metadata sections. For thesauri, ISO standard 2788 has been developed; ISO standard 5964 was meant for multilingual thesauri. Collaboration between organizations led to the demand for semantics on information exchange. In order to enable interoperability on the World Wide Web, a computer must be able to identify exactly the subject. As ever more document IS are being Web-accessible, this development is important for document IS as well. Ontologies are being developed and implemented. In an ontology the Resource Definition Framework (RDF) is a tool to define a lemma; RDF Schema [RDF(S)] to define relations between lemmas; and the Ontology Interference Language (OIL) and the Web Ontology Language (OWL) are the richest tools to define an ontology. RDF, RDFS, OIL, and OWL are W3C (World Wide Web Community) standards and XML-based.

Checksums

For data integrity a checksum can be used. Entlich describes how checksums are used to determine whether the bitstream in a document IS is still identical to the original bitstream.^[21] A well-known checksums algorithm for this purpose is the Message Digest Algorithm 5 (MD-5). The Secure Hash Algorithm 1 (SHA-1) is more extended than MD-5, SHA-1 may be more common in the future. In order to be able to prove the document has not been changed, in the fixity metadata field of an OAIS-AIP (document), the type of algorithm and the checksum value must be stored, preferably with date and time when it was computed. This is part of the proof of authenticity.

Query Language

Many libraries have used the Z39.50 query language protocol for information retrieval in distributed environments.^[22,23] It enables the client to request that the server

searches databases for information that meets specified criteria, and to retrieve some or all of the identified information. It is meant to control the search session as well. Z39.50 is also known as ISO standard 23950. The Z39.50 standard has port number 210; and the world is adopting the http protocol, port 80, for this purpose. Search/Retrieve via URL and Search/Retrieve via Web Service (SRU/SRW) is a port 80 protocol with Z39.50 semantics. The W3C defined XQuery for the query language for XML repositories.

Data Formats

Adobe Portable Document Format (PDF) must be regarded as the factual standard; PDF/A is a part of PDF for stills, without encryption, private fonts, and patented compression, that is an ISO standard (ISO standard 19005) and suitable for long-time storage (probably much longer than 10 years). The HyperText Markup Language (HTML, ISO standard 15445) is a presentation structure compliant to XML to represent XML in a browser. HTML (and XML documents that are transformed to HTML) and PDF are different types of solutions to the way a bitstream can be presented in a browser. Kasdorf compares PDF and XML; they are complementary and can both be necessary.^[24]

The Tagged Image File Format (TIFF, ISO standards 12234 and 12639), and JPEG 2000 (cf. the Joint Photographers Expert Group; ISO standard 15444) are two more examples of frequently used format standards for visual materials with good prospects to longevity.

The list of information science standards and standard components for document IS could be expanded with items that are not yet common and stable. It can be foreseen that this list will gradually, slowly, be expanded with items that are stable and have been accepted worldwide. There are also ICT standards from outside the document area. They are outside the scope of this entry.

Awareness of standards and standard components is something different from using them without second thoughts. Their use takes time and costs effort. In every case, it is recommended to study whether the advantages to use them match the drawbacks.

Finally, we draw attention to the fact that such an authoritative list of commonly-used standards and standard components could not have been drawn a decade ago. Evidently, document IS have come of age and it is not only necessary, but now also possible to draw up such a list.

DESIGN METHODOLOGICAL ASPECTS OF DOCUMENT IS

The design of an information system for document information requires building upon the functional requirements and technical tools and craftsmanship.

The design means finding a balance between specific needs and wants and profits of an organization on the one hand and ICT possibilities on the other. This balance is important. Too little attention to organizational requirements will generally result in systems that have limited value to the problem-owner; too little attention to ICT may lead to unrealistic and expensive demands on technology. IS design surely is an engineering process!^[25,26]

The benefit is difficult to predict. We found for evaluation of the benefits of document IS, that an ex ante representation of the benefits is rarely fully correct, even if the costs and benefits have been properly calculated. Often, during the design and implementation of the document IS or immediately afterwards, personnel came up with ideas for modification, new developments, task restructuring, or new services. Of course, the original goal was adapted. So, the benefits are partly ascribed to other circumstances. But for measurements on the benefits, then, it is not clear *what* to measure.

Moreover, the increased use of ICT is a step in the development path of an organization. The ability to grow and to change with help of ICT is a vital condition for an organization. (Less kind but more succinctly: an expanding document IS is only a battle in a war.) The problem with benefit measurements, then, is *when* to measure.

There are different types of users. "A good document information system" contains aspects of economic and managerial nature on the one hand and quality and usability aspects on the other hand. Not surprisingly, the aspects of an economic and managerial nature are of more interest to the executive staff, the management level of an organization. The quality and usability aspects refer to the personnel who will be using the document IS every day, the employee level. Important at the employee level is that users will be happy to work with the document IS if it is functioning well. Most employees in an organization will be proud to perform good quality work, and the challenge for the information system designer is to enable them to do so.

For the design of any IS, other than a very simple one, a design methodology is used. (A methodology is defined as a coherent collection of methods and techniques to solve a class of practical problems.) There are advantages to use a design methodology.

Firstly, the experiences of expert designers are used, one can use tested and proven ways to describe an organization (top-down, bottom-up, processes, actors); there are checklists; there is less chance that vital parts of significant organizational and technical problems or solutions are overlooked. Secondly, communication is enabled, there are rules to make representations, documentation and software can be shown in a standardized way to the customers, to problem-owners, and to other members of the design team; communication enables to share work among colleagues.

The use of a design methodology has disadvantages as well. Methodologies are made for problem solving in general, for a class of practical problems. But in practice each design problem is different. Whatever methodology is chosen, it will miss views and tools on some of the problems; some actions will be described too globally and other actions receive needlessly much attention. A methodology will not do the work! A methodology is just a toolbox in the hands of a designer, who does need an open eye for actual circumstances.

The design methodologies differ considerably. The elements of one design methodology may even have no counterpart in another methodology. This leads to the question what kind of elements exist and what elements should be provided to ensure that a document IS can be effectively designed. The Delft framework is used to adjust theoretical views to practical needs. It characterizes design methodologies by the following ways.

- Way of thinking (the “Weltanschauung”—the perspective on the problem domain—from which among others can be derived what objects are pertinent).
- Way of modeling (what conceptual models are made and what are their mutual relations).
- Way of working (what steps and actions must be taken by the designer).
- Way of control (what successive stages are distinguished in the progress of the design and what happens after each stage).
- Way of support (what electronic diagram and scheme tools will be used for the models, the way of working and the way of control). The way of support is the least interesting one. All kinds of tools are available to support representations of static models that are used for document IS. For dynamic situations (like process models and document routing), excellent results have been reported with simulation and animation techniques for dynamic modeling. They need not be discussed here.

These ways may eventually be added to any methodology that is used by or known to the organization for which the document IS is meant.

Way of Thinking

The objects that are pertinent for the document IS are documents, information, users, and usage. These four terms will appear in a document that describes its purpose or for instance from the result of a Balanced Scorecard approach. They then must be the main objects in the methodology and in the actual design. Other terms that can be found occasionally here are: time to complete, action sequence, and queuing. In these cases, document routing and workflow management play a role.

Way of Modeling

A model is a representation by reduction of an all-too-rich and heterogeneous reality (an existing or an intended reality) to something that can easier be understood. Modeling is thus “the science and art of leaving out.” Top management, department managers, employees, ICT management, and others all have their own views on their own relevant parts of reality. Therefore, the relations between models are as important as the models themselves. The way of modeling is a part of the core of expertise of the designer.

Models of document IS will refer to the documents, the information, the users, and the usage.

- Examples of document models: document types, readiness level (under construction, ready, published), and classification level.
- Examples of information models: its (analytical) components: content, structure, lay-out, context, and behavior (for dynamic information); and information quality: correctness, preciseness, timeliness, completeness, and controllability of the information; next to that information relevance to a topic should be modeled.
- Examples of user models: role-based user models, indicating which users have access to the IS; expertise models, distinguishing novice users from experts; and personalization models, for instance the habit to adapt the lay-out of information if it was shown to that user before.
- Example of usage models: processes to which the document belong, document management leads to requirements on, for instance, version management of documents, folder management, appraisal procedures, removal of documents that are no longer needed, selection of documents for transfer to the static archives. Frequency of document use is another example.

In the design phase the attention is usually directed to the new situation, however, one needs a valid and easy but sufficiently detailed description (a model) of the current situation. This is necessary for a proper problem-solving cycle that exists of conceptualization, validation, and verification of a problem situation. Only after the current situation has been described, one or more models of new situations with consequences and benefits can be compared to the current situation.

Modeling is difficult. It takes students a lot of time to learn to model sensibly. A problem and one or more solutions, new situations have to be modeled. The current and new, foreseen situation must be conceptually modeled and represented. It is difficult to make one’s new view explicit, to make choices, to think through a new situation.

Way of Working

The way of working indicates the steps and actions that have to be taken to solve the ill-structured problem of the

design of a document IS. This is part of the core of the expertise of the designer.

1. In order to get an impression of the sizes and amounts the document IS will contain, an inventory must be made up of the document data.
 - a. Data on the static document database (numbers, sizes, requirements on document colors, document storage space, index storage space).
 - b. Data on the dynamic requirements (numbers of incoming documents per day, period of record keeping, printing capacities).
 - c. The technical infrastructure (server requirements, work stations, printers, other peripherals, network requirements for data communication).
 - d. The index structures.
2. Man-machine interaction aspects form an important part of usability. Surprisingly, this aspect still does not always get the necessary attention. The usability of document IS is often not satisfactory. The meaning of document data depends on the context and structure, which is only partly visible on a computer screen with its limited size.

The dialogues should contain command shortcuts and adaptive responses for experienced users, informative feedback during an operation (for instance “please wait”), closed dialogues, and simple error messages.

3. Communication to users and training of users. Users differ in their level of education, their familiarity with computers, and in the frequency they will use the document IS, but they are the ones that decide on its success. This also holds true if the users are the general public. In one case announcements of the automation project were given, a formal introduction, informal demonstrations, and tests with users to find out whether the system is foolproof. Communicative talents of the designer are extremely valuable.

More formally, three consecutive stages are distinguished.

- a. Communication before the document IS will be built (give an introductory course, ask users who will want to participate some time in the design stages).
- b. Communication during the design and development (manage participation, present reports on the progress, show a prototype, let users work with an experimental IS).
- c. Communication afterwards (training, courseware, help desk).
4. Digitization

Papers arrive in the mailroom. Here, it is decided by selection which documents will be put into machine-readable form. The images are put on temporary magnetic media until they are indexed and it is decided for how long they will be kept; then they are put on permanent media. The end users index incoming documents but, even so, information management (the

responsibility for the documents and the index terms) remains centralized. Digitization of documents is costly.

The following design questions are characteristic for a digitization project:

- a. Which documents to convert: digitization of all documents may be costly; but that part that is not digitized loses part of its value, even if it is indicated that there are folders and collections present that have not been digitized.
- b. The quality of the metadata (indexes): if they have to be modernized, corrected, or adapted to the ideas of some cooperative body, they will be very expensive.
- c. The resolution of the images: it seems attractive to make high-resolution scans, but the scan of an A4 page at 300 dpi (dots per inch) results in some 8.7 million pixels (picture elements), the scan of an A4 page at 1600 dpi will need far more, some 250 million pixels. Storage space is cheap but not for free.
- d. Compression of the images: lossless compression is attractive, as original details can always be restored, but lossy compression is stronger. LZW, ZIP, and JPEG2000 can be used in a lossless way. Present and future compression algorithms may bring about that a dead (flipped) pixel results in a dead image, a feature that may be chosen to be avoided.
- e. The color in the images: color schemes that are used most are RGB (Red, Green, Blue); CMYK (Cyan, Magenta, Yellow, and Black); and HSL (Hue, Saturation, Lightness). The standard technology of RGB will result in 24 bits to represent one pixel, each color is represented by 8 bits or 256 possible “color intensities” for that pixel.
- f. The format of the images: next to PDF, TIFF, JPEG 2000, and sometimes HTML other formats are met: BMP, GIF, JPEG, PNG, and others.
- g. Image correction is technically easy; improve contrast, color correction, despecle by removal of surface pollution.
5. The aspect of digital document longevity, digital archiving and preservation is important. There is no experience with the behavior of electronic document repositories over the ages. Important standards are referred to in the section of Technical aspects.
6. For management purposes it must be possible to obtain static and dynamic data from the document IS. Document use and process control to have a managerial dimension. The need to generate management information, however, is not limited to *document* IS.
7. A complex document IS is expensive to design and expensive to maintain. Therefore, possibilities to reduce complexity must always be kept in mind. An example to reach this is downsizing, and if necessary data interchange between modules. Guarding clear

responsibilities of personnel is one more principle. Reduction of complexity is not a problem to *document* IS design only. We refer to standard works on IS design.

8. Both in the design and in the deployment of document IS, tasks can be outsourced. The advantages of outsourcing are the availability of manpower, expertise, and infrastructure. Outsourcing, however, does not mean that the stakeholder gets rid of all responsibilities. An outsourcing situation or a quotation request for outsourcing demands clear statements of the problem-owner on the purpose of the services, the way of collaboration of the partners, the technical situation (hardware, software, functionality, availability, support), the management, the costs, and the legal aspects; the number of legal suits has spectacularly grown. There is much experience on outsourcing document IS, but also on other IS. It is an important issue for which we refer to standard works on outsourcing.
9. For implementation there is a choice between a phased, controlled growth path, and a big bang approach, in which a complete information system is put into use at once. A strong argument for a controlled growth path is the limited predictability of a new system. One should always be prepared for unprepared setbacks. A strong argument for a big bang approach is of economic nature, the big bang approach will bring benefits soon after the complete document IS has been installed, while in a controlled growth path the benefits will evolve only gradually. In practice document IS tend to be complex. That may be the reason that most organizations choose for a gradual growth path.

Way of Control

The way of control indicates how the design process should be managed and controlled. Overall, this is an important issue. A change in document information provision affects an organization so pervasively that organizational understanding and rethinking are vital. Information is a primary production factor, after all. Organizational aspects are a main feature rather than of secondary importance.

1. User acceptance is too weak an approach for the design of document IS. On the design of a document IS user participation or user centered design should be required rather than mere user acceptance. There is a group of design methodologies based on Rapid Application Design (RAD). They adhere to the principle of participation. In fact, the document sector has been aware for a long time of the need to let users participate and contribute to the design and realization process. Mumford's design methodology ETHICS, a thoroughly participative methodology, published

already around 1980, was based on experiences in the document sector.

The flow of phases in projects in this area is something like Joint Requirements Planning—Architecture definition—One prototype (specify functions and construct)—One more prototype—Just one more prototype—Integration of the software with other present software—Cutover (i.e., deployment).

2. Cascade control models flow such as: requirement engineering—global functional design—technical design—programming—testing—implementation. This approach is used if a document IS must fit in a rigid architecture.
3. Extreme Programming, XP, is meant to investigate the ICT possibilities for a domain. The XP way of control is not used too often.
4. In most cases, standard tested and proven document IS applications can be bought and tailored. In automation of document information, software engineering and the quality of the software is important but not the main concern in the realization. There are other points demanding much attention.

CONCLUSION

Document IS are used for reasons of economy, manageability, presentation, quality and usability. This entry contains an overview of functional, technical, and design methodological aspects on document IS.

The functional aspects of document IS derive from ISO standard 15489, with best practices and guidelines for good document management, and the U.S. Sarbanes-Oxley Act, stating legal demands on document management that are impracticable without document IS. They are answered in the descriptions of functions for software for records management that have been established in MoReq and in the DoD 5015.2-STD. There is an increasing demand to find information while an increasing amount is sent every day; there is an increasing demand to share information; there is awareness that in some future a small part of the documents of today may still be used. So, these functions are demanded of document IS, too.

The nature of document use calls for the document being unchanged over time. So, the demands and possibilities to ensure authenticity of electronic documents have been discussed. The UVC approach, based on a minimal and future-proof instruction set, seems to guarantee digital longevity of document information that is represented by a bitstream.

Technical aspects refer to building blocks like standards and standard components for document IS. Some 12 of them are stable and used worldwide. We draw attention to the fact that such a list of standards and standard

components, as described in this entry, can be written down; this is a witness that the field of document IS has come of age.

Design methodological aspects are building upon functional demands and technical possibilities. Most interesting here are models. A model, a representation by reduction of an all-too-rich and heterogeneous reality (an existing or an intended reality) to something that can easier be understood, is in the case of a document IS made for documents, for information, for users, and/or for usage. Examples of models are given. Moreover, the steps and actions to be taken to realize a document IS are indicated, for instance in case of a digitization project.

Document IS being of age does not imply there will be no developments anymore. The increasing value of information is one reason for future changes in document IS; the demand to standardize technical components to use them as standard building blocks or as Web services in applications is a second one; developments in semantics, so that computers will "understand" the information they handle is a third reason for future changes. The author does not contradict the opinion that the development in semantics is a bit further away.

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Document Theory

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Abstract

This entry provides an overview about the historical development of theoretical reflections on documents and formulation of document theories. Starting out with its Latin predecessor *documentum* and the use of the conception in the European state bureaucracy from the seventeenth century, the first interest for document theory was a professional one and can be observed at the beginning of the twentieth century, closely connected with names like Paul Otlet and Suzanne Briet. While the notion of document and documentation was well established around 1930, it was replaced by the notion of information after World War II, at least in the Anglophone community. Nevertheless, at the same time, a new kind of document theory was emerging, a critical one connected to names like Michel Foucault, Harold Garfinkel, and Dorothy E. Smith. While the “professional” document theory developed by Otlet and others was focused on the knowledge more or less inherent in the documents and to make documents *about* something, then the general document theory developed by critical social scientists such as Foucault is much more about what the documents *are* and *do*. Since the 1990s, there has been a growing interest in general in the notion of document and documentation as well as inside Library and Information Science (LIS). Together with a growing interest in digital documents, document theorists around the world are emphasizing the complexity in document theory and a need of a complementary approach to document theory connecting physical, social, and cultural dimensions in how documents are and do.

INTRODUCTION

An interest in a document approach within the Library and Information Science (LIS) has varied from time to time. Since the late 1980s, there seems to have been an increased emphasis on a document perspective in LIS as well as in society in general. The reasons may be very diverse, depending on the different contexts for using the notion of document.

If one begins tracing the use of the word *document* through history and making a kind of conceptual archeology, one will realize that *document* has been understood in many different ways throughout history. The word *document* and its Latin predecessor, *documentum*, was from its beginnings in antiquity not only something to be held in hand or a piece of written evidence. It was primarily related to teaching and instruction. In 1214, the Latin form *documentum* was registered as meaning example, model, lecture, teaching, and demonstration. The word *document* until the seventeenth century meant *primarily* “ce qui sert à instruire, enseignement, leçon” (something serving the act of instruction, teaching, and giving a lecture).^[1] An oral lecture or instruction could be a document and may indeed have been the norm and prototype of a document. This oral document tradition oriented toward educational purposes is almost forgotten today, and many would think of the legal conception of the document as being its original one dating back to antiquity. However, this conception is more related

to the emergence of the European state bureaucracy from the seventeenth century and onward. In France, it was first found in 1690 in the combination of “titres et documents.”^[1] It is defined as “écrit servant de preuve ou de renseignement”^[1] or “something written, inscribed, etc. which furnishes evidence or information upon any subject, as a manuscript, title-deed, tombstone, coin, picture, etc.”^[2] From the beginning of European modernity and enlightenment, a document is first and foremost a written object stating and proving transactions, agreements, and decisions made by citizens. It was an essential part of the creation of a public bureaucracy across and independent of local customs based on a “droit coutumier” contrary to “droit écrit,” laws and rules varying from place to place, being oral or gestural like handshaking agreements on a market place. Second, documents became a matter of proof, a question of whether the statements in the documents were true or not; the authenticity of the documents became crucial. Many court trials have been and are still dealing with exactly this issue. Third, the document is still an issue of “renseignement,” of delivering information partly drawing on the earlier educational concept of document. It is a piece of writing which tells you something. These three characteristics can be merged into one central phenomenon in the modern society: written, true knowledge. During the eighteenth century, an essential part of the development of modern bourgeois society and especially its public sphere was that the legitimacy of politics,

economy, the court, and science became increasingly dependent on one's ability to document one's rights and claims.

Following the legal tradition, in the late eighteenth century science began to be a question of empirical proof and thus “appuyer (une thèse) par des documents (1876).”^[1] During the nineteenth century, the noun *documentation*, created from the verb *to document*, became a key word in administration as well as in science. From now on, the quality of scientific work depended on the documentation that the researcher could present to his colleagues and the public. It was no longer enough to make a good narrative or to present good logical arguments without empirical evidence. Scientists as well as humanists, especially historians, from then on had to demonstrate true positive knowledge by either making controlled experiments or collecting documents which demonstrated that they had empirical proof as basis for their arguments. This created the perfect setting for the first explicit document theory to be articulated as part of what has been called the first documentation movement, first and foremost led by the Belgian lawyer Paul Otlet (1868–1944).

PROFESSIONAL INTEREST FOR DOCUMENT THEORY

About 100 years ago, around 1900, many European scholars worked together in creating environments and tools for international collaboration among scholars. Many scientific associations as well as international journals were founded. This created also an urgent need for tools by which to find work by colleagues, to locate the publications, and to use the collections of data, collected by scholars. This was the background for the work started by Henri La Fontaine, who within the Society for Social and Political Studies created the bibliographic section of the Society. Together with his younger colleague, Paul Otlet, in 1893, he opened the International Office of Sociological Bibliography. Very soon, in 1895, this was extended to be the International Institute of Bibliography (IIB), being the center for international cooperation able to create its catalog, *Repertoire Bibliographique Universel* (RBU), organized by an elaborated version of Dewey classification scheme resulting in the Universal decimal classification (UDC). All this was being done for practical reasons, in order to provide useful tools for scholars. Neither Otlet nor Fontaine were theoretical people. For Otlet, the main purpose was the organization of documentation on an increasingly comprehensive basis in an increasingly practical way in order to achieve for the intellectual worker the ideal of a “machine for exploring time and space.”^[3]

But in order to realize his ideal and improve the practical organization of documentation, he had to define what is meant by document. For that purpose, he needed a new science of bibliography:

The Science of Bibliography can be defined as that science whose object of study is all questions common to different kinds of documents: production, physical manufacture, distribution, inventory, statistics, preservation, and use of bibliographic documents; that is to say, everything which deals with editing, printing, publishing, book-selling, bibliography, and library economy. The scope of this science extends to all written or illustrated documents which are similar in nature to books: printed or manuscript literary works, books, brochures, journal articles, news reports, published or manuscript archives, maps, plans, charts, schemas, ideograms, diagrams, original or reproductions of drawings, and photographs of real objects.^[3]

Otlet developed a very broad concept of document while he also kept a bias toward printed texts, toward books. He always talked about “books and documents” as well as “bibliography and documentation.” He developed a document theory for libraries, not for social life in general. While the spoken word is the primary focus for linguists, it is the written sources which are of interest for Otlet and his fellows in IIB:

Today Documentation is understood to mean bringing into use all of the written or graphic sources of our knowledge as embodied in documents of every kind, though chiefly printed texts. [...] Knowledge and impressions would last for only a limited time without the help of graphic documents to capture and hold them fast because *memory* alone is insufficient for recollection.^[4]

Even if Otlet acknowledged oral communication as having some value, for him it is graphic documentation that ensures the memory of humanity. Otlet was also realistic about the inevitable diversity of documents:

Individual publications will continue to appear quite independently of each other. They will retain their characteristics of being separate, idiosyncratic, and poorly related to the whole body of knowledge itself.^[5]

But he was very optimistic about the possibilities for and advantages of a *Universal Book*. He strongly emphasized the technical possibilities of new media at the time for realizing the Universal Book as one large *hyper-book*. This book should be created by the so-called monographic principle. It was a question of isolating each *fact* by pulling apart all documents and make a card or sheet for each *fact* by cutting out the original documents and pasting the isolated fact-card into an order, creating a coherent cosmos out of the chaos of idiosyncratic documents. While this method of *codification* could be fatal in an analog environment, destroying the original document for ever, Otlet envisioned the possibilities for a digital *hyper-book*, in which you can cut and paste without destroying the original document. Otlet thought a great deal about how to solve this problem and was inspired by H.G. Wells' ideas about a World Brain.

Even if Otlet primarily was interested in the written documents, he was in principle open for other kinds of documents: not only images and sound recordings, but also natural objects, models, games, etc.^[6] In this way, he went beyond the graphic universe and the library model to the idea of Palais Mondial or Mundaneum as a kind of complete worldwide documentation including all kinds of documents, transgressing the traditions of libraries, archives, and museums.

While there were others besides Otlet who considered the theoretical issues regarding documents, like Walter Schürmeyer and Donker Duyvis, the most important person regarding theoretical discussions on documents is without any doubt Suzanne Briet (1894–1989), the French documentalist and author of many articles on documentation.

Like Otlet, Briet was also mostly engaged in practical documentation and not theoretical questions. At the same time, she was very conscious about what she was trying to accomplish. In order to promote her vision of a new professional field, she wrote a small pamphlet, a manifesto, in 1951, on the basic question: “Qu’est-ce que la documentation?” (What is documentation?), naturally including the question of what constitutes a document. She starts referring to a very general definition: “A document is a proof in support of a fact,”^[7] and to the “official” definition of the French Union of Documentation Organizations from 1935, “all bases of materially fixed knowledge, and capable of being used for consultation, study and proof.”^[8]

At the same time, Briet acknowledges that there may be some theoretical problems related to this pragmatic kind of definition of a document, saying:

This definition has often been countered by linguists and philosophers, who are, as they should be, infatuated with minutia and logic. Thanks to their analysis of the content of this idea, one can propose here a definition, which may be, at the present time, the most accurate, but is also the most abstract, and thus, the least accessible.^[8]

Unfortunately, Briet did not specify her sources and references in this discussion and analysis, but we may be able to identify some of the sources by reading her following proposal of definition:

any concrete or symbolic indexical sign [*indice*], preserved or recorded toward the ends of representing, of reconstituting, or of proving a physical or intellectual phenomenon.^[8]

It appears to be in accordance with the semiotics of Charles S. Peirce (1839–1914) and the theory of three basic kinds of signs: iconic, indexical, and symbolic signs.

From this, one may see why Briet claims that documents primarily are indexical signs compared to the quality of symbolic signs.

This is illustrated in her following paragraph:

Is a star a document? Is a pebble rolled by a torrent a document? Is a living animal a document? No. But the photographs and the catalogs of stars, the stones in a museum of mineralogy, and the animals that are cataloged and shown in a zoo are documents.^[8]

The major difference between the two kinds of objects is that the star and other objects named are concrete objects unconnected with any specific sign, while the photograph, catalog, etc. are specifically intended to represent something like stars, a special kind of mineral, or a special animal specimen such as a new kind of antelope, which Briet uses as an example of the relationship between document and the whole process of documentation. They are initial documents distinguished from what she calls secondary documents. She describes how new documents are created as derivatives or secondary documents, from the antelope considered as the initial document and being the basis for a whole complex of documents like catalogs, sound recordings, monographs about antelopes, articles for encyclopedia about antelopes, and so on, all together creating a new kind of culture for scientists, centers of documentation conducted by documentalists “performing the craft of documentation,” using a new cultural technique of documentation:

The proper job of documentation agencies is to produce secondary documents, derived from those initial documents that these agencies do not ordinarily create, but which they sometimes preserve. [...] We are now at the heart of the documentalists’ profession. These secondary documents are called translations, analyses, documentary bulletins, files, catalogs, bibliographies, dossiers, photographs, microfilms, selections, documentary summaries, encyclopedias, and finding aids.^[9]

Like Otlet, the document theory presented by Briet is a very specific theory on documents with the aim of promoting a new professional field defining the role of libraries as centers of documentation in a very proactive sense.

Both Otlet and Briet played a key role in the international community of documentation, and it was indeed international. It was the foundation for a movement across the continents making it possible to talk about “fifty years of documentation,” as Samuel Bradford did in 1948 working within the international organization of International Federation for Information and Documentation (FID). In 1924, The Association of Special Libraries and Information Bureaux (ASLIB) was created and they founded the *Journal of Documentation* (which is still running). In 1931, L’UFOD, Union française des organismes de documentation, was founded. In 1937, the American Documentation Institute came into existence with a journal, *American Documentation*, and a similar French comité of documentation was created. International cooperation has continued since then, but an important difference between the Anglo-American and francophone worlds began slowly, but

steadily to emerge due to two distinctive traditions for libraries in North America and continental Europe.

While the North American library tradition is focused on the user of the library trying to provide all relevant materials in the most convenient way for the user, the continental European, not least the French library tradition is much more a matter of preserving and taking care of the materials in the library, the documents, and keeping them in a secure distance from the user inside the walls of the libraries.^[10] In a paradoxical way, this difference may explain some part of the decision of the American Documentation Institute in 1968 to change its name into American Society for Information Science.^[11]

GENERAL SCIENTIFIC INTEREST FOR DOCUMENT THEORY

In the late 1960s and 1970s, professional document theory lost power, especially in the Anglophone world, in favor of information theory as the basis for the transformation of the sciences of documentation into information science. However at the same time, a new kind of document theory was emerging, a critical document theory. It was developed primarily within the critical and Marxist traditions of philosophy, sociology, and anthropology.

The French philosopher Michel Foucault states the following about documents in the introduction to the *Archeology of Knowledge*:

[...] ever since a discipline such as history has existed, documents have been used, questioned, and have given rise to questions; scholars have asked not only what these documents meant, but also whether they were telling the truth, [...] all this critical concern, pointed to one and the same end: the reconstitution, on the basis of what the documents say, and sometimes merely hint at, [...] the document was always treated as the language of a voice since reduced to silence, its fragile, but possibly decipherable trace.^[12]

From this case of the discipline of history, Foucault develops a general document theory turning the focus away from the assumed content or message of the document to the very material and active role of documents as bricks or parts in the construction of a historical totality. In his later book on the emergence of the prison, *Discipline and Punish: The Birth of the Prison*, he demonstrates how this document theory not only can be used in historical studies, but also as a critical analytical tool in relation to the modern society in general. This is a fundamental critique of the belief that a document contains a message in itself, as if a book is a document per se. It is only when a particular material thing such as a printed book becomes a part of a constructed totality, such as the literary world, that it becomes a document. When one compares this conception of document to the concept of a documentary

culture by Briet, there actually seems not to be a big difference between Foucault and Briet. However, one may argue that Foucault's critique of the assumption of an inherent content in documents challenges the belief of Otlet of the possibility of making a hyper-organization of knowledge with a lot of cards with facts.

It was not only Michel Foucault who understood documents as material building bricks in the social construction of the world. In the late 1960s and during the 1970s, American sociologists like Harold Garfinkel and Dorothy E. Smith developed similar theories about documentary practices and developed methods for studying these practices. These methodologies, the so-called ethnomethodology and documentary interpretation, were to a large degree based on the German sociologist Karl Mannheim, who formulated what he called "documentary or evidential meaning."^[13] The *documentary meaning* is the meaning the document reveals "unintentionally," which might be the meaning in a larger social context, or in other words, the documentary interpretation deals with the social role of the document which is not explicitly expressed in the document but nevertheless demonstrated by its place in the construction of a social world as a whole. Inspired by Garfinkel, Foucault, and others, the French sociologist Bruno Latour made similar studies of how scientific facts were constructed in the laboratory and has demonstrated this in several works, notably by the work together with Steve Woolgar from 1979. Latour and Woolgar made anthropological fieldwork in a scientific laboratory in California observing how *scientific facts* were constructed by making documents of different sorts, articles, monographs, diagrams, photos, etc. Since then a large field of science studies has emerged based on the same general document theory, stressing "[d]ocuments of various kinds come into play, but their connection with human agency varies according to the particular instance of interaction."^[14]

While the "professional" document theory developed by Otlet and others was focused on the knowledge more or less inherent in the documents and to make documents *about* something, then the general document theory developed by critical social scientists such as Foucault is much more about what the documents *are* and *do*.

This general approach to documents is followed by John Seely Brown and Paul Duguid in an essay from 1996. Here they presented a social theory of documents based on their own document oriented readings of a number of theorists in sociology, communication, and media studies.

They start out with questioning the "the widely held notion of the document as some sort of paper transport carrying preformed 'ideas' or 'information' through space and time" based on the "conduit" metaphor and belief of "information as 'in' books, files, or databases as if it could just as easily be 'out' of them." Brown and Duguid say:

As new technologies take us through major transformations in the way we use documents, it becomes

increasingly important to look beyond the conduit image. We need to see the way documents have served not simply to write, but also to underwrite social interactions; not simply to communicate, but also to coordinate social practices.^[15]

The research Brown and Duguid are using comprises works primarily by authors like Anselm Strauss, Benedict Anderson, Stanley Fish, and Bruno Latour. It is interesting to notice that apart from Latour, these scholars very little, if at all, use the notion of document in their writings. Brown and Duguid translate a number of related theories of social life into one theory of the role of documents in social life. These related theories are all characterized by an interest in how worlds, communities, and networks of humans and objects are created and constructed through shared documents.

Brown and Duguid develop a general document theory claiming that it is up to humans to discuss and decide if anything is a document. The Italian philosopher Maurizio Ferraris goes even further in his book on documentality,^[44,45] drawing on the works of Derrida and Foucault, presenting a whole document oriented philosophy, an ontology of documentality, claiming that the whole social world is based on documents and that there is nothing social outside texts or one may say documents. Ferraris says that social objects are made by acts of inscription, acts of registration. When you marry, it is being registered and people will know you are married. When you make a piece of art, it is registered either for yourself or for the public as a piece of art and you can look at it as art. Each certificate of marriage and each piece of art are characterized by an element of individuality (the names of the persons or the style) as well as by an element of regularity (standards and traditions).

DOCUMENT THEORY: A PART OF A MATERIALISTIC CRITIQUE OF LIS

One of the main arguments for leaving the documentation approach in the 1960s in the documentation/library field was that it was believed that when one got the computer, it was possible to go beyond physical barriers directly into cyberspace independent of time and place, having realized the Otletian dream of a world brain having everything in one place, in one format. In principle, this gives a possibility of focusing almost only on the user and his or her needs of information. It became a matter of formulating the information needs of the users, or in other words of observing how users thought, of getting a hold on their cognitive structures in order to match them with data structures in the computer.

While many definitions of document stress the physicality of the document, some might think that the document approach will become outdated when everything

becomes digital and gathered together into one big database. The reality is that the digital documents are no less physical than printed documents, but their type of physicality differs.

Following the historical approach, Michael Buckland has in a number of articles focused on the physical dimension, notably in the article "Information as thing" (1991). Buckland makes a distinction between "information-as-process," "information-as-knowledge," and "information-as-thing." Buckland believes that "information-as-thing," by whatever name, is of especial interest in relation to information systems because ultimately information systems, including 'expert systems' and information retrieval systems, can deal directly with information *only* in this sense.^[16] Buckland tells us that he deals with the ultimate condition for information, thingness, or material conditions for information. He wants to "clarify its meaning," "affirm the fundamental role of 'information-as-thing'" and by that "bringing theoretical order to the heterogeneous, ill-ordered fields associated with 'information science.'^[16] In this context, the notion of "document" is discussed as a possible concept for the "informative thing," being the core object for the whole field drawing very much on the contributions by Otlet and Briet.

In the classic article "What is a document" (1997), Buckland reviews a number of definitions of a document. Most authors, except for the Indian S.R. Ranganathan, are in fact in favor of a very broad definition of a document such as the general international definition from 1937: "Any source of information, in material form, capable of being used for reference or study or as an authority."^[17]

So one may ask whether the most important question is how far you can push the notion of document or whether it is the questions of the defining properties that may divide people. This brings us to another important issue, which Buckland brings up in his concluding comments:

One difference between the views of the documentalists discussed above and contemporary views is the emphasis that would now be placed on the social construction of meaning, on the viewer's perception of the significance and evidential character of documents.^[18]

This shifts the focus from being on the materiality of the document to a focus on the social and perceptual dimensions of a document, moving back to the semiotic tradition of "object-as-sign." After being told in the beginning that the materiality/physicality is the ultimate condition for dealing with information, it is surprising to read that one should not focus so much on the physical form but give more priority to the social function and how it is perceived by people in different social settings. According to Buckland, this must be seen in the light of the digital technology:

any distinctiveness of a document as a physical form is further diminished, and discussion of "What is a digital

document?” becomes even more problematic unless we remember the path of reasoning underlying the largely forgotten discussions of Otlet’s objects and Briet’s antelope.^[19]

This apparent paradox of where to put emphasis in document theory can be understood better when we see the work by Buckland not only as a materialistic critique of the dominating information paradigm in LIS, but also as part of several attempts to formulate one or more socially and culturally oriented alternatives in LIS since the early 1990s. In addition to Buckland, this has been dealt with by North American scholars like Ronald E. Day and Bernd Frohmann, and Scandinavian scholars like Birger Hjørland and Vesa Suominen.

Drawing on many general theories from philosophy, especially Benjamin, Foucault, Derrida, Deleuze, Peirce, etc. it has been a major theme for Ronald Day in several of his works to demonstrate the metaphysical character of the dominating information paradigm, which perceives the idea of information as something abstract, existing in our heads or in the air, and thus ignoring the objects, the “information-as-things” as the material basis for information. At the same time, Day has shown how the material qualities are dependent on their cultural and social conditions and cannot be separated from them. In this perspective, the notion of document and the works by Otlet and Briet become essential.

Bernd Frohmann started out in the early 1990s by making a number of critical inquiries on some of the dominant paradigms, in order to present the alternative paradigm of a materialist approach to documentary systems formerly known as information systems. Frohmann established this as his major field through several contributions.

Like Day, Frohmann draws on several larger theories not only to make a critique of the information paradigm, but also to present a paradigmatic alternative. In an article from 2000, Frohmann argues in favor of using the ideas of Foucault regarding materiality providing a possibility for studying what documents do in social life.^[20]

The most important contribution by Frohmann is his monograph from 2004, where he manages to present a full-scale paradigmatic alternative to the dominating LIS paradigms, based on a complex document theory. Frohmann defines documents as “different material kinds of temporally and spatially situated bundles of inscriptions embedded in specific kinds of cultural practices.”^[21] What interests Frohmann is how documents work in different situations, how they function as stabilizing factors in social communities, like the role of scientific journals in scientific communities. In this way, he follows the document theory developed by Foucault and other critical philosophers and social scientists like Garfinkel, Smith and so on as has been mentioned above.

A similar approach has been taken by a number of Scandinavian scholars. Birger Hjørland recommends that “the

object of study [changed] from mental phenomena of ideas, facts and opinion, to social phenomena of communication, documents and memory institutions.”^[22] Hjørland claims that the most important thing is that “the intrinsic natures of these objects are relatively irrelevant.”^[22] They only become documents once they are assigned an informative value by a collective or domain, as Hjørland has called the communities involved in the decision whether a thing becomes a document or not. Here we are told that documents are used as stabilizing means in our society, being “relatively stable forms of practice”^[23] creating a sociocultural document theory along the lines of the work by Ron Day, Vesa Suominen, and notably Bernd Frohmann.

The Danish scholar Jack Andersen attempts to develop a theory of the social organization of documents and knowledge in society, and it is the German social theorist, Jürgen Habermas, who functions as Andersen’s primary theoretical background, especially his work on the Public Sphere. The theory of the Public Sphere can be considered a social theory stressing the role of various communication media in the organization and transformation of modern societies, in the formation of public opinion and how it relates to the capitalist mode of production.^[24] This understanding enables Andersen to translate the theory of public sphere into a theory of the social organization of documents and knowledge in society. In this way, it creates the basis for saying:

What is crucial about this variety of document genres operating in society and state is that they organize the communicative activities of the various spheres and domains. The spheres generate documents in order to act within and in-between the particular spheres and are thus forming a communicative action.^[25]

Therefore, the theory of the social organization of documents in society as formulated by Andersen explains the need for and potential advantages of the diversity of documents, in contrast to Otlet’s interest in bringing all documents of the world into one format.

THEORIES ON DOCUMENTS IN A DIGITAL AGE

David Levy, who already in 1988 launched the idea of having a large program for document research, wrote in 2001 about how documents may make sense in a digital age. According to Levy, documents “are, quite simply, talking things. They are bits of the material world—clay, stone, animal skin, plant fiber, sand—that we’ve imbued with the ability to speak.”^[26] Levy relates this function to the theory by Bruno Latour on delegation of responsibility not only to other humans through networks, but also to inanimate objects.

After having presented a very broad definition of documents, David Levy wants to look more closely “at the

nature of digital documents” with the hope of sorting out what is new and what is not.^[27] He says: “Digital materials are made up of both the *digital representation* and the *perceptible forms* produced from it.”^[28]

As a result of all these threads of invention and adaption, a global infrastructure for the production, distribution, and consumption of digital documents is now emerging.^[29]

This leads to one of the important issues: “How to guarantee fixity and permanence?”

One may ask: What is meant by being the same, How do you identify the likeness of two documents? This is a theme that has attracted a number of scholars and which leads to a number of questions concerning the nature of a document. If you identify two documents as being alike, you must be able to define the criteria for them being the same. In the article “Towards identity conditions for digital documents,” Allen Renear and David Dubin deal exactly with this problem, wondering why so little has been done in document theory since it is crucial for dealing with digital documents.

As a result, not only is this critical concept under-theorized, but progress on a number of important problems—including preservation, conversion, integrity assurance, retrieval, federation, metadata, identifiers—has been hindered. The development of identity conditions for a particular kind of entity is not something separate from, let alone subsequent to, defining that entity, so we cannot *begin* our development of identity conditions with an explicit definition of what we mean by “document”. [...] By *document*, then, we refer to the abstract symbolic expression that may be physically instantiated repeatedly and in various media. This use corresponds more or less to the FRBR term “expression”^[17] and has the colloquial synonym “text.” Although now fairly common, this sense of “document” does compete with another well established and closely related use of the term [...] to the physical carrier with its instantiated inscription.^[5] Terminological choices in this area are difficult, but we believe our usage is consistent with common and emerging practice in publishing and information science.^[30]

They touch one of the core issues in document theory regarding competing use of the notion of a document as referring either to the physical instantiation or the abstract expression and one could add the understanding of a document as a sociocultural construction.

This theoretical challenge has been dealt with in one of the largest theoretical projects regarding document theory, the French network-based project, RTP-doc: Recherche thématique pluridisciplinaire (<http://rtp-doc.enssib.fr/>). It illustrates that the document approach has survived more prominently in the Francophone world, in contrast to the Anglophone world. The group consists of scholars from many different disciplines enabling an interdisciplinary project on document theory. It was decided to approach the concept of document from three angles: first,

a document as form, emphasizing the materiality of document. The second perspective was to see the document as a sign, focusing on the way the document may make sense, being meaningful, and being based on an intention. The third approach concerns how a document is a social object, depending on its position in a social context.^[31]

GENERAL INTEREST FOR DOCUMENT THEORY: A COMPLEMENTARY APPROACH TO DOCUMENT THEORY

In 1996, a program in documentation studies at the University of Tromsø, Norway was established on all levels from an undergraduate to Ph.D. program.

Before the program started, a committee of librarians and faculty members from different disciplines formulated the general conceptual framework for the program, at this point not knowing very much about Otlet or Briet. The main reason for choosing the name documentation studies was not based on a theoretical interest in making a new paradigm within LIS, but on a much more pragmatic and general political interest in relation to the establishment of a National Library in Norway in 1989 and at the same time the launching of a very broadly defined act of legal deposit in Norway, including documents of all kinds, printed matter, broadcast television, radio and movies, and last but not least including the new digital documents on the Web changing all the time! One may say that it made the Otletian ideal explicit and challenged the Norwegian Library system in two fundamental ways, regarding open and free access and preservation. One challenge was posed by the complicated copyrights connected to interests of users as well as producers of all the documents and the other challenge was no less than about the “intrinsic” nature of the documents, how to preserve the documents making them available at the right time for any user in all future.

This practical challenge called for a so-called complementary approach to document theory formulated by Niels Windfeld Lund.^[32,33] It is not a question of making a synthesis, but to view the document from three complementary angles, all together making a complete description. That means that the document does not partly carry one of these three features, but it is 100% a physical phenomenon, 100% a social phenomenon, and 100% a mental phenomenon. Any document is a physical object as well as a social and mental object. The core issue is how these dimensions are interacting with each other in different ways, depending on the physical, social, and mental environments in which documentation takes place, for example, health care, the arts, business, local as well as virtual subcultures, politics, and so on.^[34] Instead of a belief in making one format for documentation, document theorists today are focusing on the diversity of documents and studying the wide range of problems related to

processes of documentation and the resulting documents posed by concepts of “authorship,” “identity,” “intellectual property,” as well as by document retrieval, annotation, principles of preserving digital documents, multimedia documents, politics of documentation, and many more.^[31]

Since 2003, The Annual Meeting of the Document Academy, DOCAM,^[35] has been one of the main fora for the “neo-documentalist movement.”^[36] The Document Academy is an international organization discussing document theory as well as presenting a diversity of document-oriented studies in their annual meetings. One of the key discussions has been where and how far can you take and apply the document approach: does it cover orality,^[37,38] literature and movies,^[39,40] and museums^[41]?

Another recent tendency is that the notion of document is being used as concept and focus in other disciplines than Library and Information Science like anthropology,^[42] medical informatics/telemedicine,^[43] and philosophy.^[44]

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Document Type Definition (DTD)

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Abstract

Document Type Definitions (DTDs) are schemas that describe the structure and, to a limited extent, the content of XML and SGML documents. At its inception, the XML standard inherited the DTD from SGML as its only schema language. Many alternative schema languages have subsequently been developed for XML and are widely used in data-centric applications. But the DTD is still alive and actively used to define some narrative-based document types, particularly journal articles. This entry describes the basic syntax of the DTD and compares it to its two main rivals: W3C XML Schema and RELAX NG.

INTRODUCTION

Despite their names, Extensible Markup Language (XML) [ref XML entry] and its predecessor, Standard Generalized Markup Language (SGML) [ref Markup languages entry], are not languages *per se*. Rather, they are systems for creating customized markup languages. As XML is a subset of SGML, many of the comments made in this entry will be relevant to both. However, given that the SGML standard has now been largely superseded by XML, this entry will concentrate on XML. Some examples of XML languages of particular interest to the Library and Information Science community are listed in Table 5.

The set of rules that defines an XML or SGML language is called a schema. Schemata describe the structure and, to a varying extent, the content and semantics of documents that conform to specific languages. For example, a schema for XHTML 1.0 Strict, would, among other things, identify which elements and attributes are allowed or required in an XHTML 1.0 Strict document.

There are several common formats used to express schemata; such formats are referred to as schema languages. The schema language designed to express SGML schemata was the Document Type Definition (DTD). At its inception, the XML standard inherited the DTD as its only method of defining schemata. Many alternative methods have subsequently been developed for XML, the most influential of these being the W3C XML Schema Definition (XSD)^[1] and RELAX NG.^[2] These latter two schema languages are widely used in data-centric applications. However, despite its rivals, and continuous predictions of its demise, the DTD is still alive and actively used to define narrative-based document types, such as e-journal articles, prose, poetry, and archival finding aids, as is illustrated in Table 5.

This entry describes the basic syntax of the DTD and explains some of its more common features, such as elements, attributes, and entities. Methods of

associating DTDs with XML documents are mentioned, along with an explanation of the function of validating parsers. This is followed by a comparison of the DTD with its two main rivals: W3C XML Schema and RELAX NG. Sample XML languages that employ each of these schema languages are listed. They demonstrate how the DTD has been losing ground to its rivals but also that it is still an important schema definition format in some domains.

VALIDATING XML INSTANCES

XML documents are commonly referred to as XML instances. The software that reads and interprets these instances is called an XML parser. The parser may be contained within another piece of software, such as a browser or an editor, or it may exist independently. Parsers come in two main varieties: nonvalidating and validating. Nonvalidating parsers simply check whether XML instances are well formed, that is, whether they obey basic constraints such as including a document element (previously known as a root element) that contains all other elements [ref XML entry]. Validating parsers also check whether instances are valid, that is, whether they conform to the rules of a schema, for example, a DTD.

DTD SYNTAX

Fig. 1 illustrates an example of a well-formed XML instance, prefaced by the relevant DTD (within square brackets). This simple DTD comprises a series of element and attribute declarations. The first thing to notice is that a DTD is not written using XML document syntax; rather, it uses a distinctive syntax of its own.

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE catalogue [
<!--ELEMENT catalogue (entry)+>
<!--ELEMENT entry (authors , title , publisher? , isbn+ , notes* , related, location)>
<!--ATTLIST entry id ID #REQUIRED>
<!--ELEMENT authors (#PCDATA)>
<!--ELEMENT title (#PCDATA)>
<!--ELEMENT publisher (#PCDATA)>
<!--ELEMENT isbn (#PCDATA)>
<!--ATTLIST isbn version (isbn-10 | isbn-13) "isbn-10">
<!--ELEMENT notes (#PCDATA | reference)*>
<!--ELEMENT reference (#PCDATA)>
<!--ELEMENT related EMPTY>
<!--ATTLIST related related-ids IDREFS #IMPLIED>
<!--ELEMENT location (shelved-at | url)>
<!--ELEMENT shelved-at (#PCDATA)>
<!--ELEMENT url EMPTY>
<!--ATTLIST url href CDATA #REQUIRED>
]>
<catalogue>
  <entry id="X123">
    <authors> St.Laurent, Simon </authors>
    <title>Inside XML DTDs</title>
    <publisher>Osborne/McGraw-Hill,U.S.</publisher>
    <isbn version="isbn-13">978-0071346214</isbn>
    <notes>Includes bibliographical references
    <reference>(p.100-120)</reference> and
      <reference> index</reference>.
    </notes>
    <!-- These IDs are in other catalog entries-->
    <related related-ids="X345 X456 X567"/>
    <location>
      <url href="http://www.location.com"/>
    </location>
  </entry>
  ...
</catalogue>
```

Fig. 1 An XML instance of a simplified book catalogue entry plus DTD.

Elements

The basic structure of an element declaration is as follows:

```
<!--ELEMENT elementName (content model)-->
```

Note that reserved words, such as ELEMENT, must appear in upper case. The right-hand side of the element declaration, referred to as the content model, details what combinations of child elements and plain text (indicated by #PCDATA) are permitted to appear in the element in question and in what order they may appear.

Sequence within the content model is indicated by the comma. For example, in the following element declaration, the *authors* element is followed by *title*, which is followed by an optional *publisher* element, and so on:

```
<!--ELEMENT entry (authors, title, publisher?, isbn+, notes*, related, location)-->
```

The occurrence indicators +, ?, and *, listed in Table 1, define how many times an element (or a more complex pattern within parentheses) can be repeated. For example, an *entry* may include

- One optional *publisher*
- At least one *isbn*, but it can have any number
- Any number of *notes* or none at all.

Options are indicated by a vertical bar. For example, in the following element declaration, the *location* element may contain either the *shelved-at* or the *url* element, but not both.

```
<!--ELEMENT location (shelved-at | url)-->
```

Mixed Content

When an element can contain a mixture of plain text and child elements, the content is referred to as “mixed.” For example:

```
<!--ELEMENT notes (#PCDATA | reference)*-->
```

Table 1 Occurrence indicators.

Occurrence indicator	Meaning
?	Optional
+	Must appear one or more times
*	Can appear 0 or more times
(no indicator)	Must appear once

Here, the *notes* element may contain any number of *reference* elements interspersed with the plain text. In the sample instance, it contains two *reference* elements. The plain text comprises the words “Includes bibliographic references,” “and,” and a full stop.

SGML allowed a range of mixed content types. However, as part of a concerted effort to make the XML standard as simple as possible, there is only one form of mixed content allowed in XML. The basic structure is as follows:

```
<!ELEMENT elementName (#PCDATA | childElementA
| childElementB | ...) *>
```

Limitations of the Element Declaration

Some grammatical expressions are not easily expressible via a DTD. For example, number ranges and unordered content may require complex or inelegant element declarations, as illustrated by the following examples.

Indicating a number range

To define the *authors* element as having between one and five child elements called *name*:

```
<!ELEMENT authors (name, name?, name?,
name?, name?)>
```

Indicating unordered content

To imply that the child elements *authors*, *title*, and *publisher* must all appear in element *entry* but can appear in any order:

```
<!ELEMENT entry ((authors, title, pub-
lisher) |
(authors, publisher, title) |
(title, publisher, authors) |
(title, authors, publisher) |
(publisher, authors, title) |
(publisher, title, authors)) >
```

In the real world, this would probably be modeled as

```
<!ELEMENT (authors | title | publisher) +>
```

which allows the unordered nature of the content model to be validated. The numerical aspect (one of each and only one), however, would need to be enforced via an additional schema or programming language, such as Schematron.

Attributes

Attributes appear within element start tags and supply additional information, or metadata, about the element that is not part of normal document content. Since the inception of SGML, there has been heated discussion concerning when to use elements and when to use attributes. There are no fixed rules, but Ogbugi^[3] provides some useful guidelines.

Table 2 Attribute types.

Attribute type	Explanation of attribute value
CDATA	Character Data is plain text, that is, text that does not contain markup
Enumerated list of form (x y z)	One of a predefined set of values
ID	A unique identifier
IDREF	Reference to a unique identifier
IDREFS	List of references to unique identifiers
ENTITY	An entity
ENTITIES	A list of entities
NMTOKEN	A valid XML name
NMTOKENS	A list of valid XML names
NOTATION	The name of a notation

The general structure of a declaration for one attribute is as follows:

```
<!ATTLIST element-name attribute-name attribute-type
default-value>
```

One attribute declaration may be used to define any number of attributes relating to a single element. For example, if two attributes were to be defined for one element, the format would be

```
<!ATTLIST element-name attribute-name attribute-
type default-value attribute-name attribute-type default-
value>
```

Table 2 lists all of the allowable types of attribute. CDATA is probably the most commonly used attribute type; enumerated lists, ID, IDREF, and IDREFS are also common. Possible *default values* for attributes are listed in Table 3.

Examples

Attribute of type CDATA

In DTD:

```
<!ELEMENT url EMPTY>
<!ATTLIST url href CDATA #REQUIRED>
```

In instance:

```
<url href="http://www.location.com"/>
```

An empty element, indicated by the / at the end of the tag, has no content, thus no close tag. The sole function of an empty element is often to be the placeholder for an

Table 3 Attribute default value types.

Default-value	Explanation
Value	Attribute has specified default value
#REQUIRED	Attribute must always be included
#IMPLIED	Attribute is optional
#FIXED value	Attribute must always have specified value

attribute, as in this example. The `#REQUIRED` default value for attribute `href` indicates that this attribute is compulsory for the `url` element. There could be no sensible default value for `href` but the DTD author still wants to force the attribute to be present.

Attribute of type enumerated list

In DTD:

```
<!ATTLIST isbn version (isbn-10 | issb-13)
"isbn-10">
```

In instance:

```
<isbn version="isbn-13">978-0071346214
</isbn>
```

The attribute declaration indicates that the default value of attribute `version` is `isbn-10`. Defaults may be left out in the document instance. Thus,

```
<isbn>007134621X</isbn>
```

has the same meaning as

```
<isbn version="isbn-10"> 007134621X
</isbn>
```

Attributes of type ID and IDREFS

In DTD:

```
<!ATTLIST entry id ID #REQUIRED>
<!ATTLIST related related-ids IDREFS
#IMPLIED>
```

In instance:

```
<entry id="X123">
<related related-ids="X345 X456 X567"/>
```

Attribute type ID facilitates attribute values that are unique and nonrepeatable throughout an XML instance. In the example, each entry is given a unique identifier via the `id` attribute. It is common, but not compulsory, to use `id` as the name of an attribute of type ID.

The attribute `related-ids` lists the identifiers of all entries related to the current entry. The identifiers listed in an attribute of type IDREF or IDREFS must appear within the current instance. Thus, this instance would only be valid if the three entries, referenced by identifiers `X345`, `X456`, and `X567`, were listed in the same document as entry `X123`.

An entry may not have any related entries; thus, the use of the default value `#IMPLIED`. The latter implies that the inclusion of an attribute value in the document instance is optional.

Entities

The basic concept of an entity is simple: it is shorthand for a larger piece of text or an alias for some other form of data, for example, a special character. When an XML parser comes across a reference to an entity, the reference is replaced with what it represents. Entities can be divided

into two main groups: general entities, which provide short cuts for use within an XML instance, and parameter entities, which perform the same function for use within a DTD. An entity must be defined in the DTD before any reference is made to it. Because of this, it is good practice to place all entity declarations at the beginning of the DTD.

General entities

There are three types of general entity: internal parsed, external parsed, and external unparsed.

Internal parsed general entities: The data referenced by the entity is internal to the DTD. For example:

```
<!ENTITY rights "All rights reserved">
```

The inclusion of the entity reference `&rights`; in a document instance results in the text “All rights reserved” being placed in the text at that point when the instance is parsed.

External parsed general entities: The data referenced by the entity is in a file external to the DTD, as indicated by the reserved word, `SYSTEM`. For example:

```
<!ENTITY rights SYSTEM "rights.txt">
```

The inclusion of `&rights`; has a similar effect as in the previous example, but in this case, the contents of the file `rights.txt` is placed in the text.

External unparsed general entities: These entities enable the embedding of non-XML content in XML documents. For example, such an entity could be used to include a movie file in a document instance. Such entities are described as “unparsed” because the XML parser does not look at their contents.

Using general entities to represent special characters.

Unicode provides a unique number for each text character in most of the world’s writing systems. For example, the character `â` is represented by the number 226.

To include a Unicode character that cannot be typed directly via the keyboard, an internal parsed general entity reference may be used in the XML instance. For example, the character `â` may be represented by the entity reference `â`. Given that the latter refers to a specific character, it is described as a character entity reference. Assuming that a character set containing the glyph is available on the computer in question, this will result in the character `â` being placed in the text when the instance is parsed.

The general entity reference `â` does not need to be defined in the DTD because all XML processors are required to support Unicode. However, if, instead of this numeric reference, the use of a mnemonic character entity reference such as `â` is preferred, the latter should be defined in the DTD using an internal parsed general entity as follows:

```
<!ENTITY acirc "&#226;">
```

Table 4 Built-in general entities.

Built-in entity	Character represented
<	<
>	>
&	&
"	"
'	'

There are five mnemonic character entities that do not have to be declared in the DTD because they form part of the definition of XML. They are listed in Table 4.

Parameter entities

Parameter entities are similar to general entities but are for use in the DTD itself. As with general entities, parameter entities can be internal or external but, unlike general entities, they are always parsed. In the real world, complex DTDs are rarely presented as a simple list of element and attribute declarations as illustrated in Fig. 1. Rather, a combination of internal and external parameter entities are used to modularize the DTDs.

Internal parameter entities: These can be useful if an element or attribute content model is repeated regularly or if the model is complex. The following entity declaration is taken from the ANSI/NISO Z39.96-2012 JATS: Journal Article Tag Suite (JATS):^[4]

```
<!ENTITY % app-model "(%sec-model;,  
permissions?)">
```

This defines a parameter entity describing the content model for the appendix of a journal article. Note that the syntax for parameter entity declarations is the same as for general entities, with the addition of a % symbol after the reserved word ENTITY. The parameter entity *app-model* is subsequently used in the element declaration for the appendix. Again, the syntax for parameter entity references is similar to that for general entity references but includes % instead of &.

```
<!ELEMENT app %app-model;>
```

In this example, the value of the parameter entity itself includes a reference to another parameter entity: *%sec-model*. The use of nested parameter entity references is a common method of modularizing large DTDs.

External parameter entities: External parameter entities are also used to modularize DTDs. For example, the following declaration occurs near the beginning of the XHTML 1.0 DTD:

```
<!ENTITY % HTMLlat1 PUBLIC "-//W3C//  
ENTITIES Latin 1 for XHTML//EN"  
"xhtml-lat1.ent">
```

The keyword PUBLIC indicates that what follows is the formal public identifier for the entity. This identifier is followed by the name of the file containing the entity's

content, namely *xhtml-lat1.ent*. In the XHTML 1.0 DTD, this entity declaration is immediately followed by an invocation of the entity:

```
%HTMLlat1;
```

As a result, when the DTD is parsed, the contents of the file *xhtml-lat1.ent* are placed at this point within the DTD.

The file *xhtml-lat1.ent* contains declarations for several dozen mnemonic character entities, for example:

```
<!ENTITY Agrave "&#192;">  
<!ENTITY Aacute "&#193;">  
<!ENTITY Acirc "&#194;">  
<!ENTITY yen "&#165;">
```

Thus, by using the parameter entity, all the mnemonic character entities defined in file *xhtml-lat1.ent* are available for use within document instances. Incorporating external files of general entity declarations that define useful mnemonic character entities is a common use of parameter entities.

Readability

If the reader is familiar with basic DTD syntax, a well-written DTD can be relatively simple to interpret. Good human readability is one of the advantages that DTDs have over schema languages such as the W3C XML Schema and is one of the reasons why the DTD has not yet been superseded. It is therefore important to ensure that DTDs are as readable as possible, for example, by using meaningful element and attribute names and including a liberal number of comments. In fact, many DTDs contain far more comments than code. The syntax for comments is as follows:

```
<!-- Comments go here -->
```

Apart from listing entities before using them, there are no rules concerning the order of declarations in DTDs. However, authors should attempt to ensure that DTDs are clear and logical to human readers.

DOCUMENT TYPE DECLARATIONS

A DTD is associated with an XML instance via a Document Type Declaration (DOCTYPE). The latter is placed after the XML declaration at the beginning of the XML file, as illustrated in Fig. 1.

The most widely recognized DOCTYPEs are those related to HTML as they appear—or should appear—at the start of every HTML file. Because HTML5 is not an XML language and so not definable by a DTD, its DOCTYPE is very simple:

```
<!DOCTYPE html>
```

Table 5 Sample XML languages of particular interest to the Library and Information Science community.

Language	Original format	Definitive form	Other formats available	Comments	Website
NISO Journal Article Tag Suite (JATS)	DTD	DTD	XSD RELAX NG	Almost everyone is still using the DTD for production and publishing ^a	http://jats.nlm.nih.gov/
Text Encoding Initiative (TEI)	DTD	ODD (One Document Does it all)	Does ODD can be compiled into DTD XSD RELAX NG	DTD use gradually giving way to RELAX NG and XSD	http://www.tei-c.org/
Encoded Archival Description (EAD)	DTD	DTD	XSD Relax NG	Some migrated away from DTDs, but they are still widely used	http://www.loc.gov/ead/
CrossRef	DTD	XSD		Based on (The Making of America II, MOA2) DTD	http://www.crossref.org/
Metadata Encoding and Transmission Standard (METS)	XSD	XSD			http://www.loc.gov/standards/mets/
Metadata Object Description Schema (MODS)	XSD	XSD			http://www.loc.gov/standards/mods/
ETD-MS: Electronic Theses, and Dissertations Metadata Standard	XSD	XSD			http://www.ndltd.org/standards/metadata
Visual Resources Association (VRA) Core	XSD	XSD			http://www.loc.gov/standards/vracore/
Docbook	DTD	RELAX NG (with integrated Schematron rules)	DTD XSD		http://www.docbook.org/
OASIS Darwin Information Typing Architecture (DITA)	DTD	DTD	XSD RELAX NG		http://dita.xml.org/
XHTML 1.0	DTD	DTD	XSD RELAX NG	XHTML 2.0 abandoned at Working Draft stage in favor of HTML5	http://www.w3.org/TR/xhtml1

Key: XSD, W3C XML Schema.

^aSee http://www.niso.org/workrooms/sts/for_ongoing_efforts_at_standardization.


```
<?xml version="1.0"?>
<!DOCTYPE catalogue SYSTEM "http://www.catalogue.com/catalogue.dtd"
[
<!ENTITY Acirc "&#194;">
<!ENTITY Atilde "&#195;">
<!ENTITY Ccedil "&#199;">
]>
XML instance follows
```

Fig. 2 An XML instance with internal and external DTD subsets.

XHTML 1.0 Transitional, on the other hand, is an XML language and the structure of its DOCTYPE reflects this:

```
<!DOCTYPE html PUBLIC "-//W3C//DTD
XHTML 1.0 Transitional//EN"
"http://www.w3.org/TR/xhtml1/DTD/
xhtml1-transitional.dtd">
```

In this latter DOCTYPE, *html* is the DTD's document element, that is, the element that must contain all other elements in documents that conform to this DTD. The document element is followed by the keyword PUBLIC, then the formal public identifier, and, finally, a Uniform Resource Identifier locating the DTD. As can be seen, there are parallels between the structure of document type declarations and external parameter entities.

In this example, the DOCTYPE simply identifies the document element and provides information to identify and locate the relevant DTD. It is also possible for the DOCTYPE to include the DTD, or an *internal subset* of the DTD. In Fig. 1, the DTD is included within the DOCTYPE between square brackets. In Fig. 2, the main DTD, referred to as the *external subset*, is in file *catalogue.dtd* at <http://www.catalogue.com/>. An internal subset, comprising three mnemonic character entity declarations, is contained within the DOCTYPE. The declaration of mnemonic character entities is a common use of an internal subset within an XML file. As this method is recognized by all schema languages, this limited use of DTDs is often used in conjunction with other schema languages.

VALIDATING PARSERS

It is compulsory to include a DTD with every SGML instance. With XML, it is optional; many XML documents are not related to any form of schema. This is appropriate for some uses of XML, particularly one-off machine-to-machine communications that are not meant to be archived. But it is not appropriate for documents that require consistency of markup. In addition, it is important to note that DTDs often do more than provide validation rules for XML instances. They may also add to the document's information set, or *infoset*, that is, the information provided by the document. For example, they may define entity references or provide default values for attributes.

Parsers vary as to how they deal with internal and external DTD subsets. Although nonvalidating parsers do not check documents for validity, some do read the external subset of the DTD, process default attributes, and expand entities. And all conforming parsers should do this for internal subsets. When receiving a document from a third party, it is preferable to use a parser that performs all of these tasks. However, when authoring documents, it is prudent to assume that the receiving parser may not read the DTD. Thus, the DTD should not be used to add to the infoset.^[5]

ALTERNATIVE SCHEMA LANGUAGES

W3C XML Schema Language

SGML and the DTD were designed to enable the markup of document-centric applications: full-text documents such as technical manuals, journal articles, prose, poetry, and drama. They were not designed for data-centric documents. XML was intended to be a simplified web-enabled version of SGML. When XML became a W3C standard in 1998, the DTD was adopted as XML's only schema language.

However, it soon became clear that the most widespread use of XML would be in data-centric applications such as eCommerce and Web Services. And, for XML to achieve its full potential in such applications, a more data-centric method of describing document validity was required. In particular, finer control was needed over the validity of element content and, to a lesser extent, of attribute content.

So, in 2001, the W3C XML Schema language, commonly, if confusingly, known as XML Schema, became a W3C standard. One of the two main advantages of XML Schema is the powerful data typing facilities for element and attribute values. There are 40 two different types that can be assigned to an attribute or element, including integer, date, string, qualified name, positive integer, and so on. Users can also define their own types, for example, currencies, colors, phone numbers, and so on. The other main advantage of XML Schema over DTDs is the support for namespaces, which is a method for avoiding naming conflicts when more than one XML language is used in the same instance. Datatype declarations and namespaces were both added to DTDs as part of the

Document Schema Definition Languages (DSDL).^[6] However, no developer of XML software has ever showed an interest in implementing these aspects of DSDL.^[7]

The W3C XML Schema language has come in for criticism due to its verbosity and its lack of human readability. But, at this stage, it is well established and well supported by XML software. Further, the schemata of many data-centric applications are not primarily intended for human consumption but for machine-to-machine communication, thus human readability is not paramount. For such applications, software-generated graphical views of XML Schemas are generally sufficient for the end user.

RELAX NG

Whereas the use of XML Schemas is currently best practice for data-centric applications, best practice for narrative-centered applications is far less clear. The main contender, RELAX NG (which stands for REgular LAnguage for XML Next Generation and is pronounced “relaxing”) is widely regarded as technically superior to DTDs. It can do almost everything that DTDs can do (apart from defining entities and notations), almost everything that XML Schemas can do (apart from defining its own data types) and quite a few things that XML Schemas cannot do. What is more, RELAX NG schemas are easy to read, easy to write, and easy to extend. They can represent more powerful content models than can DTDs and, unlike the latter, they support namespaces.

However, RELAX NG has not yet displaced the DTD in some domains, for example, the publishing industry. This is due to a combination of reasons. Because RELAX NG is not a W3C standard, it has not received the same level of support as XML Schema. Tool support, although growing, is not yet adequate for some industries to consider its use. There is also the issue of legacy data and whether the advantages of RELAX NG constitute a good enough reason for a potentially costly migration.

Using More Than One Schema Language

The validation of XML documents is too diverse to rely on a single schema language across all domains. It is likely that the medium term future will see the use of a range of schema languages, particularly XML Schema, RELAX NG, DTDs, each potentially in combination with Schematron.^[8] Increasingly, applications do not rely on one document model to provide all the information necessary for validation. For example, DTDs may provide the tag set but additional rules about how these tags may be used is enforced via another schema language, such as Schematron, or via a traditional programming language

Table 6 Advantages of the DTD.

A simple, mature, robust, well-tested standard
An integral part of the XML recommendation, so wide tool support
Includes entity definition (not available in RELAX NG and XML Schema)
Supports widely used practices in industries such as publishing
Easy to author and maintain
Most appropriate for narrative documents, particularly those with considerable mixed content
Designed for human consumption; easy to read
Good support for validation of element and attribute structures
Easily modularized
Considerable legacy data exists

such as Perl, JavaScript, XSLT, Python, Java, C#, C++, or Ruby.

Table 5 lists some sample XML languages of particular interest to the Library and Information Science community, along with their normative, or definitive, schema form and any other schemas available. The trend of using one schema language to produce the normative version of a schema and then auto-generating other versions from it is likely to increase. For example, both JATS and Encoded Archival Description [ref EAD entry] are available in DTD, XML Schema, and RELAX NG versions. In both cases, the DTD is the normative form.

It is interesting to note that, although the DTD was the original schema language for many applications, the normative version is now often in an alternative schema language. For example, the master version of the Text Encoding Initiative (TEI) [ref TEI entry] is now in ODD (One Document Does it all) format. This may be compiled into schemas in DTD, W3C XML Schema, or RELAX NG format as required. Rahtz^[9] summarizes the position of the competing schemas in TEI (as of August 2014) as follows: “Periodically, the TEI Technical Council asks itself “do we need to maintain TEI DTDs any more? doesn’t everyone use RELAX NG or W3C Schema now?”. The answer is (usually) always “yes, we do, some people have DTD technology embedded in their workflow.”

Tables 6 and 7, respectively, summarize the advantages and disadvantages of DTDs.

Table 7 Disadvantages of the DTD.

Non-XML syntax
No data typing for element content
Limited data typing for attribute content
No <i>implemented</i> support for namespaces
No support for newer features of XML (i.e., constraining the number of element occurrences)
Some common grammatical expressions are not easily expressible

CONCLUSION

The DTD schema defines the structure and, to a limited extent, the content of conforming XML documents. At the turn of the twenty-first century, it appeared that DTDs would soon be obsolete, to be imminently superseded by W3C XML Schema and RELAX NG. However, this did not happen. The move away from DTDs has been significant, particularly for data-centric applications, where the W3C XML Schema language has all but won the day. But the move has not been universal. Although alternative schemas may now be made available for many document-centric XML applications, this does not mean that users are actually employing them. In the medium term, it is likely that DTDs will come to be regarded as a legacy technology in many domains. But, in some industries, the DTD will continue to be widely used for some time to come.

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Dublin Core Metadata Initiative (DCMI): A Personal History

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Abstract

This entry is a personal remembrance of the emergence and evolution of the Dublin Core Metadata Initiative from its inception in a 1994 invitational workshop to its current state as an international open standards community. It describes the context of resource description in the early days of the World Wide Web, and discusses both social and technical engineering brought to bear on its development. Notable in this development is the international character of the workshop and conference series, and the diverse spectrum of expertise from many countries that contributed to the effort. The Dublin Core began as a consensus-driven community that elaborated a set of resource description principles that served a broad spectrum of users and applications. The result has been an architecture for metadata that informs most Web-based resource description efforts. Equally important, the Dublin Core has become the leading community of expertise, practice, and discovery that continues to explore the borders between the ideal and the practical in the description of digital information assets.

IN THE BEGINNING

In 1994, Internet search engines were virtually unknown, “resource description” meant library catalogers in technical services departments, and the idea of harvesting and indexing billions of pages of electronic resources was too fantastic for most people to contemplate. Information assets, if they were cataloged at all, were described using a collection of library content and format standards known as MARC, and even the description of traditional paper resources was typically backlogged in overburdened cataloging departments.

Web-scale harvesting and indexing has long since carried the burden of open online search, but many electronic resources (e.g., images, services, or applications) have no suitable harvestable surrogates. Metadata—information about other information resources—is intended to fill this gap, providing explicit descriptions to support many administrative, commercial, and management needs. Governments use metadata to connect legislative mandates and citizens, and target services to those who need them. Electronic commerce requires metadata to match search queries with products. Publishers need metadata to create product catalogs and manage rights. Corporations use metadata to organize and integrate documentation, business processes, reporting requirements, and products. Thus, descriptive metadata remains a key aspect of resource management, on the open Web as well in organizational intranets. As the importance of images grows in online media, so too does the metadata that describes such images. Normally-sighted people need image metadata to search for images. For the visually impaired, an image without a description is worse than no image at all—an unfulfilled promise of inaccessible content.

As the Web exploded on our desktops, it was evident that MARC of electronic resources would be too complex and costly, and might not be suitable for many electronic resources in any case. Might there be a simpler alternative for describing Web assets that does not require the experience of expert catalogers?

That was the question posed over coffee between sessions at the Second International World Wide Web meeting in Chicago in October of 1994. Joseph Hardin, Yuri Rubinski, Eric Miller, Stuart Weibel, and Terry Noreault were bemoaning the fact that it was difficult to find a given item among the nearly 500,000 addressable resources on the World Wide Web (never mind how many single sites of that size there are now). Joseph Hardin was leader of the software development team at the National Center for Super Computer Applications (NCSA) that developed Mosaic, the first cross-platform Web browser. The late Yuri Rubinski founded SoftQuad, and is credited with popularizing SGML, the precursor to XML. Terry Noreault was then director of the OCLC (Online Computer Library Center) Office of Research, and Eric and I were colleagues in the Office of Research. Why not convene a group to look at the question systematically? Eric Miller and I spent the next few months organizing such a meeting, driven by the timeline of the next Web conference to be held the following April in Darmstadt, Germany.

THE OCLC–NCSA METADATA WORKSHOP

The OCLC and NCSA (the National Center for Super Computer Applications at the University of Illinois) cosponsored this first meeting. We invited people from

three general categories: content specialists, Internet technologists, and librarians (later we thought of these groups affectionately as the “freaks, the geeks, and the people with sensible shoes”). Fifty-two people attended that first two and a half day workshop in March of 1995. We started with the notion of “document-like object (DLOs)” on the Web—something familiar to give us a mental image without being too precise about what we might want to describe. This vagueness was comforting in our early, unbounded expectations, but sometimes confounded later efforts to bring description standards to bear in actual applications. We stopped talking much about *DLOs* and often struggled with the differences among Web resources and how they should be characterized to enhance their discoverability.

What we hoped to do was to characterize conventions for resource description—to give people (authors, Web site managers, content providers) a set of common descriptive metadata elements for describing electronic assets on the Web. We hoped that a relatively simple set of descriptors could be widely applied so the task of traversing silos of information would become easier on the Web than it has been in the physical world.

Dublin, Ohio, (OCLC’s headquarters, and location for the first workshop), gave us the name for the original set of 13 metadata elements—attributes of our document-like-objects that would help others locate and categorize them. We called this set of elements the “Dublin Core” or simply “DC” for short. Our objective, naïve in some respects, was to balance practicality and complexity, aiming for descriptions that untrained users might construct reliably, and which would make resources more findable. We created something that had some traction in the loose, fast-moving community of the early Web, something that attracted consensus from content specialists, Web technologists, and librarians. Bottom-up consensus building was, and remains, an essential attribute of what evolved into the Dublin Core Metadata Initiative (DCMI).

The name of the element set, in addition to reflecting its geographic patrimony, captures the notion that DC is a starting place (a core). It has always been an expectation that DC would be a kernel around which other metadata would grow. That first meeting generated basic principles that continue to guide DC development: Elements would be:

- Intrinsic (describe one thing)
- Extensible (modular, easily expanded)
- Syntax Independent (keep syntax and semantics separate)
- Optional (use only the elements you need)
- Repeatable (as many instances of a given attribute as appropriate)
- Modifiable (element “refinements” could be used to sharpen descriptions)

We wrote up the report,^[1] and published a synopsis in the first issue of *DLib Magazine*.^[2] Eric and I felt like we’d launched something of interest, but neither of us knew what to do next. We hoped a path would reveal itself, and in fact it did, in the person of Lorcan Dempsey, then leader of the United Kingdom Office of Library Networking (UKOLN) in Bath, United Kingdom.

THE WARWICK METADATA WORKSHOP^[3]

Lorcan suggested we might extend the reach of the original effort through a follow-on event in the United Kingdom. Thus did our one-off effort acquire a trajectory. The University of Warwick had a perfect conference venue for the sort of meeting we envisioned: good meeting rooms, all accommodations onsite, and a great bar that stayed open late.

Each of the early workshops had a tight-wire feel about it, a sense that what we were doing was fragile, and to emerge from a workshop without a major step forward would be fatal. The major result of the Warwick meeting was what came to be known as the “Warwick Framework,”^[4] a conceptual architecture for metadata that recognized the requirement for modular, extensible metadata. The ideas articulated in the Warwick Framework helped us decide what should be part of the Dublin Core and what might be borrowed from metadata element sets designed by others. The infrastructure scarcely existed to support deployment in those days, but the idea survived the intervening years of change, slowly morphing into what we today refer to as “application profiles”—hybrid schemas comprised of elements drawn from some number of metadata sets.^[5] These ideas hold up well in the current world of metadata, as long as the element sets can be declared within a common data model, a proviso that has been a sticking point for interoperability from the very beginning.

DC-3: OCLC–CNI WORKSHOP ON IMAGE DESCRIPTION^[6]

At this point in 1996, we still didn’t have a strong sense of where we were going. In fact the third “DC workshop” wasn’t chartered as such at all. It was co-sponsored by the Coalition for Networked Information (CNI), one of the last major efforts of Paul Evan Peters prior to his untimely death. Eric Miller did most of the organizational work, building on our experiences with the first two DC workshops. We didn’t announce it as part of the series, but the subtext of the meeting was basically: Can a simple DC element set be used effectively to describe images? The consensus of the group was yes, though there was a strong sense that the 13 elements needed to be augmented with two additions: “Rights” and “Description.” We declared,

somewhat belatedly, that this workshop was the third in the DC series.

The group felt fairly strongly that without the means to determine intellectual property rights (IPR) associated with an image, just finding it was inadequate. History tells us otherwise. The use of the “Rights” element remains marginal at best, largely because it is a difficult problem, with many infrastructural and legal dimensions that are not easily dealt with in a simple declarative metadata element. Nonetheless, it at least has provided for simple declarations about IPR, and a convenient hook for future deployment.

The “Description” element was brought into being because conferees felt that the “Subject” element did not encompass the notion of an image description sufficiently well, and that a separate element was necessary. One may argue such distinctions forever—I would probably resist this element more strongly today. It is easy enough to condense these two elements as “aboutness.” But DC was then, and continues, to be a consensus activity: a roughly-right solution that attracts usage is to be preferred over perfection that never arrives.

At this point it was clear we had a workshop series on our hands, and the acronym DCMI—Dublin Core Metadata Initiative—came into use. One memorable moment, which reinforced this sense of impact, came at a metadata interoperability workshop held near Bonn, Germany, late in 1996.^[7] I attended this small workshop to learn that a group in Osnabrück, Germany had launched a digital library effort that harvested metadata for mathematical preprints. Judith Plümer reported on work she and Roland Schwänzl had led using Dublin Core metadata. It was the first time I encountered people who had not been active in the DC effort, but had simply recognized it as something of use to them and deployed it. Roland later became an enthusiastic DCMI contributor until his death in 2004.

DC-4: SURFACING DOWN UNDER^[8]

We certainly thought of ourselves as working on a problem of international scope, and we wanted the venues of the workshop series to reflect that. Australia was actively shaping a government metadata standard based on Dublin Core. Renato Iannella, then of the Distributed Systems Technology Centre in Brisbane, Australia and Warwick Cathro, of the National Library of Australia in Canberra, had attended the Warwick Workshop (DC-2, if you will), and were enthusiastic about broadening the geographic scope of the effort. The National Library of Australia offered to host the meeting. We wondered how we could manage to get people (especially public sector people, who rarely benefit from international travel support) to attend. Australia is a long way from both Europe and the Americas. But it is the “World-Wide Web,” not the U.S. Web or the European Web, and we felt it was important to

reflect that global perspective in our efforts. This approach remains central to choosing locations for DC conferences, rotating venues among Europe, the Americas, and Asia.

We enlisted the support of the National Science Foundation, attracting small amounts of funding that we shared with applicants to help make their trips look (financially) more like domestic travel. No one got a free ride, but rather these funds helped to keep travel costs manageable. “DC-Down Under” helped consolidate the work that we’d done to date, and resulted, in part, in the first adoption of DC as a national information standard. This precedent continues today—adoption and localization. Australia was then, and continues to be, an important locale for the advancement of information description standards, and their hosting of DC-4 was a convincing testament to the international character of the effort.

Discussions at DC-4 raised the specter of “creeping elegance” within the community. We all want simple... but exactly the right degree of simple. The functional requirements differ from application to application and domain to domain. For the first time we tried to instantiate notions articulated in the Warwick Framework—modular and extensible metadata. The so-called “Canberra qualifiers” emerged—a first attempt to provide the extensibility that developers wanted to meet the local requirements in their applications. One may cavil about complexity and simplicity, and where the right balance lies, but that balance point is found in applications rather than theory.

Thus were element refinements born. We agreed that the basic fifteen “buckets” could be refined in order to sharpen the description. A date might be a date of publication, a date of copyright, a date of availability, or something else. It is permissible to refine or qualify the basic date field so as to make explicit the character of the instance.

But what if people use different refinements? The “dumb-down principle” emerged as (an unfortunately named) rule of thumb, decreeing that applications that lacked knowledge of a given refinement could simply ignore them. Some information may be lost, but the user will be no worse off than having had unrefined elements in the first place.

The “one to one principle” emerged in Canberra as well: in Erik Jul’s paraphrase of Ranganathan: “to each resource, its [own] description.” Why is this not obvious? Once again, the tension between alluring simplicity and tempting complexity arises. In the ideal world, all descriptions should be as discrete as their referents. “Stuart Weibel” is the author of this history, but his email address has nothing more than an accidental relationship to it. Still, I might want to have it in the document. Is it metadata? About what? Certainly not the document, though readers may find it handy to have it. It is metadata (contact information) pertaining to a “person,” not an “information asset.” “One to one,” then, is a many-headed-snake, and it has bitten us often over the years.

There was one other advance at DC-4: the workshop T-shirt. Lynn Marko, of the University of Michigan, arrived with her husband, Ken, then of Ford Motor Company. Unfortunately, Ken's luggage didn't make it. We gave him a couple of T-shirts to tide him over. Ken repaid the kindness many times, sponsoring several future workshop T-shirts.

DATA MODELS: WHENCE THE DEVIL RESIDES

While it is useful to recount DCMI history in the rhythm of its annual workshops, a good deal of activity took place outside as well. Workshops begat working groups, tasked with specific objectives, and laden with sunset provisions (working groups were chartered with specific objectives and expired at the following conference). Among the most difficult of objectives was the evolution of a data model for the Dublin Core. No experience of my professional life has been as contentious as these meetings. They were so singularly disruptive that we changed the names of the working groups to protect the guilty and innocent alike. Initially we had a Data Model group, and later an Architecture group, and the name of the outcome evolved from data model to abstract model. (More on this topic follows).

The early DC workshops were about broad consensus, and they were fiery experiences. Those early "bun fights" revealed a pattern of rising expectations, followed by a rapid slide into a trough of contentious argumentation before we "bounced" to find a plateau of consensus that moved us forward. In Canberra we had to push beyond the surface of simple descriptive metadata to the rather more complicated underpinnings necessary to achieve interoperable metadata systems. This realization paralleled similar recognition elsewhere in the Web. Protocols were evolving, new standards, both formal and informal, were emerging. DC at this stage was far from a standard, but certainly there was recognition that it needed to be if it were to take root.

Somewhere in this interval, Bill Arms, then of the Coalition for National Research Initiatives (CNRI), arranged a meeting that would help jumpstart the formulation of the Resource Description Framework (RDF) working group at the World Wide Web Consortium (W3C). Political pressure to support filtering of content so as to avoid the inadvertent exposure of minors to pornography had led to something called PICS (Platform for Internet Content Selection). PICS was a bit of *ad hocery* born of expedience without great forethought, and did little but provide a sense that someone was at least working on the problem. Recognizing that PICS was a rather-too-specialized solution, W3C folks had it in mind to generalize it as a platform for formalized semantics—metadata. Tim Berners-Lee is credited with originating the notion of the Semantic Web, and RDF would become a key enabling technology to support it.

Jim Miller, then of the W3C, Dan Connolly, also and still of the W3C, Bill Arms, and myself met to discuss the idea of an open community working group to address the issue. I was there largely as a prospective consumer of the results (that is, as leader of a community that could both use such a technology and provide practical functional requirements). Thus began DCMI's tightly coupled relationship to the beginnings of the Semantic Web. Key DCMI participants have been intimately involved in Semantic Web activities in the W3C and the wider community since that time. Indeed, my colleague at OCLC, Eric Miller, would eventually move to the W3C and become the Semantic Web Lead.

THE UNFINISHED CACOPHONY: DC-5—HELSINKI AND THE FINNISH FINISH^[9]

Early DC workshops were hosted by the players: the organizations and people with a stake in the effort. Juha Hakala of the National Library of Finland stepped to the line for DC-5, hosting the meeting in Helsinki. We stayed in a wonderful hotel on the waterfront, within easy striking distance of the herring boats and an urban architecture evocative of Tolstoy.

Resource Description Framework (RDF) was a hot topic in Helsinki, held high by some participants as the answer to the infrastructure impediments holding back metadata applications. Others grumbled, eyes narrowed with skepticism, concerned that RDF was immature and over-hyped. But everyone was eager to find solutions, and knots of conferees could be found huddled over laptops in the lobby at 2 A.M or with laptops open on restaurant tables sorting through problems of syntax and semantics. The stamina, good will, and collective work done at these workshops remain for me the epitome of professional dedication, as well as foundations of lifelong friendships.

As for elements and refinements, our slogan was the "Finnish finish. . ." the equivalent of the "Mission Accomplished" banner on the aircraft carrier of metadata. While it is true that no elements have been added since DC-2, and a number of element qualifiers were in use, there were yet plenty of arguments to be heard.

Among the DC geezers, people still talk of the tar ice cream served at the conference dinner in Helsinki. . . a crystalline, ice-white concoction that, paradoxically, evoked tar and freshness at once. The flavor of pine tar and peppered strawberries defines my memory of this great northern city. The T-shirt was great, too. . . we had a Dublin Core World Tour T-shirt with the element set in three languages on one side, and the stops and dates of the global tour on the other. The listing embodied at least three variant syntaxes for dates, and some of us imagined mischievous intent in Juha's grin. T-shirts, and now, too, a song. The workshop came to a close with a group sing-along, a characterization of workshop achievements

superior in brevity and eloquence to the workshop report. I confess having been taken somewhat aback at this development. At a followup meeting soon after, I asked Roland Schwänzl, our German Mathematician-cum-metadata wonk. . . “Is this sort of thing common in Europe. . . a song of summary after a workshop?” Roland seemed surprised at my question. . . “Ja Ja!”

GROWING PAINS AND CONSOLIDATION: DC-6 (DC:DC)^[10]

Our premature declaration of success from Helsinki was not long un-tattered. The DC Tour traveled next to the Library of Congress in Washington, D.C. The meeting included representatives of the INDECS project (a metadata activity focused on rights declarations), who felt we’d gotten a few things wrong. Of course, we had. The tension between INDECS and DC is classically a top-down/bottom-up conflict. DC evolved by consensus and the judgment of practitioners, INDECS by deductive inference. Each model has strengths, and each has weaknesses. To quote Marshall Rose:

The distance between theory and practice is always smaller in theory, than in practice.

We had hopes of finding the means to bring the two efforts closer together, and I think both activities would have benefited. DC and INDECS supporters collaborated on a paper in an effort to promote this convergence,^[11] but in the long run our differences were too great. One proposal motivated in part by this hope of consolidation, and in part by an ongoing recognition that simplification of the set would be a benefit in the long run, became known as the “secret agent proposal.” The notion of consolidating Publisher, Contributor, and Creator into a single element (“Agent,” or “Names” perhaps) was floated quietly among some DC participants. The idea never got to the point of serious open consideration, as there was strong opposition based on breaking legacy applications. This was perhaps the first time we were aware that DC *was* a legacy system. We weren’t engaging in an intellectual exercise in resource description: people cared, and systems depended on stability. The outcome of this attempt at reconciliation was almost certainly impaired as well by a sense of hostile intent between the two camps. This was, I believe, an unfortunate interpretation of the very natural inclination to cling to one’s own ideas. The clarity of hindsight leaves me with regret that we did not accomplish this simplification of model and application.

In this same vein, the RDF proponents lobbied hard to make this syntax the preferred encoding of DC metadata instances. There was strong pushback by others, who judged that simpler encodings (embedded HTML meta-tags for example) were being deprecated in favor of what

they judged to be an over-elaborated and unproven technology that mere mortals found hard to grasp. The practitioners reined in the wild-eyed theoreticians with a “Now just hold on!” Those of us who believed in the value of RDF (I count myself among them) had to acknowledge that we weren’t marching inexorably toward a single, coherent deployment strategy, but that various paths would persist, progressing at their own speeds, indefinitely. DCMI needed to support each of these paths. It still does.

Hindsight may be 20/20 vision, but I am still blind on this one. On the one hand, a single deployment path would have greatly simplified the onerous task of syntax support, and consolidated more effort around reference code. This would have been helpful (still would be, for all that). On the other hand, the Web teaches us that technology deployment in the early twenty-first century is riverine and decentralized. Attempts to channel and coerce are rarely successful. As I write this, nearly a decade later, RDF struggles on, seemingly gaining momentum, but the tools and techniques we expected to catch fire have mostly smoldered. Timing is everything, and we may have been ahead of the curve, or perhaps off in the weeds. The last chapters are yet unwritten.

The conference dinner for DC:DC was held in what was once the library for the Smithsonian Institution—a large and lovely hall in the Smithsonian’s “castle,” its first building. On the way into the dinner, there were Buddhist monks engaged in the composition of a sand Mandela. These meticulously wrought sand paintings take many hours on the part of several monks, and at the end, the visual esthetic, created as an act of prayer, is swept away. Standards creation is a bit like this, a kind of hopefulness that is inevitably short lived, but may nonetheless result in an abstraction of intent that reverberates in many ways through its practitioners and community.

That dinner was a great one, and fomented another workshop sing-along. I do not know all the details of its genesis, but I am given to understand that Diann Rusch-Feja and Godfrey Rust of the INDECS project were co-conspirators. The lyrics, sung to the tune of “Both Sides Now,” were, as in Helsinki, a far more succinct summary of the workshop than any reports could have captured. I hope someone still has the lyrics.

THE BIG VOTE

The instability of consensus regarding qualifiers led to a formal voting procedure in 2000 that marked an inflection point for DCMI, creating for the first time a structured (if yet messy) procedure for decision-making. We subsequently borrowed governance methods where we could find them—the Internet Engineering Task Force (IETF), MARBI (the community that looks after the MARC standards), the W3C, and others. From these, we crafted

procedures to make evident a commitment to open, public processes to manage the element sets in our care.

The DC Advisory Committee, made up of working group chairs and invited experts, agreed to vote on proposed qualifiers. The results of this vote comprised the first formal approval of terms beyond the basic 15, and what we learned in the process informed the next stage of formal procedures, which remain largely intact today. This vote, contentious though it was in certain respects, marks the maturing of the Dublin Core from a group of metadata enthusiasts to a formal standards community. The character of the meetings changed at about this time as well, evolving away from contentious passions to a more business-like collegiality.

DC-7 FRANKFURT

Die Deutsche Bibliothek hosted the next workshop in their splendid facility in Frankfurt, Germany in 1999. The tenor and scope of the workshops evolved towards a stronger educational and informational tone, leaving behind us the sense of “we’ll-die-if-we-fail” and strengthening the recognition that DC had a strong foothold that wasn’t going to evaporate. There were, of course, myriad details of contention and ambiguity that required attention. But the approach was workman-like and deliberate, with a confidence born of more stable ground beneath our feet.

DC-8, OTTAWA, AND LOM^[12]

The following year we returned to North America for DC-8 at the National Library of Canada in Ottawa. One of the important developments that emerged at this meeting was a closer alignment between the Learning Object Metadata (LOM) community and the DC community. LOM embraces both descriptive metadata for resources, based on Dublin Core semantics, as well as a variety of other classes of metadata intended to support management and use of educational resources.

Unfortunately, the two initiatives evolved in different directions structurally, a problem that plagues the technical implementation of metadata to this day. In Ottawa, DCMI and LOM agreed on a Memorandum of Understanding that has helped to guide a slow process of convergence. One of the deliverables of that agreement remains an important articulation of common principles that should be useful to many communities: “Metadata Principles and Practicalities,” co-a by principals of both initiatives.^[13]

The enduring lesson of the long history between DCMI and LOM is that without a common underlying data model, sharing metadata becomes difficult, imprecise, and (perhaps most crippling) expensive. I’ve drawn

an analogy elsewhere to the incompatibilities between railway gages.^[14] Different underlying rail gages force the unpacking and reloading of cargo, whether bales of cotton or metadata. The lack of a common underlying metadata model remains, in my estimation, a major impediment to broad cross-disciplinary metadata interoperability.

DCMI COMES OF AGE

In 2001, the DCMI community transitioned from workshops to conferences. In addition to the working group meetings, we offered a tutorial track and a refereed conference paper track. The National Institute for Information (NII) in Tokyo hosted the meeting in their beautiful facility a short walk from the Imperial Palace. We marked this transition in the names of the conferences, using years to distinguish them. The transition from a standards creation activity to a standards maintenance activity was taking place as well, and much more of the effort involved sharing of practice, through tutorials, plenary lectures, conference papers, and poster sessions. The locations of the conferences, listed in Table 1, are testament to the ongoing commitment of DCMI to its international foundations.

Behind the public face of the Initiative, much work was still underway to strengthen the procedures necessary to support an evolving standard. We reorganized the structure and procedures of the initiative, to include:

- A Board of Trustees: distinguished representatives of sectors and regions with experience and commitment to the advancement of the Dublin Core, and metadata in general.
- The DCMI Directorate: administrative staff to manage the activities of the Initiative.
- A Usage Board: recognized experts in the field who would review and guide proposed additions or changes in the standard.
- An Affiliate Program: Institutional sponsors for DCMI in various countries around the world to promote and support DCMI activities.
- An Advisory Board: (successor to the original Advisory Committee) Working group chairs that have been involved in the evolution of DCMI and other invited experts who provide consultation and advice.

Table 1 The Dublin core conference series.

DC-2001	Tokyo, Japan
DC-2002	Florence, Italy
DC-2003	Seattle, WA, United States
DC-2004	Shanghai, China
DC-2005	Madrid, Spain
DC-2006	Colima, Mexico
DC-2007	Singapore
DC-2008	Berlin, Germany

Building an organizational structure for the initiative also exposed issues of ownership and sponsorship. OCLC generously paid most of DCMI's bills for more than the first decade of its evolution, but certainly never owned or directed its development. OCLC's role as host was a side effect of the organizational involvement of myself and Eric Miller and the willingness of OCLC management to support our efforts. Subsequently, the formal link between OCLC and DCMI has been (amicably) severed, DCMI having been established as a limited liability company under the auspices of the National Library of Singapore; DCMI's formal organizational structure now reflects what was always operationally true—a genuine operational independence befitting a community-based initiative.

As the need for managerial capacity evolved, Makx Dekkers and Tom Baker were enlisted as members of the DCMI Directorate. Tom had been an active contributor to DC since the second workshop, and has authored many papers and DCMI documents that are milestones of DC development. His knowledge of languages and linguistics have been particularly valuable. I have been privileged to have shared with him many wonderful brainstorming sessions about metadata. Two particularly memorable experiences—developing notions of metadata grammar atop a sunlit tower in Lucca, overlooking the Tuscan hills, and a middle of the night Japanese “onsen” (hot springs bath)—rank among the most pleasurable of work experiences. Makx, also a long time DC participant, brought to the initiative strong project managerial skills and experiences in the European standards world.

My own role in the Dublin Core began to decline during this period. Start-up and sustenance require different skill sets. Separating from guidance and management of DCMI was both difficult and right (for the Initiative and for myself). But surely surviving its founders is an important measure of success for any organization!

STANDARDIZATION STRATEGIES

For most countries and many large organizations, information management practices must be built around formal standards. Our approach was to transition DC from simpler to more formal efforts. We started with an IETF RFC (request for comments). The IETF route had two advantages: many of our anticipated adopters came from the Internet culture, and establishing an RFC was relatively simple. An informational RFC is little more than a public declaration of an approach, useful for informing others of what has been done and why it is the right thing to do. It requires a minimum of external review or persuasion. Publication of RFC 2413 in 1998^[15] constituted the initial stake in the ground for standardization of DC metadata (this RFC was updated as RFC 5013 in 2007^[16]).

Subsequently DCMI embarked upon standardization in the National Information Standards Organization (NISO)

in the United States. NISO approval was seen as a step to international standardization in ISO, as NISO is a U.S. organizational member of ISO. NISO standardization proved challenging, both because DCMI encountered political opposition in various quarters, and because we were the initial use case for a “fast-track” approval process intended to reduce the latency of standardization activities in a rapidly changing Web environment. Pat Harris, then director of NISO, skillfully negotiated the minefields, and helped DCMI achieve this important imprimatur, and DC metadata was standardized as ANSI/NISO Z39.85 in 2001. Once DC metadata became a NISO standard, ratification as ISO 15836 followed relatively easily.

THE DCMI ABSTRACT MODEL AND INTEROPERABILITY

As alluded to earlier, data modeling has from the start been problematic for DCMI. In pre-Web days, it was less important to have a formal model for metadata. MARC standards, for example, have never benefited from an underlying data model, and yet have enjoyed wide adoption and usefulness. As infrastructural boundaries between domains have dissolved in the universal solvent of Web protocols, the need for agreements about syntax and structure increased. While humans readily distinguish nuances of meaning and structure, machines do not.

The formal emergence of a data model for DC took a decade. The final breakthrough was spearheaded by Andy Powell and Mikael Nilsson, following on Tom Baker's exposition of DC grammar^[17] (and a decade of vociferous argumentation from many quarters). The DCMI Abstract Model (DCAM)^[18] abstracts the basic metadata entities used in DC metadata and specifies their expression in RDF.

Sharing metadata requires agreements on a variety of levels. Some of the salient issues:

- What is the meaning conveyed in metadata assertions? Meaning, of course, resides in the minds of people, not machines. The focus of the Dublin Core was initially on promoting common meanings and making them sharable on the Web.
- How are metadata assertions packed so that one machine can send them to another without changing their meaning?
- How can metadata be structured so as to assure consistent and unambiguous interpretation? Reliable syntax encoding requires consistent data structures. The sorts of things that must be specified in a well-structured metadata assertion include:
 - The boundaries of a set of assertions (what constitutes a record)
 - Cardinality: can an element be repeated, and if so, is there a limit on the number of repetitions?

- How is a name structured? What is the delimiter separating elements of a compound name (“Prince” and “Bono” excepted, most names are compound structures, many with surprising and confounding complexity).
- At what granularity are descriptions associated with resources? How is nesting managed for hierarchical resources?
- How are dates encoded? YYYY-MM-DD? DD-MM-YYYY? MM-DD-YYYY?
- How does one identify an encoding scheme that specifies the above question?
- How are character encodings declared?
- How does one identify a value-encoding scheme (e.g., LCSH, MeSH, Dewey...) from which metadata values can be chosen? Are such schemes required or optional?
- Are metadata values specified by reference (URI) or by value (literal strings)?

It is in these details that the success or failure of interoperability is written; understanding and declaration of these details remains incomplete.

Current thinking among DCMI metadata architects suggests it is useful to distinguish four levels of interoperability, each characterized by a set of choices, costs, and benefits:^[19]

Level 1: Informal interoperability: A vocabulary of concepts expressed in natural languages that support sharing of meaning among people. Metadata terms can be described as informally interoperable with Dublin Core if their natural language representations can be mapped to the 15 legacy DC elements. There is no requirement for DCAM conformance, and values for metadata are expressed as human-readable strings. Prospects for machine-to-machine interoperability at this level are low.

Level 2: Semantic interoperability: Metadata that can be accurately and completely expressed using RDF formalisms, but which is not conformant with additional structures elaborated in the DCAM.

Level 3: Syntactic interoperability based on the DCMI abstract model: RDF-compatible metadata that conforms to all elements of the DCAM (in particular, “bounded descriptions”—a collection of metadata assertions bound together and identified as what is thought of as a “record” in traditional bibliographic practice).

Level 4: Singapore Framework Interoperability: Conformance to a complete specification of functional requirements, a domain model, and description set profile.^[20]

Levels 1 and 2 roughly define the divide between human-sharable and machine-processable metadata strategies of

the first decade of DC’s existence. Level 3 promises a higher level of interoperability through conformance to abstract metadata structures that are defined in the DCAM (in particular, bounded records which can be identified using URIs). The benefits of these additional structures accrue to managing and validating metadata collections.

If Level 4 seems vague, it is perhaps a reflection of yet-poorly understood requirements for bringing together large aggregations of heterogeneously managed metadata collections. This remains an area of active exploration.

At this writing, metadata modeling experts do not agree on the finality of the DCAM, or its general usefulness for all metadata. It is currently the closest approximation of a generalized data model for metadata in a Web environment, and is one of the most important contributions of the Dublin Core to the larger metadata community, the result of many years of grappling with a difficult problem.

SUMMARY

The protocols and standards that underpin our digital lives are, in the long term, as ephemeral as the sand mandalas of the monks. The understanding that emerges from their creation, however, is part of a more persistent trajectory. The Dublin Core marks its 15th year in 2009, arising and co-evolving with the Web itself. The conference series remains the preeminent venue for defining and deploying structured description on the Web. Its practitioners are found in 50 or more countries, and its descriptions are quietly at work in applications that serve literally billions of people over a range of domains that includes the latest media formats, government publications, scientific data, Internet syndication feeds, image collections, and many more.

The architecture and details of DCMI metadata have evolved over its lifetime. Its practitioners have labored together in meetings in 30 countries or more. Notable venues for DC events include the rolling hills of Kataminga, outside Melbourne, Australia (the first DC-Education meeting), the magnificent National Museum of Art in Canada (DC-8 conference dinner, Ottawa), the splendid conference hall in the National Institute for Information in Tokyo (DC-2001), the Shanghai Library (DC-2004) and perhaps most spectacular of all, the Hall of the 500 in the Palazzo Vecchio in Florence (DC-2002 conference dinner). The privilege of working and socializing in such places (and so many others, too numerous to mention), have left rich imprints on participants and the work alike.

The principles and practices elaborated in DCMI reverberate throughout the metadata community and provide a useful framework for metadata now and into the future. That this is so is a credit to the many people who have contributed their time, their expertise, and their passion to its evolution. These efforts are an important and lasting contribution to the digital future.

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Economics Literature: History [ELIS Classic]

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Abstract

One of the objectives of the information disciplines is to study the universe of recorded information—that is, to study the documentary products of domains of human activity—and to come to understand such bodies of literature as social and historical phenomena in and of themselves. Cole and Kipp describe the development of the literature—including periodicals—of economics from the Renaissance to the twentieth century. The development of economic theory and understanding is discussed in relation to the development of the literature of the field.

—*ELIS Classic*, from 1972

INTRODUCTION

This survey aims to consider the printed materials dealing with economic and business activities in Western Europe and the United States, with some reference to publications emanating elsewhere. It seems appropriate to handle all economic and business printed literature as a single whole, for when the entirety of this literature is examined, one finds no clearly marked dividing lines. All items can be regarded as falling in a spectrum, extending perhaps from a mathematical formulation of international trade to a flyer in Canadian uranium stocks. The differences are notable at the extremes, but there are no sharp breaks in the succession of types.

Nearly all economic and business literature is purposeful, intended by its authors to be of use in modifying public policies, improving business performance, informing the youth or the general public, and providing other than amusement or aesthetic enjoyment. This review of economic and business literature, therefore, seeks to determine how it has served its purposes. It is also necessary to determine whether the materials for the formation of public policies has changed over the centuries. If so, how and when? More in some countries than in others? It is also pertinent to inquire whether economic theorizing has improved over the centuries, i.e., can economists be said now to think better than those of 100 or of 200 years ago? And do economist and businessmen think differently from their predecessors of 1850 or 1750? If so, in what ways? and as result of what forces?

Concepts are slippery things and seem often to have gotten into the literature only with difficulty. This study of economic and business literature, therefore, attempts to reflect the process and the timing whereby and when concepts important in this area were introduced into printed form, repeated in other printed items, and incorporated

into libraries where the policy makers or the research members of their staffs could gain access to them and use them.

The centuries since Gutenberg seem divisible, as far as economic and business literature is concerned, into four periods of somewhat variant length—one lasting until the latter half of the seventeenth century, another extending thence until the closing years of the eighteenth, a third from then until about 1880, and a fourth extending to the present. These are set off by more than one phenomenon in all cases, and the dividing dates become rather fuzzy. However, the periods have distinctive characteristics.

HISTORY

The First Period

The first period was one of mixed movements, extending from the invention of printing with movable type to the latter decades of the seventeenth century. Within it, there was an extension of themes from preprinting days; there were new themes that failed to persist, as if lacking in pertinence; and there were other new themes that gained the strength to spill over into subsequent periods.

The publications of the earlier portion of this period, and to some extent throughout it, reflect considerations or controversies of pre-Gutenberg days. There were the treatises and tracts pertaining to usury and incunabula, such as the booklet by Consobrinus, and as late as 1634 John Braxton's *Usury Condemned*. Books on agriculture also kept appearing all through these centuries—and of course have never ceased appearing. The classical writers on agriculture were frequently reprinted in the early decades of printing: *Scriptores Rei Rusticae*, among the incunabula; the collection called *Geoponica* somewhat later; plus

individual Latin authors, often also in translation, rather thickly down through the middle of the sixteenth century. Overlapping with them and continuing later were the books by such authors as Estienne, Heresbach, Markham, and Tusser.

There was a third type of continuing item: compilations and treatises upon commercial law. They appear in the fifteenth century and continue like the books on agriculture. In some measure there was change here over time. For example, the “Consulate of the Sea” type of compilation reaches back into pre-Gutenberg days, but they became infrequent after about the middle of the sixteenth century. And then there is the case of Malynes. His *Consuetudo, vel, Lex Mercatoria*, the leading English specimen of its genus, first published in 1622, went through a growth that seems to mirror the changing business world. By 1656, appendices had been added in which the exchange of money by bills was “anatomized,” and the “ordering and keeping” of merchants’ accounts were explained. Knowledge of the law was apparently moving over to give place to knowledge of business practices.

In these decades, there were some literary occurrences that stirred no immediate continuing developments. One is the Malynes-Misselden debate over the effects of the exchange rates. Their contentious pamphlets flew back and forth in the early 1620s and then everyone appears to have forgotten about the matter. There was a considerable number of items pertaining to money in the sixteenth century, including Jean Bodin’s famous *Apologie*, but then little was published again until the eighteenth century. Finally, one may note the tracts of the Levellers, especially Gerrard Winstanley, in the Commonwealth period, expounding communistic ideas that were not to become common for another couple of centuries.

On the other hand, some novel developments may be recorded. One is the rise of the controversial pamphlet related to secular affairs. This was something new in the world. The outpouring was much the greatest in England. The names of Sir Dudley Digges, Thomas Mun, and many others will occur to students of the history of economic thought. There were some comparable items of Continental origin, such as those of Laffemas in France or of Pieter de la Court in Holland. On the whole, however, the Continent remained an inhospitable area for publications of this type, even to the end of our next time period, the close of the eighteenth century, except for the Netherlands and Sweden. With all due allowance for these countries, England provided the richest and most productive soil for this form of literature.

The period also brings the first calls to make money. The oldest book on retail selling, William Scott’s *Essay of Drapery* (1635) seems to take a stand with one foot in the Middle Ages and one in the modern world. As early as 1558, Roger Bieston had been willing to argue that money was “a necessary mean to mayntayne a vertuous quiet lyfe” in his *Bayte and Snare of Fortune*. Gervase Markham

thought it advantageous—presumably in keeping with the spirit of the times—to label a book on agriculture practices *A Way to Get Wealth* in 1625. So uninhibited had the sponsors of wealth seeking become by 1684 that a volume with the gay title of *The Pleasant Art of Money Catching* could be published.

There were also the first publications of types that have since blossomed luxuriantly. One may note two subvarieties of manuals: one with a geographical and another with a technical base. The former type existed as early as the fourteenth century. There were specialized printed specimens devoted to the moneys of various regions, appearing as early as 1530 in Antwerp, and in Vienna in 1563 (which had progressed to being a reckoning book). Books of broader coverage were soon to be issued: one in 1576 out of London, which gave data on “the most famous cities in Europe,” their “trade and traficke,” “their coynes and the places of their mynts,” to be followed half a century later (1638) by Lewes Roberts’ famous *Merchants Mappe of Commerce*. This extensive folio manual went through at least four editions, the last appearing in 1700.

The other subvariety includes books of arithmetic and ready reckoning, compounded particularly for the use of merchants, the expositions of bookkeeping such as Ympyn’s *Nieuwe Instructie* published in Antwerp in 1543, together with volumes of applied science, which may perhaps be considered to begin with Schopper’s illustrated book on mechanical arts, printed in Frankfurt in 1574.

A second general type of literature with a modern flavor is that stimulated or issued by individual companies. John Wheeler wrote his *Treatise of Commerce* (1601) in support of the Company of Merchant Adventurers; Sir Dudley Digges addressed his *Defence of Trade* (1615) to the governor of the East India Company; and Thomas Mun composed his *Discourse of Trade* (1621) in defense of that Company. Before 1680, quite a flock of pamphlets had been printed about enterprises from the “West-Indische Compaignie” of Holland to the “Company of Royal Adventurers of England Trading into Africa.” Sometime in the 1650s, if not indeed earlier, such enterprises commenced to issue material on their own initiative, e.g., *The Advantages of the Kingdome of England* from the operations of the “Fellowship of the Merchant’s-Adventurers of England” (c. 1650), which looks very much like a “public relations” piece or minutes of meetings of the general court of the English East India Company.

Despite these new sorts of items and despite the issue and reissue of divers books on agriculture, the general impression of the literature of this whole period is that of discontinuity and some naivete.

The Second Period

The second period was characterized by enhanced continuity, by the beginnings of measurement, and by the

development of integration—a period extending from the late seventeenth to the late eighteenth century.

The “continuity” is evident on various sides. The effort of the Parisian Académie des Sciences to prepare and issue its *Description des arts et métiers* is a case in point. The original idea was broached as early as the 1660s, it recurred fitfully in the next few decades, a more formal start was made in the 1730s, and the volumes appeared from the 1760s to 1788. The successive editions of Savary’s *Parfait négociant* from 1675 to 1763, of Ricard’s *Traité générale de commerce* from 1706 to a fifth edition in 1732, or of Thomas Mortimer’s *Every Man His Own Broker*, first published in 1761 and reaching its twelfth edition in 1798, yield the same picture—there was a persistent interest in the particular line of thought. Publishing houses were increasing within the economic and business field.

However, institutional connection was not essential. Continuity begins now to be more clearly apparent in the evolution of economic thought. Some such condition is evident in English mercantilist thought, especially after Mun; but it takes a more creative turn on the Continent. In France, there was the development of speculative ideas in Boisguilbert, Cantillon, Quesnay, and Dupont de Nemours, resulting in the advent of an informal group that promoted discussions and supported journals of communications. In Germany, one can find a persistent growth of cameralistic thought, beginning actually a little earlier than physiocratic ideas or preliminary notions, namely, with the publication of Becher’s *Politische Discurs* in 1668. Here, evolution took the road leading into administration and education. Officials of Austria and the German states were intimately connected with the development. And Hermann Conring (1606–1681), Gottfried Achenwall (1719–1772), and many other professors gave lectures that by and large were presentations of economic data relevant to public administration. This concentration of economic thought, teaching, and governmental activity persisted into the nineteenth century.

Continuity in the area of business communication presents a curious but intriguing picture. During the seventeenth and eighteenth centuries, merchants dominated the business communities of all countries; and merchants have always been interested in changes in commodity prices, movements of ships, and alterations in the course of exchange rates in about that order of declining values. A natural evolution in instrumentalities, once the volume and diversity of business required more than the partial picture conveyed by private letters from agents and correspondents, was that an entrepreneur would set up a reporting agency to serve a given community. Thus began *Oram’s New York Price Current and Marine Register* (1798–1804) and *Ming’s New York Price Current* (1805–1813, 1815–1817), which would be displaced in time by a newspaper of broader coverage—in this New York case, by the *Shipping and Commercial List and New York Price Current*, which in fact ran continuously (with only one

minor change in title) from 1815 to 1861.^[1] At other places, a mercantile journal carried current commodity price quotations as a regular portion of its news; this “prices current” section was reprinted on a flyer, sometimes with a merchant’s name added as a running head, and merchants distributed copies of these prices—currents to their correspondents.

Neither of these sequences occurred in the Netherlands and in England. In the one case, printed lists of commodity prices began to appear in the first years of the seventeenth century. They were soon compiled under regulations of the city and may have been printed by various booksellers for distribution. They continued to be issued up into the first part of the nineteenth century, and no general commercial journal seems to have blossomed on this stem. In the case of England, supposedly the “land of shopkeepers,” the story is one of unexpected deficiencies. Some privately printed merchants’ price lists appeared in 1670 and thereafter, but only intermittently until the first decades of the succeeding century. The only periodical that carried such price data seems to have been John Houghton’s *Collection of Letters for the Improvement of Husbandry and Trade*, which ran from 1692 till 1703. For 30 years or so after 1715, there appears to have been no public or semipublic commodity price reporting; then perhaps some specializing sheets; and not until 1775 and the launching of Prince’s *London Price-Current* can one grasp commodity price reporting that persisted into modern times in some form, if under various aspects.^[2]

In the meantime, to be sure, there had come periodicals that reported on financial affairs and on shipping: the semiweekly called *The Course of the Exchange* begun by John Castaing at almost the peak of the South Sea speculation, specifically in 1719, but carried on by him and his successors continuously ever since; and *Lloyd’s List*, which, starting in 1734, gave news of ship movements, share prices, and some general matters of commerce.

The eighteenth century has been referred to as the “era of political arithmetic,” and surely measurement became a more widely recognized desideratum. Doubtless, Sir William Petty should be canonized as the patron saint of modern economics. Writing of his “Method,” he stated that, “instead of using only comparative and superlative Words, and intellectual Arguments,” he had taken the course of expressing himself “in terms of Number, Weight, or Measure.” It is the creative ideas that are important: that in economic affairs, one might emulate the practices of the natural scientist; and from measurements one might derive apparent uniformities in economic life. Already John Graunt had seized upon London’s “bills of mortality”—perhaps the only good result of the plague—and had laid the first bricks in demographic studies and actuarial science. Graunt was followed by Halley, de Moivre, Price, and a continuing band of students and writers in England; and by an equally notable, if not really superior chain of successors on the Continent.

Other seventeenth and eighteenth century English writers in various fields of economics adopted the Petty approach. Arthur Young wrote a *Political Arithmetic* of his own, devoted largely to agricultural problems of his times. There was a new stress on “experience” and “experiments,” as in William Harte’s *Essays on Husbandry* (1764). In the meantime, too, the British government had seemingly become infected. Governmental reports began to be issued, often largely statistical in character, on the course of trade, the activities of the East India Company, public finance, and the like. These reports were generally irregular, but they laid the basis for the series that in 1801 began as the Parliamentary Papers.

In other countries, the zeal for measurement burned with variant brightness. In France, the impact appears not to have been great in this period though Vauban, Deparcieux, and few others were influenced. On the other hand, “political arithmetic” appears to have been quite congenial to cameralism. Johann Peter Süssmilch (1708–1767) became an exponent of the “method” in his own right. His *Göttliche Ordnung*, published in 1742, was noteworthy for its contributions to the study of what came to be called “vital statistics.” His contemporary, Gottfried Achenwall, was the first person to use the term “statistics.” Actually the word then signified general description of economic phenomena, not specifically quantified measurements and statement.

The notion of a census of population has been traced back to Bodin and Montchrétien. And certain censuses of population were taken in the eighteenth century: Sweden from the middle of the century onward; Austria in 1753, 1762, and 1777; not to mention certain Canadian provinces even in the seventeenth century. However, in Europe, population data were not broadly published until the nineteenth century; military rivalry was too severe.

The evolution of syntheses seems a third feature of this period. One aspect of this trend was the compilation of dictionaries or collections of information on various subjects—not merely merchants’ *vade mecums* such as Savary’s and Ricard’s but more specialized, topical affairs, such as the *London and Country Brewer* (1736), or Duhamel du Monceau’s six volumes on fishes and fishing (1769–1782). The Germans were particularly given to such compilations. Another type can be represented by *Select Essays on Husbandry* printed in Edinburgh in 1767 or John Almon’s *Collection of Tracts, on the Subjects of Taxing the British Colonies in America, and Regulating their Trade* published in 1773.

More noteworthy yet were the efforts of theorists Quesnay, Sir James Steuart, and particularly Adam Smith to describe or analyze economic systems. Professor Schumpeter speaks of “quasi-systems” in earlier times. By this Schumpeter seems to mean partial views of the whole economy, from which one may properly infer that their authors possessed quite surely a sound concept of the whole.^[3] There can be less doubt of the physiocrats, Steuart, and the “father of political economy.”

Smith’s *Wealth of Nations* illustrates the importance of conceptualization. It has been said of Smith’s book that, like the American Constitution, there is little that is original in it, and what is original isn’t very good. However, Schumpeter—curiously reluctant to see virtue in “A. Smith”—does assert:

We know that the skeleton of Smith’s analysis hails from the scholastics and the natural-law philosophers. . . . They had worked out all the elements of such a scheme, and Smith was no doubt equal to the task of co-ordinating them without further help from anyone.^[3]

The leading features of this period may be embraced under the general term “increased sophistication.” The developments of the decades after 1660 reveal a level of thought hitherto unattained in the economic and business field. Other phenomena lend support to this contention. One is the awakening of a historical sense, at least in this field of thought and publication.

The eighteenth century is noteworthy for the increase in number and the extension in variety of historical studies. Interest in coinage of the past was very early evoked (e.g., in Occo’s survey of Roman coins, published first in 1579). However, much more substantial works in this area were produced two centuries later (e.g., those of Leake and Snelling in England). And now appeared also such items as Madox’s *History and Antiquities of the Exchequer of the Kings of England* (1711), Raynal’s famous *Histoire philosophique et politique des établissements & du commerce des Européens dans les deux Indes* (1770), even such a piece of business history as Henning Calvör’s *Historische Nachricht von der Unter und Gesamten Ober Harzischen Bergwerke* (1765). Also not to be overlooked is the launching of effort in the area of price history—surely a “sophisticated” realm [e.g., Bishop Fleetwood’s innovating volume entitled *Chronicon Preciosum: or, An Account of English Money, the Price of Corn, and Other Commodities, for the Last 600 Years* (1707)].

Data of a somewhat different sort are supplied by the reprintings of earlier materials. Among those were John Smith’s *Chronicon Rusticum-Commerciale; or, Memoirs of Wool* (1747) and Robert Vansittart’s *Certain Ancient Tracts Concerning the Management of Landed Property Reprinted* (1767). The tracts were reproduced, not primarily because they would presumably be of utility in practical affairs, but seemingly because they were interesting in themselves; the wisdom of earlier times should not be forgotten, even if not immediately applicable to contemporary problems.

The increased sophistication, the rise of a historical sense, and the power of cameralistic thinking were responsible for another important development: the creation of bibliographies of economic literature. According to Kenneth E. Carpenter:

The first bibliography of economics was J. B. von Rohr's *Compendieuse Hausshaltungs Bibliothek* (first ed., 1716). For each of the subjects covered—"Cammeralwesen", agriculture, commerce, mining, etc.—Rohr provides a kind of encyclopedia article, with comments on books, which are in most of the languages of western Europe. Rohr disclaims any attempt at completeness, but as a classified bibliography, it is perhaps still useful for some purposes.

In his *Hausshaltungs Bibliothek*, Rohr added his voice to that of numerous advocates of university chairs of Cameralism. The first in Europe was founded at Halle in 1727, and others in Germany soon followed. It is probably to this early recognition of economics as an academic subject that we owe a long series of German bibliographies.^[4]

Carpenter identifies other bibliographies of the period:

Two unusual and very definitely usable items are J.J. Moser's *Bibliothec von Oeconomischen-Cameral-Policey-Handlungs-Manufactur-Mechanischen und Bergwercks Gesetzen, Schrifften und Kleinen Abhandlungen* (1758) and J.H.L. Bergius' *Cameralism Bibliothek* (1762). They are essentially indexes to periodicals and laws and can make available much detailed information.

These were published "prior to the work which has generally been considered the first bibliography of economic literature—the 34-page 'Catalogue d'une bibliothèque d'économie politique formée pour le travail du nouveau dictionnaire de commerce' in Mollet's *Prospectus d'un nouveau dictionnaire de commerce* (Paris, 1769)."^[4]

However, lest the element of sophistication be overemphasized, Professor Edwin F. Gay made a considerable reputation for himself by controverting statistically certain allegations of sixteenth century writers on the extent of the contemporary enclosures; and Professor Brebner has remarked that economic history writing of these centuries should generally be examined with much care; much of it was compounded to prove a case of some sort or another.

The use of earlier materials and of libraries was limited. One of the first notes about economic and business literature is contained in John Houghton's *Husbandry and Trade Improved* (1728).^[5] He lists what looks like 35 titles: something like 20 in Latin, of which 6 or 8 are reproductions of classical authors; 2 in Italian; 3 or 4 about trees; 2 or 3 about fishes; 1 about gardens; and More's *Utopia*.

It is recognized that the *Wealth of Nations* was not composed with a wealth of citations. It had not become the prevailing practice among scholars of Smith's time to acknowledge sources, but it is significant that in Smith's collection of books and pamphlets aggregating approximately 1600 items, there are scarcely 150 that could be labeled economic.^[6]

In the case of David Ricardo, there was apparently slight interest in predecessors. Despite Smith and Malthus and a few others, writers in the field were not generally learned.

Any impression that all proceeded smoothly in the evolution of economic and business literature is erroneous. Generally, the most advanced thinkers of given periods are taken to represent those decades. This, of course, is not a satisfactory procedure if one is interested in this literature as a vehicle of the formation of public opinion and public policy. Some attention to the irregularities or bulges from any trend line is justified. There was the Cromwellian period in England, with its enhancement of volume and its manifestation of new idea through its John Lilburne, Gerrard Winstanley, Henry Parker, Henry Robinson, Thomas Violet, William Potter, and others. There was also the peculiarly interesting period between Robert Murray's *Corporation Credit* (1682) and the early years of the next century. The volume of economic writing expanded now, especially in the 1690s, and particularly with the first sizeable crop of anonymous pamphlets, but it is also interesting how many writers of note from Nicholas Barbon to John Briscoe, and from Daniel Defoe to Sir Humphrey Mackworth fall into these decades.

In the meanwhile, cameralistic writings had flourished rather extraordinarily in greater Austria, if one may use that term. After Becher came his brother-in-law, Philipp Wilhelm von Hörnigk, with his *Oesterreich über Alles, wenn es nur will*, which went through 13 editions in the course of a century; Wilhelm von Schröder's *Fürstliche Schatz- und Rentkammer*, which enjoyed 6 editions between 1686 and 1752; and scores of lesser writers. There was also the especially interesting phenomenon of Paul Jacob Marperger (1656–1730). Perhaps he should be recorded as the first full-time economist; some 90 separate publications may be credited to him, running literally into thousands of pages. He did not really rise to the level of theory, yet Marperger did not publish trash. He represents at least a bulge from any general trend line, greater than that produced by Defoe, or earlier Samuel Hartlib or Gervase Markham.

A bulge of a different type centers in the South Sea and Mississippi Bubbles. This movement may be measured in the numbers of items recorded in the Kress Library printed catalog which lists 524 titles published in the years 1720 and 1721, compared with 128 in the years 1719 and 1722.

In Holland, this "bulge" seems to have flooded Amsterdam with scores of satirical prints. Several plays and several poems were also prepared relative to the speculation in shares. These and other documents pertaining to actual company ventures were gathered up and issued as a warning in a thick folio volume entitled *Het Groote Tafereel der Dwaashied* (or "The Great Mirror of Foolishness").

Similar deluges were to accompany later periods of excitement: the controversy of England with her colonies in America; in France, the problems of the new

government after 1789, especially those of currency, taxes, and the disposition of the lands of the Church and nobility; shortly thereafter in England and Ireland, the question of union between the two islands; and later still the “bullion controversy.”

The Third Period

The third period, from the late eighteenth to the late nineteenth century, was marked by the efflorescence of printed matter and by the very considerable spread of organization within the business world.

Professor Innis has posited a hypothesis that media of communication succeed one another as the arteries of business are lengthened geographically and the pulse of business quickens. Oral communication was feasible when merchants could make frequent journeys in promotion of their enterprises, although each journey might run into months. As a second stage, correspondents kept in touch with their principals by letter. This latter system must have been quite unsatisfactory and could not function adequately in such a trade as that which New York, Salem, and other American towns initiated with China after 1790.

The long period of wars between 1790 and 1815, with the uncertainties and changing demands that war always brings, seems to have stirred all segments of Western societies to cast aside the slow, private means of communication, to seek by political means an increase in the volume of governmental publication and to stimulate, by means of subscription payments to venturesome entrepreneurs, the expansion of commercial vehicles.

The British Parliamentary Papers began to be issued regularly in 1801; by the 1840s, 50 folio tomes were required, and by the 1880s, 90–100. The publication activity of the U.S. government kept close pace with that of the British. Regularity was imparted to the *Congressional Documents* only with the Fifteenth Congress (1819–1820), but many statistical and other materials were printed as individual *Documents* in the preceding 30 years.

In Canada, a documentary series of the Dominion began in 1841 and one of the province of Quebec in 1869. France and Germany have contented themselves with the publication of the reports of *Enquêtes* and *Ausschusses* and with that of special series, e.g., the French *Catalogue* and successive reports on inventions from 1791 onward or its *Tableaux généraux du commerce* in 1818 and later years.

A considerable proportion of this governmental activity may be attributed to the desire for measurement that arose in the late seventeenth century. The United States was a leader in statistical developments. The census of population of 1790 was the earliest to be published; in 1810 and 1820 the federal government made some effort to secure data on manufacturing facilities as well as population; and the reports on manufactures in the 1850, 1860, and 1880 censuses were more extensive than any elsewhere in the world.

Some of the American states became active in collecting data on population and in other lines: New York and Massachusetts, manufactures; Maine, ownership of bank stocks; and the like. There was the famous (if not too thorough) survey of manufactures and their likelihood of growth made by Hamilton, the better inquiry made by McLane in 1833, useful reports on various industries that accompanied the censuses of 1860, and 1880, and essays on such topics as coal measures or movement of tobacco accompanying that of the later date. The annual statistical reports, such as those on commerce and navigation (regularized in 1820), and some special reports such as that of I. DeW. Andrews on the commerce of the Great Lakes, or on internal commerce of the country (1876–1891), produced notably useful data.

Quantitative reports also appeared in such periodicals as Niles's *Weekly Register*, *Hazard's Register of Pennsylvania*, *DeBow's Review*, and Hunt's *Merchants' Magazine*. Two other private statistical publications not seen duplicated in any other country for some decades appeared: Benton and Barry's *Statistical View of the Number of Sheep* [in northwestern United States]; *And an account of the Principal Woollen Manufacturies in said States* (1837); and the other is William H. Sumner's *Statistics of the Woollen Manufactories of the United States* (1845). But the major private efforts come a bit later with the quantitative reporting of the *Commercial and Financial Chronicle*, including its annual *Investors' Supplement* volume of many years after 1875, and *Poor's Manual of Railroads*, of which a historical volume appeared in 1860 and regular annual ones after 1868.

In Europe (probably with the exception of Germany over the last decade or two of the period), the developments were less pervasive and somewhat more scholarly. There were published censuses of population, as in England in 1802 (and later decades), Sweden 1811, etc., but no industrial or agricultural censuses. Europe's principal contributions fell elsewhere.

“Statistical” activity in the sense of descriptive economics there was, and especially noteworthy examples pertain to agriculture in the British Isles, perhaps attributable to the influence of Arthur Young. The agricultural surveys of English, Scottish, and Irish counties were made between 1790 and 1815 or thereabouts. Those related to the British countries were prepared under the auspices of the semiofficial Board of Agriculture and Internal Improvement, some of them composed by Arthur Young. They number nearly 90 and were published between 1793 and 1800. Another series ran to more than 60 volumes and appeared between 1804 and 1815. Between 1801 and 1812, the Royal Dublin Society published surveys of 21 Irish counties (three others being published later: 1824, 1832, and 1833) with the slightly variant titles of a “general view of the agriculture and manufactures” of a given county, or “statistical observations” of the same.

More important was another contribution, namely, what Funkhouser describes as “the gradual merging of political arithmetic and the theory of probabilities in the science of statistics.” Funkhouser traces the evolution of probability theory back to Pascal and Fermat working in the middle of the seventeenth century and notes that de Moivre discovered the formula for the normal probability curve in 1733, that J.B.J. Fourier drew the curve in 1821, and that de Morgan first made published use of the curve in 1838.^[7]

There was a third contribution from Europe: new organizations in the field of statistics. The Statistischer Verein for the Kingdom of Saxony began publishing in 1831, the London Statistical Society was founded as early as 1825 and was publishing its own *Journal* in 1837, and the corresponding Dublin society followed somewhat later (1855). Shortly after the middle of the century, specifically in 1853, a series of International Statistical Congresses were launched, largely as a result of the initiative of Adolphe Quetelet, that until 1876 convened pretty regularly in alternate years in some European city. Their proceedings were published.

Another aspect of the increasing quantity of literature is the marked growth of periodicals. Before this period, journals that could be called professional were few and short-lived, although the *Leipziger Sammlungen von Wirtschaftlichen-policey-cammer-und finantz-sachen* was published from 1744 to 1761 and the *Ephémérides du citoyen*, published in Paris and carrying the discussion of the physiocrats, was maintained from 1765 to 1772 and from 1774 to 1776 under the title *Nouvelles éphémérides économiques*. A German endeavor to sustain publication of similar materials, issued under the title *Ephemeriden der Menschheit*, carried action along to 1782. If we look on the *Journal économique* (1751–1772) and the *Gazette d'agriculture, commerce, arts et finances* (1776–1781) as in part supplementing the *Ephémérides*, it is obvious that professional publications did flourish for a quarter of a century in France's *ancien regime*.

Thereafter came a considerable hiatus. The *Journal of the London Statistical Society* was one of the first items in the new crop: the semiprofessional *Journal des économiques* and *London Economist* were launched in the early 1840s, the publication activity of the American Social Science Association started in the middle 1860s, Conrad's *Jahrbücher für Nationalökonomie und Statistik* began in 1863, and the *Jahrbuch für Gesetzgebung, Verwaltung und Rechtspflege* (which later became *Schmoller's Jahrbuch*) in 1877. However, organized professional publication in the English-speaking world had by and large to wait until the decade of the 1880s and later years.

One phenomenon in the 1785–1885 century marked that century as at least quantitatively unique: the reprinting of earlier materials. The Italians provided the startling example. Beginning in 1803 and continuing

through 1816, they produced an amazing 50 volumes that they entitled *Scrittori classici italiani di economia politica*. A sequence of reprinting and translation efforts which took place after 1850 produced five more series with 71 volumes. Between 1840 and 1848, a *Collection des principaux économistes* was published in France, running to 16 volumes, whereas in England, McCulloch edited a half-dozen volumes of “early” or “scarce and valuable” tracts on “economical” subjects. A German, Reinhold Pauli, unearthed and published *Drei volkwirtschaftliche Denkschriften aus der Zeit Heinrichs VIII* in 1878. The background was being laid for professional economics.

Carpenter has pointed out that “not until the nineteenth century is well along does one find bibliographies compiled by historians for historians.” He then identifies several landmark bibliographies. The first general bibliography of economic literature of this period is John Ramsey McCulloch's *The Literature of Political Economy: a Classified Catalogue* (1845), based on his own library.

The first attempt at a comprehensive historical bibliography of a nation's economists was Manuel Colmeiro's *Biblioteca de los economistas españoles de los siglos XVI, XVII, XVIII* (1880), [while] Luigi Cossa's *Saggi bibliografici di economia politica* (1891–1990, reprinted 1963) made a good start at doing for Italian economic literature what Colmeiro did for Spanish.^[4]

In these same decades, the volume of business publication increased rapidly in the United States to cover a great geographical spread and the lack of any predominant city as in England or France. The start came in the form of prices currents, but not long thereafter arose journals of wider characters, such as the *General Shipping and Commercial List* at New York, soon the *Shipping and Commercial List and Price-Current* (from 1815 onward), the *New York Journal of Commerce* (1827 onward), even the *New Orleans Price Current* (1822 onward) despite its name. These were followed by specializing periodicals: the *American Railroad Journal* and *Advocate of Internal Improvements* (1832–1838 and succeeded by organs of somewhat similar titles); the *Banker's Magazine* (founded in 1846); before the Civil War, a number of peculiarly American aids to the businessman, banknote detectors; but also journals that pertained to mining, iron manufacture, and shoes and leather, beyond Hunt's *Merchants' Magazine*, already cited.

Activity in England was much more limited and still less considerable on the Continent. England did have agricultural journals, Herepath's and other railway periodicals, a *Mining Journal and Commercial Gazette* that began in 1835, and a *Bankers' Magazine* that started 2 years prior to the American one of similar name. Perhaps the localization of merchants in specific regions in London—Mark Lane, Mincing Lane, etc.—was adequate for much

communication; and mercantile newsrooms may have helped. Perhaps commodity bourses on the Continent served similar purposes.

For the most part, a single agricultural journal served England; but the United States had a journal for nearly every region: the *New England Farmer* (1822 onward); the *New York Farmer* (after 1828); the *Southern Farmer* and the *Prairie Farmer* (launched in 1840 and 1841, respectively); and others.

Two developments in the decades between 1780 and 1880 were of great magnitude: the rapid expansion of materials published by new organizations and the increase in the international flow of ideas.

Note has already been made of the East India Company, the Board of Agriculture and Internal Improvement, and the like. The number of such organizations was greater in the United States than in any other country. Societies for the promotion of agriculture were soon joined by those devoted to the promotion of manufacturing and the “useful arts.” There were the private corporations (turnpike, canal, and railroad, particularly) that sought to keep in touch with their stockholders and with customers. By 1880 the volume of publications produced by American railroads was already considerable: not only annual reports, but indentures, leases, and other financial documents; freight tariffs; timetables; advertisements of lands for sale; even occasional public relations pieces. There were the periodicals stimulated by private enterprise, and there were publications flowing from trade associations, chambers of commerce, stock exchanges, labor unions, credit reporting agencies, and other bodies.

A start in company histories had been made in the decades before 1780, but the period between that date and 1880 witnessed a significant expansion of output. Occasionally, these documents arose from conditions of distress, as when Caleb Eddy wrote a sketch of the Middlesex Canal in 1846, when the enterprise was suffering from competition of the Boston and Lowell Railroad. Usually, they were sponsored—at least blessed—by individual firms as a tribute to their successful existence over a substantial period of years. Such were Ludwig Wachler’s *Geschichte des ersten Jahr-hunderts der Königlichen Eisenhütten-werke in Malapane* (1851) or Henry Domett’s *Bank of New York* (1884). Historical accounts prepared by competent scholars who endeavored to write objectively were yet to appear.

Somewhat the same can be said of businessmen’s biographies and autobiographies which were usually efforts at praise or self-justification. Such were Stephen Simpson’s *Biography of Stephen Girard* (1832) or Bethel Henry Strousberg’s document, *Dr. Strousberg und sein Wirken* (1876). There was quite a rash of such biographies in France: biographies of Laffitte (1884), several on the Rothschilds (1846, 1847, 1868, and 1869), François de Wendel (1851), Casimir Périer (1858), and a dozen others. The flow diminished after 1870 and has never really

increased much in later decades. Businessmen’s biographies have never amounted to much in England; they were infrequent in the United States before 1890. An interesting number of collected biographies, written generally in a popular vein, did appear; e.g., Smiles’s lives of George Stephenson (1868) or Boulton and Watt (1865), and the collection entitled *Men of Invention and Industry* (1884) in England; Otto Spamer’s *Buch berühmter Kaufleute* (two series, 1868 and 1869); and Freeman Hunt’s *Lives of American Merchants* (1858) in America. Perhaps again the ground was being laid for higher grade performances later.

The international movement of ideas and materials had been indicated by the acceptance by German scholars of Petty’s “political arithmetic,” or the Italian translation and publication of works of non-Italian authors. However, movement in the nineteenth century appears to have been much enhanced. Relative to Swedish economic development of that century, e.g., Professor Heckscher stated that “perhaps the most fundamental change of all was the tremendous increase in the international exchange of scientific and technological information.”^[8]

There had been occasional translations of economic and business items in the earlier centuries, especially the eighteenth: Garzoni’s *Piazza universale* (1st Italian, 1585; German edition, 1619); Savary’s *Parfait négociant* (1st French, 1675; German, 1676); Savary des Bruslons’ *Dictionnaire universal de commerce* (1st French, 1723–1730; English, 1751–1755; Italian, 1770–1771); Mandeville’s *Fable of the Bees* (1st English, 1714; French, 1740); or Arthur Young’s *Political Arithmetic* (1st English, 1774; French, 1775). Such movement was slow, with more international movement of items at the business end of the spectrum than at the economics end.

Adam Smith was important in helping to break down international barriers. Steuart’s *Inquiry into the Principles of Political Economy* (1767), to be sure, was translated into the German promptly, appearing in 1769–1770. Smith’s contacts were closer to France, at the time a more advanced country than Germany. Smith brought a foreign body of thought into English economic thinking for the first time in history. His *Wealth of Nations* was especially welcome in France. Before the end of the century, nine editions had been published in French, and editions had appeared in the United States, Ireland, Italy, Germany, Switzerland, Spain, France, Denmark, and the Netherlands. Excerpts appeared in Sweden in 1799 and a translation appeared in Russia in 1802–1806. Ricardo seems not to have been influenced by non-English ideas, but communication did increase more or less steadily in the decades between 1780 and 1880.

One vehicle of that communication was the international congress, which not only provided for verbal exchanges of ideas during its sessions but also left behind published proceedings or other documents. There was a “Congrès des économistes” in 1847, one on “réformes

douanières” in 1856, one on “propriété littéraire et artistique” in 1859, meetings of the International Association for Social Progress in 1862–1865, an International Commercial Convention in 1868, and a series on “Sunday rest” beginning in 1876.

Another vehicle of communication among countries was the international exhibition. Elkanah Watson was the “father” of our agricultural fairs, which were initiated in 1810. Customarily, a report of some sort was issued covering the awards. Fairs are alleged to have been organized earlier, but little is known about them. Quite surely they produced no published residuum. One held in France in 1798, organized by M. de Neufchateau and devoted to French industrial productions, did yield a report, drafted by M. Chaptal. And there was a succession of such exhibits until the eleventh in 1849.

The Grand Exhibition of 1851 in London in the Crystal Palace was truly international in scope and set the pattern for Philadelphia in 1876 and Chicago in 1893. These gatherings with their displays of machinery and products did much to promote industrial communication and left behind a considerable literature in the reports of judges and in the findings of delegations from foreign countries. Documents published on Philadelphia’s Centennial Exposition of 1876 ran to more than 20 volumes.

Two features of the decades between 1780 and 1880 pertain to quality of output. One might be construed as a development from “political arithmetic,” the graphic presentation of statistical data. The innovator was William Playfair, who in 1786 published his *Commercial and Political Atlas*, which was followed in 1801 by his *Statistical Breviary*. In these and other works of Playfair, one finds several varieties of diagram: line, bar, and pie.

The employment of diagrams expanded rather slowly, however, and their popularity came more in France than in their country of origin. Playfair’s first book was translated into French, where it appeared under the title of *Tableaux d’arithmétique linéaire*, almost as if it were a study in method rather than a “commercial and political atlas” of England. Quetelet and other French vital statisticians made use of graphs and so did the French government engineers having to do with public works and with transportation. C.J. Minard composed the first memoir on the graphic method in 1861, and E.J. Marey composed a notable text on *La Méthode graphique* 1878. Funkhouser calls the period from 1860 to 1890 “the golden age of graphics...marked by the unrestrained enthusiasm, not only of statisticians, but of government and municipal authorities.”^[7]

The other qualitative change in the 1780–1880 period is that of economic thought. What Adam Smith had started, the generation of Ricardo, Malthus, James Mill, and Jean-Baptiste Say advanced further. As Professor Rogin put it, “Ever since the advent of economic science as a separate academic discipline there has existed an impulse to model it in the alleged image of an exact

natural science and thus to evade both the intractability of history and disagreement as to values.” From the physiocrats and Smith came the competitive equilibrium; and this provided the basis of abstract elaboration of principles in the nineteenth century, especially the roles of the different factors of production.^[9] Already in the first quarter of the century, Say was complaining of his contemporary, Ricardo, that the latter was “drawing all his results from a small number of principles, putting or leaving aside all others.” He thought his case to be all the stronger because he believed Ricardo through his method “arrived at results different from the real state of the case.”^[10] Also it may be significant that in the generation after Ricardo and James Mill, economists began to be concerned with their own procedures. John Stuart Mill published in 1843 his *Logic* in which he exposed “the methods of physical sciences as the proper models for the political”; John Elliot Cairnes wrote his *Character and Logical Method of Political Economy* in 1857; meanwhile, the “historical school” in Germany had begun its creative response to the intellectual methods of the English proponents of political economy; and as late as 1891, John Neville Keynes, the father of John Maynard, issued a well-received volume on the *Scope and Method* of his subject. And in the 1870s and 1880s appeared the first substantial group of histories of economic thought—books that, unlike Blanqui’s of 1842, dealt almost wholly with the abstractions and concepts that had sprung up in the preceding century.

These changes in the intellectual apparatus of economists apparatus of economists indicated an enhanced sophistication. In the eighteenth century and earlier, political economy had been largely a set of rather specific rules, not very broadly entertained, all more or less slanted toward spelling out the roles that individuals could play in the promotion of a richer, somehow better economy. In the nineteenth century, more and more came the increased regard for imponderable, impersonal forces—maximization of profits, the interest rate, demand and supply, etc.—with at least an implied dichotomy between political and business economy. By reason of the change in the quality of political economy in the nineteenth century, a professional literature evolved within those decades—in the era, say, between David Hume and Alfred Marshall.

The Fourth Period

The final period, extending from about 1885 to the present, has been marked by a greatly increased volume of publication in the field, by enhanced professionalization in the ranks of economists, and by a revolution in the area of business administration and its literature.

The extraordinary enlargement of economic and business literature in the last century has resulted from the operation of many forces: the alterations in printing technology; the changes in the publishing world; growth in the field of communication commanded by governments;

increase in the number and variety of private organizations active in publication performance; and transformations of thought within both economics narrowly construed and business administration similarly viewed. There has also been a geographical expansion. Countries such as Canada, Australia, or Sweden were publishing relatively little in the field in the 1880s.

Publishing houses have contributed to the whole movement through their creative activities. Institutions, such as McGraw-Hill or Simmons-Boardman, were set up originally by innovating entrepreneurs. It was to the advantage of the publishing concerns to have more readers and the information they purveyed proved to be advantageous to the readers. Improved operations of business institutions, higher profits of the purchasers, meant in turn greater demand for the publisher's products. Beyond this, publishers were frequently creative by virtue of the missionary zeal for reform. Henry Varnum Poor waged almost continuous war against evils or in advocacy of reform while he was editor of the *American Railroad Journal*. The Simmons-Boardman Company promoted through its periodicals such improvements as standardized threads for bolts and nuts and standardized design for automatic coupling for railroad vehicles. The *American Journal of Mining* sponsored the American Bureau of Mines. This was good business for the economy as a whole, and it helped to swell persistently the volume of business literature.^[11]

The change from laissez-faire to welfare government meant a tremendous increase in governmental production of literature concerned with economic and business affairs. Particularly pertinent is the conversion of occasional investigatory efforts into persisting regulatory ones, with a marked enhancement of literary output. Already this change had occurred in England relative to railroads. It came in the United States primarily after 1880. The Windom and Cullom Committees that inquired respecting railroads were followed by the Interstate Commerce Commission. The Aldrich Committee of 1891–1893 and the National Monetary Commission of 1909–1910 were succeeded by the Federal Reserve Board. In the end, the country possessed not merely these agencies of regulation but the Federal Trade Commission, the United States Tariff Commission, and numerous others equally well staffed and equally capable of issuing orders and regulations and special reports as well as the stock annual ones.

National governments have also become “service” states, assuming an obligation to provide freely, or at low cost, data essential or convenient for policy formation in agriculture and business, for public appraisal of economic and business affairs, etc. Such data are useful to various federal governmental agencies, but chiefly it has value to economists and businessmen scattered over the country. This is true of much work performed by the Bureau of Standards, the Department of Agriculture, and the Library of Congress. The American state governments have been equally active, or nearly so.

The enlargement of the flow of literature from private institutions has been particularly great in the United States. The decades since 1880 have witnessed notable increases in the number of trade associations, chambers of commerce, cooperatives, produce exchanges, and the like. But now international chambers of commerce, organizations of bondholders or taxpayers, and many other new institutions issue publications, especially periodicals or other serials.

Important with respect to volume and quality have been the new professional organizations and educational institutions. To the local statistical societies above noted were now added national economic and statistical associations in many countries: the *Nationalekonomiska Föreningen* (or Economic Society) launched in Sweden in 1877, the Royal Economic Society set up in England in 1888, the American counterpart founded the next year, down to the International Economic Association organized subsequent to World War II. In the field of business the launching of new institutions has been even more noteworthy, especially in the United States: the American Association of Public Accountants in 1887, the National Association of Credit Men in 1896, the Advertising Federation of America in 1905—and on down through the decades organizations of industrial advertisers and controllers, of sales executives and management engineers.

Schools of business have also manifested a capacity for publication. The area of business management possessed few established facts when the first schools of business were established. The Bureau of Business Research set up by the Harvard School and the Department of Industrial Research launched by the Wharton School were early responses to this situation.

Note should be taken of corporate research agencies, organized separate from governmental or educational institutions, and the financial foundations that have promoted research in the economic and business field. Both are largely the children of twentieth century United States. The research agencies have been varied in character. One early group (rather loosely organized) was devoted to the promotion of a series of studies in American economic history. The financial support came from the Carnegie Corporation of Washington, and the studies were published by it—of which the best known are Victor S. Clark's three volumes on our manufacturing industries and L.C. Gray's two volumes on Southern agriculture before 1860. Somewhat later came the International Committee on Price History, financed by the Rockefeller Foundation and constituted of representatives from several interested countries under the chairmanship of Sir William Beveridge. Institutions with centralized research staffs have arisen: the National Bureau of Economic Research, the Commonwealth Fund, and the like. Some are loosely connected with educational institutions as the Food Research Institute at Stanford or the Scripps Foundation for population research at Miami University.

Their publications bear the implied and sometimes the explicit indication that the specific item has been developed with aid from the whole body of scholars attached to the institution and perhaps issued only after criticism by another body of scholars. The day of the individual scholar has not passed, but such institutionalized research was unknown a half century earlier.

As for the financial foundations, all that one need note is that the funds supplied by the Rockefeller, Carnegie, Ford, and other such bodies have permitted and stimulated research and publication in a measure undreamed of prior to World War I. The impact has been largely in this country, but more recently moneys for these purposes have gone abroad from the same foundations.

Not only has the volume of economic and business literature expanded in an extraordinary degree, but the general complexion of that literature has undergone revolutionary changes.

In some measure, to be sure, there was persistence of trends, such as in the matter of continuity or accumulation. By the later decades of the nineteenth century, it had become an almost universal practice for writers in the economic and business field to consult previous writings. By the twentieth century, it had become a test of scholarly quality that a man remember whence he had borrowed significant ideas or important statements of fact. The growth of national libraries, such as the British Museum or The Library of Congress, and of university and large public libraries, comes chiefly in the past three quarters of the century, especially in the United States. Cumulation has been promoted by large bibliographical works such as Gregory's *Union List of Serials*, Stammhammer's bibliography of socialism and communism, or Daniel C. Haskell's "check-list" of early European railroad literature. Cumulation has also been fostered by service departments of national governments or private research organizations. Information is collected and hoarded in such governmental agencies as the American Bureau of Labor Statistics or Bureau of Agricultural Economics. It is also assembled and hoarded by organizations such as the National Bureau of Economic Research or the Brookings Institution. Now no one on its staff launching work on almost any historical theme need really "start from scratch."

There was also continuity from past eras in the persisting effort at measurement. The statistical work of governments increased, and there was marked enlargement of activities on the part of private organizations. Here again the United States has taken the lead with such reporting agencies as Dodge on building construction, Cram on automobile production, Dun & Bradstreet on business failures, or Dow-Jones on stock market movements. The measurements recorded by the quasi-private, quasi-public Federal Reserve Banks make the expansion of recent decades even more striking.

Changes in the character of economic and business literature since 1880 may also be pictured correctly as

proceeding from tranquility to profound disturbance. Optimism, general agreement on principles, calmness of exposition—this was the economists' "era of good feeling." Something of this spilled over into the twentieth century in the writing of such an economist as Thomas Nixon Carver. In the meantime, business had settled into a belief in the necessity of learning only by doing; experience was not merely the "best," but really the only teacher.

Of course, troubles of various sorts were already brewing. Marx and Engels had formulated their "manifesto," and Marx was busy writing in the British Museum. More immediately important, Jevons, Walras, and Menger were introducing ideas of marginal utility. And still more unsettling, at least over the intermediate future, Walras was hatching his general equations, and with Pareto was introducing mathematics into the previously common-sense field of economic theory. In the same years, "practical" problems were causing controversy: bimetallism, the return of protectionism, social insurance, regulation of railroads, spread of labor unionism, and the like. The world of economics seemed to grow ever more complex.

Efforts to solve some of these problems gave encouragement to the advocates of measurement and to those who were moved to improve the science of statistics. On the whole, the protectionist-free trade controversy and that surrounding monetary affairs did not lend themselves to much quantitative handling. The field of social insurance was also somewhat infertile in this regard. However, the governmental bureaus charged with the supervision of railways in England and on the Continent collected statistical data with avidity. Some of the earliest treatises in the field, such as Gerstner's out of Austria or Audiganne's out of France, displayed a considerable bias toward quantification. And the Interstate Commerce Commission was issuing statistical volumes with its formation in 1887.

Sometimes a measurement-resisting subject would yield indirectly at least to quasi-statistical treatment in the hands of an intellectual innovator such as Professor Taussig who spoke of the "verification" of the theory of international trade under the "abnormal" conditions of dealings between a gold-standard and a paper- or silver-using country.

The study of business cycles represented most clearly the convergence of trends. Juglar demonstrated the existence of cycles in his examination of bank data from France and England (1860) in quantitative data. Subsequently, the tendency in the treatment of the subject—by Jevons in 1875, the American Frederick B. Hawley, Hull in his handling of building cost data, and preeminently Wesley C. Mitchell in his pathbreaking volume of 1913—was for an ever-increasing reliance on measurement. The literature concerned directly or indirectly with the business cycle would cover many running feet of library shelving, constituting a "bulge" from the trend line for this period.

Concurrently with the study of the business cycle had gone a considerable expansion in the exploration of

population trends and of the associated field of actuarial science. International congresses, professional journals, a series of examinations for advanced standing, and the like have created a literature within a literature.

Not least important has been the development over the past few decades of statistical inference—with its literary products. The advances here have been linked closely with the name of R.A. Fisher of England, whose *Statistical Methods for Research Workers* (1925) and *Design for Experiments* (1935) led the way. Fisher asked what could be learned about a “universe” or aggregate from a sample out of it and whether a sample could be selected out of the universe that would display the characteristics of the whole, or characteristics with recognized deviations from the whole. Out of this line of thought has grown quality control in business, opinion research in business and elsewhere, and the like—with another sizeable addition to the volume of economic–business literature.

In the area of economic theory a noteworthy change has occurred—especially as far as the English-speaking world is concerned. In the preceding period, Cournot, Walras, and Pareto emphasized that the ideas of the theorists could be expressed clearly and precisely in mathematical language. Marshall, Edgeworth, Irving Fisher, and Pigou helped to introduce this language into England and the United States, whereas more recently still, the developments in this area and in statistics have coalesced to produce econometrics, and these three in turn, with the ideas on national income stemming from Keynes, to yield model building, linear programming, and the like. By a more direct route from the mathematical “fathers” has come Professor Leontief’s input-output analysis and the work that this innovation has promoted.

Twentieth century bibliographies in this field, Carpenter states, “have been compiled [to] cover all the subjects generally falling under the heading economics, rather than just the writings of economists or the literature of public finance [with] a greater emphasis on the ephemeral literature.”^[4] Henry Higgs, setting himself the goal of listing books in all Western languages, produced the important *Bibliography of Economics, 1751–1775* (1935). Magdalene Humpert’s *Bibliographie der Kameralwissenschaften* followed in 1937 and a major French work, *Economie et population, les doctrines francaises avant 1800; bibliographie générale commentée*, was issued by the Institut national d’études démographiques in 1956. L.W. Hanson’s *Contemporary Printed Sources for British and Irish Economic History, 1701–1750* (1963), reaches a new height in economic bibliographies, according to Carpenter.

Another significant aid to scholars is the *Catalogue* of the Kress Library of Business and Economics at the Harvard Business School, which has been issued in four volumes between 1940 and 1967.

A novel development of the era since the 1880s is the publication of “festschriften.” Action of this sort suggests respect for the subject of the honor and a high appraisal of

the results of research. Such publications began to appear in Germany in the latter half of the nineteenth century, and the example was followed in Italy, Scandinavia, the Low Countries, the United States, and less so in France and England.

A second novelty was the publication of manuscript material. There had been printing of governmental materials for some time—national and local, administrative and legal—and some of the first publications in our field were so constituted, or were largely so, e.g., documents in Schmoller’s study of the Strassburg cloth gild (1879), Hintze’s compilation relative to the Prussian silk industry (3 vols., 1892), Hayem’s *Mémoires et documents pour servir à l’histoire du commerce et de l’industrie en France* (12 series, 1911–1929), even Bland, Brown, and Tawney’s *Select Documents* (1914). The publication of private papers has come chiefly through the printing of documents from the archives of such historic institutions as the East India Company and the Hudson’s Bay Company.

Literature which pertains specifically to the operation of business institutions had in these decades since 1880 been going through no less extraordinary an experience. There had been manuals that told the merchants how things *are* done—what weights, what types of money, what procedures, and the like; and occasionally a manual as to how things *should* be done. In the latter category would fall the books that linked religion with business activities. As early as the sixteenth century, John Browne’s *Merchants Avizo* (1588) had given instructions to young merchants going to Spain and Portugal. Soon there were the manuals of Savary and Kruse, of Malachy Postlethwayt and Wyndham Beawes, descriptions of what was done and sometimes advice on the best among several possible practices. Even in the nineteenth century, with Babbage and Freedly and others of the midcentury, there was very limited conceptualization of business functions.

A break appears to have come in the 1880s. We know that Henry Varnum Poor and some of the American railroad executives had had ideas relative to their industry as far back as the 1850s. A new, broader, more vigorous start came in the 1880s, largely through the American Society of Mechanical Engineers. From this background came Frederick M. Taylor and what in 1905 rose to be labeled “scientific management.” In these years, too, books of a new character were beginning to appear in England. There was J. Slater Lewis’ *Commercial Organization of Factories* (1896), F.G. Burton’s *Commercial Management of Engineering Works* (1899), and somewhat later, E.J. Elbourne’s *Factory Administration and Accounts* (1914). In general, the English approach was more largely accounting and commercial control than the American. In France, Faye was making a major contribution in his materials on the functional organization of business operations. And the Germans made at least an indirect contribution in the “line” and “staff” organization of their army.

These steps represented a forthright belief that generalizations, abstractions, perhaps “principles,” were possible

with respect to business structures and performances. The abstractions were those of business functions (marketing, production, finance, etc.), which tended to make all business institutions into an “extended kinship group,” if not into one closely knit family.

In step with the changing climate of opinion in the business world, there was the initiation of specialized training in business at the college and university level: the Wharton School of Finance at Pennsylvania, the Amos Tuck School at Dartmouth, and that on Business Administration at Harvard—with a rapid increase in popularity at other universities in the years after World War I. And a specialized literature began to flourish. Mr. Arch W. Shaw had launched *System, Business*, and other publications in the field. Other publishers kept close pace and books of professional character began to appear: Hatfield’s quasi-classic *Modern Accounting* (1909), P.T. Cherington’s *Advertising as a Business Force* (1913), and a small flood of items on scientific management.

Business literature has flourished most luxuriantly in the United States. Germany has been a rather distant second, although vigorous in the theoretical phases of the field, with England, France, and other countries less involved. The general attitude in England has been that one could not learn business out of books.

In the United States, the growth of the literature has been notable for its increased sophistication and its changed time perspectives. Business literature reveals an increasing concern with the future. The introduction of budgeting, of market analysis, of employee training or executive development, etc., has turned businessmen’s eyes increasingly toward the future; and a whole new stream of literature reflects this change. The field of business has also developed a sophisticated *historical* interest. Histories of individual business units and business functions had appeared intermittently over past centuries, but the conscious effort to create a new branch of historical study and writing relative to the operation of individual business enterprises may be regarded as a contribution of Dean Wallace B. Donham of the Harvard Business School (who brought Professor N.S.B. Gras to that institution to implement his ideas) and their imitators and admirers of that period. An almost contemporary development—seemingly independent—occurred in Germany under the inspiration of Professor Kurt Wiedenfeld of Cologne.

A number of factors have encouraged the preparation of histories of companies: increasing longevity, which makes possible semicentennial or other anniversary volumes; an improved sense of public relations; sometimes the aroused curiosity of scholars; sometimes the letter of the tax laws, etc. Increasingly, at any rate, the flow of company histories has broadened and the quality risen. Nor is the enhancement in volume and quality restricted to merely the United States and Germany. By and large, England and France have lagged behind (except for

histories of banking institutions in the former), but to their output must be added quite a flood from the Netherlands and Scandinavia.

Beyond businessmen’s biographies there have been studies of business practices and institutions other than individual houses: methods of dealing in foreign exchange, the commercial paper market, trade associations, and the like—even the businessman as a social creature.

CONCLUSION

This survey of the evolution of economic and business literature suggests that a narrowness in the concept has dominated the histories of economic thought. The wide-ranging literature reflects, for the Western world as a whole, the changes in the entrepreneurial and governmental systems over the centuries. Economic and business literature constitutes a connecting link between economic and business performance and the realm of ideas. It throws light, too, on the formation of public opinion and the relation of that opinion to social action. The differences in rates of economic change among nations are of increasing interest among scholars, and here, too, a study of economic and business literature may prove of value. There is recognition that economic sophistication is a prerequisite to forward-looking public administration and that there are forces and conditions in business life not adequately taken care of in the economists’ abstractions. Again, the materials for a history of economic and business literature are those also for a history of economists, or of explorers and innovators among economic historians. No less than in medicine or natural science, this literature seems to manifest a tremendous increase in the volume of communication, an evolution and testing of new ideas, and a marked advance in sophistication.

The above article draws heavily upon a longer consideration of the topic by Arthur H. Cole, which was published first under the title “Conspectus for History of Economic and Business Literature” in the *Journal of Economic History*, 17(3), (September 1957) and, in a slightly revised version, under the title *The Historical Development of Economic and Business Literature* (Publication #12 of the Kress Library of Business and Economics, Graduate School of Business, Harvard University, Boston, 1957).

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Electronic Records Preservation

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Abstract

The need to preserve electronic records and publications has been expressed in archival and library literature, but analysis of the challenges and development of strategies for achieving reliable retention are in their infancy. Many archivists and librarians perceive that information created in or converted to electronic form is at risk as a result of several notable losses of important electronic information like National Aeronautics and Space Administration's electronic files from the 1976 Viking mission to Mars, pre-1997 e-mail communications of U.S. Vice President Al Gore, and photographic image files damaged by the "I Love You" virus in 2000.

WHAT IS AN ELECTRONIC RECORD?

Electronic records can include information originally created in an electronic format or information created in hard copy or analog format and subsequently digitized through use of digital imaging, optical character recognition technologies or direct analog to digital conversion for audio and video information. Electronic records can include digital image files, audio files, and geographic information system files, as well as the more common documents produced by word processing or e-mail. Compound documents may include several of the above technologies in a single product.

An electronic record is a form of information produced in the course of an event or a routine activity by an individual or an organization. Electronic records are created and retained as specially designed output from an information system or personal computer. They may be selected for retention because of their comprehensiveness and portability, or they may not be retained since other forms of the same information (e.g., hard copy, microfilm) may be preferable for personal use, acceptable as evidence, or retained at lower cost. Most files output or saved from information systems or personal computers are not electronic records. Simple backups or downloads usually do not contain sufficient contextual information to authenticate and verify the accuracy of the content.

Connecting Content and Context

For many years, archivists have struggled to understand and explain the difference between an electronic record and electronic information or data. Archivists have made important distinctions between the content of information and its context, since elements of the context of information creation can certify the accuracy and authenticity of information content. Context is also essential for documenting how and when content changes have been

made over time. Electronic records must have content *and* context in order to successfully document an event, an activity, or a business transaction.

Electronic publications often serve as a record of an activity or transaction since they generally are presented with attributions of authorship and sources. They are often granted the status of records because authors, footnotes, and bibliographies provide sufficient context for readers to have confidence in the accuracy and authenticity of the information presented. Other electronic information products such as specially formatted output from a large information system are intended to serve as records, but often that output does not include the contextual information necessary to be considered a reliable record of an event or transaction. Much of the research in electronic record preservation has centered on identifying the contextual information necessary to authenticate the content of an electronic record.

History of Electronic Records Preservation

Early attempts to collect and preserve electronic records began with the establishment of data libraries that supported social science research in the 1970s. These projects generally concentrated on retaining textual and numeric research data in a software-neutral form for access and reuse. Although certain quality control tests were conducted and error logs were investigated, it was the mission of these institutions to retain data derived from specific research projects to facilitate subsequent reuse and research replication. Contextual information about the data was generally retained in separate data dictionaries and codebooks that described the functions and allowable data values for specific pieces or fields of information.

The U.S. National Archives received its first accession of electronic records in 1970, and this function was retained through several reorganizations to this day. The current

Center for Electronic Records physically acquires and preserves similar textual and numeric data sets produced by government agencies and does not generally retain electronic records in software-dependent formats. The center and its predecessors developed and implemented standards for selecting and accessioning electronic records, conducting quality control tests, and establishing public access services.

As more electronic content was produced with the advent of inexpensive personal computers and mainframes in the 1980s, computing professionals established facilities and routines for system backups. They generally did not consider long-term retention other than content presented in computer output microfilm (COM). Quite often the labeling on COM sets and backup tapes was not sufficient to describe the scope or age of the content within. At the end of this decade, electronic reformatting technologies such as digital imaging became widely available and many institutions implemented imaging to reduce paper record storage costs. Legal standards were soon established for certifying the accuracy of digitally reformatted content, but these standards generally focused on documenting imaging and quality control as routine business practices for litigation defense support.

In the 1990s, e-mail and word processing became essential features of business and personal life, and questions of the accuracy and authenticity of electronic records began to emerge in highly publicized cases of fraud and unauthorized system security breaches.

The landmark 1993 U.S. Court of Appeals decision in *Armstrong versus Executive Office of the President* highlighted the challenges of increasing government efficiency through technology, while retaining citizens' right to access government records. The decision confirmed that, in this case, e-mail did constitute a federal record that must be retained or destroyed in accordance with the Federal Records Act. The court also ruled that printouts of White House e-mails did not contain sufficient structural and contextual information to authenticate the communications and that the electronic version of the communications needed to be retained to satisfy federal record-keeping requirements.

In the next few years, widespread availability of digitization technologies and production of electronic books, journals, and indexes enabled the development of digital libraries that presented locally owned and commercially licensed content made accessible through the Internet. The opportunity for development of digital libraries caused librarians to take a more active interest in preservation for electronic publications and establishment of metadata standards to support Internet resource discovery.

In 1997, the Virginia Institute of Technology (Virginia Tech) initiated the first university program to accept electronic theses and dissertations. This project highlighted the similarities between librarians' concerns for preserving electronic publications and archivists' interest in

preserving electronic records. Theses and dissertations are simultaneously considered a publication and also a student record. As a result of the Virginia Tech initiative and in response to the 1996 Research Libraries Group report *Preserving Digital Information*, archivists and librarians began to study the relationships between content and context. Academic research on these issues emerged with the support of the National Historical Publications and Records Commission, a division of the National Archives and Records Administration that made electronic records research a funding priority throughout the 1990s.

Beginning in 1989, Luciana Duranti of the University of British Columbia published a series of articles in the journal *Archivaria* that examined the applicability of diplomatics for modern record-keeping practices. Diplomatics was a mid-seventeenth-century discipline that viewed the character and content of individual documents, as well as the organizational context of document production, as indicators of document integrity and authenticity. Intrinsic and extrinsic elements of particular documentary forms are cataloged and used as tests of authenticity. Extrinsic elements included medium used, script, language, seals, and annotations, while intrinsic elements included document protocol, actions taken or described in the document, and final responsibility for the content.

In 1994, Duranti's interest in diplomatics and document authentication led her and colleague Terry Eastwood to establish the "University of British Columbia (UBC) Project," which defined requirements for creating, handling, and preserving reliable and authentic electronic records in active record-keeping systems. Duranti and Eastwood then collaborated with the U.S. Department of Defense to set standards for record management system requirements that are used for certifying software vendors and their products. A planned second phase of the UBC Project was intended to address long-term preservation of inactive electronic records, but the scope of such a project required a larger and more diverse research team. As a result, the "InterPARES" (International Research on Permanent Authentic Records in Electronic Systems) project was launched in 1999, an international research initiative in which archivists, computer engineers, national archival institutions, and private industry representatives are working to develop the theoretical and methodological knowledge required for the permanent preservation of authentic electronic records.

Meanwhile, in 1991, the Minnesota Historical Society hosted the "Working Meeting on Research Issues in Electronic Records," which established the National Historical Publications and Records Commission's research agenda for electronic record keeping. In response to this agenda, Richard Cox of the University of Pittsburgh launched a three-year project, beginning in 1993, to establish functional requirements for record keeping in electronic information systems. The project also investigated several

related topics including organizational culture, technical capabilities of existing software, utility of standards and policies for satisfying archival requirements, and evaluation of technology and policy strategies.

The "Pittsburgh Project" resulted in dissemination of lists of functional requirements for record keeping, an analysis of tactics for implementing record-keeping systems, and an assessment of variables that may affect the use and implementation of those systems. In 1994, project consultant David Bearman of *Archives and Museum Informatics* and project researcher Ken Sochats asserted that the functional record-keeping requirements could be converted into formal requirements for specific metadata elements. In 1995, Philip Bantin of Indiana University began testing this model in an analysis of records systems for the Financial Management Support and Enrollment Services offices at that institution. More recently, the Australian Recordkeeping Metadata Research Project has made substantial progress on metadata issues, with record-keeping metadata standards issued by the Commonwealth, Victorian, and New South Wales governments between 1998 and 2001.

The search for electronic record preservation strategies also led to attempts to enunciate the competencies necessary for archivists, records managers, and librarians to participate in electronic preservation projects. In 1993, the Committee on Automated Records and Techniques of the Society of American Archivists established the Automated Records and Techniques Curriculum Project, and this work also resulted in the publication of a special edition of *The American Archivist* dedicated to electronic records case studies.

In addition, two annual national conferences on electronic records preservation were established. Cohasset Associates, a Chicago consulting firm established the MER: Managing Electronic Records conference in 1993, which serves as a forum for presentation of emerging preservation strategies that is widely attended by corporate and government organizations. In 1999, Arizona State University established ECURE: Preservation and Access for Electronic College and University Records, which focuses on the special record-keeping needs of colleges and universities and is dedicated to the critical analysis and dissemination of practical strategies for electronic records access and preservation.

Advanced technologies are now being applied to electronic preservation issues. In 1999, the Distributed Object Computation Testbed project was established as a partnership between the U.S. Patent and Trademark Office, the National Archives and Records Administration, and the San Diego Supercomputer Center. The test bed was developed to store complex documents on geographically distributed data archives and systems using the processing power of supercomputers to implement preservation strategies from the digital library, archival, and computing communities. Brewster Kahle's Internet

Archive established technology that finds and stores snapshots of websites from around the world in an attempt to comprehensively document the Internet. Both the National Archives and the Library of Congress recently implemented programs to collect archival snapshots of selected web pages, but none of these projects have fully addressed the potential software incompatibility and proprietary markup issues related to websites.

At the beginning of the twenty-first century, implementation of new technologies continues to advance as archivists, librarians, and technology professionals continue to work on several aspects of the electronic records preservation challenges. The Government Paperwork Elimination Act of 1998 and the Electronic Records and Signatures in Global and National Commerce Act of 2000 (known as E-Sign) mandated widespread implementation of electronic government services and electronic signatures. Similar legislation has been adopted in several state governments.

Interactive Internet technologies and the advent of virtual reality and desktop videoconferencing are increasing the complexity of electronic record keeping. Electronic content is increasingly software dependent so that long-term retention of products may require continued support for obsolete software and operating systems, active migration of records to new software, or development of emulation hardware and software. Increasing data storage capacities and the fast development and implementation of proprietary compression and backup technologies are hastening the obsolescence and increasing the incompatibility and interoperability of data storage media and systems. Widely distributed computing facilities and multi-institutional or multinational collaborations make retention and appropriate deletion of electronic records much more difficult than before. Distributed computing places greater pressure on policy, procedure development, and oversight since file maintenance is no longer centralized.

Preserving Electronic Information

Thirty years of work in acquiring and retaining electronic content has not resulted in complete solutions for electronic record preservation, but researchers have started to identify and catalog the major barriers to successful electronic record keeping. A successful electronic record preservation strategy requires attention to seven major challenges (Table 1).

Storage media

Storage media is often used to support backups, off-line storage, or distribution of electronic content. These challenges have received a great deal of attention in the popular media and the professional literature, but they are the easiest to manage since estimates of the reliable shelf life of various media and interoperability of certain media

Table 1 Seven challenges of electronic record preservation.

Challenge	Example
1. Physical degradation of storage media	CD does not read anymore since the recording surface has been degraded by air pollutants.
2. Physical obsolescence of storage media	5.25 inch floppy disc does not fit in CD-R drive.
3. Incompatibility/noninteroperability of storage media	One manufacturer's DVD disc will not play in DVD players produced by a different manufacturer.
4. Software, operating system, or encoding incompatibility/noninteroperability	New software release will not run file from old release. New software release opens old file, but contents are corrupted. Software is not compatible with operating system. Product designed for display with one Internet browser does not look the same in a different browser. Proprietary backup software and storage format not compatible with new release or other backup software. Proprietary codes from HTML editing packages do not convert to XML.
5. Human error/vandalism	Accidental or malicious deletion. Website is vandalized.
6. Backups and snapshots	Backups lost or overwritten. Wrong files backed up. Incomplete snapshot: Video server backed up, Web server not backed up. Snapshots of different servers not contemporaneous.
7. Metadata	Insufficient context to verify source and authenticate content.

formats like CD-R are available. We can project the expected physical life of the media, track changing format standards for media players, and plan to move the information to new media based on the expected physical shelf life and availability of new formats and players. The generally accepted reliable shelf life of compact discs for example is 5–100 years, depending on several factors, including manufacturer, production materials used, storage conditions, level of use, etc. However, many experts believe that physical obsolescence and incompatibility and noninteroperability of storage media occur faster than the media can physically degrade. One source reports that media players are becoming obsolete every 2 to 5 years. It is critically important to move electronic content from old storage media to newer media before the old media player fails or becomes unavailable. Commercial data conversion and recovery services and

some archival repositories retain and maintain some obsolete media players, but the usable life of this equipment is unknown.

Software and document encoding issues

Software incompatibility or noninteroperability results in files that will not open at all or documents that are corrupted and must be repaired if possible (usually through comprehensive manual reentry or manual editing and correction of content). The two major strategies for addressing software incompatibility and noninteroperability issues are known as emulation and migration.

The emulation concept proposed by Jeff Rothenberg of the Rand Corporation involves writing new software that mimics the appearance and functionality of old software. Recently, experts in this area have challenged emulation, suggesting that efforts to write emulation software solutions have not resulted in exact reproductions of appearance or function. Approximate reproductions of appearance or function might be sufficient for some record-keeping applications, provided that the information content is accurate and can be authenticated.

Migration tends to be the more widely accepted preservation strategy, in which files are regularly saved to new releases of the same software as they become available or are converted to new software produced by another manufacturer. Migration is not always successful, as conversion programs do not always have full “backward compatibility” that results in “clean” conversions between old and new software releases. Many electronic document managers are selecting ubiquitous software packages, relying upon a large “installed base” in the hope that that the manufacturer will survive for many years and that future releases will have complete backward compatibility. In addition, software manufacturers have not always supported “interoperability” by including reliable conversion programs for moving files between their own products and those of other manufacturers without corruption. Manufacturers are increasingly including backward compatibility and limited interoperability into their product designs, but, for now, migration cannot be considered a fully reliable preservation strategy.

When electronic information is encoded to support electronic publication or display on the Internet, the selection of encoding syntax or language is an important issue. Although standards for encoding electronic documents such as SGML (standard generalized markup language), HTML (hypertext markup language) and XML (extensible markup language) have been established, software developers have not always complied with the standard, introducing proprietary codes in their document-editing software. These are codes that may be misinterpreted or cannot be read by other software packages, resulting in data-processing errors or changes of document color or formatting. Color or formatting may not be essential

elements of a textual electronic record but may be significant components of multimedia presentations that incorporate graphic or video content. Proprietary codes can sometimes be replaced with their standardized equivalents but the appearance and functionality of the document could be changed as a result.

Human error and vandalism

Human interaction with electronic information presents important challenges for electronic records preservation. At a very basic level, the culture of technology transfer, adoption, and implementation makes preservation more difficult since our faith in new technology sometimes precludes critical analysis of its effectiveness. Those who would champion system design changes that support effective record keeping often are met with resistance since record keeping is often not valued as highly as fast implementation. One result of our culture is that although sound data management practices are available, systems managers for large enterprise level systems or users of desktop personal computers do not always rigorously follow them.

Electronic records can also be intentionally compromised through actions of individuals who have access to the content or have learned to circumvent data security measures. Records can also be corrupted as an intended or unintended consequence of a computer virus infection. An individual can compromise any encryption and security technology with access to specialized expertise and high-performance computing facilities. Often, violations of system security are undetected until damaged content or other evidence of the violation is subsequently discovered. These threats to electronic record keeping can be minimized through the retention and maintenance of off-line backups.

Backups and snapshots

Reliable backups of electronic records are essential for successful short-term retention since data can easily be deleted or corrupted with the push of a button. Redundancy has always been a very successful preservation strategy and inexpensive data storage can make redundancy cost effective. Backups are intended to support recovery from disasters, system failures, or human error, but many data losses can be attributed to improperly managed backups.

Backup failures can result from improper backup system configuration, lack of quality control, failure to migrate the content before backup system failure, incompatibility with new backup systems, or simple operator command error. Most backup systems use proprietary compression and software that has a very high degree of noninteroperability and incompatibility. In addition, the rapid increases in storage technology capacity and the

increasing frequency of new backup software releases make long-term survival of backups unlikely. Accurate file backups must be made to a nonproprietary and compressionless environment, and they must be effectively migrated or emulated for successful long-term preservation. The timing and scope of backups should be established in advance, rigorously followed, and tested for accuracy and completeness. Many experts believe that given the risks, backups are not effective for record keeping. Migration of records to a specially designed record-keeping system or redundant live-server storage may be more reliable, especially for long-term retention.

Specially designed downloads of websites known as “snapshots” are key issues for preserving a record of an interactive website since their scope and timing are critical for capturing a “record” of the changing content. Many complex Web products are now stored on a number of different servers to facilitate efficient retrieval and display. The products themselves only exist for a moment in time on a patron’s computer screen, but the sources of the content are distributed. All the source files of product components must be included in the snapshot so that the record of the website is complete, unless certain parts of the content are deemed “nonrecord,” such as the chat room attached to an electronic college course.

The timing of snapshots is also important since an interactive website may have certain components that are static and others changing. Snapshot timing needs to be established with some attention to the rate and nature of change in the website. Ideally, the snapshot of the record components across a series of servers should be done contemporaneously so an accurate record of the components and their relationships can be retained.

Metadata and retention of context

The essential difference between data or electronic information and an electronic record is that electronic records have information content *and* specific pieces of contextual information that authenticate or explain the content. This contextual information is called “metadata.”

In general, metadata tags or “metatags” are elements of textual information inserted into the header of an electronic file to enable automated searching, retrieval, and use of the content within the file. In the record-keeping context, metadata is divided into two types: descriptive metadata and administrative metadata.

Descriptive metadata is generally used for describing or indexing the content of an electronic file. The Dublin Core is recognized as the most commonly used structure for presenting metadata, and the development of this standard and other descriptive metadata standards is driven by the need to support Internet commerce or other business applications. Dublin Core does contain elements that support retention of some but not all of contextual information necessary for effective record keeping.

Administrative metadata addresses more of the contextual information necessary to understand the accuracy and authenticity of the content. It also can facilitate management and preservation of the electronic file over time. Administrative metadata can document such attributes as document version, software and hardware requirements, location and availability of other metadata such as software documentation, location and availability of backup files, and migration history. Establishing and implementing administrative metadata standards would greatly improve the prospects for electronic record preservation in the future.

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Electronic Resources & Libraries (ER&L)

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Abstract

The annual Electronic Resources & Libraries conference (ER&L) was first held in 2006 to bring people together to focus directly on the trends, workflows, and technologies involved in managing electronic resources within the library community. Attendees gather, both in person and online, to find common ground, learn, and have an impact on their profession.

INTRODUCTION

The Electronic Resources & Libraries conference, or ER&L, is an annual international library conference focused on trends, workflows, and technologies involved in the management, maintenance, and accessibility of electronic resources in libraries. ER&L's stated mission and purpose, as found on <http://electroniclibrarian.org/about/>, focus on the need for communication and collaboration to enable individuals that deal with electronic resources to keep up in a quickly evolving environment. With these in mind, attendees gather annually both in person and online to learn from one another, make connections, and develop a better understanding of how to go about their work.

Mission: ER&L facilitates the communication and collaboration for information professionals around issues related to managing electronic resources in the digital world.

Purpose: The goal of the ER&L conference is to bring together information professionals from libraries and related industries to improve the way we collect, manage, maintain, and make accessible electronic resources in an ever-changing online environment. We do this once a year at an in-person conference. In addition, sessions are recorded and made available in an online conference. ER&L allows for cross-pollination of ideas across fields of librarianship not often brought together in traditional public services or technical services conferences.

HISTORY AND GROWTH

ER&L was first conceived by Bonnie Tijerina, a librarian at the Georgia Institute of Technology (Georgia Tech) at the time. Tijerina attended a conference where someone presented on a survey they conducted with a new area of the profession called e-resources librarianship. The results of the survey indicated people working primarily with electronic resources felt isolated and overwhelmed. Survey respondents said their colleagues didn't understand what

they did and that there was a lack of standard practices across library vendors. In an e-mail interview, Tijerina recalled, "While I attended the session I thought that if a lot of the librarians from across the country could get together, they could build community, share best practices, and work closely with vendors to communicate the needs of the library community." She put out a call to the broader community, asking a few questions about what conferences cover e-resources professional development and if a new conference was needed. Getting a lot of positive responses, as well as volunteers to help, she set about organizing a conference.

What was to become the first annual ER&L was held March 23–26, 2006, in Atlanta, Georgia, on the Georgia Tech campus. Featuring two keynote speakers and 33 sessions spread across 10 tracks, the conference drew approximately 100 attendees. The opening keynote by Robert McDonald, associate director of Libraries for Technology & Research at Florida State University at the time, set a tone that has continued to drive the forward thinking nature of the ER&L conference since. He applied the concept of Internet 2.0 to libraries, using the term Library 2.0 to illustrate how library systems and services could develop in the coming years. The presentation tracks from the first ER&L reflected the broad topics that staff working with electronic resources were wrestling with, mostly on their own.

First ER&L Conference Tracks

Organizational Change
Access
Electronic Resource Management
Partnerships
Consortia
Usage Data
Workflow
Licensing
Resources
Technology

From that first event to celebrating its 10th annual in 2015, ER&L has changed location several times and grown considerably. In addition, the organizers and volunteers have continued to adjust their plans to ensure the conference evolves and continues to meet its mission and purpose in the changing world of electronic resources.

ER&L remained in Atlanta then moved to Los Angeles in 2009. As of 2010, ER&L has had a regular home in the early spring on the University of Texas at Austin campus.

Throughout this time, Tijerina has continued to serve as the conference coordinator, assisted by numerous regular volunteers. Among these volunteers are several that have been key to ER&L since the beginning. Elizabeth Winter (Georgia Tech) has been the chair of program planning committee, managing the process of reviewing and finalizing the extensive set of presentations that are at the primary content of ER&L. Jill Emery (Portland State University) has filled many different roles including program planning, engaging sponsors, communication, and social media. As of 2015, there are dozens of individuals involved in planning the conference and dozens more that volunteer on-site to help keep everything running smoothly.

Since 2009, Tijerina has relied on the advice and business skills of her sister, Sandy Tijerina, who in 2012 became ER&L's first and only full-time paid employee. As sponsorship and communications director, Sandy handles the logistics for the conference planning as well as the physical conference itself. She also coordinates the vendor exhibits and sponsorship activities that are a major part of sustaining ER&L.

Attendance has grown steadily from those initial 100 in 2006. By 2010, the number had reached 400, then up to 650 on-site in 2015. Although the vast majority of attendees come from the United States, a growing number are travelling from abroad with representation from 22 countries across 6 continents.

Beginning in 2011, ER&L introduced an online conference option, recording and streaming select sessions to an online audience. Since 2014, the online conference has streamed most of the live sessions and keynote speakers. This has allowed participation in the conference to grow further, enabling people to attend the conference after the attendance cap has been reached or if they are unable to travel to Austin in person. In addition to the on-site attendees in 2015, another estimated 450 joined via the online option. A group rate makes it more affordable for several individuals from an institution to take advantage of the online conference. Presenters, in-person attendees who pay to add online access, and all online attendees are able to access the recorded sessions to cover any that they missed or wish to review.

In addition to examples like the online conference, ER&L continues to innovate to keep ahead of trends and to push boundaries of what people who work with e-resources consider important to their work and

profession. This can be seen in the topics that the keynote speakers address, in the focus of the presentation sessions in any given year, and in the nature of the related events (see the following text) that have emerged out of ER&L.

Keynote speakers over the history of ER&L have been invited specifically to provide insight into the broader world of libraries and beyond. A few examples from past ER&L conferences illustrate how the keynotes can serve as bridges to topics that are not traditionally associated directly with electronic resource management in libraries. In 2013, Michael Eisenberg, dean emeritus of the Information School at the University of Washington, presented "Listening to Users: What the 'Google Generation' Says About Using Library & Information Collections, Services, and Systems in the Digital Age," sharing how young users do research and what they think of the library. That same year, Rachel Frick, director of the Digital Library Federation (DLF) at the time, gave an inspirational talk titled "The Courage of Our Connections: thoughts on professional identities, organizational affiliations and common communities," about the increased role librarians can play in the networked world. In her 2014 talk "Freeing Knowledge: A Values Proposition," Barbara Fister, a librarian at Gustavus Adolphus College and blogger for *Inside Higher Ed* (<https://www.insidehighered.com/>), spoke about library values, the open movement, and how libraries could lead in developing an open network. These and other ER&L keynote addresses are available to the public on the ER&L website.

The selection of concurrent presentation sessions and longer workshops changes from year to year, as new topics emerge in the world of electronic resources. ER&L's program planning committee sorts through submissions and hosts an online community voting process to finalize the slate of presentations. This allows the community to have a direct impact on the upcoming conference to make it as relevant and timely as possible. These sessions are supplemented by informal activities like lightning talks and roundtables to provide opportunities for people to actively discuss ideas that may not have been previously proposed.

Throughout its first 10 years, the organizers for ER&L have actively worked to increase the social aspects of the conference. In addition to being a useful networking opportunity for people working with electronic resources and library vendors, ER&L includes a number of social and entertainment opportunities to give attendees a chance to connect outside of conference presentations. Early on, these included organized dining events, tours, networking sessions, and receptions. Recently, organizers have held a Battledocks competition and a gaming night.

ER&L had benefited from sponsorship since its inception. Growing from 11 sponsors in 2006 to 56 in 2015, the conference draws interest and support from publishers, library content and service vendors, and related organizations. Sponsors support ER&L by hosting luncheons and

receptions, providing scholarships, and helping to cover the costs of the conference services such as A/V technology.

ER&L TODAY

Planning and organizing ER&L occurs throughout the year, coordinated by both Bonnie and Sandy Tijerina. They are in communication regularly with the host site, sponsors, and volunteers during the lead up to the actual conference. As of the 2016 conference, the planning committee consists of the following subcommittees and functions: program planning, fellowship, fun and games, grants, sponsorship, social media, web, workshop, and local logistics.

The typical calendar for conference planning begins 6–8 months before the conference and includes

- Keynote speakers identified and invited
- Sponsors recruited on an ongoing basis
- Call for workshops in early fall
- Call for concurrent session proposals in the fall
- Community voting several months before the conference
- Notifications of acceptance by late fall or early winter
- Developing the official schedule
- Conference typically held in late March/early April

As with many conferences, individual sessions are assigned to a track to help attendees identify a focused group of session to attend. The focus of the conference tracks change over time as the nature of the library electronic resource world changes. The tracks from 2016 conference website are as follows:

Managing e-resources and licensing: Managing electronic resources is a challenge, whether you're new to it or have been engaged in it for years. Which systems and tools can be used to manage electronic resources more effectively? What kinds of challenges are new formats posing? How are we rearranging our workflows to find solutions to e-resources problems? What can we achieve through more thoughtful licensing? How can standards and best practices assist our efforts?

Collection development and assessment: How do we demonstrate value to our larger organizations? Are our collection and analytic processes as efficient as they could be? Can collecting data be easier? How can we best analyze what we collect?

Organizational strategies: Our organizations regularly evolve due to changes in leadership and strategic vision, budget constraints, user needs, and the simple fact that so many of our resources are now online. All of these impact the way we manage e-resources. What type of leadership has helped create positive change? What are some

examples of beneficial organizational shift and improved communication? Where are there opportunities for internal collaboration? Where do we still need to open up communications?

External relationships: In the digital world, libraries don't stand alone. They work closely with consortia, vendors, other libraries, and intermediaries. Are all these relationships working? Are we getting the most out of our relationships with other organizations or groups? How can we improve our external relationships?

User experience: Libraries exist in large part to support our users. How can we better serve our user populations? What kinds of communications will help us reach them when so much is competing for their attention? How can we demonstrate to users the value of libraries and create a better user experience?

Scholarly communication: How do we deal with new models of scholarship that are emerging? How do we accommodate new forms of content? What can we do to facilitate knowledge sharing and access?

Library as publisher: What role can the library play in the creation and distribution of the products of scholarship and creativity?

Emerging technologies and trends: So much of what we do in libraries today is driven by technology, and so many of the problems we face can be solved, at least in part, by employing or developing new technologies. How are current technologies being used? What emerging technologies are on the horizon? How can we employ them effectively to meet the information needs of the library, internally and externally?

RELATED EVENTS

Library Idea Drop House—(<http://electroniclibrarian.org/ideadrop/>): Starting in 2012, Tijerina hosted the Library #IdeaDrop House, inviting speakers from the SXSW Interactive Conference to discuss topics of interest to libraries in a small, relaxed setting. Partnering with regular ER&L sponsor, ProQuest, the IdeaDrop House has continued annually to offer conversations about libraries, data, privacy, and other topics.

UX Day: Andrea Resmini, information architect and a teacher and researcher at Jönköping University in Sweden, was an ER&L keynote speaker in 2012. He spoke about cross-channel experience for our users and how the information and services they utilize from a library's digital space is one of many facets of the larger information landscape they interact with in their daily lives. This concept led to a user experience or UX Day at ER&L 2014 with the goal, as expressed on its website (<http://electroniclibrarian.org/erlplus/uxday/>), “to educate and expose librarians and other information professionals to colleagues working on user experience, discovery, usage and usability projects in libraries and professionals working

in user experience outside of libraries.” The concept of UX Day was to concentrate on user experience–related sessions, speakers, and workshops. Invited presenters included Susie Herbstritt, senior interaction designer for Dell; Brian Taylor, senior user experience researcher and designer for Dell; and Matt Franks, professor at the Austin Center for Design and product owner and lead interaction designer at MyEdu. UX for Good founders, Jason Ulaszek and Jeff Leitner, and TEDxAustin Executive Producer Nancy Giordano led a hands-on workshop. ER&L attendees could attend the UX Day and individuals could register separately to join the UX Day on its own.

Designing for Digital: The success of UX Day led Tijerina to start Designing for Digital (<http://www.designingfordigital.com/>), a separate conference immediately following ER&L in 2015. Designing for Digital is held in the same location as ER&L, allowing interested people to attend both without additional travel, while it provides a robust enough conference experience to draw additional attendees that are specifically working on user experience, discovery, design, and usability projects inside and outside of libraries. Tijerina is joined by UX designer, Judy Siegel, to coordinate Designing for Digital.

Library Publishing Unconference: An example of how ER&L fosters innovative ideas, ER&L hosted a Library Publishing Unconference in 2013. A regular attendee, Amy Buckland (McGill University), proposed the idea and was encouraged to go ahead and organize it with the support of ER&L. The announcement for the Unconference encouraged attendees to come with their own questions, ideas, and enthusiasm to discuss issues around open access publishing, how the library can support and/or supplement the university press, and how to help faculty comply with open access guidelines.

AWARDS AND SCHOLARSHIPS

DLF/CLIR + ER&L Cross-Pollinator Travel Award (2013–): Cosponsored by ER&L and the DLF, this grant

was introduced to provide an opportunity to a library professional who might not normally attend ER&L, but whose work might align well with the goals of ER&L. As a cross-pollinator, the grantees bring perspectives from the DLF, connecting ideas from the broader library profession to the core ER&L mission. The travel grant includes a conference registration, air travel costs, and housing.

Taylor & Francis Group Student Travel Grant (2013–): Taylor & Francis Group has offered an annual scholarship for two aspiring e-resource librarians to support their travel, registration, and lodging at the ER&L conference. This scholarship was introduced in an effort to promote and increase opportunities for students to attend the conference. Applicants must be currently enrolled students from anywhere in the world. They are required to answer questions in writing about how ER&L can help them meet their professional goals.

CONCLUSION

ER&L arose in response to a vacuum of resources and support for those who manage electronic resources in libraries. Over its first 10 years, the conference and community has filled this gap and innovated to keep at the forefront of this continually changing area of the field. ER&L offers professional growth opportunities for new librarians and information professionals, those who are new to electronic resources, and to those who have been involved for many years. It was founded on the principle that by coming together as a community, ER&L participants can find common ground with each other to learn and have an impact on their profession.

ER&L can be found on

The web at <http://electroniclibrarian.org/>

Twitter as @ERandL

Encoded Archival Description

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Abstract

Encoded Archival Description (EAD) is an international standard based on Extensible Markup Language (XML) for encoding descriptions of archival records. People living their lives as individuals, as members of families, and as members of corporate bodies create and assemble records that serve as instruments for carrying out or documenting the performance of activities. Based on the archival principles of *respect des fonds* (or provenance) and original order, archivists traditionally have treated all of the records created and assembled by one individual, family, or corporate body as a collection or *fonds*. Archivists describe records as an essential part of their responsibility for preserving and facilitating access to and use of archives. Archival description provides information essential for establishing the authenticity and completeness of *fonds* and serves effective administration, discovery, access, and understanding of records. Traditionally, archivists have described each *fonds* hierarchically in a single apparatus commonly called a finding aid. Until the advent of computing, finding aids were typically in printed form. In the 1990s, archivists created EAD, an encoding standard for archival description that made it possible to derive online and print finding aids from the same structured data. EAD is based technologically on XML and intellectually on *General International Standard Archival Description (ISAD(G))*, a descriptive framework developed by the International Council of Archives (ICA). The third version of the standard, EAD3, will be released in 2015 and will continue to develop in the future. Future changes to EAD will be influenced by ICA descriptive standards, in particular the conceptual model and ontology for archival description to be developed by the Experts Group on Archival Description, and related encoding standards. This entry is organized into six sections: introduction, archival records, archival description, EAD, history, and future.

INTRODUCTION

Encoded Archival Description (EAD) is an international standard for encoding descriptions of archival records. An individual archival description is commonly called a finding aid, archival guide, handlist, inventory, or register. Though these terms cover a wide variety of apparatus, they most commonly refer to a hierarchical description of records that share a common origin or provenance. A collection of records sharing a common provenance is called a *fonds* or simply a collection. The hierarchical description begins with a description of all records in a *fonds* and then proceeds to a description of components, typically identified by the activity or function that they document (for example, correspondence or minutes of meetings). These components and components of components, and so on, may be analyzed and described, with the hierarchical analysis and description terminating in the description of a file or an item. The depth of analysis is determined by both intellectual criteria and available time and resources.

EAD is a standard for communicating archival descriptions and is not itself a standard for the content of the

descriptions. The general standard for descriptive content is *General International Standard Archival Description (ISAD(G))*,^[1] developed by the International Council on Archives (ICA). *ISAD(G)* provides general guidance on the composition of archival descriptions and serves as the basis of national standards such as the Society of American Archivists' *Describing Archives: A Content Standard (DACS)*.^[2] As a communication standard, EAD has a number of interrelated purposes. In conjunction with complementary content standards, it is intended to promote the regularization of description in order that the data are consistent and readily understood by users across archives. Regularized description and encoding enables intelligent searching, rendering, navigation, access, and use of archival materials. And since EAD is based on Extensible Markup Language (XML), a widely used and supported standard for developing encoding schemas, it provides reasonable assurance that the data will endure changes in hardware and software. Finally, standardized description enables the repurposing of archival description, including its eventual migration into successor encodings, and aggregation of descriptions across repositories to provide union access to distributed archival resources.

The Society of American Archivists (SAA) is responsible for the maintenance and development of EAD and the Library of Congress hosts the standard and official documentation. Within SAA, the Technical Subcommittee for Encoded Archival Description (TS-EAD) is responsible for the intellectual and technical content of the standard. The members of the Technical Subcommittee reflect the international nature of the standard, with members from the United Kingdom, Germany, France, the Netherlands, Sweden, Italy, Canada, and the United States.

The standard was first released in 1998. It was revised in 2002 and a third version—EAD3—will be released in 2015. The first two versions of the standard were in the form of an XML Document Type Definition (DTD) with an accompanying Tag Library. In 2007, EAD was released in the form of a schema, an alternative syntax for defining the standard. EAD3 will be maintained as a Relax NG schema but will also be available as a W3C schema and a DTD. The schemas and DTD provide the formal semantic and structural requirements of the standard and are used by software to validate encoded instances of archival descriptions. The Tag Library provides guidance on the use of the elements and attributes prescribed in the schemas and DTD and used to encode descriptive data.

ARCHIVAL RECORDS

Archival records are created and assembled by people living their lives as individuals, as members of families, and as members of corporate bodies. The creation of records is typically not the objective of the activities, but rather the records serve as instruments for carrying out or documenting the performance of activities. Archival records thus document people and organizations performing activities or functions, and as such, may serve as legal evidence and historical evidence. By contrast, the books and journals that constitute the bulk of most library collections are the objectives of the activities that created them. To illustrate this difference, it is useful to look at the creation of an encyclopedia.

At the beginning, the editors have the objective of publishing an encyclopedia. They correspond with a publisher with the proposal. Or perhaps the publisher conceives of the encyclopedia and contacts one or more editors. In either case, through a series of exchanges the publisher and editors negotiate the scope and content of the encyclopedia, the form or forms of publication, financial arrangements, methods for soliciting authors and editing entries, and so on. In turn authors for entries are solicited and a series of exchanges take place between the editors, authors, and publisher. Various agreements are formally made and signed. The authors are given formal instructions and deadlines. The authors create and submit drafts of articles to the editors, and after another series of exchanges, the authors submit entries to the publisher for publication. At each

stage, the participants in the creation and publication of the encyclopedia generate and maintain copies of the correspondence, agreements, instructions, drafts, financial transactions, and so forth. All of these documents serve the dual purpose of creating and publishing the encyclopedia and documenting the activities that lead to its publication. Each document is not an objective in itself but an instrument by which the objective is realized.

The participants' involvement in the creation of the encyclopedia constitutes only one set of activities over the course of their existence. The authors and the editors have both professional and personal lives. The publishing company publishes more than one book. Each participant generates and accumulates records over the course of a lifetime or existence. Many of these records will be kept for legal reasons, such as financial accounting and reporting, as proof of responsibilities performed, or perhaps self-consciously as records documenting a life or the history of a business. All of the records generated or accumulated by an individual, family, or corporate body, collectively serve as documentation of the life of the individual, or the history of the family or organization. When they are assembled and preserved, they are archival records. Each collection of records generated and accumulated by one individual, family, or organization is called a *fonds*. The items in a *fonds* share a common origin or provenance.

When considered individually, records frequently make little sense and thus have little value. It is only when individual records are considered in context, in relation to other records that document a network of interrelated transactions or series of transactions carrying out a particular function, that they can be understood. In this way, archival records are quite different from books and journals, as the latter are intended to function independently. This statement ignores the issue of intertextuality, which is beyond the scope of present considerations. Archival records are by and large unique. In this respect, archival records again differ fundamentally from books. Books and journals are not unique, at least not in ways that would be of interest to most users. Typically, books and journals exist in many copies, and any one copy will serve as well as any other.

Archival records are varied in both content and format, and the number of items in any given *fonds* may be quite large. While many records are exclusively or primarily textual, these may be in the form of handwritten, typed, printed, or digital. The content may be minutes of a meeting, a marriage license, receipts, a report card, correspondence, and so on. Sound, photographic, and audiovisual records may be in any format used for recording each of these forms. Content again will be varied, depending upon the context and the purpose of the recording. Maps, similar to textual records, may be hand-drawn, printed, or in digital form, as images, graphics, or as geographic information system (GIS) data. While a *fonds* may contain

exclusively one form or content, it is more likely, in particular with respect to personal and family records, that both the form and content of the records will be diverse. In addition to a variety of form and content, the number of items in any given *fonds* may be quite large. The administrative records of Tom Bradley, who served as the mayor of Los Angeles from 1973 to 1993, are stored in 4253 boxes occupying 2101.5 linear feet of shelf space.^[3]

ARCHIVAL DESCRIPTION

Archival description reflects the nature of archival records and the mission of the archival institutions into which their care and management is placed. Like museums and libraries, archives have a responsibility to remember on behalf of others. Preservation is the first essential responsibility, for without the physical preservation, memory fails. Equally important though is a description of archival records that provides information essential for establishing their authenticity and completeness and serves effective administration, discovery, access, and understanding. Archival preservation and description make the remembering as trustworthy, reliable, and thorough as possible. To serve these objectives, archival description has traditionally focused on the *fonds* as the fundamental unit of description rather than the individual items, as is the common practice in libraries and museums. While there is an obvious savings of time and effort in collection-level description, this descriptive practice is based on the nature of archival records and the objectives to be served.

Archival description rests on two fundamental principles, *respect des fonds* and principle of original order. *Respect des fonds* is frequently also called the principle of provenance. While understanding of this principle has undergone ongoing interpretation since its articulation by French archivists in the early nineteenth century, its fundamental meaning has remained unchanged. Archivists must honor the origin and integrity of records generated or accumulated by an individual, family, or corporate body. The records generated or accumulated by a single source are intricately related to that source, whether it is a corporate body performing the functions with which it is charged or an individual pursuing personal and occupational activities. Given this intimate relationship, records cannot be understood apart from their origin. From this follows the archival practice of treating all records with a common provenance as a group.

The principle of original order addresses the arrangement of the archival records. The concept of original order is frequently conflated with the physical arrangement of records as received by the archive, though it is better understood as an intellectual arrangement that reflects the purpose and use of the records by the creating entity.^[4] Commonly, particularly with records deriving from and maintained within a corporate body (such as a government

agency or business), records have been arranged and maintained to support the functions and related transactions performed by the body. In such cases, the physical order reflects the purpose and use of the records. It is quite common, though, that the arrangement of the records as received by the archive does not reflect a discernable order, and it is incumbent on the archivist to analyze and arrange the records to reflect their understood purpose and use.

Based on the application of the principle of *respect des fonds* and the principle of original order, archivists maintain and describe all records in a *fonds* together, physically arranged to reflect the original order. A description of a *fonds* begins with a description of the whole and, through a progressive, hierarchical analysis, describes components of the whole based on a shared characteristic or characteristics, which may in turn be analyzed into components and described. The analysis and description can progress to the item level, though frequently do not. Each level of description has a formal designation based on the nature of the shared characteristics that identify them as a coherent group: *fonds*, series, file, and item. Series and files may have intervening levels. The depth of the description is based on both intellectual and economic considerations. While it may seem counterintuitive, excessive analysis and description may hinder rather than facilitate the discovery, identification, and use of archival records, a phenomenon known as “getting lost in the details.”

Archival hierarchical analytic or multilevel description is shaped in part on two rules. First, the description of a component at any given level applies exclusively to that component (including its hierarchical descendants). Second, the description of a given component inherits the description of its parent, including any description the parent inherits from its parent, and so on up to the top level. A number of distinctive features follow from these two rules. Typical finding aids begin at the top level with several descriptive components, many of which may comprise detailed prose. At each successive level, the number of descriptive components and the amount of data supplied decrease. It is quite typical for the top level of description to provide lengthy narrative description, while an item-level description may be no more than a title or a date. Viewed from the perspective of the entire archival description, though, the item inherits all of the description back to the top level.

A third rule governing archival description dictates that all components of description are available at each level of description. This rule addresses the fact that individual archival collections are each unique, as they each reflect the lives and activities of individuals, families, or corporate bodies in particular places and times. They also vary greatly in the forms and quantity of records. In principle, all elements of description may be appropriate at any level of description. In practice, though, given inheritance and progression from general to specific, both the elements and quantity of description typically follow common patterns.

In a typical description, the top- or *fonds*-level contains information about the entire collection. The following information is typically given succinctly:

- Identifier or designation that is unique within the repository
- Title of the *fonds*
- Date range giving the earliest and latest dates of creation, frequently with a second range for the dates within which the bulk of the materials was created
- Provenance or creator information
- Extent of the collection, typically given in linear units of shelf space occupied and number of boxes
- Repository holding the collection
- Language or languages represented in the content

Information generally provided in brief text form at the top level includes the following:

- Restrictions on physical access to the materials
- Copyright restrictions
- Scope and content or biography/administrative history abstract
- Preferred form of citation
- Processing and acquisitions information
- Related and separated materials

Finally, the following information is commonly given in expansive text form:

- Biographical/administration history
- Scope and content
- Overview of the arrangement of the materials

The detailed analysis of the *fonds* into components follows. The form of this analysis varies considerably from description to description, and sometimes within a single description from component to component. Some patterns of analysis, though, are prevalent: *Fonds*-series-file, *fonds*-series-subseries-file, *fonds*-series-file-item, and *fonds*-series-subseries-file-item. The pattern of the hierarchical analysis is not prescribed but is determined by the judgment of the archivists analyzing and processing the collection.

Series and subseries descriptions frequently include the following information:

- Title
- Dates range giving the earliest and latest dates of creation
- Extent
- Scope and content
- Arrangement

File or item information commonly includes the following:

- Title
- Date or date range
- Container information

Container information or storage location is provided at the terminal node of description, which corresponds to the most specific intellectual unit that can be requested for use. In the scenario described earlier, this may be an item or file; though when the description terminates at the series or subseries level, container information will be provided at these levels.

ENCODED ARCHIVAL DESCRIPTION

Technical Foundation

Traditionally, archival description was typescript and then later printed using word processors and to a lesser extent, database software. With the emergence of markup technologies in the middle to late 1980s, it became possible to create machine-readable findings that were descriptively encoded and thereby supported a much broader range of functional possibilities. Standard Generalized Markup Language (SGML) was first issued as a formal standard in 1986 by the International Standards Organization (ISO). In the early 1990s, the Hypertext Transfer Protocol (HTTP) and an accompanying document encoding standard, Hypertext Markup Language (HTML), became the foundation of the rapidly emerging World Wide Web (WWW). The success of HTTP and HTML gave rise to the World Wide Web Consortium (W3C), which turned its attention to the development of standards. While remarkably successful, HTML was insufficient for secure, flexible, semantically rich exchange of information, and SGML, though supporting flexible, semantically rich exchange, was difficult to process. As an alternative to both SGML and HTML, the W3C developed XML, releasing version 1.0 in 1998. Among the key features of both SGML and XML was the ability to develop community-based rules or schemas to govern the encoding of specific kinds of documents, employing a semantics that reflected the nature of the document and the professional language of the community. The archival community was one of the first to employ XML.

The archivists developing EAD chose XML as the best available technology for developing a communication standard for archival description for a number of reasons. Markup and database technologies are the two prevailing techniques for representing textual data in forms that support complex, multipurpose processing. While they have some overlapping functionalities, each is optimized to support specific and distinct kinds of data. Markup technologies support traditional documents, such as books, journals, and journal articles, where the order of components and unbounded component hierarchies are prevalent. Database technologies support information with complex many-to-many relations, and the particular order of data elements has minimal if any significance. Archival description can best be characterized as occupying a

middle ground, having structurally different data components that map well to one or the other technology. For the purposes of communicating information, as opposed to its creation and maintenance, XML is the superior representation, as it will accommodate native XML data and data derived from databases.

In addition to its representational capability, XML also offers other attractive features. Since its release in 1998, XML has been widely adopted and supported, not only by the original document community where SGML had had reasonably good success, but also by the database development community. As a widely used and supported standard for developing encoding schemas, XML provides reasonable assurance that the data will endure changes in hardware and software, an essential concern because digital data are absolutely dependent on computers for retrieval and rendering into human readable form. The semantically and structurally rich descriptive encoding made possible by XML also enables multiple uses of the data: a wide range of alternative renderings for onscreen presentation and printing, in-depth and descriptive component-specific indexing and retrieval, and, when a successor to XML emerges, migration into a successor digital representation.

There are several apparatus for a defining rule-based encoding for a particular class or kind of documents, including DTD, ISO Relax NG Schema, and W3C Schema. EAD exists in all three forms. The semantics and structure of each are the same, although the schemas add compliance with other XML and descriptive markup schemas, constraints on some data values, and the option to embed XML objects defined according to external rules.

Semantics and Structure: Top Level

In EAD3, the new version to be released in 2015, EAD (<ead>) comprises two main sections: Control (<control>) and Archival Description (<archdesc>). The <archdesc> contains the archival description itself, while the <control> contains control information about the description. Both <control> and <archdesc> are required. For detailed information on the semantics and structure of EAD versions 1.0 and 2002, see the Society of American Archivists, and Library of Congress^[5] and Ruth.^[6] When it is published, the EAD3 Tag Library will be hosted at the Library of Congress.

While an EAD document provides information describing and documenting archival materials, it is itself a resource that must be maintained and managed. The <control> section contains information that facilitates control of the resource. It contains the following sections:

Record Identifier (<recordid>): a unique designation for identifying and tracking the EAD instance.

Other Record Identifier (<otherrecordid>): an alternate designation for identifying and tracking the EAD instance.

Representation (<representation>): a link to a deliverable version of the description.

File Description (<filedesc>): title, edition, publication, series, and notes describing the description.

Maintenance Status (<maintenancestatus>): enumerated values indicating the drafting status of the EAD instance.

Publication Status (<publicationstatus>): enumerated values indicating the publication status of the EAD instance.

Maintenance Agency (<maintenanceagency>): the institution responsible for the creation, maintenance, or dissemination of the Encoded Archival Context—Corporate bodies, Persons, and Families (EAC-CPF) instance.

Language Declaration (<languagedeclaration>): declaration of the language used in the EAD instance.

Convention Declaration (<conventiondeclaration>): declaration of the rules or conventions, including authorized controlled vocabularies and thesauri, applied in creating the EAD instance.

Local Type Declaration (<localtypedecclaration>): declaration of any local conventions used in the local type attribute in the EAD instance.

Local Control (<localcontrol>): additional control entries necessary to accommodate local practice.

Maintenance History (<maintenancehistory>): information on the history of the creation and maintenance of the EAD instance.

Sources (<sources>): the sources used for the description of the records in the EAD instance.

Of these sections, <recordid>, <filedesc>, <maintenancestatus>, <maintenanceagency>, and <maintenancehistory> are required.

The section dedicated to an archival description is <archdesc>. The <archdesc> is probably best understood as representing the logical semantics and structure of archival description, with additional semantics and structure that facilitate navigable and intelligible rendering for those seeking archival records. These additional structures enable labeling sections or descriptive components and rendering them in forms that are readily understood. An example of the former is Head (<head>), which enables the archivist to supply section titles, and an example of the latter is Paragraph (<p>), which enables rendering of prose description. The primary focus of <archdesc>, though, is the hierarchical description itself.

The first component of the archival description is Descriptive Identification (<did>). The <did> is intended to succinctly provide all of the information

necessary to uniquely identify the collection and make a competent first-pass judgment of its relevancy. The information is succinctly stated and collocated in order to function as a summary surrogate for the complete description, in particular in retrieval sets in union archival description systems (such as those used by state and regional consortia, and archival gateways). Archivists have identified the following descriptive elements to support these objectives:

Unit Identifier (<unitid>): unique identifier of the *fonds*, including a national identifier and repository identifier.

Unit Title (<unittitle>): title of the *fonds*.

Unit Date (<unitdate>) or Unit Date Structured (<unitdatestructured>): date range of the earliest and latest creation, frequently with a second range for the dates within which the bulk of the materials was created.

Origination (<origination>): Provenance or creator information.

Physical Description (<physdesc>) or Physical Description Structured (<physdescstructured>): description usually of the extent of the materials described, either in terms of the space occupied (e.g. linear feet), carriers (e.g. number of boxes), or material types (e.g. a count of photographs).

Repository (<repository>): archival institution holding the collection.

Language of the Materials (<langmaterial>): Languages or scripts represented in the content, with languages provided in Language (<language>) and scripts provided in Script (<script>).

Abstract (<abstract>): summary of either or both the scope and content, or biography or administrative history.

Following the summary description of the *fonds*, several components already described in summary form are described in more detail. In addition, some new descriptive elements that are not considered essential to the objectives of the summary description but are essential or at least useful for fully understanding and using the collections are provided. Expanded descriptions are commonly provided for Scope and Content (<scopecontent>) and Biography or History (<bioghist>), both of which may have been provided in summarized form in the <abstract> in the <did>. Further information may be provided in the following descriptive components:

Arrangement (<arrangement>): information on the intellectual analysis and arrangement of the records, reflecting, in principle, the original order

and the hierarchical analysis reflected in the description.

Access Restrictions (<accessrestrict>): information concerning limitations on physical access to the records because of privacy, agreements with donors, or other reasons.

Use Restrictions (<userrestrict>): information concerning copyright restrictions.

Acquisition Information (<acqinfo>): information on the immediate source of the records and the circumstances of the acquisition.

Controlled Access (<controlaccess>): controlled personal name, family name, corporate name subject, genre or form, function or activity, geographic, title, and other headings under authority control.

Preferred Citation (<prefercite>): information on the preferred form of citation of the records in referencing or citing publications.

Processing Information (<processinfo>): information on archival record processing activities applied to the records such as accessioning, describing, preserving, and storing.

Related Material (<relatedmaterial>): information, usually in the form of a citation, on intellectually related records (though not related by provenance).

Separated Material (<separatedmaterial>): information, usually in the form of a citation, on publications and artifacts in a collection, or archival records that have been separated from the *fonds*, frequently for curatorial reasons.

Accruals (<accruals>): information about anticipated additions to the materials, including (when available) information indicating the quantity and frequency of additions.

Several additional descriptive components are available. This additional information is provided when it is appropriate and available. When copies of the records, such as microfilm copies or digital facsimiles are available, this is typically noted. The corollary is also true, that is, in the description of copies of archival records, information about the originals is provided. If there is more than one description of a *fonds*, each description will reference the alternative description. For example, predominately French-language *fonds* may be held by an institution that prepares descriptions in English. A French translation of the original English description would function as an alternative finding aid.

EAD attempts to be comprehensive in accommodating accepted components of archival description. Due to the nature and complexity of archival records and the *fonds* within which they are interrelated, descriptive information deemed essential or at least useful may not be

accommodated within an existing element. EAD accommodates such information with the Other Descriptive Data (<odd>). It is similar to the use of a general note in bibliographic description.

Semantics and Structure: Hierarchical Analysis

The EAD apparatus used in the hierarchical analysis is the Description of Subordinate Components (<dsc>). The key element within the <dsc> is the Component, which comes in two forms, simple and enumerated. To enable hierarchical description, each Component is recursive, which is to say, it is available within itself. The simple form is called <c>, and the enumerated form is called <c01>, <c02>, through <c12>. The major difference between the two forms is that the <c> permits unlimited recursion or depth of analysis, and the enumerated limits depth of analysis to 12 levels. Because more than 12 levels of analysis is rare, choosing which form of the Component to use is primarily a decision based on ease of use and processing, usually influenced by the software chosen for processing.

Each <c> or <c01> through <c12> contains all of the descriptive components available in the <archdesc>, beginning with the <did>. This availability reflects a rule governing archival description described earlier, that all components of description are available at each level of descriptive analysis. Thus all of the <did> contained elements are available, as are <scopecontent>, <arrangement>, and so on. While all of the components are available throughout the hierarchy, because of the inheritance of description both the number of elements employed and the quantity of description contained in them typically decrease through each descending level of analysis.

In order to understand the way in which the hierarchical analysis unfolds as reflected in the EAD structure, it is useful to translate common patterns of analysis. The following examples exclude the *fonds* description, as it has been covered immediately above.

Fonds-series-file (3 levels including *fonds*)

```
<c01 level="series">
  [description]
  <c02 level="file">
    [description]
  </c02>
</c01>
```

Fonds-series-subseries-file (4 levels including *fonds*)

```
<c01 level="series">
  [description]
  <c02 level="subseries">
    [description]
    <c03 level="file">
```

```
      [description]
    </c03>
  </c02>
</c01>
```

Fonds-series-file-item (2 levels including *fonds*)

```
<c01 level="series">
  [description]
  <c02 level="file">
    [description]
    <c03 level="item">
      [description]
    </c03>
  </c02>
</c01>
```

Fonds-series-subseries-file-item (5 levels including *fonds*)

```
<c01 level="series">
  [description]
  <c02 level="subseries">
    [description]
    <c03 level="file">
      [description]
      <c04 level="item">
        [description]
      </c04>
    </c03>
  </c02>
</c01>
```

It is very important to note that <c01> through <c12> are not to be equated with the level of analysis. The <c01> places the description within a hierarchy but does not itself indicate the level of analysis. The level of analysis is rather indicated through the use of a Level attribute on the tag, for example, <c01 level="series">. Note that in example 1 mentioned earlier, <c02> has the Level attribute value "file," while in example 2, the <c02> has the Level attribute value "subseries." This is further complicated by the fact that even within one series, for example, the Level attribute values of the same subordinate Component may change, depending on the arrangement of the records.

Following the same pattern as the <archdesc>, the first and required descriptive element in each descriptive component is <did>. Typically, each <did>, no matter what the level of analysis (*fonds*, series, subseries, file, item), will contain a <unittitle>, a <unitdate>, or <unitdatestructured>, and often a <physdesc> or <physdescstructured>. For series and subseries analysis, the <did> is generally augmented with a <scopecontent> and an <arrangement>.

When a user identifies records of interest, the archival staff and the user need to know in what box and folder or folders the records will be found (or other container types, as

appropriate to the nature of the records). The organization of records in storage containers has its own inherent physical logic and structure, independent of the intellectual arrangement of the records. EAD privileges the intellectual arrangement in the single hierarchy that XML supports, and thus information on the physical organization and storage is subordinate to the intellectual arrangement. Information about the box and folder or other medium of storage is given in Container (<container>), an element contained in the <did>. Container information is most appropriately supplied at the deepest or terminal components of description. Following this practice, in the hierarchies illustrated earlier, <container> would appear within the <did> in the following component descriptions:

1. <c02 level="file">
2. <c03 level="file">
3. <c03 level="item">
4. <c04 level="item">

Access to archival records can also be facilitated via the Digital Archival Object (<dao>) element. Like <container>, <dao> provides necessary information for the retrieval and delivery of records, but in the form of a link to an online resource rather than a box or folder number.

In order to complete our understanding of how the hierarchical descriptive apparatus works in EAD, it is necessary to understand one additional feature of the use of Component. Not only are the Component elements recursive, they are also repeatable. Thus, at the top level of analytic description, the <c01> is repeated. A *fonds* comprising four series will have a sequence of four <c01>s, one for each series. Within a series, a series containing 12 files will begin with a <c01>, and within it, a sequence of 12 <c02>s, one for each file. While the order of the sequence (arrangement) may not always be significant, in many and perhaps most descriptions it is important, such as, when a sequence of files is arranged chronologically by date of creation or alphabetically by title.

Repeating <c01> components

```
<c01 level="series">
  [description of series 1]
</c01>
<c01 level="series">
  [description of series 2]
</c01>
<c01 level="series">
  [description of series 3]
</c01>
```

HISTORY

Work on an encoding standard for archival description began in 1992 at the University of California, Berkeley.

In the early 1980s, archivists developed the MARC AMC (MAchine-Readable Cataloging for Archives and Manuscript Control) format that enabled archivists to make collection-level summary descriptions available in online catalogs. While representing a major improvement in archival access, the full, detailed descriptions found in finding aids remained available only in printed forms. There was a widespread perception in the archival community that a method for making the full descriptions Internet-accessible was needed. Many archivists experimented with the use of database technologies as a solution. The complex, unbounded hierarchical descriptions found in finding aids, however, were not easily accommodated using database technology. The Berkeley effort was initiated by Timothy Hoyer in the Bancroft Library, who recruited Daniel Pitti to work on the problem. With a grant from the U.S. Department of Education, Pitti developed a prototype SGML DTD based on representative sample finding aids contributed by archivists at collaborating institutions in the United States. The FindAid DTD, as the prototype was called, served to demonstrate the feasibility and utility of using markup technologies, rather than MARC or database technologies, to develop an encoding method that would enable Internet-accessible finding aids.

At the conclusion of the Berkeley project, the Commission on Preservation and Access sponsored a conference in Berkeley to bring together archivists, librarians, and technologists to evaluate the results. With encouragement from the participants at this conference, Pitti applied for and was awarded a Bentley Historical Library fellowship that brought together seven archival description experts, Pitti, and Steve DeRose, a systems designer and developer at Electronic Book Technologies. The description experts were Jackie M. Dooley (University of California, Irvine), Michael J. Fox (Minnesota Historical Society), Steven L. Hensen (Duke University), Kris Kiesling (Harry Ransom Center), Janet E. Ruth (Library of Congress), Sharon Gibbs Thibodeau (National Archives and Records Administration), and Helena Zinkham (Library of Congress). The team met for one week in summer, 1995, in Ann Arbor, MI. Based on experience with the FindAid prototype, the team substantially revised the underlying conceptual model, in part in reference to *ISAD(G)*. The prototype standard that emerged from this meeting was renamed EAD.

Subsequent to the Ann Arbor meeting, the Library of Congress and the SAA agreed to share responsibility for further development and maintenance of the emerging standard. SAA formally charged the EAD Working Group (EADWG) in August 1995 with overseeing the ongoing development of the standard. With support from the Library of Congress National Digital Library Program, Delmas Foundation, and Council on Library Resources (now Council on Library and Information Resources), the EADWG met several times from 1995 to 1998 to further

revise the conceptual model, and review and revise first the alpha and then the beta versions of the EAD DTD and Tag Library. Version 1.0 of the EAD DTD and Tag Library were released in summer 1998. The version 1.0 DTD was compliant with both SGML and XML.

Subsequent to the release of EAD version 1.0, there were developments in both technological and descriptive standards that led the EADWG to begin revising EAD. Released in early 1998 by the W3C, XML was quickly embraced by both developers and users. The availability of software for the editing, validation, and processing of XML made it possible for users of EAD to make a transition from SGML to XML. The ICA also completed its review and revision of *ISAD(G)* in 2000. With funding from the National Historical Publications and Records Commission (NHPRC), the EADWG began revision of EAD in 2000. Based on comments and suggestions solicited from the EAD user community and the second edition of *ISAD(G)*, EAD 2002 was developed and released. Following the release of version 2002, responding to the emergence of schemas as an alternative to DTDs, the EADWG released two schema versions of the 2002 DTD in early 2008, one in the Relax NG Schema syntax and the other in W3C Schema syntax. Funding for this work was again provided by NHPRC.

By 2010, 8 years after the release of EAD 2002, significant developments in both archival description and information technologies made a second revision of EAD necessary, in particular the release of EAC-CPF^[7] in 2010, the development of collection management systems such as Archivists' Toolkit and Archon, and the emergence of Linked Open Data. The SAA Standards Committee charged a new group, the Technical Subcommittee for Encoded Archival Description (TS-EAD) to replace the EAD Working Group, and tasked it to complete a revision of EAD within 5 years. Funding for the revision was provided by the Gladys Krieble Delmas Foundation, the National Endowment for the Humanities, and the Nationaal Archief of the Netherlands. The revision process encompassed four public comment periods and three draft releases, and the resulting version—EAD3—will be released officially in 2015. EAD3 is a significant revision of the standard, with many changes intended to achieve greater conceptual and semantic consistency, make it easier to exchange or incorporate data maintained according to other protocols, and better support multilingual description.

Since its release in 1998, adoption and use of EAD by institutions with archival holdings has increased steadily. While only a few institutions employed EAD in the first year or two after its release, today EAD is used around the world by scores of academic research libraries, business archives, historical societies, museums, national libraries and archives, and other archival repositories. State and regional consortia in the United States have formed to provide union access to the archival holdings of members.

Similar regional, national, and international consortia have formed in Europe and elsewhere. The EAD Tag Library has been translated into Spanish, Greek, Chinese, French, German, Italian, and Russian. Reflecting the internationalization of EAD, the members of the TS-EAD represent seven countries.

FUTURE

Paralleling the ever increasing utility of computer and network technologies, archival descriptive practice has been undergoing a transition from the printed finding aid to an integrated archival description system. This transition is at least in part inspired by the advancements in the technology. Particularly important have been database technologies, in particular relational and object-relational databases, and markup technologies. Each of these technologies is optimized to represent and facilitate the maintenance and use of distinct data structures. Many real world data structures, however, are not wholly of one type or the other, which has required those promoting automation to make difficult compromises when choosing which technology to use. But there are indications that this situation is changing. Many of the major developers of database technologies, responding to real world data structures and needs, are exploring the integration of database and markup technologies. If these efforts are successful, archivists will no longer have to choose between the two technologies and will be able to take advantage of the strengths of each.

In a world dominated by print technologies, archivists have generally employed a single apparatus, the finding aid, to describe all of the records created by a single person, family, or corporate body. For a given *fonds*, the finding aid brought together information describing the creator, the functions performed by the creator, the records that facilitated or documented the performance of the functions, and the archival institution responsible for the records. Since at least the early 1980s, archivists have been discussing “relational” archival systems that enable creating and maintaining each of these fundamental components of description separately and bringing them together dynamically upon user request. Such an approach not only has economic advantages, but also supports more flexible and accurate description, and greatly enhanced access.

The ICA has supported the development of four standards for the components of archival description. The first of these standards, *ISAD(G)*, addresses the description of archival records and was first released in 1993. A second edition was released in 2000. Following *ISAD(G)* was *International Standard Archival Authority Control for Corporate Bodies, Persons, and Families (ISAAR(CPF))* in 1996, with a second edition in 2003.^[8] The third and fourth standards, *International Standard for Describing*

Functions (ISDF)^[9] and *International Standard for the Description of Institutions with Archival Holdings (ISDIAH)*,^[10] were released in 2007 and 2008, respectively. Each of these standards provides a framework for the intellectual content of the four areas of description: records, creators, functions, and repositories. All are intended to function together in a complete archival description. In order to be realized in a dynamic archival description system, though, communication standards for each are necessary.

EAD was originally designed as a communication standard for archival description as represented in finding aids. As such, the four descriptive components were and continue to be interleaved in EAD. Separate, dedicated, and detailed encoding standards for each are necessary, however, to achieve the goal of dynamic and efficient archival description. EAC-CPF is the communication standard for *ISAAR(CPF)*, and preliminary work to develop a communication standard for *ISDF* is under way. A future version of EAC-CPF will likely serve as the communication standard for *ISDIAH*. In addition to communication standards, however, it is necessary to formalize and express in consistent terminology how the components of archival description relate to each other. Toward that end, ICA charged the Experts Group on Archival Description for a term spanning 2012–2016 with the goal of developing a formal conceptual model for archival description and an accompanying ontology.^[11] Future versions of EAD will be heavily influenced by the conceptual model developed by the EGAD and will further integrate with the related communication standards for archival description.

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Engineering Literatures and Their Users [ELIS Classic]

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Abstract

Research on the information seeking of engineers over decades has found—despite the many changes in information technologies—on the whole, relatively stable behaviors. This ELIS Classic article from 1993 is written by several people who have been at the forefront of research in this area for some time.

—*ELIS Classic*, from 1993

INTRODUCTION

Engineers are an extraordinarily diverse group of professionals, but an attribute common to all engineers is their use of information. Engineering can be conceptualized as an information processing system that must deal with work-related uncertainty through patterns of technical communications. Throughout the process, data, information, and tacit knowledge are being acquired, produced, transferred, and utilized. (See Entry 2, “Technology Policy and the Technology Base” in *Beyond Spinoff: Military and Commercial Technologies in a Changing World*, by John A. Alic et al. for an in-depth discussion of “tacit” knowledge.) The fact that these data, information, and tacit knowledge deal with hard technologies or may be “physically or hardware encoded”^[1] should not detract from the observation that engineering is fundamentally an information processing activity. The engineer can be viewed as the center of that information processing system. According to Sayer:^[2]

Engineering is a production system in which data, information, and knowledge are new materials. Whatever the purpose of the engineering effort, the engineer is an information processor who is constantly faced with the problem of effectively acquiring, using, producing, and transferring data, Information, and knowledge.

While acknowledging that other models exist (see Wilkins^[3] for a discussion of other models), we have chosen to view the information-seeking behavior of engineers within a conceptual framework of the engineer as an

information processor. This article uses the chosen framework to discuss information-seeking behavior of engineers, reviewing selected literature and empirical studies from library and information science, management, communications, and sociology. The article concludes by proposing a research agenda designed to extend our current, limited knowledge of the way engineers process information.

BACKGROUND

Stevens^[4] and Paisley^[5] provide useful discussions of information in terms of history, definitions, and frameworks for analysis. The concept of information-seeking is imbedded in studies of users, use, and uses. These studies constitute “one of the most extensive and amorphous areas of research in library and information sciences over the better part of four decades.”^[6] (See the *Annual Review of Information Science and Technology* for reviews of information needs and use). The majority of the studies, and certainly the early studies, concentrated on the uses of scientific and technical information (STI). In the majority of these STI usage studies however, scientists, not engineers, were the subjects of investigation.

The literature regarding the information-seeking behavior of engineers is fragmented and superficial. The results of these studies have not accumulated to form a significant body of knowledge. The difficulty in applying the results of these studies has been attributed to the lack of a unifying theory, standardized methodology, and

common definitions. With specific reference to engineers, the difficulty may be attributed to the failure of researchers to take into account the essential difference between science and technology and, similarly, between engineers and scientists.^[7] This fundamental difference is emphasized by Vincenti^[8] in his analysis of the role of knowledge in technological developments.

Engineering is a process dominated by engineers and technology as opposed to scientists and science. As Joenk points out, this fact “leads to different philosophies, habits, and behaviors not only about contributing to the technical literature but also to using the technical literature and other sources of information.”^[9] Recent interest in the information-seeking behavior of engineers corresponds to rising interest and concerns regarding industrial competitiveness and technological innovation. Consequently, an understanding of the information-seeking behavior of engineers is essential to predicting information use and to planning, developing, and implementing engineering information systems. Such an understanding is also critical to enhancing economic competitiveness, improving productivity, and maximizing the process of technological innovation.

THE WORLD OF ENGINEERING

According to the U.S. Bureau of Labor Statistics, engineers held almost 1,411,000 jobs in 1988. About half of these jobs were located in manufacturing industries: about 511,000 were located in nonmanufacturing industries; and about 185,000 were employed by federal, state, and local governments. About one-third of these jobs (439,000) were held by electrical engineers followed, in decreasing order of frequency, by mechanical (225,000), civil (186,000), and industrial (132,000) engineers. A bachelor's degree in engineering from an accredited engineering program is generally acceptable for beginning engineering jobs. Most engineering degrees are granted in branches such as electrical, chemical, or nuclear engineering. Within these branches, most engineers specialize; more than 25 major specialties are recognized by professional societies. *The Occupational Outlook Handbook*^[10] lists and discusses the ten branches of engineering: aerospace; chemical; civil; electrical and electronics; industrial; mechanical; metallurgical, ceramic, and materials; mining; nuclear; and petroleum.

Formal registration is a requirement in the United States for engineers whose work may affect life, health, or property, or who offer their services to the public. Registration generally requires, in addition to a degree from an engineering program accredited by the Accreditation Board for Engineering and Technology (ABET), four years of relevant work experience and satisfactory performance on a state examination.

The engineering profession cannot be described fully without reference to the nature of engineering work, knowledge, and communication. These three areas are also important in establishing the conceptual framework of the engineer as an information processor.

ENGINEERING WORK

What is engineering work like? What tasks and activities are performed by engineers on a day-to-day basis? Florman,^[11] an engineer who has written extensively on the nature of the professional, proclaims that

the essence of engineering lies in its need and willingness to embrace opposites. Empiricism and theory, craftsmanship and science, workshop and laboratory, apprenticeship and formal schooling, private initiative, and government venture, commerce and independent professionalism, military necessity and civic benefit—all of these and more have their place.^[11]

In trying to sort out the diversity of engineering, Adams notes that it may be categorized according to, among other things, particular industries, fields, disciplines, job functions, and end products. He concludes that engineering is interlocked with science, mathematics, and business in a complex environment that “requires a multidimensional map for understanding.”^[12]

The characteristic activity of engineers is making things. Expressed more formally, engineering is usually defined as the application of scientific knowledge to the creation or improvement of technology for human use.^[13] The term “technology” as used in the context of describing engineering work encompasses products, systems, structures, and processes. Engineering work is often described as a process that originates with the first idea for a new or improved technology that is put into use. The National Research Council, for example, describes what it calls “the product realization process” as extending “over all phases of product development from initial planning to customer follow-up.”^[14] Phases in this process include: definition of customer needs and product performance requirements, planning for product evolution, planning for design and manufacturing, product design, manufacturing process design, and production.

Engineering work can also be described in terms of the kinds of tasks and activities that engineers perform on a day-to-day basis. Because of the multidimensional nature of engineering work and the extensiveness of the product development process, engineers perform a wide variety of tasks. Engineering work involves cognitive activities and physical tasks that include the technical and the nontechnical, the routine and the creative, the rational and the serendipitous. According to Ritti,^[15] engineering work consists of scientific experimentation, mathematical analysis, design and drafting, building and testing of

prototypes, technical writing, marketing, and project management. Murotake calls attention to the nontechnical elements of engineering work: “the process of engineering work is not only a technical one, but a social one in which management, communication, and motivation influence the efficiency, quality, and innovativeness of the project team’s work.”^[16] If the characteristic physical activity of engineering is making things, the characteristic cognitive activity is problem-solving. Laudan notes that “change and progress in technology is achieved by the selection and solution of technological problems, followed by choice between rival solutions.”^[17]

The great variety in the nature of the tasks and activities that comprise engineering work is often reflected in the individual engineer’s work, as well. Kemper notes that the typical engineer is likely to define problems, come up with new ideas, produce designs, solve problems, manage the work of others, produce reports, perform calculations, and conduct experiments.^[13] Hollister also describes the work of an engineer as multifaceted: “He begins with an idea, a mental conception. He conducts studies, and when necessary, research into the feasibility of this idea. He directs the building and operation of what he has planned.”^[18] Mailloux highlights the centrality of knowledge production and transfer to engineering work. She reports that about

20% of an engineer’s time is spent in the intellectual activities of engineering—conceiving, sketching, calculating, and evaluating—with the remaining 80% spent on activities associated with creating, accessing, reviewing, manipulating, or transferring information.^[19]

Although engineers perform many tasks independently, most products result from team effort, requiring engineers to share their knowledge and the result of their work with others.^[20] For complex products, teamwork is required at each stage of the engineering process. The literature on concurrent engineering indicates that teamwork is a natural requirement of the need to integrate the various stages of the engineering process. (see, e.g., Stoll^[21]). Bringing a high-quality product to market in an efficient manner often requires, for example, that design engineers communicate with managers, manufacturing and marketing staff within their firm as well as with people outside their organizations, such as clients, funders, and suppliers.

Engineering work takes place in a variety of environments, depending not only on the nature of the product being developed and the stage of product development, but also on the type of employing organization. Organizations employing engineers include universities, research centers, government laboratories and agencies, and private sector manufacturers and consulting firms. The basic goal of engineering is to produce usable products in the shortest possible time at the lowest possible cost. This goal drives the work and communication activities of virtually all

engineers, but it is manifested to a different degree in different employment settings.

ENGINEERING KNOWLEDGE

What kinds of knowledge do engineers need to perform the tasks and activities described above? How is knowledge acquired? Engineering work and knowledge are so closely intertwined, that it is difficult to discuss one without the other. As noted by Vincenti, “. . . engineering knowledge cannot—and should not—be separated from engineering practice. The nature of engineering knowledge, the process of its generation, and the engineering activity it serves form an inseparable whole.”^[8] Engineering practice, in other words, involves both knowing and doing. Even the popular literature suggests the wide variety of knowledge needed by engineers, due to the diversity of their work:

[The engineer’s] task is not alone that of contrivance with material things, for which he must possess an extensive working knowledge of scientific principles and facts. He must also thoroughly understand the functions to be performed by the projected work when it is completed, the methods of its manufacture and construction, and the economics that govern its use. He must have an understanding of the crafts that are to be used and of the organization of the work. It is his responsibility to coordinate and guide the contributions of labor, machines, money, and ideas, and to exert the control necessary to attain his objectives within the prescribed limits of time, cost, and safety.^[18]

Scholarly literature on the nature and generation of engineering knowledge reinforces such popular accounts. Donovan asserts that the range of scientific and technical knowledge used by engineers includes “not only the more formal types of experimental and theoretical knowledge but also all forms of practical skill and tacit understanding as well . . .”^[22]

Schön rejects the model of technical rationality which is typically applied to scientific and technical professions and paints instead a different picture of engineering knowledge. He argues that the situations encountered by practicing professionals are increasingly characterized by “complexity, uncertainty, instability, uniqueness, and value conflicts”;^[23] such situations require intuitive, artistic, and ethical responses in addition to purely technical and rational ones. Schön labels this model of professional work “tacit knowing-in-action”^[23] and describes the development of a new process to produce a desired gun-metal color to illustrate his argument. He represents the activities of the mechanical engineers involved in this project as “a reflective conversation with the materials of the situation . . . [that] wove its way through stages of diagnosis, experiment, pilot process, and production design.”^[23] Throughout this process, experiments are used

to explore puzzling phenomena, test the applicability of potentially useful theories, or achieve particular technological effects. These experiments, however, often produce unanticipated phenomena and outcomes, which then trigger new hypotheses, questions, and goals.^[23] Schön's analysis of this and other examples suggests that the knowledge required to reach a technological solution is derived from the integration of intuition, past experience, creativity (often in the form of analogy development), theory, experimentation, and reflective thinking that occur in a particular problematic situation. He also argues that engineering solutions incorporate social and ethical considerations.

As these accounts suggest, the notion of tacit knowledge permeates discussions of engineering work. Tacit knowledge is knowledge that cannot be articulated. Polanyi describes tacit knowledge—part experience, part intuition, part tactile sensation—as combining “knowing what” and “knowing how” and declares that it is expressed in such actions as expert diagnoses, the performance of skills, and the use of tools.^[24] Another important type of engineering knowledge, visual information, is also expressed in a nonverbal manner. The importance of visual information in technological work is the subject of a paper by Ferguson and is also discussed by Breton.^[25] Layton^[26] describes this phenomenon, too: “technologists display a plastic, geometrical, and to some extent nonverbal mode of thought that has more in common with that of artists than that of philosophers.”^[26] The importance of these two nonverbal modes of thought is rooted in the essence of engineering as the production of physically encoded knowledge. Engineers must know how to make things, and the results of this knowledge are, first and foremost, encoded in the technologies produced. Engineers rely heavily on nontextual information, such as interpersonal communication, drawings, and the examination of physical objects, to acquire the knowledge they need to perform their work.

Holmfeld found three common mechanisms for generating needed knowledge in engineering work. Engineers rely on the “cut and try” method to refine and fine tune.^[20] They also frequently search their memories for familiar concepts and designs in order to increase their confidence in some new variation.^[20] Finally, they make use of that scientific knowledge which they deem to be relevant and readily applicable. This knowledge is often in the form of a simple fact, such as the optimum hole size or speed rotation, resulting from scientific work.^[20] A number of other writers also note that engineers adopt, at times, the methods used by scientists to generate knowledge. Florman describes engineering work as encompassing both theory and empiricism.^[11] Ziman writes that

technological development itself has become ‘scientific’: it is no longer satisfactory, in the design of a new

automobile, say, to rely on rule of thumb, cut and fit, or simple trial and error. Data are collected, phenomena are observed, hypotheses are proposed, and theories are tested in the true spirit of the hypothetico-deductive method.^[27]

Constant presents a detailed history of the origin of the modern jet engine, a revolutionary technological advance. He presents a “variation-retention” model of technological change that is based on the process of random variation and selective retention that occurs in biological organisms. Technological conjecture, which can occur as a result of knowledge gained from either scientific theory or engineering practice, yields potential variations to existing technologies. These variations are subsequently tested, and successful variations are retained.^[28] In the case of the turbojet revolution, technological conjecture was based on engineers’ knowledge of scientific theories. The design, development, and testing of systems that resulted in the retention of the most successful variation involved, on the other hand, the technical and craft knowledge needed to carry out those tasks.

Vincenti traces five “normal” (as opposed to revolutionary) developments in the history of aerospace engineering to detail what he calls “the anatomy of engineering design knowledge.”^[8] His examples reveal that technological developments require a range of scientific, technical and practical knowledge as well as information about social, economic, military, and environmental issues. Vincenti conducts three important analyses of engineering knowledge. The first involves his own elaboration of the variation-selection model of the growth of technological knowledge. Vincenti concludes, after examining numerous examples from history, that the mechanisms for producing variations in engineering design include three types of cognitive activities:^[8] searching past experience to find knowledge that has proved useful, including the identification of variations that have not worked; incorporating novel features thought to have some chance of working; and “winnowing” the conceived variations to choose those most likely to work. Vincenti notes that these activities occur in an interactive and disorderly fashion. Selection occurs through physical trials such as everyday use, experiments, simulations (e.g., the use of wind tunnels), or analytical tests such as the production of sketches of proposed designs, calculations, and other means of imagining the outcome of selecting a proposed variation.^[8]

Vincenti also proposes a schema for engineering knowledge that categorizes knowledge as either descriptive (factual knowledge), prescriptive (knowledge of the desired end), or tacit (knowledge that cannot be expressed in words or pictures but is embodied in judgment and skills). Descriptive and prescriptive knowledge are explicit; tacit knowledge is implicit. Both tacit and prescriptive knowledge are procedural and reflect a “knowing how.”^[8] Finally, Vincenti enumerates and defines specific

engineering knowledge categories: fundamental design concepts, criteria and specifications, theoretical tools (i.e., mathematical methods and theories and intellectual concepts), quantitative data, practical considerations, and design instrumentalities (i.e., procedural knowledge and judgmental skills).^[8] He then presents a matrix that details how each type of knowledge is acquired. The possible sources of engineering knowledge that he describes include transfer from science or generation by engineers during invention, theoretical and experimental engineering research, design practice, production, or direct trial and operation.^[8]

Communications and management studies confirm the findings of historical and sociological research about the range of knowledge, information, and data needed in engineering work. Ancona and Caldwell investigated the tasks and communication of new product development teams in high technology companies. The authors note that such teams

are responsible not only for the specific technical design of a product, but also for coordinating the numerous functional areas and hierarchical levels that have information and resources necessary to make the new product a success.^[29]

Ancona and Caldwell found that new product teams progress through three phases of activity: creation, development, and diffusion. The communication- and information-intensive tasks that accompany these phases include:^[29]

- Getting to know and trust team members
- Determining the availability of resources
- Understanding what other functional groups think the product can should be
- Investigating technologies for building the product
- Exploring potential markets
- Solving technical problems
- Coordinating the teams' work internally and externally
- Keeping external groups informed
- Building relationships with external groups that will receive the team's output
- Promoting the product with manufacturing, marketing, and service groups.

Ancona and Caldwell conclude that information systems designed to support these changing activities must be flexible and support the team's need to identify and contact relevant external groups, generate and evaluate ideas, and coordinate work. Barczak and Wilemon also look at the communication patterns of new product development teams and find a similar range of communication purposes: to discuss product features, technical issues, customer needs, manufacturing issues, schedules and timing, financial issues, managerial issues, and resources issues.^[30]

THE ENGINEERING COMMUNITY

Engineering work and communication are rooted in the concept of "community." A community is a group of people who maintain social contact with each other and who exhibit common interests, goals, norms of behavior, and knowledge. As members of a profession, engineers share a common knowledge base and set of espoused values. The profession prescribes its own approach to work behavior. Engineering is also a social activity; most work is accomplished as a result of group effort and requires extensive interpersonal communication.

Studies of scientific communities look at the values, norms, knowledge, methods, reward system, and culture shared by community members and frequently underscore the role of interpersonal communication in defining the community and holding it together. (see e.g., Barber-Kuhn^[31–33]). This type of investigation has not often been performed in relation to engineering communities. Gaston notes that "[the problem of the internal workings of the technological community] is virtually unexplored. . . . In contrast to the sociology of the scientific community, little is known about the sociology of the technological community."^[34] Constant also notes the lack of research on technological communities. He writes that "While extensive research has been done on 'invisible colleges,' research fronts, and the community structure of science, there has been little analogous [sic] sociological or historical investigation of technological practice."^[35] Rothstein, pointing to the diversity inherent in engineering, warns that defining the entire profession of engineering as a single community provides a model that is inadequate to describe engineering behavior. He argues that the huge variety of occupations and disciplines in engineering demonstrates that there is no such thing as a single engineering community. Further, he contends that most discussions of professional communities fail to direct enough attention to the nature of professional knowledge and its influence on behavior. He contends that the heterogeneity, rate of change, and degree of specialization of engineering knowledge also lead to the emergence of specific communities in engineering.^[36]

Some work has begun to explore the extent to which members of engineering communities share similar work tasks, goals, and methods; are governed by shared social and technical norms; and engage in extensive informal information exchange among themselves. Laudan finds justification for this approach in that

cognitive change in technology is the result of the purposeful problem-solving activities of members of relatively small communities of practitioners, just as cognitive change in science is the product of the problem-solving activities of the members of scientific communities.^[17]

Layton also contends that "... the ideas of technologists cannot be understood in isolation; they must be seen in the context of a community of technologists . . ."[27] Donovan notes that "the study of engineering knowledge must not be divorced from the social context of engineering" and suggests that "the interplay of social values and theoretical understanding in the evolution of scientific disciplines certainly has its analogues in engineering, although the values and knowledge involved are often quite different."^[22]

Rosenthal discusses the design-manufacturing team in new product development. He says that such teams represent "a community of interest" with a shared commitment to the group effort. The group shares information and advice, as well as instructions and decisions.^[37] He describes the difficulties in merging these two subcommunities or cultures, because design and manufacturing engineers have developed their own "tacit understandings built up through years of working on particular problems with special points of view."^[37]

The notion of an engineering community has also been addressed in connection with aerospace work. Vincenti describes informal communities of practitioners as the most important source of knowledge generation and means of knowledge transfer in aerospace. He defines a community as those involved in work on a particular aerospace development or problem (e.g., fasteners, airfoils, or propellers). Vincenti attributes several functions to these engineering communities. Competition between members supplies motivation, while cooperation provides mutual support. The exchange of knowledge and experience generates further knowledge, which is disseminated by word of mouth, publication, and teaching and is also incorporated into the tradition of practice. The community also plays a significant role in providing recognition and reward. Vincenti describes the particular roles of important types of aerospace engineering institutions, such as government research organizations, university departments, aircraft manufacturers, military services, airlines, professional societies, government regulatory agencies, and equipment and component suppliers.^[8] He concludes, however, that

formal institutions do a complex multitude of things that promote and channel the generation of engineering knowledge. They do not, however, constitute the locus for that generation in the crucial way that informal communities do. Their role . . . is to supply support and resources for such communities.^[8]

Constant also describes aerospace communities as the central locus of technological cognition. He notes that the aeronautical community is, in fact, composed of a multilevel, overlapping hierarchy of subcommunities and he argues that technological change is better studied at the community as opposed to the individual, firm, national, or industry level. Constant describes the community as the embodiment of traditions of practice.^[28]

[Technological traditions of practice] define an accepted mode of technical operation, the conventional system of accomplishing a specified technical task. Such traditions encompass aspects of relevant scientific theory, engineering design formulae, accepted procedures and methods, specialized instrumentation, and, often, elements of ideological rationale. A tradition of technological practice is proximately tautological with the community which embodies it; each serves to define the other. Traditions of practice are passed on in the preparation of aspirants to community membership. A technological tradition of practice has, at minimum, a knowledge dimension, including both software and hardware, and a sociological dimension, including both social structure and behavioral norms.

Constant discusses further the importance of community norms in engineering. He alleges that, at least in connection with complex systems, there are "fundamental social norms governing the behavior of technological practitioners which are very close in structure, spirit, and effect to the norms governing the behavior of scientists."^[28] Such norms guide the development of techniques and instruments and the reporting of data. Constant also argues for the existence of "counternorms" in engineering that are similar to those attributed to scientists by Mitroff.^[38] Constant explains that

Technological practitioners are required to be objective, emotionally neutral, rational, and honest. Yet technological practitioners often are—and protagonists of technological revolution usually are—passionate, determined, and irrationally recalcitrant in the face of unpleasant counter evidence bearing on their pet ideas.^[28]

These descriptions of the world of engineering indicate that the activities performed by engineers are diverse and multifaceted. Engineering is defined as the creation or improvement of technology; as such, it clearly encompasses both intellectual and physical tasks, i.e., both knowing and doing. Engineering work is fundamentally both a social and a technical activity. It is a social activity in that it often involves teamwork, as individuals are required to coordinate and integrate their work. It is also a social activity in that the production of the final product depends on the ability to maintain successful social relationships (e.g., negotiate with vendors, maintain smooth personal relations among members of a work group).

The nature of engineering work suggests that engineers require access to a variety of tools and information resources. Further, the use of these tools and resources and the way they are integrated into engineering work may be planned in some cases and ad hoc in other situations. The engineering community, although it has received little attention from researchers, clearly plays an important role in the conduct of engineering work and the generation and transfer of engineering knowledge, information, and data. From this depiction of the engineering

profession, we now move to the establishment of a broader conceptual framework for our model of engineers as information processors.

TOWARD A CONCEPTUAL FRAMEWORK FOR INVESTIGATING THE INFORMATION BEHAVIOR OF ENGINEERS

Engineers are not scientists. Arguments that a scientist is a more generic term merely implies that the two are one and the same. They are not. The practice of lumping the two groups [engineers and scientists] together is self-defeating in information behavior studies because confusion over the characteristics of the sample has led to conflicting results and to a greater difficulty in developing normative measures for planning, developing, and implementing information systems and policy in either science or technology.

Further, the terms “engineer” and “scientist” are not synonymous. Although the previous section has made it clear that many engineers—especially in high tech branches such as aerospace—perform a variety of empirical and theoretical tasks, the differences in work environment and personal/professional goals between the engineer and scientist prove to be an important factor in determining their information-seeking behavior. The following sections explore the science/technology and scientist/engineer dichotomy.

THE NATURE OF SCIENCE AND TECHNOLOGY

The relationship between science and technology is often expressed as a continuous process or normal progression from basic research (science) through applied research (technology) to development (utilization). This relationship, which is illustrated in Fig. 1, is based on the widely

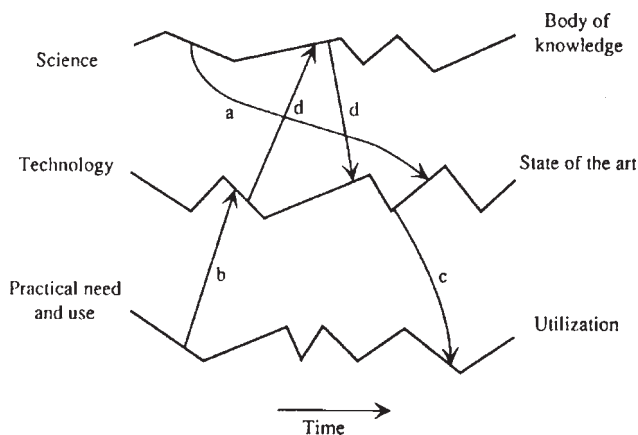


Fig. 1 The progression from science through technology to development as a continuous process.

held assumption that technology grows out of or is dependent upon science for its development. This “assumed” relationship is the foundation upon which U.S. science policy is based and may help to explain the use of the conventional phrase “scientists and engineers.”

However, the belief that technological change is somehow based on scientific advance has been challenged in recent years. Technological change has been increasingly seen as the adaption of existing technological concepts in response to demand.^[41] Moreover, several years of study that attempted to trace the flow of information from science to technology have produced little empirical evidence to support the relationship.^[40–41] Price, for example, claims,^[42]

The naive picture of technology as applied science simply will not fit the facts. Inventions do not hang like fruits on a scientific tree. In those parts of the history of technology where one feels some confidence, it is quite apparent that most technological advances are derived immediately from those that precede them.

The single-tree concept, shown in Fig. 2, is often used to illustrate the relationship between science and technology as a continuous process. Shapley and Roy argue that such a metaphor is historically inaccurate. In their case for a reorientation of American science policy, they argue that the two-tree concept, which is shown in Fig. 3, is a more accurate metaphor and is much more useful in developing science policy.^[43]

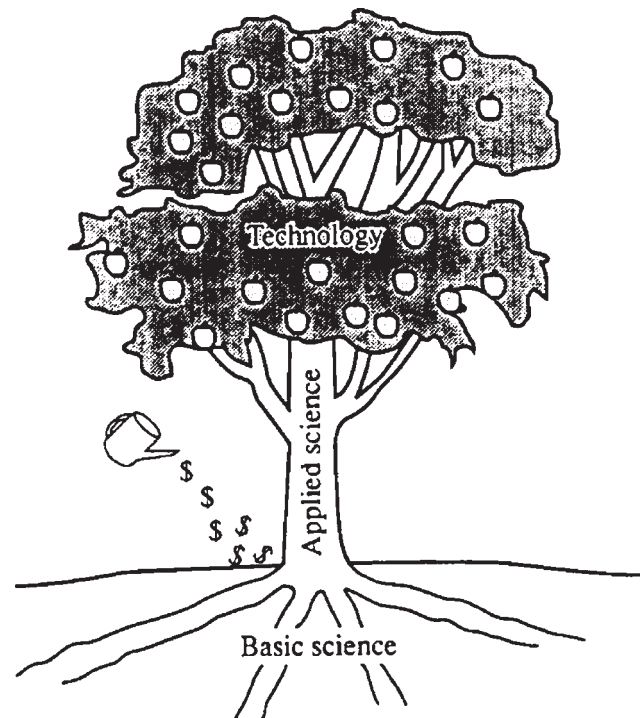


Fig. 2 Science and technology as a single tree.

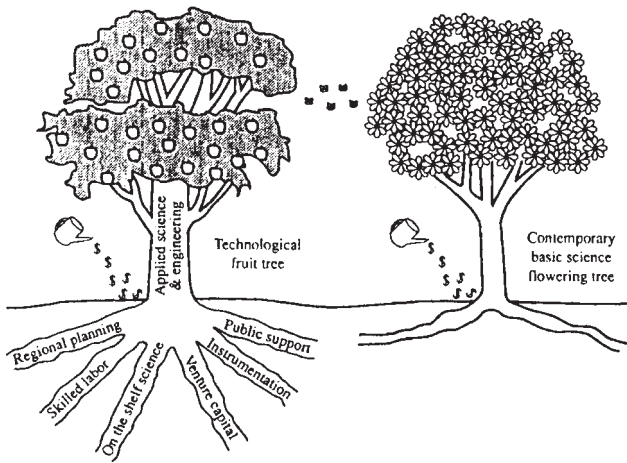


Fig. 3 Technology and science as separate trees.

Shapley and Roy contend that a normal progression from science to technology does not exist, nor is there direct communication between science and technology.^[43] Allen's 1977 study of transfer of technology and the dissemination of technological information in R&D organizations found little evidence to support the relationship between science and technology as a continuous relationship. Allen concludes that the relationship between science and technology, which is depicted in Fig. 4, is best described as a series of interactions that are based on need rather than on a normal progression.^[44]

According to Allen,^[44] (a) the results of science do progress to technology in the sense that some sciences such as physics are more closely connected to technologies such as electronics, but (b) overall a wide variation exists between science and technology. The need for a (c) device, technique, or scientific understanding influences technology. Technology, in turn, (d) responds to a need and, in doing so, may generate the need for an understanding of certain physical phenomena.^[44] A direct communication system between science and technology does not exist to the extent that communication between science and technology is restricted almost completely to that which takes place through the process of education.

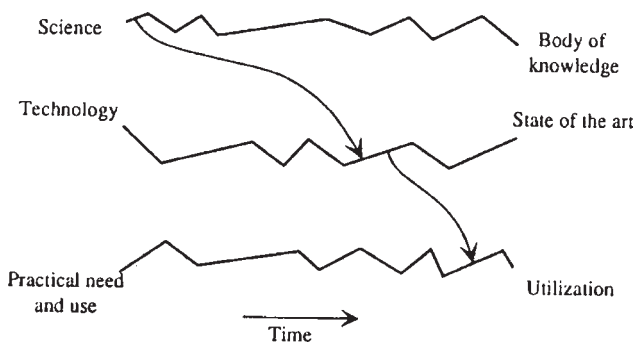


Fig. 4 The progression from science through technology to development as a series of interactions.

Price concludes that science and technology progress independently of one another. Technology builds upon its own prior developments and advances in a manner independent of any link with the current scientific frontier and often without any necessity for an understanding of the basic science underlying it.^[42]

In summarizing the differences between science and technology, Price makes the following 12 points. (1) Science has a cumulating, close-knit structure; that is, new knowledge seems to flow from highly related and rather recent pieces of old knowledge, as displayed in the literature. (2) This property is what distinguishes science from technology and from humanistic scholarship. (3) This property accounts for many known social phenomena in science and also for its surefootedness and high rate of exponential growth. (4) Technology shares with science the same high growth rate, but it shows quite complementary social phenomena, particularly in its attitude to the literature. (5) Technology therefore may have a similar, cumulating, close-knit structure to that of science, but the structure is of the state of the art rather than of the literature. (6) Science and technology each therefore have their own separate cumulating structures. (7) A direct flow from the research front of science to that of technology, or vice versa, occurs only in special and traumatic cases since the structures are separate. (8) It is probable that research-front technology is strongly related only to that part of scientific knowledge that has been passed down as part of ambient learning and education, not to research-front science. (9) Research-front science is similarly related only to the ambient technological knowledge of the previous generation of students, not to the research front of the technological state of the art and its innovation. (10) This reciprocal relation between science and technology, involving the research front of one and the accrued archive of the other, is nevertheless sufficient to keep the two in phase in their separate growths within each otherwise independent cumulation. (11) It is naive to regard technology as applied science or clinical practice as applied medical science. (12) Because of this, one should be aware of any claims that particular scientific research is needed for particular technological breakthroughs, and vice versa. Both cumulations can only be supported for their own separate ends.^[42]

Allen states that the independent nature of science and technology (S&T) and the different functions performed by engineers and scientists directly influence the flow of information in science and technology.^[44] Science and technology are ardent consumers of information. Engineers and scientists both require large quantities of information to perform their work. At this level, there is a strong similarity between the information input needs of engineers and scientists. However, the difference between engineers and scientists in terms of information processing becomes apparent upon examination of their outputs.

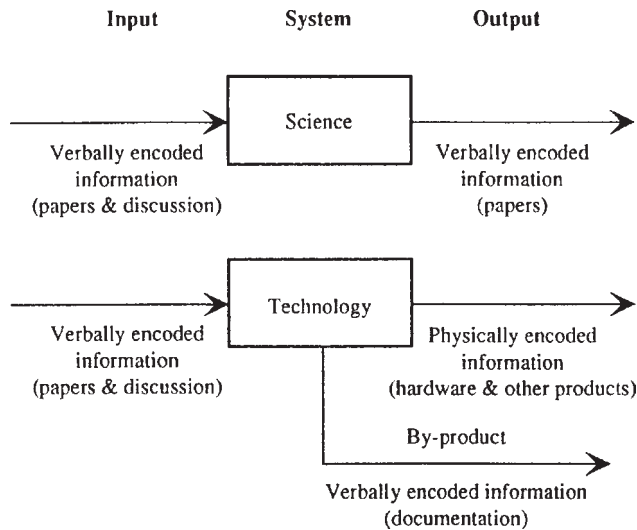


Fig. 5 Information processing in science and technology.

Information processing in S&T is depicted in Fig. 5 in the form of an input-output model.^[44] Scientists use information to produce information. From a system standpoint, the input and output, which are both verbal, are compatible. The output from one stage is in a form required for the next stage. Engineers use information to produce some physical change in the world. Engineers consume information, transform it, and produce a product that is information bearing; however, the information is no longer in verbal form. Whereas scientists consume and produce information in the form of human language, engineers transform information from a verbal (or often visual or tacit) format to a physically encoded form. Verbal information is produced only as a byproduct to document the hardware and other physical products produced.

According to Allen, there is an inherent compatibility between the inputs and outputs of the information-processing system of science. He further states that since both are in a verbal format, the output of one stage is in the format required for the next stage.^[44] The problem of supplying information to the scientist becomes a matter of collecting and organizing these outputs and making them accessible. Since science operates for the most part on the premise of free and open access to information, the problem of collecting outputs is made easier.

In technology, however, there is an inherent incompatibility between inputs and outputs. Since outputs are usually in a form different from inputs, they usually cannot serve as inputs for the next stage. Further, the outputs are usually in two parts, one physically encoded and the other verbally encoded. The verbally encoded part usually cannot serve as input for the next stage because it is a byproduct of the process and is itself incomplete. Those unacquainted with the development of the hardware or physical product therefore require some human intervention to supplement and interpret the information contained

in the documentation. Since technology operates to a large extent on the premise of restricted access to information, the problem of collecting the documentation and obtaining the necessary human intervention becomes difficult.

DISTINGUISHING ENGINEERS FROM SCIENTISTS

Engineers and scientists exhibit important differences other than the evident differences in education (degree), technical discipline, and type of work/activity. They share such common psychological needs as survival, security, self-esteem, self-expression, belonging, opportunity for growth, and self-determination. The strength of these needs varies from person to person and fluctuates over time. In a collective sense, engineers and scientists share the following attitudes that are conducive to high productivity:^[45]

- effective communication
- optimum salary band benefits
- freedom and authority
- optimum utilization

There are also differences that tend to create sharp distinctions between the two groups. At the risk of inviting a charge of “overgeneralization,” Peake offers the list of differences shown in Table 1.

Danielson investigated engineers and scientists in an attempt to identify those characteristics that affect their motivation and utilization. He concluded that there are recognizable differences between the two groups. He concluded that engineers and scientists are fundamentally different in terms of how they approach their job, the type and amount of supervision required, the type of recognition desired, the personality traits exhibited, and the differences in their goals.^[46]

In their study of the values and career orientation of engineering and science undergraduate students, Krulee and Nadler found that engineering and science students have certain aspirations in common: to better themselves and to achieve a higher socioeconomic status than that of their parents. They report that science students place a higher value on independence and on learning for its own sake, while engineering students are more concerned with success and professional preparation. Many engineering students expect their families to be more important than their careers as a source of satisfaction, but the reverse pattern is more typical for science students.^[47]

Krulee and Nadler also determined that engineering students are less concerned than science students with what one does in a given position and more concerned with the certainty of the rewards to be obtained. They report that, overall, engineering students place less emphasis on independence, career satisfaction, and the inherent interest their specialty holds for them and place more

Table 1 Peake's list of differences between engineers and scientists

Most engineers	Most scientists
Do development, design or applications work	Do research, basic or applied
Apply scientific knowledge	Seek new knowledge
Have engineering degree	Have science degree
Recognize managerial authority	Respect "colleague" authority
Want assignments to good, challenging projects	Want freedom to select their own projects
Like a company with a good record of engineering accomplishment	Like a company with a reputation for scientific advancement
Are hardware oriented	Are software oriented
Dislike preparing talks and publications	Insist on freedom to publish their work
are company oriented (i.e., committed to a variety of work areas, tasks, positions)	Are career oriented (i.e., committed to limited kinds of work areas, tasks, positions)
Dislike ambiguous, uncertain situations	Can work effectively with ambiguity, uncertainty
Are interested in processes, results, realizations	Are interested in concepts, meanings, abstractions
Believe in equalitarian group practices	Believe in authoritarian group practices
Expect to be faced with work schedules, deadlines, constrained resources	Abhor schedules, believe schedules should be self-determined, desire autonomy

Source: H. J. Peake, Technical and Management Notes: Difference Between Engineers and Scientists, *IEEE Transact. Eng. Mgt.*, EM-15, 50–53 (February 1969). p. 52.

value on success, family life, and avoiding a low-level job. Engineering students appear to be prepared to sacrifice some of their independence and opportunities for innovation in order to realize their primary objectives. Engineering students are more willing to accept positions that will involve them in complex organizational responsibilities and they assume that success in such positions will depend upon practical knowledge, administrative ability, and human relations skills.^[47]

In his study of engineers in industry, Ritti found marked contrast between the work goals of engineers and scientists. Ritti draws the following three conclusions from his study: (1) the goals of engineers in industry are very much in line with meeting schedules, developing products that will be successful in the marketplace, and helping the company expand its activities; (2) while both engineers and scientists desire career development or advancement, for the engineer advancement is tied to activities within the organization, while advancement for the scientist is dependent upon the reputation established outside of the organization; and (3) while publication of results and professional autonomy are clearly valued goals of the Ph.D. scientist, they are clearly the least valued goals of the baccalaureate engineer.^[15]

Allen states that the type of person who is attracted to a career in engineering is fundamentally different from the type of person who pursues a career as a scientist. He writes that

perhaps the single most important difference between the two is the level of education. Engineers are generally educated to the baccalaureate level; some have a master's degree while some have no college degree. The research scientist is usually assumed to have a doctorate. The long, complex process of academic socialization involved in obtaining the Ph.D. is bound to result in persons who differ considerably in their lifeworlds.

According to Allen, these differences in values and attitudes toward work will almost certainly be reflected in the behavior of the individual, especially in their use and production of information.^[5]

According to Blade, engineers and scientists differ in training, values, and methods of thought. Further, Blade states that the following differences exist in their individual creative processes and in their creative products: (1) scientists are concerned with discovering and explaining nature; engineers use and exploit nature; (2) scientists are searching for theories and principles; engineers seek to develop and make things; (3) scientists are seeking a result for its own ends; engineers are engaged in solving a problem for the practical operating results; and (4) scientists create new unities of thought; engineers invent things and solve problems. Blade states that "this is a different order of creativity."^[48]

INFLUENCE ON INFORMATION BEHAVIOR

Communications in engineering and science are fundamentally different. Communication patterns differ because of the fundamental differences between engineering and sciences and because of the social systems associated with the two disciplines. Holmfeld offers the following examples of how the social systems affect the communication behavior of engineers and scientists.^[20]

Engineer

- Contribution is [technical] knowledge used to produce end items or products
- New and original knowledge is not a requirement
- Reward is monetary or materialistic and serves as an inducement to continue to make further contributions to technical knowledge

- Seeking rewards that are not part of the social system of technology is quite proper and also encouraged
- The value of technical knowledge lies in its value as a commodity of indirect exchange
- Exchange networks found in the social system of technology are based on end-item products, not knowledge
- Strong norms against free exchange or open access to knowledge with others outside of the organization exist in the social system of technology
- Restriction, security classification, and proprietary claims to knowledge characterize the social system of technology

Scientist

- Contribution is new and original knowledge
- Reward is social approval in the form of professional [collegial] recognition
- Recognition is established through publication and claim of discovery
- A well-developed communication system based on unrestricted access is imperative to recognition and claim of discovery
- Since recognition and priority of discovery are critical, strong norms against any restriction to free and open communication exist in the social system of science
- Seeking rewards that are not part of the social system of science in return for scientific contribution is not considered proper within the social system of science
- Exchange networks commonly referred to as “invisible colleges” exist in the social system of science; in these networks the commodities are knowledge and recognition.^[49–50]

Taylor,^[51] who quotes Brinberg,^[52] offers the following characteristics for engineers and scientists:

Unlike scientists, the goal of the engineer is to produce or design a product, process, or system; not to publish and make original contributions to the literature. Engineers, unlike scientists, work within time constraints; they are not interested in theory, source data, and guides to the literature nearly so much as they are in reliable answers to specific questions [39–40].

Anthony et al. suggest that engineers may have psychological traits that predispose them to solve problems alone or with the help of colleagues rather than finding answers in the literature. They further state that

engineers like to solve their own problems. They draw on past experiences, use the trial and error method, and ask colleagues known to be efficient and reliable instead of searching or having someone search the literature for them. They are highly independent and self-reliant without being positively anti-social.^[53]

According to Allen,

engineers read less than scientists, they use literature and libraries less, and seldom use information services which are directly oriented to them. They are more likely to use specific forms of literature such as handbooks, standards, specifications, and technical reports.^[44]

What an engineer usually wants, according to Cairns and Compton, is “a specific answer, in terms and format that are intelligible to him—not a collection of documents that he must sift, evaluate, and translate before he can apply them.”^[54] Young and Harriott report that

the engineer’s search for information seems to be based more on a need for specific problem solving than around a search for general opportunity. When engineers use the library, it is more in a personal-search mode, generally not involving the professional (but nontechnical) librarian.^[55]

Young and Harriot conclude by saying that

when engineers need technical information, they usually use the most accessible sources rather than searching for the highest quality sources. These accessible sources are respected colleagues, vendors, a familiar but possibly outdated text, and internal company [technical] reports. He [the engineer] prefers informal information networks to the more formal search of publicly available and cataloged information.^[55]

MAJOR EMPIRICAL STUDIES OF ENGINEERING INFORMATION BEHAVIOR

Studies concerned with the information-seeking behavior of engineers were reviewed by Pinelli^[56] to further develop the conceptual framework. Table 2 lists those major research studies deemed significant to this topic and which are discussed in this section.

HERNER^[57]

Herner’s work is one of the first “user” studies specifically concerned with “differences” in information-seeking behavior. He reports significant differences in terms of researchers performing “basic and applied” research, researchers performing “academic and industry” type duties, and their information-seeking behavior. Herner states that researchers performing “basic or academic” duties make greater use of formal information channels or sources, depend mainly on the library for their published material, and maintain a significant number of contacts outside of the organization.

Table 2 Overview of Engineering Information Behavior Studies.

Principal Year	Investigator	Research Method	Population	Sample Frame	Sample Design	Sample Size	Percentage Response Rate (number responding)	Description
1954	Herner ^[57]	Structured interview	All scientific and technical personnel at Johns Hopkins	Unknown	Unknown	600	100	Survey to determine the information- gathering methods of scientific and technical personnel at Johns Hopkins
1970	Rosenbloom and Wolek ^[58]	Self-administered questionnaire	Members of 5 industrial R&D organizations Members of 4 IEEE interest groups	2430 Unknown	Census Probability	2430 Unknown	71 (1735) Unknown (1034)	Survey to determine how engineers and scientists in industrial research and development organizations acquire STI
1977	Allen ^[44]	Record analysis Self-administered questionnaire	Unknown	Unknown	Unknown	Unknown	Unknown (1153)	Survey to determine technology transfer and the dissemination of technological information in research and development organizations
1980	Kremer ^[57]	Self-administered questionnaire	All design engineers at one engineering design firm	73	Census	73	82 (60)	Survey to identify and evaluate the information channels used by engineers in a design company
1981	Shuchman ^[60]	Structured interview Self- administered questionnaire	Engineers in 89 R&D and non-R&D organizations	14797	Probability	3371	39 (1315)	Survey to determine information used and production in engineering
1983	Kaufman ^[61]	Self-administered questionnaire	Engineers in six technology-based organizations	147	Census	147	100 (147)	Survey to determine the use of technical information in technical problem solving

Researchers performing “applied or industry” duties make greater use of informal channels or sources, depend on their personal collections of information and colleagues for information, make significantly less use of the library than do their counterparts, and maintain fewer contacts outside of the organization. Applied or industry researchers make substantial use of handbooks, standards, and technical reports. They also read less and do less of their reading in the library than do their counterparts.

ROSENBLOOM AND WOLEK^[58]

In 1970, Rosenbloom and Wolek published the results of one of the first “large-scale” industry studies that was specifically concerned with the flow of STI within R&D organizations. They report three significant and fundamental differences between engineers and scientists: (1) engineers tend to make substantially greater use of information sources *within* the organization than do scientists; (2) scientists make considerably greater use of the professional (formal) literature than do engineers; and (3) scientists are more likely than engineers to acquire information as a consequence of activities directed toward general competence rather than a specific task.

In terms of interpersonal communication, the engineers in the Rosenbloom and Wolek study recorded a higher incidence of interpersonal communication with people in other parts of their own corporation, whereas scientists recorded a greater incidence of interpersonal communication with individuals employed outside their own corporation. When using the literature, the engineers tended to consult in-house technical reports or trade publications, while the scientists made greater use of the professional (formal) literature.

Rosenbloom and Wolek also report certain similarities between engineers and scientists. The propensity to use alternative types of technical information sources is related to the purposes that will give meaning to the use of that information. Work that has a professional focus draws heavily on sources of information external to the user’s organization. Work that has an operational focus seldom draws on external sources, relying heavily on information that is available within the employing organization. Those engineers and scientists engaged in professional work commonly emphasize the simplicity, precision, and analytical or empirical rigor of the information source. Conversely, those engineers and scientists engaged in operational work typically emphasize the value of communication with others who understand and are experienced in the same real context of work.

ALLEN^[44]

Allen’s study of technology transfer and the dissemination of technological information within the R&D organization is the result of a 10-year investigation. Allen describes the

study, which began as a “user study,” as a systems-level approach to the problem of communication in technology. Many information professionals consider his work to be the seminal research on the flow of technical information within R&D organizations. Allen was among the first to produce evidence supporting different information-seeking behaviors for engineers and scientists. These differences, Allen notes, lead to different philosophies and habits regarding the use of the technical literature and other sources of information by engineers. The most significant of his findings is the relative lack of importance of the technical literature in terms of generating new ideas and in problem definition, the importance of personal contacts and discussions between engineers, the existence of technological “gatekeepers,” and the importance of the technical report. Allen states that “the unpublished report is the single most important informal literature source; it is the principal written vehicle for transferring information in technology.”^[44]

KREMER^[57]

Kremer’s study was undertaken to gain insight on how technical information flows through formal and informal channels among engineers in a design company. The engineers in her study were not involved in R&D. The reason given most frequently to search for information is problem solving; colleagues within the company are contacted first for needed information, followed by colleagues outside of the company. In terms of the technical literature, handbooks are most important, followed by standards and specifications. Libraries are not important sources of information and are used infrequently by company engineers.

Regardless of age and work experience, design engineers demonstrate a decided preference for internal sources of information. They consult personal files for needed information. The perceived accessibility, ease of use, technical quality, and amount of experience a design engineer has had with an information source strongly influence the selection of an information source. Technological gatekeepers exist among design engineers; they are high technical performers and a high percentage are first line supervisors.

SHUCHMAN^[60]

Shuchman’s study is a broad-based investigation of information transfer in engineering. The respondents represent 14 industries and the following major disciplines: civil, electrical, mechanical, industrial, chemical and environmental, and aeronautical. Seven percent, or 93 respondents, were aeronautical engineers. The engineers, regardless of discipline, display a strong preference for informal sources of information. Further, these engineers rarely find all the information they need for solving technical problems in one source; the major difficulty

engineers encounter in finding the information they need to do their job is identifying a specific piece of missing data and then learning who has it.

In terms of information sources and solving technical problems, Shuchman reports that engineers first consult their personal store of technical information, followed in order by informal discussions with colleagues, discussions with supervisors, use of internal technical reports, and contact with a “key” person in the organization who usually knows where the needed information may be located. A small proportion of the engineering profession uses technical libraries and librarians.

In general, Shuchman finds that engineers do not regard information technology as an important adjunct to the process of producing, transferring, and using information. While technological gatekeepers appear to exist across the broad range of engineering disciplines, their function and significance are not uniform; considering the totality of engineering, gatekeepers account for only a small part of the information transfer process.

KAUFMAN^[61]

Kaufman’s study is concerned with the factors relating to the use of technical information by engineers in problem solving. The study reported that, in terms of information sources, engineers consult their personal collections first, followed by colleagues and then by formal literature sources. In terms of the formal literature sources used for technical problem solving, engineers use technical reports, followed in order by text books, and technical handbooks.

Most sources of information, according to Kaufman, are found primarily through an intentional search of written information, followed by personal knowledge and then by asking someone. The criteria used in selecting all information sources, in descending order of frequency, are accessibility, familiarity or experience, technical quality, relevance, comprehensiveness, ease of use, and expense. Engineers use various information sources for specific purposes. They primarily utilized librarians and information specialists to find leads to information sources. Engineers used online computer searches primarily to define the problem and technical literature to learn techniques applicable to dealing with the problem. They rely primarily on personal experience to find solutions to the problem.

Kaufman reports that the criteria used in selecting the most useful information sources, in descending order of frequency, are technical quality or reliability, relevance, accessibility, familiarity or experience, comprehensiveness, ease of use, and expense. In terms of the effectiveness, efficiency, and usefulness of the various information sources, personal experience is rated as the most effective in accomplishing the purpose for which it is used; librarians and information specialists receive the lowest rating for efficiency and effectiveness. Most engineers use

several different types of information sources in problem solving; however, engineers do depend on their personal experience more often than on any single specific information source.

ENGINEERS AS INFORMATION PROCESSORS

To establish a specific conceptual and organizing framework for further research on information use by engineers, engineering can be viewed as an information processing system that must deal with work-related uncertainty through patterns of technical communications. Throughout the process, data, information, and knowledge are being acquired, produced, transferred, and used. The fact that these data, information, and knowledge may be physically or hardware encoded should not detract from the observation that the process of engineering is fundamentally an information processing activity.

The concept of engineering as an information processing entity represents an extension of the arguments developed by Tushman and Nadler.^[62] The concept has its roots in open systems theory developed by Katz and Kahn.^[63] The major work on organizations and work-related uncertainty can be traced to, among others, Galbraith and Duncan,^[64] who have conceptualized organizations as information processing systems.

Uncertainty, defined as the difference between information possessed and information required to complete a task, is central to the concept of engineering as an information processing activity. Rogers^[65] states that coping with uncertainty is the central concept in information behavior. The process of engineering is one of grappling with the unknown. These unknowns or uncertainties may be technical, economic, or merely the manifestations of personal and social variables. When faced with uncertainty, engineers typically seek data, information, and knowledge. In other words, data, information, and knowledge are used by engineers to moderate technical uncertainty. Because engineering always entails coping with a relatively high degree of uncertainty, engineering can certainly be viewed as an informational process. Consequently, information behavior and patterns of technical communication cannot be ignored when studying engineers.

AN ORGANIZING MODEL FOR RESEARCH

The conceptual framework, shown in Fig. 6, represents an extension of Orr’s scheme of the engineer as an information processor. The framework focuses on information-seeking and assumes that, individual differences notwithstanding, an internal, consistent logic governs the information-seeking behavior of engineers.^[66]

A project, task, or problem that precipitates a need for information is central to the conceptual framework for this

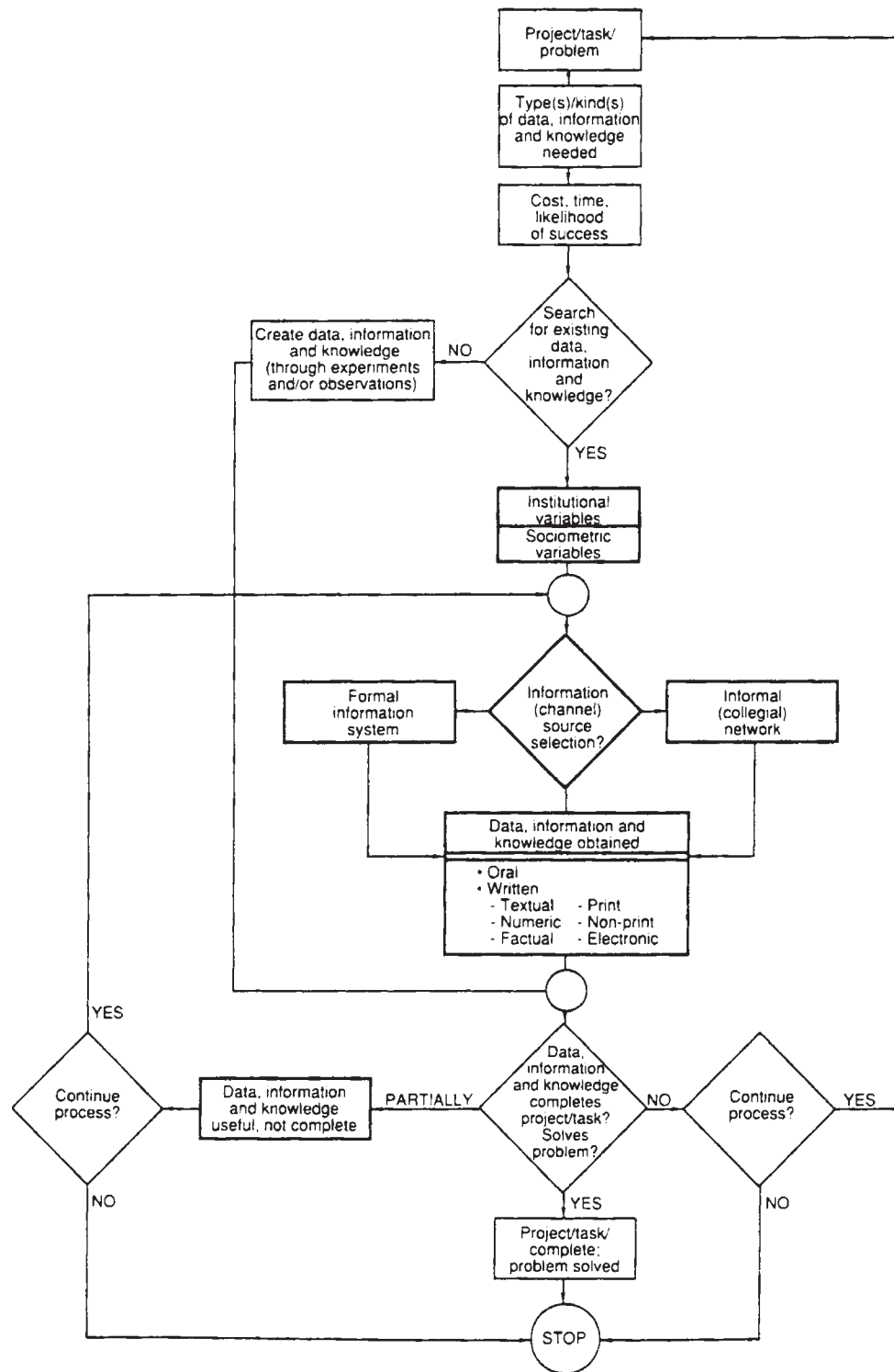


Fig. 6 The engineer as an information processor: A structure analysis with data on variables related to information-seeking behavior.

research. This need for information may, in turn, be *internally* or *externally* induced and is referred to by Orr as *inputs* or *outputs*, respectively. Orr,^[66] who cites the work of Voight,^[67] Menzel,^[68] Storer,^[69] and Hagstrom,^[70] states that inputs originate within the mind of the

individual engineer and include data, information, and knowledge needed to keep up with advanced in one's profession, to perform one's professional duties to interact with peers, colleagues, and coworkers, and to obtain stimulation and feedback from them.

Outputs frequently, but not exclusively, result from an external stimulus or impetus. Outputs serve a variety of functions, including responding to a request for information from a supervisor, a coworker, peer, or colleague; reporting progress; providing advice; reacting to inquiries; defending; advocating; and proposing. Inputs and outputs require the use of specific kinds and types of data, information, and knowledge.^[66]

The conceptual framework for this research assumes that, in response to a project, task, or problem, specific kinds or types of data, information, and knowledge are needed. In response to this scenario, engineers are confronted with two basic alternatives: they can create the information through experimentation or observation or they can search the existing information. If they act rationally, the decision to “make or buy” the information will depend upon their subjective perception of the relative likelihood of success in acquiring the desired information by these two alternatives with an acceptable time, and on their perception of the relative cost [money and/or effort] of these alternatives.

If a decision is made to search the existing information, engineers must choose between two information channels. One is the *informal or collegial network*, which is characterized by interpersonal (oral) communications with peers, coworkers, colleagues, gatekeepers, vendors, consultants, “key” personnel, and supervisors and by personal collections of information. The other is the *formal information system*, which includes libraries, technical information centers, librarians and technical information specialists, information products and services, and information storage and retrieval systems. It is assumed that the decision to choose a particular information channel is influenced by institutional and sociometric variables operating within the previously identified systems. Gerstberger and Allen,^[71] Rosenberg,^[72] and Orr^[66] theorize that certain sociometric variables influence information source and product selection.

More recent work highlights the value of exploring contextual and situational variables related to information-seeking and use. Taylor’s theoretical investigation of information use environments emphasizes the importance of understanding the context in which information is sought, conveyed, and applied. Context for professional groups, including engineers, is defined as a combination of the nature of work problems, solutions, and settings associated with particular types of jobs. Taylor assumes, in other words, that members of a profession share tasks, goals, and needs in a way that influences their use of information. Taylor’s analysis recognizes, as Fig. 6 shows, that information-seeking and use is determined by the nature of the particular project, task, problem at hand.^[73]

A shift in emphasis toward the study of cognitive and situational variables surrounding information-seeking and use, and away from users’ personal characteristics and specific systems features, has been advocated by a number

of communications and information science researchers, most notably Dervin and Nilan (see *Annual Review of Information Science and Technology*, 21, 1986). They devote special attention to understanding what there is about a particular situation that encourages an individual to use networks in fulfilling an information need. In Fig. 6, the subjective perception of cost, time, and likelihood of success may often be situationally driven.

The resulting data, information, and knowledge are evaluated subjectively. The engineer as an information processor faces three possible courses of action. *First*, if the acquired-obtained data, information, and knowledge complete the project or task or solve the problem, the process is terminated. *Second*, if the acquired-obtained, data, information, and knowledge are useful but only partially complete the project or task or solve the problem, a decision is made either to continue the process by reevaluating the information source selection or to terminate the process. *Third*, if the acquired-obtained data, information, and knowledge are not applicable to or do not complete the project or task or solve the problem, a decision is made either to continue the process by redefining the project, task, or problem or to terminate the process.

An Empirical Study: The Aerospace Knowledge Diffusion Research Project

We noted earlier that the literature regarding the information-seeking behavior of engineers is fragmented and superficial and that the results have not accumulated to form a significant body of knowledge. The inability to apply these findings is attributable to the lack of a unifying theory, standardized methodology, and common definitions. The simple truth is that little is known about the information-seeking behavior of engineers generally. Further, there is little evidence that addresses differences that may exist among various engineering branches or specialties. We have little knowledge of whether the attributes and information-seeking behaviors associated with engineers in one discipline (e.g., civil) are transferable to engineers in another discipline (e.g., nuclear).

The authors are involved in a research project currently underway that is investigating the production, transfer, and use of federally funded aerospace R&D by aerospace engineers from the perspective of the model presented in Fig. 6. This four-phase project is providing descriptive and analytical data regarding the diffusion of aerospace knowledge at the individual, organizational, national, and international levels. It is examining both the channels used to communicate and the social system of the aerospace knowledge diffusion process. Phase 1 investigates the information-seeking behavior of U.S. aerospace engineers and scientists and places particular emphasis on their use of federally funded aerospace R&D and U.S. government

technical reports. Phase 2 examines the industry-government interface and places special emphasis on the role of information intermediaries in the aerospace knowledge diffusion process. Phase 3 concerns the academic-government interface and places specific emphasis on the information intermediary-faculty-student relationship. Phase 4 explores the information seeking behavior of non-U.S. aerospace engineers and scientists in selected countries. Another portion of the project looks specifically at the use of electronic networks by U.S. aerospace engineers.^[74]

Over the long term, the project findings will provide an empirical basis for understanding the aerospace knowledge diffusion process itself and its implications at the individual, organizational, national, and international levels. The results of the project should provide useful information to R&D managers, information managers, and others concerned with improving access to, the quality of, and the utilization of federally funded aerospace R&D.^[75] Selected descriptive results from this research, as it pertains to the information-seeking behavior of aerospace engineers, are reported in this section.

Patterns of technical communication

The communication of technical information (e.g., producing written materials or oral discussions) is an important aspect of aerospace engineering. Based on a 40-hour week, aerospace engineers spend an average ($\bar{X}$) of 8.7 hours per week writing technical information and 10.3 hours per week communicating technical information orally. Combining these means shows that aerospace engineers spend an average of 19 hours per week communicating in written and oral form. On average, aerospace engineers spend more time per week communicating technical information ($\bar{X} = 19.06$) to others than they do working with technical information received from other ($\bar{X} = 14.64$). As their years of work experience increase and as they advance professionally, so too does the amount of time they spend communicating (i.e., producing and using) technical information.

On average, the majority of aerospace engineers prepare written technical communications alone. Of the approximately 22% who write with a group of engineers, about 40% write with the same group of engineers. The average size ($\bar{X}$) of the group is 5.75 people. Of those who write in or with a group, about 22% indicated that doing so made them more productive than writing alone, and 21% indicated that doing so made them less productive than writing alone. Letters and memos were the technical information products most frequently prepared alone. Drawings/specifications were the technical information product most frequently prepared in a group. Drawings/specifications were the most frequently used technical information product.

Patterns of technical information use and problem solving

Aerospace engineers use a variety of technical information sources when solving technical problems. In general, aerospace engineers are not interested in guides to the literature nearly so much as they are interested in reliable answers to specific questions. They prefer informal sources of information, especially conversations with individuals within their organization. Aerospace engineers may also have psychological traits that predispose them to solve problems alone or with the help of colleagues rather than seeking answers in the literature. When they use libraries, they tend to use them in a self-help mode. When they use them, aerospace engineers tend to turn to librarians and library services for assistance only after they have consulted their personal store of information, talked to co-workers and colleagues, consulted a "key" person, and used a library in a personal search mode. Having failed to that point, aerospace engineers search or have a database searched and/or seek the assistance of a librarian or technical information specialist.

The role of the library

Regardless of their relative position in the problem solving process, libraries and librarians provide an important link in the aerospace engineer's quest for information. Overall, libraries and technical information centers are important ($\bar{X} = 3.8$ with 5 being most important) to aerospace engineers in performing their professional duties. Statistically, academically-affiliated aerospace engineers assign a higher rating of importance to libraries and technical information centers than do their counterparts in government and industry. Academically-affiliated aerospace engineers also tend to use libraries and technical information centers more often than do government- and industry-affiliated aerospace engineers.

Why do aerospace engineers not use libraries and technical information centers? The primary reasons include "no information needs" and "information needs met some other way." There also appears to be a positive correlation between "use" by aerospace engineers and "physical distance." In other words, the closer the aerospace engineer resides to the library, the greater the probable use of the library or technical information center.

Factors affecting use of technical information

The relevant literature overwhelmingly favors accessibility as the single most important (variable) determinant of use. Gerstberger and Allen reported that among R&D engineers, accessibility rather than technical quality influences use.^[71] Allen^[44] stated, "There is apparently some relationship between the perceptions of technical quality

and channel accessibility, but it is the accessibility component that almost exclusively determines frequency of use.”^[44] Rosenberg in a study of research and non-research personnel in industry and government found that both groups exhibited similar information-seeking behavior. Of the eight variable investigated by Rosenberg, both groups indicated that accessibility had the greatest influence on information use.^[72] Orr, on the other hand, disagreed, stating that quality of information was the most important consideration in selecting/using an information product.^[66] Our results indicate that accessibility influences the use of information products by aerospace engineers. However, accessibility does not “exclusively” determine information use. Relevance and technical quality, together with accessibility, are the factors that affect the use of information products by aerospace engineers.

Use of Information Technology

In Shuchman’s investigation^[60] of information transfer in engineering, aeronautical engineers made greater use of information technologies, including computers, than did engineers in other disciplines (see Bishop^[76] and Pinelli^[77] for an overview of recent literature on the use of information technology in aerospace engineering). Study data indicate that aerospace engineers tend to use many forms of information technology and that they are likely to use information if accessible via a computer. Approximately half of all aerospace engineers have access to and use electronic networks. Electronic networks are used by aerospace engineers for various purposes including online database searching; communicating via electronic mail, bulletin boards or conferencing systems; logging into remote computers to run programs; and exchanging data and other files.

The need for theory-based practice

With its contribution to trade, its coupling with national security, and its symbolism of U.S. technological strength, the U.S. aerospace industry holds a unique position in the nation’s industrial structure. However, this industry, in particular the commercial aviation sector, is in the midst of profound change and now faces a significantly more challenging competitive and global environment. To remain a world leader in aerospace, the U.S. must improve and maintain the professional competency of its engineers and scientists, increase the R&D knowledge base, improve productivity, and maximize the integration of recent technological developments into the R&D process. How well these objectives are met, and at what cost, depends on a variety of factors, but largely on the ability of U.S. aerospace engineers and scientists to acquire and process the results of aerospace R&D. Hence, an understanding of the information-seeking behavior of aerospace engineers

would offer valuable insight for maintaining U.S. supremacy in aerospace.

Despite the expenditure of considerable effort, there is no generally accepted or systematically acquired body of research that can accurately describe or explain information-seeking behavior or predict the use of information by engineers in general and aerospace engineers in particular other than at the most elementary levels. A variety of environmental and structural changes, including the growth of computer and information technology, combine to significantly weaken the relevance and reliability of this research. Hence there is the need for a modestly constructed engineering-oriented research agenda.

ENGINEERING INFORMATION-SEEKING BEHAVIOR: DEVELOPING A RESEARCH AGENDA

Considerable research and numerous user studies have been conducted over the past 25 years. The generally held beliefs are that (1) the results of this research and these studies have not accumulated to form a significant body of knowledge that can be used by information professionals and (2) the results that are usable have been virtually ignored by those concerned with the design and provision of information policy, products, services, and systems.

An acquired body of research is vital to the development of theory and the solution of professional problems, to the formation of tools and methods for analyzing organizations, services, environments, and behaviors, to determining the cost and benefits of information products, services, and systems, to establishing and developing theories upon which to base practice, and to contributing paradigms, models, and radically new conceptualizations of information-seeking behavior. The following outline suggests the directions that continued research should take.

1. Previous research regarding the information-seeking behavior of engineers is noncumulative, has been variously criticized, and has largely been dismissed on the basis of research and scholarship.
 - A. Conduct a “critical” review, analysis, and evaluation of previous research, identify and remove spurious research findings, and establish a starting point or foundation for “what is known and accepted as fact” vis-a-vis engineering information-seeking behavior.
 - B. Identify the criticisms and deficiencies of previously used research designs and methodologies and compile a list of “lessons learned” to guard against committing the same or similar mistakes.
 - C. Consider the lessons learned in the context of existing research designs and methodologies and identify those that correct or compensate for previous mistakes.

2. Previous research regarding the information-seeking behavior of the engineer has been limited to a particular system, product, or service in a particular organization or environment. Hence, the results are often confusing, conflicting, and not sufficient to form the basis for the development of theory.
 - A. Develop standard definitions, terms, and terminologies.
 - B. Develop, test, and validate research tools, instruments, and techniques.
 - C. Develop a standard set of variables.
 1. Types of Users
 - a. Engineers
 - b. Scientists
 - c. Intermediaries
 - d. Gatekeepers
 - e. Managers
 2. Types of Organizations
 - a. Academic
 - b. Government
 - c. Industry
 3. Size of Organization
 - a. Small
 - b. Medium
 - c. Large
 4. Types of Environment
 - a. Research
 - b. Development
 - c. Design
 - d. Manufacturing
 - e. Production
 - f. Test and Evaluation
 - g. Marketing and Sales
 - h. Service and Maintenance
 - i. Management
 5. Types of Knowledge
 - a. Tacit knowledge
 - b. Information
 - c. Data
 6. Types of Product/Service
 - a. Print
 - b. Nonprint
 - c. Electronic
 7. Types of Engineering Discipline
 - a. Civil
 - b. Electrical
 - c. Mechanical
 - D. Determine which variable(s) (institutional and situational) best describe and explain the use of information by engineers in a variety of environments.
3. What is known about the information-seeking behavior of engineers seems not to explain information use and nonuse. Hence, there is little knowledge that can

be used for testing existing and developing new paradigms.

- A. Conduct engineering information-seeking behavior research within a conceptual framework that embraces the production, transfer, use, and management of information. One possible outcome could be the identification of barriers that prohibit or restrict the use of information by engineers.
 - B. Seek to understand the diffusion of engineering knowledge as a precursor to describing and explaining the information-seeking behavior of engineers.
 - C. Develop and test hypotheses, the results of which, can lead to the formation of theory that can be used to predict the use of information by engineers.
 - D. Develop a series of experiments, the results of which will lead to the formation of paradigms, models, and radically new conceptualizations of library and information science phenomena.
4. Conventional wisdom states that a “disconnect” exists between researchers and practitioners in the field of library and information science.
 - A. Develop a mechanism that couples the results of basic and applied research with users in the field.
 - B. Develop the means by which researchers and practitioners have greater opportunities for interaction.

Determining what we know and where we are will provide a starting point to formulate the questions that must be asked. The answers to these questions will form the elements of a basic research program and lead to the development of theory-based practice. Applied research can then be used to test and validate these theories. Tests and validation will lead to the identification of spurious findings and eventually to the accumulation of a significant body of knowledge that can be used by information professionals to design aerospace information policy, products, services, and systems.

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John D. McDonald
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Library and Information Sciences, Fourth Edition

Volume 3

From: *Epistemology* To: *Information
Retrieval Experimentation*

Encyclopedia Edited By

John D. McDonald

and

Michael Levine-Clark



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Encyclopedia of Library and Information Sciences, Fourth Edition

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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable.

Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

They acknowledge and thank the Taylor & Francis Group editors, Claire Miller and Rich O'Hanley, as well as Susan Lee, who passed away at the early stages of the preparation of this edition, and more recently, Alexandra Torres, who supported and kept the editors and authors on track over the course of the years of work on this edition of the encyclopedia.

The editors thank the authors who wrote and revised entries, and the huge number of reviewers who refereed the entries. Without their dedication, expertise, and willingness to share their knowledge with others, there would be no encyclopedia. They also wish to thank the Editorial Advisory Board for their advice, suggestions of topics and authors, their hours spent writing or reviewing for the final edition. They also wish to thank the previous editors, Marcia Bates and Mary Niles Maack, whose organization and structure for ELIS-3 provided an excellent blueprint for ELIS-4.



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Epistemology–Faceted

Federal–Fuzzy

Games–Global

Government–Historical

History–Hospital

Human–Indexing

India–Information Behavior

Information Crises–
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Epistemology

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Abstract

Philosophers and others have long tried to formulate an explanation of the nature, origin, and scope of knowledge. Epistemology is the philosophical project of formulating such an explanation. It has occupied philosophers at least since the time of Plato, and it continues to provide a central field of study in contemporary philosophy. If we claim to have genuine knowledge in any area of inquiry, or information gathering, we should be prepared to offer the kind of explanation of knowledge that is constitutive of epistemology.

INTRODUCTION

Epistemology is the theory of knowledge, the philosophical study of the nature, origin, and scope of knowledge. Classical and contemporary epistemologists have debated (1) what knowledge consists in (e.g., justified true belief); (2) what knowledge is based on (e.g., sensory experience and/or pure reason); and (3) what the extent of our knowledge is (e.g., objective, conceiver-independent facts as well as subjective, conceiver-dependent facts). Debates over such topics have occupied epistemologists since the time of Plato. Contemporary epistemologists have not put an end to such debates by any means, but they have made some distinctive contributions. This entry surveys such topics.

ANALYZING KNOWLEDGE

In analyzing (the concept of) knowledge, epistemologists seek to identify the essential, defining constituents of knowledge. The standard analysis of knowledge stems from Plato's *Theaetetus*, and proposes that knowledge is justified true belief. Despite its distinctive heritage, this analysis faces a serious challenge called "the Gettier Problem." In 1963, Edmund Gettier published a crucial challenge to the view that if you have a justified true belief that *P*, then you know that *P*. One of Gettier's counterexamples to this view is the following. Smith is justified in believing the false proposition that (a) Jones owns a Ford. On the basis of (a), Smith infers, and thus is justified in believing, that (b) either Jones owns a Ford or Brown is in Barcelona. As it happens, Brown is in Barcelona, and so (b) is true. So, although Smith is justified in believing the true proposition (b), Smith does not know (b).

Gettier-style counterexamples illustrate the reality of cases where a person has justified true belief that *P* but lacks knowledge that *P*. The Gettier problem is the problem of

finding a modification of, or an alternative to, the standard analysis of knowledge that sidesteps problems from Gettier-style counterexamples. Many epistemologists take the main lesson of Gettier-style counterexamples to be that propositional knowledge requires a fourth condition beyond the justification, truth, and belief conditions. No specific fourth condition has attracted a consensus, but some approaches to a fourth condition have become prominent. A proposed "defeasibility condition," for example, requires that the justification appropriate to knowledge be "undefeated" in that some appropriate subjunctive conditional concerning defeaters of justification be true of that justification. One simple defeasibility fourth condition requires of Smith's knowing that *P* that there be no true proposition, *Q*, such that if *Q* became justified for Smith, *P* would no longer be justified for Smith. So, if Smith knows, on the basis of visual perception, that Jeanne removed books from the library, then Smith's coming to believe the true proposition that Jeanne's identical twin removed books from the library would not undermine the justification for Smith's belief concerning Jeanne herself. A different approach avoids subjunctive conditionals of that sort, and implies that propositional knowledge requires justified true belief that is sustained by the collective totality of actual truths. This approach requires a detailed account of when justification is undermined and restored. After four decades of vigorous research, however, contemporary epistemologists have still not come up with a widely accepted solution to the Gettier problem. The Gettier problem is, nonetheless, epistemologically important, because our having a precise understanding of propositional knowledge requires our having a Gettier-proof analysis of such knowledge.

MODERN EMPIRICISM

Contemporary Anglo-American epistemology began with the departure of Bertrand Russell (1872–1970) and G. E.

Moore (1873–1958) from Kantian and Hegelian idealism. They opposed idealism not only with the ontological claim that there are mind-independent facts, but also with the epistemological claim that they *know* that there are such facts. The ground for the latter epistemological claim, according to Russell, is “common sense, uninfluenced by philosophy or theology.”^[29]

What exactly is common sense? Surprisingly, Russell and Moore do not say in any detail. Russell speaks of common sense *uninfluenced by philosophy or theology*. Why, however, should we regard such common sense as a philosophically adequate ground for challenging idealism and supporting its opposite, realism? In particular, why should we regard such common sense as a reliable source of *correct* belief regarding idealism and realism? Russell excludes from his ground for realism common sense influenced by philosophy or theology.

On what ground may one recommend that common-sense beliefs uninfluenced by philosophy or theology are reliable or any more reliable than other commonsense beliefs? Commonsense beliefs influenced by certain kinds of physics, chemistry, biology, astronomy, sociology, psychology, or politics, for example, can be just as unreliable as commonsense beliefs influenced by certain kinds of philosophy or theology. A popular belief uninfluenced by philosophy or theology could still be highly unreliable owing to influence from other sources: for example, prejudicial political views.

The commonsense epistemology of Russell rests on *empiricism*: the view that the empirical input of the senses (e.g., visual, auditory, tactile, or gustatory experiences) is evidence appropriate to genuine knowledge. Russell sides with such empiricists as Locke, Berkeley, and Hume, against the rationalist view that a priori knowledge—knowledge independent of specific experience—can provide knowledge of what actually exists. Russell sides with such rationalists as Descartes and Leibniz, however, on the view that logical principles, whether deductive or inductive, are not known on the basis of evidence from experience. All evidence from experience, Russell claims, *presupposes* logical principles. Russell does allow, though, that our knowledge of logical principles is elicited or caused by experience. He thus permits a distinction between the *evidence* and the *cause* of a belief. In sum, Russell holds that “all knowledge which asserts existence is empirical, and the only a priori knowledge concerning existence is hypothetical, giving connections among things that exist or may exist, but not giving actual existence.”^[26] Russell’s empiricist epistemology is thus moderate, allowing for some a priori knowledge.

Russell^[25,26] distinguishes between knowledge *by acquaintance* and knowledge *by description*, and between knowledge of *things* and knowledge of *true propositions*. Knowledge of things can be either knowledge of things by acquaintance or knowledge of things by description. Knowledge by description requires knowledge of a true

proposition: knowledge *that* something is the case. Knowledge by acquaintance, in contrast, consists of direct non-propositional awareness of something, not of knowledge of truths. Russell holds that “to say that *S* has acquaintance with *O* is essentially the same thing as to say that *O* is presented to *S*.”^[25] Russell would say that readers are acquainted with the color of these printed words as they read them.

Russell’s epistemology attributes decisive epistemological significance to the natural sciences, so much so that the sciences are given epistemological priority over common sense. Russell acknowledges that the sciences begin with commonsense notions, such as notions of causation, space, time, and things, but that the sciences often need to revise or to eliminate such common notions to achieve their explanatory purposes. Russell observes that we typically start our theorizing from “naive realism,” the view that things are as they seem. We initially think that the objects we perceive really are as they appear to us: that pomegranates are red, that ice is cold, and so on. The natural sciences, however, offer a strikingly different view of the objects we perceive, a view entailing that the features ascribed to external objects by naive realism do not really inhere in the external objects themselves. Russell thus remarks that “naive realism leads to physics, and physics, if true, shows that naive realism is false.”^[28]

Philosophy, according to Russell, serves an important purpose, because it identifies how fundamental commonsense notions can be reconstructed to benefit the explanatory aims of the sciences. Russell denies, however, that philosophy offers a kind of knowledge ultimately different from scientific knowledge. He holds that “philosophy involves a criticism of scientific knowledge, not from a point of view ultimately different from that of science, but from a point of view less concerned with details and more concerned with the harmony of the whole body of special sciences.”^[27]

Why, however, should we take science as our final epistemological authority? This question will be especially urgent for people inclined to skepticism about the reliability of science. Russell offers little by way of reply: “For my part, I assume that science is broadly speaking true.... But against the thoroughgoing sceptic I can advance no argument except that I do not believe him to be sincere.”^[31] This reply will probably convince nobody with any cognitive caution. Russell understands the *truth* of statements as their describing *facts* that may be objective in that they transcend experience.^[28,30] He gives no reason, however, for thinking that everyone doubtful of science’s providing such truth is insincere. Epistemologists, among others, have long debated whether perception, memory, and the procedures of the natural sciences deliver objective truths. We cannot cogently settle this debate by assuming that beliefs based on perception, memory, or the sciences are broadly true, and that people doubting this assumption are insincere.

Russell's epistemology will not be helped here by the classical pragmatist view of William James (1842–1910), John Dewey (1859–1952), and C. I. Lewis (1883–1965) that knowledge has an unavoidable pragmatic component, viz., an element of “active interpretation.” Often we do seek a pragmatic rationale for a manner of interpretation: we then wonder about the practical consequences of wielding certain concepts (or, ways of classifying), relative to our explanatory purposes. Such a pragmatic rationale concerns the instrumental effectiveness of certain concepts in achieving our theoretical purposes, whatever those purposes happen to be. Traditional epistemologists, however, have wondered whether we can assess concepts relative to something more objective and less variable, viz., relative to the reliability of their portrayal of the objective, conceiver-independent world. Some philosophers hold that the latter kind of assessment, in terms of objective reliability, is distinctively “epistemological,” and that a merely pragmatic rationale can be, and often is, irrelevant to such epistemological assessment. They assume that epistemological assessment is centrally concerned with objective, purpose-independent truth, and reliable indications of such truth. Pragmatic success can sometimes proceed with beliefs that are unreliable and even false, such as when it is convenient for our (theoretical) purposes to maintain an unreliable, false view on something.

Given a coherent notion of objective, purpose-independent correctness, we can distinguish epistemological from pragmatic assessment. A notion of purpose-independent correctness allows that the concepts we use in theorizing often depend on our purposes in theorizing. A key issue, however, is whether it makes sense to talk of the purpose-independent correctness of concepts. A critic of pragmatism will suggest that the external world is featured in certain mind-independent ways (e.g., many of its objects have “natural” boundaries), and that our classificatory concepts can be more or less accurate, or reliable, in how they “fit” the mind-independent features of the external world. Given such coherent talk of accurate fitting, we can raise a distinctively epistemological issue about whether we know that our concepts accurately fit the external world. This issue drives much of traditional epistemology, and raises a skeptical problem noted in this entry's concluding section.

EXPLAINING EPISTEMIC JUSTIFICATION

According to the “standard analysis” of knowledge suggested in Plato's *Theaetetus*, we know that *P* if and only if we have a *justified* true belief that *P*. We might believe a true groundless guess (say, about the winning horse at the track), but would not thereby *know* that this guess is true. On the traditional analysis, knowledge requires not only that a belief condition and a truth

condition be satisfied, but also that the satisfaction of the belief condition be *suitably related* to the satisfaction of the truth condition. The latter requirement leads to a justification condition for knowledge, a condition that excludes such coincidental phenomena as lucky guesswork.

Contemporary epistemologists have given careful attention to the defining and explanatory conditions for *epistemic* justification, the kind of justification appropriate to knowledge. They typically have allowed for justified false beliefs, and this allowance is called *fallibilism* about justification. Fallibilism allows, for example, that the Ptolemaic astronomers before Copernicus were justified in holding their geocentric model of the universe, even though it turned out later to be a false model. In addition, justification for a proposition, according to most contemporary epistemologists, need not logically entail the proposition justified: It need not be such that necessarily if the justifying proposition is true, then the justified proposition is true too. When justification does logically entail what it justifies, we have *deductive* justification. *Inductive* justification, in contrast, does not logically entail what it justifies; it rather is such that if the justifying proposition is true, then the justified proposition is, to some extent, *probably* true. Contemporary epistemologists do not share a single account of the kind of probability appropriate to inductive justification. Most contemporary epistemologists agree, however, that epistemic justification is *defeasible*, that a justifying proposition can cease to be justifying for a person when that person acquires additional justification. For instance, one's justification for thinking that there is a pool of water on the road ahead can be defeated by new evidence one acquires upon approaching the relevant spot on the road.

A major topic of controversy in contemporary epistemology concerns the kind of justification we have for our beliefs about the external world, including the belief that conceiver-independent physical objects exist. Most contemporary epistemologists hold that such beliefs are justified only inductively, in terms of justification that does not logically entail the beliefs justified. Some skeptics, doubting that we have epistemic justification for the belief that external objects exist, have required deductive support for that belief; others have questioned whether we can even have inductive, probabilistic justification here. Epistemologists have no consensus here; nor is consensus anywhere in sight.

Some skeptics have used a *regress argument* to contend that we are not justified in believing anything about the external, conceiver-independent world (see Oakley^[22]). This argument stems from the question whether, and if so how, we are justified in holding any belief about the external world *on the basis of other beliefs*, that is, on the basis of *inferential* justification. A skeptic's use of the regress argument aims to show that each of the available accounts of inferential justification fails, and thus that such

justification is not to be had. The initial skeptical worry is: if our belief that external objects exist is supposedly justified on the basis of another belief, how is the latter, allegedly justifying belief itself justified? Is it justified by a further belief? If so, how is the latter belief itself justified? We seem to be threatened by an endless regress of required justifying beliefs, a regress that seems too complex to employ in our actual everyday reasoning or information gathering. Our options, according to many contemporary epistemologists, are straightforward. Either 1) explain how an endless regress of required justifying beliefs is not actually troublesome; 2) show how we can terminate the threatening regress; or 3) accept the skeptical conclusion that inferential justification is impossible.

A simple example illustrates the problem of inferential justification. While walking along the base of the highest mountain in Oregon, Mount Hood, we decide that a climb would be enjoyable, but that the current dangers of a snowstorm are too great. Our belief that mountain climbing today is dangerous is supported by other beliefs we have. We believe, for example, that (a) local meteorologists have predicted blizzard conditions today on Mt. Hood, (b) there is foreboding cloud cover overhead, and (c) the meteorologists' reports and the presence of the foreboding clouds are reliable indicators of an impending snowstorm. Our belief that mountain climbing today is dangerous receives support from our belief that (a), (b), and (c) are true. What, however, supports (a), (b), and (c) for us? Other beliefs we have will naturally contribute support here, and thus the chain of inferential justification will continue. Part of our support for (a) might be our belief that (d) we have seen internet reports today from some local meteorologists; and part of our support for (b) might be our belief that (e) we see foreboding cloud cover overhead. Our support for (d) and (e) might be similarly inferential, and thus extend the chain of inferential justification further.

Nonskeptical epistemologists have offered two noteworthy replies to the regress problem concerning inferential justification. One reply is *epistemic coherentism*: the view that all justification is inferential and systematic in virtue of "coherence relations" among beliefs. Justification for any belief, according to epistemic coherentism, ends in a system or network of beliefs with which the justified belief coheres. We should not confuse a coherence theory of *justification*, epistemic coherentism, with a coherence theory of *truth*. A coherence theory of truth, of the sort endorsed by Brand Blanshard,^[1] aims to specify the meaning of "truth," or the essential nature of truth; a coherence theory of justification aims to explain the nature not of truth, but of the kind of justification appropriate to knowledge. Recent advocates of epistemic coherentism, of one version or another, include Wilfrid Sellars,^[32–34] Nicholas Rescher,^[23,24] Gilbert Harman,^[11,12] Keith Lehrer,^[13,14] and Laurence Bonjour.^[3]

Advocates of epistemic coherentism have tried to answer two pressing questions. First, what kind of

coherence relation is crucial to justified belief? Second, what kind of belief-system must a justified belief cohere with? Regarding the first question, many proponents of epistemic coherentism acknowledge logical entailment and explanation as coherence relations among beliefs. Explanatory coherence relations are instantiated when some of one's beliefs effectively explain why some other of one's beliefs are true. For example, my belief that it is snowing outside might effectively explain the truth of my belief that my office windows are wet. Regarding the second question, not just any belief-system will serve the purpose of epistemic coherentism. Some belief-systems, such as those consisting of science-fiction propositions, seem obviously erroneous, and thus seem unable to provide a basis for epistemically justified belief. However one answers the previous two questions; epistemic coherentism implies that the justification of any belief depends on that belief's coherence relations to other beliefs. Such coherentism suggests that justified belief is systematic, given that it emphasizes the role of interconnectedness of beliefs in epistemic justification.

Skeptics will ask why we should regard coherence among one's beliefs as a reliable indication of empirical truth, of how things actually are in the empirical world. Consider, in addition, the following so-called *isolation objection* to epistemic coherentism: Epistemic coherentism entails that one can be epistemically justified in accepting a contingent empirical proposition that is incompatible with, or at least improbable, given one's total empirical evidence.^[17–19] A proponent of this objection does not restrict empirical evidence to empirical propositions believed or accepted by a person.

The isolation objection becomes directly applicable to coherence theories of justification once we expand the scope of empirical evidence beyond the propositions (or, judgments) believed or accepted by a person. Suppose, for example, that one's empirical evidence includes the subjective nonpropositional contents (e.g., visual images) of one's *nonbelief* perceptual and sensory awareness-states, such as one's seeming to perceive something or one's feeling a pain. Such contents, being nonpropositional, are not among what one believes or accepts. One might, of course, accept *that one is having* a particular visual image, but this does not mean that the image itself is a proposition one accepts. If we include the nonpropositional contents of nonbelief perceptual and sensory states in one's empirical evidence, the isolation objection will bear directly on coherence theories of justification. Coherence theories, by definition, make epistemic justification depend just on coherence relations among propositions one believes or accepts. They thus neglect the evidential significance of the nonpropositional contents of nonbelief perceptual and sensory states. Proponents of epistemic coherentism have not yet achieved a uniform resolution of the problem raised by the isolation objection.

A second nonskeptical reply to the regress problem is *epistemic foundationalism*, the view that epistemic justification has a two-tier structure: some instances of justification are noninferential, or foundational, and all other instances of justification are inferential, or nonfoundational, in that they derive ultimately from foundational justification. This structural view was outlined in Aristotle's *Posterior Analytics* (as a view about knowledge), and it received an extreme formulation in Descartes' *Meditations*. It is also represented, in one form or another, in the twentieth-century epistemological works of Bertrand Russell,^[28] C. I. Lewis,^[15,16] and Roderick Chisholm,^[4,5,7] among many others.

Versions of foundationalism about justification differ on two matters: the explanation of noninferential, foundational justification, and the explanation of how justification can be transmitted from foundational beliefs to nonfoundational beliefs. Some philosophers, following Descartes, have assumed that foundational beliefs must be *certain* (e.g., indubitable or infallible). Such an assumption underlies *radical* foundationalism, a view requiring not only that foundational beliefs be certain, but also that such beliefs guarantee the certainty of the nonfoundational beliefs they support. Two considerations explain why radical foundationalism attracts very few epistemologists. First, very few, if any, of our perceptual beliefs are certain; and, second, the beliefs that might be candidates for certainty (e.g., the belief that I am thinking) are insufficiently informative to guarantee the certainty of our highly specific inferential beliefs concerning the external world (e.g., beliefs suitable to physics, chemistry, biology, and astronomy).

Most contemporary foundationalists accept *modest* foundationalism, the view that foundational beliefs need not possess or provide certainty, and need not deductively support justified nonfoundational beliefs. Foundationalists typically characterize a *noninferentially justified, foundational* belief as a belief whose epistemic *justification* does not derive from other beliefs, but they leave open whether the *causal* basis of foundational beliefs includes other beliefs. Further, they typically hold that foundationalism is an account of a belief's (or a proposition's) *having* justification for a person, not of one's *showing* that a belief has justification or is true.

Modest foundationalists can choose from three influential approaches to noninferential, foundational justification: (1) self-justification; (2) justification by nonbelief, nonpropositional experiences; and (3) justification by a reliable nonbelief origin of a belief. Recent proponents of self-justification have included Roderick Chisholm^[4] and C. J. Ducasse.^[9] They contend that a foundational belief can justify itself, apart from any evidential support from something else. In contrast, proponents of foundational justification by nonbelief experiences avoid commitment to literal self-justification. They hold, following C. I. Lewis,^[15,16] that foundational perceptual beliefs can be

justified by nonbelief sensory or perceptual experiences (e.g., my nonbelief experience involving seeming to see a rectangular screen) that either make true, are best explained by, or otherwise support those foundational beliefs (e.g., the belief that there is, or at least appears to be, a rectangular screen here). Proponents of foundational justification by reliable origins hold that noninferential justification depends on nonbelief belief-forming processes (e.g., perception, memory, introspection) that are truth-conducive to some extent, in virtue of tending to produce true rather than false beliefs. The latter view invokes the reliability of a belief's nonbelief origin, whereas the previous view invokes the particular sensory or perceptual experiences that underlie a foundational belief. Despite the disagreement here, proponents of modest foundationalism typically agree that noninferential justification, at least in most cases, can be defeated upon expansion of one's justified beliefs. The justification for our belief that there is a blue screen before us, for example, might be defeated by the introduction of new evidence that there is a bright blue light shining on the screen.

Foundationalists must explain not only the conditions for noninferential justification, but also how justification is transmitted from foundational beliefs to inferentially justified, nonfoundational beliefs. Modest foundationalists, unlike radical foundationalists, allow for nondeductive, merely probabilistic connections that transmit justification. They have not, however, reached agreement on the exact nature of such connections. Some modest foundationalists hold that some kind of "inference to a best explanation" can account for transmission of justification in many cases. For example, the belief that there is a computer screen before us can, in certain circumstances, provide a best explanation of various foundational beliefs about our perceptual inputs. This, however, is a controversial matter among epistemologists.

A special problem threatens versions of foundationalism that restrict noninferential justification to subjective beliefs about what one *seems* to see, hear, feel, smell, and taste. Those versions must explain how such subjective beliefs can provide justification for beliefs about conceiver-independent physical objects. Clearly, such subjective beliefs do not logically entail beliefs about physical objects. Since extensive hallucination is always possible, it is always possible that one's subjective beliefs are true while the relevant beliefs about physical objects are false. Perhaps a foundationalist, following Chisholm^[5] and Cornman,^[8] can invoke a set of nondeductive relations to explain how subjective beliefs can justify beliefs about physical objects. This remains, however, as a challenge, since no set of such relations has attracted widespread acceptance from foundationalists. We should note, though, that some versions of foundationalism allow for the noninferential justification of beliefs about physical objects, and thus avoid the problem at hand.

In sum, then, the regress problem for inferential justification has a troublesome resilience about it. Coherentism and foundationalism, may provide a viable solution to the problem, but only after a resolution of the problems noted above. Let us turn briefly now to some complications facing the scope of knowledge.

SKEPTICISM

Epistemologists have long debated the scope of human knowledge. The more restricted we take the scope of knowledge to be, the more skeptical we are. Two influential types of skepticism are *knowledge*-skepticism and *justification*-skepticism. Unrestricted knowledge-skepticism implies that no one knows anything, and unrestricted justification-skepticism implies the more extreme view that no one is even justified in believing anything. Some forms of skepticism are stronger than others. Knowledge-skepticism in its strongest form implies that it is *impossible* for anyone to know anything. A weaker form would deny the *actuality* of our having knowledge, but leave open its possibility. Many skeptics have restricted their skepticism to a particular domain of supposed knowledge: for example, knowledge of the external world, knowledge of other minds, knowledge of the past or the future, or knowledge of non-empirical items. Limited skepticism is more common than unrestricted skepticism in the history of epistemology.

Arguments supporting skepticism take many different forms. One of the most difficult is *the problem of the criterion*, a version of which comes from the sixteenth-century skeptic Michel de Montaigne:

To adjudicate [between the true and the false] among the appearances of things, we need to have a distinguishing method; to validate this method, we need to have a justifying argument; but to validate this justifying argument, we need the very method at issue. And there we are, going round on the wheel.

This line of skeptical argument originated in ancient Greece, with epistemology itself (see Sextus Empiricus, *Outlines of Pyrrhonism*, Book II). It forces us to face these questions: how can we specify *what* we know without having specified *how* we know, and how can we specify *how* we know without having specified *what* we know? Is there any reasonable way out of this threatening circle? This is one of the most difficult epistemological problems, and a defensible epistemology must offer a plausible solution to it. Contemporary epistemology still lacks a widely accepted reply to this urgent problem. One influential reply from Roderick Chisholm^[6] rules out skepticism from the start, with the assumption that we do know some specific propositions about the external world. Chisholm endorses a *particularist* reply that begins with an answer

to the question of what we know. Such a reply seems, however, to beg a key question against the skeptic. A *methodist* (not to be confused with Christian Methodists) reply to the problem of the criterion begins with an answer to the question of how we know. Such a reply risks divorcing knowledge from our considered judgments about particular cases of knowledge. It also must avoid begging key questions raised by skeptics.

Cognitively relevant access to *anything* by us humans depends on such belief-forming, or information-gathering, processes as perception, introspection, judgment, memory, testimony, intuition, and common sense. Such processes, however, are subject to skeptical question regarding their reliability, and cannot themselves deliver non-questionbegging support for their own reliability. Put bluntly, we cannot assume a position independent of our own cognitively relevant processes to deliver a non-questionbegging indication of the reliability of those processes. This seems to be the human cognitive predicament; and nobody has yet shown how we can escape it. This, too, is a straightforward consideration favoring the conclusion that we must take skepticism quite seriously.

Questions under dispute in a philosophical context cannot attract non-questionbegging answers from mere *presumption* of the correctness of a disputed answer. If we allow such questionbegging in general, we can support *any* disputed position we prefer. We may then simply beg the key question in any dispute regarding the preferred position. Given that strategy, argument becomes superfluous in the way circular argument is typically pointless. Questionbegging strategies promote an undesirable arbitrariness in philosophical debate. They are thus rationally inconclusive relative to the questions under dispute.

Our question about the reliability of our belief-forming, or information-gathering, processes should be coherent. For instance, we should not demand non-questionbegging evidence indicating the reliability of vision, for example, while we call into question, and thus refuse, *any available evidence* indicating the reliability of belief-forming processes. That would be to demand that we stand somewhere to assess reliability while we are not allowed to stand anywhere at all. Such a demand would undermine itself in virtue of a kind of incoherence: *demand incoherence*. One *can* coherently question the reliability of all evidence available to us, and some skeptics do just this. In that case, however, one *cannot* coherently demand that we supply non-questionbegging evidence indicating the reliability of our belief-forming processes. If *all* available evidence, including that from any of our belief-forming processes, is under question, then *no* evidence will be non-questionbegging. As a result, a demand for non-questionbegging evidence cannot coherently include *unrestricted* questioning of all available evidence. Any demand, then, that we establish the reliability of our belief-forming processes must allow that some evidence

not be under question regarding reliability. Otherwise, a kind of incoherence threatens.

Arguably, we have a firm place to stand in answering questions about evidence and reasonable belief: we may stand firmly on our semantic, concept-forming intentions that give meaning to our terms. Consider the term “epistemic reason.” Philosophers of different outlooks share the general notion of an epistemic reason as a (*possibly fallible*) *truth-indicator*. An epistemic reason for a belief thus indicates, perhaps with only a degree of probability, that the belief is true. Our meaning-forming intentions to use terms in a certain way give semantic content to our talk of an “epistemic reason for a belief.”

We may form a settled semantic intention to use “truth-indicator” and “epistemic reason” as follows: a visual experience, for example, of an *apparent* pomegranate in a situation with no accessible contrary evidence is a (fallible) truth-indicator and thus an epistemic reason for a visual belief that an actual pomegranate exists. This semantic intention, owing to its meaning-conferring role for us, could then serve as a directly accessible semantic truth-maker for our ascription of an epistemic reason for a visual belief that an actual pomegranate exists. It would then be *part of what we mean* by “epistemic reason” that *such* an ascription captures an epistemic reason for a visual belief that an actual pomegranate exists. Our semantic intentions concerning “epistemic reasons” may thus serve as ultimate, even if revisable, truth-makers for ascriptions of an epistemic reason.

Skeptics might object that our semantic intentions can be “mistaken,” say in virtue of failing to capture language-independent justification. We can sidestep such an objection, however, because reality (the objective world) does not settle how *in particular* we must seek truth. For better or worse, it does not settle *which specific variant* (or specific concept) of justification, warrant, or knowledge is binding on a truth-seeker. Even so, a person seeking to acquire truth and to avoid error should accommodate any necessary conditions for truth-acquisition (e.g., logical consistency in a belief) and for reliable and warranted belief.

Skeptics cannot convincingly hold nonskeptics to a specific concept or strategy of truth-acquisition that recommends skepticism. In particular, skeptics cannot cogently require an epistemic concept or strategy for us that undermines the aforementioned kind of epistemic reason (for visual beliefs) grounded in semantic intentions regarding “epistemic reason.” A problem here for skeptics is that the aforementioned kind of epistemic reason is, so far as we can tell, at least as effective for judicious truth-acquisition as anything skeptics offer. In addition, skeptics lack firm footing to propose that such a semantically grounded epistemic reason is defective as a fallible truth-indicator.

Skeptics cannot plausibly charge us with question begging or circular reasoning here. It is *part of what we mean*

by “epistemic reason” that the kind of ascription in question captures an epistemic reason for a visual belief that an actual pomegranate exists. So, we may now shift the burden of argument to the skeptic, and call this *the skeptic’s burden*. We have produced a skeptic-resistant truth-indicator grounded in cognitively significant semantic intentions. We have also challenged skeptics, among others, to avoid demand incoherence. The skeptic’s burden is now *properly* the skeptic’s. Until this burden is met, we may endorse the reasonableness of some of the beliefs delivered by our belief-forming processes. We may even endorse the reasonableness of belief in the reliability of some of our belief-forming processes.

Traditional epistemology began with skeptical questions in ancient Greece, and contemporary epistemology must face similar questions. In facing skeptical questions, we can learn much about epistemology and its quest to explain the nature, origin, and scope of human knowledge. We can also improve our understanding of well-founded information gathering.

CONCLUSION

Epistemology, as the philosophical study of knowledge, will be valuable as long as knowledge is valuable. When pursued aright, it illuminates the nature, sources, and limits of knowledge. In doing so, it contributes to a critically important area of human understanding. Clearly, this discipline will not run out of controversy and difficulty in its important explanatory pursuits.

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Ethical and Legal Aspects of Archival Services

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Abstract

Archivists deal with legal and ethical issues every day in the course of administering collections of personal papers. This entry will discuss legal and ethical aspects of archival services in three areas: acquisitions, access, and terms of use, in the context of research libraries and manuscript repositories. It will not deal with government, corporate, or institutional archives.

INTRODUCTION

Archivists who work in government or institutional archives oversee the noncurrent records generated by their organization. Other archivists, sometimes called curators or manuscript librarians, who work in libraries or manuscript repositories, administer collections of personal papers or organizational records that have been acquired from the outside, either by gift or by purchase. Both types of archivists face a variety of legal and ethical challenges as they oversee the materials entrusted to their care, and, despite the helpful codes of ethics compiled by the library and archival professions, these challenges often require archivists to make difficult decisions for which there is insufficient guidance. In one article, there is not sufficient space to treat adequately all types of archival settings, so this entry will discuss the legal and ethical issues that archivists must deal with for collections of personal papers.

The legal and ethical issues they face often fall within three broad areas of archival enterprise: acquisitions, access, and terms of use. The area of acquisitions encompasses both gifts and purchases of archival material, and includes such legal issues as the establishment and transfer of clear title, legal documentation of the terms of a transfer, and establishing fair market value. Ethical aspects of acquisitions include the courtesies of working with dealers, donors, and sister institutions.

The second area—access—consists of making research material available according to fair and equitable policies and procedures, within the guidelines of one's institution. For government archives, security and freedom of information determine access, and for institutional and organizational archives, access might be governed by the presence of sensitive or proprietary information in the records. For collections of personal papers, with which this entry is concerned, questions of access often revolve around the question of privacy and confidentiality.

The third legal and ethical area relates to terms of use. This generally pertains to copyright restrictions, literary

rights, and fees for publication or reproduction from original material.

ACQUISITIONS

In libraries and manuscript repositories, archivists acquire material by both gift and purchase from individuals or organizations outside their own institution, rather than by transfer from within the institution. This material may consist of collections of personal papers relating to prominent people, or they may be the records of an organization that are transferred to the repository for long-term safe-keeping. Certain legal considerations apply to such acquisitions, for both gifts and purchases.

First, the archivist must try to determine whether the donor or seller has clear title to the material and therefore has the right to transfer it to the repository. A certain degree of trust must obviously apply to such transactions, but the archivist should explore with the donor or seller the ownership of the material, albeit with delicacy and finesse. The best approach is to ask questions of the donor/seller, to learn as much as possible about the ownership and other history of the material. Such information is enormously useful in any event, to provide intellectual and historical context for the material, but it can also provide valuable clues as to the legal status of its ownership. For example, the donor/seller might recount a story of the papers turning up in a trunk in the attic or garage, or being held in safe deposit boxes by successive family members, or she might tell of holding onto the records of her activist organization in her den until the bulk reached a proportion she couldn't handle any longer.

Stories like these, when they appear plausible and straightforward, generally tend to indicate that ownership is not in doubt. The key for archivists, though, is to ask questions and to listen carefully. Equally important, archivists should trust their instincts. If something sounds wrong, it may well be wrong. The biggest danger signals of all are donors or sellers (the latter, especially) who say

they obtained their items at a swap meet or on eBay, for example. The rise of online auction sites has increased the opportunities and the motivations for the sale of stolen goods and, as a result, archivists must examine especially carefully all items that are offered for sale by an individual who either cites an online auction as his/her source or recounts a suspect story about the provenance, i.e., the ownership history.

Once the archivist is satisfied that the seller or donor has clear legal title, and that there is no other joint owner lurking in the wings, and if the material on offer fits the institution's collecting policy, the next step is to prepare a deed of gift or of sale setting forth the terms of transferring the material to the repository. Such documents are essential, but they have not always been employed by institutions acquiring manuscripts or other rare material.^[1] For more than half the twentieth century, curators or archivists simply relied on a handshake to seal a transaction. This practice, however, fell out of use during the 1960s, once its obvious failings were recognized, and when archivists increasingly had to deal with the aftermath of undocumented gifts, in the form of donors suddenly appearing to reclaim collections for which institutions had no paperwork to prove ownership.

Deeds of gift and of sale may be quite simple or more elaborate, depending on the institution's preference and on the needs of each transaction. The basic elements include the date, the name, address and phone number of the donor/seller, the conditions of transfer (sale price, for example, and the transfer or retention of copyright or literary rights), a description of the papers being transferred, a note about the disposition of duplicate or undesired material, and a note about any restrictions on the use of the papers, e.g., identification of items to be sealed for privacy reasons. The document should be signed by the donor/seller and by the archivist or other representative of the repository, and each party should receive a copy.^[2,3]

A similar document is a deed of deposit, which sets forth terms under which a repository accepts material not as a permanent acquisition but on temporary deposit. Deposits often become gifts, but archivists should accept deposits only with the greatest care. The deed of deposit must fully outline the terms of the deposit, leaving nothing to chance and nothing as merely an understanding. Archivists should take care not to accept open-ended deposits, i.e., having no terminal date. Open-ended deposits can hold an archivist hostage, subject to the demands of the depositor, with no end in sight. It is far preferable to state an end-date, by which time the collection is to be kept by the repository or returned to the depositor. Also, the deed of deposit should indicate whether the depositor will pay the cost of processing and housing the collection if he or she reclaims it. The amount of these costs should be clearly spelled out.

For either sale or gift transactions, it may be advisable or necessary to have the material's fair market value

determined by an outside appraiser. With sale situations, it is better for an objective, outside appraiser to establish a fair price for material than for either the seller or purchaser to set a price. Both of the parties involved in the transaction have agendas, the seller to gain the maximum return for the material, and the purchasing repository to spend as little money as possible. Only an outside party, in the form of a qualified appraiser, can approach the situation with the necessary objectivity. There are rare book and manuscript dealers nationwide who know the market and can perform appraisals for a fee. Dealers and appraisers often specialize in particular formats (manuscripts, books, or photographs, for example) or subjects (literature or western history, for example), so archivists do well to locate an appraiser who specializes in the type of material at hand, in order to secure the best possible appraisal. Most but not all dealers are members of the Antiquarian Booksellers of America (ABAA), an organization that sets forth its own code of ethics to which its members are expected to adhere.^[4] When engaging an appraiser, the archivist or seller should ascertain what the fee will be and should avoid anyone who sets a fee that is a percentage of the appraised value of the material, a clear conflict of interest.

Appraisals are required in gift situations, if the donor wishes to take a tax deduction for the appraised value of the papers. As with sale situations, the appraisal should never be performed by a party holding interest in the transaction but always by an objective outsider. An appraiser doing the work for a tax deductible gift will prepare a detailed appraisal report providing his or her credentials, a narrative about the material and about the market history of its value, and a list of the items and their fair market value. The question of who is to pay the fee should be discussed and agreed upon before the appraisal begins. Repositories' policies vary about the question of who pays an appraisal fee. Often, institutional policy requires that the donor pay for the appraisal, but some institutions stipulate that, if the institution pays the fee, then the donor must reduce his or her tax deduction by the amount of the appraisal fee. Archivists must learn the policy of their institution and should obtain legal advice if necessary.

There is one category of donation for which the donor can not obtain a tax deduction—self-generated papers. According to statute of the Internal Revenue Service (IRS), an individual who donates his or her own papers may take as a deduction only the value of the materials themselves, i.e., the paper or other surface, not of the text or art created on those materials. This came about when papers donated by former President Richard Nixon carried inflated market value, yielding a bountiful tax deduction. Since that time, donations by the creators of personal papers to repositories have declined, since the only incentive is altruistic, with no financial benefit.

In a cruel irony, family members, collectors, and others who have acquired an individual's creations may take a

full tax deduction for the market value of those creations. Thus, an author, composer, or artist cannot derive any real tax benefit for donating his/her own works, but others can. Moreover, the IRS has taken a strict construction of the code, deeming incoming correspondence, for example, as “self-generated” since it comes in response to letters sent by the creator of the papers. This means that a creator cannot receive a tax benefit from any part of his papers, even those parts written by others. In addition, the creator cannot give papers to a spouse or other family member in order to derive benefit. The IRS watches for such efforts to circumvent the tax code.

When papers are donated to a repository by someone other than its creator, and when the material holds sufficient fair market value, then the donor can receive a tax deduction for the appraised value. As in sale situations involving private sellers, an outside appraiser is engaged to evaluate the papers, and the appraiser writes a full report after examining the material. In addition to the report, the appraiser generates and signs an IRS 8283 form, which is then signed by the donor and the repository before the document becomes part of the donor’s tax filing.

Beyond the legal considerations surrounding gifts, purchases, and deposits, there are ethical aspects to the acquisition of archival material by libraries and manuscript repositories. With regard to purchases, archivists work with private sellers, manuscript dealers, and auction houses. With all three, archivists should proceed with honor and the highest of ethics. In working with private sellers, who may never have undertaken such a transaction before, archivists should never take advantage of the person’s inexperience. As already discussed, an outside appraisal should be secured in order to determine a fair purchase price.

When working with manuscript dealers, archivists should develop good relationships and behave with courtesy and consideration. Dealers are archivists’ allies and will often make referrals and contact archivists when appropriate material comes to them for resale or on consignment. In addition, dealers are often the first to learn of archival thefts, when a thief brings items to sell. Dealers know major library holdings and especially the collections of repositories in their geographic area, and they are likely to recognize stolen material when it comes in the door and to contact the repository that has suffered the theft. When archivists develop an ongoing relationship with a dealer, it is often possible to request that material be sent on approval, giving the archivist a chance to examine it before committing to purchase it. In such instances, it is crucial that the archivist treat this as a privilege and not abuse it, either by holding onto the material at length and then finally sending it back, or by treating material carelessly or damaging it before returning it.

In auctions, which are the most competitive of purchase situations, archivists must nonetheless proceed with integrity. Archivists often use agents to bid for them, especially when auctions take place a continent or half a world away.

An agent examines the items and reports to the archivist, who then issues clear, unambiguous bidding instructions. When engaging an agent, the archivist should ask questions about the agent’s fee and policies, to ensure a compatible working relationship. Archivists must avoid collusion with other individuals and must refrain from bidding on an item unless seriously interested in it. Occasionally, it is possible for an archivist to defer to a colleague from another repository, but this can be risky, since it involves delicate discussion about each repository’s intentions.

As with purchase situations, ethics come into play when archivists deal with donors, and, as with purchases, the fundamental principle is to behave honorably. Many donors have never been in this situation before, and they don’t know how to approach a repository or what to expect. It is incumbent on archivists to explain, fully and honestly, every step and aspect of the donation process, so the donor understands the choices and possibilities involved. Occasionally, donors will behave as though they don’t know much about the gift process, when in fact they have visited other libraries and are listening to see if an archivist’s explanation matches that heard elsewhere. Whether a donor has prior knowledge of the gift process or not, archivists must offer a straightforward, even selfless description of the gift situation. In working with donors who are family members, especially spouses or life partners, of a deceased creator of papers, the archivist should be especially patient and sensitive to the emotional wrench caused by parting with a collection. It is important to give donors time and space to say good-bye to material that is, to a great extent, the tangible representation of a beloved individual.

For purchases and gifts alike, archivists must be willing to refer collections to other libraries, if appropriate. A healthy spirit of competition among repositories is fine, but it must never become ruthless. Archivists must be willing to defer to their colleagues in other repositories when appropriate, no matter how much they might covet the material in question. The bottom line with acquisitions, and the higher ethic, is for archivists to ensure that collections go to the most appropriate home, wherever that might be. Therefore, archivists should know the holdings of other repositories and should pursue cordial relationships with their colleagues, in order to foster interinstitutional cooperation for the good of the materials they preserve.

ACCESS

Just as archivists must proceed fairly and impartially when acquiring manuscripts and archival collections, so must they provide access to their collections in a fair and equitable manner. In the past, and up to the 1960s, research libraries holding rare materials including archival collections, often granted to researchers exclusive access to certain collections and would then turn away other researchers seeking to use the same material. This practice led to the tying up of collections for years, and sometimes

decades, when researchers would hang on to their exclusive right of access like grim death, moving forward at a glacial rate while other researchers waited in frustration on the sidelines. A more recent instance of this kind of exclusive access occurred with the Dead Sea Scrolls, which, for several decades after their discovery in 1947, were available for research only among a small circle of “authorized” editors who closely guarded their own right of use and passed on that right to favored graduate students or other recipients. Other scholars seeking access to the Scrolls were turned away. Only in 1992 was this exclusive and exclusionary Scrolls cartel broken, when William A. Moffett, the library director at the Huntington Library, boldly opened the library’s set of Scroll photographs to all researchers, in contravention of explicit threats from the cartel of official editors.^[5]

In another dubious access practice that persisted in research institutions into the 1960s, many libraries allowed access to certain groups or categories of researchers, while denying it to others. In this kind of selective access, whose terms were often dictated by donors of collections, the use of manuscript material might be denied on the basis of religion, gender, or ethnic group. For example, one collection had long been closed to women and to people of British heritage. As soon as a new chief curator (a woman, and of British extraction) was appointed in the late 1960s, she quietly lifted this restriction. In another example, a collection had been off-limits to Jews, Catholics, and the donor’s nephew. Again, this unfair, inequitable, and onerous restriction was quietly lifted with a change in administration. By the late 1960s, research libraries began to abandon both types of restriction—the exclusive use for a given researcher, and the exclusion of certain people—in favor of fair and equitable access for all researchers.

Since the late 1960s, the most common way in which archival material might be restricted is for reasons of privacy and confidentiality.^[6] Repositories increasingly collect modern archival material, containing letters, diaries, and other material written by or referring to people still living. For this reason, archivists must be aware of privacy issues and of the possible presence of sensitive material in the collections they oversee. The Code of Ethics of the Society of American Archivists (SAA) includes this statement about privacy in archival collections: “Archivists protect the privacy rights of donors and individuals or groups who are the subject of records.” (The code also protects patron confidentiality, continuing: “They [archivists] respect all users’ right to privacy by maintaining the confidentiality of their research and protecting any personal information collected about them in accordance with the institution’s security procedures.”)^[7]

Typically, the sealing of items or files in an archival collection comes at the request of the donor of the collection, or as a result of discussion between the donor and the archivist. When material is sealed for reasons of privacy,

this restriction must apply to all people who use the collection. That is, it must not apply only to selected individuals or groups of people, and no exceptions should be made to the administration of the restriction.

Certain categories of data are protected by law and may not be seen by researchers under any circumstance. These categories include medical records, personnel records, student records, and attorney–client files. Archivists overseeing such materials must know the law regarding them and must ensure that they are never made available to researchers. Many repositories refrain from even acquiring these kinds of records, because they are so problematic.

For other archival material that falls outside these legal categories, the question of safeguarding privacy can be extremely difficult, especially when there is no directive from a donor or when there is no family member or other person in a position to advise the archivist about potentially sensitive material in a collection. In the absence of guidance from someone knowledgeable about a collection, an archivist who identifies sensitive items is faced with a tough challenge. It can be risky, and potentially improper, for an archivist to take upon himself or herself the responsibility of restricting private or sensitive material. Archivists tend to have a highly developed sense of ethics and therefore often worry about possibly violating the privacy of individuals represented in collections they oversee. However, they tread in dangerous territory when they begin to act on their own to seal manuscripts in order to protect the privacy of the individuals represented in the collections. To do so is a presumptuous act, and archivists who are tempted to take that action must examine their motives to ensure that they are not engaging in censorship. For example, an archivist might discover in a collection a series of recent letters that discuss someone’s sexual preference or reveal an abortion obtained without a husband’s knowledge. Should the archivist take on the responsibility of sealing such material, or should he or she avoid making such a difficult, even subjective judgment?

While the SAA Code of Ethics advises archivists to safeguard the privacy of those whose papers are entrusted to their care, it does not, and can not, provide specific advice about how to proceed in such challenging circumstances. Instead, archivists must navigate on their own the turbulent currents that roil the privacy/openness seas. Most institutions have policies for dealing with sensitive documents, and most of these policies land in the gray area somewhere between the extremes of sealing on a wide scale, on the one hand, and sealing nothing, on the other. One British library hewed to the restrictive end of the continuum, as a matter of policy sealing all letters written by individuals still living. This approach held the seemingly unassailable virtue of consistency, but for most Americans it was too draconian and it kept a vast amount of research material unavailable. At the other end of the continuum, some American repositories seal nothing,

asserting that their archivists are unqualified to make the difficult judgments required in restricting material. This approach also possesses the virtue of consistency, and it can ensure that a repository is unlikely to be held liable for breaching privacy since it seals nothing. Most repositories, however, land somewhere between these two practices, occupying the difficult gray area of restricting under some circumstances.

The difficulty of attempting to safeguard privacy in archival collections has been made even more problematic by virtue of the rise of the Internet and electronic files. The current trend toward digitizing archival documents and posting them on the Internet profoundly increases the potential risk to the privacy of those represented in the documents. Posting a private or confidential document on the Internet where millions of people might read it constitutes a far greater threat to privacy than is the case when a few researchers read that document in a library's reading room. In addition to the documents themselves, the finding aids that describe and catalog the documents in collections can breach privacy to a greater degree when they are posted online. For example, a collection of documents relating to a girls' reformatory can carry a note cautioning researchers in the reading room not to use the girls' names in publications. But, if the online finding aid includes a list of the files, by name, the girls' privacy would be violated. Thus, both for the collections themselves and for the catalog records and finding aids that provide access to those collections, archivists must stop and think about the privacy implications of posting on the Internet. This is not to assert that documents and finding aids in general should not be made available over the Internet, but just a cautionary note to be aware of privacy and confidentiality when determining which materials should be posted online.

TERMS OF USE

Once a research library has acquired a manuscript collection, by either gift or purchase, and when it is opened for research access, the archivist must begin to deal with the third general area of legal and ethical issues—copyright, literary rights, and the publication or other use of the material. For more than 200 years, the United States has had copyright statutes in place, granting authors, artists, composers, and other creators of original works the exclusive right to control, and benefit from, the publication, reproduction, and further use of their creations. Throughout this time, attorneys and other interested parties have struggled to balance creators' rights against the rights of others to quote from or use in part the works created.

The copyright act has changed over the years, and the basic provision of the current law provides copyright protection for the life of the author plus 70 years, although there are further provisions based on the date of creation

and whether a work is anonymous. The statute's provisions are strict and do not allow copying unless the archives owns the copyright. However, there are two special exceptions to the law. First, the doctrine of fair use (Section 107) allows copies of a copyrighted work to be made "for purposes such as criticism, comment, news reporting, teaching (including multiple copies for classroom use), scholarship, or research." Second, in order to assist libraries, archives, and scholars, Congress enacted Section 108, which allows an institution to copy certain works if the purpose is preservation, security, or replacement of the work. The allowance is complicated and holds certain conditions that an institution must meet in order to proceed within the guidelines of Section 108, so archivists would be well advised to consult the copyright law itself, as well as interpretive sources.

The single best source for details about the copyright law provisions and for helpful charts, including a "copyright decision tree," is the Copyright Information Center at Cornell University, and there are many other very useful sources for explanation and interpretation of the copyright law.^[8-10] It can be difficult to identify and locate the current owner of copyright, but a helpful Web site, called "WATCH: Writers, Artists and Their Copyright Holders" has been created and is maintained by the Harry Ransom Center at the University of Texas, Austin, in collaboration with the University of Reading Library. This site maintains a data base of copyright holders that can be searched by author, artist, or other creator name and that provides the name and contact information of the copyright holder.^[11]

Similar to copyright is the right of first publication of an unpublished, original creation. This right is known as the literary rights, and modern collections in particular often arrive in a repository carrying material whose literary rights are held by the creator or by his/her heirs. Donors or sellers of collections seldom are willing to transfer their literary rights to the repository, choosing instead to retain those rights in order to reap whatever profit might accrue to the publication or reproduction of the works. When receiving a new acquisition in which literary rights are at issue, the archivist should always ask about the rights and should inquire whether the donor, creator, or family would be willing to pass the rights to the institution, either immediately or eventually. The gift or sale document should describe fully the disposition of literary rights so the institution is fully informed and will be able to refer researchers to the holder of the rights in order to obtain permission to publish or reproduce.

Even though a library or repository might only occasionally receive either the copyright or literary rights along with the collection material, the institution does hold the physical property rights. When the material is given or sold to the repository, and the gift or sale document has been signed, the physical items themselves become the property of the institution. Thus, there are two forms of ownership of documentary material—the

copyright or literary rights, and the physical property rights—and these separate rights can be held simultaneously by different parties. Moreover, once a work has gone out of copyright, or once the literary rights are no longer an issue, the physical property rights still apply. This allows the owning repository to charge use fees to researchers, film makers, and others who wish to quote from, publish, or reproduce material from the repository's collections.

The question of whether libraries and archives should charge use fees holds some degree of controversy among library and archival professionals. Some feel that researchers and others wishing to use material, especially material in the public domain, should not have to pay any fee at all. Others feel that users should pay for the privilege of publishing or otherwise making use of unique material held in a repository. Among the institutions that charge use or publication fees, most use a graduating scale of fees, charging higher fees for commercial use and lower fees or no fees at all for scholarly or nonprofit use. This issue becomes more complicated with regard to material whose literary rights are held by an individual or estate that takes an active role in administering those rights. Archivists often go ahead with charging use fees when a literary rights holder is involved, but they may decide to defer to the literary rights holder, especially in cases when commercial use involves hefty payments to the literary rights holder.

CONCLUSION

As the foregoing discussion indicates, archivists must face many ethical and legal challenges every day, as they administer the collections entrusted to them. There can be many different types of legal and ethical dilemmas, but many fall within three areas: acquisitions, access to collections, and terms for the use of the collections. In these areas, and in all facets of their work, archivists must not only follow the laws that apply to archival enterprise, but they must also strive to hew to a high level of ethical

behavior. Although doing so will always be challenging since many situations fall within gray areas, archivists have many resources at hand to assist them in making the decisions that face them as they follow the codes and tenets of their profession.

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Ethical Aspects of Library and Information Science

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Abstract

This entry discusses many of the ethical considerations in the library and information science professions: collection development, censorship, privacy, reference services, copyright, administrative concerns, information access, technology-related issues, and problems with conflicting loyalties. It surveys the factors that affect ethical deliberations in the information professions: social utility, survival, social responsibility, and respect for individuality. It also looks at professional factors in ethical deliberations, such as professional codes of ethics, and the values that support ethical principles of professional conduct: truth, tolerance, individual liberty, justice and beauty. In the final section, it indicates the kinds of actions to promote ethical conduct at the organizational, professional and individual levels. As a final caveat, it indicates that ethical decisions require deliberation and reflection. While one can articulate values, factors, codes, and actions, they inform ethical reflection that must often confront and negotiate dilemmas and tensions.

INTRODUCTION

Many of the individuals who occupy our most important professions, such as politicians, lawyers, business executives, and bankers are given low marks for their ethics and honesty.^[1] A cursory glance at daily newspapers reveals religious leaders who have less than moral lifestyles, politicians who lie and benefit from the public purse, and businessmen who manipulate financial markets and unduly influence public policy.

Despite the general sense of ethical decline, the ethical dimensions of our personal and professional behavior are transparent in day-to-day activities. The actions we take everyday are reflexive in terms of ethical conduct; our days are not replete with ethical reflection. Rather, we operate with a subconscious ethical system, whether poorly or well developed, that emerges into consciousness only when a special event or situation makes us doubt or defend our judgments or actions. At these times individuals try to make explicit the values and beliefs that underlie their actions or judgments.

Consider what situations occur in the library and information workplace that create this type of ethical dissonance:

1. When we are about to lie to someone
 - a. Indicating that there is no problem when there is.
 - b. Giving someone a good performance review when he or she has performed poorly.
 - c. Lying about why a person did not get a job.
 - d. Reporting in sick when we are not sick.
 - e. Reporting or recording inaccurate data in business reports.
2. When we believe that we are about to do someone harm
 - a. Permitting a young person open access to Internet sites we feel could be psychologically harmful.
 - b. Disciplining or terminating an employee.
 - c. Violating an individual's privacy or disclosing a confidence.
 - d. Unobtrusive monitoring of a patrons Internet use.
3. When we believe we are about to receive something we did not deserve
 - a. Receiving too much money in our paycheck and not reporting it.
 - b. Receiving credit that someone else should have.
 - c. Misrepresenting the quality of our work.
4. When we deprive someone of information or ideas
 - a. Censoring or restricting library materials.
 - b. Withholding information from a fellow employee to encourage his or her failure.
 - c. Withholding information concerning the inadequacies of an information source or database.
5. When we are asked by someone in authority to act in an unlawful or unethical fashion
 - a. Falsifying or backdating a record to hide unlawful activity.
 - b. Being encouraged to misrepresent oneself to get information from an unknowing source.
 - c. Being asked to deceive others for the "best interests" of the organization.

Most individuals feel ethical qualms in these situations, and there is general agreement that there should be standards of conduct to limit unethical actions on the part of information workers. Buckley, for example, has proposed

that the “Golden Rule” has application in understanding our ethical obligations in reference work.^[2] In addition, ethical constraints apply not only to individuals but to organizations. Institutions, including libraries and other information organizations, are not value-neutral; they act, make choices, affect human beings, and receive, allocate, and disseminate resources in ways analogous to individuals. Many corporations and industries have recognized the importance of organizational and employee ethics, which often manifest themselves in ethical codes. Fleisher and Blenkhorn report that over 95% of all major corporations use ethical codes.^[3]

Some of the issues and values that underlie ethical action in libraries and other information organizations will be discussed below. Of course, such a brief exposition cannot cover all of the ethical issues and concerns involved in library and information service. This discussion is meant to provide a framework to help structure further ethical analysis. In addition, there are several other limitations:

1. First, there are many different types of library and information services. Not only are there different types of libraries (academic, public, school, and special), but the information services could include database searchers, information consultants, and chief information officers. Trying to find a common ethical basis for these many different types of information providers and administrators may not be possible. Although general ethical principles will be advanced in this discussion, specific types of information workers especially those in for-profit enterprises may not find the discussion completely relevant to their type of information work.
2. Second, the discussion presented is based primarily on Western ethical traditions. The ideas suggested or values advanced may not apply in the same way to other cultural traditions. For work on intercultural information ethics, see Capurro.^[4]
3. Third, this essay proposes one view of ethical conduct among information providers. Other views are possible; indeed, alternative perspectives should be encouraged so that diverse ethical dimensions can be exposed and analyzed.

MAJOR AREAS OF CONCERN: AN EXAMINATION OF THE LITERATURE

The library and information professions have recognized the ethical dimension of information work through irregular discussions in professional publications. The focus on ethics in librarianship and information science has become even sharper in the last few years, due to the growth of the Internet, the application of library and information skills to new domains related to the Internet, and the

convergence of information-related disciplines. In 1989, the University of Illinois, Graduate School of Library and Information Science, sponsored a conference on ethics.^[5] Since then, the body of ethical literature in the library profession has increased and the domain of concern has been enlarged to “information ethics” (see Smith^[6] for an overview and Froehlich^[7] for a brief history). The literature includes some writers who have attempted to identify specific factors that produce ethical friction, and who have advanced rules of conduct (e.g., Rubin^[8] and Baker^[9]).

The potential for ethical conflicts in library and information services is considerable. Among the major issues that have appeared in the literature are the following.

Selecting Materials and Censorship

Many selectors confront the unpleasant possibility that the selection of certain materials will cause controversy in the local community. Such controversy could generate considerable anger and negative publicity and jeopardize library budgets and the jobs of librarians. Similarly, the librarian may believe that certain materials actually have a harmful effect on patrons, most notably children. This belief might be supported by other members of the community. Ethical tensions are bound to arise in such circumstances. To what extent is refusal to select items justified because of the possibility of controversy in the community and the expectation that some materials may harm others? These problems are some of the many associated with ethical issues in acquisitions and censorship.^[10–14]

Privacy Issues

Privacy issues have grown in importance and have been of increased concerns to librarians and other information professionals especially since September 11th. As the powers of government have expanded in order to catch terrorists, so has the capacity of government to entrap innocents in the Net. With the passage of the USA Patriot Act, the new crime of “domestic terrorism” was created. The law expanded the power of government to issue wiretaps, obtain search warrants, and gather records that at earlier times were unavailable or required a court to determine probable cause.^[15] Today, such organizations as the American Library Association (ALA) express a need for constant vigilance to protect the rights of patrons to use new and traditional sources of information without unnecessary surveillance. The ALA has supported a variety of activities including supporting amendments to the USA Patriot Act, most notably the freedom to read protection act, to exempt libraries and bookstores from some of the more invasive aspects of the law.^[16] The ALA has also supported a variety of resolutions exhorting the need to protect citizens from undue intrusions on their privacy. These include the “Resolution Reaffirming the Principles of Intellectual Freedom in the Aftermath of Terrorist

Attacks,” and “Resolution on the USA Patriot Act and Related Measures That Infringe on the Rights of Library Users.”^[17,18]

Not only are libraries concerned with monitoring of Internet use or use of other electronic databases, but they are also concerned with more traditional records such as circulation records. Even if the Patriot Act did not exist, circulation records have been at the core of privacy issues in libraries for many years. Requests for such records have come from parents of children, police, prosecutors, courts, and the FBI.^[19] From the perspective of librarians, revealing such information would create a “chilling effect” on borrowers, who, if they believe their reading habits were made public, would subject them to embarrassment. Consequently, patrons would not take out certain books or have online searches conducted on some controversial topics if they felt they could be subjected to public scrutiny or the scrutiny of unsympathetic individuals.^[20] On the other hand, as a public institution, there are those who would argue that such records are public records, and the right of the citizenry to know what is happening in a public institution outweighs the privacy rights of individuals. Similarly, in circumstances in which a crime has been committed and the request for circulation records comes from law enforcement agencies and the courts, librarians also feel a public duty to cooperate with such agencies.

Another typical privacy issue relates to the age of the library user. For example, does a library user under the age of 18 have the right to privacy in terms of materials used, and does that right vary? For example, if a teenager takes a book out of a library, does the parent or guardian have a right to know the titles of those books, especially if there are fines on the material and the parent is responsible for the material? If a teenager has a right to privacy in the use of materials, what about a pre-teen—someone who is six or eight years old? What if the material is secured from a school library? Are there additional legal burdens in that case?^[21]

Privacy issues may also involve the monitoring of library users in regard to copyright violations or unlawful use of digital resources. On many occasions one may observe a patron making multiple copies of copyrighted material, or copying an entire book. Similarly, an individual may be observed accessing material that may be a violation of law, i.e., accessing child pornography. To what extent is the librarian ethically obligated to surveil and report such individuals, or, at the least, to warn the individual that such conduct is unlawful and to desist?^[22]

Reference Services

The fundamental tenet of reference service is to provide the information requested by the patron or client. Given the importance of this service, a variety of ethical questions arise, including the following:

1. To what extent does ability to pay for an information services raise ethical issues? Is it ethical to charge for certain types of reference services (e.g., online services) even if charging tends to discriminate against those who cannot afford the service?^[23,24]
2. Is it ethical to provide different levels of reference service? For example, is it proper to provide library board members or influential politicians quicker, better, and more comprehensive service than regular patrons?
3. Is it ethical to use support staff to answer reference questions that should be answered by degreed librarians?^[25]
4. Is it ethical to provide reduced time in the reference interview to a patron because the librarian is in a hurry to serve other patrons?
5. Is it ethical to limit information if you believe the information may harm the patron?
6. What is the degree to which an information provider should divulge the inadequacies of the information being provided or the information systems providing it?
7. What are the ethical limits for the information provider in obtaining information? For example, to what extent can the information provider deceive others to get information or invade other information systems without permission or without identifying their purpose?
8. To what extent can a librarian provide medical and legal reference services without giving the impression that legal or medical advice is being proffered?^[26–28]
9. To what extent is a reference librarian obligated to report school or college plagiarism or other student’s inappropriate use of the Internet to the appropriate educational authorities?
10. What is the obligation of a reference librarians to violate (interpret very liberally) a digital rights management contract that severely restricts use by librarians or patrons?

For additional issues related to reference services see Bunge,^[29] Katz and Fraley,^[30] and Ulvik and Salvesen.^[31]

Copyright Issues

Information activities generally require the use of print, nonprint, and electronic sources. The copying or transferring of such information is often a necessity. While a primary motivation of publishers and electronic database producers is the profit earned through sale or lease of their product, the motivation of many information providers, most notably librarians, is access to information for the patron at the lowest cost. An ethical tension arises when the information needed is difficult or impossible to obtain

efficiently without violating copyright restrictions. One's ethical feelings regarding obeying the law and respect for the rights of copyright owners conflicts with one's ethical obligation to provide the information. The issue is further complicated in the digital environment because of the concerns of electronic information providers concerned about excessive copyright abuse of their content. This has led to new treaties and laws including the WIPO treaty, the Digital Millennium Copyright Act, and the Teach Act—each attempting to balance the interests of the user or information intermediary (e.g., the librarian or information specialist) with the interest of the copyright owner. In addition, greater restrictions arise regarding electronic information because the providers of the digital information often require that a license be signed before access is provided. Such licenses may contain no "fair use" provision or right of first sale available under copyright law. This may prevent redistribution of useful content.^[22]

Administrative Issues

There are many opportunities for library managers and administrators to encounter ethical situations in the workplace. Oftentimes certain actions seem necessary in the organizational context, which, in other circumstances, might be problematic. Among the areas of ethical tension are the following:

1. Purposely withholding information.
2. Making deceptive statements, providing distorted or false information, or acting deceptively.
3. Violating the privacy of individuals, e.g., monitoring employee e-mails or use of the Internet.
4. Being motivated by personal likes, dislikes, anger, or desire for retribution when making a decision.
5. Being motivated by personal gain when making a decision.
6. Acting in a discriminatory fashion.

For issues related to library administration and personnel see Heim,^[32] Rubin,^[8] Baker,^[9] and Du Mont.^[33]

Issues of Access

Of considerable concern to librarians and other information professionals is free access to information. Is information access a privilege or a basic right? If it is a right, is it a right to all sorts of information (e.g., expensive online services) or to information bearing upon the basic needs of life (e.g., health, housing, governmental issues, etc.)?^[34] Arguments have been put forth for services for which a library could charge by Williams.^[35] Access issues have been aggravated because the costs to acquire, store, catalog, and retrieve materials have escalated, partly because of the rapid growth of information and partly because of the increasing need for and costs of technologies to cope

with this growth. Put another way, the new technological means for information storage and transmission exacerbate the differences of information "haves" and "have-nots" in the world. Is there an ethical obligation to equalize the differences? Also in the electronic environment, questions of monitoring access has arisen. This has become particularly sensitive with the passage of the Child Internet Protection Act which requires some type of Internet filtering in schools and public libraries that receive certain types of federal funds. The monitoring of patron use of materials and services generally raises concern over the "chilling effect" this may cause on the use of materials that may be considered useful but controversial. Hence librarians are placed in the position of enforcing a law which may inhibit individuals from finding the information they want and need.^[36] Other access issues concern access to data collected by various local, state, and federal agencies, such as through the Freedom of Information Act (FOIA). In the post-9/11 era, there have been significant restrictions of governmental information that was traditionally available. For example, information on water resources, electrical grids, or locations of power plants, or other aspects of the U.S. infrastructure may now be unavailable to the citizens who financially support them.^[15]

Cataloging issues may also be seen as issues of access; materials cataloged in various ways can either facilitate or pose a barrier to access. Ethical issues may arise for example when decisions are made regarding whether simplified or more complex cataloging rules are applied or whether to place materials in particular subject areas (where do creationist texts go—in religion or science?).^[37] For ethical issues and suggestions for a code of ethics for catalogers, see Bair.^[38]

Technology-Related Issues

Many of the problems that have been raised existed prior to the extensive use of information technologies, but these issues are magnified or aggravated through their applications in information environments. For example, circulation records collected in a centralized electronic storage computer provides additional vulnerability to invasions of privacy and confidentiality. Similarly, records of Internet searches may be saved electronically revealing the nature of information being sought and consulted by patrons. In addition, there are issues that have arisen because of the technologies themselves. The technologies are of two types: (1) intellectual technologies; and (2) computer technologies. Classification, cataloging, and indexing can be seen as intellectual technologies. As such, they provide a mechanism for providing access to the universe of available information; but at the same time, they may distort that universe, for example, classification schemes reflect the biases of the general population,^[39] and the very act of providing access to information, by applying a limited,

inaccurate, obsolete, or faulty set of descriptors to a particular citation, creates impediments to access.^[40]

There are also ethical issues associated with computer technologies that in part extend the intellectual technologies and that create their own sets of problems. One set of problems is related to electronic access. For example, incompetent searchers, ones insufficiently trained to deal with commands, syntax, and qualifiers of access and/or who is unfamiliar with the differences in databases, not only prevents access to the information for the patron, but also conceals their incompetence from themselves.^[41] Another set of problems concerns the library or information center–vendor relationships,^[42,43] including the use of consultants, fair bidding, licensing, and award practices.^[44]

Conflicting Loyalties

There are many varieties of ethical conflicts that emerge in the context of the information professions. There are conflicts between loyalties to oneself, one's organization, and the profession. For example, very often in information work information professionals demonstrate more loyalty to their organizations than to their professions,^[45] primarily because of economic motivations. This is unfortunate to the degree that such acquiescence to local authority may result in an endorsement of unjust pay scales or the inappropriate use of nonprofessionals. Martha Montague Smith provides a structure for articulating conflicting loyalties in a professional environment, and suggests that there are five possible levels of orientation in the workplace: (1) ideal ethics, which represents the highest aspirations or goals of an individual or group; (2) practical working ethics, which represents high aspirations, yet conformable to institutional, professional, and personal goals, is enduring but is also flexible and adaptable; (3) pressure ethics, which represents a scenario in which internal and/or external pressures split institutional or professional goals from those of workers; (4) subversive ethics, which represents a situation in which a small or large group of people advance what they perceive to be worthy goals for the profession or organization by working outside the system of articulated or tacit organizational goals; and (5) survival ethics, which represents a situation in which institutional demands threaten employee integrity, safety, or security to such an extent that individuals isolate themselves within the organization.^[46] These are various scenarios that information professionals may undertake, given a particular context of institutional life. What this framework underscores is that not only do ethical conflicts arise throughout the history of one's work in an organization, but that one's response to them may vary, depending on factors that affect organization life. While professionals should strive for the level of "practical working ethics," it is often the case that circumstances, such as declining budgets or forays at censorship of library

materials by patrons or groups, predispose professionals to operating at lower levels, such as "survival ethics." And of course, one may well be operating at different orientations with regard to different problems, one may undertake a stance of "practical working ethics" except for forays of censorship against the library, in which one's mode may be that of "subversive ethics."

Societal Issues

It is easy when discussing ethical issues of the information profession to forget that information agencies have a significant impact locally, nationally, and internationally. It is important to consider the ethical ramifications of this impact. Among the issues that foster ethical concern are the following:

1. To what extent does centralization over the control of information create a monopoly over the amount and quality of information being provided, and who receives the information?
2. To what extent do information technologies developed in Western societies, especially English-speaking societies, create a condition of cultural dominance over non-English speaking countries?
3. To what extent does information provided to lesser developed countries adversely affect the stability and health of those societies?

Such is a preliminary look at diverse ethical issues that arise in the information professions. The ALA has endorsed the importance of ethical conduct through the *ALA Code of Ethics*,^[47] a history of which is given in Lindsey and Prentice^[48] and through the ALA Committee on Professional Ethics. Similarly, the American Society for Information Science and Technology (ASIS&T) has issued the *ASIS&T Professional Guidelines*.^[49] But they are not without their problems (see, e.g., Barnes^[50]) so much so that they are frequently challenged for revision (see, e.g., Finks^[51]).

It is impossible in this brief entry to list all the resources available on ethical issues. For a fairly comprehensive bibliography, one can consolidate those provided by Hauptman et al.^[52] listed in the "General Introductions and Bibliographies" section of the Bibliography at the end of this entry. In addition to the articles cited here, resources are also provided in the sections: "Journals and Web Sites" and "Bibliography on Specific Topics."

FACTORS AFFECTING ETHICAL DELIBERATIONS IN THE INFORMATION PROFESSIONS

Libraries and other information organizations are subject to competing demands from a variety of sources, including the

public, clients, board members, administrators, and staff. Attempts to satisfy these demands often produce ethical tensions. Some authors have attempted to identify the ethical influences on librarians. McMenemy, Poulter, and Burton, for example, identified five influences: the employers ethical code; the professional association's ethical code, pressure from the customer to provide service, personal ethical beliefs, and society's ethical norms (p. 11).^[37] We would contend that when decisions are made, there are at least four factors that affect the deliberative process. These factors may not be consciously considered by the individuals making the decision, but are at least conceptually implicit and underlie the decision-making process. Such factors are not in and of themselves ethical principles; they are frequently considerations that come into play when ethical deliberations are attempted. Attempting to balance them often produces ethical frictions. It is therefore important to understand clearly the nature of these factors.

The Factor of Social Utility

All organizations have a purpose or a function. One might say, for example, that a public library's purpose is to meet the educational, cultural, informational, or recreational needs of its patrons or clients through the provision of materials and services. Insofar as the library performs such a socially valued service, it has a right to act in a way that would maintain and promote such activity.

Information organizations acting in this manner may make decisions that produce ethical qualms. For example, an organization may have to terminate an employee who is performing poorly because such performance interferes with the proper function of the organization. The employee may be a likeable individual whose performance may be the result of illness or personal problems, yet the decision to take action may be rationally based on the responsibility of the organization to execute its proper functions. Furthermore, the *Library Bill of Rights* of the ALA affirms the "Books and other library resources should be provided for the interest, information, and enlightenment of all people of the community the library serves" (p. 14).^[53] Such an assertion articulates a concern for the factor of social utility.

The Factor of Survival

One obvious purpose of organizations is to survive. This principle has been recognized in management theory for many years and is a simple recognition that organizations view their perpetuation as a central function. It is also grounded in philosophical traditions in which self-interest is recognized as a fundamental component of moral reasoning [^[54], Book III, Prop. 55; 55, Chap. XIV].

It is easy to envision an ethical issue in which survival is threatened. For example, if there is considerable public

outcry concerning certain "objectionable" materials in a library, the librarian may have to choose between removing library materials or facing a taxpayer's revolt. One is therefore tempted to censor library materials to ensure the physical survival of the library. This also highlights how the wish to preserve the library as a financially viable institution can come into conflict with a significant goal of the library—freedom of access to a diverse collection of materials. Ethical dissonance is bound to arise when one hopes to preserve the existence of the library by sacrificing in part its social utility (e.g., by reducing the number of hours a library is open so the library can continue to exist despite a constrained budget).

Factor of Social Responsibility

Another consideration involves the broader purpose that institutions—especially public ones—have. That is a purpose to serve the society at large and to promote the altruistic goals of that society. To this end, organizations might purchase and use recyclable materials whenever possible, promote "green libraries" that promote sustainable development in their own actions, in their patrons, or in the community,^[56,57] prohibit smoking on their premises, or employ only hiring and promotion policies that encourage equal employment opportunity and affirmative action. Of course, determining what "greater good" to satisfy is problematic, and would depend on the institutional values of the organization, the attitudes of those who direct an organization, and the political, economic, and environmental conditions in which the information organization is embedded. One may, for example, believe that the use of recyclable materials increases costs and hence negatively affects the survival and social utility of the organization. One may feel uneasy about affirmative action programs to the extent that they treat people as members of classes rather than as individuals. Nonetheless, when ethical deliberations are being made, organizations, especially those that provide a social service such as libraries, may take into account the need to accomplish and comport with broader social goals. This factor conforms to the second statement of the *Library Bill of Rights*: "Libraries should provide materials and information presenting all points of view on current and historical issues. Materials should not be proscribed or removed because of partisan or doctrinal disapproval." (p. 14).^[53] There is a tension between this statement and factor and the corresponding statement acknowledging the factor of social utility—one patron's meat is another patron's poison—but the library must provide a complete selection of coldcuts; that is, in providing information representing all points of view, the library may be acquiring material useful to one patron but offensive to others (e.g., *The Joy of Gay Sex*). The problem is that if some patrons obsess about "the poison," the survival of the library may also be at stake.

The Factor of Respect for Individuality

This factor recognizes that all individuals deserve to be treated with dignity and respect because they are people. It is a concept embedded in ethical traditions, most notably through the works of the eighteenth century German transcendental philosopher, Immanuel Kant, whose moral imperative required that we “Act in such a way that you treat humanity, whether in your own person or in the person of another, always at the same time as an end and never simply as a means.”^[58]

Respect for the individual has many implications for information functions. In terms of patrons or clients, it implies an obligation of the organization to collect materials and provide services that reflect diverse individual interests, wants, and needs, not just mass appeal. For public libraries in particular, this obligation has been noted by several writers as fundamental to the library’s collection-building function.^[59,60] This factor also implies that the organization provide service to people as individuals and not merely as members of a particular class, age group, race, sex, or ethnic background. In terms of employees, this factor implies that the library must treat its employees fairly, with respect and dignity. The organization must be responsive to individual employees’ feelings, wants, and needs. In addition, it implies that employees should treat each other in the same fashion and that administrators are also entitled to their *individual* opinions on issues, despite the position they may have to take in their managerial roles.

Such a factor may, however, generate ethical concerns. For example, in serving individual needs, should a public library sacrifice “mass appeal”? After all, appealing to the average consumer has the salutary effect of promoting taxpayer support (i.e., of increasing circulation), and reducing the likelihood of complaining patrons who are unhappy when materials representing unorthodox points of view are included in the collection. Ethical qualms might also be generated in terms of staff treatment; for example, when we fail to uniformly apply personnel policies by making exceptions for “individual circumstances.” We might be threatening the survival of the organization by subjecting it to potential legal liabilities and labor unrest. Finally, ethical qualms can be generated when we feel that we are not treating ourselves with respect. For example, we may be asked by others (employers, clients, competitors) to do something we believe is unethical. Acting in this manner diminishes us.

In attempting to make ethical judgments, these factors are constantly present. As ethical concerns arise, one might phrase concern for these factors in four questions:

1. To what extent is the survival of the organization threatened?
2. To what extent will the purpose of the organization be benefited or harmed?

3. To what extent is the organization or employee socially responsible or irresponsible when acting in a particular manner?
4. To what extent are the actions of the organization (or individuals acting in its behalf) harming or benefiting other individuals, organizations, or the profession?

The relative importance of these four factors depends on the specific situation and the seriousness of the effects. How should we make ethical judgments when so many competing factors are in operation? Before offering one possible answer it is necessary to examine a second ethical perspective, the professional dimension of ethical behavior.

PROFESSIONAL FACTORS IN ETHICAL DELIBERATIONS

The professional aspects of ethical behavior deal with the obligations and duties of information professionals while serving in the capacity of information providers. The Association for Library and Information Science Education (ALISE) has noted that ethical education “should be encouraged as an important aspect of education, research, scholarship, service, and practice in library and information studies and in other related profession.” ALISE encourages “special attention to information ethics. . .”^[61] As noted previously, most of our work decisions are made and actions taken with little or no ethical reflection. In this sense, we rely on our basic ethical training acquired in childhood and on our formal training regarding information work. This latter point is important, because it suggests that if our actions are often performed by habit rather than deliberation, then to the extent that information professionals are socialized into the ethics of the discipline, the greater the chance that these ethical standards become part of our basic ethical framework and will be consummated in day-to-day work life. It also places in relief the recognition that ethical training cannot be limited to “professionals.” Indeed, calling codes of conduct professional ethics diminishes their scope and underestimates the ethical responsibilities of all library workers. Nor should the concept of professional ethics imply that these ethics are different than those we use in everyday life, or that they should take precedence over those of everyday life. Professional ethics should be viewed as ordinary ethical standards applied in a particular environment.

The ALA has attempted through its code of ethics to provide ethical guidance, and it serves as a touchstone for the ethical socialization of librarians. This code states the following:

- (i) We provide the highest level of service to all library users through appropriate and usefully organized resources; equitable service policies; equitable access; and accurate, unbiased, and courteous responses to all requests.

- (ii) We uphold the principles of intellectual freedom and resist all efforts to censor library resources.
- (iii) We protect each library user's right to privacy and confidentiality with respect to information sought or received and resources consulted, borrowed, acquired, or transmitted.
- (iv) We respect intellectual property rights and advocate balance between the interests of information users and rights holders.
- (v) We treat coworkers and other colleagues with respect, fairness, and good faith, and advocate conditions of employment that safeguard the rights and welfare of all employees of our institutions.
- (vi) We do not advance private interests at the expense of library users, colleagues, or our employing institutions.
- (vii) We distinguish between our personal convictions and professional duties and do not allow our personal beliefs to interfere with fair representation of the aims of our institutions or the provision of access to their information resources.
- (viii) We strive for excellence in the profession by maintaining and enhancing our own knowledge and skills, by encouraging the professional development of coworkers, and by fostering the aspirations of potential members of the profession.^[47]

Adopted June 28, 1997, by the ALA Council; Amended January 22, 2008.

Published professional codes serve useful purposes. They provide support and guidance when ethical concerns arise and serve as a tool for the inculcation of values in library employees that are ideally assimilated into daily behavior. But articulation of such a code is frequently misleading; one must understand the values inherent in it. This points up the central defect of such a code. The "thinking" behind the code is obscure, because only a very few were present at the deliberations that created it or because the formalized, collective product reflects a compromise among divergent viewpoints. Understanding the thinking behind code is critical in understanding its meaning. But the thinking behind ethical codes is often dialectical and didactic, representing an articulation of perspectives, competing views, and the tensions among them. When one fails to recognize this evolution or rationale for codes, the codes are seen as finished and foster dogmatic beliefs. One merely invokes a provision of a code instead of offering cogent reasons that would justify the conduct prescribed by the code.

Ordinary ethical principles provide the framework for, and are not inconsistent with, the professional values of the information profession. Within that ordinary ethical framework, the information professional includes the values inherent in the information profession. Such values should personally guide the information professional when acting in this capacity. It is therefore ironic that the

ALA code specifically mandates that individuals separate their personal philosophy and attitude from those of their institutions or professional bodies (provision VII). What is actually desirable is that the individuals come to realize that there are important values of library and information service that should be a part of our own values when we serve in the capacity of information provider. This does not mean that individuals must give up other values to subscribe to those of the profession; rather, it is a recognition that the values of library and information service are worthy of admission to our individual value structure when we become information professionals. This sense of professional ethics becomes most important when individuals experience internal value conflicts while serving as information professionals, for example, when an individual who opposes abortion is asked to provide information on the topic. Although one may be personally opposed to abortion, one can also personally subscribe to the professional responsibility to be objective and to provide different points of view.

THE VALUES OF INFORMATION PROFESSIONS

It is fruitful to explore what values support the ethical principles of individual professional conduct. Understanding these values improves our ability to recognize ethical situations and to make ethical decisions and balance the competing organizational factors.

There are at least five values of the information professions that can serve as values of the individual as well as the organization (for a discussion of different values that are associated with the profession see Finks^[62]). These values can be characterized in the following manner.

The Value of Truth

Information professionals have as one of their important ends the advancement of truth and the search for knowledge. Certainly promoting truth fulfills a fundamental mission of the library (social utility) and meets a broader social end of improving the society as a whole (social responsibility).

The commitment to truth does not imply that information professionals, most notably library workers, should attempt to suppress materials they believe are untrue (or to promote materials they believe to be true, for that matter). To the contrary, as John Swan has aptly noted, untruths are essential to stimulate our thinking and reveal pathways in the search for truth (p. 49).^[60] The search for truth requires that the library provide an array of knowledge and information and access to expertise, so that individuals can apply their efforts in this search. Information professionals must act so that patrons and clients have the greatest opportunity to search for knowledge and truth.

This concept of truth as a value also pertains to the internal activities of the organization. Relations among

employees and administrators and between workers must have truthfulness as a value. Such actions as deception, withholding of information that is essential to the performance of others, and falsification of records abrogate this value. This does not mean that administrators or managers are ethically obligated to answer any question put to them. There may be occasions in which the appropriate response is to refuse to answer. Examples include answers that would violate confidentiality. Rather, the value of truth implies that when answers are given they are truthful. Information professionals must act so that employees treat each other truthfully in their actions and communications.

The Value of Tolerance

The value of tolerance is closely aligned with that of truth and its search. Many people seem to hold the belief that there is one truth, but libraries function on the assumption that many people believe many truths. A belief in the value of the pursuit of truth does not imply that “the Truth” is in fact achievable in all areas of life (science, ethics, religion, politics). One must tolerate diverse truths, and even if there were one truth, different people may use different avenues to attain it or to attain different aspects of it at a time.

It has been said many times in the writings of the library profession that the free exchange of ideas forms the basis of democracy and library services. A similar case can be made for most forms of information dissemination within and outside libraries. It is an ethical obligation of information professionals to promote exposure to different ideas, even those that are unorthodox. Decisions concerning library and information service that affect the free flow of such ideas ipso facto generate ethical concern. This does not require that information professional accept or be tolerant in all aspects of their life. One may, for example, not subscribe to the value of tolerance within the home. It requires only that one’s set of values reflects tolerance of ideas in the information workplace; that is, when one is performing library or information work, one must accept as a value that people have a right to information that one might find offensive. Parenthetically, the value of tolerance may not be as strongly held within the workplace. An employee, for example, whose remarks to other staff consistently cause demoralization and lower productivity might be disciplined or removed. But from the perspective of information service, it is essential that library professionals act so that library and information services increase the flow of ideas.

The Value of Individual Liberty

Library and information service is meant to assist individuals in their individual pursuit to have a better life. This does not mean that each time an information worker answers a question it profoundly alters a patron’s life, but

it does imply that every time questions are answered correctly the patron is able to accomplish a task, resolve a problem, or plan their future just a little better. In this way, the profession assumes that not only individuals, but organizations and society as a whole are changed, and, in the long run, improved by ideas. Improvement may mean many different things: providing information to a scientist to discover a new drug; stimulating the imagination of a child by providing reading or viewing material; providing training information to adults; or providing programming for mothers or the elderly. Actions that would impair this important function interfere with the basic liberties of people to make their lives better and generate ethical friction. Information professionals should therefore act so that library and information services respond to the information wants and needs of users.

The Value of Justice

This value pertains both to information users and to fellow information professionals within a given organization. From the public perspective, it implies that all citizens have equal access to library services. But even in nonpublic settings, it implies that all individuals should receive the best quality service. Similarly, for both private and public information organizations, it implies that the delivery of inferior information service on the basis of race, sex, religion, origin, disability, sexual orientation, or age is a violation of such a value.

But the concept of justice is complex, and a distinction noted by the philosopher John Rawls is especially appropriate in the information context. Rawls realized that justice cannot be understood merely as equality, but as “fairness” (p. 168–169).^[63] One may, for example, accept as just the fact that the library director and maintenance worker are paid unequally. This is an important distinction because it implies that ethical action requires fair rather than equal service or treatment. Unequal service might, in fact, be an ethical obligation if the needs of individuals differ. This recognizes, for example, that children may receive unequal service because their needs are different from those of adults, or that less knowledgeable adults may require different levels of service. The value of justice implies that we do not necessarily provide equal service, but that we provide service that recognizes individual circumstances. This does not imply that equality is absent in the concept of justice or library ethics. Equality of *access* to information services is certainly inherent in the concept of public library and information service, and fairness in access is inherent in any information service. The information professional must act so that library services are provided fairly to all users.

The value of justice also applies to the internal workings of library and information services. Employees should be treated fairly and consistently by managers and administrators, and equal access to opportunities within

information organizations must be provided. In addition, this value implies that employees should treat each other fairly. To this end, the library professional must act so that employees are treated and treat each other fairly.

The Value of Beauty

The value of beauty suggests that librarians have a deep and abiding respect for those works that please and educate. This includes works that occupy a notable position in literature and the arts. Such works are valued because they broaden and deepen human understanding. It also includes works that provide pleasure and recreation to all individuals. Such a value implies that librarians make such collections available. Similarly, it is common that such collections come under attack by censors who feel that even classics (e.g., *Huckleberry Finn*), should be restricted or removed. Librarians must act so that works that provide aesthetic experiences be maintained, preserved, and available to users. Such a consideration may also imply an obligation that materials of high literary quality not be sacrificed with excessive attention to mass appeal (e.g., excessive quantities of gothic romances).

ACTIONS THAT PROMOTE ETHICAL CONDUCT

If one assumes that these values play an important role in ethical actions for information professionals, then it is important to determine what actions information organizations and librarians can take to promote ethical actions. These actions can be seen from three perspectives: organizational, individual, and professional.

Organizational Actions

When attempting to balance the factors that generate ethical tensions in organizations, the values of library and information service are pivotal concerns. For example, when library staff, supervisors, administrators, or board members make decisions or take actions that could affect the organization's utility or survival, one must also reflect on the central values that make the library what it is. To the extent that one sacrifices these values to other ends, one must accept the diminution of ethical standards. Few complex decisions in the workplace produce wholly satisfactory resolutions, even when the decision maker believes that no better decision could be reached. There is often a residue of uneasiness, sometimes because one suspects that an ethical dimension has been abandoned for the sake of utility or self-interest. It is every information professional's responsibility to maintain an ethical environment, but this is also a special responsibility of the management because of the increased ethical burden. Below are a variety of actions that the leadership of information organizations might take to meet this burden:

1. *Have a board and administration committed to leading by example.* Each individual is responsible for his or her own ethical actions. But these actions are also, in part, modeled by the behavior of those in authority. Rules and regulations are important and influence employee actions, but the ethical environment is a culture that is shaped as much or more by example than by rule. For this reason, the actions of board members, administrators, and supervisors must be ethically exemplary.
2. *Establish a written ethics policy.* The library's commitment to ethical behavior should be formally stated along with the rationale for that behavior. A professional code may be part of this commitment, but it is not in and of itself sufficient. The policy should include a clear statement on the part of the board and administration regarding their commitment to ethical conduct in relation to the patrons, the profession, and the organization. For example, it should be an ethical responsibility of staff
 - a. To promote a sense of confidence about the organization and its purpose with the public or appropriate clientele.
 - b. To make the organization as effective and efficient as possible both internally and with its relations with the public or clientele.
 - c. To strive for personal and professional growth.
 Such a written policy should also include what will happen to employees who violate these ethical obligations, and how such violations can be reported. Although it is hoped that employees, once they understand the rationale for ethical behavior, will comport with that behavior, the organization should have some means to sanction those who violate ethical conduct. Otherwise, some employees may interpret the organization's position as "lip service." However, unusually severe punishments, especially for first infractions, are undesirable, because it would tend to inhibit reporting of such infractions if observed by others (p. 76).^[57] Penalties for ethical violations should be progressive, with early violations being dealt with through discussion. Whenever violations occur, action should be taken swiftly, and continued violations should be dealt with harshly.
3. *Conduct orientations that include discussions of ethics.* When new employees are hired, it is important not only to provide them with general information concerning the mechanics of the organization, but also to begin the process of socialization, inculcating the values of public service. In such a discussion, the new employee should receive a clear understanding of what constitutes ethical and unethical conduct. Emphasis should be placed on the important role that the organization plays and the organization's commitment to the values noted above.

4. *Conduct staff development and training programs.* It is not enough to mention ethical concerns at the time of hire. Employees must experience ongoing reinforcement. This will increase the chance that ethical actions will become habitual. Emphasis should not be placed on the rules themselves, but on the values and deliberations that underlie such rules. It should be assumed that individuals want to behave ethically, especially when they understand how important such conduct is, and how destructive unethical conduct can be in terms of loss of trust and confidence of the public or of other staff. Programs and meetings on ethical issues should therefore be a regular part of staff development and training for all staff and might include case studies in which staff actually go through ethical deliberations that reveal the conflicting tensions within information organizations.
5. *Hire and promote individuals with ethical awareness.* There are many aspects that must be considered when hiring and promoting individuals. One area to explore is how they deal with job-related ethical issues. It should be kept in mind that organizational environments are very powerful. A newly hired employee may possess considerable scruples, but if the prevailing ethics of the organization tolerates unethical conduct, then new hires, in order to fit in, may well adapt rather than attempt to change the environment.

Professional Actions

Ethical conduct should also be promoted by the information profession itself to ensure that the standards of conduct are consistent with the highest levels of professional service.

1. *Create a code of conduct.* A professional association can be seen as the voice of a profession. The most obvious channel used by a profession is to establish a written code of ethics and create sanctions for those who violate it. These sanctions, found in such professions as law and medicine, include temporary or permanent suspension of a professional's ability to practice. Codes, however, may not have sanctions and it may be undesirable for all professions to have them. The ALA has no sanctions for its code of ethics, nor does ASIS&T for its professional guidelines, and hence, comportment with these codes is strictly voluntary. Although sanctions can promote certain types of behavior, they may do so for the wrong reason—fear of punishment. The purpose of an ethical code is first and foremost to promote ethical understanding. Focusing on penalties diverts attention from understanding the values that should determine our conduct.
2. *Offer training and advice in ethical conduct.* Professional associations are also obligated to reinforce their

codes of conduct by providing programming and information on ethical issues. Associations such as the ALA and ASIS&T provide such programs, usually at their conference sites. In addition, the ALA has divisions that deal with ethical concerns, including the Committee on Ethics, which considers ethical issues and infrequently provides materials that promote discussion of ethical concerns (e.g., the *Ethics Sin List*^[65] and the Intellectual Freedom Committee which deals with ethical issues when they coincide with intellectual freedom issues). It is notable, however, that the Committee on Ethics does not operate like the Intellectual Freedom Committee in that it does not promulgate official interpretations of the code of ethics or intervene in ethical matters outside the association. Similarly, the Professional Committee of ASIS&T issued the ASIS&T Professional Guidelines, but does not promulgate its interpretations or intervene in ethical matters outside the association.

Individual Actions

Ethical actions are associated most often with the conduct of individuals, and there is a clear obligation for information professionals to act ethically in regard to the provision of library and information services.

Information professionals are obligated to act ethically on at least three different levels: they have a responsibility to their profession, to their employer—clients—system users, and to the society as a whole. The ASIS&T Professional Guidelines has set forth the following provisions (abridged):

1. *Responsibilities to employers/clients/system users*
To act faithfully for their employers or clients in professional matters;
To uphold each user's, provider's, or employer's right to privacy and confidentiality and to respect whatever proprietary rights belong to them by limiting access to, providing proper security for and ensuring proper disposal of data about clients, patrons, or users;
To treat all persons fairly.
2. *Responsibility to the profession*
To truthfully represent themselves and the information systems which they utilize or which they represent. . .
3. *Responsibility to society*
To improve the information systems which they work or which they represent to the best of their means and abilities. . .
To promote open and equal access to information, within the scope permitted by their organization, and to resist procedures that promote unlawful

discriminatory practices in access to and provision of information. . . .^[49], adopted May 30, 1992].

These principles can easily be applied to librarians as well as information scientists and other kinds of information professionals.

ETHICAL DILEMMAS

Even with these responsibilities clearly delineated, there are times when the values of information provision appear to conflict with other personal or social or cultural values. This conflict is most conspicuous when the values of information professionals appear to conflict with commonly accepted notions of moral or right conduct. A common example, involving a public library, highlights this type of situation:

An adolescent child comes to the librarian in a public library and asks for a book on how to commit suicide. The child looks very depressed and upset. The librarian is aware of a book that would provide substantial amount of accurate and up-to-date information on committing suicide. The librarian is also aware that the material would really be understandable to the patron. What should the librarian do?

Admittedly, this situation is contrived and its occurrence would be very rare. Nonetheless, it places into relief a situation in which the information provider's general concept of right conduct (the belief that one should not intentionally harm another person) seems to conflict with one's obligation to respect individuals and their right to information. Of course, implicit in this situation is the belief that the individual will in fact commit suicide. If this was actually known, then providing the information could hardly be defended by invoking provisions of the ALA code of ethics or any other professional code. Nor could one sensibly say that one is obligated to find this information for the patron because of a person's "right to information." Such a rationalization is contrary to our everyday ethical notions of right conduct.

But the situation described above is extraordinary and presupposes knowledge seldom, if ever, available to the information professional. In almost every case, the knowledge of the librarian regarding the patron is imperfect and very limited. This is due to the fact that most patron contacts are very brief. Librarians seldom have substantial information about the personal lives of their patrons or their psychological condition, nor are they qualified to evaluate this information. Consequently, the librarian has little or no ability to predict what a patron will do with the information and the consequences of the patron's actions. In the vast portion of circumstances, acting consistently with the values of the information profession does not require that one give up one's ordinary concept of moral

action; rather it is to accept the ethical obligation to recognize the individual's right to information. Such an obligation could only be violated with clear knowledge that significant harm to others will result. It is also to recognize that the information provider's predictive ability regarding the consequences of the information provided is minimal at best. The duty of the librarian is to accept the right of individuals to receive information and to use that information. Although librarians may be concerned as to how certain information may be used, without sure knowledge of such misuse and the substantial harmful consequences of the use, it becomes too easy for the information professional to project those consequences inaccurately, with harmful ethical consequences of their own.

The dilemma posed by the suicide example brings out another point about the purpose of information giving. One can view information provision simply as an obligation to answer a specific question, but this is an inappropriate and impoverished model for the information professional. The purpose of information giving should be seen in the broader context of resolving an information need of problem. This is consistent with the notion that the purpose of information giving is to assist the patrons in living their lives in the manner they see fit. It is the "problem context" or "problem environment" of the patron^[66] that is the focus of the information provider. In this context, information providers need to know the context in which information is requested. If, in the unlikely ethical situation posed, a librarian actually had a strong suspicion that a patron was going to use the information to commit suicide, the information provider would in fact be obligated to locate additional information (perhaps the name and telephone numbers of suicide counseling agencies or community mental health agencies) that might resolve the problem in a manner that would promote the health of the individual. In other words, the information question involved how to commit suicide, the information problem was actually unstated: "How can I deal with a life so difficult that I wish to end it?"

There is no simple way to resolve the myriad of ethical problems that confront information professionals, but the fact that ethical issues are complex does not relieve us of the burden to act ethically.^[67] On the contrary, the absence of ethical concerns would make the information profession very dangerous. As the information professions mature, expand, and grow in importance, information professionals need to redouble their efforts to define their ethical responsibilities and find the means to ensure that all professionals are aware of and accept their ethical obligations.

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Ethical Issues in Information Systems

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Abstract

Information technology and information systems built around its artifacts can have powerful effects on individuals, both in their private life and in the workplace. As professionals and users, we should use ethical principles and codes of ethics to avoid and prevent deleterious effects of technology. Infoethics is the application of ethical theories to the development and use of information systems. The principal infoethical issues are privacy, accuracy, property (in particular, intellectual property), and access. These issues have come into a sharp focus as we spend ever more of our time online and as our actions are mediated by systems available over the Internet. Ethical decisions in the information-related domains are made by identifying the issues involved and applying ethical theories—classified as consequentialist and deontological—in the decision-making process.

INTRODUCTION

Information technology (IT) offers potent tools that can serve to fulfill an individual's life, to further organizational goals, pursue national and international interest, or support environmentally sustainable regional development. The same technology can also be used to infringe on property in a digital form, invade individuals' private sphere, and to hold them in fear of omnipresent surveillance. The way the technology is deployed depends on our decisions as professionals and as users of information systems. It also depends on the policies enacted by the government and business organizations, and on legislation. All of us, therefore, should make the relevant decisions guided not only by the economic, organizational, and technological aspects of information systems, but also in consideration of their effects on individuals. Our knowledge of ethics helps us in making such decisions. Furthermore, this knowledge can inform the evolution of the relevant public and organizational policies. What we may call infoethics is the application of ethical thinking to the development and use of information systems.

Ethics and Codes of Ethics

Ethics is a study of the principles of right and wrong that ought to guide human conduct. Ethics concerns itself with what values are worth pursuing in life and what acts are right. Therefore, ethics is a study of morality.

Human behavior and decision-making fall into three domains, as shown in Fig. 1. The legal domain governs a variety of relatively well-defined behaviors, specified by law enforceable in the courts of a given country or within a local jurisdiction. International bodies increasingly address legal issues that cross national borders. Computer crime and abuse, such as the destructive deployment of

malware (e.g., computer viruses or worms) or misrepresentation of electronic identity toward financial gain, are the breaches of law and fall into this domain.

However, not every legal action is ethical. The domain of ethics is governed by the general norms of behavior and by specific codes of ethics. To see whether your decision-making in a given case involves an ethical issue, you may apply the "sunshine test": "What if I read about my decisions and subsequent actions in tomorrow's paper?" Ethical considerations go beyond legal liability, and the breach of norms not punishable by law meets with social opprobrium. Only if the action is both legal and ethical, does it fall in the discretionary domain, where we properly act entirely according to our preferences.

Knowledge of ethics as it applies to the issues arising from the development and use of information systems, which we may call infoethics, helps us to make decisions in our professional life. Professional knowledge is generally assumed to confer a special responsibility in its domain. This is why the professions have evolved codes of ethics, that is, sets of principles intended to guide the conduct of the members of the profession. The principal code of ethics for information systems professionals is the Association for Computing Machinery (ACM) Code of Ethics and Professional Conduct, binding on the members of the ACM.^[2] The code should be familiar also to all whose professional life is affected by information systems. We have reproduced the fundamental statements of the ACM Code in Fig. 2. In addition, corporations and other employers should establish their own codes of infoethics. Such corporate codes have been shown to influence the behavior of people who would otherwise not think that an important ethical issue was involved in their decision-making.^[3,4]

To select a course of action in an ethical dilemma, we turn to ethical theories.

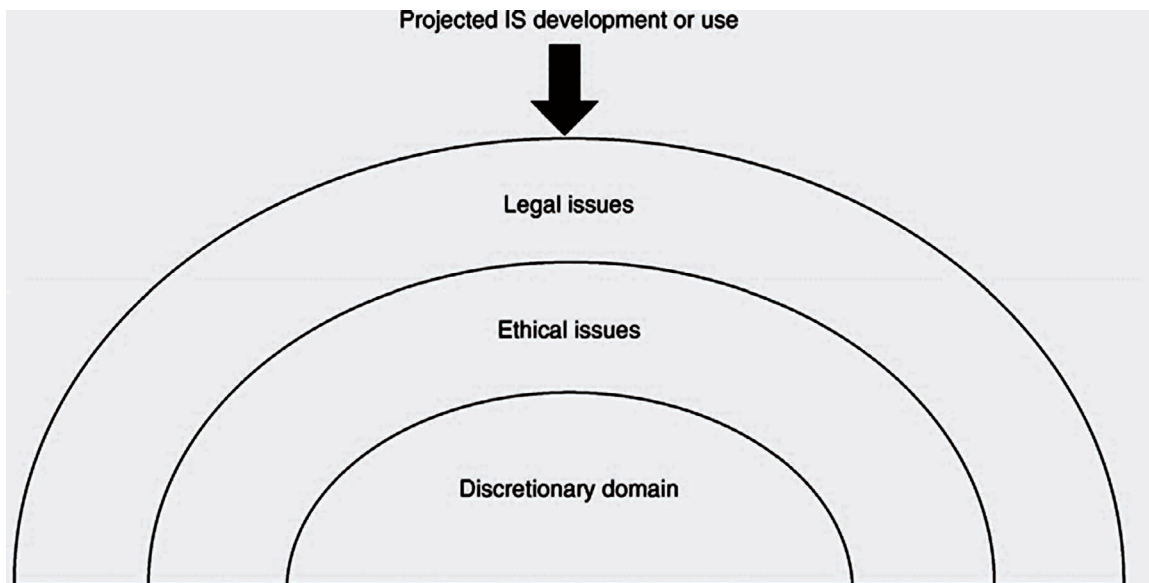


Fig. 1 Domains of pursuit in problem-solving or opportunity-seeking with information systems.

Source: From Zwass.^[1]

Ethical Theories

Ethical theories give us the foundation for ethical decision-making. Some of them are grounded in an individual's pursuit of virtue, such as justice or generosity. While important in the development of the moral sense of individuals, these lend themselves, only to a limited degree, to a reasoned decision-making process. There are two fundamental effective approaches to ethical reasoning:

- Consequentialist theories tell us to choose the action with the best possible consequences. Thus, the utilitarian theory that prominently represents this approach holds that our chosen action should produce the greatest overall good for the greatest number of people affected by our decision. The difficulties lie in predicting the consequences of an action, and in deciding what the "good" is and how to measure and compare the resulting "goods." The approach may also lead to sacrificing the rights of a minority. A social contract

among the members of social groups implies the need to consider the lot of all these members. There are certain acts that are wrong in themselves and should be always avoided. These unethical acts interfere with the rights of others, the rights that may be derived from the other principal group of ethical theories.

- Deontological theories argue that it is our duty to do what is right. Your actions should be such that they could serve as a model of behavior for others—and, in particular, you should act as you would want others to act toward you. Our fundamental duty is to treat others with respect—and thus not to treat them *solely* as a means to our own purposes. These theories have been assailed by the claims that varieties of cultures exist, with differing norms and models of behavior.

Treating others with respect means not violating their rights. It is, therefore, vital that we recognize the rights of each human individual. The principal individual rights, enshrined

1. Contribute to society and human well-being.
2. Avoid harm to others.
3. Be honest and trustworthy.
4. Be fair and take action not to discriminate.
5. Honor property rights including copyrights and patents.
6. Give proper credit for intellectual property.
7. Respect privacy of others.
8. Honor confidentiality.

Fig. 2 General moral imperatives of the ACM Code of Ethics and Professional Conduct.

Source: From ACM Code of Ethics and Professional Conduct.^[2]

in the United Nations' Universal Declaration of Human Rights and recognized in liberal democratic societies, are

1. The right to life and safety
2. The right of free consent—individuals should be treated as they freely consent to be treated
3. The right to private property
4. The right to privacy
5. The right of free speech, extending to the right to criticize truthfully the ethics or legality of the actions of others
6. The right to fair treatment—individuals who are similar in regard relevant to a given decision should be treated similarly
7. The right to due process—individuals have a right to an impartial hearing when they believe their rights are being violated.

Recent work by ethicists attempts to make ethical theories more effective in practice. An ethical theory that supports a process of deliberation between the future system users and its developers is discourse ethics, grounded in the theory of communicative action of Jürgen Habermas.^[5] The emerging empirical moral psychology attempts to relate the actual human behavior in ethically challenging situations to the precepts of ethical theories.^[6] Thus, we learn empirically about the implicit or explicit use of ethical theories by information-systems professionals in their decision-making processes.^[7] This helps us inculcate values and ethical decision-making modes. The application of ethical theories is best illustrated by considering practical cases, which we will now proceed to do.

SCENARIOS IN THE ETHICAL DOMAIN

Consider the following three scenarios, adapted from Parker.^[8] We will come back to these scenarios after we discuss the tenets of infoethics.

Transactional Information on Smart Cards

The manager of the smart-card division of a financial institution has developed a new debit card as a smart card, containing a microprocessor chip with memory. Unbeknownst to its holder, not only the amount spent was debited, but also detailed data about every purchase transaction were stored on the card. As a result, any merchant presented with the card could evaluate the credit history of the cardholder. The financial institution was also planning to allow the merchants to upload the data from the smart cards to their own servers. This would enable the retailers to use personal information about their customers for promotional purposes.

Consider these questions: Do you believe that there are any ethical issues involved? If so, what ethical principles were breached?

Who Owns E-mail?

A firm had a policy allowing employees, upon approval, to use their personal devices, such as PCs, laptops, tablets, and smartphones, which were the property of the company, for personal purposes, including e-mail and web access. When a possible acquisition of the company by another one was announced, a rising employee unrest was suspected. The president of the company ordered the security department to use specialized software to monitor all the online activities of the employees, including the contents of their memos, e-mail messages, budgets in preparation, and so forth. Reports produced by the security department detailed what the employees produced both during their work and during private use of their devices. The monitoring and reporting was done without employees' knowledge.

Was the action of the company management ethical or unethical in allowing personal use of corporate IT by employees? How about the president's monitoring decision?

Let's Just Release This System

A project leader in the corporate information systems division was assigned by her manager, the vice president of sales for the company, a task to develop a new Internet-based billing system. When the work was being assigned, the project leader thought that the time and human resources provided were adequate to complete the project. However, due to an unexpected turnover of computing specialists, it became clear that the system could not be completed as designed within the available budget and time frame. The project leader warned her superior about the impending problem. She was forced to deliver a "bare bones" system, without adequate error detection, exception handling, security safeguards, and audit trail. When the system was fielded, it became a source of problems in customer service. Many customers were billed incorrectly and, following heated exchanges, switched suppliers. Cases of fraud were discovered but proved impossible to trace. Business losses resulted and the project leader was blamed.

Was the action of the project leader ethical in knowingly implementing an inadequate system? How would you evaluate the actions of her superior in ordering an inadequate system into production?

The following general discussion of infoethics will allow us to discuss the issues involved in these cases.

ETHICAL ISSUES IN THE DEVELOPMENT AND USE OF INFORMATION SYSTEMS

The welfare of individuals and their specific rights, postulated by the ethical theories we discussed, need to be safeguarded in the environment of an information society. The principal ethical issues of concern with regard to information systems may be categorized as privacy, accuracy, property, and access.^[9]

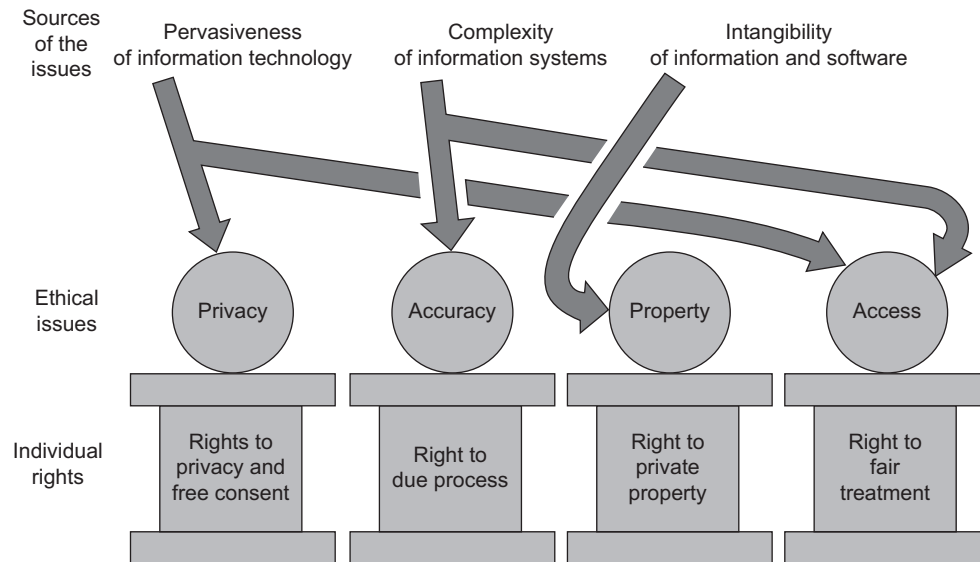


Fig. 3 Ethical issues, their sources, and the underlying individual rights.
Source: From Zwass.^[1]

We have shown these principal ethical issues as the four circles in Fig. 3. As shown in the figure, we can trace these issues to their sources: 1) the pervasive role and immense capabilities of systems for collecting, aggregating, storing, communicating, and accessing information in our information society; 2) the complexity of IT; and 3) the intangible nature of information and digital goods, such as digitized music or software. We also show in the figure the specific individual rights whose potential violation brings the issues to a head.

Tracing an ethical issue to its source and understanding the individual rights that could be violated help us understand the issue itself. For example, the intellectual property (IP) rights embodied in digital goods, such as software, are relatively easily violated because software is intangible and can be easily copied at a marginal cost close to zero. At the same time, the development costs of software are very high. Since IT pervades so many aspects of our lives, particularly after the infusion of the Internet–web compound, our privacy can be more easily violated than in the absence of this technology. Indeed, without computerized databases accessible over the Internet, fed by information systems that process our purchases, loan applications, insurance policies, and other transactions, it would hardly be possible to assemble the detailed record of our lives within fractions of seconds. With the broad move to business analytics based on the many trillions of facts collected about individuals as “big data,” our lives can be laid bare through the use of IT. Access to the information-based systems enhances our lives and the commercial activity in uncountable ways, as it exposes us to privacy risks. At the same time, those bereft of access to the technology are impaired in many of the life’s pursuits and their right to fair treatment is violated. An individual in a modern society who cannot make use of the Internet is deprived of a principal source of information,

transactions, and relationships, and the means of self-expression. A handicapped person without effective access to IT in a society where such use is needed to work is not treated fairly. We will now proceed to consider the four ethical issues in the following sections.

PRIVACY

Privacy is often considered the most important ethical issue raised by information systems. Privacy is the right of individuals to retain certain information about themselves without disclosure and to have control over the information collected about them. When our privacy is invaded, we are embarrassed, diminished, and perceive a loss of autonomy—a loss of control over our lives. Invasion of privacy is a potent threat in an information society. Individuals can be deprived of opportunities to form desired professional and personal relationships or can be politically neutralized through surveillance and gathering of data from the myriad databases that provide information about them. Most authorities agree that it is necessary to uphold the right to privacy as a basic individual right; Justice Louis Brandeis, over a century ago, called this right “the most valued by the civilized man.” Even though this right is not guaranteed by the Bill of Rights in the United States, that constitutional document stresses that other rights, beyond those enumerated there, are retained by the people. The right to privacy is considered to be such a right.

Concern about privacy had existed for many years before computer-based IT entered human affairs. Yet, computer-related technologies, and especially the massive use of the Internet–web compound, create opportunities for privacy invasion that had not existed previously. As much of our lives are now lived online, traces are left of

our behaviors and activities which may persist for decades. Databases containing minute details of our lives can be assembled at low cost, fused with others, and made accessible anywhere and at any time. A web search can be conducted at the behest of a governmental or business institution, or in a personal pursuit, to be augmented by information acquired from a data broker, that will yield a comprehensive profile of an individual.

Collection, storage, and dissemination of records concerning individuals are all necessary to our business, government, indeed, to the very fabric of our lives. To balance this need with privacy protection, both legislation and ethical approach to the acquisition and use of these records are necessary. In the United States, privacy is protected by a variety of legislative acts, the most prominent of which is the amended Privacy Act originally enacted in 1974, which regulates the treatment of personal data by federal agencies. The handling of personal information by corporations has received far less legislative attention, and the essential legal mechanism in this case is the law of contract. A 1999 U.S. law requires financial institutions to send out their privacy policies to their customers. The Health Insurance Portability and Accountability Act (HIPAA) provides privacy protection for medical records. However, gaps in legislation and in its enforcement make it difficult to protect privacy through the legal system and leave much of the privacy issue in the domain of ethics.

The Privacy Act and the legislation that follows it specify the limitations on the data records that can be kept about individuals and are based on what is known as Fair Information Practice Principles. These principles also underlie the guidelines set by the Organization for Economic Cooperation and Development (OECD). These fundamental privacy safeguards are the following:

- Individuals should be given notice of the information practices of the entity that wishes to collect personal information from them.
- No use can be made of the records for other than the original purposes without the individuals' consent.
- Individuals have the right of inspection and correction of records about them.
- The collecting agency is responsible for the integrity and security of the record-keeping system.
- There is a mechanism in place to enforce the safeguards and offer redress.

These principles lie at the foundation of the Consumer Privacy Bill of Rights fostered by the United States executive branch as the framework aiming at limiting the scope and increasing the transparency of data collection practices by business organizations.^[10] Ensuring privacy in the face of rapidly expanding technological possibilities for its invasion is not easy. Controversies arise and the trade-offs involved test the ethical frameworks. Many privacy advocates favor an opt-in practice in soliciting personal information. In this case, the individual releasing the

information needs to consent expressly to the information being used for the purpose specified by the requester. An alternative, the opt-out regime, favored by information collectors, makes the release of the information a default in the absence of an express prohibition by the individual.

Legislation and enforcement in the area of privacy in the United States are behind those in a number of other countries. Much is left to spotty self-regulation by business entities. Privacy statements to all clients by financial companies in the United States typically include such tropes: "We also may share information with other companies that are able to extend special offers we feel might be of value to you." Opt-out options are cumbersome. Online privacy policies have been found to aim at protecting the firms from litigation rather than reflect a commitment to fair data practices.^[11]

The countries of the European Union (EU) offer particularly extensive legal safeguards of privacy. In the environment of business globalization, this creates difficulties in transborder data flow, that is, transfer of data across national borders. Countries with more stringent measures for privacy protection object to a transfer of personal data into the states where this protection is more lax. Therefore, a number of U. S. corporations have signed the so-called safe harbor agreement, complying with the EU privacy standards. The United Nations has stated the minimum privacy guarantees to be incorporated into national legislation. The harmonization of privacy regimes across borders remains a challenge.

Privacy safeguards, such as privacy policies posted on websites, even when audited by independent agencies (e.g., TRUSTe, <http://truste.org>), are insufficient to protect this information from abuse. A common loophole is the dissolution of the original firm that had collected the information under certain safeguards, for example, during a merger or an acquisition. Conflicts arise between an individual's right to privacy and the right of a larger community to protect itself.^[12] Such issues include the rights of governments to decipher encrypted messages in the cases of suspected terrorism or crime, or the rights of parents to have access to the records of sex offenders who may endanger their children's welfare. In discharging their responsibility to enhance national security, governments may move to take away the ability of individuals to remain anonymous in a variety of situations, for example, by demanding identification in the airports.

The marketing and personalization of products and services acquired and sometimes also delivered over the web requires personal information about the consumer. Recommender systems that facilitate our online transactions rely on the minute knowledge of our buying habits. Effective m-commerce, that is, relationships and transactions conducted over smartphones and other mobile devices, indeed calls for consumer intimacy: The more information the system stores about the user, the higher is the speed and quality of the interaction.^[13] Pervasive information systems that introduce ubiquitous computing and sensing technology into everyday objects magnify the exposure to

potential intrusions on privacy.^[14] Fair Information Practice Principles should serve as the essential decision-making guideline. Matching of the online profile with personally identifiable data is of particular concern. Privacy concerns should inform technological solutions in system fielding; such concerns are, for example, debated before the radio-frequency identification tags are deployed on a wider scale.^[15] There are various methods of de-identification in data sets, which should be considered before releasing the data from the originating organization.^[16]

Information systems have made it possible to conduct systematic monitoring and surveillance of persons and groups. Among the technologies are the video-based systems that monitor city traffic for infractions, as well as the systems that monitor the use of rental cars to account for driving habits. The use of cookies and monitoring of the clickstream by websites, while facilitating commercial transactions and marketing, is troubling to many. Device fingerprinting allows monitoring users' online behavior even in the absence of cookies.^[17] Tracking an individual's whereabouts with a geographic positioning system, embedded in a cell phone, although useful in m-commerce, presents a danger to privacy. Notably, human mobility traces are unique and can easily lead to identification.^[18] Focused and context-specific data collection is a basis for privacy.

Aggregation and analysis of "big data" enables a broad product and process innovation, with evidence-based decision-making in various sectors of the economy. Of special concern is the personally identifiable information (PII), that is, the information that can be traced to an identifiable individual. The powerful and economically important use of the "big data" also creates new privacy risks with the commodification of data, including in many cases PII, and the loss of control over their flow and aggregation.^[19,20] Since the value of the "big data" emerges mostly in its multiple and varied secondary uses, great care has to be exercised over the aggregation.^[21] There are many options available to IT designers to build systems that foster limitations on the collection and transmission of PII with, among other measures, "privacy patterns" to be used in building the relevant software.^[22]

Two database phenomena create specific threats of privacy invasion. The first, database fusion, makes it possible to merge separate facts collected about an individual in multiple databases in order to develop a comprehensive profile of a person. If minute facts about an individual are put together in this fashion in a context unrelated to the purpose of the data collection and without the individual's consent or ability to rectify inaccuracies, serious damage to the person's rights may result. The dispersion of personal data among several independent databases is one safeguard against invasion of privacy. The other concern relates to statistical databases that contain large numbers of personal records, but are intended to supply only statistical information (the U.S. census database is the best example). A snooper, however, may deduce personal information by constructing and asking a series of statistical queries that would gradually narrow the

field down to a specific individual. To prevent such disclosure, limitations on the allowed queries need to be placed (e.g., a query would not be answered if the answer would refer to fewer than 10 persons).

Active generation of online content by users leads to exposures we are just learning to control. Cocreation of value by users and consumers, along with the producers, through user-generated content and through conducting their relationships online has become a major economic factor.^[23] Users are offered access at no charge to a great variety of social networks and expression media – and the content they produce and the traces they leave become the property of the sites. For example, these sites have become media for the management, or even manipulation, of one's public persona. Such reputation management often surrenders various aspects of the individual's privacy, to the individual's future regret. Social norms in that respect are in a state of flux.^[24]

As privacy norms are being formed and as laws are emerging, it is important to consider the context of the system use and the expectations of privacy in that context, be it private life, school, or workplace.^[25] The complexity of this consideration comes from the pervasiveness of IT throughout the various—and interlocking—contexts of our lives. Although we cannot "engineer privacy," there are numerous practices that can serve the goal of controlled approach to data.^[26] As stated in Fig. 2, the ACM Code of Ethics obligates information systems professionals to "respect the privacy of others" and goes further to offer specific guidelines on how to do that.

ACCURACY

Pervasive use of information in our societal affairs means that we have become more vulnerable to misinformation. Accurate information is error-free, complete, and relevant to the decisions that are to be based on it. Accurate information is grounded in high-quality, secure information systems, constructed by responsible professionals. OECD data quality principle states that the data "should be accurate, complete, and kept up-to-date."^[10] Although stories about inaccurate information surface most frequently with regard to the credit-reporting industry, they reflect a generally low level of data quality control throughout the public and private sectors of the economies.

Inaccurate information can prevent an applicant from obtaining a credit card—or a job. When people rely on inaccurate information, other people may be deprived of their right to due process. An incorrect medical record can threaten your life. A weather report that incorrectly forecast the trajectory of a storm because the data from a failed buoy were unavailable to the computerized model sent a sailor to his death.^[9] French police officers, in hot pursuit of a car recorded as stolen in their database, opened fire and wounded a law-abiding driver. The records of the car recovery by the legitimate owner and of the subsequent sale of the car were missing from the database. Multiple

accidents involving massive radiation overdose administered by the radiation-therapy system Therac-25 have been traced to imperfectly tested software.^[27]

Is the development of information systems that provide accurate information just the question of professional competence? In the third scenario presented in “Scenarios in the Ethical Domain,” a “bare-bones” system was knowingly forced through by a firm’s executive and knowingly implemented by a project leader. Similar events could have been behind any of the systems that led to the loss of individual welfare—or life—in the cases we just described. Beyond that, there exist various sources of possible bias in information systems—and the information system developers should be aware of that. The bias of concern to infoethics represents a persistent discrimination against certain categories of individuals and groups reflected in the design of an information system, which negatively affects the accuracy of information provided.^[28] Data analysis grounded in the “big data” may extrapolate individuals’ behavior from that of “people like them” and, possibly, punish an individual for the expected, rather than the actual, deeds.^[21] Professional integrity is an essential guarantor of information accuracy.

An ethical approach to information accuracy calls for the following:

- A professional should not misrepresent his or her qualifications to perform a task.
- A professional should indicate to his or her employer the consequences to be expected if his or her judgment is overruled. The ACM Code of Ethics and Professional Conduct speaks of the professional’s obligation to “avoid harm to others” by carefully assessing potential impacts of an information system to be implemented.
- System safeguards, such as the controls and audits, are necessary to maintain information accuracy. Regular audits of data quality should be performed and acted upon.
- Individuals should be given an opportunity to correct inaccurate information held about them in databases. The sources of inaccuracies should be tracked down and eradicated.
- Contents of databases containing data about individuals should be reviewed at frequent intervals, with obsolete data discarded.

Regrettably, some information-systems professionals are likely to choose implementing a system with quality problems in the conditions known as moral hazard, that is when they have an incentive to act in their own interests and against the interests of their employer, while being able to hide this.^[29] The same research has also shown that the ethical climate of an organization can influence these actions in the positive direction.

Accuracy problems have wider societal implications. A claim has been made that the absence of proper controls

in some computerized election systems may threaten basic constitutional rights. An independent assessment of the e-voting systems certified for use in the State of California, as one example, showed serious security vulnerabilities.^[30] Democratic process will require substantive information-accuracy safeguards before a wide move to electronic voting.

PROPERTY

The right to property is largely secured in the legal domain. However, intangibility of information is at the source of dilemmas that take clarity away from the laws, passing many problems into the domain of ethics. At issue are primarily the rights to IP: the intangible property that results from an individual’s or a corporation’s creative activity. The web, which has become a uniquely valuable medium for legitimate distribution of data, information, and knowledge in a digital form, has also become a common means for breaching the rights to this property.

IP, such as software or other digital content, is protected by three legal mechanisms: copyright, patent, and trade secret. These means serve to protect the investment of creators and to ensure public good by encouraging disclosure so that further innovations can be made by others. Indeed, the copyright and patent laws are designed to assist in the public disclosure and thus further technological progress. Copyright registration, which is easy to obtain, protects the form of expression (e.g., a given program) rather than the idea itself (e.g., an algorithm). Because the underlying problem solution is more valuable than its coded expression, this is a limited protection. Patents, which are more difficult to secure, protect novel and nonobvious discoveries that fall in the United States within the subject matter of the U.S. Patent Act. Many patent applications for software failed to prove that they qualify under this “subject-matter” criterion. However, a U.S. Federal Appeals court has affirmed in 1994 the patentability of sufficiently innovative software. Because of the limitations of copyrights and patents with respect to intangible products, software developers most often rely on trade-secret protection. Trade-secret law protects the confidentiality of IP through licenses or nondisclosure agreements.

An elaborate software system is expensive to create. The same software, or another digital product, can be copied at a negligible cost. Such is the nature of IP, which includes software, books, video, and music. Piracy in the form of selling illegally reproduced software has become a serious problem in international trade. In a number of countries, far more than the three quarters of the sales of U.S. software packages are illegal copies. Worldwide software piracy costs the U.S. software industry many billions of dollars annually. Because the legal system trails the pace of technology and because ethical guidance is sought in framing the legal issues, many controversies spill over into the ethical domain.

To “honor property rights” is one of the eight general moral imperatives of the ACM Code of Ethics.

The legal system and ethicists are grappling with many unresolved issues, such as

- To what extent can information and knowledge be considered property?^[31]
- How to reconcile the public’s right to access with the rights to IP and to privacy?
- What makes one digital product distinct from another?
- Would computer-generated works have a human author? If not, how would the property rights be protected?

In the case of property rights to electronic collections of data, such as directories, the U.S. courts have ruled that the copyright law protects only collections that display some creativity in the selection or arrangements of the data and does not protect such labor-intensive but nonoriginal collections as telephone white pages. Yet, the distinctions are often too fine to make a difference.

The industrial ecosystems producing digital goods, such as the music industry, have been transformed by the arrival of the web as a mass medium. Owing to the compression of the content and to the broadband telecommunications technologies, high-quality music and video can be streamed or downloaded. Music and video producers and sellers can be bypassed by consumers communicating in peer-to-peer mode and propagating copies of digital products. The technological domain offers, if only temporarily, a variety of methods of protecting this property, such as digital watermarks, as well as a broad encryption-based technology of digital rights management (DRM). The Digital Millennium Copyright Act, promulgated in 1998 to protect digital property, has made it illegal to circumvent a technological measure that controls access to a protected digital property. Taken together with the DRM technologies, the act goes beyond the preexisting copyright law and is likely to be challenged—justifiably, in much credible opinion.^[32] As we may conclude, many legal issues regarding IP remain unresolved. This is why it is particularly important to approach this property from an ethical standpoint to ensure that our decisions do not violate property rights of others.

ACCESS

It is a hallmark of an information society that access to information and knowledge is mediated by IT, notably the Internet–web, most of the workforce is employed in the processing of information and transformation of knowledge, and most of the goods and services available for consumption are information-related. To gain full access to the benefits of such a society, an individual must possess at least four things: 1) the intellectual skills to deal with information; 2) access to IT, including the Internet–

web; 3) access to information; and 4) access to a free expression over the digital media. If we consider these issues on national and global scales, we see that inequalities persist. Because each of us in a human society draws an economic benefit from the equality of opportunity and because each of us is ethically concerned about fairness, the issue of capable access to information and IT redefines our concern for literacy.

IT does not have to be a barrier to opportunities. Quite the contrary, when deployed purposefully, it can *provide* opportunities not previously accessible. Internet access can bring the contents of the world’s libraries, participation in the world’s markets, and the advice of the world’s experts to a remote location. Intensive work is being done on developing assistive technologies that enhance access of the handicapped to the IT, and, thus, in many cases, to the social and economic mainstream. Assistive technologies for the blind include screen displays that work in an auditory mode through screen-reading software and speech synthesizers, and screens that work in a tactile mode with the use of a Braille display. Access to trustworthy electronic virtual communities, designed with ethical principles in mind, is a great source of support to people bearing afflictions.^[33]

Indeed, with the phenomenal growth of shared computational resources, PCs, smart mobile devices, and of the Internet–web services, the accessibility of IT has grown vastly. But it has not grown equally. Access to the Internet is necessary to participate in the benefits of an information society and economy. Yet, several regions of the world, notably many of the countries of sub-Saharan Africa, remain with limited access. Significant digital divide persists between the developed and poor countries both in the information technologies and complementary assets, such as qualified professionals. Various digital divides also exist in developed countries. Action to eradicate these divides and expand the domain of inclusion in the Internet benefits is an important ethical concern.

Another ethical concern is the expansion of access to the content available online. The claims of IP have to be balanced by the needs of expanding the commonwealth of accessible knowledge and information.^[34] The One Laptop per Child global initiative brings low-cost laptop computers, connected to the web, within the reach of children in poor countries. The Digital Commons initiative provides open access to the knowledge contributed by scholarly journals, as well as to the books not protected by copyright. The movement toward open source and free software makes both the digital products and the tools for their further development accessible to all. A broad understanding of access is gaining worldwide support.

Numerous countries limit their citizens’ access to free expression over the web, erecting digital firewalls to filter and limit the content. Considering the power of the smartphone-armed citizens to organize disrupt dictatorial regimes, this is not surprising. The conscience of the IT professionals—and their ethics codes—will guide them on how to render their service.

MAKING ETHICAL DECISIONS

Let us consider how to make decisions applying ethical principles in the information-related domains—and then apply them to the scenarios presented earlier. The following decision-making sequence can be adopted:

- Examine the issues to see whether they fall in the ethical domain. Seek appropriate professional guidance if the issues seem to be in the legal domain. Apply the “sunshine test” to see whether the issue is ethical or discretionary: Would your decision withstand public disclosure?
- If you believe that ethical issues are involved, would a course of action you are considering violate individual rights? Would the action violate a professional code of ethics?
- Choose the course of action that would not result in an ethical breach.

Let us now view, in this light, our three scenarios presented earlier.

Transactional Information on Smart Cards

The ethical issue of privacy is involved. The legality of the action can be challenged. However, it is obvious that the developers and the users of the system invaded privacy of the debit-card holders with the system that gathered and released data about them without their knowledge. People may consent to their personal data being stored for a specific purpose; however, no such consent was sought. The individuals were also deprived of their right to inspect and, if appropriate, correct their personal data. Furthermore, the financial institution’s prospective plans imply an even broader breach of privacy by indiscriminate, uncontrolled release of transactional information to third parties and should not be pursued. A breach of ethics may have financial consequences to all parties. A possible consumer outcry may render the system useless. Such an argument may indeed carry the day, if you need to defend your recommendation to not go ahead with developing a similar system.

Who Owns E-Mail?

Certainly, the management decision to allow employees the use of the company-owned computers and systems for private purposes violates no ethical principles. We could judge this to be a discretionary action and not an ethics issue. An employee stands in a different relationship to a workplace than a consumer does to a marketplace. But the monitoring action was taken without employees’ knowledge and clearly it is a violation of their right to privacy and, thus, highly unethical if there was a justified

presumption of privacy. However, employers have a right to set policy—and an obligation to make the employees aware of their terms of employment. Should you, as an employer, wish to pursue this course of action, such acceptable use policy has to be drawn up. Perhaps the employees should be able to label certain communications as private, with the employer undertaking an obligation to respect their rights. The least invasive forms of computer-based work monitoring should be adopted. Thus, monitoring of performance, rather than of behaviors or personal characteristics, is preferred.

Let’s Just Release This System

The vice president not only made a poor business decision (that would place the issue in the discretionary domain). By knowingly forcing the development of a defective system, he violated his duty to do what is right. What about the action of the project leader? The ACM Code obligates a professional to “give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks.”^[2] The project leader failed to do so in this case by agreeing to implement a defective system and by failing to call her superior’s action to the attention of higher authorities.

These three scenarios show that ethical decision-making protects not only professional integrity and upholds the social contract. The expediency of “cutting ethical corners” often produces adverse business results.

CONCLUSION

Information technologies have the power to affect significantly the quality of our personal and working lives. Therefore, all knowledge workers and system users, and particularly computing professionals, face IT-related problems whose solution involves ethical considerations. Purely technological or legal means of protecting individual rights affected by information systems are insufficient in separation from the tenets of infoethics.

The four principal infoethical issues, privacy, accuracy, property, and access, are subjects of professional and organizational codes of ethics, which should be familiar to computer professionals. Our lives have been vastly enriched by the ability to form relationships and express ourselves on social media and social network sites, to form and nurture e-commerce enterprises, and to educate and entertain ourselves online. In the workplace, the use of IT may have positive or negative impacts on the worker, depending on the way the technology is deployed. Potential positive impacts include the increased ability to develop and exercise individual skills, and integration of work into meaningful tasks that can be performed with a large degree of autonomy. Potential negative impacts include reducing skills, routinization of work, and

excessive monitoring of workers. Computer-based performance monitoring should be made the least invasive and should be organized in accordance with ethical principles. Infoethical principles should be inculcated in the workplace as a component of the corporate culture. Ethical practices can and should be incorporated in the software engineering and other computer science curricula.^[35] On the deeper level, our moral lives require reexamination in the face of the new technologies that confront our ethical principles.^[36]

An information society both drives and is driven by incessant innovation. Emerging technologies present threats to the ethical uses of information systems, as well as the means to deal with these threats.^[37] Beyond that, they offer the promise of a better life in an increasingly more inclusive global society. The proper deployment of emerging technologies has to be informed by the decision-making processes keeping in view the ethical issues raised by information systems.

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Ethiopia: Libraries, Archives, and Museums

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Abstract

This entry explores the historical development of the national, public, academic school and special libraries, museums and galleries in Ethiopia. The country's effort to collect and preserve its documentary heritage started during the Aksumite period (fourth to eighth century A.D) and continued informally until the National Library was established in 1944. Since then, public and other types of libraries have been established and modestly expanded in the country. In addition, the collection and preservation of cultural objects and the development of museums and galleries goes back to the same Aksumite period when churches and monasteries served as custodians and preservers of these objects. The growth of museums and galleries can initially be attributed to the interest demonstrated for Ethiopian cultural and historical objects by foreigners who came to Ethiopia and to the archaeological discoveries carried out by different expeditions during the time of Menelik II (1889–1913) and thereafter. Since then, there has been a fairly slow growth of museums and galleries in the country as a result of an acute shortage of financial resources and trained manpower.

HISTORICAL INTRODUCTION

Ethiopia is located in the horn of East Africa. It lies between latitudes 3°15' and 18° north of the equator and between 33° and 48° to the east of the Meridian. It is bordered by the Sudan on the west, Somalia and Djibouti on the east, Eritrea on the north, and Kenya on the south. The country has been called a cultural mosaic, due to its 80 different languages and dialects and as many, if not more, cultural varieties. The languages found in the country belong to the two major phyla found in Africa: Afro-Asiatic and Nilo-Saharan. The Afro-Asiatic phylum includes the majority of the languages of Ethiopia: the Ethio-Semitic languages of which Amharic and Tigrinya are the best known and the largest members, Cushitic, of which the major languages are Oromo and Somali, and Omotic languages that are entirely spoken in Ethiopia of which Wolaytta is the largest one.^[1] The Nilo-Saharan languages found in the country include Berta, Suri, Me'en, Murle, Kwegu, Majang, and others.

Ethiopia is one of the oldest nations in the world, with great antiquities, cultures, and traditions stretching back 3000 years. It is one of the world's great crossroads, where the peoples and cultures of Africa, the Middle East, and the Mediterranean have interacted for thousands of years. The history of Ethiopia as an organized polity began around 100 B.C. in the northern region of the country. One of the most powerful early kingdoms of Ethiopia was the kingdom of Aksum, which had a complex society. During Aksum's prosperous centuries, it enjoyed contacts with the Mediterranean world, the Nile Valley, and the Indian Ocean as far as China.^[2] Archaeological findings attest to the prosperity of Aksum by the third and fourth century C.E.

The Aksumite kingdom had its own urban centers, coinage in gold, silver, and bronze, buildings, exceptional monuments, and extensive trade contacts within Africa and beyond. Trade most likely was the main source of the kingdom's revenue and wealth. Its exports included ivory, rhinoceros horn, live animals, aromatic spices, and frankincense. Aksum started to decline during the seventh century C.E. as a result of: (1) the rise of Islam in the Arabian Peninsula, which limited its access to the sea; (2) geographical degradations in the capital and surrounding areas; and (3) internal political troubles.^[3] This forced the power and the capital to move to the south and a new dynasty known as the Zagwe Dynasty (Cushitic speaking) came to power around 1137 C.E. It ruled the country until 1270. As devout Christians, the rulers of the Zagwe Dynasty constructed churches and monasteries including the rock-hewn churches of Lalibela. The southward expansion continued for several centuries. In 1270 C.E., power was transferred from the Cushitic speaking people to the Amhara, another Semitic speaking group. The Amhara stayed in power until the Imperial government of Haile Selassie was overthrown by the military in 1974. The current government came to power after it had defeated the military government of Mengistu Hailemariam in 1991. Throughout the history of the country, contacts between the Semitic, Cushitic, and other ethnic groups found in the country continued as the capital moved further south and the kingdom expanded and created a unique cultural diversity. This resulting ethnic and cultural diversity has given rise to many unique and dynamic visual traditions. Ethiopia has also had its own language and its own script for more than 2000 years. Inscriptions on stones that were crafted in the first century C.E. testify to the antiquity of writing.

In addition, for more than 1500 years quite a number of manuscripts (the very earliest ones on vellum) were produced.

Ethiopia accepted Christianity in the fourth century C.E. As a result, many churches were built and a significant number of religious texts were translated into Geez, the liturgical language. Eminent church scholars attracted disciples, and centers of learning developed where calligraphy, manuscript illumination, music, and poetry were taught. Each church and monastery retained a collection of religious literature used for services, teaching, and scholarship.^[4] Hence, the churches, monasteries, and a few respected elderly church dignitaries served as the custodians of the manuscripts and literary works of the country. This trend continued until 1863 when Emperor Thewodros II (1855–1868) put together the largest and the finest collection of Ethiopian manuscripts that well exceeded 981^[4] from the donation of a church at his mountain fortress of Magdalla. The manuscripts were collected from churches, monasteries, and individuals. They were, however, seized by the British when Thewodros was defeated in 1868. The Napier expedition that defeated the king destroyed many manuscripts and looted several others. Some of these manuscripts were returned to Ethiopian Churches while others were kept by the British officers and soldiers. Some 350 came into the possession of the British Museum.

Although the printing of Ethiopic texts in Europe dates back to the late fifteenth century in Mainz, Germany (in the woodcut specimen by Erhard Reuwich),^[5] print technology was not introduced in Ethiopia until the reign of Thewodros. The first printing machine was established at Macaw on the Red Sea coast in 1863.^[4,6,7] When we look closely at the establishment of printing machines in Ethiopia, we find that all of them were primarily introduced to produce religious materials for the consumption of the local people. However, in the beginning of the twentieth century, increased contacts with the outside world made secular education necessary. The country started to build elementary schools. With the increasing number of schools, the need for textbooks also grew. This in turn encouraged the government to establish its own printing press in 1921 in Addis Ababa (the capital city of Ethiopia) which was called Berhanena Selam in 1923.^[7] Although Ethiopia has a long history of language, script, and manuscripts, the history of printing and publishing is very short. The real development of printing started in the twentieth century, and proceeded very slowly. More and more printed materials began to emerge in the early 1930s to serve the erudite Ethiopians and foreigners that resided in the country. This advanced the idea of organizing a central reading room, collecting and making accessible all materials which existed in print.

In 1936, the then emperor Haile Selassie I, commenced a small library with books he collected in different European languages which either he bought or was presented

with.^[8] However, these were only accessible to people in his closest circle.

In another development, Italians who occupied the country during World War II from 1936 to 1941 organized a Central Government Library in Addis Ababa for Italian East Africa, which also included Ethiopia, Eritrea, and Italian Somaliland with a branch in Asmara, the current capital of Eritrea.

LIBRARIES

The National Library and the Development of Public Libraries

The national library

Research shows that efforts to collect and keep in one center the country's documentary heritage dates back to the Aksumite era (the kingdom that flourished between the fourth and eighth centuries A.D.), and churches and monasteries were used to produce manuscripts and to serve as the first "traditional" libraries or storage houses as indicated earlier. However, the intent to organize a National Library commenced only during the time of Emperor Menelik II (1844–1913).^[8] His effort to establish a National Library did not come to fruition for reasons not known. After quite some time had elapsed, "Yehizb Meshaf Bet," and now the National Archives and Library of Ethiopia (NALE) [formerly known as National Library of Ethiopia (NLE)], was established on May 5, 1944. Its foundation signifies the beginning of the modern library in Ethiopia. In his speech to announce the establishment of the National Library, Haile Selassie emphasized that he laid the foundation of the National Library for the liberation of the minds of his people.^[9]

Serke Berhan Gebreegzy was appointed as the first director of the organization. The initial collection of the library came largely from the East African Italian Government Library. At its inception, the National Library was under the auspices of the Antiquities Administration and had two divisions: the public library and the research library. The public library division was the most important resource for the city of Addis Ababa. One of the functions the National Library was to serve as a Central Lending Public Library. It also had a children's collection housed in a separate building. Finally, in the 7 years preceding the revolution (1967), the public library division embarked upon opening one library per year in a provincial town in order to organize a public library system.^[9] The research library division contained materials and books that were transferred from the colonial collection, United Nations documents received on deposit, a number of manuscripts, an Ethiopian Studies collection, and books published in Ethiopia acquired from publishers on the basis of a letter from the Ministry of the Pen requesting the five printing

houses to deposit to the library three copies of every title printed (in 1951). Since this was not promulgated by a separate act of parliament, it could not be enforced. Thus, the lukewarm and spontaneous response from the publishers resulted in the acquisition of few publications.

In the early days of the Ethiopian revolution, the libraries were threatened to be purged in order to get rid of “reactionary” literature. However, to the credit of heads of the different libraries and other intellectuals, books and other materials were not destroyed. More importantly, in 1975 the National Library came under the Department of National Library and Archives of the Ministry of Culture and Sports with four divisions: the public library, the technical services, national library, and archives. The overall objectives of the department were to serve as the center of studies and bibliographic information, to play a central role in leading and coordinating libraries in the country, and to serve the nation as a whole.^[10]

The most important development in the history of libraries in the country was the Legal Deposit Proclamation no. 50 of 1976, which required all printed matter to be deposited in three copies in the National Library.^[10] This has allowed the library to increase the gathering of book and other published material tremendously. The current collection includes 58,854 books, 33,627 periodicals, 859 manuscript, 9239 microfilms, 2650 bound newspapers, and 4408 CDs, audios, and videos.^[10]

Since the establishment of the National Library, three problems have hindered it from achieving its goals: shortage of financial resources, dearth of qualified professional librarians, and space to catalog and store the materials acquired. These problems and others, except the problem of space, still prevail.

The acquisition of library materials for the National Library significantly benefited from the project sponsored by the United States for the microfilming, cataloging, repair, and return of manuscripts in churches and monasteries in Ethiopia. This project was launched in 1971 and steadily continued the filming of manuscripts from church and monastic libraries, private libraries, souvenir shops, and bazaars. For a long time, the copies of the microfilms were housed in the Ministry of Culture which created the Microfilm and Microfiche section of the Department of Libraries and Archives. They were also accessible for viewing for the public.^[11] In 1987, the NALE was newly reorganized to incorporate and assume the responsibilities of the former Ethiopian Microfilm and Microfiche Library in addition to its function as a Department of Library and Archives under the Ministry of Information and Culture.

Since the 1980s, the Legal Deposit and Bibliography section of the Department of Libraries and Archives has published a series of bibliography indexes in Amharic and English entitled “Ethiopian Publications.” The indexes are similar to those that are produced by the university library as mentioned below. They list all materials published in

the country and abroad about Ethiopia, collected annually by the Legal Deposit and Bibliography section.

The National Library has taken on broader duties and responsibilities imposed upon it despite the sector not having been given enough attention to play a proper role in the country’s social and economic activities. Now the organization, by proclamation 191/1999, has been authorized to receive three copies of every item published in the country, including visual and audiovisual materials, as legal deposit. These then form the basis of the bibliographical indexes called “Ethiopian Publications.” NALE also serves as a registry of ISBN and ISSN numbers in order to create a union catalog in the country. In addition to acquiring materials by being the legal depository of the country, NALE gathers documents through purchase and donations. Other numerous duties were also assigned to the organization, such as serving as an information center and being the treasury of Ethiopian literary heritage, which requires the collecting of oral traditions including poems, hymns, and proverbs.

Much has been done to tackle the problems of libraries and archives. Special attention has been given to the development of libraries. NALE was established to serve as an information center and has become accountable to the profession at the national level. Other duties of the NALE staff include the editing, publishing, and distribution of the National Bibliography and periodicals index publications.^[10] NALE is also required to serve as a training center. Moreover, NALE is accorded the responsibility of acquiring and returning to the country the originals or the copies of the priceless literary heritage of the country that have been taken out of the country.

The formation and growth of this information center can play a vital role in the country’s development. NALE, in cooperation with the World Bank, inaugurated its Development Information Service Center in 2004 with duties that include: providing Internet access to the library users; providing information on the activities and mission of the World Bank; and making available up-to-date information on HIV/AIDS prevention programs.

Some of the major problems that continue at the NALE are limited financial resources; shortage of trained professional librarians and archivists; scarcity of modern computers and other types of machinery that could be used by technical services and library patrons; and much needed space for more storage, work space, public use areas, and offices.^[8] The idea to construct a new building and to move the collection into this building came up in the 1950s, but it did not materialize until 2006. With the help of various sponsors and nongovernmental organizations, a corner stone was laid in 2002. The construction work began toward the end of the year and was completed in August 2006.^[13] This temporarily solved the space problem that National Museum had for a long time.

The development of public libraries

The number of public libraries found in Ethiopia has now reached 249 (IFLA 2007).^[8] Interestingly enough, 100 of these libraries are located in Addis Ababa.^[13] Their sizes and collection of items varies greatly. As indicated earlier, the major functions of the National Library are providing service to the public and the development and expansion of public libraries in the country. In this regard, the public library division continued to render service to the public and promoted the expansion of public libraries in the southern part of the country, whereas the new technical services division was assigned to acquire and catalog for the National Library and for the public library in Addis Ababa. The plan was to extend its cataloging expertise to other public library branches located outside the capital city. Currently, there seems to be a concentrated effort to expand public libraries in the regional and rural areas of the country. The users of the majority of the public libraries are high school and college students from the surrounding areas. The major problems that the public libraries face today are limited financial resources, lack of trained librarians, and a shortage of space.

Academic Libraries

The Addis Ababa University (AAU), the oldest institution of higher education in the country, was established in

1950. Its library system is the largest in Ethiopia. It was established in 1961 (Fig. 1). The library system has seven branches, including law, medical, engineering, science, agriculture, and public health. The library has a collection of over half a million items.^[12,13] The main library and some of the branches serve patrons 24 hr a day.

The main library has computers for users to access the library's catalog and also houses about 12 computers usually reserved for graduate students. In addition, the current government has opened a number of public universities in the different regions of the country with various subject specialties.^[14] Moreover, quite a number of private universities have also been created.

As far as the development and growth of academic libraries in Ethiopia are concerned, we need to touch upon the collection of AAU [first known as University College of Addis Ababa (UCAA)], which was then named in the 1960s as Haile Selassie I University and other regional universities found in the country. A unique competitive relationship exists between the University College of Addis Ababa Library and the National Library. The UCAA Library was established in the 1950s and it employed well-qualified librarians. Its collection exceeded that of the National Library in a short period of time as a result of the donations it received. Over time, the UCAA collection became more important for research purposes than that of the National Library. Interestingly, it was the UCAA library that held the first exhibition of books published in Amharic (the national language) and later



Fig. 1 F. Kennedy Memorial Library of Addis Ababa University.

made available its first bibliography in 1964.^[13] The collection of the UCAA library steadily grew whereas that of the National Library grew more slowly.

Other universities outside the capital city that have libraries with significant collections are University of Gondar, Bahir Dar University, Haramaya University, and Jimma University.

The first university library to be discussed is the University of Gondar Library. The University of Gondar is located 738 km from the capital city. The City of Gondar was the capital city of Ethiopia from 1636 to 1868. The University was inaugurated in 2004. It is an expansion of the former Gondar College of Medical Sciences that was established in 1954. The college library was also founded in the same year in order to serve the health professionals trainees, the faculty, and the staff. This is one of the few libraries in the country with “open access” whereby students are allowed to browse the bookshelves by themselves. It also has an online catalog for its users to access the collection. The library houses a good collection of scientific, health, business, and computer science materials. In addition, its collection has strength in information technology, computing, nursing, engineering, and medicine. The total collection of the university exceeds 100,000 items, which includes books, serials, and other materials. The library also offers access to more than 10,000 electronic journals, electronic books, video programs, slide images, and track music.^[15]

The second institution to be considered is the Bahir Dar University located some 575 km from the capital city—Addis Ababa. Bahir Dar University was established in 1993 by combining the old Polytechnic Institute, which was established in 1963 under the cooperation between the government of the Soviet Union and the Imperial government of Ethiopia, with the Bahir Dar Academy of Pedagogy, which was established in 1972 by a cooperative agreement and contribution made by the Ethiopian government and UNESCO/UNDP. Thus, the current library houses the collections of both institutions. The University Library system has five libraries: the main library, the Law Library, Freshman Library, the Engineering Library that is located in the Engineering Faculty campus, and the Textile Industry Institution Library. The collection of the libraries has about 86,000 printed books.^[16]

The third institution to examine is Haramaya University and its libraries which is located 510 km east of the capital in the town of Haramaya. Haramaya University was established in 1952, and was formerly known as the Imperial Ethiopian College of Agriculture and Mechanical Arts which then became Alemaya University of Agriculture (1985). It was founded by an agreement made by the then government of Ethiopia and the United States of America, and at the beginning, the Oklahoma State University was given the responsibility for finding staff from abroad and for running the academic research and extension programs. The college was also responsible for coordinating

the agricultural research and extension programs in the country. The library system of the university has four branches: the main library, the School of Graduate Studies Library, and the Female Students' Library are located in the main campus in the town of Haramaya, whereas the Health Sciences Library, which was opened in 2003, is situated in the city of Harar. The collection in the main campus consists of 140,350 items that cover a wide range of academic subjects currently offered by the university.^[17]

The last university library to be considered is the Jimma University Library. Jimma University is located about 335 km southwest of the capital. It was established in 1999 by merging the former Jimma College of Agriculture, which was founded in 1952, and Jimma Institute of Health Sciences, which was founded in 1983.

The university library system was created in 1985 to promote the instructional, research, and public service goals of the university community through the acquisition of necessary materials. The University Library has seven branches, each specializing in a particular subject area: Health Science Library, Education Library, Technology Libraries, Social Science Library, Law Library, Graduate Studies Library, and College of Agriculture Library. The total collection is about 131,715 items which includes books, monographs, texts, journals, magazines, and databases. It also offers full text electronic databases and audiovisual materials.

School Libraries

In IFLA's 2007 World Report,^[18] the government of Ethiopia did not provide the number of school libraries found in the country. During the time of Emperor Menelik II, the first high school Teferi Makonnen was opened in 1908 in Addis Ababa. In the 1960s and 1970s, the Ministry of Education made a concerted effort to improve library services in schools with the help of a UNESCO expert who came to study and make recommendations on the development of various kinds of libraries for Ethiopia.

Efforts were made to improve the library services in high schools in the 1960s and 1970s. The Ministry of Education started to train school librarians and to purchase books following the recommendations of the UNESCO expert Paton (1964).^[18] However, school libraries still have a shortage of books and trained manpower.

Special Libraries

In Ethiopia, there were about 100 special libraries which are affiliated with the various ministries and governmental departments, research centers or institutes, and international organizations in the 1990s.^[19] The majority of the special government libraries are located in the ministries and parastatal organizations and serve the various professionals working for them. Examples of these include the

governmental libraries of the Ministry of Agriculture and Commission for Water in Addis Ababa, and parastatal libraries, such as those of the Ethiopian Institute of Agricultural Research (EIAR) and the Medical Research Library of Ethiopia.^[19] Here below, we will discuss the EIAR Library and Documentation Center, the Ethiopian Orthodox Library–Museum, and the Ministry of Foreign Affairs Library.

The EIAR Library and Documentation Center is located in Addis Ababa. It was established in 1966.^[19] The EIAR Library and Document Center's collection includes a variety of materials on agriculture. It has print, electronic resources, and CD-ROMs, such as books and journals for the staff of the research center, postgraduate students, and other research and development workers from other institutions.^[20]

The Ethiopian Orthodox Library–Museum was inaugurated on July 13, 2004 in Addis Ababa. The objectives of the library–museum are to preserve books and other historical relics for the coming generation and to assist local and international scholars in carrying out research on the Ethiopian Orthodox Church.

The Ministry of Foreign Affairs has its own library located in the premises of the ministry. The collection of the library is mainly used by the staff members of the ministry. The library houses international documents on political, social, and economic conditions of the country and other countries around the world. The library receives free publications locally from different publishers as well as from international organizations abroad.

Among the major international special libraries found in Ethiopia, the UN Economic Commission for Africa's (ECA) library and the library for the International Livestock Research Institute (ILRI) will be considered.

The ECA library was opened in 1959 to cater to the administrative and information needs of the commission and its member states. The collection of the library includes African government documents, periodicals, pamphlets, maps, microfiches, CD-ROMs, videotapes, books on Africa, bibliographic databases, and online databases.

ILRI, a nonprofit organization, was established in 1994 by merging the former International Livestock Center for Africa founded in 1974 and International Laboratory for Animal Diseases created in 1973. The headquarters of the institute is in Nairobi, Kenya with a principal campus in Addis Ababa. The organization focuses on issues around livestock management in poor countries. The library (information center) in Addis was launched in the 1980s.^[19] It has a diverse collection of books, journals, and CD-ROMs in print and online forms, as well as microfiche, videotapes, journals, theses, conference proceedings, maps, photographs, newspapers, and other forms of literature. The library also houses a unique microfiche collection of 30,000 unpublished documents from research centers in over 25 countries of sub-Saharan Africa.

Other special libraries that provide invaluable service to the community are the British Council, Alliance Française, and the German and Italian Cultural Institutes.

Library Education

As indicated earlier, one of the responsibilities of the National Library of Ethiopia has been to organize formal professional training to allow the trainees to acquire proper knowledge of the profession and its practices.^[19] To this effect, the formal organized professional training in the library profession started in 1959^[7] with a few short courses organized by the Ministry of Education in the evenings. The instructors came from the United States of America, the National Library itself, the United Nations Economic Commission for Africa Library, and the University College of Addis Ababa. To further strengthen the profession, the first Ethiopian graduate student was sponsored to obtain a higher degree in librarianship in the United States in the 1960s.

In 1966, the Haile Selassie I University introduced librarianship courses as a UNESCO teacher-training project.^[21] The main objective of this project was to produce librarians who would be working in small school libraries.^[8] In addition, the university began to offer 1-year full-time and 2-year part-time library science courses in order to produce mid-level librarians. More people were sent abroad for training in the library profession, and those started to return in the 1970s. Moreover, a new Bachelors degree program in Library Science was introduced in 1988. Finally, with the assistance of the International Development Research Center (IDRC) and UNESCO, a new program leading to a masters degree in information science began with the establishment of the School of Information Science (SISA) at AAU (formerly known as Haile Selassie I University) in 1989. Unfortunately, the training of librarians in undergraduate degree and diploma programs has ceased in the university since 1994 and some activities have been undertaken in private colleges to fill this gap. Thus, the dearth of mid-level library professionals still prevails in the country.

Professional Association

Another important item that needs to be addressed for the development of the library profession is the existence of some kind of association that can promote professional development and leadership in the field. The Ethiopian Library Association (ELA) was first established as a library club in 1961. It was then registered and achieved its official status in 1969. ELA was unable to play its role because of bad image of the profession, migration of professionals to the West, and dissatisfied professionals. Presently, ELA does not exist as a professional organization; however, there is a movement toward reestablishing the association.^[22] Just a year ago a new library, archives and

information systems association was formed which was sponsored by the British Council and is called Ethiopian Library, Information Science and Archives Professional Association.

THE NATIONAL ARCHIVES

The National Archives of Ethiopia was established in 1979 as a main division of the NALE. The main objectives of this section were to gather and store documents of historical importance. In 1999, by virtue of proclamation 179/1999, the National Archives was clearly separated from the National Library in spite of the fact that it is housed in the same building with the National Library and still shares the same Board of Directors. The new responsibilities it has assumed are wider in scope. Some of its responsibilities are cataloging all the newly gathered materials: collecting chronicles, letters, historical documents and photographs, articles and research papers, correspondence, publications, maps, and materials concerning law and the judiciary; preserving priceless archival materials exposed to dangers (such as publications at an organization that is defunct or closed); and preventing any archival materials from being taken out of the country.

Currently, the National Archives houses 3218 folders of archives, 537 Plans and Maps, 665 bound audit and financial matters archives, and 2487 photographs. In addition, under special custody, it has 422 files and 38 bound archives. When considering the sources of these archival materials, the first collection came from the Ministry of the Grand Palace, Palace of the Crown Prince, and others. The collection of the National Archive includes letters by Ethiopian Kings, such as Emperor Thewodros' letter (1855–1868) to Queen Victoria explaining misunderstandings between the two; Emperor Yohannes IV's letter (1872–1889) to Queen Victoria explaining the threat his country faced with Muslims; and Emperor Menelik II's (1889–1893) letter to Nicolas II of Russia about his victory against the invading Italians and his interest in fostering the relationship between their countries. Most of the archival items collected are in Amharic, Geez, French, Italian, English, and Arabic.

As mentioned earlier, the origins for the collection of the National Archives are a wide range of organizations and private collections housed in individual residences. The Archive Repository and Research section was required to sort out and move all the items that were stored in the Prime Minister's office. These documents cover the administrations of Emperor Menelik (1889–1913), Lij Iyassu (1913–1916), Empress Zewditu (1916–1930), Haile Selassie I (1930–1974), Mengistu Hailemariam (1974–1991), and the current Prime Minister, Melesse Zenawi.

In addition, in the 1980s and 1990s, the National Archives collected materials from private sources. For

instance, in 1981 the National Archives acquired the personal archives of Dejazmach Zewde Gabre Sellassie, who served as departmental attaché in the Ministry of Foreign Affairs, mayor of Addis Ababa and who also held other positions in other ministries. Some of the valuable items that were transferred are maps and archives in Amharic, English, Italian, French, Geez, and Tigrigna. The collection consists of handwritten, typed, and published materials.^[21]

The second individual collection that was transferred to the National Archives was that of Aleka Taye Gabre Mariyam. The National Archives acquired it in 1993. The significance of the transfer of this collection is that Aleka Taye was a famous intellectual who served as instructor of Amharic and Geez languages, visited many countries, and befriended royalties. Most of the materials in his collections were handwritten, including the Book of Philosophers, the History of the Wanderer, the History of the Royalties in Geez, and the Book of Religion.^[23]

The third valuable archival material that was transferred was the collection of Dejazmach Kebede Tessema who served as a palace attendant, the first mayor of Addis Ababa, vice-member of the legislative body, and vice-president of the same legislative body. His collection includes research conducted to alleviate prostitution, and letters he exchanged with various patriots since 1940.^[23]

Finally, the fourth significant collection that was transferred to the National Archives was the collection of Bilata Mersie Hazen Wolde Kirkos, who served as a teacher, school director, Secretary of the Commission formed to resolve the British–French border dispute in French-Somaliland, and High Court judge. His collection comprises a historical account of ministerial appointments in Ethiopia and a list of ministers appointed, an account of confrontation between Egypt and Ethiopia, and the history of the national flag.^[23]

The National Archives issues guidebooks and calendars for its users. Guidebooks are items that provide information on the available archival materials that are owned by the National Archives whereas calendars list the archival materials compiled on the basis of the guidebooks.^[23]

MUSEUMS AND GALLERIES

Museums and galleries are the two types of institutions that collect and preserve cultural objects of a society. In most cases, museums are cultural centers where public properties are housed whereas galleries are privately owned for the purpose of collecting and exhibiting art objects. In addition, the main purpose of galleries seems to be promoting emerging artists and selling their works to art collectors and museums (in its current use of the term in Ethiopia).

The emergence of museums and galleries in Ethiopia goes back to the introduction of Christianity to the country in fourth century A.D. Since that time, religious centers,

such as churches and monasteries, became custodians and preservers of ethnographic and religious objects. The emergence and growth of museums in Ethiopia can be divided into three periods: 1) from the formative period until the occupation of the country by Italians (1936–1941); 2) from the liberation to 1974 when the revolution started; and 3) the expansion of museums since 1974.

Museums

The shaping of museums before the Italian occupation

As mentioned earlier, the collection and preservation of cultural items in Ethiopia seems to begin after Christianity was introduced in the fourth century A.D. Some of the items that were gathered by the religious institutions include clothes, books, parchments, paintings, and crosses (either religious or secular in type). Kings and members of the ruling class also kept items of historical importance in their own private collections. The major problem with church or private collections was access to them by the general public. However, the endeavor to systematically collect objects of historical importance started during the reign of Menelik II immediately after the Battle of Adwa (1896). One of the reasons for the development of museums and galleries was the interest exhibited by foreigners, who came especially to Addis Ababa, for art works. According to Professor Richard Pankhurst,^[4] the only person who opened a gallery and sold art objects was a certain Greek named Giyorgis, who fought against Italians alongside with Menelik II in the Battle of Adwa. In addition, this demand by travelers for art objects created cultural awareness among the local people at the same time.

The emergence of museums in Ethiopia was further advanced by the archaeological discoveries carried out by Europeans. The first one was a German Expedition that came to the north city of Aksum in 1906. Moreover, in the 1920s and 1930s, a group of artists who were educated in painting in France returned to the country. This created a demand for their products. The efforts of systematically collecting and preserving cultural and historical objects continued to grow under Haile Selassie I, who signed a cultural and scientific agreement with the French government. More importantly, the temporary occupation of Ethiopia during World War II had fundamentally changed the demand for and supply of touristic objects and this development was also seen as a new dimension of economic benefits among artists.

Development of museums from 1941 to 1971

The second major stage in the growth of museums and galleries was the time period between 1941 and 1974. The first significant step that was taken by Haile

Selassie I was the organizing of a museum-like section that was attached to the National Library in 1944. In this section, precious objects of high value representing the ruling class members were stored, including cloaks, ceremonial clothes, and household objects. This led to the establishment of what is now called the National Museum of Ethiopia (Fig. 2; it seems nobody knows when this name was actually given to the museum-like building).

The second significant stage in the development of museums and galleries in Ethiopia during this period arose when the University College of Addis Ababa (UACC) was opened in 1950. Soon after its opening, the UACC began to sign cultural agreements with foreign governments. For instance, in 1952, UACC signed a cultural agreement with the French government that allowed the French archaeological mission into the country in 1954. The mission performed its archaeological excavations in the northern part of the country (Tigray and Eritrea).

The 1906 German and 1950s French archaeological missions were rewarded with rich archaeological findings that included potteries, stone tools, and inscriptions.^[4] Quite a number of their findings are now exhibited and preserved in the National Museum and Aksum Archaeological Museum, whereas some are stored in a facility near the Archaeological Museum in the city of Aksum.

Another important event in the development of museums and galleries in the 1950s was the celebration of the Silver Jubilee of the imperial period of Emperor Haile Selassie I. He invited foreign heads of states and other dignitaries to witness this celebration. For this event, he wanted an exhibition on the rich heritage of Ethiopia. UACC was given the responsibility to organize such an exhibition.^[24] The Chief Librarian at UACC at that time, Professor Chojnacki, commenced to direct the collection of cultural objects from the different ethnic groups of the country through students (the students did some of the collecting). The efforts of gathering cultural objects from the various ethnic groups were also aided by the Ethnological Society (a professional association of scholars) that was established in 1951.^[25] This in turn led to the creation of the Institute of Ethiopian Studies Museum in 1963 in Addis Ababa (Fig. 3).

Finally, there were two other national and international events that played important roles in the development of museums in Ethiopia. The national event was the small exhibition of 1958 that displayed the cultural items that were discovered by the German and French archaeological excavations conducted in the northern part of the country. The emperor himself visited the exhibition. This particular event at the same time increased the awareness of the public and led to having a permanent exhibition open to the general public. The international event that indirectly had an important role in the development of museums was that Ethiopia increasingly became a center for African and



Fig. 2 National museum of Ethiopia.

international affairs. The Organization of African Unity (OAU) was established on May 25, 1963. The Emperor wanted an exhibition to be organized at the university for this historic moment, and the responsibility was assigned

to the then University Librarian Professor Chojancki. This resulted in the founding of the Institute of Ethiopian Studies and its museum as well. The items displayed in this museum include



Fig. 3 The institute of Ethiopian studies.

icons, triptychs, diptyches, religious and folk paintings, processional crosses, hand crosses, neck crosses, miscellaneous church objects as far as religion and art were concerned while its objects of material culture include agricultural implements, basketry, gourds, horn and ivory ware, leather objects, jewelry, metal objects, musical instruments, national costumes, outdoor life objects, pottery, weapons, other objects not classified.^[25,26]

An important fact to mention is that the archaeological artifacts collected by the expeditions accumulated over time. Thus, citizens of Ethiopia wanted to know the past and there was a need to open a museum where the items could be displayed for the general public to view. This is the third stage in the development of museums in Ethiopia in the mid-1960s when the Ministry of Finance transferred the former office of the Ministry of Foreign Affairs to the National Museum on a temporary basis. Even at this time, there still is no law that formally establishes a national museum in the country. In 1966, the imperial government passed a proclamation that established the Office of Archaeology and Antiquities Administration as a result of the increasing archaeological findings that require proper preservation and handling for future researchers.

Finally, in 1968, there was a new milestone in the development of museums in the country. The Society of Friends of the Institute of Ethiopian Studies Museum (SOFIES) was founded as an organization that assumed the responsibility for collecting Ethiopian cultural objects within or outside the country, by organizing fund-raising activities in order to buy them back.

In summary, the development of museums in Ethiopia during the imperial time was modest. There were no plans or visions how to establish and run them. We can say they are mainly the products of the tremendous amount of artifacts uncovered by the archaeological missions conducted by foreigners and the interest showed by SOFIES.

Development of museums since 1974

In 1974, the military junta known as the Dergue overthrew the regime of Emperor Haile Sellassie I and assumed power until 1991. It was during this period that many ethnographic museums began to emerge in the different parts of the country. However, the development and the growth of the galleries took a different path as they were privately owned.

Some of the ethnographic museums that were established during this period include the Wollega Museum, the Harar Museum, the Dessie Museum, the Mekele Museum, and the Jimma Museum even though it was created earlier in 1973. The majority of these museums were founded with cultural objects collected by the different communities in their respective regions. In addition, in the capital city, Addis Ababa, another historical and ethnographic museum was founded in 1984.

We attempt to provide a brief description of these ethnographic museums here below.

The Addis Ababa Museum was first established in 1984 in dedication to the Founding Congress of the Workers Party of Ethiopia (WPE) on the tenth anniversary of the Ethiopian Revolution. Then, it became the city museum in 1986 during the centenary anniversary of its founding. The museum's exhibition consists of items that reflect the culture, social affairs, health, education, and housing and urban development of the city. In addition, the armed forces exhibition displays the Ethiopian national struggle against foreign invaders and aggressors and the growth of Ethiopia's modern armed forces.

The Jimma Museum is located about 340 km southwest of the capital city. It was in 1973 when the then Emperor Haile Sellassie I visited the city of Jimma that the collection of the cultural objects began. In 1989/90, the local office of the Ministry of Culture acquired these collections and started to run it as a museum. The museum currently displays royal objects from the local king Jimma Aba Jifar (1878–1932), cultural objects from the various areas in the region, Koran Holy Books on parchment, Christian Holy Books also on parchment, and paintings.^[4]

The Wollega Museum was created in 1987 and is located 334 km west of Addis Ababa. The items collected for this museum predominantly represent the Oromo culture and the early rulers of the kingdom. The museum building is one of the two buildings in the country that show the architectural design of a museum. The objects in this museum include royal objects of the rulers of the kingdom, traditionally curved wooden chairs, photographs, and paleoanthropological and geological items.^[27]

The Dessie Museum is located in the city of Dessie which is 400 km from the capital city. It was established in 1981. This museum displays fossils, bones, ancient manuscripts, weapons captured from the Italians during the battle of Adwa, pottery, handicrafts, ethnic costumes from the area around, a book written in Arabic about the introduction of Christianity, wooden products, musical instruments, leg bracelets, necklaces and neck crosses, baskets, and artifacts from King Mikael, Menelik II, and Haile Sellassie I.^[27]

The Mekelle Museum (Yohannes VI) is another ethnographic museum located north of the capital. It was established in the compound of the palace of Emperor Yohannes IV (1872–1889). The items on display include clothing of dignitaries, family pictures of the Emperor, his bed, a jar, containers made of goat skin, ceramics, books, neck crosses, bracelets, a gold-plated knife, and a statue of Mussolini in front of the museum.

Finally, the Harar National Museum and Community Museum, created in 1981, are located in the eastern old city of Harar. The Harari (an Ethio-Semitic ethnic group) Community Museum houses cultural objects that completely represent its own ethnic group whereas the items displayed in the Harar National Museum come from

the various ethnic groups that are found in the region. The items exhibited in the two museums include pottery, gourd, and wood-cut products.^[27]

In summary, during the time of the Dergue and thereafter, museums saw a modest growth in the country. However, this growth cannot be enough when considering the many ethnic groups that exist in the country.

An Overview of the Development of Galleries

The beginning of galleries in Ethiopia is associated with the two brothers Assefa and Serek Yimaneberhan. They were graduates of the Menelik II Secondary School which had a painting and art training section. They had informal training by their father who was a traditional painter. After they had completed their school, the two brothers opened an art gallery, or some prefer to call it an art studio at Arat Kilo (just on the opposite side of their school) in the 1950s. Their works were not sold to the general public but they were commissioned to paint by the various offices of the military and prominent individuals. This gallery closed because of financial difficulties the two brothers faced in the 1950s.^[27]

In another development, foreigners who resided in the country had keen interest in art works in the country. Some of them had the opportunity to open their own art galleries. One such gallery (souvenir shop) worthy of mentioning was the one opened by Madam Riva of Italian origin in 1957/1958 in Addis Ababa (Piazza area). Her shop sold paintings and antiquities of Italian, Greek, Ethiopian, and other origins.^[27]

The second foreigner to open another gallery in the country was an Armenian. It was opened in the early 1960s. It was called Belvedere Gallery and was organized in a better way than the earlier one. It is in this gallery that Ethiopian artists began to display their works to the general public for the first time. The gallery continued to play that role until the 1974.

The development of galleries in the early 1970s started to decline. This decline could be attributed to the political situation that prevailed in the country at that time. In 1974, the Emperor was overthrown by the military and soon after a Marxist style of government that discouraged private ownership of property was formed. Thus, the role of the galleries was taken over by big hotels and foreign cultural centers, such as the Alliance Française, the German Cultural Center, and others. Artists commenced to use these new venues to exhibit their works.

Currently, there seems to be a significant increase in the growth and development of galleries in the country. The regime that is in power has created a suitable atmosphere for private investment and ownership of private property. As a result of this, galleries have started to reemerge in the country. One of the galleries that operates at this time is St. George Interior Decoration and Art Gallery that was

founded in 1991. The gallery displays traditional tables, chairs, headrests of kings, decorated cotton clothes, jewelries, and modern and traditional paintings. The gallery acquires its cultural objects from different parts of the country.^[28]

In 1996, another gallery named Goshu Art Gallery was established in Addis Ababa. The owners of the gallery, who are artists themselves, opened it in order to promote artists and art in the country. The items exhibited in the gallery include traditional and modern paintings, sculptures from West Africa, masks and decorated vases from Yemen, and household items with Ethiopian touches. In addition, the owners use this gallery to exhibit their own art works.^[27,29]

Another art gallery that was also created in 1996 was Asni Gallery. It is housed in a traditional villa in Addis Ababa whose architecture is very interesting by itself. This art gallery features modern art. The last gallery is the Universal Arts and Crafts that was opened in 2000 in Addis Ababa too.^[27] The gallery displays household ornaments, African art, Imperial Furniture, oriental art, lampshades, and paintings.^[27] These are some of the significant galleries that are found mainly in the capital city Addis Ababa.

The development of museums and galleries in Ethiopia shows the same kind of problems shared by the National Library and Archives. The first and the most important problem is a lack of financial support coupled with a shortage of professionally trained manpower. In addition, the museums lack space for the objects to be properly displayed to the people who come to visit them.

In conclusion, the development of the National Library, National Archives, and museums and galleries requires proper planning, financing, trained-manpower, and legislation in order for the country to successfully utilize its rich cultural heritage. There are some indications pointing to this direction, but it needs a real commitment from the government, the people, and other organizations that have a stake in it.

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Everyday Life Information Seeking

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Abstract

Information seeking may be analyzed in two major contexts: job-related and nonwork. The present entry concentrates on nonwork information seeking, more properly called everyday life information seeking (ELIS). Typically, ELIS studies discuss the ways in which people access and use various information sources to meet information needs in areas such as health, consumption, and leisure. The entry specifies the concept of ELIS and characterizes the major ELIS models. They include the Sense-Making approach (Dervin), the small world theory (Chatman), the ecological model of ELIS (Williamson), ELIS in the context of way of life (Savolainen), the model of information practices (McKenzie), and the concept of information grounds (Fisher). ELIS practices tend to draw on the habitual use of a limited number of sources, which have been found useful in previous use contexts. Since the late 1990s, the Internet has increasingly affected the ELIS practices by providing easily accessible sources. Even though the popularity of the networked sources has grown rapidly, they will complement, rather than replace, more traditional sources and channels.

INTRODUCTION

Information seeking is a major constituent of information behavior or information practices, that is, the entirety of ways in which people seek, use, and share information in different contexts.^[1–3] Information seeking may be analyzed in two major contexts: job-related and nonwork. The present entry concentrates on nonwork information seeking, more properly called everyday life information seeking (ELIS). Typically, ELIS studies discuss the ways in which people use various information sources to meet information needs in areas such as health, consumption, and leisure.

Due to space restrictions, the present entry focuses on ELIS research conducted in the field of information studies or library and information science since the 1990s. First, for this reason, certain types of studies relevant to ELIS will not be discussed. These studies include marketing and consumer research, communication studies (e.g., audience research), and public library use studies. Second, specific questions of ELIS such as search strategies during interactions with Internet search engines will not be considered in the present entry. The entry is structured as follows. In the next section, the concept of ELIS will be clarified. Then, the ways in which various sources and channels are used in ELIS will be discussed, and the major conceptual models of ELIS will be characterized. The last section concludes the entry.

THE CONCEPT OF ELIS

Thus far, a rich variety of themes has been explored in ELIS studies. They have focused on people belonging to diverse groups such as the following:

- Young adults^[4–6]
- Adolescents making career decisions^[7]
- Elderly people^[8,9]
- Abused or battered women^[10,11]
- Women struggling with overweight^[12]
- People diagnosed with cancer^[13,14]
- Homeless parents^[15]
- Unemployed people^[16]
- Immigrants^[17–19]
- Hobbyists of various kinds, for example, amateur genealogists, coin collectors, and cooks^[20–23]
- Environmental activists^[24,25]

As these examples suggest, the phenomena of ELIS can be approached from a number of viewpoints, for example, by concentrating on the demographic features of information seekers, or investigating information needs and seeking of young people. The issues of ELIS can also be explored by focusing on the problems faced by people, for example, losing one's job, or having a chronic disease such as diabetes. Finally, ELIS can be investigated in the context of leisure activities such as hobbies.

Particularly in the early years of ELIS research, concepts such as citizen information needs and seeking were utilized to denote information seeking taking place outside work tasks.^[26] Even though the concept of citizen information needs and seeking is illuminating in itself, it is rather narrow because it primarily refers to people's rights and obligations toward social institutions as voters or participants in activities of civil society. Alternative concepts such as nonwork information seeking are problematic due to its residual nature and negative connotations: nonwork information seeking is implied to be less significant because it deals with

something that is not associated with daily work.^[27] The definition problem is further aggravated by the fact that issues of job-related and nonwork information seeking tend to overlap and they may be interwoven in everyday settings.^[28] For example, seeking information about computer courses may serve both professional ends and hobbies.

Terminological problems originating from the false dichotomy of work-related and “nonwork” information seeking may be avoided by taking the concept of ELIS as starting point.^[27] The key word is everyday life, which refers to a set of attributes characterizing relatively stable and recurrent qualities of both work and free time activities. The most central attributes of everyday life are familiar, ordinary, and routine, and they qualify the structural conditions of action (e.g., the recurrent “rhythms” of work and leisure hours). These characteristics of familiar, ordinary, and routine become real only in the process in which they are reproduced, day after day.

From this perspective, information seeking may occur in both work-related and leisure-related contexts of everyday life. Because the field of work-related information seeking is relatively well defined and the term work-related information seeking is self-explanatory, usually there is no need to use the more specific expression of “work-related information seeking in the context of everyday life.” Thus, the concept of ELIS may be reserved to denote information acquisition taking place in less clearly specified contexts and activities such as hobbies and household care. These activities and contexts are seen as important in their own right; they are not only residuals of work-related phenomena. Hence, the positive term ELIS indicates that ELIS is not inferior to work-related information seeking.

Generally defined, the concept of ELIS refers to the acquisition of various informational (both cognitive and expressive) elements, which people employ to orient themselves in daily life or to solve problems not directly connected with the performance of professional tasks or full-time study.^[27] Similar to work-related information seeking, ELIS may have two modes. On the one hand, ELIS may refer to seeking of problem-specific information (e.g., finding a fact). On the other hand, ELIS may manifest itself in the seeking of orienting information (i.e., monitoring of everyday events by using various sources and channels).

EVERYDAY INFORMATION NEEDS

A considerable number of ELIS studies focus on the ways in which information sources are used to meet various information needs. The specificity of research settings varies from general-level surveys of source usage to studies on ELIS focusing, for example, on health issues.^[29–31] However, due to space restrictions, the present entry concentrates on general-level studies.

Strictly defined, the tradition of ELIS research dates back to the early 1970s, when extensive surveys were launched in

the United States to investigate ordinary people’s information needs and seeking. At that time, the first attempts were made to elaborate conceptual and methodological tools for ELIS studies. Marcia Bates^[32] pioneered by introducing the concept of life information in 1974: By “life information” is meant information needed for successful living. The area of need ranges all the way from sheer survival (stay away from dogs that walk funny and foam at the mouth) to the most advanced forms of self-realization (where can I study ceramics or transcendental meditation?). Thus defined, the aforementioned concept includes “vast amounts of information about how to do many different things in one’s culture that will be acceptable and lead to one’s survival and emotional satisfaction.”^[32]

Somewhat later, Brenda Dervin, a communication scholar, created innovative approaches to enrich traditional ELIS survey research settings. Douglas Zweizig also contributed significantly to methodological issues, primarily in the field of public library use studies.^[33,34] One of the pioneering surveys of ELIS was based on interviews with about 1000 people in Baltimore in 1972. The informants represented various demographic groups. This massive study revealed almost 9000 everyday life questions or problems reported by the interviewees. These problems were categorized into problem areas indicating daily information needs as follows:^[35]

- Neighborhood
- Consumer habits
- Housing and household maintenance
- Crime and safety
- Education
- Employment
- Transportation
- Health
- Recreation
- Discrimination
- Financial matters
- Legal problems
- Public assistance

Later surveys have demonstrated that these need areas are largely also valid today. For example, a nationwide project on citizenship information conducted in Great Britain in 1997 revealed similar areas of everyday information needs.^[36] Apparently, the major information need areas are relatively stable, and the variation between (Western) countries is rather insignificant.

THE USE OF INFORMATION SOURCES

ELIS studies have also identified the most popular information sources and channels used to meet people’s information needs. Traditionally, human sources are preferred in ELIS. An extensive telephone survey conducted in

New England, the United States, in 1979 showed that three out of four respondents had drawn on their own experience in problem solving; in addition, friends, neighbors, and relatives appeared to be popular sources.^[37] Later studies have demonstrated that people tend to favor familiar sources such as newspapers, television news, and health professionals because they have functioned well in earlier use contexts.^[38] Overall, ELIS seems to be characterized by a conservative attitude: people tend to draw on familiar information sources that are often used almost routinely.^[38]

Since the late 1990s, particularly e-mail and World Wide Web (WWW) have been widely accepted as new tools for communication and information seeking. The surveys indicate that people use the networked services for various purposes (e.g., keeping in contact with others by e-mail, seeking health information from web pages, buying products and services, and participating in online discussions).^[38–40] For example, a study conducted in Sweden demonstrated that in the early 2000s, the Internet had already gained a fairly significant place in the informants' communication and information-seeking practices, providing a wide variety of sources for different purposes of use.^[41] The Internet was also found to be useful as a source of market information (e.g., flight schedules, car rentals, objects for sale, and job opportunities). The preference for the networked sources was also strengthened by the availability of search engines such as Google.

Along with the development of Web 2.0 technologies, the forums of social media have become increasingly popular in ELIS. These forums provide user-generated content (UGC) such as blog postings, answers available on social reference sites, and Wikipedia entries that can be used to support everyday problem solving and decision making. Empirical studies have demonstrated that blogs and online discussion forums can provide useful sources of information for people struggling with health problems, for example.^[42,43] In addition, social media forums such as Question & Answering (QA) services, for example, Yahoo! Answers, and virtual communities such as *Tripadvisor* have gained popularity as sources of ELIS.^[44,45] Even though UGC can provide rich sources of information since UGC originates from "real experiences by real people,"^[46] the credibility of UGC may be an issue because it is often a mixture of fact and opinion, impression and sentiment, founded and unfounded tidbits, and experience.^[46] Although the networked sources have gained popularity, the Internet has not been able to replace other media such as the telephone, television, radio, and newspaper with ELIS. On the contrary, the network sources and services complement them both in job-related and nonwork contexts.^[47,48]

THEORIES AND MODELS OF ELIS

Compared to job-related information seeking, the number of theoretical frameworks and models of ELIS is still quite

low. This is partly due to the relatively short tradition of this subfield and the smaller number of researchers who are active in ELIS issues.

The Sense-Making Methodology (Dervin)

Brenda Dervin can be counted among the most influential researchers of ELIS since the early 1970s. Her early studies focused on the communication practices of urban poor people.^[49] In the early 1970s, Dervin began to develop the sense-making approach as a methodology focusing on human communication and the design of communication-based systems and activities. Since then, the theoretical and methodological bases of the sense-making approach, currently referred to as sense-making methodology (SMM),^[50] have been transformed and refined. The SMM has been applied in numerous contexts to explore information needs and seeking of specific groups of people.^[50–52] Dervin employs the metaphors of situation, gaps, and uses to depict information seeking and use them as a sense-making process. Metaphorically, the situation stands for the time–space context, where the individual becomes aware of the insufficiency of one's earlier definition of a situation. Gaps refer to questions or information needs elicited in situations of this kind. Uses stand for the ways in which information being sought or received from various sources helps to bridge the gap and to create a new sense. Examples of uses include getting ideas and understanding, being able to plan ahead, deciding what to do, and getting out of a bad situation.^[51] More generally, information seeking and use may be approached by drawing on the metaphor of gap-bridging. However, this metaphor does not suggest a substantive conception of information seeking and use. The metaphor gives methodological and heuristic guidance to posit contextual questions as to how people interpret information in order to make sense of it. These questions focus on the ways in which cognitive, affective, and other elements useful for sense-making process are constructed and shaped in order to bridge the gap.^[50–55]

Although the SMM draws heavily on metaphorical formulations, it has gained empirical support. It strengthens the hypothesis that information seeking is a constructive process based on the utilization of categories of situation, gaps, and uses. For example, a study focused on blood donors who were asked to describe the process of donating: What happened first in the donating situation? What are the questions they themselves posed? How did they hope the answers to their questions would help them?^[56] Other sense-making studies have focused, for example, on the information needs and seeking of cancer patients.^[57] The SMM has inspired, for example, Julien's investigation focusing on barriers to adolescents' information seeking for career decision making;^[7] and the study of Pettigrew et al.^[58] reviewing the ways in which people use public library-community network systems.

In sum, the SMM has contributed significantly to the conceptual and methodological development of ELIS research. By emphasizing the role of individuals trying to bridge gaps in everyday situations and the nature of information as a situation-bound human construct, sense making has advocated the user-based approach, as opposed to the traditional information system-centered viewpoint. Thus, Dervin has not only introduced a new viewpoint to ELIS studies but has also more broadly contributed to the theoretical and methodological breakthrough of the user-centered approach to information-seeking studies.^[59]

ELIS in the Context of Small World (Chatman)

Elfreda Chatman is one of the most distinguished researchers in the field of ELIS studies. In the 1980s and 1990s, she conducted a highly original ethnographic research project focusing on information-seeking behavior of people living in the margins of society. The project was characterized by an attempt to develop a genuine social scientific theory, which describes ELIS in the context of “small world.” This concept refers to social environments where individuals live and work, bound together by shared interests and expectations, and often economic status and geographic proximity as well.^[60] In small-scale communities of these kinds, activities are routine and fairly predictable. Everyday information seeking and sharing are oriented by generally recognized norms and role expectations based on beliefs shared by members of the community.

Chatman explored ways in which poor people seek, use, and communicate information within the context of their everyday settings. In a study characterizing the information world of low-skilled workers, Chatman^[61] examined the information needs and seeking behavior of female janitors at a university. It appeared that they had a narrow, concrete, and local view of the world restricted to the most familiar social milieu. Thus, information originating outside of this “small world” was not of great interest to them. The repertoire of information sources appeared to be narrow. Much daily information came from television. To some extent, information was also sought in newspapers. Most informants felt that personal experience was the most reliable source of information. They favored “first-level information” received through personal experiences or hearsay from someone who is accepted as having knowledge of the matters to be discussed. In contrast, the value of “second-level” information received from outsiders was suspected and often ignored because this type of information is not compatible with the common sense reality of the small world.

The specific features, characteristic of information seeking in the small world, were also studied among elderly women residing in a retirement complex.^[62] Ethnographic analysis was conducted to ascertain their information and recreational needs and to explore the most

popular information sources. The informants appeared to be active users of mass media. In contrast to the janitor study, the informants of this study favored quality TV programs, and they read books and magazines quite frequently but were not active users of public library.

Based on the aforementioned studies, Chatman^[63] concluded that everyday information seeking of small world people is affected by four major factors forming the basis of the theory of information poverty: risk taking, secrecy, deception, and situational relevance. For example, the women of the retirement community avoided risk taking by not telling anyone about declining health concerns, thus giving up to seeking information or gaining emotional support.^[63] The notion of secrecy is closely related to risk taking in that the elderly women concealed physical and mental ailments. Third, deception represents a deliberative attempt to act out a false social reality.^[63] In this way, one engages in activities in which personal reality is consciously and forcefully distorted, and the individual tries to appear better than one really is. Finally, situational relevance is instrumental in explaining information poverty. Potentially useful information will be not used because people living in a small world do not see a generalized value of sources provided by outsiders intended to respond to their situation. The source is ignored because it is not legitimized by “contextual others.”^[63]

To specify the ideas of small world, Chatman^[64] developed “a theory in the round,” based on the ethnographic study of female prisoners. The concept of “life in the round” refers to a dynamic world based largely on approximation; in this world, things are understood implicitly.^[64,65] When people live in the round, imprecision is largely accepted and inexactitude is tolerated. In this context, “members move in and out of the round depending on their need for more systematic, precise, and defined information.”^[66] Understanding life in the round results when information is clear enough to give sensible meaning to things. The most important consequence of this construct for the practice of ELIS is that life in the round adversely affects information seeking in day-to-day situations; people will not search for information if there is no need to do so. Small world inhabitants ignore information if they perceive that their world is working without it (i.e., they have enough certainty, comfort, and situational predictability so that the need to seek information is negated).^[66] Individuals will cross information boundaries only if 1) information is perceived as critical, 2) there is a collective expectation that the information is relevant, and 3) a perception exists that the life lived in the round is no longer functioning.^[64]

Chatman^[67] summarized the theoretical developments in a theory of “normative behavior.” The theory may be seen as an elaboration and extension of the theory of life in the round. In brief, the normative theory of behavior suggests that ELIS is affected by the worldview and norms characteristic of specific communities. In addition, ELIS is

affected by the ways in which actors are classified into insiders or outsiders. Ultimately, norms and roles determine what kind of information sources will be preferred, accepted, and used.

Chatman's research project on the information-seeking practices of marginalized people inspired other projects (e.g., the study of Hersberger^[15] focusing on the ways in which homeless parents living in family shelters seek for everyday information). The research line opened by Chatman is promising both theoretically and methodologically. Importantly, Chatman's research project exemplifies the genuine need to utilize the repertoire of social scientific theories and ethnographic approaches to enhance our understanding of information seeking as an integral part of everyday action in social contexts.

The Ecological Model of ELIS (Williamson)

By drawing on the findings of an empirical study in which some 200 older adults were interviewed in Australia in 1992–1994, Kirsty Williamson^[8,68] developed an ecological model of information seeking and use. It can be called ecological because it sets information seeking and use in the context of social and cultural factors, which may have an influence on the ways of selecting and using information sources and channels. The model suggests that, although people purposefully seek information in response to perceived needs, they also monitor their world and receive information incidentally. The ways in which they monitor the everyday world is mediated by social-cultural backgrounds and values, physical environments, and personal characteristics (e.g., their states of health), as well as their socioeconomic situations and lifestyles.

The model suggests that in purposeful and incidental information seeking, information sources of various types are given differing importance. The intimate personal networks (family and friends) are closest to the user and are probably also perceived by the user as most easily accessible. The other source types are located farther in the "ecology of sources" [i.e., wider personal networks (clubs, churches, and voluntary organizations) and the mass media (newspapers, television, radio, and magazines)]. Institutional sources such as professionals, government departments, and other organizations are perceived to be even more remote in this sense. The ecological model has been applied in empirical studies focusing on ELIS of diverse groups such as blind and visually impaired people.^[69] The strength of the ecological model is that it allows information seekers to be conceptualized as both individuals and members of social groups. The model also takes into attention the influence of particular physical and social environments. The individual is seen as a creative and thinking entity, but within contexts that involve various kinds of biological and social constraints.

ELIS in the Context of Way of Life (Savolainen)

"Way of life" is a social scientific concept that provides a broad context to investigate individual and social factors affecting ELIS. Reijo Savolainen^[27] defined the concept of way of life as "order of things," which is based on the choices that individuals make. "Things" stand for various activities taking place in the daily life world, including not only jobs but also necessary reproductive tasks such as household care and voluntary activities (hobbies); "order" refers to preferences given to these activities. Because, in most cases, the order of things is a relatively well-established constellation of work and nonwork activities taking place in a day or a week, this constellation is easily taken to be the most natural or normal way of organizing one's everyday life. Correspondingly, people have a "cognitive order" indicating their perceptions of how things are when they are "normal." Through their choices, individuals have practically engaged in a certain order of things, and it is in their own interest to adhere to that order as long as they find it meaningful. Thus at least implicitly, most people seek for an internal coherence in everyday matters because it gives them better chances to plan their choices and act meaningfully.

The most central issues of way of life manifest themselves in the structure of the time budget, described as a relation between working and leisure time, models of consumption of goods and services, and nature of hobbies.^[27] The structure of the time budget reveals the proportions of time spent on work, necessary activities outside work such as household care, and, finally, the time devoted to recreational activities such as hobbies. By analyzing the models of consumption, one may draw a picture that indicates the share of money spent on the acquisition of various goods or services (e.g., books). The analysis of hobbies sheds light on the substance of way of life because the nature of hobbies informs us of the things that people find most pleasant. The analysis also reveals the role of informational interests (for instance, newspaper reading) in leisure time.

Because the meaningful order of things may not reproduce itself automatically, individuals are required to take active care of it. This caring activity can be defined as mastery of life, implying the importance of the coherence of the everyday life projects at large. The nature of these projects may vary. As aptly specified by Hektor,^[41] some life projects may be generic in that they are common to most people (e.g., household care). Other projects are specific because they originate from an individual's life situation (e.g., child rearing or one's specific interests, i.e., hobbies).

Mastery of life serving one's life projects may be either passive or active. It is passive when people are satisfied with seeing that everything is going on as expected, at least on the whole.^[27] Active mastery of life is associated with pragmatic problem solving in cases where the order

of things has been shaken or threatened. Mastery of life is a general preparedness to approach everyday problems in certain ways in accordance with one's values. Information seeking is an integral component of mastery of life, which aims at the elimination of continual dissonance between perceptions of "how things are at this moment" and "how they should be." If there is no dissonance, mastery of life goes on quite routinely and the information seeking attached to it can be characterized as a rather passive monitoring of everyday life events. In other cases, mastery of life may grow into active problem solving aimed at restoring the disturbed order, usually requiring active seeking of practically effective information.

Savolainen^[27] utilized the aforementioned model in an empirical study conducted in Finland. The study focused on two groups: teachers and industrial workers. The empirical study strengthened the assumption that way of life directs information seeking in a significant way. Teachers were more eager to seek factual information from various media, and they took a more critical stand toward the supply of light entertainment from radio, television, newspapers, and magazines. The interviews revealed that personal interest and current life situation also affect media use. There appeared to be teachers not particularly interested in the culture or politics sections of newspapers; similarly, some workers preferred documentaries and other serious programs and took a critical view of entertainment.

Later on, Savolainen^[38] elaborated the aforementioned framework into the model of everyday information practices. This model differentiates three modes of everyday information practices: information seeking, information use, and information sharing. The model makes use of the ideas of social phenomenology^[70] by approaching information seeking, use, and sharing in the context of life world in which everyday projects of diverse kinds are embedded. For example, looking for a new job and concern for the environment exemplify such projects. Everyday information practices may serve as tools to achieve the goals of these projects. Furthermore, the model suggests that the concept of information source horizon is central for the constitution of everyday information practices since this horizon indicates the ways in which people prefer information sources and thus navigate the information world. The ideas of the model were used in an empirical study examining information practices among environmental activists and unemployed people.^[38]

Information Practices (McKenzie)

One of the newest models of ELIS is proposed by Pamela McKenzie.^[71] The model was developed in the context of health information seeking by pregnant women. McKenzie specifies a two-dimensional model of context-bound information practices. The model describes four modes: active seeking, active scanning, nondirected monitoring, and

obtaining information by proxy. When seeking information, the modes may appear in varying order, depending on the information need at hand and the situational factors. The modes can take place in two phases: first, at times of connecting information sources; and, second, interacting with them. Thus, the second phase implies the use of the information source to which one has been connected. The indications of use are, for example, reading a text or actively asking specifying questions when consulting a doctor.

By drawing on the aforementioned model, the process of health information seeking may be described as follows.^[71] Active seeking can be defined as the most directed mode of information practice. Consulting a previously identified source (e.g., a family physician), re-reading an entry in an encyclopedia, or conducting a systematic known-item search in a medical database exemplifies active seeking. Active scanning refers to semidirected browsing or scanning in likely locations (e.g., medical books in a bookstore, or web pages discussing diabetes). Nondirected scanning involves serendipitous encounter with, and recognizing, a source (e.g., incidentally getting a useful idea from a TV program on how to reduce smoking). Finally, obtaining information by proxy may take place when interacting with information sources through the initiative of another agent: either the information source or some other gatekeeper or intermediaries. For example, an individual interested in the stopping of smoking may receive e-mails from her friend informing about new web pages related to this topic. Alternatively, her friend may have bought a new book on this topic and lends it to the information seeker.

McKenzie's model exemplifies the major tenets of recent studies on information seeking. Information seeking is seen as a highly dynamic and context-dependent activity, drawing on a number of modes that may appear in various orders. The model also exemplifies the growing complexity of ELIS processes (e.g., the ways in which various information resources perceived to be accessible afford ELIS to meet the needs of orienting and problem-specific information).

Information Grounds (Fisher)

Drawing on a series of ethnographic studies, Karen Fisher (née Pettigrew) and her colleagues have developed the concept of information grounds that stands for a spatio-temporally sensitive context of ELIS.^[72] Information grounds may be defined as an environment temporarily created by the behavior of people who have come together to perform a given task, but from which emerges a social atmosphere that fosters the spontaneous and serendipitous sharing of information.^[73] In other words, information grounds stand for an individual's combined perceptions of place, people, and information.^[74,75] Examples of everyday information grounds include medical clinics,

hair salons, bars, clubs, daycare centers, metro buses, bookstores, and libraries.^[17] Grounds of these kinds stand for information-rich places where people indicate an awareness that an appropriate source might be located.

A major characteristic of information grounds is that they can occur anywhere, in any type of temporal setting, and are predicated on the presence of individuals. Second, people gather at information grounds for a primary, instrumental purpose other than information sharing and seeking. Third, social interaction is a primary activity at information grounds, and information flow is a by-product. Fourth, people engage in formal and informal information sharing, and information flow occurs in many directions.^[73] Even though information grounds primarily serve the needs of information sharing, they are also interesting from the viewpoint of ELIS. While people share information, they may also ask specifying questions related to the topic of discussion. Purposive information seeking occurs when someone voluntarily visits an information ground with the purpose of obtaining information.^[71] Nonpurposive information seeking takes place when someone serendipitously encounters information without prior intent.^[73]

In a study focusing on information sharing and seeking at the foot clinic, Pettigrew^[73] found that everyday information flow did not occur solely from nurses to customers, but the latter appeared to be ripe sources of everyday information for the nurses themselves. Multiple persons participated in exchanges and customers shared information while waiting for treatment and afterward. It also appeared that information needs were rarely stated as direct requests but instead emerged subtly as people shared their situations with one another and chit-chatted. This suggests that information sharing may give rise to occasional seeking of information. On the other hand, information may also be shared in the context of information encountering because the information received this way may be passed on to others. Another study explored how new immigrants use coping skills and literacy programs run by Queens Public Library, New York.^[17] Then, the study showed that the immigrants share information in multiple directions often as a part of social interaction and that topics of information seeking could arise quite serendipitously as well as through framing via the literacy program's subjects. Finally, a survey drawing on telephone interviews of residents in East King County, the United States, showed that people favor information grounds by diverse criteria.^[74] However, a common denominator was the opportunity to share common interests or needs, and the feeling as if other people understood their needs, and that these people may be trusted. For example, a health-care facility can provide opportunities to talk with people having similar life experiences.

In the most recent characterization of information grounds, the concept is specified by referring to the people-place-information trichotomy.^[75] More specifically,

information grounds are perceived as a social construct rooted in an individual's combined perceptions of place, people, and information. As the numerous examples of recent studies^[74–76] suggest, the construct of information grounds has not been explicated in a final form; on the contrary, the approach is continually elaborated, both conceptually and empirically.

CONCLUSION

Studies conducted since the 1970s indicate that everyday life information needs and seeking are affected by a number of cognitive, emotional, cultural, and situational factors. ELIS has two major modes. On the one hand, people may seek for orienting information by monitoring daily events through the media; newspapers, television, and the Internet are the most central sources of orienting information. On the other hand, they may seek for problem-specific information. Most frequently, information seeking of this kind is triggered by needs related to health issues, consumer problems, housing, and various kinds of hobbies. To meet these needs, people tend to favor a limited number of easily accessible sources, which have been found useful in previous use contexts.

To a large extent, the major features of ELIS may be condensed into the principles of information seeking proposed by Harris and Dewdney.^[77] Most importantly, these principles suggest that the needs for problem-specific information arise from the situations in which information seekers find themselves; that is, any need for information is situationally based and dependent on a particular context. People also tend to look for the information that is most accessible, sometimes referred to as the principle of the least effort. It also seems that daily information-seeking habits change quite slowly. One of the recurrent findings of ELIS research is people's tendency to favor human sources due to easy access to them and the opportunity to get immediate feedback. However, source preferences may vary in differing information need situations. Depending on their requirements, for example, Wikipedia may be preferred over human sources in cases in which facts about an issue are urgently needed. Since the late 1990s, the Internet has increasingly affected ELIS practices by providing easily accessible sources. Even though the popularity of the networked sources has grown rapidly, it seems that they will complement, rather than replace, more traditional sources and channels.

As the daily information environment becomes more complex and information seeking is affected by an increasing number of contextual factors, there is a need to elaborate the research settings of ELIS. The major challenge is to study contextually the dynamic (situation-bound, sometimes nonlinear and cyclical) processes of ELIS as related to the recurrent patterns of information seeking. More reflective attention is being devoted to the

ways in which the researchers gain access to the everyday life settings of the informants and conceptualize the phenomena of ELIS.^[78] One indication of the progress made in this respect is the elaboration of the theoretical and methodological bases, as exemplified by Chatman's project to develop a social scientific theory of ELIS. Recent examples of promising lines of research include the approaches to information grounds^[72] and information practices.^[38,71] In addition, there is a growing interest in the role of the affective factors, such as emotions and feelings, in the study of health-related^[13,14] and hobby-related information seeking^[21,79] in particular. The study of affective factors is also important because they often make it understandable why people avoid information although it may be readily available.^[14] These developments suggest that the best way to elaborate the picture of ELIS both conceptually and empirically is to thematize it as a contextual everyday practice that incorporates cognitive, affective, and sociocultural elements.^[3,38,67,80] However, ELIS is not rendered meaningful as a separate practice because it is often connected to practices of using and sharing information.

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Evidence-Based Practice

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Abstract

Evidence-based practice (EBP) is the conscientious, explicit, and judicious use of current best evidence in making decisions. Its aim is to gather, assess, and apply research results that are pertinent to questions that arise in the course of everyday professional practice. Its focus is pragmatic rather than theoretic. Evidence-based library and information practice (EBLIP) comprises a set of principles and practices derived from EBP, primarily the health professions. These principles are described and referenced to examples from the library and information science (LIS) literature. While EBLIP's strongest proponents are found among health sciences librarians, efforts to incorporate evidence into practical decision-making may be found in other sectors in the library and information professions. It is also used as a rationale to encourage enlarging and improving the evidence base of library and information science as a discipline. EBLIP is an international movement of library and information professionals from a number of countries, especially the United Kingdom, Scandinavia, North America, and Australia. As a relatively new movement within the professions, EBP continues to evolve, with changing emphases depending on discipline, region, organization, and topic. Increasing use of qualitative methods and interest in data-driven decisions may affect the role of EBP in LIS.

INTRODUCTION

Evidence-based practice (EBP) is the conscientious, explicit, and judicious use of current best evidence in making decisions. Its aim is to gather, assess, and apply research results that are pertinent to questions that arise in the course of everyday professional practice in a variety of fields. Although EBP encourages the conduct and use of research, it focuses primarily on using research results to solve everyday problems, rather than on undertaking basic research that may or may not have a practical application. EBP is an approach increasingly used in the professions, most notably those in health, education, policy, and social service, in addition to library and information science (LIS). Evidence-based library and information practice (EBLIP) comprises a set of principles and practices derived from EBP in other sectors and espoused by library and information professionals from a number of countries, especially the United Kingdom, Scandinavia, North America, and Australia.

EBLIP evolved during the 1990s as a result of health science librarians' involvement in evidence-based medicine (EBM). As medical librarians participated in the EBM initiatives, they began to explore the feasibility of applying EBM principles to the problems facing a rapidly evolving library world. EBLIP encourages improving the research skills of practicing librarians in order to build a research base that can be applied to improving professional practice in libraries and other information-intensive organizations. As such, its focus is pragmatic rather than theoretical.

While EBLIP's strongest proponents are found among health sciences librarians, efforts to incorporate evidence into practical decision-making may be found in other sectors of the library and information professions. It is also used as a rationale to encourage enlarging and improving the evidence base of the discipline. As a relatively new movement within the professions, EBP continues to evolve, with changing emphases depending on the discipline, region, organization, and topic.

This evolution has benefitted from the biennial, international conferences on EBLIP that began in 1999 and have been held at various locations in Europe, Canada, Australia, and the United States. An open-access, peer-reviewed quarterly journal, *Evidence-Based Library and Information Practice*, was established in 2006 to "provide a forum for librarians and other information professionals to discover research that may contribute to decision-making in professional practice."^[1] The journal's international editorial board includes many of the most prolific writers and strongest advocates for EBLIP. In addition to research reports and commentary, it publishes evidence summaries of previously published research. The journal complements the major text in the field *Evidence-Based Practice for Information Professionals: A Handbook*^[2] and adds to the growing body of literature in the field, much of which has been published in the *Journal of the Medical Library Association*, in *Hypothesis*, the newsletter of the Research Section of the Medical Library Association (MLA), and in *Health Information and Libraries Journal*.

Beginnings in Clinical Medicine

The EBM movement resulted from the observation that clinicians pursued answers to only a few of the information needs they identified during daily practice because they lacked time and access to current, high-quality resources, including critical reviews of the literature that were organized and presented systematically. Increased pressures on clinicians' time due in part to changes in professional practice, and the growth of the biomedical literature, led to concerns that clinicians were making clinical decisions based on tradition and personal inclination rather than on established, scientific evidence. Few of the clinicians' information needs were expressed as actual questions, and even fewer generated searches for answers.^[3] EBM advocates challenge clinicians to become lifelong, self-directed learners, to seek out and apply the results of systematic reviews and meta-analyses, and to practice audit and feedback about their clinical decisions.

By most measures, EBM is a central tenet of clinical practice. EBM is now a part of most medical school curricula, it has been endorsed by the Institute of Medicine, thousands of systematic reviews have been published, and numerous electronic databases and digital devices deliver evidence-based summaries to the clinician at the bedside. Despite this success, EBM has also been criticized as an attempt to make practice formulaic ("cookbook medicine") and to remove professional judgment and values from decision-making. Such criticism prompted Sackett,^[4] the author of a major EBM text, *Clinical Epidemiology*, to reassert the need for a balance between scientific evidence and clinical judgment. Although EBM continues to be critiqued, few dispute the need to collect, filter, synthesize, and apply the available information to clinical practice.^[5,6]

EBP in the Information Professions

Advocates for evidence-based information practice have written extensively to encourage colleagues to adopt evidence-based methods, but at the same time they acknowledge that LIS provides few evidence tools and even fewer incentives for adoption. Not only is the comparatively small research base a barrier to EBP, cultural and communications gaps exist between researchers and practitioners. These gaps, which have been attributed to a myriad of factors—from lack of educational preparation to "semantic impenetrability" and lack of practical utility—have prompted calls to action to address them.^[7] The MLA's research policy *Using Scientific Evidence to Improve Information Practice* (1995) and its successor *The Research Imperative* (2007) envision health information practice whose "core consists of verified scientific evidence, with LIS professionals as creators, managers, and active users of such evidence."^[8,9] The revised policy also links EBP with quality improvement, stating that evidence

[will be] identified, applied, and assessed in a continuous loop of quality improvement with research as the critical underlying construct.^[9] Evidence-based principles are beginning to diffuse through other sectors of library and information practice as indicated by the variety of evidence summaries published in the journal *Evidence-Based Library and Information Practice*.

COMPONENTS OF EVIDENCE-BASED PRACTICE

Though they may be described in a variety of ways and the details may differ according to domain, the components of EBP remain constant. They are

- Formulate the question
- Search for the evidence
- Evaluate the evidence
- Apply the results
- Evaluate the effect

Formulate the Question

In EBP, formulating a question is the ability to state the problem at hand in the form of an answerable question. This step is often preceded by recognizing an information need or "gap" that prompts the question. For example, researchers have analyzed the ways in which physicians decide to pursue answers to questions and studies of the information needs in other domains have found similar patterns.^[10] Once an information need is identified, the need is transformed into an answerable question following a specific pattern. In clinical medicine, the pattern is known as PICO, a mnemonic translated as problem (or patient or population), intervention (prognostic finding or exposure), comparison (with the alternative, including placebo for trials), and outcome (or effect). Examples that apply PICO to clinical questions may be found at many websites such as <https://www.ncbi.nlm.nih.gov/ezproxy2.library.drexel.edu/pmc/?term=3140151>. A template for use when formulating either of two different types of PICO searches in PubMed is available at <http://www.pubmedhh.nlm.nih.gov/nlm/picostudy/pico3.html>. These examples are drawn from clinical medicine, but Booth has taken these models and developed SPICE—setting, perspective, intervention, comparison, and evaluation—an approach that is specific to LIS questions. SPICE stands for facets of a problem that are relevant library and information practice.^[11]

Acknowledging the importance of stating questions in an answerable form has prompted efforts to develop a taxonomy or classification of questions. For example, some basic types of questions in clinical medicine are those having to do with diagnosis, treatment, etiology, prognosis, or prevention, each of which is one facet of a clinical situation.^[10] Similar work has been undertaken with regard to

Table 1 Classification of library questions.

Question from <i>Hypothesis</i> ^a	Revised question	Domain	Potential resources
How can we predict the future usability of a print monograph collection in this electronic environment?	In academic libraries, how do electronic subscriptions affect usage of the print monograph collection?	Collections	LISA, Library Literature, CINAHL
Are students who have been taught information skills more or less likely to continue to further study?	Among students, does being taught information skills by a librarian affect future academic pursuit?	Education	ERIC, MEDLINE, Educational research abstracts, PsycInfo
Is there a way to measure the economic value of the medical library within a hospital?	In hospitals, does having a medical library vs. not having a library impact the hospital's economic viability?	Management	ABI Inform, CBCA, EconLit, MEDLINE
How do we apply outcomes-based evaluation to services in order to realistically demonstrate the impact of what we do?	In presentations to library boards, does the use of outcomes-based evaluation of library services impact upon board members' perception of the importance of library services?	Marketing/Promotion	ABI Inform, CBCA, Library Literature
OPAC vs. library Web sites/databases for e-journal/e-book management—why...?	IN managing e-journal access and retrieval, is using an OPAC vs. a library Web site database for indexing those journals a more user-friendly medium?	Information access and retrieval	LISA, Library Literature, CINAHL, MEDLINE
Can we prove that librarians are more effective at answering reference questions and running literature searches than library technicians?	In reference transactions, do librarians, as compared to library technicians, provide a more complete answer? In literature searching, does a librarian search vs. a library technical search yield higher quality results?	Reference/Enquiries	LISA, Library Literature, CINAHL, MEDLINE

^a <http://www.mlanet.org/p/cm/ld/fid=737&tid=511&sid=647>.

questions in LIS. An illustrative list of questions generated by practicing health science librarians restated as EBL questions and mapped onto six domains of library practice appears in Table 1.^[12] In addition, Eldredge^[13] has proposed three question types—prediction, intervention, and exploration—which can be linked to research designs. Such efforts sharpen questions and help focus on an appropriate research design that will produce useful evidence that can be tapped to solve practical problems.^[13]

Search for Evidence

The next step in EBP is the search for evidence. The purpose of the search for evidence is to enable both researchers and decision-makers to quickly access what is known about a particular topic. In addition to the usual criteria of relevance and recall, an evidence-based search uses special techniques to filter the retrieval, retaining only those items that meet criteria for quality. Indeed, the process of filtering evidence (“quality filtering”) prompted medical librarians to engage in evidence-based activities on behalf of healthcare practitioners.^[14,15] Evidence searching in biomedicine is greatly facilitated by using various “filters” that can restrict retrieval to specific study designs such as randomized controlled trials (RCTs).^[16] These filters limit retrieval to research studies and sort them by research design. When these tools are fully deployed, they constitute an infrastructure of systematic reviews, meta-analyses, guidelines, and statements of best practice that can support evidence-based medical practice.

An infrastructure comparable to that found in medicine does not yet exist in LIS; its modest research base is dispersed across many cognate disciplines such as computer science and technology, education, management, and other social sciences where there are many different approaches to research. While standards for structured abstracts, such as those required by MLA, can simplify the process of retrieving a body of relevant work, they have yet to be universally adopted, and indexing terms do not typically identify study design.^[17,18] Lacking this infrastructure, most LIS searchers employ citation searching, pearl-growing, or snowball strategies enhanced with text words to identify research studies from which evidence can be extracted.

Systematic Review and Evidence Appraisal

The literature search is part of the larger process referred to as a systematic review. A systematic review is a concise summary of the best available evidence that addresses a well-formulated question. It differs from the traditional literature review in that it includes a detailed description of the search strategy, the date(s) of searches, and databases searched (including hand searches) because it is expected that it will be replicated and updated. A systematic review aggregates and synthesizes research findings rated by the strength of their evidence—their validity or freedom from bias, their reliability or trustworthiness; and their applicability or impact. Differences in these dimensions are usually a function of the research design itself,

Table 2 EBL levels of evidence, revised.

Prediction	Intervention	Exploration
Systematic review	Systematic review	Systematic review
Meta-analysis	Meta-analysis	Summing up ^a
Prospective cohort study	RCTs	Comparative study ^b
Retrospective cohort study	Prospective cohort study	Qualitative studies ^c
Survey	Retrospective cohort study	Survey
Case study	Survey	Case study
Expert opinion ^d	Case study	Expert opinion ^d
	Expert opinion ^d	

^{a-d} Eldredge, J. The most relevant and answerable research questions facing the practice of health sciences librarianship. *Hypothesis* 2001 15 (1), 9-14,17. <http://www.mlanet.org/p/cm/ld/fid=737&tid=511&sid=647>.

and because research varies in rigor, each study must be retrieved and reviewed, and the evidence extracted and rated according to a specified protocol. The process of rating the evidence is called evidence appraisal. The results of the appraisal are presented in a format referred to as an evidence table that orders the research according to the strength of its design.

A hierarchy of evidence was first developed in clinical medicine, where the RCT was placed at the top of the hierarchy, reflecting its importance in determining effectiveness of therapeutic interventions. RCTs are rare in LIS; nevertheless, research evidence can be appraised, and several approaches to appraising LIS evidence in LIS have been proposed. Eldredge's^[13] hierarchy of evidence is one of the most well known and resembles the one used in clinical medicine; see Table 2.

In addition to classifying the levels of evidence, critical appraisal of evidence entails detailed analysis of each study selected for inclusion. There are numerous dimensions that can be used; in medicine, for example, there are estimated to be as many as 40 systems used to appraise or grade evidence. These systems incorporate both quantitative and qualitative measures, the former being represented by measures such as statistical power and effect size, while qualitative measures may use designations such as "gold star" or "fatal flaw."^[19]

Because the systematic reviews are fundamental to EBP, bringing them together in a searchable database serves an important purpose. The Cochrane Collaboration, begun in 1993, is the oldest and largest collaborative effort in which hundreds of researchers cooperate to search the medical literature, appraise the evidence, and publish systematic reviews.^[20] While the majority of these are only tangentially related to LIS EBP, they can sometimes be useful; see, for example, the Cochrane Collaboration review on opinion leaders, as well as the collection of Methodology Reviews. In addition to the Cochrane Collaboration, the Cochrane Library collects other databases containing high-quality, independent evidence.

In LIS, Glynn^[21] has developed a critical appraisal tool for LIS that effectively combines questions aimed at internal validity such as research design and execution, with external validity such as whether the evidence is meaningful in a particular setting. Answering these questions can help determine the value of a research report to an organization and problem at hand.

Another evidence-based resource of potential use to LIS is the Campbell Collaboration whose mission is to provide high-quality, sound evidence for practitioners and the public when making decisions about public policy, particularly in education, criminology, social welfare, and other policy areas.^[22]

Meta-Analysis in LIS

Meta-analysis is another important part of EBP in many fields. It is a procedure in which statistical techniques are used to summarize the data of several comparable studies. To conduct a meta-analysis, the study design must be sufficiently detailed and transparent to assure that the studies are comparable. Unfortunately, the research base in LIS lacks standards for reporting research, making it difficult to draw conclusions across multiple studies. Despite these limitations, there are some examples of meta-analysis in LIS research. See, for example, Trahan's^[23] meta-analysis comparing computerized searching to paper-based searching, Chen and Rada's^[24] meta-analysis of hypertext systems, Saxton's^[25] meta-analysis of reference services, and Koufogiannakis and Wiebe's^[26] meta-analysis of methods for teaching information literacy skills.

In order to accomplish the goal of providing a succinct summary of what is known in an area to facilitate and support decision-making, an alternative to meta-analysis known as meta-synthesis has emerged in LIS. Although meta-analysis is usually conducted using quantitative data, the approach described by Light and Pillemer^[27] can produce useful, reliable summaries of research using many different research designs. Their checklist of 10 questions to ask in assessing a review can be particularly useful in LIS because of its applicability to education, policy, and other social science studies. Urquhart describes the technique of meta-synthesis and applies it to information behavior research.^[28] Ke and Cheng examine issues surrounding the application of meta-analysis techniques in LIS, and they conclude that although the body of research in LIS is not currently large enough to support robust meta-analyses or meta-syntheses, the benefits are sufficient to warrant taking steps toward that goal.^[29]

Apply the Results

Applying the results from a systematic review is a goal of EBP, but it is often this step that presents the great barrier. In medicine, the phrase "from bench to bedside" is frequently invoked to illustrate the transition that must take

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Fig. 1 Examples of evidence-based research from LIS.

Source: From *The Research Imperative: The Research Policy Statement of the Medical Library Association*, by C. Perryman and J. Marshall. In *Appendix 2 Selected Bibliography: Evidence-Based Librarianship*, file:///C:/Users/pwd28/Downloads/2007_mla_research_imperative_full.pdf (accessed January 13, 2017); Reprinted from Dalrymple, P.W., *The application of systematic research, in Administration and Management in Health Sciences Libraries*; Forsman, R.B., Ed.; Medical Library Association and Scarecrow Press, Lanham, MD, Vol. 8, 173–194, 2000, Current Practice in Health Sciences Librarianship. With permission from the Medical Library Association.

place for the results of research to be used in patient care. While much has been written about the slow pace with which research is translated into practice, caution must be exercised to avoid exposing patients to therapies whose effectiveness has not been established or whose side effects not fully explored.

In LIS practice, applying evidence obtained from systematic reviews requires an organizational culture that values research and provides incentives and opportunities to practice the basics of EBP. The lack of easily accessible evidence tools and the relatively small research base in LIS contrasts with clinical medicine and creates additional challenges for creating a culture of EBP.

Two recent initiatives have attempted to address this problem. EBLIP advocates conducted Delphi studies in North America and Sweden and developed a research agenda whose objective is to create an evidence base for LIS practice by encouraging a collaborative community of EBP LIS professionals willing to address each of the research questions. This community of practice would undertake both basic research and systematic reviews of existing research to augment the current evidence base supporting LIS practice.^[30]

Another approach advocates building an “evidence base” that can support data-driven decisions. Nicholson proposed aggregating data from multiple sources into a data warehouse that can be used to explore patterns in the data.^[31] While such an approach might lead to “fishing expeditions,” current advances and refinements in data mining techniques are promising. An advantage of using

data is that they reflect the “real world” in all its diversity, rather than an “artificial” or “ideal” world created as part of a research study. This approach—referred to as practice-based evidence—contrasts with EBP and has only very recently been considered. The Association for Research Libraries’ LibQUAL+ suite of services to solicit, track, understand, and act upon users’ opinions of service quality that can be adapted locally may be regarded as an example of practice-based evidence because it uses a systematic approach to data collection and analysis.^[32] Comparing the evidence to the local situation on variables such as user population, budget and funding source, circulation, collection size and characteristics, as well as overall mission and values can help the practitioner assess whether the outcomes presented in the evidence are comparable to the local context and therefore applicable to the problem under consideration.^[33]

Fig. 1 lists examples of LIS research that exemplify evidence-based approaches to solving problems of library and information practice.^[34] To encourage additional work along these lines, EBP researchers and advocates have written extensively on the transfer of research to practice, and the EBLIP literature contains numerous articles that provide practical suggestions for implementing EBP.^[33–39]

Evaluate the Effect

The final step in EBP is evaluation, which includes an assessment of the effort itself and using that assessment in future planning. In this regard, EBLIP benefits from

and uses typical evaluation and assessment techniques. Among them are performance and output measures, quality improvement, audit and feedback, benchmarking, and other performance indicators, to name just a few. Some advocates for EBP have noted that Schön's notion of reflective practice is particularly compatible with the spirit of inquiry implied by the term "reflective practitioner."^[40,41] Through reflective practice, EBLIP professionals engage in a cycle of inquiry, evaluation, reflection, and renewed inquiry that suggests the initial character of EBM—conscientious and judicious, as well as scientific, practice.

SUMMARY

EBLIP is an approach to professional work in which scientific evidence provides the basis for systematic problem-solving. EBLIP encourages both the conduct and the application of practical research in order to improve information practice.

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Exhibition Design

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Abstract

Exhibition design, sometimes called exhibit design, is the conceptualizing, planning, and creating of exhibitions—built, spatial environments that communicate with audiences moving through them. As a field of practice, exhibition design has only recently begun gaining definition and standards. Meanwhile, it is flourishing worldwide, as exposition attendance soars, retail environments reinvent themselves, and cultural institutions increasingly appeal to tourism and promote themselves as centers of entertainment, as well as education. Bringing together a constellation of disciplines, exhibitions are designed by teams working through a phased process that translates a script into an immersive experience. Audiences engaging with the experiences interpret them through interactions with their elements, including their architecture, colors, lighting, graphics, artifacts, and media. Design teams continually develop understandings of their audiences as they plan and arrange exhibitions' elements in context. As exhibition design expands in the beginning of the twenty-first century, it turns up new challenges, but as with all design fields, exhibition design views challenges as opportunities.

INTRODUCTION

Exhibition design, sometimes called exhibit design, is the conceptualizing, planning, and creating of exhibitions—built, spatial environments that communicate with audiences moving through them. Broadly, any exhibition can be categorized as either cultural or commercial, but more commonalities than differences are shared across this border. Really it is the permutation of many particularities, including content, intention, size, setting, duration, expected audience, and experience type that determine what an exhibition can be and how it gets designed.

In the world of museums, there are those that use artifacts, archival images, and text to document events for visitors with preexisting knowledge, and those that engage wide audiences in explorations of phenomena, ideas, and themes through interactivity and play. Among visitor centers, many attract year-round tourism to civic icons, while others showcase corporate accomplishments to employees and invited guests only. From trade shows to international expos, independent environments compete on the same floor for the attention of industry associates or the general public, whose interests in a new product, brand, or philosophy can translate into investment. Any of these exhibitions can be open for a matter of days or decades, and designing them requires attending to their distinct natures appropriately.

All exhibitions are designed by teams. To be sure, the exhibition designer's contribution is the core of the work, as the final product is inevitably a physical environment that functions and directs people in intended ways.

However, in order to create a total design, subteams, who together determine the story that guides the design, give the design its shape and tone, plan and create vital elements, and build and install the actual components.

Because the field of exhibition design is quite young, few exhibition designers, or design team members for that matter, have come to their titles through a course of exhibition design study. Rather, most approached the field through one of several avenues: designers through architecture, industrial design, commercial package design, and furniture design; and other team members through education, anthropology, and creative writing. Each of these has some bearing in exhibition design, but also requires designers and team members to think beyond their fields and work cooperatively, as none address all of an exhibition's needs.

Like all processes, the exhibition design process follows a sequence of phases, moving from concept design to schematic design, into design development, and finally fabrication documents and fabrication and installation. Each of these phases, often referred to differently by different designers, can be further delineated into smaller steps, and are typically completed in a reiterative fashion. Culminating in the production of documents that signify milestones and transitions, the phases keep team members working toward common goals in a shared time frame, and enable ongoing assessment of a project's progress that is captured and presented. A truer exploration of exhibition design would require quite a bit more space, and a few exceptional books have been written for that purpose, including David Dernie's *Exhibition Design*, Larry

Klein's *Exhibits: Planning and Design*, Kathleen McLean's *Planning for People in Museum Exhibitions*, and Jan Lorenc, Lee Skolnick, and Craig Berger's *What Is Exhibition Design?* Also, because the field is one that is constantly reinventing itself, a richer understanding of exhibition design can be had with some continual study. Periodicals, like *Exhibitor* and *Exhibitionist* would encourage this, as would attendance at conferences, like the annual American Association of Museums conference. Finally, the best way to discover the burgeoning field of exhibition design is to visit exhibitions. Each one is so different from the next that comparisons made between them would awaken any curious person to the craft invested in them.

A last note: The background shared by the writers is mostly of cultural exhibition design in American settings. Much has been done to reach outside this limited scope, but the history of exhibition design in Europe, and the excitingly expanding field in both Europe and Asia are topics that easily warrant entire articles all their own. Exhibition design has unquestionably become a worldwide phenomenon, and its ubiquitous trends are reaching into other fields everywhere. While this entry is reliable in its overview of exhibition design, there is much more to explore, and readers are enthusiastically encouraged to do so.

HISTORY

The origins of exhibition design are at once self-evident and evasive. Humans naturally arrange objects for the communication of particular statements. We do it in our homes and other environments. Arguably, creating exhibitions is innate, and people have been doing it since the day they realized they could manipulate their surroundings.^[1]

European Roots

Appearing in biblical passages and Roman history, trade fairs are as ancient as trade, itself, but trade fair exhibitions as they appear today have their roots in European history, as do exhibitions in museums.^[2,3] The first of the known major fairs, which has continued since at least 1165, was the *Leipziger Messe* in Leipzig, Germany.^[4] Meanwhile, the origins of museums has been traced to the European Age of Enlightenment, when proponents of the Age's interest in making sense of the world, cultivated the first natural history collections in *wunderkammern*, or *cabinets of curiosity*.^[5] Essentially the province of royalty and the Church, several *wunderkammern* grew into renowned institutions, the *Modern Museums of Copenhagen* and the *Louvre* among them.^[6,7] While most *wunderkammern*, overflowing with collectibles and exotic rarities, were meant to impress onlookers with their owner's prestige, a number showed early signs of design,

like thematically arranged floor plans and inclusion of interpretive text.^[8,9]

Transition to Planned Experiences

In 1786, Charles Willson Peale brought museums to the public, opening *Peale's American Museum* in Philadelphia, PA.^[10] While Peale's museum set a new precedent for curation, that of collecting and displaying culturally representative objects for the benefit of its visitors, its displays followed from the *wunderkammern*, voluminous, and somewhat indiscriminate. This style would hold sway until the *Museum of Modern Art* in New York shifted the paradigm in the 1940s with minimally displayed arrangements of "empathetic" pieces.^[11]

Meanwhile, in the commercial sphere, exhibition design took a leap forward in 1851 with *The Great Exhibition of the Works of Industry of All Nations*.^[11] Planned by Prince Albert and Henry Cole of England, the *Great Exhibition* was the first truly international exhibition. Bringing 13,000 exhibitors and 6,000,000 visitors together under the roof of Joseph Paxton's *Crystal Palace*, the *Great Exhibition* set the standard for future expositions, and led to the formation of formal oversight organizations, like the *Bureau International des Expositions*. In the coming years, expos grew increasingly impressive, with permanent structures designed by reputable engineers and architects, including the *Eiffel Tower* by Gustave Eiffel for the 1889 *Universal Exhibition*, the current *Museum of Science and Industry* for the 1893 *World's Columbian Exposition* in Chicago, and the *German Pavillion* by Ludwig Mies van der Rohe for the 1929 *Barcelona International Exposition*.^[12-14] Also in the nineteenth century's latter half, department stores began appearing worldwide. Their competition for an emerging spending culture led them to install exhibitions of power and branding in their entrances and main floors.^[15] *Wanamakers* in Philadelphia built a *Grand Court* with a commanding bald eagle as its dome.

Toward a Contemporary Vision

In 1939, expositions moved into a new era. With the *New York World's Fair's* theme *Tomorrow's World*, expos began addressing humanity and cultural issues, rather than technology and inventions.^[16] Amusement rides and stage set architecture set the scene for designers to begin creating entire environments at fairs, one more exciting than the last. Following this course, the 1964 New York World's Fair marked a seminal moment with 140 full pavilions, four designed by the Walt Disney Corporation, and one by Charles and Ray Eames. Disney, equipped with a team of *Imagineers* and a list of *Mickey's Ten Commandments*, had by this time opened Disneyland in California, 1955.^[17] The Eames team, with their chairs that both broke and set the mold, had already opened a

number of exhibitions, including the *American Pavilion* in Moscow, 1959, and *Mathematica* in 1961, which remained open at the Los Angeles Museum of Science and Industry until 1998, and has since been duplicated at several institutions.^[18]

Also at this time, many larger American institutions, like the National Museum of American History and the Field Museum of Natural History, created exhibition planning departments, shifting power away from curators. These departments created *blockbuster* exhibitions, like the Field's *Tut*, that drew enormous crowds and set a new pace for museum exhibition design. In this atmosphere, museums began rethinking the purpose of exhibitions and the structures of the departments responsible for them. Michael Spock of the field museum advocated for including into design teams educators and content developers who could translate scholarship into stories for general audiences. Frank Oppenheimer of the Exploratorium in San Francisco challenged the nature of museum exhibitions altogether, populating them with interactive experiences from which visitors derived their own interpretations. A series of workshops at the Field in 1982, sponsored by the W. K. Kellogg Foundation demonstrated the effectiveness of a team approach to designing museum exhibitions, an approach that has been adopted and adapted by museums far and wide.^[19]

Today, at the onset of a new century, fairs, trade shows, and expos around the world draw attendance rates rivaling those of the Olympic Games.^[20] Museums and visitor centers find themselves competing for expanding tourism and audiences looking for entertainment as much as education.^[21] Design firms are increasingly contracted to plan both cultural and commercial exhibitions, and the resulting cross-pollination is benefiting both arenas.^[22] Undoubtedly, exhibition design is flourishing, and work by firms in Japan, Korea, and other Asian nations is inspiring exciting movement worldwide.^[22]

ELEMENTS

All exhibitions are compositions of space, architectural elements, materials, graphics, color, lighting, and acoustics. Most also include objects, artifacts and images, and increasingly media components. The available variety of materials and methods is remarkably vast, and expanding rapidly with technological advances. The possible uses of them in shaping immersive, transcendent experiences for visitors are as many as the needs of each individual exhibition, and those needs are governed by the exhibition's narrative and context.^[23]

Narrative

The narrative, also variably known as the script, messaging, or storyline, is in plain terms what the exhibition is

about. It is developed from a body of knowledge, a corporate philosophy, a set of ideas, concepts or messages or a promotion of a brand, and subsequently completed with additional research as necessary. Structuring the information to be presented in the exhibition, the narrative also suggests how the information should be accessed and interpreted. Thus, it sets the foundation for decisions about how the environment will communicate with its visitors.^[24]

Context: Physical and Cultural

An exhibition set inside a building not yet constructed, allows opportunities to work with an architect in tailoring important features to the exhibition's needs. These can include circulation, ceiling heights, natural lighting, and access to mechanical, electrical, and plumbing systems. However, more often designers plan exhibitions for existing buildings, working either with or around the context's features.^[23] Meanwhile, the situation of an exhibition in a surrounding culture determines who might attend it, and how it might be interpreted by attendees, as well as by press outlets, schools, various communities, and other groups. Depending on its reach, an exhibition's cultural context can require wrestling with every detail of its narrative and design, especially in the handling of controversial topics.

Space

Space is the volumetric area that the exhibition organizes and thematically conditions. It is usually contained by structural walls, a floor and a ceiling within an interior, or imaginarily assigned within a larger interior, as with the space designated to a trade show booth. An exhibition can also be outside, but its space is still limited and its organization is still in the designer's hands. To organize space, designers consider aesthetic and experiential properties, including scale, proportion and balance, site line, and visitor flow, among others. All together, these properties choreograph the positioning of exhibition elements in relationship to one another.^[25]

Architectural Elements

Architectural elements are those that are constructed to define the exhibition's space and display its feature elements. Walls built to partition spaces, ramps pitched to steer visitor flow, platforms created to elevate experiences, and built forms inserted for interpretive effect are just a few examples. In interactive exhibitions, these elements also serve a second purpose of housing and protecting mechanics and audio/visual and computer equipment. Furniture built for comfort or as part of an experience, and cases that contain collection items or display products are also architectural elements that have design qualities all their own, and whose appearance in the space further defines it.

Materials: Construction and Finishes

Materials are used to build the exhibition's architecture, enable the mounting and presentation of other elements, and evoke particular associations and sensations. Construction materials, often hidden from view, are usually generic, like wood, steel, drywall, and fiberboard. Finishes are materials that exhibition visitors see, or that support the other elements that visitors see, like affixed graphics and painted colors. Traditionally, these materials have been finished woods and different grades of glass, as in the display cases of object-based exhibitions.^[26] Recently, technological advances have opened an expansive repertoire of materials to designers, including ranges of new metals, plastics, and laminates, making it easier to evoke emotions and interpret information and themes through shape and texture. New materials also aid in placing graphics and colors in desired locations, as their properties make them lightweight and receptive to paint and adhesives.^[27]

Graphics

Graphics are two-dimensional designs applied to surfaces. In some instances, they are painted directly onto finishes. More often, they are created with computer software, printed on substrates with adhesive backings, and applied to surfaces prior to their installation. Featuring text, diagrams, and images, graphics are used to deliver information and suggest context. Composed of typefaces, color palettes, patterns, and illustrations, graphics are also used to set an exhibition's tone, and unify its interpretive and navigational systems. As computer and printing technology advances, graphics are increasingly designed to cover large exhibition surfaces, like entire walls, floors, and ceilings.^[28,29]

Color, Lighting, and Acoustics

Color, lighting, and acoustics can be grouped together as environmentally interpretive tools. They are often the most effective tools in transporting visitors to believable places, or immersing them in convincing ideas. Colors conjure emotions and psychological associations, especially in juxtaposition or cooperation with one another. Lighting both makes things visible and sets a range of moods. Acoustics control sound, dampening it in some places, and allowing it to escalate in others. Together, these elements make a richly interpretive exhibition experience possible, and also strongly influence its feeling.^[30]

Objects, Artifacts, and Images

Objects, artifacts, and images are often a client or institution's reason for creating an exhibition, in the first place. In many cases, the display of one or more of these elements is intended to create a brand by which an institution or

business becomes known to the public. They can be small enough to require a microscope, or large enough to fit groups of people inside; sensitive enough to warrant controlled conditions, or best experienced through touch and manipulation. Exhibition designers create environments that both highlight these elements as attractions and storytelling elements, and protect them as necessary.

Media

Media in exhibitions commonly refers to on-screen media, which includes film, video, and interactive virtual experiences. Increasingly, media is becoming a standard expectation. A handful of exhibitions have even been designed with media as their central themes, or with media pieces serving as pinnacle experiences. Media has become highly sophisticated, able to respond to users in surprising ways, and to perform ever more complex functions. Fully immersive media experiences are now not only possible, but are even becoming commonplace. Balancing these powerful experiences with the rest of an exhibition has become an important challenge for designers.

PROCESS

From start to finish, the creation of an exhibition can take several weeks to several years, depending on its size and the complications of its content, context, and physical requirements. Certainly, every designer has his or her own approach to bringing an exhibition from nonexistent to open to the public, but all create through a process that advances through a series of work phases.^[31] Referring to the phases, designers often use different terminology, but commonly they are known in sequence as concept, schematic, design development, fabrication documents, and fabrication and installation.

From here, the process appears step-by-step and direct. However, the progression of an exhibition's design is rarely so simple and linear. Rather, designers work in what is called a reiterative fashion, meaning that within each phase iterations of designs are completed, reviewed, and revised until satisfactory. On a macro level, whole phases can be reiterated until complete; on a micro level, single drawings or written descriptions can cycle in their own reiterative processes. Further emphasizing the process' reiterative direction, exhibition designers typically allow for returns to previous process phases either to complete unfinished steps, or to revise designs as new information and insights emerge. In mapping a process at a project's outset, designers try to plan ahead for these motions, doing their best to keep to schedule and within budget.

Throughout the exhibition design process, a succession of document sets, or packages is produced. Each set signifies a benchmark, simultaneously presenting the culmination of

the designer's work up to that point, and establishing the new foundation from which the work will continue. Titled after the process phases they complete, the document sets are typically known as concept, schematic, design development, and fabrication documents. In the fabrication and installation phase, there are no benchmark documents, as the culmination of this phase is the opening of the exhibition itself.

Concept

The concept phase marks the initiation of an exhibition design project. Its primary goal is the establishment of the exhibition's foundations, and its principal work is characterized by research, brainstorming, and exploration. To determine what the exhibition will be about, initial research into its topic is conducted, structured into a hierarchy or framework, and developed into a preliminary script. The script determines the exhibition's perspective or approach to the topic, and with it in place, the exhibition's general look, feel, and function begin to bloom through a series of brainstorming sessions. From the sessions, designers make explorations, sketching architecture, and exhibit ideas that could appropriately translate the script into an experience.

The concept document set can include:

- Concept outline, exhibition criteria, preliminary script.
- Sketches or diagrams of the whole space and its components.
- Analyses of projected attendance and circulation.
- Initial rough budget projections.
- Preliminary schedule.
- Suggestions of graphic style, copy style, and object and artifact placements.
- Suggestions for marketing and outreach.

Schematic

During the schematic phase, the approved concept is used to create a preliminary design for the entire exhibition. The goal of the schematic phase is to identify the exhibition's components and make them imaginable, while leaving room for their details to be developed and debated. Extending from the preceding phase, script writing, brainstorming, and exploration continue until the concept is fully fleshed out, and a design for the entire exhibition can be proposed and discussed. Making this possible, designers begin seriously assessing the physical context in which the exhibition will be installed, as well as the host's resources for marketing, outreach, and staffing.

The schematic document set can include:

- Finished preliminary script.
- Revised project budget and schedule.

- Floor plans.
- Sketches of vignettes and component elevations.
- Foam core spatial models and mock-ups, or photographs of them.

Design Development

While the body of the exhibition has been made imaginable by the schematic designs, its details still need to be elaborated. The goal of the design development phase is to specify the exhibition's details. The thrust of the phase is in making definite choices about the tangible things that will compose the three-dimensional environment, including materials, colors, graphics, text, equipment, lighting schemes, A/V scripts, and computer software. The decision-based character of design development shifts the focus of the exhibition design process from imagining possibilities to making the chosen possibilities work.

The design development document set can include:

- Plan, elevation, and sectional drawings of all exhibition components.
- Written descriptions of all exhibition components.
- Preliminary *schedules*, lists of materials, graphics, A/V equipment, and hardware and descriptions of their uses.
- Updated project budget and schedule.

Fabrication Documents

In the fabrication documents phase, the decisions made in the design development phase are incorporated into a set of technical drawings and specifications. The goal of the fabrication documents phase is twofold: first, to produce documents so highly detailed that they can serve as instructions for fabricating the exhibition; second, to identify a fabricator. Every detail of the exhibition, down to its literal nuts and bolts, is specified, recorded in *schedules* and indicated in hard-line drawings. Once this is done, designers open a competitive bidding process, unless a trusted fabricator is already known. Designers also open bidding for other contractors, including media producers, graphics producers, and copywriters, if they have not yet been chosen.

The fabrication document set can include:

- Hard-line, dimensioned plan, elevation, section, and "exploded" drawings of every exhibition component with close-ups of important details and specifications of materials and hardware.
- Finalized *schedules*.
- Plans for lighting, electricity, A/V connections, mechanics, and plumbing.
- Final project budget and schedule.

Fabrication and Installation

The final phase, fabrication and installation, takes the exhibition from drawing and study to actuality. The goal of this phase is a successful opening, and to get there takes meticulous decisions on behalf of clients. First, the fabrication drawings are delivered to the chosen fabricator. The fabricator reviews them and returns them as *shop drawings* with suggestions of necessary, and sometimes creative revisions. The designer then reviews the revisions, and either approves them or makes further suggestions. This back and forth shuttling continues until the fabricator is confident he or she can build precisely what the designer wants. Ensuring the fabrication meets the design's intents, the designer makes frequent visits to the fabricator's shop during this phase, as well as to the studios of other contractors. Present at the exhibition's installation, designers watch over details to the very end.

No documents are delivered during the fabrication and installation phase. The culmination of the phase is the exhibition's opening.

UNDERSTANDING AUDIENCE

Throughout the process, designers strive to understand their audience as best they can, and get ideas from them about how to better the exhibition's design.^[32] To reiterate the point: Any exhibition is a medium for communication. Its very purpose for being built rests on the fact that people will visit it.^[33] Who those people are—children, adults, scholars, the general public, etc.—determines the verbal, visual, and experiential language most appropriate for the dialog.^[34–36] Cultivating an understanding of the audience not only encourages an exhibition's success, it recognizes its responsibility. To this end, many designers conduct formal studies of their audiences at different phases of the process. Often, contracted evaluators are hired to perform these studies more systematically and objectively.^[37]

Initial Understanding: Front-End

During the concept phase, or even prior to it, many designers conduct *front-end evaluations*. Learning what an audience already knows and feels about an exhibition's topic can help set the parameters of its script and influence its possible presentation and tone. Considering an audience's abilities and learning styles helps produce exhibits that are suitable for them. Certainly, fair generalizations about an exhibition's intended audience can be made with demographics, learning theories, and past precedents, but many designers prefer to “meet” their audiences, or representatives thereof, through formal studies, such as questionnaires, focus groups, and interviews.

Informed Understanding: Formative

Arguably, the most useful evaluation, *formative evaluation*, can be conducted in the schematic design phase, when it becomes possible to gauge audience reactions accurately before moving into the latter decision-making phases.^[38] By providing them with drawings, designers can ask evaluation participants direct questions about a fairly imaginable exhibition. By presenting them with foam-core mock-ups, designers can observe participants' interactions with their designs, often adjusting the mock-ups to test various possibilities. Follow-up interviews and questionnaires provide insights into what audiences are deriving from their experiences. Results and recommendations from these tests are used to finalize schematic plans and prepare for making determined design decisions in the next phase.

Specific Understanding: Prototyping

During the design development phase, concerns about the operations of particular exhibit components arise. Because the level of detail is so specific in this phase, it becomes possible to build full-scale *prototypes* of these components. If the budget allows, designers can try variations of actual materials and mechanics until the component works exactly as intended. Including audiences in prototype testing can be extremely informative, as very reliable observations can be made from their engagements with and reactions to the exhibition.

Final Understanding: Summative

No better reaction to an exhibition can be gauged than that of an actual audience in the actual space. Often, designers add a postopening phase to the exhibition design process during which modifications can be made to exhibit components that for all their planning do not result as intended. Formal studies of audiences during this phase, known as *summative evaluations*, time and observe interactions and behaviors, and gather audience responses through interviews. The findings of these studies can often point to simple solutions to apparent issues, or lessons for the next project.

DESIGNERS AND DESIGN TEAMS

Because by their nature, exhibitions are cross-disciplinary experiences, they are designed by teams. Depending on the size of the exhibition, teams can be comprised of individuals, or entire departments. In many cases, coordination of the players' contributions, and assurance of their mutual understanding of a shared process are as crucial for a project's success as any individual's talent.

The assembling of a team can be the task of a lead team member, or a manager who serves a more supervisory role. In most design firms and museum exhibition departments, team members are chosen from full-time staff. Meanwhile, it is not uncommon for firms and departments to complete teams by hiring freelance workers. In some cases, teams are formed solely for the project at hand. In still other cases, teams can include a core team surrounded by peripheral ones, made up of hired experts, volunteer advisors, interested community members, and so on. In any instance, when assembling a team, the goal is to select compatible team members, whose talents and interests match the needs of the exhibition, some of which will unfold as the project develops.^[39,40]

Making decisions together, and communicating in general, are critical tasks for exhibition design teams, especially those working on large projects that take years to complete. Many models exist for structuring teams and enabling their collective efforts.^[41] They range on a spectrum from linear hierarchies, with one chief decision maker, to egalitarian committees that strive for consensus.

Similar to teams working in other fields of design and communications media, exhibition design teams generally divide their responsibilities into at least two sides (not a technical term, but one commonly used), one to handle the development of the story, *content*, and the other to handle its telling, *design*. Often, teams also include a third side, *project management*, to coordinate the actions of the whole team and supervise the production of the entire project.

Within their sides, individual team members work toward common goals, but it is through the collaboration between sides that an exhibition is fully designed. Both content and design bring their work to the table, and management ensures that the story and its telling remain within the project's feasibility. Thus, some permeability between sides is usually important for best practice. A team whose members respect each other's roles, but can think in each other's terms is the most likely to succeed with greatest ease.

Content Team

Responsible for the story itself, team members on the content side can include curators, educators, exhibit developers, interpretive planners, content developers, content coordinators, researchers, and writers. Collectively, their role is to cultivate the ideas, topics, and information to be conveyed in the exhibition, and articulate them in a manner that visitors will be able to grasp. The process of doing so typically follows a reiterative course of accumulating, editing and arranging knowledge that relies on research, organization, analysis, association, and story-writing skills.

In the design of exhibitions that are rich in objects and artifacts, content team members also maintain knowledge

of available collections and external sources. Sometimes, entire stories are constructed around the showing of a single item. Other times, it is through categorizing items and selecting the most totemic ones that a story emerges. Knowing what is obtainable, and understanding how the inclusion and omission of particular objects and artifacts will affect a story is the job of content team members.

Once a compelling story has been developed, the collective role of content team members becomes that of ensuring that the design expresses it, and that the expression is appropriate to the intended visitors. Often, this calls for responses to evaluation findings, and additional research and development to inform the details of the story as its translation manifests.

Design Team

Determining how to tell the story, the design side of the team can comprise a variety of designers from various disciplines, including graphics, media, lighting, and acoustics, all of whose work is coordinated by a lead exhibit designer, typically also supervising the efforts of junior exhibit designers. Oftentimes, draftspeople, model makers, illustrators, and other talents are added to the design side to aid its diverse disciplines. All together, design team members give the exhibition dimensionality that people can enter, navigate, use, and share.

Beginning with rough sketches, designers' transition to drawings, and finally hard-line drawings as they reiteratively conceptualize, plan, and detail the visual and experiential communication of the content. Inevitably, the act of drawing reveals problems in the exhibition's functionality and challenges to its proper expressions. Solving these problems is part of designing exhibits, and doing so often requires invention. Most designers welcome such detours, viewing their pursuit as opportunities to make their designs unique and successful.

As the exhibition develops, the various designers' work affects each other. Graphics influence the exhibition's look, light reflects on graphic surfaces in unexpected ways, audio from media transforms acoustic spaces. Meanwhile, each of the design contributions carries material concerns. Lighting grids need to be suspended and electrically wired, graphics need substrates that adhere to surfaces, and acoustics call for very specific finishes. Each of these is researched, sized, and specified by the design side, and the responsibility for all of it fitting together, both conceptually and tangibly, resides with design team members.

Project Management Side

Responsible for the exhibition's opening on time and within budget, the management side of the team usually includes one project manager. Typically the liaison between the team and the project's client, the project

manager drafts a scope and a schedule and budget for its completion, and communicates progress, delays, and changes between parties. Because the project manager remains aware of time, money, and the client's concerns, design teams frequently look to him or her to remind them of parameters on their creativity. While this can be a politically sensitive position, it is a critical one. Not only does it help the team accomplish the job properly, but it also protects team members from investing beyond the project's bounds, keeping them from overworking and making sure they'll be available when needed for the next project.

Because bringing an exhibition to its fruition involves the weaving together of so many efforts over time, coordination is the project manager's principal and constant task.^[42] With the many team members working independently on their ends of the project, the project manager resides at the center, keeping everyone apprised of each other's progress, and helping maintain the team's camaraderie and morale. At times, this can require great tact, as any one team member's progress can easily influence changes, or even pose difficulties in that of another.

CONCLUSION: CONTEMPORARY TRENDS AND CHALLENGES

The current state of exhibition design is an effervescent one. Still relatively young, and certainly younger than the museums and expos it services, its movement toward becoming a formalized field has accelerated in recent years, but its standards of practice have yet to be codified. Only a handful of design schools teach it as a subject, and only in rare instances is it offered as a full course or major.^[43–45] Professionals of various types are filling its positions, and their writings about their own experiences are some of the first. Meanwhile, exhibition design is growing by leaps and bounds, and gaining momentum around the world, as cultural institutions, corporations, businesses, public awareness campaigns, city governments, and more call upon the unique mode of communication that only exhibitions can offer.

The Next Big Way to Present the Next Big Thing

Over the last few decades, attendance rates at international expos have skyrocketed into the tens of millions. Meanwhile, casinos like *New York, New York*, and retail chains like *Apple*, *Niketown*, and *IKEA* have realized the power of reshaping their stores into total, experiential environments.^[46] In both arenas, the goal of communication is to present the next big thing, be it a product, brand, lifestyle, or philosophy. Competition in the commercial sphere has become intense and fast-paced, and designers are constantly looking for the next big way to present the next big thing. As a result, in many ways, commercial exhibition

design has become a proving ground for many new technologies, materials, and strategies.^[47]

More and more frequently, these new technologies, materials, and strategies are also being incorporated into cultural exhibition design. One possible reason is that most exhibition design firms work in both arenas, often supplementing their abilities in the cultural sphere with earnings from the commercial sphere. Another is the recently emergent phenomenon of in-house teams collaborating with contracted designers, who give shape to expertly researched content in institutions whose staff knows the audience quite well.

New Perspectives of Interpretation

In years past, knowing an audience was less valued by cultural institutions who viewed themselves as having a more authoritative role. The shift toward gauging visitor expectations and interests, often through focus groups, surveys, and other tools familiar to the commercial sector, is a recent one that is swiftly setting a new paradigm. Responding to visitors, cultural institutions have learned how to maintain and expand their public reach. Enabling this response, designers increasingly plan exhibitions that are more able to communicate with particular audiences. To do so, many design teams have added educators to their talent and educational theory to their tool kits.^[48] Not limited to cultural exhibitions, commercial designers have also begun to consider experiential learning, constructivism, multiple intelligence theory, theories of intrinsic motivation, and others as helpful guides in creating communicative environments.^[49–52]

Universal Access

Along the same lines, a recent phenomenon is the requirement of planning for people with disabilities. While designers have always taken this into consideration, as one goal has always been to reach as many people as possible, allowing for universal access has in many places become enforceable by law. In the United States, title III, section 36.101 of the Americans with Disabilities Act (ADA) of 1990 “prohibits discrimination on the basis of disability. . . and requires places of public accommodation and commercial facilities to be designed. . . in compliance with the accessibility standards established” by the ADA.^[53,54] As stated in explicit terms, exhibition designers, like the designers of any nonresidential facility, are now legally obligated to plan environments that do not exclude physically impaired people. The ramifications of this are enormous, as are the opportunities. On one hand a suite of new constraints are imposed; on the other hand, implementing standards like the ADA's positions designers to revolutionize communities by creating wholly inclusive environments.

New Narratives

The trend in museums to respond to visitors' interests has engendered the rise in popularity of issue-based exhibitions, made possible by a popular push away from object-based exhibitions and towards concept-based ones. As race, death, health, fear, and other conceptual explorations become crowd-draws for museums, exhibitions are changing shape to suit a very different genre of narrative. Designers increasingly plan environments that embody questions and journeys, rather than simply representations of topical times and places.^[55]

New Technology

One undeniable force that has transformed exhibition design in just the last few years is digital technology and the hurrying pace of its advances. Computers are now small enough and powerful enough to easily be hidden from view, while providing incredibly rich experiences. Video and screen-based interactivity can deliver massive amounts of self-discovered information without consuming much space. The temptation to fill an exhibition with digital experiences is a pressing one for many designers, and often something close to that is requested by a client.

Meanwhile, computers' shrinking dimensions and escalating abilities are placing more of them in more people's homes and pockets, equipping people with rich experiences that require no environmental contexts. The need to create digital experiences that are unique, or more sophisticated than what is available to consumers, has become demanding for exhibition designers. Likewise, the challenge of designing real environments equally or more exciting than virtual ones has become an actual pressure.^[56]

One emerging solution is the design of digital experiences that are integrated into exhibition environments.^[57] As technologies like motion tracking and multitouch flat screens become more accessible, this solution has grown more viable. Another emerging solution is the invention of new technologies and varieties of interfaces. Speaking to both solutions, a new industry is burgeoning.^[58–60] Digital designers contracting with exhibition designers are gaining popularity, often winning bids for jobs as collaborative teams.

New Technology Backstage

The influence of technology's innovations is also revolutionizing exhibition design behind the scenes. Software applications, like *Photoshop*, *Illustrator*, *AutoCAD*, *3D Studio Max*, *Sketch Up*, *Revit*, and *Vectorworks*, have nearly rendered obsolete traditional design tools, like compasses, shape palettes, drafting tables, and pencils. At the same time, the Internet has become an indispensable resource for content developers and researchers, as well as

a location for idea-exchange forums hosted by design communities, like the Association of Science-Technology Center's *Exhibit Files* Web site and blog.^[61] E-mail and FTP's have expedited communications between teams and clients, and also made it possible to easily collaborate across oceans. The effect of this sweeping change of tools is not only immeasurable, but also hardly complete.

Accounting for Sustainability

All exhibitions are made of materials whose processing and transportation extracts natural resources and emits greenhouse gasses.^[23,62] Lighting, video projections, and other electrically powered elements drain large amounts of energy and produce pollution when sources of power are fossil-fuel-burning power plants. Publicly supported regulations and institutions like the World Green Building Council are setting standards for designers to follow, and making those standards achievable by helping grow an economy for them. As these concerns swell in the public conscience, designers have an opportunity to serve as vanguards by creating sustainable exhibitions visited by millions of people.

Looking Forward

In any field of design, the root of the practice is in presenting information and emotion in new and more effective fashions. Responsively, designers view the challenges of the day as abundances of promising opportunities. As today's exhibition designers plan environments that engage people in experiences in compelling new ways, they raise the field from its youth to its fruition. As they stay aware of trends and plan one step ahead of them, they raise the bar.

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Facet Analysis [*ELIS Classic*]

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Abstract

The brothers Foskett, Anthony and Douglas, have both made major contributions to the theory and practice of subject analysis and description. Here, Douglas Foskett explains facet analysis, a vital technique in the development of both classification schemes and thesauri. Foskett himself created faceted classification schemes for specific disciplines, drawing from the philosophy of the great Indian classificationist, S.R. Ranganathan.

—*ELIS Classic*, from 1972

INTRODUCTION

The term “facet analysis” was first introduced into discussions of bibliographical classification by S.R. Ranganathan to denote the technique of separating the various elements of complex subjects in relation to a set of abstract fundamental concepts. The *Colon Classification*^[1,2] is the only example of a general classification scheme covering the whole of knowledge that is entirely based on facet principles, but many other special schemes have been made using this technique, and a simple account of the methodology was presented to the Washington Conference on Scientific Information in 1958.^[3] Ranganathan has expounded the theory and practice in many writings; the basic theoretical work is the *Prolegomena to Library Classification*, of which the third edition has appeared,^[4] and advances in his research are regularly reported in the Indian journal *Library Science with a Slant to Documentation*. Perhaps the best introductions to his work, however, remain a paper to the British Society for Visiting Scientists given in 1948^[5] and a monograph prepared for the Library Research Monograph series of the University Library in Copenhagen.^[6] In the latter, Ranganathan defines facet analysis as

the mental process by which the possible trains of characteristics which can form the basis of classification of a subject are enumerated and the exact measure in which the attributes concerned are incident in the subject are determined. Facets are inherent in the subject.

B.C. Vickery, in a contribution for the Classification Research Group (q.v.), writes that “a faceted classification is a schedule of standard terms to be used in the subject description of documents,”^[7] and he has shown the relation of facet analysis to the general analysis of information in his article “Analysis of Information” (q.v.).

BACKGROUND

Classification, both the word and the process, begins with the Greeks, who used it for the purpose of forming definitions of *things*. For Plato, to know things meant to place them in their correct class according to their permanent, ideal form, or essence, and Aristotle in his *Logic* analyzed in detail the processes by which one could identify things by starting with a group or class of objects, and then eliminating all members of the class except the one aimed at, by enumerating specific properties not possessed by the others. Thus, by starting with the class, or *genus*, one could arrive at the individual, or *species* by enumerating properties that stated differences between one species and another. This form of division is still best seen in the so-called “classificatory sciences,” especially Zoology and Botany, in which the genera may be divided into the individual animals and plants; we may start with a class such as vertebrates, and by the division on the basis of successive characteristics we arrive at a chain of sub-classes such as mammals—(primates)—anthropoid—apes (chimpanzees). This sort of classificatory process proved of great value for the development of these sciences, and the description of individual species is still of value today. We can, for example, profit by the description of individual libraries and information services, studying their similarities and differences to arrive at a more general theory of what these organizations should be like under ideal conditions.

One of the most important aspects of the achievement of Melvil Dewey in the decimal classification was to show how the use of the decimal fraction notation could provide a systematic sequence of subjects, which mirrored this form of classification and which would therefore arrange books or other documents, such as index cards, in a pattern that would be readily recognized by the specialist in any subject as corresponding to the way in which he thought

about his subject. But the literature of specialist subjects in all fields, including the “classificatory sciences,” is no longer mainly a literature of description of individual species, as it was to a great extent in the nineteenth century. The field of knowledge has advanced in complexity, and specialist writing now consists much more of the discussion of the relations and interconnections subsisting between entities than of mere descriptions of the entities themselves. We need, therefore, a scheme of categories of terms which will do more than imitate the genus–species relation.

Dewey had already realized that this problem existed and provided for a certain element of synthesis as well as analysis in his schedules. He knew that any subject might in principle at least be subdivided geographically, but rather than enumerating a complete geographical table under each subject, he introduced the technique of adding on the schedule from the class 900, inserting a zero in front of the 9 to indicate that this was the point at which a new aspect (or facet) of the subject was about to be introduced. This process was carried much further by the International Federation for Documentation (q.v.) in its revisions of the universal decimal classification, and in his bibliographic classification, H.E. Bliss used the systematic auxiliary schedules to carry out the classificatory process which he called “composite specification.”

All of these schemes, however, failed to provide a systematic basis for the use of synthesis in classifying a complex subject, and the inevitable result is a mixture of subjects in the same array, arrived at by applying different characteristics of division in one series instead of one at a time. In the Dewey decimal classification, for example, we find arrays like this:

370	Education
370.1	Theory
370.7	Study
370.71	Meetings
370.72	Conferences
370.73	Teachers’ Colleges
370.732	Courses and programs

It is obvious that “Courses and programs” are not *species* (i.e., special types) of “Teachers’ Colleges,” and that “Teachers’ Colleges” themselves are not *species* of “Study”; on the other hand, “Conferences” might reasonably be called *species* of “Meetings.” The true nature of the various hierarchies are not demonstrated; all terms are enumerated as if the genus–species relation were the only one, and all subdivisions were examples of it.

The aim of the writer of a document is to study phenomena in the round; he observes all the aspects of a given entity—its appearance, its structure, and the interrelationships and interactions that exist between one entity or group of entities and another. He tries to describe a

universe that is dynamic and not static, and this means that it is not sufficient to rely any longer on schemes of classification that attempt to force all types of relation into a pattern that actually exhibits only the generic relation.

Perhaps the simplest way of illustrating this is to consider a technology. The aim of a technology is to take some material or object, such as a piece of steel or aluminum, or a measure of some substance, and then to work on it to change it into something else. We apply an activity or operation to the entity or raw material and turn it into another entity—the end product. Thus, we have two types of entity terms (raw material and end product) and the operation terms (which might be stamping, extruding, heating, and so on).

The purpose of facet analysis is to provide a framework within which all these various types of terms can be accommodated, together with rules for their combination as required by the literature. It uses the term “analysis” to replace the older term “division” because division implies the breaking up of a single entity, but analysis has a wider connotation and may be applied to the study of complexes as well as of entities. A facet can be said to be all the classes produced when a subject is divided by one and only one characteristic. Classes in a scheme of classification are represented by words or terms, and a facet is therefore a list of terms in which each term stands in the same relation to the subject of which it is a part. A facet may consist of entity terms, such as elements in chemistry, or crops in agriculture; forms of entities, such as solid, liquid, gas; operations made on entities, such as combustion, forging, harvesting; tools for operations, such as presses, x-rays for therapy, microscopes; states of being, such as health and disease.

In applying facet analysis to a subject, the first step is to examine a representative sample of the literature and enumerate the subject of each article, book, or abstract. It soon becomes clear that the terms encountered may be grouped together in sets according to their relation to the subject and to each other, that they represent, in fact, the various aspects of the subject, each of which can be studied apart from the others, at least conceptually, even though in practice it may be impossible to separate them into groups of static entities apart from the phenomena in which they are observed. Consider the following subjects from journal articles in the field of occupational safety and health:

The lighting of underground roadways in coal mines.
 The protection of workers against ionizing radiations.
 The examination and testing of dust masks.
 Dermatologic aspects of the chromate problem.
 Guarding of machines used by blind workers.
 Registration of accidents in nuclear reactors.

From these, and other subjects like them, one can easily deduce the following facets:

Classes of workers (blind, etc.)
 Industries (where hazards exist: coal mines, reactors)
 Sources of hazards (things causing danger: dust, chromates, radiation, machines)
 Accidents and diseases (results of hazards: dermatitis)
 Prevention (masks, guarding)
 Administration (registration, etc.)

It can readily be seen now that the basic difference between a faceted classification and a merely enumerative one is that here the terms are itemized as elementary terms and are not combined into complexes for insertion in the schedules of the scheme. For classifying documents, terms are used mainly in a postcoordinate manner because they are not precoordinated in the schedules, except insofar as a generic hierarchy may still legitimately be inserted into a facet. In a faceted scheme for education, we can find, in the “Educand” facet, the following sequence:

Exceptional children
 Handicapped children
 Physically handicapped children
 Blind
 Deaf
 Brain-injured

Terms signifying other aspects, such as curriculum subjects or teaching methods, will likewise be enumerated only as elementary terms in separate facets, and any combination of elementary terms that may appear in the literature can therefore be catered for as it arises.

One particular kind of facet is called a differential facet. This is a facet of a class in which the terms are secondary to another facet and may differ according to the term to which they are attached in the primary facet. If we look at the subject “Food Technology,” for example, we can enumerate the various groups of foodstuffs in the primary facet: meat products, dairy products, vegetable products, and so on; in the “Process or Operations” facet, the types of process vary according to the food group. The operations for processing dairy or cereal products are different from those used in processing meat or fish products. Thus, although the name of the facet may be a general term such as “Process” or “Operation,” the individual terms in the facet will fall into several separate groups depending on the term in the product facet to which they apply.

To find a sound theoretical basis for the choice and sequence of facets in a scheme, Ranganathan advanced the solution of relating facets to a set of fundamental abstract notions, which he called time, space, energy, matter, and personality. Every facet of a basic class is regarded as a concrete manifestation of one of these. The time facet is for chronological division, and the space facet for geographical division; these are clear and are to be found in virtually every classification scheme. Energy and matter, illustrated in a technology by raw material and process, are

not so easily identified in some other subjects in the social sciences and humanities, for example. Personality, if interpreted as the end product in a technology, or the educand in education, can be seen to be a recognizable entity with an identity that is unique and clearly separable from other entities, but it has certainly caused more difficulty and controversy than any of Ranganathan’s other fundamental categories. Nevertheless, for him it is the most important of the categories, because it is the personality facet that contains the terms that give the class itself its own identity in the field of knowledge.

It is clear that many compound subjects found in the literature will display more than three basic facets, excluding space and time, which normally will only appear once. To meet this situation, Ranganathan introduced the idea of levels and rounds of facets. In Class I, Botany, of the Colon Classification, the individual plants are classified into natural groups as the First Level Personality; for example:

1	Cryptogamia
2	Thallophyta
22	Algae, seaweeds
23	Fungi
237	Basidiomycete
2375	Mushroom
5	Phanerogamia
7	Monocotyledon
8	Dicotyledon

But parts of plants are also personality terms and are placed as Second Level Personality in the same facet as the plants themselves (i.e., before the appearance of any other facet). For example:

1	Basic and regional
13	Root
14	Stem
16	Flower

The two levels of the personality facet are joined by a comma. Thus, the notation symbol for the plant gentian is I 8516, and the symbol for the flower of the gentian is I 8516,16; the preceding comma enables us to distinguish between the 16, which indicates the division gentian of the group *Dicotyledons*, and the 16, which indicates the part flower and which could be added in the same way to the symbol for any other plant.

Rounds of facets are necessary because each type of term may appear more than once in a compound subject. In a technology, we may very well find the tool specified which carries out a certain operation on a certain raw material to produce a certain end product. A tool is an entity and in the context of the manufacture of the tool it would appear as the primary personality. But it is not

primary in the context of using it for the production of another entity; that entity is the primary personality because that is the entity on which primary attention is focused. Similarly, in the class agriculture, fertilizers are regarded as personality terms, but agriculture is not concerned with the production but with the use of fertilizers. The crop is the primary focus of attention in agriculture and is, therefore, the First Round Personality facet. This facet is followed by an operation or energy facet that contains, among others, these terms:

1	Soil
2	Manure
4	Disease
7	Harvesting

The symbol that introduces an energy term is the colon. Thus, the notation for the crop turnip is J 332, and the symbol for the subject, the manuring of turnips is J 332 : 2. After this, the different kinds of fertilizer that may be used for the manuring of turnips are listed as the Second Round Personality facet. Ranganathan has postulated that there are no subdivisions (second levels) of any energy term, so that Second Round Personality terms do not require any indicating symbol but may run straight on after the symbol for the appropriate energy term:

1	Green manure
2	Farm
4	Fertilizer
41	Nitrogenous
42	Phosphatic

The combined symbol for “the use of phosphates in the cultivation of turnips” is therefore J 332 : 242. A full explanation of these devices has been given by Ranganathan in his Rutgers seminar.^[2]

There is no doubt at all that these fundamental categories are easy to identify in some subjects and particularly in science and technology. They have been used with success as a checking device for subject analysis in relation to the decimal classification in the *British National Bibliography* and in relation to an alphabetical index in the *British Technology Index* (q.v.). It is very useful to have in mind some generalized idea of the structure of subjects when either constructing a classification scheme or when classifying documents. Unfortunately, it is not so easy to see the application in the Social Sciences or the Humanities, and the Classification Research Group and other research workers, particularly on the Continent, have tended to follow a more pragmatic approach and, while using facet analysis, to give

the facets a more precise name limited to the subject field being classified. Examples are given by Vickery in another Rutgers seminar;^[8] whether the technique is allied to the notion of fundamental categories or not, however, it certainly provides the most powerful tool yet devised for the analysis of subjects, both for classifying documents and for search strategy in information retrieval.

There are some who seem to think that the arrival of computers has relieved librarians and information officers of the necessity to perform this operation and that all that will be required in the future is for clerical workers to file text into the machine in the natural language of authors and file requests in the natural language of users, and take for granted these two varieties of natural language will match. Operating experience (with perhaps the exception of stores that are so small as to be insignificant for real-life purposes) shows the contrary; and most machine-based systems now are provided with some form of vocabulary control, usually in the form of a “thesaurus.” Although many of the early thesauri were no more than what had hitherto been called by librarians “subject headings lists,” it has lately been realized that the efficiency of these lists, both for input and search strategy, is greatly increased if there is, in addition to the alphabetical list, a second list of the same terms arranged into categories. In one case these have been called “facets,”^[9] and the superiority of this Barhydt-Schmidt thesaurus of educational terms over the alphabetic thesaurus issued by the U.S. Office of Education is so marked that the latter has included in its second edition a rough and not very ready approximation to a set of categories called “descriptor groups.”

The most effective combinations to date have been those produced by D. Soergel for a chemical company in Germany and by Jean Aitchison as a new version of the faceted classification scheme compiled for the English Electric Co. and described in Vickery’s Rutgers seminar.^[8] The new version has been called a Thesaurofacet,^[10] and Jean Aitchison has also published a simplified account of the technique.^[11] She has used the faceted structure to present a pattern of the most basic relationships subsisting between the phenomena denoted by the terms in the system and has complemented this by introducing all the other manifold relationships that may appear in the actual literature into the thesaurus, which now acts as both an entry vocabulary to the system for precisely named terms and a detailed and highly structured alphabetical index to the faceted classification. The characteristic features of each technique have been exploited to achieve a very complete pair of structured vocabularies with the maximum of economy: relations that are more satisfactorily displayed in one list are not repeated in the other. The two lists are linked by the notation of the classification scheme.

Thesaurus Entry		
Jets		
RT	Jet condensers	
	Jet dispersal valves	
	Jet dispersers	
	Jet pumps	
	Jet rectifiers	
	Nozzles	
NT (A)	Jets (Hovercraft)	REJ
	Plasma jets	EXQ
Classification Schedule		
CWJ	Jets	
CWK	Jet streams	
CWL	Plumes	
CWM	Wall jets	
CWO	Couette flow	
CWP	Jet mixing	
CWQ	Propulsive jets	
EXP	Plasma experimental apparatus	
EXQ	Plasma jets	
EXR	Plasma guns	
EXT	Plasma arcs	
REI	Hovercraft components	
REJ	Jets (hovercraft)	

CONCLUSION

Information science, unlike information theory, is concerned with meaning and communication as well as with the transfer of messages. Communication means conveying the meaning of a message so that the recipient is able to fit it into the pattern of ideas that already exists in his mind. Library systems should be so formed that they can do this; they should attempt to correspond with the structure of reality, which writers attempt to describe so that the system of terms in the writer's mind may be inserted into a matrix that can be used in turn as a pattern for matching with the system of terms in a user's mind.

It should be a lattice system able to form the same relations as those existing in the infinitely varied phenomena of Nature, and not a single hierarchy, however "logical," such as those on which the traditional library classification schemes are based. Facet analysis provides such a lattice system. It corresponds to the way in which specialists think about their subjects and has, therefore, a vital role to play in modern library and information services, including those that make use of the most sophisticated of machines.

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Faceted Application of Subject Terminology (FAST)

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Abstract

FAST (faceted application of subject terminology) is a faceted subject heading vocabulary derived chiefly from the Library of Congress Subject Headings (LCSH), a widely-used subject heading system published and maintained by the Library of Congress (LC). A controlled vocabulary with simple application rules and a design well suited to Linked Data applications, FAST has been developed through a multi-year collaboration of OCLC Research and the Library of Congress with advice from the library community. OCLC is responsible for the ongoing development of FAST.

INTRODUCTION

Faceted application of subject terminology (FAST) is an enumerative, faceted subject heading vocabulary that consists of eight categories of terms, or facets, that cover key attributes of information resources (topics, persons, organizations, events, places, titles of works, time, and form/genre). Derived chiefly from the Library of Congress Subject Headings (LCSH), FAST retains the rich vocabulary of LCSH and benefits greatly from the ongoing development of LC-controlled vocabularies. In contrast to LCSH, which provides authority records for main headings and subdivisions but not all valid combinations allowed by LCSH application rules, all authorized FAST headings, except FAST chronological headings, are established in an authority file. The FAST authority file is available in multiple representations including MACHine-Readable Cataloging (MARC) and Resource Description Framework (RDF). Individual FAST authority records can also be accessed through a web interface and as Linked Data.

FAST was developed to meet the need for a general-use subject vocabulary that is easy to learn, apply, and control. As a controlled vocabulary that consists of eight independent but complementary facets, FAST is designed to work well in a Linked Data environment and in information systems that support post-coordinate retrieval and faceted navigation. Ongoing development of FAST includes synchronizing with LCSH, providing tools for users, and enhancing FAST records with supplemental information.

BACKGROUND

History of the FAST Project

The origins of the FAST project can be traced to work with Dublin Core (DC) features in the Cooperative Online

Resource Catalog (CORC) service (1998–2002). CORC included a novel metadata editor that allowed input and modification of metadata in both DC and MARC views^[1] and the ability to easily shift between DC and MARC views by virtue of a sophisticated crosswalk.^[2] OCLC staff members and CORC participants valued this feature, but it revealed difficulties in mapping LCSH between DC and MARC. The chief issue was that valid LCSH topical strings can include multiple aspects (e.g., topic, place, time, form) in the same MARC tag, but in DC each aspect typically belongs to different DC elements. The machine logic required to properly map parts of LCSH constructed headings between MARC and DC was judged impractical, and in a best-case scenario would only have allowed a one-way mapping.

With this issue in mind, OCLC Research staff members began exploring the possibility of faceting LCSH into a new vocabulary. If the project was successful, LCSH's rich vocabulary would be recast to be more amenable to use in contexts where metadata was expressed in DC or other non-MARC formats or in workflows that relied on staff unfamiliar with LCSH application rules.^[3,4]

Influences

The release of the report, *Subject Data in the Metadata Record*, in 1999 further inspired the FAST team to persist in its efforts to simplify and adapt LCSH. The report included the following recommendations:

Schemes for supplying subject data should, to the fullest possible extent:

- *be simple and easy to apply and comprehend;*
- *be intuitive so that sophisticated training in subject indexing and classification, while highly desirable, is not required in order to implement them;*

- *be scalable for implementation from the simplest to the most sophisticated;*
- *be logical so that it requires the least effort to understand and to implement; and,*
- *be appropriate to the specific discipline and subject, and to the domain of implementation such as libraries, museums, archives, information services, the scientific community, and personal knowledge management.*^[5]

These objectives resonated with the general goals of the FAST project. While never expressly adopted by the team, the subcommittee's recommendations have influenced the team in its decision-making over the course of the project.

FAST AND LCSH

FAST is derived from LCSH and benefits significantly from LCSH's strengths as a large, general vocabulary maintained by LC. As a widely adopted vocabulary, LCSH covers all subject areas, imposes synonym and homograph control, includes many cross-references, and is updated regularly by LC. LCSH has been added to tens of millions of metadata descriptions including nearly 100 million in WorldCat. The FAST authority file is built chiefly from three sources: 1) the LCSH authority file, 2) millions of constructed LCSH present in WorldCat, and 3) the NACO Authority file. Constructed headings, representing authorized combinations of LCSH, serve as literary warrant and effectively focus FAST on the universe of things represented in library collections. As LCSH evolves and improves, FAST is adapted to reflect the changes and enhancements.

The individual terms in the FAST vocabulary are divided into seven subject facets and a form/genre facet.^[6] The headings in the subject facets are used to describe what a work is *about*; the terms in form/genre facet are used to represent what a resource or document *is*, for example, an encyclopedia. The facets are named

- Topical
- Geographic name (place)
- Corporate name (organization)
- Personal name
- Title of work
- Event name
- Chronological (date or time period)
- Form/genre

FAST is intended for use in post-coordinate retrieval; however, FAST does contain multiple concept headings. They appear as compound phrases (e.g., *agriculture and state*), prepositional phrases (e.g., *conservation of natural resources*), and as main heading/subdivision combinations (e.g., *natural gas—conservation*).^[7] Headings

such as these reflect the vocabulary of LCSH and will be familiar to users of LC Subject Headings. Where FAST differs from LCSH is in the rules for combining subdivisions. In FAST, all terms in the heading must come from the same facet. Topical headings can only be combined with topical subdivisions, geographic names with other geographic names. A main heading may not be combined with a subdivision from another facet.

FACETS

Topical Headings

FAST topical headings look very similar to established topical headings in LCSH. Topical headings in FAST are made up of topical main headings and main heading/subdivision combinations that have been used in WorldCat bibliographic records, including topical heading/free-floating subdivision combinations and expansions of multiple headings.^[8] Topical headings are the majority of subject headings used in cataloging.^[9] The following are examples of FAST topical headings:

AIDS (disease)
 Church work with youth
 Cities and towns
 Murder—investigation
 Political science
 Roads—design and construction
 Roads—design and construction—safety measures
 Travel
 Water—pollution
 Women—employment
 Women—employment reentry—public opinion

Geographic Names

The FAST geographic name facet contains place names that are the subject of a work, including names of countries and political or administrative divisions within countries, states, cities, and towns. These names are referred to as jurisdictional names. FAST also includes names for natural features and man-made structures, referred to as nonjurisdictional names. Jurisdictional names are derived primarily from the NACO Authority File, and nonjurisdictional names are derived from LCSH.

Jurisdictional names

China
 France
 Texas
 Wales

Nonjurisdictional names

Arizona—Grand Canyon
 Maritime Provinces
 North America
 Pacific Ocean

In FAST, the structure of geographic names is hierarchal and is based on the *MARC Code List for Geographic Areas*.^[10] The heading begins with the first-level name and may contain two additional levels. First-level names are normally names of countries or larger areas except for Australia, Canada, Great Britain, and the United States. For these areas, second-level entities such as provinces and states are treated as first level names (Texas rather than United States—Texas). Additional geographic entities are given special treatment in FAST including extinct cities, bodies of water, and extraterrestrial bodies.^[11] The following are examples of geographic name headings:

First-level names

Atlantic Ocean
 North America
 Texas

Second-level names

Arizona—Grand Canyon
 Atlantic Ocean—Baltic Sea
 England—London
 France—Provence

Third-level name

California—Los Angeles—Sunset Boulevard
 England—London—Chelsea
 New York (State)—New York—Central Park

Personal Names, Corporate Names, and Title of Work

Personal and corporate names and titles of works are established as FAST headings. They are based on headings in the NACO Authority File. Only the names that have been used at least once as a subject in a WorldCat bibliographic record are established in FAST.

Personal Names

Personal name headings in FAST look much like established headings in the NACO Authority File. They may not be combined with subdivisions from other facets, but contain one or more following elements:

- Personal name (surname and/or forename)
- Numeration
- Words associated with a name
- More complete form of the name
- Date(s)

The following are examples of personal name headings:

Austen, Jane, 1775–1817
 Beyoncé, 1981–
 Downey, Robert, Jr., 1965–
 Francis, Pope, 1936–
 Marie Antoinette, Queen, consort of Louis XVI, King of France, 1755–1793
 Milne, A. A. (Alan Alexander), 1882–1956
 Sting (Musician)

Corporate Names

Corporate name headings are established for corporate bodies, which include public and private organizations, associations, institutions, governments, government agencies, commercial firms, nonprofit enterprises, and religious bodies. Corporate name headings may not be combined with subdivisions from other facets, but they may contain one or more elements for subordinate units combined with the main heading. The following are examples of FAST corporate name headings:

Canada. Parliament. House of Commons
 eBay (Firm)
 European Union
 Metropolitan Museum of Art (New York, N.Y.)
 Peace Corps (U.S.)
 United States National Aeronautics and Space Administration
 World Bank

Title of Work

A FAST heading for title of work is the title of a work used as subject heading. For example, a critical work about *Pride and Prejudice* by Jane Austen would have the FAST heading *Pride and Prejudice* (Austen, Jane) as a subject heading. Headings for titles fall into three main categories: anonymous works, works of known personal authorship, and works from corporate bodies.^[12] FAST headings for titles begin with the title followed by the name of the creator except for anonymous works. Dates of authors/creators are not included unless the dates are necessary to avoid conflicts. The following are examples of titles of works:

Beowulf
 Dame aux camélias (Play) (Dumas, Alexandre, 1824–1895)
 Declaration of Independence (United States)
 Divina commedia (Dante Alighieri)
 Pride and Prejudice (Austen, Jane)
 Romeo and Juliet (Shakespeare, William)
 Trois mousquetaires (Dumas, Alexandre, 1802–1870)
 Winnie-the-Pooh (Milne, A. A.)

Qualifiers are added to titles to identify the type of work or distinguish between works with the same title, for example:

- Romeo and Juliet (Choreographic work : Balanchine and Nijinska)
- Romeo and Juliet (Motion picture : 1936)
- Romeo and Juliet (Motion picture : 1968)

Event Names

In FAST, an event is defined as something that occurs during a particular time period. An event may be recurring or a single occurrence. FAST event headings are derived from LCSH topical and geographic headings and chronological subdivisions, conference names and meeting names in the NACO Authority File, and subject fields in WorldCat bibliographic records. There are four main types of event headings:

1. Military conflicts—headings for wars, battles, and sieges, etc., include the place and date as the qualifier unless it is redundant.
 - Cuban Missile Crisis (1962)
 - Revolution (France : 1789–1799)
 - Soviet Occupation of Afghanistan (1979–1989)
 - World War (1914–1918)
2. Conferences and meetings
 - G8 Summit
 - Paris Peace Conference (1919–1920)
 - South by Southwest Music and Media Conference
3. Sporting events
 - Stanley Cup (Hockey)
 - British Open (Golf tournament)
 - World Cup (Rugby football)
4. Other types of events, for example, strikes, festivals, natural disasters
 - Burning Man (Festival)
 - Fukushima Nuclear Disaster (Japan : 2011)
 - Indian Ocean Tsunami (2004)

Only event names that have been used at least once as a subject in a WorldCat bibliographic record are established in FAST.

Chronological

FAST chronological headings contain either a single date or date range consisting of a beginning date and an ending date. Either the beginning date or the ending date can be open. An individual date usually consists of only a year. The chronological facet is not controlled but relies on syntax rules for formulating headings.^[13] The following

are examples of four types of commonly occurring chronological headings:

1. Single date
 - 1975
 - 1941 (December 7)
2. Beginning date
 - Since 2000
3. Ending date
 - To 1900
4. Date range
 - 2003–2011

Form and Genre Headings

FAST form and genre headings are derived from LCSH. Form and genre terms are used to describe what a work *is* in contrast to what a work is *about*. Form headings are used to indicate form of presentation or arrangement, intended audience, or physical medium. Genre headings indicate categories of works characterized by plot, theme, setting, etc. The following are examples of form and genre headings:

- Atlases
- Catalogs
- Fiction
- Guidebooks
- Periodicals
- Photographs
- Scores

APPLICATION RULES

When applying any subject vocabulary, catalogers and indexers must also choose between summarization and depth indexing. A cataloger employing summarization will apply subject terms based the overall theme or content of the resource. A metadata specialist using the depth indexing approach will attempt to represent all significant aspects of a work. Either method is appropriate for use with FAST.

As the first step in assigning FAST, a cataloger or other user applies personal judgment to determine which attributes (e.g., topic, geographic name, event, etc.) are primary for the resource being described, and whether the resource should also be categorized as a particular form or genre. The next step is to categorize the concepts by FAST facets and then select the appropriate heading from the FAST authority file. The FAST database contains all

valid main headings and main heading/subdivision combinations and selected tracings for variant and related headings. If no FAST heading for a particular topic has been established, then either a broader heading or multiple headings may be assigned to represent the topic. It is common practice in subject cataloging to use the most specific term available in the vocabulary to describe the resource. For example, for a resource about mice, the FAST heading, Mice, should be used instead of the headings, Rodents or Mammals.

DEVELOPMENT AND MAINTENANCE OF FAST

Generating FAST Headings

FAST headings are generated from 1) established headings in the LCSH Authority File, 2) headings extracted from WorldCat bibliographic records, and 3) name headings in the NACO Name Authority File. The initial steps in the development of FAST were to algorithmically facet and validate all unique LCSH topical and geographic headings in WorldCat records. The validity of a heading from WorldCat was calculated based on frequency of use, source of cataloging, and various validation tables built from LC subject cataloging guidelines. A MARC 21 authority record was then created for each validated heading. As part of the generation and updating of FAST authority records, metrics for frequency of use of a given heading are generated and included in the FAST authority record. Table 1 provides a mapping of the facets to the appropriate fields in MARC21 bibliographic and authority records.

The FAST authority file is available for download^[14] as a single file or by individual facet. In a particular application, some facets may not be required, or one or more of the facets may be used with another controlled vocabulary. The following are examples of a FAST topical authority record and a FAST geographic authority record, respectively:

```
LDR00000cz a2200037n 45 0
001 fst01099527
003 OCoLC
```

Table 1 Mapping of FAST facets to MARC 21 fields

FAST facet	MARC 21 format for authority data	MARC 21 format for bibliographic data
Chronological	148	648
Corporate name	110	610
Event name	111	611
Form/genre	155	655
Geographic name	151	651
Personal name	100	600
Title of work	130	630
Topical	150	650

```
005 20090915093506.0
008 041024nn anznnbavn ll ana d
016 7#$a fst01099527$2 OCoLC
040 ##$a OCoLC$b eng$c OCoLC$f fast
053 #0$a QL737.R6$b QL737.R688$c Zoology
053 #0$a SB994.R6$c Agricultural zoology
150 ##$a Rodents
450 ##$a Rodentia
550 ##$a Mammals$0 (OCoLC)fst01006948
688 ##$a LC (2014) Subject Usage: 111 (239)
688 ##$a WC (2014) Subject Usage: 1,944 (3,626)
750 #0$a Rodents$0 (DLC)sh 85114803
LDR 00000cz a2200037n 45 0
001 fst01222022
003 OCoLC
005 20120706140721.0
008 060620nn anznnbavn ll ana d
016 7#$a fst01222022$2 OCoLC
034 ##$d W0785815$f W0785815$g N0405637$g
N0405637$2 geonames
040 ##$a OCoLC$b eng$c OCoLC$f fast
043 ##$a n-us-pa
151 ##$a Pennsylvania$z Punxsutawney
451 ##$a Pennsylvania$z Punxsy
670 ##$a GeoNames [algorithmically matched]$b
ppl;40°56'37"N 078°58'15"W
688 ##$a LC (2014) Subject Usage: 16
688 ##$a WC (2014) Subject Usage: 99
751 #0$a Punxsutawney (Pa.)$0 (DLC)n 82132956
751 #7$a Punxsutawney$0 (GeoNames)5207307$2
geonames$w nna
751 #0$a Punxsutawney (Pa.)$0 (viaf)146606875$0
(uri)http://viaf.org/viaf/146606875
```

FAST geographic name records include latitude, longitude, and geographic feature type when available. The sources of this information are LCSH and NACO authority records, and the GeoNames database. Software was created to match FAST geographic names to entries in the GeoNames database as part of the development of FAST.

Maintaining the FAST Authority File

Each month new and changed LCSH and new main heading/subdivision combinations from WorldCat are incorporated into the FAST Authority file. Headings from WorldCat must meet thresholds for literary warrant. Most of the updates are algorithmically determined; however, the more complicated mappings may require manual editing or review. When a valid FAST heading changes, its previously authorized form is maintained in a tracing field (MARC 4xx \$wnne). Authority records for all previously valid headings are marked as obsolete (record status changed to “x” and retained in the FAST authority file.

TOOLS AND IMPLEMENTATIONS

Tools

Several tools are available from OCLC Research to help users understand and apply FAST.

FASTConverter

FASTConverter is a web application that converts LCSH headings to FAST headings.^[15] This tool helps users become familiar with FAST and see the differences between LCSH and FAST. When a bibliographic record contains valid LCSH, it is possible to programmatically generate the corresponding set of FAST headings. Each subject heading is processed separately to create one or more FAST headings. The resulting FAST headings are then sorted and duplicate headings are removed. Conversion of sample sets of records allows for the evaluation of FAST as a subject cataloging system.

A central component of the FAST project is computer code that efficiently converts LCSH to FAST headings in bibliographic files. FASTConverter provides access to the conversion process for manually entered headings or for small sets of bibliographic records. LCSH headings can be entered as text, with conversion results displayed as plain text; or, MARC21 format bibliographic files can be uploaded for conversion. A link to the converted file is returned. Conversion files are limited to 50,000 bytes, or approximately 500 records. The following is an example of a set of LCSH headings before and after conversion to FAST:

LCSH before conversion

Personal name headings

Lacks, Henrietta, 1920-1951—Health

Lacks, Henrietta, 1920–1951

Topical headings

Cancer—Patients—Virginia—Biography

African American women—History

Human experimentation in medicine—United States—History

HeLa cells

Cancer—Research

Cell culture

Medical ethics

FAST headings after conversion

Personal name headings

Lacks, Henrietta, 1920–1951

Topical headings

African American women

Cancer—Patients

Cancer—Research

Cell culture

Health

HeLa cells

Human experimentation in medicine

Medical ethics

Geographic names

United States

Virginia

Form/genre headings

Biography

History

The same headings, as they would appear in a MARC 21 bibliographic record, are shown later. Each FAST heading includes a link to its corresponding FAST authority record in subfield \$0. The inclusion of FAST authority record numbers in subfield \$0 facilitates the automated validation and maintenance of FAST headings in bibliographic records.

Headings before conversion

600 10\$a Lacks, Henrietta, \$d 1920–1951 \$x Health.

650 #0\$a Cancer \$x Patients \$z Virginia \$v Biography.

650 #0\$a African American women \$x History.

650 #0\$a Human experimentation in medicine \$z United States \$x History.

650 #0\$a HeLa cells.

650 #0\$a Cancer \$x Research.

650 #0\$a Cell culture.

650 #0\$a Medical ethics.

FAST headings after conversion

600 17 \$a Lacks, Henrietta, \$d 1920–1951 \$2 fast \$0 (OCoLC)fst01914767

650 #7 \$a African American women \$2 fast \$0 (OCoLC)fst00799438

650 #7 \$a Cancer \$x Patients \$2 fast \$0 (OCoLC)fst00845411

650 #7 \$a Cancer \$x Research \$2 fast \$0 (OCoLC)fst00845497

650 #7 \$a Cell culture \$2 fast \$0 (OCoLC)fst00850172

650 #7 \$a Health \$2 fast \$0 (OCoLC)fst00952743

650 #7 \$a HeLa cells \$2 fast \$0 (OCoLC)fst00952578

650 #7 \$a Human experimentation in medicine \$2 fast \$0 (OCoLC)fst00963042

650 #7 \$a Medical ethics \$2 fast \$0 (OCoLC)fst01014081

651 #7 \$a United States \$2 fast \$0 (OCoLC)fst01204155

651 #7 \$a Virginia \$2 fast \$0 (OCoLC)fst01204597

655 #7 \$a Biography \$2 fast \$0 (OCoLC)fst01423686

655 #7 \$a History \$2 fast \$0 (OCoLC)fst01411628

assignFAST

The assignFAST service provides autosuggest-style searching of the FAST subject heading database. The

feature is accessible through a web-based user interface and through an application programming interface (API).^[16] The user interface is ideal for day-to-day cataloging tasks. When a user of the web application starts typing, suggested authorized headings and variant headings are displayed. When a user selects either type of heading, the application presents a correctly formatted heading that can be copied into a cataloging interface. The API allows software developers to integrate the feature into another service or application.^[17] The API enables easy selection of controlled FAST headings and can eliminate cut and paste operations.

searchFAST

SearchFAST is a full-featured search interface to the FAST authority file^[18] that simplifies the process of heading selection. The user interface provides a search box, brief results list, and full view of a selected record on a single page. To increase searching accuracy, the application provides several indexes and the ability to restrict the results to a desired facet. Search results are ranked by usage, which positions the most likely candidate headings near the top of the results list. Search results can also be sorted alphabetically and in facet order. The user interface includes an autosuggest feature that makes the selection process even easier.

Implementations

WorldCat and FAST

Beginning in September 2013—in response to interest and requests from member libraries and to make OCLC's use of FAST easier to implement—OCLC began systematically adding FAST headings to WorldCat bibliographic records.^[19] The records affected are those with LCSH assigned, and the routines are applied only to records that are attributed as being English-language-of-cataloging. The FAST enrichments are presented to users of WorldCat.org (a discovery interface) and Connexion (a cataloging interface) when users view an individual record, and also appear in Linked Data serializations of WorldCat that OCLC supports.

Metadata editing tools and FAST

OCLC WorldShare Record Manager provides a convenient means of adding FAST headings for users that are using the “text” view in the editor. This feature was made available as part of Record Manager in 2014.^[20]

MarcEdit, a popular open source metadata editing tool maintained by Terry Reese, has a “Generate FAST Headings” tool feature. This feature was added to MarcEdit in October 2013 and makes use of the assignFAST API.^[21]

The BIBFRAME Scribe prototype by Zepheira demonstrates how to catalog materials in a native BIBFRAME

serialization. Scribe includes a search-and-FAST component in its editing toolkit.^[22]

Backstage LibraryWorks provides a FAST validation service to its customers. The service can determine whether a given heading in a bibliographic record is a valid FAST heading.^[23]

Agencies using FAST

Based on a study^[24] by OCLC and other sources, at the writing of this entry a small number of institutions are known to be using FAST routinely. These include

- Bodleian Libraries, University of Oxford (UK)
- Chronicling Illinois & The Papers of Abraham Lincoln projects (US)
- Cornell University Libraries (US)^[25]
- Databib.org (US)
- National Library of New Zealand (New Zealand)
- OCLC (US)
- RMIT Publishing (Australia)
- University of North Dakota (US)

Common applications include the use of FAST in metadata for digital materials (Oxford, Chronicling Illinois, Papers of Abraham Lincoln, University of North Dakota), journal articles (National Library of New Zealand, RMIT), datasets (Databib), and inside discovery tools (Cornell, OCLC).

RESEARCH

FAST Linked Data

During the initial phases of the FAST project, OCLC made a copy of the FAST authority file available up request, in MARC 21 authority format, to a small number of parties. As OCLC began releasing publicly accessible data sets, the FAST team pursued publishing FAST for open access.

In late 2011 with the support of LC, OCLC made the FAST authority file available as a data set under the ODC-By open license.^[26] Formats offered include RDF, MARC 21, and MARC XML. FAST incorporates links to corresponding LCSH authorities. In addition, many of the geographic headings have links to the GeoNames geographic database^[27] and personal names, corporate names, and titles of works records link to the VIAF (Virtual International Authority File) database^[28] hosted by OCLC. FAST as linked data (expressed as schema.org) also appears in many worldcat.org linked data representations of WorldCat bibliographic data. An example of a FAST authority record as RDF is shown next:

```
<rdf:Description rdf:about="1222022">
< dct:identifier>1222022</dct:identifier>
```

```

<skos:inScheme rdf:resource="ontology/
  1.0/#fast"/>
<rdf:type rdf:resource="http://schema.
  org/Place"/>
<skos:inScheme rdf:resource="ontology/
  1.0/#facet-Geographic"/>
<skos:prefLabel>Pennsylvania--
  Punxsutawney</skos:prefLabel>
<schema:name>Pennsylvania--
  Punxsutawney</schema:name>
<skos:altLabel>Pennsylvania--Punxsy</
  skos:altLabel>
<schema:name>Pennsylvania--Punxsy</
  schema:name>
<schema:sameAs>
<rdf:Description rdf:about="http://id.
  loc.gov/authorities/names/n82132956">
<rdfs:label>Punxsutawney (Pa.)</rdfs:
  label>
</rdf:Description>
</schema:sameAs>
<skos:relatedMatch>
<skos:Concept rdf:about="http://id.loc.
  gov/authorities/names/5207307">
<rdfs:label>Punxsutawney</rdfs:label>
</skos:Concept>
</skos:relatedMatch>
<schema:sameAs>
<rdf:Description rdf:about="http://
  viaf.org/viaf/146606875">
<rdfs:label>Punxsutawney (Pa.)</rdfs:
  label>
</rdf:Description>
</schema:sameAs>
<schema:geo>
<schema:GeoCoordinates>
<schema:latitude>40.94361</schema:
  latitude>
<schema:longitude>-78.97083</schema:
  longitude>
</schema:GeoCoordinates>
</schema:geo>
</rdf:Description>

```

OCLC Research Prototypes

OCLC Research develops prototypes and demonstrations systems to test ideas and processes. FAST appears in several OCLC Research prototypes. The following are some examples:

mapFAST

mapFAST is a mashup of FAST geographic and event authority data and Google Maps. The prototype is

designed to provide map-based access to bibliographic records.^[29] Mobile versions are also available.

WorldCat Identities

WorldCat Identities provides a characterization for every name in WorldCat. It includes a list of works by and about the identity, a FAST tag cloud of places, topics, etc., closely related to works by and about the person, links to coauthors, and more.^[30]

Classify

Classify is an Functional Requirements for Bibliographic Records (FRBR)-based prototype designed to support the assignment of classification numbers and subject headings for books, DVDs, CDs, and other types of materials. FAST headings are used for the subject index and on the summary display.^[31]

CONCLUSION

FAST, with its simple application rules, modular design, and tools for automated application and maintenance, is well positioned to meet the needs of catalogers and indexers challenged to provide efficient subject access to growing numbers of diverse resources. However, the future of FAST as a subject access tool will depend on the continued updating and development of the vocabulary, application of FAST to content, and a growing partnership with the community of FAST users.

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Federal Electronic Information in the United States

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Abstract

The dissemination of federal information in electronic form, and in particular the use of the Internet, offer the opportunity to provide more timely, convenient, and widespread access to government information resources. However, identifying and locating needed government information can be difficult and frustrating for users attempting to navigate the fragmented and complex federal information landscape. This fragmentation is seen in the overwhelming number of federal Web sites that lack central coordination, even within a specific organizational hierarchy (e.g., departmental or legislative). It also appears in the varying media and formats in which the information may be offered and in the use of partnerships and privatization to distribute government information. Navigation is made more difficult by the fact that government information offered via the Web frequently changes location or apparently entirely disappears. The existence of multiple comprehensive locators, GPO Access, FedWorld, and the GILS, all established at the direction of Congress, and the Executive Branch's FirstGov, illustrates the lack of an overall strategy for the provision of access to federal information. The development of a comprehensive government-wide policy framework is needed to realize the promise offered by technology to improve public access to government information.

INTRODUCTION

Information producers and users alike have embraced electronic information technologies for the production and dissemination of electronic information resources. Information producers seek savings in the costs of producing and disseminating information, and both producers and users benefit from more timely dissemination of information and the greater ability to manipulate data disseminated in electronic formats. Because personal computers have become more affordable to a larger segment of the population and access to the Internet has become more widespread, electronic information resources have become increasingly accessible to individuals, businesses, and government agencies.

The federal government is one of the largest producers of information in the world. It has collected and disseminated information in a variety of electronic media and formats. Tangible information products have included magnetic tapes, to 5¼- and 3½-inch floppy disks, CD-ROMs, and DVDs. In addition to tangible products, throughout the 1990s there has been increasing on-line access to information housed in a wide variety of government databases and files accessible via dial-up bulletin boards and via the Internet. The electronic transformation of the Federal Depository Library Program (FDLP) began in 1989 with the distribution of the first CD-ROM to depository libraries, Census Test Disk Number 2, one of a number of pilot projects on disseminating electronic information to depository libraries, which were the result of much lobbying by the depository community. Through

the 1990s, the CD-ROM was the primary means of electronic information dissemination by FDLP. The number of titles distributed on CD-ROM peaked in 1998 and thereafter began a steady decline as online access replaced a growing number of titles formerly distributed on CD-ROM, print, and microfiche. By fiscal year 2001, about 60% of the titles in the FDLP were available online.^[1]

Also in 2001, the 107th Congress was considering two electronic government (e-gov) bills, and the president had embraced the concept of a "citizen-centered electronic government."^[2] Information technologies today play a major and ever-increasing role in the conduct of government business, and the access of citizens to information by and about their government will continue to be influenced by this transformation to an electronic federal information environment. Many of the policy issues being discussed today were first raised in the 1980s and early 1990s. These issues include questions of centralized versus decentralized dissemination and access points for federal electronic information and the role of the Government Printing Office (GPO) and the FDLP; concerns about the electronic information technologies creating the "information rich" and the "information poor"; concerns about the lack of a comprehensive policy framework addressing the life cycle of federal electronic information and the necessity of not only archiving or preserving it but also of ensuring persistent public access; and concerns about privacy, security, and ensuring the authenticity of federal electronic information resources. Other issues, such as debates over defining information as a public good or as a

commodity, and the privatization of government information, are also long-standing concerns that have resurfaced in part because of other pressures such as reducing the cost of government and the information industry's concerns over the proper roles of government and private business in the dissemination of government information.

MAJOR FEDERAL INFORMATION LAWS AND REGULATIONS

An informed citizenry has long been considered to be one of the cornerstones of our system of government, and our nation has a long tradition of providing public access to government information. In 1813, to inform the people of the actions of their government, an act was passed to authorize the distribution of the House and Senate Journals to selected libraries and historical institutions.^[3] By the late 1880s, the Government Printing Office was responsible for the depository library program. The depository system was expanded in the 1850s by the addition of congressionally designated libraries and was considered to be a "safety net" for making federal government information available to the public without cost to the individual user. The regional depositories, which were mandated to receive and retain a copy of all government publications, ensured long-term public access to the nation's historical record.

Throughout the past several decades, there has been a pronounced lack of a coherent overall policy framework for handling the dissemination of federal electronic information resources. Developments in information technology have made necessary a reexamination of the federal information laws and regulations that were created with printed information resources in mind, to incorporate access to electronic government information. New laws that addressed various aspects of the new information environment have been proposed during this time, and some have been enacted. An overview of the major laws and regulations related to government information dissemination can aid in understanding the current policy environment as well as public expectations for access to federal electronic information resources.

Title 44 United States Code: Public Printing and Documents

Title 44 of the U.S. Code is the statutory authority that gives the GPO's Superintendent of Documents responsibility for acquiring, classifying, cataloging, distributing to libraries, and ensuring the preservation of government publications. This centralized distribution system has been described as a funnel:

Before the advent of the Internet, a primary method of access to federal information was one in which the U.S.

Government Printing Office (GPO) acted as a funnel through which agency produced information resources were distributed to federal depository libraries. Depository libraries, physically dispersed throughout the United States, offered local access to federal information. This model has typified most existing federal information dissemination programs, including the Patent and Trademark Office's depository library program, the GPO sales program, and the Education Resources Information Clearinghouse and National Technical Information Service.^[4]

When agencies began to disseminate information in tangible electronic formats and online, the language of Title 44 was no longer adequate to accomplish its intent, providing for a centralized system to ensure the dissemination of and free public access to government information. The lack of statutory authority specifically requiring the dissemination of electronic information resources through the GPO to depository libraries has meant uneven compliance with the spirit of the law. Although some agencies have continued to use the GPO to distribute both their print and electronic information products, others have followed the guidance of the Office of Management and Budget (OMB), which, up until 1996, did not consider electronic products to be subject to Title 44. The various legislative efforts to revise the definition of government publications to include electronic information have all failed, including an attempt in the 105th Congress with Senate Bill 2288, the Wendell H. Ford Government Publications Reform Act of 1998, which sought a comprehensive reform of public printing and dissemination of government information in Title 44. The bill enjoyed the support of the library community and of the GPO, which saw it as "an important step forward in updating and modernizing the ability of the public to gain access to government information."^[5] It failed primarily because of opposition from private publishing and information technology groups.^[6]

The Paperwork Reduction Act (44 USC § 3501 et seq.)

The Paperwork Reduction Act (PRA), as first enacted in 1980 and amended in 1986, was an attempt to reduce the burden on the public of federal information collection and reporting requirements. This early PRA focused on cost-savings and efficiency, and one of its main effects was to discourage agencies from disseminating their information. In the PRA of 1995 (P.L. 104-13), public access to government information was specifically established as a responsibility of federal agencies. The PRA of 1995 instructs agencies to contribute to the Government Information Locator Service (GILS), an online inventory of federal government information that describes the content and location of their publications and records. It also established an Office of Information and Regulatory

Affairs (OIRA) within the Office of Management and Budget (OMB) to oversee agency information resources management activities and to develop information resources management policies, principles, standards, and guidelines. OMB's role in information resources management was revised and clarified by the PRA of 1995, in which the OMB was assigned oversight responsibility for information technology and for the life cycle of information resources in all formats. Under the PRA, each executive branch agency is responsible for its information resources management activities. The Information Technology Management Reform Act of 1996 (P.L. 104-106, Division E) amended the PRA by establishing a Central Information Officer (CIO) in each agency with the responsibility for its information technology programs and information resources management functions.

The primary directive issued by OMB in relation to its oversight of government information resources management policy is Circular A-130, *Management of Federal Information Resources*.^[7] As first issued in 1985, Circular A-130 treated government information as a commodity and encouraged executive branch agencies to look to the private sector for the dissemination of their information resources and to price their products based on cost-recovery. It also discouraged the distribution of agency information through the GPO and the FDLP. Revisions to the Circular in the 1990s reversed the OMB's earlier policy of limiting the government's role in disseminating its information. Circular A-130 now affirms that the free flow of information between the government and public is essential to a democratic society and that agencies are responsible for providing information to the public. It limits user fees to a level sufficient only to recover the cost of dissemination and also specifies that agency publications, including those disseminated electronically, must be provided to the GPO for distribution to depository libraries, a provision sought by the depository community for many years.

Government Printing Office Electronic Information Access Enhancement Act of 1993 (P.L. 103-40)

Although the definition of government publications in Title 44 has not yet been amended to include electronic information resources, the GPO was given a formal role in providing access to federal electronic information with the passage of the Government Printing Office Electronic Information Access Enhancement Act of 1993. Popularly known as the GPO Access Act, it directs the Superintendent of Documents to:

1. Maintain an electronic directory of federal electronic information.
2. Provide a system of online access to the *Congressional Record*, the *Federal Register*, and other appropriate

publications distributed by the Superintendent of Documents.

3. Operate an electronic storage facility for the federal electronic information made available on that system.
4. Accommodate as feasible, agency and departmental requests to have their information included in the system.

GPO Access debuted in June 1994. Although free access was given to depository libraries, an access fee to recover the cost of dissemination was charged to other users as provided for by the act. Free access was extended to the general public in December 1995.^[8]

Electronic Freedom of Information Act Amendments of 1996 (PL 104-231)

The Freedom of Information Act (FOIA) of 1966 (5 USC § 552) delineated the public's right of access to unpublished and unclassified federal agency records while protecting personal privacy and government security. As was the case with the definition of government publication in Title 44, agencies were not consistently interpreting the FOIA to include access to records in electronic form. The 1996 Electronic Freedom of Information Act (EFOIA) amended the FOIA and expanded the definition of a record to include electronic formats. It also mandated the establishment of "electronic reading rooms" to facilitate public access to major government records.

High Performance Computing Act of 1991 (P.L. 102-194)

The development of a national supernet of networks or "information superhighways" forming the backbone of a National Information Infrastructure (NII) was supported by the High Performance Computing Act of 1991. The act provided for a number of interrelated programs including high-performance computing research and development, the establishment of the National Research and Education Network (NREN) linking research institutions, government, and industry, and research and development of software and hardware. Federal agencies were to work with private network service providers, libraries, educational institutions, and others, to ensure that researchers, educators, and students had access to the network. The network would in turn provide access to a variety of electronic information resources including information from federal agencies and departments.

In 1993, the Clinton administration launched its National Information Infrastructure (NII) initiative to create partnerships between business, government, academia, and the public with the purpose of developing and extending access to the NII. Among the goals of the initiative were universal access, and improving the accessibility

of government information.^[9] The High Performance Computing Act was amended in 1998 by the Next Generation Initiative Research Act (P.L. 105-305), which continues the development of the NII by providing for the improving Internet capabilities, reliability, security, stability, and performance, and the development of advanced Internet applications. The act specifically recognized that an increasingly important role of the Internet is keeping citizens informed of the actions of their government.

IDENTIFYING AND LOCATING FEDERAL ELECTRONIC INFORMATION

Agencies are producing an increasing volume of their information products and services on a decentralized, local basis through the Internet. Nevertheless, public access to these web-based information resources may be limited, since they are not consistently included in the various existing government programs that foster information dissemination or information access, such as the FDLP, GPO Access, or NTIS.^[10]

GPO Access

In today's Internet environment, there is a strong trend to decentralized dissemination of federal electronic information, yet the GPO still plays a valuable role in providing access to federal electronic information. Through its GPO Access system it provides free access to a wide variety of federal government electronic information resources such as databases housed on the GPO Access servers containing regulatory, congressional, and agency information. GPO Access also hosts federal agency files available for download via GPO's Federal Bulletin Board, hosts some federal agency Web sites, and provides a variety of tools to locate government information. GPO's *Catalog of U.S. Government Publications*, one of the major indexes to federal government publications, contains not only records for tangible products distributed through the FDLP but also records for and links to resources in the FDLP Electronic Collection, a virtual library comprised of core regulatory and legislative information on GPO servers and selected remotely accessible products.^[11,12] A few of the other GPO Access finding aids include topical pathfinders to U.S. government information developed by volunteer government information librarians, an index to federal agency Internet sites, developed by government information librarians at Louisiana State University, and links to indexes created by federal agencies to identify their publications.

The National Technical Information Service

The National Technical Information Service (NTIS) has been another major clearinghouse of government information, specializing in government-funded scientific,

technical, engineering, and business related information. Under direction by the American Technology Pre-Eminence Act (ATPA) of 1991 (P.L. 102-245) to develop a comprehensive inventory of federal government information products and services, by 1992 it introduced FedWorld, a gateway to information available through federal agency bulletin boards.^[13] Today, FedWorld bills itself as "the online locator service for a comprehensive inventory of information disseminated by the Federal Government." Still offering its electronic gateway of more than 100 government bulletin boards, it also offers searching of agency Web sites and databases hosted by FedWorld and links to other government Web sites; a FedWorld FTP site contains more than 10,000 federal government data files. Although access to FedWorld is free, a number of the databases it offers are not.

The Government Information Locator Service (GILS)

Under the PRA of 1995, each agency is to establish and maintain an electronic agency information locator service to identify its major public information systems, holdings, and dissemination products, including electronic information resources. GILS records describe the information available in a resource and tell how to obtain or access the resource. Records describing resources accessible via the Internet should include a link to the resource.^[14] Taken as a whole, this distributed system of agency information locators forms the federal GILS.^[15] Uneven agency compliance with this decentralized approach to creating a governmentwide system has been one of its weaknesses. Other limitations are the lack of a single point of access that would truly define a federal GILS and that all agency GILS databases cannot be searched simultaneously. GPO Access offers the only cross-agency searching of GILS records, although it is limited to the 32 agency GILS databases it houses. It has also created pointer records describing and linking to the GILS of other agencies.^[16] FedWorld's GILS page offers a search form and list of agency GILS databases, but only one can be selected and searched at a time.^[17] Users have also been disappointed with the results of GILS searches because they expect to retrieve the full text of the resource instead of a description of it and information on how to get it.^[18]

Subject Portals

Most federal government entities are using the Web to provide public access to varying amounts of information by and about them. In 1995, at the direction of the House of Representatives, the Library of Congress developed a Web site called THOMAS to make federal legislative information freely available to the public over the Internet.^[19] THOMAS provides a search bill summary, status and text, voting, the Congressional Record, and committee

information. It also provides links to congressional reports and Web sites, directories, guides to the legislative process, and historical documents. Much of THOMAS' content, the text of congressional bills, reports, the *Congressional Record*, is obtained from the GPO, and THOMAS offers users the option of linking to the pdf. or text versions of these legislative resources on GPO Access.

The Department of Energy's Office of Scientific and Technical Information (OSTI) is a shining example of agency use of the Internet to make its information resources available to the public. In partnership with GPO, OSTI introduced its *DOE Information Bridge* in 1995, giving access to the full text of research and development reports from DOE national laboratories and grantees.^[20] OSTI has followed this well-received database with a number of others including the GreyLIT Network, a collaboration with the Department of Defense, NASA, and the Environmental Protection Agency.^[21] GreyLIT provides access to the full text of technical reports generated through federally funded research and development projects, resources that were previously difficult to identify and locate. OSTI is now involved in a partnership with a coalition of science agencies to create Science.gov, a unified gateway to their scientific and technical information resources in the physical and life sciences. Science.gov is projected to become public in early 2002.^[22,23]

FedStats, the "gateway to statistics from over 100 U.S. Federal agencies" is another cross-agency information-access partnership, providing a single location from which to discover federal government statistical information maintained on agency Web servers.^[24] Access points include alphabetical lists of topics and agencies and an option to search across all or selected agency Web sites. Other departments and agencies, such as the U.S. Department of Agriculture (USDA), partner with educational institutions for assistance with disseminating their electronic information resources. The Mann Library at Cornell University hosts the Department of Agriculture Economics and Statistics System containing reports and data sets from USDA economics agencies.^[25]

Web Search Engines

FirstGov is the latest "comprehensive" locator to emerge from the federal government.^[26] An executive branch initiative administered by the General Services Administration, FirstGov was launched in September 2000 amidst a storm of publicity. Introduced by President Clinton, FirstGov was embraced by the Bush administration as an essential building block of a citizen-centered e-government.^[27] It is touted as the "only official U.S. Government portal to 47 million pages of government information, services, and online transactions" and offers both a search engine and topical and agency directories.^[28] On its release, it was found lacking in its general and apparently haphazard topical directory structure and in the poor performance and simple search

features offered by its search engine.^[29] Its search engine has since improved, and the directory structure is currently under revision. Publicity for FirstGov overlooks the existence of GPO Access and other governmentally sponsored locators such as THOMAS, and how these other information providers and locators are to be integrated with FirstGov is not clear. Currently, FirstGov includes links to the GPO Access and DOE databases and to THOMAS under its "Reference Shelf." Although initially FirstGov did poorly in comparison to other major search engines at retrieving GPO Access pages, GPO Access has had some success in working with FirstGov to improve its search engine's retrieval from databases on the GPO Access servers. One study found FirstGov gave the best performance of 23 major search engines in retrieving information from GPO Access.^[30]

Several other search engines focus on government Web sites, including usgovsearch and Google Uncle Sam.^[31,32] Usgovsearch is a joint venture between NTIS and Northern Light and searches the citations and abstracts of material in the NTIS database, selected government Web sites, and Northern Light's Special Collection, a library of full-text journals, books, magazines, newswires, and reference sources. Searching usgovsearch is free, but there is a charge to retrieve the text of material from the NTIS Archive and the Special Collection. Google Uncle Sam is an option offered by the popular Google search engine that restricts searches to .gov and .mil domains. Although using Google Uncle Sam does limit retrieval to government Web sites, it also includes other levels of government using the .gov domain such as state government Web sites, and it omits Web sites in .org, .edu., .net, and .com domains with government information such as those created with partners in educational institutions. However, a great advantage either version of Google has over other search engines, including FirstGov, derives from the fact that a large amount of government information is posted to the Web as pdf files and other non-HTML formats, and Google is the only search engine to search non-HTML file types such as pdf and Microsoft Office documents.

Despite FirstGov's claims that its search engine searches every word of every U.S. government document, no single search engine retrieves all of the government information available on or through the Internet. Because of different searching and ranking methods, different search engines find and offer overlapping but different retrieval sets. Nonetheless, some or all material lurking in the "invisible Web" and the "opaque Web" eludes every search engine. This includes material that is accessible to the search engine but is not indexed for reasons including restrictions on the depth of crawl (amount of material indexed on a single site), frequency with which sites are revisited and reindexed, or that the crawler is not aware of the web page. It also includes pages not accessible to search engines such as databases that require registration to search and resources that require interaction such as the

selection of variables that generates a custom page.^[33] The Census Bureau's American FactFinder, THOMAS, and the GPO Access databases are examples of deep Web resource.^[34] The best strategy to use in searching for federal government information accessible via the Web is to use multiple search engines in combination with subject directories, the various cross-agency tools such as offered by GPO Access, and NTIS, and to mine government agency sites by browsing and using their own site search engines and databases.

OTHER INFORMATION POLICY ISSUES

Variation and Obsolescence of Media and Formats

The variety of formats and media used to distribute government information was shown in the *Assessment of Electronic Government Information Products*.^[35] This wide variety, together with the frequent lack of accompanying documentation, creates difficulties in providing access. Access to information distributed in older formats and media, such as the 5¼-inch floppy disks, is also threatened and sometimes lost because the required equipment or software is no longer available. Historical research and time series comparisons can be hindered because over time agencies have distributed data in a variety of formats and media. Several projects initiated by depository librarians are attempting to ameliorate some of these barriers to access. The GODORT CD-ROM Documentation Service provides bibliographic, content, use, technical, and management information for government-produced and government-related CD-ROMs, DVDs, and floppy disks.^[36] The Floppy Disk Project at the Indiana University Bloomington campus provides a central location through which floppy disks that were distributed through the FDLP, and of which many are no longer accessible locally, can be located and downloaded.^[37] Two projects illustrative of attempts to deal with the variation in user interfaces are the Oregon State University's Government Information Sharing Project, which provides Web access to a variety of federal statistical information issued through the FDLP on CD-ROM, and the University of California's announced Counting California, which has developed a single interface to data compiled by a growing number of federal, state, and local agencies.^[38,39]

Economics of Access to Information

The initial use of electronic publishing technologies by agencies was to produce a less expensive printed product. It is now common for information to remain in electronic form from creation through dissemination. Although this may yield cost savings for the publisher, it can be viewed as a cost increase for the end user who now bears the cost

of the equipment and software required to gain access to the electronic product, as well as the cost of printing the material as needed. Because it is becoming increasingly necessary for citizens to have access to computers and the Internet to connect with government information and services, there have been a variety of studies and reports on measures of "digital inclusion." Census Bureau surveys have shown a dramatic increase in the percentage of households with computers, from 8.2% to 51% between 1984 and 2000, and households with access to the Internet have increased from 18.0% in 1997 to 41.5% in 2000.^[40] Although there were increases in computer ownership and Internet access across socioeconomic and geographic groups, "noticeable divides still exist between those with different levels of income and education, different racial and ethnic groups, old and young, single and dual-parent families, and those with and without disabilities."^[41] However, an even greater divide is apparent when looking at high-speed, high-capacity, or broadband connections, because only half of those with access to the Internet have the option of a broadband connection. The 12% of Internet users who do subscribe to a broadband service tend to be of a higher income level and live in large metropolitan areas.^[42]

The burden of the cost shift to the information user is exacerbated by the trend to commercialize or privatize government information. Commercialization refers to agencies that, by choice or by mandate, treat government information resources as a commodity and recover costs or generate revenues from their sale. An example of this is the National Technical Information Service, which is mandated by the American Technology Pre-Eminence Act of 1991 to be self-supporting. It sells access to its own database as well as to many of the agency databases it distributes, for example, the Department of Labor's Davis-Bacon Wage Determination Database. The Davis-Bacon database has been made available without charge through GPO, unlike some other commercialized resources such as the federal courts' PACER (Public Access to Court Electronic Records) system. PACER is funded through the collection of user fees by direction of congress and provides access to electronic versions of the opinions of the lower federal courts. Although some of the courts provide users free access to the actual opinions, others only link to the fee-based PACER. No free alternatives are available to the user because PACER is not made available without charge to depository libraries. The dissemination practices even within a commercialized program are not necessarily consistent, as seen with STAT-USA, an agency in the Economics and Statistics Administration of the U.S. Department of Commerce. It is also required by law to be self-sustaining but manages to acknowledge Title 44 by providing depository libraries with one-password access to its main databases, State of the Nation, and GLOBUS and NTDB. It does not, however, extend this to its USA Trade[®] Online database, a

STAT-USA and U.S. Census Bureau, Foreign Trade Division collaboration.^[43-46]

Privatization refers to federal agencies making exclusive contracts with the private sector, which “adds value” to and disseminates government information resources. A well-publicized example of privatization and the problems it can create for public access is the U.S. Department of Justice’s contract with the West Publishing Company to maintain its database of case law and digests:

JURIS includes a mix of non-copyrighable, public domain government information with proprietary information created by West Publishing Company. The JURIS database exemplifies the loss of government information to the public when an agency enters into an exclusive contract with a private entity without including in the licensing agreement provisions for public access mandated under Title 44. To this day, parts of the JURIS database, including its public domain content, is still controlled by West Publishing Company and public access, even under the Freedom of Information Act (FOIA), is prohibited.^[47]

In contrast, although its dissemination subsystem is privatized, the U.S. Security and Exchange Commission’s EDGAR (Electronic Data Gathering, Analysis, and Retrieval) database provides free public access through the SEC Web site.^[48] The private sector has been vocal in its campaign to claim a larger and more exclusive role in the dissemination of government information resources and sees any value-adding activity as an encroachment onto the private sector’s turf.^[49] In the electronic information environment, an agency that creates software to provide public access to its own databases is seen by the information industry to be adding value and, therefore, engaging in inappropriate competition. The information industry also objects to projects such as PubScience, the Department of Energy’s (DOE) database of citations with abstracts to peer-reviewed journal literature in the physical sciences and other disciplines of concern to the DOE.^[50] DOE created the database and makes it available to the public for free as part of its mission to provide for the accessibility and dissemination of scientific information. The challenge to PubScience raises concerns that similar agency indexing projects, such as the National Library of Medicine’s PubMed and the Education Department’s ERIC database, may be forthcoming.^[51-53]

The Safety Net

Disparities in access to information technology and the varying abilities to of citizens to pay the access fee for commercialized or privatized information has raised concerns that the government is participating in the creation of an information-rich and an information-poor situation. The government has recognized the necessity of connecting

libraries to the Internet to help provide access to those without access at home.^[54] However, access to the information technology is only part of the equation. Librarians have long maintained that to ensure equitable access in the spirit of Title 44, depository libraries should have free access to databases and other electronic information products created by the government whether they are distributed by the government.

Privacy, Security, and Authenticity

The push to widespread implementation of e-government initiatives has heightened concerns for data privacy, security, and authenticity, and aspects of these issues are directly relevant to a discussion of federal electronic information resources. The Privacy Act of 1976 (P.L. 93-579) addressed aspects of personal privacy protection and restricted the ability of the federal government to collect and disclose personal information. It was amended in 1988 by the Computer Matching and Privacy Protection Act (P. L. 100-503), which regulates federal agency use of personally identifiable records in computer matching programs. The 1998 amendment applies only to records in systems subject to the Privacy Act and excludes matches performed for certain purposes such as statistics, law enforcement, and research. Maintaining the confidentiality of data is an ongoing concern for, as technologies continue to make it easier to access and share data, agencies and researchers see efficiencies and advantages in sharing and “repurposing” or linking data collected from multiple sources:

Record linkage projects like these raise privacy issues, such as whether consent to linkage was obtained; whether linkages required sharing identifiable data with other organizations; and whether “deidentified” linked data are subject to reidentification risks when released for research or other uses.^[55]

If people are not convinced about the confidentiality of their responses to government surveys and other data collection efforts, the reliability of those surveys and databases will decrease. Access to government data might be severely curtailed as an answer to privacy concerns, a reaction researchers and the data community hope to avoid.^[56]

Another privacy concern is the collection of personal information about individuals who use government Web sites. OMB’s Memorandum M-99-18 directed agencies to post on privacy policies on their principal Web sites to disclose what information is collected, why, and how it will be used. It was followed by M-00-13, which specified that the presumption should be that “cookies,” which can be used to track an individual’s use of Web sites, will not be used by federal Web sites.^[57,58]

The Computer Security Act of 1987 (P.L. 100-235) established minimum security standards for federal computer

systems. The Government Information Security Reform, Act (P.L.106-398 Title X, subtitle G) was an amendment to the PRA of 1995 requiring each agency to develop, implement, and maintain a security program and plan. Each agency must ensure the integrity, confidentiality, authenticity, availability, and nonrepudiation of information and information systems. Authenticity and nonrepudiation were addressed by the Government Paperwork Elimination Act (GPRA) of 1998 (P.L.105-277 Title XVII), which also amended the PRA to facilitate e-government by requiring agencies to make electronic versions of their forms available and allow the use of electronic signatures to file the forms electronically. One of the applications of electronic signature technologies is to ensure the recipient of downloaded federal electronic information that they have received a complete and unaltered copy of that information. The GPO is pursuing the use of public key infrastructure (PKI) technology to validate that the user has received the official text of congressional bills that reside on GPO Access.^[59]

Permanent Public Access

Elimination of tangible government resources without a clear and systematic policy for electronic preservation and retention could greatly increase the number of fugitive federal documents and result in the deletion of important unique materials from computer systems.^[60]

Historically, libraries in the Federal Depository Library Program were responsible for providing permanent access at no cost to the public for the government information products in tangible formats that were distributed through the program. Their role in providing permanent access focuses on public access to reference copies of publications and is distinct from that of the National Archives and Records Administration, which preserves an official copy of federal government records, including electronic records in its Center for Electronic Records. Permanent access in the electronic environment involves technological aspects of preservation, such as refreshing or transferring data from one medium to another and reformatting information due to software or platform obsolescence.^[61] It also involves making the information accessible to the public on a continuing and indefinite basis in some online mode and/or through the collections of depository libraries. With the decentralized dissemination of online publications and databases combined with the lack of a centralized information policy, it is alarming but not surprising that much federal electronic information is neither making it into the depository system as tangible products for dissemination and permanent public access, nor are agencies themselves ensuring permanent access to their own information resources. Electronic-only publications

are easily revised or removed altogether, including annual reports and statistical publications from previous years.^[62] Dynamic databases, allowing the creation of a "publication" tailored to an individual user that ceases to exist at the end of the session, are an advantage of the on-line environment, yet they are also endangered information if provisions are not made for the permanent accessibility of either the database or at the least, of prepackaged publications derived from the database.

The GPO has taken a number of steps to address the issues regarding preservation of and access to federal electronic information. The FDLP Electronic Collection Archive, established by authority of the GPO Access Act, contains "publications which are identified, described, and pointed to as part of the FDLP Electronic Collection and which are not part of the FDLP in any other form nor guaranteed to be permanently available by their issuing agency or entity."^[63] GPO also coordinates a Permanent Public Access Working Group with participants from federal agencies, national libraries, congressional committees, the GPO and the FDLP, and public interest organizations.^[64] Partnership agreements between GPO and federal agencies, such as DOE and the National Library of Medicine, ensure that content from their Web sites will be permanently available. The GPO also enters into content partnerships with depository libraries, who agree to host part of the electronic Permanent Online Collection for free use by the public. Two examples of content partnerships are Department of State Foreign Affairs Network (DOSFAN), a partnership with the U.S. Department of State and the University of Illinois at Chicago, and the "cybercemetery" at University of North Texas Libraries, which provides permanent online access to electronic publications of selected federal government agencies that have ceased operation.^[65] Although these initiatives by the GPO to ensure permanent public access are still evolving, there is still much federal electronic information that is being missed by these efforts. Concerns have also been voiced about the loss of the safe redundancy offered by the depository system with multiple copies housed in collections across the nation and the shift of responsibility for permanent public access from libraries to the government. In response, it has been suggested that GPO acquire agency databases and digital versions of government publications posted on agency Web sites and make them available for selection by digital depository libraries.^[66]

CONCLUSION

The dissemination of federal information in electronic form, and in particular the use of the Internet, offer the opportunity to provide more timely, convenient, and widespread access to government information resources. However, identifying and locating needed government

information can be difficult and frustrating for users attempting to navigate the fragmented and complex federal information landscape. This fragmentation is seen in the overwhelming number of federal Web sites that lack central coordination, even within a specific organizational hierarchy (e.g., departmental or legislative). It also appears in the varying media and formats in which the information may be offered and in the use of partnerships and privatization to distribute government information. Navigation is made more difficult by the fact that government information offered via the Web frequently changes location or apparently entirely disappears. The existence of multiple comprehensive locators, GPO Access, FedWorld, and the GILS, all established at the direction of Congress, and the Executive Branch's FirstGov, illustrates the lack of an overall strategy for the provision of access to federal information. Although overlap and multiple points of access are not inherently bad, the lack of a unified vision and coordination of effort, as well as competition for funding, weaken the overall effort to provide access to federal information.

The development of a comprehensive governmentwide policy framework is needed to realize the promise offered by technology to improve public access to government information. Such a framework should incorporate the strong foundation of the past as embodied in the Federal Depository Library Program. Five principles for the dissemination of and access to federal government information were offered in the *Study to Identify Measures Necessary for a Successful Transition to a More Electronic Depository Library Program*:

1. The Public has the right of access to government information.
2. The government has an obligation to disseminate and provide broad public access to its information.
3. The government has an obligation to guarantee the authenticity and integrity of its information.
4. The government has an obligation to preserve its information.
5. Government information created or compiled by government employees or at government expense should remain in the public domain.^[67]

Long overdue and made more urgent because much government information is increasingly available only electronically, perhaps the current move to e-government with its discussions of electronic access to government information and services will help bring about a review and reform of national information policy. A new comprehensive federal information policy framework that incorporates these historical principles and encompasses federal electronic information resources would recognize the vital role government information plays in the nation's economy, scientific, technical, and educational endeavors, and in our system of governance.

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Film and Broadcast Archives

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Abstract

Film and broadcast archives serve as repositories for moving image and sound resources. Whether found in commercial or noncommercial settings, these archives aim to collect, describe, preserve, and make accessible audiovisual materials for users. Archives face many challenges in maintaining film, video, and audio materials, including physical deterioration, format obsolescence, and storage requirements. Audiovisual collections also require significant investment in appraisal, metadata generation for description, and access technologies. The abandonment of the motion picture film as a format for distribution and exhibition and the narrowing window of opportunity to transfer analog magnetic media will continue to drive the archival agenda. Copyright legislation, such as the Copyright Term Extension Act and the Digital Millennium Copyright Act, also complicate the mission of audiovisual archives to preserve and provide access to their materials.

INTRODUCTION

This entry aims to familiarize readers with the mission, goals, and activities of film and broadcast archives, which serve as the repositories for moving image and sound resources. These organizations, which may be found in commercial and noncommercial settings, aim to collect, describe, preserve, and make accessible audiovisual materials for users. While commercial archives tend to focus on the maintenance of collections for the purposes of republication in ancillary markets such as CDs and DVDs, web streaming, or for reuse in new productions, noncommercial archives more often aim to serve users interested in using moving images and audio for educational, artistic, or research purposes. Film and broadcast collections can be found in a variety of settings, including libraries, museums, archives, universities, radio and television news stations, corporations, and many other organizations where these materials are produced and used for education, information, or entertainment purposes.

Film and broadcast archives face unique challenges in providing the same sort of services that are often taken for granted by libraries and traditional archives. Audiovisual material requires different approaches and tools for its appraisal, description, access, and preservation. Yet, the current demand for visual and aural resources to enrich education, scholarship, news services, and entertainment means that institutions and organizations must invest in these rich sources of information.

This entry discusses the major institutions and organizations involved in audiovisual archiving, the scope of activities in which they are involved (including preservation,

appraisal, cataloging and description, and access), and key issues archives are currently facing, including the transition from analog to digital formats, intellectual property concerns, funding for preservation of film and broadcast material, and educational opportunities for audiovisual archivists.

DEFINITION AND CHARACTERIZATION OF MOVING IMAGE ARCHIVES

Film Archives

Although collections of motion pictures were accumulated early on after the introduction and commercial exploitation of film in the 1890s, primarily by the distributors and exhibitors of early films, the prevailing attitude at the time of those involved in the motion picture industry was that films were disposable commodities rather than being seen as the subjects of study or artistic appreciation. This attitude changed quickly as intellectuals and film fans began to articulate the importance of motion pictures as cultural artifacts and information sources and clamored for the long-term retention of films for posterity.

The desire to provide a more permanent haven for film accelerated as the silent era drew to a close, when many motion picture studios attempted to jettison their libraries in the wake of sound film. The fear that the first decades of film would be lost encouraged several individuals to found organizations dedicated to the protection and exhibition of what were considered to be treasures of film heritage.^[1]

By the early 1930s, the first film archives recognized as such emerged in the United States and Europe. Operating primarily as either national repositories or collections within larger cultural institutions, these archives soon formed an international association known as the International Federation of Film Archives (FIAF) in 1938.^[2] Founding members of FIAF included the Cinémathèque Française, the Museum of Modern Art Film Library in New York, the British Film Institute (BFI) National Film Library, and Germany's Reichsfilmarchiv. The establishment of cultural institutions devoted to the care of film heritage was evidence that films were beginning to be taken seriously as cultural artifacts and information sources. Readers interested in further information about the history of the film archive movement should consult Steven Ricci's article on this subject, found in this volume.

Collections of motion picture film were first amassed in the early decades of the twentieth century, as producers of films—production companies—began to build up their film libraries. Early film archives had mixed success in getting studios to donate material from their libraries to archive collections, due to fears that archives would somehow exploit films in violation of copyright law.^[1] Some of this initial antagonism was overcome by the 1970s, however, as studios began to look for ways to unburden themselves from the expenses of storing large quantities of nitrate film and later, 16 mm television prints.^[3] In this manner, a number of archives in the United States acquired access copies of the first half-century of motion picture production. Due to copyright deposit requirements, the Library of Congress has amassed the largest collection of film in the United States, and one of the largest in the world. Table 1 summarizes the most prominent film collections in the United States, including size of collections and strengths. For an extensive list of film archives and research centers throughout the world, please consult the website of the Library of Congress, which maintains a directory.^[4] Many commercial copyright owners maintain their own library of titles and footage, and thus must also be considered as important sources for film resources. These libraries are maintained primarily for the purposes of commercial exploitation, rather than as public resources, however.

Outside of the United States, many archives have acquired copies of films through deposit laws that require production companies to give copies of films, particularly those financed in whole or in part by the government, to the national archive. For a complete list of European Union countries that have deposit laws, please consult the list compiled by the International Federation of Film Producers Associations (FIAPF).^[5]

Broadcast Archives and Collections

Until quite recently, producers of broadcast radio and television in the United States had an inconsistent record of

preserving their productions for long-term retention. While some earliest productions were captured on transcription discs (in the case of radio), or on film (for early television), the switch to videotape, which began in the 1950s with the introduction of the earliest formats and became near universal by the late 1960s/early 1970s, meant that content often was seen as more disposable. Due to the expense of the new magnetic medium, it was quite common for commercial stations to erase and reuse the newly adopted tape. While certain news and entertainment segments were seen as having potential for reuse in other programs, others were quickly deleted to make way for new programming. Yet, many commercial stations still own unique historic material that has great use in education, research, and other uses.^[6] The television and video archives movement in North America was a response to the new use of videotape for education and documentation. Furthermore, the 1976 revision of the American copyright law encouraged off-air taping of hard news broadcasts and established the new American Television and Radio Archives.^[7]

Broadcast archives and collections exist in many different sizes and formats throughout the world. Table 2 summarizes the most well-known broadcast archives collections in the United States, Europe, and Asia, including size of collections and strengths.

The following section will describe various archives and collections throughout the world, which may be categorized as academic, museum, government, or station collections.

Academic Collections

The United States has many different academic broadcast collections covering both television and radio, commercial and noncommercial. First, Special Collections in Mass Media & Culture (SCMMC), as a unit of Special Collections and University Archives at the University of Maryland Libraries, holds a wide-ranging assortment of resources documenting the history of commercial, public, and educational radio and television broadcasting, through its two component collections, the National Public Broadcasting Archives (NPBA) and the Library of American Broadcasting. SCMMC also has substantial secondary resources in the areas of cinema, print journalism, and humor studies.^[8]

The first organized library of radio history was the Broadcast Pioneers Library, which began in 1972. From 1964 to 1971, former National Broadcasting Company (NBC) executive William S. Hedges collected items for the Broadcast Pioneers History Project. These materials, comprising approximately 13,000 items, including correspondence, articles, and speeches, formed the core collection of the Broadcast Pioneers Library and were housed in the National Association of Broadcasters' (NAB) headquarters in Washington, DC, until 1994. That year, it

Table 1 Major motion picture archives in the United States (collections consisting of at least 10,000 titles, items, or equivalent).

Archive	Collection size	Collection strengths
Academy Film Archive ^a	Over 190,000 items	Academy Award–nominated films; film and television programs relating to the Academy Awards shows; documentary film holdings including the collection of the International Documentary Association; home movies and amateur films, particularly those related to the history of Hollywood, the motion picture industry, and the history of the Los Angeles region
Archive Films (parent company is Getty Images) ^b	31,000 titles	Documentaries; news footage; actualities; industrial films
George Eastman House ^c	More than 28,000 titles; collection of stills, posters, and papers with over 3 million artifacts	Silent film; personal film collections of directors Kathryn Bigelow, Ken Burns, Cecil B. DeMille, Norman Jewison, Spike Lee, and Martin Scorsese; largest collection of nitrate Technicolor negatives in the United States
Human Studies Film Archives, Smithsonian Institution ^d	Approximately eight million feet of film and video	Ethnographic film
Indiana University Libraries Moving Image Archive ^e	More than 86,000 items	Educational film and video collections, many produced by Indiana University
Library of Congress ^f	More than 400,000 titles (approximately 750,000 items)	Studio features; independent features, documentaries; newsreels; animation; trailers
Museum of Modern Art (NY) ^g	More than 22,000 films; four million film stills	International cinema; silent film (particularly Biograph and Edison companies, and the films of D.W. Griffith); circulating collection of more than 1200 16 mm prints that include many classics of world cinema
National Archives and Records Administration ^h	Nearly 300,000 motion picture films; more than 200,000 sound and video recordings	Universal Newsreel collection; motion pictures created by the U.S. Armed Forces; Ford Motor Company Collection; U.S. Atomic Energy Commission
Northeast Historic Film ⁱ	900 collections; 29,000 individual items	Film and videotape related to the northern New England region (Maine, New Hampshire, Vermont, and Massachusetts); major collections include film and videotape originating from television stations or created primarily for broadcast, industrial works created by and for corporate and industrial entities, professionally created fictional works, titles made by independent creators intended for public viewing, and amateur films
Pacific Film Archive ^j	More than 16,000 films and videos	International features (particularly Japan, Soviet Union, Eastern Europe, and Central Asia); studio features; independent features; documentaries; experimental/avant-garde films; educational films; animation; trailers
UCLA Film and Television Archive ^k	More than 350,000 films and 160,000 television programs; 27 million feet of newsreel footage	35 mm collections from Paramount Pictures, Twentieth Century Fox, Warner Bros., Columbia Pictures, New World Pictures, Orion Pictures, RKO Pictures, and Republic Pictures; Hearst Metrotone newsreels; 16 mm film collection of over 5000 titles; animation; live-action shorts; personal donations from William Wyler, Jean Renoir, King Vidor, George Pal, Stanley Kramer, Tony Curtis, and Robert Aldrich

(Continued)

Table 1 Major motion picture archives in the United States (collections consisting of at least 10,000 titles, items, or equivalent).
(Continued)

Archive	Collection size	Collection strengths
Walter J. Brown Media Archive and Peabody Awards Collection, University of Georgia Libraries ¹	250,000 titles in film, video, and audio formats; 5 million feet of newsfilm clips	Entries for the Peabody Awards for broadcast journalism; newsfilm and amateur film (focusing on the Southeast and Atlanta regions, particularly Civil Rights era documentation); documentaries

^a **Source:** Academy of Motion Picture Arts and Sciences, <http://www.oscars.org/filmarchive/about/index.html> (accessed December 7, 2016).

^b **Source:** *AMIA Compendium of Moving Image Cataloging Practice*, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

^c **Source:** George Eastman House International Museum of Photography and Film, <https://www.eastman.org/moving-image> (accessed December 7, 2016).

^d **Source:** Human Studies Film Archives, Smithsonian Institution, <http://www.anthropology.si.edu/naa/home/hsfahistory.html> (accessed December 7, 2016).

^e **Source:** <http://libraries.iub.edu/iulmia> (accessed December 7, 2016).

^f **Source:** *AMIA Compendium of Moving Image Cataloging Practice*, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

^g **Source:** Museum of Modern Art, <http://www.moma.org/explore/collection/film> (accessed December 7, 2016).

^h **Sources:** National Archives and Records Administration, <https://www.archives.gov/research/start/by-format.html#film> (accessed December 7, 2016).

AMIA Compendium of Moving Image Cataloging Practice, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

ⁱ **Sources:** Northeast Historic Film, <http://www.oldfilm.org> (accessed December 7, 2016). *AMIA Compendium of Moving Image Cataloging Practice*, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

^j **Sources:** Pacific Film Archive, <http://www.bampfa.berkeley.edu/about/bampfa-collection> (accessed December 7, 2016). *AMIA Compendium of Moving Image Cataloging Practice*, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

^k **Sources:** UCLA Film and Television Archive, <https://www.cinema.ucla.edu/collections/explore-collections> (accessed December 7, 2016). *AMIA Compendium of Moving Image Cataloging Practice*, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

¹ **Sources:** Walter J. Brown Media Archive and Peabody Awards Collection, University of Georgia Libraries, <http://www.libs.uga.edu/media/about/history.html> (accessed December 7, 2016). *AMIA Compendium of Moving Image Cataloging Practice*, ed. Abigail Leab Martin; Association of Moving Image Archivists: Beverly Hills, CA, 2001.

moved to the University of Maryland and changed its name to the Library of American Broadcasting (LAB). The LAB collection, which is one of the most extensive collections in the history of broadcasting, includes audiovisual materials, books, photographs, pamphlets, periodicals, manuscripts, oral histories, and scripts pertaining to the history of the field.^[9]

The NPBA is another academic broadcast collection. Since it began in June 1990 at the University of Maryland, NPBA's mission has been to preserve and make accessible the archival record of the major organizations of public broadcasting, to archive personal papers of individuals who made significant contributions to educational and public broadcasting, and to provide archival services to several Washington, DC, metropolitan area public stations. While NPBA's first concern is textual material, it also has a growing audiovisual component.^[10]

Other academic collections of note include the Wisconsin Historical Society's Mass Communications History Collections, the UCLA Film & Television Archive, and the Vanderbilt Television News Archive. The Wisconsin Historical Society's Mass Communications Collection began in 1955 with the purpose of documenting the importance of mass media in twentieth century American life. Its collections include the records of NBC, the Association of Education in Journalism and Mass Communications, and National Educational Television (NET), as well as

the papers of David Brinkley, H.V. Kaltenborn, and Howard K. Smith.^[11]

The UCLA Film & Television Archive, the second largest moving image archive in the United States, began in 1965, when the Academy of Television Arts and Sciences and the UCLA Theater Arts Department created the ATAS/UCLA Television Library. In 1976, the Television Library merged with the Film Archive to become the UCLA Film & Television Archive.^[12]

Finally, the Vanderbilt Television News Archive began in August 1968 with the mission of preserving and providing access to television newscasts from U.S. national news networks. It operates in conjunction with the Motion Picture, Broadcasting and Recorded Sound Division of the Library of Congress, providing copies for the Library's permanent collection.^[13]

Museums and Libraries

Prominent museums and libraries with broadcasting collections include the Museum of Broadcast Communications (MBC), the Paley Center for Media, and the Thousand Oaks Library collection. The MBC, located in Chicago, Illinois, is a combination of archive, media arts center, educational institution, and museum. Since 1987, the MBC collects and preserves historic and contemporary broadcasting content in order to educate and entertain

Table 2 Major broadcast archives and collections worldwide (consisting of at least 10,000 titles, items, or equivalent).

Archive	Collection size	Collection strength
Special Collections in Mass Media and Culture—Library of American Broadcasting (LAB), National Public Broadcasting Archives (NPBA) ^a	10,000 books and monographs, 8,000 broadcasting industry pamphlets, 93,000 audiotapes of various formats, 20,000 audio CDs, 11,000 videotapes of various formats, 1,000 films and kinescopes, 8,000 recorded discs, 2,500 radio and television scripts, 300,000 photographs	Extensive collections making the past and present of commercial and noncommercial broadcasting widely accessible. Key NPBA collections include Archives of the Corporation for Public Broadcasting, National Public Radio, Children's Television Workshop, WAMU-FM Programming Archives, C. Scott Fletcher Papers, and James Day Papers. Key LAB collections include WNET-Thirteen Arthur Godfrey Collection, <i>Vox Pop</i> Program Collection, Radio Advertising Bureau (RAB) Collection
Wisconsin Historical Society. Mass Communications History Collections ^b	1000 ft ³ of paper collections, more than 5000 audio recordings, and more than 500 films	Papers of significant individuals, organizations, corporations in mass communications including NET, David Brinkley, and Joseph Hanna
UCLA Film and Television Archives ^c	More than 350,000 films and 160,000 television programs, more than 100,000 News and Public Affairs programs, more than 2,000 radio programs	Materials cover broadcast history such as DuMont TV, the Hearst Metrotone News, news and public affairs taped off-air from 1979 to 2003
Vanderbilt Television News Archive ^d	More than 60,000 news broadcasts from NBC, ABC, CBS, Fox, and CNN	Materials span the presidential administrations from Johnson to Obama. Notable topics covered include political conventions, presidential speeches, events of September 11, 2001, the Persian Gulf War, and the wars in Afghanistan and Iraq
Museum of Broadcast Communications (MBC) ^e	Scores of radio memorabilia, working radio and television studios, etc. 62,000 ft ² facility that includes the National Radio Hall of Fame	Films, videos, photographs, audio recordings, and scripts representing genres including television entertainment, television news, and instructional/educational programming
Paley Center for Media ^f	Nearly 140,000 programs and advertisements	Documents the intersection between media and society through collections and public events
Library of Congress ^g	Approximately 80,000 television programs	Examples include the NBC Collection comprising a wide variety of genre programming and the NET Collection with more than 10,000 titles from early noncommercial U.S. television
WGBH Media Archives and Preservation Center ^h	More than 1 million audiovisual materials accessed through Open Vault	Examples include television series like "Vietnam: A Television History," "American Playhouse," and "The French Chef"
Pacifica Radio Archives ⁱ	More than 50,000 recordings	Programs document political, cultural, and artistic movements since the 1950s
United Kingdom		
British Broadcasting Company (BBC) Sound Archive ^j	Over 1 million discs, 185,000 tapes, and many other sound and video recordings from all over the world	Includes off-air radio programs since 1960, and off-air television programs since 1980. Subjects include music, drama, literature, oral history, and wildlife sound
BBC Written Archives Centre ^k	Thousands of files, scripts, and working papers	Documents BBC history from formation in 1922 to the 1980s; other topics include history and development of mass communication and changes in popular culture
National Archive, British Film Institute ^l	Nearly one million film and television titles.	Rich resource of British television programming

(Continued)

Table 2 Major broadcast archives and collections worldwide (consisting of at least 10,000 titles, items, or equivalent). (Continued)

Archive	Collection size	Collection strength
National Media Museum ^m	More than 3.5 million items of television history including television receivers, studio equipment, and video recorders	Documents the technological evolution of television and film
Japan		
Nippon Hoso Kyokai (NHK) ⁿ	More than 8 million news and program items	Documents Japanese programs, both current and historical
Canada		
Canadian Broadcasting Company (CBC) Program Archives ^o	Millions of discs, tapes, films, photographs, written records, and computer files	Documents 70 years of Canadian radio and television history
Australia		
Australian Broadcasting Corporation (ABC) Archives and Library Services ^p	More than 100,000 radio and television programs, photographs, and documents	Documents Australian media created since 1932
National Film and Sound Archive ^q	More than 2.3 million films, radio programs, television programs, videos, audiotapes, etc.	Documents Australia's audiovisual heritage

^a **Sources:** Special Collections in Mass Media and Culture (SCMMC), <http://www.lib.umd.edu/special/collections/massmedia/home> (accessed December 7, 2016). C. Howell, Collection Leader, SCMMC (personal communication, November 4, 2014).

^b **Sources:** A.E. Bridger, Archivist – Bibliographic Information Systems, Library – Archives Division, Wisconsin Historical Society (personal communication, September 18, 2014).

WHS – Mass Communications History Collections Factsheet, <http://www.wisconsinhistory.org/pdfs/la/WHS-MassCommFactSheet.pdf> (accessed December 7, 2016).

^c **Source:** UCLA Film and Television Archive – Explore Collections URL, <https://www.cinema.ucla.edu/collections/explore-collections> (accessed December 7, 2016).

^d **Source:** Vanderbilt TV News Archive URL, <http://tvnews.vanderbilt.edu/web/tvnews/about/> (accessed December 7, 2016).

^e **Source:** Museum of Broadcast Communications – About Us – URL, http://www.museum.tv/about_us.htm (accessed December 7, 2016).

^f **Sources:** Paley Center URL, <http://www.paleycenter.org/> (accessed December 7, 2016).

Mission and History. About Us – Paley Center, <http://www.paleycenter.org/about-mission-history/> (accessed December 7, 2016).

^g **Source:** Murphy, W.; Library of Congress. *Television and Video Preservation 1997: A Report on the Current State of American Television and Video Preservation: Report of the Librarian of Congress*, Library of Congress: Washington, DC, 1997.

^h **Sources:** WGBH Open Vault – About; Open Vault – Series: <http://openvault.wgbh.org/about/> (accessed December 7, 2016). <http://openvault.wgbh.org/series> (accessed December 7, 2015).

ⁱ **Source:** Pacifica Radio Archives – About the Archives, <http://www.pacificaradioarchives.org/about-archives> (accessed December 7, 2016).

^j **Source:** BBC Sound Archive – About, <http://www.bl.uk/subjects/sound> (accessed December 7, 2016).

^k **Source:** BBC Written Archives Centre, http://www.bbc.co.uk/informationandarchives/access_archives/bbc_written_archives_centre (accessed December 7, 2016).

^l **Source:** British Film Institute National Archive, <http://www.bfi.org.uk/archive-collections> (accessed December 7, 2016).

^m **Source:** National Media Museum – Television Collection, <http://www.nationalmediamuseum.org.uk/Collection/Television.aspx> (accessed December 7, 2016).

ⁿ **Sources:** NHK International, <http://www.nhkint.or.jp/en/foundation/> (accessed December 7, 2016).

NHK Video Bank, <http://www.nhkint.or.jp/en/footage> (accessed December 7, 2016).

^o **Source:** CBC Digital Archives, <http://www.cbc.ca/archives/> (accessed December 7, 2016).

^p **Source:** ABC Archives, <http://www.abc.net.au/archives/> (accessed December 7, 2016).

^q **Sources:** About Us – National Film and Sound Archive, <http://www.nfsa.gov.au/about/> (accessed December 7, 2016). National Film and Sound Archives of Australia, Annual Report, 2013–14.

visitors and researchers through various outreach activities including public programs, exhibits, on-site visits to the archives, and online access.^[14] Formerly known as The Museum of Television and Radio, the Paley Center has a large collection of television and radio programming documenting 100 years of media history.^[15]

The American Radio Archives, found in the Special Collections Department of the Thousand Oaks Library System, California, has an extensive broadcast document collection including thousands of radio and television scripts, pamphlets, sound recordings, manuscripts, and personal papers. The library also holds personal papers of people such as Norman Corwin and Rudy Vallee.^[16]

Government

The Library of Congress began collecting and preserving radio and television programs in the 1940s. In 1976, the Copyright Act established the American Television and Radio Archives at the Library of Congress, which is now administered by the Motion Picture, Broadcasting and Recorded Sound Division.^[17] This collection contains approximately 80,000 television programs, focusing on prime-time entertainment series. For example, the NBC Collection consists of a wide variety of genre programming including sports and children's programs from 1948 to 1977. Its NET Collection has over 10,000 titles from

early noncommercial U.S. television.^[18] In 1993, after years of negotiations, the Library of Congress agreed to accession all programs aired and retained by Public Broadcast Service (PBS), which could exceed over 100,000 items.^[17]

The National Archives and Records Administration (NARA) is the other governmental body with a significant amount of broadcast-related material. Examples include the Records of the Federal Communications Commission (FCC).^[19] and the Records of the National Telecommunications and Information Administration (NTIA).^[20]

Broadcasting Stations

Many stations either have their own archives or work with local universities and historical societies when appropriate. For example, while the NPBA cannot serve as a central repository for all public broadcasting stations, NPBA's mission includes advising stations to create archival agreements with local universities and historical societies.^[10] One prominent public broadcasting station archive is the WGBH Media Archives and Preservation Center. Established in 1978 as part of the Film Operations Department, its collection mostly consists of nearly 1 million audio, video, and digital assets. With funding support from the Andrew W. Mellon Foundation, the WGBH MLA created Open Vault, an online media archive content delivery system for academic and research use.^[21]

The Pacifica Radio Archives, described as "... one of the oldest and most important audio collections in the world," has audio material from five member stations ranging from documentaries to poetry readings. Its mission is to "... appraise, collect, organize, describe, and preserve the creative work generated by or produced in association with Pacifica Radio... and to make it available for reference and research use".^[22]

INTERNATIONAL

On the international scene, broadcast collections tend to be less widely dispersed, as stations are usually government owned. This section will look at broadcast archives and their respective repositories in the United Kingdom, Japan, Canada, and Australia.

United Kingdom

In the United Kingdom, the broadcasting collections range from materials aired by the public service television entity, the British Broadcasting Company (BBC), and the commercial broadcasters, Independent Television News (ITN) and Thames Television, as well as material located at the BFI.

The BBC began under a Royal Charter of Incorporation in 1927, granted when the company was a radio organization. The BBC is mostly funded through a license fee

system with supplemental income through foreign sales and cable and satellite contracts. It is a national broadcaster based in London with eight regional studios in England and other studios in Wales, Scotland, and Northern Ireland.^[23] Selected BBC radio and television programs are archived in the BBC Sound Archive at the British Library with its holdings reflecting trends and interests of different generations. The holdings include off-air radio programs since 1960 and off-air television programs since the late 1980s with subjects such as music, drama, literature, oral history, and wildlife sound.^[24] The BBC written documentation is archived in the BBC Written Archives Centre, located in Reading. The Centre has material that documents the history of past programming (more than 3 years old), the history and development of mass communication, and changes in tastes and popular culture.^[25]

Commercial television in the United Kingdom began in the mid-1950s when Parliament established the Independent Television Authority (ITA) on July 30, 1954. Other commercial television companies such as Thames Television, Associated-Rediffusion, London Weekend Television, Granada Television Network, and Channel 4 decided to work together to compete with the BBC for audience share. Jointly they own ITN, a profit-making news business.^[23] Part of ITN Source, one of the largest moving image libraries in the world, the Archive began in 1955 with the first ITN news program broadcast. In 1998, after housing ITN's news programs since 1955, the ITN Archive signed a deal to sell Reuters' news library. In 2002, ITN Archive began managing the Channel 4 Archive clip-sales business, and in 2003, it started marketing and managing the historic British Pathé film archive with footage dating back to 1896. Other deals benefiting the ITN Archive include the representation of Granada Television clips in 2003, the representation of U.S. Fox News and Fox Movietone archives in 2004 and becoming a key launch partner with Google Video in 2006.^[26] Researchers can search for and order footage to be used under a license agreement.^[27]

The National Television and Film Archive at the BFI, located in London, is another rich resource of British television programming, holding around 625,000 programs.^[28] Their television holdings are through donations and through various agreements with the broadcasters including Independent Television (ITV) and Channels 4 and 5. The Archive also selects examples of regional programs and has an access arrangement with the BBC in which researchers can view material produced by BBC1 and BBC2 since August 1990 and from BBC3 and BBC4 since their inception.^[29] The Archive offers a variety of services to researchers, both nationally and internationally, including a researchers' guide of film libraries and archives listings and a searchable film and television database.^[30]

The National Media Museum, located in Bradford, UK, is part of the National Museum of Science and Industry

(NMSI) Museums Group.^[31] The Television Collection represents the evolution of television production since the late nineteenth century to the present. Types of materials include television recorders, television cameras, and television receivers.^[32]

Japan

While Japanese experimental television began in 1939, World War II ended research until the early 1950s, which saw the beginnings of Nippon Hoso Kyokai (NHK) and Nippon Television (NTV). NHK, Japan's public broadcasting system, began in 1926 as a radio network. After World War II, the Occupation Authorities issued the Radio Law, the Broadcast Law, and the Radio Regulatory Commission Law, all to reduce government control over broadcasting. Due to these regulations, NHK is independent from the government and is mostly funded through consumer fees. Its programming, divided into two networks, includes news, cultural and entertainment programs on NHK Sogo, and educational programs on NHK Kyoiku.^[33] The Japanese network, NHK, established its archives in February 2003 in commemoration of the 50th anniversary of television in Japan. In its Tokyo headquarters, the NHK Archives has over 500,000 programs that visitors can view on-site.^[34]

Canada

The Canadian Broadcasting Company (CBC), a public network operating under a parliamentary mandate, has its archives in Toronto. These archives hold more than 70 years of radio and television history on millions of discs, tapes, films, photographs, written records, and computer files. Originally a low priority, the CBC gradually realized that archiving past material was worthwhile, especially after technology made production cheaper and storage easier.

The work of the archives staff includes the ongoing capture of new material, doing research and technical preparation for programming, and selling and sourcing of archival content to broadcasters and other third parties. The archives' first priority is the capture, cataloging, and storage of new material. The archive also tries to gain intellectual and physical control over its backlog of material.^[35]

Australia

The Australian Broadcasting Company archive materials are located in various repositories. The ABC Archives and Library Services serve the needs of ABC Radio, Television, and Multimedia as well as external customers worldwide. To this end, the Archive selects, catalogs, and preserves material representing an audiovisual record of Australian history.^[36–38]

Researchers can find additional Australian broadcasting material at the National Film and Sound Archive (NFSA) in Acton. The NFSA's mission is to collect, store, preserve, and make available Australia's audiovisual history.^[39] Through this mission, the NFSA supplies footage and recordings for use in television and radio productions. With expert technicians skilled in preservation practices, the NFSA transfers, duplicates, restores, and reformats materials in all formats.^[40]

SCOPE OF ACTIVITIES OF FILM AND BROADCAST ARCHIVES

Preservation of Audiovisual Material

Film

While digital formats are now the dominant mode of motion picture production, postproduction, distribution, and exhibition, analog formats continue to predominate in most film archives and may continue to do so for many years. Over the last 100 years many motion picture formats have been marketed, as new developments in film gauge, composition, and aspect ratios emerged. Flammable nitrate-based film, used for the first 50 years of commercial film production, was replaced in the mid-1950s by acetate "safety" film. (Note that nitrate was only used for 35 mm motion picture film, never for the amateur or semi-professional gauges of 8 or 16 mm film [Fig. 1].) There have been numerous color and sound systems over the decades as these technologies were engineered and perfected. Fortunately, for film archivists, the drive toward standardization spearheaded by the Society of Motion Picture Engineers (now the Society of Motion Picture and Television Engineers (SMPTE)) has resulted in relatively few modern analog motion picture formats currently in use (in comparison to the bewildering array of digital formats now available).^[41] Table 3 summarizes the most common analog film formats. Those readers interested in a concise introduction to film technology should consult Enticknap.^[42]

For most noncommercial film archives, as well as for many commercial ones interested in protecting their assets, preservation is seen as a core function. While archives focused on copying of decaying nitrate film to acetate in the early days as their primary preservation treatment, the emphasis for most archives now is on providing appropriate, secure storage facilities that control temperature and relative humidity, protect against damage from natural disaster and fire, and reduce airborne pollutants such as the acetic acid produced by the deteriorating acetate film. By placing collections in good storage facilities that slow down the rate of physical deterioration for motion picture film, archives can extend the life of their

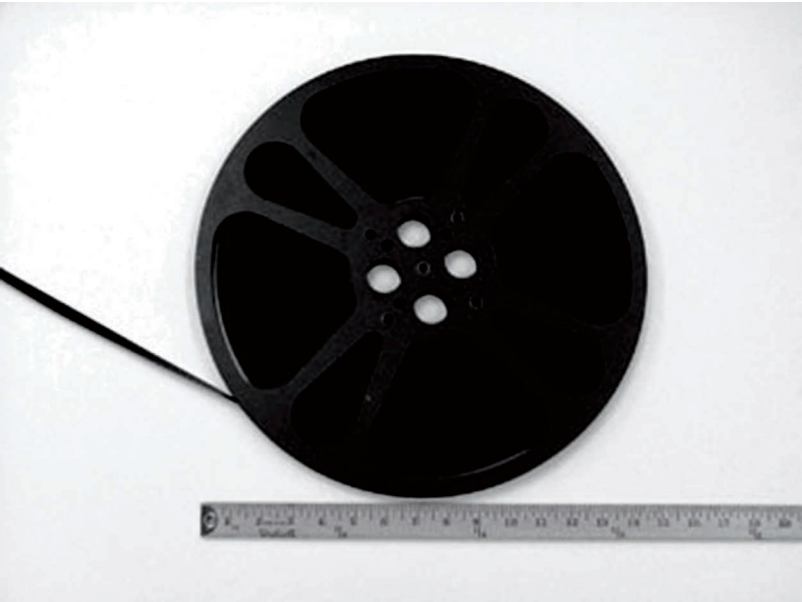


Fig. 1 Reel of 16 mm motion picture film. The 16 mm format was commonly used for television production as well as government, business, medical, and industrial filmmaking from the 1930s through the 1980s until it was largely supplanted by videotape technology.
Source: Photograph courtesy of Tom Connors.

Table 3 Common analog film formats.

Gauge	Users	Bases
35 mm	Professional market	Cellulose nitrate (1894–1953) Cellulose diacetate (1909–1940s) Cellulose triacetate (1948–present) Polyester (1950s–present)
16 mm/Super 16	Professional, industrial, educational; also used by artists and amateur filmmakers	Cellulose acetate, various esters (16 mm: 1923–present; Super 16: 1971–present) Polyester (1950s–present)
8 mm/Super 8	Consumer market (amateur/home movies; small gauge enthusiasts)	Cellulose acetate, various esters (8 mm: 1932–present; Super 8: 1965–present)

Sources: *Film Preservation Guide: The Basics for Archives, Libraries, and Museums*; National Film Preservation Foundation: San Francisco, CA, 2004. Horak, J.C., Introduction to film gauges, <http://archive.today/xt5rw> (accessed December 7, 2016). *Restoration of Motion Picture Film*; Read, P. and Meyer, M.P., Eds.; Butterworth-Heinemann: Oxford, U.K., 2000.

collections and obtain a longer window for making preservation decisions.

Analog Audio and Videotape Materials

According to the organization Independent Media Arts Preservation (IMAP), electronic media is especially vulnerable because the short life expectancy of magnetic tape rules out its use as a permanent, archival storage medium.^[43] Additionally, most analog audio and video formats are already or close to becoming obsolete—tape formats, machine, computer hardware, and software are constantly being upgraded—making it difficult to maintain machines for playback of older media.^[43] The earliest videotape, the 2” Quadraplex, introduced in 1954, required large, compressed-air-driven machines that can only be run and maintained by engineers trained to operate them (Fig. 2). Later analog formats, such as ¾” U-matic, VHS, Betamax, and Betacam, each require their own machines, all of which are becoming increasingly rare and which do not read other formats (see Figs. 3 and 4). Though newer

digital formats such as Digital Betacam, DVCAM, and Digital 8 are recommended for preservation masters, these formats also have problems with tape stability and incompatibility with other formats. For an overview of videotape formats, see Tables 4 and 5.^[44]

Problems with magnetic tape as a storage medium include natural deterioration such as binder hydrolysis, also known as “sticky shed syndrome,” in which the tape’s binder coating absorbs moisture in high heat and humidity and leaves a gummy residue on the tape and machine surfaces.^[43] Signal loss is a common risk for analog formats. Signal loss can occur as a result of either physical damage to the tape or degradation of the tape components (most often the binder). Archivists are encouraged to reformat these tapes through expert vendors after cleaning and to rehouse originals in nonacidic, nonreactive containers.

Audio formats, both analog and digital, also have their preservation issues. Radio archives can have many formats including transcription discs dating from 1929, wire recordings from the 1930s, acetate-based magnetic recording tape dating from 1948, digital audiotape recordings



Fig. 2 Ampex 2 in. Quadruplex machine, located at the Library of Congress Packard Campus for Audio-Visual Conservation.

Source: Photograph courtesy of Karen F. Gracy.



Fig. 3 One inch Type C videotape, developed by Ampex and Sony and used as a broadcasting standard from the late 1970s through the early 1990s, replaced the cumbersome 2 in. Quadruplex format.

Source: Photograph courtesy of Tom Connors.



Fig. 4 The family of Betacam products, including Betacam (1982), Betacam SP (1986), and Digital Betacam (1993), are all one-half inch in width. Tapes come in S and L sizes (Betacam videotape recorders accept both sizes, but Betacam cameras use the S size exclusively). The Superior Performance (SP) variety was the format of choice for preservation purposes for many years, although it is now considered to be an endangered format in the wake of Sony's decision in 2002 to cease production of recorders and players.

Source: Photograph courtesy of Tom Connors.

Table 4 Video—analog formats.

Name	Year introduced	Years used	Users
2" Quadruplex ^a	1956	1956–early 1980s	First video format, for in-studio use
1" [Philips, Grundig, etc.] ^b	1964	1964–early 1970s	Industrial, consumer markets
½" open reel ^c	1965	1965–late 1970s	Industrial, educational, consumer markets. Examples include artists, independent producers, community organizers, schools, television stations
1" Ampex (A-Format) ^d	1965	1965–early 1980s	Industrial, educational, consumer markets
EIAJ ¼" VT-100/110/120	1969	1969–end 1970s	Consumer, education markets
B&W open reel ^e			
¾" U-matic ^f /¾" U-matic SP ^f	¾" U-matic, 1971/¾" U-matic SP, 1986	¾" U-matic, 1971–present/¾" U-matic SP, 1986–present	Industrial, educational markets. Used in 1970s and 1980s for electronic news. 1990s—artists, community activists, academic institutions, production houses
EIAJ-2 Cartridge color video NV-5120 ^g	1971	1971–early 1980s	Industrial, educational, consumers markets
VCR-1500/VCR-1700 ^h	1971	1971–early 1980s	Consumer, educational markets
V-Cord ⁱ	1974	1974–end 1970s	Consumer, educational markets
Akai VK ^j	1975	1975–early 1980s	Home Video, Educational markets
Betamax ^k	1975	1975–late 1980s in the United States	Developed for consumer, industrial, and educational markets. Users included schools, community centers, artists
1" B-format, Philips–Bosch ^l	1976	1976–present	Professional, broadcast markets
VHS/VHS-C/S-VHS ^m	VHS, VHS-C, 1976/S-VHS, 1987	VHS, VHS-C, 1976–present/S-VHS, 1987–present	VHS: consumer market VHS-C: consumer, educational markets S-VHS: consumer, educational, and industrial markets
1" Type C ⁿ	1978	1978–1980s	In-studio use. Also used as a preservation master format in the late 1980s and early 1990s
Quasar VX ^o	1978	1978	Home video market
Video 2000/VR-2000 mono/VR-2000 stereo ^p	1979	1979–1980s	Home video market
CVC ^q	1981	1981–1984	Consumer, educational markets
Betacam/Betacam SP ^r	Betacam, 1982/ Betacam SP, 1986	Betacam, 1982–present/Betacam SP, 1986–present	Broadcast industrial, educational, professional markets. Betacam SP—preservation master in the last 10–15 years
U-matic-HB, BVU ^s	1982	1982–early 1990s	Broadcast professional market
Panasonic M/MII ^t	1982	1982–early 1990s	Professional market
Video8/Hi8 ^u	Video8, 1984/Hi8, 1989	Video8, 1984 to present/Hi8, 1989 to present	Video8, consumer market. Hi8—consumer, industrial, and educational markets

^a **Sources:** The Little Reference Guide for Small Video Tape Collections, Video formats: Quadruplex 2 in., <http://www.little-archives.net/guide/content/1quadruplex.html> (accessed December 7, 2016). Texas Commission on the Arts Video Identification and Assessment Guide, 2004, pp 4–5, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^b **Source:** The Little Reference Guide, Video formats: 1 in. different brand names, http://www.little-archives.net/guide/content/2_1inch_diff.htm (accessed December 7, 2016).

^c **Sources:** The Little Reference Guide, Video formats: ½ in. EIAJ, http://www.little-archives.net/guide/content/2_half_inch_sony.htm (accessed December 7, 2016), ½ inch different brands; http://www.little-archives.net/guide/content/2_half_inch_diff.htm (accessed December 7, 2016). Texas Commission, pp 8–9, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^d **Source:** The Little Reference Guide, Video formats: 1 in. Ampex, http://www.little-archives.net/guide/content/2_1inch_ampex.htm (accessed December 7, 2016).

^e **Source:** The Little Reference Guide, Video formats: ¼ in. EIAJ, http://www.little-archives.net/guide/content/3_kwart_inch_akai.htm (accessed December 7, 2016).

^f **Sources:** The Little Reference Guide, Video formats: U-matic LB, http://www.little-archives.net/guide/content/5_umaticlb.htm (accessed December 7, 2016). Texas Commission, pp 10–12, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^g **Source:** The Little Reference Guide, Video formats: Cartridge National, http://www.little-archives.net/guide/content/7_cartridge.htm (accessed December 7, 2016).

^h **Source:** The Little Reference Guide, Video formats: VCR-1500 / 1700, http://www.little-archives.net/guide/content/6_vtr.htm (accessed December 7, 2016).

ⁱ **Source:** The Little Reference Guide, Video formats: V-Cord, http://www.little-archives.net/guide/content/20_v_cord.htm (accessed December 7, 2016).

^j **Source:** The Little Reference Guide, Video formats: Akai VK, http://www.little-archives.net/guide/content/6b_akai.htm (accessed December 7, 2016).

^k **Sources:** The Little Reference Guide, Video formats: Betamax, http://www.little-archives.net/guide/content/9_betamx.htm (accessed December 7, 2016).

(Continued)

Table 4 Video—analog formats. (*Continued*)

Texas Commission, pp 13–14, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^l **Source:** The Little Reference Guide, Video formats: B-format, http://www.little-archives.net/guide/content/2_1inch_b_format.htm (accessed December 7, 2016).

^m **Sources:** The Little Reference Guide, Video formats: VHS / S-VHS / VHS-C, http://www.little-archives.net/guide/content/8_vhs.htm (accessed December 7, 2016).

Texas Commission, pp 15–16, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

ⁿ **Sources:** The Little Reference Guide, Video formats: C-format, http://www.little-archives.net/guide/content/2_1inch_sony_ampex.htm (accessed December 7, 2016).

Texas Commission, pp 6–7, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^o **Source:** The Little Reference Guide, Video formats: Quasar VX, http://www.little-archives.net/guide/content/10_quasar_vx.htm (accessed December 7, 2016).

^p **Source:** The Little Reference Guide, Video formats: Video 2000, http://www.little-archives.net/guide/content/11_video_2000.htm (accessed December 7, 2016).

^q **Source:** The Little Reference Guide, Video formats: CVC, http://www.little-archives.net/guide/content/21_cvc_format.htm (accessed December 7, 2016).

^r **Sources:** The Little Reference Guide, Video formats: Betacam SP, http://www.little-archives.net/guide/content/15_betacam_sp.htm (accessed December 7, 2016).

Texas Commission, pp. 17–19, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^s **Source:** The Little Reference, Video formats: U-matic-HB (High Band) BVU, http://www.little-archives.net/guide/content/12_umatchb.htm (accessed December 7, 2016).

^t **Source:** The Little Reference Guide, Video formats: Panasonic M / MII, http://www.little-archives.net/guide/content/13_m_format.htm (accessed December 7, 2016).

^u **Sources:** The Little Reference Guide, Video formats, Video 8 – Hi 8 (HB), http://www.little-archives.net/guide/content/14_video8_hi8.htm (accessed December 7, 2016). Texas Commission, pp 20–22, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

dating from 1962, audiocassettes dating from 1963, compact discs dating from 1983, and Super Audio CD (SACD) and streaming audio from 1999.^[45] These formats require compatible machines, some of which have become increasingly obsolete (see Figs. 4 and 5).^[46] The fragility of transcription discs, usually coated with lacquer or, during World War II, made of breakable glass, makes these materials particularly at risk and in need of reformatting.^[47]

Digital Formats

Preservation of digital audio has progressed significantly in the last 20 years. Echoing the transition to digital in audio production and distribution, archivists have embraced digital technology as the primary method to preserve audio for the future. As most analog audio formats have now become obsolete, with the exception of LP records, most archives have chosen to migrate their analog recordings on cylinders, discs, and magnetic tape to an uncompressed digital format such as Broadcast WAV for long-term preservation purposes.^[48] The significant storage requirements of uncompressed digital video have thus far hindered wide-scale adoption of digital formats as target preservation formats in the conversion of analog moving images to digital storage systems. The rapid decline of motion picture film manufacturing in the wake of transition to digital distribution and exhibition for most commercial film releases, combined with carrier degradation and obsolescence of most analog video formats, will hasten many archives' decision to migrate their significant analog film and video collections to digital formats.^[49,50] While the moving image archiving community still works

primarily with analog material, the influx of digital material has begun and most archives are grappling with a potential solution for long-term preservation of digitized and born-digital material.^[51]

Appraisal

Film

For many years, the appraisal of films was seen as an unusual, even dangerous, activity. Given the number of films lost due to deterioration or discarded by their owners when no longer profitable, early film archivists aimed to save as much as they could.^[52] While some archivists, such as Iris Barry, film curator at the Museum of Modern Art, were quite selective in what was chosen as part of the collection, other archivists preferred to “take the films now and ask questions later,” reserving judgment on films until further assessment of their value could be undertaken.^[53] The latter attitude toward appraisal often meant that collections grew beyond the capabilities of the facility and staff who worked at the archive. Even today, it is rare to find appraisal as part of the institutional mission and activities. An atypical example is films collected for the NARA, which are subject to the record retention and disposal schedules created for government agencies. Outside of such government archives, however, appraisal has rarely been formalized as an archival activity, and what little has been done has often been scattershot. Interestingly, some archives are more likely to be interested in monetary appraisal, for purposes of accepting a film collection from a private donor, than in an assessment of the material's archival values.^[53]

Table 5 Video—digital formats.

Name	Year		Users
	introduced	Years used	
D1 ^a	1986	1996	Professional market, broadcast sector
D2 ^b	1988	1988–present	High-end professional market. Used as mastering format
HDV-1000 ^c	1988	1988–present	Professional market, broadcast sector
D3 ^d	1990	1990–present	High-end professional market. Used as mastering format
DCT ^e	1992	1992–present	Professional market, broadcast sector
Digital Betacam (DigiBeta) ^f	1993	1993–present	Developed for professional market. Used for electronic news gathering, broadcast television—industry standard. Advertising, high-end TV programming, corporate—mastering format. Format for video preservation masters
D5 ^g /D5-HD ^h	1994	1994–present	D5: Professional market, broadcast sector/D5-HD: Professional market
D9 Digital-S ⁱ	1995	1995–present	Professional market, broadcast sector
DVCAM ^j	1995	1995–present	Industrial, educational, professional markets. Used for electronic news gathering, cable television, field production. Used as mastering format by artists, independent producers
MiniDV (DV or DVC) ^k	1995	1995–present	Consumer, industrial, educational markets. Users: artists, community activists
D6 ^l	1995	1995–present	Digital Cinema
D7 (DVCPRO-25) ^m /D7 (DVCPRO-50) ⁿ	1995/1998	1995–present/1998–present	Industrial, educational, professional markets. Used for electronic news gathering, cable television, field production
Digital Beta SX ^o	1996	1996–present	Professional market, broadcast sector
D11-HDCAM ^p	1997	1997–present	Professional market, broadcast sector
Digital8 ^q	1999	1999–present	Consumer market, educational sector
D10-MPEG IMX ^r	2001	2001–present	Professional market, broadcast sector

^a **Source:** The Little Reference Guide for Small Video Tape Collections, Video formats: D1, http://www.little-archives.net/guide/content/di_d1.htm (accessed December 7, 2016).

^b **Sources:** The Little Reference Guide, Video formats: D2, http://www.little-archives.net/guide/content/di_d2.htm (accessed December 7, 2016); Texas Commission on the Arts Video Identification and Assessment Guide, pp 23–24. <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^c **Source:** Little Reference Guide, Video formats: HDV-1000, http://www.little-archives.net/guide/content/di_hdv1000.htm (accessed December 7, 2016).

^d **Sources:** The Little Reference Guide, Video formats: D3, http://www.little-archives.net/guide/content/di_d3.htm (accessed December 7, 2016); Texas Commission, pp 25–26, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^e **Source:** The Little Reference Guide, Video formats: DCT, http://www.little-archives.net/guide/content/di_dct.htm (accessed December 7, 2016).

^f **Sources:** The Little Reference Guide, Video formats: Digital Betacam, http://www.little-archives.net/guide/content/di_beta.htm (accessed December 7, 2016); Texas Commission, pp 27–28, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^g **Source:** The Little Reference Guide, Video format: D5, http://www.little-archives.net/guide/content/di_d5.htm (accessed December 7, 2016).

^h **Source:** The Little Reference Guide, Video Format: D5-HD, http://www.little-archives.net/guide/content/di_d5hd.htm (accessed December 7, 2016).

ⁱ **Source:** The Little Reference Guide, Video Format: D9 Digital-S http://www.little-archives.net/guide/content/di_d9.htm (accessed December 7, 2016).

^j **Sources:** The Little Reference Guide, Video Format: DVCAM, http://www.little-archives.net/guide/content/di_dvcam.htm (accessed December 7, 2016); Texas Commission, pp 29–30, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^k **Sources:** The Little Reference Guide, Video format: DV, http://www.little-archives.net/guide/content/di_dv.htm (accessed December 7, 2016); Texas Commission, pp 31–32, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^l **Source:** The Little Reference Guide, Video Format: D6, http://www.little-archives.net/guide/content/di_d6.htm (accessed December 7, 2016).

^m **Sources:** The Little Reference Guide, Video Format: D7 (DVCPRO-25), http://www.little-archives.net/guide/content/di_d725.htm (accessed December 7, 2016); Texas Commission, pp. 33–34, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

ⁿ **Source:** The Little Reference Guide, Video format: D7 (DVCPRO-50), http://www.little-archives.net/guide/content/di_d750.htm (accessed December 7, 2016).

^o **Source:** The Little Reference Guide, Video format: Digital Beta SX, http://www.little-archives.net/guide/content/di_betax.htm (accessed December 7, 2016).

^p **Source:** The Little Reference Guide, Video format: D11-HDCAM, http://www.little-archives.net/guide/content/di_d11.htm (accessed December 7, 2016).

^q **Sources:** The Little Reference Guide, Video format: Digital 8, http://www.little-archives.net/guide/content/di_digital8.htm (accessed December 7, 2016), Texas Commission, pp 35–36, <http://www.arts.texas.gov/wp-content/uploads/2012/04/video.pdf> (accessed December 7, 2016).

^r **Source:** The Little Reference Guide, Video format: D10 MPEG IMX, http://www.little-archives.net/guide/content/di_imx.htm (accessed December 7, 2016).

Radio

Sound archivists often acquire materials from collectors in an ad hoc fashion instead of based on a set records management schedule. As a result, they often have to weed out

unwanted materials to make a more cohesive collection. Due to limits on space, staffing, and finances, archives cannot be unlimited storehouses, keeping every sound recording in perpetuity. Those who advocate retention of all materials often forget that archivists do not have



Fig. 5 One-quarter inch magnetic audiotape, once considered the gold standard for preserving sound recordings, has been largely abandoned in favor of transfer to digital formats stored on high-density magnetic tape formats (such as LTO), hard drives, or secure servers.

Source: Photograph courtesy of Tom Connors.

unlimited time to go through hundreds of hours of material to appraise, process, and make it available for research. Unlike textual materials, audio recordings must be listened to in real time. The audiovisual archivist must use disciplined appraisal methods to keep materials selected in accordance with archival principles. If possible, the archivist should be involved in prearchival control by working with collectors to ensure that material is recorded on good quality audiotape to maintain minimum technical standards.

The basic principle of selection, which is a craft rather than an exact science or an art, is to preserve material with evidential or research value in order to ensure a balanced, representative collection relevant to the nature of the subject matter and the archive's purpose. Two types of selection processes, as defined by Rolf Schuursma, are coarse and fine mesh.^[54] With coarse selection, the archivist evaluates complete collections without investigating individual recordings. The result is a larger but less manageable collection, especially if there is little documentation.

With fine mesh selection, the archivist examines each recording, providing documentation and adequate cataloging. This selection type is good for material that enters the archives in small groups or singly. Another type of selection process, sampling, is especially useful for radio broadcasting material. One example, based on the policy of the Public Television Archive of PBS, has the archive keep the first, last, and representative episodes of a series. Radio archives also use this process to keep one news broadcast daily as the main broadcast. Material that is then weeded out is not always destroyed but may be stored elsewhere or offered to another archive.

Television

In 1995, NPBA curator Thomas Connors and then WGBH Archivist Mary Ide received a Bentley Fellowship to research appraisal standards for public television materials. In his article, "Appraising Public Television Programs: Toward an Interpretive and Comparative

Evaluation Model,” Connors offered a three-tiered ranking scheme to evaluate programs for preservation.^[10] For this scheme, the archivist would examine the following elements for each program: provenance, cost of retention, implications of selection decisions, reference potential, and critical values. The archivist would then rank the programs into three tiers. The first-tier programs would be reformatted for permanent retention. If resources become available, then the second-tier programs would be reformatted. Finally, the third-tier programs would be kept in their original format.

Approaching the appraisal question from the station’s point of view, Mary Ide and Leah Weisse described the retention criteria of the WGBH Media Archives and Preservation Center in their 2003 article “Developing Preservation Appraisal Criteria for a Public Broadcasting Station”.^[55] Every WGBH-produced program sent selected production elements, records, and multiple masters to the Archives. Soon, to save retention costs, the WGBH Archives began to implement a preservation selection standard in order to create a quality collection of program content. This production standard was based on four values: institutional, informational, reuse, and the cost of retention. For institutional values, the WGBH Archives kept track of the program category and genre to maintain a balanced selection as mandated in the WGBH mission statement. Thus, the Archives would describe programs by category such as humanities, music, or science and by genre such as documentary, public affairs, or instruction. Next, for informational values, the Archives looked at the level of cataloging, whether from the shot level by the production staff to descriptive video and closed-captioning after the production has finished. This information is useful for future research and reuse. Reusing a program also plays a factor as to whether it is worth preserving, as maintaining an archive of editorial content saves the station research time and money. Thus, the Archives work with both WGBH Enterprises and the Media Library to determine marketing possibility through possible footage sales. When the Archive has determined what to keep, the next value considered is the cost of retention. There, the Archives looks at such costs as tape transfers, storage, processing and cataloging masters for preservation, adding new catalog information to the Archives database, and the reshelving of newly dubbed material.

Cataloging and Description

Just as archivists need to preserve materials, they also need to know what they have. To reach this goal, the archivist describes the material and creates a record of who authored a work, its format, how many copies the archive has, the work’s value, and who owns the copyright. However, there are many challenges in cataloging and describing audiovisual media. Often, the media object

does not have accompanying labels and must be played in order to determine its contents. Due to the potential danger of damaging older audiovisual material by playing it, archivists often create an incomplete catalog record until they can make a preservation copy and can then update the record.

The organization and description of film and broadcast material has not followed the same path of standardization that helped librarians assume intellectual and physical control over library resources. Sound and moving image cataloging schemas often grew organically within institutions and corporations, with the primary goal of facilitating the retrieval of particular titles, broadcasts, or footage. The approach of a museum registrar describing a collection of avant-garde films was likely to be quite different from the method of a librarian cataloging outtakes for a stock footage house or an archivist organizing a set of corporate in-house productions. While some catalogers have adapted their descriptions to currently existing standards like Resource Description and Access (RDA), Machine-Readable Cataloging (MARC), and the Library of Congress Subject Headings (LCSH), others have created in-house rules for description and subject access.

Digitized and born-digital materials require new ways of cataloging and providing access to material through the use of metadata standards. Metadata, or data about data, helps describe, explain, and locate information about various types of textual and nontextual objects. The three types of metadata include descriptive, such as title, author, and keywords; structural, such as the information about how the parts of complex digital objects relate to one another, for example, the information needed to order individual shots and synchronize picture and soundtrack to create audio or video news stories; and administrative, such as access information and creation information.^[56]

Audiovisual archivists have developed or adapted several metadata standards to meet the functional requirements of describing, preserving, and providing access to moving images. Some archives, particularly those within library organizations, have tailored the Metadata Object Description Schema (MODS) standard, an XML-based derivative of MARC, to describe audiovisual media in collections. For those working outside the library community, other standards have been developed to address the particular needs of moving images. The PBCore data standard was originally developed for the public broadcasting community but has been adopted by other organizations with audiovisual collections that are looking for a way to describe their media items’ intellectual content, property rights, and formats. The PBCore standard is based on the Dublin Core Metadata Element Set, with added fields that are specific to the requirements of describing audiovisual media.^[57] Audiovisual archivists have also developed application profiles for media description that employ elements from metadata standards such as the Metadata Encoding and Transmission Standard (METS), which is

used for bundling and encoding descriptive, administrative, and structural metadata regarding objects within a digital library, and the Preservation Metadata: Implementation Strategies standard (PREMIS), which supports the long-term preservation of digital objects. Other archivists may adopt metadata standards used by the commercial motion picture and television community that are more appropriate for materials in production environments, including MPEG-7 (the Multimedia Content Description Interface), MPEG-21 (a standard for expressing rights, permissions, and restrictions on the use of moving images and sound), and SMPTE standards (including the SMPTE Data Dictionary and the MXF container format for digital audio and video media, which can record various types of metadata in its file header).^[58]

Audiovisual Cataloging Resources

A number of cataloging resources have emerged that take existing sets of rules or headings and tailor them to the needs of moving image and sound description. One such rule set is the *Archival Moving Image Materials (AMIM)* standard, which is based on the *Anglo-American Cataloguing Rules (AACR)*.^[59] Another rule set is the *FIAF Moving Image Cataloguing Manual*, developed by representatives of institutional members of the FIAF. The FIAF rules have recently been revised to reflect the Functional Requirements for Bibliographic Records (FBRR) model and aim to be compatible with multiple metadata schemas such as Dublin Core and MARC.^[60]

While catalogers have often taken terms from LCSH to assign indexing terms, particularly for nonfiction films, the Moving Image Genre-Form Guide (MIGFG) term list was specifically created to give film seekers access to films by type or category and often is used to supplement LCSH.^[61] Similarly, the Radio Form/Genre Terms Guide (RADFG) provides a list of subject headings for sound archivists cataloging such material.^[62]

For materials such as stock footage and news stories, which often lack the hallmarks of authorship such as formal titles, catalogers have often developed separate databases using software like FileMaker Pro or Microsoft Access and created their own thesauri specific to the collection at hand, rather than attempt to integrate records of moving image resources with preexisting catalogs. While the variety of resources created by moving image catalogers often served the internal needs of the organization well, such homegrown systems were rarely interoperable with other systems.

Access

Whether the material is textual or audiovisual, researchers want access to it. Preservation and cataloging are key methods for providing this access. However, the Library of Congress television and video preservation report notes

that obstacles to access include “. . . underfunding in public archives, lack of descriptive cataloging and reference copies, copyright interests, and very restrictive usage policies” (p. 9).^[17] Other problems, as noted in the Council on Library and Information Resources (CLIR) 2004 report, *Survey of the State of Audio Collections in Academic Libraries*, include physical deterioration, lack of staff, intellectual property rights, and space problems.^[63]

On-site

While audiovisual archives, particularly those found in public institutions, have always had the capability to provide on-site access to materials in their collections, preservation imperatives and copyright restrictions have often made it difficult or impossible for institutions to lend films to users for off-site use. Larger archives had the resources to create study centers, which users could visit for the purposes of requesting titles to view that have been transferred to CD, video, or DVD, while smaller archives must often make do with a few listening or viewing stations. One problem for many archives is the inability to provide even on-site access to users, either because they lack the proper equipment to view material or because they do not want to risk damage to fragile, often deteriorating, material by screening it for users before it has been transferred to a more stable format.

Online

With recent advances in audio and moving image digitization and streaming technologies, many archives are exploring the Internet’s promise for increasing access to collections and reaching new users who are unable to travel to the archive to listen to recordings or view films and videos. While copyright restrictions still limit archives’ ability to provide access to many materials in the online environment, for those films and broadcasts that are in the public domain or for which archives have the rights to distribute, archives can now provide digitized versions of sound recordings, films, and videos for downloading or streaming. Users can integrate digital audio and moving images into new works or research much more easily than before. The explosion in video sharing services such as YouTube and Vimeo also offers a new template for archives to consider when designing sites for accessing material—users can now provide valuable information through tagging and commenting activities that may enrich the catalog.^[64]

Projection of Motion Picture Film

The lure of online access has the unfortunate side effect of overshadowing an important mode of access to analog film materials: presentation through projection. In the wake of the digital transition, the number of working

projectors for the 35 mm format has dwindled rapidly. The National Association of Theatre Owners reported that conversion of motion picture theaters to digital projection had occurred for approximately 94% of all commercial venues in the United States by May 2014.^[65] In the current environment, where most theaters have abandoned the 35 mm format, specialized venues such as museums, archives, and universities with large collections of features on 16 and 35 mm may be the only locations where users will be able to see film as a projected medium.^[42]

The 16 mm format, once the mainstay for schools, churches, nonprofit organizations, and others to show educational, industrial, amateur, and other types of non-theatrical films, has largely been abandoned in the wake of video, DVD, and other digital forms of exhibition. Used equipment for 16 mm projection has been widely available in the past, although the challenges of maintaining such equipment and the preference for newer formats of such material by most users are the reasons why most institutions have jettisoned much of their 16 mm collections (buying DVD replacements where available, or transferring them to a newer format if no DVD replacement can be found).^[66]

The 8 mm and the Super 8 formats are no longer used by most amateur and home moviemakers, who long ago adopted video formats (initially flocking to the analog video formats first introduced in the 1980s and, more recently, to digital video formats). These small gauge film formats continue to have a fan base, however, with enthusiasts such as experimental filmmakers and archivists. While these collections are found much more often in personal collections than in institutional settings, the

rediscovery and celebration of small gauge films by organizations such as Home Movie Day means that more and more of this valuable material may find its way into archives and museums.^[67]

ISSUES AND TRENDS AFFECTING FILM AND BROADCAST ARCHIVE WORK

Developing Digital Archiving Systems to Support Production, Access, and Storage

As the film and broadcast industries continue to adopt new modes of production, distribution, and exhibition, archives must prepare themselves to care for the new formats generated by production companies, artists, researchers, and amateur filmmakers. The digital formats of today will challenge archivists to develop solutions to problems such as rapid media and format obsolescence, restrictive copyright laws hindering preservation and access imperatives, and creating preservation-ready repositories for reliable and affordable long-term storage of digital moving images (Fig. 6).

While many archives have focused attention on obtaining appropriate storage facilities for their analog collections and maintaining machines to access film and video elements, they also have been contemplating requirements for accessioning, maintaining, and making accessible digital moving image collections. While media asset management systems predominate in commercial organizations where systems must support production environments, many noncommercial organizations are



Fig. 6 DAT uses 4 mm tape and its dimensions are roughly half that of the Philips compact audiocassette. Its recording quality represented a great improvement over analog magnetic tape; however, it has been used largely by professionals rather than being a consumer format. Sony ceased production of DAT recorders in 2005, which adds it to the long list of obsolete magnetic tape formats.

Source: Photograph courtesy of Tom Connors.

choosing to construct digital storage repositories according to the Open Archival Information System (OAIS) model in order to meet needs to preserve the content, integrity, and authenticity of moving image material and manage the migration of files in obsolete formats to current formats. Specific features that are desired of these new preservation-oriented systems include support of on- and off-site ingest; centralized metadata creation and maintenance (where metadata can be acquired throughout production workflows, as well as in later assessment and cataloging workflows); automated migration of analog and digital files to uncompressed, nonproprietary formats; hierarchical storage management; selection criteria for long-term preservation; quality control; and environmental control for data storage systems. Larger organizations with significant resources may prefer to build customized in-house systems, but other smaller organizations are exploring the adoption of open-source solutions in whole or in part to accomplish preservation and access goals. The Hydra repository and associated software components is one such open-source solution being employed by organizations such as WGBH, Indiana University Libraries, Stanford University Libraries, and Northwestern University Library.^[68]

Copyright Legislation

Copyright legislation such as the Copyright Term Extension Act (CTEA) of 1998 (Public Law 105–298) and the Digital Millennium Copyright Act (DCMA) of 1998 (Public Law 105–304) often restrict the ability of archives to fulfill their missions of preservation and access, particularly those noncommercial archives holding large quantities of copyrighted material still considered to have commercial value. The CTEA has ensured that most material from the sound era of motion pictures remains under copyright (except for those titles whose copyright lapsed back when the United States required copyrights to be renewed for continued protection). For films still under copyright, archives cannot distribute them freely (access is limited to on-site viewing), must pay copyright owners for any public exhibitions, and have limited powers to make copies of them for preservation purposes.

The DCMA further limits archives in achieving preservation goals by forbidding them from circumventing mechanisms meant to protect copyrighted material such as digital rights management (DRM) systems and encoding and encryption schemas, in order to make copies for preservation purposes. While archivists have lobbied the Copyright Office to provide exemptions for preservation work, no rulings from the Office have yet given archivists the power to do so. Some hope may be drawn from a 2006 exemption that allows university educators to rip clips from DVDs and other digital files in order to make compilations for use in the classroom as part of film or media studies courses.^[69]

In certain motion picture genres, such as silent, educational, and industrial films, many titles have fallen into the public domain or are no longer cared for by their owners, who may no longer be in business. These films have been dubbed “orphans” by the moving image archiving community, and interest in protecting and preserving them has grown exponentially in the last decade, particularly as federal grant programs have targeted them as strong candidates for preservation funding. The Orphans Film Symposium, first established in 1999 by Dan Streible and fellow enthusiasts (known as orphanistas), has become the premier event for archivists, scholars, educators, and others eager to celebrate these films.^[70]

Attempts to remedy the problem of copyright limbo for orphan works through the introduction of legislation to the U.S. Congress in 2006 failed due to opposition by photographers, illustrators, and textile designers. Since then, the U.S. Copyright Office has been investigating this issue through studies and public comment periods; these activities may eventually lead to some sort of exemption to the current copyright law.^[71]

The issue of copyright is also important in the field of broadcast archives. The Copyright Law of 1976 encouraged scholarly use of audiovisual material by permitting off-air taping for educational purposes.^[46] Under the law, retention of off-air videotapes for classroom use is limited to 45 calendar days and further use requires a license from the copyright owner. However, unlike the American Society of Composers, Authors, and Publishers (ASCAP), there is no copyright clearinghouse, and researchers thus have problems finding accurate copyright information on older programs. The 1997 Library of Congress report on television and video preservation recommends that interested parties discuss issues such as revising fair use guidelines and policies for off-air recording, especially concerning programs without clearly identifiable copyright ownership.^[17]

Copyright limitations affect access to materials both on-site and remotely. For example, Vanderbilt Television News Archive provides limited access to its collection via streaming video due to copyright consideration. While it makes dubs of news programs on request, the archive considers the tapes to be loans.^[13] Another example is the Paley Center for Media, which encourages researchers to view programs on-site. The Paley Center does not have any rights to the tapes that were donated to the Center, which are “only to be viewed or listened to in the Paley Center by the general public.”^[72]

For government collections, deposit laws vary from country to country and are not always equally applied. For example, the collections in the Library of Congress Television Archive offer a broad but incomplete view of television history. Reasons for incomplete runs of television series include the Library’s earlier practices of selectively keeping deposit copies for copyright protection, earlier producers deciding not to register their programs, problems with legal definitions of publication, and the

underestimation of broadcast recordings as a scholarly resource. In 1966, the Motion Picture Section's reference staff started answering television questions, and the acquisition of programs began to expand.^[73]

Building New Storage Facilities for Audiovisual Media

In the last 20 years, many archives have focused on the construction of the new storage facilities for their collections, in an effort to prolong the life span of fragile film and video material in danger of decay. The Museum of Modern Art in New York completed the Celeste Bartos Film Preservation Center in Hamlin, Pennsylvania, in 1996; Northeast Historic Film, a small archive in Bucksport, Maine, built a cold storage facility in 2003 that rents space to other institutions in the New England area seeking a place to store their moving images; the Library of Congress built the National Audio-Visual Conservation Center in Culpeper, Virginia (which opened in 2006 and includes facilities for storage of digital moving images as well as analog film and video elements); and the UCLA Film & Television Archive relocated all conservation activities to a new facility in Santa Clarita, California in 2015 (Fig. 7).^[74–77]

Other smaller collections found within larger institutions may also be benefiting from trends of academic libraries such as the University of Toronto, the University of Pittsburgh, the University of California, Berkeley, the Harry Ransom Center at the University of Texas at Austin, and, the University of Texas at Arlington, to create cold storage facilities to house those types of photographic and magnetic media that require colder temperatures and lower relative humidity than print collections.^[78]

Funding for Audiovisual Preservation

Funding for Film Preservation

In the last two decades, the sources of funding to support film preservation activities have changed significantly.

Whereas the primary funding source in the 1970s and 1980s was the federally funded American Film Institute-National Endowment for the Arts (AFI-NEA) grant program, cuts in federal funding to the NEA in 1994 led to the discontinuation of this program. In 1997 the National Film Preservation Foundation (NFPF) was established by the National Film Preservation Act of 1996. As a public charity, its goals are to support preservation of orphan films by facilitating fundraising from individuals, organizations, and corporations and encouraging in-kind contributions of goods and services from laboratories and suppliers of preservation materials.^[79] To date, the NFPF has contributed to the preservation of over 2,000 films.^[80] Other federal grant sources funding film preservation have included the National Endowment for the Humanities (NEH) and the National Historic Publications and Records Commission (NHPRC).

Archives have come to rely increasingly on the donations from private individuals and foundations in recent years to fund capital expenditures, such as new storage facilities and study centers, or to defray costs of digitization and access projects. The Film Foundation, the David and Lucile Packard Foundation, and the IBM Corporation have supported major projects at film archives in recent years.^[81,82] Archives have worked together with studio copyright owners such as Sony, Paramount, and Walt Disney, which often contribute funds for laboratory services and lend production elements to assist with preservation projects.

Funding for Television and Video Preservation

The Library of Congress television preservation report notes that often funding of television and video preservation has been inadequate, with some exceptions. Many foundations reject video preservation grant applications because videotape is perceived as inadequate for long-term preservation. While federal agencies such as the NHPRC and the NEH have awarded funds to public archives primarily to improve access, there has been little



Fig. 7 Exterior of the Packard Campus for Audio-Visual Conservation.
Source: Photograph courtesy of the Library of Congress.

coordination and communication among the different agencies.^[17]

Based on the recommendations of the Library of Congress report, the National Television and Video Preservation Foundation (NTVPF) was created to raise private funds and provide grants for preservation projects in institutions with television and videotape collections.^[83] Since its inception, NTVPF has awarded grants for projects such as ten hours of videotapes from the Experimental Television Center in 2004.^[84] NTVPF is currently dormant, with no new grants being announced in the last decade. The future of this foundation is not clear at the time of this writing, unfortunately.

The American Archive of Public Broadcasting is another funded television preservation project. In 2007, the Corporation for Public Broadcasting (CPB) started an inventory of public media content from participating stations resulting in over two million records representing a wide range of media content including complete programs, unedited interviews, and live music sessions. The first 40,000 hours of content digitized for permanent preservation and public access was funded by CPB.^[85] The American Archive of Public Broadcasting, instituted in 2013, continues to preserve public television programming through funding from CPB.^[86]

Funding for Radio Preservation

In the area of radio, funding for preservation comes primarily from the following sources. The GRAMMY Foundation awards grants to archives for planning, assessment, consultation, or implementation of preservation projects.^[87] One prominent recipient of preservation grants from the GRAMMY Foundation is the Pacifica Radio Archive's weekly radio show *From the Vault*.^[88] Other funding sources for preservation and access have come from the NEH's Preservation and Access program and the Save America's Treasures program (cosponsored over the years by various government and civilian agencies including the National Park Service (NPS), the National Trust for Historic Preservation, NEA, and the Institute of Museum and Library Services (IMLS)), which have also made grants relating to preservation and access projects.^[89–92]

Education and Professionalization Opportunities for Film and Broadcast Archivists

Graduate Programs in Moving Image Preservation and Archiving

The Library of Congress report *Redefining Film Preservation* strongly urged the moving image archiving community to develop educational programs at the graduate level to produce archivists trained to care for the burgeoning collections of analog and digital material in U.S. repositories.^[93] Within a decade, several programs had been

established, including the L. Jeffrey Selznick School of Film Preservation at the George Eastman House (established in 1996; the School began to offer a joint M.A. degree combined with a Certificate in Film Preservation with the University of Rochester in 2005); the M.A. in Moving Image Archive Studies at the University of California, Los Angeles (2002); and the Moving Image Archiving Program at New York University (2003). Internationally, several programs are available in Canada, Europe, and Australia. Additionally, moving image archiving courses have been added to the curricula at several library and information science (LIS) programs in the United States, making educational opportunities much more widely available. The Library of Congress maintains a current list of moving image archiving educational opportunities available both in the United States and abroad.^[94]

Similar recommendations have been made to train a new generation of sound archivists.^[95] These suggestions have yet to result in many formal educational training opportunities at the graduate level, unfortunately. Several LIS schools have begun to offer electives in sound archiving and reformatting, including the University of Texas at Austin and UCLA, which have regularly offered courses in this area.

Moving Image and Recorded Sound Archives Associations

In North America, the primary professional association serving the moving image archiving community is the Association of Moving Image Archivists (AMIA).^[96] As noted earlier, FIAF also plays an important role; however, it must be acknowledged that only institutions can be members of FIAF, while AMIA has both individual and institutional membership, which allows it to facilitate communication among archivists more directly than FIAF. For sound archivists, the national organization that supports the profession is the Association of Recorded Sound Collections (ARSC).^[97] Other international associations that provide leadership in the field include the Southeast Asia-Pacific Audiovisual Archive Association (SEAPAVAA), the International Association of Sound and Audiovisual Archives (IASA), the International Federation of Television Archives (IFTA/FIAT), the International Council on Archives (ICA), and the International Federation of Library Associations and Institutions (IFLA). Many of these organizations offer opportunities for continuing education through their annual conferences, particularly AMIA and ARSC. FIAF holds a Summer School for training film archivists every other year as well.

CONCLUSION

To summarize, the authors defined the scope, mission, and activities of film and broadcast archives, focusing

particularly on archival functions including preservation, appraisal, description, and access to moving image and sound material.

Several important factors emerged as critical issues for film and broadcast archives. First, film and broadcast material requires extensive description, which is not fully supported by traditional library descriptive tools such as Resource Description and Access or MARC. Metadata standards developed or revised specifically to address preservation and access activities, particularly for newer digital formats, have been developed or adapted by the film and broadcast archiving communities, including PREMIS, PBCore, the FIAF Moving Image Cataloging Manual, MXF, MPEG-7, and MPEG-21 to provide archivists with opportunities to make full descriptions of legacy and digital formats. Adoption of these standards will facilitate interoperability among film and broadcast archive repositories, and may lead to increased information sharing among archives and facilitate searching across collections.

Second, appraisal methods for audiovisual archives must continue to be developed and refined to establish best practices for selecting film and broadcast materials for long-term retention. Models developed in the area of appraisal for television broadcast material should be tested for other audiovisual media and digital materials.

Third, preservation concerns such as format obsolescence, as well as copyright considerations, can often complicate efforts to provide access to audiovisual archives. Archives will need to be proactive in advancing archival interests in the areas of copyright reform and development of new formats suitable for long-term storage of audiovisual media.

Finally, audiovisual archives, while continuing to emphasize the importance of caring for legacy formats, must now deal directly with the effects of the digital transition and its accompanying new paradigms for preservation and access. These new directions and responsibilities require financial support both from within their institutions and from external sources. Archivists will need to lobby their own organizations and government agencies for the continued support of funding for preservation and access activities, as digital repositories are designed and launched to care for moving image and sound archives into the future.

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Film Archiving: History

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Abstract

This entry provides an overview of the evolution of motion picture archiving from its beginnings as an uncoordinated set of craft-oriented skills to its modern status as a profession. It discusses the role of the profession's major historical associations including the International Federation of Film Archives, the American Film Institute, the Library of Congress, and the Association of Moving Image Archivists.

This entry retraces the evolution of the field of motion picture archiving in order to provide the cultural and philosophical background to the extraordinary practical challenges that public-sector archives currently face. The two most useful books on the history of film preservation are Anthony Slide's *Nitrate Won't Wait* (Jefferson, North Carolina: McFarland, 2000) and Penelope Huston's *Keepers of the Frame* (London: British Film Institute, 1984). While Slide focuses on the major film archives in the United States, Huston concentrates on the large international institutions. Around the world, only 15%, at best, of all silent films survive. This means that almost 90% of what was screened during the first 30 years of cinema history cannot be seen by today's audiences. It is estimated that roughly half of the 21,000 feature films made in America prior to 1950 have been lost. If we then consider that much of what actually remains suffers from general wear and tear, color fading, deep scratches, shrinkage, and sprocket damage, and that only a small percentage of the extant films have been professionally restored and preserved, the picture is perhaps as bleak as it is barren. Although precise statistics vary somewhat, most estimates already tell us that significant moving image inventories are lost. Author Frank Thompson estimates the percentage of lost silent films at 80%.^[1] In the documentary *Keepers of the Frame* (Produced by Randy Gitsch, 1999), the estimated loss is 90%.

According to Penelope Houston, "it is generally assumed that some 75–80% of all silent cinema has been lost, most of it gone beyond recall unless caches still exist in the unexplored recesses of the archives or in the holdings of private collectors"—*Keepers of the Frame: The Film Archives* (London: British Film Institute, 1994). Moving Image Collections asserts that "only 10% of pre-1929 films survive."

The "Silent Era" Web site states that "educated guesses estimate that only 10–15% of the films made during the silent era survive today."^[2]

Exactly how much of America's film production has already been lost remains difficult to say. The most

familiar statistic, which has attained its authority primarily through repetition, is that we have lost 50% of all titles produced before 1950.^[6] This estimate may not be inaccurate so long as one qualifies it in three ways. First, it would apply only to full-length fiction films. Anecdotal evidence suggests that survival rates for other film types, even major studio newsreels and shorts, are lower. Second, among those studio features, there is a sharp break in survival rates at 1929, the year that sound film became the industry standard. Features of the 1930s have been recently documented to survive at a rate of no less than 80%, probably closer to 90%.^[7] However, fewer than 20% of the features of the 1920s survive in complete form; for features of the 1910s, the survival rate falls to slightly above 10% (and those in copies generally made from projection prints, not negatives, which are almost entirely lost)...Third and last, the familiarity of that 50%-before-1950 statistic also implies, by omission, that there are few preservation problems with films produced after that year—something which is not the case, as will be discussed (p. 56).^[3]

Historical memory of the world's moving image heritage is incomplete in three profound ways. Many films are permanently lost. Much of what remains is in immediate need of archival attention, and some of these films may never be able to be restored to an integral state. Even after the remaining titles have been repaired or reconstructed, it is extremely rare that these works can be exhibited to the public in a manner that even remotely resembles their original presentations.

Contemporary moving image archives, particularly in the public sector, face unprecedented practical challenges and a new set of opportunities. On the one hand, the soon-to-be expected disappearance of duplicating stocks constitutes a new threat to the long-term preservation of moving images on film. The major manufacturers of photographic raw stock have, over time, introduced, replaced, or simply discontinued numerous types of negative, reversal, and print stocks. For example, many of the 16 mm color reversal stocks, which were once the medium of choice for

television news films, are no longer available. Starting in the early 1990s, just as announcements began to appear about the anticipated deployment of digital cinema projection and distribution, Kodak significantly reduced its budget for research and development of new film stocks. These reductions certainly reflected the wide-spread transition from consumer still photography to digital cameras. One of the more troubling developments, however, is that newer moving image stocks do not accurately reproduce the visual qualities of Kodak's earlier products. This most recent technical problem represents potential loss that could far exceed the combined effects of nitrate and acetate deterioration. These two forms of chemical deterioration, which progressively destroy the film emulsion and/or its base, are responsible for the greatest loss of legacy films from the history of cinema. Cellulose nitrate was the dominant 35 mm film stock until the early 1950s until it was replaced first by cellulose acetate and then by polyester stocks. The latter types are generically referred to as "safety" film. What becomes of the millions of hours of unprotected archival footage when the ability to accurately copy film to film disappears? In 1993, it was estimated that 97 million feet of unique nitrate film footage, held in tax-exempt archives, was yet to be preserved. This estimate is even more staggering if we consider that a good portion of the original film-to-film duplications were done very quickly, and that current laboratory techniques have significantly improved. In other words, much of what was accomplished in the modern archival era needs to be redone.

On the other hand, new technologies may constitute new opportunities for the acquisition, preservation, and documentation of moving images. The technical capabilities of a digital future are regularly described as virtually limitless, unchained by the scarcity of time or material resources. Although it may be too early to assess precisely the long-term effect that these technologies (DVD, High Definition Television, Internet) will have upon moving image culture, they will certainly provoke intriguing ethical and theoretical questions. Given the vertiginous pace at which post-production technologies and new delivery platforms are evolving, the vital role of public-sector archives as agencies for historical memory will undergo a paradigmatic shift. Kay Hoffman has suggested that these changes are as significant as the most significant historical upheaval in all of cinema history:

The fundamental consequences of digitalization for movie production, post-production, and distribution can only be compared with the sea change brought about by the transition from silent to sound film at the end of the 1920s.^[4]

In comparison to traditional records and document-based archives, moving image archiving is a recent phenomenon. Its first formal association came only in 1938 with the establishment of the International Federation of Film

Archives (FIAF). On the one hand, this relatively new field does share many of the core functions of traditional archives, including collection development, preservation, documentation, and access. On the other hand, it diverges from these traditional archival institutions given the priority it has historically assigned to both the restoration and exhibition of archival materials. For example, the first lines of FIAF's Web site emphasize the importance of exhibition as part of its core mission: "... the world's leading archives whose purpose has always been to ensure the proper preservation and showing of motion pictures."^[5]

In contrast, the welcoming message to the International Council on Archives' Web site instead emphasizes key terms such as evidence, memory, and records. "Archives, by providing evidence of human actions and transactions, underlie the rights of individuals and of states, and are fundamental to democracy and good governance. Archives safeguard the memory of mankind by preserving records of its past."^[6]

Moving image archives also confront special challenges, perhaps shared only by photographic archives, generated by the complex question of what constitutes "any" original item. Throughout their entire history, moving images have generally been manifested in works existing in multiple copies, in multiple versions, and often in multiple physical formats. Moreover, the very separations between a work's carrier and its message, between its material status and its presentation, between structure and event, require additional attention to each and every level of archival practice. As we will discuss later on, these unique characteristics are both practical and philosophical in nature.

Although the field of moving image archiving has a comparatively short history, it has already moved through several distinct phases: 1) 1938–WWII: the early years of FIAF; 2) 1946–1970: preservation reigns; "Nitrate Won't Wait"; 3) 1970–present: the craft becomes a profession (AMIA) the era of Access. The mass circulation of moving images was a distinctive phenomenon of the twentieth century. Moving image media have been subject to a particularly accelerated rate of technological and cultural change. Precisely because of this accelerated evolution we can already point to at least three significant historical benchmarks or phases. Each of these phases was characterized by a substantial reconceptualization of some of the field's core goals and methods.

Archiving motion pictures has been practiced and discussed since almost the birth of the cinema itself. As early as 1898, photographer and documentarian Boleslaw Matuszewski, in his often cited essay *A New Source of History*, called for the creation of a proto-archive, a "Depository of Historical Cinematography." Matuszewski argued that the value of such an enterprise was found in cinema's "unique" ability to record history. "The cinematographe does not perhaps show history in its complete

form, but what it does show is indubitable and constitutes absolute truth. . . . It is an eyewitness par excellence, reliable and infallible.”^[7] From the time of this clarion call until the establishment of FIAF in 1938, it would be difficult to describe either a systematic response to Matuszewski or a system of shared practices codified by archival groups or associations. It is true, however, that during this pre-history, several major archival institutions began to operate, including the Imperial War Museum (1917), the Academy of Motion Picture Arts and Sciences (1927), the British Film Institute/National Film Library (1933) (For a detailed discussion on the evolution of the British Film Institute’s archival operations, see Dupin),^[8] the Film Library of the Museum of Modern Art (1935), and the Cinémathèque Française (1935). But it was only with FIAF that the loosely affiliated, individual archives made efforts toward establishing “universal” codes of conduct, and thus advanced toward the transformation of independent national archives into an international network with shared goals.

These initial efforts were characterized by two dominant philosophical orientations. On the one hand, some archives (most notably the Cinémathèque Française under Henri Langlois) concentrated on the exhibition of films as works of art. On the other hand, the British Film Institute (under Ernst Lindgren) focused almost exclusively on the long-term preservation and cataloging of its collections. Although it led to numerous internal battles, this foundational contradiction went unresolved, philosophically and practically, until the late 1970s. Despite the various maneuvers carried out by the field’s charismatic figures, FIAF’s inability to arrive at standards needed to define archiving as a profession of consistent practices was inextricably linked to Cold War tensions between its member nations. For decades, the Association’s Western-nation members were concerned about the potentially disproportionate influence that Soviet-block institutions might exert on international cultural policy. Thus, FIAF’s extraordinarily detailed statutes and rules effectively sought to achieve a political stalemate on many archival issues in light of the external Cold War political tensions.

Remarkably, the philosophical tension between “preservation” and “exhibition” would not be undone until FIAF’s Lisbon Congress in 1989. The event, entitled “Rediscovering the Role of Film Archives: To Preserve and to Show,” crystallized growing consensus over the rights (actually, the “duty” and obligations) of professional archives with respect to the exhibition of films. Under the umbrella of various publications and manifestos, this particular historical turn was expressed by the capstone mantra “To Preserve, To Show.” Public exhibition was thus recast as an organic result of the preservation mandate and accorded equal legitimacy and validation in the ideology of the Federation. Significantly, the new episteme led to a general liberalization of FIAF’s statutes and rules. As the Cold War’s cultural stalemate dissolved,

reforms within FIAF resulted in the admission of regional institutions, archives which prominently featured nonfiction materials, and, particularly, archives from the developing world.

During this first historical phase, a number of public-sector archives began to operate in the United States. Long before the advent of the American Film Institute (AFI) these had evolved into serious film preservation institutions. However, a common genealogy of the archival profession can be charted in relationship to the AFI, which had engaged in archival activities from almost its inception in 1967. Although the AFI had formally administered National Endowment for the Arts (NEA) preservation funds starting in 1971, it would not be until 1979 that the program would achieve a measure of budgetary and policy autonomy from the AFI’s traditional commitment to its film school. In these “early” years, funding was devoted to the acquisition and preservation of silent films and was dispensed to only a few of the country’s larger archives. From 1979 to 1982, 53% of the AFI/NEA funds went to silent film preservation and approximately 87% of the total was distributed to three nonprofit archives: the Museum of Modern Art, George Eastman House, and UCLA Film and Television Archive. During these years, the Motion Picture and Sound Recording Branch of the Library of Congress duplicated hundreds of American film titles. But, it too is an agency of the federal government, the Library was ineligible to receive NEA funding.^[9]

The decade of the 1970s witnessed the rapid expansion in public-sector archives and the birth of the modern archival movement in the United States. During this brief period of time, the tax-exempt archives vastly enlarged their holdings by acquiring studio collections (nitrate original negatives, fine grain masters, and prints) of classical “Hollywood” feature films that the major film studios were about to destroy. For a number of reasons, the establishment of the National Center for Film and Video Preservation in 1984 (the NCFVP at the AFI) was the apex of this evolution. Under the ubiquitous slogan of “nitrate won’t wait,” the cause of film preservation gained culture-wide visibility and film archiving made significant progress in its professional standing. Interestingly, Robert Rosen, the director of UCLA’s Film and Television Archive (who also served as the first director of the NCFVP) has referred retrospectively to the period leading up to the Center as the “buccaneer” years of film archiving.^[10] Not only would the NCFVP come to serve as the secretariat for the nascent Association of Moving Image Archivists (AMIA), it revitalized an AFI project to build a complete catalog of American Motion Pictures and established the National Moving Image Database (NAMID). Although the NAMID project would eventually be commercialized by the AFI, it was a significant step toward conceptualizing the totality of the archival field insofar as it was designed to acquire and share holdings

information for the totality of archival materials held in both the private and public repositories.

It is important to point out that the evolution of the field took place neither in a cultural vacuum nor only on a national level. One of the chief public voices in support of both archival practice and discourses on their importance came from the scholarly world and specifically from cultural and media historians. The cultural corollary for the birth of the modern archival movement was most clearly in evidence at FIAF's Brighton Congress in 1978. The Congress symposium focused specifically on newly restored films from the period 1900 to 1906. In addition to representatives of archives from around the world, Brighton also welcomed a new generation of scholars who would soon play a central role in the development of film education both in the United States and abroad, including Richard Abel, Robert Allen, Andre Gaudreault, Tom Gunning, Miriam Hansen, Charlie Musser, and Janet Staiger. In a special section of *Cinema Journal* dedicated to the "historical turn" in film studies, Musser described this evolution as a "...new integration of academic and archive-based history and fostered tendencies that contributed to the formulation of a new historiography." One of the most fundamental changes involved a new approach or attitude toward the subject.^[11]

Since this rapprochement, if not partnership between archivists (as custodians of history) and scholars (as writers of history), other significant forces have come into play.

CONCLUSIONS

Two benchmarks which characterize the contemporary moving image archive field in the public sector are the arrival of new digital technologies and the establishment of graduate-level degree programs in moving image archiving (at UCLA, NYU, and the University of Amsterdam). Paradoxically, the added archival capabilities offered by the new technologies only increase the need for additional advanced training of new generations of archivist. Although the new delivery platforms (such as DVDs, Blu-Ray, and the Internet) increase the professions capability to provide access to its collections, the exponential growth in content far exceeds the public sector's ability to serve as professional repositories.

The establishment of the AMIA in 1991 expressed both the need to codify professional behavior and a fundamental shift toward democracy within the field. A particularly good example is AMIA's MIC project, an attempt to provide a common portal for the cataloging of moving image collections.^[12] As a membership-based organization, AMIA accepts archivists from across the entire spectrum of archive types and passions. Whereas participation within FIAF is limited to institutional members, literally anyone can join AMIA. Furthermore, this "structural" democracy ignores the distinction between

private and public sectors, thereby theoretically narrowing the hierarchical and economical divisions between professionals. Even FIAF, which for decades had maintained hierarchical distinctions between types of members (full, associate, provisional) has in recent years sought to stimulate participation by moving away from its historically restrictive membership rules to a more open code of ethics in 1999. FIAF's code was constructed in part because the Association found it difficult to actually enforce certain aspects of its membership rules. Adherence to the Code, however, is now a precondition of membership.

Benefiting, in some cases, from the lessons learned by other archival traditions, film archiving, in its relatively recent move toward professionalism, has also recently placed increased importance on the issue of access to archival resources. Key benchmarks include, by the late 1980s, both the Motion Picture and Sound Recording Branch of the Library of Congress and the UCLA Film and Television Archive placing extensive information about their holdings online. For decades, public-sector archives had been reticent to share such information. Recognizing the importance of the access issue, FIAF itself created a specialist commission on the topic and went so far as to devote a special issue to this topic, a professional manual for access in its *Journal of Film Preservation*.^[13] Another significant benchmark has been the shift of emphasis in the types of films and media objects to be collected, preserved, and accessed.

The vast majority of public spending on archives in the "buccaneer" years and the early modern era was applied to laboratory costs associated with film-to-film duplication of classical Hollywood feature narratives. And although the movement toward film preservation had picked up considerable steam during these years, the level of federal funding continually decreased. In 1980, the highest annual disbursement (federal support for preservation through the NEA/AFI grants) was \$514,215 (for a fuller account of the AFI's early contributions to film preservation, see Mann).^[14] By 1992, the total Federal funding had declined to \$355,600 which allowed for the preservation of only 26 feature titles. In part, precisely because the AFI/NCFVP had failed in its mission to stop the erosion of Federal support and secure meaningful new sources of funding, to raise sufficient funds for film and television preservation, the field turned to a new organizational model, and embarked on a series of initiatives; including a much expanded commitment to film preservation on the part of the Library of Congress, the creation of the National Film Registry, and most significantly, the creation of a new, Congressionally funded entity, the National Film Preservation Foundation (NFPF) devoted solely to funding preservation and access projects among archives. Since 1997, the field has looked to the NFPF for financial support and cultural leadership.

This shift was accompanied by a broad reconceptualization of the idea of film preservation, influenced by the reformulation of technical standards for the long-term

survival of legacy collections. Thus the realization that optimal storage conditions were as important to preservation as film-to-film transfers leads to the epochal conclusion that nitrate, for example, could indeed wait.

More importantly, the public-sector archives began to focus on the importance of nonclassical titles by validating orphan films, a category of media types that includes amateur productions, nonfiction films (particularly news reels), titles in the public domain, and works whose copyright status was unclear or unprotected by large corporate interests. Proponents of orphan film studies cite their value as complex historical and cultural artifacts. It is also true that their unclear or ambiguous legal status affords archives additional flexibility in their handling and use. Indications of this new focus are plentiful: the establishment of the European Association Inedits (which now includes 41 archives as members), the ongoing research presented at the annual *Orphans of the Storm* conference, the amateur cinema topic for FIAF's 1997 Congress in Cartagena, and the many *Home Movie Days* that have been organized throughout the United States. Whereas the AFI used to channel federal funding to large U.S. archives for the preservation of nitrate-era feature films, the NFPF's funding priorities now clearly express this change in emphasis. As outlined on its Web site and in its annual reports:

The NFPF offers several types of grants to help public and non-profit institutions preserve and provide access to American orphan films. The grants are made possible through the National Preservation Act of 2005, the support of the Library of Congress, and the contributions of public spirited donors.^[15]

The generally anti-classicist orientation leads the NFPF to also include avant-garde works in the category of the orphan film. Indeed, one of its funding programs directly supports the preservation and archival treatment of avant-garde productions (the Avant-Garde Masters Grants). While the particularly social orientation of the orphan film movement validates local identities and cultural diversity, it also shares some of the theoretical tenets of New Historicism. The keynote address for FIAF's 1997 Congress, for

example, was delivered by Patricia Zimmerman, whose seminal *Reel Families* argues for the value of such voices in the construction of historical accounts that are alternative to traditional, grand narratives.^[16] Orphan works make for *new sources* of history. Arguably, one century later, Matuszewski might feel an appropriate measure of vindication.

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France: Archives, Museums, and Libraries

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Abstract

There are many similarities in the history and the evolution of contemporary French archives, museums, and libraries. All three have their roots in the Ancien Régime, but it was the Revolution that imposed their administrative structure. Over the centuries, all three have evoked similar questions and have been the subject of identical political and intellectual debates. At the end of the twentieth and the beginning of the twenty-first century, all three have finally become the object of ambitious public policies. Last, all three are today confronted with profound transformations—often experienced at a dizzying pace of change.

INTRODUCTION

In geographical area, France is the largest country in the European Union (EU) and the second largest in Europe. It has an extensive coastline, bordered on the north and west by the Atlantic Ocean and on the south by the Mediterranean Sea. The Alps, the Pyrenees, and the Rhine also provide natural boundaries. With an estimated population of 62,150,775 (July 2008) France is the second largest country in the EU. Governed under the constitution of the Fifth Republic, adopted in 1958, France has long time been a highly centralized state that has gradually ceded greater autonomy to local and regional authorities.

France not only has a long history of developing rich library and museum collections, it has been a leader in the field of archival training. The idea of the citizens' right to access archives dates from the French Revolution, and the principal of creating a national museum open to the public also dates from this period.

Since the nineteenth century, the central government has a tradition of offering financial support to national and local cultural institutions such as libraries, museums, and historic sites. This has led to the continuous enrichment of cultural heritage institutions, and these institutions have in turn provided a stimulus for the growth of cultural tourism among French residents and visitors from abroad. Attracting 81.9 million foreign tourists in 2007, France was ranked as the most popular tourist destination in the world.

FRANCE—ARCHIVES, LIBRARIES, AND MUSEUMS

There are numerous similarities in the history and the evolution of archives, libraries, and museums. All three have their roots in the Ancien Régime, but it was the Revolution

that imposed their administrative structure. Over the centuries, all three have evoked similar questions and have been the subject of identical political and intellectual debates. At the end of the twentieth and the beginning of the twenty-first century, all three have finally become the object of ambitious public policies. Today these three “places of memory” are all confronted with profound changes: the growth of collections, the technological revolution, the increase in costs, and the effects of globalization. Another important transformation has been the increase in the number and type of users, and archives as well as museums and libraries now welcome a much broader segment of the public. At the same time profound changes in professional philosophy have had a significant impact on the way in which resources and services of archives, libraries, and museums are conceptualized and how these three institutions are situated within the public space (Fig. 1).

ARCHIVES

According to the law on French archives (January 3, 1979), archives are defined as “the totality (ensemble) of documents, whatever their date, their form, or their format, produced or received by any person or corporate body, and by any agency or organism, public or private, in the course of their activity” (Article 1). This new definition is considerably broader than the one which prevailed in the past, and the current law is meant to give archives responsibility for conserving and making available the “memory of the nation.”

From the Ancien Regime to the Present

The well-known *Encyclopédie* of Diderot et d'Alembert described archives as “deeds or charters that contain the rights, claims, privileges, and prerogatives of a household,



Fig. 1 Map of France.

Source: CIA *The World Factbook*, <https://www.cia.gov/library/publications/the-world-factbook/geos/fr.html>

a city, or a kingdom.” Until the twelfth century, sovereigns traveled with the collection of documents which proved their legitimacy. However, the theft of this “treasure” during a battle lead Philippe Auguste (1165–1223) to organize his archival documents and to make plans for their conservation in a fixed location. The succeeding kings continued and augmented this organization of royal and governmental records. Over time, the archives increased to the point that in 1774 France had 5700 archival depositories. During this time specific disciplines were constituted such as paleography, which is the science of deciphering ancient writing through expert knowledge of the inks used as well as the writing material (such as parchment, vellum, or paper). Paleographical skills that were initially developed in monasteries became essential competencies of the first archivists.

One of the foundational acts of the French Revolution was the creation of the National Archives (September 7, 1790) as “the depository of all the acts which form the constitution of the kingdom, its public law and its administrative division into *départements*.” Throughout France the confiscation of the archives of the nobility lead to the establishment of bureaus for triage that were set up to process this historic influx of nearly a billion documents. The necessity of organizing the archives of the young republic lead to passage in June 1794 of a new law that established the right of citizens to have free access to the archives—a dramatic departure from the practices during the *Ancien Régime* when secrecy had been the rule. The *départemental* archives were created in 1796.

Nonetheless, during this period there were new concerns regarding the preservation of the national memory. Because the policies of the First Republic were diametrically opposed to those of the *Ancien Régime*, vandalism and destruction went with the establishment of new memory institutions: nearly two-thirds of the documents were eliminated, in most cases because they bore witness to the property and privileges of the hated nobility and clergy who produced them.

The archival institutions and practices established during the First Republic continued to be pursued during the nineteenth century even though France again became a monarchy. Archival knowledge continued to develop and new institutions were set up. The *Ecole des Chartes*, which still trains archivists, was created in 1821. In addition, the Daunou classification, an alphanumeric archival classification scheme, was developed; it is still in use today, although with modification. Despite advances in the field, by 1870 there were only 31 archivists at the National Archives. These archivists came under the authority of the Ministry of Public Instruction, and in 1897 the creation of a Directorate for Archives within the ministry underlined the importance of archives in regard to public policy. At the same time regulations were established regarding access to the archives and the appraisal and de-selection of documents.

After 1945 public investment in archives was strengthened, but, as often is the case in France, this lagged behind the enormous growth in the number of documents that needed to be collected and preserved, and did not keep pace with the increased demands placed by the public. In 1959, the Directorate for the Archives became a part of the brand new Ministry of Culture headed by André Malraux.

Situated in the heart of Paris in a historic mansion, the National Archives has for a long time lacked adequate space to process, preserve, and make its collections available. For those documents created after 1945 a new facility was inaugurated in 1969 at Fontainebleau (in the Parisian region), but this building soon became inadequate. In 1988 at the Paris site a new building was made available to users. Finally in 2004, the complaints of historians and researchers and the continuous petitions of archivists resulted in a project of much greater scope: the construction of an archival campus (*Cité des Archives*) in the Paris suburbs. Designed by the architect Massimiliano Fuksas and scheduled to open in 2011, this building will have a 60,000 m² surface, and a stocking capacity of 320 linear kilometers.

Contemporary Structure of the French Archives

The Directorate for Archives within the Ministry of Culture has an advisory role in regard to the public archives of France as well as regulatory functions and the responsibility for encouraging good practice. In addition, the directorate is charged with the evaluation, control and appraisal of classification, description, and conservation of the

archives as well as the provision of access to researchers and to citizens. The Directorate not only oversees the national archives, but also supervises the local, municipal, and *départemental* archives. In addition it supports the general development of archival science.

Created in 1988, the Superior Archives Council (Conseil supérieur des archives) is a consultative body for public and private archives and is concerned with both content and policy. The mandate of the Conseil supérieur is to analyze the situation and make recommendations but it has no administrative power.

The National Archives are responsible for the collection, conservation, and access to the administrative archives of the central government and its institutions. The ministries, public institutions, and all government agencies are required to deposit their archives in the National Archives which then processes them and makes them available. Only the Ministry of Defense and the Ministry of Foreign Affairs, for longstanding reasons of security, administer their own archives. Today the National Archives includes:

- The Historic Center of the National Archives (le Centre historique des archives nationales—CHAN) preserves and makes available archives covering the period from the Middle Ages to 1958; this collection occupies 100 linear kilometers of stacks.
- The Center for Contemporary Archives (le Centre des archives contemporaines—CAC) holds documents for the period from 1958 to the present day; it occupies 193 linear kilometers of archives.
- The Center for Overseas Archives (le Centre des archives d'outre-mer—CAOM) maintains the archives of the former “French Empire” with its colonies and overseas territories.
- The Center for Labor Archives (le Centre des archives du monde du travail—CAMT), is located in Roubaix, in the North of France. Opened in 1993, it is dedicated to preserving the papers of commercial enterprises and their workers. This new center provides evidence of the recognition by the government of a broadened contemporary conception of archives.

The collection, conservation, and access to archives is also carried out on at the level of the commune, the department, and the region. Local authorities in France include: 36,600 communes, 100 *départements*, and 26 regions. The regional archives have grown in importance along with the increasing power of the 26 regional administrative districts which were created in 1972 as political and administrative entities. The regional archives have also been enriched by the decentralization of the services of the central government.

The *départemental* archives collect the records of the 100 French administrative units known as *departments*. The importance of these collections has also increased as a result of the laws passed between 1983 and 1986; this legislation lead to the decentralization of public

responsibilities and strengthened the powers of the General Councils (Conseils généraux) that administer the *départements*. The *départemental* archives also administer the archives of small communes (fewer than 2000 inhabitants) that lack the resources necessary to maintain their own archives. The archives of the larger communes collect and maintain the records of the cities and towns. All of these local archives constitute a rich source of information on a wide range of subjects.

The law of June 20, 1992 enlarged the National Audiovisual Institute (Institut national de l'audiovisuel) legal deposit rights to all radio and television programming. As of 2008 these depository rights extended to most of the national television channels and to 17 public and private radio stations. This archives contains approximately 90% of all radio programs and 60% of all television programs created in France since the origins of radio and TV programming. By 2008, over 4,000,000 hr of programs could be consulted, and each year nearly 540,000 hr of radio and television programs are recorded. Nonetheless the French audiovisual archives prior to 1990 are vulnerable, because the recordings themselves (reel-to-reel tapes and cassettes) are threatened by physical deterioration due to chemical mutations over time. The disappearance of equipment needed to play these recordings also creates a threat to future access to these collections. If nothing were to be done, 835,000 hr of audiovisual archives would be lost between now and 2015 (almost one-third of the total). The preservation and the restoration of the original recordings and systematic digitization of these materials are both necessary. By the end of the twentieth century, when audio recordings and videos had expanded into the world of the Internet, the National Audiovisual Institute became interested in methods for the conservation of such materials originating from the Web.

Contested Issues Concerning Access to Archives

The concerns for the conservation of archival collections and the protection of the confidentiality of individuals had for a long time been considered more important than access, and this was particularly true for contemporary archives. Without special authorization, no access was allowed to documents issued after 1940 (a particularly sensitive period). As a result of the law of 1979, the regulations became more flexible. The period of restricted access was reduced, and is as follows:

- 30 years after being issued all administrative archives of a general nature can be consulted, with a possibility of exemption.
- 60 years restriction is placed on any document containing information on the private life of individuals, the security of the state, or national defense.
- 100 years for any archive concerning documents relating to judicial affairs or pardons.

- 120 years after the birth of the individual concerned for documents regarding personnel records of administrative employees and professionals.

Exceptions to these rules are allowed for by the law, and they are often accorded. This liberalization represented a real breath of fresh air and has permitted considerable progress in regard to the consultation of contemporary archives and the scholarly study thus made possible.

It was the progressive opening up of the archives that made possible significant advances in the study of topics relating to the Second World War and this in turn encouraged a modification of the collective memory and a change in our understanding of this dark period of French history. Greater access to primary sources has allowed progress in the study of the French state of Philippe Pétain, as well as the collaboration and the resistance, and it has enabled scholars to revisit issues raised by earlier historians (such as Robert Paxton, an eminent example of a historian who was not allowed access to the many of these archives when he worked on his seminal book, *Vichy France, 1940–1944. Old Guard and New Order*, 1971).

Nonetheless other primary sources remain inaccessible, such as archives related to the war in Algeria. It took the concerted activism of historians before the Prime Minister finally issued two circulars, the first in 1997 and the second 2001 that increased access to the archives of the Nazi occupation and those of the last colonial war. Then in 2001 the law on the information society established the right of each citizen to have access to all archives that personally concerned him or her. The potential for historical study of the World War II period was also increased by the belated return, beginning in 1994, of many kilometers of French archives (mainly governmental administrative records), seized by the Nazis in the early years of the Occupation. At the end of the war when the Nazis were defeated by the Soviets, these French documents were confiscated by the Russians who considered the archives to be legitimate spoils of war. The repatriated French archives consist of 1.2 million archival folders. However, not all these “special archives” have yet been returned, and their processing is an immense task.

Despite the increasing availability of archival materials, many researchers continue to protest against restrictions to access, and consider “the secrets of the archives” as not being in conformity with the exigencies of scholarly research and democratic process.

Private archives

An important aspect of the nation’s history and collective memory is not found in the various administrative archives described above. However, numerous initiatives have addressed a growing preoccupation with other sources of archives that can contribute to the

national memory and identity. Out of a desire to encourage the deposit of private collections in public archives, the Directorate of Archives of France has been systematically inventorying the private papers held by the National Archives and the départemental archives. This information has been entered into the Database for Orientation and Research in the Archives (Base d’Orientation et de Recherche dans les Archives—BORA). When completed, it will be possible for scholars to locate several 1000 collections of private papers relevant to their research.

In 1993, when the Centre des archives du monde du travail was opened in the north of France, the region was experiencing significant social and economic problems due to the changes in industrial production. Nonetheless, the new center for labor archives was also one of the signs of the commitment of public institutions to create a space for alternate memories. Located in a building that had been constructed as a factory in the second half of the nineteenth century, this facility collects the archives of industrial enterprises, commercial firms, professional bodies, unions, employers, associations, and even the personal archives of individuals who had played an important role in the professional world. These archives are largely made up of collections of private organisms that have no legal obligation to deposit their papers.

There are also a very large number of private archives in French libraries which often welcome the archives of local leaders, historians, artists, writers, etc. It is at the Bibliothèque Nationale on the rue Richelieu, within the Department of Manuscripts, that the largest number of private papers are conserved; these include not only the papers of writers but also scholars and statesmen.

The concern for preserving the diverse facets of national heritage has increased. Created in 1988 at the initiative of scholars and professionals from the publishing world, the Institute for the History of Contemporary Publishing (l’Institut Mémoires de l’édition contemporaine—IMEC) brings together, organizes, and preserves archival materials and research related to major publishing houses and important periodicals. L’Institut Mémoires de l’édition contemporaine also holds the papers of editors, writers, artists, researchers, critics, graphic designers, booksellers, printers, periodical editors, literary agents, journalists, and acquisition editors.

In a completely different domain, Génériques, an association created in 1987, has for 10 years taken on the task of inventorying the resources of public archives concerning foreigners in France. In addition, Génériques is working to safeguard and preserve private archives (associations, unions, and activists) related to immigration. Its goal is to make these papers available to the public in the hope of encouraging historical studies of immigration as well as increasing public awareness of the contributions made by immigrant populations throughout the history of France.

Transformations

Contemporary changes affect not only professional practice but also the formats that must be preserved and the nature of the public who use services of the archives. The advent of documents “born digital” (*tout électronique*) also represents a major change. Basing their work on the international standards for the description of documents (General International Standard Archival Description—ISAD-G), archivists find that more and more they are describing documents that utilize the XML format. French archivists also use Encoded Archival Description Document Type Definition (EAD DTD), which can be applied to the description of both paper and electronic documents. These standards and formats have been adopted because they permit the precise description of documents and allow for the exchange of records as well as database searching. Archives are also confronted with the long-term conservation of electronic documents. In numerous countries there are rules stating that under certain conditions the same legal validity is accorded to the electronic text as to documents on paper. However, as the French specialist, Catherine Dhérent asserts:

To describe digital texts, evaluate, and select them takes much more time than to organize archives in traditional formats or to prepare a finding aid like those used in the past—even one that is very detailed. . . The archivist must intervene much earlier in the life cycle of information.

In fact the initial structure of information is of primary importance, and from the time when electronic data is created, the intent to preserve these records must be factored into the software and the databases. Efforts to ensure effective records management and archival deposit must be integrated in all practices of those institutions concerned with preserving electronic records.

Archival services, like libraries, are also faced with the need to preserve Web sites, especially those of administrative authorities. Competencies expected of archivists now include application of new techniques for the capture of electronic data and the establishment of metadata, as well as knowing how to preserve digital documents. More than ever the archivists must plan in advance for tasks not made explicit and they must therefore become immersed in the professional or administrative milieu whose records they preserve and maintain. Archivists are no longer actors whose role begins after a document is written, but instead they must intervene early, anticipating the production of electronic texts in order to preserve them.

The public using archives has grown and diversified considerably during the last 30 years. In 1999, more than 300,000 individuals used the *départemental* and communal archives. Even though scholars and researchers are still numerous, the archives are now used by more and more people interested in genealogy who are researching their

family history. One-third of the users of *départemental* and communal archives are academics or administrators and one-third are retirees; the remainder include university students and individuals from other professions. Half of the users are undertaking genealogical research. General history or local history is the central interest of the majority of these readers. Half of them consult documents from the nineteenth century, and half use earlier materials, from the Revolution or the *Ancien régime*—notably parish records or registers of civil records.

Issues relating to the maintenance and preservation of archives is now of concern to a significant number of persons interested in social history or engaged in researching their family roots. The increasing presence of amateur genealogists has lead the archives of France to collaborate with the French Genealogical Federation in order to establish the portal Nomina. Set up in 2005, Nomina offers simple direct access to a significant collection of references and resources that can aid genealogists. Through this portal one can search four databases of names; within 3 years these databases included 13 million names, and the number is rapidly growing.

New segments of society also seek to be represented in the archives. At the same time research topics have diversified and multiplied and as a result more varied kinds of archival documents are being consulted. For example, because of an increasing research interest in daily life, ordinary social practices are now an integral part of the field of investigation. As the interest in historical sources are accompanied by the explosion of digital texts, paper, and pixels combine to increase in a dramatic way the reach of memory institutions that are now part of global information society.

MUSEUMS

Since the 1980s, French museums have experienced enormous transformations such as: a significant increase in the number of museums; construction of new buildings and ambitious renovations; a large growth in the number of visitors; an increase of large ambitious temporary exhibitions; and greater administrative challenges for managers. Trends include the temptation to commercialize museum practices; the redoubled efforts to attract philanthropy; and projects to “delocalize” certain important museum with branches elsewhere in France or abroad.

From Princely Collections to Public Collections

French princes and nobles have always collected works of art as signs of their power and their refinement. By the seventeenth century, the taste for collecting spread to other collectors (labeled “curieux”) whom Jean de La Bruyère, a satirical writer, mocked for their desire to simply amass an exhaustive collection. However, the

“cabinets of curiosities” bore witness to the growing knowledge in the area of natural history. An interest in antiquities developed as well as greater attention to historical monuments. Scholars such as Pereisc, Caylus, Gaignères, or Montfaucon established the concept of cultural heritage (*patrimoine*), and certain collectors opened their galleries to other amateurs. It is thought that the first museum was opened in 1694 in Besançon thanks to the donation of a priest who willed his books and works of art to the city on the condition that his collection would be open for consultation two times per week.

Starting in 1748, the Royal Academy of Painting organized a Salon with the aim of exhibiting and promoting the painters recognized by the king; at this time historical paintings were especially favored. From 1750 onward 100 paintings from the royal collections were presented at the Luxembourg Palace, which could therefore be considered the first example of a public museum. Soon a growing number of agents became involved in shaping aesthetic taste in France and bringing new perspectives to the art world; these individuals included the artists themselves, art dealers, new kinds of collectors, and the first art critics.

At the same time the field of museology was invented and attention was given to questions relating to the selection of works, the kind of space best adapted for the exhibition of the collection, and reflections on how to classify and organize works of art. During the 1770s several provincial cities opened museums, but these were generally scientific and technical. At the same time “lycées” dedicated to works of art were established; these institutions were often as a result of the efforts of scholars, artists, and writers. In addition, there were schools for design set up to train apprentice artists.

Although buildings and works of art that symbolized the hated Ancien Régime were sometimes destroyed during the French Revolution, it was also the Revolution that established and organized cultural heritage institutions dedicated to the arts. In addition, the Revolution encouraged the creation of three types of museums: the fine arts museum, the natural history museum, and the local museum. The newly established republic scrupulously inventoried “paintings, drawings, and statues,” “models and machines” and collections of natural history that were designated to become part of the Central Museum of the arts established at the Louvre in 1793. According to historian Dominique Poulot, this project was envisioned as a “world museum” (*musée-monde*). The intent was to return to the nation its treasures, reinterpreting them in the light of the new ideology of emancipation. These collections were enriched with art works brought back during the conquests of the Republic and later augmented by Napoleon I. The task of organizing these extensive collections fell to Dominique Vivant-Denon, one of the first directors of the Louvre. Similar pedagogical goals were envisioned for the Museum of Monuments, founded by

Alexandre Lenoir who sought to illustrate the history of French architecture.

During the nineteenth century, the paintings exhibited at the Salon des artistes français which were selected by designated members of the Academy of Beaux-Arts became more and more numerous, going from 1900 in 1848 to 7000 in 1880. Over time, the criteria of the Academy were contested and a group of artists created an alternative venue called the “Salon des refusés” (also known as the Salon of the independents) where the works of the impressionists were welcomed. The setting of aesthetic standards and of artistic achievement escaped from the control of the state and the growth of salons was the prelude to an increase in other types of exhibitions.

At the same time, museums spread throughout France and their interests began to diversify. The idea of national heritage (*la mémoire nationale*) began to be defined through museums. The same trend was seen in local history (*la mémoire locale*): regionalism encouraged the flaunting of specific local identities, sometimes contesting the dominance of an identity restricted to characteristics considered national. At the end of the century the Third Republic (1870–1940) established a policy of public funding that enriched provincial museums through purchases by the central government. The construction of museums in large cities was integrated into urban public works projects, and thus the discourse of local identity was translated into stone. Situated in the center of the city the museum often shared the same building with the municipal library, and it was never far from city hall.

During the last decades of the nineteenth century museography progressed as a discipline. However, despite the construction of some new buildings, museums and their treasures became mausoleums without adequate financial support (much like the situation of libraries during the same period). The image of the French museum was dusty and conventional, without impact on the contemporary world of art. The irruption of modernity thus took the path of subverting or bypassing existing institutions. Thus, in France until very recently museums lacked an openness to contemporary art and they failed to respond to important cultural and aesthetic trends such as the regional or local aspects of nineteenth century culture or the focus on popular culture, heightened in the twentieth century by the emerging disciplines of anthropology and ethnography.

The first part of the twentieth century was difficult for museums. Museum curators found their selection of works contested by the avant-garde, while at the same time they were confronted with the growing financial power of private collectors, art dealers, and galleries and soon became marginalized in the art market. Allotted insufficient funds by administrative authorities, French museums became somewhat fossilized around collections that were not being renewed.

Nonetheless, during the 1930s a new kind of museology and new preoccupations came to the fore. These included the contribution of the ethnographic perspective to the understanding of non-Western civilizations as well as a growing interest in popular culture in France. Such trends lead to the creation of different types of museums, such as the renowned Anthropology museum (Musée de l'homme) and the Museum of Popular Arts and Traditions, whose respective founders, Jean Rivet and Georges-Henri Rivière, were guided by the modern museographical ideas.

Museology was also evolving, and the accumulation of collections gave way to greater selectivity, accompanied by more effective exhibition techniques and a pedagogical discourse which was intended to aid visitors who were no longer left on their own to confront works of art unaware of the context of their creation. Henri Focillon, a scholar and director of the museum of Lyon, laid the foundation for the International Council of Museums, created in 1946 at a time when the museum world was becoming interested in international exchanges with the goal of creating standards for museum practices.

As was the case in the domain of archives and libraries, public policy initiatives in the museum domain were redoubled after the Liberation. A 1945 law whose aim was to increase the administrative support of the central government distinguished three types of museums throughout the country; this typology was based on the size and value of the collections. The largest were given the status of national museums, followed by those designated as classified museums (*musées classés*) and finally by smaller museums that were inspected from time to time by representatives of the central government. The idea of monitoring museums should not be thought of as retrograde Jacobinism. On the contrary, at this time, it represented greater governmental support for museum development and stimulated the professionalization of museum practice.

André Malraux, writer and author of the *Imaginary Museum* (*Museum Without Walls* in the English translation) was well qualified to become the first Minister of Cultural Affairs in 1959. Basing his policies on a desire to promote an aesthetic shock (*choc esthétique*) in the confrontation between the public and the works of art, his goal was to “make accessible the great works of humanity, and especially of France, to the largest possible number of French people” (Law of 1959 founding the Ministry of Culture). Malraux not only initiated the renovation of museums, he also saw to the construction of cultural centers (*Maisons de la Culture*) in the heart of the larger cities. These centers were a kind of “space for the totality of culture” offering concerts, theatrical performances, debates, and sometimes they even included an “*artothèque*” lending art that could be displayed at home. The *artothèque* usually contained reproductions of paintings or works by young artists. Despite his best efforts, Malraux’s objective of consecrating 1% of the national

budget to the activities of the Ministry of Culture was not attained until 1981 when the Left gained power.

Museums Today

The law of January 4, 2002 renewed the statute for those museums that are administered by public authorities. This law designated 34 national museums, thus emphasizing their scope and importance; national institutions includes: the Chateau of Versailles, the Louvre, the Orsay Museum, the Rodin Museum, the Picasso Museum, and the Museum of Franco-American Cooperation at Blérancourt, etc. At the next level are 1173 “museums of France” which are administered by local authorities or by associations. These museums hold collections that are in part owned by the central government, but the museums themselves are now under the responsibility of local or regional authorities. The designation “museum of France” is defined by specific cultural and scientific criteria: these establishments must

conserve, restore, study, and enrich their collections; make their collections accessible to the general public; plan and implement educational activities with the goal of assuring to all equal access to culture; and contribute to research and to the advancement of knowledge and to its diffusion.

(article 2). A High Council for Museums (Haut Conseil des musées) brings together representatives from different kinds of museums.

The total number of museums in France today is between 5000 and 6000 institutions. Numerous museums are under the authority of ministries other than the Ministry of Culture; others are administered by territorial collectivities, by association or even by private individuals, such as collectors. The city of Paris also is responsible for numerous museums such as Carnavalet Museum of the History of Paris, the Museum of the Petit Palais, the Museum of the Art and History of Judaism, etc.

Within the Ministry of Culture the Directorate for the Museums of France provides funding for the 34 national museums over which it exercises a supervisory role. In addition, the Directorate has an overarching mission of orientation, programming, and coordinating museums throughout France. The Directorate also has the responsibility to:

- Monitor and provide technical and scientific advice to museums that are administered by municipalities, by départements or by associations.
- Implement the government’s policy of contribution to the enrichment of national public collections.
- Establish and promulgate rules for the protection and conservation of works of art.

- Set rules for loans, and authorize or deny permission for works of art to leave French soil.
- Support the training of museum professionals.

Public collections of art are governed by the rule of inalienability; no works can be sold unless they are first “declassified.” The evaluation of works to be declassified is carried out by museum advisors who belong to one of the 26 Regional Directorates of Cultural Affairs.

Other services that support and coordinate museums are also under the authority of the Directorate of the Museums of France. One of these is La Réunion des musées nationaux, an agency whose main mission is to acquire works of art to enrich the national collections; the Réunion also organizes major exhibits and edits their catalogs as well as selling any tie-in products. Another body known as Center for Museum Research and Conservation in France (le Centre de recherche et de restauration des musées de France) carries out research in the domain of restoration and conservation and participates in the implementation of new practices and techniques.

As in other cultural domains, the last 20 years were marked by growing power of territorial collectivities. By 2008, half of the museum professionals were employed by regional or local museums. In order to structure and coordinate their activities, the départements often employ a museum advisor (*conseiller patrimoine*) who attempts to promote networking. The fine arts museums of Northern France and of Pas-de-Calais coordinate their exhibition programs and their public relations work. In Auvergne, an association to promote local museums has been established. In large cities, the Directorate of Cultural Affairs employs a museum advisor who supports the development of museums and seeks to establish partnerships with other institutions within the city, especially in activities that relate to public relations and education.

Local museums in France are not limited to fine arts, even though here the tradition of local history museums is less developed than that in Great Britain or the United States. Numerous French museums are dedicated to history, prehistory, ancient archaeology, natural sciences, while other focus on specific social or economic activities. Since the 1970s there has been a flowering of eco-museums as well as museums that collect objects related to popular culture, to professional, industrial or technological activities; in addition there are museums that collect artifacts representing the ethnographic heritage of France. There are over 200 of these kinds of museums throughout France—a fact which demonstrated the viability of a new socioeconomic orientation for museums.

Audacious Architecture

During the past 30 years there has been a spectacular development of museum buildings in France. Renowned

architects have been commissioned for numerous new building projects and for the audacious renovation of existing museums. The landscape has been radically transformed. This wave of construction began in 1977 with the Centre Georges Pompidou designed in an unabashedly modernist style by Renzo Piano and Richard Rogers. The building consists of eight levels that are entirely modular. All the weight bearing supports as well as the water pipes and ducts for electrical cables, elevators, and air conditioning were pushed out to the exterior of the building, thus giving the center a unique appearance that has been compared to an oil refinery by certain critics.

During the 1980s, numerous museums in Paris and the provinces have been renovated or rebuilt. In 1985, a private mansion in the Marais historic district on the right bank of the Seine was transformed into the Picasso Museum by the architect Roland Simounet. A year later three architects and interior designers working under the direction of Gae Aulenti carried out an even more radical transformation of the Orsay railway station in Paris, creating exhibition space for a museum consecrated to the nineteenth century.

In the late 1980s Ieoh Ming Pei, a renowned architect who is known for numerous projects, especially the new wing of the National Gallery in Washington, D.C., was chosen to renovate, modernize, and enlarge the Louvre. Pei's audacious design was centered around a stunning glass pyramid in the heart of the Louvre's courtyard. Another group of notable architects, J. M. Wilmotte, Rudy Ricciotti, and Mario Bellini, have been commissioned to carry out the interior design of the galleries of Louvre. This expansion was carried out from 1981 to 1999.

Jean Nouvel, architect of the Institute of the Arab World and the Cartier Foundation for Contemporary Art, constructed the Quai Branly Museum, dedicated to non-Western art; this innovative new museum opened in 2006. Numerous projects are now in the process of being constructed, such as a building in Paris by Frank Gehry which will house the private collection of François Pinault.

In the provinces, the construction of a new fine arts museum in Grenoble was followed by the Carré d'art (museum and library) in Nîmes designed by Norman Foster in 1993 and the Museum of modern art of Villeneuve d'Ascq. Important renovations were carried out in Lyon, Nantes, and Lille and many other cities. All these innovative constructions and renovations of French museums offer visitors the pleasure of viewing newly enhanced and enriched collections shown to their best advantage.

A Few Major Museums

The *Louvre Museum* occupies 160,106 m² of which 58,470 m² are used for exhibits. It is the third largest museum in the world after the Metropolitan Museum of Art in New York and the Hermitage Museum in Saint

Petersburg, Russia. In 1993, the Louvre became a public institution under the Ministry of Culture, and this change in its statute permitted the museum to enjoy greater autonomy. The collections of the Louvre cover the period from antiquity to 1848 and exhibits represent a wide geographical area from Europe to Iran, via Greece, Egypt, and the Near East. Among the most famous masterpieces are the Code of Hammurabi, the Venus de Milo, the Mona Lisa by Leonardo da Vinci, and Liberty Guiding the People by Eugène Delacroix. The renovation of the Louvre allowed for an increase of 30,000 m². The Pyramid of the Louvre is the center of gravity for the collections, and functions as the principal entry, allowing visitors access to the three wings of the Louvre palace: Richelieu, Sully, and Denon.

The *Orsay Museum* presents diverse works of the second half of the nineteenth century, from 1848 to the birth of Cubisme. By featuring artists born between 1820 and 1870, it provides the transition from the collections of the Louvre and the collection of the Museum of Modern Art at the Pompidou Center.

The *Pompidou Center* is the result of the vision of President Georges Pompidou (1911–1974) who wished to create an innovative cultural center in the heart of Paris—a center not only dedicated to fostering creativity in the plastic arts but also offering access to books, drawings and graphic design, music and cinema within the same building. The Pompidou Center houses an Institute for Contemporary Music, theaters for performing arts and movies, and the largest public library in Europe at the time—the Bibliothèque publique d'information (BPI). Occupying two levels of the Pompidou Center, the National Museum of Modern Art/Center for Industrial Creation holds 59,000 works, making it one of the most important collections of modern and contemporary art in the world (rivalled only by the New York Museum of Modern Art). Out of its vast collection, the Pompidou center offers 1330 works on permanent display, but it also has galleries for temporary exhibits as well as the Kandinsky library which offers a specialized collection of works related to twentieth century art. In the course of its three decades of existence, the Center has offered some remarkable exhibitions, such as *Paris–New York*, *Paris–Berlin*, *Paris–Moscow*, or later *Vienna, Turn of the Century* (1986).

The *City for Science and Industry* (*Cité des sciences et de l'industrie*), designed by architect Adrien Fainsilber, opened in 1986 and has since become very popular with the public. The mission of the Cité is to promote an understanding of science and technology to the general public, especially targeting children and adolescents. In addition, it attempts to stimulate the interest of citizens in the challenges to society that are linked to scientific and industrial research. Located in the immense La Villette Park, this complex offers many theaters and auditoriums, a music conservatory, and a concert hall.

In the course of the twentieth century non-Western art began to occupy a major place within museum collections.

This development was due in part to the efforts of artists known as Fauves and Cubists, as well as to the work of ethnographers such as Claude Lévi-Strauss and to writers and critics from Apollinaire to Malraux. The *Quai Branly museum*, opened in 2006, is entirely devoted to the arts of Africa, Asia, Oceania, and the Americas. Its goal is to stimulate the study of these objects using diverse perspectives, from ethnography to art history, and to recognize the importance of the civilizations and heritage of people sometimes marginalized by contemporary globalization of Western culture.

In 2007, a new national museum on the history of immigration (*la Cité nationale de l'histoire de l'immigration*) was opened. It is the goal of this new institution to collect, protect, interpret, and display artifacts relating to the history of immigration in France since the nineteenth century and to contribute to the development of new scholarly perspectives and to influence public attitudes (*mentalités*) by increasing the understanding of the role and contributions of immigrants in France. Narrative accounts, archival documents, photographs, drawings, and works of art are used to illustrate the history of immigrant experience. Among the important French historical museums one should also note those museums dedicated to the First or Second World War which have also benefited from recent building projects as well as new approaches to museology. Since 1988, more than 7 million people of all nationalities have visited the Peace Memorial dedicated to the Second World War in Caen, a city 73% destroyed during the summer of 1944.

The Museum Professions in Evolution

The curators of national or regional museums are trained at the National Heritage Institute (*l'Institut national du patrimoine*). Founded in 1990, the institute has as its mission the training of curators and conservators who work in cultural heritage institutions. These curators practice their profession in archives or museums; some conduct inventories and others work for organisms dealing with archaeology, historical monuments, or with other types of heritage collections in natural history, science or technology. Curators are appointed head of the national museums and major museums under local authorities; working under the curators are technical assistants (*attachés de conservation*) who belong to a national technical corps established in 1991. Trained in schools for territorial administrators, these technical assistants have become more and more numerous in museums operated by local authorities, and they direct some of the smaller local museums. Other staff in territorial museums include assistants and credentialed assistants with an expertise in conservation; both must pass a national examination. The guards are the most numerous museum employees, and they are given a double role of providing security and of welcoming the public.

The growth in the number of museums and the increase in temporary exhibitions has initiated or contributed to the professionalization of related occupations, such as registrars of works of art. It has also given rise to the function of exhibit planning, which is usually carried out by curators who are chosen either for their specialized subject knowledge or for their special competence in mounting temporary exhibits and organizing programs. Such exhibitions are often the moving force behind museums, attracting a different public than those who come to see the permanent collections. For major exhibits great care is taken as to the presentation, which is conceptualized by designers (*scénographes*). Finally, most museums now have a cultural service or an educational department which oversees a variety of interpretive activities offered to a diverse public of adults as well as children. These offerings include debates, meetings, concerts, lectures, or guided visits as well as pedagogical activities and special programs for schools.

For curators, scholarly expertise remains the primary requirement and they must be specialists in the art genre and period in which they work. Curators are increasingly engaged in research which primarily (but not solely), relates to catalogs focused on a single artist or accompanying a thematic exhibition. In addition to research and publication, the concern for documentation has lead museums to mount reproductions of their holdings online (<http://www.culture.gouv.fr/culture/bdd/bdd3g.htm>).

Opened in 2004, the National Institute for the History of Art (Institut national d'histoire de l'art—INHA) supports research in art history carried out by teacher-researchers in higher education institutions or by museum curators. To aid these researchers INHA has created databases, directories, dictionaries, and compilations of sources materials that are useful for research in art history. In addition, INHA has an important library with a rich collection of 1.7 million items that are used for specialized research in the history of art, archeology, and architecture. The institute also welcomes foreign researchers and contributes to the training of young researchers.

The School of the Louvre (Ecole du Louvre) is aimed at a broader public. Founded in 1882 and still located in the Louvre Palace, it offers courses in the history of art, archeology, epigraphy, history of civilization, and museology. It also welcomes individuals wishing to audit its courses, and offers evening courses and series of lectures for the general public.

The Growth of the Public

The great public success of museums and exhibits is not a recent phenomenon. The French Revolution inaugurated the doctrine that all citizens should share in the enjoyment of national treasures. From that time on a broad public has visited the Louvre and the Museum of French Monuments. It is estimated that number of museum visitors had tripled

by the end of the eighteenth century. The “grand tour” of Europe which became obligatory for wealthy families on the other side of the Atlantic also brought an increasing number of visitors to European museums, including some who came in search of their roots and their identity. At the same time growing crowds of French bourgeoisie were seen at the Salons: 360,000 persons at the Salon of 1870 and 500,000 at the Salon of 1874. Despite the burgeoning interest in art, the public who visited museums remained dominated by scholars or members of the elite and the nineteenth century did not greatly add to this audience.

Since the 1980s, the museum-going public has increased and diversified due to a combination of factors: the investments by public authorities in museums; the renovation of key museums; and the attraction of temporary exhibits not restricted by a narrow scholarly discourse and therefore open to a much wider audience. If the public was eager to respond to these new incentives, it was because the structure of the French population had changed during the intervening years. There were many factors that stimulated a much greater demand for cultural activities. These included: the general lengthening of schooling; the increase of the number of graduates from secondary schools and higher educational institutions among the middle class; an increased life expectancy; and the growth of cities. Nonetheless, only 30% of French citizens visit at least one museum per year.

The Louvre is the most visited museum in the world with 8.5 million visitors in 2008; that year the Pompidou center welcomed 5.5 million visitors, and Versailles 3 million—mostly foreigners as is the case at the Orsay Museum. Major exhibitions bring crowds of people ready to stand in long lines waiting to enter exhibit halls so packed that it is difficult to calmly reflect on or enjoy the works of art displayed. Examples include an exhibit of the works of Manet in 1983 that drew 700,000 visitors; another on Renoir in 1985 welcomed 825,000 visitors; 660,000 came to view the Gauguin exhibit in 1989; for Toulouse-Lautrec in 1992 attendance was 700,000, and for, Cézanne in 1995 630,000. Nonetheless, the large audience for exhibitions remains marked by social distinctions: museum visitors are still drawn from among the highly educated and from those in higher social and economic levels. Broad democratization of the museum-going public is still far from being realized.

In order to respond to large scale changes that require heavy expenditures in museums, France encourages philanthropy. This is done by offering a substantial reduction in income tax for corporations. If the work of art purchased is considered a “national treasure” and has been refused a certificate for exportation, the individual donor or the corporation can benefit from a tax reduction equivalent to 90% of the price paid for the work of art.

In 2007, the Louvre and the emirate of Abu Dhabi provoked considerable controversy. The Louvre assisted the emirate in planning a museum that would bear the

name of the Louvre for 30 years. French museums will organize traveling exhibitions and will loan works (300 initially, more subsequently). In return the emirate will deposit important sums of money [1 billion euros] into the account of a new International Agency for the Museums of France (Agence Internationale des Musées de France).

France, like a number of European countries, has not only developed a passion for heritage institutions and sites of memory (“*lieux de mémoire*”) but has also succumbed to the vogue of the “patrimonialisation du monde.” Everything represents heritage and every place is a site of memory in this movement that has led to both a greater openness and to a turning inward. If modernity and globalization extend one’s perspectives and stimulate curiosity, these trends also stimulate a desire to return to one’s roots, to be inscribed into a more circumscribed world, into a history and geography that are more familiar. Revealing an opening to the larger world, the celebration of heritage also bears witness to a certain fear of the future and a redoubled need to share common social beliefs and practices, a desire to belong to a community. Finally, as globalization has brought about mass cultural tourism, the great museums of France are welcoming an impressive number of foreign visitors.

LIBRARIES

Like museums, libraries have experienced unprecedented development at the end of the twentieth century. The provision of library resources and services has undergone a continuous reconceptualization and readjustment due to the transformation in educational and cultural policies, the evolution of professional practice, and the revolution in information technologies.

A Rich History

French libraries have had a very long, rich, and varied history. In the Middle Ages, monasteries were the major centers for the production of manuscripts, and their *scriptoria* were the source for many theological works. The monks were not only responsible for exegesis but also for the conservation and reproduction of manuscripts at a time when copying was the only means of reproducing and diffusing a work. Each manuscript was unique, because every copy could contain variants, glosses, and errors; it is this characteristic unicity that makes these manuscripts so valuable today. By the thirteenth century, the first universities and colleges established libraries where valuable large format, manuscript books were chained to lecterns. In contrast, the kings traveled with their books, and from 1483 onward the kings passed their collection intact from father to son. The royal library was first installed in a fixed location in the Chateau of Blois then moved to the Louvre

palace in the 1560s. Soon the first classification schemes and library catalogs were developed.

Meanwhile, the invention of printing and the era of religious disputes altered the world of books. Access to religious works in the vernacular was one of the challenges of the Protestant reformation, and around the same time scholars such as Erasmus of Rotterdam (1467–1534) and Michel de Montaigne (1533–1592) affirmed the right to personal reflection and free thought as an essential component of humanism. The library (“*librairie*”) of these humanists was a personally selected collection of works that became a space outside of the control of the authorities.

In 1521, François I made legal deposit of printed books obligatory—an act that has continuously enriched the royal library with books published in France. Nonetheless, the establishment of legal deposit was an act characterized by mixed motives; on the one hand, it reflected the king’s desire to collect and preserve all works published throughout the nation and, on the other hand, it represented his intent to control the printed word through the exercise of censorship. In addition to royal oversight there was also ecclesiastical control of French printing; the requirement that writings receive a license to be printed (*l’imprimatur*) from the Catholic church was one of the triumphs of the Counter-Reformation in face of the challenges by Protestant “heretics.”

Meanwhile educated princes, nobles, and other cultivated people began to collect personal libraries, and some of these were quite important. In the seventeenth century, Cardinal Mazarin (1602–1661) owned one of the largest collections of his time, enriched by the efforts of Gabriel Naudé (1600–1653), a librarian active in the Republic of Letters. By the time of the Enlightenment in the eighteenth century, books and libraries had become instruments for the conquest of public space, then opened to the exercise of reason, dialog, and freedom of thought. At this time libraries were more numerous, offered more abundant collections, and were sometimes opened to the public. Even the Royal Library was open to the curious (“*curieux*”) and to the amateurs two afternoons a week.

In France, the first establishment of libraries placed under public responsibility was an outcome of the emancipatory ideology and policy of the Revolution. These newly created libraries were supplied with books confiscated from the libraries of the aristocrats and the clergy, whose collections were sometimes expurgated. Between 4 and 7 million items were seized and placed in literary depositories (*dépôts littéraires*), then given to colleges; finally in 1803 they were entrusted to the communes. At this time the Royal library was renamed the Bibliothèque nationale (BN), and both the BN and a number of other large libraries were enriched by the works that were seized.

For a time this rich heritage was the glory of French libraries, and during the 1860s British librarians and

members of parliament who wished to develop libraries in their country, held up French libraries as the example to imitate. Although the municipal collections throughout France were slowly cataloged, preserved, and made available to the public, these libraries acquired few new works and their services to the public were limited. Paradoxically, the richness of the collections became a dead weight on municipal libraries; neglected by the authorities, these institutions only attracted scholars and students who appreciated their rare and precious works. However, by the end of the nineteenth century the demand for reading materials increased in France.

Literacy became much more widespread, and the working class as well as women and children were becoming readers. These changes lead to the creation of popular libraries (*bibliothèques populaires*) which were financed by philanthropic organizations, by cities, by schools, and by religious bodies. Although the collections of these lending libraries were often limited, they included carefully selected books, often chosen with the intent of using “good books” to combat the taste for “bad books”; the founders of these libraries also hoped that the working classes would engage in reading instead of pursuing leisure activities considered bad. Nonetheless, in addition to nonfiction works these libraries did loan out novels (a genre that was considered illegitimate for a long time). These popular libraries initially met with great success and it is estimated that there were tens of thousands of them by the late nineteenth century when they began to rapidly disappear.

In the early years of the twentieth century, modernist librarians struggled to gain acceptance of a new model of free public libraries inspired by examples they found in Great Britain and the United States. After the First World War, these reformers were able to point to model public libraries constructed by the American Committee for Devastated France (Comité américain pour les régions dévastées—CARD), a philanthropic organization active in the reconstruction of villages destroyed by the German invasion.

Jessie Carson, a librarian from the New York Public Library was responsible for the CARD library projects, and she oversaw the creation of five small libraries installed in wooden barracks. Although the CARD libraries were modest, they were nonetheless significant in the history of public librarianship in France. Later Carson worked with CARD and with French library leaders to establish a Paris public library branch that featured open shelves and used American cataloging and classification systems. Another American philanthropic organization later gave the Paris municipal library system the first children’s library with open shelves. Known as l’Heure joyeuse, this collection was directed for many years by Marguerite Gruny, who is considered a great pioneer of children’s services in France.

After the Second World War important new policies for library development were put in place. Within the

Ministry of Education a new Directorate for Libraries and for Public Library Services (*Direction des bibliothèques et de la lecture publique*) was established. At the départemental level the Directorate set up Central Lending Libraries (*Bibliothèques centrales de prêt-BCP*) in order to encourage the development of rural public library services in a country that still had a significant population living in rural areas. Charged with bringing the “food for the spirit” to homes in small communes and rural areas, these Central Lending Libraries deposited book boxes in schools and town halls, sent out bookmobiles that traversed the countryside, and later offered users direct access to the central facility whose shelves were filled with books.

The Directorate also promoted significant development of university libraries by assuring that they were allotted greatly increased financing, better facilities, and more staff. Significant investment in libraries and in the advancement of librarianship continued into the 1960s. This enabled the restructuring and strengthening of training for librarianship, and provided incentives for professional meetings and publications. In addition career opportunities in the field were improved, and the National Graduate Library School (Ecole nationale supérieure des bibliothèques) was established to train professionals at a level equivalent to a master’s degree.

Despite considerable progress in the field, it was not enough to keep up with new demands placed on libraries by the rising educational and cultural level of the population and the rapid growth of specialized knowledge which stimulated an exponential growth in publishing. During the 1970s, French libraries again experienced a crisis. Renewed efforts first came at the local level as cities finally decided to develop new cultural policies to meet the needs of urban populations who were more highly educated than in the past. The opening of the new municipal library in Lyon in 1972 and that of the *Bibliothèque publique d’information* at the Centre Pompidou in Paris in 1977 clearly demonstrated the huge popular success of rich open-access collections that were regularly updated. At the same time there were numerous new construction projects as well as renovations of buildings and renewal of collections. At the same time libraries began offering books and other materials in a variety of formats. A new term, “médiathèque” (media center), was chosen to signify the wide range of materials and formats offered by these facilities whose development found a favor among city policy makers.

At the national level after 1981 the left wing coalition government vigorously supported the development of public library services. The renaissance of university and research libraries came somewhat later, and it was not until the late 1980s that universities received an important increase in funds to develop their libraries.

Today, there are several types of library systems or networks in France.

- Municipal libraries under the authority of cities; they may benefit from support from the central government, especially in regard to construction.
- Départemental libraries, governed by départemental authorities; their mission is to promote the development of library services in cities with fewer than 10,000 inhabitants;
- School libraries which include centers for documentation and information (CDI) offered by most secondary schools and middle schools, and library documentation centers (bibliothèques centres documentaires—BCD) found in a certain number of primary schools;
- Academic libraries that belong to universities and are placed under the authority of the ministry in charge of higher education;
- Libraries under the authority of the Ministry of Culture and directly financed by the ministry. These include for instance the Bibliothèque nationale de France (placed under the ministry in 1981) and the BPI at the Centre Pompidou.

The Transformation of Public Libraries

The development of public libraries in France has occurred along several important lines, and could be thought of as the implementation of professional philosophies and practices which originated in the nineteenth century, first being used in the young American democracy and then spreading to northern Europe. These practices, adapted to twenty-first century France, include:

- Providing extensive multimedia collections regularly updated and enriched.
- Facilitating easy use of the collections by offering readers direct access to all the types of materials from books to electronic resources and DVDs.
- Fostering a welcoming ambiance and an openness to all levels of readers from experienced scholars to novice users.
- Offering nonjudgmental services to all users, whether their reading needs are cultural, educational, informational, or recreational.

The above principles of service have been widely adopted and to them have been added two more principles that may be specifically French. First is the importance given to architecture and also to the use of space in a way that not only promotes the shared national heritage but also links cultural needs with the common good. Second is the desire to respect the tastes of the readers and, at the same time, to promote cultural policies which are characterized by a refusal of librarians to follow the simple supply and demand logic of the market place.

In 2006, France had a total of 2913 municipal libraries which employed 24,200 staff members and occupied 1.8

million m² of shelf space. Their collections provide users with access to 100 million items: 90.5 million printed materials (2.6 books per inhabitant only); 8.4 million pieces of music or discs; nearly 1.4 million films, videos, and still photographs, as well as language learning materials and an ever increasing number of electronic resources and digital documents of all types. Annually, municipal libraries acquire 4.9 million printed works (or 18 printed works per 100 inhabitants), purchased at a cost of 2.72 Euros per capita, and about 800,000 CDs or DVDs. However, it is audiovisual materials and electronic resources that have increased most rapidly, both in terms of their importance as a proportion of the collections and in terms of items loaned. These collections are largely available through direct access, which has radically transformed the relationship between the users and the knowledge or information they need. Now people can make use of the library without preconceived ideas and without knowing exactly what they are looking for.

The 97 départemental libraries (Bibliothèques départementales de prêt, BDP, which were known as Bibliothèques Centales de prêt prior to 1992) offer services to the 30 million inhabitants of France who live in 17,000 communes with a population of less than 10,000. They offer a total of 27 million print and nonprint materials (90 works for 100 inhabitants) in 17,000 libraries or book deposit stations, buying a total of 1.5 million documents a year (1 Euro per inhabitant per year). The départemental libraries also assist small municipal libraries and intercommunal libraries with their programming and operations. In addition, they provide support for the smallest library units known as “*bibliothèques-relais*,” and they send rotating deposits of books to schools, daycare centers, town halls, or to prisons and retirement homes. In addition, they provide for bookmobiles (bibliobus or médiabus) that offer direct access to their collections and also provide training to volunteers who staff the small book depositories or libraries.

Now very well integrated into local educational and cultural policies, public libraries have increased their efforts to partner with other civic organizations; they participate in many kinds of cultural programs and activities, and they promote reading in disadvantaged neighborhoods through outreach programs. Public libraries also network with other educational and cultural institutions and organizations, such as schools and associations. In a number of cities, libraries work with diverse institutions and agencies to plan and coordinate city-read programs (*ville-lecture*).

One of the weaknesses of French administration is the extreme partition and dilution of political responsibilities among 36,700 communes, each of which has considerable autonomy within its jurisdiction. In contrast, other European countries started regrouping their smallest territorial divisions into larger units during the mid-1960s; for example in Great Britain there are only 209 local authorities. It seems that the time has finally come in France for

cooperation and sharing responsibilities through inter-communal groupings. For the past decade and a half at the départemental level elected officials have often worked together in developing joint cultural policies and programs, and they have frequently taken on responsibility for promoting reading through various federated efforts.

School, Academic, and Research Libraries

For a long time French academic and school libraries have suffered from the indifference of public policy makers, a fact which remains paradoxical in a country with a strong intellectual tradition. In the long sweep of history there are a number of reasons for this situation. Those countries that were predominantly Catholic had a longstanding tradition of clerical control over the written word, because the church wished to monitor reading and “protect” readers. In contrast, Protestant countries claimed the right of individuals to have direct access to the Bible which was read in the vernacular. Meanwhile, in France aristocratic traditions favored an individual relationship with reading, which depended more on the wealth of personal collections, often inherited, than on the public provision of libraries. These aristocratic traditions in regard to education and cultural questions (so well analyzed by Alexis de Tocqueville), still have traces remaining today in contemporary attitudes, especially among the elite. Finally, educational system in France for a long time favored orality and privileged the spoken words of the teacher (*maître*) to the written word. Educational authorities also devalued the practice of gaining knowledge based on everyday experience and not simply by reading literary texts.

These factors explain why, despite significant funding in the nineteenth century, school libraries have had to wait until the mid-1970s to be given professionally trained personnel. It was not until the 1980s that school libraries were present in a large majority of schools. Centers for documentation in schools nowadays are expected to play a double role: supporting the instructional curriculum and providing increased opportunities for students to gain access to the broader culture. The CDI in secondary schools and middle schools teach young people to make use of all kinds of printed and electronic resources, and they now think of themselves as having a dynamic role of key agents for the modernization of the relationship that students have with knowledge.

Within universities and research institutes, the modernization of library collections and services has passed through several stages. In the traditional French system, universities are largely financed by the central government and are almost free to students. This has been changing since 1985 when universities entered into a contractual relationship with the government. University finances still depend on the number of students served, the level of study offered, and the disciplines covered, but now their

funding is also based on a four-year plan and on the evaluation of performance. Regional authorities also contribute to the support of universities, especially in the area of construction. In July 2007, a law was passed giving greater autonomy to the university in its relationship to the government, and university administrators were given much broader responsibilities.

Under these new regulations, university libraries have become “shared services” that are expected to coordinate acquisitions and prepare union catalogs to provide federated access to all resources offered on the campus. As in the past, university libraries have to provide learning materials for a more and more massive student body (1.4 million students, or 55% of all those students who have completed secondary school and have successfully passed their baccalauréat examination). At the same time these academic libraries must furnish researchers with specialized resources that are becoming more and more numerous and more onerous to acquire. There has been considerable tension between these two missions—to provide for both the needs of beginning students and advanced researchers. In the 1980s, specialized centers were established for the acquisition and diffusion of scientific and technical information (*Centres d'acquisition et de diffusion de l'information scientifique et technique—CADIST*); through this coordinated program certain university libraries that already had rich collections in a particular domain of knowledge were given national responsibilities.

Another example of cooperation is the Couperin consortium of French research libraries. Set up in 1999 to negotiate favorable pricing for electronic periodicals, Couperin also coordinates strategic initiatives in regard to publication and dissemination of international scientific and technical publications in the context of globalization. Another very important collaborative effort involves the creation of a union catalog containing information on the holdings of more than 2000 participating libraries in France. Known as the university documentation system (*Système universitaire de documentation—SUDOC*), this database, which joined Worldcat in 2008, contains over 8 million records and offers location information for 25 million items; it also provides information on periodical collections in 4200 institutions. In 2008, over 25 million data bases searches were conducted using the SUDOC catalog. In addition SUDOC collects, archives, and offers access to French theses in electronic format and offers a portal providing access to a number of other digital resources.

Academic libraries in France have experienced an impressive increase in the number of users. In 2006, 62% of all university students were active users and visited the library more than 50 times per year; statistics show that the total number of visits had doubled since 1990. University libraries throughout the country were open 58 hr per week on average. A total of 69 million volumes of printed

works are available in all French university libraries (30 million books and 39 million of bounded volumes of periodical) and each year 1.4 million books are acquired (less than one volume per student). In addition, university libraries subscribe to 141,000 printed periodicals and 480,000 electronic periodicals. As elsewhere the impact of new technologies has been overwhelming and the increase in electronic resources has expanded exponentially; for example the number of subscriptions to electronic journals grew by 30% between 2004 and 2005. Although the expense per user for acquisitions varies, the average per capita acquisitions expense in French university libraries has increased fourfold since 1990 and in 2006 it had risen to 70 Euros. Training students to use library resources is strongly encouraged. In contrast to what has happened in other countries following the development of mass use of the Internet, in France the use of libraries is stable, although consultation of printed materials in the library has fallen slightly—by less than 4% (i.e., 13 items per person per year). Interlibrary loan has experienced a slight decline, and the provision of electronic documents is not yet sufficiently developed in France.

Modern Buildings and a Growing Public

A library tour in France offers fine examples of architecture including new construction and the renovation of historic buildings. If architectural achievement is shown through large projects (such as the wave of construction of municipal libraries with a regional vocation), smaller libraries also demonstrate the significance of the library in urban development policies as well as highlighting the talent of the architect. During the 1970s, the concept of the library as a temple or cathedral was rejected in favor of libraries integrated into fabric of the neighborhood, housed in newly constructed facilities that were intentionally modest. In contrast, the end of the twentieth century saw a triumphal return of the landmark library, with striking architecture that had a certain seductive power. Nonetheless this return to libraries that are monumental, or at least built on a grand scale, did not minimize questions concerning urban development or social issues. Sometimes it was decided that a new library building should be not situated in the city center, but should instead be located in an outlying suburb where it could give renewed life to a neighborhood that had a negative image. In such a location, the library could also serve to promote books among disadvantaged populations who were less likely to be readers. The construction of a library thus has become a major element of the cultural policy of cities and at the same time has become a factor in urban planning and social development.

Library space planning and interior design has not only been the object of considerable attention in France, but has also become the physical expression of the intellectual and

utopian ideology of the contemporary *médiathèque*—a concept which calls for unimpeded passage from children's spaces to adult reading areas and reflects a holistic approach to cultural activities, bringing together reading, listening to music, watching documentary or feature films, and consulting electronic materials in all forms and formats. The new ideal of the *médiathèque* also represents a dramatic shift in focus—from collection-centered structures and practices to a user-centered orientation. The emphasis is now on the intellectually curious reader, open to all kinds of resources and services, disposing of free time to browse the shelves, and sample their diverse materials—a kind of all encompassing reader (*lecteur total*). The intellectual itineraries and journeys of this new type of reader are now the focal point of the library, which offers its collections and services with the unique goal of facilitating, enhancing, and maximizing their use. Several principles have become central in every library design project; these include attention to the flow of movement through the library; openness in the arrangement of spaces for reading and consultation; and requirements for transversality and fluidity.

At the beginning of the twenty-first century, 43% of the population in France visited libraries and 21% were registered library users. The percentage of the population visiting a library has doubled between 1989 and 2005. Municipal libraries have experienced the greatest increase: 35% of the population visits the library and 20% are registered, with children accounting for 35% of registered users. The modernization of libraries has stimulated an increase in the number of new users and once open access to the shelves became common librarians observed a considerable increase in visits by individuals who are not registered borrowers, and whose presence had previously been quite marginal in terms of library statistics. The library, which had once been above all a place where one came and quickly selected books to borrow, has now become a place where more people remain for a longer time, profiting from the collections, enjoying the ambiance and the comfortable space, and appreciating an opportunity for sociability with few constraining rules. Nonetheless, despite the spectacular increase in the use of municipal libraries, the percentage of the public who visit libraries in France has remained considerably lower than that in the United States, Great Britain, or in Scandinavia where libraries serve 60% to 80% of the population.

Sociological studies have often emphasized socio-cultural differences at play in regard to the use of libraries and in the reading of books. For example, young people visit libraries more than their elders, but less than they did 20 years ago and those groups who are over represented among library users include the most educated segments of the population, upper level professionals, and the middle classes in general. Gender is also a factor and women library users are more numerous than men. Finally registered borrowers are not necessarily loyal library users;

only one-third of them renew their membership each year. Furthermore, the number of books borrowed by registered users has declined among adults, only 18 books were taken out per borrower per year in 2006,

La Bibliothèque nationale de France

Despite major nineteenth- and twentieth-century efforts to enlarge the facilities of the Bibliothèque nationale on the rue Richelieu, it lacked adequate space. As a result, the tension between conservation and access to the collections became more and more acute. Confronting considerably increased demands, the Bibliothèque nationale was forced to consider drastic measures. In 1988, President Mitterrand announced his decision to provide France with “one of the largest and most modern libraries in the world.” The design of the architect Dominique Perrault was selected. As in any profound change, the plans for a radically new library were plagued by early difficulties, including polemics as to how the project should be conceptualized, its location, and the conditions necessary for the conservation of the collections as well as how to provide access to the public.

Situated in the east of Paris with a surface of 207,000 m², the François-Mitterrand site of the BNF opened in 1998, offering two levels of complementary services and collections. The upper garden level, which is open to the general public, offers a seating capacity of 1700. Here one can consult a research collection in all areas of scholarship-science, the arts, history, literature, and law; the collection offers access to 300,000 works available on open shelves, 3,500 periodical subscriptions, 3,000 films, 10,000 musical recordings, a digital library, and numerous databases. Located on the lower garden level, the research library offers access to 10 million volumes of printed materials, 95,000 films, 900,000 sound recordings, and 60,000 multimedia materials. These vast collections have been acquired over many centuries through copyright deposit or as a result of gifts, collections bequeathed to the library, exchanges, and acquisitions by purchase. The reading rooms on the lower level offer seating for 1,900 users who have open access to 290,000 volumes and 4,000 periodicals as well as audiovisual and multimedia materials and electronic resources.

In addition to these new offerings are collections conserved in specialized départements located elsewhere in Paris. In the historic building on the rue Richelieu one can find:

- The Département for Prints and Photographs (15 million items acquired through copyright deposit).
- The Département of Occidental and Oriental Manuscripts (225,000 works including the collection of oriental manuscripts written in 100 languages on diverse writing materials, e.g., clay, papyrus, palm leaves, etc.).
- The Département of Maps and Plans (600,000 printed and manuscript maps 104 globes and 10,000 atlases).

- The Department of Coins and Medals and Antiquities, which originated in the collection of the kings of France, and now contains more than 530,000 items.
- The Department of Music which receives copyright deposit for printed music and also administers the Library and Museum of the Opera; the combined collections consist of 2 million items.
- The Department of Performing Arts has approximately 3 million items related to cinema as well as theater and opera. These collections will soon be renovated and opened for a wider consultation.

The BNF also administers Library of the Arsenal which has a rich collection of literary materials and works on the history of ideas from the sixteenth century to the nineteenth century (contains 1 million printed materials, 14,000 manuscripts). In addition the BN administers other units devoted to preservation and restoration.

Each year through copyright deposit the library adds 170,000 monographs, 34,000 pamphlets, 1.3 million issues of periodicals, numerous audiovisual materials and electronic resources, and nearly 40,000 specialized items. Items acquired through purchase include 60,000 volumes in foreign languages. The BNF has also been charged with responsibility for archiving the Web; this is carried out by Web crawlers programmed to automatically collect this data. However, to capture sites on the deep Web and to take into account frequent changes within each site, manually assisted procedures are needed.

The general catalog of the BNF maintains cataloging records for all kinds of media; in 2008 it contained 5 million authority records and over 10 million bibliographic records. In the course of its reorganization, the BNF has pursued important collaborative projects with other libraries in France that have rich cultural heritage collections and specialized research materials that complement those of the national library. These partnerships in specific focus areas include various kinds of cooperative efforts such as the retrospective conversion of catalogs, collective bibliographic databases and abstracts, joint conservation efforts, and collaborative digitization projects. One result of this kind of cooperation is the French union catalog (*le Catalogue collectif de France*) which includes descriptions of the collections of 4000 institutions and allows users to find the location of 15 million items.

Gallica, the French digital library project launched in 1997, offers access to 3,50,000 items, of which 90,000 digital works, more than 2,30,000 images, and many hours of audio recordings. This collection of images and printed works covers many disciplines such as history, literature, science, philosophy, law, economics, and political science. Although Gallica now contains mainly image files, in cooperation with the European Digital Library, it plans to make available searchable text files at a rate of 100,000 documents a year between 2008 and 2010.

Other digital projects involved cooperation between libraries and research institutes, governmental bodies, or scientific publishers. As the result of cooperative efforts of four publishing houses and the BNF the Cairn portal has been created to offer access in digital form to articles appearing since 2001 in 126 journals in humanities and social sciences. Another portal named Persée has been sponsored by the Ministry of Higher Education in order to provide access to other scholarly journals essential to the work of French researchers. Other important, large scale digitization projects are now underway in municipal libraries that contain important historical collections. Such initiatives are flourishing, and now many libraries find that their daily operations must include digitization of historic collections or preparation of electronic databases needed by the communities they serve.

CONCLUSION

The tidal wave brought by the Internet and the promise of digital collections has radically transformed the work of the libraries and archives, but also of museums, and it has also changed the practices and expectations of users. The entire documentary cycle (from the acquisition of materials to their use) has been radically transformed by this technological revolution that has modified how collections and constituted and processed, organized, and made available. In addition, it has profoundly transformed the nature of learning, the representation of knowledge and attitudes toward the written word.

ACKNOWLEDGMENT

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Functional Requirements for Subject Authority Data (FRSAD): Conceptual Model

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Abstract

Functional Requirements for Subject Authority Data (FRSAD) is the third model of the FRBR family developed by IFLA. This paper traces the history of the development of the model through the activities of the Working Group that developed the model (Part I), and describes the constructs of the FRSAD model, including the entities, attributes, and relationships defined in the FRSAD model (Part II). The paper also summarizes a number of issues around the model (Part III) and discusses application-related studies (Part IV).

I. IFLA FRSAR WORKING GROUP AND ITS ACTIVITIES

Background

In 1998, the International Federation of Library Associations and Institutions (IFLA) published the Functional Requirements for Bibliographic Records (FRBR) conceptual model, which identified entities, attributes, and relationships based on a logical analysis of typical data included in bibliographic records. The FRBR model divides the identified entities into three groups:^[1]

1. Group 1 contains four entities that represent the different aspects of user interests in the products of intellectual or artistic endeavor. These are
 - a. *Work*—A distinct intellectual or artistic creation
 - b. *Expression*—An intellectual or artistic realization of a *work*
 - c. *Manifestation*—A physical embodiment of an *expression*
 - d. *Item*—A single exemplar of a *manifestation*
2. Group 2 contains entities defined as actors or those who are responsible for the intellectual or artistic content, the physical production and dissemination, or the custodianship of Group 1 entities. These are
 - a. *Person*
 - b. *Corporate body*
3. Group 3, as defined by FRBR in relation to Group 1 and 2, represents an additional set of entities that serve as subjects of intellectual or artistic endeavor *works*. They are
 - a. *Concept*
 - b. *Object*

c. *Event*

d. *Place*

Continuing the tradition set by the IFLA FRBR model, two new IFLA working groups (WG) were formed: the Working Group on the Functional Requirements for Numbering and Authority Records (FRANAR) and the Working Group on the Functional Requirements for Subject Authority Records (FRSAR).

FRANAR WG was established in 1999 to develop a conceptual model for authority records. The WG released a draft of the Functional Requirements for Authority Data (FRAD) model in 2007 and published the FRAD Final Report in 2009, parallel with the work of the FRSAR WG. The FRANAR WG defines authority records as aggregates of information regarding entities that are assigned as controlled access points in bibliographic records.^[2] Although all three FRBR entity groups (with the “Family” entity added to Group 2 by FRAD) are covered in the FRAD conceptual model, its major focus has been given to Group 1 and 2 entities.

The FRSAR WG was formed in April 2005 to report to the IFLA Classification and Indexing Section. The original terms of reference were

- Build a conceptual model of Group 3 entities within the FRBR framework as they relate to the aboutness of *works*
- Provide a clearly defined, structured frame of reference for relating the data that are recorded in subject authority records to the needs of the users of those records
- Assist in an assessment of the potential for international sharing and use of subject authority data both within the library sector and beyond

By definition, IFLA FRBR Group 3 entities “represent an additional set of entities that serve as the subjects of *works*. The group includes *concept* (an abstract notion or idea), *object* (a material thing), *event* (an action or occurrence), and *place* (a location)”^[3] (emphasis added). This part of the FRBR model has been questioned as to whether it is sufficient to cover everything that can be viewed as a “subject” of a *work*, for example, “time.”^[4,5] One of the FRSAR terms of reference, as listed above, was to build a conceptual model of Group 3 entities within the FRBR framework as they relate to the “aboutness” of *works*. In this framework, all controlled access points related to all three entity groups, as defined by the FRBR conceptual model, have the potential to be the topics of a *work*. In other words, Group 1, 2, and 3 entities can have an “is-the-subject-of” relationship with the *work* (to be discussed in detail in the following sections.)

The FRSAR Working Group

The FRSAR WG was chaired by Marcia Lei Zeng (who was at the time the Chair of IFLA’s Standing Committee of the Classification and Indexing Section) and cochaired by Maja Zumer (who was a member of the same Committee and also of the FRBR Review Group) and Athena Salaba (who also served as the secretary of the WG). In May 2005, an invitational workshop titled “FRBR in 21st Century Catalogues” was held in Dublin Ohio, hosted by OCLC. It was during this workshop that the FRSAR WG chairs started to invite WG members and Advisory Group (AG) members. Table 1 lists WG and AG members who served on this task and contributed to the development of the FRSAD conceptual model (Table 1). The WG divided tasks among members of two groups: the User Tasks Subgroup, led by Salaba and including members of Bultrini, Chan, Riesthuis, Miller, McGarry, and Zeng; and the Subject Entities Subgroup, led by Zumer and including members of Bultrini, Chan, Furner, O’Neill, Vizine-Goetz, and Zeng.

In addition to the whole group meetings held at IFLA Annual conferences, numerous meetings, combined with teleconference facility, were conducted from 2005 to 2009, not to mention many emails among the members. Kent State University, OCLC Headquarters (both located in Ohio, United States), and IFLA provided support or facilities for these meetings. The WG also conducted meetings in other related professional conferences, with the support of the hosting institutions, especially the University of Vienna, during the International Society for Knowledge Organization (ISKO) 2006 Conference, and the University of Montréal, during the ISKO 2008 Conference.

FRSAD Development Timeline

The WG started by defining user tasks as soon as the subgroups were formed. A survey on the use of subject authority data was conducted worldwide, and over 800

Table 1 IFLA FRSAR Working and Advisory Groups Membership

2005–2008 (74th IFLA)	2008 (74th IFLA)–2010 (76th IFLA)
WG members	WG members
Leda Bultrini, Italy	Leda Bultrini, Italy
Lois Mai Chan, USA	Lois Mai Chan, USA
Gerhard Riesthuis, The Netherlands	Jonathan Furner, USA
Athena Salaba, USA	Edward O’Neill, USA
Diane Vizine-Goetz, USA	Gerhard Riesthuis, The Netherlands
Ekaterina Zaytseva, Russia	Athena Salaba, USA
Marcia Lei Zeng, USA	Diane Vizine-Goetz, USA
Maja Zumer, Slovenia	Ekaterina Zaytseva, Russia
	Marcia Lei Zeng, USA
	Maja Zumer, Slovenia
AG members	AG members
Victoria Francu, Romania	Dorothy McGarry, USA
Jonathan Furner, USA	David Miller, USA
Hemalata Iyer, USA	(Liaison to ALA SAC)
Dorothy McGarry, USA	Päivi Pekkarienen, Finland
David Miller, USA (Liaison to ALA Subject Analysis Committee (SAC))	Barbara Tillett, USA
Edward O’Neill, USA (Liaison to OCLC FRBR and to ALA SAC)	
Päivi Pekkarienen, Finland	

responses were received between June and August of 2006. At the June 2006 ISKO Conference in Vienna, the WG had a full-day meeting to discuss the conceptual model according to the first term of reference given to the WG by IFLA (i.e., to build a conceptual model of Group 3 entities within the FRBR framework as they relate to the aboutness of *works*). At that point questions around “Group 3” started to emerge. The WG meetings at the 2006 IFLA Conference in Durban, South Africa, resulted in a number of alternative models. Based on two tests conducted by the WG members, extensive discussions of existing conceptual models of aboutness and the alternative FRSAD models examined during 2007 and 2008, the WG had a major breakthrough. Eventually a conceptual model was developed and finalized at the ISKO conference in Montréal and the IFLA conference in Québec City, Canada, in August 2008. A draft report was completed at the end of 2008, and reviewed by the Advisory Group members. The revised Draft Report was officially released for its worldwide review in June 2009. It received many comments by individuals and institutions, which provided a solid foundation for the WG to revise and prepare the Final Report. The FRSAD conceptual model was presented at the 75th IFLA General Conference and Assembly held in Milan, Italy, in August 2009. The Final Report, titled “Functional Requirements for Subject Authority Data (FRSAD): A Conceptual Model,” was

submitted for approval in April 2010 and was approved by the IFLA Standing Committee of the Classification and Indexing Section in June of the same year. In July 2010, the Chair of Division III Library Services, on behalf of the IFLA Professional Committee, informed the WG that the FRSAD Final Report was validated and released for publication by IFLA. The FRSAD Final Report was published as the 43rd volume of the IFLA Series on Bibliographic Control by De Gruyter Saur in May 2011 (Fig. 1).

The FRSAD Final Report contains seven chapters and four appendices. Some sections in the Final Draft, such as the research-based background, the development processes, and implementation examples, were moved to the appendices in the Final Report. The final chapters and appendices are

- 1. Background
- 2. Purpose and Scope
- 3. Entities
- 4. Attributes
- 5. Relationships
- 6. User Tasks
- 7. Conclusion
- Appendix A. Modeling Aboutness
- Appendix B. Relationship of FRSAD with FRBR and FRAD
- Appendix C. FRSAD Model and Other Models
- Appendix D. Examples from Subject Authority Systems

FRSAR Working Group Studies

The FRSAR WG identified four user groups of subject authority data. They are: 1) information professionals who create and maintain subject authority data, including cataloguers and controlled vocabulary creators; 2) information professionals who create and maintain metadata; 3) reference services librarians and other information professionals who search for information as intermediaries; and 4) end-users who search for information to fulfill their information needs.^[6]

In an effort to define user tasks based on empirical data, the FRSAR WG deemed it necessary to conduct user studies. Two surveys were distributed in 2006. The first was a pilot study at the 2006 Semantic Technologies Conference (San Jose, California, USA). Most participants of this first study were either creators of semantic tools, including controlled vocabularies, taxonomies, and ontologies, or developers and managers of semantic technology systems. The second, an international survey among information professionals throughout the world, received about 800 responses. The majority of the participants were authority record creators, vocabulary creators and managers, catalogers, metadata librarians, and reference librarians.

Based on findings from these two surveys, which covered use scenarios for all user groups, four subject authority data user tasks were defined. Users may *find*, *identify*, and *select* a subject entity or entities and they may also

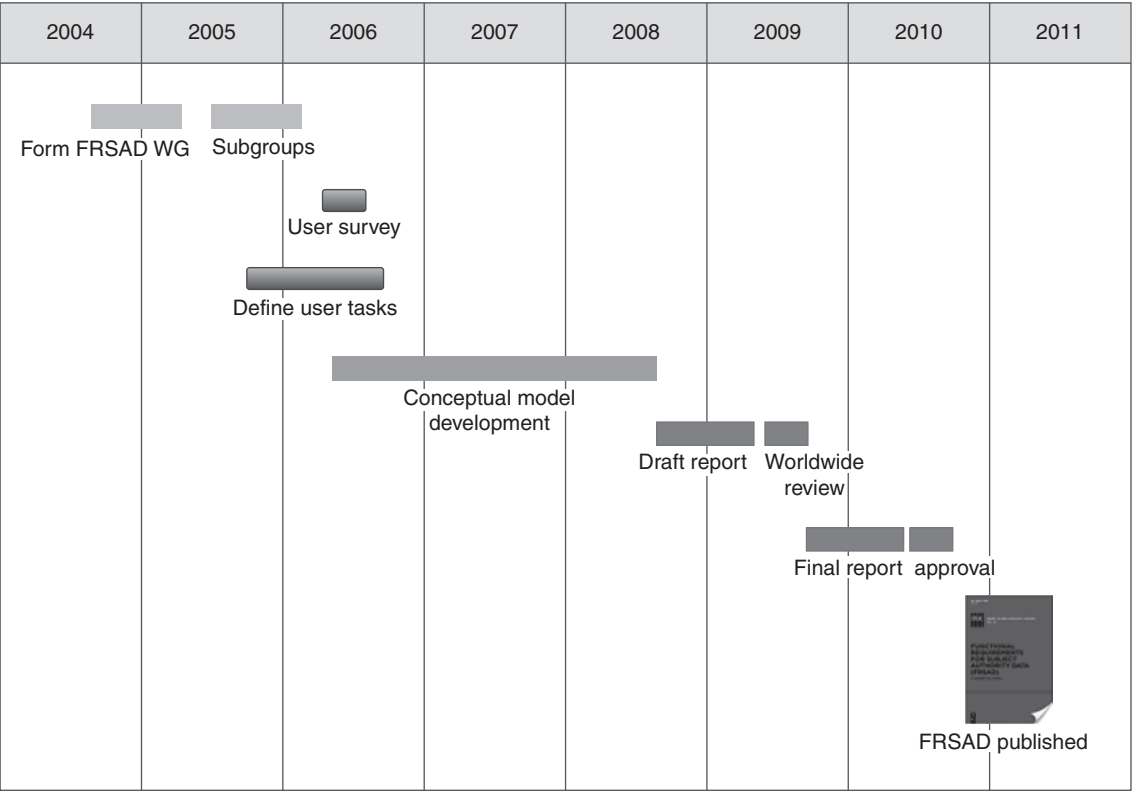


Fig. 1 FRSAD Working Group activities timeline.

Table 2 Comparison of the User Tasks Defined by FRBR, FRAD, and FRSAD

User Tasks		
FRBR (1998)	FRAD (2009)	FRSAD (2011)
Find entities of Group 1 that have entities from Groups 1, 2, and 3 as their subject	Find one entity or entities	Find one subject entity or entities
Identify	Identify an entity	Identify
Select		Select
Obtain	Contextualize , place in context, explore relationships Justify the form of an access point	Explore a subject domain or relationships

choose to *explore* a subject domain and its terminology as well as the relationships that exist among subjects. Table 2 provides a comparison of the user tasks defined in FRBR, FRAD, and FRSAD.

The four user tasks for subject authority data defined by FRSAD^[7] are

- **Find** one or more subjects and/or their appellations that correspond(s) to the user's stated criteria, using attributes and relationships
- **Identify** a subject and/or its appellation based on their attributes or relationships (i.e., to distinguish between two or more subjects or appellations with similar characteristics and to confirm that the appropriate subject or appellation has been found)
- **Select** a subject and/or its appellation appropriate to the user's needs (i.e., to choose or reject based on the user's requirements and needs)
- **Explore** relationships between subjects and/or their appellations (e.g., to explore relationships in order to understand the structure of a subject domain and its terminology)

As illustrated in Table 2, the *explore* user task is a new task introduced in FRSAD; whereas the *find*, *identify*, and *select* user tasks have been previously introduced in the FRBR and/or FRAD conceptual models.

In an attempt to verify the Group 3 entities originally defined by the FRBR model, the FRSAR WG collected comments found in published documents (refer to the next section, II.A) and conducted a small study to classify existing subject terms used by U.S. National Science Digital Library (NSDL) contributors into the categories based on FRBR entities (*Concept*, *Object*, *Event*, *Place*) plus *Time* and *Other*. These included about 3,000 terms assigned to NSDL metadata records. The terms were classified into six categories: concrete stuff, abstract stuff, event, time, place, and other. The study results indicated difficulties in the distinction between concrete and abstract concepts, as well as in categorizing named instances, which resulted in many subject terms being put into the "other" category. Findings of this study resulted in the development of FRSAD as a more abstract conceptual model.

II. THE FRSAD MODEL

A. The Development of the FRSAD Model

FRBR defines the many-to-many subject relationship between *work* and entities of Groups 1, 2, and 3 (Fig. 2). IFLA FRBR Group 3 entities are recognized as the subjects of *works* (i.e., the results of intellectual or artistic endeavor). They "represent an additional set of entities that serve as the subjects of *works*"^[3] (emphasis added), in addition to any of the Group 1 and 2 entities, which can also be subjects of *works*. Group 3 includes *concept* (an abstract notion or idea), *object* (a material thing), *event* (an action or occurrence), and *place* (a location).^[8]

From the time the FRSAR WG was formed, there seems to have been a general agreement in the FRBR research community that Group 3 entities should be revisited.^[9] The WG was considering several scenarios. In addition to enhancing the FRBR model based on Group 3 entities by adding "time," the approaches of other existing models were discussed. These models include the <indec> model,^[10] Ranganathan's facets,^[11] and the pragmatic list of entities developed by Buizza and Guerrini.^[12] These models present solid references for revising the FRBR conceptual model. The WG analyzed and discussed possible solutions based on each of these models, from conservative (making minor amendments of FRBR Group 3) to radical (proposing a completely new model). However, the WG found that none of the existing models and the ones based on them could be universal enough to reflect the needs of today's subject authority data, considering particularly different domains and subject access tools. In 2007, the WG shifted focus from the revision of the FRBR model to the development of a more general and abstract model, justified by the WG studies, which confirmed that there is no universally applicable and useful categorization of subjects. At the 2008 IFLA Québec meeting, the group concluded the development of the model as represented in the following figure (Fig. 3).

In this framework, instances of all entity types of all three entity groups, as defined by the FRBR conceptual model, have the potential to be the topics of a *work*. In

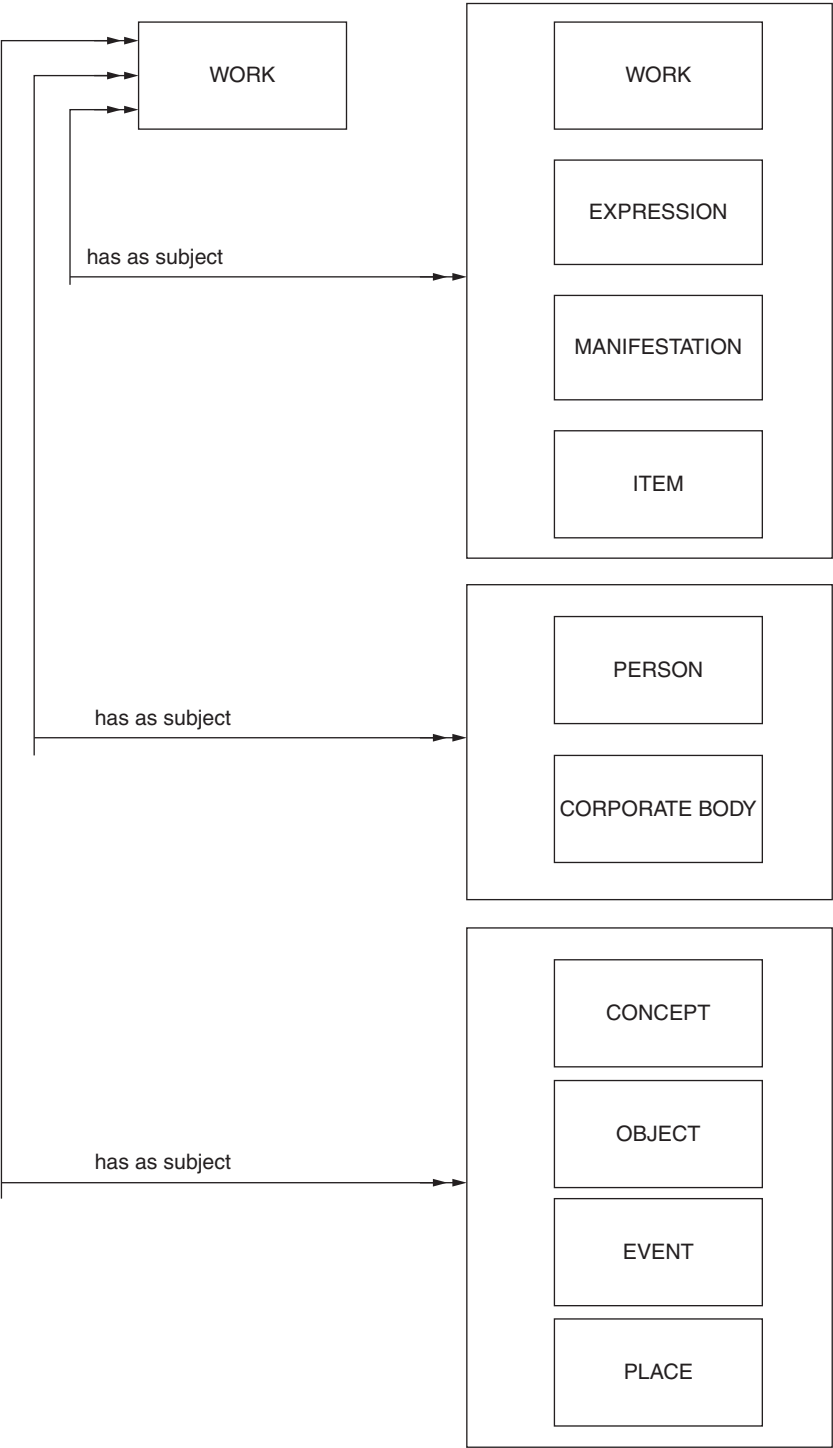


Fig. 2 Subject relationship as presented in FRBR 1988 final report Fig. 3.3 (Ref. 1, p. 15.).

other words, any instance of the Group 1, 2, and 3 entities can have an “is-subject-of” relationship with the *work*. The FRSAR Entity subgroup proposed a more abstract conceptual model. As presented in the following Figure 4, the model should be understood with two key points of view (Fig. 4):

1. This model confirms one of the basic relationships defined in FRBR: *WORK* has as subject *THEMA* / *THEMA* is subject of *WORK*.
 - a. *THEMA* is defined as any entity used as a subject of a work.^[13]
 - b. *THEMA* includes any FRBR entities—existing Group 1 and Group 2 entities and, in addition, all other subjects of *works*. This is a very abstract view, enabling us to model relationships and attributes on a more general and abstract level.

A Greek term (also used in Latin), *THEMA*, is used to avoid misunderstanding in translating the English term.

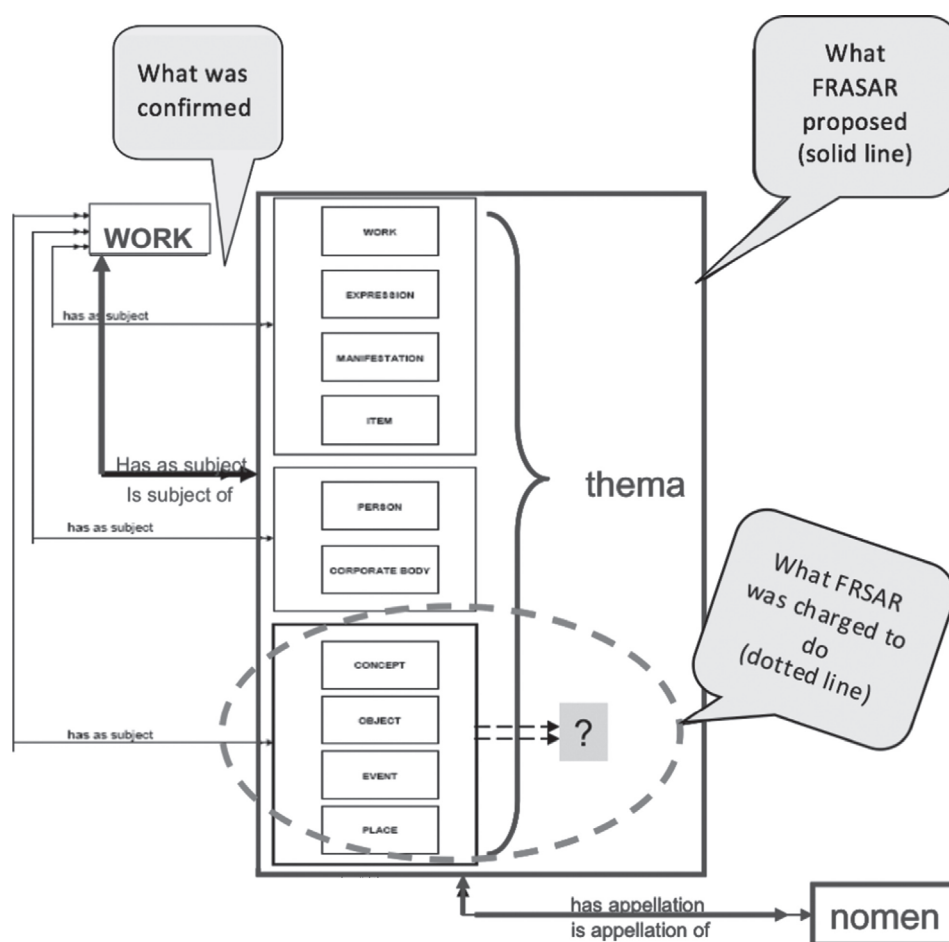


Fig. 3 FRSAD representation in 2008.

2. This model also proposes a new relationship: *THEMA* has appellation *NOMEN* / *NOMEN* is appellation of *THEMA*.
 - a. *NOMEN* is defined as any sign or sequence of signs (alphanumeric characters, symbols, sound, etc.) that a thema is known by, referred to, or addressed as.^[13]
 - b. Examples include “love,” “∞”, or “595.733.”

A Latin term, *NOMEN*, was chosen for the same reason as above.

This was a major breakthrough because, for many years, terms or labels representing concepts have been mixed with concepts in subject authority tools.

To simplify Figure 3, FRSAD model can be presented by the following illustration (Fig. 5):

Some important accents regarding the model:

- The “has as subject/is subject of” relationship is a many-to-many relationship. Any *work* can have more than one *thema*, and any *thema* can be the subject of more than one *work*.

- In general (i.e., in natural language or when mapping different vocabularies) the “has appellation/is appellation of” relationship is also a many-to-many relationship. A *thema* has one or more *nomen* and there may be a *nomen* referring to more than one *thema*.
- It is important, however, to note that, in a given controlled vocabulary and within a domain, a *nomen* should be an appellation of only one *thema*.

Attributes of *thema* and *nomen*, relationships between *themas* and between *nomens*, as well as *thema*-to-*nomen* relationships are all discussed in detail in the FRSAD report.

An Overview of the FRSAD Model

Presented below is an overview of the constructs in the FRSAD model: 1) the entities (*thema* and *nomen*), 2) the attributes of *thema* and *nomen* (Table 3), and 3) relationships between the entities (*work*–*thema* and *thema*–*nomen*)

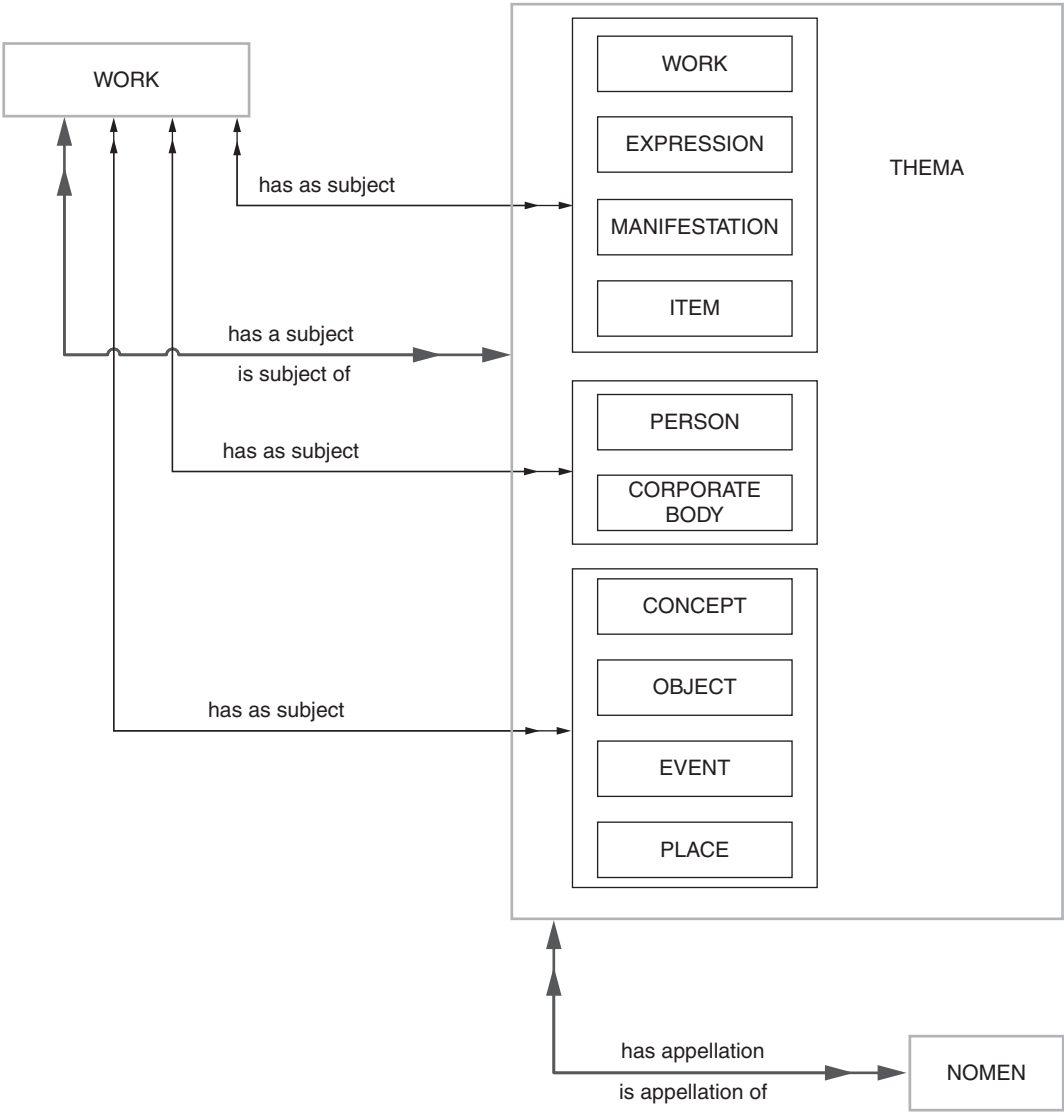


Fig. 4 FRSAD’s relation to FRBR.



Fig. 5 FRSAD conceptual model.

and within the entities (*thema–thema* and *nomen–nomen*) (Table 4).

The importance of the *THEMA–NOMEN* model for the subject authority data is to separate *themas* from what they are known by, referred to, or addressed as. This enables us to define attributes and relationships for the appellation separately.

It is therefore up to application profiles, developed to support particular implementations, to deal with the complex *themas* by specifying the rules for creation of

complex *nomens*. Rules guide creation of subject heading strings or faceted classification. This is therefore another area that is language/domain/system specific and should be addressed within application profiles.

Differences between FRBR, FRAD, and FRSAD

Two models, FRAD and FRSAD, are complementing and further developing some aspects of FRBR. All three have been labeled the “FRBR family,” suggesting that they all

Table 3 Entities and Attributes in FRSAD

Thema	
Type:	Entity
Definition:	Any entity used as a subject of a <i>work</i> .
Attributes:	Type of <i>thema</i> The category to which a <i>thema</i> belongs in the context of a particular KOS. Scope note A text describing and/or defining the <i>thema</i> or specifying its scope within the particular subject authority system.
Nomen	
Type:	Entity
Definition:	Any sign or sequence of signs (alphanumeric characters, symbols, sound, etc.) that a <i>thema</i> is known by, referred to, or addressed as.
Attributes:	Type of <i>nomen</i> Category to which the <i>nomen</i> belongs. Scheme The scheme in which the <i>nomen</i> is established, including value-encoding schemes (particular subject heading lists, thesauri, classification systems, name authority lists, etc.) and syntax encoding schemes (standards for encoding dates, etc.). Reference source of <i>nomen</i> The source in which the <i>nomen</i> is found. It may also be modeled as a relationship with the appropriate Group 1 entity (<i>work</i>, <i>expression</i>, <i>manifestation</i>). Representation of <i>nomen</i> The data type in which the <i>nomen</i> is expressed. Language of <i>nomen</i> The language in which the <i>nomen</i> is expressed. Script of <i>nomen</i> The script in which a <i>nomen</i> is expressed. Script conversion The rule, system, or standard used to render the <i>nomen</i> in a different representation. Form of <i>nomen</i> Any additional information that helps to interpret the <i>nomen</i>. Time of validity of <i>nomen</i> The time period in which a particular instance of a <i>nomen</i> is/was used or is/was valid within a subject vocabulary system. Audience The community or user group for which this <i>nomen</i> is the preferred form. Status of <i>nomen</i> The status of a particular <i>nomen</i> in a subject authority system.

Table 4 Relationships Defined by FRSAD

Work-to-thema relationship	
“has as subject”	
Reverse:	“is subject of”
Domain:	<i>Work</i>
Range:	<i>Thema</i>
Cardinality:	Many-to-many
Thema-to-nomen relationship	
“has appellation”	
Reverse:	“is appellation of”
Domain:	<i>Thema</i>
Range:	<i>Nomen</i>
Cardinality:	Many-to-many
Thema-to-thema relationship	
- Hierarchical relationship	
“has broader <i>thema</i> ”	
Reverse:	“has narrower <i>thema</i> ”
Domain:	<i>Thema</i>
Range:	<i>Thema</i>
Cardinality:	Many-to-many
“has narrower <i>thema</i> ”	
Reverse:	“has broader <i>thema</i> ”
Domain:	<i>Thema</i>
Range:	<i>Thema</i>
Cardinality:	Many-to-many
- Associative relationship	
“has related <i>thema</i> ”	
Reverse:	“has related <i>thema</i> ”
Domain:	<i>Thema</i>
Range:	<i>Thema</i>
Cardinality:	Many-to-many
Nomen-to-nomen relationship	
“is equivalent to”	
Reverse:	“is equivalent to”
Domain:	<i>Nomen</i>
Range:	<i>Nomen</i>
Cardinality:	Many-to-many
“has part”	
Reverse:	“is part of”
Domain:	<i>Nomen</i>
Range:	<i>Nomen</i>
Cardinality:	Many-to-many
“is part of”	
Reverse:	“has part”
Domain:	<i>Nomen</i>
Range:	<i>Nomen</i>
Cardinality:	Many-to-many

are considered parts of a larger general model. There exist some differences among them due to different modeling decisions made during their independent development over time. At the time of writing, the FRBR Review Group is working on the harmonization of FRBR, FRAD, and FRSAD. The project was completed in 2017 with a the new IFLA Library Reference Model (LRM), replacing all three FR family models.

Relationship of FRSAD with FRBR

The FRSAR WG follows FRBR in the methodology, specification, and presentation of entities and relationships. The “has as subject” (many-to-many) relationship, established between the *work* and the entity(ies) representing the aboutness of the *work*, is kept in its entirety in FRSAD. The four areas where some differences were introduced in FRSAD are as follows:

- The “Explore” task is added.
- *Thema* is introduced as a superclass of all entities that can be subjects of a *work*.
- No entity types are explicitly predefined in Group 3.
- *Nomen* is introduced (including attributes and relationships) and is defined as a separate entity instead of an attribute of an entity.

In Fig. 3.3 of the FRBR report, the depicted “subject” relationship has three boxes representing all three groups of entities, respectively, on the right side of the “has as subject” relationship. FRSAD has developed this further by creating a superclass (*thema*), thus enabling the modeling of the “has as subject” relationship on a more general level. *Thema* includes Group 1, Group 2, and all other entities that can be the subjects of a *work*. Therefore, the subject relationship can easily be modeled as “*work* has as subject *thema*.”

FRSAD introduces a differentiation between a thing itself and its appellation. The appellation (name, label, etc.) is often modeled as an attribute of the entity it refers to (e.g., in FRBR). While seemingly simpler, such an approach makes it impossible to introduce the attributes (e.g., language, script) of appellations and relationships between appellations (e.g., between a former and a latter name). In FRSAD, *Nomen* is introduced as an entity to enable appropriate modeling.

Relationship of FRSAD with FRAD

The FRANAR WG was established in 1999 with the mandate to develop further FRBR in the area of authority files. Later, the decision was made by FRANAR to focus on Group 2 entities and *work* only. As a consequence, the FRSAR WG was established to cover the “has as subject” relationship and the appropriate entities. The FRAD and FRSAD models were therefore developed independently. The most significant differences are as follows:

- User tasks: “Contextualize” and “Justify” in FRAD vs. “Explore” in FRSAD
- *Subject* as an attribute of *work* in FRAD
- *Name* in FRAD vs. *Nomen* in FRSAD
- *Name*, *Identifier*, and *Controlled access point* as separate entities in FRAD vs. values of the attribute “Type of *Nomen*” in FRSAD

- *Rules* and *agency* as new entities in FRAD and not explicitly modeled in FRSAD

FRSAD’s user task “explore” is a generalization of FRAD’s “contextualize” and expresses better the user task of browsing, getting acquainted, becoming familiar with, and discovering. FRAD “justify,” on the other hand, is a task of information professionals and not end users. It is an important task on its own, but in the context of metadata creation and not metadata use.

Although similar at first glance, FRAD’s entity *name* (defined as “a character or group of words and/or characters by which an entity is known in the real world”) and FRSAD’s entity *nomen* are different. The FRSAD *nomen* is a more general entity, comprising any (textual or other) appellation both in the real world and in artificial systems. In relation to FRAD, *nomen* is a superclass of FRAD *name*, *identifier*, and *controlled access point*.

Rules and *agency* are not specifically modeled in FRSAD, because again they apply to the cataloging process. If needed, *rules* (which are applied in all phases of cataloging, not merely in creation of controlled access points) should be considered instances of *work*. *Agencies*, which apply the rules, should be considered instances of *corporate body*. If modeled, they are in a relationship with the attribute assignment event.

III. DISCUSSION ON FRSAD MODEL

Following the release of the FRSAD Draft Report for worldwide review in June 2009, the WG received a number of comments. Four major comment categories are presented and discussed below.

FRSAD Terminology

While many explicitly praised the choice of Latin terms for the main entities of FRSAD, some expressed concern about this choice: Latin terminology was labeled as old fashioned, confusing, and presumptuous. Meanwhile, no real alternative was suggested. The choice of Latin terms is explained in the FRSAD Final Report^[14]:

The Working Group chose Latin terms, *thema* (plural *themata* or *themas*) and *nomen* (plural *nomina* or *nomens*), because they have no pre-existing meaning in our context, are culturally neutral, and do not require translation. For *thema*, other possible (English) terms include “subject,” “topic,” and “concept”; however, even discussions within the WG proved that there are very different views on granularity (some see “subject” and “topic” as synonyms, while others see “topic” as a component of “subject”). The WG needed to distinguish *thema* from the previously defined FRBR entity *concept* because *thema* is a superclass of all FRBR entities (to be explained in the next

section). For *nomen*, it is the case that the term “name” is often considered synonymous to proper name. In addition, the WG needed to distinguish *nomen* from the FRAD entity *name* because *nomen* includes FRAD entities *name*, *identifier*, and *controlled access point*.

The terminology problems would be similar in languages other than English. The choice of Latin, which does not have to be translated, has already been tested in translating FRSAD presentations into all official IFLA languages. Translators reported no problems.

FRSAD Is General and Abstract

Soon after FRBR was published, Strunck^[15] noted, “Some students find it unnecessarily complicated to operate with the abstract entities of the model as you cannot study these entities per se. They find the definitions of the entities to be academic and airy.” The problem seems to persist with FRSAD.

The library community has no tradition of conceptual models; FRBR is the first of its kind. It is therefore understandable that practicing librarians are often focusing on detailed rules and not on the big picture. Modeling is difficult and cannot be mastered without some education. It would therefore be necessary to include those topics in the curricula of library schools and continuing education opportunities for professionals. Not only will this enable professionals to understand and contribute to the development of FRBR and related models, it will also help them to more efficiently communicate with developers of computer tools.

FRSAD’s Applicability in Libraries

Some have commented that FRSAD does not closely model the current cataloging practice and is not directly applicable to Library of Congress Subject Headings (LCSH). While this is true, it is also intentional. A lot of developments in the area of subject access, including the development of different knowledge organization systems, are currently conducted outside the library domain. In addition, the mission and purpose of a conceptual model is not to blindly model the current practice but rather to question it and propose improved solutions in order to pave the way for better, more popular, and widely used bibliographic information systems.

The FRSAD Final Report addressed the applicability issue by including an appendix that provides examples using a variety of existing subject authority systems, including *The USP Dictionary of U.S. Adopted Names and International Drug Names*, *Getty Thesaurus of Geographic Names*, and *Medical Subject Headings (MeSH)*^[16].

This appendix provides examples found in implementations of existing subject authority systems through the perspective of the FRSAD model, presented

in four parts: 1) existing models of *thema* types; 2) *thema-thema* relationships presented in subject authority data (both in individual vocabularies and cross-schemes); 3) same *thema* represented by *nomens* from different schemes; and 4) examples of display records from controlled vocabularies or subject authority systems.

COMPLEXITY OF *THEMA*

According to these comments, *thema* is too general and does not appropriately cover the difference between simple and complex *themas*.

Although everybody intuitively understands that some topics are simpler than others (e.g., “cats” vs. “winter fishing in the Cuyahoga River”), a proper definition of complexity is difficult. It seems that we mostly associate the complexity of a *thema* with the complexity of its *nomen*. The problem is addressed in the FRSAD Final Report^[17]:

Themas can vary substantially in complexity or simplicity. Depending on the circumstances (the subject authority system, user needs, the nature of the *work*, etc.) the aboutness of a *work* can be expressed as a one-to-one relationship between the *work* and the *thema*; this means that the totality of the aboutness is encompassed in a single *thema*. In other circumstances the relationship is one-to-many, meaning that the aboutness of the *work* is captured in two or more *themas*. It is virtually impossible to define what the universal “atomic” level of a *thema* might be, because any *thema* can be fragmented further. The argument can be reversed: simple *themas* may be combined or aggregated, resulting in more complex *thema(s)*. In each particular implementation the atomic level is specified and rules guide the creation of *nomens* for complex *themas*.

IV. APPLICATIONS OF FRSAD MODEL

Developed as a general conceptual model that focuses on the subject relationship, FRSAD provides a theoretical framework for all knowledge organization structures, systems, and services (KOS) and their data models. FRSAR WG aimed to develop this model in order to assist in an assessment of the potential for international sharing and use of subject authority data both within the library sector and beyond.

Because the *thema* entity class includes anything that is or has the potential of being or becoming a subject, not restricted to actual subjects of *works* within a particular collection, the FRSAD model is applicable in a wide range of activities related to the development and management of KOS. FRSAD’s modeling of *nomen* as an entity also allows tremendous flexibility for modeling attributes and attribute values for *nomens* representing *themas*. The WG

members have conducted a series of studies on the implementation of FRSAD for various KOS since the model was finalized, especially in controlled lists, subject headings systems, and thesauri, as well as taxonomies and classification systems. The studies have focused on the following issues^[18,19]:

- The granularity of *themas* in different KOS vocabularies.
- Representation of *themas* by various appellation forms in these KOS vocabularies. These can be seen from different perspectives: single, compound, or multiple-word terms; pre-coordinated or stand-alone; notations with captions or category labels, etc.
- FRSAD model for authority data in general (i.e., not restricted to subject authority data).
- The potential of FRSAD for multilingual and multicultural community needs.
- Approaches for handling vocabulary mapping in situations where vocabularies have or have not already applied the FRSAD model.

The studies conducted by the WG have also confirmed that the FRSAD model coincided with the works of a number of other efforts of standardization for KOS construction, publishing, and interoperating, particularly:

- ISO 25964-1:2011 Thesauri and interoperability with other vocabularies—Part 1: Thesauri for information retrieval (published in 2011)^[20]
- SKOS Simple Knowledge Organization System Reference. W3C Recommendation March 17, 2009^[21]
- SKOS Core Vocabulary Specification. W3C Working Draft May 10, 2005^[22]
- SKOS eXtension for Labels (SKOS-XL). In: SKOS Simple Knowledge Organization System Reference. W3C Recommendation March 17, 2009^[23]

Conceptual models and data models have been developed or enhanced by the working groups of these standards, each with particular implementation targets in mind. FRSAD WG conducted careful studies and mappings to these models; the results have been presented in several conferences. In general, the conceptualization of the relationship between a concept (*thema*) and the representations of the concept (*nomen(s)*) is consistent with all these models. As indicated previously, FRSAD added a new entity, *nomen*, to the FRBR family. This enables the modeling of *nomen* by defining its attributes as well as relationships between instances of a *nomen*. This important conceptualization can be found to have echoes in the data models of ISO 25964. It is also paralleled by the newer version of the SKOS, which supplements an eXtension for Labels (SKOS-XL) (SKOS Simple Knowledge Organization System Reference, 2009, Appendix B) specification in 2009. SKOS has been widely used by the

Linked Data datasets of subject authorities such as the *Library of Congress Subject Headings (LCSH)*, *Dewey Decimal Classification (DDC)*, *AGROVOC*, and *Eurovoc*, as well as name authorities such as the *Library of Congress Name Authority File (LCNAF)* and *Virtual International Authority File (VIAF)*.^[24]

Another important model FRSAD WG has studied is the Dublin Core Metadata Initiative (DCMI) Abstract Model, a DCMI Recommendation.^[25] The FRSAD model is consistent with the DCMI abstract model in the sense that FRSAD allows any *thema* to be independent of any *nomen*, including any syntax that a *nomen* may use. Furthermore, it will enable the sharing, linking, and reuse of subject authority data among not only the subject vocabularies themselves but also metadata resources.

These studies conducted by the WG and the fact that FRSAD complies with the models presented in ISO 25964, SKOS, and the DCMI Abstract Model provide proof that the FRSAD model can meet the needs of subject authority data in both the conventional information management environment and the emerging Linked Data environment.

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Fuzzy Set Theory

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Abstract

This entry presents a definition of fuzzy set theory and an overview of some applications to model flexible information retrieval systems. The entry focuses on a description of fuzzy indexing procedures defined to represent the varying significance of terms in synthesizing the documents' contents, the representation of structured documents so as to model a subjective view of document content, the definition of flexible query languages which allow the expression of soft selection conditions, and fuzzy associative retrieval mechanisms to model fuzzy pseudothesaurs, fuzzy ontologies, and fuzzy categorizations of documents.

INTRODUCTION

The objective of this entry is to provide an overview of some applications of fuzzy set theory to design flexible information retrieval systems (IRSs). The term “flexible” implies that we consider IRSs that can represent and manage the uncertainty, vagueness, and subjectivity, which are characteristic of the process of information searching and retrieval.

Consider the notions that index terms offer only an approximate and incomplete view of a document's content, that query languages (such as those incorporating Boolean logic) do not usually allow users to express vague requirements for specifying selection conditions that are tolerant to imprecision, and that a document's relevance to the user's query is a subjective and an imprecise notion. We show how imprecision, vagueness, and subjectivity can be managed within the formal framework of fuzzy set theory. This means that retrieval mechanisms capable of both modeling human subjectivity and of estimating the partial relevance of documents to a user's needs can be designed.

The retrieval process is introduced as a fuzzy multi-criteria decision-making (MCDM) activity in the presence of vagueness. Documents constitute the set of the alternatives described using weighted index terms. The query specifies a set of soft constraints on the document representations that are created via indexing. The retrieval mechanism performs a decision analysis in the presence of imprecision to rank the documents on the basis of their partial satisfaction of the soft constraints.

This entry is organized as follows: in the section on “Current Trends in IR,” the current trends and key issues in IR are discussed. In the section on “Fuzzy Retrieval Models,” an overview of the basic notions of fuzzy set theory to model flexible IRSs are presented. In the section on “Fuzzy Document Indexing,” a description of the traditional fuzzy document representation is first illustrated. In addition, both a fuzzy representation of documents structured into logical sections that can be adapted to the subjective needs of a user and a fuzzy representation of HTML documents are presented. In the section on “Flexible Querying,” a description of how the Boolean query language of IR can be extended so as to make it flexible and suitable to express soft constraints by capturing the vagueness of the user needs is presented. Both numeric and linguistic selection conditions are introduced to qualify term's importance, and it is shown how linguistic quantifiers are defined to specify soft aggregation operators of query terms. In the section on “Fuzzy Associative Mechanisms,” a description of how fuzzy sets can serve to define associative mechanisms to expand the functionalities of IRSs are presented. The focus of current research trends in IR is on the semantic web, i.e., the capability to represent concepts and to model their semantic relationships: fuzzy sets provide notions that can be applied to this purpose allowing to model either fuzzy pseudothesaurs and fuzzy ontologies and to build fuzzy categorizations of documents by fuzzy clustering techniques. In the section on “Fuzzy Performance Measures,” fuzzy performance measures for IRSs are introduced and the conclusion summarizes the main contents of this entry.

CURRENT TRENDS IN IR

In this section the current trends and the key issues in IR are introduced.

Current Trends in IR

Some of the current trends in IR research run the gamut in terms of expanding the discipline both to incorporate the latest technologies and to cope with novel necessities. In terms of novel necessities, with the diffusion of the Internet and the heterogeneous characteristics of users of search engines, which can be regarded as the new frontier of IR, a new central issue has arisen, generally known as the semantic web. It mainly consists in expanding IRSs with the capability to represent and manage the semantics of both user requests and documents so as to be able to account for user and document contexts. This need becomes urgent with cross-language retrieval, which consists in expressing queries in one language, and retrieving documents written in another language, that is what commonly happens when submitting queries to search engines. Cross language retrieval not only implies new works on text processing, e.g., stemming conducted on a variety of languages, new models of IR such as the development of language models, but also the ability to match terms in distinct languages at a conceptual level, by modeling their meaning.

Another research trend of IR is motivated by the need to manage multimedia collections with nonprint audio elements such as sound, music, and voice, and video elements such as images, pictures, movies, and animation. Retrieval of such elements can include consideration of both meta-data and content-based retrieval techniques. The definition of new IRSs capable to efficiently extract content indexes from multimedia documents, and to effectively retrieve documents by similarity or proximity to a query by example so as to fill the semantic gap existing between low-level syntactic index matching and the semantics of multimedia document and query are still to come.

In addition, modern computing technology, including storage media, distributed and parallel processing architectures, and improved algorithms for text processing and for retrieval, has an effect on IRSs. For example, improved string searching algorithms have improved the efficiency of search engines. Improved computer networks have made the Internet and the World Wide Web a possibility. Intelligent agents can improve retrieval in terms of attempting to customize and personalize it for individual users. Moreover, great improvements have been made in retrieval systems interfaces based on human-computer interface research.

These novel research trends in IR are faced by turning to technologies such as natural language processing, image processing, language models, artificial intelligence, and automatic learning.

Also fuzzy set theory can play a crucial role to define novel solutions to these research issues since it provides suitable means to cope with the needs of the semantic web,^[1,2] e.g., to model the semantic of linguistic terms so as to reflect their vagueness and subjectivity and to compute degrees of similarity, generalization, and specialization between their meanings.

Key Issues in IR

Modeling the concept of relevance in IR is certainly a key issue, perhaps the most difficult one, and no doubt the most important one. What makes a document relevant to a given user is still not fully understood, specifically when one goes beyond topicality (i.e., the matching of the topics of the query with the topics of the document). Of course, this leads to the realization that relevance is gradual and subjective.

A second key issue is the representation of the documents in a collection, as well as the representation of users' information needs, especially for the purpose of matching documents to the queries at a "semantic" level. This implies introducing incompleteness, approximation, and managing vagueness and imprecision.

Finally, a key issue is how to evaluate properly an IRS's performance. Here, too, one sees imprecision.

IMPRECISION, VAGUENESS, UNCERTAINTY, AND INCONSISTENCY IN IR

Very often the terms imprecision, vagueness, uncertainty, and inconsistency are used as synonymous concepts. Nevertheless when they are referred to qualify a characteristic of the information they have a distinct meaning.^[3] Since IR has to do with information, understanding the different meanings of imprecision, vagueness, uncertainty, and inconsistency allows to better understanding the perspectives of the distinct IR models defined in the literature.

Vagueness and imprecision are related to the representation of the information content of a proposition. For example, in the information request, "find *recent* scientific chapters dealing with the *early* stage of infectious diseases by HIV," the terms *recent* and *early* specify vague values of the publication date and of the temporal evolution of the disease, respectively. The publication date and the phase of an infectious disease are usually expressed as numeric values; their linguistic characterization has a coarser granularity with respect to their numeric characterization. Linguistic values are defined by terms with semantics compatible with several numeric values on the scale upon which the numeric information is defined. Imprecision is just a case-limit of vagueness, since imprecise values have a full compatibility with a subset of values of the numeric reference scale.

There are several ways to represent imprecise and vague concepts. Indirectly, by defining similarity or proximity relationships between each pair of imprecise and vague concepts.

If we regard a document as an imprecise or vague concept, i.e., as bearing a vague content, a numeric value computed by a similarity measure can be used to express the closeness of any two pairs of documents. This is the way of dealing with the imprecise and vague document and query contents in the vector space model of IR. In this context the documents and the query are represented as points in a vector space of terms and the distances between the query and the documents points are used to quantify their similarity.

Another way to represent vague and imprecise concepts is by means of the notion of fuzzy set. The notion of a fuzzy set is an extension to normal set theory.^[4] A set is simply a collection of objects. A fuzzy set (more properly called a fuzzy subset) is a subset of a given universe of objects, where the membership in the fuzzy set is not definite. For example, consider the idea of a person being middle-aged. If a person's age is 39, one can consider the imprecision of that person being in the set of middle-aged people. The membership function, μ , is a number in the interval $[0, 1]$ that represents the degree to which that person belongs to that set. Thus, the terms *recent* and *early* can be defined as fuzzy subsets, with the membership functions interpreted as compatibility functions of the meaning of the terms with respect to the numeric values of the reference (base) variable. In Fig. 1, the compatibility function of the term *recent* is presented with the numeric values of the time-scale measured in years. Note that here a chapter that has a publication date of the current year or 1 year previous is perfectly *recent*; however, the extent to which a chapter remains *recent* declines steadily over the next 2 years until chapters older than 3 years have no sense of being *recent*.

In the next sections we will see how the notion of fuzzy set has been used in the IR context to represent the vague concepts expressed in a flexible query for specifying soft selection conditions of the documents.

Uncertainty is related to the truth of a proposition, intended as the conformity of the information carried by the proposition with the considered reality. Linguistic

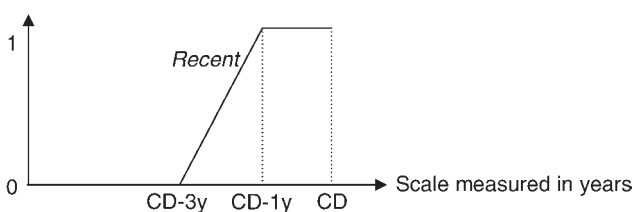


Fig. 1 Semantics of the term “recent” referring to the publication date of a scientific chapter. CD, current date; y, years.

expressions such as “probably” and “it is possible that” can be used to declare a partial lack of knowledge about the truth of the stated information.

Further, there are cases in which information is affected by both uncertainty and imprecision or vagueness. For example, consider the proposition “probably document d is relevant to query q .” Possibility theory^[5,6] together with the concept of a linguistic variable defined within fuzzy set theory^[7] provide a unifying formal framework to formalize the management of imprecise, vague, and uncertain information.^[8]

However, the same information content can be expressed by choosing a trade-off between the vagueness and the uncertainty embedded in a proposition. For example, one can express the content of the previous proposition by a new one “document d is more or less relevant to query q .” In this latter proposition, the uncertain term *probably* has been eliminated, but the specificity of the vague term *relevant* has been reduced. In point of fact, the term *more or less relevant* is less specific than the term *relevant*. A dual representation can eliminate imprecision and augment the uncertainty, like in the expression “it is *not completely probable* that document d fully satisfies the query q .”

One way to model IR is to regard it as an uncertain problem.^[9]

On the basis of what has been said about the trade-off between uncertainty and vagueness to express the same information content, there are two alternative ways to model the IR activity. One possibility is to model the query evaluation mechanism as an uncertain decision process. Here the concept of relevance is considered binary (crisp) and the query evaluation mechanism computes the probability of relevance of a document d to a query q . Such an approach, which does model the uncertainty of the retrieval process, has been introduced and developed by probabilistic IR models.^[10–12] Another possibility is to interpret the query as the specification of soft “elastic” constraints that the representation of a document can satisfy to an extent, and to consider the term *relevant* as a gradual (vague) concept. This is the approach adopted in fuzzy IR models.^[9,13] In this latter case, the decision process performed by the query evaluation mechanism computes the degree of satisfaction of the query by the representation of each document. This satisfaction degree, called the retrieval status value (RSV), is considered as an estimate of the degree of relevance (or is at least proportional to the relevance) of a given document with respect to a given user query. An RSV of 1 implies maximum relevance; an RSV value of 0 implies absolutely no relevance. And, an RSV value in the interval $[0, 1]$ implies an intermediate level or degree of relevance. For example, an RSV value of 0.5 could imply an average degree of relevance.

Inconsistency comes from the simultaneous presence of contradictory information about the same reality. An example of inconsistency can be observed when submitting

the same query to several IRSs that adopt different representations of documents and produce different results. This is actually very common and often occurs when searching for information over the Internet using different search engines. To solve this kind of inconsistency, some fusion strategies can be applied to the ranked lists each search engine produces. In fact, this is what metasearch engines do.^[14,15]

In this entry, we analyze the representation and management of vagueness as a means of improving the flexibility of IRSs. In particular, we will focus on the modeling of vagueness and in fuzzy IR models.

The document representation based on a selection of index terms is invariably incomplete. When synthesizing the content of a text manually by asking an expert to select a set of index terms, one introduces subjectivity in the representation. On the other hand, automatic full-text indexing introduces imprecision since the terms are not all fully significant in characterizing a document's content. However, these terms can have a partial significance that might also depend upon the context in which they appear, i.e., which document component.

In the query formulation, users often only have a vague idea of the information for which they are looking. Users therefore find it difficult to translate their needs into a precise request using a formal query language such as one employing Boolean logic.

A flexible IRS should be capable of providing more detailed and rich representations of documents and of interpreting vague queries in order to perform retrieval processes that tolerate, and account for, this vagueness.

FUZZY RETRIEVAL MODELS

Fuzzy retrieval models have been defined in order to reduce the imprecision that characterizes the Boolean indexing process, to represent the user's vagueness in queries, and to deal with discriminated answers estimating the partial relevance of the documents with respect to queries. Extended Boolean models based on fuzzy set theory have been defined to deal with one or more of these aspects.^[16–24] Surveys of fuzzy extensions for IRSs and of fuzzy generalizations of the Boolean retrieval model can be found in Kraft^[9] and Bordogna.^[13]

Fuzzy “knowledge-based” models^[25,26] and fuzzy associative mechanisms^[27–30] have been defined to cope with the incompleteness that characterizes either the representation of documents or the users' queries. Miyamoto^[31] illustrates a wide range of methods to generate fuzzy associative mechanisms.

It has been speculated that Boolean logic is passé, out of vogue. Yet, researchers have employed p-norms in the vector space model or Bayesian inference nets in the probabilistic model to incorporate Boolean logic into those models. In addition, the use of Boolean logic to separate a

collection of records into two disjoint classes has been considered, e.g., using the one-clause-at-a time (OCAT) methodology.^[32] Moreover, even now retrieval systems such as Dialog and Web search engines such as Google allow for Boolean connectives. It should come as no surprise, therefore, to see extensions of Boolean logic based upon fuzzy set theory for IR.

It is noteworthy that most of the research on fuzzy retrieval has been conducted by a relatively few scholars. Moreover, that research has focused upon theoretical models, focusing primarily upon text retrieval, so that precious little testing has to date been conducted.

Extensions of Fuzzy Boolean Retrieval Models

The fuzzy retrieval models have been defined as generalizations of the classical Boolean model. These allow one to extend existing Boolean IRSs without having to redesign them. This was first motivated by the need to be able to produce proper answers in response to the queries. In essence, the classical Boolean IRSs apply an exact match between a Boolean query and the representation of each document. This document representation is defined as a set of index terms. These systems partition the collection of documents into two sets, the retrieved documents and the rejected (non-retrieved) ones. As a consequence of this crisp behavior, these systems are liable to reject useful items as a result of too restrictive queries, as well as to retrieve useless material in reply to queries.^[33]

The softening of the retrieval activity in order to rank the retrieved items in decreasing order of their relevance to a user query can greatly improve the effectiveness of such systems. This objective has been approached by extending the Boolean models at different levels. We shall consider those levels in order to model retrieval using a MCDM model that allows the expression of the users' queries as soft constraints and produce discriminated answers.

Fuzzy techniques for documents' indexing

The aim here is to provide more specific and exhaustive representations of each document's information content. This means improving these representations beyond those generated by existing indexing mechanisms. We shall introduce the fuzzy interpretation of a weighted document representation and then later introduce a fuzzy representation of documents structured in logical sections that can be adapted to a user that has subjective criteria for interpreting the content of documents.^[17] In this same vein, we shall describe an indexing procedure for HTML documents.^[34]

Definition of flexible query languages

The objective here is to define query languages that are more expressive and natural than classical Boolean logic. This is done in order to capture the vagueness of user

needs as well as to simplify user–system interaction. This has been pursued with two different approaches. First, there has been work on the definition of soft selection criteria (soft constraints), which allow the specification of the different importance of the search terms. Query languages based on numeric query term weights with different semantics have been first proposed as an aid to define more expressive selection criteria.^[18,21,22,24,35] An evolution of these approaches has been defined that introduces linguistic query weights, specified by fuzzy sets such as *important* or *very important*, in order to express the different vague importance of the query terms.^[36] Second, there is the approach of introducing soft aggregation operators for the selection criteria, characterized by a parametric behavior which can be set between the two extremes of intersection (AND) and union (OR) as adopted in Boolean logic. Boolean query languages have been extended and generalized by defining aggregation operators as linguistic quantifiers such as *at least k* or *about k*.^[16]

As we shall see, the incorporation of weighted document representations in a Boolean IRS is a sufficient condition to improve the system via a ranking capability. As a consequence of this extension, the exact matching that is employed by a classical Boolean IRS is softened using a partial matching mechanism that evaluates the degree of satisfaction of a user's query for each document. This degree of satisfaction is the RSV that is used for ranking.

Fuzzy Associative Mechanisms

These associative mechanisms allow to automatically generating fuzzy pseudothesaurs, fuzzy ontologies, and fuzzy clustering techniques to serve three distinct but compatible purposes. First, fuzzy pseudothesaurs and fuzzy ontologies can be used to contextualize the search by expanding the set of index terms of documents to include additional terms by taking into account their varying significance in representing the topics dealt with in the documents. The degree of significance of these associated terms depends on the strength of the associations with a document's original descriptors. Second, an alternative use of fuzzy pseudothesaurs and fuzzy ontologies is to expand the query with related terms by taking into account their varying importance in representing the concepts of interest. The importance of an additional term is dependent upon its strength of association with the search terms in the original query. Third, fuzzy clustering techniques, where each document can be placed within several clusters with a given strength of belonging to each cluster, can be used to expand the set of the documents retrieved in response to a query. Documents associated with retrieved documents, i.e., in the same cluster, can be retrieved. The degree of association of a document with the retrieved documents does influence its RSV. Another application of fuzzy clustering in IR is that of providing an alternative way, with respect to the usual ranked list, of presenting the results of a search.

FUZZY DOCUMENT INDEXING

In order to increase the effectiveness of IRSs, the indexing process plays a crucial role. In fact, it is not sufficient to provide IRSs with powerful query languages or sophisticated retrieval mechanisms to achieve effective results if the representation of documents oversimplifies their information content.

Vector Space, Probabilistic, and Generalized Boolean Indexing

The vector space model and the probabilistic models generally adopt a weighted document representation, which has improved the Boolean document representation by allowing the association of a numeric weight with each index term.^[10,33] The automatic computation of the index term weights is based on the occurrences count of a term in the document and in the whole archive.^[37–39] In this case, the indexing mechanism computes for each document d and each term t a numeric value by means of a function F . An example of F which has the index term weight increasing with the frequency of term t in document d but decreasing with the frequency of the term in all the documents of the archive is given by

$$F(d, t) = tf_{dt} \times g(IDF_t) \quad (1)$$

where

- tf_{dt} is a normalized term frequency, which can be defined as:

$$= tf_{dt} = \frac{OCC_{dt}}{MAXOCC_d};$$

- OCC_{dt} is the number of occurrences of t in d ;
- $MAXOCC_d$ is the number of occurrences of the most frequent term in d ;
- IDF_t is an inverse document frequency which can be defined as: IDF_t

$$IDF_t = \log \frac{N}{NDOC_t};$$

- N is the total number of documents in the archive;
- $NDOC_t$ is the number of documents indexed by t ; and
- g is a normalizing function.

The computation of IDF_t is particularly costly in the case of large collections which are updated online.

The definition of such a function F is based on a quantitative analysis of the text, which makes it possible to model the qualitative concept of significance of a term in describing the information carried by the text. The adoption of weighted indexes allows for an estimate of the

relevance, or of the probability of relevance, of documents to a query.^[10,33]

Based on such an indexing function, and by incorporating Boolean logic into the query, the first fuzzy interpretation of an extended Boolean model has been to adopt a weighted document representation and to interpret it as a fuzzy set of terms.^[40] From a mathematical point of view, this is a quite natural extension: the concept of the significance of index terms in describing the information content of a document can then be naturally described by adopting the function F , such as the one defined by Zadeh^[5] as the membership function of the fuzzy set representing a document's being in the subset of concepts represented by the term in question. Formally, a document is represented as a fuzzy set of terms: $R_d = \sum_{t \in T} \mu_{R_d}(t)/t$ in which the membership function is defined as $\mu_{R_d}: D \times T \rightarrow \{0, 1\}$. In this case, $\mu_{R_d}(t) = F(d, t)$, i.e., the membership value, can be obtained by the indexing function F . We describe later that through this extension of the document representation, the evaluation of a Boolean query produces a numeric estimate of the relevance of each document to the query, expressed by a numeric score or RSV, which is interpreted as the degree of satisfaction of the constraints expressed in a query.

Fuzzy set theory has been applied to define new and more powerful indexing models than the one based on the function specified in Eq. 1. The definition of new indexing functions has been motivated by several considerations. First, these F functions do not take into account the idea that a term can play different roles within a text according to the distribution of its occurrences. Moreover, the text can be considered as a black box, closed to users' interpretation. Such users might naturally filter information by emphasizing certain subparts on the basis of their subjective interests. This outlines the fact that relevance judgments are driven by a subjective interpretation of the document's structure, and supports the idea of *dynamic* and *adaptive* indexing.^[17,41] By adaptive indexing, we mean indexing procedures which take into account the users' desire to *interpret* the document contents and to "build" their synthesis on the basis of this interpretation.

Fuzzy Representation of Structured Documents

We also consider the synthesis of a fuzzy representation of structured documents that takes into account the user needs.^[17] A document can be represented as an entity composed of sections (e.g., *title*, *authors*, *introduction*, and *references*). For example, a single occurrence of the term in the *title* indicates that the chapter is concerned with the concept expressed by the term, while a single occurrence in the *reference* suggests that the chapter refers to other publications dealing with that concept. The information role of each term occurrence depends then on the semantics of the subpart where it is located. This means that to the aim of defining an indexing function for

structured documents the single occurrences of a term may contribute differently to the significance of the term in the whole document. Moreover, the document's subparts may have a different importance determined by the users' needs. For example, when looking for chapters written by a certain author, the most important subpart would be the *author name*; while when looking for chapters on a certain topic, the *title*, *abstract*, and *introduction* subparts would be preferred.

Of course, when generating an archive of a set of documents, it is necessary to define the sections which one wants to employ to structure each document. The decision of how to structure the documents, i.e., the type and number of sections, depends on the semantics of the documents and on the accuracy of the indexing module that one wants to achieve. A formal representation of a document will be constituted using a fuzzy binary relation: with each pair <section, term>, a significance degree in the interval [0, 1] is computed to express the significance of that term in that document section. To obtain the overall significance degree of a term in a document, i.e., the index term weight, these values are *dynamically* aggregated by taking into account the indications that a user explicits in the query formulation. Other non-fuzzy approaches have also introduced the concept of boosting factor to emphasize differently the contribution of the index terms occurrences depending on the document sections to the overall index term weights. However these approaches compute *static* index term weights during the indexing process, without taking into account the user interpretation.

On the contrary, in the fuzzy approach the aggregation function is defined on two levels. First, the user expresses preferences for the document sections (the equivalent of the boosting factors), specifying those sections that the system should more heavily weight in order to take proper account of the evaluation of the relevance of a given document to that user's query. Second, the user should decide which aggregation function has to be applied for producing the overall significance degree. This is done by the specification of a linguistic quantifier such as *at least one*, *at least k*, or *all*.^[42] By adopting this document representation, the same query can select documents in different relevance order depending on the user's indicated preferences.

An indexing model has been proposed by which the occurrences of a term in the different documents' sections are taken into account according to specific criteria, and the user's interpretation of the text is modeled.^[17] During the retrieval phase, the user can specify the distinct importance (preference) of the sections and decide that a term must be present in *all* the sections of the document or in *at least a certain number* of them in order to consider the term fully significant. A section is a logical subpart identified by s_i , where $i \in 1, \dots, n$ and n is the total number of the sections in the documents. We assume here that an archive contains documents sharing a common structure.

Formally, a document is represented as a fuzzy binary relation:

$$R_d = \sum_{(t,s) \in T \times S} \mu_d(t,s)/(t,s) \quad (2)$$

The value $\mu_d(t,s) = F_s(d,t)$ expresses the significance of term t in section s of document d . A function $F_s: D \times T \rightarrow [0, 1]$ is then defined for each section s . The overall significance degree $F(d,t)$ is computed by combining the single significance degrees of the sections, the $F_s(d,t)$ s, through an aggregation function specified by the user. This function is identified by a fuzzy linguistic quantifier such as *all*, *at least k*, or *at least l*, which aggregates the significance degrees of the sections according to their importance values as specified by the user.

The criteria for the definition of F_s are based on the semantics of section s and are specified by an expert during the indexing of the documents. For example, for sections containing short texts or formatted texts, such as the *author* or *keywords*, a single occurrence of a term makes it fully significant in that section: in this case, it could be assumed that $F_s(d,t) = 1$ if t is present in s but 0 otherwise. On the other hand, for sections containing textual descriptions of variable length such as the *abstract* and *title* sections, $F_s(d,t)$ can be computed as a function of the normalized term frequency in the section as for example:

$$\mu_s(d,t) = tf_{dst} * IDF_t \quad (3)$$

in which IDF_t is the inverse document frequency of term t [see definition (5)], tf_{dst} is the normalized term frequency defined as:

$$tf_{dst} = \frac{OCC_{dst}}{MAXOCC_{sd}}$$

in which OCC_{dst} is the number of occurrences of term t in section s of document d and $MAXOCC_{sd}$ is a normalization parameter depending on the section's length so as not to underestimate the significance of short sections with respect to long ones. For example, this normalization parameter could be computed as the frequency of the term with the highest number of occurrences in the section.

To simplify the computation of this value, it is possible to heuristically approximate it: during the archive generation phase, with an expert indicating the estimated percentage of the average length of each section with respect to the average length of documents ($PERL_s$). Given the number of occurrences of the most frequent term in each document d , $MAXOCC_d$, an approximation of the number of occurrences of the most frequent term in section s of document d is

$$MAXOCC_{sd} = PERL_s * MAXOCC_d$$

Term Significance

To obtain the overall degree of significance of a term in a document, an aggregation scheme of the $F_s(d,t)$ s values has been suggested, based on a twofold specification of the user.^[17] When starting a retrieval session, users can specify their preferences on the sections s by a numeric score $\alpha_s \in [0, 1]$ where the most important sections have an importance weight close to 1. Moreover, users can select a linguistic quantifier to specify the aggregation criterion; the quantifier can be chosen among *all* (the most restrictive one), *at least one* (the weakest one), or *at least k* which is associated with an intermediate aggregation criterion.

Within fuzzy set theory linguistic quantifiers used to specify aggregations are defined as ordered weighted averaging (OWA) operators.^[43] When processing a query, the first step accomplished by the system for evaluating $F(d,t)$ is the selection of the OWA operator associated with the linguistic quantifier lq , OWA_{lq} . When the user does not specify any preferences on the documents' sections, the overall significance degree $F(d,t)$ is obtained by applying directly the OWA_{lq} operator to the values $\mu_1(d,t), \dots, \mu_n(d,t)$:

$$F(d,t) = OWA_{lq}(\mu_1(d,t), \dots, \mu_n(d,t))$$

When distinct preference scores $\alpha_1, \dots, \alpha_n$ are associated with the sections, it is first necessary to modify the values $\mu_1(d,t), \dots, \mu_n(d,t)$ in order to increase the "contrast" between the contributions due to important sections with respect to those of less important ones. The evaluation of the overall significance degree $F(d,t)$ is obtained by applying the operator OWA_{lq} to the modified degrees $\alpha_1, \dots, \alpha_n$: $F(d,t) = OWA_{lq}(\alpha_1, \dots, \alpha_n)$.

We can now briefly sketch a comparison of the effectiveness of a system adopting a simple weighted representation versus a system with this structured weighted representation. In particular, the different rankings of two documents obtained by adopting the two different representations are outlined by an example. The two documents considered in the archive of CNR research projects contain the term "genoma." Fig. 2 shows the normalized frequency of "genoma" in the sections of the two documents; as it can be noticed, the term "genoma" has the same total number of occurrences in both documents. Since the normalization factors are the same, by applying F as defined in Eq. 1, the significance of "genoma" in both documents gets the same value $F(d_1, \text{genoma}) = F(d_2, \text{genoma}) = 0.8$. Fig. 3 shows the significance degrees for each section in which the term "genoma" occurs. These degrees are obtained using the fuzzy representation of structured documents; since the title and keywords sections are short texts, μ_{title} and $\mu_{keywords}$ are defined so as to take values in $\{0, 1\}$. After estimating that the objective section takes up averagely 30% of the documents' length, and the

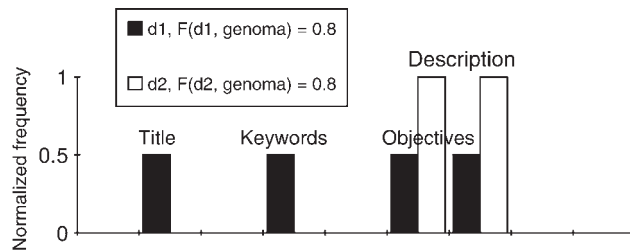


Fig. 2 Normalized frequency of “genoma” in the sections of the two documents.

description section is around 40%, $\mu_{\text{objective}}$ and $\mu_{\text{description}}$ are defined.

When the user does not specify any criterion to aggregate the single degrees of the sections, a default aggregation operator is used.^[16,17] Since no importance is specified to differentiate the contributions of the sections, all of them are assumed to have the same importance weight of 1. Notice that the document d_1 , which contains “genoma” in the *keywords* and *title* sections is now considered more significant with respect to document d_2 that contains the term just in the *objectives* and *description* sections.

These results could be reversed if the user specifies that the presence of the term “genoma” in the *objectives* section is fundamental. Fig. 4 illustrates this situation, showing the modified degrees of significances of the sections when the user sets the aggregation criterion equal to at least 1 and $\alpha_{\text{objective}} = 1$, $\alpha_{\text{title}} = \alpha_{\text{keywords}} = \alpha_{\text{description}} = 0.5$, and $\alpha_i = 0$ otherwise.

The fact that the user can explicate the preferences on the section and the aggregation criterion by a linguistic quantifier allows a subjective interpretation of document content and gives the user the possibility of full control on the system behavior. This is not the case for other IR models, the probabilistic model (e.g., Bayesian updating of the probabilities as part of relevance feedback), and Rocchio’s relevance feedback mechanism for the vector space model, or even the calculation of the rank for Web pages retrieved by Google using PageRank. In these models the retrieval criteria remain implicit and are not observable directly by the user.

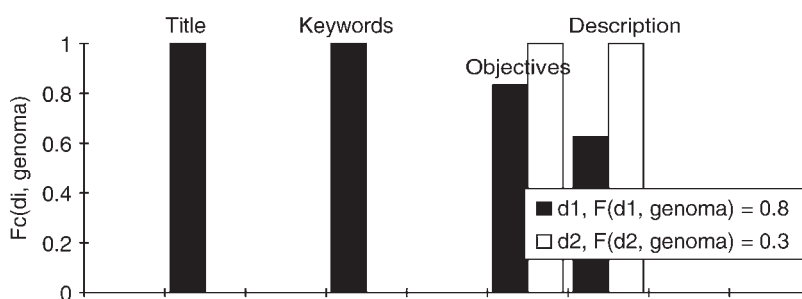


Fig. 3 Significance degrees of “genoma” in each section of the two documents.

Experimental Results

A comparison of the results produced by using the traditional fuzzy representation of documents and the fuzzy representation of structured documents can be found.^[17] In this experiment, a collection of 2500 textual documents about descriptions of CNR research projects has been considered. The indexing module of the prototypal IRS named DOMINO, used for the experiment, has been extended in order to be able to recognize in the documents any structure simply by specifying it into a definition file. In this way it is not necessary to modify the system when dealing with a new collection of documents with a different structure. The definition of the documents sections has been made before starting the archive generation phase. During this phase it was also necessary to specify the criteria by which to compute the significance degrees of the terms in each section. Two kinds of sections have been identified: the “structured” sections, i.e., the research code, title, research leader, and the “narrative” sections, containing unstructured textual descriptions, i.e., the project description and the project objective. It has been observed that while the values of precision remain unchanged in the two versions of the system, the values of recall are higher by using the structured representation than those obtained by using the traditional fuzzy representation.

We illustrate another approach which produces a weighted representation of documents written in HTML.^[34] An HTML document has a specific syntactic structure in which its subparts have a given format specified by the delimiting tags. In this context, tags are seen as syntactic elements carrying an indication of the importance of the associated text. When writing a document in HTML, an author associates varying importance to each of the different subparts of a given document by delimiting them by means of appropriate tags. Since a certain tag can be employed more than once, and in different positions inside the document, the concept of document subpart is not meant as a unique, adjacent piece of text. Such a structure is subjective and carries the interpretation of the document author. It can be applied in archives, which collect heterogeneous documents, i.e., documents with possibly different “logical” structures.

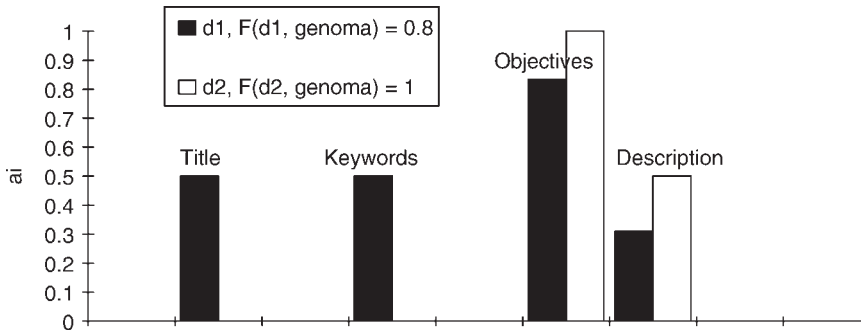


Fig. 4 Modified significance degrees of the term “genoma” in the documents sections.

When generating a HTML document, an author exploits the importance weights associated with different subparts of the text. If characters of different fonts are used, it is assumed that the larger the font, the more important the information carried by the text. Moreover, to use boldface or italics for characters generally means the highlighting of a portion of the text. Tags constitute then indicators of the importance of documents' subparts.

An indexing function has been proposed which provides different weights for the occurrences of a given term in the document, depending on the tags by which they are delimited.^[34] The overall significance degree $F(d, t)$ of a term t in a document d is computed by first evaluating the term significance in the different document tags, and then by aggregating these contributions. With each tag, a function $F_{\text{tag}}: D \times T \rightarrow [0, 1]$ is associated together an importance weight $\mu_{\text{tag}} \in [0, 1]$. Note that the greater is the emphasis of the text associated with a tag, the greater is its importance weight. A possible ranking of the considered tags has been suggested^[34] in decreasing order of tag importance. The definition of such a list is quite subjective, although based on objective assumptions suggested by commonsense. These rankings include notion such as a larger font for the characters in a portion of text yields greater importance of that portion of text, or text in boldface or italics or appearing in a list can be assumed as having a higher importance. Of course, other orderings could be defined.

To simplify the hierarchy of the tags, we see that certain tags can be employed to accomplish similar aims, so one can group them into different classes. It is assumed that the members of a class have the same importance weight. Text not delimited by any tag is included into the lowest class. A simple procedure to compute numeric importance weights starting from the proposed ranking can be achieved. The definition of F_{tag} follows the same mechanism as the previous approach.^[17] The following normalized frequency is now proposed:

$$F_{\text{tag}}(d, t) = \frac{\text{NOCC}_{\text{tag dt}}}{\text{MAXOCC}_{\text{tag d}}}$$

in which $\text{NOCC}_{\text{tag dt}}$ is the number of occurrences of term t inside tag in document d , and $\text{MAXOCC}_{\text{tag d}}$ is the number of occurrences of the most frequent term inside the tag.

Once the single significance degrees of a term into the tags have been computed, these have to be aggregated in order to produce an overall significance degree of the term into the document. In the aggregation all the significance degrees should be taken into account, so as to consider the contribution of each tag, modulated by their importance weights. To this aim a weighted mean can be adopted:

$$A(F_{\text{tag1}}(d, t), \dots, F_{\text{tagn}}(d, t)) = \sum_{i=1, \dots, n} F_{\text{tag i}}(d, t) * w_i$$

in which $\sum_{i=1, \dots, n} w_i = 1$. Starting from the list of tags in decreasing relative order of their importance, the numeric weights w_i are computed through a simple procedure. Assuming that tag_i is more important than tag_j iff $i < j$ (i and j being the positions of tag_i and tag_j respectively in the ordered list), the numeric importance weight w_i associated with tag_i can be computed as $w_i = (n - i + 1) / \sum_{i=1, \dots, n} i$.

In the computation of the overall significance degree $F(d, t)$, the inverse document frequency of term t could be taken into account:

$$F(d, t) = \left(\sum_{i=1, \dots, n} F_{\text{tag i}}(d, t) * w_i * g(\text{IDF}_t) \right)$$

in which the definition of $g(\text{IDF}_t)$ is given in formula (5).

FLEXIBLE QUERYING

A flexible query language is a query language that incorporates some elements of natural language so users have a simple, powerful, and yet subjective mechanism by which to express their information needs. Flexibility can also be a characteristic of the query evaluation mechanism to

allow a tuning of the query's concepts' semantics with respect to the document collection, the user's subjective statement of information need, and even the user's application domain. Linguistic variables provide a suitable framework to generalize, to represent, and to manage the linguistics of the query's concepts. Thus, this approach can be used to formalize the semantics of linguistic terms introduced in a Boolean query language.

Flexible query languages have been defined as generalizations of Boolean query languages that employ Boolean logic. Within the framework of fuzzy set theory, we have the idea of a softening of the rigid, crisp constraints of a Boolean condition being strictly true (a document has a keyword) or false (the document does not contain the keyword).

A flexible query consists of either or both of two soft components. First, there can be selection conditions interpreted as soft constraints on the significance of the index terms in each document representation. Second, there can be soft aggregation operators, which can be applied to the soft constraints in order to define compound selection conditions. The atomic selection conditions for individual terms are expressed by pairs $\langle \text{term}, \text{weight} \rangle$, in which the weight can be a numeric value in the interval $[0, 1]$ that is used to identify a soft constraint or the weight can be a linguistic value for the variable *importance*. The compound conditions for combining terms via Boolean logic are expressed by means of linguistic quantifiers used as aggregation operators.

Query Evaluation Mechanism

Query processing within retrieval can be interpreted as a decision-making activity. Its aim is to evaluate a set of alternatives or possible solutions, in this case a set of documents, based upon some criteria or selection conditions in order to select the optimal list (perhaps ranked) of documents in response to a user's query.

In the case of a Boolean query, the alternatives are the document representations as described based on the presence or absence of index terms or keywords. The selection conditions, as expressed by terms specified in a query, define a set of constraints requiring the presence or absence of these terms within a document's representation. These conditions are expressed connected by aggregation operators, i.e., the Boolean logic operators of AND, OR, and NOT. The decision process is performed through an exact matching function, which is strictly dependent on the system query language. This decision process evaluates the global satisfaction of the query constraints for each document representation. Relevance is modeled as a binary property of the documents with respect to the user's query.

Given a fuzzy approach to retrieval, query processing can be regarded as a decision activity affected by vagueness. In fact, the query can be seen as the specification of

a set of soft constraints, i.e., vague selection conditions, that the documents can satisfy to a partial extent. The documents described through the significance degrees of the index terms constitute the alternatives. The query evaluation mechanism is regarded as fuzzy decision process that evaluates the degree of satisfaction of the query constraints by each document representation by applying a partial matching function. This degree is the RSV and can be interpreted as the degree of relevance of the document to the query and is used to rank the documents. Then, as a result of a query evaluation, a fuzzy set of documents is retrieved in which the RSV is the membership value. In this case the definition of the partial matching function is strictly dependent on the query language, specifically on the semantics of the soft constraints.

A wish list of requirements that a matching function of an IRS must satisfy has been proposed.^[18,24] Included in this list is the separability property that the evaluation of an atomic selection condition for an individual term in a query should be independent of the evaluation of the other atomic components or their Boolean connectors. The matching function should be based solely upon a function evaluating atomic conditions. Following the calculation of these evaluations, one can then aggregate them based upon the Boolean operators in the query. It has been shown that this property guarantees a homomorphic mapping from the space of all single terms to the space of all possible Boolean queries using these terms.^[44] This property has been considered widely within fuzzy retrieval models, especially in the definition of flexible query languages.

By designing the partial matching mechanism from the bottom-up the separability property is ensured. First, each atomic selection condition or soft constraint in the query is evaluated by a function E for a given document. Then the aggregation operators are applied to the results starting from the inmost operator in the query to the outermost operator by a function E^* . This E function evaluates the soft constraints associated with the query atoms on the fuzzy set R_d representing each document, where these soft constraints are defined as fuzzy subsets. The membership value $\mu_{\text{atom}}(i)$ is the degree of satisfaction of the soft constraint associated with the atomic query atom , i.e., $E(\langle \text{atom} \rangle, d) = \mu_{\text{atom}}(F(d, t))$. In other words, E evaluates how well the term t , which has an indexing weight $F(d, t)$ for document d , satisfies the soft constraint specified by atom . The result of the evaluation is a fuzzy set, $\sum_{d \in D} \mu_{\text{atom}}(F(d, t)) / d$ in which $\mu_{\text{atom}}(F(d, t))$ is interpreted as the RSV of document d with respect to the query atom.

The function $E^*: D \times Q \rightarrow [0, 1]$, where Q is the set of all the proper queries in the query language, evaluates the final RSV of a document, reflecting the satisfaction of the whole query. The definition of E^* depends strictly upon the structure of the query language, specifically upon the aggregation operators used to combine the atomic

components. The AND connective is classically defined as the minimum (min) operator, the OR connective as the maximum (max) operator, and the NOT connective as the one-minus (1−) or complement operator. These definitions preserve the idempotence property. A fuzzy generalization of the Boolean query structure has been defined in which the Boolean operators are replaced by linguistic quantifiers.^[16] In this context, linguistic quantifiers are used as aggregation operators to determine the degree of satisfaction for the soft constraints. They allow to improve as well as to simplify the expressiveness of the Boolean query language.

Query Weights

To render a Boolean query language to be more user-friendly and more expressive, one can extend the atomic selection conditions by introducing query term weights.^[22,23,45,46] An example of weighted query is the following: $\langle t_1, w_1 \rangle$ AND ($\langle t_2, w_2 \rangle$ OR $\langle t_3, w_3 \rangle$) in which t_1, t_2 , and t_3 , are search terms with numeric weights w_1, w_2 , and w_3 in the interval $[0, 1]$. These weights are implicitly given as being equal to 1 in the classical Boolean query language.

The concept of query weights raises the problem of their interpretation. Several authors have realized that the semantics of query weights should be related to the concept of the “importance” of the terms. Being well aware that the semantics of the query term weights influences the definition of the partial matching function, specifically of the E function, different semantics for the soft constraint imposed by a pair $\langle t, w \rangle$ have been proposed in the literature trying to satisfy as much as possible properties of the wish list, in particular the separability property.

Early on, query weights were interpreted as a relative importance weight where the separability property does not hold. Two distinct definitions of E have been proposed for conjunctive and disjunctive queries, respectively.^[22,47] Later, other models^[23,24,46] used an interpretation of the query weights w as a threshold on the index term weight or as an ideal index term weight.^[35,45]

Implicit query weights

The simplest extension of the Boolean model consists of the adoption of a weighted document representation but with a classical Boolean query language.^[40] This retrieval mechanism ranks the retrieved documents in decreasing order of their significance with respect to the user query. In this case, an atomic query consisting of a single term t is interpreted as the specification of a pair $\langle t, 1 \rangle$ in which $w = 1$ is implicitly specified. The soft constraint associated with $\langle t, 1 \rangle$ is then interpreted as the requirement that the index term weight be “close to 1” and its evaluation is defined as $\mu_w(F(d, t)) = F(d, t)$. This means that the desired

documents are those with maximum index term weight for the specified term t , i.e., index term weights closest to 1. This interpretation implies that the evaluation mechanism tolerates the under satisfaction of the soft constraint associated with $\langle t, 1 \rangle$ with a degree equal to $F(d, t)$.

Relative importance query weights

Here, query weights are interpreted as measures of the “relative importance” of each term with respect to the other terms in the query.^[22,47] This interpretation allows the IRS to rank documents so that documents are ranked higher if they have larger index term weights for those terms that have larger query weights. However, since it is not possible to have a single definition for the soft constraint μ_w that preserves the “relative importance” semantics independently of the Boolean connectors in the query, two distinct definitions of μ_w have been proposed, depending on the aggregation operators in the query. This approach, sadly, gives up the separability property. Two alternative definitions have been proposed for conjunctive and disjunctive queries.^[22,47] The first proposal^[22] yields

$$\begin{aligned}\mu_w(F(d, t)) &= wF(d, t) \text{ for disjunctive queries and} \\ \mu_w(F(d, t)) &= \max(1, F(d, t)/w) \text{ for conjunctive queries;}\end{aligned}$$

while the second proposal^[47] yields

$$\begin{aligned}\mu_w(F(d, t)) &= \min[w, F(d, t)] \text{ for disjunctive queries} \\ \mu_w(F(d, t)) &= \max[(1 - w), F(d, t)] \text{ for conjunctive queries}\end{aligned}$$

Notice that any weighted Boolean query can be expressed in disjunctive normal form (DNF) so that any query can be evaluated by using one of these two definitions.

Threshold query weights

To preserve the separability property, an approach treating the query weights as thresholds has been suggested.^[23,46] By specifying query weights as thresholds the user is asking to see all documents “sufficiently about” a topic. In this case, the soft constraint identified by the numeric query weight can be linguistically expressed as “more or less over w .” Of course, the lower the threshold, the greater the number of documents retrieved. Thus, a threshold allows a user to define a point of discrimination between under- and over satisfaction.

The simplest formalization of threshold weights has been suggested as a crisp threshold^[23]

$$\mu_w(F(d, t)) = \begin{cases} 0 & \text{for } F(d, t) < w \\ F(d, t) & \text{for } F(d, t) \geq w \end{cases}$$

In this case, the threshold defines the minimally acceptable document. Due to its inherent discontinuity, this formalization might lead to an abrupt variation in the number

of documents retrieved for small changes in the query weights. To remedy this, continuous threshold formalization has been suggested:^[46]

$$\mu_w(F(d, t)) = \begin{cases} P(w) * \frac{F(d, t)}{w} & \text{for } F(d, t) < w \\ P(w) + Q(w) * \frac{(F(d, t) - w)}{(1 - w)} & \text{for } F(d, t) \geq w \end{cases}$$

where $P(w)$ and $Q(w)$ might be defined as $P(w) = 1 + w/2$ and $Q(w) = 1 - w^2/4$.

For $F(d, t) < w$, the μ_w function measures the closeness of $F(d, t)$ to w ; for $F(d, t) \geq w$, $\mu_w(F(d, t))$ expresses the degree of over satisfaction with respect to w , and under satisfaction with respect to 1.

Ideal query weights

Another interpretation for the query weights has been defined.^[35,45] Here, the pair $\langle t, w \rangle$ identifies a set of ideal or perfect documents so that the soft constraint μ_w measures how well $F(d, t)$ comes close to w , yielding

$$\mu_w(F(d, t)) = e^{\ln(k) * (F(d, t) - w)^2}$$

The parameter k in the interval $[0, 1]$ determines the steepness of the Gaussian function's slopes. As a consequence, k will affect the strength of the soft constraint *close to w*. So, the larger the value of k is, the weaker the constraint becomes. This parametric definition makes it possible to adapt the constraint interpretation to the user concept of *close to w*.^[36] The retrieval operation associated with a pair $\langle t, w \rangle$ corresponds in this model to the evaluation of a similarity measure between the importance value w and the significance value of t in R_d : $w \approx F(d, t)$.

Comparisons of these query weight semantics

In order to analyze the results obtained by these different semantics associated with the query weight w , let us consider the archive represented by the fuzzy sets in Table 1. The rows are the documents, the columns are the terms, and the elements are the values of the index term weights, i.e., an element of row d_i and column t_j is the value $F(d_i, t_j)$. Let us consider the query: $q = \langle t_1, 1 \rangle \text{ AND } \langle t_2, 0.6 \rangle \text{ AND } \langle t_4, 0.2 \rangle$, as represented in Table 2.

Table 3 yields the results of the evaluation of q for each of the query weight semantics, assuming that the AND connective is evaluated using the MIN operator.

Table 1 Each row is a fuzzy set representing a document.

	t_1	t_2	t_3	t_4
d_1	1	0.9	1	0.2
d_2	0.7	0.6	0.3	0.8

Table 2 Query q (ANDed weighted pairs).

	t_1	t_2	t_4
q	1	0.6	0.2

Linguistic Query Weights

The main limitation of numeric query weights is their inadequacy in dealing with the imprecision which characterizes the concept of importance that they represent. In fact, the use of numeric query weights forces the user to quantify a qualitative and rather vague notion and to be aware of the weight semantics. Thus, a fuzzy retrieval model with linguistic query weights has been proposed^[36] with a linguistic extension of the Boolean query language based upon the concept of a linguistic variable.^[7] With this approach, the user can select the primary linguistic term "important" together with linguistic hedges (e.g., "very" or "almost") to qualify the desired importance of the search terms in the query. When defining such a query language the term set, i.e., the set of all the possible linguistic values of the linguistic variable *importance* must be defined. Such a definition depends on the desired granularity that one wants to achieve. The greater the number of the linguistic terms, the finer the granularity of the concepts that are dealt with. Next, the semantics for the primary terms must be defined. A pair $\langle t, \text{important} \rangle$, expresses a soft constraint $\mu_{\text{important}}$ on the term significance values (the $F(d, t)$ values). The evaluation of the relevance of a given document d to a query consisting solely of the pair $\langle t, \text{important} \rangle$ is based upon the evaluation of the degree of satisfaction of the associated soft constraint $\mu_{\text{important}}$.

The problem of giving a meaning to numeric weights reappears here in associating a semantic with the linguistic term *important*. The $\mu_{\text{important}}$ function is defined based on the ideal semantics of the numeric weight to yield^[36]

$$\mu_{\text{important}}(F(d, t)) = \begin{cases} e^{\ln(k) * (F(d, t) - i)^2} & \text{for } F(d, t) < i \\ 1 & \text{for } i \leq F(d, t) \leq j \\ e^{\ln(k) * (F(d, t) - j)^2} & \text{for } F(d, t) > j \end{cases}$$

We see that if $F(d, t)$ is less than the lower bound i or greater than the upper bound j , the constraint is under satisfied. The strength of the soft constraint $\mu_{\text{important}}$ depends upon both the width of the range $[i, j]$ and the value of the k parameter. The values i and j delimit the

Table 3 Results of query q in Table 2 referred to documents in Table 1.

Query weight semantics	d_1	d_2
Ideal index term weight	0.3	0.6
Relative importance	0.8	0.6
Threshold on index term weight	0.2	0

level of *importance* for the user. We note that as the value $|i - j|$ increases, the soft constraint becomes less precise. So, for the case of the ideal semantics of numeric query term weights, k determines the sharpness of the constraint in that as k increases, the constraint increases in fuzziness.

We can define the $\mu_{\text{important}}$ function based upon the threshold semantics to yield^[48]

$$\mu_{\text{important}}(F(d, t)) = \begin{cases} \frac{1+i}{2} * e^{\ln(k) * (F(d, t) - i)^2} & \text{for } F(d, t) < i \\ \frac{1+F(d, t)}{2} & \text{for } i \leq F(d, t) \leq j \\ \frac{1+j}{2} * \left(1 + \frac{F(d, t) - j}{2}\right) & \text{for } F(d, t) > j \end{cases}$$

We note that this compatibility function is continuous and nondecreasing in $F(d, t)$ over the interval $[0, 1]$. For $F(d, t) < i$, $\mu_{\text{important}}$ increases as a Gaussian function. For $F(d, t)$ in the interval $[i, j]$, $\mu_{\text{important}}$ increases at a linear rate. For $F(d, t) > j$, $\mu_{\text{important}}$ still increases, but at a lesser rate. The compatibility functions of non-primary terms, such as *very important* or *fairly important*, are derived by modifying the compatibility functions of primary terms. This is achieved by defining each linguistic hedge as a modifier operator. For example, the linguistic hedges are defined as translation operators in^[48] to yield

$$\mu_{\text{very important}}(x) = \mu_{\text{important}}(x)$$

$$\text{with } i_{\text{very}} = i + 0.2 \text{ and } j_{\text{very}} = j + 0.2 \text{ and } \forall x \in [0, 1].$$

$$\mu_{\text{averagely important}}(x) = \mu_{\text{important}}(x)$$

$$\text{with } i_{\text{averagely}} = i - 0.3 \text{ and } j_{\text{averagely}} = j - 0.3 \text{ and } \forall x \in [0, 1].$$

$$\mu_{\text{minimally important}}(x) = \mu_{\text{important}}(x)$$

$$\text{with } i_{\text{minimally}} = i - 0.5 \text{ and } j_{\text{minimally}} = j - 0.5 \text{ and } \forall x \in [0, 1].$$

in which i and j are values in $[0, 1]$ delimiting the range of complete satisfaction of the constraint $\mu_{\text{important}}$. With these definitions, any value $F(d, t)$ of the basic domain of the *importance* variable fully satisfies at least one of the constraints defined by the linguistic query terms.

In Herrera-Viedma^[49] a query language with linguistic query weights having heterogeneous semantics have been proposed so as to benefit of the full potential offered of fuzzy set to model subjective needs.

Linguistic Quantifiers to Aggregate the Selection Conditions

In a classical Boolean query language, the AND and OR connectives allow only for crisp (non-fuzzy) aggregations which do not capture any of the inherent vagueness of user information needs. For example, the AND used for aggregating M selection conditions does not tolerate the no satisfaction of but a single condition which could cause the no retrieval of relevant documents. To deal with this

problem, additional extensions of Boolean queries have been provided which involves the replacement of the AND and OR connectives with soft operators for aggregating the selection criteria.^[33,50,51]

Within the framework of fuzzy set theory, a generalization of the Boolean query language has been defined based upon the concept of linguistic quantifiers that are employed to specify both crisp and vague aggregation criteria of the selection conditions.^[16] New aggregation operators can be specified by linguistic expressions with self-expressive meaning, such as *at least k* and *most of*. They are defined to exist between the two extremes corresponding to the AND and OR connectives, which allow requests for *all* and *at least one of* the selection conditions, respectively. The linguistic quantifiers used as aggregation operators are defined by OWA operators.

Adopting linguistic quantifiers more easily and intuitively formulate the requirements of a complex Boolean query. For example, when desiring that *at least 2* out of the three terms “politics,” “economy,” and “inflation” be satisfied, one might formulate the Boolean query as:

(politics AND economy) OR (politics AND inflation)
OR (economy AND inflation)

However, a simpler one can replace this,

atleast2(politics,economy,inflation)

This new query language via the nesting of linguistic quantifiers supports the expression of any Boolean query. For example the query

<image> AND (<processing> OR <analysis>) AND <digital>

can be translated into the new, more synthetic and clear formulation:

all (<image>, *at least 1 of* (<processing>, <analysis>), <digital>).

A quantified aggregation function can be applied not only to single selection conditions, but also to other quantified expressions. Then, the E^* function evaluating the entire query yields a value in $[0, 1]$ for each document d in the archive D .

If S is the set of atomic selection conditions and Q is the set of legitimate Boolean queries over our vocabulary of terms, then the E^* function can be formalized by recursively applying the following rules

1. if $q \in S$ then $E^*(d, s) = \mu_w(F(d, t))$ in which $\mu_w(F(d, t))$ is the satisfaction degree of a pair $\langle t, w \rangle$ by document d with w being either a numeric weight or a linguistic weight.

2. if $q = \text{quantifier}(q_1, \dots, q_n)$ and $q_1, \dots, q_n \in Q$ then

$$E * (d, q) = \text{OWA}_{\text{quantifier}}(E * (d, q_1), \dots, E * (d, q_n))$$

3. $E^*(d, \text{NOT } q) = 1 - E^*(d, q)$

in which $\text{OWA}_{\text{quantifier}}$ is the OWA operator associated with *quantifier*.

The formal definition of the query language with linguistic quantifiers with the following quantifies has been generated^[16]

- *all* replaces AND.
- *at least k* acts as the specification of a crisp threshold of value k on the number of selection conditions and is defined by a weighting vector $w_{\text{at least } k}$ in which $w_k = 1$, and $w_j = 0$, for $i \leq k$ —noting that *at least 1* selects the maximum of the satisfaction degrees so that it has the same semantics of OR.
- *about k* is a soft interpretation of the quantifier *at least k* in which the k value is not interpreted as a crisp threshold, but as a fuzzy one so that the user is fully satisfied if k or more conditions are satisfied but gets a certain degree of satisfaction even if $k-1, k-2, \dots, 1$ conditions are satisfied—this quantifier is defined by a weighting vector $w_{\text{about } k}$ in which $w_i = \frac{i}{\sum_{j=1}^k j}$ for $i \leq k$, and $w_i = 0$ for $i > k$.
- *most of* is defined as a synonym of *at least $\frac{2}{3}n$* in which n is the total number of selection conditions.

With respect to non-fuzzy approaches that tried to simplify the Boolean formulations, the fuzzy approach subsumes the Boolean language, allows reformulating Boolean queries in a more synthetic and comprehensible way, and improves the Boolean expressiveness by allowing flexible aggregations.

Other authors have followed these ideas by proposing alternative formalization of linguistic query weights and flexible operators based on ordinal labels and ordinal aggregations,^[52] thus reducing the complexity of the evaluation mechanism.

FUZZY ASSOCIATIVE MECHANISMS

Associative retrieval mechanisms are defined to enhance the retrieval of IRSs. They work by retrieving additional documents that are not directly indexed by the terms in a given query but are indexed by other, related terms, sometimes called associated descriptors. The most common type of associative retrieval mechanism is based upon the use of a thesaurus to associate index or query terms with related terms. In traditional associative retrieval, these associations are crisp.

Fuzzy associative retrieval mechanisms obviously assume fuzzy associations. A fuzzy association between

two sets $X = \{x_1, \dots, x_m\}$ and $Y = \{y_1, \dots, y_n\}$ is formally defined as a fuzzy relation

$$f : X \times Y \rightarrow [0, 1]$$

where the value $f(x, y)$ represents the degree or strength of the association existing between the values $x \in X$ and $y \in Y$. In IR, different kinds of fuzzy associations can be derived depending on the semantics of the sets X and Y .

Fuzzy associative mechanisms employ fuzzy thesauri, fuzzy pseudothesauri, fuzzy ontologies, and fuzzy categorizations to serve three alternative, but compatible purposes: 1) to expand the set of index terms of documents with new terms; 2) to expand the search terms in the query with associated terms; and 3) to expand the set of the documents retrieved by a query with associated documents.

Fuzzy Thesauri

A thesaurus is an associative mechanism that can be used to improve both indexing and querying. It is well known that the development of thesauri is very costly, as it requires a large amount of human effort to construct and to maintain. In highly dynamic situations, i.e., volatile situations, terms are added and new meanings derived for old terms quite rapidly, so that the thesaurus needs frequent updates. For this reason, methods for automatic construction of thesauri have been proposed, named pseudothesauri, based on statistical criteria such as the terms' co-occurrences, i.e., the simultaneous appearance of pairs (or triplets, or larger subsets) of terms in the same documents.

In a thesaurus, the relations defined between terms are of different types. If the associated descriptor has a more general meaning than the entry term, the relation is classified as broader term (BT), while a narrower term (NT) is the inverse relation. Moreover, synonyms and near-synonyms are parts of another type of relationship associated by a related term (RT) connection.

The concept of a fuzzy thesaurus has been suggested,^[27,31,53,54] where the links between terms are weighted to indicate the relative strengths of these associations. Moreover, fuzzy pseudothesauri are generated when the weights of the links are automatically computed by considering document relationships rather than concept relationships.^[30,55]

The first work on fuzzy thesauri introduced the notion of fuzzy relations to represent associations between terms.^[54,56] Let us look at a formal definition of a fuzzy thesaurus.^[27,28] Consider T to be the set of index terms and C to be a set of concepts. Each term $t \in T$ corresponds to a fuzzy set of concepts $h(t)$:

$$h(t) = \{\langle c, t(c) \rangle \mid c \in C\}$$

in which $t(c)$ is the degree to which term t is related to concept c . A measure M is defined on all of the possible fuzzy sets of concepts, which satisfies:

$$\begin{aligned} M(\emptyset) &= 0 \\ M(C) &< \infty \\ M(A) &\leq M(B) \quad \text{if } A \subseteq B \end{aligned}$$

A typical example of M is the cardinality of a fuzzy set. The fuzzy RT relation is represented in a fuzzy thesaurus by the similarity relation between two index terms, t_1 and $t_2 \in T$ and is defined as

$$s(t_1, t_2) = M[h(t_1) \cap h(t_2)] / M[h(t_1) \cup h(t_2)]$$

This definition satisfies the following:

- if terms t_1 and t_2 are synonymous, i.e., $h(t_1) = h(t_2)$, then $s(t_1, t_2) = 1$;
- if t_1 and t_2 are not semantically related, i.e., $h(t_1) \cap h(t_2) = \emptyset$, then $s(t_1, t_2) = 0$;
- $s(t_2, t_1) = s(t_1, t_2)$ for all $t_1, t_2 \in T$; and
- if t_1 is more similar to term t_3 than to t_2 , then $s(t_1, t_3) > s(t_1, t_2)$.

The fuzzy NT relation, indicated as nt , which represents grades of inclusion of a narrower term t_1 in another (broader) term t_2 , is defined as:

$$nt(t_1, t_2) = M[h(t_1) \cap h(t_2)] / M[h(t_1)]$$

This definition satisfies the following:

- if term t_1 's concept(s) is completely included within term t_2 's concept(s), i.e., $h(t_1) \subseteq h(t_2)$, then
- $$nt(t_1, t_2) = 1;$$
- if t_1 and t_2 are not semantically related, i.e., $h(t_1) \cap h(t_2) = \emptyset$, then $nt(t_1, t_2) = 0$; and
 - if the inclusion of t_1 's concept(s) in t_2 's concept(s) is greater than the inclusion of t_1 's concept(s) in

$$t_3 \text{'s concept(s), then } nt(t_1, t_2) > nt(t_1, t_3)$$

By assuming M as the cardinality of a set, s and nt are given as:

$$\begin{aligned} s(t_1, t_2) &= \frac{\sum_{k=1}^M \min[t_1(c_k), t_2(c_k)]}{\sum_{k=1}^M \max[t_1(c_k), t_2(c_k)]} \\ nt(t_1, t_2) &= \frac{\sum_{k=1}^M \min[t_1(c_k), t_2(c_k)]}{\sum_{k=1}^M t_1(c_k)} \end{aligned}$$

A fuzzy pseudothesaurus can be defined by replacing the set C in the definition of $h(t)$ above with the set of

documents D , with the assumption that $h(t)$ is the fuzzy set of documents indexed by term t . This yields

$$h(t) = \{(d, t(d)) | d \in D\}$$

in which $t(d) = F(d, t)$ is the index term weight defined above. F can be either a binary value defining a crisp representation, or it can be a value in $[0, 1]$ to define a fuzzy representation of documents. The fuzzy RT and the fuzzy NT relations now are defined as:

$$\begin{aligned} s(t_1, t_2) &= \frac{\sum_{k=1}^M \min[F(t_1, d_k), F(t_2, d_k)]}{\sum_{k=1}^M \max[F(t_1, d_k), F(t_2, d_k)]} \\ nt(t_1, t_2) &= \frac{\sum_{k=1}^M \min[F(t_1, d_k), F(t_2, d_k)]}{\sum_{k=1}^M F(t_1, d_k)} \end{aligned}$$

Note that $s(t_1, t_2)$ and $nt(t_1, t_2)$ are dependent on the co-occurrences of terms t_1 and t_2 in the set of documents, D . The set of index terms of document d , i.e., $\{t \mid F(d, t) \neq 0 \text{ and } t \in T\}$, can be augmented by those terms t_A which have $s(t, t_A) > \alpha$ and/or $nt(t, t_A) > \beta$ for parameters α and $\beta \in [0, 1]$.

Suppose that in the definition of F we have the set T as a set of citations which are used to index documents, rather than a set of terms. In this case, a fuzzy association on citations can be defined through the fuzzy relations of s and/or nt . By using citations, a user may retrieve documents that cite a particular author or a particular reference. In addition, a keyword connection matrix has been proposed to represent similarities between keywords in order to reduce the difference between relationship values initially assigned using statistical information and a user's evaluation.^[57] A new method is also proposed in which keywords that are attached to a document and broader concepts are hierarchically organized, calculating the keyword relationships through the broader concepts.

Moreover, a thesaurus can be generated based on the max-star transitive closure for linguistic completion of a thesaurus generated initially by an expert linking terms.^[58] In addition, a probabilistic notion of term relationships can be employed by assuming that if one given term is a good discriminator between relevant and nonrelevant documents, then any term that is closely associated with that given term (i.e., statistically co-occurring) is likely to be a good discriminator, too.^[10] Note that this implies that thesauri are collection-dependent.

One can also expand on Salton's^[59] use of the $F(d, t)$ values. Salton^[60] infers term relationships from document section similarities. On the other hand, one can manipulate the $F(d, t)$ values in order to generate co-occurrence statistics to represent term linkage weights.^[61] Here, a synonym link is considered, defined as:

$$\mu_{\text{synonym}}(t_1, t_2) = \sum_{d \in D} [F(d, t_1) \leftrightarrow F(d, t_2)]$$

where $F(d, t_1) \leftrightarrow F(d, t_2) = \min[F(d, t_1) \rightarrow F(d, t_2), F(d, t_1) \leftarrow F(d, t_2)]$ and $F(d, t_1) \rightarrow F(d, t_2)$ can be defined in variety of ways. For instance, $F(d, t_1) \rightarrow F(d, t_2)$, the implication operator, can be defined as $[F(d, t_1)^c \vee F(d, t_2)]$, where $F(d, t_1)^c = 1 - F(d, t_1)$ is the complement of $F(d, t_1)$ and $\vee$ is the disjunctive (OR) operator defined as the max; or it can be defined as $\min(1, [1 - F(d, t_1) + F(d, t_2)])$. Here, a narrower term link (where term t_1 is narrower than term t_2 , so term t_2 is broader than term t_1), is defined as:

$$\mu_{\text{narrower}}(t_1, t_2) = \sum_{d \in D} [F(d, t_1) \leftrightarrow F(d, t_2)]$$

Note that fuzzy narrower relationships defined between fuzzy sets can help the purpose of identifying generalization and specialization of topics, while the fuzzy similarity relationship between fuzzy sets can be of aid to identify similar topics. Thus they serve to build a labeled graph of relationships between concepts, regarded as fuzzy sets of terms, in the specific domain of the collection.

Fuzzy Clustering for Documents

Clustering in IR is a method for partitioning D , a given set of documents, into groups using a measure of similarity (or distance) which is defined on every pairs of documents. Grouping like documents together is not a new phenomenon, especially for librarians. The similarity between documents in the same group should be large, while the similarity between documents in different groups should be small.

A common clustering method is based on the simultaneous occurrences of citations in pairs of documents. Documents are clustered using a measure defined on the space of the citations. Generated clusters can then be used as an index for IR, i.e., documents which belong to the same clusters as the documents directly indexed by the terms in the query are retrieved.

Similarity measures have been suggested empirically or heuristically, sometimes analogously to the similarity measures for documents matched against queries.^[33,38,62] When adopting a fuzzy set model, clustering can be formalized as a kind of fuzzy association. In this case, the fuzzy association is defined on the domain $D \times D$. By assuming $R(d)$ to be the fuzzy set of terms representing a document d with membership function values $d(t) = F(d, t)$ being the index term weights of term t in document d , the symmetric fuzzy relation s , as originally defined above, is taken to be the similarity measure for clustering documents:

$$\begin{aligned} s(d_1, d_2) &= \frac{\sum_{k=1}^M \min[d_1(t_k), d_2(t_k)]}{\sum_{k=1}^M \max[d_1(t_k), d_2(t_k)]} \\ &= \frac{\sum_{k=1}^M \min[F(t_k, d_1), F(t_k, d_2)]}{\sum_{k=1}^M \max[F(t_k, d_1), F(t_k, d_2)]} \end{aligned}$$

in which T is the set of index terms in the vocabulary and M is the number of index terms in T .

In fuzzy clustering, documents can belong to more than one cluster with varying degree of membership.^[63] Each document is assigned a membership value to each cluster. In a pure fuzzy clustering, a complete overlap of clusters is allowed. Modified fuzzy clustering, also called soft clustering, uses thresholding mechanisms to limit the number of documents belonging to each cluster. The main advantage of using modified fuzzy clustering is the fact that the degree of fuzziness is controlled. The use of fuzzy clustering in IR have several applications, that span from unsupervised categorization of documents into homogeneous overlapping topic categories, so as to offer users an overview of the contents of a collection or to organize the results of a search into labeled groups, thus allowing users to have an immediate view of what has been retrieved. With respect to crisp clustering, fuzzy clustering allows finding a document in several labeled groups, thus reflecting distinct interpretation of document's content.

FUZZY PERFORMANCE MEASURES

One problem with current criteria to measure the effectiveness of IRSs is the fact that Recall and Precision measures have been defined by assuming that relevance is a Boolean concept. In order to take into account the fact that IRSs rank the retrieved documents based on their RSVs that are interpreted either as a probabilities of relevance, similarity degrees of the documents to the query, or as degrees of relevance, Recall–Precision graphs are produced in which the values of precision are computed at standard levels of recall. Then the average of the precision values at different recall levels is computed to produce a single estimate.

Nevertheless, these measures do not evaluate the actual values of the RSVs associated with documents and do not take into account the fact that also users can consider relevance as a gradual concept. For this reason some authors have proposed some fuzzy measure of effectiveness. Buell and Kraft^[46] proposed the evaluation of fuzzy recall and fuzzy precision, defined as follows:

$$\text{Fuzzy precision} = \frac{\sum_d \min(e_d, u_d)}{\sum_d e_d},$$

$$\text{Fuzzy recall} = \frac{\sum_d \min(e_d, u_d)}{\sum_d u_d}$$

where u_d is the user's evaluation of the relevance of document d (u_d can be binary or defined in the interval $[0, 1]$) and e_d is the RSV of document d computer by the IRSs. These measures take into account the actual values of e_d and u_d , rather than the rank ordering based in descending order on e_d .

These measures can be particularly useful to evaluate the results of fuzzy clustering algorithms.

CONCLUSIONS

This entry reviews the main objectives and characteristics of the fuzzy modeling of the IR activity with respect to alternative approaches such as probabilistic IR and vector space IR. The focus of the fuzzy approaches is on modeling imprecision and vagueness of the information with respect to uncertainty. The fuzzy generalizations of the Boolean Retrieval model have been discussed by describing the fuzzy indexing of structured documents, the definition of flexible query languages subsuming the Boolean language, and the definition of fuzzy associations to expand either the indexes or the queries, or to generate fuzzy clusters of documents. Fuzzy similarity and fuzzy inclusion relationships between fuzzy sets have been introduced that can help to define more evolved fuzzy IR models performing "semantic" matching of documents and queries, which is the current trend of research in IR.

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Games and Gaming

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Abstract

Games and gaming are more visible and viable in libraries as computer, console, and tabletop games gain popularity as a form of leisure and recreation. Even though libraries have supported games in one form or another for many years, this type of collection is still controversial. Librarians with the guidance of professional groups, scholars, and educators are working together to show the value of games in all types of libraries. Games and gaming in public libraries are growing beyond simply providing space for their recreational use to include targeted programs to increase diversity. They are also being used to encourage collaboration and learning across all ages. Many public libraries host game programs, facilitate game play, and even encourage game creation. All types of games are now more readily recognized for their educational value in school classrooms and libraries. School librarians encourage the use of games to meet educational goals, life skills, and digital citizenship in the classroom. Academic libraries and archives are not only building game collections to aid in programming, retention, and research, but also creating archival and digital repositories to aid future scholars. Despite the technology and digital rights management difficulties inherent to video games, libraries recognize the historical and cultural value of games and the need for this type of collection. Librarians are not only developing ways to support leisure, research, and game preservation, but also the creation of games in and for libraries.

INTRODUCTION

Games and gaming in libraries is a hot topic at the present time for many librarians who wish to attract users to the library. Game collections and gaming as an activity mean different things to different people in the library and community at large. Librarians are working together to provide access to this type of collection as well as promote the positive influences of games in the library.

This entry will give a basic definition of what games are and why they belong in the library. It will also give brief descriptions of how games are being used in public, school, and academic libraries to enhance recreation, learning, and scholarly research. Lastly, an overview of how librarians are not only collecting games but also creating games to help entertain and educate their patrons. Librarians are creating organizations and harnessing the positive influence of this dynamic and evolving format.

DEFINITION OF A GAME

What is a game? The definition of a game changes context according to the situation in which it is used. Kevin Maroney defines games as a form of play that has structure and set goals. The structure can include sequence and timing of the action. These actions can be strictly

described in the rules or more flexible, such as those in a role-playing game where a player is limited by their specific attributes. Actions the players take in any game are to reach a set goal or objective and possibly win the game.^[1] Jesper Juul adds to this by including player effort and attachment as necessary elements of a game. A player invests effort to influence the outcome and, therefore, becomes attached to that outcome.^[2] This goes to show that games are not just physical objects with goals and structure but also an activity.^[3] Each iteration of gameplay can be different than the one before as the players and their knowledge, ability, and expertise change. Games must be played, and gameplay is different every time a game is played. This means games are ever changing and players must react and refine their play to be successful. Play is a valuable part of learning and video and tabletop games let us play regardless of age or infirmity. It allows users to practice behaviors and experiment without any real-life consequences.^[4] Gamers interact, collaborate, and engage with the game and each other as they seek to accomplish the game's goals.

Most library games fit this definition of a game. Library collections are most likely in the format of computer, console, and tabletop games. PC games or computer games are video games played on a personal computer. Video games can also be played on game consoles. These games are usually specific to a certain console type and model.

Consoles, unlike PCs, were designed just for the purpose of playing games, although that has been changing to include Internet access and other uses with the latest console models.^[5] Computer and console games are digital games that require hardware platforms to be playable. Tabletop games is an inclusive term that refers to games that can be played on a table's surface such as board games, card games, role-playing games, and dice to name a few. These games vary in their materials to include boards, pieces, dice, cards, paper, pencil, and role-playing guides, in book and digital form. These are just the predominant formats that a library might have in their collection. The world of games is very broad and varied.

GAMES IN THE LIBRARY

Gaming might appear to be a new type of activity in the library to many people; however, games have been in libraries, in one form or another, for the past 150 years.^[6] As both tabletop and video games have become mainstream and connected to other types of mass media, gaming in libraries has gained visibility. Over the last 40 years, gamers have grown up and had children that may also game. This has led to gaming being a more readily accepted leisure activity for all ages.

The Entertainment Software Association Industry Facts show that 59% of Americans play video games. This means that 183 million people play video games in America. It's not just kids playing these games. The average age of a gamer is 31.^[7] Why do people play video games? The author of *Reality is Broken*, Jane McGonigal, believes that games are fulfilling some of the needs that people are not getting from the real world. Engaging games teach and inspire gamers. Unable to find this type of fulfillment in their daily real-world life, people are turning to virtual worlds.^[8] One benefit of games is the ability to fight, die, and rise up to try another strategy that can accomplish the games' given goals. People are able to vanquish villains, be a hero that saves the world, or simply have a successful farm in their virtual life. Games give this type of success to the average person.

Beyond the use of games for leisure, librarians have a duty to consider collections that have cultural significance. Music, movies, books, and games are more intertwined now than at any time in the past. Barwick, Dearnley, and Muir note that games deserve a rightful place in libraries because they are an important part of the history of play. Games are a part of our cultural legacy.^[3] Although digital games are what usually come to mind when people think of a game collection, tabletop games have also had a resurgence in the last 10 years. Now tabletop games offer better design and deeper engagement while also being more accessible because of the Internet.^[9] Librarians are ignoring a significant part of modern cultural heritage if they do not consider tabletop and digital games worth collecting for their user's benefit.

This resurgence in tabletop games and the continued popularity of video games as a type of mass media led to the creation of an American Library Association (ALA) Member Interest Group focused on games and gaming in libraries in 2008. In 2012, this group became the ALA Games and Gaming Round Table (GameRT). The GameRT website (<http://www.ala.org/gamert/home>) lists their mission as offering librarians a professional forum for ideas, resources, and support. As a professional group, GameRT is able to provide a positive voice and create awareness of the value of games and gaming in libraries.

Do Games Belong in a Library?

There has always been conflict around the inclusion of games and other new media in libraries. The idea of supporting leisure materials, regardless of format, has been debated by librarians for at least 150 years. Hayes and Morris note that collections including leisure materials struggle to be accepted by librarians but are generally the reason that the public uses libraries. Librarians in the past were asked by social reformers to provide only materials that improve both the user and society through their leisure activities. Problems arise in the fact that no one can agree to just what type of material this is.^[10] Librarians today are still fighting this battle. Librarians in the process of establishing a new collection should keep in mind that almost every new type of library material was seen as a threat to literacy, even fiction novels.^[11]

Not only do librarians need to deal with ingrained ideas about librarianship and library collections, they must also deal with how today's popular media portrays gaming. News stories tend to focus on controversial games or the negative aspects of games, while ignoring the vast number of players who play without any issues arising.^[12] James Paul Gee articulates that the number of people who have killed others or aided them because of a book is vastly larger than those who have done so because of a game, movie, or television show.^[13] Focusing only on the negative aspects of any material or format will only lead to an empty library that no one wants to visit or support.

Despite naysayers, some librarians have responded to the public's demand and started game collections. These librarians realize that games are a part of our culture and, as such, should be collected for their users' benefit. Libraries have a duty to provide materials for their users to be informed citizens. Many might say games don't count, whereas Sandy Farmer explains that entire conversations take place in society today that revolve around the cultural references that occur in games.^[14] Providing access to these games allows users without home access to understand these references and participate in this part of culture. Library game collections still cause some controversy; however, the benefits of games and gaming are developing day by day. Game collections are merely another resource for the edification and leisure of library patrons.

Public Libraries and Gaming

Games and gaming fit the mission of many public libraries, which is to support the public's information and learning needs. Public libraries support these needs in many different ways. For example, The Mechanics' Institute Library of San Francisco has been supporting the public by hosting a chess club since 1854.^[6] Public libraries are not only playing chess but are expanding to include other types of games and gaming programs in their libraries. Public library game programs exist for all ages. John Pappas at The Primos Library in Secane, Philadelphia, began a Golden Gamers Group for gamers aged 65+. Board games provide these gamers with a social experience that is also interactive and engaging.^[15] Patrons at the Bainbridge Library in Bainbridge Island, Washington, get to solve a Murder Mystery, searching for clues throughout the library. Audrey Barbakoff initiated this type of game to help bring in a more diverse crowd and this program met its goal.^[16] Gaming programs can be developed to cater to an individual library's needs.

Who is gaming in public libraries? In a survey from 2007, when the question was asked very broadly to include hosting a chess club or allowing web-based games to be played on public computers, the results were that 77% of public libraries support gaming. Nearly half of these libraries hosted gaming programs. 90% of the formal programming used board games, with 45% of this group noting the games were traditional games such as chess. Almost a quarter of libraries with game collections included console games, and a much smaller group, 7%, included computer games. Card games, other than those considered traditional such as Bridge, were used 19% of the time, with role-playing games being used 4% of the time.^[17]

Some of these libraries support the in-house use of games as well as circulating them. Twenty percent of public libraries surveyed in 2007 circulated games, with board and card games being the most circulated types of games. These libraries also circulated computer games, puzzles, and console games.^[17] In 2008, the Houston Public Library started circulating video games, controllers, and consoles. They estimate the average cost to be about \$1 per library customer.^[14] These circulating collections give patrons a chance to try out new games when they would not be otherwise able to do so because of costs or availability.

Games and gaming are a natural fit for public libraries. Public libraries have shown that games are a valuable part of their collection as well as a great resource for event programming. Thoughtful use of a library game collection can encourage collaboration and communities through play.

Games in School Libraries

Like in public libraries, games have been a fixture in public schools for years. Nicholson notes in his article,

"Playing in the past: a history of games, Toys, and Puzzles in North American Libraries," that various other libraries and library associations have encouraged the use of games to facilitate learning. The use of games in libraries was included in a guide published by the ALA in 1920 because games stimulate an interest in reading. Another *School Library Journal* article in 1979 promoted developing learning games.^[17] The interest in using games and gaming for educational goals, like games themselves, is having a resurgence. This renewed interest is due to technology, new designer games, and recent changes in educational goals.

How are public schools using games? Scott Nicholson surveyed librarians to gather a census of gaming programs and practices in 2007. Of the 314 responses, 78 were school media libraries. Thirty percent of these school media libraries circulated games, with the majority, 19%, being board games. Nine percent circulated PC games and 3% circulated Nintendo, PlayStation, or Xbox console games. Web-based games were allowed in half of these school media libraries. Thirty-two percent of these libraries only allowed educational games, but 17% allowed recreational games during free periods. This survey also gathered data on the programs being offered in the school media libraries. Half of the programs were educational and half recreational. Problems with noise, space, and supervision were noted as being limitations for recreational school gaming programs.^[18]

As the survey shows, school libraries are using games, but not to their full potential. School librarians, with the right resources, can help educators meet educational goals with games and gaming. Brian Mayer and Christopher Harris are two educators who are actively involved in integrating tabletop games into the classroom curriculum in their school district. They believe that using games, especially the new Eurogames, require students to explore, learn, and act on what they have learned. They often must gather information from several sources to be successful.^[19] Many games can be aligned with the learning standards and outcomes while also allowing collaboration and cooperation among players. In classrooms, gameplay is often used as a reward; it can also function as a valuable part of the lesson. Games can be used, much like fiction is used in English classes, as a part of daily instruction to enhance learning and provide historical context.^[19]

In the article "Three different paths for tabletop gaming in school libraries," three school librarians detail how they are using games educationally as well as recreationally to benefit their students. The first school, a high school in the United Kingdom, took the path of starting an after school board game club called "Unplugged." This club offers a haven for students. It allows them the benefit of team building and socializing with their peers.^[20] Tabletop gaming clubs, for many librarians, is one of the easier ways to start a games and gaming collection because of the minimal costs and labor involved at the outset. A successful afterschool club confirms the benefits of

gaming to educators and school administrators. This small step can lead to the start of a library game collection and eventually to the successful integration of games into classroom learning.

The second path is to have students act out a game of the “Trials of Socrates,” based on the role-playing game series developed by Barnard College called “Reacting to the Past.” To be successful in this game, students must study the time period, read *The Iliad* and *The Odyssey*, and hone their debate skills. These students learn by role-playing a character. They immerse themselves in a role with a background, alliances, and goals. The teacher acts as the game master. This type of learning through role-playing has led to the students and teachers becoming more creative. After this success, some of the teachers wrote a role-playing scenario to teach about the “Salem Witch Trials.” This school also offers the students an opportunity to create their own games.^[20]

The third path is to build a comprehensive library collection that aligns with state and national learning standards to help teach students through play. Brian Mayer, the specialist who curates this collection, actively facilitates gameplay in the classroom. This allows him to grow the collection to align with learning standards and incorporate life skills, such as fine motor skills, social skills, and problem-solving.^[20] All three of these paths are beneficial to students; however, it requires buy-in from students and staff. The first step is always hardest and the same holds true for introducing games and gaming to an institution.

Information literacy can be developed using games. Digital citizenship, a form of information literacy for responsible participation in a networked society, is taught to students in schools using *Minecraft*. The virtual world, *MinecraftEdu*, was created in 2011 to help support learning. Students collaborate, communicate, and engage with each other in this world. Their virtual interactions inherently lead to virtual offenses and conflicts. This facilitated and monitored play allows these students to learn suitable online behaviors under the guidance of a teacher in an environment with minimal consequences.^[21]

There are still obstacles for game collections in schools. The value of a game for use in a curriculum is measured by its educational components. Many games produced for the education market are lacking in their ability to engage users. This is because the educational value of a game cannot be determined by the label but by what the player brings and takes away from the game. Mass market games and even independent games can be educational because many of these games incorporate good learning principles, such as strategic thinking and problem-solving.^[22] These games usually succeed where games designed with educational goals fail because they grab the buyer’s attention and keep it to stay profitable. Many popular games motivate the user by offering challenges that require learning and research to be an effective player. These games have communities and wikis

that discuss strategy, include statistical analysis of attributes for each class, expand on the lore or history of the game, and much more. Players are building up skills and literacies as they accomplish the game’s goals.^[23] Many games developed purely for the educational market are still falling short of their educational goal because they are skill and drill games. They are more palatable but often do not offer the user a chance to be a creative and innovative problem solver.^[24] This is not to say that games designed to be educational should be ignored; however, librarians should look at all genres of games to find suitable items for their school library collection.

The use of facilitated and guided play using games and gaming in schools is valuable for students as they move through a world of technological and social change. The benefit of play is that it gives students a chance to learn from their mistakes and improve on their strategies as they encounter their world, both real and virtual, without worldly consequences. School librarians are seeing success in their integration of games into learning. This will continue to grow as students, teachers, and administrators become more comfortable with this media.

Games in Academic Libraries

Games and gaming collections in academic libraries have a slower growth than in public and school libraries. It’s gaining momentum and acceptance as the need for research into games and their social impact grows. Academic libraries are starting to build collections to support research, programs that use games in their curriculum, as well as for student recreation and retention.

Do games belong in an academic library? The growth of games and gaming in society and as an industry has spurred several academic libraries to begin a collection to support its study and research. Laskowski and Ward note what issues need to be explored while building a video game collection in their paper, “Building next generation video game collections in academic libraries.” They include the following as the main issues to explore, determining what students, instructors, and researchers need for their work; purchasing the appropriate hardware to support the required formats, navigating the software and licensing issues related to video games, and providing appropriate library support.^[25] This type of collection development is dependent on the technology changes and evolution of video games and their platforms, whether PC or console. The amount of technology support in the library is important to the collection’s goals. Without the appropriate technology, a collection will not be usable. Sustainability of game’s accessibility and collection goals should be taken into account with all purchases and donations.^[26]

Technology, digital rights management, and computer security on college campuses are big concerns for a video game collection. The technology related to games, like other digital technology, is in constant flux, so new hardware, formats, and digital updates are always on the

horizon. Access to games is limited by digital rights management that the manufacturer includes and security networks on the campus or in the library. The viability of a digital game collection in a library is vulnerable to many factors out of their control. Despite these odds, academic libraries are building leisure and educational collections on their campuses.

Not only is the technology and accessibility of games changing, but the types of courses that might use games in the curriculum is changing fairly rapidly as well. Computer science programs with classes in game design will probably benefit from use of a collection; however, programs that use games exist in other academic departments as well, such as art and design, music composition programs, communications, and mass media. As the research in games and the culture that surrounds it changes, the library collection needs to change as well.

Tabletop games should not be overlooked when building an academic game collection. These games are generally much easier to collect than video games. However, they do bring their own set of issues as do other nonbook formats. A tabletop collection is a great way to introduce games and gaming into the library without the technology and digital rights management issues of video games. If the library does not have sufficient technology or administrative support for a video game collection, a successful tabletop collection can garner positive attention and eventually draw support for a video game collection. Small, successful steps are better than big fails for a gaming collection.

For most academic libraries, a gaming collection is much more than just a research resource; it can also be used for library programming and outreach. Library outreach seeks to introduce students to library services and help with retention—especially among first-year students—by building a sense of community. Library space is not limited to particular departments, so students from diverse programs can use it to meet and work together. Libraries with gaming collections and programming are particularly well suited for community building. Most gameplay includes social elements either through cooperative and collaborative play or discussion around single-player games. Gaming is like electricity for some college students today. It has always been a part of their lives even if they didn't actively take part in gaming while growing up.^[27] With a little help from residence life coordinators, campus student groups, and social media, librarians can create a physical, social space for gaming in the library. The space alone may not help with retention, but it provides a level environment for interactions between faculty and students. These informal interactions can nurture a sense of belonging and self-worth.^[28] All of these feelings are integral to building community and ultimately increasing retention. An enthusiastic librarian or staff member that encourages play can easily accomplish this kind of fun, safe space.

Gaming, teaching, technology, and research are rapidly evolving, and there is much to do to support research

related to games. Academic libraries have an opportunity to move beyond collection building and into actively participating and collaborating in this interdisciplinary field.^[25]

Digital Preservation

Another aspect of games in libraries is the preservation and collection of digital data related to video games. Many academic libraries have digital repositories that include collections of digital objects. The digital objects include audio, visual, and text items. These repositories are capturing items from the past as well as current projects to aid researchers. The Game Preservation Special Interest Group of the International Game Developers Association has a white paper, "Before it's too late: a digital game preservation white paper," addressing the need to preserve electronic games.^[29]

Gaming enthusiasts with the technical expertise to convert games have emulated older games as a form of preservation, but with no regard for the rights of the creator. One of the largest old game collections is hosted on the Internet Archive. Part of the Internet Archives goal is to be "a searchable memory of society, and not just for scholars this time, but everyone".^[30] This has led them to provide access to classic arcade, console, and computer games on their software website at <https://archive.org/details/software>. These games are emulated to work in an Internet browser. Although the Internet Archive does not own the rights to these games, the Electronic Frontier Foundation is working to make it legal for older abandoned games to be modified by fans to remain playable.^[31]

Academic Libraries have their part to play in the preservation of games. Professional preservationists in libraries and museums are beginning to see the need to gather games and gaming data in their local repositories to aid in the preservation of gaming culture and history.^[3] Librarians can aid in the preservation of games by encouraging scholars and students to add copies of their digital game data to a university repository for preservation and research purposes.

Creating Games in Libraries

A number of librarians have created games for use by library patrons. There are two main reasons librarians will create a game: for outreach purposes and for instruction. Outreach games, such as murder mysteries or scavenger hunts, can help students and library patrons become comfortable with the library and hopefully cause them to visit the library more often in the future.

Public libraries hold outreach events, such as murder mysteries for adults or literature-themed events, like Hunger Games for teens. These events are fun in nature and used to help promote the library as a community place where community events can be held.^[32] The Daring Librarian shares an example of having students complete a QR Codes Quest (or scavenger hunt) to help them become familiar with library services at the school library.^[33]

Academic libraries can hold scavenger hunts as a fun way to help first-year students learn about the library during an orientation period. For example, the University of South Carolina Upstate invited first-year students to complete a photo scavenger hunt using the social media site of their choice and tagging the library in their photos.^[34] This is one of the promoted events during their orientation week. Students seem to enjoy taking selfies or photos of their new friends throughout the library. Some academic libraries make use of the murder mystery theme. The University of North Carolina Chapel Hill held a Clue event night at their special library to help students become comfortable being in the library.^[35] With Clue, a number of librarians helped out as different characters and provided participants with hints if they asked the right questions. Additionally, students looked in different parts of the library for additional hints.

These outreach events can take time to prepare, but are usually successful with patrons. There are websites where murder mysteries can be purchased for use in libraries, but librarians can design their own murder mysteries from scratch. Lycoming College held a Harry Potter-themed night for students with activities and games designed around the books for a number of years and this was quite successful with the students.^[36] This event was planned with the assistance of a number of librarians and faculty across campus. Assistants played different Harry Potter characters, as well as helping come up with games and activities.

One final type of outreach game that can be held in the library are large-scale, live-action games, such as *Capture the Flag* or *Humans versus Zombies*. These are events held inside libraries, often after the library is regularly closed, when large numbers of students can participate and have physical activities, such as using nerf guns to “kill” the zombies.^[37] At large universities, these types of large-scale events can bring hundreds of students to the library.

Instruction is an important part of academic librarianship in addition to school librarianship. Quite a few librarians started creating their own games with instructional goals. While the outreach games and events have an instructional component, the major purpose of these events is having fun in the library. There are a number of ways to create games for instructional purposes: the easiest being a board game and the most advanced being a digital game or web application.

The University of South Carolina uses a board game as an exit activity. After an instruction session, the game is played for a quick review of the material covered during class.^[38] The librarians used a map of the library that existed and added some numbers at key locations of the library. Students then answered questions about each location on the board. The students who correctly answer questions at the seven locations can leave first.

This is a quick and easy way to use games for instructional purposes. Board games are useable in any type of library and do not have to be complicated to create. Similar to board games, gamification can be used during

library sessions. Gamification is essentially using game elements to make things more fun and engaging. For example, Kahoot! is a recent quiz tool that creates multiple-choice questions to give students a gamified review of material. The game elements of Kahoot! include a timer, sound effects, images, and score-keeping (<https://getkahoot.com/>). More gamification tools will likely become available in the not-too-distant future.

One of the best and most used digital games created by a librarian is *Goblin Threat* by Mary J. Snyder Broussard at Lycoming College (<http://www.lycoming.edu/library/instruction/tutorials/plagiarismGame.aspx>). Mary allowed a number of librarians to use her game in their classes to help students avoid plagiarism. When playing *Goblin Threat*, students must answer questions about plagiarism correctly to make the goblins disappear and save the university. The librarians at the University of South Carolina Upstate used this game as a fun final activity for students during their plagiarism prevention workshops and students often listed this as their favorite activity.

The University of South Carolina Upstate has created an Agoge Game based on the journey of becoming a Spartan to fit the university’s mascot of Sparty, the Spartan (<http://agoge.uscupstate.edu/agoge/agogegame.html>). This game is based on *Goblin Threat* in its layout with multiple levels, answering questions correctly to advance, and a score. Music and images are included to create a more game-like atmosphere. Throughout the game, the warrior gains more armor and weapons after completing each level until they are a Spartan. This game was geared toward transfer students to test their information literacy skills. As an instructional tool, the game has embedded videos and screenshots of various library tools to help students who wish to learn more about the library.

The Game Making Interest Group within the Library and Information Technology Association of the ALA has a wiki that contains a wealth of game-making information (<http://gamemakinginterestgroup.wikispaces.com>). There are suggestions for incorporating games into instruction, as well as game creation best practices. A number of library game examples are included with links to more information and suggested readings (including books and articles about games in libraries and creating games). *Games in Libraries: Essays on Using Play to Connect and Instruct*, edited by Breanne A. Kirsch, provides more information about a number of the games discussed in this entry and suggestions on creating a library game.

CONCLUSION

Games and gaming in all types of libraries are evolving along with the gaming market and its consumers. Technology development will undoubtedly challenge libraries while educational changes will provide guidance. Librarians show that games, like any other media, have a

recognizable cultural influence and deserve a space in libraries as a beneficial collection to students, scholars, and the community.

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Genealogical Literature and Its Users

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Abstract

Genealogical literature is the body of writings on genealogy, which is the study of ancestry and descent. This entry describes the history of genealogy, the users of genealogical literature, and the procedures and resources used in genealogical research. The steps in genealogical research consist broadly of a preliminary survey to identify what is already known about one's ancestors, using compiled sources, and then verifying and extending what is known, using original sources. A discussion of both compiled and original sources, along with reference tools and periodical, news, and networking sources, is included. Tables are presented outlining the major resources available in each of these areas, including resources for specific countries. Both print and online resources are identified.

INTRODUCTION

Definitions

Genealogical literature is the body of writings on genealogy, which in turn is the study of ancestry and descent. The term "genealogy" is sometimes used interchangeably with "family history." Powell explains the difference as follows:

"Genealogy, the study of ancestry and descent, refers more to the actual search for ancestors, while family history, the narrative of the events in your ancestors' lives, denotes the telling of your family's story. Family history is genealogy come alive."^[1]

This entry will focus on the literature and resources that are used to identify one's ancestors (i.e., names, and dates and places of birth, death, and marriage), though some of the resources discussed may also include the additional information one may want to know in writing a detailed family history.

Interest in Genealogy and Expansion of the Literature

Genealogy is the second most popular hobby in the United States, after gardening, according to an ABC News report.^[2] Polls show a steadily increasing interest among Americans in tracing their family history, with 60% "somewhat interested" in 2000 and 73% "interested" in 2005.^[3] A study commissioned by Ancestry.com in 2014 found "Over the past decade, online family history research has grown in the United States by 14 times, with two-thirds (63%) of respondents in a recent study reporting that family history has become more important than ever."^[4]

The increasing interest in genealogy is also evident in the growing number of theses and dissertations being written on various aspects of the genealogical literature and its users, with several examples discussed later.

Crandall, in the foreword to *Printed Sources*, describes the growing literature that is now available for genealogical research due to the increasing interest in genealogy:

"Genealogists are now much more numerous and genealogy much more popular than at any time in our national history. As this interest has proceeded, many authors and compilers have added immensely to the fast-growing multitude of printed sources for every kind of genealogy—compiled family or local histories, multi-ancestor works, new periodicals, guidebooks, printed source records, bibliographies, indexes, and reference works."^[5]

Meyerink adds the following concerning the genealogical literature:

"... [There] has been an explosion of printed genealogical sources. Every day several new books are published by and for genealogists; some major genealogical publishers release three or more new books and reprints *every week*."^[6]

He notes further:

"Although research methodology does not change rapidly, and original records are much the same as they were twenty or more years ago, there have been many changes in printed sources. In 1975 there were very few census indexes. The limited number of transcribed records meant limited access for the research. There were no computer programs or databases for family historians. Bibliographies and other research tools were fewer and much older than they are today."^[6]

Overview

This entry consists of a description of the history of genealogy, the users of genealogical literature, and the procedures and resources used in genealogical research. A discussion of both compiled and original sources, along with reference tools and periodical, news, and networking sources, follows.

HISTORY

Antiquity (to 1500)

A short history of genealogy is found in an article by Potter-Phillips, describing the keeping of genealogies in various ages, starting with Biblical times. References to genealogies are found in both the Old and New Testaments. The ancient Greeks, Assyrians, Egyptians, and Chinese also kept genealogies. Genealogies have been kept by many native peoples, including African clans, Maori and Inca peoples, and the North American Indians. During the Middle Ages in Europe, proving one's descent was required to claim the privileges of the nobility and gentry.^[7]

Beginning of Record Keeping and Modern Interest (1500s to Mid-1800s)

The ancient genealogies were frequently fragmentary and unreliable. In modern times, laws have been established in various countries requiring that records be kept of birth, marriage, and death, which in turn provides the documentation needed to construct accurate genealogies.^[7] However, even through the nineteenth century there were errors and lack of proof in genealogies because records were difficult to locate and examine.^[8]

The following are some important events in the development of record keeping in the United States and Europe:

- 1538—In Britain, an edict from King Henry VIII required that ministers keep records of christenings, baptisms, marriages, and burials.
- Mid-1500s—The lands that later became Germany began keeping records similar to the British records, and the Scandinavian countries followed.
- 1630s—In the American colonies, civil records were required in the General Assembly of Virginia in 1632 and in the Massachusetts Bay Colony in 1639.
- 1837—Civil registration began in Britain.^[7]

The first known genealogy in the United States was prepared in 1698: Pedigree of the Byrd family (at the Virginia Historical Society in Richmond).^[9] Genealogy, however, has not always been popular in the United States, due to the societies from which the early colonizers came. Traditions of inheritance and caste had denied them opportunities in achieving success, thus they often wanted to forget their heritage. Also, the early pioneers did not have the time required to do the research to identify their ancestors.^[8]

Rise of Organized Genealogical Endeavors (Mid-1800s to Early 1900s)

Bockstruck proposes that the beginning of genealogical research and publication in the United States occurred in the 1840s,^[9] with Bidlack noting that the publication of

genealogical source materials did not begin until after the Civil War.^[8] Wood describes the period 1848–1921 as a boom for genealogy.^[10]

Important developments occurred in the mid- to late 1800s with regard to county histories and historical associations. The first county history in America was published in 1848, for the County of Westchester (New York). In 1876, a Joint Resolution of Congress recommended that each county prepare a historical sketch to present on the centennial anniversary of the nation's independence, with copies to be filed in the county clerk's office and the office of the Librarian of Congress.^[9] In the latter half of the nineteenth century, historical associations were established in towns, counties, and states, and provided help in recording and preserving the local history.^[8] Key events regarding the historical associations include

- 1845—New England Historic Genealogical Society was founded,^[9] first genealogical society in the world.^[7]
- 1876—American Centennial stimulated the formation of patriotic societies and interest in looking back.^[8]
- 1876—Sons of the Revolution was organized in New York, first patriotic organization in America.^[9]
- 1903—National Genealogical Society was founded, in Washington, District of Columbia.^[9]

Scientific Genealogy and Growing Interest (Early 1900s–1969)

Mills reviews the history of genealogy, with a focus on the development of standards and scholarship. She describes various movements in genealogical scholarship and the emergence of “scientific” genealogy in the 1930s. The school of “scientific” genealogists was led by Donald Lines Jacobus (1887–1970), the father of American genealogy.^[11] Jacobus was the first American to make his living as a genealogist, for which he gained entry to *Who's Who in America* for his accomplishments.^[8] He established standards of genealogical scholarship^[11] and published important genealogical guides and reference materials, including

- 1930—*Genealogy as Pastime and Profession*, the first real guide for the beginner in family history^[8]
- 1933—*Is genealogy an exact science?*^[12]
- 1932–1953—*Index to Genealogical Periodicals*^[9]

Wood notes that prior to the 1970s organized genealogical research in North America tended to be a pastime for the white Euro-North American upper classes.^[10] Both of the world wars, however, promoted an interest in genealogy among Americans, as soldiers found themselves in the lands of their ancestors.^[8] After 1945, with the growing interest in genealogy, there was an increase in the number of hereditary societies^[9] and an increase in genealogical

source materials. Bidlack attributes the latter to the large number of people involved, along with the impact of technology, including offset printing, microfilm, copying machines, and, later, computers.^[8]

Wood describes the 1950s as the beginning of modern genealogy.^[10] Mills notes the establishment of several important organizations, beginning in 1940, which fostered the growth of standards and scholarship in the United States:^[11]

- 1940—American Society of Genealogists, recognized as the field's scholastic honor society
- 1950—National Institute for Genealogical Research, based at the National Archives
- 1964—Samford University's Institute of Genealogy and Historical Research
- 1964—Board for Certification of Genealogists, created in Washington, District of Columbia, to establish standards and a register of qualified genealogists^[8]

Genealogical Research Comes of Age (1969–1980s)

In 1969, the World Conference on Records, sponsored by the Church of Jesus Christ of Latter-day Saints (LDS Church), was held. This event promoted scholarship in genealogical research, as did the succeeding conference in 1980.^[8] Filby, Kaminkow, and others published important reference works during this period, including

- 1970—*American and British Genealogy and Heraldry*, by P. William Filby (ALA)^[9]
- 1972—*Genealogies in the Library of Congress: A Bibliography*, edited by Marion J. Kaminkow (Magna Carta Book Co.)^[9]

In 1976, Alex Haley's book, *Roots: The Saga of an American Family*, was published and the popular television drama based on it began in 1977. Both stimulated interest in family history among a wider range of people, including minority groups.^[10] Patrons at genealogical and historical libraries doubled and tripled during the 1970s,^[8] including a 70% increase in use, in 1979, by genealogists at the National Archives and Records Administration.^[10]

Prior to 1980, the image of genealogy was poor, since genealogy was often performed for exclusion and the promotion of social ambition. Changes in the 1980s prompted American historian Samuel P. Hays to maintain that a "new genealogy" had emerged. Wood, in a thesis, examines the "new genealogy" over the period 1969–2004, noting "a significant shift in the characteristics of genealogical research in North America at least" during this period. Characteristics of the new genealogy included:^[10]

- More focus on archival research by those outside the social elites.

Interest in family history among a wider range of people.

Interest in more than illustrious or elite ancestral ties.

Interest in the historical context in which the family lived.

Flourishing of genealogical societies, publications, and codes of ethics.

Adoption of the Internet as a major research tool.

Improvement in the relationship between archivists and genealogists.

Genealogical research becoming the basis of media reports, plays, and books.

Genealogical research becoming an important aspect of medical care.

The Internet and Digitization (1990s–2000s)

The Internet and digitization have played major roles in developments pertaining to genealogy in the 1990s and on. Crandall notes that: "...CD-ROMs and the Internet ... will not so much replace the older literature as place it in a new format."^[5] Following are some of the genealogical websites established during the 1990s to early 2000s (see Table 1 for further details):

- 1993—RootsWeb
- 1996—Cyndi's List
- 1996—WorldGenWeb Project
- 1997—Ancestry.com
- 1999—FamilySearch
- 1999—Heritage Quest
- 2003—Linkpendium (beta version)
- 2005—MyHeritage

Over 40 million hits were received at the FamilySearch website on its first day of operation in 1999.^[10] As the popularity of the genealogical websites has grown, so has the interest in building family trees online and in sharing the trees within families and communities. Sites that provide these capabilities include Ancestry.com, MyHeritage, and FamilySearch (see Table 1).

As the genealogical websites have evolved, so have efforts to digitize resources. Digitization, the process of converting data or an image to digital form,^[13] is making possible the display of genealogical records on the Internet. Partnerships have been developed with genealogical providers to digitize extensive collections of genealogical materials. Several recent digitization projects are described below.

FamilySearch, a major player in the digitization efforts, announced partnerships in early 2014 with several commercial providers. Agreements were reached with Ancestry.com, Findmypast, and MyHeritage. The partnerships are seen as a way to accelerate digitization and to deal with the staggering amount of material needing digitization, as noted in the following:^[14]

Table 1 General resources

Category	Title	Content and URL (\$ = fee-based)
Directories— Intl.	Cyndi's List	http://www.cyndislist.com —Search by (1) category (place or topic), (2) keyword —Original directory of genealogical links —Over 300,000 links
Directories— U.S. emphasis	Linkpendium	http://www.linkpendium.com —Search by (1) surnames worldwide, (2) localities in the U.S., U.K., and Ireland —Largest directory of genealogical links —Over 10 million links
Intl.	Ancestry.com	\$ http://www.ancestry.com —16 billion historical records (many digitized) —U.S. records (census, court, immigration, military, and vital records) —International records (U.K., Europe, Canada, more) —70 million family trees —Family tree-building tools, Ancestry Community, family/local histories, reference tools
Intl.	FamilySearch	https://familysearch.org —Hundreds of millions of individual birth, christening, or marriage dates for deceased individuals —Original records (census, immigration, military, naturalization, probate, and vital records) —User-submitted family group records and pedigrees —Wiki research guides, by place and topic
Intl.	Google	https://www.google.com —Search for names, places, records, maps, and translations, using the search guidelines below: —Tips for using Google in genealogy searches, at: http://www.searchforancestors.com/google/searchtips.html —Google for genealogy, at: http://www.cyndislist.com/google/google-for-genealogy

(Continued)

Table 1 General resources (Continued)

Category	Title	Content and URL (\$ = fee-based)
Intl.	MyHeritage	\$ http://www.myheritage.com —Search engine built specifically for genealogy, searches hundreds of major genealogy databases in a single query —7.7 billion historical records —39 million family trees —Family tree builder, message boards
Intl.	WorldGenWeb Project	http://www.worldgenweb.org —Resource and reference information for each country, along with a surname query feature
Intl.	WorldVitalRecords	\$ http://www.worldvitalrecords.com —Scanned and indexed state and country vital records, family histories, books, gazetteers, and maps. —U.S. small town newspapers (especially strong) —MyHeritage family trees
U.K., U.S.	Archives.com	\$ http://www.archives.com —4.8 billion photos, newspapers, vital records —How-to articles, tutorials, Ancestry Community
U.K., U.S., Pacific	FindMyPast	\$ http://www.findmypast.com —Over 2 billion census, church, migration, military, and vital records —User-created family trees —How-to articles
U.S. emphasis	Heritage Quest Online	\$ http://www.heritagequestonline.com —Genealogical information for America since the late 1700s —U.S. census images (1790–1940) —Family history books —Periodical Source Index (PERSI) —Revolutionary War records —U.S. Congressional Serial Set (from 1789) —American State Papers

“Notwithstanding the astounding success of the FamilySearch indexing program and the tireless dedication of hundreds of thousands of volunteers, it will still take many generations to index and publish just the records contained in FamilySearch’s Granite Mountain Records Vault. This estimate does not account for the more than 35 million new images of records that are digitized each month—and that rate is increasing.”^[14]

Another significant partnership, between FamilySearch International and GenealogyBank, was announced on October 1, 2014. The two groups plan to make over a billion records from historical obituaries searchable online. This initiative has been described as the largest online U.S. historical record access initiative yet.^[15]

Many important U.S. records are being digitized through partnerships developed by the National Archives and Records Administration (NARA) with Ancestry, Fold3, and FamilySearch. The partners are digitizing selected NARA microfilm and original records and making the records available on their websites, with free searching allowed on some or all of the index terms. Free access to the records is available in the NARA Research Rooms and regional archives and Presidential libraries.^[16]

USERS OF GENEALOGICAL LITERATURE

Interest in Genealogy

Genealogical researchers have various reasons for their interest in genealogy. In earlier periods of time, the motivation for creating genealogies had to do with proving one’s descent so as to claim special privileges or social recognition. In more recent times, some have done genealogical research because of an interest in history. Others have sought meaning in their lives by developing ties with those in the past and present. Genealogical research is also performed to identify missing heirs of estates and to learn about hereditary diseases.

Still others have religious reasons for identifying their ancestors. The following explanation of LDS beliefs is found on the FamilySearch Wiki: “Members of the Church [of Jesus Christ of Latter-day Saints] believe that the family can continue beyond the grave. . . . Members of the church also believe that their deceased ancestors can receive this blessing of being eternally united with their families. This can be accomplished when Church members make covenants in temples in behalf of their ancestors, who may accept these covenants in the spirit world if they so choose.”^[17]

Studies of User Behavior and Needs

Most previous studies of genealogical users, in the library and information science and archival literature, have focused on managerial issues rather than the information needs and behavior of the users. A growing number of studies and

dissertations are now focusing on the information-seeking behavior of genealogists. Several studies are discussed here, with the findings summarized in the following five areas: 1) goals in genealogical research; 2) how genealogists search; 3) how genealogists learn; 4) how genealogists manage information; and 5) unmet needs of genealogists.

Goals in genealogical research: Yakel found no clear end goal in the genealogist’s search for information.^[18] “The ultimate need is not for a fact or date, but to create a longer narrative, connect with others in the past and present, and find coherence in one’s own life.” Self-identification and self-discovery are thus important dimensions of genealogical research.^[18] Yakel and Torres found, further, that genealogists as seekers of meaning are “less invested in proving the truth of stories and records, but more in uncovering coherent narratives.”^[19]

Antcliff Tucker, in a related dissertation, investigated whether people use family history to explore and articulate a sense of cultural identity. It was verified that family history research develops a sense of cultural identity, through discovery of one’s particular genealogy and through connecting with ancestral places and with a cultural group. Certain of the findings coincided with two of Yakel’s findings, namely, 1) “participants need to know their ancestors beyond a list of names and dates” and 2) “participants need to find and understand their ancestors’ stories.”^[20]

How genealogists search: Duff and Johnson identified three stages that are followed in genealogical research. In the first stage, genealogists gather names of their family members. In the second stage, they collect further details about the individuals. In these two stages, genealogists search by name and place, consult specific record forms for particular time periods, and search maps and gazetteers for names of localities in their area of research. The third and final stage involves finding out about the society and time period in which their ancestors lived.^[21]

Darby and Clough also looked at the research process used by genealogists and family historians, but with a different focus. A model was developed to describe the stages of activity carried out during a person’s lifelong family history research. The authors provide a multiphase view of the research process, showing “(1) the different research phases themselves; (b) the inter-relationship between phases; (c) distinct phase-specific behaviours; and (d) phase-specific resource preferences.”^[22]

Lucas, finally, in a dissertation focused more narrowly on how genealogists resolve problems, identified two distinct processes that are used. The two steps consist of 1) the location and selection of sources and 2) an information selection process for finding information in the sources. Once a problem is solved, new problems are identified and researched in an iterative process.^[23]

How genealogists learn: Duff and Johnson found that genealogists learn from one another. They tend to rely on their own expertise but when help is needed they consult most frequently with colleagues. A strong network exists

among genealogists, through associations developed in taking courses and attending genealogical society meetings and through newsletters.^[21] Fulton, in a related study of amateur genealogists researching their Irish ancestry, confirmed the importance of networking. Fulton found that networking and information sharing among fellow genealogists is an important means for advancing one's research.^[24] Yakel adds that genealogists and family historians turn to genealogical organizations for "education, celebration, and support." They also use Internet resources, such as online databases, chat rooms, LISTSERVs, and sites providing contact information for libraries and archives.^[18]

How genealogists manage information: The way genealogists and family historians manage information, according to a study by Yakel, is tied to how they conceptualize their role. Three roles were identified: narrators (telling a story), archivists (creating an archive of the research findings), and navigators (creating pedigree charts). The organizational devices used include genealogical software, notebooks, loose-leaf binders, and narratives.^[18]

Unmet needs of genealogists: Archives are organized by provenance or creator, but genealogists usually seek information concerning specific people. Duff and Johnson found that while expert genealogists have learned to use the provenance-based finding aids, the finding aids are a challenge for novice genealogists. Time constraints are also an issue for genealogists using archives. Professionals work on an hourly basis and need to find efficient ways to retrieve information in the archives. Nonprofessionals have concerns about the limited hours of service, especially in the evenings and on weekends.^[21]

USE OF LIBRARY CATALOGS AND CLASSIFICATION

Library catalogs and classification systems are important tools in providing access to the genealogical literature. Several studies and projects describe the problems and needs of genealogists in the use of the library catalog, and subject and classification systems. Though some of the studies were done prior to the implementation of the online library catalog, the findings remain relevant since many of the cataloging rules are still the same. The findings are described here.

Problems genealogists have with the library catalog: Users of genealogical libraries have been studied to identify the problems they have with the library catalog. The problems that occurred with the highest frequency at the Genealogical Library (Utah), in a study by Dilts, concerned 1) call numbers, 2) indirect locality entries in the catalog, 3) subject headings; and 4) filing rules. It was found, further, that these problems were often related to 1) patron inexperience with the Library (or catalog system), 2) the patron's use of incorrect or incomplete data, and 3) poor or inadequate cataloging.^[25]

Bibliographic elements of most use to genealogists: In another study, by Johnson, patrons at the Genealogical Library (Utah) identified the following bibliographic elements as needed or helpful, each having a combined percentage of 90% or more: title, author, illustrations, content notes, bibliographic references, index notes, and locality tracings. It was concluded that the existing catalog should be replaced with an abbreviated short entry catalog, since most patrons did not understand the more detailed catalog entries.^[26]

Analytic entry needs of genealogists: Sowers describes a project that identified how users approached research at the Kansas State Library. It was found they were often looking for specific information on individuals, events, institutions, etc. Subject access in the library catalog, however, was very broad. Following an experiment to create analytic entries in the catalog, for articles from the journal *Kansas History*, there was an immediate increase in the use of the articles and in interlibrary loan requests for the articles. The analytic entries provided access to the specific information the users were seeking.^[27]

Subject access needs of genealogists: Genealogists often seek information on the county level. To meet this need, the Rowan Public Library (North Carolina) added county-level headings, along with relevant subdivisions, to the library catalog, for example: "Wilkes County (N.C.)—Marriage records." These headings complemented the authorized LCSH headings, for example: "Marriage records—North Carolina—Wilkes County."^[28] With both kinds of headings in the catalog, access for the users was greatly improved.

Classification needs of genealogists: Genealogists have a need to browse library shelves by geographic area. The Rowan Public Library (North Carolina) designed a new classification for the History Room collection to accommodate this need, with materials arranged by geographic area and then by subject content, for example: KS KIN .34 [Kansas, Kingman County, marriage records]. In interviews, following the change, users said they liked the ease of use of the new system and being able to find materials for a county grouped together.^[28]

PROCEDURES IN GENEALOGICAL RESEARCH

Genealogical research is performed to identify and learn about one's ancestors. Some researchers are satisfied with creating only a pedigree chart, showing their line of descent, with names, dates, and places of their ancestors' births, deaths, and marriages. Other researchers want to learn more, including information about their ancestors' occupations, education, moves, and religious beliefs. In this entry, the focus will be on the steps needed to identify the basic details about one's ancestors, relating to birth, death, and marriage.

Steps in Research

An introduction to genealogical and family history research is found on the FamilySearch Wiki, in a document entitled: *A Guide to Research*. The document describes five steps in the research process:

- Step 1: Identify what you know about your family
- Step 2: Decide what you want to learn about your family
- Step 3: Select records to search
- Step 4: Obtain and search the record
- Step 5: Use the information^[29]

Step 1 in the research process consists of identifying what one already knows about one's ancestors, including information obtained from other family members. In gathering information, it is useful to contact both close and more distant family members and relatives. The objective is to learn about any research they have done and any family histories or genealogies they may have.

As one identifies names, dates, and places for one's ancestors, the information can be recorded on pedigree charts and family group records. A pedigree chart is "A chart that shows an individual's direct ancestors, [including] parents, grandparents, great-grandparents, and so forth. A pedigree chart may contain birth, marriage, and death information."^[30] A family group record is "A printed form that lists a family, parents and children, and gives information about dates and places of birth, marriage, and death."^[30] For each pair of ancestors one identifies (e.g., a grandfather and a grandmother), one would complete a family group record, with information about the husband and wife and their children. Both the pedigree charts and the family group records can be printed from the FamilySearch website.

Step 2 consists of choosing one ancestor about whom one wants to know more. One normally starts with the generation closest to oneself and then works back. In step 3, one selects the resources one will search, including both compiled and original records (discussed later). In step 4, one obtains the records and searches them. Step 5, finally, consists of evaluating and using the information found, copying any new information to one's pedigree and family groups records, organizing newly found records, and sharing the information with others.

This entry will focus on step 3, selecting records to search, since this is the step that is concerned most directly with the genealogical literature and in particular with the resources one must use to identify one's ancestors. In determining which records to search, one usually proceeds as follows:

- First, use compiled records to identify research already done on a given individual or family.

Second, use original records to locate new information about the individual or family.

As needed, use reference tools (background and finding aids) to assist in the two foregoing steps.

Classification and Evaluation of Genealogical Literature

The genealogical literature can be classified according to the types of resources used in the research process. Meyerink describes a classification that places genealogical resources into two broad classes:

1. "*Research sources* are those books and records which actually provide data that a researcher needs to solve a problem at hand. For family historians, these are the genealogical records which provide family data for charts and family group records."^[6]
2. "*Reference tools* provide auxiliary information to help researchers find the right research sources. Reference tools include bibliographies, indexes, instructional material, and other reference aids."^[6]

Research sources can, further, be subdivided into the following two classes:

1. "Original records are those sources that contain the first recording of an event...; they are generally recorded near the time of the event by someone who was present and associated with the event."^[6]
2. "Compiled records are those records that provide actual genealogical information whose content is derived from the research and evaluation of original records and/or other persons' research."^[6]

Reference tools, in turn, can also be subdivided into two classes:

1. "Background information helps researchers understand the settings in which records were created..."^[6]
2. "Finding aids indicate where specific information can be found..."^[6]

The foregoing subclassification of research sources contrasts with the more traditional view of primary versus secondary sources. Meyerink proposes that the information in the sources should be classified as primary or secondary, while the sources themselves should be classified as original or compiled, as explained here:

"The traditional definition of a 'primary source' has been that it is a record created at the time of the event by someone associated with the event. For example, a death record is usually considered to be a primary source because it is created at the time of the event by someone associated with the event, such as the attending physician or a close relative. However, only *some* of the information

in a death record is primary in nature. . . . Thus, on a death certificate, the death date and cause of death are primary information, but the dead person's birth date or parents' names are *not* primary information. Such information, which significantly predates the event being recorded, is secondary information. . . .^[6]

In conducting genealogical research, it is important to evaluate the information one finds, including a determination of whether the information is primary or secondary, as noted above. Other areas needing evaluation include relevance, origin of the information, nature of the record, format of the record, directness of the evidence, consistency and clarity of the facts, and likelihood of the event(s).^[6] Further guidance on evaluating information may be found in the how-to resources and guides listed in Table 4.

GENEALOGICAL RESOURCES

The genealogical literature will be discussed in further detail here, within the structure described earlier. Research sources will be described first, including compiled sources and original sources, followed by a discussion of reference tools. Some reference tools (e.g., indexes) will be discussed in conjunction with the original or compiled sources with which they are used. Resources that consist of a combination of original, compiled, and reference resources will be considered in the section that seems most pertinent. Periodical, news, and networking sources will be discussed separately, since these sources often contain a combination of resource types.

Tables have been prepared corresponding with the areas noted before, including

Table 1—General resources

Table 2—Compiled sources

Table 3—Original sources

Table 4—Reference tools

Table 5—Periodical, news, and networking sources

Table 1 identifies some of the major websites available for family history research. A few of the sites are megasites, providing links to many other sites. One can use the sites in Table 1 to access both compiled and original sources, as well as reference tools, for a variety of geographic areas.

Compiled Sources

Compiled sources, as described earlier, are used to identify research previously done. Table 2 contains a list of compiled sources commonly used to identify previous research, along with the finding aids used to access the sources (e.g., library catalogs may be used to locate family

Table 2 Compiled sources

Category	Title	Content and URL (\$ = fee-based)
Biographies— Intl.	World Biographical Information System— DeGruyter	\$ http://db.saur.de/WBIS —Over 6 million biographical entries
Family/local histories—Intl.	FamilySearch Catalog	https://familysearch.org —Click on: Search, Catalog [or Search, Books], then search by surname or place (as subject) —Large collection of published family and local histories, including 325,000+ digitized family and local histories and related publications —Overview of Family History Library resources, classes, and research assistance at: https://familysearch.org/locations/saltlakecity-library
Family/local histories—Intl.	Library of Congress Online Catalog	http://catalog.loc.gov —Search by family or locality (as subject) —Premier collection of U.S./foreign publications, including 50,000+ genealogies and 100,000+ local histories —Overview of LC Local History and Genealogy Reference Services, including genealogical materials, digitized materials, searching tips, and online orientations at: http://www.loc.gov/rr/genealogy/
Family/local histories—Intl.	WorldCat or other library/archive catalog in area of interest (national/state/ local)	http://www.worldcat.org —Search by family (as subject), e.g., Walsh family —Search by locality (as subject), e.g., —Logan (Utah)— History, or Stuttgart (Germany)—Genealogy —Worldwide library records of published family and local histories

(Continued)

Table 2 Compiled sources (Continued)

Category	Title	Content and URL (\$ = fee-based)
Family/local histories— Intl./U.S.	Periodical Source Index (PERSI)— Allen County Public Library Foundation	\$ http://www.findmypast.com/persi —Search by family or locality to identify periodical articles about the family or locality https://familysearch.org —Click on: Search, Genealogies, then search by name —User-submitted lineage linked trees, including: Ancestral File (1979–2000, names merged) —Pedigree Resource File (1999- names not merged)
Pedigrees— Intl.	Genealogies— FamilySearch	
Pedigrees— Intl.	Family Tree— FamilySearch	https://familysearch.org —Click on: Family Tree, Find, then search by name (must create account) —Community-submitted pedigrees http://www.worldgenweb.org —Surname queries by country (some) —Country- and county-specific e-mail lists (some) http://boards.ancestry.com —Search bulletin boards by category —More than 198,000 bulletin boards http://www.cyndislist.com/surnames —Search by surname to find association or surname websites —Search association or surname websites to locate genealogies, family histories, query lists, and information on the organization’s library/archive, publications, and events http://www.cyndislist.com/societies
Query services— by country	Query services— WorldGenWeb Project	
Query services— by country	Message boards— Ancestry.com	
Society resources— Intl.	Family association and surname Websites	

(Continued)

Table 2 Compiled sources (Continued)

Category	Title	Content and URL (\$ = fee-based)
Society resources— Intl.	Genealogical and historical societies (national, state, local)	—Search by locality or ethnic group along with the word “societies” to find society websites —Search society websites to locate genealogical indexes and records, and information on the society’s library/archive, publications, and events
Society resources— U.S.	National Genealogical Society	\$ http://www.ngsgenealogy.org —Quarterly publication, online courses, conferences, family group sheets, databases

histories). Six types of compiled sources are described, including

- Biographies
- Family histories and genealogies
- Local histories
- Pedigrees
- Query services
- Society and association resources

The latter two categories, “Query services” and “Society and association resources,” may be thought of more as finding aids, but are included here since they can direct one to compiled sources that are important in the research process. Each of the six types of compiled sources is described below.

Biographies

A biography is “A history of an individual’s life.”^[30] An early index of biographies, by Freemont Rider, consolidated all American biographical–genealogical records. This index has been published in two series:

- 1st series, *American Genealogical Index*, 1942–1952.^[9]
- 2nd series, *The American Genealogical-Biographical Index to American Genealogical, Biographical, and Local History Materials*, 1952–2000 (with supplements).^[9]

Table 3 Original sources

Category	Title	Content and URL (\$ = fee-based)
Cemetery records	Find a Grave	http://www.findagrave.com —160,000 worldwide grave records
Emigration and immigration records	Emigration and Immigration Records and Resources—WeeMonster	http://www.germanroots.com/ei.html —Links to emigration, immigration, naturalization, and passenger list resources —Indexes and guides for ports in: U.S. (all ports), Canada, Europe
Vital records	International Vital Records Handbook (Kemp)	\$ http://www.genealogical.com [*Search for title] —Genealogical Publishing Co., 7 th ed., 2017 —Vital records information, by country
Vital records	Vitalrec.com	http://www.vitalrec.com/links2.html —Search by country (U.S., Canada, Europe, Pacific) —Links to vital record indexes, record ordering services, guides
Ethnic Groups		
By ethnic group	Cyndi's List	http://www.cyndislist.com —Search by ethnic group, then by type of record
Europe		
Denmark	Arkivalieronline—Statens Arkivers	https://www.sa.dk/content/dk (also in English) —Census, church, emigration, and probate records (some digitized)
E. Europe	Foundation for East European Family History Studies (FEEFHS)	http://www.feeffhs.org —Umbrella organization for east/central Europe —Links to resources (by country/ethnic group) —Conferences, calendar, news

(Continued)

Table 3 Original sources (Continued)

Category	Title	Content and URL (\$ = fee-based)
France	FranceGenWeb	http://www.francegenweb.org (English via help) —Links to databases, directories, by region
Germany	GenWiki—Verein für Computergenealogie	http://wiki-de.genealogy.net (also in English) —Portal for all German speaking areas —Links to databases, societies, mailing lists
Italy	Italy GenWeb	http://www.rootsweb.ancestry.com/~itawgw/ (in English) —Links to guides, records, by region
Norway	Arkivverket Digitalarkivet	http://arkivverket.no/Digitalarkivet (also in English) —Digitized census, church, probate, property, and tax records (some searchable online)
Spain	Spain GenWeb	http://www.genealogia-es.com —Links to databases, directories, by region
Sweden	SVAR (Svensk Arkivinformaton)	\$ https://sok.riksarkivet.se/svar-digitala-forskarsalen (also in English) —Digitized census, church, court, land, property, and vital records (some searchable online)
U.K.	U.K. BMD	http://www.ukbmd.org.uk —Links to websites offering online transcriptions of U.K. births, marriages, deaths, and censuses
U.K., Ireland	GENUKI—U.K. and Ireland Genealogy	http://www.genuki.org.uk —Portal for the U.K. and Ireland, by county/parish —Links to census, church, probate, and vital records
North, South, and Central America		
Canada	Genealogy and Family History—Library and Archives Canada	http://www.bac-lac.gc.ca/eng/discover/genealogy

(Continued)

Table 3 Original sources (Continued)

Category	Title	Content and URL (\$ = fee-based)
Central/ South America	Central and South America— Cyndi's List	—Links to census, immigration, naturalization, and vital records http://www. cyndislist.com/ central-and-south- america/ —Links to sources for countries in Central/South America —Links to vital records, family histories
Mexico	Genealogy of Mexico	http://members. tripod.com/~Gary Felix/index1.htm —Names of early settlers of Mexico (from mission registers, civil records) —Spanish-American family histories
U.S.	Resources for Genealogists— National Archives and Records Administration	http://www.archives. gov/research/ genealogy —Indexes, how to find/access records —Links to both NARA and non- NARA sites for census, court, immigration, land, military, naturalization, passport, and vital records
U.S.	GenealogyBank— NewsBank, Inc.	\$ http://www. genealogybank.com —Modern obituaries, news from 7000+ historical newspapers, military/ pension records, land grants —Social Security Death Index, 1962- (free)
Africa, Asia, and the Pacific Africa	Africa— Cyndi's List	http://www. cyndislist.com/africa —Links to sources for countries in Africa —Links to vital records (S. Africa), queries

(Continued)

Table 3 Original sources (Continued)

Category	Title	Content and URL (\$ = fee-based)
Asia and Pacific	Asia and the Pacific— Cyndi's List	http://www. cyndislist.com/asia —Links to sources for countries in Asia and the Pacific —Links to vital records, queries

A large international biographical resource, the World Biographical Information System, currently provides access to over 6 million biographical entries (see Table 2).

Family histories and genealogies

A family history is defined as “A recorded account of the events occurring in one or more generations of a family.”^[30] A genealogy is “A published account of an individual’s ancestors, descendants, or both.”^[30] These terms are sometimes used interchangeably. Family histories and genealogies are published both as books and as articles in periodicals, in print and online, and may include only basic genealogical information or a longer narrative history of the family and individuals.^[6] The growth in family histories may be seen in the following figures:

- 1698—First genealogy in the United States (Byrd family)^[9]
- 1862—108 family histories available (from a bibliography by William H. Whitmore)^[9]
- 1982—50,000 family histories available (estimated by Willard Heiss)^[8]

One can search for genealogies and family histories in online catalogs, using subject terms such as “Jones family.” Three large online catalogs providing access to numerous family histories are identified in Table 2: the Library of Congress Online Catalog, the FamilySearch Catalog, and WorldCat. A useful resource for identifying family histories in the periodical literature is the *Periodical Source Index* (see Table 2).

Family histories are being digitized in growing numbers. Family History Books is a collection of over 325,000 digitized genealogy and family history publications on the FamilySearch website. The resources come from several partner institutions, including the Allen County Public Library, Brigham Young University, the Houston Public Library, and the Family History Library in Salt Lake City.^[31]

As family histories become digitized and searchable, massive amounts of text will be available online and the need to search effectively will increase. A dissertation designed to identify properties of family history literature

Table 4 Reference tools

Category	Title	Content and URL
Directories– Societies– U.S.	Federation of Genealogical Societies	http://www.fgs.org —Click on: Find a society —Information on 473 societies (mostly U.S.)
Directories– Societies, Libraries– Canada, U.S.	Directory of Genealogical and Historical Societies, Libraries and Museums in the US and Canada(Carson)	http://www.irongate.com [*Click on title] —Iron Gate Publishing, 2016 —Information on 47,000 societies, libraries, archives, and museums
Directories– Software	Software and Computers–Cyndi’s List	http://www.cyndislist.com/software —Information on genealogical software and tools
Guides– by country / ethnic group	Guides to Tracing Family Trees– RootsWeb	http://rwguide.rootsweb.ancestry.com —Search by country, ethnic group, or record type
Guides– by country / state	Record Selection Tables– FamilySearch	https://familysearch.org/wiki/ —Search wiki by country or state, then click on Record Finder link to see Record Selection Table —Advice on records to search for specific information (e.g., to find names of parents)
Guides– Canada, U.S.	The Researcher’s Guide to American Genealogy (Greenwood)	\$ http://www.genealogical.com [*Search for title] —Genealogical Publishing Co., 3 rd ed., c2000, reprinted 2005 —Text used in college and university courses on American genealogy
Guides– U.S.	Red Book: American State, County, and Town Sources (Eichholz)	http://www.ancestry.com/wiki [*Click on title] —Ancestry, Inc., 3 rd ed., 2004 (digitized) —Information on records and holdings for every county in the U.S.

(Continued)

Table 4 Reference tools (Continued)

Category	Title	Content and URL
Guides– U.S.	The Source: A Guidebook to American Genealogy (Szucs and Luebking)	http://www.ancestry.com/wiki [*Click on title] —Ancestry, Inc., 3 rd ed., 2006 (digitized) Information on original U.S. records —“The genealogist’s Bible”
How to– Beginning research	Genealogy Online for Dummies (Helm & Helm)	\$ http://www.dummies.com/ [*Search for title] —John Wiley & Sons, 7 th ed., 2014 —Description of online and offline research techniques, social networks, and mobile aps
How to– Citations	QuickSheet: Your Stripped-Bare Guide to Citing Sources (Mills)	\$ http://www.genealogical.com [*Search for title] —Genealogical Publishing Co., 2017 (2-pages) —Template for citing any type of source material
How to– Classes	Learning Center– FamilySearch	https://familysearch.org/learningcenter/ —Search for lessons by place or other topic
How to– Handwriting– U.S.	Reading Early American Handwriting (Sperry)	\$ http://www.genealogical.com [*Search for title] —Genealogical Publishing Co., 1998, reprinted 2008 —Guide to reading early American handwriting
How to– Standards	The Genealogical Proof Standard– Board for Certification of Genealogists	http://bcgcertification.org/resources/standard.html —Click on Genealogy’s Standards link to see list of elements to establish credibility and proof in genealogy
How to– Standards	QuickSheet: Your Stripped-Bare Guide to Historical Proof (Mills)	\$ http://www.genealogical.com [*Search for title] —Genealogical Publishing Co., 2014 (2 pages)

(Continued)

Table 4 Reference tools (*Continued*)

Category	Title	Content and URL
Maps and gazetteers— Intl.	GEOnet Names Server—National Geospatial-Intelligence Agency	—Description of three ways to arrive at proof: evaluating the source, the information, and the evidence http://geonames.nga.mil/gns/html/ —Information on foreign place names sanctioned by the U.S. Board on Geographic Names
	Perry-Castañeda Library Map Collection— Univ. of Texas, Austin	http://www.lib.utexas.edu/maps —Online maps (current and historical) —Links to maps and gazetteers on other sites
Maps and gazetteers—U.S.	Geographic Names Information System— U.S. Geological Survey	http://geonames.usgs.gov/pls/gnispublic —Information on every place name in the U.S.

applicable to full text searching was completed by Molto relevant to this issue. Several properties of the literature were identified, including differences between male and female search term patterns. These differences would suggest gender-specific strategies when searching a full text family history database.^[32,33]

Local histories

A local history is “An account of the historical events surrounding a particular area.”^[30] Local histories include county histories, as well as histories of particular communities. These resources are helpful in family history research, since they usually contain information about early residents of an area, especially those prominent in the community. The growth in local histories may be seen in the following figures:

- 1848—First county history in America published (County of Westchester, New York)^[9]
- 1862—62 local histories available (from a bibliography by William H. Whitmore)^[9]
- 1975—90,000 local histories available (from a bibliography by Marion J. Kaminkow)^[8,9]

As with family histories, one can locate local histories through online catalogs, such as WorldCat (see Table 2).

One would search the catalog under a subject term, such as “Los Angeles (Calif.)—History,” or “Stuttgart (Germany)—Genealogy.”

Pedigrees

A pedigree chart, sometimes also referred to as a family tree, is “A chart that shows an individual’s direct ancestors, [including] parents, grandparents, great-grandparents, and so forth. A pedigree chart may contain birth, marriage, and death information.”^[30] Pedigrees are available on many websites, including the FamilySearch website. Three FamilySearch resources that include extensive pedigrees are the Ancestral File, the Pedigree Resource File, and Family Tree (see Table 2). The websites listed in Table 1 provide additional possibilities for locating pedigrees.

Query services

A query, relevant to family history, is “A request for information, such as information about a particular ancestor.”^[30] A query service provides a medium (e.g., via a message board) for communicating with individuals researching or wanting information on the same person. Forums are a variation of a query service, allowing one to read or post comments about a particular family or individual. Query services are available through various websites, including Ancestry.com and WorldGenWeb Project (see Table 2). Query services are frequently hosted by genealogical societies and family associations, and query lists can be found in genealogical periodicals relevant to one’s area of research.

Society and association resources

Genealogical and historical societies, such as the National Genealogical Society (United States), publish and archive numerous compiled resources (see Table 2). The societies often publish periodicals, which include family and local histories. They also gather pedigrees and genealogies from members of the organization, and house these materials in libraries or post the information on websites. Family and surname associations, likewise, provide access to compiled resources (e.g., pedigrees and histories), collected from members of the association (see Table 2). Directories can be used to identify societies and associations relevant to the ethnic group, locality, or surname being researched (see Table 4).

Original Sources

Once previously completed research has been identified, one can use original sources to verify the information or to extend what is known. Original sources, as previously described, contain information recorded near the time of

Table 5 Periodical, news, and networking sources

Category	Title	Content and URL (\$ = fee-based)
Blogs– Intl.	Eastman's Online Genealogy Newsletter	http://blog.eogn.com —News about events, societies, companies, hardware/software, book reviews —Postings searchable under: Categories
Blogs– Intl.	GenealogyBlog (Meitzler)	http://www.genealogyblog.com —News about events, societies, companies, software, database content, book reviews —Postings searchable under: Categories
Periodicals–Computers	Internet Genealogy (print/PDF/app)	\$ http://internet-genealogy.com —Moorshead Magazines, 2006- —Articles on online genealogical resources and strategies
Periodicals (scholarly)– U.S.	The American Genealogist (print)	\$ http://americangenealogist.com —D. L. Jacobus, 1937- —Articles on difficult research problems, showing how to analyze and apply scholarly standards to the problem
Periodicals– U.S./Intl.	Family Tree Magazine (print/digital)	\$ http://www.familytreemagazine.com —F & W Publications, 1999- (also UK edition) —Articles on record types, country-specific research, websites, and research tools
Periodicals–Indexes– U.S./Intl.	Periodical Source Index (PERSI)– Allen County Public Library Foundation	\$ http://www.findmypast.com/persi —Index to names, places, and research methods, in English and French genealogical and local history periodicals, since 1800s —Growing number of links to digitized articles through the Findmypast partnership (July 19, 2013)
Social networks– Intl.	Popular social networks for genealogy– FamilySearch	https://familysearch.org/learn/wiki/en/Popular_Social_Networks_for_Genealogy —Information on blogs, forums, message boards, podcasts, wikis

the event. Examples of original sources include birth records, marriage records, death records, probate records, land purchase records, census enumeration records, and pension records.^[6] Some original records have been copied, in whole or in part, forming new resources known as abstracts, extracts, transcripts, or translations.^[6] Indexes and other finding aids must be used to locate names in the original sources. More and more original records are becoming viewable and searchable online through digitization and massive indexing projects.

Tables 1 and 3 list resources that will assist one in locating original sources. Table 1 identifies general resources and Table 3 identifies resources pertaining to specific countries, geographic areas, and ethnic groups. Umbrella websites will direct one to other sites for the relevant information. Not all countries are included in Table 3, due to space limitations, but websites for major regions (e.g., Africa) will direct one to resources within that region.

Original sources are generally housed in archives. An archive is “A place where institutions such as governments, businesses, and churches keep their records and official documents.”^[30] Government sources (e.g., census records) are housed on either the national, state (or equivalent), or local level. For example, in the United States, the National Archives and Records Administration houses federal records, whereas the Massachusetts State Archive

would house records pertaining to Massachusetts. Nongovernment sources are housed in repositories relevant to the organization. Church records, for example, would be housed by the local church or in a regional repository for the particular denomination.

The Family History Library in Salt Lake City maintains a vast repository of microfilmed and digitized records. The records are copies of original church, government, and other archival resources from throughout the world.^[29] Access to the Library's microfilmed records is available at over 4700 branch FamilySearch centers located worldwide. The digital records can be viewed on the FamilySearch website. The Family History Library is managed by FamilySearch, previously known as the Genealogical Society of Utah which dates back to 1894.^[34,35]

Following is a description of the major types of original records.

Vital records and civil registration

Vital records are “...birth, marriage, divorce, and death records created by governments.”^[30] Civil registration is an alternate term used in many countries to refer to the process of keeping vital records. These records are especially important in genealogical research, since they document dates and places of birth, death, and marriage.^[29] Vital records, however, have not been kept until fairly recently

in some countries. In Great Britain, for example, civil registration began in 1837.^[17] Most government offices now keep vital records, and indexes to these records are available online for many countries (see Tables 1 and 3).

The following sources, described in Table 3 (International section), will direct one to vital records in specific countries:

International Vital Records Handbook
Vitalrec.com

National archives in various countries can also provide information on how and where to obtain vital records, as can the country-specific articles available on the FamilySearch Wiki.^[36]

Church records

Church records are “Records kept by religious institutions.”^[30] Churches usually keep records of their christenings, baptisms, confirmations, marriages, and burials.^[29] In some countries, especially those with state churches, church records are the most significant source for documenting births, deaths, and marriages in earlier time periods, since civil vital records were often not begun until the mid- to late 1800s. Information on church records in specific countries is available on the FamilySearch Wiki, in the country-specific articles.^[36]

Cemetery records

Cemetery records include records kept by cemeteries, as well as information from headstones. Cemetery records and headstones contain names, birth dates, and death dates. One can often identify members of families in these records, since family members are usually buried near each other. Epitaphs may help establish the relationships between individuals.^[29] The Find a Grave website is an excellent resource for viewing and searching headstone information (see Table 3). Information on cemetery records in specific countries is available on the FamilySearch Wiki, in the country-specific articles.^[36]

Census records

A census is “An official count and description of the people living in a country, colony, state, county, township, or city.”^[30] Most national governments conduct periodic censuses. In the United States, the 1850 census was the first to list every member of a household, by name, sex, age, country or state of birth, and occupation. Census records are helpful in determining where one’s ancestors lived.^[29] Census information is available online for some countries (see Tables 1 and 3). Information on census records in specific countries is also available on the FamilySearch Wiki, in the country-specific articles.^[36]

Probate records

Probate records are “Legal documents dealing with the distribution of an individual’s property after his or her death.”^[30] Probate records may contain a copy of a person’s will, if one exists, as well as names of family members and their relationships.^[29] In some countries and time periods, people did not generally own property, so probate records are not available. Information on probate records in specific countries is available on the FamilySearch Wiki, in the country-specific articles.^[36]

Military records

Military records are “Records detailing an individual’s service in a country’s armed forces.”^[30] The kinds of military records available vary by country, but may include service records, draft or conscription records, records of regular military forces, and veterans’ benefit records. Indexes to a growing number of military records are available online (see Tables 1 and 3). Information on military records in specific countries is available on the FamilySearch Wiki, in the country-specific articles.^[36]

Immigration and emigration records

Immigration records are “Records that document a person’s arrival into a country.”^[30] Emigration records are “Record[s] documenting an individual’s move to a different country.”^[30] Examples of these records include passenger lists, permissions to emigrate, and records of passports issued. Especially important are the passenger lists,^[37] for which indexes are available online, through services such as Ancestry.com (see Table 1).

A helpful resource for tracing an ancestor’s town of origin is Tracing immigrant origins, available on the FamilySearch Wiki. The following advice is given:

“The best approach is to start searching records created in the immigrant’s new country, especially if you know little about the person. Only rarely is it better to use country-of-origin records first... Obituaries are an excellent source of biographical information about immigrants... Even if a place of origin is not given, an obituary may provide additional research clues... ”^[37]

Useful links for immigration and emigration information are found in the following resource: Emigration and Immigration Records and Resources (see Table 3). Information relevant to specific countries is available on the FamilySearch Wiki, in the country-specific articles.^[36]

Other original records

Other types of original records include court, land, naturalization, taxation, business, medical, and school records. One should check all jurisdictions (e.g., town,

county, state, and country) that may have kept records about one's ancestor.^[29] Detailed descriptions of the many kinds of records available for specific countries can be found on the FamilySearch Wiki, in the country-specific articles.^[36]

Reference Tools

Reference tools are often divided into two types: background information and finding aids. Each type is discussed here.

Background information

Reference tools that are useful in providing background information in the research process include^[6]

- Guides
- How-to resources
- Maps and gazetteers

A growing number of guides and how-to resources for genealogy have become available. Table 4 includes descriptions of some of these, including guides to research in particular countries. An example is Greenwood's *The Researcher's Guide to American Genealogy*. The Research Selection Tables, available on the FamilySearch Wiki, also provide research guidance, by country, state, and equivalent areas, including detailed information about which resources to use to find specific information about one's ancestors (see Table 4).

A basic how-to resource, listed in Table 4, is *Genealogy Online for Dummies*, by Helm and Helm. This resource provides an introduction to genealogical research. Other how-to resources from Table 4 include a citation guide, standards guides for establishing proof in genealogical research, a handwriting guide, and a reference to online classes. A prime source of information for maps and gazetteers (geographical dictionaries) is the Perry-Castañeda Library Map Collection, with links to maps from throughout the world (see Table 4).

Finding aids

Reference tools that serve as finding aids for locating information in record collections include^[6]

- Bibliographies
- Catalogs
- Directories
- Indexes

Several finding aids are identified in Table 4, along with some additional references in Tables 2 and 5. Bibliographies, though not listed in the tables, are a useful finding aid for identifying published family histories.

The following bibliographies, edited by Kaminkow and by Filby, are classics in the genealogical literature:

- 1970—*American and British Genealogy and Heraldry*, by Filby^[9]
- 1972–[1987]—*Genealogies in the Library of Congress* (including supplements) by Kaminkow^[9]
- 1981—*A Complement to Genealogies in the Library of Congress*, by Kaminkow^[9]

Library catalogs (listed in Table 2) are another type of finding aid for locating family histories and local histories. Directories (listed in Table 4) are helpful in identifying societies, libraries, museums, software, and other items of genealogical interest. Indexes, finally, are a finding aid that is useful for searching the periodical literature. Examples of periodical indexes are provided in the next section and in Table 5.

PERIODICAL, NEWS, AND NETWORKING SOURCES

A periodical is defined as “A periodical publication... with a fixed interval between the issues or numbers.”^[13] Periodicals often contain all three types of resources discussed earlier: compiled and original sources, as well as reference tools. Periodicals are available for specific countries, regions, and ethnic groups, as well as for other topics relevant to genealogy. Examples of several genealogical periodicals are provided in Table 5.

Society periodicals

Bidlack notes “At least half the genealogical journals and books being published today come from societies.... Below the state level there are scores of genealogical societies that publish periodicals devoted, usually, to a county.”^[8] Two of the earliest society periodicals, relevant to the United States, are

1. 1847—*The New England Historical and Genealogical Register*—oldest continuing genealogical periodical in the United States.^[8]
2. 1912—*National Genealogical Society Quarterly*—including primary source material from throughout the United States.^[8]

Non-society periodicals

Many non-society genealogical periodicals are also available. A periodical focusing on computers and technology in genealogy is *Internet Genealogy* (see Table 5). An example of a scholarly genealogical periodical is *The American Genealogist*, whereas a periodical useful for practical advice is *Family Tree Magazine* (see Table 5).

Periodical indexes

Indexes are important in providing access to the information found in genealogical periodicals. Jacobus produced the first index to periodicals, with others continuing his work in subsequent years:

- 1932–1953—*Index to Genealogical Periodicals*, by Donald Lines Jacobus^[9]
- 1957–1963—*Annual Index to Genealogical Periodicals & Family Histories*, by Inez Waldenmaier^[9]
- 1963–[2002]—*Genealogical Periodical Annual Index*, by various editors^[9]
- 1987–present—*Periodical Source Index (PERSI)* (see Table 5)

The *Periodical Source Index* is the most comprehensive and up to date of the genealogical periodical indexes and may be accessed online from two vendors, with a growing number of links to articles that have been digitized (see Table 5).

News and networking

Periodicals and blogs are important sources for genealogical news. A blog is “a website that contains online personal reflections, comments, and often hyperlinks, videos, and photographs provided by the writer.”^[13] Blogs are especially useful for news, since they are often updated daily. Two genealogical blogs are described in Table 5: Eastman’s *Online Genealogy Newsletter*, and the *GenealogyBlog*. Various social networking tools are also available for genealogists, for communicating with other researchers and for obtaining research advice (e.g., via podcasts and wikis). A FamilySearch Wiki article, entitled “Popular social networks for genealogists,” describes these tools (see Table 5).

CONCLUSION

Interest in genealogy began in antiquity, with references to genealogical records found in both the Old and New Testaments. During the earlier periods, those tracing their genealogies were often interested in proving their nobility. In the United States, it was not until the 1970s that interest expanded to people of all classes and ethnic groups. The availability of printed records, from which to derive accurate genealogies, did not exist in some countries until the mid-1500s, with civil records not available until the 1700s and 1800s. Genealogy as a scholarly pursuit came into being in the 1930s in the United States. Since then, a growing number of resources have become available, including microfilmed and digitized records. The Internet has revolutionized the way research is done, by providing access to genealogical resources from one’s home

computer. Genealogy is the second most popular hobby in the United States.

A growing number of user studies have been conducted to determine how genealogists perform their work. There is a need, however, for further research relevant to the growing use of the Internet in genealogical research. One concern relates to how genealogists can effectively navigate the Internet to access the many resources now available. More studies are also needed relating to the novice genealogist, since previous studies have focused on the professional.

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Genre Theory and Research

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Abstract

This entry provides overviews on current genre theory and research that investigates texts in their social contexts. Specifically, the entry focuses on relevant theory in Rhetorical genre studies and Linguistics and provides illustrations from applied studies in Professional Communication and Composition research. Since much current research in genre theory utilizes social theories that deal with questions of structure and agency, relevant theories in that area are reviewed as well. Finally, the entry notes some of the pedagogical implications of genre research.

Information Studies scholars such as Andersen^[1] have recognized the importance of the concept of genre especially for scholars in information disciplines. Andersen points out that the term genre does not just encompass classification of text types. Rather he suggests that using a nuanced understanding of genre to refer to “situated and typified document production and use” can assist researchers to have a “more informed understanding of the ways in which information systems help, or fail to help people in their work” (p. 341). In fact, from a variety of perspectives genre researchers have developed theoretical and methodological tools to investigate texts in their social contexts. This research could assist information discipline scholars in enriching their own understanding of the important social action of categorization.

This entry provides overviews into the two main areas investigating the concept of genre: Rhetorical genre studies (RGS) and Linguistics. Because genre scholars are concerned with the interaction between texts and their social contexts, some relevant social theories are also described. Finally, since many investigations into genre have occurred in educational or workplace settings devoted to training, several theories of particular importance to teaching and learning are also reviewed.

RHETORICAL GENRE STUDIES

Rhetorical genre studies surfaced in the North American academy in the early 1980s and was adopted and refined by researchers particularly in professional communication who recognized its importance for investigating workplace communication practices. From the RGS perspective, either genres are not just classifications of texts (such as poetry versus the novel) or classification itself as an enterprise means much more than simply slotting texts into various categories. As its name suggests, RGS

began among rhetorical scholars namely Bitzer,^[2] Campbell and Jamieson^[3] and most importantly, Miller^[4] in reaction to traditional rigid systems of classifying texts according to regularly occurring features. Classical rhetoricians, Aristotle^[5] for example, designated persuasive texts into one of three categories. A text or speech could be forensic, epideictic, or deliberative. Thus, forensic discourse tended to occur in law courts and focus on past actions in order to determine guilt or innocence; epideictic speeches, associated with the present, emerged in ceremonial occasions such as weddings or funerals and elaborated on praising or blaming an individual; and deliberative performances occurred in political venues and were intended to move their audiences to future action. This system, as useful as it might have been for classical rhetoricians, breaks down in the face of complex modern texts such as a report that might combine a forensic analysis of a problem together with a deliberative plan to address the problem. Nor does it account for the various ways that a report might appear in different organizations. In fact, what a report entails can differ significantly in government agencies, engineering companies, or hospitals. And yet people in these organizations do classify oral events and written documents such as reports and know among themselves what they mean and expect in a meeting, interview, case presentation, record, consultation letter, or any of the other multitudinous tasks that people accomplish in their daily lives.

Miller asserted that genres were, in fact, forms of social action—that they functioned to coordinate the work of organizations or to accomplish some kind of significant task for individuals. Miller based this argument on Campbell and Jamieson’s insight that “a genre does not consist merely of a series of acts in which certain rhetorical forms recur. . . Instead a genre is composed of a constellation of recognizable forms driven by an internal dynamic” (p. 21). As Miller explains, this sense of an “internal dynamic” is

crucial because it conveys the sense that these language events emerge as fusions of substantive and stylistic features in response to specific situations. Using Bitzer's notion of "exigence," Miller suggests that people in their social networks or contexts over time both recognize the need to respond (exigence) to specific situations and to typify those situations. For example, healthcare workers have long recognized the need to record their observations, consult with experts, and transfer information about patients in order to accomplish their work. Over time these practitioners developed ways to handle these needs and these strategies evolved into recognizable text types or oral speech events such as patient records, consultation letters, and case presentations. These already existing structures, fusions of content, style and organization, now facilitate practice in these settings, and newcomers have to learn how to wield them in order to get their work done.

Miller's insights were important for several reasons. She recognized the pragmatic function of genres (they get work done) and that this work occurred in social settings such as workplaces and not just in literary texts. She argued that genres constitute epistemological categories (types evolved and created by their users) and were composed of sets of content, stylistic features, and organizational structures that tended to re-occur within these typified events. In short, Miller's reconceptualization of genre as a theoretical concept opened the way for professional communication researchers to investigate texts in their social contexts. Researchers who operationalized and refined Miller's insights include Winsor^[6] and Artemeva^[7] in engineering, Smart,^[8] Orlikowski and Yates,^[9] and Schryer^[10] in business communication, Spinuzzi^[11] in software development, and Devitt^[12] and Bawarshi^[13] in composition studies.

Another important source for the renovation of genre theory was the work of Bakhtin^[14] and his circle including Volosinov.^[15] Although Bakhtin developed his ideas during the 1920s and into the 1930s (and mostly in reaction to de Saussurean linguistics and literary formalism) his dynamic ways of thinking about language did not enter into the North American academy until the 1970s and even the 1980s. Rhetoricians such as Bialostosky,^[16] Kent,^[17] Klancher,^[18] anthropological linguists such as Hanks,^[19] and professional communication researchers such as Schryer,^[20] Cross,^[21] Berkenkotter and Huckin^[22] recognized the relevance of Bakhtin's insights for investigating texts in their contexts. As Dentith^[23] notes, central to Bakhtin's thought is the basic principle "that communicative acts only have meaning, only take on their specific force and weight, in particular situations or contexts" (p. 3).

Two key terms—utterance and speech genre—evoke Bakhtin's dynamic way of conceptualizing language and constitute his major contribution to genre theory. As he explains in "The Problem of Speech Genres," the primary unit of communication is not the sentence or the word but

the utterance. The utterance is "individual" and "concrete" and generated by participants in the "various areas of human activity" (p. 60). The utterance is inherently, he suggests, addressing and responding to another person or collective of people. This understanding of language stands in direct opposition to traditional linguists (such as de Saussure) who see language as an objective system with classifiable elements (*langue*) that the writer or speaker operationalizes (pp. 67–69). Instead Bakhtin sees that as we speak or write we are always shaping our language for real or imagined others. For example, a dictionary definition of the word *right* would indicate that it is an adjective meaning *correct*. However, note what happens in the following conversations.

1. A mother and teen-aged daughter are watching TV.
 Mother: Doesn't he (referring to news anchor) look good today?
 Daughter: Yeah, right (said quickly, emphatically, and sarcastically).
2. A mother is driving her adult son back to his apartment. He is a doctoral student trying to finish his dissertation.
 Son: You know, my advisor tells me that I have to produce three publishable articles before I complete my dissertation. So I think I am going to have to take an extra year to get everything done.
 Mother: Right (said very slowly while she nods her head).

In the first instance *right* does not mean correct but might mean something like *you must be out of your mind*. In the second instance *right* might mean something like *I respect your decision but can see some financial implications that we will have to discuss later*. The utterance captures this process wherein speakers and listeners, writers and readers, inflect on the fly their language to mean something appropriate for that person and that situation. Furthermore, as these examples suggest, an utterance "is a link in a very complexly organized chain of other utterances" (p. 69). The utterance *right* is a response to an utterance and could generate a host of other utterances.

This profoundly situated understanding of language might suggest that for Bakhtin communication is indeterminate and chaotic. However the concept of "speech genre" provides a balance. He suggests that although utterances are individual "each sphere in which language is used develops its own *relatively stable types* of these utterances" which he calls "*speech genres*" (original emphasis, p. 60). He indicates that genres are heterogeneous and range from "short rejoinders of daily dialogue...to the fairly variegated repertoire of business documents" and include the "diverse forms of scientific statements and all literary genres" (pp. 60–61). Bakhtin's theory can accommodate this diversity because he posits that speech genres are both centrifugal and centripetal.

The centrifugal quality of utterances or speech genres refers to the forces of change (de-normalizing, clowning, or mimicry) that occur within text types; whereas the centripetal quality refers to the social forces that attempt to keep an utterance stable. An important feature of Bakhtin's thought is that both actions (stabilizing and destabilizing) co-occur within utterances.

Because of their very heterogeneity, speech genres can be difficult to identify. However, Bakhtin provides some features that allow researchers to argue that a specific language event could be defined as participating in a genre. He notes that a change of speaking subjects or a sense of *finalization* marks the boundary of a speech genre (p. 76). Like Miller, Bakhtin sees that agents in their social milieus simply know when a speech event has been accomplished and when or if they can interrupt and start a new utterance or chain of utterances. Bakhtin points to three aspects whereby social agents can recognize that the speech event is complete and that they can respond: "1) semantic exhaustiveness of the theme; 2) the speaker's plan or speech will; and 3) typical compositional and generic forms of finalization" (pp. 76–77). In some contexts such as the military, the semantic resources can be limited (for example requests and orders) whereas in other contexts semantic resources can be rich as in creative or scientific endeavors. His understanding of genres as affected by the speaker's plan is particularly interesting as he suggests that speakers and listeners together enact a genre. He explains "We learn to cast our speech in generic forms and, when hearing others' speech, we guess its genre from the very first words; we predict a certain length. . . and a certain compositional structure; we foresee the end" (p. 79). In a way genres function very much like a piece of jazz. When the first performer lays down the track or musical line, the other performers improvise around it, and all the performers know by listening and looking at each other when the piece is completed. Many of our daily language events such as interviews, condolence letters, and classroom interactions have this felt sense of improvisation within structure. As Kent^[17] explains, genres are like "guessing games we employ in order to produce utterances and to understand the utterances of others" (p. 46).

Finally, Bakhtin indicates that "typical compositional and generic forms" (p. 77) mark specific genres. In some contexts, especially those associated with power, these typical features can seem regulated, "compulsory and extremely stable" (p. 79). But in most situations genres are "flexible, plastic, and free" (p. 79). In other words, speakers and writers, when they launch into a genre, do not actually know which strategies they will use to accomplish their purpose but they also tend to stay within a generic range so as to accommodate their readers' or listeners' expectations.

Bakhtin's insights into genre shifted the ground for communication researchers in several important ways. First, his work obviously extends concepts of genre far

beyond literary texts into examining the powerful genres such as records, reports, and letters that constitute our social worlds. Secondly, his insights, like those of Miller's, offer a way to theorize the process of classifying utterances. It really matters how social agents classify their text types or speech events. These classifications tell researchers a great deal about what a group values and recognizes as assisting in accomplishing its social purposes. At the same time, however, these same utterances are not simply instances of a category. Because each instance of a genre is addressed to a different context, audience, and time, it evokes a different set of strategies within an acceptable (to participants) range. In effect, genres are abstractions or ever changing sets of socially accepted strategies that participants can use to improvise their responses to a particular situation. As I^[20] suggested in an early study of veterinary medical records, genres are "stabilized-for-now or stabilized enough sites of social and ideological action" (p. 200). This definition expresses the sense that genres are just stabilized enough so that agents can accomplish their social purposes but that genres are constantly evolving. Finally, Bakhtin's work suggests that utterances or genres are the socially situated ways that we learn to communicate. Rather like a singer who learns to sing by singing songs, we all learn to communicate through these constellations of resources.

RGS researchers, using a range of qualitative methods, have profited from a synthesis of Miller's and Bakhtin insights into order to investigate the social contexts that both structure and are structured by specific texts. To name just a few, Smart's^[8] work has investigated reading and revision practices associated with banking; Hanks^[19] has investigated historical government documents; and Bazerman^[24] and Spinuzzi^[11] have explored genres as existing in networks or systems.

GENRE RESEARCH IN LINGUISTICS

Although both RGS and genre researchers in linguistics recognize the relationship between texts and their social contexts, it is fair to say that RGS has often concentrated on investigating the social practices associated with text types; whereas genre research in linguistics has often focused on analyzing the textual features found in various text types. The development of genre studies has also experienced more controversy in linguistics than it has in RGS.

In fact, the recognition of the dynamic interaction between texts and their social contexts captures an intense debate that has been occurring within linguistics. For some time, applied and critical linguists have disparaged each other's projects. Applied linguists, mostly from the systemic functional linguistic (SFL) tradition, have critiqued critical discourse analysis (CDA) for its failure to

develop rigorous methodologies, especially in terms of precise terminology for analyzing text.

According to Chapelle,^[25] SFL views “language as a social semiotic a resource people use to accomplish their purposes by expressing meanings in context.” Although SFL provides ways to analyze syntactic structures, as a theory it insists that the functions of language are central. Consequently, the dynamic interaction between social contexts and language are central for SFL. Much of SFL stems from the work of Halliday and his many collaborators.^[26,27]

As Wodak^[28] explains, CDA involves “an interdisciplinary approach to language study with a critical point of view” for the purpose of studying “language behavior in natural speech situations of social relevance.” Kress^[29] notes that CDA differs from other forms of linguistic analysis as it has an overt political agenda—exposing relations of power.

Luke^[30] for example, points out that CDA does not have a consistent taxonomy. The CDA researchers such as Young and Harrison,^[31] on the other hand, have challenged SFL to move beyond descriptions of linguistic structures to accounts that provide a “social critique by documenting structures of inequality” (p. 2).

The terms of this debate are echoed in applied linguistic genre research. Applied linguists, especially those interested in issues related to second language learning, literacy, and pedagogy have found the concept of genre particularly useful. One group, especially associated with English for Specific Purposes (ESP) (much of the ESP understanding of genre derives from Swales^[32] focus on text types as characterized by specific organizational structures or moves), has provided detailed descriptions of the moves or “schematic structures”^[33] within genres as diverse as the research article,^[34] grant proposals,^[34,35] and business letters.^[36] Another group, more influenced by SFL, has emphasized the social purposes of genres and has sought to explain not only the moves of specific genres but also lexical, grammatical, and cohesive patterns. The work of Cope and Kalantzis^[37] and Martin^[38] has contributed significantly to this group, often called the Sydney School. This school, in particular, points to the pedagogical implications of genre research and claims that the often tacit rhetorical and linguistic choices within powerful genres need demystification for those with less access to privileged forms of education. Consequently, these scholars call for more overt teaching of genres in order to resolve this inequity.

The Sydney School also critiques RGS researchers on two counts. They note that North American genre researchers through their dependence on qualitative studies have focused on exploring social context rather than texts and that RGS has failed to link genre research to pedagogical issues. RGS advocates, on the other hand, have critiqued linguistic genre research, especially the Sydney School, for abstracting genres from their social contexts and attempting to codify them.^[39] The pedagogy

associated with this type of research, they suggest, fails to address issues related to situated learning. Gee et al.^[40] effectively dramatize the issue by pointing to the discourses associated with law school. They point out that law students are not directly taught the strategies associated with legal discourse. Rather they are subjected to an immersion program wherein they learn “inside the procedures, rather than overtly about them” (p. 13). This immersion program works for two reasons. First, as Gee et al. point out, trying to spell out the rules of the game involved in doing law would only offer a “panacea” (p. 12). They assert that, “All that goes into thinking, acting, believing, valuing, dressing, interacting, reading, and writing *like a lawyer* cannot be put overtly into words” (p. 12) and the attempt to codify all these strategies would produce stilted performances. Secondly, learning inside procedures ensures that a learner “takes on perspectives, adopts a worldview, accepts a set of core values and masters an identity without a great deal of critical and reflective awareness” (p. 13). No field or organization wants its newcomers to question its basic values as such questioning would undermine the kinds of “fluent and fluid performances” (p. 13) that mark a speaker as a member of a field. Of course, Gee et al. suggest that field-specific discourses should be critiqued but not during the process of acquiring them.

Critical Discourse Analysts critique both RGS and other linguistic projects for being too descriptive and for failing to deal with issues of power and hegemony. As Luke^[30] explains CDA advocates for “principled reading positions and practices for the critical analysis of the place and force of language, discourse, text, and image in changing contemporary social, economic, and cultural conditions” (p. 97). In fact, what sets CDA analyses apart is their, as Luke explains, “attempt to inform text analyses with broader social theory” (p. 101). This emphasis has resulted in diverse studies of public discourse,^[41,42] racism,^[43] and organizational discourse^[44] that focus on issues of power and hegemony.

Until recently, RGS scholars, genre researchers in applied linguistics, and CDA scholars have not been addressing each other’s research. In fact, these groups all offer useful resources for genre-focused projects. Genre research can only profit from a combination of RGS with its strong commitment to rigorous qualitative studies and the rich development of linguistic concepts in the work of Swales,^[33] Hodge and Kress,^[45] Stillar,^[46] Hyland,^[32] and Giltrow.^[47]

SOCIAL CONTEXT THEORIES

Much of the integration within genre studies has been made possible by the incorporation of the social theories exploring the relationship between structure and agency. Genre research has always struggled with issues of

agency. Critics of genre theory have complained that the concept of genre implies rigid discourse structures that impose actions on agents. In order to develop models of research that negotiate the difficult terrain between power, social structures, and agency, some genre researchers have turned to the theoretical and methodological resources present in social theories such as those of Giddens,^[48,49] Bourdieu^[50,51] and Engeström^[52,53] that investigate the dynamic between agents (readers and writers), their products (genres), and social contexts. Central to Giddens'^[50] work, for instance, is his insistence on the "mutual dependence of structure and agency" (p. 122). Giddens rejects structuralist and functionalist notions that conceptualize social structures as abstract systems outside of time. Such accounts describe agents as either fully in control of their own operations or as fully subject to their social contexts. For example, in de Saussurean linguistics, language users are conceptualized as fully in control of their language systems; whereas in Levi-Straussian structuralism, agents are at the mercy of systems (such as systems of myths) which compel them to articulate essentially the same structure (despite discrepant details). Neither account explains, in Giddens' view, the complex and nuanced way that human agents are affected by and reproduce their social environments. Rather Giddens suggests that agents bring with them their memories of past experiences and/or they use already existing structures—such as reports, meetings, memos, patient records, etc.—to guide them in their interactions with other social agents. These already constructed social structures are filled with "rules" or the resources and constraints that enable and constrain the constant reproduction of social life. However, as Giddens explains, these "rules" are not like the rigid rules present in a game of chess. Rather they are more fluid, emergent and dependent on the collective agreement of those involved in the interaction (pp. 118–120). He also asserts that agents can change these social structures in the midst of social interaction. As he puts it, "*All reproduction is necessarily production, however; and the seed of change is there in every act which contributes towards the production of any 'ordered' form of social life*" (p. 101, emphasis in original). For Giddens, in fact, all social contexts are ordered but changing social accomplishments—constantly being co-constructed by social agents.

Giddens' insights help explain how relationships exist between texts and their social contexts. For instance, my interdisciplinary research group^[54] investigated the effect of medical case presentations on new physicians. We noted that the case presentation preexists the students who use it. It is filled with rules and resources that both constrain and enable the performance of their cases. These rules and resources resonated with professional attitudes and values. At the same time the case presentation can only exist if users reproduce it, and no case

presentation ever uses the exact same rules and resources as another case presentation even in the same setting even though the users recognize the case presentation as a recurrent event.

Giddens also offers useful methodological insights. He parallels his focus on agency with an insistence that agents "are able to explain most of what they do, if asked" (p. 93). Researchers need to include participant information in their data collection because social agents have access to both discursive and practical knowledge about their routine activities. Social agents, according to Giddens, are reflexively monitoring their own activities and have valuable explanations (discursive knowledge) of their practices. At the same time agents have tacit, "practical knowledge" or "knowledge embodied in what actors 'know how to do'" (p. 126) in their daily activities. Consequently, researchers need to develop methodologies that capture both kinds of knowledge.

My own work^[55] and others such as Yates and Orlikowski^[56,57] have profited from Giddens's insights. For instance, my interdisciplinary research group^[55] also investigated the resources and constraints associated with forensic letters written by physicians charged with providing an opinion as to whether a child had experienced abuse or neglect. We identified many regular features associated with these letters and yet no two of these letters are the same. Yates and Orlikowski^[56] also draw on a combination of rhetorical and structuration theories when they observe that workplaces genres such as the memo, the proposal, and the meeting are organizational genres "embedded in social processes" (p. 299) and that genres such as email both shape and are shaped by discursive practices in workplaces.^[57]

Another social theorist, Bourdieu, offers significant theoretical and methodological insights in terms of addressing issues of power. For Bourdieu, the most important aspect of social agents is that they are *social* or inhabited by "habitus." Bourdieu^[52] defines habitus as "socialized subjectivity" (p. 126). As Wacquant,^[52] one of Bourdieu's main collaborators, explains, the habitus "consists of a set of historical relations 'deposited' within individual bodies in the form of mental and corporeal schemata of perception, appreciation and action" (p. 16). Habitus, thus, is not a passive kind of socialization; it produces an active engagement wherein social agents, because of their prior experiences, recognize how to respond appropriately and even strategically to "fields" (p. 14) or specific social contexts. To respond agents must have a range of resources that predispose them to react appropriately. Thus, for example, healthcare fields accept students from academic programs that predispose them to work within healthcare paradigms. These professions or fields then further shape students to perceive, communicate, and behave in professional or acceptable ways.

The concept of "field" or "market" or "game" is central to Bourdieu's way of conceptualizing disciplines,

organizations, or social systems and their relationship to power. For Bourdieu,^[52] society is not a seamless totality, but rather an “ensemble of relatively autonomous spheres of play” (p. 17). He^[51] explains that a game, market, or field is a “structured space of positions in which the positions and their interrelations are determined by the distributions of different kinds of resources or capital” (p. 14).

In other words, agents are structured by their experiences within a field. At the same time they also structure or reproduce those fields but not in purely reductive ways. Rather, because agents occupy different positions within their fields (and thus have different access to power) and because fields themselves occupy different positions in relation to each other, agents enact different strategies (although only within a specific range). Bourdieu^[58] calls these regulated, improvisational strategies, triggered by the interaction between habitus and field, “the logic of practice” (p. 112).

Integral to habitus is linguistic habitus,^[52] or the improvisational communication strategies that agents use to enhance and distinguish their own position. Language, particularly that aspect of language called style, is deeply implicated in this struggle to succeed. Bourdieu observes that “style exists only in relation to agents endowed with schemes of perception and appreciation that enable them to constitute it as a set of systematic differences” (p. 39). Furthermore, this process of differentiation, or style production is deeply implicated in the reproduction of symbolic power. Bourdieu notes that:

This production of instruments of production, such as rhetorical devices, genres, legitimate styles, and manners and, more generally, all the formulations destined to be “authoritative” and to be cited as examples of “good usage,” confers on those who engage it a power over language (p. 58).

As instruments of production, some genres, especially those enacted by well-positioned agents in well-positioned fields such as medicine, can reproduce forms of symbolic power that can literally shape their receivers’ views of the world. From Bourdieu’s perspective, then, genres can be seen as constellations of regulated, improvisational strategies triggered by the interaction between individual socialization, or “habitus,” and an organization or “field.”

Bourdieu, like Giddens, also provides methodological insights. He suggests that two types of analyses are needed in order to uncover the structures that maintain and reproduce power.

First, we push aside mundane representations to construct the objective structures (spaces of *positions*), the distribution of socially efficient resources that define the external constraints bearing on interactions and representations. Second, we reintroduce the immediate, lived experience of agents in order to explicate the categories of perception and appreciation. (p. 11, emphasis in original)

From a genre perspective, the first step entails the close reading of a set of text types, suspected to be participating in a genre, in order to describe and critique the kinds of strategies evoked within this discursive event. Already existing terminology from linguistics can prove useful at this stage. The second step involves interviewing readers and writers and asking them for explanations for their strategies and problem-solving techniques.

Bourdieu’s insights resonate across much genre studies in work such as that done by Devitt^[12] and Bawarshi.^[13] My own work^[10] has certainly profited from Bourdieu’s work not only in terms of developing a critical perspective that can demonstrate that certain genres can enact forms of symbolic violence but also in terms of developing a methodology that can accommodate both linguistic and qualitative forms of analysis. Another researcher, Hanks,^[19] from linguistic anthropology, has done groundbreaking work integrating Bakhtin and Bourdieu in order to create a model to investigate historical genres of subjugation in fifteenth century Mexico.

Finally, activity theory has provided additional insights to explain the complex, dialectical interaction of agents, and their social structures. According to Vygotsky,^[59] activity theory emerged as a counterbalance to simplistic notions of socialization which either envisioned individual agents as self-contained preformed entities (psychological model) or as entities totally at the mercy of their environments (behaviorist model). Instead, Vygotsky envisioned agents as learning through using tools in purposeful, goal directed activities. He saw that these tools, both physical (hammers, pencils) and cultural (language, genres), preexist their users and mediate the interaction between agents and their social environments. By using tools, human agents internalized the values, practices, and beliefs associated with their social worlds. At the same time as they become experienced users, agents can, in the midst of purposeful activity, affect their social contexts or even modify their tools. Certainly in my group’s research,^[55] we saw that, by using the mediating tool of case presentations, healthcare students were internalizing the values and practices while involved in purposeful activities that would lead to their own ability to affect future social contexts (i.e., their ability to deal with their own future patients or clients).

Engeström^[52,53] and other researchers such as Cole,^[60] Scribner,^[61] and Wertsch^[62] have extended Vygotsky work into a model for the analysis of complex interactions between agents and social structures in professional and workplaces settings. While retaining the concepts of tools mediating the socialization of agents, they have expanded the analytical concepts within the notion of system to account for more of the dialectical, or rather dialogical, interactions that occur between social agents and between social agents and their settings. Engeström^[63] defines an activity system as a system “that incorporates both the object-oriented productive aspect and the person-oriented

communicative aspect of human conduct,” and he suggests that a human activity system, “always contains the subsystems of production, distribution, exchange, and consumption (p. 67).”

Research integrating theories of genre together with activity system theory include Bazerman,^[64] Russell,^[65] Artemeva,^[66] Spinuzzi,^[11,67] Yates and Orlowski,^[68] and Varpio^[69] among many others. Activity system theory has proved particularly valuable in terms of exploring “genre sets,”^[64] systems of genre,^[65,66] or genre repertoires,^[68] in order to explain the ways that text types affect each other and create hybrid forms. Activity theory has also proved useful in terms of investigating the ways that systems of genres interact with various technologies.^[69]

LEARNING THEORIES

As noted earlier, genre theorists have been debating the impact of their contextualized findings on education. Much of the debate has focused on whether genres should be taught directly at all. On one side of the debate are members of the Sydney School^[38] who insist that genres need to be directly taught. On the other side of the debate are RGS scholars such as Freedman^[70] and Dias et al. Dias et al.,^[71] for instance, in their thought provoking comparison of writing practices in the workplace and the academy claimed that the school genres of the academy were “worlds apart” (p. 3) from workplace genres. Reflecting the purposes of schooling, educational genres typically create the circumstances wherein “epistemic” or knowledge-making tasks are evaluated on an individual basis (p. 44). As Dias et al. explain, “Within the classroom context each paper is graded in comparison to all others, and the institution has a vested interest in a quality spread” (p. 62). Workplace genres, on the other hand, mediate the interactions of agents in different ways. In workplace settings, for example, managers will intervene in writing processes as “the institutional goal is to elicit the best possible product from each employee each time writing is undertaken” (p. 62). In fact, Dias et al. conclude that the activity systems of education and workplaces differ so radically, that educational institutions cannot claim to be teaching the genres of workplace communication. This perspective, of course, is deeply troubling to educators in professional communication^[72] who claim that the strategies that students learn in professional communication classrooms translate into useful practices in workplace settings.

Much of Dias et al.’s arguments stem from their understanding of activity theory and their realization that the activity systems of the workplace and education have inherently different purposes. However, their insights were also shaped by current research into learning theory particularly the concept of “communities of practice” (COP) as developed by Lave and Wenger^[73] and later refined by Wenger.^[74] This body of work focuses on

apprenticeship experiences. Lave and Wenger describe a COP as “a set of relations among persons, activity and world, over time and in relation with other tangential and overlapping COP” (p. 98). Lave and Wenger and their many supporters also insist that learning is a natural and ubiquitous phenomenon and that it occurs most naturally and effectively within COPs through the process of “legitimate peripheral participation” (p. 34). As Lave and Wenger explain, “learning is an integral part of generative social practice in the lived-in world” (p. 35) and occurs naturally and constantly in groups consisting of expert and inexperienced members. Less expert members learn through their involvement in legitimate (recognized by the group) practices. At first this involvement is peripheral (by observing, by being assigned part of the task, by being supervised) but eventually less expert members assume full participation in the group’s activities.

More recently, research has challenged the either/or nature of this debate. Researchers such as Artemeva et al.^[75] have pointed out that activity systems and COP overlap and that often strategies learned in one context can be transferred to another. Certainly Bourdieu’s work on linguistic habitus predicts this kind of movement. At the same time students can also be taught to see text types not as rigid formalizations but as constellations of strategies that they can adjust to different circumstances. In other words, students can be taught to be ‘savvy’ users of genres. This kind of pedagogy as advocated by Giltrow^[48] means^[1] getting students to see the regularities often associated with specific text types such as academic research papers,^[2] pointing to the range of different strategies that exist among different instances of the text types,^[3] explaining the often ideological reasons for certain strategies,^[4] and advocating that students chose their strategies according to the needs of their audience and situation rather than following a rote format.

CONCLUSION

This overview of research on genre theory and research can only provide snapshots of the rich discussions about genres or texts in their social contexts that are occurring in a variety of interdisciplinary settings. These discussions could be of value to researchers in the information sciences. Most importantly, they point to the important role of categorizing. As readers and writers, speakers and listeners, we anticipate (categorize) text types and improvise with each other on the fly. We are also constantly bringing resources from one text type to another and thus experiencing constant genre hybridity. In many ways information scientists are at the heart of much genre work as they often have to reflect in their categorization schemes the ever evolving social process that is genre.

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Geographic Information Systems (GIS)

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Abstract

This entry, describing the world of geographic information systems (GIS), begins with a synopsis of the considerable academic debate over the classification of GIS as a tool or a science. The state of the art for GIS technology is described along with the current concern over the teaching of spatial thinking, a necessary prerequisite for the successful use of GIS. The importance of spatial autocorrelation in the statistical analysis of geographic data is explained. Recent developments including public participation GIS (PPGIS) and volunteer geographic information are recounted. The second part of the entry describes GIS applications and software packages along with the anticipated future for GIS. This entry concludes with a resource section that includes information on GIS Day and GIS conferences, journals, books, and organizations.

INTRODUCTION AND OVERVIEW

In 1998, *The Encyclopedia of Library and Information Science* published an entry on geographic information systems (GIS)^[1] that reviewed both the history and the body of knowledge associated with GIS. A sequel in 2001^[2] documented the progress made by the community during the following 3 years, with particular detail given to the “systems versus science” debate. For the sake of completeness and self-containment, this overview of the subject again begins with formal definitions of GIS. Next, the state of the art as it existed in 2008 is described. This is followed by a discussion of spatial thinking as conceptualized within the (generally American) educational system.

In recent years, GIS has come to represent a synthesis of science and application. The “systems versus science” debate has become passé. Internet applications have flourished, with many users unaware they were using GIS technology to create maps or obtain driving directions. This entry concludes with an overview of the near-term future of GIS and with a list of GIS resources, both online and traditional print materials. The present account does not provide a complete and comprehensive introduction to GIS, and readers wishing to learn the basics before consulting the rest of the entry are advised to go to the following online tutorials: the U.S. Geological Survey (USGS) GIS education Web site at <http://education.usgs.gov/common/lessons/gis.html> and the Environmental Systems Research Institute (ESRI) discussion of GIS presented at <http://www.gis.com/whatisgis/>. A comprehensive description of those topics belonging to the body of knowledge associated with GIS may be found in DiBiase et al.^[3]

In addition, this entry does not review the history of GIS. The reader may consult the extensive discussion in Waters^[1] or in Clarke.^[4] A complete review may be found in Foresman^[5] and comprehensive online resources are maintained with The GIS History Project (<http://www.ncgia.buffalo.edu/gishist/>). Chrisman^[6] has described the transformation of computer mapping software into GIS at the Harvard Laboratory for Computer Graphics and Spatial Analysis during the 1960s and 1970s.

MODERN DEFINITIONS OF GIS

A terse, useful definition of GIS continues to elude the community. Two views of GIS pervade the literature, differing largely because of the difference in the “S” in the acronym. Those scholars that represent the “S” as systems include Clarke,^[4] who provides a number of definitions of GIS. Clarke begins by stating that a GIS is a computer-based system for linking attribute data from a database with spatial information. He notes that a GIS can be described in various ways. Thus some authors have referred to GIS as a toolbox. Similarly, Burrough and McDonnell^[7] state that GIS is a “a powerful set of tools for storing and retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes.” Longley et al.^[8] review definitions that describe GIS as both data analysis–data display tools and as map-making tools. These definitions emphasize the applied nature of GIS and are generally used by practitioners in the field, such as the government and related industry contractors. These definitions have become more entrenched with the increasing use of software programming packages and languages (e.g., Visual Basic, Python,

and Java, among others) to create sets of procedures that specialized user groups can employ (e.g., transportation planners, see Kang and Scott^[9]).

Alternatively, the “S” in GIS can be taken to represent Science (Mark^[10]). This approach has been advocated by scholars who are actively developing new methods and who view themselves as more than simple toolmakers. Goodchild provides an overview of the differences between GISystems, GIScience and GISudies at <http://www.ncgia.ucsb.edu/giscc/units/u002/u002.html>. According to Goodchild GIScience is the science behind the technology of GIS. It is also the science that keeps GIS at the research frontier. GIScience is thus a multidisciplinary field in which cartography, cognitive psychology, computer science, geodesy, geography, photogrammetry, and spatial statistics are all important contributors.

The tool versus science debate has been reviewed by Wright et al.^[11] It has been resolved largely by the acceptance of both terms and an increased vagueness in the use of the GIS acronym. Within universities this dichotomy is evident in the number of “professional master’s” programs available largely to fill the market for increased application courses and community-based GIS funding in the vein of GISystems. GIScience remains as a realm for continued research and software development, and is popular as a specialization, minor, or additional certificate in degree programs. Academic units with a mix of GIScience and GISystems activity remain healthy.

Finally, Chrisman^[12] has defined GIS as an “organized activity by which people measure and represent geographic phenomena then transform these representations into other forms while interacting with social structures.” This definition reflects the increased interest in the use of GIS for community planning and advocacy. It is such an important new trend that it has been variously referred to as community-based GIS and Public Participation GIS (PPGIS) and more recently as VGIS where the “V” in the acronym indicates volunteer involvement. These developments are described in further detail below.

GIS: THE STATE OF THE ART IN 2008

In 2008, GIS software packages for making maps and for displaying and analyzing spatial data in a variety of ways was commonplace. Large price differences existed, with GIS software packages ranging in cost from free (for GRASS and other open source initiatives) to a few hundred dollars (for Idrisi, MapInfo, and Maptitude) to tens of thousands of dollars (for enterprise versions of TransCAD and ArcServer). These packages generally come with a graphical interface and run on the Windows operating system, although Unix-friendly server editions are becoming common. Mac OS X and Linux are poorly represented, and can only run a subset of existing GIS software without

a Windows emulator or interpreter. Open source software has been particularly successful with these operating systems, to the point that dedicated teams focus on GIS-specific Linux distributions (see information on Debian-GIS at <http://wiki.debian.org/DebianGIS>).

Conducting analysis with GIS software still requires extensive training and this is especially so if it is to be used for decision-making and policy implementation. Most GIS education and training is completed in university undergraduate programs. Post-degree diploma programs are also popular as are graduate level master’s degree programs, and employers frequently pay for such education for their employees.

Web-based GIS applications and the use of software and data online are becoming increasingly common. Many of these Web-based devices are lowering the technical know-how necessary to interact with spatial data. GPS units are capable of calculating driving directions as well as tracking traffic information from a server and rerouting the user on the fly. Cell phones, such as the iPhone, can track their location, navigate users, and check the weather with a few touches of the screen.

Spatial data is still extremely costly in most countries where cost-recovery models are often used by government agencies (see Taylor^[13] for an exhaustive discussion of this topic for various countries around the world). The United States is almost the lone exception to this approach to the provision of spatial data, and it is arguable that this has done much to spawn the world’s most active and innovative GIS industry.

Although GIS, even today, cannot be considered more than a niche application it is now a common place subject in university curricula and is frequently used as a research tool by a large number of university disciplines.^[1] In addition, it is being taught more and more in the K-12 curriculum in schools and is being used in an increasingly extensive number of applications in both the public and private sectors.

Public Participation GIS and Volunteered Geographic Information

During the last decade, GIS has been used more and more for community planning and social advocacy. Such developments have been variously described as Public Participation GIS and Participatory GIS with the acronyms PPGIS and PGIS, respectively, in common use. The most extensive set of resources for participatory GIS may be found at the portal Web site maintained by the integrated approaches to participatory development (IAPAD) organization at <http://www.iapad.org/>. IAPAD maintains a list for those interested in PGIS research and also stores numerous case studies which may be downloaded. In recent years it has promoted as participatory three-dimensional modeling (P3DM) of physical environments

and the ethically responsible use of GIS to protect lands belonging to indigenous communities.

PGIS has now been well accepted by mainstream GIS researchers with highly regarded texts such as that by Craig et al.^[14] devoted to this topic. For a number of years PGIS had its own series of conferences sponsored by the Urban and Regional Information Systems Association (URISA) although during 2006 and 2007 PGIS was again merged into URISA's main, annual conference. The PPGIS Web site (<http://www.ppgis.net/>) maintains an open forum on Participatory GIS and associated technologies.

Volunteered geographic information is an increasingly important and associated development. Software developments that include Google Earth, Google SketchUp, Wikimapia, and OpenStreetMap have allowed citizens with limited or indeed no specialized knowledge of GIS to upload their geographic knowledge to publicly accessible Web sites. This process of "geotagging" and its impact on the future of GIS is discussed by Goodchild.^[15] The Geography Network (<http://www.geographynetwork.com/>) supports project Globe (<http://www.globe.gov/GaN/analyze.html>) which allows students in elementary schools to observe data, for example, the brilliance of the night sky. It is easy for these students to record their observations and upload them to a map where they can become part of a network of thousands of observations from schoolchildren around the world. As Goodchild notes, the children have become geographic sensors.

TEACHING SPATIAL THINKING

GIS Education continues to progress as spatial thinking has received attention at all educational levels. Many vendors of GIS software offer reduced or free versions of their packages for education institutions, and resource materials including data sets and lesson plans are widely available.

Schools

Recently the National Research Council has produced a major study^[16] advocating the teaching of spatial thinking and GIS across the K-12 curriculum. The authors of the report argue that spatial thinking is a constructive mix of three elements: spatial concepts, methods of representation, and spatial reasoning. Indeed the Association of American Geographers has argued recently (<http://aag.org/nclb/nclb.pdf>) for changes to the U.S. No Child Left Behind Legislation that would see an appropriation of funding in this legislation for the teaching of geography and GIS.

It can be argued that GIS should be incorporated into the K-12 curriculum for several reasons. First, it helps with the teaching of geography, a core academic discipline. Major software manufacturers such as ERSI (<http://www.esri.com>)

have made available at no cost software such as ArcGIS Explorer which, at the time of writing is available with seven worldwide coverages that include various themes such as physical relief and political boundaries. Second, spatial thinking is advocated because it helps with other disciplines such as the physical, mathematical and environmental sciences. Third, it prepares students to be better citizens in that the data embedded within a GIS provides them with an understanding of other regions of their country and of other countries within the world. A GIS also prepares them to interact with the world in a more effective manner as an entrepreneur or merely as someone who can use an in-car navigation system more resourcefully.

Evidence to support improved spatial thinking and education in the National Research Council Report is contained in Chapter 4 and Appendix C of the study. Unfortunately, most of this research is dated and will have to be revisited if the council is to succeed in its goal of developing new GIS software that is age appropriate in its design, scope, and sequence.

Information on geographic information technology for teachers and the lay person may be found at http://geography.about.com/od/geographictechnology/Geographic_Technology.htm. A complete set of links summarizing articles, lesson plans, and software for teaching GIS in the K-12 curriculum is available at <http://www.esi.utexas.edu/gk12/lessons.php>.

GIS and geography teaching in elementary and secondary schools has moved forward quickly since 1990. Bednarz and Bednarz^[17] take an optimistic view of the progress that has been made and how future challenges may be addressed. Doering (<http://gis2.esri.com/library/userconf/educ02/pap5039/p5039.htm>) has analyzed the effectiveness of various strategies for teaching about GIS in the K-12 curriculum (see also Doering and Veletsianos^[18]).

Simply put, GIS is a highly effective way of teaching schoolchildren about their world. There is, however, a steep learning curve for teachers and professional development resources constantly need to be upgraded (McClurg and Buss^[19]). Others have argued for a minimal GIS software package that increases in complexity with grade level and focuses on the introduction of geographical concepts appropriate to a child's intellectual development (Marsh et al.^[20]).

Resources for teachers may be found at a link on the ESRI Web site at <http://www.esri.com/industries/k-12/education/teaching.html>. These resources include lesson plans for a variety of ages and skill levels. A list of resources for teachers including annotated bibliographies of the use of GIS in the K-12 system may be found at the Web site <http://gislounge.com/k-12-education-in-gis/>. Links to resources on best practices and "white papers" discussing the future of GIS in school education may be found at this link on the ESRI Web site: http://www.esri.com/library/whitepapers/pdfs/higher_ed.pdf.

The work of the National Center for Geographic Information and Analysis (NCGIA) at the University of California at Santa Barbara in supporting the integration of GIS into the secondary school curriculum may be seen at the following Web site: <http://www.ncgia.ucsb.edu/education/projects/SEP/sep.html>. This Web site also contains links to other sites providing resources and support for K-12 GIS initiatives. Resources for schools in the United Kingdom and a sourcebook that may be ordered online can both be found at http://www.abdn.ac.uk/gis_school/.

A new trend is the linking of qualitative geography to GIS (Mei-Po Kwan^[21]). This development may also unite interest in another new area of research, Children's Geographies (see the new journal of that name and introductory editorial by Matthews^[22]). Children and youths may be used to supply volunteer information that can be incorporated into GIS (see discussion above and Dennis^[23]).

Despite all these developments the reality is that in the year 2008 many schools still do not have the computers or the teacher expertise to take advantage of the resources that are available to them on the Internet. It can only be hoped that this will change in the coming years.

Universities

University education in GIS grew substantially after the introduction of the core curriculum in GIS by the NCGIA in 1990. The original core curriculum was designed to provide university faculty with notes for 75 lectures that represented a year-long introduction to the fundamental issues and concepts in GIS. This curriculum was remarkably successful and about 2000 copies were distributed to over 70 countries after being translated into at least eight languages (including Portuguese, Chinese, Hungarian, Japanese, Korean, Polish, Russian, and French). It may still be found at <http://www.geog.ubc.ca/courses/klink/gis.notes/ncgia/toc.html>.

The new Core Curriculum in GIScience may be found at <http://www.ncgia.ucsb.edu/education/curricula/giscc/> and is still under development. It includes two sets of lecture notes specifically on teaching GIS within a university setting http://www.ncgia.ucsb.edu/education/curricula/giscc/units/u158/u158_f.html. A core curriculum for the closely related field of remote sensing may be found at <http://userpages.umbc.edu/~tbenja1/umbc7/>.

A related occurrence has been the NCGIA's development of CSISS (The Center for Spatially Integrated Social Science <http://www.csiss.org/index.html>).

GIS research and teaching in Universities in the United States has been substantially stimulated through the creation of the University Consortium for Geographic Information Science [UCGIS; (<http://www.ucgis.org/>)]. The UCGIS defines its mission to be "an effective, unified voice for the geographic information science research community." A listing of university-based, GIS courses in the United Kingdom may be found at <http://www.agi.org.uk/> under the Education Link. University based GIS research in the U.K. was also supported by the Regional Research Laboratory initiative.^[1] Canadian GIS degree programs may be accessed at http://www.canadian-universities.net/Universities/Programs/Geography_and_GIS.html.

org.uk/ under the Education Link. University based GIS research in the U.K. was also supported by the Regional Research Laboratory initiative.^[1] Canadian GIS degree programs may be accessed at http://www.canadian-universities.net/Universities/Programs/Geography_and_GIS.html.

Masters courses

In recent years, master's degrees have proliferated at universities in the United States and in many other countries around the world. A listing of these programs, including distance-based offerings, may be found at http://www.ucgis.org/priorities/education/GIS_Cert+Masters_Prog/certificates.htm. Many of these master's degree programs now include modules on programming in GIS. Popular choices for programming languages include Visual Basic, Java, C, C#, and C++ . Students find these courses most attractive and often feel that their education in the GISciences is not complete without some basic training in programming. The more important software vendors such as ESRI (see below) are moving away from their own, proprietary scripting languages toward industry standard languages such as Visual Basic.

In some cases these masters programs have been seen as terminal, professional degree programs which supply a need generated by the GIS industry. Others have seen them as the ideal "springboard" into Ph.D. research in Geography and other disciplines such as Archaeology that use spatially distributed data (see the Web site at http://www.le.ac.uk/geography/postgraduate/msc_gis_hg.html which discusses the Master of Science degree in GIS at the University of Leicester).

Colleges

The NCGIA has developed a core curriculum for technical programs taught in colleges and this may be accessed at <http://www.ncgia.ucsb.edu/education/curricula/ccpt/Welcome.html>. GIS has found a particularly successful niche in technical colleges that offer postgraduate diploma programs. One of the oldest and most successful of these programs has been taught at the College of Geographic Sciences in Nova Scotia, Canada, since the early 1980s. A description of this program may be found at <http://www.cogs.ns.ca/Programs/Geomatics/>. A partial listing of some of the better known college programs in GIS may be found at http://www.ncgia.ucsb.edu/education/curricula/ccpt/resources/example_courses/examples_f.html.

Virtual Campuses

Distance education is a well-established method of instruction in GIS and is sponsored by the UCGIS organization among others. A "white paper" on this topic may be found at (<http://dusk.geo.orst.edu/disted/>). Links to many

U.S. sites that offer distance education may be found at this location together with a link to the UNIGIS International site (<http://www.unigis.org/>) which has offices in 10 separate countries around the world. Perhaps one of the most outstandingly successful attempts at distance education is ESRI's virtual campus which may be found at <http://training.esri.com/gateway/index.cfm?fa=trainingOptions.gateway>. These courses may be either self study or instructor led.

While distance-based education represents an affordable and convenient way of learning about GIS or indeed any other subject it is not without its critics such as Noble.^[24]

SOFTWARE PACKAGES

Software vendors have done much to popularize the use of GIS in academia, government, and industry. This they have achieved by sponsoring software distribution, conferences, Web sites, Web services, and trade newsletters. Here the activities of a number of the more important vendors and software developers are described. Most software vendors now support their own online listserves, Web knowledge banks, and other interactive communities in order to resolve problems for their user base. Information on Open Source GIS software may be found at the Open Source Geospatial Foundation Web site (<http://www.osgeo.org/>) and is discussed in more detail below. A survey of this software undertaken in late 2007 is available at http://www.foss4g2007.org/presentations/view.php?abstract_id=136. The rest of this section lists the leading commercial GIS software.

ESRI

Founded in 1969, ESRI (<http://www.esri.com/>) continues to dominate the industry as the GIS market leader. ESRI offers various configurations of its ArcGIS software. The current version of the ArcGIS software is 9.3 but new releases occur about every 6 months. The Desktop configuration has three components: ArcGIS Desktop, ArcGIS Engine, and ArcGIS Explorer (<http://www.esri.com/products.html#arcgis>). The Desktop product allows for the creation, editing, and analysis of geographic data and the development of professional, publication-quality maps. ESRI provides a server configuration for delivering maps and geographic data across an organization and over the Web. This configuration requires their ArcGIS Server and Image Server products. ESRI's Mobile GIS products include ArcGIS Mobile and ArcPad, products that allow the development of GIS products in the field and full use by clients with mobile devices including phones. ESRI offers data in various formats to populate these GIS products and also as Web services that are available online (<http://www.esri.com/software/arcwebservices/index>

[html](http://www.esri.com/software/arcwebservices/index)). Other organizations that offer Web services include GIS factory (<http://gisfactory.com/webservices.html>) where the services include address finders, district finders, and route finders (http://gisfactory.com/whitepapers/wp_giswebservices.pdf).

ESRI sponsors the ArcWatch e-mail newsletter, the ArcUser magazine, and the ArcNews publication. In 2008 it will hold its 28th annual user conference (<http://www.esri.com/events/uc/index.html>), one of the most popular and enduring of all the yearly GIS conferences. Recently attendance at this premier, vendor-sponsored conference has been around 14,000 attendees. The functionality of the ESRI ArcGIS software has been augmented by a series of extensions that can be deployed to perform specific functions. For ArcGIS these include extensions for analysis, such as Spatial Analyst and Network Analyst, for productivity including, Publisher and Street Map, and solution based software such as Business Analyst and Military Analyst and, finally, Web services. A complete list of ESRI supported extensions may be found at http://www.esri.com/software/arcgis/about/desktop_extensions.html. Extensions developed by their partners may be found at <http://gis.esri.com/partners/partners-user/index.cfm>. A review of these extensions, organized by application type, is provided by Limp,^[25] an article which may be accessed by registering at the GeoPlace Web site (<http://www.geoplace.com>), a GIS industry Web portal. Some extensions are packaged in the form of toolboxes that perform specific GIS operations that are often missing from the standard GIS packages. A prototypical example is Hawth's Tools that provides functionality for a variety of spatial, sampling, and animal movement operations and may be found at the spatial ecology Web site (<http://www.spatial ecology.com/htools/tooldesc.php>).

IDRISI

One of the most popular, affordably priced, GIS products is Idrisi which was developed in 1987 by Ron Eastman and is now supported by Clark Labs at Clark University in Worcester, Massachusetts (<http://www.clarklabs.org/>). Idrisi's roots are as a raster GIS and as such it has been most widely used in resource management, land use change, and image processing applications. At the time of writing, the Andes Edition, the 15th major release, was the current version of this enormously popular GIS software package. The unusual name of the software owes its origins to the famed, twelfth century, Moroccan cartographer, Muhammad al-Idrisi. The Idrisi software is a fully functional GIS and image processing package that is now used in more than 175 countries. It has an especially rich and diverse set of processing modules for analytical research that include the first ever machine learning algorithms for use in a GIS and image processing system, soft classifiers, multi-criteria and multi-objective decision making that provided the first GIS implementation of

Saaty's Analytical Hierarchy Process (Saaty^[26]), sophisticated geospatial statistics, and a dynamic modeling routine that is implemented through a graphical interface.

Intergraph

Intergraph is ESRI's chief competitor for the title of GIS market leader and has been providing GIS and related software for 35 years. Intergraph has a suite of GIS-related products including its GeoMedia products (<http://www.intergraph.com/geomediasuite/>). Intergraph also sponsors its own annual user's conference and publications including the trade publication, *Insight*, which is available online together with Intergraph's e-Connection Newsletter. Intergraph works with business partners such as Hansen Information Technologies (<http://www.hansen.com/>) to provide additional geospatial functionality, in this case for asset management and transportation and related solutions.

MAPINFO

Since 1986 MapInfo Corporation, Troy, New York (<http://www.mapinfo.com/>) has been producing affordable GIS software that is eminently suited to desktop mapping and such applications as geodemographics and target marketing. MapInfo emphasizes location-based intelligence especially in the field of business planning and analysis. It too supports an annual conference, the MapWorld Global User Conference, and provides customer support through online user groups.

Caliper Corporation

Caliper Corporation, Newton, Massachusetts (<http://www.caliper.com/>), produces one of the most sophisticated low-cost GIS desktop mapping products available, Maptitude. This software comes complete with extensive data sets from the U.S. Bureau of the Census and is ideal software for many GIS applications and has been favorably reviewed. A special version of Maptitude is available for building and analyzing political and other redistricting plans. Caliper Corporation's flagship product is TransCAD, a transportation GIS package that has the most complete set of transportation planning and related routines available in any GIS package. The latest release of this software, Version 5, is also produced as a Web mapping package that may be used for developing online transportation planning applications. One suggestion is that this software could be used to do online travel surveys greatly reducing the cost of traditional in-house, paper-based surveys (<http://www.caliper.com/web/gist2002.pdf>). Caliper Corporation is now marketing a GIS-based traffic simulation package, TransModeler.

Autodesk

Autodesk, San Rafael, California (<http://www.autodesk.com>), is the major software developer in the Computer Assisted Drafting market with its AutoCAD product. In recent years it has also added desktop mapping and GIS to its product line with its Map 3D product.

Bentley

In a 2006 study the Daratech organization (<http://www.daratech.com/>) rated Bentley Systems, Inc., as the number two provider of GIS systems worldwide. Their flagship GIS/CAD product, Microstation, was originally developed for Intergraph. It is now available as Bentley Map.

Manifold

Manifold (<http://www.manifold.net/index.shtml>), manufactured by CDA International Ltd., is a low cost GIS that is highly popular with organizations that have limited budgets and lack the technical expertise to work with open source software. It has an online users' support group (<http://forum.manifold.net/forum/>). It is a full featured GIS that in its current release of 8.0 offers 64 bit processing, an Internet map server, and is available in personal and enterprise editions.

Free and Open Source Software

There are numerous GIS packages now available in various amounts of free and open-source packages. GRASS (the geographic resources analysis support system) has made large strides in development since its release under the open source GPL license in 1999 (<http://grass.itc.it/>). It is designed primarily to work on Linux and other operating systems that use X windows (not to be confused with Microsoft Windows).

GeoDA is a specialized analysis tool used to examine spatial autocorrelation and related spatial regression analyses implemented on Windows. PySal (python spatial analysis library) is a shared set of libraries for both GeoDA and the STARS software that is available at the Regional Analysis Laboratory at San Diego State University (<http://regionalanalysislab.org/>).

Software, such as the crime analysis package, Crimestat (<http://www.icpsr.umich.edu/CRIMESTAT/>), are free and used frequently in the professional world, although they are not truly open source. GIS also shares a great deal of overlap with the PostgreSQL and MySQL server backends, and postgis serves as "spatially-enabled" upgrade for PostgreSQL and has been implemented in both the U.S. and U.K. Programs such as terraview (<http://www.terralib.org/>), and mapserver (<http://mapserver.gis.umn.edu/>) have more niche audiences but are also growing in popularity.

Geoexploration Systems

There now exist a number of competing technologies that have been described as geographic exploration systems (Ball^[27]) or geoexploration systems. These technologies include Google Earth, Microsoft's Virtual Earth, NASA WorldWind, and ESRI's ArcGIS Explorer among others. They have become extremely popular since the introduction of "mashup" technology that allows even the neophyte user to combine their spatial data with real world environments across a nation or indeed across the globe. Visualization software such as GeoFusion (<http://www.geofusion.com/>) has been developed to improve download times, allow the integration of multiple data sets, and enhance the interface of these systems. Geoexploration systems have proved extremely useful in aiding the development of participatory GIS where nonspecialists use GIS technology for advocacy planning or to protect the rights of indigenous populations (see discussion above). Volunteer geographic information has been made far more effective by the ease of use of this new type of GIS.

Geographic social networking is a new development that represents the integration of social network technology such as MySpace, video technology such as YouTube, and geoexploration systems like Virtual Earth. This approach is being pioneered by The Carbon Project (<http://www.thecarbonproject.com/>).

SPATIAL AUTOCORRELATION

Spatial analysis continues to be the crux of GIScience's growth. The forms of analysis special to geographic information have continued to be developed and remain unique to the discipline (Gould^[28]). Spatial autocorrelation, the problem of observations near each other having correlated regression residuals, and related analysis has become ubiquitous in the geography literature. Increases in computational resources have allowed for most desktop computers to be able to create weight matrices, calculate spatial autocorrelation, and map significance scores (Anselin;^[29,30] and Anselin and Florax^[31]). These tools were originally implemented in stand-alone software, but are increasingly part of commercial software such as Idrisi and ArcMap.

For more sophisticated forms of analysis, researchers are still forced to use packages such as SpaceStat (<http://www.spacestat.com/>) or the spatial statistics routines in S-Plus (<http://insightful.com>). Modern spatial analysis continues to focus on local models of spatial association (Fotheringham et al.^[32]). These Local Indicators of Spatial Association (LISA) statistics, such as Local Moran's I, are frequent in the literature. Anselin's GeoDA software is the most frequently used software employed to examine these local autocorrelation statistics. GeoDA allows for the creation and analysis of weight matrices, as well as the use of

them to account for spatial autocorrelation in modified regression analysis. Another approach has been to allow the coefficients within regressions to vary over space. This method, termed geographically weighted regression, is promoted by Fotheringham and has received a mixed reception in the literature.

Markup Languages

Markup languages are the *lingua franca* of the Internet. Since its inception hypertext markup language (HTML) has been the dominant method for encoding information for text that is transmitted over the Internet. Essentially HTML does little more than provide a "picture" of a document for the Web user. All markup languages seek to provide information about the data that is transmitted over the Internet. When that data has unique characteristics, as is the case with spatial or geographical data, it requires its own markup language.

Geography markup language has been in development since 1998 and this has been largely due to the efforts of Ron Lake and his company Galdos Systems (<http://www.galdosinc.com/>). GML v3.0 was released as ISO Standard 19136 for the storage and transport of geographic data. GML is now the standard for the GeoWeb (<http://www.geoweb.org/>). It thus allows devices that are connected to the Internet to store and transmit geographical data across the Internet permitting the efficient use of Web services. Like XML, it has also spawned other related markup languages including CityGML which enables the storage and exchange of three dimensional objects that describe urban infrastructure (<http://www.citygml.org/>). In late 2007, CityGML was officially adopted by the Open Geospatial Consortium as the preferred markup language for urban infrastructure.

More commonly, GIS data on a server is accessed through flash and JavaScript applets that do not require the screen to refresh every time the user makes a change but instead the onscreen image will change "on the fly." This has vastly increased the usability of many online GIS applications. However, it also has made it far more difficult to create these GIS systems, with more advanced training required for these software and database packages.

GIS AND ITS APPLICATIONS

A major strength of GIS has been its ability to prove itself useful in a great many application areas. The reader may find detailed discussions of the use of GIS in the management of utilities, telecommunications, emergency management, land administration, urban planning, military applications, library management, health care, political redistricting, geodemographics and target marketing, agriculture and environmental monitoring in Longley et al.^[8]

Each of these application areas has an extensive literature of its own and these are described in the various chapters included in Longley et al.'s comprehensive review of the discipline.

CERTIFICATION OF GIS PROFESSIONALS

An ongoing concern for GIS professionals has been the need for certification. Many individuals and organizations have argued that GIS professionals should be certified in a manner similar to the certification of engineers, geologists, psychologists, and others in professional disciplines. In 1998 the Urban and Regional Information Systems Association (URISA: <http://www.urisa.org/>) created a Certification Committee. After extensive industry-wide debate, the finalized portfolio-based certification program was established in 2003. This certification process was adopted and administered by the newly established GIS Certification Institute (<http://www.gisci.org/>). Certification involves establishing evidence of professional competence and ethical conduct. Until January 1, 2009, a "grandfathering" process was also permitted. At the end of 2007 almost 2000 individuals have availed themselves of the certification process.

GIS AND THE FUTURE

Judging the future of the discipline is difficult, as rapid advancements make such statements outdated by the time of publishing. Such is the case in a recent work by Reuter and Zipf (<http://www.i3mainz.fh-mainz.de/publicat/zipf05/gis.where.next-reuter-zipf.pdf>), that predicts the trajectory of a device to support trip planning that is partially implemented in a new release of the iPhone. As GIS presses onward, it will continue to be embedded within more and more electronics. While appliances such as refrigerators and stoves do not generally need location information, most devices that move today already have some sort of location-finding mechanism inside them. The future of these devices may rely on the ability to more precisely locate themselves, particularly inside buildings. Reuter and Zipf suggest this may come in a ground-based GPS system they term a "Global Universal Computer."

The amount of spatial data is blossoming and will likely continue to do so. As users mark important personal events and places linked to particular places, storage and retrieval of this data will become increasingly important. Reuter and Zipf suggest it is the storage and search of these items that will be most important. This technology may be crucial to historians and psychologists working to understand the reasons for individual behavior.

At some point, the lack of widespread spatial education will segment the population further, based on those who can use new integrated devices and those who cannot.

Technological advances will make up for some of this digital divide by simplifying interfaces. However, these new interfaces generally cannot wholly account for such differences and maintain full functionality without a significant paradigm shift.

Finally, it may be noted that GIS in the future will become more involved with the third and fourth dimensions. The third dimension is already being implemented in geographic exploration systems and the integration of products such as Google SketchUp (<http://sketchup.google.com/>) into Google Earth. The fourth dimension is time, a difficult concept to incorporate into traditional GIS software structures. Peuquet^[33] has provided part of the theoretical paradigm for this new implementation and new versions of commercial software such as ESRI's ArcGIS 9.3 make it easier to create animated visualizations of geodatabases. 3-D/4-D GIS will be the new frontier.

BIBLIOGRAPHY AND ADDITIONAL RELATED RESOURCES

GIS Day

On November 14, 2007, GIS Day was held in over 80 countries around the World and in all 50 states in the United States. GIS Day is a grassroots movement in which GIS users and vendors (academics, government employees and entrepreneurs) open their doors to schoolchildren and all members of the general public in order to showcase the capabilities of GIS projects which they have developed (<http://www.gisday.com/>). The event is sponsored principally by the National Geographic Society, the Association of American Geographers, the University Consortium for Geographic Information Science, the United States Geological Survey, The Library of Congress, Sun Microsystems and Hewlett-Packard and ESRI, and by local GIS organizations. The next GIS Day will be held on November 18 and 17 in 2009 and 2010, respectively. The event is usually held as part of Geography Awareness Week, which has been sponsored by the National Geographic Society since 1987. The U.S. e-Government Web site using data from Daratech estimates that there are 1,000,000 users of GIS worldwide, half of whom are in the United States (<http://www.whitehouse.gov/omb/egov/c-7-10-b-geospatial.html>).

Books

The most important reference works for GIS are the so-called "Big-Books" of GIS. The first edition of this huge, two-volume review of the state of the art in GIS was edited by Maguire, Goodchild, and Rhind^[34] and published in 1991, while the second edition was edited by Longley, Goodchild, Maguire, and Rhind^[35] in 1999.

More recently, the second volume has been published in a paperback edition with editorial updates based on input from the individual chapter authors, various additional chapters, and a CD featuring all the chapters from the second edition (Longley et al.^[36]). Popular textbooks discussing the concepts behind GIS include Longley et al.^[37] and Clarke.^[4] The latter author provides an extensive list of GIS books magazines and journals, conference proceedings, and professional organizations. Price's^[38] text is a guide to operating the industry leading ArcGIS 9.2 software and includes a series of hands-on tutorials to aid the novice user.

A searchable GIS bibliography may be found at ESRI's Web site: <http://training.esri.com/campus/library/index.cfm>. Important publishers of GIS texts include ESRI (http://store.esri.com/esri/category.cfm?SID=2&Category_ID=35) and Taylor & Francis (<http://gis.tandf.co.uk/>). Longley et al.^[37] provide a list of major GIS textbooks while Chrisman^[6] describes the earliest days of the discipline. Vendor publications have been discussed above. Suffice it to note that most major vendors have a company publication designed to inform their user base of the latest developments in their software products and many of these are now available online.

Journals and Magazines

Some of the main academic journals in which GIS research is published include

Annals of the Association of American Geographers (<http://www.aag.org/>);
 Canadian Geographer (<http://www.blackwellpublishing.com/CG/>);
 Cartographica (<http://www.utpjournals.com/carto/carto.html>);
 Cartographic Perspectives (<http://www.nacis.org/index.cfm?x=5>);
 Cartography and GIS (<http://www.cartogis.org/>);
 Computers, Environment, and Urban Systems (<http://www.elsevier.com/locate/compenvurbsys>);
 Computers and Geosciences (<http://www.elsevier.com/locate/cageo>);
 Conference Papers in GIS (<http://srmwww.gov.bc.ca/gis/papers/index.html>);
 ESRI User Conference Proceedings (<http://gis.esri.com/library/userconf/index.html>);
 Geocarto International (<http://www.geocarto.com/geocarto.html>);
 Geographical Systems (<http://link.springer.de/link/service/journals/10109/>);
 GeoInformatica (<http://www.wkap.nl/journalhome.htm/1384-6175>);
 Geoscience E-Journals (<http://paleopolis.rediris.es/geosciences/>);

Geographical Journal (<http://www.ingentaconnect.com/content/bpl/geoj/latest>);
 GeoJournal (<http://www.ingentaconnect.com/content/klu/gejo/latest>);
 GIS Law;
 IEEE Transactions on Computer Graphics and Applications (<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=38>);
 IEEE Transactions on Geoscience and Remote Sensing (<http://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=36>);
 International Journal of Geographical Information Science (<http://www.tandf.co.uk/journals/titles/13658816.asp>);
 International Journal of Remote Sensing (<http://www.tandf.co.uk/journals/frame/loader.html?http://www.tandf.co.uk/journals/tf/01431161.html>);
 International Journal of Mapping Sciences and Remote Sensing (<http://www.ingentaconnect.com/content/bell/msrs/latest>);
 Journal of Geographical Systems (<http://link.springer.de/link/service/journals/10109/index.htm>);
 Photogrammetric Engineering and Remote Sensing (<http://www.asprs.org/publications/pers/www.asprs.org/publications/pers/>);
 Public Health GIS News and Information (http://www.cdc.gov/nchs/about/otheract/gis/gis_publichealthinfo.htm);
 Remote Sensing Reviews (<http://www.tandf.co.uk/journals/online/0275-7257.asp>);
 Transactions in GIS (<http://www.blackwellpublishing.com/journals/tgis/>);
 The Spatial Odyssey Website also has a list of GIS Journal Abstracts and Citations (<http://libraries.maine.edu/Spatial/gisweb/journals/journals.html>).

Many **magazines** are available in both an online and a paper version. Some of the more notable examples are

ArcNews Online (<http://www.esri.com/news/arcnews/arcnews.html>);
 ArcUser Online (<http://www.esri.com/news/arcuser/index.html>);
 Challenges: A news letter from UCGIS (<http://dusk2.geo.orst.edu/ucgis/news/>);
 Asian surveying and mapping (<http://www.asmmag.com/>);
 GEOWorld (<http://www.geoplace.com/>).

Other online GIS-oriented magazines include

Directions Magazine (<http://www.directionsmag.com/>);
 Earth Observing Magazine (<http://www.eomonline.com/>);
 GeoCommunity (<http://www.geocomm.com/>);

Geomatics Information and Trading Centre (<http://www.gitc.nl/>);
 GeoSpatial Solutions (<http://www.geospatial-online.com/>);
 GeoVision (<http://www.gisvisionmag.com/>);
 Geomatics Info Magazine International (<http://www.reedbusiness-geo.nl/Home.asp>);
 GPS World (<http://www.gpsworld.com/>);
 Spatial News (<http://spatialnews.geocomm.com/>);
 Mentor Software (<http://www.mentorsoftwareinc.com/cc/ccdir.htm>);
 Position Magazine (<http://www.positionmag.com.au/>);
 Professional Surveyor Magazine Online (<http://www.profsurv.com/>);
 The CADD/GIS Technology Center CADD/GIS Bulletins Page (<https://tsc.wes.army.mil/news/bulletins/>).

Organizations

The following are some of the better known organizations with a strong interest in GIS:

The American Congress on Surveying and Mapping (ACSM) (<http://www.acsm.net/>);
 The American Society for Photogrammetry and Remote Sensing (ASPRS) (<http://www.asprs.org/>);
 The Association for Geographic Information (AGI) (<http://www.agi.org.uk/>);
 The Association of American Geographers (AAG) (<http://www.aag.org/> this organization has a specialty group devoted to GIS) (<http://geography.sdsu.edu/aaggis/>);
 The International Geographical Union which has a Commission on Geographical Information Science (<http://www.hku.hk/cupem/igugisc/>);
 The North American Cartographic Information Society (NACIS) (<http://www.nacis.org/>);
 Geospatial Information and technology Association (<http://www.gita.org/>);
 The Urban and Regional Information Systems Association (URISA) (<http://www.urisa.org/>).

Conferences

This section lists a number of the more important conferences other than the vendor-specific conferences mentioned above. Many of the general, omnibus GIS Conferences have in recent years folded as more specialized offerings take their place. These conferences have usually produced either a print proceedings or a proceedings on CD-ROM.

Most of the major GIS organizations such as URISA will also have annual and even regional GIS conferences. Some conferences are strictly devoted to a single theme and are strongly oriented toward training. This is true of

the Web mapping conferences (<http://www.gisconferences.com/>). In 2007, the following was a selection of the conferences held across the globe:

ACM GIS conference in Bellevue, Washington
 Africa GIS conference in Ouagadougou, Burkina Faso
 AGIC (Arizona Geographic Information Council); GIS conference in Prescott, Arizona
 AGILE (Association Geographic Information Laboratories Europe); conference on GIS in Aalborg, Denmark
 Annual CA Geographic Information Association conference in Cypress, California
 Annual GIS conference, ASPRS and URISA in Vancouver, Washington
 Annual GIS for Oil & Gas Conference in Aurora, Colorado
 Annual International airport GIS conference in Budapest, Hungary
 Annual Minnesota GIS conference in Rochester, Minnesota
 Annual Missouri GIS conference in Osage Beach, Missouri
 Annual NC GIS conference in Winston-Salem, North Carolina
 Annual Ohio GIS conference in Columbus, Ohio
 Annual Virginia GIS conference in Virginia Beach, Virginia
 Arc GIS conference in Biloxi, Mississippi
 Biennial GIS conference, Iowa Geographic Council in Sioux City, Iowa
 California GIS conference in Oakland, California
 Croatian GIS Association conference in Sinj, Croatia
 Delaware GIS conference in Dover, Delaware
 East Tennessee GIS conference in Pigeon Forge, Tennessee
 Eastern Montana GIS conference in Miles City, Missouri
 ESRI Asia-Pacific User Conference in New Delhi, India
 ESRI Australia: GIS user conference in Sydney, Australia
 ESRI Eastern Africa: GIS user conference in Kampala, Uganda
 ESRI Federal Users GIS conference in Washington, District of Columbia
 ESRI GIS solution expo in Danvers, Massachusetts
 ESRI Health GIS conference in Scottsdale, Arizona
 ESRI International User conference in San Diego, California
 ESRI New Zealand: GIS user conference in New Zealand
 ESRI South Asia user conference in Novotel Clarke Quay, Singapore
 EUC (European User Conference) in Stockholm, Sweden

The GeoTec Event in Ottawa, Ontario, Canada
 GI and GIS conference in Porto, Portugal
 GIS conference, Office of Lt Governor, U.S. Virgin Islands
 GIS Engineers Society conference in Trivandrum, India
 GIS for public sector conference in London, U.K.
 GIS for Urban Environmental summit in Johannesburg, South Africa
 GIS in Rockies conference in Denver, Colorado
 GIS in Transit in Tampa, Florida
 GIS South Africa conference in Umhlanga Rocks, Durban
 Historical GIS conference in Nagoya, Japan
 Homeland Security GIS summit in Denver, Colorado
 Illinois GIS conference (ILGISA) in Oak Brook, Illinois
 Indiana GIS conference in Indianapolis, Indiana
 Indonesian Geospatial Technology Exhibition in Jakarta, Indonesia
 Intermountain GIS conference in Donnelly, Idaho
 International conference of GIS/RS in Hydrology in Guangzhou, China
 International conference on Health GIS in Bangkok, Thailand
 International GIS crime mapping conference in Brussels, Belgium
 Ireland GIS conference in Dublin, Ireland
 Kentucky GIS conference in Louisville, Kentucky
 Kuwait GIS conference in Kuwait
 Map Asia in Kulamanpur, Malaysia
 Memphis Area Geographic Information Council GIS conference in Memphis, Tennessee
 National GIS symposium in Saudi Arabia in Khobar, Saudi Arabia
 Nebraska GIS Symposium in Omaha, Nebraska
 Nordic GIS conference in Herning, Denmark
 North Dakota GIS user conference in Bismarck, North Dakota
 North Western PA GIS conference in Clarion, Pennsylvania
 Northeast Arc Users Group: GIS conference in Burlington, Vermont
 NSGIC (National States Geographic Information Council); in Madison, Wisconsin
 NYS GIS conference in Liverpool, New York
 PA GIS conference in Harrisburg, Pennsylvania
 Pacific Islands GIS/RS conference in Suva, Fiji
 Real estate GIS user conference in Scottsdale, Arizona
 Rhode Island GIS conference in Narragansett, Rhode Island
 ScanGIS—Scandinavian GIS Conference in As, Norway
 Southern Forestry and Natural Resources Management GIS conferences in Kissimmee, Florida
 Super map GIS conference in Beijing, China

Towson GIS conference in Towson, Maryland
 UGIC (Utah Geographic Information Council)—GIS conference in Salt Lake City, Utah
 URISA & IAAO 11th Annual GIS conference in Las Vegas, Nevada
 URISA (urban regional information systems association)
 VIGIC (Virgin Islands Geospatial Information Council)
 Washington GIS conference in Lynnwood, Washington

GIS Dictionaries

The Association for Geographic Information has an online dictionary at <http://www.geo.ed.ac.uk/agidict/welcome.html>. For a published GIS dictionary McDonnell and Kemp's^[39] International GIS Dictionary can be referred to.

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Geographical Literature: History [ELIS Classic]

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Abstract

One of the objectives of the information disciplines is to study the universe of recorded information—that is, to study the documentary products of domains of human activity—and to come to understand such bodies of literature as social and historical phenomena in and of themselves. Corley traces the development of the discipline of geography in parallel to the development of the literature of geography.

—*ELIS Classic*, from 1973

INTRODUCTION

Geography is, by definition, the science that describes the surface of the earth: the land, the sea, the air, the distribution of animals and plants, man and his works, and the relationships of all of these elements. The word “geography” itself is derived from Greek words meaning “earth description.”

Like other academic disciplines, geography has its own body of literature and its own peculiar ways of looking at the problems under investigation. As a science, geography dates back to antiquity, in fact, it is perhaps the oldest science of all. But scientific geography as we know it today dates back only to the end of the eighteenth century, when Kant, Humboldt, Peschel, Ratzel, and others defined the scope and content of geography, and dictated the methods of collecting, organizing, and presenting the material.

HISTORY

Primitive man has always been a keen observer of his own country and any he traveled through (even today Eskimos can give an extremely detailed description of an area that to the untrained and unfamiliar eye might otherwise be called featureless).

Geography was held in great esteem by the ancient Greeks, who traveled and accumulated facts, charted and mapped their world, and speculated about the knowledge they had gathered. The information they collected was of prime importance to their merchants, administrators, statesmen, and military.

Thales of Miletus (624–546 B.C.), thought to be one of the most talented men of all time, was one of the earliest geographers. In fact he founded Greek mathematics, astronomy, and physics, as well as geography. Thales realized that the surface of the earth was curved because of the different slant of the sun as one traveled north. He also noted that the slant of the sun’s rays changed with the

seasons, and he invented the equator and the plane of the ecliptic. He also suggested that the earth could be divided by circles parallel to the equator and lines perpendicular to it, now known as lines of latitude and longitude.

Hecataeus (fl. 500 B.C.), sometimes called the father of geography, wrote about his travels to Egypt, Persia, Libya, Spain, and Italy; unfortunately only fragments of his narrative are extant. He considered the earth a flat disk surrounded by a river of ocean. His works were the first regional geography. His map was an extension of one made by Anaxemander who, along with Thales, Aristotle, and Eratosthenes, developed mathematical geography. They proved the earth to be a sphere; computed its size fairly accurately; established the latitude and longitude of many places; and began the practice of plotting maps on grids.

Homer, too, is sometimes referred to as the father of geography, as much of his poetry dealt with the geographical lore of the day, gleaned from the tales of ancient travelers.

A third claimant to this same title was Herodotus (ca. 485–428 B.C.), who was the first to designate Europe, Asia, and Africa as three distinct continents. Herodotus had traveled widely throughout the Near and Middle East, seeking out and questioning the intellectuals in each locality. He did not ascribe to the theory of a disk-shaped earth rimmed by a river of ocean. Instead he gave a detailed description of the world as he knew it as far east as India, west to the Pillars of Hercules, north to the forest boundary of the steppes, and south to the present Sudan. His work is distinguished by the excellent descriptions of town sites.

Theophrastes (ca. 370 B.C.) was the first to note the relationship between plants and climate, and so began the study of plant geography.

Eratosthenes (ca. 276–194 B.C.) was the curator of Ptolemy II’s library in Alexandria, which contained some 40,000 books. He was reputed to be the most learned man of antiquity. His *Geographica* described the world as he knew it, summarizing the history and concepts of

geography. He is credited with naming the subject, though he certainly did not invent it. Eratosthenes also calculated the circumference of the earth at 250,000 stadia (approximately 25,000 miles), coming very close to the actual figure.

Pomponius Mela (ca. A.D. 50) employed the concept of a world symmetrically divided into four by two narrow strips of ocean, despite the fact that realistic geographies had been written based on explorers' and travelers' reports. In his textbook, written in Latin (which made it influential in medieval times), he maintained that the unknown parts of the continents were not necessarily inhabited by people, and that those who lived at the "bottom" of the world were foot to foot with those at the "top," and so he called the former Antipodes (a term no longer used for a people, but rather for a place).

The Romans were not scientifically minded and so added little to geographic thought. Rather, they were concerned with more practical things such as the problems of commerce, administration, and military conquest. They did, however, contribute the *itinerarii* which were descriptions of their road systems—a kind of map, without scale or projection. They were designed only as a convenience to travelers.

Strabo (63 B.C.—A.D. 36) was a Greek regional geographer living in Rome. He summarized (in 17 volumes) the geographical knowledge of his time in his *Geographica*, which has survived.^[1] Strabo relied heavily on other Greek authorities, but maintained that it was the geographer's task to describe the known world, to write about the different countries, and to discuss the differences between them. He used the reports of travelers and merchants, seamen's handbooks, and histories of Alexander's conquests as well as material relative to the Roman empire and its trade routes. Strabo's treatment of regional geography at the turn of the millennium is the most elaborate to survive. Since it was written in Greek and was not translated until a long time after, it did not have the influence that it deserved.

Ptolemy (Claudius Ptolemaeus) taught and studied in Alexandria from A.D. 127–151. His great general work *Geographike Syntaxis* dealt with map projections, included tables for latitude and longitude, and gave calculations for the length of day and night for various places depending on their distance from the equator. This work was far beyond the standard of its predecessors. It was translated into Arabic in A.D. 815 and much later (A.D. 1475) into Latin, thus becoming both a Christian and a Moslem authority.

Ptolemy considered *geography* as the description on mathematical principles of the whole world, *chorography* as a detailed account of a region, and *topography* as a minute account of a smaller area. The world, according to Ptolemy, stretched from Spain to China, and from Thule to south of the equator.

During the Middle Ages geography as a science almost disappeared. It was forbidden by the Christian Church as a

pagan science; the theory of the spherical shape of the earth was denounced and the accepted concept was that of a flat disk with Jerusalem at the center. However, at this time geography was being encouraged by the Arabs. Their empire extended, at its height, over most of Europe, Asia, and Africa. In the eastern Mediterranean they came into contact with Greek learning and libraries. Because of Ptolemy's work, descriptive geography flourished. The continued existence of the Roman roads and the compulsory pilgrimages to Mecca encouraged people to travel throughout the empire, and so trade arose as a natural result; all of which influenced geography. The Arabs made accurate calculations of latitude and longitude and the size of the earth, but they made no improvement in the science of cartography. Arab maps were often distorted because of their love of flourish and ornamentation. However, their sea charts, which were based on a cylindrical projection, were highly thought of by the explorer Vasco da Gama. Regional geographical handbooks were written for travelers, merchants, and administrators by ibn Haukal, Masudi, and Idrisi. These were not translated and so had no influence in the West.

Because of the relatively easy travel throughout the Arab empire, it was possible for Marco Polo (1254–1324) to travel overland to China. His account of his journey, and his return by sea has been a widely read story since it was first published. *The Book of Marco Polo* (1296–1299) is an attempt at systematic geography. He was not writing from his own observation in every chapter, but assembled the best information that was available to him. This is particularly true of his chapter on the Indian Ocean. His adventures stimulated exploration in the Christian world, and though written in the thirteenth century, at the end of the next century it supplied Columbus with considerable support to his theories.

About 1357 the spurious *Travels* of Sir John Mandeville (ca. 1300–1372) were published and, thought to be authentic, they were very popular. The book was based on real travelers' tales and tall stories, as well as on Pliny and Solinus. The author also noted the spherical shape of the earth.

Beginnings of Modern Geography

Explorers

Modern geography began when man became aware of the fact that there were lands still to be discovered. Numerous people went exploring—found new worlds, circumnavigated the earth, and returned home with detailed observations and maps of what they had seen. They were exercising a modern geographer's technique—that of gathering data in the field. Their notes were used by contemporary writers of books and compilers of atlases.

About 1418 Henry the Navigator (1394–1460) established a school of geographers. Though he did not travel

himself, Henry sent out many exploring expeditions, notably Vasco da Gama's in 1498 which opened the way to the Indies via the Cape of Good Hope. About the same time Columbus discovered America, and so did Cabot. Vespucci discovered South America and in 1520–1521 Magellan sailed completely around the world, proving for once and for all the sphericity of the earth and the continuity of the oceans. The narratives of these great explorations took an important place in the literature of geography during the great age of discovery.

Editions of Ptolemy's works continued to appear, enlarged with new tables. Sebastian Münster's (1489–1552) *Cosmographia universalis*,^[2] a political and regional work based on Strabo, was the most complete attempt to rewrite the classics, and was most popular.

In 1570 Abraham Ortelius (1527–1598) published his *Theatrum Orbis Terrarum*^[3] of regional and world maps. This was the first modern atlas. A few years before (1598) his friend Gerhard Kremer, better known as Mercator (1512–1594), had published his famous map projection, now known as the Mercator projection, for use in navigation.

Philipp Clüver (1580–1622), a German, published an *Introduction to Universal Geography*.^[4] This was a brief account of mathematical geography, with regional descriptions of the world. It was an excellent work, and set a standard for regional geography that was long unsurpassed.

By 1642, when the Dutch mariner Abel Tasman (1602 or 1603–1659) completed the delineation of Australia, the land masses of the world, except for the Antarctic, were fairly well known. The next 150 years saw further exploration.

Writers

Another Dutchman, Varenius (Bernhard Varen, 1622–ca. 1650) published in 1650 the most notable geographical textbook of the time: *Geographia Generalis*.^[5] This was the first book to include the new theory of the universe as set forth by Copernicus, Kepler, and Galileo. Varenius defined geography as a branch of mathematics, not wanting to limit it merely to the regional descriptions of countries. He included human geography only as a concession to custom. In 1672 his book was reprinted in London at the insistence of Sir Isaac Newton, who wished to have it as a text for his students at Cambridge. It was translated into English in 1732, but Varenius was considered a very difficult writer, and though his book, unfinished because of his early demise, was not expected to be read outside the universities, it was for centuries considered a standard text.

The English geographer Nathaniel Carpenter (fl. early seventeenth century) had some years before delineated geography in two books.^[6] His methods and sources were similar to Varenius's, and he came to the same conclusions. Many of Carpenter's themes were drawn from the French

political theorist Jean Bodin—especially in dividing the world into three climatic zones: torrid, temperate, and frigid; and attributing to the inhabitants of each region certain general characteristics. Carpenter was dogmatic on this aspect—men in colder climates were strong, tall and active; those of the warmer regions were languid; also people living in mountains or highlands were superior to those of the plains. He deemed Europe the most favored region in the world.

For a century after Varenius there was little geographical research; most interest was in the natural sciences. However, the unprecedented expansion of knowledge in these fields made it possible to give a more scientific description of the earth. By the early eighteenth century geography was taking its place as an independent science.

Geography as a Science

Though Jean Jacques Rousseau (1712–1779) was not a geographer, he made many interesting geographical observations. He noted that environment exercised influence on primitive man; the varieties of soils, climates, and the seasons introduced differences in their manner of living. He accepted these differences between northerners and southerners without going into the matter to any degree. He was apt to select unique instances to support his geographical arguments. He realized that the relationship between geography and history was not as simple as generally supposed.

Anton Friedrich Büsching (1724–1793) in his *Neue Erdbeschreibung*^[7] described the surface of the earth, being as accurate as possible, without trying to explain facts or relationships. A regional description was made by political units, and he insisted on a very high standard of accuracy and on the critical handling of his sources. Büsching opened a new era in the science of geography—for the next 150 years, up until the beginning of the twentieth century, geography became almost solely a German science, and the significant developments were made by German scholars.

Next came Johann Rheinhold Forster (1729–1798), and his son, Johann Georg. The elder Forster had a keen scientific mind and great powers of observation. He collected facts, classified them and compared them, made generalizations, and sought explanations. His works were noted also for their contribution to human geography. He was one of the first to try to explain the relationship between man and his environment.

Johann Georg Forster (1754–1779) was not as gifted as his father but, as is often the case, he was more honored in his lifetime. He translated his father's famous *Observations* (1778);^[8] he was a friend of Humboldt, who had been stimulated by the younger Forster's *Voyage around the world* (1777)^[9] (based on the elder Forster's travels), and by whom he was often quoted.

The philosopher Emmanuel Kant (1729–1804) stressed physical geography in his lectures and writings, and he recognized its position in relation to the other natural sciences.

The nineteenth century saw the exploration of the interiors of the continents. The journals and diaries subsequently published by the explorers were an important contribution to regional geography, and later to historical geography. They described the country as they saw it, and in most cases, as it is no longer. In Canada there were Samuel Hearne, Sir Alexander Mackenzie, David Thompson, and Sir John Franklin; and later Sir John M'Clure, Sir Edward Parry, and others opened up the Canadian Arctic searching for Franklin's lost expedition. In the United States there were explorers such as Merriweather Lewis and William Clark, Zebulon Pike, Stephen Harriman Long, Benjamin Bonneville, and John C. Fremont.

In Africa there were such men as Mungo Park, David Livingstone, Stanley, Sir Richard Francis Burton, and John Hanning. In India Sir Francis Younghusband, Evariste Régis Huc, and Nikolai Przhevalsky. Sven Hedig and Sir Aurel Stein visited the interior of the Asian continent, and Ferdinand Baron von Richthofen made seven journeys into China. In Australia there was Captain Charles Sturt, Thomas Mitchell, Dr. Ludevig Leichhardt, Robert O'Hara Burke, and William John Wills.

The Antarctic continent did not come in for intensive exploration until the twentieth century, when Robert Falcon Scott and Sir Douglas Mawson and others made their mark. At the beginning of the twentieth century the Arctic also contributed some famous explorers: Robert E. Peary, Frederick Cook, Knud Rasmussen, Roald Amundsen, Fridtjof Nansen, Vilhjalmur Stefansson, and Otto Nordenskiöld.

MODERN GEOGRAPHY

It is generally agreed that modern geography was founded by two German masters of the subject: Alexander von Humboldt (1769–1859) and Karl Ritter (1779–1859). Humboldt was a great scientist and traveler. He traveled extensively throughout Latin America and Asia gathering data, mapping and sketching in the field, and returned home to write up his results. Ritter, on the other hand, was a historian who carefully considered and cataloged other researchers' data. Though these two scholars approached geography from different backgrounds, they both made such a significant contribution to the subject that the course they charted for the science of geography is still largely followed today.

Humboldt made his first foreign tour with J.R. Forster, whose methods of careful observation and treatment of facts, as well as his scientific description of landscapes, greatly impressed him. Humboldt spent five years in Latin American and the next 20 writing up his notes. His *Ansichten der Natur*,^[10] written when he returned from

Mexico in 1808, gave a suggestion of a pattern of regularity on the earth's surface and received widespread attention. In 1829 he went to the Urals to study the ore-bearing regions, and eventually ended his career as chamberlain to the King of Germany.

Humboldt's *Kosmos*,^[11] published in five volumes, was a comprehensive survey of the universe. His was an empirical approach to research. He combined geography and astronomy in a classical fashion, but kept to the principle of the unity of nature.

Karl Ritter spent 20 years as tutor in a rich family and the rest of his life teaching (he was professor of geography at the University of Berlin), writing, and directing the Gesellschaft für Erdekunde. His great work was his *Die Erdkunde, im Verhältnis zur Natur und zur Geschichte des Menschen, oder Allgemeine, Vergleichende Geographie*,^[12] a comparative regional geography of the world. It was never finished although 21 volumes were published on Asia and Africa. Ritter's approach, like Humboldt's, was empirical. He stressed comparison of phenomena in various regions rather than drawing conclusions from only one. His rule was to proceed from observation to observation and not from hypothesis or opinion to observation. Ritter's literary style was very difficult, often lacking clarity or precision of expression, and so he is frequently misunderstood. Though his books are today considered to be unreadable, his position as a father of geography has been established on the basis of the whole of his writings, and not on any one particular work.

The writings of the two great men were complementary. Humboldt gave method and form to systematic geography; Ritter founded regional geography. Unfortunately, they left no followers. Humboldt never taught, and Ritter's vacated chair was never filled. In their wake they left confusion and shifting points of view. Physical geography was stressed; there was a desire that it be considered a natural science. Human geography, thought to be unscientific, was treated only when necessary to the description of various regions.

One of the most notable geographical works of the nineteenth century was the *Physical Geography* (1848)^[13] by Mary Somerville (1780–1872). This book showed an interest in historical geography and a concern for its basic physical foundations, thus anticipating two popular trends of the twentieth century.

Arnold Henry Guyot (1807–1884), a Swiss and a follower of Ritter's, wrote *The Earth and Man*,^[14] which was translated into English in 1849. This book helped introduce German ideas to English-speaking geographers. Guyot set forth some of geography's significant problems and so helped define the limits of the new science. As professor of geography at Princeton he contributed to the advance of physical geography, stressing the study of structure, surface formations, and erosional processes.

Ritter's most successful pupil was Jean Jacques Elisée Reclus (1830–1905) whose *La Terre* (1867–1868)^[15] was

a systematic study in physical geography. His 19 volume *Nouvelle Géographie Universelle* (1875–1894)^[16] was another complete regional geography of the world. This work shows a wide knowledge and understanding of contemporary advances in the natural sciences, and it also demonstrates a deep appreciation of natural beauty.

Pièrre Guillaume Frédéric LePlay (1806–1822) studied environmental influences on man in urban and rural areas, and so laid the foundations for regional surveys such as town and country planning. His *Ouvriers Européens* (1855)^[17] in six volumes was based on carefully collected data, such as family budgets, a method that has since been used in many economic surveys.

Oscar Peschel (1826–1875) revolutionized morphological research. His work, systematic and empirical, tended to produce geomorphologists and climatologists first, and geographers second [*Neue Probleme der Vergleichende Erdkunde als Versuch einer Morphologie der Erdoberfläche* (1870)^[18]].

Friedrich Ratzel (1844–1904) developed systematic and scientific human geography, though he also made contributions to physical geography, geology, zoology, and ethnology. His *Anthropogeographie* (1882),^[19] a word he coined, attempted to show in the first volume that man's distribution on earth was more or less controlled by nature. In the second volume he described man's existing distribution, going over Ritter's ground and developing his ideas. However, Ratzel's work differed from Ritter's in that he treated human geography regionally rather than systematically. His *Politische Geographie* (1897),^[20] another term he coined, reshaped an old subject. Ritter's last great work *Die Erde und das Leben* (1901–1902)^[21] sought to discuss the earth as an integral whole.

Baron Ferdinand von Richthofen (1833–1905) taught geography at Leipzig, where he stressed a unified geography based on the concepts of Humboldt and Ritter. Trained as a geologist, he developed scientific morphology in his studies of the loess regions of China. His *China. Ergebnisse eigener Reisen und darauf gegründeter Studien*^[22] appeared in five volumes, partly posthumously, from 1877–1912, and set the seal on his reputation. A master of observation in the field, his first two volumes were immediately recognized as a great scientific work, and for them he received the Royal Geographical Society's Founders Medal. For many years von Richthofen was president of the Berlin Geographical Society and he founded the Oceanographical Institute of Berlin. He is still regarded as a dominant influence in modern German geography.

Paul Vidal de la Blache (1854–1922) was a distinguished scholar and the master of French geographers. Acknowledging his debt to Ritter who had strongly influenced him, he refashioned geography by his teaching and writing. Trained in history, geography, and the classics, and widely traveled, Vidal de la Blache united the study of sociology with geography, infusing the French school with a humane spirit which it has since retained.

In 1902 he prepared for Lavisses's *Histoire de la France* a masterly paper, *Tableau Géographique*,^[23] which has become a classic in geographical literature and played a major role in developing the concept of regions. In it he analyzed and interpreted the "geographical personality" of France. Vidal de la Blache never completed a systematic work on human geography, but he expressed his views in many articles published in *Annales de Géographie*, which he founded. In his work he stressed three topics—physical geography, biogeography, and human geography. These were welded together to make up the territorial units within which a distinctive way of life flourished. He also believed that in seeking to understand a human region, history cannot be neglected; and so history and geography were joined together on a sounder basis than they were in the days of Carl Ritter. His most original and important work was *France de l'Est* (1917),^[24] devoted to the study of the foundation of landscapes and rural societies in Alsace and Lorraine.

Jean Brunhes (1869–1930) was a pupil of Vidal de la Blache. His *La Géographie Humaine* (1910)^[25] limited human geography to human phenomena that modify nature, and at the same time are modified or controlled by it, e.g., unproductive occupation (houses, settlements, roads); cultivation and stock raising; and destructive economy (mineral exploration, deforestation).

Another pupil, Albert Demangeon (1872–1940), studied the use of archives in establishing the past human geography of a region.^[26] His study of Picardy is a model of regional geography.

Alfred Hettner (1859–1941) contributed to the methodology of geography.^[27] To him geography was the study of the different characteristics of various regions, resulting from their soil types, plant cover, and the results of man's activity. Studying such phenomena on a worldwide scale enabled the geographer to establish a general comparative geography. In 1895 he founded the *Geographische Zeitschrift* as a forum for the general problems of geography.

Before Halford John Mackinder (1861–1947), British geography was largely centered on exploration. Geography did not become a "proper" subject until 1887 when Mackinder, at the age of 26, was appointed to Oxford University, half his salary being paid by the Royal Geographical Society. His great energy, and his gift for stimulating and brilliant generalizations were indelibly impressed on British geography.

In that same year he lectured to the Royal Geographical Society on the scope and methods of geography, defining it as "the science whose main function is to trace the interaction of man in society and as much of his environment as varies locally," and "the science of distribution, the science, that is, which traces the arrangement of things in general on the earth's surface." Mackinder's lectures, particularly those in historical geography, always drew large audiences.^[28] In 1902 he published *Britain and the British*

Seas,^[29] which is now considered as a classic of British geography; it summarizes the fundamental concepts based on his wide reading and thought, followed by a summary of British history in relation to this background.

His paper "The Geographical Pivot of History" brought him unexpected fame. In it he stated that the maritime age had passed and that land powers would be decisive; that the greatest land area was in the Old World, the heart of which lies within continental or arctic drainage; ringing this "heartland" is an inner crescent of marginal states, with an outer crescent of overseas powers (Great Britain, the United States of America, and Japan). If the balance of power should favor the pivot state, it would then expand over the marginal lands of Eurasia, permitting the vast continental resources to be used for building fleets of ships, thus permitting a world empire. Because of this threat the overseas powers would be obliged to maintain bridgeheads, thus forcing the "pivot allies" to develop their land forces and preventing them from maintaining large fleets.

Mackinder developed his "heartland" theme in *Democratic Ideals and Reality* (1919)^[30] in which he maintained that whoever rules eastern Europe commands the Heartland; whoever rules the Heartland commands the World Island; and whoever rules the World Island commands the World. This theory attracted little attention when it first appeared, but was later taken over by German geopoliticians. Mackinder's influence is still strong, and his ideas are still being developed.

William Morris Davis (1850–1934), a pioneer geomorphologist, laid solid foundations for the study of modern physical geography and established geography as a subject in American universities.^[31] His work exerted considerable influence on the subject, and he was the founder of the Association of American Geographers. In his studies of erosion cycles Davis did not forget the relationship of man's activities to various landforms. In this his influence was felt by other geographers. His emphasis on the time factor has since been established in the concept of "dynamic geography."

Davis's pupil Ellsworth Huntington (1876–1947) stressed the influence of climate on the life and activities of man and the relationships of the distribution of culture with the world's main climatic regions concluding, as did Carpenter, that western Europe was climatically the most favored region for human activities. Huntington trained originally as a geologist, but as a result of a trip to Tibet and central Asia changed to climatology. His hypotheses that central Asia would progressively break up as an influence in the historical and human geography of the continent caused much controversy. He wrote *The Pulse of Asia* (1907),^[32] *Civilization and Climate* (1915),^[33] and *The Mainsprings of Civilization* (1945)^[34] which summarized much of his life's work.

Isaiah Bowman (1878–1950) is considered foremost among modern geographers. He began his career as a

physiographer, and later was inspired and influenced by Davis. His first important publication, *Forest Physiography: Physiography of the United States and Principles of Soils in Relation to Forests* (1911),^[35] constituted a sound basis for the study of North America's physical regions. *The New World: Problems in Political Geography* (1921)^[36] is a valuable source of political and human geography as they were affected by the peace settlements made after World War I. Bowman was director of the American Geographical Society from 1915–1935, and was adviser to the American delegation to the Peace Conference at Versailles. He was always quick to seize opportunities to advance the status of geography in academic circles and the world of public affairs.

The foregoing gives only the barest outline of the history of the literature of geography up to the early years of the twentieth century. Those geographers so briefly discussed were the giants, but there were numerous others who also contributed to the science with their field work, their theories, or both. To have given proper credit to all concerned would have necessitated a several volume work.

As an academic discipline geography has continued to grow and mature, to the extent that no one geographer can any longer be competent in all branches of the field, specialization being necessitated by the new scope of the old subject. Always a dynamic field, geography is continuously changing its methods and tools, striving to provide accurate and useful descriptions of our planet.

Since World War II when the position of geography was consolidated, the number of geographers has greatly increased, as have university departments of geography and so, as a natural consequence, has the literature. Modern geographers, like their spiritual forebearers, are great travelers, theorists, and writers. Some do write books, but generally important works appear as articles in geographical journals (which in turn are usually published by geographical societies). The following is a list of thirty geographical serials^[37] considered to be of "particularly broad international value and interest."

Annales de Géographie: Bulletin de la Société de Géographie, Paris, **1**, 1891, 6/yr.

Association of American Geographers. Annals, Washington, DC, **1**, 1911, 4/yr.

Australian Geographer, Geographical Society of New South Wales, Sydney, **1**, 1928, 2/yr.

Australian Geographical Studies, Institute of Australian geographers, Hobart, 1963, 2/yr.

Cahiers d'Outre-mer; Revue de Géographie de Bordeaux, Université, Faculté des Lettres et Sciences Humaines. Institut de Géographie; Institut d'Outre-Mer de Bordeaux; Société de Géographie de Bordeaux, Bordeaux, **1**, 1948, 4/yr.

Canadian Geographer. Géographe Canadien, Canadian Association of Geographers, Toronto, **1**, 1951, 4/yr.

- Economic Geography*, Clark University, Worcester, MA, **1**, 1925, 4/yr.
- Die Erde. Zeitschrift der Gesellschaft für Erdkunde zu Berlin*, Berlin, **1**, 1853, 4/yr.
- Erdkunde: Archiv für wissenschaftliche Geographie*, Bonn, **1**, 1947, 4/yr.
- Geoforum. Journal of Physical, Human, and Regional Geosciences*, Braunschweig, Germany, **1**, 1970, 4/yr.
- Geografiska Annaler. Series A, Physical Geography*, Svenska Sällskapet för Antropologi och Geografi, Stockholm, **47**, 1965, 4/yr.
- Geografiska Annaler. Series B, Human Geography*, Svenska Sällskapet för Antropologi och Geografi, Stockholm, **47**, 1965, 2/yr.

[The preceding two serials succeed *Geografiska annaler*, **1–46**, 1919–1964.]

- Geographia Polonica*, Polish Academy of Sciences, Institute of Geography, Warsaw, **1**, 1964, irregular.
- Geographical Journal*, Royal Geographical Society, London, **1**, 1893, 4/yr.
- Geographical Magazine*, London, **1**, 1935, 12/yr.
- Geographical Review*, American Geographical Society, New York, **1**, 1916, 4/yr.
- Geographische Zeitschrift*, **1–50**, 1895–1944; **51**, 1963, Wiesbaden, 4/yr.
- Geography*, Geographical Association, Sheffield, **1**, 1901, 4/yr.
- Institute of British Geographers. Transactions*, **1**, 1935, London, 3/yr.
- Journal of Tropical Geography*, Departments of Geography, University of Singapore and University of Malaya, Singapore, **1**, 1953, 2/yr.
- Méditerranée; Revue Géographique des Pays Méditerranéens*, Instituts de Géographie des Facultés des Lettres et Sciences Humaines d'Aix-en-Provence-Nice. Gap, **1–10**, 1960–1969; n.s., 1970, 4/yr.
- New Zealand Geographer*, New Zealand Geographical Society, Christchurch, **1**, 1945, 2/yr.
- Noroi; Revue Géographique de l'Ouest et des Pays de l'Atlantique Nord*, Universités de Caen, Nantes, Orléans-Tours, Poitiers, Rennes, Rouen, Brest, et Limoges, Poitiers, **1**, 1954, 4/yr.
- Österreichische Geographische Gesellschaft. Mitteilunge*, Vienna, **1**, 1857, 3/yr.
- Petermanns geographische Mitteilungen*, Geographische Gesellschaft der Deutschen Demokratischen Republik, Gotha, **1**, 1855, 4/yr.
- Revista Geográfica*, Instituto Panamericano de Geografia e História. Comissão de Geografia, Rio de Janeiro, **1**, 1941, 2/yr.
- Revue Géographique de l'Est*, Instituts de géographie des Universités de Besançon, Dijon, Metz, Nancy, Reims, et Strasbourg, Nancy, **1**, 1961, 4/yr.

- Soviet Geography: Review and Translation*, American Geographical Society, New York, **1**, 1960, 10/yr.
- Tijdschrift voor Economische en Sociale Geografie (Netherlands Journal of Economic and Social Geography)*, Koninklijk Nederlands Aardrijks-Kundig Genootschap, Rotterdam, **1**, 1910, 6/yr.
- Zeitschrift für Geomorphologie. Annals of Geomorphology. Annales de Géomorphologie*, Stuttgart, **1–11**, 1925–1940; n.f. **1**, 1957, 4/yr.

CONCLUSION

It is in publications such as these that the modern classics of geographical literature can be expected to be found.

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8. Forster, J.R. *Observations Made during a Voyage Round the World, on Physical Geography, Natural History and Ethic Philosophy*, G. Robinson: London, U.K., 1778.
9. Forster, J.G. *A Voyage Around the World, in His Britannic Majesty's Sloop Resolution, Commanded by Capt. James Cook, During the Years 1772, 3, 4, and 5*, B. White [etc.]: London, U.K., 1777; 2 Vols.
10. von Humboldt, A. *Ansichten der Natur, mit wissenschaftlichen Erläuterungen*, Cotta: Stuttgart, Germany, 1849; 2 Vols. in 1.
11. von Humboldt, A. *Kosmos. Entwurf einer physischen Weltbeschreibung*, Cotta: Stuttgart, Germany, 1845–1862; 5 Vols. (English trans. by E.C. Otté, *Cosmos: A Sketch of a Physical Description of the Universe*; Harper: New York, 1860; 4 Vols.).
12. Ritter, K. *Die Erdkunde, im Verhältniss zur Natur und zur Geschichte des Menschen, oder Allgemeine, Vergleichend Geographie als sichere Grunlage des Studiums und Unterrichts in Physikalischen und historischen Wissenschaften*, Reimer: Berlin, Germany, 1822–1859; 19 parts in 21 Vols.

13. M. (Fairfax), Somerville. *Physical Geography*, Lea and Blanchard: Philadelphia, PA, 1848.
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16. Reclus, E. *Nouvelle Géographie Universelle; la Terre et les Hommes*, Hachette: Paris, France, 1876–1894; 19 Vols. (*The Earth and Its Inhabitants*; Appleton: New York, 1882–1895; 19 Vols.).
17. LePlay, F. *Ouvriers Européens. Études sur les Travaux, la Vie Domestique, et la Condition Morale des Populations Ouvrières de l'Europe*, Imprimerie impériale: Paris, France, 1855.
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Germany: Libraries, Archives, and Museums

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Abstract

This entry discusses the role and status of German libraries, archives, and museums, with a focus on the two decades following the Reunification of Germany. Although the emphasis is on contemporary trends and issues, a short historical overview is provided. Major topics include: library legislation, public, school, and research libraries and programs for professional education as well as archival science and archival institutions (national, state, and local). There is also a discussion of museology and profiles of major museum in range of areas including archaeology, fine arts, national and local history, natural history, and science and technology. Digital projects are also discussed as are numerous cooperative efforts among libraries.

INTRODUCTION

The Federal Republic of Germany is situated in the center of Europe and is bounded on the north by the Baltic Sea and the North Sea. Germany has 16 Federal States (Länder) with the capital Berlin (Fig. 1). In February 2008, the population was over 82 million with a high percentage of inhabitants over 50 years old; migrants make up approximately 9% of the population. The strong economy manifested by a trade surplus is not always mirrored at the community or state level, as the money earned goes to global players. The percentage of unemployed persons in June 2008 remained at 7.5%. Since the Reunification of East and West Germany in 1990, there slight decline in population and the gap between rich and poor has increased.^[1]

Germany is known as a nation of poets and thinkers—from Goethe and Schiller to Heine and Rilke, from Hegel and Kant to Adorno and Heidegger. It is a nation as proud of its cultural heritage as of its technical inventions like Gutenberg's printing press. Before the German Empire in 1871 was founded and even after, many formerly independent regions and small kingdoms had their own cultural activities. They supported musicians from Bach to Beethoven and commissioned works from celebrated artists such as Albrecht Durer and Caspar David Friedrich. Local rulers and noble families built up collections of precious books, hand-painted maps, and beautiful art works and crafts. This pluralistic cultural heritage strongly influenced the decision for political federalism in culture and education when the Federal Republic of Germany (Bundesrepublik Deutschland—BRD) was founded in 1949. A second reason was the still remaining resistance to the centralized censorship in culture and education during the terror regime of the Nazis.

In contrast to the BRD, a centralized structure in culture and education was kept in tact in East Germany

during the years 1945–1990 when the German Democratic Republic (GDR) existed. After World War II, there were two very different political systems in Germany—one being embedded in the Western bloc with the political influence of the Allied Forces, and the other integrated into the Eastern bloc with an even stronger influence by the Soviet Union. Both systems had different impact on the respective cultural institutions. Different standards and methods were introduced. In the Western part, libraries developed step by step and open stacks were introduced, first in public libraries and from the end of the 1960s also in some university libraries. In contrast, all research libraries in the GDR had reading rooms with reference works and a catalog from which one could find the call number and then request the desired work from the collection that was kept in closed stacks. There were not many official contacts between the two parts of Germany during that time and certain libraries, archives, and museums whose collections had been divided during the bombing in the Second World War remained separated after the War because of the political split. Only after the Reunification did it become clear what the real losses were—not only from the First and the Second World War but also through Nazi Tyranny, the book burnings and destruction of many authors' books in the libraries. A cultural generation of poets, musicians, and artists were killed or emigrated and their art and books were destroyed. Shortly after World War II, the Russians took away many cultural works as compensation for their losses during the War. All the cultural activities in both parts of Germany were monitored, either by Allied troops from United States of America, France and Britain or by Russia. During the process of Reunification of West Germany and East Germany in 1990, federalism was revitalized and this became the foundation of new developments in culture and education.

Modern information services began to be established at the end of the 1970s and the beginning of the 1980s in



Fig. 1 Map of Germany.

Source: *CIA World Factbook*: <https://www.cia.gov/library/publications/the-world-factbook/geos/gm.html>.

German libraries. There was increased progress toward the end of the 1990s and into the twenty-first century with the integration of many Internet services and digital libraries' available through the Internet. Archives and museums started to use technology some years later, but made great progress as soon as digitization became more common.

In December 2007, after 4 years of work, a Parliamentary Enquête Commission on Culture in Germany finished its report.^[2] The report gives an excellent overview of the legal framework for culture in Germany. Many specific recommendations for libraries and museums are presented and an important outcome of the work of this Commission is the strong commitment in support of a library law at the Länder level.

LIBRARY AND INFORMATION PROFESSIONALS IN GERMANY—SYSTEMS AND SERVICES

Brief Overview

The German library system with its approximately 11,500 libraries is organized on four levels of service provision to meet the public's information and literature need:^[3]

Level 1: First level information needs should be met by small and middle-sized public libraries, i.e., by public libraries in villages or small towns, branch libraries, or bookmobiles.

Level 2: This level represents an increased need for books and information, to be met by city libraries especially by their central library.

Level 3: The needs for specialized information and literature are to be met cooperatively by some metropolitan libraries, special libraries, and university libraries in the region.

Level 4: This level refers to highly specialized needs that can only be met in cooperation on the part of designated special libraries, university libraries with their special collections, the three central specialized libraries, and last but not least, the libraries with national collections and services.

There is no general public library law at the national level, and at the state level public library legislation has just started to be enacted. In Thuringia, the first law concerning public libraries was passed at the state level in July 2008 and this puts libraries in an important position as educational and cultural institutions.^[4] There are various laws on different governmental levels in regard to their responsibility for libraries. For example legislation regarding responsibilities of the National Library of Germany was renewed in 2007.^[5] At the state level in Germany there is legislation from 2005 with regard to regional libraries (called *Landesbibliothek*).^[6] Interlibrary loan between libraries in different states in Germany also requires an agreement of all states. To facilitate this, the Conference of the Ministers of Culture from all 16 Federal States—which is the highest cultural organ—has to formulate a common agreement, which is then passed by each state legislature individually before it can begin to function.

National Library and Information Services

The National Library of Germany was founded as the *Deutsche Bücherei* in 1912 by German publishers in cooperation with the Kingdom of Saxony and the city of Leipzig. In 1970, the *Deutsche Bücherei Leipzig* was assigned the function of being the central coordination institution for bibliography in the German Democratic Republic. In 1947, when Germany was divided, publishers of the Federal Republic of Germany founded the *Deutsche Bibliothek* in Frankfurt am Main as their bibliographical center. In 1969, it changed its status under public law and became a federal cooperative agency for all the states, with legal deposit and support by the Federal Republic of Germany. One year later in 1970, the Music Archives were created in West Berlin to receive deposits of all musical works and production. The *Deutsche Bücherei Leipzig* and the *Deutsche Bibliothek* with the Music Archives as a department were united in 1990 under a new name: "*Die Deutsche Bibliothek*." In June 2006, a new law changed the name of the institution into *Deutsche*

Nationalbibliothek (=German National Library). The same law reconfirmed support for the national legal deposit at this Library which receives two mandatory deposit copies of each of the more than 100,000 items published in Germany every year. According to the collections policy with regard to German language literature, the German National Library not only receives materials from Austria and the German-speaking part of Switzerland but also collects German-language publications worldwide. Now the law includes online publications to be collected by the library, cataloged, and stored as part of Germany's cultural heritage.^[7] The German National Library compiles various series of the Deutsche Nationalbibliographie (=German National Bibliography), which can also be searched online.^[8] The German National Library collects German imprints only from 1913 onward. Due to the history of numerous German kingdoms, it had never been possible to create a unified collection of all printed materials produced in Germany that would be comparable to other large national libraries in Europe. Therefore, the National Library is collaborating with a group of five libraries with significant collections in order to develop a complete collection of printed literature published in German-speaking countries from the beginning of Gutenberg's press, over 550 years ago. This venture is called *Arbeitsgemeinschaft Sammlung Deutscher Drucke* (=Working Group for the Collection of German Imprints) and has led to the creation of a combined virtual national library in which the participating libraries are responsible for the following periods shown in Table 1.^[9]

A national library, besides collecting the nation's production of published works, often collects the most important scholarly literature from all over the world. Again in Germany this task is shared by several libraries on the national level. The Bayerische Staatsbibliothek (=Bavarian State Library) in Munich holds a multitude of Incunabula, but also has important international collections, as does the Staatsbibliothek zu Berlin—Preussischer Kulturbesitz (=State Library Berlin-Prussian Cultural Heritage). These two libraries are very important sources for humanities studies due to their collections of works in all European languages and special collections in Oriental, Asian, and East European languages. The State Library of Berlin is not a regular state library with legal deposit (the legal depository library for Berlin is the Central and

Regional Library Berlin). However, it is a library with rich collections like those of a national library.

On the national level, Germany has three central subject libraries.^[10] They collect national and international materials in their subject area quite comprehensively and function as national resource

- For science and technology at the Technische Informationsbibliothek (=Technical Information Library) in Hanover.
- For medicine and biology at the Deutsche Zentralbibliothek für Medizin (=German National Library of Medicine) in Cologne and Bonn.
- For economy at the Deutsche Zentralbibliothek für Wirtschaftswissenschaften (=German National Library of Economics) in Kiel and Hamburg.

Together with the two state libraries in Berlin and Munich and a few other institutions these are the key institutions for national licenses, fully financed up to now by the German Research Foundation [=Deutsche Forschungsgemeinschaft (DFG)]. The national licenses can be used by all faculty members and interested private persons in Germany.^[11]

Germany—a country with so many different states in its history—has developed a refined system of financial support for special collections in university and state libraries to fulfill the need for highly specialized literature in research. This service can be provided thanks to the “special subject collections system” or nationwide library service of the Deutsche Forschungsgemeinschaft (=German Research Foundation). The German Research Foundation covers 50% of the cost of foreign literature in libraries participating in this program which are then designated as the special subject libraries for that subject area. Libraries participating in this system have to commit themselves to building up and maintaining this collection from their own budget and also to sending this material to another library via the interlending library system, when required. The special material may be searched by subject or region using WEBIS^[12] software that enables the user to find the library with holdings on special subject area—for example Psychology in Trier, English language, and literature in Göttingen, etc. All these activities at the national level is seen as the level 4 in serving the information and literature need of the country. Six regional union catalogs facilitate access to these collections.^[13] A search covering all these catalogs can be executed by the Karlsruher Virtueller Katalog (KVK) (=Karlsruhe Virtual Catalog),^[14] The KVK also provides the possibility to search many different national library catalogs from Australia to the United States at the same time.

Academic and Research Libraries

Academic and research libraries have a long tradition in Germany. In the Holy Roman Empire (962–1806), the first

Table 1 Sammlung Deutscher Drucke.

1450–1600 Bayerische Staatsbibliothek in Munich
1601–1700 Herzog August Bibliothek in Wolfenbüttel
1701–1800 Staats- und Universitätsbibliothek of Göttingen
1801–1870 Universitätsbibliothek Johann Christian Senckenberg in Frankfurt/Main
1871–1912 Staatsbibliothek zu Berlin—Preussischer Kulturbesitz in Berlin
1913–Deutsche Nationalbibliothek in both Frankfurt/Main and Leipzig

university and university library was founded in Prague in 1348. In what is now Germany, the oldest university library is the library of the oldest university—the Ruprechts Karl University in Heidelberg, founded in 1386. In the following two centuries, many German dukes and kings founded universities for the education of the nobility. In 1388, the University of Cologne was founded and quite a few other university libraries like the ones in Erfurt, Würzburg, Leipzig, Rostock, Greifswald, Freiburg, Trier, and Tübingen were established.

Many university libraries did not develop substantial collections until 1800, some not even until the end of the nineteenth century when the Prussian empire started to build up special collections in the university libraries of Prussia. At that time Prussia covered a great part of east and northern Germany with boundaries stretching to the Rhineland. University libraries developed in the beginning of the twentieth century as did individual departmental libraries. During the Nazi regime, university libraries hid or destroyed works by Communist, Socialist, and Jewish authors, and the role of librarians in this dark period of the German history still has not yet been fully investigated.^[15] In the GDR 1945–1990, university libraries became centralized institutions and were part of a regulated system with each library playing a special role in the access structure to Western literature. In the Federal Republic of Germany in the 1970s, many new university libraries were opened with the new concept of open stacks and often these institutions had only one single centrally organized library. This structure is in contrast to the two-level system still in existence in many universities where there is a main university library and many independent faculty and departmental libraries. After Reunification, libraries of the former East Germany received new buildings and upgraded their collections. Some university libraries have developed remarkable service ideas: the 24-hour library in Konstanz (Konstanz University library was the first university library in Germany with 24-hour-opening starting in 2001^[16]); a cooperative subject list of accessible databases from 195 libraries organized by the university library of Regensburg;^[17] and research on digital resources and repositories in projects of the university library of Goettingen.^[18] Following a discussion of open access journals the Regensburg university library developed the Electronic Journals Library (=Elektronische Zeitschriftenbibliothek EZB)^[19] with a very simple method: green for free access to full text, yellow for free access for users from certain institutions, and red no full text access available. Libraries of universities of applied science are oriented toward providing study materials and they have a high rate of duplication in their collections to serve the needs of their students.

At the same time, the European Union has started a reform of European Higher Education which was articulated in the Bologna Declaration of June 1999. The aim of this reform is to make academic degree standards and

quality assurance standards more comparable and compatible throughout Europe.^[20] Since the Bologna Process started, academic institutions in Germany are changing from a self-determined study system to a streamlined Bachelor's and Master's degree program with specified requirements for the students. Bachelor students often need the same books as before, but they frequently use library space for learning and they need information literacy training. To meet those needs, academic libraries have changed to provide far more space with wireless Lan connections, and librarians have been successful in integrating information literacy into the curriculum at some universities.

Public Libraries

German public libraries have gone through various dramatic changes during the 160 years of their existence. In the beginning, city libraries had to collect important publications needed by the administration and they were usually viewed as being open to the public even though only the upper class could have access to them. The first “true” public library was opened on October 24, 1828, in Grossenhain, Saxony, on the initiative of Karl Benjamin Preusker (1786–1871) and since 1995, October 24 is now designated as “Library Day” in Germany. The creation of this library came at the beginning of a political awakening of the German nation which cumulated in the March Revolution of 1848. Many public libraries were founded in the middle and the end of the nineteenth century, supported by private “Bildung” educational initiatives (the word Bildung means more than education, it includes the whole person). These initiatives included the “private reading room movement.” At the same time there were official community activities like the opening of public reading rooms and public libraries, which were sometimes combined with the former city library.

At the end of the nineteenth century, more information about American public libraries reached Germany through the librarian Constantin Nörrenberg who reported on what he observed in his travels. In 1893 Constantin Nörrenberg took part in a library conference in Chicago. His report in ‘Centralblatt für das Bibliothekswesen’ suggested reforms in German libraries. These new ideas influenced the profession and stimulated the movement for creating Bücherhallen (public reading rooms) and public libraries. Many German public libraries were founded during the first years of the twentieth century and another wave of public libraries were founded after the First World War. From 1912 onward an intense dispute arose between Paul Ladewig (1858–1940) from Essen,^[21] who supported a free and tolerant approach of library service and Walter Hofmann (1879–1952) from Leipzig who preferred a strong socio-pedagogical approach.^[22] This dispute still has influence on public libraries in Germany today. Instead of combining the service for the general public

with older and traditional works in the collection, German librarians in their tendency to be very exact, divided library collections and services clearly into research or scientific materials on one side and easy reading material for the entertainment of the public on the other side. After 1945, many new public libraries were founded in the GDR—not only in cities and villages but also in factories. A system of large public libraries called Wissenschaftliche Allgemeinbibliothek (General Research Library), was established to serve the scientific needs of the public. East Germany became known as “Leseland,” a country of reading.

In Germany today small and medium-sized libraries have a good mixture of different books and media to offer at the basic level. In serving people at this level, the library provides a central access point for information and markets its services to everybody. Public libraries at this level are financed by local communities. The libraries’ tasks at levels 1 and 2 include:

- Meeting the citizen’s information needs, by facilitating access to the complex world of books and nonbook resources, including the Internet.
- Supporting the use of new technologies.
- Promoting reading and cultural work within their community.
- Inspiring people to spend their leisure time creatively,
- Motivating learning.
- Helping to integrate different user groups, such as people from different cultural and linguistic backgrounds.

According to the Bibliotheken 1993 libraries at level 2 have to meet the following standards:

- Two books or nonbook items per resident.
- A stock of current periodicals.
- 20% of the collection should be nonbook materials (CD, video, DVD etc.).
- Minimum opening hours of at least 35 hr a week.
- Participation in union cataloging and interlibrary lending systems.
- 5% of the collection should be current reference books that provide extensive information and information about products and prices, as well as about tested technical products.

Libraries at levels 1 and 2 should offer access to selected databases.^[23] The traditional organizational system of the public library is still in existence: there is a central library either with district and branch libraries or just branch libraries. Some public libraries have special music libraries providing musical scores, books on music, and CDs. A special home delivery system for handicapped people delivers books and nonbooks materials; often this service is supported by volunteers. The mobile library stops at

schools and at places outside the city center where there are no branch libraries. One mobile library can serve approximately 25,000 inhabitants.

During recent years, many new public libraries have been built in Germany. Some of these have very interesting architecture; examples include Münster and Ulm which have fascinated architects and librarians alike, and have sparked the development of new concepts for library architecture in Germany. One of the most famous public libraries is the Würzburg library which has won different prizes like the “Library of the Year” prize in 2003 and which was often at the top of the German library benchmarking public libraries of this size. German public libraries have developed interesting concepts for youth libraries all over the country, with good examples in Düsseldorf and Hamburg. The largest public library system in Germany is found in Munich with the traditional central library and many different branches. Munich was the first metropolitan library to use Radio Frequency Identification in bar codes.

The establishment of five or six Combi(Combination)-libraries, where research library and public library are integrated into one organization, illustrates a trend which is not only found in Germany but also in Europe and elsewhere. The most developed integration can be seen in the Central-and Regional-Library in Berlin, where the general books for the public and scientific information and scholarly works are all shelved together. The Zentral-und Landesbibliothek Berlin functions as a public library and as a state library with legal deposit for the city and state of Berlin. The combined Berlin library offers 3.2 million books and nonprint media in an integrated research and public library collection which provides users with a wide range of materials.

Other Libraries for the General Reader

“Factory” libraries are public libraries for the employees of the factory and their families. West Germany was a country with numerous factory libraries up to the 1970s and East Germany had many factory libraries until the change in the industry after Reunification. During the last decade, factory libraries decreased from several 100 to fewer than 50 during the 1990s and the German Association of Factory Libraries dissolved in 2004. In hospitals, libraries for the patients that provide a kind of public library service are still prevalent, but often they are administratively combined with the highly specialized library for the medical staff. Libraries in prisons received more attention when the prison library in Münster won the National Library Price in 2007.

Quite a number of public libraries are financed by the Christian churches with philosophy of practice based on their own cultural traditions. They have fewer opening hours and are run by volunteers.

School Libraries

In Germany only 5% of all public schools have any kind of school library. Some school libraries have a good collection of books and media, enough space, and high speed internet connections. Others have only a small collection of donated books, collected by parents and supported by volunteers. The reason for a lack of school libraries in Germany has its roots in the civil servant hierarchy in which librarians and teachers often have a different status and hence, schools do not usually have the means for employing a librarian for the school.

Special Libraries

Special libraries are often part of their institutions and are focused on internal services. Their collection policy often covers digital research data and grey literature in all kinds of formats. Librarians in these special libraries are often expected to synthesize detailed content information to suit their users' needs and in most cases, these special libraries are not open to the public, although some may allow use of the reading room. Nevertheless, special libraries play an important role in Germany's library services; innovative information services often develop from these libraries' activities in response to their highly specialized users' needs. There are special libraries of research institutes, such as Max-Planck Institutes or Fraunhofer Institutes, which serve the basic research programs in these institutes. These libraries are of high quality and very well financed. Many special libraries in Germany are one-person-libraries and these solo librarians have created a small, informal network for mutual support, and exchange of ideas. Germany has nearly 1000 special libraries, including those located in ministries and in administration, law libraries and medical libraries, and libraries of museums and art galleries.

Digital Library Collections and Services

Digitization is a very important activity of German libraries. From the small special library all the way up to the National Library, digitization is a topic of great interest. There are three important digitization centers, one at the German National Library and a second center at the University Library Göttingen and the third being the Google Library Digitization Project at the State Library Munich. Most of the projects focus on digitization of special collections, incunabula, and older manuscripts. The Google project in Munich is different as it is the first mass digitization project in Germany and is concentrated on the eighteenth- and nineteenth-century collection in Bavaria. There are quite a few other digitization projects which are heavily used, such as the address-books of Berlin from 1799 to 1943 at the Central and Regional Library in Berlin^[24] or the digital Gutenberg Bible^[25] at the

University library of Göttingen. Many of the ongoing digitization projects are cofinanced by the German Science Foundation, which supports library technological development and cooperative research library activities for better science.

LIBRARY AND INFORMATION SCIENCE AS A DISCIPLINE AND A PROFESSION AND LIS EDUCATION

Library and Information Sciences is offered as a discipline in different types of institutions. There is only one academic university—the Humboldt University in Berlin—which offers a doctorate as well as a Bachelor's and Master's degree. Although the Master's degree will soon become the qualification needed by professional librarians an older system of credentialing is still in place. In the past, to become a professional academic librarian, the candidate must have already completed a university diploma or master's degree in some field like German literature, history, or physics, before he or she is admitted to a 2-year course of library and information science to get a second master's degree in this field. This qualifies him or her to work as a subject librarian at the university level and for different higher management positions including the head librarian position at larger public libraries.

Since the Bologna process has altered the European higher education practices, the former course for certified librarian or Diplom-Bibliothekarin at different universities for applied sciences has now changed to a Bachelor's degree in library and information science. This training program qualifies the candidate for cataloging and many other positions in university and research libraries as well as for management positions in small- to medium-sized public libraries and special libraries.

At the lower level, students who have completed the 10th grade (or German middle school) may enroll in a 3 year vocational training program to become a specialized employee in media and information services. This is an integrated qualification for work in libraries, archives, and audiovisual archives. This program is administered like other German vocational training programs, i.e., the training takes place alternating between 3 weeks in a library followed by 3 weeks of courses in a corresponding vocational school for the period of 3 years and requires a series of final examinations. This training program provides German libraries with well-qualified young staff able to carry out various tasks from simple cataloging to lending services and periodicals' maintenance to Web page management and so on. In Germany, it is very common that everybody in a library and information service does front desk work (check-out, reference desk, etc.), or public relations work combined with back office work like cataloging or acquisition.

Continuing education is a very important activity in German libraries. Each year the Bibliothekartag (German librarians' conference) is the most important continuing education meeting for German library and information professionals. There are many other possibilities for continuing education for librarians at the level of the Länder and a virtual marketplace makes it easy to find them all.^[26]

Professional Associations

Cooperation is at the heart of *Bibliothek & Information Deutschland* (BID = Federal Union of German Library & Information Associations), the national federation of library associations, founded in 1989 as an umbrella organization of German library and information associations. This umbrella organization unites four major association:

1. *The Deutscher Bibliotheksverband* (DBV—German Library Association), represents 1700 institutions and includes both academic and public libraries. DBV was created in 1949 and in 1991, after being separated for 27 years, the German Library Association (East) and the German Library Association (West) reunited.
2. *The Berufsverband Information Bibliothek* (BIB—Association of Information and Library Professionals) has 6300 members and is the largest association of library and information professionals. It was founded in 2000 through a merger of four separate associations. Its members include many public librarians and library assistants.
3. *The Verein Deutscher Bibliothekare* (VDB—the Association of German Librarians) the oldest librarian association in Germany, was founded in 1900. Most of the library directors and many professional librarians in Germany are among its members. Its membership includes academic and research librarians with university degrees.
4. *The Deutsche Gesellschaft für Information* (DGI—German Society of Information) founded in 1948, represents documentalists and information specialists.

The German Library Association (DVB) has developed and has taken the leadership of a Competence Network of Services like the library statistics and the library portal for Germany.^[27] This library portal is the best information source about libraries in Germany.

ARCHIVES AND ARCHIVAL SCIENCE IN GERMANY

Overview

Germany's archival law was issued in 1988 in the Federal Republic of Germany with amendments added in 2005^[28] that apply to the freedom of information legislation

concerning the accessibility of archives and official records by everybody. Following World War I the first national archival law of 1919 created a central archive for all historical records. Today, materials in all formats (printed materials, maps, data and images, and films and sound recordings) produced by government agencies at different levels must be collected by the Bundesarchiv (=Federal Archive). In a federal state like Germany there is a national archival law and there are archival laws in the different federal states (Länder) to regulate archiving of government records at all levels.^[29] The national law of January 1988 establishes the basic rules for the legal deposit of official records for all administration and government agencies at the national level, and regulates the organization and the accessibility of these records. An important part of the archival law is the question of delayed access. In general, archival records are accessible to the public after 30 years; however, records containing personal information or having special security concerns (medical records, tax data, etc.), are not accessible for 60 years. Other personal data can be accessed 10 years after the death of the person, although there are exceptions to this concerning the official records of the German Democratic Republic. They are freely accessible by law.

The history of Germany with its many small kingdoms is reflected in the development of archives at the state and regional levels. In managing historical records of a territory, archivists must cope with many situations where boundaries recognized in the past often differ from the current political borders of the territory. An excellent overview on archives in Germany has been produced by the Archivschule Marburg which lists State archives at the level of the Länder, community archives, and all other kinds of archives in a full list.^[30]

National Archives and Services

The Bundesarchiv (=Federal Archive) in Koblenz is the central Federal archives in Germany and is under the State Minister of Culture and Media of the Federal Republic of Germany. Some of its records go back to 1411, but the regular collection of records started in 1867, just 4 years before the Foundation of the German Empire in 1871. The Federal Archive is the successor of the Archives of the German Empire that was founded in 1919. The Federal Archive is responsible for collecting the records of all federal constitutional bodies, government, and courts, except the parliament. After Reunification in 1990, the development of eight branches of the Bundesarchiv shows the integration of the two parts of Germany very well. In Koblenz, the records of the Federal Republic of Germany are maintained, in Berlin the records of the German Reich and its successors since 1871, and all other records from 1495 to 1871 except the time from 1807 to 1814 when Napoleon occupied Germany (this archive is in Paris). The Berlin Branch of the national archive keeps the record of

East Germany and of a foundation which was created to protect the records and documents of parties and mass organizations of the GDR (Stiftung Archiv der Parteien und Massenorganisationen der DDR im Bundesarchiv).

As part of the Federal Archives the Berlin Film-Archive is the biggest film archive of the world. The Bayreuth Branch keeps records concerning lost property of Germans in former German territories and former GDR as the records on the search services of the Red Cross, which played an important role after the Second World War 1945.

The German Military Archive is kept in the Freiburg Branch of the Federal Archive and in Ludwigsburg the records of Nazi Crimes can be found. Many records were destroyed during the Second World War 1939–1945, as was a part of the former Military Archive of the Army.

There are four other important Archives at the national level: First:

- *The Parlamentsarchiv des Deutschen Bundestags* (=Archive of the German Bundestag) with all parliamentary records since the Federal Republic of Germany was founded in 1949, and some records from 1945 to 1949 of the military government of the Allies.
- *Die Beauftragte für die Unterlagen des Staatssicherheitsdienstes der ehemaligen Deutschen Demokratischen Republik* (=The Office of the Federal Commissioner for State Security Services of the former German Democratic Republic) preserves the records of the former Ministry for State Security in its archives and makes these available to private individuals, institutions, and the public in accordance with strict legal regulations. These legal regulations differ from the archive law, as there is a special law for this archive which makes it possible to have access to files on persons.^[31] In the archive of the central office in Berlin and in the 14 archives of the outposts of the Federal Commissioner, one can find the records of the former intelligence service of the GDR which developed during the four decades of the existence of the Ministry for State Security. This archive is very active in public relations and often presents results of the research to the press when politicians or other public persons are confronted with their past—as victims or as employees of the Ministry of State Security in the German Democratic Republic.
- Another very important Archive at the national government level is *the Politische Archiv des Auswärtigen Amtes* (=The Political Archives of the Foreign Ministry) with all bilateral and international contracts from 1876 up to the present.
- Last but not least the *Geheime Staatsarchiv Preußischer Kulturbesitz* (=Secret Central Archives of Prussian Cultural Heritage)—a name applied in 1803—can be traced back to 1282 with a location in Brandenburg and it became an autonomous body

in 1598. This archive is no longer secret and provides access to records from 1188 to 1933 relating to Prussia including the history of the king's family and the archive of the Foundation Prussian Cultural heritage since 1957.

German State Archives (Landesarchives)

In the 16 federal states of Germany today, the central state archives or Landesarchive together with some archives of special territories contain important collections of official archives. Due to the historical existence of many duchies and kingdoms, “state” archives have been developed by small territorial units, not identical with the political boundaries of the German states (Länder) as they presently exist. There is still two-tiered structure of archival responsibilities in some of the German federal states, especially those with double names. Since 2003, there have been some organizational changes. First in the state of Saxony-Anhalt, later in North Rhine-Westphalia, Lower Saxony, and Saxony and Baden-Wuerttemberg, the archives of smaller territories have been integrated in one Hauptstaatsarchiv (=central state archive) or Landesarchiv of the respective federal state. This practice has created a single streamlined organization in each these states, as well as a standardized appraisal policy, and it will prepare for the next step toward a digital future.^[32] At the level of the Länder, the archives have the task to collect material of the state governments including the ministries, administrative units, and courts at this level. Just as the National Parliament has its own Bundestagsarchiv, the state parliaments also have their own parliamentary archives. Many archives on the level of the Länder also collect materials from parties and civil organizations. The archives in the new Länder of former East-Germany also have files from the former state-owned companies and factories. Parliaments of the Länder have their independent archives or deposit their archival materials at the state archive. The archives in North Rhine-Westphalia have collected a Linklist as a guide to using materials in all kind of archives in this region.^[33]

Local Archives in Germany

Germany has a very strong community life with more than 12,000 cities, districts, and villages. At the local level, Germany has city archives and county archives. In addition to collecting the records of the local government and the local courts, these archives are active in obtaining materials about civil organizations and famous persons. Besides the official records at this level, many kinds of local organizations have created historical records. There is a saying that wherever there are three Germans, they will found an organization. In many cases, records of local groups may be collected in a community archive. Some of

the local archives have special materials like calendar collections, leaflets and posters, and theater programs and postcards. To support communities with archival services and to give advice on archival problems, in some parts of Germany, such as Brandenburg and Westfalen, service institutions for archives have been established to support the local level. As we have seen, the history of Germany as a country is more complicated than in centralized states, and this is mirrored at the local level, where the situation is even more complicated. Preparations for research in a local archive must be accompanied by a good knowledge of the region's history, what state it belonged to in which time period. Only with this detailed information is it easy to determine the correct archive that was responsible at that time for collecting the files. The principle that the archive must be organized according to the principles used by the government then in power is a very important principle for Germany's changing landscape of small territories over centuries.^[34]

School Archives and University Archives

Archives of famous schools, especially of some of the early secondary schools (Gymnasien) in Germany, have been maintained very well. One example is the school archive of the Berlinische Gymnasium zum Grauen Klosters held in the Central and Regional Library in Berlin. This is a school which many famous people attended and where you still can find the grades of Bismarck, the first chancellor of the German Empire. All records of students and teachers have been kept since 1574.

All universities in Germany have their own university archives, which is often part of the university library and collect student data and documents of the university administration and manuscripts of famous professors. Some of the old university archives like Heidelberg have a long tradition but may have lost documents during times of war in the seventeenth, nineteenth, or twentieth century.

Film Archives and Other Audiovisual Archives

The most important film archive has already been mentioned as a part of the national archive. The most important audiovisual archives are those from the radio and television stations. The ARD Radio stations and other public radio and television stations have maintained public archives from the beginning of radio and television in Germany. The Deutsches Rundfunkarchiv in Potsdam is supported by all public radio and television stations in Germany and has to be especially mentioned because its collection includes the first public radio announcement from October 1923. Current activities include the SWR 2 archive radio with presentation of interesting features from the archive.^[35] The German Music Archives collect all audiovisual media on music and is part of the German National Library. Besides the Bundesarchiv one of the

biggest image archive with 12 million images is the Bildarchiv Preussian Cultural Heritage. In Dresden, the Deutsche Fotothek, a famous archive with more than 800,000 photos, is a part of the university library.

Literary Archives

In the tradition of the classical literature, Germany has quite a few archives of literary figures—the extensive Goethe and Schiller archives in Weimar are only one model. The Literature Archive in Marbach is the main institution that holds manuscripts and typescripts of many German authors and poets. There are some other literature archives with a special focus on regional authors, more or less famous, like the Theodor Fontane Archive in Frankfurt/Oder.

Corporate Archives

Corporate archives are known for being less well organized and are often integrated into the archives of the Länder, state libraries, or university libraries. For example, the 200-year-old library and the corporate archives of the family of Thurn und Taxis, which started the first private postal system in Germany, was given to the university library in Regensburg as a deposit. Other large companies still have their own corporate archive like Krupp in Essen and are able to answer requests from interested persons. The family archives for family-owned concerns are often integrated with the documents of the firm. When companies are dissolved, regional economic archives collect some of those records. A good example is the Bergbauarchiv in Bochum for the coal mining industry of the Ruhr District.

Religious Archives

In Germany, the main type of religious archives are from the Catholic and the Protestant churches with their diocesan or state-level church archives. Protestant archives at the local church level are the most important local sources for genealogy research. Social activities for the poor and for orphans are also well documented in these archives.

Private Archives

Quite a few historical societies have their own archives as do important families. Many family archives of nobility or important men and women are found in Germany, and, if they are not collected by the state archive, they remain in the hands of the families. The nobility has played an important role in Germany in agriculture, economy, military, civil services, and as public persons. Therefore, the archives of nobility like the Deutsches Adelsarchiv (=German Nobility Archive) may have important historical records. In Germany, some active special interest

groups have created important private archives as a grassroots initiative: these include the women's archive, the migration archives, and others called Archive von unten (=Archive from the grassroots). One of these very special private initiatives that needs to be mentioned here is the Archiv der Jugendkulturen (=Archive of Youth Culture) in Berlin, a private institution which resembles both a library and an archive. This archive collects Fanzine, the magazines and flyers produced by fans, and they also collect all kinds of record about the fan culture. It relies on voluntary contributions. Nowadays, the fan culture is moving to the Net and the Fanzines are produced electronically. So, as in all other archives, this archive faces new challenges. The Archiv der Jugendkulturen produces an electronic list of these records, the Fanzine-Index.^[36]

Digital Archival Collections and Digital Finding Aids

Digitization as a form to give access to archival materials is being discussed. The Bundesarchiv in Koblenz and the Berlin branch were very active in digitizing finding aids of their archives. Finding aids are presented at the homepage of the institution. All other archives are increasingly placing their finding lists on the Internet, like the Berlin Landesarchiv. In contrast to the libraries, the discussion on digitizing the material itself is not so intensive. The amount of time spent on doing digitization is judged in relation to the importance of the records. There are many projects on digitization supported by the German Science Foundation, focusing on the conversion of the finding aids. One of the first activities to digitize archival documents was the digitization of the pre-eighteenth century records of the Archive of Duderstadt. This was a project in connection with the Max Planck Institute of History in Göttingen. It was also a pilot program for long-term conservation.

In contrast to Germany's libraries, the archives do not enjoy the same kind of cooperation. During recent years this has changed and more cooperation and discussion has started. The digitization activities are growing, but prior to this there were many successful efforts to save archival records on microfilm. New cooperation has begun with the cooperative cataloging of manuscripts in Kalliope, a central catalog of manuscripts in Germany, run by the State Library Berlin Prussian Heritage.^[37] There is information about 1.3 million manuscripts and for over 400,000 individuals. Approximately 300 libraries and archives are cataloging their manuscripts in this database, which is a partner of the BAM-Portal, a Web server for libraries, archives, and museums.

ARCHIVAL SCIENCE AND EDUCATION

Archival science becoming more important in Germany. Educational programs for archivists and records managers

are offered at various levels and there are ongoing discussions concerning examinations, certification, university level programs, and continuing education.

Besides, the Fachangestellte für Medien und Informationsdienste with their integrated training program for work in libraries, information and media centers or archives, one category of the archivists employed in Germany are still trained according to the rules for civil servants. This means, to become an archivist, with a credential comparable to a bachelor's level degree, the Landesarchiv, or state archive select candidates with high school degree (Abitur). They go through a 3 year program including a 4 month training module at a school of administration and on-the-job training periods in the archive which has selected the student. At the end, the student passes a professional certification examination for civil servants in archival institutions. Then he or she is able to look for the middle management level position in German state archives.

The higher level of civil servants are selected by the State Archives. As a prerequisite, they must have finished a full course of university study, a master's degree, preferably in history, and they are encouraged to have a doctorate. Following an 8-month training period in the archive, the candidate for this level has 12-month program of study at the School for Archivists in Marburg, and a 1-month internship at the Bundesarchiv. Certain universities of applied science in Germany have changed the former Diplome-programs for archivists to bachelor and master's degree programs of study. The 3- to 4-year courses include one semester of work experience at an archive. At the University of Applied Science in Potsdam, preparations for the start of a nonconsecutive master course for working archivists have begun, following the distance learning model for librarians at the Humboldt University in Berlin. The consecutive master's course will start in 2010. The most famous school for archivists is the Archivschule Marburg, a university of applied science solely for archival studies. Its library is the special library for archival science in Germany.

Professional Associations

The main professional association of archivists is the *Verband Deutscher Archivare und Archivarinnen* (VdA) (=Association of Archivists) founded in 1946. With 2200 members it is the largest association of archivists in Europe. Archival appraisal is discussed in the position paper of a working group "Archival Appraisal" within the Association of German Archivists.^[38] The association publishes papers on basic principles, standard procedures and as special problems like handling large quantities of similar case files, statistical records, electronic, and audiovisual records with checklists. These publications help to build a common level of appraisal in state and local archives in Germany. Since November 2008, the

association has a new working group on archival documents of the twentieth and twenty-first century.^[39]

Electronic Records

There is an ongoing discussion about using electronic records, about the complexity of permanent data retention and other issues. In many German archives, the focus is now changing to long-term preservation of electronic records—a very difficult task as government agencies and administrations use different technologies for their archival systems.

Preservation of Documents

Preservation and conservation is one of the main challenges in German Archives. Since 1961, a selection of archival documents of national and state archives are preserved additionally by preservation microfilming, supported by the Bundesamt für Bevölkerungsschutz und Katastrophenhilfe (=Federal Office of Civil Protection and Disaster Assistance).^[40] Methods of restoration and conservation of the materials including removal of mould and deacidification are regularly discussed as paper made between 1840 and 1990 contains acid and German companies have devised different methods to extract the acid and stabilize the paper.

Other Issues

Archival pedagogic or user education is new to the archival field, as is public relations work for the archives in Germany. More and more activities are initiated by key archives for the public, including not only exhibitions but also discussions for students of middle school who are doing learning projects on history.

MUSEUMS AND MUSEOLOGY

National Museums

There are more than 6000 museums in Germany. Most of them are organized at the community level. At the level of the federal states (Länder), there are Landesmusseen (State museums), as well as other special and more important collections. Due to the federal structure, there is not one National Museum in Germany. Instead, there are several museums at the national level supported by the Federal Minister of Culture together with the Länder. Today, some of these museums are organized as a public foundation or a limited company, with representatives of the national government on the board of trustees, often together with those from the Länder.

The most important museum complex of this kind is the *Stiftung Preussischer Kulturbesitz* (=The Prussian

Cultural Heritage Foundation) and its museums, libraries, and archives. The Foundation was created in 1957, and two-thirds of its budget is financed by the Federal Government of Germany and by the 16 Länder.^[41] It is one of the largest museum complexes worldwide and the most extensive in Germany with 25 individual institutions altogether. The Museum collection, called the *Staatliche Museen zu Berlin—Preussischer Kulturbesitz*, (=Berlin State Museums—Prussian Cultural Heritage) originated with collections of the treasures of the Prussian kings and emperors, and on the travels of important German archeologists. Since Re-unification of Germany in 1990, the collections and museums from the East and the West are united again. Most famous of these is the *Museumsinsel* (=Museum Island) in Berlin, a UNESCO World Heritage Site, with the Pergamon-Museum as its public magnet. This is surrounded by museums with extensive archeological artifacts and nineteenth-century collections. At the *Kulturforum Site* (=Cultural Forum) in the former West part of Berlin is another major complex of art museums with collections of paintings from more than five centuries and galleries with twentieth-century art. The *Dahlem Museums*, another part of the Prussian Cultural Heritage, combines museum collections of ethnology and Asian art. Collections of contemporary art, design, and photography; these collections are located at the Museum Hamburger Bahnhof, at Museum Berggruen and the New National Gallery and at other facilities of this Foundation which includes the *Institut für Museumsforschung* (=Institute of Museum Research) which produces documentation and statistics, as well as research on German museums.

The *Deutsche Historische Museum* (=The Germany Historical Museum), supported by the Federal Minister of Culture, was officially founded in 1987 after a long discussion about the need and relevance of a national museum of history. Opponents saw this as a growing tendency toward nationalism which was at the base of the Nazi ideology—still a sensitive topic in German society. The museum now offers German history from its beginnings, but places this history within the European context. After Re-unification of Germany, the museum moved back to the center of Berlin, and took over the collection of the former Historical Museum of German Democratic Republic.

The *Stiftung Haus der Geschichte der Bundesrepublik Deutschland* (=Foundation House of the History of the Federal Republic of Germany) in Bonn and Leipzig, documents the history and the democratic development of the Federal Republic of Germany since 1945. As the eastern branch of the Foundation, the Leipzig Forum of Contemporary History was opened on October 9, 1999, in recognition of Leipzig as the center of the peaceful revolution in East Germany 1989 which led to Re-unification of Germany. This History Museum collects items of from all media to art, graphic art and political caricatures, designs, textiles and objects of daily life, and currencies.

There is one contemporary art collection at the national level called *Bundeskunstsammlung*. Since 1970, the German Federal Republic collects German art from 1949 onwards. The whole collection is not located in one museum but is placed in embassies, ministries, and public spaces. Today, this collection includes 1200 pieces of art.^[42]

Although culture is the responsibility of the Länder, there is a special law for a “blue list” of those cultural institutions from Western Germany which are cofinanced by the Federal Government. Accordingly, 20 important cultural institutions of Eastern Germany are listed in a so-called “bluebook” of the Federal Government. Some of the following museums of the Länder belong to one of the lists and receive national support as cultural beacons of national importance.

The Castles and Gardens of the Prussian Kings are combined in the *Stiftung Preußische Schlösser und Gärten Berlin-Brandenburg* (=the Foundation of Prussian Castles and Gardens in Berlin and Brandenburg). It was founded in 1994 as a combination of two former institutions in West and East. The foundation maintains and documents the heritage of the castles and gardens including their collections of royal art and interior furnishings.

The *Klassik Stiftung Weimar* (=Foundation of the Weimar Classics) is a large museum complex comprising 11 sites: a library, the archives, and museums of Goethe and Schiller, palaces and historical houses as well as the parks in and around Weimar. The Weimar Classic forms the ensemble Classical Weimar, honoring this famous period in German culture.

Other institutions from the blue list include

- Kunsthalle Bremen (=Art Gallery Bremen).
- Bauhaus-Archiv Museum für Gestaltung (=Bauhaus-Archiv Museum of design) Berlin.
- Schiller Nationalmuseum (=Schiller National Museum) Marbach.
- Franckesche Stiftungen Halle (=Francke Foundations).
- Leibniz Science Society museums.
- The Römisch-Germanisches Zentralmuseum (=Roman-Germanic Central Museum) Mainz.
- Germanisches Nationalmuseum (=Germanic National Museum) Nürnberg.
- Deutsches Museum München (=German Museum Munich).
- Deutsches Bergbaumuseum (=German Mining Museum).
- Bochum, Deutsches Schifffahrtsmuseum (=German Maritime Museum) Bremerhaven.

Major Art Museums and Galleries

Altogether there are about 500 art museums in Germany. Germany's major art museums and galleries are in Berlin, but Munich, Dresden, Kassel, Hamburg, Cologne,

Düsseldorf, and Stuttgart all have significant art museums and galleries. Especially famous are Munich's *Alte Pinakothek* with European masterpieces of the fourteenth to the eighteenth century (one room just for Rubens) and the *Neue Pinakothek* which covers nineteenth-century art. Munich also has the *Pinakothek der Moderne* which collects graphic art from the fifteenth century to the twenty-first century; it also includes one the first design collections that originated in 1907.^[43] The *Staatliche Kunstsammlungen Dresden - The Old Masters Picture Gallery in Dresden*—displays Italian renaissance, Dutch and Flemish masterpieces, Spanish and French paintings of the seventeenth century and older German art as that by Dürer, Cranach, and Holbein. As one of the few museums from Germany represented in the virtual reality of the “Second Life,” there are rooms from this Museum reproduced true to scale with all 750 masterpieces.^[44] The New Masters Picture Gallery is well-known for modern art. The Staatsgalerie (=State Gallery) Stuttgart has art from the Middle Ages up to the modern period, although the Stuttgart Kunstmuseum (=Stuttgart art museum) concentrates on modern art. In Kassel princely state supported museums have very rich collections. The Hamburger Kunsthalle (Hamburg Art Gallery) supported by the Hamburger Kunstverein (Hamburg Art Society) is known for its art from the Northern Germany, from Holland, France, and Italy, with many masterpieces from the fourteenth century. Since 1995, it also has a contemporary section. The development of German artists belonging to the “Brücke” (Ludwig Kirchner, Emil Nolde, and others) is very well represented with 400 art works in the Brücke Museum in Berlin Grunewald. The Bauhaus, a design and architecture school from 1919 to 1933, is represented in the Bauhaus-Archiv Museum Berlin, and in museums in Dessau and Weimar, where the Bauhaus was founded. The art museum of the Land Berlin, the Berlinische Gallery, has a fine collection from 1870 until the present with special themes Fluxus and Dada. The Kunstsammlung von Nordrhein-Westfalen K20 K21 (=the Art Collection K 20 K21 of the Land North Rhine-Westphalia)^[45] is a fabulous collection of the art of the twentieth century focused on Western European and American art (Picasso, Beuys, and Klee). Nearby, the Museum Ludwig of the city of Cologne collects twentieth century and contemporary art, too. This is one of the few museums with Russian avant-garde art of the 1920s and 1930s and is known as the third largest collection of Picasso's works in the world. Frankfurt City's Museumsufer—11 museums at the bank of the river Main—can be seen as a museum complex, representing all kinds of special art collections.

Science and Natural History Museums

Natural history museums in Germany often developed from university collections of minerals, fossils, plants, and insects. At a global level, Germany's various

collections of millions of specimens are of great importance for biodiversity research. There is no one central national museum for natural history but instead, the specimens are divided among 12 major museums and more than 100 smaller ones. Germany's natural history museums comprise seven direct nodes of the *Global Biodiversity Information Facility*. They are responsible for collecting data representing seven major taxonomic groups:

- Insects at the Staatlichen Museum für Naturkunde Stuttgart (=State Museum of Natural Science in Stuttgart).
- terrestrial invertebrates at the Zoologische Staatssammlung München (=Zoological State Collections Munich).
- marine invertebrates at the Forschungsinstitut und Naturmuseum Senckenberg (=Research Institute and Museum of Nature Senckenberg) in Frankfurt.
- animals with vertebrae at the Zoologischen Forschungsinstitut und Museum Alexander Koenig (=Zoological research institute and museum Alexander König) in Bonn.
- botanical specimens at the Botanischer Garten und Botanisches Museum Berlin (=Botanic Garden and Botanic Museum Berlin).
- mycology at the Botanische Staatssammlung München (=Botanic State collection Munich).
- prokaryotes at the Deutsche Sammlung von Mikroorganismen und Zellkulturen Braunschweig (=German collection of prokaryotes and viruses).

In Germany, technical history museums have seen rapid development during recent decades. Due to a total economical change in certain regions in Western Germany and after the Re-unification in the East of Germany, large coal mines, and old steel production sites, as well as abandoned industry sites of different kinds, have been preserved, making Germany very rich in technical history sites. There are large museums of the former mining and steel industry and groups of volunteers run the museums in their leisure time, sometimes supported by the local governments. Other technical museums have a longer tradition, such as those displaying handicrafts and other items that represent the rich diversity of local traditions in Germany's small communities.

The *Deutsches Museum* (=German Museum) in Munich founded in 1903, has one of the richest technical collections of the world. Besides the traditional display of mechanical and technical inventions, the museum has created a transportation museum to explain the development of bicycles, cars, and trains, and in 1992 opened a special airplane museum with an old airport and maintenance hangar outside of Munich.

Established only during the 1970s, the *Stiftung Deutsches Technik Museum in Berlin* (= Foundation of

German Museum of Technology in Berlin) presents impressive exhibitions of technical masterworks ranging from locomotives to small scale technology. Many exhibits with a strong experiential character have been developed in order to involve visitors in all kinds of activities using new interactive concepts. The Museum has opened a new section in 2006—recognizable from afar by an example of the “Raisin bombers” aircraft during the Berlin Air Lift on its roof. The attached Sugar museum 6 km north shows 500 objects on the history of sugar and is typical of traditional museum culture in Germany.^[46] It was founded in 1904 as a part of the sugar industry, before it came under the support of the city and state of Berlin. It is typical for the development of small industry museums in Germany to go from private institutions to ones that are supported by state or local authorities.

On the level of the *Länder*, important museums of crafts and technology are located in Mannheim, Hagen, Hamburg, and many other cities. From the German Radio Museum in Potsdam to the clock museum in Furtwangen or the famous toy museum in Nuremberg, many special museums possess rich collections of crafts and technological inventions. Since Germany is so famous for its organs, clavichords, and pianofortes as well as other instruments like violins, the museums of music must be mentioned. The collection of the *Musikinstrumentenmuseum* (*Museum of Musical Instruments*) in Berlin with more than 3000 instruments is one of the biggest in Germany.

All technical museums are a wonderful world for children and many of them have special tours for children or offer their location for birthday parties in the museum. However, there are only a few institutions specifically designated as children's museums in Germany, and most of these are based on private initiatives like the Exploratorium in Potsdam or the Machmit Museum (Hands-on Museum) in Berlin, where even a few objects like a special “path to feel” can be borrowed.

Many of the older universities in Germany have museum-like collections with plant and animal specimens, and technological artifacts from the history of their university. The most famous and oldest university museum is in Heidelberg. Marburg and Halle have important university museums and with them, the Berlin Humboldt-University collection are all famous in medicine and science. Altogether there are 700 collections existing at universities with significant objects of science, technology, medicine, history, and art.^[47]

Historical, Anthropological, and Archeological Museums

Besides the large national institutions, there are more than 2000 historical museums and historical sites in Germany and many of these local museums were founded during the Nazi regime. During recent years important new themes have developed for these museums such as

memory-culture (Erinnerungskultur), oral history, and multicultural collections. Local history museums are key to the historical understanding of the people, and now the museums exploring the oppression of the Nazi period are becoming important. Some of these museums consist of historical parks to explore the history of early settlements, old housing, and economy. Often positioned in the countryside, these outdoor museums have special functions in supporting regional tourism.

There are many historical sites associated with Germany's world-famous authors, philosophers, artists, and other historical personages. There are museum houses of Goethe and Schiller not only in Weimar but also in the towns of their birth, Frankfurt and Marbach, and the same is true for Bertold Brecht in Augsburg (his birthplace) and in Berlin where he lived and worked for so long.

Archeological finds in Germany cover a wide range of periods, starting with the Homo Neanderthalensis in the Neanderthal near Düsseldorf (130,000 years ago). The Hedeby Viking Museum, (eighth to eleventh century), and artifacts from the Roman era found along the Rhine and Mosel and exhibited in archeological sites and museums from Cologne to Trier, from Xanten to Mainz. Site museum also represent the complex history of German duchies and small kingdoms. From the Middle Ages to the Renaissance, from the Baroque to a new Gothic style all types of castles can be visited. Many castles and palaces are regional museums and there are special tours along the Rhine to visit the numerous, beautiful castles on the mountains there. More than 80 scenic holiday routes throughout Germany are integrating local museums into their proposed itineraries; these include museums related to fairy tales, toys, windmills, or asparagus, just to name a few.

Special museum sites have developed in Germany to honor the victims of the crimes of Nazi Terror—the Gedenkstätten (=the memorial sites of the Holocaust). They are more than a normal holocaust museum as they commemorate the site, where the Jews, the Communists, and the Roma were murdered. Many of the buildings of these sites still exist and show the brutality of that time. All these memorial sites have many activities for students and host regular lectures for the public.

ZOOS AND BOTANICAL GARDENS

In Germany, zoos and botanical gardens are not counted in the statistics of German museums.^[48] Nevertheless, Germany has many zoos and the Berlin Zoo has the most animals and species of any zoo in the world. *Berlin Zoologischer Garten*, founded in 1841, has 13,722 animals of 1388 species and has now been combined with the Tierpark Berlin-Friedrichsfelde in former East Berlin, founded in 1954 with 7955 animals of 976 species.^[49] Important zoos are Hagenbeck in Hamburg, Hellabrunn

in Munich, Wilhelm in Stuttgart and the Cologne Zoo. Altogether, there are more than 750 zoos listed in the German Zoo Database.^[50]

Botanical gardens in Germany have existed since the sixteenth century. Often such gardens developed from former monastery gardens and were later affiliated with the neighboring university (as in Leipzig, 1539). Today, more than 90 botanical gardens offer great attractions. The *Berlin Botanischer Garten and Botanisches Museum* (=Berlin Botanical Gardens and Botanical Museum) with more than 22,000 plants is the third biggest botanical garden of the world. Every 2 years a new botanical garden is founded in Germany as the result of the Bundesgartenschau, a biannual Federal horticulture show.

DIGITAL MUSEUM EXHIBITS AND SERVICES

Creation of digital museums in Germany is just starting. As more and more museums have the documentation of their collections accessible in digital form, the museums are starting to put these materials online. Digital museums often just mean that the list of objects can be found on the museum Web site. Nevertheless, a few museums have scanned their objects and put these up in the Web. The German Historical Museum in Berlin has already digitized 250,000 items which are searchable via Internet.^[51] Big museums like the German Historical Museums are in the forefront in developing virtual exhibitions. Together with Bonn, they are part of the LEMO, the Living Museum Online, a collection of Germany's history with interesting historical multimedia files from 1871 up to the present.^[52] The Gemäldegalerie Dresden is one of the few German museums represented in virtual reality with attractive explanations accompanying its objects online. German museums have started a Web presentation to concentrate their virtual activities. This Virtual Library Museum has been created by the German Museum Association in cooperation with International Council of Museums (ICOM) Germany and the Museum Institute, and cosponsored by the Historisches Centrum Hagen. Thus, all museums in Germany with virtual activities, documentation, and Web sites are listed here.^[53]

Museology as a Discipline and Profession

In November 2007, a very important conference on museum research took place in Berlin, sponsored by the Volkswagenstiftung—Volkswagen Foundation. More than 4000 museums were asked to respond to a questionnaire on research in museums. Research is an important part of museum activities and in 2008, as a follow up, the Volkswagen Foundation launched an initiative of research in museums with support of doctorate and post doctorate research in middle-sized museums, international research networking of curator; they also provided funds for

making more information about research in museums available to the public. Major museums have research agendas, as has the Museum of Natural Science in Berlin. Currently, this research concentrate on six different research lines including biodiversity, evolution, impact research, and research history.

Education for Curatorship and Museum Administration

More than 50 universities and universities of applied science offer a wide range of courses from museology in Leipzig to museum studies in Berlin, and they teach practical knowledge of how to run a museum. Cultural management and museum paedagogics (museum education) are also research fields at some universities. Nevertheless, many museum curators have studied art history or have other traditional university degrees before the Bologna process in 1999 introduced the bachelor and master degrees in Germany. New developments in this field can be expected.

The “Voluntariat,” (a museum assistant in German museums) is a 2 year, low-paid training period at an institution, which is prerequisite to gain a permanent position in one of the museums. After finishing a university master’s degree or doctorate, one can apply for a “voluntariat” at a museum. In contrast to training for librarianship, there is no clear museology curriculum, but only on-the-job training for these museum specialists. Therefore in 2007, a group was founded by the museum associations to establish regulations and standards for training museum assistants.

Professional Associations

The Deutscher Museumsbund (=German Museums Association), founded in 1917, is the premier organization for museums and its membership includes both institutions and individuals. The Association works closely with the Institute of Museum Research in Berlin which produces the German museum statistics each year and supports museum research. The statistics on museums only include museums that are open to the public and not commercial. The Institute is also the home of the central special library on museology in Germany. It was founded in 1979 in response to similar developments in the German Democratic Republic. The Museumsbund also cooperates with the National Committee of the International Council of Museums—ICOM Deutschland which supports international exchange programs. There is no strong cooperation between the regional associations of the German Museum Association. The most important meeting is an annual conference.

Small- and middle-sized museums are supported by some institutions in the Länder, which give advise and help. In some Länder like Bavaria and Baden-

Württemberg these are public institutions, in other Länder like Lower Saxony or Brandenburg, the Museum Association has this task. Therefore the regional museum organizations are important in the Länder.

Key Contemporary Issues

The museum associations have established various projects and research groups. The educational task of museums has been one of the main topics in German museum discussions for more than 30 years. Museum education programs are aimed at children as well as at adults, and their goal is to inform and support understanding of the museum objects. These discussions have focused on methods of integrating museum education: either as supplementary to the exhibition or as an integral part of the exhibition concept. There is a special association for museums’ educational tasks. In cooperation between different partners some projects like <http://www.schule-museum.de>^[54] have developed very successfully.

Other contemporary issues under discussion are visitor research, marketing museums, and managing volunteers. A lot of research is being done on conservation and restoration in museums and there is an active exchange of knowledge on disaster prevention. Research on museum visitors is a one of the most important aspects of modern museology in order to optimize exhibition content and location, and to analyze the impact of the museums. A working group on volunteers in museums has published a position paper and the discussion shows different views and activities with volunteers. For several years, the multicultural aspect of museum work has produced discussion and new activities now focus on the history of the Germany’s immigrants in the local Heimatmuseums. The “Long Museum Nights” with museums being open without fees for the entire night first started in Berlin in 1997 and has become a very attractive event twice a year and a role model for other museum nights all over Germany.

In February 2006, the German Museum Association published standards for museums. These are not rigid regulations, but important guidelines to assist in developing individual activities along these standards. The German view on museums is determined by these regulations set out by the Museumsbund: professional supervision with adequate support for researchers and scientific specialists. Another basic principle: The original has to be placed in the center of all exhibitions.

CONCLUSION

Convergence and cooperation among the various information institutions in Germany have not been developed extensively and there are few strong ties between them. Libraries, archives, and museums have their specialized standards, different software tools, and different training

programs. It is difficult to merge databases and information.

Provenance Research, a common topic for museums, archives, and libraries, is currently gaining importance, as during World War II many collections were lost, confiscated or displaced. The Nazis seized art collections and libraries from Jewish civilians before they were deported to concentration camps. Many of these objects were placed in museums and libraries. After more than 50 years it is extremely important to clear up the “smudges” in ownership, to learn more about the lost and looted art, and to support the Washington Declaration from 1998 about restitution, which has also been reinforced by a declaration by the government of the Federal Republic of Germany. Libraries, archives, and museums are working together to identify Nazi-confiscated cultural property and place it into <http://www.lostart.de>, the Internet Portal of the Koordinierungsstelle für Kulturgutverluste (=the coordination office for lost cultural property) in Magdeburg.^[55]

One model of cooperation is the BAM-Portal, a Web portal for libraries, archives, and museums, which helps libraries, archives, and museum to coordinate digital projects. This includes European digital projects like EUROPEANA which include Germany's cultural heritage at the European level. In future digitization will play a greater role in convergence between libraries archives and museums. Nestor,^[56] the German network of expertise in digital long-term preservation, will become an important cooperation for libraries, archives, and museums and their future in the digital age.

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Global Open Knowledgebase

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Abstract

The Global Open Knowledgebase (GOKb) is a project to build an open-data, community-managed knowledge base that describes academic publications as they appear in the supply chain. GOKb was designed and implemented by the Quali Open Library Environment founding partners and Jisc Collections, and is maintained by the Open Library Environment. This entry describes the history of the project and the core functionality of the GOKb service.

INTRODUCTION

This entry will introduce readers to the Global Open Knowledgebase (GOKb) project, including project history and core functionality.

GOKb is an open, community-managed repository of metadata describing electronic resources as they are represented with the academic publishing supply chain. Like existing commercial knowledge bases, GOKb includes standard metadata elements describing the components that support the marketing, sale, purchase, and hosting of electronic resources. Through GOKb, users can acquire information about the titles sold by a particular publisher, the package grouping used by the publisher for sales purposes, and the access platforms used to make resources available to library customers and their end users.

Founded in 2012, GOKb began a project of the Quali Open Library Environment (OLE) founding partners, including North Carolina State University (NCSU), Indiana University, the University of Florida, Lehigh University, Duke University, the University of Chicago, the University of Maryland, the University of Michigan, and the University of Pennsylvania; and Jisc of the United Kingdom. NCSU served as the lead school for the project. As of 2016, GOKb continues to be supported by OLE.

FOUNDING AND BACKGROUND

The GOKb project was initially conceived as a way to provide an integrated knowledge base for Quali OLE, a community-source library services platform (LSP) that began development in 2011. During the initial planning for GOKb, the organizers recognized that an open, global knowledge base could serve the needs of similar projects in addition to OLE. Knowledge Base Plus (KB+), an electronic resources management service provided by Jisc Collections of the United Kingdom, was already in development at the time and shared a need for a central

repository of data describing the packages and titles managed by its users. KB+ was recruited as a partner in the development of GOKb and began collaborating closely in the initial planning phases of the project.

In 2012, the Andrew W. Mellon Foundation awarded the NCSU Libraries a \$499,000 grant to serve as the lead institution in the development of GOKb. Quali OLE and Jisc were named as partners in the project.^[1] This grant funded the first phase of GOKb development, which ran through September 2014. Phase 1 included data model design, the development of a web-based interface for browsing and editing data, and the development of a rules-based tool for validation and data ingest.

At the conclusion of the Phase 1 grant funding period, the GOKb project launched a public preview designed to demonstrate the latest version of the GOKb software, including the web application, API, and co-reference service. The preview also contained a small amount of seed data to illustrate the different record types found within the system. Additional data was added throughout Phase 2 of the project. The preview period was intended as a demonstration of GOKb's potential, with the intent of attracting additional partners to the project.^[2]

The Mellon Foundation awarded a \$333,000 grant to the NCSU Libraries in 2014 for additional development of GOKb. This funding period ran through March 2016 and supported new development directions for GOKb including expansion of the data model to support e-books, implementation of linked data, and exploration of intersections with other projects addressing open access and open data in scholarly communication.^[3]

The primary governing body of GOKb is a steering committee that contains representatives from OLE, NCSU, and other stakeholder groups. The steering committee is responsible for the operations of the GOKb project and has joint reporting responsibility to the OLE Board.^[4] The GOKb project has one full-time staff position, the GOKb editor, which reports to the principal investigator of the project based at NCSU Libraries.

RELATIONSHIP WITH OLE AND JISC

The GOKb development team worked closely with OLE participants to design a data model and tools that would support the management of electronic resources within the OLE LSP. These efforts included the development of an API that would allow OLE to consume data from GOKb and receive updates when changes were made at the global level. The benefits of the planned integration between these two systems included the ability to create local records linked to their global counterparts via a canonical identifier and to manage changes to these entities through a management dashboard. As changes were made within OLE, they could be communicated back to GOKb and shared across all users of the system.

In mid-2016, the OLE partners decided to cease development of the existing OLE LSP and proposed e-resource features, including integration with GOKb. Also in 2016, OLE became a participant in FOLIO, a new community collaboration to develop an open source LSP. Other FOLIO partners include EBSCO and Index Data. While GOKb is not explicitly part of the FOLIO roadmap at this time, the project partners have put forth a stated goal of integration with multiple knowledge bases, and GOKb remains a candidate for inclusion in the project.

GOKb also maintained a relationship with Jisc throughout most of its early development. At the time of GOKb's initial request for funding, Jisc had already begun development of the KB+ project, which aimed to create a knowledge base describing journal collections negotiated by university libraries within the United Kingdom. Leadership from both projects recognized the similarity of the data being collected and concluded that each could enhance the progress and quality of the overall effort through collaboration [5]. GOKb and KB+ functional experts and developers worked together to create a shared data model for both projects. KB+ originally intended to shift the management of its knowledge base data from a local environment to GOKb. However, changes to the mission and distribution model of KB+ prevented the change from being implemented.

The GOKb project remains closely aligned with OLE in its governance. While GOKb operated semi-independently throughout the grant-funded phases of the project, once the funding expired, its governance was folded more closely into the OLE project to ensure long-term sustainability. The OLE project partners provide ongoing financial support for GOKb through partner dues. Financial contributions primarily support the continuation of the GOKb editor position, which is part of the OLE core team of staff.

CORE FEATURES OF GOKB

GOKb expands on the traditional knowledge base feature set in a number of ways. While existing knowledge bases

have offered a snapshot of electronic resources that exist at the current moment in time, GOKb's data model will include an expanded set of attributes to facilitate tracking of changes. GOKb can store information about changes to works, such as a bibliographic title change or a transfer between publishers. Additionally, the system uses a series of status to track information about resources that have ceased or are not yet available, thus allowing users to see how the contents of a package have or will change over the years it is offered for sale.^[6]

Another key component of GOKb is its open-data model. GOKb's data are freely available under a Creative Commons 0 license, which allows use by anyone for any purpose without attribution. This openness means that GOKb's data can be consumed by its official partners, as well as any interested party, including commercial entities. The GOKb project has cited several benefits to the open-data approach, including the potential to partner with a wide variety of institutions and corporations, as well as the benefits of separating data from software.^[6] By making well-structured, accurate metadata freely available across the industry, GOKb hopes to see adoption not just by library partners but also by academic publishers and library vendors, who can use GOKb's service to improve their own products.

The use of a community contribution model for data sourcing and maintenance is another differentiator for GOKb. Discussions with partners, as well as a number of potential collaborators internationally, have highlighted the similar problems that institutions face when it comes to managing knowledge base data.^[5] Users from across these institutions spend time on tasks such as reconciling publisher- and vendor-provided title lists against knowledge base data and investigating title changes. These activities commonly result in customers informing their commercial knowledge base vendors of a series of changes, which are then incorporated into that vendor's product.^[2] By harnessing these efforts and capturing the outcome in a freely available, centralized environment, the GOKb project aims to increase the impact of this work by making it available across the entire community of libraries and vendors.

It is also important to note that GOKb differs from the traditional knowledge base in two major ways. First, GOKb is not a discovery knowledge base; rather, it is intended to support that management of electronic resource purchasing and licensing operations. GOKb does not support discovery tools such as a link resolver, MARC record service, or unified search index. This means that GOKb is not intended as a replacement for those products that rely on vended knowledge bases. Second, GOKb is not an environment for users to store information about their local entitlements. It exists purely as a data repository. It will be the role of partner systems to provide an interface that can consume GOKb's data and allow users to create local variations on the data.

DATA MODEL AND DATA ELEMENTS

GOKb uses a bill of materials data model to represent the elements that make up the e-resources landscape. This model represents the raw materials needed to create an end product. In the bill of materials model, raw materials are called “components” and the end product is a “combination” of those components.^[7] In GOKb, for example, one of the core components is the title. Titles can be combined to form packages. A combination like a package can then be linked to another component, such as an organization, to create a new combination. The advantage of this model is that its flexibility makes it extensible. Components and combinations can always be linked in new ways to meet the changing landscape. If, for instance, GOKb was expanded to include article-level information, articles could be added as a new type of component, which could then be linked together to form a journal combination.^[6]

The core components that make up the GOKb data model are titles, packages, platforms, and organizations. The title component describes a journal or other resource at the work level. Title history information, such as publication dates, current and past publishers, and relationships to other titles, are also stored on the title component (see Fig. 1). Packages represent groups of titles that are commonly sold together for a set price, while platforms represent the websites where those titles and packages are hosted. A unique feature of GOKb is a combination of components called the title instance package platform, or TIPP. The TIPP goes beyond simple bibliographic description to represent a resource as it is purchased and managed by a library. By creating an entity to represent

this combination, GOKb provides a place to store meta-data describing salable units. The TIPP record also allows GOKb to assign an identifier to this important concept as well as to link it to other components and make machine-readable statements about it.

Organization records can be linked to any component type to provide additional detail. Organizations can play different roles depending on their context. For example, the organization Springer can be related to a title in the role of publisher, while it may also be related to a platform in the role of platform provider.^[2]

METHODS OF ACCESS

Web Application

The GOKb web application provides a public interface for browsing and searching of GOKb data, as well as an editing tool for project partners. Users can navigate the various components found in the knowledge base and explore combinations using links between records. The data in GOKb may provide general value as a reference tool, supplying such information as bibliographic metadata, details of changes over time, lists of available packages and their contents, and basic access information.

For project partners, the web application provides additional functionality, including the ability to edit the data found in most fields. This allows for easy correction of isolated errors or basic updates. The web application also allows users to perform a series of more complex actions, including title changes and transfers. Finally,

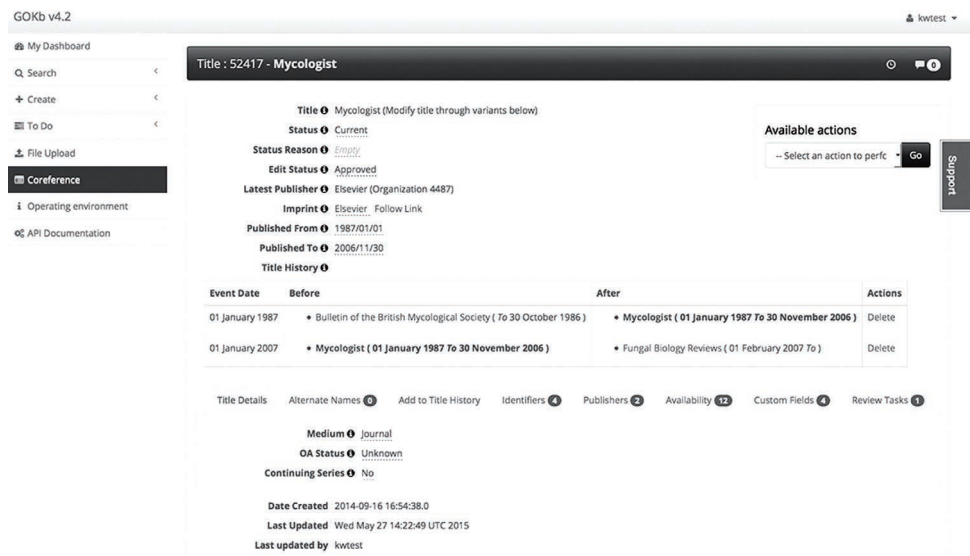


Fig. 1 A title record in GOKb.

GOKb Validation Status

- DateFirstPackageIssue**
One or more rows contains invalid dates in the column "DateFirstPackageIssue".
- KSARTEmbargo**
Data in the column "KSARTEmbargo" must follow the KSART guidelines for an embargo.
- DateLastPackageIssue**
One or more rows contains invalid dates in the column "DateLastPackageIssue".
- CoverageDepth**
Import does not specify an CoverageDepth column.
- title.oastatus**
Import does not specify an title.oastatus column.
- title.imprint**
Import does not specify an title.imprint column.
- PrimaryTIP**
Import does not specify an PrimaryTIP column.

AS	PublicationTitle	title.Identifier.Issn	title.Identifier.eIssn	DateFirstPackageIssue	num_first_vol_online	num_first_issue_online	DateLastPackageIssue	num_iss
1.	AI EDAM	0890-0604	1459-1760	1987-02-01	1	01		
2.	AJS Review	0364-0094	1475-4541	1978-04-01	1			
3.	APBPA Transactions on Signal and Information Processing		2048-7703	2012-12-01	1			
4.	ASTIN Bulletin	0515-0361	1783-1350	1958-12-01	1	01		
5.	Abstracts of Working Papers in Economics	0951-0079	0951-0079	1986-03-01	1	01		
6.	Acta Neuropsychiatrica	1801-5215	1801-5215	2002-02-01	14	01		
7.	Acta Numerica	0952-4929	1474-0508	1992-01-01	1			
8.	Acta geneticae medicae et genealogicae: twin research	0001-5560		1953-01-01	2	01	1998-10-01	47
9.	Advances in Animal Biosciences	2040-4700	2040-4719	2010-04-01	1	01		

Fig. 2 The OpenRefine custom extension for GOKb.

the application contains a lightweight problem tracking system that allows users to create review tasks and assign them to themselves or other users. Review tasks are also generated automatically when new data ingested into GOKb conflicts with existing data in the knowledge base.

OpenRefine

GOKb uses an open-source data manipulation tool called OpenRefine to allow population of the knowledge base with large, externally sourced data sets. Through OpenRefine and a custom GOKb extension, users can validate data and upload it to the knowledge base. The GOKb extension applies a set of rules designed to help users modify data so that it complies with GOKb's data specification. Common transformations include renaming columns, adding missing information, reformatting dates and abbreviations, and resolving data conflicts like duplicate ISSNs (see Fig. 2). The GOKb extension for OpenRefine also provides a collaborative workspace and version control features, allowing users to share project files.

API

GOKb offers an API that allows external services to extract data from GOKb and credentialed users to contribute changes back to the knowledge base. The API uses the OAI-PMH protocol.^[5]

Co-Reference Service

Many of the components in GOKb can support multiple identifiers. GOKb can collect and store identifiers

across namespaces that describe roughly equivalent concepts. On the title record for example, GOKb may store title identifiers that include the ISSN and e-ISSN, DOI, and publisher's proprietary identifier. These identifiers are linked together through the title component, which is assigned a GOKb identifier. The co-reference service provides a crosswalk between identifiers by allowing users to search for any identifier and return a list of all identifiers associated with the same component. The co-reference service is not a registry and makes no assertions about the correctness of any of the identifiers stored within GOKb. The co-reference service can be accessed through the GOKb web application (see Fig. 3) or through the API using a JSON or XML query.^[5]

CONCLUSION

The development of GOKb has established the principles and structure needed to create and provide a comprehensive, open repository of key metadata about scholarly publications. These core components include a data model to support the description of electronic resources, both in the present moment and as they change over time, multiple modes of access to support human and consumption; and a community of invested partners who can contribute expertise and resources to the collection and maintenance of knowledge base data. The work on GOKb to date serves as a strong proof of concept for the technical feasibility of and community interest in an open knowledge base. Future efforts for GOKb will include evaluating the potential for the project to increase its scale and continue building community interest.

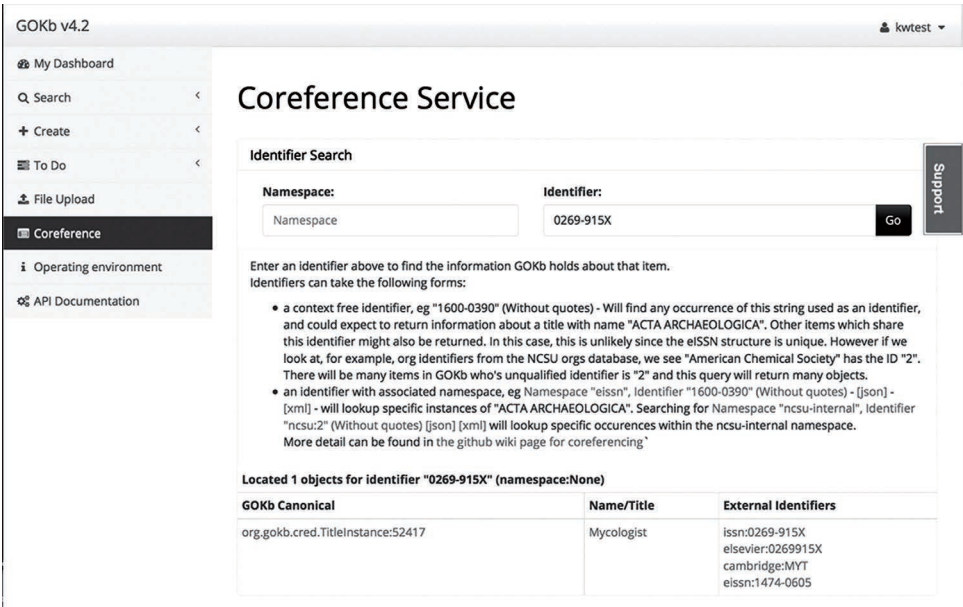


Fig. 3 The GOKb co-reference service.

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Government Documents: Collection and Management

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Abstract

Collecting and managing government information in the twenty-first century is a challenge to most libraries and librarians. Historically, government documents were difficult to collect and manage in a print environment; yet while the digital transformation of information makes some government publications more available, at the same time, the Internet allows for valuable content to be more readily removed. This entry examines government information in all its forms and formats to offer a comprehensive assessment of issues involved in the development and management of government information (publications, documents, etc.) collections in print, electronic, and digital formats. The goal of this entry is to explore how nineteenth-century bibliographic description shaped the twenty-first-century government information society and this particular field of librarianship is paving the way for future developers of collections. The first three sections of this essay focus on U.S. documents at the federal, state, and local levels; The fourth section concerns international publications. Each section will detail the relevant history and strategies for developing and managing a viable, fluid government publications collection.

INTRODUCTION

What is a government document? It is informational matter created by a government. The U.S. government defines it as any informational matter printed at government expense or as required by law, 44 USC 1901 (2012). Government documents librarianship is a field that is guided by this U.S. law. Government documents collections include materials found in libraries including digital objects, monographs, serials, periodicals, maps, technical reports, ephemera, kits, etc. The main difference is they emanate from government bodies. All government bodies produce documents. Libraries of all kinds (academic, public, school, and special) collect government documents. When most people think of government documents, images of unending pages of census figures and appropriation hearings come to mind, but few consider that one of the most popular government documents is the re-release of the Warren Commission Report. Think you are smarter than an 8th grade civics student? Then, you should check out the Civics Quiz on the Government Book Talk blog at <http://govbooktalk.gpo.gov/?s=civics+quiz>.

In this entry, the phrase “government documents” is used interchangeably with “government publications” and “government information.” The form or format of a government document does not negate the laws that require printing or dissemination. This entry examines collecting

and managing government documents at the federal, state, local, and international levels of government. A bibliography along with relevant websites is included at the end. Please note, as the field changes, so too does this bibliography.

FEDERAL PUBLICATIONS

Historical Foundations

From the time Congress first started publishing the *Journal* as required by the *Constitution of the United States*, American libraries were interested in collecting government documents. Publications issued by the government cover all manner of subjects and disciplines ranging from weather reports and train schedules to budget analysis, judicial decisions, and administrative laws. Although the interest still exists, government documents are still as mysterious today as they were in 1860 when the Government Printing Office (GPO) was created to counter the growing corruption in printing contracts, the advent of newspaper patronage, and concerns about the cost of official publication. The foundation for what is today known as Federal Depository Library Program (FDLP) originated in the first 12 Congresses and later became centralized in the Printing Act of 1895 (28 Stat. 601) along with the

Office of the Superintendent of Documents.^[1] First, this act developed a federal depository library program as a means to consolidate printing, publishing, distribution, and dissemination of official government publications. Second, the act led to the development of a central collection of government documents by Adelaide Hasse, the inventor of the Superintendent of Documents (SuDocs) classification scheme. Ms Hasse began developing this classification scheme when she worked at the Los Angeles Public Library and later took her skills to Washington to begin developing a documents library at the GPO between 1895 and 1903.^[2] Based on the principle of provenance, or issuing agency, rather than a subject-based scheme, it is an alphanumeric organization based on the status of the government agency. Her creation of a comprehensive list of publications from the Department of Agriculture was the first of many tools created to build, develop, and maintain library collections of government documents including the development of the *Monthly Catalog of United States Government Publications*, the basic finding tool for federal publication until the advent of the Internet. This act firmly established government printing, publishing, dissemination, and distribution of materials as *functions of both* the Legislative and Executive branches of government. Prior to the act, all materials were published at the express request of Congress and many libraries tried to develop their government collections based upon lists of publications rather than an overall strategy catering to local need. As the country grew, so did the government, and soon the Executive branch took over as the main producer of government information. One of the provisions of the Printing Act of 1895 was to create a depository library system to ensure all citizens had access to their government's activities via publication. *The fundamental purpose of the Federal Depository Library Program is to ensure that all Americans have permanent public access to their government's information regardless of form or format.*

The next major change to the FDLP was the Depository Library Act of 1962 (76 Stat. 352), which enhanced access to depository libraries by expanding the number of depository libraries per state and creating two types of depositories: regionals, which are required to keep permanently all government publications disseminated through the FDLP, and selectives, which may pick and choose which kinds of publications to house plus may dispose after 5 years. For a short history of the program, please see http://www.access.gpo.gov/su_docs/fdlp/history/macgilvray.html.

Today, the FDLP is a partnership between the GPO and 1,175 libraries representing most Congressional districts across the nation (see Table 1). GPO prints, digitizes, and disseminates government information products utilizing all information technologies available. Additionally, this agency is recognized as the authority for the bibliographic control, cataloging, and classification for all federal government publication. The GPO serves as a model for state

Table 1

Library Type	Number	Percent
Academic General	627	54%
Public Library	180	16%
Academic, Law Library	150	13%
Academic, Community College	56	5%
State Library	39	3%
Federal Agency Library	37	3%
Highest State Court Library	37	3%
Federal Court Library	11	1%
Special Library	14	1%
Service Academy	4	0%
TOTAL	1155	100%

Note: Special thanks to the U.S. Government Printing Office. Data accurate as of March 30, 2016.

and international government depository programs. Building upon both a history and tradition of public service, these depository programs are still germane in an electronic environment. While the publications themselves may not be tangible, knowledge of the interconnectedness of governments, how agencies work or in some cases do not work together and why government publications are developed differently than other information resources are all examples of why this field in librarianship is thriving. For additional information about the FDLP, please see <http://www.fdlp.gov/>.

Throughout its history, the U.S. government embraced technology. GPO frequently was in the forefront in implementing new technologies from handset to machine set typesetting to digitization and everything in between. In January 2014, Public Printer Davita Vance-Cook led the move to change the name of the 154-year printing establishment, Government Printing Office to the Government Publishing Office, in an effort to better describe the digital transformation beginning with Public Law 104-30. She testified: "It's time for our name to catch up with who we are and what we do. It's time for a new name for the digital age."

Transforming Government Information

In the introduction to the textbook *Fundamentals of Government Information*, the authors discuss the transition of the FDLP and the need for permanent public access to government information eloquently stating:

The formats of government information have transitioned quickly in recent years. The print era evolved to the web era; then HTML and PDF documents became blogs and wikis, which became videos, which became ever-evolving websites . . . As revolutionary as this electronic migration has been for government information, many aspects of depository libraries and services are less changed.^[3]

The information revolution taking place is changing the very nature of American society. Fondly called the

“Information Age,” the twenty-first century is a time where every American is overwhelmed with too much content but little organization of information. The growth and permeation of the social media everywhere means that more information is available without the filters provided by proofreaders, editors, reviewers, etc., which was prevalent in the era of print publication. The digital divide of the previous decade is not the same concern it once was; instead, libraries are faced with a three-pronged dilemma of providing access to born digital information, preserving tangible collections, and creating safe digital spaces for users.

Aside from depository library programs, collecting government information is difficult regardless of where it is housed in a library, on a server, or in the cloud. Many librarians still comb the “media” for stories about government-funded studies, reports, proposed legislation, guidelines, and/or regulations to find what is most germane for their collection, regardless of whether they are available in electronic or tangible formats. The advent of digital information not only made finding information easier but also made removal of information just as simple. In fact, most library research conducted today is focused on the policies of electronic creation, dissemination, and preservation of government information. Current writing focuses on the sheer volume and integrity of electronic information. And yet, digital information is not immune to the guidelines limiting how it should be distributed via social media.^[4] It is up to those librarians to work collaboratively in building permanent collections.

Congress enacted additional legislation such as the Government Printing Office Electronic Information Access Enhancement Act of 1993 (107 Stat 112) and the E-Government Act (116 Stat 2899) to further provide access to government information in electronic form, but neither piece of legislation provided GPO the same authority over electronic information produced by the U.S. government as print distribution of depository materials. There remain many questions of access and equity. This division is examined in detail.^[5] The question remains with collecting and managing electronic information. “Who is responsible for permanent public access to electronic and digital content?” This question permeates depository librarianship in the early twenty-first century.

Depository Libraries and Management

As mentioned earlier, government information permeates society unlike other publications. Whether it is interest in the Iraq War or reading the “Starr Report” or filing a tax form, more and more Americans use government information more readily than ever. During the age of print, government publications followed a fairly narrow hierarchy for publication. It was mainly due to this form that the bibliographic control and organization of government

documents is based on issuing agency rather than on subject. Thus, the SuDocs classification scheme became the primary means to organize print collections. This classification scheme further allowed for the FDLP to develop its mission and goals: to be the primary means of government information dissemination and preservation. Several print indexes and abstracts were developed in order to provide access to government publication. Building upon Adelaide Haase’s list of USDA publications, bibliographic tools such as *The Monthly Catalog of U.S. Government Publications*, *GRA&I (Government Reports Announcements & Index)*, *ERA (Energy Resources Abstracts)*, and *RIE (Resources in Education)*, plus the many products from the Congressional Research Service were developed in order to provide bibliographic access to government publications. While online equivalents of these print reference resources exist, they do not provide the same level of bibliographic control simply because the online equivalent works quite differently from the print. However, the GPO continues to work with their partners in the FDLP to use newer technologies to enhance access to government information and provide permanency of this information. This program is still one enduring example of how government works well in keeping the citizenry informed.

The success of the FDLP led to the creation of other depository programs including state, local, international, and foreign programs based upon a government providing copies of its public documents to libraries in exchange for those libraries housing the material, providing access to these materials, and in many cases, providing experts to assist the citizens in locating the information. This principle is the basic strategy librarians use when developing government publication collections. Not so long ago, this strategy of having agencies send materials directly through the GPO was a reasonable method for developing a depository collection. The U.S. Census Bureau and Patents & Trademark Office (PTO) both created successful depository programs after the initial success of the FDLP. Each agency looked at libraries as places where citizens could obtain specialized agency information.^[6] In fact, the PTO Depository Program was more successful in some ways since the PTO instituted a plan to ensure that patent librarians were trained by the experts employed in the Office. Detailed descriptions of the various depository programs are widely discussed in the literature, but no better sources exist than the works of Laurence F. Schmeckebier, including his agency histories and his overview of government publications. While his books are nearing their century mark, their importance is still as great as when first published, especially given the challenges of managing government publications in an electronic environment.

The complexity of the modern world, coupled with ever-changing and increasing information policies and technologies, makes the dissemination of government information more challenging. Even before the beginning

of printing, governments made policies to control the flow of information.

Information Policy

Jaeger defines information policy as “the combination of laws, regulations, rules, and guidelines that steer the creation, management, and use of information.” The Internet transformed the entire way society views and uses information thus public policy on information is more on the mind of legislators and administrations. It is common knowledge that whoever controls the flow of information, controls the government, hence the fight within governments regarding the release of information.^[7] Each session of Congress deals with more issues related to information, from freedom of information to protections of intellectual property; security and civil rights; and personal privacy versus the government’s need for personally identifiable information.

One overwhelming challenge early in the depository process was when government agencies did not furnish copies of their publications to the GPO, leading to what is known as “fugitive documents” or those publications that belong in the program by law, but are not included, for various reasons internal to particular agencies. This same problem is echoed today by those agencies that continue to produce digital documents but provide no mechanism for digital preservation, thus denying permanent public access. Public access to government information is considered by many to be a right of citizenship, although there is no law or official policy enforcing that right. An example of this was seen in President Obama’s revocation of EO 13233 by his own executive order.^[8] This Executive Order offered the president to extend executive privilege to other members of the Executive Branch including appointed officials within the Cabinet or senior staff members. Another proviso of EO 13233 allowed a president to exert this privilege at any time over any document of any president. By rescinding this Executive Order, President Obama restored Congress’ original intent of the law limiting the time allowed for the privilege and who can use this privilege. This example ensures the people the right to know what the president is doing. The principles of our society are built on a democratic framework that requires citizens to be informed of their government’s actions. The *Constitution of the United States* outlines how that framework will work, including a provision that requires a journal be kept of proceedings and actions.

The importance of information policy and e-government is discussed in other chapters in this encyclopedia. As more scholars analyze these policies as part of their study, government publications become more preeminent in their work and analysis. The need for collecting and managing this material is still a vital role for librarians and administrators. While the federal government provides an overarching view of information policy, states and local

governments each have their own opportunities and challenges in developing their information policies.^[9]

STATE PUBLICATIONS

The formation of territories and state governments was authorized by acts that are included with other laws in the *United State Statutes at Large* and may also be found online at some individual state Web portals.^[10] State government impacts daily life through taxes, education, public safety, economic growth, laws, and regulations. State government agencies communicate with the public in a number of ways. For some agencies, educating the public is an important part of their mission. Service-oriented agencies such as departments of health and human services have historically produced a large number of public documents. A public document, loosely defined, is any informational matter, regardless of format, which is produced for public distribution by state agencies or state institutions of higher learning. Vital statistics such as number of births, and number of and causes of deaths, are examples of public information found in state documents. Other examples include schedules of state elections, statistics about public schools, and instructions for acquiring a driver’s license.

While the FDLP provides leadership, best practices, and regulations for federal publications, there is no central governing unit to manage access to state publications. Individual states are left to their own devices to develop, implement, and manage the lifecycle of state-produced public information. Using the FDLP as a model, many states have established state depository library programs.

In most cases, it is the state library or an equivalent agency that administers the state depository library program. Typically, depository programs are charged by their respective legislatures with collecting, indexing, distributing, and preserving state public documents.

Depository programs collect state documents by obtaining physical copies from state agencies or by acquiring and archiving electronic copies. Electronic copies are most commonly harvested from the web, received by e-mail, or uploaded by state agencies directly to a database or repository. Even though most depository laws require agency compliance, many agencies ignore them or selectively comply, resulting in an incomplete collection. Because state library resources are limited, efforts are typically made to collect at least core materials, items that are deemed the most important to preserve and make accessible. Items collected are commonly classified using a classification scheme developed specifically for that state’s publications—though some programs do use Library of Congress (LC) or Dewey Decimal numbers—and recorded in a catalog, index, and/or list. Cataloging records are usually made available in the state library’s online catalog and may or may not be added to a national

bibliographic database such as *WorldCat*. Shipping lists and monthly checklists, organized lists of items received since the last listing, are often used to notify participants about the arrival of new items into the depository program.

Physical publications are typically distributed to a network of depository libraries throughout the state and often to the LC as well. Like state agencies, depository libraries are required to comply with the laws, rules, and regulations governing the depository program. They provide space for the collection, staffing to assist the public with finding state publications, and most often have to retain depository publications for a certain number of years and obtain permission before disposing of them. In some programs, depository libraries are required to make digital publications available by including bibliographic records with live links in their online catalogs. Archived copies of electronic publications are generally made available online via links in the state library's catalog, or in a dedicated, searchable state documents database or repository (i.e., *Iowa Publications Online* at <http://publications.iowa.gov/>). Collectively, the libraries in the network attempt to preserve access to state publications in perpetuity.

For a more detailed overview of key state publications and state depository library programs, consult Lori Smith and others' *Tapping State Government Information Sources* published in 2003.^[11] In part one, Smith discusses general sources covering all 50 states, including publications that are both state government produced and commercially produced. Part two contains a chapter for each individual state with information regarding its depository system, as well as useful addresses and telephone numbers, indexes to state publications, essential titles, pertinent commercial publications, and its Web portal. For an overview of efforts to archive and preserve federal, state, and local digital documents, see *Managing Electronic Government Information in Libraries: Issues and Practices*.^[12]

Beyond print publications and their electronic siblings, state governments provide a wealth of additional information and services online. Technology and electronic resources have led to the rise of e-government. According to a 2007 report from the National Association of State Chief Information Officers (NASCIO), the number of citizens using the Internet to access state agency information and transact business was increasing, and the sophistication of state government Web portals was improving.^[13] In 2010, a Pew Research Internet Project publication reported that 82% of Internet users had accessed government information or utilized a government service online.^[14] A 2011 report from the Pew Research Internet Project noted that the Knight Commission on the Information Needs of Communities in a Democracy had found that two key indicators of a successful "community information system" were "A vibrant public library, or other public center for information that provides digital resources and professional assistance," and "A majority

of government information and services online, accessible through a central and easy to use portal."^[15]

Entities other than states have undertaken efforts at the national level to increase awareness of and access to state- and local-level documents. In 2007, the State and Local Documents Task Force (SLDTF) within the Government Documents Round Table (GODORT) of the American Library Association (ALA) created a "50 State Agency Database Registry" wiki.^[16] Volunteers adopt one or more states and maintain lists of databases that agencies in that particular state have built. The SLDTF wiki also offers, among other things, a list of links to state depository system Web pages and a list of librarians within each state who are willing to facilitate the exchange of state publications between libraries in different states.^[17]

The LC maintains Web pages featuring links to state and local government information from all 50 states.^[18] The Law Library of Congress also has a Web page with links to legal information for states and territories.^[19]

The LC collects state and local publications with a goal of building a research-level collection, which does not mean everything issued.^[20] Administrative reports, publications issued by state legislative and judicial branches, and planning and policy statements are examples of the types of items collected. With the exception of a few counties, the LC does not collect publications of U.S. counties. It does manage a comprehensive collection of cartographic materials for all counties, cities, and towns. Publications from a select number of major population centers are also actively collected.

From 1910 to 1994, the LC published the *Monthly Checklist of State Publications*.^[21] This publication was recognized as the national bibliography for U.S. state publications, but the demand for it decreased as online alternatives to it increased. Not everything in the *Checklist* was retained by the LC and not everything issued by a state was sent to the LC, resulting in an incomplete record of official state publications. Since the *Checklist* ceased, there has been no comprehensive bibliography to publications of the 50 states, but today a large part of what would have been included in the *Checklist* is available in Online Computer Library Center (OCLC) and Research Libraries Information Network (RLIN).

Many state checklists are now available online. In 1977, the SLDTF of ALA first approved guidelines for compiling and distributing state publications checklists.^[22] At that time, checklists were seen as necessary for bibliographic control. They are now useful as a current awareness tool. For more information about a particular state, check *StateList: the Electronic Source for State Publications Lists*, a project of the University of Illinois at Urbana-Champaign.^[23]

The *StateList* project uses the Web to make citizens aware of the publishing activities of state governments. In late 2014, a total of 37 states had provided links to state publication checklists and shipping lists currently available on the Internet.

The Center for Research Libraries (CRL) has acquired a collection of state documents that consists of the official publications of the legislative bodies, departments, and agencies of all 50 of the United States from the earliest period of state government through 1950. It also has holdings of legislative journals through 1990. Most of these materials are not in the CRL's catalog, but they are organized by state, by agency on the shelf. Additionally, the CRL has the pre-1951 *Records of the States of the United States of America: A Microfilm Compilation*.^[24]

This is currently a static collection with no concerted effort to develop it further.

When looking for historical information on state documents prior to 1908, refer to the four volume set covering 1899 to 1908 entitled *State Publications: A Provisional List of the Official Publications of the Several States of the United States from Their Organization*.^[25] For more state information prior to 1904, consult the multiple part set of the *Index of Economic Material in the Documents of the States of the United States* created between 1907 and 1922.^[26] The next major reference tool would be the *Manual on the Use of State Publications*.^[27] Published in 1940, it contained a detailed record of available bibliographic sources by state. In 1942, this was followed by *Government Document Bibliography in the United States and Elsewhere*, which included 20 pages of state bibliographic sources.^[28] This source remained the authoritative source on state document bibliography until 1975 when *Government Publications: A Guide to Bibliographic Tools* was published.^[29] Sixteen years later, in 1981, Margaret Lane's classic *State Publications and Depository Libraries: A Reference Handbook* was published.^[30] In part one, Lane provides the characteristics of depository library legislation. In part two, there is a state publications literature review followed by lists of bibliographic items that represents the largest portion of the book. In part three, 2–10 pages of information are provided for individual states.

The trend for the future is clearly toward more emphasis on digital information. Some depository programs are already predominantly electronic and nearly all have a strong digital component. Debate will continue about the long-term efficacy of electronic archives, and more focus will be placed on issues such as state government transparency, cybersecurity, open access, and big data. As with the FDLP, attention will inevitably turn toward digitizing the older publications housed in depository libraries and making those materials freely available online as well.

LOCAL DOCUMENTS

Local documents “are those materials issued by local governmental agencies and their subunits including municipalities, counties, townships, villages, special districts, school boards, park districts, and the like. Typical types of local documents include municipal codes, building

codes, zoning ordinances, annual reports of agencies, financial reports, minutes and proceedings of boards and committees, reports of committees and commissions, and any similar materials produced by governmental units.”^[31] One of the unique challenges for collecting local government documents is the plethora of local government entities, which leads to the lack of a central dissemination point. To provide some perspective on this challenge, according to the 2012 Census of Governments there are 90,107 governments in the United States, of which 90,056 were local governments. The breakdowns of these governments are

County: 3,031

Municipal: 19,519

Town or township: 16,360 special districts (school): 38,266

The state of Illinois alone has 6963 local governments.^[32]

While difficult to collect, local government publications provide unique information about the community—everything from urban life, to local health, to tourism. Local agencies may or may not keep publications for historical purposes, so preservation is a major concern for information originally available on government websites and in print. Like state and federal publications, another key challenge is learning about the existence of the document. Few local government agencies set up depository library programs, although some individual agencies will add a library to a mailing list. As more local documents move to the Internet, it becomes harder to track them, much less provide any kind of bibliographic control. According to Alexander Stille: “One of the great ironies of the information age is that, while the late twentieth century will undoubtedly record more data than have been recorded at any other time in history, it will also almost certainly lose more information than has been lost in any previous era.”^[33] The nature of the information published online also differs from that which was traditionally published in print.

It is estimated that more than 75 percent of local governments now maintain web sites. . . . Local government web sites tend to place an emphasis on showcasing the community's attractions to draw business and tourism to an area rather than featuring annual reports, in-depth statistical data, and full-text land use and planning documents. Annual budgets and summaries are sometimes posted, but it is rare to find more than the current year.^[34]

As mentioned previously, effective depository systems are virtually nonexistent at the local level of government. Nearby libraries may receive a small number of locally produced government publications, but may need to actively pursue their acquisition. Public libraries often collect local documents and typically view providing

access to them as a means of promoting and assisting citizens' involvement in government. The strength of local collections varies. There is a common practice to have open access to local documents that are organized by series such as "minutes" and "reports" and that have not been cataloged or added to a searchable database. To access information, it must first be findable, and publications that have not been cataloged or indexed are only minimally findable. A local government collection often includes names and contact information for agencies, departments, and elected officials. Other items collected may include the local municipal code, the annual budget for the city and/or county, and zoning ordinances. State and academic libraries, typically, are selective in regard to acquiring local-level publications.

For a more detailed overview of this topic, see *Local and Regional Government Information: How to Find It, How to Use It*.^[35]

INTERNATIONAL PUBLICATIONS AND ORGANIZATIONS

Patrons also seek out international government information, and the first place they typically look will be a search engine. This is a rational decision but may lead to frustrations. Most recent international government information is online (free or priced—and sometimes both at once) and legacy collections are rapidly being digitized. In this environment, one could argue the role of the library is marginal, but things are not that simple. The volume of international government information is immense, and much of it is embedded in the "deep Web" of databases that must be queried. Some international government information is distributed exclusively on priced electronic libraries or sold in print and/or online formats by commercial publishers. Other international organizations (IOs) distribute Machine Readable Cataloging (MARC) records for their publications, which enhances discovery for patrons unaware of the nature of their work. In an environment of "too much information," libraries still have a valuable role to play in providing access, curation, and preservation of this material.

IGOs and NGOs

If the concept of international governmental organizations (IGOs) is unfamiliar to some, the *Yearbook of International Organizations* is a good source to start. Edited by the Union of International Associations and published by Brill, the *Yearbook* is not just a directory of names and addresses. The online version contains searchable entries of over 66,000 IOs including both intergovernmental organizations (IGOs) and international nongovernmental organizations (INGOs) in over 300 countries and territories. Approximately 1200 new organizations are added

each year.^[36] The print *Yearbook* set of six volumes includes organizational descriptions with information broken down by subject, country, and region. A separate volume identifies organization publications and resources, and there are additional volumes for statistics and visualizations, memberships, and secretariats. Additional information is available at <http://www.uia.org/yearbook>.

IGOs are generally defined as 1) treaty-based, 2) made of three or more member states, and 3) having a secretariat for ongoing tasks. Statistics from the current *Yearbook of International Organizations Online* show that as of 2013/2014 there were 7710 IGOs.^[37] Definitions of nongovernmental organizations (NGOs) vary, but generally NGOs are 1) individual/nongovernmental actors and 2) voluntary associations. NGOs are often specialized in their goals, and work to make improvements in the fields of the Environment, Human Rights, Education, Women's Issues, Humanitarian Aid, or Economic Development. Think-tanks and independent research institutes are sometimes also included.

Examples of well-known NGOs include Médecins Sans Frontières, The International Red Cross, Partners in Health, Transparency International, and Oxfam. More widely recognized NGOs are often based in developed countries, but this is changing as NGOs in China and the Global South become better known: examples include the Grameen Bank, BRAC, and Friends of Nature (自然之友). Statistics from the current *Yearbook of International Organizations Online* show that as of 2013/2014 there were 58,588 NGOs.^[37]

Both IGOs and NGOs offer a wealth of statistical, historical, and administrative information that can help librarians serve their patrons' information needs. Libraries can develop and provide access to international information collections through a variety of avenues. Six IO collection development strategies and access models are discussed in this article. These include the following:

1. IGO depositories
2. IGO/NGO information on the Web
3. Digital MARC records
4. IGO publications offices
5. IGO priced databases
6. Third-party vendors that distribute IGO and NGO information IGO depository programs

IGO depositories

Historically, IGOs distributed documents and publications to a global network of depositories, chiefly based at national libraries and universities. With the widespread availability of free digital content, one could argue that IGO depository libraries have become irrelevant except as warehouses of historical print collections, destined for eventual digitization. We are indeed in the midst of a significant transformation. In 2010, the Asian Development Bank (ADB)

announced it would cease print distribution of depository materials except a handful of flagship publications. Tangible depository publications from the Organization for Cooperation and Security in Europe (OSCE) are now issued exclusively on an annual DVD. Document distribution from the European Union (EU) depository program has declined significantly, with some EU agencies no longer publishing anything in print. In 2012, the United Nations (UN) Depository Library System office in New York ceased distribution of print publications, although some material is still dispatched via its global network of offices. The UN Dag Hammarskjöld Library is developing a digital depository for UN documents, but at present no UN Sales Publications will be available for download on this platform. UN Depository Libraries will need to subscribe to a fee-based digital library constructed in partnership by the Organization for Economic Cooperation and Development to search for and download publications within a consolidated database environment.

Details about the current UN Depository program is available at <http://www.un.org/depts/dhl/deplib/index.html>

And information about EU depositories is at <http://www.euintheus.org/resources-learning/depository-libraries-in-the-us/>.

However, IGO depository libraries or the information professionals working in them are not relics of a bygone era. Effective government information retrieval is an advanced skill and librarians at these depositories possess a wealth of knowledge and historical collections one can tap into for assistance. Any librarian needing assistance with international information can contact these specialists, or use the Web guides created by them as reference sources.

Freely available IGO and NGO information on the Web

All IGOs and NGOs now provide substantial amounts of information on their Web sites, and some have taken the dramatic step of publishing virtually all of their unclassified documents online, free of charge. While there are certainly exceptions to this (see later text), the trend is unmistakable and linked to the open government, open access, and open data movements championed by libraries and civil society organizations.

IGOs, like the UN and the EU, and International Financial Organizations like the World Trade Organization (WTO) have published “documentation” (working documents and official records created by an organization in the course of conducting its business) online for years: examples include the United Nations Official Documents System (<http://documents.un.org/>), the World Bank’s Projects and Operations (<http://www.worldbank.org/projects>), and the WTO’s Documents Online (<https://docs.wto.org/>).

Other organizations such as the World Health Organization, which historically did not release any public documentation, now do so also (<http://apps.who.int/gb/bd/>). More IGOs are following suit. This movement allows access to IGO documentation scarcely imaginable only a few years ago as citizens now have digital access not just to publications produced and sold by IGOs, but also to information about their deliberative processes, budgets, decisions, and official records.

In addition, many IGOs now post previously priced “publications” (monographs and serials intended for use by the general public) freely online also. The World Bank, in a dramatic move in 2012, launched its “Open Access Policy,” which requires that “Bank research outputs and knowledge products be deposited into the World Bank institutional repository (the OKR), allowing any user in the world to read, download, save, copy, print, reuse and link to the full text of the work, free of charge.”^[38] This is among the most liberal publications policies of any IGO, but others are not so transparent: conditions of reuse, copyright, and access vary tremendously. The EU posts publications online at no charge, but has a copyright statement that only permits reuse of content published by the European Commission and the Publications Office.^[39] The UNESCO Open Access Policy is three pages long and quite complex.^[40] Other IGOs publish all, or virtually all, of their publications free online, but when in doubt check the policy and investigate the availability of digital content—you may be surprised.

Other IGOs publish only a limited amount of free content: examples include the Council of Europe, the UN Tourism Organization, the International Monetary Fund (IMF), and the OECD. Some IGOs sell their titles to commercial publishers who may publish the item in print or distribute them via e-book aggregators. The OECD licenses most publications via its subscription database, the OECD iLibrary, but there are free titles also. Publications from the Council of Europe (again, with exceptions) are priced, both in print and as PDFs. The IMF is making its priced online statistics databases free in 2015, but will still license an “eLibrary complete,” which will provide access to more than 14,000 IMF publications.

Furthermore, other IGOs offer both free and priced options for the essentially the same content. Some IGOs will sell a print publication on its bookstore, a priced digital copy on an electronic library, and a free digital version elsewhere its Web site. The World Bank eLibrary (<http://elibrary.worldbank.org/>) offers much of the same content found in the Open Knowledge Repository, but the eLibrary search is more robust and the historical content more extensive: it also includes MARC records. The subscription-based United Nations iLibrary (<http://www.un-ilibrary.org/>) also offers search and download features within a consolidated database environment—but in fact much of the same content can be found and downloaded elsewhere within the global network of UN agency web sites. But much of the same content should

also be free online via the wide network of UN agencies and offices around the world.

The resulting situation is thus very complex. Librarians, when considering which option is best suited for their clientele, should carefully consider whether print, free online, or priced online content best meets their needs: the various options all have advantages and disadvantages. Careful research should be conducted for each organization of interest as there is no consistency across the board, and policies can change rapidly.

And then, there is Open Data. Not long ago the UN, World Bank, IMF, and other IGOs sold most of their numeric data on subscription databases, prompting world renowned open data advocate Hans Rosling to diagnose them (during the H1N1 flu outbreak) with “DbHd” “Database Hugging Disorder.”^[41] Slowly but steadily IGOs have been curing themselves of this malaise. The UN was among the first, when it changed the name of its priced *UNSTATS Common Database* to *UNData* (data.un.org) and made it freely available online. Other previously priced data sets, including *FAOStat* from the Food and Agriculture Organization (FAO) and *World Development Indicators* from the World Bank, are now entirely free. The IMF is scheduled to make its subscription-based numeric databases, including *International Financial Statistics*, freely available in 2015. But other data sets, notably from the OECD and the International Telecommunication Union remain priced, as does the “premium access version” of *UN Comtrade*, the UN’s International Trade Database. What follows are some examples of freely available and commonly used IGO numeric databases:

United Nations—UNData: <http://data.un.org/>
 European Union—Eurostat: <http://epp.eurostat.ec.europa.eu/>
 World Bank Data: <http://data.worldbank.org/>
 International Labour Organization—ILOStat: <http://www.ilo.org/ilostat>

Digital MARC records

Even when international government information is online (free or priced), it may be buried so deep within a database that the information is virtually unfindable unless the patron knows in advance it exists. Some organizations have addressed this discoverability issue by assigning Digital Object Identifiers (DOIs) or Uniform Resource Identifiers (URIs) to publications, but not all. Here are two examples of IGO documents dealing with the Ebola Outbreak.

Economic Impact of the 2014 Ebola Epidemic: Short and Medium Term Estimates for West Africa. <http://hdl.handle.net/10986/20396>
Liberia Ebola Emergency Response—Update N.1 <http://www.fao.org/emergencies/resources/documents/resources-detail/en/c/243283/>

The first document has a URI that is easily cited: the second is more problematic. But whether a patron would have found either of these documents on search engine is debatable: many patrons would not have thought of the World Bank or the FAO when researching Ebola. To address this problem, libraries may wish to upload digital MARC records into their catalogs that some IGOs make available. With MARC records, a patron does not need to know in advance about the work of an international organization: they can find these documents in a keyword search in the catalog. Examples of IGOs that offer this service include the following. Some are free; others are priced via Electronic library subscriptions.

OECD iLibrary (subscription-based): <http://www.oecd-ilibrary.org/about/about>
 Asian Development Bank: <http://www.adb.org/publications/marcrecords>
 World Bank eLibrary (subscription-based): http://elibrary.worldbank.org/page/services_benefits
 EU Bookshop Publications Services for Librarians: <http://bookshop.europa.eu/en/publications-office-services-for-librarians-pbOA0114666/>

Another way patrons can search for IGO and NGO publications of interest is to use one of the Google Custom Search Engines that conduct searches across hundreds of IGO and NGO Web sites. For more information and links to these please, see next.

IGO publications offices

A number of large IOs have online bookstores for print publications. Furthermore, even smaller IOs will have their publications either online for free or available for order and purchase. A few of the more popular IGO bookstores include

EU Bookshop: <https://bookshop.europa.eu/en/home/>
 OECD Online Bookshop: <http://www.oecdbookshop.org/>
 United Nations Publications: <https://shop.un.org/>
 World Bank Publications: <https://publications.worldbank.org/>

The fact that many of these publications are free online has not stopped this business, and libraries may wish to consider print publications for clientele who prefer them, or for preservation and archival purposes.

IGO subscription databases

Another avenue of providing IO information to patrons is through IGO subscription databases. Even when much IGO content is free online, the benefit of acquiring these

is that the information is consolidated into one place, allowing patrons to perform detailed searches by country, topic, or time period. Most databases include MARC records and some include longer runs of historic material. Examples include

World Bank Elibrary: <http://elibrary.worldbank.org/>
 OECD iLibrary: <http://www.oecd-ilibrary.org/>
 IMF eLibrary/eLibrary Complete: <http://www.elibrary.imf.org/>
 UNWTO Elibrary: <http://www.e-unwto.org/home/main.mpx>

Third-party vendors for IO information

Many libraries work through third-party vendors to obtain international publications. This can be useful for placing standing orders for specific categories of publications or obtaining difficult to find or out-of-print material. Some leading vendors include

Renouf Press: <http://www.renoufbooks.com/>—"North America's leading distributor of governmental and international reports and documents."

Bernan Press: <http://www.bernand.com/>—"A leading distributor of essential publications from the United States government and intergovernmental organizations."

Readex United Nations Documents Collections: <http://www.readex.com/content/united-nations-documents>—Only comprehensive digital index to United Nations documents from the founding of the UN to present, as well as a collection of UN documents on microfiche. The avenues a library takes to build collections will depend on the library's goals, patron needs, finances, and staffing resources. Many libraries use several means to add International Organization information to their collections.

Professional Organizations and Online Research Guides

Any librarian or informational professional interested in international information should consider joining the Government Documents Roundtable (GODORT) of the American Library Association. GODORT's International Documents Task Force (IDTF) is a group of professionals who work with or specialize in this field. Their Web site is located at http://wikis.ala.org/godort/index.php/International_Documents and contains lists of current projects, research guides, and other valuable information. It also contains links to library research guides, some of which are listed next.

As a general note, many comprehensive government information guides have been "retired" as online search

has improved and governments have improved the usability of their own sites. What is increasingly done is librarians create research guides that explain the process of finding, understanding, and interpreting information for international organizations.

Finding IGOs

Northwestern University's International Government Organizations: <http://www.library.northwestern.edu/libraries-collections/evanston-campus/government-information/international-documents>.

Union of International Associations' Open Yearbook (free version of the priced yearbook): <http://www.uia.org/ybio/>.

IGO Custom Search—Google custom search engine for IGOs, sponsored by GODORT and maintained by James Jacobs at Stanford University: http://wikis.ala.org/godort/index.php/IGO_search.

Finding NGOs NGO Research Guide at Duke University: http://guides.library.duke.edu/ngo_guide.

Idealist—Online directory of NGOs searchable by region and area of activity: <http://www.idealists.org/>.

NGO Custom Search—Google custom search engine for NGOs sponsored by GODORT and maintained by James Jacobs at Stanford University: http://wikis.ala.org/godort/index.php/IGO_search/.

Finding foreign national governments

Northwestern University's alphabetical list of foreign national government Web sites: <http://www.library.northwestern.edu/govinfo/resource/internat/foreign.html>

Foreign Information by Country at the University of Colorado Boulder: <http://ucblibraries.colorado.edu/govpubs/for/foreigngovt.htm>

Detailed information about specific organizations

United Nations Dag Hammarskjöld Library Research Guides: <http://research.un.org/en>

European Union Research Guide: <http://www.law.georgetown.edu/library/research/guides/EuropeanUnion.cfm>

WTO & GATT Research: http://nyulaw.libguides.com/wto_gatt

CONCLUSION AND OUTLOOK

Given the rise of e-government, it is likely that future users will demand more online access to government information while tangible collections of materials will be few and far between. Requests for government

information are growing across all nations and at all levels of governments. In many ways, all government information is becoming local in that demand is based on how the release of the information impacts the local community. In order to meet future demands, librarians must build their documents collections (both physical and virtual) based upon the overall mission, goals, and audience of an individual library.

In 2012, the U.S. Government Printing Office (later the U.S. Government Publishing Office) began a strategic planning process to outline the future of the Federal Depository Library Program. A series of forecast questionnaires and action plans will eventually result in a new national plan for the program that will attempt to ensure permanent access to published federal information, no matter the medium in which it is issued. On a grander scale, national and local governments around the globe will continue to grapple with controlling the flow of information. In the digital era, ensuring the security of information that is not intended for public release has become as great a challenge as ensuring ongoing access to public information.

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Greece: Archives

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Abstract

This entry discusses the development of national and regional archives in Greece, focusing on the period from the early twentieth century to the present. College and university archives, private archives, and audiovisual archives are also discussed. Archival science is a new field in Greece. The Society of Greek Archivists was founded in 1990, and the first university level archival studies program was established in 1993 at Ionian University.

NATIONAL ARCHIVES AND SERVICES

The Greek national archive service is the “General State Archives” (Genika Archeia tou Kratous, GSA). It was established in 1914 by the Eleftherios Venizelos government and aimed at “the collection and supervision of all historical and public archives, including documents dated up to 50 years ago.”^[1] The foundation of the archive service was the result of the efforts of two exceptional men, the historian Spyridon Lamprou and the author and history researcher Giannis Vlachogiannis. The already existing Archives of the Ionian Islands, Crete, and Samos were incorporated into this service as well. Giannis Vlachogiannis, who donated his valuable collection to the Hellenic State, was the first director of the GSA. The next act was voted in 1939.^[2] The legislation in force today concerning archives consists of the following Acts: 1946/1991 “GSA and other provisions”^[3] and 2846/2000 “Archives of the Prime Minister, the Ministers, deputy ministers, and the General Secretariat of the Council of Ministers.”^[4] Access to public information is regulated by Act 1690/1999 (Article 5, “Access to documents”), in effect of article 5A of the Constitution, 2001^[5] and Acts 1599/1986, article 16, “Right of access to administrative documents,” and 1943/1991, article 6, “Publicity of administrative actions.”

The Constitution of Greece:

All persons have the right to information, as specified by law. Restrictions to this right may be imposed by law only insofar as they are absolutely necessary and justified for reasons of national security, of combating crime or of protecting rights and interests of third parties.

All persons have the right to participate in the Information Society. Facilitation of access to electronically transmitted information, as well as of the production, exchange and diffusion thereof, constitutes an obligation of the State, always in observance of the guarantees of articles 9, 9A and 19.

The protection of personal data is regulated by Act 1472/1997 on the Protection of Individuals with regard to

the Processing of Personal Data, enforcing article 9A of the Constitution, 2001:

All persons have the right to be protected from the collection, processing and use, especially by electronic means, of their personal data, as specified by law. The protection of personal data is ensured by an independent authority, which is constituted and operates as specified by law.

The GSA has been since then, with the exemption of a short period (1971–1985), fallen under the jurisdiction of the Ministry of National Education and Religious Affairs. The state archives service was reorganized in 1939 by an act in force until 1991, when it was substituted by Act 1946/1991.

The GSA operate according to the provisions of act 1946/1991 and constitute an autonomous, unified public service, under the auspices of the Ministry of Education and Religious Affairs. Issues concerning Archives are managed by the Direction of Libraries and General, with the administrative support of the Department of Historical Archives of the Ministry of Education and Religious Affairs.

The primary mission of the GSA, as described in article 9 of the above act, reads as follows:

- The supervision, preservation, collection, conservation, cataloging, micro photographing, arrangement, and indexing of the archival material of the country. Making all public and private records, documents, and manuscripts concerning the cultural heritage of the Greek nation and the administrative, economic, and social activities of the Hellenic State available to researchers for consultation;
- Location of public records of historical interest, their selection, acquisition, and transfer in the GSA, their preparation for consultation by the researchers and the creation of finding aids;
- Supervision of the special archives, which are founded and operate in public agencies;

- Publication of archival studies and catalogs;
- Cooperation with the church authorities, monastic institutions, and other religious authorities for the preservation of archival material;
- Cooperation with owners of private archives, which have historical interest;
- Enrichment of its collections by purchase or acceptance of donations of archival material by private owners and copies of archival material in the possession of foreign countries or organizations; and
- Participation in scientific research, in cooperation with other scientific authorities as well as in all kinds of exhibits, in Greece and abroad.

The Archival Service is divided into the Central and the Regional Services. The head of the Service is the “Director of the General State Archives.” The GSA of Greece are governed by a Board of nine members, whose duty is to decide, give expert opinion or advice on various matters concerning archives, based on proposals of the Director of the GSA.

The Central Service consists of the following departments: The General Index Department, the Contemporary Archives Department, the Organizing and Planning Department, the Department of Secretariat and Accounting, the Conservation and Reproduction Department, and the Reading Room and Library Department.

The regional services are divided into a) the Archives of the prefectures (nomoi) seated at the capitals of the prefectures, entitled and having the name “GSA—Archives of the Prefecture of . . .” and b) Archives operating in towns of the Prefectures and having the title “GSA—Local Archives of . . .” The responsibilities of the regional services are relevant to those of the Central service. Today, the network includes 62 services, covering the mainland and all the islands of Greece.

Archives in any kind or form, of all public agencies, of judicial authorities, local authorities, educational institutions, and notaries are collected and deposited in the GSA. The holdings of the GSA also include private archives, and their acquisition is considered to be of great importance. For that reason, an effort is made for the enrichment of the private archives collections by purchasing archival material and by seeking active collaboration with donors, holders, or owners of private archives of historical interest.

The GSA at the Prefecture level collect and keep the archives of the public and local authorities, judicial records, notaries, and educational records as well as private collections.

INDIVIDUAL STATE ARCHIVES

A special mention should be made of certain Archives having significant archival material. They include the following:

- *The Central Service*, where archives date back to the period of the Struggle for Independence (early nineteenth century) and the establishment of the Greek State are kept.
- *The Historical Archives of Macedonia*, where archives created by the Ottoman government and concerning certain areas of Macedonia (Thessalonicki, Veroia, Kilkis, Katerini, and Chalkidiki) are deposited. This includes the archives of the Religious Court (1694–1912), archives of administrative and judicial acts (1875–1912), and estate and tax registers.
- *The Historical Archives of Epirus* (Ioannina) which keep archives of the General Administration of Epirus (1912–1940).
- *The Archives of the Ionian Islands* (Corfu, Kefalonia, Ithaca, Zakynthos, Lefkada, Kythira, and Paksoi), which keep archives of their governments before their union with Greece. These include archives of the Venetian domination the “Serenissima Signoria” of St. Mark (1500–1789), of the Democratic French (1789–1799), of the Ionian Government (1799–1807), of the Imperial French (1807–1814), of the Cambell’s provisional government (1814–1817), and of the English Protectorate (1817–1864).
- *The Archives of the Prefecture of the Dodecanese*, where archives of the Italian administration, Ottoman manuscripts, archives of the Greek military administration, and of the General Administration of Dodecanese are deposited;
- *The Historical Archives of Crete* keeps archives of the Ottoman administration, as well as the official correspondence of the Cretan revolutions (1821–1835, 1866–1869, 1877–1878, 1895–1898 and 1905), archives of the Cretan State, of the German Occupation, during the Second World War, as well as private collections about important periods of Cretan history;
- *The Archives of Samos*, where collections (various documents—Ottoman, ecclesiastical, etc. of the eighteenth and nineteenth centuries) and archives of the Samian Hegemony (1834–1912) are saved.

STATE/PROVINCIAL AND LOCAL ARCHIVES

In Greece, all public Archives are incorporated in the GSA. As a result, archival agencies at the local authorities level (Provincial and Local Archives) are part of the State Archives. However, legislation concerning archives allows for the founding and operation of Archives by public sector agencies. Some of the most important are mentioned below:

- *Center for the History of Thessaloniki* The Center houses the municipal historical archive. Part of this archive is kept in the Center’s building and is gradually becoming accessible to scholars. The Center also

possesses a number of important private archival collections. It contains an important photographic collection, a map collection, and a collection of postcards printed in the beginning of the twentieth century.

- *Municipal Center for History and Documentation of Volos*.^[6] The Center possesses today a rich archive, consisting of the Volos Municipality archive (1883–1982), numerous private archives concerned directly or indirectly with the city and its greater area, archives of old industrial enterprises, as well as important material of building plans, maps, aerial photos, slides/transparencies, and photographs. In the context of electronic processing of the archive collections and the compilation of an index, the Municipal Center for Historical Research and Documentation, in cooperation with the *National Documentation Center*, proceeded with the electronic publication of the search tools for the archival collection.

COLLEGE AND UNIVERSITY ARCHIVES

Some of the oldest and most important universities in Greece have gathered archival material related to their domain or to their own activity. To name a few:

- *The Historical Archive of the National and Capodistrian University of Athens*^[7] was established in 1991 and since then has constituted an important research and administration unit of the University. From the beginning, the main goal was the gathering of archival material, scattered since the foundation of the University in 1837. Today, archives from that date up to 1970 are well organized, arranged, and described. Electronic finding aids are also available, as well as a growing number of digitized documents. The Historical Archive has created a solid infrastructure for the study of the history of university education and science. It also participates in research programs on Modern Greek and European history, in collaboration with universities and research centers all over Europe and contributes to the organization of archives and records management in other Universities, institutions, and business establishments.
- *The Aristotle University of Thessaloniki Historical Archives* Its educational, literary, social, and historic archival collections, concerning Macedonia (mainly from the beginning of the nineteenth century until 1950), are kept in different Departments of the University. The holdings of the historical archives include documentary records from the Teachers College of Thessaloniki (1933–1990), elementary and secondary private and public schools, educational authorities, hospitals, parishes, and monasteries.

OTHER ARCHIVES

There are also organizations maintaining important collections of specific interest, due to their nature or acquisition policy. Some representative examples include the following:

- *The National Bank of Greece Historical Archives (NBG)*^[8] were set up for the preservation and display of archival material of the National Bank of Greece, deemed to be of historical importance. The NBG has demonstrated particular concern for its archival material since its early days. As a consequence, NBG possesses a comprehensive historical archive whose time span coincides practically with the history of the Modern Greek state. The material held in the NBG Historical Archives covers the Bank's history from 1841 to 1966, while it also contains originals or copies of various archives of other institutions or individuals entrusted to its safekeeping.
- The *Hellenic Literary and Historical Archive*^[9] keeps an important collection of archival material (nineteenth and twentieth centuries), of historical, literary, social, economic, and artistic interest.
- The document collection of the *Foreign Ministry's Diplomatic and Historical Archive*^[10] encompasses the period from the beginning of the Greek national liberation struggle in 1821 to the present day. The Service of Diplomatic & Historical Archives of the Hellenic Ministry of Foreign Affairs (M.F.A.) is responsible for safe-keeping, preserving, classifying, and utilizing the written, audiovisual and electronic archives of the Ministry, and managing the Library and the Film Archive of the M.F.A.

AUDIOVISUAL ARCHIVES

In recent years, special care has been taken in Greece for audiovisual archives, which have been preserved in public agencies.

- The *Secretariat General of Communication and Information*^[11] maintains an important film archive (about 2100 titles), documenting important aspects of the political, economic, social and cultural life of Greece from 1908 to 1996. The material is divided into three categories: "Contemporary," "Chronicles," and "Documentary." A project of digitalization is currently aiming at facilitating the effective management and utilization of the film archive. According to Law 3444/2006, the film archive will be turned over to the National Audiovisual Archive.
- The task of the *Hellenic Audiovisual Institute Archive*^[12] is the conservation and preservation of audiovisual and

born-digital material, for wide access by any interested party. The Archive manages audiovisual and born-digital material with informational-news, historical-political and, in general, social-cultural content, related to the heritage of the Hellenic State and Hellenism as a whole.

- The *Archive Museum of ERT* (Hellenic Broadcasting Corporation)^[13] was established in 1990. It comprises the departments of the Museum, the Picture Archive, and the Audiovisual Archive. ERT's holdings of more than 15,000 reels of film, 300,000 negatives of pictures and photographic archives, are the most important ones of their sort in Greece. Since 1996, it has been operating as a maintenance and restoration workshop for films, while in 1999 it started operating as a restoration workshop for videotapes—the only one of its kind in Greece—as well as a workshop for the maintenance of photographic material.

The archival landscape in Greece could not be complete without mentioning the following institutions:

- Archive of Cinematograph and Archive of Documentaries of the Ministry of Foreign Affairs, http://www.mfa.gr/greek/the_ministry/history_archive/index.htm
- National Bank of Greece Cultural Foundation—Historical and Paleographical Archive, <http://www.miet.gr/web/en/archive/>
- Archives of Contemporary Social History, <http://www.askiweb.gr>
- Historical Archives of the Benaki Museum, <http://www.benaki.gr>
- Historical Archives of the Agricultural University of Athens, <http://www.aua.gr/gr/arxeio/>
- The American School of Classical Studies at Athens, <http://www.ascsa.edu.gr/archives/Gennadius/Catalog1.htm>
- The Konstantinos G. Karamanlis Foundation Historical Archive, <http://www.Karamanlis-foundation.gr/gr/drastiriotites/arxeio.html>
- Association for the salvage of Historical Archives 1940–1974 <http://www.edia.gr/>
- The Konstantinos K. Mitsotakis Foundation, http://www.ikm.gr/archive_purpose.cfm
- Army History Directorate, http://www.army.gr/html/GR_Army/dieuthinseis/DIS/index.html

DIGITAL ARCHIVAL COLLECTIONS AND ELECTRONIC FINDING AIDS

Most of the repositories mentioned above have digitized part of their collections and provide electronic finding aids, accessible over the Internet. During the last 5 years, a large number of digitization projects, funded by the EU

Information Society Operational Programme, have been launched and continue to be carried out.

ARCHIVAL STUDIES

Archival science is a relatively new field in Greece. Employment positions are available in the state archives (provided by law), while new prospects are being developed in the private (banks and corporations) and public (Local Administration, Police, Universities, and Research Centres) sectors.

A Department of Archival and Library Sciences was established at the Ionian University in 1993.^[14] It is a 4-year course of study leading to a Bachelor's Degree. Graduates may work as archivists in the GSA or in the archival institutions of the public or private sector, mentioned above. The Departments of Library Studies and Information Systems of the Technological Educational Institutions of Athens and Thessaloniki provide basic courses in Archival science (in two of the eight semesters). Graduates may take positions as assistant archivists in GSA and other archival institutions, or record managers in public and private organisations. Continuing education programs are available through seminars and workshops organized by the GSA, as well as the Society of Greek Archivists.

PROFESSIONAL ASSOCIATIONS

The Society of Greek Archivists was established in 1990.^[15] Society of Greek Archivists, the sole professional association of archivists in Greece, currently has more than 200 members, and includes archivists, historians, and researchers. Some of its main constitutional functions are attracting the attention of citizens and decision makers about the salvage and preservation of archives, promoting the national archival heritage, providing consultancy and expertise concerning the management of archives to various organizations, and promoting the archival training and education of the archives and record management professionals.

One of the main concerns of archival professionals is the management of electronic records as archival documents. Existing legislation is not adequate on this issue, while the implementation of the e-government project raises an important number of problems that should be resolved as soon as possible. This issue holds back the efforts of archivists concerning long-term preservation of the documents in their original form. Microfilming and digitization are starting to be widely used for improved access of archival information. On the other hand, there are institutions focused on managing special archival mediums, e.g., audiovisual *registrations*, maps, and plans. The GSA are promoting the standardization of best practices for the preservation of traditional and electronic documents.

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Greece: Libraries

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Abstract

This entry provides an overview of the development of different types of libraries in Greece. Although the authors make reference to what is known of similar cultural institutions in ancient Greece, the focus is on modern period from the Greek Enlightenment and the establishment of the modern state in the early nineteenth century to the present. Special attention is given to recent trends, challenges, and accomplishments.

INTRODUCTION

Greece, a peninsular country, plus an archipelago of many islands, is situated on the south-eastern edge of Europe. It contains an area of 131,957 km² and has a population of 10,964,020 (2001 census).^[1] Greece was declared independent in 1830 and has been a parliamentary republic since 1974. It has been a member of the European Union since 1981. The 2007 GDP amounts to 209,268 billion €, and the per capita annual income is 22,700 € (estimated figure in 2006) (Fig. 1).

LIBRARIES

History

The first indications of libraries in the ancient Greek world can be found in the Minoan and Mycenaean periods. The Library of Peisistratos (about 560 B.C.) is considered to be the first public library in Athens. The most famous library, however, was the Library of Alexandria, founded by Ptolemy II Philadelphus (309–246 B.C.). During the Byzantine Empire, the first “imperial” library was set up in Constantinople in the fourth century. Nevertheless, the kind of libraries that flourished at the time were monastery libraries (Mount Athos, Meteora, Patmos).

After the Fall of Constantinople to the Turks (A.D. 1453), some libraries continued to operate, while others ceased to exist. During the Modern Greek Enlightenment (late eighteenth to early nineteenth centuries), many schools were established, most of which had a library available to serve the needs of the curriculum. That period is considered the starting point for the modern era of libraries. The Library of Zagora, on Mt. Pelion, one of the most significant libraries in those days, opened its doors in 1762. Since 1955, it has

been known as the Public Library of Zagora. Another library opened at that time was the Library of the Dimitsana School, in the Peloponnese, which began to operate in 1764. Its present name is Public Library of Dimitsana. Finally, in 1828, the Zosimaia School, in Ioannina (Epirus), set up its library, which has borne the name Zosimaia Central Public Library of Ioannina’ since 1987.

Contemporary Libraries

Recently, as many as 1145 libraries were identified in a 1998 survey that aimed to record all libraries. Of all those libraries recorded, 61.4% were public libraries, 13.9% academic libraries, 2.9% school libraries, and 21.8% special libraries.^[2]

As far as book production is concerned, 730 publishers released 9209 new titles in 2006.^[3] A survey on reading behavior indicates that 43.8% of Greek citizens do not read at all, 19% read only “practical” books, 0.9% only professional books, and 2.4% read both practical and professional books. On an annual basis, 25.4% read a few books (one to nine) as opposed to 8.6% that read several books (over nine). When stating the way of obtaining their books, 70.8% indicate that they buy them themselves, 17.9% borrow them from their acquaintances, 4.7% borrow them from libraries, and 3.9% receive them as gifts.^[4] 28.9% of the Greek population aged 16–74 have Internet access.^[5]

For years, Greek libraries had been underdeveloped and provided poor services. There had never been a national plan for library and information development, and the involvement of various ministries, state, and local agencies in government created many problems in planning and coordinating services. The fact that the majority of Greek libraries belonged to the public sector, with limited funding available, made any efforts for improvement even harder. This has changed radically. Funding of libraries has



Fig. 1 Map of Greece.

Source: Modified from CIA *The World Factbook*.^[10]

undergone a positive change: more state funds are now made available and European Union funds have flowed into the country. Information technology has become a part of library operations and plays an important and dominant role in the dissemination of information. Users, introduced to the wealth of electronic sources, have become more demanding. The range, kind, and modes of services which are provided now reflect active organizations, and do not resemble the warehouse-type institutions of the past.^[6]

National Library of Greece (NLG)

After the liberation of Greece, the National Library of Greece (NLG) began to operate in Aigina, which was then the capital of Greece. It was established under the initial name of Public Library, by decree in 1832. In 1834, it was transferred to Athens, which had become the new capital of the Greek State. In 1842, it was incorporated into the library of the University of Athens, established in 1837 and in 1866, the above collections merged into a single library under the formal Greek title “*Ethniki Vivliothiki tis Ellados*” (The NLG).

Since 1903, it has been housed in a building that was erected with funding by the Vallianos brothers, merchants, ship owners, and bankers, who, in the nineteenth century had businesses in Russia, Marseille, Constantinople, and London. It was designed by the Danish architect Theophil Hansen and built under the supervision of Ernst Ziller, a prominent German architect, whose work constitutes a milestone in contemporary Greek architecture. On June

11, 2007, a memorandum of understanding was signed between the Greek State and the Stavros Niarchos Foundation, for the construction of a new building. The project is expected to be completed in 2013 (Fig. 2).

The NLG is under the authority of the Greek Ministry of National Education and its institutional framework is prescribed by Law 3149 (FEK A, 141/10–06–2003). Its collections include approximately five million documents, and it is the main legal depository library in Greece. It publishes the *National Bibliography* and it operates as the national center for the assignment of ISBN, ISSN, and ISMN numbering. The Library was granted the authority to transfer *Library of Congress Subject Headings* into a Greek database, translate them into Greek, and adopt them to the Greek context. Various bibliographic tools, such as the *Catalog of Greek Subject Headings* and a translation of IFLA’s *UNIMARC Manual* into Greek, have been published. Access to the library’s OPAC (Online Public Access Catalog) is now possible, enabling librarians to check their collections, locate and verify items and copy bibliographic data.

Parliament Library

The Greek Parliament Library (*Vivliothiki tis Voulis*) was founded in 1844. It is housed in three different buildings in Athens. The “Main Library” of the Parliament Building houses collections of social sciences, rare books dating from 1471 to 1850, and maps and engravings, as well as documents pertaining to modern Greek history. The “Benakeios Library” houses collections of humanities and sciences. It also contains the personal libraries of prominent Greek politicians and scholars. The “Old Tobacco Factory” was converted into a library and houses the Microphotography and Preservation Departments as well as the largest part of the collection of Greek newspapers and periodicals. Mainly for preservation reasons, the Library began in 1984 to microfilm its serial collections; the outcome was 14,500 microforms. Following this



Fig. 2 National Library of Greece.

project, the Library is digitizing its rare books and works of its art collections. Along with the National Library, the Parliament Library is one of the mandatory legal deposit agencies.

Public Libraries

When discussing Greek public libraries some clarifications need to be made. In the Greek context there are two kinds of public libraries, depending on the supervising and regulating authorities; the “dimosies” (public) and the “dimotikes” (municipal).

Public libraries operate within a common institutional framework and are under the authority of and funded directly by the Greek Ministry of National Education. Their operation is prescribed by Law 3149. Their by-laws have been established by Ministerial Decision 83064/IZ (FEK B, 1173/20–8–2003). There are 45 such libraries spread throughout the country.

On the other hand, municipal libraries belong to the respective municipalities that provide their funds. This results in the lack of uniform regulations concerning the operation of these libraries and, as a consequence, there is considerable diversity in the way municipal libraries are organized and funded. A network of mobile libraries has been in operation since the early 1960s, to serve small communities and schools in remote areas. Of those, 38 operate as part of public libraries, two operate under the Ministry of Macedonia-Thrace, and another 11 libraries operate, since 1992, under the Union of Local Authorities, offering services to an equal number of prefectures.

In 2003, within the framework of the European Union’s Information Society Operational Program, Public Information Centers were set up in 45 public and 30 municipal libraries; funding for networking and computing was included. Also electronic equipment to facilitate people with special needs to access the centers’ electronic sources, was acquired. A network of mobile libraries has been in operation since the early 1960s, to serve small communities and schools in remote areas. Of those, 38 operate as part of public libraries, 2 operate under the Ministry of Macedonia-Thrace and another 11 libraries operate, since 1992, under the Union of Local Authorities, offering services to an equal number of prefectures.

Central Public Library of Veroia, Macedonia: Founded in 1952. Since 1976, it has operated as a public library. Under the direction of Ioannis Trochopoulos, it has become a leader in the field, implementing new technologies, cooperating with libraries in other countries, and participating in European projects. In addition to its innovative services, it offers free Web page hosting to local cultural associations and educational bodies and maintains the portal of Greek public libraries (infolibraries.gr) (Fig. 3).

Central Public Library of Sparta, the Peloponnese: Founded in 1972. Since 1989, it has operated in a new



Fig. 3 Public Library of Veroia.

building. It is one of the first public libraries to provide equipment for people with special needs. Under the leadership of E. Tzinieri-Tzanetakou, and in cooperation with other institutions, it developed and published library standards and building specifications for Greek public and school libraries.

Municipal Library of Thessaloniki (Founded in 1932) Originally under the leadership of G.M. Cacouris, it is one of the few municipal library systems, that since 1984 has been organized in a modern way, based on international standards and staffed by professional librarians. It comprises the Central Library, which has been housed in a new building since 2000, and a network of 15 branch libraries, including very active children’s libraries. The total of its collections amounts to 220,000 books. It has the most comprehensive collection of newspapers and periodicals in Northern Greece (Fig. 4).

The Vafopouleio Cultural Center, also under the authority of the Municipality of Thessaloniki, was founded in 1983 with funds provided by the eminent poet George Vafopoulos and his wife Soula Gerakopoulou. The Center, which includes Libraries, an Art Gallery, and a Theater has had a positive impact on the cultural life of Thessaloniki.

School Libraries

While the establishment of the first school libraries dates back to 1835, school libraries have yet to be valued by the Greek educational system. Libraries in a number of private secondary schools (Athens College, Anatolia College of Thessaloniki, and Pierce College) were until recently the only examples of well organized and functioning school libraries. The centralized Greek educational system, the outdated learning styles, the heavy schedules of students, the absence of professional librarians in schools, and the lack of appropriate space are some of the reasons for this pattern. Also, the prevalence of the one textbook



Fig. 4 Municipal Library of Thessaloniki.

for every subject, the same in all primary and secondary schools throughout the country, is another reason for the low priority libraries have in the educational system.

The situation of school libraries is changing. The 499 libraries, founded in secondary education schools in 1999, were the first properly organized state school libraries. They were provided for the first time with an institutional framework by a special decision of the Greek Ministry of National Education (19/11/2003, acc. no. 128800/G7/Es. F.11/1240). The development of EDUNet, a national network for primary and secondary education, connects school libraries with the international information world. ABEKT has been used for the automation of all library functions, ensuring standardization. The establishment of another 266 libraries in secondary education schools as well as the pilot establishment of 25 libraries in primary education schools are well under way.

Academic Libraries

In Greece, public higher education is comprised of 22 universities and 15 Technological Educational Institutions (TEIs). Until, the late 1970s the educational system did not require the use of libraries, especially for undergraduate studies. Students relied mainly on professors' lecture

notes or on a single textbook. This, along with the fact that the Greek educational system in the nineteenth century was influenced by the German educational model, resulted in the creation of small departmental collections in every institution. Laws 1268 (art. 7, par. 7, FEK A, 87/16–07–1982) and 1404 (art. 49, par. 5, FEK A, 173/24–11–1983), and Law 3404 (art. 16, FEK A, 260/17–10–2005), which provides for the existence of only main libraries and libraries at the faculty level, have been adopted to rectify this fragmentation.

The necessity to converge on and participate in the integrated European educational environment of higher education, and generous funding from the European Union within the Community Framework of Support (from 1996 onwards) were critical for academic library development. Libraries were staffed with professional librarians, the necessary technological infrastructure was established, their collections were developed, and electronic services were organized and offered. National policies in certain areas were developed and common decisions were taken.

National and Capodistrian University of Athens: Founded in 1837, it was the first university in the Balkans and the Eastern Mediterranean. Due to the fact that the university buildings were scattered over a large area, 47 independent branch libraries were created, which, following a decision of the Rectorial Council in 1998, were united to form 12 Central Libraries. Although they administratively belong to and are supervised by the respective academic departments, they are "managed by" the Library Management Center of the University of Athens.

Aristotle University of Thessaloniki: Founded in 1925, it is the largest academic institution in Greece. Although a large number of branch libraries were originally created, currently the libraries constitute a single system with one catalog and common by-laws. However, they are funded and economically managed independently. Apart from the main library (in operation since 1974), the system comprises of four subject and 40 branch libraries. It has been a pioneer in automating its collections, acquiring electronic sources, digitizing its material, and providing electronic services to its users (Fig. 5).

University of Macedonia of Economics and Social Sciences: This is a Thessaloniki-based university that was founded in 1948 and began its operation in 1957. Its library was established in 1962, and since 1993, under the leadership of its director Anna Fragkou, it has been reorganized, provides innovative services, and participates in many European projects. It is also the leader among academic libraries in providing services to students with special needs and organizing seminars and workshops to train librarians in this area.

University of Crete: It was founded in 1973 but began to operate in 1977. Its library includes the main library in Rethymno and three branches in Irakleio. Under the guidance of Michalis Tzekakis, it was the first large academic library in Greece to be organized as a single administrative



Fig. 5 Aristotle University of Thessaloniki Library.

unit, and served as a model for the organization and management of other academic libraries. Michalis Tzekakis is also to be noted for his pioneering efforts for the automation of academic libraries and their cooperation on the national level. It was one of the very first libraries to have connections and cooperate with foreign libraries and has carried out many advanced and innovative projects; on the national level. The most serious attempt to create software for the automation of library procedures was PTOLEMEOS, which was in operation in various libraries from 1985 to 2004 (Fig. 6).

University of Patras: Established in 1964, the library started to operate in 1966 to serve the needs of a new University. Committed to quality, change, and improvement, it was the first Greek library in 1988, under the leadership of Catherine Synellis, to subscribe to electronic databases. It is currently involved in digitization projects and quality assessment efforts.

Special Libraries

In the 1998 library survey, 341 special libraries were recorded. They include libraries operating in organizations of the public or private sector (35.2%), research institutions (17.9%), hospitals (19.4%), cultural institutions (12.9%), banks (4.4%), churches (5.3%), and prisons (5%).^[2]

The Gennadius Library: It was created in 1922 when the personal collection of Ioannes Gennadios, a diplomat, was donated to the American School of Classical Studies at Athens. The Carnegie Foundation undertook to erect the building on land provided by the Greek State. It has the personal collections of Lord Byron and the scholar A. Korais as well as 42 archival collections (including the archives of Ali Pasha, the amateur archaeologist Heinrich Schliemann, the composer Dimitris Mitropoulos, and two Nobel prize winners—G. Seferis and O. Elytis, etc.).



Fig. 6 University of Crete Library.

Benaki Museum: Its library was established in 1931. It is the largest museum library in Greece. Since 1991, it has included as a branch the library of the N. Chatzikyriakos-Gkikas Gallery, holding the personal collection of the famous painter.

Music Library of Greece “Lilian Voudouri”: Although there are two more music libraries operating in Greece (University of Thessaloniki and Ionian University in Corfu), this was the first Greek library to fully deserve its name. It was founded in 1997 by the Friends of Music Society. It houses books, sheets of music, and sound recordings, as well as the archives of composers, such as Mikis Theodorakis, etc.

Other special libraries worthy of mention are those of the Benaki Phytopathological Institute, the Center for Planning and Economic Research (KEPE) and the Technical Chamber of Greece (TEE).

DIGITAL LIBRARIES AND INSTITUTIONAL REPOSITORIES

Following the trend for the digitization of Europe’s cultural heritage and the provision of a common access point, Greek cultural institutions have been active in this area. There are 75 digital collections to date. Of these, 30 are full-text collections, 15 are book databases, five combine the types above, 19 are defined as institutional repositories, and the remaining six are collections of online periodical articles. As regards the software used, 32 are open-source applications and 30 collections use commercial applications.^[7] Besides the above projects, one of the largest Greek digitization projects is currently under way; public libraries and the NLG, will digitize their rare book collections, estimated to amount to 15 million pages.

Anemi: Created in 2006 by the Library of the University of Crete. It contains digitized material on Modern Greek culture. Digital Library, the first institutional repository of

a Greek institution, has been in operation at the same university since 1997.

e-fimeris: The National Library Newspapers Digitization Project has the full text of five newspapers of the period 1893–1983.

Psifiothiki: It is being implemented by Aristotle University of Thessaloniki, starting in 2003. It includes newspaper and magazine articles on Greek philology and theater. The university's institutional repository is being implemented using the same database.

Digital Collections and Institutional Repository at NTUA (National Technical University of Athens): The digital collection began in 2005 and includes 300 books and periodical titles. The repository began to operate in 2007.

National Documentation Center, Digital Library: Creator and owner of 22 mainly bibliographic databases, such as Argos and the full-text database of Hellenic Doctoral Theses.

NETWORKS, CONSORTIA, AND UNION CATALOGS

Hellenic Academic Libraries (HEAL)-Link: The Association of Greek Academic Libraries was established during this trend toward modernization. Heal Link (Syndesmos Ellinikon Akadimaikon Vivliothikon), began to operate in 1997 and took its final legal form under Article 17 of Law 3404 (FEK A, 260/17–1–2005). Its members are 37 academic institutions, 17 research institutions, the Academy of Athens, the National Library, the Parliament Library, and the University of Cyprus. The Association is a significant innovation on the library scene, since this is the first time there is planning and action at a central level. Today all academic and research institutions have access to digital material and services, a central union catalog was created, and an interlibrary loan network started to operate. The number of e-journals and e-books that the libraries have access to through the consortium is quite impressive, when compared to the number of journals academic libraries had access to in the print world. Access to the full text of about 14,000 journals is provided, and while it started off with 202,500 downloads, in 2006 it reached about 4.5 million. Claudine Xenidou-Dervou, Librarian at Aristotle University of Thessaloniki, is recognized for her significant effort in the creation and maintenance of Heal-Link.

Zephyr: Virtual Union Catalogue of Greek Academic Libraries. Created in 2003 by the Technologies and Information Service of the University of Crete Library, it supports MARC21 and UNIMARC formats and its design is based on the Z39.50 protocol. It includes all bibliographic records of Greek academic libraries in real time.

Union Catalog of Greek Academic Libraries: It includes the catalogs of Greek academic libraries. Its participants are the Academy of Athens, the National Library,

the Pedagogical Institute, the University of Cyprus, and the Open University of Cyprus. Works on its creation began in 1997, while it first operated in 2005. It is a main (natural) slave type catalog. It uses the UNIMARC format.

Greek Public Libraries Union Catalog: It includes the collections of public libraries and began to operate in 1999. The Central Public Library of Levadeia undertook its creation, with support from the Greek Ministry of National Education and the EKT. It is an integrated catalog that has a master record for each document and supports the UNIMARC format. The records of 10 libraries have been included to date.

Union List of Serials: Since 1984, the EAT has developed and managed the national union catalog of scholarly journals held in Greek libraries, through which online ordering for interlibrary loan can be done. Some 250 Greek libraries of all types participate in the project and make their print journal collections nationally available.

Openarchives.gr: A search engine, based on open-source software, has been in operation since 2006. It conducts simultaneous searches of Greek digital libraries and institutional repositories.

OTHER RELEVANT BODIES

National Documentation Center (EKT): Pressure exercised by the Greek scientific community resulted in 1980 in the establishment of the National Documentation Center. The Center, supervised by the Ministry of Development General Secretariat for Research and Technology, is the national organization for the development of an information system for science and technology.

The Greek doctoral dissertations database, and 20 more bibliographic databases, along with union catalogs of various types of libraries, have been developed by the Center. It has also produced an integrated library automation system, ABEKT, which has solved automation problems in many small libraries, which otherwise could not have afforded to purchase a commercially available system.

Organization of Juvenile and Adolescent Libraries (O.P.E.B.): Founded by the late Anne Gruner Schlumberger, a librarian originally from France, who wished to offer opportunities for culture and education to children coming from rural or underprivileged areas. Originally supervised and coordinated by the Ministry of Agriculture, in conjunction with local agricultural Cooperatives, it has been, since 1993, under the supervision of the Greek Ministry of National Education (Law 2174/1993). Today there is a network of 29 O.P.E.B. supported libraries throughout Greece, including three libraries in prisons.

National Book Center of Greece (E.K.E.BI): This independent legal entity was established in 1994 by the Ministry of Culture. Its goal is to formulate a national policy on books. Its main objective is to support and organize the book trade, with parallel activities focusing on readers and

books. "The modernization, support, and animation of libraries" are also included among its interests.

The Book Monitoring Unit (PAB): It was established in 1997 under the aegis of the National Book Center and is responsible for statistics and measurements about book production. In 1998, it developed the electronic book database BIBLIONET which contains Greek books in print.

Total Quality Management Unit of Greek Academic Libraries (MOPAB): It has been in operation since 1999, under the responsibility of George Zachos, director of the University of Ioannina Library. Its main objectives are to collect, process, analyze, and present data on Greek academic libraries, and to develop assessment indicators concerning academic libraries.

Union of Hellenic Librarians and Information Scientists (E.E.B.E.P.): The professional association of Greek librarians was founded in 1968, originally under the name Union of Greek Librarians. It was renamed in 2004 to encompass the new developments in the field. G.M. Cacouris was the first elected president. Its membership is around 2000. Regional divisions exist in the Peloponnese, Crete, Thessaly, and Northern Greece.

Association of Archivists and Librarians in Greece (E.A.B.E.): Founded in 2000, it is the professional body of graduates of University departments of archives and library sciences.

LIBRARY AND INFORMATION SCIENCE STUDIES

The first efforts to provide formal library education programs were made in 1957 through training seminars. On the invitation of the Greek State, UNESCO commissioned Leon Carnovsky (in 1960), professor at the University of Chicago, and Preben Kierkegaard (in 1962), director of the Danish Library School, to study the situation and make appropriate suggestions. They both proposed the establishment of a library science school at the university level. A 1-year vocational school was set up by the YWCA in Athens in 1961 and operated until 1976.^[8] G.M. Cacouris, as its director, and Maria Alexandraki, as member of its faculty, inspired, trained, and created employment opportunities for a large number of graduates. G.M. Cacouris also contributed to the establishment of library science departments at TEI, the new institutions founded in the early 1970s, in order to foster new emerging professions and applied disciplines.

In 1977, the Department of Library Science was set up at the TEI of Athens. Its name was changed to Department of Library Science and Information Systems in 2003, to reflect the new developments in the field. Alkmini Skandali and V. Moniarou, were among the first members of its faculty and worked for the development of a modern curriculum. Over 4000 students have graduated from the department to date. A second department was founded in 1981 at the TEI of Thessaloniki. Under the guidance of professors G.M. Cacouris and M. Moreleli-Cacouris, the

first library and information science collection in Greece was organized, exchange programs with schools in Europe and the United States were developed, and courses on information technology started to be taught. Over 2500 students have graduated from the department to date.^[9]

In 1993 the Department of Archives and Library Sciences at the Ionian University, Corfu was founded. George Bokos, contributed to the development of its curriculum, and soon the department started offering doctoral degrees; also since 2003, course-based master's programs have been organized, in conjunction with the TEI of Athens department.

PUBLISHING ACTIVITIES AND CONFERENCES

The publication of *Cataloguing Rules* (1969, 1974) and *Librarian's Dictionary* (1974) by G.M. Cacouris, as well as the *Bibliography of Greek Library Science* by K. Delopoulos (1974) were the first efforts to publish professional material in Greek.

The E.E.B.E.P. published (and continues to publish) the first library periodical, *Libraries and Information (Vivliothikes kai Pliroforisi)*, Issue 1 (June 1984). In addition, the E.E.B.E.P. has published handbooks and organized seven Panhellenic conferences (the last one in 1993). The Department of Archives and Library Sciences of the Ionian University has been publishing a yearbook *Document (Tekmirion)*, since 1998. Also, two short-lived titles *Modern Library and Information Services (Sygchroni Vivliothiki kai Ypiresies Pliroforisis)*, Issues 1 (March 2000) to 21 (August 2003) and *School Library (Vivliothiki sto Scholeio)*, Issues 1–3 (2001) were published by private publishers.

Libraries have started to implement Web 2.0 applications in order to communicate with their users. The EKT publishes the electronic newsletter *Public Libraries... on the Move (Oi Dimosies Vivliothikes ... kinountai)* (Issue 1/June 2004), and the Goethe Institute brings out the online magazine *Synergasia*, Issue 1 (April 2006).

The EKT also published the Greek translation of the 13th abridged edition of the DDC in 2001. Since 2002, it has developed and made available the first bilingual (Greek and English) *Thesaurus of Greek Terms of General Content*. AACR2 was published by TEI of Thessaloniki in 1996.

The annual conference of Greek academic libraries is an important event for the library community. It was first organized in 1992, and the library of a different institution organizes it every year.

CONCLUSION

With the establishment of library science departments and the provision of European Union funds from 1996 onwards, a new era has begun for Greek libraries. Libraries have managed to overcome the adversity of many decades,

creating a modern environment that meets the needs of the information society. New buildings have been erected, older buildings have been renovated and up-to-date equipment has been acquired. The appointment of professional librarians has been a significant factor contributing to success. Greek libraries, funded by European Union Programs, have started the digitization of conventional material and the management of born-digital material, and the provision of innovative services. They have learned how to cooperate, conduct research projects, and actively claim their right to participate in the new globalized information environment.

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Greece: Museums

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Abstract

The entry provides some general statistics about the number of museums and their visitors in Greece. It then examines the development of the idea of the museum from antiquity to modern times, focusing mainly in the nineteenth century, when the modern Greek state was founded. The first museums in Greece were associated from their beginnings with the strengthening of national identity and its links with ancient Greece, while they had a public mission and a strong educational character. In modern times the Greek museum scene shows an increasing interest in current museological concerns and practices. The entry covers in greater detail the National Archaeological Museum, the Byzantine and Christian Museum, the National Gallery-Museum of Alexandros Soutsos, and the Benaki Museum.

INTRODUCTION

There are over 280 museums in Greece that operate under the supervision and the administrative control of the Ministry of Culture (founded in 1971). The majority of these are archeological (165). They are legal entities governed by public law, but the Ministry also supervises 105 museums which are legal entities governed by private law. Apart from these, there are also a number of private, local authority, university, church, and independent museums, but there is not a reliable, comprehensive list of these, as they do not belong to the list of museums supervised by the Ministry of Culture.

According to the 2006 National Greek Statistical Service survey, about 2,800,000 people (Greeks and non-Greeks) visited the state museums (more than a third of whom were admitted free of charge).^[1] A 2007 Eurostat survey on European Cultural Values reported that only 25% of Greeks declared that they had visited a museum or gallery within the last 12 months (2006–2007) (average in the European Community: 41%), while a higher percentage, 33% had visited a historical monument (EC average: 54%).^[2] The Acropolis Museum was by far the most visited (annual average of over 1 million visitors between 1998 and 2005, while the rest had less than 400,000 visitors annually, on average). The same survey reported that 28% of Greeks use the Internet for visiting museum or library Web sites.^[3] According to another Eurostat survey, in Greece 2.1% (4382) of people in employment worked in the cultural sector in 2005, compared with 2.4% (4.9 million) in the remaining 27 countries of the European Union.^[4]

FROM ANCIENT TO MODERN TIMES

For ancient Greeks, “mouseio” was the sacred precinct of the Muses, the space dedicated to the protectresses of the

arts. During the Hellenistic period, the term referred by association to a research center and congregating point for the scholars of the time and was usually associated with a large library, like the one in Alexandria.

During the Roman period, noblemen and officers of the Roman army demonstrated their affinity with Greek education by forming collections of Greek art (mainly fifth to fourth century Athenian), often looted and brought back home. These were also used as symbols of political messages and of military victories. It is, however, during the Renaissance that the contemporary meaning of the museum evolved. It is then that the idea of the public role of the museum also evolved, followed by the notion of the specialist who studies and curates a collection.

In the nineteenth century, the idea of the museum in Greece was closely linked with its role as guardian and tangible evidence of the ancient Greek roots, thus strengthening the modern Greek national identity. Following the emergence of the independent state in 1830, the primary role of the museums aimed at the protection and safekeeping of antiquities, and not so much for their display. Furthermore, unlike most European museums, whose early beginnings were rooted in private collections, Greek museums had a public mission and a strong educational character. They addressed all members of society from the time they were founded, even though they were in practice accessible only to a small educated elite. The new Greek state recognized early in the 1830s the importance of protecting the ancient heritage. It founded the first national museum in 1829 in Aigina (first capital of the state) and established measures for the protection of antiquities. In those early days, several ancient monuments functioned temporarily as museums, like the Parthenon, the Pinakothiki in the Acropolis, and the Stoa of Hadrian in Athens, where the capital moved later. In the rest of Greece, the movable antiquities were collected and guarded in schools, churches,

and public buildings, since there were no funds yet for building museums. The first purpose-built museums in Greece were the Acropolis Museum (1874) and the National Archaeological Museum in Athens (1866–1889).

The first museums in Greece were associated directly with the strengthening of national identity and its links with ancient Greece. The influence of neoclassicism which dominated in Europe, as it was filtered through the modern Greek Enlightenment, emphasized primarily the classical period, even though the collections of the museums covered a period from the prehistoric to the late-Roman times. The belief in the historical continuity of Hellenism and the imitation of the ideals of classical antiquity served the rising middle class, which, influenced by the principles of the Enlightenment, aimed at the reduction of the power of the church and at democratic government. With the arrival of the first modern king of Greece, Otto (or Othon) from Bavaria in 1832, whereby Greece became a new independent kingdom under the protection of the Great Powers (the United Kingdom, France, and the Russian Empire), and the import of western-European political and cultural standards, foreign to the Greek society, the middle class resorted to a sterile historicism and a strong worship of the ancestors.

After World War II there was an expansion and growth of many new museums in Greece; in addition to archaeological museums (which still kept their original role), there were also ethnographic and local history museums and many other types (such as children's museums, theater museums, etc). This expansion of public museums was followed by the creation of many private museums and the involvement of the cultural departments of several banks and private companies and individuals. There has also been a recent expansion of museums of modern and contemporary art.

As the role of science and technology and industrial archaeology became more widely recognized, related museums have also become more widespread in Greece, although their development is much later than in many other European countries. Activities of the Cultural and Technological Foundation of the Greek Bank of Industrial Development (ETVA) and later, of the Piraeus Bank Cultural Foundation, have been instrumental in preserving and promoting Greece's industrial and technological past and in creating related museums.

CURRENT DEVELOPMENTS AND CONCERNS

Currently, a dialog about modern museums' role and ways of operating is becoming more widespread (often influenced by related discussions in the United States and Western Europe). This is evidenced also by an increase in the number of conferences related to museums as well as the number of university undergraduate and postgraduate courses like the undergraduate courses and the MSc in

Cultural Informatics with a Museology option offered by the Department of Cultural Technology and Communication of the University of the Aegean, the interdepartmental MA in Museum Studies of the University of Athens, the interdepartmental MA in Museology of the Aristotle University of Thessaloniki, and the MA in Cultural Management of the Hellenic Open University, specialized journals, (Such as the *Museology Notebooks* [*Tetradia Mouseiologias*] by the publisher Kaleidoskopio, and the online *Journal of Museology*, published by the Department of Cultural Technology and Communication of the University of the Aegean^[5]) and publications. Apart from the theoretical discussions, since the late 1990s there have also been increasing signs of a greater professionalism in the functioning of museums and galleries in Greece; collaboration with trained museologists in the creation of museums, exhibitions, and services; and improved communication with visitors. There have also been encouraging steps to promote professional development and training, where the Greek Committee of the International Council on Museums (ICOM) plays an important role.

In the twenty first century, the opening of the Greek museums to the public is primarily evidenced by educational programs offered by museums, which are becoming more widespread. The early pioneers for these were in many cases private museums (like the Benaki Museum which started its educational programs in 1978, and the Museum of Cycladic Art of the N.P. Goulandris Foundation, from its first year of operation in 1986), but also the Department of Educational Programs of the Directorate of Prehistoric and Classical Antiquities of the Ministry of Culture which was founded in 1985. An important initiative in this direction was the Melina Project, which ran from 1995 till 2003 organized by the Ministries of Culture and Education and the General Secretariat of Adult Education, which supported programs of museums and cultural organizations for primary school pupils (incorporating theater, music, dance and movement, arts, and audiovisual expression).

Another sign of the influence of contemporary museological thinking has been evidenced in the exhibitions created in many Greek cultural organizations since the 1990s. Several of these aim to incorporate audiovisual and interactive media, special lighting, and advanced graphic design in order to support more effective communication of their messages. The use of new technologies is generally spreading behind the scenes to support the management and documentation of the collections as well as for enabling worldwide communication over the Internet and presentation of the collections in different contexts. These developments are followed by an increased interest in the use of standards in all areas of documentation, such as terminology, data organization, and structure. Most Greek museums have some form of computerized collections catalog (even though, with the exception of the Benaki Museum, none of these are available online yet). There have also been initiatives by the Ministry of Culture

for designing and using a common system among state-run archaeological museums. Some Greek museums have also experimented with new technologies for presenting the collections, usually in the form of information kiosks positioned in or near exhibitions, and with electronic publications, such as CD-ROMs and DVDs on the highlights of their collections. The privately funded nonprofit Foundation of the Hellenic World in Athens, established in 1993, was one of the early pioneers in the use of Information and Communication Technology and particularly virtual reality, such as the CAVE-like system, and more recently, the virtual reality Tholos (Dome), an interactive theater with stereoscopic projection inaugurated in 2006, with a seating capacity of 132 visitors. These efforts create an interactive experience for visitors mainly about the ancient Greek past.

NATIONAL ARCHAEOLOGICAL MUSEUM

The National Archaeological Museum is the largest museum in Greece. It was initially founded in 1829 at the Orphanage of Aegina (the first public building built at the first capital of Greece, which housed also the National Library), and its first director was the scholar Andreas Moustoxydis. According to modern museological standards, the first National Museum resembled more a museum storage area and warehouse, as its primary role

was the protection of antiquities. A few years later, in 1833, the Archaeological Service was founded in Athens in order to compliment the Museum's role of protection with those of research, study, and excavation. The Museum was transferred to the new capital of Athens in 1834 and was then named "Central Archaeological Museum," housed initially at the Hephaisteion, the ancient temple of Hephaestus, until 1874 and then changing location several times. It is currently housed in a neoclassical building from the end of the nineteenth century (completed in 1889), which was designed by Ludwig Lange and later remodeled by the German architect Ernst Ziller. During World War II, parts of the collections were boxed, removed for safety and buried. After the war, the redisplay of the collections was organized by the then director Christos Karouzos and his wife Semni Karouzou. The building has undergone several expansions to accommodate the rapidly increasing collections. After its more recent refurbishment, it was reopened in 2004 (Fig. 1).

Although the original purpose of the Museum was to preserve and protect all the finds from the nineteenth century excavations in and around Athens, it was gradually enriched with finds from all over Greece. Its over 20,000 archaeological exhibits cover the beginnings of Prehistory to Late Antiquity in Greece and are organized in five large permanent collections: The Prehistoric Collection includes works of the civilizations that developed in the Aegean from the sixth millennium B.C. to 1050 B.C.



Fig. 1 National Archaeological Museum.

Source: From http://en.wikipedia.org/wiki/File:National_Archaeological_Museum_Athens_building.jpg.

(Neolithic, Cycladic, Mycenaean), and finds from the prehistoric settlement at Thera. The Sculptures Collection shows the development of ancient Greek sculpture from the seventh to the fifth centuries B.C. The Vases and Minor Objects Collection, which contains representative works of ancient Greek pottery from the eleventh century B.C. to the Roman period, includes the Stathatos Collection, a corpus of minor objects of all periods. The Metallurgy Collection includes statues, figurines, and minor objects. And, finally, there is the only Egyptian and Near Eastern Antiquities Collection in Greece with works dating from the predynastic period (5000 B.C.) to the Roman conquest. The Museum functions today as a Special Regional Service of the Ministry of Culture and its five permanent collections are administered autonomously.

BYZANTINE AND CHRISTIAN MUSEUM

The end of the nineteenth century saw the recognition of the role of the Byzantine, late Byzantine, and later period as the bridge connecting historically and culturally antiquity with contemporary Greece. The objects surviving from these periods were treated as testaments to the continuous character of Greek civilization which survived from ancient Greece. In this climate, the Christian Archaeological Society aimed for the creation of a Museum of Christian Archaeology since 1884, when the Museum was initially founded and its director Georgios Lampakis started collecting related objects (mainly religious relics), even though the Museum did not have yet a permanent home. In 1914, the Byzantine and Christian Museum was officially founded as a national organization with Professor Adamantios Adamantiou as its first director, who enriched the collections with objects of national history and art. In 1923, Professor Georgios Sotiriou was appointed the next director and started organizing the collections under scientific principles. In 1930, the government offered to the Museum the mansion of Villa Ilissia, originally the home of the Duchess of Plakentia.

In recent years, a large extension was designed with a basement and buildings partly aboveground, which was then complemented by a varied program of exhibitions and activities. The recently redisplayed collections of the Byzantine Museum show the course of Greek art from the fourth to the nineteenth century. The collections include icons, sculptural works, ceramics, mosaics, manuscripts, and small works representing the artistic production of the Greek mainland and of other regions of the Byzantine Empire.

NATIONAL GALLERY—MUSEUM OF ALEXANDROS SOUTSOS

The National Gallery was founded in 1900 after the bequest of the jurist and art lover Alexandros Soutsos to

the Greek State aspiring to the creation of a “Museum of Fine Arts” a few years earlier. Its first curator was the painter Georgios Iakovidis and it was housed until 1939 at the Technical University buildings (Polytechnion), where the first nucleus of the collection was formed from 1878. After the war, it was housed in several different buildings until it was moved in 1976 to its current purpose-built location. The expansion of the collection and the new needs of the Gallery have led to plans for extending the current space.

The main foci of the collections are twofold: renaissance art (a small but important collection) and the representation of Greek painting through time (from the late Byzantine period until today). Temporary exhibitions are usually supported by sponsorships, which cover about 50% of the Gallery’s budget. The mission of the National Gallery focuses on the enrichment of the collections, the care and study of artworks as well as in “the aesthetic cultivation of the public, the ongoing education through art and the pleasure that it offers, but also in national self-consciousness through the history of Greek art that expresses national life on a symbolic level.” Responding to this role, the National Gallery-Alexandros Soutzos Museum aims to present its permanent collections in a manner that highlights both the evolution of art and the parallel development of the society which it expresses. In order to serve this mission more effectively and expand its activities in the periphery of Greece as well, it has also founded a series of annexes: the Koumantareios Art Gallery in Sparta, the annex of the National Gallery in Corfu, and one in Nafplion which opened in March 2004, as well as the National Sculpture Gallery, inaugurated in 2006 and housed at the former royal stables in the Alsos Stratou in the area of Goudi in Athens.

BENAKI MUSEUM

The Benaki Museum is the largest and oldest museum in Greece operating as a foundation under private law. Its nucleus was the extensive collections housed at the private neoclassical mansion of Antonis Benakis, scion of one of the leading families of the Greek diaspora of Alexandria, which were donated to the Greek state together with the building in 1931.

The Museum collections are organized under the following departments: Greece at the Benaki (which covers Greek cultural objects from antiquity until 1922, aiming to show the continuity of Hellenism through time), Greek artists of the twentieth century (including the Gallery of the Greek painter Nikos Chatzikyriakos-Gkikas and the Studio of artist Giannis Pappas), the Department of Childhood, Toys and Games, Coptic Art, Chinese Art, Pre-Columbian Art, and Islamic Art. The collections also include rich and wide-ranging archives (photographic, historical, performing arts, and modern Greek architecture ones).



Fig. 2 Benaki Museum Pireos Street Annex.

Source: From Photograph by Erieta Attali.

Despite various extensions of the original building, the continuously expanding collections, needs of the Museum, and modern museological demands led to a large project of decentralization of services and buildings. This follows the satellite concept with a number of autonomous branches (located at several impressive and in many cases historic buildings around Athens) organized around an initial central core (housed at the original main building, whose displays are currently devoted to narrating the history of Hellenism over time). The projects included the establishment of the New Benaki at 138 Peiraios Street (Fig. 2), one of the central development axes of Athens, at a recently refurbished building, which currently shows only changing exhibitions and performances (art, music, architecture, drama, cinema, dance) and functions as a cultural center, but is anticipated to also house the rare (in Greece) Chinese, African, Indian, and Pre-Columbian collections. Another part of this restructuring and expansion project included the creation of the Benaki Museum of Islamic Art, which is housed in a neoclassical building complex at the historical center of Athens (near the ancient Kerameikos cemetery) that was inaugurated in 2004. The collection of children's Toys and Games will be housed in the Kouloura Building, in Palaio Faliro, a seaside suburb of Athens.

Apart from the high quality and size of the collections, since its foundation, the Benaki Museum has played an important role in the Greek museological scene. It was the first to organize an educational program, a museum cafe, a museum shop, an association of Friends of the Museum, and an Information Technology Department.

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Grey Literature [ELIS Classic]

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Abstract

This entry provides an overview on the definition and evolution of grey literature in the emerging environment of digital resources and open access to scientific and technical information as well as the social sciences and humanities. First, it gives some empirical evidence on the importance of grey literature in scientific publications from different domains, especially library and information sciences (LIS), based on citation analysis. Other topics include the impact of Internet on the production of grey literature, the place of grey resources in open archives and institutional repositories, the development of bibliographic control and standardization, and the difficulties of identification and accessing grey documents. The entry ends with some predictions on the future of grey literature and open questions for research in LIS.

INTRODUCTION

A great part of scientific results are published first and/or exclusively in reports, conference proceedings, pre-prints, working papers, theses, dissertations, personal communications, technical notes, etc. In spite of their widespread differences, all these documents are known by library and information science (LIS) experts as “grey literature” because they share two common characteristics: they are outside of the realm of commercial publishers, and they are rather ephemeral—often poorly controlled by catalogs, databases, and bibliographies.

How important is grey literature for scientific publishing, are there distinctions between the different research domains? What is the usual definition of grey literature, does it change in the environment of digital libraries and New Technologies of Information and Communication (NTIC)? What types of science and technology information (STI) does the term “grey literature” cover, how is it disseminated, how can it be assessed? In which way is grey literature related to and impacted by open archive initiatives? Who does research on grey literature, and what are the frontline topics for LIS research?

The following entry addresses these and other questions but acknowledges that there still remain unanswered questions because of the rapid evolution of information technologies and practices. Nevertheless, we conclude with nine predictions on the future of grey literature.

WHAT EXACTLY IS GREY LITERATURE?

There are several definitions of grey literature, the most common being the so-called “Luxembourg definition,” which was discussed and approved during the Third International Conference on Grey Literature in 1997: “[Grey literature is] that which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers.” In 2004, at the Sixth International Conference on Grey literature in New York City, a post-script was added to the Luxembourg definition for purposes of clarification “. . . not controlled by commercial publishers i.e., where publishing is not the primary activity of the producing body.”

This definition in itself contains two of the main characteristics of “grey” resources: On the one hand they are universal and ubiquitous, but on the other hand, they are difficult to identify and to obtain through conventional publishing circuits.^[1] The Luxembourg definition is also vague enough to reflect the problem of determining exactly what a type of literature variously described as “ephemeral,” “nonconventional,” or “underground” really means. To quote two experts from the British Library, “grey literature is difficult to define.”^[2]

Another definition is from the U.S. Interagency Gray Literature Working Group, “Gray Information Functional Plan,” January 18, 1995, that defines gray (or grey) literature as “foreign or domestic open source material that usually is available through specialized channels and may not enter normal channels or systems of publication,

distribution, bibliographic control, or acquisition by book-sellers or subscription agents.”^[3]

In fact, the term traditionally covers three categories of documents—conference proceedings, reports, and doctoral theses—that are often printed in short runs. Nevertheless, the borderline with “white” or “conventional” literature is permeable, since some conference proceedings are published by commercial publishers, as monographs in serial publications or journals, and the same is true for some reports. As for doctoral theses, especially in the humanities and social sciences, some are also found on the commercial publishing market.

However, regarding all the other documents that circulate outside conventional publishing circuits, the lack of “commercial control” raises real problems for academics and scientists as well as for information professionals when it comes to locating and acquiring them. The lack of “commercial control” and promotion also often implies a lack of “bibliographic control.” In other words, these documents are often inadequately referenced in catalogs and databases, so that searches through this category of scientific information require specialized knowledge on sources and circuits.

THE WHO'S WHO IN GREY

Information professionals—including archivists, librarians, researchers, and teachers—have been contributing to studies on grey literature for nearly 30 years now, compiling a rich corpus of articles and, since 1993, international conference papers on grey literature.^[4] In 1985, several European national libraries and information centers founded European Association for Grey Literature Exploitation (EAGLE) to identify and disseminate grey literature. In the 1990s, governmental initiatives in France resulted in particular in the establishment of two national “one-stop shops” for accessing reports of general or scientific interest (La Documentation Française, INIST-CNRS). Other countries have designated “deposit and distribution centers” [such as the British Library^[5] for the United Kingdom or the TIB (German National Library of Science and Technology) Hanover^[6] for Germany] or established portals for scientific reports (such as GrayLit for U.S. Federal Agencies), which was discontinued in 2007.

From 1992 on, Farace, a former member of the EAGLE technical committee founded GreyNet, the Grey Literature Network Service,^[7] which organizes the international conference series on grey literature. Conferences in the GL-Series have since taken place in Amsterdam (1993 and 2003); Washington, D.C. (1995 and 1999); Luxembourg (1997); New York City (2004); Nancy, France (2005); New Orleans, Louisiana (2006); Antwerp, Belgium (2007); and the next in this series—the Tenth International Conference on Grey Literature—

returns to Amsterdam in December 2008. The more than 250 authors and researchers in the field of grey literature, who have contributed over the past years to the above conference programs form as it were the WHOIS in grey literature along with the host and sponsoring organizations, whose financial contributions guarantee the continuity and longevity of research programs and projects in the various sectors of government, academics, business, and industry.

The Textrelease Web site^[4] provides biographical notes for over 75 academics, scientists, and professionals who work and publish on grey literature.

Special tribute should be paid to five outstanding personalities who made lasting contributions to specific areas in the field of grey literature in the four decades from 1960 to 2000:^[8] A.M. Weinberg (the United States), author of the famous “Weinberg Report 2000”; V. Alberani (Italy), organizer of a national program for grey literature; C.P. Auger (the United Kingdom), who provided the first Roadmap of Grey Literature Systems and Services; P. Wattenberg from the German Max-Planck-Gesellschaft, who specialized in the infrastructure of grey literature for the Japanese JICST (now JST, Japan Science and Technology Agency); and A. Zemskov (Russia) from VNTIC, the National Public Library for Science and Technology, where he explored the free access of information and grey literature.

To date, only one monograph has been published on grey literature.^[9] In 1989, in his second edition for Bowker-Saur, Charles P. Auger re-titled his work “Use of Reports Literature” (Butterworths, 1975) to “Information Sources in Grey Literature.” This title change was indicative of the fact that reports were only one type of grey literature among increasing sundry of other types; and that the term “grey literature” was most suited to capture this phenomenon. Auger’s work saw a 4th edition in 1998. Unfortunately, however, in this his final edition, the rise of electronic grey literature was almost completely neglected. TGJ, *The Grey Journal* (ISSN for the print edition 1574-1796) from TextRelease/GreyNet in Amsterdam is the only current journal dedicated to this topic. Since its creation in 2005, some 70 articles were published in the first four volumes. TextRelease/GreyNet also maintained a cooperative publishing agreement with PRQ, Publishing Research Quarterly (2004–2007) whereby the annual spring issue of that journal was solely dedicated to articles on grey literature that originated as conference papers within the GL-Conference Series; and this accounts for another 35 journal articles. Both TGJ and PRQ maintain licensing agreements with EBSCO Publishing, whereby the full-text of both TGJ and PRQ are online, available in the Library, Information Science & Technology Abstracts (LISTA)-FT database. Earlier IJGL, *International Journal on Grey Literature* (ISSN 1466-6189) was edited in 2000 by Emerald (former MCB University Press). However, it ceased publication after the

first volume of four issues totaling 23 journal articles; these articles are nevertheless still available on the Emerald server. Most other articles on grey literature are published in other serials in LIS or journals from other scientific domains such as *The Lancet*, *Marine Policy*, and *European Psychiatry*.

While it is rather easy to identify specific landmarks in the history of grey literature studies, it is perhaps first more constructive to indicate timeframes in which grey literature has developed. Five such periods can be distinguished.

1. They begin with the years leading up to 1979 in which numerous uncontrolled terms such as ephemera, fringe literature, fugitive literature, nonconventional literature, non-published literature, report literature, research outputs, small-circulation literature, unconventional literature, unpublished literature, etc., were coined to capture the growing phenomenon.
2. The period 1980–1990 covered the development and launch of national and international programs on grey literature (1985 is the year in which the European network EAGLE was created).
3. The period 1990–2000 included the creation of GreyNet, the Grey Literature Network Service (1993 is the year in which the first international conference on grey literature was convened).
4. The years 2003–2005 covered the re-launch of the Grey Literature Network Service showcasing new projects in the context of the explosion of digital resources, the movement for open access to scientific and technical information, and the Web2.0 (these research results were presented at GL conferences in Amsterdam (NL, 2003), New York (US, 2004), and Nancy (FR, 2005). This growth occurred notwithstanding the fact that EAGLE and its System for Information on Grey Literature in Europe (SIGLE) database was also terminated in 2005.
5. The current timeframe from 2006 onward is one in which new cooperative research initiatives in the aftermath of EAGLE-SIGLE are on the rise.

One of the recent projects is the OpenSIGLE project,^[10] an initiative powered by INIST to provide access to former SIGLE records in an open source context. In the spring of 2008, GreyNet signed on to the OpenSIGLE Repository in order to preserve and make openly available research results originating in the International Conference Series on Grey Literature.^[11] And, in so doing, the OpenSIGLE Repository has become the intersection of more than 25 years of bibliographic information on grey literature with 15 years of research in the field. Another initiative is the collaboration of researchers in the field of grey literature on institutional levels involving cross-country and international

partnerships. And yet another recent initiative was the pilot for a distance learning course on grey literature for (post)graduate students, one that was accredited by the University of New Orleans (UNO) and which is now available to other academic institutions. These and other such cooperative initiatives were introduced and discussed at the GL conference in New Orleans (US, 2006) as well as the GL conference in Antwerp (BE) in December 2007.

ON THE (RELATIVE) IMPORTANCE OF GREY LITERATURE

Grey literature has a role of its own as a means of distributing scientific and technical information,^[12] and professionals insist on its importance for two main reasons: research results are often more detailed in reports, doctoral theses, and conference proceedings than in journals, and they are distributed in these forms up to 12 or even 18 months before being published elsewhere.^[1] We might add that some results simply are not published elsewhere.

But how do researchers actually use grey literature? One way of evaluating this is to analyze the citations given in their publications. In order to obtain empirical evidence, we present two different approaches: first, results from a Franco-Dutch study launched in 2004 and revisited in 2005 with evidence for different scientific disciplines, and second, results from a small study of bibliographic references published in four different journals in LIS.

Citation Analyses

Let us look first at some results from the Franco-Dutch study^[13,14] which analyzed 64 citation analyses published between 1987 and 2005, citing altogether several thousands references. Table 1 shows the proportion of grey literature cited in publications from different scientific disciplines.

The relative importance of grey literature is largely dependent on research disciplines and subjects, on methodological approaches, and on sources used. In some

Table 1 Proportions of grey literature citations in selected scientific domains

Field	Grey literature citations (in %)
Soil science	14
Biology	5–13
Veterinary medicine	6
Psychiatry (addiction)	1
Psychology	3
Engineering sciences	39–42
Economic sciences	9–17
Sociology	7–9
Education sciences	14–19

fields, especially the life sciences and medical sciences, there has been a traditional preference for conventional distribution media (journals), while in others, such as agriculture, aeronautics, and the engineering sciences in general, grey literature resources tend to predominate.

In particular, public administrations and public and industrial research laboratories produce a great deal of “grey” material, often for internal and in some cases “restricted” dissemination.^[15]

Publications in LIS

For a more accurate idea of the way grey literature is used in LIS, we analyze recently published articles from four representative, refereed LIS journals with impact factor.

Emerald’s *Journal of Documentation* (ISSN 0022-0418) published 13 articles in the first two issues of 2007 (vol. 63), with 472 bibliographic references. About 16% of these references are to grey literature.

The first issue of 2007 (vol. 43) of Elsevier’s journal on *Information Processing & Management* (ISSN 0306-4573) contains 17 articles with a total of 469 references. Of them, 80% cite commercial material (e.g., serials, monographs, and conference series), while the other 20% are grey.

The journal *Information Technology & Libraries* (ISSN 0730-9295) is published by the American Library Association (ALA). The four issues in 2006 (that comprise vol. 25) contain 24 articles with 512 references, 36% of which are to grey literature.

Finally, when we examine the 18 papers comprising the second issue of 2007 (vol. 12) *Information Research* (ISSN 1368-1613), we find 374 bibliographic references, 18% of which are to grey documents. Note that “Information Research” is an international electronic open access journal from the University of Sheffield (U.K.).

Four journals, eight issues, 72 articles with 1827 bibliographic references is not a large sample. Nevertheless, let’s sum up the evidence in the following three points:

Grey literature apparently plays a considerable part in the LIS, accounting on average around 20% of all sources used. This figure may be compared with the citation habits in economics and educational sciences (see above).

Even so, citations to grey material vary widely between different papers from 0% to 50% and more, depending at least in part on subject areas and methodologies.

Most of the noncommercial documents might be identified as unpublished material e.g., doctoral or master theses, reports, legal texts, working papers, lecture notes, Web sites, and even posted messages. This also holds for some conference proceedings and other serial resources, for the identification of the exact nature of the cited material poses difficulties. However, all of these above mentioned types of documents have in fact been published by

what can be referred to as corporate authors i.e., organizations responsible for producing the grey literature, but whose primary activity is not publishing.

ON THE TYPOLOGY OF GREY LITERATURE

To return now to the definition of grey literature, we indicated earlier that the term traditionally refers to reports, conference proceedings, and doctoral theses. We will now take a closer look at what these cover in reality. The SIGLE database has been supplied since the 1980s with information from organizations in several European countries. Its more than 800,000 references are distributed as follows (Table 2).

Reports are the most numerous by far among the different types of grey literature in the SIGLE database. But the “reports” category covers a wide variety of very different documents: institutional reports, annual or activity reports, project or study reports, technical reports, reports published by ministries, laboratories or research teams, etc. Some are disseminated by national and international public bodies; others are confidential, protected, or disseminated to a restricted readership, such as technical reports from industrial R&D laboratories. Some are voluminous, with statistical appendices, while others are only a few pages in length.

In the other categories, citation analyses^[14] offer a tremendous range of grey resources. Besides theses and conference proceedings, they also include unpublished manuscripts, newsletters, recommendations and standards, patents, technical notes, product catalogs, data and statistics, presentations, personal communications, working papers, house journals, laboratory research books, preprints, academic courseware, lecture notes, and so on. GreyNet in fact maintains an extensive online listing of document types, which are categorized as grey literature (Table 3).

However diverse, these documents all share one thing in common, they contain unique and significant scientific and technical information that is often never published elsewhere. The lack of descriptive referencing and adequate circulation is therefore, as we have said earlier, a real problem for scientific communication.

Table 2 Distribution by the types of documents referenced in the SIGLE database

Document types	Proportion (in %)
Reports	62.7
Theses	31.7
Conferences	2.3
Data files	2.1
Translations	0.9
Other	0.3

Table 3 Document types in grey literature

A
Announcements
Annuals

B
Bibliographies
Blogs
Booklets
Brochures
Bulletin boards
Bulletins

C
Call for papers
Case studies
Catalogs
Chronicles
Codebooks
Conference papers
Conference proceedings
Country profiles
Course materials

D
Databases
Datasets
Datasheets
Deposited papers
Directories
Dissertations
Doctoral theses

E
E-prints
E-texts
Essays
Exchange agreements

F
Fact sheets
Feasibility studies
Flyers
Folders

G
Glossaries
Government documents
Green papers
Guidebooks

H
Handbooks
House journals

I
Image directories
Inaugural lectures
Indexes
Internet reviews
Interviews

(Continued)

Table 3 Document types in grey literature (Continued)

J
Journals
• Articles
• Grey journals
• In-house journals
• Noncommercial journals
• Synopsis journals

L
Leaflets
Lectures
Legal documents
Legislation

M
Manuals
Memoranda

N
Newsgroups
Newsletters
Notebooks

O
Off-prints
Orations

P
Pamphlets
Papers
Patents
Policy documents
Policy statements
Posters
Précis articles
Preprints
Press releases
Proceedings
Product data
Programs
Project information documents
Proposals

Q
Questionnaires

R
Readers
Registers
Reports
• Annual reports
• Bank reports
• Business reports
• Committee reports
• Compliance reports
• Draft reports
• Feasibility reports
• Government reports
• Intelligence reports
• Internal reports

(Continued)

Table 3 Document types in grey literature (*Continued*)

• Official reports
• Policy reports
• Progress reports
• Regulatory reports
• Site reports
• Stockbroker reports
• Technical reports
R (continued)
Reprints
Research memoranda
Research notes
Research proposals
Research registers
Research reports
Reviews
Risk analyses
S
Satellite data
Scientific protocols
Scientific visualizations
Serials
Show cards
Software
Specifications
Speeches
Standards
State of the art reviews
Statistical surveys
Statistics
Supplements
Survey results
Syllabi
T
Technical documentation
Technical notes
Tenders
Theses
Timelines
Trade directories
Translations
Treatises
W
Web site reviews
Web Pages
Web sites
White books
White papers
Working documents
Working papers
Y
Yearbooks

Source: From <http://www.greynet.org/greysourceindex.html>.

The Internet, however, is now altering the entire landscape. Not only because of changing user behavior, but also, and especially, because more and more grey literature is being published on the Web. As one study from

the German Centre for Information in the Social Sciences has pointed out,^[16] the switch from paper to digital does not necessarily mean that more grey literature is appearing. Instead, the Internet has radically changed access and distribution methods, accentuating the ephemeral and volatile nature of grey literature. This same study also drew attention to the fact that many journals and the journal articles contained therein can be categorized as grey literature i.e., where publishing is not the primary activity of the producing body. The fact that in Europe, for more than two decades the SIGLE database did not identify journals and journal articles as grey literature may account in part for the apparent neglect of these two types of grey documents.

And yet, another special type of grey material is also likely to gain more importance. Until now, raw data—the basis for many scientific publications—are widely unpublished and inaccessible. Today, public research organizations are starting to develop national and international strategies for the control and archiving of these files, the data, and statistics (scientific data infrastructure or eScience, see Hey and Trefethen^[17]). The principle of open access to datasets is generally accepted (astronomy, life science, physics, etc.) but major Scientific, Technical, and Medical (STM) publishers, because of their historical role and responsibility in the dissemination of scientific results, claim that such data should become part of their portfolio of added value products much like scientific journals and articles. Up until the mid-1990s, the Dutch Social Science Information and Documentation Center (SWIDOC), an institute within the Netherlands Academy of Arts and Sciences (KNAW), maintained a paradigm, whereby current research information and statistical datasets were linked to reports and other grey literature. Unfortunately, this model was abandoned. However, with the rise of repositories such as OpenSIGLE, where attachments and links to a metadata record allow access to the enriched publication, this paradigm can now be fully realized. The coming years will determine who will gain control over the deposit and dissemination of these materials. Will it be the public bodies or corporate information companies, who win out? The question is not only political but economic as well.

GREY LITERATURE IN OPEN ARCHIVES

Since 1994, the movement toward open access to scientific information has been crystallizing around various initiatives to promote open archives.^[18,19] The first preprint server, ArXiv, set up by P. Ginsparg at Los Alamos in 1991 was a means for distributing research results organized by and for physicists, without intermediaries. This initiative was entirely independent of any commercial circuit for scientific publications.^[20] In this sense, the server

(which today contains over 410,000 documents) corresponded exactly to the definition of grey literature.

However, the case is more complex. “Preprints”^[21] would not have existed without the prospect of “print”—in other words, ArXiv would not have existed without scientific journals. Ginsparg’s aim was simply to circulate results quickly and immediately. The point then was not to bring commercial publishing into question, since Ginsparg did not offer any alternative to the peer review system still run by the conventional publishing circuit. ArXiv was in fact creating a kind of symbiosis between grey literature and traditional publishing, which was linked to the highly specific organization of the nuclear physics community.

But the crisis that has hit scientific journals along with the appropriation of new technologies of information and communication has together helped to turn the means of distribution into an alternative model of scientific publishing. This model has two objectives, one being economic: in that it offers a cheaper alternative to scientific publications by increasing pressure on STM publishers introducing competitive and parallel publishing channels. The other being an administrative one: by facilitating control over scientific production issuing from various research organizations and universities by way of identifying and evaluating publications through a central database.

Given the methodological and interpretative diversity among different scientific communities, one may well wonder whether a system that has operated for more than 15 years in physics will be equally effective in other fields, especially in view of the constraints induced by research evaluation. However, we are seeing derivatives of that system in the social and human sciences spearheaded by organizations such as the New York Academy of Medicine (NYAM) with their Grey Literature Report,^[22] the Centre for Information on Low External Input and Sustainable Agriculture (ILEIA) with their LEISA e-magazine and database,^[23] and the New York University (NYU), School of Social Work with their Web-based resource Information for Practice.^[24]

What is the part played by grey literature in this new environment? The international “Directory of Open Access Repositories” (OpenDOAR), established by the Universities of Nottingham and Lund,^[25] identifies 1,115 different sites, including 250 from the United States and 94 from the United Kingdom (June 2008). OpenDOAR indexes some categories of grey literature, including theses^[26] and conference proceedings, but also learning objects (especially university lectures) and research results (data sets). Table 4 shows the number of open archives that contain certain categories of grey literature.

At first sight, these figures seem to suggest that grey literature is relatively well represented in open archives: 50% contain doctoral theses, and about 40% contain conference proceedings, reports or working papers. However,

Table 4 Presence of different document types in the OpenDOAR archives ($N = 1115$)

Document types	Number of archives	% of OpenDOAR sites
Theses	585	51
Unpublished	533	46
Conferences	427	37
Multimedia	262	23
Special	193	17
Learning objects	166	14
Datasets	62	5
Reports	56	5
Software	26	2
Working papers	16	1

the picture becomes less clear with an analysis of archive descriptions, which show that the number of sites explicitly dedicated to grey literature is considerably smaller: less than 20% are identified for doctoral theses, only 5% for reports, and just 1% for conference proceedings. Probably, a lot of grey material is hidden in categories like “special” (letters, images, sound, sites, etc.), “unpublished” (preprints, etc.) or “multimedia.” Observations made at the Seventh International Conference on Grey Literature in 2005 indicate that these documents are often swamped within the sheer mass of documents that are deposited in archives and/or difficult to identify. The development of open archives does not therefore seem to have altered the situation of grey literature to any great extent.

To sum up, we observe a steadily growing number of open archives that (also) contain grey literature. It is nearly impossible to give an overall number of grey documents in these repositories. And even if it were possible, those documents are not currently representative of the national output of scientific and technical information. Moreover, there are even fewer repositories in smaller countries, especially outside of Europe and North America; and, non-English material remains until now largely invisible and un-retrievable.

IMPROVING “BIBLIOGRAPHIC CONTROL”

We said earlier that the lack of “commercial control” of grey literature implies a lack of “bibliographic control.” In other words, “grey” documents are often inadequately referenced in catalogs and databases.^[27] This does not mean that there are no standards or recommendations for cataloging reports, conference proceedings, theses, and so on. However, contrary to the situation with journals and books, the absence of commercial stakes has contributed to a (relative) “success” of the rules that have been set out.

The way in which the different types of grey literature are referenced still depends more on choices made

by the bodies that produce, collect, or distribute these documents, rather than on any national or international standard (ISO, ISBD). The failure of the International Standard Technical Report Number (ISRN) is symptomatic in this respect. France, having been the only country with an active ISRN agency (INIST) for several years, eventually had to agree to the ISO, thus abandoning the ISRN. The only remaining exception in France concerns doctoral theses submitted to French universities for which the academic union catalog *Système universitaire de documentation* (SUDOC) imposes a uniform bibliographic format.

On a European level, input requirements for the SIGLE database forced the network's member countries to attempt to harmonize their "grey" resources around a single SGML format. But input to SIGLE ceased in April 2005, and its EAGLE association has gone into liquidation.^[28] The predictable outcome is that each organization will be returning to its own referencing methods and rules abandoning any kind of uniform bibliographic control.

The rapid development of the Internet, and its ever-multiplying online resources, is affecting bibliographic control in two ways.^[16] In one way, this "wild growth" is speeding up the decline in the application of formal and controlled standards, with the risk that grey literature is becoming "even more greyish." However, in another way, the same risk has also boosted global awareness of the need to define a few minimal data—called metadata^[29]—in order to provide a framework for referencing digital documents.

Examples include: a project aiming to adapt the Dublin Core to reports^[30] or doctoral theses; the French "Thèses Electroniques Françaises" (TEF) initiative, which is working on a set of metadata and a single XML schema,^[31] the "Text Encoding Initiative" (TEI) designed to develop and recommend, at international level, common tagging standards that are independent from IT upgrades,^[32] and the creation in 2005 of a TEI support centre for Europe located in Nancy, which will also address the matter of grey literature.

The problem of poor standards and lack of uniformity in referencing documents deposited in institutional archives was the reason why JISC (Joint Information Systems Committee)^[33] was established in the United Kingdom in 1993. Its task was to look into the interoperability of these archives and to describe their resources in order to facilitate identification by end-users.

One final example: after the Seventh International Conference on Grey Literature in 2005, P. de Castro and S. Salinetti from the Istituto Superiore di Sanità in Rome initiated the International Steering Committee on Grey Literature (GLISC), which would develop recommendations (the "Nancy Style") for the production and distribution of scientific and technical reports as well as other grey literature. The second version of the document is now published on the Web,^[34] with translations into French, Italian, German, and Spanish.

This last example is symptomatic in some ways of the problem of bibliographic control of grey literature. It is an international issue to which national responses have only brought partial solutions, thereby actually increasing the diversity of data and the difficulties involved in identifying and locating documents. Since there are no set commercial issues at stake, improved referencing will always be dependent on the initiatives and willingness of producing and distributing organizations steered by a few committed information professionals.

ACCESS AND DISSEMINATION

Identifying, locating, and obtaining grey literature is generally not easy—and this is inherent to its nature. To get some idea of the problem, readers might attempt a search for some of the reports, working papers, Web pages, conference proceedings, and doctoral theses cited by the authors of the four LIS journals mentioned earlier in this entry.

For 20 years, the SIGLE database offered a solution at EU level, insofar as its partner organizations were under obligation to keep referenced documents at their end-users' disposal via lending or document delivery services.

Users today are faced with a huge variety of sites, archives, catalogs, and databases, which makes searches for "grey" information not only painstaking but sometimes prohibitive—taking into consideration the linguistic difficulties involved.

In view of the rapidly changing face of STI within the digital environment, all the major traditional centers collecting and distributing grey literature, such as the British Library, the Canadian Institute for Scientific and Technical Information,^[35] the TIB in Hanover, and INIST have undertaken to develop free access services to these documents, especially theses and preprints, but also reports and other types of grey literature.^[36]

What is now needed are portals and search tools that are specifically dedicated to "grey" documents. Elsevier started to index in their SCIRUS search engine NASA reports and dissertations, MIT courseware, working papers and communications from a number of institutions, as well as theses in electronic format from the United States, China, India, and other countries. The Office of Scientific and Technical Information (OSTI) at the U.S. Department of Energy (DOE), hosted the GrayLit Network's unique science portal of technical reports from U. S. Federal Agencies. Now that this portal has been discontinued, we look to OSTI/DOE's Keynote Address at the Tenth International Conference on Grey Literature (Amsterdam, December 2008) in order to see if and how the global science gateway, WorldWideScience.org and its multilateral governance structure, the WorldWideScience Alliance will incorporate scientific and technical grey literature (including the social sciences and humanities).^[3] A European comparative initiative

from members of the former EAGLE association to launch a metasearch engine dedicated to grey literature collections is still in draft stage.^[37] In the meantime, users have no other choice but to conduct searches on their own using whatever means at hand (Google), or to remain with the search services provided by established organizations.

The short history of EAGLE indicates some challenges of grey resources. Initially funded by the Commission of the European Communities in order to provide access to European grey literature and improve bibliographic coverage,^[1] EAGLE was faced 20 years after its creation with major problems that lead to its liquidation.^[28] The SIGLE database offered no solutions for online cataloging, meta-data harvesting, links to full-text, and other resources. National input became increasingly unrepresentative of the national production, and was continuously decreasing while digital documents were not referenced. And last but not least, the economic model of its nonprofit, low-budget association did not allow for necessary strategic decisions, because further investment for the development of the database was not provided by the European Union or by the member institutions.

THE FUTURE OF GREY LITERATURE

Grey literature will remain a challenge for information and documentation professionals as well as an interesting field for research activities in at least six areas:

The need for a new definition: The traditional definition of grey literature needs to be further refined and/or redefined by way of an accurate analysis of new means of access and distribution, in line with Mackenzie Owen's observation that "Grey does not imply any qualification (but) is merely a characterization of the distribution mode."^[38] What we see is that the current "Luxembourg" definition moved from emphasis on the acquisition of grey literature to the production of grey literature. And now, the definition should reflect both.

The need for an economic model: Despite the absence of "commercial control," collecting, distributing, and searching grey literature all come at a price, which may in fact be much higher than for journal article and book searches. To date, there is no clear economic model in this area and further analysis is needed in terms of investments, direct and indirect costs, acquisition prices, and so on. The case of EAGLE underlines the need for public funding and a sustainable economic model to guarantee the bibliographic coverage and full-text, enriched dissemination of grey literature.

The need to oversee archiving practice: New technologies of information and communication facilitate resource archiving in general, and there is strong incentives from the "open access" movement. Nevertheless, the question of "who should archive what, where, when, and for how long" has remained largely unanswered.

Aware of information policy and the concomitant financial aspects involved, answers are rather urgently needed, even if they were to now address only part of grey literature resources.

The need for a new "value chain": In the Netherlands, Roosendaal has in the past few years, been examining the process whereby universities re-appropriate publications. In his work, he highlights the radical changes taking place in the "value chain" of scientific publication.^[39] This type of research and evaluation of scientific publications brings to the forefront major issues in the context of emerging STI trends. What is the future of peer review? Which "quality label" applies to working papers or scientific communications on blogs or in open repositories? Does the community approach of Web 2.0 offer a viable solution for the need for quality standards of noncommercial STI materials? The impact of new technologies in information and communication on the dissemination of nonconventional literature is a complex matter, and the potential field for research is vast. To date, research and analyses have only broken ground giving way to a vast and virtually untapped field of investigation.

The need to clarify the legal aspects: In our study, the issue of intellectual property rights in grey literature has been deliberately left aside. Nevertheless, the legal status of grey resources and rights in their use (deposit, archiving, distribution, etc.) is (another) major challenge for the future of this form of STI publishing. The national and international legal environment is evolving rapidly, and all restrictions, exceptions, and technical constraints [Digital Rights Management (DRM), interoperability, etc.] of the new laws on intellectual property, author's rights, and copyright also apply to grey resources. Nevertheless, very few documentary analyses have addressed legal aspects in the field of grey literature and their subsequent economic consequences. This issue, however, will be taken up in a plenary session during the Tenth International Conference on Grey Literature (Amsterdam, December 2008). While the outcome of this forum may not be conclusive, much needed groundwork will have been covered.

The need for education and training: At the Sixth International Conference on Grey Literature (New York, 2004), the results of an online survey in which 102 respondents participated not only indicate that an increasing number information professionals involved in grey literature are also involved in teaching and instruction but also they were in agreement (69.2%) with the statement that grey literature constitutes a field in information studies. Over the past years, training courses, guest lectures, seminars, and workshops have been organized by information professionals on the topic of grey literature. Most of these endeavors have undoubtedly had some impact on this field of information. As mentioned earlier in this entry, an accredited college course on grey literature was carried out via UNO's distance education program in the fall semester 2007. And, it has been rescheduled for the spring

2009 semester. Education and training is fundamental to the future of grey literature—not only for LIS students and their instructors but also for information practitioners in government, business, and industry as well.

While the above six areas of consideration remain as yet to be fully addressed, there has been considerable effort on the part of INIST and GreyNet over the past 15 years to use the results of research compiled within the International Conference Series on Grey Literature,^[13,14] and, at the same time, to involve the existing pool of GL authors and researchers, who have contributed to its information and knowledge base. Without them, the future of grey literature would have little or no direction based on empirical data and would be simply *speculative*. It would have remained among the myriad of uncontrolled terms listed earlier in this entry.

CONCLUDING REMARKS

In concluding our current review on the state of grey literature, we might offer the reader some prospects in further need of reflection.

It seems likely that:

1. Grey literature will not disappear, but will continue to play a significant role alongside commercial publishing. Our research has led us to believe that information discovery into the various types of grey literature available in print and electronic formats is ever increasing.
2. The borderline between “grey” and “white” (commercial) literature will become increasingly indistinct, particularly in an environment that is moving toward open access to STI. However, in our limited research we find that the approaches and appropriations to these two kinds of publications are still quite distinct.
3. The proportion of “grey” documents published on the Web will continue to increase. We see this development closely linked to the production of grey literature in e-environments, as well as to retrospective activities leading to republication.
4. The Internet will encourage a greater diversity in the types of “grey” resources available (raw research results, notes and personal comments, lectures, newsletters, product catalogs, etc.). Also as our own research indicates, grey journals and the articles contained therein even now challenge reports as being the mainstay of grey literature.

It also seems likely that:

5. Bibliographic control of grey literature will remain problematic despite the trend toward standardization of digital documents. We find that this has everything

to do with the application and use of standards, which are in transition.

6. Open archives will offer more appropriate services and functions for at least some segments of grey literature i.e., preprints, doctoral theses, and reports. We mention these three types of grey literature, because they have come to form special collections making them more visible in and for repositories.
7. Some organizations—especially in the public sector (e.g., national libraries and STI centers) but also in the private sector (e.g., Elsevier, Google, etc.)—will develop tools and services to aid in the efficient exploitation of grey resources on the Web. This in all likelihood is based on the response by such organizations to our research efforts.

However, it seems unlikely that:

8. Searching and collecting grey literature will become as straightforward as it is for journals and books in the traditional publishing sector. We adjudge that the increase in grey over commercial publications is the main explanation for this.
9. New tools for collecting, depositing, and archiving will make grey literature less ephemeral and volatile than in the past. Our research indicates that until an organization formulates a policy on grey literature backed by budget appropriations, the implementation of technology cannot be guaranteed and thus the environment in which grey literature has coexisted in the past will remain unstable in the likely future.

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HathiTrust

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Abstract

HathiTrust is a partnership of major research libraries working together to create and maintain a digital archive of the human cultural record. Its programming includes not only a digital library but also a growing array of programs and services to facilitate scholarship.

HathiTrust is an international partnership of research libraries formed for the purpose of preserving, curating, and making access available to the record of human knowledge.

HathiTrust was formally created in 2008, but its roots can be found in conversations that were taking place among research libraries in the early 2000s, a period during which it was becoming clear that cooperative, large-scale digitization of printed documents might soon become technically and fiscally feasible. A watershed moment came at the inception of Google's massive Google Print initiative, which within months had been expanded to encompass what came to be called the Google Library Project.

The Google Library Project is a partnership between Google and a number of major research libraries including those of the University of Michigan, Harvard University, Stanford University, and Oxford University, as well as the New York Public Library.^[1] Under the agreements struck with these libraries, Google agreed to digitize portions of the libraries' collections; partner libraries received a copy of all digitized works. The libraries negotiated the right to share those digitized copies with other libraries, thus laying the foundation for the broad collaboration that underlies HathiTrust.

The Google Library Project eventually became an international initiative, attracting participants from Germany (the Bavarian State Library), Spain (Complutense University of Madrid), France (Bibliothèque Nationale de Lyon), and Japan (Keio University) among other countries.^[2]

Among the earliest and most extensive libraries participating in this project were those affiliated with the Committee on Institutional Cooperation (CIC), a consortium of research libraries affiliated with universities in the Big Ten athletic conference, plus the University of Chicago.^[3] In 2005, the members of this consortium began making plans for a shared repository to hold the digitized copies of books from their collections—not only for the purpose of permanent preservation but also to make the content of those books more readily available to readers and

researchers. In 2008, the libraries of the University of California System joined the shared initiative, and the resulting program was redubbed HathiTrust.^[4]

THE “HATHITRUST” NAME AND INITIAL GOALS

“Hathi” is the Hindi word for “elephant,” and it was chosen at the outset of the collaborative project to “(underscore) the immensity of this undertaking” as well as to “evoke memory, wisdom, and strength,” according to John Wilkin, who was at the time associate university librarian at the University of Michigan and the first executive director of HathiTrust.^[5] Early in the process of forming the coalition and defining its mission, the partner institutions settled on a set of six initial goals:

1. To build a reliable and increasingly comprehensive digital archive of library materials converted from print that is co-owned and managed by a number of academic institutions
2. To dramatically improve access to these materials in ways that, first and foremost, meet the needs of the co-owning institutions
3. To help preserve these important human records by creating reliable and accessible electronic representations
4. To stimulate redoubled efforts to coordinate shared storage strategies among libraries, thus reducing long-term capital and operating costs of libraries associated with the storage and care of print collections
5. To create and sustain this “public good” in a way that ensures the greatest availability of materials to the public but offers additional value to members, mitigating the problem of “free riders”
6. To create a technical framework for the repository that provides significant centralized functionality, such as full-text search, but also supports distributed development of tools and services to allow partners and nonpartners to meet specific access needs of their user communities^[4]

SHORT- AND LONG-TERM FUNCTIONAL OBJECTIVES

In accordance with the goals outlined above, the HathiTrust partners also agreed on a set of short-term and long-term functional objectives. These were not meant to define the scope of HathiTrust's mission, but rather, in Wilkin's words, to help "articulate goals for a quickly emerging organization, a way to give some initial direction until other mechanisms could create a more nuanced roadmap." These objectives were

Short Term

1. Creation of a page-turner mechanism
2. Branding
3. Format validation, migration, and error-checking
4. Development of application programming interfaces that would allow partner libraries to access information and integrate it into local systems
5. Access mechanisms for persons with disabilities
6. A public discovery interface
7. The ability to publish virtual collections
8. A mechanism for the direct ingest of non-Google content

Long Term

1. Compliance with required elements in the Center for Research Libraries' (CRL) Trustworthy Repositories Audit and Certification (TRAC) criteria and checklist
2. Robust discovery mechanisms, such as full-text cross-repository searching
3. Development of an open service definition, to make it possible for partner libraries to develop other secure access mechanisms and discovery tools
4. Support for formats beyond books and journals
5. Development of data-mining tools for HathiTrust, and use by HathiTrust of analysis tools from other sources^[6]

PRESERVATION AND ACCESS

From the beginning, a central tenet of the HathiTrust program was the twinned imperatives of preservation and access. The purpose of the initiative was never to create a "dark" archive but rather to focus simultaneously on two overarching goals: first, both curating and safeguarding the digitized documents; second, making them as freely and easily available as technology and the law would allow. To this end, the HathiTrust partners determined early on that—while it would recognize and respect all legal constraints around copyright and other intellectual

property law—the program would not accept for deposit documents whose original owners wished to keep them inaccessible, where access rights could be lawfully granted. Books and other documents that are in the public domain are, thus, freely available for the general public to view and download (though HathiTrust members have enhanced access capabilities, as will be discussed below), whereas documents currently protected by copyright are available for full-text searching; search results do not include views of full-page texts but instead indicate the number and locations of occurrences of the search terms across titles in the HathiTrust database, enabling the user to see which books contain significant occurrences of those terms. The researcher can then pursue access to the relevant books through his or her local library or bookstore.

CONTENT

As of January 2014, the HathiTrust digital collection contained just under 11 million volumes, comprising approximately 5.7 million book titles, 286,000 serial titles, and 3.8 million pages of text. Of its 11 million volumes, 3.5 million are in the public domain. Just over half of the books are in languages other than English; more than 400 languages are represented in the collection. While the great majority (roughly 82%) of the volumes in HathiTrust were originally published in the twentieth or twenty-first century, the collection includes books several centuries old, including more than 25,000 books published during the seventeenth century and just over 1,000 from before 1500. (Though it is worth noting that roughly 350,000 volumes in the collection are of either not-yet-determined or indeterminate date.) A very large majority of the volumes in the collection deal with disciplines in the humanities and social sciences, especially history and literature, in a wide variety of languages.

Because HathiTrust's collection is built on digitized materials taken primarily from large North American research libraries (which comprise the roughly 115-member Association of Research Libraries, or ARL), there is significant and growing overlap between HathiTrust content and the physical collections housed in most ARL libraries. In 2011, a white paper prepared by Constance Malpas of OCLC on the feasibility of "cloud-sourcing" research library collections noted that, for example,

in June 2009, approximately 20% of titles in NYU's Bobst Library (as measured by holdings in WorldCat) were duplicated in the Hathi repository; by June 2010, the rate of duplication has increased to about 30%.^[7]

Wilkin subsequently found that this pattern was "remarkably constant" across ARL libraries. Writing in 2011, he observed that as of June 2010

nearly every ARL library could depend on finding approximately 31% of its collection online in HathiTrust. The rate of overlap (continues) to grow; by June 2011, I estimate the overlap rate to have hit a median of about 45%, and (to) reach something like 50% overlap early next year.^[6]

MEMBERSHIP

To join HathiTrust, an institution must submit summary information about its print holdings. This information is used to determine the amount of overlap between the institution's holdings and the contents of the HathiTrust collection; that overlap partially determines the institution's membership fee, which is calculated according to two formulas. The first combines an equally distributed share of the cost of hosting public-domain content with a sliding share (based on local holdings overlap) of the cost of hosting in-copyright materials. The second is a cost multiplier designed to generate a surplus sufficient to support new services and programmatic infrastructure for the organization. As of January 2014, the multiplier is 1.5, though the Board of Governors will review that value periodically.

Members of HathiTrust have the option (though are not required) to contribute digital documents of their own to the collection. As of January 2014, there are no additional costs associated with deposit, as long as the materials submitted are formatted and submitted according to HathiTrust specifications.^[8]

A significant benefit of membership consists in enhanced access to the public-domain materials housed in the collection (that are not subject to third-party restrictions). While these materials are freely available to the general public for online discovery and reading as well as printing and download, nonmembers can only print and download such materials page by page. Users affiliated with member institutions are able to download and/or print entire books from the public domain collection as single .pdf files.

Another member benefit is the ability to make in-copyright materials available to users who have disabilities that make use of printed materials difficult or impossible; if the library in question currently holds (or once held) a physical copy of an in-copyright book held digitally by HathiTrust, that library can obtain a full .pdf copy of the book from HathiTrust on behalf of such a user, subject to a set of guidelines and restrictions designed to keep the program in compliance with copyright law. (HathiTrust provides one set of guidelines for institutions in the United States and another for those in Canada.)

HathiTrust also provides member institutions with limited access to materials falling under the provisions of Section 108 of the copyright law—"where the print copies

of the works are damaged, deteriorating, lost or stolen, and a copy is not available on the market at a fair price."^[9]

REPOSITORY CERTIFICATION

In March 2011, HathiTrust was certified by the CRL as being compliant with TRAC criteria.^[10] This certification came as the result of a one-year audit that examined HathiTrust's organizational infrastructure, digital object management practices and technologies, technical infrastructure, and security practices. CRL found HathiTrust to be most solidly in compliance with regard to the latter category and most in need of improvement (though still certifiably robust) in the first; ongoing certification requires HathiTrust to report progress every two years in several areas, including significant changes in system architecture, new policies, additions to content, financial activities, and significant organizational events.^[11]

GOVERNANCE

HathiTrust was originally chartered for a five-year period, from 2008 to 2012, with an expectation of formal review of its governance and structure in the third year.

Prior to 2012, HathiTrust was governed by an Executive Committee, which was composed of library administrators from its founding institutions: two members each from Indiana University, the University of Michigan, and the University of California system. In addition, the Committee included HathiTrust's executive director and one member drawn from another CIC institution. The Executive Committee was guided by a Strategic Advisory Board, the chair of which acted as a member of the Executive Committee *ex officio*. This arrangement was intended to be provisional until a new governance structure could be put in place with broader input from the HathiTrust membership. The organization contracted with Ithaka S&R to conduct a three-year review of the organization's progress.

In late 2011, HathiTrust held a Constitutional Convention for the purpose of creating a new and more permanent governance structure and set of bylaws. Over the course of two days, delegates from all HathiTrust partner institutions and consortia considered and voted on ballot proposals dealing with such issues as an approval process for development initiatives, the disposition of U.S. government documents, and the new governance structure.^[12]

The governance structure settled upon in the Constitutional Convention provides for a Board of Governors consisting of 13 members: six appointed by the founding HathiTrust institutions, six elected by the membership, and the Executive Director (in a nonvoting role). Of these 13 board members, five (including the Executive Director,

ex officio) serve as an Executive Committee. All board members are elected to a three-year term; however, in order to establish a staggered rotation of members (and thus ensure some degree of continuity), members of the inaugural board were assigned a variety of term lengths from three to five years.

INITIATIVES, TOOLS, AND SERVICES

In addition to serving as a permanent repository and offering search and download capabilities, HathiTrust has developed a variety of services designed to add value to the hosted content. Such development is ongoing; as of this writing, notable tools and services include:

HathiTrust Research Center

The HathiTrust Research Center (HTRC) is the research arm of HathiTrust and makes possible computational use of the HathiTrust digital library for nonprofit and educational researchers. A joint venture of Indiana University, the University of Illinois Urbana-Champaign, and HathiTrust, the HTRC provides a secure environment in which researchers can use text mining and other data-intensive research techniques to interrogate and analyze digitized texts on a massive scale. Currently, the HTRC environment allows researchers to conduct such analysis of public-domain titles, but HathiTrust is working toward agreements that would allow such use of in-copyright works as well.

HathiTrust has created e-mail listservs, a User Community wiki, and a portal for workset construction, and has hosted two annual 1-1/2-day “UnCamps” for those in the research community interested in learning how to make use of the HTRC’s offerings.^[13]

mPach

mPach is a project of the University of Michigan’s Michigan Publishing program, in collaboration with the University of Michigan Library’s Digital Library Production Service. It is designed to provide support for born-digital publications, and to that end, in collaboration with HathiTrust, mPach will provide a modular platform for the creation and publication of open-access journals and will offer integration with other open journal applications such as Open Journal Systems. As of January 2014, completion of the project is projected for sometime between October and December of that year.^[14]

Zephir

Zephir is a bibliographic metadata management system developed for HathiTrust by the California Digital Library.^[15] It is the first component of HathiTrust that has

been developed and will be managed by an entity outside of the University of Michigan.

Copyright Review

HathiTrust member institutions have been working since 2008 to identify materials in the collection that are in the public domain. In some cases, this is easy to determine based on standard bibliographic data points, but in many cases such a determination requires significant work. This effort has resulted in the public availability of hundreds of thousands of titles.

Government Documents

In 2013, HathiTrust began a project to preserve and provide access to a comprehensive collection of U.S. federal government documents (which are in the public domain by definition). As of January 2014, this project is still underway, beginning with the creation of a formal registry of those documents including information about which of them are available in digital formats.^[16]

Shared Print Monograph Archive

In an effort to help libraries reduce their long-term storage and preservation costs, HathiTrust is developing a framework for a distributed network of print monograph archives; the network’s holdings will correspond to HathiTrust’s digital collection.

DPN Participation

The Digital Preservation Network is a network of digital repositories working to “ensure that the complete scholarly record is preserved for future generations.”^[17] HathiTrust is working with that initiative to help define its technical, business, and administrative models. In November 2013, it announced its intention to become a “replicating node” in the DPN.^[18]

ISSUES AND CONTROVERSIES

Because the HathiTrust is built on a multimillion-volume repository of digitized books, most of which are still under copyright, there have been questions and issues surrounding both the legality of the original digitization project (carried out primarily by Google, Microsoft, and the Internet Archive) and of HathiTrust’s subsequent use of the collection.

Authors Guild v. Google

In 2005, Google was sued by the Authors Guild of America and the Association of American Publishers (AAP),

both of whom asserted that Google's digitization project constituted massive copyright infringement.^[19] A finding for the plaintiffs in either or both of these cases would have had significant implications for HathiTrust's ability to continue providing access to its collection. The lawsuits were eventually consolidated and the parties reached a settlement; however, the proposed settlement was rejected and a separate settlement was subsequently reached between Google and the AAP. The Authors Guild persisted with its suit, which was dismissed in 2013. As of January 2014, the Authors Guild intends to appeal that decision.

Authors Guild vs. HathiTrust et al.

In 2011, the Authors Guild filed suit against HathiTrust and the governing bodies of its founding universities, asking for "injunctive and declaratory relief" from what it characterized as "the systematic, concerted, widespread and unauthorized reproduction and distribution" of the digitized books in HathiTrust's collection. The lawsuit did not ask for damages, but rather asked the court to affirm and declare the illegality of HathiTrust's actions and to impound the digital books.^[20]

One aspect of the case came to dominate public discussion; this was HathiTrust's plan to make "orphan works" available online to those who have "the right to check out these works from the Library's print collection for scholarly and educational purposes."^[21] Orphan works are generally defined as titles that are under copyright, but whose copyright holder is unknown. Since orphan works are almost invariably out of print, they are unavailable for purchase in the primary book market (though used copies may be available in the secondary market). Michigan's justification for providing free—though limited—access to the full text of the digitized orphan works to its faculty and students was that since the copyright holders were unknown or could not be located, since the books were not commercially available anyway, and since access would be limited to a controlled population of Michigan-affiliated readers, the provision of them was very unlikely to harm any stakeholder in the work. In addition, HathiTrust publicly offered to curtail providing access to any orphan work whose copyright holder identified himself or herself and submitted a form provided for the purpose.

The program began in 2011 with the posting of a list of orphan works identified as candidates for this treatment; the list was to remain live for 90 days, during which copyright holders were invited to contact HathiTrust either to formally grant permission or to withhold it. Following the 90-day period, the books would be made available, but copyright holders could subsequently contact HathiTrust and request a takedown at any point thereafter, and HathiTrust promised to honor that request.^[22]

The Authors Guild, however, objected quickly—noting, among other things, that it had succeeded without too much effort in identifying and locating rightsholders to several titles on HathiTrust's list of orphan works. Michigan subsequently removed some titles from the list and then announced a suspension of the program. In a public statement, the institution said that "the close and welcome scrutiny of the list of potential orphan works has revealed a number of errors, some of them serious. This tells us that our pilot process is flawed." The statement expressed the Michigan Library's intention to "create a more robust, transparent, and fully documented process," at which point it would "proceed with the work, because we remain as certain as ever that our proposed uses of orphan works are lawful and important to the future of scholarship and the libraries that support it."^[23]

In October 2012, the court dismissed the Authors Guild's suit, finding in particular that its claims regarding the orphan works project were "not ripe for adjudication," given that the project had been stopped too soon for its ultimate nature and impact to be assessed.^[24] The Authors Guild is appealing the decision.

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Health Science Professional Literatures and Their Users

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Abstract

Information behaviors of the major health sciences professionals are described, in particular those of physicians, nurses, and public health workers. Biomedical researchers are mentioned to illustrate new approaches to information. Continuing barriers to information use include information overload and lack of time, but there is also increasing use of Web resources and growing self-sufficiency. Strong preferences are apparent for information resources that are convenient, accessible, customized, and “just in time.” Challenges remain in motivating busy health care professionals to adopt routine information-seeking strategies. Future work should focus on embedding information in workflows by using new technologies and new workers such as informationists.

The dynamics between health care professionals and their information use forms the basis for bridging the gap between the biomedical knowledge base and the use of it in daily medical practice and clinical decision-making. Health care professionals’ information needs typically require responses within a short time frame. They need information that is credible, current, and relevant to the specific case at hand. While the knowledge base of the health sciences is the biomedical literature, primarily the journals, additional sources such as collegial expertise, continuing education programs, drug information resources, and various online knowledge services augment the published literature. Library services and technologies that connect the health care professional with this knowledge base in a meaningful and efficient way must be grounded in information-seeking and information-use studies.

Today’s health professionals span many areas of practice. This entry focuses primarily on information behaviors of three major professional groups: physicians, nurses, and public health workers. Biomedical researchers who support clinical practice are mentioned briefly because their transforming approach to information may well foreshadow the future information behaviors of all health scientists. Allied health professionals are not addressed in this entry as there is still a need for a solid base of information studies in most of these disciplines.

PHYSICIANS

The 760,000 physicians in the United States are found largely in medical practice; they also work in medical education, health care administration, and research. Physician education programs add to this workforce through 8500

residency programs that train 11,000 residents. The 126 schools of medicine maintain enrollments of more than 70,000 students, and the 20 schools of osteopathic medicine educate another 13,500 students.^[1–3]

During the last 25 years, research has contributed to a better understanding of information needs and information-seeking practices of physicians. The published literature in the 1980s and early 1990s set the stage for subsequent studies on physicians’ information-related behaviors. Much of this research focused on physicians’ preferred information sources, whether patient care questions were being answered, and whether physicians’ information needs were being met. These studies showed that physicians frequently asked colleagues for information, used their personal libraries, and consulted textbook sources.^[4–6] Covell found that many information needs were not recognized by practicing physicians, and that others went unanswered.^[7] Osheroff analyzed information requests during clinical teaching and found that there were frequent requests but that often these requests required synthesis of patients’ information and medical knowledge and therefore were difficult to fulfill.^[8] Gorman showed how the biomedical literature could answer primary-care information needs, while Dee’s study of rural physicians proposed a new information-retrieval system that would build on the positive factors related to collegial consults and would provide concise, relevant, and synthesized answers to specific questions in a format conducive to rapid comprehension and immediate use.^[4,9]

Numerous factors influence physicians when they consider using an information resource. These factors include convenience of access, habit, reliability, quality, speed of use, and applicability.^[10] Also availability, credibility, currency, rapid delivery, compatibility with their own and their colleagues’ experience, and cost in time, effort, and

money have been found to affect physicians' preferences for information resources.^[6,11-14] The organizational culture and an emphasis on use of the biomedical knowledge base, along with searching skills, may be leading factors stimulating use of online systems by health care professionals.^[15]

Common barriers to health professionals' information seeking include lack of time to search, information overload, the belief that there is likely to be no answer, and lack of urgency.^[10] When searching for answers to physicians' questions, Ely developed a taxonomy of obstacles encountered. Of the 59 obstacles identified, six were considered particularly prominent, including not having adequate time to find information, difficulty framing a complex issue into an answerable question, difficulty selecting the best search strategy, failure of a seemingly appropriate resource to answer the question, uncertainty in knowing when all the relevant evidence had been gathered, and lack of prepackaged syntheses of multiple bits of evidence.^[16]

After a slow uptake of the use of technology, physicians are now employing and benefiting from the Internet and online information resources. An important early study of use of the National Library of Medicine's MEDLINE database by physicians for clinical problem-solving found that MEDLINE searches were performed by and for physicians to meet a diversity of clinical-information needs. Physicians reported that in situations involving individual patients, rapid access to the biomedical literature via MEDLINE was at times critical to a patient's care, and that such rapid access favorably influenced patients' outcomes.^[17] More recent studies are showing that Web-based information resources are playing an increasingly central role in the delivery of care. The use of multiple online information resources has been shown to enhance the accuracy of answers provided by experienced clinicians to typical clinical problems.^[18] And Bennett found that the average time spent by physicians on the Internet had doubled between 2001 and 2003, with the primary reasons being to access the latest research, locate information in a specific disease area, and find information for patients' problems.^[19] While information overload on the Internet remains a barrier, physicians are now more skilled in using preferred Web sites, and they are encountering fewer technical challenges and becoming increasingly confident that they will find needed information.^[20] Patterns of use of Web-based resources may vary somewhat by physician specialty, as was shown in a study comparing family physicians with specialists' use of the Internet. Family physicians were more likely to seek patient-oriented information while specialists searched the literature and exchanged information with colleagues. Almost half of the family physicians involved in this study utilized handheld computers, primarily for drug reference.^[11]

The emphasis on the practice of evidence-based medicine (EBM), a formal process that enables patient-care

decisions to be based on "the conscientious, explicit and judicious use of current best evidence" that has been compiled through systematic research,^[21] has led to new efforts to convey the biomedical knowledge base to the point of care. The need to overcome barriers to accessing the evidence base was underscored by the Institute of Medicine's report on improving the quality of our nation's health care system.^[22] There are formidable challenges in locating the best evidence and applying it at the point of care given the ever-growing amount of biomedical literature and its sometimes conflicting viewpoints, the distance between the evidence and patient care, and the variables inherent in individual patient cases. The market place has stepped up with several electronic evidence-summary services. In a small study of EBM summary databases, Schwartz found that slightly more than half of clinical questions could be fully or partially answered, and that these answers often did modify physicians' opinions and influence patient care. However, the time spent in searching for answers was greater than most clinical settings would allow.^[23] When an online evidence system was readily available to health professionals in Australia, it was used by almost half of the clinicians. Use was shown to be associated with patient care, particularly hospital admissions, often influencing clinical decision-making.^[18]

Slawson proposes that while patient care based on evidence is important, EBM at the bedside is not yet always feasible. Therefore medical school and residency curricula also need to emphasize effective information management. The three skills needed are the abilities to select the correct tools for staying up-to-date; to find the right "just-in-time" information that is appropriate, easily accessed, and speedily available as well as usable at the point of care; and to combine the best evidence with patient-centered care, considering both the needs and perspective of the patient.^[24]

Another strong influence on physicians' information needs and behaviors is the growing use of the Internet by their patients. Fox estimates in the 2008 Pew Internet & American Life Project that between 75% and 80% of Internet users have looked online for health information. Fox's comparison of the Pew estimate with Harris Interactive's latest data on health-information seekers shows that 81% of Internet users and 66% of all adults have sought health information online. Pew's data show that 67% of Americans expect to find reliable information about health or medical conditions online. When asked where they would go the next time they need health or medical information, 46% of Internet users said they would use the Internet and 47% said they would contact a medical professional. Overall (i.e., Internet users and nonusers), 31% of all Americans say they would try to find health information online, while 59% say they would contact a medical professional.^[25]

As a result, more patients are better informed about their health conditions, and they ask their physicians more

questions. When searching the Internet, they may be supplementing information received from their physicians, looking for a second opinion, discussing sensitive issues with patient groups, or looking for information for another person or for a child.^[26] Web-based resources for consumer health information require careful evaluation. Credible Web sites are maintained by medical professional groups such as the American Academy of Family Physicians; by health associations such as the American Cancer Society; and by patient advocacy groups. The award-winning National Library of Medicine's MedlinePlus Web site provides a well-organized portal to health care information on a wide range of topics.^[27] Physicians' information needs that relate to communications with their Internet-literate patients will only increase in the coming years as the United States meets the challenge of improving the overall health literacy of the general population.^[28]

NURSES

Nurses make up the largest professional group in the health care community, numbering more than 2,200,000 in the United States. About 80% of these registered nurses work part-time or full-time. With 1500 schools offering registered nursing degrees, close to 100,000 new graduates are added each year to the workforce.^[1] However, the nursing shortage continues to be severe and, with the aging of those in nursing profession, the shortage is only expected to increase in the coming decade. The shortage is also a reflection of the limited capacity of the nation's training programs as compared with the demand.

These nursing professionals' health information needs are broad and varied addressing both their clinical and educational needs. A small pilot study demonstrated that nurses' information needs are indeed quite different from those of physicians.^[29] Research has shown that nurses often need information for their practice and those with advanced degrees may recognize these information needs more frequently than their colleagues. Their information requirements are typically patient-centered, frequently relating to nursing procedures and protocols.^[29-32] Cogdill found that nurse practitioners' information needs most often related to drug therapy and diagnosis.^[33]

As is the case with other health care professionals, nurses appear to prefer obtaining information from resources that are convenient and accessible.^[34] Colleagues are favorite resources for nursing information. Print materials are another group of preferred resources of information, including nursing textbooks and journals.^[33-36]

The literature however, indicates an underutilization of the available nursing literature. As with other health care professionals, nurses find that time is a leading obstacle to using the literature. Additional barriers include lack of value for research in practice, lack of organizational

support, lack of understanding of electronic resources and their structures, difficulty in accessing research materials including electronic resources in clinical areas, and lack of critical appraisal and searching skills.^[31,37] The need to achieve a supportive culture in the profession for use of the literature is reinforced in McKnight's study, which found that many nurses believed that taking time to read published information on duty was not only difficult, but perhaps also ethically wrong.^[30] For these and other reasons, nurses do not pursue all of their information needs. Nurse practitioners self-reported that they followed up on slightly more than half of their information needs; however, a second measure in the same study indicated that significantly fewer information needs were actually pursued.^[33]

Mid-1990s research found that electronic sources of information such as CINAHL and MEDLINE were increasing in popularity with nurses, but usage reports differed from study to study. Estabrooks suggested that database searching as a source of nursing information appeared to be much less appealing to some nurses than did personal experience and colleagues. While nurses' Internet and e-mail use at home has increased, Internet use at work is low despite adequate workplace access.^[38] In a national survey, Pravikoff found that nurses acknowledged their need for information, but they had greater confidence in consulting the Internet or colleagues than they did in using bibliographic databases such as PubMed or CINAHL.^[31]

Ready availability of information resources and training do appear to facilitate greater use by nurses of the knowledge base. A recent report of an evaluation of the information-seeking practices of nurses before and after access to a library's electronic collection of information resources showed that at the inception of the project, nurses used colleagues and print textbooks or journals to satisfy their information needs. However after 1 year with access to the electronic library, 20% of the nurses had begun to use the electronic resources.^[36] A smaller but similar project initiated by the same library suggested practicing clinical nurses will use online information resources with appropriate training and accessibility.^[39] In a clinical setting with unlimited access to the Internet, nurses used and accessed the Internet for a combination of work and nonwork-related activities. Information enthusiasts emerged who facilitated use for other nurses. Again, training was a recommendation from this study.^[40] Recent research showed that more nursing students than clinical nurses used online databases, including CINAHL and PubMed, to locate health information, and that nursing students were more likely than clinical nurses to report performing a database search at least one to five times a week.^[35] Confirming this consensus in the value of computer instruction, Secco found that good computer and literature searching skills were positively associated with greater use of electronic information and also with

expectations that desktop information would improve practice.^[32]

Low use of information resources has led nursing leaders to question the readiness of the nursing profession to transition to a more evidence-based practice. The need for evidence-based practice and access to the latest information is particularly critical in the nursing profession where, as Pavikoff noted, more than two-thirds of those practicing graduated prior to 1990.^[31] A systematic review of the literature found that predictors of research use by nurses could be categorized according to beliefs and attitudes, involvement in research activities, information seeking, professional characteristics, education, and other socioeconomic factors. Only the beliefs and attitudes category was actually substantiated in the reviewed research.^[41] Milner found that clinical nurse educators, clinical nurse specialists, advanced nurse practitioners, and nurses working in research leadership positions are important in facilitating evidence-based practice. However, Milner found also that not all nurses in those categories have the necessary critical appraisal skills and research knowledge to use research effectively in practice.^[42] Pravikoff concluded that significant changes are needed through a multifaceted approach involving students, educators, clinicians, and administrators before nurses in the United States fully implement evidence-based practice.^[31]

In the era of evidence-based practice and increased accountability for all health care professionals, facility with searching and using electronic information resources is an important skill for nurses. However, many nurses still do not have the necessary skills to pursue their information needs. Health sciences librarians can play an important role in providing instruction to nurses in accessing and evaluating the literature.

PUBLIC HEALTH

Public health is distinct from other medical fields in that its focus is on the population as a whole, rather than on the individual patient. Information requirements are therefore quite different but nonetheless critical. Ready access to the public health knowledge base is fundamental to achieving the nation's goals established decennially^[43] to improve health, including finding the best solutions to community health needs, promoting healthful lifestyles and disease prevention, and providing informed responses to public health issues. And in public health emergencies, public trust requires rapid, well-informed responses to health threats, often of unknown origin and continually unfolding over hours and days.

The public health sector itself is a complex amalgam of federal, state, and local units, health care institutions and providers, as well as many health-related organizations and advocacy groups. The workforce is drawn from at

least 35 professions as well as 20+ other job categories. Examples of public health workers included public health medical officers, nurses, environmentalists, nutritionists, sanitarians, inspectors, and laboratorians. Workers' educational backgrounds range from advanced degrees and specialty training to technical backgrounds to those with high school diplomas and on-the-job training. The United States, which is currently experiencing a severe shortage in the public health workforce, has an estimated 450,000 public health workers. Less than 1% are epidemiologists, biostatisticians, or infection-control specialists who have critical responsibilities in the post-9/11 world.^[44] Efforts are underway to better define the workforce, accelerate recruitment into the field, and to implement more systematic enumeration strategies.

While there is general consensus on the critical need to make information accessible to the public health community, there have been few formal studies of information needs. These studies can be confounded by the public health workforce's diversity, worker-role variation and overlap, and the fuzzy boundaries of the field. As noted by Revere and colleagues in their literature review, it is not possible to design a comprehensive needs assessment that would neither yield informative data nor design a one-size-fits-all information system solution.^[45]

Because information services are often unavailable, information needs, when they occur, may not be recognized by public health workers.^[46] When recognized, there may be lack of awareness of what information is available and how to search for answers. A Norwegian study showed that while public health workers value research-based information, they do not appear to identify scientific information as a resource for questions encountered in daily practice.^[47] Along with lack of awareness there are other barriers including difficulty in finding the needed information given the breadth of the field, general information overload, limited access to computers and licensed online resources, lack of search skills, limited ability to appraise information quality, and lack of time.^[48,49]

A few studies have examined the types of information used by public health workforce segments. LaPelle found that six categories of information were needed: early reports on new risks and preventive behaviors; early reports on public health practices and programs; information on evaluated interventions; synthesized information about public health threats and practices; published research including systematic reviews and meta-analyses; and evidence-based guidelines.^[49] In looking at five types of public health workers, Rambo found needs for tools to connect with experts; to get updates on legislative issues; and to find structured information about datasets, best practice resources, templates for frequently used applications, and synthesized knowledge-based information.^[50] Other studies have examined specific groups of workers, such as Dobbins' study of public health decision-makers,

in whom there was a strong preference for executive summaries and systematic reviews.^[51]

Like the workforce, the public health literature is diffuse and appears in many disciplines. There is no single index or database that serves the field. While the National Library of Medicine's PubMed database continues to strengthen its public health content, often other databases are required to locate needed information. As noted by Howes,^[52] 44% of the Medical Library Association's list of Core Public Health Journals^[53] and 38% of the University of Massachusetts Lamar Soutter Library's list^[54] are not indexed in MEDLINE. Alpi, in her overview of the major resources for searching in the public health field, notes that the challenges include the range of resources along with the lack of public health indexing terminology in many databases.^[55] A useful compilation of free public health databases is provided at the University of Massachusetts' Evidence-Based Practice for Public Health Web site.^[54] Examples of specialized resources include the National Library of Medicine's Health Services/Technology Assessment Text (HSTAT) database^[56] and the Centers for Disease Control and Prevention's human genome epidemiology (HuGE) knowledge finder.^[57]

In addition to the journal literature, influential white papers, government reports, policy, and opinion papers are important information sources in public health. This gray literature can be discovered at the Web sites of federal and state government health agencies and public health organizations. The New York Academy of Medicine Grey Literature Report captures many public health documents.^[58] A search for statistics, which are frequently sought in public health, should begin at the Centers for Disease Control and Prevention's National Center for Health Statistics Web site.^[59]

As in medicine, there is growing emphasis in public health to use scientific evidence to guide policy making and program planning. Evidence-based public health faces challenges that are different from those of evidence-based medicine: there is considerably less evidence available; the study designs typically cannot match the rigor of controlled clinical trials; population studies generally require a longer time; the workforce has less professional training; and decisions to act on evidence are made by teams as opposed to individual practitioners.^[60] Because public health is interdisciplinary and because a significant portion of its knowledge base lies outside the scope of traditional databases, gathering the evidence for systematic reviews and meta-analyses is difficult.^[61,62] However, a body of public health evidence is beginning to emerge. The *Guide to Community Preventive Services* is the leading source for evidence-based public health best practices.^[63] The well-regarded Cochrane Collaboration includes a Cochrane Health Promotion and Public Health Field group that promotes systematic reviews, identifies new studies, and explores methodology issues in the public health literature.^[64] The Canadian Institutes of Health is sponsoring a

broad-based initiative to assist with the production, dissemination, and application of public health research evidence in Canada.^[65] One outcome is a centralized online registry of systematic reviews, meta-analyses, and evidence-based summaries that are relevant to public health interventions.^[66] The European SPHERE (Strengthening Public Health Research in Europe) project is an example of a recent project to examine public health research publications in order to identify new research priorities and to develop ways to facilitate the integration of research findings into public health policy.^[67]

Providing information services to the public health workforce has fallen outside the mainstream of library services. Where once there were many state public health libraries, only a handful remain. Very few states have formal arrangements for library and information services for their public health workers. A landmark national conference in 1998 assembled stakeholders, highlighted the need for better information services for the public health community, and initiated discussions about solutions.^[48] Progress is now being made in better supporting the information needs of the public health community. One notable result of the 1998 conference was the formation of the Partners in Information Access for the Public Health Workforce, which has developed a public-private collaboration to augment access to and use of information by public health workers at the state and local levels.^[68]

BIOMEDICAL RESEARCHERS

Underpinning the practice of medicine is a large community of clinical and biomedical researchers and scientists. While not practitioners of health care, these researchers contribute to the field by discovering the new knowledge that advances the practice of medicine. Their recent approaches to research are transformational, heralding enormous developments in information systems and the information sciences that will eventually permeate other health care professional groups. Advances in technology and large-scale national and international collaborative research efforts are driving these changes, affecting both the way scientific information is generated and the way it is communicated, particularly in the burgeoning fields of molecular biology and genomics.

While colleagues remain an important information resource for these researchers, scientific discovery is now often derived from databases rather than laboratory bench experimentation as was the case for much of the last century. Primary information needs are increasingly being met by complex nonbibliographic databases that constitute the new knowledge base.^[69] The success of the Human Genome sequencing project and the recent Framingham Heart Study data release illustrate the power of large collaborations to generate new findings.^[70] A leading provider of new research tools is the National

Library of Medicine's National Center for Biotechnology Information (NCBI) that provides a growing list of new resources such as their Entrez databases and the NCBI Map Viewer.^[71] Other examples of new approaches to information include ExPlain, a gene expression analysis platform, and Collexis, a knowledge management and text-mining tool.^[72,73]

Biomedical researchers are often self-sufficient information users and do use traditional information resources, valuing both online journals and a well-organized library Web site that makes locating information more efficient than an Internet search engine such as Google or Yahoo.^[74] However, additionally these researchers work collaboratively, using Web 2.0 methods for rapid dissemination of scientific information. They also work together to build new databases. They require new tools for mining the biomedical literature and the large shared datasets, and tools for synthesizing their retrievals in order to discover relationships and generate new hypotheses.^[75] The current emphasis on translational research, that is moving from science to practical application in health care, highlights the need for new workflows, interoperable data repositories, infrastructure and statistical tools for meta-analyses, integrated ontologies, and other approaches that enable collaborative work and data analysis.^[76] The challenge for health sciences librarians is to become proficient in the new tools and new ways of managing, accessing, and integrating biomedical research information, particularly as many of these strategies may become standards for all health care information.

CONCLUSION

While researchers and academicians are traditionally more facile in using the biomedical research knowledge base than health care practitioners are, a growing trend toward self-sufficiency in information seeking is apparent in the larger health sciences community. Additionally, the need for "just-in-time" clinical evidence at the point of care was emphasized in the findings of a large medical center's information-needs study.^[77] The literature is showing that many health care professionals now expect information services customized to their professional information needs, preferences, and patterns of use.^[74]

The emerging solution to customized services at the point of need appears to employ both technological and human interventions. As Bakken pointed out, an informatics infrastructure is essential for evidence-based practice. This infrastructure must include standard terminologies and structures, electronic information resources, data exchange standards to enable transfer of information across heterogeneous systems, processes that enable evidence appropriate to specific patient cases, and informatics competencies. Among the challenges to achieving this goal are building a persuasive business case; achieving

consensus in describing, organizing, accessing, and archiving information resources; designing clinically relevant information-retrieval strategies; and integrating evidence-based processes into the clinical setting and organizational structure.^[78] Davidoff and Florance have argued that in addition to informatics tools, a new informationist specialist is needed as a full member of the clinical team: a professional who specializes in information, who possesses information science, informatics and domain knowledge, and who works outside the library in the health care setting.^[79] Model informationist programs are now emerging in clinical programs as well as in health policy, public health, biomedical research, and other related domains.^[80]

An understanding of each client group's unique information needs and behaviors will result in the development of clearly targeted products and services. Customized services include both technology tools and embedded librarians that together enable successful and seamless integration of information resources and services into the workflow of health care professionals.

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Historical and Archaeological Sites: Development and Preservation

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Abstract

Historic and archaeological sites provide windows to life in the past. The sites are the in situ repositories of the human activities. Studying these sites helps this and future generations understand the past and our links to it. Preserving these sites honors those who came before and strengthens our connections to our roots. Sites may be as grand as an historic district or an architectural treasure, or as simple as a small campsite used by ancient hunters. Yet, each has an important story to tell about people in the past.

INTRODUCTION

Historic and archaeological sites are important places. Something happened there. Perhaps it was an event that changed history and is the subject of legend and lore. Other times, such sites are small and the people who created the site are nearly forgotten. However, large or small, famous or obscure, historic and archaeological sites are incredibly important windows on the past. They are our history, our heritage, and our link to the people who came before us.

An object, whether from the past or present, can tell a story. The recent obsession with forensic sciences demonstrates how trained researchers use their knowledge and skills to turn something as seemingly insignificant as a hair into a powerful clue to a past event. Archaeologists sometimes call this process “reading” an object. Any object made by humans can be analyzed as to its means of manufacture and its use. Indeed, objects have a “life cycle” from manufacture through use to abandonment. Determining what has happened to the object after abandonment also can be determined from telltale changes to the object. Many times, these processes are natural processes of decay and destruction that leave their own signatures.

If history can be deduced from a single object, then an historical or an archaeological site has even greater potential for revealing past human behavior. The site provides the context for interpreting objects; the locus of activity at which the objects were used. Perhaps there is a progression of understanding here. An object has a specific and limited function. A group of objects found together may reveal the activity in which the objects were used. The site reveals the holistic picture of the human behavior that used the objects and provides information on the who, what, when, and where that helps researchers look back in time to reconstruct entire events and ways of life.

REVEALING THE SITE

Historic and archaeological site museums have multiple functions. At a minimum, they preserve the record of the past in its original location and they present a story for today’s students of the past. Revealing the story told by these sites often requires the skills of many kinds of scientific and historical researchers. The tasks often begin with precise and careful examination of the site to determine the details of the human-made structures, whether forts, cliff dwellings, a 200-years-old barn, or the remains of a small campsite used by nomadic hunters thousands of years ago (Fig. 1).

Once the site has been mapped to include the natural features and human-made structures, then decisions will be made about how to take care of those structures. Do structures or buildings need stabilization, renovation, reconstruction, or to be left alone? The term “stabilization” means to make the structure as safe as possible with the least change necessary. Today’s conservation ethic, whether in an historical or archaeological context, is that modern changes should be visible and reversible so that future generations of researchers and the public will be able to differentiate between the original structure and any modifications made to it. The reason for making sure that modern changes are visible recognizes that some interpretation is involved in any reconstruction. Over time, the reconstruction may be thought to be original and thereby confuse scholars and the public. As new data is collected, details of the original structure may impact future reconstruction efforts. Each new generation of scholars needs to be able to distinguish between the “original” and the “reconstructed.” Making the distinctions obvious allows each new generation of scholars and researchers to use new methods, tools, and materials to start from the original more easily and efficiently.



Fig. 1 Prehistoric sites such as Legend Rock have been used by a succession of pre-European cultures. Such sites provide powerful experiences for today's visitors but also must be protected from vandalism.

Renovation and reconstruction implies that efforts will be made to enhance the original structure, perhaps bringing it back to the way it looked when it was being used. Historic houses often have been renovated through time so that the visitor has the experience of being in a "living house" not an old musty and abandoned one. Historic site specialists do not always agree on the extent to which renovations or reconstructions are acceptable. Some historic site specialists prefer to make as few alterations or additions as necessary to provide safety for the structure and the people who work in or visit it. In other cases, the goal is to let the visitor see and experience the site as it would have been at the time it was in use. Both of these perspectives can be seen around the world at various houses, forts, and historical places (Fig. 2).

Historic Oak Park, Illinois, was the home of Frank Lloyd Wright and the location of many of the houses he designed. Many towns, such as Santa Fe, New Mexico, or



Fig. 2 Galena, Illinois, has protected sections of the town to create an historic district that keeps its nineteenth century look.

Charlotte, North Carolina, have entire historic districts of period buildings that are being preserved but also used for contemporary purposes. On the world stage, the great cities of Rome, Beijing, Bangkok, Jerusalem, and Mexico City just to name a few, have extensive districts of historic importance that are still part of the urban milieu. Cities often have strict rules that dictate what kinds of materials or physical changes are allowed in order to maintain individual buildings and the look of the entire district. However, the importance of historic sites is not universally appreciated. As cities strive to modernize, particularly national capitols and centers of industry, whole blocks and quarters are sometimes razed to accommodate the needs of current city dwellers. Beijing's preparation for the 2008 Olympics was an excellent example. While the needs are real, the loss of precious historic resources should not be taken lightly.

Archaeologists have a slightly different challenge when it comes to inventorying archaeological sites. By definition, most archaeological sites are buried by centuries or millennia of debris and natural forces. There are many sites that are known by their aboveground presence, but in fact are simply part of much larger sites that are under foot. Throughout the world spectacular aboveground archaeological sites such as Stonehenge in England, the Pyramids of the Giza Plateau and Saqqara in Egypt, Greece's Parthenon, Peru's Macchu Picchu, Mexico's Teotihuacan, and Nan Madol on the Pacific Island of Pohnpei have attracted countless generations of the curious. Today, these sites often are sources of national pride and sometimes considerable generators of revenue.

Yet, these same sites sometimes become targets of intentional destruction. The massive Buddhas of Bamiyan in Afghanistan were destroyed because they represent an earlier religion that is not accepted by some of the current residents of that country. Sometimes, archaeological sites become pawns in contemporary geopolitical affairs.

The great city of Cahokia, on the Illinois side of the Mississippi River across from St. Louis, is no less monumental but differs from many of the world sites in that it was constructed entirely of earth, not stone. Between about 1050–1200 C.E., Cahokia included well over 100 mounds, a great plaza, and extensive housing areas. Cahokia's largest human-made structure, Monk's Mound, can be seen towering above the trees. Its base covers an area larger than the base of the Pyramid of the Sun at Teotihuacan in Mexico. In past decades, excavation was the main method archaeologists used to find buried sites (Fig. 3).

Archaeology is a destructive science. Revealing a buried site requires excavation to see it in detail. Excavating destroys the context. Excavation exposes the buried structures and objects to environmental factors that destroy them much more quickly than if they had been left in the ground. Today, most archaeologists are keenly aware that archaeological sites are like endangered species: If we do

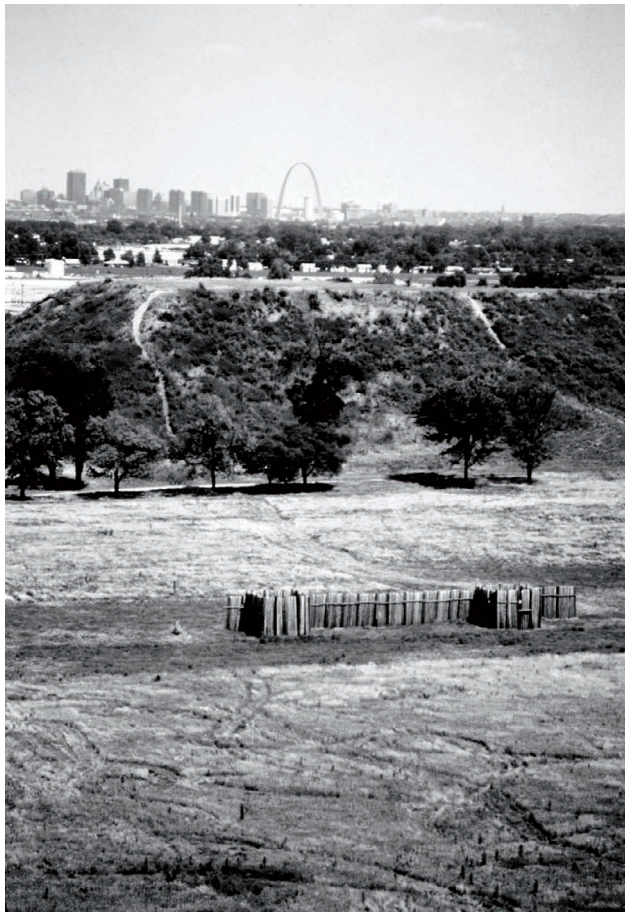


Fig. 3 Monk's Mound at the site Cahokia (the St. Louis Arch in the background), has been encroached up by modern urban development.

not preserve them, they will disappear. Therefore, archaeologists are very careful about what they choose to excavate. Large-scale excavations today must consider not only excavation, but a broad spectrum of data collection and recording, object care, and stabilization of the site. When excavation is initiated, a multidisciplinary team of scientists and technicians are often required so that the record of the site will be as complete as possible and will be preserved through time.

Today, noninvasive tools such as ground penetrating radar, aerial photography with special films and cameras, and magnetometry let archeologists "see" underground structures without having to resort to excavation. Thanks to the technological advances, the need to conduct expansive and expensive excavations to identify architectural features is no longer necessary. In recent years, robotic technology has played a role. Within the Great Pyramid at Giza, there are small shafts that extend out from the tomb chamber. Many theories have been presented as to their function. Using small robots with lights and cameras to explore these shafts might provide new insights into the shafts form and function. Egyptian authorities review

proposals such as these and always have the best interest of the monuments and sites in mind.

Whether in the historical or archaeological context, mapping is only the initial step in creating a great site that can be accessed by the public. Historians and scientists representing many different specialties will analyze the site to determine what actually occurred there. Geologists and soil scientists will help the archaeologist understand what kinds of natural geological formations and processes are important to the site's history. Specialists in conservation, photography, and statistics help preserve and document each piece of the past. Educators and interpreters work with the researchers to help them develop the stories, activities, and information banks which are available to the public. Today, it is common for many of those interpretations to be available on the Web or through other electronic media. This incredible technology makes it possible for people to experience the site, virtually, even if they cannot visit it in person. The experience is not the same, but it is still valuable.

Human beings lived in North America for at least 12,000 years before Christopher Columbus arrived. Some archaeological evidence suggests that North American human history may span 20,000 or more years and that there were numerous waves of migration that brought people to this continent.

In Africa, Asia, Europe, and some other parts of the world, people and even prehuman hominids have lived on the land for longer periods of time. Unfortunately, contemporary human populations often like to live in the same areas as did earlier cultures.

Here then is a conundrum. If people have been here for all those thousands of years and have lived all across the landscape, should we preserve every site that is found? On a shorter timescale, is every old building, farm site, or construction created by humans important enough to save for the future? While it is true that in many ways, each site is unique and definitely each site tells a story, it isn't necessary—it isn't possible—to save all of them. If we did, there would be no land available for this generation and future ones to build their lives. At the same time, is it good enough just to record these sites through images, documents, and to salvage artifacts from those sites, knowing that the bulldozers will destroy the sites? No, every culture needs and wants to preserve the best of its past and its heritage. Disregard for the past would make us a people without a past: a culture with no roots connecting us to previous generations of people and entire cultures that came before us.

SAVING IMPORTANT SITES

Who determines what is worth saving? Does anyone actually decide that some historic or archaeological sites can continue to deteriorate under natural conditions or the

quick destruction of bulldozers? These issues are common in local communities and also on the national level. In recent decades, many important Civil War battle sites in the United States have become threatened by real estate and mining development. These pieces of ground saw some of the most terrifying battles in a war that defined this country. To see them become shopping malls was more than many people could bear. The Civil War Preservation Trust was founded to stop the destruction of these historic sites. Their annual report, *History Under Siege*, provides insight into the strong emotional connections that many people feel toward our heritage and shows how individuals can become actively engaged in the preservation effort.

The Civil War Preservation Trust is one of many such preservation organizations that work to save important historic and archaeological sites. From passionate individuals to local historical societies to national organizations, many Americans have joined the preservation efforts. Moreover, many of these sites are not just protected, they are interpreted through many kinds of on-site programs and museums that help visitors understand what they are seeing. Many also go beyond providing just the visual experience; they actually create activities to engage the visitor at the site.

In some countries, the preservation of past sites became an issue long ago. For example, in 1666, Sweden passed a law to protect prehistoric sites and antiquarian monuments. The American Antiquities Act of 1906 was the first significant American law to keep archaeological sites from being desecrated and destroyed. The law was a result of a grassroots effort to preserve important sites from America's pre-European past. Devil's Tower in Wyoming was the first monument designated under the Act by President Theodore Roosevelt. This site is sacred to many Plains tribes including the Crow, Kiowa, Lakota, Cheyenne, and Arapahos. Each tribe had their own name for and legend regarding Devil's Tower. Many of them focused on an association with the bear. Bear Lodge, Bear Lair, and Grizzly Bear Lodge are examples.

In the late 1800s as Euro-American populations increased in the American Southwest, an interest in the region's living and ancient Indian cultures increased. Sadly, some of the interest focused on looting at grand sites in Chaco Canyon, Mesa Verde, and smaller sites across the arid landscape. Without protection, these monuments of the past would become pockmarked fields of destruction. Acts such as the early Swedish law and the American Antiquities Act are courageous efforts to stop the destruction (Fig. 4).

In 1966, the National Historic Preservation Act became law and with it, the National Register of Historic Places (NRHP). This law protects not just single buildings, but also entire sites and even districts that have historical importance. This act also pertains to archaeological, as well as historical sites across the country. Each state has a

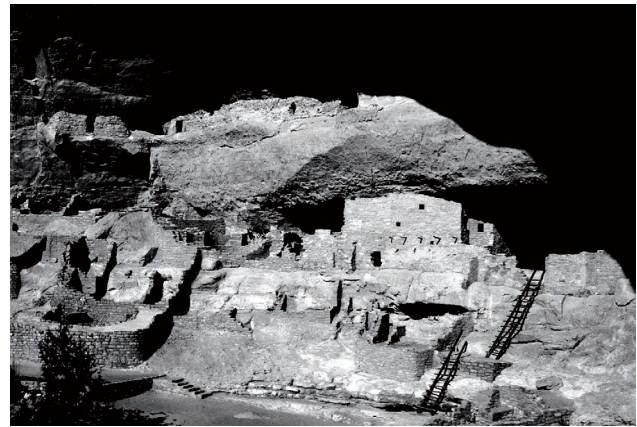


Fig. 4 The fine architecture of Mesa Verde is the most visible remnant of ancient life ways that have evolved into the Southwestern Pueblo cultures of today.

State Historic Preservation Officer (SHPO) who is responsible for site protection and overseeing the process by which additional sites are proposed for protection. The SHPO's office normally maintains data on all of the archaeological sites that have been found in the state.

According the NRHP Web site, the criteria for protection are:

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and:

- A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
- B. That are associated with the lives of persons significant in our past; or
- C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or
- D. That have yielded or may be likely to yield, information important in prehistory or history.” <http://www.nps.gov/history/nr/listing.htm>(accessed August 2008)

The Archaeological Resources Protection Act (ARPA) of 1979 expands the protection of archaeological sites beyond the American Antiquities Act (1906) and more clearly defines what kinds of activities are prohibited. ARPA also provides for incarceration and larger financial penalties for convicted violators. The law was enacted:

to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to

foster increased cooperation and exchange of information between governmental authorities, the professional community, and private individuals.

<http://www.nps.gov/archeology/tools/Laws/arpa.htm> (accessed August 2008)

Many archaeological sites are living sites upon which individuals, families, or entire communities conducted the myriad activities that constituted their lives. Such landed sites can be very large, with boundaries changing through time as the use of the site changed. Moreover, the living sites may represent large numbers of people doing very different things within the boundary of the historic site.

UNDERWATER SITES

Shipwrecks are underwater archaeological sites that tell important stories, too. Recovery of the 17th Swedish *Vasa*, England's *Mary Rose* sinking in 1545, and the *Atocha* which sank in 1622 off the Florida Keys have yielded not only spectacular artifacts, but also insights into their special history and times. Closer to our times, the sinking of the *Titanic* was a traumatic event that continues to generate interest and intrigue. The *Titanic* has not been salvaged, although it has been explored through remote devices. Indeed, the rush to salvage the ship has brought new attention to the need to preserve the ships and keep their human passengers from being disturbed.

Early ships, especially those involved in the early exploration or exploitation of the Americas, were small by today's standards. The number of people on board was limited. The contents of the ship tend to directly reflect the ship as a sailing vessel and a conveyance of people and material. These wrecks represent a very thin slice of time and a limited range of activities—a much more compressed picture than that given by a land site. For those reasons, the proper discovery, recording, and recovery of these sites is both delicate and critical to our understanding of the past.

In the 1960s and 1970s, a movement developed to protect these sites in addition to dryland sites. Various maritime laws already pertained to shipwrecks, e.g., the Law of Salvage and the Law of Finds. However, these laws were more focused on who had rights to the material found on a wreck. The purpose of these laws was not conservation or care of the wreck. Moreover, establishing the exact location of a wreck is important in determining if the wreck comes under specific national or state laws, international laws of the high seas, or international conventions. The U.S. Park Service has created a number of National Marine Sanctuaries to protect underwater cultural sites, such as shipwrecks. The Abandoned Shipwreck Act of 1987 vested the states with the authority to manage abandoned historic shipwrecks. In 2001, the Convention on the Protection of the Underwater Cultural Heritage was

adopted by UNESCO to provide uniform definitions and protections for underwater sites. http://www.indiana.edu/~arch/saa/matrix/acl/acl_mod12.htm (accessed August 2008).

In 1985, Mel Fisher and his team found a ship from the Spanish treasure fleet of 1622, *La Nuestra Señora de Atocha*, or, just the *Atocha*, and the *Santa Margarita* (Fig. 5). Both ships sank in a violent storm with all hands on board and a fortune in gold, silver, and emeralds. Fisher's finding of the ships sparked a controversy about who owned the riches, and who had the rights to salvage the riches. In archaeological circles, the controversy also centered on the role of private excavations, or excavations for profit, versus scientific investigation. It is certainly true that much important historic research was conducted on these two important ships. Not only was there gold and silver, but also there were navigation instruments, military arms and swords, personal items, and many, many bones. Some of the objects had been made by new world craftsmen but under Spanish direction—some of these items are unique. The analysis of the animal bones told a fascinating picture of life on board an overcrowded ship of the time. However, regardless of the historic and scientific potential and actual work done, it is the wealth of the *Atocha* that continues to capture the imagination of the public.

Finding the *Atocha* sparked the search for many other sunken treasure ships. The legal arguments resulting from the private recovery of the *Atocha* still have impact today and continue to be tested.

The sinking of the *Sultana* offers another fascinating example of an underwater wreck. However, unlike an oceangoing treasure ship, the *Sultana* was a steamship full of people and commercial goods steaming up the Mississippi River toward St. Louis. On April 27, 1865, the ship exploded and burned. More than 1,500 people were killed, many of them Union POWs recently released from a Confederate prison. The ship sank and eventually its original



Fig. 5 Beautiful artifacts recovered from the *Atocha* spark the imagination but tell only a small portion of the story represented by the shipwreck.

location was lost because the channel of the Mississippi River itself moved. The sunken ship became entombed in earth. Both the *Atocha* and *Sultana* are important shipwrecks that reveal important historical incidents. Both were recovered using many appropriate archaeological techniques and both drew upon the services of professionals and nonprofessional alike. However, the presence of great wealth on the *Atocha* will forever overshadow its historical importance while the *Sultana* will be remembered for the tragic event that caused its sinking.

The Sunken Military Craft Act H.R. 4200 was passed as part of the Ronald W. Reagan National Defense Authorization Act for Fiscal Year 2005.

The House bill contained several provisions (sec. 1021–1028) that would protect sunken U.S. military vessels, aircraft, and spacecraft, as well as the remains and personal effects of their crews from salvage, recovery, or other disturbance without authorization from the secretary of the military department concerned. These provisions would clarify the circumstances under which such sunken craft, entitled to sovereign immunity when they sank, remain the property of the flag state until officially abandoned. They would also encourage the negotiation of international agreements to protect sunken military craft. Finally, the provisions would authorize the secretary of the military department concerned to issue and enforce permits for activities directed at sunken U.S. military craft, including contract salvage. This system would not invalidate any permitting system currently in place nor affect any prior lawful transfer or express abandonment of title to any sunken military craft. The Senate amendment contained no similar provision. The Senate recedes with an amendment that would authorize the Secretary of the Navy, in consultation with the Secretary of State, to apply the permitting system established by these provisions to any foreign sunken military craft located in United States waters, if requested by the flag state of that craft. It would also authorize in rem liability against a vessel involved in a violation of these provisions, and would authorize the Secretary concerned to request the Attorney General to seek other relief in certain cases. It would establish an eight-year statute of limitations for actions to enforce violations of these provisions or any permit issued thereunder. It would also extend the prohibition on applying the law of finds to sunken military craft to foreign craft located in U.S. waters. Finally, it makes technical changes to the definitional section. <http://www.history.navy.mil/branches/org12-12b.htm> (accessed August 2008)

SITE PRESERVATION IN AN INCREASINGLY CROWDED WORLD

All of these laws recognize that the “site” has the most historic value and integrity when the human-made structure is left on its original location. The laws also recognize the problem of looting of sites for monetary and personal gain. Looting of artifacts for profit is a very old activity

but one that is still vigorous today. Yet, the world does not stand still; the locations of many historical and archaeological sites, per se, make them vulnerable. Archaeological and historic house sites increasingly draw the attention of real estate developers as they try to satisfy the needs of our expanding human population. Perhaps an archaeological site along a river was isolated or an historic farm might have been miles from the nearest town when it was built a 100 or 200 years ago. Today, those same sites may well be in the city or targeted for housing development.

When such sites are endangered, the options are few and rarely ideal from the standpoint of historic preservation. Of course, the best option for the historic structure is to preserve it on its original site and require that any development bypass the site. If the site is of sufficient historical importance and if there is an active preservation community to advocate for preservation, then the site can be saved. Other outcomes are more likely, however.

Sometimes, historic structures are moved from their original sites. While not the best solution from an historical perspective, this solution may put an historic building on a site that can be preserved through time. The Conner Prairie historical site near Indianapolis, Indiana, is an excellent example (Fig. 6). In decades past, architectural and historically significant buildings were moved from their original sites to one expansive private property owned by the philanthropist, Eli Lilly. The buildings were variously conserved and renovated depending on their conditions. Today, Conner Prairie offers a wide variety of excellent living history programs that utilize the period buildings on the site. It is a popular destination for families to not only see a glimpse of the past through the buildings, their contents and interpreters, but also to participate in a wide range of programs for all ages of visitors.

An example of how an historical house can be saved and moved is the Isaac Cody house, built in 1841 in LeClaire, Iowa. Isaac was the father of William F. Cody, later to become known as Buffalo Bill (Fig. 7). In 1933,



Fig. 6 Conner Prairie, near Indianapolis, uses buildings, objects, activities, and in-character presenters to bring the past alive.



Fig. 7 Buffalo Bill's Boyhood Home is an example of an historic structure that has been saved although it has been moved; in this case from Iowa to Wyoming.

Cody's boyhood home was obtained by the Chicago, Burlington & Quincy Railroad Company and moved to its station in Cody, Wyoming. The boyhood home served as a tourist attraction in the town founded by Buffalo Bill in 1896. By 1948, railroad business was rapidly diminishing as a result of the rise of the private automobile. The railroad company donated the 106-years-old house to the Buffalo Bill Memorial Association which placed it on the site of the original museum near downtown Cody, Wyoming. In 1969, the Buffalo Bill Museum moved across Sheridan Avenue to a new museum facility and more expansive space. The boyhood home moved, too. In 2004, the house was moved a fourth time to its present location within the Greever Garden of the Buffalo Bill Historical Center. With each move, the house was thought to be important enough to protect, but as circumstances and ownership changed, so too did the location of the house itself. Hopefully, the house's roaming days are over.

Archaeological sites face other pressures. In North America and much of the world, archaeological sites are not remnants of stone, adobe, or wooden structures that stand above the ground. Rather they are beneath the ground's surface. For that reason, they are difficult to see and sometimes hard to find. Determining the actual physical land area and significance of such sites is often difficult. Archaeological sites, small and large, have been destroyed by the thousands over the last century through expanding mechanized agriculture. Destruction was not the intent of the farmer who tries to make a living and feed the world, but the impact of using larger equipment, deep plowing equipment, and terracing practices to reduce erosion have had negative effects on sites. Making the situation worse, many archeological sites were created by their original inhabitants along the nation's rivers and major streams. These areas provided the richest resources for ancient people who depended on hunting, gathering, and early agriculture to support ancient cultures. Unfortunately, those same rich river valleys are the places that

Euro-American farmers chose for their farms, too. Modern farming and river towns often were built on ancient sites.

Today, states have continuing archaeological survey programs that document sites as they are found. Many historic preservation officers actively work with local farmers, ranchers, and avocational archaeological groups to identify sites and preserve them. The Archaeological Conservancy, founded in 1980, is a national nonprofit organization that seeks to identify threatened sites and provide economic incentives to the owners to preserve such sites. *American Archaeology* is a magazine published by the Conservancy to highlight important sites, research, and issues related to America's prehistoric past. Destruction of archaeological sites is still a problem, but today, there are many more active individuals and organizations who work to save this dwindling resource for future generations.

THE IMPACT OF TOURISM

Historical tourism has been a major factor in preserving many sites and important structures, but it is also a double-edged sword. Increased tourism generates considerable money that can be used for preservation and interpretation of important places. Tourism brings much needed public attention to important sites and provides an economic incentive to local businesses to preserve the resource. At the same time, the increase in foot traffic degrades the site. Increasing tourism has spawned a variety of approaches to presenting the past. In decades past, there were numerous archaeological sites, often burial sites, which exposed ancient human remains and their accoutrement of grave goods, for the benefit of fee-paying visitors. In the late 1960s, some American Indian groups began to object to what they saw as sacrilegious exploitation and cultural commodification of their ancestors for profit.

Initially, mutual distrust was common among the various constituencies. At Dickson Mounds, near Lewistown, Illinois, many local residents believed that Indian people from other parts of the country were unfairly maligning Dickson Mounds and the local people themselves. With picketing, intervention of the Governor, and hard feelings on all sides, Dickson became a flashpoint of controversy. However, out of this conflict have come new sensitivities and new approaches to presenting the past. Dickson Mounds, a branch of the Illinois State Museum, has been a leader in this effort. Today, the skeletons of the ancient dead are no longer on view, but there are excellent life-sized dioramas that depict aspects of past cultures that lived along the Illinois River. In addition to the fine museum exhibits, there are a wide range of living history activities for visitors related to practices of agriculture, tool making, and house construction developed by Indian peoples over thousands of years. Temporary exhibits show that Euro-American inhabitants of the valley farmed,

fished, hunted, and collected in the valley and on the river for the same purposes as did generations of Indian peoples millennia earlier.

Other kinds of archaeological sites also have become historical attractions. One of the most common methods for hunting buffalo on the vast American and Canadian Plains was the buffalo jump. In its simplest terms, Indian cultures of the last 10,000 years periodically drove herds of buffalo, sometimes small numbers of animals and sometimes large, over a cliff. Those animals that were not killed by the fall or crushed by the bodies of other buffalo falling on top of them, were killed with lance, club, or arrow. The Head-Smashed-In site, near Fort Macleod, Alberta, Canada and the Vore site, just off Interstate Highway 90 on the southern edge of the Black Hills in Wyoming are examples. Head-Smashed-In offers many programs for the casual visitor to learn more about buffalo jumps and the Indian people who used them. Equally important, the site continues to be an important cultural site to the Blackfeet people.

Mammoth Cave in Kentucky offers yet another unusual type of site. As the name implies, it is a massive natural complex that offers an extraordinary view of underground geology, flora, and fauna. The cave also was used by Indian people to mine minerals. In the eighteenth century, Euro-Americans mined other kinds of minerals in the cave. Truly, Mammoth Cave provides an immersion experience.

MUSEUM EXHIBITS AND LIVING HISTORY SITES

The philosophy of presenting the past to today's visitors may be described as two dichotomies; the museum exhibit versus living history, and description versus interpretation. The "museum exhibit" perspective often provides displays, dioramas, or other constructed means of showing a past event or activity. For the visitor, the experience is usually passive and the methods of communicating the museum's messages are primarily visual and auditory. In contrast, a "living history" approach uses real people wearing period clothing and using period objects to engage the visitor in the experience of an earlier time. Here, the visitor may be immersed in the past and the interpretive messages may impact all the senses. In simplest terms, there is learning by seeing and learning by

doing. Most really good site museums will use many different ways to engage the visitor. Museum interpreters recognize that people learn in a variety of ways and therefore the messages should also be delivered through a variety of methods in order to be effective.

The second dichotomy, description versus interpretation, also underlies presentations at historical and archaeological site museums. Description and interpretation are not independent or mutually exclusive. Perhaps they should be thought of as different points on the same scale. Description tells the visitor what he or she is seeing. The farther one goes back in time or the more distant from today's urban, virtual life, the less likely it is that visitors are able to intuitively determine what they are seeing. Description may tell a person that the object in front of them is a stone-tipped spear point, fastened to a wooden shaft. Naming the type of stone or wood involved may give the viewer additional appreciation of the objects. Interpretation provides a context for the objects on view and helps answer the questions, "Who made this?" and "How was it used?" Interpretation has the power to use a single object to reconstruct an entire culture. Using the stone-tipped spear point as an example, interpretation leads to reconstruction of how the raw material was found, shaped into a tool, and then used. Behind the object, the person who made or used it is revealed. Was the tool made by a man or woman, an aged craftsman, a young hunter, or a child learning the process? From the reconstruction of the event in time, interpretation leads the audience to questions about the society in which the people lived.

CONCLUSION

Historic and archaeological sites are connections to our past. They offer incredible opportunities to not only see, but to vicariously experience what it must have been like to live in another time. Such sites also are like endangered species. They are few in number and under considerable pressure because of the land upon which they occupy. Many individuals and organizations have worked to create laws to protect the most important of these sites. When such sites are managed and interpreted by professional staffs, the site is more likely to be saved. A well interpreted site also is likely to be of greater appeal to audiences who help support the site, and thereby, help preserve it.

Historical Societies

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Abstract

The central mission of historical societies, to collect and preserve the records of the past, has remained consistent over the course of the last two centuries, but the scope and the functions associated with these original objectives have changed markedly. This entry will look at some of the major historical developments that shaped the goals of historical societies, while highlighting some of the institutional transformations among historical societies that resulted from new ways of thinking about the collection, preservation, and dissemination of historical records.

INTRODUCTION

Modern historical societies are a product of the developing nation-state. Their development follows the course of public interest in collecting, preserving, and publishing documents of the founding and pioneering generations, indigenous cultures, and natural history. By the turn of the twentieth century, historical societies were adopting professional standards of scholarship and librarianship then being articulated through advanced degree programs and the publication of referenced and peer-reviewed articles and books. At mid-century, many historical societies began to adapt their missions and provide funding in support of public programs. Over the last half-century, historical societies have recognized the need to actively engage a public audience and present historical content through history education and museum programming. Computer technology has enhanced the ability of historical societies to deliver digital content including images, text, and music, anywhere in the world. Currently, historical societies are collaborating with partners from other academic and cultural heritage institutions, as well as professionals in the fields of education and information technology to create digital content that is accessible on the Internet and the World Wide Web. In fulfilling the mission of historical societies to collect, preserve, and provide access to historical records, librarians and archivists will increasingly rely on computer technology such as digital scanners, Web design tools, e-mail, and chat programs to develop and manage their unique collections and provide reference services.

HISTORICAL SOCIETIES TODAY: ORGANIZATION AND MISSION

Historical societies collect, preserve, and provide access to printed records and material culture of enduring value

related to a particular place, people, way of life, or event. Historical societies are typically structured as state-chartered, nonprofit corporations that operate as private and independent institutions or as quasi public-private institutions that receive financial aid from state and local governments. Historical societies define their mission statement, their area of interest, and their goals in a founding charter document; periodically, a society reviews and updates specific policies such as its collections policy. For example, the Georgia Historical Society (GHS), a private, nonprofit corporation chartered by the Georgia General Assembly in 1839, upholds the institutional mission “to collect, preserve, and share Georgia history through a variety of exciting educational outreach programs and research services.” More specifically, the GHS collection policy describes its primary areas of interest in terms of geographical boundaries, chronology, and historical themes, including Georgia and Georgians, the original 13 colonies, and immigration to the state. The GHS manages its collections through the processes of acquiring, accessioning, and deaccessioning historical records. Within the bounds of its legal authority, and its technological and financial resources, the GHS builds its collections by acquiring materials through purchase, donation, and deposit. Once records are acquired, librarians or archivists accession the materials into a library catalog or an archival listing, and devote all necessary and available resources to preserve the entire collection. However the GHS also reserves the right to deaccession, or dispose of, previously acquired materials that are no longer considered suitable for its collections.^[1]

While the central mission of historical societies to collect and preserve the records of the past has remained consistent over the course of last two centuries, the scope and the functions associated with these original objectives have changed markedly. This entry will look at some of the major historical developments that shaped the goals of historical societies, while highlighting some of the

institutional transformations in historical societies that resulted from new ways of thinking about the collection, preservation, and dissemination of historical records.

NATIONALISM AND THE RISE OF THE MODERN HISTORICAL SOCIETY

Modern historical societies are a product of the developing nation-state. Their development follows the course of public interest in collecting, preserving, and publishing documents of the founding and pioneering generations, indigenous cultures, and natural history. The first modern, independent historical societies were established in the United States during the late eighteenth and early nineteenth centuries. In the wake of the American Revolution, bibliophiles and amateur historians such as Reverend Jeremy Belknap (1744–1798) and John Pintard (1759–1844) solicited and combined print resources in private library associations for the purpose of collecting and communicating to the members of the society unpublished manuscripts, printed books and pamphlets, artifacts, and reports on “the natural and political history of America from the earliest times to the present day.”^[2] Under the stewardship of Reverend Belknap, the Massachusetts Historical Society (MHS) (1791), became the first historical association funded and operated by its members. Other independent historical societies including the New York Historical Society (NYHS) (1804) and the American Antiquarian Society (1812) took the lead in acquiring books, pamphlets, newspaper, and other records that documented the regional cultures of New England, the Mid-Atlantic, Virginia, and the Carolinas and helped to distinguish and connect the history of these societies with the larger Atlantic world. Historical societies made their records accessible to their members through the library and through the sale of published collections. Among the early publications were catalogs of materials held by the larger societies like the MHS and the NYHS.^[2]

As an expanding nation, the United States began in the 1790s to organize large western land territories into self-governing states. Emigrants, predominantly from the eastern seaboard states, settled newly constituted territories like Wisconsin (1787). One such immigrant, Lyman Copeland Draper (1815–1891), a seminarian and an avid collector of history and biography, settled in Wisconsin after living many decades in upstate New York. Lyman Draper helped promote the first state-funded historical society in Wisconsin. Draper successfully lobbied the newly constituted Wisconsin State Legislature (1848) to establish a charter for a historical society. The succeeding charter of 1853 stipulated that the state legislature would provide the State Historical Society of Wisconsin (SHSW) with annual subsidies, and that membership to the SHWS would be open to any who paid an annual fee of \$1. This aspect of the charter gave the SHSW the character of a

public subscription library, which distinguished it from the independent historical societies of the East like the MHS that provided services to a limited membership. The society’s institutional mission also spoke of the unique conditions upon which Wisconsin was founded. The charter of 1853 called upon the society “to secure from oblivion the memory of its early pioneers, and to obtain and preserve narratives of their exploits, perils and hardy adventures.”^[3] Over the course of the nineteenth century, the SHSW collections came to embody Wisconsin state and American historical consciousness, as its members sought to shape the state’s historical identity vis-à-vis the nation and the West.^[4]

The development of modern historical societies is unique to each nation, state, and locality. During the mid-nineteenth century Russia and Britain, like the United States, were rapidly expanding their continental and oceanic empires. At the same time, explorers and amateur ethnographers were documenting the lands and peoples of Asia, Africa, and the Americas. Institutions of learning such as the Geographical Society of London (1830) and the Russian Geographical Society (RGS) (1845) were established to collect, preserve, and publish ethnographic and historical records about the people who inhabited the imperial domains. The ethnography department of the RGS actually served as the first historical society of St. Petersburg. By 1866, a separate historical society was founded in the same city. The RGS charter called upon its members to “study national culture, arrange archaeological expeditions, and preserve monuments of the past.”^[5,6]

At the turn of the twentieth century, the breakup of empires around the world led to the rise of independent republican forms of government. The birth of independent republics quickly led to the development of cultural institutions that were capable of expressing national and regional identity through history. Six years after gaining independence, the Republic of Turkey established the Turkish Historical Society (1931) through the patronage of leading nationalist figure and first president of the Republic, Mustafa Kemal, Atatürk.^[7] Similarly, the creation of the Commonwealth of Australia in 1901 spurred organizing efforts among local and regional societies including the Royal Australian Historical Society (1901), the Royal Historical Society of Victoria (1909), and the Royal Historical Society of Queensland (1913).^[8]

Over the course of the nineteenth and early twentieth centuries historical societies were formed into state and local associations. These societies protected and preserved the past at a time when few other institutions were in place to assume guardianship over the founding documents of the community, state, and nation. The generations of historians, ethnographers, and genealogists who established independent and state historical societies were amateurs and enthusiasts, not trained professionals. Figures like Lyman Draper were not professionally trained historians; they pragmatically developed their skills as librarians and

archivists, genealogists and ethnologist, historians and editors. Though as the nineteenth century neared its end, a new generation of professionally trained librarians and historians assumed responsibility for collecting and preserving the past.

PROFESSIONALISM AND LIBRARIANSHIP

By the turn of the twentieth century, the practice of history and librarianship were becoming increasingly professionalized through higher education and the issuance of advanced academic degrees, and the publication of referenced and peer-reviewed articles and books. Beginning with the *Historische Zeitschrift* in Germany in 1859, historical associations published journals featuring original research, analysis, and annotated bibliographies. Journals like *Revue historique* (1876) and the *American Historical Review* (1895) provided a national forum and standards for historical scholarship while also offering university education programs scholarly publications for use in training future historians. In this professional environment, the historical society library came to be seen as a source of authentic historical records to be used by scholars and students. And the increasing scholarship would be published in an expanding array of historical society journals such as *The Pennsylvania Magazine of History and Biography* (1877) and the *Virginia Magazine of History and Biography* (1893).

Historical societies reinforced their role as centers for scholarly research by forming partnerships with state universities and archives. The SHSW was one of several publicly funded historical societies that established an institutional connection with a major research university; in 1900, the SHSW celebrated the opening of its new library on the campus of the University of Wisconsin at Madison. The Georgia Historical Society, on the other hand, established an editorial partnership with the University of Georgia in 1917 through which they published the scholarly journal *Georgia Historical Quarterly*. For some historical societies, legitimacy and institutional standing would become intimately tied to professional standards issued by and judged according to the historical academy. National associations such as the American Library Association (ALA) (1876) and the American Historical Association (AHA) (1884) reinforced professional standards through published resource guides and codes of ethics, annual conferences, and the issuance of accreditation standards.

Reuben Gold Thwaites (1853–1913) was among the generation of professionally trained historians who took an active interest in developing national standards of librarianship and historical research among societies in the United States. Thwaites served as the director of the SHSW from 1887 until his death. During his tenure at the SHSW, Thwaites edited several major historical documents series including 73 volumes of *The Jesuit Relations and Allied Documents* and 10 volumes of the *Collections*

of the *State Historical Society*. He was also instrumental in relocating the SHSW library collections to the University of Wisconsin at Madison.

As a member of the AHA and as president of the ALA (1900), Thwaites was an outspoken promoter of professional standards for state and local historical societies. In 1906, he wrote a report on behalf of the AHA entitled, “State and Local Historical Societies,” in which he laid out general professional guidelines for historical societies to follow. Thwaites urged historical societies to avoid the tendency to passively accept whatever was deposited on their doorstep and to actively collect public and private records and oral history accounts of the pioneering generations. These records, he noted, were to be cataloged and indexed so they may be located upon request.

Thwaites also presciently understood the power of public exhibitions for generating interest in history. Citing evolving standards of museum display, he suggested that historical societies cultivate public interest in history by introducing a rotating schedule of museum exhibits featuring carefully labeled books and objects, and lectures presented to teachers and students. Societies, he argued, could also reach a larger public audience by publishing original essays and primary source documents, monographs, and bibliographic guides to publications held in other state and local history centers. Not satisfied to allow historical societies to continue publishing inaccurate or poorly edited sources, Thwaites sounded a call for a more scholarly approach to historical research.^[9]

Historical societies incorporated the theories and practices of librarianship to organize and manage their growing collections. The experience of the Historical Society of Pennsylvania (HSP) demonstrates the fitful approach many historical societies adopted with regard to establishing professional standards of librarianship during the period 1890–1945. On the one hand, the HSP committed to a sustained collections preservation program. Between 1889 and 1910, the society set about renovating or constructing fireproof structures to house its collections. Over the ensuing decades, the HSP added steel bookcases and fireproof enclosures. However, during the renovation process HSP staff uncovered “thousands of documents. . . that had been allowed to languish unprocessed and uncataloged in boxes in out-of-the-way corners.”^[10] A lack of financial and human resources was surely a principal reason for the constant backlog of uncataloged materials at the HSP. However, as Sally Griffith noted in her study of the HSP, even by the 1920s, “none of the staff had received formal training.”^[10] Those employed at the HPS “took pride in holding complete knowledge of their collections in their head” and felt uncomfortable with “the new public libraries and had little interest in standardization or efficiency.”^[10]

Like many historical societies operating in the first half of the century, the HSP employed a variety of native catalog and classification schemes to organize their collections. Historical society indexes and card catalogs often

did not conform to nationally recognized standards such as Melville Dewey's decimal system, the Library of Congress's subject headings classification, or to archival arrangement and description inventories developed by the National Archives. It was enough for historical society librarians to know how to locate items requested by its patrons.

In the 1930s, under the guidance of head librarian Julian Boyd, the HSP revised its collections management program. Boyd sought to improve and monitor access to the society's collections through the use of circulation records and the publication of research guides, indexes, and bibliographies. Boyd recognized that he did not have enough staff to implement the ambitious program; it was difficult simply to reduce the backlog of uncataloged materials—including tens of thousands of pamphlets—let alone catalog current acquisitions. As Boyd himself learned, the mountain of uncataloged materials hid unknown treasures. While preparing a catalog of HSP materials for an exhibit to commemorate the 150th anniversary of the Constitution, Boyd uncovered the only known original copy of the document. Over the ensuing decades, HSP librarians and catalogers tried to keep pace with acquisitions, and in 1944 the manuscript department could claim some measure of satisfaction in having cataloged about 95% of its collections.^[10]

The HSP was initially slow in recognizing the advantages to be gained by using technology to improve library services. For example, during the period 1912–1930, when research institutions throughout the United States had begun to use new Photostat copying equipment to reproduce and circulate precious historical documents for use outside their own libraries, the HSP leadership steadfastly refused to give reproductions of its collections to other libraries. However, in the 1930s, as the society became increasingly aware of the extent to which other institutions were accumulating Photostat collections for use as reference and research materials, they adopted new policies that allowed for the photocopying and circulating of materials held in the HSP collections. Whereas the HSP was initially hesitant to adopt Photostat technology, under Boyd's tenure, the HSP adopted the use of microphotography as a method to copy and preserve its own collections and gain permanent access to original materials held by institutions.^[10]

Though historical societies were adopting professional standards of scholarship and librarianship during the first half of the twentieth century, most societies were providing library services for a limited clientele. Primarily, historical societies opened their doors to the ranks of historians and librarians; some of these professionals went on to staff historical society libraries, while others made use of historical society collections to write articles for historical society journals. The HSP, for its part, opened its doors to the general public in the twentieth century; it just did not advertise this fact. The HSP leadership and

staff “did not consider it part of their purpose to try to attract a broader audience.”^[10] However, at mid-century, many historical societies began to adapt their missions in order to provide funding and staff support for programs aimed at public audiences interested in national and local history. In the process, some historical societies learned how to connect history with popular museum exhibitions and ultimately donor solicitations.

PUBLIC HISTORY AND INSTITUTIONAL GROWTH

Over the last half-century, the number of historical societies has increased markedly in absolute terms. The mission of historical societies has also expanded with the drive to actively inform citizens through history education and public programming.

Jan Partridge, in her article about cultural heritage institutions in Australia, noted that the number of local studies centers has increased significantly since the 1950s. She cites figures based on a 1999 study conducted by Alan Bundy which indicate that 76% of public libraries in Australia possess a local studies collection.^[11] Likewise, the number of historical societies operating in the United States has increased dramatically. The Conference of Historical Societies' *Handbook of American Historical Societies* published in 1926 listed 338 national, state, and local historical societies. By the mid-1980s the number of historical societies had surpassed 9000.^[12,13]

At the local level, it has often been the case that public support for historical societies follows the commemoration of significant historical events. Jan Partridge noted that the overwhelming majority of public libraries in Australia began collecting local studies materials in the 1980s, a decade that coincided with the bicentennial celebration of white settlement in Australia.^[11] Similarly, in 1987, around the time of the centennial anniversary of the founding of Boksburg, South Africa, a local resident, Connie Nelson-Esch, published an article in the *Boksburg Advertiser* about the history of the community. The article spurred other residents to organize the Boksburg Historical Association (1993) to collect and preserve the “history of the city and its people.”^[14]

Local historical societies around the world have been aided by national organizations such as the American Association for State and Local History (AASLH) (1940), the British Association for Local History (1982), and the Federation of Australian Historical Societies (1977). Since the 1940s, the AASLH has served as a clearinghouse of information for societies in the United States and Canada. The AASLH regularly publishes a *Directory* of members, as well as how-to guides on topics like *Organizing a Local Historical Society*, *The Management of Small History Museums*, and *A Guide to the Care and Administration of Manuscripts*, as well as bulletins about topics ranging from historic house renovation to public relations.^[15]

Today most historical societies offer a good deal more than a research library collection and a catalog of publications. The experience of the Virginia Historical Society (VHS) in the postwar years highlights two significant trends in the development of historical society missions. Over the last 30 years, historical societies have assumed a larger role in educating the public about their collective past. At the same time, historical societies have found it necessary to adopt corporate models of business management particularly in regard to advertising and fund raising.

In 1978, the VHS changed its executive committee structure replacing the formerly self-appointed executive committee with an elected board of trustees. With this institutional change came an incremental shift in the VHS's focus away from its traditional emphasis on developing its research collection and offering library services to a selective academic clientele. In the wake of the United States Bicentennial, the trustees of the VHS became aware of the growing commitment of universities, museums, libraries, and other historical societies to engage students, teachers, and the general public in historical conversations about the nation, freedom, diversity, and unity.^[16] In particular, scholarly debate and public discussion embraced a new social history of underrepresented historical figures. Indigenous populations, minorities, and women, and broad social movements for labor and civil rights found expression in public exhibitions, lectures, and education programs.

The VHS began offering its first public museum exhibits in 1987. It would later add theme exhibits such as the Jewish experience in Virginia, racism, and labor. Along with museum exhibits, the VHS took active steps to help shape history education curriculum for teachers and deliver new historical materials to students. The VHS initiated an education program under a separate department in the mid-1990s. Among the many programs initially sponsored by the education department of the VHS were school tours of the museum and library, docent training for volunteer staff, the writing of educational primers for teachers, and guest lectures at affiliated educational institutions. By the mid 1990s, the VHS's mission statement included a research library, a museum and historic houses, traveling exhibits, lectures, and programs, training and services for students, educators, and other local history societies, book and periodical publications, fellowship programs, and collaborative archival projects. With the wealth of public programming being made available, the question became how to pay for it all.^[17]

For the VHS, the postwar years were years of growth: by the mid-1970s, the VHS added over 6.5 million processed manuscript items, while the photographic and print collections doubled in size. For most historical societies, meeting the demands of an expanding collection, an aging building, and technology upgrades required the infusion of millions of dollars. In an era of shrinking federal and state budgets, this could only come from private and corporate donors. The VHS undertook its first

large-scale donor solicitation program in the late 1980s with the Center for Virginia History and the Fifth Century Campaign to raise \$12 million for capital construction. In order to reach its goal, the VHS had to sell itself to the public, and this required publicity. The VHS established a publicity office in 1988 and a development office soon thereafter. The society opened its first corporate-sponsored public event in 1989, an exhibit of the society's premier object collection. Over the next two decades, the VHS solicited close to \$100 million with much of the proceeds earmarked for the support of public programming such as a new 10,000 sq. exhibit hall. By the late 1990s, the VHS maintained a permanent museum exhibition, and offered 8–10 temporary installations per year, while drawing an average of over 20,000 visitors annually.^[17]

HISTORICAL SOCIETY AS DIGITAL LIBRARY

Historical societies are currently collaborating with partners from other academic and cultural heritage institutions, as well as professionals in the fields of education and information technology to create digital content that is accessible on the Internet and the World Wide Web. Historical societies are making use of digital scanners and camera equipment to capture images of text documents, photographs, and objects that can be easily stored in multiple file formats and integrated into an online public access catalog. The introduction of lower-cost, user-friendly digital capturing, storage, retrieval, and networking technologies, along with the development of nationally recognized standards for digital cataloging and description metadata has greatly enhanced the means through which small and medium-sized historical societies can preserve and provide access to their unique collections such as phone directories, loose sheet maps, or post cards.

Over the course of the last decade, historical societies have developed digital libraries as a means to reach out to larger communities of users and provide a nexus for collaboration between scholars, students, teachers, and amateur historians. State and local repositories including historical societies are establishing digital consortia to facilitate cooperative collecting of historical records that document a particular social theme, historical era, or ethnic group. These cooperative collections emphasize the institutional strengths of individual historical societies and support the needs of educators, researchers, and students. The Oregon Historical Society (OHS), for example, has joined with Washington State University and the state historical societies of Idaho and Washington to create a tristate Columbia River Basin Ethnic History Archive (CRBEHA). The goal of the project “was to identify, digitize, and describe library and museum collections concerning non-Native American ethnic groups of the Columbia River Basin, and to stimulate public use of and

discussion of those sources.” Principally, the CREBHA project allowed the OHS to pursue its mission to raise public awareness about its collections and develop educational resources.^[19] In this regard, the OHS was able to provide public access to some of its vast collection of photographs and family papers.

The Web portal developed by the CREBHA consortium offers direct access to selected historical records and novel ways of collocating records based on key word searches. The Columbia River Basin Ethnic History Archive also offers interpretive tools for users and teaching aids, and allows for the migration of content pointers and metadata from one database or catalog to another through the Open Archives Initiative-Protocol for Metadata Harvesting.^[18]

The introduction of new technologies has not significantly altered the mission of historical societies to collect, preserve, and disseminate the records and material culture of a specified place, people, way of life, or event. However, the digital library environment and electronic publishing do offer efficient and inexpensive means for historical societies to provide access to their unique collections, present rich, interactive educational content, and, perhaps most importantly, collaborate with other historical societies and cultural heritage institutions to build fully searchable, subject specific digital catalogs.

CONCLUSIONS

Historical societies will continue to provide a number of services to the public in the digital age. Historical society librarians will produce a variety of research and reference materials including bibliographies, indexes, guides to the collection, and educational materials. As with librarians more generally, society librarians will answer reference questions about local and national history, geography, current events, institutions, and personalities. However, in fulfilling the mission of historical societies to collect, preserve, and provide access to historical records, librarians and archivists will increasingly rely on computer technology such as digital scanners, Web design tools, e-mail, and chat programs to develop and manage their unique collections and provide reference services. The process of digitizing historical collections will raise many significant challenges for historical society staff, not the least of which will be acquiring skills in database design, navigating copyright law and fair use provisions in a digital environment, and securing continued funding for the preservation of digital and non-digital content. Historical societies will, however, find technological, financial, and legal support through consortia partnerships with research universities. Ultimately, the unique collections of historical societies will be widely shared for the purposes of research, public exhibitions, and educational programming.

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Historical Sources and Their Users

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Abstract

This entry discusses the evolution of historical study from its beginnings in the realm of mythology to the present complex world of multiple audiences, multiple approaches, and a scope that touches virtually every area of human endeavor. Paralleling this evolution of scholarship has been a constantly expanding universe of sources deemed appropriate to provide the evidence upon which historians base their assertions. The related topic of scholarly communication among historians also receives attention.

INTRODUCTION

This entry will attempt to show how the world looks from the historian's point of view. It will discuss the values and priorities of historians. It will endeavor to illuminate the relationship between the questions they pose and the sources they use, and to shed light on how both internal and external forces are changing the enterprise.

History—writing about the past, not the past itself, which is also “history”—is an endeavor, activity, and discipline of great complexity, with little unity and an internal logic that is often contradictory. It is like an old mansion with many rooms that has been periodically added to and remodeled to suit succeeding generations. Despite extensive modification, however, a basic structure remains. The business of history was and is to provide answers to two fundamental questions: what happened and why did it happen? New additions have not changed this fundamental purpose.

Answers to those questions require evidence. The evidence may be obtained from written documents, from objects, from pictures, from oral accounts, or from any other source that contains relevant information. Records created at the time the event under investigation took place are called primary sources and offer an inside view of the event; they are the heart of any research project. Sources that interpret and analyze the event are created later and are called secondary sources. The distinction between primary and secondary sources is always relative. If, for example, someone is doing a study of Irish immigration to the United States, records like ships' registers, records of the ports of departure and arrival, and letters written by the immigrants are all primary sources. Newspaper stories and other commentaries about that immigration would be secondary sources, but could themselves be primary sources for a study of popular reaction to Irish immigration. The scholarly writings of historians themselves can become primary sources, as when the views of the nationalist German historian Heinrich von Treitschke

(1834–1896) are examined in a study of the tradition of Prussian militarism.

History depends upon a sense of linear time: there is the present; there was the past; and there will be the future. Each is different from the other and the past does not repeat itself. History also depends on the presence of a belief that an understanding of the past can illuminate present realities and that the present will influence the future.

Historical scholarship and writing serve multiple purposes. The results of such scholarship increase our understanding of human nature. They can be used to glorify the achievements of a group and to strengthen a sense of group identity. They can create myths and they can debunk myths. They provide explanations for present conditions.

It is no accident that the nineteenth century, during which nationalism spread and flourished in Europe, was a period of major development of the discipline. During the nineteenth century, many of its practitioners wrote to reinforce emerging states or to advance the claims of ethnic groups to their own state; Frantisek Palacký's (1798–1876) *Dejiny národu českého v Čechách a v Moravě* (*History of the Czech Nation and Moravia*) is credited with a major role in the development of Czech national consciousness. Not only did Palacký celebrate the Bohemian past, his use of the Czech language—in the nineteenth century Austro-Hungarian Empire Czech was the language of the peasants of Bohemia—in the volumes published in 1848 and after was highly symbolic. Twentieth century historians interested themselves in additional types of groups, such as those defined by age, by sex, by ethnicity, and by social and economic characteristics.

Those who have helped make history—the events, not the writing about the past—have often written their version of what happened in pride or self-exculpation. Among the best have been the *History of the Rebellion*, a history of the English Civil War by Edward Hyde (1609–1674), advisor to Charles I and Charles II, kings of

England, the *Personal Memoirs* of U.S. Grant (1822–1885), General in Chief of the Union forces in the American Civil War, and *The Second World War*, by Winston Churchill (1874–1965), Prime Minister of Great Britain during World War II. Now, a memoir by presidents and commanding generals is almost *de rigueur*.

How history is written can be as important as what is written. Originally, historical writing was one form of literature. Not until the development of professional history in the nineteenth century did the distinction develop between history written for historians and history written for Everyman. Today, both categories of publication flourish, although they are usually quite separate. In addition to the many books published every year by scholars and intended primarily for other scholars, there are many books on historical topics published in the hope that they will sell to and be read by a general, popular audience. In the United States, historical topics of perennial popularity are the American Civil War and World War II.

THE EVOLUTION OF HISTORICAL SCHOLARSHIP: THE BEGINNING

The writing of history has its own long history. Although they are not based on historical evidence, the creation myths that are among the earliest literature to survive are attempts to explain the past. The growth of kingdoms and empires produced annals and chronicles of events; royal chronicles date from the Middle Kingdom period of Egypt (21st–18th century B.C.). Such chronicles tend to be brief recitations of facts, but they are nonetheless a form of historical writing and have their modern counterparts, such as Elizabeth Stone's *American Library Development, 1600–1899* (1977) which gives a chronology of important occasions in American library history, but no narrative establishing connections or interpretations.

The first true historians in the West are considered to be Herodotus (c. 484–after 424 B.C.), who wrote about the Greek wars with Persia, and Thucydides (c. 460/455–399 B.C.), who wrote about the wars between Athens and Sparta. In China Ssu-ma Chien (145–90 B.C.) is usually given that honor. Thucydides wrote about war and politics as did Herodotus, but Herodotus was also interested in different peoples and their cultures. Ssu-ma Chien wrote treatises on the economy of China and on the control of its rivers and canals. What distinguished the work of these historians from that of the chroniclers was that they made an effort not only to state what happened but also to explain why it did. In addition, they paid attention to the accuracy of their sources. This combination of emphasis on sources and interpretation of the information they provide has remained a constant of historical writing through the centuries. As Sir Charles Oman wrote in 1939, "History, then, is the investigation of evidence, written or

sometimes unwritten, about series of events concerning which we are able to make some conclusion."^[1]

Historians of the late classical period and the Middle Ages carried on and expanded the genre. Sallust (86–34 B.C.) attempted to make connections between events; he portrayed the rivalry between the Roman generals Marius and Sulla to dramatic effect. Both the Venerable Bede (c. 672/673–785), an English monk, and Einhard (c. 775–840), a German monk, wrote biographies, Bede of the abbots of Wearmouth and Jarrow, Einhard of Charlemagne. In the Islamic world, Ibn al-Athir (1160–1233) produced annals of world history; Ibn Khaldun (1332–1406) constructed a model of dynastic rise and decline in his history of the Arab and Berber dynasties of North Africa. In the writings of these periods one can find examples of persisting features of historical scholarship, such as attention to sources. The Roman historian Tacitus, for example, is known to have used the official records of the Roman state, both the minutes of the Senate and the collection of the acts of the government. Bede used both documentary and oral sources. Writing about events that the historian has participated in, such as the *Anabasis* of Xenophon (431–355 B.C.), is another continuing feature of historical writing, as is the effort to obtain rewards, exemplified by Froissart (c. 1337–1405), the chronicler of the Hundred Years' War, who modified the editions of his *Chronicles* to appeal to his successive patrons.

THE EVOLUTION OF HISTORICAL SCHOLARSHIP: THE RENAISSANCE AND ENLIGHTENMENT

A shift to greater emphasis on interpretation and historical causation can be observed in the histories written during the Renaissance period. Niccolò Machiavelli (1469–1527), best known as the author of *The Prince*, was the historian of the City of Florence and wrote a history of that city–state. He took the Roman historians Sallust and Livy (59 B.C.–c. 17 A.D.) as his models and sought to illuminate universal principles and general laws. The *History of Florence* can be read as a commentary on historical method.

The Enlightenment of the eighteenth century increased the emphasis on analysis and the description of change over time in historical writing. The eighteenth century also produced the man many consider the greatest historian of all time, Edward Gibbon (1737–1794), author of *The Decline and Fall of the Roman Empire*. Gibbon's approach was to combine the new "philosophic" fashion in historical writing exemplified by such men as David Hume (1711–1776), with the antiquarian tradition and its emphasis on accuracy. Gibbon is also noted for broadening the range of source materials used; his use of the critical geography of Jean Baptiste Bourguignon d'Anville (1697–1782) and the publications of the Académie des Inscriptions are only examples.

THE EVOLUTION OF HISTORICAL SCHOLARSHIP: THE NINETEENTH CENTURY

The nineteenth century brought a constellation of changes. In 1800, most historians in Europe and the United States were amateurs and probably independently wealthy. By the end of the century they were far more likely to be professionally trained university professors. During the century universities expanded both in number and in the range of subjects in which advanced study was possible. New areas of study, of which history was one, were added to curricula that had their roots in ancient Greece. Study beyond the undergraduate level offered a means of professional preparation. The growth in higher education made it possible for those with historical interests but modest means to earn a living as historians. Simultaneously, scholarly periodicals devoted to history were established, such as the *Historische Zeitschrift* in 1859, and organizations dedicated to historical scholarship were founded, such as the American Historical Association in 1884.

In much of this extension and amplification of the historical enterprise, Germany—and one man in particular—led the way. Leopold von Ranke (1795–1886) is often described as the “father” of modern historical scholarship. Responsible for the exhortation to write history “wie es eigentlich gewesen ist” (as it really was), Ranke wrote voluminously. His first major work was the *Geschichten der lateinischen und germanischen Völker* (History of the Latin and German Peoples) which appeared in 1824 and included an appendix in which he set forth a distinctive historical methodology. His last was an ambitious world history that he was working on at the time of his death. In between, came—among others—books on the Ottoman and Spanish empires in the sixteenth and seventeenth centuries, a history of the Roman papacy in the four preceding centuries, books on Germany in the time of the Reformation, and on Prussia, not to mention books on Britain and on France. His work demonstrated what would become the creed of the professional historian: intensive research, usually in records created as close to the events as possible; and interpretation of the findings, which usually meant an attempt to distinguish between significant and details.

His own scholarship, however, was only a part of Ranke’s contribution to history. Beginning in the early 1830s, Ranke trained in his seminar at the University of Berlin the first generation of professional historians, men like Georg Waitz, Theodor Mommsen, and Jakob Burckhardt. One student, Maximilian II, king of Bavaria, established an historical commission within the Bavarian Academy of Sciences. For the remainder of the century, German universities were the places to go for the best historical training. American historians who studied in Germany included George Burton Adams (1851–1925) of Yale, William Dunning (1857–1922) of Columbia, Albert Bushnell Hart (1854–1943) of Harvard, and Clarence

Alvord (1868–1928) of the University of Illinois. J. Franklin Jameson (1859–1937), longtime first editor of the *American Historical Review*, was notable as the first American historian of distinction who had not studied in Germany.

Ranke also contributed to the development of the discipline with his attempt to found a scholarly historical periodical. The *Historisch-Politische Zeitschrift* (1832–1834) was in fact more political than historical, but it attempted to provide an historical background for current political problems. A second abortive effort was the *Zeitschrift für Geschichtswissenschaft*, founded by Adolf Schmidt (1812–1887) in 1844. The void was eventually filled by the *Historische Zeitschrift*, begun in 1859 by Heinrich von Sybel (1817–1895), which continues today. Both Schmidt and von Sybel were among Ranke’s students.

THE EVOLUTION OF HISTORICAL SCHOLARSHIP: THE SPREAD OF HISTORICAL SCHOLARSHIP

By 1900, German innovations were spreading and other features were being added. In the United States, for example, the first doctoral degree in history was awarded in the 1870s. Universities and colleges had begun to establish departments of history. The American Historical Association was founded in 1884 and the *American Historical Review* in 1895. Some universities had set up presses to publish the results of scholarship; historical scholarship was prominent on their lists from the beginning. There were, of course, national variations. In England and France, the pattern was less one of addition than of modification of older forms to new purposes. In non-European countries these developments came later, but today almost every developed country or one with aspirations for development displays similar patterns.

These nineteenth century innovations, the introduction of new canons of scholarship, the development of opportunities for advanced study in history, the foundation of organizations devoted to history, and the creation of media for the dissemination of scholarship did not, however, mean the disappearance of older patterns. Individuals who were not academically trained continued to write history, books on historical topics intended for general readers continued to be published, and articles on historical topics continued to appear in general intellectual periodicals like the *North American Review* and *Atlantic Monthly*. Among examples of American historians without formal historical training who did distinguished work at this time were Francis Parkman (1823–1893), author of the classic *The Oregon Trail*, and Henry Charles Lea (1825–1909), best known for his work on European religious history. Barbara Tuchman (1912–1989), author of *The Guns of August* (1962), is a more recent example.

THE EVOLUTION OF HISTORICAL SCHOLARSHIP: DIVERSIFICATION

The development of this integrated structure of education and publication of research brought expanded opportunities. Historical scholarship increased in quantity and diversified. While the characteristic publication format of the nineteenth century was the multivolume history, the formats of the twentieth century were the scholarly monograph and, increasingly, the scholarly article. These newer formats both contributed to and were the result of the increasing specialization of the field.

Initially, specialization tended to be by geographic area. American historians began to identify themselves as historians of a region, such as the South, the Mississippi Valley, and the West. In departments of history in the United States, the number of historians specializing in various European countries, beginning with Great Britain, increased and other areas like Asia began to be represented as those areas became of interest to Americans. Topical specialization followed; economic history and social history were added to traditional political history. In 2007, the history department of the University of California, Berkeley, a major research university and leader in doctoral study in history, had faculty who identified their specialties as Reformation Germany, comparative civil rights, women in Mexico, the history of biology, the history of crime in the United States, Chinese popular culture, and African health and gender.

Periodicals reflect this trend toward specialization. There are journals to match each of the specializations named in the Berkeley history department, journals of women's history, journals of religious history, journals of German history, journals of African-American and African history, even a journal of criminal justice history, and a journal of the history of biology. Specialization in periodicals has progressed to the point where some journals are doubly specialized, such as the *Journal of African Economic History*. There are also journals that are specialized by what one might call outlook, such as the *History Workshop Journal*, which was founded on the premise that history was a collaborative enterprise involving all interested parties. And there are interdisciplinary journals in which history is an element. When writing an article, the historian must decide which journal is the journal in which he or she would like to have the article published. That choice will affect emphases of presentation and can influence the research process to a certain extent.

University presses, the primary publishers of book length historical scholarship, also show some specialization, but theirs is more limited, since their mission is the much broader one of the advancement of scholarship rather than the advancement of one particular piece of it. A press may have a series in an area as the University of California Press does in the History of the American Cinema. Alternatively, it may lack a named series but still

have a recognized interest in an area as the University of Alabama Press does in Alabama history and the University of Notre Dame Press does in Roman Catholic history. In recent years, pressures on university presses to emphasize sales potential have forced many to publish more books on American history, for example, than on European history, as well as more non-scholarly books.

THE EMERGENCE OF THEORY

Another differentiating feature of historical scholarship that has developed in the last century and a half is that of theory. Theory in history is not the same as theory in the natural sciences, although it shares some of the same properties. In the natural sciences, theories are usually the result of experimental research. They are an explanation for a set of data or a model that can be tested by experiment. In history, theories are not subject to testing. They offer explanations, but have more in common with the older and more amorphous concept of world view or *Weltanschauung* than they do with scientific theories. They function as an approach or an intellectual framework rather than a true theory. According to John Tosh, theories in history arise because of the difficulty of understanding the interrelatedness of all aspects of human experience at a given time and because of the nature of historical change and lack of change. A theory may also attempt to provide an explanation of the overall direction of historical events.^[2]

Although historical theories have been particularly prominent in the late twentieth century, theory has been part of historical scholarship since Ranke. Until the end of the nineteenth century, the dominant principles of historical scholarship were those of historicism, a creed shaped by Ranke and his students. Historicism (Ger. *Historismus*) was, in fact, so closely identified with historical scholarship that for a longtime historical scholarship was defined by it. It emphasized the importance of close research in historical sources and the centrality of the state and political events and, by extension, defined what constituted proper subjects for historical inquiry. In contrast to Hegel's dialectic theory of history, Ranke's view was that each event is unique and an outgrowth of particular local conditions.

Not until late in the nineteenth century was there a serious challenge to historicism, a challenge usually associated with the name of Karl Lamprecht (1856–1915). Lamprecht criticized both historicism's emphasis on the state and its emphasis on political events. He urged more attention to economic and social issues, and—influenced by the newly emerging area of psychology—can be considered an early proponent of the study of *mentalités*, a concept used to describe the collective attitudes of a group. Stifled by the German historical establishment, Lamprecht's influence in Germany was largely outside

the universities and limited to regional and local history. Outside of Germany, however, his ideas were much more favorably received, as in France and the United States.

However novel his ideas about what should be studied, Lamprecht did not challenge the fundamental principle of close attention to sources. Like Ranke, he used archival collections, but where Ranke sought information relative to political developments, Lamprecht sought information relevant to social and economic developments. Ranke used repositories like the Archives nationales in Paris, the Public Record Office in London, the Central State Archives of Moscow, the Vatican, and the Venetian State Archives, Lamprecht used ecclesiastical and city archives in the Rhineland, as well as manuscript collections in libraries and private hands. Ranke's evidence might come from the reports of the Venetian ambassadors, Lamprecht's from manorial records, but the appropriateness of a particular document depended upon the questions asked rather than the form.

In contrast to the relative stability of outlook of nineteenth century historical scholarship, the twentieth century saw a succession of "theories," each one attracting a share of attention and adherents, only to be joined by yet another that attracted its own attention and adherents. The most influential of these multitudinous approaches have been those of the Annales School, the Marxist historians, the historians who have devoted themselves to the study of a particular, hitherto ignored group such as women, and the postmodernists. No single outlook succeeded in vanquishing all others or achieving dominance and the pattern has been one of addition rather than replacement. For the individual historian, these theories have not necessarily been mutually exclusive. It has been entirely possible for a historian to be simultaneously a feminist historian and a Marxist historian; the founders of the Annales group were Marxists. In the twenty-first century, enthusiasm for such intellectual structures seems to be decreasing, as Lynn Hunt, a former president of the American Historical Association, suggested in one of her columns, "Where Have All the Theories Gone?"^[3] Historians of different persuasions, however, continue to write history that is influenced by one or another outlook, even if the theoretical controversies are less strident.

The most robust of the various theoretical offerings has probably been that of the Annales group. Named for the journal founded in 1929 by Marc Bloch (1886–1944) and Lucien Febvre (1878–1956), the Annales School was characterized by openness, openness to new methods, and openness to new objects of study. Their guiding principle was that of total history (*histoire totale*); another concept identified with them is that of *mentalités*. One important member of the group, Fernand Braudel (1902–1985), contributed a unique approach to time, conceiving historical phenomena as having three periods: the *longue durée*, a period of long, centuries-long, stability in human experience, determined by such factors as climate and modes of

production, the *moyenne durée*, a period of a major trend, particularly economic cycles, and the *courte durée*, a period of a brief phenomenon like a political movement, not lingering enough to be a trend. The breadth of what was considered appropriate for study is reflected in the various names of the *Annales*, one of the more recent of which was *Annales: Économies, Sociétés, Civilisations*. Braudel's book, *The Mediterranean and the Mediterranean World in the Time of Philip II*, (orig. Fr. ed., 1966) epitomizes this breadth, both temporally and in terms of subjects, as well as by the author's attention to the writing of historians from the entire region, not only those of Western Europe. The Annales group also looked to the developing social sciences for methods and insights, early leaders in what would become a common practice.

Marxist history asserts the primacy of economic, rather than political or cultural factors, as "the engine of history." Marx's concepts of class, capitalism, and production are used to interpret events. How these ideas should be applied in historical scholarship has been the subject of debate, and individual Marxist historians have increasingly added additional components to their thinking. They have tended to interest themselves in economic history or in social and cultural matters relating to the lower classes. Frequently cited examples of works by English-speaking Marxist historians are E.P. Thompson's, *The Making of the English Working Class* (1963) and E.J. Hobsbawm's *The Age of Revolution: Europe, 1789–1848* (1962) and *The Age of Capital, 1848–1875* (1975).

Other important approaches have come from historians of gender and historians of other disadvantaged groups. These groups have found new questions to ask, new sources from which to obtain evidence, and new ways to examine previously examined events. Often inspired by personal activism, they have revealed their subjects as actors, not passive objects, and full participants in the creation of the present world. Joan Scott is a prominent gender historian.

One of the most recent schools of thought is that of postmodernism, a complicated constellation of ideas drawn from philosophy, linguistic theories, and textual criticism. In the nineteenth century, historians tended to be positivists, to believe that the past was knowable. Historical knowledge was achieved using the historian's version of the scientific method, immersion in the sources, and generalization from the evidence obtained. Historians assumed that others who used the same sources and the same techniques would come to similar conclusions. In contrast, postmodernism casts doubt on the possibility of a shared understanding of the past, a view reinforced by radical relativism's position that absolute truth does not exist. Instead, understanding depends on the reader's cultural and ideological context and, by virtue of living in another time, the historian can never share the cultural and ideological context of the document. At most, the scholar can situate a text within different discourses. Pushed to its

extreme, this position questions the possibility of historical knowledge. On the positive side, it has strengthened interest in cultural history.

These approaches hardly exhaust the varieties of approaches to historical scholarship. Some types, such as quantitative history, are more methodological practices than anything else, offering useful approaches for historians of vastly different interests. Historians, especially economic historians, have long concerned themselves with numbers, but perhaps influenced by the use of statistics in the social sciences, the use of numbers in history has considerably increased in recent years, an expansion facilitated by the development of computers. Quantitative techniques can be applied to a variety of situations; R.W. Fogel (1926–) worked on subjects as diverse as railroads, slavery, and hunger and premature death in modern populations. Other approaches draw on insights from fields outside history, like anthropology and sociology.

THE SOURCES

The character of the primary sources used by scholars in the twentieth century shows somewhat more variety than those of the nineteenth century, but overall there is a remarkable stability. The references in the articles of the first volume of the *American Historical Review* (1895–1896), a journal that has great prestige and includes history of all times, places and subjects, were compared with those in its 111th volume (2006). In both volumes, the primary materials used by the authors were almost exclusively manuscript records or printed primary material. Exceptions in the 2006 volume were a Web site that provided documentary evidence (a speech by the Tony Blair, British Prime Minister from 1997 to 2007) in one article and photographs that were a significant source of information in another article. An exception in the 1895/1896 volume was an interview in which the author of the article on the Underground Railroad had spoken with “an intelligent colored man—a barber, J.J. Minor by name,” who had been an agent on the Railroad.^[4] The citations to secondary sources in the two volumes, on the other hand, are quite different. In the 2006 volume there are abundant references to the monographs and articles of other scholars. There are virtually no citations to any kind of secondary material in the 1895/1896 volume. That difference reflects the paucity of historical scholarship in the late nineteenth century and its abundance in the early twenty-first.

History has been and continues to be largely identified with written records, but in the twentieth century the definition of appropriate source has expanded to include many kinds of non-written records. The desire to explore the history of peoples who have not left written records behind or who appear only in the written records of others inspired creativity. A particularly good example of this

new inclusiveness is recent scholarship on African history. Jan Vansina (1929–), a Belgian who after training in medieval history was appointed a researcher in anthropology in the Belgian Congo, pioneered the use of oral sources. Growth in types of sources used to write African history has progressed to the point where evidence not only from oral sources is used but also evidence from linguistic, botanical, biological, archaeological, and artistic sources.^[5] Nor is it only in less well documented fields that such alternative sources are used. Historians in general, impressed by what anthropology and sociology have achieved, show growing interest in their methods and sources of information.

A new project in history can begin in different ways: either a historian finds a question intriguing and decides to investigate it or a historian finds a collection of materials that promises to answer questions about an interesting topic. That collection may be newly discovered, as were the records of Cahokia, the first French settlement in Illinois to survive for any length of time, that were found by Clarence Alvord (1868–1928), or it may be a collection that has used by previous historians, but not used in the way the newcomer envisions. For the historian who begins with a question, the next step is the location of appropriate sources; for the historian who begins with the collection, the next step is immersion in the source.

How does a historian who begins with a question locate appropriate sources? The answer depends on what kind of sources are sought. Primary sources can be identified by the use of guides to archives and special collections, many of which are now available online, bibliographies of manuscripts, and in the bibliographies of scholars who have written on closely related topics. Conversations with knowledgeable archivists can be invaluable. Some primary sources are printed, either transcriptions of manuscript records, like the *Monumenta Germaniae Historica*, the great series of sources for German history begun by the Prussian statesman Freiherr vom und zu Stein (1757–1831) in 1819 or because the evidence the historian seeks originally appeared in a book, pamphlet, or government document.

For a book on public libraries in Nazi Germany material was located through guides to German archives, through inquiries directed to every provincial and city archives, through inquiries to existing provincial library administrations, and through inquiries to larger libraries about their own records. Printed reports of contemporary library agencies were identified through the German national bibliography. Librarians contacted frequently identified surviving librarians of the period who might be willing to be interviewed; one librarian had an important document in his possession. Secondary material was found through bibliographies and indexes and in books and articles on related topics by other scholars. Imagination, an eye for clues, and persistence are all essential. For that book on public libraries in Nazi Germany, the mention of

a 1931 attack on the collection of the public library in Rostock in a document in one repository led the historian to write to the Rostock Public Library, which forwarded the query to the university librarian in Rostock, who had done research on the episode and graciously shared his results.

The importance of archives and manuscript collections to the historian cannot be overstated, although for some topics, particularly those where quantitative methods are used, the same statement could be made about published sources like censuses, statistical reports, etc. Fortunately for the historian, governments, religious bodies, organizations, and other enterprises need to know what their actions and decisions were. Archives, defined as either a collection of records and historical documents or the place in which they are collected, date back to the ancient classical world.^[6] For the most part, however, institutions that store and service records are a modern creation. With the exception of the Papacy, heir to the Roman Empire, political entities in Europe did not begin to make formal, centralized arrangements to regulate the preservation of their records until the late eighteenth century. The Archives Nationales of France was created in 1790, the Public Record Office of Great Britain followed in 1838. The National Archives of the United States was finally established in 1934.

Public access to archives followed. After an 1851 petition signed by 83 individuals, including Charles Dickens, Thomas Babington Macaulay, and Thomas Carlyle, the right of access to the Public Record Office for scholarly purposes was granted. By early in the twentieth century, however, the interests of scholars in archives were generally acknowledged, and American historians were among the interest groups that pushed for the National Archives.

Not all records, of course, are open for to the public for use. Some government records may be closed for security reasons or what one might call pseudo-security reasons, such as the attempts of the second Bush presidency to reclassify unclassified documents to protect its actions and policies from scrutiny. Privacy concerns affect access; stringent laws have been passed in some countries to protect the privacy of individuals. Nongovernmental records, such as the records of organizations and businesses and the papers of individuals, are private property and may remain in the custody of the organizations and individuals that created them or of their heirs and successors; they may not have been opened to scholars.

Limitations imposed by inefficiency, bureaucratic indifference, and design also impede historical research. Records may have been destroyed by those who hope to protect reputations; the famous erasures on the Nixon tapes by his loyal secretary, Rose Mary Woods, are a prime example. Less purposeful but no less final is the destruction of records by administrators who considered them no longer worth bothering about. Many records never reach appropriate repositories and will not,

therefore, be used; how many records lie buried in dusty file cabinets in the office where they originated or forgotten in some storage area can only be imagined.

Underfunding of archives and records management programs can create major problems. As of the summer of 2006, the National Archives of the United States had over 1,000,000 feet of undescribed records. Those million feet of almost certainly unclassified documents contain useful information on some historians' topics, but they have no way of verifying that fact. A historian should be smart enough to figure out that the records of the Agency for International Development will contain information on United States foreign aid even if there is no guide to them, but in which boxes, folders, and documents the desired facts reside will remain a mystery until they are described at the folder level—unless, of course, the historian is willing to go through, box by box, folder by folder, sheet by sheet, however many hundreds of feet of records there are.

Although many of these limitations are present in the United States today, a rich array of archives is in place, beginning with the National Archives, and includes state and municipal archives, archives of organizations like the Rockefeller Foundation, as well as archives of numerous churches, businesses, and groups. In addition, there are many special collections of the papers of prominent individuals that are either housed in independent institutions like the presidential libraries or have been deposited at some library or archival establishment. Other countries have their own counterparts; the richness depends on the financial resources available and the priorities of those responsible for collecting and preserving the records. These collections make possible historical scholarship, and research in an archives is typically the defining experience of a historian in the same way that field research is usually the defining professional experience for the anthropologist.

Once a relevant source is identified and located, the next question is, is it trustworthy? With modern records, that is rarely a problem. In all probability, the records moved directly from the organization where they were created to the archives. The records themselves may contain information that is untrue or misleading, but the misinformation was either recorded in good faith by a creator who believed it to be true or was recorded by someone who wished to influence an intended reader in a particular direction. It is the historian's job to separate truth from falsehood, to weigh what is in the records, and to compare it with information from other sources. Modern history offers a few examples of deliberate fakes like the Hitler Diaries of 1983, but such frauds are usually detected early.

Earlier sources, however, are more likely to be either fraudulent or altered. In the early modern period, interest in history largely focused on religion and the Church. Concerted efforts to copy and publish manuscripts relating to the lives of saints and the history of the Church began in

the late sixteenth century. These great collective enterprises were carried out primarily by the Bollandists, an association of Jesuit scholars, and the Maurists, a congregation of Benedictines.^[7] Because the souls of men and women were at stake and because the preceding centuries had seen a flourishing market in religious fakes, standards needed to be developed to identify fraud. In defense of his work on the Benedictine charters of St. Denis, Jean Mabillon (1632–1707) published *De re diplomatica* (about Diplomatics) in 1681. This work defined principles for determining the authenticity of medieval manuscripts and charters and in many respects has not been superseded.

TECHNOLOGY

As far as historians are concerned, technology has had both positive and negative consequences. The introduction of printing, by making possible multiple copies of the same document, increased the chance of its survival. The introduction of the typewriter in the late nineteenth century vastly improved legibility. The telephone, on the other hand, has been detrimental. By its nature a telephone conversation is evanescent. Only in the rare cases in which a recording was made or a conversation summarized in a memorandum or other communication is there a record of what was said.

The development of digital records has affected the historical enterprise in the identification of source materials, in access to source materials, and in the creation of source materials. Historians, like those in other fields, have benefited from the creation of machine-readable bibliographic databases brought by the advance of library technology. There are now numerous databases that include indexes to periodical literature, like *Historical Abstracts*, and some that offer the full texts of articles, like *JSTOR*, as well as online bibliographies and catalogs that list books, pamphlets, and manuscript collections, like *WorldCat*. Because they are so convenient and accessible, historians use them far more readily than they ever used their print counterparts.^[8,9] Many guides to individual collections have been made publicly accessible by repositories, like the finding aids for the archives of the American Library Association at the University of Illinois Archives. Some repositories are also making the materials themselves digitally accessible, like the C.S.S. Alabama Digital Collection at the University of Alabama Library (<http://www.lib.ua.edu/libraries/hoole/digital/cssala/main.htm>). And there are programs underway to digitize books, like the Google Book Project and Project Gutenberg, which will increase access to both primary and secondary source books.

As far as historians are concerned, the leading challenge of digital records lies in the third area, digital records as primary sources. Since about 1960 an

increasing proportion of all records has been created digitally, whether the creating body is a government agency, a business firm, or an individual. For many of these records there is no paper equivalent; the electronic voting machine, for example, generates no hard copy register of the votes. As more recent times become the object of historical study, digitally produced sources will increasingly be the sources of the evidence on which historians base their accounts.

Why are they such a challenge? One reason is their sheer volume. The ease of creation of an electronic record, paired with a general trend to ever more documentation by increasingly legalistic and regulated societies, has brought superabundance. Nor is this abundance always well controlled. The physical presence of paper forced individuals and offices to create and use filing systems. Such systems are possible in a digital environment, but individuals appear to use them less consistently.

The inexorable progress of technology, both of hardware and software, brings other problems. Files created before an office's last upgrade often cannot be read. Records were created during the Vietnam War using systems that have long since been superseded and replaced. Their conversion is sometimes possible, but if it is, it is costly. There are also preservation issues. We know the problems the preservation of paper poses; we are only beginning to discover those posed by electronic records. Every other format of information storage degrades; there is no reason to think that digital information will be immune.

HISTORY AND THE PUBLIC

As with many areas of activity, history has popular appeal. Because knowledge of the history of one's own country is regarded as a vital element in the socialization of citizens, some history is included in most high school-level curricula. This practice provides most students with at least a minimum level of knowledge and sometimes stimulates interest in history in later life.

Many publications are available to those who are interested in history. Commercial presses publish numerous biographies and other works of history. Such works involve research, but they are usually written in a more accessible style than works of historical scholarship intended for historians, usually emphasizing the story rather than analysis. Historical fiction is another way in which history reaches a wider audience. It can be very good, like the Captain Horatio Hornblower series of C.S. Forester (1899–1966), or it can be very bad, like the typical "bodice ripper." There are also historical journals intended for the interested public, such as *American Heritage* and *History Today*.

Local history attracts many amateur historians. Many cities and counties have societies dating back to the

nineteenth century that hold meetings and offer history-related activities. Frequently, they publish a periodical or some other type of publication. The county of Somerset in England, for example, has both the Somerset Archaeological and Natural History Society, founded in 1849, that publishes proceedings and various other papers and pamphlets, and the Somerset Record Society, founded in 1886, that publishes transcriptions of original documents relating to Somerset, like the 1342 Feodary of Glastonbury Abbey.

Modern means of communication have also been used to create and to disseminate historical products. Many films and television programs have historical themes; those of Ken Burns are both popular and well-regarded. More and more people are contributing to various oral history programs. Story Corps, a national project of the American Folklife Center at the Library of Congress, is a large scale project intended to encourage people from all walks of life to tell their particular stories.

Popular history also has a recreational aspect. Recreations of battles attract numerous participants. Preservation efforts like Williamsburg and Sturbridge Village, two of the most ambitious examples, attempt to portray life in the past with fidelity and are visited by thousands of sightseers annually.

CONCLUSIONS

What is the future of historical scholarship? In the absence of a crystal ball, it seems safe to predict that its future will be one of both stability and change. The foundational questions, what happened and why did it happen, will continue to be asked as long as humans remain curious about their past. The foundational skills of the historian, the ability to identify questions of significance, the ability to find, select, understand, and evaluate evidence, the ability to argue logically and persuasively and to write clearly are not likely to change.

Change will occur in the questions that are posed. Historical scholarship has always had a presentist bias, a truth expressed most eloquently by Benedetto Croce's famous dictum, "All true history is contemporary history." Experience influences what people deem important; depressions are good for economic history and going to war with a country stimulates curiosity about its past. Different generations will have different priorities and concerns and ask different questions.

Already in progress is change in the sources that historians use. Influenced by the success of historians at using nontraditional sources to study the history of peoples without written records, it is probable that historians will expand the range of types of sources even further to supplement traditional sources. The increased use of primary sources in digital form is inevitable as the events of recent years become the object of historians' interests.

Another realm in which change can be expected is that of theory. Both small-scale theories like the Whig theory of history that viewed history as progressing toward parliamentary government on the British model and world view-type theories like the Marxist theory of history will be replaced by new explanations and newer world views.

Less clear is what can be anticipated in the relationship between the historical writing and the public. The distance between scholarly history and popular history appears to be growing. Although many scholars would very much like to reach a wider audience, it is an uncomfortable fact that what entices readers who are not scholars conflicts with the present canons of historical scholarship.

Historical scholarship has its traditions. Standards of scholarship are well-defined. It is not, however, a discipline with paradigms in the sense in which Thomas Kuhn defined paradigm in his book, *The Structure of Scientific Revolutions* (1962). Ultimately, the individual historian decides which questions are worth asking and how they should be examined. Each has his or her own viewpoint and it is entirely possible for two historians to come to quite different conclusions from the same evidence. As the narrator in Dorothy Salisbury Davis's story, "By the Scruff of the Soul," commented, "history's like a story in a way: it depends on who's telling it."¹⁰

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History of Libraries

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Abstract

Society created the library in response to individual, community, and national needs for memory and self-understanding. The development of the library as an institution follows the story of literate humankind and facilitates the telling of the human story in multiple languages and cultures. The library documents growth in intellection and other changes in the human condition. It preserves resources for those of minority as well as majority opinion, ensuring preservation and access for the unorthodox in human affairs. The library respects the full range of human interests and creates networks of resource sharing and international cooperation on behalf of reader interests.

THE ORIGINS OF LIBRARIES

The precise origins of libraries are impossible to trace, although scholars have accumulated knowledge of particular libraries in certain locations. Historians have concluded in general that the invention of writing combined with the impulse to preserve inscriptions have marked the beginnings of the historic era, a period of consciousness about the importance of human memory. The earliest ideas about libraries emerged as a natural outgrowth of interest in preserving such memory, and the library has acted on behalf of society to collect and organize things that are written. The library thus meets a vital social obligation by gathering accounts of the human experience.

DEVELOPING THE INTELLECT: THE ANCIENT WORLD

The creation of libraries likely began with the Sumerians who flourished during the fourth millennia B.C.E. in the region of Mesopotamia between the Tigris and Euphrates rivers. The Sumerians and succeeding civilizations—Akkadians, Babylonians, and Assyrians—inscribed clay tablets using a stylus and imprinting combinations of “wedges” (or Latin *cunei*) into soft clay. With the Sumerian economy based on grain, most of the extant cuneiform tablets describe agricultural transactions. The temples, which were seats of government, stored cuneiform inscriptions in wooden boxes with a tablet labeling the box’s contents. Temple storehouses preserved commercial and governmental documents, hymns, prayers, and incantations, and major literary works such as the *Epic of Gilgamesh*.

In the ancient Syrian city of Ebla, a comprehensive, well-organized royal library housed more than 15,000 tablets. The cities of Nippur, Nuzi, and Mari established similar collections. During the seventh century B.C.E., King Assurbanipal (669–633 B.C.E.), who ruled Egypt and Babylonia and Assyria, established a great library in the capital at Nineveh. Assurbanipal sought to collect every available work relating to cultural, social, and religious matters within his kingdom. His agents scoured the empire to acquire or to copy such works; his scriptorium in Nineveh produced new editions and his library emerged as an encyclopedic collection of human knowledge.

The growth of ancient libraries continued with the Greeks who developed a taste for book collecting and erected a number of Greek temples that featured libraries. In the sixth century B.C.E., Polycrates of Samos and Pisis-tratus of Athens established public libraries. During the Age of Pericles (ca. 495–429 B.C.E.), an emerging book trade supported the growth of private collections by philosophers, writers, and other scholars. Aristotle built an extensive manuscript collection to support his catholic intellectual pursuits. Plato’s Academy and Aristotle’s Peripatetic academy nourished the idea that books were essential to the growth of an educated populace.^[1]

The military conquests of Alexander the Great expanded Greek interest in books and learning to a wider audience, and Aristotle’s organizational scheme provided the basis for the library in Alexandria, Egypt, which would become the most significant library in the ancient world. Founded by Ptolemy I in the third century and brought to fruition by his son Ptolemy II, the museum and its accompanying library swiftly became the premier site for learning and scholarship. Led by some of the major intellects of its time, including the grammarian Callimachus (ca. 305–240 B.C.E.), the astronomer and writer Eratosthenes (276–

194 B.C.E.), and the philosopher Aristophanes of Byzantium (267–180 B.C.E.), the Alexandrian library gathered enormous collections of papyrus and vellum scrolls, which were painstakingly cataloged by Callimachus in his famous *Pinakes*. Eventually, war took its toll on the Alexandrian Library and, by the end of the fifth century C.E., its collections were scattered and lost to the ages.

In Asia Minor, Attalus I (269–197 B.C.E.) and his son Eumenes II (197–159 B.C.E.) established another important library at Pergamum. When Ptolemy II banned the export of papyrus, book makers at Pergamum adopted parchment, which was much more durable since it was made from animal hides, thus marking major progress in preserving library materials. In his history, Plutarch claimed that, with the coming of the Romans in the first century B.C.E., Mark Antony bequeathed to Cleopatra about 200,000 volumes of the Pergamum Library, later absorbed into the Alexandrian Library.

The Romans mirrored Greek interest in books and learning to the extent that Roman emperors—like their counterparts in Alexandria—confiscated and copied books for central libraries. Eminent scholars like Cicero and Seneca created large private collections. Excavations have revealed library rooms in private dwellings in Rome and other major cities throughout the empire. Plutarch and Pliny mentioned that prominent citizens had built extensive private libraries some of which featured separate rooms for Greek and Latin books.

Successful military leaders often acquired books as part of plunder, Mark Antony being the most prominent example. Julius Caesar envisioned the construction of several libraries, some of which were completed after his assassination. The emperors Augustus, Tiberius, Vespasian, Trajan, and Hadrian all established libraries in Rome during the first two centuries C.E. Trajan's Bibliotheca Ulpia, completed about 100 C.E., served as the Public Records Office of Rome until the fifth century. In Byzantium, the emperors Constantine the Great (280–337 C.E.), Julian (331–363 C.E.), and Justinian (482–565 C.E.) sought to expand the holdings of the imperial, patriarchal, and scholarly libraries at Constantinople and elsewhere. Through the efforts of countless scribes and copyists over the centuries, the Byzantine libraries preserved the intellectual heritage of Athens, Rome, and Alexandria, thus preserving ideas from the ancient world and making possible the cultural richness of the Renaissance.^[1]

In South Asia, the Aryans, who had established themselves in the Indus Valley in the middle of the second millennia B.C.E., promoted the growth of Jainism and Buddhism, both religious movements with sacred canons. Libraries and archives soon appeared to help organize and preserve this extensive literature. In China, the Han dynasty (206–220 B.C.E.) endeavored to preserve ancient texts that had often been scattered by warfare in earlier centuries. Han emperors encouraged the writing of literature and developed a culture of meticulous record keeping.

The Chinese created a seven-part classification scheme that organized knowledge into Confucian classics, philosophy, prose and poetry, military accounts, medicine, scientific and occult writings, and summaries. The Chinese later revised this system into four parts: the classics, history, philosophy, and miscellaneous works.^[2]

DEVOTED TO PRESERVATION: THE MEDIEVAL ERA

With the decline of the ancient libraries in the last years of the Roman Empire, the era of great classical libraries came to an end. For the next thousand years the typical European library—which could more accurately be called a “special” library—consisted of several dozen, or perhaps a few hundred, laboriously copied manuscripts housed in monasteries overseen by learned monks. Religious motivations influenced library development in Western Europe during this period. Copies of the Bible along with letters and commentaries made up the contents of these rudimentary collections.

During the first centuries of the Common Era, the classical format of the book changed both in structure—from scroll to codex—and in type of surface upon which words were written—from papyrus to parchment and vellum. The advent of the emerging Christian culture influenced the eventual adoption of this new format, which led to the construction of a portable and easily readable collection of individual books that became the Bible. Thus the texts contained within the codex became more durable and easier to use and to store. They also had the decided advantage of accommodating the contents on both sides of the codex sheet. Books were shelved on their sides, in chests (*archiva*), or on shelves or desks and, as collections grew, the shelving would sometimes occupy the walls of an entire room, often referred to as a *bibliotheca*. At the outset of the Medieval Era, the *libraria* was a licensed distributor or dealer in books, and the *bibliothecarius* was curator or custodian of the collection. Monasteries often provided space for the library and for the *scriptorium* where copyists plied their craft; eventually, the term “librarian” came to denote one who worked with books in an organized collection.^[3]

In the early Middle Ages, two monastic leaders, St. Benedict of Nursia (ca. 480–547) and Flavius Aurelius Cassiodorus (502–597), building on the early precepts of St. Jerome, established rules for transcribing and maintaining manuscripts and general guides for library maintenance. Benedict's rules for copying manuscripts governed that process for the next several centuries. St. Isidore of Seville (ca. 560–636) also wrote standards for operating these fledgling libraries. Such practices continued under the Carolingians, and imperial patronage in Visigothic Spain and Ostrogothic Italy maintained libraries devoted to the preservation of Latin and Greek texts.

More than 220 monasteries existed in Merovingian Gaul although fewer than 300 manuscripts from their collections have survived. By laboriously copying—and thus preserving—numerous classical writings, hardworking monks transmitted an intellectual heritage for future generations. Although the classical texts were not Christian, and therefore considered pagan, early church fathers valued them as precursors of the Christian revelation. By transferring these decaying texts from papyrus to parchment, the church preserved the wisdom of the ancient world.

In contrast to the lands of the Roman West, the Eastern Empire maintained its independence for several centuries, not passing to the control of Islamic forces until 1453. Both Diocletian (245–312) and Constantine (280–337) had promoted the creation and maintenance of imperial libraries at Nicomedia and Constantinople. The great Justinian (527–565) relied on the large palace library to compile his famous code. Photius of Constantinople (820–893) created an influential reference work, the *Myrobiblion*, a classified digest of 280 works. Over the centuries, libraries thrived in great cities and small villages. Given the blending of church and state in the Byzantine Era, it became common practice for imperial and cathedral libraries to organize collections that included secular and religious works. By 1204, the libraries in Constantinople had suffered grievously at the hands of the Crusaders, many never recovering from such devastation.

Meanwhile to the south, a vibrant new civilization was growing from the sands of Arabia based, like Christianity, on the importance of the book. The *Qur'an* encouraged the acquisition of learning and knowledge and, for the Muslim scholar, the private library became essential. Many small libraries were eventually absorbed into larger mosque libraries, the most famous being that of al-Azhar in Cairo, founded in the ninth century. Under the Abbasid Caliphate (750–1258) the *Dar Al-Hikmah* (House of Wisdom) was established in Baghdad in the early 800s. The third most important Islamic collection in the Middle Ages was the court library of the Umayyad rulers of Cordoba, Spain (750–1031), which ultimately boasted a collection of over 400,000 volumes. The steady growth of libraries continued under the Seljuks (1037–1300) and the Ottoman Turks (1299–1923). By the end of the first millennium, Islamic culture supported the construction of numerous libraries, many of which were open to the public. Islamic scholars, moreover, performed an invaluable service for the West by translating Greek and Latin manuscripts into Arabic, thus making them available for future scholars during the Renaissance. The Muslims also acquired knowledge of Chinese papermaking, transmitting this important technology to the West.

While much of Europe sank into cultural depression, King Charlemagne of Frankish Gaul was leading a revival of learning. Under the tutelage of Alcuin of York, who had been influenced by monastery libraries in his native

England, Charlemagne founded a school at Aachen, which established the importance of libraries for learning and scholarship. Thus a new educational system emerged, stimulating library growth in the last years of the millennium. This flurry of intellectual activity led to the founding of libraries at monasteries in Mainz, Salzburg, Fulda, Würzburg, and the famous Abbey of St. Gall in Switzerland, which had been erected in honor of the great Irish monk.

During the eleventh and twelfth centuries, production efficiencies vastly reduced costs, thus making it possible for libraries to acquire more volumes. Cathedrals established schools that took the lead in promoting education among the elite, and their libraries provided resources for learning and the professions. The Carthusians (founded in 1084) and Cistercians (founded in 1098) both instituted special rules for the operation of libraries. Meanwhile, during the late thirteenth and fourteenth centuries, fledgling universities—prompted by the earlier appearance of cathedral schools—began to appear at Oxford, Cambridge, and Paris. The universities sought to supply moderately priced books to students, with libraries playing a large role in obtaining duplicates and cheaper editions to distribute freely to young scholars, and keeping extra copies for themselves.^[2]

The Vatican had maintained a library at the Lateran Palace since the fourth century, but it had been repeatedly sacked by Rome's invaders. During the exile of the papacy to Avignon in the fourteenth century, the limited collections were further dispersed. Vatican librarian Bartolomeo Platina (1421–1481), who served during the papacy of Sixtus IV, reorganized the collection, carefully describing it, making it available to Catholic scholars and convincing Sixtus to establish consistent funding for new acquisitions.

Princely collections emerged in distributed fashion in the years from 1350 to 1500. In the later Middle Ages, kings began to establish libraries in royal residences. Ruling elites expended great financial resources to obtain and house books, prices for which exceeded what most common people could afford. The nobility viewed a fine library as not merely a scholarly apparatus but also a shrine to the word of God or a monument to individual achievement. Resources such as these could enrich research libraries in a later era. Thus, the French king Charles V installed a library on three floors of the Louvre, which would eventually become the Bibliothèque Nationale, and in England, Henry VI donated some of his private collection to King's College in Cambridge.

REDISCOVERING THE PAST: THE RENAISSANCE

Humanists came to dominate the intellectual climate of the fourteenth and fifteenth centuries, regarding the book—its collection, preservation, reproduction, and

distribution—as instrumental in fostering the new learning that would characterize the Renaissance. Humanists devoted themselves to writing and speaking eloquently, to living an upright and moral life, and to serving God as unique individuals, rather than merely as insignificant beings in a massive unfathomable universe.

Seeking fresh perspectives, the fifteenth century reader turned to the classics of ancient Rome and Athens. Scholars rediscovered Cicero, Virgil, Horace, Caesar, and Plato. The advent of the printed book as a result of Johannes Gutenberg's (1400–1468) invention of moveable type in the 1450s—and the subsequent dramatic growth of the craft of printing led by luminaries such as the Venetian Aldus Manutius (1449–1515)—spurred unprecedented expansion in the volume of printed works. This powerful new movement of literary and political expression yielded a vast outpouring of publications in many new subjects which, along with steadily rising literacy rates, promoted libraries as an essential feature of early modern intellectual life.^[4]

In Italy, the Venetian book collector Francesco Petrarch (1304–1374) inspired dozens of other scholars to scour European and Middle Eastern countrysides for Greek and Latin manuscripts. Petrarch's personal library numbered only about 200 volumes but contained significant classical works previously unavailable to scholars. In Florence, Coluccio Salutati (1331–1406) and Niccolò de' Niccoli (1346–1437) built libraries exceeding 800 volumes. In Rome, Cardinal Basilios Bessarion (1403–1472), who was of Greek descent, sponsored the collecting and copying of ancient Greek manuscripts and maintained a personal library of more than 1000 volumes. After the fall of Constantinople in 1453, Bessarion's library was donated to the city of Venice. Subsequently, book collectors helped to unearth and make available hundreds of long neglected classical manuscripts. Many private collectors relied on agents who visited bookshops for rare manuscripts, and the literate classes circulated lists of recently published works.

Niccoli's library became the basis of the magnificent Biblioteca Marciana established by Cosimo de' Medici in the mid-sixteenth century and served as one of the first public libraries in Italy. In 1571 Cosimo's grandson, Lorenzo the Magnificent, founded his own public library in a building designed by Michelangelo. While Renaissance humanists might use the term “public library,” their notion of it was a collection intended for use by the wealthy, the politically connected, cultural elites rather than by the masses of humankind.

In palatial settings, books were often laid open on pulpit-style lecterns and consulted while standing. By the latter part of the sixteenth century, books were placed on shelves, spines facing inward, with notations on the book's title inscribed on the exposed fore-edge. Collections were managed by library workers who created subject catalogs of their contents and who made initial

attempts at classifying books based on prominent subjects such as religious works, canon and civil law, and medicine, followed by philosophy, history, poetry, rhetoric, and grammar.

By the early fifteenth century, the French king Charles V and the British king Henry VI had established royal libraries. In Germany and Central Europe, impressive court collections grew at Augsburg under the influence of the wealthy banker, Jakob Fugger, and at Wolfenbüttel in Lower Saxony, which could boast as its most famous librarian, the philosopher Gottfried Leibniz (1646–1716). Similar libraries appeared in other countries, including the Escorial library in Spain, and in the cities of Vienna, Prague, Munich, and Buda (Hungary). The European intelligentsia developed collections in support of their respective professions. Thus at Ferrara, Italy the physician Nicolò Leonicensio sought ancient Greek manuscripts relating to medicine, and in Seville, Spain, Hernando Colón, son of Christopher Columbus, created an extensive library devoted to ancient and modern geographical sources. Many Renaissance court libraries also housed informal academies filled with collections of scientific instruments.

The growth of libraries during the Renaissance was driven by the dual impact of the printing press and the thirst for both new and rediscovered learning that characterized intellectual life during the fifteenth and early sixteenth centuries. Literate elites sponsored large secular collections which were accompanied by the rise of organized efforts to create bibliographic tools to improve the accessibility of these materials.

NEW HEAVEN AND NEW EARTH: THE REFORMATION

The sixteenth century was a period of intense conflict on the European Continent as the Reformation, beginning with Martin Luther in 1517, shook the very foundations of the established religious order. As a result of the burgeoning Protestant crusade, monastic libraries were damaged, gutted, or razed. The destruction went beyond obvious Catholic Church facilities with even the university libraries in England at Oxford and Cambridge bearing the brunt of anti-Catholic sentiment. The library at Oxford was reduced to such an extent that the furniture was sold, a practical response owing to the loss of so many books. Despite the devastation that resulted from his complaint with Roman Catholicism, Luther fervently supported libraries, and in 1524 he urged in a public letter to all German towns that no expense be spared in establishing good libraries in each community. In response, many new municipal libraries appeared during this time including those at Hamburg (1529) and Augsburg (1537). This period also featured the rise of new universities at Königsberg, Jena, and Marburg, all requiring the acquisition of new book collections.

The rapid expansion of printing promoted the Reformation and the Counter-Reformation as both sides produced thousands of publications to support their positions. Even before 1520, the Catholic Church had sponsored the printing of specialized texts for scholars as well as practical manuals for parish clergy. One significant outcome of the Reformation was the production of numerous translations of the Bible into the vernacular for use among the literate classes. Thus Luther's German Bible appeared in 1534. Meanwhile translations into other languages were published across the Continent: in Dutch (1526), French (1530), Italian (1530), English (1535), and Spanish (1543).^[5]

Although literacy was still limited to upper classes or to those educated in Catholic traditions, the Reformation fostered the production of large quantities of popular literature, intended for the common people, resulting in larger numbers of readers and even greater demand for publications. Religious conflict in the sixteenth century stimulated a remarkably powerful output of printed works which emanated from dozens of skilled printers throughout Europe. This vast literature, combined with steadily rising levels of literacy on the Continent, stimulated library growth at impressive rates. The major libraries grew and consolidated their holdings from smaller, private collections. Examples include the Hofbibliothek in Munich (1558), the Escorial Library near Madrid (1575), the Imperial Library in Vienna (1576), and the Ambrosiana Library in Milan (1609). Still the great libraries were not available to most citizens, only the wealthy or those sponsored by well-connected patrons.

ENLIGHTENING THE EYES: THE SEVENTEENTH AND EIGHTEENTH CENTURIES

The rapidly expanding output of published books during the period of the Reformation merged with renewed interest in study and learning that had grown out of the Scientific Revolution to accelerate intellectual life in the early seventeenth century and contributing to growth in all types of libraries. By mid-century, scientists in England, France, Germany, and Italy were expressing the need to move beyond book fairs and the printed lists of booksellers in order to stay abreast of the latest developments. They established the scholarly journal at about the same time that science was becoming more specialized and diverging from *belles lettres* and philosophy. The scholarly journal would come to disseminate research among intellectual communities, fueling the steady growth of private collections.

Libraries were of two kinds: collections built by the wealthy in their homes and those established to support educational, religious, or governmental institutions. Library workers ceased the chaining of books, preferring to place them in cases lining the walls with spines facing outward. Library collections served elite patrons who

were permitted access during limited hours. Private libraries, such as the one developed by French Cardinal Jules Mazarin (1602–1661), grew large enough to require unprecedented organization. Mazarin's library was directed by Gabriel Naudé (1600–1653) who, in his 1627 treatise on library practice *Avis pour dresser une Bibliothèque*, laid the foundation for arranging and managing private libraries. Naudé recommended that books be valued for their content—rather than for their beauty or rarity—and that they be organized by subject and readily available to those with scholarly interests who themselves may have limited resources for building their own libraries. The collection should be described in separate author and subject catalogs. Presciently, Naudé also proposed that libraries be housed in stable and safe environments, free of dirt, moisture, and noise. Following Naudé's instructions, Mazarin's library eventually opened to the public in 1691 and became the basis for the Bibliothèque Nationale following the French Revolution.

The seventeenth century yielded another library-related classic, one that was destined to take its place among the great documents of humankind. In *Areopagitica* [1644], John Milton (1608–1674) addressed an agency of the British Parliament with a sweeping argument that continues to reverberate. Milton argued for a free press, freedom of mind, freedom of conscience, and that ideas freely expressed and heard and deeply considered constituted the highest order of civil liberty. Milton claimed that even bad books deserve a place, but that one who destroys a good book destroys reason itself, something made, as it were, in the image of God. Although the ideas that he integrated into a whole were not original with Milton, he was the one to present them most cogently and eloquently.

Milton thus developed a theoretical framework for the freedom of the reader and for the protectors of books and ideas as rightly oppositional to forces of suppression. Despite an intrusive (though predictable for his time and place) anti-Catholic rhetoric, Milton provided future librarians, professors, readers, and authors with the conceptual tools necessary to argue for the free distribution of printed materials. An important complementary essay written by John Stuart Mill (1806–1873) appeared in 1859. In *On Liberty*, Mill elaborated on Milton, broadening notions of toleration using as foundational ideas an additional two centuries of liberal thought, yet still advocating restricted rather than unfettered access on the part of young people. In the twentieth century, echoes of Milton and Mill have been heard in official documents of library practice in democratic societies. Concepts of intellectual freedom as articulated by librarians, journalists, and professors have tended to proliferate in those societies grounded in well-defined relationships between society and the individual.^[6]

Among major libraries appearing in the early seventeenth century was the Bodleian Library at Oxford University (1602), steady growth for which was spurred

by its energetic chief benefactor, Sir Thomas Bodley (1545–1613). August, Duke of Braunschweig (1579–1666), founded his library in 1604; it was destined to become one of the finest on the Continent, eventually being renamed the Herzog August Bibliothek at Wolfenbüttel. These were followed soon thereafter by the Ambrosiana Library and the Angelic Library in Rome (1620). Centuries removed, interpretations as to dates of founding may vary as do library names as a result of restructuring and mergers.

In addition to the Bibliothèque Nationale, other nascent national libraries emerged during this period. The library assembled by Friedrich Wilhelm of Brandenburg (1620–1688), starting in 1659, became the Prussian State Library. Catherine II of Russia, an admirer of Voltaire and Diderot, greatly expanded Peter the Great's original collection by capturing as spoils of war the extensive library maintained in Warsaw by Andrej and Jozek Zaluski in the 1790s. The British Museum, which opened in 1753, came about as a merger of the private collections of Sir Hans Sloane (1660–1753), Sir Robert Cotton (1571–1631), and Robert (1661–1724) and Edward (1689–1741) Harley. In 1757 the British Royal Library, which contained works collected by English kings beginning with Edward IV, further enhanced the British Museum's holdings.

The better libraries in early America were assembled by business elites, individual collectors whose books and journals would eventually enrich the great research libraries such as Harvard and Princeton and Yale universities, the New York Public Library, the Library of Congress, and the American Antiquarian Society. Many of the private collectors were motivated by religious interests; the bequest of Puritan minister John Harvard established the Harvard College Library in 1638. Thomas Bray (1656–1730), Anglican minister and bibliographer, devoted to educating clergy and expanding mission work, established some fifty parish libraries throughout the colonies from New York to the Carolinas to Bermuda with about half of them in Maryland. Later he founded some 80 such libraries in England and Wales.

Another movement was underway in North America, that of the social or circulating library. Owned by a private association, books would supply reading matter for members and their families. Benjamin Franklin (1706–1790), scientist and scholar, pioneered in establishing the Library Company of Philadelphia in 1731. Also known as subscription libraries since association members paid fees to become joint owners, the social libraries mirrored similar arrangements in Europe, especially in England where by the mid-eighteenth century more than 250 such libraries were thriving in London and in the countryside. Social libraries established variously by business or working class interests demonstrated the value of reading to an increasingly sophisticated citizenry and became conceptual predecessors to the tax-supported free public library. Robert Keayne's (1595–1656) bequest of 1656 marked an

early attempt to create a library in Boston for use by the public; the collection eventually built was destroyed by fire in 1747.

In the Far East, during the Qing Dynasty reigns of K'ang hsi (1662–1722) and Ch'ien-lung (1736–1795), the Imperial Library, palace collections, and governmental agency collections continued to grow. In 1686 K'ang hsi issued instructions about proper maintenance of the Imperial Library. Western works on science and astronomy were translated and added. Ch'ien-lung's (1711–1799) great contribution was to create the Four Treasures Library, an effort resulting in a definitive collection of 36,000 volumes in Chinese philosophy, history, literature, and other subjects.

REVOLUTION IN POLITICS AND SOCIETY: 1776–1875

The fresh winds of democracy blew across the Atlantic from the new United States of America and into France, and the French revolution resulted in expanded access to reading materials. From the fall of the Bastille in 1789 to 1795, the French wrote 20 decrees pertaining to libraries. Rising middle classes confiscated ecclesiastical property and private collections of the nobility, establishing *dépôts littéraires* throughout the nation. This program was visionary, as it included plans for a union catalog and conceived of the scattered collections in urban and district repositories as a commonly held national resource. Two major developments emerged; one involved vastly expanded middle class access to books with middle class defined as white males. The concept of free public libraries also arose, with more robust expressions in Paris than in the countryside. But many provinces had municipal and parish libraries, some of which escaped confiscation due, only in part, to having been considered of minimal value.^[7]

A second major trend in the politics of nation building was the movement to establish central libraries with national level responsibilities. In the years from 1793 to 1795, the Bibliothèque Nationale won authorization to obtain first manuscripts and then books from throughout France. Central libraries with nationalizing impulses also arose in Lisbon (1796), The Hague (1798), Washington, DC (1800), Budapest (1802), Buenos Aires and Rio de Janeiro (1810), Oslo (1811), Santiago de Chile (1813), and Reykjavik (1818). In the leading cities of Russia, private collections formed the basis of the Imperial Public Library, opened in 1814 in St. Petersburg, along with the N.P. Rumiantsev Library founded posthumously in 1831 and transferred to Moscow 30 years later as the core of the Lenin Library. With the British Museum (more recently the British Library) as forerunner, these national institutions gradually assumed the role of keepers of the cultural record and as leaders in organizing collections and services and in training staff.

The Industrial Revolution in the early nineteenth century brought an influx of rural populations into the great cities of Europe and North America. Millions left the farm, seeking employment in the factory and economic and educational opportunity in the city. Crowded conditions among the new urban masses exacerbated crime and illiteracy. Multiple social responses, both secular and religious, incorporated the tools of self-enlightenment: reading and the distribution of literature, a robust popular press, lyceums, books clubs, and libraries. Literacy emerged to stimulate social critique, but also to quell urban unrest and acculturate youth into the national ethos. Reformers distributed small portable libraries which featured moral instruction but other topics as well.

Reformers also established mechanics institutes representing the reading interests of working class males but most such organizations were eventually absorbed by middle class business interests. The Society for the Distribution of Useful Knowledge (SDUK), established in England in 1826, promoted the expansion of reading and libraries for the working class. In 1839 the SDUK issued *A Manual for Mechanics Institutes*, an early analysis of the value of resource sharing. The *Manual* recommended interlibrary lending that incorporated cathedral libraries, county seat collections, municipal archives, the holdings of book clubs, and the reading rooms of religious denominations.

The Sunday school movement promoted literacy for both genders, something that mechanics', businessmen's, and early subscription libraries had failed to do. The interdenominational Society for Promoting Christian Knowledge (SPCK) had been active in England and Wales for more than a century. The Wesleyans, Presbyterians, and Episcopalians established circulating libraries in North America. Sunday school libraries, partially dependent on the societies, featured not only biblical studies and moral rhetoric but also light fiction, drama, and contemporary nonfiction. In early nineteenth century England, the Religious Tract Society rivaled the SPCK as a distributor of evangelical publications. Sunday schools reached socioeconomic strata below the middle classes and, in fact, provided models for literacy instruction among ethnic minorities. Sunday schools were also among the earliest organizations to take seriously the reading interests of children and young adults in part because of their intense focus on moralistic and middle class behavioral norms. By 1850 Protestant denominations had established more than 2000 Sunday school libraries in the United States and adjoining territories.

Public education at the elementary and secondary levels obtained governmental support, laying the foundation for apprenticeships, vocational training, and civic participation, and providing school libraries. By the 1850s the English common school movement had spurred the establishment of libraries especially in secondary schools. Local control played a larger role in school library support

in North America than it did in Europe and the Far East where national leadership became a more powerful determinant.

In the nineteenth century German universities thoughtfully took library functions beyond custodial and scholarly interests. The University of Göttingen established policies to expand professorial and student access. American student, and later founder of the Boston Public Library, George Ticknor (1791–1871) was made to feel welcome enough that he came to regard Göttingen's rich collections as a common treasure not merely for Germany but for the entire world of scholarship. German intellectuals, moreover, sought a wide audience by publishing encyclopedias intended for home use, thus making feasible a collection of searchable knowledge and practical information for the nuclear family.^[7]

PROFESSIONALIZATION AND GROWTH: 1876–1988

Landmark events in 1876 marked the dawn of a new era in the professionalization of librarianship. Melvil Dewey (1851–1931) developed a system of classification on the concept of relative location, thus rendering obsolete earlier fixed-location arrangements. Published in 1876, the Dewey Decimal Classification (DDC) found ready acceptance throughout North America. The year 1876 also marked the first issue of *American Library Journal*, retitled *Library Journal*, the first journal in the United States devoted solely to library topics. At the same time, the United States Office of Education issued its massive report, *Public Libraries in the United States of America, Their History Condition and Management: A Special Report of the U.S. Commissioner of Education* [1876], thus launching a large body of professional literature rooted in historical precedent, in contemporary best practices, and in commonly held yet often conflicting assumptions about the social and political purposes of libraries. Librarians established the American Library Association (ALA) in 1876, the first national conference of library practitioners since 1853, which began annually thereafter to address current issues, and to promote the growth of libraries and, to a lesser extent, the professional and economic development of library workers. The Library Association was established in Great Britain in 1877. With the emergence of a professional literature and professional societies, the foundation was laid for the unprecedented expansion of libraries and for the education and training of library workers throughout the English-speaking world.

The editors of *Public Libraries in the United States* considered a public library as any library to which an individual could gain access, a view inclusive enough to incorporate mercantile and subscription libraries, academic libraries, and specialized libraries such as those devoted to law, medicine, and theology. In the year 1876

the origins of such libraries could be traced back more than 200 years. But the tax-supported free public library was altogether different according to William Frederick Poole (1821–1894) who claimed that the free libraries of Europe had served the intelligentsia, rather than the masses, and had not been supported by taxation. Perched atop the public libraries of first Cincinnati and then Chicago, Poole defined the public library much as we know it today—established by state legislation, supported by local taxes and by gifts, and maintained for citizens invited to share equally in its intellectual bounty.

Kathleen Molz describes the tax-supported free public library as essentially an Anglo-American phenomenon, an ameliorating influence responding to the Industrial Revolution in Britain and the United States, an influence associated with reformers who also opposed slavery and promoted education for youth and better treatment for the mentally ill. She observes that the public library movement gained momentum at about the same time in both England and in New England with enabling legislation from the British Parliament in 1850 and 1855 and with locally supported municipal libraries in the United States. Among the American pioneers were Salisbury, Connecticut and Peterborough, New Hampshire, although the first major metropolitan public library opened its doors in Boston, Massachusetts in 1854 and soon emerged as worthy of emulation.^[8]

The Boston Public Library has attracted the attention of historians for another reason—research into the motivations of founding elites. In the 1970s Michael Harris studied the Boston Public Library, challenging the previously accepted view of the Library as essentially altruistic, committed to providing reading materials that responded to democratic impulses for political participation and economic opportunity. In “The Role of the Public Library in American Life: A Speculative Essay” Harris pointed to more sinister purposes, that elites created libraries to inculcate compliance from the citizenry, a willingness to accept the *status quo*, not challenging dominant political and cultural norms.^[9] A revisionist perspective on social and political purposes thus entered public library historiography and *The Journal of Library History, Philosophy, and Comparative Librarianship* [commonly referred to as *JLH*] recorded much of the vibrant conversation advanced by Elaine Fain,^[10] Michael Harris,^[11] and Dee Garrison^[12] in 1975, Edward G. Holley^[13] in 1977, and Michael Harris^[14] and Phyllis Dain^[15] in 1978.

In collegiate education, Germany had provided a model for her European neighbors and for North American institutions of higher learning in the late nineteenth and early twentieth centuries. Research as a university ideal came first alongside undergraduate liberal arts education then, in many places, eclipsed it. The Universities of Göttingen and Tübingen, for example, led evolving conceptions of critical historical and literary analyses. Germans refined the seminar method of teaching, which featured graduate

students making presentations based on examination and comparison of original sources. The intellectual structure for seminar methods was rooted in disciplinary expansion; the social sciences spawned the new disciplines of sociology, economics, political science, and psychology, all of which were growing increasingly sophisticated and examining new paradigms.

German universities attracted scholars from across the globe to pursue studies in the humanities and the emerging social sciences from new, more scientific perspectives. Herbert Baxter Adams (1850–1901), a Johns Hopkins University professor and founder of the American Historical Association, joined the trek of Americans who returned from Germany to the States with the gospel of scholarship for expanding academic libraries into strong retrospective collections organized around disciplinary strength. Rationales for seminar libraries followed inevitably especially from 1880 to 1920 when the broad outlines for the modern university began coming into view, and when new university library buildings featured interior reading rooms organized by discipline and later referred to as subject departmental libraries. Seminar libraries had become powerful symbols of institutional commitments to doctoral research and teaching.

Historians of higher education acknowledge the Social Gospel and Progressive periods as encompassing the formative phases for higher education and its libraries and the twentieth century as the time when university research libraries—based on internal organization and collection size—came to full maturity. Kenneth J. Brough chronicled the transition of the American university library from storehouse to workshop in *Scholar's Workshop: Evolving Conceptions of Library Service* [1953]. He explored the history of the ideas, notions, terms, and phrases for the university library, providing metaphors for its purpose in academe.^[16] The leading American university research libraries, based on the depth and range of printed collections, include private universities Harvard, Yale, and Stanford, and public universities Illinois, Michigan, and California at Berkeley. And in the United Kingdom, Oxford and Cambridge had long since set the standard for collections, having been established in the Middle Ages. In 1918, the British Parliament established the University Grants Committee for institutions of higher education throughout England, expanding the national role in financial support. In Italy an 1889 statute had created a council at each university governing library book expenditures. These models differed substantially from the more diverse methods in the United States, which relied on combinations of local, state, and private support.^[7]

The Industrial Revolution dominated life in Europe and North America in the late nineteenth century. In those nations most advanced economically, industrialists combined technological innovation with mass production as they constructed factories in big cities. Population centers swelled to unprecedented proportions, creating new

wealth amidst unrestrained business expansion. On occasion, a wealthy industrialist would demonstrate civic virtue and cultural influence by supporting colleges, museums, and libraries. One such leader was steel magnate Andrew Carnegie (1835–1919) who contributed funds to construct 3000 library buildings in Canada, England, Ireland, and the United States.

Carnegie used his library contributions to refine the relationship of the municipal library to its constituents and to expand the public library movement throughout the English-speaking world. Precursors of the tax-supported free public library had featured 1) subscription libraries serving upper and middle class, and sometimes working class, interests for members only and 2) municipal reference libraries dependent on wealthy philanthropists. By implementing the requirement that grant recipients collaborate with local governments to elicit tax revenues for library maintenance, Carnegie underscored the value of public–private partnerships but also the importance of continuous public support for cultural institutions. With a new Carnegie library building, even the smallest village was afforded the opportunity to promote literacy, leisure reading, adult education, and political engagement with an institution that stirred a sense of civic pride and accomplishment.

As the great cities had attracted burgeoning populations seeking opportunity, so also they attracted the social problems that followed in the wake of humans as economic commodities in the great industrial engine. The unrestrained rise of industrialization, immigration, and urbanization had created dislocations that permeated Western nations. Individuals felt keenly the loss of belonging and social control formerly inhering in towns and neighborhoods, schools, and churches. Citizens sought order amidst unprecedented change; they felt deeply a loss of community; and they came to see the professions as vital ameliorating influences.^[17] A better life, it was hoped, would require more nurses, social workers, teachers, and librarians, thus giving rise to formal education for the helping professions and exemplifying the best Victorian impulses to exercise social control through service for the commonweal.^[18]

Educating Library Workers

Since earliest times, aspiring librarians had been apprenticed to the directors of large libraries on the premise that those who oversaw the largest collections dealt with matters of greatest complexity in processing and housing collections, and in making them available to readers. Simultaneously, bibliographers and other library workers continued to develop the core information that would come to be used in formalized training. The writings of Gesner and Naudé advanced this thinking, accompanied by the writings of book collectors, scholars, and philosophers who offered larger intellectual perspectives

and thus helped to establish foundational requirements for practitioners.

As the search for new ideas about the meaning of librarianship intensified, the resulting information provided frameworks for formal instruction. As early as 1821, the *Ecole des Chartres* in Paris offered conceptual development in the form of archival training. During the early and middle years of the nineteenth century, increasingly nuanced ideas were advanced by the Germans Martin Schrettinger (1772–1851) and Friederich Adolph Ebert (1791–1834), the Danish scholar Christian Molbech (1783–1857), by the Italian Antonio Panizzi (1797–1879) who directed the British Museum, and by Charles Coffin Jewett (1816–1868) in the United States.

As important as these contributions were, they could not match Melvil Dewey's power to educate and to otherwise influence rising generations of library workers. His conceptual grasp of classification and early adoption of standardization laid a solid foundation for library training, a program he launched at Columbia College in 1887 and later moved to the New York State Library in Albany. Dewey had observed vast public and school library movements spreading across a growing nation; he saw the educational potential of libraries and the employment potential of educated librarians. He would prepare individuals for frontline services: his graduates would create catalogs—the essential finding aids for local collections—and they would teach and assist readers and oversee reading rooms. The librarians would become resourceful guides for inquisitive citizens in the big cities and small towns of the rapidly expanding Industrial Age. Though Dewey may have been North America's most visible library educator, he did not labor alone. Indeed, a number of library schools appeared around the turn of the century and soon thereafter, some of them in the public libraries of major cities including Atlanta, Los Angeles, New York, and St. Louis.

Schools flourishing during the first generation of American education for librarianship rode the wave of emphasis on efficiency in business and civil service reform when government workers advanced beyond political patronage into more professionalized settings. The intellectual foundations for library training were quite rigorous and, in fact, schools often required tough entrance exams that assumed knowledge of history, literature, geography, the arts, and foreign languages. Thus early graduates promoted dominant cultural values and mastered the multiple routine tasks that marked librarianship as an entry-level middle class profession. Library education worldwide sprang from independent schools—some of which emulated Dewey and his counterparts—in Munich (1905), Leipzig (1914), Copenhagen (1918), London (1919), Padua (1922), and in Wuhan, China (1920). By the mid-twentieth century many schools had moved into university masters' degree programs. While the master's became the basic requirement for practice in public, academic, and special

libraries, undergraduate programs also trained librarians, especially for school libraries, and a small number of nations and states admitted practitioners through examination.^[19]

Meanwhile, an alternative model for educating library workers was offered by the redoubtable Karl Dziatzko (1843–1903), a German scholar and early adopter who organized cataloging records by interfiling slips alphabetically. In the 1870s Dziatzko restructured library collections at the University of Breslau. By 1886 he was at the University of Göttingen presenting scholarly lectures for librarians-in-training, moving beyond the older systems of patronage and apprenticeships. Holding professorial rank, Dziatzko rooted his lectures in classical scholarship and descriptive bibliography, offering for the Continent a more intellectual approach than either Melvil Dewey or the training programs provided under the aegis of urban public libraries. Unfortunately, the German bibliographer never created a full curriculum and never attracted wide interest on the part of prospective librarians. More scholarly iterations of library education lay dormant until 1926 when the Carnegie Corporation funded the first doctoral program in librarianship at the University of Chicago.

Women Working

Library training programs succeeded in attracting large numbers of females into the profession. As with other helping professions, librarianship was thought by contemporary opinion leaders to be especially suited to women who sought employment beyond home and whose gender traits it was argued were appropriate for successful practice. A male-dominated profession in the nineteenth century and earlier, librarianship transitioned quickly to become female-intensive.

Female participation in the profession has reflected dispositions in the society at large, that women have suffered from discriminatory attitudes and practices. From the earliest years of the twentieth century, according to Mary Niles Maack in “Gender Issues in Librarianship,” the library press reported on the absence of women in the top administrative posts of the largest libraries. Maack underscored instances of “hierarchical discrimination,” recalling that in 1952 the Public Library Inquiry had documented a dual career structure for males and females and that, in 1987, males constituted 73% of the directorships of member university libraries of the ARL (Association of Research Libraries).^[20] The term “glass ceiling” came to describe the barrier faced by women librarians possessed of administrative talent but, due to systemic ideologies arrayed against them, were denied the opportunity to exercise that talent at the highest possible levels.

Maack also identified “territorial discrimination” as the sequestering of women into technical processing and children’s and youth services, regarded by many as roles well-suited to female attributes. Another type of territorial

discrimination has been the dispersal of professionals by type of library with men predominant in settings with higher social status, university research libraries, and with women often clustered in less prestigious workplaces such as small public libraries.

Recent scholarship devoted to the history and biography of women librarians has confirmed their skill as resourceful promoters of library services that extend beyond well-connected elites. The impulse of women to transcend the boundaries of gender, class, and race has influenced cultural life as varied as that in China, India, France, Germany, Nigeria, the United States, and the states of the former Soviet Union. Historical precedent has combined with civil rights movements, feminist theories, and case law to provide new tools for the profession to create more equitable settings for women library workers.^[20]

Twentieth Century Expansion

Much of the world was engaged in all-consuming war during the early years of the twentieth century. Governments also waged ideological battles, with democracies competing with socialism, fascism, and with repressive governments on virtually every continent. During World War I, libraries supported the war effort with their own special expertise. The American Library Association collaborated with the American Red Cross, the Y.M.C.A., and other social service agencies to support troops through book distribution programs. Librarians shipped 1.5 million books overseas and processed additional millions for libraries for more than 600 military encampments and seagoing vessels, a process that transformed ALA into a much more robust organization.

Military services and related support functions stimulated the expansion of governmental libraries of all types, especially among dominant nation states. These subject collections ranged from patents, to social science data, to foreign affairs, to classified documents. Some of the great libraries in the U.S.S.R., for example, were in Moscow, collections devoted to the social sciences, the sciences, agriculture, and military affairs. Among the finest special libraries in the world were those held by the British Museum. Others of special significance in the United Kingdom include libraries of the Royal Society of Medicine, the Royal Geographical Society, and the School of Economics at the University of London.

Libraries experienced dramatic growth after World War II in the years of economic expansion and the Cold War. Massive federal subventions were designed to prepare nations in the fight against opposing ideologies. Much more was at stake than merely differing points-of-view. The United States and the U.S.S.R. had developed weapons of mass destruction, challenged each other for technological superiority in space, and fought wars of proxy while literate societies began to process the

meaning of the Holocaust, and the Israelis carved out of Palestine an economically viable but constantly threatened militarized state. Nations committed support for all levels of education as part of larger movements to establish economic and military superiority. Librarians frequently argued for greater library support as vital to national security, military power, and economic expansion. Libraries devoted to technology and science enjoyed unprecedented growth; a number of academic libraries doubled in collection size every 20 years. During 1968 on college campuses in the United States, 68 major building projects were underway; during 1993, 25 years later, that number had risen to 100.^[21]

Sharing Resources

The modern idea of bibliographic control of a library's holdings has developed slowly over the centuries culminating in today's policies and tools for classification, cataloging, and complementary means of bibliographic description. Librarians have come to value such tools, understanding that the local collection rarely meets every request of the local reader, and have thus sought to meet the needs of multiple readers by sharing resources. Since the days of the Sumerians, library keepers were assisting readers in finding materials of interest. This task became especially complex during the Renaissance as the great increase in secular knowledge, produced by a small army of publishers springing up throughout the Western world, resulted in vast new amounts of reading materials and expanding library collections.

The idea that a single volume could guide the inquiring reader and encompass all human knowledge was an idea that had attracted a number of scholars including Konrad von Gesner (1516–1565). In 1545, he published *Bibliotheca Universalis*, a catalog in Greek, Hebrew, and Latin intended to identify all writers (with titles of their works) who ever lived. What may have been the first printed catalog of an academic library appeared in 1595 at the University of Leiden. Most catalogs of this period were arranged into general classes such as theology, medicine, philosophy, and history and then subdivided by the size of the volume. Thomas James (1573–1629), the energetic first librarian of the Bodleian Library, was encouraged by his benefactor, Sir Thomas Bodley, to devise more detailed listings of that library's holdings so that, as a result of book-buying tours of the Continent, the Bodleian would not duplicate what it already owned. The 1620 catalog was likely the first catalog arranged alphabetically by title, an approach vastly improved by 1674 when Thomas Hyde (1636–1703) and later Thomas Hearn (1678–1735) added cross-references to the alphabetical title lists.

A landmark event in resource sharing was the adoption of individual cards to replace entries in static printed volumes, thus providing flexibility and currency in catalog

information. Led by such early leaders as Charles Coffin Jewett and Charles Ammi Cutter (1837–1903), American libraries had, by the end of the nineteenth century, begun replacing their printed catalogs with cards. This change yielded fresh interest in improving the description of cataloged works. Sir Antonio Panizzi's groundbreaking 1841 *Catalog of Printed Books in the British Museum* laid the foundation for later efforts by Jewett in 1853 and Cutter in 1876. Influenced by Panizzi and by the 1871 *Prussian Instructions*, catalogers continued to revise rules in subsequent years and throughout the twentieth century. Revisions included those of the American Library Association's *Catalog Rules: Author and Title Entries* (often called the 1908 code), a 1941 revision (sometimes called the 1941 draft code), the 1949 *Rules for Descriptive Cataloging in the Library of Congress*, the 1961 International Conference on Cataloguing Principles (known as the *Paris Principles*), and the well-known 1967 *Anglo American Cataloging Rules*. In 1978 AACR was revised to become the AACR2 which itself was revised in 1988, 1998, and in 2002. Complementary developments included standards for monographic description as reflected in the 1974 International Standard Bibliographic Description which was later applied to nonbook sources.^[22]

Description represents only half of the challenge of establishing bibliographic control. The other half is the use of classification to facilitate location in a specific library. A number of classification schemes have been invented with that of Melvil Dewey becoming most widely accepted. While at Amherst College, Dewey created his Dewey Decimal Classification (DDC) which has undergone numerous revisions in order to update nomenclature and concepts, and has become popular in American public, school, and academic libraries. The Library of Congress (LC) developed its own system, drawn initially from an arrangement by Thomas Jefferson (1743–1826) whose approach to classifying knowledge had, in turn, been rooted in concepts of knowledge articulated by Sir Francis Bacon (1561–1626). The LC system was greatly elaborated in the early twentieth century by J. C. M. Hanson (1864–1943) and Charles Martel (1860–1945). In 1901 the Library of Congress began distributing copies of cards to libraries throughout the nation, one important result being the widespread adoption of the LC system especially in academic and research libraries. Other classification systems were the Colon Classification developed by S.R. Ranganathan (1892–1972) in 1933 and the Bibliographic Classification of Henry Evelyn Bliss (1870–1955), which appeared in segments between 1940 and 1953.^[23]

By the late nineteenth century, librarians as a learned community had begun to seek professional growth through the formal exchange of ideas both practical and philosophical. Enthusiasm at the inception of the American Library Association spread across the Atlantic Ocean to the first International Conference of Librarians in

London in 1877. Attendees represented the United Kingdom, and the United States as well as Australia, Belgium, Denmark, France, Greece, and Italy. The opening session credited the Germans for contributing the term *bibliothekswissenschaft*, translated “library science.” Participants established The Library Association of the U.K., taking note of the differing perspectives of their American counterparts. A second international conference hosted in London in 1897 drew 641 (more than twice the attendance 20 years earlier), representing the Far East as well as Europe and North America. Conferees presented papers on administration, architecture, bibliography, cataloging and classification, children’s services, education for librarianship, employment opportunities, and public services.^[7]

Cooperative enterprises advanced considerably as a result of the International Conference on Bibliography (Brussels, 1895) which, in turn, established the International Institute of Bibliography (IIB) to develop a universal bibliography on the structure of Dewey’s classified subjects. Paul Otlet (1868–1944) and Henri La Fontaine (1854–1943) negotiated with Dewey to adapt the fifth edition of the DDC in order to develop the Universal Decimal Classification (UDC) which they completed in 1907. The UDC, a faceted scheme, was especially well-suited to scientific and technical subjects, and has been widely adopted throughout the world, particularly in Europe, French-speaking North Africa, Spain, and Latin America.

Otlet and La Fontaine pursued a number of educational and organizational ideas, establishing, in 1910, the Union of International Associations. The IIB itself continued UDC development in French, German and English and later became the International Federation for Information and Documentation (FID). The FID subsequently affiliated with other international organizations such as UNESCO (United Nations Educational, Scientific, and Cultural Organization) and IFLA (International Federation of Library Associations and Institutions). In the 1960s and 1970s, FID, IFLA, UNESCO, and others collaborated on library education for developing regions, establishing and strengthening programs in China, Ethiopia, Indonesia, Jamaica, Morocco, Nigeria, the Philippines, Senegal, Uganda, and Venezuela.^[24]

In the 1960s in the United States, the Library of Congress led a collaborative effort to create the MARC (Machine-Readable Cataloging) format. With MARC records as a standard, two American networks began distributing online bibliographic records contributed by member libraries: OCLC (Online Computer Library Center, originally Ohio College Library Center) and RLIN (Research Libraries Information Network), affiliated with the Research Libraries Group. OCLC emerged as the core database provider for regional networks, most of which provided a broad range of services including preservation, document delivery, and continuing education. Varieties of MARC were adapted for the United Kingdom, Korea, and other nations, further enriching what functionally became

an international database, a vitally essential tool for resource sharing.

Serving Diverse Populations

Ethnic minorities routinely confront multifaceted challenges to economic and educational opportunity, a truism in both free and totalitarian nations. Such circumstances of daily existence describe, for example, Iranians in the United Kingdom, Palestinians in Israel, and African Americans in the United States. Libraries hold the capacity to preserve racial memory, enhance ethnic pride, and acculturate immigrants into the national ethos. The histories of urban public libraries, such as Phyllis Dain’s *The New York Public Library: A History of Its Founding and Early Years* [1972], feature discussions of ethnic collections and services to immigrant populations. The role of the librarian, extrapolating from Dain’s account, embraces an appreciation for every minority perspective however misunderstood or unusual. Thus, without ignoring the interests of the majority, the librarian incorporates peace literature into a military library, or resources on Islam in a predominantly Christian community, or Hispanic materials in a largely Caucasian city. The library, as it provides resources for minorities, becomes a harbinger of economic and intellectual mobility. A reference source such as the one by Stephan Thernstrom, Ann Orlov, and Oscar Handlin, eds., *Harvard Encyclopedia of American Ethnic Groups* (1980) provides entry into the multiple layers of minority status; and E.J. Josey and Marva L. DeLoach, who edited *Handbook of Black Librarianship* (2nd. ed., 2000), provide a well-informed guide to collections and services for one particular minority culture.

The task of the librarian who would serve the citizens of a pluralistic, multicultural readership constitutes a balance of the tension between advocacy and neutrality. The librarian advocates for access on behalf of the reader who explores the unorthodox in politics, theology, art, sex, and other areas of human interest. At the same time, the librarian—understanding issues of authority and credibility—does not discriminate as to content, preferring as highest priority the task of bringing readers together with the subjects they pursue, regardless of where reader interests might lead. This work is highly political, requiring that people of courage promote professional ideals. Sam Walter Foss (1858–1911) illustrated this professional tension at its best. He wrote that the librarian

is both Greek and Barbarian, Jew and Gentile, realist and romanticist, aristocrat and democrat, theosophist, secularist, orthodox, liberal, populist, and patrician. . . . the janitor of an amphitheater where warring creeds, beliefs, and tastes contend like gladiators. [The librarian] champions none and antagonizes none, but simply keeps his amphitheater in good repair and takes a sportsman’s like delight in seeing the fight go on.^[25]

GLOBALIZATION: 1989–PRESENT

Two cataclysmic events in 1989 signaled the arrival of a new age: 1) political revolt in China, fueled by students, professors, and labor activists who had been communicating, in part, through e-mail, culminating in the Tiananmen Square Massacre, and 2) the destruction of the Berlin Wall, the reunification of Germany, and the dispersal of the nations of the U.S.S.R. into independent states. These events symbolized unprecedented intellectual and economic exchange transcending geopolitical borders and barriers of ethnicity, language, and culture. The internet expanded from scientific and military uses into general business and educational purposes, transforming the way the world conducts its affairs. Commercial entities that never before existed came to redefine for-profit and not-for-profit institutions. Thomas L. Friedman heralded the new age in his synthesis, *The World Is Flat [Updated and Expanded]: A Brief History of the Twenty-first Century* (2006). Reading material provided by librarians became available in digital form, accessible anywhere one could find a computer with an Internet connection, no longer bound by a printed or film-based format.

The new age also marks new expressions of religious, economic, and political fundamentalism and militarism. The world of the twenty-first century is as dangerous as in any previous time. Libraries that would pursue successfully their highest ideals require open societies characterized by relative political and economic stability. War, terrorism, and natural disasters destroy libraries, books, the freedom to read, and the unfettered pursuit of ideas. These valued object lessons appeared in sharp relief at Library History Seminar XI, an international symposium hosted October 27–30, 2005 by the University of Illinois Graduate School of Library and Information Science. Hearing tales of fire and flood, bomb and bayonet, conferees recalled once again that the challenges to progress are relentless, but also that the purposes of libraries and the lessons of history have become a narrative intertwined.^[26]

WHY SOCIETY NEEDS LIBRARIES

The meaning of the thousands and thousands of stories that make up the library narrative lies embedded in the human impulse to record transactions, experiences, and ideas. Persisting issues in the imperatives to collect and preserve involve the processes and criteria for deciding what content merits preservation, at what levels of expertise and support, and within which formats. The first edition of a literary classic, for example, receives a form of storage, organization, and access that differs from that afforded a current municipal telephone directory. Choices about things to keep, things to treat in a special way, and

things to discard must never be made in a vacuum. Such decisions rely inevitably on a mixture of professional perspectives and individual and collective judgments in the context of institutional, cultural, economic, and political priorities and realities. The complex of factors influencing the nature of library collections is thus rooted in historically understood concepts of the library's function in society.

The Library as Repository

Michael Harris defines the library as a collection of graphic materials, intended for specific readers, and that is cared for by individuals familiar with those materials and engaged in making them accessible.^[21] The Harris definition may be usefully enriched with the notion of the library story as a foundational chapter in books devoted to the growth of civilization. Pierce Butler (1886–1953) wrote that the library came into existence to meet society's need to preserve accumulated human experience and to transfer it to succeeding generations who would adapt it for contemporary use. The library was a legacy for the living. The story of the library became a narrative with historic roots in people, ideas, and broad environmental trends, yet also with an eye to future generations as a matter of moral obligation.^[27]

David Reith has argued that, since the library emerged from a complex of values and social organization, the elements of its structure connect by their nature to cultural phenomena or to components of the social structure.^[28] Reith posited the fundamental purpose of the library as a repository, that the library collects and preserves the full range of expressions of human curiosity and intellect, yielding a plethora of resources essential for individual, community, national, and global progress. While some results of human creativity (i.e., art, music, patents, or pharmaceutical formulas) may reside in museums, digital repositories, or research centers, they have, at the root of their creation and distribution, a content-based structure that a specialist can adapt for storage and retrieval. While library classification and arrangement share some concepts with those of museums and archives, the latter institutions are bounded by concerns for format that the library—with its ultimate focus on content—does not share. To place a high value on the organization of materials goes to the very heart of a library's purpose since it considers the interests of future readers in ways that transcend the boundaries of language, culture, ethnicity, gender, ideology, and time.

The Library as Change Agent

The library has also possessed capacities as an agent of change, assuming a dynamic rather than a static universe, and thus a vital work of the library becomes documentation of that change. Although appearing on the surface as a

passive and dependent institution, the library has also challenged the status quo, having promoted revision of economic, political, educational, or social norms. The library as change agent represents an important interpretive departure from an earlier view of the library, the public library in particular, as a follower of change rather than a creator of it.^[29] While consensus about the library as an agent of change or a follower of change might be elusive, consensus about the library as serving the common good might be more tangible. Historically that good has been regarded as inherent, something understood intuitively by the library and its constituents though too seldom stated in the public square.

The story of the library as an advocate for change is rich with political ideas including that, for example, during the late nineteenth and early twentieth centuries in the United Kingdom and the United States, the library should support the national interest by helping to assimilate immigrant cultures and ethnic minorities, teaching new arrivals the language of democratic participation and economic stability. More recently, library collections have nurtured the goals of civil rights for women and ethnic minorities, for people with physical disabilities, and for those with gay, lesbian, bisexual, and transgendered preferences. This makes the library a potentially safe haven and valued resource for those threatened or intimidated by dominant social behaviors, but these value commitments may also make the library an unwelcome target of suppression by fundamentalist impulses. Since libraries depend on the societies into which they are integrated by politics, economics, and ideology, they are rarely positioned for unfettered allegiance to professional ideals but rather offer mixed policies, sometimes promoting change by advocating for minority interests and sometimes limiting change by appealing to the powerful and well-connected.

The Library as Educator

Another role for the library involves that of education, a role that is at once both noble and suspect. Stakeholders in democratized settings tend to disagree about the values the library as educator should promote. Consequently the library, depending on its environment and those interpreting its purpose, has either educated readers to higher levels of perception and understanding or it has suppressed information that readers would find helpful in pursuit of opportunities for intellectual, economic, or political growth.

The librarian as a promoter of certain values, as someone who chooses an educational objective and then pursues that objective by building and promoting collections of a particular character or who simply discerns within an existing collection certain educative potential, is a concept that intellectual and social historians have come to explore with increasing nuance. Seminal monographs by Dee

Garrison,^[30] Evelyn Geller,^[31] Wayne A. Wiegand,^[32] and Louise S. Robbins^[33] analyze ambivalent perspectives that have marked the library as promoter of an educational ethos with programming and collections that target identifiable constituents.

In the face of misuse of the library as an educator, it must be recognized that the great religious movements possessed a powerful instructional obligation, honoring the written word, the creeds and liturgies and other sacred writings of prophets and priests. In fact, most religious traditions deserve a debt of gratitude for preserving classical secular texts in literature, history, economics, and government in addition to theological treatises. Scholars and scribes transmitted literature from the past, often migrating content to more durable media, performing such tasks as matters of educational purpose as well as religious observance. Claims to cultural reproduction in this particular way mark the stories of Eastern religions such as Hinduism and the Middle Eastern religions of Judaism, Christianity, and Islam.

Modern iterations of the library as educator may be observed in the adult education movement of the early twentieth century, which valued self-education as a tool of economic opportunity, as well as in twenty-first century literacy programs. The educative power of the library has tended to find its richest expressions in the great universities established in Europe in the Middle Ages and which—along with newer universities in the United States—have been transformed into the multicampus universities of today. These institutions, in concert with great national and private research libraries, have become part and parcel of intellectual and scientific progress—in the most literate nations—in the discovery and production of new knowledge, that most precious of commodities that marks human striving for a better world. The universities are also part of larger public and private educational systems, having been constructed on the foundation of K–12 (kindergarten through 12th grade) schooling wherein the school librarian through the reading and telling of stories, or equally often the public librarian, provides children with their earliest strategic impressions of the learning potential of books and libraries. The special role of the public library remains that of accommodating a wide range of reading tastes, serving citizens with a variety of community programs, welcoming readers in ways for which schools and universities are less well structured, and protecting the freedom to read.

The Ideology of Reading

The desire to use the collections and services of a library or to pursue the practice of library work or research and teaching in library and information science is a desire that, hypothetically at least, is rooted in the desire to read. Biographies and autobiographies in all fields of endeavor, including librarianship, provide abundant testimony to

early transformational moments when individuals were mentored by a library worker, or when they spent countless hours browsing library collections and reading books.

Michael Harris defines the ideology of reading as a consensus about the value of reading and the widespread dissemination of books and writing to the growth and progress of a nation or a community. This ideology becomes clear in three particular constructs. The first of these is control, the idea that books and libraries symbolize power exercised by elites in order to support their values and interests. Social control may function to cultivate compliance among lower classes in order to maintain the political *status quo* and avoid civil unrest. Not uniformly shared among library historians, this view likely represents the minority perspective contrasted with the more widely appreciated opinion of the public library as an expression of democratic impulses. A second category is the library as commodity, that it is integral to an elaborate enterprise that incorporates the related work of authors, publishers, marketing specialists, booksellers, and libraries. Partners in the enterprise thrive in those societies with economies diverse enough to support them.

A final category of the library is that of memory. A nation or a municipality develops the capacity to reflect on its progress and to examine and revise its history but also to perform these tasks in settings that are monumental, places that are iconic enough to remind citizens of their cultural and intellectual maturity.^[21] Thus millions of words organized into the reading matter of civilizations, confirming and promoting human progress, make up the multitude of stories that constitute the large narrative of the library, and they become essential to the high aspirations of individuals and groups, of families and communities, of movements and nations, of actions and ideas.

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History of Museums

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Abstract

Making collections of objects is a universal human practice. Collections were made long before there were museums. The concept of the museum was developed from the association of objects and learning at the Temple of The Muses of ancient Alexandria. Museums have evolved from the private Renaissance cabinets of curiosities, which were open only to a few, into modern institutions with primarily educational functions that both reflect and shape human society.

INTRODUCTION

When James Smithson (ca. 1765–1829) left his fortune to the U.S. government, he stipulated that it be used for “the increase and diffusion of knowledge.”^[1] After debating using the gift to establish a library or a university, Congress instead decided that knowledge could best be increased and diffused in the new republic by creating a public museum. The Smithsonian Institution, established in 1846, now includes 19 museums, 9 research centers, and a zoological park.^[2]

Museums developed in response to the human need to understand the world by using collections of objects—abstractions of the real world^[3]—to make sense of the chaos around them. The collecting and ordering of things is a universal human trait that takes different forms in a diverse array of human cultures.^[4] The earliest evidence of collecting is utilitarian objects and grave goods that were part of the material culture of the earliest humans.^[2] One writer has suggested that the making and keeping of collections stems from “the human propensity to inquire and acquire” and the “twin concepts of preservation and interpretation.”^[5]

Collections are distinguished from random assemblages of objects by the presence of order (the recognition of relationships among the objects). All collections have order even if it is an order that is comprehensible only to the collector. Collections are made for a purpose, while assemblages occur by accident.^[6] What distinguishes the objects in a collection from other objects is that objects in a collection are musealized—that is, they have been removed from their original natural or cultural environment to become part of the collection.^[7,8] In the process of being musealized, objects acquire new meanings and they continue to acquire new meanings as long as they are part of a collection. The history of museums is, in effect, the history of the collection and classification of objects.

COLLECTING IN HISTORY

Collections have a longer history than do museums. Collecting began with the earliest human societies,^[2] and there were established collecting traditions in Africa, Arabia, and Asia long before collecting developed in Europe.^[9] Ancient collections were assembled for a variety of purposes, including for prestige, as economic hoards, and to promote group loyalty. One of the oldest documented collections dates from ca. 530 BCE in the ancient Sumarian city of Uruk, located in present-day Iraq, about 120 miles north of Basra.^[5,10] Excavations of a temple site there by C.L. Woolley and his colleagues in the early 1900s unearthed a collection of antiquities dating back to 2000–2500 BCE that included a boundary stone, a mace head, fragments of a statue, a clay foundation cone, and clay tablets. The objects were documented by inscriptions on a clay drum cylinder on which a scribe had recorded that they were “found in the ruins of Ur, the work of Bur-Sin, King of Ur, which while searching for the ground plan [of the temple] the governor of Ur found, and I saw and wrote out, for the marvel of beholders.”^[11]

By the third millennium BCE, there were extensive collections in the Sumarian state archives at Ebla, and by the second millennium in Mesopotamia, collections of old inscriptions were being used to teach scribes how to make records. During the Shang dynasty in China (ca. 1600–1025 BCE), gold and bronze artifacts were collected; by the time of the Tang dynasty (CE 618–907), collecting had become very popular among the ruling elite.^[10] In what is now Iraq, Nebuchadnezzar (605–562 BCE) acquired a large private collection that included antiquities and natural history specimens, and Nabonidus (555–539 BCE) of Babylonia kept collections of antiquities and natural history objects.^[5] Tuthmosis III (1504–1450 BCE) of Egypt had an extensive collection of art, antiquities, flora, and fauna from Asia.^[5] In an Egyptian tomb, a fossil sea urchin from the Eocene was found that was inscribed in

hieroglyphs with the date, name of the collector, and locality where it was collected.^[12,13] Art collecting was an ancient Greek custom, associated with the exhibition of paintings and sculptures in the entrance peristyles and porches of temples^[14–16] in an area known as the pinakothekē or picture gallery. Wealthy Roman citizens collected paintings and objects that were considered to be “unusual and curious.”^[5] Several private collections of exotic sea shells have been found during the excavation of the ruins of Pompey, and collections of fossils have been found in ancient Greek and Roman cities, as well as collections of precious stones, decorative objects, and antiquities.^[9,12] The oldest continuously functioning museum in the world is probably the Shōsōin at the Tōdai Temple in Nara, Japan, founded in the eighth century, which still exhibits secular and sacred artworks.^[14]

THE MUSEUM CONCEPT

Both the modern concept of a museum as a place where learning and objects are associated and the source of the word museum (from the Greek *mouseion*, or “seat of the muses”) originated in antiquity at a philosophical institution called the Temple of the Muses (a reference to the Greek sister-goddesses).^[17] The temple was considered to be “a place of contemplation” in which learning and objects were combined.^[9,18,19] The Temple of the Muses was founded in the third-century BCE in the city of Alexandria by Ptolemy Soter (305–283 BCE). Objects of art and natural history were collected at the institution, and many learned scholars worked there, including Euclid and Heraclitus.^[20] The Temple of the Muses had the largest library in the ancient world, lecture halls, gardens, and dormitories for scholars. It continued to flourish under Ptolemy Philadelphus (285–246 BCE). The temple and its collections were ultimately destroyed, probably in a fire that swept Alexandria.^[5]

The concept of preservation is closely related to the concept of collecting because for collections to be useful the objects in them have to endure. Some objects are much more durable than others, thus the material the objects were composed of determined, in large part, what went into early collections. For example, preserving organic matter is particularly difficult—animal skins, plant-based materials, leather, and textiles require much more care to preserve so that they can be passed on from one generation to the next than do ceramics or stone.^[21] Dehydration (mummification) is the oldest known method of intentional preservation of organic materials. Mummies were made of both humans and other animals on purpose (by removing the soft tissues most prone to deterioration, dehydrating the flesh with salts, wrapping the body in textiles or skins, and treating the bundle with oils and resins to keep pests away) at least 8000 years ago in Peru and at least 5000 years ago in Egypt.^[22,23] In classical Greece, the tradition of donating

objects to treasuries at public sanctuaries led to attempts to prevent deterioration by such means as coating metal objects in pitch and preventing dehydration of ivory and wood by the use of oils.^[14,24,25]

For collections to be useful in helping understand the world, the objects in them have to be organized or classified. Much like collecting, the organization of objects also stems from an innate human impulse.^[26] The organization of objects is based on real or perceived similarities and patterns. In order to sort out objects, people must be able to distinguish them, hence the collection and the organization of collections is closely linked to the establishment of naming systems (taxonomies). In many cultural traditions, establishing a taxonomic system is part of the creation story, as in the Judeo-Christian-Islamic creation myth in which one of the first tasks of the first human is to name the animals.^[2]

The first useful and enduring taxonomy of animals was proposed by Aristotle (384–322 BCE), and for plants, by a student of Aristotle named Theophrastus (ca. 372–287 BCE).^[27] Aristotle had been a student of Plato in Athens and later moved to Macedonia to become the tutor for the young prince Alexander, the future conqueror of the world.^[19] Aristotle arranged all the known animals—about 540 species—in a gradual progression or *scala natura* based on what he perceived to be their degree of perfection, with invertebrates at the lowest part of the scale and humans at the highest.^[28] Aristotle’s knowledge of animals was based mostly on his own observations and dissections, but he made a few curious mistakes that reflected dominant cultural traditions (e.g., while noting that the internal organs of a dog and a lion were very similar, he also repeated the ancient folklore that a lion has only one bone in its neck; and although familiar with human anatomy, he thought that the heart was the seat of the soul and that the only functions of the brain were to cool the blood and produce mucous).^[29] Much of Aristotle’s knowledge of non-Mediterranean species was based on specimens or descriptions sent back to Macedonia by Alexander the Great. For example, Aristotle’s account of elephants and their natural history in *Historia Animalium* was derived from eyewitness descriptions^[27] and possibly from direct examination of bones or pieces of skin (the first elephants that Alexander saw were those used by Darius at the Battle of Gaugamela in 331 BCE).^[30] Aristotle’s *scala natura* concept had a profound influence on Western perceptions of nature and cultures for the next two thousand years, which was expressed in the way specimens, artifacts, and other objects were arranged in collections.^[31]

EVOLUTION OF THE MUSEUM CONCEPT

Between approximately 900 and 1200 CE, a great intellectual awakening took place in the Middle East, including the translation of many Greek texts into Arabic and the

development of extensive archives and collections of artistic works/>>.^[32] At this time, an Arabic collecting tradition was formalized by the Islamic concept of property given for the public good and the donation of objects, similar to the deposition of objects in the treasuries of Greek temples.^[5] The work of the Islamic scholars did not reach Europe until the twelfth or thirteenth centuries when the Arabic texts and the Arabic translations of Greek texts were translated into Latin. These translations initiated an admiration for the works of classical antiquity in Europe, which in turn spurred the growth of private collections and encouraged several popes, princes, and other wealthy citizens to fund the excavations of classical sites, particularly between about 1450 and 1550.^[2] This is the period when the first *cabinets of curiosities* (also called *Kunst-* or *Wunderkammern*) appeared in Europe.^[33]

Pre-Renaissance collecting in Europe was largely confined to collections acquired by churches, which were the centers of intellectual life.^[14,33] Church collections included not just sacred art and religious objects, but also rare and unusual things such as the bones of giants, griffin's eggs, classical statuary, and artifacts of historical note.^[9,14] Some of the objects in these collections were quite fantastic—the Cathedral in Milan (Italy) claimed a hair from the beard of Noah; the Cathedral of Halberstadt (Germany) exhibited a bone from the whale that swallowed Jonah; the Cathedral in Brunswick boasted a griffin's claw, personally brought back from Palestine by Duke Henry the Lion.^[9] From surviving collections, it is now known that goat and antelope horns were often thought to be griffin's claws, fossil sharks teeth were thought to be snake tongues, and elephant bones were assumed to be the bones of giants. Such objects were accepted in the church collections not just because they were unusual, but also because they were thought to be useful in understanding the world. For example, at a time when very few Europeans had seen an ostrich or even an illustration of an ostrich, it was easy to believe that ostrich eggs were the eggs of griffins. However, ostriches were also mentioned in the Biblical book of Job, where it was recorded that the ostrich sometimes forgets its eggs, but when it finds them again, the bird cherishes them all the more, thus ostrich eggs were symbolic of God's love for repentant humans.^[9]

MUSEUMS, CLASSIFICATION SYSTEMS, AND SOCIETY

As collections began to be assembled in private cabinets of curiosities in the 1400s, classification schemes were needed to give order to the objects.^[34] Initially, objects were simply separated into *mirabilia* (finite marvels) and *miracula* (infinite or divine marvels), or into *artificialia* and *naturalia* (Table 1). As the collections grew larger and more complex, new categories were added, such as *antiquitas* for objects of historical import.^[33] The first cabinets of curiosities were small cabinets filled with

Table 1 Some museum collection classification schemes.

Date	Categories	Source of classification
Early 1400s	Mirabilia (finite marvels) Miracula (infinite or divine marvels)	Wunderkammers, Kunstkammers, Cabinets of Curiosities
Mid 1400s	Artificialia Naturalia	
Late 1400s	Artificialia Naturalia Antiquitas	
1565	Material glorifying the founder Handcrafts from antiquity Natural specimens Technical and cultural objects Paintings and sacred objects	Samuel von Quicchebert
1679	Objects from mines Growing things Animals Works of art	Jan Swammerdam
1727	Naturalia Artificialia Curiosa	Caspar Neikelius
1714	Natural history Things sacred and superstitious Artificial rarities Apparatus (philosophical, mathematical, anatomical, surgical, and chemical) Coins and medals	Michael Bernhard Valentini
1759	Manuscripts, medals, and coins Natural and artificial productions Printed books	British Museum
1814	Manuscripts, medals, and coins Natural and artificial productions Printed books Antiquities and art	British Museum
1823	Ancient relics Arms Dresses and implements of half-civilized nations Rarities (gifts, memorials, amulets, curious works of art) Pictures Books and manuscripts Zoological specimens	Ashmolean Museum at Oxford

treasurers of nature and interesting works of art, but the term rapidly evolved to refer to whole rooms filled with treasures. Francis Bacon (1561–1626) described a typical cabinet of curiosities as containing “. . .whatsoever the hand

of man by exquisite art or engine has made rare in stuff, form, or motion; whatsoever singularity, chance and the shuffle of things hath produced; whatsoever Nature has wrought in things that want life and may be kept.”^[35] The cabinets contained such things as unicorn horns (narwhale tusks), giant’s bones (usually the bones of elephants or mastodons), Egyptian mummies, and snake’s tongues (fossil shark teeth), as well as relics of saints, religious and secular classical art, statuary, and the occasional object from Asia or Africa.^[9] Along with the cabinets of curiosities came a new “...veneration of the rare, the unusual, the wonderful and the miraculous...”^[36] The collections in these cabinets confirmed the existence of a divine being and demonstrated to their collectors that there was a divine order in nature, thus “One of the true *raison d’être* behind the growth of cabinets of curiosities was a restless desire to establish a continuity between art and nature. Thus they demonstrate the existence of a supreme unifying principle.”^[33]

In addition to their value as collectables, many of the objects in the cabinets of curiosities were highly prized for their use in the practice of medicine and alchemy, such as healing stones and mummy dust, or because of the power the objects were believed to possess.^[9] Lorenzo the Magnificent (1449–1492), a member of the Medici family of Florence, had a unicorn horn (a narwhale tusk) in his collection, which was particularly valuable as unicorn horns were believed to sweat in the presence of poison.^[9] Lorenzo’s collections included books, intaglios, precious stones, medals, tapestries, Byzantine icons, sculptures, natural history specimens, and paintings (many of which had miraculous properties).^[37] The word *museum* was first used in Europe in the fifteenth century to describe the collection of Lorenzo^[38] in reference to the encyclopedic nature of the collections (the word *museum* made its first appearance in an English work in 1615); the word *gallery* is derived from the name of the long, narrow corridors in the Medici palaces where their treasures were exhibited.^[12] Curiously, the word *collector* was not used until 1582, and then only to refer to a literary compiler.^[39]

The development of the collections in the Medici palace was based on “Wealth, patronage, and the use of the past...” to glorify the family members based on the role of magic and occult cosmology in giving power to objects.^[37] By possessing objects of great power, the Medici family showed that it, too, had great power. The Medici collections were opened to the public at the Uffizi Palace (which had originally housed Florentine administrative offices) in 1582, and ultimately were bequeathed to the state of Tuscany in 1743.^[5]

THE POWER OF OBJECTS AND THE TRANSMISSION OF KNOWLEDGE

A common object in the cabinets of curiosities, including that of Lorenzo the Magnificent, was a snake-stone (Fig. 1),



Fig. 1 A snake-stone or ammonite (a fossil cephalopod from the early Cretaceous, *Pulchella veleziensis*).

Source: Photo by J.E. Simmons.

named for its resemblance to a coiled snake.^[37] Snake-stones were believed to prevent snake bite and to cure both snake bite and rabies. Another name for a snake-stone was an ammonite, derived from its resemblance to the *Cornu Ammonis*, or Ammon’s Horn, a reference to the Egyptian deity who was depicted with the body of a human and the head of a ram with a coiled horn (Alexander the Great had coins struck featuring his profile wearing the Horn of Ammon to affirm his deity).^[12] In Medieval times, fossils were thought to be formed by exhalations, as described by Aristotle (fuliginous exhalations formed fossils, ochre, sulfur, and vermillion, while vaporous exhalations formed metals), or believed to grow in the earth.^[9] Snake-stones were valued in alchemy because they were thought to be formed by the conjunction of two pure salts. Snake-stones are still common in museums and still popular with collectors even though they are now known to be fossil cephalopods about 400–1400 million years old. The snake-stone shown in Fig. 1 was purchased as an example of the oxidation of pyrite in a geological collection stored at too high a relative humidity. These various conceptions of snake-stones—as medical devices, alchemical substances, scientific specimens, collectables, and teaching aids—are all dependent on the concept that underlies why museums grew and flourished from the cabinets of curiosities onward: *objects are perceived to have power*.^[13] The belief in the power of objects greatly influenced what was collected and preserved. For example, “No museum of any repute was considered complete without one or more specimens of unicorn’s horn, an article which was believed to possess wonderful virtues, and was much employed in medicine.... The Grand Inquisitor Torquemada always carried about with him the horn of a unicorn to protect him against poison and assassins,” and mummies were believed to be “endowed with extraordinary virtues.”^[9] Mummy dust was used to stop bleeding, to heal bruises and fractures, and to relieve convulsions. Murray notes

that “although all museums could not attain an entire mummy, nearly every one had one or more fragments,” such as a finger, a foot, or a head.^[9]

Since the sixteenth century, collectors have organized their collections in ways that promote the transmission of knowledge.^[26] Museum classification systems grew more sophisticated when it became possible to print and circulate collection catalogs.^[2] The first museum catalogs were little more than descriptive inventories of collections, but these rapidly evolved into detailed listings of museum contents with illustrations, histories of significant objects, and critiques of the collection.^[40] Ulisse Aldrovandi (1522–1605) went so far with his museum catalog as to also produce a “...*Catalogus virorum qui vistarunt Musaeum nostrum*, in which he categorized his visitors according to their geographical origins and social standing.”^[33]

One of the first printed museum catalogs was prepared by Samuel von Quicchebert (1529–1567), a physician in Antwerp, and published in Munich in 1565.^[41] Quicchebert wrote that a collection should be a systematic classification of the materials of the universe, and he provided guidelines for assembling what he considered to be an ideal cabinet of curiosities. Quicchebert proposed an organization scheme (Table 1) that classified objects into five groups that Pearce has pointed out correlate well with modern museum divisions: material glorifying the founder and handcrafts from antiquity (historic objects); natural specimens (natural history materials); technical and cultural objects (applied art and crafts); and paintings and sacred objects (fine art).^[3] Quicchebert recommended that a museum include a library, workshop, and apothecary shop, and he described his ideal institution as “A theater of the broadest scope, containing authentic materials and precise reproductions of the whole of the universe.”^[33] In the same year that Quicchebert’s catalog was published (1565), Johannes Kentmann (1518–1574) of Torgau published a catalog of his 1600 rock and mineral specimens, organizing the catalog according to the newly published classification of rocks and minerals in *De re metallica* (1556) developed by Georgius Agricola (1494–1555).^[9]

One of the best-known European collections of this time was compiled by Olaus Worm (1588–1654) in Copenhagen beginning in 1620 and described in an extensive catalog, *Museum Wormianum*, published in 1655.^[42] Worm’s catalog included a woodcut depicting the main room of the museum that has been widely reproduced in many publications about museums. The *Wunderkammer* of Jacobz Swammerdam, a Dutch pharmacist, was cataloged by his son, Jan Swammerdam, after the elder Swammerdam died in 1679.^[2] Swammerdam the Younger divided the large and by then famous collection into four categories (Table 1) consisting of objects from mines, growing things, animals, and works of art (which included ethnographic objects). One of the first museum catalogs to be printed in English appeared in 1691, entitled the

“Catalogue of all the chiefest Rarities in the Publick Theater and Anatomie-Hall of the University of Leyden,”^[9] prepared primarily for the use of visitors to the museum. The catalog listings included shoes and sandals from Russia, Siam, and Egypt; the skin of a man dressed as parchment; “A drinking cup [made] of the skull of a Moor killed in the beleaguering of Haerlem”; Chinese paper; Egyptian mummies; a Roman lamp believed to be capable of burning eternally; “an Hand of a Meermaide presented by Prince Mauritz”; and a 100-year-old mushroom.^[9]

The oldest surviving purpose-built museum building was designed by Wilhelm Egkl and constructed in Munich between 1563 and 1567 to exhibit the paintings of Wilhelm IV and Albrecht V.^[38] The building is now known as the Mint (Münzhof) as it housed the Bavarian mint from 1809 to 1983.

Two of the great collectors of the Renaissance were Konrad Gessner (1516–1565) and Ulisse Aldrovandi (1522–1605), both of whom compiled and published detailed, illustrated catalogs of their collections.^[31] Gessner, born in Zurich, wrote *Historia animalium*, a work of 3500 pages in four immense folio volumes in which he arranged all the known animal species according to the *scala natura* scheme proposed by Aristotle. After Gessner died of the plague at the age of 49, his collection was acquired by Felix Potter (1536–1614) and then passed on to the Natural History Museum at Basle where some of the specimens are still extant.^[38] Aldrovandi, who was from Bologna, taught medicine in Padua and Rome while spending his family’s fortune collecting specimens of animals and plants and hiring artists to illustrate them. The Aldrovandi collections are now in the University of Bologna.^[38] About this same time, the first herbarium was made by Luca Ghini (1490–1556) in Padua, Italy, when he invented the practice of pressing and drying plants and then attaching them to paper sheets, called a *hortus siccus* or “dry garden.”^[38,43]

THE MODERN MUSEUM

The modern museum dates to the time when collections began to be made for the specific purpose of exhibiting the objects to the public, but this is not an easy-to-define moment. One of the first public European museums was formed when the Grimani family bequeathed their private collections to the government of Venice between 1523 and 1583.^[38] The Grimani collections are now part of the present-day archeological museum of Venice. Many other such donations of collections and the subsequent creation of public museums followed. During this time, systems and scientific methods were being applied to understand both human culture and nature.^[38] For example, Francis Bacon (1561–1626) argued for the application of inductive empiricism to the cataloging of knowledge, and

Table 2 Nature of museum collections.

Museum type	Collections description
Art	Aesthetic
History	Documentary
Science	Systematic

René Descartes (1596–1650) sought to rationalize science and religion, developments that were reflected in the nature of museum collections (Table 2).^[44]

In England, the Tradescants sought the services of Elias Ashmole (1617–1692) to catalog their own extensive collections, which ultimately became the first public museum in England.^[39] John Tradescant the Elder (ca. 1570–1638) and his son John Tradescant the Younger (1608–1662) collected natural history specimens, precious stones, weapons, coins, carvings, paintings, and medallions from all over the world.^[34] Tradescant the Elder wrote to the Secretary of the Admiralty in 1625 and asked for help in obtaining things “. . . that be Rare or Not knowne to us” as well as “Any thing that Is strang.”^[39] This request came at the same time as the Tradescant collections began to be exhibited to the public at Lambeth.^[38] Ashmole’s catalog of the Tradescant collection was published in 1656 under the title *Musaeum Tradescantianum*. After the elder Tradescant died, the ownership of the collection passed to the younger Tradescant, and after his death Ashmole moved to take over the collection even though the widow, Hester Tradescant, resisted.^[39] Ultimately, after a protracted legal battle, Ashmole gained control over the collection and donated it to Oxford University, where a part of it is still on exhibition as the Ashmolean collection.^[45] The Ashmolean Museum established the pattern for what eventually became the modern university museum. Opened in 1683, the Ashmolean included not only space for exhibition and storage of collections, but also offices for the teaching staff associated with the university.^[46]

Sir Hans Sloane (1660–1753) made the collections that became the core of the British Museum.^[9] Sloane’s collections were encyclopedic in scope.^[39] The catalog of the collections of the Royal Society of London included listings for “A piece of BONE voided by Sir W. Throgmorton with his urine,” “A Weesle Headed Armadillo,” and a piece of “skin from the Buttock of a Rhinoceros.”^[47] Museums had objects like these in their collections largely because “The object of showing such things was that they were expected and that the museum should not seem to be incomplete by their not being there.”^[9] John Henry Parker, the curator of the Ashmolean Museum, wrote in 1871 that “I do not wish to exclude curiosities from [the museum]; they attract people, and when they are brought hither by curiosity, they may stop to learn something better; they may want to know something of the history of the curiosities they have come to see.”^[9]

Museums were numerous enough in Europe after 1700 that a museum object dealer from Hamburg named Caspar Neikeli (a pseudonym for Kaspar Freidrich Jenequel)

published a book called *Museographica* in 1727, considered to be the first museological work.^[48,49] Neikeli provided guidance for acquisitions; addressed problems of classification of the objects in the collection as naturalia, artificialia, and curiosa (Table 1); presented techniques for caring for collections; and suggested putting a table in the middle of each room “. . . where things brought from the repository could be studied.” Neikeli recommended that museum objects be stored in dry conditions and kept out of direct sunlight, and that museums should have an accession book and a general catalog.^[15] Neikeli was the first to articulate the difference between viewing objects clustered in a small room (e.g., as in a cabinet of curiosities) and displayed in a long room (an exhibition hall derived from the *grande sale* of the French medieval chateaux).^[48] As late as 1759, the original organization of the British Museum reflected Neikeli’s divisions of knowledge with its collections divided into three departments: manuscripts, medals, and coins; natural and artificial productions; and printed books (Table 1).

In 1753, David Hultman published his recommendations for museums, writing that a museum building should be made of brick, be longer than it is wide, and have windows facing north.^[9] Despite the appearance of the books by Neikeli and Hultman, collection care in museums at this time was, in general, not terribly good. “. . . William Swainson compared the storerooms [of the British Museum] with the catacombs at Palermo, each of which was apparently opened once a year to determine how much decay had occurred and to deposit fresh material.”^[36]

As museums grew larger and more complex early in the eighteenth century, they began to diverge into specialized institutions such as art, ethnographic, history, military, natural history, and technology museums, based on the characteristics of their collections and the systems of order used to categorize the objects in their collection (Table 3).^[2] For example, natural history collections benefited greatly from the advent of new taxonomic classification systems for plants (in 1735) and animals (in 1758) developed by the Swedish naturalist, Carl Linnaeus (1707–1778).^[50] These efficient, modern classification systems quickly became the principle around which natural history collections were organized and collection growth was directed. An equivalent common universal

Table 3 Generalized systems of order used in museum collections.

Type of museum	Ordering system
Art	Artists’ name, period, medium, genre, school
Natural history	Linnaean taxonomy
Geoscience	Epochs, strata, chemical composition
History	Material, topical class (use), style, Chenhall classification
Anthropology	Material, provenance, cultural association

cataloging taxonomy for human-made objects did not become available until 1978.^[51] By contrast, the Dewey Decimal system for cataloging library materials in 10 major classes appeared in 1876, the Library of Congress system (using 21 classes) was first published in 1897, and the Universal Decimal Classification was published in Europe in 1895.^[2]

Many of the new museums were less encyclopedic and more focused in their collections, such as the first of what are now the Vatican Museums, the Museo Sacro, which opened in Rome in 1756.^[52] A number of museums specializing in art, history, and natural history were founded at this time. The first museum devoted exclusively to art, the Pio Clemente Museum, was opened in 1773 in Rome by Pope Clement XIV (the museum's holdings are now part of the Vatican collections).^[52] Most early European museums started with collections assembled by happenstance, but some were planned more thoroughly. The first modern art museum was the Hermitage in St. Petersburg, Russia, which was established in 1764.^[9] The Czartoryski Museum (Krakow) was founded in 1796 to bring collections from the aristocracy to the general public. In 1779, Christian Von Mechel suggested that the Belvedere Museum in Vienna should be arranged to present "a visible history of art," in a chronological framework.^[48] This was followed by the Altes Museum in Berlin (1830), also designed to provide "a visual history of art from its beginnings."^[5] The Alte Pinakothek in Munich (1836) opened with a chronological exhibit of art by organized by schools, with gallery spaces designed to protect the artwork from fire, dust, and vibration, with north-facing windows, and moderate heat in the winter.^[38]

The first museum in the United States was established in 1773 by the Charleston Library Society, in Charleston, South Carolina.^[53] In 1785, the first public museum in the United States was operated by Charles Willson Peale (1741–1827), initially in his home in Philadelphia.^[54,55] Based on the European concept of a museum, Peale's innovation was his democratic intention to provide instruction and entertainment to all classes of people. Peale's museum included paintings by himself and his sons, taxidermy mounts, fossils, a mastodon skeleton, ethnographic objects, and live animals.^[54] Peale's museum eventually failed when it was confronted with many of the same problems that many museums face today—funding, maintaining audience, and presentations. The Peale collections were dispersed at auction in 1858—of the 1600 bird taxidermy mounts prepared by the Peale family, only 14 are known to exist today.^[55]

A number of significant museums were founded around this time (Table 4). The British Museum was opened to the public in 1759 (with free admission), with its collections of art, anthropology, history, science, and a library, making it a universal institution.^[38] Charles III of Spain brought together works of art and natural history in 1785 as a museum of natural science, which eventually became

Table 4 Founding dates of some significant museums.

Date of founding	Museum
1523	Grimani collections given to Venice and opened to public
1567	Wilhelm IV and Albrecht V collections established in a purpose-built structure (Munich, Germany)
1582	Medici collections opened to the public at Uffizi Palace (bequeathed to Tuscany in 1743)
1620	Museum of Olaus Worm (Copenhagen)
1625	Tradescant collections on public exhibit in England, to become the Ashmolean Museum at Oxford in 1683
1752	Museo Nacional de Ciencias Naturales (Madrid)
1756	Museo Sacro, Rome (now part of the Vatican Museums)
1759	British Museum (London)
1764	Hermitage (St. Petersburg)
1773	Charleston Library Society (Charleston, South Carolina)
	Pio-Clemente Museum (Rome)
1778	The Batavia Society for Art and Science (now the Central Museum of Indonesian Culture, Jakarta)
1784	The Indian Museum (Calcutta)
1785	The Peale Museum (Philadelphia)
1787	The Prado (Madrid)
1791	The Massachusetts Historical Society (library and public exhibition gallery)
1793	Muséum Central des Artes, now the Louvre (Paris)
1796	Czartoryski Museum (Krakow)
1802	National Museum (Pest)
1814	Asiatic Society of Bengal (Calcutta)
1815	Rijksmuseum (Amsterdam)
	National Museum (Rio de Janeiro)
1818	Moravian Museum (Brno)
1822	Picton Academy, the first Canadian museum (Nova Scotia)
1823	Museo del Pais, now Argentine Museum of Natural History (Buenos Aires)
	Raffles Museum and Library, now Singapore National Museum (Singapore)
1824	National Museum of Colombia (Bogotá)
1825	South African Museum (Capetown)
1830	Altes Museum (Berlin)
1836	Alte Pinakothek Museum (Munich)
1837	Ethnology Museum (Leiden)
1838	National Gallery (London)
1841	Nelson Provincial Museum (New Zealand)
1842	Ancanthe Museum (Hobart)
	Wadsworth Atheneum at Harvard University (Cambridge)
1843	National Museum of Canada, now Canadian Museum of Nature (Ottawa)
	Egyptian Museum (Cairo)
1850	Hasbrouck House (Newburgh)
1853	The Australian Museum (Sydney)

(Continued)

Table 4 Founding dates of some significant museums.
(Continued)

Date of founding	Museum
1858	Smithsonian Institution (Washington, DC)
1861	Museum of Art, now National Gallery of Victoria (Melbourne)
1862	Municipal Museum and Library (Guayquil)
1864	Lahore Museum (Lahore)
1865	National Museum (Wellington)
1869	American Museum of Natural History (New York)
1870	Metropolitan Museum of Art (New York)
	Museum of Fine Arts (Boston)
1872	Forerunner of the Tokyo National Museum (Tokyo)
1873	Nordiska Museet, the first folklore museum (Stockholm)
1874	Grand Palace Collections, now the National Museum of Thailand (Bangkok)
1875	Indian Museum (Calcutta)
1877	National Museum (Colombo)
1881	Skansen Museum, (Stockholm)
1887	National Museum (San Jose)
1888	Musée Alaoui, now the National Museum (Tunis)
1889	Brooklyn Children's Museum, the first children's museum (Brooklyn, New York)
1891	Skansen Museum (Stockholm)
	Geological Museum (Lima)
1901	National Museum (Bulawayo)
1903	Museum of Islamic Art (Cairo)
1905	Nan t'ung Museum (Kiangsu)
1906	Peshawar Museum (Peshawar)
1908	Uganda Museum (Kampala)
1909	National Museum of Kenya (Nairobi)
1912	Openluchtmuseum (Arnhem)
1915	Dar Batha Museum (Fez)
1924	Central Order of Lenin Museum of the Revolution (Moscow)
1926	Colonial Williamsburg (Virginia)
1928	Henry Ford Greenfield Village (Dearborn)
1930	Pergamon Museum (Pergamonmuseum) (Berlin)
1937	Musée national des Arts et Traditions Populaires (Paris)
1949	National Museum of India (New Delhi)
1953	Yad Vashem holocaust memorial museum (Jerusalem)
1964	Museo Nacional de Antropología (Mexico City)
1968	Ontario Science Center (Ottawa)
	The Exploratorium (San Francisco)
1979	Écomusée du Val de Bièvre (Fresnes)
1986	Musée d'Orsay (Paris)
1990	Vasa Museum (Vasamuseet) (Stockholm)
1997	Nelson Mandela National Museum (Mthatha, South Africa)
2000	Tate Modern (London)
2009	Acropolis Museum (Athens)

the Prado in 1819.^[38] The Louvre opened to the public as the Muséum Central des Artes in Paris in 1793, shortly after the French Revolution, exhibiting royal collections that had previously been unavailable to the public, outside of an occasional special exhibition.^[38] The new French museum grew rapidly as Napoleon appropriated objects for the collections during his European campaigns, but most of this material was later repatriated, after the Congress of Vienna in 1815.^[5,38]

The development of mercantilism, the rise of an affluent merchant class, and the decline of royal patronage systems together led to a greater public interest in the arts beginning early in the eighteenth century.^[5] By the middle of the eighteenth century, the dawning Industrial Revolution sparked public interest in technology and science. At the beginning of the nineteenth century, “the first realization of the role of the museum in contributing to national consciousness arose in Europe. With it came the recognition that the museum was the appropriate institution for the preservation of a nation’s historic heritage.”^[38] Thus came the first big museum “boom” in the second half of the nineteenth century in Europe. So much museum growth occurred during this time that the nineteenth century has been called the Golden Age of Museums in Europe; nearly every country in Western Europe opened a comprehensive museum during this time.^[14]

One influential museum pioneer in the United States was Phineas T. Barnum (1810–1891), who opened a huge public museum called The American Museum in New York after his purchase of the collection of John Scudder (1775–1821).^[56] In his museum, Barnum exhibited more than 600,000 objects,^[1] but finally gave up on museums and went into the circus business after a series of disastrous museum fires. In 1842, Barnum acquired a specimen of “a feejee mermade,” which he put on exhibit with much fanfare in his New York museum, where it tripled revenues.^[57] Once the novelty of the mermaid wore off in New York, he sent it out on tour. Scientists throughout the United States protested the local showings, claiming that the mermaid was an obvious fake, but their protests only served to push ticket sales higher. The mermaid was described in the press as an “ugly dried-up, block-looking, and diminutive specimen about 3 ft long. Its mouth was open, its tail turned over, and its arms thrown up, giving it the appearance of having died in great agony.” The mermaid was made from the torso and head of a monkey sewn onto the body of a fish.^[58]

THE CHANGING ROLE OF MUSEUMS

In the latter part of the nineteenth century, museums were recast as primarily educational institutions as the “new museum idea” took hold—this was the separation of study collections from exhibition collections.^[2] The new museum idea was formally articulated by Sir William Henry Flower

(1831–1899), director of the British Museum, who proposed organizing museums around the dual purposes of research and public education.^[59,60] Until this time, museums had been expected to put all of their collections on display, with the result that exhibit halls were often vast arrays of carefully labeled and arranged objects in ordered cases. Although it has become fashionable to criticize this style of exhibit, it was very popular with visitors who sought out museums to see things that they had never seen before, arranged in a ways that brought made sense the chaos around them. The second half of the nineteenth century was also the time of the first period of major growth in museums, with more than 100 new museums opening in the United Kingdom and at least 50 new museums in Germany,^[5] and many significant museums opening in the Americas (Table 4).

The first ethnology museum opened in Leiden in 1837.^[16] Historic house museums first appeared in the mid-nineteenth century in Europe and the United States, dedicated to preserving buildings because of their significant architecture or association with a significant person or historical event (Fig. 2). The first historic house museum in the United States was Hasbrouck House, founded in 1850 in Newburgh, New York, once the headquarters of General George Washington.^[1]

Open air museums or living museums (Fig. 3), which usually include period architecture (often recreated) and historical re-enactors, were developed in the late nineteenth century in Scandinavia.^[2] The first open air museum was

opened in 1881 near Oslo, Norway, to exhibit the collections of King Oscar II. In 1891, Arthur Hazelius founded the Skansen museum in Stockholm, which became the model for subsequent open air museums around the world.^[2] The first outdoor museums in the United States were the historic environment known as Colonial Williamsburg, established in 1926,^[23,33] and the Henry Ford Greenfield Village museum, which opened in Dearborn, Michigan, in 1928.^[54] The first mobile museum was developed in Liverpool in 1884 to serve school children.^[16]

Natural history museums underwent a major change following the publication of *On the Origin of Species* by Charles Darwin (1809–1882) in 1859.^[2] The fundamental revolution in biology that was triggered by Darwin's theory of evolution by natural selection had far-reaching effects on how specimens were collected, preserved, and exhibited. Prior to Darwin, species were thought to be immutable, so natural history museum collections contained only one or two specimens of each species, and museums exhibited all of their collections in large synoptic displays, grouped according to the prevailing systems of classification.^[2] Darwin's theory demonstrated the importance of studying variation within species, which meant the essentialist or typological natural history collections were no longer very useful for research. In fact, Darwin could not have developed his theory of evolution using just the museum collections of his day because museums did not have sufficient specimens of each species to show the wide degree of variation in nature.^[2]



Fig. 2 A historic house museum, the *Casa Museo Antonio Nariño*, Villa de Leyva, Colombia.

Source: Photo by J.E. Simmons.



Fig. 3 An open air museum, the *Prasat Hin Pimai Historic Park*, Nakhon Ratchasima (Khorat), Thailand.

Source: Photo by J.E. Simmons.

At the time that the Smithsonian was founded (in 1846), universities were essentially finishing schools; the creation of knowledge was centered in museums, with the result that "... museums made the fruits of their research available to a general public through exhibits, unlike colleges and universities, which were open only to a few."^[61]

There are some significant differences in how museums were established in different regions of the world.^[2] In Europe and Canada, museums were usually established through local or national government agencies, but in the United States most new museum growth was initiated by individual or small group patronage at the local level. In other countries, centralized state museum systems were developed, as in France and the former Soviet Union.^[62]

Although the idea of the modern public museum is essentially European in origin, it was successfully exported to other parts of the world through trade and colonialism.^[38] There were periods of growth in Latin American and Asian museums in the 1800s, and in African museums in the early 1900s.^[62] Many of these colonial-era museums evolved into important national museums (Table 4) such that "the emergence of the nation-state, the public, and the public museum in the late eighteenth century, were intimately bound together,"^[63] particularly in South America and Asia. As independent nations arose from their colonial roots, some museums became important agencies for developing national identification by offering interpretations of their collections that reflected feelings of national ownership (e.g., defined national culture) as well as defined

nationality compared to other nations and cultures.^[63,64] Some of these museums played a significant role in the rejection of colonialism. For example, during the 1970s many Caribbean museums shifted their emphasis from a strong focus on their society's colonial past to present more inclusive cultural and natural histories.^[65]

Although two significant American museums were founded in 1870—the Metropolitan Museum in New York and the Museum of Fine Arts in Boston^[52]—only 4% of museums in the United States were in existence before 1900.^[62] At least 75% of U.S. museums were founded after 1950, and 40% were founded after 1970.^[1]

Further changes in museum development have occurred in the twentieth century. Technological developments during the First World War, such as efficient indoor lighting and the production of large sheets of polished plate glass, have allowed museums to make much larger display cases.^[3] The population shift in many industrialized countries away from urban centers has spawned the development of community museums.^[38] The growth of museums worldwide resulted in the founding of the International Council of Museums (ICOM) in 1946.^[62] Not all institutions recognized as museums today even own collections. The definition used by the Accreditation Committee of the American Alliance of Museums states that a museum is "An organized and permanent nonprofit institution, essentially educational or esthetic in purpose, with professional staff, that owns or uses tangible objects, cares for them and exhibits them to the public on some

regular schedule,” in contrast to the most widely used definition, that of the International Council of Museums, which states that “A museum is a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment.”^[2]

Two of the newest concepts in museums are ecomuseums and virtual museums.^[66,67] Ecomuseums interpret not just an event, a place, or a culture, but an entire community. Developed by Hugues de Varine in France in 1971, ecomuseums have proven to be popular in parts of Europe, Canada, and much of the developing world. The hundreds of ecomuseums around the world today define themselves by managing heritage in a sustainable environment. In contrast to ecomuseums, virtual museums exist only in cyberspace, although many are usually based on real, physical collections, and show great promise for repatriation of cultural knowledge and a wider sharing of information around the world.^[68]

CONCLUSION

The significance of the role of museums in presenting history and defining culture has been demonstrated by such events as Chinese museums being forced to interpret a particular political agenda or be closed during the Cultural Revolution of the 1960s, and the attempt by some members of the United States Congress to interfere with the curator's presentation of the bombing of Hiroshima in the Smithsonian's Enola Gay exhibit.^[2] Museums in Eastern Europe both expanded under the post-Communist governments and later struggled to survive in a free market economy. More recently, museums in Iraq and the former Yugoslavia have suffered greatly the ravages of warfare.^[2]

History shows that museums have evolved to serve different needs at different times, but have always played a significant role in interpreting nature and culture. Museums have been “. . . the institutions charged with furthering knowledge and creating order . . .”^[61] due to the fact that they “. . . assumed intellectual leadership because they fostered original research through the careful and systematic way they dealt with objects.”^[61] Museums will continue to serve a significant role in society as long as humans remain curious about the world around them.

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History of Paper

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Abstract

Centuries before paper was invented, ideas were communicated in various ways other than orally. We know of the paintings on cave walls, and the use of wood, clay, stone, bamboo, wax, silk, palm leaves, and other surfaces. In the West, the immediate predecessors to paper are papyrus and vellum or parchment, the dried skins of animals, which was in use in the West at about the same time as was the earliest papers in the Orient: the second century B.C. But paper has had by far a greater impact on civilization than has any other material ever invented.

INTRODUCTION

Paper is matted fibers.

If that were all there were to it, this entry would not be 9000 words. Paper is an almost magically simple product to make, and it is perhaps—along with printing—one of the most important inventions in history. (Someone suggested that Printing, Paper, and the Alphabet are the “top three” inventions of all times.^[1])

ANTECEDENTS TO PAPER

Centuries before paper was invented, ideas were communicated in various ways other than orally. We know of the paintings on cave walls, and of the use of wood, clay, stone, bamboo, wax, silk, and other surfaces, none of which needs to be rehearsed here. In the West, the immediate predecessors to paper are papyrus and vellum or parchment, the dried skins of animals, which was in use in the West at about the same time as was the earliest papers in the Orient: the second century B.C.^[2]

Papyrus

Papyrus, used as early as 3500 B.C. in Egypt, is a plant of the sedge family, growing in warm moist climates. It can reach heights of 18 feet or more. Much ignorance about papyrus was passed along to us in the West by scholars knowing little or nothing about it, who made pronouncements based on logic rather than on fact. [Witness this rather ludicrous statement: “Papyrus. . . is only one of the predecessors of paper that together are known by the generic term ‘tapa’ and are mostly made from the inner bark of paper mulberry, fig and daphne”; quoted from http://www.paperonline.org/history/3000/3000_frame.html (accessed July 29, 2008). This could hardly be more wrong.] Hence, misstatements abound about papyrus’

manufacture. Only through the efforts of Hassan Ragab were we able to rediscover the secrets of the plant and the writing surface made from it. (His dissertation, *Contribution à l’étude du papyrus (Cyperus papyrus.L) et à sa transformation en support de l’écriture (papyrus des anciens)* (L’Institut National Polytechnique de Grenoble, 1979), was self-published into a book, *Le papyrus* in Cairo in 1980.)

As Alia Hanafi writes:

In 1962, [Hassan Ragab] started the process of re-discovery. But he faced two major obstacles. First, that papyrus was vanished in Egypt, and he had to go to Sudan to re-import the plant. Second, the entire process of papyrus making was maintained as a secret. Therefore, Dr. Ragab read books by Herodotus, Strabo and Theophrastus, but none could describe the process. The only but very vague indication he found in the studies of Pliny the Elder. Nevertheless, this description was so inaccurate that it did not help him in any way. So, he spent the next 4 years researching the method. In July 1966, he produced his first papyrus paper. In 1967, Dr. Ragab founded on a houseboat on the Nile an Institute for the remanufacturing of Papyrus. He started to collect some information from experts, and began his own experiments. Therefore, gradually he found the way to produce sheets in the same quality, the same structure as it was done some thousands years ago [sic].^[3]

One thing to remember is that papyrus is *not* paper. Paper is made from matted fibers—fibers that have been macerated and ground down into pieces of tiny lengths. Papyrus fibers have not been macerated. So to call the material “papyrus paper” as Hanafi does is to misrepresent the sheets.

Another common misperception is that sheets of papyrus are “prepared from the pith of the papyrus plant by cutting it in longitudinal strips, arranging them crosswise in two or three layers, soaking them in water, and pressing them into a homogenous surface.”^[4] This statement has at

least two errors. First, the order of events (laying the strips out and then soaking them) is wrong: the soaking of the strips takes place before the arrangement of the strips. Second, “two or three layers” is incorrect. All one needs is two layers and no literature mentions (and no papyrus sheets evidence) a third layer.

A third error, propagated in the nineteenth century by scholars guessing how the sheets were made, is that one must pound the strips of the stalk. Pounding them would disperse the long fibers and mess up the final leaves. We see such statements as, “The strips may have been soaked in water long enough for decomposition to begin, perhaps increasing adhesion, but this is not certain. While still moist, the two layers are hammered together, mashing the layers into a single sheet.” (This error comes from the error-prone *Wikipedia*.^[5]) The author is following a long tradition of error calling for hammering, smashing, or pounding the layers.

The simple method of making papyrus is as follows:

The stems of the papyrus plant, which are covered with a green “skin” or “bark” and are almost triangular, are filled with a pulpy pith somewhat thicker than but similar in consistency to the pulp of watermelon and with long stringy fibers like those in celery. The stalks are cut down, and then cut into whatever lengths the papyrus maker desires. The green skin is pared off two of the three sides of the stalks, the stalks are sliced into thin strips, and then the last of the green outer “bark” is sliced away.

The strips are then soaked in water to hydrate the fibers. The pith has to be as wet and mushy as possible since it is the blending of this pith within strips lying in different directions that will determine the solidity of the final product.

Various sources talk of how long these strips should be soaked. Soaking for several days, with the water being changed often, will allow for the maximum hydration of the fibers and will allow the pith to break down and become quite soft. The strips are then laid out on a flat surface, first in one direction (slightly overlapping) and then a second layer placed at right angles over the first layer (also overlapping). The strips are then put under great pressure to squeeze out the water and to press the pulp for all of the strips into one solid mass of pulp. Several pressings, each time replacing wet blotting material with dry, pulls the water out of the strips, which are eventually merged into one single leaf of papyrus.

Several leaves can be glued together to make longer and still longer pieces, so that a long text can be written onto a single piece of papyrus. Since the sheet is relatively brittle and will not withstand folding, the standard format of a text on papyrus is either a broadside or a roll (or scroll). The final product is flexible, light and portable, and stable; that is, it has no inherent vice, so it will not deteriorate if it is properly stored and handled. It is generally written on one side only. And while it *is* portable, a long scroll is somewhat unwieldy. Its practicability,

however, and the abundance of such plants made papyrus the most used surface for communication for perhaps 2000 years.

Parchment/Vellum

The word “parchment” has descended from the city Pergamum, an ancient city in Asia Minor, now Bergama, in western Turkey. “Vellum” comes from the French word “velin,” a calf (related to “veal”).

A good deal of confusion about the terms “parchment” and “vellum” has led to their being used practically interchangeably today. Brown and Lovett say, “It is now usually accepted that parchment is sheep or goat skin and vellum calf skin.”^[6] Some writers use the term “vellum” only for calf and “parchment” for any other dried animal skin, including horse, pig, goat, and other mammals. There is even a company making what it calls “parchment” out of snakeskin, the skins of various fish and lizards, and other such creatures. It is dried skin, and it is used in bookbinding and for other artistic products. For all practical purposes, and partly because most people cannot distinguish the skin of one mammal from another (especially that of sheep from that of cows), the two terms have become perfectly interchangeable.

Beverly Boyd claims, “Nowadays... manufacturers of stationary have settled these words for the public by using the term ‘vellum’ to denote a suede-like finish and ‘parchment’ to denote a crisp finish.”^[7] Since that was written (in 1973), the distinction has essentially disappeared.

The following description of the preparation of the skin is necessarily brief, leaving out many details. (For a more thorough treatment see books by Reed.^[8,9]) The butchered animal is flayed, its skin is soaked in lime then stretched on a frame, and the parchment maker, using a lunellum (a moon-shaped knife), pares down the flesh from one side and shaves off the hair from the other. A fine talcum called “pounce” is sometimes burnished onto the skin to smooth it off and act as a mordant, allowing pigments to adhere to the skin. This yields a fine surface, with a hair side and a flesh side. When the signatures of a book made of sheets of parchment were designed, written or drawn on, folded, and gathered, the artists and scribes knew to have hair sides face hair sides and flesh sides to face flesh sides, since the hair sides tended to be somewhat darker than the flesh sides.

The skins were pared down to be quite thin and were thus easy to fold. The modern codex—the book as we know it with leaves written on both sides, folded, and then sewn together through the folds at the inner margins—is the product of book makers of about the second century A.D.

The skins of young animals were generally preferred to those of older ones, but many a large folio attests to the fact that full-grown cows and sheep, goats and pigs were used as well.

A particularly fine kind of vellum, quite thin, strong, white (or just off-white), and lovely, is called “uterine vellum,” presumably because the fetuses were aborted, so that the parchment makers could have such fine skins to work with. Recently, the notion of aborting the fetus has been questioned, especially since an extremely fine skin can be made from a young animal by a skilled craftsman. Using a microscope, an expert may be able to distinguish skin types and follicle patterns to show what animal was used for a particular sheet. But to the naked eye, it is often difficult or impossible to say what animal was used. On the other hand, certain goat skins have a distinct and distinguishable skin.

Naturally, the maker would get out of the skin the largest rectangle he could. But none of the skin would be wasted, for the remainder could be cut into thongs or rendered down to make glue.

Since books were produced one at a time, by hand, the amount of parchment available kept up with the demand for it of the scribes and authors. But certain social forces in the West in the Middle Ages—perhaps the most important of which was the growth of the guild system with a concomitant growth of a middle class—brought about a need for an increasing amount of writing surfaces. Paper in the West was just ripe to be invented.

PAPER

Paper: History

The history of paper is shrouded in mist. We have a few clear facts, like that it was invented in the second century B.C. by the Chinese. We don’t know where in China nor do we know the inventor. We can speculate—as many have done—that some genius observed the work of wasps, who made their nests by macerating the pulp of various trees or shrubs, and whose nests were the inspiration for the making of paper. Whether this is true or not is debatable.

One “fact” that has been foisted on the world for many decades is that paper was invented by a court eunuch, Ts’ai Lun (or Cai Lun, or Lung—his name has several other spellings) under the emperor Ho Ti in 105 A.D. This error has been perpetuated so often and for so long that it has taken on a life of its own, and it is difficult to supplant it with the truth. It is wrong, and for the sake of accuracy and historical correctness, I have made this point emphatically in this long paragraph.

We know that paper existed in China in the second century B.C. One source enigmatically says, “True paper is believed to have originated in China in approximately the 2nd Century A.D., although there is some evidence for it being used before this date”; the source follows this with, “Papermaking is considered to be one of the Four Great Inventions of Ancient China, since the first papermaking process was developed in China during the early

2nd century.” Then this source says: “the discovery of specimens bearing written Chinese characters in 2006 at north-east China’s Gansu province suggest [sic] that paper was in use by the ancient Chinese military more than 100 years before Cai [Lung], in 8 B.C.” And finally, from the same source: “Archeologically, however, true paper without writing has been excavated in China dating to the reign of Emperor Wu of Han from the 2nd century B.C., used for purposes of wrapping or padding protection for delicate bronze mirrors.”^[10]

The Chinese guarded the secret of papermaking for centuries, knowing of the power paper has for transmitting texts. It made its way to Korea and Japan (c. 604 A.D. and 610 A.D., respectively), and then, through Samarkand, to the West in the middle of the twelfth century. By about 1150 the first European papers appear, but how they were made—in a mill or by more primitive methods—no one can determine. We know where the paper came from by what was written on it, so we know that in the last half of the twelfth century paper was being made in Xativa, Spain. And by 1276, the mill in Fabriano, Italy, was at work.

To write a full account of paper’s manufacture in the East and the West would take several volumes. In the short space of an encyclopedia entry, only the most superficial information can be imparted. Even when the information may seem minutely detailed, it is really only scratching the surface since the variety of methods, materials, machinery, and practices is measureless.

Manufacture—Asian Methods

Over the centuries, from its earliest practice in China to today, methods of making paper by hand in Asia have evolved tremendously in some respects and have remained the same in others. This brief discussion will look at only one form of Asian papermaking, the so-called Nagashizuki method, since the other (the Tamezuki method) is similar to that of making paper by hand in the West.

To make paper using the Nagashizuki method, the craftsperson must harvest the fibers. Traditionally, the three basic fibers for making paper are kozo, mitsumata, and gampi, the first being the most common. Kozo is *Broussonetia papyrifera*, the Paper Mulberry, common to many cultures throughout the world.

Because the Japanese have become the most prolific and imaginative, creative and artistic papermakers in history, and because they have been practicing the craft for more than 1400 years, this entry uses the Japanese terminology. Papermaking in China over the centuries and even today is light years behind that in Japan.

Though the process of harvesting and preparing the bark is more complicated than this brief discussion reveals, the basic process is described here.

The plant is harvested in the winter once the leaves have fallen off. The stems are cut into pieces about 4 in. long and are cooked until the outer bark is soft and can be scraped off. This outer bark is tied into bundles and dried. They are stored until they are ready to be made into paper in the spring. When it is time to make the paper, the strips are rehydrated until they are soft. They are crushed in running water with the papermakers' feet. The crushing removes the dark outer layer. This is followed by the careful paring and scraping off of the green middle layer, which adheres to the white inner bark. The long white strips of bark are then dried again until the actual papermaking begins.

The bark is then rinsed, removing the last remaining dark or green bark, and is then cooked in an alkaline solution (usually wood ash or caustic soda). After the cooking, the strips are cooled and the scum on the top of the pot is skimmed off. The strips of fibers are now soft; they are lain onto a board and hit with a stick, with automatic stampers, or in a beater—a machine that slices or grinds up the fibers.

When the fibers are all macerated or cut to the right length (the proper length differs with the different kinds of paper to be made), they are floated in water that has a formation aid in it. The formation aid, called *tororo aoi*, is a slimy gelatinous substance made from the roots of the hibiscus plant. It is called a "formation aid" because it helps the fibers form into a sheet by allowing them to be distributed evenly on the surface of the paper mold.

The mold is dipped into the vat containing the fibers, and a small amount of water and fibers are slid over the mold's surface. This action is done several times until the papermaker has the sheet to the desired thickness.

The mold is in two parts, a *su* and a *geta* (or *keta*). The *geta* is the frame on which the *su* (the screen) sits. Once most of the water has dripped through the *su*, the fibers now distributed on the *su* are matted into a sheet of paper. The flexible *su*, made of thin strips of bamboo, detaches from the *geta* and is taken to a stack of recently made sheets, onto which the fresh sheet is lain. When the *su* peels away, the newly made sheet transfers onto the stack of other sheets. The laying down of the *su* must be done from one long edge, while all the strips of bamboo are "rolled" over the stack of sheets beneath it, so that no air bubbles form under the new sheet.

When the stack of sheets is "complete," the papermaker presses it to squeeze out the water and then dries the sheets in various ways. One common way was to peel a sheet off the pile, brush it onto a tall wooden board along with several other sheets (on both sides of the board) and set the board out into the sun to dry. This also whitens the sheets. A more modern method has the papermaker brushing the wet sheet onto the surface of a metal drum that has been heated. This dries the sheet rather quickly. Both methods leave fine brush strokes on the sheet, and the final product has a board (or drum) side and a brush

side. This accounts for the different feel of the two sides of many pieces of *Washi* (handmade Japanese paper).

Manufacture—Western Methods

The method of making paper in the West has many features of that in the Orient, but with a good number of differences. In fact, the *Tamezuki* style of papermaking in Japan may well come from the Western version of the craft.

To begin with, the fibers in the West were different: there was no *kozo*, *mitsumata*, or *gampi*. In the West, linen and cotton were used. Further, since there was no bamboo, and since metallurgy was well advanced in the West, the paper molds used wires stretched along the long measure of the mold. And finally, since there was no *tororo aoi* in the West, papermakers developed a method of sheet formation that allowed for only a single dipping of the mold into the vat and that did not allow the sheets to be couched (transferred from the mold) onto previously couched sheets. The sheets had to be couched onto woven woolen felts, which pulled the sheets from the mold.

Before the fibers were macerated, they were usually retted—that is, soaked in a tub until the natural action of bacteria caused the fibers to begin to break down. This is sometimes called "bacterial pulping," though the actual pulping, the final maceration, was a mechanical process.

Macerating the fibers was originally done with stamping mills, essentially large mortars and pestles, the latter driven by water or, in the Netherlands, by wind. Wet pulp was placed into the cups of the mortars, and the pestles, driven up and down, pounded the fibers, beating them into little pieces. In the last quarter of the seventeenth century, the Dutch invented the Hollander beater, a machine consisting of a large oval tub divided partly down the middle, forming a sluice around which the water containing the pulp was forced by a large rotating cylinder on the surface of which were blades running parallel to the width of the cylinder. The rotating cylinder forced the pulp under it, and the blades ground and cut the fibers against a bedplate, breaking them down to the desired length.

The wooden mold—four pieces of wood made sturdy and rigid by having supports affixed across the short measure—had metal wires stretched lengthwise across it. The wires were sewn down with chain stitches along the length of each support. The vatman, scooping up the fibers from the tub onto the mold's surface, shook the mold to distribute the fibers evenly over the wires. The fibers settled evenly over the surface except where the chain stitches ran along the supports, at which points the fibers fell more thinly since the chain stitches were above the rest of the surface of the wires. Since the fibers were more thinly distributed where the chain stitches were, when the sheet was held up to the light, more light would shine through the sheet where it was thinner. These so-called "chain

lines” distinguished the handmade papers of the day. Holding a sheet of such paper up to the light, the viewer could see the wire lines going horizontally along the long measure of the sheet and chain lines, separated by a half inch or an inch, going in the other direction.

Also, when the sheet was pressed onto the felt, the supports beneath the wires pressed the fibers above them densely, so when a piece of laid paper was held up to the light, the densely packed fibers would create a dark area around the chain lines, like shadows. What one would see in this so-called “antique laid paper” were the wire lines and chain lines, with shadows around the chain lines.

To avoid the appearance of these shadows, mold makers stretched a second layer of wires across the long measure of the mold, a fraction of an inch above the first layer of wires. Now when the sheet was pressed onto the felt, the supports did not exert any pressure where the chain lines were, so no shadow was formed along them. This new mold created “modern laid paper,” sheets showing the wire lines and chain lines, but no shadows around the chain lines.

After dipping the mold into the vat and distributing the fibers over its surface, the vatman would give the mold to a coucher or layman, who couched the sheet (pressed the mold containing the wet sheet to the felt, transferring the sheet to the felt). (The words are pronounced /koocher/ and /koocht/.) The newly formed sheet would be covered by another felt, and another sheet would be couched upon that, and so forth, until there was a large stack consisting of sheets interleaved with felts. This was called a “post.”

The post was pressed in a large machine and much of the water would be squeezed out. In the vat, the percentage of water to fiber was about 96% to 4%. After the first pressing, the percentage was more like 90% fiber and 10% water. The felts were then removed and the remaining “white post” was pressed a second time. After this second pressing, the sheets could then be removed from the post and hung (or laid out in spurs of five or six sheets) to dry.

The mold was flat, of course, and if it were used by itself, the fibers and water from the vat would run off the edges when it was dipped into the vat. To keep the fibers and water on the surface of the mold while the water dripped away through the wires, a deckle, a rectangular frame, was placed over the mold. Fibers would adhere to the inner edges of this deckle or they would slide under the deckle, forming slightly uneven edges on the sheet—called “deckle edges” or “deckled edges.”

As Allan Stevenson has shown, a typical commercial hand mold was composed of two molds and one deckle. While the vatman was dipping out a sheet from the vat, the coucher (also called the “layman”) was couching another sheet onto a felt from the second mold. When he was done and the sheet had been removed from his mold and deposited onto the post, he would exchange his now-empty mold for the one the vatman had just lifted out of the vat.

The vatman would hand off the mold with the newly formed sheet on it and take the empty mold to begin the process again. If the molds had watermarks, the maker of the molds would try to get the watermarks to look identical and be placed in exactly the same position on the two molds, but that was not always the case, and sometimes we can see variations in watermarks or in their placement on sheets made at the same time by the same makers.^[11]

Sheets made with only water and fiber are called “waterleaf.” The tiny fibers have infinitesimal air pockets around the matted fibers. These pockets, through capillary action, would draw in ink, which could feather out on a sheet as does fountain pen ink on a modern newspaper. The sheets, therefore, needed to be sized, infusing a glue (usually an animal-based glue) into the sheet. The dried sheets would be soaked in the sizing bath, taking the glue in, filling all the tiny air pockets, and preventing inks from feathering out.

It was possible to size the paper by putting the sizing into the vat during the initial sheet formation, but the result would have been pressing the sized sheets onto the felts, imparting the glue to the felts. This would have necessitated a thorough washing of the felts. More common was sizing the papers in a special bath, after the initial drying of the sheets. Hence, there are two kinds of processes: vat sizing and tub sizing, the latter much more common than the former.

The sizing essentially glues all the fibers together, bonding them to one another. Hence the term “bond paper,” which merely designates sized paper, as opposed to waterleaf.

Sheets thus made would be pressed again, and then often calendered—that is, run through a calendering press consisting of two smooth cylinders that put the sheets under great pressure, smoothing off the surfaces. The cylinders could be heated up, so there were hot-pressed and cold-pressed sheets.

In the middle of the eighteenth century, John Baskerville designed a new typeface with fine serifs. If during printing the serif landed exactly on a chain line, where the paper was thin, it may not print perfectly. Baskerville wished to have a smoother, even distribution of fibers in his printing papers. He, or perhaps the famous papermaker James Whatman, devised a mold consisting of wires pulled left to right and also top to bottom, woven together. The result was a sheet formed on a smooth screen, showing no wire lines or chain lines. This paper is called “wove,” not that the fibers are woven, but that the screen from which the paper was made was woven. On the manufacture of wove paper see Hunter.^[12]

Hence, paper can be categorized in several ways: by fiber distribution (modern laid, antique laid, or wove); by content (sized or unsized; and vat sized or tub sized); by surface (calendered or uncalendered; and hot-pressed or cold-pressed papers); and then by other features (colored or not; trimmed or not; watermarked or not; and so forth).

With the invention of wove paper made from a screen, papermakers were no longer forced to use hand molds. The laid wires on the hand mold needed to be held in place by the frame of the mold itself. But a woven screen could be “freestanding.” It was only a matter of time before a clever inventor could take a screen, make a huge loop out of it, and attach one end to the other in a loop. This led to the mechanization of papermaking.

Frenchman Nicholas-Louis Robert is generally given credit for the invention of a papermaking machine—in 1798. The formal patent is recorded on January 18, 1799.^[13] As Hunter explains, Robert quarreled with his backers, sold and then reacquired the patent, and unsuccessfully tried to get a commercial-level machine built in France. He eventually turned to his contact in England, papermaker John Gamble, who interested Henry and Sealy Fourdrinier, stationers, in the machine. They hired Bryan Donkin, a brilliant engineer, who created his own version of the papermaking machine, based on Robert’s patented plans, and on June 23, 1801, the English patent was issued.^[14] To this day, all papermaking machines are called Fourdriniers.

A cylinder machine was invented by English papermaker John Dickinson in 1809, and a similar machine was created by Thomas Gilpin in the United States, in 1817, the first papermaking machine in this country.^[15]

Eventually, the Fourdriniers got to be quite long, containing rollers for drying, embossing, calendering, and otherwise treating papers, along with parts of the machine that added sizing, color, and other modifications to the basic sheet. One such modification was a watermark, created near the very beginning of the papermaking process, before the fibers had fully settled onto the screen. A large roll, called a “dandy roll,” containing the pattern for the watermark disrupted the fibers as they were settling, thinning out the sheet at the point where the dandy roll “landed in” the settling fibers. So lovely watermarks are not necessarily a sign of a handmade sheet.

Similarly, a handmade piece of paper has four deckles around it; such a treatment can be put into a machine-made sheet. And a pattern of chain lines and wire lines can be imparted to the sheet by a dandy roll, so laid paper—which was once purely a handmade product—can also be machine made. Sometimes distinguishing between a handmade and a machine-made sheet can be difficult (but see below under “Grain.”)

PAPER FIBERS

For several centuries in the West (say, from the middle of the twelfth century until the middle of the nineteenth century), the supply of rags was sufficient to satisfy the world’s paper needs. By the second half of the nineteenth century, however, it was clear that another source of fiber was needed. As early as the late eighteenth century,

experiments were being done with straw and certain kinds of wood.

Matthias Koops in England was making paper from straw as early as 1800; and straw was experimented with for decades in the trade. Many other fibers were tried. In fact, since paper is matted fibers, just about any fiber will do. Even synthetic fibers have been used in papermaking. Witness Tyvek®, a synthetic olefin plastic, that makes sturdy, almost untearable paper.

In the last 30 years or so, many hand papermakers have experimented with papermaking by using seriously non-traditional fibers, like vegetables, plants of all kinds, many species of cactus and succulents, and many more unusual materials. They all produce paper of various qualities, and most of them are mere curiosities, not useful for printing or bookbinding.

By the third-quarter of the nineteenth century, wood pulp was adopted as the preferred fiber. It had been experimented with as early as 1765 by Dr. Jacob Christian Schäffer in Germany.^[16] (See the book by Hunter for a more detailed treatment of the use of wood fibers in papermaking.) As Hunter points out, “the first ground-wood pulp produced commercially on this continent was the output of a machine based on the patents of Heinrich Voelter.” “In 1867, Albrecht Pagenstecher founded at Curtisville (now Interlaken) near Stockbridge, Massachusetts, the first ground-wood pulp mill in the United States.”^[17]

Because wood pulp is much more difficult to macerate than hemp or cotton, methods were created to break down the pulp chemically, using sulfuric and other acids. The old method, using sticks, stamping mills, or Hollander beaters, was a mechanical way to prepare the fibers. The new method was chemical; and today we make a distinction between mechanical pulp and chemical pulp.

If the pulp is allowed to soak (or to be cooked) in acids, and then the acids are not sufficiently washed out of the fibers before the paper is made, the acid remains in the sheets. The aim of using chemicals to break down the fibers is to “break down, the chemical structure of the lignin and render it soluble in the chemical liquor so that it may be washed from the cellulose fibers. Because lignin holds the plant cells together, chemical pulping frees the fibers and makes pulp.”^[18] Conservators call the residual acids in the fibers “inherent vice”: a deteriorating material inherent in the papers themselves; they will cause the pulp to break down, the acids attacking the fibers, from within. Paper from the third quarter of the nineteenth century on (and especially commercially made paper) was likely to be made from chemical pulp, and thus millions upon millions of books and documents using this paper will have browned and become brittle if not deacidified. But by the time the deterioration is noticed, the paper has already gotten brown, and the damage is done.

If the lignin remains in the paper, the paper will be acidic. Papermakers can remove the lignin and can also

add buffers like calcium carbonate or magnesium carbonate, so the paper has an alkaline reserve to make it lignin free and acid free. It took a law (Public Law 101-423), signed by President George Bush in October 1990, to require all government printing to be done on acid-free archival paper. Called The Permanent Paper Law, it encouraged the use of acid-free permanent papers for all government documents.

WATERMARKS

One feature of paper that has been a great help to historians and other scholars is whether the paper is watermarked or not. When one holds sheet up to the light, any area that is thinner—that is, an area that has fewer fibers than the areas around it—will show light through the paper. To make the paper thinner at any give point or points, the papermaker affixes something to the surface of the mold that forces the fibers to fall more thinly there than elsewhere on the mold. If a wire in the shape of the letter “R” were sewn or soldered to the surface of the mold, the fibers would fall thinly over it, and the result would be a watermark in the shape of that letter.

Papermakers often identified themselves in simple or elaborate watermarks, sometimes putting the date into the watermark along with their logo. Often a second mark, called a “countermark,” would be put into a sheet, so the final sheet would show a watermark of, say, an animal, a building, a flower, or some other decorative element, along with a countermark of the name of the firm or of the party commissioning the paper.

The word “watermark” is a misnomer since water has little to do with the creation of watermarks.

Watermarks can be produced in several ways, but the key is that the fibers are more thinly (or thickly) distributed where the watermark is than they are in the rest of the sheet. For instance, on a hand-mold, the papermaker can fashion a letter, word, or number out of thin wire and sew or solder it to the surface of the mold. When the fibers fall onto the surface of the mold during the papermaking process, they will fall more thinly where the wire watermark sticks up above the surface. Note that this can be done on any kind of paper mold, antique laid, modern laid, or wove. Also note that the wires themselves are called a “watermark,” and so is the resultant pattern seen in the back-lighted sheet.

A second kind of watermark is done in wove paper only. A male and female die with a pattern in it is used. The wove screen is heated to make the metal malleable, and it is then pressed between the two faces of the die, which contains the pattern for the watermark. The result can be a standard watermark, where a part of the woven screen is embossed (raised in relief), making the fibers fall more thinly where the screen is raised,

and thus creating a watermark in the paper. But the screen can also be de-bossed, that is, pressed inward so that more fibers fall into the groove. The resultant sheet is thicker where more fibers have fallen, and therefore less light shines through the sheet where the watermark is. The notion that a watermark is always revealed in light is thus not strictly correct, for in this case, the mark consists of darker areas of the paper.

Many such male-and-female-die watermarks have both embossed and de-bossed levels in them, so the watermark they produce can have the light that comes through the rest of the sheet, a lighter area for part of the watermark, and a darker area for the other part. This is called a three-plane watermark.

Another kind of mark is also made from a male and female die, but rather than having only embossed and de-bossed surfaces in it, it has graduated levels, creating a watermark with many shades of light penetration. This is called a shadowmark, a light-and-shade watermark, or a chiaroscuro watermark.

Watermarks were used in paper by the end of the thirteenth century. They can appear anywhere in a sheet that the papermaker desires, but the standard placements are either in the center of the sheet or, more common, in the center of one-half of the sheet. As I have noted, many sheets have two such marks, the main one called the watermark, the other called the countermark. Since they yield a thinness to the paper and might affect the printing of the sheet, printers folded the sheets in such a way that the watermarks usually fell into margins. As noted, they can reveal the name or logo of the paper manufacturer, images of animals, buildings, hands or other body parts, geometrical designs, dates, or anything else desired. Paper made specifically for an artist can be fashioned with the artist’s name in the watermark.

There is a vast literature on watermarks, for a study of them can help with the dating and localization of otherwise anonymous documents and books. One should probably start with the monumental volumes compiled by Charles M. Briquet, *Les Filigranes: Dictionnaire Historique des Marques du Papier des Leur Apparition Vers 1282 Jisqu’en 1600* (Geneva: 1907, or one of the later reprints). The Paper Publications Society of Hilversum, Holland, has published many grand volumes that are compendia of watermarks.

PAPER SIZES

Paper made by hand was produced in many sizes, there not being any standard sizes that printers demanded. The size of any handmade sheet is determined by the inner dimensions of the deckle. Throughout Europe, sheets were made from fairly large to quite small, and each size was given a name—though, of course, the dimensions represented by any given name are approximate. The following chart

reveals approximate sizes since the dimensions varied from paper mill to paper mill and from country to country. The table uses English terms; the nomenclature in other countries obviously differs. (This listing of Paper Sizes was adapted from Labarre.)^[19]

E.J. Labarre, in his extraordinary *Dictionary and Encyclopaedia of Paper and Paper-Making*, lists over 200 paper sizes, each with its own name and particular dimensions. The most common of them are listed here, the dimensions given being approximate since papermakers throughout history used whatever size molds they had available for them, and there was no standard for any given book format, broadside, or other use. Other sources will give the same or similar names, but sometimes with varying dimensions (Table 1).

PAPER WEIGHT

Paper is often spoken of in terms of its weight. We use “20 lb. bond” for professional correspondence, “16 lb. paper” for taking notes, “24 lb. paper” for charts, and so forth. The terminology emanates from the weight of a ream of the full-size sheet. So a ream (in the United States this is 500 sheets; in England it was 480, but now the British use 500 as well) of full sheets of paper that weighs 20 pounds yields “20 lb. paper.”

The Wikipedia says it this way:

The basis weight of paper is the density of paper expressed in terms of the mass of a ream of given dimensions and a sheet count. In the U.S. system, the weight is specified in avoirdupois pounds, and the sheet count of a paper ream is usually 500 sheets.^[20]

Papers created for different purposes have different base (or basis) weights since the “standard size” of a sheet differs depending on its use (see Table 2).

The base weight of a sheet of Index bristol is higher than is the weight of Tissue, though two sheets are exactly the same size.

GRAIN OF PAPER

When a sheet of paper is hand made, the vatman shakes the fibers over the surface of the mold, forwards, back, and side to side, in such a way that the fibers get distributed in no particular order of alignment. On a Fourdrinier, however, since the screen on which the paper is formed moves constantly in one direction, the fibers tend to line up in that direction, creating a grain in the sheet. The grain can be seen under a microscope, or one can tear the sheet. If a newspaper is torn in one direction, the tear goes straight—with the grain. If it is torn in the other direction, the tear will be jagged and crooked—against the grain.

Table 1 Names of paper sizes.

Names of paper sizes	Sizes	Paper weight
Emperor	72 × 48	W, D
Quad	56 × 38	P
Double Atlas	55 × 31½	P
Antiquarian	53 × 31	D, B
Quad Royal	50 × 40	P
Quad Demy	45 × 35	P
Double Demy Oblong	42 × 16	W
Double Elephant	40 × 27	W, P, D, B
Double Royal	40 × 25	P, W, D, B
Double Demy	35 × 22½	W, P, D
Colombier	34½ × 23½	W, D, B
Atlas	34 × 26	W, D, B
Double Folio	34 × 22	W
Double Large Post	33 × 21	W, P, D
Double Post	30½ × 19	W, P, D
Imperial	29 × 22½	Wp
Elephant	28 × 23	W, P, D, Wp
Double Foolscap (also called Chancery)	26½ × 16½	W, P, D, B, Wp
Super Royal	27 × 19	W
Cartridge	26 × 21	Wp
Royal	24 × 19	W, P, D, B, Wp
Sheet and a Half Post	23½ × 19½	P
Demy	22½ × 17½	P
Medium	22 × 17½	W, D
Large Post (also called Draft, Medium, or Double Small Loaf)	21 × 16½	W, P, D, B, Wp
Small Demy (also called Demy)	20 × 15½	W, D
Copy (also called Tea Copy)	20 × 16	W, P, D, Wp
Post	19 × 15½	W, P
Crown (also called Single Small Hand)	20 × 15	W, P, D, B, Wp
Small (also called Pinched Post)	Post 18½ × 14½	W, P, D
Foolscap	17 × 13¼	P
Foolscap (also called Brief, Small Foolscap)	16½ × 13¼	W, D
Pott	15 × 12½	W, P, D
Half Crown	15 × 9½	D
Half Foolscap	14 × 9	D

Dimensions are given in inches, and a letter following each size indicates the use for which the paper was originally intended: W, Writing; P, Printing; D, Drawing; C, Cards; B, Boards; Wp, Wrapping. Smaller sizes of sheets for cards, notes, and envelopes are not listed here.

Printers and bookbinders must be particularly careful in their work, getting the grain to align throughout the work (usually vertically). It should be added, however, that handmade and machine-made sheets, composed of the same fibers and no other additive, will be of just about equal quality. Because a piece of paper is machine made does not mean that it is of inferior quality to a handmade one. The only difference between them may be the grain.

Table 2 Paper sizes.

Paper type	Paper size	Number of sheets
Bond, writing, ledger	17 × 22	500 sheets
Manuscript cover	18 × 31	500 sheets
Blotting	19 × 24	500 sheets
Box cover	20 × 24	500 sheets
Cover	20 × 26	500 or 1000 sheets
Bristol and tag	22½ × 28½	500 sheets
Tissue	24 × 36	480 sheets
Newsprint	24 × 36	500 sheets
Hanging, waxing, bag, etc.	24 × 36	500 sheets
Book, text, offset	25 × 38	500 sheets
Index bristol	25½ × 30½	500 sheets
Paperboard (all types)	12 × 12	1000 sheets (1000 square feet per ream)

PAPER PRESERVATION

Simple waterleaf (that is, unsized paper), if it is made from clean water and basic alkaline fibers, is alkaline (with a pH over 7), and will not deteriorate unless it is exposed to acids, high humidity and water (which will produce mildew), fire, or other deleterious agents. Hence, paper produced in the fourteenth century should be good as new if it has been stored properly.

As noted above (under “Paper fibers”), chemical pulp, and even good papers made from nonacidic materials, exposed to bad conditions (especially high humidity), will tend to show signs of deterioration. Papers that have been in a moist atmosphere may show “foxing,” the little orange or black spots that form from spores that are activated by water.

The best environment in which to store paper for its longest preservation is in a deep freeze. But that renders the materials inaccessible and creates other problems when the materials need to be used. For most libraries and other repositories, a steady environment of 68 degrees (±2°) and 50% humidity (±2% points) is ideal.

Further, steady readings of temperature and humidity are better for paper than are fluctuations since paper will expand and contract with such changes. It is better to have paper-based materials in a temperature, say, 75 degrees at all times than it is to have the temperature fluctuating frequently between 65 and 75.

Papers should be kept away from lights, especially fluorescent lights with their ultraviolet rays, which are damaging. Sunlight also has UV rays, so paper should be kept in acid-free folders or in books away from direct light. Even incandescent bulbs can be damaging over time.

Air filtration is a must, since outside air, especially in cities, can have acids that will harm paper. Witness the tombstones in New England graveyards, with their carving completely worn away.

Papers with acid in them can be deacidified, but the process, which leaves an alkaline base (like calcium carbonate) in the sheets, will not strengthen the papers nor whiten them.

Good storage conditions and careful handling will lengthen the life of all paper items.

Finally, paper is a fine material for preservation. In the Florence flood of November 1966, millions of books were damaged. The bindings of most of those bound in leather and vellum were beyond repair. Those in paper survived to a much greater extent. The paper could be washed the way the leathers could not.

PAPER DECORATION

Over the centuries, paper has been decorated in a variety of ways, for many reasons. There are many enhancing techniques, but the most common are marbling and paste paper decoration.

While marbling is probably a sixteenth-century Persian invention, the true history is shrouded in mist. The Japanese had their own version of “marbling,” called “Suminagashi,” in which the artist, holding one or more brushes containing the pigments, would put droplets of colored pigments onto the surface of a water trough by touching the tips of the ink-laden brushes to the water. The drops would spread out, often with a series of drops placed inside previously laid-on drops. With a fan, a hand, or breath, the artist would make the rings move into various loosely controlled “patterns.” When the desired distribution of lines was achieved, the artist would place a sheet of Washi (handmade Japanese paper) onto the surface and the pattern would transfer to the surface of the sheet. If the paper was waterleaf, as were many of the soft Japanese papers, the design would impregnate itself into the sheet and be visible from both sides.

There is no way to know if this decorative paper was known to the West, or if it had any direct or indirect effect on the development of marbling in the Middle East or the West.

Marbling is quite a simple process to do, but preparing all the equipment and supplies for it is not. One needs a tray to marble in, water, a thickener for the water, brushes and combs and other tools to create the patterns, pigments, paper, ox gall, and alum.

Sheets of paper are prepared by having a wash of alum brushed over them as a mordant—that is, the binder that will allow the pigments to stick to the sheet. The sheets are then allowed to dry.

The size is prepared: water slightly thickened with Irish moss, carrageen, or gum tragacanth. When it is poured into the trough, it looks like water, but it is thick enough that drops of pigment will “sit still” on its surface.

The pigments can be any kind: watercolor, gouache, acrylics, or other kinds. A color is put into a container

(like a cup) and is mixed with ox gall, the thick, brown, odorous liquid from the gall bladder of an ox. The ox gall allows the pigments to float on the top of the size, to spread out into circles (the more ox gall in the pigment, the more the drops spread), and to touch other drops without blending.

Pigments are placed carefully or dropped stochastically onto the surface of the size. They are then manipulated with combs or needles or other tools into a pattern, still sitting on the size in the trough. A piece of alum-coated paper is placed carefully over the surface and the pattern transfers to the sheet. This lifts most of the pigment off the size, so the process must be done from scratch for each sheet. Hence, no two sheets of marbled paper are alike.

The method produces patterned sheets, many of the patterns with names, many with representational art on them, like flowers, animals, calligraphic words, and so forth. Some of the decorative patterns have become familiar over the centuries: bouquet, French snail, Dutch curl, zigzag, chevron, non pareil, Spanish wave, and so on. The process can also be done with no combs, but with the pigment droplets falling at random onto the size. This produces sheets with no particular pattern, but recognizable nevertheless, and often named (like “vein,” “stone,” “Stormont,” and the like).

While the method of marbling was kept a secret during the earlier centuries of its practice, in the nineteenth century the “secrets” were exposed, and today there is a worldwide interest in the art, with practitioners all over the world.

About contemporaneously to marbling, Paste Paper emerged as a way of enhancing books and other surfaces. Both methods (paste and marbling) were early on used by (and even practiced by) bookbinders, who saw them as a way to enhance the beauty of a book at a fraction of the cost of using leather.

Paste paper decoration is much simpler than marbling and is easier to master. One mixes up a batch of paste (wheat starch or rice starch works fine), mixes in a pigment, and spreads the colored paste with a brush or sponge over a sheet of dampened paper. While the pigment is still wet, any way it is touched will disrupt the smooth lines of the brushed-on paste. Touch the paste with a fingertip and the result is a little circle in the paste.

At this point, the artist’s imagination comes into play. Using any of a myriad of tools, the artist manipulates the paste into an endless selection of patterns. When the pattern is as the artist wants it, she or he stops moving the paste around and sets the sheet out to dry. The results can be astonishingly beautiful sheets.

There are many other ways to decorate paper: block printing, batik, tie-dye, folding and dyeing, impregnating or covering the sheets with materials like sparkles, pigments, or threads, weaving strips of paper together, stenciling, pricking, and so on.

The use of decorated papers in books has been around for two millennia. The attractive materials enhance the volumes and protect them. The papers are less expensive than leathers or parchments, and they do not deteriorate the way poorly processed leathers will.

Modern Papermaking

Today, the basic methods of papermaking that were invented in China more than 2000 years ago still hold: identification and gathering of fibers, preparation of fibers (breaking the raw materials down into tiny fibers); distributing the fibers over a screen to form the paper; removing the paper from the screen and drying it.

Even before the coming of the Industrial Revolution, papermaking was mechanized with the inventions of wove screens, the steam engine, and the Fourdrinier. The need for increasing amounts of paper in the nineteenth century led to experimentation with nontraditional fibers (hemp and cotton—essentially old rags—and various grasses). Wood pulp was the “final” choice since it is abundant, relatively renewable, manipulable, and inexpensive.

Just about all commercially made paper today comes from Fourdriniers, giant machines that perform many functions beyond the initial formation of the paper. Modern papermaking begins in the forest, with the harvesting of the trees, which are taken to the mill and debarked and chipped (the bark is removed and the wood is broken down into chips). It is then macerated, usually after being subjected to an acid bath which begins the breaking-down process. The pulp is then washed, refined, cleaned, and usually bleached. At this stage, if the washing does not remove all of the acids used to break down the pulp, or if the bleaching leaves an acid deposit in the pulp, inherent vice may wind up in the final paper.

At this point, the paper is transferred to the part of the Fourdrinier that actually forms the paper. Many kinds of additives can be put into the giant vats, like colors, inclusions to add tiny flecks to the papers, deacidifying agents like calcium carbonate, coating materials, sizing, and so on.

The pulp is then pumped over the moving screen, and the actual paper formation takes place. Just as the fibers are beginning to settle onto the screen, a dandy roll, a large cylinder containing a raised pattern, rolls over the screen, displacing the fibers to thin out the papers to create watermarks. Water drips through the screen and the paper is now formed into sheets that are as long as the manufacturer wants them to be. That is, if the machine keeps running and the screen keeps moving, and if the pulp continues to be distributed over the screen, an “endless web” of fibers will continue to form paper.

The paper now leaves the “wet end” of the Fourdrinier and enters the “press section,” then it goes on to the “dryer section,” and finally it goes to the “calender section.”

The machine performs many functions, so on the Fourdrinier are other rolls and other features: vacuum pumps to remove water, warm cylinders to dry the paper, calendering cylinders to burnish (smooth out) the paper, and so forth.

Paper is also produced from recycled materials, but each time old papers are prepared for new manufacture, the fibers are macerated further than they were the first time, they get smaller, and the resulting paper is generally not as strong as was the paper created from “new” materials. Often recycled pulp is added to new pulp to reduce costs and to keep the papers fairly strong. Though part of the manufacture of recycled paper is de-inking, the process still yields paper that costs less than does paper manufactured from new materials. More than half of the paper produced in the United States today contains recycled fibers.

If one considers the vast number of uses of paper today and the thousands of manufacturers of so many kinds of paper worldwide, it is easy to see why statistics on the quantities of paper manufacture are difficult to compile.

University of Illinois Library School Professor F.W. Lancaster, in the 1970s, predicted a “paperless society.” He did not mean this literally, but he did predict that, early in the computer age, society would be in a position to reduce its reliance on paper if it wanted to, thanks to the memories of computers. Taken out of context innumerable times, this phrase has proven correct and incorrect. It is true that a vastly increasing amount of information is being stored in digital form, thus reducing the need for paper. But the computer has given the world the capacity to print out (download) draft after draft of documents, millions of bits of information from the World Wide Web, photographs and other illustrative matter, and an endless stream of other materials, thus immeasurably increasing the amount of paper used today.

Hence, the amount of paper produced today continues to accelerate, and there is no end in sight.

Modern Hand Papermaking

While the great preponderance of paper today is machine made, there has been, for more than 60 years, a desire to return to the hand crafts.

Douglas Morse Howell was one of the earliest proponents of “modern hand papermaking,” having set up his own paper mill in 1946, making paper for artists such as Jackson Pollock and Lee Krasner. Many others followed his lead, and today there is a small but thriving hand papermaking community in the United States. There is even a fine magazine/journal, *Hand Papermaking*, that in 2008 hit its 25th year of publication and is still going strong.

There is still a call for handmade papers throughout the art and book world, for printers, artists, and those who love the feel and rattle of a handmade product.

Several operations have been around for decades, like Henry Morris’ private press, The Bird & Bull Press, which has specialized in publishing books about books, with a sub-specialty on handmade paper. Morris’ own work *Omnibus* (Bird & Bull Press: North Hills, Pennsylvania, 1967) is a classic in the field, along with Walter Hamady’s *Hand Papermaking* (Perishable Press: Mt. Horeb, Wisconsin, 1982).

Many artists, like Robbin Ami Silverberg in Brooklyn, produce their own handmade papers for the books they print. And in fact, an extensive network of fine presses in the United States (and throughout the world) use only handmade papers in their work.

While Wookey Hole Mill in Somerset, England, and its compatriot mill in Maidstone run by Barcham Green and then by Simon Green, have closed, other mills are still holding on. For nearly 40 years, Kathryn and Howard Clark have run Twinrock Paper Mill in Indiana. Tim Barrett, with extensive training in Japanese papermaking, teaches the subject at the University of Iowa. And papermaking classes are offered throughout the country, as a glance at any of the *Hand Papermaking* newsletters attests.

Running alongside the papermakers are those decorating the papers: marblers, paste paper makers, book artists needing specific decorative sheets for their publications, and many others. In the United States alone there are hundreds of marblers and scores of people working in paste papers.

In Europe the situation is comparable, with active mills in Germany, France, Czechoslovakia, Italy, and Spain, to name just a few countries. While some mills are there for demonstration only, others, with many private practitioners, are at work producing papers for printers and artists. And in the Far East, the Chinese, Japanese, Thais, Nepalese, Indians, Koreans, and many others are making splendid papers. Even in Africa there is a rudimentary handmade-paper industry. The continued demand for the product from artists, kite makers, scrapbook enthusiasts, origami experts, bookbinders, printers, and even people looking for lovely wrapping papers or greeting cards has spurred interest in the craft, and the production of handmade paper in the world today seems endless.

OTHER MATTERS

Today there are several associations of papermakers, including the International Association of Paper Historians (see <http://www.paperhistory.org/>); the International Association of Hand Papermakers and Paper Artists (<http://www.iapma.info/>); many professional and commercial paper associations; and smaller groups throughout the world whose interest is commercial, noncommercial, handmade, decorative, or other kinds of paper. (For instance, there are the American Forest and Paper Association, the National Paper Trade Association, Pulp & Paper

Product Council, Canada, and dozens of others in North America alone.) Worth repeating is the fact that in the United States an important magazine has been published for over 25 years, *Hand Papermaking*, keeping its readers up to date on all kinds of hand papermaking throughout the world.

The medium is important enough to have several museums devoted to it. For instance, The Robert C. Williams Paper Museum at the Institute of Paper Science and Technology in Atlanta, Georgia, contains, among many other things, the original Dard Hunter Collection of Paper. In Europe there are more than three dozen paper museums,^[21] and in Asia there are several, including the Pan Asian Paper Museum in Korea, The Paper Museum in Tokyo, and the Ino-Cho Paper Museum in Kochi Prefecture.

The importance of paper in our lives cannot be understated. It is perhaps the most vital material in the world for the advancement of learning, the recording of history, and for thousands of other common uses. It is also one of the most versatile materials, manifesting itself in endless appearances, decorations, shapes, thicknesses, and colors. In the library world, there would be no library world without it.

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History of Public Libraries *[ELIS Classic]*

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Abstract

The history of public libraries is surveyed, with particular emphasis on public libraries in the United States.

—*ELIS Classic*, from 1978

INTRODUCTION

It was suggested that the contemporary public library in the United States can be “understood to some degree through the historical perspectives of its origins in the 19th century. . . .” The library described in that context is a public institution supported by taxation, one that opens its collections, facilities, and services, without distinction, to all citizens. With minor variations because of differences in political philosophy, national experience, and state of educational development, this statement may be applied equally to the public libraries of Asian countries, of Eastern and Western Europe, of Australia and New Zealand, and of other parts of the world today in which public libraries have been established. The fact remains, however, that the “public library as we understand it is an Anglo-Saxon idea.” It developed in England and America at about the same time, “and was original in both countries.”^[1]

HISTORY OF THE PUBLIC LIBRARY

A century ago, William Frederick Poole, then librarian of the Chicago Public Library, wrote:

The public library is established by state laws, is supported by local taxation and voluntary gifts, is managed as a public trust, and every citizen of the city and town which maintains it has an equal share in its privileges of reference and circulation.^[2]

At that point, three-quarters of the way through the nineteenth century, Poole was writing of a well-established social and educational agency. Its roots, however, lay at least two millennia in the past. The term “public library” may be applied to some libraries in the pre-Christian era, but its meaning differed considerably from that of today; the libraries were public in a far different sense than present public libraries. It might be said that they were public as opposed to the libraries that were the private possessions of individuals who restricted use to their own purposes. Ancient “public” libraries were, of

course, for the use of the founder but also for scholars, students, priests, and officials who were permitted to use their collections for approved study.

It was suggested by the writer Aulus Gellius that near the middle of the sixth century B.C. the tyrant Pisistratus “collected a large library of books and later gave it to the city of Athens, where it was opened to the public.” There is no corroboration of the account, however.^[3]

Julius Caesar had the idea of founding a national or public library in Rome “to open to the public the greatest possible libraries of Greek and Latin books.” He planned to place Marcus Terentius Varro in charge, an erudite and prolific writer.^[3,4] Caesar was assassinated before he could carry out such a project. It fell then to C. Asinius Pollio to provide the first public library in Rome in the Atrium Libertatis, 39 B.C.^[3]

Rome, by the end of the fourth century, was reputed to have 28–30 public libraries. Again, these were not the public libraries of today but were available to those who could and would use them. Rome had, after all, in the imperial period, an increasing number of persons who were literate. There were booksellers in Rome and in many of the larger cities of the provinces. It was fashionable, too, to have books in one’s home. As the Roman Empire declined in the West, the libraries also declined, as did book publishing and acquisition.^[5]

A step closer to the modern public library was the “town library” that came into existence in the fifteenth to nineteenth centuries in England, Scotland, France, and Germany.

The early libraries in England were founded as gifts of individuals or by a “public and joint-stock contribution, and then entrusted to the guardianship of the respective municipalities.” Norwich, Leicester, and Bristol in England had examples of such town libraries founded in the first third of the seventeenth century, but their books and quarters after some vicissitudes ended up in a state of neglect or in the possession of a private society. In Bristol, as an example, the library, the structure provided to house it (Library House), and the books came into the possession of a private subscription library that relieved the Town Council of the need of its support. At Leicester, the town

library, founded in 1632, was in the latter part of the seventeenth century permitted to sink “into careless guardianship and ultimate neglect.”^[6] Scotland had to wait until late in the eighteenth century (1791) for a library, which soon was forced to become a subscription library to continue in existence.^[7]

There was at least one other English public library that deserves mention, the Chetham Library in Manchester, founded in 1653, and the gift of Humphrey Chetham, wool-factor and money-lender, who left £1000 to be used for books “for or towards a Library within the town of Manchester and an additional £1000 for the purchase of ‘some fit place for the said library.’” There were £200 additional for the purchase of “godly English books, such as Calvin’s, Preston’s, and Perkin’s works.” After other bequests—including a Hospital for Maintenance and Education of poor boys—had been met, the residue of the estate was to go for the further purchase of books. The income ran between £750 and £500 annually. By 1826, the library was reputed to have 14,276 items, the larger portion of which were folios and quartos. The next several decades did not do much for the library.^[6,8]

Many of the town libraries in France suffered the same fate—“a gross breach of trust”—as those in England, and disappeared. In many other cases, however, the library was quite successful and continued in existence.^[7] The library at Caen, for example, was established in 1431, and after suffering from the effects of religious wars and suppression, it was restored in 1736. Subsequently, it received books at the time of the suppression of the Jesuits and further contributions of books were made after the Revolution. In 1809, “when it was organized for public use,” it had some 25,000 volumes and continued to grow.^[7] Edwards also mentioned a library at Lyons, established in 1530, that early in the nineteenth century had 120,000 volumes and 1500 manuscripts.^[7] Edwards was particularly impressed with the state of libraries in the provinces of France at the time he was writing (1850s), the result of the fact “that in some eminent instances French Municipal Councils have consistently displayed, during a series of years, an enlightened appreciation of the value of store-houses of learning.”^[7]

In Germany, town libraries were established in Ratisbon (1430), Ulm (ca. 1440), Erfurt (1440), Nuremburg (1445), Hamburg (1529), and Lübeck (1530), to cite a few. In general, they grew out of bequests. In the early days, their contents were largely juridical, but when the religious houses were dissolved, many came into a number of rare manuscripts. As in France, a number continued in existence and had important collections by the mid-nineteenth century.^[7]

THE UNITED KINGDOM

In the United Kingdom, there were a number of other forerunners of the public library. There were the parish

libraries of the Reverend Thomas Bray that provided collections for laymen as well as for clerics. In Scotland, the Reverend James Kirkwood developed an elaborate scheme for “founding and maintaining bibliotheks in every paroch throughout this kingdom.” The scheme entailed providing a place for books in each parish, handing over to the library the personal books of the minister, cataloging of books, and making of four copies of each catalog, one of which would go to the principal library in Edinburgh that would make a general catalog of all books in kingdom. The scheme called for compensation to the minister for his books, cooperation between parishes, the lending of books, book binding, and ultimately, a “Printing-House and Paper Manufactory.”^[9] The Reverend Samuel Brown of East Lothian developed a plan involving “itinerating libraries,” through which there would be provided “a library or division of 50 books in each town or village of a county.” The library would remain in the town 2 years, move to another town, then move again in another 2 years, and so on. In each case, the collection would be replaced by another. The plan went into operation in 1817 in Haddington, where Reverend Brown was then provost, and in four other villages. In general, the circulation was good in the first year and fell off fairly sharply in the second year. The books had a strongly religious cast, but there were books of a “plain and popular nature” in the arts and sciences as well as in history, biography, and travel. The plan developed to the point that by 1836 there were some 47 libraries with 2380 volumes. After the death of Reverend Brown in 1839, the project slowly declined, partly because there was no one to offer the management and financial support he had supplied.^[9]

Also a forerunner of the public library was the social library: both proprietary and subscription. In larger cities, circulating libraries (strictly profit-making ventures) appeared, particularly in Scotland in the early eighteenth century.^[9] For the workers, there were apprentices’ libraries and mechanics’ institutes. These will be discussed in some detail later.

Toward the middle of the nineteenth century, the modern public library moved closer to reality by the passage of the Museums Act of 1845, primarily the work of William Ewart, who had been a member of Parliament for Liverpool (1830–1837) and was then member for Dumfries. Impetus for passage of the act had come from a meeting held in Manchester in November 1844, a meeting presided over by Richard Cobden. Joseph Brotherton, member for Salford (also in attendance), was influenced to appeal to William Ewart to work on the proposal. The result was passage of an act “Encouraging the Establishment of Museums in Large Towns.” It authorized the levying of a ½ d. rate in towns of not less than 10,000 population for the erection of museums of science and art; the act provided only for the building. An admission charge of 1 d. was authorized for support. Within a short time, three

towns—Canterbury, Warrington, and Salford—had taken advantage of the act to set up combined museums and libraries. The library at Canterbury, established in 1847, grew out of the purchase of the museum and library of the Philosophical and Library Institution. Warrington followed in the next year with the location together in rented quarters of the museum of the Warrington Natural History Society and the collections of the Warrington Subscription Library. There was a full-time curator who also served as librarian. Salford established a museum and library in 1849, although it was not opened until the following year.^[10]

William Ewart was further stimulated to work toward a public library act by an article written by Edward Edwards, “Statistical View of the Principal Libraries in Europe and the United States.” Edwards, a prolific writer on the subject of libraries, was then a supernumerary assistant at the British Museum and had testified before an earlier Select Committee inquiry into British Museum activities. Ewart drew upon Edward’s knowledge of libraries and by 1849 had convinced Parliament to establish a Select Committee to inquire into the establishment of “libraries freely open to the Public, especially in large towns.” The committee and its successor recommended, after inquiring into libraries on the Continent and in the United States, that Parliament authorize town councils to levy a small rate to establish and support public libraries.^[6,9,10] In February 1850, Ewart moved for permission to introduce “a Bill for enabling Town Councils to establish Public Libraries and Museums.” After considerable debate, the motion passed. After further debate and some amendments, the bill went to the House of Lords and then “received Royal assent” on August 14.^[6] The main provisions of the act were that corporate towns of 10,000 persons might levy a ½ d. rate to buy land and build buildings for libraries. The act of 1850 applied to England and Wales. It was extended in 1853 to the “Municipal Boroughs in Ireland and the Royal and Parliamentary Burghs in Scotland.”^[9]

The Museums Act passed with rather general support, but the Public Library Act ran into considerable opposition. Whatever popular support for it there might have been, it was not marshaled, partly because the franchise was not then as widely extended as later. It can be said that it was sponsored by a strong, determined minority drawn from members of the library profession and from the upper strata of society. In general, the arguments ran to extending the benefits of reading to the lower classes. The benefits were seen as social, moral, and educational. Brotherton argued that reading would reduce crime and “provide the cheapest police that could be gathered.” Others argued that it would keep workers from the evils of the gin shops. Opposition came from those who objected to an increase in rates and those who feared that agitation and social unrest would result.^[10,11]

Libraries were rather slow to appear. Edward Edwards suggested that Manchester was the first to establish a library

under the act, for the “preliminary subscription towards the expenses of its foundation had been set on foot, whilst the Bill was still pending in the House of Commons, by Sir John Potter. . . .” The poll at Manchester was not taken until August 1852, “when a library of 21,000 volumes was in complete working order.” The subscription raised amounted to £12,823.^[6] The first city in which a poll was taken was Norwich, however. Although the poll was taken on September 17, 1850, no service was begun until 1857.^[8,10] Twenty-three libraries were opened between the years 1851 and 1862, and 98 more between 1868 and 1886, for a total of (with the four previously established) 125.^[8,10]

Ewart attempted to have the act of 1850 amended in 1854, but it was not until the next year that the amended act became law: *An Act for further promoting the establishment of Free Public Libraries and Museums in Municipal Towns, and for extending it to Towns governed under Local Improvement Acts, and to Parishes*. It reduced the number of inhabitants necessary to qualify under the act from 10,000 to over 5000. Two neighboring parishes with populations that together aggregated more than 5000 persons and with vestries that chose to unite to establish a public library might do so. The rate was set at “one Penny in the Pound on the rateable value of the property assessed,” and “Books, Newspapers, Maps, and Specimens of Art and Science, Fuel, Lighting and other similar matters” might be purchased.^[6]

Over the years, there were a number of Public Libraries Acts, but the changes were minor, “no more than further provisions for adoption, area definitions and powers for Authorities to take joint action.”^[8] In 1892 (June 27), a new Public Libraries Bill received royal assent. The act repealed former legislation and, in effect, consolidated previous advances and changes. The act of 1919 not only permitted the development of urban library service by removing the rate limitation, but it also gave library powers to counties. A major drawback of the national library legislation of the latter half of the nineteenth century had been the continuation of the penny rate limitation. A number of library authorities, about 30 by 1900, had freed themselves of the limitation “by means of clauses in Local Acts.”^[8] It was not until the close of the year 1919 (December 23), however, that the rate limitation was removed. Other provisions of the act were important too. County Councils might now adopt the Public Libraries Acts for all or part of their areas. They might accept library powers from existing library authorities or give up, with approval of the Education Committee, their powers “in respect of any part of its library area to permit the establishment of an independent library service.”^[8,10] As Lionel McColvin pointed out, the county system was in position to serve “people living under a variety of circumstances—in isolated farms, in little villages, in mining and industrial townships or market towns, in new towns and in the suburbs.”^[12] This act was a dominant factor in library development from 1919 to 1965.

Andrew Carnegie contributed significantly to the public library movement in the United Kingdom, as he did in the United States. His first gift was that of £8000 to his native Dunfermline in 1879. By 1883, the library had opened.^[8]

Carnegie made subsequent grants in Scotland and in England. As in America, grants were usually for buildings and equipment, not for books or operation. By the time of his death, about half the library authorities in England and Wales and more than half in Scotland had profited from his generosity. In 1913, he created the Carnegie United Kingdom Trust (CUKT) with a capital of £2,000,000, and he indicated libraries were a high priority. Most of the public library development had come in the larger cities and towns. It was logical, therefore, that the Carnegie Trust would turn its attention toward helping the rural areas of the counties. Various local “schemes” for assisting public libraries were used as experiments, such as the Workshop Authority project to supply book service for the nearby rural parishes of Nottinghamshire.^[8] At Staffordshire, the Trustees of CUKT funded a “central Repository of books...from which should be dispatched to the Schools of the County consignments of books which would reach their readers through the agency of the schoolmasters and the schoolchildren.” The plan had first been suggested to Oxford, which turned down the offer of funding in the amount of £5000. When the new Public Library Act of 1919 provided for the establishment of County Library Authorities, the trustees of the foundation began to make grants to the authorities in terms of books, book boxes, shelving, and other equipment.^[8] One measure taken by the trustees to further the cause of county libraries was a grant of £4000 for the provision of a County Library sign that became a familiar reminder of library service across the countryside and of Carnegie “benefaction to a grand total of £500,000.” For the early years following the passage of the 1919 act, service consisted of boxes of books that eventually gave way to the “library van” or bookmobile. Gradually, in the smaller urban areas subject to the County Library Authority, a room or library building was provided. Utilizing a provision of the 1919 act that permitted the levy of a rate above the normal county rate to provide branch library service, counties began to provide service on the urban pattern.^[8]

Library service remained uneven, however, for the populations served by local authorities varied from 30,000 to 1,000,000 or more persons. The smaller authorities had neither the manpower nor the financial resources to provide a satisfactory level of library service.

The number of public library authorities in England and Wales was sharply reduced (345 to 83) by comprehensive local government legislation, the Local Government Act of 1972. The amalgamation was to be accomplished by April 1, 1974. Most of the new authorities had populations of 200,000 or more persons, which made it possible to have greater financial resources than before. The London area, reorganized in 1965, was not changed.

THE UNITED STATES

In America, the first library to meet the test of a modern public library was that established in Peterborough, New Hampshire, in 1833. Money originally appropriated by the state for other purposes (a state university) was put into a Literary Fund and made available to towns to devote to the support and maintenance of “common free schools, or to other purposes of education.”^[13] The purpose to which Peterborough put the money was to provide books for a town library to which there would be access without charge. The collection, reports Jesse Shera, was rather like those of the social libraries of the day.^[13] The library’s true significance, however, was that

for the first time an institution was founded by a town with the deliberate purpose of creating a free library that would be open without restriction to all classes of the community—a library supported from the beginning by public funds.^[13]

Before the establishment of the Peterborough library, there had been books and libraries in America for some two centuries, for a number of private libraries had come with the early settlers. Several—like those of Elder William Brewster of Plymouth Colony and John Winthrop, Jr., governor of Connecticut—were, in the early part of the seventeenth century, quite impressive. In New England at the close of the century, the largest private libraries were those of Increase and Cotton Mather; in Westover, Virginia, Colonel William Byrd is reputed to have had a library of 4000 volumes, and in Philadelphia, James Logan, a library of 3000 volumes.^[3,14] The number of those who read was, as in the mother country, rather limited, although there were presses in the colonies and booksellers as well.

Robert Keayne—a merchant described variously as “a conscientious & upright man in the generall,” an “extortioner,” “contentious and stubborn,” and fined for “profiteering”—bequeathed a public library to Boston in the 1650s. In his will, written between August and December 1653, he provided that £300 were to be set aside for public use, in particular, a Town House in which a room was to be provided for a public library. Included in the bequest were his “three great writing bookes which are intended as an Exposition or Interpretation of the whole Bible.” His son and his wife were to choose from his personal books those they wished, the balance to go to the library. In the event the town of Boston failed to act upon his gift by providing the Town House, the money and books would go to Harvard College. The building was erected and put into use, but it suffered two fires. One in 1711 destroyed the building, but the library was largely saved. The restored structure and the library were totally consumed by fire in 1747. No more was heard of the library. Keayne had hoped his example would lead others

to donate books, but few books came by way of contribution. The library served for almost a century as a repository of town records and was generally known as a public library owned by the town and supported by it.^[13,15] Another early library for the public resulted from the will of Theophilus Eaton, governor of New Haven, which provided that the books formerly belonging to his late brother Samuel be held in trust for a college that was to be established in New Haven by John Davenport. Davenport left the colony, and the college failed to materialize. The books then belonged to the town and are believed to have eventually found their way into the schoolhouse, where they were kept but seldom used until sold in 1689 for “forty pounds of rye and thirty-two bushels of Indian corn, appraised at 12 pounds, 18 shillings.”^[13,15] Concord, Massachusetts also had a library owned and supported by the town before 1672. There were other towns in New England that owned and supported libraries in the early years of the eighteenth century. Shera mentions three in Massachusetts: Oxford (1719), Lancaster (1731), and East Sudbury (1726). The first collection was a gift, but the latter two were purchased at town expense, kept in the meeting house, and made available to the townspeople.^[13]

At the beginning of the eighteenth century, there appeared for the colonists another source of books, the parish and provincial libraries instigated by the Reverend Thomas Bray. Dr. Bray was appointed commissary of the Anglican Church in the Colony of Maryland in 1695. He early realized that to supply ministers and missionaries for the relatively unappealing parishes in the colony, he was going to have to draw upon the “poorer and less influential men,” men who would have difficulty supporting themselves and could not be expected to provide themselves with a library, which Bray considered essential. A minister could do “his best only if he had ready access to a library. . . .”^[16] Bray was assisted in his work of getting libraries to America by two groups he was instrumental in forming: the Society for the Promotion of Christian Knowledge and the Society for the Propagation of the Gospel in Foreign Parts (SPG). Later in his life when he fell ill, he was assisted by a group known as Dr. Bray’s Associates.^[16]

Although his primary interest lay in Maryland, Bray made the effort to extend such libraries to all of the colonies. He thought of one large library in each colony, a provincial or general library, and of a parochial library for each parish. He also provided libraries for laymen. Bray served as commissary for Maryland from 1695 to 1704. In that period of less than a decade, he and those who worked with him established:

provincial libraries at Boston, New York, Philadelphia, Annapolis, Charleston and Bath, North Carolina. He provided thirty-nine parochial libraries, of which twenty-five were located in Maryland, although each of the other colonies had at least one such library. Finally he provided

over thirty-five layman’s libraries and sent over 35,000 religious books and tracts to the colonies for three distribution.^[16]

The libraries were not large; the largest, 1095 volumes, was in Annapolis and was considered the “Publick Library” of the colony. Governor Francis Nicholson, with a view to enlarging the collection, suggested that the king be asked for permission to divert some military defense funds for library. The Assembly, however, did not acquiesce.^[15] The library in Charleston had support from Bray, the Assembly, and the proprietors of the colony. In 1700, the Assembly of South Carolina passed a law, one of the earliest in America, that put the books in the “care” of the minister of Charleston, with a board of nine commissioners appointed by the Assembly to manage it. Use was without restriction. Books might be borrowed, the length of time depending upon the size of the books: “if a *Folio*, in four months time; if a *Quarto*, in two months time; if an *Octavo*, or under, in one month, upon Penalty of paying three times the full Value of the said Book or Books so borrowed, or damnifying the same.” The collections of the libraries were heavily theological but they were not entirely so. More than one-third of the initial purchase of books for the Charleston library were nonreligious. It was not Bray’s intention to supply a complete library for the parish. He hoped, although the hope was seldom realized, that there would be additions made locally to the collections.^[13,15,16]

In the main, the Bray libraries were not public libraries, even though a few were so designated. Quite a number of laymen had access to all of the libraries, for ministers permitted members of the parish to use some of their books. Their significance was that they “did much to enrich the book resources of the clergy in the American Colonies at the beginning of the eighteenth century.” Shera suggested further that their relationship to the public library movement was “more symptomatic than influential.” Laughter counters with the observation that “if the libraries had no effect, the SPG would not have continued sending such reading matter to the colonies, in an amount estimated to exceed 100,000 volumes.”^[13,16]

Of more significance in the chronicle of the predecessors of the public library in America was the social library, a library resulting from the association of a group of persons who contributed or subscribed money for the purchase of books. Title to the books remained with the association, although all contributors could use or borrow them. The library might be proprietary, that is, the members of the group subscribed to stock and owned shares; or it might be a subscription library for which the members of the group subscribed an initial fee, with which the first books were bought, and followed the initial subscription with the payment of an annual fee. Both the proprietary and the subscription libraries soon permitted nonsubscribers to use the collections upon payment of a

set fee. In general, these libraries were legal entities operating on a charter issued by the individual colonies and later by the states.^[13]

The movement toward the social library was started in America by Benjamin Franklin, who in late 1720s, was the organizer of a group interested in “socializing and debating,” the Junto. An experiment of pooling personal books to provide a resource for their debating material and for other use was not a success. Franklin then proposed a library provided by the subscription of 40 shillings by each member of the Junto and an annual fee of 10 shillings. Out of this proposal came the Library Company of Philadelphia, founded in 1731, often referred to as the mother of the social library in America. Before long, subscription libraries began to appear in all of the colonies.^[13]

Three other early major social libraries—like the Library Company of Philadelphia, still in existence—are the Redwood Library of Newport, Rhode Island, the New York Society Library of New York City, and the Charleston Library Society of Charleston, South Carolina.

The Redwood Library was founded in 1747 and was the first of these libraries in America to receive a charter. It too grew out of a discussion group, the Literary and Philosophical Society dating back to 1730, or at least the society seems to have been influential in Abraham Redwood’s offer to donate £500 if a company for the establishment of a library were formed. The offer was accepted, and money was pledged for a building on property donated by one of the society’s members. The Provincial Assembly issued a charter in 1747. By 1750, the library was in its own building, and 5 years later, Dr. Ezra Stiles (pastor at Newport, who later became president of Yale University) became its librarian. He seems to have devoted some of his time each week to the library, but the founder decried the Anglican influence of Stiles and those who controlled the library.^[15] According to Horace Scudder, the character of the original collection attracted Stiles to Newport. “The books bought with Mr. Redwood’s money were considered at the time the finest collection of works on theology, history, the arts and sciences in the American Colonies.”^[17] The library suffered during the Revolution, and in 1790, it was described as “in a sad plight and in the period of stagnation many books disappeared and about three quarters of the collection was lost.” The library achieved a “renewed prosperity” in the nineteenth century. In 1952, the library began a buying campaign to restore the original collection.^[18]

The New York Society Library, organized in 1754 as the City Library, held its first board meeting at the City Arms on Broadway. The meeting was concerned with the raising of money to erect and maintain a “publick Library.” It was reported that “not less than 70 gentlemen have already subscribed Five Pounds Principal and Ten Shillings per Annum, for that Purpose.” Soon, the 118 subscribers were asked to submit a list of books each considered to be desirable. To books purchased was added a collection of about 2000 volumes, known as the

corporation library. This was a gift to the city from two Anglican clergymen who were distressed with the paucity of reading material in New York: the Reverend John Sharpe, chaplain of Queen Anne’s forces in New York, who observed “there being no place I know of in America where it [learning] is less encouraged or regarded”; and the Reverend John Millington of Kensington, England, who found New York an “uncultured little city of seven thousand souls in the ‘Plantations in America.’” The latter left his books to the SPG to be shipped to New York. The library was open not only to city residents as subscribers but also to those who lived in the colony. Nonsubscribers might borrow books by leaving a deposit of more than one-third the value of the book or books taken. The library was first located in a room in City Hall with Benjamin Hildreth as library keeper, “who received £6 annually for ‘his Trouble and Care while in that Office.’”

By 1795, the library had erected its own building. It had fallen upon evil days during the Revolution but began to move toward recovery in 1788, when operations were resumed. A catalog of 1793 listed 5000 titles. In 1840, the library was located at Broadway and Leonard and remained there for 13 years. A large lecture room in these quarters permitted varied entertainment, discussions, and assemblies. Among those who appeared were Fanny Kemble, the Swiss Bell Ringers, Campbell’s Minstrels, and Edgar Allan Poe, who lectured on American poetry.^[17,19]

The Charleston Library Society was founded in 1748, the earliest proprietary library in America according to Edgar Reinke. Established by 17 young men, the number of members increased to 160 before mid-century. The library was granted a charter by the colony, confirmed by the crown in 1755. It began with the intent of acquiring magazine and pamphlet material but soon acquired books as well. The library prospered because the early members “were all of the aristocratic, paternalistic class prevalent in much of the South at that period.” Many of them had received their formal education abroad and sent their sons and daughters abroad for education. There were weekly meetings to which members came, usually 20 to 30. A part of the income of the society was invested in bonds, with the result that by 1775, the funds amounted to £18,000. With sophisticated, well-educated members, the library emphasized the classics and had a fine collection of classical literature. It suffered some from the occupation of Charleston by British troops during the Revolution but was largely destroyed by a major fire. It continued for some years as a social club, and then in 1790, it was reorganized with the remaining books as part of its collections.^[17,20]

Shortly after the successful beginning of Franklin’s Library Company of Philadelphia, subscription libraries of varying sizes began to proliferate in the middle colonies and particularly in New England. Prior to the Revolutionary War, however, there were only two or three in the South.^[20] The social libraries, like the parochial libraries

that preceded them, filled a need in the colonies, which were beginning to expand in population. Their collections were quite different, with less emphasis upon religion and more upon secular matters of concern: history, biography, travel, poetry, grammar and rhetoric, agriculture, arithmetic, and natural science are examples of the areas of more prevalent works. Shera suggested that the year 1790 was the midpoint in the effective life of the social library, with its period of most vigorous activity from 1790 to 1815 and a gradual decline from 1815 to 1850.^[13] Like most social agencies, the social library suffered in periods of economic decline. The social library declined largely as a result of a number of factors of which the rise of the public library was but one. For one thing, it could not "meet the expanding demand for library resources"; it was restrictive, that is, its clientele was limited at a time when the movement toward popular education was becoming strong. It made a major contribution to the library movement:

Almost from the very beginning the social library movement assumed the central attributes of a public library system. . . . By virtue of the implications for the future, as well as of the character of its past, the social library is an important factor in the evolution of the modern public library.^[13]

A strictly commercial library was the circulating library, perhaps more accurately, a collection of books gathered together for those who wanted them for home use. And the intent of the proprietor was profit. He was more likely than not to cater to popular taste and to avoid concentrating on "good literature." Quite often, circulating libraries were operated in conjunction with bookstores. Although they had been in existence on the Continent and in England much earlier, these libraries became active in the latter half of the eighteenth century in America. One of the earliest, that of William Rind of Annapolis, opened in the fall of 1762. This library and many of those that followed it had a relatively short life. One of the major problems was that of relending on the part of patrons, a practice that deprived the proprietor of needed revenue. It was necessary, too, for the circulating library to anticipate and keep up with the more ephemeral materials. A major criticism of this form of library was that it relied heavily on fiction, "a discredited literary form."^[13]

Other types of libraries rose to fill a need for books prior to the appearance of the public library. While rather similar in character, they were known variously as mercantile libraries, mechanics' libraries, young men's libraries, and apprentices' libraries. These libraries were closely related to the growth of the education movement in the first half of the nineteenth century. Mechanics and apprentices turned to libraries for satisfaction of their need for education, and the form of library they used was a

modification of the social library.^[13] In England at the turn of the century, workers' institutes devoted to the "intellectual development" of the workers appeared with emphasis upon science in the beginning but expanding later to include literature, history, and the arts. There were libraries, lectures, and discussions as part of their programs. The movement was extensive in England and spread to America.^[13] Most of such libraries in America, according to F.B. Perkins, had an education department or school as a principal activity. Classes were offered in bookkeeping, arithmetic, writing, and language. Some also had, in addition to a reading room, a game or chess room, and in some instances, a gymnasium. Perkins further suggested that they were "planned rather like a sort of business college, as if to furnish a general higher education to those who were not able to go as far as desirable at school."^[21] Their collections, he reported, varied, were "founded on old and solid libraries," and were "of much positive value." Most were, however, "to a predominating extent. . . as they must necessarily be, collections of popular literature." Like most other libraries of their era, there was a major lack of money. They overcame a part of their difficulty by bringing in a group of older men whose concern was control of the property interests of the group.^[21]

Mercantile libraries, "as distinct from other social libraries. . . may be described as primarily for the use of merchants' clerks; secondarily, also, for all general readers."^[21] More specifically, they were intended to satisfy the reading requirements of the merchants' clerks and were supported in part by merchants and a periodic fee. They differed from mechanics' and apprentices' libraries in that they began as libraries; their educational aspects came later. There was also a greater emphasis not only on business-related areas but upon history and literature.^[13]

Still another type of library providing books primarily to young men and artisans, but to others as well, was the YMCA Library. The first Young Men's Christian Association in America was founded in Boston in 1851, "for the improvement of the spiritual and mental condition of young men." The YMCA Libraries, therefore, developed in the period when the "public" library, as exemplified by the Boston Public Library, was emerging. By 1859, there were 145 associations with libraries, 12 of which had 1000 or more volumes. In 1875, it was calculated that there were 478 associations with an aggregate membership of 43,612; of these associations, 180 reported having libraries, with a total of 164,188 volumes. The largest of these libraries was said to be that in Washington, with a collection of about 15,000 books. Like the mercantile, mechanics', and apprentices' libraries, they also had lectures. In the larger towns, the YMCA was apt to have classes in "those branches of practical knowledge which are especially available in business pursuits." In many towns, the only library "open to the public" was that of the Young Men's Christian Association. The reading rooms "are always free to the general public." An effort was made to

have the libraries open “at hours when they will be conveniently accessible to the young men of the community.” Occasionally, they were open on Sunday. The library in New York was reputed to have the best collection. The information in Table 1 indicates its breadth.

The libraries described in the preceding paragraphs served as forerunners of the tax-supported library that provided free access to all comers. They provided access to books for several levels of society, when in most cases, there would otherwise have been little access to them. While the social library was still in the ascendant, the first moves toward the public library were made.^[22,23]

Caleb Bingham, a Boston bookseller and publisher, in 1803 made a donation of 150 titles to his native town of Salisbury, Connecticut, to serve as a library that would provide reading he did not have as a boy. A self-perpetuating Board of Trustees was to have control of the Bingham Library for Youth, open “freely” to those between 9 and 16 years of age. The library was accepted gratefully by the town, which appropriated \$100 for the purchase of “suitable books.” Such support continued fitfully for years, and then the library was entirely neglected until it was absorbed toward the end of the century by the Salisbury Library Association, which became the Scoville Memorial Library Association.^[13]

The town of Lexington, Massachusetts, also had a library, funds for which were appropriated in 1827. By 1839, however, the town discontinued its periodic payments for support. Shera suggested that a pattern had begun to emerge, that municipal support had been given to these two libraries, and that the next step was “institutional permanence and stability” for the public library derived from municipal support. This came with the establishment of the Peterborough Library in 1833.^[13]

In 1835, New York State passed legislation that permitted the levying of a tax to support school district libraries. Other states followed, but by 1876, the impetus was lost. Oliver Garceau credited their decline to the fact that they were artificially created by state planners, following no local pattern of cultural loyalties; they served too small an area—in New York, only 267 persons to the district; they were inadequately housed, poorly supervised by school trustees, and badly managed by elected librarians.^[24]

In Indiana, an attempt was made to set up county libraries under the constitution of 1816. Because of the frontier conditions, it failed.

The first large municipality to establish a library that met the requirements of a modern public library was Boston, which opened the doors of its library to the public on March 20, 1854. The concept of a public library for Boston had been suggested in a letter written by George Ticknor, Smith Professor of the French and Spanish Languages at Harvard, to Daniel Webster in 1826, 7 years before the Peterborough Library was established. Ticknor, a trustee of the Boston Athenaeum—once called a public library by Charles Coffin Jewett (“practically it is such”)—wrote that he had a project to join all of the libraries of Boston, including the Athenaeum, into “one establishment.” He would let “the whole circulate.” He envisioned elimination of duplication of books, of quarters, and of librarians and their salaries. With the money saved, he would buy more books. Nothing came of the proposal.^[25] Suggestions as to combining the libraries of Boston into one large unit also came from a Frenchman, Alexandre Vattemare, a ventriloquist whose stage name was M. Alexandre. Vattemare had visions of bringing peoples closer together by an international exchange of books—as had the Reverend Brown’s associates before him.^[9] He appeared in New York in 1839 and over the next 2 years he advocated his plan during his various appearances in the United States and Canada. In Boston in 1841, he interested a group of young men who used the Boston Mercantile Library and several prominent citizens, notably, Charles Francis Adams. No project materialized, but there was an exchange of gift books between Vattemare in Paris and the City of Boston. One of the gifts, a rather handsome one of nearly 100 volumes, led to the appointment by the City Council of a Select Committee to recommend a suitable return gift and a place where the gift books should be kept. The committee recommended a room in City Hall. It also included the recommendation that there be established a public library and advised that an anonymous donor (Mayor Quincy) was offering \$5000 toward the project with the proviso that \$10,000 for the purpose be raised “at large.” The library was to be “fully used by all, as may be consistent with the safe-keeping of the property.” As a result of this proposal, the council in November 1847 appointed the Joint Special Committee on the Public Library, which among other charges, was to consider the feasibility of applying to the legislature for the authority to establish and operate a public library. In early 1848, a new City Council directed the mayor to apply to the legislature for such authorization, which resulted in an act authorizing the City of Boston to establish and maintain a public library. The governor of Massachusetts signed the act on March 18, 1848.^[25] A prime force in the progress toward the establishment of the library was the zeal of Mayor Josiah Quincy. Also important in the movement were

Table 1 Holdings of New York YMCA library.

Category	Percent of holdings
History	11½
Biography	4
Travel and geography	3½
Bibles and biblical works	6
Theology	3½
General literature	18
Poetry and drama	7
Fiction and tales	29½
Arts and sciences	17

George Ticknor, Edward Everett, and Mayor Joseph Bigelow, who followed Josiah Quincy as mayor in 1849. Quincy, treasurer of the Boston Athenaeum, naturally favored joining the two libraries. The Athenaeum had been established in 1805, an outgrowth of the Anthology Society organized to continue publication of the *Monthly Anthology and Boston Review*, about to go out of existence. The next step was an Anthology Reading Room and Library, a subscription to which would cost \$10 per annum. Soon there were 160 subscribers. When the library opened on January 1, 1807, there were more than 1000 volumes and English, French, and American periodicals.^[15] The Athenaeum grew and prospered, although it was in some difficulty in mid-century because of unanticipated costs in the construction of its new building. The proposal to join the two libraries fared well until it was put to the proprietors for approval. The proprietors postponed the matter indefinitely, and the Public Library proceeded on its own.^[25]

The library began operation by opening to the public the first of its two rooms in the Mason Street Schoolhouse on March 20, 1854. It was open daily (except Sunday) from 9:00 A.M. to 9:30 P.M. and all “inhabitants” of Boston over 16 years of age might use it. A single volume might be withdrawn for home use for 14 days on signature and agreement to observe library rules by a select list of people including, among others, city officials and employees, ordained ministers, teachers in private schools, and benefactors (contributors of \$100 or more). Other inhabitants of Boston who wished to borrow a book had to deposit the full value of the book with the librarian.^[25] The first librarian appointed by the council, Edward Capen, was a Harvard M.A. who later became a graduate of Harvard Divinity School, and who had served as a clergyman for several years. He was appointed in May 1852. While he was still serving as librarian, the council at the behest of the trustees appointed a superintendent who would have the general responsibilities of administration. The appointment was an annual one, and the position might remain vacant by decision of the council or by the trustees’ decision not to make a nomination. The first appointee was Charles Coffin Jewett, who served from 1858 until his death a decade later. Jewett had been librarian of the Smithsonian Institution in Washington and had come to Boston to work with the books received through the munificence of Joshua Bates. For that purpose, the trustees rented a house on Boyleston Place in 1855, wherein Jewett was installed.^[25] Joshua Bates, a poor boy of Boston who grew up with nothing to spend on books, had the good fortune to be able to satisfy his great desire to read in the bookstore of Hastings, Ethridge, and Bliss, after his long work hours in a counting house. Remembering his own lack, Bates, who was senior partner of the London Banking House of Baring Brothers and Company, offered the sum of \$50,000 for books. When the council put a new building under construction, Joshua Bates offered a

second gift, the purchase of a “considerable” number of books to be held in trust for the new quarters so that when they opened there would be an adequate number on hand. He estimated the cost would run \$20,000 to \$30,000. It was this latter gift that Jewett was hired to prepare (in the temporary quarters on Boyleston Place) for use in the new building.^[25]

Under Jewett’s administration, the library made substantial progress. The library had moved into its new building on Boyleston Street on New Year’s Day, 1858, and Jewett became its new superintendent almost immediately. On Jewett’s death, January 8, 1868, he was succeeded by a trustee, Justin Winsor, under whom the library continued to progress. When he resigned and became librarian of Harvard in July 1877, it was an outstanding library.^[25] By 1868, it had a collection of 144,000 volumes and 50,000 pamphlets, second then only to the Library of Congress, which had 175,000 volumes and 70,000 pamphlets. At that time, Winsor noted that only two other public libraries had fairly sizable collections: New Bedford, 21,000 volumes; Cincinnati, 20,000. He noted that Liverpool, the largest of the English public libraries supported by the penny rate, had 84,000 volumes. By 1877, too, there were six branches, several stations, and regular deliveries of books to 13 firehouses and a fireboat.

The motives of those who were largely instrumental in the founding of the Boston Public Library and libraries in larger cities have come under question. Michael Harris, in an article entitled the “Purpose of the American Public Library,” attacked what he called the comfortable concept, widely held, that the public library movement was “launched in the 1850’s by an intelligent middle class led by a group of enlightened civic leaders.” George Ticknor is seen as insisting that the public library should be “dedicated to the continuing education of the ‘common man.’” Actually, public libraries, Harris argued, were always “generally cold, rigidly inflexible and elitist institutions.” He makes a strong case to support his contention that the founders were men of substance, conservative, and dedicated to the preservation of the form of the society they ruled over. The library, as they saw it, would help educate the new residents of the city, for they were not capable of understanding the country’s free institutions. They would be brought “in willing subjection to our own institutions.” Harris continued with the concept that those who were hired to run the libraries were “technicians” who were “dedicated” to the founders’ concept of the library. Carnegie, when he appeared, was equally authoritarian in his approach to the founding of libraries, and he saw them as a means of helping persons to help themselves, to “make men not violent revolutionists, but cautious evolutionists; not destroyers, but careful improvers.”^[26] Harris further saw librarians as moving the public library in the first half of the twentieth century toward assuming the role of a bastion of democracy “by assisting the successful working

of self government.”^[26] The library would do so by providing information on both sides of a subject. The user would decide for himself, and the librarians’ traditional “passivity” would not be brought into question. Harris’s “revisionist interpretation” has not gone unchallenged. Phyllis Dain in her article “Ambivalence and Paradox” pointed out that Ticknor was “aristocratic and conservative” and that his choice of the public library as a means to open opportunities to people, rather than to close them, was “an expression of the 18th century rationalists’ faith that the lower classes could be integrated into society through education.”^[27] She also pointed out that in view of the urban masses’ lack of leisure time, lack of access to those who controlled the money, and low level of education, none but an “elite group” was left to foster the public library. As noted earlier, there were many other forms of libraries—mercantile, apprentices’, mechanics’—supported in part and used by groups who were not elitist. Phyllis Dain also challenged Harris’s criticism that librarians had become technicians and bureaucrats. The increase in numbers of libraries, size of collections, and in staff naturally led librarians to “rationalize procedures and bureaucratize personnel.”^[27] The Harris thesis, too, does not account for the large numbers of public libraries established in modest-sized towns that lacked urban poor. It might be noted in passing that in England, there were in Parliament members of the “elitist” group who “almost feared that these libraries might be converted into normal schools of agitation.”

The public library movement in the latter part of the nineteenth century was stimulated by the philanthropy of many who had made their fortunes in America’s burgeoning industries. One very early benefactor was John Jacob Astor, who in a codicil to his will, in August 1839, set aside \$400,000 for the establishment of a public library. He was directed toward this philanthropic move by Joseph Green Cogswell, who subsequently (at Astor’s request) moved in with him and spent some years prior to Astor’s death in 1848 in buying books, preparing catalogs, and seeing to it that the benefactor did not change his mind about his bequest. He helped plan the building and served as superintendent of the library from its establishment until 1861 and as a trustee until 1864. Cogswell thought of the Astor Library as a reference library and primarily for those engaged in research. No circulation was permitted. Its hours were short and access difficult. As a result, it enjoyed a poor press, and complaints were widespread. Members of the Astor family continued to contribute to the library for some years, so that it was able to grow and to achieve preeminence. From 1876 to 1894, however, “it had lost its pre-eminent position and slipped into somnolence.”^[28,29] James Lenox, a wealthy and prominent New Yorker, founded a second reference library in New York City. The founder, a merchant and large property owner, was a bibliophile who gathered a fine library of 20,000 volumes, which in 1870, he had incorporated into a public

library. If anything, it enjoyed an even poorer reputation as a public institution than the Astor Library. It was some years after its establishment before it was finally opened to the public. Because of its great treasures and the fear of its founder that they would be lost or vandalized, access was limited. Further, “stress was placed not on use of materials but on viewing them.”^[29] A third major bequest for the establishment of a library was that contained in the will of Samuel J. Tilden, which placed the largest part of his estate, \$5,000,000, in the Tilden Trust. Tilden, a successful lawyer, had established his reputation by prosecuting successfully the Tweed Ring. He had run on the Democratic ticket for the presidency of the United States in 1876 but lost the election in the recount of votes made in three southern states. The trust was attacked by members of the family, nieces and nephews. Although the court suit went against the trust, there was eventually an agreement to partition the estate, which provided the trust with something between \$2 and \$2½ million. In 1895, the two libraries, Astor and Lenox, were merged with the Tilden Trust to create the New York Public Library. The first director was John Shaw Billings under “whose forceful leadership they [the trustees] saw the New York Public Library built almost overnight into the illustrious institution of their ambitions.”^[29] The library created in 1895 was a reference library. The circulation function was achieved when an agreement of consolidation was completed with the New York Free Circulating Library, January 8, 1901. The Free Circulating Library, incorporated in 1880, was the outgrowth of the efforts of the teachers of a sewing class in Grace Church who wished to raise the reading level of the children. As interest grew in the project and more women became involved, a reading room was provided for the 500 books collected. The project expanded, was incorporated, and at the time of the consolidation, the library possessed some \$300,000 in cash and securities and five buildings (valued at \$300,000) and operated 11 branches with 160,000 books that accounted for an annual circulation of 1,600,000.^[28]

In Baltimore, Enoch Pratt, a successful merchant and investor and a native of New England, presented the city in 1882 with a sum of \$1,058,333.33 for a library, provided the city would agree to create an annuity that would provide \$50,000 per annum. The gift consisted of a building already under construction that would cost \$225,000 and “upon its completion, the additional sum of eight hundred and thirty-three thousand three hundred and thirty-three and one-third dollars.” The library grew rapidly, and in a decade, had a collection of 150,000 volumes and five branches. Andrew Carnegie in 1905 offered \$500,000 with which to build 20 branch libraries. The branches were built over a period of years. The City of Baltimore, too, began adding money each year to supplement the annuity’s yield as operations expanded and expenses rose. Much of the later success of this library may be attributed to Joseph L. Wheeler, who became its

director in 1926; he was an outstanding administrator who later became a sought-after library building and management consultant.^[30]

Many libraries, some quite large and others designed to serve relatively small towns, were established by gifts of wealthy men and women in the next few decades. The major benefactor of libraries, of course, was Andrew Carnegie. Born in Dunfermline, Scotland, in 1835, he came when a boy (1846) to the United States with his parents, who settled in Allegheny, Pennsylvania, a city across the Allegheny River from Pittsburgh. Successively a bobbin boy in a cotton mill, a telegraph messenger, a telegrapher, and a section superintendent for the Pennsylvania Railroad, he began to invest his money in profitable projects and then entered the iron and steel business. From his various sources of income, Carnegie amassed a huge fortune for the day. About 90% of that fortune went into various charitable and philanthropic projects—more than \$333,000,000.^[31] He donated \$56,162,622 to construct 2509 library buildings in the English-speaking world. Except for a few instances, Carnegie donated money only for buildings and did not support or endow libraries. The support of the building by the municipality was a stipulation required before the grant was made. In America, he provided \$41,033,850 to construct 1412 buildings.^[31] With the library acting as his agent, he entered into an agreement with New York City on July 17, 1901, to provide the city with funds to acquire in the boroughs of Manhattan, Bronx, and Richmond “not more than 42 [later raised to 50] library sites” and erect buildings on them. Earlier, Carnegie had made a contribution to the Free Circulating Library.

The Carnegie library grants were given between the years 1886 and 1919. The bulk of the gifts were made in what he called the “wholesale” period, 1898–1919, to libraries in 1406 communities in the amount of \$39,172,981.^[31]

At the time of publication of the Bureau of Education’s Special Report, *Public Libraries in the United States of America* (1876), the editors were able to include a “Table of public libraries numbering 300 volumes and upwards” which included 3649 libraries. The majority of those listed were university, college, academy, public school, mercantile, and social, and were not municipally supported. There was a fair sprinkling of libraries bearing the title “public library.” In 1890, however, of America’s 16 largest cities, only seven had municipally supported central libraries.^[27] The period of the Carnegie gifts changed this situation markedly. Not only did his gifts account for more than 1400 library buildings, but they stimulated communities that had avoided applying to Carnegie initially to provide libraries on their own at a later date. Libraries had spread over the United States in increasing numbers as the last decades of the nineteenth century were reached, but the major growth came after the Carnegie period.

The growth of the public library movement was slowed somewhat by the great depression of the 1930s. As with many other public agencies, the libraries found themselves with shrinking appropriations and revenues but with increasing use. Library adult book circulation, particularly nonfiction, was up. Total expenditures were down, but expenditures for books dropped relatively more than did salary expenditures. Two of the economic factors that explain increased use of the public library are unemployment and the reduced earnings of those employed.^[32]

During World War II, a definite move toward improved public library service in the years to follow the close of hostilities was the *Postwar Standards for Public Libraries* (1943), followed in 1948 by the publication of *A National Plan for Public Library Service* prepared for the Committee on Postwar Planning of the American Library Association by Carleton B. Joeckel and Amy Winslow. In 1950 came the Public Library Inquiry, which was designed to be “a thorough and comprehensive study of the American free public library.”

By 1956, the Coordinating Committee on the Revision of Public Library Standards, Public Libraries Division of the American Library Association, had produced *Public Library Service: A Guide to Evaluation with Minimum Standards*. The document was made up of principles and standards and covered subjects, books and nonbook materials, personnel, the organization and control of materials, and physical facilities. The *Standards*, as they came to be called, were criticized by some librarians as being goals rather than standards, for they were impossible to attain by most libraries. Other librarians complained that there were not enough “measurements” given. A supplementary publication subsequently provided such statistical measures for libraries in several categories by size. In 1967, the American Library Association published an updating of the *Standards* entitled *Minimum Standards for Public Library Systems, 1966*. This publication contained a number of finite standards as well as the principles and broad standards.

The 1956 *Standards* contained a statement that was to affect public library development for some years to come:

Libraries working together, sharing their services and materials, can meet the full needs of their users. *This co-operative approach on the part of libraries is the most important single recommendation of this document.* Without joint action, most American libraries will probably never be able to come up to the standard necessary to meet the needs of their constituencies.^[33]

Library systems were not new. They had developed out of county libraries at the turn of the century. In particular, they developed into county systems in California. By 1916 “thirty-seven of California’s fifty-eight counties were persuaded to establish libraries.”^[24] From the county system, it was but a small step to the multi-county library system

or regional library system. In 1969, the American Library Association (ALA) published a survey of systems. The system concept has become an integral part of most state public library plans, to which are being added networking and resource sharing. These techniques are being made more effective through the use of computer bibliographic data banks like the Ohio College Library Information Center (OCLC), which extends its service over a large part of the United States. Another benefit of OCLC is its classification and cataloging service.

Despite the efforts of the ALA to improve library service after the end of World War I and the efforts of its committees as noted above, there were still over 85 million Americans without adequate library service in mid-century, particularly in rural areas. In 1956, a U.S. Office of Education report revealed that 26 million rural residents were without any public library service. An additional 50 million rural residents had inadequate service. A strong effort with farm block support succeeded in passing the Library Service Act in that year (1956). It authorized the appropriation of \$7.5 million annually for 5 years. The funds were for “services” and were limited to rural areas (10,000 or less). No money was appropriated until 1957, when the Congress appropriated \$2,050,000. The next year it appropriated \$5 million, and \$6 million for each of the next 2 years.^[34] In 1961, the act was renewed for another 5 years, but in 1964, it was amended to become the Library Services and Construction Act. It contained two titles: I. Services; II. Construction. Funding was in the amounts of \$25 million and \$20 million, respectively, and the restriction of funds to rural areas was removed. The act again was amended to provide two additional titles in 1966: III. Interlibrary cooperation; IV-A. State Institutional Library Service, and IV-B. State Library Services to the Physically Handicapped. The act was renewed in 1970 and continued through fiscal year 1976. Title IV was joined with Title I, which resulted in some fear that both Title I activities and services to the handicapped might suffer if funds ran out.

The Library Services and Construction Act has generally been considered to have had a beneficial effect upon public library programs. It resulted in the institution of service to many unserved rural people, in service to the disadvantaged, in the upgrading of services at the state agency level, and in a great number of new library buildings. Federal funds were provided for demonstration projects that resulted in the provision of local funding for their continuation. One criticism levied at the program was that too much of the federal allotment in many states went into agency operational costs, to the detriment of libraries in need of support. Of particular importance was the money (relatively less than for other titles) awarded under Title III for cooperation between types of libraries.^[35] Out of early experiments have come “networking” and “resource sharing” that may well cut into duplication of materials, services, and costs.

Until the mid-1960s, funding for public libraries under the Library Services and Construction Act seemed to be growing at a rate quite satisfactory to librarians and their supporters. The amended act of 1966 projected a total authorization over the next 5 years of \$700 million for the four titles of the act. As the extent of the United States’ involvement in Southeast Asia became a major factor in the nation’s economic life and inflation increased accordingly, there was less funding available for social and educational programs at the national level. Table 2, covering fiscal years 1969, 1972, and 1973, indicates the changes that occurred.

The figures in Table 2, taken from *The Bowker Annual* for the years cited, do not tell the complete story, for funds could be and were impounded by executive order. To replace categorical funding such as LSCA, the president proposed in 1972 a new type of funding, revenue sharing, which provided funds for state and local governments over a 5-year period. These funds were to be spent for “priority expenditures,” which included libraries but placed them somewhat down the list of priorities. In many instances, local governments had other programs they preferred to fund, and some municipalities merely substituted revenue sharing funds for local funds they had been appropriating for libraries.

The public library in America in the 1960s and early 1970s moved actively to take materials and programs to the people who were not accustomed to coming to the library for them. More specifically, librarians were seeking ways to stimulate minority groups and others who did not have library use in their backgrounds to take advantage of and use library services. One major approach was “outreach,” taking programs and services to the inner city or wherever these persons might live. Reference and information services were greatly improved, and the library became responsive to the multimedia orientation of the country’s youth. The public library too, became actively involved in continuing education. It was suggested by one of the library’s strong supporters that it had “become the most economically effective educational institution evolved by mankind.” It served as the resource center for those enrolled in “external university” or “university without walls” courses, and for high school students preparing for the College Level Examination Program (CLEP).

Table 2 LSCA appropriations, 1969–1973.

Fiscal year	Title	Authorization (\$)	Appropriation (\$)
1969	I	55,000,000	35,000,000
	II	60,000,000	9,185,000
	III	10,000,000	2,281,000
1972	I	112,000,000	46,568,500
	II	80,000,000	9,500,000
	III	15,000,000	2,640,500
1973	I	117,600,000	30,000,000
	II	84,000,000	0
	III	15,750,000	2,640,500

Some of the larger city libraries, too, entered cooperatively into continuing education programs sponsored by nearby colleges and universities. For the individual proceeding on his own, it provided the source of information and materials for his self-education. Librarians enrolled in courses designed to train them to work with patrons who wished to retrain themselves or raise the level of their knowledge. The public library thus provided information, books, and nonbook materials supportive of individual and group educational efforts.

CONCLUSION

As the public library approached the last quarter of the twentieth century, it was beset with a number of difficult problems. The principal one continued to be that of adequate financial support. Urban libraries, particularly those in the older cities of the Northeast and Midwest, were suffering from the effects of urban blight, the flight to the suburbs, and sharply increasing expenses of operations. The library, a part of municipal government that unfortunately did not command as high a priority as some other functions, was forced in many instances to close some branch operations and curtail the hours of opening at the main building. To cope with these problems and to pressure for federal support, the Urban Library Council, made up of the librarians of nearly 50 major urban libraries, was formed. Despite what seemed to be a rather dark picture, a number of cities have managed to keep the library operation on a fairly even level and, in some instances, to float bond issues to construct new main libraries and branches. During the year 1976, there were 277 public library construction projects completed, of which 90 were building alterations. The total expenditure for the projects was \$66,374,466, with the majority of this construction for medium-sized and small buildings. Most librarians who considered the problems of administration and who wrote of their reactions were not pessimistic about the future.

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History of Records and Information Management

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Abstract

Records management is the information management discipline that addresses the “life cycle” or “birth-to-death” concept of records and the information they contain. It includes the principles and practices that cover the creation, processing, storage, retrieval, protection, and final disposition of records. Records management also evaluates the administrative, financial, legal, operational, and historical need for records. These principles and practices apply to all records, regardless of media, and have been of significant value as business and government transactions have moved from paper, to micrographic, to electronic format. This entry presents an historical overview of the discipline, the factors that brought it into being, the events and individuals that contributed to its development, acceptance, and use as a valuable management tool.

INTRODUCTION

One of the major problems facing business, industry, and government today is how to most effectively and economically manage and utilize a continually expanding accumulation of information. Technological and social changes have resulted in the creation and dissemination of an endless volume of data in a wide variety of records formats. While much of the information demanded and produced is needed, there is also a proliferation of useless and duplicated materials. The object of an organized approach to the management of information must have two principal goals—first, to obtain the maximum value from all information disciplines and second, to obtain that value in an orderly, productive, and cost-effective manner.

Information management is the process of identifying and utilizing all of the information disciplines and information resources enterprise-wide to achieve efficient, effective, and competitive management decisions. Records Management is an information management discipline that involves the principles and practices used by an organization to properly manage its records from their creation to final disposition. A record is recorded information, regardless of medium or characteristic, made or received by an organization that is evidence of its operations and has value requiring its retention for a specified period of time. Since it deals with the information content of records as well, the discipline is popularly referred to as records and information management (RIM). Records management has also been identified as the “life cycle” or the “birth-to-death” concept of records and includes such elements as

- Forms/reports management—The establishment of procedures for the control and design of forms and reports needed in the processing of transactions and summarization of data. This program may also include directive and manual preparation.
- Correspondence management—Assuring the proper preparation, routing, and control of internal and external communication.
- Filing systems—Evaluating and selecting the best type of filing and indexing system to be used as well as the equipment being considered for housing records.
- Retention scheduling—The physical flow requirements of records and their value at each action location (office, storage, and final disposition). The term “records retention or control schedule” is preferred to “disposition schedule.” This avoids concern that the program is being used primarily for throwing out records.
- Records centers—The establishment and use of central repositories, as may be required, for the low-cost housing of inactive, vital, and archival records, and to maintain such repositories in an orderly, efficient, and economical manner. Such facilities may be operated in-house or outsourced to commercial companies specializing in the records storage business.
- Records protection—Providing records classifications, procedures, and facilities necessary for the protection of records needed to continue or resume business following a disaster.
- Image management—Making effective use of image processing technologies (micrographics, optical disk, and the like) for the handling, processing, protection, and retention of records.
- Archives management—Providing for the continuing evaluation and preservation of records having historical value and to assure their proper housing and indexing.
- Information technology—Carefully reviewing new technologies that impact on the manner in which businesses use such technologies to manage their records and assuring the proper administrative and legal uses of such technologies.

The past 50 years have produced significant technological developments in the information and records management field. The above principles are applicable regardless of media being used. The first major transition came from the application of microfilm for replacing paper copies. It had two primary values as a replacement for storing paper records and for duplicating vital records. It was hailed as the panacea for reducing the volume of stored records. This quality disappeared as the use of low-cost records centers proved to be a more cost-effective approach. This competitive element shifted the focus of microfilm to systems applications and brought about its major value in the form of computer output microfilm (COM)—a system of converting computer output to microfilm, computer-assisted retrieval (CAR)—rapid retrieval of information on microfilm, and computer output to laser disk (COLD). Further advances included optical disks, bar coding systems [upgraded to radio-frequency identification (RFID)]. All became part of the computerization age and the birth of the electronic record.

Records management has proven to be of particular value when applied to electronic records. An *electronic record* is a record created, generated, sent, communicated, received, or stored by electronic means. Usually the term applies to all electronic records systems, whether in microcomputers, minicomputers, or mainframe computers, regardless of storage media, in networked or stand-alone systems, including small computers, such as memory typewriters, calculators, and embedded systems. Examples include records stored on a server, or on magnetic media, such as tapes, disk packs, compact disks, or optical disks.

Electronic records keeping or *electronic records management* is the use of records management principles for records maintained electronically. An *electronic record keeping system* (ERS) is primarily a software-based methodology used by an organization to manage all its records, regardless of format, over the entire record's life cycle. Primary records keeping functions of these systems must include categorizing, locating, identifying, and controlling record disposition requirements, including management of the storage, retrieval, protection, and disposition of the records regardless of repository.

BEGINNING OF MODERN RECORDS MANAGEMENT

Records management is an outgrowth of archives management and is concerned with the need to preserve records that have long term or permanent value. The rapid growth of business, government, and industry resulted in a significant growth in the amount of documentation needed to manage and operate such activities. This growth resulted in an uncontrollable amount of records, with related administrative costs. Records management has provided

the principles and practices needed to properly balance the cost of providing needed records and their retrieval and maintenance costs.

Following World War II, President Harry Truman established the *Commission on the Reorganization of the Federal Government* to address the many operating issues of the U.S. Government resulting from its growth and expansion from the war years. Former president Herbert Hoover was named head of the commission (thus the popular name Hoover Commission). One of the Task Forces under the commission was given the responsibility for examining the government paperwork growth and to recommend methods for its management. Emmett Leahy (a former member of the National Archives and responsible for organizing the records of the Navy Department and a private consultant following his government career) was named chairman of the Paperwork Task Force. The study results were significant. They applied the previously mentioned elements of records management to government paperwork activities with a significant reference to cost savings. Although the term “paperwork management” was used in the report, the term was soon broadened to “records management” to address all records media. These actions were the beginning of records management as it is practiced today.

Two major legislative acts resulted from the Hoover Commission efforts. The Federal Property and Administrative Services Act of 1949 transferred the National Archives to the newly created General Services Agency. The name, National Archives, was changed to the National Archives and Records Services (NARS) to reflect its responsibility for current records as well as archival records. The Federal Records Act of 1950 defined “records management,” further clarified and expanded the records management role of NARS (requiring each agency to establish an active and ongoing records management program), and NARS began establishing a series of records centers to store semi-active federal records. NARS remained part of the General Services Agency until 1985, when, through the efforts of the then archivist Robert M. Warner, the National Archives again attained independent status as an agency and became known as the National Archives and Records Administration (NARA).

Emmett Leahy

Emmett Leahy was the leading figure in the introduction of the concept of “modern records management.” He joined the staff of the National Archives in 1935 as a Special Examiner to inspect records classified as “useless records” in agency lists. Such records could be destroyed or otherwise disposed of because they had no “permanent value or historical interest.” He soon determined that the federal agencies had no systematic means of identifying records of permanent value and the only way to address this issue was involvement in the creation and filing of

records. This would provide a process for segregating records of temporary value from those of permanent value. Emmett Leahy became a principal leader in the emerging government records administration program.

In 1941 Leahy left the National Archives to become the Director of Records Coordination for the Navy in the Office of the Secretary of the Navy. In that position he established a model records management program that introduced new records management concepts and techniques similar to those defining records management at the beginning of this entry. In this position he installed the first centralized records centers in the world for the storage of inactive Navy records. In 1945, with World War II coming to an end, he decided to join the civilian market and accepted the position of National Sales Manager in the Microfilm Division of Remington Rand. He left Remington Rand in 1947 to form the National Records Management Council (NAREMCO), a nonprofit records management consulting company, and the Leahy Business Archives, the first commercial records center in the United States. Based upon his experiences with the navy records centers, the records center's principal equipment was standard sized cardboard containers housed on steel shelving. The container was 10" × 12" × 15". Referred to as the "cubic foot" box it could accommodate legal as well as letter-sized documents. It is to this day the main storage container used in records center operations, both in-house and in commercial repositories. It was in this capacity, as a private consultant, that he was named chairman of the task force on records management for the Hoover Commission. In 1953, he left NAREMCO and formed Leahy & Co., a consulting firm, which also included the Leahy Business Archives, Inc.

Emmett Leahy died on June 23, 1964. An award in his name was established and sponsored in 1968 by Rodd Exelbert, then Editor and Publisher of the *Information and Records Management Journal*, and Leahy & Co. It is currently underwritten by the Huron Consulting Company and is presented annually by the Institute of Certified Record Managers. It is considered to be the most prestigious award given in the RIM field today. The Web site devoted to the Leahy Award (<http://www.leahyaward.com>) includes comments made by peers of Emmett Leahy that provide a personal insight into his influence in the development of the records management profession. The 1968 recipient of the award and author of this entry provided the following comments.

I was teaching junior–senior high school in the 1947–1950 period and taking my master's degree at NYU in accounting and foreign trade. I selected as my thesis "The Preservation of Accounting Records" (I don't really know why). I felt I didn't really want to be an accountant but I wondered what such practitioners did with all their records. Bob Schiff, a senior officer in the National Records Management Council (NAREMCO) was teaching at NYU at the time, had read my thesis, *Preservation of Accounting*

Records and suggested I make an appointment to meet Ed Leahy, president of NAREMCO and discuss a fellowship with the organization. Thus started a long and happy career in records management, but the real inspiration was my first meeting with Ed Leahy.

I was impressed the moment I met him. He had an exciting gleam in his eyes, an award winning smile, and an air of dignity and knowledge. He immediately put me at ease with his relaxing approach to talking about me and my interests with his personal anecdotes injected as we went along. From that day forward I felt the confidence to make a mark in the records management profession. At the time Ed Leahy also operated the Leahy Business Archives (the first commercial records center system) and I spent the first six months as a records center clerk in that operation. Then I quickly graduated to consulting analyst and worked on projects at Union Carbide, Monsanto Chemical, the City of New York, Oneida Knitting Mills, and Mine Safety Appliances (my first solo operation). While I had the opportunity to work with such notables as Bob Schiff, Bob Weil, and Art Barken, Ed was always available for comments and concerns. He had a practice of taking his analysts out to lunch when they were in town at his favorite Irish restaurant on 23rd Street in New York. The purpose of such get-togethers was to make us feel a part of a great adventure into this exciting world of records management.

I had the opportunity to attend many of Ed Leahy's speeches and accompany him on visits to company president's offices to talk about impending projects. Each trip was a learning experience and critiques that followed these meetings left long-range values for individual growth. I was continually impressed with his ease of presentation and ability to sell his ideas to all levels of management. I remember his telling me that 80% of records management was salesmanship, making certain your clients felt at ease by listening to them and taking their ideas into account. Salesman extraordinaire, you bet, and only in the most positive manner.

With Ed Leahy as a mentor, success was guaranteed. He had the dedication, the personality, and the knowledge to inspire confidence and commitment. What better advocate could there have been to address the records management needs of business, government and industry.

Professional organizations today grant a series of awards for records management based upon government and business program accomplishments, individual accomplishments, and literary awards. The Records Management Association of Australasia sponsors the J. Eddis Linton Award for the individual they consider to be the "father of records management" in Australia. Early in his career Eddis Linton formulated ideas about the need to manage business records in an organized and systematic way. He developed and implemented these ideas incorporating keyword filing systems, inactive records storage, and micrographic systems long before they became mainstream practices. "Fellow" designations are also granted

by records and archival management organizations to individuals making major contribution to the profession.

ACHIEVING RECOGNITION

The Hoover Commission Paperwork Task Force study resulted in the disposition of a significant amount of government records and clearly demonstrated the operating efficiencies possible through proper records administration. The results of studies subsequently conducted by Emmett Leahy through his consulting efforts showed similar results could be achieved in business. Through the development of retention schedules based upon careful value analysis, 30% of the records maintained by an organization could be destroyed, 30% could be transferred to low-cost records center facilities due to their reduced activity, and the balance would represent the currently needed and referenced records. Although these figures only represented one facet of records management (proper appraisal of records) they became the driving force for total records programs.

Many of the staff people from the NAREMCO took lead records management positions in government and business (Bethlehem Steel, State of New Jersey, Lockheed Corporation, IBM). The NARA, by virtue of the Hoover Study and the legislation that followed, began extending its program to government agencies and publishing training aids for records programs. Its publications, although directed to governmental operations, have been applicable to the private sector and it is one of the prime resources for all aspects of the subject. Under the able leadership of Everett O. Alldredge (Assistant Archivist for Records Management) and Herbert Angel (Assistant Archivist for Federal Records Centers), NARA took a major role in the development of the profession. One of its major contributions of this government agency in the early years of the professions was the preparation of an annual "Compendium of Federal Recordkeeping Requirements." This booklet covered all the records retention requirements by government agencies. It was organized by government department, described each record, and indicated the period of time the records had to be retained. Unfortunately, this valuable publication became the victim of one of the government's austerity programs. Private firms offering this information on a subscription update basis soon addressed the void. Another former government employee, Frank Knox, joined the commercial consulting world and introduced *Functional Forms Filing*, a system for analyzing business forms to assure better design for processing, to consolidate forms serving the same purpose, and to eliminate unnecessary forms.

Companies started to implement promotional programs to increase exposure to records management and to demonstrate the savings and efficiencies possible through a constant application of records management techniques.

They carried such names as "Operation Round File" (Northrup Aircraft), "Mile High File Pile" (Cleveland Electric Illuminating Company), and "Operation Trim" (Lockheed Corporation) and were further supported by a designated "National Records Management Weeks" [American Records Management Association (ARMA)]. Natural and man-made disasters, in the form of floods, earthquakes, and civil unrest, also put a major focus on records management as organizations became concerned about the need to assure business continuity in the event of a disaster.

Low-cost storage facilities, or records centers, modeled after those used in the U.S. government and the Leahy Business Archives, became a standard part of organizations' records programs. They were the first major part of records management outsourcing as commercial records centers started offering services for the storage, referencing, protection, and disposition of records. The increasing number of organizations providing such services resulted in the formation of the *Professional Records and Information Management, International Association* (PRISM) (<http://www.prismintl.org>). PRISM publishes an annual directory of its members' locations and services. There are independent non-PRISM member companies as well.

The NAREMCO had issued several reports on the impact the bombings in England during World War II had on the preservation of government and business records. This concern was further emphasized subsequently in the United States by the "Cold War," the "Cuban Crisis" situations, civil riots in Detroit, Michigan and Newark, New Jersey, the New York twin towers destruction, floods in North Dakota and Louisiana. Records protection programs identifying vital records needed to resume or continue business after a given disaster became a priority. Such programs have become an critical part of an overall records management programs.

Over the years, company and commercial facilities have been established to assure dispersal of backup records, including the use of abandoned railroad tunnels, underground limestone and mushroom caves, abandoned mines, and company facilities at company-owned locations remote from central business districts. The National Fire Protection Association (NFPA) in Quincy, Massachusetts (<http://www.nfpa.org>) issues a standard, NFPA 232, *Standard for the Protection of Records*. It primarily addresses the types of facilities that best serve to protect records. ARMA, International has also issued a standard covering vital records identification and management.

PROFESSIONAL ORGANIZATION GROWTH

For many years prior to the popular introduction of modern records management there had been several associations concerned primarily with the filing and maintenance of records. In 1955 several of these filing associations

(Chicago, Detroit, Minneapolis, Cleveland, Milwaukee, and New York), recognizing the broader professional impact of records management, formed the ARMA. Jack Britt, records manager for Ford Motor Company, was its principal organizer. The Britt Literary Award is presented annually by ARMA for the author of the article the association's magazine judged to be the best in terms of contribution to the field during a given publication year. The association was officially chartered in 1956 with headquarters in Detroit. A separate organization was also established at this time in New York. It was called the Association of Records Executives and Administrators (AREA). The main distinction was in the level of management authority held by the members. ARMA was open to all levels while AREA restricted its membership to the supervisory and managerial level. In 1975 the two organizations merged and became the Association of Records Managers and Administrators but retained the ARMA designation. Membership was open to all levels of practitioners in the field. In 1987, ARMA changed its logo to incorporate "International" in its name, becoming "ARMA, International." The association currently has a chapter in Japan and individual members in 30 countries around the world.

ARMA has had a rapid growth. From its original membership of approximately 375 it today numbers over 10,000. From the founding six filing associations (Filing Association of Chicago, Filing Association of Detroit, Filing Association of New York, etc.) there are currently in excess of 120 ARMA chapters in the United States and Canada in addition to individual members-at-large throughout the world. From an all volunteer operated organization, it progressed to a part-time executive secretary and then to a full time Executive Director with a paid staff headquartered in Lenexa, Kansas. ARMA has become the leading advocate of RIM, sponsoring national conferences and seminars, developing standards, monitoring legislation impacting records management, and providing technical reports on all aspects of the profession. It provides a continuing promotional program involving annual "Records and Information Management Week" utilizing posters and brochures for use by its chapters and by individual companies. It has undertaken special activities to highlight issues at hand. One notable example was the 1980 introduction of "Project ELF" (Eliminate Legal Files), aimed at reducing the paper and filing costs of legal-sized documents vs. letter-sized documents. This project had a positive impact on the filing procedures in many courts and businesses.

The National Association of Government Archivists and Records Administrators (NAGARA) was established as an independent group shortly after the formation of ARMA. Its membership is based solely on federal, state, and local practitioners in the field of archives and records management. It provides a member only quarterly publication covering issues restricted to governmental concerns.

The Association of Information and Image Management (AIIM), formerly the National Microfilm Association (NMA), also supports the records management concepts and provides materials on its website (<http://www.aiim.org>) and its *infonomics Magazine* (<http://www.infonomicsmag.com>). This organization retains the AIIM logo but is now referred to as the *enterprise content management (ECM) organization* ECM, like "re-engineering" and "knowledge management (KM), have been computer age terminology additions to processes for the effective use of information within an organization. AIIM works closely with ARMA on special studies, standards, and research efforts.

Other groups have been formed to address specialty areas concerns for RIM such as the Nuclear Information and Records Management Association (NIMRA) (<http://www.nirma.org>) and the American Medical Records Association. The latter changed its name in 1991 to American Health Information and Management Association (AHIMA) (<http://www.ahima.org>). The ARMA organization as part of its educational program also sponsors select groups addressing the interests of specialty fields in business and industry.

RECORDS MANAGEMENT TRAINING

This growing interest in the needs and benefits to be gained by the implementation of records programs by the private and government sectors led to the development of training programs and the establishment of forums to discuss and exchange ideas about the subject. From the mid-1950s to the mid-1980s, many leading universities started offering evening courses in records management. Introduced initially as special evening courses instructed by practitioners in the field, these courses became part of daytime curriculum. In 1964, the ARMA introduced the "Records Management Correspondence Course," authored and instructed by Mr. Benedon and administered by the association. This course was offered until 1985 when the ARMA national headquarters published its own version. This course was supplemented by one offered by North Dakota University in 1969. Many schools of higher learning offer records management courses today in their general business management, library sciences, and computer technology programs.

The first conference completely devoted to records management was held in New York in 1950 and sponsored by the NAREMCO. It introduced records management to a national audience and set the stage for annual conferences on information management. The American Management Association began a series of seminars in New York featuring speakers from companies that were embarking upon programs devoted to records management conferences. In 1956, the Visual Communications Congress, sponsored by the Society of Reproduction Engineers, and

the American Institute for Design and Drafting, added ARMA to its program roster. This group is no longer in operation. The ARMA, International organization has sponsored annual conferences since 1956.

PROFESSIONAL STATUS

A profession is recognized when it has developed a body of knowledge, a code of ethics, and a standard for measuring efficiency. ARMA and the other referenced associations have each contributed to the achievement of this recognition. As a professional measurement of these accomplishments and to officially measure the efficiency of practitioners in the RIM field, the Institute of Certified Records Managers (ICRM) was established in 1975 (<http://www.icrm.org>). Its initial Board consisted of the following representatives from ARMA and the former AREA organizations. Board member backgrounds covered business, government (local, state, and Federal), and education.

President:	William Rofes, IBM Corporation.
Vice	Col. Seymour J. Pomerenz, Department of the
President:	Army
Secretary:	Dr. L. Ruth Thomas, National Archives & Records Service
Treasurer:	Dr. Thornton W. Mitchell, State of North Carolina
Directors:	William Benedon, Lockheed Corporation
	Maj. Stanley Gordon, City of Los Angeles
	Mr. Dudley F. Judd, Exxon Corporation
	Mr. H. J. (Mark Koenig), Consultant
	Mrs. Katherine A. Mutchler, Lever Brothers Company
	Dr. Mary F. Robek, Eastern Michigan University

Following compliance with educational and experience requirements, and the successful completion of a six part examination administered by the Institute, one is granted the Certified Records Manager (CRM) status. The six part examination covers

Part I	Management Principles and the RIM Program
Part II	Records Creation and Use
Part III	Records Systems, Storage, and Retrieval.
Part IV	Records Appraisal, Retention, Protection, and Disposition
Part V	Technology, Equipment, and Supplies
Part VI	Case Studies

To assure continued professional competency, a maintenance program based on 5-year cycles is administered. Points are granted for continuing education, writings, presentations, or other professional activities. Training for the certification is provided through a study manual published by the Institute. This study manual also contains an excellent bibliography of reference materials for RIM. Special

examination study sessions are also presented during ARMA's annual conference and through ARMA chapter review programs. The examination can be taken at designated sites or online. The CRM examination is continually updated to reflect the latest applications of technology to the management of records.

The Institute has provided the professional basis for the recognition of records management, as an essential part of managing the information needs of business, government, and industry. Its examination is continually updated to reflect changes in technology and it addresses, as well, all information systems needs, regardless of media involved. Since the early 1990s ARMA attempted to add to this professional status by developing and defining the core competencies of RIM (knowledge, skills, characteristics, or traits that contribute to outstanding performance in a particular profession). This goal was achieved in 2007 with the publication "Records and Information Management Core Competencies." It is expected that this study will also impact on the content of courses being offered in RIM.

The NIRMA, with an additional section on nuclear operations, also uses the CRM certification exam.

LITERATURE

Professional recognition also comes from literary exposure. This availability of this needed resource is reflected in the rapid growth of publications that currently address the records management principles and practices. Prior to the 1950s there were several filing books published. These dealt mainly with filing principles and equipment since that was considered to be the main records maintenance requirement. The first book that covered records scheduling, records centers, and filing was published in 1963 and titled *Modern Records Management* and was authored by Emmett Leahy and Christopher Cameron. The first definitive text on records management addressing all the elements listed in the introduction to this entry was *Records Management* by William Benedon, published in 1969 by Prentice-Hall. From the mid-1970s on there have been several such texts.

The first technical study on records management, "Rules for Alphabetical Filing" was published by ARMA in 1960. This was followed in 1962 by the publication of the "Records Management Workshop" authored by William Benedon and adopted by ARMA as one of its publications. In the late 1970s ARMA expanded its own publication efforts through special studies and standards development and by marketing publications by individual authors. ARMA has a bookstore that provides an abundance of publications on the subject of records management. The bookstore can be accessed at <http://www.arma.org>.

ARMA's first official general publication for the profession was the "*Records Review*" introduced in 1960. This was an eight-page booklet covering articles on the subject and association news. In an effort to promote records management, the "*Review*" featured a mascot cartoon in the form of a clipboard with arms and legs and called *Scrappy*. This was the brainchild of Bernie Trumbull, a general records manager at Northwestern Bell Telephone Company of Omaha. *Scrappy* became a popular lapel pin for a period of time and was also used on promotional office supply items. In 1974, ARMA and its South Carolina chapter created "*Scrappy and Records Management*," an instructional video in five parts as an "in-house educational television training environment." ARMA upgraded the *Records Review* to a magazine *Records Management Quarterly* (RMQ) in 1967. This publication was renamed in 1999 (*The Information Management Journal*). Association news was dropped by the magazine and replaced by an insert, "News and Notes" and later "InfoPro" to highlight specific association issues and news. Inserts are now used solely for special studies or white papers. Prior to the merger of ARMA and AREA, the latter published the *Records Management Journal*. This publication was discontinued with the merger. In January 2009, ARMA dropped the word Journal from its magazines title. The only other magazine devoted strictly to records management was the trade journal, *Information and Records Management Journal* (IMJ), edited by Rodd Exelbert. This magazine is no longer published.

AN INTERNATIONAL CONCEPT

The initial interest in records on an international basis came from the archival community's interest in documents such as letters, official papers, photographs, or recorded materials kept for their historical interest. Individual country archival societies existed worldwide to address these interests. In 1948, through the efforts of then U.S. archivist, Solon J. Buck, the International Council on Archives (ICA) was formed. Current records were of secondary concern and referred to as just that—"current records." In 1976, the ICA formed a *Section on Records Management and Archival Professional Organizations* and has had cooperative efforts with records management organizations since that time. ICA has a global network of more than 1400 institutional members in 190 countries. It also has over 200 archivists and records managers as individual members. The records management and archival functions are closely linked today in both the public and private sector.

The traditional international archive community, mainly in Europe, did not initially recognize records management as a distinct discipline and referred to it as "current records." The rapid growth of records management principles in the 1950–1980 period brought about a

change in attitude as is evident in 1984 revision of the ICA's "Dictionary of Archival Terminology." It stated:

This Lexicon was the first attempt on an international scale to draw up a glossary of the main terms then current in archival usage principally in European countries. It was produced in a period of change in the archival world when microforms were in their infancy, when records management was not yet an inseparable component of the archivist's task, and when the application of the computer to the archivist's stock in trade and to his techniques and practices rarely thought of. Now, twenty years on, the archivist's task, his holdings, techniques and practices – and his terminology – have all passed beyond the classical frontiers of his immediate predecessors.

This recognition of the unique principles and practices of records management by archivists has brought about a closer working relationship between the archivists and records managers. Many organization archivists, primarily in the government sector, have expanded their operations to include records management personnel while others coordinate the overall records needs of the organization with separate records management departments. Records management departments, in the private sector, have generally included the identification and collection of historical (archival) records. It has also brought about a cooperative effort in conferences and technical studies between the associations representing the two professions.

In 1969 individual records management group activities were conducted primarily in Melbourne (Victoria) and Sydney (New South Wales) in Australia. This, in turn, led to State Associations being formed in those two states. The pilot committee formed to consider formation of a Federal association, were assisted by a group from the ARMA organization (Eunice Thompson, O. Crawford Jenkins, William P. Southard, John D. Culton, and William Benedon). The ARMA "Records Management Workshop" and the records management objectives it addressed were used in forming the objectives for an association. The Records Management Association of Australia (RMAA) was formed later that year. With the addition of a chapter in New Zealand, the name Australia was changed to Australasia. It currently has nine branches throughout Australasia.

In 1970, Tom Lovett, an RMAA past president, recommended the formation of the International Records Management Council (IRMC) for the worldwide exchange of information and publication on records management. It included, in addition to ARMA and RMAA, the Records Management Society of Great Britain, the Records Management Association of the Philippines, the Records Management Association of South Africa, as well as individual memberships worldwide. It was funded by the individual organizations and published a multilingual *International Records Management Journal* as well as special records management studies and multilingual glossaries (French, German, Japanese, and Portuguese). As the

individual country records management associations started to acquire international memberships, support for the IRMC was not provided and it is currently dormant. It currently has a chapter in Japan and individual memberships in 30 countries around the world and maintains an ongoing working relationship with ICA through joint committees, seminars, and publications.

INTERNATIONAL STANDARD

Standards are a part of a profession's efforts to define and promote the "best practices" to be followed in organizing and using any given technology or process. Standards are developed through a sequence of submittals, reviews, and approvals. Organizations have been established in every country to develop standards and in this process to set development procedures, coordinate participation with professional organizations, and to publish approved standards. In the United States it is the American National Standards Institute (ANSI). The major international organization is the International Organization for Standards (ISO), founded in 1947 and located in Geneva, Switzerland.

Most of the international standards relative to records management have been in the area of technologies, such as micrographics and computerized applications. American professional groups have participated in these efforts, mainly AIIM. Individual records management associations have issued individual country approved standards. The first international standard to focus on records management principles was ISO 9000. The global recognition of this standard for measuring product quality in international trade resulted in a coordinated effort for compliance. It brought with it the need for high-level and organization-wide attention to managing quality records. Although the term "records management" is not used directly in the standard, the control element it addresses are clearly founded on records management principles.

The most significant standard, to date, in the history of the development of records management was the issuance of an international standard (ISO15489) in 2001. It addressed all of the principles outlined in the introduction to this entry and set forth guidelines needed for their proper implementation. It provided the needed policy and management involvement and direction for its success. The development of the standard came about through the efforts of the Records Management Association of Australasia. In 1996, as a result of a cooperative effort in Australia between government and public interests, the Australian Records and Information Standard (AS4390) was issued. The positive response from records organizations worldwide led to a concerted effort for an international standard and ISO15489 was the result. The

Association of Records Managers and Administrators (ARMA) held a special program at its Montreal conference in 2001 to launch the standard. It included a Web broadcast to records managers gathered in England for a conference of the Public Records Office.

The NARA, like other government archival organizations worldwide has developed and issued standards that are primarily applicable to government agencies. (<http://www.archives.gov>) They cover all the standard elements of a records management program. These have been adaptable to business as well. In keeping with the concept of addressing all media, the agency in 1997 adopted the Department of Defense (DOD5025.2) design criteria standards for electronic records management applications. Vendors providing such software to Federal government agencies must abide by this standard.

ARMA, International, through its Standards Development Committee has also issued standards on various aspects of records management that have become approved U.S. standards.

CONCLUSION

The history of RIM has been an uphill struggle to convince management that it was not a file and find occupation but a discipline that, properly applied, could assure the effective and economical use of an important business asset. It elevated an "out of sight, out of mind" approach to inactive records, evidenced by records stored in capitol building domes, basements, attics, moth-balled navy ships, to modern low-cost records center. It assured the orderly and timely disposition of unneeded records. It provided timely access to both active and inactive records needed to conduct daily business and support litigation. Business continuity and the information needed to resume or continue business following a disaster has become a clearly defined program and "vital records" are clearly identified and protected. Records and information management has become an essential ally in the development of systems, the selection of equipment, and the utilization of technologies.

Legislation has also had a major impact on the acceptance and growth of records management. Laws are being continually enacted that address the requirements for proper documentation for business actions and transactions. The Federal Register, issued daily by the NARA, is an ongoing record of rules and procedures that are published for public comment or have been adopted. Records accessibility and access were prominent issues with the passages of the Freedom of Information Act in 1966 and the Privacy Act of 1974. The Paperwork Reduction Act of 1980 addressed efforts to reduce the amount and cost of submitting government reports by requiring agency justification of need and reporting effort. The Occupational Safety and Health Act

(OSHA) and the Employee Retirement Income Security Act (ERISA) impacted the demands for retaining employee records. Health Insurance Portability and Accountability Act (HIPAA) in 2001 established national standards for protecting individual medical records and personal health information. The most significant legislation to date, impacting on the need for and importance of a sound records management program, has been the Sarbanes–Oxley Act of 2002.

The Sarbanes–Oxley Act was a legislative reaction to a series of major corporate accounting scandals involving such companies as WorldCom, Tyco International, and Enron. These scandals, involving corporate executive and leading accounting firms, resulted in investor losses of billions of dollars from share losses. The act mandated new and enhanced standards for all United States public company boards, management, and public accounting firms, including the retention and filing requirements of filing and auditing records.

All regulations regarding the availability and retention of records are applicable regardless of the format in which they are produced. In many cases it is specified that the evidence copy must be produced in paper regardless of the media employed in its generation. The extensive use of electronically stored information today has resulted in changes to the Federal Rules of Civil Procedure (FRCP). Electronic discovery has become a critical factor in litigation and these rules address the requirements for the maintenance and production of records on such media. In 2004, The Sedona Conference addressed the critical issue anti-trust law, complex litigation, and intellectual property in the *Sedona Guidelines: Best Practices and Commentary for Managing Information and Records in the Electronic Age* (http://www.thesedonaconference.org/contact_html).

Information management is the process of identifying and utilizing all the information disciplines and information resources organization-wide to achieve efficient, effective, and competitive management decisions. An organization can best achieve this goal by implementing a workable system that manages the creation, processing, use, maintenance, protection, and disposition of records, regardless of media. It is, therefore, essential that such a system involves all the disciplines that contribute to the maximum utilization and management of information. This interdisciplinary approach includes records management, computer systems, telecommunications, library sciences, archives management, and general management. This entry has addressed the history and maturing value of records management as part of this “interdisciplinary approach.”

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History of the Book

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Abstract

The history of the book is a new academic field that explores how books shape society and how society shapes books. It covers not only books per se but all kinds of documents, including manuscripts, periodicals, newspapers, and ephemera. It addresses the social, economic, and cultural history of authorship, editing, scribal and print production, publishing, bookselling, literary property, libraries, censorship, literary criticism, literacy, and reading.

Editor's note: Other scholars sometimes use the term “the new book history” to distinguish this emerging multidisciplinary field from those earlier studies that focused mainly on the physical book and the changes it underwent over time. For coverage of earlier bibliographic and historical studies that focus on books and printers see the following entries in this encyclopedia: “Bibliographical Society of America (BSA),” p. 517; “Bibliographical Society [London],” p. 510; “Bibliography,” p. 522; “History of Paper,” p. 2107; “History of Three Basic Printing Processes,” p. 2148; “Illumination [ELIS Classic],” p. 2233; “Incunabula [ELIS Classic],” p. 2254; “Papyrology,” p. 4106; “Private Presses and Fine Printing [ELIS Classic],” p. 4297; and “Provenance of Rare Books,” p. 4333.

One of the newest fields of academic research—and one of obvious interest to librarians—is the history of the book. Its basic premise is simple: that books shape society, and society shapes books. In the original Anglo-Saxon, *bok* could mean any kind of document, and book historians likewise define the term expansively, to include not only books per se but also manuscripts, periodicals, newspapers, and ephemera. Some scholars prefer the term “print culture history,” though that has the disadvantage of excluding written documents. But all book historians agree that, in all literate cultures, script and print are the prime means of communicating information, disseminating ideas, preserving memory, distributing wealth, and exercising power. (This is not to deny the importance of oral and electronic media, but they pose different historiographical questions and involve different methodologies and sources.) Book historians are concerned with the creation, dissemination, uses, storage, and destruction of documents: thus they focus on the social, economic, and cultural history of authorship, editing, scribal and print production, publishing, bookselling, literary property, libraries, censorship, literary criticism, literacy, and reading.

Histories of books and printing go back almost as far as the printing press itself, but only more recently have historians systematically studied books to illuminate larger movements in society. Daniel Mornet's 1910 essay “Les Enseignements des bibliothèques privées” searched 500 prerevolutionary French private libraries and found only one copy of the book that was supposed to have sparked the revolution, Jean-Jacques Rousseau's *The Social Contract*. In *The Puritan Pronaos* (1936), Samuel Eliot Morison recognized that the intellectual climate of seventeenth-century New England could not be understood apart from its printers, booksellers, and libraries. Richard D. Altick's *The English Common Reader 1800–1900* (1957) explored several dimensions of book history avant la lettre: literacy education, public libraries, readers, the book trade, periodicals, and newspapers. In *L'Apparition du livre* (1958) (translated as *The Coming of the Book: The Impact of Printing 1450–1800*), Lucien Febvre and Henri-Jean Martin deployed the methods of the *Annales* school of history to explain the role of print technology in the development of capitalism and Protestantism. In 1979 two major books introduced American historians to the history of the book and popularized the term (from the French *l'histoire du livre*): Elizabeth Eisenstein's *The Printing Press as an Agent of Change* and Robert Darnton's *The Business of Enlightenment: A Publishing History of the Encyclopédie, 1775–1800*. The book was coming to be seen more and more as a driving force in history, a factor that could help explain the dissemination of the Renaissance, the Protestant Reformation, the rise of modern science, and the French Revolution.

In the final years of the twentieth century, book history began to create the structures of an organized academic discipline. The first specialists in the field had to train themselves, until formal graduate programs were set up at the University of Toronto, the University of Wisconsin, the University of Iowa, Florida State University, Drew University, the University of London, the University of Edinburgh, Leiden University, and the Johannes

Gutenberg University in Mainz. The first volume of the *Annual Bibliography of the History of the Printed Book and Libraries* was published in 1970: the information therein is now being transferred to *Book History Online*, based at the Koninklijke Bibliotheek (the National Library of the Netherlands). The Society for the History of Authorship, Reading and Publishing (SHARP) was founded in 1991 and held its first annual conference at the CUNY Graduate Center in 1993. It became the leading international organization of book historians, at least in the Anglophone world. Its Web site, at <http://www.sharpweb.org>, is the most current and extensive listing of resources in the field, with links to publishers' archives, book catalogs, scholarly journals, databases, ephemera collections, research projects, museums, libraries, online exhibits, course syllabi, academic programs, and conferences. In addition to SHARP there arose more specialized scholarly societies defined by nationality or subfields, such as the Book Trade History Group (Britain), the Canadian Association for the Study of Book Culture, the Nederlandse Boekhistorische Vereniging (Netherlands), the Gesellschaft für Buchforschung in Österreich (Austria), the Early Book Society, and the Textbook Colloquium. New journals appeared, such as *Publishing History* (Britain), *Book History* (United States), and the *Jaarboek Nederlandse Boekgeschiedenis* (Netherlands). Textbooks were produced, and monograph series were launched by a growing number of university presses (e.g., Penn State, University of Massachusetts, University of Toronto). Ultimately, all this research was distilled into encyclopedic multivolume histories of the book in the United States, Britain, Scotland, France, Australia, and Canada.

Book history became a highly interdisciplinary discipline, bringing together scholars from a wide range of fields. Sociologists, anthropologists, and reading instructors found it a useful method for studying the uses of literacy. Art historians came to appreciate that the physical book was itself an important art form. Students of theology increasingly understood that books are a prime means of spreading gospels, and that every religious denomination is also a publishing house. (The techniques of mass-market publishing were pioneered by evangelical Christians in early nineteenth-century Britain and America.) And publishing professionals began to take an interest in the history of their business. But most book historians are historians, literary scholars, or librarians—and all three had compelling reasons to be attracted to this new academic enterprise.

By the 1970s intellectual historians found themselves challenged by social historians, who often dismissed the history of ideas as “elitist,” oblivious to economic realities and material culture. In fact the project of intellectual history could no longer limit itself to describing conversations among great thinkers: it had to explore how ideas were incarnated in published texts and disseminated to

mass audiences. Thus intellectual historians like Robert Darnton met the criticisms of social and economic historians by adopting their methods, studying the *Encyclopédie* as a business venture and tracing the spread of the “low Enlightenment” among common readers. Indeed, book historians reminded social historians of a fact they usually overlooked: that books and the ideas they contain have long been an important part of the everyday lives of ordinary people.

Meanwhile, departments of English and foreign languages were confronted by the rise of postmodern literary theory, which was raising provocative questions about canon formation, reader response, the politics of literary criticism, and the sociology of authorship. These questions needed to be asked, but some Modern Language Association members felt that the answers offered by postmodernists were glib, tendentious, and founded on precious little research. Was the canon simply something constructed by white male critics? Did metropolitan publishers dump European literature on colonized peoples? Do women really read differently from men, and if so, in what ways? (The school of “reader-response critics” was notorious for failing to study actual readers.) “Empirical” was the foulest epithet in the postmodern vocabulary, but some literary scholars began to do the kind of archival research that historians had always done, and their work helped to usher in a “posttheory” revisionist approach to literary history.

Librarians had always felt undervalued in the academic hierarchy, and they were eager to prove that they were more than just warehousekeepers of books. Some of them saw an opportunity in the theories of Michel Foucault, who argued that cultures are defined by how they archive and classify knowledge. In that case, the acquisition, cataloging, borrowing, and culling of books all became vitally important intellectual questions—and librarians, who knew how to find the relevant facts and figures, could make a valuable contribution to writing cultural history.

Regardless of which department they teach in, book historians address the following common questions:

Authorship. Each and every book must be created by someone—or something—but the precise role of the person named on the title page is open to debate. Some literary scholars have gone so far as to proclaim “the death of the author,” arguing that books are called into existence by impersonal social, economic, political, and cultural forces, but this is an extreme position. Most of us would agree that, whoever else was involved in creating *The Pickwick Papers*, Charles Dickens had something to do with it. But book historians rightly insist that no book is created *solely* by its author: publishers, printers, illustrators, designers, binders, salesmen, and lawyers all shape the final product in important ways. And all texts are revised, often dramatically, by editors, as A. Scott Berg illustrated in *Max Perkins: Editor of Genius* (1978). Mary Ann Gillies, in *The Professional Literary Agent in Britain*,

1870–1920 (2007), has focused attention on the most under-researched figure in the book trade, who has played a critical editorial role in advising authors to tailor their manuscripts to the demands of publishers and reading publics. Book history is deeply concerned with the sociology of authorship and has generated quite a large body of literature exploring the gender factor: for example, Susan Coultrap-McQuin's *Doing Literary Business: American Women Writers in the Nineteenth Century* (1990), Bette London's *Writing Double: Women's Literary Partnerships* (1999), and Carla Hesse's *The Other Enlightenment: How French Women Became Modern* (2001). Less attention has been paid to class issues, but see Nigel Cross's *The Common Writer: Life in Nineteenth-Century Grub Street* (1985) and Christopher Hilliard's *To Exercise Our Talents: The Democratization of Writing in Britain* (2006).

Printing. The recent volume *Agent of Change: Print Culture Studies after Elizabeth L. Eisenstein*, edited by Sabrina Alcorn Baron, Eric N. Lindquist, and Eleanor F. Shevlin (2007), is only one manifestation of the wide-ranging scholarly debates that her work incited. Did Gutenberg foment a “print revolution,” or was his impact on European society less dramatic? Did printing make possible certain kinds of books (such as scientific texts) which were not really possible before? Did it promote “fixity of text” or simply perpetuate textual errors (a question explored in Adrian Johns's *The Nature of the Book* [1998])? Why were certain parts of the world (notably India and the Islamic regions) slow to adopt print technology, and what were the social consequences of that delay? How did the adoption of Western print technology in the nineteenth century transform East and South Asia? As the first mass-production industry, was printing the driving force behind the development of modern capitalism? How did printers change literary texts, with or without the permission of the authors (an issue addressed in Allan C. Dooley's *Author and Printer in Victorian England* [1992])? Print technology changed little between 1450 and 1800, but in the nineteenth century there was arguably a second printing revolution, with the introduction of steam power, rotary presses, stereotype plates, and papermaking machines, all of which made possible mass-market publishing. Book historians also explore reproduction technologies other than movable type, both pre-Gutenberg (xylography) and post-Gutenberg (lithography, mimeographing, microfilm, photocopying, desktop publishing, and the e-book).

Publishing. Publishers have long written or commissioned celebratory “house histories,” but book historians have developed this genre to show how particular firms promoted particular kinds of literature—either Tory (David Finkelstein, *The House of Blackwood: Author–Publisher Relations in the Victorian Era* [2002]) or leftist (Sheila Hodges, *Gollancz: The Story of a Publishing House, 1928–1978* [1978]), classics (Jay Satterfield, *The World's Best Books: Taste, Culture, and the Modern*

Library [2002]) or smut (Iain McCalman, *Radical Underworld: Prophets, Revolutionaries and Pornographers in London 1790–1840* [1988]), fine printing (William S. Peterson, *The Kelmscott Press* [1989]) or paperbacks (Thomas L. Bonn, *Heavy Traffic and High Culture: New American Library as Literary Gatekeeper in the Paperback Revolution* [1989]), highbrow (J. H. Willis, Jr., *Leonard and Virginia Woolf as Publishers: The Hogarth Press 1917–41* [1992]), lowbrow (Larry E. Sullivan and Lydia Cushman Schurman, eds., *Pioneers, Passionate Ladies, and Private Eyes: Dime Novels, Series Books, and Paperbacks* [1996]), or somewhere in between (Joan Shelley Rubin, *The Making of Middlebrow Culture* [1992]).

Publishing histories have cast a new light on the work of much-studied authors: see Morton Cohen and Anita Gandolfo, *Lewis Carroll and the House of Macmillan* (1987); Robert L. Patten, *Charles Dickens and His Publishers* (1978); and Peter Shillingsburg, *Pegasus in Harness: Victorian Publishing and W. M. Thackeray* (1992). The very structure of many Victorian novels was determined by their initial publication in serial form, as illuminated by Linda K. Hughes and Michael Lund, *The Victorian Serial* (1991), and Carol A. Martin, *George Eliot's Serial Fiction* (1994).

In one area in particular, book historians have dramatically revised the conventional narrative of literary history. Modernist authors were once accepted at face value as pure artists resisting the commercial pressures imposed by mercenary publishers. But the close study of publishers' ledgers and correspondence reveals a more mixed reality: it turns out that Joseph Conrad, James Joyce, and D. H. Lawrence were interested in profit maximization as well. Some of the key works on “marketing modernism” include James Nelson, *Elkin Mathews: Publisher to Yeats, Joyce, Pound* (1989); Joyce Piell Wexler, *Who Paid for Modernism? Art, Money, and the Fiction of Conrad, Joyce, and Lawrence* (1997); Peter D. McDonald, *British Literary Culture and Publishing Practice 1880–1914* (1997); Lawrence Rainey, *Institutions of Modernism: Literary Elites and Public Culture* (1998); Josephine M. Guy and Ian Small, *Oscar Wilde's Profession: Writing and the Culture Industry in the Late Nineteenth Century* (2000); Paul Delany, *Literature, Money and the Market: From Trollope to Amis* (2002); Catherine Turner, *Marketing Modernism between the Two World Wars* (2003); and Robert W. Trogon, *The Lousy Racket: Hemingway, Scribners, and the Business of Literature* (2007).

Bookselling. Bookseller's records can tell us a great deal about the availability and demand for books in a particular time and place. William J. Gilmore used such sources to illuminate literary life in a backwater of the early American republic, in *Reading Becomes a Necessity of Life: Material and Cultural Life in Rural New England, 1780–1835* (1989). Colporteurs (traveling book peddlers) can sometimes convey a very clear picture of what their customers wanted. And so do histories of big modern

bookselling chains, such as Charles Wilson's *First with the News: The History of W. H. Smith* (1986).

Literary property. The first modern copyright legislation was enacted in Great Britain in 1710, and its impact is described in Mark Rose's *Authors and Owners: The Invention of Copyright* (1993). However, the concept of literary property is almost as old as printing itself, as explained in Cynthia J. Brown's *Poets, Patrons, and Printers: Crisis of Authority in Late Medieval France* (1995) and Joseph Loewenstein's *The Author's Due: Printing and the Prehistory of Copyright* (2002). Until Congress ratified an international copyright treaty in 1891, American readers enjoyed a windfall of cheap pirated foreign literature, as analyzed most recently in Meredith L. McGill's *American Literature and the Culture of Reprinting, 1834–1853* (2003). And Chinese literature has been profoundly shaped by a traditional lack of respect for literary property: see William P. Alford's *To Steal a Book is an Elegant Offense: Intellectual Property Law in Chinese Civilization* (1995) and Andrew C. Mertha's *The Politics of Piracy: Intellectual Property in Contemporary China* (2005).

Libraries. Library history was once a relentlessly uplifting tale about public enlightenment, philanthropic gentlemen, and dedicated collection-builders. Under the influence of book history, however, this field has become more deeply rooted in social history, as exemplified in Alistair Black's *A New History of the English Public Library: Social and Intellectual Contexts, 1850–1914* (1996). In *Reading on the Middle Border: The Culture of Print in Late Nineteenth-Century Osage, Iowa* (2001), Christine Pawley analyzed library records to reconstruct the intellectual milieu of an entire midwestern community. And in *Free to All: Carnegie Libraries and American Culture, 1890–1920* (1995), Abigail Van Slyck used the public library movement as a window into the history of American philanthropy and civic architecture. Wayne Wiegand's *Irrepressible Reformer* (1996) was more than just a biography of Melvil Dewey: it cast light on the invention of information science and the ideological biases built into that profession. One of the distinguishing features of this new approach to library history is a willingness to explore some of its grimmer aspects: for example the McCarthy era, in Louise S. Robbins, *The Dismissal of Miss Ruth Brown: Civil Rights, Censorship, and the American Library* (2000); or convict libraries, in Janet Fyfe, *Books Behind Bars: The Role of Books, Reading, and Libraries in British Prison Reform, 1701–1911* (1992); or James Raven, ed., *Lost Libraries: The Destruction of Great Book Collections since Antiquity* (2004); or, darker still, Ambrus Miskolczy's *Hitler's Library: A Socio-Historical Overview* (2003) and Timothy Ryback's *Hitler's Private Library: The Books That Shaped His Life* (2008). In 12 years the Nazis destroyed an estimated 100 million volumes throughout Europe, as documented in David Shavit, *Hunger for the Printed Word: Books and*

Libraries in the Jewish Ghettos of Nazi-Occupied Europe (1997); and Jonathan Rose, ed., *The Holocaust and the Book: Destruction and Preservation* (2001). See also Rebecca Knuth's *Libricide: The Regime-Sponsored Destruction of Books and Libraries in the Twentieth Century* (2003).

Censorship. It is bleakly ironic that the twentieth century, when most Western societies achieved near-universal literacy, also witnessed the most ruthless and extreme suppression of literature. But censorship and expurgation—for moral, political, or religious reasons—have always been with us. Book historians have set themselves the task of explaining why, how, and upon whom censorship was imposed. For example, in *Word Crimes: Blasphemy, Culture, and Literature in Nineteenth-Century England* (1998), Joss Marsh found that blasphemy laws were enforced only against working-class atheists, not gentleman agnostics like T. H. Huxley. Scholars have found that censorship in ancien régime France and Czarist Russia was notoriously leaky and inefficient, allowing in much subversive literature. And we have already begun to study the newest front in the censorship wars: see *The Rushdie File*, ed. Lisa Appignanesi and Sara Maitland (1990). Book historians have also pioneered the serious scholarly study of pornography and its role in culture and politics: see Lynn Hunt, ed., *The Invention of Pornography: Obscenity and the Origins of Modernity, 1500–1800* (1993), and Robert Darnton, *The Forbidden Best-Sellers of Pre-Revolutionary France* (1995).

Literacy and Reading. Where earlier historians focused on estimating rates of literacy, book historians such as David Vincent (*Literacy and Popular Culture: England 1750–1914* [1989]) have delineated the everyday uses of literacy—in the workplace, in political and labor organizations, in everyday letter-writing. A fairly high degree of literacy was necessary to negotiate modern urban environments, as illustrated by Peter Fritzsche in *Reading Berlin 1900* (1996) and David M. Henkin in *City Reading: Written Words and Public Spaces in Antebellum New York* (1998).

Until fairly recently it was widely assumed that recovering the intellectual experiences of ordinary readers in history was impossible, but a growing number of book historians have managed to penetrate that mystery. They have used such sources as probate and booksellers' records, which reveal the ownership and distribution of books. Remarkably detailed sociological surveys of reading were conducted as far back as the 1790s (in the case of *The Statistical Account of Scotland*) and in the old USSR (used by Stephen Lovell to write *The Russian Reading Revolution: Print Culture in the Soviet and Post-Soviet Eras* [2000]). The minutes of reading groups and literary societies can be mined for what they reveal about popular reading habits, as Elizabeth McHenry did in *Forgotten Readers: Recovering the Lost History of African–American Literary Societies* (2002). Equally illuminating

are library borrowing records and the memoirs of plebeian readers, as employed in Jonathan Rose's *The Intellectual Life of the British Working Classes* (2001). Much information about learning literacy can be found in the records of educational institutions: Heather Andrea Williams made use of the Freedmen's Bureau archives in *Self-Taught: African American Education in Slavery and Freedom* (2005). No less valuable are letters to magazine and newspaper editors, particularly those that were never published, as studied by David Nord in *Communities of Journalism: A History of American Newspapers and Their Readers* (2001). In his *Faith in Reading: Religious Publishing and the Birth of Mass Media in America* (2004), Nord also made effective use of reports that canvassers sent back to evangelical publishers, essentially an early form of market research. For their book *Everyday Ideas: Socioliterary Experience among Antebellum New Englanders* (2006), Ronald J. Zboray and Mary Saracino Zboray gleaned observations about reading from the letters and diaries of more than 900 individuals. Other revealing sources include interviews (Martyn Lyons and Lucy Taska, *Australian Readers Remember: An Oral History of Reading 1890–1930* [1992]), fan mail (Clarence Karr, *Authors and Audiences: Popular Canadian Fiction in the Early Twentieth Century* [2000]), iconography in illuminated manuscripts (Laurel Amtower, *Engaging Words: The Culture of Reading in the Later Middle Ages* [2000]), and comments scribbled in margins (Heather Jackson, *Marginalia: Readers Writing in Books* [2001]). As Carlo Ginzburg demonstrated in *The Cheese and the Worms* (1980), the Inquisition was keenly interested in what people were reading, and their proceedings are an invaluable historical resource.

Finally, the Reading Experience Database, begun in 1996, is assembling a searchable pool of thousands of individual reading experiences in Britain between 1450 and 1945 (<http://www.open.ac.uk/Arts/RED/>). And in the United States, the "What Middletown Read" project has constructed a searchable database of the usage of the Muncie Public Library between 1891 and 1902, covering more than 6,000 borrowers, 13,000 volumes, and 400,000 loans (<http://www.bsu.edu/middletown/wmr/>).

Literary politics. Canon formation has been a hotly contested and highly politicized issue among the last generation of literary scholars. A number of book historians have addressed it in a systematic way, notably Jan Gorak in *The Making of the Modern Canon* (1991), John Guillory in *Cultural Capital: The Problem of Literary Canon Formation* (1993), and Timothy Morris in *Becoming Canonical in American Poetry* (1995). Sex bias in literary criticism, no less controversial a topic, is treated in Nicola Thompson's *Reviewing Sex: Gender and the Reception of Victorian Novels* (1996). For studies of single authors, a model is John Rodden's *The Politics of Literary Reputation* (2nd ed., 2002), which retells the intellectual history of the Cold War though a survey of critical responses to

George Orwell. The question of what gets translated—and how—can also be political, as André Lefevere has explained in *Translation, Rewriting, and the Manipulation of Literary Fame* (1992). Specialized studies in this field have often focused on Germany: Walter Grünzweig, *Constructing the German Walt Whitman* (1995); Bernhard Fabian, *The English Book in Eighteenth-Century Germany* (1992); and Fania Oz-Salzberger, *Translating the Enlightenment: Scottish Civic Discourse in Eighteenth-Century Germany* (1995).

Studies of the development of English as a scholarly discipline, in both the United States and Britain, inevitably focus on academic politics: Chris Baldick's *The Social Mission of English Criticism 1848–1932* (1983) (a Marxist perspective), Franklin Court's *Institutionalizing English Literature* (1992), John Dixon's *A Schooling in "English"* (1991) (more sympathetic than either Baldick or Court), David R. Shumway's *Creating American Civilization: A Genealogy of American Literature as an Academic Discipline* (1994), Kermit Vanderbilt's *American Literature and the Academy* (1986), and Gerald Graff's *Professing Literature: A Institutional History* (2nd ed., 2007). For a devastating treatment of postmodern criticism, see David Lehman, *Signs of the Times: Deconstruction and the Fall of Paul de Man* (1991).

There have also been numerous studies of the political impact of books, including two on *Silent Spring*: Priscilla Coit Murphy's *What a Book Can Do: The Publication and Reception of Silent Spring* (2005) and Mark Hamilton Lytle's *The Gentle Subversive: Rachel Carson, Silent Spring, and the Rise of the Environmental Movement* (2007). Following the lead of Robert Darnton, several historians have looked for the seeds of the French Revolution in print culture: Jack R. Censer in *The French Press in the Age of Enlightenment* (1994), Roger Chartier in *The Cultural Origins of the French Revolution* (1991), Elizabeth Eisenstein in *Grub Street Abroad: Aspects of the French Cosmopolitan Press from the Age of Louis XIV to the French Revolution* (1992), Arlette Farge in *Subversive Words: Public Opinion in Eighteenth-Century France* (1994), Dena Goodman in *The Republic of Letters: A Cultural History of the French Enlightenment* (1994), and Jeremy Popkin in *News and Politics in the Age of Revolution: Jean Luzac's Gazette de Leyde* (1989). An entire volume of critical essays has been devoted to *The Darnton Debate: Books and Revolution in the Eighteenth Century* (ed. Haydn T. Mason, 1998).

Science. Elizabeth Eisenstein argued that print made the scientific revolution possible, and in her wake historians have investigated the publication and reception of scientific ideas. Here the outstanding work is James Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation* (2000). But see as well Aileen Fyfe, *Science and Salvation: Evangelical Popular Science Publishing in Victorian Britain* (2004); Lydia Marinelli

and Andreas Mayer, *Dreaming by the Book: Freud's Interpretation of Dreams and the History of the Psychoanalytic Movement* (2003); and Marina Frasca-Spada and Nick Jardine, eds., *Books and the Sciences in History* (2000).

Lexicography. Print technology made the national standardization of spelling and vocabulary necessary, and that gave rise to the modern dictionary, which in turn has been an almost irresistible force for defining language. Critics from various points on the ideological compass have charged lexicographers with the crimes of slanginess, "prescriptivism," or linguistic imperialism. Book historians, however, recognize that dictionary makers are publishing professionals who have to balance a host of completing pressures: they must work within deadlines and budgets and space limits, they must coordinate the work of an army of contributors and subeditors, they must track down and historicize and define literally hundreds of thousands of words, and they must produce a book that is both marketable and absolutely accurate. Studies that are particularly sensitive to these problems include Herbert C. Morton's *The Story of Webster's Third: Philip Gove's Controversial Dictionary and Its Critics* (1994), Allen Reddick's *The Making of Johnson's Dictionary, 1746–1773* (2nd ed., 1996), and Lynda Mugglestone's *Lost for Words: The Hidden History of the Oxford English Dictionary* (2005).

Future directions. Until very recently book history was a First World enterprise, concentrating almost exclusively on Europe, North America, and Australasia, but now it is beginning to engage other parts of the globe as well. India in particular has attracted a critical mass of scholars, among them Priya Joshi (*In Another Country: Colonialism, Culture and the English Novel in India* [2002]), Anindita Ghosh (*Power in Print: Popular Publishing and the Politics of Language and Culture in a Colonial Society, 1778–1905* [2006]), and Rimi Chatterjee (*Empires of the Mind: A History of Oxford University Press in India under the Raj* [2006]). Recovering the African common reader might seem to be an impossible task, but it has been accomplished by Wendy Griswold (*Bearing Witness: Readers, Writers and the Novel in Nigeria* [2000]) and Stephanie Newell (*Literary Culture in Colonial Ghana: How to Play the Game of Life* [2002]). For other groundbreaking works, see Christopher A. Reed's *Gutenberg in Shanghai: Chinese Print Capitalism, 1876–1937* (2004)

and Eugenia Roldán Vera's *The British Book Trade and Spanish American Independence: Education and Knowledge Transmission in Transcontinental Perspective* (2003).

As noted at the outset, book history is concerned with all types of documents, so the next logical frontier for the field should be the history of archives. Our culture is defined by the records that we choose to preserve or destroy, their organization and accessibility, and the information they contain, all of which determines the kinds of history we can reconstruct. The importance of this type of scholarship for all historians should be obvious, but archival history is still a very new field, so new that it is scarcely organized. It has no dedicated academic journals or societies, though the International Conference on the History of Records and Archives (I-CHORA) has been meeting since 2003. For examples of some recent work, see *Ancient Archives and Archival Traditions: Concepts of Record-Keeping in the Ancient World*, ed. Maria Brosius (2003). A promising approach to this subject is via the historiography of paperwork, for example Miles Ogborn's *Indian Ink: Script and Print in the Making of the English East India Company* (2007), Cornelia Vismann's *Files: Law and Media Technology* (abridged and translated by Geoffrey Winthrop-Young, 2008), and Jacob Soll's forthcoming *The Information Master: Jean-Baptiste Colbert's Secret State Intelligence System*.

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History: Three Basic Printing Processes

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Abstract

The present entry will discuss three types of printing processes as they have been practiced in the West for centuries. Moveable type printing that originated with Johannes Gutenberg in Europe is called relief printing because the ink adheres to a raised surface from which it is imparted to the printed surface. The second basic kind of printing in the hand press period is intaglio, that is, printing from inks delivered to a surface from beneath the surface of the printing block. The third type of printing is called planographic and the process is referred to as lithography, which involves printing from the flat surface of a stone.

INTRODUCTION

Printing was developed in China long before Johannes Gutenberg came on the scene. The Chinese were printing from clay maybe by the eighth century and certainly by the ninth century. Also by the ninth century they were printing from wood blocks, carved (in reverse, i.e., in mirror writing) from a flat surface. Hence, the first printing that we know of is one of three types of printing: relief, intaglio, and planographic. The present entry will discuss these three types of printing as they have been practiced in the West for centuries.

RELIEF PRINTING

When something is in relief, it is raised up from a surface below. A relief map shows mountains that actually protrude upward from the surface of the map.

With the growth of the guild system in the Middle Ages, there was a concomitant growth of the middle class, with a simultaneous enlargement of the educational system. With the flow of money to the middle class, there was an increase in leisure time and a parallel demand for education. The number of books produced in the monasteries and by the Stationers—by secular scribes—could not keep up with the demand caused by the expansion of the education system. Manuscript books could be produced only one at a time. But the numbers of students were increasing rapidly.

In this climate, the need arose for a process of book production that would allow multiple copies of books, rather than one at a time. Johannes Gutenberg (1398–February 3, 1468) satisfied this need by adapting several techniques of metallurgy and design to a new craft: printing.

Gutenberg neither invented printing nor did he invent the press, which had existed for centuries before him, for pressing olives or grapes. He did not invent ink, which, of course, had existed for centuries and was used in the

production of manuscripts. His genius lay in the use he made of his metal-casting skills, combined with a couple of innovations that made relief printing as we know it possible.

The Chinese could cast words in matrixes (also called matrices), but because they had a pictographic language, every word had to be cast separately. A text with, say, 5000 different words would have required that many individual matrixes. Gutenberg had the good fortune to live in an area of the world that used not pictograms but the individual letters of an alphabet to build up words. The number of matrixes he needed to create was only a tiny fraction of the number needed for a pictographic language.

Gutenberg's first challenge was to design a full font—an alphabet and all the other characters he would need: letters of various sizes, numbers, punctuation signs, and other special figures. With manuscript hands as his model, he designed a font of printing type that perfectly suited his needs, looking sufficiently like the perfectly legible handwriting of scribes.

In fact, though he was creating printed books, to an observer not familiar with printing (and practically no one was since these were the first printed items in the West), what he made looked like multiple, identical copies of manuscripts. Items that were absolutely identical might have received the censure of the Church as being produced with the help of the Devil. Gutenberg got around that potential peril by producing as his first book a Bible.

With a full font designed, Gutenberg set about the kind of work he was familiar with: creating matrixes to cast the type. As a goldsmith, he knew how to create matrixes. He began with a short iron bar, squared off horizontally and vertically. On one end it had a perfectly flat surface onto which he transferred, backward (that is, in mirror writing) the character he wanted to cast. As he carved and filed away, he removed metal from the end of the bar—called a *punch*—leaving behind in relief the character he would eventually cast. As he got closer and closer to the final

form, he would take smoke proofs. That is, he would hold the carved end of the punch in a flame, allowing lamp-black to settle on the punch's surface. Then he would press the punch onto a piece of paper to make a print of the character.

If it was not filed or "carved" sufficiently, he would continue, taking further smoke proofs, until it was just as he wanted it. If he went too far, removing too much metal, he would have to begin again. When the punch was exactly as he wanted it, he would hold it in a flame until it glowed to just the right color, and then he would plunge it into cold water to harden it. The steel punch was now ready for the next step: creating the matrix.

A small squared-off bar of copper was the raw matrix. Gutenberg carefully hammered the punch into the copper, creating in it the impression of the character from the tip of the punch. It displaced some copper, so the matrix had to be filed down and squared off—called "justifying the matrix." The punch had to make an impression in the copper to exactly the right depth (the same depth into every matrix for all of the characters). This would assure that every piece of type—every "sort"—would be exactly the same height from its feet to its face. This of course was necessary since all the sorts, when composed into a text, needed to be exactly the same height from foot to face, creating a smooth surface of faces to receive the ink uniformly and to offer up a perfectly uniform impression to the paper or vellum laid upon it.

Once the matrix was justified, it was ready for casting. Here is where Gutenberg's great genius lay: he created an adjustable mold, adjustable "left to right" to accommodate matrices of different horizontal measures. Thus, a matrix of an "I" would fit into the mold with only a narrow "funnel"—formed by the two halves of the mold—above it; while an "M" would be in a matrix that was considerably wider left to right. The mold could slide open to accommodate the wider letter.

With the matrix at the bottom of the mold, which formed a little funnel above it, the type caster would pour molten type metal down the funnel. The metal, which would solidify in a split second, would fill the impression of the character in the matrix and create the sort, with a "jet" of metal above the just-cast sort. This jet, made up of the extra metal poured in that was not needed to create the sort, would be broken off, the sort would be put with other like sorts, the type would be "brushed off" to remove any extra slag or other minute particles of metal that attached to the sort, and the feet of the sort would be created when the point at which the jet was attached would be filed down—thus creating a tiny groove on the bottom of every piece of type, and two "feet" around the groove that the sort would sit on. (All the broken-off jets would be dropped back into the melting pot to be used for further casting.)

When the requisite number of characters was cast from that matrix, it would be removed from the hand mold and

another matrix, created in the same way the previous one was, would be put in and used for casting.

Once the typesetter had created all the sorts needed and distributed them into a typecase into little compartments, the compositor would take these sorts and place them one at a time into a handheld device called a composing stick, lining up the sorts to form words, sentences, and paragraphs, or whatever the copy required. When the composing stick was full, the lines of type, all justified to exactly the same length in the stick, would be transferred to a galley, a three-sided tray (usually made of metal). More lines of type from the composing stick would join the earlier ones until the text was completed, or until the galley was full. Additional galleys were needed for longer texts, and, in fact, a whole galley rack holding perhaps dozens of galleys could contain the text of an entire book.

The text would be proofed in the galleys (hence our modern term "galley proofs" or "galleys"), corrected, and proofed again. Eventually the printer would transfer from the galley to the bed of the press, the pages she or he needed to print one side of a sheet. Later the sheet would be "perfected"—that is, the second side of the sheet would be printed. Little by little stacks of printed and perfected sheets would form, and when all the sheets were finished being printed, they would be folded and gathered into groups (called "quires," "gatherings," or "signatures") in the proper sequence to form the continuous text from beginning to end. At this point, the printing was done and the sheets went off to the binder.

* * *

In the hand press period (before, say, 1800), printers faced a dilemma: once they set a book into type, how many copies should they print? If they did a run of 1000 copies and sold only half, they would lose money. If they printed 1000 copies and distributed the type back into the typecases, and then needed more copies, they would have to reset the type. Further, if they printed the 1000 but thought they might need to print more, they could store the type in galleys. But this would take up a good deal of space, and it would render the type unusable for other projects.

The solution was stereotyping, which entailed taking a mold of the pages of type—in plaster, clay, or papier-maché—and using that mold to cast a plate that contained a perfect image of the standing type. (Note that the printing from stereotype plates is indistinguishable from the printing of the text from the type itself. They are both relief printing and will leave the same kind of indentation in the paper. Also, since an edition of a text is constituted by all of the copies printed from a single setting of type, pages printed from type and those printed from stereotype plates cast from that same type are both part of the same edition.)

Many experiments in stereotyping as early as the close of the seventeenth century took place, but it was William Ged in Edinburgh who seems to have made the first

practicable stereotype plates about 1725.^[1] (This statement is on p. 526. Though this is an old reference book, it is authoritative and reliable.) The process became commercially accepted with its “reinvention” by Andrew Tilloch,^[2] the editor of the *Philosophical Magazine*. (The Dictionary says, “Tilloch declared. . . that he had known nothing of Ged’s process, but this is not believed by [Luke] Hansard,” the author of a well read printer’s manual (p. 527). Tilloch partnered with Andrew Foulis, printer at the University of Glasgow, in 1782. In 1784 they took out four patents for printing with metal plates rather than from standing type.^[3])

Stereotyping was almost completely superseded by electrotyping, another way to make a matrix for casting printing plates. The set type is placed in a galvanic bath and a perfect mold of another metal, usually copper, is formed over the type. It is considerably more complicated than this brief statement indicates, but the point is that a printing plate that looks like a stereotype plate, but that is covered with a layer of copper, is formed, and books can be printed from the plates. Copper is much more durable than is the type metal used in stereos, which is a composition of about 80% lead, 10% tin, and 10% antimony. Hence, electros will hold up longer than will stereos.

Electrotype plates, like stereotypes, are of the same edition as was the type they were made from, and they print in relief as do the type and the stereos.^[4] (Note that nickel, brass, or steel could be deposited onto the original form of type, but copper was the most common. See the *American Dictionary*, p. 164.) Further, since the printer using these plates is not constrained by thousands of pieces of type, the plates can be bent in such a way as to fit over a cylinder and can be placed into high-speed cylinder presses. Electros can also be made from woodcuts, allowing for the high-speed printing of text and illustration in one operation.

INTAGLIO PRINTING

The second basic kind of printing in the hand press period is intaglio, that is, printing from inks delivered to a surface from beneath the surface of the printing block. (Note that the G in the word “intaglio” is not pronounced.) The text—verbal or pictorial—is incised or carved into the surface of the plate, which traditionally was wood or copper, but later on could be zinc, magnesium, linoleum, or any of several other materials.

Relief printing preceded intaglio by several centuries, probably invented by the Chinese in the second century. “Intaglio engraving, as a method of making prints, was invented in Germany by the 1430s”^[5] and the method was soon employed by the Italians and Dutch, though the incising of surfaces of metals clearly predates this by centuries in the decoration of metal objects like armor or trays.

In the most basic method, the artist, using burins and gravers, would incise the image or text into the plate,

leaving grooves of varying widths and depths, then cover the surface of the plate with ink, which was pressed into the grooves. The surface of the plate would then be wiped clean with a tarlatan, a plain-weaved cotton fabric (sometimes the artist would swipe a bare hand over the plate’s surface for the final wiping), leaving the ink in the grooves.

A sheet of dampened paper is then placed over the plate, backed with a soft blanket, and run through the press under great pressure. The dampened paper is pressed into the grooves and picks up the ink, transferring the image or text to the sheet.

Additionally, before the printing but after the wiping of the plate, the plate could be colored in various ways on its surface, allowing the artist to add a second, third, or many colors to the final print, creating a monoprint—a print unique in that, while the intaglio-printed text can be reproduced, the coloring on the surface of the plate cannot.

What has just been described is one kind of intaglio printing, engraving, since the artist has engraved the surface of the plate with tools. There is another way to get the grooves into the plate: etching. This is done using acids that burn into the surface of the plate. In etching, the plate is covered in wax, which is impervious to acid. The artist, using a fine metal tool like a needle, scratches off the wax where the image is to go, exposing the metal. When acid is put onto the plate (either being washed over the surface or having the plate dipped into the acid bath), the acid etches the plate. The longer the metal is exposed to the acid, the deeper and wider will be the grooves and dots.^[6]

A related method which is not strictly intaglio is drypoint printing. The artist uses the gravers and burins as with engraving, but instead of removing the incised-out metal, the artist leaves a burr of metal at the edges of the incised grooves. These get inked (rather than having the ink go into the grooves) and the print is made from the inked burrs. Since the paper is pressed against the burrs, these burrs do not last long, so only short runs of drypoint prints are made—sometimes fewer than a dozen before the image breaks down.

If the incising is done in wood, the result is a wood engraving, as opposed to a woodcut or woodblock print, which is a relief method. Extremely hard woods can yield exceptionally fine lines, and—as with all of the intaglio methods—prints of exquisite fineness can be produced, with great subtlety in line and shade. Artists like Barry Moser have used a product called Resingrave, which is a synthetic material, mounted on a type-high block, that can be engraved in the same way one cuts into copper.

There is some confusion about the terminology here. Some people see metal engraving as an intaglio process and wood engraving as a relief process. But if the wood is engraved the same way the metal (e.g., copper plate) is, then the ink is delivered to the paper from beneath the surface of the woodblock; hence, this is an intaglio method of printing.

Intaglio-printed texts have a three dimensionality caused by the pressing of the paper into the grooves of the plate. Since this is a labor-intensive, and hence expensive, method of printing, it is highly prized. In the twentieth century a cheaper method of raised printing was invented: thermography. In this process, a newly printed sheet, with the ink still wet, is passed under a part of the press that drops a powder onto the ink. The powder sticks to the ink and the rest of the powder is vacuumed off. The sheet then is exposed to heat, which sets the powder, now raised above the sheet, creating a three-dimensional printed image. It looks from the printed surface like engraving, but from the back of the sheet one can see that the paper has not been pressed into the grooves of a printing plate.^[7] Since engraved printing is expensive and looks elegant, it was a sign of wealth and affluence to have engraved such things as business cards, wedding invitations, and stationery. Thermography imparted such a look and cost a fraction of the cost of engraving.

Advances in etching have to do with the use of lute-makers' varnish or acid-resistant resin rather than wax, the use of steel plates rather than copper, the incorporation of photography, and so forth. But the basic method of printing is nonetheless intaglio.

PLANOGRAPHIC PRINTING

In 1796 a Bavarian actor, Alois Senefelder (1771–1834), looking for an inexpensive way of printing music, invented lithography, printing from the flat surface of a stone. The invention was more of a discovery, for he was apparently not actively looking for the method that he came up with.^[8]

The basic principle is simple: oil and water do not mix. Senefelder was fortunate to be living where a particular kind of limestone was quarried. It had the properties of being able to hold on its surface an oil-based ink—called tusche—and being covered completely with water where the tusche was not, and holding both water and tusche with equal full coverage. The artist would draw the words and/or images onto the perfectly flat surface of the stone. Since the tusche was oil based, when the stone was covered with water, the tusche would repel the water and remain exposed to the air. But the rest of the stone would be covered with the water. Then an oil-based ink would be rolled on, adhering to the tusche, but being repelled by the water, hence not adhering to any other part of the stone. The paper or other material to be printed would be laid over the stone and rolled in a press similar to an etching or engraving press, and the ink would be transferred to the printing surface of the stone to the printed surface. The printing surface was absolutely flat, not in relief or in intaglio, as in the other two methods of printing described here. Hence it is called “planographic printing,” having been done from a flat plane.

The tusche is drawn onto the stone with crayons or fine pens, and under the hands of a master artist, pictures of great beauty and fineness can be created. Also, written text could be created, simply by having the lithographer write or “print out” the text in writing. Since the tusche “lies chiefly on the surface of the stone it is liable to be rubbed off, and therefore a coating which will resist any application of water is applied to it.”^[9]

The stone can be reused once the printer is finished with its image: it is reground, removing the fine layer of tusche and rendering the stone clear. The thick stones, hence, can be used over and over. By the middle of the nineteenth century the stones were printed on steam presses, speeding up the process considerably from the old method of handprinting. The thick stones are quite heavy, so a method of planographic printing was developed using zinc plates. This method was called zincography. “In 1834, the Frenchman Breugnot patented a zincographic printing process, producing large maps called géoramas.”^[10] (For this information, Wikipedia cites the dissertation of Pearson.^[11])

In 1818 Senefelder himself wrote about printing in color using lithography,^[12] and by the 1830s, chromolithography was being used in much of Europe. Chromolithographs (or “chromos”) sometimes had a dozen or more colors built up to produce the final pictures. The products from the presses often combine printing processes: usually chromos are printed first, followed by letterpress (i.e., relief) printing and/or intaglio (i.e., engraved) printing.

[More modern printing techniques are not covered in this entry. They include offset printing, rotary-press printing, flexography, screen printing, dye-sublimation printing, photocopying (Xerography), laser printing, dot matrix printing, thermal printing, inkjet printing, digital printing, and three-dimensional printing.]

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Abstract

Hospital libraries, defined as specialized professional health sciences libraries, located in hospitals, medical centers, acute care facilities, and even long term care facilities, provide biomedical information and clinical evidence-based resources to healthcare professionals, and affiliated hospital staff. In addition, many hospital libraries provide consumer health information services to patients, their families and the community. Clinical resources, particularly those focused on patient care and patient safety, differentiate hospital libraries and distinguish them from academic medical center libraries.

INTRODUCTION

Hospital libraries, defined as specialized professional health sciences libraries, located in hospitals, medical centers, acute care facilities, and even some long term care facilities, provide biomedical information and clinical evidence-based resources to healthcare professionals, and affiliated hospital staff. In addition, some hospital libraries provide consumer health information services to patients, their families and the community. Clinical resources, particularly those focused on patient care and patient safety, differentiate hospital libraries and distinguish them from academic medical center libraries. Academic medical libraries generally provide research, medical education, and clinical information to faculty, students and staff of the academic medical institution. The hospital library staff conscientiously responds to day-to-day information needs yet is always ready to handle clinical information emergencies. Hospital libraries satisfy the individual and collective needs for knowledge-based and evidence-based health information of physicians, nurses, lab technicians, students, hospital administrators, and many others. The physical library space meets multiple needs serving as a place for study, scholarly enrichment, collaborative meetings, consultations, discussions, debates, and solitude. The hospital library offers a peaceful refuge for physicians and medical school students, as well as an activity center for scholarly research and hospital-wide operational and strategic collaborations.^[1] Many other factors such as the clinical demands of the clientele, specialized print-based medical resources, electronic clinical resources, and emphasis on point-of-care patient centered information services set the hospital library apart from other medical libraries. Hospitals, especially community hospitals usually employ minimal staff for the library, often only staffing, a one-person library. Minimal square footage, limited budgets, and small resource collections are often characteristics associated with community hospital libraries. Yet even

in these less than optimum conditions a special commitment to the environment of care is demonstrated through the vision, expertise, and dedication to service of hospital librarians.

This encyclopedia entry on hospital libraries is designed to promote a deeper understanding of the:

- Value and role,
- Programs, services and information products
- Clientele and community access, and
- Changes and adaptation being made by hospital libraries

The impact of new healthcare policies, changes in the healthcare environment, new development in educational standards and evidence-based medicine, new and innovative technologies, and developing trends and patterns in hospital librarianship will serve as the basis for discussion of the above stated criteria.

HISTORICAL OVERVIEW

The hospital library of today has roots extending back to Colonial America. Dr. John Fothergill presented the Pennsylvania Hospital with its first book *An Experimental History of Materia Medica* by William Lewis, which served as the catalyst for the allocation of fund and the establishment of a Medical Library. Many hospital libraries originated from medical staff libraries, whereas others evolved from nursing libraries that supported hospital-based nurse diploma programs.^[2] The earliest medical libraries were often the results of pooled physician resources. The oldest medical library in America, established in Pennsylvania Hospital in Philadelphia, was founded in 1762. In 1847 the American Medical Association designated it as the first, largest and most important medical library in the United States. Many early hospital library collections were supported by student admission fees to

clinical lectures, bequest, gift and purchases. Through the help of Benjamin Franklin,^[3-5] John Winthrop founded a collection for the New York Hospital that was transferred in later years to form the New York Academy of Medicine. The 1800s ushered in the establishment of several notable medical libraries: the Treadwell Library of Massachusetts General Hospital in 1847, Mt. Sinai Hospital Library in 1883,^[6] and the largest hospital library at Johns Hopkins Hospital.

MISSION OF THE HOSPITAL LIBRARY

Hospital libraries, also known in some hospitals as medical libraries or health sciences libraries, are an integral part of the health care environment, which provides essential evidence-based information services.^[7] Hospital libraries, much like the hospitals and medical centers that they occupy, vary in size, scope of service, subject focus, access to resources, character and clientele.^[8] Some hospital libraries operate as independent departments, whereas others are subunits of departments, such as hospital education medical records, the medical staff office, or even quality improvement. Others are blended departments such as the Medical Library and Continuing Medical Education. The hospital's mission, vision, areas of specialty, educational offerings, participation in research and the needs of its clientele dictate the services and functions of the hospital library. Timely needs assessments and frequent usage evaluations conducted by hospital librarians provide the evidence librarians need to support the sustainability of current programs and the development of new programs and services. As hospitals add new services and expand to form multicampus systems, hospital libraries continue to develop library services to complement, strengthen and support the information needs of distance learners and the evolving needs of on-site and off-site health care providers.

In the American Hospital Association's publication, *Hospital Statistics*, hospital libraries were found to comprise the largest group of Health Sciences Libraries.^[9,10] According to statistics compiled from the National Library of Medicine's Docline records, hospital libraries in the United States currently total 3355. Today's hospital library is a uniquely specialized, patient-focused, service-oriented hub of continuous activity.^[11] Much like other departments and units of the hospital, the library contributes to the primary mission of providing service excellence and quality health care to the hospital's patients. The hospital library supports the delivery of patient care by providing library services to various types of students and health care professionals, including physicians, nurses, allied health professionals, and hospital administrators. Depending on the setting, some hospital libraries also serve nonaffiliated health professionals, such as pharmaceutical representative, and the community at large,

represented by patients and their families. The hospital library provides health care professionals with access to information used in their day-to-day clinical practice and answers to difficult health information questions.^[12] Hospital libraries also provide consumer health information and layman-oriented resources for patients, families, and the community.

Hospital libraries are the source of vital patient care information, resources to enhance education, and knowledge-based information resources needed for research endeavors. Knowledge-based information is vital to the hospital, in that it supports patient care; strategic decision making; performance improvement, patient safety, lifelong learning and reflective practice, research initiatives, patient and family education, and professional competency of hospital and medical staff. Lessons traditionally taught by hospital librarians, such as how to cite references, how to use indices, and how to develop search strategies are now being accompanied by lessons on how to search electronic resources, and how to seamlessly access health information on the web. Study shows hospital libraries save lives; ammunition in the fight to reinstate required medical libraries, the survey shows library information was often the key to proper diagnosis and treatment.^[13] Hospital librarians guided by changing roles and technology, train hospital staff to develop search strategies, search electronic books, journals and databases, seamlessly access health information from their desktop and provide training in how to analyze and filter health information.^[14] Hospital libraries also play a key role in supplying the hospital's administrative staff with information critical to making ongoing data-driven decisions.

ROLE OF HOSPITAL LIBRARIES

Historically, the hospital library has been viewed as a non-revenue generating department of the hospital, which existed predominantly to provide information and library resources to the medical staff for patient care, education, or research. The increased emphasis on the value of the hospital library in clinical care, patient safety and health literacy are presenting new roles and responsibilities for hospital librarians. These new roles have contributed to the expansion of the target audience for library services to include "all" hospital staff, patients, families, and the community served by the hospital.^[15] There are numerous types of hospitals: large and small, general and specialty, teaching and nonteaching, and acute and long-term facilities. Larger hospital libraries and multisystem hospital libraries often have more staff, larger budgets, and more resources available than smaller hospital libraries. Teaching hospitals benefit from the abundant access to monetary and physical resources particularly electronic resources of the affiliated Academic Medical Center. The library serves as a vital component in the clinical training of future

physicians, and it also serves the work-oriented need of all hospital personnel.^[16] In community hospitals, physicians and other health care professionals are made aware of the unlimited resources that the library can provide through networking with other libraries, usage of health resources on the World Wide Web and participating in consortia resource purchases and collaborative ventures.

The role of hospital libraries continues to change and evolve as information is recognized as a corporate asset.^[17] Evidence-based medicine, medical information filtering, patient safety and JCAHO requirements all focus on the quality of information and its value to the field of medicine. Providing accessibility of up-to-date, accurate, and authoritative information while the primary role of hospital libraries is not the only role. The role of the hospital library is to be agile and flexible enough to rapidly respond within the changing environment of the hospital and to provide accessibility to information for crucial data-driven decision making. However, with more emphasis on return on investment hospital libraries struggle to define themselves in such a way that the true value of intangible library services can be recognized and valued.

TYPES OF HOSPITAL LIBRARIES

Community Hospital Library

Many small community hospital libraries are designed as core medical libraries that make optimal use of limited resources. They offer a basic core collection of medical journals and texts that cover the major areas of medical practice, such as Family Medicine, Internal Medicine, Surgery, Obstetrics and Gynecology, Radiology, Public Health and Emergency Medicine. Hospital libraries provide free access to Web-based resources such as the National Library of Medicine's (NLM) Databases; PubMed, MedlinePlus, and several other Web-based NLM resources. Due to dramatic changes in access facilitated by journal publisher with input from hospital librarians, even small libraries have access to some electronic journals with the purchase of print journals. Local, regional, and national consortia affiliations help facilitate access for small libraries to electronic books, journals, and databases from recognized medical resource vendors.

Doody's Core Titles for the selection of books for the core print collection has replaced the Brandon Hill List of Books and Journals for the Small Medical Library as the resource tool of choice used to develop medical library collections.^[18] These resource collections tools are logically arranged using the National Libraries of Medicine's, NLM Classification Scheme.^[19] The smaller hospital libraries, like their larger counterparts, provide invaluable library services that include document delivery, online searching, and access to Web-based resources. The librarians in these

libraries serve as facilitators, guides, information providers, expert searchers, and negotiators.^[20] Most smaller community hospital libraries have access to the Internet, either dial-up through an Internet provider or more commonly now, through the institution-wide direct Internet connection.^[21]

Teaching Hospital Library

According to the Association of American Medical Colleges (AAMC) teaching hospitals are providers of primary care and routine patient services, as well as centers for experimental, innovative, and technically sophisticated services.^[22] Hospital libraries in teaching hospitals are vital information centers associated with teaching programs serving the hospital's objectives of patient care, education, innovation, and research. Hospital Libraries strive to develop library services that support the AAMC curricula objectives. Studies show that work-related activities are the starting point for learning for medical residents. Subsequently their information literacy skills and knowledge base are the result of the interpretation and the level of understanding that they draw from instruction and experiences such as library skills training.^[23] Teaching hospital libraries incorporate interaction into the learning process through hands-on database training, problem-based learning, the incorporation of new technologies and medical informatics applications. These libraries not only provide the core resources of the community hospital including access to point of care resources in the electronic medical record, e-textbooks, print medical text and other clinical educational resources needed in a teaching environment, but go a step further to evaluate services, analyze collections and develop more value added services for their clientele. The services of a teaching hospital's library are expanded to include bibliographic instruction (basic searching techniques), virtual reference, clinical medical librarianship, morning report, information retrieval and the incorporation of new technologies such as PDA's, iPods, smartphones and learning e-portfolios for student centered learning and the integration of resources into the electronic medical record. Many teaching hospital libraries have even begun to use some of the new social technologies, i.e., blogs, wikis. MySpace, Facebook and others social networking tools "leveraging the connectivity of the sites and using them to form communities around library products, media or information services to really be in contact with users."^[24]

Specialty Hospital Library

Specialty hospitals include acute care hospitals with one or more area of special concentration. Specialty hospitals include specialties such as pediatrics, obstetrics and gynecology, ophthalmology, otorhinolaryngology, orthopedic,

sports medicine, diabetes treatment, spinal cord injury treatment, general and plastic surgery, and diagnostic breast care. Other types of specialty hospitals are long-term care facilities such as psychiatric, rehabilitation and Veteran's Administration hospitals. Specialty Hospital Libraries foster innovation and improvement in the specialty learning environment with increased attention on residency programs and improving faculty research and patient care outcomes. Specialty hospital libraries offer residents and attending physicians a "space" in which to make connections between clinical experience, bench research projects, and program learning objectives as set forth by their program directors and department chairs. These specialty hospital libraries have in-depth collections aligned with the mission and specialization of the hospital. The collections in these facilities are comprised of core clinical journals and text, however, the primary focus of these collections is on the area of specialization of the organization.

Nursing Library

Nursing libraries provide access and preservation of scholarly records and nursing text to nursing student and nurse educators. In the 1980s, the proportion of registered staff nurses, the patient–nurse ratio increase, and a growing demand for nurses with bachelor's and master's degrees fueled the evolution of nursing. These trends toward the requirement of a bachelor's degree for nurses and the growth of nursing literature brought about by the upgrading of academic programs of nursing schools prompted the development of nursing libraries.^[25] Nursing libraries use Doody's core titles to select nursing text as well as other selection tools to build strong nursing collections. CINAHL the Cumulated Index to Nursing and Allied Health Literature is one of the Web-based resources used to locate nursing and allied health journal articles. "In many hospitals the nursing library was formalized before the medical library."^[26] Nursing libraries today are more often found in nursing schools than hospitals; however, hospital libraries provide well-developed nursing collections within their library resources, as nurses are quite often the largest user group of hospital libraries. Nursing excellence requires access to evidence-based information resources appropriate to guide health care decisions. Many hospitals today are seeking the powerful Magnet Status, recognition by the American Nurses Credentialing Centers (ANCC) Magnet Recognition Program that support nursing excellence and enhanced nursing practice, yet is very difficult to achieve. Hospital librarians are instrumental in hospitals achieving this recognition. They contribute support to the application process in many ways yet specifically by providing evidence for care delivery models, access to high quality resources and encouraging nursing research and publication.^[27–29]

IMPACT ON CLINICAL DECISIONS

Federal legislation enacted in 1986 by the Health Care Financing Administration (HCFA) eliminated the requirement that hospitals maintain a library to be eligible for Medicare and Medicaid funding. Decisions for maintaining hospital libraries were left up to the individual hospitals. The JCAHO in the 1994 standards integrated hospital libraries into the Management of Information giving hospital libraries the opportunity to explore new roles as part of the team charged with managing the organizations information.^[26] HCFA and the JCAHO have noticeably impacted decisions about the necessity of hospital libraries. As a result of the HCFA decision, the need for developing new approaches to evaluating and determining the value of hospital library services has become more apparent. Although value studies conducted by the Special Libraries Association measured monetary and time saving, additional studies of the impact of hospital library services on patient care were needed. The Rochester study was devised with objectives "to encourage hospital libraries to develop methods of analyzing current user services in order to improve the visibility and status of the library." Health care professionals make many decisions while treating patients, which are crucial to patient care outcomes and quality of care. Using the Chicago study of the contribution of the hospital library to clinical care as a model, the Rochester group developed a questionnaire to measure the impact of information on clinical decision making. This study confirmed the Chicago study findings that information provided for physicians by hospital libraries is perceived to have significant impact on clinical decision making and helps to establish the relative value of information provided by the hospital library. The Rochester study reported the information provided by librarians saved time, contributed new knowledge, improved patient care, and saved cost for 85% of participating physicians.^[27] Hospital libraries are in need of more current validation of their value. A new version of the Rochester study is being planned to help provide hospital libraries with the evidence that they need to visibly illustrate the positive impact hospital libraries have on patient care, education, research, patient safety, and health literacy. In an American Medical Association (AMA) study of New York physicians, "information provided by the library was rated more highly by the physicians than other information sources such as diagnostic imaging, laboratory tests, and discussions with colleagues."^[28,29]

LIBRARY STANDARDS

Two important sets of standards affecting hospital libraries have been significantly revised. These are the Medical Libraries Association Hospital Libraries Standards and the Joint Commission on Accreditation of HealthCare Organizations (JCAHO) Standards.

The Medical Library Association Standards

The Medical Libraries Association (MLA) is the organization representing health sciences librarians and other health information professionals dedicated to improving their leadership and quality to foster the art and science of health information services. The Hospital Libraries section of MLA composed standards for hospital libraries that were approved in 1952. A major revision to the Hospital Library Standards was performed in 2002 with updates made in 2004. The Medical Library Association's *Standards for Hospital Libraries 2002* were developed as a guide for hospital administrators, librarians, and accrediting bodies to ensure that hospitals have the resources and services to effectively meet their needs for knowledge-based information (KBI).^[30]

JCAHO STANDARDS

The Joint Commission on Accreditation of Healthcare Organizations (JCAHO) is the major accrediting agency for hospitals. In the JCAHO standards for information management, the importance of the need for access to knowledge-based information provided by hospital libraries is outlined in the Agenda for Change. JCAHO has identified expert knowledge-based information as vital to an organization's ability to provide patient care. Knowledge-based information refers to current expert information, produced externally to the organization, including:

- Journals, texts, documents, and databases in print or electronic format;
- Benchmarks, best practices, guidelines, consensus development statements;
- Research studies;
- Quality-filtered Internet resources

According to JCAHO, knowledge-based information is a collection of stored facts, models, and information that can be used for designing and redesigning processes and for problem resolution.^[31] Knowledge-based information is found in the clinical and management literature, derived from in-house library collections and external databases. The JCAHO standards for information management focus on the accessibility, availability, and the authoritative nature of knowledge-based information included in the institution-wide planning.^[26] "Knowledge-based information supports clinical decision making, continuing education of staff, administrative planning and management, performance assessment and improvement, patient and family education, and research."^[32] JCAHO regards information management as a function composed of seven strategic processes that look at needs identification, systems design, information definition and capture, data analysis, data transformation, data transmission, data reporting, and

information assimilation and usage. The newly revised integrated JCAHO standards incorporate information management as a component of quality improvement. As part of the continuous efforts to monitor the library services within the health care environment, the JCAHO developed a new vision of information that is critical to quality care and thus integral to all JCAHO standards.

The JCAHO has changed standards affecting hospital libraries. While the standards state that access to knowledge-based information is needed for the hospital environment, they no longer definitively state that the hospital library is the place for this access. The JCAHO is currently proposing revisions to the management of information standards that could classify hospital libraries standards as nonessential standards. MLA and the hospital library community are providing valuable feedback to the JCAHO to maintain the recognition of the value and need for the hospital library.^[33-37]

LIBRARY CLIENTELE

Hospital libraries serve the entire hospital community. Research, training, and information resources are provided to physicians, nurses, allied health professionals and other hospital staff. Drug information and pharmaceutical reference materials are available for pharmacists and other clientele needed drug information. Patient education materials are provided to case managers and staff who plan patient discharge strategies. Dietary information is provided to dietitians and nutritionist. Information on the environment-of-care is provided to administration, hospital safety personnel and public safety officers. Comparative data is provided to quality improvement teams and senior administration to make critical data-driven decisions. New technological developments and innovations are provided to information systems personnel and informatics researchers. Knowledge-based, data-driven decisions are made by hospital administrators based on information obtained by the hospital library from business, statistical, technological, and hospital administrative literature resources. Hospital libraries also serve students, interns, and residents by offering bibliographic instruction, reference assistance, seamless access to print and nonprint resources, paper-based and online catalogs, dictionary, thesauri, controlled vocabularies, and standard nomenclatures.

The information explosion has made us acutely aware that medical literature is growing at an astronomical rate.^[38] The number of medical articles available on the Internet increased from zero in 1992 to 107 in 1995 to 3.8 million in 1997 and continues to grow exponentially.^[39] A quick Google search reveals 217,000,000 medical articles. Physicians find they can't keep up with the enormous volumes of biomedical information published, even when regularly reviewing current literature. The information

explosion has brought about a new age of technology for hospital libraries and a new value to hospital librarians as information experts.^[40] The hospital library also plays a major role in the service to patients and their families. Information can increase consumers' receptivity to treatment by improving their knowledge about disorders and treatment alternatives. Information also enhances the patient-clinician relationship by facilitating informed consent and fostering patients' active participation in their treatment. Some hospital librarians have gone as far as to participate in training consumers of health information to make sense of medical data by supporting literacy initiatives.^[41]

The current emphasis of the JCAHO on patient education and the rights of consumers to be informed before consenting to test, treatment, and drug therapy have led to a renewed interest in patient libraries.^[42] A resurgence of patient libraries is being seen in all types of hospital libraries. Patient and consumer library services in today's hospital provide layman's level, easy to understand information about illness and wellness for the general public. The educated e-health consumer of today seeks direction in searching the literature and locating alternative avenues of health care.

LIBRARY STAFF

Role of the Hospital Librarian

Hospital librarians function as problem solvers, change agents, and invaluable resources of timely information delivery, yet they also serve as generalist. Although generalism contributes greatly to library work, specialized skills are especially critical to developing quality collections and first rate services.^[43] As medical librarianship became more widely accepted as a profession, standards for certification were established, which have evolved into the present day Academy of Health Information Professionals (AHIP).^[44,45] The staffing of hospital libraries is uniquely different, depending on the size of the hospital, the availability of funding for library resources, and the organizational commitment to lifelong learning.

The medical librarian, a specialized information professional, is uniquely prepared to provide oversight and management of knowledge-based information (KBI) resources and services to hospital or healthcare system. The hospital librarian plays a significant role in bringing specialized competencies to the institution, for the selection, organization, dissemination, evaluation, and expert retrieval of information in support of knowledge-based and evidence-based clinical, administrative, and scientific decisions. Hospital libraries have a vested interest in training health sciences practitioners and other library clientele in the best methods of information retrieval for knowledge-based and evidence-based practice, research, and lifelong learning.

Today's hospital librarians function in the roles of library manager, information specialist, webmaster, database manager, clinical medical librarian, information analyst, chief information officer, informationist, and internal consultant. The hospital library manager works closely with hospital managers and professionals in other disciplines on a daily basis. The job of hospital library manager is accompanied to a great degree by autonomy that allows flexibility and rapid response to the ever-changing needs of the hospital staff. As information specialist, hospital librarians focus on providing expertise in the location and delivery of information resources. The role of web master taps the creative and organizational skills of hospital librarians. Designing, organizing, and maintaining a web site for the library and sometimes multiple sites for the organization, provide a different dimension to the hospital librarian's job. As database manager, hospital librarians develop, classify, and maintain databases of pertinent information, making it available for rapid retrieval. Clinical medical librarians connect with the clinical staff as a part of the clinical team to provide information at the point-of-care. In the role of chief information officer, the librarian is the architect of the organizations' strategic information plan.^[46] As internal consultants, hospital librarians cultivating entrepreneurial spirit, evaluate current processes and contribute to the development of new services such as competitive intelligence. These services are the basis of ideas that produce new income streams and incorporate significant cost savings for the organization.

Educational Requirements for Hospital Librarians

The staff of hospital libraries ranges from the one-person librarian experiencing a wide variety of work interactions, to a library staffed with three or more full-time staff members, each devoted to one or more specific aspect of library operations (i.e., document delivery and circulation). Most hospital librarians hired today to manage hospital libraries have earned a master's degree in library science from an American Libraries Association accredited library school. The master's degree provides general, multidisciplinary preparation for library work. Specialized course work in medical librarianship provides the subject concentration in medical and health sciences resources. The educational background of library staff varies from certified medical librarians with master's degrees in library science, to library specialist with undergraduate degrees in related disciplines, to library assistants with 2 or more years of college and library experience.^[47] Although having a science background is not a requirement to become a hospital or health sciences librarian, the knowledge-base of the life sciences curriculum prepares librarians for in-depth analysis, research, and filtering of biomedical information which proves invaluable in biomedical informatics. The staff of hospital libraries provide valuable database search

training, while offering service assistance in retrieval of information from Web-based resources, locating and delivering needed documents, developing resource collections, providing access to electronic resources and supplying other vital information services.^[48]

Most hospital libraries not employing a full-time certified medical librarian seek support from the services of a degreed medical librarian, either as a consultant or circuit rider librarian. Library consultants assist libraries in the day-to-day maintenance of the library and keep the library's operational policies in compliance with JCAHO standards. Library consultants provide a variety of services onsite or virtually. Circuit rider librarians usually serve a number of hospitals. They travel from library to library providing basic information services and collection maintenance for several hospital libraries, usually in rural areas.^[49] Library and information services provided by professional librarians are critical to the organization's ability to not only respond to information requests but also proactively meet the ever changing needs and systematically link current, standard evidence from the literature with health care processes.

SERVICES

The Medical Library Association sites 19 services as being essential to hospital libraries. These essential services are categorized as distinct functional areas that include Technical Services, Reference and Information Service, Educational and Outreach Services, and Administrative and Management Services.^[50,51]

TECHNICAL SERVICE

One of two major functions of libraries, technical services includes processes for acquiring, arranging, indexing, and storing the collection. The constant replenishing of selected materials and the routine update of standard library references fulfill the mission of acquisitions. The acquisitions process includes tasks that involve ordering, receiving, and paying for information resources.^[52] For most library clientele, the processing of books, journals, A-Vs, CD-ROMs, electronic resources and software is invisible. The process-oriented functions that convert collection development decisions into acquisition are the backbone of the development of a strong authoritative library collection. Many methods, such as analysis of citations and resources, library usage studies, and subject expert collection evaluation, are used to judge the value of library resources.^[53] The acquisitions staff of hospital libraries, one-person or larger, perform a variety of tasks that address many complex issues concerning licensure, contracts, discounts, and electronic format of resources.

Collection Development

The library's mission, objectives, and goals reflect those of the parent organization, as do the library's collection development policies. The information needs of the organization served by the hospital library are figured prominently into the collection development plan.^[54] Selecting materials for inclusion in the collection of a hospital library can be a complex process. The needs of library clientele, the current collection strengths and weaknesses, the demands of cooperative collection agreements, the need to preserve historically important documents, the available space, in-house and online journal use counts, and impact factors enable a balanced, objective approach when making difficult choices of how to spend limited collection development budgets.^[55,56] The scope of the collection development plan parallels the organizations commitment to various activities and disciplines. The proliferation of published materials, in all forms, is so vast that no single hospital library, not even the largest, can hope to acquire everything. Selection is necessary to ensure the viability of the collection and the incorporation of various materials in subject specialties. The underlying principle of the selection policy defines what the library should get rather than what it does get.^[57] The basic principle of selection is derived from assessing and understanding the needs and interests of the clientele and applying basic selection principles. Assessment of information use, demand, and needs of library user groups, both potential and immediate, provides a context for the library staff to make selection decisions for the library.

Medical books correlate information from many primary sources such as journal articles and present the subject in context, often revealing both past and present advances, and future trends. Medical books provide tremendous timesaving when clientele need comprehensive literature analysis, review and comparisons to find different perspective, interpretations, and outlooks.^[58] The transformation of traditional print medical books to online digital electronic books is occurring very rapidly. Online medical books are an important resource for digital library collection building, especially in the context of clinical medicine. Hospital libraries have a unique obligation to advocate for the shift from print book collections to electronic book collections. Hospital Libraries have been successful in increasing their electronic book collections by focusing on the elimination of space requirements for electronic books, the convenience of access, and the cost benefits of acquiring e-books within database packages, such as in the case of MD Consult. Consortial collaborative purchases of product such as STAT!Ref or Books@Ovid are other ways Hospital Libraries facilitate the shift to electronic books.

The hospital librarian has a responsibility to establish and maintain library liaison groups, to evaluate information trends, and to be proactive in response to changes in

health care.^[53] An important aspect of selection is learning about new publications that can enhance and strengthen the library's collection and purchasing the most appropriate format of that resource. Information is being packaged in a variety of innovative formats, yet budgetary constraints drive hospital libraries to develop more rigorous selection methodologies and to redefine the criteria and processes by which decisions are made to insure accessibility to resources and efficient allocation and use of funds.

Circulation

A major function of the hospital library is to provide conditions for optimal, seamless use of library resources by clientele both inside and outside of the library. Development of circulation policies and procedures for hospital libraries begins with the identification of the population to be served. The policies governing the use of the library by the clientele reflect and enhance the vision and mission of the hospital. Establishing use policies in hospitals often involves collaboration between the librarian(s), the library committee, and hospital administration. The library circulation policies reflect a wide range of library clientele with varying and unique needs.^[59] Circulation of print resources has been significantly impacted by the introduction and proliferation of electronic resources, yet many high use titles are maintained in both electronic and print format.

Access to the Library Collection

Information is viewed as a basic commodity in the health care field. Access to up-to-date, authoritative information is critical to the success of a hospital library in serving the needs of its clientele. The library collection is comprised of its information sources (i.e., journals, e-journals, books, e-books, audiovisuals, databases, practice guidelines, patient education materials and Web-based resources. Many hospital libraries, historically, have limited access to physicians, because of the limitations of spaces and staff, and the technical level of the library resources.^[60] Today's access to the hospital library collection is provided to all hospital staff and the community during normal business hours. After hours access is provided for clinical staff and hospital administrators, which give them 24-hr access to the resources of the library. The availability of books and journals in electronic Web-based formats provide opportunities for desktop access to library resources virtually 24 hrs a day. Desktop access to online catalogs, bibliographic databases, full-text journals, electronic reserves, and virtual reference services has visibly changed library use patterns. These new formats provide searching, filtering, analytical and access capabilities that aid in rapid location and critical appraisal of information. Libraries are experiencing decreases of in-house use of

library resources, with patrons opting to use the convenience of online full-text resources made freely available from the hospital library. The provision of resources in the myriad of formats currently available support the "equal access to health information resources" called for in MLA's WHCLIS platform.^[61]

Access to Bibliographic Information

Two types of documents (indexes and abstracts) contain catalogs and bibliographies of original materials, primarily articles in periodicals. The National Library of Medicine created Index Medicus, a finding aid for biomedical journal articles. Index Medicus was produced as a monthly listing of current articles and cumulated yearly into the Cumulated Index Medicus. Index Medicus is the paper index whose entries dating back to 1966 comprised the MEDLINE database.^[62] Most indexes and abstracts used by hospital libraries are currently available electronically. The "List of Serials Indexed for Online Users" (LSIOU), listing 5164 journal titles, provides bibliographic information for all journals ever indexed over time for MEDLINE®. It includes titles that ceased publication, changed titles, or those that were deselected.^[63,64] CINAHL, the Cumulative Index to Nursing and Allied Health Literature was originally a print index to the literature of nursing and eventually allied health information. The CINAHL® database has emerged as a comprehensive, authoritative and versatile guide to current periodical literature for nurses, allied health professionals and to an exploding body of health related knowledge, which now extends beyond the limits of a bibliographic print index. Approximately 2900 nursing, allied health, and health related journals are regularly reviewed and indexed for inclusion. Full text articles are available for selected nursing standards, practice acts, pamphlets, state nursing journals, research instruments, and critical paths.^[65]

For subject areas not highly demanded, hospital libraries obtain journal article information by searching other indices and databases. For subject areas in high demand, libraries purchase a site license to the Web-based content, access databases through resources purchased in consortia packages, call upon colleagues at academic medical center for help, or use resources of statewide library resource sharing project such as Georgia's GALILEO. GALILEO, or Georgia Library LEarning Online, is a world wide Web-based virtual library, providing access to multiple information resources, including secured access to licensed products. GALILEO provides access to over 100 databases indexing thousands of periodicals and scholarly journals, 2000 full-text journal titles and other resources including encyclopedias, business directories, and government publications available primarily to citizens of Georgia.^[66] Many states have similar resources that hospital libraries tap to locate needed resources. One major

advantage of electronic indexes and abstracts is the feature that enables clientele to search for information using words from titles and abstracts in addition to the author and subject access provided in print versions. This significantly expands the number of information paths available to locate bibliographic information.

Library catalogs are used in the circulation and location of library resources. The early systems still used by only a few hospital libraries are catalog card dependent. This type of card catalog facilitates location of library materials though access to cards organized by subject, title, and author. Hospital libraries now use computerized integrated library systems (OPAC) Online Public Access Catalogs, which record information about both the user and the circulating materials. The OPAC records are created from the library's electronic bibliographic records. The records are accessible through searching software. OPACs can be a part of an integrated system or self-contained packages, as they are in many hospital libraries.^[63] The online catalog provides menu-driven searching of book, journals, and audiovisual databases by author, subject, title, format, and keyword. These catalogs provide features such as browsing by title, limiting searches by date, access from remote terminals and other specialized features.

EDUCATIONAL SERVICES

End-User Training in Database Searching

Bibliographic instruction (BI) of medical literature searching in the hospital setting focuses on teaching effective use of appropriate health information resources. Many hospital librarians provide BI to new and seasoned employees, residents, nursing students, house staff, and liaison groups of the hospital. Topics traditionally taught include accessing and organizing information, using library locator tools, citation verification, computerized bibliographic database use, searching electronic journals, utilizing interlibrary loan services, and using Medical Subject Headings (MeSH).^[67] Internet searches for information constitute one of the most popular applications taught in BI. Training of end user (library clientele) to search in-house databases, Web-based resources and electronic full text journals are high-profile services common in hospital libraries. Alper and Visnon conclude in a study at the University of Missouri, that introducing students to useful Web sites, practicing answering clinical questions, and integrating this process with clinical rotation experiences can reduce the effort that students need to find answers and improve the quality of answers they find.^[68]

The introduction of end user searching systems beginning in the late 1980s initiated a wave of change at the traditional reference desk as users began to discover new ways to utilize library services. With the introduction of end user MEDLINE in the 1980s, many hospital libraries

found an increase in requests for individualized instruction, technical assistance, and in-depth reference assistance. With the availability of new information resources, library users find reference services helpful in helping them adapt to newly emerging information landscapes. Enabling end-user access has contributed to a decline in traditional reference services such as mediated searching yet has stimulated the development of new roles of hospital librarians performing more comprehensive subject focused expert searching, filtering, and critically appraising literature.^[69] Critical appraisal is the study of two main elements of research; how the research was performed and how the research and findings are presented. When hospital librarians critically appraising a study they are attempting to reduce the uncertainty, focus on important issues, dissect complex problems and corral group participation. Critical appraisal is an essential step in evidence-based decision making. The decision to implement change can be made more accurately after conducting a critical appraisal.^[70]

The need to assess the quality of end-user training has drawn attention to the need to evaluate both search ability and the ability to use the resulting information to accomplish a clinical task. End-user searching is usually conducted using electronic bibliographic databases such as PubMed and CINAHL. These databases allow searching by keyword and retrieval of references list. The end user must then sort, read, and critically evaluate the results to uncover answers and results for patients. New third generation evidence-based medicine search engines allow access to hundreds of the best known therapy options through clinical knowledge management systems. These systems use simple "ask a question" interfaces to retrieve the latest peer reviewed research. Results are synthesized into article summaries, tables and graphs with links to original articles. Hospital librarians teach end users to search these databases focusing on their ability to synthesize large bodies of information, and the expanded modules available. Up-to-Date, Dynamed, Cochrane, Google Scholar, Pubmed, and Medical Evidence Matters are valuable resources for obtaining new evidence-based medicine information.^[71]

REFERENCE AND INFORMATION SERVICES

Reference and Information Services are the services that range from provision of quick answers to simple questions, to providing in-depth research to answer complex questions. The challenge of reference services is providing precisely what the client needs, in the allotted time, and format.^[72] Day-to-day reference work in a hospital library follows a pattern influenced by the nature of the requests for services. Hospital librarians conduct reference interviews, the process of asking open-ended questions, to clarify the client's request, in-person, via telephone, and even virtually. Request for information takes several forms: factual or "direct" inquiries, bibliographic or "indirect" inquiries, and

verification request. Factual inquiries include statistics, biographies, locations, a historical data, a formula, a definition, or some similar fact. Five filters are used by librarians to translate request into searchable questions. They include defining or qualifying the subject, establishing the need for the information, pinpointing personal traits of the requester, exploring the relationship of the inquiry to the organization, and determining acceptable answers.^[73] The rise in electronic document access has revolutionized rapid delivery of health sciences information, making desktop access to and electronic delivery of health sciences information the preferred method.

Reference

The reference process consists of three primary elements: information, the user, and the librarian.^[74] Hospital libraries house a myriad of sources, which prove to be useful for answering factual questions. Virtually every book and journal in the collection is a potential information source. However, dictionaries, directories, catalogs, handbooks, encyclopedia, or similar publications are typically referred to as reference resources because of their format. The user or client is the person posing the question, who generally is unsure of what information they need or the best method of locating needed information.

The role of librarians in the current problem-based hospital environment is to provide the knowledge that facilitates expert performance. The hospital librarian interprets the reference question, evaluates available resources, and identifies the exact resource to supply the answer.^[9] Reference services can be broadly divided into three functional areas: 1) information retrieval; 2) information access; and 3) information management. Performing reference services, librarians have traditionally given personal assistance to clientele making the best use of collections to satisfy their information needs. Librarians use their skills and acquired techniques to access, sort, transfer, evaluate, filter, and disseminate information.^[75] The publication of printed catalogs and bibliographies, the accessibility of online catalogs and multimedia databases, along with the organizing of the national interlibrary loan system (DOCLINE) have widened the range of resources available to the individual library client.^[76] As a result, librarians are increasingly called on to help clientele determine the most efficient tools to use in their research. In hospital libraries, assistance includes explaining the layout of the library, the process of locating material, and the availability of services. Also, providing guidance about information on subject-specific medical resources is a popular service. This process is greatly expanded by the enormous increases in research worldwide, the virtual explosion of Web-based electronic resources, and the quantity of language formats available for media and publications.

Virtual reference, the delivery of personalized information resources to users physically outside of the library, is

a sophisticated use of Web-based technology, yet only being explored and contemplated in the majority of hospital libraries.^[77] The potential benefits of using a virtual reference chat service to answer remote patron questions has not been convincingly conveyed to hospital librarians. Providing key services through the Internet has challenged hospital libraries to embrace the library without walls philosophy. It has become increasingly important to reach those people who don't come to the library to request library services. Chat services offering personal and immediate connections provide a place to connect with users and non-library users offering them both convenience and information service. Questions directed to virtual reference services ideally are ready reference questions that can be answered quickly. Complex labor intensive reference questions are often answered via e-mail following the chat session, if additional resources are needed. Many questions can be answered satisfactorily using features such as co-browsing or page pushing that facilitate librarians demonstrating use of electronic resources. Firewall issues and Hospital Information Technology department restrictions block many hospital libraries from using popular free chat based utilities like AOL instant messenger, MSN messenger, Yahoo! Messenger, Google Talk, or Trillian. Commercial services such as Docutek, Tutor.com, Live Chat and QuestionPoint are expensive and often out of reach for hospital libraries. Hospital libraries are finding ways to work cooperatively with Information Technology to uncover the benefit of the free virtual reference environment.^[77]

Information Services

The subject search is one of the areas on which advancing technology has had the greatest impact. The transformation from timed fee-based database searching, to CD-ROM access, to free Web-based access to MEDLINE has provided hospital librarians the opportunity to search more thoroughly and use specialized features to create a variety of enhanced services. In many hospital libraries, a variety of computer-based information retrieval systems provide access to materials on- and off-site. For example, one development in subject access increases the amount of information that is available within library catalogs by including details from the table of contents, a book's index or keywords. Other systems provide enhanced features that include full-text articles, and links to related articles. "These full-text references eliminate intermediate steps characteristic of older systems requiring users to first perform an electronic search and then obtain the articles themselves in print."^[78]

MEDLINE

The availability of electronic resources has made a dramatic impact on today's health care professionals' access

to information. The need for information services in a hospital setting has rapidly changed as the virtual library emerges. A trend equally important is the ongoing role hospital librarians play in creating, strengthening, reshaping, and transforming hospital libraries into integrated knowledge management centers.^[63]

The literature search is one of the primary services of hospital libraries. MEDLINE, the National Library of Medicine's database of references provide access to more than 16 million articles published in 5000 biomedical journals. The subject scope of MEDLINE is biomedicine and health, broadly defined to encompass those areas of the life sciences, behavioral sciences, chemical sciences, and bioengineering needed by health professionals and others engaged in basic research and clinical care, public health, health policy development, or related educational activities. MEDLINE also covers life sciences vital to biomedical practitioners, researchers, and educators, including aspects of biology, environmental science, marine biology, plant and animal science as well as biophysics and chemistry.^[79] Many of the listings also have short summaries of the article (abstracts) and quite often a link to the complete article (full-text) through BioMed Central or a link to the journal. Most of the articles found in MEDLINE are written for health professionals and thus are complex and not easily understood by layman.^[80]

In 1997, the National Library of Medicine opened up MEDLINE (the world's largest database of medical literature) to the public on the Internet free of charge. PubMed is the National Library of Medicine's search service that provides access to MEDLINE, PreMEDLINE, and other related databases, with links to participating on-line journals. Access to medical information is provided by a number of aggregators supporting access to several biomedical databases and electronic journals using one common search protocol. Aggregators such as OVID, EBSCO, Thomson, Elsevier, and McGraw Hill producing such products as MD Consult, Up-to-Date, DynaMed, STAT! Ref, and many other products are commonly used in larger hospital libraries and those affiliated with teaching hospitals, whereas smaller hospital libraries depend primarily on free access to PubMed and its related biomedical resources.^[9]

Current Awareness Services

Hospital libraries provide current awareness services sometimes called SDI's (Selective Dissemination of Information or Alert Services). These services set up literature searches on specific topics that are run automatically to provide current updated information. Patrons are alerted periodically via e-mail, receiving URLs to web pages of automatically generated updates to their selected topic and of new journal issues, and new publications pertinent to their field. This type of service can increase a user's ability to keep current and may have a positive

impact on efficiency and productivity.^[81] Some hospital libraries use (TOC) or Table of Content Services as a means of promoting review of current article titles. The TOC allows library clientele to view online contents pages of journals selected from the hospital's list of serials. These services are ideal for keeping patrons up-to-date on their areas of interest.^[82] For those hospital libraries unable to subscribe to fee-based TOC services, free alerting service such as Pubcrawler, BioMail and Jade whose scans are updated daily to PubMed databases and provides individuals with listings of new database entries that match their research interests.^[83] Other less expensive alternative methods such as scanning of tables of content pages and locally distributing them to enables libraries to increase access to journals and, more importantly, provides a viable alternative to routing and potentially losing journals. Some small hospital libraries still use routing of new journals from office to office as their method of increasing clientele awareness of recent journal literature.

Interlibrary Loan and Document Delivery

Interlibrary loan (ILL) is the process of borrowing and lending books, audiovisuals, and journal issues to other libraries for use by library clientele. Interlibrary loan is a long-time cooperative effort among all types of libraries, as are serials union list and cooperative cataloging projects on the Internet, such as EPIC/OCLC (Online Computer Library Center) and RLIN (Research Libraries Information Network).^[84] Document delivery is the process of delivering journal articles or photocopies of needed documents. Hospital libraries use DOCLINE, a comprehensive routing system of the National Library of Medicine to facilitate reciprocal borrowing and lending of library materials from hospitals and major medical libraries around the world. Hospital libraries routinely use DOCLINE as their primary electronic network for requesting loans and lending resources.^[85] More than 57,000 libraries in 112 countries and territories around the world use the Online Computer Library Center (OCLC) services to locate, acquire, catalog, lend and preserve library materials. Hospital libraries use OCLC to locate nonmedical documents, reports, proceedings, and other nontraditional resources.^[86] Larger hospital libraries sometimes purchase software that allows them to manage their resource sharing activities. OCLC's ILLiad Resource Sharing Management Software helps libraries automate routine interlibrary loan functions, which increases productivity and dramatically reduces paperwork.^[87] All of the library's borrowing, lending and document delivery activities are managed through a single Windows-based interface, which allows library patrons to submit and track their own requests via the Web. Prospero, an open access Document Delivery System is available free of charge to libraries seeking low cost resources management software.^[88]

Outsourcing

An alternative to in-house initiation of document delivery, cataloging and other library services used by some hospital libraries is the contracting of library services to independent information professionals, information brokers and consultants. Hospital libraries use independent information professionals or consultants when patron expectation of rapid delivery increases and more comprehensive document delivery services are needed. When budgetary constraints prevent hospital libraries from supplying needed materials, library clientele are sometimes referred directly to independent information professionals or consultants often affiliated with the Association of Independent Information Professionals (AIIP).^[89] The Association of Independent Information Professional members are owners of firms providing such information-related services as online and manual research, document delivery, database design, library support, consulting, writing, publishing, library space planning, website design strategic planning and overall information architecture.^[90]

Online Access to Other Library Collections

For years, libraries shared information about the resources held in library collection through union catalogs available on microfiche or in print using the consortium approach. Access to Web-based union catalogs has enhanced the hospital libraries access to library resources owned by other libraries. These catalogs have been redesigned and have evolved to Web-based products, such as WorldCat, OCLC's union catalog. WorldCat is the world's largest collaboratively-produced network of library services built upon a massive database of bibliographic, ownership and other forms of metadata. The core WorldCat database contains the merged catalogs of thousands of OCLC member libraries and is collectively maintained by those members' information professionals. WorldCat includes over 88 million bibliographic records and serves more than 57,000 participating libraries worldwide.^[91] Hospital librarians search the computerized catalog holding of libraries around the world to locate needed resources. The National Libraries of Medicine offers hospital libraries an invaluable resource for locating hard to find materials, foreign journal titles, and obscure publications.^[92,93] Hospital libraries use NLM's online catalog, LocatorPlus (<http://locatorplus.gov>) to find biomedical articles held by academic medical centers, hospitals, and other health care agencies. LocatorPlus is continuously updated and includes: over 1.2 million catalog records for books, audiovisuals, journals, computer files, and other materials in the Library's collections. Holdings information for journals and other materials, links from catalog records to Internet resources, including online journals and circulation status information for materials, even those on-order or in-process at NLM can be found in LocatorPlus.^[94]

ADMINISTRATIVE AND MANAGEMENT

The hospital library manager will spend much time in the future developing analytical skills to look more at what can be rather than at what presently is the state of hospital libraries. Steven O'Connor notes that a change in thinking must occur, suggesting that library managers must understand not only what business the hospital library is in but what business it should or could be in.^[95] The use of new cutting edge technologies, more stringent legal requirements, heightened standards of accountability and outcomes driven services have dramatically impacted the management of services, staffing, and physical facilities of hospital libraries. Hospital library managers are responsible for budgeting and personnel management, as well as developing policies for acquisitions, planning, marketing, fundraising and service evaluation. Hospital library managers analyze customer satisfaction data to restructure priorities, functions, and supporting services of the library. Keeping up with the enormous amount of information available, forging new methods for 24/7 access to up-to-date biomedical resources, and mapping out unique approaches to outreach are only a fraction of the managerial decisions that hospital librarians face each day. Like managers of other hospital departments, hospital library managers use tried and true participatory and shared models of management to engage employees in the day-to-day operations of the library. In addition to making organizational information decisions, hospital library managers review policies and procedures, comply with internal organizational mandates and create, implement and sustain a vision of service for the hospital library. Hospital library manager must face the hard cold fact that perception of service bears far greater importance than reality. These managers exhibiting intelligence, creativity, and leadership must be willing to leave their comfort zone and begin to mold and shape the perception of reality of their clientele.

Fiscal Management

A mission statement quickly and concisely identifies the role of the one-person or multiperson library, connects it to the parent organizations' mission, and describes briefly what the library does. As part of their administrative duties, hospital managers develop skills in preparing, presenting, and negotiating appropriate budgets. Collective concortial purchasing, creative fund-raising, and project-specific grant writing are alternative means of acquiring needed funds for operational, personnel, and capital expenditures. The hospital funding environment, particularly for technology purchases has become very competitive. Many hospital libraries must prepare business cases and cost savings analysis that illustrate the return-on-investment expected to justifying expenditure of large technology purchases. The National Networks of

Libraries of Medicine and the Institute for Museums and Libraries Services are but a few of the national organizations that offer to large and small hospital libraries, funding options through grants proposal solicitation.

Human Resources

Hospital library managers are responsible for the recruitment, hiring, evaluation, professional development, and ultimately the retention of staff in the hospital library. It is not uncommon to have a library staff range from .5fte to 5fte. Regardless of staff size, staff development is important to personnel enrichment. In today's hospital setting, library team dynamics are extremely important. Librarians serve on teams with their library colleagues, as well as with colleagues from other hospital departments and other hospital affiliates. Working in a library presents unique service-oriented situations, as a vast percentage of your requests come from unscheduled encounters, walk in, phone in or e-mail request. This creates special time management challenges, whereas in most other professional environments clients are meticulously scheduled.^[96] Balancing the management of time, setting goals and priorities and appropriately delegating responsibilities are proven strategic skill sets that hospital librarians and hospital library managers must fully embrace. In the fast paced clinical environment where scheduled agendas can quickly be erased by the need for clinical information to deal with a medical emergency, it is imperative that hospital librarians master the art of providing just in time, right on time health information.

Marketing

Marketing perpetuates the hospital library focus on customer-centered approaches to promoting health and wellness. Hospital librarians continuously reevaluate services and target markets to assess the true value of library services. Establishing library advocates among library users and supporters to champion library causes is a strategically insightful way of avoiding budget cuts and staff downsizing. The Internet and newly created social technologies have presented fresh approaches to reaching target markets. Using resources like Blogs, Wikis, Podcast and unlikely sources for advertising like Facebook or Utube hospital libraries can provide the visibility that the library needs to attract new patrons and meet the new generation of users where they connect. For many hospital libraries word-of-mouth marketing has worked for years, however, as hospital systems grow and expand, more and more hospital libraries develop more formalized marketing efforts. National Medical Librarians month in October and National Library Week in April are great times to devote to marketing of current and new services for the library. New marketing techniques such as merchandising can be useful to hospital libraries in drawing attention to

their consumer health information collection.^[97] The fundamental function of merchandising is to encourage the customer to discover and select more than they anticipated. Strategically placed, book features prominently displayed and other powerful illustration play a crucial role in steering customer traffic. Merchandising does the job of maximizing turnover of popular categories or drawing attention to under-utilized parts of the collection. The overall objective is to create interest and prompt impulse loans.^[98]

Planning

The rapid pace of change and the transformation from traditional library roles to new roles supporting advanced technology and electronic environments requires library staff to routinely conduct service audits and environmental scans. Strategic planning and scenario planning are critical component of an efficient, cost effective hospital library operation plan. To stay agile and responsive to client needs hospital libraries need to examine their services, processes, and structure.^[99] Using the mission and vision of the hospital the hospital librarian examines the environment to develop an environmental scan, conducts a SWOT analysis, and map out goals supported by measurable SMART objectives. Developing a staff strategic plan for 3–5 years is recommend, although the library staff should review the strategic plan often to make sure that their services, collection development, educational programs, and capital expenditure are aligned with the stated goals.

Space planning supports the library's strategic direction, creating a reality of collaborations and virtual service. The hospital library manager charged with the task of planning renovations and new construction of hospital libraries space seeks to blend high tech and high touch services. Using vision, knowledge of operations, functional process analysis, and flexibility, library managers can assist architects in designing space that is both aesthetically pleasing and functionally sound. The current trend in libraries is to devote a significant portion of the space to computers and collaborative meeting space.^[100] Electronic resources have reduced some of the needs for collection space but surplus workspace in hospitals is always at a premium and rarely available.

As demands for hospital resources increase, hospital library managers face competition for limited resources, and therefore, must continuously cultivate their management skills and fiscal resources to be competitive and effective. The future hospital library manager will need to have a more global outlook, applying more flexible and creating more options for developing plans for the hospital library.

Assessment

The Medical Library Association Standards 6 for medical librarians recommends that librarians provide evidence of

an ongoing assessment of the knowledge-based information needs of the organization and best practice.^[101,102] The hospital librarian is charged with developing and implementing a plan to provide appropriate resources, services, and technology to meet those identified needs. Library decision makers can more accurately evaluate the quality of current library services, and appropriately allocate scarce resources when assessments of library performance are properly designed.^[103]

Using many adapted variations of formal and informal tools, techniques and methodologies hospital librarians assess the knowledge-based information needs of the hospital or health care organization. Assessments that incorporate, opinions and feedback from library users and nonusers can play a significant role in directing the library's strategic path.^[104] Some of the more popular techniques used include focus groups, surveys, usage patterns analysis, environmental scans, strategic planning, inventory, budgetary planning, and one-on-one interactions with health care leaders focusing on clinical and organizational information needs.

ORGANIZATIONAL CONTRIBUTIONS

Access to the Internet

Staff access to Internet services is available in most hospital libraries; however, public access to the Internet may not be as accessible, depending on the size of the library, the availability of computer workstations, and type of Internet connections available. When the computer to user ratio changes from "one to one" to "many to one" a significant change in how people relate to health information can be expected. Libraries use the Internet to access resources in response to reference questions, for searches on specific data, providing public access to customers, participating in listserv or discussion groups, and relaying resources electronically to their customer.^[74] Constructing home pages for World Wide Web access has become a vital activity in hospital libraries. Library staff participates in defining policies and setting guidelines, designing user-friendly interfaces, and producing easy access to all inclusive electronic information resources. Community hospitals in rural and isolated areas have traditionally lacked the infrastructure for institution-wide access to the Internet, so dial-up access is used as a low-cost, low-risk means of access to the Internet for the hospital library. Using the Internet to connect community hospitals with major research centers is particularly important especially in areas sparsely populated and where large distances separate facilities.^[74] Advances in telecommunication and information technologies have been the foundation of connectivity for small and community hospitals.^[105] Hospital libraries that directly access the Internet are connected through the organizations' computer network. As with so many other

initiative in community hospitals cost remains a major barrier to establishing direct connections to the Internet. The National Libraries of Medicine recognizes the role of information in the provision of care and have developed, through the Regional Medical Libraries, Library Improvement Project Grants and Express Welcome Grants to assist community hospitals in getting equipment and Internet Service Providers to connected to the Internet.^[106]

Hospital librarians play a central role in introducing the Internet to clinical settings. Trends show a rapid increase in the Internet's importance as a source of medical information. The Internet has the potential to empower patients and to bring evidence into medical practice, but also to facilitate reference questions, instruction and seamless access to endless health sciences resources. External information resources continue to be more affordable and more readily available to hospital libraries of all sizes. These external resources help create a network of virtual resources that expands the collection of even the smallest hospital library. To meet the information needs of health professionals, many librarians are using the Internet to access NLM databases and other specialized databases for document transmission, search training tutorials, extend library hours with after hours access, connect directly to NLM publications and other resources, and participate in professional discussion groups and electronic mail.^[107] The vast amount of current information on the Internet and the relative ease with which it can be searched make it today's best medium for health research.

Customized Services

Hospital librarians are information experts who can decipher the vast body of information available in print and nonprint resources. Along with providing information on what is available additionally they customize search strategies that help locate the exact information needed. As an accepted organizational information experts hospital librarians participate on internal committees, special task force, new project initiative and as vital members of the information management team.

As educational programs and the need for continuing education expand, hospital libraries provide medical students, residents, health care providers and hospital staff with resources for participation in distance learning, technology application, social networking connections and system-wide collaborations. Likewise they provide opportunities to access continuing education programs using cutting-edge technologies, such as podcasting, webinars, video streaming, web casting, and using other digitally formatted media.

Services for Decision Makers

Hospital administrators play a vital role, managing hospitals, outpatient clinics, hospices, long-term care facilities

and drug-abuse treatment centers. The hospital administrator's primary job is to make sure the hospital operates efficiently and provide optimal medical care to patients. Their abundant responsibilities sometimes require the assistance of support staff such as hospital librarians. Administrators focus on expanding existing programs and services and developing new ones for preventive medicine and systematic research, in research oriented hospital. Administrators in teaching hospitals focus on pursuits necessary to educate future doctors. They plan and monitor departmental activities, evaluate health care professionals, create and update policies, develop medical treatment standards, continuously improve quality patient care services, and proactively participate in fund-raising and community health planning.^[108] Hospital administrators must keep up with innovations and advances in the medical and health care environment, computer and information technology, diagnostic and therapeutic equipment, government regulations, health insurance industry trends, and financial options. Hospital libraries provide the comprehensive, reliable information.^[108] Hospital administrators need to make critical decisions about the myriad relevant health issues and the exponential changes and challenges in health care. The hospital library serves the administrative and health care needs of the administrators, supplying them with the tool needed to compare cost, review trends, assess feasibility and analyze return-on-investment. The foundation for administrators' priority setting criteria are interwoven in the mission of hospital libraries. Hospital library services support the organizations' strategic direction, supplies research for government regulation compliance, reinforces education and research through scholarly resource access, provides clinical evidence to insure clinical competence, and partners with patients and communities encouraging coordination, collaboration and seamless access to health information resources.^[109] Business resources such as *Business Week*, and the *Harvard Business Review*, in addition to newspapers, news wires and other business related databases are frequently searched and filtered by hospital librarians, to retrieve data, statistics, trends, regulations, standards, and data-driven information that impacts hospital policies and procedures. While doctors strive to keep the pulse regulated and the heart beating, the hospital administrators keep the hospital alive and vibrant with the expert assistance of hospital librarians who keep them well-informed and data-driven.

Clinical Medical Librarianship

Clinical medical librarians (CML) provide special services to teaching hospitals by participating in medical staff rounds with assigned clinical teams noting clinical questions as they arise. Clinical medical librarian services allow hospital librarians to be highly visible and integrated into research, teaching, and clinical services.^[110] The presence of the clinical medical librarian in the hospital

corridors often inspires clinicians to remember questions they had forgotten to pursue with the library. The clinical medical librarian is seen as a valuable team member in health care education and delivery. When clinical cases are presented, and discussed the clinical medical librarian is able to recognize and respond to information needs that are never formally voiced or directly requested. The clinical medical librarian sees medical problem solving and decision making take place in the actions and the informal, abbreviated language of the health care practitioner. This gives the clinical medical librarian an opportunity to learn how knowledge-based information is used and to understand clinicians' requests more clearly.^[111] The future of clinical librarianship is deeply rooted in health sciences informatics and the Informationist. Health Sciences informatics has been defined as science that deals with the structure, acquisition, and use of health related information. Florance defines an informationist as one who is "cross-trained in medicine, computer science and information science."^[112] The role of the Informationist is to clearly understand the principles of clinical work and information science. The ultimate responsibility is to enable clinicians to apply better judgment based on improved use of medical literature.^[109] Davidoff estimates that of the 6500 U.S. acute care hospitals, only about 200 have implemented clinical librarianship programs due to the lack of financial incentives. Several funding ideas have surfaced such as, inclusion of cost in telemedicine grants and demonstrating information value to improved outcomes and cost reduction to the Health Care Finance Administration to justify reimbursement.^[112]

Health Literacy

Physician-patient communication is vital to patients complying with physician instruction; however, research shows that patients have problems understanding medical instructions from physicians. The use of medical jargon, the lack of confirmation that patients understand instructions, and the delivery of too much information at one time contribute to low health literacy. At the end of the medical encounter, patients remember less than half of what the physician tried to explain, and they may be uncertain about what steps to take next.^[113]

Thirty million Americans are below basic literacy levels and are unable to perform literacy task above simple, basic interactions, according to the 2003 National Assessment of Adult Literacy. Another 63 million are only able to read and understand short, everyday text, placing them at the Basic literacy level.^[114] Health Literacy is defined simply as the ability to read, write, and understand health information. Increasing attention has been given to the provision of health information to patients, families, caregivers, and the public. The American Hospital Association (AHA) has stated that health education is an integral part of high-quality patient care and has issued a Patient's Bill of

Rights, expressing patient's rights to obtain understandable information concerning diagnosis, treatment, prognosis, and support documentation for informed consent.^[115] Hospital libraries have been increasingly engaged in exhibiting their capabilities to provide easy to read, understandable information to patients. At the same time, new consumer health information services have been incorporated in hospital libraries, aiming to combine the subject expertise of the hospital library with the accessibility of the public library. The amount of published literature on health topics for lay people has expanded exponentially. The shift to consumer health information has been encouraged by government health policies that emphasize consumer's right to choose. In 1991, the Patient's Charter, which emphasizes patient's rights to receive health care on the basis of clinical need, regardless of their ability to pay, was launched by the government. More importantly for libraries, the charter guarantees patients the right to be given clear explanations of any treatment proposed, including risks or alternatives, before they decide on treatment.^[116] The Center for Clear Health Communication provides many tools to help libraries and health educators select easy to read materials and create health care documents using minimal jargon and simple easy to follow instructions.

Many contemporary patients expect to be educated about their medical conditions and treatment options. In response to these expectations, hospital libraries provide consumer health information written in layman terms to patients and their families. Books, magazines, videos, and computer-based resources are available to answer questions dealing with patient health concerns. The Medical Library Association has defined the role of the medical librarian in the provision of consumer health information. Their responsibilities are to determine the most prevalent diseases and to identify the most authoritative resources pertaining to these diseases.^[117]

Hospital librarians often use the National Library of Medicine's (NLM) MedlinePlus database, <http://www.medlineplus.gov> to locate easy to read patient education materials, drug information, and interactive tutorials. MedlinePlus provides access to MEDLINE and numerous other helpful tools, including a medical encyclopedia, several medical dictionaries, a drug reference guide, and general health information. MedlinePlus also includes detailed reports on the diagnosis, prognosis, and treatment of numerous medical conditions, along with links to hundreds of reputable health organizations.^[118] Hundreds of consumer health and layman-oriented web sites are currently available on the World Wide Web; however, the absence of authority of much of the information is a formidable problem. Different methods of quality control are being proposed for information on the Internet. One promising approach is automatic downstream filtering, the process of software (browser) checking of metadata-labeled information to determine if the information meets the personal quality requirement of the searcher. Metadata

describes the content and context of the information, thus allowing the user to determine suitability of the information for individual use.^[119] Hospital librarian also provide guidance on evaluating health information Web-site for accuracy and quality.

In recent years, there has been a growing body of research producing evidence on the positive effects of the provision of information to patients. These positive effects are noted as improved patient satisfaction, reductions in pain, fewer postoperative complications, shorter hospital stays, reduction in blood pressure, and improved self-management of conditions such as diabetes and kidney disease.^[120] In 1991, a consensus statement was issued "underlining the effect of information giving." Two key areas were identified as benefits of giving health information: reduction of anxiety in patients and families and increased compliance with medical instruction given by care providers.^[121] The power of information to produce a more informed, thus more compliant patient population is becoming evident. The provision of information to patients is equated to raising expectations, challenging professional mystiques and outdated ideas, sharing decision making, and most importantly, sharing power. All health care consumers need access to a wide variety of unbiased health information resources, regardless of their age, sex, educational level, socioeconomic status, or ethnicity.^[122]

CONTRIBUTIONS TO OTHER HEALTH CARE ORGANIZATIONS

Participation in Cooperative Networks

"The focus of library cooperation is the network. The network is defined as, a group of individuals or organizations that are interconnected to form a system to accomplish some specific goal." Hospital librarians serve as knowledgeable guides through the maze of resources and as liaisons to networks with other libraries for resource sharing.^[123] Hospital libraries participate in cooperative networks with the National Library of Medicine, other hospitals, and academic health science libraries to expand their base of available resources. Hospital libraries band together to form consortia that provide enrichment opportunities for hospital librarians, maximize purchasing power, and address community health needs. Hospital library consortia support law librarians and their thirst for medical information, public librarians, in their quest for medical information retrieval skills, and other special libraries seeking comparative medical information for benchmarking, innovative research and scholarly enrichment.

Loansome Doc

Library staff are extremely service-oriented, providing access not only to all categories of staff at the parent

institution but frequently also to community health professionals not affiliated with the institution and to patients and their families. Many hospital libraries participate in the National Library of Medicine's program of supplying medical documents to health professionals not affiliated with their parent institution. Recent surveys show that usage of Loansome Doc is low. Additionally, the major barriers to use are cost and timeliness of the service.^[124] Greater promotion of what Loansome Doc is and how it can benefit libraries can increase the number of participating libraries. While satisfaction of Loansome Doc end users is high, satisfaction could be increased with more help on the PubMed screen, more library training, and faster delivery methods.^[125]

Loansome Doc is a service that allows nonaffiliated groups or individuals to set up an agreement to have a specified hospital library serve as their "home" library for retrieval of articles and library resources that they need. Independent unaffiliated physicians, attorneys, pharmaceutical companies, and other health care organization representatives search MEDLINE and then request photocopies of articles of interest via Loansome Doc. Copies are provided from the home library collection or requested by using the DOCLINE network.^[126] These services are generally provided on a cost-recovery basis.

Hospital libraries advocate for access to authoritative up-to-date health information for all affiliated users. Hospital librarians provide an environment that discourages the digital divide by providing libraries with computers for access to technology and fostering an open attitude of cooperation.

FUTURE CHALLENGES

In the information age, sensitivity to the stresses of change affect information utilities like libraries as much as they do other organizations. In a time characterized by layoff, downsizing, rightsizing, restructuring and reengineering, the ability to look forward reflectively, and plan for significant transformation in health care is a huge challenge to all types of libraries, but especially hospital libraries. Future challenges for hospital libraries and the librarians that staff them will center on finding solutions to budgetary constraints, significant changes in user demands, and effects of massive technological changes. The continued need to reach out globally beyond physical walls, firewalls and country boundaries drives the vision of the global virtual library. Heighten pressure will engulf hospital libraries forcing them to continuously demonstrate their contribution to better health care outcomes through the provision of point-of-care access to information resources and services. The visual illustration of the hospital libraries' positive impact on the bottom line of the organization will also be a point of concern. Hospital libraries continue to be challenged to demonstrate their value through

research, outreach, making multiple resources available to patrons onsite and offsite, and revising data gathering. Concentrated effort will also be centered on improvement of dissemination operations, analyzing and evaluating self-help information access, mapping information activities to outcome measures analysis, and visibly supporting innovative problem-based learning, and evidence-based medicine practice.

Electronic Resources

Desktop access to online catalogs, bibliographic databases, and full-text journals is changing library use patterns.^[127] Hospital libraries' shift from ownership of physical collections to licensing content for electronic resources has occurred quickly in support of medicine and science, despite budgetary limitations.^[128] Changes in the practice of medicine and technological developments offer hospital librarians unprecedented opportunities to select and organize electronic resources, use the web to deliver content throughout the organization, and improve knowledge at the point-of-need. Due to the vast array of available electronic products, access protocol, and pricing structures hospital librarians are faced with anticipating the electronic resource needs of users, identifying leading resources, making sound budgetary decisions, efficiently managing the collection, and seamlessly organizing health information resources. The electronic resource marketplace requires much vigilance, considerable patience, and continuous evaluation. Hospital librarians employ several strategies to proactively stay ahead of the electronic resource curve, including accepting and marketing free trials from publishers; conducting user-based new product evaluation; monitoring and testing products directly marketed to clientele; beta testing new products and services; working with aggregators or re-publishers; joining vendor advisory boards; benchmarking institutional resources against competitors; and forming or joining a consortium for group negotiating and purchasing.^[129] Access to electronic books and journals in large and small hospital libraries is due in part to publishers providing limited free access to electronic journals when print copies are purchased, and greatly attributed to shifts in physician's demands for easy to access information resources onsite and offsite. Hospital libraries continue to struggle with journal issues such as access vs. ownership. Constantly faced with electronic access issues ranging from content, licenses, cost, interfaces, technical presentation, and management of electronic journals, hospital librarians are called upon to develop new strategies for building the library's collection and integrate digital resources. Recent trends in hospital libraries shows evidence of a growing shift toward totally digital libraries in hospital settings.^[130]

Electronic document delivery systems are setting the stage for exploitation of image technology and providing

more global access to full-text digital images. The development of document delivery enhancement products, such as ILLiad and Prospero, to assist in the efficient management of document delivery processes have helped hospital librarians reduce turnaround time on delivered health care documents, improve customer service and better manage their electronic resource.^[131] The quality standards of electronically delivered documents continues to improve as PDF (Portable Document Format) formatting of electronic documents is adopted nearly universally as the format of choice.^[132] Hospital librarians join their academic counterparts to advocate for the adoption of HTML (Hypertext Markup Language), SGML (Standard Generalized Markup Language) and Open eBook, XML-based formats as the new standards for electronic content.^[133]

Training in the use of electronic resources is extremely important in the hospital library. Not only are hospital librarians responsible for acquiring and organizing electronic content but they must assess the best ways to train hospital personnel in the effective location, access method and utilization of electronic resources.

Social Networking Technologies

Witnessing a rapid increase in the use of Web-based “collaborationware” in recent years has made hospital librarians begin to seek ways to implement this technology in the hospital library. Web 2.0 applications, particularly wikis, blogs, and podcasts, have been increasingly adopted by many health sciences libraries. This “collaborationware” offers the opportunity for powerful information sharing and ease of collaboration. Their ease of use and ability for rapid deployment make them desirable particularly for hospital libraries however, often hospital system firewalls prevent their implementation.^[134]

Wikis are Web sites that can be edited by anyone who has access to them. The word “blog” is a contraction of “Web Log”—an online Web journal that can offer a resource rich multimedia environment. Podcasts are repositories of audio and video materials that can be “pushed” to subscribers, even without user intervention. These audio and video files can be downloaded to portable media players that can be taken anywhere, providing the potential for “anytime, anywhere” learning experiences (mobile learning). Wikis, blogs, and podcasts are all relatively easy to use, which partly accounts for their proliferation. The fact that there are many free and Open Source versions of these tools may also be responsible for their explosive growth. Web 2.0 sociable technologies and social software are presented as enablers in health care environments.^[135] The most prevalent social networking technology includes: social networking services, collaborative filtering, social bookmarking, folksonomies, social search engines, file sharing and tagging, mashups, instant messaging, and online multiplayer games. The more popular Web 2.0 applications in education, namely wikis,

blogs, and podcasts, are but the tip of the social software iceberg. Web 2.0 technologies represent a quite revolutionary way of managing and repurposing/remixing online information and knowledge repositories, including clinical and research information.^[136]

As internal organization Information Technology departments loosen their restrictions on the use of social technologies in the hospital environment, hospital libraries will be challenged to incorporate these “collaborationware” technologies to more seamlessly connect, and collaborate with library patrons. The new social technologies combined with innovations with instructional technology create new digital learning environments for educating hospital staff in the use and location of digital resources. Research centered on information-retrieving patterns of clinicians and other focused groups will become more important in the design of libraries and the introduction of new services. As hospital libraries grapple with staffing issues, they will see an increased need for development of instructional interactive video media for provision of more seamless library tours, orientations, and bibliographic instruction.^[137]

Evidence-Based Librarianship

The evidence-based movement has changed in response to health care; as a result, evidence-based healthcare has evolved with greater flexibility and adaptability for disciplines outside clinical medicine. Evidence-based librarianship (EBL) incorporates the decision-making framework, the basic process, and many similar research methods apparent in evidence-based medicine yet its’ flexibility and adaptability are characteristics of evidence based health care.^[138] The conceptual framework of evidence-based librarianship seeks to improve library practice using a combination of librarian experience and best evidence. It encourages the application of best evidence and the pursuit of increasingly rigorous research strategies. Hospital librarians are incorporating evidence based librarianship as they convert clinical information needs into answerable questions, tracking down and critically reviewing the best possible evidence, estimating benefits, judging value and ultimately developing clinical practice guidelines to efficiently guide future similar decisions.^[139] The EBL process enables hospital librarians to focus on a specific problem in need of immediate attention thus integrating research findings into their daily practice.

The EBL process consists of formulating a practical question, searching for the evidence needed to answer the question, and systematically evaluating the gathered evidence for its usefulness and validity for answering the initial question.^[138]

Health care professionals suffer from information overload and struggle to filter evidence relevant to their

field. Hospital librarians provide filtering and delivery of information specifically tailored to meet the needs of researchers and practitioners. One special need filled by hospital librarians is the production of systemic reviews. The systematic review process is the concept of evidence-based medicine (EBM), which Sackett defines as “the conscientious, explicit and judicious use of current evidence in making decisions about the care of individual patients.”^[140] One way hospital librarians provide support for EBM is by using the Cochrane method of conducting systematic reviews of the literature. The hospital librarian’s training as an expert searcher, organizer, and analyzer uniquely quality them to conduct systematic reviews.^[141]

Educational Role in Outreach

Hospital librarians are defining new expanded roles for supporting the educational needs of the hospital. As they do this they present a variety of opportunities to bring professional expertise to ongoing assessment and the development of best practice. New technologies provide new forums including using online instructional technology like Moodle to provide Web-based training.

Disparities in health between minority and majority populations have become a topic of high interest in the health care and information communities. Hospital librarians are aggressively embracing their role in working with physicians to develop solutions to issues addressing health disparities, patient safety, and environmental justice.^[142] They design and implement personal digital assistants (PDA) programs to assist physicians in getting information at the point-of-care, and institute clinical librarianship programs allowing them to make clinical rounds with physicians, thus impacting decisions from the question’s origin.

Hospital librarians play a significant role in reaching out to teach information access skill but also in teaching courses on information filtering, evidence-based medicine, interactive learning techniques, critical appraisal, editing and refereeing of online journal articles, and the construction of specialized knowledge bases to other health professionals in the community.^[143] Teaching hands-on information retrieval instruction enhanced by computer-assisted instruction programs to facilitate problem-based learning skills and simulations for decision processes and strategies will strengthen patient-centered librarianship and solidify the role of hospital librarians as evidence educators. Hospital librarians will be challenged to search more complex information, analyzing and synthesizing results into packaged reviews while interacting with their clientele primarily by using electronic mail, blogs, wikis, electronic teaching platforms, podcasts, and other electronically linked networks.^[144,145]

Digital Resources

As more hospitals merge into integrated health care systems, hospital librarians are challenged to function as

outreach consultants, serving the needs of staff at off-site facilities. The rapid growth of scanning and digitizing technologies has provided new methods for retrieval and delivery of print documents, pictures, graphs, charts, and full text to off-site hospital staff. Portable Document Format (PDF) is the standard format for delivering full text of electronic journal and book resources.

The shift to wireless computer access, flat-screen technology, iPods and other Mp3 players, eBooks, sharper image handheld devices (as easy to read as paper), are presenting unique planning challenges for all health sciences libraries. Recent developments in computer technology have introduced us to the optical mouse, wireless networking, USB ports, jump drives, fiber optic and video transmission systems, for distance education, webinars for teleconferencing. Desktop computer applications have become more adaptable and interface with more customizable technology. Cellular telephone devices such as the iPhone now integrating telephones, iPod, Internet, cameras, blue tooth, and other technologies provide consumers with endless communication options.^[146] Voice over Internet Providers (VoIP) are providing access to telephone service through internet connections. Given these innovative options hospital librarians focus on finding ways to integrate these new technologies to enhance seamless delivery of information solutions. The future for hospital libraries holds possibilities of teledesk located throughout the hospital allowing interactive visual and voice connections. Hospital libraries are faced with designing facilities and reallocating space to support wired and wireless technology while building platforms to integrate innovative connectivity and point-of-care information access.

In addition to the changes in the methods of information delivery, new forms of information that include “hypertext, cd and digital video interactives, expert systems, knowledge bases and virtual reality” show significant promise in providing a new qualitative approach to information delivery.

Value Added Service

“Value-added” is a marketing concept that expands or modified a product or service so that it has added value to the customer. For example, offering a MEDLINE search may be a basic service provided by the library; a value-added MEDLINE search is one where, the librarian has analyzed the search, selected several of the most relevant articles, and included full-text copies of these articles in a complete package.^[147,148] Hospital librarians may even filter the articles included to provide a summary of the pertinent points outlined in the articles. Quality filtering is a service usually performed on research studies or clinical trial articles. It involves identifying the hypothesis of the study and extracting vital information from the article to give clinicians a clear picture of the type of research study conducted and the validity of the results.^[149]

Hospital libraries continually seek to develop and promote value-added services to ensure customer satisfaction and quality service. One of the significant challenges for hospital librarians continues to be the use of knowledge-based information resources and new technologies to create Web portals for the provision of easy access to resources tailored to suit the institutions' unique needs. License agreements and institutional restrictions often limit patron access depending on their affiliation with the hospital.

Occurrence screening is a service that provides the opportunity for librarians to independently analyze raw quality improvement data to determine the overall need for information. Information provided through information screenings is distinctive in that it isn't a response to a specific case presented in the morning report; rather, occurrence screening educational packages address best practice patterns or state-of-the-art methods of patient care to anticipate and diminish future clinical problems.^[150]

Communicating the role of information in the provision of care continues to challenge hospital librarians. However, as Quality Oversight Organizations (QOO) encourage community hospitals to embrace the concept of integrated information management for the improvement of quality, hospital librarians have begun to realize opportunities to incorporate Internet usage as a clinically indispensable tool.^[151]

Knowledge Management

Knowledge is defined by Peter Drucker as "Information that changes something or somebody—either by becoming grounds for actions or by making an individual (or an institution) capable of different or more effective action."^[152] Knowledge Management (KM) is a platform for implementing organizational change; by getting people to record knowledge (as opposed to data) and then share it. In short, it is a way of channeling raw data, into meaningful information.

The concepts of knowledge management is providing a new dimension in library service, as the collection and preservation of explicit (informal) internal knowledge is further explored and meshed with the application and use of tacit (formal) knowledge. KM is linked to what people know, and how what they know can support the organizational objectives. Based on assumptions of strategic planning, the time value of information, and cross-functional teams, KM deals with the most meaningful, practical, and purposeful ideas. KM is ever changing, value added, and visionary. The constant revision and updates of knowledge illustrate the importance of viewing KM as an ongoing process that draws upon pooled expertise, relationships, and alliances. The role of the hospital library in KM is to introduce the concept, provide knowledge expertise and generate enthusiasm, buy-in, and motivation, encouraging managers to work together toward reaching common knowledge preservation goals.^[153]

Hospital Librarians will be challenged to share their expertise in categorization and segregation of knowledge to create and update working databases and digital libraries, allowing more efficient access to specific, recent, relevant information through keyword or subject searching. Hospital librarians can also provide more information support through participation in research teams that use information-based techniques such as meta-analysis to blend integral digital and traditions knowledge.^[154]

Electronic Health Record and Electronic LATCH

The merging of information technology and health care has contributed to the shifting of attitudes from health care provider to consumer and facilitated the creation of the Electronic Health Record (EHR). The patient centered electronic health record is designed as a cross-institutional, longitudinal information record aimed at establishing a record that contains all consumer health information from "the cradle to the grave."^[155] Hospital libraries have the opportunity to challenge conventional thinking about the (EHR) to offer Literature Attached to Chart (LATCH) programs to expand the library's patient care support and compliment other health information. LATCH programs will enable health care personnel to request and review, up-to-date disease specific articles attached directly to the electronic medical record as URLs, PDF or scanned document. Librarians will be able to document evidence to support clinical decisions, thus potentially contributing to reduction in medical errors and cost. LATCH programs will also provide documentation of physician's verbal request for literature to support a diagnosis or treatment, thus providing supporting documentation to help resolve legal disputes.^[156]

Good communication between patients, providers and librarians is an essential component of high-quality patient centered health care. Communication between patients and providers has traditionally occurred through in-person, telephone, or paper-based encounters. Due to the evolution of technology patients and providers are enabled to communicate electronically to obtain follow-up test results, collect information before a visit, schedule appointments, send reminders, ask questions, renew prescriptions and in the near future to request health information for addition to their electronic medical record.^[157] The EHR offers great potential for hospital librarians to develop and evaluate access protocol, research information seeking behaviors, manage personalized health information web page development and facilitate usage of digital resources.

Consumer Health Trends

One of the highest priorities in today's hospital is the provision of quality care to patients. Consumer health information services make important contributions to

consumer choice, safety, literacy, and quality health care. They indicate the need to set up networks for shared development of quality standards and training. Consumer health databases in all formats and the extension of services into new areas that examine quality of care and effectiveness of treatment are warranted. Attention needs to be focused on developing networks to maintain current awareness and creating more standards for best practice.^[158] Hospital librarians will be challenged to assist consumers and hospital staff in checking the authenticity and integrity of Internet sites and providing consumers with a higher level of decision-enabling information. A congressional report published in 1988 points to new emphasis on scientific reviews of the outcome and effectiveness of treatment.

The report states that providing information to consumers on quality of care enables people to avoid poor quality providers and educates the public on the concept of quality. It also injects competition into the medical marketplace and stimulates clinicians to improve practice.^[159]

For this to take place, hospital libraries must begin to support consumers with a more focused level of information. Information should be provided on the mortality rates of hospitals and the adverse effects of treatment, including nosocomial (hospital acquired) infections. Disciplinary actions against doctors and patient satisfaction results should be readily available to help individuals make informed personal choices.^[160] Evidence-based Librarianship seeks to provide replicable standards for information retrieval and dissemination. The challenge of information providers is to find a way to translate this technical information into digestible information that patients and their families can understand and use to make more informed health care decisions. The creation of the individual health record is an excellent start. This record will allow patients to track their medical care in all aspects of care. This record is a logical place to have literature searches about conditions and disorders recorded to assist the physician in providing optimal care and monitoring the literature as it related to your health conditions.^[161]

CONCLUSION

"Clearly, for hospital libraries to survive, their existence must be validated and their contributions must be shown to be consistent with the overall goals of the hospitals they serve."^[162] The future of hospital libraries depend on their ability to promulgate new images of hospital librarian's work that convey professionalism, documented value and quality. Hospital libraries are transforming into hubs of electronically based research, where hospital librarians provide practical, workable solutions to the information

challenges of the constantly changing world of evidence-based health care. Balancing information resource formats, cutting edge technologies, patient safety concerns, innovative social networks of communication, and an environment centered on Evidence Based Health Care will continue to create unique challenges for hospital libraries.^[163] As hospital libraries continue to reengineer themselves, define new roles, focus on resource access and service excellence, the intangible and tangible value of health care information at-the-point of care will become more apparent. Hospital libraries and librarians must take the lead in proactively identifying and adopting new and changing responsibilities. Hospital librarians must take the lead in developing essential evaluative measures, ideas, energy, and relationships through out the hospital to promote and market the vision, mission and value of the hospital library. As Garfield states, "unless the hospital library becomes fully recognized as a legitimate part of the medical facility, cost-conscious administrators will use outdated models of library service to cut library budgets."^[164]

Hospital libraries will serve as the gateway to the application of new creative ways to use internal wikis, comment-enabled internal blogs and other collaborative tools. Hospital libraries will more thoroughly explore the applications of web 2.0 technology, such as creating internal podcast lab to enable users to generate podcast, and creating user generated content tagging, making content easier to locate.^[165] Hospital Libraries will be challenged to help create new knowledge tools, using such as organization-specific mashups, to integrate internal information with open source content, creating new discovery tools.^[166]

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Human–Computer Interaction Research in Information Retrieval

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Abstract

Human–computer interaction is a very important topic in studying computerized information retrieval systems, as it takes into account both the human searchers and the information system features. This entry surveys the major research streams and applications of interactive information seeking and retrieval. It also presents how the expectations and requirements for interactive information seeking and retrieval have been expanded and what the challenges are ahead for evaluating such systems.

INTRODUCTION

Human–computer interaction research has increasingly become an important component of information retrieval studies, as the information infrastructure has become largely dependent on computer technology, at personal, group, or organizational levels.

Human–computer interaction research in information retrieval is about identifying the key characteristics of searchers, tasks, and contexts, that affect the search tactics and behaviors of searchers and proposing system features for proper supports. Various streams of research are under this umbrella, including:

1. Interactive information retrieval, which Ingwersen^[1] defines as “the interactive communication processes that occur during the retrieval of information by involving all the major participants in information retrieval (IR), i.e., the user, the intermediary, and the IR system.”
2. Information retrieval in context, or situated information retrieval, i.e., to incorporate aspects of the searcher or environment that are typically not reflected in queries or search statements, such as the time, place, and history of interaction, the tasks motivating the interaction and the technical possibilities of the information systems.
3. Human–computer information retrieval, which “aims to empower people to explore large-scale information bases but demands that people also take responsibility for this control by expending cognitive and physical energy”.^[2]
4. Cognitive information retrieval, which takes into account interface issues, the role of information retrieval system interaction in the total range of people’s information behaviors, and the information situation, task situation, and problem situation of users when using an IR system (pp. 3,4).^[3]

This entry will first describe the history of how we get to this research paradigm in section “History” and then proceed to cover the major research streams in section “General Research Streams,” the applications and tools proposed and developed in section “Applications, Tools, and Techniques for Interactive Information Seeking and Retrieval,” the evaluation methods for studying the interactive information retrieval systems in section “Evaluation of Interactive Information Retrieval Systems and Interfaces,” the important conferences, workshops, organizations, and institutions in section “Important Conferences, Workshops, Organizations, and Institutions.” It will conclude with the expectation of the bright future for this research paradigm.

HISTORY

Information retrieval is defined as the process of searching a collection of documents with the goal of identifying documents pertaining to a particular topic.^[4,5] The process of information retrieval is inherently interactive between the information searcher and an information environment/system,^[6,7] as such a process depends on initiatives on the part of the information searcher, feedback from the information environment, and decisions on subsequent initiatives based on this feedback (p. 17).^[8]

The factors associated with both searchers (e.g., type, context of use, kinds of information needs, and immediacy of information needs, etc.) and systems (e.g., size and subject coverage of document collection or database, information representation, indexing methods, algorithms of matching queries against document collections, etc.) plus those associated with the interaction process between the two (e.g., revision of queries or search statements, search logics, and tactics) all could affect the performance of information retrieval.^[7,9–12]

Despite the interactive nature of the information retrieval process, the information retrieval field has its tradition in “system-centered” research or the matching paradigm, which focuses “solely” on improving the match between query terms and document representations, without taking into account the complexities of the users.^[11,13,14] A closely related research community takes the “user-centered” approach, mainly focusing on information seeking behavior/processes, as well as contextual, cognitive, and even affective factors related to such information seeking processes.^[1,15,16] While related, the two research communities hold a critical stance toward each other,^[17] and much of the user-centered research does not directly address the design of information systems. From the user-centered perspective, the term “information retrieval” is too confined to cover a wide spectrum of information searching phenomenon, as it implicitly connotes that the information searcher already has clearly-defined “information needs” and only needs to “retrieve” the documents from the system that can fittingly answer those needs. The uncertainty of user “information needs” that users are still struggling to form into shape is overlooked. In other words, if the user is not sure what he/she is or even should be looking for, how could the system possibly provide the best answer to his/her “information needs?” Information seeking, thus, is a preferred term over information retrieval in the user-centered studies.

The gaps between the two schools of thought are self-evident, as both have their significant shortcomings. The system-centered studies could contribute to effective information retrieval, but may not be efficient. The success of an information retrieval system totally relies on 1) whether the user can produce the queries that “perfectly” reflect the user’s information needs, which could be still evolving, and 2) on its own capability of matching its document collection against those “perfect” queries. It is a daunting, if not impossible, task, given that many studies have shown the non-specificity of “information needs.”^[4,18–21]

Moreover, the information retrieval process is more than just simply articulating queries and evaluating search outcomes.^[22] Marchionini^[23] argued that most of information retrieval systems focus on query formulation and results examination functions but ignore problem identification/clarification and information extraction.

Other common search tactics are found, including but not limited to, chaining, differentiating, and extracting, scanning, listing ideas, and many others to either tolerate uncertainty about “information needs” or develop the “information needs.”^[15,18,24]

In addition, the fact that the information retrieval process frequently takes place over multiple search sessions is often overlooked in system-centered studies.^[25–31] Failure to consider the nature, evolution or stages of the information seeking processes likely results in an IR system that requires more effort and time from the searchers to find satisfactory results.

Studies also have reported that searchers often engage in multiple tasks at the same time.^[28,32] By concentrating on the information retrieval task itself without considering its context or broadening its perspective, the questions of “could’ve” and “should’ve” linger, as other information tasks that are associated with information retrieval, such as question answering, information assimilation, and personal knowledge management, are isolated and thus the information flow and transition among them not supported.

Traditional IR systems are designed primarily to support individuals. Yet, individuals often need to collaborate on information seeking, searching, and retrieval.^[33] Research on information retrieval thus expanded to collaborative information seeking and retrieval, just as research efforts in Human-Computer Interaction expanded beyond the individual levels to support collaborative computer work. Research on collaborative information seeking and retrieval has drawn heavily from studies on computer-supported collaborative work (CSCW), information science, information retrieval, and human-computer interaction studies. Foster^[33] provided a literature review of the social and collaborative approaches to information seeking and retrieval in the four specific contexts: academy, industry, medicine, and the military. Understanding how people work together has direct implications on designing effective and efficient collaborative information retrieval applications.

The problems of user-centered studies are just the opposite to those of the system-centered ones. Vakkari and Järvelin^[34] noted that the user-oriented Information Science approach suspects the realism of the Computer Science system-oriented experimental approach, while the latter suspects the usefulness of the former. While user-centered studies have provided a great understanding of human information tasks and cognitive processes, they often failed to empirically demonstrate the effects and magnitudes of the factors that could affect the information seeking processes.^[35] Moreover, many of the studies under this paradigm do not pragmatically suggest possible system solutions for the problems identified.

The differences in the research foci of the “system-centered” vs. “user-centered” research streams were mainly due to the lack of interdisciplinary studies in the earlier IR research community. The “system-centered” IR studies were likely from the computer science discipline, while the “user-centered” IR studies were likely from the disciplines of library and information science, communication, etc.

The cry for the interaction approach that takes both the system and the user into account was heard first in the early 1970s.^[36,37] For example, the workshop on The User Interface for Interactive Search of Bibliographic Databases is considered the first occasion on which the general problem of user interfaces for computer systems was raised.^[6] The effort to bridge the two camps went extensively into the 1980s and 1990s, and has continued today.

With more and more information systems going electronic and an increasing amount of information collections being digitized, the fields of human-computer interaction (HCI), library and information science (LIS) and computer science (CS) inevitably converge on interactive information retrieval/seeking. On the one hand, HCI sheds light on how to bridge the user-centered vs. system-centered paradigms with the HCI concepts and research models being applied to the studies of IR systems.^[11,38-42] On the other hand, the work of the LIS researchers^[26,34,43-55] and CS researchers,^[56-64] who respond to this outcry, are HCI per se, as they aim to streamline the collaboration between the human searchers and system enablers to improve the overall performances and outcomes of information retrieval processes by considering both users characteristics and system features in the design of information retrieval systems.

GENERAL RESEARCH STREAMS

Major Theories and Models on HCI Research in IR

Although the major theories and models on HCI research in IR might utilize some HCI concepts, such as two-way communication between message sender and receivers and interaction with texts or content rather than information systems (p. 857),^[65] they hardly adopt entirely well-established HCI theories or models. For example, the Goals, Operators, Methods, and Selections model (GOMS), a human information processor model,^[66] is considered best suitable for routine, more structured and predictable information tasks and behavioral patterns.^[67,68] The information seeking/retrieval process could be too interactive and too highly complex to be explained by GOMS.^[65,68,69] Consequently, the major theories and models on HCI research in IR are likely to be developed from within the field of information science and meet the following criteria:

1. They must enumerate the variables that are associated with both users and computerized IR systems.
2. They must describe, explain and/or predict the interactions between the variables associated with the human searcher and the computerized IR system for the information retrieval/seeking tasks.
3. The description, explanation, and/or predictions of interactions between the searchers and the IR systems would serve as a conceptual framework to provide design implications for IR systems.

Ingwersen's cognitive IR theory

Ingwersen's cognitive IR theory^[1,17] identified cognitive processes that occur in information processing. The main

model components are 1) IR system objects which consist of text/knowledge representation (e.g., meta data), semantic entities like full text and pictures, 2) IR system setting, including search languages/IR techniques, database structure, indexing rules/computational logics, 3) intermediaries that facilitate the information retrieval process, e.g., computer interfaces, human intermediaries and 4) individual searchers' cognitive space, including work task/interest, current cognitive state (the currently known, drawing upon emotions, tacit knowledge, and external factors influencing the searcher), problem space, uncertainty, information need, and information IR behavior, and 5) social/organizational environment, including such variables as domains, strategies, and tasks and preferences.

Ingwersen described the following interactions among these model components: 1) Users interact not only with IR systems, but with information objects, i.e., "texts," "documents," etc.; more specifically, it is the cognitive space of the user that interacts with the "information space" of IR systems; 2) The social and organizational environment influences and shapes the individual cognitive space; 3) From the system design perspective, for the five model components to interact to produce the more effective IR outcome, each of them can "model" or profile how other components would behave cognitively; and 4) The success of the IR process relies on the polyrepresentation in IR. Searchers' queries requested can be enhanced with problem/goal statement and work task/interest description, because in the searchers' cognitive space, work task and interest domains define what is known (current cognitive state) and prompt for what is unknown (problem space) and the gap in between the two (information need). In the information space of IR, different methods of knowledge representations can facilitate the matching of the representations of searcher's cognitive space against semantic entities.

Saracevic^[11] pointed out that the strength of the Ingwersen's model lies in the detailed description of the interactions between the searchers and the systems, while the weaknesses of the model could be its testability and application to the evaluation of interactive IR system. Such an assessment is accurate to some degrees, as the main purpose of the Ingwersen's model was to inform the design of an interactive IR system with a descriptive account of the essential processes from both the user and system perspectives; the model did not intend to enumerate the key performance variables for evaluation.

Belkin's episode model

Belkin's episode model^[22,70,71] postulates that because the searchers may not always be capable of best representing their information problems with effective query terms, a variety of information interactions to

clarify the information problems would be necessary. Sixteen types of information seeking strategies are identified and characterized with four dimensions or factors, each of which has two possible values: method of interaction (scanning vs. searching), goal of interaction (learning vs. selecting), mode of retrieval (recognition vs. specification), and resources considered (information vs. meta information). Based on an empirical study of knowledge workers, Cool and Belkin^[72] extended these facets to create information behavior facets, consisting of access, objects interacted with, common dimensions of interaction, and interaction criteria. The access facet includes two sub-facets from the four original ones: method and mode of interaction. The “objects to interact with” facet includes level (information vs. meta-information), medium (e.g., image, written text, speech, etc.) and quantity (e.g., one object, set of objects, database, etc.). The “common dimensions of interaction” facet entails information objects (part vs. whole), systematicity (random vs. systematic), and degree (selective vs. exhaustive). The “interaction criteria” facet is about evaluation criteria or tactics, including accuracy, alphabet, authority, date, person, etc.

Belkin and his colleague suggested that all the information seeking strategies can be supported with a combination of a variety of IR techniques, including representation, comparison, summarization, navigation, and visualization. The initially proposed idea was to use a script-based dialogue to assist the searchers in utilizing proper information seeking strategies that are optimally supported by specific combinations of IR techniques. Yuan and Belkin^[54] prototyped an IR system, that simply provides a small selection of information seeking strategies to the searcher. They found that subjects using the prototyped system were likely to spend a fewer number of iterations in submitting queries and the query was likely to be longer than the baseline system. They also found that in terms of usability, the integrated system was significantly easier to use and significantly more useful than the baseline system.

Saracevic^[11] made the following critiques of Belkin’s episode model. On the plus side, the model directly addresses a greater range of various interactions in the activity level that are so specific that they can easily be mapped onto the designed system features. On the potentially negative side, Saracevic wondered whether the scripts identified would be insufficient to reflect the full complexity and extension of human–computer interaction in IR. However, the Belkin’s episode model has proven a great starting point in designing and evaluating interactive IR system. The fact that Yuan and Belkin^[54] only focused on a portion of the model not only shows the complexity of the model that is too much to be covered in one single system, but also demonstrates the practical applicability of the model in designing and evaluating IR system artifacts.

Saracevic’s stratified interaction model

Saracevic’s stratified interaction model^[7,11,73] borrows from the concepts elucidated in HCI and from the notions incorporated in the stratification theory in linguistics and communication. The model postulates that the IR interaction is a dialogue between the participants, searcher and “computer,” through an interface with the main purpose being to affect the cognitive state of the searcher for effective use in order to apply a found solution to an information problem or task at hand. The model components are users (with such variables as knowledge, intent, and belief, etc.) related to a situation (task, problem-at-hand) within an environment, while interacting with computers to seek for/retrieve information. “Computer” is depicted as having computational resources and capacities, but also separately informational resources—“texts” as cognitive structures, representations, meta-information about texts, and informational and computational resources, and possibly other information for adaptation to different kinds of interactions and user intents.

The model depicts three levels of interaction between the searcher and the system and in some ways, seems to integrate the Belkin’s model with Ingwersen’s. First, it is on the surface level, where the user engages in a variety of interactions with the IR system as portrayed in Belkin’s model. Second, on the cognitive level, users interact with the “texts” (including images, data, and their representations) in the information resources, considering them as cognitive structures, to learn or to assimilate information in order to update their current cognitive state and revise the problem space, as argued by Ingwersen. Third, on the situation level, like Ingwersen, it is about how the environment interacts with or affects the searcher’s cognitive activity. However, Saracevic emphasized the effects of the application of the information found to the information problem at hand. Utility becomes a prominent relevance feedback criterion, which could change the information problem at hand and affect the decisions made.

Saracevic^[73] further extended the stratified model to encompass specific processes or phenomena that play a crucial role in various IR interactions, including the notion of relevance, user modeling, and feedback types. For the notion of relevance, the stratified model helps distinguish between the following manifestations of relevance as presented in Table 1.

For user modeling, the stratified model helps identify eight types of communication factors or artifacts that manifest the interactions taking place during IR processes, as summarized in Table 2.

For relevance feedback, the stratified model of IR interaction has served as a framework to observe and categorize the following different relevance feedback types in IR in Table 3.

Spink and Saracevic^[7] further elaborated the stratified interaction model with how relevance feedback is

Table 1 Types of relevance identified from the stratified model.

Type of relevance	Definition	Inferred criteria
System or algorithmic relevance	Relation between a query and information objects (texts) in the file of a system as retrieved, or as failed to be retrieved, by a given procedure or algorithm	• Comparative effectiveness
Topical or subject relevance	Relation between the subject or topic expressed in a query, and topic or subject covered by retrieved texts, or more broadly, by texts in the systems file, or even in existence	• Aboutness
Cognitive relevance or pertinence	Relation between the state of knowledge and cognitive information need of a user, and texts retrieved, or in the file of a system, or even in existence	• Informativeness • Novelty • Information quality
Situational relevance or utility	Relation between the situation, task, or problem at hand, and texts retrieved by a systems or in the file of a system, or even in existence	• Usefulness in decision making • Appropriateness of information in resolution of a problem • Reduction of uncertainty
Motivational or affective relevance	Relation between the intents, goals, and motivations of a user, and texts retrieved by a system or in the file of a system, or even in existence	• Satisfaction • Success • Accomplishment

represented by the interplay between levels (i.e., the cognitive, affective and situation levels on the user side and the engineering, processing, and content levels on the system side), giving rise to the following types of feedback in Table 3. But Spink and Saracevic^[7] stopped short of illustrating how the engineering, processing, and content dimensions of IR systems can make use of this feedback in supporting the searchers. Kelly^[50] examined the decisions during interactive information retrieval as to what to examine, retain (save, print), reference, annotate, and the like. Such decisions are assumed to indicate relevance implicitly, which would be very operationalizable for IR systems to make use of and support the searchers.

Saracevic^[11] himself noted that the strength of the stratified model lies in decomposition of different types of interactions as related to different elements involved, while the decomposition is not easy and depiction of interplays between levels is hard to specify and consequently the model is difficult to test. But the works of Saracevic^[73] and Spink and Saracevic^[7] have provided a positive direction to test the model by focusing on the manifestations of specific interactions or communications in IR processes, such as search terms, relevance feedback, etc.

Bates's cascade of interaction model

Bates's cascade of interaction model^[74] proclaims that the design of IR systems needs to take into account many design layers, including user understanding and motivations, user searching activities, interface design, search capabilities, system front end, search engine, information in searchable form, database structure, computer system, network, actual indexing, system of metadata and information content. The term, "cascade," is to describe how design features of earlier layers would affect the success

of those of later layers, while the latter could affect the effectiveness of the former.

Although the cascade model is neither a human-computer interaction model nor an interaction in information retrieval model per se (p. 385),^[74] it, as a design model for operational online IR systems, in a way, does summarize Bates's series of work^[12,75,76] in depicting how different factors concerning both the information searchers and the IR systems affect the performance of information seeking and retrieval. For example, the details of user search capabilities have been described by Bates.^[12] Moreover, the different design layers in the cascade model respectively correspond to the factors about the system infrastructure (i.e., the upper left part of the model), the information infrastructure (i.e., the bottom left part of the model), the interface infrastructure (i.e., the middle part of the model), and the human searchers (i.e., the right part of the model). The interactions between the human searchers and the interface infrastructure as well as between the human searchers and the information infrastructure are what substantiate human-computer interaction in IR.

Thus, even though the cascade model does not directly enumerate the variables that are associated with both users and computerized IR systems and instead focuses solely on the interactions of different layers of IR systems, the cascade model, under the broader context of Bates's works to date, still can be considered as a theoretical model in provision of a rich description of HCI in IR. Wilson et al.^[77] pointed out that Bates' cascade model actually can be perceived as extending the Saracevic's stratified model in greater detail with additional levels that interact and affect each other.

The strength of the cascade model is the emphasis on the tight coupling of different layers in IR system design. The weakness might be that additional works to directly identify variables in the layers in the cascade model may

Table 2 Factors or artifacts that manifest IR interactions identified through the stratified model.

1. Context	User's problem or task at hand; information seeking stage; information if any collected so far; expectations and other aspects underlying the question; user domain and problem knowledge; user plans.
2. Terminology and restrictions	Elaboration on and modification of concepts, terms, keywords, descriptors; generation of terms; specification of borderlines; restrictions such as to language, years; spelling of technical terms.
3. Systems explanations	Workings and technical aspects of system used; technical explanation of searching; characteristics of databases and documents in system; other possible information sources; obtaining texts; costs involved.
4. Search tactics and procedures	Selection and variation of terms, fields, morphology, logic in search statements; commands; selection and variation in magnitude and output sizes, formats, order; output specification; correcting mistakes.
5. Review and relevance	Review of tactics as to the output; evaluation of output sources or content; relevance judgments of and feedback from outputs; decisions or questions on what is wanted based on tactics or output.
6. Action	Description of an ongoing or impending activity e.g., thesaurus lookup, output formats, printing; explanation of what is happening.
7. Backchanneling—prompts, echoes	Communication prompts, fillers, acknowledgments, formulaic expressions etc. indicating listeners involvement, e.g., "O.K.," "Wow!" "Unhuh," "Right;" echoes and requests for repetitions e.g., "What?" "Pardon?" "Say that again"; pauses.
8. Extraneous	Utterances extraneous to the search interaction—greetings, formulaic courtesies, social comments, and questions; personal matters.

Table 3 Relevance feedback types identified with the stratified model.

Content relevance feedback	User query followed by an IR system output of retrieved items then judged by the user for relevance followed by a query or reformulation.
Term relevance feedback	User query followed by an IR system output of retrieved items and user selection of a new search term(s) from the retrieved output used in a subsequent query.
Magnitude feedback	User query followed by a judgment based on the size of the output from a query that effects the next query.
Tactical review feedback	User input followed by a strategy related judgment to display the search strategy history influencing the subsequent query.
Term review feedback	User input followed by a strategy related judgment to display terms in the inverted file influencing the subsequent query.

system, 3) search activity in which the searcher actually interacts with an IR system, 4) search contextual factors (e.g., time, perception of information availability, etc.), 5) information attainment (i.e., with the emphasis of interaction with text, particularly collected information objects), and 6) information use activity (e.g., like Saracevic's situational interaction level, with the emphasis on the impacts of the information sought on the evolution of the information problem, including such factors as decision making, cooperation, communication, commercial transactions, etc.). The model attempted a comprehensive list of variables that matter in successive multisessions information searches and depicted how the variables in these components interplay with each other.

The point of departure is the phenomenological perspective. MISE highlights how different search episodes of the same or similar information problems could be connected. MISE identifies eight different scenarios that a searcher could engage in successive searches based on the nature of how an information problem evolves. They are 1) transmuting information problems which a searcher learns to define or clarify over sessions, 2) spawned information problems which are derived from the main problem and take over the priority, 3) transiting information problems in which the solution of one information problem leads to the beginning of another, 4) rolled-back information problems resulting from the feedback of information use activity, 5) lost-answer problems in which the efficiency of locating the solution may be more important than effectiveness, 6) unanswered information problems, 7) cultivating information problems due to long-term interests, and 8) anticipating information problems foreseen to materialize in the near future.

The MISE model does not include the interface or computer intermediary directly in the model. Instead, it

still be needed to create a prescriptive evaluation procedure for interactive IR systems.

Lin's MISE model

The MISE model by Lin and Belkin^[25,26] and Lin^[51] continues in the footsteps of Ingwersen^[1,17] and Belkin et al.^[71,22] to incorporate the following components into the model: 1) searcher (including variables pertaining to problematic situation and information problems), 2) IR

uses the variables associated with the model components to characterize the problems a searcher could encounter during the different processes of search activity (i.e., articulation of information problems, navigation of the information space, evaluation of search outcomes, monitoring the state of the problem space) and consequently propose system features to mitigate the problems and support those processes.

Lin^[52] described an actual prototype, *PERsonalized and Successive Information Search Tools (PERSIST)*, which assists the searches for transmuting information problems; *PERSIST* enables the searcher to visualize his/her information collection by using representative words to label and categorize (i.e., explicit coding) his/her own information collection. Such an information collection and their associated labels/category terms can further be dynamically reorganized, expanded, modified, removed, and potentially filtered as the information problem of the searcher evolves. The design goal is to improve monitoring the state of the problem space and navigating the information space (e.g., revisiting information objects) to interact with information objects. The same goal is shared by Komlodi and her colleagues,^[53,78,79] who explored how automatically and manually recorded search histories can support information seekers in finding and using information. Komlodi^[80] and Komlodi and Soergel^[81] proposed three search-history-based user interface tools, including 1) user-manipulable search history displays, 2) a scratchpad interface to allow users to take notes and to save various granules of information and the search history, and 3) an organized collection tool to allow searchers to bridge the gap between finding and using information. All three of these user interface tools include functions to support planning, monitoring, evaluation, task integration, and context preservation.

The main strengths of the *MISE* model include broadening the scope of searcher-system interactions from single episode to multiple episodes and the apparent applicability from the conceptual model to the design and evaluation of system features (e.g., *PERSIST*). The major weakness could be that the system component is not as detailed and as well-layered as the stratified model and the cascade model; the design of system features to mitigate the problems occurred in the search process may not be as intuitive or as straight-forward as it could have been.

User-Centered Studies with Design Implications

More and more of the user-centered information search theories, models and their extensions have begun to explore the design implications for interactive information retrieval. Below are a few selected models.

Vakkari and his colleagues^[30,31,34,82–84] elaborated Kuhlthau's *ISP* model^[15,16] by providing more specific variable values in characteristics of information search

processes and how those variables interact with each other through time. Particularly, Vakkari and his colleagues have focused on how the number and type of search terms and operators and search tactics evolve over time as the information problem continues to develop, which could potentially have very operationalizable design implications for *IR* systems.

Cole^[85] described the interaction between searcher and system as a message coding and encoding process, proposing the idea of “enabling *IR* system” that would employ interactive devices (e.g., a visualized representation of comparing and contrasting concepts) to help the searcher clarify the state of his/her information problem. Extending Cole's work, Propper's model of the communication process, and Pask's conversation theory, Ford^[86] argued that an enabling *IR* system would be equipped with pedagogic structuring and intervention (e.g., computer-as-assisted learning technologies, such as conceptual maps, summaries, abstracts, classifications, and ontologies, etc.) to enable the searcher to process and build on his/her descriptive knowledge and procedural knowledge in need and help the searcher develop effective metacognitive information handling skills. Cole et al.^[47] made a similar argument as Ford, proposing the selection state-information channel model, urging an interactive *IR* system to develop mechanisms to interactively stimulate the searcher's cognitive ability in reaching a “selection state,” which can be seen as a refined, better-defined “information need” or information problem. In other words, instead of asking the searchers to represent their “information needs” that are still in need of clarification in query terms, the system should understand the task that prompts the searchers to seek for information and interact with them to clarify their “information needs.”

A growing number of user-centered studies focus on human information interaction, as opposed to human-computer interaction, in the process of interactive information retrieval and seeking. For example, Spink and her colleagues^[3,46,87–89] are developing the theory of human information behavior (*HIB*), postulating that information seeking should be tightly connected to other information processing behavior such as information organization and use. Under this theory, an interactive *IR* system could be integrated into a greater information system that would function for more than just information retrieval and should support other forms of information organization and use. Fidel et al.^[90] used the cognitive work analysis framework to observe how collaborative information seeking and retrieval takes place in the form of human information interaction, suggesting that interactive *IR* systems should include “mechanisms that support the interactions between the collaborating actors and enhance their access to one another's knowledge, ideas, and opinions or help them keep on track” (p. 951).

APPLICATIONS, TOOLS, AND TECHNIQUES FOR INTERACTIVE INFORMATION SEEKING AND RETRIEVAL

The theories, models and conceptual framework reviewed in section “General Research Streams” have directly or indirectly helped develop or called for the following interactive IR applications, tools, and techniques: user profiling,^[17,73] automatic or user-controlled relevance feedback to adjust or expand the users’ queries,^[7,73] computer-assisted learning technologies, such as conceptual maps, summaries, abstracts, classifications, and ontologies,^[86] pedagogic structuring and intervention mechanisms to help clarify and develop the searchers’ explicit representation of their information problems,^[44,47,86] supports beyond searchers’ representation of their information problems to facilitate overall information retrieval, such as browsing, learning, evaluating search outcomes, monitoring the evolution of information problems, annotating and preserving the context, and organizing information collections.^[22,25,26,53,71,78,79,91]

More detailed reviews of the types of the applications, techniques, and tools that have been developed during various periods of research in interactive IR can be found in the works of Shaw,^[39] Marchionini and Komlodi,^[37] and Savage-Knepshield and Belkin.^[6]

EVALUATION OF INTERACTIVE INFORMATION RETRIEVAL SYSTEMS AND INTERFACES

The evaluation of information retrieval systems have traditionally used the two measures, precision and recall, developed by the system-driven approach to IR,^[92–94] which typically takes place in controlled laboratory tests. These measures, however, are not the best to evaluate interactive IR systems, due to their restricted assumptions on the cognitive and behavioral aspects of the searcher,^[93] as described in the previous sections about the limitations of the system-centered approach on IR system design. In addition, finding information on the Web has its specific characteristics, making the applicability of the findings from traditional IR research questionable. Traditional IR research focuses on the development of retrieval strategies for relatively small, static, and relatively homogeneous text corpora. Web information, on the other hand, is massive in size, diverse and dynamic in content and format, and uncontrollable in quality. This makes it impossible to construct a representative test collection to support the conventional evaluation measures such as precision and recall.^[95]

Robertson and Hancock-Beaulieu (pp. 458–459)^[96] set forth three revolutions: the cognitive revolution, the relevance revolution and the interactive revolution. The cognitive and relevance revolutions require realism with

reference to the formation of information need, and relevance assessment processes. This means that an information need ought to be treated as a potentially dynamic concept, and the multidimensional (rather than just topically relevant) and dynamic nature of relevance should be taken into account. Likewise, relevance should be judged against the problematic situation in which the information need arises, not merely the explicit representation of that information need such as query or request statement, and it should be judged by the user. The “interactive revolution” requires the evaluation of IIR systems to include the user’s interactive information searching and retrieval processes, where evaluation of the search outcomes can be fluid itself, depending on the stage of information searches^[15] or the nature of the information problem.^[26]

While the user-centered information seeking studies potentially could help generate measures to fulfill the three requirements described above,^[97] they seldom directly design or implement an interactive IR system, let alone providing evaluation measurements. For the studies that do evaluate interactive IR systems, many of them quantify performance effectiveness as “relative” recall and precision ratios in spite of collecting non-binary-based relevance assessments^[97] or use the measures that are ad hoc in nature or not universally agreed upon (e.g., satisfaction, the amount of time required to complete a search task, etc). Also, the operationalization of these measures is often not derived from previously well-established questionnaire inventory items.

Performance Measures

Combining the elements from both system-centered and user-centered approaches, Borlund^[97] developed a hybrid evaluation approach to evaluate the systems “in a way which takes into account the dynamic natures of information needs and relevance as well as reflects the interactive information searching and retrieval processes.” The highlights of Borlund’s approach include 1) the emphasis in use of simulated work task situations to trigger simulated information needs and as the platform for the assessment of situational relevance in the context of IR, and 2) the development of alternative performance measures: relative relevance (RR), ranked half-life (RHL).^[98] The RR measure acknowledges the fact that different types of relevance^[99,100] are involved in evaluation of IR systems. The RR measure computes the degree of agreement between two results of relevance assessments; for example, one may represent the system’s output (algorithmic relevance) and the other the user’s subjective assessments (e.g., intellectual topicality, pertinence or situational relevance) of the retrieved output. The RR measure proposes a pragmatic solution of how to bridge the gap between subjective and objective relevance. The RHL indicator, a position-oriented measure, denotes the degree to which relevant documents are located on the

top of a ranked retrieval result, using two parameters: 1) the algorithmically ranked order, which represents a list of decreasing degrees of predicted objective relevance to the user's information need and 2) the applied subjective types and values of the relevance assessments representing the assessor's or user's interpretations of the ranked information objects.

There are several position-oriented single performance measures already developed. Based on the binary approach to relevant ranked information objects, Losee^[101,102] developed average search length (ASL), to indicate the expected position of a relevant information object in the ranked list of information objects. The expected search length (ESL) measure^[103] and Expected Search Duration (ESD),^[104] which is a modification of the ESL, both calculate the number of non-relevant information objects that the user has to view in the process of retrieving a chosen relevant information object. Seeking to estimate the cumulative relevance gain the user receives by examining the retrieval result up to a given rank, Järvelin and his colleagues^[105,113] developed cumulated gain (CG) and cumulated gain with discount (DCG). Both CG and DCG are positional oriented performance measures, but the CG measure builds upon the fact that highly relevant documents are more valuable than marginally relevant documents, while the DCG measure takes into account the relevance assessment behavior of users. The DCG measure has the following advantages not provided by the ASL or RHL measures: 1) it realistically weights down the gain received through the documents found later in the ranked list of results; and 2) it allows modeling the user persistence in examining long ranked result lists by adjusting the discount factor (p. 43).^[105]

Evaluation methods for non-traditional IR system, such as question-answering systems, have also been developed. Wacholder et al.^[106] described a procedure for quantitative evaluation of interactive question-answering systems and illustrated it with application to the High-Quality Interactive Question-Answering (HITIQA) system. Kelly et al.^[107] identified potential evaluation criteria for interactive, analytical question-answering (QA) systems by analyzing evaluative comments made by users of such a system.

Non-performance Measures

As stated in the major theoretical section of this entry, interactive information seeking is considered as a term that more properly portrays the actual interaction of the searcher with the IR system than interactive information retrieval, in that it covers a wider spectrum of the IR system user's search behavior. In addition, as Belkin et al.^[71,22] and Lin and Belkin^[26] pointed out, a variety of interactions other than querying and document matching is necessary in the design of interactive IR systems. Performance or retrieval effectiveness, alone, cannot completely

measure the success of an interactive IR system. Other important measures could concern efficiency (e.g., spending less time, cognitive efforts, cost effectiveness, etc., in seeking for the information), satisfaction, and goal-oriented effectiveness (e.g., meeting the goal of learning more about the subject) and will require more development in the near future.

Multi-dimensional relevance remains a key measure in interactive IR system. Saracevic^[73,100] provided an excellent review of relevance measures up to date.

Continuing the thread of research that promotes the idea of broadening information retrieval to its contexts,^[108] particularly the task that prompts for information retrieval,^[30,82-84] for achieving overall effectiveness and efficiency of information searches, Järvelin and Ingwersen^[105] proposed the nested contexts and evaluation criteria for task-based information seeking and retrieval in an interactive IR system. From the inner to the outer, the four contexts are the information retrieval context, the information seeking context, the work task context, and the social-organizational and cultural context. The information retrieval context is evaluated based on traditional IR performance measures such as recall and precision plus efficiency and quality of information/process. The information seeking context is evaluated in terms of usability and quality of information/process. The work task context is evaluated with the criteria like quality of information and work process/result. The social-organizational and cultural context is evaluated with social-cognitive relevance and quality of work task result.

Measures other than performance, such as described above, should increasingly affect the design and evaluation of interactive IR systems in the future, as the expectations and requirements of interactive IR systems continue to expand.

Validity and Reliability of Methodologies

In general, there is still a long way to achieve the robustness of evaluation measures in interactive information retrieval. Crudge and Johnson^[109] reported that the repertory grid technique is a suitable method of eliciting a definite set of constructs from an ordinary information seeker without instilling unacceptable levels of bias. Käkik and Aula^[110] present methods for controlling the complexity of user-centered evaluations of search user interfaces through within-subjects designs, balanced task sets, time limitations, preformulated queries, cached result pages, and through limiting the users' access to result documents. Kelly et al.^[111] investigate the relationship between questionnaire mode (pen-and-paper, electronic and interview) and subjects' responses to a usability questionnaire comprised of closed and open questions administered during an interactive IR experiment. Their findings suggest that researchers should use the interview mode to

elicit responses to closed questions from subjects and either pen-and-paper or electronic modes to elicit responses to open questions.

IMPORTANT CONFERENCES, WORKSHOPS, ORGANIZATIONS, AND INSTITUTIONS

The Text REtrieval Conference (TREC) is co-sponsored by the National Institute of Standards and Technology (NIST) and the U.S. Department of Defense. It started in 1992 as part of the TIPSTER Text program with the purpose of supporting research within the information retrieval community by providing the infrastructure necessary for large-scale evaluation of text retrieval methodologies. There have been four research tracks in TREC particularly pertaining to interactive information retrieval. The first and the one most relevant to interactive information retrieval is the interactive track. The participating groups developed a consensus experimental protocol and carried out studies with real users using a common collection and set of user queries, but used their own interfaces and each group could add additional focus on different research topics. Relevance feedback was a predominant topic in this track. The interactive track last ran as an adjunct to the Web Track in TREC 2003. The second is the Web track, featuring search tasks on a document set that is a snapshot of the World Wide Web. It last ran in TREC 2004. The third is the HARD track. The track aims to achieve High Accuracy Retrieval from Documents by leveraging additional information about the searcher and/or the search context, through techniques such as passage retrieval and using very targeted interaction with the searchers. It last ran in TREC 2005. The most current one is the question answering track, designed to take a step closer to information retrieval rather than document retrieval. The relevance to interactive IR studies lies in one of its sub-tracks, the complex interactive QA task.

Dumais and Belkin^[112] provided a great summary of the history and the evolving experimental framework of these interactive tracks in TREC. The summary reflected the following main points. First, the main contribution lies in the development of standard methodologies for studying interactive IR and comparing performance of interactive IR systems, including experimental designs, techniques for reporting event logs, and detailed narrative description of the search process. Second, many interesting systems have been developed to support interactive query formulation and reformulation as well as results presentations and explorations, which enabled the investigation of individual differences in the search process. Third, the reported results have been often variable or not statistically significant. Fourth, the lack of consistent and significant findings could be due to a small number of analysis units (e.g., tasks, subjects) and/or the complexity

of the interactive search process that is hard or insufficient to control during experiments. Fifth, the interactive tracks have continued to at least bring to the surface various important theoretical and pragmatic issues in conducting experiments with human participants. With the points above, various tracks that looked into interactive IR have ceased or evolved, while the goal remains the same: providing a focal point for work in designing and evaluating interactive IR systems.

The annual conferences of Special Interest Group on Information Retrieval (SIGIR) and Special Interest Group on Computer-Human Interaction (SIGCHI) in the Association for Computing Machinery publish many quality research articles and hold workshops on the topics of human-computer interaction research in information retrieval.

The MIT Computer Science and Artificial Intelligence Laboratory, or CSAIL, was born on July 1, 2003 by the merger of the Artificial Intelligence Lab and the Laboratory for Computer Science. It held the first Workshop on Human-Computer Information Retrieval in 2007.

The Annual Symposium of the Human-Computer Interaction Lab at the University of Maryland often includes research on human-computer interaction vs. information retrieval/information seeking. It marked its 25th anniversary in 2008.

CONCLUSION

Human-computer interaction research in information retrieval is a very rigorous research stream. It brings two distinctly separate research communities, system-centered information retrieval research and user-centered information seeking research, closer, if not together, for the same research goal: a more effective and efficient information search system that would take advantages of the respective strengths of humans and computers for interactions. In practice, the Web has also propelled highly interactive IR interfaces that demand that these two communities work together, as information retrieval on the Web faces the challenges of supporting different information interaction purposes and motivations from very diverse end users who may have unpredictable information seeking behaviors.^[2,95]

Many studies in the field of CS have started to treat the user as a dynamic and evolving participant in the IR process, designing IR systems that are adaptable and personalizable, while an increasing number of user-centered studies in the field of LIS have attempted to draw design implications from their findings. This entry has addressed the main efforts made by both research communities so far to bridge the gap, in terms of theoretical models, system designs, and ever evolving evaluation metrics and methodologies. In the future, it can be fully expected that the overall research stream will flourish with

the emphasis on human-computer interaction as the means, as well as the goal of effective and efficient information searches as the end.

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Humanities Literatures and Their Users

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Abstract

This entry discusses definition of the humanities, reviews briefly the history of study of uses of information in the humanities, presents the characteristics of different types of literature used in humanistic scholarship in various fields, outlines how scholars identify and access different types of literature, and discusses the use of digital information by humanities scholars.

INTRODUCTION

This entry has five goals. First, the entry aims to show the range of approaches toward definition of the humanities. Most relevant to library and information science (LIS) is a definition that distinguishes the humanities from the sciences and social sciences in terms of the sources of information that provide humanists with their basic evidence. Second, the entry gives a very brief history of the study of use of different types of literature in the humanities. Third, the entry explains what primary literature is, its importance for humanistic scholarship, and how humanists identify and locate the primary literature they use. Fourth, the entry explains what secondary literature is, its importance for humanistic scholarship, the distinguishing characteristics of the secondary literature of the humanities, and how humanists identify and locate the secondary literature they use. The discussions of identification and location of primary and secondary literature review what is known about how humanists use access services (sometimes called tertiary literature) and consult with archivists and librarians as they seek relevant literature. Finally, the entry talks about where information seeking and use fit into the workflow of humanities scholars.

At several places, the entry refers to the use of digital literature and access services in the humanities. Until recently digital information has played a limited role in the humanities. This is likely because only a small portion of primary and secondary literature for humanities scholarship was available in digital form. The entry asserts that, now that a substantial and expanding body of literature is available in digital form, the major challenge for future research about humanities users and their literatures will be charting growth in use of digital sources and the ways in which use of them affects the conduct of humanities scholarship.

DEFINITION OF THE HUMANITIES

Approaches toward definition of the term “the humanities” vary. First, many do not define the term, but list disciplines

they think constitute the humanities. The most influential example of this approach is the legislation that established the National Endowment for the Humanities in 1965. This law asserted

The term ‘humanities’ includes, but is not limited to, the study of the following: language, both modern and classical; linguistics; literature; history; jurisprudence; philosophy; archaeology; comparative religion; ethics; the history, criticism and theory of the arts; those aspects of social sciences which have humanistic content and employ humanistic methods; and the study and application of the humanities to the human environment with particular attention to reflecting our diverse heritage, traditions, and history and to the relevance of the humanities to the current conditions of national life.^[1]

Others assert the humanities cannot be defined, but only characterized. In LIS, an influential example of this approach is Allen who states “the nature of the humanities is better understood through observation of their characteristics than by reading definitions.” She finds the humanities have

concern for the individual and for the thoughts, imagination, achievement, creativity, performance, and impact of individuals. There is a concern for culture and for all kinds of human behaviors that produce cultural artifacts. And perhaps all these concerns are framed by the larger concern for values, for quality, and for expression (p. xi).^[2]

Finally, some do define the term. In LIS, an important instance of this approach is Blazek and Aversa’s *The Humanities* (2000) that follows the Commission on the Humanities and defines the humanities as “those fields of scholarship and study that are ‘dedicated to the disciplined development of verbal, perceptual, and imaginative skills needed to understand experience.’” (p. 1)^[3]

Also within LIS, Wiberley and Jones have defined the humanities as those fields of scholarship that strive to reconstruct, describe, and interpret the activities and accomplishments of people by establishing and studying

documents and other artifacts created by those people. They recognize that all scholarship is a continuum from the sciences to the social sciences to the humanities. There is overlap between the social sciences and the humanities, but clear difference between the core of each area.^[4]

Following Wiberley and Jones, the present entry contrasts the humanities to the physical sciences that strive to describe and explain the world through evidence derived from observation and experimentation and the social sciences that strive to describe and explain the activities and behaviors of people through evidence developed by experiment, field work, and survey. Unlike scientists and social scientists, humanities scholars do not construct data gathering instruments (e.g., digital sensors or survey questionnaires) that shape their basic evidence and initially record it. Instead the basic evidence for humanities scholars are artifacts, including documents, that other people created.

The grounding of a definition of the humanities in sources of information makes it relevant to LIS. Tibbo, for example, followed Wiberley and Jones's definition in her discussion of user instruction for database searching in the humanities.^[5] The definition, in effect, includes most of the fields normally associated with the humanities: classics; archaeology; literary studies; and history, criticism and theory of the arts, including both fine arts and music. Nevertheless, the definition is unconventional in that it, in effect, includes most of history, often categorized as a social science, and excludes philosophy in the Anglo-American tradition and most of linguistics that are usually grouped with the humanities in universities and by funding agencies and are included in a number of LIS studies about the humanities. This entry discusses philosophy and linguistics, but its conclusion summarizes the article in relation to the Wiberley/Jones definition.

HISTORY OF STUDY OF USES OF INFORMATION IN THE HUMANITIES

In 1975, Bebout, Davis, and Oehlerts asked why there were so few user studies in the humanities, when user studies in the sciences and engineering had a long history and user studies in the social sciences were a growing interest.^[6] Four of the five studies of humanities users they referenced were citation studies. Less than a decade later, Stone, citing over 80 different sources, summarized what had been learned to that point about humanities scholars. Few of the sources Stone cited were user studies, most were informed opinion of an individual about the humanities and the work of humanities' scholars. Among the user studies were a handful of surveys from the United Kingdom and the United States.^[7] In 1994, Watson-Boone synthesized the findings from seven interview or questionnaire studies and six studies of sources used, including two studies covered by Bebout, Davis, and Oehlerts and one that Stone had reviewed.^[8]

Since 1994, researchers have conducted additional questionnaire and interview studies as well as more citation studies. Some scholars, including Bates,^[9] Cole,^[10] Cullars,^[11] Dalton,^[12] Heinzkill,^[13] Knieval and Kelsey,^[14] Palmer and Neumann,^[15] Tibbo,^[16] and Wiberley and Jones,^[17] have published multiple studies that build on their previous work. Because the most recent, relevant publications by these authors cite their earlier work and many other germane publications, this entry generally cites only their latest work.

Unlike Bebout, Davis, and Oehlert, we today know much about how humanities scholars use the literatures of their fields. At the same time, there is more to learn, both because our knowledge is incomplete and the rapid growth of digital primary and secondary literature is likely to change greatly humanities scholarship. Among other things, we need to learn about the predominant types of humanities scholarship so that information professionals can understand humanists better and serve them more effectively.

TYPES OF LITERATURE USED IN THE HUMANITIES

This entry is about the literatures of the humanities. By literature is meant written sources, usually called documents. The social sciences and the sciences have two kinds of literature. First, there is the literature in which social scientists and scientists write about the results of their scholarship. Second, there is a literature that describes and indexes the publications written by social scientists and scientists. This second kind of literature is often called access services. For scholarship in the humanities there are three kinds of literature: primary literature that contains the evidence on which humanists base their scholarship, secondary literature in which humanists write up their scholarship, and access services that describe and index the publications written by humanists. This entry will focus on the primary and secondary literature because there has been substantial research about use of them. It will discuss access literature in relation to them.

Use of primary sources is essential for any work in the humanities. Use of secondary literature is not essential. For example, some significant twentieth century literary criticism cited no secondary sources. But today, the more one aspires for expertise and recognition in the humanities, the more one must engage and cite the secondary literature.

Primary Literature

The primary literature is that which is written by the persons whose activities and accomplishments the humanist seeks to describe or interpret or by persons who observed first-hand the subject whose activities and

accomplishments the humanist studies. For a study of George Washington during his presidential years, the following are examples of primary literature a humanities scholar might use: the correspondence of Washington, his family, friends, political allies, and opponents, and diaries, newspapers, and magazines from his era. For a study of Mark Twain's *Huckleberry Finn*, primary literature could include editions of the novel prepared with the author's participation, Twain's notebooks and correspondence, the papers of the novel's publisher, the records of the persons who manufactured copies of it, and publications and personal papers that contained responses to it.

There are a variety of perspectives for analyzing and classifying sources that can be considered primary literature. Does the source exist only in its original version or are there later versions of the source? Was the source unpublished, that is, created only for personal use or limited, controlled distribution or was the source published, that is, purposely disseminated to the public through established channels of distribution? Does only one copy or do many copies survive? Is the source in the possession of an individual or in an institutional collection? If in an institutional collection, is the collection organized as an archive or as a library? In what medium does the source exist: paper, microform, or digital?

Each of the characteristics of primary literature outlined above affects use. Generally speaking, the more public a source, the easier it is for people to use that source. That is, if a source was initially published in many copies (e.g., a popular novel), it is more likely to be available than if it has only existed in one copy that was made for personal use (e.g., a letter to a friend). Similarly, if a source is in a publicly accessible repository, it is easier to locate and use than if it is in private hands.

While there are numerous cases of scholars using primary sources from private, including personal, collections, for the most part humanists use sources held in institutions—libraries, archives, and museums. This is especially true of older sources in original format. As time passes, few artifacts survive for scholars' use unless they are under institutional care.

Primary literature also includes the digital file of a document. An interesting question is whether a digital file is in itself primary literature or its display on a screen or in print is primary literature. The characteristics that make it primary literature are not apparent until they are displayed, yet without the stored file their appearance is impossible.

Extent of use of primary literature

The landmark work of Cullars on citation patterns in humanities monographs is the best starting point for learning about the extent of use of primary sources in humanities scholarship. Cullars's research and his review of other studies tell us that approximately half of all references in

humanities scholarship are to primary sources. In fine arts scholarship, references to primary literature range from 30% to 45% of all references. When references to art objects (also primary sources) are added to references to primary literature, the percentage ranges from slightly less than 50% to more than 60%. In investigations of studies of literature in western European languages, Cullars found that the percentage of primary literature cited ranged from 49% to 61%.^[18] Other research has found that citations to primary sources are normally more than half of all citations.^[12,13] Interestingly, Cullars's discussion of characteristics of citations in philosophy questions the applicability of the distinction between primary and secondary sources for that discipline because essentially all philosophical writing interprets other philosophical writing. He finds that it is impossible to make a distinction between teachers (in other humanities disciplines the authors of secondary sources, e.g., literary critics) and practitioners (in other disciplines the authors of primary sources, e.g., novelists).^[11]

Access to primary literature

How do humanities scholars gain access to the primary literature that they use? Normally to gain access a person first has to identify a given source as relevant and then locate a copy. Sometimes location comes first and then identification follows. For example, location precedes identification in browsing of book stacks.

Presuming the normal sequence of identification preceding location, we can ask how identification occurs. This question has two parts. First, what terminology do humanities scholars use when they seek primary literature? Second, what sources do humanities scholars use when they seek primary literature?

Regarding terminology, the Getty End-User Online Searching Project showed that humanists distinguish themselves from scientists and social scientists by using proper terms in their information seeking.^[19] Proper terms include names of people (Charles Dickens), places (London), and time periods (Victorian Era). While the Getty study was about retrieval of secondary literature, its findings about use of proper terms apply to primary sources. Reports about users of archives and manuscript collections also tell us that they use names of people and organizations to find relevant sources. In addition, the evidence indicates that humanities scholars use proper terms to organize their notes and to build their understanding of their topics.^[10,20] Humanities scholars do use common terms in their searching, but when they have a topic that lends itself to being described or pursued with proper terms, they use them.

There are several means that humanities scholars use to locate primary literature. For primary literature in archives and manuscript collections, Tibbo's survey of historians in 2001 is the most informative study about historians'

self-reported approaches to archival materials at the turn of the century. First, almost all scholars, at some time, identify relevant collections through leads and citations in printed books and articles. Roughly four-fifths use printed bibliographies, finding aids, and repository guides as well as their home institution's online catalog. Approximately three-fifths search other institutions' online catalogs and bibliographic utilities like OCLC (Online Computer Library Center), and visit repository Web sites. About two-fifths use Web search engines. Younger historians tend to use electronic means more than older historians. Because an increasing number of finding aids and archival documents are appearing on the Web, it will be important to chart change in use of electronic means of identifying relevant collections. Scholars also consult curators and colleagues to find needed materials. Approximately four-fifths ask colleagues, and most ask repository personnel for assistance whether by writing, telephoning, or e-mailing.^[16]

Once at the archives, scholars make great use of finding aids.^[12,16,20] Finding aids describe the individual or corporate body that created or gathered the records, and they enumerate, usually at the folder but sometimes at the document level, the collection's components. While at the archives, scholars also seek help of curators. Because archive and manuscript collections contain unique materials that are not described and cataloged in standardized ways as are books and journals, they are not as easy to find. Interviews with scholars who use archives and manuscripts reveal that most report enlisting the help of collection curators to tell them of recent acquisitions not yet processed, to identify collections the scholar has not found by other means, and to pinpoint relevant materials within collections that the scholar has identified as relevant but not yet examined.^[20]

By no means are all primary sources found in archives and manuscript collections. Literary critics or theorists, for instance, may never use an archival source. For many topics, most relevant primary literature was published. Published literature may include books, magazines, newspapers, and government publications. It also includes modern scholarly editions of older sources, for example, the University of California Press edition of the works of Mark Twain and the University Press of Virginia edition of the papers of George Washington. To locate published sources, use of library catalogs—ranging from the global WorldCat to the local catalog—is essential.^[12]

It should be noted that scholarly editions are an important exception to the general rule that humanists do not contribute to the development of their basic evidence. In scholarly editing, editors make choices, sometimes numerous and sometimes debatable, that shape the content of the scholarly edition. To be sure, editors must be faithful to the content of the original primary literature that initially recorded the basic evidence and must have evidence to justify changes they make. Nevertheless, scholarly

editions differ, even if slightly, from manuscript correspondence, first editions of novels and the like on which they are based.

Digital primary literature

Since the 1980s, studies of humanities scholars have explored the role of digital primary literature in their work. In general, these studies found that few scholars used digital sources and those who did were usually at the margins of their disciplines. This led to the claim that humanities scholars were intrinsically not just opposed to digital sources, but to information technology. Research, however, has shown that, in general, humanists adopt information technology whenever it benefits their work. Most important, the limited use of digital literature appears to have been a function of the scarcity of sources in that format.

The case of ancient Greek texts is instructive in this regard. Since the mid-1980s, the *Thesaurus Linguae Graecae* (TLG) has made available a vast digitized dataset of those texts. Once available, these were used widely by classicists.^[21] The advantage that classics had was that Greek primary literature was limited in scope and much of it could be digitized with the given technology available at the time. For many years, other fields, where the potential primary literature was vast or innumerable, were not in a position to launch such a conversion.

In the present century, the availability of digitized primary literature has grown enormously, largely driven by commercial firms that convert microfilmed sources into digital form or digitize books from partner libraries' collections. Presumably use of these digitized sources is following. A major challenge and obligation for future research about the use of primary literature by humanities scholars is to chart the growth in use of digital literature and how that growth changes use of information and humanities scholarship. To give a simple example of how scholarship might change, we can consider that traditionally historians have identified relevant passages in archival sources by what Cole aptly calls "scan reading."^[10] With computers, scholars can have the machine identify relevant passages either by simple keyword matching or more sophisticated software analysis. Traditionally, scholars have debated each other's judgment and thoroughness in examining the primary literature. In the future, debate may center on choice of keywords or on software selected to screen primary literature.

Because primary literature, often in its original state, is important for humanities scholarship, the preservation of born-digital sources is essential. So far there is no demonstrated ability to preserve digital information over the long-term as well as we can preserve print-on-paper information. Even the most basic forms of documents, for example, e-mails and word-processed letters or drafts of literary works, are at risk. Beyond the fundamental need to

preserve the character strings, it is highly desirable, in some cases at least, to preserve digital information so that it has the same appearance as in its original state. Preservation of the original look of a text may prove extraordinarily difficult, if not impossible. An important question is whether future humanities scholars will be able to analyze the appearance of decades-old, born-digital literature, the way their predecessors analyzed the layout and typography of literature from the print era.

Secondary Literature

In the humanities, secondary literature is writing that describes or interprets what people, usually scholars, find or conclude when they study primary sources about the activities and accomplishments of other people. A book about Washington's presidency and an article in a literary journal about *Huckleberry Finn* are examples of secondary literature. One distinctive characteristic of secondary literature in the humanities is that it normally is the work of a single author. In much of the social sciences and most of the sciences, coauthorship is the norm. Single authorship does not mean that humanities scholars never interact with other scholars. In fact, they normally consult colleagues as well as information professionals. But they do more of their work in isolation than scientists and social scientists.

Also noteworthy about the secondary literature of the humanities is the possibility that it can become primary literature. For instance, scholars may study the evaluation that other scholars have given to Washington's presidency over the years, or they may study critical reaction to *Huckleberry Finn* during different eras. In these cases, books about Washington's presidency or journal articles that interpret *Huckleberry Finn* become primary literature.

A portion of the secondary literature that humanities scholars use is published during their careers. As a result, given natural patterns of book purchase and journal subscription, scholars often use personal copies of secondary literature. For many humanists, use of personal copies of secondary literature contrasts with use of primary literature that is often available only in repositories. At the same time, topical and temporal scatter of secondary literature is normally so great in the humanities that few humanists will own more than a fraction of the secondary sources they use and will rely on libraries for the rest.

Format

In the humanities, the formats in which scholars publish their research are books and journals. Most books are monographs by a single author about a single topic, but a small percentage is books that contain chapters by different authors. Research about formats cited in humanities publications has almost always reported the percentages of books without differentiating between

those single-authored and those with different chapter authors. Also, almost all reports about format are separate from reports about proportions of primary and secondary sources, so there is little to say about the proportions of primary and secondary sources among books and journals. As a result, a synthesis of citation studies cannot present a detailed picture. Despite difficulties in generalization, one trend seems clear. Scholars today cite more literature than their predecessors.^[12,22]

While most research has not differentiated between format of primary and secondary literature, two studies of citations to secondary literature have found that about 75% to 80% of those citations were to books and 20% to 25% to journals.^[12,14] Interestingly, these percentages for books and journals also hold with small variations when citations to primary and secondary literature are combined.^[8,11,13] Linguistics appears not to fit this pattern. In linguistics, studies have found books to be 50% to 60% of citations and journals 40% to 50%.^[14,23]

Age

Humanities scholars are noted for the age of the literature that they use. While in many scientific and social scientific fields it is unusual to cite literature that is more than 10 years old; in the humanities, it is normal to cite literature that is more than a decade old or older. How much of this difference in age of sources is attributable to secondary sources is impossible to say because citation studies in the humanities have not differentiated age of primary sources from age of secondary sources. Furthermore, because different studies use different time frames to report their findings, we can only generalize broadly about their results. That said, the available data are worth presenting, if only to reinforce the overall difference in the use of literature by humanities scholars from the use of literature by scientists and social scientists. Watson-Boone's summary of eight studies shows that roughly one-third of sources cited or used are more than 30 years old.^[8] Later research supports this generalization, except for linguistics.^[11,13,18] In linguistics, almost 90% of the citations are to publications less than 30 years old.^[14,23]

Language

Increasingly after World War II, English became the language of science and today most of the important scientific publications are in that language. The social sciences are less tied to English, but many important international journals are in that language. In the humanities, non-English language publications remain important. As with age, some of the difference stems from citations to primary literature. Nevertheless, Knieval and Kellsey's study of citations to secondary sources in English-language journals in eight humanities disciplines found that the percentage of non-English language publications cited

ranged from one-sixth to one-third, except for linguistics (10%) and philosophy (1%).^[14] Other research supports the finding for linguistics, but not philosophy.^[11,23] Topic of study and the language of a study's author affect language of sources cited. Thirty percent of citations in a sample of English-language monographs in fine arts that included titles about artists from non-English speaking countries were to non-English language publications. German and French fine arts monographs cited their native language about 70% of the time.^[18] In English-language journals about English and American literature nearly 100% of the sources cited were in English.^[13]

Identifying and locating secondary literature

While there are few studies of the use of bibliographic databases like *Historical Abstracts* or the *Modern Language Association International Bibliography* by humanities scholars, evidence indicates that these databases are used more today than their print counterparts were in the past. Dalton and Charnigo found that in 2003 historians preferred bibliographic databases more than other means to identify secondary literature relevant to their research. This contrasts with Dalton's 1981 survey that found abstracts or indexes ranked fifth among means to identify relevant secondary sources.^[12] Increased reliance on bibliographic databases makes sense given that they are easier to use than print indexes—searching of the entire database can be done at the scholar's desktop, eliminating a trip to the library and a series of lookups in separate index volumes—and given the growth in the literature with which scholars must cope.

Besides using bibliographic databases, scholars employ traditional methods of following references in publications they read, looking at specialized bibliographies (e.g., one about the American revolutionary war), searching library catalogs, and reading book reviews and listings of new books and journals. To a lesser extent, scholars consult colleagues and other experts, and, to a slightly lesser extent, librarians. Interestingly, online discussion forums of various sorts seem to have almost no value for identifying secondary literature.^[12]

The previously mentioned Getty End-User Online Searching Project showed that when searching for secondary literature in bibliographic databases, humanists use proper nouns much more than scientists and social scientists. The Getty researchers compared queries of humanists whom they studied with queries of scientists and social scientists found in a study by Saracevic and Kantor. Only 18% of the science and social science queries used proper terms, while 84% of the humanities queries did. Among proper terms, nearly 50% of the humanities queries used the names of individuals. From the perspective of common terms, 100% of the science and social science queries used common terms, while only 57% of the humanities statements did.^[19]

Digital secondary literature

During the past 10 years, more and more of the secondary literature of the humanities has become available in digital format. Major university presses have begun to release digital copies of their books, and humanities journals are increasingly available over the Web. How humanities scholars are using digital secondary literature needs investigation. The book is the most important format for humanists, yet the length of books makes it difficult to read them on screen and impractical to print them out. After scholars discover online relevant books, they may obtain printed copies for reading by purchase or borrowing from a library. Because journal articles are shorter than books, online versions may be what all libraries need to acquire. Scholars who do not read journal articles on-screen can print them out for reading. Even if scholars read only the digital version of a book or journal, they likely will find it easier to cite those articles in traditional form without their URLs. Thus citation data may not necessarily tell what format of a publication the scholar actually used. Survey research will be necessary, while recognizing that what people say they do does not necessarily correspond to their behavior. Important too will be learning if there is a difference between use of digital primary literature and use of digital secondary literature. One hypothesis to test is that humanists use computers to identify relevant passages of primary literature and then read only these passages, but read through secondary sources and use information technology only to deliver the source, not parse it.

How humanities scholars integrate information into their work

Thus far this entry has discussed use of the literatures of the humanities from the perspective of the literatures themselves, both primary and secondary, characteristics of those literatures, mechanisms of access, and digital formats.

Another way to discuss literatures is in terms of how they fit into the scholar's workflow. At what points in a project do humanities scholars normally seek primary and secondary literatures? When do they read those literatures? For literary critics, Chu has proposed a model and noted common variants to it. Not surprisingly, the greatest concentration of searching for primary and secondary literatures occurs after the scholar decides to pursue a topic and before the scholar drafts the write-up. Between those two points, the scholar reads the sources that the search has identified. For some projects of mature scholars, there is no initial search to identify relevant primary and secondary literature, because the scholar already knows what they are. Nevertheless, in all cases, whether the topic is new or familiar, analysis and writing reveal that the scholar needs slight to moderate amounts of additional information and this revelation leads to searching for that information and reading of the sources identified by the search. An important

difference between literary critics, on the one hand, and scientists and social scientists on the other, is that literary critics do not spend time constructing data gathering instruments to record initially their basic evidence. Construction of instruments for initial data recording is unnecessary in the humanities because that evidence already exists.^[24]

Other research by Case on how historians work concludes that “stages of research are illusory” and that “choosing and refining topics, planning and conducting studies, gathering and interpreting evidence, and writing and revising manuscripts can go on concurrently, both within and across individual projects.”^[25] It may be that humanists, like Chu’s literary critics, who begin with an interest in specific works of art, literature, and music and then study those works differ from humanists, like Case’s historians, who begin with topics and then explore bodies of archival materials and other blocks of primary sources like newspapers in order to understand those topics. The projects of the latter group of humanists are usually more open ended than those of the former group necessitating more iterations of seeking additional information, refining the topic, and revising the write-up.

Exposition of the elements of the workflow of humanities scholars is an important advance in our understanding of their use of information. With models in mind, practitioners can be more sensitive to the needs of humanists with whom they work. For example, while identifying a long list of relevant literature can help a humanist at the start of a project, a long list probably will be a hindrance after the analysis and writing stage when the humanist is addressing specific information needs.

There is still much to learn about how humanists use information for different types of scholarship. Tibbo, for example, found that social historians differ from biographers in the ways they seek information about archival collections.^[16] We know that critical and documentary editions differ from publications of interpretative types of humanities scholarship like criticism, history, and theory. But we lack analyses of the nature of these and other differences, their relationships to searching for and use of primary and secondary literatures, and their meaning for practice by information professionals. This is a challenge because to understand well humanities scholarship, one must study both scholars in many disciplines and books that are far more difficult to analyze than journal articles. The greater availability of digital versions of books should help in this regard, because it provides machine-readable data for such analyses.

CONCLUSION

The literatures of the humanities and the uses of them have several characteristics that distinguish them from the literatures of the sciences and the social sciences and use of those literatures. While the sciences have as their basic evidence results of observation and experiment and the

social sciences the results of experiment, field work, and survey, the humanities study artifacts, especially documents, created by other people. The documents that are the humanist’s basic evidence constitute the primary literature of the humanities. Scientists and social scientists do not have a comparable literature. Almost half of the citations in humanities scholars’ publications are to primary literature or other primary sources. Because the humanities study what people have done in different places and at different times, proper terms, especially the names of individuals, are very important in retrieval of literature, both primary and secondary. Also, because humanities scholarship builds upon documents and artifacts created by different people in different places and times and not by the humanist who uses them, there is less possibility for conventions of method or uniformity in procedure in humanities scholarship than there is in the sciences and social sciences where scholars themselves initially record their basic data. Without a role in the initial recording of their basic data, humanists are less able to construct paradigms than are scientists and social scientists. One consequence of uniqueness of setting and basic evidence and the lack of paradigms and conventions of method is that publications in the humanities generally have to be longer than those in the sciences and social sciences in order to explain the context of the findings and the way in which the scholar developed them. As a result, the book, rather than the journal article, is the predominant form of publication. Lacking paradigms and conventions of method, humanities publications do not build on a sequence of preceding scholarship as easily as do the sciences and social sciences, and so are less likely to cite new scholarship than scientific or social scientific publications. Given that they discuss past activities and accomplishments in different places around the world, there is greater diversity in language of sources cited in the humanities publications than in scientific and social scientific publications.

Because humanists generally do not have a role in the development of their basic evidence as do scientists and social scientists, they have applied more slowly information technology to their scholarship. Since the turn of the century, the availability of digital primary literature has increased very significantly, as countless documents are born digital and innumerable paper-based sources are converted into digital form. Increased digitization of primary evidence and secondary literature is likely to change greatly humanities scholarship. Today, the primary task for research about use of literatures in the humanities is to study effects of this digitization on humanities scholarship.

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Hungary: Libraries, Archives, and Museums

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Abstract

After briefly introducing the history of Hungarian literacy, libraries, publishing, record keeping, and museums, this entry gives an overview of Hungarian libraries, the discipline of information science, and the library and information profession, including education for library professionals, and professional associations in the country. A similar review follows about archives: an overview of the different kinds of archives, archival science, education for archivists, and the issue of electronic records. The last section of this entry describes the various kinds of museums, museology, education for curatorship, and professional associations in Hungary.

INTRODUCTION

Historical Context

Hungary is a country in Central-Eastern Europe. 10.3 million inhabitants live in a territory of 35,907 miles² (93,000 km²) (see Fig. 1). The capital is Budapest. Its official language is Hungarian, a Finno-Ougric language. The Hungarian alphabet consists of Latin with the addition of diacritics and two or three letter combinations in order to cover the characteristics of Hungarian phonemes.

The history of literacy and the currently used Latin alphabet is 1000 years old: it goes back to the years after 1000 A.D. when the Hungarian state was established. István I (Stephan I, 1001–1038) Christianized the formerly tribal and pagan people that had used a special type of cuneiform as their writing system. Literature had been orally transmitted during the nomadic period, with written literature appearing shortly after 1000. István I founded monasteries that fulfilled not only religious but also educational functions. Most of the early monasteries probably had libraries holding handwritten literature for ecclesiastic purposes. The most famous was the monastery and library of Pannonhalma, founded in 1001, that operated the first school of the country. An inventory from 1093 indicates the ownership of 80 books. Very little from the early monastic library holdings remained as they were all destroyed during the Mongol invasion (1241).

Early texts as well as the official documents of the royal court were written in Latin. Charters recorded medieval land transactions from the turn of the eleventh century onward. Béla IV (1235–1270) ordered the compulsory recording of land transactions and other legal acts. Systematic tracking of regal decrees (Regestrum) started from 1308 on. The earliest extant Hungarian text is a funeral sermon, “Halotti Beszéd,” which has been found in the Latin *Pray Codex*, a work from 1192.

The first universities were founded in the second half of the fourteenth century in Pécs (1367) and Ó-Buda (1387), but were closed during the Turkish occupation of the country (1541–1699). The earliest predecessor of the current universities was founded by the Catholic Church during the first half of the seventeenth century in Nagyszombat (now Trnava, Slovakia) where the Esztergom Archbishopric moved from the territory occupied by the Turks.

Book culture was restricted to the church until the end of the fourteenth century, but extended to secular areas during the Humanist Movement of the fourteenth and fifteenth centuries when lay people began to collect books and build small libraries. The first printed book written in Hungarian dates from the first half of the fifteenth century.

The great Humanist ruler Matthias Corvinus (Corvina Mátyás, 1458–1490) represented the high point of early book culture. Matthias’ library, the *Corvinae*, included 2000–2500 mainly handwritten illustrated codices in Greek and Latin, their topics ranging from physics and mathematics to philosophy. Most of these books, created by some of the famous Italian workshops, were richly illustrated, decorated with gold, and individualized by Matthias’ coat of arms. The library was open to those who needed to use the books, particularly scholars, many of them visiting Hungary because of the library itself. Only 216 pieces of this famous collection remain: 52 in Hungarian libraries, the rest in the libraries of 43 different cities in 16 different countries. Rulers succeeding Matthias were not interested in preserving or developing his library, and the collection was given away; what remained was destroyed during the Turkish occupation of the country.^[1]

Andras Hess founded and operated the first printing press in Buda in 1473, during the reign of King Matthias. The workshop’s first product was a book entitled *Chronicle of Buda (Chronicon Budense)*. This press closed after a few years, and Hungarian books were printed abroad for almost a half century.



Fig. 1 Map of Hungary.

Source: CIA World Factbook.^[59]

During the Turkish occupation (1526–1699) of a large part of Hungary's territory, book culture and the Humanist Movement continued in the territory held by Austria and in Transylvania. Printing presses were established in these territories rather than in Hungary because the Sultan officially forbade the printing of books in occupied land.

Government documents of the Hungarian Kingdom were systematically archived from 1613 on, but the documents stayed in private property, and were sometimes destroyed or distributed by the heirs until 1723 when a law ordered their deposition in specific governmental archives.

The foundation of the first university (Nagyszombat) and Catholic and Protestant colleges (Debrecen, Sárospatak, Pápa) from the mid-sixteenth century on paralleled the establishment and development of new libraries. Book printing spread all over the country; important Catholic printing firms operated in Vienna, Pozsony (now Bratislava, Slovakia), and Nagyszombat. The most important figure of early Hungarian book printing, *Misztótfalusi Kis Miklós* (1650–1702), studied in Amsterdam in the workshop of the Bleau family and published more than 100 books, the most famous of which was the *Golden Bible* (*Aranyos Biblia*, 1685). The Reformation gained momentum and had a positive effect on the diffusion of the use of Hungarian language and printing. Protestant printing presses were established in Debrecen, Pápa, and Eperjes (now Presov, Slovakia). The first Hungarian journal, *Magyar Hirmondó*, was started in 1780 in Pozsony.

Building library collections in richly furnished library rooms became fashionable among high-level aristocrats

and clergymen during the seventeenth and eighteenth centuries. The Festetics Library in Keszthely has been preserved in its wonderful original state as has the Teleki Family's library in Marosvásárhely (now Târgu-Mureș, Romania).^[2]

The spirit of Romanticism and the emergence of national consciousness generated an increased interest in language standardization and the establishment of a broad range of new institutions, among them the Hungarian Academy of Sciences (*Magyar Tudományos Akadémia*), the Budapest University Library (*Egyetemi Könyvtár*), and other libraries, archives, and museums. The most important among them was the Hungarian National Museum and Library (*Magyar Nemzeti Múzeum és Könyvtár*), created in 1802 by count Ferenc Széchenyi who donated to the new institution his library, his collections of coins and sculptures, as well as other valuable objects. A law proclaimed the foundation in 1807. The current building of the museum, planned by architect *Mihály Pollack*, was completed in 1846. Before the close of the century, several new museums emerged from the collections of the National Museum. The current Museum of Science (*Természettudományi Múzeum*) grew out of a large collection of minerals donated by Ferenc Széchenyi's wife. The Ethnographic Museum (*Néprajzi Múzeum*) split from the National Museum at a later date. The second part of the nineteenth century saw the foundation of a series of new museums (Museum of Applied Art, *Iparművészeti Múzeum*; Museum of Fine Arts, *Szépművészeti Múzeum*, the Zoo, etc.) due mainly to the enhanced economic

conditions after 1867 and the activity of a few great scholar-managers, e.g., *Ferenc Pulszky*, *Flóris Römer*, *Károly Pulszky*, and *György Ráth*.^[3] Libraries and museums have been overseen together by the Main Supervisory Office of Museums and Libraries since the end of the nineteenth century. The main goal of this cosupervision was to increase cooperation between the two types of institutions. This governmental office started the first periodical of the two fields, the *Múzeumi és könyvtári értesítő* (Museum and Library Bulletin) in 1907.

A nationwide effort to standardize the national language began in the second half of the eighteenth century; in this era, the greatest writers and poets created those linguistic forms that effectively determined classical national literature and language. In 1844, Hungarian became official language of Hungary instead of Latin; official documents had to be composed in the national language from this time on. Compulsory sixth grade education begun in 1868.

Formerly, Hungary's governmental documents had been written in Latin and had been collected and stored together with Austria's governmental documents in the *Haus-, Hof- und Staatsarchiv* of the Austro-Hungarian Monarchy since 1749. In 1756, however, a separate archive was created for holding the governmental documents of Hungary, now part of the Habsburg empire. The Palatine, lieutenant-governor of the emperor, exercised supervision over its operations; he was responsible for collecting, preserving, and passing along the documents to the office of the next Palatine.

Independence from Austria, the main goal of the 1848 revolution, failed but a few decades later, the Compromise (Kiegyezés, 1867) established a dual state structure and numerous measures that assured partial independence, self-government, and economic growth. Among many other changes, the Palatine's Archive (*Archivum Palatinum*) was transformed into *National Archives* (Országos Levéltár), signifying the relative independence of Hungary from Austria. A renowned historian, *Gyula Pauler* was appointed chief archivist; he introduced new regulations that permitted scholarly research in the institution. The new Archive took over the documents of the feudal governmental institutions and juridical courts collected by its predecessors. More appropriate space for this immense set of historical holdings was built and opened in 1923. This building still houses the Archives and is located at the southern entrance of the castle area in Budapest.^[4]

Citizens and families were allowed to deposit their own private documents in a different archive that was part of the National Museum and Library; this archive later split off from the parent institution, and became independent under the name Museum-Archives (*Múzeumi Archivum*) in 1926 until its ultimate merger with the National Archives (*Országos Levéltár*) around 1934.

Book printing became an important industry in the nineteenth century when several technologically advanced

printing companies were established together with major editorial firms (*Franklin, Athaeneum*). *Izidor Kner* and *Andor Tevan* were the most outstanding representatives of artisan bookmaking. Popular demand for broader ranges of books resulted in the opening of public libraries; the first among them was the *Fővárosi Könyvtár* (Library of the Capital), opened in 1904 by *Ervin Szabó*, a social scientist-librarian, who successfully convinced book producers and traders that public libraries will not ruin the flourishing book industry. He established a large network of public libraries in the capital based on the Anglo-American model; its book circulation in 1914 was 190,000 volumes.

During the interwar period, Hungarian libraries—with a few exceptions—were in decline due to insufficient funding. The only library that made some progress was the National Széchényi Library where special collections were enhanced by the return of 16 Corvina codices, the Picture Chronicle, and the *Gesta Hungarorum* among other texts from the Habsburg Court Library of Vienna. The National Library developed its classification system as well by abandoning the Munich subject system for the Universal Decimal Classification that is still the organizational principle of the books in the stacks. According to Charlotte Réthi's calculations, about 1000 academic and specialized libraries held about 11 million volumes by 1939, while the holdings of the school, public, union, and other libraries was under 1 million.^[5] During World War II, many of the libraries were destroyed, and their holdings decimated, in part by looting and confiscation.

Three general trends characterized the development of libraries, archives, and museums after 1945 when Soviet-type state socialism was introduced: the radical nationalization of private institutions, the ambitious creation of village and union libraries, and the centralization of management. Library and museum collections that had been confiscated from private institutions, except a portion of those belonging to the Church, were either added to the holdings of the National Library of state-owned museums, destroyed, or distributed among other libraries. County and municipal archives were taken over by the state. Central managerial organizations were created: the National Library Center (*Országos Könyvtári Központ*) and the National Center of Archives (*Levéltárak Országos Központja*). The Central Economic Archives (*Központi Gazdasági Archivum*) was created to collect documents of the nationalized firms, factories, and other economic units, and the National Museum Center (*Országos Múzeumi Központ*) was developed to govern every single institution on the basis of 5 year plans. This structure only changed in 1968 when municipal and metropolitan libraries were again subordinated to the municipalities. According to Charlotte Réthi, the number of libraries skyrocketed: almost 10,000 libraries operated around 1953, holding more than 27 million volumes, circulating about 8 million, and serving 1.2 million users.^[6] (Works

by Madas and Monok,^[7] Blazovich and Müller,^[8] Dóka,^[9] Varjas,^[10] and Kent and Lancour^[11] are consulted on the history of literacy, book publishing, libraries, archives, and museums.)

State socialism collapsed in 1989–1990 as capitalism and democracy gained momentum. Previously confiscated holdings whose former owners could be identified were returned to church libraries, archives, and museums. Private individuals founded art galleries and other institutions, and hidden private art collections became known. On the other hand, most of the small union libraries and hospital libraries have been shut down.

Some of the archives experienced unprecedented numbers of clients requesting documents in support of restitution requests for the Shoah, prisoners of war, victims of expulsion, those turned in to the secret police, and so on. Within 4 years, almost 2 million people turned to the Hungarian archives. A number of new laws were passed about the freedom of information and the operation of archives, libraries, museums, and historical monuments. An unparalleled effort to overcome technological backwardness began: computerization and automation accelerated due to the disappearance of internal (ideological, financial) and external (trade embargo) obstacles. By 2005, 25% of Hungarian households had an Internet connection, about half of the average found in the 15 most developed European Union countries. This technological level has facilitated Hungarians' access to the growing number of digital library, archive, and museum collections and services.

From 2001–2005, the number of registered library users in Hungary grew by 19%, a feat hailed by the library profession and government authorities as an achievement in an era when libraries now compete with the Internet. The number of computer terminals in libraries grew by 47% during that same period, raising the proportion of libraries equipped with computers to 52.9%. The biggest change has been a 145% rise in interlibrary loan/document delivery transactions, contributing to more equal access to library holdings across the Hungarian population. The number of items checked out and the number of items read in the libraries themselves has remained the same—a tendency that experts interpret as a shift in the user behavior, i.e., users are turning more and more to electronic resources instead of the print.^[12]

LIBRARY AND INFORMATION PROFESSIONS, SYSTEMS, AND SERVICES^[13]

Overview of Legislation

The rights to intellectual freedom and free access to information are declared in the Constitution: “In the Republic of Hungary everyone has the right to the free declaration of his views and opinions, and has the right of access to

information of public interest, and also the freedom to disseminate such information.”^[14]

The law that specifically regulates Hungarian libraries is part of a larger legal document: the 1997 CXL Law on the Protection of Cultural Heritage, Museums, Public Libraries, and Continuing Education.^[15] The section about libraries guarantees Hungarian citizens' rights as library users, and regulates the operation and development of “libraries open to all users” (a concept broader than “public libraries”). As defined in the law, the following are “libraries open to all users”: the National Library (*Országos Széchényi Könyvtár*), local municipal libraries, county libraries, the libraries of state universities, and 11 national specialized research libraries and documentary centers listed in the appendix as the National Technical Information Center and Library (*Országos Műszaki Információs Központ és Könyvtár*), the National Health Policy Library (*Országos Egészségpolitikai Könyvtár*), the Library of the Hungarian Academy of Sciences (*Magyar Tudományos Akadémia Könyvtára*), the National Library and Information Center for Agriculture (*Országos Mezőgazdasági Könyvtár és Dokumentációs Központ*), the Library of the Parliament (*Országgyűlési Könyvtár*), the National Library of Foreign Literatures (*Országos Idegennyelvű Könyvtár*), National Educational Library and Museum (*Országos Pedagógiai Könyvtár és Múzeum*), the Metropolitan Ervin Szabó Library (*Fővárosi Szabó Ervin Könyvtár*), the Library and Documentation Service of the Central Statistical Office (*Központi Statisztikai Hivatal Könyvtár és Dokumentációs Szolgálat*), the Library of the Hungarian Film Institute (*Magyar Filmintézet Könyvtára*), and the Library of the Institute of Military History (*Hadtörténeti Intézet Könyvtára*).

Those institutions that have their own libraries, like churches, may request and receive the “library open to all users” status and, as a result, receive state support for their institutions if they fulfill all those requirements that the law stipulates. Libraries open to all users are cosupported by their parent institutions or local municipalities (if they have one) and the state.

The law guarantees free in-house access to library materials in these institutions. Users' names, addresses, ID numbers, and date and place of birth may be recorded. Additional services (borrowing, etc.) are available for a membership fee that is waived for persons under 16 or over 70 and for the disabled.

Libraries open to all users are required to employ professional librarians, develop their collections, and provide access to their own and other library collections. They participate in interlibrary loan activities, and supply statistical data about their operations.

An official current list of libraries open to all users is maintained by the Ministry for Education and Culture, the government agency that is responsible for the strategic development and supervision of the Hungarian library systems. Libraries listed by the Ministry receive financial

support from the state. The Minister for Culture and Education is required to assure a national network and database of library materials including a catalog of library holdings, a system of interlibrary loans, and a method of forwarding weeded/withdrawn materials to those libraries that want to add them to their collections. The law regulates the responsibilities of the national library, the academic and research libraries, and public municipal libraries and directs publishers to provide depository copies of books and periodicals. Specific sections deal with the management and financial regulation of public libraries.

Fair use is regulated in the 1999 LXXVI Copyright Law.^[16]

The 2003 XXIV “Transparent Pocket” (*“Üvegzszeb”*) Law requires public institutions to publicize the amounts and use of their public funding. Most public institutions—among them, libraries, archives, and museums—publicize the details of their budgets and spending on their Web sites.

The Ministry for Education and Culture appoints two supervisory bodies: the National Library Board (*Országos Könyvtári Kuratórium*), which oversees the operations of the national library and the Library Institute, and the Accreditation Committee of Libraries (*Könyvtári Akkreditációs Szakbizottság*) which makes accreditation decisions regarding programs for the education of librarians and library assistants.

National Library

The Hungarian Széchényi National Library (*Országos Széchényi Könyvtár*) collects, processes, and preserves the written heritage of Hungary and all documents pertaining to it. The Library’s complete collection of Hungarica (books and other documents published in Hungary, as well as publications related to Hungary or Hungarians published abroad) is available for users in all formats: parchment, paper, and electronic. The National Széchényi Library is the largest depository library for copyrighted materials published in the country. Its special collections include manuscripts, ephemera, photographs, old imprints, theatrical publications, maps, and musical scores. Hundreds of medieval codices, incunabula, and the most precious first-known Hungarian texts are held in these special collection sections. Surviving pieces of the library of King Matthias, the Corvinae, also belong to the Library’s exceptional collections.^[17]

The collections of the National Library are part of Hungary’s national cultural heritage; hence their use is regulated by the Ministry differently from the use of the materials held in other libraries. The main difference is that its holdings can be consulted only in-house; its collections are noncirculating. Unlike in other public libraries or libraries open to the general public, users have to buy a day ticket or membership card for in-house consultation of the collections.

The Hungarian National Bibliography (specific lists of published books, periodicals, maps, music scores, and recordings) is produced in the National Széchényi Library, and its most recent 5 years are available freely through the Internet. The library became the host and central agent of the Hungarian National Union Library Catalog (*MOKKA*), which currently unites the holdings of 17 large Hungarian libraries. MOKKA was founded during the 1980s and has thrived since 2002. Another database housed in the National Library, the National Document Delivery System, provides the software which is the basis for nationwide interlibrary loans.

Several special databases are being developed by the Széchényi Library: they provide access to the *Bibliographia Hungarica*, a searchable catalog of 73,000 foreign language translations of Hungarian literary authors since 1800. Currently in development is *Bibliotheca Eruditionis*, a database of 1500–1700 imprints published in the Carpathian basin. A virtual reconstruction of King Matthias’ Library, the *Bibliotheca Corviniana Digitalis*, is also in the making.

The Library Institute (*Könyvtári Intézet*), housed and operated in the National Széchényi Library, is a library and information science research center responsible for creating the national strategic plan, providing certain central services for librarians and libraries, offering courses for education, and conducting research in library and information science. One of the central concerns of the Institute’s 2003–2007 strategic plan is the coordination with and adjustment of Hungarian librarianship to the standards and requirements of the European Union.

The National Library was founded by Count Ferenc Széchényi on November 25th, 1802 with these words: “[This institution] I bestow upon for the good and benefit of my beloved country and the community for ever and irrevocably.” The foundational holdings included 13,000 printed books, more than 1200 manuscripts, hundreds of maps, coats of arms, etchings, coins, and more. The opening ceremony was held in 1803. A nationwide campaign was launched to raise the necessary funds from private citizens and other sources for its operations and maintenance. These financial resources made possible the foundation of the Hungarian National Museum, of which the National Széchényi Library was a part. Both institutions moved into the classical-style building of the National Museum in 1846–1847. The library later became independent from the museum in 1949. In 1985, the institution moved into the F building of the Royal Castle in Buda. Most of the collections—now about 7.5 million—are held in storage, but the most important works of reference, essential works in the different disciplines, and a certain part of the university textbook collections are available on the shelves of the reading rooms. General reading rooms are two floors above the entrance (on the seventh floor of the building). Special collections are located on the fifth, sixth, and seventh floors. Guided tours of the library, both

for individuals and groups, are available by appointment. The most valuable pieces from the collections are displayed in temporary exhibitions.

Academic and Research Libraries

The National Library, the *Central Library of the Lajos Kossuth University*, the libraries of the state universities, and the 11 research libraries listed in the 1997 CXL Law are the main institutions providing library materials for research in Hungary.

The most famous among them is the Library of the Hungarian Academy of Sciences (*Magyar Tudományos Akadémia Könyvtára*). The library is adjacent to the nineteenth-century neo-Renaissance central building of the Academy on the Pest (east) side of the river Danube. This institution was founded in 1836 by the donation of József Teleki's collection of 30,000 volumes, shortly after the foundation of the Academy itself in 1825 by count István Széchenyi. The library's main function has been to support research within the most important scholarly institution of the country. Its special collections currently include a world famous collection of Tibetan, Turkish, Persian, and Central Asian materials, as well as Hebraica. The central library of the Academy, holding more than 2 million volumes, collects materials on languages and literatures, classics, Oriental research, science-related policy, research management, and the history and methodology of science. Members of the broad network of research institutes of the Academy all include discipline-specific libraries collecting scholarly materials in a broad range of the sciences, social sciences, and humanities.

The National Technical Information Center and Library (*Országos Műszaki Könyvtár és Dokumentációs Központ*) collects materials and provides services in the sciences, economics, and engineering. More than 2 million items are held in the institution. The Center builds and provides access to a number of important databases, including the Hungarian Repertory of Technical and Economic Information (*Magyar Műszaki és Gazdasági Repertórium*), and the Hungarian Research and Development Abstracts (in English).

The National Library of Health (*Országos Egészségszakkönyvtár*) compiles the Hungarian Medical Bibliography and extensively collects materials related to public policy, international health organizations, and management of medical institutions.^[18–20]

The National Library and Information Center for Agriculture (*Országos Mezőgazdasági Könyvtár és Információs Központ*) compiles the Hungarian Agricultural Bibliography. Its comprehensive agricultural collections serve a broad range of academic and practical needs for professional institutions as well as the general public.

The holdings of the National Educational Library and Museum (*Országos Pedagógiai Könyvtár és Múzeum*) include a comprehensive Hungarian and selective foreign

collection of publications—monographs and periodicals—on pedagogy and its interdisciplinary fields (psychology, sociology, etc.). Its special collections include publications (yearbooks) of Hungarian schools as well as children's and youth periodicals. This institution houses the Hungarian branch of the Center to Promote Language Education in Europe, an institution of the Council of Europe helping European Union (EU) member countries to encourage excellence and innovation in foreign language teaching. This library produces the Hungarian Educational Technology Database.

The Library of the Parliament (*Országgyűlési Könyvtár*), founded around 1866, is located in the renowned nineteenth-century neo-Gothic building of the Hungarian Parliament, on the east bank of the river Danube. Its main collections focus on law, government information (as a depository library of the EU), and the social sciences (particularly political science and sociology).

The Library of the Central Statistical Office (*Központi Statisztikai Hivatal Könyvtára*), one of Europe's largest statistical collections, was founded together with the Hungarian governmental statistical service in 1867, and became a research library open to the public as of 1897. The library collects comprehensively in Hungarian and selectively in foreign materials on statistics, demography, and other social sciences, especially the economic-statistical aspects of the other social sciences.

The National Library of Foreign Literatures (*Országos Idegennyelvű Könyvtár*) is the newest from among the large Hungarian research libraries. Belles lettres—especially contemporary literature—linguistics, and music constitute the core of its collections which are primarily in English, French, German, Italian, Russian, and Spanish. This library is a research center and coordinator of public libraries serving minorities (Slovak, German, Serbian, etc.) living in Hungary. The library has borne its current name since 1989; its predecessor, the Gorky Library, founded in 1956, was a center for Russian culture.

More than 200 private- and state-funded university and college libraries served higher education and the general public in 2002.

University and college libraries demonstrate considerable strength in their print collections: the collections of the libraries of *Eötvös Loránd University* (Budapest), *Attila József University* (Szeged), and *Janus Pannonius University* (Pécs) number in the range of 3.5, 1.2, and 1.6 million volumes, respectively.

A sharp increase in the number of college students, the economic conditions of the transformation period from state socialism to capitalism and democracy, and the required merger of small specialized institutions into larger organizations brought many challenges to these libraries during the 1990s and early 2000s. These changes generated more active cooperation and resource sharing especially in the fields of digitization, delivery of online services, license negotiation, and electronic resource management.

Public Libraries

Budapest, the capital city, has its own central public library, the Metropolitan Szabó Ervin Library (*Fővárosi Szabó Ervin Könyvtár*), named after an early twentieth-century social scientist and librarian. The city also hosts a broad network of metropolitan district libraries (57 in 2007). The central library is located in the beautifully renovated building of the Wenckheim palace and extends to the neighboring Pálffy palace, home of the music collections. All 19 counties and all of the nearly 300 municipalities are required by law to operate a public library. Small settlements have to run their own public libraries if their population exceeds 2500–3000. These towns may choose to run their own libraries, or, order library services through the Service System for Rural Areas. Mobile libraries are routed to villages with fewer than 1000 inhabitants. In 2007, more than 2500 villages had their own public libraries that, in addition to supporting primary, secondary, and continuous education, information, and leisure-reading, have a special role in collecting and preserving locally published documents and documents of local interest.^[21,22]

The National Document Delivery System (*Országos Dokumentum-ellátási Rendszer*) ensures enhanced access for users to library holdings not held in their local public library or at libraries open to the general public. Established in 1998 and operated by the Hungarian National Library, it provides a searchable database for locating library materials for interlibrary loan. The Hungarian government supports this program by not only financing the central database, but also by funding the acquisition of materials and their postal or electronic delivery to the patrons located anywhere, including small villages. This program is one of the central elements of the government's strategic initiative that considers public libraries and libraries open to all users as pivotal institutions of the information society. The program helps library services in rural areas reach the same level of access as any larger library. Services include physical and electronic document delivery, online information services, organization of exhibitions, and events.

School Libraries

Teaching library skills has been part of the National Curriculum since 1995. The 2003 Law of Public Education stipulates the existence of libraries and the hiring of librarian-teachers in most public schools. However, the quality of these school libraries, their holdings, and their equipment is not always up to the required level; their conditions depend mostly on the economic circumstances and leadership of the given educational institutions. The number of school libraries in Hungary exceeds 4000. The National Pedagogical Library and Museum (NPLM) develops their standards and coordinates their professional

work. The NPLM provides a wide array of resources for librarian-teachers. Libraries of private educational institutions have to satisfy the same standards and requirements as public schools.^[23,24]

Special Libraries

In spite of the early appearance of the first book collections in hospitals (like Rókus Hospital at the end of eighteenth century, and a number of libraries from the early twentieth century on) most medical libraries were founded after the 1956 Library Law. The medical library network counted more than 300 specialized libraries during the early 1960s and more than 400 during the mid-1970s. This abundance was followed by a period of mergers and shutdowns during the 1980s and 1990s that paralleled a controversial integration and reform process for medical institutions. The Hungarian Medical Library Association counted 171 medical libraries in 2000, excluding the libraries of medical schools.^[25,26]

The Library of the Parliament (*Országgyűlési Könyvtár*) and the libraries of the law schools are the special legal libraries in Hungary. Though law firms have book collections, law libraries have not been institutionalized. The first searchable online law collections appeared during the late 2000s.

Religiously affiliated libraries are maintained by the Catholic, Calvinist, Lutheran, Eastern Orthodox, and Unitarian churches, and Jewish religious communities, and offer access to their collections for users within and outside of their religious institutions and communities. *Theca*, the shared bibliographic database of religiously affiliated libraries, provides access to a growing proportion of their post-1850 holdings.

Digital Library Collections and Services

The Hungarian Electronic Library (*Magyar Elektronikus Könyvtár*^[27]) collects and preserves freely available documents on Hungary and Central Europe in the areas of culture, education, and scholarly research. The depository is open to the public not only for access, but also for uploading materials. A description helps prospective contributors with content and format criteria. Added works must be out of copyright or accompanied by the permission of the copyright holder. Contributed documents are uploaded via file transfer protocol to the depository. People are invited to send their own works and suggest documents stored on other servers for transfer. This archive of books—and, in small proportion, maps and music scores—was a private initiative of enthusiastic librarians in 1994. It became a project of the National Information Infrastructure Development Program as well as a later popular movement. In 2007, the number of works archived in the depository exceeded 5000. Part of the archives is the result of a major digitization project:

the Digital Library of Hungarian Studies (*Hungarológiai Alapkönyvtár*), making almost 4000 classical texts and reference materials available in the area of Hungarian studies. Both the latter project and the Hungarian Electronic Library are coordinated by the National Széchényi Library.

The National Electronic Periodicals Archive and Database (*Elektronikus Periodika Archivum és Adatbázis*^[28]) is a catalog and archive of Hungarian and Hungary-related periodicals. The archives also include digitized or born-digital resources which are either stored here or are linked from other sites. Users can search by title, year, subject, and full text (if the resource is locally archived). In conjunction with the periodical titles, the depository presents the text of the copyright agreement with the publishers of the resources about the use of the full text. Opened in 2004, the EPA is rapidly growing; its aim is to become a comprehensive gateway to Hungarian and Hungary-related periodical literature. In 2007, it included about 1200 periodical titles of which 153 were locally archived and more than 1500 were linked from another site.

The John von Neumann Digital Library (*Neumann János Digitális Könyvtár*^[29]), named after the Hungarian-born American mathematician, is a state-funded institution performing digitization projects of Hungarian cultural heritage. Its collections are selected from among the most valuable and respected literary works and secondary literature. The Neumann Library supports e-learning from early childhood to continuing education. The deposited works are freely available for reading and full-text searching. Parts of the Neumann Library include: the *Bibliotheca Hungarica Internetiana*, a virtual collection of critical and popular editions of the works of Hungarian—literary and nonfiction—classical authors; the Digital Literary Academy (*Digitális Irodalmi Akadémia*), a gateway to the works of the best living Hungarian literary authors; a collection of children's readings, audio and visual materials, animated stories, videos and games, and the Reading is Fun program (*Olvasni jó*); The latter part includes carefully selected educational materials for the youngest generation.

The Hungarian National Library is digitizing the available pieces of King Matthias' fifteenth-century library. In 2007, the *Bibliotheca Corviniana Digitalis*^[30] included 36 codices—all held in the National Library—and provided information about the other "Corvinae" held in libraries in 16 countries. Full codicological description, an analysis of their art historical context, and a full bibliography completes the collection.

The National Digital Data Archive (*Nemzeti Digitális Adattár*^[31]) is a searchable catalog of metadata representing Hungarian and Hungary-related content: virtual libraries, museums, archives, and other digital documents (including the items held in the above-mentioned databases). The cooperation, including more than 50 partner institutions, is based on the use of a standard metadata

system and shared data operation. The NDA provides a catalog of metadata, a search engine, and their technological background; it does not run digitization projects itself.

A large number of other archives, catalogs, and databases are available at their own Web sites or through the National Digital Data Archive: e.g., Fine Arts in Hungary (*Képzőművészet Magyarországon*^[32]), Budapest Photo Archive (*Budapest Képtár*^[33]), Hungarian Film History Online (*Magyar Filmtörténet online*^[34]), the Data Archive of the Social Research Center TÁRKI (*Társadalomtudományi Digitális Adattár*^[35]), and the BMC Hungarian Music Information Center (*BMC Magyar Zenei Információs Központ*^[36]), among many others.

LIBINFO^[37] is a Hungarian national online reference service. A few dozen listed librarians provide answers to e-mailed reference questions within 48 hr. The service operates on a consortial basis; questions are triaged to the most appropriate librarian expert on the list. The service is hosted and coordinated by the Hungarian National Library.

Library and Information Science as Discipline and Profession

Scholar bibliographers were the first representatives of library science in Hungary in the eighteenth and nineteenth centuries (*Péter Bod*, 1712–1769 *Károly Szabó*, 1824–1890, *Géza Petrik*, 1845–1925), and bibliographies and collections of authors' biographies were the first works of the discipline. *József Szinnyi* (1830–1913), founder-director of the Periodicals Collections of the National Library wrote the most comprehensive 14-volume Hungarian bio-bibliography on pre-1900 authors published between 1890 and 1913.^[38] He also published the first comprehensive repertory of Hungarian and foreign serials in three volumes.^[39] Library science became an academic discipline in 1901 at the University of Kolozsvár (now Cluj) and in Budapest in 1914. *Pál Gulyás* continued Szinnyi's work, publishing a main bio-bibliographical work on post-1900 authors. Early twentieth-century librarians wrote the first works on specific issues (cataloging etc.) of librarianship, and the first research center dealing with the discipline (*Országos Könyvforgalmi és Bibliográfiai Központ*, National Center for the Book Trade and Bibliography) was established in 1923; it was transformed into a National Center for Libraries in 1945. The successor of this center is the *Institute of Librarianship* (*Könyvtártudományi Intézet*), operating within the framework and in the building of the National Library (*Országos Széchényi Könyvtár*).

Several prizes honor libraries and librarians: the *Library of the Year Award*, the *Széchenyi Ferenc*, and the *Szinnyi József prize* are the most important ones.

Journals of librarianship include the *Könyvtári Figyelő* (Library Review) and the *Könyv, Könyvtár, Könyvtáros* (Book, Library, Librarian)—the latter more interested in

international issues and technology, the former aimed for a broader audience more focused on current issues in Hungarian librarianship. These journals are published by the National Library and the Library Institute, respectively. The journal *Tudományos és Műszaki Tájékoztatás* (Scientific and Technical Information) deals with information science and promotes the latest developments in information technology. *Hungarian Library and Information Science Abstracts* reviews Hungarian publications of the discipline for an international audience.

Education for LIS

Prior to World War II, experts with degrees in some of the humanities disciplines were recruited to librarianship. University-level librarian programs started in 1948. Currently, two levels of librarian programs are offered at colleges and universities: BA and MA, some of them with an information studies specialization. Four of the universities (Budapest, Pécs, Szeged, and Debrecen) have Ph.D. programs.

Institutions such as the National Library offer mid-level education for future library assistants. A high school diploma is the prerequisite for these programs.

Professional librarians are required to participate in 120 hr of organized continuing education every 7 years; certificates are provided by institutions accredited specifically to offer these courses.

Professional Associations

Founded in 1935, the Association of Hungarian Librarians (*Magyar Könyvtárosok Egyesülete*) is a civil nonprofit organization with more than 2000 individual and 60 institutional members. Its ten professional sections reflect the main interests and specializations of Hungarian librarians. The Association abides by the Code of Ethics of Hungarian Librarians that sets behavioral standards for professionals.

The Alliance of Libraries and Information Institutes (*Informatikai és Könyvtári Szövetség*) is a national organization of about 230 member institutions. Its mission is to enhance library services and cooperation as well as increase the profile of member libraries. A series of further associations bring together special types of libraries (*Magyar Orvosi Könyvtárak Szövetsége*, Association of Medical Libraries; *Publika Magyar Könyvtári Kör*, Public Library Group; *Egyházi Könyvtárak Egyesülése*, Association of Ecclesiastic Libraries, etc.)

ARCHIVES AND ARCHIVAL SCIENCE

(The main sources of this section are works by Blazovich and Müller^[8] and Dóka.^[40])

Overview of Legislation

The 1995 LXVI Law regulates the charge and operation of Hungarian archives. The conditions for research in archival resources are specified partly by this law and partly by the 1992 LXIII Law dealing with the protection of private personnel data and the availability of public data. These laws apply equally to repositories holding documents of archival value whether they are financed and/or operated by the state, municipalities, organizations, churches, trade unions, or private citizens.

National Archives and Services

The holdings of the Hungarian National Archives (*Magyar Országos Levéltár*) include an immense historical collection of governmental and private documents. They also provide access to the complete archives of the ruling party of the 1945–1989 period, large historical collections of maps, coins, photos, stamps, and microfilm. The National Archives include materials formerly held in the New Hungarian Central Archives (*Új Magyar Központi Levéltár*), an institution that operated and collected current governmental documents between 1970 and 1992. The National Archives manages the e-Archives (*e-Archívum*), an online union catalog of nationwide archival holdings. Since e-Archives is a relatively new tool, retrospective conversion is still going on. A number of the finding aids are digitized, and full-text digitization of a few important holdings has also begun. The database of digitized materials (*Digitarchív*) is searchable.

A special state archive, the Historical Archives of the Hungarian State Security (*Állambiztonsági Szolgálatok Történeti Levéltára*), was established in 2003 holding documents produced between December 21, 1944 and February, 1990. Its collections include documents of state security organizations, state security documents of the Ministry of Defense and the Hungarian People's Army—all operating during the period of state socialism.

A few additional archives are operated and funded by the state: the Archives of Military History (*Hadtörténeti Levéltár*) holding historical and current governmental documents of the military and its predecessors, the Archives of Environmental and Water Issues (*Környezetvédelmi és Vízügyi Levéltár*), and the Archives of the Central Statistical Office (*Központi Statisztikai Hivatal Levéltára*).

Hungary's 19 counties, the capital city, Budapest, as well as some towns have their own archives collecting local official and private documents.

College and University Archives

Documents on Hungarian higher education held in different collections go back to the seventeenth century. However, the first university archive was not established until 1958 at the Loránd Eötvös University, Budapest. In the

second half of the 1970s and early 1980s, six universities deposited their documents into specialized archives, soon followed by the rest of the universities.^[41] From 1992 on, college and university archives united into an association to assist member institutions to organize their documents more quickly and to publish the most important sources.

Film Archives and Other Audiovisual Archives

The Hungarian National Film Archives (*Magyar Nemzeti Filmarchívum*) collects, processes, preserves, and stores films and other documents related to Hungarian motion picture production and reception. The Film Archives serves as a depository for films created in Hungary.

The National Audiovisual Archive (*Nemzeti Audiovizuális Archívum*) is a depository of the locally produced programs of the most important Hungarian television channels and radio stations. The cataloging records of the programs are freely accessible for searching through the Internet. An amended Hungarian copyright law made access to the full content of the records and recordings possible for education and research purposes via a network of public terminals (“NAVA points”) located in libraries open to the public, in schools, in museums, and in print, visual and audio archives.

Other Kinds of Archives: Corporate and Religious Archives, Manuscript Repositories, Historical Societies

The Archives of the Hungarian Academy of Sciences (*MTA Levéltára*) holds the historical and current documents of the central governing bodies and offices of the organization. Since the Academy plays a pivotal role in granting postgraduate degrees in all disciplines, the archives hold these documents as well.

Private archives open to the public include the archives of the trade unions (*Szakszervezetek Archívuma*), the Institute of Political History (*Politikatörténeti Intézet*), some parties (e.g., *Független Kisgazda és Polgári Párt*), and a variety of religious archives.

The Catholic Primate Archives of Esztergom (*Esztergomi Prímási Levéltár*) is the largest ecclesiastic archive. Its importance follows from the size of its territory as well as the importance of the Bishop residing here. Highlights of the huge collection include 1200 pre-1526 charters and all minutes from the Canonica Visitation (1557–1940). Other religiously affiliated archives include a number of Protestant, Serbian Orthodox, Jewish, and Unitarian institutions.

The Open Society Archives, a product of the philanthropic activity of the Soros Foundations network, obtains, preserves, and makes available research resources for the study of Communism and the Cold War, particularly in Central and Eastern Europe. The archives of the research institute of Radio Free Europe constitute the core of the

OSA’s collections. They also hold the complete documentation of the *Index of Censorship*, a journal published in London.

Archival Science as a Discipline and Profession

Traditionally, the profession of archivist has been closely connected to the profession of historian in Hungary. Degrees in economics, German, Latin, library science, and others may also be an educational basis for archivists. Only somewhat more than half of the professionals working in Hungarian archives have a degree in Archival Science. Scholar archivists mainly publish works on historical sources rather than the methodological, theoretical, and technological issues of the profession.

The Educational and Methodological Center in the National Archives (*Oktatási és Módszertani Központ*) offers courses on all levels and provides certificates for archivists and archivist assistants. The College of Archives (*Levéltári Kollégium*), an expert body appointed by the Ministry, participates in the governing, quality control, and strategic planning of the field. Current strategic plans (e.g., *A levéltárak középtávú informatikai stratégiája és feladatterve, 2006–2010*,^[42] Medium Term Information Technology Strategy and Goals in Archives, 2006–2010) target the need for archivists who are skilled in information technology, the need for archives better equipped with current technology, and the need to archive electronic documents.

Two main journals are published in the field: the *Levéltári Közlemények* (*Archival Digest*, published since 1923) is the publication of the National Archives, and deals with the analysis and publication of primary historical sources, as well as main issues of archival science nationally and internationally. The *Levéltári Szemle* (*Archival Review*, published since 1951) is the publication of the Association of Hungarian Archivists; it targets the practical work of archivists, facilitates cooperation, and publicizes main Hungarian events of the profession. The *ArchivNet* (subtitled “Historical Sources”) is a new online periodical edited by the National Archives since 2001. Its main goal is full-text electronic publishing of twentieth-century historical sources.

Prizes that recognize archivists’ outstanding achievements include: the *Ervin Szabó Medal* and the *Gyula Pauler prize*.

Education for Archivists and Records Managers: Examinations, Certification, University-Level Programs, and Continuing Education

Higher education for archivists is provided by some universities (currently the Eötvös Loránd in Budapest, the Debrecen, Miskolc, and Szombathely) offering BA and MA programs in history. History majors may specialize in Archivist Studies and get a BA or MA degree. History

and other MAs and PhDs may take specialized postgraduate courses offered by the National Archives and other major archives in order to earn a certificate. Accredited archival institutions (e.g., the National Archives) offer courses and certificates for future archivist assistants. The prerequisite for these courses is a high school diploma. This system of education is in flux and modifications are expected. Accreditation of educational institutions is provided by the Committee of Archivist Accreditation (*Levéltári Akkreditációs Szakbizottság*) appointed by the Ministry for Education and Culture.

Professional Associations

Several associations unite archivists in Hungary. The largest is the Association of Hungarian Archivists (*Magyar Levéltárosok Egyesülete*), which, until 1986, was a section of the Association of Librarians. Three other associations bring together archivists specializing in particular areas: The Council of Municipal Archives (*Önkormányzati Levéltárak Tanácsa*), The Alliance of Religious Archives (*Magyarországi Egyházi Levéltárosok Egyesülete*), and the Coalition of Hungarian University and College Archivists (*Magyar Felsőoktatási Levéltári Szövetség*) focus on professional issues relating to a specific type of archives and to archivists working in these institutions.

Electronic Records as Archival Documents

The issue of electronic documents and their preservation has been a key concern in the twenty-first century. Standards, equipment, skilled archivists, and funding for the handling, storing, and processing of the electronic documents have been lacking. Archivists are aware of the need, and their strategic plan^[42] contains action items related to the institutional, technological, and personnel aspects of archiving electronic documents. The realization of this strategic plan is expected in the near future.

Preservation of Documents in All Forms and Formats

The Ministry for Education and Culture exercises quality control over state-financed and municipal archives, as well as private archives open to the public, via a body of experts—the College of Archives (*Levéltári Kollégium*)—that conducts annual surveys and analyses of the individual archives. These analyses include a review of preservation activities among other issues. Lack of space is a major problem as well as lack of funding for improved air-conditioning and climate control. The annual reviews oversee preservation efforts that produce surrogate copies: archives make microform and, increasingly, digitized copies of endangered paper-based materials. Recently, the College raised the issue of the preservation of nonpaper-based documents (photos, sound and video recordings, films, CDs,

DVDs, and electronic documents) and suggested solutions. Preservation standards for these nontraditional materials are under consideration.

MUSEUMS

(Most of the information on individual museums is based on data published in *Magyarország múzeumai. Múzeumlátogatók kézikönyve*.^[43])

Overview of Laws

The 1997 CXL Law pertains to museums as well as to libraries. The law lays down the rules for the protection of cultural heritage monuments and objects as well as the ways in which they may be declared protected (e.g., change of ownership has to be traced under specific circumstances; the Ministry has to give permission if they are taken abroad, etc.). It specifies conditions for archeological digs and the protection of these sites. With regard to museums, it defines the prerequisites and methods for the founding and closure of museum institutions. Additionally, it defines the specifications for types of museums in relation to the ways they operate and get funding.

Seven hundred and seventy-two museums and galleries operate all over the country. The Ministry for Education and Culture oversees the activity of museums partly directly and partly via a number of expert bodies: the National Museum Council (*Országos Múzeumi Tanács*), the Accreditation Committees for Museology and Protection of Objects of Museological Value (*Műtárgyvédelmi és Muzeológiai Akkreditációs Bizottságok*), and the Museum College (*Múzeumi Kollégium*), a body that evaluates grant applications.

Museums of National Jurisdiction

The National Museum (*Nemzeti Múzeum*) is located in its nineteenth-century neoclassical building and holds more than 1 million archaeological, numismatic, historical, and artistic artifacts.^[44] Highlights of the collections include the coronation cloak of the Hungarian kings and the sword of Saint Stephan (*Szent István*), the first king of the country. The most valuable crown jewels (the crown, the orb, and the scepter) are permanently exhibited under the main dome of the Parliament building and can be seen during guided tours. The following sections present the vast collections of the National Museum and are divided into sections encompassing archeological and historical materials, photographs, coins, and historical paintings. Staff dedicated to data processing, information technology, preservation, restoration, and library services ensure the professional operation of the museum.

The Ethnographic Museum (*Néprajzi Múzeum*) is one of Europe's largest ethnographic collections with 140,000

Hungarian artifacts and more than 50,000 international artifacts. Its permanent exhibit presents traditional Hungarian culture.

The most complete historical collection of Hungarian fine arts (more than 100,000 pieces) is held and part of it permanently exhibited at the Hungarian National Gallery (*Magyar Nemzeti Galéria*), located in one of the most spectacular buildings of the Buda castle. The Gallery provides a variety of services such as research service on Hungarian works of fine arts; this service is available to the public. The Gallery also supplies permissions for transporting Hungarian works of art abroad. Housed in a neoclassical building located with the *Műcsarnok* (a gallery of contemporary art) on the large and impressive Heroes' Square, the Museum of Fine Arts (*Szépművészeti Múzeum*) holds an internationally renowned collection of fine arts, which includes an exceptional series of Spanish paintings by El Greco, Velázquez, Murillo, and Goya. For a fee, the museum's museologists and art historians will provide expert opinions about the authorship, quality, authenticity, etc. of the art pieces submitted for appraisal by patrons.

Documents and objects related to Hungarian literature are collected and exhibited in the Petőfi Museum of Literature (*Petőfi Irodalmi Múzeum*). The Manuscript Archive of the Museum is the largest collection of its kind in Hungary. The Audiovisual Collections hold recordings of interviews and conversations with the most eminent representatives of Hungarian literature. The Reception Databank monitors, collects and processes the German, French, English, and Italian reception and criticism of Hungarian literature, and makes these results accessible for the public.

The stunning majolica-roofed and eclectic Secession-style building of the Museum of Applied Art (*Iparművészeti Múzeum*) is Ödön Lechner's work; the museum was the third of its kind in the world in 1857 after the opening of similar museums of design in London and Vienna. Its four major collection areas are ceramics, glass, and china; textiles; furniture; and gold and silversmithing.

Additional government-sponsored museums are the Museum of Medical History (*Orvostörténeti Múzeum*), the National Technical Museum (*Országos Műszaki Múzeum*), the Agricultural Museum (*Mezőgazdasági Múzeum*), the Museum of Transportation (*Közlekedési Múzeum*), the Museum of Military History (*Hadtörténeti Múzeum*), and the Budapest Historical Museum (*Budapesti Történeti Múzeum*)—all located in the capital, Budapest; and the Outdoor Ethnographic Museum (*Szabadtéri Néprajzi Múzeum*) located in Szentendre, a small township north of Budapest.

Since the early 1970s, a number of national parks have been opened. The Hortobágy National Park (*Hortobágyi Nemzeti Park*) was the first, presenting the natural history and current wildlife of the Hungarian plain, followed by national parks representing different regions, landscapes,

fauna, and flora, such as the *Kiskunság*, *Bükk*, *Aggtelek*, and *Őrség*.

Major Art Museums and Galleries

In Budapest, in addition to the Museum of Fine Arts and National Gallery, a series of museums maintain permanent exhibits of art (e.g., the Ludwig Museum, *Ludwig Múzeum*, in the royal castle area, the Picture Gallery of the Capital Museum of Kiscell, *Fővárosi Képtár Kiscelli Múzeum*, etc.). A number of smaller museums present the works of individual artists, (e.g., *Victor Vasarely*, a Hungarian-born French painter; *Imre Varga*, a twentieth-century sculptor, etc.). Galleries such as the *Műcsarnok* (Palace of the Arts), *Vigadó Galéria* (Vigadó Gallery), and the *Ernst Múzeum* (Ernst Museum) offer exhibition spaces for contemporary art. The *Sculpture Garden* (Szoborpark) is an unusual collection of public sculptures which have been removed from their original location and gathered together in one place. These sculptures, produced 1945–1989, express the spirit of state socialism.

A few other cities have a high concentration of museums and galleries. Szentendre has been a favorite town of artists, and subsequently is home to the many memorial museums which have been created to display their artistic achievements. For example, there are museums for the works of *Margit Anna*, *Imre Ámos*, *Jenő Barcsay*, *Béla Czóbel*, *János Kmetty*, and *Lajos Vajda* (twentieth-century painters) the *Ferenczy family* (nineteenth- and twentieth-century painters and sculptors), *Margit Kovács* (twentieth-century ceramic artist). The latter, located in a late eighteenth-century building, and presenting ceramic sculptures of unique character, consistently attracts record numbers of visitors.^[45]

On the museum walk of the southern Hungarian city of Pécs, the Janus Pannonius Muzeum (*Janus Pannonius Múzeum*) is an umbrella organization for a number of local museums which include, among others, the collections of the Modern Hungarian Picture Gallery (*Modern Magyar Képtár*); the Exhibit of Zsolnai Ceramics (*Zsolnai Kerámia Kiállítás*); a museum for the works of *Victor Vasarely* and another for the works of *Amerigo Tot*, both born in Hungary; the most complete collection of works by early twentieth-century expressionist Hungarian painter, *Tivadar Csontváry Kosztka*; and a large collection of works by *Erzsébet Schaár* (a twentieth-century sculptor).

Kecskemét, a township southeast of the capital, became a center of folk art. The Museum of Hungarian Folk Design (*Magyar Népi Iparművészeti Múzeum*) holds a rich collection of folk arts and crafts. *Szórakoténusz*—the name is part of a counting rhyme—is a museum of folk childrens' games and toys. The Museum of Hungarian Naïve Art (*Magyar Naív Művészek Múzeuma*) also presents paintings and sculptures originating of folk art.

Science and Natural History Museums

The Science Museum (*Természettudományi Múzeum*) split from the National Museum in 1934. Its animals, plants, humans, minerals, and geology sections hold millions of species and other scientific objects. About the history of the main Hungarian museums see work by Holló.^[46] The National Technical Museum (*Országos Műszaki Múzeum*) holds historical artifacts of Hungarian science, technology, and industry.

An interesting series of museums hold historical artifacts related to industry and transport. The Museum of Transportation (*Közlekedési Múzeum*) opened in 1899 in Budapest, preserving the objects exhibited at the large 1896 show that commemorated the 1000th anniversary of the conquest of Hungary. The museum collects boats, trains, cars, and other transportation vehicles. The exhibition in the Expo of Flying and Space (*Repüléstörténeti és Űrhajózási Kiállítás*) completes this collection—all of the above are located in Budapest. The Kner Printing Museum (*Kner Nyomdaipari Múzeum*) in Gyomaendrőd displays books and other imprints as well as the workshop of a famous nineteenth-century bookmaker. The Tokaj Museum (*Tokaji Múzeum*) in Tokaj collects tools, objects, and documents related to winemaking. Two museums in the west Hungarian town of Sopron (*Bányászati Múzeum*, *Bányászati Emlékmúzeum*) and museums in Oroszlány and Tatabánya—all mining areas—present objects and historical documents related to mining. In the city of Herend, in the original late classicist style building of the Herend china factory, the Museum of the Art of China (*Porcelánművészeti Múzeum*) presents the history of this world famous company established in 1839.

Religiously Affiliated Museums

The Christian Museum in Esztergom (*Keresztény Múzeum*) is the richest among the private collections in Hungary.^[47] Highlights of the holdings include a late medieval collection (Passion paintings of Master MS, the Calvary altar of Tamás Kolozsvári, etc.) and a collection of postmedieval paintings, design, and graphics. The museum is located in a seventeenth-century Jesuit monastery.

Established in 1909, the Jewish Museum (*Zsidó Múzeum*) collects and preserves cultural, historical, and religious objects of Hungarian Jewry.^[48] In spite of a successful 1938 exhibit presenting the long history of Hungarian–Jewish life beginning with King Béla IV's charter (1256) and a large exhibit of Jewish artists in 1939, the museum had to close due to the anti-Semitic laws and government. Thanks to two museologists of the National Museum, the most important pieces of the collections were hidden in the cellars of the National Museum, survived the war, and were given back to the institution afterward. The museum is now located in a building right next to the main synagogue of the capital,

on the place of the house where Tivadar Herzl, founder of the Zionist movement, was born. More than 800,000 items are held in the collections, the largest such collection in Central Europe.

Szentendre, the small artist city north of Budapest, is the home of the Serbian Orthodox Museum (*Szerb Ortodox Múzeum*) located in a building of the Orthodox Church. Icons, goldsmith works, and other objects reflect the culture of seventeenth- and eighteenth-century Serbs in Hungary.

Historical, Anthropological, and Archaeological Museums

A number of larger cities have their own general historical museums. The Ferenc Móra Museum (*Móra Ferenc Múzeum*) in Szeged owns 273,000 objects, and offers permanent exhibitions, among them an exhibition of Avar finds and another on pharmacies. The István Dobó Castle Museum (*Dobó István Vármúzeum*) in Eger presents spectacularly the castle's Turkish siege of 1552 through the objects that have remained from the sixteenth century. The collections of the King Stephan Museum (*Szent István Király Múzeum*) in the city of Székesfehérvár present the ruins of the medieval cathedral, along with archaeological finds and a large collection of paintings.

A number of historical sites became museums. *Aquincum's* Roman ruins present the remains—mosaic floor, organ, water pipes, etc.—of a prospering city on the border of the Roman Empire (currently in north Budapest). *Visegrád*, the ruins of King Matthias' castle have been transformed into a museum. The National Historical Park (*Nemzeti Történeti Emlékpark*) in Ópusztaszer is the site where, according to the legend, Hungarian tribes, went into a blood union with Árpád's leadership after the conquest of the Carpathian basin in 896. A painting of exceptional size (about 18,000 sq.ft) depicts the historical event. One site in Budapest and another one in Sopron, west Hungary, keep alive the memory of Hungarian Jewish communities: the Medieval Jewish Prayer House (*Középkori Zsidó Imaház*) exhibits the remains of Jewish tombstones and gothic carved stones of the synagogue. The Medieval Old Synagogue (*Középkori Ó-Zsinagóga*) in Sopron goes back to the early gothic era around 1300.

Many historic homes have been preserved and turned into museums all over the country; each municipality pays special attention to those houses and sites that recall memories of a great artist, writer, or politician. Homes of great statesmen (e.g., *Széchenyi István* in Nagycenk, *Lajos Kosuth* in Monok), aristocrats (the *Duke Esterházy* family in Fertőd), poets, and writers (e.g., *Ferenc Kazinczy* in Sátoraljaújhely, *János Arany* in Nagykőrös), artists (e.g., *József Rippl-Rónai* in Kaposvár, *Lajos Kassák* in Budapest), and musicians (e.g., *Ludwig van Beethoven* in Martonvásár, *Franz Liszt*, *Béla Bartók*, *Zoltán Kodály* in

Budapest) are preserved, maintained, and presented to the general public.

Zoos and Botanical Gardens

The Budapest Zoo, officially called *Fővárosi Állat- és Növénykert* (Animal and Plant Garden of the Capital), opened in 1866 with 500 diverse animals. János Xántus, an ethnographer-traveler, was its first director. The zoo became a research institution during the 1950s. The institution is widely known for its nature conservation activities.

The Botanical Garden of Vácátót (*Vácrátóti Botanikus Kert*) is the largest of its kind in Hungary with the largest collection of living plants. Its creation dates back to the first half of the nineteenth century. The garden became the site of the Botanical Research Institute of the Hungarian Academy later on. Twelve other botanical gardens present the fauna of the other Hungarian regions; the most important of them is the Arboretum of Szarvas (*Szarvasi Arboretum*), the site of the University of Horticulture and Food.

Digital Museum Exhibits and Services

Every museum and gallery has a Web site offering basic information about services and collections as well as digital samples of the holdings.

Access to the most important digital museums and exhibits is provided by the National Digital Data Archive (*Nemzeti Digitális Adattár*^[31]). The digital collection Fine Arts in Hungary (*Képzőművészet Magyarországon*^[32]) provides a comprehensive history of the fine arts (painting and sculpture) in Hungary from the eleventh century to the twentieth century. It does not include contemporary fine arts. In 2007, the collection held 5200 digital reproductions. The permanent digital exhibition of the National Gallery (*Nemzeti Galéria*^[31]) presents 1000 digital reproductions of its most important holdings; viewers may choose to visit the exhibit with the help of a virtual guide. A smaller collection of the holdings of the Christian Museum of Esztergom (*Keresztény Múzeum*^[49]), 164 digital reproductions, is also available through the NDA. Archaeological sites, historical buildings, and objects protected by the state are cataloged (11,000 records) by the Office of Cultural Heritage (*Kulturális Örökségvédelmi Hivatal*^[50]). Digital photos and descriptions of 3200 historical buildings (fortresses, castles, churches, etc.) are also available through the NDA database among a number of further collections.

Museology as a Discipline and Profession^[51]

Museum professionals are experts in art history, archaeology, ethnography, and history, as well as the sciences and engineering, specializing in museological aspects of their respective fields. Leading figures of the field have conducted research and contributed to the emergence of a

museology discourse from the early nineteenth century on. Thanks to their scholarly activity, the legal and institutional framework of this field has developed steadily since the 1880s. The first organization dealing with the inventory and protection of historical monuments (*Műemlékek Országos Bizottsága*) was created in 1881. This institutional background helped professionals produce a series of comprehensive works on Hungary's historical monuments^[52–54] that served as a basis for the creation of a thorough register, topography, and standardized approach to sites and buildings of historical importance. Though collecting of ethnographic, historical, scientific, and other types of artifacts as well as art started in the eighteenth century among the aristocracy, and extended to the affluent middle class in the third part of the nineteenth century, no laws and institutions protected collections held by collectors and museums until 1949. The decree on museums (1949) at last made it compulsory to keep standardized records and statistics of museum holdings as well as private property of museum value. These legal and institutional changes have provided a data-oriented background and overview to the type of museological research that deals with the collection, preservation, exhibition, etc. of museum holdings nationwide. The outstanding scholarly production of nineteenth and early twentieth century paved the way for museologists on individual collections, objects, and institutions, and for approaches that map and evaluate the whole cultural heritage. Efforts have been made (especially by the publications of László Mravik^[55]) to identify and reclaim art works illegally moved out of the country before and during the Second World War.

Magyar múzeumi arcképcsarnok, a recently published biographical lexicon lists all those experts who worked and published during the last two centuries. About 2000 expert professionals have been working in Hungary's 772 museums in 2005;^[56] their research contributions are published in books and scholarly periodicals.

Several periodicals focus on museums. *Múzeumi Közlemények* (Museum Proceedings) concentrates on theoretical and methodological issues of museology. The content of *Múzeumi Hírlevél*'s (Museum Newsletter) is more practical; its articles describe current issues and events pertinent to Hungarian museums. *Magyar Múzeumok* (Hungarian Museums), published by the Pulszky Society, is an illustrated magazine targeting a broader audience; it publishes special issues dealing with specific types of museums and subjects related to them.

The best museologists, curators, and managers are annually recognized by the *Ferenc Pulszky* and *Károly Pulszky Prizes*, museums by the *Museum of the Year Award*.

The main academic frameworks for museum research are departments of history and ethnography of the major universities (in Budapest, Debrecen, Miskolc). Expert museum curators and managers conduct research at their institutions; publications are requirements for promotion.

In 2004, the International Council of Museums (ICOM) accepted the Code of Ethics of Museums that has been subsequently accepted by the Hungarian National Committee of ICOM. The document has been translated and published in Hungarian. This code sets standards for professional activity and performance.

Education for Curatorship and Museum Administration

Archeologists, historian-museologists, art historians, and other experts may become museologists. The history and ethnography departments of a few universities offer BA and MA degrees in “museologist specialization” within their disciplines. Postgraduate courses and certificates are offered for future curators at the Hungarian University of Fine Arts (*Magyar Képzőművészeti Egyetem*) and the Management Section of the Pulszky Society (*Pulszky Társaság*). Courses for cultural managers are also offered by the Pulszky Society as well as within the framework of continuing education at some universities (e.g., *Janus Pannonius University*, Pécs).

Professional Associations for Curators and Museum Administrators

The Pulszky Society, Hungarian Association of Museology (*Pulszky Társaság, Magyar Múzeumi Egyesület*) is the largest Hungarian association of museum professionals; its sections deal with such concerns as preservation, management, art history, and continuing education. The association promotes museums and museology, facilitates cooperation among institutions and professionals, publishes a journal, and votes annually on two awards—one for a museum, and one for a professional. Other associations unite special interest museums and museologists including the Association of Public Collections (*Közügyűjtemények Szövetsége*) and the Association of County Museums (*Megyei Múzeumok Igazgatóságainak Szövetsége*).

Key Contemporary Issues

Current priorities are listed in the *Alpha Program*,^[57] the mid-range plan for Hungarian museums—most of these priorities relate to the strategic plan of the cultural government of Hungary as a new member country of the European Union. Broadening access to the collections, and strengthening their educational role is the top priority. The second major priority is to develop requirements for open and visitor-friendly museums in each museum service. This goal has consequences for infrastructure as well as for the level and quality of cooperation between schools and museums. The government supports this goal by not only providing free access to museums for schoolchildren, but also providing free public transportation (including

long distance train) to groups of schoolchildren to 14 major museums of national jurisdiction. Annual special events like the Museum May Day (*Múzeumi Majális*) and Museum Night (*Múzeumok Éjszakája*) attract more and more people to these institutions, and transform museums into popular meeting places. The third major priority is qualitative development and preventive preservation of the collections, as well as digital access to collections information. This complex professional goal also harmonizes with the EU strategy of preservation declared by the International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) in Vantaa, Finland, in 2000.

CONCLUSION

Current tendencies and future plans of Hungarian libraries, archives, and museums harmonize with trends that characterize these areas worldwide and interests (and financial resources) that the European Union has elaborated for its member countries. The Strategy of Libraries for 2008–2013 (*A könyvtárügy stratégiája 2008–2013*) is currently (in 2007) being widely discussed.^[12] Its main goals are the continuation of the development of libraries and library access in rural areas; delivery of around-the-clock access to library materials from any location; and improved ability for the disabled to access libraries. The digitization of extant primary and secondary Hungarian literature as well as current publications will also continue.

The mid-range strategic plan of Hungarian archives identifies the major deficiencies in the current situation as follows: lack of financial resources, lack of appropriate technological knowledge and skills among archivists; lack of theoretical–methodological background. In order to resolve these problems, the mid-range plan (*A levéltárak középtávú informatikai stratégiája és feladatterve, 2006–2010*)^[42] projects the transformation of archives from institutions providing merely storage and preservation for the materials, and access to the materials for researchers into institutions that provide access to their materials 24/7 from any location. The document defines future archives as basic institutions of a democratic society, and proposes that the government finance a breakthrough project of e-government and e-public-administration. The plan envisages the creation of an e-archive within the framework of the Hungarian National Archives, and the establishment of a degree in information and archive management as well as records management—both related to public administration rather than to traditional history.

The most important efforts in the museum field will continue to be related to the Alpha Modernization Program which has as goals making museums more accessible and user-friendly, further developing their relationships to education, and increasing the mobility of collections and professionals nationwide and internationally.

Every major trend of Hungarian libraries, archives, and museums over the next 7 years (2007–2013) will certainly be harmonized with or based on the “culture program” of the European Union, accepted for the aforementioned period of time by the European Parliament.^[58] The general objective of this program is to “enhance the cultural area common to Europeans with a view to encouraging the emergence of European citizenship.” Its central objectives are “supporting the transnational mobility of professionals in the cultural sector; encouraging the circulation of works of art and artistic and cultural products beyond national borders; and promoting intercultural dialog.”

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APPENDIX: KEY DATES

896	Hungarian tribes settle in the Carpathian Basin.
997–1038	Stephen of the Árpád dynasty rules the country.
1000	Stephen is converted to Christianity. Christianization of the population follows.
1001	Foundation of the first monastery and monastic library (Pannonhalma).
1055	The earliest written record extant in the Hungarian language: the foundation charter of the Tihany abbey.
1192	The earliest Hungarian text, a funeral sermon, inserted in the Latin Pray Codex.
1241	Mongolian Tatars invade and devastate the country.
1367	Foundation of the first university (Pécs).
1458–1490	King Matthias, a true Renaissance ruler, elevates the country to a high European standard.
1460	Foundation of the Bibliotheca Corviniana, King Matthias' library.
1473	Publication of the first printed book (in Latin), <i>Chronicle of Buda</i> .

1526	Turks defeat the Hungarian army at Mohács, and the King dies in the battle.
1533	The first book in Hungarian language is published in Krakow.
1541	Turks occupy Buda. Hungary is split into three parts.
1613	Official documents of the Habsburg Monarchy start to be deposited in archives.
1686	Buda is recaptured from the Turks.
1703–1711	Ferenc Rákóczi II, Prince of Transylvania, leads an unsuccessful uprising against the Habsburgs.
1749	Foundation of the Habsburg monarchic archives in Vienna, the <i>Haus-, Hof-, und Staatsarchiv</i> .
1756	Foundation of the Hungarian Royal Archives, predecessor of the Hungarian National Archives.
1780	Publication of the first Hungarian journal, <i>Magyar Hírmondó</i> .

First half of the nineteenth century

	A national reform movement is launched for the political and economic modernization of the country and the development of its Hungarian national identity.
1802	Foundation of the Hungarian National Museum and Library by count Ferenc Széchenyi.
1825	István Széchenyi founds the Hungarian Academy of Sciences.
1844	Hungarian becomes Hungary's official language.
1848–1849	Revolution and war for independence.
1866	Opening of the Budapest Zoo. Foundation of the Library of the Parliament.
1870–1900	A series of new museums are opened: Ethnographic, Fine Arts, Applied Arts, etc.)
1867	Compromise with the Habsburgs; beginning of a double-centered monarchy of Austria-Hungary. Foundation of the Hungarian Statistical Office and its Library.
1907	Publication of the first periodical on libraries and museums, <i>Múzeumi és Könyvtári Értesítő</i> .
1904	Opening of the first public library, <i>Fővárosi Könyvtár</i> .
1914–1918	World War I; the Austro-Hungarian monarchy is Germany's ally. After the defeat, the Monarchy disintegrates.
1920	The Trianon Treaty reduces Hungary's territory.
1923	Publication of the first periodical on archives, <i>Levéltári Közlemények</i> .

- 1935** Foundation of the Association of Hungarian Librarians, includes archivists until 1986.
- 1944** Hungary is occupied by Nazi Germany.
- 1945** The Soviet Army liberates Hungary.
Central institutions are founded to administer libraries, archives, and museums.
- 1946–** Nationalization of most private libraries, archives, museums.
- 1947** Beginning of Communist control; establishment of Stalinist dictatorship.
- 1948** University level program for librarian education is established.
- 1956** Uprising against Stalinism.
Foundation of the Gorky Library, a center for Russian culture.
The first Library Law is accepted.
- 1965** Cautious economic market reforms, the New Economic Mechanism, are launched.
- 1985** The Hungarian National Library moves to a building of the Royal Castle.
- 1986** Foundation of the Association of Hungarian Archivists.
- 1988** Beginning of transition from state socialism to capitalism and democracy.
- 1990** Multiparty parliamentary democracy is established. The Soviet army leaves Hungary.
- 1995** LXVI Law regulates Hungarian archives.
- 1997** CXL Law regulates Hungarian libraries and museums.
- 1999** Hungary becomes a full member of NATO.
- 2002** The first online union catalog, *MOKKA*, goes live.
- 2004** Hungary joins the European Union.

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Hypertext and Hypercard: Early Development [*ELIS Classic*]

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Abstract

The ease of linking and hopping from one text to another that we associate today with the World Wide Web was implemented in a different context prior to the Web. The creation of “hypertext” has a long and interesting history prior to the Web, as this entry demonstrates. At the time it was issued, the HyperCard software application was expected to be the foundation of a widely-used new means of information organization. We can see now that the key ideas of hypertext were present in HyperCard, without the ease of use of subsequent World Wide Web features.

—*ELIS Classic*, from 1992

INTRODUCTION AND DEFINITION

Hypertext has been defined by many people in different ways. It has been called nonsequential writing,^[1–3] the creation and representation of links between discrete pieces of data,^[4] an associative information management system,^[5,6] and a database with “active” cross references.^[7] However defined, the point is this: electronic links are created between pieces of information in a machine-readable document and a computer is used to make the quick leaps between those pieces of linked information. A computer is required to define those links in the course of creating a hypertext document, and a computer is required to execute those links during the course of reading or using that document. It can be described, written, and talked about, but the essence of hypertext comes from using the speed of a computer to make those links.

Imagine the scope and contents of an extensive reference work. Generally, it will have title and cataloging information; a contents page; various entries that each contain headings, subheadings, footnotes, see and see also references, and notes; there might also be charts, maps, illustrations, or photographs; and in the back, a bibliography, index, glossary, and one or more appendices. When using such a volume, the researcher scans the title first, then probably the contents and index pages, looking for the desired material. Once an appropriate entry is found, its contents are scanned, key word definitions are checked, the notes and references are scanned, and then the bibliography is reviewed. All of this requires considerable page turning and page flipping, as the researcher verifies that the book contains essential information, before he or she even starts to read it and take notes from it. Consider the options available to any researcher if all of this material was linked electronically and could be called up at the

stroke of one key. To access a glossary with specific definitions, double check the source of a quote, to consider further study along somewhat different lines, verify the extent of a particular source, or even jot down the salient facts and figures culled from that source—all of these things can now be done electronically (even taking notes on the sources being utilized) without great amounts of effort and time being expended.

As mentioned earlier, reference books often contain illustrations such as maps, charts, or photographs. Given the speed and memory capabilities of modern computers, this has become one of the most appealing features available when creating a hypertext document. Modern computers can access plain photographs such as exist now in reference books, and they can also provide moving video pictures from a variety of sources and audio capability by accessing tape recorders, CD-ROM players, or prerecorded sounds on a floppy disk. The hypertext reference work can provide, for example, a life of Beethoven, a picture of him, a related discussion of his country and fellow composers, and a sample of sounds from his compositions. It might even include access to some video footage from a film or documentary of his life.

As the user moves through such a collection of reference material (called hypermedia if more than one medium is being used), he or she has the ability to select and choose the most pertinent material. The user can move through the material and select paths or links to other pieces of information that are the most relevant. Presumably no two people use a reference work with exactly the same motives or needs, and their paths through the material are now no longer restricted to structured, linear information. Each may select the same material, but in a different order, or each may spend varying amounts of time in different areas. This flexibility and user-defined

approach is probably the most significant area of hypertext research currently being undertaken at major universities.

The relationship between the way people think, and the way they learn is of considerable consequence to researchers in education and psychology, as well as in the newer fields of computer and cognitive science. Hypertext presents a new way of looking at material, free from the constraints of linear access. People do not think in a linear fashion and their minds are structured into associative patterns. Access to material or information that allows and even encourages associative browsing is highly desirable, and test results just beginning to be reported in academia are highly supportive of this theory. "Learning by discovery" is becoming a popular basis for hypotheses in educational research.

Finally, in understanding the concept of hypertext, it is necessary to learn a few new words in context. There are four elements to a hypertext program that must be understood, and although software packages may name them differently, their meaning does not change. These four words are: node, button, link, and jump. Node refers to a discrete collection of information. This may range from a single word to a picture, a video clip, or supplementary text. A button represents the beginning point of a connection from one node to another. The link is that connection between nodes and a jump represents taking the link to a new node. In its simplest fashion, therefore, a hypertext document may have two nodes: for example, a paragraph describing a picture and the picture itself. Within the paragraph is a button that links the paragraph to the picture. When the button is pressed, the user jumps to the picture via a link that was pre-established during the creation of the hypertext document.

Another way of looking at this kind of system is to imagine a telephone network. In the simple system described above, there are two nodes (two telephones), one button to press (the dial), and a jump (or call) to make across one link (telephone line). In a more complex telephone system, many calls can be made from one telephone, but it is entirely dependent on how many lines have been strung across the land by telephone workers first.

Electronic technology allows us to access a number of places or things (telephones, video broadcasts, nodes, etc.) from a single unit on our desk or in our home. Keeping this electronic network idea in mind will help in understanding the concepts of a hypertext document and the links it contains.

HISTORY

Popular knowledge of the technology known as hypertext began with the introduction of HyperCard by Apple Computer, Inc. at MacWorld Expo in August 1987. But before that time, a surprising number of people were working on

hypertext projects, or had contributed substantially to the growing field of knowledge in this area. Chief among these people are H.G. Wells,^[8] Vannevar Bush,^[9,10] Ted Nelson,^[1-3] Doug Engelbart,^[11] and Alan Kay.^[12]

H. G. Wells

In 1936, H.G. Wells delivered a lecture at the Royal Institution of Great Britain, entitled "World Encyclopaedia." In it, Wells posited the theory that man would be faced with too much information to be able to deal with it logically, and that he would not be able to find the material he needed. To rectify this situation, Wells came up with the idea of a world encyclopedia which would be continuously updated and easily accessible to anyone anywhere. He did not trouble himself with the technical details of how this would be achieved, only that it would definitely be necessary.

Vannevar Bush

The article by Vannevar Bush entitled "As We May Think," was published in the August 1945 issue of *Atlantic Monthly* magazine. In it, Bush, science advisor to President Roosevelt, describes a machine he calls the memex (p. 77),

a device in which an individual stores all of his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged supplement to his memory. . . . It affords an immediate step, however, to associative indexing, the basic idea of which is a provision whereby any item can be caused at will to select immediately and automatically another. This is the essential feature of the memex. The process of tying two things together is the important thing.

Even today, there is no better way to describe or define hypertext. When you consider that Bush described an earlier version of his memex in 1939 (more than 50 years ago!), you realize that Bush is indeed one of the most visionary of the hypertext pioneers.

When his entry was published in *Atlantic Monthly* (and another version in *Life* shortly thereafter), Bush found that his ideas created a great deal of controversy and inspired a number of other researchers. He continued to write about his ideas and belief that mechanization was one way to sort through the ever-increasing piles of information that confront researchers. This process of sorting and selection by means of association was central to the memex and recurs throughout all of Bush's writing.

In 1967, Bush wrote "Memex Revisited" in which he discussed his earlier entry and the technical developments that had taken place since 1945. He concluded that the transistor, video tape, high-speed circuitry, and the ability

to compress information storage had all contributed to the theoretical practicality of his memex. Bush reiterated his belief that the mechanization of “selection by association” would bring about a successful personal machine that would allow a human being to “think creatively and wisely, unencumbered by unworthy tasks . . .” and that he will be able to “face an increasingly complex existence with hope” (p. 100). In words very reminiscent of Wells, Bush said: “Each generation will receive from its predecessor, not a conglomerate mass of discrete facts and theories, but an interconnected web which covers all that the race has thus far attained” (p. 99).

An interesting sidelight to the work going on during this period was a project at MIT known as Intrex (Information Transfer Experiments). Described in Stephen Salmon’s book, *Library Automation Systems*,^[13] Intrex began in 1965 and was terminated in 1973. Its principal aim was to provide an “augmented catalog” (p. 121) for libraries that would provide more information online beyond the usual bibliographic references and subject headings. It also attempted to provide the storage and retrieval of full-text documents to library patrons using terminals. When the project was introduced in 1965 to a large conference of librarians, engineers, publishers, government officials, and others, one of those present was Vannevar Bush. He praised the efforts of the Intrex group as reaching far beyond his original ideas of “analytical machinery” (p. 5).

Theodor Holm Nelson

Ted Nelson^[1-3] is considered by many to be the father of hypertext. Certainly he was the one who gave it the name, as well as the term hypermedia. He would be the first to laugh at the “overnight” success of hypertext since he began working on his theories and articulating them back in the 1960s. His first published work on the subject was “The Hypertext” in the *Proceedings of the World Documentation Federation* in 1965. A more well-known work, *Computer Lib/Dream Machines*, was published in 1974 and then reissued in 1987 by Microsoft Press. This marvelous collage of ideas, facts, fantasies, drawings, trivia, and profound thinking is must reading for anyone interested in computers or hypertext.

One of Nelson’s biggest projects is called Xanadu (after Samuel Taylor Coleridge’s “magic place” in the poem *Kubla Khan*), which he started as a graduate student in 1960. Nelson wanted the Xanadu project to store all of the world’s literary resources in an electronic format and to link parts of those documents and pieces of text to create new composite documents. In 1988 the Xanadu project was taken over by Autodesk, creators of large information management systems.

Nelson also has a special interest in education and was one of the first to recognize the value of hypertext in both teaching and learning. In an entry entitled, “No more teachers dirty looks. . .”, he said:

Let the student pick what he wishes to study next, decide when he wishes to be tested, and give him a variety of interesting materials, events, and opportunities. . . . Under such circumstances, students will actually be interested, motivated to achieve far more than they have ever achieved within the normal instructional framework.

Nelson continues his work today, lecturing at conferences and workshops, and further developing the concepts of the Xanadu project.

Douglas Engelbart

Douglas Engelbart^[11] began his work at the Stanford Research Institute in the 1960s and was heavily influenced by Vannevar Bush’s theories. He worked on a system called NLS (ON Line System) that was designed to link text segments of 3000 words or less. In addition, there was a filter capability that selected information from the database of segments, and a visual capability that allowed the user to view the results of his linked (filtered) selection. NLS subsequently evolved into a hypertext system called Augment, used internally and marketed by McDonnell Douglas. Augment is used primarily for text editing, and features windows and electronic conferencing for multiple users. Engelbart used the term “augment” to describe his system because it augments or extends the human intellect, and his major goal is to aid “knowledge workers.” Engelbart is also the developer of the mouse, windows, and numerous other technological advances, and works today at Stanford University on Operation Bootstrap.

Alan Kay

Alan Kay^[12] was present at a demonstration done by Engelbart in 1968 on the system he had developed, and it had a profound effect on him. Kay had been formulating his ideas on education and computers during the time he had spent learning to program computers in the Air Force and doing his doctoral work at the University of Utah. There he became involved with the domain of artificial intelligence research as well as the work of Seymour Papert^[14] at MIT, who designed the programming language for children called LOGO.

Kay was convinced that the ultimate goal of all software was the enhancement of the ability to learn. He subsequently wrote a language called Smalltalk and began work on the ultimate, small personal computer—something he called the “Dynabook.”

Kay was working in those days at Xerox PARC, and he was very concerned with the effect of different kinds of media on children. He wrote an entry in 1977 in which he described the Dynabook as a “dynamic medium for creative thought” and from there he went on to explore the idea’s enormous potential for education as well as creative processes in computer simulation. Defining simulation as the power to see what you can imagine. Kay has gone on

to develop what he calls the “fantasy amplifier,” to preserve and extend that sense of wonder that children have. Kay also pioneered the use of symbols (icons) instead of words for telling a computer what to do next.

After PARC, Alan Kay went to work for Atari as chief scientist. He now works for Apple Computer as an Apple Fellow and indulges his lifelong interests in education and music.

ACADEMIC AND CORPORATE PROJECTS

At the academic and corporate level, a number of prominent scientists and researchers have been working on research projects over the past several years. These hard-working and dedicated people are contributing vital elements to the growing body of knowledge on hypertext and hypermedia.

The Jefferson notebook

Mark Chignell and Tyde Richards are two members of the Jefferson Notebook team at the University of Southern California in Los Angeles. Formerly called Project Jefferson, the project was conceived and designed as a tool for writing research papers in the Freshman Writing Program at USC. Organized as an electronic notebook with access to the instructors assignments, background information, citations of relevant documents, and commercial databases loaded on the mainframe computer at the USC library. Project Jefferson has become the basis for a number of similar applications in varying disciplines such as psychology, anthropology, and library science.

Project Emperor-I

Professor Ching-chih Chen^[15] is the Associate Dean of the Graduate School of Library Science at Simmons College in Boston. Dr. Chen has authored many entries and books on the subject of information technology and management for libraries and scholars. She is also editor of the journal *Microcomputers for Information Management* and is the principal director of Project Emperor-I, a project supported by a number of government and business organizations as well as Simmons. The project combines videodisc and microcomputer technology, providing over 100,000 graphic images of the first emperor of China and his terracotta army of warriors and horses excavated in 1973 in Xian, China. Using a HyperCard interface, the project provides not only these images, but film footage, audio tracks of interviews, and related study materials and it also provides the audio and textual materials (including screen design) in Chinese as well as English. It is a major humanities project that has been utilized by Apple's new Visual Almanac, and the videodiscs will soon be available to schools in this country.

Notecards

Randall Trigg, Frank Halasz, and Tom Moran have contributed substantially to the NoteCards project at the Intelligent Systems Lab at Xerox PARC in Palo Alto, California. Trigg is the author of the first doctoral dissertation on the subject of hypertext. NoteCards is a network-based system designed for processing ideas, and has formed the basis for a number of important discoveries on the storage, linking, and retrieval of information, and the concept of the card as a structure for pieces of information has been widely used by HyperCard as well.

Intermedia

The Institute for Research in Information and Scholarship (IRIS) at Brown University in Providence, Rhode Island, has been doing hypertext research for over 20 years. Andries van Dam, Paul Kahn, and Nicole Yankelovich, along with Karen Smith, Norman Meyrowitz and many others have made substantial contributions to our knowledge of hypertext in education. The current project at Brown is Intermedia, a complex and interactive system for creating hypermedia courseware that allows the student to make links to related materials in other areas.

Hyperties

Another university that has devoted time and energy to hypertext research is the University of Maryland. Here Ben Schneiderman, long interested in the human-computer interface, helped develop Hyperties (ties = The Interactive Encyclopedia System) project. Other hypertext research has been done at the University of Maryland by Gary Marchionini, Ronald Weissman, and others.

Bioquest

At the University of Oregon in Portland under the direction of Nils Peterson, a major effort has been made to create a computer-based introductory biology course. Complete with elaborate laboratory simulations. BioQUEST intends to enhance the students' ability to recognize and solve problems. BioQUEST includes text materials, applications software, and an online reference source in HyperCard.

Project Perseus

Elli Mylonas, Kenneth Morrell, and Gregory Crane are three researchers on Project Perseus at Harvard University in Boston. This project is a collection of materials on the classical Greek world, and includes 100 megabytes of text and several thousand images.

Superbook

The Bell Communications Research (Bellcore) lab in Morristown, New Jersey, has done some superlative work in hypertext and hypermedia, including SuperBook. Developed by Tom Landauer among others, SuperBook is a system that reads in an existing (and usually very large) document already in electronic format, and then allows the reader—via the dynamic table of contents, search capabilities, and windows—to access specific parts of the document. It has proven particularly effective in the use of very large technical documents.

HYPERMEDIA AND HYPERTEXT SOFTWARE

Implementations of hypermedia and hypertext for personal computers vary greatly in price, ease of use, and capability. In general, some packages have special facilities for working with electronic text or graphics while others excel at integrating computers with other devices such as videodisc or CD-ROM players. Some are useful for developing applications while others are standalone products. Ideally, the choice of software should be based on a combination of price, ease of use, number of features, and use, but a previous hardware commitment can significantly affect this decision. Therefore, the next entry will provide an overview of hypermedia and hypertext on three personal computer/software systems: the Apple II, MS-DOS, and Macintosh computers.

Apple II Software

HyperScreen

Published in early 1990 by Scholastic Software and developed by George Brackett, HyperScreen works with all members of the Apple II family. HyperScreen supports graphics, sound, animation, and video.

HyperStudio

Unlike HyperScreen and Tutor-Tech, Roger Wagner's HyperStudio will run only on the Apple IIGS. Like HyperCard, each screen is a card and a collection of cards is a stack. HyperStudio is unique among the packages discussed here because it comes with software and hardware to allow the digitization and playback of audio from a variety of sources. In addition, it works with Apple's Video Overlay Card, allowing a developer to integrate video with other forms of hypermedia.

Tutor-Tech

Techware began selling its Tutor-Tech software in 1985. Like many other hypermedia programs, the basic building

block is the page. A page is one screen of information and may contain buttons for linking to other pages or to control external devices such as videodisc players and speech synthesizers. Although Tutor-Tech is neither as powerful nor as flexible as HyperCard, it offers the basics of hypermedia to a wide audience.

MS-DOS Software

Guide

Introduced in mid-1987 for computers running Microsoft Windows, Guide 2.0 for the PC performs almost identically to its counterpart on the Macintosh. This can be an important selling point for schools that have both Macintosh and MS-DOS equipment. As noted above, Guide works particularly well with large amounts of text although it also can incorporate graphics. Version 2.0 does not come with a programming language. Guide 3.0 for Windows, just announced, adds a programming language and support for dynamic data exchange with other programs.

HyperPAD

Billed as a HyperCard clone for the PC, HyperPAD runs on machines with a minimum of 384K of RAM and MS-DOS 2.0. The program has basic hypertext features and an excellent built-in programming language called PADtalk. In Hyper-PAD, a file is a pad and a screen of information, a page. Pages can use only character-based graphics since the program runs on monochrome monitors. A good touch is the ability to use either the keyboard or a mouse to control all the functions of the program. Like HyperCard, the package comes with several built-in programs: a calculator, a telephone dialer, a puzzle, and so on. In short, Jim Lawyer and his team at Brightbill-Roberts have done a reasonable job of transferring the non-graphics-related functionality of HyperCard to MS-DOS computers.

Hyperties

Hyperties was originally developed by Dr. Ben Shneiderman and others at the University of Maryland in the early 1980s. Cognetics Corporation now distributes the program. Hyperties provides basic hypertext capabilities to machines with as little as 256K of RAM. Applications can be developed as text-only or a combination of text and graphics. Each application is built around one or more entries and a collection of entries is called a database. In line with its straightforward approach, users can choose between running the program using the keyboard or a mouse.

KnowledgePro

Created by Bev and Bill Thompson. KnowledgePro for DOS combines hypertext and expert systems technology and requires 512K RAM to run. In KnowledgePro, a file is called a knowledge base and consists of a number of topics. Users can add sophisticated features to topics using the built-in programming language. Although KnowledgePro for DOS uses character graphics, bit-mapped images can be added via the Graphics Toolkit. For those interested in more advanced forms of hypermedia, the Videodisc Toolkit enables KnowledgePro to control the Sony LDP 2000 videodisc player.

LinkWay

Developed in response to Apple's HyperCard, LinkWay is IBM's flagship hypermedia product. Created by Larry Kheriaty, it requires a minimum of 384K, a CGA display, a Microsoft-compatible mouse, and one floppy drive. A LinkWay file is called a folder and a screen of information, a page. A page may contain data, buttons, and graphics. LinkWay comes with a paint program, a text editor, a font editor, and sample applications. Although not as powerful as HyperCard, LinkWay does bring some excellent hypermedia tools to the PC.

Macintosh Software

More hypertext/hypermedia software is available for Apple Computer's Macintosh line than any other type of computer. Sporting a mouse and windowing interface, the Macintosh is a natural for hypertext and hypermedia. Development environments include ArchiText, Business Filevision, Guide, Intermedia, Plus, and SuperCard. Inasmuch as HyperCard is the most well-known hypertext software, it will be treated in a separate entry following that describing other Macintosh software.

Business Filevision

An early form of Business Filevision was introduced in August 1984, making it the first hypermedia software for the Macintosh. The product, created by Howard Metcalfe, combines hypermedia with a flat-file database. The result is a synergistic product with more power than HyperCard for certain applications such as geographic information systems. Like ArchiText, Business Filevision lacks a programming language and this makes it less versatile than other products.

Guide

Guide 2.0 draws on several years of research on reading electronic documents conducted by Dr. Peter Brown at the

University of Kent in Canterbury, England. In 1985, Guide was ported to the Macintosh and then, 2 years later, to the IBM PC. Basically, Guide acts like a word processor with extra features for linking text and graphics. Its trademark is its ease of use.

Intermedia

Developed by Norman Meyrowitz and others at Brown University, Intermedia runs under the A/UX operating system (Apple's version of UNIX). A copy may be obtained through the Apple Programmers and Developers' Association. Intermedia comes with elegant drawing, mapping, and writing tools. Although few schools have the necessary computer resources to run Intermedia, its sophistication points the way for the future of hypermedia software on the Macintosh.

Plus

Plus is available in the United States from Spinnaker Software under a special agreement with its West German developers. While Plus can run most HyperCard stacks, it is much more than a clone. Its programming language, PPL, is a superset of HyperTalk. Overall, it is an excellent development environment for those who find the limitations of HyperCard too restricting. More importantly, Spinnaker expects to release versions of Plus for Microsoft Windows and OS/2 in 1990, which should make it possible to run HyperCard stacks on IBM and compatible computers.

SuperCard

Like Plus, SuperCard from Silicon Beach Software is not a clone of HyperCard, but an extension. Its extra capabilities come at a price, however. For example, running the program in color requires 2 MB of RAM. HyperCard stacks may be imported into this environment, but they run more slowly than applications developed using SuperCard. SuperCard also uses some unexpected terminology: a group of cards is called a window and a group of windows, a project. The program's strengths are its animation/drawing tools and its SuperTalk programming language.

HYPERCARD

Bill Atkinson and the beginning of HyperCard

Bill Atkinson, developer of HyperCard, graduated from the University of California at San Diego with a Bachelor's degree in chemistry, and went on to get a Master's in electrical engineering at the University of Washington in Seattle. After graduation, he worked for

Rah Systems, and was president of Synaptic Systems Corporation, a company he founded in Seattle.

Atkinson went to work for Apple Computer, Inc. in 1978, adapting a Pascal program to the Apple II. He wrote the first graphics program for the Macintosh. MacPaint, but he is most well known for the development of HyperCard. He calls HyperCard a “software erector set” for building other kinds of applications and programs. His insistence that this new program be given away by Apple with every new Macintosh computer is certainly one of the major reasons for the success not only of this particular program but of the whole concept of hypertext itself. He believes strongly in the concept of sharing knowledge, both in the immediate sense (he visualized hundreds and thousands of people sharing “stacks” of information through HyperCard), and in the overall sense, in which information and results are linked and shared so that duplication of effort is avoided.

Atkinson is currently an Apple Fellow and is investigating the factors that go into the makeup of a good teacher, with the hope of incorporating those factors into future software developments.

Hypercard basics

HyperCard uses an index card metaphor. That is, a screen of information is a card and a collection of cards is a stack. (See Figs. 1 and 2.) The mouse is used to select choices from pull-down menus as well as to navigate among cards in a stack. One innovation to the basic card file concept is the use of backgrounds. The same background may be shared by all of the cards in a stack or each card can have its own distinctive look.

Ready-to-run stacks included in the standard HyperCard package are a rolodex card file, a calendar, an appointment book, and a notebook with activities. There are also demonstration stacks with pictures, quotations,



Fig. 1 HyperCard.



Fig. 2 The Home Card in HyperCard.

and ideas for buttons, cards, and stacks. Going through any of these sample stacks of working through the Intro Stack is a good way to get to know HyperCard.

HOW HYPERCARD WORKS

There are nine major elements in the HyperCard browsing environment: buttons, fields, cards, backgrounds, stacks, the Home Stack. Recent, the Help Stack, and the Message Box. The first five are the basic elements of a HyperCard application: the next three are navigational aids (ways to help move around and through stacks); and the Message Box is a communications device between the user and the HyperCard.

Building a Stack

Every HyperCard application (or stack) consists of a number of cards. A card is equivalent to a screen of information and may contain fields, buttons, and backgrounds. Fields contain text and buttons signal the existence of a link between two cards or fields. Fields and buttons can be layered on top of each other in the card foreground. The background of each card in a stack may be the same or each card may have a different look.

Navigational AIDS

The Home Stack is the index to the entire program. The first card in the Home Stack is the Home Card and is displayed when HyperCard is launched. There are icons on the Home Card that connect to the applications or stacks currently available.

Clicking on Recent shows up to 42 of the most recently viewed cards in the program. This function helps the user keeps track of his or her location in the program by

highlighting the current card. It also permits direct access to any of the 42 cards.

The Help icon (a question mark on the Home Card) or the keyboard equivalent Command-? takes the user to the first Card in the Help Stack. This stack contains basic information about HyperCard.

The Message box

The Message box is brought up by holding down the command key and pressing the letter m. The box appears as a small text field at the bottom of the screen. The Message box may be used to send any one-line command directly to HyperCard. For example, the user may tell HyperCard to “Find” something, “Go” somewhere, or “Play” a noise like “beep” or “boing.” Other commands include “The Date,” “The Time,” and “Show” (which displays a particular card or series of cards). (See Figs. 3 and 4.)

USING HYPERCARD

HyperCard has five levels of accessibility that accommodate the novice as well as the experienced user. In order of increasing complexity these are browsing, typing, painting, authoring, and scripting. Each level builds on the capabilities of the previous level.

Browsing: The Browsing level provides access to short file and edit menus, permits movement from card to card, and allows the use of the Browse tool.

Typing: The typing level allows the user to explore HyperCard’s stacks search for text, and edit text.

Painting: By moving to this level, the user gains full File and Edit menus. Paint tools (but not Button and Field tools), and the Power Keys option.

Authoring: At this point, the user has access to the Object menu and the Button and Field tools.

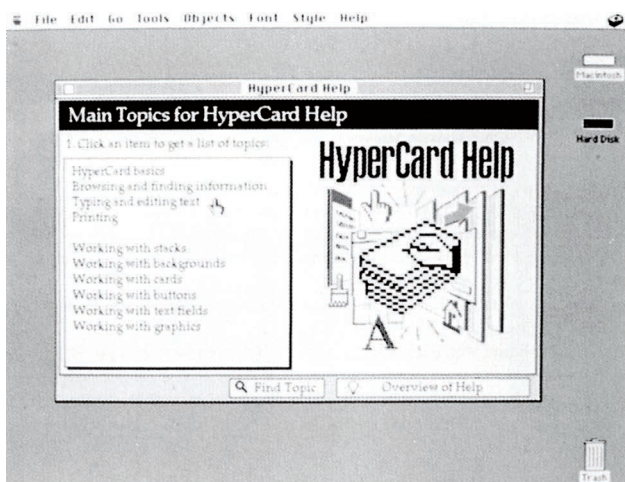


Fig. 3 HyperCard Help.

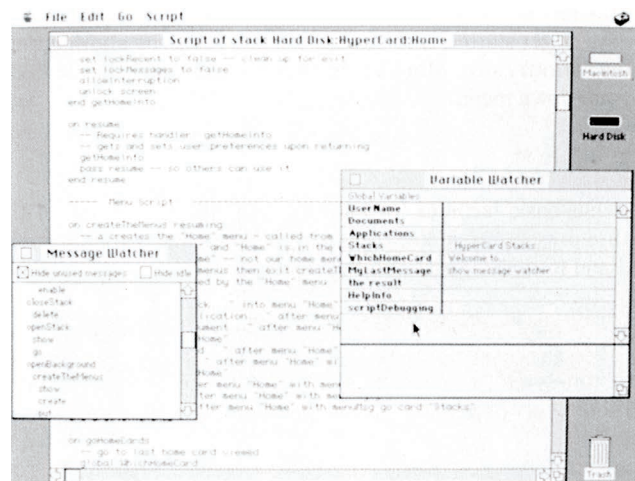


Fig. 4 HyperTalk Script.

Scripting: Finally, the scripting level places all the capabilities of HyperCard at the user’s fingertips. Features available only at this level include script editing and access to the Message box even when it is hidden.

GETTING STARTED

The first time HyperCard is launched, the Home Card will appear. Pointing and clicking with the mouse on one of the icons takes the user to the linked stack. One of the easiest ways to get started is to change existing stacks by altering the text or the pictures on the various cards. More adventuresome users may decide to create a new stack via the pull-down menu.

Text Editing

HyperCard has basic facilities for entering and editing text. All of the standard editing tools are present for adding, changing, and deleting text as well as for moving blocks of text and formatting margins, font styles, etc.

Graphics

HyperCard comes with a complete set of painting tools very similar to those in MacPaint. These tools help create bit-mapped graphics by turning pixels (picture elements) on or off. An extension of this capability is the “Fat Bits” option that enlarges the painting to allow editing of individual pixels. HyperCard does not have drawing tools—tools which create graphics as objects.

When a particular painting tool is selected, three additional menus (paint, options, patterns) appear in the menubar. These new menus provide additional tools to enhance or modify a painting. These menus can also be “torn off” and placed in convenient spots on the screen so

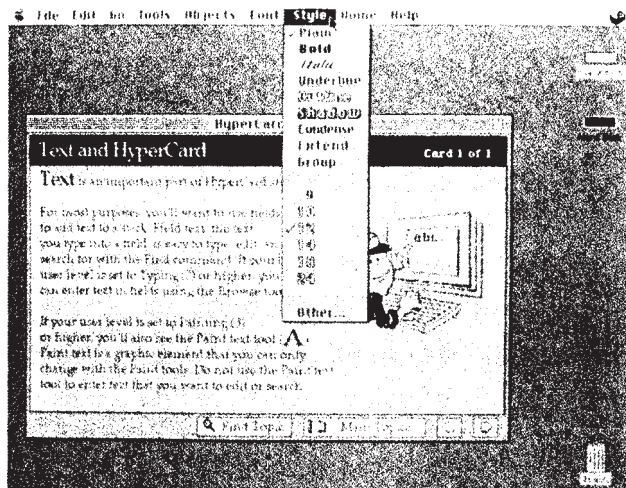


Fig. 5 Text and HyperCard.

they are visible while working on a painting but do not interfere with the image.

HyperCard's graphics tools are moderately sophisticated and powerful. They are also easy to use and follow the patterns of other similar graphics programs. Combined with the Cut-Copy-Paste tools that are also available in the text-editing mode, the graphics tools are more than adequate for most tasks. (See Figs. 5 and 6.)

Scripting with Hypertalk

The most sophisticated and powerful part of HyperCard is its built-in programming language called HyperTalk. Just as text or graphics may be edited, it is also possible to alter the way things work by using the authoring tools. The first step is to switch to the Scripting level. This level is adjusted by going to the Home Card and clicking on the arrow for the previous card (the User Preferences Card). This card allows the user to select any one of the five levels desired.

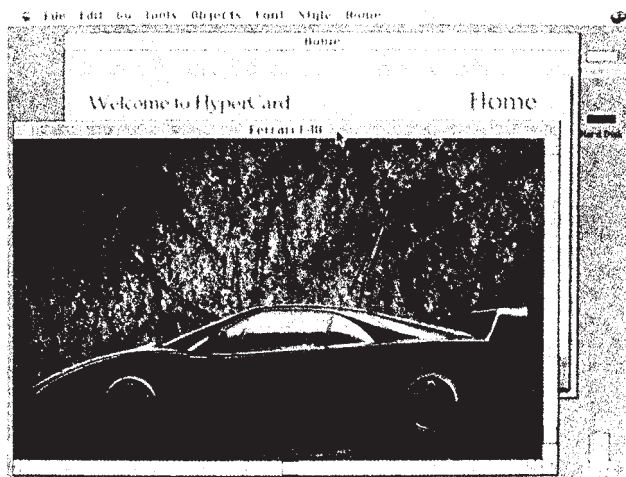


Fig. 6 A customized Home Card.

One advantage of HyperTalk is that it looks and sounds like ordinary English. Jargon is not needed in order to write simple scripts. Other advantages are that it closely resembles object-oriented programming, which has a simplicity of approach and design. Message passing between objects is the basis of object-oriented programming, and also of HyperTalk. All activity in HyperCard involves messages, whether from the system itself, between stacks, or among cards. HyperCard's major strength is its programmability. Virtually any application can be created using HyperTalk. This is the main reason for the proliferation of stacks all over the country—and even throughout the world. Teachers, librarians, students, and business people alike can use HyperCard to create a unique application.

Advanced features

The power of HyperCard does not end with scripting. The programmers at Apple Computer have made it possible to actually add features to HyperTalk through XCMDs and XFCNs. XCMDs are external commands (written in another programming language such as Pascal). XFCNs are external functions that are similar to XCMDs except that when they finish executing, they return a value. In effect, XCMDs and XFCNs make HyperTalk one of the most flexible programming environments in existence.

Hypermedia Interface

A number of options are available to produce sophisticated educational stacks involving hypermedia. For example, Apple Computer sells the CD-ROM and Videodisc. Toolkits to enable HyperCard to communicate with optical disc systems. Additionally, hypermedia developers can add synthesized speech to their projects through the public-domain HyperMacinTalk stack. For those interested in sound effects or digitized speech, there's the MacRecorder from Farallon. Animation buffs, on the other hand, will want to look into Video Works II from MacroMind and HyperAnimator from Bright Star. VideoWorks II allows the creation of digital movies that can be accessed from HyperCard. Hyper Animator adds talking actors with realistic expressions to stacks. In short, almost any conceivable enhancement can be made to HyperCard for a price.

SUMMARY

HyperCard is only one of the software packages available that enables the user to experiment with the world of hypertext and hypermedia. It is the most widespread, however, and probably the cheapest and easiest to obtain. As more sophisticated applications are developed that use video, laserdisc, sound, and graphics, more and more people will find a way to integrate them into their work and

personal information management. The changes that have taken place within the computing world in the last two decades alone are astounding, and the promise is for many more. Voice-operated computers, virtual realities, and fully integrated applications will become the norm. The idea of *linking* that is so central to hypertext is a powerful feature of all of the current and promised technologies. The associations that we have in our minds for the management of the information we need and use are the associations we will actually be able to employ through our computers, thanks to hypertext and hypermedia technology. The world of tomorrow is on our doorstep.

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Illumination [ELIS Classic]

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Abstract

“Illumination is the art of embellishing manuscripts with gold or silver and bright colors,” according to the author. “The art of illumination or manuscript painting is ancient and widespread. It flourished in Japan, China, India, Central Asia, the Near East, and Europe, as well as in pre-Columbian America. Basically, however, illumination is a medieval art *par excellence* that flourished mostly in Europe and the Orient until the introduction of engraved illustrations in printed books.” The history of ancient and medieval illumination is traced, with emphasis on Europe, the near East, and Central Asia.

—*ELIS Classic*, from 1974

INTRODUCTION

Illumination is the art of embellishing manuscripts with gold or silver and bright colors. In contemporary usage illumination incorporates illustration, historiation, miniatures, paintings, and designs not only in polychrome but also in monochrome. Illumination is derived from the French *enluminure* and Latin *illuminare* meaning “to light.” The art of illumination, though ancient, is generally restricted to medieval manuscripts on parchment characterized by the use of gold or, rarely, silver to light the ornamented letters, chapterheads, marginal borders, painted scenes, and sometimes the whole page.

COLOR ILLUSTRATION

Illustration in color is an ancient technique basically employed to clarify the contents of a manuscript. The ancient Egyptians used the technique on papyrus rolls. Historiation or the illustration of texts by relevant paintings or continuous scenes in historical sequence is also an ancient practice.

Miniature, derived from *miniare* in Latin, means to paint in red or with *minium*, a brilliant red pigment. The word “miniature” is commonly used for painted individual illustrations in ancient manuscripts and medieval codices. It is also applied to portraits, landscapes, and figural scenes of minuscule dimension in a manuscript. Paintings in Islamic manuscripts are usually referred to as miniatures. Miniatures may be executed without the use of gold or silver, while in illumination the use of gold is a must.

The main colors used in the embellishment of manuscripts were red, blue, and gold, and less frequently purple, yellow green, plain black, and white. These colors were made from earth minerals or plants, for example red from minium, and later from cinnabar, purple from

turnsole or shellfish (*Murex*), yellow from turmeric roots, white from burnt bones, black from sloe berries, green from copper, etc.

The art of illumination or manuscript painting is ancient and widespread. It flourished in Japan, China, India, Central Asia, the Near East, and Europe, as well as in pre-Columbian America. Basically, however, illumination is a medieval art *par excellence* that flourished mostly in Europe and the Orient until the introduction of engraved illustrations in printed books.

ANCIENT AND CLASSICAL ILLUMINATION

Ancient Egypt

Illumination owes much for its origin to the techniques of illustration used on papyrus rolls by ancient Egyptians. These illustrations were pictorial rather than ornamental, an artistic development due to the fact that one of the earliest forms of Egyptian writing was pictographic. The illustrations in continuous scenes are used to explain the text.

Several of these earliest texts of the second millennium B.C. are now preserved in the British Museum, and are commonly called the *Book of the Dead* as they used to be kept along with a dead body in the tomb.

The earliest known copies containing the *Helipolitan Recension* are assigned to the eighteenth dynasty (1570-ca. 1350 B.C.). The texts are written in black ink, but the titles and the first words of the chapters are written in red ink, and the designs or vignettes are in black outline.

Another text, known as *Papyrus of Ani*, has a border of two colored lines, the inner one brick red and the other dull yellow. The vertical columns of text are broken at intervals by pictures and vignettes in brilliant color, illustrating the passage of Ani and his wife to the other world. Numerous gods are also represented.

Hunefer Papyrus shows the use of systematic pictorial designs in continuous scenes in monochrome and water colors of great delicacy and brilliance. The illustration depicts scenes of a funeral procession with the mourners, wailing women, and a reader who recites the funeral services, and another Anubis holds the outer coffin before the family of Hunefer.

Another copy of the *Book of the Dead* shows Orisis, outlined in black, wearing a garment decorated with bright red dots and a crown and neck ornament of inlaid gold. Border and outlines are drawn in black ink. This color scheme marks the beginning of illumination, which was continued in Christian and Islamic examples.

Greco-Roman Period

Greek art, which mainly flourished in Hellenistic Alexandria, shows a strong ancient Egyptian influence of papyrus style. A fragment of a papyrus roll (Bibliothèque Nationale, Paris) assigned to the second century, has three columns of writing, each bearing illustration in Egyptian style. The figures, however, are drawn in black and have heavy brush strokes. The garments are pink and blue-gray and the faces are brown.

The surviving materials of the classical Greek period are very few and most of them were found in Egypt, apparently dating from about the fourth century B.C. to the seventh century A.D. In the early fourth century, vellum and parchment superseded papyrus and became the chief material for ornamental writing.

The *Ambrosian Iliad* (Biblioteca Ambrosiana, Milan) is the earliest extant fragmentary example of an ancient Greek manuscript on vellum in roll form. Only 58 illustrations on the verso of the 52 leaves of the vellum have survived, probably out of 386 leaves with 240 pictures. The colors used are red, blue, purple, and green with outlines in ink, and a bright yellow in place of gold. Landscape appears in the backgrounds. Frames of red and blue bands of varying heights surround all miniatures. The scenes, however, are not well proportioned. The date of origin of the *Iliad* is uncertain, but the text on the recto of the leaves is in Greek uncial script characteristic of the fourth to fifth century.

Vienna Dioscorides or *Constantinopolitanus* (National Library, Vienna) is another ancient Greek illustrated text on science by the great Greek botanist Dioscorides of Anazarbos. It consists of 431 leaves each about 15 1/4 × 13 1/4 in. It is the earliest known codex with gold background. No illustrated Latin manuscript has survived from the early Roman period.

Vatican Virgil (Vatican Library) has 76 leaves, about 12 in. wide and over 12 in. in length. Its 50 pictures are uneven in quality but some of them are very well executed. The codex constitute one-sixth to one-fourth of the original manuscript. The main colors used are dark and light blue, light yellow, brown, green, red, pink, light

purple, orange, gray, white, black, and gold. Flesh has the color of brick red. Miniatures are of Roman origin. The text is in rustic capital of fourth or fifth century.

Roman Virgil (Vatican Library) has 309 square leaves of about 13 1/2 × 13 1/2 in., with 19 miniatures painted in gold, black, white, yellow, brown, purple, blue, green, yellow green, and red. The painting reflects a decadent classical style.

Alexandria, Antioch, and Rome were the important centers where Greco-Roman art flourished.

BYZANTINE ILLUMINATION

In A.D. 330 Constantine shifted his capital from Rome to Byzantium and renamed it Constantinople (presently Istanbul in Turkey). He also declared Christianity the state religion. Constantinople became not only the seat of the Roman empire or the new Byzantine Empire, but also flourished for over 1000 years as one of the great intellectual and artistic centers of the whole ancient world. In true sense, illumination developed in Constantinople around A.D. 500. The main components of the Alexandrian school and the Eastern heritage of the Syrian school centered in Antioch.

The first period of the fourth and fifth centuries is formative and marks the beginning of early Christian elements of rather pagan symbolism. At this time, books were in roll form and illustration was more common. The *Joshua Roll* (ca. A.D. 472, Vatican Library) is a good example of this period. Its origin, however, is debatable. It is written in the script of tenth century minuscule. Until 1902 it remained in roll form, measuring 35 ft. × 1 ft., but since then it has been divided into separate sheets and gathered into an album.

In the sixth century A.D., during the reign of Justinian (527–657), Byzantine illumination reached its first golden age, and became a Christian rather than East Christian art. Main features were the use of vellum in the form of codex comparable to the book of today, decoration of manuscripts of gospels with brilliantly painted ornamental designs, use of gold or silver lettering, superbly executed miniatures embellished with highly gilded backgrounds, angularity of outline, meagerness and elongation of form, and richness of costume, which indicated oriental influences. But very few manuscripts of this period could be preserved. The style and color combination of the period, however, are noticeable in mosaics and frescoes of Roman Churches of medieval times.

The period of iconoclasm (a movement against image worship due probably to Judaeo-Islamic influence) from 726–843 wrought havoc to the art of illumination. Precious illuminated manuscripts were destroyed and mutilated. The artists of this period substituted ornamentation for miniature, and flora, fauna, and geometric forms for figure paintings. In the second half of the ninth century

there were two divergent styles: those of the court, “aristocratic” or aulic, based on the sixth century Alexandrian Hellenistic pattern for dogmatic and liturgical canons; and the monastic, based on the Eastern manner of Syria-Palestine called “Cappadocia,” in which the illustration of contemporary life became more common. Revival of image worship in 843 brought about the return of figures to paintings, which gradually helped in producing the best miniatures of the Byzantine period.

The most glorious period of Byzantine art is from the tenth to the twelfth centuries, which can be called the age of brilliant miniaturists. *Paris Psalter* (Bibliothèque Nationale, Paris) of the tenth century is a good example in presenting freshness and brilliancy in life. *Vatican Psalter* (Vatican Library) of 1059 has rich miniatures of brilliant coloring. *Vienna Genesis* (National Library, Vienna), an illuminated manuscript, claimed to be of much earlier date, was actually produced later. Its decorative pattern, such as arcades surmounted by monsters, beasts, birds, vases, trees, plants, flowers, interlaced borders and crosses, became very popular in medieval Europe.

The most marked influences of the period could be seen in tessellated and mosaic pattern, interlaced fret work, or twining branches of gold or white over a background of variegated colors, which became a general style in Western Europe.

Byzantine art received a heavy setback by the Latin occupation of Constantinople in 1204, and it ended in 1453 when Constantinople fell to the Ottoman Turks. This was also the time when national styles of illumination were highly developed in Western Europe and also in the Orient. The influence of Byzantine artists was manifested in later works. The areas that were predominantly in the Byzantine sphere of influence were Syria, Palestine, Coptic areas, Armenia, Georgia, the Balkans, and Russia.

EUROPEAN WEST, SIXTH TO ELEVENTH CENTURIES

Western illumination, while it reflects a strong Eastern influence, developed its own original pattern, tendencies, and styles, which in a true sense were more decorative than illustrative. Three outstanding traditions of illumination, the Hiberno-Saxon, Carolingian, and Ottonian are noteworthy.

Hiberno-Saxon Illumination

The seventh and eighth centuries gave rise to the most outstanding schools of Hiberno-Saxon illumination, also called Celtic art. Main features of Celtic illumination are introduction of initials and margins, and full page designs with intricacy of interlacing spirals, zigzags, and ribbons that entangle animal and human shaped fancies, knots and other designs, all executed with a marvelous precision of

mathematical accuracy, delicate touch, and brilliant coloring. Irish illumination is decidedly oriental in execution and conception. The decorative schemes are more similar to the Arabic than to any other.

The best example of Celtic illumination is the *Lindisfarne Bible* (British Museum) written in the early eighth century in honor of Saint Cuthbert. Insular majuscule for initial letters and half uncial script for text are used. Figures show the influence of Byzantine models.

Another most outstanding work is “*Q*” *Codex* or the *Book of Kells* (Trinity College, Dublin). The 339 surviving leaves contain an incomplete Latin text of the gospels written in combination of uncial and round half uncial script. The ornamentation includes leaf and plant forms, zoomorphic forms, interlaced geometrical patterns, and curious figures. The use of lapis-lazulic blue, the unusual square punctuation marks, and introduction of vine foliage as a new decorative element suggest a later date than seventh to eighth century as usually assigned. No gold was used in *Book of Kells*.

Another example is the *Book of Durrow* of late seventh or early eighth century origin. It is in four colors, dark brown, brick-red, bright yellow, and green.

In Southern England, the Canterbury Scriptorium became an important center of illumination. Here the art was based on early Christian figural tradition in stiffly outlined forms and partly on the Hiberno-Saxon style ornamentation.

In the last decade of the tenth and early eleventh centuries an independent style of illumination flourished in England at Winchester. Borders with foliage in soft shades or in gold, and large initials were the chief characteristics of Winchester style. Later, Hiberno-Saxon art strongly influenced Western European illumination.

Carolingian Illumination

The flowering of Carolingian illumination began with the crowning of Charlemagne (Charles the Great, 742–814) as Emperor of the West in A.D. 800. Charlemagne’s court was the scene of great splendor where many cultures met and fused.

A large number of superbly illuminated purple codices of gospels and sacred texts were produced at the monastic and imperial scriptoria. Carolingian illumination reflects the influence of Byzantine art in the arcaded canon tables, brilliant miniatures, and lavish use of gold or silver in letters as well as illustrations on purple ground. Celtic style can be seen in large initial page designs, and the inclusion of exotic birds seems of Syrian origin. Miniatures represent historical themes. Carolingian illumination, however, shows a tendency to coarseness of workmanship and clumsiness of figure painting on purple vellum.

The Carolingian art flourished in Germany, France, and Italy. The main centers included Tours, Rheims, Aachen

(Aix-la-Chapelle), Metz, Fulda, Lorsch, and Hautvillers. *Otto Gospels* (John Ryland Library, Manchester) of the second half of the tenth century is a good example. It has a full page of decorative patterns in purple and gold and was executed at Cologne or Saint Gallen.

In the second half of the tenth century there was a great influx of Byzantine artists due to the marriage of Otto II to the Byzantine Princess Theophano in 972. The combined technique was an improvement in that facial expressions were more human and had better sense of proportion.

Important centers were the Benedictine Abbey of Reichenau; Regensburg, the seat of the Bavarian School of Illumination; Salzburg; Bamberg; Magdeburg; Trier; Mainz; the Monastery of Fulda; and the Scriptorium of Hildesheim.

ROMANESQUE PERIOD

The eleventh century marked the beginning of Romanesque style. The principal features were monumentality, growth of distinct national styles in art and architecture, religious fervor due to the crusades, large scale building of monasteries and scriptoria, and production of large bibles, psalters, gospel books, missals, biblical commentaries, particularly on the Apocalypse, and other liturgical and religious works, lectionaries, homilies, lives of saints, sacramentaries, and secular codices.

The Romanesque style had as its model the later Hiberno-Saxon and Ottonian as well as Byzantine works. Its main characteristics were elaborate decoration of initial letters ornamented with interlaced ribbons. Gold ground became more popular, and borders and backgrounds composed of a system of frames were used. Illustration directly related to the texts became very common.

During the Romanesque period the development of national styles of illumination in England, France and Low Countries, Spain, Germany, and Italy was notable.

England

The Romanesque or Norman period of the eleventh and twelfth centuries is the greatest in the history of English illumination, with Winchester, Canterbury, Durham, Westminster, St. Albans, Bury St. Edmunds, Hereford, Peterborough, and Croyland as the main centers. Fine bibles, psalters, missals, and liturgical books were the principal products.

The main features of Norman illumination were reflection of Romanesque style of architectures, Byzantine and Syrian influence in striking use of gold and heavy color, mushroom trees in the background, interlacing foliations and fantastic animals, and scenes illustrating the text of Hiberno-Saxon origin, elegant figures with elongated forms, and often full page illumination revealing Carolingian influence. The full page miniature and the stately and

monumental size are important features of the twelfth century books. The *Winchester Bible* (Winchester Cathedral Library) is a good example of this period. Originally it was in two, but is now in three stately volumes, and is generally considered the finest of the monumental bibles. It has beautiful miniatures, full page outlines of drawings, good proportion of figures, with rich and beautiful coloring in dark deep tones, deep blue-green historiated initials, human figures, plants, and luxuriant foliage.

France and the Low Countries

Two schools of illumination, Southern and Northern, developed in the eleventh century. The Northern School had the influence of the Anglo-Saxon while the Southern developed on Italian and Spanish models of illumination. The color scheme shows Mozarabic influence as practiced in Moorish Spain.

At the scriptoria of various abbeys in Paris, Rheims, and in Alsace and Lorraine, magnificently illuminated bibles, psalters, gospels, sacramentaries, lectionaries, homilies, lives of saints, and commentaries on holy books, as well as secular works, were produced. Illumination rather than calligraphic work excelled in ornamental draftsmanship. The color scheme included red ink with blue, green, or yellow backgrounds. The decoration had interlacings and coils, foliage, and panels of ornamental lettering. The human figure, however, is not well portrayed. Initials were done in gold and silver on a purple background. The decline of scriptoria of the great monasteries dates from the middle of the twelfth century.

An important example of the period is the copy of the *Commentary on the Apocalypse* (Bibliothèque Nationale, Paris). Its color schemes and decoration reflect the Mozarabic character of Spanish models. In the regions now known as Belgium a great number of huge bibles were produced. The best known is *Stavelot Bible* (now in the British Museum).

Spain

A new style developed by the Christians under the influence of Muslims in Spain is called Mozarabic art. Early Mozarabic manuscripts had primitive illumination consisting of ornamented colored initials, with green, yellow, and violet colors. Mozarabic illumination greatly influenced medieval art particularly in Spain, Italy, and Southern France. About 25 manuscripts of this period are extant and are known as *Beatus Manuscripts*.

Germany

In Germany and German speaking areas, the Ottonian tradition of illumination remained strong. Typical variations are productions of great bibles with illustrations of

tiny framed scenes, huge initials of gold, silver, and other colors, and arcaded canon tables.

The main features of German illumination of this period are artistic design of linear outline, fine drawings with rich and massive grouping of foliage presented in the ornamental initials of white foliated branch outlines in red on soft blue and green fields, and dignified border designs. Emphasis was also placed on artistic calligraphy. Initials became smaller but were exquisitely drawn; dragons and birds were often added to the intertwining stems and leaves to form effective head and tail pieces to the letters, and occasionally human figures were added as part of the decorative scheme.

Italy

Italian illumination had the influences of Byzantine, Carolingian, Ottonian, and Hiberno-Saxon elements. Illuminated manuscripts, produced at Benevento in southern Italy from the eleventh to the thirteenth centuries, consisted of long rolls of parchment or vellum. The color scheme contrasted light blue, pale-green fields with ultramarine or crimson background, on which orange-yellow or gold letters paneled with geometric patterns in red, white and blue, filled with intertwining white vine tendrils, stood in sharp relief. Decorative work was of high quality, although the historiated initials with portrait miniatures were flat, wooden, and generally monotonous.

GOTHIC PERIOD

The rise of Gothic art in the thirteenth century was supremely demonstrated in its architecture with pointed arch and stained glass, which eventually had its great impact upon the book decoration. The main feature of this period was the production of smaller books intended for individual or family use in large numbers. Large and bold characters were replaced by neat minuscules. Historiated initials became more popular. Full page pictures, common in the Romanesque period, became rare and were much reduced in size. Besides liturgical works, private devotional works such as the *Book of Hours* became very popular. In addition, many secular works such as histories, chronicles, and romances began to appear. Gradually, the interest of the monasteries showed a marked decline because of Cistercian disapproval of extravagant forms of illumination. The influence of glass painting became manifest in manuscripts. Interest in landscape and contemporary life became more apparent in painting, and the use of burnished gold leaf became more common.

Gothic initials had elongated terminals, from which sprang rich borders gradually surrounding the text on all four sides. The main part was first straight and rigid, called bar border, but gradually developed a trend toward

transforming the bar into a thin cylindrical rod adorned with rings and other ornaments.

Gothic illumination first flourished in France, and then in England, Italy, and elsewhere in Europe.

France

The rise of universities and the growing interest of abbots, kings, dukes, feudal lords, and rich merchants in books made Paris the main center of art, culture, and learning in Europe. Urban bookshops, traveling artists, and guilds of scribes, binders, and illuminators were organized and developed.

The main products consisted of psalters, breviaries, and especially Books of Hours, which were superbly illuminated. Contemporary scenes of knights, ladies, troubadours, and minstrels were depicted in the art, including a background of landscape with richness of color, abundant in gold. In the Grisaille technique developed in Paris, the picture is not fully painted. The color, in part pale semiluculent monochrome, creates a harmony between picture and script and transforms illumination into something foreshadowing painting and other graphic arts. The figures are on a colored ground and are faintly shaded and modeled in a cold gray so that they appear as if carved in relief against brocaded and tessellated gold grounds and bright colors.

The examples of this period are numerous, but some of the important illuminated manuscripts are *St. Louis Psalter* (Bibliothèque Nationale, Paris), which has a linear and supremely elegant style, and *Roger of Parmis Treatise on Surgery* (British Museum), which has fully illuminated pages in gold and colors.

In the late thirteenth and early fourteenth centuries richly illuminated books were in great demand by laymen. Illustrated books such as *Biblia Pauperum*, the *Legenda Aurea*, and *Speculum Humanae Salvationis* became very popular.

Paris also was the center of famous artists such as Honore and his son-in-law, Richard de Verdun, and Jean Pucelle, a pioneer in the study of nature, the invention of marginal drolleries, the exposition of traditional iconography, and in rendering buildings in perspective. Pucelle's works, *Belleville Breviary* (Bibliothèque Nationale, Paris) and the *Hours of Jeanne de Evreux* (Cloister, New York City) are good examples. His workshop dominated the first half of the fourteenth century.

Low Countries

Illumination in the Low Countries was of Northern French and Northern German origin. The principal characteristics were plain burnished-gold background, deep blue coloring paling toward the horizon, and natural landscape in the background.

The abbey scriptorium of Stavelot was very famous for its excellent illuminated works. Its chef d'oeuvre, a great two-volume bible, is a good example of the work produced there.

Zwolle Scriptorium in Northern Holland was famous for calligraphic ornament, the painting of the initial letters, and the decoration of the borders with flourished scrolls of penwork, neatly drawn and finely painted.

Flemish psalters of outstanding beauty and elegance were produced by the middle of the thirteenth century. The most famous, the *Maastricht Hours* (British Museum), measuring only $3 \frac{3}{4} \times 3 \frac{3}{4}$ in., represents scenes such as a fox shamming death, and three living and three dead kings.

England

England of the thirteenth and fourteenth centuries had two predominant traditions, Gothic and East Anglican.

The Gothic style had delicacy of drawing and refinement of taste with luxuriant decoration of bar borders and margins full of whimsical animals, birds, and creatures of fantasy. Human figures had a softer, more rounded and gracious contour.

The color scheme frequently used included deep rich blue, balanced by red and light green and lightly shaded with buff, gray, and pink. All psalters contained superbly illuminated initials, "B" for Beatus, and historiated initials. Spaces at the end of verses were usually filled in with pen designs in blue and red with flourishes, geometric patterns, or witty drawings of animals.

The main features of the illuminated manuscripts are their small size (sometimes like pocket books), firm, delicate draftmanship, and neat calligraphic script with ornamentation restricted to foliated initials in burnished gold and warm coloring at the beginning of each book.

The Abbey of St. Albans was a great center for the production of illuminated manuscripts. *Windmill Psalter* (Pierpont Morgan Library, New York) and *Tickhill Psalter* (New York Public Library) are some of its outstanding surviving examples.

Norwich was the center of East Anglican style. Its manuscripts have large borders, decorated with ornamental foliage interspersed with human figures, birds, animals, little grotesque armorial bearings, and the like. The principal characteristics are a rich and harmonious color scheme, with ornament in the design of frame borders, and initial decoration. A good example of this style is *Robert de Lisle* (British Museum).

Germany and German-Speaking Countries

In Germany, Byzantine and Romanesque traditions continued. But the Thuringian-Saxon School and the Benedictine monastery of Weingarten produced exquisite psalters; *Berthold Missal* is the chief product of the latter school.

The late thirteenth century Gothic style of Southern France influenced Germany. Austria also became important for its delicate pen drawings. In Bohemia, the Austrian and Italian influences could be seen in the Prague School, their main characteristics being soft, curling foliage, and fresh colored flowers. A detached initial "U," representing the Holy Trinity (National Gallery, Washington) is a good example of Bohemian style. This school influenced English illumination in the late fourteenth century due to the marriage of Charles's daughter, Princess Ann, to Richard II of England. Another work is *Passional* (University Library, Prague) with fine allegorical miniatures in water color. It shows architectural details in Gothic style. A copy of the *Golden Bull* (National Library, Vienna), the constitution of the Holy Roman Empire, is at its best in its style.

Italy

The Gothic style in Italy developed in the thirteenth century. In addition to liturgical works, the main products were law books and legal commentaries, mainly produced at the University of Bologna. Although the period had strong French Gothic influence, Byzantine influence also continued. The main features of illumination were conventional border ornament, long pointed leaves with lobes generally on one side only, cup shaped beads threaded on the wands and stems, and comical use of human, animal, and grotesque figures, such as a hare hunting a man, as can be seen in a small bible now in the British Museum. Fourteenth century illumination is like fresco or panel painting on a small scale, found in municipal accounts books.

In the middle of the fourteenth century English illumination came to a sudden end due to the plague. In the late fourteenth century, however, a new style of illumination on the model of the German School, particularly Rhenish or Bohemian, is noticeable. Its chief characteristics were independent borders with stem and leaves throwing off thin twisted tendrils with gold balls at the end, greater softness in the treatment of the face, depending more on use of brush than pen and pencil, a more harmonious color scheme, a more skillful use of architectural ornament, and the introduction of new forms of foliage and of a white scroll with sinuated edges, wrapped round the upright shafts of pillars or initials. Landscapes were presented in gilded ground, tapestried, or checkered backgrounds.

John Siferwas, a Dominican friar, is famous for his work, particularly his masterpiece the *Sherborne Missal* (Alawick Castle Collection, Northumberland).

FIFTEENTH CENTURY TO THE DECLINE OF ILLUMINATION

In the fifteenth century or during the Renaissance, illumination became a pursuit of professional artists patronized

by ruling kings, dukes, and the Papal Court, and developed as a true art. The painting was more real, depicting men and women of flesh and blood. The modeling of flesh became three dimensional, portraying a true feeling of life.

Luxuriously illuminated manuscripts were produced during this period. The main features were decorative frameworks and a transition from the miniature, with its three dimensional space construction, to the flatness of the empty ground of the page.

In this period illumination flourished most in Italy, France, and the Low Countries. Each region had its own distinct characteristics.

Italy

In Italy, calligraphy and illumination both flourished as independent arts. The use of humanistic script in manuscripts became more popular. The manuscript was regarded not only as a show piece but also as something that could be used by scholars; illumination began to be confined only to the frontispiece. Its main feature was border illumination, consisting of narrow gold bands in a rectangular frame interlaced with scrolls of vine tendrils in white, on grounds of alternating blue, green, and crimson. The border enclosed putti, animal forms, and medallions in wreaths of foliage. Sometimes human figures, heraldic or symbolic designs, or busts, were copied from antique models. Miniature painting was linked with monumental painting. In Florence, the cradle of the Renaissance, famous artists such as Fra Angelico, Botticelli, Lorenzo Monace, and Attavante degle Attavanti developed their own styles. The masterpiece of illumination of this period is *Lorenzo Hours* (Biblioteca Laurenziana, Florence) a small book of 4 in. × 6 in., with lovely borders with scrolls of foliage and flowers and rayed gilt disks painted on plain white vellum.

Another great work is the illuminated bible made for Borso d'Este, the *Borso Bible* (Modena Estense Library), a product of the Ferrara School of illumination, which is famous for its distinct character and elaborate margins. Sixteenth century Italy marked the decline of illumination, but the products of such famous miniaturists as Giulio Clovio are notable. Clovio attempted to translate the most monumental qualities of Renaissance frescoes into miniature. The *Book of Hours*, which he illuminated for Cardinal Alessandro Farnese in 1546 (Pierpont Morgan Library, New York), is a good example of his work.

France

In the fifteenth century, France saw the greatest flowering of illumination. Books of Hours were the finest and most numerous. Three great masters were Rohan Master, Jean Fouquet, and the painter of *Livre du Coeur d'Amour e pris* (National Library, Vienna). Rohan Master's art can be

seen in the *Grandes Heures de Rohan* (Bibliothèque Nationale, Paris).

The Limbourg brothers's (Pol de Limbourg and his brothers) *Très-Riches Heures* of the Duc de Berry (Musée Conde, Chantilly), which they left unfinished at their death, is a sumptuous codex. Every page has a luxuriant full border with brilliant title medallion miniatures and superb portrait pages.

Jean Fouquet of Tours spent his early days in Italy, and shows that influence in both panel and miniature painting. He was an artist of international fame in his own time. His illumination in the 47 preserved pages of *Hours of Etienne Chevalier* (Bibliothèque Nationale, Louvre; British Museum, Musée Conde) created miniatures which are elegant and show the influence of the Limbourg brothers.

The third important work, the *Livre du Coeur d'Amour e pris* was written and illustrated by King Rane of Anjou. The miniatures depict the spirit of late medieval chivalry.

In the Low Countries, Trounai, Ypres, Bruges, Ghent, and Brussels were important centers of illumination. Paintings in grisaille were also popular.

Germany

German illumination in the fifteenth and sixteenth centuries can be characterized by putty-colored border frames in which green and scarlet often appear. Franco-Flemish influence is very strong, as can be seen in a seven volume bible with richly illuminated border now preserved in Rome.

Masterpiece of the Glockendons, a prayer book executed by Albrecht Glockendon for the Duke of Bavaria (Biblioteca Estense, Modena) contains 41 full page miniatures and numerous colored initials on gold. Other rich illuminated manuscripts are those that were commissioned by the Emperor Maximilian.

The sixteenth century finally marked the end of illumination in Germany and elsewhere in Europe except for casual execution of religious books and invitation cards.

ISLAMIC ILLUMINATION

Islamic illumination developed from a modest beginning. The early art was purely calligraphic and centered around the development of script, style of writing, and beautification of letters. Then came decoration, first with the use of gold and then with colors. Early illuminated manuscripts basically consisted of Quranic texts and had no illustration or painting depicting any life, as they are not allowed in Islam. Illustrations and paintings were included later in secular works only. The art of miniature painting, which attained an independent pictorial composition, developed in Persia and strongly influenced Turkey and Mughal India.

Arabic script written from right to left became the main script of the Islamic world, and it played the same role as Latin in medieval Europe. It has five variants: Kufic, Naskh, Maghribi, Taliq, and Nastaliq.

Kufic (angular vertical) was named after Kufa in Mesopotamia. It remained the chief script of the Quran for over four centuries, and for about a century for general use. It was a most popular early script and is used even now for epigraphy. After the ninth century, letters evolved into distinctive ornamental style, were elaborately intertwined with shafts, and linked closely with the leaf scroller of the ground, and are usually called Kufic fleuri.

Naskh (round and cursive and later developed into calligraphic form) originally was the cursive form of Kufic, but it is generally said to have been developed by Ibn-i-Muqla in the early ninth century. Naskh became most popular for religious as well as secular writing. By the twelfth century it finally replaced Kufic. Now the Quran is universally written in the Naskh script.

Maghribi (round and heavy) is a variant of Naskh script, which became popular in Islamic West or Northern Africa. In Moorish Spain it was called institutional script, as it was used for both religious and secular works at Cordova.

Taliq (cursive) was developed in Iran by Hasan Farsi in the early tenth century and was used for popular writing. It became popular in Turkey by the name of "Diwani" or court style. Later on it became popular in India also.

Nastaliq (elegant and round with thick and thin strokes) is an Iranian variant of Naskh but quite independent and distinctive in style, developed by Mir Ali Tabrizi in the late fourteenth century. Nastaliq gradually became the main writing style in Iran and India for secular subjects. The best illuminated manuscripts in Iran and India are in Nastaliq script, except for Quranic text, for which Naskh script is universally used.

Style

Twelve different styles were developed from Kufic script by Ishaq bin Hammad in the early ninth century. They are: Tumar, bold letters for Quran and inscriptions; Sajalat, or Court style; Ohud, for deeds; Amanat, for agreement; Madih, for eulogy; Ghubar, the use of dots to give an impression of cloud, for beauty; Moammerat, for official deliberations; Dibaj, writing on silk; Murassa, ornamental; Hasan, elegant and thin; Riyash, or pictorial; and Bayaz, for documents.

In the late ninth century the famous calligrapher Ibni-Muqla (886–940) developed six styles: Thulth, or one-third, just like uncial script, was bold and was used for Quran and religious texts; Naskh, round and cursive, for religious text; Toqi, bold letters used for official statement; Riqa, for correspondence and accounts; Muhaqiq, book style used by scholars; and Rehan, thin letters used by ladies.

In the beginning, the calligrapher had to illuminate and rubricate, but gradually each of these functions was performed independently by the calligrapher, the illuminator, and the painter. Ink was made from soot and arabic gum, with vitriol or alum; pigments were prepared from gold leaf, powdered lapis lazuli, orpiment, yellow ocher and the like, again with the use of arabic gum.

Decoration included a title page, which always had double headings of the chapter and border medallions. Later, it became a fashion to include in the text the name of the calligrapher, and the date and place of production in a modestly worded tail colophon following the text at the end of the page.

Illumination, though still in fashion for Quranic texts, basically flourished in the Islamic world from the eighth to eighteenth centuries. The following periods and areas are important for developing their own distinctive styles of illumination.

EARLY ISLAMIC PERIOD

The Muslim era begins from September 13, A.D. 622. Most of the manuscripts, including the complete text of Quran and the letters of Prophet Mohammed (560–632), were written after this date. The earliest preserved Quranic manuscript is the one used by Hazrat Uthman, the third Caliph (644–656) at the time of his martyrdom in A.D. 656. It is now in the State Library, Tashkent, and a photocopy is in the National Museum of Pakistan, Karachi. It is on a broad parchment sheet written in large early Kufic letters. The earliest dated copy of Quran is of A.D. 784 (National Library, Cairo).

The earliest style of decoration developed in Mesopotamia, Syria, Northern Africa, and Moorish Spain.

In Mesopotamia, the earliest center was Kufa, where Kufic script originated. The Kufic writings of this period were thick and rounded, with short verticals and large horizontals. For decoration, gold was used, and later a few colors, more frequently natural or colored blue, violet or red, and black were also added. Illuminated pages at first had interlacing, foliate forms, and palmette scrolls outlined in brown ink. This style was common in Syria and Egypt.

MAGHRIBI SCHOOL

The term Maghribi or Western Islamic is used for Northern Africa and Moorish Spain. Syrian style of illumination had strong influence in these regions. Damascus in Syria, the capital of Umayyad Caliphs (661–749), had developed a distinctive style of writing which, unlike Kufic, was very close to Naskh. The same variant spread in Northern Africa, particularly in Spain where a fugitive, Umayyad

Prince Abdur Rahman I (756–788), laid the foundation of Moorish rule in Spain with his capital at Cordova.

MOORISH SCHOOL (756–1492)

In the whole of Maghrib (Islamic West) the calligraphic form has not been so well developed and refined as in the east, but the illumination on parchment in polychrome is exquisitely rich. The Moorish codices with arabesque work, executed primarily in gold and blue, surrounding the pages in variants, twining round the headings, and the marginal decoration are superb.

In the fourteenth and fifteenth centuries, Granada became very famous for its vivid color composition, and Alhambra style became an established model for embellishment of a codex. Some texts have free drawing of tree forms with their branches spreading across the text, and can be associated with Sicily in decorative pattern.

Examples of early illuminated Maghribi manuscripts are rare. There are some from the later period in Morocco and Tunis but they are not brilliant examples.

MOZARABIC ILLUMINATION

Under Muslim influence, a new style of book decoration was developed by Jews and Christians in Spain, generally called Mozarabic art. For example, Jewish illumination of *Exodus* (British Museum) shows a marked influence of Islamic style. The majority of the Hebrew codices from the tenth to fifteenth centuries were produced in Spain. The illuminations are executed in bright colors on a gold background. Besides religious manuscripts, there are also illustrated secular works, for example a finely illuminated fourteenth century copy of Avicenna's *Canon of Medicine* (Biblioteca University, Bologna, Manuscript 2197).

Christians in Spain were influenced by Moorish style, particularly in ornamentation of initials, as can be seen in *Beatus Manuscripts* produced in Spain, Italy, and Southern France.

FATIMIDE SCHOOL (909–1171)

The Fatimides, after defeating Aghlabides in Tunis in A.D. 908, became master of almost the whole of North Africa and first made their capital at Mahdiya near Tunis. A half century later they added Egypt and Syria, and founded the city of Cairo, which became one of the greatest intellectual centers of Islamic learning, particularly at the famous Al-Azhar University, which they founded. The Fatimides patronized the Nestorians and Jacobite Christians from Syria who were famous illustrators and illuminators. Many richly illuminated manuscripts of this period are found in the Cairo National Library and the Vienna

National Library. The style of writing is very close to Naskh, with rather heavy strokes. Illuminations are rich.

MAMELUKE SCHOOL (1250–1516)

After Fatimides, Ayubides (1169–1250) came into power, followed by Mamelukes or white slaves (1250–1516). Both of the later dynasties were of Central Asian rather than Turkish origin.

Mamelukes are noted for building great mosques and having inscriptions on walls and arches in majestic Tumar (bold) like Thulth, a variant of Naskh form. The large luxury Qurans in Tumar or Thulth, in gold on blue and brown ground, usually have title pages without text and are divided up geometrically into lattice or star shaped compartments with arabesques and palmettes. The chapter headings are generally in Kufic-like letters on a ground of leaf scrolls and surrounded by a border of interlacy. The illuminated texts of the Quran executed in this period and now preserved in great quantities (National Library, Cairo, and National Library, Vienna) are the best examples of Egyptian illumination.

ABBASIDE PERIOD (750–1258)

The Abbaside period was an age of great splendor in Islamic history. Harun-al-Rashid (786–809), of Arabian nights fame, and his successors, Mamun, Moatasim, and Matawakkil, were great patrons of art, learning, and scholarship. Charlemagne (742–814) had close cultural contacts with Harun. The court of Abbasi Caliphs at Baghdad witnessed the scenes of great cultural fusion. Baghdad, Samarra, Mousal, Basra, Nishapur, Dayar-i-Bakr, and Bukhara, were the chief centers of book art, particularly noted for the development of calligraphic styles. Two schools, those of Baghdad and Seljuk, were famous.

Baghdad School

The Baghdad School is noted for book art. It had the master minds of Ibn Muqla (886–940), Ibn Bawwab (991–1032), and Yaqt-al-Mustasemi (1221–1268), who developed various exquisite styles from Kufic and Naskh forms. The early form of writing was Kufic, and then ordinary cursive Naskhi, the most important features being the curving and elegant Thulth (bold) generally used for the Quran.

The Caliph Mamun-al-Rahid (813–833), son of Harun, patronized Manichian style from its founder, Mani, one of the greatest Iranian painters. The style had central Asian elements and was executed in Baghdad earlier than in Iran. Other famous painters were Abdullah Ibn al Fadhl and Yahya al Wasiti. Ornamentation included designs of

rosettes or palmettes, and the colors used were yellow, red, blue, green purple, and gold.

Not many illuminated copies of the Quran of this period have survived, but some are in the National Library, Cairo; Quran manuscripts of A.D. 883 and 890 are in the Bibliothèque Nationale, Paris. Another manuscript of A.D. 870 is in the Cambridge University Library.

Some of the old secular illustrated manuscripts such as *Kalila wa dimna* (fables of Bidpai), dated A.D. 1222, and *Maqamat Hariri*, dated A.D. 1237, are now in the Bibliothèque Nationale, Paris.

Seljuk School (1055–1256)

Seljuks were Turks. At the time of their appearance the empire of the Caliphate was vanishing. Art and learning flourished during the reigns of the great Seljuks Tughril Beg (1037–1063), Alp Arslan (1062–1072), and Malik Shah (1072–1092). They made Nishapur their capital. Besides Baghdad, other important centers were Raqqa, Ardh-Rome (Konya), Ray, and Kashan. The manuscripts available are of late Seljuk period of the twelfth and thirteenth centuries. Naskh style predominates in manuscripts, on metal works, and pottery. Decorations are executed in miniature style representing single figures, episodes from legends, and court scenes. The colors used are pink, olive green, cobalt blue, violet, brown, black, and gold on white or turquoise blue ground.

MONGOL PERIOD (1258–1500)

The Mongol period, though noted for ruthless wars, is equally famous for the development of sumptuous book art. Two important styles of writing, those of Taliq (cursive) and Nastaliq (round), were developed. Calligraphy and illumination attained highly rich and ornamental styles, with predominant influences of Chinese, Central Asian, and Iranian color composition. Two schools of illumination, those of Ilkhani (1258–1336) and Timuride (1387–1500), are important.

The glorious period of Abbasides ended with the sack of Baghdad by the Mongol invader Hilaku Khan (1256–1265) in 1258, Hilaku, or Hulagu, and his successors ruled Persia and part of Iraq, and were known as Il-Khanis. Tabriz, in Persia, and Maragha, just across the Eurphrates in Iraq, were their capitals. Ghazan (1295–1304), the grandson of Hilaku, accepted Islam, and while he continued the Abbaside tradition of illumination, he also encouraged the development of a new Mongol art.

Early Il-khani styles had Arabic influences, but gradually they developed their own pattern. The Naskh script, for example, became more angular and cursive and came to be known as Taliq. Illumination brought more Chinese and Persian elements in color scheme, and it became more figurative.

The earliest manuscript is that of *Manafeul-haiwan* (Morgan Library, New York), a bestiary executed by the order of Ghazan (1295–1304) at Maragha, with 94 illustrations. Miniatures show landscapes, clouds, plants, and peony flowers of Chinese origin.

Another manuscript is *Jameut-Tawarikh*, a world chronicle written in 1306 by Rashidal-Din, the Wazir of Ghazan and Uljaitun, at Tabriz. It has exceptionally rich illuminations with strong Chinese influence, particularly in costume, landscape, and the pale colors applied in washes. The manuscript has 55 miniatures superbly executed, of which a few have survived and are preserved in the Edinburgh University Library and in several private collections. Smaller copies of *Shah Nameh* (Book of King) of Firdausi (935–1010) are illustrated at Tabriz in 1320, and a few manuscripts are preserved in the Kofler-Truniger Collection, Lucerne, and in the Vever Collection, Paris. The pictures are placed in strips between the text with figures, costumes, and bright colors. Shiraz, next to Tabriz, was famous for illumination, but its work is less elaborate. Painting is generally in black outline on red or ocher background, with additional colors in blue, red olive, green lilac, and gold.

Ahmad Musa is regarded as one of the greatest artists of the Ilkhani School.

Timuride School (1386–1500)

The Timuride School is noted for an extraordinary artistic productivity and quality of illumination. Timur Lang (1335–1405), the founder of the Timuride dynasty, was a great conqueror and lover of art. He invaded India, Iraq, and Turkey and made himself the unchallenged ruler of Central and Western Asia. He brought artists from Baghdad and Tabriz to his capital at Samarkand. Some of the famous artists were Abdul Hayee and Junaid from Baghdad and Mir Babar Ali (1330–1404), the originator of the famous *Nastaliq* style, from Tabriz. Unfortunately, no manuscript of this period survives, except inscriptions on walls and frescoes.

Herat

Shah Rukh (1404–1447), one of the younger sons of Timur, and his own sons Baisunkur Mirza (1399–1433) and Ulugh Beg (1447–1449), beautified their capital, Herat, which became one of the greatest centers of illumination. Baisunkur was a great bibliophile. He founded a library and the Academy of Book Arts, which included 40 calligraphers, painters, illuminators, and miniaturists. Famous artists like Khalil; Jafar Baisunkuri; Abdullah, son of Mir Ali, and his pupil, Mawlana jafar Tabrizi, chief of 40 copyists; and a host of others were at his academy. Most of the masterpieces of the Timuride period were produced at Herat during the time of Shah Rikh, Baisunkur, and later, during the time of Sultan Husain Mirza.

A beautiful copy of *Gulistan* (Rose Garden) of Saadi (1184–1292) is preserved in Chester Beatty Library, Dublin. *Shah-Nameth* (Book of Kings) of Firdausi, elaborately illuminated in polychrome, is dated Herat, 1430, and is in Gulistan Museum, Tehran. *Fables Kalila and Dimna*, ca. 1420, Herat, is in the Gulistan Museum, Tehran.

Notable features of the Herat School are delicate rendering of figures, Iranian landscape with high horizon, and spongy mountains. Naturalistic plants and ornaments are derived from China, and are combined with birds and animals. Color combination shows Chinese influence, but is vivid and harmonious.

Shiraz

Another famous center of illumination that had a longer tradition than Herat was Shiraz, the capital of Ibrahim Sultan, son of Shah Rukh. Two styles of writing, Diwani (official) and Dashti (Tughra script) were developed. Some of the very superbly executed works extant are three copies of *Khamasa Nizami*, magnificently illustrated in 1444, now in John Ryland Library, Manchester; Royal Asiatic Society Library, London; and in Victoria and Albert Museum, London. The usual feature is that texts are on main and on border while pictures are between the texts. *Shah Nameth*, a finely executed copy in the Gulbenkian Collection, Lisbon, is a good example. A very fine copy of *Khamasa of Nizami* is in the Museum Dahlam, Berlin.

The main features of Shiraz style are cooler, lighter, but pale gold color scheme with dark blue ground. *Transoxiana*, the capital of Ulug Beg, son of Shah Rukh, was also an important center, but had the strong influence of Herat style.

The most prominent period of illumination flourished under Sultan Husain Mirza Bayaqara (1458–1505) at Herat, the last of the Timuride Sultans, Bihzad, Sultan Ali Meshadi, and his teacher Mawlana Azhar, the three versatile artists of their time, were at the court of Sultan Husain Mirza and were equally patronized by Mir Ali Sher Nawai, a great poet, musician, and painter. The Wazir of Sultan Husain was also a great patron of these artists.

The chief characteristics of this period were grace and elegance and a larger freedom of movement, gold, and brilliance in range of colors.

PERSIAN ILLUMINATION (1502–1736)

Shah Ismail, the founder of Safvide Dynasty, and his successors were great patrons of art, architecture, and learning. The period of Safvide rule over Iran for over 200 years, from 1502–1736, is the most glorious in the history of Persian illumination. Tabriz and then Isfahan became the centers of art. This was an age when the quality of the work depended very much upon the fame of the artists, and the fame of the artists of the Safvide

School was such that their works became models for Turkish and Mogul miniatures.

Safvide School

Tabriz, the new capital of Shah Ismail (1510–1524), once again became the leading center of book art. Shah Ismail appointed Kamaluddin Bihzad (ca. 1440–1536), a great calligrapher and artist, director of the Royal Library.

Bihzad had previously worked at Herat under the patronage of Sultan Husain Mirza, the last of Timurides, from 1470–1506. After the defeat of Timurides by Shaibanides in 1507, Bihzad remained in Herat and worked for Uzbek Sultan Shaibani Khan (1500–1510). But when Shah Ismail Safvi conquered Herat in 1510, Bihzad moved to Tabriz.

Bihzad built up a famous school of court painters at Tabriz and organized works separately for copyists, painters, gilders, margin drawers, gold mixers, gold beaters, and washers of lapis lazuli. Bihzad trained a good number of gifted pupils who continued his tradition at Herat, Bukhara, Tabriz, and Shiraz. Among his famous disciples were Qasim Ali Mirak, Shaikh Zadeh Mahmud, Abdullah, and Sultan Muhammad Nur.

Illuminated manuscripts of Bihzad are very few. The most artistic works were executed for Shah Tahmasp (1524–1576), one of the famous among them being *Shah Nameh* (British Museum). It contains 285 miniatures, some of them by Bihzad. *Khamasa Nizami* (British Museum) is also a richly illuminated copy. *Bustan of Saadi* (National Library, Cairo) has six miniatures by Bihzad, four of them signed. A copy of *Khamasa Nizami* (British Museum) illustrated by one of Bihzad's pupils, Qasim Ali, generally called Mirak, contains 16 beautiful miniatures. There are a large number of miniatures, now preserved in single leaves in various important libraries, art galleries, museums, and private collections in Europe and America, but the majority of them are in the Gulistan Museum, Tehran.

The characteristics of the Bihzad School are painting of borders in water colors in several tones of gold with a cool color scheme of blue, gray, and green, around a text of fine calligraphy. Later, Sultan Muhammad and Ustad Muhammadi employed pure wash technique in painting without any reference to a text. The other technique was the use of brush or red pencil, which became very popular during the time of Shah Abbas when he was at Qazvin.

Shah Abbas (1587–1629) made Isfahan, his capital, the center of decorated palaces and mosques. He established an academy of arts and employed leading artists of the time. The most famous were Mir Imad of Qazvin (d-1615), a master calligrapher, and Riza Abbasi (1587–1629), a great artist. Shafi Abbasi (son of Riza Abbasi), Muin, Yousuf, and Mohammad were other gifted artists.

The main work of Riza Abbasi is Nizami's *Khusrau and Shirin* (Victoria and Albert Museum, London). A large number of his signed paintings are preserved in the Tehran Museum. His style can be characterized with his

keen observation of life, and use of green, light blue, black, and gold colors on pale ground, with curves and short strokes in calligraphic form.

By the end of the seventeenth century a decline in Persian painting began. Shah Abbas II (1642–1667) tried to check it by sending some artists to Rome, but this admixture of foreign style finally finished the originality of the great art of manuscript painting in Iran.

TURKISH ILLUMINATION (1451–1900)

Ottoman Turks, as long as they had their capital at Konya, had Mongol-Persian models before them for book decoration. But after the conquest of Constantinople by Sultan Muhammad in 1453, a preference for Byzantine style developed. Therefore, European artists, along with Persian, were employed.

Characteristics of Turkish calligraphy and illumination are use of Naskh as standard script for religious works, development of Diwani, a variant of Naskh as official script, and use of Tughra, or decorative signature of the reigning Sultan with three long uprights and a large sweeping loop to the left. Production of finely executed texts of the Quran in pocket size became very popular. The color scheme included blue, black, and gold.

Turkish book art, however, remained essentially Persian in style and execution. The decline began toward the end of the seventeenth century.

Among famous calligraphers and artists who were either Turks or came to Turkey from other places were the following: Sanaullah of Brussa, a poet and a painter who worked under Murad II (1422–1451); Bellini, an Italian painter, who also trained Prince Ahmad and worked under Sultan Mohammad (1430–1481); Osman; Hyder; and Shah Kuli and Wali Jan of Tabriz, who were at the court of Sulaiman the Magnificent (1520–1566).

There is a large stock of illuminated manuscripts in the rich libraries of Turkey, but unfortunately all of them have not yet been explored.

MOGUL MINIATURES (1525–1707)

Mogul emperors were great lovers of art and architecture. The Mogul period is noted for the production of richly illuminated works usually called Mogul miniatures. There was no tradition of manuscript painting in India before the Moguls.

Babar, the first Mogul emperor of India (1525–1530), had remarkable talents. He wrote a vivid account of his life in Tartar language, *Tuzak-i-Baburi*, which is now among the classics of the world. He collected finely illuminated books, several of them now preserved in the princely collection of Alwar State. One painting depicting a sea fight, said to have been in the album of Emperor

Jehangir, is now in the State Library, Berlin. Babar attracted artists from Bukhara who introduced Bihzad style and cooler gouache tone.

Humayun (1530–1556), while in exile in Iran for 10 years, met the two leading artists, Khwaja Abdus Samad Shirazi and Mir Sayyed Ali at the court of Shah Tahmasp in Tabriz. Both were invited to Kabul and then to India to supervise the illustration of *Amir Hamza*, which is said to be the work of 50 painters and was completed during the reign of Akbar. It contains 1400 paintings on linen pages 22 in. × 28 in. Its leaves are now scattered in the libraries of the British Museum, National Library, Vienna, and Metropolitan Museum, New York. The completion of *Amir Hamza* marks the beginning of the Mogul School of miniature painting in India.

Akbar the Great (1556–1605) made Fatehpur Sikri his capital and built palaces decorated with mural paintings, executed by Iranian and Indian artists. While the Persian influence of Bihzad, Mirak, and Sultan Nur was strong, a new influence of Indian national style also took a firm root during his reign. Akbar established an Academy of Arts and employed 100 painters, the majority of them being Hindus. The work of all the painters is said to have been submitted to him every week. Akbar imposed his own ideas and themes upon the artists, but he also accepted the ideas of Hindu painters who introduced Hindu legends and religious epics. One of the best illuminated manuscripts of this time is the *Mahabharata* (Razm Namah), containing 169 miniatures, and now preserved in Jaipur. The execution of this sumptuous volume cost £40,000.

Some of Akbar's famous artists from Kashmir, Gujrat, and Punjab were Dharam Das, Sanwlah, Shankar Lal, Sur Das, Nar Singh, Mukand and Govardhan, Daswanth, Manohar, and Khem Karan. A good number of them were pupils of Khwaja Abdus Samad. The principal characteristics of their works were gradations of tone and effects of light and shade with atmospheric landscape and perspective and modeling in faces and costumes.

Jehangir (1605–1628) intensified painting, although his interest in illustration lessened. Artists were required to be more realistic and to describe court life, receptions, and audiences, festivities, hunts, and polo tournaments, and to chronicle noteworthy episodes from the life of the ruler. He liked western paintings and introduced them to his artists. Mansur, Murad, Manohar, and Abul Hasan (son of Riza Abbasi) were some of Jehangir's famous painters.

Shah Jehan (1628–1658) was a great calligrapher. Portrait art and ceremonial group painting received greatest attention during his reign. Famous artists of his time were Mohammad Fakirullah Khan, Mir Hashim, Bichitr, Anup Chhatar, and Sayed Amir Khan. Abdur Rashid Dailami, nephew of Mir Imad, also came from Isfahan. He was tutor of Dara Shikoh and also the founder of the Indian School of Calligraphy.

Aurangzeb (1659–1707), the last of the great Mogul emperors, was himself a calligrapher and wrote the Quran

for himself and for the princes. Being an orthodox Muslim, he discouraged painting and turned out the court painters, who then took refuge at the court of nobles and rajahs. This princely patronization to artists gave birth to a native style of painting, usually called the Rajput School of Painting.

Rajput School of Painting

Under the influence of the Mogul School of painting the Rajput School was developed. The same Hindu artists who had worked at the Mogul courts, along with their pupils, developed the Rajput style.

Characteristic features of the style were depiction of themes and ideas from Hindu religion, and epic, folklore, and cultural mode of life, which were more romantic and musical. The colors most frequently used were bright red, blue, and gold.

There are two predominant styles of the Rajput School, those of Rajasthani, covering Rajputana and Bundel Khand, and Pahari, covering Kangra, Basohli, Guler, and Jammu. The best examples are the scenes portrayed from *Krishna Lila* and *Nala Damyanti*, both of eighteenth century Kangra School.

The nineteenth century marks the total decline of illumination due to lack of princely patronage and also the vanishing skill of the artists.

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Impact Assessment of Cultural Institutions

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Abstract

In the United Kingdom, and in England in particular, concern with the “impact” of cultural institutions, cultural activities, and cultural policies has grown exponentially. Prompted by the government’s requirement for greater accountability within the public sector and its desire to implement evidence-based policy, this has particularly affected organizations in receipt of public funding. In the United Kingdom, these include the majority of cultural institutions.

This entry considers the context within which a preoccupation with the “impact” of cultural sector institutions came about. It examines the background to the introduction of the impact assessment of cultural institutions, the requirements made of them, and the impacts considered desirable for them to exert. It explores some of the difficulties of assessing those impacts, including definitions, approaches, and the problematic relationship between assessment and advocacy. The entry closes with a discussion of developments of impact assessment within the cultural sector. The principal focus of this entry is museums in England.

INTRODUCTION AND BACKGROUND

Since the 1997 general election, when New Labour came to power, the ways in which cultural policy in the United Kingdom have been articulated, disseminated, and assessed have been transformed. Prior to this, cultural policy was, to all intents and purposes, implied by the actions of such agencies as the former Museums & Galleries Commission and Arts Council of Great Britain. Despite being directly funded by government, these organizations tangibly operated at “arms’ length” from it. Indeed, it has been suggested that they functioned in what was, effectively, a “policy vacuum.” At best, the successive government departments responsible for funding the cultural sector reviewed current provision, sought to improve the management of advisory and funding bodies, and promoted examples of best practice. Performance measurement was generally considered inappropriate for cultural provision and was effectively steered clear of.

The requirement to evaluate policies and performance in the public sector was initially recognized by the Conservative government’s Financial Management Initiative of 1982. This called for greater efficiency, effectiveness, and “value for money” at central and local government levels—demands which were largely implemented through the National Audit Office and the Audit Commission both of which were established in 1983. The former was responsible for reporting on public spending programs in England, Scotland, and Wales; the latter for auditing and examining the management of local authority auditing in England and Wales. While neither body was, or is, specifically responsible for cultural services—museums, galleries, and the arts, nevertheless, fall within

their remits and are subject to the philosophy which they represent.

At this time, the museums sector had almost no measures to assess its success or progress except for the most basic indicators of attendances, budget size, staff size, etc. From the late 1980s various initiatives were introduced in an attempt to introduce a more sophisticated degree of performance management for national and regional museums and galleries including a registration scheme based on minimum standards and intended to provide an assurance of quality and professionalism.^[1]

Once in government, Labour insisted on greater accountability than previous Conservative administrations and emphasized the delivery of evidence-based policy making by central, regional, and local government. In that context, the question, “what works?” became a reference point for designing new policies and measuring performance. Analysis and the use of evidence were prescribed as core skills within the civil service.^[2–4]

The establishment of the Department for Culture, Media and Sport (DCMS) in July 1997 was marked by responsibility for cultural policy strategically being “reclaimed” by central government. By 1998, it had made it clear that cultural institutions’ increases in funding, and specially earmarked initiatives for the sector, were designed to meet the Department’s expectations and would directly influence the sector’s development.^[5] Predicated on the assumption that cultural provision is instrumental and can deliver on government objectives, DCMS’s “sponsored” (or subsidized) bodies have been required to commit to agreed targets, specified through a series of linked agreements which cascade down from the Treasury. Not only did the arts and culture become subject

to the same policies and regime of impact assessment, but they were all committed to achieving cross-government objectives which were intended to achieve broader economic and social policy aspirations. It was assumed that the impact of their particular contributions could be assessed (this is explored in Selwood^[6]).

Museums, which are the focus of attention in this entry, have been particularly close to DCMS's heart. They account for about a quarter of its total grant in aid and, therefore, carry considerable responsibility for delivering on the government's objectives. Indeed, from 2000 onward the Department has specifically credited museums with stimulating economic impact; creating employment; stimulating the development of ancillary services;^[7] tackling social exclusion;^[8] contributing to social and environmental impacts through transformational projects;^[9] and playing a part in the well-being of local authority areas.^[10] It has also referred to them as "centres of social change" and "learning."^[11]

Against a background of DCMS's interest in monitoring "outputs" and "outcomes" against its "investment" and its increased scrutiny of the performance of subsidized organizations, this entry considers the impact assessment of cultural institutions, museums in England in particular. It comprises four sections:

- The first section describes the requirements made of cultural institutions, and the kind of impacts that they are expected to exert;
- The second considers some of the difficulties of assessing the impact of cultural institutions;
- The third section comments on developments in thinking about impact assessment within the cultural sector; and
- The fourth, and final, section concludes with some observations.

Given that they share the same policy regime, both the arts and culture are occasionally referred to in this entry.

THE REQUIREMENTS OF CULTURAL INSTITUTIONS

The Department for Culture, Media and Sport's pledge that its sectors would deliver on a multitude of central government agendas was set out in its strategy document, *A New Cultural Framework* (1988) and its first annual report. This described its aims as being

... guided by four central themes: the promotion of access, for the many not just the few; the pursuit of excellence and innovation; the nurturing of educational opportunity and the fostering of the creative industries, which provide a growing proportion of Britain's employment

and wealth... aims which resonate across every other department of Government.^[12]

This section considers the application of those themes to the cultural sector and the instrumentalist values with which it became associated.

Although it has been argued that many museums were already committed to a community-based agenda, the Department incentivized the wider cultural sector's engagement through a combination of increases in funding and formal requirements. As Labour's first Secretary of State for Culture, Media and Sport, Chris Smith, put it, public funding would no longer to be regarded as

... 'something for nothing'. We want to see measurable outcomes for the investment which is being made. From now on, there will be real partnership with obligations and responsibilities.^[13]

As the Treasury's guidelines for departmental bids to the 2004 Spending Review made clear:

In principle, all spending decisions should be supported by evidence, demonstrating that the money being spent will achieve the desired effects as efficiently as possible.^[14]

Smith later admitted that this kind of climate demanded a particular kind of response from government departments:

Spare a thought... for the poor old Minister, faced with the daunting task of getting the increased funding out of the Treasury to start with. The Treasury won't be interested in the intrinsic merits of nurturing beauty or fostering poetry or even 'enhancing the quality of life'. So I acknowledge unashamedly that when I was Secretary of State, going into what always seemed like a battle with the Treasury, I would try and touch the buttons that would work. I would talk about the educational value of what was being done. I would be passionate about artists working in schools. I would refer to the economic value that can be generated from creative and cultural activity. I would count the added numbers who would flock into a free museum. If it helped to get more funds flowing into the arts, the argument was worth deploying.^[15]

These comments demonstrate the values that DCMS was encouraged to assume and the way in which it promoted the cultural sector within the wider political economy. Such political expediency set the tone for assessing the impact—or rather, the impacts of cultural institutions. Public subsidies were ostensibly invested in culture for any number of reasons—to reduce the incidence of social exclusion; contribute to education to encourage social regeneration; create destination locations; boost employment in service industries and inward investment in cities. But, in return, cultural institutions were obliged to provide evidence of how effective their contributions were.

Assuming that cultural institutions were making a difference was one thing, but quantifying, if not qualifying, the precise impact of such cultural institutions' effectiveness was another. As one arts minister explained: "I know that Arts and Culture make a contribution . . . but I don't always know how to evaluate or describe it. We have to find a language and a way of describing its worth. It's the only way we'll secure the greater support we need."^[16]

DIFFICULTIES IN ASSESSING THE IMPACT OF CULTURAL INSTITUTIONS

The model of accountability established by DCMS suggests that the relationship between policy, implementation, the delivery, and effectiveness of outcomes was highly determined as well as relatively simple. It assumes that the impact of various forms of cultural provision can be identified and quantified through the collection of "evidence," defined—"the end result of a complex analytical process beginning with the collection of raw data" (Table. 1). Indeed, for DCMS, an enhanced understanding of impacts was part of a virtuous circle in which the gathering and use of evidence would ensure that policies had maximum effect on key priorities and delivery targets.

However, DCMS's model conceals a number of difficulties which were not easily resolved and which, 5 years on, remain problematic. These include defining "impact"; the creation of objective and robust approaches to its measurement; and, the relationship between evidence and advocacy (for a more detailed discussion of these issues, see Selwood^[17]). These are addressed in the following paragraphs.

Definitions

The term "impact" is often used synonymously with "output" and "outcome." But in differentiating between these terms, "impact" has been defined as

. . .the effect of the outcomes on the environment. . . using that term very broadly to include people and society at large - and is usually in the long term. An example here

Table. 1 DCMS's understanding of the relationship between raw data and evidence.

Raw data	whether counted or measured once codified, checked and systematically set out/tabulated >
Information	which in turn when focussed on a particular set of hypotheses/policies yields >
Analysis	which when weighed, reviewed assessed and subject to professional judgement and scrutiny becomes >
Evidence	on the impact of a particular hypothesis, policy/ programme/or projects

Source: DCMS.^[18]

might be the growth in literacy (or even improvements in mental well-being) as a result of reading library books.^[19]

By comparison, outputs are

. . .the things that the organisation produced. They might be book or videotape issues, reference questions answered or seats occupied by readers. Very often, measurement consists of counting the number of outputs produced.

And outcomes are ". . .the short to medium-term results of applying outputs. The number of books read might be an outcome of book issuing."

Approaches

There have been a number of criticisms of impact assessments of cultural institutions, not least by DCMS itself. These stem from the early 2000s when the Department's systems of performance management were new. They pertain to the relative absence of hard evidence on cultural institutions' impact on tackling social exclusion: "Demonstrating the impact of activities to combat social exclusion is not easy, and it may be some time before the benefits are fully evident."^[20] The lack of robustness of the evidence on cultural activities generally in relation to wider social and economic policies was also criticized. Beyond DCMS's immediate funding stream, gaps in local authorities' cultural services' evidence-base were identified—stories about the performance of cultural services tended to be based on anecdote "rather than hard evidence through monitoring and evaluation."^[21]

The quantitative data collected was described as "patchy, inconsistent, and incomplete." According to conventional wisdom, this was not only regarded as inadequate but as inappropriate for evidencing the sector's contribution toward the achievement of the government's learning, access, inclusion, and economic development agendas. Acknowledging this, DCMS regarded quantitative evidence as proxies for qualitative outcomes. Thus, opening hours were interpreted as "a good measure of the availability of the collections for access"^[22] and numbers of repeat visits to museums as indicative of the likelihood that visitors' quality of life was being enhanced. But emerging research^[23] suggests that habitual visiting may be more indicative of visitors' dogged pursuit of personal interests than their satisfaction with particular venues.

Although data collection is becoming more sophisticated (for the most recent advice to DCMS on its museum performance indicators see Morris Hargreaves McIntyre^[24]), this has not detracted from the need for the cultural sector having to construct an increasingly more robust "evidence" base. Yet, the collection of data still emphasizes "the quantitative in a field where qualitative assessments have been regarded as central"^[25] and although impact is logically only discernable over the long-term, the government's

system of performance measurement, driven by biennial funding reviews, militates against this.

There are no cheap thrills in art, but there are real thrills. They come slowly, gradually, over years and as a result of effort. How do you market such an unappealing message, which happens to be the real message of the arts, the core—to use the market-speak—of their ‘Unique Selling Proposition’?^[26]

Thus, DCMS’s agencies’ habit of collecting short-term “evidence” on “new audiences” (as determined by the funding cycle) is likely to be relatively meaningless.

Reviews of the available evidence on the social impact of cultural projects have covered meta-analyses and critiques of single studies (see, for instance, Wavell et al.^[27]). The consensus is that much of the evidence presented is insufficiently robust for a variety of reasons including the non-substantiation of claims; the antagonism of cultural institutions towards the collection and use of data; the fact that projects have limited jurisdiction and limited potential to influence outcomes; the lack of robustness of the methodologies used; the quality of evidence gathered and a failure of reporting of methods; the difficulties of attributing causality; and the preponderance of short-term, as opposed to long-term, evaluations.^[28] More recently, issues of sustainability have come to the fore.

A prevailing theme has been economic impact. The assumption that various forms of culture are economically significant informs any number of policy papers published by DCMS, its agencies, regional bodies, and local authorities.

Culture, whether as a central part of a regeneration initiative, or as a substantial component of a broader programme, can play a distinctive role in bringing economic benefits to an area. It does not just bring direct economic improvement by providing employment and generating revenue, but can have a wider economic impact on the general prospects of an area by making it a more desirable place to live and work, and, subsequently, for businesses to invest.^[29]

Although DCMS initially regarded museums as being of marginal economic importance in terms of wealth and job creation,^[30] by January 2005, the Secretary of State for Culture, Media and Sport insisted that “Museums and galleries are . . . major employers and an important part of the economy.”^[31] And although the case for investment in museums on the basis of their impact on tourism, education, or the economy had apparently already been won,^[32] the commissioning of economic impact studies remains standard practice.

While it might be supposed that economic impact studies provide neutral assessments of the economic consequences of specific strategic interventions and that they provide evidence for future planning, they are primarily

recognized as a lobbying and advocacy tool. It was not by chance that Tate Modern celebrated its first and fifth birthdays by publishing an economic impact studies^[33–35] or that the National Museums Directors’ Conference (which represents the leaders of the U.K.’s national museums and galleries) thought it appropriate to commission major reports on their collective economic impact in anticipation of government’s spending reviews.^[36,37]

However, economic impact studies of the cultural sector are considered contentions and a considerable, specialist critical literature exists on the subject. (There is insufficient room here to review the literature. Readers are, therefore, referred to Reeves.^[38]) Direct impacts are considered at personal, community, local, regional, and national levels; indirect impacts, at ancillary levels (e.g. suppliers, restaurants, and accommodation) and in relation to the “wider community.” Sometimes economic impact is calculated through analyses of inputs and outputs, although more sophisticated theoretical applications include cost-benefit analysis; hedonic pricing; travel cost; contingent valuation; multipliers; displacement; and isolating the many variables that contribute to the impact of any activity or group of activities.

Highlighting the shortcomings of impact studies, of course, runs counter to the desire of DCMS and its agencies to report positive and demonstrable benefits, and to defend the sector against criticisms that it is not fulfilling the task it set itself.

Advocacy

From the outset of New Labour’s project to assess the impact of cultural institutions, critics have suggested that

The evidence, such as it is and it is limited, seems to indicate that museums have had really very little impact on their communities. No research results are available that prove that museums have an impact upon the problems of social exclusion.^[39]

Moreover, the political neutrality of “evidence” and, by extension, assertions of impacts, have often been contested. A fundamental reason for this is that evidence of impacts tends to be conceived positively, not least in terms of advocacy.

Evidence provides the proof of our ‘case’—whatever that case may be. It should, for example, prove beyond contradiction that investment in museums, libraries and archives will deliver social, educational, economic or political benefits on a scale that clearly makes investment highly attractive to government, a lottery distributor or some other funding body.^[40]

Over the past decade, the default among DCMS’s agencies has been to commission impact studies—especially in

anticipation of biennial Spending Reviews. Guided by the government's continuing commitment to social and economic aspects of the nation's well-being, these exercises are invariably intended to present the best possible evidence on effective activity.

But since DCMS's evidence-base primarily depends on data provided by institutions with obligations determined by their funding, distinguishing between advocacy-inspired research and objective social science enquiry is of fundamental importance. It is hardly surprising that those agencies, whose *raison d'être* is to promote the subsidized cultural sector and whose objective is to increase their funding, should be most interested in findings likely to serve their institutional goals. Indeed, in Britain, cultural institutions such as Museums, Libraries and Archives (MLA) Council and Arts Council England make no apology for their interest in research that fuels advocacy.^[41] In a bureaucratic culture encouraged to pursue evidence-based policy, it has been suggested that what agencies actually produce is "policy-based evidence."

The pursuit of advocacy obviously imposes severe restrictions on the kind of research conducted, if not what is published and disseminated. Cultures of advocacy tend to lead to biased reporting.^[42] For example, DCMS has consistently celebrated the national museums' success in attracting increased audiences since the introduction of free admission for all in December 2001. It has claimed that "the national museums are giving millions of people the opportunity to be stimulated, educated and inspired"^[43] and that "Free admission has democratised the nation's treasures making them accessible to all."^[44] But early objective and careful scrutiny of the data suggested that that while attendance was increasing, the most significant rises in visit numbers were among those who had always been well represented in museums and gallery.^[45] Moreover, subsequent analyses of attendance data reveals that it is not possible to tell how many more people from lower social groups, for whom this policy was designed, have attended museums and galleries as a result of free admission.^[46]

DEVELOPING THE IMPACT ASSESSMENT OF CULTURAL INSTITUTIONS

Assessing the impact of cultural institutions has been subject to issues of definition, methodology, and advocacy. But, underlying this has been a more fundamental uncertainty about the appropriateness of even attaching instrumental value to cultural institutions and products.

It appears that even as the former Secretary of State for Culture, Media, and Sport was putting a system of performance indicators in place to measure the impact of cultural institutions, he was aware of several drawbacks:

The first is that it ignores the fundamental life-force of the cultural activity that gives rise to the educational or

economic value in the first place. (Not, I hasten to add, that there is anything wrong in hailing the value of the educational or economic impact of culture; culture can be profoundly important for a fulfilling education and for a flourishing economy; it is simply that these should not be elevated above the innate value of the art of itself.) The second drawback is that any measurement of numbers, quantity, or added value by figures is necessarily going to be inadequate.^[47]

As this section reveals, such reservations are affecting changes in attitudes toward the impact assessment of cultural institutions.

Over the years, cultural institutions have accounted for themselves in relation to expectations of policy. Broadly speaking, they have described their putative contributions to employment and improvements in health and education, crime reduction, the strong communities, the economy and the nation's well-being,^[48] neighborhood renewal and regeneration.^[49] It has been assumed that they possess a sufficiently detailed "knowledge of, or interest in, the cultural needs of communities,"^[50] that this is central to their missions, and that they are "key to achieving the Government's overall goals of a safe, just and tolerant society and providing the opportunity for everyone to realize their true potential."^[51]

But, the rejection of instrumentalist arguments to justify support for cultural provision is becoming more vociferous. Twenty years ago, the publication of Myerscough's *The Economic Importance of the Arts in Britain* (1988) prompted economists to observe that the primary function of the arts was not to create economic impact.^[52] More recently a number of commentators have similarly disputed the political expectations of culture to solve social problems:

We assume, ludicrously, that the effect is embedded in the cultural form itself, released when it is 'consumed'. If this were true, then it would be relatively easy to give each of us doses of good culture, making us into model citizens. Few carry faith in cultural effect that far. Yet the popular accounts of the Mozart effect implied just that—a dose of a sonata would improve brain wiring and math ability.^[53]

The notion that culture can make the world a better place is arguably no more than a form of political displacement activity:

If we want to improve our children, our schools, our inner cities, and the lives of the marginal, the elderly, the impoverished, then we should do so directly, rather than argue for an injection of 'more arts.'

In some cases, improvements to such social and economic agendas could be addressed that more efficiently elsewhere. Measuring culture in relation to these and other political ambitions has come to be regarded by many

practitioners as “naïve”^[54] “extraneous” and potentially “antithetical to their basic functions and purposes,”^[55] and DCMS’s ambitions fundamentally appear to deny the “inherent value” of culture.

For its part, DCMS is discernibly moving away from its earlier commitment to the instrumentality of cultural provision. Conceivably prompted by the work of the think tank, Demos, which has sought to revitalize the importance of cultural value,^[56,57] Labour’s successive Secretaries of State for Culture, Media and Sport have not only indicated that their thinking has moved on, but have expressed doubts about the adequacy of attempts to measure their impact. Smith’s successor, Tessa Jowell, published a personal essay on *Culture and the Value of Culture* in which she proposed that culture should be “faced on its own terms and with recognition of what it does”^[58] and that the debate should be shifted back to “cultural value.”

Her successor and Labour’s third Secretary of State for Culture, James Purnell, pursued a similar train of thought. While maintaining that targets were probably necessary in 1997, he considered that public subsidy of culture needed less defense now than it once did. “We no longer need to quote export figures to get a hearing.” But despite still believing that culture and the arts remain “the most effective ways of reaching disaffected teenagers, of helping people to think about mental health, of regenerating inner cities or coastal towns,” he insisted that they would still matter

... even if they did none of those things. They are intrinsically valuable before they are instrumentally so. The arts hold the ring for our national conversation. They are where we find our meanings, individually and collectively.^[59]

He maintained that although encouraging attendance by priority groups was still vital, DCMS’s focus should shift to “... what people have access to. If any part of our cultural sector is substandard, doesn’t take risks, doesn’t push barriers, ducks difficult questions, it’s not worth subsidising. Garbage in, garbage out.”^[60] Indeed, he commissioned a review of the role that government and public funding can play in enabling excellence, “how we can move from top-down targets, to empowering and risk-taking.”

But even as the substance of the impact assessment of cultural institutions is changing, it is still assumed that the “inherent value of culture” is synonymous with its “transformative power” and that can raise levels of aspiration. For the Arts Council’s outgoing Chief Executive, this realization potentially shifted the focus of impact studies. He called “investigation into the value of culture itself in terms of its inherent power to move people, change people, and give people new meaning in their lives.”

... the issue is for researchers to try and understand better how that transformative value might be captured. This

raises some challenging questions: First, how can we begin to describe transformative experience? ... Second, can we find out what conditions need to be in place for transformative experience to happen? ... ‘What research techniques would be most applicable to an investigation of this nature?’^[61]

CONCLUSION

This entry has explored the introduction of the impact assessment of cultural institutions by the New Labour government which came to power in the 1997 general election. It has considered the rationale of the Department for Culture in doing so, as well as setting out the pragmatic and philosophical difficulties encountered. In tracking the development of impact assessment, particularly as it pertains to the English museums sector, this entry has demonstrated how the government’s attitude to the impact assessment of cultural institutions has shifted away from instrumentalism to cultural value. However, assessing impact still remains central.

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Incunabula [ELIS Classic]

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Abstract

The word “incunabula” derives from the Latin word meaning “cradle.” Incunabula are books from the “cradle” of modern printing, that is, those printed with movable metal type in the fifty years from the invention of movable type to January 1, 1501. These books are the focus of special interest in the study of the history of books, and are designated with this special term. The development of printing during those years, and the search for, discovery, and analysis of books printed during that period are discussed in this entry.

—*ELIS Classic*, from 1974

INTRODUCTION

Incunabula are any books printed with movable metal type prior to January 1, 1501. This definition includes only the first 50 years of typographic printing. Block books or xylographic books of the same time period are normally not considered to be incunabula because they would not have been printed typographically (i.e., with movable metal type). It may also be noted that the exactness of the date of January 1, 1501, precludes many similar but later works. Most scholars today, however, accept this date as appropriate. Edwin Emerson states,

In correct English usage, the word “incunabula,” in my opinion, should be strictly limited to printed texts or titles or printers’ marks from the middle of the fifteenth century to its end. While previous blockbooks, printed from fullpage woodcuts with text, or the later products of some of the first printing presses of the early sixteenth century in England, Spain, Portugal, Mexico and Scandinavia are undoubtedly as rare and primitive as those of preceding printers in Germany, Bohemia, Switzerland, Italy, France and the Netherlands, so that the former books fitly could be said to be in their infancy or cradle, nevertheless neither they nor still earlier Chinese, Korean and Japanese prints from movable types or full page blocks are rated by competent scholars as incunabula. After all, even the most comprehensive students and insatiable collectors of early prints must draw the line somewhere in their ever extending researches. So they might as well draw the incunabula line between the Spring of 1450 and the last day of the year 1500.^[1]

Alfred Pollard defines this term in the eleventh edition of the *Encyclopedia Britannica*,

... a Latin neuter-plural meaning “swaddling-clothes,” a “cradle,” “Birthplace,” and so the beginning of anything,

now curiously specialized to denote books printed in the 15th century. Its use in this sense may have originated with the title of the first separately published list of 15th-century books. Cornelius Beugheem’s *Incunabula typographiae* (Amsterdam, 1688). The word is generally recognized all over Europe and has produced vernacular forms such as the French *incunables*, German *Inkunabeln* (*Wiegendrucke*), Italian *incunaboli* though the anglicized *incunables* is not yet fully accepted. If its original meaning had been regarded the application of the word would have been confined to books printed before a much earlier date, such as 1475, or to the first few printed in any country or town. By the end of the 15th century book-production in the great centres of the trade such as Venice, Lyons, Paris and Cologne, had already lost much of its primitive character, and in many countries there is no natural halting-place between 1490 and 1520 or later. The attractions of a round date have prevailed, however, over these considerations, and the year 1500 is taken as a halting-place, or more often a terminus, in all the chief works devoted to the registration and description of early printed books.^[2]

The extension of this date beyond the end of 1500 is found in Svend Dahl’s *History of the Book*. He states about his native area, “In the Scandinavian countries, when printing did not begin until the 1480’s the incunabulum period is extended to 1550.”^[3] Occasionally and inaccurately, the term incunabula may be applied to the first 50 or so years of printing in a country (i.e., American incunabula for early printed books in the United States). Konrad Haebler, a famous German scholar of incunabula, presents the following argument for justifying the January 1, 1501, date.

To-day, the end of the year 1500 is quite generally accepted as the close of the incunabula period. It agrees with the usage prevailing from early times to the present,

and is easily justifiable as an average date. The year 1500 is a very fitting limit for the early printing of Germany in particular, and as the home of the invention of the “black art” this country may well lay claim to special consideration. The mechanical side of the printing process had begun to gain footing in some places in Germany even before the year 1500. The prominent workshops in which that was the case, those of Anton Koberger in Nuremberg, Johann Grüninger in Strassburg, Peter Drach in Speyer, nevertheless had so undeniably gotten their start in the incunabula period, and so, not with standing their attention to the commercial aspect, still retained so much feeling for the scholarly and artistic conception of printing that it would be wrong to deny their books the characteristics of true incunabula. In any case, most of the smaller printing-shops which appeared in Germany up to the year 1500 bore quite unmistakable marks of the incunabula period. As far as Germany is concerned, we might feel in favor of extending the limit of this period still further, to the Reformation, for that was the first event to mark a general and obvious change in the field of printing. To do this, however, would be unfortunate, for the years 1501–17 in Germany were a time in which printing played a considerably diminished role as much in comparison with the preceding as with the following period.

In Italy we find a somewhat different situation. Here one must make a distinction between the printing of Venice, which began as early as the seventies to assume the leading role in the printing art in general, and the workshops of the rest of Italy, for their existence developed under essentially different circumstances. The incunabula period, as we have herein characterized its essentials, ended in Venice about 1480, for not in vain was Venice in the second half of the fifteenth century the indisputable centre of European commerce. . . . In the other Italian states conditions were almost the same as in Germany. . . . In fact, the introduction of italic by Aldus Manutius in the year 1501 plainly strengthens our conception of the end of the incunabula period as the year 1500.

In France, too, a distinction should be made between the printing of Paris and that of other cities. The limit for Paris was a considerably later one, however, than for Venice; yet about the middle of the nineties bookmaking even in Paris saw the introduction of methods of management which were contrary to the fundamental principles of their incunabula period. . . .

The situation was similar in other countries into which printing found its way before the end of the fifteenth century. Up to that time, however, Spain and England entirely lacked a centre in which, as had happened for example in Venice or Paris, the art should have had a chance to develop earlier than was possible in the provinces. Not with standing all their presses, in comparison to Italy and France, they remained provincial, their entire output persistently retaining the characteristics of incunabula even down to the sixteenth century. In the north and east we find printing only sporadic, often as offshoots of the workshops which we have already met with in the

older centres of culture. For all these countries, then, the limit of the year 1500 is altogether too early; yet this is not very significant, relatively speaking, since the entire book production in these regions in comparison with that of Germany, Italy or France is of no great importance. For all the reasons here set forth, then, the year 1500 is almost universally recognized as the limit of the incunabula period.^[4]

Attempting to make no such defense as Haebler does, the *Encyclopedia Britannica* simply states, “The limit is convenient but arbitrary, since no special development in the printing art can be connected with it.”^[5]

The first established use of this Latin word in relation to printing occurs in a tract, *De ortu et progressu artis typographicae* written by Bernard von Mallinckrodt, dean of Münster Cathedral, and published in 1639 in Cologne. This work was issued as part of the second centenary celebration of Gutenberg’s invention of typography. Mallinckrodt described the period from mid-fifteenth century to 1500 as “prima typographiae incunabula.”^[6] The first bibliographic use of this newly indicated time period was 4 years later in 1643 by J. Saubertus in *Historia bibliothecae reipublicae Noribergensis. . . Accessit. . . appendix de inventore typographiae itemque catalogus librorum proximis ab inventione annis usque ad a. Chr. 1500 editorium*.^[4] In 1653, Philippe Labbé equated the word with the time period in his *Nova bibliotheca mss. librorum s. specimen antiquarum lectionum latinarum et graecarum*.^[4] According to Haebler

The first independent catalogue of incunabula was that by Cornelis à Beughem, *Incunabula typographiae s. catalogus librorum scriptorumque proximis ab inventione typographiae annis ad annum Christi MD inclusive in quavis lingua editorum*, Amstelodami 1688, 8°. This was no longer the inventory of a single collection but a first attempt to comprehend the collected literature of the period of early printing, the author having brought together approximately three thousand titles.^[4]

Additional major incunabula catalogs and bibliographies will be covered in the following sections of this entry.

As the term *incunabula* became more commonly used to designate a particular period of typographic production, various vernacular forms developed. In English, the following three terms have all been used as a vernacular equivalent: incunables, fifteeners, and cradle-books; of these, incunables is the most common English term today. Three terms have also developed in French: *incunable*, *impression ancienne*, and *impression primitive*. *Incunable* is the most commonly used term of these three. In German, four terms have evolved: *Inkunabel*, *Wiegendruck*, *Frühdruk*, and *Erstlingsdruck*. Of these four terms, *Wiegendruck* is the most common. In Dutch, there are two terms: *incunabel* and *weigedruk*. The Spanish term is *incunable*. *Incunabulo* is the Italian term. The Russian is

ИНКУНАБУЛ (*inkunabul*). There are two terms used by the Scandinavian languages (Swedish, Danish, and Norwegian): *inkunabel* and *paleotyp*. In Finnish, there are three terms: *inkunaabeli*, *paleotyyppi*, and *kehtopaino*. The Polish term is *inkunabul*. The Greek is *τυπομαρχατοογ* (*typoma archaion*). The Bulgarian term is ИНКПУНАБУЛ (*inkunabul*). The student of incunable bibliographic literature should be aware of all these different terms that may be used to refer to *incunabula*. The catalogs of foreign collections will often have titles in the vernacular, although the entities will usually be listed in the original languages.

CHIEF REFERENCE WORKS

Possibly no other period in the history of printing has been so well covered (i.e., studied and described) by that which so nearly approaches a complete bibliography, as the period of the incunabula. As early as the end of the eighteenth century ("early" understood with reference to Sir Walter Greg's dating for the beginning of true bibliographical scholarship), George W.F. Panzer published at Nuremberg, during the period 1793–1803, an 11-volume study titled *Annales typographici ab artis inventae origine ad annum MD*. The first five volumes covered the history of typography from the invention of printing to 1500; in 1803, the study was carried on to 1536 and six more volumes were added. This work is considered by some scholars the first important modern bibliography.

Inspired by Maittaire's work, *Annales typographici ab artis inventae origine ad annum MDCLXIV* (Hagae-Comitum, 1719–1725), Panzer borrowed both Maittaire's title and basic method and set out to trace the course of early printing. In the *Annales typographici*, Panzer's principle of division is alphabetical. Listing the main printing centers alphabetically by their Latin names, he then arranged in seniority all the printers who worked in these centers and followed this by a chronological listing of their publications.

The *Annales typographici* is divided into two parts: the first lists books printed up to and including 1500, whereas the second part covers the years 1501–1535. Panzer's annalistic approach gives the *Annales* a rather pronounced scientific tone. And the entries (although brief) include a detailed reference to sources and are more complete and technical than those of his predecessor, Maittaire. Furthermore, by a careful examination of types, Panzer was successful, especially when studying the Strassburg printers, in assigning certain books, published without a printer's name, to a definite printer of that city.

Panzer's work was criticized by Proctor, who in his preface to the *Index to the Early Printed Books in the British Museum*, wrote that:

Panzer's method of grouping of books by years rather than printers has many merits, but obscures the work of the

individual printers, and is unsuitable to a work in which the chief stress is laid in this point, and on the types which the printers used.^[7]

Despite its limitations, Panzer's work is an early example of how the scientific method can add much to the knowledge of a printed book.

Twenty-three years after Panzer's *Annales*, Ludwig Hain published the *Reptorium bibliographicum in quo libri omnes ab arte typographica inventa usque ad annum MD. typis expressi ordine alphabetico vel simpliciter enumerantur vel adcuratius, recensentur* (Stuttgart, 1826–1838, 2 vols. in 4 parts). This is still considered the standard reference work for incunabula studies; but as Roy Stokes has rightly noted, in view of Greg's accomplishments, standard does not necessarily imply the note of immutability. It may nevertheless be considered and used as the first bibliographical tool and as a springboard to other studies in this period of printing history.

The *Repertorium* lists alphabetically and numbers consecutively (by author order) 16,000 books printed before the end of the fifteenth century. Because of Hain's death, the later part of the alphabet is incomplete.

Although the entries preceded by an asterisk were compiled by Hain himself from copies under his care at the Hof und Staatsbibliothek (Munich) and are, therefore, more detailed and descriptive, the others, relying on earlier (XVI, XVII) and contemporary bibliographers, are less descriptive and informative. Each entry is composed of an assigned heading and transcripts. The assigned heading includes the author's name and a brief title. The transcripts are of the incipit, major section titles, and colophon. A folio number is given with reference to the place of the incipit, explicit, and colophon in the incunabula. Thus, for example, in entry 13387, *F l a* plus the title caption means that this is to be found on recto of the first folio. When, however, the title caption is printed on a subsequent leaf, the form *F l a vacat* is used and the transcript made with the appropriate folio reference. (Cf., e.g., Hain 13463.) The explicit transcript (or colophon) is always preceded by the words *In fine* and is made in full in the style of the type used in the original text. (Cf., e.g., Hain 13408.) The collation of the incunabula is given in code (i.e., in a series of initials and abbreviations that need some practice to decipher). Thus, the collation for Hain 5530 reads: s. 1. a. et typ. n. f. g. ch. s.s. c. et pp. n. 2. col. 421. 304ff. This reads (when deciphered): sine loco, anno et typographici nomine, folio, gothicis characteribus, sine, signatoribus, custrodibus et paginarum numeris, 2 columnae, 42lineae, 304 folia. And when translated means: without place, year and printer's name, in folio, in gothic characters, without signatures, catchwords and page numbers, 2 columns, 42 lines to the page, 304 folios. It should be noted, as a point of useful information to students, that a list of the abbreviations used by Hain can

be found in Stillwell's *Incunabula and Americana 1450–1800*, pp. 223–225.

Hain's *Repertorium* is, as has been stated, important on account of the wealth of description that it affords the consultor. Although earlier bibliographers furnished the reader with a title for the incunabula based on the incunabula's contents, Hain faithfully recorded the incipit and explicit of each book. This exactness made it possible, for the first time, to identify books with a good amount of certitude and to check them for their completeness.

The *Repertorium* does fall short of the mark, however, on two counts: first, Hain's failure to furnish information that would help to link the books described with their printer; second, his failure to collate the signatures (when present).

To the *Repertorium*, there have been added a series of supplements, which have both augmented and corrected with the original material furnished by Hain. One of the most important of these supplements is the work prepared by W.A. Copinger and titled *Supplement to Hain's Repertorium Bibliographicum*. This work, published between 1895 and 1902, is—as scholars know, and students soon discover—far less accurate than Hain's and should be used with the greatest caution.

Copinger's *Supplement* comprises two volumes, divided into three parts. Volume I, Part I, lists 7000 corrections of collations and additions to collations of works already described or mentioned in Hain. This volume and part was severely criticized because of its many errors and because of the absence of certain authorities (whose presence, as quoted, cited, and referred to, scholars felt to be indispensable). The entries in Volume I, Part I, retain Hain's original numbering and are referred to as H–C (=Hain as corrected or added to by Copinger). Thus, for example, H–C 12259 is the same number in Hain as augmented/corrected by Copinger.

Volume I, Part II, furnishes the user with a list of numerous collations and bibliographical particulars concerning nearly 6000 volumes printed in the fifteenth century and not referred to by Hain. Here Copinger seems to have profited from previous criticism, for the level of his work is considerably better and he is careful to refer to authorities. The entries for this section are in Hain's style, but their numbering is Copinger's own, and an entry in this section is referred to as *Copinger*, *Cop*, or just *C* (always, of course, followed by the corresponding number). Copinger gives the collation before the transcript of the incipit and explicit (colophon). Although in Hain, undated editions are merely listed prior to the dated editions, Copinger instead based his order for undated editions by studying the number of lines per page. It was his contention that a smaller number of lines and a larger number of leaves probably indicated an earlier edition, and so he used this as his criterion for dating undated editions. He also retained (in Volume I, Part II) some of Hain's abbreviations and introduced the *sine notâ*

(without place, name of printer, or date) to be used if these were lacking.

Volume I, Part II, covers the alphabet from letter A to O, and Volume II completes the list of works not mentioned in Hain, covering letters from P to Z. It then furnishes an Addenda to Parts I and II.

Immediately after the Addenda to Part II, there was published as an index to Copinger's *Supplement*, Konrad Burger's *The Printers and Publishers of the XVth Century With a List of Their Works*. Some scholars think that the inclusion of Burger's study (which they consider to be the best brief chronological record of the output of each fifteenth century press) helped somewhat to redeem Copinger's work and give it a certain, acceptable status.

Burger's masterful work was, as he himself notes in the preface, a labor of love to which he could attend only after the day's work was over. What Burger did was to extract all the printers mentioned in Hain and list them (by their self-adopted names) in alphabetical order. Under each printer he then placed the dated books (in chronological order) and then (in alphabetical order) those issued *s. a.* and *s. n.* In his entries, usually kept to a single line to afford easy reference, Burger includes not only the books listed by Hain and Copinger but also adds material from Proctor, Pellechet, and Haebler. Burger also appended to his list a second listing of books which, although dated, bear no indication of printer or place of printing. Relying on Proctor's dating, he assigned to these impressions an approximate date.

Finally Burger, writing in the *Preface* to his *Printers and Publishers of the XVth Century*, apologized for not enumerating about 2000 books, which had appeared without indication of printer's name, place, and date. He also regretted not furnishing his readers with a listing of printing centers and indications concerning their printers and publishers. But he suggested that:

Whoever desires to gather information on this point may use Proctor's *Index*, which I recommend as a standard work for those engaged in the study of incunabula, and as a book from which further researches must start.^[8,9]

In 1905 D. Reichling published the first of six fascicles titled *Appendices ad Hain-Copingeri Repertorium Bibliographicum* (Munich 1905–1911, with a Supplement added in 1914). This work, which is much more authoritative than Copinger's *Supplement to Hain's Repertorium Bibliographicum*, is considered as a further step toward the goal of a complete bibliography of all fifteenth century books. Reichling furnished notices for more than 2000 incunabula not listed in Hain or Copinger and augmented/corrected about 3400 of their descriptions.

The *Appendices* is, as stated, published in six fascicles (fascicles I–VI, followed by an *Indices fasciculorum* numbered as I.VI, and then closing with a *Supplementum*) with two sequences running through them, all of which does not make this work very easy to use.

The first sequence, numbered consecutively, consists of books unknown to Hain and Copinger. This section is titled: *I. Additiones. Incunabula typographica Hainio–Copingero ignota*. The second sequence, consisting of additions, corrections, and emendations to entries in Hain, Hain–Copinger, and Copinger is titled: *II. Emendationes. Incunabula Typographica ab Hainio–Copingero minus accurate recensita*. Each entry in this second sequence or section is preceded by the appropriate number reference to (sic.) H. = *Hain, Repertorium bibliographicum*. H.C. = *Hain, Repertorium, et Copinger, Supplement P.I.: Corrections*. And Cop. = *Copinger, Supplement P.II., et vol. I. et II.: Additions*. Thus, for example, in Fascicle I: pp. 1–81 are the *Additiones* and pp. 83–206, the *Emendationes*.

The index for this work is to be found in Fascicle I.VI (*Indices Fasciculorum I.VI*) and is quite comprehensive. But in the *Supplementum* there is (besides additional entries) a General Index, which brings together in one alphabetical listing all the items listed in the preceding fascicle.

Again, it is suggested that before a student begins consulting Reichling, he page through the fascicles and become thoroughly familiar with the general layout and arrangement of the material. The *Appendices* may not be a very easy bibliographical tool with which to work, but it is nevertheless a very important one.

Influenced by the insights and contributions of previous and contemporary scholars, but most especially Henry Bradshaw, Robert Proctor (as V. Scholderer has remarked) found the history of early printing guesswork and left it a science.^[10]

Proctor's aim was to illustrate the history of early printing by listing (as far as possible) in chronological order all the fifteenth century presses and types. When he came to publish *An Index to the Early Printed Books in the British Museum: from the invention of printing to the year MD with notes on those in the Bodleian Library* (2 vols. K. Paul, 1898–1899; 4 Supplements 1899–1902), he had sorted out (on the basis of typographical evidence) and brought order to some 10,000 volumes, a third of which were, perhaps, without printer's names.

Basically, Proctor applied on a large scale Bradshaw's principle of natural history order. Going from the known to the unknown (as all science must), Proctor compared the types used in signed and dated books against those in books without date, name of printer, or even place of publication. He was so proficient at this identification that A.W. Pollard, writing in the *Introduction* to Volume I of the *British Museum Catalogue of Books Printed in the Fifteenth Century* (1908, p. xi) stated that Proctor could identify types almost always on sight. Pollard's remark is no exaggeration, for not only was Proctor able to identify the vast majority of the unsigned books that he studied, but subsequent studies have by and large attested to his accuracy. His work has, in fact, become the basis for the still

incomplete *British Museum Catalogue of Books Printed in the Fifteenth Century*.

Proctor's *Index* is arranged in what is now commonly known as Proctor Order. That is, the books are sorted out, on the basis of typographical evidence, under their countries, towns, presses, and dates.

Proctor intended that his *Index* should include all books printed up to 1520. He selected 1520 rather than the more commonly accepted date of 1500 because he felt that the initial period of printing really ended at this date.

The *Index* is divided into two parts. The first lists all fifteenth century books and concludes with an index listing places, printers, and publishers (all in alphabetical order). There are also—at the end of this first part—other indexes of authors arranged by their Hain or Campbell number and in alphabetical order. Part II lists books printed in Germany during the period 1501–1520. Proctor's death in 1903 left the *Index* unfinished. At his death he had completed only the first section of Part II (i.e., that covering Germany). It was left to Frank Isaac to complete sections 2 and 3 (covering Italy, Switzerland, and Eastern Europe). These were published in 1938.

Proctor's entries are brief: each book is given a short title and the general format is noted, but there are no further collational details. It must be remembered that Proctor's work was meant to be in fact, what it was in name, that is, *An Index*.

Some critics have objected that, properly speaking, Proctor's *Index* is more a catalog than a bibliography. The novelty and complexity of his approach was defended by Proctor himself in the Preface to his *Index*, when he stated:

They (the books) are arranged, mainly in chronological order, under the printers of them; the printers are arranged in their order under the towns, and the towns under the countries; the precedence assigned to countries, towns, and printers is the same in principle, and is determined by the *terminus a quo* in point of date, in each case.^[7]

When the first volume of the *British Museum Catalogue of Books Printed in the Fifteenth Century* appeared in 1908, Pollard set the question to rest when he noted in his Introduction that Proctor's experience with his *Index* had made this the obvious arrangement for a much more expanded catalog.^[11] Much of the importance of this superb bibliographical tool depends on its arrangement, which is in the Proctor Order.

It is good to remark here, as Roy Stokes has stressed all these years (in the classroom and in print), that although the student may make his first acquaintance with these bibliographical tools by general descriptions and introductions, he must do everything possible to enable himself to handle the books themselves. The student must become familiar with the scope and the arrangement of these bibliographical tools, for on his

knowledge and skillful use of them rests much of the efficiency that he is expected to exercise in the whole area of bibliographical scholarship.^[12]

EXTANT INCUNABULA

The normal reaction to the tremendous amount of work and superb scholarship that have been expended in the study and description of the incunabula is to wonder whether, indeed, there is anything left to uncover or discover, much less to describe. Pollard himself wondered if at times the game (in incunabula scholarship) was not played for its own sake without any great consideration of practical utility.^[2]

A solution to this questioning can be had by both remembering the past and keeping a keen eye on present developments in this area of historical bibliography.

Pollard believed that the total output of the fifteenth century presses is not likely to have exceeded 40,000 editions and that given the number of copies produced by an individual printer (250 copies by Roman printers, 300 by Venetian printers or even 500 copies toward the end of the century), a possible total of 20 million books were placed on the European market.^[13] Today, scholars believe they know about the existence of at least 48,000 incunabula (about three times the amount originally recorded by Hain). But these are neither all registered in a single listing, nor is their description always adequate or complete. Furthermore, it is not infrequent to come across the word/note “unrecorded” in sale catalogs.

Extreme caution must be exercised with regard to new discoveries and the word “unrecorded” in sale catalogs. In this matter, one need only recall the latest hoax uncovered by the Italian bibliographer Roberto Ridolfi, which was fully described and explained in his article, “‘Un incunabulo sconosciuto’ (e inesistente)” in *La Bibliofilia*, Firenze, 1971, pp. 191–195.

All this does not mean that there is absolutely nothing else to be discovered/uncovered. Rather it means that new discoveries will be difficult if not improbable. History, of course, will be the final judge, and the margin of possibility together with scholarly scepticism will always serve to make the future interesting.

An area of work does exist, however, in searching out libraries and private collections, and in aiming toward both a more accurate/exact description and a cumulative bibliography of all incunabula.

TYPOGRAPHICAL DETECTIVES

The study of typography, with the intention of using the types as bibliographical evidence for dating books is, certainly, one of the more scientific branches of bibliography.

Typography is not unlike paleography because the early types were imitations of the book hand.

Most of the fifteenth century printers both designed and cast their own types. Therefore, books not bearing a printer’s name can be assigned to a printer through the comparison and identification of the fonts. This theory is called the “one type, one printer” theory. Because a printer could (and, in fact, did) sell his fonts to others or even pass down his type to successors; many thought that the one type, one printer theory was no longer valid.

But the work of Bradshaw, Proctor, and Haebler (which to a large extent supported this theory) has in no way suffered from these doubts. In fact, their method has been vindicated by subsequent studies and scholars. Today all agree and know that types can be the most reliable guide to both determining a printer and dating a volume.

Henry Bradshaw, whom Greg has called “the founder, or one of the founders, of the modern study of typography, . . .”^[14] developed for the study of incunabula a theory based on Darwinism, which he called the natural history method. By grouping books together by origin, he was able to compare them and draw conclusions concerning their genus (i.e., press on which they were printed). His natural history method was worked out in *A Classified Index of the Fifteenth Century Books in the De Meyer Collection* and can be found in *The Collected Papers of Henry Bradshaw*, University Press, Cambridge, 1889, pp. 208–236.

Robert Proctor, who based his work on that of Henry Bradshaw, Holtrop and Campbell, was the first to study the identification of early types in great detail. The result of his labor, *An Index to the Early Printed Books in the British Museum: from the invention of printing to the year 1500 with notes on those in the Bodleian Library*, gave the world of incunabula scholarship the first clear picture of the development of fifteenth century printing and presses.

Useful and important as is Proctor’s *Index*, however, the best and to date most important handbook for typographical detection is Konrad Haebler’s *Typenrepertorium der Wiegendrucke*. The user will soon come to know—and so should be previously warned—that Haebler’s book is a difficult, but important, bibliographical tool. The *Typenrepertorium* is, in fact, a highly detailed classification of types based on the characteristics of design and (in part) of sizes. Haebler selected 102 forms of the upper case M (for Gothic types) and Qu (distinguishing between those printed as two letters or as a logo type) for Roman types. These two letters were selected because it was these that underwent the greatest amount of changes and variations.

The *Typenrepertorium* is divided into two parts: the first on the types of Germany and those countries, which were directly influenced by German printers, and the second covering the types of Italy, France, Portugal, England, and the Netherlands. Under each country, Haebler listed the towns alphabetically and then their printers in chronological order.

The types used by each printer are provided by a series of symbols and numbers. But most important for a fruitful use of Haebler's work is a frequent consultation and familiarity with the two indexes he provides—one for Gothic and a second for Roman type.

Haebler's work, of course, is not the final word, nor does it provide easy solutions to typographical detection. When the user can come to the conclusion that a type compares as closely as possible with what he finds in Haebler, then the next step is to check further in facsimiles, etc. But, as Roy Stokes has rightly remarked, great discretion is needed, and hasty identification is a snare, particularly after 1480.

EXAMPLES OF FAMOUS INCUNABLES

Of the approximately 40,000 editions printed during the incunable period, there are a few that are truly outstanding. These include examples of very fine printing as well as various notable first occurrences. The following discussion includes only a small number of these famous incunables.

Perhaps the most famous incunable is the so-called "Gutenberg Bible." Although there is no absolute proof that Johann Gutenberg of Mainz printed or rather supervised the printing of this Bible, he is generally given credit for planning and at least supervising the early stages of its printing. The completion of the work is assumed to have been done by Gutenberg's successors, Johann Fust and Peter Schoeffer in approximately 1455. A copy that was housed in the Mazarine Library in Paris is signed and dated August 15, 1456, by its rubricator and binder, Heinrich Cremer. The final version of the Bible was in two columns of 42 lines each; hence, this Bible is often called the 42-line Bible. It is the first printed book extant. Margaret B. Stillwell states, "There is a grandeur about this Bible, a superb air of finality, that stands in curious contrast to the fact that it is the first book to have been printed with movable metal types, and thus the starting point in the history of modern book-making."^[15] Of the estimated 150 copies on paper and 30 on vellum, there are 21 surviving, 3 of which are on vellum. A large paper copy was placed on sale for \$2,500,000 by Kraus.^[16] One of the vellum copies is on permanent exhibition at the U.S. Library of Congress. The type design in the 42-line Bible is *textura* or *Lettre de Forme*. *Textura* is the most formal of the types of the Gothic family and is sometimes called "Wedding text" or "Old English" by printers today.

The *Mainz Psalter* is the first printed book to have a complete colophon. It was issued by Gutenberg's successors, Fust and Schoeffer. It is a Latin Psalter dated 1457. The catalog of the famous Printing and the Mind of Man exhibition of 1963 describes it.

This famous masterpiece of printing surpasses even the 42-line Bible in the beauty of its type and the richness of

its ornament. It is the first printed book to give the name of its printer and the date of printing. One of the printers, Johann Fust, had been in partnership with Gutenberg and had advanced money for the first essays in printing. It is supposed that a lawsuit between the partners in 1455 led to the dissolution of the partnership and that thereafter Fust exploited Gutenberg's invention with the help of his son-in-law, Peter Schoeffer, the other printer named in this book.

The colophon at the end may be translated from the Latin as follows:

"The present volume of the psalms, adorned with beautiful initial letters and with the proper rubrics in red, has been given this form artificially by means of a contrivance for printing and inscribing without any use of a pen, and laboriously brought to completion for the service of God by Johann Fust, citizen of Mainz, and Peter Schoeffer of Gernsheim in the year of our Lord 1457 on the Eve of the Assumption" (i.e., on 14 August).

It is an extremely elaborate book, set in two founts of type, excellently cut and cast, with 292 impressions of initial letters cut in metal and printed in colours. The text was printed in black and red and the big initials in red and blue or grey and printed for the most part at one pull, but here and there by two impressions and some stamping by hand. The inking was remarkably laborious: the red and blue letters were picked out of the forme before each impression and separately inked; in the case of the two-colour initials, the block for background ornament, given its colouring, and put back (probably fastened in also) before each copy was printed. Many changes were made in the formes during the run, so that no two of the surviving ten copies, all on vellum, are alike.

Some authorities contend that Gutenberg had a hand in the early stages of the printing; but this can be no more than conjecture.^[17]

The type design is *textura*. Another edition was printed in 1459 by Fust and Schoeffer.

A third important book printed in Mainz is the 1460 *Catholicon*. It is a thirteenth century Latin dictionary compiled by Johannes Balbus and printed in Mainz in 1460. It is thought that Gutenberg may have been the printer. Binns says, "There is no definite evidence that he was, in fact, its printer, but most experts are agreed in crediting the work to him in default of any other person to whom it can be assigned."^[18] It is "the first printed publication of any work in the field of secular knowledge."^[16] A less formal Gothic type called *Fere-Humanistica* or *Lettre de Somme* is first used in this book.

Another important Latin Bible is the 48-line Bible printed by Fust and Schoeffer in Mainz in 1462. This is the first printed Bible to contain a colophon and the first printed appearance of the twin shields printer's device of Fust and Schoeffer. The Gothic type used is called

Fust–Schoeffer Bible type and has the overall appearance of Fere–Humanistica.

The *Subiaco Lactantius* is the first dated book to be printed in Italy. Two German printers from Mainz, Conrad Sweynheym and Arnold Pannartz, settled for a short time in Subiaco, Italy, and printed this book in 1465. The text is *De Divinis Institutionibus* or simply *Opera* of Lucius Coelius Firmianus Lactantius. The type is a semi-Roman or transitional face. It is also the first printed book to contain short passages of Greek type.

The Recuyell of the Histories of Troy, written by Raoul Le Fevre and translated by William Caxton, is the first book printed in English. Although the book is not dated, Binns says "...it is generally agreed that it was printed at Bruges between 1472 and 1475."^[18] In his epilogue Caxton states,

I have practysed & lerned at my grete charge and dispense to ordeyne this said book in prynte after the maner & forme as ye may here see, and is not wreton with penne and ynke as other bokes ben, to thende that every man may have them attones, ffor all the bookes of this storye named the recule of the historyes of Troyes thus enpryntid as ye here see were begonne in oon day, and also fynysshid in oon day.^[16]

This type face is of the Gothic family of a French Bastarda or Lettre Bâtarde. An edition of the French original, *Le Recueil des Histoires de Troyes*, appeared in 1476 and may have been printed also by Caxton. It is probably the earliest French literary work in print (see also *Caxton, William*).

Nicholas Jenson's first important book is probably Eusebius' *De evangelica praeparatione* printed in Venice in 1470. The type designed for this work is of the Roman family and called Venetian. It is considered to be one of the most beautiful Roman text types. B.A. Uhlenborn states, "...Jenson created the most beautiful Roman type we have: a perfect symmetry in size and form, an unparalleled imitation of the lapidary forms of Roman inscriptions, meeting at the same time all the requirements of a printing type."^[19]

A very famous book from Nuremberg was printed by Anton Koberger in 1493. Although commonly called the Nuremberg Chronicle, its correct title is *Das Buch der Chroniken* or *Liber Chronicarum* by Hartman Schedel and Georg Alt. It is a massive folio volume of 596 pages containing some 1809 illustrations from woodcuts by Michael Wohlgemuth and Wilhelm Pleydenwurff. Only 645 different wood blocks were used to make the many illustrations so that many illustrations are used more than once.

The *Hypnerotomachia Poliphili*, printed by Aldus Manutius in Venice in 1499, is often considered one of the true masterpieces of the incunable period. The Roman type face is Old Face designed by Francesco da Bologna.

The book is illustrated by delicate woodcuts and intricate initials. William M. Ivins analyzes this book in the following quotation.

It would be possible to name but few objects that have had the influence on subsequent design that this book had. In Venice and Italy it had little popular acclaim, its text too erudite and its illustrations too familiar in type and style, to arouse much interest. It took forty-odd years to sell off its first edition of six hundred copies, and with the possible exception of the *Nuremberg Chronicle*, which was too big to be read or used, it is today the commonest of fifteenth-century books. In the year of its second edition, 1546, a translation of it into French, accompanied by French copies of the woodcuts of the original, was published at Paris. This translation went through four or five editions, the last of which found a market after the beginning of the seventeenth century. It is doubtful whether any one set of designs has ever played so extraordinary a role as did this in the conversion of France from its Gothic to its Renaissance. It was the first and the greatest of the printed carriers of the revived classical feeling to the peoples of the north.

The *Hypnerotomachia* thus immediately raises several questions that are of extreme importance in any critical discussion of book design and illustration. As far as its text went it was an impossible, erudite, silly romance, fittingly written in a jargon that is almost macaronic, devoted in largest measure to abstruse symbolism and the maundering of a mad collector of classical remains. It describes, as only an Italian platonic humanist could, temples, groves, palaces, ruins, gods and goddesses, and fragments of ancient art. ... And it was illustrated with pictures of many of these things. Thus it happened that within the covers of this crazy book were to be found more representations, clear, lucid, and simple, of the architectural and monumental forms that intelligent Italy had evolved from the classical, than had ever before been printed. ... A richly illustrated book, filled with outline drawings of architectural motifs and details, vases, capitals, arches, pilasters, and other such things, it could not well escape being itself a rather effective object. ... Its draftsman was anything but a great artist, but its subject matter and the traditional technique in which he worked lent themselves most admirably to the creation of a homogeneous object of art. Between its letter press and its illustration there was no conflict or color or linear form—a result purely accidental, possible only because the draftsman lacked personality and his subject forbade it. Its success from the typographic point of view is grounded in the fact that its figures display almost as little personality or color or draftsmanship as those in a Euclid. The result is that by many in these modern times it has been declared to be the most beautiful of all illustrated books.^[20]

CONCLUSION

Many outstanding collections of incunabula exist in European libraries. The four most important collections, perhaps, are in the British Museum, the Bibliothèque Nationale in

Paris, the Staatsbibliothek in Munich (formerly the Royal Library), and the Vatican Library. In addition, there are major collections in the libraries of Berlin, Milan, Vienna, Manchester (including the John Rylands Library), Brussels, and The Hague. There are also many smaller European collections.

Although none of the American collections can truly match these European ones, the following libraries are noteworthy in this country: the Library of Congress, the Lenox collections of the New York Public Library, Harvard University Library, the Pierpont Morgan Library in New York, the Henry E. Huntington Library in San Marino, California, the Hispanic Society of America in New York, Columbia University Library, Yale University Library, Cornell University Library, the University of Michigan Library, the Chapin Library at Williams College, both the Newberry Library and the John Crerar Library in Chicago, the University of Chicago Library, the Free Library of Philadelphia, the National Library of Medicine, the Boston Athenaeum, the Grolier Club Library of New York, the General Theological Seminary Library, the Annmary Brown Memorial at Brown University, and the Lilly Library at the University of Indiana.^[15]

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Indexing: History and Theory

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Abstract

The history and theory of human textual indexing are surveyed. Basic terms are defined, the extent of the literature is discussed, and key concepts are explained, with an emphasis on thesaurus-based indexing. A section on the consistency of human indexing leads to a discussion of automatic indexing algorithms. An assessment of the future of human indexing concludes the entry. Pages from an early printed index and a manuscript index illustrate the structural elements of index entries as well as features of the format of early indexes that are still found in contemporary publications.

SCOPE AND ORGANIZATION OF THE ENTRY

The focus of this entry is on the history of indexing practices and the theory of indexing. The emphasis is on serial/database indexing, but implications are drawn for related techniques in back-of-the-book indexing, concordances, and various indexing-related activities. Other articles in this encyclopedia address a variety of related topics, such as subject headings, descriptive cataloging, metadata, thesauri, and citation indexing. Although Anderson believes that indexing and classification are the same thing,^[1] this entry treats index headings that are arranged alphabetically, while hierarchical display of content indicators is discussed in other articles.

This entry begins with definitions of basic terms, proceeds to vogue words, and then surveys the literature of indexing. A history of indexing is followed by sections on the theory of indexing and on the use of thesauri in the indexing process. A discussion of the consistency of indexing serves as a segue to the section on automatic indexing, a method of content analysis that is always consistent. The entry closes with a summary and a discussion of the future prospects of indexing.

THE TERMINOLOGY OF INDEXING

Definitions of Basic Terms

An *index* leads from a known order of symbols to an unknown order of information. An index is in a different order from the document or collection to which it provides access. The card catalog of a library is a type of index. The book collection of a library is generally classified by subject. If one knows the author or title of a book of interest, one may use one's knowledge of the alphabet to locate entries for the author or title of the book in the card catalog. The bibliographic record will provide the call

number of the book, which indicates its location within the classified collection.

The type of index most familiar to us is one in which the entries are arranged in alphabetical order, with *locators*, such as page references, pointing to a text that is arranged in a logical, hierarchical sequence. The most common example of this is a book index: The text is in an order established by the author, usually treating general topics before specific ones. The index arranges the terms representing specific topics alphabetically.

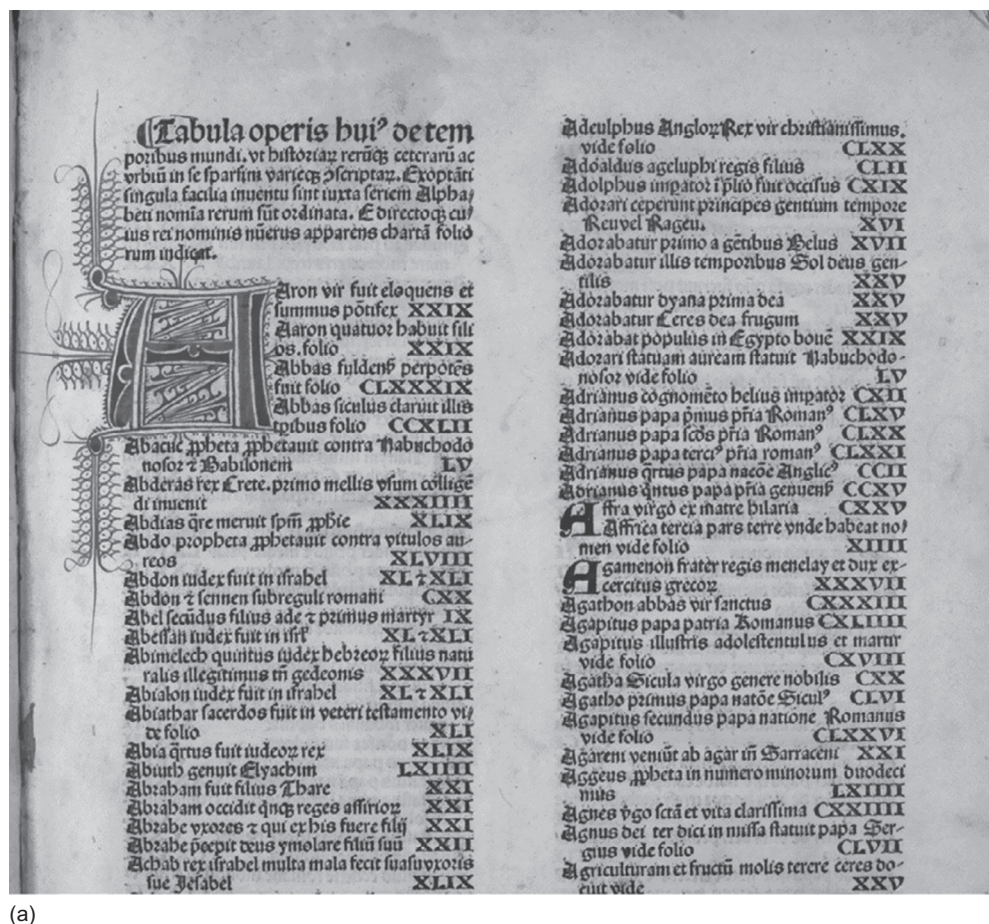
In discussing the history of the word *index*, Wellisch^[2] noted that the term was once used to refer to many types of information structures: abstracts, titles, etc. The word *index* is still encountered today as a heading for tables of contents, although these are far less sophisticated information structures than indexes. A table of contents lists the chapter titles and headings of a systematically organized work; such a list can be generated automatically. An index, in contrast, provides efficient access to the specific topics covered in a document. Compilation of an index requires far more cerebration than does preparing a table of contents.

Although the word *index* has acquired a specific meaning, a recent article on the history of indexes^[3] calls an ancient pictorial catalog—not arranged in a known order—the first index. Many finding aids on the web that are called *site indexes* are in fact *site maps*; the latter are the equivalents of tables of contents.

An index *entry* consists of three elements: a heading, a subheading, and a locator. Of these, the first and last are required, and a subheading is optional. An example of an index entry with all three elements is

Libraries
Georgia, 365

These structural elements are found in the earliest indexes. Index entries with Roman numerals as locators can be



(a)

Fig. 1 (a) Part of the first page of the index to *Liber Cronicarum*, an incunable. Copyright Plantin-Moretus Museum, Antwerp (R 38.4). The introductory note begins with the word *tabula* [= index]. The locators are folio numbers in Roman numerals. The initial A was decorated by hand (cf. Fig. 1c).

seen in Figure 1a–c. Indented subheadings are in Fig. 1b. These illustrations come from an *incunable*, a book issued during the infancy of printing from movable type—before the year 1500.^[4]

The sample entry above could occur in the index to a book or to a single volume of a journal. In an index to multiple volumes of a journal, a volume number would precede the page reference. In an index to *multiple journals*, the full bibliographic reference would serve as the locator:

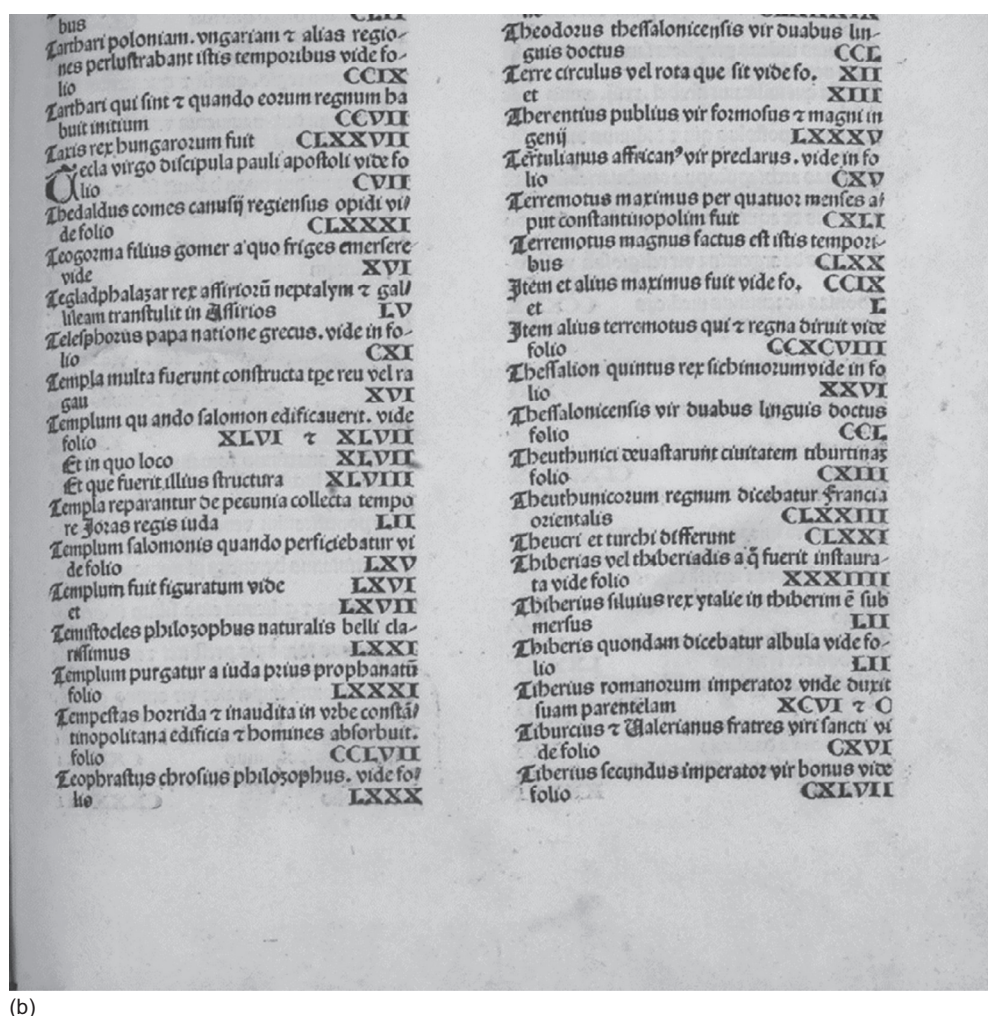
Smith, John. Libraries in Georgia. *American Libraries* 14
 (1): 25–26, January 1999.

A wide variety of locator formats has been described by Weinberg.^[5] Fig. 2 illustrates the use of a homily number, rather than a page number, in a manuscript index.^[6] Section number is often the locator in legal texts, while chapter and verse numbers generally constitute the locator in indexes to the Bible. Browne advocates the use of section

and paragraph numbers as locators to increase the granularity of indexing.^[7]

Klement^[8] has introduced the term “open- vs. closed-system indexing” to explain the difference between the indexing of journals and books, respectively. A key difference lies in the nature of subheadings for the two formats. Subheadings in books are *coined modifications*,^[9] i.e., phrases formulated by the indexer, while those in journals or databases are standardized; the former are more specific. In a book index, for example, one might encounter the heading–subheading combination “caffeine: effect on sleep”; in a database index, the combination may read “caffeine—adverse effects.” The introductory sections of controlled vocabularies (such as *Medical Subject Headings*) usually list their standard subdivisions along with rules for assigning them.

Both book indexes and journal indexes include (or should include) cross-references, although the number of such references should be minimized to save the time



(b)

Fig. 1 (b) Part of a page with entries beginning with T from the index to *Liber Cronicarum*. Copyright Plantin-Moretus Museum, Antwerp (R 38.4). Indented subheadings are in the left-hand column.

of the user. The network of cross-references is called a *syndetic structure*, a term coined by Cutter in his guidelines for a dictionary catalog.^[10] A book index has an ad hoc syndetic structure—one created by the indexer to link the synonyms and related terms relevant to that book. The cross-references in journal/database indexes are generally drawn from a thesaurus with preestablished term relationships.

Wellisch^[11] has published a glossary of indexing terminology. Dictionaries of library and information science also include definitions of indexing terms.

Vogue Words

Perhaps because the compilation of an index seems as simple as the ABC, the field of indexing is subject to the general linguistic phenomenon of *vogue words*, fashionable words that may not last long in the active vocabulary of speakers. Examples of vogue words germane to the field of indexing follow.

The term *metadata*, once reserved for data about websites, has been applied retroactively to all cataloging and indexing data. A recent article on early encyclopedias and indexes calls them *knowledge management tools*.^[12] This is ironic because the focus of the field of knowledge management is on the *unrecorded* information stored in experts' brains, while indexing deals with recorded documents.

Indexing is a type of *content analysis*, now often termed *knowledge representation*. (Abstracting is another type of content analysis, often done by indexers.) Amateurs call the process of assigning index terms *keywording*, although the term *keyword* usually means *free-text term*, not subject to vocabulary control. The controlled vocabularies used in indexing are now frequently called *taxonomies* or *ontologies*. Not long ago, they were called *knowledge bases*.^[13]

It takes some effort to analyze the vogue words of indexing in order to determine whether they are renaming a familiar phenomenon or naming a new one.

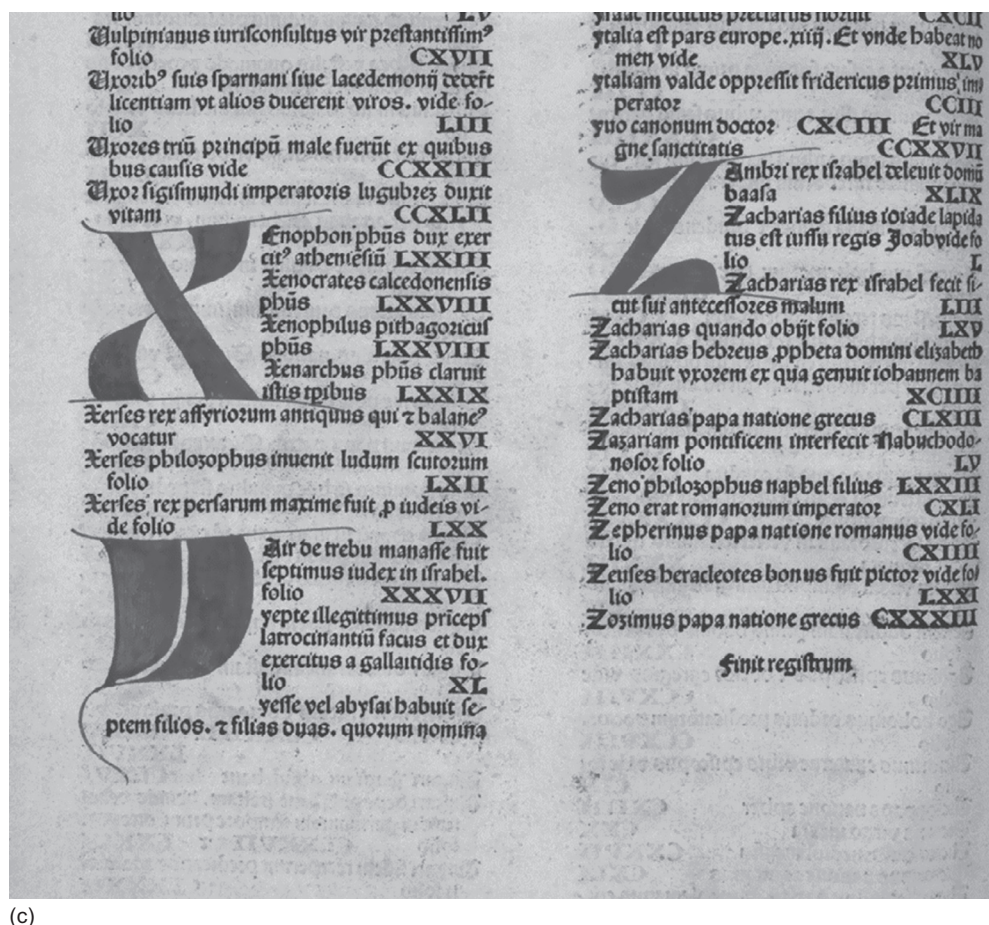


Fig. 1 (c) Part of the last page of the index to *Liber Cronicarum*, from a second copy of the incunabulum held by the Plantin-Moretus Museum. Copyright Plantin-Moretus Museum, Antwerp (R 9.7). The different style of the rubrics, as compared with the decorated A in (a), proves that the large initials were drawn by hand. Note the final line, “Finit registrum”; the latter word is a synonym for *tabula*, used at the head of the index.

THE LITERATURE OF INDEXING

The vastness of the literature about indexing is evident from the two book-length bibliographies on this subject compiled by Wellisch.^[14] Supplements to these appeared in *The Indexer*, the primary journal of the field.^[15] Recent publications on indexing have occasionally been cited in the state-of-the-art reviews entitled “The year’s work in subject analysis” in *Library Resources & Technical Services*,^[16] the journal of the division of the American Library Association that is most concerned with cataloging. The journal *Knowledge Organization* (formerly *International Classification*) until 2008 had a current-awareness bibliography^[17] that included many items germane to the field of indexing. Current issues (2017) have a column entitled “Books Recently Published.” State-of-the-art reviews on subject analysis in general, or on special aspects of indexing, were published periodically in the *Annual Review of Information Science and Technology*, which ceased publication in 2011.^[18] Coe reviewed the literature on the usability of

book indexes.^[19] Bell published a bibliography on the indexing of biographies and fiction.^[20]

The subject of indexing is also covered by the major print indexes and databases in the field of library and information science. Reviews of books on indexing have been collected in an anthology by Weinberg.^[21]

Several editions of a standard for indexes were approved by the American National Standards Institute (ANSI).^[22] The most recent revision failed to achieve consensus among the Voting Representatives of the National Information Standards Organization (formerly ANSI Committee Z39); the draft standard was published as a technical report.^[23] There are British and international standards for indexing as well; the British adopted the 1996 international standard^[24] as their own. Related standards were surveyed by Shuter.^[25] A standard for indexes to e-books is under development.^[26] These standards cover the principles and the format of indexes; the *process* of indexing is detailed in book-length manuals.

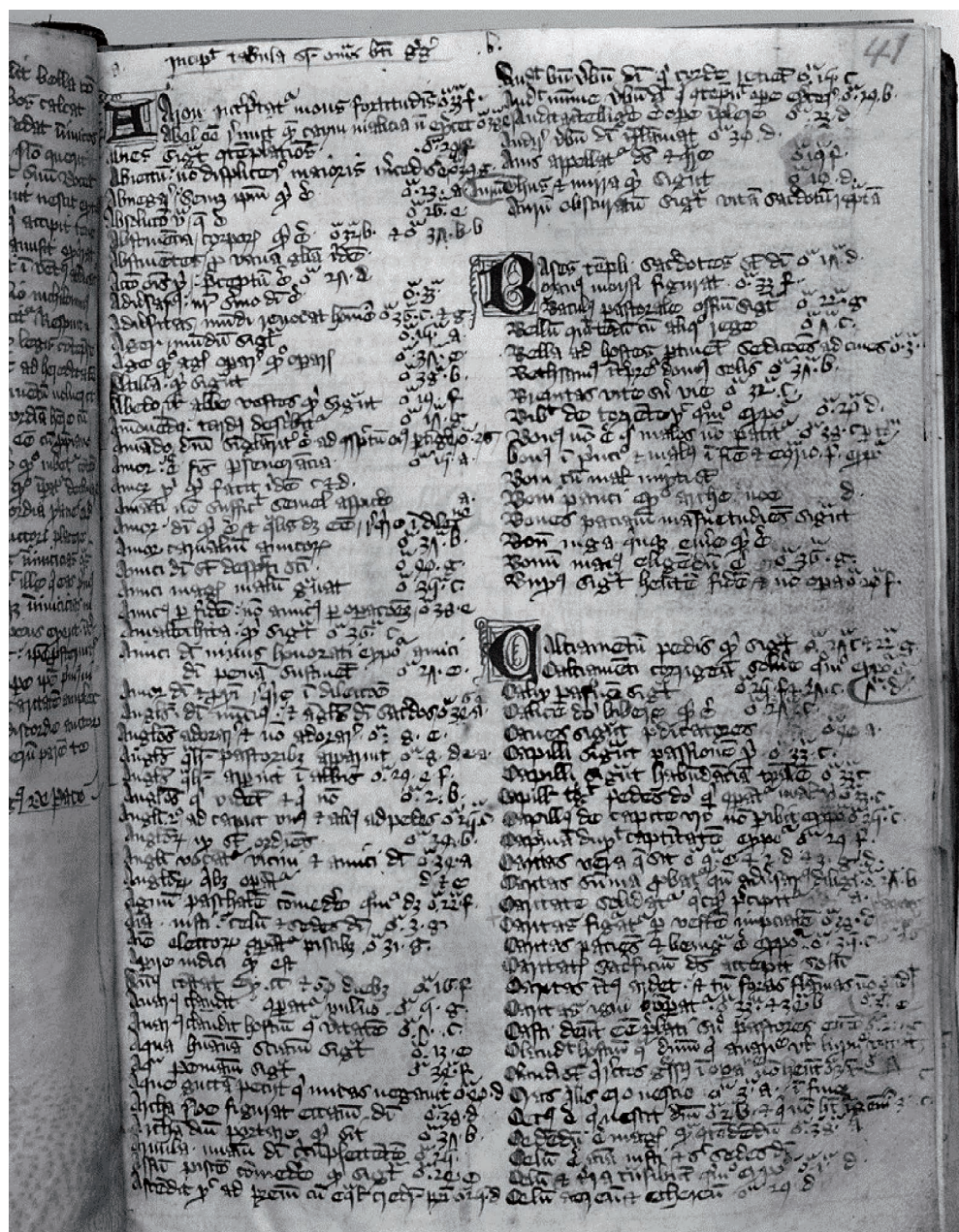


Fig. 2 Initial page of the manuscript index to the homilies of St. Gregory. Copyright Plantin-Moretus Museum, Antwerp (M 216).

DISCIPLINES RELATED TO INDEXING

The preceding section on the literature of indexing provides some clues as to the disciplines related to indexing. The primary one is information science, formerly called *documentation*, with an emphasis on the detailed analysis of information contained in documents. Indexing is often taught in schools of library and information science, but about 50% of book indexers lack a degree in library and information science, and many journal/database indexers are trained in-house.

Indexing is germane to every discipline. The National Library of Medicine has rigorous rules for indexing the

literature that it acquires.^[27] The policies of databases in other disciplines are often unpublished.

A discipline particularly concerned with indexing is genealogy, as the indexing of names is the primary focus of genealogists. Indexing manuals used to have their own rules for the formulation of name headings, but in recent years these manuals deferred to the rules of the library cataloging community published in *Anglo-American Cataloguing Rules*, 2nd ed. (AACR2), which as of June 5, 2007, is no longer updated.^[28] AACR2 has been replaced by RDA (*Resource Description and Access*). Appendix F of the 2014^[29] edition of RDA contains guidelines for names in some languages other than English. Spidal

discussed these cataloging codes as well as other sources of name headings.^[30]

The international journal *The Indexer* has since 2006 been publishing a series of “Centrepieces” focusing on rules for formulating headings for names in a variety of languages;^[31] these articles provide more detailed guidance than AACR2 or RDA on the entry element of names in languages other than English, such as La Fontaine, Da Vinci, and Van der Camp.

The expansion of the Internet has stimulated interest in the history of the book and the organization of information. Evidence for this statement is the large number of books and articles published since the year 2000 that deal with the history of books and the impact of printing. Scholars of intellectual history and the Renaissance often write about early indexes and the encyclopedists. The literature of indexing is thus widely scattered. In documenting the history of citation indexes, Weinberg^[32] observed that early Hebrew citation indexes were described in journals in the field of religion, not in the literature of information science.

Indexing is of interest not only to academic communities but also to individuals, both scholars and laypersons. Within the context of information science, Jones^[33] has written about personal information management, which includes indexing the documents that one decides to keep. “Professional organizers” provide advice on the organization of personal files, focusing on the creation of category structures in which to file personal papers. Weinberg^[34] has reviewed a great many manuals authored by professional organizers and found most of the indexing advice incorrect. Many of these manuals advise their readers to file personal papers under the *broadest* heading they can think of, while *specificity* is considered praiseworthy in the field of indexing. Golub^[35] cites studies of how people organize their machine-readable files, notably e-mail.

HISTORY OF INDEXING

An index is a form of auxiliary memory. Historian Daniel Boorstin^[36] observed that indexing begins when memory declines. If one has not memorized a text that one has read, an index helps one locate the passage(s) of interest quickly, obviating the need for a sequential search of the text. An index also serves those who have *not* read the text. The title pages of early printed books (in Hebrew as well as Latin) that contain indexes often mention their time-saving nature.

Our knowledge of the history of indexing is limited because so much of the evidence has been destroyed by the ravages of time, the burning of books, and the fragility of materials on which information has been recorded. This is especially true for Hebrew books, which were often subjected to censorship and burnings. Furthermore, as Beit-Arié pointed out,^[37] Hebrew books tended to be

copied for personal use, while Latin books were copied in institutional settings, notably monasteries. In comparing the state of early Hebrew citation indexes with manuscripts of the first Latin citation index, Weinberg^[38] commented on the beautiful calligraphy and ornamentation in the latter.

Kilgour^[39] described the underlining of keywords in red in hieroglyphics documents. This is analogous to the marking of *indexable matter* (terms to be indexed) on the page proofs of books. Berger^[40] detailed the history of alphabetical order, which is essential to many indexes. Witty^[41] published one of the first papers on the history of indexing, beginning from antiquity and proceeding to the Middle Ages. Witty emphasized the concept of the *known order* of index entries as a means of facilitating access to written records.

Wellisch^[42] dated the origins of indexing to a fourth-century Greek work entitled *Apothegmata*, a collection of sayings of the Church Fathers. Weinberg^[43] has demonstrated that most early indexes were in the domain of religion, which was considered the “queen of sciences” in the Middle Ages. Fig. 2, a page from a manuscript index to the homilies of Pope Gregory, illustrates this point. Painting-Stubbs wrote about the early English indexes (1576–1587) of Abraham Fleming, many of which provided access to religious books.^[44]

Richard and Mary Rouse^[45] have described the earliest Latin Biblical concordances (word indexes), which date back to the early thirteenth century. Sophisticated concordances contained the three elements of index entries: a word from the Bible (the heading), the phrase in which the word occurs (subheading), and the chapter number (locator). Weinberg^[46] has demonstrated that selected lists of words from the Hebrew Bible were compiled by the Masoretes at least three centuries earlier, while Busa^[47] theorized that concordances to the Bible probably existed in the seventh century.

Rouse^[48] stated that subject indexes were invented in France; some of those compiled in the thirteenth century have sophisticated features, such as networks of cross-references. Weinberg^[49] described medieval indexes and concordances compiled in France, analyzing their structure and format. Failing to cite Wellisch, Cevolini^[50] cites Rouse and other authors who believe that indexing began in the thirteenth century. Humphreys posited that the oldest index is the 3000-yr-old *I Ching*, as she translated its hexagram structure into that of an alphabetical index.^[51]

Among the features of medieval indexes that are emulated today is the *introductory note*, which explains the structure of locators or some other aspect of an index. Introductory notes are evident in Figs. 1a and 2. Early printed indexes emulated the format of manuscript indexes, as was noted by Wellisch.^[52] This can be seen in Fig. 1a and c, which contain images from two copies of an incunable (a book from the infancy of printing, i.e.,

fifteenth century) with initial letters calligraphed in different styles.

Thesauri are considered to be an invention of the middle of the twentieth century, but work on synonym control and lexicography dates back to the ancient period. Krovetz^[53] has demonstrated that hierarchical relationships are embedded in definitions, e.g., “a horse is a *mammal*.” Thus, the roots of broader-term relationships in thesauri are in early dictionaries. Hlava^[54] reviews the history of such relationships, i.e., taxonomy.

Multilingual thesauri are considered a modern phenomenon, but Wellisch^[55] has described medieval multilingual herbals, in which plant names were provided in several languages and scripts. Wellisch^[42] also described a graphic display of relationships among index entries in an incunabulum.

Vocabulary switching is viewed as a contemporary problem, but sophisticated work was done in the 1930s on the translation of the American Library Association's subject headings into Library of Congress subject headings.^[56]

Wellisch^[57] described and translated a sixteenth-century manual of indexing written by Conrad Gessner, the “Father of bibliography.” Gessner provided detailed instructions for the technique of indexing: one should write index entries on sheets of paper and then cut the entries apart in order to arrange them in the desired order. In the twenty-first century, this method may seem laughable, but it is not as obsolete as one may think. As president of the American Society of Indexers, I chaired the jury of the H. W. Wilson Award for Excellence in Indexing; the award-winning indexer used a technique similar to that of Gessner: typing entries on adding-machine tape and later cutting them apart and alphabetizing them!

The Society of Indexers (in England) recently reprinted an early twentieth-century manual of indexing, considered a classic.^[58] Wheatley's book devoted a lot of attention to the format of indexes, but he also articulated important principles of indexing that are still cited. His dictum “one index, indivisible” is often violated in contemporary works, resulting in confusion on the part of the user of books with multiple indexes, online catalogs with unclear search options (e.g., subject/keyword), or websites that lack a single search box and require the user to select a category.

In sum, content analysis is an ancient activity; sophisticated indexes were created in the medieval period; and work on vocabulary switching antedates online searching and the Internet era.

THEORY OF INDEXING

Indexing is not really a theory-based profession. John O'Connor's dictum, “Good indexing permits good

retrieval” (stated at a conference of the American Society for Information Science), crystallizes the essence of the field, emphasizing its practical purpose. Principles of indexing have been inferred from practice. Wellisch^[59] criticized the high percentage of articles about indexing that describe individual projects without reference to principles or the prior literature.

Jonker^[60] wrote a book of indexing theory that was cited in Borko's paper “Toward a theory of indexing.”^[61] Svenonius^[62] questioned the theoretical basis of indexing and suggested directions for research, while noting the methodological difficulties of comparing indexing systems with different structures. Quinn^[63] reviewed more recent theoretical approaches, focusing on the subjectivity of indexing and on attempts to delineate the steps in the indexing process. Quinn also noted the lack of American theoretical contributions to the literature of indexing and classification.

The textbook of indexing authored by Lancaster^[64] records important principles, such as specificity, and demonstrates that all so-called theories of indexing in fact are not. He devoted particular attention to the “axioms” of Robert Fugmann. And yet, Hjørland has classified theories of indexing, including his own.^[65]

A key concept in the indexing literature is *aboutness*. Weinberg^[66] has suggested that the linguistic concepts of *topic* and *comment* should be applied to enhance the quality of indexes. This would, for example, facilitate the retrieval of documents containing negative views of a topic while excluding those with positive views. Andersen and Christensen^[67] also took a linguistic approach to indexing theory, suggesting that it be based on a philosophy of language, with particular attention to the theory of meaning. The authors applied the ideas of Ludwig Wittgenstein to indexing by stating that this process must take into account the social, historical, and linguistic contexts of documents.

While there is no generally accepted theory of indexing, there are standard measures of the characteristics of indexes. *Exhaustivity* of indexing is measured by the number of terms assigned to a document, such as a journal article, or by the number of index entries assigned to a page in a book. Weinberg^[68] discussed the exhaustivity of indexes in books, journals, and full text. She has attempted to get the indexing community to use the terms *entry* and *heading* consistently because the definition of entry has implications for the fee structure of indexers.^[69,70] Weinberg's letters to *Key Words* contain numerous references to publications on the density of indexing and related terminology. For example, the following line of an index with a heading and multiple locators represents four entries, although some indexers charge by the number of *lines* in an index:

Libraries, 40, 86, 112, 256

Density and *depth* of indexing are often-used synonyms for exhaustivity, although Wellisch^[71] defined depth of indexing as a combination of exhaustivity and specificity. Anderson^[72] has explained *specificity* as “goodness of fit”; in other words, a term in isolation cannot be called specific; its specificity can be evaluated only with reference to the text being indexed. For example, the term *Birds* is a specific descriptor for an article about birds in general, but it is not specific for an article about robins.

Ranganathan^[73] developed the concept of *coextensiveness* of classification numbers and index terms, i.e., that the full scope of a document should be expressed in a single classification number or index term. For example, if a document deals with the topic “The manufacture of silk shirts in 20th-century Italy,” Ranganathan believed that all facets of the topic should be represented in one classification number, synthesized from the elements that designate the key concepts. Alternatively, a single indexing string should contain all the concepts in a specified order.

The use of machines in the indexing process led to the concepts of *precoordination* (combination of terms at the indexing stage) and *postcoordination* (combination of terms at the searching stage). An example of a precoordinated index entry is the heading–subheading combination “Boston—Museums.” In a postcoordinate system, the two terms would be indexed separately and combined only at the searching stage. Kilgour^[74] wrote that the latter system began to replace precoordinated subject indexing in the mid-1930s. Taube^[75] worked extensively in the 1950s and 1960s on the development of [post]coordinate indexing.

Although postcoordination has been presented as superior to precoordinate indexing, the disadvantages of the former method of indexing have been pointed out by several experts in the organization of information and summarized by Weinberg.^[76] Milstead^[77] noted that it is not a question of better or worse: precoordination is the *only* appropriate method in the print environment. Human beings were not designed to compare lists of document numbers posted to keywords in order to locate a combination of concepts. In using printed indexes or card catalogs, humans require subheadings in order to quickly locate documents that deal with the aspect of interest.

Soon after the implementation of postcoordinate indexing, it was recognized that the loss of word order led to many *false drops*, i.e., the retrieval of documents that were not relevant to the query. If one were seeking information on the Philosophy of History, for example, one would retrieve documents on the History of Philosophy. To deal with this problem, information scientists developed the devices of *roles* and *links* to connect related descriptors. It was quickly recognized that these artificial devices were not assigned consistently, and they were abandoned. Weinberg^[78] has reviewed many complex indexing systems that were dropped, including those based

on contemporary linguistic theories. Craven^[79] described numerous *string indexing* systems—systems in which a set of terms is selected by a human indexer but manipulated by computer.

In library and information science, there has long been a distinction between technical services and public services. But just as reference librarians must understand the structure of a catalog, so must online search intermediaries understand how databases are indexed. Kesselman and Perry^[80] have discussed this, with particular reference to the way precoordinated or multiword terms are processed by online vendors. Searching is the obverse of indexing. As searching of the World Wide Web by end users has increased, consultation of fee-based databases has declined.

Frohmann^[81] criticized those who wrote about the mental process of indexing. Anderson responded to the criticisms in his textbook.^[82] Bates^[83] reviewed research findings on indexing that are germane in the Internet era. She focused on the mismatch between the terms used by the indexer and the searcher, the inconsistency of naming concepts and objects, and on folk classification. The last-mentioned topic is currently receiving a lot of attention in the context of social networks and tagging by laypersons.

Indexing is an art, not a science. Many intelligent people lack the ability to distill the essence of a document and to represent its main topics in a few words. Some people who have gone through formal training will never make good indexers, while others who are self-taught are excellent indexers and have even won awards in the field.

An indexer must be something of a prophet—envisioning the concepts likely to be sought by users of a document, expressing those concepts in terms likely to be sought by users, and providing cross-references from synonyms and alternative spellings as well as links to related terms to assist users in finding all the information that is relevant to their topics of interest.

THE USE OF THESAURI IN INDEXING

This section explains how the features of thesauri are used in the indexing process. The most common term for a preferred heading in a thesaurus, i.e., a term that may be assigned in indexing, is *descriptor*. Numerous synonyms exist for descriptor, including *postable term*, i.e., a term on which index entries may be “posted.”

An indexer scans a document and thinks of terms that represent its “aboutness.” If the term selected by the indexer is a synonym of the preferred term in the thesaurus, there will (or should) be a USE reference from the nonpreferred term to the descriptor, e.g., “attorneys USE lawyers.” If the term selected by the indexer is more specific than any of the descriptors, the thesaurus may provide a USE reference from a *quasi-synonym* (not a true synonym), e.g., “chairs USE furniture.” The reciprocal of USE

is UF (Used For). By examining the terms coded UF, the indexer sees which terms are considered equivalent:

lawyers
UF attorneys
barristers

The rationale for the USE/UF relationship is that the time of the user will be saved if information is not scattered among synonymous or nearly synonymous headings. The equivalent of USE in book indexes is the command *see*.

A descriptor may be followed by a scope note (SN) that tells the indexer when to assign the term; SNs often refer to related headings. An example of an SN that does this is taken from the Educational Resources Information Center (ERIC) Thesaurus.^[84]

Occupational Home Economics

SN formal preparation for occupations using home economics knowledge and skills—below the baccalaureate level. (Note: For the baccalaureate level and above, use “Home Economics Education.”)

A study conducted in Israel found that for nearly a third of the index terms assigned to books by librarians using a Hebrew thesaurus, there was no information relating to those terms in the books.^[85] This was explained by the lack, or inadequacy, of SNs in the thesaurus used for indexing.

A thesaurus record for a descriptor often displays narrower terms, coded NT. If an indexer has selected too general a term, the NTs lead the indexer to the most specific term available:

plants
NT flowers

flowers
NT roses

Reference librarians are well aware that users express their information needs in more general terms than they actually require; such librarians are trained to draw out the true information need via a reference interview. When users consult indexes on their own, the downward cross-references serve this function. In a book index, *see also* is the (rough) equivalent of NT.

The reciprocal of NT is BT, for *broader term*. BTs set the hierarchical context of a descriptor:

flowers
BT plants

Some indexing systems have the practice of *upposting*, i.e., assigning a more general term in addition to the

descriptor that matches the scope of the document. In older subject heading lists and in book indexes, *see also* references to BTs are usually not provided, although some argue that such cross-references would be especially useful to children, who may have a hard time thinking of BTs if they find little information on a specific topic of interest. For example, if the subject of interest is Turtles, and all the books on that subject have been borrowed from the library, a child may not think to look under the broader term Reptiles.

The final code for semantic relationships in standard thesaurus format is RT, for *related term*. RTs are descriptors that are neither broader nor narrower than the selected term, but semantically related to it. Usually, RT relationships in thesauri are symmetrical: Gold RT Money; Money RT Gold. In older subject heading lists and in book indexes, RT is represented as *see also* in both directions. In light of recent studies of user persistence, showing that laypersons input one or two words to a search box and do not try synonyms or related terms if the search fails, RT references are essential to help users modify or expand their searches.

USE references are called *prescriptive*; they give an instruction to the indexer: You may not use this term; you must use the preferred term. BTs, NTs, and RTs are *suggestive* references; they ask the indexer to consider other terms that may be more appropriate for the document in hand.

James Anderson believes that indexers should not be constrained by controlled vocabularies. (He has expressed this opinion at conferences of the American Society for Information Science.) Anderson recommends that indexers assign the terms they feel are appropriate, and that *post-control* be done by a thesaurus editor: identifying synonyms and related terms, and coding them appropriately.

In indexing operations that use thesauri, indexers are (or should be) encouraged to propose new terms and semantic relationships through paper or electronic forms. The speed with which new terms are added to an indexing thesaurus affects users' perceptions of the quality of an index. Obsolete descriptors make a poor impression.

Some indexing operations use a combination of descriptors and *identifiers*. ERIC has descriptors for topical terms, and *identifiers* for proper names and newly minted terms. ERIC has been controlling (i.e., standardizing) its proper name identifiers, just as libraries establish name headings in authority files. Topical identifiers in ERIC, such as *burnout*, may later be upgraded to descriptors.

Some indexing systems have a combination of descriptors and *free terms*; the latter are uncontrolled terms made up by the indexer, usually for highly specific topics not represented in the thesaurus. Keywords made up by authors may also complement the descriptors assigned by indexers, as is mentioned in Wikipedia's article on “Subject indexing.”^[86]

A wide variety of thesaurus display formats and codes exist. These are explained in the NISO thesaurus standard.^[87] Translating one structure into another requires considerable training. Indexers as well as searchers—not to mention end users—may not comprehend the structure of complex thesauri, and this may affect the quality of indexing and retrieval.

Most members of indexing societies work on books, creating ad hoc syndetic structures, as was noted earlier. Workshops and tutorials about thesauri are increasingly being offered to such indexers.^[88] Thesauri may be constructed to enhance searching, i.e., they operate behind the scenes to add synonyms and, perhaps, related terms, to the search terms input by an end user. Studies of this practice have been reviewed by Shiri.^[89] Errors in, and omissions from, Shiri's references to thesaurus standards are in a review of his book.^[90] Hlava^[91] describes more recent standards for thesauri.

One of the rationales for indexing with a thesaurus is that this enhances consistency. Indexing consistency is considered a measure of indexing quality; this is discussed in the following section.

CONSISTENCY OF INDEXING

The fact that there are no rigorous theories or rules for indexing is reflected in the repeated finding that human indexing is highly inconsistent. A thorough review of the literature on indexing consistency published through 1975 was done by Leonard.^[92] Saracevic,^[93] who conducted an important study of the consistency of *searching*, cited more recent studies of indexing consistency and observed that in all phenomena related to words, consistency rarely exceeds 25%. This has become evident in the Internet environment, with social tagging, i.e., the assignment of "keywords" by laypersons, as is noted by Golub.^[94]

It is to be expected that terms assigned to electronic documents and images by those not trained in indexing will be highly inconsistent, but a low percentage of inter-indexer consistency is obtained even among professionals using a controlled vocabulary.

As Lancaster pointed out, there is no single correct set of index terms for a document.^[95] Indexing may be slanted to the purpose of an organization, in which case it is called *mission-oriented* indexing. Stibic's book on personal documentation for professionals^[96] takes this idea to the level of an individual. Index terms assigned by individuals may have nothing to do with "aboutness."

INDEXING THEORY AND AUTOMATIC INDEXING

One of the arguments for automatic indexing is that it is always perfectly consistent. In order to develop an

algorithm for automatic indexing, one must have a theory of human indexing. Most of the early algorithms for automatic indexing were statistically based: they theorized either that the most frequent words—excluding function words (e.g., *the*, *for*)—in a text are the content indicators, that the rarest words in a collection are significant, or that terms that are relatively more frequent in a single document than in a collection are significant. In research done for her dissertation, Weinberg^[97] tested all these theories and found that none of them yields results that match those of human indexing.

Another approach to automatic indexing is *positional*. It is based on the assumption that words in certain fields, such as titles and figure legends, are significant. Human indexers also look closely at such components of a document to select index terms. In fact, an international standard^[98] suggests doing precisely this.

Most automatic indexing is *extractive* (or *derivative*) indexing—pulling out terms from a recorded text, while human indexing entails *assignment* indexing—assigning terms from a controlled vocabulary, or composing index headings and subheadings without reference to a standardized list. Terms assigned by humans may not occur in the text at all, or they may appear as morphological variants of the standardized term, e.g., *registration* (a noun) for *register* (a verb in the text).

The main reason that automatic indexing algorithms fail to do a thorough job of content analysis is that a substantial percentage of humanly assigned index terms are not expressed in the text. Human beings are good at identifying concepts that are not explicitly named in a text; computers perform poorly in this regard.

Machine-aided indexing projects include those that have a computer select terms from a text and then consult a machine-readable thesaurus. If a synonym of the selected text term is the preferred term in the thesaurus, the computer assigns the latter to the document. An early system of this kind was implemented at the American Petroleum Institute;^[99] that system still serves as the basis of Machine Aided Indexer, a software package of Data Harmony. Hlava's *Taxobook* includes a screenshot of this software in which a pop-up window displays suggested terms for assignment to a text.^[100]

At information science conferences, the concern has been expressed that when computers suggest terms to indexers, these people will view the machines as oracles and will accept the suggestions without evaluation of their validity and without thinking of errors of omission.

Most of the early experiments on automatic indexing were done on journal articles. For a short while, a product was available whose developers claimed could index books automatically. Two prominent indexers tested the product and wrote such a critical review of it in 1994^[101] that the software was withdrawn from the market. Fifteen years later, a software package called TExtract received mixed reviews.^[102]

Book indexers use specialized software to assist them with the clerical aspects of indexing, but term selection and entry formulation are done by human beings. As Hirschmann observed in 2011, “Although we currently have several tools that assist in the preparation of back-of-the-book indexes, their preparation by computers without human intervention seems to be beyond their reach, at least for now.”^[103]

SUMMARY

Indexing is an intellectual activity with a practical purpose—fast retrieval of information. This activity began in ancient times and was highly developed in the Middle Ages.

The selection of content indicators is not subject to rigorous rules, but a scholarly terminology has been developed to characterize various aspects of indexing, such as its depth, and whether the index terms are pre- or postcoordinate. Theories of the mental process of indexing have been subjected to sharp criticism. Indexing remains an art.

FUTURE PROSPECTS

In the late 1990s, I was asked by an editor of *The Indexer* to predict the future of indexing after the millennium. Many of the observations made in that article^[104] remain true 25 years later.

The paperless society has arrived far less quickly than predicted. Despite improvements in the format of e-books, traditional books continue to be printed, and the nonfiction ones (at least) require indexes.

Automatic indexing experiments on journal articles have not eliminated human indexers and thesaurus designers. In fact, indexers have found new markets in developing indexes for websites, as many users recognize the limitations of keyword retrieval. Browne and Jerney^[105] produced a manual of website indexing that covers both concepts and software.

Anderson^[72] expressed the view that only important documents merit human indexing; the rest should be indexed by machine. In the Middle Ages, texts in the domain of religion were considered important and thus received detailed indexes. Today, medical texts are more likely to get thorough indexes, compiled by a professional. When the managers of an organization realize the advantages of fast and thorough access to information, they will pay for the compilation of indexes to printed corporate documents as well as websites.

The Semantic Web is a nice vision, but far from being implemented. As Moore wrote, “The semantic web has so far failed to live up to the initial hype surrounding it at the turn of the millennium.”^[106] Many of the writers on the

Semantic Web seem to have no background in library–information science. Northedge demonstrated that the origins of *topic maps*, which are considered a Semantic Web technology, lie in indexing.^[107]

There must be substantial advances in computational linguistics and natural language processing before the need for human indexing is eliminated. Artandi^[108] made a similar observation more than four decades ago: “. . . additional research is needed, both in linguistics and in the theory of indexing, to develop methods which will compare favorably with good human indexing.”

The recent founding of indexing societies in countries including China, South Africa, Germany, and the Netherlands—as documented in *The Indexer*.^[109]—provides evidence for the viability of the profession of indexing and for international interest in the principles and best practices of providing efficient access to information.

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India: Libraries, Archives and Museums

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Abstract

The National Library, Kolkata, is the largest single library that serves as the depository as well as the repository of all the published material of India. It also has built up a large collection of foreign publications. Besides, there are two other national libraries, namely, National Science Library, New Delhi and National Medical Library, New Delhi. There are a large number of academic, research, public and special libraries. Steps are being undertaken to modernize the libraries to meet the increasing demands of users. The National Archives of India (NAI), New Delhi, is the premier records repository of India. It has set up four regional archival repositories in Bhopal, Bhubaneswar, Jaipur, and Pondicherry. Each State has its own archives. There are a large number of college and university archives, corporate archives, religious archives, manuscript repositories, etc. India is a country that is rich in culture, heritage, science, and artifacts. Its museums and art galleries house a great cultural heritage. The National Museum, New Delhi, is the apex museum in the country. In addition to State museums and art galleries, there are a large number of art museums and galleries (noncommercial) that display India's rich heritage. India is also rich in biodiversity. The National Zoological Park, Delhi, is one of the finest zoological parks in India. Some of the best jewels of Indian wilderness include the Great Himalayan National Park, Dachigam National Park, Corbett National Park, Ranthambore National Park, Sundarbans National Park, and Kaziranga National Park.

INTRODUCTION

With a rich cultural heritage, India has one of the oldest civilizations in the world. With a population of 1.14 billion, India is the world's largest democracy. It has made tremendous socioeconomic progress during the last 62 years since its independence (1947). Today, India has become the tenth most industrialized country in the world.

of the Executive branch of the Union is the President. But the real executive power lies with the Council of Ministers that has the Prime Minister as its head. There are 28 states and 7 Union territories in the country. In the states, the Governor, as the representative of the President, is the head of the Executive body. However, Union Territories are administered by the President through an Administrator appointed by him.

Geography and Population

India covers an area of 32,87,263 sq km. It is bounded by the Great Himalayas in the north, the Indian Ocean on the east, and the Arabian Sea on the west. The population of India was 1,028,737,436 based on the 2001 census, but the projected population as of March, 1, 2008 is 1,147,677,000 (592,245,000 males and 555,432,000 females).^[1]

Government

India, also known as Bharat, is a Union of States. It is a Sovereign Socialist Democratic Republic with a parliamentary system of government. The constitutional head

History

The History of India begins with the birth of the Indus Valley Civilization, more precisely referred to as the Harappan Civilization. It flourished around 2500 B.C. in the western part of South Asia (present Pakistan and Western India). By 1500 B.C., the Harappan Civilization came to an end.

In the third century B.C., King Ashoka united large parts of India. During the reign of the Mauryas (322–185 B.C.E.), Hinduism (the major religion of India today) as a religion took a form that basically exists even now. It was during the eighth century that Islam first came to India. However, by the eleventh century, it had established itself as a strong

political force. The North Indian dynasties of the Lodhis, Tughlaqs, and others ruled India and were succeeded by the Mughal Kings.

From the mid-eighteenth century to the mid nineteenth century, India was gradually annexed by the British East India Company. The dissatisfaction with the rule of the East India Company resulted in a revolt that assumed the form of the 1857 Mutiny. This led to the First War of Indian Independence (1857–1858). After this war, India was incorporated into the British Empire completely and began to be directly administered by the British. During the first half of the twentieth century, a nationwide struggle for independence from British rule was initiated by the Indian National Congress. It was a long struggle. In 1947, the subcontinent of India gained freedom from British rule and the subcontinent was partitioned into the countries of India and Pakistan.

Education

The national level pattern exists with 12 years of schooling (8 + 2 + 2), consisting of 8 years of elementary education (that is, 5 years of primary and 3 years of middle school education for the age groups of 6–11 and 11–14 years, respectively), followed by secondary and higher secondary education, of 2 years of each, besides 2 years of preprimary education. The entry age in class 1 is 5+. Preprimary classes form age group 3 to 4. The higher secondary school certificate enables students to pursue studies either in universities or in colleges for higher education in general academic streams and in technical and professional courses.

According to the recent report of the National Sample Survey Organisation (NSSO), in 2005–2006 the literacy rate was 68.3%.^[2] Thus, goal of universal elementary education and total eradication of illiteracy has not been achieved so far. To achieve the goal would require higher level of investment in school education, especially at the elementary level.

The higher secondary school certificate enables students to pursue studies either in universities or in colleges of higher education, in general academic streams and in technical and professional courses. Today, India has a well-developed system of higher education, especially in engineering, technology, and management science.

The Emerging New India

India's greatest asset is a large pool of talent with more than 620 million people of working age. A large majority of its population is young, ambitious and dynamic, and has great aspirations. Its economy is growing rapidly. John F. Welch, Chief Operating Officer of General Electric, said "India is a developing country, but it is a developed country as far as its intellectual infrastructure is concerned. We get the highest intellectual capital per dollar here."^[3]

Toward the end of twentieth century, R. Mashelkar in his presidential address to the Indian Science Congress, made a prediction that "The next century will belong to India, which will become a unique intellectual and economic power to reckon with, recapturing all its glory, which it had in the millennia gone by. . . ."^[4]

LIBRARY AND INFORMATION PROFESSIONS, SYSTEMS AND SERVICES

Library Legislation

Pre-independence period

The first landmark in the pre-independence history of the public library movement in India was the enactment of the Delivery and Registration of Publications Act of Bombay Government in May 1808. Almost a century later, on January 31 1902, the Imperial Library Act was passed, creating the Imperial Library at Calcutta (now called Kolkata). In the history of library legislation, passage of the Kolhapur Public Libraries Act, 1945, remains a landmark event. It was the first public libraries act to be enacted in pre-independent India. This Act is now defunct.

Post-independence period (1947–2000)

The Imperial Library (Change of Name) Act, 1948 (Act no. 51 of 1948) was enacted on September 8, 1948. Thereafter, the Imperial Library came to be known as "The National Library". The Delivery of Books "and Newspapers" (Public Libraries) Act, 1954 [The delivery of Books (Public Libraries) Act, 1954: No. 27 of 1954, as amended by the Delivery of Books (Public Libraries) Amendment Act, 1956: No. 99 of 1956.] is another important Act. This is an Act that provides for Delivery of Books to the National Library, Calcutta, and to three other public libraries (Delhi Public Library, Delhi; Connemara Public Library, Chennai; and State Central Library, Mumbai).

Indian Copyright Act, 1957 and as amended in 1994/1995 governs matters related to copyright, including computer software. The act, as amended in 1994/1995, has incorporated many provisions keeping in view the changes in information technology. The Information Technology Act, 2000 (No. 21 Of 2000) [June 9, 2000] deals with issues concerning transactions carried out by means of electronic data interchange and other means of electronic communication, that fall under "electronic commerce."

"Through the good offices of the then Minister for Education, Avinaslingam Chettiar, a modified Bill was introduced in the state legislature which was passed as the Madras Public Libraries Act in 1948."^[5] Thus, due to the efforts of Dr S. R. Ranganathan, Father of Library Science in India, the Madras (Tamil Nadu) Public

Libraries Act was enacted in 1948. This was the first public libraries act to be passed in independent India.

The following public libraries acts were passed:

1. Madras (Tamil Nadu) Public Libraries Act (1948)
2. Andhra Pradesh Public Libraries Act (1960)
3. Mysore (Karnataka) Public Libraries Act (1965)
4. Maharashtra Public Libraries (1967)
5. West Bengal Public Libraries Act (1979)
6. Manipur Public Libraries Act (1988)
7. Kerala Public Libraries Act (1989)
8. Haryana Public Libraries Act (1989)
9. Goa Public Libraries Act (1993)
10. Mizoram Public Libraries Act (1993)

Twenty-first century

The following public libraries acts were passed:

1. Gujarat Public Libraries Act (2002)
2. Orissa Public Libraries Act (2002)
3. Uttaranchal Public Libraries Act (2005)
4. Rajasthan Public Libraries Act (2006)
5. Uttar Pradesh Public Libraries Act (2006)

Thus, through 2008, out of 28 states and 7 Union territories in the country, only 15 states have enacted library laws.

National Library and Information Services

Introduction

There are three national libraries of India, namely, the National Library, Kolkata; the National Medical Library, New Delhi; and the National Science Library, New Delhi. Other important libraries include the Central Reference Library, Kolkata that compiles *Indian National Bibliography* and *Index Indiana*. As mentioned above, Delhi Public Library (DPL), Connemara Public Library, Chennai and the State Central Library, Mumbai, are the depositories for the printed cultural heritage of India under the Delivery of Books “and Newspapers” (Public Libraries) Act. These depository libraries are not the national libraries in the strict sense of the term but form a very important part of the National Library sector because India is a vast, multi-lingual country with a rich written heritage in different Indian languages, including English. Thus, the need to cover the large country is realized through a network of national libraries and depository libraries.

There are a number of national documentation centers in different fields. These include the National Institute of Science Communication and Information Resources (NISCAIR) (formerly called Indian National Scientific Documentation Centre), the National Social Science Documentation Centre (NASSDOC) and the Small Enterprises National Documentation Centre (SENDOC). In this list,

we may also include the Defence Science Information and Documentation Centre (DESIDOC). These documentation centers were set up mainly to serve the fields of science, social sciences, small-scale industries and defense science respectively.

National Information System for Science and Technology (NISSAT), New Delhi, was launched in September 1977 as a national level coordinating and funding agency for creating information infrastructure in the area of Science and Technology. This agency was set up and supported by the Department of Scientific and Industrial Research, Government of India. NISSAT created and supported over 13 sectoral information centers, in specific subjects, such as leather, drugs, machine tools, food, etc. By 2004, the NISSAT program ended but the host institutions are continuing the centers with their own resources.

The University Grants Commission (UGC) is the apex body that monitors and funds higher education in the country. It established three information centers covering different disciplines as given below:

- National Centre for Science Information (NCSI) at Indian Institute of Science, Bangalore,
- National Social Science Information Centre (NASSIC) at M.S. University, Baroda (now called Vadodara), and
- National Information Centre (NIC) at SNDT Women’s University, Mumbai.

NCSI covers science and engineering, while NASSIC and NIC deal with the social sciences (such as economics, political science, education, and psychology) and other disciplines (such as sociology, women’s studies, home science, special education and library science) respectively.

Role of Government of India in relation to libraries

Under the Government of India (Allocation of Business) Rules,

the work pertaining to the Central Libraries of national importance, the Delivery of Books Act and publication of rare manuscripts is assigned to the Department of Culture. The Central Government, is not a lawmaker for a library system of the country as a whole as the subject ‘Libraries’ is included in the State list. However, the Central Government takes initiative to secure the voluntary cooperation of the State Governments and to promote coordinated development of national, and State Library system... Apart from maintaining and developing the libraries of national importance, the Central Government is giving financial assistance to libraries sponsored by voluntary organizations throughout the country.^[6]

The National Library, Kolkata

The National Library, India is the largest library in the country (see Table 1), located at Kolkata (formerly

Table 1 National Library Statistics as of 31 March 2006.

Books	2,402,579
Books in Indian languages	6,006,508
Maps	88,047
Manuscripts	3227
Books received under the D.B. Act	1,009,182
Current periodical titles	17,530
Bound volumes of periodicals	139,961
Newspapers (titles)	905
Bound volumes of newspapers	11,745
Indian Official Documents	499,509
Microfilms	5553
Microfiche	96,997
Shelf space	More than 45 km
Area of Belvedere Campus	30 acres

Source: http://nlindia.org/useful_info.html^[7].

Calcutta City). It is an institution of national importance under the "Department of Culture, Ministry of Tourism and Culture, Government of India." The major aim of the library is to collect, disseminate and preserve the printed material produced in the country. Another important aim of the National Library is to collect all the books published on India, in any part of the world, in any language. At the same time, it is also collecting foreign materials in different languages for the use of the country.

The National Library receives books and periodicals in almost all the Indian languages under the Delivery of Books and Newspapers (Public Libraries) Act 1954 (D.B. Act). It also has

an invaluable collection in English language, because of the systematic collection development by Calcutta Public Library as well as by the Imperial Library. Way back in 1848 itself, an attempt was being made to acquire journals issued by the foreign learned institutions. Serious works were purchased in large numbers than the light literature. Now a days also the same policy is being continued.

It has a strong collection in the humanities, British and Indian history and literature.^[8] Digitization of books is a useful project, undertaken by the Library. To date, 6600 selected books in Indian and English languages have been scanned and stored on 548 CDs, covering a total of over 2,500,000 pages.

The library has separate reading rooms in all of its four buildings, and for each language division, the Foreign Language Division, Foreign Official Documents, Rare Books, Maps and Prints, Science and Technology Division, and Asutosh Collection. Any person above 18 years can use the reading room facilities.

Limited number of books are lent out to the readers (local members) under certain terms and conditions. To use this facility, one has to become a member of the Lending Division of the library. Outstation persons (members living outside Kolkata) are allowed to borrow books through post.

Selected lists of reading materials or bibliographies are prepared by the library on request. Special bibliographies are also compiled when exhibitions are held. Compilation of exhaustive bibliographies is underway on special topics, such as Indology. The library is responsible for providing bibliographies and/or bibliographic statistics to national and international organizations.

Central Reference Library (CRL), Kolkata

The Central Reference Library is a subordinate office of the Ministry of Culture, Government of India. It was carved out of the National Library, for the compilation of the *Indian National Bibliography* and *Index Indiana* (an index to selected articles appearing in current language periodicals).

National Medical Library, New Delhi

The National Medical Library (NML) aims to provide wide and efficient library and information services to the health science (HS) professionals in India. The Library is mainly a reference library in the field of Medical and Allied Sciences. It is open for consultation by Medical, Paramedical and Allied Professionals. The National Medical Library is considered one of the largest medical libraries in South Asia. It has 360,000 volumes of books, reports, bound volumes of journals and other literature and adds about 3000 books and serials every year. It subscribes to 2000 current periodicals. NML is also the National Focal Point of HELLIS (Health Literature Library and Information Service) Network set up by WHO in Southeast Asia in 1982.^[9]

NML has established a network of health science libraries in India. For this purpose, it has identified six Regional Medical Libraries (RML) and eight Resource Medical Libraries (RL) in the country. All RMLs and RLs have been provided with equipment such as micro-computers, CD-ROM Drives, the MEDLINE database and a photocopier. A grant-in-aid has been provided to each RML and RL to strengthen their document collection.

National Science Library, New Delhi

The National Science Library (NSL) was set up in 1964 as a part of Insdoc (now named National Institute of Science Communication and Information Resources (NISCAIR)). NSL aims at acquiring all-important Science and Technology publications published in the country and strengthening its resource base for foreign periodicals by acquiring the journals on CD-ROM or other electronic form as far as possible. The library is open to the public. Individuals and institutions can become members to use its collection.

NSL has a collection of over 200,000 volumes including monographs and bound volumes of journals in the fields of science and technology. E-Resources include

CD-ROM databases of primary and secondary sources and E-Journals. NSL has an Electronic Library Division with a collection of more than 5000 foreign journals, conference proceedings, etc. and a large number of databases on CD-ROMs. Services include Readers' Service, Technical Query Service, Copying Service, Inter-Library Loan Service, e-Journals Access (The library provides free access to electronic journals from 13 leading international publishers).

The Indian Agricultural Research Institute Library, New Delhi

The Indian Agricultural Research Institute Library (IARI Library) is a focal point for collecting, organizing and disseminating agrobiological information generated within the country as well as abroad. Due to its rich collection and services, it may be regarded as a national library in the field of agriculture. However, it has not been formally designated as such.

IARI Library has the largest collection in the field of agriculture and is considered a primary library in this field in India. The Library has over 600,000 highly specialized research publications on agriculture and related sciences. The collection is growing annually at the rate of 8000 to 9000 documents. The Library has 10,500 serial files, and 4000 current serials are being procured from 80 countries through subscription, gifts and exchanges.^[10]

National Institute of Science Communication and Information Resources, New Delhi

The National Institute of Science Communication and Information Resources (NISCAIR) came into existence on September 30, 2002 through the merger of the National Institute of Science Communication (NISCOM) and the Indian National Scientific Documentation Centre (INSDOC) (Set up in 1952). Its mission is to become the

prime custodian of all information resources on current and traditional knowledge systems in science and technology in the country, and to promote communication in science to diverse constituents at all levels, using the most appropriate technologies.^[11]

NISCAIR is basically concerned with collection, storage, publication and dissemination of science and technology information. It is a premier institution of information science engaged in dissemination of information in the field of S&T.

National Social Science Documentation Centre, New Delhi

The Indian Council of Social Science Research (ICSSR) was set up in 1969 as an autonomous organization to

promote research in social sciences in the country. In 1970, ICSSR established the Social Science Documentation Centre that was renamed the National Social Science Documentation Centre (NASSDOC) in 1986. It has a rich collection of reference sources, bibliographies, 5000 doctoral theses, 3500 research project reports (funded by the ICSSR) and 12,500 books and documents. NASSDOC has created a number of databases and information locating tools.

Defence Scientific Information and Documentation Centre (DESIDOC), Delhi

DESIDOC functions as a central information resource for DRDO (Defense Research and Development Organization). It provides science and technology information, based on its library and other information resources, to the DRDO headquarters as well as its various laboratories located at various locations in India. DESIDOC maintains an excellent library in the defense sector. It has more than 262,000 documents and provides document supply to its users quite fast. The library management activities have been computerized. More than 1000 DRDO scientists (and a few others) are provided monthly SDI (Selective Dissemination of Information) services, based on about 10 CD-ROM databases. It also brings out a number of publications to serve its users.

Small Enterprises National Documentation Centre, Hyderabad

The Small Enterprises National Documentation Centre (SENDOC), Hyderabad, was set up in 1971 as an organ of the SIET Institute. This Institute is now called National Institute for Micro, Small and Medium Enterprises. The Centre serves as a national bibliographic center to meet the information needs of micro, small and medium enterprises.

Inter-library cooperation

Today, there are several library networks that have come into existence to advance inter-library cooperation. A number of library networks were originally sponsored by NISSAT (National Information System for Science and Technology), such as ADINET (Ahmedabad Libraries Network), BALINET (Bangalore Library Network), BONET (Bombay Libraries Network), CALIBNET (Calcutta Libraries Network), DELNET (Delhi Libraries Network, now Developing Library Network), MYLIBNET (Mysore Libraries Network) and PUNENET (Pune Libraries Network). MANLIBNET (Management Library Network) was formed by libraries in the field of management.

A number of consortia have been formed. These include Indian National Digital Library in Engineering Sciences and Technology (INDEST), Council of Scientific

and Industrial Research Consortium, UGC-INFONET (established by INFLIBNET Centre links more than 172 universities across the country) and ICICI Virtual Information Centre. One of the major activities of these consortia is resource sharing.

National planning

Planning at the national level is done through five-year plans. At present, XI Plan (2007–2012) is in operation. The following thrust has been identified by the Ministry of Culture as a major Thrust Area for the XI Plan (2007–2012):

Overhauling the library sector to meet the needs of a knowledge society has been found to be the need of the hour by the Ministry... The recommendations of the National Knowledge Commission will be taken into account while formulating the XI Plan proposals in the Library sector.^[12]

With the efforts that are going on, it is hoped that it will bring major changes in the library sector, including the national libraries.

Academic and Research Libraries

Size of the sector

As of March 31, 2006, 355 universities and 18,064 colleges existed in the Higher Education sector. During the academic year 2005–2006, the total enrolment in all courses and levels in regular stream had been 11,028,000 including 4,466,000 female students (40.5%). The strength of the teaching faculty in universities and colleges was 488,000. The number of research degrees (Ph.D.) awarded during 2004–2005 was 17,898.^[13] The above data shows that the higher education sector is a massive one.

Main players in the higher education sector

The University Grants Commission (UGC) is “responsible for coordination, determination and maintenance of standards, release of grants.” Professional Councils are “responsible for recognition of courses, promotion of professional institutions and providing grants to undergraduate programs and various awards.” Central Government is “responsible for major policy relating to higher education in the country. It provides grants to the UGC and establishes central universities in the country.” State Governments are “responsible for establishment of State Universities and colleges, and provide plan grants for their development and non-plan grants for their maintenance.”^[14]

Higher education—history

Problems of educational reforms were reviewed by several commissions and committees, notably the University Education Commission (1948–1949) and the Secondary Education Commission (1952–1953). Some steps to implement the recommendations of the Commissions were taken and a Resolution on Scientific Policy was passed under the leadership of Jawaharlal Nehru, the then Prime Minister of India. As a consequence of the resolution, development of science, technology and scientific research received special emphasis. The Education Commission (1964–1966) was appointed to advise the Government on the national pattern of education and other matters. Its recommendations on education are a landmark in the history of education in India. A new education policy (NPE) was adopted by the Parliament in 1986. A revised Programme of Action (POA) was placed in the Parliament on August 9, 1992, and approved by it. The eighth five-year plan (1992–1997) was prepared keeping in mind 1986 NPE and 1992 POA.

The National Knowledge Commission (NKC) is a high-level advisory body to the Prime Minister of India, formed with the objective of transforming India into a knowledge society. In 2007, it gave its recommendations for higher education.^[15] The recommendations of the NKC are far reaching in nature. For example, it recommended creation of 50 National Universities that can provide education of the highest standard. These can result in revolutionary changes leading to excellence in higher education.

College libraries

A college, in general, is an institution of higher learning that offers a three-year degree after higher secondary school. However, most professional degrees are of four-year duration. Some colleges offer postgraduate courses of two-year duration. Usually, research is the prerogative of universities rather than colleges.

Colleges in India are regarded as the forerunners of universities. The same is true for college and university libraries as well. Collections of college libraries usually consist of books and periodicals. They may have some nonbook materials. However, the situation is changing. College libraries are increasingly acquiring nonbook materials. Most of them do not provide open access. The majority of the libraries use the *Dewey Decimal Classification* system and *Anglo-American Cataloging Rules*. As regards services, they render lending service, help to users in the location of materials and the use of the library catalog, and provide library orientation to new members. Some college libraries also provide bibliographical services. Teachers are usually provided with intensive reference service and inter-library loan. As regards the

photocopying service, it is usually provided by a private vendor appointed by the authorities under the conditions laid out by the authorities. The vendor may set up his machine within the library or anywhere on the college campus.

In recent years, many college libraries have automated their operations. The University Grants Commission (UGC) provides one-time grants for computerization of college libraries. In Delhi, a large number of college libraries have been computerized. Recently, the University of Delhi provided 40 computers to each college library affiliated with it, along with network facility and access to databases available at Delhi University Library System. Thus, faculty and students of colleges have free access to the total resources of the Delhi University Library System. Some of the colleges are using IT to provide highly specialized services. For instance, Farook College, Kozhikode, has set up the Digital Talking Book Library for the benefit of visually challenged students and named it "Insight."^[16] College libraries in metropolitan towns are well developed. However, libraries in small towns in economically underdeveloped states are in a poor state of development. UGC has recognized some leading colleges as autonomous colleges that get special assistance from UGC. Libraries attached to autonomous colleges are especially well equipped and maintained.

University libraries

The University Grants Commission. The University Grants Commission (UGC) was set up by the Central Government in 1953. However, in November 1956 the UGC was formally established through an Act of Parliament as a statutory body of the Government of India for the coordination, determination and maintenance of standards of university education in India. The UGC is the only grant-making agency in the country that has been given two responsibilities, namely: 1) providing funds and 2) coordination, determination and maintenance of standards in institutions of higher education. It also advises the union and state governments on measures to be taken in higher education.

UGC formulates rules and regulations for overall teaching and research at higher education. It also looks after the academic libraries (sets various standards for library education, library staff, library services, etc.). Committees are set up by the UGC from time to time for the support of higher education in general and the library services in academic (university and college) libraries in particular.

The UGC Panel on Library and Information Science is a standing body that examines and makes recommendations about issues and library problems. In 1957 UGC appointed the Committee on University and College Libraries to advise it regarding functioning and management of libraries. UGC adopted many of the recommendations from the

report of that Committee as norms for college and university libraries.

Present Scenario. University libraries in India have developed steadily but have not succeeded fully in their objective to build up sound library collections as a base for providing satisfactory services. However, the scene is changing due to the application of information and communication technology (ICT).

The UGC meets most of the total expenses of central universities. However, in the cases of state universities and institutions deemed universities, UGC adds to their funds for various development activities under the five-year plans. Libraries attached to central universities receive large financial support compared with libraries of state universities. Very often, state university libraries all over the country are starved of funds.

Information and Library Network (INFLIBNET Centre), has been a boon to university libraries. It is an autonomous Inter-University Centre of the UGC. It has supported many university libraries for creating computer facilities, databases and automation of libraries. It has also given training on a large scale to library staff in computer application, thus preparing them for modernization of libraries and their operations. The UGC-Infonet Digital Library Consortium launched by INFLIBNET Centre provides current as well as archival access to

more than 4500 core and peer-reviewed journals and nine bibliographic databases from 23 publishers and aggregators in different disciplines. So far 120 Universities out of 171 that come under the purview of UGC, have been provided differential access to subscribed e-resources.^[17]

University libraries have participated very actively in information and library networks that have been set up in recent years and benefitted considerably from these networks.

The above mentioned consortium is a program wholly funded by the UGC and executed by the INFLIBNET (Information and Library Network) Centre, Ahmedabad. The benefit of subscription to e-resources will soon also be extended to colleges, to begin with the College for Potential with Excellence (CPE). The Consortium also "plans to launch its "Associate Membership Programme" wherein private universities and other research organizations, would be allowed to join the Consortium for selected e-resources."^[18]

Public Libraries

The nineteenth century

The enactment of Delivery and Registration of Publications Act of Bombay Government in May 1808 is considered as the first landmark in the pre-independence history

of public libraries in India. Calcutta Public Library was established in 1836. It was not a Government institution. It was being run on a proprietary basis. The Calcutta Public Library is regarded as the first public library in this region of the country. Khuda Bux Oriental Public Library, Patna, was established in 1875. In 1969, it was declared, an institution of national importance under an Act (the Khuda Bakhsh Oriental Public Library Act, 1969) of the Parliament. On March 22, 1890 the foundation stone of Connemara Public Library was laid at Madras (now Chennai) and on December 5th 1896, it was formally opened. It is today, an excellent library with a rich collection and is heavily used by the public.

The Imperial Library was formed in 1891 by combining a number of Secretariat libraries. The most important one was the Library of the Home Department. However, the use of the library was restricted to the senior officers of the Government.

By the middle of nineteenth century, the towns of Bombay, Calcutta and Madras had subscription libraries, established with the active support of Europeans. By the end of nineteenth century,

all the provincial capitals and many district towns had so-called public libraries. In addition many princely states had public libraries in their capitals (e.g., Indore, Travancore-Cochin, Patiala). However, in general the masses did not take full advantage of those institutions.^[19]

The beginnings of the “public library movement in India can be traced to 1885, when the Indian National Congress was founded. This was the time when national awakening was taking place, leading to cultural renaissance. The Swadeshi movement was taking root.”^[19] Towards the end of the century, political, economic, and social pre-conditions necessary for the origin of public libraries were coming into being due to the awakening of national pride in national culture and heritage. National leaders, such as Bipinchandra Pal and Lala Lajpat Rai were responsible for this awakening.

The twentieth century (up to 1947)

On January 31, 1902, the Imperial Library Act was passed. This is considered as another landmark in the pre-independence history of public libraries in India. The Imperial Library, then located at Metcalf Hall, Calcutta (now called Kolkata) was formally opened to the public on January 30, 1903. The aims and objectives of the Imperial Library, were defined in a Notification in the “Gazette of India.”

It is intended that it should be a library of reference, a working place for students and a repository of material for the future historians of India, in which, so far as possible, every work written about India, at any time, can be seen and read.^[20]

Maharaja Sayajirao III, Gaekwar of Baroda, an enlightened ruler, thought of establishing public libraries along modern lines throughout the State of Baroda. Therefore, he invited W.A. Borden, the Librarian of the Young Men’s Institute, New Haven, Connecticut, to fulfill his dream. During the period of Borden’s stay, 1910–1913, he established the Central Library and initiated a public library system. The modern public library movement in India began in Baroda during the first decade of the century, due to the efforts of Borden, who was fully supported by the enlightened Maharaja.

In the year 1914, a public Library was established in the Seshadri Iyer Memorial Hall at Cubbon Park, Bangalore. In 1966, this library was taken over by the Government of Karnataka and was given the status of the Central Library. However, in 1986, this library was redesignated as State Central Reference Library.

Post-independence period (twentieth century, from August 15, 1947 onward)

After independence, the Government of India changed the name of the Imperial Library to the National Library, through an enactment of the Imperial Library (change of name) Act, 1948. Delhi Public Library was started initially by Government of India in 1951, as a UNESCO project. The purpose of the Library was to serve as a model public library for Asia. It is claimed that today, Delhi Public Library is the biggest Public Library System in India and also one of the busiest Public Libraries in South East Asia.

Public library scene in the states

The public library scene is briefly described for five states that have developed, comparatively speaking, better public library systems. These are Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, and West Bengal. In the state of Andhra Pradesh, there are nearly 5000 public libraries including 2348 village libraries.^[21] The Department of Public Libraries of Karnataka State has established a large network of public libraries consisting of 3778 libraries including 3251 Gram Panchayat (rural) Libraries. There are, in addition, 42 aided libraries.^[22] In Kerala State, the State Central Library is a separate independent Department, functioning in isolation. Kerala State Library Council looks after public libraries in the state. The Government releases grant-in-aid to 3458 public libraries of different categories through Kerala State Library Council. Library Service is provided to the public cent per cent in cities and towns and 90% in villages.^[21] The public libraries in Kerala are well developed. The coverage of rural population is of a very high order, compared with other states. The State of Tamil Nadu has set up a network of public libraries. The total number of public libraries is 3751 including 1492 village libraries. Besides this, there are three Government aided libraries.^[23] West Bengal is the only state in India having a separate Minister

in-charge of library services. It has 2465 public libraries including 2209 rural libraries.^[24] The state has a fairly well-developed public library system.

Raja Rammohun Roy Library Foundation, Kolkata

The Raja Rammohun Roy Library Foundation (RRRLF), established in 1972, is a central autonomous organization. It is the nodal agency of the Government of India for supporting public library services and systems as well as promoting the public library movement in the country. It also functions as an advisory and consultancy organization and a funding body for public library development in India. Since its inception, the Foundation has “assisted 31,274 libraries in the country under various schemes,” such as construction of library buildings, increasing book stock, centenary celebrations, preservation, TV-VCP, computer application in libraries, children section, mobile library services, public library research, etc.^[25]

The twenty-first century

Computer Applications. The public libraries are being modernized. Toward this aim, they are undergoing the process of computerization. Computerization of public libraries started in early 1990s. Initially, it was slow and now it has picked up. RRRLF has played a significant role in computerization of public libraries. It has provided computers to all state central libraries and district central libraries. For instance, Delhi Public Library started automation of library activities in the year 1995 by installing Computers.^[26] During the last decade of the twentieth century, computerization was started at Connemara Public Library. However, it was in 1998 that 2 servers and 12 nodes were added. The staff input 350,000 records.^[27] In June 2003, OPAC (Online Public Access Catalog) was introduced. A touch screen system for library information was also added. An Internet Browsing center, a separate CD Room Section and book bar code were introduced in 2005. Now renewal of books due can be done online. Computerization facility has been “extended to 17 District Central libraries in Tamil Nadu. . . The remaining 12 District Central Libraries will be provided with computers in 2004–2005.”^[28] The Directorate of Library Services, West Bengal, has created a database of the Public Libraries of West Bengal. All data regarding the Government Sponsored Public Libraries is available in the database.

Public Libraries Acts. In twenty-first century, five states have enacted public libraries acts. These are Gujarat Public Libraries Act (2002), Orissa Public Libraries Act (2002), Uttaranchal Public Libraries Act (2005), Rajasthan Public Libraries Act (2006), and Uttar Pradesh Public Libraries Act (2006). Thus, today out of 28 states and 7 Union territories in the country, only 15 states have enacted library law.

Table 2 Penetration of public libraries.

Category (number)	Library type (number)	Coverage
States and Union Territories (35)	State Central Libraries (28)	80.0%
Districts (592)	District Libraries (451)	76.0%
Talukas ^[a] (3987)	Taluka Libraries (501)	2.5%
Villages (587,226)	Rural Libraries (28,820)	4.9%

^aA taluka is an administrative division forming part of a district within a state or union territory.

Source: Cited in Das and Banwari.^[29]

Penetration of Public Libraries in India. From Table 2, we may conclude that urban areas are comparatively well covered by libraries but talukas (sub-areas below district level) and rural areas are almost totally neglected. This data is quite old. Today, there may be around 100,000 public libraries (an estimate). Now, there is a greater stress on development of public libraries in rural areas. In recent years, a number of schemes for public library development in talukas and villages have been introduced.

Rural Libraries. “Lack of resource is another serious bottleneck in developing library services. The condition of the majority of rural libraries, particularly, in the heartland of India, is extremely miserable.” The situation of majority of rural public libraries is indeed truly miserable. This is in spite of the efforts of a national agency like RRRLF and state governments. “On analysing the trend of assistance rendered by Raja Rammohun Roy Library Foundation in the course of 28 years, it is found that the lion’s share of assistance . . . in the current year goes for the rural people of our country.”^[21]

Till recently, public libraries in rural areas were neglected as an area for library growth and development. But now, these areas are getting special attention from the center and state governments. For instance, in Tamil Nadu, a District Rural Development Agency (DRDA) has been set up in each district. One of the DRDA’s aims is to establish rural libraries.

The School Education Minister of Tamil Nadu announced the State Government’s proposal “to set up about 12,400 rural libraries within the next five years under the scheme ‘Anaithu Grama Anna Marumalarchi Thittam’ to benefit the rural population.”^[30] Similar schemes are being implemented in rural areas of different states. Nongovernmental organizations, such as Rajiv Gandhi Foundation have been quite active in this regard.

Role of nongovernmental organizations

Maharashtra and West Bengal have a long tradition of voluntary organizations providing public library services. “From 1830s, 100s of voluntary organizations came up in

the States, more so during the freedom struggle this led to establishment of 1000 of subscription libraries which charged annual subscription and a deposit to finance the library.” The Manipur Government passed the library legislation in 1967 and declared subscription libraries as public libraries. The Government of West Bengal passed its library law in 1979 and covered most of the subscription libraries as sponsored libraries.^[21]

Nongovernmental organizations are becoming more active in recent years, aiming to empower women, rural areas and backward areas through public libraries. One such example is that of the Rajiv Gandhi Foundation (established in 1991). The Foundation has nurtured a countrywide village library program since 1993. “In all, since 1993, RGF has established a total of 1444 libraries in 22 states, which includes 1344 village and 100 slum libraries.”^[31]

National policy

In October 1985, the Government of India constituted a committee under the chairmanship of D.P. Chattopadhyaya to formulate the National Policy on Library and Information System (NAPLIS). The final report was submitted, via a letter of May 30, 1986. It is an excellent report. However, the national policy was never approved by the Parliament. Another report that deserves special mention was submitted by the National Knowledge Commission, appointed by the Government of India. In its report on libraries dated December 7, 2006, it recommended setting of a National Commission on Libraries, modernizing of library management, encouragement of greater community participation in library management, promotion of information and computer technology (ICT) applications, etc. Some of the steps have already been taken to implement the recommendations. However, there is a lack of public library policy at the national level that could give direction to library movement in the country.

Current priorities

The following area has been identified by the Ministry of Culture, Government of India, as a major Thrust Area for the XI Plan (2007–2012): “In the Public Library sector, the main thrust will be on Rural Public Libraries. Existing plan schemes of RRRLF will be enlarged and intensified during the XI Plan.”^[12] With the efforts that are ongoing, it is hoped that this Plan will bring major changes in the public library sector.

School Libraries

Educational system

Introduction. The Indian educational system is regarded as the second-largest system in the world in terms of the

number of students, teachers, and institutions. The system is also highly diversified.

Size. The *All India School Education Survey*, seventh in the series of All India Educational Surveys (AIESs), was conducted with reference date as 30 September 2002. The survey covered 1,031,000 schools functioning in 587,000 villages and around 5300 towns/urban areas. It also provided information about 5.53 million teachers imparting education to more than 200 million pupils in the country. The survey is comprehensive in its scope. There are 883,667 elementary (primary and upper primary), 90,741 secondary schools and 43,869 higher secondary schools in the country.^[32] Thus, the Indian school education system is quite large.

National education policy

Today, the Central Government continues to play a

leading role in the evolution and monitoring of educational policies and programs, the most notable of which are the National Policy on Education (NPE), as updated in 1992 envisages a National System of education to bring about uniformity in education. . .

The National System of Education as envisaged in the NPE is based on “a national curricular framework, which envisages a common core along with other flexible and region-specific components.”^[33] The country is certainly moving towards the goals. The scheme of Navodaya Vidyalayas, aims to promote excellence along with equity and social justice. It has been a trend setter and a great success.

Library facilities

Salient findings of the *Seventh All India School Education Survey* (7th AIES)^[32] regarding library facility in Secondary and Higher Secondary Schools are as follows: 70,090 (77.24%) secondary schools and 39,301 (89.59%) higher secondary schools have library facilities. 73.99% of rural secondary schools have library facility, whereas 84.85% of urban secondary schools have library facility. Similarly, 87.21% of rural higher secondary schools have library facility as against 92.17% of urban higher secondary schools. In secondary and higher secondary schools with a library facility a proportion of 14.98% secondary schools and 41.03% higher secondary schools have full-time librarians. Only 10.07% secondary schools and 12.49% higher secondary schools have part-time librarians. In secondary schools with a library facility, the largest proportion of schools, i.e., 32,615 (46.53%) schools have book strength of up to 500 books. Only 2700 (3.85%) schools have book strength of more than 5000 books. Among higher secondary schools with library

facility, the largest proportion of schools, i.e., 10,126 (25.77%) schools have a book strength of 2001 to 5000 books. Only 7190 (18.29%) schools have a book strength of more than 5000 books.”^[32] As per 7th AISES, “70,090 (77.24%) secondary schools and 39,301 (89.59%) higher secondary schools have a library facility.”

These figures are quite impressive. However, the majority of these libraries do not meet the minimum standards for a school library. Only 46.53% of secondary schools have a library facility housing up to 500 books. This indicates the existing situation.

As per 7th AISES, “70,090 (77.24%) secondary schools and 39,301 (89.59%) higher secondary schools are having library facility.” The figures are quite impressive. The data must be taken with a pinch of salt as the library facilities in a large majority of libraries are inadequate.

The data indicates that a large majority of so-called school libraries do not have a full time librarian. The size of collections in the majority of the libraries is meager. The usual library services provided by school libraries include circulation and some reference service. Library use instruction provided to students is rare.

The best schools in India are mainly those that come under the category of public schools, members of Indian Public School's Conference. These schools have excellent library facilities, usually with individual libraries for the junior and senior classes. Their libraries are computerized with access to the Internet for students and faculty. The collection usually ranges from 30 to 40 thousand volumes, including multimedia collections. They provide a variety of services to students and teachers, such as reference service, circulation of materials and often, some sort of library use instruction is also provided.

Disparities in Facilities and Standards. There are wide disparities in facilities and standards among different types of schools, varying from rural to urban areas and from state to state. Schools in rural areas are a neglected lot. Some states have done better than others. The “public schools” designed after the British models, along with schools called Navodaya Vidyalayas (established by the central government) and Kendriya Vidyalayas (also called central schools) are well-equipped, well-staffed and adequately supervised. However, government rural or municipal schools are ill-equipped, understaffed and poorly supervised. There are a variety of private schools; some are quite good, and others are poor. On the whole, primary education has been in a very bad shape. The above situation is equally applicable to school libraries.

Special Libraries

History

The history of special libraries in India is interrelated with the growth of research institutions and learned

societies. It was only after World War I that learned societies and research institutions began to be established. As a consequence, research activities began to receive a boost at that time. Thus arose the need for improved library facilities. In order to meet the demand for improved library services and facilities, special libraries were established.

Several learned societies or research institutions and their libraries were established as early as the eighteenth century. The Survey of India, The National Survey and Mapping Organisation of the country under the Department of Science and Technology, Government of India, was set up in 1767. It is the oldest scientific department of the Government of India and is India's principal mapping agency. The Asiatic Society, Calcutta, formed in 1784, is an institution of national importance. It is the oldest institution of learning. It has made a tremendous contribution to the growth and development of antiquarian, scientific and literary institutions in India.

Several others were established in the latter part of the nineteenth or early twentieth centuries, before World War I. The Geological Survey of India (GSI), established in 1851, is considered one of the oldest surveys in the World. It is a premier organization of Earth Science Studies with a strength of 2100 geoscientists and technical professionals. The Khuda Bakhsh Oriental Library, Patna, was established in 1875 by Md. Khuda Bakhsh in 1891. Now, this library is an institution of National Importance. The Botanical Survey of India was formally constituted on February 13, 1890. The Survey, with its headquarter at Kolkata, co-ordinates the botanical works of regional centers and botanical explorations. In 1911, the Government of India established the Indian Research Fund Association (IRFA) for the “purpose of sponsoring and coordinating medical research in the country.”

In 1949, It was renamed as the Indian Council of Medical Research (ICMR) with expanded functions. Today, the ICMR is funded by the Government of India through the Ministry of Health and Family Welfare.^[34] It is the apex body in the field of biomedical research.

After World War I special libraries grew more rapidly. The Indian Council of Agricultural Research (ICAR) was established in 1929 along with associated committees for research. ICAR network is a vast one that includes Institutes, Bureaux, National Research Centres and Project Directorates.

It employs, a manpower of about 30,000 personnel. Out of which nearly 7000 consist of research and management personnel. There are thirty-eight Agricultural Universities (SAUs) that employ about 26,000 scientists for teaching, research and extension education.^[35]

Second World War II provided an impetus to the development of scientific and industrial research activities. Thus, the Council of Scientific and Industrial Research

(CSIR) was formed in 1942. This is considered a turning point in the history of scientific and industrial research in India. Today, "it has a network of 38 laboratories/institutes, 39 outreach centers, employing 4555 scientists and 8001 technical persons." CSIR is "amongst the largest R&D organizations in the world for scientific and industrial research"^[36] The Indian Atomic Energy Commission was set up in Aug 1948 in the Department of Scientific Research, Government of India. The Department of Atomic Energy (DAE) was established on August 3, 1954 under the direct charge of the Prime Minister. The Defence Science Organization was set up in 1949. Defence Research and Development Organization (DRDO) was formed in 1958 from the amalgamation of various defense organizations. Today, DRDO has 50 laboratories and is engaged in developing Defense technologies. At present, the Organization employs over 5000 scientists and about 25,000 other scientific, technical and supporting personnel.

The Sahitya Akademi, New Delhi, was formally inaugurated in 1954. Indian Council of Social Science Research (ICSSR) was established in the year of 1969 by the Government of India to promote research in social sciences in the country. Central Institute of Indian Languages was established in 1969, to coordinate the development of Indian Languages. Under it, there are 12 centers and 7 regional centers.

The National Information System in Science and Technology (NISSAT) was launched with the assistance of UNESCO in September 1977. It gave a push to special libraries through the establishment of sectoral information centers in various fields of research. Today, there are 13 sectoral information centers in different areas of science and technology, such as leather technology, food technology, marine science etc., although NISSAT itself ceased operations in 2004.

The Indira Gandhi National Centre for Arts (IGNCA), New Delhi, is a multilingual, multimedia, and multidisciplinary organization. It was set up in 1985, as a Centre in the field of the arts. The Centre is a premier research and academic institute engaged in preservation and documentation of Indian Cultural Heritage. The Kala Nidhi Division of the Centre is "responsible for preservation and dissemination of Indian Cultural Heritage Knowledge Resources."^[37]

The above description shows that it was only after independence (1947) that a large number of scientific laboratories, research organizations and learned societies were set up. In the same time period India has experienced rapid industrialization. This resulted in growing demand for library facilities and services. Thus, special libraries were established to meet growing demand. The majority of them came into being during the last six decades or so.

The institutions and learned bodies that excel in their field of specialization usually have excellent libraries attached to them.

Health sciences libraries

There are three leading libraries specializing in health sciences. These are the National Library of Medicine, the All India Institute of Medical Sciences Library, and the National Documentation Center of National Institute of Health and Family Welfare. All of them are located in New Delhi.

Another institution also has an excellent health sciences related library. The CDRI (Central Drug Research Institute) Library, Lucknow, established in 1951, is a modern and well-managed Library, with a rich collection. It has systematically built up a specialized collection of reading materials consisting of books, periodicals, reference works, serials and various macro and micro-documents in the areas of Biomedical Research and Drugs and Pharmaceuticals. NICDAP (National Information Center for Drugs and Pharmaceuticals), a Sectoral Information Centre on Drugs and Pharmaceuticals came into being in 1977 at CDRI Library.

Food Science and Technology Information Services (FOSTIS) is the central library of Food Technological Research Institute (CFTRI), Mysore and India's National Information Centre for Food Science and Technology (NICFOS). The library is one of the major information resource centers serving the food processing profession with an extensive collection of print and non-print materials.

The National Medical Library (NML) has set up a network of health science libraries in India. It has with the support from WHO, identified six Regional Medical Libraries (RML) and eight Resource Medical Libraries (RL) in the country. A grant-in-aid was given to each RML and RL to strengthen their document collection.^[38]

Law libraries

There are three types of law libraries: academic, judicial and research law libraries.

The leading academic law libraries include Bangalore University College of Law Library, Government Law College (Mumbai) Library, Bombay University Library, Calcutta University Law Library, Delhi University Law Library, Kashmir University Law Library, Madras Law College Library, NALSAR University of Law (Hyderabad), and the National Law School of India University (Bangalore). Delhi University Law Library is regarded as one of the best law libraries in the country.

Recently established National law school libraries are modern, well equipped and provide wide-ranging services. Libraries attached to NALSAR University of Law (Hyderabad), National University of Judicial Sciences (Kolkata), National Law University (Jodhpur), Hidayatullah National University of Law (Raipur) and Gujarat National Law University (Gandhinagar) have good legal collections.

National Law School of India (NLSIU), Bangalore, has one of the best academic law libraries in the country. It has set up a state-of-the-art digital library. The library has computerized its library facilities for house keeping and information retrieval. It possesses modern gadgets with wi-fi Internet connectivity and modern audio-visual equipment with teleconferencing capability. In addition, the library provides the facility access to a library portal through which the users can access contents of the current journals, the holdings of current print journals, e-journals, special collections of the library, and information about the library, its staff and services.

Judicial libraries include the Supreme Court Library (New Delhi), High Court Libraries in the states (many of these have good legal collections), bar association libraries attached to the Supreme Court and the high Courts. The Supreme Court Library is the largest law library in the country. Other leading judicial libraries include Calcutta High Court Library, Karnataka High Court Library (Bangalore) and Madras High Court Library. Bar Association libraries serve their lawyer-members and are financed by membership subscription.

Organizations involved in legal research maintain their own libraries. Indian Law Institute Library (New Delhi) is a major library having a rich collection. The Legal Information Resource Centre has been established for

“retrieving legal information from Indian and foreign Web sites of the Apex Courts, International Courts, Legal Information Institutions, Law Commissions, Human Right Commission. The library subscribes to about 150 legal journals, national and international, and receives nearly 200 periodicals as gifts or in exchange... The library currently houses a collection of 70,000 books and periodicals. In addition, has 25 CD-ROM titles.”

It provides Indexing of Indian Legal Periodicals, Indexing of Indian Legislation, Newspapers Clippings Service, Internet Service, Documentation and Bibliographical Services. It has an online library catalog.^[39] Besides the above libraries, National Law Institute (Bhopal) Library is another good library.

An example of a modern special library

The Institute for Plasma Research (IPR) Library, Gandhinagar, is a good example of a modern special library. It is a state-of-the-art library. It has a rich collection, helpful staff, wide-ranging services, a soothing ambience, and an atmosphere conducive to scientific research. It gives access to more than 2200 e-journals. The Library has designed a Web site that serves as a gateway to plasma information and provides links to the OPAC, electronic journals, local resources, web resources, etc.^[40]

Conclusion

Special libraries are

primarily, a twentieth-century phenomenon in India. Although a handful existed in the nineteenth century, the majority of these libraries came into being only during the last five decades or so. They are largely concentrated in major towns like Bangalore, Calcutta, Delhi, Hyderabad, Mumbai, and Madras. On the whole, special libraries have succeeded in building a better image than academic and public libraries. They have shown initiative and done better than other types of libraries. They have been forerunners in computer application in Indian libraries.^[41]

Thus, special libraries in India have been trendsetters in many ways.

Digital Library Collections and Services

Introduction

In India, a number of libraries, information centers and other institutions have initiated digital library projects by creating databases and e-journals, or by digitizing their own valuable collections. Some of these are described in the next few paragraphs.

General

The Digital Library of India (DLI) is a major project that aims to “digitize all the significant works of mankind.” The DLI has three sites which are mirrors of each other, IIIT-H being one of them, as given below:

<http://www.new.dli.ernet.in/index.html.en>
<http://dli.iiit.ac.in/>
<http://www.dli.cdacnoida.in/>

DLI covers primarily books.^[42] Though some newspapers and manuscripts are mentioned in one of the sites, they actually point to the external site of the respective newspapers. That is why, what is shown as “manuscripts” or “journals” is really not correct. It is a project hosted by Indian Institute of Science, Bangalore, in cooperation with CMU, IIIT, NSF, ERNET, and MCIT, for the Government of India and 21 participating centers. The mission is to “create a portal for the Digital Library of India which will foster creativity and free access to all human knowledge.” Indian Institute of Science, Bangalore, is coordinating the Digital Library of India project along with Carnegie Mellon University.^[43]

The UGC-Infonet Digital Library Consortium was formally launched in December, 2003. The Consortium provides current as well as archival “access to more than 4500 core and peer-reviewed journals and nine bibliographic

databases from 23 publishers and aggregators in different disciplines.” The program is funded by the UGC and administered by the INFLIBNET (Information and Library Network) Centre, Ahmedabad.^[44]

Vidyanidhi is India’s premier “Digital library initiative to facilitate the creation, archiving and accessing of doctoral theses.” Vidyanidhi Database offers “access to more than 1,00,000 Indian theses metadata records. . . Vidyanidhi provides access to 6500 Full Text Theses Database.” It is supported by NISSAT, DSIR, Government of India, the Ford Foundation and Microsoft India.^[45]

INLIBNET Centre under “Electronic Theses and Dissertations Project,” hosts a bibliographic database of 200,000 dissertations from about 200 Indian universities going back to 1905. Panjab University Digital Library provides access to Library OPAC, online journals, online books, e-reference sources, theses and dissertations, conference proceedings, UN and other information agencies publications, subject gateways, INFLIBNET databases, DELNET databases, LIS portal and miscellaneous.

Indira Gandhi Memorial Library, University of Hyderabad, is one of the first libraries in India to start digitization of books. Since 2002, the library has digitized around 250,000 pages, primarily theses and dissertations, as well as 300 books in English and Indian languages.^[46]

University of Delhi has initiated a repository called University of Delhi Eprint Archive. This repository uses GNU Eprints open repository software. Many other universities have also created institutional repositories.

Science

e-Prints is a repository at Indian Institute of Science (IISc), Bangalore, that collects, preserves and disseminates in digital format the research output created by the IISc research community (depository of their preprints, post prints and other scholarly publications). It uses a web interface, and organizes these publications for easy retrieval.^[47]

The National Centre for Scientific Information (NCSI), Bangalore provides a

variety of electronic information services to the Institute’s scholars. These include: intranet and Internet access to world’s leading bibliographic databases; gateway services for electronic journals and open access resources on the Internet; customized web access (‘MySciGate’); IISc e-print archive; and document delivery services.^[48]

NISCAIR (New Delhi) has already started the work on the project known as National Science Digital Library (NSDL). It is first of its kind in the country that aims at providing access to digital resources for students.

There are a number of digital repositories of scientific materials at leading scientific institutions using DSpace. These include the Indian Institute of Astrophysics, Bangalore; Raman Research Institute, Bangalore; National Chemical Laboratory, Pune; and the National Institute of Oceanography, Goa.

Medicine

Bioinformatics digital library at Jaypee University of Information Technology, Solan (HP), provides a centralized access for existing resources in bioinformatics.

Traditional Knowledge Digital Library (TKDL) for Indian Systems of Medicine is a collaborative project of the National Institute of Science Communication and Information Resources (NISCAIR), the Council of Scientific and Industrial Research, the Ministry of Science & Technology and Department of AYUSH, and the Ministry of Health and Family Welfare. The project is being implemented at NISCAIR.^[49]

Engineering and technology

The Ministry of Human Resource Development (MHRD) set up the Indian National Digital Library in Engineering Sciences and Technology (INDEST) Consortium.

The Ministry provides funds required for subscription to electronic resources for^[33] institutions including IISc, IITs, NITs, IIMs and a few other centrally-funded Government institutions through the consortium headquarters set-up at the IIT Delhi. Besides, 60 Government or Government-aided engineering colleges and technical departments in universities have joined the Consortium with financial support from the AICTE.

Later on, it was renamed INDEST-AICTE Consortium.^[50]

The Indian Institute of Technology, New Delhi (EPrints @IIT Delhi) provides access to Online courseware, older volumes of journals, more than 500 theses and dissertations are available in the repository. There are facilities for submitting material to the repository.

The Indian Institute of Technology, Bombay repository provides bibliographic information and abstracts for dissertations from 1965 onward. The masters thesis database has bibliographic information and abstracts from 1999 onward. There are more than 3000 full text theses and Dissertations available in the ETD database.

Nalanda, the Digital Library initiated in 1999 at the National Institute of Technology, Calicut, is one of the largest digital libraries in the country. The repository contains theses and dissertations, course materials, articles, and annual reports. It serves members of the campus with value added services in all the areas of Science/Engineering/Technology.

Social sciences

The Archives of Indian Labour is a unique digital project initiated at the V.V. Giri National Labour Institute (NOIDA, UP), in collaboration with the Association of Indian Labour Historians (AILH). The archive, is a prime repository of labor related records in the country, that aims at preservation of rapidly decaying documents and material on labor.

A Digital Library of electronic publications was set up in 1997, at the Parliament Library (New Delhi), to serve the information needs of members of the Parliament and officers of Lok Sabha Secretariat. The digital collections consist of reference books (atlases, directories etc), reports, e-journals, etc.

Humanities

India has one of the oldest and largest collections of manuscripts in the world. A significant proportion of them have not been preserved scientifically. National Mission for Manuscripts was established specially to tackle the problems related to manuscripts. The mission has already started a pilot project for digitizing the manuscripts in five states.^[51] The National Library has undertaken a project for Digitization (Down the memory lane). The scanning and archiving of rare and brittle books and other documents on compact disc has been under taken. English books and documents published before 1900 and Indian publications of pre 1920 are being digitized. Up to now, 6600 selected books in Indian and English languages have already been scanned and stored on 548 CDs.

The Centre for Development of Advanced Computing (C-DAC) Digital Library of Art Masterpieces is “the first initiative of its kind in Asia. It will digitize 200 rare paintings of Rabindranath Tagore and Amrita Shergill from the National Gallery of Modern Arts (NGMA).”^[46] The Indira Gandhi National Centre for the Arts (IGNCA), New Delhi, in collaboration with the Ministry of Communication and Information Technology, initiated a project, KALASAMPADA (Digital Library: Resources of Indian Cultural Heritage), for the development of databank of cultural heritage. Kalasampada facilitates the scholars (users) to access and view the materials including over 200,000 of manuscripts, over 100,000 slides, “thousands of rare books, rare photographs, audio and video along with highly researched publications of the IGNCA, from a single window.”^[52] It is a rich resource of information on Indian art and culture.

Other subjects

Indian Institute of Management, Kozikode (IIM-K), has established a repository for documents limited to the IIMK research community. They can submit preprints,

postprints, and other scholarly publications for archiving. The Librarian's Digital Library is a repository set up at the Documentation Research Training Centre, Indian Statistical Institute, Bangalore. It aims to cover material of interest to librarians world-wide. The repository contains articles, theses and dissertations, presentations, multi-lingual documents, photographs, etc.

Information Science as a Discipline and Profession

Discipline

Today, Information Science is considered as a discipline in its own right, an interdisciplinary area of study. Its growth in India has been rather slow. There are very few information schools. They are coming into being slowly. There are only a few institutions conducting courses in information science as given below:

Birla Institute Of Technology, Ranchi (Jharkhand)

The Department of Information Science, Mersa, Ranchi, offers courses leading to an M.Sc. (Information Science) (two-year integrated program) (1993–) and a Ph.D.

Documentation Research and Training Centre, Bangalore (Karnataka), Indian Statistical Institute

From 2008, DRTC has introduced MS (LIS), that is Master of Science in Library and Information Science, that offers comprehensive instruction in the theory and practice of documentation and information science. DRTC also conducts a Research fellowship program, where the emphasis is on special libraries.

National Institute of Science Communication and Information Resources (NISCAIR) (formerly INSDOC), New Delhi

The Education and Training Division of NISCAIR, offers a two-year course leading to Associateship in Information Science (AIS) since 1976. AIS is a two-year program equivalent to Master's degree in Library and Information Science, recognized by Government of India and many Indian Universities.

University of Madras

In 1995, the Department of Library and Information Science, University of Madras, replaced its Master of library and Information Science, with a Master of Science (M.Sc.) in Library and Information Science. In 2004, the Department of Library and Information Science, University of Madras, was renamed Department of Information Science, as the first of its kind. Master of Library and Information Science course was replaced by “Master of Science” in Information Science (that is M.Sc. [Information Science]) beginning in academic session 2004–2005. It has also a provision for Ph.D. in Information Science.

The University of Mysore

Mysore, has established a new generation centre called the International School of Information Management

(I-SiM). ISiM, is a new age school for the knowledge Society. ISiM offers the following programs:

M.Tech. in Information Systems & Management (started in 2008), Doctoral Degree Program (Ph.D.) in Information Systems & Management, Executive Education Programs, Corporate Training.

Impact of information science on library science

In the 1970s, library schools introduced topics from information science. The UGC Panel on Library and Information Science (1982), recommended that library schools might consider changing the nomenclature of library science courses named B.Lib.Sc. and M.Lib.Sc. to BLISc. (Bachelor of Library and Information Science) and MLISc. (Master of Library and Information Science) respectively, so as to reflect the changes introduced in their curriculum. As a result, Library Schools have changed the names of their degrees.

At one time, a library school in India was generally called a "Department of Library Science." Beginning in the late 1970s, most were renamed as a "Department of Library and Information Science," as most of the library schools are called today. Thus, traditional library schools are teaching both library science and information science and their names and their degrees include the term "library and information science."

Profession

Information science as a profession is emerging slowly. The Society for Information Science (SIS) was formed during 1975, to look after the interests of people in the profession.^[53] SIS is an all India professional body devoted to encouraging interaction among information professionals, scientists, managers, and users of information. Many of the members are also members of library associations. Another association that looks after the interests of information professionals is IASLIC (Indian Association of Special Libraries and Information Centres). It has created Special Interest Groups (SIGs) to bring together persons of common interests.

Librarianship as a Discipline and Profession

Discipline

Today, librarianship is a full-fledged discipline in its own right. It is recognized as a subject of study and research, worthy of study at the university level at par with other disciplines. There are separate library schools at university, college and institute level, often called Department of Library and Information Science. Librarianship as a discipline is taught at universities, colleges and institutes with curricula leading to the following degrees:

- Bachelor of library and Information Science
- Master of Library and Information Science
- M.Phil.
- Ph.D.
- Post-doctoral degree

The trend is toward establishing two-year integrated Master of Library and Information Science, and abolishing the Bachelor's degree. In recent years, there is also a trend toward offering specialized postgraduate courses. For professional jobs, a degree in library and information science, from a library school affiliated to a university, is a basic requirement. Thus, librarianship as a discipline is well established.

Profession

A profession is an occupation, vocation or career where specialized knowledge of a subject, field, or science is applied.^[54]

To become a library professional in India, one is required to possess a degree in library and information science, obtained from a library school attached to a university or college/institute (affiliated to a university). Standards for library education have been formulated by the University Grants Commission (UGC), a coordinating and grant-giving body at the national level. There is an increasing emphasis on continuing education. There is a trend toward providing internship in libraries. For the job of an assistant librarian in a university library or a college librarian, one is required to pass a UGC Net or state level test. In India, the provision of "Licensed practitioners" has not been applied. Joint Council of Library Associations of India (JOC LAI) has formulated a Code of Ethics for the library profession in India. From the above, it follows that librarianship in India fulfills most of the major characteristics of a profession.

Education for LIS

History

William Alanson Borden (1853–1931), an American-trained librarian, was invited by His Highness the Maharaja Sayajirao III, Gaekwar of Baroda (1862–1939), to establish libraries in the princely State of Baroda. Borden started a training program in the State in 1911. It was the first library school to be established in India. Thus, the history of library education in India began in the year 1911. In 1937, the University of Madras introduced, effective from July 1937, a one-year postgraduate diploma course. This was the first full-time course conducted in India, another land mark in the history of library education. This was also the first diploma course conducted by a university.

The Department of Library Science at the University of Delhi initiated a postgraduate course in 1947. In 1948, the University of Delhi became the first university in India to institute a degree course in Library Science (a post-graduate course of study). In 1949, the first batch of students completed the two-year study program. They received their B.Lib.Sc. (Bachelor of Library Science) degrees in 1949. In 1949, a two-year course leading to the award of M.Lib.Sc. (Master of Library Science) degree was introduced to replace the previous program of B.Lib.Sc. The first cohort of students received their M.Lib.Sc. degree in 1951.

The University of Delhi was the first university in the British Commonwealth to introduce this course at the master's level. In 1951, it also became the first university in the country, as well as in the British Commonwealth to introduce doctoral studies in library science by framing regulations for such a doctoral program. A Ph.D. candidate was registered at the University of Delhi in the 1952–1953 academic session. The first Ph.D. in library science was awarded in 1957 to D.B. Krishna Rao by University of Delhi under the guidance of Dr S.R. Ranganathan.

The period of growth of LIS (Library and Information Science) education started in the early 1960s, when there was sudden growth of library education. Many new library schools were started in the 1960s. Realizing the need for standardization of syllabi, examination, qualifications of teachers, etc in the field of library science, UGC in 1961, appointed a Review Committee, under the Chairmanship of S.R. Ranganathan. The Committee submitted its report in 1965.^[55] The report made many useful and far reaching recommendations regarding syllabi, standards, etc. This report is a landmark in the history of library education in India.

The Indian Association of Teachers of Library and Information Science (IATLIS) was founded in 1969. It has played a significant role in LIS education.

UGC set up in July 1977, a Specialist Panel, called UGC Panel on Library Science. Its aim was to advise the Commission regarding measures for improvement of standards and facilities for teaching and research, and for the development of interdisciplinary and multidisciplinary programs, etc.

The period of modernization started in the early 1990s. Library schools started revising their curriculum, introducing courses on computer application in libraries, and also included substantial amount of information science. It is also during this period that the library schools began to establish computer laboratories for giving hands-on experience to their students.

Growth of library schools

In 1947, at the time of independence, there were just five library schools at the university level. By the end of 1950s, there were 13 such schools. According to the *Directory of*

library and information schools in India published in 1988, that covers information about 93 schools and other institutions in India offering training in library and information science at different levels, there are 66 university departments that offer a bachelor's degree in library and information science, 38 of which also offer a master's degree in library and information science, and four of which offer a master of philosophy degree in library and information science. There are 19 schools that offer a doctoral program in library and information science.^[56] Today, there are 167 library schools (including information schools) conducting postgraduate courses (121 university level library schools and 46 colleges and institutes conducting library and information science programs including one organization, namely, NISCAIR (formerly INSDOC) that offers two-year Associateship in Information Science). There are 41 universities offering library and information science courses through correspondence or distance education. 129 universities are offering bachelor's degree including four offering a Post-graduate Diploma in Library Automation and Networking and one a Diploma in Health Science Librarianship; 118 offer master's degrees including 37 library schools that conduct two-year integrated master's program; 22 offer M.Phil. degree; 72 offer Ph.D. degree (based on data gathered by the present authors from various sources).

Levels of courses

Basically, Indian library Schools are providing library education at four levels:

1. B.LISc. (Bachelor of Library and Information Science)
2. M.LISc. (Master of Library and Information Science)
3. M.Phil (Master of Philosophy)
4. Ph.D.

Now, most of the universities award Bachelor of Library and Information Science (B.LISc.) degree. There are 118 library schools that are offering master's degrees. Out of these, 37 offer two-year integrated programs.

It was a guideline from UGC to universities that recommended introduction of M.Phil. program as a research degree between Master's and Ph.D. degrees. As a result, some library schools introduced M.Phil.

There are more than 50 Ph.D.s being produced annually. Ph.D. programs are now well established.

Admission requirements

For admission to bachelor's degree in LIS or two-year integrated master's course, the usual minimum qualification is a B.A./B.Sc. Some library schools, they conduct an admission test and/or interviews for admission, in addition to minimum academic qualifications prescribed for the

purpose. For admission to one-year master's degree course, bachelor's degree in library and information science is prescribed. Many library schools conduct an admission test. Some schools have also prescribed professional experience as an essential requirement as well.

Qualifications for admission to M.Phil. and Ph.D. vary from school to school. To obtain a Ph.D., 2–3 years of residence is essential in many universities. In some universities, only a short period of residence is required.

Course content (outline)

Typical course content (outline) for Master of Library and Information Science (two-year integrated course) at University of Mysore is given below:

Foundations of Information Science and Society; Fundamentals of Information Technology; Information organization; Personality Development and Communication Skills; Content Organization (DDC)—Practicum; Information Resources; Organizing Information Resources-I; Information Retrieval Systems; Information Technology Skills—Practicum; Content Organization (UDC)—Practicum; Managing information Resources-II; Managing information and information centre; Data communication and networking; organizing information resources—Practicum I; Technology for information management—Practicum; Digital libraries; Information resources, systems and services; Research methods and project management; Organizing information resources—Practicum II; Project.^[57]

The above two-year integrated program is spread over four semesters. The stress is on information science and technology. There is less stress on traditional library science.

The Indira Gandhi National Open University (IGNOU) is one of the premier institutions in the country providing Library and Information Science (LIS) courses through distance education. An outline of the syllabi is given below:

Syllabus for B.LISc.

Library and Society; Library Management; Library Classification Theory; Library Classification Practice; Library Cataloging Theory; Library Cataloging Practice; Reference and Information Sources; Information Services; Information Technology: Basics.

Syllabus for M.LISc.

The Program has been designed and developed keeping in view the handling of information rather than library materials as a whole. The program consists of six core courses, one project and six electives (out of which two have to be selected). Information, Communication and Society; Information Sources, Systems and Services; Information

Processing and Retrieval; Management of Library and Information Centres; Fundamentals of Information Communication Technologies; Information Communication Technologies: Application; Project.

Electives (any two are to be chosen by the learner)

Preservation and Conservation of Library Materials (Elective); Research Methodology (Elective); Academic Library System (Elective); Technical Writing (Elective); Scientometrics and Informetrics (Elective); Public Library System and Services (Elective).

The school follows a multi-media approach for instruction. The students are offered self-instructional learning course material packages along with:

- Assignments for assessment and feedback
- Supporting audio–video programs
- Face-to-face interaction with academic counselors at Study Centers
- Practical work at designated institutions
- Telecast of Video Programmes on National Network DD1 and EDUSTAT
- Broadcast of Audio Programmes by All India Radio (Selected Stations)
- Teleconference sessions through Gyan Darshan.
- Interactive Radio Counselling Programmes.^[58]

IGNOU conducts BLISc. (one-academic year) and MLISc. (one-academic year) courses, as well as PGDLAN (Post Graduate Diploma in Library Automation and Networking) (one-academic year) through distance mode. BLISc. and MLISc. courses at IGNOU provide a combination of library science and information science. It has introduced many innovative approaches for providing distance learning to the learners. The courses offered by IGNOU are very popular. They have set new trends in multi-media based LIS education in the country. In 2008, IGNOU has introduced MLISc. online. The course was inaugurated in June. This the first online course in LIS to be introduced in India.

Methods of teaching and evaluation

There are a variety of methods of teaching being used in Indian library schools. However, the lecture method predominates.

Usually, evaluation is based on performance on a written examination. The students are tested through written examination at the end of the year or at the end of each semester. The written examination is based on essay type questions. There may be some questions requiring writing of short notes or questions involving objective questions or multiple-choice questions. The examination may last for 2–3 hours.

Oral examinations are used to assess dissertation/ project report, sessional work, etc. Increasingly library schools are introducing internal assessment. Internal assessment is done by the teacher teaching the course, based on written assignments, seminar, practical work, etc.

As regards internship, the system varies from library school to library school. In some library schools, it is a compulsory part of the course.

Accreditation

There is no system of accreditation of library schools by a national organization in India. UGC, Association of Indian Universities, and the Ministry of Human Resource Development (Government of India) have played a definite role in the matter of equating degrees within India and degrees awarded by foreign universities. Each university has a specified procedure to equate degrees. Usually, they follow the advice of higher bodies as mentioned above. The National Assessment and Accreditation Council (NAAC) is an autonomous body established by the University Grants Commission (UGC) of India to assess and accredit institutions of higher education in the country. It has started the process. In due course of time, library schools will also be covered. However, courses conducted by IGNOU have been accredited by the Council responsible for accreditation of courses run by the open universities.

Continuing education

The University Grants Commission, in pursuance of the National Policy on Education 1986 and its program of action, had set up 57 Academic Staff Colleges (ASCs) in different Universities/Institutions in the country. These Academic Staff Colleges conduct specially designed Academic Staff orientation programs for newly appointed lecturers and refresher courses for in-service teachers. These programs have proved to be quite useful for LIS teachers and librarians working in universities and colleges, coming under the purview of UGC.

In regards to librarians and teachers of LIS, library associations, library schools, institutions like DRTC, NISCAIR, DESIDOC, etc. also conduct continuing education programs for their benefit.

Conclusion

There has been a proliferation of library schools. Emergence of such a large number of library schools (i.e., 167) has led to an oversupply of library professionals. Library schools are beginning to regularly revise their courses, keeping in mind the latest developments in LIS as well as in ICT. Reports of the UGC Curriculum Development Committee^[59,60] have proven to be quite useful in this regard.

Professional Associations

Introduction

There are a variety of professional organizations and associations in India that are organized at national, state, and local levels. They number more than 200, if students' associations are included. Some of the major organizations are described here.

Indian Association of Teachers of Library and Information Science

IATLIS is a professional association of about 500 teachers and library professionals. Since its inception in 1969, IATLIS has been involved in issues of LIS Education in India, especially curriculum development, teaching methods, infrastructure, teachers' training, etc. It looks after promotion of the professional interests of LIS teachers. It conducts national seminars, workshops, training programs etc and brings out *IATLIS Communications* (official journal) and publishes pre-conference volumes and other books.

The Indian Library Association

At the second session (September 13, 1933) of the first "All India Library Conference" held at Calcutta during September 12–14, 1933, a resolution was passed, that led to the formation of Indian Library Association. The objectives of the Association:

1. Promotion of library movement and improvement in library services in all its aspects in India
2. Promotion of library science education and improvement in the training of librarians in India
3. Establishment of libraries, documentation and information centers and assistance in their establishment and working
4. Promotion of appropriate library legislation in India
5. Providing a common forum to all persons engaged or interested in library and information work by holding conferences and meetings for discussion of professional, technical and organizational issues
6. Accreditation of institutions imparting library and information science education and training
7. Promotion as well as formulation of standards, norms, guidelines, etc. for management of library and information systems and services^[61]

In 1933, ILA had 70 members and in 2006, it had 7218 members. In a large country like India, where around ten thousand professionals (degree holders) are estimated to be produced every year and the total number of professionals may be around 200,000; the membership figure is low. This is a matter of concern.

The ILA has a president, six vice-presidents, a general secretary and an executive committee. It is organized so as to operate through 11 sectional committees. Major activities of ILA include sponsoring conferences, seminars, conventions, training programs, lectures, etc. It organized an International Conference on Ranganathan's Philosophy at New Delhi in 1985. In the same year, in collaboration with Sarada Ranganathan Endowment for Library Science, it organized the Second Regional FID Conference. ILA hosted the 1992 IFLA Conference at New Delhi. It was a great success. It brings out *ILA Bulletin* and *ILA Newsletter* on a regular basis. It publishes professional tools, conference and seminar proceedings, and annual reports.

ILA was founded in 1933. Thus, the year 2008 was the Platinum Jubilee Year of ILA. It was being celebrated by ILA through various programs. The year 2010 is the Centenary Year of Library Movement in the country. Plans for celebration are underway. ILA has been in the forefront, in taking up issues facing Indian librarianship, such as salary scales, library legislation, status of librarians, etc.

IASLIC

A meeting of librarians was held on September 3, 1955 at the Lecture Hall of the Indian Museum, Calcutta. This is the meeting in which the Indian Association of Special Libraries and Information Centres (IASLIC) was formally established.^[62] The major objectives are:

To improve the quality of library and information services and documentation work;

To coordinate the activities of and to foster mutual co-operation and assistance among the special libraries, scientific, technological and research institutions, learned societies, commercial organisations, industrial research establishments, as well as other information and documentation centres to the fullest extent;

To serve as a field of active contact for libraries, information bureaus, documentation centres, scientists, research workers, specialists, and others having common interest;

To improve the technical efficiency of the workers in special libraries, and information and documentation centres; and to look after their professional welfare;...^[63]

IASLIC publishes monographs and other types of documents. *IASLIC Bulletin* is the official journal, published quarterly since 1956 and The *IASLIC Newsletter* has been published bimonthly since 1966. The Association conducts short-term courses, workshops, round tables, seminars etc. It provides consultancy services. It has created Special Interest Groups (SIGs) to bring together persons of common interest. In addition, it organizes conferences, seminars, lectures and study circles.

State level associations

There are a large number of associations at the state level. Each state and union territory has a separate association, sometimes even more than one. The leading associations include Andhra Library Association, Bengal Library Association, Delhi Library Association, Madras Library Association, etc.

Conclusion

The National Library, Kolkata, is the largest single library that serves as the depository as well as the repository of all the published material of India. In addition, there are two other national libraries, namely, the National Science Library and the National Medical Library. India is a large country having one of the largest education systems in the world. Academic and research libraries are under tremendous pressure due to lack of resources and increasing number of students, research scholars and faculty to be served by them.

Public libraries in India have made much progress after independence. However, their penetration is inadequate. They have yet to reach the masses spread over remote corners of the country especially in rural areas.

School libraries form the weakest link. Public schools and schools run by central government are doing a better job in providing good school libraries. Schools located in metropolitan towns have better libraries. However, libraries attached to rural schools need a massive reform.

Special libraries exist in great variety and have done fairly well compared with other kinds of libraries. There are many special libraries, especially in the field of science and technology, that are well-equipped to provide highly satisfactory services to meet the needs of their users.

Today, there are 167 library schools (including information schools). There are 41 universities offering LIS courses through correspondence or distance education. 118 schools offer master's degree and 72 of them offer Ph.D. program. Thus, India has a fairly large system of LIS education.

ARCHIVES AND ARCHIVAL SCIENCE

Introduction

The valuable history of India is embedded in millions of records that exist in the form of manuscripts, inscriptions, and other kinds of records. Unfortunately, most such materials have yet to be preserved and restored in a scientific manner. However, efforts are being made in this direction.

Archival studies has been a rather neglected field in India. It has fewer than 100 archives. However, the situation is changing. Industrial houses, universities and research institutions are beginning to set up their archives.

Legislation Concerning Archives and Regulations That Relate to Record Keeping

The Public Records Act was passed by the Indian Parliament in 1993 to regulate the Management, Administration, and Preservation of Public Records of the Union Government, Union Territories, Public Sector Undertakings, Statutory Bodies and Corporations, Commissions and Committees constituted by the Union Government or Union Territory Administrations. The functioning of the Act is given in detail under the Public Records Rules, 1997.^[64] Under the Act, the National Archives of India (NAI) has been given the major responsibility regarding management, administration, and preservation of public records.

National Archives and Services

The National Archives of India, New Delhi

The National Archives of India (NAI), New Delhi, is the premier organized record repository in India. It was set up in March 1891 at Calcutta (now called Kolkata) as the Imperial Record Department. It was shifted to New Delhi after the transfer of the Capital from Calcutta to New Delhi in 1911. It has set up four regional repositories in Bhopal, Bhubaneswar, Jaipur, and Pondicherry.

Activities. NAI is the repository of the noncurrent records of the Government of India and holds them in trust for the use of administrators and scholars. It is an Attached Office of the Department of Culture under the Ministry of Tourism and Culture. NAI performs a wide range of activities. Its main activity is concerned with "Preserving the records of Government of India in its custody, and regulating the Access and Record Management policy of the Government" as per the provisions laid down in Public Record Act.^[65]

Holdings. The holdings of records in the National Archives

run into 40 Kms. of shelf-space area and are in a regular series from the year 1748 onwards, though there are stray records of the earlier period as well. . . Apart from records on paper, we also have records on palm leaf, birch bark, parchment etc. The records are broadly of four categories: Public Records, Oriental Records, Manuscripts and Private Papers. These records throw light on the activities of the later Mughals, the East India Company and British

Rule and the emergence and growth of the freedom struggle in India. They also shed valuable light on our social, political, economic and cultural life. In addition, there is a rich collection of Private Papers and more than 7500 microfilm rolls of records acquired from different countries. . .

The total holdings in the custody of NAI comprises of 3,875,332 files; 64,221 volumes; 110,332 maps and cartographic items; 3601 Bills assented to by the President(s) of India; 1065 Treaties; 2442 rare manuscripts. NAI has a wide ranging and an extremely rich collection, including government records and private papers especially records of national importance that are invaluable to research scholars.^[66]

Services. NAI offers xeroxing, microfilming and photocopying facilities and also undertakes search for records on behalf of scholars and institutions on payment. Facilities for online access to records are available from the Research Room of the Department.

Finding Aids. To facilitate retrieval of information, there are various types of finding aids that have been designed. These include Guide to Records, Indices, Press Lists, Calendars, Descriptive Lists, Subject Lists etc.

Eleventh Five-Year Plan. The report of the Working Group on Art and Culture of the Ministry of Culture, Government of India for the 11th five-year plan (2007–2012) recommended "six new schemes to be taken up by National Archives of India during the 11th Five Year Plan. These schemes are aimed at modernizing the National Archives and enhancing the quality of services besides conservation of public records."^[67] The work on some of the schemes has already started.

Other national repositories

Other national repositories include:

Archives of Indian Labour, Noida (UP)
Indira Gandhi National Centre for the Arts, New Delhi^[68]
National Library, Kolkata^[69]
Nehru Memorial Museum and Library, New Delhi
Parliamentary Museum and Archives, New Delhi
Reserve Bank of India Archives, Pune

State archives

Some of the leading state archives are listed below:

Gujarat State Archives, Gandhinagar. Gujarat State Archives have been created from records (files and manuscripts) of several Princely States and Political Agencies of British India. The records holdings of the Gujarat State Archives are broadly divided into two series, namely, the records of the former princely states and the secretariat records. Gujarat is very rich in terms of archival wealth.

The Karnataka State Archives, Bangalore. The Karnataka State Archives is a repository of non-current records of the Government. It also has Ecclesiastical (Religious) Archives, Business Archives, Industrial Archives and other Private Archives. Work has been initiated to computerize all the required information about the documents. The State Archives has undertaken a program called “Oral History.”

The Kerala State Archives Department, Thiruvananthapuram. It is the custodian of all public records (non-current) of permanent value of State Government and its various departments. The records received from private individuals and institutions are also being maintained in the department.

Punjab State Archives (Patiala and Chandigarh). Punjab State Archives have nearly 1 million records in its custody. “Punjab archives have illustrated manuscripts, including copies of *Ain-I-Akbari*, *Zaffarnama* of Guru Gobind Singh, *Shahnama* of Firdausi, *Adi Granth* of 1666, tales of *Laila Majnu*, rare Tibetan palm-leaf manuscripts etc.”^[70] Punjab Archives has inherited a large number of records from the various princely states that got merged into the present Punjab.

The Tamil Nadu Archives, Chennai. Tamil Nadu Archives and Historical Research is regarded as one of the biggest Archives and Research Institutions in South East Asia. It is a rich resource of records going back to the seventeenth century. It houses

...the records of various Departments of the Secretariat, erstwhile Board of Revenue, a few Heads of Departments, pre-mutiny records of Collectorate and District Courts and records of defunct Departments. The records dating back to 1657 A.D. (Dutch Records) are preserved in this Archives.^[71]

West Bengal State Archives, Kolkata. The

collections include East India Company’s administrative records from 1770 to 1858, some Persian and Bengali records from 1624. Dutch records relating to Chinsurah from 1702 to 1827, some Danish records on Serampore, records of the Secretariat Departments and records of the Crown period 1858–1947 and indices.^[72]

College and university archives

There is an increasing awareness in academic institutions about the value of archives. Therefore, a number of colleges, universities and other academic institutions have set up their archives. Some of these are described below:

Indian Institute of Astrophysics Archives, Bangalore

Indian Institute of Astrophysics archives has important collections, “some of which are more than 200 years old.”^[73]

Indian Institute of Science Archives, Bangalore

The Institute has established an Archives and Publications Cell to collect, catalog and preserve all documents of relevance to the Institute.

Jawaharlal Nehru University, New Delhi

The Archives on Contemporary History set up in 1970 at the Jawaharlal Nehru University, New Delhi, is a “repository of variety of materials on the leftwing movement in India.”^[74]

Jesuit Madurai Province Archives, Sacred Heart College, Kodaikanal

Jesuit Madurai Province Archives has a large collection of rare books, manuscripts, personal papers, antique instruments (pocket watches used by missionaries, old French medical instruments) etc.^[75]

Maulana Azad Library, Aligarh

Maulana Azad Library of Aligarh Muslim University has a wide-ranging collection consisting of books, periodicals, pamphlets, manuscripts, paintings and photographs. The Library “performs the functions of a National Library so far as its collection of Oriental manuscripts are concerned. It is because of these rich collections of immense research value that this Library is reckoned among major libraries of the world.”^[76] The library has a rich collection of manuscripts, rare books and early paintings.

Film archives

The mission of the National Film Archive of India is

to safeguard the heritage of Indian Cinema for posterity and act as a centre for dissemination of a healthy film culture in the country. Promotion of film scholarship and research on various aspects of cinema also form part of its Charter. Familiarizing foreign audiences with Indian Cinema and to make it more visible across the globe is another declared objective of the Archive.

The National Film Archive of India acquires

National and State Award winning films, Indian Panorama films, Box-office hits and films shown in international film festivals. Film adaptations of famous literary works, films

representing different genres of Indian Cinema, news-reels, documentaries representing the categories mentioned above also find their way to the Archive. Selected foreign films representing national cultures, different genres and landmark works of major filmmakers from different countries are also acquired and used for archival and research purposes.

Books and periodicals covering

Indian and World Cinema, Festival Publications, ancillary material like Song booklets, photographs, wall posters, pamphlets, folders, disc records and other memorabilia on Cinema are also collected and preserved by the Research & Documentation Section.

The treasures of the NFAI's film collection include "the surviving fragments of the films of D.G. Phalke and Baburao Painter, the silent films of Himansu Rai and Franz Osten, a representative collection of films of the great film companies and studios of the 1930s and 1940s. . ."[77] NFAI has a rich and unique collection about Indian Cinema, not to be found anywhere else.

Other kinds of repositories

A few of the other kinds of repositories are described below:

The Archives of Krishnamurti Foundation India (KFI), Chennai

The materials include

documents and records of Krishnamurti's life, books, manuscripts, transcripts, journals, letters, newspaper cuttings, organizational documents, photographs, audio tapes (including digital audio tapes), gramophone records, videotapes, films, and CD-Rom.^[78]

J. Krishnamurti was a great scholar and thinker.

Godrej Archives, Mumbai

It is a record of the contribution made by the Godrej Group to the "industrial history of India, as well as the country's future." Being company archives,

it houses an assortment of agreements, letters, technical drawings, press clippings, old catalogs, advertisements, testimonials from clients and customers, audio-visual recordings, photographs, awards, medals and unique memorabilia items.

The collection consists of manuscripts, photographs, audio-visual materials, memorabilia, printed materials and oral history records. The Manuscript Collection (1836–2007) includes old documents (553 accessioned files). Based on information provided by Ms. Vrunda Pathare, Godrej Archives, Godrej & Boyce Mfg. Co. Ltd., Mumbai. *The French Institute of Pondicherry, Pondicherry*

The major collection consists of 8187 palm-leaf bundles, 360 paper codices and 1144 recent paper transcripts (i.e., post-1950 paper manuscripts commissioned or copied by employees of the IFP), which are now on-line.^[79]

Mukul Dey Archives, Santiniketan

Mukul Dey was a pioneer Indian graphic artist, who has left behind a large body of work. The work throws light on the early twentieth century Indian art scene. This is a private archives. The entire body of the Archives consists of "anywhere between 500–750 individual files and more."^[80]

The Roja Muthiah Research Library, Chennai

The Roja Muthiah Research Library (RMRL), founded in 1994, provides research materials and facilities for students of Tamil studies.^[81]

Sarasvati Mahal Library, Thanjavur

The Thanjavur Maharaja Serfoji's Sarasvati Mahal Library is one gem among a few medieval libraries existing in the world. "It is an unparalleled repository of culture and an inexhaustible treasure house of knowledge built up by successive dynasties of Nayaks and the Marathas of Thanjavur."^[82] It is considered as a great treasure house of manuscripts, maps, paintings and books on art, literature and culture.

Tata Institute of Fundamental Research Archives, Mumbai

TIFR Archives, Mumbai, stores the collective memory of the institute by preserving records that tell the history of the Institute from 1945 to the present. The holdings include manuscripts, photographs, oral histories; print and audio-visual material; fine arts and scientific instruments as well as digitized recordings of lectures given by distinguished visitors to the Tata Institute Based on notes provided by Dr Indira Chowdhury, Consultant Archivist, TIFR Archives, Mumbai. Under one roof, researchers can find a rich resource for not only history of TIFR, but also for history of science in India.

The Tata Central Archives, Pune

The Tata Central Archives (TCA) is the first ISO 9001:2000 Certified Business Archives in India. They "collect, and retain letters, documents, images, printed books, group publications and ephemera of potential historical and critical significance to the Tata Group, one of the largest and most respected business houses in India."^[83]

Realizing the importance of archives, many other corporate groups also have set up their archives. These include Ambanis, Indian Aluminum Company and DCM group.

Digital archival collections and digital finding aids

There are many projects for digitization of archival collections that have been undertaken during the last few years. Some of these are described here.

Computerization and digitalization program at NAI, for an “Automated Retrieval System” has been undertaken and

computerization of reference media to records of the Home (Pub.) (1748–1859), Home (Pol.) (1907–1968), Foreign & Political Deptt. (1860–1946), Ministry of External Affairs (1947–1970) and Ministry of State (1947–1953) has been completed.

NAI has also computerized the reference media of Library Books. A Project for WAN Connectivity of five Libraries under Ministry of Culture is in progress. NAI has also undertaken a project with the assistance of the National Institute of Advanced Studies, Bangalore, for digitalization of rare and valuable manuscripts.^[84]

Under five-year plan (2007–2012), it has been proposed that

In order to minimize deterioration of rare and old records due to continuous handling, a new scheme of digitization of rare and old records may be implemented by NAI. . . Under the new proposed scheme for 11th Five Year Plan, NAI is to launch an archives of E-Records in collaboration with those Ministries where e-governance has made considerable head way.^[67]

The work is going on under this scheme.

The Indira Gandhi National Centre for the Arts (IGNCA), has created a digital library on Indian art and culture.^[85] The digital library of IGNCA is a tremendous effort and a valuable asset, covering a wide range of records.

Archival Science as a Discipline and Profession

Archival science in India has become a discipline in its own right. It has a growing body of knowledge. The theoretical issues are coming to the forefront. Archival science as a subject of study is being taught in India at the university/college/institute level.

Archivists are mostly employed by the National Archives and its branches, in state and local archival departments. However, increasingly, industrial and commercial firms, business houses, universities, religious institutions and libraries also have positions for archivists.

Education for Archivists and Records Managers

The NAI has been conducting training course in Archives Keeping since 1941. Archival education at the formal level can be traced to 1976, when the Institute of Archival Training was established at New Delhi. It was later, in 1980, renamed as the School of Archival Studies. Today, there are a number of universities and institutes that impart education for archivists and record managers.

The information about the courses offered is given in the next few paragraphs.

School of Archival Studies, National Archives of India, New Delhi

The School offers a one-year diploma course in Archives and Records Management. This School also offers certificate courses in Care and Conservation of Books, Manuscripts and Archives (8 weeks) and Reprography (4 weeks). Short-term certificate courses in Archives Management and Record Management and sub-professional courses in Servicing and Repair of Records are also being run by it.

Institutes/Universities offering post-graduate diploma, postgraduate certificate and undergraduate degree in archival studies include:

Post-graduate diploma courses

1. Diploma in Archival Studies (one-year)
School of Archival Studies, NAI
2. PG Diploma in Archives Keeping (part-time)
Annamalai University, Annamalai Nagar
3. PG Diploma in Archives and Documentation and Management
4. PG Diploma in Archival Science and Manuscriptology, Osmania University, Administrative Building, Hyderabad
5. PG Diploma in Archival Studies
Pondicherry University, Pondicherry
Postgraduate certificate courses
6. PG Certificate in Archives, Gujarat Vidyapith, Ahmedabad
Undergraduate courses
7. BA in Archival Science, Maharishi Dayanand Saraswati University, Ajmer—Eligibility: 10 + 2

According to Johare,

There is little evidence of concern for education and training of record keepers in managing electronic records in India. . . the curriculum content remains traditional in approach due to the lack of local expertise and facilities to deliver education and training programs on ERM.^[86]

In view of the significance of electronic records management (ERM), this area needs to be covered adequately in courses for education and training of record keepers.

There are no advance courses at the Master's level and there is also a need to start a Ph.D. program. Need exists for starting separate departments of archival science at universities.

Professional Associations

There are two major professional bodies in the country. These are The National Committee of Archivists and the Indian Historical Records Commission as described below:

The National Committee of Archivists

The National Committee of Archivists is a professional body of archivists from all the States and Union Territories. It has a purely advisory role.^[87]

The Indian Historical Records Commission

The Indian Historical Records Commission was set up by the Government of India in 1919 as a consulting body.^[88] The Commission has played a significant role in various matters relating to different aspects of archives. Its opinions carry a great deal of weight with different levels of the government.

Association of Indian Archivists, New Delhi

Association of Indian Archivists is a national association. Archivists and archival institutions are its members. The association is rather inactive and many archivists are not aware of its activities.

Electronic Records as Archival Documents

Under the 11th five-year plan (2007–2012), it has been proposed that “...NAI is to launch an archives of E-Records in collaboration with those Ministries where e-governance has made considerable head way.”^[67] ERM presents many challenges. One main challenge is to ensure that digital records remain sustainable, authentic and accessible over a period of time.

Preservation of Documents

Preservation of documents is a major issue. In recent years, the state has taken active steps in this direction. For the latest five-year plan (2007–2012), the Working Group of the Ministry of Culture,

also recommended implementation of a new scheme: ‘Assistance to the State Archives to Conserve and Digitize Records of National Importance.’ Under the scheme, identification of records of national importance held by the State Governments Archives will be undertaken so that these Archives could be assisted on a project mode to conserve and digitize the same.^[89]

A scheme of financial assistance to support Archival Repositories, Government Libraries/Museums of State/ Union Territory Administrations for their developmental activities and preservation of records, books and manuscripts, is available. The Department of Culture, Government of India has set up a Grants Committee under the above scheme for allotting grants in aid of preservation of records. The above scheme is being used by state archives,

libraries and other institutions for preservation/conservation/repair of the records.

NFAI is taking good care of its film collection.

In the beginning, the NFAI film collection was stored in improvised film vaults in the premises of the Film and TV Institute of India. Since the inauguration of its new building in 1994, NFAI has its own film vaults designed according to international film preservation standards.^[90]

Other Issues

Archival studies in India face a large number of issues.

Many records collections are still without any guides or hand-book let alone comprehensive descriptive lists, and very few repositories, public or private, have yet developed a well-articulated program of documents-publication. Most of the collections still continue to be housed in primitive conditions... Very little systematic effort has been made to survey, describe, organize or make use of records in private custody, and particularly, those of institutional, religious or commercial provenance. Lack of trained archivists continues seriously to impede the archival work in the country...^[88]

Similar issues have been raised by Rakesh Mohan. He has pointed out that “Establishing physical, administrative and intellectual control over our documentary heritage is the most challenging job because of sheer variety of media on which records are stored.”^[91]

Conclusion

Up to now, the field of archival studies in India has been a rather neglected one. In recent years, business houses such as Ambanis, TATA, DCM, Godrej, Indian Aluminum Company, etc. have set up their archives. In addition, a number of academic and research institutions have taken initiative to establish their archives.

Under the Eleventh Five-Year Plan (2007–12) of the Government of India, a number of schemes and projects are being implemented for collection of private papers, networking of state and national archives, digitization and preservation of records and modernization of archives. In view of these developments, the demand for trained archivists should increase. There is going to be an increasing potential for employment in this area.

MUSEUMS AND MUSEOLOGY

Introduction

History of museums

In India, precursors of the museum included prehistoric cave paintings, *alekhyagrihas* (*Ranga Mahal*—Hall of

paintings), *chitrasalas* (Paintings Gallery), *devakulas*, *visvakarma mandirs* and monasteries, that served the purpose of education and healthy entertainment. The great stupa at Bharhut with its inscriptions in the contemporary *Brahmi* for identification of schemes did exist as an open-air museum. Even today, temples, monasteries etc., function as museums in the country. The genesis of the present day museum goes back to the foundation of the Asiatic Society of Bengal in 1784. For the first time, the Asiatic Society of Bengal, by a historical decision in 1796 to open its collection to the public, established the Indian Museum, Calcutta in 1814. Six provincial museums were established in South India around that time. This period was a great incentive for other parts of the country to accelerate the museum movement slowly but steadily.

The outburst of Indian Mutiny in 1857 left its impact on the growth of the cultural institutions. By the year 1857, there were twelve museums in India. The progress of the Indian Museum Movement was slowed down for a short while. During the coronation year of Queen Victoria, 1887, many museums were established.

The dawn of the twentieth century was an era of awakening and great reforms. Because of the efforts of Lord Curzon many on-site museums were opened at important sites through the Archaeological Survey of India. During the visit of the Prince of Wales to India, in order to commemorate this occasion, the Prince of Wales Museum was opened. It was completed in 1914. In 1936, there were 105 museums of all sorts in India. In 1946, all the museums under the Archaeological Survey of India were brought under the control of the Museum Branch of the Archaeological Survey of India. In the middle of the twentieth century State Museum of Assam, Guwahati (1940), Central Museum, Arunachal Pradesh (1956), Punjab Government Museum (1959), Orissa State Museum (1963), and Manipur State Museum (1969) were established. As of 2008, there are about 700 museums in India.

In recent times, there has been a tremendous interest taken by national policy makers, scholars and cultural icons in museums. This has led to an extraordinary growth in museums of different kinds. During the last 10 years are so, major changes in the field of museology in India have taken place. Museums are using ICT (information and computer technology) in the display of museum objects, digitization of museum objects, dissemination of knowledge through the Web sites, publications, e-governance, ticketing, security, audio-guide, etc.

A National Mission on Monuments and Antiquities has been established. It has launched its activities throughout the country with independent functional strategy in each state and union territory. It is envisaged that the mandate of the Mission should be achieved within a stipulated time frame of 5 years i.e., 2007–2012. These are positive developments.

Legislation

The cultural renaissance of the early nineteenth century included enactment of the first ever-antiquarian legislation in India known as Bengal Regulation XIX of 1810. This was soon followed by another legislation called as Madras Regulation VII of 1817. Both these regulations vested the Government with a power to intervene whenever the public buildings were under threat of misuse. The Act XX of 1863, was therefore enacted to empower the Government to prevent injury to and preserve buildings remarkable for their antiquity or for their historical or architectural value.

The Indian Treasures Trove Act, 1878 (Act No. VI of 1878) was promulgated to protect and preserve treasures found accidentally but had the archeological and historical value. In a landmark development in 1886, James Burgess, the then Director General, succeeded in prevailing upon the Government for issuing these directions: forbidding any person or agency to undertake excavation without prior consent of the Archaeological Survey of India and debarring officers from disposing of antiquities found or acquired without the permission of the Government.

Cultural heritage ushered in a new era when The Ancient Monuments Preservation Act, 1904 (Act No. VII of 1904) was promulgated. This Act provided effective preservation and authority over monuments particularly those, which were under the custody of individual or private ownership. The next important act was The Antiquities Export Control Act, 1947 (Act No. XXXI of 1947).

When the Ancient and Historical Monuments and Archaeological Sites and Remains (Declaration of National Importance) Act, 1951 (No LXXI of 1951) was enacted, all the ancient and historical monuments and archaeological sites and remains protected earlier under “The Ancient Monuments Preservation Act, 1904” were re-declared as monuments and archaeological sites of national importance. Another 450 monuments and sites of Part ‘B’ States were also added. Some more monuments and archaeological sites were also declared as of national importance under Section 126 of the States Reorganization Act, 1956.

The Ancient Monuments and Archaeological Sites and Remains Act 1958 (No 24 of 1958) was enacted on August 28, 1958. This Act provides for the preservation of ancient and historical monuments and archeological sites and remains of national importance, for the regulation of archeological excavations, and for the protection of sculptures, carvings and other like objects. The Antiquities and Art Treasures Act 1972 (No. 52 of 1972) is the latest Act, enacted on September 9, 1972 for effective control over the moveable cultural property of antiquities and art treasures.^[92]

The Archaeological Survey of India (ASI), under the Ministry of Culture, is the premier organization for archaeological research and protection of the cultural heritage of the nation. Maintenance of ancient monuments

and archaeological sites and remains of national importance are the prime concerns of the ASI. Besides, it regulates all archaeological activities in the country under the Acts of 1958 and 1972. At present there are 41 site museums under the control of ASI.

National Museums

Indian Museum, Kolkata

This Museum is an autonomous institution of national importance, funded by the Department of Culture, Government of India. It was established on February 2, 1814 at the Asiatic Society, the earliest learned body in the country. It is considered one of the oldest regular museums of the world and repository of the largest number of museum objects in India.

National Museum, New Delhi

On August 15, 1949, C. Rajagopalachari, the then Governor General of India inaugurated an exhibition at the Audience Hall of the Rashtrapati Bhavan that later formed the nucleus of the National Museum. The exhibition at the Audience Hall consisted of items which had been sent to the Royal Academy, London for an exhibition earlier in 1949. The objects received from various museums for the purpose of the exhibition were not returned to the respective museums. Instead it was decided to keep the objects in New Delhi to form the National Museum. The National Museum, New Delhi, started functioning in a true sense only with the inauguration of the first unit of its building on December 18, 1960. Apart from collections of Pre-history, Archaeology, Jewellery, Paintings, Decorative Arts, Manuscripts, Central Asian Antiquities, Anthropology, Pre-Columbian and Western Art, Arms and Armour and Numismatics and Epigraphy, the museum today has separate branches of Publications, Public Relations, Education, Library, Exhibition, Display, Modeling, Photography, Security and Administration. A well-equipped Conservation Laboratory not only provides restoration to all the art objects but also training facilities to the students and deserving professionals. There are galleries for Pre-history, Indus Valley Civilization, Maurya, Satavahana and Sunga Art, Late Medieval Art, Indian Bronzes, Central Asian Art, Chamba Rangmahal, Indian Miniature Paintings, Manuscripts, Pre-Columbian and Western Art, Indian Coins and Copper Plates, Arms and Armour, Wood-carvings and Musical Instruments. New galleries include Buddhist Art, Tantra Art, Evolution of Indian Scripts and Coins, Decorative Arts, Paintings from Tanjore and Mysore, Tribal Life Style of North-East India, Jewellery, Indian Textiles have been set up recently. An exhibition of India's maritime heritage set up by the Indian Navy in the National Museum covers the evolution of maritime activity of India.

National Museum of Natural History, New Delhi

In 1972, it was decided that the country needed a museum of Natural History to depict its flora, fauna and mineral wealth, to provide an out of school facility for education of children and to promote environmental awareness among the masses. The museum opened its doors to the public on June 5, 1978, with a gallery on Natural History. Since then it has added three galleries, a Discovery and Activity Room for pre-school children. It has also conducted a variety of educational programs and brought out popular literature. In addition, the museum started three regional centers at Mysore, Bhopal and Bhubaneswar. The museum has four exhibit galleries, namely: The Introduction of Natural History, Nature's Network Ecology, Conservation and Cell—The Basic Unit of Life. These not only provide useful information to the visitors but also serve as valuable resources in supplementing classroom teaching.

National Children's Museum, New Delhi

The National Children's Museum displays a rich collection of toys and dolls from different countries, stone and bronze objects, traditional jewelry, arts and crafts, musical instruments, currency of various countries, etc. The Children's Creative Work Gallery, displays the pieces of arts created by children. Summer camps are organized, with workshops on arts, theatre, painting, music, dance, etc. The Museum also provides drama kits, stories, puppets, toys, costumes and puppet shows. The museum complex includes a hostel, sports facilities, science park, aquarium, jet fighter, functional mini train, etc.

National Rail Museum, New Delhi

The National Rail Museum is a museum in Chanakyapuri, New Delhi which focuses on the rail heritage of India. It opened on the February 1, 1977. It is located in over 10 acres of land with both indoor and outdoor exhibits. A toy train offers rides around its site on regular days. The Museum houses the world's oldest operational steam locomotive (certified by the Guinness Book of Records), the Fairy Queen, built in 1855.

National Gandhi Museum, Delhi

The National Gandhi Museum, Rajghat, has an extremely impressive collection of books, journals and documents, audio-visual materials, exhibits, photographs, relics, memorabilia and art pieces that are related to Mahatma Gandhi, Father of the Nation (India). This museum was opened in the year 1961. It is an excellent place for researchers and students interested in Gandhian thoughts and the Indian Freedom Struggle.

The Allahabad Museum, Allahabad

The Allahabad Museum, Allahabad, was declared as an institution of national importance by the Government of India in 1985. This Museum is famous for its collection of Bharhut, Bhumara and Jamsot, Sculptures and for the terracotta from Kausambi, Bhita, Jhusi, Patliputra, Sarnath, Rajghat and Ahichhatra. The Museum also has paraphernalia and heirlooms of the Nehru family, including manuscripts of *An Autobiography* by Jawaharlal Nehru and a large volume of correspondence. Among the Museum collections are paintings by members of the Bengal School of Painters and Vijayavargiya. Among the foreign painters, mention may be made of Nicholas Roerich, his son Svetoslav Roerich and Anagarika Govinda.^[93]

The National Gallery of Modern Art, New Delhi

The National Gallery of Modern Art was inaugurated on March 29, 1954. The Gallery is the premier institution of its kind in India. The NGMA has two branches at Mumbai and Bangalore. The gallery is a repository of the cultural ethos of the country and showcases the changing art forms in the field of Visual and Plastic arts, starting from about 1857.

National Gallery of Portraits, Chandigarh

The visuals and documents which are displayed in the gallery tell the story of how the people of India waged a struggle to win back their freedom and to build a new India. These give a glimpse of the reawakening of India from the time of first war of independence of 1857 to the achievement of freedom in 1947. The gallery displays forty- one well researched computer generated photo and document panels. The panels are supported by the oil paintings of portraits, metal and plaster cast sculptures of selected freedom fighters, murals and dioramas.

The Government Museum and Art Gallery, Chandigarh

The Government Museum and Art Gallery, Chandigarh is an art gallery. Established in August 1947, the building is square (165 feet by 165 feet) and was designed by Le Corbusier (Charles-Édouard Jeanneret-Gris).

Other than the gallery itself, it has the following sections:

- The National History Museum
- The National Gallery of Portraits
- The Chandigarh Architecture Museum

The museum/art gallery exhibits 10,000 mostly Indian artwork such as sculptures and paintings. The attached reference library houses approximately 10,000 media.

National Philatelic Museum, New Delhi

The Museum is located in the Dak Bhavan which has a post office with a popular outlet for the philatelists interested in Indian stamps. The National Philatelic Museum has an elaborate collection of stamps both of the pre- and the post-independence periods. The museum depicts the story of Indian Philatelic Heritage and also the stamps issued by the Indian government. The postal history of India is displayed in the museum, which serves to be an education for visitors. The stamps, which were cancelled, are also displayed in the National Philatelic Museum, New Delhi. The sales counter of the museum sells stamps from all over the world.

National Science Centre, New Delhi

This Centre houses a unique collection of science models to arouse interest among children. The children are made aware of the effective use of science in our lives. It is one of the best science centers of the National Council of Science Museum (NCSM) exhibiting scientific models and intriguing artifacts. Several galleries in the centre pertaining to various themes have a plethora of exhibits. These exhibits are based on different laws and theories of science.

Strengthening and Modernization of Museums

Emphasis has been given for Modernization of Museums in four metropolitan areas, namely Delhi, Kolkata, Mumbai and Chennai during the 11th five year plan (2007–2012). Accordingly, a new scheme for “Modernization of Museums in Metro Cities” will be taken up for its implementation during the Eleventh Plan. As such, technological up-grades of various important museums/galleries such as the National Museum, National Gallery of Modern Art, Salar Jung Museum and Indian Museum are being taken up.

The existing Scheme of Promotion and Strengthening of Regional and Local Museums also has been revised to make those museums effective and much more relevant. In order to develop the Gandhi Darshan at Rajghat, Gandhi Smriti and Darshan Samiti (GSDS) will take up the development work of the complex to make it into a tourist destination and a Center of Excellence.^[94]

Major Art Museums and Galleries (Noncommercial)

Chhatrapati Shivaji Maharaj Museum (Prince of Wales Museum), Mumbai

The Museum was opened to the public on January 10th, 1922. The collection of the museum includes the

collections of Sir Purushottam Mavji (1915), the gift of Sir Ratan Tata (1921), the collection of Sir Dorab Tata (1933) and the collection of sculptures and coins from the Poona Museum and Bombay Branch of Royal Asiatic Society. There are terracotta objects of the Indus Valley civilization, Buddhist sculptures like Bodhisathva, Maithreya, Uma Maheswara panel, a panel of Brahma, Vishnu on the Sessa, clay and stone tablets, personal emblems of traders, jewellery, paintings, thankas, Bidri work, decorative art works, glass, jade, porcelain wares, mammals, birds, and fishes are the important collections of the museum.

Goa State Museum, Goa

The Goa State Museum is known as much for its impressive architecture as for the splendid collection of ancient artifacts and sculptures. It houses an eclectic collection of over 8000 items including stone sculptures, wooden objects, bronzes, paintings, manuscripts, numismatic collection, and anthropological objects.

Government Central Museum, Jaipur

Government Central Museum not only houses many rarities and beautiful objects but its own building is also a sight to behold. The upper floor/level of the Museum mainly has portraits of royalty and Jaipur Maharajas. It has an extensive collection of jewelry, metalwork and sculpture. There are also many objects made of brass, which display the skills of the expert hands that have hammered and chiseled them to perfection. The Museum also has a huge collection of miniature paintings from the Udaipur, Jaipur, Bundi, Kota, and Kishangarh schools of painting. There are also fine specimens of woodwork, metal objects and other arts & crafts.

Government Museum, Chennai

The Madras Museum was organized during the year 1851, with about 1100 geological specimens. Museum doors were thrown open to the public on April 29, 1851. In 1896, the Front Building with the Museum Theatre and The Connemara Library was built. In 1909, Victoria Memorial, the present National Art Gallery Building, was constructed. In 1939, the New Extension Building, i.e., the main entrance building was opened. In 1963, the buildings for the Bronze Gallery, Birds' Gallery and the Chemical Conservation and Research Laboratory were added to the museum. The Contemporary Art Gallery and the Children's Museum were added to the museum in 1984 and 1988 respectively.

This museum is the oldest museum in the country, having its own conservation laboratory. The laboratory of the museum was established in 1930. In the beginning it was catering to the needs of the Madras Museum, especially to preserve the bronzes and metallic objects. Now it

is meeting the conservation needs of the Central museum and the 15 district museums. Training programs are conducted for the museologists, archivists, executive officers of the Hindu Religious and Charitable Endowments Department and others.

International Dolls Museum, Chandigarh

International Dolls Museum in Chandigarh, established in 1985, is one of the best museums of India. It houses splendid dolls and puppets gathered from all over the world. It has about 250 different kinds of dolls collected from countries like Denmark, Germany, the Netherlands, Spain, Russia, Korea, etc. An added attraction for children is the toy train.

Salar Jung Museum, Hyderabad

Salar Jung Museum, Hyderabad, has a great history behind its formation. Its collection grew out of the rich and variegated collection made by the family of Salar Jungs. In 1961, through an Act of the Parliament, the museum, along with its Library, was declared as a Museum of National Importance. Salar Jung Museum has a total collection of 48,361 items. These objects are being classified into Indian, Western, Middle Eastern and Far Eastern collections. It is a very popular museum.

Thanjavur Art Gallery, Thanjavur

The Art Gallery at Thanjavur is housed in the former palace of the Nayaks, who were once the viceroys of the Vijayanagara rulers and later became rulers themselves. The gallery houses a treasured collection of bronze icons, stone sculptures and other artifacts. The examples of art that we see today at this gallery are the finest of their kind. Most of the pieces belong to the Chola period between the ninth and the thirteenth centuries A.D., to the post-Chola period and to the Nayak period, from the seventeenth to the eighteenth Century A.D. The gallery also houses a few sculptures from the Pallava period.

India's First Sex Museum (Antarang), Mumbai

The clinic-cum-museum, Antarang, was the brainchild of Grant Medical College alumnus and artist Dr. Prakash Sarang. City authorities in Mumbai in 2002 opened a sex museum to raise understanding about sex and related issues. This is the city's—and probably India's—first such museum.^[95]

Science and Natural History Museums

Science museums

From the early days of its independence (1947), an emphasis was placed on research in science and technology that

transformed India into an important industrial and technological power in the twenty-first century. Science museums have played an important role in creating a social awareness about scientific progress made by the country. Some of the leading science museums are described in the next few paragraphs.

Birla Industrial and Technological Museum, Kolkata. Birla Industrial and Technological Museum was established in 1956, by the Council of Scientific and Industrial Research. Since 1978, the museum has come under the National Council of Science Museums (NCSM). The primary objective of the museum is to arouse scientific curiosity and an understanding of science and technology among the common people, especially the student-community.

It has a large number of exhibits. Galleries cover models showing Electricity, Nuclear Physics, Iron and Steel, Optics, Motive Power, Communication and Mining. The Optics Gallery has since been converted into a Popular Science Gallery. Popular activities of the Museum include films shows, demonstration-lectures, hobby activities, and periodical programs of sky-observation through telescopes. The museum also has a small “animalorium” with live snakes, reptiles, rabbits, an aviary and aquariums. An Underground Mock-up Coal Mine, Rabbit House, Snake Pits, Aquarium, Aviary, Bonsai and Cacti Garden are some of the other attractions.

Nehru Science Centre, Mumbai. Nehru Science Centre uses innovative ways to communicate science in ways that enthuse, entertain, initiate, excite and to enhance public understanding of science and spread scientific literacy. The galleries in the main building are full of exciting, interactive and interesting exhibits on topics quite relevant to school curriculum and general interest in science. These exhibits also facilitate people in general to understand and appreciate principles of science through fun and pleasure.

The National Science Centre, Delhi. The National Science Centre, Delhi, was inaugurated on the January 9, 1992, is a pioneering institute engaged in the organization of science among the people of the northern part of India in general and among students in particular. Since opening, the Centre has rendered yeoman service to the cause of science organizations.

Periyar Science and Technology Centre, Chennai. The Periyar Science and Technology Centre was established in 1986. It is a Science and Technology Museum run by the Government of Tamil Nadu. This thrust of the museum is to popularize science and technology among students, the general public and tourists. This museum has seven galleries popularizing scientific and technological aspects through working models. Most of the exhibits are

interactive. It also has a Science Park, Eco Park, Energy Park, Traffic Park and a model meteorological observatory.

The Regional Science Centre, Bhopal. The Regional Science Centre, Bhopal was opened on January 12, 1995. Umbrella—The Atmosphere, Fun Science, Life Science, 3D Science Show Theatre, Children’s Activity Corner, Science Park are some of the important galleries of the Centre. The Fun Science Gallery of the Centre offers learning through play.

The Regional Science Centre, Lucknow. The Regional Science Centre has been functioning since 1989 as a centre of interactive science learning. The upgrade of the Centre to the Regional Science City was effected on September 21, 2007. The objective of the upgrade is to create scientific awareness and temperaments among students and the public, and to supplement formal science education and create interest in science among students. Some of the attractions include underwater Exploration, Biotechnological Revolution and Being Human, 3-D Science Show and Space Theatre where Large Format Film Projection.^[96]

Science City, Kolkata. The Science City, Kolkata, was built recently, in the twenty-first century. The concept of science city is simply mind-blowing. There are cable cars, a toy train and a children’s playground with jungle gyms and slides. Dynamotion is a great favorite among children, with its large exhibit on physics and mechanics. Life-size dinosaurs, aquariums, insectariums and the butterfly corner are also great attractions. Science City also has a Time Machine, which simulates a journey into the past and future with sights and sounds. The Space Theatre is by far the most popular attraction.

Visvesvaraya Industrial and Technological Museum, Bangalore. The museum opened to the public in 1965, has seven permanent exhibition halls viz. Engine Hall, Electro-technic, Fun Science, Space-Emerging Technology in the service of mankind, Biotechnological Revolution, BEL-Hall of Electronics, Science for Children and two special exhibits viz. Dinosaur Corner and Wright Brothers’ Aero- plane.

Natural history museums

The Natural History Museum, Chandigarh. In 2001, the existing museum of Evolution of Life was upgraded to its present status as the Natural History Museum with five major sections:

- Cyclorama of Evolution of Life
- Nature in Art section
- Manuscript section

- Evolution of Man section
- Dinosaurs of India section

The Nehru Planetarium, New Delhi. The Nehru Planetarium in New Delhi is situated in the sprawling surroundings of the Teen Murti House. In 1964, the Jawaharlal Nehru Memorial Fund was set up to promote ideas of Jawaharlal Nehru and subsequently it undertook to build the Nehru Planetarium. The primary aim of the Planetarium is the promotion of astronomy and space education.

Historical, Anthropological, and Archaeological Museums

Nehru Memorial Museum and Library, New Delhi

This museum revolves around the life and works of Jawaharlal Nehru (former Prime Minister), especially those objects pertaining to the freedom struggle. A collection of photographs and newspapers enables one to have a feel of the stirring events that led to the birth of the Indian Republic. The Museum has a library also which is a storehouse of books on Indian history and Indian national movement.

Birla House, New Delhi

The Gandhi Smriti or Birla House or Birla Bhavan, in New Delhi, is the location where Mahatma Gandhi (the Father of the Nation) spent the last 144 days of his life and was assassinated on January 30, 1948. It was originally the house of the Indian business tycoons, the Birlas. It was acquired by the Government of India in 1971 and opened for the public on August 15, 1973 and renamed the Gandhi Smriti (or *Gandhi Remembrance*). The museum in the building houses a number of articles associated with Gandhi's life and death. Visitors can view the preserved room where Gandhi lived and also visit the place on the grounds where he was shot while holding his nightly public walk. The Martyr's Column now marks the place where Gandhi, the "Father of the Nation" was assassinated.

Anthropological Museum (Department of Anthropology, University of Delhi), Delhi

The Museum consists of

a large number of material cultural objects associated with different economic and social types, such as hunting and food-gathering, fishing, horticulture, animal breeding, farming and agriculture. Musical instruments from different societies are also kept in the Museum. So are the models of different types of habitation from Indian tribes. Dresses and ornaments, and weapons, constitute a separate section in the Museum.

The museum has a

rich collection of stone and bone implements ...The Museum also had a handsome collection of the casts of fossil man. Stuffed great apes are also kept, so are the bones of the nonhuman primates. All these are used for physical anthropological work.^[97]

The Museum is considered one of the best anthropological museums in the country.

The Archaeological Museum, Khajuraho (Madhya Pradesh)

It was established in 1904 and has excellent exhibits of sculptures from the temples of Khajuraho.

Sarnath Archaeological Museum

Amongst the exhibits at the museum are the figures and sculptures that date back to the Mauryan, Kushan and Gupta period of Sarnath. While holidaying in Sarnath one should not miss the Asokan Pillar, the prime attraction of the archaeological museum.

The Archaeological Museum, Nalanda

The Archaeological Museum at Nalanda in Bihar is a storehouse of the excavations from Nalanda and Rajgir. The exhibits at the museum include sculptures and various other archaeological remains.

The Archaeological Museum, Delhi

The Archaeological Museum of Delhi is situated in the Mumtaz Mahal (Palace) of the Red Fort. The museum has on display some of the rare relics dating back to the Mughal era, along with specimens of the fine calligraphy of the past. The main reason to establish the museum was to bring together all the items reminiscent of the history of the city of Delhi under one roof. The Museum includes excavated objects belonging to the Maurya, Sunga, Kushana, Rajput, and the Muslim period.^[98]

Surveys of India

There are various Surveys in India that take stock of the situations in respective disciplines such as anthropology, archaeology, botany, geology and zoology. These Surveys are under the control of the Government of India. They are closely connected with museums and museology.

The Archaeological Survey of India (ASI), under the Ministry of Culture, is the premier organization for archaeological research and protection of the cultural heritage of the nation.

The Anthropological Survey of India (AnSI) is a unique organization dealing with the anthropological research in public or private sector and regulates the anthropological activities such as studying tribes and other communities.

The Botanical Survey of India (BSI) is an institution under the supervision of the Union Ministry of Environment and Forests that surveys the plant resources of the Indian empire.

The Geological Survey of India (GSI), one of the oldest surveys in the world, is a premier organization of Earth Science Studies in the sub-continent. The Zoological Survey of India (ZSI), as the premier national organization under the Government of India engaged in field survey and laboratory investigation on faunal resources of India.

Zoos

There are 169 recognized zoos in the country. Leading zoos are described below:

The Alipore Zoological Gardens, Kolkata

The Alipore Zoological Gardens (also informally called the Alipore Zoo, Calcutta Zoo or Kolkata Zoo) is India's oldest formally stated zoological park (as opposed to royal and British menageries) and a big tourist attraction in Kolkata. It is home to one of the few captive breeding projects involving the Manipur Brown-antlered Deer.

Arignar Anna Zoological Park, Chennai

Chennai has the distinction of having the first zoo in India, which was started in 1855. It has a Lion safari, Bird aviaries, Reptile House, Nocturnal House, and Mountain Cave Entrance.

Indira Gandhi Zoological Park, Visakhapatnam

Indira Gandhi Zoological Park is located amidst Kambalakonda Reserve Forest in Visakhapatnam. Nearly 80 species numbering about 800 animals are found in the zoo. The Zoo Park has different sections for primates, carnivores, lesser carnivores, small mammals, reptiles, ungulates and birds caged in their natural ambiance.

Madras Crocodile Bank Trust

The Madras Crocodile Bank Trust or CrocBank is a reptile zoo and herpetology research station, located near Mahabalipuram, 40 km south of the city of Chennai. It was established in 1976 with the aim of saving the three Indian species of crocodiles—the marsh or mugger crocodile, the saltwater crocodile, and the gharial—which at the time were all nearing extinction. The captive breeding program of CrocBank has been highly successful, with

thousands of crocodiles reintroduced to the wild and more still sent to zoos and wildlife parks around the world. The CrocBank is currently home to over 2400 crocodiles, and also houses many species of turtles, snakes, and lizards which are viewable by the public.

Mysore Zoo, Mysore

The Mysore Zoo was established under royal patronage in 1892, making it one of the oldest zoos in the world. It is home to a wide range of wild species. The official name for the zoo is Shri Chamarajendra Zoological Gardens, though it is known commonly by its shortened name. Mysore Zoo is one of the city's most popular attractions.

Nandan Kanan Zoological Park, Bhubaneswar

The zoo was established in 1960–1961. A major renovation was done during 2000. Nandan Kanan is famous for its white tiger population, the species it claims to have produced. Endangered species such as the Asiatic lion, three Indian crocodilians, Sangal lion-tailed macaque, Nilgiri langur, Indian pangolin, mouse deer and countless birds, reptiles and fish have been breeding successfully at Nandan Kanan. Some of the other attractions of Nandan Kanan are the 34 aquaria which are home to a large variety of fresh water fishes. Around 67 kinds of mammals, 18 varieties of reptiles, 81 species of birds, and overall more than 1200 (as of 2005–2006) wild animals coexist in the deep forest. The zoo enjoys a good reputation, internationally, for successfully breeding black panthers, gharial crocodiles and white tigers in captivity. This is one of the few zoos in India where one can see animals in their natural environments.

National Zoological Park, New Delhi

The Delhi National Zoological Park is among the finest Zoological Gardens in the country. It has 2,000 varieties of animals and birds. The animals include Gir Lions, Zebras, Spider Monkeys, and Chimpanzees as well as innumerable reptiles and birds. There are also about 200 varieties of trees in the Park.

Nehru Zoological Park, Hyderabad

Nehru Zoological Park is the largest zoo in India. It was established in 1963. It has a wide selection of nearly 1500 species of birds, animals and reptiles housed here. The zoo runs different safari trips, like Lion Safari, Tiger Safari, Bear Safari, and Butterfly Safari. Other attractions include elephant rides, a Natural History Museum, and a children's train.

Padmaja Naidu Himalayan Zoological Park, Darjeeling

This Zoological Park specializes in breeding animals adapted to alpine conditions, and has done successfully captive breeding of the snow leopard, the critically endangered Himalayan wolf and red panda. The zoo now contains endangered animals like snow leopards, red pandas, gorals (mountain goat), Siberian tigers and a variety of endangered birds.

Parassinkkadavu Snake Park, Kannur, Kerala

There are about 150 varieties of snakes including the spectacled cobra, King cobra, Russell's Viper, Krait, and Pit Viper living in the park. The park also has a large collection of nonpoisonous snakes, including pythons.

Sakkarbaug Zoological Garden, Junagadh

Sakkarbaug Zoological Garden is also known as Sakkarbaug Zoo or Junagadh Zoo. It is famous worldwide for providing purebred Asiatic Lions for the Indian and the international endangered species captive breeding program for critically endangered Asiatic Lions. Wild free ranging Asiatic Lions have become extinct all over Asia and are today found only in the nearby Gir Forest.

Trivandrum Zoo, Thiruvananthapuram

This is one of the best designed zoos in Asia. It is also one of the oldest in the country, established as an annexe to the Museum (Napier Museum) in 1857 by the erstwhile Maharaja of Travancore. The Zoo has 75 different species of animals, not only from India but also from abroad.

Taraporewala Aquarium, Mumbai

Here one can view beautiful marine life, such as rare species of fish, and wonderful pearl jewelry.

National Parks

Indian National Parks provide many opportunities to the visitors to have a close encounter with the wild. But what is so fascinating about the Indian National Parks is that they have a great deal of variety. Seeing the flora, avifauna, and aquafauna, or witnessing various wild forms in their natural surroundings on an elephant or inside a jeep, or through wild ventures is a great experience not to be missed.

Some of the best jewels of Indian wilderness include the Great Himalayan National Park, Dachigam National Park near Srinagar, Corbett National Park in Uttar Pradesh (also a famous tiger reserve), Ranthambore National Park

in Rajasthan, and Sundarbans National Park in West Bengal. Worth visiting in the East Indian part of the country, in "The Land of Rhino" Assam, is Kaziranga.^[99]

Great Himalayan National Park (GHNP)

This national park, built in the year 1984, is located in Kullu region in the state of Himachal Pradesh. It is home to more than 375 faunal species. So far, 31 mammals, 181 birds, 3 reptiles, 9 amphibians, 11 annelids, 17 mollusks and 127 insects have been identified. A trek of 35–45 km. takes one to the high altitude habitat (3500 m and above) of various animals such as blue sheep, snow leopard, Himalayan brown bear, Himalayan tahr, and musk deer.^[100]

Dachigam National Park

Dachigam National Park is located 22 km from Srinagar, Jammu and Kashmir. The park has been a protected area since 1910. It was declared a National Park in the year 1981. The main animal species that Dachigam is most famous for is the Hangul, or the Kashmir stag. Other species that inhabit its interiors include musk deer, leopards, Himalayan gray langurs, leopard cats, Himalayan black bear, Himalayan brown bear, jackals, hill fox, Himalayan weasel, yellow-throated martens, jungle cats, long-tailed marmots and otters.^[101]

Corbett National Park, Ramnagar

This is the oldest national park in India. The park was established in 1936 as Hailey National Park. Located in Ramnagar, Nainital district of Uttarakhand State, the park is a protected area for the critically endangered Bengal tiger of India under the Project Tiger, an Indian wildlife protection initiative.

Ranthambore National Park

Ranthambore National Park is one of the largest and most famous national parks in India. It is situated in Sawai Madhopur district of Rajasthan, about 130 km from Jaipur. This Park was established as the Sawai Madhopur Game Sanctuary in 1955 by the Government of India. It was declared one of the Project Tiger reserves in 1973. Ranthambore became a national park in 1980. In 1984, the adjacent forests were declared the Sawai Man Singh Sanctuary and Keladevi Sanctuary. In 1991, the tiger reserve was enlarged to include both Sawai Man Singh and Keladevi sanctuaries as well. The park is famous for its tiger population. The major wild animals include the tiger, leopard, nilgai, dhole, wild pig, sambar and chital. It also has a wide variety of trees, plants, birds and reptiles. Ranthambore has one of the largest Banyan trees in India.

Sundarbans National Park

Sundarbans National Park (since 1984) is a Tiger Reserve, UNESCO World Heritage Site (since 1987) and a Biosphere Reserve (since 1989). It is located in the Sundarbans delta in West Bengal, lying in a region that is densely covered by mangrove forests. It is considered one of the largest reserves of the Bengal tiger. The park has a large variety of bird, reptile and invertebrate species, as well as salt-water crocodiles.

Kaziranga National Park

Kaziranga National Park is in the Golaghat and Nagaon districts of Assam. It was established in 1905 as a reserve forest. It is both a national park and World Heritage Site. Two-thirds of the Great One-horned Rhinoceroses of the world live in the park. Kaziranga has the highest density of tigers among protected areas in the world. It was declared a Tiger Reserve in the year 2006. The park has also a large population of elephants, water buffalo and swamp deer. Kaziranga is recognized as an Important Bird Area for the conservation of avifaunal species.

Digital Museum Exhibits and Services

Indian museums have been lagging behind in creating digital museums. However, there are signs that they are getting involved in this seriously. Some of the examples of museums that have ventured into this field are given below:

The Government Museum and Art Gallery, Chandigarh

A few years back, the Museum established the “Data Collection Management” section. Inputting of inventory data, object description and conservation data of the collection was started with a pilot project of 627 pieces of Gandharan sculptures. Inputting data about Indian miniatures, contemporary paintings, Indian Medieval and contemporary sculptures is also in progress.

Digital Library of India (Program)

The mission is to create a portal for the Digital Library of India (DLI) which will foster creativity and free access to all human knowledge. This portal will also become an aggregator of all the knowledge and digital contents created by other digital library initiatives in India. The Digital Library of India is mirrored at several locations so as to protect the integrity and availability of the data. The DLI is also a partner with other country specific Digital

Libraries initiatives as part of the Universal Library Project (<http://www.ulib.org>) spearheaded by Prof. Raj Reddy and Carnegie Mellon University.

Indian National Museum, New Delhi

Computerization and digitization for an automated retrieval system for the Museum has been completed. Computerization of reference media for certain records (such as records for the Ministry of External Affairs (1947–1970), Ministry of State (1947–1953), etc.) has also been completed. A project for digitization of rare and valuable manuscripts is ongoing.

The Indira Gandhi National Centre for the Arts (IGNCA), New Delhi

The National Mission for Manuscripts is one of the departments of IGNCA, created in February 2003 with an aim to protect the manuscripts culture of this country and it is also to carry out the digitization of the manuscripts.

Museology as a Discipline and Profession

Museology has come of age. Today, it has become a multi-disciplinary and increasingly interdisciplinary area of studies. At one time it was a minor area of studies, but now it has become a subject forming part of the mainstream.

Museology in India has grown into a profession in its own right. Museum scholars belong to different disciplines and backgrounds, bringing together a broad range of perspectives. Museology fulfills the characteristics of a profession. In recent years, there has been recognition of the need for trained professionals. Today, museum professionals are expected to possess professional qualifications obtained from recognized institutions.

Education for Curatorship and Museum Administration

Due to the recognition of need for professional training, a number of university level courses have been started.

The National Museum Institute of History of Art, Conservation and Museology came into existence in 1983 and now is deemed to be a University. It provides various Courses with its campus at National Museum (New Delhi).

Some of the Universities offering courses are:

Aligarh Muslim University, Aligarh

M.A. Program besides one-year diploma in museology and Ph.D. Programs

Banaras Hindu University, Varanasi

Diploma in Museology, M.A. in Museology after graduation and Ph.D
 Jiwaji University, Gwalior
 M.A. in Ancient History, Culture and Archaeology
 M.A. (Museology)
 PG Diploma in Archaeology
 Maharaja Sayajirao University, Baroda
 M.A. (Fine) Museology and Ph.D. Courses as well as 1 year Diploma Course for in-service people.
 National Museum Institute of History of Arts and Conservation and Museology, New Delhi
 M.A. (Arts History), M.A. (Conservation), M.A. (Museology); Ph. D (Art History), Ph.D (Conservation), Ph.D (Museology). Besides, the Institute also runs short-term courses in the History of Art stream for general public. The courses are:

- Art Appreciation Course (English)
- India Art and Culture Course (English)
- Bhartiya Kala Nidhi (Hindi)

University of Calcutta, Kolkata
 Diploma in Museology after graduation, M.A. in Museology, PG diploma in Museology and Ph.D. in museology.
 Vikram University, Ujjain
 1-year PG Diploma in Museology

Besides these many museums also provide training in museology and related subjects.

Chemical Conservation and Research Laboratory, Government Museum, Chennai, started a refresher course in 1974 on Care of Museum Objects. At present, it offers one-month long training in Care of Museum Objects for those who are working in museums in allied departments; Course on Care of Temple Antiquities for the Executive Officers of the Hindu Religious and Charitable Endowments Department, Government of Tamil Nadu, Chennai, a course on Care of Archival Materials exclusively for the Archivists, a Course on Care of Library Materials for Librarians etc.^[102]

The Conservation Laboratory of the National Museum, New Delhi organizes training programs for students, curators and conservators and also provides training facilities to students and professionals, including restoration of oil paintings. It organizes workshops and seminars at various places from time to time on conserving the vast cultural heritage of the country.

INTACH, Indian Conservation Institute offers various courses in Conservation of Paintings, Documents, and Manuscripts to graduates in Science or Chemistry graduates or BFA degrees at New Delhi and Lucknow.

Professional Associations for Curators and Museum Administrators

The following are the major professional associations:

Indian Council of Historical Research, New Delhi

The Indian council of Historical Research, New Delhi is an autonomous body established by the Government of India with a view to providing funds for historical research and to fostering objective and scientific writing of history. The Council has taken a broad view of history so as to include in its fold archaeology, socio-economic formations and allied subjects.

National Council for Science Museums, Kolkata

The National council of Science Museums, an autonomous organization under the Department of Culture, was set up in 1978 and is primarily engaged in the task of popularization of science and technology among the students in particular and the masses in general through a wide range of interactive programs and activities. It administers 21 science museums/centers/parks throughout the country.

Museum Association of India (MAI), New Delhi, c/o National Museum, New Delhi

The Museum Association of India was founded in 1944. The aim of the Association is to further the cause of museums in India by making them popular with the public by providing new ideas through seminars and publications, and by promoting mutual appreciation of mutual problems by holding museum conferences. The Association has also taken up the responsibility for representing the cause of museums and their personnel. The Museum Association of India brings out the *Journal of Indian Museums* and *Museum's Newsletter*.

Indian Association for the Study of Conservation of Cultural Property in India (IASC) c/o National Museum Institute, Janpath, New Delhi—110011

The Indian Association for the Study of Conservation of Cultural Property was started in New Delhi to create a common platform for conservation scientists, conservation chemists, conservators, architectural conservation engineers etc. It provides a professional centre devoted to the cause of conservation and study of cultural property including historic, archaeological, ethnological, artistic, archival and other material in libraries, manuscript repositories and museums. It brings out a journal called *Conservation of Cultural Property India* annually and *Conservation Newsletter* in August every year. Besides these, it also publishes books on special topics.

Indian National Trust for Art and Cultural Heritage (INTACH) Indian Conservation Institute

The main aims and objectives are: To take up conservation and restoration of different types of objects, to impart

training in different branches of conservation and to create awareness among the public about the need for conservation and the problems involved through periodical exhibitions, seminars and workshops.

The Indian Conservation Institute has branches at Bangalore, Bhubaneswar, New Delhi, Rampur, Jaipur, Trissur, etc.

Key Contemporary Issues

Publicity

An on-going study by the National Museum Institute has revealed that “about 90 percent of the people standing at the bus stop right outside the museum did not know where the museum was or what was in it?”^[103] This may be true to a large extent, even today. This shows lack of publicity.

Procurement

A large number of rare items of Indian origin are held by museums and private individuals in Europe and in South-east Asian countries. From time to time they appear at auctions. Indian museums sometimes have tried to acquire them, but due to lack of sufficient budget, they have not been able to acquire many pieces.

Preservation

The contemporary scene in India is abysmal and needs to be redressed for any meaningful discussion on plunder of the heritage. Although the ASI has declared over 3000 monuments as nationally important, it is the sixteen sites that have been declared as part of World Heritage that receive greater attention. Thus there is clearly an imbalance in regional coverage both of heritage sites and protected monuments. Similarly there are far more museums in cities than in rural areas, though even within the cities the situation is far from satisfactory.^[104]

Access

The social service role of Museums and Art Galleries in making their resources accessible to all is an important issue. There is a need for a National Policy on Museum Accessibility that gives due importance to accessibility factors.

Museums are currently creating Web sites. The question arises as to what should be the role of museum Web sites? Should each be a separate entity from the museum itself? Should the Web site be a mere advertising medium for a museum?

Education

In a country as large as India, only 25 university departments across the country conduct archaeological field-work and offer post-graduate education on the subject. Even in the national capital, none of the prestigious universities has a full-fledged department of archaeology at the undergraduate or postgraduate level.^[104]

There is a need for setting up full-fledged departments of archaeology at universities for teaching and research.

Presentation techniques

Museums in India are not updating their presentation techniques due to lack of funds and training of the curators. New lighting methodologies have been adapted in national museums and other large State museums. But all small museums, such as the district level museums, school and college museums do not have adequate funds for updating the museums.

Conservation

Major museums have their own conservation laboratories. There are also regional conservation laboratories in various regions. But they are inadequate to meet the needs of existing museums. There is a need for more conservation laboratories to serve the increasing number of museums.

Conservation of Extinct Species of Wild Animals. India once had rich biodiversity that has become considerably depleted. The question arises as to how this fall in biodiversity can be checked and also reversed.

Project Tiger was launched in 1973 to provide tigers an opportunity to breathe and grow in their natural habitat. However, as administration focus has dwindled and priorities have changed, implementation of the program has certainly suffered and funds sanctioned for Project Tiger have also not been properly utilized. There is a need for such projects to cover other species as well that are facing extinction.

Present Situation

India is a country that is rich in culture, heritage, science and artifacts. Its museums and art galleries house a great cultural heritage. The National Museum, New Delhi is the top museum in the country. In addition to State museums and art galleries, there are a large number of art museums and galleries (non-commercial) that display India's rich heritage. Strengthening and modernization of museums in four metros, namely, Delhi, Kolkata, Mumbai, and Chennai is taking place under the 11th five year plan (2007–2012). Hopefully, this will lead to resurgence of Museums and Museology.

India also has a rich biodiversity. The country possesses bountiful forest areas that display the richness of species and the range of habitat types. The National Zoological Park, Delhi, is the finest Zoological Gardens in India. Some of the best jewels of Indian wilderness include the Great Himalayan National Park in Himachal Pradesh, Dachigam National Park near Srinagar, Corbett National Park in Uttar Pradesh (which is also a famous tiger reserve), Ranthambore National Park in Rajasthan, and Sundarbans National Park in West Bengal, and Kaziranga in Assam (the land of rhino).

CONCLUSION

With a population of over one billion, India is the world's largest democracy. It has a large pool of talents with over 620 million people of working age. Its economy is growing at an average rate of 8%. With booming IT services, state-of-the-art communication, and fast growing service industries, India is poised to become a global power.

Convergence of Libraries, Archives, and Museums

There are certain areas and issues of common interest among the three fields of specialization. Areas of common interest include acquisition, organization, preservation, and digitization of documents, designing of Web sites, organization of exhibitions, display of items, management problems, status in the society, etc. These areas can serve as a starting point for a fruitful dialog. Today, the situation is such in India is that there is very little interaction between these three areas.

There is little convergence happening in India. The National Mission for Manuscripts is an example of convergence, where libraries, museums and archives are involved in the effort. The post of Librarian at Jawaharlal Nehru University was advertised recently, the desirable qualification was M.Phil./Ph.D. degree in library science/information science/documentation/archives and manuscript-keeping. This is a step toward convergence. There are very few examples of this kind.

There is a need to create linkages across different kinds of information institutions in India. Librarians, archivists, and museologists need to work out common strategies for making collections accessible and facilitating inter-linkages between different kinds of collections. Plans for common content strategies can be worked out in various programs and projects involving digital work. In fact, there are common problems faced by information professionals, such as that new materials often are in unstable digital formats.

They should work together joining hands to do a better job, in spite of differences in focus, practices, perception, standards for digital format, etc. It may be kept in mind that often users want information, rather than a specific

book, an archival folio, or a museum object. Let there be cross-fertilization of ideas, practices and experiences. This will do a lot of good for information professionals and institutions in India.

Cooperation among Information Institutions

There are some ongoing projects involving cooperation among information institutions such as the Digital Library of India, National Mission for Manuscripts, etc. The Digital Library of India is hosted by the Indian Institute of Science, Bangalore in cooperation with CMU, IIIT, NSF, ERNET, and MCIT for the Government of India and 21 participating centers. The National Mission for Manuscripts was launched in February 2003 by the Ministry of Culture, Government of India, to save the manuscripts, one of the most valuable but less visible cultural heritage. The main aim of the mission being to create an electronic database of manuscripts.

Trends

In memory institutions, there is a definite shift in emphasis toward access to information instead of ownership of information. Digitization of documents has helped in this shift. Computerization of libraries, archives and museums is taking place. All major information institutions have their own Web sites. Large number of digital libraries have been designed. Museums are putting out digital exhibitions and digitizing their collections. Archives are also digitizing their collections.

Digital libraries in information institutions are beginning to become the center of information services. Information institutions are increasingly participating in creating open sources. The open source movement in India is getting quite strong. These are healthy signs.

Issues

The question arises, are the graduates being produced by the schools of library science, archival science and museology employable? The quality of graduates being turned out in India leaves much to be desired. The quality of education needs to be improved to bring it up to the international level.

There is not enough financial support available for the information sector. However, there are signs that in the 11th five-year plan (2007–2012), the Government of India is committed to providing better support for preserving the national heritage and making it accessible to the people.

Lack of a good image is a matter of concern. Improvement in quality of education can go a long way in this respect. In addition, the theoretical basis of the disciplines of library science, archaeology and museology needs to be strengthened, so that they are considered on a par with other disciplines in higher education.

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Indigenous Librarianship

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Abstract

Indigenous librarianship unites the discipline of librarianship with Indigenous approaches to knowledge, theory, and research methodology. It has a developing bibliography and local, national, and international professional associations devoted to its growth. A focus of Indigenous librarianship is the provision of culturally relevant library and information collections and services by, for, and with Indigenous people. Grounded in the contemporary realities of Indigenous people and Indigenous aspirations for self-governance and sovereignty, it has a critical theoretical base. Its practice may be carried out in spaces from small Indigenous community libraries to specialized collections in large research institutions. As an emergent scholarship the field is in the process of defining itself. This entry serves as an introductory overview to the history, practice, issues, and theoretical approaches associated with Indigenous librarianship.

INTRODUCTION

Indigenous librarianship unites the discipline of librarianship with Indigenous approaches to knowledge, theory, and methodology. It emerged as a distinct field of practice and an arena for international scholarship in the late twentieth century bolstered by a global recognition of the value and vulnerability of Indigenous knowledge systems, and of the right of Indigenous peoples to control them.^[1,2] Its growth converges with the development of Indigenous research paradigms that place Indigenous control, benefit, and values at the center of research.^[3] The field of Indigenous librarianship is rooted in long-standing and established practices that Indigenous peoples employ to create, transmit, and preserve knowledge. These practices maintain Indigenous cultural and social systems and provide protocols for ownership and the appropriate use of community knowledge.^[4,5]

Indigenous librarianship has a developing bibliography and local, national, and international professional associations devoted to its growth.^[6] Its foundations rest on strong understandings of the concerns of Indigenous people about the intersections between Indigenous knowledge and culture, and library and information science. Indigenous cultural principles are considered critical to restoring and continuing the principles of Indigenous knowledge management and sharing. Indigenous librarianship

encourages the broader profession to move beyond its own disciplinary knowledge base and engage in multidisciplinary approaches with Indigenous cultural experts, information technology (IT) developers, governments, and other institutions.^[7]

The purpose of the entry is to survey this protean field through establishing its social and historical contexts, profiling leading practitioners, and highlighting some of the key issues. This entry focuses on Indigenous librarianship within the United States and Canada, and is informed by Indigenous scholarship in Aotearoa/New Zealand and Australia with reference to other international initiatives in order to give a sense of the breadth and the diversity of the provision of library and information services by, for, and with Indigenous peoples. As an emergent scholarship, the parameters and scope of Indigenous librarianship are fluid and although it has a rich discourse there is as yet no codified definition of the field. This entry therefore describes some of the features and begins to map the landscape of Indigenous librarianship.

Methodology

The reality of the practice of Indigenous librarianship is underreported and exists beyond the literature: it exists in the lives of those who work directly with Indigenous peoples.^[8] Indigenous library workers who often work outside

of the mainstream and librarians in Indigenous cultural and collecting institutions that are outside of state or public systems are the “local heroes” who serve as a link between the past and present generations.^[9] This entry incorporates a biographical approach in order to recognize and celebrate the achievements of Indigenous librarians and library workers. This approach is informed by Indigenous research methodologies that strive to surface the contributions and legacies of Indigenous people, and aligns with Linda Tuhiwai Smith’s Indigenous projects of testimony, storytelling, sharing, and returning.^[10]

Terminology

The original inhabitants of North and South America, Australasia, Africa, and Asia are often identified as a type of collectivity that is seen in contradistinction to the Western or dominant society. Terminology that represents this collectivity includes words such as *Tribal*, *Native*, *Aboriginal*, and *Indigenous*. Original inhabitants within a specific country are culturally and linguistically diverse although they may also be classified as a single group within their countries. The terminology used by the state often reflects a classification established by the force of law within a country and imposes external concepts of identity that may or may not be accepted by an Indigenous individual or collective. This is a complex area with its own literatures and discourses where meanings are constructed in legal, social, cultural, and political contexts.^[11] In addition to specific names of nations, communities, cultural, and language groups, there are various generic terms used to denote Indigenous peoples.

In Canada the term Aboriginal is defined under Section 35 of the Constitution Act (1982) to include Indian, Métis, and Inuit peoples. For the purposes of this entry it is used more broadly to include all First Nations, status and non-status Indians, Métis, and Inuit people. First Nations is a term that arose in the 1970s to replace the word “Indian” which is sometimes considered offensive, and refers to a body of Aboriginal people with a shared national identity. First Nations is also used to replace the word “band,” a term defined by the Indian Act to mean a body of people defined as Indian by the government. A status Indian is a person who is registered as an Indian under the Indian Act; conversely a non-status Indian is a person not registered as an Indian under the Indian Act. Métis people are of mixed First Nations or Inuit and European ancestry who may also identify as a nation, often the Métis Nation within Western Canada.^[12]

Within the United States, the collective term Native American may include American Indian, Alaska Native, and Native Hawaiian. In Canada, the United States, Australia, and New Zealand, Indigenous people claim the right to define their own cultural identity and membership and may not accept the definitions of the state. Within international arenas, the term Indigenous peoples is pluralized to

denote the great diversity among Indigenous groups at the same time as it serves as a collective term. Indigenous peoples are seen to be

the inheritors and practitioners of unique living cultures and ways of relating to other people and to the environment who have retained social, cultural, economic, and political characteristics that are distinct from those of the dominant societies in which they live.^[13]

INDIGENOUS PEOPLES AND LIBRARIES

The United Nations (UN) estimates that there are 4000 to 5000 Indigenous cultures existing in the world, and over 370 million individuals belonging to these cultures, living in more than 70 countries.^[14] This enormous cultural and linguistic diversity among Indigenous peoples belies a shared common experience of historic and ongoing colonialism. Indigenous peoples globally continue to face the ongoing effects of the dispossession of their lands, languages, cultures, and knowledge. Many Indigenous people face economic marginalization, lack of access to social services and educational opportunities, and racial discrimination. Consequently, Indigenous people share concerns relating to the protection of their rights, lands, resources, and their cultural and intellectual property. As Lynette Russell, Director of Monash University’s Centre for Australian Indigenous Studies observes, “The First peoples in Aotearoa/New Zealand, Canada, the United States of America along with many other Indigenous peoples face similar issues relating to access to, and control of, information about their cultures and communities.”^[15]

United States

According to the 2000 census, 4.1 million American Indians and Alaska Natives comprise 1.5% of the total population of the United States.^[16] Approximately one-third live on one of 300 reservations with the remainder living in urban and rural areas. The population is young in comparison with the general population. One-third of the population lives below the poverty line, experiencing lower high school graduation rates, and less presence in higher education.^[17] There are 175 Indigenous languages spoken in the United States however, 55 are spoken by fewer than 10 people; 70 are spoken only by Elders; and only 50 of them are spoken by two or more generations. As in other countries, Indigenous language loss is considered a key factor in cultural erosion, and Native language maintenance and revitalization are a high priority.^[18]

The relationship between Native Americans in the United States and librarianship is fundamentally different from that of other cultural groups because tribal nations have a formal relationship with the federal government. This relationship is set out in treaties and court decisions

intended to assure tribal groups of certain benefits, such as, health, education, and general welfare.^[19] Although education is a treaty right of American Indians in the United States, and access to libraries and information is integral to the education process, library services to reservations were not available until the 1970s.^[20] During the 1970s, fostered by a convergence of changes in federal legislation, court decisions, and an increased receptivity to American Indian self-determination efforts, tribal libraries slowly began to develop. The National Commission on Libraries and Information Science (NCLIS) hearings in 1974 examined library services to urban and on-reserve American Indians and identified the great need in these communities and an “abysmal” lack of formal policy. The *White House Pre-Conference on Indian Library and Information Services On or Near Reservations* (1978) brought together 103 tribes to lay the groundwork to improve library services for American Indians and shape U.S. Federal library and information policy. Native Americans actively promoted and advocated for tribal libraries, the spaces that foster and preserve cultural heritage and protect a tribe’s heritage for future generations, which were a keystone in this national library service framework. Tribal libraries support oral traditions through preservation programs and the dissemination offered by print and new media. They also serve the educational, informational, and recreational information needs of Native Americans and provide vital access to government data that supports self-governance activities.

Nonetheless, the comprehensive NCLIS report *Pathways to Excellence: A Report on Improving Library and Information Services to Native American Peoples* (1992) documented inadequate library services for Native Americans characterized by discrimination and lack of culturally appropriate services for off-reserve populations, and geographic barriers to access on-reserve.^[21] Ten challenges were identified for the development of tribal libraries: consistent funding at federal, state, local, and tribal government levels; training and technical support for Native American communities; relevant collection development; improved access; state and local partnerships; identification of model programs; the expansion of the tribal library program to include museum and archival services; support for literacy and job skills training; support for IT; and the establishment of federal responsibilities.

Currently, support of tribal libraries crosses multiple jurisdictional boundaries: tribal, local, county, state, regional, and federal. Each represents potential revenue streams to buttress tribal library sustainability and capacity building. At the federal level, the Institute for Museum and Library Services (IMLS) pursues a multidimensional strategy including basic noncompetitive support for local tribal libraries, enhanced support for innovative developments within tribal libraries, national leadership initiatives designed to promote collaborative efforts and develop best

practices, and funding capacity building diversity scholarship program initiatives such as Knowledge River at the University of Arizona and Honoring Generations at the University of Texas, Austin. At the state level, some examples of tribal library initiatives are found in Arizona, New Mexico, Montana, and Oklahoma. The Arizona Gathering of Tribal Librarians is currently planning its seventh Gathering for the Spring of 2008, and a Tribal Library Consultant is employed within the Arizona State Library, Archives and Public Records. The New Mexico State Library’s Tribal Libraries Program (TLP) includes the TLP Direct noncompetitive grant for tribal libraries^[22] and the Indigenous Nations Library Program (INLP) at the University of New Mexico.^[23] In Montana, the Tribal College Librarians Professional Development Institute has been held annually since 1990 at Montana State University in Bozeman.^[24]

The Tribal Archives, Libraries and Museums conferences held biannually since 2003 are excellent examples of cross-jurisdictional collaboration in support of the development of tribal libraries. Originating from an IMLS National Leadership Grant awarded in Arizona in 2003 and 2005, the concept was expanded through an IMLS Laura Bush Librarians for the twenty-first Century Grant to the Western Council of State Libraries for 2007–2009. The Oklahoma Department of Libraries hosted the 2007 National Tribal Archives, Libraries and Museums Conference. Four National Immersion Institutes followed in 2008, one each focusing on Archives, Caring for Native American Objects, Photographic Preservation, and Tribal Libraries. The final conference of this grant cycle will be hosted by the Oregon State Library and Tamástslikt Cultural Institute in Oregon in 2009.^[25] The ability to create these platforms for collaboration and professional exchange are essential to the development, definition, and vitality of the emergent field of Indigenous librarianship. They provide the opportunity to discuss issues from Indigenous standpoints, meet other practitioners, and allow Indigenous librarians to center their practice within their ways of knowing (Fig. 1).

Canada

Canada’s Aboriginal population is young and growing six times faster than the general population. It is now over 1 million. The increase may be attributed to a variety of factors, including tendency to self-identification, birth rate, and legislative changes in definitions. The Aboriginal population consists of approximately 60% First Nations people, 33% Métis people, and 4% Inuit who live primarily in the Arctic regions. Over half of the Aboriginal population lives in urban areas. By 2017 it is projected that the Aboriginal young adult population (aged 20–29) will comprise one-third of the young adults in the province of Saskatchewan; 24% in Manitoba; 40% in the Yukon Territory and 58% in the Northwest Territories.^[28] In Canada

Fig. 1 Profile: Lotsee Patterson.

Dr. Lotsee Patterson, an enrolled member of the Comanche Nation raised on her mother's allotment in southwestern Oklahoma, is Professor Emeritus at the University of Oklahoma School of Library and Information Studies. Dr. Patterson is a founder and past president of the AILA. She is a well-known lobbyist for national legislation to fund and improve library services to United States tribes, and for helping to establish tribal libraries in the United States. Beginning in the early 1970s, Dr. Patterson wrote successful grant applications to hold training institutes for American Indian library aides, believing that training staff would pave the way for tribal libraries. Patterson carried out a series of groundbreaking tribal library demonstration projects in the 1970s, eventually publishing the seminal TRAILS (Training and Assistance for Indian Library Services) manual in 1984, a key resource for tribal librarians. Dr. Patterson cochaired both the 1979 and 1991 Native American preconferences to the White House Conference on Library and Information Services, and has mentored hundreds of American Indian librarians and students throughout her career while persistently spotlighting the critical need to fund tribal libraries and commit resources to library services for American Indians. In 2005, Dr. Patterson was recognized as "one of the most outspoken advocates for equitable library services for American Indians" with an honorary ALA membership award for her outstanding and lasting contributions to the field of librarianship.^[26,27]

there are 615 First Nations, 10 unique language families and over 60 different Aboriginal languages spoken in the country although, many Aboriginal languages in Canada are endangered or have been lost. The Indian residential school system which operated from the nineteenth century to the 1980s resulted in the dislocation of Aboriginal families, communities and cultures, and in the loss of Aboriginal languages. The ongoing intergenerational impacts of the residential school system continue to be felt today.^[29] On June 11, 2008, the Prime Minister of Canada and the Federal party leaders issued an official apology to the Aboriginal people of Canada for the damage and suffering caused by the assimilationist policies of the Canadian government.^[30] The courage and resilience of Aboriginal people and the strengths of Aboriginal cultures were acknowledged, and a Truth and Reconciliation commission established to foster reconciliation between Aboriginal people and all Canadians, and to rectify the public historic record of the past.

Public library services for Aboriginal people are uneven across the country. In some provinces, jurisdictional issues are cited as a rationale for the lack of free access to the public library system for Aboriginal people. As First Nations and Métis people are considered federal jurisdiction^[31] and public libraries are often funded at the municipal level, the principle of universal access to public institutions does not extend in practice to Indigenous peoples. In British Columbia (B.C.), there are no public

libraries on reserve, and the libraries that do exist on reserve are generally small, underfunded band council collections, and band school libraries.^[32] In Ontario, the provincial government contributes to the development of public libraries in First Nations communities. However in 2001–2002, only 52 of 141 First Nation libraries in Ontario received operating grants, and because the operating grants are based on population size many small communities are underfunded.^[33] Among First Nations communities, libraries are not always a priority when there are pressing needs in the areas of rights and title claims, infrastructure, education, and health. A First Nations library worker explains: "We need all our money to fund our land claims. If we don't have land, we don't have community. If we don't have community, we don't need a library."^[34]

The province of Saskatchewan is among the leaders in developing equitable, culturally relevant Aboriginal library and information services in Canada. The Saskatchewan Minister's Advisory Committee on Library Service for Aboriginal people report, *Information is for Everyone* (2001), makes 46 recommendations for improved library and information services for Aboriginal people. It highlights universal access to library services for all Aboriginal people, including on-reserve and off-reserve; partnerships for equitable access; increased awareness, and public education regarding Aboriginal people.^[31] A key recommendation, similar to repeated earlier ones in Ontario service reviews, is that First Nations retain control of library services on reserve, and responsibility for determining the kind of library services on reserve. The Library Services for Saskatchewan's Aboriginal Peoples Committee is composed of Aboriginal and public sector representatives who meet six times a year to advise on the implementation of the recommendations.

Public libraries in urban centers tend not to differentiate between Aboriginal people and the general population. As a consequence urban Aboriginal peoples are often not well served. There are exceptions, such as the Albert Library branch of the Regina Public Library^[35] and the Spadina branch of the Toronto Public Library that work closely with the local urban Aboriginal communities. The Edmonton Public Library conducted a survey in order to improve library services and programs for the urban Aboriginal community in Edmonton. The final report, *Library Services to Aboriginal Peoples: Task Force Report* (2005), includes an environmental scan with recommendations.^[36]

At the national level, a Library and Archives Canada national consultation on Aboriginal library services resulted in a report that included 10 focus areas for improvement in the areas of consultation and partnerships; funding and resources; jurisdiction; planning and administration; universal and equitable access; education and training; advocacy; promotion; authenticity of voice; and outreach and networking (Fig. 2).^[37]

Fig. 2 Profile: Charles Angus Cook (Thawennersere) (1870–1958).

The tenacity and vision of Charles Angus Cook (Thawennersere or Da-ha-wen-nen-se-re), a Kanesatake Mohawk, set a standard for the aspirations of Aboriginal library services in Canada. Da-ha-wen-nen-se-re (Charles Cook) worked for the Canadian Indian Affairs Records Branch from 1893 to 1926 as a clerk who classified documents relating to Indians in Canada, and as a translator who translated Iroquois dialects into English. Early in his career he envisioned and advocated for a National Indian Library. He also lobbied tirelessly for the development and proper organization of the Department of Indian Affairs' collection of Indian materials and recommended supplementing the government collection with materials contributed by Aboriginal people in order to reflect Aboriginal perspectives and understandings. He recommended free access to the collections for departmental staff and for all status Indians. In later years, Da-ha-wen-nen-se compiled a Mohawk dictionary and published a Mohawk language newspaper, *Onkweonwe*, the first newspaper in Canada to be produced and published solely by an Aboriginal person.^[38]

Australia

Aboriginal Australians and Torres Strait Islander people are two culturally distinct Indigenous peoples of Australia. The Torres Strait Islanders are the traditional inhabitants of the Torres Strait Islands which lie north of Cape York, Queensland; Aboriginal people are located primarily in mainland Australia, including Tasmania. In 2006, 2.5% of Australia's total population of over 21 million are identified as Indigenous.^[39] The Indigenous population in Australia is growing rapidly and is also young; 39% are under 15 years of age. While the largest proportion of Indigenous people live in urban areas (30%), a high proportion live in Outer Regional (23%), Remote (9%), and Very Remote (18%) areas when compared against national statistics.^[40]

Before European contact, Indigenous peoples in Australia comprised over 500 different language groups. Beginning in the late 1700s, British colonization violently suppressed Aboriginal cultures: colonial legislation regulated segregation, restricted movement, and forcibly removed children from their families.^[41] The Australian government's *Bringing Them Home* report (1997) documented the impact of over 150 years of these policies that dislocated families, impacted physical and mental health, resulted in losses of language, culture, and connection to traditional land. On February 13, 2008, a historic parliamentary vote adopted Prime Minister Kevin Rudd's apology on behalf of all Australians for the harm done to the Indigenous people of Australia.^[42]

A 1993 report revealed that Australian Indigenous library services relied on erratic grant funding and were usually initiated by community or educational organizations.^[43] A year later, an Indigenous Advisory Committee

was established to assist with the development of equitable access and inclusive services. The Library and Information Service of Western Australia (LISWA) generated a number of Indigenous-focused service plans aimed at improvement, including *Public Libraries: Good Places for Aboriginal People* (1995) and *Services to Aboriginal and Torres Strait Island Peoples* (1997).

The State Library of Queensland, acknowledging that Indigenous Australians had been "denied, excluded, and/or discouraged access," implemented an Indigenous Library Services Strategy in 2002 focusing on the establishment of Indigenous Knowledge Centres (IKCs) in remote communities, improving public library services, raising the profile of Indigenous people in libraries particularly the State Library, and increasing employment and training opportunities.^[44] By 2008, the State Library of Queensland had established 17 IKCs in partnership with Indigenous communities who own and manage the IKCs. An IKC is a community space that offers traditional library services and can be located in community Keeping Places and small museums. In addition to the initial setup costs, the State Library of Queensland provides ongoing support to IKCs in the form of training and development support, and community training programs to help preserve and share local Indigenous Knowledge, orally and digitally, and access cultural material in collecting and cultural institutions throughout the world. The State Library of Queensland has established the first Indigenous Knowledge Centre in a State Library called *kuril dhagun* which welcomes Indigenous and non-Indigenous people to engage with traditional and contemporary expressions of Queensland Indigenous knowledge. The Library has been instrumental in the development of the *National Policy Framework for Aboriginal and Torres Strait Islander Library Services and Collections*,^[45,46] as well it has developed its own policies and strategies on reconciliation, cultural protocols, language preservation and maintenance, public library services, and employment and training in the library and information sector.^[47]

In 2006, an evaluation of the Northern Territory's Libraries and Knowledge Centre (LKC) model led by Dr. Martin Nakata, a Torres Strait Islander, and Director of Indigenous Academic Programs at Jumbunna Indigenous House of Learning, University of Technology Sydney, concluded that the model had the potential for extension across the Northern Territory.^[48] The model incorporates Indigenous knowledge as part of a community-centered information and knowledge base to support the goals of community-building through libraries, and the provision of sustainable public library services that are relevant to multilingual, clan-based, Indigenous communities. Indigenous knowledge centres are also being established in Africa, Latin America, and Asia to revitalize endangered cultures and languages, contribute to economic development, and center Indigenous planning and development (Fig. 3).^[49]

Fig. 3 Profile: Joe Gumbala.

Joe Neparrnga Gumbala, a Gupapuyngu Yolŋu Elder and musician from North East Arnhem Land is a leading authority on Yolŋu intellectual and legal traditions. Gumbala is respected for his Yolŋu knowledge and his ability to interpret other knowledge systems using traditional frames of reference.^[50] As a Community Liaison Officer at the Galiwin'ku Indigenous Knowledge Centre in northeast Arnhem Land, Gumbala travels throughout Australia locating collections of Yolŋu family histories and other cultural heritage materials, and returning digital copies to Gupapuyngu communities for local access. Gumbala applies the Yolŋu traditional knowledge organization systems to the management of the knowledge centre's digital collections. Yolŋu knowledge, ceremony, and law have three strata—restricted, peri-restricted, and public. All Yolŋu materials are bound by these access and ownership principles. Kinship relations define related secondary rights to intellectual and physical property, and determine access to both historic and contemporary Yolŋu materials at the Galiwin'ku IKC.^[51]

Aotearoa/New Zealand

Māori people are the *tangata whenua* (“indigenous people”) of New Zealand. The Māori call their traditional lands Aotearoa, Land of the Long White Cloud. In Aotearoa/New Zealand, Māori people represent about 15% of the population and are expected to reach 21% by the year 2051. Like many Indigenous people, Māori are increasingly urbanized, and they experience social and economic challenges, including comparatively high unemployment, incarceration, and mortality rates, and lower outcomes in educational achievement, health, and income.^[52]

The colonization period in Aotearoa/New Zealand began during the mid-nineteenth century after the signing of the Treaty of Waitangi in 1840. Signed by over 500 chiefs, the Treaty of Waitangi guaranteed ongoing ownership of lands, fisheries, and other possessions to the Māori, and granted full British citizenship to the Māori. The orthography of the early missionaries was readily adopted by the Māori and resulted in a significant body of manuscript and printed materials written in the Māori language. In 1975 a permanent commission of enquiry, the Waitangi Tribunal, was established to address ongoing infringements on Treaty of Waitangi provisions and enable Māori people to contest breaches of promises and make claims. Evidence used in Treaty claims frequently relies on the documentary materials held in libraries and archives throughout Aotearoa/New Zealand. The Tribunal has been instructed to make its decisions based on both the English and the Māori text. Māori access to library and archive holdings is therefore central to the ongoing settlement of Māori claims and to the national reconciliation process. In addition, libraries and archives in New Zealand also play a central role in supporting Māori language revitalization efforts.

This socio-legal background sets the stage for Indigenous librarianship in New Zealand and for understanding the development of the Ngā Ūpoko Tukutuku/Māori subject headings and their role in the provision of access to Māori collections for and by Māori people.

In 1993 the Library and Information Association of New Zealand Aotearoa (LIANZA) initiated a two-phase national research project on biculturalism issues and services to Māori, *Te Ara Tika* (translated as “the right path”). The first phase undertook an analysis from the perspective of the library profession; the next phase surveyed Māori information needs and Māori opinion about libraries and library services. The findings are documented in *Te Ara Tika Guiding Voices* report (1997) which identified strong Māori interest in library and information services within six dominant themes that emerged as intellectual access and information literacy; relationships between youth literacy, libraries, and schools; Māori staffing; establishing libraries in Māori communities; and intellectual property issues. These findings echoed a 1960s report conducted by the New Zealand Library Association, and the replication of results highlights a persistent Māori interest in library-centered issues.^[53]

The library community's response to *Te Ara Tika Guiding Voices* report has included the National Library of New Zealand's *Te Kaupapa Mahi Tahi—A Plan for Partnerships* (2001), a renewable five-year plan focused on the National Library's service to Māori. It also includes the Manukau Libraries' *Te Ao Marama* (2002), a Māori service strategy from one of the country's largest public libraries. In addition, a new National Library Act (2003) was passed that acknowledges Māori interests in library collections and services: it specifically references Mātauranga Māori (Māori knowledge), and has established the Library and Information Advisory Commission Ngā Kaiwhakamārama i ngā Kohikohinga Kōrero (LIAC) as an advisory body on the role of library and information services in the social, cultural, and economic life, including Mātauranga Māori. The LIANZA includes knowledge of Mātauranga Māori and the Treaty of Waitangi as essential components of professional competence for the library and information sector (Fig. 4).

Indigenous Libraries and Their Intersections

From Māori perspectives the past and the present are seen as a continuum: the past is a taonga (knowledge/treasure) to understand the present, to learn and grow from. The past forms part of the Māori living traditions that connect Māori to their past, and to their identity.^[56] Traditional taonga knowledge comes in many forms: it may be carried in carving, woven into wall panels, as well as inscribed in early Māori writings, archival documents, and other forms of transmission. For millennia Indigenous peoples have passed on their unique legacies through the chain of oral tradition. It is transmitted through habits and customs as

Fig. 4 Profile: Chris Szekely.

Chris Szekely served as a lead on the *Te Ara Tika Guiding Voices* national research project on library and information services for Māori, and has written widely in support of improved library services for Indigenous New Zealanders and on issues related to Indigenous librarianship. On March 19, 2007, Mr. Szekely became the first Māori Chief Librarian of the Alexander Turnbull Library, a division of the National Library of New Zealand and the country's leading heritage research library and storehouse of the nation's documentary collections. One of his first tasks is to provide leadership on a major expansion of the facility to be completed in 2011.^[54] Prior to this appointment, Chris Szekely served as City Librarian at Manukau City Council heading one of the largest and fastest growing public library service regions in New Zealand. During his tenure as City Librarian, he opened a number of new branches, including one designed with and for Pacific Islander youth, and established a bilingual catalogue and Web site for the library.^[55] He is a founding member of Te Rōpū Whakahau, the National Association of Māori library and information workers, and was instrumental in the formation of the International Indigenous Librarians' Forum (IILF).

well as through those Elders who serve as the living libraries of their communities: the carriers of knowledge of traditional governance, science, technology, philosophy, values, healing, and history. This type of knowledge is often largely undocumented and Indigenous peoples are developing more permanent structures such as libraries, and utilizing new media technologies, to protect and preserve it. At the same time Indigenous nations require access to all of the information resources and technologies required for self-governance and activities related to education, social services, economic development, law, and environmental issues in the twenty-first century.^[21]

Indigenous understandings of knowledge continua are sometimes manifest in institutional convergences between libraries, archives, and museums. As a function of both worldview and resource constraints, Indigenous libraries may traverse the conventional institutional boundaries separating library–archive–museum and creatively converge these institutions for Indigenous purposes. The locations of knowledge centers may range from an ecotourism center to a school media center, or postsecondary academic library, to a literacy program, treaty office, health services unit, or urban friendship center. There is extensive variation in locale, clientele, services, and governance and with the local and external institutions with which they intersect (Fig. 5).

KEY ISSUES IN INDIGENOUS LIBRARIANSHIP

While the practice and the location varies, a focus of Indigenous librarianship is the provision of culturally relevant library and information collections and services for

Indigenous people. Within Indigenous communities there are standard information requirements in addition to unique information needs that are related to the maintenance and revitalization of Indigenous cultures and languages; Indigenous self-governance; rights and title claims; stewardship of traditional territories and resources; preservation of traditional knowledge systems; and the protection of intellectual and cultural property. The web of service provision ideally begin with Indigenous-controlled libraries in Indigenous communities and extends to the networks of small, rural, urban, academic, legal, special libraries, archives, and other institutions. All of these sites offer rich ground for the development of practice, theory, scholarship, and methodology in Indigenous librarianship. Several overarching themes that recur in practice and in the literature have been selected as key issues for Indigenous librarianship under the umbrella concepts of library development, access, and intellectual property. The development of Indigenous-controlled libraries and other forms of memory institutions is fundamental for Indigenous cultural and intellectual sovereignty. Social justice demands that Indigenous people have equitable access to public institutions and their resources. Equitable access includes a range of considerations including resolution of jurisdictional barriers, the provision of culturally appropriate and meaningful collections and services, and development of accurate knowledge representation tools: these may be bilingual or multilingual depending on the locale and clientele. Public institutions have a responsibility to staff their services with a diverse staff that represents the clientele being served and to explore innovative measures to ensure diversity. Prerequisites to the provision of equitable access include the basic infrastructure and skills to utilize library services and collections, such as Internet access, telecommunications, and multiple literacies. Literacy forms pathways composed of skills and knowledge that facilitate various levels of access to the resources offered by libraries and is therefore a fundamental issue for Indigenous librarianship. The protection of and protocols for use of Indigenous cultural and intellectual property (ICIP) guide the design of appropriate services, and collections and inform standards of professional ethics: virtual repatriation, an emergent area within the field may be included within this purview.

Indigenous Libraries

Against the odds Indigenous libraries endure and continue to grow. Although diverse in form, size, purpose, and location, Indigenous libraries share many similar challenges: they often compete for funds with basic services, such as roads, utilities, and more urgent priorities on reserve and are staffed by nondegreed personnel with little training.^[57] Perennial funding challenges contribute to high staff turnover, inadequate facilities, and a lack of

Fig. 5 Profile: Gene Joseph.

Gene Joseph, Wet'suwet'en Dakehl, has been involved in developing First Nations libraries in Canada for many years. She also manages First Nation litigation research for cultural and legal issues, and served as the librarian for the Gitksan Wet'suwet'en in the precedent setting Delgamuukw case in the Supreme Court of Canada. Gene Joseph reflects on her experiences during this landmark trial.

"On December 11, 1997 the Supreme Court of Canada handed down its decision in the court case Delgamuukw vs. British Columbia, [1997] 3 S.C.R. 1010 which affirmed the inherent meaning of aboriginal title. It was also the first court to rule that oral history or oral evidence be placed on equal footing with that given to historical documents.

In 1984 two First Nations, the Wet'suwet'en and the Gitksan, filed their statement of claim to 58,000 km² which was divided into 133 territories with traditional ownership accorded to 71 Houses of the Gitksan and Wet'suwet'en people.

In 1982 I had graduated from the University of British Columbia School of Library and Archival Sciences and it was an honor to me that in 1984 I was recruited by the Gitksan and Wet'suwet'en to work on a collection of oral history materials from the elders and chiefs. I returned to my home in Hagwilget, a Wet'suwet'en village near Hazelton. There, I worked on the oral evidence with senior Gitksan and Wet'suwet'en researchers: oral evidence was thoroughly reviewed, transcribed, and translated by the chiefs and elders.

In 1986 Mass Gaak (Don Ryan) again recruited me to return to Hazelton, this time to work on the historical documents that had been collected as evidence. I continued to work through the trial. The trial ran for 374 days starting May 11, 1987 and ending February 7, 1990. The trial had 9200 exhibits with thousands more documents previously listed in numerous document lists, and 26,000 pages of transcripts. The decision was handed down on March 8, 1991. This was followed by the B.C. court of Appeal. This decision came down on June 25, 1993 and was appealed by the Gitksan and the Wet'suwet'en to the Supreme Court of Canada, which rendered its decision on December 11, 1997.

Delgamuukw drew upon the technical skills I had learned at the Union of B.C. Indian Chief's Library, and the organizational, archival, and computing skills learned at Library school. The oral recordings needed to be preserved and treated as archival as they recorded people who were in ill health or quite elderly. Their knowledge was invaluable. The case started just as personal computers began to be introduced into office environments, which in turn required the development of new software programs, database structures, and the incorporation of continually developing and advancing hardware and software. The Delgamuukw Gisdawwa case was one of the first court rooms in Canada to use personal computers by the court and counsel.

Historical documents had been collected from various archives in Canada, England, and the United States. There were numerous scientists from various fields: archaeologists, anthropologists, linguists, historians, geographers, and genealogists gave evidence and presented documents. Therefore the language, classification, and headings covered many streams of knowledge, both Western and Indigenous. Litigation support as well drew upon court requirements, counsel's needs, and court reporters which were in the throes of moving from the traditional hard copy to an electronic court room.

Most of all, the trial drew upon the knowledge of the traditional systems, history, and culture that I had learned from my family, and then from the elders and chiefs with whom I worked among the Gitksan and Wet'suwet'en people. While I did not speak the language, I was constantly surrounded and worked with sound and video recordings, translators, and linguists who were for the first time having to spell personal, place, and spiritual names. We worked closely with the cartographer as he recorded these names onto the new maps of the territories, continually cross-checking with the chiefs, elders, and researchers. The map was named "The map that roared" by the court.

collections and technology. Indigenous communities in remote areas face transportation and communications difficulties. These barriers to the development of Indigenous libraries have remained much the same over time, however, the priorities are changing due to the ubiquity of information and communication technologies (ICTs) in a global networked world. ICTs present the added challenges of an ever-changing technical environment that requires the acquisition and maintenance of hardware and software, the skills sets to utilize them, and broadband access. Even if funds are available, Internet connectivity may be inadequate in remote locations, and distance may also discourage the recruitment and retention of qualified IT staff.^[18]

Digital Divide

ICTs have been defined as "a diverse set of technological tools and resources used to communicate, and to create, disseminate, store, and manage information."^[58] The term digital divide is generally understood as the gap between ICT "haves" and "have-nots." It encompasses issues, such

as infrastructure and access to ICTs, use and barriers to use, and the critical role of ICT skills and literacy in an information society. From Indigenous perspectives ICTs support the revitalization of culture and language, and they serve as knowledge and communication building blocks that enable the development of community infrastructure in a range of areas from education to health, from economic development to environmental protection.^[59] They enable access to the global web of information, and perhaps more importantly they provide the means to participate in local and distributed communities of interest. As authorial tools ICTs have the potential to create and distribute Indigenous perspectives in order to correct some of the ubiquitous stereotypes and misrepresentations, to shape attitudes, and to change the ways in which history is understood. National information policy in Canada and the United States aims to provide affordable access to the Internet and to the skills required to use it. However, in the National Telecommunications Information Administration (NTIA) in the United States reported that only 9% of Native Americans in rural areas have home Internet access and that access tends to be through schools or libraries.^[60]

In Canada, the BC First Nations Technology Council research shows that in one-third of BC First Nations communities 75% of the homes are without Internet access, and in almost 20% of BC First Nations communities there are homes without basic telephone service.^[61] In Canada, the Community Access Program (CAP) is one of the primary federal connectivity programs that benefits Aboriginal communities and the Gates Foundation is making improvements to technology access, equipment, and support in both the United States and Canada. The digital divide, the ICT gap in access, services, and skills, however, continues to exist for Aboriginal people.

Profile: Jean Whitehorse

Jean Whitehorse, a Navajo member of the Towering House clan and Born for Bitter Water clan, is making a difference. As a training and outreach coordinator for the New Mexico State Library, Whitehorse conducts IT training at libraries and Navajo chapter houses in New Mexico. Exclaiming “get ready the world is going to change with or without you!” her advocacy has resulted in the hiring of more Native American trainers and in a new internship program for tribal college student ICT trainers working with the tribes. Whitehorse believes that as comfort with technology increases the tribal community members are empowered with new skills, and this in turn encourages the children, the future leaders, to explore the benefits of the virtual world. She draws an analogy between the artistry and expertise involved in weaving a Navajo rug and that of weaving technology education for the nations (Fig. 6).^[62]

This type of multidimensional model of ICT access underlines the many threads that must be woven together for effective use of technology, including political support at multiple levels, funding, perceived relevance to

Indigenous interests, culturally based evaluation and training, social relationships and skills sets.

Universal Access

Librarians have long upheld the principle of universal access to public libraries because as the UNESCO Public Library Manifesto states, “The public library, the local gateway to knowledge, provides a basic condition for life-long learning, independent decision-making and cultural development of the individual and social groups.”^[63] However, universal access to the public library is not a reality for Indigenous people in North America although it is a cornerstone of the national educational and information infrastructure in the United States and Canada. For Indigenous people who do “technically” live inside a library service catchment area, there continue to be many visible and invisible barriers presented through library practices, collections, and services. Many public institutions are seeking to improve their services for Indigenous people, after all, Indigenous people are community members in urban centers as well as in rural communities. Indigenous students, teachers, and faculty members populate the schools and academic institutions, and are within the ever-expanding circles of the digital community.^[64]

Literacy

From Indigenous perspectives the notion of literacy is conceptualized as being multidimensional one that may extend from an ability to read the land to an ability to read text. It includes the range of skills and knowledge required to read and interpret meaning, to allow deeper understandings, and ultimately to become the authors of new meaning. Indigenous approaches to literacy seek to honor and build bridges from existing knowledge and skills to strengthen Indigenous cultural identity, languages, and values. They are centered on local issues at the same time as they connect with an awareness of the global world. The legacies of cultural and language disruption left by colonial education systems and education designed for assimilation are integral to understandings of Aboriginal literacy and Aboriginal literacy education.^[65] Low text literacy levels are frequently a challenge in Indigenous communities. In Canada, the rate of illiteracy on-reserve is almost two times the rate of the off-reserve Aboriginal population and three times that of the general Canadian population.^[66] Within Indigenous contexts, it is important to acknowledge familial and social networks of authority and various types of literacy, in addition to English language text literacy. The relationships between ideas and knowledge, social practices, and responsibilities are considered to be important.^[67] English may be a second language for some learners, and for some learners Aboriginal English is the dialect used in the home, not mainstream English. Successful literacy strategies therefore

Fig. 6 Profile: Jean Whitehorse. Cyber sovereignty: Digital diné.

* Navajo weavers	NM State legislatures supporting Senator Tsosie
* Raw material in the wool	State funding and grants
* Shearing the sheep	Advocacy at the chapter houses
* Tools: shears/combs/spindle/batten	Infrastructure, planning and program development
* Loom	Networking
* Wash the wool	Outreach to the chapters and tribal leaders
* Card the wool	Collaborating with the Gates Foundation
* Dye the wool	Collaborating with Navajo Community Development
* Spinning, grandma can teach you	TLP Tech support and computer training
* Design and pattern	Trainings evaluations

Fig. 7 Profile: Loriene Roy.

Loriene Roy is Anishinabe, an enrolled member of the Minnesota Chippewa Tribe, White Earth Reservation, and a Professor at the University of Texas at Austin School of Information since 1987. Dr. Roy has devoted her career to improving literacy and instruction services for Native youth, advocating for library services for and by Native communities, and supporting the education of American Indian librarians. Guided by Indigenous protocols and Anishinabe teachings in her teaching and writing, Dr. Roy is a respected and visible advocate for Indigenous perspectives on national literacy and library issues in the United States, and has been an active participant in international Indigenous librarianship gatherings, serving on committees that organized the first and second IILF in 1999 and 2001. In 2007, Dr. Roy became the first American Indian president of the American Library Association, a role she filled with the same spirit and vision that she brought to her presidency of the AILA in 1997–1998. In addition to her national and international leadership, she has served as the director of the Native American youth reading club program, “If I Can Read, I Can Do Anything” since its founding in 1999; established the “Honoring Generations” scholarship program for tribal librarians at University of Texas at Austin; assisted tribal schools with developing culturally responsive curriculum; created online resources for tribal college students; and inspired successive generations of American Indian librarians and students.^[68,69]

incorporate programming by and for Aboriginal people that are designed for a specific cultural clientele to develop the range of literacy skills required to succeed in education, and to succeed in integrating Aboriginal approaches to education into twenty-first century Indigenous pedagogies (Fig. 7).

Indigenous Knowledge Organization

The dominant North American classification and subject heading systems, the Dewey Decimal Classification and the Library of Congress systems, are not adept at representing Indigenous peoples and topics. These types of knowledge organization systems are shaped by culture and they reflect world view through the selection of terminology, concepts, and the ways in which they show or do not show relationships.^[70] The literature documents that the mainstream systems tend to marginalize, omit, or misrepresent Indigenous topics. These types of inaccuracies can occur through historicization, lack of specificity, lack of relevance, lack of recognition of sovereign nations, and the omission of the historical realities of colonization.^[71,72] Cataloging practice for Indigenous topics must recognize the names, relationships, places, histories, and concepts used by Indigenous peoples. If Indigenous perspectives are not incorporated into knowledge organization tools, it creates another barrier to access for Indigenous peoples at the same time as perpetuating inaccurate and culturally inappropriate representation for the

general public. From Indigenous perspectives, intellectual access to public collections in libraries, archives, and museums is important for educational and informational purposes, and also for claims research, genealogy, and the revitalization of traditions, languages, and histories.^[73] The dominant classification and subject heading systems are now used on a global scale, and while this enables unprecedented sharing of knowledge, it also has unprecedented power to marginalize Indigenous knowledge domains, and to establish the cultural perspectives of mainstream North America as a global norm.^[74] Ambitious national Indigenous thesaurus projects have been undertaken in both Australia and New Zealand to provide more balanced representation and access: the Māori subject headings provide access to the Māori body of knowledge held in public institutions for Māori people.^[75] The Australian Aboriginal and Torres Strait Islander Thesaurus aims to improve access to Aboriginal and Torres Strait Islander materials: “It is important that the Indigenous voices of Australia are heard and felt through proper representation in catalogues.”^[76] International bodies, such as, the UN and the International Federation of Library Associations and Institutions (IFLA), assert the importance of preserving Indigenous knowledge and protecting the individual and collective rights of Indigenous people.

Intellectual and Cultural Property (ICIP)

The concept of ICIP rights refers to past, present, and future tangible and intangible expressions of heritage. These expressions exist within a body of cultural practices, knowledge systems, and resources that serve to define cultural identity.^[77] The results of a global study of Indigenous heritage led by Professor Erica-Irene Daes, Chairperson of the UN Working Group on Indigenous Populations, is widely cited as a standard and it shaped The Declaration on the Rights of Indigenous Peoples^[78] which was adopted by the UN General Assembly on September 13, 2007. One of the most comprehensive statements on the individual and collective rights of Indigenous people, the Declaration states:

Indigenous peoples have the right to practice and revitalize their cultural traditions and customs. This includes the right to maintain, protect and develop the past, present and future manifestations of their cultures ... taken without their free and informed consent or in violation of their laws, traditions and customs.”^[79] When knowledge is removed from communities and the systems are disrupted, there is a community loss of control over ways they are represented and used. Some Indigenous legal concepts, such as, the notion of collective rights, do not easily fit into existing legal frameworks. Public institutions, such as libraries, archives and museums that hold Indigenous collections face a range of ICIP issues, such as, the retrospective identification of heritage materials; identification of the community of origin; the determination of copyright

and ownership; ascertaining restrictions on access.^[80] Because existing copyright law and intellectual property law do not wholly protect ICIP, protocols have been developed as guidelines for institutions and organizations to use in their interactions with Indigenous people.

Indigenous Protocols

Protocols are seen as a bridge between Indigenous customary law and existing legal instruments. Protocols guide practice, and are localized in order to reflect the approaches of specific communities and the contexts of each institution's mission and collections.^[81] *The Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN) Protocols* are considered to be a leading guide for libraries. They serve as a compass for discussion, policy, and practice related to the care of Indigenous materials and to the development of relationships between Indigenous communities and individuals, and institutions. First published in 1995, the protocols were revised in 2005, and are considered to be living documents that are continuously updated.^[81] Some of the primary concerns regarding information issues from Indigenous perspectives are governance and policy, education and training, and increased Indigenous employment and staffing.^[82] In addition Indigenous peoples have concerns regarding community ownership and rights management, guidelines for access to sensitive or sacred knowledge, and ownership of oral traditions and songs.

Virtual Repatriation

Indigenous communities have had their knowledge systems disrupted in many ways. One significant outcome is that collecting institutions, such as museums, libraries, and archives throughout the world hold large collections of materials collected from or of significance to Indigenous people. Virtual repatriation is the process by which digital copies of objects, recordings, images, and documents are returned to the originating Indigenous community. In some cases virtual repatriation partnerships exist between Indigenous groups and collecting institutions, such as, the Smithsonian National Museum of the American Indian (NMAI) Spiral of Knowledge project. In other cases, Indigenous communities repatriate digital copies from collecting institutions or churches, or from individual collectors such as anthropologists, missionaries, and others. The returned digital materials gradually amass to form local Indigenous knowledge bases which in themselves may present significant IT issues, and ethical and knowledge organization challenges for the community.^[83] Frequently multidisciplinary in scope with various types of content and different file formats, these knowledge bases use software and hardware that are vulnerable to change. Systematic planning for data migration, attention

to standards compliance, and consideration of sustainability, interoperability, and portability issues are therefore required at the community level. Intellectual property and copyright guidelines, and digital rights management are increasingly important in these types of environment where the boundaries of collecting institutions are coalescing and technologies are converging. Collecting institutions meet their own ownership and access requirements in order to repatriate materials to communities, and Indigenous communities then face ongoing intellectual property issues related to both the returned materials and to contemporary materials. Communities may face a range of ICIP considerations, including different kinds rights for different types of knowledge and material formats; considerations for individual viewing, public viewing, and reproduction of materials by Indigenous people or external groups; and considerations regarding community members adding their own annotations to shared databases. The rights management systems utilized must satisfy Indigenous customary approaches, as well as national laws and institutional regulations. Dr. Martin Nakata suggests that coordinated approaches at the community level, the state level, or possibly national level may be beneficial as the number of knowledge bases and amount of content can only be expected to increase over time both within individual communities and among communities. The complexities of these virtual repatriation processes are beginning to constitute a specialist area of practice.^[84]

RESEARCH IN INDIGENOUS LIBRARIANSHIP

Indigenous scholars are asking new questions of research and creating an emergent scholarship that speaks to Indigenous interests in reclaiming languages, histories and knowledge, and creating new solutions to address the negative impacts of colonialism.^[85] These processes require (re)conceptualizing research as a transformative practice: capable of transforming the world and capable of transforming itself. Indigenous research methodology offers expanded systems of knowledge and ways of knowing that hold potential for sustainable research practices with global applicability in the twenty-first century.

Practitioners of Indigenous librarianship are positioned to take up the new methodologies of Indigenous theorists to inform research practice: there is a need for empirical, theoretical, evaluation, and policy research in Indigenous librarianship. In 1992 Cheryl Metoyer-Duran observed a lack of baseline data needed to conduct research in order to plan, develop, implement, or evaluate services in tribal communities. "At present, there is no comprehensive study which considers the definition of tribal libraries, their location, description of resources and services, staffing or clientele."^[86] This still holds true in 2008 and continues to impede the further development of planning,

preservation, and the dissemination and evaluation of services and collections.

The key issues for Indigenous librarianship highlighted in this entry suggest a range of areas for future research. Areas of applied research could include, best practices in Indigenous library development, Indigenous approaches to digitization, local and national information policy, literacy education, cultural and intellectual property rights, knowledge organization and representation, professional ethics and professional competencies. There is a need for further development of social justice, critical and Indigenous theoretical frameworks within library and information science. Linda Tuhiwai Smith's work on decolonizing methodologies could be used to provide a map of the terrain of research relationships: some research will be undertaken only by Indigenous researchers in Indigenous communities, other types of research will be controlled by Indigenous people with outside partners, and some will constitute a whole range of collaborative research partnerships with Indigenous people and others.^[87] A fundamental issue for research and for practice is the education of Indigenous librarians and education for Indigenous librarianship.

EDUCATION FOR INDIGENOUS LIBRARIANSHIP

Kelly Webster, past president of the American Indian Library Association (AILA) and a member of the Oneida Tribe of Indians of Wisconsin, recalls her experience in library school.

I went to library school in the mid-1990's, and like most other students I did not hear a word about library services to American Indians in my classes, meet another Native person in the program, or encounter anything in my assigned readings on the topic^[88]

Employment and education of Indigenous people across the library and information sector is repeatedly cited as a high priority in the United States, Canada, Aotearoa/New Zealand, and Australia. However, there has been limited success at recruitment and relevant curriculum development. The Association for Library and Information Science Education (ALISE) statistics on ALA accredited programs in the United States and Canada (2004) show full-time American Indian LIS faculty represented six positions (0.8%) of the faculty in 51 schools.^[89] In 2002–2003, only 26 American Indian graduates were awarded LIS degrees out of a total of 7284 graduates: there were no American Indian doctoral graduates.^[90] Part of the recruitment challenge hinges on the development of culturally relevant and responsive curriculum. The Knowledge River program at the School of Information Resources and Library Science (SIRLS), University of Arizona; the University of New Mexico, INLP; and Honoring Generations

at the University of Texas at Austin Information School are promising initiatives in education and recruitment of Indigenous people.^[91–93] The LIANZA statement of core competencies includes awareness of Indigenous knowledge paradigms and describes it in sufficient detail to guide to curriculum development by education providers.^[94]

There is a need to educate tribal librarians who can plan and implement infrastructure for twenty-first century community library and information services, and professionals who can design and manage Indigenous memory institutions, facilitate repatriation efforts, and navigate the complex relationships required to build alliances. At the same time, the broader profession and collecting institutions require education to address widespread issues of ignorance and misunderstandings that are a legacy of past educational failures. An example of staff professional development is modeled by the University of Queensland where Indigenous and non-Indigenous library staff have partnered on developing a staff education program about Indigenous issues and histories. This occurred within an organizational climate that has a Senate-approved mandate to improve Indigenous education by challenging preconceived ideas of knowledge creation, dissemination, and recognition.^[95]

PROFESSIONAL ASSOCIATIONS

From the seminal work of the National Indian Education Association with the American Library Association that produced the *Goals for Indian Library and Information Service* (1973) to the formation of the International Indigenous Librarians' Forum (IILF) in 1999, the initiatives of Indigenous peoples' associations guide the field. The following are key groups at national and international levels.

The IILF was formed in 1999 for Indigenous library, archives and information workers to share experiences and to discuss common issues and concerns. The IILF meets every 2 years and publishes conference proceedings on an irregular basis. The first forum was convened by the Māori in Auckland Aotearoa/New Zealand in November 1999. Subsequent forums have been hosted by local Indigenous groups in Jokmökk, Sweden in 2001; Santa Fe, New Mexico in 2003; Regina, Saskatchewan in 2005; Brisbane Australia 2007; Otaki in Aotearoa/New Zealand in 2009.

The AILA, founded in 1979 as a result of the 1978 White House Pre-Conference, has a mandate to improve library services to American Indians and Alaska Natives in school, public, and research libraries, both on- and off-reservation, and to disseminate information about American Indian and Alaska Native library issues. AILA holds meetings twice a year in conjunction with the American Library Association, runs an e-mail list that networks American Indian librarians and librarians serving American Indian communities, publishes a quarterly newsletter,

and has formed a classification and subject access committee that plays a leadership role in shaping culturally appropriate subject representation.

The Aboriginal and Torres Strait Islander Library and Information Resource Network (ATSILIRN) was established in 1993 to provide an information network and support for Aboriginal and Torres Strait Islander peoples working in libraries. The organization also includes members and institutions whose work addresses the information needs of Australian Indigenous peoples. ATSILIRN holds annual conferences and has participated in the development of protocols for libraries and archives serving Aboriginal and Torres Strait Islanders and the compilation of the Aboriginal and Torres Strait Islander Thesaurus.

In 1992, Māori library workers established a professional association, Te Rōpū Whakahau (TRW, the Māori Library and Information Workers' Association). Its goals are to provide cultural and professional support to Māori working in libraries, and to create a forum for Māori voices to inform policies and practices relating to the care of Māori material in libraries and archives. The TRW publishes a regular newsletter, makes policy submissions, participates in research projects, organizes *hui* (gatherings/conferences), and produces publications related to Māori library issues.

In addition, there are numerous professional associations at the local, state/provincial, and national levels within the United States, Canada, Australia, and Aotearoa/New Zealand that are involved with the development of Indigenous library and information services, and educating the general population about Indigenous issues, histories, and diverse approaches to knowledge and ways of knowing. At the international level, a proposal to form a Special Interest Group (SIG) on Indigenous knowledge was submitted to the International Federation of Libraries and Institutions Association (IFLA) at its annual conference in Quebec City (2008).

CONCLUSION

In the United States, Canada, Australia, and Aotearoa/New Zealand Indigenous librarianship is located within policy environments of Indigenous self-governance and national reconciliation. Two clear implications for librarianship are: (1) Indigenous information demands will continue to grow exponentially due to expanding Indigenous self-governance activities and the exigencies of demographics and (2) Indigenous library and information services can only succeed under the direction of Indigenous nations, or in ethical partnerships between Indigenous and non-Indigenous partners.^[96] The development of Indigenous libraries and information services is key for cultural revitalization and maintenance, and for the economic and educational interests of Indigenous communities and

individuals. At the same time rapidly growing young Indigenous populations can be expected to increase demands for youth programs, education, and bridging programs from public institutions.^[97] Equitable access to public institutions and infrastructure are necessary to avoid creating systemic two-tiered systems that will further marginalize an increasingly large proportion of national populations.

The scholarship of Indigenous librarianship has important contributions to make to library and information science as a discipline that speaks to real-world issues in local and global contexts. It has the potential to mobilize Indigenous knowledge to shape the theory and practice of the broader profession, including curriculum development and research in library and information science faculties. As Indigenous librarianship serves Indigenous interests, it also serves the education of all learners who are citizens of countries where Indigenous peoples are the First Peoples.

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Information

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Abstract

A selection of representative definitions of information is drawn from information science and related disciplines and discussed and compared. Defining information remains such a contested project that any claim to present a unified, singular vision of the topic would be disingenuous. Seven categories of definitions are described: communicatory or semiotic, activity-based (i.e., information as event), propositional, structural, social, multi-type, and deconstructionist. The impact of Norbert Wiener and Claude Shannon is discussed, as well as the widespread influence of Karl Popper's ideas. The data–information–knowledge–wisdom continuum is also addressed.

The work of these authors are reviewed: Marcia J. Bates, Gregory Bateson, Paul Beynon-Davies, B.C. Brookes, Michael Buckland, Ian Cornelius, Ronald Day, Richard Derr, Brenda Dervin, Fred Dretske, Jason Farradane, Christopher Fox, Bernd Frohmann, Jonathan Furner, J.A. Goguen, Robert Losee, A.D. Madden, D.M. McKay, Doede Nauta, A.D. Pratt, Frederick Thompson.

INTRODUCTION

The concept “information” is of signal importance to all the information disciplines. Perhaps for that reason, it is a term that has been defined in countless ways over many decades. It would be fair to say that there is no widely agreed-upon definition or theoretical conception of the term. The meaning of this term is still highly contested. In this regard, the status of the term is similar to that of “communication” in the communication sciences.

In light of the lack of agreement about the definition of the term “information,” the main objective of this entry will be to lay out some of the major classes of definitions and theoretical constructions of the term that are currently or recently in play. No effort will be made to capture and discuss every definition that has been provided in the literature; rather, major types will be presented, as well as popular ideas that are recurrent in the literature. The discussion draws from writings over the last sixty years; the approach is by category rather than by chronology.

The effort to define information is active in other disciplines besides those explicitly concerned with the topic; philosophy, cognitive science, electrical engineering, computer science, and systems theory, among others, have been active players on this scene as well. The objective of this entry, however, is to concentrate on the ideas about information either that have been developed within the information disciplines or, in a few cases, that have come from other fields but have also been influential in the information disciplines. For coverage of other approaches to the concept, the reader is directed to reviews by Aspray,^[1] Belkin,^[2] Capurro and Hjørland,^[3] Cornelius,^[4] Furner,^[5] Meadow and Yuan,^[6] and Wersig,^[7]

A different way of acquainting oneself with the numerous issues and debates across the disciplines about information would be to examine several collections of articles written by authors bringing a variety of perspectives to the question. See Kornwachs and Jacoby,^[8] Davies and Gregersen,^[9] and Ibekwe-San Juan and Dousa.^[10] In the latter volume, Furner takes an amusing, but highly illustrative, approach by citing and discussing 18 papers across the disciplines—almost entirely not in information science—that have the title “What is information?” and that have appeared between 1955 and 2012.^[11]

Some authors embed a discussion of information within a much larger philosophical or theoretical program. In other words, exposition of the meaning of the term “information” is not a primary goal, but only incidental to much larger projects. It is beyond the focus of this article to attempt a review of these larger intellectual programs. Prime examples include Søren Brier's “cybersemiotics”,^[12] Benny Karpatschof's dissertation on “Human Activity”,^[13] Howard Resnikoff's analysis of information within a mathematical, physical, and signal detection framework,^[14] Jan Kåhre's “mathematical theory of information”,^[15] and separate disquisitions on the relationships among physics, biology, and information by Roederer^[16] and by Stonier.^[17–19] A recent book by Reading^[20] in the biosciences is intended to be broad, readable, and compact on the subject of information in those fields. Another author in this category is Luciano Floridi, a philosopher, who is developing and promoting an area of philosophy to be known as “philosophy of information.”^[21] He develops his own view of information as a philosopher, with attention to the issues of concern to that discipline in the article “Information,”^[22] as well as in a

short book.^[23] Floridi's recent book, *The 4th Revolution: How the Infosphere is Reshaping Human Reality*,^[24] has been reviewed scathingly by the philosopher John Searle, who comes from a distinctly different perspective on information.^[25]

Because Norbert Wiener's and Claude Shannon's ideas of information were so influential at the dawn of the "Information Age," their influence is discussed in a preamble in the following text. Shannon's actual "information theory," however, is reviewed elsewhere in an entry by that name in this encyclopedia.

After the preamble, conceptions of information of the following types will be reviewed in succession:

- Communicatory or semiotic
- Activity-based (i.e., information as event)
- Propositional
- Structural
- Social
- Multi-type
- Deconstructionist

Between these categories, we will take two interludes, one to discuss the "Problem of Popper's Worlds," regarding the philosopher Karl Popper, and the other to address "DIKW" or the commonly discussed sequence known as "data-information-knowledge-wisdom." Both of these, Popper's "three worlds" concept and the DIKW sequence, have motivated so much discussion in the information sciences around information that they merit separate discussion.

In the process, the work of the following people will be addressed: Marcia J. Bates, Gregory Bateson, Paul Beynon-Davies, B.C. Brookes, Michael Buckland, Ian Cornelius, Ronald Day, Richard Derr, Brenda Dervin, Fred Dretske, Jason Farradane, Christopher Fox, Bernd Frohmann, Jonathan Furner, J.A. Goguen, Robert Losee, A.D. Madden, D.M. McKay, Doede Nauta, A.D. Pratt, and Frederick Thompson.

In this entry, no summary conclusion is made about "the best" or "the truest" understanding of the concept of information. Rather, the purpose is to present the array of ideas flowing around this core concept in the information disciplines, so that the reader may become acquainted with the issues.

PREAMBLE: THE ROLES OF WIENER AND SHANNON

It is almost impossible to overestimate the impact of Claude Shannon's ideas about information on the (American) intellectual culture of the 1950s and 1960s. In that era, there was a tremendous amount of attention directed to the technical revolution(s) that had become possible with the development of computers, television, new

communication technologies, and a new way of thinking about information. This new way of thinking percolated out of the academic world into the society at large and imbued at a subconscious level the thinking of people who had no understanding of Shannon's ideas per se.

Today, many scholars write dismissively about the concept of information (see the last portion of this entry) and reject the earlier excitement around the "Information Age" and the "Information Society" as a love affair with a cold, technical, even militaristic conception of the technology-driven society.^[26] Indeed, Frank Webster, writing in this encyclopedia about the "Information Society," analyzes the term's many weaknesses and confusions, without seeming to recognize the positive value originally gained from the ideas carried by the concept. Shannon appears in Webster's discussion only in terms of the "deracinated" definition of information that arises out of Shannon's writing. Ironically, as we shall see, it was, in fact, the very fecund power of that deracinated definition of information—i.e., a concept of information as independent of meaning—that allowed an explosion of scientific and social development around information and its social and technical role.

The new conception of information that came with Shannon was so fundamental, so pervasive in science and engineering, that today's critics do not actually see *it as it was to people then*. The several streams of new thinking on information were startling, different, and stimulating, compared to prior understanding. I believe that the impact was so fundamental that an earlier generation can be forgiven for inventing ideas like the "Information Age," the "Information Society," and "Information Explosion." The consciousness of information was so new and changed so many established ideas that it really felt to the participants like a new age marked by the new awareness of information.

It is fashionable now to deride that earlier absorption with the new concepts, but we are *able* to deride these concepts only because we have so thoroughly absorbed the learning from that time that it feels easy to dismiss it in favor of newer ideas. The ever-present fact is that people both build on and react to what was present earlier in their lives. Today's critics are, of course, doing that too. This author is old enough to remember that earlier time, and I choose to present that era as I understood it, as a bit of a counter to the somewhat dismissive attitude toward it that is popular nowadays.

Boulding wrote about three levels of organization in life: 1) static structures; 2) clockwork, that is, the world of mechanics; and 3) thermostats, that is, control mechanisms that maintain a stable condition by responding to feedback from their environment.^[27] These three levels have some parallel in the development of science in the Western world—the medieval belief in a static world created by God, followed by the Newtonian discovery and analysis of dynamic processes, followed by the cybernetic understanding of the role of information in life processes.

The world of Newton and his epigones was one in which the theory of forces and impacts of recognizable regular, measurable change was developed. The quintessential model of the mechanical universe is that of billiard balls being hit and rolling into other balls and making them move in a certain direction with a certain force.

The movement of the planets was closely measured, the mathematics of change in the form of the calculus was developed, and a deep threat to the medieval concept of the static universe arose. The long history of religious controversy, with Galileo as a prime example and proceeding through the inquisition, the Reformation, and the Counter-Reformation, was in no small part due to the fundamental challenge offered by this new dynamic idea of how the universe worked.

In the twentieth century, information began to become important in the thinking of science and society. Problems of observation and the impact of observation emerged in early twentieth-century physics. Finally, during the 1940s and 1950s, the role of information was made theoretically explicit in the theory of cybernetics. The term came from a Greek root word meaning to govern or steer. Norbert Wiener's conception of cybernetics involved the governing of action through the feedback of information.^[28]

"Feedback" is a tediously trite term nowadays, usually employed in the context of customer relations or group therapy. But the idea behind it was revolutionary in Wiener's day. Wiener illustrated just how significant the idea was in his description of research that he conducted with a physician on physiological processes.^[29] Again, grossly simplifying, the thinking in that day in physiology was that when I reach out to pick up a pencil, this process is achieved by my brain sending a signal to muscles and tendons along the lines of "go get it," and the machinery of my arm goes into action and picks up the pencil. This was a classically mechanical concept of my actions. A pulse goes out to my arm to do a certain thing, I act, and then the pulse diminishes.

Wiener and his colleague demonstrated that the process did not work that way. Instead, when I start to pick up the pencil, I extend my arm in the direction of the pencil, and then, *utilizing constant kinesthetic and visual feedback*, I micro-adjust the position of my arm repeatedly and successively until it successfully lands on the pencil, grasps it, and picks it up. Picking up the pencil is not a single, mechanical, act, but rather an extended behavior utilizing continuous information feedback telling me whether my hand is on or off course and, if off course, enabling me to adjust the tension in muscles and the direction of my reach so that I can successfully touch and pick up the pencil.^[30]

Thus, in cybernetic situations, two processes are going on continuously in parallel—the physical forces and the detection and utilization of information about the physical forces, information that is used to affect the physical actions. While the billiard ball model was the one commonly used for the mechanical understanding of the

universe, with the impact of cybernetic thinking, the household thermostat became the standard model of cybernetics and feedback. In the summer heat, I set the thermostat for a certain temperature. When the heat in the room affects a sensing mechanism in the thermostat beyond a certain point, the air conditioning starts, and cools the room down to where the sensing mechanism again achieves its desired temperature, and the air conditioning shuts off. The sensing mechanism provides continuous information, and the design of the thermostat is such that when the information indicates that the room temperature is outside a desired range, the air conditioning comes on. Governing, or steering, is about utilizing information feedback to direct the ship of action.

In the larger history of scientific thinking, the development of cybernetics drew attention to the *distinct role of information* in physical and social processes. Previously, the kinesthetic and visual feedback I get while picking up the pencil—as well as in countless other information-based processes—had been almost entirely invisible in the thinking of science. This may be one reason why the 1950s and 1960s were so obsessed with information—the role of information had at last emerged as a focal topic of interest in science; its role in influencing physical and social processes at last came to the fore and, once seen, was studied with fascination in many domains of science.

So what was Claude Shannon's role in all this scientific development? Shannon and Wiener worked on some of the same ideas during this fertile period. Shannon, working at Bell Laboratories, however, developed the mathematical and engineering theory to put an understanding of information on a firm basis.^[31] Strictly speaking, Shannon did not define information at all, at least in any conventionally understandable way. Shannon found a way to measure the *amount* of information going over a transmission channel. As Wiener puts it, "...we had to develop a statistical theory of the *amount of information*, in which the unit amount of information was that transmitted as a single decision between equally probable alternatives."^[32]

Since the alternative messages, letters, words, or other units of communication are not always sent with equal probability, the formula Shannon developed measured the amount of information as a function of two things—the number of alternatives out of which a message might be selected for sending and the probabilities of the various messages. The more possible messages from which the sent message is selected and the more equiprobable the messages, the greater the amount of information transmitted.

Shannon's analysis was revolutionary in several senses. Before him, engineers really did not have a means of computing the maximum amount of information that could be transmitted through a channel of a given size or configuration. It was assumed that it would be possible to go on improving channels to carry more and more information. Shannon's formulas enable the calculation of the

maximum possible information transmission for a given physical configuration.

Once Shannon developed a firm model of the amount of information, actual and possible, in a channel, he could clarify the role of redundancy, of error rates, and noise in a channel. For example, since the letters of the alphabet do not appear in written text with equal probabilities, the amount of information conveyed with English text is well less than 100% of the amount of information that could be conveyed if each letter were equiprobable. Further, Shannon mathematically analyzed the role of noise in a channel and the ways in which redundancy could compensate for the noise. These discoveries were immensely important for all sorts of communication engineering situations. Go to the right section of an engineering library, and you can find textbooks full of hundreds of mathematical formulas developed out of these crucial insights by Shannon. Shannon's work revolutionized communication engineering. His key paper has been cited over 7000 times in the ISI "Web of Science" database.^[33]

His impact went well beyond engineering, however. It was as if for the first time people saw the informational regularities beneath the surface variety of the text sent over a wire or the words spoken on the telephone or written in a book. Shannon's model of information is dismissed today because he separated information from meaning. What is currently forgotten, however, is that this separation was in fact an *achievement*. People had not been able to make that differentiation before. Now, with far greater clarity and understanding, the handling of information in quantitative terms at last came into its own. In 1951, the psychologist and linguist George Miller wrote the book *Language and Communication*, which essentially consisted of working out the implications of Shannon's work for those disciplines.^[34] In the process, Miller educated a generation of social scientists on this way of thinking.

The fundamental clarification of the relationship between messages and the amount of information they convey (Shannon) and the concomitant recognition of the important role of information throughout life processes (Wiener) led to an enormous surge of research and theorizing throughout science about information. (Other researchers, such as John von Neumann and Oskar Morgenstern, had important roles as well.) Just as those hundreds of mathematical formulas had to be worked out in the engineering world, so also did the social sciences need to work with these same ideas and transform some parts of those disciplines.

The application of Shannon's approach to the social and behavioral sciences was not straightforward, however. There were many insights gained, but many problems encountered as well. After a while, the initial enthusiasm in the social sciences waned—to the point where it is now fashionable to deride these post-War ideas. But we are shaped by those ideas so thoroughly nonetheless that we can only attempt to throw off their influence.

COMMUNICATORY OR SEMIOTIC DEFINITIONS OF INFORMATION

We begin with definitions/conceptions of information that are framed within a communicatory or signaling context. Some authors even take the approach to the point of identifying meaning with information.

A.D. Madden

As a recent example, in 2000 Madden defined information as "a stimulus originating in one system that affects the interpretation by another system of either the second system's relationship to the first or of the relationship the two systems share with a given environment. . . ."^[35] In 2004, he simplified it to "a stimulus which expands or amends the World View of the informed."^[36] The latter definition is reminiscent of Boulding's concept of the "image," which is the grand total of my (or any individual's) subjective knowledge, my mental image of the world, and my place in it.^[37] Boulding argued that behavior depends on this image. So in Madden's approach, information is, in effect, something that alters the image.

Gregory Bateson

Gregory Bateson applied concepts of information and feedback to the psychodynamics of human relations, most famously writing of the pathological, feedback-based, "Double Bind" relationship.^[38] He also wrote about information science. Expressing the semiotic approach still more generally, Bateson said that information is a difference that makes a difference.^[39] This approach has its roots in the idea of the single difference being the elementary unit of amount of information, the single bit, the zero or one. The difference that makes a difference, presumably, makes that difference to a sensing being.

B.C. Brookes

Brookes, one of the grand old men of British information science, took a similar tack. The following is his "fundamental equation" for the relationship between information and knowledge:

$K[S] + \Delta I = K[S + \Delta S]$, which states in its very general way that the knowledge structure $K[S]$ is changed to the new modified structure $K[S + \Delta S]$ by the information ΔI , the ΔS indicating the effect of the modification.^[40]

Thus the (human) knowledge structure in the mind is changed in some way with the input of information.

Doede Nauta

Nauta takes information quite explicitly to be meaning but in a particular sense. "Information is that which is

common to all representations that are synonymous to the interpreter (synonymity is identity of meaning).”^[41] Thus, information is the meaning that is common to all the different ways of expressing that meaning. Here, it would seem that only representations can contain redundancies, because information is the common meaning core to all the different possible representations. In this approach, Nauta drew on both semiotic and (Shannon) information theoretic approaches.

Robert Losee

Losee developed what he calls a “discipline-independent definition” of information. “Information is produced by all processes and it is the values in the characteristics of the processes’ output that are information.”^[42]

Information is always informative about something, being a component of the output or result of the process. This ‘aboutness’ or representation is the result of a process or function producing the representation of the input, which might, in turn, be the output of another function and represent its input, and so forth.^[43]

Losee takes as his central example the baking of a cake. “Examining the cake provides information about both the process and the original ingredients. . . . The choice of high quality ingredients. . . . will affect the outcome. . . . Varying the process, such as the amount of time in the oven. . . . also changes the final product...”^[43]

This definition raises a couple of questions. First, what about situations that are not processes? Can there be no information there? Or is process so universal that everything is a result of it?

Second, it is with cake baking, as with many physical processes, that the information produced from the process is often quite incomplete and can be misleading. Losee says that examining the cake provides information both about process and original ingredients. But, in fact, the person who had never seen a cake before almost certainly would not know enough to be able to figure out from the output alone all that went into making it, both in ingredients and processes. This is true with many processes. Often, there is an emergent result—yeast does things in the cake not in evidence when the baking begins. The baking causes chemical processes that lead to the final result being very different in qualities from the starting dough.

Thus, in the experience of human observers, information can be limited and distorted coming out of a process, and it can be also be quite unambiguous and complete, as when we know of the process “add +1 to the output of prior process.” In the latter case, the information we derive from the result is presumably complete and correct. Thus, it would appear that Losee’s general formulation of information includes many situations where the information is

limited or distorted, as well as situations where the information resulting from a process is unambiguously clear.

INFORMATION AS EVENT

Allan Pratt

Pratt provided probably the most developed version of a conception of information in which information is an *event*, that is, he looks at the process of being informed and derives the term “information” from that. Pratt, too, draws on Boulding’s concept of “the image.” He says: “My Image of the world, and my relationships in it, which includes my perception of cause and effect, of time, of space, of values, of everything which impinges on my consciousness, is different from yours, and from that of every other person in the world.”^[44]

After a person has received and understood the content of a message, in ordinary speech we say that he has become informed about the matter at hand. This is a surprisingly precise and accurate statement. He has been ‘in-formed.’ He has been inwardly shaped or formed; his Image has been altered or affected.

In-formation is the alteration of the Image which occurs when it receives a message. Information is thus an event; an event which occurs at some unique point in time and space, to some particular individual.^[45]

He compares the concept “information” to the concept “explosion.” “Every explosion is unique; no two are identical.” “Further, explosions cannot be stored or retrieved. One may, of course, store and retrieve potentially explosive substances. . . .” Later, he admits: “informative event” may be a more felicitous term than “an ‘information’.”^[45] Here he comes upon the practical problem of the mass-noun usage of the word “information”; “an information” as a count noun just does not fit into English usage.

PROPOSITIONAL DEFINITIONS OF INFORMATION

Propositional definitions are ones in which a piece of information is considered to be a claim about the world, a proposition.

Richard Derr

Perhaps the most accessible such definition is that of Derr: “. . . information is an abstract, meaningful representation of determinations which have been made of objects.” “A determination is a judgment of what is the case.”^[46] Using

the example of an ordinary sentence, he elaborates as follows:

Five necessary conditions of the truth of the first sentence have been identified. In order for Sentence 1 to be true, it is necessary that

1. information be a representation,
2. the representation be abstract,
3. the representation be meaningful,
4. the representation consists of determinations which have been made,
5. the determinations have been made of certain objects.^[46]

Derr states that “[n]one of these conditions by itself is sufficient to insure the truth of this sentence; however, jointly, they constitute a set of sufficient conditions.”^[46] He goes on to argue that, based on these five essential properties, four derivative properties of information can be identified as well: Information is *communicable*, *informing*, *empowering*, that is, one can take action based on having the information, and *quantitative*, that is, information varies in amount.^[47]

Fred Dretske

Dretske, a philosopher, has been widely influential in his conceptualization of information. He draws heavily on the Shannon conception of information. Much of his book is taken up with working through the logical and philosophical implications of his position, and no attempt will be made to expatiate that here. Instead, let us take his simpler, introductory description of information:

Roughly speaking, information is that commodity capable of yielding knowledge, and what information a signal carries is what we can learn from it. If everything I say to you is false, then I have given you no information. At least I have given you no information of the kind I purported to be giving.^[48]

Later, “Information is what is capable of yielding knowledge, and since knowledge requires truth, information requires it also.”^[49] Thus, to be information, a proposition must be true. Dretske takes his analysis through many complex arguments, but at the heart of every argument is the core statement “s is F.” The latter is the generic statement of a proposition, a claim.

He distinguishes information from meaning in the following way. A sentence, such as “Joe is at the office,” has a meaning that arises straightforwardly from interpreting the sentence for anyone literate in English. A sentence may, however, carry much more information as well, beyond the meaning of the sentence itself. “The acoustic signal that tells us someone is at our door carries not only the information that someone is at the door, but also the

information that the door button is depressed, that electricity is flowing through the doorbell circuit, that the clapper on the doorbell is vibrating, and much else besides.”^[50] Thus, Dretske’s sense of information includes all the demonstrable implications of a proposition, not only the (more limited) meaning of the proposition itself.

Christopher Fox

Fox takes his propositional view of information through many transformations as well. Again, using the simplest formulation for our discussion here, Fox is essentially claiming that the information (if any) contained in a set of sentences in a particular context is the proposition p such that, first, p is the conglomerate proposition expressed by the set of sentences in that particular context and, second, that the agent of that context is in a position to know that p.^[51] Put still more colloquially, information is the collective propositional claim of a set of statements in a given context, provided the agent in that context is in a position to know that p.

Fox titles his book *Information and Misinformation* and spends some time analyzing the latter concept as well. He disagrees with Dretske in that he does not feel that the act of “informing” necessarily means informing someone of a *true* proposition. He concludes, through a series of arguments based on the logical and linguistic character of true and false statements, that *informing* does not require truth, that is, the claim “that p” need not be true for someone to be informed of it. He argues, however, that we use “misinform” in a stronger sense—that to misinform someone necessarily means that the person is being informed of something that is not true. So we *inform* people of things that may or may not be true, but when we *misinform* someone, it necessarily involves telling the person something that is not true.^[52]

We are now in a position to return to Losee’s conception of information. Losee’s position admits of misinformation too. He says, “The value of a variable is information about the input; when the information is only partial and is tainted by error, it is better understood as misinformation. Essentially, this is information that is partly or wholly false.”^[53] So in Losee’s conception, the value produced by a process may indeed be inadequate or inaccurate and should then be known as misinformation.

STRUCTURAL DEFINITIONS

In addition to Frederick Thompson, discussed in the following section, we will review two other authors whose definitions are largely structural, D.M. MacKay and Marcia Bates. Their definitions are “multi-type,” however, and will be reviewed in the section on multi-type definitions.

Frederick Thompson

Thompson makes a discursive argument about information as a kind of structure. He recognizes the ways in which the structuring and organizing of information contains its own information, and is therefore likewise informative. He describes information as “a product that results from applying the processes of organization to the raw material of experience, much like steel is obtained from iron ore.”^[54] He also compares the scientist to the artist in that “[d]ata are to the scientist like the colors on the palette of the painter. It is by the artistry of his theories that we are informed. It is the organization that is the information.”^[55]

Commonly, in daily life, the forms of organization of information are seen to be neutral, content-free. Indeed, they are often taken for granted and not even noticed. Thompson brings out the ways in which these organizing activities are themselves content, influencing, to a greater or lesser extent, the overall meaning of the text or other body of information. This is an intellectual position—highlighting the impacts of the form and organization of information—that has been taken up by many more recent scholars, for example, Geoffrey Bowker and Leigh Star.^[56]

SOCIAL DEFINITIONS

The definitions considered to this point are drawn largely from logical and scientific points of view. This is sometimes known as a *nomothetic* approach; the fundamental effort in the sciences is to discover causes, effects, patterns, and tendencies that underlie the surface variety and particularity of life. The humanities perspective of valuing and studying the unique, specific characteristics of a situation, social group, or event, known as an *idiographic* approach, has not yet been represented here. In fact, probably due to the influence of the post–World War II scientific interest in information, many people coming from a humanities point of view have dismissed “information” as a specifically technological and heartless concept to be perennially contrasted with the rich detail of specific institutions and historical moments, such as a study of the library in nineteenth-century Illinois. However, the authors discussed in this section do embrace the concept of information, but argue that it must be seen as embedded in a social context.

Ian Cornelius

In 1996, Ian Cornelius wrote about an “interpretive viewpoint” to information. Taking the practice of law for his example, he argued that information should be seen as socially constructed within a set of practices. A practice is a “coherent set of actions and beliefs which we conform

to along with the other people in our practice (whatever it may be, profession or game), and it has its own internal logic and ethic.”^[57]

My claim is that information is properly seen not as an objective independent entity as part of a ‘real world,’ but that it is a human artefact, constructed and reconstructed within social situations. As in law, every bit of information is only information when understood within its own cultural packaging which allows us to interpret it.^[58]

Further,

...[T]here is no separate entity of information to discover independent of our practices. Up to the point that it is sought by a practitioner within a practice it is not information and cannot be interpreted.

When a practice is seeking to impose meaning on something, that thing will already have come within the interpretive range of that practice and will already be at an early stage in a process of interpretation.^[59]

Thus, information must be seen within the dense context of social relations, negotiations, and understandings operative in a particular social context. Cornelius compares the embeddedness of information received and interpreted with the embeddedness of most interpretations of the law.

Joseph Goguen

Writing a year later, Joseph Goguen developed a more detailed conception of a socially embedded information.^[60] His more idiographic approach may have succeeded in humanizing and detechnologizing the concept for those of a more social science or humanities bent. He defines information as follows: “An item of information is an interpretation of a configuration of signs for which members of some social group are accountable.”^[61]

He argues that all information is situated within a context and can only be fully understood within that context. He then addresses the question of whether any information is ever context-free; is some information more bound within a specific context than other information is? He describes a continuum of the character of information, from “wet” to “dry.” He states that processes of abstraction and formalization are attempts to take information out of contexts and make it as generally applicable as possible. The more decontextualized, the “drier” the information.^[62]

Certainly, many scientific results fit this description. We do not need to know the specific circumstances in which Robert Boyle discovered Boyle’s law (physics) in order to gain full value from the use of Boyle’s law. On the other hand, enormous amounts of contextual knowledge is needed in order properly to interpret the reasoning

and strategy involved in directing the prosecution of World War II or, in the information system design context, the hostile attitudes toward use of an information system in a particular government agency.

According to Goguen

In general, information cannot be fully context sensitive (for then it could only be understood when and where it is produced) nor fully context insensitive (for then it could be understood by anyone in any time and place).

According to our social theory of information, meaning is an ongoing achievement of some social group; it takes *work* to interpret configurations of signs, and this work necessarily occurs in some particular context, including a particular time, place, and group. The meaning of an item of information consists of the relations of accountability that are attached to it in that context, and . . . the narratives in which it is embedded.^[63]

He draws on ethnomethodology for the *principle of accountability*: “Members are held accountable for certain actions by their social groups; exactly those actions are the ones constructed as socially significant by those groups.”^[64]

It should be understood that Goguen is developing this concept of information in the context of information system design and usability testing. He refers to the numerous instances where massively expensive information systems were abandoned because they were dysfunctional for the organization for which they were designed. He argues that the close observation of people as called for in ethnomethodology is the gold standard for learning how a group organizes the work of their institution—what systems of categories, what contrasts, what relationships matter to the group, and how the group divides up the processes and objects in their world in order to carry out their ongoing activities. Goguen: “In particular, ethnomethodology looks at the *categories* and *methods* members use to render their actions intelligible to one another; this contrasts with presupposing that the categories and methods of the analyst are necessarily superior to those of members.”^[64]

This is a powerful conceptualization of information that incorporates its social role. Goguen argues that information, as understood through his construction of the term, is *situated, local, emergent, contingent, embodied, vague, and open*.^[63] Recall Derr’s characterization of information and compare it to Goguen’s view: “abstract, meaningful representation of determinations which have been made of objects.”^[46] The idiographic and nomothetic world views are on display in this contrast. For my part, they both carry a lot of truth. I do not see that one or the other approach has to “win” in the culture wars. By incorporating both approaches in our thinking, we may end up with the richest possible understanding.

FIRST INTERLUDE: THE PROBLEM OF POPPER’S WORLDS

We interrupt this recital of different approaches to the concept of information in order to consider the role of the work of Karl Popper, a well-known twentieth-century philosopher of science, in discussions of the nature of information. Popper was not himself interested in the concept of information and used the word very little. However, he developed another idea, of three worlds in the scientist’s life, which has had enormous impact in information science and recurs again and again through the literature on information. Popper wrote over a number of years about what he called three “worlds”: “We can call the physical world ‘world 1,’ the world of our conscious experiences ‘world 2,’ and the world of the logical *contents* of books, libraries, computer memories, and suchlike ‘world 3’” (his italics).^[65]

It was important to Popper to distinguish one person’s subjective understanding of a scientific topic from a more objective existence of knowledge of science that is independent of individual people. Once Robert Boyle died, the knowledge of “Boyle’s law” did not die with him. It was expressed and recorded in the literature of science and was in the minds of many people who studied science. In short, scientific learning has a public, independent, and thus reasonably objective existence apart from any one person’s subjective understanding of a scientific finding.

It is the daily bread of the work of people in the information disciplines to address the recorded, “exosomatic” (outside the body) forms of information. When a philosopher writes about objective knowledge, argues for its importance, and is at pains to distinguish it from other “worlds,” it may seem that at last someone from outside the information disciplines has paid recorded knowledge the attention that it deserves. At last, the very heart of the work of information managers has been recognized and validated as a key part of science!

Unfortunately, however, a close reading of Popper indicates that he did not view information resources in the way that information professionals do. Though he would sometimes refer to objective knowledge in books and journals, thus making it easy to conflate the “thingness” of books in with the objective nature of scientific findings, in fact, it is evident again and again in Popper’s writing that when he is speaking of the objective nature of world 3, he means, as his definition earlier indicates, the *logical contents* of the books and journals, not the objects themselves. When he pays attention to the books themselves, he always calls them a part of world 1. Indeed, the scientific examples he uses are generally of the very “driest” sort, in Goguen’s terms—generally mathematical and physical examples. To make his point about objective science, he is determined to select examples that can live independently in the most unambiguous way from individual knowers.

Popper was a philosopher of science and was concerned about various debates he was having with his philosopher colleagues. It was important to him to argue for the idea that the body of scientific learning can be thought of as independent from any one individual's (world 2) experience. He called this "epistemology without a knowing subject."^[66] A prime argument of his was that we can learn more about epistemological issues associated with science if we attend to the world 3 form of science, rather than to questions of how an individual person comes to know and believe something, the traditional subject matter of philosophical epistemology.

But it appears that he was not particularly conscious of the contents of libraries as a domain of study or professional practice. Indeed, Popper appears to have been unaware of John Ziman's book: *Public Knowledge: An Essay Concerning The Social Dimension of Science*, published in 1968, which took a more socially sophisticated look at the senses in which science has a public existence.^[67] Popper was not a social scientist, and he rather ignored distinctions that would be important in the social sciences. He saw libraries as the abode of the logical content, but it was only the logical content that interested him—not the vast infrastructure of information institutions, professional associations, and laboratories supporting these exosomatic forms of information storage. In fairness to Popper, it was the philosophical, not the social or professional dimensions of the material aspects of science that interested him.

Nonetheless, Popper has held a continuing fascination for information studies, and discussion of his three worlds appears in the work of many, including Brookes,^[68] Rudd,^[69] Neill,^[70,71] Capurro and Hjørland,^[3] and other information scientists' work. It is not my objective here to analyze these appearances of Popper in information studies, except to say that Popper is often misunderstood, or the subtle distinctions he made are ignored. To take just one example, Capurro and Hjørland define Popper's world 3 as follows: "intellectual contents such as books, documents, scientific theories, etc."^[72] Treating scientific theories as being in the same category as books and documents, thus conflating world 1 with world 3, misunderstands Popper in a fundamental way. Again, scientific knowledge has a public and objective existence (world 3), apart from either an individual's subjective knowledge of science (world 2) or the physical embodiment of that knowledge in texts and documents (world 1). Scientific knowledge is objective not just because it is recorded in objects called books or disks. Popper's third world is different from the librarian's sense of recorded information existing in physical objects or electronic networks.

If the reader finds tackling the large body of writings by Popper to be daunting, J.W. Grove^[73] provides a good, knowledgeable discussion of world 3. The best places to find Popper's own discussions of world 3 are in his book

Objective Knowledge^[74] and in Chapter P2 of Popper and Eccles' *The Self and Its Brain*.^[75]

MULTI-TYPE INFORMATION DEFINITIONS

Donald MacKay

Donald MacKay, writing at about the same time as Thompson, who was reviewed previously, also saw information structurally, specifically, "Information: that which determines form."^[76] MacKay took a more rigorous scientific approach to conceptualizing information than Thompson did. Elsewhere, he defines it as "that which adds to a representation."^[77] Within this general formulation, three senses of information are distinguished:

1. Structural information content, measured by "logons"
2. Metrical information content, measured by "metrons"
3. Selective information content, measured by "bits"

MacKay divided the three measures mentioned earlier into two types, constructive and selective. The first two measures are labeled "constructive." The third measure, "bits," corresponds to Shannon-type information and is labeled "selective." Since the Shannon approach measures amount of information, in part, by the number of options from which a message is selected—a message chosen from 100 possible equiprobable messages is more informative than a message selected from 10 possible equiprobable messages—the amount is measured in an indirect way, in terms of the number of messages *not* sent, hence "selective."

It is interesting, therefore, to contemplate MacKay's effort to measure information in a more direct, or positive, way, with his first two "constructive" measures, logons and metrons. The logons he sees as "[t]he number of *distinguishable groups or clusters* in a representation. . . its *dimensionality or number of degrees of freedom*"^[78] The metron, on the other hand, is "that which supplies one element for a pattern." Later, "Thus the amount of metrical information in a pattern measures the *weight of evidence* to which it is equivalent."^[79] This approach is redolent of inferential statistics, though it appears to have been intended to be still more general than that. Whatever the case, it does not appear to have caught on as a general means of measuring information.

Brenda Dervin

Brenda Dervin developed an Information^[1-3] formulation of information, drawing heavily on the work of Richard Carter, though the distinctions she makes bear some resemblance to Popper's. (Carter's works were notoriously fugitive, seldom appearing in conventional publication venues.)

Dervin states: “In the most general sense, Information¹ refers to external reality; Information² refers to internal reality.” This distinction “forces our attention to the notion that information can be whatever an individual finds ‘informing.’ It moves our attention away from ‘objective’ information, toward assessing the ‘cognitive maps or pictures’ of an individual.”^[80] She then asks how the individual moves between these two realities. “How does he impose sense on reality when he finds none there?”^[81]

She argues that “[b]oth an individual’s selection and use of Information,^[1] and his creation of Information^[2] result from some kind of behavior. It is suggested here that these behaviors are in themselves legitimate informational inputs: Information.”^[3,81] In other words, Dervin sees Information^[3] as all the ways in which people make sense of their worlds, the set of techniques they have to make this reconciliation between internal and external worlds. She then provides examples of different ways that people make sense of their experiences: by “decisioning,” by using a “liking–disliking procedure,” by a “relating to others” strategy, that is, getting advice from others. In sum, we can say that in Dervin’s terms, Information^[1] is the external world, Information^[2] is the internal world, and Information^[3] is the procedures used to reconcile these two worlds.

Michael Buckland

Buckland argues for three types of information:

1. Information-as-process: “When someone is informed, what they know is changed.” This definition is similar to Pratt’s concept of “in-formation” (see “Allan Pratt” under “Information as Event”).
2. Information-as-knowledge: “‘Information’ is also used to denote that which is perceived in ‘information-as-process’”
3. Information-as-thing: “The term ‘information’ is also used attributively for objects, such as data and documents that are referred to as ‘information’ because they are regarded as being informative. . . .”^[82]

Buckland titled his article “Information as thing” and addresses this sense of information the most in the article’s discussion. He sees the information disciplines as primarily being concerned with information in this sense. “. . . [T]he means provided, what is handled and operated upon, what is stored and retrieved, is physical information (information-as-thing).”^[83] In this regard, his thinking most resembles that of Jason Farradane, who defined information as a “physical surrogate of knowledge.”^[84] Farradane argued that such a tangible concept was needed in order to develop a proper science out of information science.

Citing examples of documents, statistical data, statutes, photographs, etc., Buckland says, “In each case it is

reasonable to view information-as-thing as *evidence*, though without implying that what was read, viewed, listened to, or otherwise perceived or observed was necessarily accurate, useful, or even pertinent to the user’s purposes.” Later, “If something cannot be viewed as having the characteristics of evidence, then it is difficult to see how it could be regarded as information.”^[85] This characterization does leave the reader wondering if Buckland always distinguishes information-as-knowledge from information-as-thing. Suppose a legal precedent is considered evidence. Is the physical book where the precedent is published the evidence, or is it the “information-as-knowledge” within the book that is the evidence? It would seem to be important to distinguish the physical form of the record from its logical content.

Buckland goes on to say that most anything can be informative; therefore information is everything. “We conclude that *we are unable to say confidently of anything that it could not be information.*”^[86]

Buckland concludes by suggesting areas in information science where distinguishing “information-as-thing” could be helpful. He notes that historical bibliography, the study of books as physical objects, and statistical analysis of information objects (now known as “informetrics”) are areas where information-as-thing has primacy. Second, in the professional activity of the information disciplines, an understanding of the physical handling of different kinds of objects and materials is vital to the effective management of those resources.

Marcia J. Bates

Marcia Bates sets out self-consciously to build a conception of information that is suitable and productive for the information disciplines to use in theory and practice.^[87,88]

Her basic definition is a structural one—arguably the most suitable approach for disciplines concerned with material storage and access to information: “Information is the pattern of organization of matter and energy.”^[89]

She aligns with Wiener on the nature of information: Wiener has said, “Information is information, not matter or energy.”^[90] That is, she argues that information is not identical to the physical material that composes it; rather information is the *pattern of organization* of that material, not the material itself. (This contrasts with Buckland’s conclusion that information is everything.)

On the other hand, though the material world is indisputably materially “there” and not a figment of solipsistic imagination, how living beings perceive and conceive of that pattern of organization is immensely variable across species and across individuals and across the same individual at different times. In this sense, information may be both objective (called “information 1”) and subjective (called “information 2”—pattern of organization of matter and energy given meaning by a living thing). Thus, nature has a physical reality independent of human beings, in

which we can posit the existence of patterns of organization, even if we perceive them poorly or not at all, while living beings experience patterns of organization in their lives that may be uniquely their own, either as a species or an individual.

At the same time, she addresses information in the larger context of the development of life on earth, drawing on a conception developed by Susantha Goonatilake of the evolution of information transfer over the history of life on earth. Goonatilake's view of the broad fundamental channels of information is well suited to the needs of the information disciplines.^[91]

He argues that over the history of life on earth, information has been stored and transmitted in three fundamental ways: genetically, neural-culturally, and exosomatically, that is, through the genome, through cultural transmission, and through storage devices external to the body, such as stelae, scrolls, books, photos, and videos. Animals moved beyond just genetic information transfer to neural-cultural information transfer when they began to teach their young to hunt and otherwise survive as adults. Humans took neural-cultural information still further when they developed language and began memorizing and telling stories to pass on culture through the neural-cultural channel. Humans then developed an explosively growing capacity for exosomatic storage and transmission once they began to carve, draw, and write on more or less durable surfaces.

In developing her conception of information, Bates argues that in living organisms, information tends to move back and forth between encoded and embodied forms. Genetic information is encoded in the genome and embodied in the living animal, the phenotype. The phenotype, in turn, encodes the genome in reproductive material to the next generation. Neural-cultural information is encoded in the brain of an animal and embodied in the experiences, actions, and communications of the animal, respectively, called experienced information, enacted information, and expressed information. Exosomatic information is encoded in the external materials in which it is stored, whence it is again embodied in human experience during reading, touching, or observing.

It is the exosomatic information that is of greatest interest in the managerial practice of the information disciplines. Types of exosomatic information include embedded and recorded information. Embedded information comes from the enduring effects of animals on the earth—from a path beaten through the woods to deliberately fashioned tools, homes, and other objects. For example, a ceramic storage vessel dating from Roman times contains embedded information in its design, in any painting on it, in any residue of its contents, etc. These aspects were generally not designed for intentional communication with later generations; but we can discern many informative things from examining them. Recorded information is communicatory or memorial

information preserved in a durable medium. This type of information is the prime domain of most of the information disciplines—librarianship, archival science, knowledge management, etc.

To Goonatilake's three channels of information transmission, she adds a fourth channel, "Residue." Residue is the flow line of extinction, where previously encoded or embodied information degrades, as in the Biblical "dust to dust." This flow line is important in the information disciplines, because relatively durable information storage does not endure forever and can degrade to the point where no socially meaningful evidence remains.

Thus, in parallel to Goonatilake's three flow lines, Bates defined the following forms of information:

- The genetic flow line is associated with genetic information.
- The neural-cultural flow line is associated with experienced information (in the mind), enacted information (actions in the world), and expressed information (nondurable communications).
- The exosomatic flow line is associated with embedded information and recorded information.
- Finally, residue is associated with trace information—the pattern of organization of the residue that is incidental to living processes or which remains after living processes are finished with it. The importance of trace information to the archaeological and museum worlds is self-evident.

Bates argues for the value of such an approach by describing several example applications of these multi-type terms for information in information studies. For example, the study of information seeking behavior needs to incorporate an awareness of *all* the forms of information a person takes in:

People get information not just from paper sources, not just from other people, but also from the physical layout of their workspaces, from the design, not just the content, of informational genres, and above all, from the interaction of these various factors in a real situation. All the patterns of organization of matter and energy—cognitive, physical, architectural, social, linguistic—are informative.^[92]

Thus, all types and forms of information need to be incorporated in our thinking in doing information research, and having these multiple types of information in mind can promote that awareness and use in research and teaching throughout the information professions.

Paul Beynon-Davies

Beynon-Davies comes at information from the perspective of the information systems discipline. "Significance" is his

core concept, rather than information.^[93,94] What he calls “the enactment of significance” consists in three levels of systems—data, information, and activity. These are called, respectively, forma, informa, and performa. Core to these three concepts are the ideas of representation, communication, and performance. Thus, a system of representation may be the ones and zeroes of a computer operating system or the alphabet. Persistent data is subject to the classic elements of information system design: read, write, update, and delete.

Information is thought about in Beynon-Davies’ work as mostly being about signaling (intentionally or otherwise), that is, as the communication of meaning that is sent by a sender and received and interpreted by a receiver. He draws on the work of biologists and ethologists, with particular attention to research on prairie dog signaling, to demonstrate how even nonlinguistic messages may be produced and interpreted.

Performa consists in the activity of performing a plan or organizational system. According to his Figure 1,^[95] moving from the data level through the information level to the performance level consists of the following: The form of data is structured into meaning, from which intentions arise, leading to actions. Thus, we start with the data, give it meaning and use it to inform, and then perform actions, collaboratively or singly, to achieve goals. As he states elsewhere, “Forma can be seen to encapsulate the objective nature of information, informa its subjective nature and performa its inter-subjective nature.”^[96]

SECOND INTERLUDE: DIKW

DIKW stands for data–information–knowledge–wisdom. Just as Popper’s three worlds frequently show up in considering information, so also does this sequence. Discussion of this sequence is based on the assumption that the terms go from the least to most processed or integrated, with data the rawest and wisdom the most rarefied.

Arguably, this view of these terms comes ultimately from their popular usage. Intuitively, we see each term in the sequence as more developed, “cooked,”^[97] or worked through than the term to its left. Discussions of this sequence, in more or less formally worked through thinking, show up in many works, including, at least, those of Houston and Harmon,^[98] Hammarberg,^[97] Meadow and Yuan,^[6] and Ferris.^[99] Sharma traced the hierarchy through the knowledge management and information science literature in the 1980s back to the poet T.S. Eliot in 1934.^[100] Thompson suggests that “signal” should be a fifth term in the sequence, preceding data (“Telecommunications” in *ELIS*).

Though this sequence may feel intuitively right, it is difficult to take it from its popular meaning and develop it into something sufficiently refined to be useful for research. Most discussions of DIKW really, at base,

elaborate the intuitive understanding and do not take theory much further. Frické concurs and argues that “the DIKW pyramid should be abandoned.”^[101]

DECONSTRUCTING “INFORMATION”

“Information” has had so much importance in the thinking of many disciplines, including library and information science, over the last 60 or more years that it is not surprising that the time has come where authors set out to debunk or “deflate” the importance of the concept of information. They choose various ways of doing this; three are illustrated in the succeeding text.

Ronald Day

In Ronald Day’s deconstruction of *The Modern Invention of Information*, he states that “I attempt to show how professional and authoritative texts about the social importance of information tried to use language (particularly through books) to construct a social, utopian value for information and helped to raise information and its connotations of factuality and quantitative measure to a privileged, even totalitarian, form of knowledge and discourse.”^[102] He says his objective is not to say what information “really is” nor to conclude that information is good or bad, but “rather that certain connotations of information, and the social and cultural privileging of certain technologies and techniques associated with it, are cultural and social productions that elevate certain values over other values. . . .”^[103] Thus, he is not defining so much as critiquing the uses of the term “information.”

Bernd Frohmann

Bernd Frohmann’s objective in his book *Deflating Information* is to replace the centrality of “information” as the focus of much of information studies and science studies with the centrality of practices surrounding documents.^[104] His objective is thus not so much defining or theorizing information, but rather, as his title says, “deflating information.”

“One of the aims of this book is to show how rich and varied the practices with scientific documents can be, especially compared to the simplistic idea that there is no more to the informativeness of a document than what happens in the mind of someone who understands it.”^[105]

Some would complain, however, that good research on information seeking has, from the beginning, also examined scientific practices around documents, and linked those practices to the subjective points of view of the people being studied. Most of the articles on information seeking in the “ancient” 1958 International Conference on Scientific Information^[106] or the 1960s era American Psychological Association’s Project on Scientific Information

in Psychology^[107] could be shown to have done that. What we can say of recent decades, though, is that consciousness of all the practices, situations, and cultural beliefs surrounding information seeking and use has grown substantially, and Frohmann's book-length treatment demonstrates that.

Jonathan Furner

Furner suggests that rather than relating information to epistemology, we should relate it to the philosophy of language. Further, "we shall find that philosophers of language have modeled the phenomena fundamental to human communication in ways that do not require us to commit to a separate concept of 'information.'" And "[o]nce the concepts of interest have been labeled with conventional names such as 'data,' 'meaning,' 'communication,' 'relevance,' etc., nothing is left (so it may be argued) to which to apply the term 'information.'" In fact, he claims that the entire field may be misnamed and "that its subject matter should more appropriately be treated as a branch of communication studies, semiotics, or library studies."^[108] Furner might not call himself a postmodernist, but the effort to design an approach that does without *the* central concept in a discipline has an objective very much in a postmodernist spirit of deconstructing hitherto core values and ideas.

He identifies what he considers to be the several ways in which "information" is used and discussed in information studies and categorizes them in three broad groupings as follows: "information-as-particular," namely, "utterances," "thoughts," and "situations"; "information-as-action," namely, "communication"; and "information-as-universal," namely, "informativeness" and "relevance."^[109] He then argues that other fields address most of these topics with deeper understanding and research results than information studies does and that even in those topic areas where information studies has done much work, such as relevance, we can draw from work in pragmatics and the philosophy of language.^[110]

One can certainly agree that we have not advanced as far as desirable in understanding information, and, as well, that we often lack an adequate theoretical basis out of which to develop our ideas. However, one can see this situation as a problem of failing to date to develop our unique intellectual substrate, rather than that we are reinventing lumpy versions of other disciplines' well-wrought wheels.

The universe of study of the physicist is the physical processes and dynamics that govern our universe; the universe of study of the biologist is the world of living things. The primary domain of study in the information disciplines is the world of exosomatic information and human beings' relationship to that world as creators, designers, and users. Heretofore, society has seen that world, if it noticed it at all, as merely an epiphenomenon of the real

world of things that matter. Increasingly, as the twenty-first century develops, we are more and more often grasping the reality that the world of information has become its own universe of study, one of immense importance to human beings, full of intriguing phenomena to observe and understand. That study should surely include identification of key terms, along with the provision of our own disciplinary definitions.

CONCLUSIONS

The understanding of the core concept of "information" in information science remains a highly contested area. Information is seen as

- A proposition, a structure, a message, or an event
- Requiring truth or indifferent to truth
- Socially embedded and under perpetual reinterpretation or as measurable in bits
- A worn-out idea deserving of dispatch or as an exciting conception understandable in terms of evolutionary forces

The much-debated concept of information remains at the lively heart of information science.

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Information Arts

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Abstract

This entry provides a survey of the field of information arts, an artistic practice that creatively and critically reflects on the collection, filtering, and dissemination of information. The term information arts is relatively new and used mostly as it relates to the information society of the digital age. This entry outlines the roots of contemporary information art practice in processes of information distribution and mass media and places it within the wider art historical context of works that have explored information flow and mass-mediated images. Among the topics addressed are the ways in which recent information artworks process data from sources such as science, humanities, and network technologies and the methods these artworks employ for giving information form, for example, data visualization and the construction of databases. This entry also briefly discusses the challenges that information art using new technologies poses to the traditional art world, ranging from presentation to collection and preservation.

INTRODUCTION

This entry explores the field of information arts and its relationship to information societies, its practitioners, their conceptual motivations, and the various manifestations their artworks take, from projected visualizations to performative interactions. A brief discussion about the historical development of the information society is included in order to elucidate information arts' relevance to that history, as well as its break from past cultural practice.

A data flow diagram depicts the range of data origins, the strategies employed by artists to process the data sets, as well as the various methods of presentation. Using examples, this entry presents two main artistic approaches to working with information, one more focused on formal and aesthetic concerns, the other addressing cultural and political aspects. Finally, this entry considers information arts in the context of the art institution, summarizing approaches to exhibition, and preservation.

DEFINING INFORMATION ARTS

It would be problematic to claim that information arts are a clearly defined field or a term that describes a specific kind of artistic practice in a specific medium. While one could argue that art throughout the centuries has been concerned with or addressed information in some form or another, the term "information arts" has been used only fairly recently. The term was formalized by Stephen Wilson when he published his book of the same name in 2002. Wilson describes the field as one primarily concerned with data as it relates to science and technology, making a strong case for the ubiquitous impact of these areas in the information

society.^[1] However, this seems too narrow an approach as it excludes valuable contributions by artists who, while working with information and its mechanisms for evaluation and distribution, do not directly comment on or use data derived from science or technology.

If one understands information science as an interdisciplinary field concerned with the collection, storage, classification, retrieval, and dissemination of information, one could say that information arts make the concerns of information science both their content and medium. Information arts consciously explore or critically address the issues surrounding the processing and distribution of information by making information itself the medium and carrier of this exploration.

The term information arts now seems inextricably interconnected with the information society that has been brought about by digital technologies and is occasionally understood as strictly digital or data driven. However, information arts are a wide-ranging category that can also be applied to analog techniques and technologies and has a history within artistic practice, as we will show in the following. We are addressing the topic with a rather broad scope, thinking of information as a cultural as well as numerical entity. While information arts are not identical with digital art or so-called new media art (art that uses digital technologies as a medium for production, storage, and distribution), these fields of artistic practice certainly overlap. One could argue that digital art is a subcategory of the broader field of information arts in that it explores and processes information by means of digital technologies only (e.g., as a data visualization or website) and predominantly understands data as digital binaries. The larger umbrella of information arts, by contrast, potentially engages with its subject

across a range of media—from print and analog radio and TV to digital media. Not all of digital art can automatically be understood as information art; a digital artwork that explores hyperlinked storytelling and narrative does not necessarily self-consciously address information processing and distribution. In terms of defining the field, one could therefore suggest that a portion of digital art—in which information is both medium and subject matter—is a subcategory of information arts at large.

A strong link between digital art and information arts in general is established by the use of algorithms or code—a procedure of formal instructions that accomplish a “result” in a finite number of steps—which forms the basis of digital or new media art. Information arts uses a variety of methods, both analog and digital, to process data but a significant portion of the practice relies on digital technologies and algorithms in this processing. The layer of code and instructions constitutes a conceptual level that connects to the artistic explorations of previous decades. Information arts can be understood as a larger category than digital art, as a field of artistic practice that consciously makes information—be it in digital form, contained in genetic code, or circulated by the mass media—its subject matter.

INFORMATION ARTS IN AN INFORMATION SOCIETY

Today, it is nothing new to think of our society as an “information society,” so much so that we might take for granted when and how this development occurred. Information, or the communication of information, was an important element in the development of ancient societies and has remained important ever since. The evolution of languages and the means for circulating those languages was a key for extending cultural influences, and the power of the societies generating them, from Babylon to Qatar. But one would not describe the late Roman Empire as an information society, despite the centralized authority over a large expanse and people of disparate backgrounds.

In fact, we typically do not think of information societies occurring until the twentieth century, and more precisely not until the latter half of the century as the economy moved from material goods to information goods. While it is not our intention to examine the evolution of information from its inception, a brief consideration of its growing role and importance to our civilization will allow us to better understand the development and relevance of what one might call the information arts.

When did the collection, classification, storage, and dissemination of information become important to society? Again, one could go back to early civilization, but a crucial moment would be after the Renaissance and the rise of rational humanism, during the Industrial Revolution, when

mechanization and automation provided for greater redundancy, predictability, and measurability—Taylorism was a symptom of this trend in business practice and philosophy, and Fordism was its crowning achievement. In the late nineteenth century, Frederick Winslow Taylor proposed that working environments and procedures be based upon analyses of the work to be done, with increased productivity being the goal, as opposed to methods adopted by convention. Fordism, a term coined by the Italian political theorist Antonio Gramsci, refers to the deskilled, task-oriented work common in twentieth-century manufacturing since Henry Ford implemented the assembly line. The economy became increasingly reliant upon efficiency and productivity, and in the meantime developing transportation and communication technologies allowed for a more dispersed clientele and a public whose solidarity increasingly defied geography and genetics.

Immigration was spurred by new technologies both because travel became easier and because booming industries lured people to travel great lengths for financial gain. The influx of immigrants in America precipitated a shift toward a greater use of images in journalism as it went “yellow” and coincided with the rise of the moving image, which was, in this regard, fortunate to be silent.

These changes did not go unnoticed by artists of the time: One can see examples of the influence of mechanization and technological idealism in cubism and futurism, while the Dadaists adopted rule-based methodologies for some of their art making, emphasizing procedure over product. It is not a surprise that today, in societies consumed by computation, the Dadaism is seen as one of the most influential art movements of the twentieth century. The conceptual artists of the late twentieth century are seen as descendents of these earlier explorations, and their de-emphasis of aesthetics and material as the central signifiers of art opened up the door for a growing number of practitioners from disciplines such as computer science, engineering, biology, and philosophy.

It was in the early twentieth century that Madison Avenue and Hollywood (not to mention the military) realized the power to persuade that the mass media possessed. However, despite the growing importance of mass-circulated information in this nascent stage, the economic engine of the West was still largely the production and distribution of hard goods, with the postwar boom yet to happen—information was mostly at the service of engineering and manufacturing. Radio, movies, and magazines made inroads into leisure time, but they all took a hit as television became the mass medium by the late 1950s. Consumerism reached new proportions as the mass media were there to guide and facilitate achieving a proper standard of living for the growing middle class. Art reflected these developments, with overt manifestations in the pop art movements of England and the United States, Richard Hamilton and Andy Warhol being prime examples,

respectively. While Hamilton and his colleagues in the Independent Group critiqued the growing trends of consumerism and the corporatization of contemporary society with wry satire, Warhol employed the visual language and marketing strategies of corporate culture to manufacture and disseminate the Warhol brand.

An appropriate parallel to these artists' approaches is the recent work of artist collectives @TMark and etoy. The former group undermines corporate authority through various strategies, among them the mirroring of websites, a common tactic of activist art projects. Artists register domain names similar to those of corporate entities or institutions, mirror the look of these entities' websites, but subvert their contents as an act of critique. In collaboration with The Yes Men, @TMark was involved in a December 2002 press release originating from the fake site Dow-Chemical.com that explained why Dow could not take responsibility for the Bhopal catastrophe, which resulted in an estimated 20,000 deaths over the years. The release created public outrage, as well as expansive press coverage and controversy.^[2] etoy frequently carry out acts designed to heighten their public profile, and hence increase their value as a cultural entity. In other words, they engage in branding. The work of these artists reveals identity as a cultural construct that is dependent upon the maintenance of a profile in the public, which is widely accepted as an entity established through communication. The value, or impact, of a given identity is reliant upon its circulation via various media, from print to the Internet. As etoy themselves state

The firm represents the core and code of the corporate sculpture, and controls, protects, promotes, and exploits the cultural substance (intellectual property) and the etoy. ART-COLLECTION. etoy intends to reinvest all financial earnings in art—the final link in the value chain.^[3] (Fig. 1)

Meanwhile, as corporations extended their reach, their desire for greater productivity was met by the burgeoning

computer industry. The UNiVersal Automatic Computer, which was capable of computing textual and numerical data, was the first commercially available computer, announced in 1951. While it took some years for computing to be adopted by industry at large and decades longer for it to become a fixture in the home, the concepts and methods that are the foundation of computing had manifestations in rule-based art from the late 1950s through the 1970s and beyond, such as Sol LeWitt's drawings, paintings, and structures, Fluxus' instructions for "being" art (one cannot overlook the relevance of Dada performance/poetry here), the psychogeographic explorations of the Situationists, the chance operations of John Cage's sound work, and the reiterative music of Steve Reich. Recognizing that technology had extended from the production floor of the factory to the cutting room of culture, artists like Nam June Paik, Vito Acconci, and Bruce Nauman began experimenting with video, and in the mid-1960s Experiments in Art and Technology, founded by engineers Billy Klüver and Fred Waldhauer and artists Robert Rauschenberg and Bob Whitman, melded the skills of engineer and artist to explore the possibilities of technologically enabled art.

Experiments in Art and Technology was far from the first such commingling of art and technology, after all photography and film have their roots in such experimentation; the linear perspective of Early Renaissance painting was based in mathematics, and architecture going back to antiquity followed mathematical principles for design and proportion. So is the emergence of the information arts of the late twentieth century anything new? Yes. While one can argue that information has been key to the existence and propagation of civilizations from their start, it is since the mid-twentieth century that the collection, classification, and dissemination of information has been such a force within society that economics, politics, and social relations depend upon it. In the United States, a

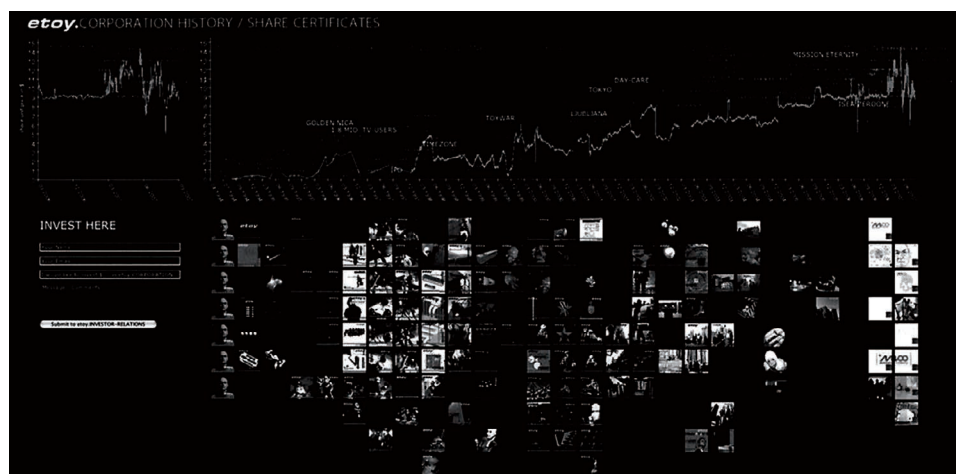


Fig. 1 etoy.CORPORATION History/Share Certificates. Screenshot.

process of deindustrialization began in the mid-1960s when the percentage of manufacturing employment peaked at 28%, dwindling by more than 10% over the next 10 years.^[4] This coincided with growth in the information industries and the growing economic activity related to the processing and distribution of information.

FROM DATA TO INFORMATION FLOW: THE PRACTICE AND PRODUCTION CYCLE OF INFORMATION ARTS

Essential to the concept of information arts is the “production cycle” of information itself, which—in its connection to all the previously mentioned aspects of information collection and dissemination—becomes the subject and means of artistic exploration. The Merriam-Webster Online Dictionary defines information as “the communication or reception of knowledge or intelligence” or “knowledge obtained from investigation, study, or instruction.”^[5] Derived from the Latin verb “informare,” which means “to put into form,” information is closely connected to the act of informing as imparting learning or instruction. Webster’s, as many other dictionaries and common language usage, to some extent conflates information with data, defining data as “factual information (as measurements or statistics) used as a basis for reasoning, discussion, or calculation.”^[6] A more precise definition and delineation of the two terms might be the understanding of information as processed data. In this sense, information would consist of the conclusions derived from the analysis of figures, statistics, etc. (data), which form the basis of reasoning. This meaning of information would be closer to Webster’s description of information as representation of data: “a signal or character (as in a

communication system or computer) representing data.” On a sidenote, the equation of information and knowledge seems equally problematic. David Sholle suggests to distinguish the two in terms of multiplicity, as well as temporal and spatial categories, arguing that (1) information is piecemeal and fragmented, while knowledge is structured and coherent; (2) information is timely and transitory, while knowledge is enduring and temporally expansive; and (3) information flows across spaces, while knowledge is a stock and located, yet spatially expansive.^[7]

Distinguishing characteristics aside, there is no doubt that information and data are closely related and feed into each other. Data commonly function as input into systems or programs that output information. However, information or segments thereof can either become or produce input data. David Sholle has pointed out that in information economics, information functions both as the resource providing input into the production process of commodities and the control of the market itself and as the output that is materialized and sold as a commodity.^[8]

The diagram in Fig. 2, which is meant to be a schematic outline rather than a definitive model, sketches some central aspects of the practice of information arts. The source data for an art project can be derived from areas as varied as the sciences (such as biotechnology and genetics or geographic information systems), the humanities (languages and literature, visual arts, and music), network processes (data flowing through or pertaining to digital networks), haptic or acoustic processes, etc.

Information arts process these data through the use of rules, algorithms and codes (instructions that accomplish a “result” in a finite number of steps), or other forms of encoding and transformation. It is important to note that code cannot be understood as separable from its overall structure. As Adrian Ward, Alex McLean, and Geoff Cox

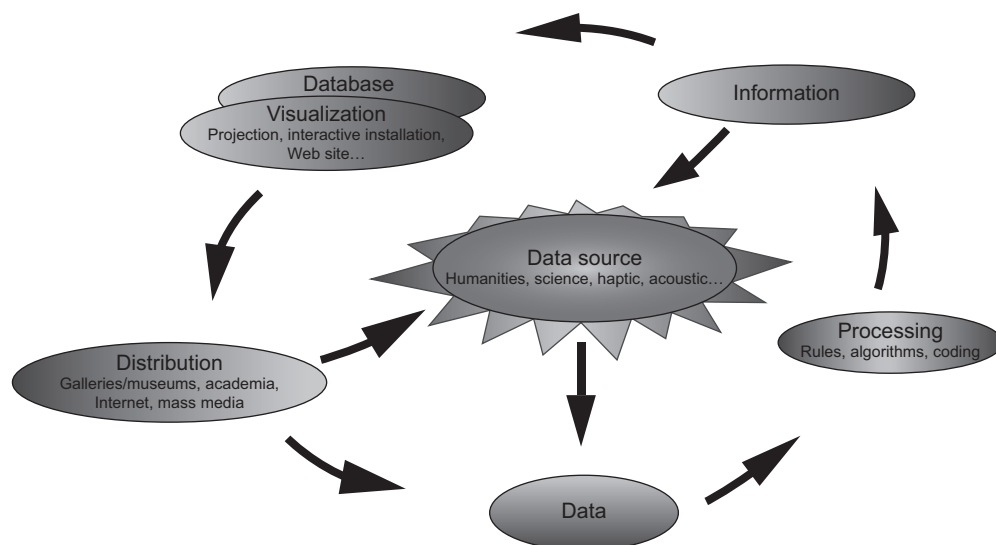


Fig. 2 Paul/Toolin, flow diagram of the practice of information arts.

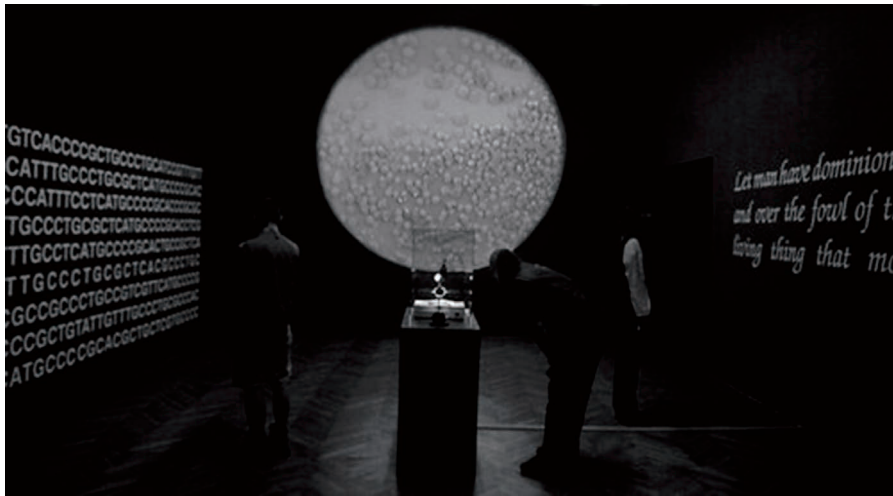


Fig. 3 Eduardo Kac, *Genesis* (1999). Transgenic work with artist-created bacteria, ultraviolet light, internet, video (detail), edition of 2, dimensions variable.

pointed out in “The Aesthetics of Generative Code,”^[9] the written form of code—as “a notation of an internal structure that the computer is executing, expressing ideas, logic, and decisions”—is “a computer-readable notation of logic” and not what the computer really executes. The execution takes place through various layers of interpreting and compiling. This layered interpretation and processing (by various means and methods) is a basic characteristic of information arts.

Eduardo Kac’s *Genesis* (Fig. 3) perfectly illustrates this process of multilayered interpretation. Taking textual and scientific data (from the field of genetics) as its source, *Genesis* uses encoding and the transformation of different materialities as a means of processing. For the project, Eduardo Kac created a synthetic “artist’s gene” by translating a sentence from the biblical book of Genesis (“Let man have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moves upon the earth”) into Morse code and converting the Morse code into DNA base pairs.^[10] The synthetic gene is cloned into plasmids, which are transformed into bacteria. In the gallery installation of the work, visitors encounter a pedestal with a petri dish containing the bacteria and, suspended over it, a UV that disrupts the DNA sequence in the plasmid and accelerates the mutation rate. Visitors to the *Genesis* website are able to remotely turn the UV light on, thus interfering with and influencing the process. Kac’s goal is to examine the relationship between information technology and science, as well as belief systems and ethics. The interplay between these fields is achieved by translating and transforming different forms of information, the result being the creation of a life form based on language and “code.” *Genesis* connects to the definition of information as the attribute inherent in and communicated by “alternative sequences or arrangements of something (as nucleotides in DNA or binary digits in a computer program) that produce specific effects.”^[5]

While Kac’s work manifests itself as a networked installation, information art can use numerous methods

to give information form, ranging from installation to a virtual reality environment or distribution over mobile devices, such as cell phones or personal digital assistants. The latter play an important role in locative media projects, which use a location in public space as a “canvas” for an art project and have become one of the most active and fast-growing areas in information arts. Locative media employ technologies such as the global positioning system for data gathering or allow their users to contribute to projects and share information via mobile devices. A number of art projects have focused on mapping and enhancing existing physical spaces and architectures, creating a virtual, public repository for information that supplements sites. Others have focused on transforming mobile devices from mere communication tools into personal measurement instruments and enabling people to collect and share data about their surroundings and environment. Other common methods for making information manifest are the construction of databases and data visualization.

As mentioned before, information art that involves the digital medium always consists of a “back end” of algorithms and data sets that often remain hidden behind a visible “front end” that is experienced by the viewer/user. This front end is produced by the code and algorithms that interpret the back end data, and the results can range from complex visuals to more abstract communication processes. Some information artworks are predominantly visual; other works are more focused on raw data and the database model. Given the fact that database structure in the broadest sense lies at the root of digital media, it is only natural that so-called database aesthetics play a major role in information arts.

The 1990s were a decade of major digitization, where libraries, archives, and museum collections were translated into digital format. While a database is now commonly understood as a computerized record keeping system, it is essentially a structured collection of data that stands in the tradition of “data containers” such as a book,

a library, an archive, or Wunderkammer. Every “container” of information ultimately constitutes a dataspace and information architecture of its own, even though its characteristics are quite different from the virtual, dynamic dataspace. What distinguishes digital databases from their analog predecessors is their inherent possibility for the retrieval and filtering of data in multiple ways, allowing for new forms of relational connections.

Databases can be distinguished according to different “data models”—that is, data containers and the ways in which data are stored in and retrieved from them. A database essentially is a system that comprises three levels: (1) the hardware that stores the data; (2) the software that allows for housing the data in its respective container and for retrieving, filtering, and processing them; (3) and the users who add a further level in understanding the data as information.

In the field of information arts and digital art, the term “database aesthetics” is frequently used to describe the aesthetic principles that are applied in imposing the logic of the database to any type of information or filtering data collections or visualizing data. In that sense, database aesthetics often becomes a conceptual, potential, and cultural form—a way of constructing information by revealing (visual) patterns of knowledge, beliefs, and social behavior. Generally speaking, the aesthetics of a database are inherently relational, be it on the level of potential (the data stored in the data container) or the actual relationships established by the software component. Database aesthetics suggest the possibilities of tracing process—individual, cultural, communicative—in its various forms on the basis of data. Largely brought about by digital technologies, database aesthetics itself has become

an important cultural narrative in information arts, constituting a shift toward a relational, networked approach to gathering and creating information and knowledge about cultural specifics.

Examples of information arts that apply a database model to reveal information about cultural and individual values are George Legrady’s projects *Pockets Full of Memories* (2001) and *Slippery Traces* (1997). *Pockets Full of Memories*, an installation with an accompanying website,^[11] explicitly focuses on the “mechanics” of database construction and the way in which we derive informational value from databases (Fig. 4). It creates an “anatomy” of personal value by inviting visitors to digitally scan an object in their possession at a scanning station and answer a set of questions regarding the object, rating it according to certain attributes (old/new, soft/hard, natural/synthetic, functional/symbolic, personal/nonpersonal, useful/useless, etc.). The algorithm used to process the data is the Kohonen self-organizing algorithm, which classifies the scanned objects in a two-dimensional map based on similarities in their descriptions and attribute ratings. The Kohonen map generates a grid with random values for each point in the grid and all the data categories for each object; the algorithm classifies one object after the other and positions it where it finds the closest values for the respective object, so that over time all the objects are positioned in proximity to the ones with similar values. Users can review each object’s data and add their own personal comments and stories. The mapping of these objects illuminates how each object is contextualized by its surrounding data and underscores the absurdities of classifying objects endowed with personal meaning.

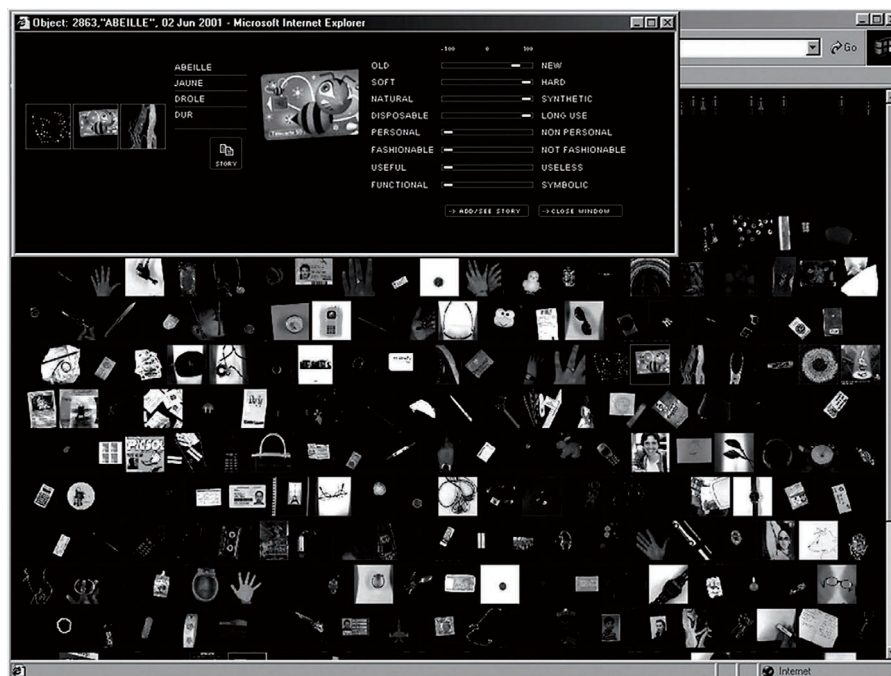


Fig. 4 George Legrady, *Pockets Full of Memories* (2001). Screenshot of the interface.

The information conveyed is obviously very much dependent on the database system as a whole—the interplay between the container, the algorithms, and the interpretation of the user. Database categories and the algorithms filtering them are never value-free but always inscribed with an interpretative angle.

Closely related to the construction of databases, data visualization is another method of making processed data manifest as information. Data visualization can be defined as the creation of dynamic visual models for data sets. For any given set of data, there are multiple possibilities for giving it a visual form, which in turn lend themselves to reconfiguration. The dynamics of the visualization and interface are yet another layer of processing that provides a context for deriving information. Context becomes key when it comes to the success of the visualization process. While there needs to be a certain focus on data changes at any given point, the visualization tends to turn into a form of wallpaper (no matter how beautiful it is) if it loses the larger context of its underlying data set.

The issue of potential relationships between the data structure or data stream and its visualization is perfectly captured by the Radical Software Group's project *Carnivore* (2001–present).^[12] The project is inspired by the software DCS1000 (nicknamed “Carnivore”), which is used by the FBI to perform electronic wiretaps and search for certain “suspicious” keywords via packet sniffing—a software-based process of intercepting, logging, and analyzing the data packets sent over a digital network. Using network traffic on a specific local area network as its data source, the project processes the data through software that performs packet sniffing. The resulting data stream is visualized by the numerous “client” applications that

artists have created since the project's inception. At the core of the Carnivore project are the unlimited possibilities of visualizing the server's data stream in a collaborative, open-source way. Jonah Brucker-Cohen's *Police State* (2003) addresses and subverts the process of surveillance itself (Fig. 5). In *Police State*, the processing of the data stream takes the form of both a visualization and a physical installation. The client sniffs the network looking for keywords relating to domestic U.S. terrorism and assigns the identified text to an active police radio code, which is translated to its binary equivalent and sent to 20 radio-controlled toy police cars as a movement sequence. Controlled by the very data that law enforcement is searching for, the police cars perform a synchronized “dance,” driven by their own surveillance.

The previous examples illustrate ways in which data are processed (through algorithms, encoding, and transformation) and methods of engaging with the data to give it form (through installations, construction of databases, or data visualization). As any information, these and other information art projects enter the larger cultural and social sphere through the media—be it the mass media of print publications and television. The technologies and distribution process of the media, as well as the information circulated by them, again produce data that information arts make their subject. An excellent example of this recapitulation of media imagery is a 2006 project by Eva and Franco Mattes (aka 100101110101101) titled *13 Most Beautiful Avatars*. This project consists of “pictures of self-portraits” featuring the avatars made by inhabitants of the virtual world Second Life, which reveal a desire to appear as someone other, someone closer to the ideals of beauty commonly seen in Western mass media. The

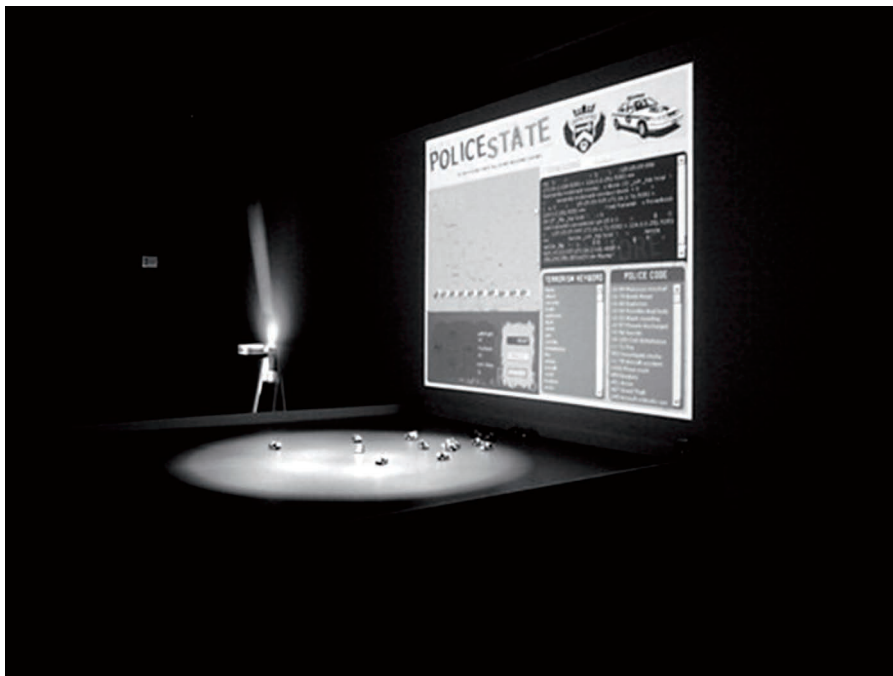


Fig. 5 Jonah Brucker-Cohen, *Police State* (2003) at the exhibition “Source Code,” Eyebeam, New York City (May 31–August 11, 2007).

project directly references two of Andy Warhol's works of the 1960, *Thirteen Most Beautiful Boys* and *Thirteen Most Beautiful Women*. The Mattes' piece is one of the many utilizing the imagery and implications of popular culture in virtual worlds and computer games.

APPROACHES TO INFORMATION ARTS: FORMALISM VERSUS CULTURALISM

The practice and data flow of information arts we have outlined so far makes obvious that the field is not at all unified but spans various artistic media and methods. This raises the question whether it is possible to identify major conceptual categories for understanding information arts rather than relying on the rather formal distinctions between different methods for processing and materializing data. Categories that may be helpful for a conceptual approach are those of formalism versus culturalism, which have been used in software art, a subcategory of digital art that focuses on artist-written code. One can argue that there is a fairly strong connection between software art, which relies on processing through code and algorithms, and information arts, which involve either the same methods or rules and "encoding" in the broadest sense for transforming data.

The jury of the pioneering software art festival Read_Me 1.2 (2002)^[13] broadly defined software art as works based on code as formal instructions or offering a cultural reflection of software. The former would apply to forms such as generative art and code poetry that put an emphasis on the aesthetics of formal instructions; the latter would apply to categories such as manipulations of existing software (cracks and patches or plug-ins) or political and activist software (e.g., cease-and-desist-ware and software resistance), which offers a critical reflection of software's cultural status, its encoded political or commercial agenda. Games, artistic tools, and conceptual software could fall into either of these two groups, depending on the execution of the respective project and the weight it places on formal aspects or critical reflection. One can rephrase this classification of software art—as focused either on code as formal instructions or on cultural reflection—as a manifestation of formalism versus culturalism. In his essay "Concepts, Notations, Software, Art," Florian Cramer also suggests this distinction with regard to software art: "a cultural, politically coded construct" versus a focus on "the formal poetics and aesthetics of software code and individual subjectivity expressed in algorithms."^[14] Applying the formalism versus culturalism distinction to the information art projects discussed earlier, one could propose that Kac's *Genesis* offers cultural reflections on biotechnology and belief systems. As opposed to Brucker-Cohen's *Police State*, which explores surveillance and political aspects, Napier's *Black and White* software is a mostly formally and aesthetically

oriented project (as many other data visualizations). Legrady's projects would also be culturally focused, be it in the interpretation of imagery or the personal value of objects. The projects of etoy, mentioned in the beginning, can be seen as a cultural investigation of the "products" of information society.

It is important to note that, as conceptual art, information arts cannot be evaluated in terms of classical standards of "visual beauty" since they may take the form of a database that concentrates on its own structure and underlying "politics" rather than the visual aspects of its contents. As Cramer puts it, the focus on the purely perceptual aesthetics of art "is a straight continuation of romanticist philosophy and its privileging of aisthesis (perception) over poesis (construction), cheapened into a restrained concept of art as only that what is tactile, audible, and visible."^[15] The range of information art projects combines both aspects and raises issues about the status of representation in an information society, which has been much discussed. If one defines representation as a "likeness" or image of an external referent (an "object" or "scene" in the broadest sense), information arts in general ultimately represent data. One could draw the conclusion that we are facing a major transformation of the status of representation itself, which becomes a process that involves data processing and is concerned at least as much with algorithmic rules and conceptual aspects as visual, textual, and acoustic manifestations.

INFORMATION ARTS IN THE MUSEUM

Over the decades, there have been a number of digital and media art exhibitions that featured information arts and some galleries have consistently presented it, but shows in an institutional context have mostly taken place at media centers and museums such as InterCommunication Center in Tokyo or Zentrum für Kultur und Medien (Center for Culture and Media) in Karlsruhe, Germany, and the art mostly found its exhibition venues under the umbrella of conferences, festivals, and symposia devoted to art and technology, among them the Ars Electronica Festival (Linz, Austria), the art show of the U.S.-based Special Interest Group for Computer Graphics and Interactive Techniques conference and ISEA International (founded in the Netherlands) and festivals such as European Media Art Festival (Osnabrück, Germany), Dutch Electronic Art Festival, Next Five Minutes (Netherlands), and Transmediale (Berlin, Germany). Traditional art institutions so far have not played a major role in the production and development of information art projects, which have been supported mostly by the research labs of educational institutions or media centers, such as V2 in the Netherlands or the Banff New Media Institute in Canada.

Information arts that do not take the form of more traditional media still pose quite a few challenges to the

traditional art world, ranging from presentation to collection and preservation. Digital print, photography, and sculpture represent the object-oriented work that museums are equipped for, but time-based, interactive works of information art raise numerous issues. These issues to a large extent are not medium specific but apply to any time-based and interactive work, be it a video, a performance, or a robotic sculpture. Information art often requires audience engagement and does not reveal its content at a glance. The basic rule of museums, “Please do not touch the art,” suddenly does not apply anymore and large segments of the audience are still hesitant to physically engage with artwork. Works of information art can be expensive to show and ideally require consistent maintenance. Museum buildings are mostly based on the “white cube” model rather than completely wired and equipped with flexible presentation systems. Information arts make us reconsider our traditional notions of space and architecture and often require the translation of information architecture or characteristics of virtual spaces into physical space. Information arts relying on new technologies ideally require a parallel, distributed, living information space that is open to artistic interference—a space for exchange, collaborative creation, and presentation that is transparent and flexible.

The specific challenges that a digital work of information art poses are dependent on the form it takes, be it a (networked) interactive installation, an online data visualization, a work involving mobile devices, or an immersive virtual reality piece. While some information art projects can be installed according to specified parameters (such as height, width, and defined lighting requirements), the variability and modularity inherent to the digital medium often means that a work can be shown in very different ways and has to be reconfigured for a specific space. Variability entails a fluent transition between the different manifestations that information art can take: The same work might be shown, for example, as an installation, projection, or kiosk setup.

Information art that has been created for the Internet tends to be particularly challenging to show within a gallery. Internet art has been created to be seen by anyone, anywhere, and anytime (provided one has access to the Internet) and doesn’t need a museum to be presented or introduced to the public. In the online world, the branding of the physical gallery and museum does not necessarily function as a signifier of status. However, physical art spaces such as galleries, museums, and festivals also play an important role when it comes to net-based art in that they provide context for the work, chronicle its developments, assist in its preservation, and expand its audience. Models for presenting Internet art in an institutional context have been widely discussed.^[16] Internet art often requires a relatively private engagement over a longer period of time, and in order to create an environment for this experience, institutions have often presented the art in

a separate area of a public space, which raised the criticism of “ghettoization.” The setup in a separate “lounge area” has the advantage of inviting people to spend more time with a piece but prevents that the art can be seen in the context of more traditional media and enter into a dialogue with them.

Ultimately, the physical environment should be defined by what a work of information art requires, and it is important to establish a connection between the physical space and the respective information architecture.

The collection of digitally based information art projects is yet another topic that has been hotly debated. The value of art is—at least when it comes to traditional models of the art world—inextricably connected to its economic value. However, the notion of the original and the scarcity-equals-value model do not necessarily work for information art, which could consist of a set of instructions or a dynamic process. Collecting is less problematic in the case of digital installations, which ultimately are objects, or software art (which sometimes comes with custom hardware), which can be sold as a limited edition as photography or video. Information art can also draw on precedents in the realm of conceptual art; instruction-based works such as Sol LeWitt’s wall drawings have been collected by major museums. In the case of Internet art, the hosting of the source code on the respective museum’s server constitutes a form of ownership. As opposed to traditional artworks, net projects are on view permanently and not only when the museum decides to mount them in a gallery.

The process of collecting art entails the responsibility of maintaining it, which is one of the biggest challenges posed by information art projects involving new technologies. The process-oriented nature of many of these works makes it evident that preserving the art requires new models and criteria for documentation and preservation. The main strategies for preservation are storage, emulation, and migration. Storage means the archiving of software and hardware as it continues to be developed, an obviously not very elegant solution that quickly requires large storage facilities. Emulation is the use of software for imitating the original version of a project by “re-creating” the software or operating systems that the project requires, and migration means an upgrade to the next version of hardware/software.^[17] Worldwide, numerous preservation initiatives are creating standards for preserving media works that involve new technologies. Among them are the Variable Media Network^[18]—a consortium project by the University of California Berkeley Art Museum and Pacific Film Archive, the University of Maine, the Solomon R. Guggenheim Museum, Franklin Furnace Archive, and Rhizome.org, among others—and International Network for the Conservation of Contemporary Art.^[19] These initiatives are developing vocabulary for catalog records, standards that allow institutions to exchange the metadata gathered for these records, and tools

(such as database systems) for the cataloging of process-oriented art. Among these tools is the “Variable Media Questionnaire,” which enables artists and museum and media consultants to identify artist-approved strategies for preserving artwork and to define the behaviors of artworks in a media-independent way. Describing artworks according to categories that are not specific to any particular medium but allow to establish a common ground beyond materiality seems to be particularly relevant for approaching the conservation of information arts, which are not bound to any specific medium.

CONCLUSION

Cultural developments in the late twentieth century have produced information societies that make it imperative for artists to be aware of or engage with changing modes of cultural production. The expansion of digital technologies and their impact on our lives and cultures will induce the creation of even more data sets, information, and research and consequentially more information artworks reflecting and critically engaging with this cultural impact. The ways in which artists encode and transform data will presumably evolve along with the latest research and technologies for data processing. The methods and platforms that artworks employ to give information in physical and visual form will also develop along with research and technologies. The pervasiveness of mobile technologies has already led to a proliferation of artwork using networked mobile devices.

The terminology for art forms involving new technologies has always been fluid and gone through numerous changes over the past few decades. Labels aside, the artistic practice that involves information circulating through research, science, technologies, and media distribution systems is certainly here to stay and will grow. Most likely information arts will always be an evolving field and exist in multiple contexts, supported and presented by art and technology centers, research and development labs, and hopefully traditional art institutions.

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Information Behavior

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Abstract

“Information behavior” is the currently preferred term used to describe the many ways in which human beings interact with information, in particular, the ways in which people seek and utilize information. The broad history of research on information-seeking behavior over the last 50–60 years is reviewed, major landmarks are identified, and current directions in research are discussed.

INTRODUCTION

“Information behavior” is the currently preferred term used to describe the many ways in which human beings interact with information, in particular, the ways in which people seek and utilize information. Information behavior is also the term of art used in library and information science to refer to a subdiscipline that engages in a wide range of types of research conducted in order to understand the human relationship to information.

Interest in this area developed out of several streams. Librarians wanted to understand library users better, government agencies wanted to understand how scientists and engineers used technical information in order to promote more rapid uptake of new research results, and social scientists generally were interested in the social uses of information in a variety of senses. In more recent years, social studies of information technology and social informatics have contributed to this area as well. Within library and information science, these various streams of research are drawn on for what they can contribute to a richer understanding of information behavior.

INFORMATION

What, then, is information? Here, rather than review the many senses in which this term has been interpreted in the field (see ELIS entry “Information”), we will rely on a sense of the term that is an extended understanding of the concept as used in general conversation. We all recognize that people search for information on, say, the history of a small town, the population of Turkey, or how to do foreign exchange trading online. All these examples make a reasonable match with the generally understood sense of information as being factual, statistical, and/or procedural.

“Information,” however, is used in a broader sense as well in the world of information behavior research. The term is generally assumed to cover all instances where

people interact with their environment in any such way that leaves some impression on them—that is, adds or changes their knowledge store. These impressions can include the emotional changes that result from reading a novel or learning that one’s friend is ill. These changes can also reflect complex interactions where information combines with preexisting knowledge to make new understandings or enables the individual to deduce or induce new thoughts and ideas. As the Hans Christian Andersen tale suggested, the ugly duckling did not realize that he was a swan until he came in contact with swans, saw his reflection in water, and figured out that he was himself a swan, too.^[1]

These information interactions can also leave a negative impact—one may ignore, deny, or reject information.^[2] (See also an excellent early analysis of relations to information by Atkin.^[3]) One may also simply discover that nothing has changed—the university admissions letter still has not come in the mail. This negative news is, of course, informative in its own way, just as a person who has ignored information has often, in some way or other, nonetheless absorbed it. In fact, probably the largest amount of all information taken in by human beings is that received passively—simply through being aware—that is absorbed in the context of daily living.^[4]

Is this not a very broad understanding of information behavior? Indeed, does it not cover all interactions people have with their environment? Bates has argued:

In comparison to other social and behavioral science fields, we are always looking for the red thread of information in the social texture of people’s lives. When we study people we do so with the purpose of understanding information creation, seeking, and use. We do not just study people in general. . . . In communications research, a cousin to our field, the emphasis is on the communication process and its effects on people; in information science we study that process *in service of information transfer*.^[5]

Bates goes on to provide a specific example:

... [T]here are social scientists today who are observing people doing collaborative work through new types of networked systems in the field of computer-supported cooperative work (CSCW). The sociologist or social psychologist identifies and describes the network of relationships and the social hierarchy that develops under these circumstances. . . .

The information scientist, on the other hand, follows the information That's the red thread in the social tapestry. When we look at that social hierarchy, we are not interested in the hierarchy per se, but, rather, we ask how it impedes or promotes the transfer of information. We ask what kinds of information people prefer to communicate through this or that new channel of information technology. We always follow the information.^[5]

Thus, the study of information behavior can cast a very wide net, looking into both individual interactions and large-scale complex group and societal interactions with information. Indeed, as we shall see, the variety of contexts in which information behavior has been studied demonstrates this breadth. But information behavior research is not communication, psychology, education, sociology, or social impacts of technology research, though all those disciplines may find the work interesting to discover. Rather, information behavior research actually studies—and largely limits itself to—information-related behavior.

HISTORY OF INFORMATION BEHAVIOR RESEARCH

From the earliest days, librarianship in the United States had a commitment to care about and serve the users of libraries. In the founding year of American professional librarianship, 1876, Samuel Green wrote to encourage librarians to “mingle freely” with the library’s users “and help them in every way.”^[6] In the mid-twentieth century, the great Indian librarian, S.R. Ranganathan, promulgated his Five Laws of Librarianship, which were very much oriented to the library user:

1. Books are for use.
2. Every reader, his book.
3. Every book its reader.
4. Save the time of the reader.
5. The library is a growing organism.^[7]

However, for many decades that commitment remained largely on the plane of values and had little other than anecdotal data upon which to develop library services. In the 1930s, the Graduate Library School at the University of Chicago^[8] introduced the first doctoral degree in library science in the United States. Sophisticated social science

researchers, such as Douglas Waples and Bernard Berelson, brought their skills to the field. Waples^[9] did research on reader preferences, and Berelson, among other things, produced a compendium of results from dozens of studies on public library use.^[10,11]

The experiences associated with the operation of “Big Science” during World War II—major projects such as the development of the atom bomb—led government leaders to see the advantages in improving the distribution and transfer of information on new discoveries to other scientists and engineers. Major conferences on scientific information, in 1948 and 1959, led to a substantial amount of money being invested during the 1950s and 1960s in research on how scientists gathered and used information in their research work. Major example publications were the proceedings of the two science information conferences.^[12,13] The 21-report series “Project on Scientific Information Exchange in Psychology” from the American Psychological Association,^[14] and the work of Garvey et al. on several disciplines.^[15,16] Other influential early works include publications by Derek de Solla Price,^[17,18] Diana Crane,^[19] and A.J. Meadows.^[20] (Note: In order to keep this entry’s long bibliography from being even longer, referenced items are often only a sample of a person’s work, and when a series of articles comes out from a project, generally only the last article in the series is referenced.)

Early on, studies on information behavior were called “use studies,”^[21] studies of “information seeking and gathering,” or studies of “information needs and uses.”^[22] Gradually, the term “information-seeking research” was used to include all kinds of research on people’s interaction with information.

More recently, however, some researchers came to feel that “information seeking” suggested only explicit efforts to locate information and did not include the many other ways people and information interacted. In the 1990s, the term “information behavior” came into wide use to replace “information seeking.” The Old Guard objected that the phrase is a non sequitur—information does not “behave”—but, they lost out, and “information behavior” remains the most commonly used term today.

During the 1960s, in particular, generous funding was available in the United States for social science research, and a great deal of knowledge, based on large, well-designed studies, was developed regarding the social aspects of scientific communication and information use.^[23–25] Important studies were also produced on information use and library use by the general public.^[26–29] Focus in the larger society during the 1960s and 1970s on identity politics of race, gender, sexual orientation, and the economically underprivileged also led to research attention being directed to information seeking of the corresponding population groups.

In the late 1960s and early 1970s, this research began to be taught in library and information educational programs

in North America.^[30] As scientists had been studied according to their disciplines—physics, biology, etc.—and many members of the general public had been studied by their social identities—the poor, the elderly, etc.—there was a tendency to study information-related behavior by looking at groups of these sorts. For example, an invited conference on “information service needs of the nation” was funded by the U.S. National Commission on Libraries and Information Science in 1973. Presentations were structured in a parallel format to address the needs of a number of groups, including people working in science, agriculture, business, labor, biomedicine, the arts, social services, as well as children, the geographically remote, the economically and socially deprived, the institutionalized, and the mentally and physically handicapped, among others.^[31]

After the earlier attention to the natural sciences, during the 1970s research attention turned to information transfer in the social sciences. Grant funding in the United States receded, and pride of place went to Great Britain, where several researchers engaged in creative and revealing research on information seeking and use in the social sciences.^[32–34]

Finally, in the 1980s and 1990s the underfunded humanities at last got their due,^[35–38] particularly with the support of large institutions such as the J. Paul Getty Trust.^[39] In the 1990s, the needs of interdisciplinary and area studies researchers were addressed.^[40] See, especially, Carole Palmer, as Issue Editor, of an issue of *Library Trends* on interdisciplinary information seeking,^[41] as well as her subsequent book.^[42]

Over the decades, varying amounts of information behavior research has been done in various professional contexts as well, including the health sciences,^[43] law,^[44] and business.^[45] Among the professions, it is almost certainly the health sciences where the largest body of information behavior research has been done—probably due to abundant funding—while the education profession, despite the importance of information seeking for teachers, seems, mysteriously, to have drawn very little attention.^[46,47]

In the 2000s, Kari and Hartel made a persuasive case for studying the information behavior of people engaged in activities aimed at fulfillment and self-realization, and their own research provided examples of what could be learned along this line.^[48] Caidi, Allard, and Quirke review another recently growing area of research: immigrant information seeking and use.^[49]

The sweeping impact of use of the Internet and of mobile devices has increasingly dominated the working and living of all the groups reviewed earlier. Recent extensive studies include Antonijevic and Cahoy's on scholars' information practices,^[50] Mizrahi and Bates^[51] on the practices of undergraduate college students, and Beheshti and Large's book on current uses by children and teens.^[52]

Throughout the years, a number of models have been proposed to characterize various aspects of information behavior. Paisley beautifully characterized the subjective world of the scientist as constituting a series of contexts—local work environment, research specialty, discipline, larger cultural and political world, etc.^[24] In 1981, Tom Wilson described information seeking in general in a model^[53] that was subsequently very widely used and also reviewed a wide range of information behavior models in 1999.^[54] Belkin et al. propounded the concept of “anomalous state of knowledge,” or ASK,^[55] as characterizing many information needs. That is to say, they argued that the information need is often complex and requires an extensive description to cover all the factors really at play in people's requests. Kuhlthau's Information Search Process model, based on extensive research, demonstrated how intricately the conceptualization of a paper or project was bound up with confusions and problems in searching for information.^[56] Bates' “berrypicking,” that is, picking up a bit of knowledge here and a bit of knowledge there, was seen to be an appropriate description of much of human searching to meet information needs,^[57] in contrast to the previous generally assumed simple query that could be answered by a single retrieval from just one database.

Though extensive research on information seeking inside and outside of library and information science had been going on since the 1950s, it was an article by Dervin and Nilan in 1986,^[58] however, that seemed to provide the impetus for a great increase in interest in the subject in library and information science. The authors articulated the value of placing the user/searcher at the center of research, and paying close attention to the internal motivations and needs of the information seeker. From a minority interest of a relatively few people, information behavior research exploded in LIS after that article appeared, and doctoral students flocked to the subject area. For example, the number of articles dubbed “Use studies,” the standard term used in Wilson Web's article database *Library Literature and Information Full Text*, doubled per year in the 5 years between 1985 and 1990—from 76 to 155—while in the subsequent 18 years, the annual number has gone up by less than 60% to 245 in 2008 (author's database search). (Of course, these results could be artifacts of the publisher's indexing practices, and a fuller exploration would be needed to verify this conclusion.)

In particular, Dervin's conception of “sensemaking,” the effort of people to make sense of many aspects of their lives through information seeking and use, has been a dominating force in recent research on information behavior.^[59]

Dervin dismissed prior studies on grounds that “the studies assumed that the information brick was being thrown into the empty bucket”—that is, into the user of information.^[60] In one blow, this clever metaphor both characterized and caricatured much of the more classically empirical scientific approaches to research on information

behavior and gave qualitative research techniques and philosophies a boost. Dervin's "brick" image was unfair to the many researchers who did not take a simplistic view of information transfer, including many of the people mentioned in this article to this point.^[61] However, her emphasis on the importance of sense-making in motivating information seeking legitimated the subsequent emphasis on qualitative techniques in the field and enlarged the perspective of the whole subdiscipline of information behavior.

Indeed, over the years, increasing dissatisfaction was expressed by some researchers toward the prior orientation either to the individual seeking information or to studying the tendencies and preferences of large social groups, such as physicists or older people. These researchers sought to expand information behavior research, drawing on several theoretical paradigms of interest in the social sciences, such as social constructivism, social constructionism, and ethnographic techniques.^[62]

The surest sign of this broader interest came in the form of the "Information Seeking in Context (ISIC)" conference that came to be presented every other year, mostly in Europe, beginning in 1996.^[63] Conference attendees have sought to study information behavior in a way that goes beyond traditional research designs. They argue that context must be understood in a much fuller sense; they argue for rich, detailed, qualitative study of specific situations and contexts in order to understand the very nuanced ways in which people might receive and shape information.

They draw upon many different information-related theories and models,^[64] as well as on the many varieties of metatheoretical and philosophical perspectives that have become popular in the social sciences and humanities.^[65] See, as examples of these newer approaches, Ellis' grounded theory approach,^[66] Talja's discourse analysis of the culture of music in relation to libraries,^[67] Xu's application of activity theory to interactive information retrieval,^[68] Reddy and Jansen's ethnographic study of collaborative information behavior in healthcare,^[69] Limberg's^[70] and Ford's^[71,72] use of educational theory, and Srinivasan and Pyati's critical reexamination of information environments for diasporic groups.^[73]

At the same time, research drawing on other, more classically scientific and engineering methodologies did not disappear. See Fidel and Pejtersen's use of the Cognitive Work Analysis Framework,^[74,75] Sandstrom and Sandstrom's analysis of the methods of scientific anthropology as applied in library and information science,^[76] Nicholas et al.'s study of online information seeking through transaction log analysis,^[77] and even Bates' use of biological and evolutionary concepts in her recent work on information^[78] and browsing.^[79]

Perhaps the greatest sign of maturity of the field of information behavior research came with the publication—at last!—of the first book comprehensively addressing

information seeking, by Donald Case, in 2002, third edition in 2012.^[80]

The popularity of the ISIC conferences demonstrates the recent efflorescence of qualitative information behavior research beyond the borders of the (sometimes self-absorbed) research culture of the United States. Scholars from the United Kingdom (Tom Wilson, David Ellis, Nigel Ford, Elizabeth Davenport), Ireland (Crystal Fulton), Scandinavia (Louise Limberg, Olof Sundin, Annelise Mark Pejtersen), and Finland (Pertti Vakkari, Reijo Savolainen, Sanna Talja, Jannica Heinström) have presented and published at ISIC and elsewhere. Australian (Kirsty Williamson, Theresa Anderson) and Canadian researchers (Heidi Julien, Karen Fisher, Gloria Leckie, Lynne McKechnie, Pam McKenzie, Roma Harris, Chun Wei Choo) have also been very active in recent years.

Recently, Savolainen may have marked the beginning of a new phase in information research when he urged that the qualitative research on information behavior be called instead the study of "information practice."^[81] He argued that the concept of "information behavior" is primarily associated with the cognitive viewpoint, while "information practice is mainly inspired by the ideas of social constructivism."^[81]

The concepts of information behavior and information practice both seem to refer to the ways in which people "deal with information." The major difference is that within the discourse on information behavior, the 'dealing with information' is primarily seen to be triggered by needs and motives, while the discourse on information practice accentuates the continuity and habitualization of activities affected and shaped by social and cultural factors . . .^[82]

More recently, Huizing and Cavanagh have enlarged and systematized the theory and methodology of research on information practice.^[83] Their lucid exposition of this methodology is a good fit for the nature of information behavior study. They break down the traditional (and tired) contrast between the subjective and objective, they give physical objects the important role they should have in any theory of people and information, and they identify the dynamic nature of information seeking, without dissolving the study of it into confusing and nongeneralizable sets of very short-term and local acts. Huizing and Cavanagh's approach provides what is perhaps the best guiding philosophy at this time for further information behavior research.

In the last several years, there has also been a very active Special Interest Group on Information Behavior, founded by Barbara Wildemuth and Karen Fisher, among others, in the American Society for Information Science and Technology, which has held a number of preconferences and conference sessions, and offered awards for research in the area.

To follow the development of the research in this area, one can read the several chapters on the subject, starting with Menzel's in 1966^[22] and ending with Fisher and Julien's in 2009,^[84] which appeared periodically in the *Annual Review of Information Science and Technology*. (That review publication has now been subsumed within the *Journal of the Association for Information Science and Technology*.)

INFORMATION SEARCHING VERSUS INFORMATION SEEKING

This discussion addressed research on how people interact with information, how and when they seek information, and what uses they make of it. But it should be understood that throughout this period of time a parallel body of research and practical application was continuing that addressed the specifics of *the act of searching itself*. That is, in working with paper and online resources, many problems were encountered and skills needed to succeed in the specific acts associated with locating information in a paper or online resource. Bates' articles on information-searching tactics and search techniques^[85,86] promoted greater attention to the complexities of identifying sources and working one's way through resources to locate the desired information. A long line of research followed that addressed both search success and desirable design features in information systems to promote ease of use^[87-91] (See also ELIS entry "Information searching and search models."). Even browsing, normally seen as the most unstructured method of information searching, came in for considerable attention.^[79,92,93]

ROLE OF TECHNOLOGY IN INFORMATION BEHAVIOR RESEARCH

In order to simplify the narrative line, the aforementioned discussion made little mention of the role of technology in information seeking and research on information seeking. But, in fact, the extraordinary changes in information technology (IT) over the last 50–60 years have meant that a great deal of information behavior research has also been concerned with impacts of and reactions to the kinds of interactions people experience when using new technologies for finding and communicating information.

Focus on impacts of, and roles of, IT in information behavior has been intertwined to a greater and lesser extent with the information behavior research over these decades. Early studies took a fairly stable, largely paper-based environment for granted. Indeed, Garvey's research^[23] made salient, perhaps for the first time for many readers of his work, the huge, complex scientific publication cycle, from early tentative verbal presentation at talks all the way through conference presentations,

summary reports, journal publication, annual reviews, and, finally, incorporation of the scientific results into the established canon in textbooks.

But consciousness of the complexity of the production and publication of science was soon joined by efforts to improve, especially to speed up, the collection, storage, organization, and dissemination of that information.

Indeed, the entire discipline of information science has, in one sense, been the story of the successive absorption of a long series of IT innovations, followed, in each case, by research on the impacts of those innovations, and efforts to improve access to information through optimal design of those innovations. With the excitement generated by each new technology, the relatively stable underlying human behaviors and reactions were sometimes forgotten, and the new technology instead seen as the source of a totally new information-seeking landscape. One thing we now know, however, after a lot of research on those successive waves of new technology, is that underlying human propensities with regard to information emerge again and again as each new technology becomes familiar and its use second nature. Often, in the end, the new technologies offer speed and ease of use, while otherwise replicating previous social structures and interactions.

We know, for example, that people are willing to commit very little energy and effort to seeking information, in contrast, say, to seeking a fortune, a family, or a reputation. In fact, the truly explosive popularity of the World Wide Web as an information source may be due to the fact that the level of effort the searcher must engage in to find an answer to a question on the Web is at last so very little as to slip in under that minimal level of (least) effort that feels "natural" in information seeking. Most of the information that people eagerly seek online was once available in their local public or academic library, but the effort required to locate that information was seen as excessive in the vast majority of cases.

In the rest of this section, we will follow several IT innovations and consider their impact on information behavior research.

The first major technology in modern times to affect information seeking was the computer. Initially, its use for library information systems was limited—computers were used to capture machine-readable versions of library catalog records ("MARC" records), which, in turn, enabled the publication of computer-produced print-on-paper book catalogs. This was followed, in short succession, by so-called "COM cats," that is, computer output microfiche catalogs, which could update book catalogs between publications of paper editions.^[94]

It will be forgotten today that in the age of card catalogs, while in one library, one could not access the catalog of any other branch of the academic or public library, or of any other library, for that matter. In academic libraries, a comprehensive copy of all the materials on campus was generally available only in the main library.

Disseminating multiple copies of the full set of library records through book catalogs and COM cats in branch libraries was a significant, time-saving innovation.

These catalog innovations during the late 1960s and 1970s were followed by a true revolution in catalog accessibility—the online catalog, which was developed in the early 1980s. These constituted the first widely available end user information search systems, and much was learned about how untrained people did and did not succeed in this form of online searching.^[95,96]

For a variety of reasons, the card catalog structure could not be simply translated into online form. Questions of redesign of catalog access in the new context, and the development of new and faster system designs to improve access occupied many in LIS research over the next 10–15 years.^[97–99] (See also ELIS entry “Online catalog subject searching.”)

In the meantime, (at least) four other overlapping information-related revolutions were occupying the field as well. The first revolution occurred in the area of information retrieval, where various forms of automatic indexing and retrieval were experimented with over decades from the 1950s forward, gradually improving the speed and effectiveness of both retrieval and ranking algorithms.^[100,101] In the 1990s, search engines, such as Alta Vista and Google, drew upon these retrieval techniques to design their Web systems.

Second, in the early 1970s, online database searching was made practicable through searching against large databases on “dumb” (typewriter-like) terminals receiving and sending data over telephone wires. “Online searching” as then understood, and as then implemented by database vendors, was a complex skill that required considerable training to do well. Teaching these skills became an important part of LIS education and drew a lot of research interest as well. That type of searching required a mix of gifts that not everyone has, and numerous studies of online searching behavior resulted.^[88,102,103]

The third revolution was the development of the Internet and World Wide Web, which enabled access to information all over the world from anywhere in the world. We are still working through the many impacts and implications of this capability for all prior information technologies and sources of information.^[104–106]

The fourth revolution occurred with the widespread interest in creating digital libraries of all manner of textual and image material—and sometimes online portals to access those resources. The Digital Libraries Initiative in the 1990s marked the moment when, at last, truly substantial amounts of research money entered the information science field. Ann Bishop and colleagues addressed at book length the sociotechnical factors of digital library use.^[107] The new capability of storing and easily accessing previously unimaginably large bodies of information in digital libraries led to innovative experiments in the storage and use of primary resources materials.

Example studies are those of children using primary archival materials,^[108] uses of texts in the field of classics in a digital library,^[109] and use of a medical portal.^[110]

During the 1970s to the present, many studies of information behavior involved, to a greater or lesser extent, research on people’s use of and success with, these innovations in information access. On the whole, more behavioral research was done in the areas of online catalogs and online database searching than in information retrieval. For a long time, IR researchers were not particularly receptive to, or interested in, the human side of the equation, though in the 1990s they came to realize that people needed attention, too, in the overall effort to improve retrieval. See, for example, the contrasting emphases in the two entries in this encyclopedia by Salton (“SMART System: 1961–1976”) and Järvelin and Ingwersen (“User-oriented and cognitive models of information retrieval”).

With the development of frequent interaction with microcomputers in the early 1980s, the already-thriving field of human–computer interaction research (HCI) exploded and became a still larger field. HCI paid little attention to LIS research, however, and LIS paid little attention to HCI research, probably to the detriment of both fields. However, there may have been good reasons for this mutual indifference. The specific circumstances of needing and seeking information are not well understood, for the most part, outside of LIS, and required the focused attention of LIS researchers. At the same time, HCI researchers were working to discover general principles applicable to all online and computer access, and therefore tended to ignore the distinctive features of various “application” fields, including information seeking. (See ELIS article “Human–computer interaction for information retrieval.”) Perhaps the best blend of information science and HCI approaches to search user interfaces can be found in Hearst.^[111]

In this encyclopedia, Diane Nahl’s two articles on early and recent “User-centered design,” as well as articles by Elaine Toms (“User-centered design of information systems”) and Judith Weedman (“Design science in the information sciences”) address, in much greater detail, the efforts and results in this area at the intersection of information technology and the study of information behavior.

RANGE OF TOPICS OF INFORMATION BEHAVIOR RESEARCH

What have we learned over the years from the study of information-seeking behavior? This is a hard question to answer briefly, to put it mildly, but a description of the sequence of research topics of interest over the years may give a hint of the growing understanding over time of the human relationship with information. What follows is a mere sampling.

In the 1940s and 1950s, information seeking and gathering tended to be viewed implicitly as the study of the use of various forms of literature—books, journals, handbooks, etc.—and of various types of institutions and their services. How many books were circulated, how many reference questions were asked, how many people of what economic strata used the public library, and so on (see Berelson^[10]).

In the 1960s and beyond, studies of information seeking and use by the general public opened out the research to incorporate many sources of information, of which the library was only one.^[27,112] The first surprise was to discover how much information—in both personal and professional contexts—people got from friends and colleagues. In a study looking at how scientists' learned of things serendipitously, Menzel found that fellow scientists were immensely important in that process.^[113] In fact, in a large number of studies, the human preference to get information from other people was soundly demonstrated.

From early on, the dominance of the “principle of least effort” in human information seeking was demonstrated over and over.^[25] It may not seem surprising that people try to minimize effort in finding information, but the research demonstrated that ease of access and ease of use mattered more to people than the quality of the information they found. People have a (sometimes unjustified) belief in their ability to filter the good and valid information from the faulty, hence their tendency to undersearch to find the highest quality information available.

Further, information seeking is often quite unself-conscious. People are trying to solve problems in their lives, not “seek information.” Activities that involve information seeking are seldom differentiated from the other actions taken to solve problems. Good research design for the study of information seeking *must* recognize this reality; asking people what they have done lately in the way of information seeking is therefore not the way to get data with high internal validity, as a rule. Dervin has made this point repeatedly and insightfully. For a prime example of her research technique, see Dervin.^[114]

Thus, as a rule, people—even including Ph.D. scholars—develop what search skills they have incidentally to their primary efforts at research or problem-solving and often fail to develop a conscious repertoire of search skills and techniques to help them over difficult stages. Particularly among college students, discomfort regarding library research has been found to be severe enough to merit the term “library anxiety,” and a number of studies have been done on this topic (see ELIS entry “Library anxiety”). Along with the evidence of student difficulties with libraries, a large literature has developed on the goals and techniques of teaching “information literacy,” that is, the capability of finding and effectively evaluating desired information (see ELIS entries “Information literacy” and “Information literacy instruction”). In sum,

people often vastly underutilize available resources and are often quite inefficient in finding what they do find.

In the study of various academic disciplines, the close attention in the 1960s to the rich complexity of the culture of science enabled a subtler analysis of the information seeking in all the academic disciplines studied from the 1970s to the present time. See, for example, Patrick Wilson on the concept of “cognitive authority,”^[115] Julie Hurd on implications of information use patterns for library design,^[116] Paisley on “information and work,”^[117] Robert Taylor on “information use environments,”^[118] Cronin on invisible colleges (i.e., informal groups of researchers with shared interests),^[119] the model by Leckie et al. of information seeking in the professions,^[120] and Budd^[121] and Bates^[122] comparing the cultures of science and humanities. In the understudied area of archival resources, Barbara Orbach^[123] and Wendy Duff and Catherine Johnson^[124] have provided insightful descriptions of the use of historical archival materials.

During the 1980s and 1990s, several researchers deepened the understanding of various aspects of information behavior by exploring questions and areas previously not as well understood. Elfreda Chatman looked at the information environments of janitors, women in a retirement home, and prisoners.^[125–127] Cheryl Metoyer-Duran applied the concept of gatekeeping to five minority groups in Southern California and developed sophisticated (and sometimes counterintuitive) understandings about information flow within minority communities, and between them and the larger society.^[128] The challenge of studying unconventional groups and domains even extended to abused women^[129] and abused children.^[130]

Carol Kuhlthau is another researcher who has had very wide influence in the information behavior world. She developed a model of student information seeking, which she refined over several studies that are themselves models of the art of research. Her model runs counter to many assumptions in both education and library and information science about how people tackle researching a paper or project, and how that experience can be substantially improved over past approaches.^[131] Specifically, she discovered that the combined process of researching and writing a paper is complex and difficult for most people—indeed, the library research is inextricably bound with the understanding and gradual formulation of the thesis of the paper. Consequently, the simple idea of “picking a topic,” like picking an apple off a tree, then going to research it in the library, is not how the process reasonably can or should be expected to proceed. Yet generations of teachers and professors have left students floundering and frustrated as they moved, essentially without guidance, through this core process in paper-writing.

David Ellis' empirically based model of common actions associated with scholarly information seeking^[132] has also been influential, spurring several follow-on studies to test for similar activities in the work of people in

other circumstances. And, of course, Brenda Dervin's concept of "sensemaking" as a motivation for information seeking constituted the underlying model for much information behavior research.^[60]

In the 1990s and 2000s, along with the growth of the ISIC community, researchers expanded their look at information behavior by incorporating the whole environment—physical, social, and technological—in the study of people's interactions with information. Social context and social situation were recognized as essential to the understanding of information seeking.^[133,134] Karen Fisher (nee Pettigrew) developed the concept of "information grounds"—the joint creation of social environments by people in which to share conversation and information.^[135] Disciplinary examples of these rich analyses include science^[42] and business.^[136] As noted earlier, the study of "information practice," as a shaping paradigm for information behavior research, has emerged strongly in the twenty-first century.^[83]

Several recent studies have demonstrated particularly creative approaches to the study of children's information seeking, traditionally an underpopulated area of research. Virginia Walter demonstrated that children's information needs were immense and were in no way limited to requests made of school librarians!^[137] Joanne Silverstein studied unconventional forms of information use,^[138] and Ciaran Trace studied informal information creation and use by children.^[139] Research on the "information behavior of a new generation" is discussed in the recent book edited by Beheshti and Large.^[52]

During recent decades, a more sophisticated understanding has also developed of information genres and the ways they are shaped by practice. In a particularly elegant study, Kling and McKim showed how preexisting social information practices shaped the design of post-Web online information support in three scientific disciplines.^[140] Peiling Wang studied at the micro level how scientists actually make use of and subsequently cite other literature in the course of their research.^[141] Ann Bishop^[142] and Lisa Covi^[143] studied closely the interactions between people and the structure and genres of information.

CONCLUSIONS

Information behavior research has grown immensely from its scattered beginnings earlier in the twentieth century. We now have a much deeper and less simplistic understanding of how people interact with information. We understand information behavior better within social contexts and as integrated with cultural practices and values. The further complexity of information seeking through the use of various technologies and genres is coming to be better understood, though there is much more to be studied. In fact, even as I write, some six billion people are interacting with information

worldwide, drawing on cognitive and evolutionarily shaped behaviors, on social shaping and environmental expectations, and interacting with every information technology from the book to the wireless handheld "smartphone." There is unimaginably much more to learn about information behavior.

The state of our current understandings on these topics is reviewed in over 30 articles in this encyclopedia. See, especially, the section titled "People using cultural resources" in the topical contents list of the encyclopedia.

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Information Behavior Models

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Abstract

This entry outlines the development of models of information behavior. The concept of a *model* is defined and the different types of model are identified. Models of information behavior are presented within a typology of descriptive model, decision-based models, and causal models. It is suggested that, in research terms, a movement from descriptive models to causal models is needed if theory development is to take place in the field.

INTRODUCTION

Information behavior has been defined as

... the totality of human behavior in relation to sources and channels of information, including both active and passive information seeking, and information use. Thus, it includes face-to-face communication with others, as well as the passive reception of information as in, for example, watching TV advertisements, without any intention to act on the information given.^[1]

In addition to the specific aspects mentioned in that definition, we can add that the determination of information needs (or “information requirements” in information systems development) is part of information behavior research, as is the human interaction aspect of information retrieval (excluding, that is, the algorithmic work in the IR field), as exemplified by Ingwersen’s work referred to below.

The history of information behavior research has shown a move from the study of the information resources used by people, in an attempt by researchers to identify “information needs”, to the investigation of actual behavior in relation to information sources and systems. However, the situation is complicated by disciplinary and methodological divisions within the information disciplines, such that work in the information systems area is rarely put together with work in information science and, within information science, the human interaction aspects of information retrieval are rarely considered together with other aspects of information access and sharing. Much work in information retrieval also has a laboratory experiment basis, while information behavior research (at least over the last several decades) has been mainly qualitative in character, with the result that the two groups of researchers rarely interact.

To a degree, the interest in modeling information behavior arises out of a concern that these differences should at least be identified and recognized, in the hope that, as a result, gaps in research will be revealed and, perhaps through cross-disciplinary collaboration, explored.

MODELS

Definitions of models are numerous and include not only the *conceptual models*^[2] with which we are concerned here, but also physical models (such as those employed in architecture) and human models—the “model user” or “the model librarian.” All models, of whatever kind, are attempts at the representation, characterization, or exemplification of some aspect of reality or of human behavior. Models may be graphic, mathematical, or simply textual: we can describe a model in words, setting out, for example, a set of theoretical propositions. In this light, stating a set of hypotheses about a subject of investigation is to express a model of anticipated relationships among variables. We can also express those relationships in graphic form and, very often, in quantitative research the results of hypothesis testing are modeled graphically. Finally, we can express the same relationships mathematically, indicating the strength of relationships and again, a graphic model of the results of hypothesis testing may also show the strength of relationships. Mathematical models for weather forecasting, for example, will employ huge amounts of data in complex equations of relationships among many variables, but some mathematical models are quite simple in construction: $E = MC^2$ is a simple equation, modeling the relationship between energy, mass, and the speed of light, with enormous implications.

There are also pseudo-mathematical models (i.e., those for which units of measurement are lacking), which attempt to say something about relationships in information science, the most cited of which is that by Brookes,^[3] $K(S) + I = K(S + \Delta I)$. This is simply a more concise way of saying that a new “knowledge state” $K(S + \Delta I)$ is brought about by the addition of information (I) to the existing knowledge state ($K(S)$).

The use of models of these different kinds is as old as scientific endeavor: indeed, geometry itself can be seen as a system for modeling spatial relationships. In astronomy, certainly from the time of Kepler and Copernicus, models

of the planetary system, and their representation, subsequently, in the physical model of the orrery, have been commonly used. The same applies in the social sciences, particularly since the introduction of system approaches to social phenomena and, from the social sciences, models, particularly graphical models, have found their way into information science. Case's^[4] treatment of models constitutes a valuable supplement to the ideas presented here.

MODELS IN INFORMATION BEHAVIOR RESEARCH

In information behavior research, the word *model* is generally used to describe graphical models: diagrams that express actual or theoretical relationships, or ideal processes of interaction with information. The common elements of such models are the information user and his or her environment or context, the information resources available to the user and the "tools" available (which may include various levels of technology, or, for example, a human intermediary). Inevitably, therefore, because they all attempt to portray the same phenomena, the various models are very similar and, to a large extent, map on to one another.

It is noted above that models probably found their way into information science from the social sciences, and this may well be the case for the behavioral aspects of the subject. However, in other fields, such as bibliometrics and information retrieval, mathematical and pseudo-mathematical models have also been used.

We find three kinds of models in information behavior research: the first is the purely descriptive, which sets out the connections between user, tool, and information

resource, showing the general communication flows among these elements. Wilson^[5] set out a very generic model of this kind (Fig. 1), which, in spite of changes in the technology between 1981 and the present, can still be used to outline the connections.

This kind of model simply maps out the actions that an information user may engage in to obtain or exchange information, as indicated by the lettered lines: thus, one strategy is indicated by lines f, g, j—an information user seeks the help of an information intermediary, who uses the available technology to access structured information resources. Clearly, in this kind of diagram not all of the lines of communication can be shown without making the diagram virtually unreadable: thus, in this diagram no feedback lines are shown, which would indicate, for example, what happens when information is found or fails to be found.

The model suggests that information seeking can be seen as the interaction of three "systems": the user in his or her life-world and in particular groups in that life-world, with the "reference group" shown to illustrate this notion; the information systems that mediate access to information resources (either used directly by a person or by an intermediary acting on behalf of that person); and the system of information resources, accessed through the information system or directly, for example, in the case of the person browsing library shelves. The whole is shown to exist in a "universe of knowledge," implying that the individual may access other information resources, which are not organized, such as using direct observation of phenomena, or talking to other people. There is no suggestion in Fig. 1 of any limitation of the model to work life or ordinary life, it is sufficiently general to cover both: Savolainen's^[6] model of everyday life information

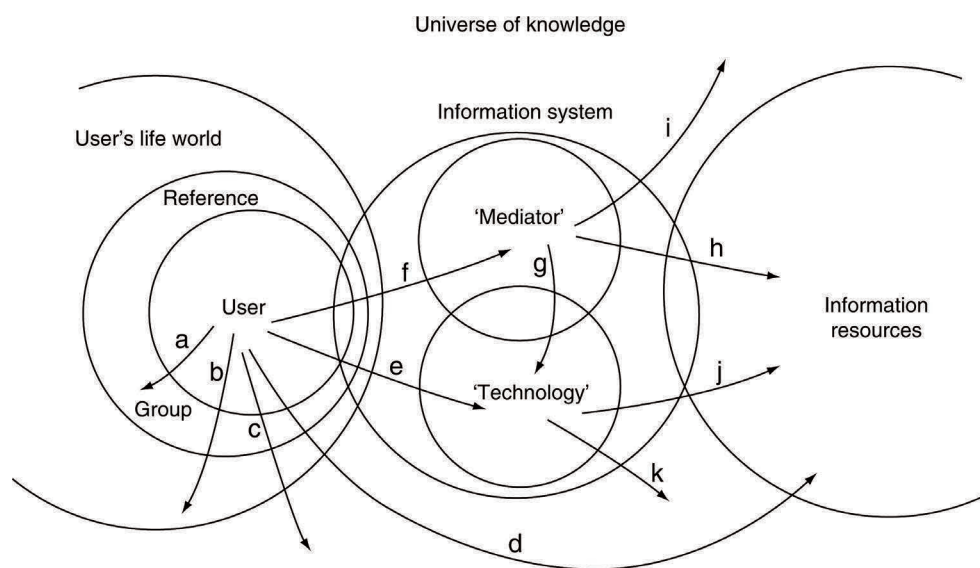


Fig. 1 Information seeking—a generic model.

Source: From Wilson.^[5]

seeking elaborates the left-most set of “nested” circles in that particular context, drawing upon sociological theory in a more explicit manner.

We might label models of the kind shown in Fig. 1 as models of “what can be done” in seeking information. Such models are not generally theoretical in character, although theory may inform their construction; thus, reference group theory^[7] clearly informs the model and the use of the term “life-world” suggests a phenomenological orientation, since this is a term derived from that field.

The second type can be characterized as models of “what happens.” Such models, of which Fig. 2 is an example, have more the character of decision diagrams, showing alternative courses of action and, in some cases “if A then B” situations.

This kind of model makes some things more obvious than models of the kind shown in Fig. 1: it brings in the notion of success or failure to find information, identifies “information sources” as formal or informal (“information systems” and “other information sources”); it brings in “information” use and the idea that use may or may not lead to the satisfaction of the initial “information need.” Again, theory is not explicit in the model, but “social exchange theory”^[8] has influenced the model in the notion of “information exchange” to show “other people” as sources of information.

Clearly, more lines and more detail could be provided in this model; for example, by showing that a need for information does not always lead to information-seeking behavior, or that a failure to find information does not necessarily lead to a further round of information seeking. However, more boxes and more lines may only serve to confuse and one of the advantages of simple graphical models is that they are easy to understand and the lack of

detail allows the reader to think further about what appears to be missing and what further relationships might be embodied in the diagram.

The point that all models of this kind map on to one another can be illustrated by reference to the model by Krikelas,^[9] which has similarities to Fig. 2. However, Krikelas introduces the notion of ‘deferred need’ and specifies ‘memory’, ‘personal files’ and ‘direct observation’ as ways of acquiring information that would be subsumed under ‘demands on other information sources’ in Fig. 2.

Models with a rather similar intent include those of Leckie et al.^[10] and Byström and Järvelin.^[11]

Models of the second type are concerned with the individual information-seeking process and probably the best known of these is that proposed by Kuhlthau,^[12] which is not usually expressed graphically. However, Kuhlthau does provide a graphic model which associates the stage process of information searching, the feelings experienced by the information seeker, the cognitive dimension and the actions taken (Fig. 3).

An important aspect of Kuhlthau’s model is that it is based on theory: thus, the stage process is derived from theories of the construction of learning by Dewey, Bruner and Kelly [12, Ch. 2]. This recognition of the role of theory distinguishes models of this kind from the first type.

Wilson’s^[13] “problem solving” model is, similarly, a stage process model: however, it is based not on stages of the search process but on the stages in coping with a problem. Thus, it hypothesizes a four-stage model, problem recognition, problem definition, problem resolution and solution statement, and associates the need to seek information with these stages (Fig. 4).

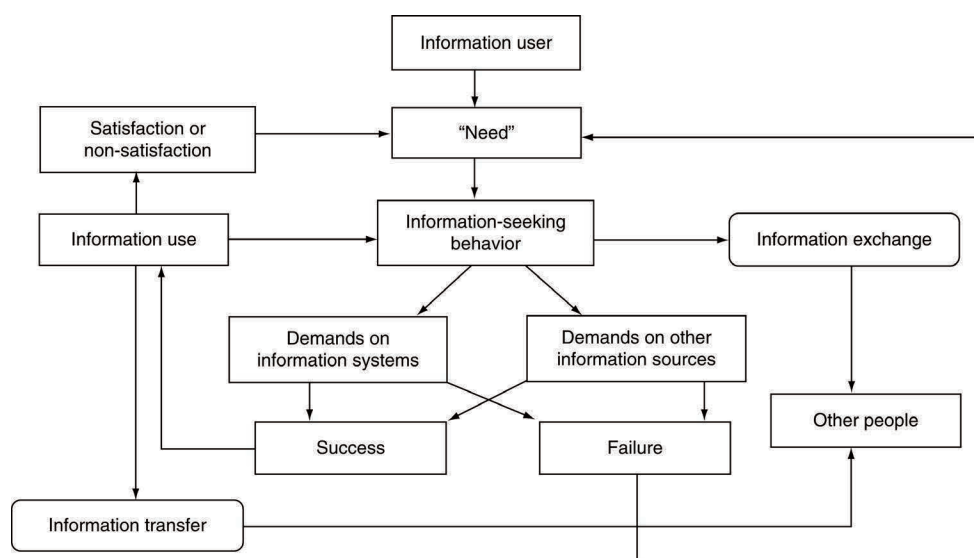


Fig. 2 A model of information behavior.

Source: From Wilson.^[5]

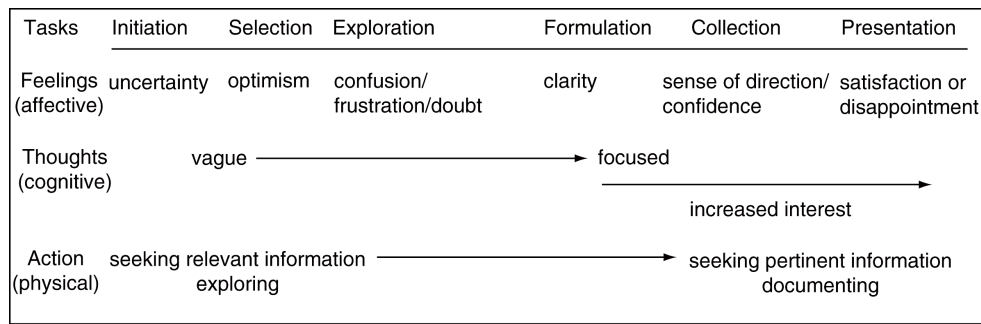


Fig. 3 Kuhlthau's model of the information search process.

Source: From Kuhlthau.^[12]

Rather being derived from theory, this model states a theory: that in the course of solving a problem and delivering the solution, the individual's state of uncertainty on how to proceed is resolved by information seeking. It is a modest theoretical statement but, like Kuhlthau's model, serves to associate information-seeking behavior with a more general phenomenon. The information-seeking element is not specifically shown in Fig. 5, but the paper notes that uncertainty is resolved through information seeking and use and the figure could be modified to show this.

A third example of models of this kind is Ingwersen's^[14] (Fig. 5) which draws upon cognitive psychology and the idea of mental models as a way of indicating the cognitive processes involved in information searching.

Within this category of models, a slightly different perspective is offered in Wilson's model of 1996 (Fig. 6), which is based on his earlier models: the top level of this model is a simplified version of one of the 1981 models, which is then expanded to indicate the demographic and other variables that influence information seeking, the different modes of information-seeking behavior and theories that may be of explanatory value.

Thus, "stress/coping theory" from the health field^[16] is suggested as possibly explaining why some people seek information in response to a problem situation while others do not. For some, the stress created by the "need to know" is not strong enough to overcome the barriers (represented here as "intervening variables") that must be overcome, actually to engage in information seeking.

Choo^[17] has produced a model of this kind which seeks to integrate a number of ideas from research on information behavior. Fig. 7 presents three connected triangles:

the top triangle shows the circumstances of information need, while the bottom two triangles show, respectively, purposive information seeking and information use. Choo notes the complexity of the situation regarding information use, commenting:

How this information is processed and put to use depends on the cognitive style and preferences of the individual, the emotional responses that accompany information processing, and the organizational or social context surrounding information use.

He goes on to use the model to illustrate organizational information use, and its shortcomings, in the *Challenger* and *Columbia* space exploration accidents, showing how gaps in understanding and false shared beliefs contributed to the tragedies.

Finally, there are a limited number of causal models, that is, models that seek to demonstrate not only the processes of information seeking or the relationships of this behavior to other phenomena, but that attempt to show causal relationships. A very generic model of this kind is that of Johnson,^[18] which suggests causal relationships in cancer-related information seeking (Fig. 8).

Johnson's model appears to say that demographic characteristics (such as age, sex, and ethnicity) and direct experience of the phenomenon about which information is sought, together with the perceived importance of the search problem and the individual's beliefs about the problem determine the utility of the information "carrier" (source would be a more common term in information science) and these "utilities" together with specific

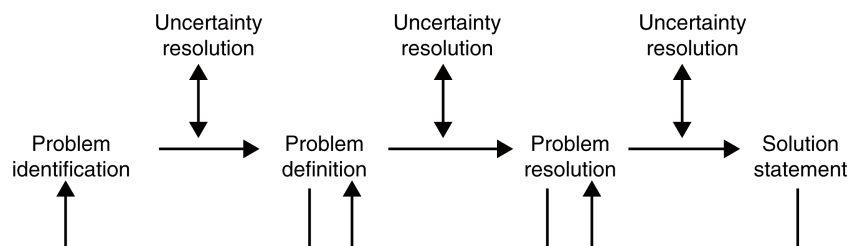


Fig. 4 The problem-solving model.

Source: From Wilson.^[13]

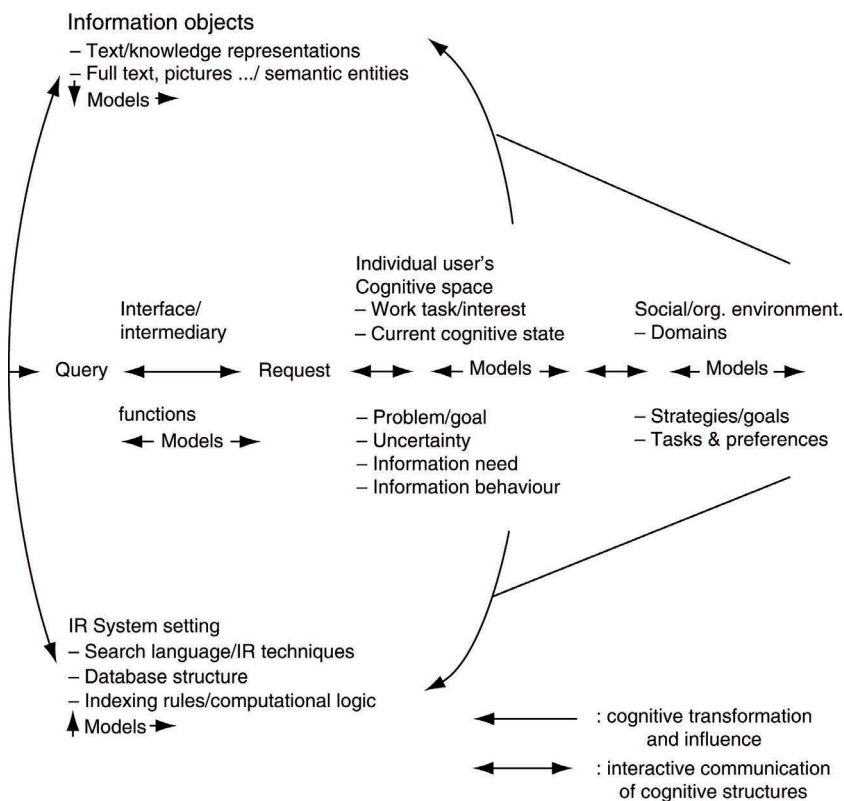


Fig. 5 Ingwersen's cognitive model.
Source: From Ingwersen.^[14]

characteristics of the source determine the information-seeking actions the individual will carry out.

It can be seen that Johnson's model is much more concerned with the motivations for information seeking (the background factors and the personal relevance factors) than with the specific operations of information

seeking, whereas the models proposed by Krikelas and Wilson are more concerned with the latter.

Finally, in this section, Höglund et al.^[19] proposed a theoretical, causal model of the relationship between information and trust in health care. The model was derived from previous research on health information and

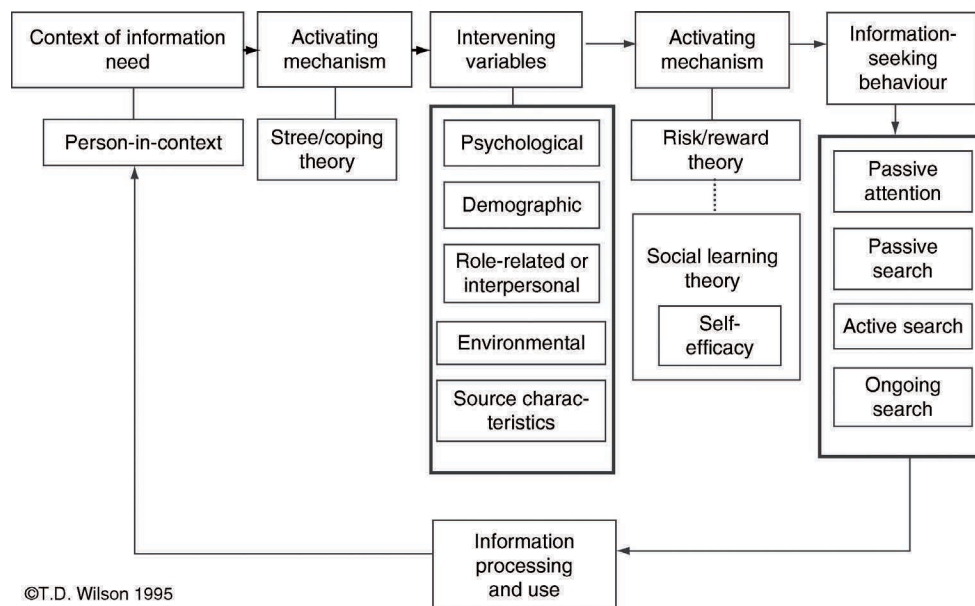


Fig. 6 Wilson's expanded model.
Source: From Wilson and Walsh.^[15]

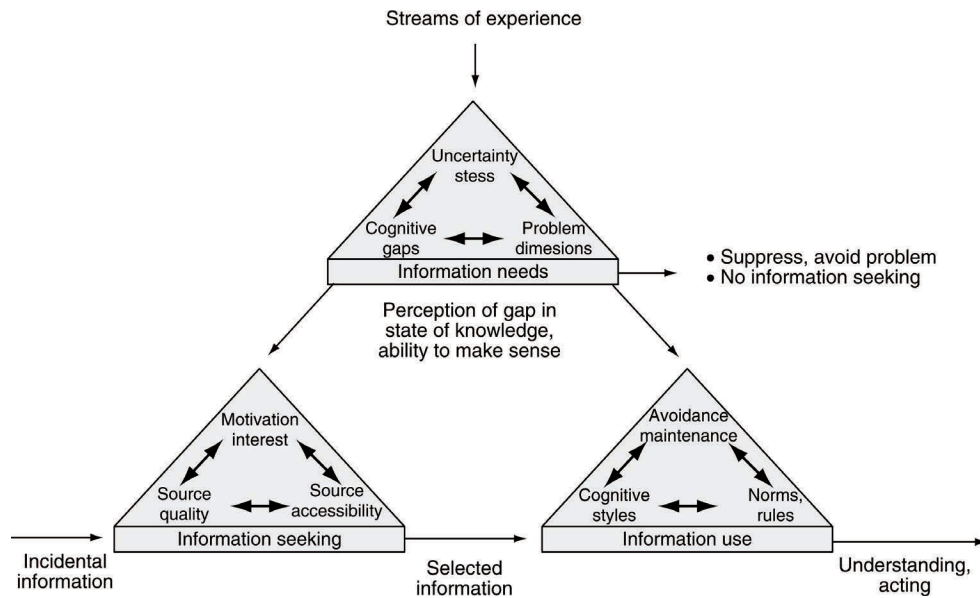


Fig. 7 Choo's model of information needs, seeking and use.

Source: From Choo.^[17]

on trust in health care and the test of the model was carried out on a large database of responses to a Swedish national survey (Riks-SOM). The model (Fig. 9) links health status, contact with health institutions, library use, Internet use, and trust in health institutions, variables that were explored in the survey. The study is an example of how large data sets can be used for secondary analysis.

There appears to have been a loss of interest in the idea of modeling information behavior between the early models of the 1980s and those from the mid-1990s onwards. Certainly, since the publication of Wilson's review in 1999, interest has revived and the development, modification, and testing of models has become a significant area of research in the field.

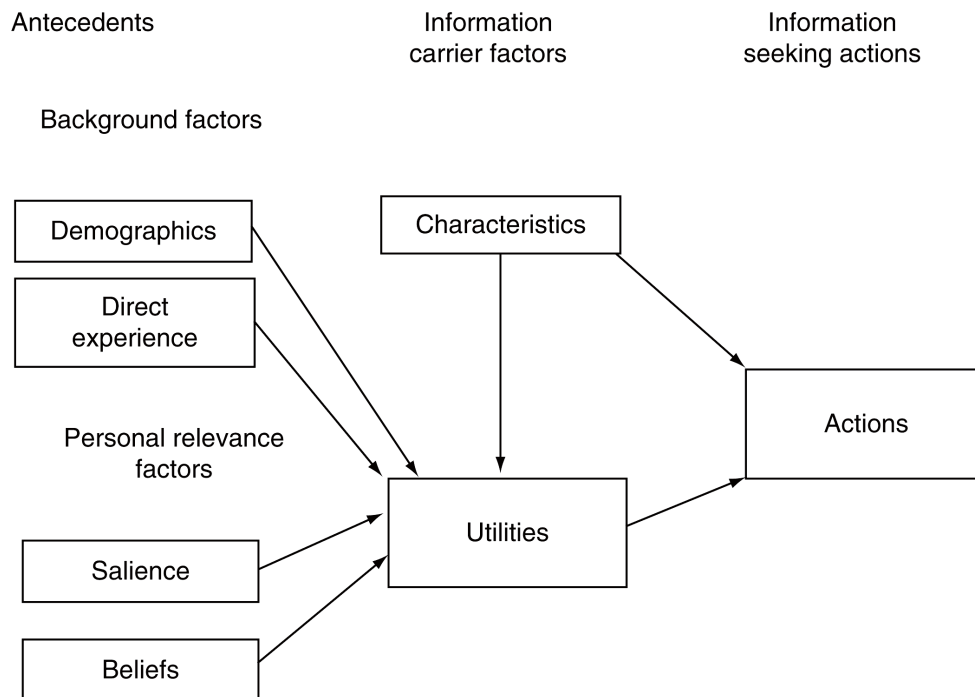


Fig. 8 Johnson's information-seeking model.

Source: Redrawn from Johnson.^[18]

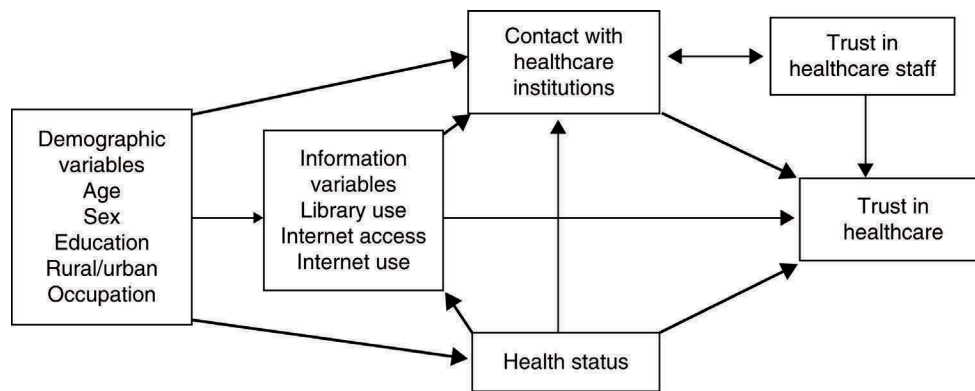


Fig. 9 A model of trust in health care.

Source: From Höglund et al.^[19]

For example, Godbold^[20] has evolved a model which seeks to marry Wilson's models with Dervin's^[21] concept of "sense making." Godbold proposes that information seeking can be seen as a multidirectional activity, rather than a mono-directional activity, and this also appears to be the thrust of Foster's^[22] "nonlinear" model. Ingwersen and Järvelin^[23] have also developed a general model of the information-seeking process within an overall cognitive framework. This appears to be a generalization of

Ingwersen's earlier cognitive model (discussed above), with the organizational, social, and cultural context given greater prominence. The international interest in modeling is shown not only by those mentioned earlier in this paragraph (which come from Australia, the U.K., Finland, and Denmark) but also by Niedzwiedzka's^[24] "proposed general model of information behavior" from Poland. Like Godbold, Niedzwiedzka begins with Wilson's 1996 model and expands it in an attempt to incorporate aspects of

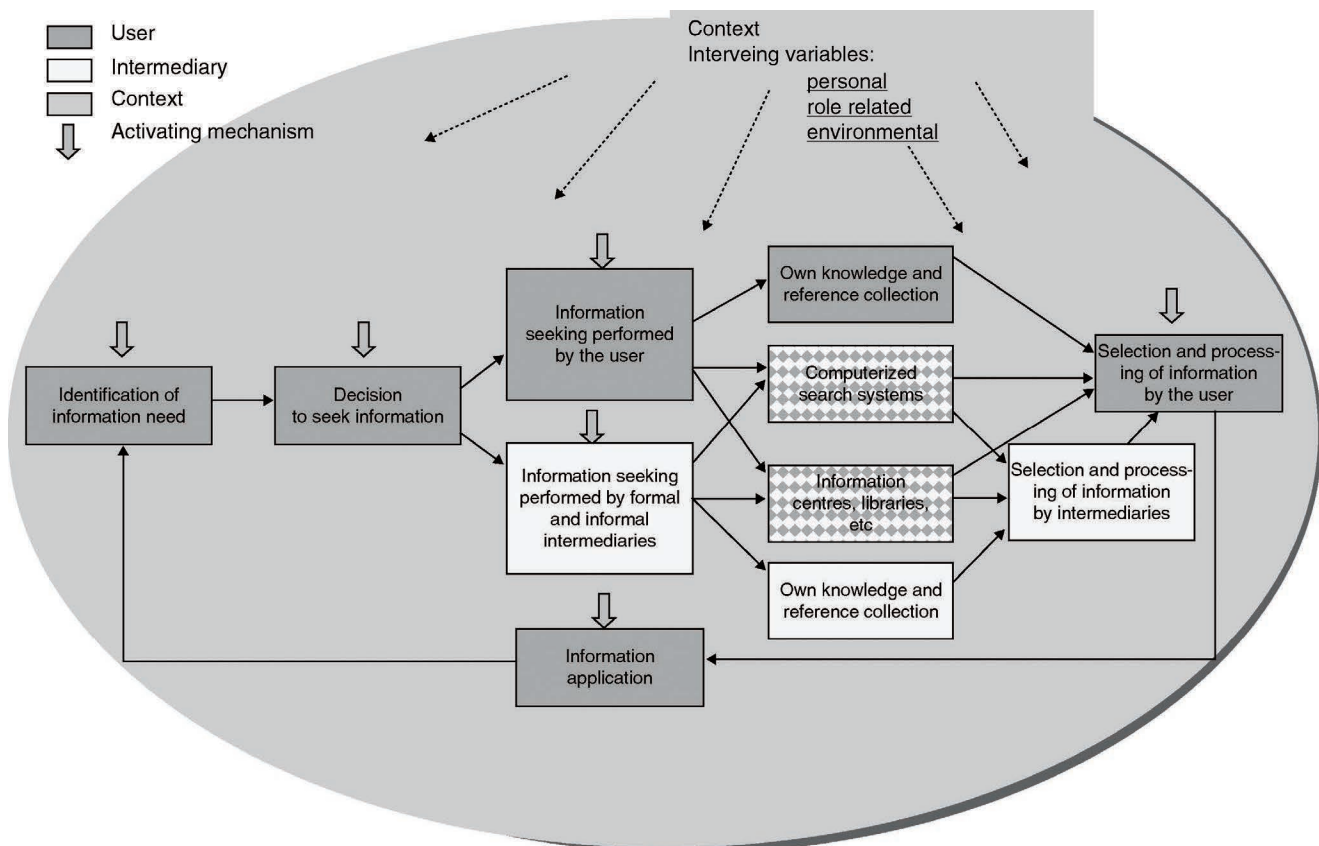


Fig. 10 Niedzwiedzka's general model of information behavior.

Source: From Ingwersen and Järvelin.^[23]

information behavior other than information seeking. The result is a kind of combination of Figs. 1 and 2 in this entry (Fig. 10).

CONCLUSION

The three types of models discussed above demonstrate a movement from models of activity, which are generally descriptive, through those that link information seeking to other aspects of behavior or to characteristics of the information user and/or information sources, to those that embody hypotheses about relationships. From the point of view of the genuine development of research in the field, it is desirable, even necessary, that this movement should take place. One can only go so far in refining descriptive models and even those that embody theory can only progress if the underlying theories are tested, and it is the function of the third type of model to graphically illustrate the postulated theoretical relationships. It is hoped that the sustained level of interest in research into information-seeking behavior will now move away from the refinement of descriptive models and on to the development and testing of theory.

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Information Crises and Crisis Information

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Abstract

Information crises are failures of sense-making in organizations, i.e., failures to attribute a meaning and interpretation that can lead to a corrective action. Challenging the hierarchy of data, information, and knowledge, this entry argues that information crises cannot be resolved through normalization and normative prescriptions, but rather by the reinstallation of behavioral-involvement mechanisms, that have been lost in electronic mass-intermediation of postindustrial organizations.

Postmodern societies are highly dependent upon various forms of information, because most of their technical, societal, social, and economic subsystems are consuming as much information that they produce. The rise of machine intermediation has contributed to a lag in the speed and accuracy of human sense-making. By 1999, most experts agreed that machine-to-machine communications could not represent more than half of world traffic before the 2020s. This figure was reached in 2008. Information mostly circulates from machines to machines, from onboard plane maintenance systems to computers on the ground, from an Internet server to a home desktop, from a financial transactions platform to a trader's desk.^[1]

One consequence of such an acceleration of information diffusion lies in its autonomous development. Society and local societal organizations rarely possess the mechanisms to influence, forbid, or shape its diffusion. In archaic, and then modern societies, access to information was conditioned, with conditions being the societal strata of groups and communities. But now information is fairly accessible to everyone. The rise of electronic communications, and in particular of the Internet in the late 1990s, has reduced the distance and privileges in accessing, producing, discussing, or emitting information. Machines handle half of the world's communication traffic, and the other half, although not fully automated, has reached an unprecedented level of reliability, not from a sense-making perspective, but from a transmission point of view. The latter half suffers none or few denials of access. While this status has produced tremendous learning opportunities for populations deprived of educational infrastructures, it has also produced on one hand, informational crises, and on the other hand, crisis information management issues.

Informational crises are situations where the opinion-makers, the stakeholders, the potential victims, the organizations, and the policymakers find themselves fully or partially incapable to give sense to critical problems. Plato, in his *Theory of forms*, already addressed what would otherwise seem a contemporary issue. For Plato,

universal nature (*phusis*, φύσις) is embodied into recognizable forms or bodies (*sōmata*, σώματα), which are merely mimetic of their real existence. In other words, information would only be a somatic expression of the likeliness (*mimēmata*) of a real existence. Modern assumptions on the definition of information follow Plato's intuition: Information is seen as a state of a system that becomes formalized through sense-making, i.e., attributing a message to a given information. Informational crises, in a Plato perspective, would hence be situations where somatic expressions of an event overwhelmed sense-making, either because a recognizable pattern or form cannot be attributed, or because any reliable meaning can be attributed to each individual mirror that compose the information source.

While Plato was trying to understand how mankind accesses nature, modern informational crises have penetrated most societal arenas, from healthcare, politics, and economics to the conduct of business and welfare. Stock markets are dependent upon a mass of information that clearly surpasses the human limitations of sense-making, with or without the support of modern information technologies. Military operations are intertwined with a global information infrastructure that leaves no place hidden from public scrutiny, no rationale unquestioned, and no legitimacy freed of questioning. Dissymmetry of the weak defending against the incumbent makes an intensive use of deliberate information crises, aimed at challenging the rationale, the legitimacy, and the morale of its offensives. One defensive mechanism, not unknown to nature and biological systems, is to develop forms, or information strategies, that defy the larger opponent's sense-making, and hence creates a somatic state within its ranks. Such deliberate informational crises are called "asymmetric campaigning."^[2] As organizations are more and more dependent on information for the continuity and stability of their operations, they also become more vulnerable to information crises, either genuine, or deliberate for the purpose of their destabilization.

Information crises, and crisis information are, therefore, very close concepts. While crisis information represents the attempt to make sense of a crisis with the purpose of solving it, information crisis represents the state in which organizations are prone to engage in crisis information. One immediate issue relates to sense-making. Attributing sense, i.e., producing a message derived from information, relies on a continuous and ongoing retrospective analysis of plausible forms that attempts to rationalize events and people's actions (p. 409).^[3] The first obvious assumption is that to make sense, people or organizations must first notice the concerned events. What people notice or do not notice is not, however, a matter of access, presence, or availability of data and information. Information becomes accessible when one is able or capable of understanding its meaning. When we fail to notice, we might simply fail to understand. Stimuli often do not escape our attention, they escape our sense-making. As R.D. Laing puts it: "The range of what we think and do is limited by what *we fail to notice*. And because we fail to notice that we fail to notice, there is little we can do to change, until we notice, how failing to notice shapes our thoughts and deeds" (quoted by Goleman (p. 24)).^[4] An informational crisis is often a sense-making crisis, rather than being a problem of availability or quality of the information at hand.

THE MECHANISMS OF INFORMATION CRISES

Information crises grow on the grounds of uncertainty, independently of the nature, the depth, and the reliability of the information at hand. Both the Columbia and the Challenger space shuttle accidents created long and painful information crises, despite dealing with some of the most documented industrial and engineering processes on earth. In contrast, the impossibility to give sense to an event can occur with a very little, ill-mastered information. The development of viruses such as H5N1 or SARS is exemplary: the lack of information about viral behavior creates the information crisis. Hence, many information crises are triggered by a failure to conduct a reductive analysis, either by too numerous interpretations being available and creating causal ambiguity, or by the impossibility of reducing reality and making it stay real (p. 327).^[5]

The first conundrum of such a principle lies in knowledge ontology. R.D. Laing's philosophical pun says that knowledge turns in circles, for its substance can only be accessed through teleological means. Data can produce information with a mindful purpose. And knowledge can be derived from information, assuming that the sense that we gave to the data and information has not been filtered by our perceptual biases. But previous knowledge is what biases our perception and the way we select information in the first place. Hence, information crises encompass both the previous learning and knowledge of concerned individuals, as well as disconcerting new information. Crises

arise when individuals are no longer capable of "labeling and categorizing to stabilize the streaming of experience" (p. 411).^[3] This situation can either arise from events that an individual has never experienced before, thus depriving them of labels and categories of reference, or from new stimuli coming through familiar channels, but that do not match the existing labels and categories.

The central mechanism of an information crisis is therefore one of imperfect, incomplete, and/or unreliable interpretation. The lack of reliable interpretation has three main sources. First, individuals themselves tend to distort their perception, more or less purposefully. Following Plato, if we accept the idea that information precedes a somatic expression of reality, then traumas, guilt, fears, and pain can lead an individual to see what he or she wants to see, instead of what is presented.^[4]

Second, organizations replicate, duplicate, and distort individual distortions, for they reflect collectively the more or less somatic reading of information conducted by individuals. "Those interpretations are generated within the organization in the face of considerable perceptual ambiguity" (p. 19).^[6] As Starbuck puts it (p. 91):^[7]

Most of the time, organizations generate actions unreflectively and non adaptively. To justify their actions, organizations create problems, successes, threats, and opportunities. These are ideological molecules that mix values, goals, expectations, perceptions, theories, plans, and symbols. The molecules form while people are result watching, guided by the beliefs that they should judge results good or bad, look for the causes of results, and propose needs for action.

Far from being a distinctive reality on which action is acted, information is an integral part of generated action. Information may be generated ahead of time to justify an intended action, and vice versa, information is often generated ex-post to justify a non-intended action. Of course, this production of information does not flow in two separate categories, so people in organizations cannot really tell if information has preceded or followed an ongoing action.^[3]

Third, information itself can be destructive. Destructive information can be defined as a set of messages, signals, and stimuli that mislead cognitive and behavioral routines of an organization, and lead an organization or an individual to generate confusion. It also threatens the reliable pursuit of the organization's goals. Goffman, in his study of interaction rituals between individuals, detected such a phenomenon (p. 141),^[8] by observing individuals purposefully distorting information to manipulate and mislead others. Others have described destructive information as "guilty knowledge" or "dirty data."^[9] Incomplete, truncated, uncertain data can lead individuals to encounter sharp crisis situations, which are either solved by the production of reliable data, or, if not solved, can exhaust reductive analysis, morale, and determination.

Hence, information, or the lack of, can produce decision paralysis, panic, fear and through somatic and secondary effects, and actual pain. While this phenomenon is well-known to the art of medicine, few studies have been conducted in organizational settings other than healthcare and patient safety.

SPIRALING, AUTO-FEEDING, AND SELF-REINFORCEMENT

Sense-making is about presumption. It is social and systemic (p. 412).^[3] Presumptions are the products of past experiences, social learning, and education. In nature, presumptions are born through interactions and propagate through interactions. When people face an information crisis, they usually seek help in their immediate surroundings, engage in collective sense-making, seek information in the press, on the internet, try to reinforce their core beliefs to fight disturbing stimuli.^[4] They engage in socializations that can reduce their anxiety and the uncertainty surrounding the situation, or reinforce both the uncertainty and the importance given to their interpretation of the new event. This second phenomenon is known as “sense-making spiraling.” Seeking help from a knowledgeable source can definitely reduce uncertainty when the lack of knowledge is dissymmetric. When ignorance and incomplete information are mutual, with little expectation to add sense to the ongoing information crisis, individuals provide feedback loops to each other that ignore better-informed sources and may aggravate the situation.^[10,11] Over time, these processes trigger more negative outcomes, and turn into vicious cycles, leading to a spiral of counter-productive influences auto-feeding with incomplete information.^[12] These deviation-amplifying loops are well-known to the Internet, in a modern version of rumors, grow shorter, more concise, easier to grasp, and to tell as they travel from one individual to another.^[13]

As individuals tend to associate the repetition of information as a sign of its reliability, the Internet with its continuous flow of commentaries and self-produced knowledge has become a vector of crisis information vulnerability. Duplication, however, is not to be blamed on individuals, but on society’s evolution as a whole. The press, facing an intensive competition from free media, is also forced to outsource most of its information, and therefore often engages in commentaries driven from secondary commercial sources. The cost structures of the press have thus evolved from mostly primary information at its birth, to mostly secondary sources and commentaries in its maturity phase. The process of validating information has become tedious, as competition forces editors and media organizations to deliver news almost instantly. Moreover, the rise of a press deriving benefits from sensational information has progressively blurred the boundaries between institutional and legitimate sources of information and

their look-a-likes. With the rise of electronic intermediation, most people in organizations access information faster through external electronic media than through internal channels. Hence, crisis information spirals are not per se an organizational phenomenon.^[14]

Contrary to the phenomenon of rumors, however, people in organizations rarely generate destructive information spirals intentionally. Most informational behavior in organizations is somewhat “positional,” in Hirsch’s terms.^[15] People seek to gain information that allows them to position themselves, reduce ambiguity, and get a perspective that they perceive as slightly better than those their own or than what they witness in their colleagues. Accordingly, people do not see information as having absolute superior value, but rather an immediate, practical leverage for their ongoing actions. Rather than challenging information being used and articulated in ongoing programs, people favor collateral and ad hoc organizations, which would leave their main programs untouched, and their deeds unchallenged.^[16] Secrecy that can turn banal information into highly destructive information follows a social psychology that is more embedded in ignorance than maliciousness.^[17] Human inferences are imperfect, and turn genuine interpretations into misleading and contaminating shortcuts.^[18] Moreover, most information is unconsciously processed by individuals, so that people are generally not able to identify how they gathered, assimilated, and transformed information that leads their actions and deeds.^[19] Hence, individuals rarely discriminate between genuine information and its many doubles. Reality is taken for granted, until proven otherwise. Artifacts are as much instrumental as reality, for realities are known as genuine only when they get dismantled.^[20] This latter characteristic of informational behavior contributes to sustaining the development of crisis information spirals in most organizations. “Information-generating” behavior is much alike the “action-generating” behavior described by.^[7] People generate information while listening upwards; they document *ex post facto* an action-generation whose rationale they might have lost; they fine-tune their past commitments with the new criteria for approval; they reuse uncompleted achievements that have bred frustration and translate them into the new set of core beliefs.

This leads us to the most puzzling characteristic of crisis information: its self-reinforcement and its capacity to feed on itself. Findings in action-generation suggest that the pursuit of programmed behavior is strongly intertwined with the self-reinforcement of an information crisis. Individuals produce learning and information by repeatedly experimenting successfully with behaviors that they turn into programs. When an action fails to produce the expected outcomes, they can either modify the behavior to alter its output, or alter the information so that their unchanged behavior matches the discordant informational output. Large banks and financial institutions have suffered such a phenomenon repeatedly from the early 1980s

till today. A trader engages in hazardous investments, realizes that their outcome does not match his or her expectations, and subsequently modifies the informational output with complicities that would prevent a behavioral change, in expectation of a positive reversal of fortune.

Self-reinforcement is often accentuated by group behavior. Janis^[21] described how small groups facing crises tend to protect their cohesiveness through collective rationalization, stereotyped views of out-groups, self-censorship, illusion of unanimity, and self-appointed “mindguards.” Different from spiraling, “groupthink” aims at protecting the group from a perceived vulnerability, by reaffirming the shared core belief, and developing an illusion of invulnerability. The immediate consequence of groupthink is the cessation of search for alternative interpretations. Group members discount early warnings, and sanction peers who would question the group cohesiveness by doing so. Historical cases discussed by Janis^[21] include the attack of Pearl Harbor and the Bay of Pigs crises.

RESOLVING INFORMATION CRISES

Resolving informational crises often involves managing the crisis itself. A crisis is a situation that seriously threatens an individual or an organization. As the etymology of its noun suggests, a crisis is a time for a decision. Crises, however, are usually unnecessary. There is no scientific evidence that crises improve or diminish organizational longevity. There also is no evidence that organizational survival indicates effectiveness (p. 54).^[22] In fact, most organizations keep their names to maintain the continuity of their recognition by individuals who deal with them. But most organizations have little to do with their constituents from a decade earlier. Two questions come immediately to mind: if escaping crises does not display any form of correlation with resilience, other than psychological at the individual level, and if organizational survival is not an evidence of their performance, why do organizations continue to manage crises? Why do they not simply leave the environments that created the crisis in the first place?

An answer comes from Staw et al.^[23] under the form of threat-rigidity effects. Perceived uncertainty over anticipated events creates slower decision-making, and organizational rigidity, that are often accentuated by groupthink at senior management levels.^[21] Accordingly, organizations persist in managing crises because they believe they can repeat their past successes; they want to protect this core belief; they do not want to disavow public commitments, and hence, most often end up escalating their commitments, not to the crisis itself, but to its resolution process. This phenomenon is not completely a stranger to Plato's intuition: information crises are somatic expressions of an inaccessible reality; hence, organizations focus

on the symptoms that are immediately accessible and actionable. But as Nystrom and Starbuck p. 55^[22] underscore: “In real crises, weathering-the-storm strategies work only briefly. Then the symptoms of trouble reappear; only this time, the organizations start with fewer resources and less time to act.” Not surprisingly, crisis information management techniques are sometimes more somatic and symptomatic than the crises themselves.

Symptoms of crisis information management that ultimately aggravates the crisis include an over-emphasis on prediction (as an attempt to reduce uncertainty), mindguards and preachers of hierarchical control (expected to bring back a sense of control), and increased demands for various rationalizations and justifications (as an attempt to analytically exhaust reality). These three “usual suspects” of inadequate crisis information management are grounded in one solid block, made of five interlocked components: the reproduction of past successes; the defense of legitimacy and legacy of concerned decision makers; preparation for potential scapegoating; the reassurance of the null hypothesis; and the evaluation of senior managers.

Firms try to reproduce their past successes, by approximating their mechanisms and re-enacting environments that approximate the conditions of the past. One obvious rationale lies in mass assets effects, and the attempt to reemploy past expertise into new lines of products and services. That is to say, firms tend to bend environmental conditions so as to fit already deployed assets on a global scale. Over time, this mass asset impact prevents firms from assessing the validity of their learning. They enact environments that tend to self-validate their learning, eventually masking vulnerabilities or misconceptions. A less obvious consideration is that firms try to “do more of the same thing,” while adapting to unexpected demands through management by exceptions. Alas, environments of the past are not replicable in the present. While this seems obvious, most organizations develop over time the core belief that efficiency and consistency of successes achieved in the past are replicable in environments that have little to do with the earlier economic, technological, and societal conditions. Hence, usual mismanagement of crisis information is rooted in the belief that trying to replicate conditions of the past will increase the capability of prediction over the present. Unfortunately, learning from repeated success makes future failure very likely.^[24]

The second “usual suspect”—i.e., increasing hierarchical control—is mostly grounded in the criteria that are used to assess, reward, or sanction senior managers. People in organizations are judged on one hand on their past legacies, and on the other hand, on the institutional “soundness” of their decision process. Past legacies are made of past successes, but also of past difficulties and the way they were handled. Immediately increasing hierarchical control in a time of crisis presents the advantage of clearly identifying the ownership of the crisis, and

eventually, the lack of ownership of the concerned senior manager, if events transform into a real disaster. Hence, an increase of hierarchical control is often a strategy that prepares for potential failure of the crisis management, prompting potential scapegoats, and preparing a defense of probably questioned legitimacy.

The third “usual suspect”—i.e., analytically exhaust reality—has more to do with the search for a reassuring absence of change, and the protection of core beliefs. Not all crises express themselves loudly, and organizations are prone to errors of appreciation. As it might be unclear whether the information crisis at stake may end up in a success or a failure, organization members usually slant interpretations to argue that nothing has really changed in the practices or the behavior of employees. Unfortunately, employees often think along the same lines and are not really willing to share information about mistakes they have made. The consequence is that the sought “null hypothesis” is easily achieved. Senior managers duly question all middle-managers and employees asking them if they had wrongly changed constituents that might have led to a crisis, and the employees and middle managers duly answer that they did not. Paradoxically, this exchange of tense and polite audits is mutually beneficial, by contributing to escapes and scapegoating strategies by both employees and senior management. Accordingly, managers tend to dismiss small failures that challenge the firm’s foundation premises, perceive errors as small deviations and experiments, and prepare the ground for justifying that a large failure is fully exogenous to both their management responsibility and their governance techniques.^[24]

As discussed earlier, information crises, and information about crises, are primarily failures of interpretation. Not surprisingly, organization members attempt to reinforce their sense-making in the most controlled and predictable manner. But when information has lost its labels, senior managers attempt to invent new ones or force data into old repositories. And while the experience has been destabilized, and the labels left untouched, managers are convinced that relabeling will improve experience. Yet when channels have been unchallenged, and the crisis still occurs, managers ask people to justify once again that they used the same channels as usual. As Nystrom and Starbuck (p. 55)^[22] put it: “They know that their current beliefs and procedures have arisen from rational analyses and successful experiences, so they have to see evidence that these beliefs and procedures are seriously deficient before they will even think about major changes.”

Crisis information management is about stopping the self-reinforced and auto-feeding phenomenon that surrounds a crisis, and is made of fears, anxiety, rumors, and apprehension about being misjudged. By increasing management control and hierarchical scrutiny, managers often “de-humanize” the crisis and the information surrounding it. Accordingly, people who feel that they need to justify

unintended actions with unintended consequences also perceive a growing distance between them and the people asking the questions. Crises are not systemic. On the contrary, the existence of a crisis explicitly expresses that both the social and the management “systems” have failed to absorb an environmental change. To reapply and reenforce a system that just failed is “doing more of the same thing,” i.e., trying to solve an information problem by substituting the same information under another “form,” to quote Plato’s expression. Increasing control, demanding facts and figures, are somatic responses. They express a mimetic symptom that does not suppress, but rather leverages the original expression of the soma.

In their seminal study of modern crises,^[2] Atkinson and Moffat surmise that the rise of information-dependency in modern organizations led to the generalization of “nonlinear dynamics” as a principal, not a peripheral component of organized societal life (Table 1). Atkinson and Moffat (p. 184),^[2] reflecting on the organizational roots of the Columbia Shuttle Accident, infer that

within the rule-based and hierarchical safety control system, information was being lost. The right information existed, but within the almost tangential network of unofficial e-mails, exchanged on a trust basis by engineers and scientists working alongside, but outside, the hierarchical control chain. Truths established by NASAs scientific and engineering networks were not getting through to those who needed them, crucially to those who needed, even if they did not want, to know.

Reflecting on the Challenger Shuttle accident, Weick (p. 397)^[25] suggests another characterization of the role of information in crises. Reviewing Diane Vaughan’s works on the Challenger accident, Karl Weick notices: “The O-rings were not the only problem with the connecting joints. Rainwater had accumulated in joints on an earlier launch (p. 304), and the putty that was supposed to prevent hot gas from even reaching the O-rings had repeatedly failed (p. 10).” Where Atkinson and Moffat are describing an institutional malformation of modern organizations,

Table 1 Characteristics of complex nonlinear organizations.

Complexity concept	Information age organizations
Nonlinear interaction	The organization is composed of a large number of nonlinearly interacting parts
Self-organization	Local coevolution induces long-range order
Nonequilibrium order	Interactions within the organization proceed far from equilibrium. Correlation of local effects is key
Collective dynamics	Cascades of local effects ripple through the organization

Source: Adapted from Atkinson and Moffat.^[2]

i.e., the spreading of uncontrolled electronic communications, Weick sees elements that

speaking to larger issues of the role of chance in organizational outcomes, distraction during moments when embedded signals of danger come across one's desk, credibility as a function of position, and organizational learning in the face of shifting attributions and incomplete data (p. 397).

In other words, the rapid growth of signal-detection opportunities, sensors, and electronic devices in organizations does not seem to improve its sense-making performance, but rather multiplies the number of nonlinear interactions, nonequilibrium orders, and noninteracting or interacting nonlinear parts.^[2] Table 1 from Atkinson and Moffat's study of modern crises and insurgencies, illustrates characteristics of postindustrial organizations as envisioned by the authors.

The multiplication of interpretations in organizations is not a new phenomenon, and in a sense, an organization cannot be anything else than the permanent re-combination of random nonlinear interactions. What is new is the loss of correlation between power and social structures and information life in organizations. Whereas information has been subdued and submitted to preexistent and prevalent authority structures for centuries, it is now able to circulate beyond hierarchical boundaries, bypassing legitimate chains of command, for better or for worse. As Karl Weick noted about the Challenger disaster, "in 1985 there was both escalating concern about safety and belief that risk was acceptable, an unusual combination of simultaneous belief and doubt that may be more common than we suspect" (1997: 398). The main difference between Von Braun's NASA in 1951 and the modern NASA in the twenty-first century is that deviance has been heard; not acted upon, but heard beyond the institutional and legitimate boundaries of the organization. The "normalization" of events^[26] that used to be a long and maturing process of many social interactions, is now attempted to be achieved by an uncontrollable nonlinear and quasi-instant process of electronic messaging. However, in such a substitution process, involvement is replaced with figuration; facing issues is replaced with declarative safety nets, as noted by Atkinson and Moffat,^[2] Weick,^[25] and Vaughan.^[26] Such attributes are symptomatic of postindustrial organizations. Huber^[27] suggested that such organizations "rely upon all available knowledge, always more knowledge," that they must face "complexity, always more complexity" and "turbulence, always more turbulence." They must make very complex decisions, which require "the consideration of an ever-increasing number of variables with ever more complex relationships between them" (1984, p. 933). From this foundation, George Huber then considered the effects of the advent of new information technology, concluding that "postindustrial organizations will be more formal,"

and that "the acquisition of information will be more directed, more integrated, and specialized" (1984, pp. 933–943). While Huber's premonition proved accurate in most points, a third sequel of postindustrial organizing has been overlooked: postindustrial organizations are not only prone to informational crises, they generate them.

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Information Explosion

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Abstract

This entry discusses the concept of the information explosion as an empirical phenomenon and, more so, as a discursive concept. The term is discussed in relation to discourses on the information society and in relation to the concept of information overload.

Within its concept the term “information explosion” most often refers to the extended and largely continual growth and proliferation of “information” (newspapers, books, journal articles, television programs, Internet Web sites, e-mail, radio programs, etc.) during the nineteenth and, particularly, the twentieth and now the twenty-first centuries. It is a term that is central in discourses that demand information management in response to social, institutional, and even personal information growth and proliferation. It is often associated with other terms, such as “the information society” and “information overload,” which mark some qualitative social and historical event arising out of these quantitative increases.

The term characterizes the growth and proliferation of data, documents, and communication in both general social and in scientific communication. With such a broad sweep, the term signifies a general cause that demands greater information management across an equally broad sweep of informational forms: bibliographic and other documentary forms; abstracts, catalogs, and other records of initial documents; informal or “grey” literature in the sciences; scientific data; internet and broadcast media. The “information explosion,” broadly conceived, brings within its domain much of what we experience in, and as, modernity, and from this viewpoint it may be seen as what has allowed local lives to be understood as global issues, as well as has allowed for the observation and even surveillance of individual lives through national and international agencies. Indeed, any discussion of the “information explosion” would be addressing some of the major social challenges of information management and evaluation in modern societies across a broad range of areas: national intelligence and many other governmental and social policy issues; social and cultural values and welfare; scientific policy; social opinion and thought; and pedagogy, psychology, and human development.

Obviously, such a broad arena exceeds the range of an encyclopedia entry. More importantly, however, we may ask if this very generality of the concept is either informative or useful? With these caveats in mind, this entry takes a more simple, and more materialist, critical, approach.

Instead of focusing on the “information explosion” as a fact, particularly in the general manner in which the term is often couched, we will ask if this term makes any sense and how it does so. Though the concept of the “information explosion” is often taken as representing an empirical fact, in this entry we will suggest that, as a general historical and social concept, at least, it functions as a rhetorical device in “information society” literatures. The term may seem to refer to an empirical fact, but as we will suggest, the term, in its often used generality, is difficult to define and to empirically validate, it is emphatic and emotive (“explosion”), and it is often embedded in arguments that are rhetorically interesting, but empirically specious. The prevalence of the term, particularly in popular accounts of the information age or information society, together with its ambiguity and problematic empirical reference, suggests that the proper approach to this topic is that of critical informatics, as a subset of social informatics, and in particular, as an analysis of the term’s rhetorical forms and discursive contexts. From this perspective, the term’s meaning may be better understood by its rhetorical deployments in social space and as cultural forms of expression, rather than by countless—and always limited—enumerations of its supposed empirical referents.

The initial task facing a critical understanding of the term “information explosion” is to ask, just what is it that is “information” which is supposed to have “exploded,” and if there is a relative overproduction or “overload” of information, then why do we use the rather dramatic term of “explosion” and what are the consequences of the use of such language?

Some of the problems involved with arguing for an information explosion can be gleaned in Peter Lyman and Hal R. Varian’s report, “How Much Information? 2003.”^[1] Lyman and Varian’s report covers the growth (and occasional decrease) in information production across the globe across a wide variety of mediums as measured in bytes of information.

Our interest in pointing to Lyman and Varian’s report is not that of reproducing their findings, findings that are reported yearly in more scattered form in a variety of

governmental and professional yearbooks. Our interest, rather, is to point out a common method of argument in discourses on the “information explosion.” The concept of the information explosion is commonly constructed through an argument that begins with asking something of the order of “how much information is produced (consumed, stored, etc.) in a given period of time or in a given geographical or organizational locale?” Such a question is not only difficult to answer because of the problem of finding standardized data pertaining to the different “forms” of information, but moreover, it is possibly unanswerable in its totality because there is not a common understanding of what the word “information” means. (Capurro and Bjørland have discussed the many different senses of the word “information.”^[2]) For example, by asking “how much information is produced?” are we to include verbal information produced in our ordinary affairs? Are we to include “grey” or informal literature? Are we to include (as Warren Weaver suggested in his commentary on Shannon’s *The Mathematical Theory of Communication*) the “affects” of the performing arts (such as dance—and what would this mean)?^[3] And, if we limit ourselves to presenting evidence about the information explosion to data on the growth of documents, then we are still faced with the problem of what is considered to be a document.^[4,5] And, substituting the term “data” for “documents” and presenting all information measured in terms of bytes blurs the values of different informational forms still further.

Such problems of definition are not marginal to the problem of the information explosion, but rather, their being considered marginal and their being forgotten are at the heart of the term’s success in seemingly representing an empirical event. This forgetting is central to its success in discourses arguing for the social need for professional information management techniques and technologies and information management organizations.

For example, if one had consulted in 2007 the homepage of the contemporary “ischools” consortium (<http://www.ischools.org>), made up of many of the top university schools in information science in the United States, one would have found there an “ExaByte-Counter,” which suggested the need for such schools:

ExaByte-Counter—the number of bytes our world is creating. (One exabyte = 10^{18} bytes)

In 2006, the world created 161 exabytes of new information.

161 exabytes would fill 2 billion 80 GB iPods.

142,000,000,000,000,000 bytes^[6]

The reason why the exabyte data is shown on the web page is, as is often the case in this type of discourse, to persuasively suggest the need for new technical, technological, or in this case, organizational and educational tools and bodies in order to “harness” the “power” of information: “The

iField addresses this fundamental issue: how do we harness that incredible flow of information for the betterment of society, rather than get swamped by it?”^[7]

This statement contains the tropes of “information flow” and, implicitly, “information power” in an unspoken metaphor that equates the ischools with something akin to a hydroelectric plant. Subsequent statements on the ischools’ Web site surrounding the above quote stressed that what we refer to as the information explosion is a product of the Information Age and that it creates conditions of information overload. The rhetorical relation of “the information explosion” to “the Information Age” (or, its near synonym, “the Information Society”) and to “information overload” will be addressed in the following sections of this entry.

It needs to be mentioned first, however, that there are plentiful historical precedents for this type of discourse. Suzanne Briet, “Madame Documentation,” used the same rhetorical strategies as those above to argue for the historical inevitability of the profession of Documentation in the beginning of her 1951 book, *Qu’est-ce que la documentation? (What is Documentation?)*.^[8,9] The father of European Documentation, Paul Otlet, in his writings used the trope of the information explosion as a reason to embark upon his own projects, which included not just written works, but the creation of a world documentation organization and dreams of adding to this a world museum and a world bank. One contemporary author, Alex Wright, has even suggested that the information explosion reaches back to prehistoric times—a rather spectacular claim!^[10] Tefko Saracevic has summarized the view that information science and the development of information technology has been a consequence of the information explosion and the “evolution” of the information society:

Addressing the problem of information explosion, information science found a niche within the broader context of the evolution of the information society. In its various manifestations and attempted solutions, the niche is getting broader and bigger.^[11]

If read deeply, the existence of such discourses suggests that we need to examine not only the rhetorical bases for the deployment of “information explosion” discourses, but we also must examine the larger social forces investing in what are supposedly explained by such discourses and their tropes: namely information infrastructures. This broader task has been undertaken, for example in Geoffrey Bowker’s book, *Memory Practices in the Sciences*.^[12]

INFORMATION SOCIETY

Frank Webster^[13] has well summarized some of the more salient points of a critical analysis of the concept of the “information society.” His comments bear repeating and

bear further commentary in the context of the concept of the “information explosion,” for both terms connote historically unique moments of information mass and overproduction.

One of the most important points that Webster makes in his article is that arguments for asserting the existence of an information society—like arguments asserting the existence of an information explosion—often take the form of asserting a qualitative social change out of the evidence of rhetorically or stylistically impressive data on information production, use, etc. The issue here is that though the data may be rhetorically or stylistically impressive (as in the ischool consortium’s “ExaByte counter”), often there is a lack of a standard for discussing why and how such data is to be used as the basis for making assertions about qualitative historical events or social values. Information society literature, for example, often argues for the existence of an information society based on data that show increases in the production and use of information and of information and communication technologies, the use of such technologies in manufacturing and in other traditionally blue-collar jobs, increases in white-collar education requirements, and various other statistical measures. This argument and these types of data are familiar in the writings of the most well-known presenters of “information society” literature: Daniel Bell, Robert Reich, Manuel Castells, etc. These arguments also sometimes appear in Knowledge Management literature as quantitative evidence for arguments asserting the reality of post-Fordism and other “post-industrial” events and values, leading up to the appearance and supposed social importance of Knowledge Management. As Webster argues, however,

...quantitative measures—simply more information—cannot of themselves identify a break with previous systems, while it is at least theoretically possible to regard small but decisive quantitative changes as marking a system break. . . . What we have here is the assumption that quantitative increases transform—in unspecified ways—into qualitative changes in the social system.^[14]

The assumption that quantitative data can give evidence of an historical event or social value without also supplying criteria for the translation of the quantitative data to the qualitative values invites a mischievous use of numbers and statistics for purely persuasive, rather than reasoned, purposes. As we have suggested, this is but one reason for suspecting that information explosion discourse, particularly in the generalist and historicist literature in which it is often found, is more polemical than empirically sound. Another suspicion is aroused by the use of the common standard of bytes for measuring informational units whose meaning and social value cannot be measured by such. (For example, stating that a book is made up of x number of electronic bytes [assuming that it

is in an electronic format] tells us nothing about its informational value in the manner that we usually say that books give their readers information.) No massive number of bytes and no well-known professional authorities can hide the fact that such arguments are specious. Data showing increases in library holdings, publication rates, and data production alone tells us nothing about the qualitative social importance of such numbers unless real historical and social effects are explained and demonstrated. And the ability to demonstrate an “information explosion” across seemingly endless varieties of documentary forms and communication events is very problematic, not only for reasons of reliable statistics, but for the more fundamental reason that the term “information” is a figure of speech that covers many different documentary forms and communication events without a reliable common element which could be pointed to for comparison between, or for combining, these forms and events.

INFORMATION OVERLOAD

If we are to account for the rhetoric of the “information explosion” we may do so in terms of its argumentative forms for evidence (quantitative data, citations to well-known authors, etc.) and in terms of its association to other claimed qualitative events and values (such as “the information society”). If the information society is often discussed as the outward manifestation of an information explosion (or just as often, the information explosion as an outward manifestation of an information society), the “inward” or psychological effect of an information explosion is often argued in terms of “information overload.” “Information overload” is often discussed in the literature in terms of a person being “overloaded” either by a single event of too much information or by the effect of an “information explosion” on a social scale.

Mary Jo Rudd and Joel Rudd in an article on the impact of the information explosion on library users distinguish information explosion and information “load” and “overload” in terms of causes and their effects.^[15] They suggest that the results of early experiments into information overload should be approached cautiously since such results fail to adequately account for personal selections of information “input” and personal avoidance behaviors for preventing “overload.” Further, however, we might add that the information processing metaphors used in Rudd and Rudd’s article are especially peculiar, for library patrons are traditionally thought of in terms of seeking information for particular needs, not as information processing systems. Given a needs-based agent it is hard to imagine an overloaded mental apparatus since needs give way to more needs or no needs when the patron is “satisfied” or ready to move on or simply stops or quits his or her search. The point is that the “information overload” trope may not work very well as even traditional explanations

explanatory devices in an of information seeking. The “information overload” trope seems to be a personal psychological equivalent to the social “information explosion” trope: both work on an energy flow metaphor for information (as we saw with the ischools consortium Web site). Indeed, these two tropes sometimes cross in the literature so that information overloads are said to occur both in terms of personal psychology and in terms of social systems.

Of course, there are many writers who suggest various psychological conditions resulting from information overload in the sense of what is sometimes called, “media overload.” The theme of information or stimulus overload goes back to the beginnings of industrial modernity, while complaints of media overload, specifically, are a bit more recent, tending to become louder in the 1930s, but continuing on through today, now focusing on digital information.

One of the more fascinating commentators on information overload may be the Italian social commentator, Franco Berardi (also known as “Bifo”). What make Berardi’s commentary so fascinating are his claims that information overload largely accounts for the rise of certain psychopathologies, such as panic disorder and depression. In many of his writings of the past 15 years, not the least being his book *La fabbrica dell’infelicità* (*The Factory of Unhappiness*),^[16] the advent of panic as a psychological disorder (panic disorder became a psychological disorder of its own—derived from the Freudian category of anxiety neurosis—only with the publication of the third edition of the *Diagnostic and Statistical Manual of Mental Disorders* [DSM III] in 1980) is linked to information overload, and the subsequent depression which occurs when the person finds him or herself unable to position his or her potential actions in this overload of stimulation. Interestingly, we may recall that Immanuel Kant, too, described a similar psychological phenomenon in his *Critique of Judgment*; the “natural sublime” or the “infinite sublime” are experienced as moments of expansive awe, and even fear and trepidation, leading to a loss of possibilities for personal action, and thus perhaps, we may speculate, eventually resulting in depression. Being in a pre-electric age, of course, Kant did not have access to the electric energy metaphor. Berardi’s is a modern account of the origins of psychological diseases (particularly, panic disorder) as caused by information overload, particularly in the form of media overload.

Another account of the effect of information overload is reviewed in Frank Webster’s previously mentioned article. This is what is sometimes referred to as a “postmodern” reading of information overload where the referential quality of language is understood as breaking down in the midst of a proliferation of signs. Particularly in the contemporary political sphere, language is sometimes critically viewed as being self-referential, its meaning

reinforced by repetition and networks of supporting signification which have no real referent, so that it might be said that “the real” disappears beneath a “simulacrum” of signs. Viewed on the vast plains of culture and society, however, the truth of this claim is difficult to judge. The complaint, really, is much the same as that of Plato and others against the sophists and rhetoricians in antiquity. What we could add in order to make a theory built around such a claim more useful is the suggestion that what is psychologically lost in the midst of multiple representations of reality are the various manners by which evidence is ascertained and by which claims about reality are justified and proven. The basis for the charge of relativism is often a feeling that criteria for judgment have been left out. The problem may not be with either an accumulation or heterogeneity of stimuli or information resources, but with a demand that all types of information be treated in the same manner. Such a demand can become more pressing or “overloading” when many information types are presented to a viewer or reader simultaneously. Conversely, the problem can also be due to a generalized semiotic grammar that is used to represent all matters in the same general form (such as in the mass media) or it can be caused by the view that many different types of semiotic inscriptions constitute equally necessary and valid “forms” of information that equally need our immediate attention. In some of the literature of this type (e.g., that of Guy Debord, Jean Baudrillard, etc.) it seems that it is not an “overload” of signs, per se, that is the issue, but rather, the problems are those of semiotic similarity and a politically motivated aesthetic leveling or foreclosure of possibilities for analysis and judgment, which these authors then point to as the source for the modern “spectacle” or simulacra. Here, the concept of “overload,” in the sense of an “information explosion,” can refer to a variety of phenomena rooted in media production, rhetoric, aesthetics, culture, and politics.

CONCLUSION

In this entry we have suggested that the term “information explosion” needs to be treated as a rhetorical device. We are led to this approach by the rhetorical roles that the term serves in arguments suggesting the historical and social necessity of new information technologies and infrastructures and by its association to other tropes such as “the information age,” “the information society,” and “information overload.” What such an analysis does is to force one to explain what are the specific values of information tools, agents, organizations, and other information infrastructures and cyberinfrastructures and what are their specific social and historical origins and possibilities, once we have eliminated explanations based on the reified trope of the “information explosion.”

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Information Management

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Abstract

Information management concerns the control over how information is created, acquired, organized, stored, distributed, and used as a means of promoting efficient and effective information access, processing, and use by people and organizations. Historically, three perspectives of information management have dominated the Library and Information Science literature: the organizational, library, and personal perspectives. Each deals with the management of the processes involved in the information life cycle. Each concerns itself with the management of different types of information resources. Today, a more consolidated view of information management in the LIS literature exists, largely due to driving forces in society such as digital convergence, changing library roles, and the emergence and popularity of Big Data. These forces have elevated the significance of information management and have raised awareness among people and organizations today of the importance and need to manage information both effectively and efficiently.

INTRODUCTION

Information management (IM) is a broad conceptual term that has various meanings and interpretations among different constituencies. Frequently the term is used interchangeably with others. For instance, IM is often equated with the management of information resources, the management of information technology (IT), or the management of information policies or standards.^[1] Some suggest that IM draws upon ideas from both librarianship and information science.^[2] The purpose of this entry is to clarify the meaning of the term information management, to showcase its major historical perspectives in the Library and Information Science (LIS) literature, and to illustrate how a more consolidated, holistic perspective exists today.

What is IM? IM is the management of the processes and systems that create, acquire, organize, store, distribute, and use information. The goal of IM is to help people and organizations access, process, and use information efficiently and effectively. Doing so helps organizations operate more competitively and strategically, and helps people better accomplish their tasks and become better informed.

This entry adopts a process orientation toward IM where IM is viewed as the control over the information life cycle. Various models of information processes exist; some of the major processes involved in information life cycle concern those that create, acquire, organize, store, distribute, and use information.

Importantly, this entry recognizes three major historical perspectives of IM found in the LIS literature: the organizational, library, and personal perspectives. By far, the organizational perspective has been the most predominant and popular. In a nutshell, this perspective deals with

the management of all information processes involved in the information life cycle with the goal of helping an organization reach its competitive and strategic objectives. A variety of information resources are managed by organizations. These include transactional information stored in databases, summarized information found in data warehouses, and unstructured information content found in documents and reports. From the organizational perspective, the management of IT is a major component of any IM plan. It is with this perspective where associated terms like information systems management, IT management, data management, business intelligence, competitive intelligence, content management, and records management have relevance.

The library perspective of IM recognizes the unique role of information provision organizations, such as libraries, whose central mandate is to provide clientele with access to information resources and services. As such, these types of organizations historically have viewed IM primarily as the management of information collections, such as books and journals. With respect to this historical view, libraries are neither the creators nor the users of this information. As such, the historical library perspective deals with the management of a subset of information processes involved in the information life cycle with the goal of helping library patrons access and borrow information items held in collections. It is with the library perspective where associated terms like knowledge organization, classification, cataloguing, digital libraries, indexes, and information retrieval systems have relevance.

The personal perspective of IM, though not strong in the LIS literature, is similar to the organizational perspective in that it involves the management of all information processes in the information life cycle. The major

difference, however, is that the organizational perspective concerns the management of information of interest to the success and well-being of an organization, while the personal perspective deals with the management of information of relevance and concern to the individual.

Importantly, a consolidated view of these three major perspectives has recently emerged over the last few years in the LIS literature. This consolidation is a result of several new shaping forces in society. One is digital convergence—the digitizing of traditional media—where a convergence of ITs and information content is happening. Another is changing library roles where libraries themselves are involved in the creation of information. A third force is Big Data where organizations and people are generating data at unprecedented levels and at an incredible pace, and analyzing this data in the hopes of discovering new patterns, associations, and insights.

In terms of this entry's organization, the remainder is structured to further explain the major points just described. First, description is given on the information life cycle and the process view of IM. This is followed by a detailed discussion on each of the three major historical perspectives of IM from an LIS vantage point: the organizational, library, and personal perspectives. Next, discussion ensues on how societal forces are helping to shape a consolidated view of IM in the LIS literature. Last, concluding remarks are made.

A PROCESS VIEW OF IM

Leading IM scholars and organizations purport a process-driven view of IM. For example, Wilson defines IM as “the application of management principles to the acquisition, organization, control, dissemination and use of information relevant to the effective operation of organizations of all kinds.”^[3] Similarly, Choo defines IM as the management of processes that acquire, create, organize, distribute, and use information.^[1] Likewise, the US Government Accountability Office defines IM as “the planning, budgeting, manipulating, and controlling of information throughout its life cycle.”^[4]

The conceptualization of IM from a process perspective emerged in the early 1990s.^[5,6] Advocates of this approach stress that a process model of IM should encompass all or some parts of the information value chain or life cycle. Choo proposes six discrete information-related processes or activities that need to be managed: 1) identification of information needs, 2) acquisition of information to address those needs, 3) organization and storage of information, 4) design and development of information products, 5) distribution of information, and 6) information use.^[1] Wilson positions the creation and use of information outside the IM rubric and purports the following six information-related processes pertain to IM: 1) acquisition, 2) organization, 3) storage, 4) retrieval, 5) access/lending,

and 6) dissemination.^[7] Not all IM frameworks include information needs identification and information use as processes to be managed. However, many see the most critical issue facing information managers is eliciting information requirements and matching those information needs in the design and delivery of information systems to promote effective and efficient information use.^[1,8,9]

With respect to this entry, the following are considered to be the predominant information processes to be managed in IM: information creation, acquisition, organization, storage, distribution, and use. Information creation is the process where individuals and organizations generate and produce new information artifacts and items. Information acquisition is the process where information items are obtained from external sources. Information organization is the process of indexing or classifying information in ways that support easy retrieval at later points in time. Information storage is the process of physically housing information content in structures such as databases or file systems. Information distribution is the process of disseminating, transporting, or sharing information. Information use is the process where individuals and organizations utilize and apply information made available to them. Effectively managing these information processes helps get the right information to the right people in the right forms at the right times and at reasonable costs.^[1,10]

THE ORGANIZATIONAL PERSPECTIVE

The organizational perspective is the most predominant perspective of IM. Under the organizational perspective, IM concerns the management and control over the full life cycle of information processes ranging from creation to use for the betterment of the organization itself. In this sense, the management of information processes is seen as a strategic advantage that affords four kinds of benefits to an organization: 1) a reduction of costs; 2) a reduction of uncertainty or risks; 3) added value to existing products and services; and 4) the creation of new value through the introduction of new information-based products and services.^[11]

Information as a Resource

Fundamental to the organizational perspective of IM is the view and treatment of information as a strategic resource—one that needs to be managed like any other critical organizational resource, such as people, equipment, and capital. Many organizations recognize the potential value of information and the need to be aware of what information resources exist in an organization, and the costs associated with acquiring, storing, processing, and using that information. Forward-looking companies consider information as a strategic asset that can be leveraged into a competitive advantage in the markets served by the company.^[8]

The concept of managing information as an organizational resource emerged in the late 1970s with the creation of the US Paperwork Reduction Act that was established to resolve the huge costs of managing and handling information by bidders for government contracts.^[12] It was at this time that the term information resources management (IRM) became popular and was used to signify the management of both information and ITs.^[13,14] In reality though, the IRM concept was more about the management of data than it was about the management of other types of information, such as documents or reports. Case in point, an empirical assessment of the IRM construct defines IRM as “a comprehensive approach to planning, organizing, budgeting, directing, monitoring and controlling the people, funding, technologies and activities associated with acquiring, storing, processing and distributing *data* to meet a business need for the benefit of the enterprise”—not other types of information (*italics added for emphasis*).^[15]

This entry suggests that within the organizational perspective of IM, IM is more than just the management of data (e.g., raw facts stored in transactional databases). Rather, IM in organizations involves the management of a varied set of information resources, ranging from data to information.^[16]

Data can be considered as “raw facts” that reflect the characteristics of an event or entity. Examples of data items held in an organization would be a customer name, an order quantity, or a unit price. The management of data in organizations traditionally belonged to the “data management” function or “data resource management” department. Data management deals with the storage and processing of low-level data items found in transaction processing systems. The focus of data management is to maximize the speed, accuracy, and efficiency of processing and maintaining transactions or records.^[1] Data management is concerned with the creation and “acquisition of data, its storage in databases, its manipulation or processing to produce new (value-added) data and reports via application programs, and the transmission (communication) of the data or resulting reports.”^[8]

Information can be viewed as “meaningful data” where data have been converted into a meaningful and useful context, such as in the identification of a best-selling or worst-selling product item from historical sales data for a company. Examples of information items managed in a company would be summarized information pulled from transactional database systems and stored in data warehouses and/or data marts. Such “business intelligent” systems support decision-making and allow for the slicing-and-dicing of summarized transactional information to find patterns and trends in operational data (e.g., sales data, supplier data, customer profile data) of importance and relevance to the organization. For example, the mining of summarized transactional data stored in a data warehouse could be used to justify the promotion of a

product or service to an untapped market segment, or to measure the effectiveness of a marketing campaign in a certain geographical area.^[16]

Though more emphasis in organizations is placed on the management of data and information that is structured and formalized (i.e., data neatly contained within a transactional database or summarized information stored in a data warehouse), the amount of unstructured information that is created, acquired, organized, stored, distributed, and used within an organization usually far exceeds the amount of structured data and information an organization manages.

Unstructured information is the type of information that can be found in reports, documents, email messages, and PowerPoint presentations, among others. This includes reports and documentation generated internally with a company and outside the enterprise as well. For example, managing information concerning industry trends, legislative regulations, competitor happenings, news bulletins, etc., is key to helping an organization stay abreast and react to competitor threats and environmental concerns. This is where IM intersects with a company’s “competitive intelligence” initiatives and “environmental scanning” activities. Competitive intelligence refers to the analysis of information about competitors and competitive conditions in particular industries or regions.^[17] Environmental scanning refers to the analysis of information about every sector of the external environment that can help an organization plan for its future.^[18,19]

Often, document management systems, also known as content management systems, help manage unstructured information that is created, acquired, organized, stored, distributed, and used within an organization. These systems support the electronic capture, storage, distribution, archiving, and accessing of documents. These systems typically provide a document repository where documents can be housed, indexed, and accessed. In these repositories, metadata information is maintained about each document that tracks each document’s editorial history and relationships to other documents. Indexing of documents within these systems, through both manual keyword classifications and automatic indexing techniques, facilitates easy document retrieval by organizational workers at later points in time.^[16]

Unstructured information also includes records of transactional information processing such as invoices, contracts, order requisitions, bills of lading, and financial statements. The actual data may be resident in a transaction database and managed elsewhere, but the entire record of the event, often with signatures, are handled as a complete entity that must be generated, stored, processed, retrieved, and archived. The management of such information is referred to as “records management” and involves the application of systematic and scientific control to all recorded information that an organization needs to do business.^[20]

Managing Information Processes

A good IM program in an organization will manage the full life cycle of information ranging from creation to use. For example:

- When generating transactional data, steps will be taken to ensure that the data will be stored following database “normalization rules” to promote data integrity, the single sourcing of data, the reduction of wasted database space, and fast transaction processing.
- When acquiring information, such as the purchase of market research data or competitor intelligence information, steps will be taken to reduce duplicate purchases and to increase the accessibility of any purchased data and information across the enterprise.
- Any data or information that is stored will be adequately protected against unauthorized access, as security, privacy, and copyright concerns exist.
- Data and information stewardship programs will be set up to identify those organizational workers or units who are responsible for the quality and management of certain data and information items.
- Data and information will be regularly backed up for recovery purposes.
- Duplicate or mirror copies of data and information items will be created to facilitate access and reduce network congestion and/or an overload of requests on the servers on which the data and information reside.
- Old data and outdated information will be archived and/or deleted.^[16]

IT's Role

IT plays a critical role in the management of information in organizations. However, having said that, it should be understood that IT is the technical medium upon which information is housed, accessed, retrieved, distributed, and used, and not the primary entity that is being managed under the IM rubric. Information processes are the entities being managed.

Nevertheless, much confusion exists over the role IT plays in the management of information in organizations, with some equating IM primarily to the management of IT itself. For example, the mission of the Society for Information Management, a professional society for chief information officers and senior IT leaders based in the United States, emphasizes the management and use of IT to achieve business objectives.^[21] Likewise, Davis and Hamilton define IM as “the management of information systems and information resources by an individual, a group, or an organization” and describe IM as a “new business function with responsibility to define organizational informational requirements, plan and build an information infrastructure and information systems applications, operate the system, and organize, staff, and manage these activities.”^[22]

This entry suggests that such descriptions of the IM function in organizations are inappropriate and are better served by alternate terms such as information systems management or IT management. Information systems management refers to the control over the development, design, roll-out, and support of information systems applications that support business processes and workflow. IT management refers to the management and control over IT (e.g., hardware, software).

A variety of factors need to be considered when managing technology in organizations. The appropriate hardware and software needs to be installed and implemented. Repair and maintenance of hardware and software systems must be done. Licensing concerns must be taken into consideration. Information systems professionals (e.g., programmers, network specialists, database administrators, systems analysts) need to be hired and trained.^[16]

IT is very important to how information is managed in organizations, and the management of IT should be an integral part of any IM plan.^[11] After all, IT facilitates the ability to support information creation, acquisition, organization, storage, distribution, and use in both efficient and effective manners.

Organizational Information Processing

IM is concerned with organizational information processing. Two broad orientations exist in the organizational information processing literature that have implications on IM.^[23]

The first, mainly developed at Carnegie Mellon University and represented by Herbert Simon, James March, and Richard Cyert, sees an organization's ability to process information as the core of managerial and organizational competencies and organizations as bounded, rational systems.^[24] Here, strategies to improve information processing capabilities concern increasing an organization's information processing capacity and reducing an organization's need for information processing.^[25]

The second, represented by Karl Weick and Richard Daft, sees organizations as loosely coupled systems where individual participants collectively develop shared interpretations of the environment and then act on the basis of this interpretation. In this sense, information processing is about reducing the equivocality or ambiguousness of information about the organization's external environment.^[26]

Taking these two orientations of organizational information processing together, IM then is about increasing an organization's information processing capacity and reducing both information processing needs and information equivocality.

Of interest, how an organization processes information is influenced by its information culture (i.e., the shared assumptions, values, norms, and behaviors that shape an organization's perception, management, and use of information).^[27] Specifically, four types of information cultures

exist (results-oriented, rule-following, relationship-based, and risk-taking) and each has influence on how an organization manages information. In a results-oriented culture, the goal of IM is to enable the organization to compete and succeed in the marketplace. In a rule-following culture, information is managed to control internal operations and to reinforce rules and policies. In a relationship culture, information is managed to encourage communication, participation, and a sense of identity. In a risk-taking culture, information is managed to encourage innovation, creativity, and the exploration of new ideas. Most organizations would display varying degrees of each of these four types of IM norms and behaviors.^[28]

THE LIBRARY PERSPECTIVE

Outside of the organizational context, IM also has meaning in the library world and to other information provision organizations whose central mandate is to provide clientele with access to information resources and services. IM is of concern to all kinds of libraries, such as public libraries and academic and research libraries. This includes corporate libraries that manage serial subscriptions and electronic access to industry reports and electronic databases for workers and employees in their organizations.

From a library perspective, IM concerns the management of information collections, such as books and journals. The goal of IM from a library perspective is to help library patrons access and borrow information items held in the collection. A variety of activities surround the management of a library collection, including the development of collection policies and materials budgets, the selection of collection items, the analysis of collection usage and end user collection needs, training of collection staff, preservation of collection items, and the development of cooperative collections with other institutions.^[29]

Since historically libraries have neither been creators nor users of information, this perspective deals with the management of a subset of information processes involved in the information life cycle. For example, Wilson identifies six information-related processes pertaining to IM that are applicable to the library perspective: 1) acquisition, 2) organization, 3) storage, 4) retrieval, 5) access/lending, and 6) dissemination.^[7]

Information acquisition involves the process of buying or securing information from sources external to the library for the collection. Care must be taken to ensure that the correct information items are acquired (those that match the information needs of end users) and at reasonable costs.

Information organization pertains to the process of indexing or classifying information housed in the collection to support easy retrieval at later points in time. Today, this process is sometimes referred to as “knowledge organization” in the library world. For example, the International

Society for Knowledge Organization utilizes the term “knowledge organization” to represent the process of how documents, document representations (such as bibliographic records), and concepts (keywords, constructs) are ordered and classified.^[30] Likewise, Anderson defines knowledge organization as the “the description of documents, their contents, features and purposes, and the organization of these descriptions so as to make these documents and their parts accessible to persons seeking them or the messages that they contain” and describes how knowledge organization encompasses “every type and method of indexing, abstracting, cataloguing, classification, records management, bibliography and the creation of textual or bibliographic databases for information retrieval.”^[31] In this sense, knowledge organization deals with both processes and systems.^[32] With respect to IM, this entry suggests that the use of the “knowledge organization” label is misleading. In actuality, information items (such as documents and document representations) are being organized or ordered (i.e., indexed, classified, catalogued) rather than knowledge items (concepts, constructs) *per se*. As such, “information organization” is suggested to be a better label to use when talking about the indexing and classification of items held in a collection, at least from a library perspective of IM.

Information storage refers to physically housing items in the collection. This encompasses the housing of both paper and electronic documents (and their document representations). This could be accomplished by storing books and journals in physical stacks in the library or storing full-text electronic versions of documents in an electronic or digital library.

Information retrieval involves the process of searching and finding information in the collection. Typically, end users will conduct a search query using electronic tools that are Web-based to find items of interest in the collection. In the information retrieval process, end users themselves, or information search intermediaries (librarians) working on the behalf of end users, “pull” the information that is needed from the collection.

Information access/lending involves the process of providing physical or electronic access to the collection and the ability to check out information items of interest. For paper-based documents, this may involve signing out and borrowing a physical information item. For information in electronic form, this may involve viewing the information item online and/or downloading a copy of the information item from the collection.

Information dissemination is the process of circulating physical information items of interest from the collection to end users. Traditionally, methods of dissemination involve the distribution of photocopied journal content pages or the circulation of documents. Today, this has largely been replaced with electronic alert services that “push” information items in the collection of interest to specific users based on stored end user profiles.

The management of library information collections is a complex and ever-evolving process.^[33] The extensive digitization of information resources has placed new pressures on libraries to respond to securing the requisite skills, resources, and competencies to successfully manage digital library collections.^[34] In order to manage the transition and reliance on digital information collections, it is important more than ever for libraries to consider the expectations and needs of end users, as well as limitations in library staff and budget adaptability.^[33] These are critical factors in rolling out any successful IM program from a library perspective.

THE PERSONAL PERSPECTIVE

IM from the personal perspective refers to how individuals create, acquire, organize, store, distribute, and use information for personal purposes.^[35,36] This can concern the management of information for everyday use (e.g., personal calendars, schedules, diaries, news items) or work-related reasons (e.g., work schedules, things-to-do, project files). As such, personal IM involves the handling and processing of information over the entire information life cycle, just as in the case of the organizational perspective. However, the personal IM perspective differs from the organizational perspective of IM in that personal IM concerns items of interest to the individual, not the organization.

Central to the personal perspective of IM is the need to manage the information processes of information creation, acquisition, organization, distribution, and use so that the right information is accessible and available in the right place, in the right form, and of sufficient completeness and quality to meet personal information needs. A variety of information items are created, acquired, organized, stored, distributed, and used by people for personal purposes. These include personal notes, personal journals, web pages, email messages, news articles, address books, calendar dates, reminders, fax communications, etc.

Technologies and tools, such as electronic personal information managers like PDAs, help people carry out these processes more efficiently and effectively.^[37,38] Cheap and fast search and storage technologies bring stability and order to people's often chaotic and messy personal information environments, and facilitate making the most of people's personal information collections.^[39] Despite the benefits of these technological tools, there is some evidence to suggest that technological advances are less important in determining how individuals organize and use information than are the tasks that people perform,^[40] and that improvements in personal ITs are required, specifically in terms of minimizing information overload, supporting easier context switching, and providing better integration across a variety of applications.^[41]

It is interesting to note that the phrase "personal information management" was first used in the 1980s with the

advent of personal computers and their capacity to process and manage information.^[42] However, the concept of "personal information management" was most likely first implied back in 1945 by Vannevar Bush when he envisioned using the "Memex" machine for personal IM—a machine that allowed an individual to store all his or her books, records, and communications and consult those personal information sources with great speed and flexibility.^[43]

As the proliferation of personal computing devices and the explosion of the amount of information that is created, generated, and used continues to increase, the relevance of IM from the personal perspective will likely gain more attention and importance from both researchers and practitioners alike.

TOWARD A CONSOLIDATED VIEW

Though, historically, the three major perspectives of IM described earlier (i.e., the organizational, library, and personal perspectives) were formed independently from each other, a variety of recent societal forces have led to the formation of a new consolidated view. These forces include digital convergence, changing library roles, and the emergence of Big Data.

Digital convergence involves the coming together of previously distinct products and services that employ digital technologies.^[44] According to a report by Deloitte, digital convergence is driven by three underlying trends: 1) the proliferation of digital data, which provides a common base for handling diverse types of information using the same devices, processing techniques, and media; 2) widespread connectivity, which helps bring diverse information together, and extends the value and capabilities of a device beyond its out-of-the-box functionality; and 3) continuous advances in technology, from battery life to processor speed.^[45] As digital convergence has occurred, organizations, libraries, and individuals have become accustomed to working with information systems that are not strictly contained to a specific organizational, library, or personal content domain, or restricted to a specific type of IT. Rather, organizations, libraries, and people are now more accustomed to working with digital technologies and devices that allow the gathering, collection, access, and use of information from a wide variety of sources and to using the same type of ITs to do so. As such, organizations, libraries, and people have been accustomed to utilizing the same types of ITs to access, collect, store, and use information.

Libraries have embraced content creation. This is a new and expanded role for libraries. Today, one can easily find libraries involved in the creation of new information through the provision of maker-spaces,^[46,47] open-access online journals,^[48,49] institutional repositories,^[50,51] and the generation of digital storytelling collections.^[52,53]

Further, academic libraries now play a lead role in the stewardship of institutional research data.^[54,55] This new recent content-creation role has increased the breadth of information processes in the information life cycle for libraries and made libraries more closely aligned with the information processes one would find in the organizational and personal IM perspectives.

Big Data refers to the tools, processes, and procedures that allow an organization to create, manipulate, and manage very large data sets and storage facilities.^[56] One of the primary reasons for Big Data is “data explosion,” largely due to the widespread accessibility, affordability, and availability of new digital devices, such as smartphones, tablets, and laptops, that make access to the Internet both easy and relatively inexpensive for billions of people worldwide. Another is that the list of data sources keeps growing as organizations and consumers generate different and vast amounts of data every day by emailing, searching, browsing, blogging, tweeting, and texting.^[57] Organizations are scrambling to leverage the overwhelming amount of Web-based, mobile, and sensor-generated data arriving at terabyte and even exabyte levels afforded by Big Data by analyzing this highly detailed, contextualized and rich content in the hopes of making insights and new discoveries for competitive and business success.^[58] The proliferation of Big Data enables companies to harness the power of predictive analysis.^[59] Of importance to this entry, organizations that wish to leverage Big Data recognize the need to follow sound IM principles.^[60] In this regard, Big Data has raised awareness of the critical importance of IM and the need to manage information efficiently and effectively more than ever before.

CONCLUSION

This entry provided a review and discussion of the IM concept. Importantly, a process-oriented definition of IM was proposed and three distinct historical perspectives of IM from an LIS vantage point were described: the organizational, library, and personal perspectives. Importantly, a consolidated view of these three historical perspectives was suggested based on recent trends and happenings.

This entry emphasized the importance of IM. IM allows organizations to reach strategic goals and make sound decisions. IM enables libraries and other information provision organizations to manage information collections effectively and efficiently. IM helps people manage their own personal information collections.

This entry also described how IM is not so much about the management of technology, but rather more about the management of the processes of IM, specifically the creation, acquisition, organization, storage, distribution, and usage of information.

According to the current scope of the *International Journal of Information Management*, the challenge for IM now is less about managing activities that collect, store, and

disseminate information, and more about placing greater focus on managing activities that make changes in patterns of behavior of customers, people, and organizations, and information that leads to changes in the way people use information.^[61] This may not be such an easy task. People and their information behaviors are hard to change. So are organizational cultures.^[11] IM is less about solving technical problems and more about addressing the human-side of IM. Humans add the context, meaning, and value to information, and it is humans who benefit and use this information. As such, “mastering information management is an essentially human task.”^[62]

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Information Needs

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Abstract

The following entry describes the concept of “information need.” The concept of “information need” has no single definition but is dependent on the perspective from which it is applied. The concept of “information need” is discussed in terms of its definition in other fields, involvement with the user-centered paradigm, and articulation in key models of information seeking, as well as how it has spurred new avenues of inquiry within library and information science (LIS).

INTRODUCTION

“Information need” is one of the most central concepts within library and information science (LIS). If people did not have information needs, then libraries and other information systems would cease to exist, even basic interpersonal human communication would be altered. An in-depth understanding of “information needs” is critical to answering some of the larger questions facing LIS from an individual, organizational, and societal perspective. These questions include: (1) how are information needs created? (2) what motivates people to seek information? (3) why do people sometimes avoid information? (4) how do people express information needs? (5) how is relevance considered? (6) how should information be organized and managed to best respond and anticipate people’s needs? and (7) how should we organize and plan for the expression of information need? LIS professionals thus require an understanding of what an information need comprises, how it develops, is met, and transforms in order to provide optimal service in collection development, cataloging, and reference—to name a few key library functions. System designers and professionals in other fields require in-depth understanding to meet users’ needs through their services as well. However, while libraries have existed for millennia, formal understanding of information needs from a user perspective has only been explored since the 1960s.

SITUATING INFORMATION NEEDS

In order to understand the term “information needs” it is important to understand how it is situated within the general context of “human needs” research as well as within the evolutionary trajectory of LIS. “Needs” or “human needs” is a central concept in many disciplines. In order to fully consider the meaning of the term information

needs, it will be examined within the general context of “human needs” research. A multidisciplinary examination of the importance of “needs” research provides an essential context for understanding the concept of “information needs” within LIS and especially from a user-centered perspective. The use of this term will also be explored as part of the historical development of the LIS field and its role in spurring new avenues of inquiry within the field.

The Definition of “Need” in Cognate Fields

The concept of “need” is unsurprisingly central to many different disciplines. Perhaps the best known is psychology and Maslow’s hierarchy of needs.^[1] Maslow’s theory of human motivation contends that human needs can be organized into a hierarchy or a pyramid of five types of needs. At the bottom of the pyramid are basic or physiological needs such as breathing, food, water, sex, and sleep. The next level relates to safety including physical security, employment, property, and resources. Above this level is a sense of love and belonging associated with friendship, family, and intimacy. At the next level is esteem which is reflected in self-esteem, confidence, and respect by others. Lastly, Maslow described the highest level of need being self-actualization, which is characterized as involving personal development associated with morality, creativity, spontaneity, and problem solving. Maslow’s hierarchy is often used as the basis for understanding human motivation. Another, simpler, categorization of human need by psychologists is that of: (1) physiological need; (2) affective need; and (3) cognitive need.^[2]

Human needs are also of central concern in the field of economics and political science. Human need is considered a driving force in the demand for goods and services. Human needs theory has played a prominent role in political economy research as a means of supporting economic development theory. For example, the political economist

and Nobel prize winning scholar Amartya Sen based his arguments on the moral grounds for public spending on a definition of human needs.^[3] Political scientists have also used theories of human needs as a way to better understand conditions for peace, conflict resolution, and negotiation.^[4]

Perhaps most closely related to many of the inquiries on information need in LIS is the definition of “educational need.” The concept of need in the field of education has been used both to assess and express individual needs as well as to measure aggregate needs at the local, state, or federal level.^[5–7] Other disciplines, such as health sciences, have conducted their own studies on “information needs” in the context of their fields.^[8]

Information Needs and LIS

Despite its centrality to information seeking, use and sharing the concept of “information need” remains ambiguous in the literature. This difficulty may stem from the fact that it is challenging to create a boundary around the concept of “information needs.” Wilson suggested that an “information need” is secondary to a primary need such as food, shelter, and clothing.^[9] In order to understand an information need, it is often necessary to understand the context of human needs that created a need for information. This approach to understanding information need requires a broad understanding of people’s personal situations. Wilson^[2] also noted that one of the difficulties faced in defining “information needs” is separating the concept from “wants,” “expressed demand,” “satisfied demand,” and so on. He partially attributed this to the “failure to identify the context within which information needs investigations are carried out” (p. 8).^[2] Hjørland^[10] later argued that “it is essential not to confuse the concept of need with the concept of demand.”^[10] To illustrate the difference, Hjørland presented a situation in which the demand for information from a library was low due to factors such as accessibility; yet, the information needs of the people in the community were high.^[10] In this situation, need and demand were clearly not equal.

Green^[11] also considered the differences between “wants,” “demands,” and “needs.”^[11] He identified four aspects as most central to an understanding of the concept of information need: (1) need is necessarily instrumental; (2) needs are usually contestable; (3) need has a strong relationship with necessity; and (4) there is no necessary psychological element in a need. Green also stressed that need does not necessarily mean that information is lacking—a person may need information that they already have.

An explicit information need is often considered to be the motivating force behind a user’s action to seek information. Understanding the motivational factors involved in human information behavior is critical to understanding other parts of the information seeking and use processes

and has raised several important questions. For example, motivation is central to research regarding passive and active approaches to information seeking as well as blunting and avoidance behaviors.

The difficulty of ascertaining a person’s information need has also been cited as cause for lack of a more thorough consideration of the concept. In the early 1980s, Belkin and Vickery^[12] argued that since information needs exist in someone’s head they are very difficult to assess.^[12] Harter^[13] later suggested that information needs are akin to a person’s mental state, arguing that they are in a constant state of flux as a person continually acquires new information.^[13] Given these considerations and the close relationship between information need and other subdisciplines’ consideration of need, it has been suggested that “needs” research may fall outside the scope of LIS and be better suited to other disciplines. Wilson^[2] suggests “it may be advisable to remove the term “information needs” from our professional vocabulary and to speak instead of “information seeking towards the satisfaction of needs” (p. 9).^[2]

Historical Evolution of Information Need Research within LIS

In a historical context, studies concerning “information need” have evolved greatly. In the famous monograph “The Library’s Public,” Berelson^[14] synthesized the results of library studies from 1930 to 1949, and reported that libraries were used primarily for accessing books and were patronized by the younger, better-schooled, culturally alert members of the community.^[14] Despite collecting demographic data, little attention was paid to the types of uses that people made of libraries, especially in connection to particular needs. Most of the studies summarized by Berelson were concerned with “demands” rather than “needs,” and were aimed at informing collection development and circulation practices.

The 1940s and mid-1950s were marked by the vast increase in the amount of scientific literature generated and released in the postwar era. Responding to Vannevar Bush’s call to “make more accessible a bewildering store of knowledge,” researchers began studying how information is used in relation to work focusing particular attention on science and technology.^[15] This type of research was primarily focused on determining how information sources could be made more useful to scientists, and in this context the information needs of scientists were studied.

The 1960s and 1970s ushered in an era in which LIS research focused on social and community issues. Several major, large-scale studies were conducted, including the study of the information needs of urban residents of Baltimore and the “The Humphry Report” of Maine.^[16,17] These public library-oriented studies sought to identify the information needs of large populations. The federal

government through the U.S. Department of Education also demonstrated a strong interest to identify the information needs of citizens. As part of this effort, the U.S. Department of Education funded a study by Ching-chih Chen and Peter Hernon investigating the information seeking patterns of the general public as well as a study by Brenda Dervin examining the information needs of urban residents of Seattle.^[18,19]

A similar large publicly funded study was conducted in Britain during this period. The INISS Project directed by Tom Wilson and David Streatfield studied the communication and information flows in local authority social services departments.^[2] The project was particularly innovative for its use of action research to foster change in the organizations, and employment of qualitative methods such as structured observation. Wilson credited this 5 year project as being a major influence of the ideas expressed in his seminal 1981 paper on user studies and information needs.

During the 1960s and 1970s a new conceptualization of information need also began to emerge. In 1962, Robert Taylor published an article in which he examined the process of information need development as revealed through question asking and answering dialogue at the reference desk of a library.^[20] He followed this article up 4 years later in 1968, with his seminal article "Question-Negotiation and Information Seeking in Libraries."^[21] During this period, other researchers, such as Brenda Dervin were beginning to focus their attention on better understanding the process by which information needs are determined and expressed. The work of these researchers launched a new way of viewing information users and information needs.^[22] In their landmark 1977 work "Public Library Use, Users, Uses" Zweizig and Dervin challenged researchers with identifying the uses (and *possible* uses) that people make of public libraries by focusing on situational needs.^[23] They observed that the time for studying "how much use is made of libraries and by whom" is past, and that focus should be switched from "the user in the life of the library" to "the library in the life of the user."^[23]

In their seminal 1986 ARIST chapter, Dervin and Nilan expounded on the paradigm shift that they claimed had occurred within LIS, a switch in focus from the system-oriented paradigm of past decades to a new user-centered or alternative approach that emphasized constructive, active users, subjective information, situationality, holistic views of experience, internal cognition, and systematic individuality.^[24] At the heart of this paradigm shift was its view of users and their inherent information needs, which were no longer seen as "empty buckets" that could be filled with "bricks of information" (to use Dervin's terminology). Dervin and Nilan gave three examples of such user-centered scholarship: Taylor's user-values or value-added approach, Dervin's Sense-Making approach, and Belkin and colleagues' anomalous states-of-

knowledge approach.^[24] Notable definitions of information need cited by Dervin and Nilan include "a conceptual incongruity in which the person's cognitive structure is not adequate to a task,"^[24,25] "when a person recognizes something wrong in his or her state of knowledge & wishes to resolve the anomaly,"^[26] "when the current state of possessed knowledge is less than needed,"^[27] and "when internal sense runs out" (Dervin, 1980). During this period, Dervin and Dewdney proposed neutral questioning, based on Dervin's Sense-Making approach, as a technique for understanding users' information needs at the reference desk.^[24] Although the paradigm shift is most often associated with the 1980s, Bates contended that the shift actually began occurring in 1960 at the time Moore's Law was published and as represented by Edwin Parker's 1966 argument that "the system should adapt to the receiver or user, rather than the user to the system" (as cited by Bates).^[28] In 1976 Dervin, herself, called for a shift in attention toward designing systems that adapt to users' needs which support their efforts to help themselves to make sense out of information.

Case,^[29] views Dervin's work and specifically the Sense-Making approach to be "the most ambitious attempt to explain the origins of information needs" (p. 75).^[29] Dervin's Sense-Making approach considers "information need" as being derived from a person's desire to make sense out of a situation.^[30] The Sense-Making approach describes a person reaching a point at which they need help to bridge a gap in their understanding. According to the Sense-Making approach, the "gap" represents a crucial point at which a person develops a need for information to allow them to move forward. The "gap" is the point at which a person begins to recognize and articulate their information needs. An important aspect of sense-making as it relates to information need is the recognition that information needs are not isolated but are connected to a larger context. When an information need is considered in a larger context it will be linked to numerous information needs. As one information need is addressed, other needs will likely develop.

The user-centered work of Dervin, Wilson, Kuhlthau, Belkin, and others in the 1970s and 1980s introduced holistic approaches to understanding information behavior and laid the foundation for an exploration of the role of "context" in understanding human information behavior. The 1990s to the present marks a period in which "context" became more deeply considered in all aspects of information behavior. Indeed, in 1996, information seeking in context began developing its own subspecialty within the field of LIS. As research interest coalesced around this topic, a conference was organized in Tampere, Finland and aptly named the Information Seeking in Context (ISIC) conference. According to Pettigrew et al. (2001), "another quantum leap ha[d] occurred within information behavior ... emphasiz[ing] the contextual interplay of cognitive, social, cultural, organizational,

affective, and linguistic factors” [Pettigrew, 2001 #463, p. 67]. Kuhlthau described information seeking in context as “focus[ing] on a holistic view of information needs in the course of people’s lives” (p. 723).^[39]

Social context has been a particularly important aspect of studies of information seeking in context. Chatman’s work exemplifies studies that carefully consider the influences of social contexts on all aspects of information behavior. For example, Chatman’s study of the information behavior of women prisoners suggests that “life in the round will, for everyday purposes, have a negative effect on information seeking” and that “people will not search for information if there is no need to do so. If members of a social world choose to ignore information, it is because their world is working without it” (p. 214).^[32] In this study, Chatman demonstrated a strong connection between information need and the social context or social world of the participants.

Lastly, research on everyday life information seeking (ELIS) has also evolved during this time period [^[34] #1276; ^[35] #1265; ^[36] #1275; ^[37] #1203; ^[38] #433; ^[39] #282]. This research focused on information seeking behavior as part of people’s everyday life experience as compared to job-related information behavior studies.

INFORMATION PARADIGMS AND MODELS

The concept of “information need” can be understood in greater depth according to three theoretical perspectives. As argued by Tuominen, Talja, and Savolainen, information science has evolved in three stages where each stage was dominated by a particular theoretical perspective.^[33] These three perspectives were labeled the “information transfer” model, the “constructivist” model, and the “constructionist” model. These three perspectives might also be termed the physical view, cognitive view, and social view, and are discussed in depth below.

Information Transfer Model

The transfer model or physical view of information need is based on the concept of demand for physical objects. This perspective considers an information system as a process for transmitting “information objects” such as books and documents. Based on this conceptualization, information need might be represented as a request for a physical document. The system might then be measured according to its capacity to deliver the physical objects meeting the information need. This view is tied to the conceptualization of information as a thing. This perspective has been influential in the development of methods to evaluate libraries and other information systems according to their ability to deliver books and documents on demand.

Constructivist or Cognitive View

Under the Constructivist or Cognitive View, “information needs” are seen in terms of the knowledge structures of people. This view seeks to understand information needs based on the mental models, processes, and relationships. Therefore, people’s information needs are based on knowledge or lack of knowledge about a topic, their level of proficiency regarding a process, and the cognitive processes they engage in to make sense of information.

Taylor’s work is exemplary of this constructionist or cognitive view. Considered a pioneer in LIS, before becoming Dean of the School of Information Studies at Syracuse University, Taylor worked as a reference librarian and developed a model of the information seeking process which articulated information need development through question formulation. This concept was described in two articles published in 1962 and 1968, the latter of which is most often cited.^[20,21]

Taylor’s conception of information need advances the idea that people progress through four levels of question formulation:

- Q1—the actual, but unexpressed need for information (the visceral need).
- Q2—the conscious, within brain description of the need (the conscious need).
- Q3—the formal statement of the need (the formalized need).
- Q4—the question as presented to the information system (the compromised need).

Taylor’s model is especially important as it was the first time the suggestion was made that a person may experience a sense of need for information before being conscious of it or able to articulate it. The very notion of such a concept creates an awareness of why professionals should support a user in articulating his or her information need and necessitates shifting the focus from information to that of understanding the user. Taylor’s model recognizes that the information need presented to a system or person is a compromised need and that a negotiation occurs between the stages of recognizing a need and presenting it to an information system. Therefore, the information need expressed to a system in the form of a query, for example, is only a representation of the information need and is constrained by the ability to fully articulate the need through the use of a language or set of tools. Taylor’s work preceded the user-centered shift in information science by close to two decades. Taylor’s levels of information need development continues to be often cited and an important underlying work for much research including the development of subsequent information models such as Belkin’s ASK model, Kuhlthau’s ISP model, and Dervin’s Sense-Making approach.

Informed by Taylor's conception of information need, several theories of information seeking arose that defined "information need" as being motivated by a sense of uncertainty. Theories falling under this category could be considered Belkin's Anomalous State of Knowledge, Kulthau's ISP, and Dervin's Sense-Making methodology.^[24,30,34,35] All these theories explain information need and the motivation for searching for information as being derived from a gap in knowledge which manifests itself as a sense of uncertainty. Although in comparison to Wilson's model they do not explicitly represent an external need that preempts an information need, they all recognize information need as a part of a larger situation. Dervin is especially clear in this regard conceptualizing a user as someone situated in context and in the process of defining their situation. Dervin's approach to situating a user in context has strong implications toward understanding the social view of information behavior although sense-making is most often considered as part of the cognitive view.^[36]

Social Constructionist or Social View

Those espousing a social constructionist perspective (the third theoretical framework according to Tuominen et al.^[33]), criticize the cognitive perspective for failing to fully recognize the impact of the social realm on information behavior. Hjørland, claims that Taylor's information need model is extremely individualistic and argues that "behind the concrete information seeking-process lies an information need that is an integration of the individual and the collective information need" (p. 168).^[10] This perspective and other holistic perspectives recognize that information need is not something static located in the user's head but as something dynamic that changes as the user interacts with information and society as a whole.^[10] This conception of information need recognizes need development as being socially situated, and that the needs of a group may be different than the needs of an individual, the needs of a group should be considered in addition to or instead of the needs of an individual.

Although Wilson's models are most often associated with the cognitive perspective, Wilson's concept of holistic "information need" might also be classified in the social realm. In his second model of 1981, Wilson made two propositions regarding information need. The first proposition argues that information need is a secondary need emerging from a primary need. A primary need is of a more basic nature encompassing needs such as food, shelter, companionship, and employment. Primary needs can be classified as the following:

1. Physiological needs—need for food, water, shelter, etc.
2. Affective needs—need for attainment, domination, etc.
3. Cognitive needs—need to plan, learn, etc.

The second proposition suggests that in the course of seeking information to satisfy their needs individuals will likely run into barriers of different kinds.^[2] In this paper, Wilson also proposed the idea of information behavior in context. The concept of information in context and the development of information needs in context was a precursor to the rise of interest in ISIC.

In his 1996 report Wilson further commented on the lack of progress in assessing information need:

At the root of the problem of information-seeking behaviour is the concept of *information need*, which has proved intractable for the reason advanced by Wilson in 1981; that is, *need* is a subjective experience which occurs only in the mind of the person in need and, consequently, is not directly accessible to an observer. The experience of need can only be discovered by deduction from behaviour or through the reports of the person in need (p. 6).^[37]

Wilson's models of information behavior have evolved throughout the past several decades [^[2] #1213; 9 #1118; 37 #1]. The significance of his treatment of information need in relation to information seeking behavior is the holistic or ecological nature of his model, which situates information behavior in a person's contextual setting. In his models of 1996 and 1999, Wilson separated information need from motivation—recognizing that information needs are not always acted upon. Others, such as Bruce have considered information needs in terms of personal information management rather than as the motivating force behind information seeking behavior. The personal anticipated information need (PAIN) hypothesis describes a person's struggle to anticipate their future information needs while making personal information management decisions related to the storage and management of information.^[38]

As discussed, there is a growing body of research that addresses information behavior in a social context and within this, research on information need is addressed. Notable research studies include those by Fisher and colleagues regarding information grounds, Harris and Dewdney on battered women, and Chatman's stream on marginalized populations.^[32,39–41] As a motivating research question, Chatman discovered that the expression and development of information needs were largely influenced by social factors. In environments such as a prison, she found evidence that information needs were socially constructed^[32]—findings that were confirmed by Fisher et al., in their studies of information flow in informal, social settings, or information grounds. Savolainen's^[39] model of information seeking in the context of way of life (ELIS) also addresses information behavior in a social context. As described by Savolainen^[42] the ELIS model "was developed to elaborate the role of social and cultural factors that affect people's way of preferring and using information sources in everyday settings."^[42]

Information need is a central concept to virtually all information models. It represents the starting point and motivation that brings a user to engage in the process of information seeking. The definition of information need is allusive and may best be defined according to the meta-theoretical framework used to guide research.

CONCLUSION

Research on information needs has taken new, exciting directions since the mid-1990s for three primary reasons: (1) important foundational work on “needs” had been carried out thus enabling exploration into new forays; (2) researchers have becoming even more interdisciplinary than in the past, applying rich ideas from other fields to their work; and (3) the advent of the Internet and the World Wide Web along with other new information and communication technologies facilitated more and new information behaviors that are more easily studied than in the past.

Promising research directions include research conducted on community information needs.^[39,43,44] Research on nonpurposive information seeking is expressed as serendipity and information encountering.^[45,46] Recognizing the role of lay mediaries in the information seeking process in terms of not only searching for information but also helping others realize their information needs through such phenomena as imposed queries and gate-keeping.^[47] Lastly, research on the process of knowledge structure transformation on information need development all show promising signs of furthering our understanding of information needs from multiple perspectives.^[48]

There is still much to learn about information needs. In his 1981 article “On User Studies and Information Needs” Wilson attempted to “reduce confusion by devoting attention to the definition of some concepts and by proposing the basis for a theory of the motivations for information seeking behavior” (p. 3).^[2] Although the LIS field has learned a great deal about information behavior while its theoretical frameworks have matured, questions regarding the nature of information need and how it relates to motivation remain. There is great promise that given the new directions of the past decade and the renewed interest in factors influencing information need, some of these questions will be answered.

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Information Needs and Behaviors of Diasporic Populations

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Abstract

Diaspora, which refers to the global and transnational spread of certain ethnic and religious groups, has been a reality for a long time. However, the increasing spread and ubiquity of new media technologies has in many instances accelerated the diasporic reality for many immigrant communities, facilitating transnational connections and senses of identity. In particular, the context of diaspora is affecting ways of approaching immigrant information behavior research. Specifically, diasporic information needs and behavior research takes account of the transnational information environments of these populations. Thus, immigrant communities are often part of rich, global information networks. New research is emerging which frames immigrant information research within a diasporic context, bridging local and global information needs and behaviors. Implications exist for rethinking concepts of assimilation, fostering cultural preservation and growth, and the development of enhanced social capital.

INTRODUCTION

In a world characterized by processes of globalization, both capital (often in the form of transnational corporations) and human beings increasingly traverse borders. The immigration of populations, often from the so-called “third-world” to the “first-world,” is a major characteristic of the modern age. The movement of human populations around the world is certainly not new, however, as mass displacements of people (both voluntary and forced) have occurred across the centuries. Thus, the African slave trade, which reached its peak in the eighteenth and early to mid-nineteenth centuries, is a prominent example of a forced and brutal migration of a population. On the other hand, however, middle-class immigrants from Asia and Eastern Europe who are working in the information technology industries in the West are examples of voluntary economic immigrants.

While the term “immigration” captures the movement of certain ethnic groups across international borders, the term “diaspora” refers to the global dispersion of various ethnic populations around the world. Diaspora is etymologically derived from the Greek word “diasperien,” which means “to sow or scatter seeds,” and has historically referred to displaced communities of people who have been dislocated from their native homeland though the movements of migration, immigration, or exile (p. 1).^[1] This term was originally applied to Jewish populations living in exile from their homeland, with later references to an African diaspora, accelerated by the slave trade. This term is now extended to refer to the global spread of a host of various ethnic groups, including Chinese, Indian, Haitian, Cuban, and Vietnamese populations, to name just a few. Thus, diaspora refers to a global spread of a population that transcends national boundaries, while

immigration focuses more specifically on communities living in a “host” or “adopted” land. Diaspora studies research is gaining in importance as a field of study, covering a range of disciplines in the humanities and social sciences.

Information needs and behavior research focus on the conscious efforts of individuals or populations to acquire information in response to needs or gaps in knowledge.^[2] The information needs and behaviors of immigrant populations have been studied to a modest degree in the literature of library and information science. Given the changing demographics of many Western countries and the increasing importance of immigration to the economic well-being of these countries, however, understanding the information needs and behaviors of immigrant groups is becoming an increasingly important endeavor.^[3] Immigrants are a diverse and heterogeneous group, and their information needs and behaviors differ based on a set of various economic, ethnic, and demographic factors.^[4] Research on immigrant information needs focuses on a range of issues such as settlement information, economic information, and information for cultural and civic engagement.^[4]

The context of diaspora is now being recognized in Library and Information Science (LIS), particularly in relation to the information needs and behaviors of immigrant communities. Diasporic information behavior research is most closely tied to diaspora research within the field of media studies. In the context of globalization, diaspora helps to situate the information environments of immigrant communities on an international scale, as the information realities of many immigrant communities stretch beyond the boundaries of Western nation-states. For instance, immigrant communities are often part of larger diasporic information and media markets, including

access to global satellite television and international Web sites.^[5] Thus, transnational information networks play an important role in understanding diasporic information needs and behaviors.^[6] This entry presents an overview of the current state of diaspora research within the context of LIS, a new area of research within the field, which extends the contours of immigrant information behavior research. The following sections discuss prominent themes in diaspora research, diaspora and media studies, immigrant information-seeking research, and the emerging field of diasporic information research.

DIASPORA RESEARCH: PROMINENT THEMES

The field of diaspora studies is a growing area of study, with coverage in fields as diverse as literature, sociology, anthropology, film studies, queer theory, area studies, and ethnic studies.^[1] Some of the leading theorists on diaspora include Arjun Appadurai, Homi Bhabha, Stuart Hall, Paul Gilroy, Lisa Lowe, and Aihwa Ong, to name a few. Diaspora studies is a diverse area, with a wide range of differing perspectives and viewpoints. Diaspora in fact is a contested term, with some scholars focusing on its liberatory potentials, while others are cautious about its limitations and abilities to transcend existing social and power dynamics.^[1] Diaspora does not, for instance, transcend differences of race, class, gender, and sexuality, nor can it be disassociated from these categories of analysis [7, as quoted in 1]. In certain cases, diasporic identities might be subject to hegemonic influence by dominant groups and elites, and can reinforce existing ideologies and power structures.^[8] Thus, while offering new possibilities for expressing transnational identity, diaspora is also subject to the same power structures and forces that shape other social formations.

Diaspora studies is related to the concept of globalization, but the focus is on the dispersion and movement of populations around the globe, rather than the movement of corporations and global capital. The following subsections will focus on a few prominent themes in diaspora research. The first subsection discusses in detail some of the differences between diaspora, transnationalism, and globalization. The next subsection discusses the related themes of hybridity, imagination, and identity—it is widely argued in the literature that diasporic communities often reside within *in-between spaces* across different cultures, which allows for a fluid and flexible sense of identity. The last subsection focuses on the role of diaspora in critiquing dominant views of the nation-state, as diaspora may allow for a certain *postnational* sensibility for people beyond the traditional rubric of nation-states.^[9]

Globalization, Transnationalism, and Diaspora

The importance of diaspora as a framework for understanding the information needs and behaviors of certain

ethnic groups cannot be discussed without reference to globalization. Globalization is seemingly the buzzword of the twenty-first century—while a concept that is complex and contested, a certain agreement exists about its occurrence and tangibility. Globalization, whether of the top-down, corporate-dominated variety,^[10] or in its more grassroots conception, is fundamentally concerned with the increasing interconnectedness of social, political, economic, and cultural relations in the world. This interconnectedness is manifested in global flows of capital and labor, especially with regard to immigration from the global “South” to the “North.” Globalization, however, often is associated with logics of cultural homogenization and the dominance of Western values and interests.^[10]

Diaspora, transnationalism, and globalization are related terms, but are not necessarily the same, however. As Brazil and Mannur^[1] discuss:

While diaspora may be accurately described as transnationalist, it is not synonymous with transnationalism. Transnationalism may be defined as the flow of people, ideas, goods, and capital across national territories in a way that undermines nationality and nationalism as discrete categories of identification, economic organization, and political constitution. We differentiate diaspora from transnationalism, however, in that diaspora refers specifically to the movement—forced or voluntary—of people from one or more nation-states to another [p. 8].

A difference between diaspora and transnationalism, therefore, is the distinction between the often impersonal forces of globalization and global capitalism, and the lived experience of migration and dispersion. Transnationalism, in its dominant version of global capitalism and global institutions such as the International Monetary Fund and the World Bank, is often associated with processes of cultural and economic homogenization.^[11] In contrast, some argue that a focus on diaspora emphasizes forces of cultural heterogeneity.^[9] Diaspora and the networks of people and associations across borders can be viewed as a form of “globalization from below,” in contrast to the top-down globalization characterized by large corporations and increasing homogeneity.^[15]

Hybridity, Imagination, and Identity

Diaspora is a contested term, with a range of political and cultural meanings. The nostalgic dislocation from a “homeland” has traditionally characterized concepts of diaspora, but increasingly differentiated meanings of the concept now proliferate.^[11] For instance, diaspora and the *diasporic identity* of these populations are often marked by hybridity and heterogeneity, in cultural, linguistic, ethnic, and national terms.^[11] Hybridity and heterogeneity thus often define diasporic identity, an identity that is not necessarily fixed and is often “deterritorialized” (p. 37).^[19]

For instance, Appadurai^[9] discusses deterritorialization in the following way:

As Turkish guest workers in Germany watch Turkish films in their German flats, as Koreans in Philadelphia watch the 1988 Olympics in Seoul through satellite feeds from Korea, and Pakistani cabdrivers in Chicago listen to cassettes of sermons recorded in mosques in Pakistan or Iran, we see moving images meet deterritorialized viewers [p. 4].

Thus, the process of deterritorialization is related to an internationalized sense of identity for many diasporic communities. Diasporic identity formation is a creative process that takes place often at the intersection of various nations and cultures.^[9]

Diasporic identity and consciousness is also a “work of the imagination” (p. 5)^[9] as diasporic communities endeavor to reimagine homelands and also articulate diverse and hybrid adaptations of cultural reality. Thus, diasporic identity and consciousness can be thought of on the one hand as a process of re-creating cultural spaces, but on the other hand as also part of an imaginary construction of identity. Benedict Anderson’s work^[11] on the role of print capitalism in the creation of imagined national communities provides a foundation for Appadurai’s work, as Appadurai extends this thesis to the role of electronic and new media for the creation of diasporic identity. Thus, according to Appadurai, the role of electronic and new media is important in facilitating these works of the imagination.^[9] These media sources and networks help in the process of diasporic identity construction and map out spaces for expressing this identity.^[5]

Appadurai’s framework for understanding the implications of globalization and new media for diaspora is influential in the field of diaspora studies. He lays out the following dimensions of this framework for understanding the new global economy in terms of “-scapes”: 1) ethnoscares (people who move between nations, such as tourists, immigrants, exiles, guestworkers, and refugees); 2) mediascapes (electronic and new media); 3) technoscapes (technology, often linked to multinational corporations); 4) financescapes (global capital, currency markets, and stock exchanges); and 5) ideoscapes (official state ideologies and counter-ideologies) (p. 25).^[12] These -scapes provide a lens to understand the disjunctions in the global cultural economy.^[12] All of these dimensions are global in nature, while at the same time diasporic communities develop their own local articulations of these dimensions. The focus on mediascapes has had the most impact on diasporic information behavior research. Appadurai^[9] further describes mediascapes as follows:

Mediascapes refer both to the distribution of the electronic capabilities to produce and disseminate information (newspapers, magazines, television stations, and film-

production studios), which are now available to a growing number of private and public interests throughout the world, and to the images of the world created by these media [p. 35].

In addition to Appadurai, Homi Bhabha^[13] discusses the notion of diasporic spaces, which is influential in the field of diaspora studies. He argues, for instance, that the movements of populations around the world have created spaces that are neither part of the “homeland” nor the “adopted country.” Bhabha^[13] discusses this in-between zone of diasporic communities as a “Third Space,” an area of identity articulation outside the homogenizing narratives of Western modernity. Bhabha discusses this Third Space as a way for diasporic communities to engage with and create new articulations of modernity. Beyond the case of diasporic communities, this Third Space of enunciation also problematizes the inherent originality and purity of cultures, as even Western cultures (despite claims to homogeneity) demonstrate hybridity.^[13] Thus, diasporic identity (and the concept of identity in general) is viewed as a hybrid and shifting concept, in contrast to notions of a *pure* identity.^[14] Diasporic groups are thus able to navigate a range of identity formations, depending on various local and global inflections.

Diaspora and the Narratives of the Nation-State

Another theme that occurs within the literature of diaspora is the disruption of the dominance of nation-states in identity formation and creation. Some scholars argue, for instance, that we are entering a stage of postnationalism,^[9] with the nation-state receding into the background, as transnational forces hold greater sway. As Braziel and Mannur^[1] state:

...diaspora forces us to rethink the rubrics of nation and nationalism, while refiguring the relations of citizens and nation-states. Second, diaspora offers myriad, dislocated sites of contestation to the hegemonic, homogenizing forces of globalization [p. 7].

The transcendence of the nation-state as a main shaper of identity is a theme that is echoed in much of the diaspora literature.^[5,9] Appadurai,^[9] for instance, argues that the United States needs to examine its understanding of immigration issues and multiculturalism. As he discusses in regard to the United States, “neither popular nor academic thought in this country has come to terms with the difference between being a land of immigrants and being one node in a postnational network of diasporas” (p. 171).^[9] The discourse of diaspora appears to challenge dominant narratives of fixed national identity and the primacy of the nation-state as a major cultural shaper. However, other forms of nationalism and ethnic identity may be privileged in lieu of traditional discourses of the

nation-state [15, as quoted by 5]. These nationalisms may be chauvinistic in nature or highlight particular politically charged and controversial notions of identity, as in the case of the imagined nation of “Khalistan” for Punjabi Sikhs in the 1980s (p. 36).^[12] Thus, diaspora may create different senses of imagined national identity beyond the nation-state.

DIASPORA AND MEDIA

This section provides a brief overview of prominent research in diasporic media studies. Appadurai’s work on mediascapes is influential in this line of study, and diasporic media research is closely related to diasporic information needs and behavior research. Electronic media are playing an increasingly important role in the development of diasporic consciousness as “moving images meet deterritorialized audiences” (p. 4).^[9] Recent scholarship on diaspora and media spans a wide range of ethnic groups and types of electronic media.^[5,14,16,17] For instance, Karim^[5] has edited an influential book which highlights some prominent research in the field of diasporic media studies.

In this edited volume, Manas Ray^[18] discusses the role that the Mumbai-based film industry of “Bollywood” plays in the identity construction of Fiji Indians. For this ethnic group, which has been displaced from the Indian “homeland” for several generations, Bollywood is playing a role as an information source in the construction of an imagined sense of identity and nationhood.^[18] Naficy^[19] discusses the role of “narrowcasting” in diaspora, how television programming for diasporic Middle Eastern groups can provide information and entertainment. In the case of Middle Eastern groups and other diasporic groups in general, both ethnic television (usually produced in the host country) and transnational television (media that is imported from overseas) play a role.^[19] DeSantis^[20] provides examples from the Latin American television environment in North America, as Mexican and Brazilian programming are gaining new audiences in this market. Thus, television can play an important role as a diasporic information source, both for purposes of entertainment and identity formation.

The Internet is also increasingly a space for negotiating diasporic identity and the sharing of diasporic information. Mandaville,^[21] for instance, discusses the role of the Internet in the creation of a virtual *ummah* (world community of Muslims) in the Islamic diaspora. In particular, Mandaville^[21] discusses how dominant discourses of Islam can be challenged by dissenting voices on the Internet, especially within the context of Western Europe and North America. A sense of virtual community amongst Muslims living abroad can be developed, and this identity often has local inflections and connotations.^[21] This ability for the Internet to provide a space for new articulations

of identity is echoed in the experiences of countless other ethnic groups. For instance, in the context of Greek populations, Tsaliki^[22] discusses how the Internet can embody Bhabha’s^[13] notion of the Third Space, as it can provide an “in-between space” between the nation and its diaspora, allowing for rearticulations of national narratives.

In addition, the work of Mitra^[23] on immigrant identities in “cybernetic space” discusses how Indian immigrants are interacting in online spaces in a process of identity formation. In the context of local, immigrant country spaces that may be threatening to an expression of immigrant identities (especially in a post-9/11 world in the United States), Mitra^[23] argues that online spaces offer an opportunity to re-create some of the physical places that have been lost for Indian immigrant communities. These examples highlight just a small portion of the growing literature on diasporic communities and their often empowering uses of the Internet.

Despite the liberating possibilities of the Internet and new media for diaspora and diasporic identity, research has also shown the potential for fragmentation, homogenization, division, and the replication of inequalities. In the case of the Indian diaspora, for instance, some scholars question the imposition of a monolithic understanding of Indian identity, often defined by Hindi language films and Hinduism.^[24] The reality of the Indian diaspora (and all diasporas in general) is that it is a multiplicity of diasporas, influenced by factors such as class, religion, language, and country of residence, to name a few factors.^[25] Issues of religious extremism and ethnic chauvinism are also a concern in the discourse of diasporic media research. Economic and technological elites can reproduce understandings of religion and culture that may not reflect the diversity of diaspora.^[8] In terms of the Indian diaspora, research has shown that Hindu nationalist discourses are being privileged, along with middle-class Hindu notions of Indian identity.^[8,26] However, the Internet can also provide spaces for marginalized voices to contest the hegemony of these dominant narratives.^[8,21] Thus, information and communication technology (ICT)-mediated diasporic information sources can both disrupt and reinforce hegemony.

IMMIGRANT INFORMATION-SEEKING BEHAVIOR RESEARCH: KEY THEMES

The reality of globalization and diaspora is affecting information seeking research as well, although it is often not explicitly referenced or referred to as such. This intersection with globalization is manifested in research focusing on the information-seeking behavior of immigrant groups. The cultural diversity of information seeking behaviors and needs is now widely recognized as an important area in the field. In the West, and especially in a post-9/11

world, immigration (both legal and illegal) and discourses about immigration are often center stage in political, economic, and national security debates. Immigrant information-seeking behavior research is related to and has a longer history than diasporic information behavior research, and this section discusses some of the main themes in this research area.

The information needs and behaviors of immigrant groups, as various studies have shown,^[4,27–29] often differ from the information needs and behaviors of dominant and mainstream groups in society. Depending on the immigrant community and variations in economic status, information needs vary, covering a wide range such as basic English literacy information, information about basic living skills in the new country to information about maintaining cultural ties to the home country, to name a few. The implications of these types of studies are important in the better design of information services and ICT-enabled information resources that meet these particular behaviors and needs. While immigration occurs at all socioeconomic levels in the United States and other Western countries, particular concerns arise regarding the needs of low-income immigrants and the reality of *information poverty* and the *digital divide*.

A valuable body of work dealing with immigrant information-seeking behavior already exists, and the work of Metoyer-Duran^[27] on ethnolinguistic gatekeepers is an important example. Gatekeepers in ethnolinguistic, minority communities in the United States, according to Metoyer-Duran^[27] “act as agents of acculturation when they disseminate information within their communities” [p. 320]. Thus, gatekeepers are key information agents and disseminators within these communities. She identifies two major “domains” in which gatekeepers operate—the cognitive and affective. She describes the cognitive domain in relation to established theories of learning that promote the hierarchical acquisition of knowledge, while the affective domain is concerned with the gatekeeper’s cultural orientation toward information needs and use. While the details of these domains are not important to this discussion, the subsequent “profiles” that Metoyer-Duran derives in relation to these domains has important consequences for understanding the information seeking behavior of these groups. She defines six different profiles for gatekeepers as: 1) impedor; 2) broker; 3) unaffiliated gatekeeper; 4) affiliated gatekeeper; 5) information professional; and 6) leader/executive.

Another strand of research in immigrant information seeking is the work on “information grounds.” According to Fisher, information grounds are “environment(s) temporarily created when people come together for a singular purpose but from whose behavior emerges a social atmosphere that fosters the spontaneous and serendipitous sharing of information” (p. 811).^[30] The key qualities of “information grounds” are their temporality and existence in “nontraditional” information environments. Examples

of information grounds include restaurants, hair salons, buses, medical offices, and grocery store queues, to name a few. For example, this particular kind of information grounds research is found in “Information Grounds and the Use of Need-Based Service by Immigrants in Queens, New York: A Context-Based, Outcome Evaluation Approach”.^[31] The researchers in this article focus on exploring how programs in literacy and coping skills run by the Queens Borough Public Library (QBPL) in New York City might function as information grounds. The researchers conclude that these programs constitute a “grand context,” and a rich information grounds for immigrant populations. Some gains achieved in these programs include improved coping skills and technology skills, and better preparation for employment. Other immigrant information grounds research points to the strength of interpersonal networks as sources of information, as the choice of which information ground to visit is related to factors such as ease of communication and perception of increased reliability of sources in these environments.^[28] Also, given the language, cultural, and economic barriers and the deep extent of everyday needs that some immigrant communities face, interpersonal sources of information are often preferred sources.^[28]

Other prominent studies on immigrant information behavior include Chu’s^[29] work on immigrant child mediators (ICMs). This study focuses on how immigrant children can serve as cultural, linguistic, and information intermediaries for immigrant parents. Chu provides suggestions for librarians on how to effectively address the needs of this group. While interpersonal networks and the use of intermediaries are important in the discussion of immigrant information behavior, the role of social capital is also important in this area of research. Caidi and Allard^[4] discuss how information access for immigrant communities can become part of developing the social capital of these communities. Social capital is a term used in various literatures, and according to Putnam,^[32] it is related to “social organization such as networks, norms and social trust that facilitate coordination and cooperation for mutual benefit” (p. 67). Social capital is related to enhanced connections to resources for immigrant communities with the potential for enhanced social inclusion and civic participation.^[4] The next section extends these ideas into the context of diasporic communities.

DIASPORIC INFORMATION BEHAVIOR: EXTENDING IMMIGRANT INFORMATION RESEARCH

While many immigrant communities in North America and the Western world are part of rich and layered diasporic communities, much of the research in LIS and information studies does not yet reflect this reality. One of the first major studies exploring the role of diaspora in

immigrant information-seeking behavior is Srinivasan and Pyati's^[6] article in the *Journal of the American Society for Information Science and Technology*, entitled "Diasporic Information Environments: Reframing Immigrant-Focused Information Research." These authors argue that studies of immigrant information behavior need to be situated within the dynamic contexts of globalization and diaspora. Specifically, they propose a methodology for understanding diasporic information behavior through the lens of what they term a *Diasporic Information Environment Model* (DIEM).^[6] This model links the local, place-based information environments of immigrant communities with the global, transnational ICT-mediated information environments of these groups. Methodological frameworks such as reflexive ethnography, social network analyses, and community-based action research are discussed as ways to develop local and global analyses of diasporic information behavior.

Srinivasan and Pyati^[6] draw in major part from the work of Arjun Appadurai, one of the leading scholars in theorizing ICT-mediated diasporas. He talks about the increasingly important role of ICTs and ICT-enabled technologies in the process of maintaining and creating diaspora, helping to further create "works of the imagination."^[6] As globalization becomes increasingly defined and mediated by ICTs, immigrant groups and their information-seeking behavior are being shaped by diasporic forces enabled by information technology.

The complex association between diasporic groups and ICTs has led to a concept of e-diasporas that actively utilizes ICTs to achieve community-specific goals.^[6] A scenario of moving migrants has made e-diasporas critical for the formation and sustenance of community for immigrant groups.^[9] Appadurai argues that nation can be formed in cyberspace, and often cyberspace serves as the sole means of providing a sense of aspiration and hope to placeless migrant populations.^[33]

The DIEM of Srinivasan and Pyati^[6] works to bridge local and global information environments by recognizing the transnational and fluid identities of immigrant and diasporic communities. Thus, these authors acknowledge the importance of local information grounds and local networks, but also recognize the increasing importance of diasporic Web sites and transnational networks for information.^[6] The authors illustrate this bridging of local and global information sources through a discussion of the Somali diaspora. Srinivasan^[34] has conducted research with Somali refugee communities in Boston, noting that this community is not isolated, as it is in constant communication with refugee pockets in other parts of the United States, Kenya, and Italy. Srinivasan and Pyati^[6] discuss how this diasporic community's needs can be effectively studied by the DIEM. For example, they discuss how social network analyses can identify the transnational information networks of this community, which can result in better community service models. The DIEM also

emphasizes community-based research which can help engage local communities to address and articulate their own information needs. The major difference between diasporic and immigrant information behavior research, as identified in the work of Srinivasan and Pyati,^[6] is an emphasis and recognition of the globalized nature of information resources for certain immigrant communities. The understanding of connections of immigrant communities to different information networks and resources beyond the local environment is a contribution of a diasporic perspective. Implications exist for the preservation and growth of culture,^[6] and this perspective emphasizes the sometimes hidden information assets of immigrant communities.^[33]

Related to the diasporic information behavior perspective is the importance of social capital and social inclusion. Caidi and Allard^[4] discuss the role that information access can play in furthering these ideals. These authors emphasize an understanding of social inclusion that is not related to social cohesion, but rather makes visible and breaks down barriers that prevent full participation in new host countries.^[4] According to these authors, "social inclusion values diverse identities and fundamentally questions both the process and result of social inclusion" (p. 313).^[4] Thus, social inclusion can be framed as a way for immigrant communities to embrace diasporic identities, while also taking part in local civic life. This orientation can have implications for information services to these communities as librarians and other information service providers can be more aware of the global and diverse nature of immigrant information environments. Thus, information for social inclusion and cultural preservation may come from diasporic and global sources. As the world becomes more globalized, concepts such as citizenship and assimilation are being problematized.^[9] Meeting the information needs of diasporic communities largely overlaps with the domain of traditional immigrant information services but brings the added perspective of providing information for global citizenship and identity. This perspective acknowledges the lived reality of diasporic communities and recognizes the Third Space^[13] of diasporic identity, a fluid and hybrid space of agency for these communities. An increasingly globalized and arguably *postnational* world may spur increasing research focused on diaspora within LIS.

CONCLUSION

This survey of the information needs and behaviors of diasporic populations has highlighted the increasing importance of ICTs and new media in the creation of "e-diasporas." Diaspora, which refers to the global and transnational spread of certain ethnic and religious groups, has been a reality for a long time; however, the increasing spread and ubiquity of new media technologies has in

many instances accelerated the diasporic consciousness of many immigrant communities. This discussion began with a brief overview of what diaspora means in the context of globalization, and how it is affecting ways of approaching immigrant information behavior research. Specifically, studying the information needs and behaviors of diasporic populations takes into account the often transnational information environments of these populations.

While the information needs and behaviors of diasporic populations mirror key ideas and concepts in standard immigrant and ethnolinguistic minority information behavior research (e.g., gatekeepers, information grounds, importance of personal social networks, etc.), diasporic information needs research is adding a globalized perspective to understanding these information needs and behaviors, providing a space to understand the global-local tension in immigrant information environments. For instance, immigrant groups are increasingly looking toward transnational and ICT-mediated sources of information not necessarily tied to a particular location. Due to the increasing influence of new media technologies, a diasporic consciousness and identity often accompanies information resources for these groups. New research that specifically looks at the relationship between the global and local nature of immigrant information environments is beginning to appear in the LIS literature,^[6] and it is likely that more research will continue to emerge that takes into account the larger context of globalization and diaspora.

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Information Needs and Behaviors of Populations in Less Developed Regions

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Abstract

The information needs of the peoples of the developing regions are for work-related activities, leisure, consumption, and daily survival. Due to low literacy levels and ignorance about other sources, the general information-seeking behaviors include passive quests for information and heavy reliance on opinion leaders, rumors, and oral sources, with the library often the least preferred source for information. Even with an emphasis on the seeking of information for utilitarian purposes, people generally have not adopted the habit of utilizing information resources such as libraries and information centers in their work, life, and study. Due to their urban locations, distance and poor information infrastructures, libraries and information centers are not patronized frequently and regularly by many potential users, who instead resort to the use of their own personal collections and individual contacts. In the face of poor retrieval devices, browsing is the most favored approach to determine the relevance of materials to be consulted. In some instances people use information outside that for which they express interest. The predicament of libraries and information centers in developing regions is made worse by lack of local content, the failure to develop indigenous knowledge systems, and especially the advent of information and communication technologies (ICTs). The latter have brought about further lower patronage because most libraries and information centers cannot afford the ICTs. Finally, the inefficiency of general municipal services makes the information seeker exert more effort and spend more time to access information than might be expected in developed countries.

INTRODUCTION

This entry will provide an understanding of the information needs and behaviors of people in developing regions. “Information needs” refers to the information that people require to conduct their businesses and live their daily lives. “Information behaviors” are the tendencies and approaches exhibited by people while seeking out information.

All human beings need information, regardless of where they live. It is required for individual growth and development, and by extension, societal growth and change, too. Information is needed both for personal, social and/or work-related activities of individuals and for development of societies and states.

As information-dependent organisms, human beings have discernible ways of looking for information to meet their information needs. However, for reasons to be discussed, access to information through libraries and over the Internet, while increasingly common in the developed world, is limited in developing or underdeveloped countries. Rather than drawing on these sources for information, people in developing countries often use a variety of other information-seeking resources that are more readily available.

THE CONCEPT OF DEVELOPING COUNTRIES

Based on their economies, the World Bank has classified the countries of the world into low, middle, and high income economies. According to the Bank, “low income and middle income economies are sometimes referred to as developing economies” or countries.^[1]

The developing countries of the world are those with low standard of living, a weak industrial base, and a generally low human development index score. Among the outstanding features of developing countries are widespread poverty and low capital formation. The developing countries are found especially in sub-Saharan Africa, Asia, the Pacific, Latin America, the Caribbean, etc. The factors responsible for the under-development of these countries are many and are subsumed under social, political, and economic considerations. Among the many political and economic considerations is improper access to education and information.^[2]

FRAMEWORK OF THE ENTRY

The framework for this entry is based on an adaptation of Ranganathan’s categorization of human knowledge.

Ranganathan categorized human knowledge using concepts of “personality,” “matter,” “energy,” “space and time” (PMEST) (p. 452).^[3] This categorization also can be used to understand human information-seeking behavior by drawing the following analogies:

- “Personality” includes individual information seekers and individual information-seeking behaviors occurring in the information environment, both of users and managers, their social networks, etc.
- “Matter” includes the information and information resources, access systems and technology.
- “Energy” entails the problems/goals, processes and tasks undertaken in the course of information provision.
- “Space” entails the work space, organization, country, or geographic unit.
- “Time” entails episodes, intervals, and total time needed for information to be accessed.

“PERSONALITY”: INDIVIDUALS AND INDIVIDUAL INFORMATION SEEKING IN THE DEVELOPING WORLD

At the most basic level, one might simply explore the ways individuals seek information, which could be through any or a combination of the following ways (p. 3):^[4]

1. Experiment(s) or adopting a trial and error approach.
2. Asking colleague(s) or discussing with him/her (them).
3. Consulting personal collections for relevant information sources.
4. Observing nature or environment for needed information.
5. Consulting library/information centers for information either through self-help or consulting the librarian/information professional.

Information-seeking behaviors vary considerably from one individual to another according to age, gender, level of education, occupation, location, religion, culture, etc. It is very difficult, if not impossible, to identify common information-seeking behaviors for all the peoples of the developing regions of the world. This entry therefore will not attempt to identify common individual information-seeking behaviors in different countries and cultures of the developing world.

Rather, this entry will explore some general parameters influencing information-seeking behavior of types or groups of individuals in developing countries. Information-seeking behavior is the noticeable, and in some instances, the unnoticeable traits individuals exhibit or ways they adopt in the course of seeking out needed

information. It is the purposive seeking for information as a consequence of a need to satisfy some goals.^[5] Information behavioral traits would be exhibited in the course of passive attention, passive search, active search, or on-going search for information (p. 433).^[6] Information-seeking behavior is therefore both a function of recognition of one’s needs for information, and knowledge of, availability of, and ability to make use of information services and resources to meet ones perceived information needs. We will consider parameters affecting meeting of the information needs of four types of individuals found in developing countries: students, professionals, farmers, and artisans. For all four groups costs, quality, or availability of information resources such as libraries, information centers, and some information networks more commonly accessible in more developed countries (e.g., professional conferences) limit their information access and contribute to their use of alternative means to obtain information.

There are millions of students engaged in academic pursuits or the pursuit of professional qualifications in the developing countries. Primarily, they require or need information to support or facilitate their academic pursuits. They would also require information for daily survival, such as information on where to get access to health care delivery, foods and drinks, clothing, spiritual needs, etc. Even though there are millions of such students, their social/professional networks are limited because of the constraints of economic resources and technological considerations. They are, therefore, hardly ever able to attend conferences, whether international or local, just as they hardly ever subscribe to journals, newsletters, etc., on their own. Due to high costs, they cannot subscribe to the membership of learned societies on their own either, even in situations where they are offered student rates. Students in developing countries are therefore more dependent for information than those in developed countries on school or university library resources that are often much poorer in quality, breadth, depth and being up to date than those in developed countries—or on other students and professors or teachers with whom they are in direct contact.

Professionals in the developing countries, as in the developed countries, include engineers, health care practitioners, legal practitioners, teachers, administrators, scientists, etc. Professionals require information to support their respective practices, and for their day-to-day living as well. Professionals in developing countries aspire to and do maintain social/professional networks, which afford them the opportunity to attend local and international conferences to discuss and exchange ideas with colleagues; subscribe to journals and newsletters; and subscribe to the membership of learned societies. However, owing to economic and technological constraints, among other reasons, most of them are unable to develop their social/professional networks to be able to acquire the needed material for research and other purposes. This contrasts with the situation of their counterparts in the developed world who

can and do develop and sustain such networks. There are, for example, professionals in the developing countries who, because of inadequate remuneration, cannot afford \$100 a year to initiate and retain membership of a single learned society. Some other professionals are unwilling to pay that much even if they can afford it because of competing needs for the money. In fact, in Nigerian universities, the highest paid professors are entitled to only \$300 a year for learned societies and \$600 for journal allowances. These amounts can hardly pay, on the average, for more than two learned societies and two journals from abroad. Due also to poor institutional funding, professionals in developing countries can hardly attend international conferences either, except in the few instances that they are sponsored by international organizations. In general, professionals in developing countries have fewer social/professional networks than their counterparts in developed countries because of these obvious limitations.

The farmer, artisan, and other less skilled workers also require information to further their practices and for their daily survival. It is probably with this category of information seekers that there would be the most major differences in terms of information needs and seeking behaviors when compared to their counterparts in the developed countries. This is so because of the big disparity in the levels of education of farmers, artisans, and less skilled workers in developing countries. In fact, in the developing regions, the majority of farmers, artisans, etc., are generally people with little or no education. Because of their low levels of education and general lack of exposure to a variety of information resources, they may not know how to go about meeting their information needs, or even if they know, they tend to wait passively for their information needs to be met instead of taking proactive measures to meet them.

Another big drawback for farmers, artisans, and less skilled workers is the lack of information in the language or form they would be able to access. Many of the developing countries, especially those in Africa have multi-ethnic groups with their own languages, yet the libraries and information centers provide information mainly in colonial languages such as English, French, Spanish, Portuguese, German, etc. Even then, libraries and information centers are available much more often in urban areas than in rural areas.

“MATTER”: INFORMATION AND INFORMATION RESOURCES IN DEVELOPING COUNTRIES

For the developing countries of the world, just as for the developed countries, information ought to be available to support the needs of the people for career-related activities, consumption, leisure, etc. Such information is available from a number of sources. Some developing countries have acknowledged the need for and attempted to provide

information resources to their populations. For example, Cai and O’Keefe (p. 23)^[7] report that both scientists and farmers in China have access to information through agricultural journals. It was also reported of China that the Management Data Team and the Library Resource Team disseminated information to village people, including farmers (p. 70).^[8] The latter effort was funded by the International Development Research Centre based in Canada. In contrast, in the Philippines urban Filipinos were better served than their rural counterparts (p. 10).^[9]

As shown by the above cases, there are a few instances of other developing countries where information is readily available, especially to urban populations. In general terms, however, most of the developing countries are both information-poor and information-starved. They are information-poor because they do not experience the kind of information flood experienced by the developed world. They are information-starved because they do not have the means to acquire the materials and infrastructure that contain needed information, or the economic resources needed to pay personnel to acquire, organize, and maintain access to the information. Developing countries, therefore, in most instances have to wait for donations, and those donations often provide outdated or non-relevant information resources.

In the developing countries, much like the developed world, current information for ready application is required. The information resources available to the populations of the developing world include print but also non-print materials, including databases (both online and offline). Electronic databases are available for use in the few libraries and information centers that have been automated and/or digitized. Where they exist libraries and information centers are located mainly in urban and semi-urban areas, with the implication that rural dwellers often do not have access to the resources to meet their information needs. Book mobiles (whether motor vehicles, boats, donkeys, etc.) are not as popular as they used to be in the past because they are little encouraged.

Information access systems in the developing countries are not well developed and coordinated because of the lack of the wherewithal of individual libraries to develop them, which is made worse by their failure to enter into cooperation and collaboration. The instances of cooperation and collaboration, where they exist, are few. This is even made worse by the fact that in most countries of the developing world, the necessary information and communication technologies (ICTs) and infrastructure required for information handling are not available.

Another issue is that most information professionals lack the necessary and requisite ICT skills. Inadequate training and human resource capacity was identified as a problem threatening the continued existence of the rural knowledge centers (RKC) in East Africa. This lack of capacity is not limited to ICT use, but there is a general lack of human resource capacity to manage even

conventional information resources and services in the developing countries such that they can meet the information needs of the communities they are meant for.

Recently and increasingly, however, there has been a considerable measure of investment in ICT acquisition and usage in many parts of the developing world, especially in rural communities, provided through international donors. On this score it has been observed with regard to East Africa that:

Rural knowledge centers, also known as community telecenters, are becoming a popular model for delivering ICT in rural areas, especially in developing countries where information and communication facilities are limited. The past decade has witnessed an explosion in projects that apply ICTs to support socio-economic development (p. 145).^[10]

These RKC include simple telephone shops, market information centers (MIC), market information prints (MIP), multipurpose community telecenters (MCT), etc. The MICs and MIPs are a creation of the Kenya Agricultural Commodity Exchange Limited, aimed at assisting small scale farmers with up-to-date market information services such as good prices for their produce and where to sell and buy at such prices, commodity stocks, etc. The ICT components of the MICs include computers and mobile phones, which farmers use to access current information. From the MICs, information is downloaded and distributed to the MIPs every market day (p. 15).^[11]

The multipurpose community centers are the most sophisticated of the RKC. Their services include telephony, Internet searching, satellite broadcasts for radio and video shows, fax, e-mail, etc. Using the examples of MCTs in East Africa, located specifically at Nakaseke, Buwama and Nabweru in Uganda; and Sengerema in Tanzania, it was reported that these centers undertake a number of projects that offer information on agriculture, education, health, and indigenous knowledge (p. 145).^[11] The information services deriving from these projects profoundly affect the ways of life of their host communities in several ways. These include opportunities for income-generating activities for farmers and local entrepreneurs who search the Internet for information on markets and agrochemicals, updating professionals with information in the fields of work as well as advertisements for job opportunities, and providing access to learning resources for students.

Despite these recent advances and occasional successes, the general prevailing practice in most developing countries is that ICT use has not impacted on information provision in a widespread way. Apart from the centers often being sparsely used, the general lack of much ICT infrastructure, replacement/update capacity, and trained personnel remain daunting challenges.

Another reason is the failure of most developing countries to develop their indigenous knowledge systems (IKS), which would have complemented the information coming from western knowledge systems (WKS), most of which emanate from the developed countries. It is observed of this situation that information flows in developing countries are segmented, divisive and uncoordinated (p. 2).^[12] Although it may arrive late (and already outdated) in printed form, WKS information is much of what can currently be obtained over the Internet and through ICTs. Professionals such as medical doctors in developing countries might be able to obtain WKS information about disease treatment, yet would also require IKS information about the traditions and cultures of the populations they serve in order to serve them well. Otherwise, if WKS information services offend the sensibilities of the populations served, they might not let themselves be served. It was reported of health workers in Upper East Region of Ghana that they required information about the beliefs, taboos, festivals, etc., of the people to be able to deliver acceptable medical practice to them (p. 367).^[13] Although developing countries have been slow in making IKS information available through channels such as libraries and information centers, indigenous knowledge items often remain available through rich oral traditions, ceremonial practices, etc. These oral traditions and active practices remain a positively valued alternative source for obtaining a wide variety of information.

“PERSONALITY” AND “MATTER”: THE INTERPLAY OF INFORMATION AND INFORMATION RESOURCE AVAILABILITY AND THE USE OF ALTERNATIVE INFORMATION-SEEKING BEHAVIORS

In most developing countries, professionals like engineers, scientists, technologists, medical doctors, pharmacists, etc., are unable to have most of their professional work information needs met because of the many factors reported in the last entry. A study conducted on the information needs of scientists and technologists in Nigeria revealed that libraries and information centers were unable to meet their information needs due to poor stocking and staffing. Current journals and databases lack good retrieval systems and interlibrary loan facilities. The other shortcomings included inadequate information sources and the poor orientation of library and information center staff to responsive reference services (p. 137).^[14] This study was conducted in the 1990s but the situations have generally not changed even with ICT availability, which for most libraries and information centers in the developing countries, is still a mirage. It is instructive to mention here that the Academic Staff Union of Nigerian Universities, which in 1991/1992 went on strike for over 6 months due to poor facilities, including libraries, in Nigerian

Universities went on strike again for several months in 2007 because the state of these facilities had deteriorated.

In the course of pursuing his academic or professional education, an average African scholar maximally exploits the limited available learning material to enhance his chances of acquiring the desired certificate(s). For him, therefore, knowledge or information is hardly sought after for purposes other than utilitarian. This is with the consequence that educated Africans, after acquiring certificates from educational institutions and professional bodies, hardly read outside newspapers and magazines. Since few people read for the sake of esthetics, it follows too that information or knowledge for esthetic purposes is hardly sought after. This situation is encouraged by the tantalizing rich oral culture to which many people turn to derive exciting and pleasurable experiences. Instead of turning to novels and other sources of information, whether print, electronic or otherwise to seek information that keeps them entertained; such entertainment can be derived from the happenings in the immediate environment(s).

Even as it was reported that the increased use of the Internet was bringing an end to the two-step flow of information seeking (p. 660)^[15] in some parts of the world, the two-step information-seeking approach still thrives very much in developing countries. The two-step information-seeking approach is a situation in which a person obtains information from friends and acquaintances who, in an earlier first step, had obtained such information from some other source. This approach still thrives in developing countries because the Internet is not readily available, especially to rural populations.

Another catalyst for the two-step flow of information seeking is the gregarious nature of the populations in developing countries, especially in Africa and Asia. This also promotes the use of oral sources by information seekers, including reliance on opinion leaders for information. This was acknowledged in a study of Indonesian farmers, who, it was reported, relied on opinion leaders and those with higher socio-economic status to get information about pest management (p. 4).^[16] The same is also true of many other settings in developing countries where community members rely for information on chiefs, community leaders, pastors, imams, and others with higher socio-economic status.

Related to the issue of two-step information seeking is that of rumors, which is prevalent and relied upon in Africa because of the propensity of African governments and their agencies to suppress information (p. 5).^[17] Rumor is not relied upon as sources of information only in Africa but also in many developing countries where dictatorial governments suppress information. In this situation, information, which one might expect to be readily available, is deliberately withheld, thus giving room to rumor peddling.

Another big barrier to the use of libraries or information centers by many people in developing countries is that

in making information and information resources available, consideration is not given to local languages, visual orientation, and the use of voice interfaces for populations that are to a very big extent illiterate. Because of this (both conventional illiteracy and ICT illiteracy), most of the populations for whom information services are meant are unable to use them, especially in the rural areas. A study on the information needs of community-based organizations indicated that most community development projects and social programs failed because information about them did not reach the people in the form or language that they understood (p. 34).^[18] This is also true of library and information services.

These are some of the problems facing information diffusion and use in many developing countries. A typical case is with regard to the developing regions of China of which it was reported that most citizens had not adopted the habit of utilizing information resources in their work, life, and study because of their low literacy levels.^[19] The developing regions of China are still better off than most other developing parts of the world because this same report indicated ICT availability to the rural Chinese, who with their ICT literacy, found the use of the Internet popular. The use of the Internet among them for information and services was, however, found to be detrimental to the patronage of reference services in public libraries, which service was obviously on the decline.

The library in most developing countries is the least patronized when users seek to meet their information needs because of irrelevant materials in terms of their language(s), form(s), and up-to-dateness. The language in which information is made available is very important, else people would be unable to use it. For example, for a setting where Kiswahili is the spoken and written language, materials provided in the English language would almost be useless. Similarly, where people are illiterate, print materials like books, journals, etc., would not be required to access information.

There is also the problem of lack of local content that meets the local and immediate information needs of the members of the communities where libraries and information centers are located. The situation is made worse by the failure of information services providers to consult with potential users to determine their information needs, and the failure still to monitor these needs regularly to be able to respond to changes. The result is that libraries and information centers are not providing services that users require.

Another major barrier to information needs and seeking behaviors of populations in the developing regions of the world is that information seekers more often than not use information other than that which they expressed a need for. It was observed in an Indian community that: "The information people usually say they need was not always what they end up using. In the M.S. Swaminathan Pondicherry Project, for example, male farmers originally

said they needed information about agriculture. In fact, their largest usage of village info-kiosks was to get information about government programs.”^[20]

The situation in India could be associated with the finding that:

Observing human information seeking has demonstrated that people do not always choose actions that would lead them to the optimal result. For example, they may bypass the most knowledgeable information provider to ask questions of someone they know. In fact, the typical findings of information-seeking studies in various settings indicate that accessibility of information is the key factor involved in what sources people select, and that interpersonal sources are preferred over other channels (p. 661).^[15]

“ENERGY,” “SPACE,” AND “TIME”: BARRIERS IN OBTAINING INFORMATION TO MEET INFORMATION NEEDS AND IMPACTS ON INFORMATION-SEEKING BEHAVIORS

There are a number of barriers to obtaining information that meets information needs and seeking behaviors in developing countries. These include outright non-availability of information and the information resources that meet the needs of users; availability of inappropriate information, and information resources; non-awareness of the information and information resources that are available; lack of time for searching for information and for learning how to use an information source; lack of the hardware and/or software with which to retrieve information; distance from users’ home to points of information, etc.

These problems have been observed to be setbacks to the free flow of information right from the source through the media to users, and have economic, social, environmental, and infrastructural dimensions (p. 5).^[15] The economic problems of information seeking relate to cost as it affects information carrying media, time, and labor. The general poverty of the developing regions makes it near impossible to develop the information infrastructure that can make information available to meet the needs of the people. Another major factor accounting for poor information services in developing countries is that they compete with other social services provision like roads, water, energy, etc., for which the people have a preference. Apart from the existence of only a few well-developed libraries and information centers, inadequate ICT development and outright lack of it is also a big factor militating against access to information.

The library and information systems are therefore not well developed to meet the information needs of users. This is especially true of the rural areas because library and information services providers, including telecommunications operators prefer to offer services in urban and semi-urban areas. Due to the poor library and information

systems, many professionals rely on their limited personal collections, and the few who can afford it own computers with Internet access. Those who cannot afford it have a Herculean task accessing desired information or are even unable to access it.

Compared to the developed countries, the information seeker in developing countries spends more time and exerts more effort in accessing the required information, which, in some instances, even after rigorous searching, is still not available. This is so because in the first place information facilities, as well as retrieval devices to aid his searching, are often just not available. The scarcity of retrieval devices makes browsing the most favored way to seek for information. It was observed with regard to the knowledge centers in East Africa that one difficulty in ensuring that they become sustainable is the lack of capacity to use ICTs to access and apply relevant information to solve problems (p. 150).^[17] This difficulty does not apply to East Africa alone but generally to most of the developing countries because of inadequate training opportunities and poor human capacity to use ICT to access information. The situation is such that it is not just the users alone, but even managers of information systems who often lack the capacity to manage information using ICTs in such a way as to produce the information that users need. Apart from their financial constraints to subscribe to information carrying media on CDs, VCDs, DVDs, and online, many information professionals in developing countries are unable to access open source materials, which can address the information needs of those they serve, due to this lack of human capacity.

Again because of the failure of municipal services provision, the information seeker spends 2–3 times over and above the time and effort he would have required to access information in better-supplied areas. An example is that in trying to access information on the Internet, power outage may be experienced, which will lead to the suspension of the exercise. Power may not be restored until some hours later, only to be interrupted again as the renewed effort to access the information commences. This may go on and on until the seeker succeeds in accessing the required information after several attempts. This makes information seeking more expensive in terms of time and labor, apart from the frustrations encountered. The prevailing poverty also makes access to information very difficult because generally most members of the populations of developing regions are unable to own information resources (books, computers with Internet connectivity, subscribe to journals, etc.) or even pay for Internet access in business centers that can enable them access the information that meets their needs.

Related to the problem of poor utility or municipal services is that of gasoline scarcity and cost that helps limit people’s ability to reach libraries or information centers. A lot of time, effort, and cost go into fueling own vehicles or boarding public transport that in the end those

who would normally seek after information to meet their needs are unable to do so.

Another major problem is the distance between the residences of information seekers and the points of information services. Such distances affect the frequency and regularity with which information is sought after and used in developing countries because of the time and cost involved. There are other activities such as social, religious, etc., competing for the time that would ordinarily have gone into the use of information. This is especially worse for women and girls because of their disadvantaged position, and the fact that they are saddled with most of the household chores.

CONCLUSION

Information is of strategic importance to the peoples of the developing regions. It is very difficult, if not impossible, to identify common information needs and behaviors for all the peoples of the developing world. However, the problems they face in the course of accessing information to meet their needs have much in common.

The issue of information needs and behaviors of populations in less developed regions was addressed from the perspective of an adaptation of Ranganathan's PMEST categorization, which stands for personality, matter, energy, space, and time. The information seekers in the developing regions include students, professionals, artisans, farmers, etc., whose limited social/professional networks constitute one of the problems for their failure to have their information needs met. Some of the potential information users have very little education, or are even outright illiterate and ignorant, and therefore do not know how to go about meeting their information needs, or at best wait passively for information to be brought to them.

It is only in a few parts of the developing countries that information infrastructures are available to meet the needs of the populace. The majority of the developing countries experience information starvation and information poverty, lack of commitment by concerned authorities to provide effective information systems, and failure to develop IKS to support WKS. The two-step flow of information is the vogue due to vast oral sources, which along with the suppression of information by authorities, is also associated with reliance on rumors, opinion leaders, and community leaders.

The information access systems are generally not well developed, and part of this is explained by the fact that most information professionals lack the requisite skills, both conventional and ICT, for the handling of information. Where ICTs have made in-roads, it is most often with the assistance or intervention of western donor agencies, and in such cases the professionals manning such libraries and information centers have the capacity to offer services

using ICTs because the training of personnel is one of the components of such interventions.

The barriers to obtaining information to meet the needs of the populations of the developing regions are many. They include outright non-availability of information and the information resources that meet the needs of users; availability of inappropriate information and information resources, non-awareness of the information and the information resources that are available; lack of time for searching for information and for learning how to use information sources; lack of the hardware and/or software with which to retrieve information; distance from users' homes to points of information; and other factors associated with the problems of daily life in developing countries.

Although the challenges are great, all hope is not lost for the populations of the developing regions to have their information needs met if only their governments and other funding authorities will rise up to make education and information provision priorities. When they do this, it will encourage western donor agencies, which are already doing much to facilitate access to information in the developing regions, to do even more. Another important thing to do is to encourage the development of IKS to complement WKS in the developing countries.

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Information Policy: European Union

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Abstract

This entry provides an overview of European Union (EU) information policy, focusing on its formation, its goals, and its influence. European Union information policy refers to the legislation and strategies pertaining to the European policy for the creation of the information society. It is concerned with economic and industrial competitiveness, with an emphasis on the role that information and communication technologies play in revolutionizing everyday life, a broad goal with far reaching socioeconomic implications. This discussion, however, will be confined to information policy areas of greatest interest to information professionals, namely copyright and intellectual property, data protection and privacy, e-government and digitization.

INTRODUCTION

European Union (EU) information policy refers to the legislation and strategies pertaining to the European policy for the creation of information society. This includes areas such as copyright and intellectual property, data protection and privacy, e-government and digitization. It is also concerned with economic and industrial competitiveness with an emphasis on the role that information and communication technologies play in revolutionizing everyday life. Information policy is viewed as contributing to the larger goals and objectives of the EU itself, particularly in relation to the European economy.

The beginning of a comprehensive information policy for the EU can be traced back to 1994 when the European Council, recognizing the profound effect that global information and communication systems were having on European society, began to establish a foundation for an information and communication infrastructure. At the root of the EU information policy was an effort to build a legal and physical infrastructure designed to promote a global information society.

Following a brief discussion of the key concepts in information policy, we will provide a brief history of the EU, before going on to discuss the formation, legislation, and implementation of information policy in the EU as they pertain to library and information science. Lastly we will discuss some of the major issues facing information policy in the EU and the influence it has had in the United States and on an international stage.

BACKGROUND

Information Policy

Information policy is an umbrella term for official government policies that govern the collection, storage, and dissemination of official information within a specific jurisdiction. Weingarten describes information policy as a set of all public laws, regulations, and policies that encourage, discourage, or regulate the creation, use, storage, and communication of information.^[1]

Information policy is a socially constructed concept and should be evaluated in relation to the environment in which it is practiced. The term “information policy” connotes a U.S. perspective and is not the preferred term of the EU. EU policy makers have adopted the term “Information Society” to denote a broader set of issues relating to aspects of information management.

While only one perspective can be presented and developed here, it is important that readers be made aware of alternative views. Keeping in mind the likely readership of the *Encyclopedia of Library and Information Science* and attempting to offer a unified perspective of information policy as expressed in the information policy entry, this entry examines EU information policy in a narrowly defined way that is analogous to the discussion of information policy as generally perceived in the United States.

We limit our discussion to the EU information policy as defined by Hernon and Relyea in the third edition of *ELIS* and diverge from it when expansion in the framework is necessary for understanding the EU landscape.

For purposes of this entry, we have chosen to adopt the definition used by Hernon and Relyea: “Information policy is [...] a set of interrelated principles, laws, guidelines, rules, regulations, and procedures guiding the oversight and management of the information *life cycle*: the production, collection, distribution/dissemination, retrieval and use, and retirement, including preservation, of information.”^[2]

At the government level, information policy is designed to be operational and is executed by a series of laws, regulations, and court cases that reflect a country’s approach to information policy. Cahill and Overman argue that information policy is value-based and that these values are normative in nature and specific to the value system of individual countries.^[3] Normative ethics attempt to balance right and wrong behaviors as they are perceived through the underlying morals and arrive at the correct moral principles by which all people should be morally guided.^[4]

A research perspective of information policy takes into account various theories that explain and justify information policies. Theoretical frameworks are important to the discussion of information policy in that they provide justification for the policies enacted, serve as the underlying imprint of policies and situate them in a specific time and place. With regard to information policies, legal jurisdictions such as federal governments, as in the United States, or supragovernmental organizations, as in the EU, design and enact policies. Such policies are intended to help resolve inherent problems in information technology and provide pragmatic models for resolving concrete problems. The wide penetration of information technologies highlighted the conflict between policy values, such as information privacy or information ownership, and unconfined use of technology. While there are numerous theoretical approaches to information policy, some of the more widespread approaches include ethical frameworks and economic frameworks.

Many ethical approaches to information policy are based on John Stuart Mill’s essay on Utilitarianism, published originally in 1859.^[5] Recognizing that absolute ethics are not possible to achieve, Mill promotes pragmatic ethics which results in the greatest good for the greatest number of people affected. A utilitarian approach will result in different policies from an approach based on basic human rights. For example, in the United States many of the areas associated with information policy are based on basic rights of the people as articulated in the U.S. Constitution. In Europe, where a Millsian pragmatic ethics approach is more common, information policy is seen to be serving greater considerations than just those of the citizenry.^[6]

Another theoretical framework for understanding information policy in the European context is to understand it as a series of policies that support economic growth. Researchers who advocate this approach contend that

thriving economies depend on uniform laws and regulations of information among and between governments. Such researchers include Samuelson and Varian^[7] and Reidenberg.^[8] While the scope of this entry does not allow us to delve deep into theoretical frameworks, the utilitarian and economic perspectives contribute to a better understanding of the approach to information policy that directs the EU.

Historical Overview of the European Union

The EU is a supranational body working towards peace and prosperity in Europe. The EU maintains a unique structure. It is not a federation of countries, but rather an organization in which each member state maintains its own independent governments and legislatures, while at the same time agreeing to have common institutions with the power to make decisions on matters of joint interest to other member states.

The origins of the EU can be traced back to 1950 when French Foreign Minister Robert Schuman conceived the idea of European integration. Europe Day is celebrated on May 9 to mark the anniversary (Europa http://europa.eu/abc/symbols/9-may/euday_en.htm).

As of June 2008, there were 27 member states as well as three candidate countries (Turkey, Croatia, and Macedonia) awaiting membership. Many of the most recent countries to join the EU in 2004 were members of the former Soviet bloc and include the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia. In 2007 Bulgaria and Romania also met the democratic and economic threshold requirements for joining the EU and became member states. They joined the earlier members, comprising Belgium, France, Germany, Italy, Luxembourg, the Netherlands (1957), Denmark, Ireland, United Kingdom (1973), Greece (1981), Portugal, Spain (1986), Austria, Finland, and Sweden (1995). Switzerland and Norway elected not to join the EU in order to preserve their neutrality.

The total population of the EU is nearly half a billion people. It covers an area of 1.67 M sq mi, making it nearly twice as large as the United States in terms of population, and slightly under half its size in area. The EU has no constitution. Attempts to ratify one failed in 2004 when France, followed by the Netherlands, voted against a proposed constitution. The prospect of a unifying constitution has become even more remote with the Irish vote against it in June 2008.

The EU functions on the basis of four founding treaties that, in the absence of a constitution, provide the rationale and justification of all decision-making for the Union. Thus, legislation is always directly linked to specific articles in the founding treaties. The four treaties that form the basis of the EU are *The treaty establishing the European Coal and Steel community, 1951* (commonly referred to as *The Treaty of Paris*); *The treaty establishing the European*

economic community, 1957 (The Treaty of Rome); *The treaty establishing the European Atomic Energy Community, 1957* (EURATOM); and the *Treaty on European Union, 1992* (Treaty of Maastricht). Treaties are referred to as Primary Law and are regarded as constitutional in statutes. All other legislation is defined as secondary and based on the treaties. Legislation in the EU is binding to all member nations, citizens living within its borders, and companies that conduct business with the EU.^[9]

As the main initiator of legislation within the EU, the European Commission is instrumental in the policy-making process regarding the information society. While the Council and the Parliament pass legislation, they can only act on proposals from the Commission. The Commission, the most powerful of the EU institutions, acts as the executive branch of the EU and is the guardian of EU treaties; as such it is entrusted with the role of initiating legislation stemming from treaties (The European Commission at a glance).^[10] The Commission is divided into 26 Directorate-Generals (which are similar to government ministries) overseeing different subject areas. Information policy falls under the domain of the Information Society and Media Directorate-General (DG Infso).

European Union government policy is divided into three “pillars.” The first pillar covers policy relating to the three communities of the European Coal and Steel Community, the Economic Community, and EURATOM (European Atomic Energy Community). The second pillar covers common foreign and security policy (CFSP). The third pillar covers justice and home affairs, judicial cooperation in civil and criminal matters, police cooperation, and immigration policy. With few exceptions, policies and legislation relating to information policy fall under the first pillar.

INFORMATION POLICY IN THE EUROPEAN UNION

History

The European Commission’s role in the EU is to prepare and implement legislation adopted by the European Council and the European Parliament in connection with EU policies acting as the EU’s executive branch. It was not until 1979 that the European Commission became involved in information policy when it issued a report that “addressed the role of networks in economic competition and the necessity of cooperation for developing new networks and services.”^[11] Not only does information policy in the EU lack the long tradition it has in the United States, the term *information policy* itself is not in frequent use in the European context, the preferred term being *information society* (Europa glossary).^[12]

Attempts to address legal and regulatory issues relating to the information society did not begin in earnest until the

1990s, with the publication of the Bangemann report, discussed below.^[13]

Objectives

The brief definition provided by the Europa glossary of the term *information society* places emphasis on information and communication technologies and their potential role in revolutionizing everyday life, and in this respect is more similar to the Clinton administration’s use of the term *National Information Infrastructure*.^[14] The information society is therefore a technologically driven phenomenon and, not surprisingly, many of the efforts of the EU are devoted to developing policies centering on technological issues, specifically policies relating to market regulation, introduction of new technologies, and benefiting from information and communications technologies (Europe’s Information Society: Information Society Policies).^[15]

Commission report (94) 347 situates the role and vision of the information society as a force for economic growth: “*The information society is on its way. A ‘digital revolution’ is triggering structural changes comparable to last century’s industrial revolution with the corresponding high economic stakes. The process cannot be stopped and will lead eventually to a knowledge-based economy*” (COM (94) 347).^[16]

Challenges

The EU, for reasons both historical and pragmatic, focuses more efforts on execution than on vision. While its institutions are democratic, and increased transparency continues to be one of the EU’s main goals, it is not in the purest sense a democratic institution since the EU’s Parliament, whose members are elected directly by the citizens of the member states, has limited ability to exercise control over the European Commission. Transparency and access to information continue to be a challenge in spite of the adoption of a code of conduct regulating access to EU information.^[17]

EUROPEAN INFORMATION SOCIETY

Unlike the United States, where information policy is piecemeal and for the most part reactive, information policy in the EU is preemptive. The EU views information policy as contributing to its larger goals and objectives, and considers it an important part of the European economy.

The 1994 Bangemann report is often identified as the foundation of information policy for the EU. It resulted from the European Council’s request for a report outlining measures and steps to be considered when laying a foundation for an information and communication

infrastructure. The report recognized the profound effect that global information and communication systems were having on European society, including economic and social life.

The report lays out a vision for a European information society and recommends actions to achieve desired outcomes, but devotes little attention to a thorough analysis of the existing preconditions in Europe. Subsequent reports, particularly by the European Commission Blankert et al.,^[18] followed the Bangemann report and advised the Commission on a recommended course of action. The Bangemann report was therefore advisory in nature, while implementation was left to EU executives.

At the root of the EU's information policy is an effort to build a legal and physical infrastructure that will promote a global information society. The European Council's vision is for the goal to be achieved by a combination of free market forces and support from the regulatory system (Bangemann report, 4) that will address the needs of all EU citizens in an equitable way and prevent a digital divide (Bangemann report, 7). The goal is for everyone to benefit from the opportunities offered by technology while controlling its adverse effects. To curb the adverse effects of an information-based society, the Bangemann report recommended emphasis be placed on education and training. Free market forces play a major role in achieving the goals of an information society, and the Bangemann report calls for ending monopolies of telecommunication operators and the system of political burdens that are inherent in them (chap. 2). The action plan of the report perceives the role of government as safeguarding competitive forces (chap. 2).

The report set out 10 areas related to ICT in which Europe needs to strengthen itself in order to compete in the global economy. These areas, included in chapter four of the report, are described as applications, or building blocks, of the information society. They include: teleworking, distance learning, a network for universities and research centers, telematic services for small- and medium-sized enterprises, road traffic management, air traffic control, health care networks, electronic tendering; trans-European public administration networks; city information highways.

To promote the goals of the information society, in 1999 the European Commission launched the eEurope initiative to accelerate Europe's entry into the digital age. The result was eEurope 2002, which sought to create a cheaper, faster, and more secure Internet, to invest in people and skills, and to stimulate the use of the Internet throughout the EU (EU Guide to the Digital Economy, 2003).^[19] eEurope 2002 was followed by eEurope 2005, and most recently i2010 (Europe's Information Society).^[20] i2010 is "an initiative which will provide an integrated approach to information society and audiovisual policies in the EU, covering regulation, research, and deployment and promoting cultural diversity." i2010 aims

to achieve through regulation, funding, and partnerships, a single European information space for competitive society and media services, and is currently the main coordinating body for European information society initiatives and implementation in the EU. i2010 actions are directed toward establishing a single European space for affordable and secure ICT both in terms of diverse content and digital services. Other objectives of i2010 are in developing private-public sector partnerships that promote technological innovation and providing an inclusive framework for ICT public services, particularly in the area of e-governments.

Within the framework of the EU, responsibility for the information society was initially that of the Commissioner for Enterprise and Information Society, but as roles expanded, so did the office, which is now known as the Commissioner for Enterprise and Industry (Enterprise and Industry).^[21]

MAJOR ISSUES

Several important directives are included under the umbrella of Information Society legislation. These are conveniently collected and updated on the EU's Web site and updated regularly (Europa. Activities on the EU).^[22] The main areas of activity most relevant to information professionals include ICT, Intellectual Property, Electronic Commerce, and Data Protection and Privacy.

Information and Communications Technologies (ICT)

The EU's information policy approach is closely linked with communication policy in general and ICT in particular. Both are perceived as equal contributors to the information society. Information and communication are valued as commodities designed for both high-end markets as well as mass consumption.

The Commission of the European Communities set about implementing the recommendation of the Bangemann report, and the initial recommendations for implementation was articulated in an action plan (COM (94) 347). The action plan reiterates the conclusions of the Bangemann report, emphasizing the role of the private sector in infrastructure development, and of the member states in creating a stable regulatory framework. In addition, the action plan proposes a response in four areas: ICT regulatory framework, intellectual property rights, privacy, and electronic protection.

The current legislative framework relating to information policy has attached information policy areas to a "Telecoms Package" that regulates electronic communications in the public sector. The Telecoms Package includes a directive on data protection,^[23] the general framework,^[24] access and interconnection,^[25] authorization and licensing,^[26] and universal access.^[27]

The objective of the Telecom Package is to provide a regulatory framework for electronic communication that opens the telecommunication markets to competition. This emerged from the recognition that enabling technologies are converging and that a single horizontal framework is therefore required to support them. The framework addresses regulation harmonization in areas of fixed-line voice telephony, mobile and broadband communications, and cable and satellite television.

The most recent assessment found that significant progress has been made in achieving that goal and that the focus should now be on management of the radio spectrum and the streamlining of market reviews (COM(2006) 334 final).^[28] In addition, since revenue growth in the area of electronic communication has outperformed growth in the overall EU economy, the framework is considered a success (COM(2006) 334 final).

The preemptive nature of EU information policy is in evidence in many of the general frameworks such as the regulatory framework for electronic communication outlined above. As in other areas of the information society that draft policy based on predictions of the long-term developments in the area (COM (2005) 229 final), the electronic communication framework also attempts to anticipate future developments in the area. Specifically, the report predicts that four major technological developments will occur by 2016: 1) a migration to “all Internet Protocol (information policy)” networks; 2) increased use of wireless communications and wireless platforms; 3) deployment of fiber-optic connections in the local access networks; and 4) the transition to digital television (COM (2006) 334 final).

Intellectual Property

One of the first official reports to address intellectual property was the 1988 Green Paper (COM (88) 172).^[29] It was followed by a Commission Working Programme (COM (90) 584).^[30] The most recent version, and currently in effect, is Directive 2001/29/EC^[31] on the harmonization of certain aspects of copyright and related rights in the information society, which passed in May 22, 2001. The Directive puts the EU in compliance with the World Intellectual Property Organization (WIPO) Copyright Treaty.

The Directive, which went into effect on December 22, 2002, is a slim document, consisting of 15 articles described in 10 pages, and outlines the EU approach to copyright in the broadest terms, leaving many details to individual member nations.

The purpose of the Directive, as described in the preamble, is primarily to contribute to the economic strength of the EU within the framework of the EU’s mandate to establish an information society. While the Directive is most commonly regarded as legislation regulating copyright, some of the related rights mentioned in the law’s subtitle are significant to the EU’s policy framework and

include freedom and expression (Directive 2001/29/EC preamble sections 1–3).

Although the underlying notion of intellectual property protection as an incentive for creativity lies outside of the scope of the Directive, the document clearly assumes that copyright and other intellectual property are economic engines for growth. Section 4 of the preamble states that the desired outcome of the Directive is increased competitiveness in ICT as well as across industrial sectors. This, it is argued, will in turn encourage new job creation (Directive 2001/29/EC preamble section 4). An additional goal of the Directive is to be in compliance with the WIPO (Directive 2001/29/EC preamble section 15).

The main articles of the Directive address reproduction rights, distribution rights, technological protection, and digital rights management. Fair Use, known in the Directive as “Exceptions to Copyright,” is addressed in article 6^[41]. The Directive takes a strict stand on avoiding technological protections, banning not only circumvention of access control technologies which regulate access to information and protected content, but also copy control technologies which prevent additional reproductions beyond the first sale of a copyrighted work (Directive 2001/29/EC Article 6). This is a departure from the Digital Millennium Copyright Act (DMCA)^[32] that only made access circumvention illegal. The Directive is interpreted as more favorable to users than the DMCA in that it tilts the balance in favor of the user.^[33]

Moral rights (commonly referred to as “droit d’auteur”), which include the right of authors to have their work properly attributed, to preserve the integrity of their work, and to publish anonymously or under a pseudonym, are outside the scope of the Copyright Directive. Section 19 of the preface leaves the exercise and implementation of moral rights to individual member states to work out the issues in accordance with the Berne Convention and the WIPO Copyright treaty.

Electronic Commerce

Within the framework of the EU, electronic commerce (e-Commerce) is viewed as an integral part of the information society structure in that it is an essential part of the network environment. The Directive on Electronic Commerce^[34] addresses electronic commerce, defamation, misleading advertising, and infringement of trademarks. The Directive sets rules and supports regulations for transparency for online service providers, and electronic contracts, and limits the liability of intermediary service providers. In addition to e-Commerce as a means of increasing for profit business transactions, it is also the basis for eGovernment services within the EU. The EU policy in the field of eGovernment is part of the previously mentioned i2010 plan (COM (2005) 229 final)^[35] and has five objectives all intended to increase services to citizens. eGovernment encourages the use of ICT in the public

sector and public administration to improve service, increase democratic participation, and encourage transparency. Areas directly affected by eGovernment initiatives are research and development and scientific, technical, and medical (STM) publishing. The eGovernment action plan (COM (2006) 173 final)^[36] outlines the steps to be taken during 2006–2010 to achieve eGovernment goals.

Data Protection and Privacy

Privacy in the context of the EU is closely linked with data protection. While in the United States the term “privacy” prevails, the legislation that regulates matters relating to privacy in the EU primarily covers the protection of personal data. The EU’s concern with data protection is mainly to allow data exchange between member states in a manner that ensures a high level of protection within the EU, as well as guaranteeing citizens the same high level of security when exporting data outside the EU. Thus the main legislation protecting privacy, Directive 95/46/EC,^[37] prohibits the transfer of personal data of or about EU citizens held in registered databases, to non-EU countries that do not meet the adequacy standard for data protection. The 1995 Directive went into effect in 1998, and subsequent legislation includes the Directive on privacy and electronic communications (Directive 2002/58/EC), an amendment to the 2002 directive,^[38] as well as additional legislation and regulation (for complete list see http://ec.europa.eu/justice_home/fsj/privacy/law/index_en.htm).^[39]

In order for U.S. companies to trade database information with the EU, the U.S. Department of Commerce established the Safe Harbor framework, a voluntary system of participation approved in 2000. This framework allows participating American companies to trade information with EU companies (Export gov).^[40] The EU has addressed data transfer with the United States in two main areas: air passenger data transfer and safe harbor agreements. Data transfer between the EU and the United States is regulation not by legislation (directive) but by a series of agreements and letters issued by the EU (Commission decisions of Third Countries).^[41] These documents allow the transfer of information about EU citizens to the United States for purposes of travel and commerce, with the condition that the United States will afford EU citizens data the same level of protection awarded to them by the EU directives. While some of these decisions are unilateral and take the form of statements issued by the EU, there also include joint agreements between the EU and the United States that enable travel and commerce.

A recent example of the impact of EU legislation can be seen in the opinion of the Article 29 Working Group.^[42] It determined that search engine companies, in order to comply with the EU Data Protection Directive, must “delete or irreversibly anonymise personal data” once collection goals have been met. The opinion states

that this requirement applies to search engine companies based outside Europe as well as those in Europe, since European privacy laws apply to search engines (Article 29).

In the aftermath of 9/11, privacy protection and violation has changed dramatically in the United States, particularly as a result of the USA PATRIOT Act. The effect in Europe has not been as pronounced. The difference in perspective is the result of Europe’s historical experience with terrorism: many European countries were victims of international and internal terrorism prior to the September 11, 2001 attack on the United States such as the Irish Republican Army in England, Bader Meinhof in Germany, and the Red Brigade in Italy. The EU has always viewed terrorism on a domestic level to be handled by each country’s own criminal code: criminal law is part of “Justice and Home Affairs” as described in the Third Pillar of the Treaty on the EU. While this approach remained unchanged following the September 11 attacks, the EU did address questions of terrorism in June 2002 with a Decision on Combating Terrorism (2002/475/JHA),^[43] which defines terrorist groups and acts with regard to groups, individuals, and supporters and calls on member states to align their legislation so that the uniform definitions apply in all member states.

While human rights were not addressed in the EU’s Decision, the Council of Europe did address the matter in its 2002 Guidelines on Human Rights and the Fight against Terrorism (Council of Europe, 2002).^[44] The Council of Europe is not part of the EU per se, although they are considered an affiliated organization operating under the flag of the EU and working toward European integration (Council of Europe, 2008).^[45] The Guidelines guarantee respect for human rights in the fight against terrorism declaring that states “may not use indiscriminate measures which would only undermine the fundamental values they seek to protect,” and prohibiting the use of torture in all circumstances. Sections V and VI of the Guidelines specifically address privacy, including privacy with respect to collection of personal data, searches of body, houses and personal effects, surveillance, and wire tapping. While such actions are permitted as measures to fight terrorism and protect citizens, the Guidelines state that they should be exercised with the utmost caution, only when no other measures exist, and should be employed in accordance with provision of domestic laws. In addition, such actions may be subject for external review and open to challenges before a court of law.

Other Activities of Europe’s Information Society

In addition to the areas outlined above, the EU is engaged in other activities to further the development of an information society. These include promoting digital infrastructure, encouraging research and innovation, and promoting a safer Internet. (Europe’s Information Society:

information society activities).^[46] The safer Internet activities address illegal and harmful content on the Internet and resulted from a green paper issued by the Commission in 1996 (Commission of the European Union COM(96) 487 final)^[47] and include a 4-year program that addresses four main issues: fighting against illegal content, tackling unwanted and harmful content, promoting a safer environment, and awareness-raising. More recent activity in the area also includes a recommendation to member states regarding protection of minors and human dignity in online activities.^[48] While U.S. case law has supported the view that the Internet is private space and therefore not directed by government action, the EU is more heavily involved in content regulation.

IMPLICATIONS

Information and communication technology, and more specifically the Internet, are making national borders more difficult to manage or control from specific jurisdictions. This trend has been occurring and gradually increasing as Internet activity grows, and is driven by two very different approaches to information on both sides of the Atlantic. The U.S. government does not regulate cyberspace and is concerned only by harmful use of information, while the EU protects its citizens from the wrongful collection of information.

In the United States, this is a *de facto* phenomenon, resulting from market forces that set standards and establish benchmarks for information flow and trade driven by private enterprises for financial benefit. In the EU the *de facto* eradication of international borders is recognized but not allowed free reign. Rather is it curtailed by *de jure* legislation and regulation by the EU that in effect imposes European standards of information trade on non-EU countries. This has compelled the U.S. government to diverge from its *laissez faire* policy and negotiate the Safe Harbor Agreement that enables information exchange between the United States and the EU. Concerns that the Internet will undermine the authority of governments have not materialized. In the case of the EU, the opposite has occurred. The EU's approach to transborder information flow has resulted in imposing these standards and practices on countries wanting to trade with the EU.

CONCLUSION

European Union information policy refers to the legislation and strategies pertaining to the European policy for the creation of information society. The goal of this entry was to provide an overview of the unique and influential nature of the EU's approach to information policy by discussing its formation, goals, and ultimately its influence. In the broadest sense, EU information policy is

concerned with economic and industrial competitiveness with an emphasis on the role that information technologies play in revolutionizing everyday life, a broad goal with far reaching socioeconomic implications. Our discussion has focused on several policy areas of greatest interest to information professionals by discussing the approach that the EU has taken addressing areas such as copyright, intellectual property, data protection and privacy, and e-government. In its aim to bring EU information to its citizens, EU information policy has challenged policy notions by establishing new levels of cooperation between major state institutions and all information and communication matters.

GLOSSARY

Directive: Legislation, which is binding to EU member nations.

Green paper: Documents published by the European Commission. Their purpose is to stimulate discussion and may eventually lead to legislation, but their recommendations are not binding. Green papers are often followed by White papers.

Information society: synonymous with "new information and communication technologies" (ICT).

Pillars of the EU: Three pillars form the basic structure of the EU, and are: 1) the Community pillar, corresponding to the three Communities: the European Community, the European Atomic Energy Community, and the former European Coal and Steel Community; 2) the common foreign and security policy, and 3) the policy and judicial cooperation in criminal pillar.

White paper: Documents published by the European Commission that contain proposals for actions in a specific area. When White papers are received favorably they lead to actions in the area they address.

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Information Policy: United States

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Abstract

Information policy, a field encompassing both public policy and information science, treats information as both a commodity—adheres to the economic theory of property rights—and a resource to be collected, protected, shared, manipulated, and managed. Although the literature often refers to information policy in the singular, there is no single all-encompassing policy. Rather, information *policies* tend to address specific issues and, at times, to be fragmented, overlapping, and contradictory.

INTRODUCTION

Information is “essential to our existence” and assumes a “life of its own.”^[1] Information policy then is a set of interrelated principles, laws, guidelines, rules, regulations, and procedures guiding the oversight and management of the information *life cycle*: the production, collection, distribution/dissemination, retrieval and use, and retirement, including preservation, of information. Information policy also embraces access to, and use of, information and records; records relate to the conduct of government business and provide an audit trail for holding government accountable. Collectively, policies form a framework that “profoundly affects the manner in which an individual in a society, indeed a society itself, makes political, economic, and social choices.”^[2]

Much of the discussion of U.S. information policy revolves around actions taken or planned by government, either at the national or subnational levels. Since the mid-1990s, commercial transactions on the Internet—called electronic commerce—have grown substantially. At the same time, governments at various levels within the United States have embraced electronic government (e-government or e-gov). At the federal level, for instance, e-government focuses on the political economy of the nation, and relevant information policies concentrate on issues related to Internet infrastructure, resource management, and the provision of online services and resources. Clearly, the Internet, and its World Wide Web, have become the primary channels for the federal government’s dissemination of resources to the public; that public is now global and extends to people of all ages (from youth to the elderly). Still, the private and not-for-profit sectors play a legitimate and important role in the provision of

government information to specific constituency groups and to the public at large.

Information policy has global implications, but it also occurs outside of government. It takes place within and among organizations, associations, and other groups. This introductory essay cannot touch on all aspects of information policy and still provide a semblance of unity. For this reason, the essay does not address censorship, telecommunications, the press, broadcasting, First Amendment issues, propaganda, intellectual property rights, patents and trademarks, and archival management. Moreover, the essay focuses on American national government information policy. It discusses some key policy areas and stakeholders, shows how policy is formulated, and identifies issues central to an understanding of information policy in the twenty-first century. There is no single corpus of statutory or administrative law to coordinate information policies of federal agencies and to eliminate ambiguities in federal information policies. Some policies pertain to an agency and specific activities; others apply to a branch of government, have governmentwide application, or have international ramifications. Nonetheless, a group of core policies pertain to the management of government information resources and the information life cycle. For an overview of these policies, see Hernon.^[3]

SIGNIFICANCE OF INFORMATION POLICY TO THE LIBRARY COMMUNITY

Government policies provide a framework within which libraries and information centers must function. These policies often determine what types of publications will be issued, the availability of government funds, and how funds will be allocated and spent. They may relate directly

to the management of libraries and the types of services provided and address issues such as Internet privacy and security. Obviously, librarians must understand the policy arena and how it affects the services they provide, as well as how to influence the policy-making process, as they try to have their perspective addressed during policy development.

Another reason why librarians should be knowledgeable about information policy is that libraries and information centers are part of a larger organization (e.g., city government, an academic institution, or a corporation). The internal policies set by that organization impact on libraries and information centers and set the constraints under which they function. Moreover, external policies also have an impact on the ability of libraries and information centers to meet stated goals and objectives.

Perhaps two examples of the importance of information policy might be beneficial. First, as part of its Library Awareness Program, during the 1970s and part of the 1980s, the Federal Bureau of Investigation (FBI) visited libraries, tried to solicit information about library users, and compiled investigative records on library personnel. A full understanding of the program and the options open to the library community necessitates knowledge of the Department of Justice's counterintelligence activities and the grounds on which the FBI justified its actions.^[4] Any rebuttal of the FBI's justification for its policies that might result in a change of agency policy and practices must address the legal basis on which the FBI justified its actions. To effect change, librarians need extensive knowledge of policy terminology (e.g., the differences among executive orders, circulars, and directives), how policy is formulated, and strategies that might result in policy modification or reversal.

Following the terrorist attacks of September 11, the U.S. Geological Survey requested the Government Printing Office (GPO) to instruct those depository libraries that received a CD-ROM on the characteristics of large surface-water supplies in the United States to destroy their copies. The GPO ordered the libraries to comply and destroy the CD-ROM immediately. "Subsequently, the Federal Bureau of Investigation visited several Federal Depository Libraries to determine whether that order had been carried out. This occurred without consultation with the GPO or the Geological Survey. . . ."^[5] In a memorandum, dated March 13, 2002, attorney Thomas Susman of Ropes and Gray observed:

The delicate balance between responding to concerns relating to homeland security while ensuring public access to government information presents new challenges to many libraries. What limitations, if any, should be on access to selected government information resources? Are there criteria to consider as to whether information resources should be publicly available? Similarly, many libraries that participate in the Federal Depository Library

Program . . . are concerned that changes may be forthcoming in the information access and dissemination policies of federal agencies.^[5]

In formulating their response, depository libraries should ask, "What does the law say?" If they are dissatisfied with the answer, they might inquire about "How feasible is it to change the law?" "What support might we gather from other stakeholders?" "Are there any changes in the law under consideration?" "What is the likelihood of those changes being enacted?" and "Can you influence the shaping of those changes?" Clearly, libraries participating in the depository program need to understand their legal responsibilities, as well as those of GPO, as specified in Chapter 19 of Title 44 of the *United States Code*.

HISTORICAL DEVELOPMENT OF INFORMATION POLICY

Information policy existed in America long before the establishment of the federal government in 1789. Indeed, it probably can be said that information policy began with the arrival of the first European colonists who brought with them the information policies of their homeland. The common law rights of Englishmen were particularly important in this regard and were directly influential in the development of the American legal system well into the early nineteenth century.^[6]

The experience of the colonists differed regarding patterns of communication and information dissemination.^[7] Consequently, their expectations about the availability and accessibility of government information varied from one region to the next. Eventually, however, as England became the predominant power in the Atlantic territories, conflicts over information and "the rights of Englishmen" came to be commonly experienced throughout the American colonies. Disputes arose over the secret activities of royal governors and colonial legislatures, the public accessibility of official records, and proper respect for personal privacy.^[8-10] These and other perceived violations of individual rights by George III kindled the fires of revolt and the rebellion that resulted in American independence.

Within the new nation, information policy was given primary expression in the Articles of Confederation and state constitutions, the latter containing expressions of fundamental rights guaranteeing freedom of the press and personal privacy. These documents would later be important sources for James Madison when drafting the Bill of Rights for the U.S. Constitution. Very little historical research, however, has been conducted on the development of information policy during the American colonial and confederation eras. Some general histories of government institutions and practices of the period provide occasional bits of pertinent knowledge, but much work remains to be done before a better understanding of information

policy prior to the establishment of the federal government can be realized.^[11–13]

The history of federal information policy development begins with the Philadelphia convention of 1787, which, itself, owing to the secrecy in which it occurred, was a special information policy event.^[14] The Constitution of the United States created a limited government with some explicit powers and responsibilities. Certain of these concerned information matters. Among the enumerated powers of Congress, for example, are authority to “establish Post Offices and post Roads,” to “promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries,” and “make Rules for the Government and Regulation of the land and naval Forces” (Article I, Section 8, clauses 7, 8, and 14), and to “make all needful Rules and Regulations respecting the Territory or other Property belonging to the United States” (Article IV, Section 3, clause 2).

In the Bill of Rights, which was subsequently appended to the Constitution, guarantees are made concerning speech and press freedoms (Amendment I), the security of personal papers against “unreasonable searches and seizures” (Amendment IV), and not being “compelled in any Criminal Case to be a witness against” oneself (Amendment V). Also included are rights to a public trial in criminal prosecution and “to be informed of the nature and cause of the accusation; to be confronted with the witnesses against [oneself]; [and] to have [a] compulsory process for obtaining witnesses in [one’s] favor” (Amendment VI).

The Constitution created a government accountable to the people and itself, as well. There was an expectation that government leaders would keep the citizenry informed of developments, or at least maintain a record of their activities. In this regard, the Constitution specifies that each House of Congress “shall keep a Journal of its Proceedings, and from time to time publish the same, excepting such Parts as may in their Judgement require Secrecy” (Article I, Section 5, clause 3). Concerning the duties of electors, the Twelfth Amendment prescribes that “they shall make distinct lists of all persons voted for as President, and of all persons voted for as Vice-President, and the number of votes for each, which lists they shall sign and certify” (Article II, Section 1, clause 3). With regard to the subnational level of government, the Constitution states: “Full Faith and Credit shall be given in each State to the Public Acts, Records, and judicial Proceedings of every other State” (Article IV, Section 1, clause 1).

Moreover, with its system of checks and balances, the Constitution anticipated that each branch would be knowledgeable of the activities and interests of the other two. In this regard, the Constitution specifically provides that, when the President vetoes a bill, “he shall return it, with his Objections to that House in which it shall have originated, who shall enter the Objections at large

on their Journal; and proceed to reconsider it” (Article I, Section 7, clause 2). Concerning interbranch accountability, provision is made for the President to “require the Opinion, in writing, of the principal Officer in each of the executive Departments, upon any Subject relating to the Duties of their respective Offices” (Article II, Section 2, clause 1). The Constitution also indicates that the President “shall from time to time give to the Congress Information of the State of the Union, and recommend to their Consideration such Measures as he shall judge necessary and expedient” (Article II, Section 3). Finally, as a consequence of the separation of powers doctrine of the Constitution, presidents determined, early in the life of the federal government, that a discretion might be exercised regarding requests for information from the other branches. For example, President Washington contemplated discretion in 1792 and exercised it four years later, the first invocation of what would subsequently be called “executive privilege” or the privilege of the Chief Executive to withhold requested information from Congress or the Judiciary for institutional reasons.^[11,15–22] Congress has claimed and exercised similar powers.^[23–25]

In many regards, these constitutional references to information matters indicate some fundamental expectations regarding government accountability and communication, the exercise of certain popular rights regarding information, and subsequent legislation on at least a few particular information subjects. Furthermore, historically, as experience and practice suggested that Congress create and refine additional statutory information policies, these, among other constitutional considerations, have guided the legislative and oversight processes.

An information policy area that quickly commanded the attention of the new federal government and continued to be refined throughout the nineteenth century was official publication. The matter had been debated during the Constitutional Convention of 1787. James Wilson of Pennsylvania, addressing a proposal to allow each chamber of the Federal Congress a discretion as to the parts of their journal that would be published, told the delegates: “These people have the right to know what their Agents are doing or have done, and it should not be in the option of the Legislature to conceal their proceedings.”^[26] The following year, during the Virginia Convention on the new Constitution, James Madison and George Mason raised a similar consideration when speaking about the importance of publishing all receipts and expenditures of public money under the new government.^[27]

In deference to views such as these, the federal Congress quickly provided for the printing and distribution of both laws and treaties,^[28–35] the preservation of state paper,^[36] and the maintenance of official files in the new departments.^[28,29,37] In 1813, the printing and distribution of both the Senate and House journals was authorized.^[38] Congressional floor debate was variously reported in the *Register of Debates*, *Congressional Globe*, and, beginning

in 1873, the *Congressional Record*. See the statutes^[39,40] and McPherson^[41] and of related interest, see Childs.^[42,43]

Provision was initially made in 1846 for the routine printing of all congressional reports, special documents (which included Executive Branch materials), and bills.^[44] Although these responsibilities were met for many years through the use of contract printers, such arrangements proved to be subject to considerable political abuse. Consequently, in 1860, Congress established GPO to produce all of its literature and to serve, as well, the printing needs of the Executive Branch.^[45] Additional aspects of governmentwide printing and publication policy were set with the Printing Act of 1895, which is the source of much of the basic policy still found in the printing chapters of Title 44 of the *United States Code*.^[46,47]

Congress, in addition to providing for publication of the statutes and a variety of legislative literature (and executive materials produced as Senate or House documents), promoting newspaper reprinting of the laws and treaties,^[48] and circulating printed documents through official sources, also developed a depository library program to further facilitate public knowledge of government actions. In 1859, the Secretary of the Interior was statutorily tasked with distributing all books printed or purchased for the use of the federal government, except those for the particular use of Congress or Executive Branch entities.^[49] A decade later, a subordinate officer in the Department—the Superintendent of Public Documents—was mandated to perform this responsibility.^[50] Distributions were made to certain libraries throughout the country that were designated to be depositories for government publications. This arrangement had been begun in 1813 with regard to congressional materials^[38] and extended in 1857 to include other federal literature.^[51] The Printing Act of 1895 relocated the Superintendent of Public Documents within GPO.^[52–54]

In the relocation process, the superintendent was also given responsibility for managing the sale of documents and preparing periodic indices of GPO products. Until 1904, the sales stock available to the superintendent derived entirely from such materials as were provided for this purpose by the departments and agencies or were returned from depository libraries. The situation was altered when the superintendent was granted authority to reprint any departmental publication, with the consent of the pertinent secretary, for public sale.^[55] Congress legislated comparable discretion to reproduce its documents in 1922.^[56]

Shortly after the dawn of the twentieth century, the federal government entered a new phase—the rise of the administrative state. Among the forces contributing to this development was the Progressive Movement, which sought greater government intervention into, and regulation of, various sectors of American society. With the United States' entry into World War I, regulatory activities further expanded and the number of administrative

agencies so involved increased. In the postwar era, government expansion momentarily slowed but began again with the onset of the Great Depression and the arrival of the New Deal.

As federal regulatory powers and administrative entities dramatically grew during this period, there was a concomitant increase in both the number and variety of controlling directives, regulations, and requirements. Soon, problems of accountability, uniformity in the form and promulgation of agency directives, and public access to agency administrative records arose. To address the first of these issues, an Executive Branch gazette was created—the *Federal Register*—in July 1935.^[57] Two years later came the *Code of Federal Regulations*. This cumulation of the authorities appearing in the gazette contained almost all operative agency regulations and was eventually updated annually.^[58] Later, the general statutory authority underlying the *Federal Register* was relied on for the creation of other series of publications, namely, the *United States Government Manual* (1939–), the *Public Papers of the President* (1960–), and the *Weekly Compilation of Presidential Documents* (1965–).

The efforts of a study committee established by the Attorney General^[59] contributed to the legislating of the Administrative Procedure Act of 1946,^[60] which brought uniformity to the form and promulgation of agency regulations. The statute also contained an important public information section that directed the agencies to publish in the *Federal Register* “the established places at which, and methods whereby, the public may secure information or make submittals or requests.”^[61] However, broad discretionary allowances also were made for protecting information, and a changing climate of opinion within the federal bureaucracy soon transformed this public information mandate into a basis for administrative secrecy. Elements of the press community gave particular attention to the unwillingness of federal agencies, as well as some other government entities, to disclose requested information.^[62–66] In 1955, a special subcommittee on government information was established in the House of Representatives; it inaugurated, with assistance from elements of the press, a major probe of agency information access policy and practice.^[67]

Subsequently, in 1966, after a long congressional examination and a difficult legislative struggle, the public information section of the Administrative Procedure Act was replaced by a new statute and a new concept in information access. The Freedom of Information (FOI) Act established a presumptive right of public access to department and agency records, specified nine categories of information that could be exempted from the rule of disclosure, and provided for court resolution of disputes over the availability of requested materials.^[68] Later amended in 1974, 1976, 1986, and 1996, with portions subject to considerable judicial interpretation, the statute has

remained a very effective tool for enabling public access to topical records of the administrative state. It has also served as a model for other information access laws, such as the Privacy Act of 1974,^[69] and open government statutes, such as the Federal Advisory Committee Act of 1972^[70] and the Government in the Sunshine Act of 1976.^[71]

With the end of World War II and the onset of the Cold War, the federal government entered still another new phase—the rise of the national security state. From the outset of the era until the mid-1960s, it was a time of strong, unilateral leadership by the president in the external affairs of the country and was marked by the creation of new agencies and policies to safeguard the nation. Several such innovations were taken regarding information policy.^[72,75] These developments, however, built on a few prior policy actions. Since the earliest days of the Republic, for example, government officials had engaged in the practice of assigning a secret status to certain kinds of sensitive information, usually concerning foreign affairs, defense, or intelligence matters. The Executive Branch, including the armed forces, engaged in such information security–secrecy practices for over a half century before they were given direct statutory authorization.^[76] Formal military secrecy directives or regulations appeared only after the Civil War. The initial Army General Order of 1869 concerning security–secrecy pertained to the physical protection of forts and coastal defenses. Such facilities were not to be photographed or otherwise depicted without prior permission from appropriate officials. This limited application underwent a series of evolutionary adjustments and, shortly after the United States' entry into World War I, resulted in a fully developed information security classification system.^[77] In 1911 and 1917, Congress provided for the criminal punishment of espionage and the acquisition of valuable defense information by spies.^[78–80] Neither law, however, specifically sanctioned the information secrecy practices of the military departments or the armed forces. Initially, the military departments made no mention of the espionage laws in their information security orders and directives, but soon such regulations began referring to these laws as a possible basis for their enforcement.

Relying on a 1938 statute concerning the protection of armed forces installations and equipment and “information relative thereto,” President Franklin D. Roosevelt assumed responsibility for security classification policy and procedures by issuing an executive order setting such policy. It largely paralleled Army and Navy regulations for marking and handling secret records and gave civilian employees of the military departments authority to classify information. However, the legislative history of the 1938 statute, on which the president relied to issue his directive, provided no indication that Congress anticipated or expected that such a security classification arrangement would be created.^[81] Nevertheless, it was the beginning of

presidential leadership in setting security classification policy.

Congress seemingly has evidenced a general reluctance to authorize directly or legislate a governmentwide information security classification system. Although it has mandated information security arrangements for special areas such as atomic energy,^[82] intelligence,^[83] or patent applications having national security implications,^[84,85] Congress, through various committees and subcommittees, for 30 years, successfully encouraged and pressured presidents from Eisenhower to Reagan to narrow classification criteria and limit discretionary authority to classify.^[77] The Reagan administration's sweeping 1982 executive order reversed the prior historical trend by expanding the categories of classifiable information, by mandating that information falling within these categories be classified, by making reclassification authority available, by admonishing classifiers to favor classification in deciding close cases, and by eliminating automatic declassification arrangements.^[86]

Furthermore, with the realization of the national security state at the end of World War II and the onset of the Cold War and the penchant for secrecy, publication of the law of the land became impaired not by circumstances of accident or inadequate means, but, instead, as a consequence of concealment by design. The National Security Act of 1947^[87] sought to preserve and perpetuate the nation *by any and all means*. In 1951, President Harry S. Truman signed an executive order giving almost every government agency broad discretionary authority to classify information “in order to protect the security of the United States.”^[88] The following year, a still secret presidential directive created the National Security Agency. Not officially acknowledged to exist until 1957, it remains one of the most reticent components of the national security leviathan.^[89]

The heart of the national security state, if for no other reason than its membership, is the National Security Council (NSC). After a modest beginning under President Truman, it gained importance during the Eisenhower administration, waned somewhat during the Kennedy administration, but regained its importance and has remained highly influential ever since. The written policy pronouncements of the president emanating from the NSC increasingly appear to have oftentimes assumed the character of secret law.

Shortly after its creation, the NSC began to produce four types of policy papers: basic comprehensive policy statements on a broad variety of national security problems, together with pertinent political, economic, and military pursuit strategies; situation profiles of large geographic areas or specific countries; assessments of mobilization, arms control, atomic energy, and other functional matters; and organizational statements on the council, foreign intelligence, and internal security structure and activities. The initial products in the series apparently

were of the geographic type; the first comprehensive policy statement was completed and given NSC approval in November 1948.^[89]

Subsequent presidents have attached different names to the NSC secret papers. For example, Jimmy Carter issued secret Presidential Directives, Ronald Reagan changed the name to National Security Decision Directives, and George H.W. Bush referred to them as National Security Directives. Under William Clinton, they became Presidential Decision Directives, and George W. Bush nominated them as National Security Presidential Directives. (See Hernon, Relyea et al.,^[3] Chap. 6 for a discussion of the national security state and the various forms in which a president communicates public policy.)

Now, most of the NSC directives produced up to 1960 have been declassified and are accessible at the relevant presidential libraries, whereas most of those produced in subsequent years remain classified, “and details about them are largely unavailable for congressional or public scrutiny.”^[89] In summary, as the General Accounting Office has pointed out, unlike executive orders, these directives “embody foreign and military policy-making guidance rather than specific instructions; are classified; are usually directed only to NSC and the most senior executive branch officials; and do not appear to be issued under statutory authority conferred by Congress...”^[90] However, these directives embody policy-making guidance, but some of them have provided specific instruction. For example, Presidential Decision Directive 63, issued by President Carter, dealt with the fight against cyberterrorism. Among the tasks it recommended were the development of a plan to improve intelligence gathering and an expansion of international cooperation.

Finally, apart from national security secrecy considerations, information is also lawfully protected to maintain the integrity of persons. In the case of individuals, such protection is understood as privacy. However, in the case of corporate persons, protection extends to proprietary or commercially valuable information.

Individual privacy, the wish not to be intruded on, probably predates recorded history. Certainly it is one of the presocietal or “natural rights” that the founding fathers sought to preserve.^[91] When drafting the Bill of Rights, they gave constitutional recognition to privacy expectations in the First, Third, Fourth, Fifth, and Ninth Amendments, which the Supreme Court characterized as comprising a penumbral right of privacy in a landmark 1965 decision.^[92,93]

Through the years, for various governmental activities and programs involving the collection and maintenance of personally identifiable information, such as the census and income tax returns, prohibitions have been legislated on the disclosure of such data. These statutory restrictions are recognized in the FOI Act,^[94] and the Privacy Act prohibits federal agencies from collecting some kinds of personally identifiable information.^[95] The Privacy Act also

allows American citizens to gain access to, and make supplementary corrections of, a great many agency records on themselves. Examples of laws that have been enacted to provide citizens with greater control over personal records held by third parties include the Fair Credit Reporting Act,^[96] the Privacy Act, the Family Educational Rights and Privacy (or “Buckley”) Act,^[97] and the Pupils’ Rights Act.^[98]

Furthermore, more than a century ago, the Supreme Court recognized corporations as being a “person,” but it has not vested them with the privacy rights reserved for individuals.^[99] Generally, when legal protection has been accorded to the information of corporate entities, it has been done for economic reasons and without explanation in terms of privacy rights. Perhaps the best-known statutory prohibition in this regard is the Trade Secrets Act, which makes the disclosure of trade secrets by a federal officer or employee criminally punishable.^[100] A 1977 study prepared by the Department of Justice identified 90 operative statutes “reflecting varied approaches to the regulation of the disclosure by federal agencies of the information they collect from or maintain about business entities.”^[101] Moreover, open government laws, such as the FOI Act and the Government in the Sunshine Act, contain exemptions for the protection of trade secrets and confidential commercial information.

A number of issues affect the continued growth of the Internet for personal, government, and business purposes. Among these, for instance, are Internet privacy, computer security, access to broadband (high-speed) services, e-commerce, commercial Web site adherence to “fair information practices” proposed by the Federal Trade Commission, the receipt of unsolicited commercial electronic mail (spam or junk e-mail), and government information technology management. The practices include: 1) providing notice to users of their information practices before collecting personal information, 2) allowing the public choice about whether and how personal information is used, 3) allowing users access to data collected and the ability to content its accuracy, and 4) ensuring security of the information from unauthorized use. A critical question relates to whether or not industry can regulate itself, or if legislation is required for the protection of consumer privacy. The Internet makes it easier for the public and private sectors to obtain information about consumers and possibly use that information to the consumers’ detriment. That issue focuses on the extent to which webmasters gather personally identifiable information about individuals and share that information with third parties, perhaps without the knowledge or consent of the people concerned.

In the wake of the September 11 terrorist attacks, the issue of law enforcement monitoring of Internet and web activity has become more controversial, with some advocating that law enforcement receive additional tools to combat terrorism, whereas others are concerned about the

intrusion on civil liberties. The USA PATRIOT Act (P.L. 107-56) grants law enforcement officials additional authority to monitor Internet activity. Some of the provisions of Title II of that law expand the scope of subpoenas for records of electronic communications to include records commonly associated with Internet usage (e.g., session times and duration); allow Internet Service Providers to divulge records or other information (but not the contents of communications) pertaining to a subscriber if they believe there is immediate danger of death or serious physical injury, or as otherwise authorized, and requires them to divulge such records or information (excluding the contents of communications) to a government entity under certain conditions; and add routing and addressing information (used in Internet communications) that a government agency may capture by using pen registers and trap-and-trace devices as authorized by court order, while excluding the content of any wire or electronic communications.

ELECTRONIC GOVERNMENT

Electronic government is an evolving concept that currently includes four important areas: 1) the delivery of services (government-to-citizen); 2) providing information to the public; 3) facilitating the procurement of goods and services (government-to-business and business-to-government); and 4) facilitating efficient exchanges within and between agencies (government-to-government). FirstGov (<http://www.firstgov.gov/>) is a portal that facilitates access to digital resources relevant to each of these areas. Regarding the provision of information, it provides access to information at the national and subnational levels and provides a link to FedStats (<http://www.fedstats.gov/>), which enables users to gain access to statistical information from more than 100 government agencies. For some agencies, a service includes the provision of e-mail reference service; the information seeker will receive a response to his or her query.

Subordinate to the four current areas of electronic government is a fifth area, namely, the government as an on-line retailer. At their Web sites, government bodies (e.g., the Department of Treasury, the U.S. Mint, Amtrak, the General Services Administration, the U.S. Postal Service, the U.S. Geological Survey, the National Park Service, and GPO) conduct on-line sales.^[102]

E-government and the various information policy instruments expand the five areas into 11 purposes:^[103]

- Communication between an agency and the public, and communication among government bodies.
 - Information access and meeting the information needs of the American public, from the nation's youth to senior citizens.
 - Service delivery and the provision of online services, including online sales.
 - Procurement or the purchase of services and goods from the private sector.
 - Security, including the protection of Internet transactions among government entities and between those entities and the public against obstruction, diversion, interception, and falsification. Security also extends to protection against hacking of home pages and safeguarding Web sites and computers against viruses. Furthermore, security pertains to the storage of electronic information to assure its integrity and prevent unauthorized disclosure.
 - Privacy of personally identifiable information and unauthorized use of cookies that can be attached to computers so that agencies can monitor the public's use of their Web sites.
 - Management of e-government operations and related matters.
 - Maintenance of information technology systems that underlie e-government.
 - Digital divide and reducing the perceived disparity that results from portions of the population not having the ability to use information technology due to a lack of access, skill, or both. This is why government agencies use standard plug-ins that the public can freely download from the Web, or agencies provide free access to plug-ins that they specially created for some of their products.
 - Emergency response, or dealing with a sudden crisis that threatens the nation. For example, following September 11, the public used government Web sites to monitor the situation and report alleged terrorist sightings to the appropriate agency. Special institutions, such as the Federal Emergency Management Agency (FEMA), have been created to respond to, coordinate the efforts of other agencies to respond to, and plan for national emergencies. Such institutions have coordinated and contributed to the preparation and maintenance of emergency plans, such as the Federal Response Plan for the delivery of federal disaster assistance, and standby directives, such as Executive Order 12656 of November 18, 1988, assigning emergency preparedness responsibilities among the federal departments and agencies. In addition, Congress has enacted various laws that provide the president ready authority to address an emergency, as well as some standby statutory powers that may be selectively activated under the terms of the National Emergencies Act of 1976, as amended.
 - Oversight of the development of e-government by both the Executive Branch and Congress.
- A central issue for policy makers is the development of a comprehensive, but flexible, strategy to coordinate the disparate e-government initiatives across the federal

government. In 2001, the Bush administration proposed the concept of plug-and-play e-government, called component-based architecture (CBA), whereby some agencies develop basic components that others can use. In March, the Office of Management and Budget (OMB) released CBA models for 24 cross-agency e-government initiatives, which “will help agencies decide what technology they need to complete their e-government projects and will also help agencies work better together.”^[104]

As William Clinton prepared to leave the presidency, the National Archives and Records Administration (NARA) revealed that it had treated the White House Web site as a record and had captured images of it every 2 years of his 8-year tenure as president. The various government bodies from the three branches offer millions of pages on their Web sites, and over the years, they have posted an extensive amount of information on these pages. Once the material is removed, most likely, it may not be regarded as a record and reviewed by NARA for possible retention. Nonetheless, federal agencies generate a “torrent of electronic records,” and this tendency “has overwhelmed the ability of “NARA to identify, review and determine which ones merit retention, and preserve them.”^[105]

THE LITERATURE ON INFORMATION POLICY

The Appendix of the *United States Government Information: Policies and Sources*^[31] identifies source material (finding aids, monographs, government reports, and Web sites) that covers information policy from the perspective of different disciplines and stakeholders. Some of the better-known sources for keeping abreast of the latest developments include the following:

- *Federal Computer Week.*
- *Government Computer News.*
- *Government Information Quarterly.*
- *Privacy Times.*

The CD-ROM accompanying *United States Government Information* reprints historically significant works on information policy and contains, as well, exercises and self-help guides.

SOME POLICY ISSUES

Overview

Since the publication of the Porat study in 1977,^[106] little progress has been made in further developing detailed typologies of policy issues, using sophisticated methods to organize and relate issues or producing better methods of clarifying issues and their interrelationships. Many

policy issues are part of both a larger and smaller issue, and resolution of one issue often depends on resolution of another.

The typologies characterize government information policy prior to the emergence of the Internet and electronic government. For example, Hernon and McClure, who analyzed a wide range of policy issues, underscored that:^[107]

- The published policy literature is repetitive in the broad themes it addresses.
- Surprisingly, little duplication exists among specific policy issues; each issue tends to emphasize specific and unique aspects of the broader themes.
- The literature devotes little attention to issues related to the role of libraries in the provision of government information and the information needs and gathering behaviors of user segments.
- Policy issues can be isolated in their impact on other policy issues.

Public Access to Government Information

As Hernon and McClure noted, “government information is a broad term that encompasses both published and unpublished information that . . . government either does or does not intend to make public.”^[107] Public information encompasses that which a government department or agency chooses to make available on its own or the courts force it to release. In contrast, private information is intended solely for internal use within government. There is a gray area between public (released) and private (protected) information. The availability of information in the gray area would be determined through the FOI Act, the Privacy Act, judicial review, and such. Clearly, the definition of key terms should be an important component of information policy.

E-government and the various information policies behind it have altered the landscape of public access. The government releases more types of information resources electronically than it did in the past, and FirstGov represents an attempt to create a portal that provides subject access to information resources across the three branches of the federal government. Although far from providing comprehensive access, it does serve as a tool for those unfamiliar with the structure and organizational complexity of the government. Beyond such a portal, the search process becomes more complex, and there are guides to navigating both the electronic and print environments. At the same time, although there is no governmentwide recommendation as to which types of viewers government entities should follow and different entities may use different ones,^[108] the government relies on those viewers that the public can download free of charge through the Web. The government has also created specialized software that might have operated in a mainframe

environment but has been modified to function in an e-government environment. Thus, the public can download these software packages at an agency's home page and run the application through a personal computer. Examples of such applications include:^[108]

- GEODE (GEO-DATA Explorer; U.S. Geological Survey (USGS); <http://dssl.er.usgs.gov/>), a tool for accessing, viewing, and downloading "information from geospatial databases containing a broad spectrum of data produced by the USGS and other government agencies."
- BASINS (Better Assessment Science Integrating Point and Nonpoint Sources; Environmental Protection Agency's (EPA) Office of Science and Technology; <http://www.epa.gov/epahome/gis.htm>) "integrates a geographic information system (GIS), national watershed data, and state-of-the-art environmental assessment and modeling tools into one convenient package."
- EXTRACT (U.S. Bureau of the Census; <http://www.census.gov/epcd/www/extract.html>), "a general purpose data display and extension tool that works with bureau files recorded in dBase format."
- Map-It (U.S. Geological Survey; <http://stellwagen.er.usgs.gov/mapit/>), a map generator that "takes longitude/latitude pairs as input and plots them on a Mercator projection map along with land/sea and political boundaries."

Another means of informing the public is webcasting, which is an audiovisual presentation, such as a lecture, training session or program, or news conference that can be viewed online in real time or archived for later viewing. The Department of Housing and Urban Development, for instance, provides live webcasts of training and public events (<http://www.hud.gov/webcasts/index.cfm>), and congressional committees often offer live hearings through webcasting. Most government Web sites recommend RealPlayer from RealNetworks, Inc. (Seattle, WA; <http://www.real.com/>) to view and hear webcasts.

EPA's Maps on Demand EnviroMapper (<http://maps.epa.gov/enviromapper/>) provides users with interactive GIS functionality using some of the agency's spatial data for the conterminous United States. The USGS's National Atlas Online (<http://www-atlas.usgs.gov/atlasvue.html>), which uses Macromedia's Shockwave (<http://sdc.shockwave.com/shockwave/download/>), allows users to customize maps interactively with a user's Web browser. Finally, EPA's "Dumptown Game" (<http://www.epa.gov/recyclecity/gameintro.htm>) also uses Shockwave, but, in this instance, as a browser viewer to watch the images move and change as users interact with the program as the City Manager of Recycle City. The "Dumptown Game" is one of more than 100 government Web sites aimed at the nation's youth.^[108]

Federal agencies are cognizant that their web visitors use a variety of workstation platforms (Intel and Apple), browsers (Netscape and Microsoft Internet Explorer), Internet access speeds [telephone, cable, and Digital Subscriber Line (DSL) modems in addition to local area networks], and workstation-installed software productivity applications (e.g., Microsoft and Corel office suites). As a result, government Web sites are making efforts to meet individual user needs by providing the public with alternative choices for viewing information and downloading files based on the speed of their Internet connection and installed viewer. An excellent example is the Video Gallery of the National Aeronautics and Space Administration (NASA) (<http://www.nasa.gov/gallery/video/index.html>), which provides users with choices of movie format based on file size (large and small versions), desired viewer (the same movie in either Quicktime or RealPlayer format), and movie resolution (which affects file size) based on the speed of the user's connection to the Internet (high resolution for larger files and for cable modems and T1 users, medium resolution and average file sizes for fast dial-up modem users, and low resolutions with smaller file sizes for slower dial-up users).^[108]

The on-line "help and customization" services that some government Web sites provide include fully functional advanced search engines with Boolean and document search options, perhaps tailored to the educational level of the information seeker (e.g., Department of Education, <http://www.ed.gov/search/advSearchForm.jsp>); excellent help pages (e.g., THOMAS of the Library of Congress, <http://thomas.loc.gov/tfaqs/tfaq15/pdfhelp.html>) and online guides (e.g., for installing GEODE, <http://dssl.er.usgs.gov/help/>); the establishment of personalized web pages, whereby the public collects their favorite information from the site and receives updates on a regular basis (the user logs onto the site using a password) (e.g., "My TradeNet," <http://tradenet.gov/>); and the free and convenient access to full-text and bibliographic records of the Department of Energy, such as research and development reports in the sciences and some other disciplines, using a persistent uniform resource locator (PURL) (see "DOE Information Bridge," <http://www.osti.gov/bridge/>).^[108]

An example of private and public sector cooperation involves mapping products that government agencies prepare. These products might be linked to a commercially available GIS that combines mapping and a data set and that permits users to display multiple data items. A GIS is a computerized system that captures, stores, manipulates, analyzes, and presents data coded to a particular location or area on the Earth's surface (latitude and longitude). Federal agencies use GISs for resource management, planning, resource allocation, and the setting of and compliance with regulations. More precisely, they use the computerized systems for land use analysis and planning, natural resource management, land cover interpretation,

demographic mapping and analysis, transportation route or traffic corridor selection, natural hazard assessment, global research, military reconnaissance, etc.^[109]

Depository Library Programs

The Government Printing Office administers the best-known depository program, in which more than 1300 libraries receive publications that GPO receives and distributes for public use. A key question is: “What is the role of this depository program (as well as other ones) in the environment of e-government that has been briefly sketched in this essay?” Is it more than being a resource for lessening the digital divide (see below) providing access to historical documents, and assisting the public in navigating the government’s presence on the Web and furnishing the necessary plug-ins to retrieval needed government information resources? Depository libraries can provide the public with free access to fee-based statistical compilations of the Department of Commerce’s STAT-USA.

Complicating matters, the only study to document the number of users of the depository program (actually only academic and public depositories) recorded 167,000 of them for a typical week in the latter 1980s.^[110] In contrast, during a typically week, the Bureau of the Census, for instance, has more than 1 million “hits” on its home page. Thus, under e-government, government departments and agencies can directly, efficiently, and effectively provide the public with both information and services, without having to rely on third parties such as depository libraries. Perhaps the major exception to this generalization is the depository program of the Patent and Trademark Office, where anyone seeking patent or trademark information can rely on the special knowledge and search skills of the highly trained staff at these libraries. Seeking information on patent and trademarks can constitute a complex search process, and even the agency’s home page acknowledges the program and encourages information seekers to use the resources under the direction of depository library staff.

Policy Framework

At the federal level of government, information policy may be developed in a variety of ways and prescribed in a number of different forms. The prescribed way for Congress to establish information policy is largely through the constitutionally specified legislative process. A member of Congress formally introduces a proposal in the form of a bill or a joint resolution. Usually the measure is one endorsed by the member, but legislation can be offered “by request” on behalf of the president. Ideally, the proposal is referred to the appropriate committee of jurisdiction; given a hearing, where public comment is received; marked up in accordance with committee wishes; reported to the floor; and voted on by the chamber membership. After the other house of Congress completes similar action

on the measure or one nearly like it, a conference committee may be necessary to resolve differences in the two adopted versions. After both houses have agreed to the single compromise bill, the proposal is presented to the president for signature. When signed into law, the measure attains the status of being a statute and, usually, is positioned within the *United States Code*. If the president vetoes it, Congress has an opportunity to override and, if successful, the measure becomes a statute.^[3]

There are, however, other techniques and procedures available to Congress for setting policy. Within its own domain, the two houses of Congress adopt rules and standards that constitute policy. In 1980, for example, the Senate adopted a simple resolution that changed the rules of that body to increase public access to its archived records.^[111,112] A similar reform was instituted in the House of Representatives in 1989 with the adoption of a simple resolution amending the rules of the House for the 101st Congress.^[113,114] Committees of the House and Senate set rules for themselves that constitute information policy. For example, many committees have a rule on how they handle and maintain security classified or other sensitive information.

Congress also appropriates funds for the departments and agencies. This fiscal authority can be directly and indirectly used to set policy. A verbal understanding or committee report language concerning the operation and/or expansion of a program in question may accompany a generous appropriation for an information program. Similarly, funds may be denied or withheld for a program. Moreover, a permanent prohibition may be instituted through the appropriation process.^[115]

Finally, policy may be set through informal but, nonetheless, documented agreements. A powerful committee chairman may ask an agency head to conduct some information operation in a particular way; the verbal agreement, extracted at a hearing, is captured in the transcript of the proceeding. In the same regard, an exchange of letters may be used to set policy. For example, shortly after President Kennedy assumed office, the chairman of the House Special Subcommittee on Government Information wrote to him asking for an explanation of how his administration would invoke “executive privilege.” By return letter, Kennedy pledged he would exclusively exercise this power and would assume personal responsibility for its use. Sometimes, of course, a record documenting an informal agreement setting policy may be difficult, if not impossible, to locate. Furthermore, sometimes no such record exists.

The federal courts also make information policy. When a judicial decision is rendered on a dispute, it may uphold the status quo or modify an existing policy at issue. Moreover, in writing an opinion on a decision, a judge or judges may offer views or prescribe a procedure that assumes a policy character. For example, law professor Robert Vaughn’s FOI Act lawsuit to gain access to Civil Service Commission evaluations of certain agencies’ personnel

management programs and other similar reports prepared by the Bureau of Personnel Management resulted not only in a ruling in his favor but also inaugurated agency creation of an index that would enable courts to facilitate reference to particular portions of documents and to know the exact exemption being relied on by the government for each controverted section of a document at issue. Such an index allows a requester to prepare better arguments for the disclosure of sought records. An agency must identify specific portions of disputed documents that are being exempted from disclosure and must justify in detail the reasons for protecting particular information under certain exemptions.^[116] The FOI Act, in particular, has been subject to a considerable amount of such judicial gloss.

Courts and individual judges also enjoy a considerable amount of authority for setting information policy for their domains. Federal court rules, practices, and procedures, not inconsistent with legislative enactments, have the force and effect of statutes, but any such rule inconsistent with a statute is inoperative. The Supreme Court promulgates rules for itself and the separate lower federal courts.^[117] These are for the general guidance of the courts. However, because the individual Courts of Appeals in their circuits and federal District Courts throughout the country encounter special local conditions and circumstances, they are empowered to make their own special rules, not inconsistent with the rules of general applications set down for them by the Supreme Court.^[118] Furthermore, within all of these rules, presiding trial judges have some latitude to control information (e.g., issue a protective order, seal documents, or perhaps close a portion of a proceedings). Such actions may be viewed as policy making; their significance will vary depending on their public effect.

Judicial opinions, once filed, are publicly available at least in typescript at the courthouse of the authoring judge (s). Some judges, however, may be slow to file their prepared views. Commercial publishing firms obtain these opinions and produce various compilations, including the well-known *Federal Reporter* and *Federal Supplement* series. Supreme Court opinions, while also available in commercially published form, are produced by GPO in the *United States Reports* series.

Within the Executive Branch, information policy may be prescribed through a wide variety of forms emanating from the Oval Office, an agency fulfilling a governmentwide responsibility, or an agency serving only its own personnel. In the first category, the president may set policy through the issuance of a directive, such as an executive order or a national security decision directive, a letter, a memorandum, or simply an announcement. In almost all cases, such policy making cannot conflict with statutory expressions and is of an administrative nature and internal to the government. Occasionally, however, the president may exercise some constitutional authority (e.g., Commander in Chief powers) resulting in policy

expression in conflict with congressionally legislated policy. For example, some speculate that one of the reasons why Congress has not directly legislated information security classification policy, except in very specific program areas, is that the president has the prerogative in this field by virtue of being constitutionally Chief Executive and Commander in Chief. Conflicts between a congressional and a presidential policy expression are sometimes settled by the courts but are oftentimes left to political settlement.

Governmentwide policy on a matter may be set by a particular agency. For many years, OMB, and the Bureau of the Budget before it, has issued circulars, announcements, and guidelines on a variety of fiscal and administrative matters. The Privacy Act of 1974 authorized OMB to issue governmentwide guidance and regulations for implementing the statute.^[119]

Finally, each agency produces forms of policy. Again, the expectation is that these agency expressions of policy will not conflict with statutes or other superior policy forms, such as a presidential directive or governmentwide guidance. Agencies issue regulations implementing and interpreting statutes and presidential policy instruments, internal administrative orders and directives governing their organization and operation, and staff manuals, such as security classification guidebooks, all of which contain expressions of policy. Most agency regulations can be found in the *Code of Federal Regulations*. Draft and new regulations, as well as some other agency orders and directives, are published, when first issued, in the *Federal Register*. Nonetheless, some of this material is unpublished and fugitive; however, it might appear on an agency's home page.

Stakeholders Affecting Information Policy

Given the impact of information policies on many facets of one's work and nonwork situations, a listing of stakeholders involved in policy formulation and review would be endless and unproductive. Most professional organizations have a body for presenting their response to draft and newly reported information policies of concern to their membership; those bodies may also try to shape those policies. For example, they might be invited to present their position at a congressional hearing or to interact with committee staff in shaping initial legislation. It is important that different stakeholders be willing to work with each other and, when necessary, to compromise. Clearly, information policy is subject to the political process. As well, policy makers will be sensitive to the costs of any proposed recommendations and will not react well to calls for creating a new government agency or program. There are, as well, competing priorities such as, of late, homeland security matters, including the creation of a new cabinet-level department charged with such responsibilities.

TOWARD NATIONAL INFORMATION POLICY

In July 1976, the Domestic Council within the Executive Office of the President submitted a report, *National Information Policy*, to President Gerald Ford. The principal recommendation was that “the United States set as a goal the development of a coordinated National Information Policy . . . that is comprehensive, sufficiently sensitive to new technology, and responsive to the implications of the Information Age.”^[120] The report advocated a unified approach to information policy coordinated in the Office of the President.

Subsequent discussions of information policy have encouraged the development of a “requisite arterial system” for “the free and equitable flow of all nonproprietary, nonconfidential information to each individual, regardless of location, level of comprehension, economic status, or other circumstances.”^[121] Such discussions focus on national information policy, but for either government or nongovernment information. Rarely has such policy been viewed as a marriage of all information resources, whether they are government or nongovernment.

Trying to develop national information policy, the National Commission on Libraries and Information Science, the British Library, and the Canadian Institute for Research on Policy formulated the Glenierin Declaration, a trilateral statement that could serve as a preamble for national, or international, information policy that recognizes the impact of information on national economies and societies. Although dated, that declaration articulates an agenda of issues, initiatives, and strategies for achieving the marriage of all information resources.^[122]

Briefly, national information policy conveys a sense of national purpose and represents guiding principles leading to the integration of all publicly available government information in the United States, regardless of the level of government producing that information. Moreover, that integration combines government and nongovernment information, extends bibliographic control over that information, and produces mechanisms for gaining effective and efficient access to that information. In contrast, federal information policy has the force of law and variously binds the federal government to prescribed courses of action.

One purpose of national information policy is to improve the dissemination of government information and to bring pertinent government information resources produced in the United States to the resolution of various information needs of the citizenry. Of course, national information policy might have another component: the identification of significant foreign source material that, e.g., will lead to a U.S.-based patent or scientific breakthrough. National information policy should encourage differentiation between quantity and quality of information and discourage the generation of information that merely adds to information overload.

The National Commission on Libraries and Information Science (NCLIS), a proponent of national information policy, has reaffirmed its support of national information policy through its declaration of “Principles of Public Information,” such as with *Principle 1: The public has the right of access to public information*: Government agencies should guarantee open, timely and uninhibited access to public information except where restricted by law. People should be able to access public information, regardless of its format, without any special training or expertise.”^[123]

In 2000, NCLIS asked Robert M. Hayes, Professor Emeritus at the University of California, Los Angeles, and chair of the 1982 NCLIS Public Sector/Private Sector Task Force, to reflect on the task force’s findings, conclusions, and recommendations 20 years later. In his reflection, he discusses seven principles and 27 recommendations.^[124] It is encouraging to note that e-government has met most of the principles and recommendations.

E-government, with its attempt to make government become “citizen-centered,”^[125] is achieving national information policy. E-government is forging partnerships and alliances with the private sector and government agencies (even those at subnational levels of government). As a result, more, better organized, and better displayed, government information is readily available. Furthermore, right on their home pages, they tailor access to information for specialized audiences. For example, the Library of Congress’s home page (<http://www.loc.gov/>) enables information seekers to search by whether they are “researchers,” “law researchers,” “librarians and archivists,” “teachers,” “publishers,” “persons with disabilities,” or “blind persons.”

Government departments and agencies have too much information—not all of which is conducive to Web delivery—to place the entire set on the Web. They might not have organized some of their information resources sufficiently for electronic delivery, and some information may not be conducive to display on the Web. In other instances, agencies may have overlooked some information resources in their possession, thereby letting information resources evade being captured bibliographically and being presented electronically, if deemed of sufficient public interest and value. Naturally, e-government cannot and does not focus on nongovernment information. It would seem that the declarations of policy principles and the private and public sector roles and responsibilities that these principles lay out merit reconsideration in the age of digital government. The conditions stated in these principles no longer exist.

LOOKING TO THE FUTURE

If there is a single dramatic and profound factor of change in information policy at present and for the future, it is the concept of e-government, which recognizes the civic and business role of government in disseminating both

information and services. For a long time, information policy has been viewed and formulated in a context of civil liberties and citizen rights in a democracy. This value will continue to be important but is being joined by the somewhat competing factor of information having economic, global, and national security value, particularly when government information is increasingly available in digital formats that are attractive to information users.

The challenge for the future will be to continue to improve information dissemination through e-government^[126] in balance with post-September 11 security concerns. At the same time, government departments and agencies will need to articulate better how they decide what to include and exclude on their home pages and what happens once information is removed from availability there. Is the information removed to a "library," which is a storehouse that may not be easy to search, "archived," or destroyed?

Most definitely, the amount of information produced annually within the federal government and other levels of government is large and ever-increasing. Although the quantity of information increases, so too does its usefulness to diverse segments of the population. Information policy is crucial to national economic well-being and scientific discovery, as well as maintaining an informed and well-educated citizenry that interacts with the government on a regular basis.

CONCLUSION

The availability of information is no longer restricted by national boundaries. Furthermore, the free market is expanding, and geopolitical structures are undergoing radical changes in the name of e-government. As a result, many policies have broad implications. Local libraries and information centers operate within this broad framework. That framework shapes what information is available, in what forms, at what price, etc. Clearly, libraries can play a part in revitalizing U.S. competitiveness in world markets. However, they have other charges as well. The result is that a host of current and potential policy issues have direct and indirect implications for library and information science as e-government continues to unfold and its infrastructure is developed. It is important that these issues be identified and that the library and information science profession develops strategies that define the role of libraries and information centers in the provision of electronic and print information to the public and that complement the goals of e-government.

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Information Practice

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Abstract

The phrase *information practice* is relatively new to the field of Library and Information Science (LIS). Using the works of individuals, such as Foucault, Vygotsky, and Garfinkel, the concept of information practice questions the historical positioning of the individual as the unit of analysis. Instead, information practice proposes that information behavior is best understood by considering information and knowledge constructed as a sociocultural context. Recent LIS scholarship in regions, such as Australia, North America, and the Nordic countries, has drawn upon explorations of discourse to theorize and apply information practice as an umbrella approach to LIS research. This entry explores the concept of information practice and its place among LIS metatheories and application in LIS research.

INTRODUCTION

To commence this entry, a truism is stated: Library and Information Science is a multidisciplinary field. The discipline embraces a multitude of information-related areas concerned with human information behaviors or practices, including information creation, access, retrieval, organization, etc., necessitating the consideration of a range of social science perspectives in the work of practitioners, researchers, and theorists in this field to legitimize and expand research. Equally, because in the social sciences Library and Information Science is relatively new (particularly in terms of empirical theory building compared to other social science disciplines), it is important to embrace new perspectives that draw upon applicable theories and research. However, it is also vital that the discipline does not ignore or negate the fundamental work that has been done by scholars who have explored and may continue to do so, the ways in which human beings engage with information both to build a theoretical basis for this field as well to guide information professionals, including librarians, in their service delivery.

For some decades, the accepted terminology for this particular area of interest and research in the field has been described as *information behavior* (IB).^[1–5] Information behavior researchers and practitioners over the years have dedicated their efforts to exploring and addressing the information needs, information seeking, and information uses of individuals and collectives. All of these endeavors have been undertaken not only to improve information service provision but as well to contribute to theory building in this relatively new field. As embodied by the Association for Information Science and Technology (ASIS&T)’s Special Interest Group: Information Needs, Seeking and Use (SIG USE), the focus of information behavior, encompassing both cognitive and affective behaviors, includes

- Shaping and identifying information needs
- Seeking (and not seeking) information that will address those needs
- Exploring information sources present in one’s context/situation
- Retrieving information from available information sources
- Sharing information with others
- Managing personal information collections
- Communicating and collaborating with others concerning an information need or information resources
- Personal and group-based information use^[6,7]

In recent years, IB has been challenged both as a term and a research approach by a respected body of researchers who have contributed significant work to empirical and IB theory construction.^[8–11] The suggested new nomenclature or “umbrella” term is *information practice*.

This entry includes not only an introduction to information practice, including the philosophical perspectives and the work of the researchers and theorists in this field, but also the recent work being done by individuals who are teasing out this possible “new” term or alternatives to IB for LIS dialog, research, and theory construction from a multidisciplinary perspective.^[12] As well, it will consider other works related to the proposed theoretical basis of information practice and review related current work that seems to place information practices within a wider definition of information behavior in a range of different contexts^[2,4] and discuss new and potentially exciting interpretations.^[2,13,14] Finally, this entry will consider whether there actually is a fundamental difference in perspective between those who describe understanding human activities as information behavior and those who choose information practice, or whether possibly, in reality, this move to an alternative categorization is a semantic

issue. The authors' review of the literature from both perspectives finds that there is mutual agreement that an information activity (or indeed inactivity) is determined by context, whether that be personal, organizational, cultural, etc. Therefore, because LIS research is incorporating the importance of context in studies of information behavior and information practice, the authors will reflect upon the possible need in LIS theory building to move away from focusing on what might be a semantic issue to placing context at the forefront of the development of LIS as a rigorous field in the social sciences.

WHAT IS PRACTICE?

The term *practice* may be defined as pertaining to routine or habitual activities, the idea being to convey a custom or tradition in experience. For example, one definition of practice offered by the *Oxford English Dictionary* is "the habitual doing or carrying on of something; usual, customary, or constant action or performance; conduct," a definition debated by Savolainen and Wilson.^[15] However, the use of the term *practice* in research has yet to be standardized. Some scholars claim to study *practice* as a theoretical construct, while others refer to *practices* as activity-based experience. Similarly, as they attempt to reconstruct their research identities, some scholars refer to their field of specialization as *information seeking practices* and combine this with *information needs*, referring to the long established field of information behavior.^[16] Others have simply appended *information practices* to *information behavior* as an addition to the field of information behavior.^[17] The varying adoptions of the term *practice* to relay disciplinary subject are suggestive of the flux around defining practice as a concept and information practice as a field of study.

Library and Information Science scholars who advocate information practice as a theoretical concept for our field have drawn on Schatzki's^[18] definition of practice. Schatzki explains practice in terms of *human activities*, explaining "Practices are the bundled activities that one type of component of social orders performs."^[18] He summarizes a practice as "a temporally evolving, open-ended set of doings and sayings linked by practical understandings, rules, teleoaffective structure, and general understandings."^[18]

EVOLVING CONCEPTUALIZATIONS OF INFORMATION PRACTICE

In their analysis of LIS metatheories, Talja et al.^[19] state that "A metatheory enables researchers to determine what kind of entities, for example, information, knowledge, users and information retrieval systems are...bringing into researchers' view a specific object of study and a

way of studying this object." The concept of *information practice* arises from the philosophical perspective that because information and knowledge creation is rooted in a sociocultural context, research approaches that concentrate on the individual as the unit of analysis inadequately address the social nature of information processes.

During the late 1970s, constructivism, or the "cognitive viewpoint,"^[20-22] based on educational theories of learning,^[23,24] emerged as a dominant research approach in LIS. Rooted in the view that knowledge is created internally through active, individualized engagement and interpretation of information, constructivism focuses specifically on the individual's sense-making^[25,26] when faced with a gap or uncertainty.^[21] Constructivist researchers^[5,21,27,28] explore the cognitive and affective dimensions of human information behavior and the situational contexts that trigger and may determine the nature and outcome of the individual's engagement with information. Wilson^[29] states that information needs should be included in any model of human information behavior, as well as the drivers that cause the perception of need, those elements that have an effect on response to need, and the nature of the response.

Criticism of the constructivist approach has been raised on a number of levels. Among these is the view that, because the focus is on the individual and his or her internalized construction of mental models or sense-making, the research is, in essence, a study of subjective meanings. Additionally, the "cognitive viewpoint" implicitly creates a perception that LIS is specifically about the effect of information on the individual,^[30] the "information man"^[31] replacing "information" as the core theoretical tenet. Despite the increased attention to information seeking in context (ISIC), constructivist research, it has been argued,^[19,32] does not adequately explore the effect of sociocultural elements on the creation of knowledge nor attributes to language more than an indistinct role as a tool for acquiring evidence of cognitive processes. Methodologically, constructivism has been challenged as well, in terms of the feasibility, either quantitatively or qualitatively, of acquiring an accurate, objective portrait of the inner workings of the human mind engaged in knowledge formation.^[33]

An alternative to constructivism is that of collectivism or social constructivism (reorienting the research approach from the individual to the collective). Based on Vygotsky's^[34] view that knowledge is created through both the individual's internal cognitive processes and their engagement with and experience of a particular sociocultural milieu, collectivism explores the ways in which individuals engage with information and form knowledge through their daily experience of, and participation in, the external, social world. At the center of collectivism is the concept that, because people are social and cultural beings, then it is erroneous to explore their information needs and practices purely from

a psychological perspective. This approach has been explored particularly in domain analysis studies. Hjørland and Albrechtsen^[35] critique the individualistic, cognitive focus of constructivism as being subjective and possibly defective, calling for “investigations of more holistic theories, incorporating knowledge about the cultures in which the information systems are functioning...this implies giving up (or at least supplementing) behavioristic and cognitivist positions in LIS.” Research in this approach has directed its attention away from a unilateral focus on the individual to the information practices inherent in different professions, communities, and environments. Because the empirical work has been conducted predominantly within scholarly discourse communities,^[36–38] there is a concern that collectivism may not have applicability to everyday life information seeking. Wenger’s^[39] theory of communities of practice, with its emphasis on how individuals within a group learn collectively, addresses this issue. Communities of practice exist and can be identified and studied, not only in professional or academic settings, but also in informal, socially based, everyday life settings.

In order to encompass the full dimensions of information seeking and use, social constructionism (or constructionism) is proposed as a potential metatheoretical alternative for LIS. Like collectivism, constructionism is concerned with the social and external use of information, as opposed to the subjective and internal. Knowledge and knowledge structures are not viewed in terms of human beings’ individualized mental states, but rather as social and cultural products and processes. Specifically, the constructionist approach emphasizes language, that is linguistic rather than cognitive processes. It differs from collectivism in that it “entails a more direct focus on rhetorics, argumentation and language use...”^[19]

Information practice has its roots in the work of several theoreticians. At the center of this discussion is philosopher Michel Foucault, whose writings have informed the development of the concept of information practice, as well as the movement to construct an overarching theory of LIS. As Buschman^[40] observes, Foucault “is widely cited, and his insights are adapted in various works that focus on LIS forms of power, discourse, archaeology, silences, exclusion, defining the *other*, domination, and micropractices in the last 15 years of critical-theoretical LIS scholarship.” Foucault^[41] describes discourses as “practices that systematically form the objects of which they speak.” This idea of discourse offers Foucault’s most influential idea adopted in LIS theoretical work.^[40]

This notion of discourse as the object of analysis has long been explored in the academy, with authors, such as Bernd Frohmann^[42,43] and Gary Radford,^[44,45] promoting discourse analysis as a means of understanding the “text” of LIS, including collections, documentary practices, etc. For example, Volosinov’s^[46] work is used to understand discourse by way of classification of discourse through the

selection, organization, and combination of concepts.^[44] In addition to Foucault, proponents of the information practice approach cite other influential figures on thinking about this area, such as Mikhail Bakhtin,^[47] Valentin Volosinov,^[46] Harold Garfinkel,^[48] and Wayne Wiegand.^[49] However, while other philosophers and scholars are linked to Foucault, Foucault remains “far more central to the project at hand.”^[41]

The underlying assumption of the discursive approach is that language holds the key to understanding or establishing meaning in information-related activities, including information needs, seeking, interaction, and sense-making.^[42] Discourse, then, holds a central role in constructing social reality. Information practice research explores “how people give accounts of their information behavior or construct the meanings of technical artifacts in work and everyday life,”^[50] the construction of which Talja and McKenzie assert as significant to “understanding information seeking and technology use from a broader sociological perspective.”^[50] From a theoretical perspective, this reasoning is sound. However, it ignores the fact that discourse, as well as being determined by sociocultural context, is also grounded in cognitive processes. Vygotsky,^[34] while emphasizing the importance of the social context for children’s development, also concentrated his work in exploring the role of inner speech or self-talk as a key to development and sense-making.

INFORMATION PRACTICE IN INFORMATION SCIENCE

Social constructionists generally explain their approach in juxtaposition with the cognitive perspective attributed to information behavior. Savolainen^[11,51] contends that information behavior has been accepted unquestioningly by LIS practitioners, the focus on the individual’s internal processes preventing the exploration of alternative ways of understanding information seeking and use. He asserts that information practice and information behavior are actually “umbrella” discourses. He calls for “a self-reflexive and critical attitude among researchers towards their familiar concepts in order to avoid being ‘trapped’ in their own discursive formations.”^[11]

In proposing an alternative, social constructionists challenge, in a broad sense, the human information behavior approach adopted by LIS researchers. While interest in human beings’ use of information can be traced back to the early decades of the twentieth century, the concept of information behavior is typically perceived to be rooted in the work of researchers, such as William Paisley,^[52] in the 1960s, with Tom Wilson’s^[53] 1981 model of information seeking and use significantly offering an early model that he would later develop to account for human information behavior. By definition, this concept of behavior includes all aspects of the individual’s engagement (or, in some

cases, nonengagement) with information both internally and externally. This approach, while endeavoring to understand the internal processes of individuals, also explores the external factors including “intervening variables”^[54] that help explain the role of information in people’s life worlds. While Wilson is typically cited for establishing information behavior as a theoretical concept for LIS, the models and theories of other prominent LIS scholars, including Paisley,^[52] Bates,^[55] Chatman,^[56,57] Sonnenwald,^[58] Krikelas^[59] (see also Henefer and Fulton^[60]), and Kuhlthau,^[61] form a canon representing a traditional viewpoint under information behavior.^[11] Social constructionists, such as Talja et al.,^[33] argue that while researchers in human information behavior have, over time, expanded their frame of reference and elements of research investigation, the term “behavior,” with its traditional association with internal, cognitive processes, will never provide real understanding, because it is impossible to observe objectively. Of the familiar pioneer names in LIS, Dervin has moved to adopt the term “practice” over “behavior,” placing her in the fold for information practice advocates.^[11]

In proposing the need for critical reflection, Savolainen^[11] argues that, although information practice and information behavior appear to overlap, the two are distinct, emerging from different theoretical perspectives and, therefore, providing differing positions for considering information seeking. Savolainen explores a selection of texts to investigate the development of information practice. In doing so, his analysis takes on a selective text choice, a problematic difficulty already criticized by Buschman^[40] in Foucault’s work. This adopted assumption underlying information practice requires further exploration to support the viability of the approach.

Buschman^[40] examines the potential for a Foucauldian approach in LIS. Importantly, he quotes Habermas’ objections to Foucault’s work, which suggest that Foucault’s logic is flawed, leaving his theory relativist and unable to escape subjectivity. Selectivity of texts and the “death of the subject” are problematic for many of Foucault’s critics, for whom theoretical construct and its language are equally hegemonic. According to Buschman,^[40] “without a theoretical subject or the ability to locate a locus of power, transgression is (literally) meaningless and hopeless, and social and economic relations are frozen—in stasis.” Issues of power remain problematic, where the danger becomes that “the point of LIS discourse analysis becomes LIS discourse analysis.”^[40]

While arguing for an alternative “umbrella” concept, Savolainen^[11] concedes that information behavior and information practice are overlapping at times, such that “researchers may flexibly draw upon alternative metatheoretical ideas in the empirical study of information seeking.” What both perspectives share in common is a belief in context, although implementation may differ. Characterizing context (“the Unruly Beast”) as “a label

for a site of struggle,” Brenda Dervin, in attempting to define what we mean by context in LIS, states that “the only possible conclusion is that there is no term that is more often used, less often defined, and when defined defined so variously as context.”^[62] A critical contribution that constructionism offers to the development of LIS research methodologies lies in its approach to context and how, as researchers, we can examine and refine our empirical studies. Again, those who are exploring the validity of identifying information practice as a more encompassing term to define and investigate the role of information in life worlds make a distinction between their approach to context as compared to that of information behavior researchers.

Constructionists’ approach to context is described as “interpretative,” in that “context is not understood as an independent entity, but as a carrier of meaning.”^[33] In comparison, context, for those studying information behavior, is defined as “objectified.” This implies that information behavior researchers are interested in context in terms of the factors that have an impact on human beings’ use of information, identifying the range of variables that will have an effect on individuals’ needs, seeking, and use, in order to anticipate information behavior in particular situations and best provide systems to facilitate information resolutions. These studies, it is argued, aim to identify the range of variables (internal and external) that either create or affect the actions (or inactions) related to information behavior that have an effect on the object of the research, that is, the individual. Although there is no argument, superficially, with this research approach, constructionists, interested in the applicability of their theory to empirical endeavors, maintain that the crucial dilemma for information behavior researchers is the assumption that this well-established and inadequately challenged methodology does not sufficiently allow for the subjectivity of language and interpretation.

The interpretative approach, proposed by those advocating information practice as an alternative “umbrella” concept, is helpful in terms of providing LIS researchers with a means to experiment with a methodology that challenges the constant critique of the “softness” of social science research. The interpretative approach to context portends that data cannot be interpreted as clear reflections of reality, but that all data collected during the process of research represent not only participants’, but also researchers’ and readers’ sociocultural background assumptions and experiences. Proponents of information practice assert that only through acknowledging that research participants, researchers, and readers bring their own particular sociocultural meanings and interpretations to information seeking and use, can we hope to arrive at a research methodology that will more adequately serve the development of LIS theory. By focusing on the analyses of sociocultural discourses, and simultaneously recognizing and reiterating the subjectivity of all participants’

interpretations (research participant, researcher, and reader), constructionists are advocating a further development in LIS research practices that will contribute to the scientific rigors of our work.

In his consideration of the relevance of a “practice approach” to information science, Cox^[13,14] recognizes that “practice theory” is applicable across a range of disciplines to support theory building. “Communities of Practice” have informed IB research for decades, Ellis^[27] model of academics’ information seeking being an obvious example. In seeking to ground LIS theory building within a robust social science perspective, IP scholars have adopted practice theory as a solution.

In her work placing information literacy within an information practice framework, Lloyd^[63] explores the historical evolution of practice theories, citing the studies of philosophers from Aristotle to Wittgenstein, Bourdieu, and Giddens. She presents the view that practice theories are effective means by which one can study and make sense of “sociality”^[63] (p. 248). In other words, they provide a potentially fruitful framework through which we can explore and build theory about the ways in which human beings engage with information (seeking, gathering, processing, etc.) and critically how the individual’s subsequent construction and use of knowledge is determined by the particular characteristics of the social site they inhabit,^[64] including (but not limited to) cultural norms and expectations, histories, linguistic traditions, economies, and politics. While making an effective argument for conceptualizing information literacy as an information practice, grounded in social sites, Lloyd does concede possible limitations to this approach stating:

At present, however, there is no unified approach or definition of practice, consequently explications of practice differ depending on the ontological and epistemological orientation and interest of the enquirer^[63] (p. 248).

Huizing and Cavanagh^[65] similarly note the lack of a unified practice-based approach. They suggest that practice theory has evolved to contemporary practice-based approaches, with five underlying premises: *including objects*, *stretching interaction*, *foregrounding dynamics*, *explicating knowing*, and *articulating practice*. *Including objects* refers to recognizing the role of material objects in social, organization, and information theories. *Stretching interaction* is about expanding definitions of social interaction to include the influence of human and nonhuman agencies and actions relevant to the interaction. *Foregrounding dynamics* prioritizes actions and practices over actors and organizations in organizing ourselves. *Explicating knowing* offers knowledge as a group, rather than individual, activity. And finally, *articulating practice* refers to the interpretative nature of practice and a contemporary definition of practice.

Bystrom and Lloyd^[12] acknowledge that information practice “lacks fixed meaning in the field of studies.” They offer information practice as a “social practice” that encompasses all human information activities, including producing, seeking, organizing, distributing, and using information. Lloyd^[66] (p. 285), drawing on Schatzki, defines information practice as “an array of information related activities and skills, constituted, justified and organized through the arrangements of a social site, and mediated socially and materially with the aim of producing shared understanding and mutual agreement about ways of knowing and recognizing how performance is enacted, enabled and constrained in collective situated action.” However, as Cox^[13] points out, practice theory in itself is inconclusive. Corraid et al.^[67] highlight that practice-based approaches embrace a range of different perspectives both from an empirical and a theoretical stance. In describing the fluidity, or perhaps fragility of practice theory, these authors describe current work in practice theory as a “bandwagon.”

FROM THEORETICAL CONSIDERATIONS TO IMPLEMENTATION

Methodological approaches often follow similar pathways to those adopted to explore other frameworks and theories in LIS. For example, Tuominen et al.^[68] cite Garfinkel’s^[48] ideas on ethnography as an important means of exploring information practice, as well as the case study method used by researchers, such as Veinot.^[69] Savolainen^[11] cites Volosinov’s^[46] analysis through classification of concepts as a useful methodological approach. Among the wide array of available research techniques, interviews with individuals and textual analysis remain commonplace in data collection and analysis under the information practice approach.

Recent scholarship has drawn upon these explorations of discourse to theorize and apply an information practice approach to LIS research. As Buschman^[40] observes, there exists a core group of LIS scholars who have taken up the challenge of Harris^[70] and Wiegand^[49] to explore Foucault’s work and its implications for LIS theory and research. Leading works have emanated largely from Australia, North America, and the Nordic countries. For example, various publications by Talja, Tuominen, and Savolainen^[31,32,68] have explored positioning of information practice theoretically.

Examples of researchers implementing social constructionism as a research approach have expanded in recent years. Michael Olsson, who presented some of his early work on social constructionism at the ISIC conference held in Dublin in 2004,^[10] currently incorporates an information practice perspective into his previously information behavior-positioned research on Dervin’s sense-making and Foucault’s discourse analysis in his more

recent conference and published works.^[71–73] Sanna Talja, Annemaree Lloyd, Reijo Savolainen, and others have collaborated variously on works about information practices, for example Lloyd and Talja's edited volume focused on information practice, learning, and information literacy.^[74]

Pamela McKenzie, who has been acknowledged by many information practice scholars to be among the most highly active in this area,^[9] is known for implementing information practice in empirical fieldwork. For example, McKenzie^[75] has applied an information practice framework to clinical midwifery. McKenzie and Stooke^[76] also analyzed a public library storytime from a collectivist perspective, concluding that the approach enables the researcher to begin connecting the actions of individuals to those of social actors in other contexts. In her study of the information seeking accounts of pregnant women, McKenzie identifies four modes of information practices that she describes as operating on a continuum: "active seeking," "active scanning," "nondirected monitoring," and "by proxy."^[77] The first mode, as its title implies, is purposive, directed and planned information seeking. "Active scanning" would include practices in which the individual browses or scans materials or locations which are likely to offer information. McKenzie states that the third mode of information practice "... involves serendipitously encountering and recognizing a source... in an unlikely place, while not seeking information at all... or while monitoring information sources... with no intent other than to become generally informed." The final information practice mode in McKenzie's model is described as "by proxy" and includes a variety of incidents when an individual would obtain information through the intervention of an external agent or intermediary.

In 2007, McKenzie and Talja edited an issue of *Library Quarterly* (Vol. 77, No. 2), devoted to *Discursive Approaches to Information Seeking in Context*, with articles exploring topics related to communication, information literacy, and work and professional practices. Contributors included Savolainen,^[11] with his comparison of cognitive and discursive metatheories, as well as various authors applying information practice to different information contexts. Park^[78] analyzed a chat group's textual output to examine communication in an online environment. Veinot^[69] focused on a case study of the blue-collar work world of an individual vault inspector at a hydroelectric utility company, using information practice as a framework for exploration of an individual's work role. Lloyd^[8] applied information practice to the role of information literacy and workplace learning among firefighters in Australia, in which the process of increasing information literacy required interaction of various textual and personal constructions of collective practice. Having previously explored discourse in various other pieces individually, with others, and together,^[79,80] Johannisson and

Sundin^[81] examined embedded discourses in the nursing community of practice that produce a professional identity for this issue of *Library Quarterly*. Olsson^[82] investigated the relationships among author, text, reader, and researcher for Brenda Dervin as an author in LIS discourse, following on from previous work on this topic mentioned earlier^[10] and having presented this entry at the *ASIS&T annual conference* in 2005.^[83] Although individuals have previously published about information practice in various venues, this issue of *Library Quarterly* is significant for publishing several pieces on this subject in a single collection.

In more recent times, the authors have found a number of studies that either are grounded in a theoretical IP position^[12,63,69,84,85] or mention information practice(s) as an element of information behavior generally. The latter adopt an IB perspective and then describe practices that they categorize as part of the holistic information behaviors of those people they are studying.^[1–4,84–87] Of particular interest are Meyer's^[2] study of cross sociocultural information exchange with regard to developing communities that explores further Chatman's theory of small worlds, as well as Webber's^[4] and Huvila et al.'s^[11] investigations of the information behavior of individuals in "Second Lives" (SL), considering the rules and practices within this virtual reality that determine participants' active and passive information behaviors. From his work researching family photography, Cox^[14] argues that it is important for theorists and practitioners to engage in discussion about the use of practice theories to understand LIS as a social science. However, he also suggests perhaps a more pragmatic approach (i.e., "information in social practice") stating:

...information activities are woven through all social practices, and this is even more evident today through ubiquitous access to information resources through the internet. Thus we need to look at the information aspect of all social practices. Escaping a narrow preoccupation with goal-oriented information, we need to first ask within any practice what, for social actors, constitutes information, and then how do they find, use, create and share it^[14] (p. 185).

CONCLUSION: OPPORTUNITIES AND THEORETICAL PATHWAYS

It has been clearly established^[5] that IB is not fixated unilaterally on the cognitive dimensions of human being interactions with information,^[25,28] (etc.). Early models of human information behavior have firmly placed context at the core. The context includes the social dynamic that includes those customs, rules, attitudes, and vernaculars that comprise the multifaceted life worlds of each individual, experienced through their work, their membership in a

community and in their personal lives and familial histories. Equally, the unique individuality of the person contributes to the context. These elements not only dictate and determine the individual's information needs but as well direct the manner in which a person goes about finding information and subsequently how they use (or do not use) the information.

Rather than looking for ways to destabilize preliminary theory building semantically in this relatively new field in the social sciences, perhaps the way forward should be exploring the different perspectives of how to study, research, and think about human information behavior with a priority on the context.

The IP argument has and continues to be helpful in that it has provided a basis for scholars to explore further a multidisciplinary perspective in LIS. A pertinent and well-reasoned example would be Lloyd's work^[63] in applying Schatzki's site theory to information literacy practices. This type of work is to be welcomed in contributing to theory building. Equally, the IP stance and literature has fuelled others to challenge their discourse, with regard to everyday life information seeking and behavior to consider and reconceptualize the ways in which people engage, or do not engage, with information.^[13]

The different approaches described in this entry are "fluid and complementary," contributing to both practical and theoretical applications in LIS. Information practice offers a different approach to understanding information behavior. Although Savolainen^[11] argues that, while the cognitive approach has been the dominant discourse in LIS until recently, information practice "must be the primary discourse of LIS" in the future to enable understanding of everyday information worlds, the two perspectives continue to function in parallel in practice. For example, proponents of each approach present varying conceptual approaches in the recent text, *Theories of Information Behavior*,^[88] which takes information behavior as its umbrella concept. Similarly, researchers interested in information behavior and information practice participate together in events, such as the SIG USE connected with the ASIS&T, as well as the ISIC conference, supporting the notion and feasibility of co-existence. Advocates of the information practice approach credit some of these venues, such as ISIC, as the beginning of the rise of this rival umbrella concept.^[62] For the moment, at least, scholarship seems engaged in an exploration of new possibilities offered by different conceptual approaches.

The range of theoretical approaches offers a variety of choices to researchers exploring behaviors surrounding information. Each contributes to the scientific rigor of our research and the practical value of our efforts in delivering information services. Olsson^[82] offers several potentially fruitful areas of development, for example, Foucault's ideas about power offer inspiration in exploring the

relationship between power and information behavior. Other potential areas include nonpurposive information behavior, which remains largely unexplored, as well as a refocus on user expertise rather than knowledge gaps.^[82]

While some advocate separation and re-boxing of areas, perhaps the perspectives noted herein actually form an evolving continuum, along which a broad field of information behavior has emerged and from which we can draw upon to maximum benefit in our research. Olsson^[82] proposes an exciting future for the development of the field of information behavior, in which we can further Dervin and Nilan's^[89] call for a more holistic approach, noting "rather than conceiving of information behavior as being driven by the desire to satisfy discrete information needs, any information interaction or encounter should be seen as one chapter in an individual's ongoing engagement with, and construction of, their lifeworld."

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Information Retrieval Experimentation [ELIS Classic]

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Abstract

Jean Tague-Sutcliffe was an important figure in information retrieval experimentation. Here, she reviews the history of IR research, and provides a description of the fundamental paradigm of information retrieval experimentation that continues to dominate the field.

—*ELIS Classic*, from 1996

INTRODUCTION

Information retrieval, the searching through collection of printed or electronic natural language material for items that may satisfy some individual's need or curiosity, has always been a core activity of information professionals. Research into the best way to carry out this activity has been a concern of information science since the field arose in the 1950s.

Information retrieval research belongs to the paradigm of empirical research. Theories are developed about the primary characteristics and relationships of the components of an information retrieval process. Hypotheses are developed about the effect of one or more factors, characteristics, or approaches (the independent variables) on the outcome of the process (the dependent variables). In experimentation, as opposed to other kinds of empirical research such as surveys, there is some control of the independent variable in order to determine the resulting change in the dependent variable.

Some of the components of an information retrieval process, as viewed by information retrieval researchers, are the collection or database that is being searched, the users, the query or verbalization of the user's need or interest, the searchers (end users or intermediaries), the search strategies or ways of searching to satisfy the user, the form of the output from a search, and the way the output is evaluated as to relevance or utility to the user. Each component can usually be further described by a number of characteristics that may vary and that may thus serve as independent variables in an experiment.

In a true laboratory experiment, all of the independent variables and other factors that might affect the outcomes are under the control of the experimenter. In an operational test, at least some will be determined by the operational setting. Some writers would restrict the word *experiment* to the laboratory setting. However, in information retrieval research, there is really a spectrum of researcher control, from situations in which

database, searchers, queries, search strategies, and output are all controlled by the experimenter, to situations in which some components are controlled and others are not, to situations in which only one component is controlled. In this entry, we will consider all situations in which there is control of at least one independent variable.

In any information retrieval experiment, the researcher will use databases and develop search strategies and forms of output that embody the variable features, the hypotheses, that he or she is investigating. In a laboratory experiment, all other aspects of the retrieval process will be held constant. At one time, information retrieval researchers ensured an even greater control by creating artificial queries and relevance determinations. A number of test collections of documents and queries with predetermined relevance assessments were developed and used to test a variety of hypotheses. The predominant present-day view of information retrieval, however, is that queries must represent real user needs and that the end user can best determine the relevance or utility of the output with respect to this need.

The advantage of a laboratory experiment is that the control of extraneous sources of variation makes it possible to draw conclusions about the effect of the features under investigation in terms that are not limited to the particular situation in which the retrieval took place. In operational tests, it is not always possible to conclude that the features under investigation really caused the observed results because there are so many uncontrolled sources of variation. However, laboratory tests have their disadvantages: they are expensive to set up, and incorporating real users and queries in a laboratory environment is difficult. If the experimental database is small or if real users and queries are not employed, the results may not apply to operational systems. However, as Hull^[1] and Salton^[2] have pointed out, there is no reason to disallow experiments with small experimental systems unless specific biases can be demonstrated.

The situation is not really one of “either/or” but of “both.” Robertson and Hancock-Beaulieu^[3] suggest that given the complexity of present-day information retrieval systems and the need to take user characteristics into account, the best solution is a facility intermediate between a laboratory and an operational environment. Called the evaluative facility, this would use real users, queries, and databases, but provide capabilities for easy modification of query and document representations and extensive data gathering and analysis.

Many different features of information retrieval systems have been evaluated in information retrieval research. Most attention has been paid to the way items are represented in the database and the way searches are carried out. In early experiments, the database usually consisted of a set of document surrogates, records that referenced, indexed, and abstracted printed documents outside the system. In more recent times, databases may consist of full-text documents or even hypertext or hypermedia documents, in which the user peruses the document via links, rather than in a predetermined sequence.

The ways in which information is represented in the database and the search strategies are closely related. This relationship can be described by an information system model. A number of these have been developed, the most prominent being the Boolean model and the vector space model. Much information retrieval experimentation has focused on aspects of these two models or on comparisons of the two.

In the Boolean model, the documents in the database are represented as sets of index headings, keywords, or descriptors (called *terms*), possibly with field delimiters such as author, title, abstract, and journal source. Search strategies consist of Boolean expressions involving these terms, possibly delimited, and the Boolean operators “and,” “or,” and “not.” For example, the search expression “interface and (database or information)” would retrieve documents containing the term *interface* and either *database* or *information*. The output from a Boolean model system is a set of retrieved documents.

In the vector space model, both documents and queries are represented as sequences or vectors of weights, one for each term in the database. The weight is a number, usually between zero and one, that indicates the importance of the term in the document or query. Search strategies determine the similarity of document and query using these weights and output documents ranked by this similarity value.

PERFORMANCE MEASURES

A number of performance measures have been used by information retrieval researchers as a basis for comparing different systems features. The best known are recall and precision, originally suggested by Perry et al.^[4] in 1956.

They are based on the idea that the purpose of a retrieval system is to present the users with all and only those documents that are relevant to their information needs. Recall is the proportion of the documents relevant to the user that are retrieved by the search. Precision (originally called pertinency) is the proportion of the documents retrieved by the search that are relevant to the user. Both recall and precision represent properties that are important to the user, however, they assume that the user can unambiguously identify relevant documents for an information need, an assumption that has been questioned by a number of investigators, for example Saracevic.^[5]

Relevance may not be a binary variable; some investigators have used a ternary scale (relevant, partially relevant, not relevant), others an ordinal scale (i.e., documents are ranked as to relevance), and still others a continuous scale. A distinction is often made between subject relevance (aboutness) and usefulness (pertinence), although Regazzi^[6] found experimental evidence of no difference in subjective judgments of subject relevance and utility. Some investigators believe that relevance requires assessment by the end user, the person with the information need, although Burgin^[7] found that variations in relevance judgments by four judges did not affect retrieval performance. Finally, Schamber et al.^[8] suggest that the relevance of a document is situational and dynamic in that it depends on what the user has already seen.

Despite these difficulties, binary relevance-based values continue to be the basis for evaluation of information retrieval features. Recall and precision are sometimes supplemented with fallout, defined as the proportion of nonrelevant documents that are retrieved. Fallout provides additional evaluative information, as it is sensitive to the size of the collection. For example, a search of a 1,000- and a 1 million-document database could produce the same recall and precision values. However, the search of the 1 million-document database would clearly be superior in terms of discriminating power, and this fact would be evident in the two fallout values.

In some retrieval experiments, performance measures reflect aspects of the retrieval process other than search effectiveness. The efficiency of the data structures and processing algorithms may be measured by such temporal variables as user connect time or number of disk accesses. In experiments concerned with features of the user-system interface, user friendliness may be assessed via user rating scales or more objective criteria such as length of learning time or number of exasperation responses or terminations.

Subjective ratings of overall system success are seen by some investigators (e.g., Su^[9]) as being superior to the more objective measures of recall and precision. However, system success is an even more elusive concept to define than relevance, and in most studies in which it is recorded, shows very little variation over users or features. Thus, it can rarely be used in an experimental setting to discriminate good performance from bad.

Hypertext and other interactive full-text systems have complicated the evaluation problem. Users follow search trails, rather than receiving sets of retrieved items. Tague-Sutcliffe^[10] suggests that evaluation should compare the actual search trail with an “ideal” one for the user. Ways of describing user actions become important in evaluating information retrieval systems; for example, Qiu^[11] suggests that user trails can be described as Markov processes, sequences of search states with certain probabilistic dependencies.

MAJOR INFORMATION RETRIEVAL EXPERIMENTS

Information retrieval experimentation is usually considered to have begun in the late 1950s with the Cranfield tests by Cyril Cleverdon.^[12–14] In Cranfield I, a comparative evaluation was made of four systems: the universal decimal classification (UDC), a conventional alphabetical subject index, a facet classification, and Uniterm (keyword) coordinate indexing. During the test, 18,000 papers in the field of aeronautical engineering were indexed by each of the four systems, and 1,200 search questions were obtained from several hundred individuals for questions based on a single document. The search was considered successful if that document was retrieved. The results showed all four systems retrieved the required paper in 74–88% of the cases, with the Uniterm system scoring the highest and faceted classification the lowest. Most failures were due to human error rather than the indexing system. A later comparison with the computer-based metallurgical index at Western Reserve University,^[14] which employed sophisticated language analysis features (role indicators and semantic factors), showed that the performance of the new system was not equal to that of the four original systems.

Cranfield II, also carried out by Cleverdon, sought to determine the effect of specific recall-increasing and precision-increasing devices in a laboratory setting. Questions were obtained from 200 authors of recently published papers who were asked to provide questions to which their paper would be an answer. A test collection of 1,400 documents and 279 questions were obtained in this way. The indexing languages evaluated consisted of single terms selected from the natural language of the document, alone or combined with various devices such as synonyms, word form variants, quasi-synonyms, term weighting, links and roles, hierarchical linking of terms, phrases, and controlled language terms. Ranked output was obtained by using ten coordination levels.

Indexing devices were evaluated by a single measure, normalized recall, which is essentially recall averaged over the points in the search where relevant documents are retrieved. The results showed that indexing based on single natural language terms, the simplest kind of

indexing to implement, performed best by this criterion. The number of index terms assigned to documents, or exhaustivity, was also found to influence performance, with the optimal level being one of thirty-three terms.

Cleverdon,^[12] speaking of these tests from a perspective of 30 years, notes that although he found the results of Cranfield II more significant than the earlier tests, “they did not arouse so much general comment, partly, I think, because the results were so unexpected as to appear unbelievable and also because the nature of the test removed it so far from normal experience.” He also notes that the tests confirmed the hypothesis that there is an inverse relationship between recall and precision, so that there are no devices that concurrently increase both.

The Cranfield II test collection was subsequently used by two other information retrieval experimenters, Gerard Salton at Cornell University and Karen Sparck Jones at Cambridge University. Salton^[2] has developed and used an experimental system, the Smart system, over a period of 30 years, to investigate a number of sophisticated approaches to information retrieval based on the vector space model and a ranked output. The earlier tests are described in Salton^[15] and Salton and McGill,^[16] and later ones in a series of papers, many of which are listed in the references to Salton’s 1992 article.^[2] Early results showed that weighted word stem indexing, where the stems are extracted from the document texts, was more effective than such sophisticated methods as phrases and classification hierarchies. A comparison with a subset of the Medlars search system at the National Library of Medicine, which uses a controlled vocabulary, showed that the Smart word stems increased recall by 12% and decreased precision by 9%.^[17]

In recent years, the Smart collection has grown to approximately 50,000 documents distributed over six test collections. Each collection covers a different subject area, and queries and relevance assessments have been obtained from a number of different user populations. Improvements, as evaluated by precision averaged over standard recall levels, have been obtained through sophisticated term weighting procedures, relevance feedback techniques, and extended Boolean logic. The optimal term weighting in noninteractive retrieval was found to be a normalized function of the within document frequency divided by the across documents frequency. Relevance feedback is a process in which the results from an initial search, evaluated by the user, are used to supplement and reweight the original query terms to provide a revised query, which can then be used to search the database again. Extended Boolean retrieval includes a set of techniques that permit a ranking of documents retrieved by a Boolean search. Thus, it allows comparison of the output of Boolean and vector space systems.

Another early set of experiments in information retrieval was performed at Cambridge University by Karen Sparck Jones and Roger Needham. Here the interest

was in automated classification, and a series of investigations as carried out^[18,19] to discover why classification techniques did not prove in experiments to be as effective as simple keyword indexing. Despite a major series of tests concluded in 1976, Sparck Jones was unable to isolate the reasons for failure of classification to improve retrieval. It was at this point that she and Van Rijsbergen proposed the development of the ideal test collection^[20] to provide a resource that could be used by the international information retrieval community to test new approaches to retrieval. Although the collection did not materialize at that point, the proposal provided the seed for the TREC tests of the 1990s.

In the 1980s, Tefko Saracevic, Paul Kantor, and others conducted a major series of information retrieval experiments at Case Western Reserve University.^[21] These tests used a more operational environment than those just described; the aim of the study was to investigate the elements involved in information seeking and retrieving, particularly related to the cognitive and human decision-making context, in conditions as close to real life as possible.

Forty users were involved, each of whom submitted one question for searching, evaluated items retrieved as to relevance for this question, and provided other information via questionnaire and interview. Each question was searched by nine different searchers from a pool of thirty-nine searchers. Searching was done on DIALOG, with one database searched for each question. The analysis investigated the impact of a number of variables on precision and recall and on the odds that retrieved items were relevant as opposed to not relevant.

An interesting finding of the experiment related to the overlap in search terms used by different searchers. Based on 800 pairs of comparisons, the main overlap was only 27% in search terms and 18% in items retrieved. Items retrieved five or more times were over six times as likely to be relevant or partially relevant as items retrieved once. In general, the more often an item was retrieved by different searchers for the same question, the more likely it was to be relevant.

A number of statistically significant results were found in this study. These were presented in the form of an increase in the odds that (1) items retrieved in association with a given characteristic of a variable would be relevant or partially relevant as opposed to not relevant, and (2) searches associated with a given characteristic of a variable would be of high precision and recall, as opposed to low precision or recall. Recall, in this case, meant relative recall; that is, the proportion of the relevant documents found by any searcher that were found in one particular search for a question.

The following variables increased the indicated odds by a factor of at least two: placing a time limit on years searched increased precision odds; low subject specificity and high complexity in the question increased precision

odds; high searcher scores for abstractness over concreteness increased precision and recall odds; and finally, retrieval by four or more searchers increased relevance odds more than any other variable.

A challenge to the validity of results from a small database was presented by the Blair and Maron full-text evaluation of the 1980s.^[22] They investigated the Boolean-based IBM STAIRS full-text document retrieval system by using it to search approximately 350,000 pages of text in a litigation support system. Some 51 queries were generated by two lawyers, who evaluated retrieved documents as relevant (vital, satisfactory, marginally relevant), or irrelevant. Searching was continued until the user stated that he or she was satisfied with the result and believed that at least 75% of the relevant documents had been retrieved. To find the unretrieved relevant documents, in order to estimate recall, the investigators generated samples of subsets of the database they believed to be rich in relevant documents. These samples were also evaluated by the users.

Average precision was 75.5% and average recall 20.3%. The investigators speculate that recall was low because "it is impossibly difficult for users to predict the exact word, word combinations, and phrases that are used by all (or most) relevant documents and *only* (or primarily) by these documents."^[22] They suggest that previous results, based on small experimental databases, cannot be transferred to larger operational databases.

Partly in response to this concern that experiments must use realistically sized test collections, the TREC (Text Retrieval Conference) project was launched by Donna Harman in 1992, under the sponsorship of the U.S. National Institute of Standards and Technology and the U.S. Advanced Research Projects Agency. The purpose of the TREC project is to provide a forum in which researchers using a variety of approaches to information representation and retrieval can compare these approaches using a large collection of textual materials, queries and associated relevance judgments, and a uniform scoring procedure. TREC conferences were held in 1992, 1993, and 1994.

TREC is designed to evaluate both ad hoc (one-time) querying and routing (filtering) searches. Participants work with approximately 1 million documents, retrieving lists of documents for fifty ad hoc and fifty routing queries. Queries may be automatically or manually constructed and may use relevance feedback. Test data consist of newspaper stories, Associated Press newswire entries, U.S. patent applications, entries from the *Federal Register*, the Ziff Computer Select database, and U.S. Department of the Environment abstracts.

The National Institute of Standards and Technology is responsible for the distribution of the test data, the evaluation of the outputs, and the analysis of the results. Relevance judgments are made by assessors at the institute of the top 100 documents from each participant for each

query. Evaluation involves the calculation of precision at standard recall levels (0, .1, .2, .3, .4, .5, .6, .7, .8, .9, 1), precision at fixed numbers of retrieved documents (5, 10, 15, 20, 30, 100, 500, 1000), and two average precision values (over standard recall levels and over the first R retrievals, where R is the number of relevant documents for the query).

There were 25 participating systems in TREC-1 and each participant submitted ranked lists of the top 200 documents retrieved for each topic. Much of the participants' time was spent in organizing the large dataset, so that results were very preliminary in nature. Harman summarizes TREC-1 by saying:^[23]

it was clear that the simple systems did the task well, but it is too early to pass judgment on the more complicated systems. The automatic construction of queries from the topics did as well as, or better than manual construction of the queries, and this is encouraging for groups supporting the use of simple natural language interfaces for retrieval systems.

There were thirty participants in TREC-2 and each group submitted ranked lists of the top 1,000 documents retrieved for each query. In general, TREC-2 results showed an improvement in effectiveness over TREC-1, in part because of the submission of a larger number of retrieved documents (1,000 rather than 200) and in part because of participants' greater experience with the data and their systems.

Approaches in TREC-2 included probabilistic models, vector space models, natural language processing, Bayesian networks, query expansion, Boolean models, combinations of strategies, and document structuring. A preliminary report^[24] notes that, as in TREC-2, the simple systems still did the best, but the more complex ones are catching up. Term weighting emerged as being especially important. Harman also notes a problem in looking solely at average measures: "there were 21 groups for which there was at least one topic on which their system had the best average precision."

The TREC tests are likely to continue to set the standard in information retrieval testing for the 1990s, however, it is also likely that more attention will be paid in the future to what is happening at the individual document-query level, using techniques such as failure analysis and analysis of passages (rather than documents) retrieved.

CURRENT RESEARCH CONCERNS

As we have seen, the two major concerns of past retrieval experimentation were first, how documents should be represented in a database, and second, how search strategies should be structured so as to retrieve all and only the relevant documents. These concerns continue to be the

focus of much current information retrieval experimentation, as reflected in the *Proceedings of the ACM SIGIR International Conference on Research and Development in Information Retrieval* and other sources listed at the end of this entry.

Recent research has tended to investigate more complicated approaches than simple document-query keyword matching and to look at the interfaces and special features needed for particular applications. In this entry, we will describe some recent work of particular interest, although it should be understood that this description represents a sampling only and is by no means complete.

A key aspect of the vector space model is the weighting of query terms. Robertson and Sparck Jones^[25] introduced an important model, called the probabilistic model, for this weighting; term weights should represent the logarithm of the odds in favor of relevance over nonrelevance for documents indexed by the term. The technique of relevance feedback, in which the user evaluates as relevant or nonrelevant an initial set of documents, makes possible an estimate of these odds for the original and for new query terms. Harman^[26] found in experiments on relevance feedback with the Cranfield collection that most improvements in retrieval using relevance feedback come from the addition of a limited number of new query terms. She also found that multiple iterations of feedback are very effective. Aalbersberg^[27] notes that despite positive experimental results, relevance feedback has not been implemented in commercial systems because of the user friendliness problem. He suggests a "friendlier" approach (incremental relevance feedback), in which documents are retrieved one at a time and relevance judgments are made directly after documents are retrieved.

Many other experiments in recent years have addressed the problem of optimal methods of term weighting and query expansion. Keen^[28] has experimented with document-ranking principles that are based on term position or the proximity of the query terms in the sentences of the document. He found that incorporating term position improved precision by 12–18%, depending on recall. Crouch and Yang^[29] and Grefenstette^[30] experimented with techniques for extending the querying by automatically generating thesaurus classes, lists of words related to the original query terms.

Despite the poor results that phrase-based indexing, as opposed to simple word retrieval, has produced in the past, a number of investigators have looked at more sophisticated ways of incorporating phrases into retrieval. Fagan^[31] showed that incorporation of statistical phrases, defined by co-occurrence and proximity of words, sometimes improved retrieval, but that imposing syntactic constraints as well did not result in further improvements. Croft et al.^[32] extend Fagan's work by incorporating weights that represent the importance of the phrase, as distinct from the individual terms, in the document and query.

Investigators continue to be concerned that retrieval is based on word stems rather than on concepts and have suggested various forms of analysis to overcome the “limitations” of uncontrolled word stem indexing. Linguistic analysis may be used to disambiguate word senses when a word may have more than one meaning. Voorhees^[33] experimented with an automatic indexing procedure that uses WordNet, a thesaurus containing hierarchically organized sets of synonyms, to carry out this task. Thus, it permits the construction of vectors of word senses rather than word stems. Deerwester et al.^[34] looked at latent semantic analysis, which permits documents to be represented by factors rather than terms. The factors are obtained as weighted combinations of the initial word stems.

Information retrieval systems are increasingly based on collections of full-text documents rather than document surrogates. Thus, the problem of passage retrieval, retrieving the passage or passages within a document that best answers a query, has become an important concern of information retrieval experiments. O'Connor^[35] carried out experiments on passage retrieval in the 1970s. More recent work experiments have been done by Salton, Allen, and Buckley.^[36] An interesting aspect here relates to the size of the text fragment that should be output and whether or not several text fragments should be combined in an “answer.”

Boolean retrieval methods also continue to be investigated. Croft et al.^[32] suggest that translating natural language queries into Boolean expressions using “and,” “or,” and “not” may be more effective than the vector space model of sets of weighted terms, and they have developed some experimental evidence for this statement. The work of Saracevic and Kantor^[21] showed that different searchers tended to generate different strategies for the same query. Similarly, Turtle and Croft^[37] found that combining natural language and Boolean combinations for the same query increased performance over either one alone. Belkin et al.^[38] experimented with five independently generated Boolean query formulations and found that progressive combination of query formulations leads to progressively improving retrieval performance. Pao^[39] found that using both term and citation searching on commercial databases improves recall and discrimination of relevant items.

In cluster-based retrieval, documents are grouped together on the basis of similarity in their term vectors. The expectation is that search time will be reduced by confining the search to a subset of clusters. Experiments with clustering have focused on optimal methods for their construction (see, e.g., Willett)^[40] and on the question of their meaning; that is, if they represent meaningful groupings or if they are simply random collections of documents. Shaw^[41] looked at evidence for clustering structure and the effectiveness of cluster-based retrieval and found an inverse relationship between them.

EXPERIMENTAL DESIGN AND ANALYSIS

In general terms, the problem in information retrieval is to assess the effects of one or more factors or independent variables on a performance measure by means of a sample of experimental units in which each unit is assigned to a combination of factor levels and measured as to performance. Experimental design is concerned with techniques for assigning the experimental units to the factor levels. In order to eliminate bias, it is essential that units be assigned randomly, and in order to assess interactions between variables, it is essential that more than one unit be assigned to combinations of factors.

Information retrieval experiments, the independent variables are the features of the database, the search strategies, the queries, and the users that we are investigating. Other factors relating to the search environment, such as the characteristics of the searcher, the order of searching, equipment problems, time, and temperature, may also affect the outcome and so should be randomized as much as possible over the factors that are of particular concern.

What constitutes an experimental unit in an information retrieval research design will depend on the purpose of the experiment, but in general it will be the smallest unit for which performance is measured. For example, an experimental unit might be a query, a search for documents relevant to the query using one particular strategy, a search using one particular strategy by one particular searcher, a single document retrieved in a search, or a step in a search process. Performance may be measured for each of these, depending on the kind of performance (query-level, strategy-level, searcher/strategy level, document-level, search-step-level).

In a minimal information retrieval experiment, there will be treatments (search strategies or indexing approaches) and queries. A major decision is whether or not to search different queries under the various treatments (independent samples) or repeatedly search each query under all treatments (repeated measures). The advantage of repeated measures is that variation in the difficulty of the query topics will not affect the overall results. The disadvantage is that there may be learning or fatigue effects (sequence effects) as a searcher repeats the same query using a different treatment. Different searchers may be used for each repetition; however, this will not be possible if searching is to be done by the end user.

To eliminate some of the variability among queries in the independent sample design a randomized block design may be used. Here the queries are separated into a number of blocks or groups of queries at approximately the same level of difficulty. Equal numbers of queries from each block are then assigned to the treatments and constitute independent samples. More complicated designs are used when there is more than one kind of treatment. Several of these are described in Tague-Sutcliffe.^[42]

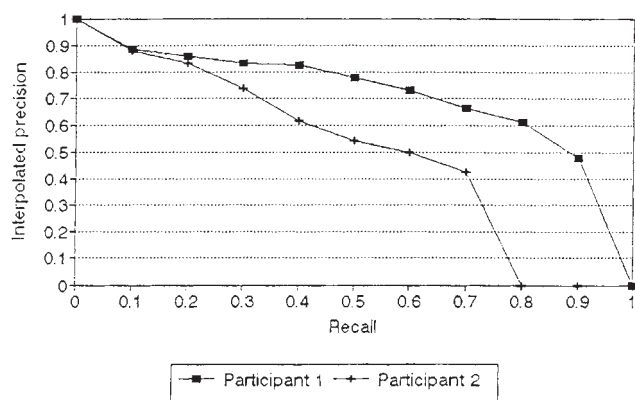


Fig. 1 Interpolated precision at standard recall levels.

Results of information retrieval experiments are usually presented in the form of averages of recall and precision values or, when output is ranked as with the vector-space model, in the form of recall-precision graphs. The most commonly used recall-precision graph shows interpolated precision values at standard recall values from zero to one. Another form shows precision at fixed numbers of retrieved documents. Both forms are shown in Figs. 1 and 2, which present these graphs for two of the participants in TREC-2.

Standard techniques of statistical analysis may be used to test hypotheses regarding differing effects of the treatments or factors in an information retrieval experiment. Analysis of variance may be used to compare mean performance scores for different treatments if the original scores satisfy the assumptions of this technique, namely approximate normality and equality of variance over treatment groups. If these assumptions are not met, then it may be necessary to transform the scores; in particular, it is often helpful to transform recall and precision scores by applying an arcsine transformation to their square root in order to stabilize the variance. If performance scores do not satisfy the requirements of ANOVA, as would be the case if they were ordinal rather than quantitative,

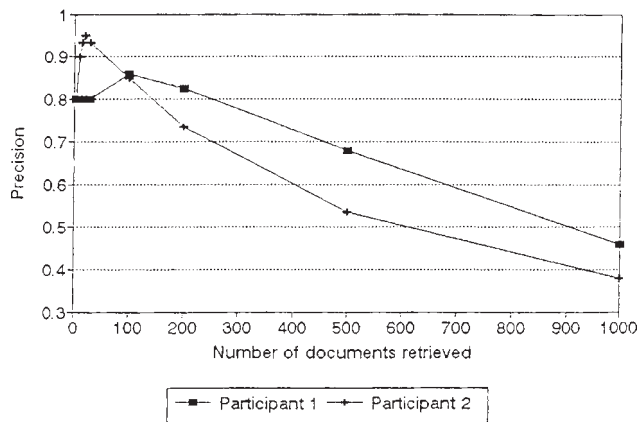


Fig. 2 Precision at retrieved document levels.

nonparametric statistical techniques are used. Hull^[1] provides an overview of both classical and nonparametric techniques that may be used in analyzing results of information retrieval experiments.

FUTURE DIRECTIONS

As text and multimedia collections continue to grow worldwide, the core problem of information retrieval—to give the user all and only that information that he or she needs—remains to be solved and, indeed, may be unsolvable. Many subproblems remain, though, that are tractable, and information retrieval research is therefore unlikely to decline.

Some specific problems that have been identified by researchers in the field and that are amenable to the experimental approach are listed below:

- Under what conditions can results from small-scale experiments be applied to large operational systems?
- How can we model user behavior in interactive windowed information retrieval environments in such a way as to be able to use the model to improve retrieval systems?
- Using the Schamber et al.^[8] dynamic situational view of relevance, how can we determine the document characteristics that should be in the system in order to satisfy this kind of relevance criteria?
- What kinds of experiments can be designed to improve the user interface to an information retrieval system?
- How can efficiency as well as effectiveness of information retrieval processes be investigated by information retrieval experiments?
- How can information retrieval experimental research have a greater impact on commercial systems development?
- Will Cranfield I ever be disproved?

SOURCES

The best source of information about current information retrieval experimentation is the *Proceedings of the ACM SIGIR International Conference on Research and Development in Information Retrieval*, published by the Association for Computing Machinery (ACM) Special Interest Group in Information Retrieval. Two other ACM publications frequently contain entries about information retrieval experiments: *Transactions on Information Systems* and *Communications of the ACM*. Information science journals such as *Information Processing and Management*, and the *Journal of Documentation* also publish experimental retrieval studies. The July-August 1992 issue of *Information Processing and Management*

(vol. 28, no. 4), a special issue on evaluation issues in information retrieval, is particularly useful.

Only one book is exclusively devoted to information retrieval experiment: *Information Retrieval Experiment*; edited by Karen Sparck Jones (Butterworths, London, 1981). Despite the date, it still contains much valuable information. A good general introduction to information retrieval is *Information Retrieval: Data Structures and Algorithms*; edited by W. B. Frakes and R. Baeza-Yates (Prentice-Hall, Englewood Cliffs, N.J., 1992)^[43].

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Volume IV

Information Retrieval Protocols – Library Publishing

Encyclopedia of
Library and
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Fourth Edition



John D. McDonald
Michael Levine-Clark

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Library and Information Sciences, Fourth Edition

Volume 4

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Encyclopedia Edited By

John D. McDonald

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Michael Levine-Clark



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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable.

Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

They acknowledge and thank the Taylor & Francis Group editors, Claire Miller and Rich O'Hanley, as well as Susan Lee, who passed away at the early stages of the preparation of this edition, and more recently, Alexandra Torres, who supported and kept the editors and authors on track over the course of the years of work on this edition of the encyclopedia.

The editors thank the authors who wrote and revised entries, and the huge number of reviewers who refereed the entries. Without their dedication, expertise, and willingness to share their knowledge with others, there would be no encyclopedia. They also wish to thank the Editorial Advisory Board for their advice, suggestions of topics and authors, their hours spent writing or reviewing for the final edition. They also wish to thank the previous editors, Marcia Bates and Mary Niles Maack, whose organization and structure for ELIS-3 provided an excellent blueprint for ELIS-4.



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Information Retrieval Protocols: Z39.50 and Search and Retrieve via URL

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Abstract

Information retrieval (IR) protocols support effective and interoperable intersystem search and retrieval. Although intersystem search methods have been envisioned and under development since the 1970s, it was the Z39.50 IR protocol, first released in 1988, that demonstrated real-world possibilities for such search and retrieval. As the networked information environment changed with the emergence of the World Wide Web, the need for standard IR protocols did not disappear, and one can argue the need is even more compelling given both the visible and invisible Web. A new protocol, based on the experience from Z39.50 but simpler and more comprehensible than Z39.50, is now being used for Web search and retrieval. Search and retrieve via URL (SRU) uses Web technologies and standards resulting in a Web friendly protocol that provides standard search access to existing Z39.50 resources and a wide-range of new non-catalog digital resources. This entry provides both an overview of the two protocols and technical details to understand both. A brief discussion of IR and communications protocols provides background to the specifics of these two IR protocols. Although communication protocols are by their nature technical specifications, this entry focuses on an overview of the functions and capabilities of the protocols. It uses technical concepts and terminology from the protocols to help explain how the protocols work but limits discussion of technical details.

INTRODUCTION

In the 1970s, a number of library leaders, such as Henriette Avram at the Library of Congress and the developer of the machine-readable catalog record (MARC), envisioned the convergence of computing and telecommunications that would enable machine-to-machine communication for accessing bibliographic and other types of information. Initial work on intersystem communication focused on connecting large bibliographic databases such as those at the Library of Congress, the Online Computer Library Center (OCLC), and the Research Libraries Group (RLG). Making this vision a reality required the development of standard protocols for intersystem communication. Protocols specify rules for communication including what information can be exchanged, in what format, and in what order. Thirty years later, the networked information landscape has changed dramatically, but the need still remains for standard protocols that support information retrieval (IR) transactions (e.g., sending a query and receiving the results of the executed query) against a range of databases or systems. Standards development work through the 1980s and 1990s yielded the ANSI/NISO Z39.50 IR Protocol, developed in a historical context predating the World Wide Web. By the late 1990s, Web technologies were providing a new context for networked IR, and implementors of Z39.50 and others responded to these changes by evolving Z39.50 into Search and retrieve via URL (SRU), a protocol that uses key Web standards and technologies.

This entry addresses both Z39.50 and SRU. A brief discussion of IR and communications protocols provides background to the specifics of these two IR protocols. Although communications protocols are by their nature technical specifications, this entry focuses on an overview of the functions and capabilities of the protocols. It uses technical concepts and terminology from the protocols to help explain how the protocols work but limits discussion of technical details.

IR

IR, in the context of protocols, can be viewed very simply or quite complexly. At its simplest, IR involves issuing a query to an IR system, having the IR system execute the query, and presenting the results of the query to the user (human or machine). Web search engines such as Google provide exactly this functionality. The vision for networked IR assumes, though, an environment that contains a large number of IR systems and their databases that provide a range of search and retrieval functionality but differing in important ways (e.g., types of field searching supported).

A first step in preparing a protocol to support IR transactions requires modeling those transactions and the components of IR systems. Fig. 1 illustrates these basic components of the IR model.

The following description provides an abstract view of IR and IR systems in the context of bibliographic

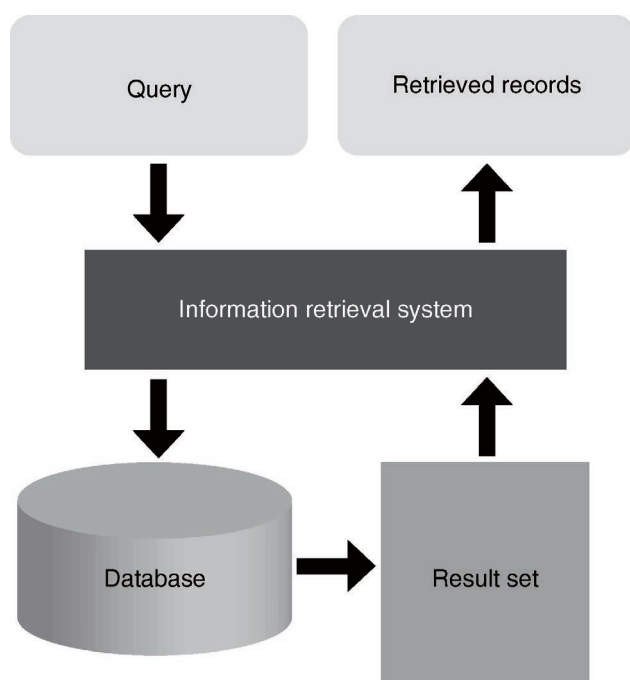


Fig. 1 Abstract model of IR.

databases (i.e., databases containing metadata records describing bibliographic items held, for example, in a library's collection). This description of an abstract model for information retrieval is derived from *ANSI/NISO Z39.89-2003. The U.S. National Z39.50 Profile for Library Applications*. The author drafted the text describing the abstract model in his capacity as chair of NISO Standards Committee AV that created this profile. Since this is an abstract view, actual implementation of these components may differ.

- **Bibliographic database:** This is the logical component that stores data representing bibliographic items. These representations can be created according to accepted standards (e.g., the Anglo-American Cataloguing Rules) and can reflect the use of various metadata element sets (e.g., MARC 21, Dublin Core, or others). Typically, the database records include information about the title, author, subject, and other salient features of bibliographic items. The physical structure of the database will be implementation specific, and no specific physical database model is assumed (e.g., relational, flat file, etc.).
- **Access points and indexes:** This is the logical component related to searching the database. This model assumes there is an index, which is a list of values with pointers to the database records that contain those values. Indexes are created for specific types of searches the IR system will support, and reflect searchable areas of the database record. A bibliographic database in an online catalog implementation typically supports title, author, subject, and other types of searches. The physical structure of an index and how it associates the

list of values with pointers to database records will be system and implementation specific.

- **IR system:** This is the logical component that manages the search of the database and retrieval of records from the database. It typically provides an interface to receive a query and then executes the query by matching the search criteria with information stored in the indexes. When values in the index(es) match the query criteria, the system retrieves the relevant records from the bibliographic database for presentation to the user.
- **Query:** This is the logical component that contains simple or complex criteria along with a search term specified by the user (human or machine). Also referred to as search criteria, the query can contain criteria related to access points to be searched (e.g., search the author access point), characterizations of the search term (e.g., treat this search term as a phrase or treat this search term as a date), and also indicate processing of the search term (e.g., perform right truncation where specified).
- **Result Set and retrieved records:** This logical component manages the results of the executed query. The result set comprises all records that the IR system identified as matching the criteria contained in the query. From this Result Set, the IR system selects one or more records to return to the user. A specific IR system may store the Result Set for later processing, but that consideration is implementation specific and not addressed by this model.

IR can include other tasks beyond what the basic model describes. For example, some IR systems allow the user to specify how the results should be sorted (e.g., by date of publication in ascending order). Protocol developers face the challenge of modeling all IR transactions and components in a way that a standard IR protocol does not privilege specific implementations or structures. Before discussing the details of Z39.50, a basic description and explanation of a protocol is needed.

COMMUNICATIONS PROTOCOLS

Protocols governing communication and behavior between two entities exist for human-to-human as well and machine-to-machine interactions. For example, diplomatic protocols guide the interaction between representatives of sovereign entities. The protocols are agreed upon rules (written or unwritten) for governing behavior. When addressing machine communication, the rules must be specific and well-documented to ensure machine-to-machine communication is successful and the machines and applications behave according to the rules.

Machine-to-machine communication typically involves the sending and receiving of messages. One machine or an

application residing on the machine (referred to here as the client) initiates the communication by sending a message requesting some service or other behavior from the receiving machine or application on that machine (referred to here as the server). The server responds by returning a message to the client. The model for this communication is characterized as request and response.

A communications protocol defines the services supported and provides the rules controlling the order in which messages can be sent, the contents of those messages, allowable request and response messages, and other aspects of the communication (e.g., the character set for encoding the data in a message). Machines conforming to the protocol can conduct successful intersystem communication because they know how to send and receive protocol messages and “understand” the content of those messages.

In the networked information environment of computers and their applications, there are a range of familiar communications protocols such as File Transfer Protocol (FTP), Simple Mail Transport Protocol (SMTP), and HyperText Transfer Protocol (HTTP) to name a few. Each is distinguished by the services or functions it provides. In fact, a large number of protocols exist to support successful communication between two machines and applications. Models representing a layering approach to intersystem communication (e.g., in the Open Systems Interconnection (OSI) seven-layer model and the five-layer model from the Internet) identify specific protocols to handle communication from the lowest layer of physical connection through routing and session information to the top layer, which in both models is called the application layer. Z39.50 is an application-layer protocol as indicated by the title of the Z39.50 standard: *Information Retrieval (Z39.50): Application Service Definition and Protocol Specification*.^[1]

Returning to the context of IR protocols, the following are basic aspects that such a protocol needs to accommodate:

- Providing a standard way to encode the request and response messages
- Specifying methods to transport request and response messages across a network
- Identifying a database on a server to search
- Utilizing a vocabulary and grammar for expressing search requests, search criteria, retrieval requests, etc.
- Specifying formats for records that are returned in response to a search request.

The Z39.50 protocol provides these and more, which are discussed next.

THE Z39.50 IR PROTOCOL

Z39.50 is a technical standard, developed under the auspices of the National Information Standards Organization

(NISO), a standards developer accredited by the American National Standards Institute (ANSI). At the international level, Technical Committee 46 of the International Organization for Standardization (ISO) worked concurrently on an IR protocol called Search and Retrieve. This section provides a brief history of the development of the Z39.50 standard, explains in relatively nontechnical terms what the standard addresses, and discusses sufficient details of the specifications to yield a basic understanding. Many resources are available that discuss the Z39.50 protocol, features, and implementations (see Bibliography).

A Brief Chronology of Z39.50 Development

The nearly 30-year period during which Z39.50 and SRU, its successor protocol, were developed was marked by major computing and networking technology changes that strongly influenced the character of these IR protocols. Technical standards often reflect assumptions and beliefs about existing technologies, and it is fair to say that this was true for Z39.50.

The genesis for the standard was the late 1960s and early 1970s when library leaders began envisioning a future of interconnected automated bibliographic systems and identified the need for computer communication protocols that would enable the interconnection of systems and sharing of bibliographic data. The need for an IR protocol emerged also from visions for a national bibliographic network articulated by library leaders such as Henriette Avram and organizations such as the Library of Congress and its Network Advisory Committee, the National Commission on Library and Information Science, and the Council of Library Resources. A detailed historical treatment is beyond this entry's scope, but readers interested in Z39.50 history can review chapter 4 in *The Development of ANSI/NISO Z39.50: A Case Study in Standards Evolution*.^[2]

Work on the Z39.50 standard began in 1979 by a formal standards committee authorized by NISO. NISO issued the first version of the standard in 1988.^[3] After 1988, work on protocol development shifted from NISO, which disbanded the standards committee, to a group of people and organizations interested in implementing the standard. This group became known as the Z39.50 Implementors Group (ZIG). NISO established the Z39.50 Maintenance Agency, located at the Library of Congress, to oversee further development of the standard. The Maintenance Agency and the ZIG worked collaboratively to produce a revision to the 1988 standard, which was submitted and approved by NISO in 1992.^[4] One specific goal of the 1992 standard, known as Version 2, was to harmonize the Z39.50 specifications with those in the ISO Search and Retrieve standard. Version 2 also specified critical services lacking from the 1988 standard such as access control, and as a result it provided a solid basis for widespread pilot projects, testing, and production implementations by members of the ZIG.

The early versions of the protocol were particularly library-centric, in that many of the specifications addressed issues related to searching bibliographic databases in the context of library catalogs. ZIG members, however, wanted to evolve Z39.50 into a more generalized IR protocol that could be used by libraries and many other information providers. Version 3 was approved in 1995 by NISO.^[5] Many new features were specified in Version 3, and it became the basis for wide-spread implementation, albeit predominantly within the library community and by information services supporting libraries. In addition, the separate ISO Search and Retrieve standard was abandoned, and in its place, ISO adopted verbatim the 1995 Z39.50 standard and labeled it ISO 23950-1998.

Part of NISO's standards development process as approved by ANSI includes regular 5 year reviews of published standards. In the late 1990s, the Maintenance Agency initiated this review and issued in 2003, a revised version of the Z39.50 standard.^[6] The Maintenance Agency viewed this version as a reaffirmation version, and included clarifications, commentaries, defect reports, amendments, and implementor agreements.

Z39.50 Protocol Details

When discussing Z39.50, it is important to distinguish between: (1) the technical standard that defines the protocol; and (2) the implementation of those specifications in software. Taking the latter first, system developers (e.g., vendors of integrated library systems) implement the protocol specifications in software programs: client-side software and server-side software. The Z39.50 client initiates a communication session with the Z39.50 server. A user (human or machine) initiates a search, which is passed to the Z39.50 client for processing into standard protocol messages and sends the query to the Z39.50 server. The Z39.50 server passes the request to a local IR system, which executes the search, finds records that match the criteria, and then returns results back to the Z39.50 client via the protocol. The Z39.50 client passes the results back to the local machine for presentation to the user. Building on the IR model presented earlier, Fig. 2 illustrates where the Z39.50 client and server software logically sit in relation to the client- and server-side applications.

The Z39.50 client and Z39.50 server each have their own responsibilities, listed below in the order of a typical Z39.50 session:

- Initiate a session: client
- Send query: client
- Execute query: server
- Create result set: server
- Request records "in" result set: client
- Specify database elements to be returned: client
- Specify format in which to return records: client
- Create retrieval records and sent to client: server

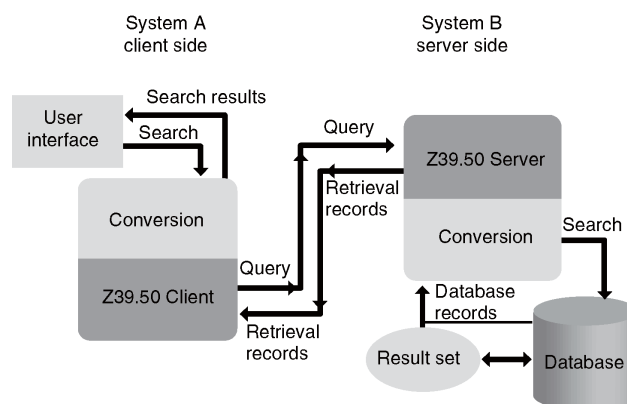


Fig. 2 Z39.50 and the abstract model of IR.

As a communications protocol, Z39.50 specifies a standard set of messages that are communicated between two systems. The initiating system's request needs to be transformed from the local language of that system into the language of Z39.50. The Z39.50 client and server both understand the meaning of the Z39.50 language, and thus provide the communication link between the two different systems. Upon receipt of the Z39.50 message, the Z39.50 server then translates it into the local language of the IR system. For example, it maps a request for a title search where the search term is a phrase into the appropriate commands, syntax, and query of the local IR system.

In the context of the protocol specifications, Z39.50 defines a set of "services." A Z39.50 service describes functionality and defines the specific protocol messages related to that service exchanged between the Z39.50 client and Z39.50 server in support of that functionality. Z39.50 defines 14 services, but for purposes here, only a few core services will be discussed: Init, Search, and Present. These services enable: (1) establishing a connection between a client and server (Init); (2) issuing a query (Search); and (3) retrieving results (Present).

Init service

The Init service provides for a Z39.50 client to initiate a connection and session with a Z39.50 server by first issuing an Init request message. Included in the structured message are a number of parameters: Version, Id/authentication, Options, Preferred-message-size, Exceptional-record-size, Implementation-id; some of these are mandatory and some are optional. The Z39.50 client sends the Init request message with values listed for each of the parameters. The Z39.50 server responds by returning to the Z39.50 client an Init response message with the following parameters (again, some of which are mandatory and some optional): Version, Id/authentication, Options, Preferred-message-size, Exceptional-record-size, Result, Implementation-id. If the server responds positively to the Init request, it returns a value of "accept" in the result parameter. Upon

successful negotiation in the Init service, the client can then move to requesting the server to execute a search using the Search service.

Search service

For successful IR interoperability between two systems, there are two important considerations: a mutual understanding of the search request and a mutual understanding of the format of records retrieved. We will examine how Z39.50 addresses these two requirements, since at its core, Z39.50 was developed to support interoperable search and retrieve.

When one submits a search to a local IR system via its native interface, there is a tight linkage between the search interface offered to the user and the underlying IR system and database. Communication is not an issue. Yet, to send a search from one system to a different IR system, the search must be transformed into a language understood by both systems where information about some of the following must be clearly communicated:

- The database to search.
- The access points or searchable fields to search.
- How search terms are to be interpreted, such as treating the search term as a word, phrase, date, normalized name, etc.
- The use of Boolean operators for complex queries.
- Other search qualifications and criteria, such as limiting the search by date, language, etc.

Z39.50 defines a standard language for expressing searches. The language is very rich and precise to reduce ambiguity in the communication. A query in Z39.50 is a specified structure for expressing the search requirements; it identifies a database to search and characterizes the search term using attribute types and values. A query can also include Boolean operators.

Key to the query is the attribute types and their values; these are what allow the search to be expressed in a standardized and mutually understood vocabulary and grammar. The following is an example of part of a Z39.50 query:

(1,1003)(2,3)(3,1)(4,1)(5,100)(6,3) Twain, Mark

The pairs of number in parentheses are the attribute/type value pairs and “Twain, Mark” is the search term. The following explains how the attribute types and values characterize the query term, “Twain, Mark.”

Attributes and their permissible values are defined in attribute sets. A basic Z39.50-related attribute set goes by the label of Bib-1 (for use when searching a variety of databases).^[7] The Bib-1 attribute set defines six attribute types (identified by the first number in parentheses): Use (1); Relation (2); Position (3); Structure (4); Truncation (5); and Completeness (6). The Z39.50 query contains a number representing an attribute as the first part of the

type/value pair. The use of numbers avoids problems of words in various languages and yields more universality.

Each attribute type represents a feature of the search and search term; for example the Use attribute indicates the index to be searched, while the Relation attribute indicates, for example, that the search term should match exactly an entry in the index, and the Truncation attribute indicates whether the IR system should perform some type of truncation on the search term. The Bib-1 attribute set defines the values associated for each attribute type. For example, if the Use attribute value is 1003, this means that the IR system should process this query as an author search; if the value is 4, the IR system should process the query as a title search. It is beyond the scope of this entry to give all the details on attribute types and values, but this indicates how the search term can be characterized using a standard vocabulary and grammar to result in intersystem communication for the purpose of searching.

Parsing the Z39.50 query listed earlier, which means in human terms “search for items where Mark Twain is listed as author,” the use of attribute type/value pairs are understood by the server as:

- (1,1003) means execute this search as an author search.
- (2,3) means exactly match the search term with an entry in the index.
- (3,1) means to begin matching the search term with the first term in the field.
- (4,1) means to treat the search term as a phrase rather than two words.
- (5,100) means to carry out no truncation on the search term.
- (6,3) means that the search term should match the complete data value in the field (i.e., the entry in the index).

The Z39.50 server receives the query as expressed in the type/value pairs, parses the query, and maps the search to the local IR system and its search engine.

Present service

The other aspect of IR is the return of records to the Z39.50 client that match the query. The Z39.50 Present service is used to request records to be returned from the result set, how many to return, what syntax the records should be returned in, and what elements in the records to return. To support interoperability, Z39.50 registers a number of record syntaxes in which records can be exchanged between Z39.50 clients and servers. The original focus of Z39.50 was on bibliographic records and the retrieval of MARC records. As Z39.50 evolved into a general IR protocol, the MARC format for records became just one of a variety of record syntaxes in which records could be formatted and returned via Z39.50. Record syntaxes include HTML, Extensible Markup Language (XML),

and others, including a syntax developed by the ZIG called Generic Record Syntax (GRS).^[8] While accommodating more applications with this variety of record syntaxes, interoperability problems also increased.

This brief glimpse into some of the details of Z39.50 illustrates that for intersystem communication to occur, the Z39.50 client and server must not only support the defined protocol messages but also understand the language of Z39.50, its vocabulary and grammar. Most current Z39.50 implementations robustly support the protocol messages. However, implementors make choices from the options available in the standard for specific protocol messages. Also, the local IR system on the Z39.50 server side does not always provide the functionality requested by the Z39.50 client as expressed in protocol messages. These and other issues have led to interoperability problems. There has been, unfortunately, a pervasive sense that Z39.50 did not live up to the promises of providing a solution for interoperable intersystem search and retrieval across disparate databases.

INTEROPERABILITY AND INTERSYSTEM IR

Implementing a standard IR protocol on systems is intended to enable interoperability of those systems and applications. System-level interoperability can be defined as the ability of two or more systems or components to exchange information and use the exchanged information without special effort on either system. One can also define interoperability from the perspective of the end user in terms of the user's ability to successfully search and retrieve information in a meaningful way and have confidence in the results. Interoperability between two systems can be assessed from a binary perspective; they either do or do not interoperate. However, experience has demonstrated that when two systems have implemented the Z39.50 protocol, it is more likely that systems may be more or less interoperable, and interoperability is better assessed as a continuum rather than a binary decision. This raises the question of what acceptable levels of interoperability can be produced, especially from the perspective of the end user.

To understand how or why IR systems may not interoperate or not have an acceptable level of interoperability, a number of factors that threaten interoperability can be identified:

- Multiple and disparate systems, operating systems, IR systems, etc.
- Multiple protocols such as Z39.50, HTTP, SOAP, etc.
- Multiple data formats, syntax, metadata schemes such as MARC 21, UNIMARC, XML, ISBD/AACR2-based metadata, Dublin Core, etc.
- Multiple vocabularies, ontologies, disciplines such as LCSH, MESH, and AAT.

- Multiple languages, multiple character sets.
- Indexing, word normalization, and word extraction policies.

If a protocol has a range of options, implementors can choose from (e.g., what protocol services are implemented, specific values for parameters, etc.) as is the case with Z39.50, different implementations of the protocol specifications can threaten interoperability. However, the experience with Z39.50 has shown that the key threats to interoperability relate mostly to differences in local IR systems specifically the differences in search functions supported, the indexes available for searching, and the record syntaxes supported for retrieved records. Examples of these differences include whether IR systems support the searches being requested by the client, such as how to treat the search term (e.g., as word, phrase, date, etc.), the access points to be searched (e.g., author, title, subject, ISBN, etc.), and the format of records available (e.g., in MARC, MARCXML, etc.)

Optimal interoperability occurs not only if the Z39.50 client and server both implement the same protocol services and choices among options within the protocol but also when the IR system on the Z39.50 server side provides the search functions requested by the Z39.50 client, including types of searches and access points, and also is able to supply the records in the syntax requested by the Z39.50 client.

A common approach to address the threats to Z39.50 interoperability was the development of application profiles. A profile specified what Z39.50 clients and servers had to implement from the options available in the Z39.50 standard, as well as the searches supported on the local IR system. Conformance to a profile's specifications increased the level of interoperability. An example of such a profile is *The U.S. National Z39.50 Profile for Library Applications* published by the NISO as ANSI/NISO Z39.89.^[1]

A NEXT GENERATION Z39.50

The development of Z39.50 and release of Version 3 in 1995 occurred in advance of the emergence of the World Wide Web in the 1990s. By the late 1990s, the ZIG was discussing how the broader Web community, and especially those involved with Web search, could be made interested in the power provided by the Z39.50 IR protocol. Yet, where the ZIG saw Z39.50's power, many in the Web community and even some in the library community—its core implementation context—perceived it as difficult and complex, heavyweight, reflecting old technology, not Web friendly, and in some cases simply broken. The ZIG recognized that the Web was quickly becoming the common implementation environment. For several years Z39.50 implementors discussed and tried out a

number of initiatives as part of a Z39.50 International Next Generation (ZING) project.^[9]

A pivotal meeting of the ZIG occurred in 2001 at which a discussion about the future of Z39.50 resulted in a consensus recognition that Z39.50 needed to evolve in the context of the Web. The goal for developing the next generation Z39.50 was to lower the barriers to implementation while preserving the intellectual contributions of Z39.50 and discarding those aspects no longer useful or meaningful. Part of lowering the barrier to implementation was to recast Z39.50 protocol specifications in terms of existing and emerging Web technologies, tools, and standards (e.g., HTTP, XML, and XML schemas). Part of preserving the intellectual contributions of Z39.50 was to separate the abstract and semantic models provided in Z39.50 from representation of the protocol in the arcane Abstract Syntax Notation (ASN.1) and associated Basic Encoding Rules (BER) and running it directly over TCP/IP for transport rather than HTTP.

In 2001, an international team of implementors and standards developers began work on a new IR protocol that would be simpler, more easily implemented, and more comprehensible than Z39.50 and most importantly Web compatible. The result of discussions and deliberations was the decision to develop a new Web services based protocol: SRU. The name of the new protocol has changed since its inception in 2001. Initially it was referred to as Search/Retrieve Web Service (SRW). This was later accompanied by SRU. Except for the method the client used for sending a search request to the server, the details of the protocol were the same. By 2007, the label SRW had been deprecated and the protocol is officially known as SRU. The first version of the protocol was released in late 2002; Version 1.1 was released in 2004, which was registered with NISO. The current Version 1.2 was published in 2007.^[10]

The Z39.50 Maintenance Agency at the Library of Congress plays a key role in managing the development of the new protocol and now serves as the maintenance agency and managing editor for SRU, supported by a SRU Editorial Board consisting of the managing editor along with a senior editor, XML editor, and associate editors. The Board oversees the development of proposals for changes and enhancements, and a SRU Implementors Group, an open membership group, serves in an advisory capacity to the Editorial Board.

SRW

SRU addresses the same IR problems confronted by Z39.50, namely, communicating with a range of information services and servers that have their own local IR systems with different database structures, indexes, and local query structures. However, SRU adopts current standards for syntax of messages and records (i.e., XML)

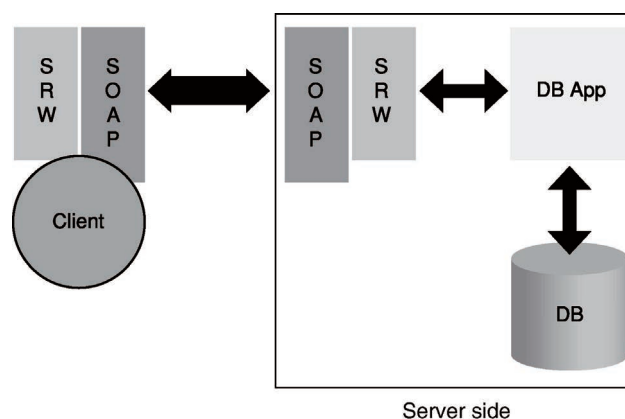


Fig. 3 SRW Communication using SOAP.

exchanged between a client and server and for transport of the messages (i.e., HTTP). It retains and builds on the abstract models, concepts, and functions developed through the experience with Z39.50 such as abstract access points, abstract record schemas, result sets, and others. The protocol defines a set of operations and associated parameters (see below) and all responses are encoded in XML. The Contextual Query Language (CQL) is used to represent queries in search requests (see below). The result is a Web friendly and standard protocol for networked IR.

At the outset of protocol development, there were two related protocols referred to as SRW and SRU. In fact, there is no real difference between SRW and SRU at the protocol parameter level but only in the way they are implemented as Web services.

The basic difference between them relate to how they issue search requests. SRW uses SOAP (originally known as Simple Object Access Protocol) and encodes messages in XML within SOAP (Fig. 3). SRU uses the Representational State Transfer (REST) approach, which encodes protocol messages from the client in the URL syntax and issues a HTTP GET request (Fig. 4). Both protocols return data encoded in XML, and both use HTTP for transport of messages.^[11]

Protocol Operations and Examples

SRU uses the concept of “operation types” to describe and define what IR functions the protocol supports and defines the following operations:

- *searchRetrieve*: Expresses the query criteria and specifications for records to be returned
- *Explain*: Allows a client to retrieve a description of the facilities available at a server
- *Scan*: Allows the client to request a range of the available terms at a given point within a list of indexed terms

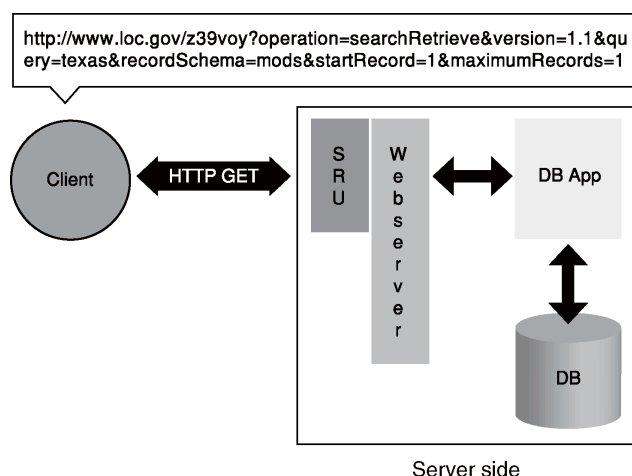


Fig. 4 SRU Communication using HTTP GET.

The searchRetrieve and explain operations are core to the protocol, and each is discussed in more detail below.

searchRetrieve operation

This operation combines the Z39.50 Search and Present services in one operation. The searchRetrieveRequest message contains the query which is expressed using CQL (see below). In addition to the query, the searchRetrieveRequest contains specifications for returning the records that match the query, such as what schema should be used to package the retrieved records.

If one uses SRW, the searchRetrieveRequest message is encoded in XML and sent via HTTP wrapped in SOAP. Fig. 5 is part of a searchRetrieveRequest (in XML) that includes a single-word query.

There are a number of parameters defined for the searchRetrieveRequest, and Fig. 5 shows two mandatory parameters (<version> to indicate the version of the protocol; <query> to express the search criteria), and several optional parameters (<maximumRecords> to indicate how many records should be returned; <startRecord> to indicate in the list of records found where to begin returning; and <recordSchema> to indicate in what format the records should be returned. In this sample case, the request is to have the records returned in the form of Dublin Core records according to a Dublin Core XML schema.

```
<searchRetrieveRequest>
  <version>1.1</version>
  <query>texas</query>
  <maximumRecords>1</maximumRecords>
  <startRecord>1</startRecord>
  <recordSchema>dc</recordSchema>
</searchRetrieveRequest>
```

Fig. 5 Sample searchRetrieveRequest expressed in XML.

If one uses SRU, the searchRetrieveRequest parameters are expressed in standard URL syntax, which includes the baseURL for the server separated from the protocol parameters with a question mark (?). Fig. 6 shows the same searchRetrieveRequest as in Fig. 5 but expressed as a URL.

Fig. 6 shows that the URL syntax can express all searchRetrieveRequest parameters without any loss of specification.

After the server receives the searchRetrieveRequest and executes the search and finds records, it returns a searchRetrieveResponse (no matter whether the searchRetrieveRequest was sent via SOAP or as HTTP GET) that indicates the number of records found and may also include the records found. Fig. 7 is a sample of a searchRetrieveResponse to the sample searchRetrieveRequest in Figs. 5 and 6.

There are a number of parameters defined for the searchRetrieveResponse, and Fig. 7 shows two mandatory parameters (<version> ; <numberOfRecords> to indicate the number of records found on the server), and several optional parameters (<records> which indicates the beginning of the records being returned; <record> which indicates the segment containing the records; <recordSchema> which indicates the XML schema according to which the records are encoded; and <recordData> that contains the actual record. In this example, the <schema> parameter indicates that the records are formatted according to the Dublin Core (i.e., DC) schema, as requested in the searchRetrieveRequest above. The <recordData> parameter in this example contains only one DC element simply to illustrate elements that might comprise the record.

In summary, the searchRequestResponse is in XML syntax and may include the actual records found in the XML schema requested by the client. Other schemas in which records can be returned (assuming the server supports those schemas) include ONIX, MODS, and MARCXML.

Explain operation

A challenge for Z39.50 in the context of interoperability was the difficulty for a Z39.50 client to discern what a Z39.50 server supported in terms of Z39.50 services and especially in terms of available access points and record formats. The development of SRU gave priority attention to ensuring a robust method for the server to tell the client what it supports. The explain operation addresses this need. A client sends an explainRequest to the server and the server responds with an explainResponse, and the response message contains a record in XML structured according to the ZeeRex schema.^[12] The ZeeRex record provides several key pieces of information including:

<http://www.loc.gov/z39voy?operation=searchRetrieve&version=1.1&query=texas&recordSchema=dc&startRecord=1&maximumRecords=1>

Fig. 6 Sample searchRetrieveRequest expressed as URL.

- Information about the database such as title and description
- Information about how to search in the database including what indexes exist to search
- Information about the record syntaxes in which records can be returned and what record elements can be returned.

With the information contained in the explainResponse, the client is able to configure searches against the server that are likely to be more successful and request records in specific schemas (e.g., MARCXML, MODS, Dublin Core, etc.) that the server is able to supply. Interoperability can be significantly improved because of this protocol operation.

CQL

In addition to the protocol, another component for successful intersystem IR communication is a standard language to express the query. Based on the experience with Z39.50 and in keeping with the desire to build upon that experience, SRU developers created the CQL.^[13] CQL is a formal language for representing queries to issue to IR systems such as Web indexes, bibliographic catalogs, and museum collection information. It is capable of expressing complex queries and yet can be used for very simple keyword searches. CQL is also human-readable, unlike the query types associated with Z39.50.

A CQL query contains one or more search clauses connected by Boolean operators. A search clause contains at a minimum the search term. A single word in a search clause comprises a perfectly legitimate instance, and this reflects the simplicity available in CQL. It has

the power of expressiveness in that the search clause can indicate a specific index to search, and CQL supports relation and proximity operators as well as masking characters (e.g., to indicate truncation) to express more complex queries.

As a general purpose query language, CQL provides a syntax for expressing the component parts of the query. The basic syntax for a CQL search clause is: [index][relation][search term]. CQL also supports searching by semantics or context and introduced the concept of context sets in relation to indexes; this begins to make the meaning of “contextual” in the name of CQL clearer.^[14] For example, a SRU search to a database can indicate that the index to be searched should be in the context of the Dublin Core element semantics. Individual communities can define their own context set to indicate the semantics of the indexes available. Context sets and individual indexes supported by the server can be listed in the ZeeRex record returned through the explain operation, which assists the client in issuing queries that take advantage of what the server offers. Fig. 8 shows legitimate CQL search clauses from the simplest to more complex.

The examples in Fig. 8 show that <index> and <relation> are optional, and further that <index> can be include a prefix to the index name to indicate that the index is from a specific context set.

Current Status and Plans for SRU

A variety of projects and implementations are using SRU for networked IR.^[15] In some cases, implementations provide a SRU gateway to existing Z39.50 servers, For example, the Library of Congress implemented SRU access to its Z39.50 server and can return records in MARCXML, MODS, and even DC.^[16] The European Library uses SRU as a search gateway to 47 European national libraries from a single interface, thus providing metasearch functionality across those libraries’ resources.^[17] SRU is used in venues

```
<searchRetrieveResponse>
  <version>1.1</version>
  <numberOfRecords>10</numberOfRecords>
  <records>
    <record>
      <recordSchema>info:srw/schema/1/dc-
        v1.1</recordSchema>
      <recordData>
        <dc:record>
          <dc:title>The prediction of subsequent violent
            offenses by the inmates of the Texas
            Department of Corrections </dc:title>
        </dc:record>
      </recordData>
    </record>
  </records>
</searchRetrieveResponse>
```

Fig. 7 Sample searchRetrieveResponse.

Search Clause	Explanation
cat	Simple single word search
cat and dog	Simple two-word Boolean search
“black cat”	Simple two word phrase; quotation marks must be used to indicate that words comprise a phrase
title = cat	Search for term cat in a title index
dc.title = cat	Search for term cat in an index defined in the Dublin core context set

Fig. 8 Sample CQL search clauses.

beyond accessing library catalogs. For example, OCLC has developed a SRU interface to the DSpace digital repository system, allowing a standard search interface to the Lucene indexer used in DSpace repositories.^[18] The NISO Metasearch Initiative has included reviewing SRU as the basis for a metasearch search and retrieval standard.^[19]

In a move to gain formal standards status for SRU, the SRU Editorial Board, with support from the SRU Implementors Group, decided to pursue standardization of a specification based on SRU through the Organization for the Advancement of Structured Information Standards (OASIS) Consortium. Work on that effort began in Summer 2007. The specification has not yet been approved as an OASIS standard, and work is continuing on moving the specification through the OASIS process. Members of the SRU Editorial Board established the OASIS Search Web Services Technical Committee and the Committee's work includes the development of an Abstract Protocol Definition.^[20] An important aspect of the OASIS work is to provide methods for accessing servers that support OpenSearch. The OpenSearch provides a method for describing a search engine's interface to assist clients in automating search Web forms.^[21] The OASIS Committee plans to define application protocol bindings that provides the description (either human-readable or machine-actionable) of a server. A client will be able to access any server that provides such a description, if only it implements the capability to read the description file and interpret the description and based on that description to formulate a request (including a query) and interpret the response.

According to Ray Denenberg, cochair of the OASIS Technical Committee and managing editor for SRU, the plans are for the committee to produce initially two bindings: SRU 1.2 (compatible with the current SRU 1.2 specification) and OpenSearch (compatible with the current OpenSearch 1.1 specifications).^[22] These will be straightforward renderings of the two existing specifications. The committee will follow with a third binding for the planned SRU 2.0, a revised version that will introduce new features into SRU. The committee will also initially produce a draft CQL 1.2 (compatible with the current CQL specifications) and will follow later with CQL 2.0, which will introduce new features into CQL.

CONCLUSION

"Information retrieval, while seemingly simple and obvious when accessing Google, is surprisingly complex."^[16] IR tasks can range from simply submitting a keyword search to a search engine to issuing complex queries simultaneously to multiple and diverse information servers living on the Web. Searching a diverse set of IR systems and the data they hold, and then returning results in useful

formats are made possible through the development and implementation of IR protocols. Z39.50 first explored the complexity of intersystem search and retrieval, and the attendant issues of interoperability. The widespread deployment of Z39.50 servers, primarily in the context of library catalogs, demonstrated the utility of a standard, protocol-based, search and retrieval interface to the diversity of library systems. Cross-database searching, or meta-search, was first explored by using Z39.50 for concurrent access to multiple resources, including but not limited to library catalogs.

Search in the context of the Web presented both challenges and opportunities for Z39.50. On the one hand, that protocol appeared to be both library-centric and not Web friendly, and thus there was little take up of that protocol by the wider Web search community. On the other hand, implementors and developers—primarily from the library community—have built on the experience and intellectual contributions of Z39.50 and evolved Z39.50 into a search/retrieve protocol and an associated query language more in line with the needs and expectations for the Web. SRU uses current standards and technologies to reduce the barriers to implementation and provides a robust IR protocol that effectively supports networked IR.

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Information Retrieval Support Systems

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Abstract

The study of Information Retrieval Support Systems (IRSS) focuses on the next generation retrieval systems and Web search engines. It is an emerging research field driven by the demands, challenges, and opportunities of the fast growing Web. The philosophy of IRSS requires us to go beyond the two basic tasks of browsing and searching provided by current retrieval systems. We must provide the necessary new utilities, tools, and languages that help and support a user to perform multiple tasks in finding useful information and knowledge. In the Web context, IRSS may be viewed as an important type of Web-based systems supporting Web Intelligence (WI). The main objective of this entry is to provide an overview of the study of IRSS, covering the emergence of IRSS, the architecture of IRSS, and implementation-related issues.

INTRODUCTION

With the advances of information and Web technologies, everyone faces a great challenge of information overload. One may feel lost in the overwhelming volume of information, and in many cases misinformation. For example, a scientist can have a real difficulty in keeping up with current research and figuring out what has been done by using Information Retrieval Systems (IRS) and search engines.^[1,2] One is no longer satisfied with retrieval systems that provide limited supports of browsing, navigation, and retrieval. There is a great demand on retrieval systems and search engines with a great variety of new functionalities and supports.^[3]

We can observe a few trends in the new, or latest versions of, retrieval systems and search engines that attempt to address the above-mentioned problems. For example, some recent retrieval systems provide better user interface that allows more user control^[4] in the search process and retrieval-results refinement and reorganization. Some search engines provide more utilities that support user exploration of a collection of information items. There are more domain-specific and narrow-scope search engines that make more effective use of domain knowledge and structures of a collection of information items. In addition, results from machine learning, data mining, intelligent agents, and other fields are being incorporated into retrieval systems and search

engines to increase their performance. However, there is still lack of a commonly agreed label for those research efforts, and there seems to be a need of a framework so that we can study them systematically. The recently proposed notion of Information Retrieval Support Systems (IRSS) may serve this purpose.^[5–7] IRSS may be used as a subsystem of a research support system (RSS).^[7–9] They may also be considered a step toward knowledge retrieval systems (KRS).^[10,11]

By introducing IRSS as a new field of study, we may be able to draw the attention of researchers working on the related topics. Many related, but isolated and scattered studies, techniques, tools, and systems can be unified under an umbrella term of IRSS. The benefits are the convergence of new generation retrieval systems, search engines, and Web services that aim to provide a variety of utilities, tools, and languages to support a user to find what they really need, including data, information, and knowledge.

Three fundamental issues are investigated in this entry. We examine the evolution process of retrieval systems, from data retrieval to information retrieval, and from information retrieval to information retrieval support. We outline the conceptual architecture of IRSS and discuss the basic concepts, characteristics, and functionalities of these types of systems. We comment on implementation issues of IRSS with reference to related fields and suggest a technical foundation based on granular computing. The materials of this entry are based on our preliminary studies.^[5–7]

EMERGENCE OF IRSS

There are several factors that affect the evolution of retrieval systems, namely, the characteristics of information items, the characteristics and demands of users, and available technologies. It can be said that retrieval systems evolve from simple and specific task to intelligent and multiple tasks. We are now entering a stage when IRSS are necessary and technologically feasible.

From Data Retrieval to Information Retrieval

Van Rijsbergen provided a comparative study of data retrieval systems (DRS) and IRS regarding their common features and differences.^[12] Both DRS and IRS focus on storage-and-retrieval functionality, with very limited support for other functionalities.

In traditional DRS, data items can be precisely described by using well-understood representation schemes, and user needs can be formally represented by query languages (e.g., SQL). The model is deterministic in the sense that the relationships between data items and user needs are well and objectively defined and consequently exact match and deductive inference can be used. The intolerance of uncertainty of data retrieval had motivated many researchers to search for generalized data retrieval models, such as fuzzy databases and extended Boolean queries.^[13]

The stringent requirements of data retrieval made it unsuitable for the case of documents storage and retrieval where a collection of natural language documents is involved. Information retrieval was evolved from data retrieval by considering the following issues. Documents and user needs cannot always be precisely described, and their relationships are ill and subjectively defined. The model is nondeterministic in the sense that partial or best match and inductive inference are used. The results of an IRS are typically a list of ranked information items. They are documents or paragraphs containing keywords in queries. One needs to read those documents in order to find the required information. In other words, IRS and search engines are reference systems that indirectly meet the user requirements.

From Information Retrieval to Information Retrieval Support

The limited functionalities of IRS and search engines is insufficient to meet the demands of users in the Web age. IRSS have emerged as the next generation in the evolution of retrieval systems that focus on more supporting functionalities at a higher intelligence level.

The emergence of information retrieval support can be seen from several important trends in the search

community. One of them is the separation of vertical search and horizontal search. While traditional horizontal search deals with general purpose search needs, vertical search handles domain-specific needs. Vertical search^[14] plays a daily-increasing important role on the Web.^[15–18] For example, Google Scholar, CiteSeerX, DBLP, MSRA Libra, etc., are specialized retrieval systems for academic literature search; Amazon, Google product search, Microsoft Live product search, etc., are for product retrieval online; Zoominfo is a vertical search engine for company, people network, and job information. All of these vertical search systems provide various ways to better support specific groups of users in particular domains. Another trend is the study of exploratory search systems for users with insufficient domain and contextual knowledge to formulate effective retrieval queries.^[10,19] Many related workshops and special issues have emerged during these years. They include HCIL SOH 2005 Workshop on Exploratory Search Interfaces, SIGIR 2006 Workshop on Evaluating Exploratory Search Systems, SIGCHI 2007 Workshop on Exploratory Search and Human Computer Interaction, a special issue on “Supporting Exploratory Search” in *Communications of the ACM* (49(4), 2006), a special issue on “Evaluating Exploratory Search Systems” in *Information Processing and Management* (44(2), 2008). Exploratory search systems support users through information visualization and multimedia presentation and allow users to browse and explore an information collection to refine queries.^[20,21] The third trend is that retrieval systems and search engines start to provide more tools for users to manipulate retrieval results, so that they may make better use of retrieved items. It becomes evident that these trends have a common goal of providing more and better supports to users by increasing the functionality and flexibility of traditional IRS.

By moving beyond browsing, navigating, and retrieval, IRSS focus on a wide range of supporting functionalities, including summarization, exploration, analysis, knowledge discovery, results organization, retrieval strategy recommendation, and so on.^[5–7,22] The objective of an IRSS is to support many different types of user tasks in finding and utilizing information, in a similar way that a decision support system (DSS) assists managers in decision making.^[23]

Characteristics of IRSS

As the next generation retrieval systems, IRSS are extensions of IRS. In order to provide more supporting functionalities by IRSS, we need to design and implement new models, languages, utilities, and tools to assist a user in investigating, analyzing, understanding, and organizing a document collection and search results. These tools allow a user to explore both the semantic and structural

information of each individual document, as well as the entire collection. An IRSS is a user-oriented system in the sense that a user plays a more central role, and the system plays a supporting role. First, the system should be very flexible so that a user can perform a wide range of tasks. In some sense, an IRSS is a platform that allows a user to work on tasks in information and knowledge search. A user can make decisions at various stages. Second, instead of being a passive system waiting for user queries, the system may actively support a user by providing useful information without being explicitly asked. Third, an IRSS is adaptive to a user by collecting implicit and explicit feedback through user-system interaction. Thus, an IRSS must have learning capacity. From the performance point of view, an IRSS emphasizes accuracy and effectiveness more than efficiency and online processing. Fourth, the results from an IRSS must be more than a simple ranked list of information items. Moreover, a user should be allowed to visualize, reorganize, and compare various search results from different perspectives.

An IRSS needs to manage a large class of models of data, information, and knowledge. Three related types of models need to be considered. Documents in a document collection serve as the raw data of IRSS. The document models deal with representations and interpretations of documents and the document collection. The retrieval models deal with search. The presentation/recommendation models deal with the representation and interpretation of results from search. A single document model, retrieval model, or presentation model may not be suitable for different types of users. Therefore, IRSS must support multiple models, and provide tools for users to manage various models.

The document models allow multirepresentation of documents. Granular computing will play an important role in the construction of document models.^[6,24,25] One can use hierarchical granulation for a document, namely, a layered and multiresolution representation of documents. The same document is represented in less detail at a higher level than at a lower level. With multimodel capability, a user can create different logical views of a document and logical links between documents, as well as compare and investigate various views. The resulting in-depth knowledge can help the user locate and infer useful information. The recent development of XML enables us to describe both the structural and semantic information of a document. Such information makes the construction of multirepresentation document models an achievable goal.

The retrieval models provide languages and tools to assist a user in performing tasks such as searching and browsing. IRSS should provide multistrategy retrieval. A user can choose different retrieval models with respect to different document models. The retrieval process of IRSS is no longer just keyword matching. Instead, it must consider different types of inference methodologies. Thus, an IRSS provides different inference models to meet various

needs from different users. Both deductive inference and inductive inference are considered. Recently, several models were proposed for inference on Web scale, and can be considered as possible choices for IRSS. For example, associative inference and analogical inference can help find relevant results more effectively.^[26] Variable precision logic can be used to develop reasoning method based on incomplete information source and under time constraints.^[27] Based on Simon's theory on rational choice,^[28] combining reasoning and search on the Web scale is proposed.^[29] which may also be related to the study of IRSS.

The presentation/recommendation models allow a user to view and arrange search results, as well as various document models. The same results can be viewed in different ways by using distinct presentation/recommendation models. Moreover, a user can analyze and compare results from different retrieval models.

An IRSS also needs to build various models of users to provide better and personalized support. An IRSS may actively collect user information, user-system interaction information, and various other logs to build user profiles. With deep knowledge of users, an IRSS may provide more intelligent support. For example, user models may help an IRSS to select the best combination of document, retrieval, and presentation models. The full function of an IRSS is achieved by managing these models, as well as the associated languages, tools, and utilities.

THE CONCEPTUAL ARCHITECTURE OF IRSS

Many retrieval systems are starting to provide more supporting functionalities to users. They are typically implemented by simply adding components to existing IRS. There is still a lack of conceptual framework that allows us to have a more systematic study. And one cannot expect great progress without such a framework. For this reason, we consider here a conceptual architecture of IRSS.

Our interpretation of IRSS draws extensively from the related field of Decision Support Systems (DSS).^[23] While DSS focus on supporting and improving decision making, IRSS focus on supporting and improving retrieval. The philosophy, principles, and techniques from DSS are applicable to IRSS by substituting the tasks of "decision making" for the tasks of "information retrieval." This view of IRSS is particularly reasonable if one considers the fact that it is necessary to obtain useful information in order to make intelligent and rational decision.^[5]

Gorry and Morton^[30] define DSS as "interactive computer-based systems, which help decision makers utilize data and models to solve unstructured problems." Turban and Aronson^[23] compare different definitions of DSS and suggest that DSS are "computer-based information systems that combine models and data in an attempt to solve unstructured problems with extensive user involvement through a friendly user interface." From these definitions,

we want to stress two important features of DSS pertinent to our interpretation of IRSS. One feature is the combination of data and models. Data are raw and uninterpreted facts. In order to make sense of raw data, one needs to construct various models. Therefore, a DSS deals with both data and their interpretations. The other feature is the emphasis on the user involvement.^[5]

A simple conceptual architecture of IRSS is shown in Fig. 1, consisting of a user interface subsystem, an information-management subsystem, a knowledge-based management subsystem, and a retrieval subsystem. Their main functionalities are summarized below:

- User interface subsystem: provides a friendly interface for user–system interaction (containing different functionalities, and tools to support retrieving and postprocessing).
- Information management subsystem: collects and manages data, information, and knowledge of a collection of information items.
- Knowledge-based management subsystem: manages various models (e.g., document models, retrieval models, presentation/recommendation models, and user models) to support other subsystem.
- Retrieval subsystem: performs the retrieval and inference tasks, and analyzes retrieval results from multiple perspectives and provides the results to users through user interface.

The four subsystems work together to provide retrieval support to users. The main concern of this architecture is based on a combination of the traditional architecture of IRS and DSS.

IMPLEMENTATION OF IRSS

In this section, we look at the implementation of IRSS by mentioning results from related fields and giving the granular computing basis of IRSS.

Fields Related to IRSS

To build a relatively new discipline, we need to draw ideas, techniques, results, and lessons from many other

fields. A few related fields are summarized below, in addition to previously mentioned DSS.^[5]

Expert systems

A well-established practice in expert systems is the separation of knowledge and inference engines. While the inference engine is logic-based and problem-independent, the knowledge base is domain-specific. Expert system shells that implement an inference engine can be used to build many different domain-specific expert systems. Similarly, we can build a knowledge-based IRSS by separating knowledge-base and management subsystems. An IRSS shell can be built that provides a set of domain- and user-independent tools. Another feature of expert systems is the explanation functionality. An expert system not only provides a solution, but can also give reasons to justify the solution. It is reasonable to insist on the explanation functionality of an IRSS.

Machine learning and data mining

By applying algorithms of machine learning, data mining, and especially text mining to documents stored in an IRSS, one may discover patterns and extract knowledge useful to a user. Such functionalities are particularly useful to users who are interested in exploratory searching and browsing. For example, a user can track trends in a particular area or discover emerging topics from the constantly changing document collection. A user may also discover links between different documents or research areas.

Computer graphics and information visualization

In many cases, a user may not want the details about particular documents. A user may want to have a general feeling before going to a more in-depth analysis. This can be accomplished with a granulated view, in which details are omitted. Most current IRS present search results in the form of ranked list of individual documents. In an IRSS, a user should be able to use graphics and visualization tools to view a particular document model and retrieval results. Graphics and visualization techniques may enable users

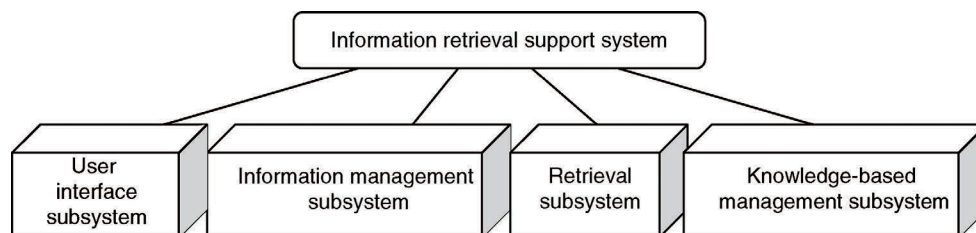


Fig. 1 The conceptual architecture of IRSS.

easily to perform qualitative inference and analysis at multiple levels.

Intelligent information agents

Intelligent information agents have been used by many IRS to collect information and interact with users. The potential of agents needs to be further explored in IRSS. In particular, a user should be allowed to construct a personalized agent to interact with an IRSS. The autonomy and learning capabilities of agents make them attractive to both IRSS and users.

Granulation in IRSS

An important task of an IRSS is the management of various models. Typically, these models provide multiview and multilevel representations of the information items and users. In order to obtain such representations, the recently proposed theory of granular computing may provide the required theoretical and technological basis.^[31]

Document space, user space, term space, and retrieval-results space can be granulated respectively, to achieve multilevel and multiview representations. The four types of space granulation are related to each other. To provide retrieval results for different types of users, user space is granulated. A user granule may require a specific type of retrieval-result granule. Term space is granulated to support document-space and query-space granulations. An IRSS can recommend relevant terms to users for refining a query based on different levels of term granulation. Document space is granulated to different categories and the document granules can be retrieved based on relevant-term granules.

Document-space granulation

Traditional IRS focus more on documents, and the associated granulations are always document clusters based on the contents of documents.^[1,12] This single view may not fully explore information and knowledge about a document collection. In general, a document collection can be granulated in at least three views: content view, structure view, and usage view.^[32]

From the content view, document-space granulation may reveal the relationships among different documents or relationships between a specific document and a given topic. From the structure view, citations and links among different documents can be considered as implicit connections, which provide a different kind of granulation.^[33] From the usage view, documents that are accessed together can be put into the same document granule.^[32]

User-space granulation

Different types of users have different needs, and hence they should be classified into different user

granules. User-space granulation is mainly based on user profiles and user access logs. Based on Web-usage mining, we can find interesting rules for certain types of users.^[34] User-space granulation is necessary for personalized retrieval support. The granulated user space will be useful for locating relevant retrieval-results granules.

Term-space granulation

In IRSS, terms are granulated into a hierarchical structure based on relationships among them. For example, some terms may be very specific and belong to a more general term, and some terms may be synonyms, etc. Manual and automatic thesauri (such as co-occurrence analysis and grammatical analysis) are concrete methods for one-level term-space granulation.^[35,36] In general, one may consider hierarchical classification methods for multiple-level granulations. A granule network of domain knowledge can be built based on term-space granulation.^[7,32] Document granulation can be based on this granule network of terms, and a document can be associated with term granules. For example, gene and protein names are used for building domain-knowledge structures for biomedical literature classification.^[37] In the retrieval process, if query terms are too general, an IRSS could suggest users to refine the query terms using the granulated term space. On the other hand, if user terms are too specific, the system could suggest users with synonyms, co-occurring words, or more general terms. The term-space granulation also can be used for retrieval-results granulation. Retrieval results can be organized into a granule network based on term-space granulation.

Retrieval-result-space granulation

In order to have an in-depth understanding of the retrieval results, one may granulate them to form a multilevel view. One way to achieve this is through the use of user-space granulation and term-space granulation. For example, by using term-space granulation, retrieval results may be organized to reflect different levels of generality of terms, which may meet the user needs at different level of details. Depending on user-space granulation, one may choose the right level of term-space granulation for presenting retrieval results. Retrieved documents can also be presented based on document-space granulations.

CONCLUSION

With the advance of any technology, we need to find new applications that realize its benefits. The introduction of IRSS is to take advantage of recent achievements in information and Web technologies on one hand, and to maximize the potential values of the Web on the other. A search engine equipped with more supporting

functionalities will enable users to make full and wise use of the Web. The main feature of an IRSS is to expand the functions of current retrieval systems beyond search, navigation, and browsing. Such systems will play an important role in the next generation of the World Wide Web and the study of WI.

This entry briefly discusses the fundamental issues of IRSS. We demonstrate that IRSS represents the next generation in the evolution of retrieval systems, from DRS to IRS, and from IRS to IRSS. A conceptual architecture of IRSS is proposed. Regarding the implementation of IRSS, we examine a few related fields. Granular-computing theory is used to obtain multiview and multilevel representations through term-space, user-space, document-space, and retrieval-results-space granulations. These multiple representations may enable an IRSS to support users more intelligently.

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Information Retrieval Systems

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Abstract

Information retrieval (IR) systems aim to select relevant material from large collections of information in response to user queries. The approaches used to accomplish this have been the focus of much research and development, and have led to the algorithms underlying many commercial and Web-based search engines today.

This entry describes the common components that go into the design of IR systems (from text processing to inverted file indexes). The major classes (or models) of retrieval algorithms (Boolean, vector, and probabilistic) are described along with formal definitions of the basic form of these algorithms and some of the variations in common use in IR research. In addition, the entry examines query expansion techniques, and in particular *relevance feedback*, and how they are used in IR systems.

INTRODUCTION

Information Retrieval (IR) is concerned with the storage, organization, and searching of collections of information. It has been part of significant part human technological development since the development of writing (or even earlier, since the mnemonic systems probably developed in prehistoric times can also be considered a form of mental IR). The earliest IR systems were the organization schemes of ancient archives and libraries, such as early Sumerian archives, or the “Pinakes” developed by Callimachus for the library of Alexandria. In the twentieth century the largest impetus to development of automated IR systems was the need to manage increasing larger quantities of information in business and scientific development. Early attempts at automating search capabilities for document collections involved techniques based on punched cards, as well as machines using optical sensing of codes on microfilmed documents.^[1] The concept of using machine-based systems for storage and retrieval of information was popularized by Vannevar Bush’s article “As We May Think” in 1945.^[2] The term “information retrieval” was coined by Mooers in 1950.^[3]

The goal of any IR system is to select the informational items (texts, images, videos, etc. which we will refer to as “documents”) that are expected to be relevant for a given searcher (or user) from a large collections of such items. Today these collections range from small sets of items on an individual’s personal computer to the vast resources of the World Wide Web. In all cases the task is the same: to extract some set of items that searchers *wants to have* from all of those they *do not want*.

This is not a simple task, and involves not only the technical aspects of constructing a system to perform such selection, but also aspects of psychology and user behavior to understand what differentiates the desired items

from the undesired from the particular user’s point of view. In this entry, we focus on the technical aspects of the system and leave the many issues of user interaction in search systems to the entry “User-Oriented and Cognitive Models of Information Retrieval.” We also do not consider, except in passing, the specific aspects of collections or of measuring relevance and search effectiveness. The entries “Information Retrieval and Evaluation,” “Test Collections,” “Web Information Retrieval,” and “TREC (Text Retrieval Evaluation Conference)” cover these aspects of IR in detail. We also note that that we will focus on computer-based IR systems and will not attempt to cover other types (indexes, catalogs, etc.), nor will we spend time discussing the related field of database management. Note also that this entry does not attempt to cover *all* of the myriad variations of approaches to IR that have been tested over the years, but only those we consider to be of interest and that have been shown to be effective in IR evaluations.

In this entry, and in much of the history of IR research, the focus has been on the system and how to obtain the best possible results using some collection of documents with predefined set of “correct” answers (known as a *test collection*). This is sometimes referred to as the laboratory model of IR, where the system and its algorithms are the primary foci of the research and user aspects of the system are considered hardly at all. There are many critiques of this laboratory approach, but it has the advantage of allowing comparability between IR systems in terms of standardized measures of effectiveness for a given collection and set of queries.

This entry describes the common components that go into the design of IR systems. The major classes (or models) of retrieval algorithms (Boolean, vector, and probabilistic) are then described along with formal definitions of the basic form of these algorithms and the

variations in common use in IR research. This section is an expansion and update of a similar description appearing in Larson.^[4] We then examine query expansion techniques, and in particular *relevance feedback*, and how they are used in IR systems. Finally, we conclude with a short discussion of experimental IR systems and their relation to commercial and public IR systems.

INFORMATION RETRIEVAL SYSTEM COMPONENTS

Information retrieval systems are made of a number of software components (varying in details from system to system) that are concerned with the primary functions of the system. These are: 1) accepting input in the form of documents, extracting information from those documents and storing that information in a form that can be quickly accessed for matching to user searches; and 2) accepting user queries and converting those to a form that can be compared to the stored information about documents. These two processes are often referred to as “indexing” and “retrieval.” In this section, we describe the common processes for indexing and retrieval, and indexes for matching the content of queries and documents. The retrieval models for ranking the results are discussed in the following section.

Text Processing

Fig. 1 shows an abstract representation of an IR system. All IR systems rely on two interdependent processes to

make their stored items (*records*, *documents*, or *document representatives*) accessible to users: *indexing* and *retrieval*. Although IR systems need not be computer-based (e.g., printed indexes and card catalogs can also be considered forms of IR systems), this entry focuses on computer-based systems.

The indexing process in IR systems (right-hand side of Fig. 1) is concerned with deriving a representation of a document according to the rules and processes set up for the particular system. One of simplest forms would be to extract all of the words occurring in each document and store them in an index along with an indication of which document they came from. This is commonly known as *binary indexing*, that is, a given word is either associated with a document, or it is not. Alternatively, an IR system may use some form of *weighted indexing*, where words are assigned to documents with an associated numerical weight indicating the importance or significance of that term to the document.^[5] Indexing will often also identify word position within a document, sometimes with enumeration of paragraph, sentence, and word position within a sentence. Such indexing can be used to determine proximity constraints for a query in a Boolean system (e.g., words in the query must occur in the same sentence or paragraph), or proximity weighting in ranked systems.

More commonly, the document normalization and index creation involve more complex text processing of the document contents than simple word extraction (the central trapezoid in Fig. 1). In the rest of this entry, we will use “terms” to indicated elements of a document

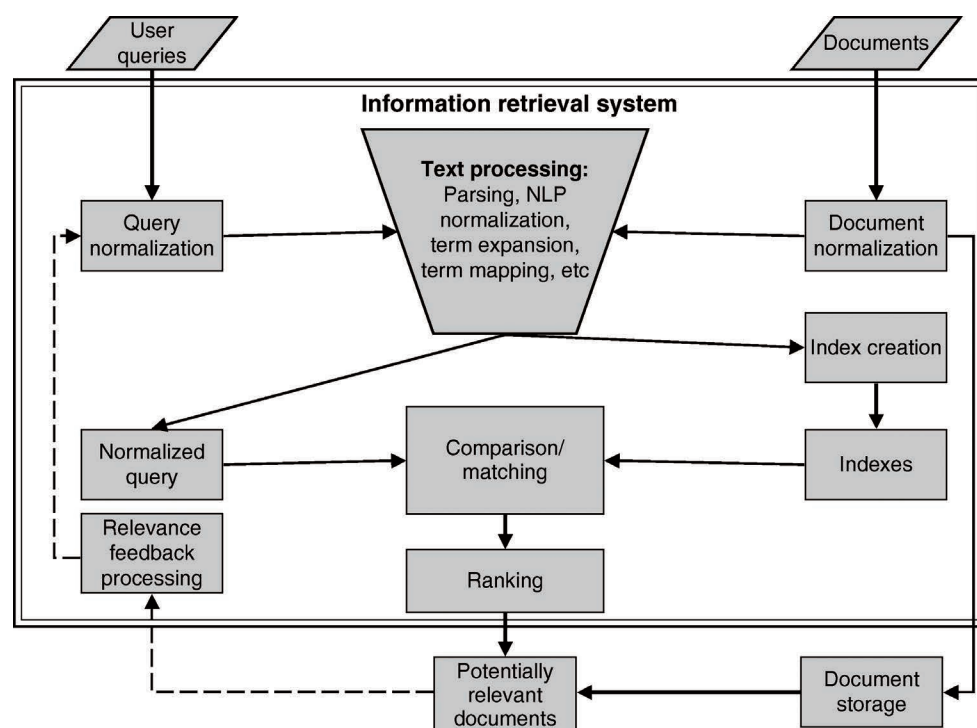


Fig. 1 Structure of an information retrieval system.

stored in the index. Terms may be words, or phrases, or some mapping of document content words to controlled vocabularies. The typical stages of text processing for document indexing may include

1. **Structural identification:** Recognition and selection of document elements based on document structure (e.g., selecting the title or author of the document). Because the structured document markup XML is now commonly used for the majority of documents available online, it has become relatively simple to identify and extract the significant structural elements of documents. Indexing may also store indications of the source of extracted terms in the index itself, permitting searches for both content and structure.
2. **Tokenization:** Individual “tokens” in the content are extracted. Tokens are portions of the content, typically sequences of alphabetic and numeric characters. Typically this involves ignoring spacing, page boundaries, and punctuation. The result is a set of tokens which may become terms in the index, or go through further processing. When individual words are extracted, their original positions in the content may also be retained in the indexes so that, for example, words near each other in the original text can be identified.
3. **Token pattern recognition:** Tokens may be examined to identify particularly meaningful or useful patterns. These may include such things as recognition of URLs or identifying sequences of capital letters (or capital letters with periods following them) as potential acronyms.
4. **Normalization of tokens:** This typically involves changing the capitalization of tokens to a single form (all lower case, for example). In some systems diacritics (accents, umlauts, etc.) may be removed and replaced with the appropriate base letter alone, or have multiple letters substituted. Some system may create duplicate tokens normalized in this fashion while retaining the original as well.
5. **Part of speech tagging:** Natural language processing (NLP) techniques such a part of speech tagging may be used to identify the different parts of speech in the content. Because the most common type of search is for nouns and noun phrases, this can be used to identify and extract noun phrases for special treatment.
6. **Stopword processing:** IR systems may have lists of words considered to be worthless in retrieval (these typically include articles like “an,” “the,” “a”). Some systems have different stopwords lists for each of identified structural elements, or for each index. Stoplists may also specify classes of tokens (such as numbers) or parts of speech.
7. **Stemming or morphological analysis:** Many IR systems use some form of stemming to collapse various inflected forms of a word (e.g., cat and cats) into a single form. Stemming uses simple rule-based

processing to perform this task and often does a poor job on some words. Morphological analysis typically uses a combination of exception dictionary lookup and rules. The intent of either is to have a single form of a word used in the indexes for all forms of that word.

Systems may include various combinations and variants of these processes. For example, some systems include both the “stemmed” form and original forms of terms, generating a table of original forms for each stem encountered during indexing and then using all forms during search. One advantage of this approach is that searches may be constrained to the original forms when needed, such as when the stemmed form is too inclusive.

As indicated in Fig. 1, both document indexing and query processing require similar or identical text processing steps. This is to ensure that the tokens from the users query are comparable with the tokens extracted during document indexing.

Indexes and Query Matching

The results of text processing on incoming documents are stored in the indexes of the IR system. These indexes provide a fast lookup mechanism for each token extracted by the text processing, along with other information including some identifier for the document(s) that the token came from, and usually other information, such as statistical information about the frequency of occurrence of the token in each document, and in the collection as a whole, and possibly information about the location that each token came from in each document.

The specific file structures used for the indexes vary from system to system, but the most common are some form of “inverted file,” where the data on all occurrences of a token in a collection are organized by a single instance of the token itself. This allows all of the data for resolving most queries to be fetched by a single lookup in the index for each token. The “comparison/matching” part of the processes shown in Fig. 1 is responsible for this task. This tends to be fairly common across a wide variety of IR systems, regardless of their type or “model.” The result of matching (or index lookup) is an unordered set of tokens and their associated information from the indexes, that were also in the *normalized query* (i.e., the results of applying the same text processing steps to the content of query that were applied to the stored documents).

INFORMATION RETRIEVAL MODELS AND RANKING

The true differentiation between IR systems occurs in the variations in the Text Processing and Ranking portions of Fig. 1. The different approaches to deriving a ranked

list of potentially relevant documents from the index matching results are often referred to as the “IR model.” In this section, we will examine the main IR models and how they obtain this ranking of potentially relevant documents.

There are three main classes of retrieval models: Boolean, vector, and probabilistic. In addition there are many systems that are hybrids of two or more of these models (e.g., a vector system with Boolean result limiting features). We begin with some formal definitions of system elements that are common to all of the models, and then examine each model in turn.

In an IR system, we have a collection, **D**, of N documents, indexed by a set, **T**, of M unique index terms or attributes. An individual document in the collection, D_i , may be represented as a vector of index term weights:

$$D_i = (w_{i1}, w_{i2}, w_{ij}, \dots, w_{iM})$$

The value of each w_{ij} term weight is determined by the indexing function applied. These values may represent binary indexing, (where $w_{ij} = 1$ if term T_j occurs in document D_i , and $w_{ij} = 0$ otherwise), simple term frequency weights (where each w_{ij} represents the number of times index term T_j occurs in document D_i), to more complex probabilistic weighting schemes (where w_{ij} is based on an estimation of the conditional probability that users would consider D_i to be relevant given that their query contains the term T_j).

The set of index terms, **T**, consists of any searchable attribute associated with the documents in the collection. These may be word stems, words, phrases, or other elements (such as class numbers) that occur in the text of the document or derived during text processing. They may also include associated elements that are not index terms in a conventional sense, such as related terms or cross-references from a thesaurus, citation information, or references to other documents (e.g., hypertext links). These index terms may be formally represented by an *inverted file*, where each index term, T_j has an associated vector of weights, I_j such that:

$$I_j = (w_{1j}, w_{2j}, w_{ij}, \dots, w_{Nj})$$

The document and index term vectors can be seen as a $N \times M$ matrix of w_{ij} weights. Thus, the collection of documents can be viewed as a matrix where the rows are individual document vectors and the columns the individual term vectors. In some systems the inverted file may also include positional information on the occurrence of the terms, and even include weights for the document, paragraph, and sentence level.

In virtually all IR systems, the inverted file is commonly used in retrieval operations instead of the document vectors.

Each query Q_k from the set of queries, **Q**, submitted to the system may be represented as a vector of index term weights:

$$Q_k = (y_{k1}, y_{k2}, y_{kj}, \dots, y_{kM})$$

where y_{kj} is the weight assigned by the user or system to term T_j in the k^{th} query.

The Boolean Model

The earliest retrieval model was the Boolean model based on Boolean logic. Systems using the Boolean model include most of the earliest commercial search services (like DIALOG or LEXUS/NEXUS), many online library catalogs, and many local search systems on individual Web sites. The Boolean model is a set-oriented model, where sets of documents are defined by the presence or absence of an individual index term. Using our formal definitions above, a single inverted file vector I_j can be considered as Boolean set, where each nonzero document weight in the vector defines a member of the set. In processing Boolean queries the sets representing the different search terms can be combined using the Boolean set operations intersection, union, and negation. These are usually expressed in a user's query as the *Boolean operators* AND, OR, and NOT.

AND: Set intersection generates a new output set from two input sets where the members (documents) shared by both sets become the members of the output set.

OR: Set union generates a new output set from two input sets where the members of either (or both) of the input sets are combined to become the new output set.

NOT: Set negation operates on a single input set, and generates a new set that contains all members (documents) that are not in the input set.

All of these operations can be performed using a simple binary inverted file, or more complex weighted inverted files. Note, however, that the unary NOT operation can be very expensive to process in inverted files, since the result set would be all documents in the system not included in the set. As a result most Boolean IR systems restrict the use of NOT to the binary “ANDNOT” operation which excludes any members of the right-hand set from the left-hand set.

In Boolean IR systems, the user is typically responsible for formulating a combination of terms and Boolean operators that will, it is hoped, select the relevant documents for the user's information need. Boolean systems are commonly extended by inclusion of other operators usually providing additional restrictions on set intersection

operations. For example, term proximity operations restrict a intersection to those documents that not only have both terms, but also have those terms within a specified distance from each other.

Pure Boolean IR systems have no inherent ordering of the result of Boolean query processing. Any order presented to the searcher is applied after the final Boolean result set is obtained. Many systems use some assumed useful ordering of the result set using document information (such as the date or author name of books in a library online catalog).

Many IR researchers have pointed out the major drawbacks with Boolean IR systems. These include

1. Boolean logic requires that the users be trained in construction of queries, because it is not intuitively obvious, and differs from common natural language usage. (e.g., a user seeking books on “cats and dogs” probably wants books on either, not just those that treat both.)
2. Boolean AND operations tend to be too restrictive. A search for “A AND B AND C” will eliminate any records that do not have all these terms. Those that have one or two of the three terms are rejected along with those that have none of the terms.
3. Boolean OR operations tend to be too inclusive. A search for “A OR B OR C” will retrieve any record with at least one of the terms, but no priority is given to those that include more than one of the terms.
4. Due to steps 2 and 3, the result of AND operations is often search failure, and the result of OR operations is often information overload.
5. Boolean logic treats each term equally, giving no priority to those that may be more important to the user’s need.
6. Boolean logic requires that the user’s query and the document indexing use the same terminology for matching to succeed.
7. Boolean logic does not permit the retrieved documents to be ranked in any significant fashion, documents are either retrieved or rejected with no “middle ground.”

Various extensions to Boolean systems have been proposed and tested over the years to allow result ranking based on applying weights to the terms and/or the Boolean operations. Examples include the use of “fuzzy sets,” where set membership is weighted instead of binary, and the “AND” operator returns the minimum of the two input weights, while the “OR” operator returns the maximum. The final result set is ordered by the weights.

Vector Model

The vector space model^[6] considers each document vector as described above to be a vector in an M -dimensional

space (i.e., one dimension for each term in the collection). Vector space IR systems base their ranking on how close together the document vectors and query vector are in this M -dimension space. This can be seen as calculation of a similarity measure based on the terms used in the query and in the documents in the collection. In practice, the inverted file is used to ensure that the processing considers only documents with at least one term in common with the query (otherwise in typical collections vast amounts of computation would be needed to process all document vectors even when they have no terms in common with the query).

In retrieval, partial match techniques based on the vector space model^[7] may be used to rank the documents in the collection in decreasing order of their similarity to the query. The simplest similarity function is the *inner product* of the document and query vectors:

$$\text{INNER}(D_i, Q_k) = \sum_{j=0}^M w_{ij}y_{kj}$$

A variety of other vector similarity measures normalize the value of the similarity to range between 0 and 1. Probably the most commonly used is the *cosine correlation*:

$$\text{COSINE}(D_i, Q_k) = \frac{\sum_{j=0}^M w_{ij}y_{kj}}{\sqrt{\sum_{j=0}^M w_{ij}^2 \cdot \sum_{j=0}^M y_{kj}^2}}$$

This is angular separation of the two vectors in the M -dimensional *vector space*.

The partial match techniques based on the vector model are distinguished by the different term weights and similarity measures used in calculating the *document weight* used to rank the retrieval. Some basic vector approaches are

1. Coordination-level matching. In coordination-level matching the term weights for documents (w_{ij}) and queries (y_{kj}) are binary and the inner product similarity function is used. The document weight calculated is simply the number of terms in common between the document and the query.
2. Cosine correlation with binary weights. This approach uses binary term weights and the cosine correlation to calculate the document weight.
3. Cosine correlation with frequency weights. This approach uses the term weights consisting of simple term frequencies, f_{ij} . That is, each w_{ij} is the number of times term T_j occurs in document D_i , and each y_{kj} is the number of times term T_j occurs in query Q_k . The

cosine correlation between these weighted vectors is calculated to yield the document weight.

4. Term frequency-inverse document frequency (TFIDF) weights. In TFIDF matching, term weights are calculated as follows:

$$w_{ij} = f_{ij} \cdot \log \frac{N}{n_j}$$

where n_j is the number of documents that contain term T_j . This gives the highest weights to terms that occur frequently in a given document, but relatively infrequently in the collection as a whole, and low weights to terms that occur infrequently in a given document, but are very common throughout the collection. Query terms are weighted by simple term frequency, as above, and the document weight is calculated as the inner product of the query and document vectors.

The TFIDF approach is the most common form of vector space weighting, although there are a very large number of variants for it. Most of the variants include some form of normalization of term frequency. Well-known IR systems that use the vector space model are Salton's SMART system,^[8] and more recently the open source Apache Lucene IR system originally developed by Doug Cutting.

Probabilistic Retrieval Methods

In the vector model there is an underlying assumption that documents which are similar to a query will be considered *relevant* to the information needs of the user who submits that query. Relevance is usually defined as a subjective assessment by a given user of the value or utility of a particular document in satisfying a particular need for information. We can say that for a particular search of an IR system, each of the documents in the collection either contains information that the individual wants, or it does not. If it does, then it is considered relevant, otherwise it is nonrelevant. The *document retrieval problem* is to select all of the records in the database that the user would find to be relevant, and reject all those that would be considered nonrelevant, that is, *all* and *only* the relevant documents should be retrieved.^[9]

Given the individual nature of relevance judgements, we can assume that there are no purely deterministic relationships between the terms used in indexing documents and the relevance of a given document, or between the terms used in searching for a document and the relevance of that document. Instead, these relationships are *probabilistic* in nature. This suggests that there are no perfect solutions to the document retrieval problem, but there may be approximate solutions. According to a significant body of theoretical work in IR, the appropriate approach

to IR is to rank each document in the database in descending order of its *probability of relevance* for a given user and query. This has been called the *probability ranking principle*.^[10]

There were originally two competing schools of thought on probability of relevance that have come to be known as Model 1^[5] and Model 2.^[11] These models were subsequently unified into a unified higher-level Model 3 and lower-level Model 0.^[12]

In discussing these probabilistic models we will assume that the set of all (present and future) documents in the collection, $\mathbf{D}$, and the set of all (present and future) queries, $\mathbf{Q}$, are described by binary vectors representing the presence or absence of index terms (although it should be noted that Robertson et al. (1982) make no such assumptions regarding representation). All possible document/query pairs (D_i, Q_j) , define a $\mathbf{D} \times \mathbf{Q}$ probabilistic event space. Within this event space we can define relevance as a relation which holds between certain document/query pairs:

$$R = (D_i, Q_j) | D_i \in \mathbf{D}, Q_j \in \mathbf{Q},$$

document D_i is judged to be relevant by a user submitting query; Q_j Nonrelevance, $\bar{R}$, is the complement of this relation.

We also define a subset of documents, $\mathbf{x} \subseteq \mathbf{D}$, such that all documents in $\mathbf{x}$ are represented by identical binary vectors i.e., those that are indexed by the same set of terms). Similarly, we have a subset, $\mathbf{y} \subseteq \mathbf{Q}$, of identical queries.

The notion of probability of relevance has a different interpretation under the four probabilistic models discussed in Robertson, Maron, and Cooper.^[12] In Model 1, first formulated in a somewhat different form by Maron and Kuhns,^[5] probability of relevance is seen as the relationship between a class of users (those submitting the same query) and a particular document:

$$P(R | \mathbf{y}, D_i)$$

Model 2, on the other hand, defines probability of relevance as a relationship between a class of documents and a particular user and use (or query):

$$P(R | Q_k, \mathbf{x})$$

The higher-level Model 3, proposed by Robertson, Maron, and Cooper,^[12] defines the probability of relevance as the relationship between an individual use (query) of the system and an individual document:

$$P(R | Q_k, D_i)$$

The lower-level Model 0, also proposed by Robertson, Maron, and Cooper^[12] and expanded by Wong and

Yao,^[13] defines the probability of relevance as a relationship between a class of queries and a class of documents:

$$P(R|y, \mathbf{x})$$

Most experimental and operational IR systems based on probabilistic principles have used forms of Model 2 for their implementation. For retrieval in a Model 2 system, the probability of relevance is used to define a Bayesian decision function, that is, for any particular query, documents with a given description $\mathbf{x}$ should be retrieved if

$$P(R|Q_k, \mathbf{x}) > P(\bar{R}|Q_k, \mathbf{x})$$

That is, documents should be retrieved if the probability of relevance is greater than the probability of nonrelevance.

This decision rule commonly takes the form of a discriminant function:

$$g_{Q_k}(\mathbf{x}) = \log \frac{P(R|Q_k, \mathbf{x})}{P(\bar{R}|Q_k, \mathbf{x})}$$

These probabilities are difficult to calculate directly, but Bayes theorem can be applied to convert them to the more convenient form:

$$g_{Q_k}(\mathbf{x}) = \log \frac{P(\mathbf{x}|R, Q_k)}{P(\mathbf{x}|\bar{R}, Q_k)} + \log \frac{P(R|Q_k)}{P(\bar{R}|Q_k)}$$

where $P(\mathbf{x}|R, Q_k)$ is the probability that if, for a given query, a particular query/document pair is judged relevant, then the document would have description $\mathbf{x}$. Since we are considering only a single query, we can define a subset, $\mathbf{D} \times Q_k$, of the $\mathbf{D} \times \mathbf{Q}$ event space, and the relevance relation:

$$R_{Q_k} = (D_i, Q_k) | D_i \text{ is relevant to } Q_k$$

where $R_{Q_k} \subseteq R$. If we define $P(R_{Q_k}) = P(R, Q_k)$, and $P(\bar{R}_{Q_k}) = P(\bar{R}, Q_k)$, and assume that index terms are stochastically independent with respect to the relevance or nonrelevance of a document then

$$P(\mathbf{x}|R_{Q_k}) = P(w_1|R_{Q_k})P(w_2|R_{Q_k}) \dots P(w_M|R_{Q_k})$$

$$P(\mathbf{x}|\bar{R}_{Q_k}) = P(w_1|\bar{R}_{Q_k})P(w_2|\bar{R}_{Q_k}) \dots P(w_M|\bar{R}_{Q_k})$$

where the w_i represent the individual index terms of the binary vector $\mathbf{x}$. We also define the symbols, $p_i = P(w_i = 1|R_{Q_k})$, and $q_i = P(w_i = 1|\bar{R}_{Q_k})$. Under these assumptions:

$$P(\mathbf{x}|R_{Q_k}) = \prod_{i=1}^M p_i^{x_i} (1 - p_i)^{1-x_i}$$

$$P(\mathbf{x}|\bar{R}_{Q_k}) = \prod_{i=1}^M q_i^{x_i} (1 - q_i)^{1-x_i}$$

By taking logs and substituting into the discriminant function, we get

$$g_{Q_k}(\mathbf{x}) = \sum_{i=1}^M w_i \log \frac{p_i(1 - q_i)}{q_i(1 - p_i)} + \sum_{i=1}^M w_i \log \frac{1 - p_i}{1 - q_i} + \log \frac{P(R|Q_k)}{P(\bar{R}|Q_k)} = \sum_{i=1}^M a_i w_i + K_1$$

where

$$a_i = \log \frac{p_i(1 - q_i)}{q_i(1 - p_i)}$$

and K_1 is a constant for any given query.

The Model 2 probabilities p_i and q_i can be calculated, or estimated, from frequency data. If there are N documents in the database and R' of them are relevant for a given query, and the i th term occurs in n_i of the documents of which r_i are relevant, then a_i can be calculated as

$$a_i = \log \frac{r_i(N - n_i - R' + r_i)}{(n_i - r_i)(R' - r_i)}$$

Notice that this assumes that relevance is known, or can be estimated, in order to provide the frequency data that are used to estimate the probabilities. In practice, what is usually done is to estimate the frequencies based on a sample of documents evaluated by the user, or when such information is not available this formula reduces to the inverse document frequency described above. Thus Model 2 is most effective applied in a secondary search, or *relevance feedback*^[14] situation, where documents retrieved in an initial search, often ranked according to a matching function based on rough estimates of the probabilities, are evaluated and the user's relevance judgments used to estimate Model 2 weights for a second search and re-ranking of the collection.

Okapi BM-25 algorithm

The most widely used form of a probabilistically based IR algorithm is known as the Okapi BM-25 algorithm developed by Robertson.^[15] The basic form of the Okapi BM-25 algorithm is

$$\sum_{j=1}^{|Q_c|} w_{(1)} \frac{(k_1 + 1)tf_j}{K + tf_j} \frac{(k_3 + 1)qtf_j}{k_3 + qtf_j}$$

where (in addition to the variables already defined)

$|Q|$ is the total number of terms in Q ,

$|Q_c|$ is the number of terms in Q that also occur in the document,

tf_j is the frequency of the j th term in a specific document,

qtf_j is the frequency of the j th term in Q ,

K is $k_1((1-b) + b \cdot dl/avdl)$,

k_1 , b and k_3 are parameters (set by experimentation for a given collection),

$avdl$ is the average document length,

$w^{(1)}$ is the Robertson–Sparck Jones weight:^[11]

$$w^{(1)} = \log \frac{\left(\frac{r+0.5}{R-r+0.5} \right)}{\left(\frac{n_j-r+0.5}{N-n_j-R-r+0.5} \right)}$$

n_j is the number of documents containing the j th term,
 r is the number of relevant components of a given type that contain a given term,

R is the total number of relevant components of a given type for the query.

The Robertson–Sparck Jones weights, when no relevance information is available, resolve to the inverse document frequency like the a_i measure above.

Logistic regression algorithm

Another approach to estimating probability of relevance uses the *Logistic Regression* (LR) algorithm originally developed by Cooper, Gey, and Dabney.^[16] The LR model of probabilistic IR attempts to estimate the probability of relevance for each document based on a set of statistics about a document collection and a set of queries in combination with a set of weighting coefficients for those statistics. The statistics to be used and the values of the coefficients are obtained from regression analysis of a sample of a collection (or similar test collection) for some set of queries where relevance and nonrelevance has been determined. More formally, given a particular query and a particular document in a collection $P(R|Q_k, D_j)$ is calculated (or estimated) and the documents or components are presented to the user ranked in order of decreasing values of that probability. To avoid invalid probability values, the usual calculation of $P(R|Q_k, D_j)$ uses the “log odds” of relevance given a set of S statistics, s_i , derived from the query and database, such that

$$\log O(R|Q_k, D_j) = b_0 + \sum_{i=1}^S b_i s_i$$

where b_0 is the intercept term and the b_i are the coefficients obtained from the regression analysis of the sample collection and relevance judgements. The log odds form can be used to rank results directly or be simply converted to probabilities:

$$P(R|Q_k, D_j) = \frac{e^{\log O(R|Q_k, D_j)}}{1 + e^{\log O(R|Q_k, D_j)}}$$

The form of the LR algorithm used in the Cheshire II IR system^[17,18] is

$$\begin{aligned} \log O(R|Q, C) = & b_0 + \left(b_1 \cdot \left(\frac{1}{|Q_d|} \sum_{j=1}^{|Q_d|} \log qtf_j \right) \right) \\ & + (b_2 \cdot \sqrt{|Q|}) + \left(b_3 \cdot \left(\frac{1}{|Q_d|} \sum_{j=1}^{|Q_d|} \log tf_j \right) \right) \\ & + (b_4 \cdot \sqrt{dl}) + \left(b_5 \cdot \left(\frac{1}{|Q_d|} \sum_{j=1}^{|Q_d|} \log \frac{N - n_j}{n_j} \right) \right) \\ & + (b_6 \cdot \log |Q_d|) \end{aligned}$$

where (in addition to the variables already defined above)

dl is the document length measured in bytes,

N is the number of documents in the collection,

b_i are the coefficients obtained through the regression analysis.

The LR approach to IR is one of a class of approaches that attempt to “learn” how to rank based on collected previous results. Other approaches use methods ranging from machine learning to genetic algorithms to learn the best ways of ranking results, usually for specific collections.

Language models

A rather different approach to probabilistic IR is based on language modeling originally developed for applications such as automatic speech recognition, machine translation, and OCR correction. A “language model” as used in IR systems is simply the statistical distribution of terms in documents and the collection as a whole. In language model-based IR instead of attempting to estimate probability of relevance, the system attempts to estimate the probability that a particular query was (or could have been) generated from language model for a given document. The results are then ranked according to this probability. The assumption is that if the query could have come from the document, then that document is likely to be relevant.

In the original description of language modeling, Ponte and Croft^[19] define the probability estimates used to rank a document in the search results as

$$P(Q_k|M_d)$$

where Q_k is a query (as above) and M_d is the language model for a given document. A simple approach to estimating this model would calculate

$$p_{ml}(T_j|M_d) = \frac{tf_j}{dl_d}$$

This is simply the *Maximum likelihood estimate* of the probability of term T_j in document d where tf_j is the raw term frequency in document d and dl_d is the length of document d (in tokens). The simplest ranking function is then the product of the individual term probabilities:

$$P(Q_k|M_d) = \prod_{T_j \in Q_k} p_{ml}(T_j|M_d)$$

The obvious problem with this ranking function is that it will be zero for any document that does not contain all of the query terms. Various approaches have been taken to normalize and *smooth* this basic model to avoid both the problem of going to zero and the implicit assumption that all documents with a given term share a common language model. Most implementations use much more sophisticated smoothing and model expressions than the simple unigram language model outlined here.

Language models have been quite effective in IR evaluation exercises like TREC (q.v.). The open source Lemur toolkit^[20] makes language modeling algorithms available to researchers and students.

Inference network models

Inference networks are a form of probabilistic model that uses networks of known probabilities of events (such as the a priori probability of a term occurring in a document) to infer the probability of unknown events (such as the probability of relevance for a given document and query). Inference networks were developed by Turtle and Croft,^[21] and are used in the INQUERY IR system. Inference networks can include nodes that are the results of Boolean operations into the probabilistic inference network.

Similar to inference networks are the IR application of neural networks where the probabilities of relevance given particular inputs are estimated by training the network, which involves adjusting the low-level probabilities of activation from one node to any connected nodes. The major difference is that in an inference net the inferential information is pre-encoded in the model (both as structure and parameters), while in neural nets nothing is encoded a priori, but instead a “blank” network is extensively trained on data and the inferences discovered based on this training.

Hybrid models

Many IR systems combine two or more of the basic models discussed above in a single system. The most common combination is to permit some form of Boolean operations or restrictions on a ranked result set. This may involve use of explicit Boolean or extended Boolean operations (such as proximity processing) to restrict a ranked result set to those items that satisfy the Boolean constraint. Other hybrid systems may use “data fusion” methods to combine results from different retrieval algorithms.^[22,23]

Combining probabilistic and (strict) Boolean elements, as well as operators to support various merging operations have been used in many systems as well. In implementation, strict Boolean operators and probabilistic searches (such as OKAPI BM-25 or LR) can be performed using the same inverted file structures, and they can be seen as two parallel *logical* search engines. Each logical search engine produces a set of retrieved documents. When a only one type of search strategy is used then the result is either a probabilistically ranked set or an unranked Boolean result set. However, both can be combined in a single query and the search results are evaluated using the assumption that the Boolean-retrieved set has an estimated $P(R|Q_{\text{bool}}, D) = 1.0$ for each document component in the set, and 0 for the rest of the collection. The final estimate for the probability of relevance used for ranking the results of a search combining strict Boolean and probabilistic strategies is simply

$$P(R|Q, D) = P(R|Q_{\text{bool}}, C)P(R|Q_{\text{prob}}, C)$$

where $P(R|Q_{\text{prob}}, C)$ is the probability of relevance estimate from the probabilistic part of the search, and $P(R|Q_{\text{bool}}, C)$ is the Boolean. In practice the combination of strict Boolean “AND” and the probabilistic approaches has the effect of restricting the results to those items that match the Boolean part, with ranking based on the probabilistic part. Boolean “NOT” provides a similar restriction of the probabilistic set by removing those document components that match the Boolean specification. When Boolean “OR” is used the probabilistic and Boolean results are merged (however, items that only occur in the Boolean result, and not both, are usually reweighted to the lower range of probabilistic results).

QUERY EXPANSION AND RELEVANCE FEEDBACK

In many IR tasks the queries submitted by a searcher are often very short and sometimes ambiguous. The goal of query expansion is to create a larger query from the searcher’s initial expression and to use that to obtain (it is hoped) more relevant results. Some forms of query expansion take place in the initial text processing of the query (as discussed above) but the most effective methods involve obtaining relevance judgements on a sample of documents obtained using the initial query expression, and performing *relevance feedback* processing on those documents (shown as the dashed lines in Fig. 1).

Relevance feedback has been shown to be remarkably effective in improving the result of a query. The Vector Space and Probabilistic models take somewhat different approaches to relevance feedback. However, the main idea is to modify the existing query based on the judged

relevant and nonrelevant documents, usually extracting terms from the relevant documents and adding them to the query and also adjusting the weights for terms already in the query.

The most widely used Vector Space algorithm for relevance feedback is the Rocchio Method.^[24] The Rocchio method is defined by

$$Q_{\text{new}} = \alpha Q_{\text{old}} + \frac{\beta}{n_1} \sum_{i=1}^{n_1} R_i - \frac{\gamma}{n_2} \sum_{i=1}^{n_2} S_i$$

where

Q_{old} is vector for the initial query,

R_i is the vector for the judged relevant document i ,

S_i is the vector for judged nonrelevant document i ,

n_1 is the number of relevant documents chosen,

n_2 is the number of nonrelevant documents chosen,

α , β , and γ are parameters to tune the importance of the initial query and the relevant and nonrelevant terms.

Common settings are $\beta = 0.75$ and $\gamma = 0.25$.

The probabilistic models commonly use some form of the Robertson–Sparck Jones weights for relevance feedback. This appears in the Okapi BM-25 Formula above. In relevance feedback the portions of that formula that need relevance information are filled in from the judged relevant and nonrelevant documents, and new weights are calculated for the query terms based on resulting weights. In the Cheshire II system the Robertson–Sparck Jones weights are calculated and used to select a number of most highly weighted terms from the judged relevant documents to add to the initial query and to reweight the initial query terms. This expanded query is then searched using the same LR algorithm as the initial query.

One interesting, and effective, technique that has been used in many retrieval evaluations with good results is the so-called Blind or Pseudo relevance feedback. In this approach there is no searcher involved nor actual relevance judgements made. Because many (if not most) IR systems tend to have relevant documents at the top of their rankings, this approach assumes that some arbitrary number of the top-ranked documents from the initial search are in fact relevant and applies relevance feedback processing to them (usually with a corresponding number of assumed nonrelevant documents from the bottom of the initial ranking). Even though there is no user judgement involved in this process, it has on average improved the results for systems using this method. Generally, however relevance feedback is most effective when the searcher is directing the relevance choices.

CONCLUSION

Information retrieval systems aim to select relevant material from large collections of information in response to

user queries. The approaches used to accomplish this have been the focus of much research and development, and have led to the algorithms underlying many commercial and Web-based search engines today. The article on Web Search Engines goes into more detail on the approaches taken by the various Web search companies. Even though the specific algorithms of any particular search engine are considered proprietary “trade secrets,” we can safely say that all existing Web search engines use some combination of the models outlined above, usually with the addition of Web-specific ranking algorithms (such as Google’s PageRank that ranks Web pages based on the numbers of ingoing HTML links for that page, as well as other “reputation-based” metrics). Effective search is considered to be one of the critical requirements of the Web, and is also an essential requirement in corporate and academic databases, digital libraries, and library catalogs. Information retrieval systems, as described here, provide proven effective search capabilities to these important services of the digital age.

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Information Scattering

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Abstract

Information scattering is an often observed phenomenon related to information collections where there are a few sources that have many items of relevant information about a topic, while most sources have only a few. This entry discusses the original discovery of the phenomenon, the types of information scattering observed across many different information collections, methods that have been used to analyze the phenomenon, explanations for why and how information scattering occurs, and how these results have informed the design of systems and search strategies. The entry concludes with future challenges related to building computational models to more precisely describe the process of information scatter, and algorithms which help users to gather highly scattered information.

INTRODUCTION

Whether one searches for research papers about a subject in journals, or for facts about a topic on the Web, a common observation is that there are very few sources (e.g., journals or Web pages) that contain many items of relevant information, while most sources have only a few. This phenomenon is referred to as *information scattering*, and has been a topic of research for over seven decades.

Although the first report on the phenomenon of information (or literature) scattering is generally attributed to Bradford,^[1] it became increasingly clear by 1900 that a large part of the scientific literature on any subject seemed to be scattered across an indefinite number of generalist and specialist journals, with no direct relationship to the subject.^[2] This phenomenon posed a problem for the bibliographic control of information because of the possibility of “missed literature” in any comprehensive search.

Bradford, a chemist turned librarian, helped to quantify this observation.^[1] He recorded a regularity in the numbers of papers on two scientific subjects across different journals. He noticed that if the journals in each of the two scientific subjects were first ranked in order of the numbers of papers they contain on a subject, and then divided into, say, three groups with an equal number of papers, the numbers of journals in successive groups grew in the ratio of 1: k : k^2 . For example, if 3000 papers on a subject were found in 800 journals, then the ratio of (ranked) journals, in successive groups of 1000 papers, is 42: 158: 600, or approximately 1: 3.8: 3.8^2 .^[3] The number of preselected groups can be other than three, which will result in a different number of journals in each group, but will result

in a similar regularity. This mathematical regularity, which predicts a core, middle, and peripheral groups of journals for any subject, is often referred to as *Bradford's Law of Scattering* and the resulting distribution of papers across journals as a *Bradford Distribution*.

When Bradford published the above quantitative findings, they were surprising as it suggested that the “missed literature” could be as much as two-thirds of the total for any subject. However, these results are relevant even today because current electronic databases (e.g., Web of Science or Scopus) analyze only a fraction of the world's journals leading to a similar result.

Subsequent to the publication of Bradford's^[1] paper, there has been considerable debate about inconsistencies in the verbal and graphical description of the law,^[4] and how to represent the law of scattering using more standard statistical measures such as frequency distributions. The latter has led to comparisons^[5] with other similar laws such as Zipf's Law^[6] and Lotka's Law^[7] which describe skewed distributions for other kinds of information phenomena (e.g., the distribution of words across books or authors across papers). Such hyperbolic distributions are referred to as the informetric laws and are studied in the broader field of Informetrics, generally defined to include all quantifiable aspects of Information Science.^[3,8] Bibliometrics, including bibliometric laws are (earlier) terms still used in the literature of information scattering.

Furthermore, there have been debates on how to define the concept of “subject”^[9] or “topic”^[10] (e.g., melanoma vs. melanoma treatment), which could produce different results when deriving Bradford distributions of papers across journals or studying the distributions of authors

across papers (Lotka's Law). However, despite these debates about specific details on the original formulation of Bradford's law of scattering, there is now general agreement that information scattering is a fundamental information phenomenon, and continues to be an active research area for bibliometricians, informetricians, scientometricians, webometricians, and other researchers.

This entry provides an overview of the research on information scattering based on five sections: (1) Types of information scatter; (2) Methods to analyze information scatter; (3) Explanations for the process of information scatter; (4) Implications of information scatter for search strategies and the design of search systems; and (5) Future research challenges.

TYPES OF INFORMATION SCATTER

One way to classify the different types of information scatter is based on how different granularities of *information objects* (e.g., articles, words, facts) are distributed across different granularities of *containers* (e.g., journals, books, Web pages). Several studies on information scatter have analyzed different combinations of information objects and containers, at different granularities. As discussed in the introduction, Bradford^[1] analyzed the distribution of articles across journals and Zipf^[6] analyzed the distribution of words within a book. More recently, research has analyzed the distribution of articles across online databases,^[11–13] the distribution of images across databases,^[14] and the distribution of facts about a topic across Web pages and Web sites.^[15,16] In each case, while the exact fitted curves (e.g., power law, exponential, Poisson) of the distributions vary, the researchers have found strong similarity to the overall regularity originally observed by Bradford. For example, as shown in Fig. 1, the distribution of facts across Web pages is best fitted by a discrete exponential curve.^[15]

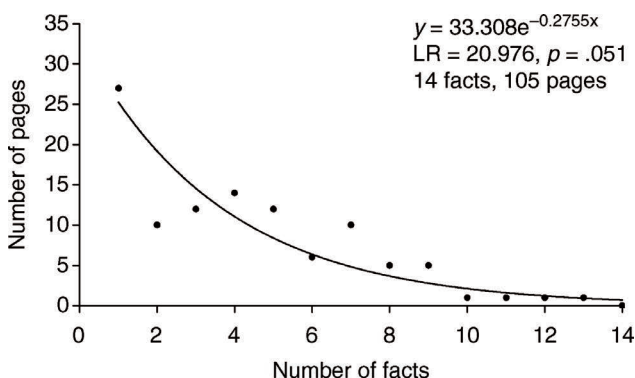


Fig. 1 Distribution of facts about melanoma risk and prevention across high-quality healthcare pages. The distribution is best fit by a discrete exponential curve.

Source: From Bhavnani.^[15]

Nicolaisen and Hjørland^[9] have also classified the different types of information scatter in terms of (1) lexical scattering (words across collection of texts); (2) semantic scattering (concepts across texts); and (3) subject scattering (items useful to a given task or problem). Furthermore, the different types of information scatter constrain the relationships between object and container. For example, facts and articles about a topic can be in multiple Web pages or databases respectively. However, a particular article can be in only one journal. These constraints result in different relationships between information objects and containers.

METHODS USED TO ANALYZE INFORMATION SCATTER

There have been three principal methods used to quantitatively characterize information scatter: (1) Frequency distributions; (2) Coverage analyses; and (3) Network visualizations and analysis.

Frequency Distributions

Frequency distribution is a standard statistical method designed to show for a dataset the relationship between a ranked list of categories of observations (e.g., 1–10 journals, 11–20 journals, etc.) and the number or frequency of data items that fit into each category (e.g., 200 articles occurring in 1–10 journals). Typically the categories are placed on the *x*-axis and the number or frequency is on the *y*-axis, however, several researchers such as Zipf^[6] chose to transpose them. Fig. 1 shows the frequency distribution of the number of facts about a topic across a ranked list of pages.^[15] Depending on the data and the point that the researcher wishes to make, frequency distributions have been used in formats other than the above to characterize information scatter. For example, while the graph in Fig. 1 represents unique occurrences of facts in each category, a *cumulative frequency* distribution includes successive values. Furthermore, when there are a large number of categories and frequencies, the distribution are often plotted on a log–log plot which significantly reduces the length of the *x*-axis for such large datasets, while preserving the overall relationship.

Coverage Analyses

While the above distributions describe the data, they cannot reveal the minimum number of information containers to visit to get all the information objects. To reveal such details, researchers use distributions which are focused on coverage. Fig. 2 shows how many databases are needed to find all the papers related to a subject.^[13] Such a distribution provides another measure for comparing the information scatter among topics or databases. Similar to Fig. 2,

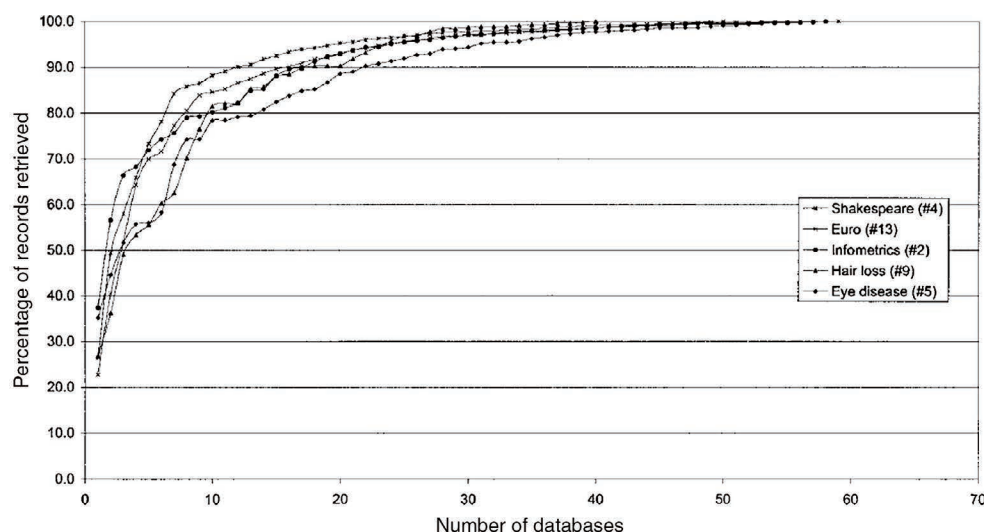


Fig. 2 Distribution of the percentage of journal articles retrieved as a function of the number of databases accessed.
Source: From Hood and Wilson.^[13]

most results in information scatter studies have revealed that it takes many containers to get full coverage of information objects.

Network Visualizations and Analyses

Graphical networks are increasingly being used in a wide range of domains to analyze complex relationships such as information scatter. A network is a graph consisting of nodes and edges; nodes represent one or more types of entities (e.g., facts or Web pages), and edges between the nodes represent a specific relationship (e.g., a Web page contains a fact). Figure 3 shows a bipartite network (where edges exist only between two different types of entities) of how facts about melanoma risk and prevention, are contained in Web pages from the top 10 healthcare Web sites for melanoma information.

Networks have two advantages for analyzing information scatter: (1) They represent a particular relationship between different nodes and therefore can reveal patterns, such as how specific facts occur in different groups of Web pages and (2) They can be rapidly visualized and analyzed using a toolbox of network analysis methods and visualization algorithms. For example, Fig. 3 shows a force-directed layout algorithm which helps to visualize the relationship between Web pages and facts.^[17] The algorithm simulates placing attractive forces between connected nodes and a weakly repulsive force between all nodes. The result is that facts which co-occur in many of the same pages are placed close to each other and close to the pages that mention them. The analysis revealed that there are two subgroups of pages (the top and bottom), which contain a concentration of different sets of facts, while another group of pages in the middle that contain both groups of facts. Furthermore, the visualization

reveals common and rare facts, and how they co-occur across the pages. Such visualizations (and related quantitative network measures used to verify the visual observations) therefore help to reveal new regularities about information scatter which are often concealed in aggregate measures such as frequency distributions.

EXPLANATIONS FOR INFORMATION SCATTER

While there are many studies that quantify information scatter, there are relatively few explanations for why information occurs. This scatter of articles across journals has been explained as follows: Although each field has a core set of a few journals where authors publish, there are many other journals with suitable subject scopes. Furthermore, because papers are often interdisciplinary in nature and therefore relevant to more than one field, authors may publish such papers in journals that are close to as well as distant to their main field. This results in the core journals of one field becoming the peripheral journals of another field.^[18] Hood and Wilson^[13] posit that information scatter could be related to the interdisciplinarity of topics: the more interdisciplinary a topic, the higher probability that the authors would choose to publish results in either a generalist journal related to the interdisciplinary topic or in a specialist journal of a field other than the authors' academic field. This publishing practice may result in the high scatter of such topics across journals and databases.

Bhavani^[15] found that facts (e.g., high UV exposure increases your risk of getting melanoma) about five healthcare topics (e.g., melanoma risk and prevention) were scattered across high-quality Web sites specializing in that topic. There were many pages which had few facts, few pages that had many facts, and no pages that had all

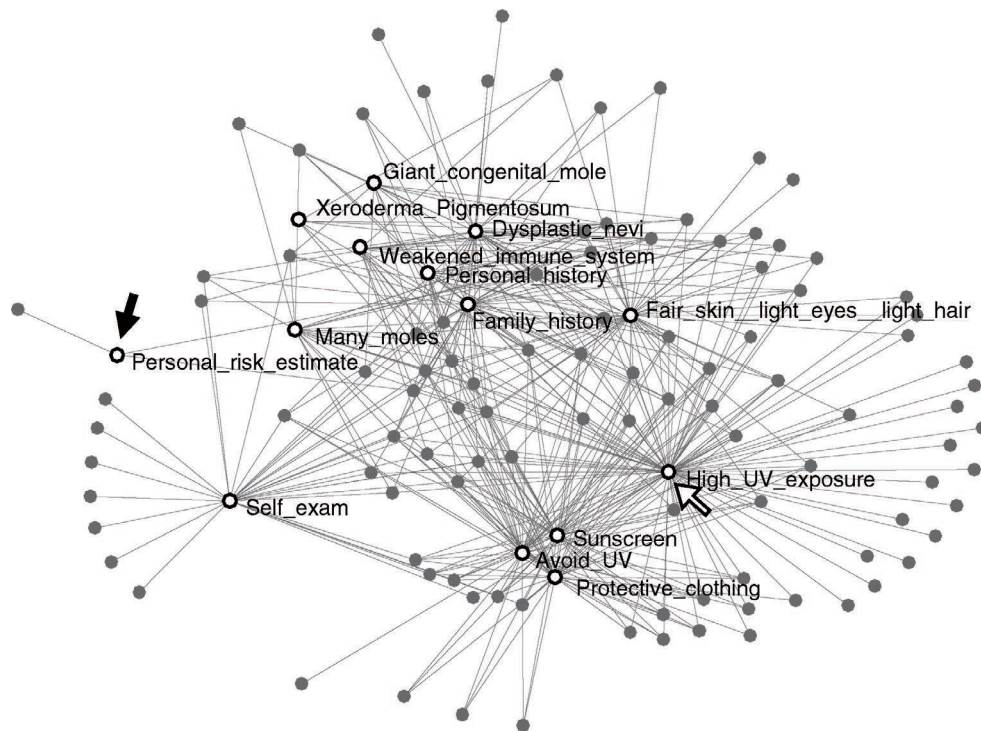


Fig. 3 The scatter network for melanoma risk/prevention showing how 14 facts (white labeled nodes) occur in 108 relevant pages (solid nodes). The white arrow points to a common fact and the black arrow points to a rare fact.

Source: From Adamic et al.^[17]

the facts. Furthermore, the analysis revealed that underlying this distribution were three different page profiles that varied in fact density and role: *General pages* which contain many facts in medium amount of detail and play the role of providing an overview of the topic (e.g., What Are the Risk Factors for Melanoma?); *Specific pages* which contain few facts in a large amount of detail and play the role of providing detailed description of a few facts (e.g., Sunscreens and Prevention of Malignant Melanoma); and *Sparse pages* which contain few facts in a small amount of detail and were pages that were of broader topics (e.g., Skin Cancer) with a brief reference to the search topic.

The above observations led to the *information saturation model*^[19] to explain this phenomenon. In this hypothetical model, Web page authors follow a process of *accumulation* to progressively add facts in detail to a page, until a length and detail saturation threshold is reached. At such a threshold, because the Web page becomes unwieldy and difficult to read, Web page authors heed design guidelines by removing detail about facts from these pages through the process of *abstraction* resulting in general pages. Concurrently, they also might be creating new pages to elaborate particular facts in high detail through the process of *specialization* resulting in specific pages. Finally as a topic becomes more important, the topic *permeates* otherwise irrelevant pages resulting in sparse pages. The above processes could lead to the creation of a large number of specific pages and sparse pages, while constraining the total

number of general pages. However, while there have been quantitative models that generate different informetric phenomena such as the distribution of papers per author,^[20] there appears to be no research that has quantitatively modeled phenomena related to information scatter.

IMPLICATIONS OF INFORMATION SCATTER FOR SEARCH AND DESIGN

While there have been claims that Bradford's law has been useful for selecting journals for libraries or databases, there are actually no references about how it has been applied in practical library and information sciences.^[9] Some researchers have explored the implications for the phenomenon of information scatter to search strategies, and the design of systems to help users find comprehensive information. Bates^[21] proposed that because the core, middle, and peripheral regions of the Bradford distribution have different densities of relevant articles, they imply the use of different search strategies. For example, when searching for articles, users should identify the core set of journals for that topic. Because there is a high density of relevant articles in the core, browsing could be sufficient to find many relevant articles. In contrast, because the middle region has a lower density of relevant articles, users need to use queries that exploit systematic organizations of articles such as indexes. Finally, in the peripheral

region where articles are very scattered, users need to use strategies such as *citation tracking* to quickly find the relevant articles.

While the above search strategies are implied by the density of articles *across* the different regions of the Bradford distribution, Bhavnani^[15] leveraged the idea of information density *within* Web pages through the *general-specific-sparse* search strategy. This strategy recommends that users first find and read general pages about a topic to get an overview of the topic and to ensure that they do not miss any facts. Next (as often prescribed by earlier authors such as Kirk),^[22] users should find specific pages that specialize in the facts they found within the general pages, to help elaborate facts of interest. Finally, they should broaden the search by finding and reading sparse pages to understand how the topic of interest relates to other topics.

The above strategy was operationalized in a Web site called the *Strategy Hub*^[23] to help users find comprehensive healthcare information. In this system Web pages were organized in terms of general, specific, and sparse pages, and users were guided to read pages that followed that strategy. In a controlled experiment, users of the Strategy Hub found more comprehensive information in the same amount of time compared to equivalent users of MedlinePlus and Google.

FUTURE RESEARCH CHALLENGES

Future research challenges include: (1) building models to understand the process of information scatter; and (2) algorithms to help users gather highly scattered information. As described earlier, although a few researchers have proposed explanations for information scatter, none of these have been formalized into a model and tested to simulate the process of information scatter. Future research should therefore develop computational models to simulate information scatter over time so that the phenomenon can be precisely understood. The second area of potential future research is to leverage a precise understanding of information scatter to develop new algorithms which either automatically aggregate different types of scattered information or work interactively with users to help them find comprehensive information.

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Information Science

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Abstract

The purpose of this entry is to provide an overview of information science as a field or discipline, including a historical perspective to illustrate the events and forces that shaped it. Information science is a field of professional practice and scientific inquiry dealing with effective communication of information and information objects, particularly knowledge records, among humans in the context of social, organizational, and individual need for and use of information. Information science emerged in the aftermath of the Second World War, as did a number of other fields, addressing the problem of information explosion and using technology as a solution. Presently, information science deals with the same problems in the Web and digital environments. This entry covers problems addressed by information science, the intellectual structure of the field, and the description of main areas—information retrieval, human information behavior, metric studies, and digital libraries. This entry also includes an account of education related to information science and conclusions about major characteristics.

INTRODUCTION

The purpose of this entry is to provide an overview of information science as a field or discipline, including a historical perspective to illustrate the events and forces that shaped it.

Information science is the science and practice dealing with the effective collection, storage, retrieval, and use of information. It is concerned with recordable information and knowledge, and the technologies and related services that facilitate their management and use. More specifically, information science is a field of professional practice and scientific inquiry addressing the effective communication of information and information objects, particularly knowledge records, among humans in the context of social, organizational, and individual need for and use of information.^[1] The domain of information science is the transmission of the universe of human knowledge in recorded form, centering on manipulation (representation, organization, and retrieval) of information, rather than knowing information.^[2]

There are two key orientations: toward the human and social need for and use of information pertaining to knowledge records, on the one hand, and toward specific information techniques, systems, and technologies (covered under the name of *information retrieval*) to satisfy that need and provide for effective organization and retrieval of information, on the other hand. From the outset, information science had these two orientations: one that deals with information need, or more broadly human information behavior, and the other that deals with information retrieval techniques and systems.

Information science is a field that emerged in the aftermath of the Second World War, along with a number of new fields, with computer science being but one example. While developments and activities associated with information science already started by the end of 1940s, the very term “information science” came into full use only at the start of the 1960s. A significant impetus for the coalescence of the field was the *International Conference on Scientific Information*, held in Washington, D.C., November 16–21, 1958, sponsored by the (U.S.) National Science Foundation, the National Academy of Sciences—National Research Council, and the American Documentation Institute, and attended by some 1000 delegates from 25 countries. The conference was meticulously planned for over 3 years and attracted wide international attention. The 75 papers and lively discussions that followed, all recorded in the *Proceedings* of over 1600 pages, affected the direction of research, development, and professional practice in the field for at least a decade if not longer.^[3] It also affected the internationalization of the field and the approaches used. They became global.

This entry covers problems addressed by information science, the intellectual structure of the field, and the further description of main areas—information retrieval, human information behavior studies, metric studies, and digital libraries. At the end, the entry includes an account of education related to information science and conclusions about major trends.

PROBLEMS ADDRESSED

To understand information science, as with any other field, a description of problems addressed and methods used in

their solution is crucial. Generally, information science addressed the problem of information explosion and used information technology as a solution.

The rapid pace of scientific and technical advances that were accumulating since the start of the twentieth century produced by mid-century a scientific and technical revolution. A most visible manifestation of this revolution was the phenomenon of “information explosion,” referring to the unabated, exponential growth of scientific and technical publications and information records of all kinds. The term “information explosion” is a metaphor (as is “population explosion”) because nothing really exploded but just grew at a high rate, even exponentially at times. Simply put, information explosion is information and information objects piling up at a high rate. The problem this presents is getting to the right information as needed at a given time.

A number of scientists documented this growth, but none better and more vividly than Derek de Solla Price (1922–1983, British and American physicist, historian of science and information scientist), recognized as the father of scientometrics. In his seminal works, *Science since Babylon* followed by *Little Science, Big Science*, Price documented the exponential and logistical growth of scientific publications linking them with the growth of the number of scientists. The logistical growth started slow right after the appearance of the first scientific journals in the seventeenth century, accelerated by the start of the twentieth century and became explosive after the Second World War.^[4,5]

The impetus for the development of information science, and even for its very origin and agenda, can be traced to a 1945 article, “As We May Think” by Vannevar Bush (1890–1974), a respected MIT scientist and, even more importantly, the head of the U.S. scientific effort during World War II.^[6] In this influential article, Bush did two things: (1) he succinctly defined the critical and strategic problem of information explosion in science and technology that was on the minds of many, and (2) proposed a solution that was a “technological fix,” and thus in tune with the spirit of the time. Both had wide appeal. Bush was neither the first nor the only one that addressed these issues, but he was listened to because of his stature. He defined the problem in almost poetic terms as “The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square-rigged ships.” In other words, Bush addressed the problem of information explosion and the associated methods for finding relevant information.

As a solution, Bush proposed a machine, dubbed Memex, incorporating (in his words) a capability for “association of ideas,” and the duplication of “mental processes artificially.” A prescient anticipation of information science and artificial intelligence is evident. Memex,

needless to say, was never built, but to this day is considered an ideal, a wish list, an agenda, and, some think, a utopia. Information science is still challenged by the ever-worsening problem of information explosion, now universal and in a variety of digital formats, and the field is still trying to fix things technologically.

A number of scientists and professionals in many fields around the globe listened and took up Bush’s challenge. Most importantly, governments listened, as well, and provided funding. The reasoning went something like this: Because science and technology are strategically important for society, efforts that help them, information activities in particular, are also important and need support. In the United States, the United Kingdom, and other countries, this led to the support of research and development related to information problems and solutions. By the end of the 1940s information science was well on its way.

Bush also participated in the establishment of the National Science Foundation (NSF) in the United States. The National Science Foundation Act of 1950 (P.L. 81-507) provided a number of mandates, among them “to foster the interchange of scientific information among scientists in the U.S. and foreign countries” [Section 3(a)3] and “to further the full dissemination of [scientific and technical] information of scientific value consistent with the national interest” [Section 11(g)]. The 1958 National Defense Education Act (P.L. 85-864) (the “Sputnik act”) enlarged the mandate: “The National Science Foundation shall [among others], undertake programs to develop new or improved methods, including mechanized systems, for making scientific information available” (Title IX, Section 901). By those mandates, an NSF division, which after a number of name and direction changes is now called the Division of Information and Intelligent Systems (IIS), has supported research in these areas since the 1950s. Information science evolution, at least in the United States, was greatly affected by the support of the U.S. government. In this respect it was not an exception. For instance, artificial intelligence, among others, was for decades supported by the U.S. government starting in the 1950s and ending by the 1990s.

Historically, one force affecting government support of information science, as of many other fields in the United States and a number of European countries, had to do with the cold war. Among others, one impetus was the establishment in 1952 of the All-Union Scientific and Technical Information Institute of the Academy of Sciences of the USSR (Russian acronym: VINITI). VINITI implemented a massive gathering and bibliographic control of scientific and technical information from around the world, eventually covering some 130 countries in 66 languages; it employed thousands of scientists and engineers full- and part-time. In the framework of the Cold War, VINITI was repeatedly brought up as a challenge needing a response.

At the start, information science was directed solely toward information explosion in science and technology.

However soon it expanded to other areas, including business, humanities, law, and eventually any area of human endeavor. In all areas, the phenomenon of information explosion is continuing and even accelerating to this day, particularly in the digital and Web environments. Addressing the problems of dealing with information explosion in any human area where information and knowledge records are overbearing is at the heart of information science. The approach to these problems involves a number of disciplines; in other words, information science, as many other modern fields, is interdisciplinary in nature.

In its goals and activities, information science established early, and maintains prominently, a social and human function—not only a technological one. On the social level, it participates actively, with many other fields, in the evolution of information society around the globe. Yet information science also has an individual human function. It relates to searching for and use of information as done by (or on behalf of) individuals. People individually search for and use relevant information. For information science, managing information is a global, social function, while providing and using information is an intense individual function.

INTELLECTUAL STRUCTURE

Information science, like any other field, has a dynamic intellectual structure; the objects of study and practice appear, change, disappear or are emphasized, realized, and interwoven in different ways over time. A general framework for the intellectual structure for the field can be derived from the Three Big Questions for information science as identified by Bates:^[2]

1. The physical question: What are the features and laws of the recorded information universe?
2. The social question: How do people relate to, seek, and use information?
3. The design question: How can access to recorded information be made most rapid and effective?

Indeed, when looking at the literature of information science since its emergence to this day, the general structure can be discerned from these questions in both research and practice reported. While they can be approached individually, the three questions are not independent but interdependent. Effective design is highly dependent on the consideration of social and physical features. Over time, details in the answers differed greatly. But, as is seen from three examples below, the general structure stands.

Three examples illustrating the intellectual structure of information science spanning some five decades are presented here. The first one is the enumeration of topics in the proceedings of the mentioned 1959 *International*

Conference on Scientific Information.^[3] The second one is an author cocitation analysis mapping information science for the years 1972–1995.^[7] And the third one is a similar analysis, using the same methods, mapping information science for the years 1996–2005.^[8] Author cocitation analysis is a statistical and visualization method developed in information science that allows for mapping of connections between authors in a given domain and identifying clusters or oeuvres of work in that domain. The raw data reflects the number of times selected author pairs are cited together in papers, regardless of which of their work is cited.

The 1959 Proceedings had seven areas covering the research, practice, and interests of information science at the time and illustrating the intellectual structure of the field by the end of 1950s. These were

1. *Literature and reference needs of scientists*. An example of a title of a paper in the area: An Operations Research Study of the Dissemination of Scientific Information.
2. *The function and effectiveness of abstracting and indexing services*. A paper example: All-Union Institute for Scientific and Technical Information (VINITI).
3. *Effectiveness of monographs, compendia, and specialized centers. Present trends and new and proposed techniques and types of services*. A paper example: Scientific, Technical, and Economic Information in a Research Organization.
4. *Organization of information for storage and search. Comparative characteristics of existing systems*. A paper example: The Evaluation of Systems Used in Information Retrieval.
5. *Organization of information for storage and retrospective search. Intellectual problems and equipment considerations in the design of new systems*. A paper example: Linguistic Transformations for Information Retrieval.
6. *Organization of information for storage and retrospective search. Possibility for a general theory*. A paper example: The Structure of Information Retrieval Systems.
7. *Responsibilities of government, professional societies, universities, and industry for improved information services and research*. A paper example: Differences in International Arrangements for Financial Support of Information Services.

Results from the next two studies are comparable—they used the same set of basic data (major journals in information science) and the same method (author cocitation analysis and mapping).^[7,8] The authors of both studies mapped clusters of authors, classifying their areas of publications in a number of categories—they labeled the categories—and showing the relation or lack thereof between

Table 1 Intellectual structure of information science as presented in studies of two time periods (labels provided by authors of respective studies).

1972–1995	1996–2006
1. Experimental retrieval (design and evaluation of IR systems)	1. User studies (information seeking/searching behavior, user-centered approach to IR, users and use)
2. Citation analysis (interconnectedness of scientific and scholarly literatures)	2. Citation analysis (scientometrics; evaluative bibliometrics)
3. Practical retrieval (applications in “real world”)	3. Experimental retrieval (algorithms, models, systems, evaluation of IR)
4. Bibliometrics (statistical distributions of texts and mathematical modeling)	4. Webometrics
5. General library systems (library automation, library operations research, services)	5. Visualization of knowledge domains (author cocitation analysis)
6. Science communication (including social sciences)	6. Science communication
7. User theory (information needs and users)	7. Users’ judgment of relevance (situational relevance)
8. Online Public Access Catalogs (OPACs) (design, subject searching)	8. Information seeking and context
9. Imported ideas (information theory, cognitive science, etc.)	9. Children’s information searching behavior (usability, interface design)
10. Indexing theory	10. Metadata and digital resources
11. Citation theory	11. Bibliometric models and distributions
12. Communication theory	12. Structured abstracts (academic writing)

categories. The categories reflecting clusters of work in the two studies, as labeled by the authors, are shown in Table 1.

Some of the areas in the three examples remain the same over time, showing an overall stability of general interests and foci of information science from its emergence to this day. The three areas of major and continuing interest are *information retrieval*, *user and use studies*, and *metric studies*. They correspond to the Three Big Questions for information science listed at the start of this section. Naturally, the variety and type of work in these three areas has changed and evolved over time, as elaborated below, but the general thrust and emphasis stayed stable.

Some areas have disappeared. The interest in the functioning of abstracting and indexing services, specialized information centers, and the responsibilities of different agencies for improved information services, so prominent in the 1959 Proceedings, are not prominent at all in later periods. Online Public Access Catalogs (OPACs) were prominent as an area cluster in the period 1971–1995 but did not appear in the 1996–2005 period; research in this area waned. The same holds for general library systems, covering library automation; the area was prominent during 1971–1995, but not anymore. The field had a prominent area of imported ideas between 1971–1995, covering the deliberations of adaptation and the application of various theories from information theory (Shannon), sociology (Merton), and other fields, but not anymore. Theory importing is not a major area any longer in information science. However, there is a significant exception. A major trend is evident in the incorporation of ideas, theories, and methods from the social sciences into many studies related to human information behavior to such an extent that they are not considered as imported any more.

In the Web age, covering the period 1996–2005, new areas have appeared. Not surprisingly, one of them is webometrics, extending the metric studies to the Web. Another new area is the visualization of knowledge domains, providing a new method of presenting retrieval processes and results and also extending citation and metric analyses.

The intellectual structure of information science also covers two camps of authors concentrating in different areas. White and McCain called them “retrieval people” and “literature people.”^[7] The first group congregates in the area of information retrieval; the second in the area of human information behavior and metric studies. They represent two broad branches of information science, one system-oriented and the other user-oriented. They are relatively isolated from each other. In the words of White and McCain again: “As it turns out, information science looks rather like Australia: Heavily coastal in its development, with a sparsely settled interior.” The relative isolation is conceived as unproductive for all areas. There were a number of calls for collaboration, some quite impatient, and a few efforts at actually bridging the gap, but the gap has yet to be effectively bridged.

INFORMATION RETRIEVAL

Considering the Three Big Questions for information science, stated above, this section addresses the design question: *How can access to recorded information be made most rapid and effective?* The area is concentrated on systems and technology.

Right after the Second World War a variety of projects started applying a variety of technologies to the problem of controlling information explosion, particularly in

science and technology. In the beginning the technologies were punched cards and microfilm, but soon after computers became available the technology shifted to, and stayed with, computers. Originally, many activities involved specific fields of application, such as chemistry. By the mid-1960s computer science joined the efforts in a big way.

Various names were applied to these efforts, such as “*machine literature searching*,” or “*mechanical organization of knowledge*” but by the mid-1950s “*information retrieval*” prevailed. Actually, the term “*information retrieval*” (IR) was coined by mathematician and physicist Calvin N. Mooers (1919–1994), a computing and IR pioneer, just as the activity started to expand from its beginnings after Second World War. He posited that

Information retrieval is . . . the finding or discovery process with respect to stored information . . . useful to [a user]. Information retrieval embraces the intellectual aspects of the description of information and its specification for search, and also whatever systems, technique, or machines that are employed to carry out the operation.^[9]

Over the next half century, information retrieval evolved and expanded widely. In the beginning IR was static. Now it is highly interactive. Earlier it dealt only with representations—indexes, abstracts—now it deals with full texts as well. It concentrated on print only, now it covers every medium, . . . , and so on. Advances in the field are impressive, now covering the Web, and still go on. Contemporary search engines are about information retrieval. But in a basic sense, IR still continues to concentrate on the same fundamental things Mooers described. Searching was and still is about retrieval of relevant (useful) information or information objects.

It is of interest to note what made IR different, compared to many other techniques, applied to the control of information records over a long period of time. The key difference between IR and related methods and systems that long preceded it—such as classifications, subject headings, various indexing methods, or bibliographic descriptions, including the contemporary Functional Requirements for Bibliographic Records—is that IR specifically included “specification for search.” The others did not. Since the days of the pioneers in bibliographic organization in the United States, Charles Ammi Cutter (1837–1903) and Melvil Dewey (1851–1931), the emphasis was on the creation of systems for bibliographic representation and control. In these long-standing techniques, what users’ needs are and should be fulfilled was specified in detail. Following that, the representation of information objects was also prescribed in detail. In other words, data about information objects (books, articles, etc.) in bibliographic records are organized in a way to fulfill the specified needs. However, how the search ought to be done was not specified or addressed at all. Searching was

assumed and left to itself—it just happens. In IR, users’ needs are assumed as well, but the search process is specified in algorithmic detail and data is organized to enable the search. Search engines are about searching to start with; everything else is subsumed to that function.

Relevance

The fundamental notion used in bibliographic description and in all types of classification or categorization, including those used in contemporary databases, is *aboutness*. Cataloging and classification describe what the documents were all about with an implied idea that *about*, among others, may facilitate searching. Machine Readable Cataloging (MARC) that was developed by Henriette Avram (1919–2006) at the Library of Congress beginning in the 1960s follows the same principle. Online Public Access Catalogs (OPACs) that emerged more than a decade later are based on MARC. They include various search mechanisms, but are relatively difficult and ineffective as search tools. While implying searching *aboutness* does not really facilitate it.

The fundamental notion used in IR is *relevance*. Retrieval is not about any kind of information, and there are a great many, but about *relevant* information (or as Mooers called it *useful to a user* or Bush *momentarily important*). Basically, relevant information is that which pertains to the matter or problem at hand. Fundamentally, bibliographic description and classification concentrate on describing and categorizing information objects. IR is also about that, but in addition IR is about searching, and searching is about relevance. Very often, the differences between databases and IR are discussed in terms of differences between structured and unstructured data, which is OK, but the fundamental difference is in the basic notion used: *aboutness* in the former and *relevance* in the latter. The two notions are not at all equivalent. Relevance entered as a basic notion through the specific concentration on searching. True, searching for relevant information precedes IR by centuries, if not millennia, but in IR the process was adapted as primary orientation.

By choosing relevance as a basic, underlying notion of IR, related information systems, services, and activities—and with it, the whole field of information science—went in a direction that differed from approaches taken in librarianship, documentation, and related information services, and even in expert systems and contemporary databases in computer science.

In this sense, information science is on the one hand connected to relevance and on the other hand to technologies and techniques that enhance probability of the retrieval of relevant and the suppression of nonrelevant information. Relevance, as a basic notion in information science, is a human notion, widely understood in similar ways from one end of the globe to the other. This affected the widespread acceptance of information retrieval

techniques globally. However, relevance, and with it information retrieval, involves a number of complexities: linguistic, cognitive, psychological, social, and technological, requiring different solutions. But the basic idea that searching is for relevant information does not.

As mentioned, relevance is a human notion. In human applications, relevance judgments exhibit inconsistencies, situational and dynamic changes, differences in cognitive interpretations and criteria, and other untidy properties common to human notions. This stimulated theoretical and experimental investigations about the notion and applications of relevance in information science. The experiments, mostly connected to relevance judgments and clues (what affected the judgments, what are people using in judgments) started already in the 1960s and continue to this day. The idea was and still is that findings may affect development of more effective retrieval algorithms. This is still more of a goal; actual translations from research results to development and practical applications were meager, if attempted at all.

Algorithms

IR systems and techniques, no matter in what form and including contemporary search engines, are geared toward retrieval of relevant information. To achieve that they use algorithms—logical step-by-step procedures—for the organization, searching, and retrieval of information and information objects. Contemporary algorithms are complex and in a never-ending process of improvement, but they started simple and still incorporate those simple roots.

The first and simple algorithm (although at the time it was not called that) applied in the 1940s and early 1950s was aimed at searching and retrieving from edge-notched punch cards using the operation of Boolean algebra. In the early 1950s Mortimer Taube (1910–1965), another IR pioneer and entrepreneur, founded a company named Documentation Inc. devoted to the development and operation of systems for the organization and retrieval of scientific and technical information. Taube broke away from the then-standard methods of subject headings and classification, by developing Uniterms and coordinate indexing. Uniterms were keywords extracted from documents; a card for a given Uniterm listed the documents that were indexed by that Uniterm. Coordinate indexing was actually a search and retrieval method for comparing (coordinating) document numbers appearing on different Uniterm cards by using a logical AND, OR, or NOT operation. Although at the time the algorithm was not recognized as Boolean algebra by name, the operation was in effect the first application of a Boolean algorithm for information retrieval. Uniterms and coordinate indexing were controversial for a time but soon it was recognized that the technique was a natural for use as a base for computerized search and retrieval. All IR systems built in the next few

decades incorporated Boolean algebra as a search algorithm and most have it under the hood today, along with other algorithms. All search engines offer, among others, Boolean search capabilities.

At the start of IR, and for a long time to come, the input—indexes and abstracts in particular—was constructed manually. Professionals indexed, abstracted, classified, and assigned other identifiers to information objects in a variety of fields. Input was manual; output—searching—was automated. Big online systems and databases, such as Medline and Dialog, which came about respectively in 1971 and 1972 and operate to this day, were based on that paradigm. Efforts to automate input, as well, commenced in the 1950s by the development of various algorithms for handling of texts. They took much longer to be developed and adopted more operationally than searching algorithms—the problem was and still is much tougher.

Hans Peter Luhn (1896–1964) a prodigious inventor with a broad range of patents joined IBM in 1941 and became a pioneer in development of computerized methods for handling texts and other IR methods in the 1950s. Luhn pioneered many of the basic techniques now common to IR in general. Among others, he invented the automatic production of indexes from titles and texts—Key Words in Context or KWIC indexing that lead to automatic indexing from full texts; automatic abstracting that lead to summarization efforts; and Selective Dissemination of Information (SDI) to provide current awareness services that led to a number of variations, including today's RSS (Really Simple Syndication). The demonstration of automatic KWIC indexing was the sensation at the aforementioned 1959 International Conference on Scientific Information.

Luhn's basic idea to use various properties of texts, including statistical ones, was critical in opening the handling of input by computers for IR. Automatic input joined the already automated output. Of course, Luhn was not the only one who addressed the problems of deriving representations from full texts. In the same period of the 1950s for instance, Phyllis Baxendale developed methods of linguistic analysis for automatic phrase detection and syntactic manipulations and Eugene Garfield was among the first, if not even the first, to join automated input and output in an operational system, that of citation indexing and searching.

Further advances that eventually defined modern IR came about in the 1960s. Statistical properties of texts—frequency and distribution of words in individual documents and in a corpus or collection of documents—were expressed in terms of probabilities that allowed for a variety of algorithms not only to extract index terms, but also to indicate term relations, distances, and clusters. The relations are inferred by probability or degree of certainty. They are inductive not deductive. The assumption, traced to Luhn, was that frequency data can be used to extract

significant words to represent the content of a document and the relation among words. The goal was to find a match between queries and potentially relevant documents, based on a probability of documents being relevant. Once expressed in terms of probabilities, documents can be ranked from those that have a higher probability to those that have a lower probability of a match. There are many methods for doing this. The basic plan was to search for underlying mathematical structures to guide computation. These were powerful ideas that led to an ever-expanding array of new and improved algorithms for indexing and other information organization methods, along with the associated search and retrieval. Moreover, they lend themselves to experimentation.

A towering figure in advancing experimentation with algorithms for IR was Gerard (Gerry) Salton (1927–1995), a computer scientist and academic (Harvard and Cornell Universities) who firmly connected IR with computer science. Within a framework of a laboratory he established, (entitled the SMART project) Salton and collaborators, mostly his students, ran IR experiments from the mid-1960s to the time of his death in 1995. Many new IR algorithms and approaches were developed and tested; they inspired practical IR developments and further IR research in many countries around the world. Many of his students became leaders in the IR community. Salton was very active nationally and internationally in the promotion of IR; he is the founder of the Special Interest Group on Information Retrieval (SIGIR) of the Association of Computing Machinery (ACM). SIGIR became the preeminent international organization in IR with annual conferences that are the main event for reporting advances in IR research. As a result of global interest in IR, these conferences now alternate between continents. While Salton's research group started in the United States, today many similar groups operate in academic and commercial environments around the globe.

Contemporary IR has spread to many domains. Originally, IR concentrated on texts. This has expanded to any and all other media. Now there are research and pragmatic efforts devoted to IR in music, spoken words, video, still and moving images, and multimedia. While originally IR was monolingual, now many efforts are devoted to cross-lingual IR (CLIR). Other efforts include IR connected with Extensible Markup Language (XML), software reuse, restriction to novelty, adversarial conditions, social tagging, and a number of special applications.

With the appearance and rapid growth of the Web starting in the mid-1990s many new applications or adaptations of IR sprouted, as well. The most prominent are search engines. While a few large search engines dominate the scene globally, practically, there is no nation that does not have its own versions tailored to its own populace and interests. While practical IR was always connected with commercial concerns and information industry, the appearance, massive deployment and use of search

engines pushed IR into a major role commercially, politically, and socially. It produced another effect, as well. Most, if not all, search engines use many well-known IR algorithms and techniques. But many search engines, particularly the major ones, in addition have developed and deployed their own IR algorithms and techniques, not known in detail and not shared with the IR community. They support aggressive efforts in IR research and development, mostly in-house. Contemporary IR also includes a proprietary branch, like many other industries.

Testing

Very soon after IR systems appeared, a number of claims and counterclaims were made about the superiority of various IR methods and systems, without supporting evidence. In response, the perennial questions asked of all systems were raised: *What is the effectiveness and performance of given IR approaches? How do they compare?* It is not surprising that these questions were raised in IR. At the time; most developers, funders, and users associated with IR were engineers, scientists, or worked in related areas where the question of testing was natural, even obligatory.

By the mid-1950s suggestions for two measures for evaluation of effectiveness of IR systems were made; they were precision and recall. Precision measures how many of *retrieved* items (let's say documents) were relevant or conversely how many were noise. Recall measures how many of the *potentially relevant items in a given file or system* were actually retrieved, or conversely how many were not retrieved even though they were relevant. The measures were widely adopted and used in most evaluation efforts since. Even today, the two measures, with some variation, are at the base for evaluation of the effectiveness of output using given retrieval algorithms and systems. It is significant to note that the two measures are based on the comparison of human (user or user surrogate) judgments of relevance with IR algorithms' or systems' retrieval of what it considered as relevant, where human judgment is the gold standard.

A pioneer in IR testing was Cyril Cleverdon (1914–1997), a librarian at the Cranfield Institute of Technology (now Cranfield University) in the United Kingdom. From the late-1950s until the mid-1970s Cleverdon conducted a series of IR tests under the name “Cranfield tests.” Most famous were the tests sponsored by the (U.S.) National Science Foundation from 1961 to 1966 that established a model of IR systems (the so-called traditional model that concentrates on query on the one end and matched with static retrieval from an IR system or algorithm on the other end), and a methodology for testing that is still in use. One of the significant and surprising finding from Cranfield tests was that uncontrolled vocabularies based on natural language (such as keywords picked by a computer algorithm) achieve retrieval effectiveness comparable to

vocabularies with elaborate controls (such as those using thesaurus, descriptors, or classification assigned by indexers). The findings, as expected, drew skepticism and strong critique, but were confirmed later by Salton and others. Not surprisingly these conclusions caused a huge controversy. But they also provided recognition of automatic indexing as an effective approach to IR.

Salton coupled development of IR algorithms and approaches with testing; he enlarged on Cranfield approaches and reaches. Everything that Salton and his group proposed and developed was mandatorily tested. The norm was established: No new algorithms or approaches were accepted without testing. In other words, testing became mandatory for any and all efforts that propose new algorithms and methods. It became synonymous with experimentation in IR.

After Salton, contemporary IR tests and experiments are conducted under the umbrella of the Text REtrieval Conference (TREC). TREC, started in 1992 and continuing to date, is a long-term effort at the (U.S.) National Institute for Standards and Technology (NIST), that brings various IR teams together annually to compare results from different IR approaches under laboratory conditions. Over the years, hundreds of teams from dozens of countries participated in TREC covering a large number of topics. TREC is dynamic: As areas of IR research change, so do the topics in TREC. Results are at the forefront of IR research.^[10]

In many respects, IR is the main activity in information science. It has proved to be a dynamic and ever-growing area of research, development, and practice, with strong commercial interest and global use. Rigorous adherence to testing contributed to the maturing of information retrieval.

HUMAN INFORMATION BEHAVIOR

Considering the Three Big Questions for information science, stated above, this section addresses the social and individual question: *How do people relate to, seek and use information?* While often connected with systems, the emphasis in this area of information science is on people rather than systems.

Human information behavior refers to a wide range of processes which people employ when engaged with information and to related cognitive and social states and effects. In his book that comprehensively covers research on information behavior (with over 1100 documents cited, most since 1980), Case defines that information behavior:

“encompasses information seeking as well as the totality of other *unintentional* or *passive* behaviors (such as glimpsing or encountering information), as well as purposive behaviors that do not involve seeking, such as actively *avoiding* information [11, p. 5]. (emphasis in the original).

As can be imagined, human information behavior, as with many other human behaviors, is complex, not fully understood, and of interest in a number of fields. A great many studies and a number of theories address various aspects related to human information behavior in psychology, cognitive science, brain sciences, communication, sociology, philosophy and related fields, at times using different terminology and classifications. Under various names, scholarly curiosity about human information behavior is longstanding, going back to antiquity.

Of particular interest in information science are processes, states, and effects that involve *information needs and use* and *information seeking and searching*. The order in which these two major areas of human information behavior studies are listed represents their historic emergence and emphasis over time.

Historically, the study of information needs and use preceded information science. Many relevant studies were done during the 1930s and 1940s in librarianship, communication, and specific fields, such as chemistry, concentrating on use of sources, media, systems, and channels. Already by the 1950s this area of study was well developed in information science—for instance, the aforementioned 1959 *Proceedings of the International Conference on Scientific Information*^[3] had a whole area with a number of papers devoted to the topic. The *Annual Review of Information Science and Technology* had regular annual chapters on “information needs and use” starting with the first volume in 1966 and ongoing through 1978. Thereafter, chapters covering this area were broadened to cover in addition various aspects or contexts of information behavior, including information seeking. This change illustrates how the emphasis in topics studied significantly changed over time. Studies in human information behavior are evolving and slowly maturing.

Information Needs and Use

Over the years “information needs and use” was used as a phrase. However, while related information need and information use are distinct concepts. *Information need* refers to a cognitive or even a social state and *information use* to a process.

For decades, *information need* was used as a primitive concept on two levels: on an individual level it signified a cognitive state which underlies questions posed to information systems and requests for information in general; on a social level it signified information required for functioning and keeping abreast of a whole group, such as chemists. On the first, or cognitive, level it was assumed that individuals ask questions and request information because of a recognition that the knowledge one has is inadequate for a given problem or situation; it is subjective as represented by individuals; it is in the head of a user. On the second, or social, level it was assumed that a social group with common characteristics, goals, or tasks shares

common information requirements that may be satisfied by specific information sources; it is more objective as determined by a group of individuals on the basis of some consensus or by experts based on experience. In general, information need was considered as instrumental in reaching a desired informational goal.

The concept of *information need* was entrenched until the start of the 1980s. Slowly, critiques of the concept gained ground by pointing out that it is nebulous, as are most other “need” concepts in every field where they are used; that it is often substituted for “information demand,” which is a very different process and not a state; that it is associated with behaviorism, which in itself fell out of favor; that it is a subjective experience in the mind of a person and therefore not accessible for observation; and that it ignores wider social aspects and realities. Moreover, underlying assumptions were challenged. By the end of the decade information need was largely abandoned as a subject of study or explanation of underlying information processes. Instead, studies of information seeking and other aspects of information behavior gained ground. However, information need is still represented in the traditional IR model (mentioned above) as the source of questions that are submitted to retrieval systems. It is not further elaborated in that framework, just listed as a primitive concept.

The concept of *information use* is more precise and it is operationally observable. Studies of information use were done for a long time and in many fields. For instance, use of libraries or use of literature in a given area was investigated long before information science emerged and before information use became one of the major topics of information science research. In information science, information use refers to a process in which information, information objects, or information channels are drawn on by information users for whatever informational purpose. The process is goal-directed. Questions are asked: *Who are the users of a given information system or resource? What information objects do they use? What information channels are used to gather information?* Or in other words: *Who uses what? How? For what purpose?*

The studies addressing these questions were, and still are, pragmatic, retrospective, and descriptive. Historically, as they emerged in the early 1950s, they were directed toward fields and users in science and technology. This is not surprising. As mentioned, information science emerged as a response to the problem of information explosion in science and technology thus the use studies were in those areas. Regarding topics, many early studies addressed users’ distribution of time and resources over different kinds of documents: scientific journals, books, patents, abstracting and indexing services, and so on. As the realm of information science expanded to cover other areas and populations, use studies expanded their coverage as well. By the 1990s, studies emerged that also covered information use in many populations and activities, including the small worlds of everyday living.

The early motivation for user studies was pragmatic: to discover guidelines for the improvement of practice. This was of great concern to practitioners, and consequently most such studies were done by practitioners. By 1970 or so there was a move toward academic studies of information use motivated by a desire to understand the process better and provide models and theories. By 2008 there are still two worlds of user studies: one more pragmatic, but now with the goal of providing the basis for designing more effective and usable contemporary IR and Web systems, including search engines, and the other more academic, still with the goal of expanding understanding and providing more plausible theories and models. The two worlds do not interact well.

Information Seeking and Searching

Information seeking refers to a set of processes and strategies dynamically employed by people in their quest for and pursuit of information. Information seeking also refers to the progression of stages in those processes. In the majority of theories and investigations about information seeking, the processes are assumed to be goal directed. In his aforementioned book, Case defines information seeking as

“a conscious effort to acquire information in response to a need or gap in your knowledge.” [11], p. 5]

Not surprisingly, information seeking is of interest in a number of fields from psychology, sociology, and political science to specific disciplines and professions, often under different names and classifications, such as information gathering or information foraging. The literature on the theme is large, spanning many decades. Historically, information-seeking concerns and studies in information science emerged by the late 1970s in academic rather than pragmatic environments. Only lately have they turned toward pragmatic concerns, as well. It was recognized that information use was the end process, preceded by quite different, elaborate, and most importantly, dynamic behavior and processes not well understood. The studies began in large part by trying to observe and explain what people do when they search and retrieve information from various retrieval systems, to expand fast to involving a number of different contexts, sources—formal and informal—and situations or tasks. The dynamic nature of information-seeking became the prime focus in observations, experiments, models, and theories. Questions are asked: *What do people actually do when they are in a quest for and pursuit of information? How are they going about and how are they changing paths as they go about? What are they going through on a personal level? What information channels are used to gather information? How?*

Information seeking, as is the case with most human information behavior, is highly dependent on context.

While context may be everything, the very concept of context is ill defined, or taken as primitive and not defined. The contexts may involve various motivations for information seeking, various cognitive and affective states, various social, cultural, or organizational environments, various demographic characteristics, values, ways of life, and so on. A number of information-seeking studies were indeed directed toward various contexts. Thus, there is a wide range of such studies regarding context, accompanied by difficulties toward generalization.

To deal with more defined contexts, and enable specific observation, task-oriented information-seeking studies emerged in the 1990s. And they are going strong up to this day. Task studies deal with specific goals, mostly related to assignments in defined circumstances, time periods, or degree of difficulty. They represent a step in the ongoing evolution, not only of information-seeking studies in particular but also in information behavior research in general. By the 2000s we also see the emergence of studies in collaborating behaviors, also related to given tasks.

Information searching is a subset of information seeking, and in the context of information science, it refers to processes used for interrogating different information systems and channels in order to retrieve information. It is the most empirical and pragmatic part of information-seeking studies. Originally, search studies concentrated on observation and modeling of processes in the interrogation of IR systems. With the advent of digital environments, the focus shifted toward Web searching by Web users. New observational and experimental methods emerged, becoming a part of exploding Web research. Such search studies have a strong pragmatic orientation in that many are oriented toward improving search engines and interfaces, and enhancing human–computer interactions.

Models and Theories

The research area and accompanying literature of information behavior in information science is strong on models and theories. It follows a tradition and direction of such research in many other disciplines, particularly psychology, communication, and philosophy. Being primarily pragmatic and retrospective, information use studies were not a great source for models and theories. In contrast, broader studies of information behavior, and particularly of information seeking, are brimming with them. Numerous models and theories emerged, some with more, others with less staying power. The extent of this work is exemplified in a compilation *Theories of Information Behavior*,^[12] where some 70 different (or differing) theories and models are synthesized. To illustrate, we should sample three well-known theories, each in one of the three areas of human information behavior described above. Each of them is widely accepted and cited, and tested, as well.

What is behind an information need? Why do people seek information in the first place? Starting in late 1970s and for the next two decades or so, Nicholas Belkin and his colleagues addressed this question by considering that the basic motivation for seeking information is what they called “anomalous state of knowledge” (ASK), thus the “ASK theory,” or as they called it, “ASK hypothesis” (described among others in Belkin, Oddy, and Brooks).^[13] Explicitly following a cognitive viewpoint, they suggest that the reason for initiating an information-seeking process could be best understood at the cognitive level, as a user (information seeker) recognizes that the state of his/her knowledge is in some way inadequate (anomalous) with respect to the ability to resolve a problematic situation and achieve some goal. Anomaly was used explicitly, not only to indicate inadequacy due to lack of knowledge, but also due to other problems, such as uncertainty of application to a given problem or situation. ASK theory is an attempt to provide an explicit cognitive explanation of information need or gap by proposing specific reasons why people engage in information seeking. It also suggests that anomalous states could be of different types. One of the strengths of ASK theory is that, unlike many other similar theories, it was successfully tested in a few experiments. One of the weaknesses is that it rests solely on a cognitive basis, using the problem or situation toward which the whole process is oriented as a primitive term.

What is behind the information search process? How is it constructed? Carol Collier Kuhlthau addressed these questions in a series of empirically grounded studies through a period of some 20 years starting in the early 1980s.^[14] Her model and theory, called the Kuhlthau Information Search Model, provides a conceptual and relatively detailed framework of the information-seeking and search process. It is based on the personal construct theory in psychology that views learning as a process of testing constructs; consequently it views the search as a dynamic process of progressive construction. The model describes common patterns in the process of information seeking for complex tasks that have a discrete beginning and ending over time and that require construction and learning. The innovative part of the model is that it integrates thoughts, feelings, and actions in a set of stages from initiation to presentation of the search process. Not only cognitive, but also affective aspects, such as uncertainty connected with anxiety, are brought in the explanation of the process. The work started within learning context in schools, continued with a series of longitudinal studies, and moved on to a series of case studies in a number of fields. The strength of the model is that it incorporates affective factors that play a great role not only in searching but in human information behavior at large; furthermore it was extensively verified and revised over time. The weakness is that its educational roots are still recognizable—many search processes have different goals and contexts, thus the model may not fit.

What types of activities are involved in information seeking in general and information retrieval searching in particular? What is the relation between different activities? Starting in the mid-1980s and continuing for close to two decades, David Ellis and his colleagues addressed these questions in a series of empirical studies that led to the formulation and continuing refinement of a model known as Ellis's Model of Information-Seeking Behavior, primarily oriented toward behavior in information retrieval.^[15] The model is based on a theoretical premise that the study of behavior presents a more tractable and observable focus for study than cognitive approaches. Consequently, its base is behavioral rather than cognitive. The model incorporates a premise that the complex process of information seeking, particularly as related to information retrieval, rests on a relatively small and finite number of different types of interacting activities, these include starting, chaining, browsing, differentiating, monitoring, and extracting. The explicit goal of studies associated with Ellis' model was pragmatic: to inform design and operations of IR systems. The strength of the model is in the reduction of a complex process to a relatively small set of distinct and dynamically interacting processes. The weakness is that it does not address cognitive and affective aspects, shown to be of importance.

The three models can be considered also as theories of information behavior. In turn, each of them is based on a different approach and theory. The first one is related to cognition as treated in cognitive science, the second to personal construct theory in psychology, and the third to behaviorism in psychology. This illustrates different approaches and multidisciplinary connections of human information behavior studies in information science. As yet, they have not found a common ground.

METRICS

Considering the Three Big Questions for information science, stated above, this section addresses the physical question: *What are the features and laws of the recorded information universe?* While often connected with systems, the emphasis in this area of information science is on information objects or artifacts rather than systems; these are the content of the systems. It is about characterizing content objects.

Metrics, such as econometrics, biometrics, sociometrics, etc., are important components in many fields; they deal with statistical properties, relations, and principles of a variety of entities in their domain. Metric studies in information science follow these by concentrating on statistical properties and the discovery of associated relations and principles of information objects, structures, and processes. The goals of metric studies in information science, as in other fields, are to characterize statistically entities under study and more ambitiously to discover regularities

and relations in their distributions and dynamics in order to observe predictive regularities and formulate laws.

The metric studies in information science concentrate on a number of different entities. To denote a given entity under study over time, these studies were labeled by different names. The oldest and most widely used is *bibliometrics*—the quantitative study of the properties of literature, or more specifically of documents, and document-related processes. Bibliometric studies in information science emerged in the 1950s right after the start of the field. *Scientometrics*, which came about in the 1960s, refers to bibliometric and other metric studies specifically concentrating on science. *Informetrics*, emerging in the 1990s, refers to the quantitative study of properties of all kinds of information entities in addition to documents, subsuming bibliometrics. *Webometrics*, which came about at the end of the 1990s, concentrates, as the name implies, on Web-related entities. *e-Metrics*, which emerged around 2000, are measures of electronic resources, particularly in libraries.

Studies that preceded bibliometrics in information science emerged in the 1920s and 1930s; they were related to authors and literature in science and technology. A number of studies went beyond reporting statistical distributions, concentrating on relations between a quantity and the related yield of entities under study. Here are two significant studies that subsequently greatly affected development of bibliometrics. In the 1920s, Alfred Lotka (1880–1949, American mathematician, chemist, and statistician) reported on the distribution of productivity of authors in chemistry and physics in terms of articles published. He found a regular pattern where a large proportion of the total literature is actually produced by a small proportion of the total number of authors, falling down in a regular pattern, where the majority of authors produce but one paper—after generalization this became known as Lotka's law. In the 1930s, Samuel Bradford (1878–1948, British mathematician and librarian), using relatively complete subject bibliographies, studied the scatter of articles relevant to a subject among journals. He found that a small number of journals produce a large proportion of articles on the subject and that the distribution falls regularly to a point where a large number of journals produce but one article on the same subject—after generalization this became known as Bradford's law or Bradford's distribution. Similar quantity-yield patterns were found in a number of fields and are generally known as Pareto distributions (after Italian economist Vilfredo Pareto, 1848–1923). Lotka's and Bradford's distributions were confirmed many times over in subsequent bibliometric studies starting in the 1950s. They inspired further study and moreover set a general approach in bibliometric studies that was followed for decades.

Data Sources

All metric studies start from and depend on data sources from which statistics can be extracted. Originally, Lotka

used, among others, Chemical Abstracts, and Bradford used bibliographies in applied geophysics and in lubrication. These were printed sources and analysis was manual. For a great many years, the same kind of print sources and manual analysis methods were used.

The advent of digital technology vastly changed the range of sources, as well as significantly enlarged the type and method of analysis in bibliometrics, or as Thelwall put it, in a historical synthesis of the topic, “bibliometrics has changed out of all recognition since 1958.”^[16] This is primarily because sources of data for bibliometric analyses proliferated (and keep proliferating), inviting new analysis methods and uses of results.

In 1960 Eugene Garfield (U.S. chemist, information scientist, and entrepreneur) established the Institute for Scientific Information (ISI), which became a major innovative company in the creation of a number of information tools and in bibliometric research. In 1964, ISI started publishing the *Science Citation Index*, created by use of computers. Citation indexes in social sciences and in art and humanities followed. While citation indexes in various subjects, law in particular, existed long before Garfield applied them in science, the way they were produced and used was innovative. Besides being a commercial product, citation indexes became a major data source for bibliometric research. They revolutionized bibliometrics.

In addition to publication sources—journal articles and citations—de Solla Price pioneered the use of a range of statistics from science records, economics, social sciences, history, international reports, and other sources to derive generalizations about the growth of science and the factors that affected information explosion.^[5] Use of diverse sources became a trademark of scientometrics.

As the Web became the fastest growing and spreading technology in history it also became a new source of data for ever-growing types of bibliometric-like analyses, organized under the common name of webometrics. The Web has a number of unique entities that can be statistically analyzed, such as links, which have dynamic distributions and behavior. Thus, webometrics started covering quite different grounds.

As more and more publications, particularly journals and more recently books, became digital they also became a rich source for bibliometric analyses. Libraries and other institutions are incorporating these digital resources in their collections, providing a way for various analyses of their use and other aspects. Most recently, digital libraries became a new source of analysis for they are producing massive evidence of the usage patterns of library contents, such as journal articles, for the first time. Thus, the emergence of e-metrics.

[From now on all the metric studies in information science (bibliometrics, scientometrics, informetrics, webometrics, and e-metrics) for brevity will be collectively referred to as *bibliometrics*.]

In the digital age, sources for bibliometric analyses are becoming more diversified, complex, and richer. They have become a challenge for developing new methods and refining existing methods and types of analysis.

Types and Application of Results

Lotka showed distribution of publication regarding authors and Bradford distribution of articles regarding journals. In seeking generalization, both formulated respective numerical distributions in a mathematical form. The generalizations sought a scientific law-like predictive power, with full realization that social science laws are not at all like natural science laws. In turn, mathematical expressions of Lotka's and Bradford's laws were refined, enlarged, and corrected in numerous subsequent mathematical papers; the process is still going on. This set the stage for the development of a branch of bibliometrics that is heavily mathematical and theoretical; it is still growing and continuously encompassing new entities and relations as data becomes available. Bradford also illustrated the results graphically. This set the stage for the development of visualization methods for showing distributions and relations; the efforts evolved to become quite sophisticated using the latest methods and tools for data visualization to show patterns and structures.

Over the years bibliometric studies showed many features of the ever-growing number of entities related to information. Some were already mentioned, here is a sample of others: frequency and distribution analysis of words; cowords; citations; cocitations; emails; links; etc., and quite a few others.

Until the appearance of citation indexes, bibliometric studies in information science were geared to analysis of relations; many present studies continue with the same purpose and are geared toward relational applications. But with the appearance of citation data, a second application emerged: evaluative.^[16]

Relational applications seek to explicate relationships that are results of research. Examples are emergence of research fronts; institutional, national, and international authorship productivity and patterns; intellectual structure of research fields or domains; and the like.

Evaluative applications seek to assess or evaluate the impact of research, or more broadly, scholarly work in general. Examples are use of citations in promotion and tenure deliberations; ranking or comparison of scholarly productivity; relative contribution of individuals, groups, institutions, or nations; relative standing of journals; and the like.

Evaluative indicators were developed to numerically express the impact of given entities. Here are two of the most widely used indicators. The first deals with journals, the second with authors. *Journal Impact Factor*, devised in the 1960s by Garfield and his colleagues, provides a numerical value to how often a given journal is included

in citations in all journals over a given period of time, normalized for the number of articles appearing in a journal. Originally, it was developed as a tool to help selection of journals in *Science Citation Index* but it morphed into a widely used tool for ranking and comparing the impact of journals. The second indicator deals with authors. A most influential new indicator of impact is the *h-index* (proposed in 2005 by Jorge Hirsh, a U.S. physicist). It quantifies and unifies both an author's scientific productivity (number of papers published by an author) and the apparent scientific impact of a scientist (number of citations received)—it unifies how much was published with how much was cited. Both of the indices are continuously discussed, mathematically elaborated, and criticized.

Evaluative studies are controversial at times. By and large, evaluative applications rest on citations. The central assumption here is that citation counts can be used as an indicator of value because the most influential works are most frequently cited. This assumption is questioned at times, thus it is at the heart of controversies and skepticism about evaluative approaches.

Evaluative applications are used at times in support of decisions related to tenure and promotion processes; academic performance evaluations of individuals and units in universities; periodic national research evaluations; grant applications; direction of research funding; support for journals; setting science policies; and other decisions involving science. Several countries have procedures in place that mandate bibliometric indicators for the evaluation of scientific activities, education, and institutions. They are also used in the search of factors influencing excellence.

The current and widening range of bibliometric studies is furthering understanding of a number of scholarly activities, structures, and communication processes. They are involved in the measuring and mapping of science. In addition, they have a serious impact on evaluation, policy formulation, and decision making in a number of areas outside of information science.

DIGITAL LIBRARIES

Long before digital libraries emerged in the mid-1990s, J. C. R. Licklider (1915–1990, U.S. computer scientist) in a prescient 1965 book *Libraries of the Future* envisioned many of the features of present digital libraries, with some still to come.^[17] While Licklider was a technology enthusiast and formulated his vision of the library in a technological context, he also foresaw the handling of content in cognitive, semantic, and interactive ways.

Many of the components were in place quite some time before they were shaped and unified operationally into digital libraries. For instance, online searching of abstracting and indexing databases; a number of network information services; library automation systems; document structuring

and manipulation procedures based on metadata; digitized documents; human computer interfaces; and others. With the advent of the Web, many of these older components were refined as needed and amalgamated with a number of new ones to form digital libraries as we know them today.

From the outset, people from a number of fields and backgrounds got involved in the development of digital libraries. Thus various conceptions were derived. Two viewpoints crystallized, one more technological the other more organizational. From the first point of view, a digital library is a managed collection of digital information with associated services, accessible over a network. From the second point of view, a digital library is that, but in addition it involves organizations that provide resources to select, structure, and offer intellectual access to collections of digital works for use by defined communities, and to preserve integrity and ensure persistence of collections and services. The first viewpoint comes mostly from computer science and the second from libraries and other organizations that house and provide digital library services. Digital libraries continue this dual orientation, technological and organizational, because, yes, they are indeed completely dependent on technology but by their purpose and functions they are social systems in the first place.

Many organizations other than libraries enthusiastically started developing and operating digital libraries—museums, historical societies, academic departments, governments, professional organizations, publishers, nonprofit organizations, and so on. As a result, digital libraries take many shapes and forms. They involve a variety of contexts, media, and contents. Many are oriented toward a specific subject. Most importantly, they are used by a variety of users and for a variety of uses. Digital libraries are a highly diverse lot.

The wide and constantly increasing diversity of digital libraries and related collections and portals suggest several issues: traditional libraries are not traditional any more, but hybrid and coming in many digital library forms; many new players have entered the arena, particularly in subject areas; and many new types of uses have emerged in addition to the traditional use of libraries. Digital libraries are truly interdisciplinary. Information science was one of the fields that actively participated in digital library formation, development, and research.

Through NSF and other agencies, the U.S. government funded research in digital libraries through Digital Library Initiatives; European Union and other governments funded similar research and development programs. Governmental funding started around 1995 and lasted about a decade. Most of the funding went toward technological aspects and demonstrations. An important by-product of this funding was the creation of a strong international community of digital library researchers from a number of fields, information science included. Here is another by-product often mentioned: Google was initially developed

at Stanford University under an NSF grant in the Digital Library Initiatives program.

From the outset, information science was involved with digital libraries in a number of ways. Professionally, many information scientists work in digital libraries, particularly in relation to their architecture, systems operations, and services. A diverse number of topics were addressed in research covering the whole life-cycle of digital libraries as reflected in numerous reports, journals, proceedings, and books. Here is a sample: development and testing of digital library architecture; development of appropriate metadata; digitization of a variety of media; preservation of digital objects; searching of digital library contents; evaluation of digital libraries; access to digital libraries; security and privacy issues; study of digital libraries as a place and space; study of users, use, and interactions in digital libraries; effect of digital libraries on educational and other social institutions; impact of digital libraries on scholarship and other endeavors; and policy issues. New research topics are coming along at a brisk pace.

The rapid development and widespread deployment of digital libraries became a force that is determining not only the future of libraries but also of many other organizations as social, cultural, and community institutions. It is instrumental in the development of e-science. It is also affecting the direction of information science in that the domain of problems addressed has been significantly enlarged.

EDUCATION

The fact that education is critical for any field is a truism that hardly needs to be stated. Information science education began slowly in the 1950s and 1960s. Two educational models evolved over time and were followed for decades to come: For brevity, they should be referred to as the Shera and Salton models, after those that pioneered them. Both have strengths and weaknesses. A third model is presently emerging, under the label of i-Schools.

Jesse H. Shera (1903–1982, librarian and library educator) was a library school dean at Western Reserve University (later Case Western Reserve) from 1952 to 1970. Among others, he was instrumental in starting the Center for Documentation and Communication Research at the library school there in 1955. The Center was oriented toward research and development in IR. Shortly thereafter, the library school curriculum started to include courses such as “machine literature searching” (later to become “information retrieval”), and a few other more advanced courses and laboratories on the topics of research in the Center. The basic approach was to append those courses, mostly as electives, to the existing library school curriculum, without modifications of the curriculum as a whole, and particularly not the required core courses. Information science (or information retrieval)

became one of the specialty areas of library science. The base or core courses that students were taking rested in the traditional library curriculum. Information science education was an appendage to library science. Library schools in the United States and in many other countries imitated Shera’s model. They used the same approach and started incorporating information science courses in their existing curriculum as a specialty.

The strength of the Shera model is that it posits education within a service framework, connects the education to professional practice and a broader and user-oriented frame of a number of other information services, and relates it to a great diversity of information resources. The weakness is a lack of a broader theoretical framework, and a lack of teaching of formalism related to systems, such as the development and understanding of algorithms. A majority of researchers in the human information behavior and user-centered approach are associated with this educational environment. Out of this was born the current and widely used designation *library and information science*.

Shera’s model, with contemporary modifications is still the prevalent approach in a majority of schools of library and information science. Some schools evolved to include a major in information science, or reoriented the curriculum toward some of the aspects of information science, or even provided a separate degree. The changes in curricula are accelerating. Dissatisfaction with the model as not in synch with contemporary developments related to information-spurred development of i-Schools discussed below.

Gerard Salton (already mentioned above) was first and foremost a scientist, and a computer scientist at that. As such, he pioneered the incorporation into IR research a whole array of formal and experimental methods from science, as modified for algorithmic and other approaches used so successfully in computer science. His primary orientation was research. For education, he took the time-honored approach of a close involvement with research. The Salton model was a laboratory and research approach to education related to IR. As Shera’s model resulted in information science education being an appendage to library science education, Salton’s model of IR education resulted in being a specialty of and an appendage to computer science education. Computer science students that were already well-grounded in the discipline got involved in SMART and other projects directed by Salton, worked and did research in the laboratory, completed their theses in areas related to IR, and participated in the legendary IR seminars. They also published widely with Salton and with each other and participated with high visibility in national and international conferences. From Harvard and Cornell, his students went to a number of computer science departments where they replicated Salton’s model. Many other computer science departments in the United States and abroad took the same approach. The strength of Salton’s model is that it: (1) starts from a base of a firm grounding in formal mathematical and other methods; and

(2) relates directly to research. The weakness is in that it: (1) ignores the broader aspects of information science, as well as any other disciplines and approaches dealing with the human aspects, that have great relevance to both outcomes of IR research and research itself; and (2) does not incorporate professional practice where these systems are realized and used. It loses users. Consequently, this is a successful, but narrowly concentrated education in IR as a specialty of computer science, rather than in information science. Not surprisingly, the researchers in the systems-centered approach came out of this tradition.

The two educational approaches are completely independent of each other. Neither reflects fully what is going on in the field. While in each model there is an increase in cognizance of the other, there is no educational integration of the systems- and user-centered approaches. The evident strengths that are provided by Shera's and Salton's model are not put together.

The late 1990s and early 2000s saw a movement to broaden and reorient information science education, spearheaded by a number of deans of schools with strong information science educations. Some library and information science schools were renamed into Information Schools or i-Schools. An informal i-School Caucus was formed in 2005. By 2008, the Caucus included over 20 schools quite diverse in origin. They include schools of: information; library and information science; information systems; informatics; public policy and management; information and computer sciences; and computing. The i-Schools are primarily interested in educational and research programs addressing the relationship between information, technology, and people and understanding the role of information in human endeavors. While the i-School movement was originally restricted to the United States, some schools outside the United States are joining. The movement is attracting wide international interest.

The i-Schools represent an innovative, new approach to information science education, with some true interdisciplinary connections. As the millennial decade draws toward an end, it is also signifying a new direction to information science education.

CONCLUSIONS

It was mentioned that information science has two orientations: one that deals with information retrieval techniques and systems and the other that deals with information needs and uses, or more broadly with human information behavior. One is technical and system-oriented, the other individual and social and user-oriented. In pursuing these orientations certain characteristics of the field emerged.

Information science has several general characteristics that are the leitmotif of its evolution and existence. These are shared with many modern fields.

- First, information science is interdisciplinary in nature. However, with various advances, relations with various disciplines are changing over time. The interdisciplinary evolution is far from over.
- Second, information science is inexorably connected to information technology. A technological imperative is compelling and encouraging the evolution of information science, as is the evolution of a number of other fields, and moreover, of the information society as a whole.
- Third, information science is, with many other fields, an active participant in the evolution of the information society. Information science has a strong social and human dimension, above and beyond technology.
- Fourth, while information science has a strong research component that drives advances in the field, it also has an equally strong, if not an even stronger, professional component oriented toward information services in a number of environments. Many innovations come from professionals in the field.
- Fifth, information science is also connected with information industry, a vital, highly diversified, and global branch of the economy.

With accelerating changes in all these characteristics, information science is a field in a constant flux. So are many other fields. The steady aspect is in its general orientation toward information, people, and technology.

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Information Search Process (ISP) Model

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Abstract

The information search process (ISP) is a six-stage model of the users' holistic experience in the process of information seeking. The ISP model, based on over two decades of empirical research, identifies three realms of experience: the affective (feelings), the cognitive (thoughts), and the physical (actions) common to each stage. These studies were among the first to investigate the affective aspects or the feelings of a person in the process of information seeking along with the cognitive and physical aspects. Central to the ISP is the notion that uncertainty, both affective and cognitive, increases and decreases in the process of information seeking. A principle of uncertainty for information seeking states that information commonly increases uncertainty in the early stages of the search process. Increased uncertainty indicates a zone of intervention for intermediaries and system designers.

INTRODUCTION

Prior to this research, most studies were constrained by the system's definition of information needs. For the most part, library and information science concentrated on the system's representation of texts rather than on the user's tasks, problems, and processes in information gathering. The classic triad of thoughts, actions, and feelings central to any constructive process had rarely been taken into consideration in study or discussion of information-seeking behavior. Although cognitive processes were increasingly recognized as significant components for understanding information behavior, affective experience continued to be overlooked. There was little or no acknowledgment that the feelings of users may have any import. In the study and understanding of information-seeking behavior, Kuhlthau's work introduced the holistic experience of information seeking from the user's perspective and stressed the important role of affect in information-seeking behavior.

The information search process (ISP) presents a view of information seeking from the user's perspective in six stages: initiation, selection, exploration, formulation, collection, and presentation. The six-stage model of the ISP incorporates three realms of experience: the affective (feelings), the cognitive (thoughts), and the physical (actions) common to each stage.^[1] The ISP reveals information seeking as a process of construction influenced by Kelly's personal construct theory^[2] with information increasing uncertainty in the early stages of the ISP.

The development of the ISP as a conceptual framework is the result of more than two decades of empirical research that began with a qualitative study of secondary school students and the emergence of an initial model, that was verified and refined through various quantitative and longitudinal methods of diverse library users and further

developed in case studies of people in the workplace. To summarize the findings of these studies of the user's perspective of the ISP, the affective symptoms of uncertainty, confusion, and frustration prevalent in the early stages are associated with vague, unclear thoughts about a topic or problem. As knowledge states shifted to clearer, more focused thoughts, a corresponding shift was noted in feelings of increased confidence and certainty. Affective aspects, such as uncertainty and confusion, influenced relevance judgments as much as cognitive aspects, such as personal knowledge and information content. Central in the model of the ISP is uncertainty described formally as a principle of uncertainty for information seeking. Increased uncertainty in the exploration stage of the ISP indicates a zone of intervention for intermediaries and system designers.^[3]

MODEL OF THE ISP

The model of the ISP describes users' experience in the process of information seeking as a series of thoughts, feelings, and actions. Thoughts that begin as uncertain, vague, and ambiguous become clearer, more focused, and specific as the search process progresses. Feelings of anxiety and doubt become more confident and certain. Through their actions, people seek information relevant to the general topic in the beginning stages of the search process and pertinent to the focused topic toward closure. Formulation of a focus or a personal perspective of the topic is a pivotal point in the search process. At that point, feelings shift from uncertain to confident, thoughts change from vague to more clear and interest increases. The model was verified in longitudinal case studies and large-scale studies of diverse samples of library users.^[4,5] Further

studies have examined the implementation of a process approach in education contexts and investigated the ISP in the workplace.^[6]

The ISP describes common experiences in the process of information seeking for a complex task that has a discrete beginning and ending and that requires considerable construction and learning to be accomplished.^[7] The model reveals a search process in which a person is seeking meaning in the course of seeking information. From the user's perspective, the primary objective of information seeking is to accomplish the task that initiated the search, not merely the collection of information as an end in itself. The ISP presents seeking information as a means to accomplish a goal. The model of the ISP is articulated in a holistic view of information seeking from the user's perspective in six stages (Fig. 1):

1. *Initiation*, when a person first becomes aware of a lack of knowledge or understanding and feelings of uncertainty and apprehension are common.
2. *Selection*, when a general area, topic, or problem is identified and initial uncertainty often gives way to a brief sense of optimism and a readiness to begin the search.
3. *Exploration*, when inconsistent, incompatible information is encountered and uncertainty, confusion, and doubt frequently increase and people find themselves "in the dip" of confidence.
4. *Formulation*, when a focused perspective is formed and uncertainty diminishes as confidence begins to increase.
5. *Collection*, when information pertinent to the focused perspective is gathered and uncertainty subsides as interest and involvement deepens.
6. *Presentation*, when the search is completed with a new understanding enabling the person to explain their learning to others or in some way put the learning to use.

In the first stage, *initiation*, a person becomes aware of a gap in knowledge or a lack of understanding, where

feelings of uncertainty and apprehension are common. At this point, the task is merely to recognize a need for information. Thoughts center on contemplating the problem, comprehending the task, and relating the problem to prior experience and personal knowledge. Actions frequently involve discussing possible avenues of approach or topics to pursue.

In the second stage, *selection*, the task is to identify and select the general topic to be investigated and the approach to be pursued. Feelings of uncertainty often give way to optimism after the selection has been made and there is a readiness to begin the search. Thoughts center on weighing prospective topics against the criteria of task requirements, time allotted, personal interest, and information available. The outcome of the possible choices is predicted, and the topic or approach judged to have the greatest potential for success is selected. Typical actions are to confer with others or to make a preliminary search of information available and then to skim and scan for an overview of alternative topics. When, for whatever reason, selection is delayed or postponed, feelings of anxiety are likely to intensify until the choice is made.

The third stage is *exploration* characterized by feelings of confusion, uncertainty, and doubt that frequently increase during this time. The task is to investigate information on the general topic in order to extend personal understanding. Thoughts center on seeking to become oriented and sufficiently informed about the topic to form a focus or a personal point of view. At this stage in the ISP, an inability to express precisely what information is needed can make communication between the user and the system awkward. Actions involve locating information about the general topic, reading to become informed, and relating new information to what is already known. In this stage, the information encountered rarely fits smoothly with previously held constructs, and information from different sources frequently seems inconsistent and incompatible.

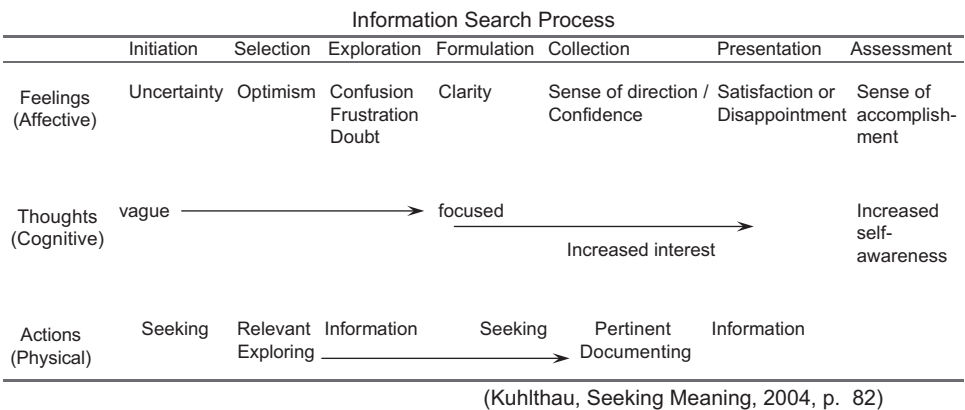


Fig. 1 Model of the information search process.
Source: From Kuhlthau.^[7]

People may find the situation quite discouraging and even threatening, causing a sense of personal inadequacy as well as frustration with the system. Some actually may be inclined to abandon the search altogether at this stage. Exploration is considered the most difficult stage in the ISP when information encountered can increase rather than decrease uncertainty, prompting a dip in confidence.

The fourth stage in the ISP, *formulation*, is the turning point, when feelings of uncertainty diminish and confidence increases. The task is to form a focus from the information encountered. Thoughts involve identifying and selecting ideas in the information from which to form a focused perspective of the topic. A focus in the search process is comparable to a hypothesis in the process of construction. The topic becomes more personalized at this stage if construction is taking place. While a focus may be formed in a sudden moment of insight, it is more likely to emerge gradually as constructs become clearer. During this time, a change in feelings is commonly noted, with indications of increased confidence and a sense of clarity. People often express an awareness of being involved in seeking meaning, such as purposefully engaging in “focusing and narrowing,” in seeking “a thread,” “a story,” “answers to all my questions,” “a central theme,” or “a guiding idea.” The four criteria used to select a topic may be employed again to choose a focus: Task; What am I trying to accomplish? Time; How much time do I have? Interest; What do I find personally interesting? Availability; What information is available to me?

Collection is the fifth stage in the ISP when interaction between the user and the information system functions most effectively and efficiently. At this point, the task is to gather information related to the focused topic. Thoughts are centered on defining, extending, and supporting the focus. Actions involve selecting information relevant to the focused perspective of the topic and making detailed notes on that which pertains specifically to the focus. General information on the topic is no longer relevant after formulation. The person, with a clearer sense of direction, can specify the need for pertinent, focused information to intermediaries and to systems, thereby facilitating a comprehensive search of available resources. Feelings of confidence continue to increase as uncertainty subsides, with interest in the project deepening.

In the sixth stage, *presentation*, feelings of relief are common with a sense of satisfaction if the search has gone well or disappointment if it has not. The task is to complete the search and to prepare to present or otherwise use the findings. Thoughts concentrate on culminating the search with a personalized synthesis of the topic or problem. Actions involve a summary search in which decreasing relevance and increasing redundancy are noted in the information encountered.

ROLE OF AFFECT IN INFORMATION-SEEKING BEHAVIOR

These studies were among the first to investigate the affective aspects or feelings in the process of information seeking along with the cognitive and physical aspects. Prior to the introduction of the ISP, the affective dimension of information seeking had not been fully recognized in library and information services and systems. One of the surprising and important findings in this research was the discovery of a sharp increase in uncertainty and decrease in confidence after a search had been initiated. A person “in the dip” commonly experienced uncertainty, confusion, and anxiety until a focus or a personal perspective had been formed.

The ISP presents information seeking as a process of construction influenced by George Kelly’s personal construct theory.^[2] Information seeking involves construction in which the person actively pursues understanding and seeks meaning from the information encountered over a period of time. The process is commonly experienced as a series of thoughts and feelings that shift from vague and anxious to clear and confident as the search progresses.

Kelly describes the emotional experience of constructing meaning from new information. The information is assimilated in a series of phases, beginning with confusion. Confusion increases as inconsistencies and incompatibilities are confronted between the information and the constructs the person already holds. As confusion mounts, it frequently causes doubt in the ability to assimilate the new information. The disruption caused by the new ideas may become so threatening that the new information is discarded and construction abandoned. At this point, Kelly proposes another alternative to move the process of construction along. The person may form a tentative hypothesis to move toward incorporating the new construct into their existing system of personally held constructs.

The ISP is a process of seeking meaning not just finding and reproducing information. This is a process of construction involving exploration and formulation that rarely proceeds directly from selection to collection. Experience influences the decisions and choices a person makes throughout the process of information seeking.

Studies of the ISP in the workplace reveal that a person’s experience of the stages in the ISP is related to how much the person knows about the problem and the degree of construction that needs to be undertaken during information seeking. In more routine tasks, where the goal is to answer a simple question or to monitor periodic change, people do not usually experience stages in their information seeking. In more complex tasks, where the goal requires considerable construction and learning, people are likely to experience a process as described in the ISP model.^[6]

Focus Formulation as a Pivotal Point in the ISP

The formulation of a focus or personal perspective is a pivotal point in the ISP. Focus formulation calls for reflective thinking about the information encountered in the exploration stage of the ISP that provides a direction for the completion of the search. A focus is a guiding idea to concentrate on to complete the search and accomplish the task.

People often find the period preceding formulation of a focus the most difficult phase in the search process. Exploration is a difficult stage because uncertainty commonly increases, rather than gradually decreasing, during this time. People can experience anxiety and frustration as they encounter information from many different perspectives, much of which may not be compatible with their specific constructs and personal knowledge. The connection between feelings and formulating is evident from the rise in confidence that parallels increased clarity as formulation unfolds. Formulation, the central task in the ISP, is frequently misunderstood when the search process is thought of as merely a process of collection not a construction activity.

Exploration facilitates formulating a focus during the search process. However, people often attempt to move from selection directly to collection without the essential exploration for the formulation that gives direction to the search. Exploring uncovers information for formulating new constructs, whereas collecting gathers information for documenting established constructs. Tolerance for the mounting uncertainty in the exploration stage is important for formulation within the ISP. Using information involves interpreting and creating. No matter the amount or the quality of the information gathered, the problem is not solved or the topic understood until the information has been interpreted. Understanding develops through extending and defining a topic by reflecting on the information encountered to solidify personal understanding.

Acquiring More Information Can Increase Uncertainty

The axiom that information reduces uncertainty is not necessarily the user's experience in information seeking. In some situations, new information actually increases uncertainty. Prior to formulation, users are likely to experience heightened uncertainty in the face of unique, incompatible, inconsistent information that requires construction and interpretation. It seems helpful for users to expect uncertainty to increase during the exploration stage of the ISP rather than thinking that increased uncertainty is a symptom that something has gone wrong. The tolerance of uncertainty is introduced as enabling the early stages of the ISP, when the experience of uncertainty may overwhelm the person and deter progress in the process. Uncertainty from the user's perspective is a natural experience in the search process.

If unexpected, the presence of uncertainty and particularly any increase in uncertainty can heighten anxiety.

Central to the ISP model is the notion that uncertainty, both cognitive and affective, increases and decreases in the process of information seeking. Uncertainty, the predominant experience in the early stages of the search process, had not been sufficiently addressed in library and information services.

PRINCIPLE OF UNCERTAINTY FOR INFORMATION SEEKING

Uncertainty is a cognitive state that commonly causes affective symptoms of anxiety and lack of confidence. Uncertainty and anxiety can be expected in the early stages of the ISP. The affective symptoms of uncertainty, confusion, and frustration are associated with vague, unclear thought about a topic or question. As knowledge states shift to more clearly focused thoughts, a parallel shift occurs in feelings of increased confidence. Uncertainty due to a lack of understanding, a gap in meaning, or a limited construct initiates the process of information seeking.^[8]

The principle is expanded by six corollaries: process corollary, formulation corollary, redundancy corollary, mood corollary, prediction corollary, and interest corollary.

Six Corollaries of the Principle of Uncertainty

1. *Process corollary*: The process of information seeking involves construction in which the person actively pursues understanding and meaning from the information encountered over a period of time. The process is commonly experienced in a series of thoughts and feelings that shift from vague and anxious to clear and confident, as the search progresses.
2. *Formulation corollary*: Formulation is thinking, developing and understanding, and extending and defining a topic from the information encountered in the early stages of a search. The formulation of a focus or a guiding idea is a critical, pivotal point in the ISP when a general topic becomes clearer and a particular perspective is formed as the person moves from uncertainty to understanding.
3. *Redundancy corollary*: The interplay of seeking what is expected or redundant and encountering what is unexpected or unique results in an underlying tension in the ISP. Redundant information fits into what the user already knows and is readily recognized as being relevant or not. Unique information is new and extends knowledge and does not match the person's constructs requiring reconstruction to be recognized as useful. Too much redundant information leads to boredom, whereas too much unique information causes anxiety. The lack of redundancy in the early stages of the ISP may be an

underlying cause of anxiety related to uncertainty. Uncertainty may decrease as redundancy increases.

4. *Mood corollary:* Mood, a stance or attitude that the person assumes, opens or closes the range of possibilities in a search. According to Kelly, an invitational mood leads to expansive, exploratory actions, whereas an indicative mood fosters conclusive actions that lead to closure. The person's mood is likely to shift during the ISP. An invitational mood may be helpful in the early stages and an indicative mood in the later stages. A person in an invitational mood would tend to take more expansive, exploratory actions, while a user in an indicative mood prefers conclusive actions that lead to closure.
5. *Prediction corollary:* The ISP is a series of personal choices based on the person's predictions of what will happen if a particular action is taken. People make predictions derived from constructs built on past experience about what sources, information, and strategies will be relevant and effective. These predictions lead to the choices they make in the stages of the ISP. People develop expectations and make predictions about the sources used or not used, the sequence of source use, and the information selected from the sources as relevant or irrelevant. Relevance is not absolute or constant but varies considerably from person to person.
6. *Interest corollary:* Interest increases as the exploratory inquiry leads to formulation in the ISP. Motivation and intellectual engagement intensify along with construction. Personal interest may be expected to increase as uncertainty decreases. The person's interest and motivation grows as the search progresses. Interest is higher in later stages after the person has formed a focus and has enough understanding of the topic to become intellectually engaged.

IMPLICATION OF ISP FOR INFORMATION SERVICES AND SYSTEMS

Information searching is traditionally portrayed as a systematic, orderly, and rational procedure rather than the uncertain, confusing process that users commonly experience. After the search is completed, the topic understood, and the problem solved, a person may look back and deny the chaos and confusion that was actually experienced in the process. A gap exists between users' expectations in information use and search design.

The ISP considers uncertainty as natural and essential for constructing personal knowledge in the process of information seeking rather than regarding the reduction of uncertainty as the primary objective of information seeking. Uncertainty is a concept that offers insight into the user's quest for meaning within the ISP. If

uncertainty is viewed as a sign of the beginning of learning and creativity, the goal of library and information services shifts from reducing uncertainty to supporting the user's constructive process.

Increased uncertainty in the ISP indicates a need for intervention that enables the person to move on to further construction and understanding. Uncertainty in the ISP indicates a zone of intervention in the ISP for information intermediaries.^[9]

Zone of Intervention for Information Services and Systems

The zone of intervention is a concept modeled on Vygotsky's notion of a zone of proximal development.^[10] Vygotsky, the soviet psychologist whose work has had a profound influence on learning theory, developed the concept of identifying an area or zone in which intervention would be most helpful to a learner. The zone of proximal development is the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined by problem solving under professional guidance or in collaboration with more capable peers. This concept provides a way of understanding intervention in the constructive process of another person.

The zone of intervention in information seeking may be thought of in a similar way. The zone of intervention is that area in which an information user can do with advice and assistance what the user cannot do alone or can do only with difficulty. Intervention within this zone enables individuals to progress in the accomplishment of their task. Intervention outside this zone is inefficient and unnecessary, experienced by users as intrusive, on the one hand, and overwhelming, on the other.

Taken together, the stages of the ISP, uncertainty principle, and the concept of a zone of intervention propose a conceptual framework for understanding information seeking as a process of construction from the user's perspective. In summary, the ISP model describes the experience and behavior of people involved in extensive research projects. People using libraries and information systems to learn about a particular subject or to investigate a problem or issue often have difficulty in the early stages of information seeking. Even when they begin with great enthusiasm and initial success, many become confused and uncertain as to how to proceed after a short period of time. This is particularly noticeable with students who have been assigned a research paper but is not limited to students. Initial hesitation, confusion, and uncertainty are reported by people in all types of libraries and in the workplace. In fact, we have no way of knowing just how many people give up after initiating a search because they become uncertain and feel incompetent to continue.^[11] It is helpful to understand that a period of cognitive and

affective uncertainty is natural and essential in the early stages of learning from a variety of sources of information.

IMPLICATIONS FOR EDUCATION

The challenge facing educators is to prepare students for learning, living, and thriving in the dynamic, cluttered, and chaotic information environment of today's world. At the core of what it means to be educated today is to know how to learn from a variety of sources of information. The ISP studies found that students need considerable guidance and intervention throughout the research process to enable a depth of learning. Without guidance, students often view research as a simple collecting and presenting assignment that can result in copying and pasting with little real learning. With guidance, students are able to concentrate on constructing new knowledge in the phases of research to gain personal understanding and transferable skills.

Based on the findings of the ISP studies, an approach called Guided Inquiry has been developed with practical strategies and tools that engage and support students in each phase of the research process.^[12] The ISP model has been translated into Guided Inquiry Design, a phased design framework that can be applied by teachers to guide students through the process of learning from multiple sources of information.^[13] The phases of the design framework, *open, immerse, explore, identify, gather, create, share, evaluate*, follow the flow of feelings, thoughts, and actions described in the ISP, as shown in Fig. 2.

Emotions play an important role in learning. Recent brain research confirms that emotions work in

conjunction with thinking in the holistic process of constructing knowledge, as described in the ISP. In Guided Inquiry, a learning team of teachers and librarians concentrate on what students are feeling as well as what they are thinking and doing as they are learning throughout the research process. Students come to realize that feeling uncertain is a normal and necessary part of learning. They acquire strategies to support them during phases of uncertainty and are guided in their efforts to learn in the research process.

CONCLUSION

People engage in an information search experience holistically, with an interplay of feelings, thoughts, and actions. Common patterns of feeling, thinking, and acting are characteristic in each phase. These studies were among the first to investigate the affective aspects or the feelings of a person in the process of information seeking along with the cognitive and physical aspects. Rather than a steady increase in confidence from the beginning of a search to the conclusion, as might be expected, a dip in confidence is commonly experienced once an individual has initiated a search and begins to encounter conflicting and inconsistent information. A person “in the dip” is increasingly uncertain and confused until a focus is formed to provide a path for seeking meaning and criteria for judging relevance. Advances in information technology, which open access to a vast assortment of sources, have not helped the user's dilemma and may have intensified the sense of confusion and uncertainty. Information systems may intensify the problem particularly in the early stages of

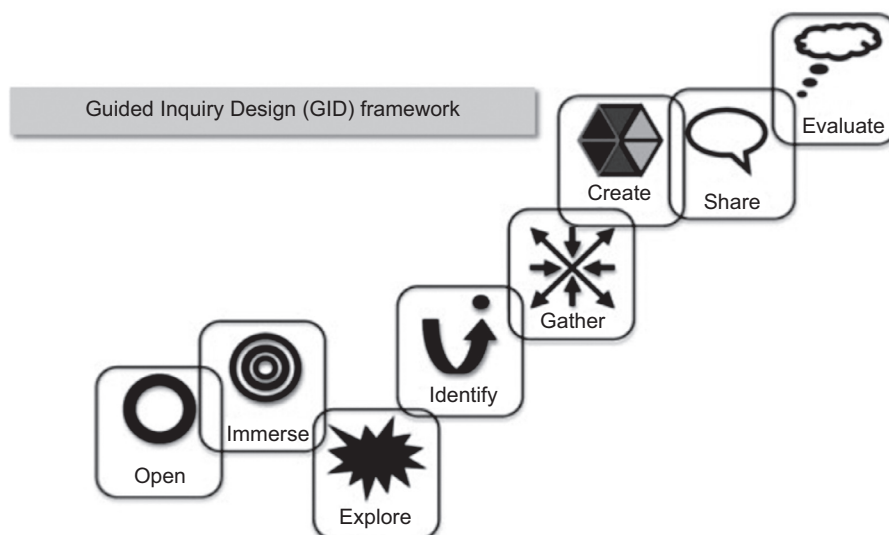


Fig. 2 Phases of the design framework.

Source: From Kuhlthau, Maniotes, and Caspari^[12,13]

the ISP by overwhelming the user with “everything” all at once. Increased uncertainty indicates a zone of intervention in the process of information seeking for information intermediaries.

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Information Searching and Search Models

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Abstract

It is a critical issue to design information retrieval (IR) systems to effectively support users in their information searching. Users are naturally drawn to systems whose features make their searching easy, intuitive, efficient, and successful. However, there is a gap between user studies and the application of study results to actual system design. This entry serves as a summary of information searching and search models, and calls for the need to incorporate these user studies into system design and testing. Key terms related to information searching and search models are defined. A historic context is provided to illustrate the evolution of the four main digital environments that users interact with in their search process to offer readers background information regarding the transition from manual information systems to computer-based IR systems, as well as the transition from intermediary searching to end user searching. New emerging research areas in information searching are also discussed. Emphasis is placed on the review of different levels of information searching, including search tactics/moves, search strategies, usage patterns, factors affecting searching in relation to tasks, user knowledge structure, IR system design, social-organization context, and search models. Search models are further classified into two types, with one type illustrating information search process and the other type emphasizing the factors that influence the process. In addition, unsolved problems and future research are discussed and suggested.

INTRODUCTION

Since the emergence of the Internet, searching for information has become part of everyday activities for the general public. Successful information searching can only be achieved if information retrieval (IR) systems can effectively support users in their search processes. Users seek out and favor IR systems that make them feel like successful and accomplished searchers in addition to retrieving the information being sought. However, there is a lack of integration between findings of user studies and actual IR system design and evaluation. This entry summarizes information searching and search models, and offers the opportunity for system designers to apply user studies into IR system designs. This entry starts with the definitions of key terminologies in the Introduction, and follows by providing the overview of the historical context portraying the history of the four digital environments. The focus of the entry is on the identification of levels of search strategies ranging from search tactics/moves, types and dimensions of search strategies, and usage patterns to the factors that influence the selection and application of search strategies. More important, this entry presents 11 search models that illustrate the dynamic search process and a variety of variables that define the search process. Finally, future research for information searching and search models is discussed.

Despite their different foci, information searching can also be used as a synonymous term for IR, information

seeking, and information access.^[1] While information seeking refers to purposive behavior involving users' interactions with either manual or computer-based information systems in order to satisfy their information goals, information searching refers to the micro level of purposive behavior when interacting with different types of information systems.^[2] IR is also a broad concept similar to information seeking but is more limited to users' interactions with computer-based information systems. Focusing on intellectual perspectives (information searching, IR, and cross-cutting) and theoretical orientations (information, people, and technology), information searching and IR were systematically compared. Based on the comparison, the authors identified 17 key constructs of information searching and retrieval. While information searching research focuses on users' interacting with specific IR systems, IR research emphasizes information representation, storage, and finding. The two areas gradually converge.^[3] Since research on information seeking and IR has contributed significantly to research on information searching, some of the associated works are also reflected here.

Information searching can be characterized at different levels including tactics/moves, strategies, usage patterns, and models. Tactics or moves are the micro-level behaviors that users exhibit in their search process. Specifically, a tactic is a move that advances the search process. In some studies, a move can be defined narrowly by researchers. For example, a move is termed as any

changes made in formulating a query.^[4] Searching strategies are a combination of tactics or moves. According to Bates,^[5] “A search strategy is a plan for the whole search, while a tactic is a move made to further a search (p. 207).” A search strategy involves multiple dimensions, such as intentions, resources, methods, and so on. Usage patterns identify patterns of query formulation and reformulation based on analysis of transaction logs submitted to electronic IR systems. Search models are illustrations of patterns of information searching and the search process. Some of the models also identify the factors that influence the search process.

Users and online IR systems are partners in the information search process (ISP). Online IR systems can be characterized as IR systems that allow remote access with searches conducted in real time.^[6] Users generally search information from four types of online IR systems: online databases, online public access catalogs (OPACs), Web search engines, and digital libraries. In recent years, users also search information in different types of social media. Information searching can be categorized into intermediary information searching and end user information searching. In intermediary searching, information professionals serve as intermediaries between users and the IR system in the search process, whereas in end user searching, users directly search for information themselves.

HISTORICAL CONTEXT

In order to discuss information searching and search models, we have to first provide a historical context, in particular, the evolution of the four major digital environments that users interact with. The emergence of online databases and OPACs indicates a new era for information searching from manual information systems to computer-based IR systems. The availability of OPACs and CD-ROM databases enabled users to search for information themselves. Later, the Web and the array of information resources to which it provided access made end user searching of IR systems much more widely available. As partners of information searching, the development and evolution of online IR systems to some extent affects how users search for information. That is why it is important to offer a historical context for information searching before presenting a discussion of information searching and search models.

OPACs hold interrelated bibliographic data of collections of a library that can be searched directly by end users. In the 1960s, library automation projects started in university libraries. Computer-based library systems were implemented in large universities by commercial vendors in the 1970s. OPAC systems designed for public access started in the 1980s. Four generations of OPACs have evolved across time, from the first generation of OPACs that followed either online card catalog models emulating the familiar card catalog or Boolean searching models

emulating online databases to the new generation of Web OPACs, which incorporate advanced search features and new designs from other types of IR systems and allow users to search for information resources generated from libraries, publishers, and online vendors.

Online databases consist of full-text documents or citations and abstracts accessible via dial-up or other Internet services. Several dial-up services were offered in the 1960s, and in 1972 commercial online services, such as Dialog and ORBIT, started. Traditionally, online searchers were information professionals who acted as intermediaries between users and online databases. After the creation of the World Wide Web, online vendors began to design Web versions of online services to help end users search for information themselves more easily. Characteristics of the new online database services include easy access, customization, and interactivity.

The emergence of the Web in early 1990 enabled millions of users to search for information without the assistance of intermediaries. Web search engines allow users to mainly search for Web materials. Four types of search engines have been developed to enable users to accomplish different types of tasks:

- Web directories with hierarchically organized indexes facilitate users' browsing for information.
- Search engines with a database of sites assist users' searching for information.
- Meta-search engines permit users to search multiple search engines simultaneously.
- Specialized search engines create a database of sites for specific topic searching.

Many of the Web search engines also offer users the opportunity to search for multimedia information and personalize their search engines. Now, Web search engines also extend their services to full-text books and articles in addition to Web materials. The popularity of Web search engines influences the way that users interact with other types of online IR systems.

Digital libraries collect, organize, store, and disseminate electronic resources in a variety of formats. The availability of online access to digital libraries began in the 1990s. Digital libraries allow users to search and use multimedia documents and can be hosted by a variety of organizations and agencies, either for the general public or for a specific user group. Digital libraries also pose challenges for end users to interact with multimedia information in different interface designs without the same support as of physical libraries.

SEARCH TACTICS AND SEARCH MOVES

Research on information searching has focused on four levels: tactics/moves, strategies, usage patterns, and

models. Tactics are moves that users apply in the search process. Different types of tactics play different roles in assisting users who are searching for information. Based on their functions in the ISP, information tactics can be classified into monitoring tactics, file structure tactics, search formulation tactics, and term tactics. While monitoring tactics and file structure tactics are tactics used to track the search and explore the file structure to find desired information, a source, or a file, search formulation tactics and term tactics are tactics applied to assist in the formulation and reformulation of searches as well as to help select and revise terms in search formulation.^[5] In addition to search tactics, idea tactics assist users in identifying new ideas and resolutions to problems in information searching. While idea generation tactics include think, brainstorm, meditate, etc., pattern-breaking tactics consist of catch, break, breach, and others.^[7] Focusing on topic management, knowledge-based search tactics are another type of tactic that broadens the topic scope, narrows the topic scope, and changes the topic scope.^[8]

Similar to tactics, search moves directly illustrate how users interact with online IR systems. Search moves in general relate to query formulation and reformulations. They can be classified based on whether the meaning of a query has changed. When operational moves that keep the meaning of query components remain unchanged, conceptual moves change the meaning of query components. Conceptual moves are highly associated with search results. The objectives of these moves are to reduce the size of a retrieved set, enlarge the size of a retrieved set, or improve both precision and recall.^[4] Search moves can also be grouped depending on whether the moves are related to conceptual or physical moves. Cognitive moves refer to moves that users conceptually make in order to analyze terms or documents, while physical moves refer to moves that users make in order to use system features.^[9]

TYPES AND DIMENSIONS OF SEARCH STRATEGIES

Search strategies consist of combinations of tactics or moves and can be characterized by types and dimensions. In online databases and OPAC environments, search strategies can be classified by different types: concept-oriented, system-oriented, interactive, active, and reactive strategies. Concept-oriented strategies refer to strategies that manipulate concepts of search topics. The majority of the most-cited search strategies belong to this type. Building block, pearl-growing, successive-fractions, most-specific-facet-first, and lowest-postings-facet-first^[10] represent concept-oriented strategies. Unlike concept-oriented strategies, system-oriented strategies focus on making good use of different system features: the known-item instantiation strategy, the search-option heuristic

strategy, the thesaurus-browsing strategy, and the screen-browsing strategy.^[11]

Search strategies can also be defined by how and to what extent users interact with IR systems and information objects embedded in the systems. Search and browsing are the main strategies users employ when they interact with IR systems. Browsing strategies require more interactions than analytical search strategies.^[12] Active and reactive strategies specify another approach to classifying search strategies. By applying active strategies, users make decisions about how to search for information before the first move, such as author, title, concepts, external support, system features, etc. By applying reactive strategies, users make decisions by following one move after another, such as focus shifts, search term relationships, error recovery, and so on.^[13]

Search strategies in Web search engine environments have their own characteristics. Search strategies that concentrate on query reformulation were generated based on log analysis: specified, generalized, parallel, building-block, dynamic, multitasking, recurrent, and format reformulation.^[14–16] Some of them are similar to search strategies in online database environments, such as specified, generalized, and building-block, but others show unique characteristics of search strategies in the Web search engine environment, such as multitasking, recurrent, dynamic, and others. In Web search engine environments, users sometimes perform different search tasks simultaneously; their searches are more dynamic, and they often apply the same search queries repeatedly. The Web environment also defines the unique design and features of the Web and Web searching. The 10 problem-solving strategies^[17,18] represent search strategies in Web searching: surveying, double-checking, exploring, link-following, back- and forward-going, shortcut-seeking, engine-using, loyal engine-using, engine-seeking, and meta-searching.

In order to further analyze the structure of strategies, researchers have explored dimensions of information-seeking strategies. A multifaceted classification of information-seeking strategies was first developed based on four behavioral dimensions consisting of the goal of the interaction (learn, select), method of interaction (scan, search), mode of retrieval (recognize, specify), and types of resources interacted with (information, meta-information). Each type of information-seeking strategy corresponded to a specific prototype of dialogue structure.^[19,20] The underlying common dimensions of browsing—scanning (looking, identifying, selecting, and examining), resource (meta-information, whole object, and part of object), goal (locate, confirm, evaluate, keep up, learn, curiosity, and entertain), and object (specific item, common items, defined location, general, and none)—were identified to illustrate nine patterns of browsing.^[21] Integrating research and empirical studies in different digital environments, dimensions of information-seeking strategies are

further illustrated by intentions, methods, entities, and attributes of interactions. Twelve types of intentions include identify, learn, explore, create, modify, monitor, organize, access, keep records, evaluate, obtain, and disseminate. Eleven types of methods consist of scan, manipulate, specify, track, select, survey, extract, compare, acquire, consult, and trial-and-error. While entities refer to what users intend to acquire or work on, attributes specify the traits/elements of these entities. Entities contain knowledge, concept/term, format, item/object/site, process/status, location, system, and human. Attributes are associated with entities; for example, specific, common, general, and undefined are attributes of data/information. Different combinations of the four dimensions represent a variety of information-seeking strategies that people engage in within an ISP.^[22]

Researchers further designed prototypes of IR systems consisting of different types of supportive techniques that have been identified, such as database summaries, navigable content tables, results clustering, and fielded query to support multiple types of information-seeking strategies. Moreover, a dialogue structure based on multiple types of information-seeking strategies was implemented into IR system design. The findings show that the supportive techniques and structure provide better support for multiple types of information-seeking strategies.^[23–25]

USAGE PATTERNS

Web searching adds new meaning to research on search strategies, in particular, the analysis of transaction logs. Unlike studies on search strategies, usage patterns identified in Web search engine environments focus on patterns of query formulation and reformulation based on analysis of transaction logs submitted to search engines. Patterns of query formulation and reformulation in Web search environments can be characterized in five ways: 1) short queries, 2) short sessions with minimum reformulations, 3) minimum use of operators and search modifiers, not always used correctly, 4) minimum viewing results, and 5) search topics ranging from entertainment, recreation, and sex to e-commerce.^[26–30] Log analysis is not limited to quantitative analysis; facets of query formulations were identified as well.

Usage patterns in different types of IR environments have also been compared. Both similarities and differences were identified. Short queries, short sessions, minimum view of search results, and similar unique queries were shown in Web search engine, Web page, and digital library environments. Search sessions vary in OPAC environments even though OPAC studies also exhibit short queries. More queries contain Boolean operators in digital library environments than in Web search engine environments.^[31,32] Wolfram and Xie^[33] defined the context of digital libraries as representing a hybrid of both “traditional” IR, using primarily bibliographic resources

provided by database vendors, and “popular” IR, exemplified by public search systems available on the World Wide Web. Usage of online databases in digital libraries reveals that users’ search topics were close to online databases and digital libraries but their search behaviors were more similar to searching Web search engines. In general, users engage in more extensive searching in more traditional IR environments, such as OPAC and online database environments.

Usage patterns in multimedia environments is an emerging area for research. Characteristics of multimedia search can be described as follows: 1) short queries with minimal usage of Boolean operators and advanced features occur frequently. 2) Among all the metadata, media format and copyright information are most searched. User knowledge and media formats affect users’ query formulation and reformulation.^[34–36] Clickthrough data are important indicators of user-system interactions. In particular, they provide implicit relevance feedback by users. Although there is disagreement on the accuracy of clickthrough data, multimedia clickthrough data are much more accurate in general than traditional text search clickthrough data. They have been demonstrated to have the functions of improving searches, suggesting queries, annotating resources, and offering relevance feedback.^[37–39]

More and more people use social media tools in searching and browsing information. In particular, browsing is the dominant user activity across social media. Social browsing is a unique behavior that people employ in using social media tools in which they browse their friend’s updated information, especially images. As a result, browsing friends’ pages increases the interactions among users.^[40–43] However, new users of social media use Facebook as a social searching tool to investigate people they met offline instead of using it as a social browsing tool.^[44] Among all the information in social media, factual, opinion, and recommendation information are the most frequently obtained information.^[45]

FACTORS AFFECTING INFORMATION SEARCHING

Information searching is influenced by different types of factors, in which four main types determine the selection and application of different search strategies: 1) user goal and task, 2) user knowledge structure, 3) design of IR systems, and 4) the social and organizational context.

As to task, complexity of task and stages of task play major roles in influencing search strategies. Task complexity has systematic relationships with the types of information, information channels, and sources needed. As the level of task complexity increases, more information channels and resources are required.^[46,47] Specifically, for a task involving less concepts, either a searching or browsing strategy is applied, although

searching plays a major role, and the interaction process is short; for a task involving more concepts, both browsing and searching strategies are combined, and the interaction process is long.^[48] The task stages, such as initiation, selection, exploration, formulation, collection, and presentation, on the one hand, affect physical actions, cognitive thoughts, and affective feelings and appropriate tasks.^[49] On the other hand, task stages such as prefocus, formulation, and postfocus decide changes in search tactics, term choices, and types of information, as well as relevance criteria.^[50–53] When users move to a more focused stage, they apply more specified search terms, additional operators, and additional tactics. The types of information they search ranging from background information, theories, and models to methods, specific information, and empirical research results. In addition, the familiarity of tasks, timeframe, and types of tasks affect how users plan and apply different types of information-seeking strategies in the IR process.^[54] Research has also demonstrated that different types of search tasks lead to the application of different types of information-seeking strategies.^[55–57]

Three types of knowledge are required for effective information searching: 1) IR knowledge, 2) domain knowledge, and 3) system knowledge. While domain knowledge helps users to develop an in-depth understanding of the search task and what they want, IR knowledge assists users to develop conceptual and procedural strategies.^[58] No doubt, experienced users apply better strategies and perform better than novice users in the ISP.^[59–62] Domain expertise was proved to affect search behaviors and strategies and search performance.^[63–66] Users in different disciplines have their unique characteristics in searching for information. For example, compared with scientists, humanities scholars engage in more searching for individual names, geographical and chronological terms, and unique terms in humanities.^[67] There are also intertwining relationships among different types of knowledge. For example, domain knowledge only influences search tactics of experienced searchers. Simultaneously, domain knowledge of users determines whether their retrieval knowledge has an impact on their search tactics.^[68]

In addition to users' knowledge structure, their cognitive abilities as part of personal information infrastructure, unavoidably, also control their search strategies.^[12] Cognitive styles, learning styles, and searching styles have been demonstrated as the main personal traits that influence search behavior and search performance.^[69–72] Learning styles affect users' selection of search tactics and their interaction strategies with help features of digital libraries.^[73,74] Simultaneously, cognitive styles and users' knowledge structure are interrelated with search performance and search behavior. For example, cognitive styles have more impact on experienced users than on novice users in their interactions with Web search engines.^[75]

The design of IR systems no doubt affects users in their selections of search strategies. Interfaces, computational mechanisms, and information objects are the main

components of IR systems that guide or impede users in their application of different search strategies. As partners of users in the ISP, IR systems—in particular, the design of interfaces—could direct users to more or fewer applications of certain strategies. At the same time, the availability or unavailability of certain features determines whether users could engage in certain strategies. Finally, the information objects that users interact with and the outcomes of interactions might influence their choices of next strategy. Many studies conducted in the Text Retrieval Conferences have compared IR systems with different designs, and the results demonstrate that the design of IR systems makes significant differences in users' application of search strategies and search performances. Researchers have enhanced their IR systems based on the results of the evaluation studies.

The social-organizational context also defines the environment that user-system interactions take place. Mainly, the work environment influences how users determine their search strategies in the search process. Dimensions of a working place, such as the goals and constraints, priorities, general functions, work processes, and physical objects, in particular, priorities, constraints, and business/work cycles, have an impact on users' choices of search strategies.^[54,76] In addition, cultural dimensions shape how users interact with IR systems.^[77]

SEARCH MODELS

Because it is difficult to differentiate search models and retrieval models, in particular interactive IR models as well as some of the information-seeking models that involve search components and process, 11 models in relation to information searching regardless of what terms are used by their original creators are presented here. These search models can be classified mainly into two types. The first type, which mainly illustrates ISPs, includes Ellis' model of information-seeking behaviors, Bates' berry-picking approach, Kuhlthau's model of the ISP, and Workman, Fiszman, Rindflesh, and Nahl's model of serendipitous information search. The second type, which emphasizes the factors that influence the process, consists of Fidel and Soergel's conceptual framework for online bibliographic retrieval, Vakkari's theory of the task-based IR process, Ingwersen and Järvelin's cognitive model, Belkin's episode model of interaction with texts, Saracevic's stratified interaction model, Xie's planned-situational interactive IR model, and Wang, Hawk, and Tenopir's multidimensional model of user-Web interaction. In order to avoid repetition, some of the search models are briefly discussed because they are also presented in other entries.

Ellis' Model of Information-Seeking Behaviors

Ellis^[78,79] developed a behavioral model of the information-seeking behaviors of academic social scientists. This

approach concentrates on the behavior instead of on cognitive activities. The six types of information-seeking characteristics are the key components of the model: 1) starting, 2) chaining, 3) browsing, 4) differencing, 5) monitoring, and 6) extracting. These characteristics cover the overall search process and indicate that users do engage in multiple types of information-seeking strategies. Ellis and Haugan^[80] further modeled the information-seeking patterns of engineers and research scientists in relation to their research activities in different phases and types of projects. Similar behavior patterns were identified from this group of users: surveying, chaining, monitoring, browsing, distinguishing, extracting, filtering, and ending. Ellis' model starts a new behavior approach to identify information-seeking patterns of users and cited widely by researchers who developed other search models.

Bates' Berry-Picking Approach

Continuing her work on search tactics, Bates^[81] illustrated the dynamic search process that searchers went through in the berry-picking approach (Fig. 1). It is one of the most cited approaches that not only identify the limitations of traditional IR models, but also characterize the complexity of the search process. It demonstrates that users engage in multiple information-seeking strategies in their search process. The berry-picking approach can be summarized with four characteristics: 1) searchers' queries evolve; 2) the search process is dynamic as people pick up berries instead of finding one retrieved set; 3) searchers apply multiple search strategies including footnote chasing, citation searching, examining journal runs, area scanning, performing subject and author searches in bibliographies

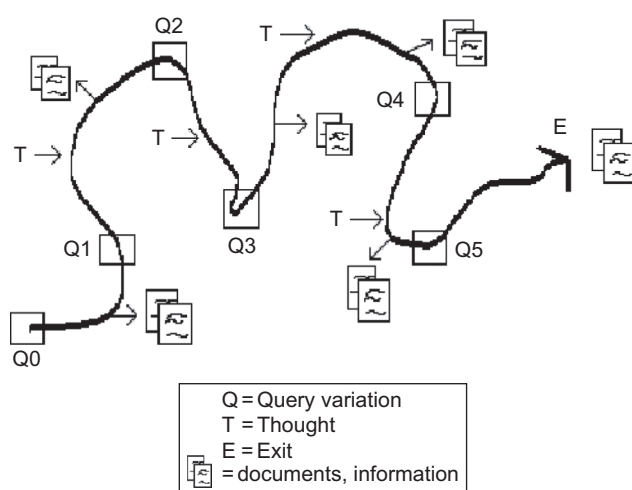


Fig. 1 Bates' berry-picking approach.
Source: From Bates,^[81] p. 410.

and abstracting and indexing services, and they shift their strategies during the search process; and 4) searchers access resources in different formats and content. The approach also outlines how to implement new search capabilities in the design of online search interfaces. Bates^[82] further developed the cascade model that describes several design layers, which have to be taken into account in the process of system implementation. Design decisions at each layer have a cascading impact on subsequent layers; therefore, the information content, its database structure, and retrievable elements are essential for effective IR. Bates' berry-picking approach sets up the foundation for interactive IR that considers search process as user-system interactions.

Kuhlthau's Model of the ISP

The ISP model was created based on a series of studies of users searching for information in different information-seeking situations.^[49] The ISP model consists of six stages of ISP with affective feelings, cognitive thoughts, and physical actions taken in each stage. The six stages comprise

1. Initiation and recognition of a need to search for information
2. Selection and identification of an appropriate topic or approach
3. Exploration of relevant information on the topic
4. Formulation of a more focused topic
5. Collection of pertinent information
6. Presentation and summarization of search results

Correspondently, affective feelings common to each stage change from uncertainty, optimism, confusion/frustration/doubt, clarity, sense of direction/confidence to satisfaction or disappointment; cognitive thoughts shift from vague to focused with increased interest; and actions range from exploring to documenting in seeking pertinent information. The ISP model has been widely tested and validated in a variety of digital environments.^[50-53,83-85]

Workman, Fuszman, Rindflesh and Nahl's Model of Serendipitous Information Search

Recently, researchers (Workman, Fiszman, Rindflesh and Nahl, 2014)^[86] have investigated serendipitous information seeking and information searching. A model was proposed to illustrate the interaction process occurring in serendipitous information search. It consists of four themes: the iterative process, changes or clarifications of initial information interests, user's prior knowledge, and information organization and presentations. Serendipitous information search is an interactive process including clarifying or changing a current topic, or introducing new topics, etc. The system output needs to be presented in

such a way as to associate users' new knowledge to prior knowledge. Information organization and presentation are the keys to facilitate opportunistic browsing.

Fidel and Soergel's Conceptual Framework for Online Bibliographic Retrieval

Fidel and Soergel^[87] presented a conceptual framework for online bibliographic retrieval. The framework highlights the main factors that affect the search process. Eight elements of the search process and interactions were identified including the setting, the user, the request, the database, the search system, the searcher, the searcher process, and the search outcome. The variables associated with these elements were systematically collected and analyzed: 1) the setting (e.g., organization's orientation, organization affiliations, subject area of the organization, organization mission, etc.); 2) the user (behavior, education, prior experience, attitude, etc.); 3) the request (degree of specificity, degree of difficulty, etc.); 4) the database (coverage, update frequency, thesauri availability, cross-reference listings, cost, etc.); 5) the search system (search aids, search support capabilities, search capabilities, etc.); 6) the searcher (cost consciousness, personality traits, cognitive factors, demographic variables, etc.); 7) the search process (interaction with the user, database selection, query formulation, termination of the search, etc.), and 8) the search outcome (quality of retrieved results, precision, recall, etc.). This framework identifies the main factors affecting online bibliographic retrieval and suggests possible relationships among the variables related to the search process. Although it is created specifically for the online bibliographic retrieval environment, it can also be applied to other digital environments.

Vakkari's Theory of the Task-Based IR Process

Vakkari's theory of the task-based IR process (Fig. 2) considers the ISP as part of the task performance process. This theory is derived from a series of longitudinal studies that investigate students' information-seeking process in their research proposal-writing process for their master's theses.^[50–52,88,89] Based on the results of a series of studies, this model illustrates how the task performance process, in particular stages of ISP, influences the information sought, search tactics applied, terms chosen, operators used, relevance judgments assessed, and documents obtained and used. It further enhances Kuhlthau's model of the ISP in terms of the relationships between stages of task and types of information searched for, changes in search tactics and terms, as well as relevance judgments. This theory systematically presents how tasks have impact on the search process.

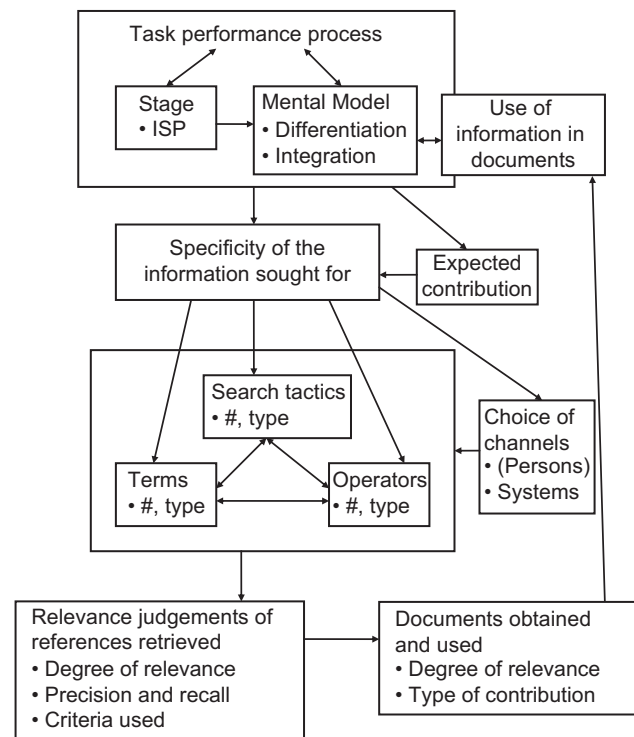


Fig. 2 Vakkari's theory of the task-based IR process.

Source: From Vakkari,^[88] p. 58.

Ingwersen and Järvelin's Cognitive Model

Ingwersen and Järvelin^[90] developed a cognitive framework of interactive information-seeking, retrieval, and behavioral processes (IS&R) (Fig. 3) based on Ingwersen's original work^[91,92] on the process of IR interaction. The new research framework places the cognitive actors or teams which bring their organizational, cultural, and social context to the interaction as the major component of the model instead of the searcher as the center of the interaction. The cognitive actors or teams include creators of information objects, indexers, designers of interfaces, designers of retrieval mechanisms, gatekeepers, searchers, and communities representing different groups. While the first four arrows (1–4) present the interaction process, the rest of the four arrows (5–8) reflect the different types of generation and transformation of cognition or cognitive influence. An information seeker's cognitive space, interacting with both social context and IR systems, plays a central role. Interaction and perception are the central processes of the model. "Models" in each of the components reflect the perception of interpretation of their own contexts by any actor or component of the framework in a certain situation. All the participating cognitive structures are interrelated. This is one of the most comprehensive frameworks that reflect the dynamics and complexity of information seeking and the retrieval process as well as associated factors.

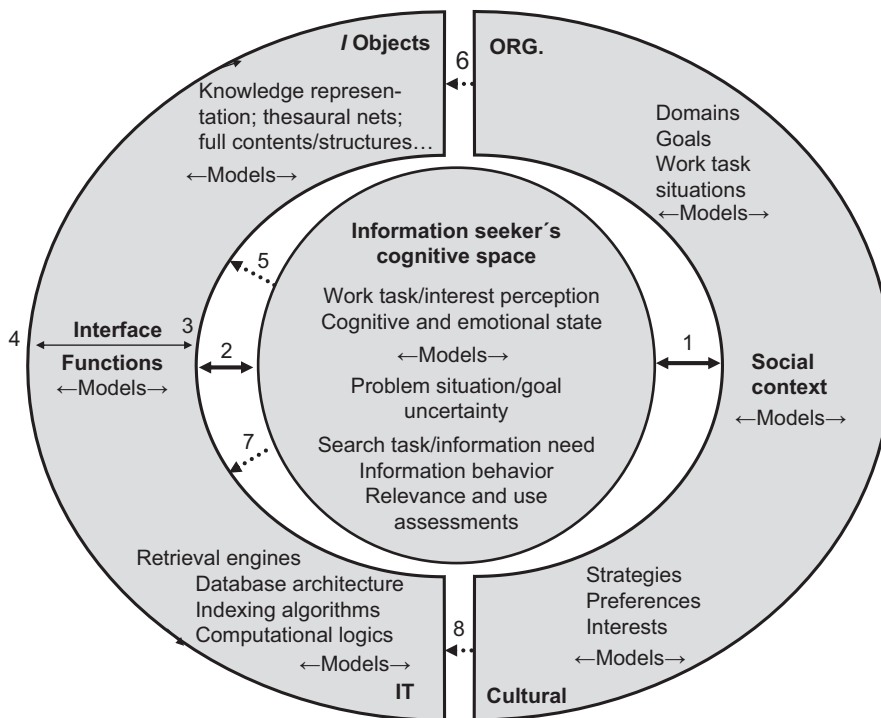


Fig. 3 Modified version of Ingwersen and Järvelin's complex cognitive framework of interactive IS&R.

Source: From Ingwersen and Järvelin,^[90] p. 274, Modified by P. Ingwersen, 2007.

Belkin's Episode Model of Interaction with Texts

Contrary to the traditional view of IR that people can specify their information needs and only engage in one type of information-seeking behavior, Belkin^[93] pointed

out that IR is interaction with texts. He^[94] proposed the episode model interaction with texts (Fig. 4), in which users' interaction with texts is the central process of IR. Belkin and his associates^[19,20] further classified information-seeking strategies into four behavior dimensions

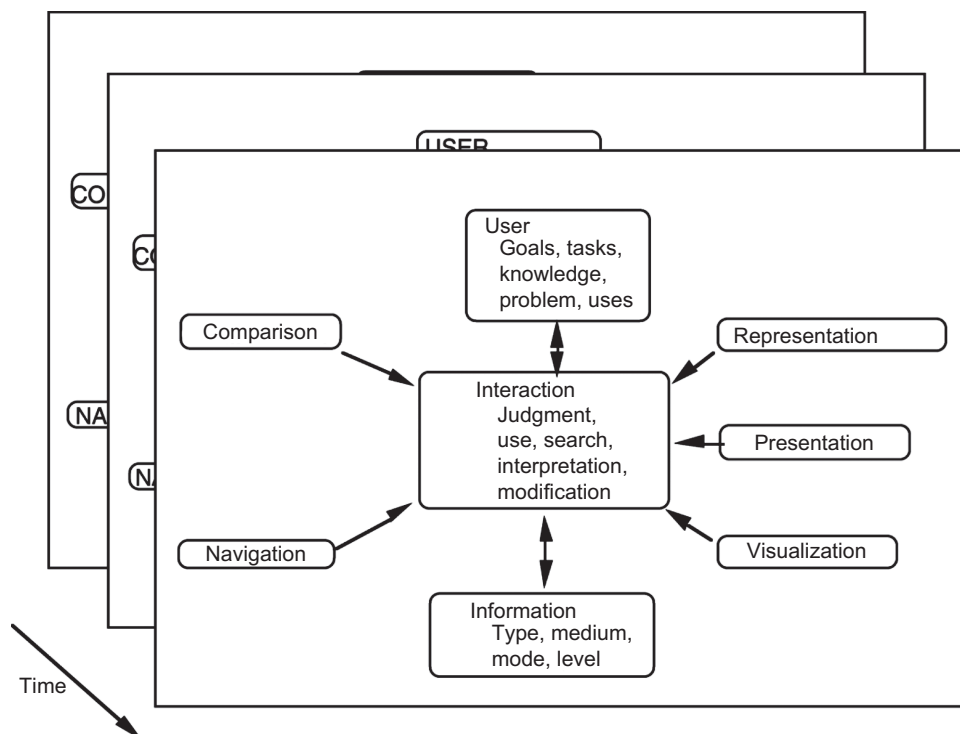


Fig. 4 Belkin's episode model of interaction with texts.

Source: From Belkin,^[93] p. 29.

(the goal of the interaction, method of interaction, mode of retrieval, and type of resource interacted with) and designed a dialog-based IR system that supports different types of information-seeking strategies. In this model, users' goals and tasks are the driving force for IR whereas representation, comparison, navigation, presentation, and visualization are the processes that facilitate users' interaction with texts. This model offers a theoretical framework for understanding how users interact with texts by applying multiple information-seeking strategies, and it further suggests how to design interactive IR systems to support multiple information-seeking strategies.

Saracevic's Stratified Interaction Model

Saracevic^[95,96] proposed and enhanced the stratified interaction model (Fig. 5) in which interaction of the interplay among different levels of users and systems is the central component. While users engage in cognitive, affective, and situational levels of interaction, system involvement includes engineering, processing, and content level. On the cognitive level, the interaction takes place between the cognitive structure of users and texts. On the affective level, users interact with intentions, beliefs, and motivation. On the situation level, users interact with tasks and problems that lead them to look for information. On the engineering level, the process level, and the content level, the hardware, software, and information resources are the foci for analysis, respectively. Users interact with IR systems via interfaces on the surface level by searching, browsing, navigating, organizing, and viewing search results, providing feedback, and other activities. Interactions not only take place at the surface level, but also occur at the deeper levels, which might also lead to changes at the surface level. The complexity and dynamic

interaction process requires changes and adaptations from both the user and system side. The main contribution of the stratified model is its identification of different levels of interactions from both the user and system side and their interplay.

Xie's Planned-Situational Interactive IR Model

Xie^[22] enhanced her previous work^[97,98] on the planned-situational interactive IR model derived from an empirical study. The planned-situational model of interactive IR (Fig. 6) is developed to illustrate how plans and situations codetermine users' applying and shifting different information-seeking strategies in their search process. User goal and task are the driving forces for people to look for information. Four levels of user goals are constructed: 1) long-term goal, 2) leading search goal, 3) current search goal, and 4) interactive intention. Dimensions of the work task (stages, timeframe, and nature) and search task (origination, type, and domain) are identified to characterize tasks. Higher levels of the goal/task impact lower levels of the goal/task. More important, levels of user goal and dimensions of tasks influence how users interact with IR systems. At the same time, information search requires users to apply different types of knowledge and skills into the search process. In addition, the social-organizational context defines the environment in which users interact with IR systems. Users and IR systems are the two partners of information searching. By interacting with the interfaces of IR systems, users interact with the information objects stored in these systems as well as with the computational mechanisms of the software and hardware of the systems.

Information-seeking strategies comprise interactive intentions and retrieval tactics, entities, and associated

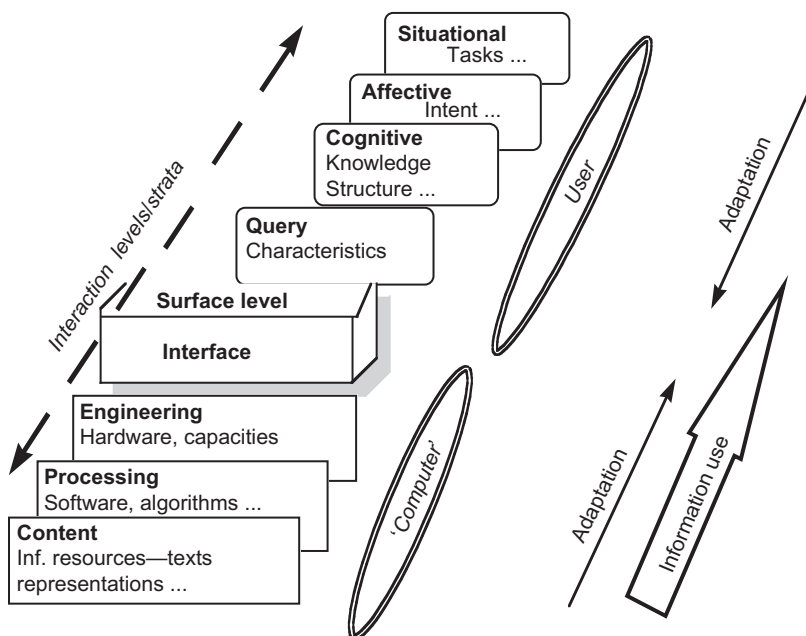


Fig. 5 Saracevic's stratified model of IR interaction.

Source: From Saracevic,^[95] p. 316.

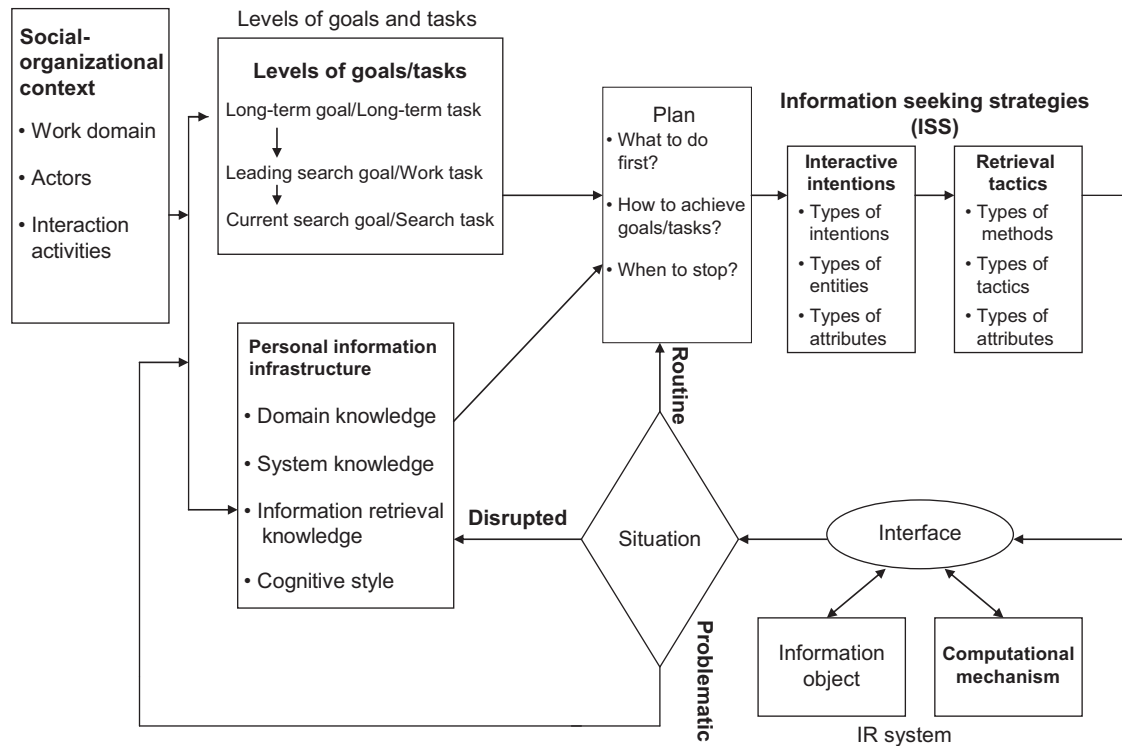


Fig. 6 Planned-situational interactive IR model.

Source: From Xie,^[22] p. 216.

attributes. Planned and situational aspects codetermine the selection and shifts in information-seeking strategies. Three types of situations (routine, problematic, and disruptive) lead to different types of shifts in information-seeking strategies. In a routine situation, the situation can be determined sufficiently with the aid of habitual knowledge. In a problematic situation, after associating the elements of situations with his/her knowledge and plans, further clarification of the open elements of the situation is required. A third type of situation is a “disruptive situation,” in which users do not encounter any problems, but they are distracted during the process of fulfilling their original current search goals/search tasks. The planned-

situational model was tested and validated by empirical studies.^[99–101] This model not only identifies the macro-level components for search and retrieval, but also uncovers shifts in information-seeking strategies and the factors that lead to the selection and shifts in information-seeking strategies at the micro level.

Wang, Hawk, and Tenopir’s Multidimensional Model of User–Web Interaction

Focusing on the Web environment, Wang et al.^[18] proposed a multidimensional model of user–Web interaction (Fig. 7). The model consists of the user, the interface, and

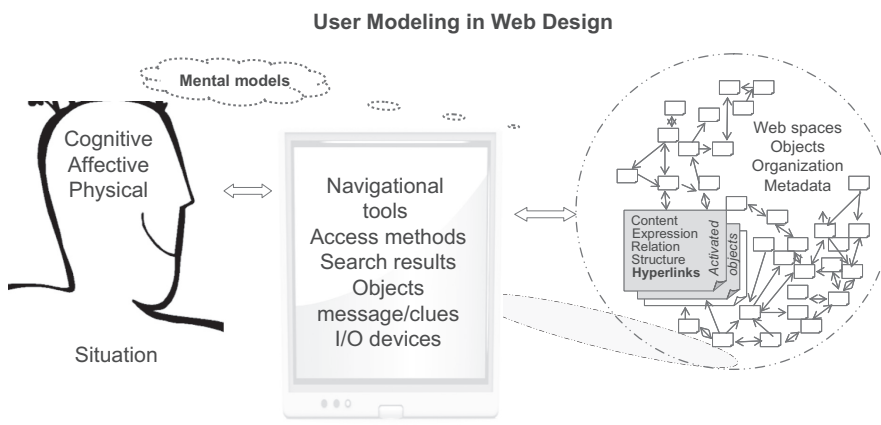


Fig. 7 Modified version of Wang, Hawk, and Tenopir’s multidimensional model of user–Web interaction in IR.

Source: From Wang et al.,^[18] p. 233. Modified by P. Wang, 2008.

the Web space. Among them, the user is the key component. Users are influenced by situation factors, cognitive behavior, affective state, and physical skills. The interface facilitates users' interactions with Web spaces. Access methods, navigation tools, access results/objects, messages/clues, and input/output devices are the elements of the interface. The Web elements contain objects, activated objects, Web spaces, organization schemes, and metadata. This model is further tested and validated by an exploratory study of graduate students' interaction with a university website. They identified approximately ten problem-solving strategies. The findings show that cognitive factors define how users analyze questions, construct search statements, and develop problem-solving strategies; affective factors affect how users adopt and use of strategies; and physical factors determine whether users can engage in efficient interactions. The multidimensional model of user-Web interaction defines how users search for information in the Web environment.

CONCLUSION

Information searching has evolved from searching for information using manual information systems to using electronic IR systems, as well as from intermediary search to end user search. Research has revealed the limitation of traditional IR research: the assumption that information searching is static and people only formulate queries in their search process. Furthermore, research has shown that the ISP is a dynamic one in which people apply multiple types of search strategies. Multimedia search and social media search have their own unique characteristics and challenges. Different levels of information searching, from search tactics/moves to search strategies and usage patterns, have been identified, as well as factors associated with task, user knowledge structure, system design, and the social and organizational context influencing the search process. More importantly, search models have been developed to illustrate either the dynamic search process or major elements that affect the search process. These models also offer suggestions for IR system enhancement and design.

Unsolved problems in research on information searching and search models still exist, however. First, although research on information searching helps reveal the nature of how people interact with different types of IR systems, very few findings of user studies have been applied to the design of IR systems and even less research has been done on testing the new designs. There is a big gap between user-oriented study and system-oriented design. More collaborative work is needed to incorporate and implement the design principles derived from user studies into IR system design and evaluation. Second, a variety of search models have been developed; the problem is that we may not be able to find a

one-size-fits-all model to account for all of the issues in the search process. Further research needs to examine how to integrate different types of search models and identify what is still missing. Third, the newer digital environments call for the need to search for multimedia information and information in different social media. More research is needed to identify search patterns in multimedia and cross-language retrieval. Finally, in order to facilitate users' easy adaptation to different digital environments, future research also needs to compare the similarities and differences of information searching in different digital environments and transform research results into IR system design.

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Information Society

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Abstract

The author problematizes the popular notion of “information society,” and demonstrates that the concept is vague and imprecise, even of dubious value. It may be, therefore, that a good deal of policy today is premised on somewhat shaky foundations. Five different definitions of an information society are presented, each of which presents criteria for identifying the new. These criteria are technological, economic, occupational, spatial, and cultural. The concepts of information and of theoretical knowledge are also addressed within the larger discussion.

INTRODUCTION

It has been commonplace for more than a decade now to say that those of us who inhabit advanced societies such as in North America, Japan, and Western Europe live in an “information society.” The claim that this is so comes routinely from politicians, educationalists, and industrialists, each of whom have concerns about how best to prepare for and compete in this information age. So familiar now is the term information society that it scarcely seems controversial: It is simply part of the accepted vocabulary of opinion leaders who currently comment on the state of the world, a taken-for-granted backcloth to more pressing issues of policy.

For the purposes of this entry, I step back from these more immediate matters deliberately to problematize the notion of the information society. I examine here more precisely than is usual what commentators actually mean when they use the term. As we shall see, when we delve a little, it becomes apparent that the concept is actually vague and imprecise, even of dubious value. Indeed, I shall argue here that the concept information society is inadequate and unhelpful when we try to establish the character of the era in which we live. This suggests, at the least, that a good deal of policy today is premised on somewhat shaky foundations.

We may proceed by distinguishing at least five different definitions of an information society, each of which presents criteria for identifying the new. These criteria are technological, economic, occupational, spatial, and cultural. Let us examine each in turn.

TECHNOLOGICAL

The most common definition of the information society lays emphasis upon spectacular technological innovation. The key idea is that breakthroughs in information

processing, storage, and transmission have led to the application of information technologies (IT) in virtually all corners of society. The major concern here is the astonishing reductions in the costs of computers, their prodigious increases in power, and their consequent application any and everywhere. Because it is now economical and feasible to put computers in typewriters, cars, cookers, watches, factory machines, televisions, kids’ toys... it follows that we are certain to experience social upheaval of such magnitude that we shall enter a new era. Many books, magazine articles, and television presentations have encouraged the development of a distinct genre that offers this viewpoint: the “mighty micro” will usher in an entirely new “silicon civilization.”

Somewhat more sophisticated versions of this technological route to the information society pay attention to the convergence and imbrication of telecommunications and computing (now termed ICT, information and communications technology). In these instances, the argument runs along the following lines: cheap information processing and storage technologies (computers) lead to their being extensively distributed; one of the major areas thus impacted is telecommunications, notably switching centers which, in being computerized, in effect, merge with the general development of computing and impel still more dramatic improvements of information management and distribution. This unification is especially fortuitous because the widespread dissemination of computers means that, for optimum use, they require connection. In short, the computerization of telecommunications means that it is increasingly the case that computer can be linked to computer: hence, the prospect of links between terminals within and between offices, banks, homes, shops, factories, schools, and the globe itself.

This scenario of networked computers is often compared to the provision of electricity: The “information grid” is seen as analogous to the electrical supply. As the electricity grid links every home, office, factory, and shop

to provide energy, so the information grid offers information wherever it is needed. This is, of course, an evolutionary process, but with the spread of an ISDN (integrated services digital network), we have the foundational elements of an “information society.” Once established, these information networks become the highways of the modern age, akin to the roads, railways, and canals of the Industrial Age. As the latter were crucial because they carried back and forth the materials and goods that made the Industrial Revolution, so an ISDN will provide the infrastructure supporting the key ingredient of the Postindustrial Society—information. The rapid growth of the Internet appears to bring about precisely this.

Undoubtedly, what we have here is a technological definition of an information society. Whether it is one that envisages this resulting from the impact of dramatically new technological innovations or as the outcome of a more incremental development of ISDN systems, all perceive technology to be the major distinguishing feature of the new order.

It is very tempting to dismiss technological approaches to the information society out of hand. There has been a surfeit of gee-whiz writing that, awed by the pace and magnitude of technological change, tells us that “the Computer Revolution... will have an overwhelming and comprehensive impact, affecting every human being on earth in every aspect of his or her life.”^[1] The genre of futurism that adopts this tone is characteristically full of “wake up” warnings, shallow analyses of the substantive realm, and the self-assurance that only the author has understood what most others have yet to comprehend. It presents but a poor case for the validity of technological measures.

Nevertheless, it is a recurrent account, one that appears in a seemingly cyclical manner. During the 1980s, amidst interest in the “microelectronics revolution,” this was offered by the likes of James Martin and Christopher Evans, and it gained much media attention. For a while it went out of fashion, only to return with heady talk of an “information superhighway” in the 1990s and in the breathless prose of MIT (Massachusetts Institute of Technology) researcher Nicholas Negroponte.^[2] However, if the likes of Alvin Toffler, Christopher Evans, and James Martin impel one toward rejection of technological criteria, it has to be acknowledged that very many more serious scholars adopt what is at root a similar approach. In Britain, for example, a much respected school of thought has devised a neo-Schumpeterian approach to change. Combining Schumpeter’s argument that major technological innovations bring about “creative destruction” with Kondratieff’s theme of “long waves” of economic development, these researchers contend that IT represents the establishment of a new epoch. This new “techno-economic paradigm”^[3] constitutes the Information Age that is set to mature early in the first century of the millennium.^[4,6]

Elsewhere, Piore and Sabel^[7,8] have suggested that it is the new technologies that provide the foundation for a

radically different way of working—“flexible specialization.” Thanks to communication and computer technologies, and the information edge they give to small firms now able quickly to assess markets and adroitly respond to them, the prospect is for an end to “mass production” and its replacement with customized products made by multiskilled and adaptable craftspeople.

It has to be conceded that, commonsensically, these technological definitions of the information society do seem appropriate. After all, if it is possible to see a “series of inventions”^[9]—steam power, the internal combustion engine, electricity, the flying shuttle, etc.—as key characteristics of the “industrial society,” then why not accept the virtuoso developments in IT as evidence of a new type of society? As John Naisbitt puts it: “Computer technology is to the information age what mechanization was to the industrial revolution.”^[10] And why not?

Technological definitions of the information society must encounter a number of well-founded objections. These include:

1. If technology is the main criterion for defining a society, then why not just call the emerging era a “high-tech society” or an “automated age?” Given the variety of possible ways in which one could describe a society in which IT predominates—Silicon Society? Cybernetic Society? Robotic Age?—why choose to designate it an “information society?” If technology is the key, then it is rather hard to see why it should need the prefix information attached. But then again the “technological society” scarcely evokes the idea of a new, or even significantly different, world that an information society does.
2. When one reads the literature that tells of profound and portentous changes that new technology is bringing about, one cannot but be struck by its palpable presence. Whether it is learning about the impact of the microelectronics revolution in the home, the consequences of robotics for the factory, or the tidal force of a “third wave” of computers, telecommunications and biotechnology that announce “the death knell of industrialism and the rise of a new civilisation,”^[11] there is a self-evident reality about the hereness of the new technologies. Since this is so, and each of us can see it with our own eyes, then it does seem obvious that the technologies are valid as distinguishing features of a new society.

But when one probes further, one cannot but be struck also by the astonishing vagueness of technology in most of these books. Asking for an empirical measure—In this society now, how much IT is there and how far does this take us toward qualifying for information society status? How much IT is required in order to identify an information society?—asking simply for a usable measure, one becomes aware that a good many of those who emphasize technology are

not able to provide us with anything so mundanely real-worldly or testable. It begins to appear, that it is everywhere. . .and nowhere, too.

This problem of measurement, and the associated difficulty of stipulating the point on the technological scale at which a society is judged to have entered an information age, is surely central to any acceptable definition of a distinctively new type of society. It is ignored by popular futurists: The new technologies are announced and it is unproblematically presumed that this announcement in and of itself heralds the information society. This issue is, surprisingly, also bypassed by other scholars who yet assert that IT is the major index of an information society. They are content to describe, in general terms, technological innovations, somehow presuming that this is enough to distinguish the new society.

There are, however, serious scholars who are not content with this and find that the issue of measurement causes considerable obstacles to progress. They encounter two particularly awkward problems. First, how does one measure the rate of technological diffusion, and, second, when does a society cease being “industrial” and enter into the “information” category? These are formidably difficult questions, and ones that should make enthusiasts for the information society scenario hesitate. For instance, in Britain, a decade of social science research by PICT (Programme on Information and Communication Technologies), one charged with mapping and measuring the information society, has not as yet produced any definitive ways of meeting its objectives.^[12,14] Certainly, there have been some advances, with several studies charting the diffusion of some IT into factories and offices.^[15] But how is one to assess this diffusion in more general terms: by expenditure on IT (Yet, given the tumbling prices of the new technologies, how is one to differentiate the economic variable from the more central element of information handling capacity?) or by the amount and range of IT introduced? Ought one to center on IT expenditure or on takeup per head, or is it better to examine this on an institutional basis? How is one to quantify the significance of the expansion of microcomputer applications vis-à-vis mainframe systems? And, if one opts to focus on the uptake of IT, just what is to count as a relevant technology? For instance, should video games come before personal computers, networked systems before robotic applications? Further, while one may be able to imagine a time at which some measures of “informatization” will have been developed that gain widespread assent, one will still be left with the serious query: Where along that graph is the break point that separates the information society from the merely “advanced industrial?”

3. Finally, critics object to those who assert that, in a given era, technologies are first invented and then, subsequently, impact on the society, thereby impelling people to respond by adjusting to the new. Technology in these versions is privileged above all else; hence, it comes to identify an entire social world: the Steam Age, the Age of the Automobile, the Atomic Age.^[16] The central objection here is not that this is unavoidably technologically determinist—in that technology is regarded as the prime social dynamic—and, as such, an oversimplification of processes of change. It most certainly is this, but more important is that it relegates into an entirely separate division social, economic, and political dimensions of technological innovation. These follow from, and are subordinate to, the premier league of technology that appears to be self-perpetuating though it leaves its impress on all aspects of society.

But, it is demonstratively the case that technology is not aloof from the social realm in this way. On the contrary, it is an integral—indeed constitutive—part of the social. For instance, research and development decisions express priorities, and, from these value judgments, particular types of technology are produced (e.g., military projects received substantially more funding than health work for much of the time in the twentieth century West—not surprisingly, a consequence is state-of-the-art weapon systems that dwarf the advances of treatment say of the common cold). Many studies have shown how technologies bear the impress of social values, whether it be in the architectural design of bridges in New York where heights were set that would prevent public transit systems accessing certain areas; the manufacture of cars that testify to the values of private ownership (as opposed to public transport), presumptions about family size (typically two adults, two children), attitudes toward the environment (profligate use of nonrenewable energy alongside pollution), and status symbols (the Porsche, the Mini, the Rover); or the construction of houses that are not just places to live but also expressions of ways of life, prestige and power relations, and preferences for a variety of lifestyles. Again, market power has an obvious influence on what gets manufactured technologically: corporations think of the customers and potential customers prior to production, so it is not surprising that there are limits to what gets made imposed by ability to pay criteria. By the same token, the corporate directors’ dictum, “curb costs, increase productivity, and lose heads,”^[17] has an obvious influence on what the engineers produce, thereby confounding the approach of those who presume that technology is the driving force of change.

There is an extensive literature on this issue that does not need to be labored. All that is required is to state the objection to the hypostatization of technology as applied to the issue of defining the information society. How can it

be acceptable to take what is regarded as an asocial phenomenon (technology) and assert that this then comes to define the social world when it is demonstrable that the dichotomy is implausible because technology is an integral part of the social world?

ECONOMIC

There is an established subdivision of economics that concerns itself with the “economics of information.” From within this, and indeed as a founder of this specialism, the late Fritz Machlup (1902–1983) devoted much of his professional life to the goal of assessing the size and growth of the information industries. Machlup’s pioneering work, *The Production and Distribution of Knowledge in the United States*,^[18] has been seminal in establishing measures of the information society in economic terms. Machlup attempted to trace the information industries in statistical terms. He distinguished 5 broad industry groups (broken down into 50 subbranches), namely:

1. education (e.g., schools, colleges, libraries).
2. media of communication (e.g., radio, television, advertising).
3. information machines (e.g., computer equipment).
4. information services (e.g., law, insurance, medicine).
5. other information activities (e.g., research and development).

Machlup, working with these sort of categories, then attempted to ascribe an economic value to each and to trace its contribution to gross national produce (GNP). If the trend is for these to account for an increased proportion of GNP, then one may claim to chart the emergence through time of an “information economy.” This is just what Machlup proposed in this early study,^[18] which calculated that 29% of the United States’ GNP in 1958 came from the knowledge industries—then a remarkable rate of expansion.

As early as the 1960s, management scholar Peter Drucker was contending that knowledge “has become the foundation of the modern economy” as we have shifted “(f)rom an economy of goods (to) . . . a knowledge economy.”^[19] It is commonplace to argue that we have evolved into a society where the “distinguishing characteristic . . . is that knowledge and organisation are the prime creators of wealth.”^[20]

Probably the best known—and certainly the most cited—study of the emergence of an information economy conceived on these lines comes in a nine-volume report from Marc Porat.^[21,22] In allocating industries to his five categories, Machlup had adopted catholic definitions of “knowledge production,” broadly including those that created new information and those that communicated it. Porat echoed much of Machlup’s approach in his reliance

on government statistical sources to design a computer model of the U.S. economy in the late sixties, but divided the economy between the “primary,” “secondary,” and “noninformation” sectors. This tripartite schema stemmed from his identification of a weakness in Machlup’s approach that failed to account for information activities that were disguised from initial examination; for example, because they are an in-house element of other industries. Porat included in the primary information sector all those industries that make available their information in established markets or elsewhere where an economic value can be readily ascribed (e.g., mass media, education, advertising, computer manufacture). Thus:

The primary information sector includes . . . industries that in some way produce, process, disseminate, or transmit knowledge or messages. The unifying definition is that the goods and services that make up the primary sector must be fundamentally valued for their information producing, processing, or distributing characteristics.^[23]

However, Porat then sought to identify a secondary information sector that would allow him to include in his typology important informational activities such as research and development inside a pharmaceutical company, information produced by government departments for internal consumption, and the library resources of an oil corporation. Thus:

The secondary information sector includes the informational activities of the public bureaucracy and private bureaucracies. The private bureaucracy is that portion of every noninformation form that engages in purely informational activities, such as research and development, planning, control, marketing, and recordkeeping. . . . The public bureaucracy includes all the informational functions of the federal, state, and local governments.^[23]

In this way, Porat is able to distinguish the two information sectors, then to consolidate them, separate out the noninformational elements of the economy, and, by reaggregating national economic statistics, is able to conclude that over 46% of the U.S. GNP is accounted for by the information sector. Ipso facto “The United States is now an information-based economy.” As such, it is an “information society (where) (t)he major arena of economic activity are the information goods and service producers, and the public and private [secondary information sector] bureaucracies.”^[23]

This quantification of the economic significance of information is an impressive achievement. It is not surprising that those convinced of the emergence of an information society’ have routinely turned to Machlup and especially Porat as authoritative demonstrations of a rising curve of information activity, one set to lead the way to a new age.

However, there are difficulties too with the economics of information approach.^[24] One is that, behind the weighty statistical tables that are resonant of objective demonstration, there is a great deal of hidden

interpretation and value judgement as to how to construct categories and what to include and exclude from the information sector.

In this regard, what is particularly striking is that, in spite of their marked differences, both Machlup and Porat create encompassing categories of the information sector that exaggerate its economic worth. There are reasons to question the worth of at least some of these categories. For example, Machlup includes in his “knowledge industries” the “construction of information buildings,” the basis of which presumably is that building for, say a university or a library is distinguishable from construction of warehouses meant to house tea or coffee. But how then is one to allocate the many buildings that, once constructed, change purposes (many university buildings, in the United Kingdom at least, are located in erstwhile domestic houses and stately homes, and one even in a former warehouse)?

Again, Porat is at some pains to identify the “quasi-firm” embedded within a noninformational enterprise. But is it acceptable, from the correct assumption that R&D in a petrochemical company involves informational activity, to separate this from the manufacturing element for statistical purposes? It is surely likely that the activities are blurred, with the R&D section intimately tied to production wings, and any separation for mathematical reasons is unfaithful to its role. More generally, when Porat examines his secondary information sector, he, in fact, splits every industry into the informational and noninformational domains. But such divisions between the thinking and the doing are extraordinarily hard to accept—where does one put operation of computer numerical control systems or the line management functions that are an integral element of production? To be sure, one could say that everything here involves information—and as we shall see, many writers identify the expansion of “managers” and “white collar” work tout court as reason for the coming of an information society—but that is not the point. The objection here is that Porat divides, arbitrarily, within industries, to chart the secondary information sector as opposed to the noninformational realm.

Such objections may not entirely invalidate the findings of Machlup and Porat, and they are not intended to do that, but they are a reminder of the unavoidable intrusion of value judgments in the construction of their statistical tables. As such, they lend support to a healthy skepticism toward ideas of an emergent information economy.

A second difficulty is that the aggregated data inevitably homogenize very disparate economic activities. In the round, it may be possible to say that growth in the economic worth of advertising and television is indicative of an information society, but one is left with an urge to distinguish between informational activities on qualitative grounds. In asking which economically assessed characteristics are more central, are more strategic, to the emergence of an information society, one is requesting scholars to distinguish between, say information stemming from

policy research centers, corporate think tanks, transnational finance houses, manufacturers of 35-mm cameras, software designers, and advertising copywriters.

The enthusiasm of the information economists to put a price tag on everything has the unfortunate consequence of failing to let us know the really valuable dimensions of the information sector. This search to differentiate between quantitative and qualitative indices of an information society is not pursued by Machlup and Porat, though on a commonsensical level, it is obvious that the 4 million daily sales of the *The Sun* cannot be equated with—still less, be regarded as more informational, though doubtless it is of more economic value—the 400,000 or so circulation of *The Financial Times*. It is a distinction to which we shall return, but one that suggests the possibility that we could have a society in which, as measured by GNP, informational activity is of great weight, but that in terms of the springs of economic, social, and political life, is of little consequence. A nation of couch potatoes and Disney-style pleasure seekers consuming images night and day?

Of course, these economists are concerned solely with developing quantitative measurements of the information sector, so the issue of the qualitative worth of information would be of limited relevance to them. However, even on their, own terms, there are problems. One, mentioned earlier, is the question “at which point on the economic graph does one enter an information society?” When 50% of GNP is dedicated to informational activities? This may seem to be a reasonable point, one at which, in straightforward quantitative terms, information begins to predominate. Sadly for information society theorists, however, we are some distance even from that point. Replication studies of Machlup and Porat lead one to qualify any initial sighting of the new age. In a large scale update of Machlup’s study, Rubin and Huber concluded that, in the United States, the contribution of “knowledge industries” to GNP increased from 28.6% to 34.3% between 1958 and 1980, with virtually no change since 1970, this constituting an “extremely modest rate of growth relative to the average rate of growth of other components of total GNP.”^[25] These econometric studies scarcely trumpet the arrival of an information society.

OCCUPATIONAL

A popular measure of the emergence of an information society is the one that focuses on occupational change. Put simply, the contention is that we have achieved an information society when the predominance of occupations is found in information work. That is, the information society has arrived when clerks, teachers, lawyers, and entertainers outnumber coal miners, steelworkers, dockers, and builders. The intellectual groundwork for this conception of the information society was done by Daniel

Bell (1919–) in the 1960s, but it is worth stressing that this definition is presently enjoying much popularity as concern has shifted from a technological measure toward an occupational notion. The emphasis here is on enterprising deal makers, people who “think smart” and quickly in a fast-changing world. Reich^[26,27] has called these “symbolic analysts,” those who do the thinking, planning, innovation, and organization of the “new economy.” They may work in the “creative industries” (media, design, arts), consultancy, or general management, but a popular idea is that such information workers are key to future prosperity. What they have in common is high-level education, and, accordingly, a priority is placed by national governments on the capability of their own education systems to produce such people.^[28]

The occupational definition is frequently combined with an economic measure. Porat, for example, whose work we discussed in the previous section, calculated that by the late 1960s, a little under half the U.S. labor force was to be found in the information sector, a growth of almost 500% during a century in which agricultural employment has plummeted and information occupations have massively expanded. Porat connects the growth in economic significance of information with changing occupational patterns as follows:

In 1967, 25.1% of the U.S. GNP originated with the production, processing, and distribution of information goods and services sold on markets. In addition, the purely informational requirements of planning, coordinating, and managing the rest of the economy generated 21.1% of the GNP. These informational activities engaged more than 46% of the work force, which earned over 53% of all labor income. On the strength of these findings, we call ours an “information economy.”^[23]

On the surface, the changing distribution of jobs seems an appropriate measure. After all, it appears obvious that as work that demands physical strength and manual dexterity, such as hewing coal and farming the land, declines to be replaced by more and more manipulation of figures and text, such as in education and large bureaucracies, then so we are entering a new type of society. Today “(o)nly a shrinking minority of the labour force toils in factories. . . and (t)he labour market is now dominated by information operatives who make their living by virtue of the fact that they possess the information needed to get things done.”^[29]

Most identifiers of an information society draw on occupational changes as indices of the approach of a new age, as many probably as see it in the introduction of new technologies. And, a great number combine the two, regarding new technologies and new informational occupations almost as synonymous. However, it should be noted that the occupational definition is by no means the same as one that identifies an information society by the take-up of new technologies. Many information occupations (e.g., solicitors, teachers) may use little IT,

while many distinctly noninformational jobs have been impacted dramatically by new technologies (e.g., factory operatives, supermarket checkout workers).

The shift in the distribution of occupations is at the heart of the most influential theory of the information society. Here Bell^[30] sees, in the emergence of “white collar society” (and, hence, information work) and in the decline of industrial labor changes as profound as the end of class-based political conflict, more communal consciousness and the development of equality between the sexes.

Robins and I^[31] have criticized Bell’s theorization elsewhere, but here it is appropriate to raise some general objections to occupational measures of the information society. A major problem concerns the methodology for allocating workers to particular categories. The end product—a bald statistical figure giving a precise percentage of “information workers”—hides the complex processes by which researchers construct their categories and allocate people to one or another.

Porat, for instance, develops what has become an influential typology to locate occupations that are primarily engaged in the production, processing, or distribution of information. His is a three-fold scheme that encompasses over 400 occupational types that are reported by the U.S. Census and Bureau of Labor Statistics. He explains it as follows:

The first category includes those workers whose output as primary activity is producing and selling knowledge. Included here are scientists, inventors, teachers, librarians, journalists, and authors. The second major class of workers covers those who gather and disseminate information. These workers move information within firms and within markets; they search, coordinate, plan, and process market information. Included here are managers, secretaries, clerks, lawyers, brokers, and typists. The last class includes workers who operate the information machines and technologies that support the previous two activities. Included here are computer operators, telephone installers, and television repairers.^[23]

Jonscher^[32] simplifies this further still, discerning just two sectors of the economy: the first, an “information sector,” is where people whose prime function is creating, processing, and handling information; the second, a “production sector,” is where workers are found who chiefly create, process, and handle physical goods. These distinctions appear reasonable, precise, and empirically valid, but there are difficulties. Not least is something of which Porat is well aware, namely that “(s)tating precisely who is an information worker and who is not is a risky proposition.”^[23] Indeed, it is, since every occupation involves a significant degree of information processing and cognition. Porat acknowledges this in his attempt to distinguish noninformational from informational labor on the basis of estimating the degree to which each type is involved with information. In other words the categorization is a matter

of judging the extent to which jobs are informational or not. Crude percentages of information workers thus disguise the fact that they are the outcome of the researcher's estimations. As Porat puts it: when "we assert that certain occupations are primarily engaged in the manipulation of symbols. . . It is a distinction of degree, not of kind."^[22]

For example, the railway signalman must have a stock of knowledge about tracks and timetables, about roles and routines; he needs to communicate with other signalmen down the line, with station personnel and engine drivers; he is required to "know the block" of his own and other cabins, must keep a precise and comprehensive ledger of all traffic that moves through his area, and has little need of physical strength to pull levers since the advent of modern equipment. Yet, the railway signalman is, doubtless, a manual worker of the Industrial Age. Conversely, the person who comes to repair the photocopier may know little about products other than the one for which he has been trained; may well have to work in hot, dirty, and uncomfortable circumstances; and may need considerable strength to move heavy machinery and replace damaged parts. Yet, he will undoubtedly be classified as an information worker since his work with new age machinery suits Porat's interpretations.

The point to be made here is simple: We need to be skeptical of conclusive figures that are the outcomes of researchers' perceptions of where occupations are to be most appropriately categorized. As a matter of fact, social scientists know very little about the detail and complexity of people's jobs; there are precious few ethnographies that record the stuff of working lives.^[33] And, researchers trying to label information and noninformation work are just as much in the dark as the rest of their social science colleagues.

One needs also to beware the oversimplifications that can come from allocating a wide variety of jobs to the same pigeonholes. Miles rightly observes that "(t)he categories of work subsumed under the different headings are often extremely heterogeneous."^[34] When one considers, for example, that Porat's first category (information producers) lumps together opticians, library assistants, composers, paperback writers, university professors, and engineers, while his second (information distributors) subsumes journalists on quality newspapers with deliverers on the street, and when the OECD (Organization for Overseas Co-operation and Development) puts together as information producers physicists, commodity brokers, and auctioneers, then one may well have doubts about the value of this composition of occupations as a means of identifying social change. Further, what of the diversity of occupations, each with the same title? Librarian, for example, can encompass someone spending much of the day either issuing books for loan or reshelving returns, as well as someone routinely involved in advising academics on the best sources of information for progressing state-of-the-art research. Again, the title journalist covers a range from hacks specializing in the sex lives of celebrities, cub reporters

describing local weddings, to feature writers whose work can match the best analyses of university professors. Is it really sensible to lump together such diversity?

Finally, an important consequence of this homogenization is a failure to identify the more strategically central information occupations. While the methodology may provide us with a picture of greater amounts of information work taking place, it does not offer any means of differentiating the most important dimensions of information work. The pursuit of a quantitative measure of information work disguises the possibility that the growth of certain types of information occupation may have particular consequences for social life.

I alluded to this distinction when commenting on economic measures of an information society, but it is especially pertinent as regards occupational measures since some commentators seek to characterize an information society in terms of the "primacy of the professions,"^[30] while still others focus on alternative sources of strategically central information occupations. It has to be said that counting the number of information workers in a society tells us nothing about the hierarchies—and associated variations in power and esteem—of these people. For example, it could be argued that the crucial issue has been the growth of computing and telecommunications engineers since these may exercise a decisive influence over the pace of technological innovation. A similar, perhaps even greater, rate of expansion in social workers to handle problems of an aging population, increased family dislocation and juvenile delinquency may have little or nothing to do with an information society, though undoubtedly social workers would be classified with IT engineers as information workers.

Or it may be argued that it is an "inner circle"^[35–37] of corporate leaders, quite different from their predecessors, which is the most decisive index of the information society. These are people who are empowered by communicative skills, analytical abilities, foresight, and capacities to formulate strategic policies, who also enjoy privileged educational backgrounds, connections through shared clubs and boardroom affiliations, plus access to sophisticated information and communications technologies. All of this provides them with extraordinary leverage over social, economic, and political affairs at the national and even the international level. They are information specialists but radically different from the run-of-the-mill information workers with whom crude quantitative methodologists would lump them.

Perhaps we can better understand this need to qualitatively distinguish between groups of information workers by reflecting on a study by social historian Harold Perkin. In *The Rise of Professional Society*, Perkin argues that the history of Britain since 1880 may be written largely as the rise to preeminence of "professionals" who rule by virtue of "human capital created by education and enhanced by... the exclusion of the unqualified." Perkin contends

that certified expertise has been “the organising principle of post-war society,”^[38] the expert displacing once-dominant groups (working class organizations, capitalist entrepreneurs, and the landed aristocracy) and their outdated ideals (of co-operation and solidarity, of property and the market, and of the paternal gentleman) with the professional’s ethos of service, certification, and efficiency. To be sure, professionals within the private sector argue fiercely with those in the public, but Perkin insists that this is an internecine struggle, one within “professional society,” which decisively excludes the nonexpert from serious participation and shares fundamental assumptions (notably the primacy of trained expertise and reward based on merit).

Alvin Gouldner’s discussion of the “new class” provides an interesting complement to Perkin’s. Gouldner identifies a new type of employee that has expanded in the twentieth century, a new class that is “composed of intellectuals and technical intelligentsia,”^[39] who, while in part self-seeking and often subordinate to powerful groups, can also contest the control of established business and party leaders. Despite these potential powers, the new class is itself divided in various ways. A key division is between those who are for the most part technocratic and conformist, and the humanist intellectuals who are critical and emancipatory in orientation. To a large extent, this difference is expressed in the conflicts identified by Perkin between private- and public-sector professionals. For instance, we may find that accountants in the private sector are conservative, while there is a propensity for humanistic intellectuals to be radical.

Our main point here is that both Gouldner and Perkin are identifying particular changes within the realm of information work that have especially important consequences for society as a whole. To Gouldner, the new class can provide us with vocabularies to discuss and debate the direction of social change, while to Perkin, the professionals create new ideals for organizing social affairs.

If one is searching for an index of the information society in these thinkers, one will be directed to the quality of the contribution of certain groups. Whether one agrees or not with either of these interpretations, the challenge to definitions of an information society on the basis of a count of raw numbers of information workers should be clear. To thinkers such as Perkin and Gouldner, the quantitative change is not the main issue. Indeed, as a proportion of the population, the groups they lay emphasis upon, while they have expanded, remain distinct minorities. Tiny in the case of Useem’s “inner circle” and more numerous where the growth of professions is identified but never more than 20% or 25% of the workforce.

SPATIAL

This conception of the information society, while it draws on sociology and economics, has at its core the geographer’s distinctive stress on space. Here, the major

emphasis is on the information networks that connect locations and, in consequence, have dramatic effects on the organization of time and space. It has become an increasingly popular index of the information society, largely because of a remarkable trilogy written by Manuel Castells titled *The Information Age (1996–1998)* in which he describes a “network society.”^[40,41]

Goddard^[42,43] identifies several interrelated elements in the transition to an information society. These include:

- Information is coming to occupy center stage as the “key strategic resource” on which the organization of a world economy is dependent.

The modern world demands the coordination of globally distributed manufacture, planning across and between sovereign states, and marketing throughout continents. What might be called the globalization of enterprise—from production, through distribution, to marketing—means that economic (and other) affairs are increasingly conducted on a world scale. As historian Eric Hobsbawm has observed, especially from the 1960s, a world economy began to come into existence “which actually has no specifiable territorial base or limits,” and by the early 1970s, such a transnational economy became an effective global force. The inexorable logic of this for the participants, chiefly transnational corporations that are “the dominant forces in the world economy,”^[44] is to develop global strategies and mechanisms to maximize their comparative advantages. Information, or what Peter Dicken calls the “circulation activities” that “connect the various parts of the production system together,”^[44] is axial to these diverse activities, thus of heightened importance in the contemporary world. It follows too that “information management” is of exceptional pertinence and that, as a result, we witness the rapid expansion of information occupations.

- Computer and communications technologies provide the infrastructure that enables information to be processed and distributed. These technologies allow information to be handled on an historically unprecedented scale, to facilitate instantaneous and real-time trading, and to monitor economic, social, and political affairs on a global stage.
- There has been an exceptionally rapid growth of the “tradeable information sector” of the economy, by which Goddard means to highlight the explosive growth of services such as new media (satellite broadcasting, cable, video) and on-line databases providing information on a host of subjects ranging from stock market dealings, commodity prices, patent listings, currency fluctuations, to scientific and technological journal abstracts.

Complementing these developments has been the radical reorganization of the world’s financial system that has

resulted in the collapse of traditional boundaries that once separated banking, brokerage, financial services, credit agencies, and the like. Inside this bewildering world of high finance—which few people understand and still fewer appear able to control—circulates, in electronic form, dazzling sums of capital (one estimate suggests there are \$2 trillion Eurodollars in the system, though there were none just over a generation ago^[45]). It might be hard to conceptualize, but it is difficult to underestimate the import of the growth of an integrated global financial market. With sophisticated IT systems now in place, plus the deregulation of stock markets and the abolition of exchange controls, we now have facilities for the continuous and real-time flow of monetary information, for round-the-clock trading in stocks, bonds, and currencies. The scale and speed of these information flows is astonishing. Hutton,^[46] for instance, observes that foreign exchange turnover dwarfs the size of national economies and makes trade flows (a traditional method of measuring national economic activity in terms of import and export levels) appear small in comparison. Thus “the total level of world merchandise trade in 1993 is two-thirds of US Gross Domestic Production; it will take turnover in the foreign exchange markets less than a fortnight to reach the same total.”^[46]

Courtesy of immediate and effective information processing and exchange economics has become truly global and with this has come about a reduction in the constraints of space. Companies can now develop global strategies for production, storage, and distribution of goods and services; financial interests operate continuously, respond immediately, and traverse the globe. The boundaries erected by geographical location are being pushed further and further back—and with them too the limitations once imposed by time—thanks to the virtuoso ways in which information can be managed and manipulated in the contemporary period.

Such developments emphasize the centrality of information networks linking together locations within and between towns, regions, nations, continents and, indeed, the entire world. As the electricity grid runs throughout an entire nation, extending down to the individual household, so too we may envisage now a “wired society”^[47] operating at the national, international, and global level to provide an “information grid”^[48] to each home, shop, or office. Increasingly, we are all connected to the network—which itself is expanding its reach and capacities. We come across it personally at many levels: in electronic point of sale terminals in shops and restaurants, in accessing data across continents, in e-mailing colleagues, or in exchanging information on the Internet. We may not personally experience it, but the ‘information ring main’ functions still more frantically at the level of international banks, intergovernmental agencies, and corporate relationships.

In many writings, emphasis is put on the technological bases of the information network.^[49] Perhaps predictably

then with these accounts of an emerging network society considerable attention is given to advances in and obstacles to the development of an ISDN infrastructure.^[50] However, notwithstanding the importance of technology and actually providing a salutary reminder of the easily neglected centrality of telecommunications to IT developments, most thinkers concerned with the emergence of a “network marketplace” place stress on ways in which networks underline the significance of the flow of information.^[40]

The salient idea here is of information circulating along electronic “highways.” Interestingly, no one has been able to quantify how much and at what rate information must flow along these routes to constitute an information society. In fact, no one has produced reliable figures capable of giving us an overall understanding of information traffic.^[51] We have data on telephone density in relation to population, figures on the expansion of facsimile services, statistics for sales of computer systems, automated telecommunications exchanges, and so on, but lack a clear picture of the size, capacity, and use of the networks.

Nevertheless, all observers are aware of a massive increase in transborder data flows, in telecommunications facilities, in communications between computers at every level from home to transnational organization, in exchanges between stock markets and corporate segments, in access to international databases, in telex messages, and in uptake of the Internet. Similarly, there is considerable awareness of increases in the global distribution of mass mediated information: satellite television being the obvious and preeminent example, though one would also have to include news gathering and distribution services in any adequate picture. As Mulgan has it, “the networks carry an unimaginable volume of messages, conversations, images and commands”^[52]

Why much greater volume and velocity of information flows should impel us to think in terms of the constitution of a new type of society returns us to the geographer’s special concern with space. All things happen in particular places and at specific times, but the characteristics of space and time have been transformed with the advent of the network society. Where once trade was cumbersome and slow moving across distances, nowadays it can be effected instantaneously with computerized communications technologies; where once corporate activity had to be coordinated by slow-moving letter that took days and even weeks to cross the space that divided the interested parties, nowadays it takes place in real time courtesy of sophisticated telecommunications and video-conference facilities.

A world built on networks calls into question older conceptions of space and power. Where the early market economies grew out of the temporal and spatial regularities of city life, today’s are built on the logical or “virtual” regularities of electronic communications, a new geography of nodes and hubs, processing and control centers.

The nineteenth century's physical infrastructure of railways, canals, and roads are now overshadowed by the network of computers, cables, and radio links that govern where things go, how they are paid for, and who has access to what.^[52]

In short, the constraints of space have been dramatically limited, though certainly not eliminated. And, simultaneously, time has itself been "shrunk" as contact via computer communications and telecommunications is immediate. This "time/space compression," as Giddens^[53] terms it, provides corporations, governments, and even individuals with hitherto unachievable options.

No one could deny that information networks are an important feature of contemporary societies: Satellites do allow instantaneous communications round the globe; databases can be accessed from Oxford to Los Angeles, Tokyo, and Paris; facsimile machines and interconnected computer systems are a routine part of modern businesses.

Yet, we may still ask: Why should the presence of networks lead analysts to categorize societies as information economies? And, when we ask this, we encounter the problem of the imprecision of definitions once again. For instance, when is a network a network? Two people speaking to one another by telephone or computer systems transmitting vast data sets through a packet switching exchange? When an office block is "wired" or when terminals in the home can communicate with local banks and shops? The question of what actually constitutes a network is a serious one and it raises problems not only of how to distinguish between different levels of networking but also of how we stipulate a point at which we have entered a network/information society.

Finally, one could argue that information networks have been around for a very long time. From, at very least, the early days of the postal service, through to telegram and telephone facilities, much economic, social, and political life is unthinkable without the establishment of such information networks. Given this long-term dependency and incremental, if accelerated, development, why should it be that in the 1980s commentators began to talk in terms of information societies?

CULTURAL

The final conception of an information society is perhaps the most easily acknowledged, yet the least measured. Each of us is aware, from the pattern of our everyday lives, that there has been an extraordinary increase in the information in social circulation. There is simply a great deal more of it about than ever before.

Television has been in extensive use for well over 40 years in Britain, but now its programming is pretty well round-the-clock, people being able to watch from breakfast time until the early morning. It has expanded from a single channel and discontinuous service to include now

five broadcast channels, while digitalization of television, now well advanced, will bring a huge increase of channels within the next decade or so. This has been enhanced to incorporate video technologies, cable and satellite channels, and even computerized information services such as teletext. An avalanche of computerized games has become attached to Personal Computers and virtual reality products have begun to enter the home. There is very much more radio output available now than even a decade ago, at local, national, and international levels. And radios are no longer fixed in the front room, but spread through the home, in the car, in the office, and, with the walkman, everywhere. Movies have long been an important part of people's information environment and, indeed, attendances at cinemas have significantly declined. But movies are today very much more prevalent than ever: available still at cinema outlets, broadcast on television, readily borrowed from video rental shops, cheaply purchased from the shelves of chain stores. Walk along any street and it is almost impossible to miss the advertising displays, the billboards, and the window arrangements in shops. Visit any railway or bus station and one cannot but be struck by the widespread availability of paperback books and inexpensive magazines—their subject matter ranging from classical, pulp fiction, middlebrow, to self-therapy—a scale and scope without precedent. In addition, audiotape, compact disc and radio all offer more, and more readily available, music, poetry, drama, humor, and education to the general public. Newspapers are extensively available and a good many new titles fall on our doorsteps as free sheets. Junk mail is delivered daily.

All of this testifies to the fact that we inhabit a media-laden society, but the informational features of our world are more thoroughly penetrative than a short list of television, radio, and other media systems suggests. This sort of listing implies that new media surround us, presenting us with messages to which we may or may not respond. But, in truth, the informational environment is a great deal more intimate, more constitutive of us, than this suggests. One may consider, for example, the informational dimensions of the clothes we wear, the styling of our hair and faces, the very ways in which, nowadays, we work at our image (from body shape to speech, people are intensely aware of the messages they may be projecting and how they feel about themselves in certain clothes, with a particular hairstyle, etc.). A few moment's reflection on the complexities of fashion, the intricacy of the ways in which we design ourselves for everyday presentation, makes one well aware that social intercourse nowadays involves a greater degree of informational content than previously.

To be sure, there has long been adornment of the body, clothing, and makeup being important ways of signaling status, power, and affiliation. But, it is obvious that historically the present age has dramatically heightened the symbolic import of dress and the body. When one considers the lack of range of meaning that characterized the

peasant smock that was the apparel of the majority for centuries, and the uniformity of the clothing worn by the industrial working class in and out of work up to the 1950s, then the veritable explosion of meaning in terms of dress since then is remarkable. The availability of cheap and fashionable clothing, the possibilities of affording it, and the accessibility of any amount of groups with similar—and different—lifestyles and cultures (divided by age, gender, race, ethnicity, affluence, region, etc.) all make one appreciate the informational content even of our bodies.

Homes too are informational laden in an historically singular way. Furniture, layout, and decorative design all express ideas and ideals: the G-plan style, the Laura Ashley settee, the William Morris wallpaper and the mixing of some and all of these according to choice and budget. Certainly, since the days of the Industrial Revolution, homes have signified ways of life—one thinks, for example, of the style of the “respectable” working class of the late Victorian period or the distinctive design of the professional middle classes between the wars. But, it is the explosion in variety, and the accessibility of it to a great many, that is most remarkable. With this has come an astonishing vista of signification.

This intrusion of information into the most intimate realms of home, bedroom and body is complemented by the growth of institutions dedicated to investing everyday life with symbolic significance. One thinks of the global advertising business, of publishing empires, of the fashion industry, of worldwide agencies of media production that bring to the domestic scene reflections of our own ways of life and images of other lifestyles, thereby presenting us with alternative meanings that may be absorbed, rejected, and reinterpreted by people, but all the time adding to the vocabulary of the symbolic environment.

Contemporary culture is manifestly more heavily information laden than any of its predecessors. We exist in a media-saturated environment that means that life is quintessentially about symbolization, about exchanging and receiving—or trying to exchange and resisting reception—messages about ourselves and others. It is in acknowledgment of this explosion of signification that many writers conceive of our having entered an information society. They rarely attempt to gauge this development in quantitative terms but rather start from the “obviousness” of our living in a sea of signs, one fuller than at any earlier epoch.

It is not difficult to explain why this should be so. For most of history, people would have lived in relatively fixed conditions with neighbors who would have been well-known to one another since all lived in the same location. Today, life is characteristically one of the interaction of strangers, each with a heightened sense of their individuality and the choices open to them. Nowadays, people live for only a few years in one place before moving on; daily, they make decisions about what to wear,

buy, eat, and do from a range that to their forebears would have seemed astonishingly broad; during the day, they are likely to meet others about whom they know little; urban dwelling is the norm. In a world of strangers, it is essential that people have means of communication to reach out to others, to establish their own identities, and to exchange information. Obviously, the spoken word is central to this, and this vocabulary has expanded over the years, but so too are goods, cars, clothes, and so forth because they provide us with “languages” with which to connect to a changing world.

Into this—the familiar story of a shift from community to association that appears to be accelerating—needs to be placed the spectacular expansion of media technologies^[54] that help produce conditions in which much of life today is experienced symbolically rather than personally encountered: news is not passed from word of mouth by people who know one another, but electronically from around the globe; our work is very often concerned with exchanging symbols with others with whom we do not come into personal contact, but substitute for by writing or telephone communications; our entertainment is more often made by watching a screen than by personally attending a show.

Furthermore, it is easy to appreciate that this world of signification is also characterized by constant change and, accordingly, with persistent shifts and strains in the symbolic environment. Just think of the proliferation of lifestyles nowadays (among students, social classes, the young, family forms, etc.), or reflect on the rapidly changing appeal of intellectual ideas, of musical tastes, and of fashionable “looks,” and consider the innovation, conflicts, misunderstandings, and tumult that this engenders.

Paradoxically, it is perhaps this very explosion of information that leads some writers to announce, as it were, the death of the sign. Blitzed by signs all around us, designing ourselves with signs, unable to escape signs wherever we may go, the result is, oddly, a collapse of meaning. As Baudrillard puts it: “there is more and more information, and less and less meaning.”^[55] In this view, signs once had a reference (clothes, for example, signified a given status, the political statement a distinct philosophy, the television news, “what really happened”). However, in this, the post-modern era, we are enmeshed in such a bewildering web of signs that they lose their salience. Signs come from so many directions and are so diverse, fast-changing, and contradictory, that their power to signify is dimmed. In addition, audiences are creative, self-aware, and reflective, so much so that all signs are greeted with skepticism and a quizzical eye, hence, easily inverted, reinterpreted and refracted from their intended meaning. Thus, the notion that signs represent some “reality” apart from themselves loses its credibility. Rather signs are self-referential: they—simulations—are all there is. They are, again to use Baudrillard’s terminology, the “hyper-reality.”

People appreciate this situation readily enough: They deride the poseur who is dressing for effect, but

acknowledge that it's all artifice anyway; they are skeptical of the politician who "manages" the media and his image through adroit PR (Public Relations), but accept that the whole affair is a matter of information management and manipulation. Here, it is conceded that people do not hunger for any true signs, because they recognize that there are no longer any truths. In these terms, we have entered an age of "spectacle" in which people realize the artificiality of signs they may be sent ("it's only the president at his latest photo opportunity," "it's news manufacture," "it's Jack playing the tough guy") and in which they also acknowledge the inauthenticity of the signs they use to construct themselves ("I'll just put on my face," "there I was adopting the 'worried parent' role").

As a result, signs lose their meaning and people simply take what they like from those they encounter (usually very different meanings than may have been intended at the outset). And then, in putting together signs for their homes, work, and selves, happily revel in their artificiality, "playfully" mixing different images to present no distinct meaning, but instead to derive "pleasure" in the parody or pastiche of, say, combining punk and a 1950s Marilyn Monroe facial style. In this information society we have then "a set of meanings (that) is communicated (but which) have no meaning."^[56]

Experientially, this idea of an information society is easily enough recognized, but, as a definition of a new society, it is considerably more wayward than any of the notions we have considered. Given the absence of criteria we might use to measure the growth of signification, it is difficult to see how students of postmodernism such as Mark Poster can depict the present as one characterized by a novel "mode of information."^[56] How can we know this other than from our sense that there is more symbolic interplay going on? And on what basis can we distinguish this society from say, that of the 1920s, other than purely as a matter of degree of difference? Those who reflect on the postmodern condition may have interesting things to say about the character of contemporary culture, but, as regards establishing a clear definition of the information society, they are glaringly deficient.

QUALITY AND QUANTITY

Reviewing these varying definitions of the information society, what comes clear is that they are either or both underdeveloped or imprecise. Whether it is a technological, economic, occupational, spatial, or cultural conception, we are left with highly problematical notions of what constitutes, and how to distinguish, an information society.

It is important that we remain aware of these difficulties. Though as a heuristic device, the term information society might have some value in helping us to explore features of the contemporary world, it is far too inexact to

be acceptable as a definitive term. For this reason, though one may readily acknowledge that information plays a critical role in the present age, one has to remain suspicious as regards information society scenarios and maintain skepticism toward the view that information has become the chief distinguishing feature of our times.

Now, however, I want to raise some further difficulties with the language of the information society. The first problem concerns the quantitative versus qualitative measures to which I have already alluded. My earlier concern was chiefly that quantitative approaches failed to distinguish more strategically significant information activity from that which was routine and low-level and that this homogenization was misleading. Here I want to reraise the quality/quantity issue insofar as it bears upon the question of whether the information society marks a break with previous sorts of society.

Most definitions of the information society offer a quantitative measure (numbers of white collar workers, percentage of GNP devoted to information, etc.) and assume that, at some unspecified point, we enter an information society when this begins to predominate. But there are no clear grounds for designating as a new type of society one in which all we witness is greater quantities of information in circulation and storage. If there is just more information, then it is hard to understand why anyone should suggest that we have before us something radically new. This is a point made well by Giddens when he observes that all societies, as soon as they are formed into nation states, are information societies in so far as routine gathering, storage, and control of information about population and resources are essential to their operation.^[57] On this axis, all that differentiates the present era from, say seventeenth-century England, is much greater quantities of information that are amassed, dissembled, and processed. Kumar voices much the same complaint against postindustrial theorists (and postindustrial society is currently synonymous with the concept of an information society): How can they uphold the claim to have identified a postindustrial society when the trends they single out "are extrapolations, intensifications, and clarifications of tendencies which were apparent from the very birth of industrialism?"^[58]

Against this, however, it may be feasible to describe as a new sort of society, one in which it is possible to locate information of a qualitatively different order and function. Moreover, this does not even require that we discover that a majority of the workforce is engaged in information occupations or that the economy generates a specified sum from informational activity. For example, it is theoretically possible to imagine an information society where only a small minority of information experts hold decisive power. One need look only to the writings of H.G. Wells to conceive of a society in which a "knowledge elite" predominates and the majority, surplus to economic requirement, are condemned to drone-like unemployment.

On a quantitative measure, say of occupational patterns, this would not qualify for information society status, but we could feel impelled to so designate it because of the decisive role of information/knowledge to the power structure and direction of social change.

The blunt point is that quantitative measures—simply more information—cannot of themselves identify a break with previous systems, while it is at least theoretically possible to regard small but decisive qualitative changes as marking a system break. After all, just because there are many more automobiles today than 30 years ago does not qualify us to speak of a “car society.” But, it is a systemic change that those who write about an information society wish to spotlight, whether it be in the form of Bell’s postindustrialism, or in Castells’s informational mode of development, or in Poster’s mode of information.

What is especially odd is that so many of those who identify an information society as a new type of society do so by presuming that this qualitative change can be defined simply by calculating how much information is in circulation, how many people work in information jobs, and so on. What we have here is the assumption that quantitative increases transform—in unspecified ways—into qualitative changes in the social system.

It is noticeable that those scholars such as Schiller and Harvey who stress the present’s continuities with the past, while they acknowledge an increasingly central role played by information, have at the forefront of their minds the need to differentiate between categories of information and the purposes to which it is put. In other words, those who insist that the “informationalized” society is not radically different from the past are at pains to differentiate information on qualitative grounds. For instance, they will examine how information availability has been affected by the application of market criteria and contend that the wealthier sectors of society gain access to particularly high quality information that consolidates their privileges and powers. Yet, while they emphasize these sort of qualitative dimensions of informatization, they do so to highlight continuities of the socioeconomic system. Conversely, those who consider that the information society is a radically different system most often recourse to quantitative indices to demonstrate a profound qualitative change.

Roszak^[59] provides an interesting insight into this paradox in his critique of information society themes. His examination emphasizes the importance of qualitatively distinguishing “information,” extending to it what each of us does on an everyday basis when we differentiate between phenomena such as data, knowledge, experience, and wisdom. Certainly, these are themselves slippery terms, but they are an essential part of our daily lives. In Roszak’s view, the present “cult of information” functions to destroy these sort of qualitative distinctions that are the stuff of real life. It does this by insisting that information is a purely quantitative thing subject to statistical

measurement. But to achieve calculations of the economic value of the information industries, of the proportion of GNP expended on information activities, of the percentage of national income going to the information professions, and so on, the qualitative dimensions of the subject (Is the information useful? Is it true or false?) are laid aside: “For the information theorist, it does not matter whether we are transmitting a fact, a judgement, a shallow cliché, a deep teaching, a sublime truth, or a nasty obscenity.” These qualitative issues are overlooked as information is homogenized and made amenable to numbering: “Information comes to be a purely quantitative measure of communicative exchanges.”^[59]

The astonishing thing to Roszak is that along with this quantitative measure of information comes the assertion that more information is profoundly transforming social life. Having produced awesome statistics on information activity by blurring the sort of qualitative distinctions we all make in our daily lives, information society theorists then assert that these trends are set to change qualitatively our entire lives. To Roszak, this is the mythology of “information” talk: The term disguises differences, but in putting all information into one big pot, instead of admitting that what we get is an insipid soup, the perverse suggestion is that we have an elixir. As Roszak says, this may be very useful for those who wish the public to accept unprotestingly change since it seems so uncontentious.

Information smacks of safe neutrality; it is the simple, helpful heaping up of unassailable facts. In that innocent guise, it is the perfect starting point for a technocratic political agenda that wants as little exposure for its objectives as possible. After all, what can anyone say against information?^[59]

Roszak vigorously contests these ways of thinking about information. A result of a diet of statistic upon statistic about the uptake of computers, the data-processing capacities of new technologies, and the creation of digitalized networks, is that people come readily to believe that information is the essential sustenance of the social system. There is so much of this food that it is tempting to agree with those information society theorists who insist that we have entered an entirely new sort of system. But against this “more-quantity-of-information-to-new-quality-of-society” argument Roszak insists that the “master ideas” that underpin our civilization are not based upon information at all.^[60] Principles such as all men are created equal, my country right or wrong, live and let live, we are all God’s children, and do unto others as you would be done by are central ideas of our society—but all come before information.

It is important to say that Roszak is not arguing that these and other master ideas are necessarily correct (in fact a good many are noxious—e.g., all Jews are rich, all women are submissive, blacks have natural athletic ability). But, what he is emphasizing is that ideas, and the necessarily qualitative engagement these entail, take

precedence over quantitative approaches to information. And, what he especially objects to is that information society theorists reverse that situation at the same time as they smuggle in the (false) idea that more information is fundamentally transforming the society in which we live.

WHAT IS INFORMATION?

Roszak's rejection of statistical measures leads us to consider perhaps the most significant feature of approaches to the information society. We are led here largely because his advocacy is to reintroduce qualitative judgment into discussions of information. Roszak asks questions like: Is more information necessarily making us a better informed citizenry? Does the availability of more information make us better informed? What sort of information is being generated and stored and what value is this to the wider society? What sort of information occupations are expanding, why, and to what ends?

What is being proposed here is that we insist on examination of the meaning of information. And, this is surely a commonsensical understanding of the term. After all, the first definition of information that springs to mind is the semantic one: Information is meaningful; it has a subject; it is intelligence or instruction about something or someone. If one were to apply this concept of information to an attempt at defining an information society, it would follow that we would be discussing these characteristics of the information. We would be saying that information about these sorts of issues, those areas, that process, are what constitutes the new age. However, it is precisely this commonsensical definition of information that the information society theorists jettison. What is, in fact, abandoned is a notion of information having a semantic content.

The definitions of the information society I have reviewed perceive information in nonmeaningful ways. That is, searching for quantitative evidence of the growth of information, a wide range of thinkers have conceived it in the classic terms of Shannon and Weaver's^[61] information theory. Here, a distinctive definition is used, one that is sharply distinguished from the semantic concept in common parlance. In this theory, information is a quantity that is measured in "bits" and defined in terms of the probabilities of occurrence of symbols. It is a definition derived from and useful to the communications engineer whose interest is with the storage and transmission of symbols, the minimum index of which is on/off (yes/no or 0/1). This approach allows the otherwise vexatious concept of information to be mathematically tractable, but this is at the price of excluding the equally vexing—yet crucial—issue of meaning and, integral to meaning, the question of the information's quality. On an everyday level, when we receive or exchange information, the prime concerns are its meaning and value: Is it significant, accurate,

absurd, interesting, adequate, or helpful? But, in terms of the information theory that underpins so many measures of the explosion of information, these dimensions are irrelevant. Here, information is defined independent of its content, seen as a physical element as much as is energy or matter. As one of the foremost information society devotees puts it:

Information exists. It does not need to be perceived to exist. It does not need to be understood to exist. It requires no intelligence to interpret it. It does not have to have meaning to exist. It exists.^[62]

In fact, in these terms, two messages, one that is heavily loaded with meaning and the other that is pure nonsense, can be equivalent. As Roszak says, here "information has come to denote whatever can be coded for transmission through a channel that connects a source with a receiver, regardless of semantic content."^[59] This allows us to quantify information but at the cost of abandonment of its meaning and quality.

If this definition of information is the one that pertains in technological and spatial approaches to the information society (where the quantities stored, processed, and transmitted are indicative of the sort of indexes produced), we come across a similar elision of meaning from economists' definitions. Here it may not be in terms of bits, but at the same time, the semantic qualities are evacuated and replaced by the common denominator of price.^[63]

To the information engineer, the prime concern is with the number of yes/no symbols, to the information economist, it is with their vendibility. But, as the economist moves from consideration of the concept of information to its measurement, what is lost is the heterogeneity that springs from its manifold meanings. The "endeavour to put dollar tags on such things as education, research, and art"^[64] unavoidably abandons the semantic qualities of information. Kenneth Boulding observed thirty years ago that "The bit abstracts completely from the content of information and while it is enormously useful for telephone engineers for purposes of the social system theorist we need a measure which takes account of significance and which would weight, for instance, the gossip of a teenager rather low and the communications over the hot line between Moscow and Washington rather high."^[65,66] How odd then that economists have responded to the qualitative problem that is the essence of information with a quantitative approach that, reliant on cost and price, is at best "a kind of qualitative guesswork,"^[64,65] "Valuing the invaluable," to adopt Machlup's terminology, means substituting information content with the measuring rod of money. We are then able to produce impressive statistics, but in the process we have lost the notion that information is about something.^[67]

Finally, though culture is quintessentially about meanings, about how and why people live as they do, it is striking that with the celebration of the nonreferential character of symbols by enthusiasts of postmodernism,

we have a congruence with communications theory and the economic approach to information. Here, too, we have a fascination with the profusion of information, an expansion so prodigious that it has lost its hold semantically. Symbols are now everywhere and generated all of the time, so much so that their meanings have imploded, hence ceasing to signify.

What is most noteworthy is that information society theorists, having jettisoned meaning from their concept of information in order to produce quantitative measures of its growth, then conclude that such is its increased economic worth, the scale of its generation, or simply the amount of symbols swirling around, that society must encounter profoundly meaningful change. We have, in other words, the assessment of information in nonsocial terms—it just is—but we must adjust to its social consequences. This is a familiar situation to sociologists who often come across assertions that phenomena are aloof from society in their development (notably technology and science) but that carry within them momentous social consequences. It is demonstrably inadequate as an analysis of social change.^[68]

Doubtless being able to quantify the spread of information in general terms has some uses, but it is certainly not sufficient to convince us that, in consequence of an expansion, society has profoundly changed. For any genuine appreciation of what an information society is like, and how different—or similar—it is to other social systems, we must surely examine the meaning and quality of the information. What sort of information has increased? Who has generated what kind of information, for what purposes, and with what consequences?

THEORETICAL KNOWLEDGE

It is tempting to stop this critique here, satisfied to have drawn attention to the peculiarly deracinated notion of information that plays a pivotal role in conceptions of the information society. However, there is another suggestion, intriguing if imprecise, that can contend that we are on the point of entry into a distinctly novel information society without any need to reflect on the meanings of the information involved. Furthermore, this proposition has it that we need not discover any of the quantitative measures of information expansion (information employees, tradeable information, etc.), because the suggestion is that it is a decisively qualitative change in information that can be pointed to and which marks a break with the past.

From this point of view, an information society is regarded as one in which theoretical knowledge takes on a preeminence that it has hitherto lacked. The theme that unites what is in fact rather a disparate range of thinkers is that, in this information society (though frequently the term knowledge society is preferred, for the obvious reason that it conjures much more than agglomerated bits of

information), affairs are organized and arranged in such a way as to prioritize theory.

It is worth noting that Bell^[30] presents this as an “axial principle” of postindustrial society and that, although the weight of his analysis leans toward quantitative increases in service—i.e., information—occupations as indicators of postindustrialism, he is emphatic that “what is radically new today is the codification of theoretical knowledge and its centrality for innovation.”^[69] It is easy enough to understand what Bell means by this when we contrast today’s postindustrialism with its predecessor industrial society.^[70] In the past, it is argued, innovations were made, on the whole, by “inspired and talented tinkerers who were indifferent to science and the fundamental laws underlying their investigations.” In contrast to this decidedly practical and problem-solving orientation, it is suggested by Bell that nowadays innovations start from theoretical premises. That is, now that we have arrived at a situation in which it is possible to codify known scientific principles, then our knowledge of these becomes the starting point of action. In this way, what was once dismissed as useless—as just theory—has become the axis of practical innovations.

Again, it is not difficult to find illustrations of this “change in the character of knowledge itself.”^[30] For instance, Alan Turing’s paper, “On Computable Numbers” (1937), sets out mathematical principles that underpin later applications in computer science; the development of integrated circuits that enabled the “microelectronics revolution” to get under way in the late 1970s was founded on known principles of solid-state physics; and innovations in areas as diverse as compact disc technology and nuclear energy were reliant on theoretical breakthroughs that were regarded initially as without practical consequences. It is rather difficult to think of technological applications nowadays that do not hinge on theoretical knowledge, whether it is calculating the needs of households for water supply, building a bridge, or estimating energy needs in a particular area. Not surprisingly, perhaps, we find historian Eric Hobsbawm confirming Bell’s perception, concluding that during this century, “the theorists (have been) in the driving seat. . . telling the practitioners what they were to look for and should find in the light of their theories.”^[71]

Bell takes his argument for the “primacy of theoretical knowledge” considerably further, to suggest that it is pre-eminent not only in the realm of technological innovation, but even in social and political affairs. For instance, governments today introduce policies based on theoretical models of the economy. These may be variable—Keynesian, monetarist, supply side, and so forth—but each of them are theories that are the foundations that underpin day-to-day decisions ministers may make in response to practical exigencies. Again, we can see emerging major concerns with environmental consequences of policies. The response is, arguably, not just to respond to a

particularly pressing problem (say, an oil spillage), but to act, increasingly, on the basis of theoretical models of the ecosystem's sustainability. To be sure, such models are at present inchoate and unrefined, but they and other instances help us to appreciate that, while theoretical knowledge does not have to be true in any absolute sense, it does play a decisive part in life in the late twentieth century.

Theoretical knowledge is undeniably an arresting idea, one that does, *prima facie* define a new type of society that hinges on the generation and use of information/knowledge. If theory is at the point of initiation of developments, in contrast to one-time practical demands, then such knowledge could be said to herald a new sort of society. Moreover, we are not talking here merely of more white-collar workers or more bits of information being produced but of a new foundational principle of social life.

Nonetheless, a major difficulty with this notion is defining with any precision what is meant by theoretical knowledge. Theory evokes abstract and generalizable rules, laws, and procedures, and, with this, there can be agreement that advances, especially in scientific knowledge, have resulted in their codification in texts that are learned by would-be practitioners and that, in turn, become integrated into their practical work. This principle can reasonably be thought to be at the heart of research and development projects at the forefront of innovations, but it is clearly in evidence, too, in a large range of professions such as architecture, building, handling of food, and even the design of much clothing.

However, there are those who would extend the notion of theoretical knowledge to encompass a much vaster range, all of which could be cited as evidence of a knowledge-based society. Here, for example, one might include the training of many white-collar employees in law, social services, accountancy, etc., as evidence of the primacy of knowledge in the contemporary world. Indeed, one might also choose to argue that the whole of higher education, at the least, is concerned with transmitting theoretical knowledge. After all, it is a common refrain that the rapid transition to mass higher education (with about 30% of the age group attending universities) has been required by the need to equip appropriately very large numbers of people to operate successfully in the knowledge society.^[72] Such knowledge as is transmitted is undoubtedly codified and generally abstracted from practical applications, and it is even generalizable, though it is surely of a different order of magnitude to the theoretical knowledge expounded in sciences such as chemistry and physics.

Stehr,^[73] proposing that we now inhabit a knowledge society, does extend the definition of theory in such a way, arguing that nowadays knowledge has come to be constitutive of the way that we live. Recourse to theoretical knowledge is now central to virtually everything that we do, from designing new technologies, producing everyday artifacts,^[74] to making sense of our own lives when we

draw upon large repositories of knowledge to help us better understand our own location. Here, we are surely extending the idea of theoretical knowledge a very great deal, but it is helpful in so far as Stehr does echo themes in the stimulating and original work of social theorist Anthony Giddens that merit some comment. Stehr^[73] proposes a three-fold typology of the development of knowledge, meaningful (the Enlightenment ideal of knowledge for better understanding), productive (knowledge applied to industry), to action (where knowledge is intimately connected to production with, for example, the inclusion of intelligent devices, and where it influences the performance of one's everyday activities). This latter form of knowledge appears close to Giddens's emphasis on what he refers to as the intensified reflexivity of "late modern" existence. What Giddens highlights here is that, and increasingly, modernity has been a story of people's release from the strictures of nature and restrictive forms of community where it appeared that one had to do what one did as it was a matter of fate, toward individuals and groups making choices about their own and collective destinies in circumstances of "manufactured uncertainty." That is, the world increasingly is not bounded by fixed and unchangeable limits, but is rather recognized as malleable and the outcome of human decisions. A requisite of this is heightened self and collective interrogation, otherwise reflexivity, though this is not to be perceived as some trend toward self-absorption. Quite the contrary, it is premised on openness to ideas, information, and theories from very diverse realms, which are examined and incorporated as circumstances and people so decide.

A key point here is that a posttraditional^[75,76] society that is characterized by intensified reflexivity of actors and institutions hinges on information/knowledge. Of course, some of this is local and particular (one's biography reflected upon, a company carefully scrutinizing its customer records), but a great deal is also abstract, emanating especially from electronic media and from other, notably educational, institutions. If one accepts Giddens's argument that we do inhabit a world of "high modernity" in which reflexivity is much more pronounced than hitherto, then it is feasible to conceive of this as heightening the import of information and knowledge in contemporary life. A world of choices, for both organizations and individuals, is reliant on the availability and generation of detailed and rich information. If one follows Giddens's contention that ours is an era of intensified reflexivity on the basis of which we forge our material, as well as psychological conditions, then it follows that this will sustain and will demand a complex and deep information environment. It is perhaps not quite the same sort of theoretical knowledge as that which Bell has proposed, but, in so far as it is frequently abstract and codified, then it could find inclusion in a suitably widened category.

Nevertheless, there are reasons why we should hesitate to depict any novel information society in these terms.

Not least is that Giddens himself is reluctant to do so. While he does emphasize that a “world of intensified reflexivity is a world of clever people,”^[76] he is unwilling to present this as other than an extension of long-term trends, hence as a high modern era rather than a postmodern or postindustrial epoch. Life today is certainly more information intensive, but this is not sufficient to justify projections that it represents an entirely new sort of society.

In addition, Giddens has also raised serious doubts about the novelty of theoretical knowledge. Several years ago, he observed that “there is nothing which is specifically new in the application of ‘theoretical knowledge’ . . . Indeed. . . rationality of technique. . . is the primary factor which from the beginning has distinguished industrialism from all preceding forms of social order.”^[77] This being so, we return to the problem of designating as novel today’s society in which theoretical knowledge is prevalent. Further, Giddens’s objection begs the key question: Just what, precisely, do commentators mean by theoretical knowledge? It is clear, from the quotation above, that Giddens feels that the classical sociologist Max Weber’s conception of formal rationality that underpins purposive action (most famously manifested in the growth of bureaucratic structures) might apply in one definition. After all, it involves abstract and codifiable principles, rules, and regulations (the entire bureaucratic machine), as well as requiring, from participants, command of abstract knowledge (how the system works). Theoretical knowledge, in these terms, is not much more than learning the rules and procedures of how bureaucracies function. If so, then one is forced also to ask what is especially new about this.

This leads us to the wider complaint about the imprecision of the term theoretical knowledge. If, for instance, the primacy of theoretical knowledge is taken to refer to known scientific principles (the boiling point of water, the conductivity of elements, etc.) that are codified in texts, then this is one matter. However, if theoretical knowledge is taken to include hypothetical models such as the relation between inflation and unemployment or social class and educational opportunity, then this surely is quite another. Again, if theoretical knowledge is conceived as the primacy of research and development funds and teams in modern innovations, then this is another matter too. And if theoretical knowledge is perceived as the prominence in modern life of expert systems that operate services like the water and sewerage systems, airlines, and retail organizations, then this is another thing again. Alternatively, if theoretical knowledge is to be understood as a trend toward very much more intensified reflexivity among individuals and institutions, on the basis of which they then shape their future courses of action, then this is another thing again. Finally, if the rise of theoretical knowledge is to be chartered by the spread of educational certification—a common strategy—then this is to introduce still another significantly different definition.

In view of such ambiguities of definition, at best, one can conclude that theoretical knowledge may be more in evidence than hitherto, but that it is a far cry from this to conclude either that it is the preeminent force in society or that it marks a decisive turning point in history.

CONCLUSION

This entry has focused on the criteria used by those who depict an information society. Each has been found wanting, chiefly because they forward inappropriate quantitative measures that cannot, in themselves, identify a qualitative change from one type of society to another. It was further demonstrated that conceptions of the information society operated with variable—but uniformly nonsemantic—definitions of information, whether it was conceived as so many bits, or so much economic worth, or as an explosion of signs. Such notions of information, all of which ignore its meaning/content, were useful in that they facilitate quantification, but they are unacceptable when it comes to suggesting that we are witnessing the emergence of a qualitatively new information society. Finally, the distinctively qualitative notion, that the primacy of theoretical knowledge is the distinguishing feature of the information/knowledge society was considered. While it has an initial appeal, the term was too vague and imprecise to persuade that the undoubted expansion of some forms of theoretical knowledge signal a new type of society.

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Information Systems

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Abstract

An information system provides information to help guide organizational actions. It typically features substantial human-computer interaction. Application software and a data base form the digital content around which a system is built. Among the different types are transaction-processing systems, management information systems, decision support systems, group support systems, and enterprise systems.

INTRODUCTION

An information system is commonly a computer-based system for providing information to an organization to help guide its actions.^[1] The term “information system” is also sometimes used in information science to refer to information retrieval systems based more on documents than on data, an application domain familiar to libraries, in particular. The term is sometimes also used very generally and informally, without reference to either computers or organizations. People sometimes refer to their own personal information systems, for instance. In this entry, we take the organizational perspective, which has its origins in business, but applies to organizations of every kind, including libraries.

In an organization, an information system typically features people working interactively with computers to accomplish a particular task. Human-computer interaction (HCI) enables both people and their machine extensions to be informed via the system. Where decisions are routine and highly structured, they may sometimes be automated and relegated to the machine.^[2] Often, the information provided serves to coordinate workers’ specialized but necessarily collective efforts. The varieties of information systems are many, reflecting the diversity of organizations and tasks to be accomplished. A typical large business firm has information systems to support its accounting and finance, operations, supply chain management, sales and marketing, customer service, human resource management, and research and development. But information systems are found everywhere, in organizations of all kinds and sizes, public as well as private.

This entry discusses information systems both as a subject and as a field of study and practice. In the sections to follow, information systems are first described in terms of their: (1) origins; (2) varieties; and (3) practices. As information systems also constitute: (4) an evolving field of study and practice with; (5) attendant social issues, these aspects too are considered.

ORIGINS

Modern information systems emerged with the rise and spread of digital computing in the 1950s, although punched card tabulating equipment was in use for data processing in organizations before then. The stored-program computer itself was initially viewed as a high-powered calculating device, suitable primarily for numerical and other sophisticated analyses. Such “scientific computing” was distinguished from what was termed “electronic data processing” (EDP), which emerged about the same time to support the more prosaic work of business, such as accounting.^[3] In the 1960s, computers came to be designed and marketed specifically for business purposes, eventually displacing the tabulating equipment. Notably, a high-level programming language for business applications, Common Business-Oriented Language (COBOL), was also developed, which emphasized data and file structures, and deemphasized the computational features found in FORMula TRANslation (FORTRAN), the language most commonly used in scientific computing. COBOL ultimately became the most widely used programming language for the development of application software for information systems on mainframe computers. As much of this code remains in use, the language persists even today.

Beyond business-oriented application software, the emergence of data base technology in the late 1960s was central to the rapid rise and spread of large-scale information systems among firms. A data base is an organized collection of related data files.^[4] A data base management system (DBMS) is system software that enables data bases to be managed as integrated wholes, where relationships among files are clearly delineated. With a DBMS, data can be defined via a data dictionary and managed separately from the different software which access it. Finally, the articulation of the relational data model as a foundation for data bases spurred the development of relational data bases in the 1970s, which came to dominate the field.^[5] Today, Oracle provides the leading relational data base

software for medium to large firms, while Microsoft's Access is well established among small businesses.

Together, application software and a related data base have come to form the digital content around which any modern information system is now built. Typically, the application software incorporates the "business rules" to be followed, while the data base incorporates the "business facts" that shape the data processing, for instance, in processing a business payroll, or in selling seats to a concert, or in managing the circulation of a library's holdings, or in almost any other endeavor in which carefully informed organizational actions are routinely taken. While the business facts and data base will typically be specific to the enterprise, the business rules and application software may be either specific or generic, i.e., commonly used, as with accounting systems that incorporate professionally mandated rules and principles. Where the business rules and application software is specific to the organization, it may underpin the unique capabilities of the enterprise, in which case it may be strategic.^[6] Today, people in a wide variety of occupations and in organizations large and small are likely to work interactively with information systems to accomplish much of their work. Through networks and the Web and Internet, in particular, and through the use of laptops and mobile devices they engage in this HCI from wherever they happen to be and at whatever times they choose or are called upon to be available.

VARIETIES

Information systems come in a wide variety, reflecting the diversity in the organizations that employ them. Among business firms, some information systems will be characteristic of the industry, in particular, as with process control systems in chemical and refining enterprises, or electronic funds transfer (EFT) systems in banks and other financial services firms. However, certain basic types are found in enterprises of all kinds, reflecting both their historical origins based in then-new technologies and the nature of organization itself. These include transaction-processing systems; management information systems (MIS); decision support systems (DSS); group support systems; and enterprise systems. These are not pure types; actual systems may combine features of two or more basic types.

Transaction-Processing Systems

Transaction-processing systems support an enterprise in its transactions with others, such as customers, suppliers, and employees.^[7] Every business transaction involves an exchange of goods, services, money, and information in some combination between the parties. Transaction-processing systems exist to ensure the integrity of these

transactions. In today's world, each time a consumer makes a purchase with a credit card, withdraws cash from an account, or books an airline ticket, the consumer likely engages the other party's transaction-processing systems. Increasingly, a consumer does this directly, by swiping a bank card at a point-of-sale (POS) device or employing an automated teller machine (ATM) or initiating a purchase from the Web.

Beyond their primary function, transaction-processing systems also enable a business to coordinate its internal operations among units, especially in the making of goods, where parts are withdrawn from inventory and a manufactured item is assembled in a series of operations, and the final product eventually distributed from one location to another, for instance. Here and elsewhere, transaction-processing systems are basically event-driven, and are often engaged to authorize formal actions, such as accepting a customer order or authorizing a credit purchase. The business rules for such data processing may be quite sophisticated, as in credit authorization which incorporates rules aimed at fraud detection, for instance. The data pertaining to these events will ultimately serve to update a data base that is typically drawn upon in processing and is relied upon to give the current status of the organization's affairs. Where the data base is immediately updated as events happen, the system is said to operate in "real time." In the case of firms, basic transaction data will further feed the accounting systems that provide a formal financial picture of the ongoing business.

Where firms do business with each other, for instance, within a supply chain, their transaction-processing systems are also sometimes tied together by means of an interorganizational system that enables them to communicate directly with each other.^[8] For such machine-to-machine communication, this necessitates resolution of disparities in how the data themselves are defined by the communicating parties. The interorganizational system may be based on electronic data interchange (EDI) arrangements or increasingly on eXtensible Markup Language (XML) standards for exchange over the Web. The concept of Web services envisions a world of business services and firm transactions seamlessly tied together via standards for business data of all kinds.^[9]

Management Information Systems

Management information systems support an organization's hierarchical structure and are targeted to management at all levels. MIS aim to support every manager's need to know within his or her scope of responsibility, typically by extracting important performance information from data gathered from the organization's transaction-processing and operational systems and presenting it efficiently in tabular or graphical form. The concept of an MIS emerged in the 1960s and signaled an important transition in information systems, from traditional EDP to

systems that served more sophisticated purposes.^[10] In the United States, both practitioners and educators embraced the MIS concept and many business schools originated programs of study under this banner. Today the term continues to be widely used, although the more generic term “information systems” has become more common.

Executive information systems (EIS) were founded in the 1980s as a new form of MIS aimed at top management.^[11] The early EIS featured access to news external to the business, in addition to traditional performance metrics, and further employed new graphics and communications technologies. Most recently, executive support systems have been developed which provide a personalized Web page and “executive dashboard” of up-to-the-minute information with which the manager is to engage and steer the enterprise. These systems are now also popularly referred to as “business intelligence systems,” reflecting the sophisticated analytics that may lie behind the dashboard metrics.^[12]

Decision Support Systems

Decision support systems emerged in the 1970s as interactive systems that supported managers and other “knowledge workers” in tasks that were semi-structured, where decisions could be aided by analytical computer-based means.^[13] These systems shifted the original MIS focus from information to decisions. Early DSS featured innovative HCI employing graphics, formal models, and heuristics or algorithms as means of support. A pioneering example was IBM’s Geodata Analysis and Display Systems (GADS), which supported organizational decisions related to urban geography, such as arranging police beats and assigning school district boundaries.^[14] Today, the concept of geographical information systems (GIS) continues in this tradition as a major area of application supported by new technologies such as remote sensing, geographical positioning, graphical analytics, and visualization. The firm ESRI is the leading provider of GIS software.

The concept of group decision support systems (GDSS) extended the basic DSS concept in the 1980s. Substantial research led to the development of decision rooms equipped with systems that facilitated complex, interactive group decision making in a particular location.^[15] The early focus was typically on largely unstructured problems, with tools provided to support collective brainstorming and idea evaluation, for instance, while further capturing a record of the group meeting. With advances in communications technologies, the GDSS concept soon evolved into one that supported group work more broadly, where group members could be at multiple locations and could also meet asynchronously as needed.

Group Support Systems

Beyond the informational and decisional needs of managers, it is well understood that communication and

cooperation more broadly in the organization is required to coordinate the work undertaken within and across units. Certain of this communication and cooperation can be built into the work systems themselves; however, other organizational means such as cross-functional teams can also facilitate lateral communication, cooperation, and coordination, thus moderating the burden on the management hierarchy.^[16] Not surprisingly, given the ubiquity of group work in organizations, a wide variety of systems have in recent years been originated to support group work, in particular.

The concept of computer-supported collaborative work (CSCW) originated in the 1980s to characterize designs for computer-enabled group work, understood to require substantial communication and coordination, typically over time and across locations.^[17] Lotus Notes exemplified the software then deployed in these new systems and remains in wide use today. Current groupware in support of group work is diverse and includes, e.g., that which provides for electronic meetings, electronic mail and messaging, calendar management, project and document management, knowledge sharing, workflow management, and collaborative design. Today, group work can also be organized and conducted on the Web, making use of a commercially available service.

Enterprise Systems

Enterprise systems emerged in the 1990s with the rise of enterprise resource planning (ERP), a concept for integrating the major functional systems of the enterprise, in particular, the organization’s financial, human resource, and operational systems around a common data base.^[18] The principal means of integration was typically a software package provided by a vendor such as SAP or Oracle. Firms sought to replace their older and disparate home-grown legacy systems, which required high maintenance, with standard off-the-shelf software that promised an integrated solution to relieve them of this burden. ERP basically incorporated the firm’s major transaction-processing and operational systems. Its adoption was further given a large boost by concerns related to the millennium bug and the threat it posed at the time to vulnerable legacy systems. Today, most large firms have adopted and implemented ERP in the form of packaged software provided by one or more leading suppliers.

A second type of enterprise system termed customer relationship management (CRM) has more recently also become popular, focusing on the “front office” of a firm, beyond the already heavily computerized “back office.”^[19] A central CRM aim is to provide the firm with a “unified view” of its customers, who might otherwise engage in separate transactions with different business units, each in the absence of full customer information. Just as it promises better customer service, CRM also typically supports a firm’s sales force and enables it to be

better managed. Still another CRM aim is to help the firm assess the profitability of its different customer segments, in the interest of focusing marketing and customer retention initiatives on achieving higher overall profits.

PRACTICE

Information systems practice rests on four closely intertwined bodies of professional knowledge: (1) application knowledge; (2) technology knowledge; (3) development knowledge; and (4) management knowledge. Each is associated with job specialties in the field.

Application Knowledge

Application knowledge refers to the domain in which the information system supports work within the organization. The system's users are of course expected to be knowledgeable in this domain, first and foremost. So too are the systems analysts who aid in specifying the requirements for any new system. The required knowledge may be relatively broad or narrow, shallow or deep, according to the work supported, which often involves multiple individuals in different roles. The purpose of the information system is typically to inform its various users within such a work system, in support of their decisions and actions.^[20] Beyond their domain knowledge, users are typically trained in their interactive use of any new system, such that they understand how to navigate it, interpret its displays or other output, and provide needed data or other input. Ease of use is a major issue in successful implementation.

Notwithstanding such training, research suggests that new information systems are unlikely to deliver full value to organizations and their users until they have been assimilated into the work practices they support.^[21] Repeated "learning by doing" is needed before users "appropriate" a system into their preferred work practices. Moreover, with such assimilation, certain application knowledge will be tacit on the part of users, demonstrated primarily in their competently doing the needed work. Users will also typically find new uses of information systems, beyond those envisioned by system designers. Systems are thus substantially "reinvented" through their use. Importantly, then, application knowledge is ultimately inseparable from the work practice that gives it meaning.

Technology Knowledge

Technology knowledge pertains to the computer-based platforms on which applications are built. This includes the computers, communications, storage and other devices, and the system software that operates these resources. Among the jobs associated with building and maintaining

these platforms are those of the system programmer, the network manager, the data base administrator, and the Web master. Technology knowledge also pertains to basic tools and resources drawn on by those engaged directly in application development; these are sometimes integrated and provided in the form of a "work bench."

The most basic aspects of a computer-based platform are its suitability, capacity, and reliability in supporting applications. Growth in firms and their information systems makes capacity planning a vital task. Also important are standards.^[22] Where the platforms are in wide use by organizations, the associated technology knowledge is similarly widespread and more easily acquired in the marketplace when needed. Even more significantly, widely used platforms attract their own extensions, as vendors build new features for them roughly according to the potential market reached. This advantage extends to the application software employed in system building, where a wider variety of packaged systems will be readily available for standard platforms.

Development Knowledge

Development knowledge pertains to the application software, data model, Web or other interface, and human procedures that are specified, built or otherwise acquired, documented, tested, installed, and maintained over the life of an information system. It pertains further to the methodology used in this particular work.^[23] Principal jobs include those of the systems analyst, who in collaboration with prospective users specifies the functional requirements for the system, and the applications programmer, who in consultation with the systems analyst designs and codes the software to meet these specifications. Within the user community, "lead users" often represent the interest of their peers in the development activity, helping in particular with system implementation and needed training.

Project management knowledge for guiding implementation of systems is especially important, as system development work tends to be organized as projects. Senior developers of individual systems often work as project managers. Projects are typically managed according to their associated deliverables, schedule, and budget. Because of characteristic pressures on schedule and budget, a particularly important aspect of project management is attention to the quality of the deliverables as well as the avoidance of their expensive elaboration through "feature creep." While these issues have long been well known among professionals, they continue to bedevil most of those engaged in the work.^[24]

Management Knowledge

Management knowledge pertains to the management of information systems activities within the enterprise. Depending on the size of the organization, managers may

include: the data center or operations manager, the network manager, the applications development manager, the applications maintenance manager, and the executive in charge of the function as a whole, who in a large organization sometimes has the title of chief information officer (CIO). A primary responsibility of the CIO is the alignment of the information systems strategy with the broader firm strategy.^[25] Another is the staffing and organization of the function and the building of its expertise, as well as setting policy and contracting for external services. A third is the building of a reliable and adaptable network and technological infrastructure.^[26] Still another is the management of the application systems portfolio, and the allocation of resources between maintenance of existing systems and the development of new or replacement systems.^[27]

One highly visible issue in recent years has been the outsourcing of the information systems function, in whole or in part. "Off-shoring" is much discussed, in particular. Much system development work in the most developed nations is now carried out in countries with more attractive wage rates and growing technical competencies, such as India and China, and certain eastern European states. Exactly which work should be outsourced and which should not remains controversial.^[28] The data center itself is a prime candidate for outsourcing. In general, programming is more easily outsourced than is systems analysis, which requires a deep grasp of the work context. The long-run implications of this shift in work are globally significant for the world economy, beyond the immediate challenges and choices faced by today's managers.

AN EVOLVING FIELD

Today, the information systems field of study and practice remains an evolving one marked by continuous change. Notwithstanding its accomplishments to date, the field faces numerous challenges. Its various professional associations, publications, and research firms and consultancies will play important roles in guiding future information systems developments.

Professional Associations

The International Federation for Information Processing (IFIP), founded by 13 national computer societies in 1960, established Technical Committee 8 (TC8) on Information Systems in 1966. TC8's aims are "to promote and encourage interactions among professionals from practice and research and advancement of investigation of concepts, methods, techniques, tools, and issues related to information systems in organizations."^[29] TC8 now includes eight working groups, the first of which, WG8.1, Design and Evaluation of Information Systems, was established in 1976, and the second of which, WG8.2, The Interaction of

Information Systems and the Organization, was established in 1977.

The International Conference on Information Systems (ICIS) is the premier academic research conference in the field, held annually since 1980. The Association for Information Systems (AIS) is the leading academic association, established in 1994 to bring IS academics together from around the world. It sponsors ICIS and three regional conferences annually: the Americas Conference on Information Systems (AMCIS); the European Conference on Information Systems (ECIS); and the Pacific Asia Conference on Information Systems (PACIS). Among its other activities, AIS publishes the *Journal of AIS* and *Communications of AIS*, and sponsors AIS World, an important Web resource for IS scholars.

The IS field today also maintains its important roots in the allied fields of computer science, operations research, and management. The Association for Computing Machinery (ACM), founded in 1947, claims to be the world's oldest educational and scientific computing society and now serves professionals in more than 100 countries. Its many publications include the widely read *Communications of the ACM*, which features many articles of interest to IS professionals. Its interest groups include the Special Interest Group on Management Information Systems (SIGMIS). Among ACM's most important contributions has been its issuance since 1972–1973 of curriculum recommendations for academic programs of study in information systems.^[30]

The Institute for Operations Research and Management Science (INFORMS), formed in 1995 from two earlier societies, is now an umbrella association of operations for research-oriented academics and practitioners that includes an Information Systems Society among its 10 societies. It also publishes the leading journal, *Information Systems Research*, begun in 1990.

The Academy of Management includes an Organizational Communications and Information Systems Division among its some two dozen interest groups and divisions.

Among practitioners, the Society for Information Management (SIM), originally founded as the Society for Management Information Systems (SMIS) in 1969, serves IS executives and professionals through a series of chapters located primarily in North America. In its early years, SIM was instrumental in advancing the MIS concept among executives.^[31] It also established the leading journal, *MIS Quarterly*, in 1977, in cooperation with the Management Information Systems Research Center (MISRC) of the University of Minnesota, which now publishes it exclusively, while SIM members receive it as a membership option.

Publications

Today, a wide variety of publications reaching both general and specialized audiences feature articles on information

systems. Business periodicals such as *The Economist*, *Business Week*, and the *Wall Street Journal* provide good coverage for the general reader. In addition to those already mentioned, other notable academic journals devoted to information systems include the *Journal of Management Information Systems*, the *Journal of Information Technology*, *Information and Organization*, and the *European Journal of Information Systems*. Practitioners in the field find the periodicals *Information Week*, *CIO Magazine*, and *Computerworld* important for following current events in the fast changing technology industry.

Research Firms and Consultancies

Practitioners are also served by a number of market research and analysis firms such as Gartner Group and Forrester Research, which offer assessments of new technologies and their markets, as well as international consultancies such as Accenture, Deloitte, Tata Consulting, and IBM Business Services, which are widely engaged in “system integration” activities, and which further help to spread “best practices” in information systems among firms. These research firms and consultancies also serve as “thought leaders” in the institutional environment within which “organizing visions” for the application of new technologies originate and serve to guide adoption and diffusion.^[32]

SOCIAL ISSUES

Information systems are associated with several ethical and social issues inherent to their nature, design, and use.^[33] The authors Kenneth and Jane Laudon identify five moral dimensions to the Information Age: information rights and obligations; property rights and obligations; accountability and control; system quality; and quality of life.^[34] We consider each briefly.

Information Rights and Obligations

Every information system poses questions of information rights and obligations, often for both persons and organizations. Rights to individual privacy are particularly salient in an age where much organizational data are gathered about customers, employees, and others, and too where those who do business on the Internet can easily gather individual data generated through Web site visits, for subsequent use in targeted advertising, for instance. Throughout the world, businesses thus now operate under various laws intended to safeguard individual privacy. In Europe, privacy protection is stronger than in the United States, as businesses there are generally prohibited from using information about persons without their prior consent. In the United States, most businesses make their privacy policy known to their customers, who

must typically then “opt out” if they wish to avoid having certain of their data shared with others for marketing purposes. As many U.S. customers do not take this opt-out step, nor do many probably even consider it, their individual data are widely shared in marketing.

Privacy concerns are of course also inherent to surveillance schemes which employ information systems. Firms may closely monitor the work of their employees, sometimes stepping over the line into private lives. Governments of all kinds are notoriously tempted to keep more than close track of their citizens as well as others, as they seek to repel threats both real and imagined.

Property Rights and Obligations

Information systems also pose challenges to certain intellectual property, which increasingly is represented in digital form, and which a firm may seek to protect as a trade secret, or through copyright or patent. Both the software and the data associated with information systems are likely to be associated with property rights, as are other digital products such as music or video or text recordings that offer entertainment and education, and which are commonly organized, managed, and distributed via information systems. An interesting illustration today is Apple’s iTunes business, which is entirely digital in nature, and which distributes music for download by consumers on demand, much of it under protection of Apple digital rights management (DRM) software that is itself a protected asset, with several different parties sharing in the resulting revenues.^[35]

Accountability and Liability

Information systems also pose new issues of accountability as well as liability, where harm results from their employment. When things go massively wrong, e.g., when an operating error at a bank results in failure to automatically deposit customer paychecks in a timely manner, it may be difficult to disentangle the reasons behind the debacle. Often we are told that a software bug was the problem, and indeed this is often the case. But because information systems are based substantially in HCI, whether it was human error or a software bug or a problem in data exchanged or the interaction itself, or more broadly a problem in the design or execution of the work being carried out, or a failure in the oversight and management of overall system quality, blame can be difficult to fix and hence may sometimes be misplaced to avoid accountability and in some cases liability.

System Quality

As just suggested, system quality is a broader issue than one of minimizing the bugs in software. Organizations bear a responsibility to attend to the broader quality of

their information systems. Research suggests that notwithstanding this responsibility, few firms systematically assess the quality of the data associated with their systems, for instance, even though data errors are known to be rather commonplace.^[36] One area where attention to data quality is typically enforced is in business accounting, where external auditors provide independent oversight. However, even here, where the financial stakes may be high, system quality may be compromised through inattention or misguided cost cutting measures. The reality is that system quality is achieved only at the cost of means that ensure it.

Quality of Life

Lastly, information systems have long been associated with a variety of quality of life issues, especially as they pertain to system users.^[37] Among ongoing issues are the extent to which power is centralized or decentralized through systems, the increased difficulty in maintaining a balance between individuals' working and private lives, new vulnerabilities to crime and abuse such as spam, the reengineering of work and its consequences for job skills needed, characteristic health problems such as repetitive stress injury (RSI), the problem of electronic trash disposal, and social inequities in access to technology, as illustrated by the much discussed problem of the "digital divide" in U.S. schools. In short, information systems have come to have pervasive consequences for the quality of our individual and social, and private and public lives.

CONCLUSION

In the relatively short span of several decades, information systems have emerged to be a dominant feature of modern organizational life, with broad implications for people everywhere. The future promises to extend this story. Currently, organizations throughout the world are rapidly building their presence on the Web, and moving from merely offering certain published content, sometimes disparagingly referred to as "brochure ware," to engaging in basic transactions with their customers, suppliers, and other partners. In short, more organizations are doing everyday business on the Web, popularly termed "electronic commerce," underpinned by information systems that make this possible. New businesses are at the same time originating everywhere on the Web to provide the basic infrastructure for doing this business (Google, eBay, and Amazon.com are widely known examples), as well as to offer new distribution for digital content in the realms of education and entertainment, in particular, attracting more traffic to the Web and thus broadening and deepening its user base, making it more appealing for social networking and advertising. As of this writing, the concept of "Web 2.0" as a social space that enables new forms of

organizing is the latest new vision to capture the fancy of the field.^[38]

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Information Systems Failure

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Abstract

Information systems (IS) failure is characterized as one particular form of evaluation of IS performance. It is multidimensional and relative to stakeholder interests. The objective of failure studies is to assist understanding of how to achieve success. This entry reviews recent performance data to assess the magnitude of the issue. It traces historical developments in the understanding of failure. It examines various changes that have affected perceptions of IS performance. It identifies a number of cognate subliterations whose emergence recently signals a growing maturity of analysis. The entry proposes a framework by which to understand the historical development of academic research in this field. Finally, it offers some key conclusions for academic research and for practice.

INTRODUCTION

Information systems (IS) failure has been a focus for study and action for both practitioners and academics since the late 1960s.^[1–3] Most organizations have struggled to deliver systems that work and deliver benefits. Practitioners have wrestled with these difficulties in their workplace and the public has experienced systems' shortcomings in trying to use them. Nobody seriously doubts that failure has been and continues to be a problem to be tackled.

The focus on failures does not mean that there are two classes of applications—those that succeed and those that fail. There is a continuum of results ranging from clear and utter failure to very high success. There are applications that are barely acceptable but survive, and there are applications that are mildly successful and fail.

This entry reviews only one end of the spectrum of results: applications that are failures. The meaning of “information system success” is a significant issue^[4] in itself and is not the purpose of this entry. Information system failure and information system success are not simply opposites.^[5] To achieve success, it is necessary to remove causes of failure, but doing so may not be sufficient for a successful outcome. More broadly, the study of failure is justified by the belief that, just as the study of cognitive malfunction can help us understand good mental functioning, it casts light on what it takes to achieve success. Understanding “information system failure,” therefore, represents one but only one part of what needs to be understood for the effective design, implementation, management, and exploitation of an information system.

Where once “failure” was viewed as an almost objectively identifiable state, today there is wide recognition that

it is an evaluation based on an assessment of some dimension or dimensions of performance relative to goals, targets, or expectations. Failure in one dimension, say a budget overrun, may be more than compensated for by success in another dimension, say timely implementation. And, as what is regarded as performance has itself changed, so the domain of failure studies has evolved. For this reason, it is appropriate for this entry to take an historical approach.

In this entry, the study of failure is treated as one important branch of the study of IS performance. Our overall objective is to provide a rigorous basis by which to understand what may be meant by “IS failure” and a set of signposts to appropriate analytical approaches by which to develop greater insight into the phenomenon.

We start with a review of recent performance data. We examine the various changes that have affected perceptions of IS performance. We identify a number of cognate subliterations that have developed over recent years and which signal a growing maturity of analysis. We provide a framework by which to understand the historical development of academic research in this field.

THE SCALE OF IS FAILURE

Prior to 1995, most assessments of the scale of IS failure were informal in nature and anecdotally derived. In 1995, the Boston-based consulting group, Standish, published its findings under the banner headline, *Chaos!*^[6] Based on data about more than 3000 IS projects, it reported that 31% were abandoned without being completed. These it dubbed failures. Some 53% failed to meet at least one of its budget, schedule, and scope targets. These were dubbed challenged projects. The remaining 16% that hit all three

targets were deemed successes. These have since become the most widely cited failure statistics.

Every 2 years since 1995, the Standish Group has released updates on these figures. Figures released for 2004 revealed 29% hit all targets, 53% were challenged in missing at least one target and 18% were classified as failures.^[7] In summary according to the Standish Group figures there has been sustained improvement but there remains continuing cause for concern. While some question the Standish survey and analysis methodology,^[8] raising questions about the accuracy of the detailed findings, in 1995 few doubted the broad conclusion that most IT projects seriously underperformed. Subsequent surveys reinforced the point (e.g., Taylor).^[9] Likewise today, more than a decade later, the improving trend they identify is commonly acknowledged.

Less clear is the extent of the improvement and therefore the extent of the outstanding problem. To measure this, it is better to use percentage variance from targets.^[10] Otherwise we cannot tell whether “challenged” projects are more or less challenged over time. Sauer et al.^[10] also argue that an absolutist definition of success by which any variance however small assigns a project to the challenged category is too strict. In most cases a small budgetary or schedule overrun is of negligible significance. Using statistical clustering techniques, they show that there is a significant gap between the majority of projects that miss their targets by just a small percentage margin and those that are clearly failing on a more substantial scale and that therefore it is worth tolerating some small margin of variance. However, even on this more optimistic assessment, at least one-third of all projects fall well short of delivering on all their targets.

THE EVOLUTION OF IS PERFORMANCE

In the previous section we saw that IS performance has changed over time and that the metrics by which performance in general and failure specifically are identified are not definitively agreed. In this section we explain how the phenomenon itself has changed and explore the implications for the measurement and identification of failure.

We start with a distinction between systems and systems projects. In the 1960s and 1970s, the system and the project were often conflated. If a system failed, say because it did not deliver the functionality its users wanted, it was usually the case that the project had been troubled too and vice-versa. This was also a period in which computer malfunctions were common resulting in breakdowns ranging from the everyday experience of the computer being “down” to catastrophic loss. Such malfunctions have been extensively cataloged by Peter Neumann in his *Inside Risks* column in the *Communications of the Association for Computing Machinery* over many years.^[11] While more reliable hardware and standardized and re-usable software

have removed many causes of such malfunctions, they remain a continuing hazard (e.g., Hodgson)^[12] but today are rarely such as to cause abandonment of a system.

With the advent of rigorous project management disciplines it has become normal to detail precise targets, in terms of budget, schedule, quality, and scope. These are essentially internal measures that in principle are within a project manager’s capacity to control. It has become apparent therefore that a project may be successful in meeting its internal targets yet not deliver beneficial business outcomes. More recently, as the role IT plays in organizations has become critical to their functioning as exemplified by the widespread adoption of e-business for front office business functions, there have been cases of projects failing to hit budget and schedule targets but nevertheless delivering highly desirable business outcomes. The distinction between the system and the project is therefore both conceptually sensible and practically relevant.

What counts as an information system and therefore what is involved in an IS project has changed over time and this has affected the measure of performance. Purpose-built systems have given way to standard packages (so-called enterprise software). Projects are therefore more about system integration than software development. This has led to two important consequences. First, it has engendered more ambitious, more complex projects that combine packaged functionality to an extent that was previously unimaginable. Second, because the software is prewritten, it has encouraged organizations to direct project managers’ efforts to implementation, business process change, and value harvesting. This latter has extended project scope considerably and turned managers’ attention to an external target, the business value achieved by investment in an information system.

This shift in emphasis from internal to external targets, from assessing performance against process to performance on outcomes, is appropriate from a commercial investment perspective. It is, however, problematic to measure because IT systems do not deliver value on their own, they do so through organizational and business process change.^[13] Even if the value itself is measurable and measured, and it often is not, the extent to which that value derives from the information system may not be possible to determine. Further problems include the question of when to measure value outcomes. Often immediately after implementation, organizational performance suffers^[14] before recovering and improving. But the longer the lag between implementation and outcome measurement, the more space there is for extraneous variables to affect the value outcome.

Thus far in this section, we have examined how IS performance has evolved in practice. We now turn to how its conceptualization has evolved academically. A significant breakthrough came with the explicit recognition that “failure” is an evaluation not an objective description. Lyytinen and Hirschheim^[15] developed a

new pluralist concept of expectations failure which explicitly recognized that failure was a judgement relative to expectations and that expectations vary among stakeholders. This pluralism opened the way to the possibility that a single system or project could be a failure relative to one set of stakeholders and a success relative to others. It also triggered discussion of whether some stakeholders' expectations might weigh more in arriving at a single overarching evaluation—this is “on balance” a failure notwithstanding some less important stakeholders viewing it as a success. Several responses have emerged. Some have tried to identify apparently unequivocal failures such as abandoned projects (e.g., Johnson^[6] and Ewusi-Mensah^[16]) though it has been argued that even an abandoned project might be viewed by some stakeholders as a success if an objective was to learn about a new technology, test customer responses, or experiment in some other way.^[17] Sauer^[17] advanced an uneasy compromise that recognized the plurality of stakeholders but recognized that a distinction should be made between supporters of a project and those who were uninvolved or active opponents. Others have finessed the issue by focusing on specific dimensions of performance such as budget and schedule variance without using explicitly evaluative terminology.^[18–20] In doing so, by the very nature of their choices of performance dimensions to study including the recent introduction of business value as an outcome measure, they can be argued to implicitly favor the expectations of traditional stakeholders such as the owners and managers of businesses. By contrast, others have embraced pluralism and absorbed it into new theoretical approaches such as Actor-Network Theory which we discuss below.

We can summarize this section by saying that the conceptualization of failure has evolved and matured in three ways. The first has been the distinction between systems and projects. The second has been the expansion of the legitimate scope of IS projects with consequences for what dimensions of performance are assessed. The third has been recognition of the evaluative nature of “failure.” This has surfaced disagreement as to which stakeholders' expectations should receive priority. This is a political disagreement rather than one of facts or data. Those who believe that owners and manager as the agents of owner matter more will adopt a more traditional view of failure where as those who believe that employees, the public, and others have just as much right to their interests and expectations being respected will take a more egalitarian and pluralist position.

EMERGING COGNATE LITERATURES

A further manifestation of the maturation of our understanding of IS failure has been the emergence of several cognate literatures. We briefly discuss in turn risk, partial abandonment, expectation management, escalation, and drift.

Risk as discussed in the extensive IS and software engineering literatures relates to failure by seeking to identify what may be conducive to failure, how to assess its probability and impact, and how to manage it. It is about the probability of failure in some shape or form. It has typically been strongest at identifying sources of risk such as starting conditions or behaviors that give rise to failure.^[21] Such studies usually result in extensive lists. The usual suspects thus identified typically include: unclear objectives, uncertain requirements, inadequate project management, too little user involvement, and shortage of top management support. The literature has been less convergent in its focus on risk assessment. While there is an in-principle agreement that risk consists of two elements (the probability of some outcome and its impact), the determination of what the actual risk amounts to has proved problematic. Some have focused on the impact of total failure as represented by abandonment,^[22] while others have looked at specific dimensions of performance such as running over schedule or budget. Some studies while recognizing that impact is an element of risk focus principally on the probability of underperformance.^[10] The management of risk, and therefore the prevention of failure, has principally consisted of attending to risk factors to prevent their occurring or mitigating their effect when they do occur.

A further set of cognate studies is that on partial abandonment.^[23,24] This recognized that a common strategy for coping with underperformance, such as projected schedule or budget overruns, or unanticipated events is to descope, which is to say abandon, some elements of a project. It advanced our thinking by showing that what might simplistically be viewed as a symptom of failure can also be an instrument for preventing failure or further failure. Failure is not a simple cut and dried function of any single indicator.

The focus on expectations failure brought into focus the idea that success and failure are a function of the targets as well as the delivery and performance of a system. That is to say that one way of preventing failure is to manage expectations closer to what is realistically achievable. Ginzberg^[25] pioneered this notion. It has received limited attention subsequently^[26] although, influenced by Danish research,^[27] the United Kingdom's Office of Government Commerce today mandates that all projects control for “strategic optimism,” the tendency to set expectations unduly high.

A more abundant cognate literature has been that on escalating commitment to a failing course of action. It addresses the key question of why organizations do not cut their losses sooner. Inspired by a substantial corpus of work in Organizational Behavior,^[28–32] and recognizing that many IS projects have been characterized by sponsors pouring in good money after bad to projects that would ultimately fail, researchers have explored the applicability of existing theory and sought to adapt it to the IS failure phenomenon.^[33–35] While escalation of resourcing

is indeed a common feature of projects and existing research enriches our understanding of why it occurs, its practical value is limited by the question of whether we can adequately recognize failure in advance and the extent to which escalation often genuinely sustains a project that would have collapsed without it.

Finally, the “drift” literature introduces a further recognizable phenomenon associated with project performance and which may often either result in failure or substitute for it. Instigated by Ciborra,^[36] the idea is that objectives are not immutable fixtures in a project but are subject to organizational politics that often neutralizes them without radically reviewing the case for the project or system. The resultant drift leaves organizations with IS investments that do not meet their real needs but which are not subjected to the scrutiny that might lead to their redevelopment or abandonment. Empirical exploration and development of this phenomenon is in its infancy.^[37,38]

So, while risk research has worked to connect failure to management practice with a view to reducing its probability, the other cognate literatures have functioned to situate failure within a more sophisticated understanding of organizational contexts and what counts as success within them. Specifically, partial abandonment recognizes that failure on one dimension of performance, namely scope, may be sacrificed to achieve better performance on another such as budget. Expectation management extends this more realistic approach to what will count as good or bad performance by recognizing that targets in the form of stakeholder expectations are legitimately subject to influence and change. Escalation theory is an inverse of partial abandonment in that it shows why larger and larger overruns on resourcing such as budget may be promoted in the interests of achieving scope and outcome expectations, and how this can be dysfunctional. The focus on drift brings a recognition that not all systems and projects are subject to clear-cut evaluations on a continuing basis and that over time objectives and expectations may be diluted through organizational political processes without any re-evaluation occurring. Failure studies if they are to embody a realistic and sympathetic understanding of the richness and complexity of organizational life must embrace the insights that these cognate studies have brought to the table.

APPROACHES TO UNDERSTANDING IS FAILURE

As our understanding of the concept of IS failure has evolved, so too have our approaches to analyzing the causes of failure. We can distinguish three broad approaches. At one extreme, we have static analyses based on the identification of factors that predispose to failure. At the other extreme, the emphasis is on dynamic analysis and the explication of processes by which failure comes about. Bridging the two is the interactionist approach.

Static Approaches

Static, factor-based approaches were at their most popular in the early days when failure was seen more as an objective phenomenon. It was easy then to ask what caused failure and to look for factors that “determined” failure. What were seen in retrospect as common features of failures rapidly became accepted as causes which if rectified would lead to improved performance and outcomes. Research was undertaken to validate this view (see Larsen^[39] for a compendious review of factors identified in the research).

Within this class of approaches, several versions developed emphasizing different perspectives and therefore different failure factors. We identify three here: the technological perspective, the organizational/cultural perspective, and the political perspective.

The technological perspective

A distinguishing feature of the technological perspective has been its strong focus on the technology elements as the most important considerations for an information system (and often the only components to consider in building the system). The efficient processing of data and the efficient operating of hardware and software provide the goals around which people and procedures are to be organized. Studies in this perspective have often embodied two important assumptions. The first is that technology in all its forms (including hardware, software, and databases) is considered to be “good.” The “imperative” in technological imperative refers to the inevitability of technology to “compel” acceptance, use, and conformity to it.^[40] Any resistance to a given technology is regarded as merely an irrational, impermanent phenomenon. The second is that implementation of technology alone is sufficient to secure organizational benefits. Together these assumptions conspire to exclude other factors as relevant to success and failure.

The technological perspective therefore implies a dominant focus on formal development procedures for systems analysis and design, the purpose of which is to build or upgrade an information system. There are four major phases in the development cycle. The first phase consists of requirements determination to identify the output of the hardware–software system and the data to be input and processed. The second phase is conceptual design to create a “logical” or conceptual blueprint for the system. The third phase is the “physical” or implementation design for specific software and hardware needed in the information system. Building or upgrading the hardware–software system follows. All formal system development methodologies, as well as the tools of computer-aided software engineering that implement them, involve these four phases or variations of them. The technological perspective tends to underlie not only most development methodologies but

also most textbooks on programming, systems analysis, systems design, database management systems, and telecommunications.

In the technological perspective, the diagnosis of an information system failure focuses on a hardware failure, a software failure, a data failure, or any combination of these. The chosen hardware platform may have defects in its manufacture or configuration. The software may suffer from poor design or error-prone construction. The database may harbor inconsistent, incomplete, or outdated data. Since the technological perspective assumes that users can correctly and completely define processing requirements, a failure in the system may also arise because the requirements were specified incorrectly or incompletely. For instance, the information system could lack the capacity to support the processing load if this were not specified correctly.

In general, the remedy for a potential information system failure based on the technological perspective view is for people to conform to the development cycle procedures and to follow processes specified for operation of the system with its hardware, software, and database. The technological perspective requires that people (analysts, designers, managers, programmers, end users, etc.) do or redo the steps of the systems analysis and design correctly. Any failure by people to respond appropriately (e.g., users who do not willingly participate in the requirements determination step, users who resist using the installed system, designers who neglect to install adequate backup procedures, or designers who themselves resist using computerized tools) is seen as a failure of developers and users and not a failure of technological solutions to organizational problems.

The organizational/cultural perspective

By contrast with the technological perspective, in the organizational/cultural perspective it is technology that must adapt to people and to organizations. An organization, in this view, is more than a collection of people. An organization is a structure of roles and rules in which the rules delimit the aims, resources, prerogatives, actions, and behaviors allowed to the person occupying a role. The "culture" in organizational culture refers to the organizational members' shared knowledge or shared understanding of the structure of roles and rules. As successive generations of participants enter, pass through, and leave an organization, its structure of roles and rules continues to exist and to evolve slowly. Upon entering an organization, an individual becomes subject to the organization's structure of roles and rules. Different individuals, when placed in the culture, tend to display similar actions and behaviors. Thus, the culture is the ongoing realization, albeit often partial, of the formal organizational design. An information system application that reflects the desires of one person or a group of people but ignores

organizational culture is unlikely to fit the way the organization works.

Preceding the installation of a new information system or the upgrading of an existing one, the organizational/cultural perspective emphasizes the existence of beliefs and assumptions shared among the organizational members, about what computers do, how technology affects jobs, why the current information system is being upgraded or replaced, and so forth. When held by people in contemporary organizations, these beliefs and assumptions operate much like myths, metaphors, and magic among "natives" in preliterate societies.^[41] In this view, an information system is but one among many artifacts crafted by organizational natives for use in their daily activities and rituals. Hence, in the organizational/cultural perspective, an information system failure is a failure of this artifact to serve and be compatible with the activities and rituals of the organizational natives.

In the organization culture of information technology, a poor fit between an information system (the hardware, software, and data) and the organizational culture is conducive to an information system failure. A framework useful for identifying a poor fit between information system and organizational culture specifies seven categories of shared beliefs and assumptions that can be violated by systems:^[42,43]

1. Shared beliefs and assumptions about innovation and action (e.g., are original and creative behaviors "good?").
2. Risk taking (e.g., is the norm to be proactive and take responsibility for one's own actions, or to be reactive and avoid responsibility?)
3. Integration (e.g., how much importance is placed on communicating and cooperating with other organizational members?)
4. Top management contact (e.g., does top management customarily relate to subordinates by being affirming or openly critical?)
5. Autonomy in decision making (e.g., are organizational members allowed, encouraged, expected, or trusted to make decisions on their own?)
6. Performance orientation (e.g., are the criteria for compensation, job security, and job promotion concretely established, explicitly known, and actually used?)
7. Reward orientation (e.g., do rewards take the form of a "carrot" or "stick?")

In this framework, the failure potential for an information system increases with the number of categories of cultural assumptions with which the information system is incompatible, as well as the extent of the respective incompatibilities. For instance, consider an information system that makes an assumption that there is open sharing of data across the organization's different divisions (integration) and that new users of the system will take responsibility

for the decisions that they make with the help of the information system (risk taking). If the organizational members share a norm in which each division guards its data as a valued resource and if the organizational members share, as an accepted practice, the custom of “blaming the computer” for their bad decisions, there is a significant threat of failure for the new system. Any additional incompatibilities between the information system and other shared beliefs and assumptions would increase the threat of an information system failure.

To prevent or to remedy an information system failure, the organizational/cultural perspective requires that the information system be designed and adjusted to respect the constraints that the organizational culture imposes. A strong proponent of this view will maintain that an information system is an artifact crafted to serve the activities of an organization, and therefore the information system should always conform to the organization, rather than vice versa. In other words, a proponent of the organizational culture view may take the position that altering an organizational culture to fit an information system, even if possible in the long run, is a dangerous course of action.

The organizational/cultural perspective extends the technological perspective by bringing in organizational/cultural factors. It also introduces the idea of a fit between the technology and the organization/culture. However, it continues to assume that the important challenge is to establish the right conditions in terms of getting two sets of factors aligned with each other.

The political perspective

The political perspective extends the organizational/cultural perspective by introducing power as the real basis by which organizations work. Power is the ability of a person, group, or organizational unit to overcome resistance or opposition to achievement of its ends; politics is the exercise of this ability.^[44-46] In this view, activities that accompany the development, implementation, and use of an information system provide an arena in which a person, group, or organizational unit can exercise power, whether or not the ends for which the power is exercised bear any relevance to the purposes that the information system is ostensibly said to serve. Success or failure of the information system relative to these ostensible purposes is secondary to the achievement of the power objectives.

In a classic case study of an information system implementation,^[47] a new information system threatened to alter the power between the corporate accounting group and divisional accounting personnel. The system was designed to allow the accounting group at corporate headquarters immediate access to data belonging to the accounting group in each of the company's different divisions. In the existing procedures, each division controlled its own data (stored in thick manual ledger books), and corporate accounting could only obtain it through reports

prepared by division accountants. Built into the design of the new information system was a presumption that there should be a different distribution of power relative to the division data. This design was contrary to the existing power over the data. In the technological imperative view and the organizational culture view, resistance to the proposed system could be explained as opposition to a more efficient system or opposition to changes in the culture of corporate versus division roles. In the political perspective, the efficiency considerations or role changes were secondary; the main objective of the system for the corporate accountants was political. They wanted to disrupt the existing balance of power in the organization and introduce a new balance of power based on data access that favored the corporate group.

In the political perspective, the failure potential for an information system application increases if it violates the constraints imposed by the organizational distribution of power. In some cases, an application will be allowed to succeed only if it supports the political agenda of a powerful group within the organization. IS may be used explicitly to change the distribution of power in an organization; in such cases, the design of the system is a secondary factor in success or failure. The major issue is the effectiveness of change agents in negotiating redistribution or organizational power.

To prevent or remedy an information system failure due primarily to strong political opposition, the political considerations must be surfaced and negotiated. Political considerations may be somewhat hidden; surfacing them through high-level discussions allows the effect of the system to be dealt with in the context of high-level goals of the organization. An explicit understanding of the effect of the system on the relative power of the organizational participants may allow negotiations and compromise. In the absence of such compromise, political opposition to a system may be sufficient to cause failure.

The political perspective has sometimes been operationalized in research in terms of the fit between an information system or project and the power structure. Such operationalizations fall under the factor approach. Others however have recognized that power can be renegotiated and as such the processes by which IS are treated affect their success or failure.

Interactionist Approaches

Interactionist approaches bridge the step from factors to processes. In accepting that factors may influence each other, they implicitly introduce a temporal element to the analysis of failure. For example, a factors analysis might identify inadequate involvement of business users in requirements specification and user resistance as critical causes of failure. The interactionist recognizes that the user resistance may be a function of the lack of involvement. In turn, perceived user resistance may deter

technologists from consulting the users. The causes of failure develop and harden over time. Implicitly, such approaches recognize that the different factor approaches embody important elements that may contribute to a comprehensive analysis of failure. We briefly describe two such approaches: the sociotechnical perspective and the exchange perspective.

The sociotechnical perspective

In the sociotechnical systems view, an information system is more than a technical system of hardware and software. An information system is a social system that uses information technology.^[48,49] Failure is not a failure of the information technology alone or the organization alone, because there is a strong interaction between the two. The same information technology will exhibit different properties when used in different organizational contexts. Sociotechnical theory^[50] predicts that optimizing only the technical system or optimizing only the social system will lead to information system failure. To avoid failure, neither system can be managed separately from the other.

The interactive effects between the social system and the information technology have a parallel in the chemical difference between mixtures and compounds. The properties of a mixture are simply a combined set of the respective properties of the individual elements that constitute the mixture. The reason is that the elements in a mixture do not react to one another; their respective properties remain intact. However, the properties of a chemical compound are different from the respective properties of the constituent elements. The reason is that the elements react to one another; their respective properties are replaced by the new properties of the compound entity. In this analogy, an information system is more like a compound than a mixture. Its constituent social system and information technology react to one another, so that their properties in combination are different from their properties in isolation.

In the sociotechnical view, failure potential is increased by development processes and procedures that do not integrate both social and technical considerations. In sociotechnical development, the future users of the system specify important job and work design considerations. There is a joint effort involving both users and technical personnel to consider alternative information system technical designs and select one that achieves a reasonable trade-off between job design and technical efficiency. Dominance of technical considerations increases the probability of failure due to user resistance. The sociotechnical approach recognizes the fact that user resistance can cause a technically well-designed system to fail and user enthusiasm can cause a somewhat mediocre technical design to succeed. These dynamics are the basis for a process that looks for the best combination of technical and social factors.

To prevent or remedy an information system failure, the sociotechnical view specifies a sociotechnical

requirements and development process. Users are empowered with sufficient information to be effective participants in design discussions and decisions. Obtaining commitment by users to make the system succeed is an essential part of the process.

The exchange perspective

The exchange perspective^[17] develops the sociotechnical perspective in one specific direction. It emphasizes one critical basis of interaction, viz. the creation and sustaining of a balanced exchange between a project team or those who manage an information system and the key supporters of that project or system. It argues that projects and systems fail if two conditions obtain:^[1] there are insufficient resources to continue developing or operating the system, and^[2] key supporters are dissatisfied.

This perspective sees systems and projects as needing a range of different forms of support from a range of stakeholders. Support can include material resources such as funds, equipment, space, practical support such as involvement in project processes, problem-solving, and management attention, psychic support such as publicly observable commitment, as well as organizational support in terms of politics and working the organizational system. Stakeholders who may be key supporters include senior management sponsors, operational users, end customers, the project team, and the supply chain. As supporters' levels of satisfaction may ebb and flow over time, the task of IS management and project management is one of maintaining sufficient levels of satisfaction to ensure a continuing flow of needed resources. Thus, for example, the project process can be seen as the challenge of marshalling the right resources to deliver sufficient progress and expectation of benefit that supporters will continue to provide those resources. If progress stalls, resources needed to overcome a hurdle may not be forthcoming resulting in further difficulties for the project and further damage to supporters' expectations. The project team may be able to break out of this vicious circle by actions that restore confidence such as bringing forward the delivery of some benefits or by actively managing supporters' perceptions. If on the other hand it is unable to break out of this vicious circle, the project will be set for failure. Projects can be seen as an ongoing complex interactive process where exchange is at the heart of the interactions.

Process Approaches

Since the mid-1990s failure analyses have emerged that focus more on a detailed examination of process and the search for patterns in process. They have tended to view success and failure outcomes as not determined by factors or even by interactions but as a function of a yet more complex account of the processes by which

multifarious influences affect projects and systems over time. As yet no single perspective has come to dominate the field. However, we shall give special attention to Actor-Network Theory because it has been widely employed in social studies of IS including failures, and because it encompasses ideas from numerous other perspectives.

From within the IS discipline, Newman and Robey^[51] enabled process analyses of failure through their more general articulation of the elements of process analysis, and Newman has applied it in his failure research.^[52,53] Outside the discipline, in the broad area of social studies of technology, a number of case studies have been published that have cast light on IS failure through detailed accounts of IS processes.^[54] This has then been brought back into the discipline by critical theory-oriented researchers such as Howcroft, Wilson, and Mitev adopting a social shaping of technology perspective and applying it to failures.^[55,56]

Actor-network theory

Actor-Network Theory has recently become a popular tool for analyzing IS failure.^[36–38,57–59] Actor Network Theory has a number of attractions. First, it is the first approach in many years to take a balanced position in relation to technology. That is, where for most researchers it has been accepted that technology is subservient to human/organizational objectives, Actor-Network Theory places technology on a par with other stakeholders. It then views the object of study, say a project failure, through the lens of the actor-network in which it is embedded. Humans, institutions, and technologies are among the stakeholders who populate the network and propagate influences through its nodes. In this manner, the complexity of the contexts within which IS failures occur is well represented. Further, one of the core ideas of the theory is that of breakdown. The essence of this insight is that when something appears to be functioning well we treat it as a black box. Only when it begins to fail do we start to unpack it to understand what is going on. Thus, for example, we can understand “drift” in these terms.

The limitations of Actor-Network Theory are that it is still evolving a set of concepts for general use. Early analyses using it have tended to be very complex and not productive of readily practical conclusions.

Conclusion: The Future of Failure

Ten years ago, the question arose as to whether the increased commodification of IT would lead to standard solutions to such an extent that the problem of failure might dissolve.^[60] The alternative scenario was that the strategic benefits of IT would be such that organizations would continue to seek to differentiate themselves and

would therefore continue to pursue distinctive, non-commodity solutions. The improvements in performance are noted earlier in this entry but the continued difficulties in achieving expectations suggest that elements of both scenarios have occurred. This suggests that the issues associated with understanding and preventing failure will continue to be highly relevant for the foreseeable future.

The challenge for research is to strike a balance between analyses that embody every causal constituent in a failure but where it is difficult to see the wood for the trees, and those that are simpler but which promise too much to the practitioner because they suggest that a relatively simple intervention will be sufficient to prevent failure. Having developed a growing maturity in our understanding it is easy for research to fall into the former category. It is this trick that Actor-Network Theory or alternatives will have to master if it is to be both academically successful and practically useful.

CONCLUSION: SUMMARY OF LESSONS ABOUT FAILURE FOR PRACTITIONERS

The entry has lessons for scholars and researchers. It also has lessons for practitioners. These can be summarized as follows:

1. The evaluation of success or failure for a project is not usually a simple “success” or “failure” or identification of a single reason for the result. Success or failure depends on the criteria being used, the stakeholders being considered, and the level of expectations.
2. Organizations respond to perceptions of failure in various ways. One response is abandonment. Other possible responses include escalation and revision of expectations.
3. The ideal lessons for practitioners would be a set of simple prescriptions to prevent failure and ensure success. The analysis of the failure research provides guidance but no simple list of prescriptions. A thoughtful practitioner seeking to reduce the potential for failure should consider both static factors that predispose to failure and the interaction of factors that may lead to failure.
4. Static causes. Three types of causes that predispose to failure and therefore should be considered as part of prevention measures are:
 - Technological. The focus in failure prevention and failure analysis is on correct and complete hardware, software, or data (or a combination of these technological elements). Today, these are the least common causes of failure.
 - Organization/culture. The focus is on a good fit between the system and the activities, rules, roles, rituals, and culture of an organization.

Political. The focus is on incorporating the effect of political power on design, acceptance, and use of a system.

5. Interaction causes. The focus on static causes may not be sufficient. Factors may influence each other. Two approaches to understanding and analyzing failure based on interactions are:

Sociotechnical. This analysis is based on the view that an information system is a social system that uses information technology. To avoid failure, the interaction of the two systems must be considered in the designs of both.

Exchange perspective. Systems and projects need forms of support from a range of stakeholders. Critical to avoiding failure is creating and sustaining a balanced exchange between a project team and key supporters.

6. An emerging view that is perhaps not ready for widespread practitioner use is to analyze the process by which a complex set of influences affect the way projects and systems develop over time.

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Information Technology Adoption

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Abstract

Since the dawn of time, humans have relentlessly continued to develop and adopt various information technologies (ITs) to thrive successfully in their environment. Generally, the rate of adoption has depended on the adopter's perceptions of the ITs' net benefits. In this entry, we draw from innovation diffusion theory, and the DeLone and McLean IS success model to discuss the literature on IT adoption by individuals and organizations. Since the proliferation of newer and more powerful ITs is apt to continue unabated for many years to come, we suggest new ways of identifying, learning, and implementing new ITs.

INTRODUCTION

This entry provides a general overview of existing literature on new information technology (IT) adoption by individuals and organizations. The terms adoption, implementation, consumption, acceptance are used interchangeably. Also the terms information technology (IT), information and communication technology (ICT), and information technology systems (ITS), are taken to be synonymous. Organizational adoption looks at adoption by aggregates: viz. work groups, departments, directorates, strategic business units, and companies or corporations including intranets and extranets. Other aggregate levels such as industries, communities, national governments, and society at large are beyond the scope of this entry. We define adoption as the process by which an IT innovation is acquired, installed, and used to perform tasks in work-related environments. The rate of successful IT adoption depends on the adopter's perceptions of the ITs' relative advantage, compatibility, and complexity, as well as its triability and observability.^[1] We draw from innovation diffusion theory,^[1] and the DeLone and McLean Information Systems (IS) success model^[2,3] to discuss adoption at each level of analysis: individual and organization. Innovation diffusion theory uses the S-Curve to classify adopters of a new IT into innovators, early adopters, early majority, late majority, and laggards. The DeLone and McLean IS success model posits that successful IT adoption is mainly determined by: 1) the quality of the technology itself; 2) the quality of the information the technology provides; 3) the quality of the service provided by IT support staff; 4) continual usage of the IT; 5) user satisfaction from the use of the IT; and 6) the overall impact it will have on the adopting individual or organization.^[2,3] The citations used are only representative of existing literature, not exhaustive. The entry starts with the premise that IT has the potential of profoundly

transforming individual and organizational welfare. That IT offers both an opportunity and a challenge (i.e., opportunity to increase productivity and effectiveness and a challenge to keep the motivation of perpetually learning newer and sometimes complex disruptive ITs), and that, whether the adoption of IT occurs voluntarily, through sanctions, or by pressure from outside parties,^[4] it will have to eventually help the individual user or the organization meet stipulated personal, strategic, or operational goals. One key factor is that there will always be a constant cycle of breakthrough IT innovations that will inevitably dislodge previous, now moribund, innovations. The entry describes the unavoidable role of IT discontinuities in the adoption process, and concludes by suggesting that since the proliferation of newer and more disruptive ITs is apt to continue unabated into the future; there is a real need for individuals and organizations to develop new ways of identifying, acquiring, learning, and implementing new technologies. Individual and organizational lifelong learning, and coping strategies are two recent constructs that depict the essence of survival in an increasingly interdependent IT-networked society.

BACKGROUND

Why IT Is Important

It is an accepted fact that IT “will change the world more permanently and more profoundly than any technology so far seen in history and will bring about a transformation of civilization to match.”^[5] It is also accepted that IT has the potential of enhancing individual and organizational performance. Individual or organizational performance is measured in terms of the tangible and intangible net benefits resulting from the using the IT innovation. Information technology is defined here as

any system, product, or process whose underlying technology base is composed of computers (both hardware and software), workstations, and/or computerized communication networks of all types, including Local Area Networks (LANs), Wide Area Networks (WANs), Metropolitan Area Networks (MANs), intranets, Internet, robotics, and smart chips.^[6] Recognition of the potential of IT has led individuals and organizations to invest enormous amounts of time and money in IT assets. It is noteworthy that a worldwide IT expenditure of more than \$4 trillion is expected in 2009 alone.^[7] Information technology is now so pervasive that more than 55% of the workforce in the developed world relies on it to produce their goods and services.^[8] For example, today's banks and global financial markets could not function without IT. It is now fashionable to refer to our generation as the information society.

Role of IT Discontinuities

Information technology discontinuities are breakthrough innovations that significantly change the rules of competition in terms of how data/information are captured, stored, processed, and used by individuals, organizations, and entire industries. Such IT discontinuities threaten to disturb the mode of doing business in the industry and have led to the collapse of companies and industries that do not adopt.^[9] For example the current convergence of digital and telecommunication technologies such as the Internet, Peer to Peer, MP3, and cellular phone on the music industry may lead to the creation of an entirely new industry that delivers music on demand; anytime, anywhere. Companies in the CD, cassette tape, or boom box businesses will be forced to adopt before an impending doom befalls them. According to Anderson and Tushman,^[10] and

Utterback,^[11] as a general rule, technological innovations tend to have a life cycle of their own.

As shown in Fig. 1, for the IT industry, the cycle begins with a new IT invention or the arrival of a newer IT (e.g., the Apple Computer) that is a substantial improvement of the prevailing technology in the industry. An era of turmoil then sets in as the new IT replaces its predecessor. In this era, innovators and early adopters identify, purchase, and learn to use the new IT. At this time, entrepreneurs and IT developers continue to experiment with alternative designs and compete for market share (e.g., Apple vs. IBM PC). Finally a dominant design emerges as the industry default standard. The industry default standard emerges by offering a combination of features and services that allow adopters to make effective use of the IT at an affordable price. We think that this is probably the time when the early and late majority adopters purchase and use the proven IT. Then the innovation cycle enters an era of incremental change where the focus is on market segmentation and lowering costs (e.g., Workstations, Laptops, PC Tablets, Internet, PC). This era continues until the arrival of the next IT discontinuity. Schumpeter^[12] argues that technological discontinuities should be encouraged and that unprofitable methods, firms, and industries must be allowed to perish in order to release trapped resources for new enterprises.

Despite the evident opportunities offered by IT, such as increases in output or decreases in the cost of some inputs in specific organizations, there is no clear evidence at least in the United States that IT consumption has raised overall national productivity. For example, "profitability rates have been falling in U.S. industries in the last decade despite the new investments in information technologies."^[13] As such, much of the investment in new IT may not have led to successful results after all. Some of the cited reasons for non-adoption are inability to learn "how

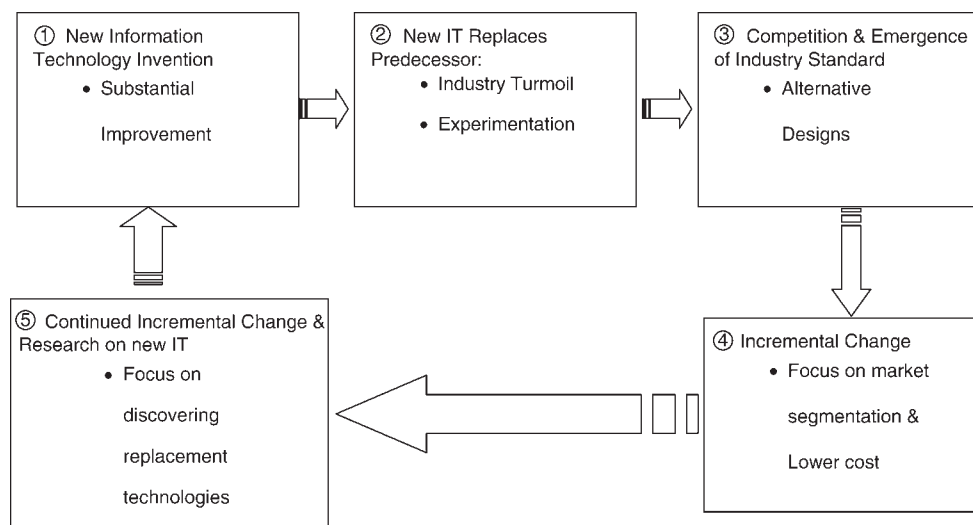


Fig. 1 Information technology innovation life cycle.

to change organizations faster than humans naturally want to change,”^[13] technically deficient ITs that are threatening to its users, low user satisfaction from usage of the IT, and high knowledge burden requirement to master the technology. Others are: users getting information that is not necessary for decision making, low individual or organizational ability to recognize the value of new information and adopt it for productive ends, and lack of adequate means to realistically measure the costs/benefits of IT. In short, there is skepticism out there about how quickly one should adopt a new IT.^[13]

At the level of the individual firm, the problem will be to overcome the resistance to change, both by individuals who feel threatened by such changes and by those who doubt the potential returns available from the large investments necessary in the new technologies. At the national level, countries may become laggards if, for example, they fail to provide an IT infrastructure adequate to enable their firms to take advantage of the new ways of doing business, ways that shrink the effects of time and distance(p. vii)

This entry provides a general overview of existing literature on new IT adoption by individuals and organizations. The guiding questions are: What role do IT discontinuities play in the adoption process? Why do individuals or organizations decide to adopt or not to adopt IT? How can individuals and organizations know whether IT adoption

has been successful? Why does the adoption of IT occur at different rates?

The entry is divided into two parts. The first part identifies the general attributes of adoption of innovations and generalizes them to IT adoption. The second part discusses the rate of IT adoption based on Rogers' S-Curve.^[1] A conclusion is provided at the end of each of the two parts.

PART 1: ADOPTION OF IT INNOVATIONS

According to Rogers,^[1] the rate of adoption of an innovation (in this entry, any new IT is considered an innovation) depends on the perceived attributes of the innovation, the type of innovation decision, the communication channels used to advertise the technology, the nature of the social system in which the IT is implemented, and the extent of the promotional efforts of change agents (see Fig. 2).

Perceived Attributes of Innovations

According to innovation diffusion theory, the perceived attributes of innovations are *relative advantage*, *compatibility*, *complexity*, *observability*, and *triability*. *Relative advantage* is “the degree to which an innovation is perceived as better than the one it replaces” as measured by

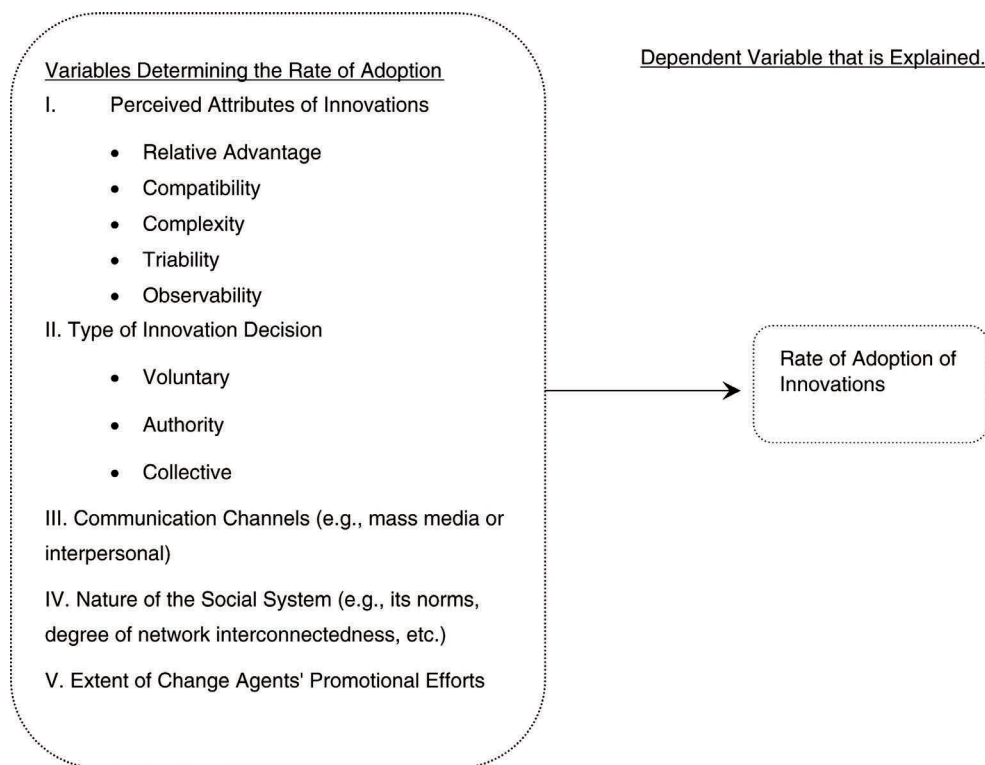


Fig. 2 Variables determining the rate of adoption of innovations.
Source: From Rogers^[1] on p. 207.

actual monetary gains, convenience, enjoyment, and satisfaction derived from its use. The greater the relative advantage, the higher the perceived usefulness,^[14] and the better the rate of adoption of the innovation. Constructs similar to relative advantage found in the literature include: performance expectancy, outcome expectations, job-fit, and extrinsic motivations.^[15] *Compatibility* is “the degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of adopters.” For example, the implementation of a new IT in a work environment that has had previous experiences with poorly designed systems is much harder than the implementation of a new IT in an environment that has had prior good experiences with a well-designed system.

Complexity is “the degree to which an innovation is perceived as being difficult to use.” The level of enjoyment one gets from using a new innovation is inversely proportional to the degree of complexity one encounters. The lower the degree of complexity; the greater the perceived ease of use of the innovation^[14,15] and better the rate of adoption. Theories of cognitive absorption stipulate that low complexity leads to heightened levels of curiosity, playfulness, personal innovativeness, and rates of adoption.^[16] *Observability* is “the degree to which the results of an innovation are observable to others.” Individuals may adopt a specific IT in order to gain recognition or make themselves indispensable. This is what the technology acceptance model calls social influence. *Triability* is “the degree to which an innovation may be experimented with on a limited scale before adoption.” Ability to pilot enables potential adopters to reduce uncertainty and become acquitted with the new innovation.

A number of research studies have investigated the efficacy of these attributes to the adoption of new IT.^[17] Moore and Benbasat^[17] used the attributes as a basis of developing an overall validated research instrument to measure the various perceptions of adopting an IT innovation. All attributes had fairly high alpha coefficients: relative advantage, 0.90; compatibility, 0.86; complexity (also called ease of use), 0.84; observability (also called result demonstrability), 0.79; and triability, 0.77. An alpha coefficient measures the squared correlation between observed scores and true scores. A high score means that the observed score is strongly correlated with the true score; which was the case with the Moore and Benbasat study.^[17] What follows is a discussion of each attribute in more detail.

Relative advantage

This construct captures both objective and perceived advantages of adopting the new IT. The literature shows that IT researchers have used different measures to assess the relative advantage of a new IT compared to the one it replaces. Six general interrelated and interdependent measures have been identified: *IT quality*, *information*

quality, *service quality*; *intention to use*, *actual usage*, *user satisfaction*, and *impact (including net benefits) to the individual and organization*.^[2,3] In 1992, DeLone and McLean^[3] reviewed 180 research studies on measures of information system success and drawing from the work of Shannon and Weaver^[68] came up with six measures: System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact. In a revised model in 2003, DeLone and McLean^[2] added Service Quality, Intention to Use, and generalized the Individual and Organizational impacts to one construct, namely, Net Benefits. We think these measures apply to IT adoption success as well. Given the multidimensional and interdependent nature of the IS success construct, the measures selected by researchers would depend on their research intentions. Fig. 3 shows the relationship between the various measures of the revised 2003 DeLone and McLean Model of Information Systems Success.^[2]

IT Quality. At the *IT quality* level, researchers have used “more engineering-oriented performance characteristics of the [IT] in question.”^[2] Specifically, research studies compared the new IT with the old one by focusing on resource and investment utilization,^[18] reliability,^[19] online response time,^[20] perceived usefulness,^[14,21] and accuracy.^[22] Overall, the studies found that any new IT that ranked higher in one or a combination of these factors had a higher chance of getting adopted compared to one that ranked lower. Other researchers have focused on measuring the relative advantage of the quality of the information generated by the new technology.

Information Quality. The perceived relative *quality of information* generated by a new IT in the form of reports is another determinant of successful IT adoption. Bailey and Pearson^[20] identified 39 IT-related items for measuring individual satisfaction with information quality. Out of the 39 items, the most important ones were accuracy, timeliness, reliability, completeness, relevance, precision, and currency. Other researchers have used other attributes of information quality such as uniqueness, conciseness, clarity and readability;^[23] and sufficiency, understandability, unbiasedness, quantitateness.^[24] Ahituv^[25] summarized the relative value of information into four main multiattribute utility category measures: *timeliness*, *content*, *format*, and *cost and benefit*. Timeliness includes a class of attributes related to the time factor in information update and retrieval. These time factors are: currency/recency, response time, and frequency. If a business transaction occurs in time t_0 , the related record may be updated later at time t_1 , and the user of this information may get a processed report at time t_2 ; the *currency of the data* presented to the user is measured by the difference $t_2 - t_0$. The *currency of the file* is measured by the difference $t_1 - t_0$ and the *response time* is measured by the

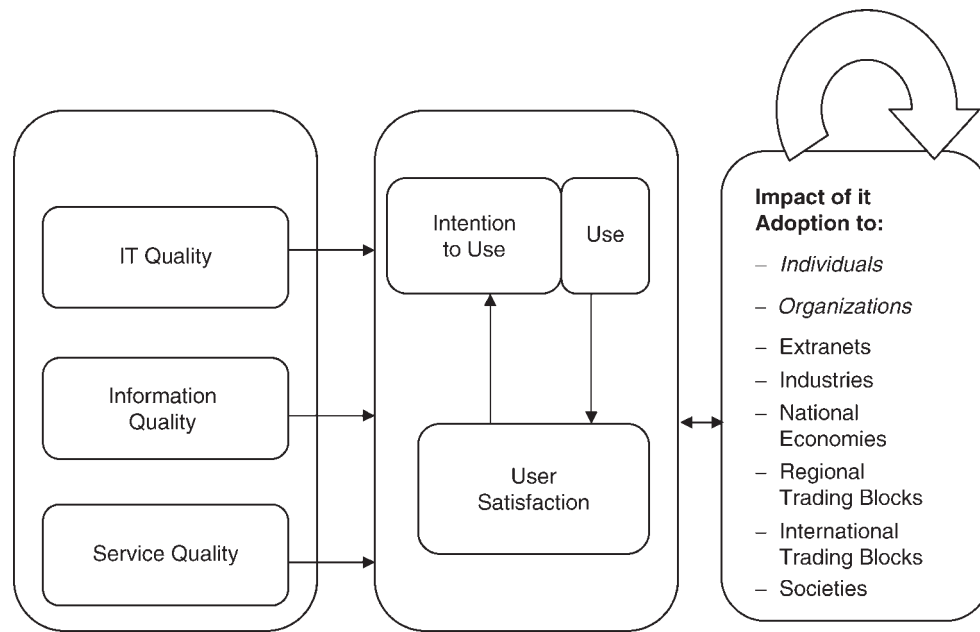


Fig. 3 DeLone and McLean IT success model.

Source: Adopted from DeLone and McLean.^[2]

difference $t_2 - t_1$. The *frequency of the reports* is measured by the number of times the user retrieves updated information for decision making. For example, if you have a bank account, monthly frequency statements may be sufficient. However, if you manage your own shares you may need daily or continuous updates of information from the stock exchanges.

Content attributes relate to the meaning of the information provided to the users. The attributes of content include: *accuracy*, *relevance*, *exhaustiveness*, *redundancy*, and *level of detail*. Accuracy refers to the integrity of the data used to produce reports. Relevance refers to the pertinence of the information to the decision at hand. Exhaustiveness refers to completeness or comprehensiveness of the information. Often, one can have relevant but incomplete information. Redundancy is the degree of repetitiveness of the information. Level of detail refers to the aggregation level of the data. The optimal level of aggregation is obtained when any extra detailed information does not improve the decision being made, and any more aggregation would worsen the decision.

Format attributes relate to the mode of presentation of the information. The attributes of format include: medium (hard copy, visual display, plotters, graphs, microfilm), layout (order of columns and rows, sequencing of detail and totals, etc.), and graphics design (colors, letter sets, fonts, etc.). Research studies on the format attributes have relied on the IT adopter's perceptions with respect to the medium, layout, and graphics design due to the problem of obtaining objective measurements. A laboratory study by Benbasat and Dexter^[26] found that whereas tabular reports led to better decision making, graphical reports led to

faster decision making by individuals under time pressure. However, they also found that reports with a combination of graphs and tables led to superior decision making when compared to tabular or graphical reports.^[26] Another study by Lim and Benbasat^[27] found that multimedia presentation using text, tables, video, and graphics reduced ambiguity, increased comprehension and accuracy of complex problem solving. These findings have been corroborated by studies on presenting spatial decision support information to managers when using geographical information systems.^[28]

Cost and benefit refers to the economic value of the new IT relative to the old one. The focus here is on reduction in fixed or variable costs, avoiding certain costs incurred while using the previous IT (e.g., overtime, stationery); profit enhancement through increased sales volume; and customer goodwill. The problem is that some benefits and costs are intangible and cannot easily be assigned monetary values. For example, it may be difficult to justify a new IT that could be used by a police 911 emergency services system to save lives. In this case how does one trade-off between the benefits of saving a life and the cost of the IT?

Overall, research studies that compared existing ITs to newer ones found that newer ITs that ranked higher on the timeliness, content, format and cost and benefit attributes; had a higher chance of getting adopted.

Service Quality. IT *service quality* is the gap between the IT adopter expected support and the actual support provided by a designated service provider, i.e., the IT vendor, the organization's Information Systems

Department, or other appointed third party. In formal settings, service level agreements (SLAs) could be made between the IT adopter and the service provider. An SLA is an adopter-driven formal written agreement that stipulates the level of service that will be provided.^[29] To evaluate an SLA, the IT adopter is asked to rate the level of service received for any number of itemized services using a rating scale, e.g., excellent (96–100%), above average (91–95%), satisfactory (86–90%), or unsatisfactory (below 86%). An unsatisfactory score may lead to non-adoption depending on the IT adopter's zone of tolerance. The zone of tolerance is the range of IT service an IT adopter would consider satisfactory.^[30] Service quality can also be measured using SERVQUAL, a 22-item instrument developed by market researchers for measuring service in general. The SERVQUAL measurement attributes are: *reliability*, *responsiveness*, *assurance*, *empathy*, and *tangibility*.^[31] Reliability is “the ability to perform the promised service dependably and accurately”; responsiveness is “the willingness to help customers and provide prompt service”; assurance is “the knowledge and courtesy of the [service] employees and their ability to inspire trust and confidence [in the IT adopters]”; and empathy is the ability to provide caring and individualized attention to the IT adopters.^[31] Tangibility is “the appearance of the physical facilities, equipment, and servicing personnel” including visual appeal, up-to-date service technology, and dress and neatness of the service personnel. Although some studies have praised the efficacy and robustness of the cognitive and psychometric properties of the SERVQUAL instrument,^[31–33] other studies provide criticism.^[34,35] Overall, such mixed results are common in most studies that solicit self-reported perceptual measures.

Behavioral Intention to Use, Actual Use, User Satisfaction. Given a relatively higher-quality new IT system that provides higher-quality information, and has high-quality service support; the other measures of successful IT adoption are: *behavioral intention to use*, *actual usage*, and *user satisfaction*. Fig. 3 shows that IT quality, information quality, and service quality have a joint impact on behavioral intention to use, actual use, and user satisfaction.

Behavioral intention to use/actual usage. Fig. 3 shows that there is a cyclical relationship between intention to use, actual usage, and user satisfaction. Behavioral intention to use is sometimes measured by a self-reported survey or by asking potential adopters their willingness to pay for the IT system.^[25] Some studies have measured actual usage by collecting data through hardware monitors, i.e., connect time,^[36] number of functions utilized,^[37] and actual charges for IT use.^[38] Other studies have measured IT use by questioning managers about their use of the IT.^[39–41] In either case, the success of an IT innovation will be measured by the degree to which the adopters rely on it, their feelings of ownership of the IT, and the degree

to which the IT becomes part and parcel of the standard operating procedures in the workplace.^[42] Moreover, in order to measure the actual use of a newly adopted IT, such use should be voluntary. We postpone the discussion of voluntariness to the section on type of innovation decision.

Each interaction with IT creates a certain level of *user satisfaction*. Other measures related to user satisfaction are *user enjoyment* and *user appreciation*. Increased satisfaction leads to repeated use of the IT, which in turn increases the user satisfaction level even further (hence the double arrows linking IT use to user satisfaction in Fig. 2). There is wide appeal among IT researchers to use this measure to evaluate success of new IT adoption. There is wide appeal to use of this measure to evaluate the success of a new IT adoption.^[2,20] Also, a number of research studies have found that user satisfaction from using a specific IT is related to their attitudes toward that IT.^[43,44] So, it is recommended that whenever user satisfaction is used as a measure of IT adoption, the users' attitudes should also be included in order to control for the biasing effects of the attitudes in the analysis—hence the arrow pointing to behavioral intention to use the IT innovation.

As shown in Fig. 2, behavioral intention to use, actual use, and user satisfaction have a joint *impact* on the *individual* or *organizations* using the IT innovation. It is generally accepted that information created by an IT is not beneficial until it is meaningful and useful to its user. Information technology benefits to the individual adopting the technology could include any of the following: a reduction in the average time to make a decision, increase in confidence in the decision made, increase in number of decisions made by a participant, increases in productivity, and increase in the number of reports requested by higher level managers. Researchers have used both quantitative and qualitative measures to evaluate the impact of IT on individual adopters. Quantitative measures include test scores, amount of performance improvement, time to make a decision, number of members participating in making a decision, and number of reports. Qualitative measures include: perceptions of improvement of decision making, perceived confidence in the decision, and the amount of money the adopters are willing to pay for the new IT.

Most managers are eventually concerned about the bottom line. It is therefore of interest to assess the *organizational* impact of new IT investments at the unit, department, or overall enterprise level. The recursive relationship on top of the “Impact of IT Adoption” box in Fig. 2 indicates that the aggregate of all individual impacts resulting from IT adoption in an organization contribute to the overall organizational impact. Several measures of IT organizational adoption impacts are available in the literature. They include overall: cost reduction,^[45,46] cost avoidance, increase in sales volume,^[47,48] reduction in overall operating expenses,^[49] and return on IT investment.^[50,51]

Current research has focused more on measuring the impact of IT on the organization structure,^[52] increases in customer switching costs, erecting barriers to new firm entry into the industry, product differentiation, and increasing organizational bargaining power with buyers or suppliers.^[46,53]

Summary. Relative advantage is “the degree to which an innovation is perceived as better than the one it replaces” as measured by the monetary gains, convenience, enjoyment, and satisfaction derived from its use. The greater the relative advantage, the higher the rate of adoption of the innovation. McLean and DeLone^[2] reviewed the IT literature and identified seven categories that can be used to assess the relative advantage of new IT investments, namely: IT quality, information quality, service quality, behavioral intention to use, actual usage, user satisfaction, and impact on the adopting individuals, organizations, extranets, industries, etc. Fig. 2 shows the relationship between the various measures.

Compatibility

One characteristic of IT is that it requires people to think, work, and behave differently. This emanates from the ability of IT to open organizational boundaries, integrate and coordinate work, speed up work, change the way work is done, provide faster feedback systems, and change perceptions of status and power.^[54] Not only should the various IT networks be compatible with each other, individuals should also adjust their work behavior to the new demands. Information technology can therefore place a significant amount of cognitive burden on users—who may not only be unsure about their job situation but also may have to invest in education and training in new skills. *Compatibility* is the degree to which the new IT is perceived as being consistent with the existing values, past experiences of adopters, and existing IT applications and networks. In Fig. 2, compatibility belongs to the behavioral intention to use, actual usage, and satisfaction category. Whenever there is lack of compatibility, passive or active resistance may occur.^[55]

It is therefore recommended that users be involved in IT acquisition and implementation decisions. As recommended by Osterman:^[54]

Beyond investing in people early, through education, training in new skills and so forth, it turns out to be helpful for the organization to develop flexible human resource policies that enable and encourage the organization to capitalize on the new IT. Employees at all levels are more inclined to experiment with new ways of working if they know their standing in the organization will not be affected by their learning process. (p. 220)

Several studies have identified compatibility as an important factor in IT adoption. One classical study is the one

reported by Markus.^[55] In the study by Moore and Benbasat^[17] a factor analysis grouped compatibility with relative advantage.

Complexity

Complexity is a relative measure of perceived cognitive burden imposed by the new IT. In Fig. 2, complexity belongs to the IT quality category. Measures of complexity include ease of use,^[14,56,57] ease of learning,^[58] and enjoyment.^[59] The more user-friendly a particular innovation is, the greater it's potential for adoption.

Triability

The ability to try out a new IT before integrating it into the routine activities and standard operating procedures of the workplace is an important measure of IT adoption. Triability affords individuals and organizations the opportunity to investigate the relative advantages, compatibility, complexity, and observability of the new IT. The study by Moore and Benbasat^[17] found that although triability had significantly less weight than other factors in an organizational context, it should be of great concern for organizations that would adopt IT at their own risk.

Observability

Observability includes the ability to demonstrate the results (benefits and costs) of using the IT to potential users, as well as making the results visible to others within and outside the organization. Users are more likely to use a new IT if they feel that using the IT will bring higher approval and recognition from management and colleagues. In Fig. 2, observability could belong to the user satisfaction category.

Summary. A new IT that is perceived to be relatively useful, compatible, easy to learn and use, has observable results, and can be used on a pilot basis will most likely be adopted than the one that is lacking in any or all of these attributes.

Type of Innovation Decision

There are three types of innovation decisions: voluntary, authoritative, and collective. Innovations requiring the adopter's voluntary decision to adopt are generally more rapidly adopted than innovations that are mandated by an organization or other external pressures.^[1] Voluntariness of use is the degree to which the use of the IT is perceived as being voluntary or of free will. In Fig. 2, the type of innovation decision belongs to the behavioral intention to use, actual use, and satisfaction category.

At the individual level, management may mandate (authoritatively) the use a specific IT, or may provide incentives for those who use the specific IT. Sometimes

management may even enact policies that discourage the use of a specific IT. The decision to adopt may also be made by a few IT champions in the organization and then imposed on the rest of the business unit or department.

At the organizational level, an organization may be forced to adopt specific ITs in order to survive competition in their industry. In this case, IT becomes the cost of doing business. For example, a new bank may adopt ATM machine technology as the cost of doing business, irrespective of whether the benefit of implementing ATM technology has been proven in the specific area of operation. These circumstances deny the adopter the freedom of choosing to reject the IT.

According to Ajzen and Fishbein,^[60] it is often not actual voluntariness that influences behavior, but rather, the perception of voluntariness. This means the rate of adoption will be increased if the people championing the adoption of the IT (change agents) can successfully make the adopters believe that they are the ones who are choosing to adopt. To accomplish this, change agents must understand the dynamics of change. Lewin^[61] and Schein^[62] proposed a three-stage model for managing change (see Fig. 4).

Unfreezing is a process of removing old habits and creating a climate receptive to change. Moving is the process of learning new work methods, behaviors, and systems. Refreezing is the process of reinforcing the new changes so that the new work processes and behavior are accepted as part and parcel of job. When a new IT is introduced, IT professionals become the agents for change. An understanding of the dynamics of change can help change agents understand how to make IT implementation more successful.

The number of people involved in decision making is another factor that may affect successful IT adoption. Rogers^[1] observed that the more people or institutions are involved in making an innovation adoption decision, the slower the rate of adoption. Few studies in the IT adoption literature have focused on this aspect. One notable study is the one by Keen.^[63] He noted that increasing the number of people involved in the IT adoption decision could be a tactic to prevent implementation success. He called this phenomenon counterimplementation.

Communication Channels

The communication channels used to spread information about the relative advantages, compatibility, complexity, triability, and observability of the new IT can also influence the rate of adoption. Mass media is recommended when the

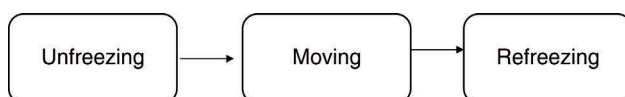


Fig. 4 The Kurt Lewin and Edgar Schein model.

new IT is relatively simple to use. For example in 2007, Microsoft spent more than \$500 million to advertise their flagship Vista operating system because they believed the Vista interface was relatively intuitive to use. Interpersonal contacts with change agents are recommended when the new IT is perceived by potential adopters to be complex. For example, we observed that computer-assisted software engineering (CASE) tools such as AutoCAD are mainly marketed via interpersonal contacts between vendors and potential professional users in academia or industry.

Nature of the Social System

This includes the norms of the organization where the new IT is being adopted and the existence of interpersonal network influences on potential but skeptical adopters. In an organization receptive to new IT ideas, opinion leaders play a significant role in providing innovation-evaluation information critical to decreasing uncertainty about the new IT. Opinion leaders are those adopters who act as role models in influencing others opinions about innovations. As will be discussed later, these people belong to the early adopters' category.

Extent of Change Agents' Promotional Efforts

The rate of adoption is also influenced by the extent of the promotional efforts of the change agents. The more opinion leaders the change agent can convert, the greater the rate of adoption. The rate of adoption and the extent of the change agents' efforts may not be direct or linear; however, Rogers^[1] observed that the rate of adoption is greatest when opinion leaders adopt, and continues to grow with little promotion by change agents after a critical mass of adopters has been established. A critical mass is defined as the point at which enough adopters have accepted the new IT to cause the perceived cost-benefit of adoption to shift from negative to positive.^[55]

Summary

Left on their own volition, not all individuals, organizations, or nations are receptive to IT adoption; there is considerable skepticism about the real benefits of IT adoption. The rate of adoption of an innovation depends on the perceived attributes of the innovation, the type of innovation decision, communication channels used to advertise the technology, nature of the social system where the IT is implemented, and extent of the promotional efforts of change agents. Often, it is not the actual voluntariness of the decision to adopt a new IT that influences behavior, but rather, the perception of voluntariness. Change agents who understand the dynamics of change can play a role in influencing successful IT adoption. The stages through which a technological innovation passes are

- Knowledge (exposure to its existence and understanding its functions)
- Persuasion (the forming of favorable attitudes toward using it)
- Decision (behavioral intention to invest, experiment, learn and commit to its adaptation)
- Implementation (putting it to use)
- Confirmation (reinforcement based on positive net benefits received as a result of adopting it)

PART 2: RATE OF IT ADOPTION CATEGORIES

In part 1, we discussed the important elements of successful IT adoption. We noted that despite the overwhelming opportunities offered by IT, however, not all individuals or organizations may implement a new IT at the same rate. Even when the adoption decision is mandated (authoritatively or collectively), users may not implement the full features of the new IT at the same rate.

One way to describe the rate of IT adoption or consumption is to use the “S-Curve of Adoption and Normality” developed by Rogers.^[1] Although some research has found only weak support for the S-Curve,^[64] many studies have supported its applicability especially in the early days of the introduction of a new IT.^[1,65,66] The S-Curve is shown in Fig. 5. According to the S-Curve, the first 2.5% (i.e., minus 2 standard deviations) of individuals or organizations to adopt IT are called the innovators. The next 13.5% (i.e., between the mean minus 1 standard deviation and the mean minus 2 standard deviations) are called the early adopters. The next 34% (between the mean and the mean minus 1 standard deviation), are called the early majority. The next 34% (between the mean and the mean plus 1 standard deviation) are the late adopters, and the remaining 16% (above the mean plus 1 standard deviation) are called the laggards.

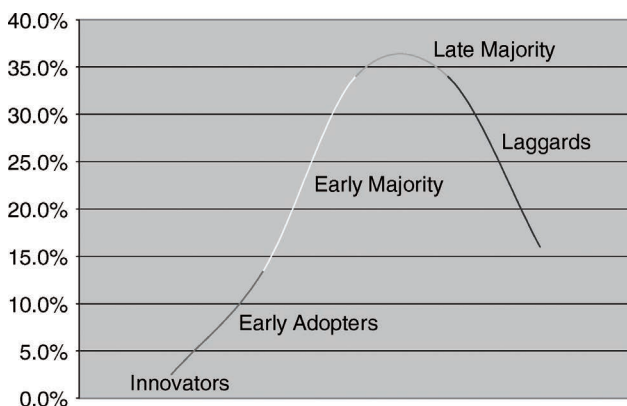


Fig. 5 The S-Curve of adoption and normality.

Individuals

Innovators are the first 2.5% of IT users. They include venturesome or cosmopolitan individuals who have enough resources to acquire and experiment with new IT or can have their organizations buy the technology for them. The value of IT to innovators is the potential return they may get for being the first to try a potentially beneficial technology. People working in beta and alpha test sites for new software applications belong to this category. Innovators command a certain amount of social prestige and peer respect for being at the cutting edge of IT. Observability and triability are the two main attributes at play here.

Early adopters are the next 13.5% of people to perceive the relative advantage, compatibility, and observability of a new IT and are willing to pioneer its use. Early adopters are valued as change agents, and as such, have high subjective norms.^[60] Subjective norm is a social influence term that refers to the importance the person attaches to opinions of referent others. “The early adopter knows that [in order] to continue to earn [the] self respect of colleagues and to maintain a central position in the communication networks of the IT system, he or she must make judicious innovation decisions...”.^[1] As such, early adopters are motivated by the social influence and respect they obtain from their peers.

Early majority is a group of individuals who adopt IT because it has been proven to work. Comprising 34% of the IT adopter category, the early majority are the first most numerous group to implement the new IT. As such they bring in a “critical mass” of IT users. This group interacts with the early adopters to get guidance on how to use the new IT. Moreover, they provide interpersonal networks to the late majority.

Late majority comprise of skeptical individuals who adopt IT for fear of losing their jobs or due to peer pressure. Like the early majority, they comprise 34% of the new IT adopter categories. Additionally, individuals in this category may not have enough resources to spend on IT and hence have to rationalize any IT expenditure they consider risky or uncertain.

Laggards are the remaining 16% of the adopters who may fear computers, have negative attitudes toward computers, or have the fear of using poorly designed systems. Laggards tend to be suspicious of new IT and change agents. They want to be sure about the costs and benefits of adopting the new IT before accepting it. Similar to the late majority, individuals in this category may not have enough resources to spend on IT.

Summary

Individuals can be innovators, early adopters, early majority, late majority, or laggard depending on the impact of the rate of adoption variables on them. There are both

intrinsic and extrinsic factors influencing how adopters perceive the rate of adoption variables. Innovators value IT for the potential returns that may accrue by being the first to try a potentially beneficial technology. They hope that by the time other groups catch on, they will be high up on the learning curve. Early adopters are motivated by the respect they obtain from their peers and their value as change agents. The early majority are risk averse individuals who join the IT bandwagon only when it has been proven to work. The late majority are skeptical individuals who adopt IT as the last resort. Finally, the laggards adopt new IT only when they can ascertain all the benefits and costs.

Organizations

Innovators are the first 2.5% of organizations which adopt a specific IT. Such organizations either have enough resources to acquire and experiment with new IT or have an influential Management Information Systems (MIS) department manager who has a secure budget for new IT. The value of IT to innovator organizations is the competitive advantage that may accrue for being the first to try a potentially beneficial technology.

Early adopters are the next 13.5% of organizations to perceive the relative advantage, compatibility, and observability of a new IT early and are willing to pioneer its use. Most organizations in volatile industries, e.g., computer hardware, computer software, telecommunications, and entertainment are forced to become early adopters of new IT. Volatile industries are ones characterized by cut throat competition and uncertainty. For example, Microsoft's late move into the Internet search engine market cost the company significant competitive advantage, albeit temporarily. Early adopters develop ways to use IT to lock in customers and lock out competitors early, and as such, tend to maintain their market share, which in turn, increases their chances for long-term survival and profitability. These early adopters are motivated by the customer loyalty they obtain due to their innovative efforts to provide higher-quality products and service.

Early majority is a group of organizations who adopt IT because it has been proven to work. Comprising 34% of the IT adopter category, the early majority are the first most numerous group of organizations to implement the new IT. As such they form part of a "critical mass" of IT using organizations. This group of organizations sometimes assigns specific individuals the role of reading the literature on the experiences of the early adopting organizations in order to get guidance on how to use the new IT. Other organizations employ people from the early adopting organizations so that they can benefit from their experiences. In other instances, organizations may acquire or enter into strategic alliances with early adopting organizations in order to learn from them. In other cases, organizations have formed a separate organizational unit

called the "emerging technology group" to oversee IT adoption into the organization.

Late majority are skeptical organizations who adopt IT for fear of being swept away by the competition. Like the early majority, they comprise 34% of the new IT adopter categories. Organizations in this category may not have enough resources to spend on IT, and hence have to rationalize the IT-related expenditure they consider risky or uncertain.

Laggards are the remaining 16% of the adopting organizations who may believe "if ain't broke, why fix it?" Laggard organizations tend to be suspicious of new IT and the hype that surrounds new ITs. They want to be sure about the costs and benefits of adopting the new IT before implementing it. Similar to the late majority, organizations in this category may not have enough resources to spend on IT. They also want tried and proven technology.

Summary

Organizations can be innovators, early adopters, early majority, late majority, or laggard depending on their mission, culture, the nature of the industry they are in, their structure, and the impact of the rate of adoption variables on the long-term profitability and survival of the organization. The decision to adopt or not to adopt is mainly driven by demands from the internal and external environment of the organization. For example, organizations with a culture that emphasizes "internal control," "creativity," and "individual autonomy" are more likely to adopt new IT than the ones that emphasize "external controls," "conformity," and "hierarchies."^[67]

Innovators value IT for the potential returns that may accrue by being the first to try a potentially beneficial technology. Early adopters are motivated by the customer loyalty they create by providing better products and superior service. Such organizations hope that by the time other organizations catch on, it would be difficult for them to tap into their market share. The early majority are risk adverse organizations which are in relatively stable operating environments. Most public sector organizations fall into this category. The late majority are skeptical organizations which adopt IT as the last resort. Finally, the laggards are would adopt a new IT only when they can establish all the benefits and costs of the new IT.

CONCLUSION

We conclude by suggesting that since the proliferation of newer and more powerful ITs is apt to continue unabated for many years to come, there is a real need for individuals and organizations to devise new ways of identifying, learning, and implementing new technologies. One way to do this is to have a clear understanding of the factors that influence successful adoption of IT. Specific factors

that may influence IT adoption in particular industries, national states, or societies are beyond the scope of this entry. This entry used the variables that affect the rate of adoption of IT innovations (see the section "Part 1: Adoption of IT innovations"), the categories of successful IT adoption (see the section "Part 2: Rate of IT Adoption Categories"), and the S-Curve (see the section "Part 1: Adoption of IT innovations") to provide a general overview of existing literature on new IT adoption by individuals and organizations. The variables that influence successful adoption and the categories of successful IT adoption are multidimensional and interrelated. For example, one cannot discuss the relative advantage of a specific IT without considering the IT quality, information quality, usage of the information provided by the IT, user satisfaction, and benefits accruing to the individual and organizational adopters. Use of the S-Curve will allow individuals and organizations to position themselves with respect to where they fit in their rate of IT adoption. It seems individual life long learning, and organizational learning are the indispensable characteristics of the very survival of an increasingly IT dependent society: One caveat though: "... management can promote the acquisition of skills by creating a climate supporting continuous learning in general and by encouraging experimentation with IT tools in particular..."^[68] (p. 275).

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Information Technology Literacy

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Abstract

Information technology literacy is a broad, many-dimensional description of the skills and knowledge needed for effective participation in business and education in the twenty-first century. First considered to be generic, those capabilities are now understood to be contextual, social, determined by the specific situation, be it workplace, academic, or social. This becomes clear when the term is compared to information literacy (knowing when information is needed, search strategy development, accessing and managing the information, and using it legally and ethically to meet the need). Information literacy (IL) is extensively explored and discussed in a vast literature. There remains considerable disagreement about what it is and how it should be taught and assessed; yet IL is relatively simple compared to the less developed concept of IT literacy. Information technology literacy involves using the tools of information technology (hardware, software, networks) as well as the data and information (as with IL), as well as working in a specific context (which might be professional, social, industrial, or academic). Workplace, social, behavioral, and cognitive issues become, therefore, part of the complexities in play. Furthermore, complexity accelerates as new media, new communication technologies, and new collaborative capabilities combine to create a dynamic information universe of participation and interactivity. This emergent reality changes the way people learn and the very nature of knowledge. Librarianship, scholarship, research, business, and the professions are all being reformulated in the process of adapting to these new conditions. Information technology (IT) literacy provides a useful concept for tracing, exploring, and better understanding this world-changing phenomenon.

INTRODUCTION

Information technology literacy is a significant, if not fully delineated, concept of the knowledge and skills needed for effective participation in the age of information, knowledge, learning, and networks that characterize the new millennium. The term offers approaches to needed knowledge and skills and guidelines to support the development of these competencies by students and learners. Information technology (IT) literacy resides among, and overlaps in some measure, other definitions including computer literacy, visual literacy, media literacy, digital literacy, multiliteracies, information literacy, information competence, fluency with information technology, and information-communication technology literacy. In this brief discussion a broad-gauged perspective is taken of the issues, suggesting that IT literacy does not require a major campaign to distinguish it from the other, closely related definitions, but that defining and discussing IT literacy provides the opportunity to trace, develop, and illustrate the relationships and manifestations of the roles and effective uses of technology in society, the workplace, and in education. The discussion loops back toward a conclusion that IT literacy—or perhaps “information and technology literacy”—is a useful descriptor for a range of theories and

practices that come together to lead to a better understanding of a complex situation.

Information technology literacy means being “information literate” (able to find, access, and use information to solve the need of the seeker) as well as “technology literate,” sufficiently skilled for competent utilization of a networked, interactive, multimedia environment.^[1] An outline history of the topic reveals major shifts in technology and its impact in recent decades and the resulting adaptations as professions exchange the lead position in discussing the significance of those changes.

With the rise of the personal computer (PC) in the 1980s, and the rapid expansion in the number of people using the tool, the need for “computer literacy” became apparent and IT specialists and information scientists took the lead in defining and refining the term. The PC was difficult to use—before Apple and Windows software and World Wide Web (hereafter simply Web) search engines rendered it more intuitive—and “technical” people led the way in exploring how to train others to utilize the new “machines.”

In the 1990s, with the growth of the Internet, intuitive and graphic interfaces, and the number of “user friendly” databases of information available, information literacy became the focus of the discussion and librarians,

particularly academic librarians, moved center stage as the champions of preparing a wider public to use the new tools, resources, and technologies made available by the Internet. The work soon expanded to encompass a much broader “digital” world of communications and visual/multiple media resources.^[2] As we entered a new millennium, a variety of substantive definitions of information literacy demanded consideration and competed for influence. A federal government initiative proposed Fluency with Information Technology (FIT) as the appropriate metaphor;^[3] the Educational Testing Service proposed information and communication technologies (ICT) literacy as the preferred concept;^[4] and academic librarians broadened their concerns to encompass “competencies” that could be measured to assure appropriate “learning outcomes.”^[5] The ground soon shifted toward a broader perspective, leading to serious consideration of the need for definitions and a model for IT literacy. Shapiro and Hughes^[6] suggested, in a much cited article, that information literacy (IL) could be a stand-alone liberal art, that both the tools of IT and an ability to perceive emerging technologies were important elements of the model.

Getting more specific, Brandt proposed in his 2001 article^[1] the need to think in terms of a broader “computer literacy” and a bridge to IL. A few years later Brandt and colleagues returned to the issue and proposed merging IT literacy with IL as the more comprehensive and proper approach.^[7] By this time, roughly 2005, focus shifted away from information literacy back toward the technology side of the IT literacy equation. There are several features of this shift. The broader view was already becoming accepted. The National Research Council reported in 2002^[8] that IT was clearly impacting teaching and research, compelling new collaboration and restructuring intellectual disciplines, pointing to a clear need for faculty and many others to “reskill.”

During the early years of the new century, communications and education professionals—and practitioners—actively engaged in the discussion, arguing for the crucial importance of media literacy, instructional design, and related concerns. The dialogue continues. While different descriptors are preferred by various proponents of IT literacy, there is a general consensus regarding the critical importance of literacy—or fluency or competence—for effective participation in the classrooms, offices, and workplaces of the day. Each of the perspectives adds something to the larger picture, and this overview will endeavor to be inclusive.

STAGES AND LIMITATIONS OF LITERACY

Tracking the evolution of literacy and its segue into considerations of fluency and competence is a useful path for exploring the power of technology and networks to change, nay revolutionize, not only how we search for

and share information, but how we learn and carry on business, polity, and entertainment. The varieties of literacy “in use” provide a connecting theme for this many-faceted development.

Basic Literacy

Literacy in the broadest sense is a process that is valued by society. The term is popularly understood, however, to mean simply the ability to read and write. By implication, basic communication skills are included. This is the social dimension to literacy in that people need others to help them learn to read and write. Literacy cannot be self-generated, as a rule, because meanings must be social and not just personal. More is involved than reading, however. Literacy is a human phenomenon, grounded in a social context. Meaning comes from interpretation and influence, both of which are social. A substantial “politics” swirls around the issue, seen by some as a means by which a society maintains control, sets priorities, and shapes cultures.^[9] Bilingual people and individuals with advanced literacies enjoy special advantage; they can communicate at another level. A consideration of literacy cannot dwell long at the level of learning how to read.

Advanced Literacies

A second spoken language, a symbolic language (such as mathematics or a programming algorithm), and various other skills indicate advanced capabilities. Basic information tool literacies, such as desktop computer literacy, visual literacy, or new media skills are alternative abilities signaling advanced literacy. Navigating the Web and participating in wikis or instant messaging systems or social gaming are necessary skills in many workplaces. Communication skills are more advanced at this level, moving beyond basic signaling to greater engagement, where information is shared and can lead to improved coordination among people and between organizations. These literacies quickly become more specialized, often requiring additional media tools or different perspectives. Literacy becomes a process of making meaning out of confusion; advanced literacy involves dealing with the complexities of learning, text, and context leading to improved understanding and dynamic relationships.^[10] Kuhlthau^[11] puts it succinctly: literacy is the ability to construct one’s own meaning from an information rich environment.

At this point, technological literacy has moved well beyond computer skills, entering the realm of working effectively in a given context which, today, is likely to have a moderate to high level of electronic devices as basic tools. Achieving technological literacy broadly across society is a great challenge and carries an enormous cost that will require involvement of the state, education, and the corporate sector.

Visual and Media Literacies

In recent decades, the impact of broadcast media and the Web requires a greater literacy, or better understanding, of how visual images are created and used. Reliance on the image, especially the moving image, in communication and the easy manipulation (morphing) of these images requires higher levels of technological competence and different ways of thinking or, more specifically, new cognitive skills.^[12] What we “see” is in good part actively “constructed” by the individual mind (amidst social influences of course), not passively received through vision.^[13] The fact that visual communication can bring together codified (linguistic) and uncoded (tacit or experiential) knowledge gives the technology enormous power. For example, hand-drawn sketches and lists of words and ideas are popular for planning and brainstorming sessions. Heretofore separate genres (text, graphics, audio, and video) converge into digital communication capabilities: symbols, images, and words are now mixed, replicated, and widely disseminated on Web pages, advertisements, and presentations.^[13]

In the emerging information-learning culture a reversal is well underway: where the word long held sway and the image augmented, increasingly the image now dominates and the verbal augments. Today visual language is proposed as a way of integrating words, images, and shapes into a new language for communication and understanding. This “visual language” makes learning accessible to many more people.^[2,14,15] Visual language warrants additional investigation and demonstration; for one thing it offers an escape route out of the gridlock of print vs. digital media arguments.

Media literacy is central to modern communication studies. It involves the ability to access, analyze, evaluate, and communicate messages in a variety of formats. Digital media literacy utilizes information digitization to perceive and present a distributed, interactive, malleable world. This is not an extension of TV, but the antithesis of it; the viewer—particularly the younger generation—is taking charge of their own information. Labeled “new media literacy,” new image production tools allow *many* more people to create media and join in the great “conversation” facilitated by the Internet even if only a tiny percentage actually gain attention and achieve influence.^[16]

Some of these literacies are narrow, of interest only to select disciplines. Nevertheless, a holistic concept of literacy permits escape from many limitations and allows entry into more demanding realms.

Literacy 2.0: Social and Workplace Literacies

At this point the discussion moves into the more complex dimension that can be called “Literacy 2.0,” the ability to use information in whatever format to interact with others to solve problems and create new knowledge. In a sense,

solving a new problem, even in a narrow field or context, can be considered the creation of new knowledge.

Literacy 2.0 or workplace IT literacies is a shorthand label for the increasing skills required in more and more lines of employment. These skills are contextual, varying with the social, professional, and intellectual practices of a given workplace. In addition to information literacy, this capacity builds competence in contexts that change frequently. Neither basic literacy skills nor higher order thinking skills are sufficient. Literacy as traditionally constructed rarely is informed by actual observations of work.^[17] Workplace literacy involves participation and is something very different from traditional training or education.^[18] In the varied and complex world of the workplace, different terminologies are used—such as fluency with IT—and other methods, such as relying on “masters” as mentors.^[19] Additionally, other articulated literacies are valuable. For example, “learning literacy” requires learning one’s own “identity” and learning style as well as learning skills.^[20] Rosen^[21] defines “social literacy” as the skills required for leadership; these include inspiring others to excellence, listening and communicating effectively, promoting common goals and values, and transforming conflict into creative action.

Socio-technical practice warrants mention. Tuominen and colleagues^[22] emphasize that IL and IT literacy cannot remain detached and generic practices but are situated, in a given workplace, context, a community of practice, or within a disciplinary, epistemic methodology. While the Tuominen article is ostensibly about IL, its breadth of consideration renders it useful for this discussion.

Multiliteracies

The case for multiliteracies provides a culmination for the literacy discussion. A wide-ranging effort of a group of international experts in learning and language has created a pedagogy of social and multimodal learning. They bring the meaning of literacy to a new level of importance by including such work life issues as competitiveness, coping with diversity, and collaboration. Information design is essential and interface icons are important as a meta-language to allow access for many more people.^[23]

An additional note on the term, literacy: The label of illiteracy clearly implies that a fundamental skill is lacking. In situations where people are engaged in learning and willing to acknowledge their limitations, illiteracy is not deemed insulting or belittling. Indeed, each of us has our illiteracies, domains where general information and skills are lacking, and where basic instruction is appropriate. But common sense requires that additional levels, beyond the basics, provide part of the scheme for the ongoing, dynamic world of interactive communication and learning that has become central for our time. That is why a literacy-competency-expertise continuum is useful as a design for framing the process of continuous learning.

There is no simple conclusion to this discussion. We live amidst increasing complexity and the list of proposed literacies allows the seeker to select the model that best fits their situation and context. Information technology literacy will work for many of these situations, but no single definition will be found satisfying to all.

THE NECESSITY OF COMPETENCE

Today's workplace requires more than either special skills or general knowledge; it also requires competence involving personal characteristics and behaviors that can be measured or recorded. Such competence encompasses cognitive knowledge, functional experience, and interpersonal, social skills and is a recurring concern in higher education and for human resource training and development. Brief consideration is necessary to complete this overview of IT literacy.

The issue is not new; a half-century ago a proposed standard of biological factors including growth potential, maturity, and behaviors defined competence as the functional ability of humans to exercise personal independence and social responsibility.^[24] Before the rise of the PC, Reisman^[25] outlined society's need for competence and higher education's poor record in developing those skills among the young. More recent versions of the need for competence stress the importance of character and emotions, both managing one's own emotions and coping with the emotional behavior of others.^[26,27]

At present, there are several approaches to competence, creating some confusion. One approach relies on behaviors, including cognitive behaviors (thinking; learning; and information processing); affective behaviors (managing and using emotions and feelings productively); conative behaviors (persistence and determination); and habits and experience. Competence requires participation in the process, whatever the work or assignment.^[28] A second approach to competence stresses skills, including managing self (adapting, dealing with change); communicating with diverse people and groups; managing people and tasks (coordinating resources and people); mobilizing innovation and change; and taking initiative.^[29] Sveiby provides a concise overview, delineating five elements: knowledge of the explicit domain ("knowing what"); appropriate skills ("knowing how"); sufficient experience in the domain; exhibiting appropriate value judgment ("knowing why"); and having a social network ("knowing who") in the domain. One cannot be an effective professional, or worker in most fields, without knowing and carrying on dialogue with others in the profession, field, or practice.^[30] To repeat for emphasis, a combination of behavior, skills, and knowledge is needed to demonstrate the broad capabilities that make up competence, or an overarching meta-competence.^[31]

Information Technology Competence

The ability to use IT in the workplace is obviously essential today.^[18] Yet that is insufficient. A more advanced level of skills, such as fluency or expertise, is required more and more frequently as businesses and organizations adapt to the information age. A federal government expression of these advanced skills is Fluency with Information Technology (FIT). Fluency is defined as higher levels of competence. Fluency with Information Technology goes beyond skills (which are quickly obsolete) and includes problem-solving capabilities.^[3] New information and communication technologies enable a new era of information and knowledge grounded in interactivity. Not media as signal, but media as action-perception cycle is the emerging reality.^[32] Individuals working alone cannot be expected to master all these technologies. Teams or workgroups are required to encompass the variety of skills and knowledge needed to deal with the complexities of today's problems with the extensive range of tools and resources available.

Social competence

Today competent people must be able to collaborate with others of diverse backgrounds. The sharing of work between genders and across ethnic lines and national and cultural frontiers is essential. New standards of people skills, supervisory skills, and management skills are vital. Teams and communities of practice are frequently required for organizations to adapt to meet the challenges they face. At this level, communication becomes interactive and participatory; top-down signals are often dysfunctional. Organizational change is becoming more common, requiring cross-boundary partnerships, research, and innovation. These techniques require social competence.^[33] Today's places of work and learning are more often participatory and interactive in nature.

Socio-technological information (cyber) competence

What would address all of the necessary elements of information-related competencies required today? One possibility is social-technological information competence, or cyber-competence for a shorthand definition. Cyber-competence consists of the converging technology-based interactive skills and practices required to find and utilize information in multiple formats and varied contexts to encourage knowledge sharing, foster knowledge creation, and enhance organizational effectiveness in a competitive global and networked environment. Elements of "cyber competence" include Internet research and communication; visual and media literacy; digitization, visualization, and presentation; interactive communication and networking; self-knowledge and reflection; and action research skills. Competent people will be able to find needed information, utilize and manipulate it for new purposes, know

how to use new tools, learn new skills, and assess their own progress and development.

To focus for a moment on the library-centered world, it is appropriate to insert here that there is growing attention to and consideration of the notion of “information competence.” Information competence is included in the general discussion of information literacy to demonstrate that the appropriate level of literacy has been accomplished.^[5] To illustrate, projects at UCLA and the California State University system have demonstrated, experimented with, and evaluated how information competence might best be implemented on the university campus.^[34,35] A review of these efforts suggests, however—regardless of the value of the endeavor—that the underlying assumption regards literacy and competence as essentially equivalent, a continuum, whereas others emphasize their differences.

More technology-minded discussants might argue that “instructional systems design” (ISD) is the path to follow. On this topic the work of the American Society for Training and Development becomes significant. Instructional systems design is work-context focused and takes a systematic, logical approach to the skills needed with tracking and assessment built in. The limitation of this model is that its intent is the *transfer* of information and/or knowledge, existing knowledge, rather than the creation of new knowledge.

It is important to realize that the emphasis on competence requires a major shift beyond the data–information–knowledge transfer continuum to a more dynamic learning domain—expressed in the term Internet 2.0 or Library 2.0—demanding more comprehensive capabilities. More content knowledge does not help; it must be tested in the real world of the workplace, or the lab, or other social–economic–political domain.

Can Competence Be Taught?

Functional effectiveness in today’s workplace requires social skills and emotional stability as a supplement to IT literacy; competence requires experience in practice. Competent behavior rarely depends entirely on formal knowledge.^[36] Individual brilliance is not always highly prized in work situations unless it produces unique solutions to problem situations. “Learning” must be broadened to mean learning to make one’s own observations, to lead, to work with others, to clarify values, to correct actions, to understand how organizations work and how to influence them. A quick look at incompetence helps define competence: Incompetence can include deficits in skills or knowledge, but the list of personal factors is longer, including unprofessional behaviors or attitudes, difficult personality traits, lack of motivation, unsafe activities, or poor communication skills.^[37]

Some efforts skip over educational standards. A U.S. Department of Education conference on “Competence without Credentials”^[38] considered whether new Internet-based

instruction could replace traditional credentials and certificates, apparently on the assumption that assessed workplace performance and computer-based learning were inadequate for the social, interpersonal, and collaborative dimensions of effective work. The assumption in this essay is, however, that enhancing student competence increasingly will be an important challenge for the future of education. While reading and writing are basic skills that can be transferred to many situations, workplace competency often is highly specialized, grounded in the specific work context. It cannot be taught; it must be learned and demonstrated “on the job.”

Beyond Competence to Expertise

If competence is the goal for workplace effectiveness, it ultimately is insufficient. In a technology-driven world, today’s competence can vanish with a new software release. It is expertise that is the goal at critical times in the information-gathering, decision-making human development process. Whether we face eye surgery or planning for retirement, there are circumstances where competence is not the ideal. We require expertise, someone who has mastered the rules and understands them so completely that they can cross the lines when circumstances demand. According to one report, it is the development of relevant knowledge structures and the ability to monitor their own thinking processes and adapt them as necessary that distinguishes the work of experts.^[39] It is this level of expertise that is the ultimate goal of the learning–literacy–competence continuum. Expertise requires capabilities of learning, growth, and adaptation to changes in the “ecology” of the context.^[40] This point takes us, however, beyond the scope of this discussion.

A BRIEF GLOBAL PERSPECTIVE

We can generalize with confidence that IL and IT literacy are of greater concern in democratic societies than in less developed countries. Training is widespread in Europe, where searches for writings on “digital literacy” uncover more activity than “IT literacy” searches. There is great variety in skill levels and the intensity of library activities promoting the capability within the EU, as might be expected with recent incorporation of former Soviet-dominated areas. A British survey of national policies suggests that the global trend is clearly toward greater openness as an encouragement to innovation, e-commerce, and e-government and growing recognition that information is now a key driver in building social and economic prosperity. A widespread pattern of specific programs to build broad citizen activity and learning has not yet emerged.^[41] The assumption that providing access to computers and the Internet is sufficient is commonly held in many parts of the world.

Henri and Asselin^[42] work from a similar premise to present widespread activity on the part of the library professions to promote IL and IT literacies in the schools in many areas of the world. The articles they present suggest emergent themes including “new learning,” new literacies and multiliteracies, and the potential role that teachers and librarians play in creating information literate schools and communities. This work does not focus on IT literacy but many of the points are relevant. The difficulties in distinguishing IL and IT literacy mentioned in the introduction of this discussion once again merit noting.

Information Culture Literacy

When focus shifts beyond the Western democracies, a different perspective comes into view. Global library leadership, associated with IFLA (International Federation of Library Associations) is working closely with UNESCO to promote global access to information and learning under a flag of Information for All Programme (IFAP).^[43] This initiative has produced additional studies and reports making a case regarding the need to address the challenges of a comprehensive information culture. Not an information society, but information culture, requiring reading, gathering, and managing information, and ongoing learning and knowledge improvement. This dynamic process encompasses upgrading knowledge and human intellect, designing and utilizing diverse media for communication, improving understanding, and expanding the uses and socialization of information throughout human activity.^[44] This perspective reveals that individuals have personal information cultures, varying widely in their world outlook and system of knowledge, seeking information narrowly or widely, competently or carelessly, thoughtfully and critically or mindlessly and without reflection. Their engagement in or neglect of the process shapes their mindset, determining whether they are open or closed-minded, learning and growing, or stagnant.^[45]

The UNESCO program, seeing information and knowledge as a global public good and basic human right for improving health, advancing education, furthering creativity, and preserving diversity and the human heritage, adds enormous value to the work of IL and IT literacy advancement. The importance of reading is stressed, compared with its declining status in this country. We find that the United States is not among the top dozen countries in achieving high levels of reading competence in its students.^[45] UNESCO positions reading for pleasure and learning as a vital task for libraries, museums, and information institutions; this is a sobering counter-trend to the technology-focused IT literacy movement.

CURRENT AND FUTURE ISSUES

Several issues and debates not yet addressed are important to the topic. They include the need to rethink the

relationship of IT literacy and information literacy, the difficulties of assessing IT literacy; the new focus on learning and innovation, the posture libraries should consider for addressing these challenges, the changing nature of knowledge, and the consequences of growing complexity in society triggered by networks and connectivism. Brief discussions of these issues follow.

Issues with Terminology

Sharkey and Brandt^[7] combine earlier arguments to make the case that both information literacy and IT literacy are required capabilities for our day. Assessment of outcomes must be part of the process. None of the pieces of the larger picture suffice. The user's access and use of the information to good effect may require an electronic presentation, or a range of papers and presentations comprising an electronic portfolio of the work done and progress achieved. Work remains to be done; greater clarity and intuitive guidelines are needed. A terminology requiring both IL and IT literacy is clumsy. Information competence, ITC literacy, socio-technical literacy, fluency with IT, and all the terms utilized to date cause confusion and hamper focused progress. Information technology literacy is probably the best label available at this time, particularly when used in the socio-technical and contextual sense presented by Talja.^[46]

Technology and Academic Literacies

The new literacies require participation. The level and form of participation is determined by the competence of the participant. Several issues emerge. First, readers become less passive and more engaged as their skills develop. The reader-author distinction fades and texts become fungible, multivoiced, and increasingly unstable. Linking and hypertext—as well as visual and audio media—diminish the role of text. Boundaries fade as discontinuities and disorientation place new demands on the participant and the organization. New “literacies”—particularly IT literacies—move beyond skills and cognitive knowledge into the realm of experience.^[47] Donald Norris and colleagues address the issue as creating a new “technology economy” that requires measurement and improvement. They label the process “action analytics.”^[48] The process they describe involves incorporating workforce factors into educational curricula, utilizing open architectures to enhance access and affordability, and adapting organizational cultures to enable greater collaboration and innovation.

It is obvious that librarians must adapt to the users of new technologies. Today's students—the Net-generation to some, “millennials” to others—are mobile (with cell phones, i-pods, and laptops), collaborative, and “game oriented.” These devices facilitate learning the skills required for the new age, but librarians need to be able to better help them with that use. Students are restless in

crowded lecture halls and impatient with “nonconnected” authority figures, for which a segment of the professoriate and the library profession qualify.^[49]

Librarians by no means have the field to themselves. Other groups and companies are pushing into the arena. Two notable examples are the European/International Computer Driving License certification program and the P21 skills development efforts of the Partnership for 21st Century Skills. Civic and corporate organizations are joining the campaign to assure that more young people have the skills necessary for the new century.

Connectivism

We have not yet discussed adequately the importance of the network and connectivity. The power of the network is widely proclaimed and increasingly self-evident. Its importance in organizational change and development is discussed elsewhere. But how does it work for people and what sort of challenge does it present for IT literacy and libraries?

Scholars and researchers are turning their attention to “connections,” their nature and importance. This is not connectivity, a technological concept that focuses on bandwidth and issues of communication and access. Connectivism is something different, an object of recent interest to select denizens of cyberspace only beginning to turn up in early 2008 searches of mainstream databases, from *Academic Search OneFile* to Elsevier’s *Science Direct*. But influential bloggers promote connectivism as a theory of learning that goes beyond behaviorism, cognitivism, and constructivism to become a learner-driven approach. Not a learner-centered approach, but a learner-driven approach. The very act of joining in, of connecting, signals the engagement of the learner.

In a persuasive argument, Siemens offers connectivism as a “learning theory for the digital age,” a view seconded, disseminated, and discussed from time to time by Downes on his influential *Stephen’s Web* blog. Siemens’ essay is spotty, with weaknesses that include his definition of the half-life of knowledge. But his description of connectivism is captivating. He asserts that connectivism integrates chaos, network, complexity, and self-organization theories. He believes that knowledge begins with a diversity of opinions, is a process connecting nodes of information, and may reside in nonhuman appliances (computers). The theory stresses the nurture of connections to enhance currency, enable the difficult perception of connections across disciplines, and regards decision-making as a learning process.^[50] The learner-driven element is suggested as the distinguishing characteristic of the new decentralized learning. A complementary case is presented in an extensive Australian study. Candy^[51] demonstrates that “learners” are busy collaborating and creating knowledge on their own, independent of their instructors. He suggests that students and learners are far ahead of their

instructors in utilizing networks and personal connections to share and create knowledge informally. Brown^[52] places this trend in a larger context: something very big is underway, a shift from “pushing” information and knowledge through our schools, systems, and media, to a system, a paradigm, whereby people seek and “pull” what they want and need. Jenkins^[53] defines the situation as one of growing technological/media convergence, and points out that the process is as much social and cultural as it is “technological.” It is not the existence of the tools and devices but their use by people at work and play that is transformative. This way of thinking fits nicely into a coherent argument that explains the power of the network through understanding the importance and character of connectivism. Fully comprehending this trend and participating in its development is one more challenge for librarians and information specialists.

Learning and Inquiry

This brings us directly to the process of learning. Libraries have always been places where people can learn. For centuries that is where the information was, in the well-ordered shelves of books, periodicals, documents, and newspapers. But now information is almost ambient, virtual, available at the click of a button. Now the problem is information overload and the learner has different needs, such as selection and evaluation and using the information legally in the variety of formats where it resides. So the librarian’s role is now different. Libraries can still be the places where people learn, but librarians must provide different kinds of assistance. Now the crucial skills have technology components, of steadily increasing complexity.

Information literacy and IT literacy attend the questions of the information seeker. Librarians help the inquirer get from “where they are” to where they want to go. Reference librarians start with the questions of the patron and work to satisfy their information needs. Information literacy and IT literacy give the learner tools to find their own way more effectively; the skill segues directly and smoothly into inquiry methods and “learning how to learn.” Judging by the extent of the literature, Commonwealth libraries are further down this path than their American counterparts in the practices of information literacy leading to inquiry learning.

Knowledge Sharing

Learning leads to knowledge, but generally accepted ideas about knowledge are proving increasingly dysfunctional. Knowledge is Janus-like, dualistic in its complexity. It is simultaneously widely dispersed and personal, articulated and emergent, tacit and codified; it can no longer be sliced definitively into neat disciplines of epistemic practice, but blends across borders into *mélanges* of perspectives.

Its meaning is found in its application to given problems and contexts, not from the quick recall of “facts” for a game show. How knowledge is used increasingly is the product of how knowledge is shared. The traditional “know what,” “know how,” and “know why” proposed by Quinn and colleagues^[54] is supplemented with the networked components of “know who” (authorities, collaborators), “know where” (positioning), “know when” (context, strategy), and “know if,” through scenarios and foresight. New tools and methods of better sharing and utilizing knowledge include institutional repositories, wikis, and other collaborative IT methods producing what has been described as a knowledge-sharing revolution.^[55]

Assessment

There is an important—and political—need for IT literacy to be assessed; we must understand how best to promote it in our schools and across society. Talja presents an important argument that the traditional assessment of computer skills is not the best way to determine needs and capabilities. She proposes that a sociocultural *context* or *domain oriented* perspective is a better approach than the more common user-psychological *generic skills* method. This view takes into consideration the social, interactive, and context-specific dimensions of the issue, suggesting that IT literacy/competence is “dialogic, multilayered, and context-dependent.”^[46] This explanation enriches the literacy–competence–capability approach presented here as an important way to think about the issue.

Others take a more critical view of assessment practice. For some there is too much focus on information processing assumptions and computational-style cognition;^[56] others point to weaknesses in the testing process,^[57] or stress the uncertainty about what can be tested (information gathering and management) and what cannot (understanding and knowledge building).^[58] The aforementioned UNESCO report^[43] makes it clear that there is no agreement on the use of standards and indicators in assessing information literacy; by extension, such is even more the case for IT literacy. The complexities of remaining current amidst rapid technological change render traditional assessment methods questionable. Additional study and alternate approaches are required.

CONCLUSION

New tools can lead to new human capabilities; at that point technologies demonstrate the potential to change society, culture, and the human condition. Today information and communication technologies exercise that power, or at least their potential. To adapt to this situation requires widespread use of knowledge and skills that best can be described as IT literacy, a new fundamental capability that is necessary for effective participation in the

twenty-first century. Librarians are well situated to play a central role in promoting those skills and guiding society in adapting to the new knowledge and lifelong learning requirements.

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Information Technology Project Implementation in Developing Countries *[ELIS Classic]*

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Abstract

Kanamugire's essay is a wise and widely knowledgeable survey of the issues and problems involved in carrying out information technology projects in developing nations. While some of the technology described has been superseded, the broad range of issues addressed and helpful solutions suggested by the author are still pertinent.

—*ELIS Classic*, from 1998

INTRODUCTION

In recognition of the importance of information and information technology (IT) in development, some governments in developing countries, as well as the international community, have implemented IT projects in library and information services in developing countries. The term developing countries is used to refer to the group of countries known as developing nations, Third World, less-industrialized, least-developed, or the South. The World Bank, for example, defines developing countries as those with per capita incomes in 1992 in the range of \$80 to \$12,000, 5% to 64% of their productive resources devoted to agriculture, adult literacy rates of 35–90%, life expectancy for residents from 40 to 73 years, and 10–75% of their populations living in urban areas. The human development index (HDI) developed by the U.N. Development Program (UNDP) is also used to complement the World Bank gross national product (GNP). The HDI index combines life expectancy, educational attainment, and income into a composite index. According to the HDI, developing countries are those with 0.191 to 0.835.^[1] The working definition in this entry, therefore, refers to the many countries in Africa, Asia, the Middle East, the Caribbean and Latin America, and Asia/Pacific, which have different degrees of scientific, technical, economic, and social developments. However, as Mahoney points out, in an immediately postcolonial world there was little argument about what constituted a developing country. Now we have the extremes of Singapore and Rwanda; enormous disparities in population wealth in individual countries, and to cap it all, the end of the Eastern bloc and all the problems of development unleashed there.^[2]

Among the many international organizations that have been involved in implementing IT projects in developing countries, the U.N. Educational Scientific and Cultural Organization (UNESCO) has played a leading role through its various programs, including UNISIST

(UNESCO/ICSU Program for the Development of a World Science Information System), NATIS (the National Information System), and PGI (General Information Program). For instance, UNESCO has underscored the significance of creating databases that can handle locally produced information and facilitate the exchange of information in computer-readable form. One of the objectives of UNESCO is therefore to promote the development and use of software packages for bibliographic and functionally related nonbibliographic applications that implement internationally accepted programs for the exchange of bibliographic data. The UNESCO/PGI program facilitates assistance in the selection, acquisition, and installation of appropriate software packages, training, and provision of hardware, especially microcomputer systems.^[3] Other UN agencies that have supported and implemented IT projects in libraries and information centers in developing nations include the International Atomic Energy Agency, the Food and Agriculture Organization of the United Nations (FAO), the U.N. Environment Program, the U.N. Development Program (UNDP), and the U.N. Fund for Population Activities through its Population Information Network (POPIN) programs.^[4]

Some regional and governmental organizations have also played a major role in implementing IT projects in developing nations. Chief among them is the EEC (European Economic Community), which has sponsored the application of IT to information systems in the ACP (Africa, Caribbean, Pacific States) countries. The Technical Center for Agricultural and Rural Cooperation (CTA) has been instrumental in implementing CD-ROM technology projects.^[5] Besides international and regional organizations, some national government institutions, such as IDRC (International Development Research Center) of Canada, have also played a crucial role in implementing IT projects in developing nations. In Saudi Arabia, for example, the Saudi Arabian Center for Science and Technology (SANCST), currently known as King Abdulaziz

City for Science and Technology (KACST), has developed IT-based national science and technology information systems.

Information, Information Technology, and Development

These international, regional, and national institutions have expended considerable effort and resources in implementing IT in information systems in developing countries hoping that their efforts would lead to information and IT transfer, and ultimately to development. UNESCO has underscored the importance of information in development in a number of documents. The *Final Report of the Intergovernmental Conference of the Planning of the National Documentation Libraries and Archives Infrastructure* underscored that the conference recognized that information has become an essential basis for the progress of civilization and society and that improving human relationships in their own societies and among peoples of different cultures and traditions contributes to better understanding and world cooperation.

The same document further reaffirms document NATIS/3's statement that "Information is not only a national resource vital for scientific and economic progress, but also the medium of social communication." NATIS declares that "access (to information) is one of our basic human rights." Recommendations 14–21 on the application of technology to documentation, library, and archives services are particularly relevant.

Some of the major pertinent recommendations include the following

- Insofar as the systematic analysis of a nation's requirements reveals the need to use modern technology, they enact special legislation or take appropriate measures in order to deploy all the technical applications of NATIS and accept the possibility of cooperation with a view to distributing resources equitably.
- UNESCO should arrange for a study on the feasibility of a file of software packages in the field of documentation, libraries, and archives.
- With regard to the application of technology to documentation, library and archives services, no indiscriminate introduction of mechanized techniques be made into information fields in countries where the technological environment is not ready for them.^[6]

The experience of many organizations involved in implementing IT projects, however, has shown that the role of information and IT might have been overestimated. Due to many problems, especially infrastructural constraints, many IT projects in developing countries have failed. There are indeed three schools of thought on this question. The first school contends that IT would help developing countries "leapfrog" the industrial age into

the electronic age by means of the application of the new technology. Abid claims that "CD-ROM will help libraries in developing countries to leap ahead into the 21st century."^[7] De Horowitz summed up the idealism of this school of thought:

New technologies, it was believed, would extend the benefits of information to all, in forms tailored to individual needs and skills and, hence, would foster development and enhance the quality of life in all nations and throughout all sectors of society.^[8]

While acknowledging the potential role of IT in development, many authors advocate a cautious approach to adopting IT and question the impact of IT in developing countries. Slamecka argues that IT unquestionably evolves in a general direction beneficial to the Third World with respect to both its utility and affordability. However, he concludes that the fundamental problem of the Third World, its poor standard of living of the masses, is caused by low productivity of their agricultural and industrial sectors and by their inability to compete in international markets; hence it is an economic problem. Developmental strategies that fail to address this fundamental point in the hope that developing countries may somehow circumvent it and blossom into postindustrial "knowledge" societies, are utopian unless one accepts the unlikely premises that these basic needs will be provided permanently by someone else and that the Third World can rapidly overcome the highly skewed distribution of knowledge resources.^[9]

On the other hand, it has been contended that developing countries need appropriate IT; that is, IT that suits their stage of development. The proponents of the appropriate technology theory contend that IT is too advanced for developing countries and that economies of developing countries are incapable of acquiring IT, as it is too expensive. They thus recommend that developing countries should continue with manual systems or make do with affordable semiautomatic technology. They argue that technology should match the level of development of a country and must be appropriate to available resources. On the contrary, the opponents of this school of thought assert that the appropriate technology ploy is dangerous because it means that the Third World should always lag far behind in development due to its poverty. Second, the Third World cannot even keep the development pace it could attain with IT. and third, there is an imminent dichotomization of the Third World as well as the development of two worlds within the Third World because the richer among them can afford IT, leaving the poor further behind.^[10]

Despite the criticisms against the role and impact of IT in development, many libraries and information centers have come to realize that the application of IT is a critical factor in their role of providing effective information

services, and thus facilitate effective transfer of information for development. Nonetheless, they have encountered numerous challenges in their endeavor to plan, implement, and manage IT projects. These challenges and possible strategies to overcome them are discussed in the following entries under management and operational concerns.

MANAGEMENT ISSUES

Most of the problems encountered in the implementation of IT projects in developing nations are intrinsically linked to their socioeconomic and political underdevelopment, and hence the existing underdeveloped information infrastructure, such as the lack of information policies. Many problems could be alleviated if there were sound information policies covering the major issues pertinent to the development and implementation of IT projects. Unfortunately, a considerable number of countries are yet to recognize information as a major sector for which policies should be developed. This could be explained by the state of the economic underdevelopment prevailing in many developing countries, whereby the majority live under the poverty line. Under these circumstances, priority goes to these sectors that are vital for meeting essential needs, such as food, clothing, health, and shelter. Since it is generally recognized that sound information policies including IT policies are crucial for successful planning and implementing IT projects, policy and decision makers should be vigorously sensitized on the important role information and IT can play in development. This may be achieved through aggressive marketing of information, especially strategic information to policy makers, planners, and decision makers. Political factors have also significantly inhibited the implementation of IT projects in developing countries. Such factors include instability which hinders the implementation of sustainable IT projects, and censorship against importing some IT equipment, such as the ban against modems during the dictatorship of Dr. Kamuzu Banda in Malawi. Thorpe summarized the political factors inhibiting IT as adopted from Eres as follows: unstable governments, desire for often excessively tight security and secrecy, constantly changing priorities, centralization of decision makers, and lack of scientific impact at the highest levels of government.^[11] The planning of IT projects should normally start with needs assessment. A thorough feasibility study may be conducted to determine the actual and potential needs of the target user population as well as the systems requirements. In conducting a needs assessment study, all parties concerned with the implementation of IT projects should be involved. In fact, it may be useful to form a working group on IT project implementation during the initial phases of planning and IT project. The working group may consist of representatives of all parties that will be involved in or directly affected by the design and

implementation of the projects. The working group may include policy and decision makers or their representatives, actual and potential users, IT departments, other departments of the library/information center, and the sponsoring institution. The objective of creating the working committee is to provide an experienced group of personnel who may steer the project through all its stages and be self-sufficient in appropriate expertise. This approach is appropriate in developing nations since it provides the opportunity to impart professional skills that may not be readily available in the library; thus the project may be completed more quickly. The planning committee would be involved in the development of the vision, strategy, and action plan of implementing IT projects. At this stage it is essential to formulate realistic and attainable goals and objectives, bearing in mind the infrastructure problems, such as financial, political, policy, procedural, cultural, and above all, human resource constraints. It is important to anticipate delays in implementing IT projects. The action plan and especially the schedule should be flexible. During actual implementation many management problems and issues are likely to arise that may delay the implementation of the project.

A number of methods such as informal interviews, structured interviews, questionnaire surveys, and observation and documentary descriptive methods have been employed in needs assessment. The informal and structured interview methods may be effective, as the interviewer can explain concepts that are difficult to understand, and pertinent information may be gathered during the process of interviewing. The main problem with this method in developing nations is that the interview appointment may not be promptly fulfilled and many interruptions are likely to occur during the interview. The questionnaire method has been useful for eliciting information from a large, geographically dispersed population. The problem with the questionnaire survey is that the response rate is likely to be low because of a number of reasons, including apathy. Although documentary or descriptive methods may provide vital data, it is often difficult to get access to institutional documents. There is a tendency to protect or hide information. Relevant documents are often labeled classified. It may also be difficult to have access to documents due to the lack of a system of organizing them.

Another major problem encountered in an attempt to conduct needs assessment in developing countries is the problem of communication. The target audience may not understand the technical jargon used in conducting a needs assessment or feasibility study. Moreover, input from the respondents may not be very useful or very reliable, as many respondents may not be familiar with IT discourse, devices, and requirements. The question of communication is even more complicated when a foreign consultant who does not understand the cultural and political milieu conducts a feasibility study. Such a consultant may often

end up formulating unattainable goals and objectives or issuing unworkable recommendations due to the lack of understanding of the socio-cultural, political, and economic environments. Projects implemented according to the “inappropriate” objectives and strategies prescribed by such consultants are often short-lived, nonsustainable, and doomed to failure. Dosa contends that the success of projects dealing with the design, management, and evaluation of information systems or the development of library and information science curricula are especially dependent on the consultant’s sensitivity to local conditions.^[12] Knowledgeable as they might be in their fields, technical advisors might become frustrated and impatient with their local counterparts if the advisors lacked practical experience with the host country’s traditional approach to changes. Mustapha stresses the need to develop clear guidelines for consultancy work in developing countries to ensure the success of future consultancies in these countries. His recommendations below are based on IFLA’s Standing Committee on Theory and Research Panel discussion at the IFLA general conference held in Manila in 1980.

1. The consultant should have an adequate knowledge of the politics, culture, history, manners, customs, language of the host country, and a thorough knowledge of library services and their administrative problems in the region/country.
2. The consultant must have good public relations skills to enable him to deal with high-ranking officials in the host country, thereby winning their confidence.
3. A clear definition of the problems and realistic expectations as to the goals and objectives of the project and a prior agreement between the consultant and the host country on the objectives of the consultancy is therefore deemed necessary.
4. There is a need for involvement of local librarians at all levels of activity, with emphasis on project continuation beyond the term of the consultant’s tenure.
5. There is a need for more contacts between the consultants and librarians and other information specialists in the host country, rather than concentrating too much on their own meetings with government officials who are influential, but who hardly understand ambiguous, and full of jargon and highly technical phrases.
6. There is a need for multi- and interdisciplinary consultancy. Such an approach may be more productive and successful than those undertaken by specialist consultants working alone.
7. Consultants should participate in the implementation of the mission’s recommendations.
8. Aid agencies should take more active roles in the implementation of consultancy rather than leaving this aspect of the outcome to the recipient countries; consultancy missions should be coordinated to avoid duplication of effort and to ensure follow-up reviews of recommendations.^[13]

In order to address some of the problems related to the language barrier, simple terms familiar to the target audience may be used in designing the interview or the questionnaire. Technical jargons familiar to the information professionals but not familiar to the respondents should be avoided. Using local information professionals who understand the local environment and local languages as consultants may help to elicit more information. They would not only translate the questionnaire into local languages, but through their influence and understanding of the local politics, policies, and procedures, they may also easily have access to essential documentary sources. They may count on their personal contacts, which are quite important not only in needs assessment, but also in the whole process of implementing IT projects in developing nations. Should it be necessary to recruit an external consultant, he should then work closely with a national counterpart.

Human Resource Concerns

Apart from the question of consultants, there are other equally significant human resource challenges faced by information systems in developing nations. These challenges range from a lack of qualified and experienced information professionals to a lack of appropriate staff development opportunities. The low status, meager salary, and lack of other fringe benefits of information workers may mean that the information profession does not attract the most competent and qualified personnel. Ideally, the person responsible for the implementation of an IT project should combine IT and library or information science qualifications, skills, competencies, and experience. In some cases, subject background or qualification in the subject of interest of the parent organization is desirable. It is difficult to recruit people with such qualifications. Even when competent personnel are recruited, it is often difficult to retain them because of unsatisfactory conditions and terms of service. Some join other institutions that offer better salaries and fringe benefits within the country, while others migrate to the so-called greener pastures.^[14] Wesley underscores the scale of the brain drain of qualified and experienced manpower in the Sudan, where over 40% of the professionals, 13.5% of the para-professionals, 23% of the clerical workers, 11.75% of the nonlibrarian graduates and 11.75% of all others, had migrated from the Sudan in 1985.^[15]

The needs assessment exercise would be useful in determining human resource requirements. There may be a need to recruit new members of staff. In such a case it is advisable to recruit computer-literate information professionals or computer professionals who are knowledgeable in library matters. Those who lack computer skills should at least have an interest in computers and the willingness and aptitude to learn and acquire computer skills. In order to avoid nepotism, corruption, and other kinds of

malpractices rampant in many developing countries, it is advisable to form a broad-based committee to deal with recruitment issues. Recruitment may involve three types of staff categories: nationals, consultants, and expatriates. One of the critical factors that should be taken into account in recruiting expatriates is their ability to adopt to local conditions. Apart from their professional/technical expertise, their experience in developing countries should be a credit. Unfortunately, it is not easy to recruit someone who combines both IT expertise and local experience. If possible, an information system may recruit both expatriates from the West as well as those from developing nations. In order to develop a sustainable IT project, it is essential that one of the major roles of expatriates be to train the local counterparts who will ultimately take over from them. A strategic plan to this effect should be developed and implemented. Many libraries and information systems may not be able to afford recruiting expatriates, but they may rely on development or humanitarian aid agencies in the recruitment of different types of experts. Some voluntary organizations, including the U.N. Volunteers, British Volunteers Overseas (VSO), and the U.S. Peace Corps provide expertise and assistance that involve training of national counterparts. Also, many NGOs, such as the British Council, the Ford Foundation, and the Rockefeller Foundation, have assisted in developing library, documentation, and information services in developing countries.

The problem of a shortage of qualified human resources may be alleviated through offering such staff development programs as in-service training, on-site training, workshops, short courses, symposia, study tours, seminars, meetings, self-instruction, distance learning, and internship or attachments to another library. Participation in seminars, symposia, conferences, and meetings are useful for providing information on the latest developments in IT. Short courses may be useful for providing basic or up-to-date information in a particular IT area. However, a major criticism of many short courses is that too much is covered within a short period. Moreover, some short courses are not tailored to a specific level of audience. Training should be an essential component throughout the various stages of project implementation. It should figure high up in the project proposal document. A comprehensive program including all categories of staff and encompassing training during the preimplementation, implementation, and postimplementation phases should be developed. Training may start with conducting a user sensitization program for policy makers and managers. This may be conducted in a center of excellence where a similar project was successfully implemented in a developing nation or a developed country. The rationale behind such sensitization programs is that policy makers would develop appreciation of the benefits of implementing IT projects and would hopefully support IT implementation projects in their own organizations. Apart from policy and

decision makers, another group needing training during the initial phase of the project comprises potential trainers, including systems librarians and/or persons from the computer services responsible for library IT projects. It is crucial to select the right person for training. In addition to appropriate aptitude and interest, the person to be trained as a trainer should also have the will to share with his colleagues the skills acquired during the training. Unfortunately, this is not always the case. In order to offer an effective IT training program, it is important to involve all the concerned parties—sponsoring agencies, international and national consultants, and institutional library and computer services department staff—in organizing and conducting the training. This strategy was adopted successfully by the University of Singapore in 1980 when it implemented a project of the MINISIS test program for an integrated system at the library of the National University of Singapore. The MINISIS project committee set up to prepare a program for staff training comprised the heads of major library departments and a systems analyst from the computer center.^[16]

Other major training issues that should be borne in mind are timing, duration, venue, content, format, method, and evaluation. The timing of training should not coincide with other activities that may be going on in the organization. Some training should be offered prior to, during, and right after the implementation of an information project. Training should indeed be an ongoing activity throughout the life of the project. This is important to enable staff keep abreast of the latest developments in IT. The issue of whether training should be offered on-site, within the country, or abroad deserves serious attention. If well-planned, on-site is valuable, since many staff members are likely to benefit from it. Moreover, some of the practical problems peculiar to a particular environment may be more appropriately addressed. On-site training is particularly useful for training staff who would be directly involved in the day-to-day operation of the IT project. Training abroad, especially in industrialized countries, is useful for planners and decision makers, systems librarians, and other senior staff members who would be involved in the actual planning and implementation of the project. Training within the country or region is useful especially for new graduates who have pursued studies in developed countries in which the IT environment differs from the situation prevailing in many developing countries. Such training is desirable to help the new graduates reorient themselves and marry theory learned in library information science schools to the actual IT environment in developing nations.

By and large, the content of the training program should be determined by the level of IT literacy of the targeted staff members as well as their functional responsibilities. For example, a microcomputer training package for information workers without computer background may include: operating systems, microcomputer hardware

and software (especially database management software packages), data and file management, word processing, desktop publishing, generation of reports by using microcomputers, and application of microcomputers in the various functions of an information system; that is, management; acquisition; information processing such as indexing; abstracting; information retrieval, including CD-ROM searching; online searching; access to network resources, especially the Internet; and electronic information marketing. Training programs are often carried out with no significant tangible impact. It is therefore imperative to evaluate the training programs on a regular basis and to modify the objectives, content, methods, and formats in response to the feedback obtained and lessons learned.

Financial Resources

Probably the most critical management issue facing information systems in developing countries in implementing IT projects is the lack of (or inadequate allocation of) financial resources. To make matters worse, many of the materials needed for implementing IT projects in developing nations must be paid for in hard currency, which may be difficult to come by. Furthermore, information systems have to undergo cumbersome bureaucratic procedures in order to obtain the necessary financial resources. To solve this problem, information systems should strive for allocation of an adequate budget for implementing or developing IT projects. Enough financial resources must be allocated to meet (a) the initial investment cost, the purchase of equipment, and the construction of buildings, (b) the recurrent costs for personnel salaries, staff development, interlibrary loan and document delivery, and (c) the acquisition of documents. Financial assistance may be sought from international donor agencies; however such external assistance may be useful as an interim measure in implementing and developing IT projects. It is not a durable solution. Recipient institutions should therefore develop some mechanism that would lead to institutional self-reliance. In addition to seeking funds from donor agencies, library information systems should endeavor to raise funds from internal institutional or other national sources. Academic libraries may seek assistance from academic and research programs that benefit from library IT resources and services. They may also exploit the possibility of hardware and software donation to the library. Value-added information services may be provided to policy and decision makers to sensitize them to the importance of information and hopefully win their financial support. Information systems may also carry out some income-generating and fund-raising activities as well as charge for some services in order to ensure the sustainability of the project at the end of external financial assistance.^[17] However, such charges may not be in the interest of the disadvantaged majority who cannot afford

to pay the fees. This practice may indeed widen the gap between the minority haves and the majority have-nots. This is not desirable in most developing countries.

Hardware and Software Options

In addition to human and financial concerns, issues related to hardware and software options such as their selection, procurement, installation, and maintenance are equally important in implementing IT projects in developing nations. Results of the needs assessment study would be useful in determining hardware and software requirements. To many information systems in the Third World, mainframes and minicomputers are too expensive to purchase and maintain. A considerable number of information systems in developing countries have therefore opted for microcomputers. Not only are microcomputers relatively cheap, but they are also easy to install and use. Moreover, they are readily available in the local markets, although purchasing microcomputers locally is more expensive than ordering them from abroad. Besides, technical support, maintenance, supplies, and training are locally available.^[18] Furthermore, microcomputers allow some kind of autonomy. Opting for mainframes or minicomputers may mean a bond with the computer departments. Experience has shown that libraries and information centers do not often get the necessary priority from computer services departments. Also, many powerful microcomputers have emerged, and through networking they may perform the same tasks as those performed by mainframes or minicomputers. Moreover, donor agencies are more willing to assist in developing microcomputer/mini-based information systems through the provision of hardware and software packages than to assist in developing mainframe-based information systems.

Although hardware and software options may be primarily determined by the requirements as ascertained during needs assessment and the application to which they would be used, it is advisable to opt for powerful and durable hardware as well as user-friendly software systems. Due to rapid developments in IT, and particularly in the use of software packages that demand a lot of memory such as Windows '95 and multimedia products, it is advisable to opt for a powerful and fast PC with a massive amount of memory. Cost and durability are crucial factors in selecting hardware and software packages because of the existing harsh climatic conditions in many developing countries coupled with the inexperienced hands of some staff members and the uncertainty of acquiring new equipment or upgrading the machine due to financial constraints. Compatibility is still a major factor for sharing information and IT resources in view of the lack of a standard hardware and software interface and the scarcity of resources in developing nations. As IBM is still the de facto standard in the PC world, it is advisable to opt for IBM or IBM compatibles or Macintoshes with a great

amount of memory and considerable expandability. Only computers manufactured by well-known companies such as IBM, Compaq, Apple, Power Computing, and HP should be used.

With regard to the acquisition of peripheral hardware, the options for printers should be primarily dictated by durability, quietness, and simple operation. Dot-matrix printers are relatively cheap, simple to operate, and fast; however, they are unsuitable for public access services since they produce a high-pitched noise. On the other hand, if an information system needs high-quality print, especially if the printer is to be used for desktop publishing, a laser jet printer would be more appropriate. In view of the existing IT environment, especially the Windows and multimedia environment. SVGA or XGA monitors should be purchased. As for Keyboards, bilingual, heavy-duty one's are recommended. The selection of communications hardware components should be determined by the existing communications IT. Power stabilizers and regulators such as power surges or uninterruptible power supply (UPS) are indispensable in most developing countries because of frequent power interruptions.

There are many problems related to the use of IT hardware in developing nations. These include such environmental hazards as dust and humidity, and natural disasters such as those caused by the Harmattan in Nigeria, hurricanes in the Caribbean, or typhoons in the Pacific. Dust leads to floppy disc failure as well as to the use of more ribbons than usual. To alleviate these problems, printers and floppy disk drives should be covered with polyethylene bags. The snag of voltage variation common in many developing nations, in which there are few power stations that are able to provide a continuous supply, may be partly solved by using a noninterruptible, surge filter supply, or UPS. Car batteries could be used, but as observed in Nigeria, they are subject to theft. Instead of car batteries, cadmium rechargeable batteries may be used, since they are seldom used in many developing nations and therefore not recognized by thieves.^[19] Given the shortage of spare parts in developing nations, it is imperative to include a wide range of supplies, including ribbons, toner, and plugs in the project budget.

As for the application software options, designing in-house software packages may not be the most appropriate option. First, most librarians in developing nations lack the expertise to design or use in-house software. Second, developing in-house programs is rather expensive and time-consuming. Since a lot of software packages suitable for a variety of library applications are available, libraries and information systems in developing countries should opt for such packages. These include CDS/ISIS, In-Magic, D-base, Sci-mate and Knowledgeman, Microsoft Access, and Excel. Among these, CDS/ISIS is the most widely used package, primarily because nonprofit organizations of UNESCO member countries obtain it free from UNESCO. Moreover, installation can be done through

CDS/ISIS local or regional offices such as ARSO in East Africa or ALESCO in the Middle East. Besides, the package comes with very clear instructions on how to install the system and there are many users, including CDS/ISIS user groups, who can offer installation and other assistance. Micro CDS/ISIS enables information systems to define a database structure, enter new records, and modify, edit, delete, retrieve, sort, display, and print existing records. CDS/ISIS can be used for most major library functions, including library catalogs, serials holdings, union lists of periodicals, union catalogs, and bibliographic and referral databases. On the other hand, CDS/ISIS has been criticized for lack of user-friendly documentation as well as search software interface.^[20] Other two software packages that have been widely used in many developing nations are In-magic and dBase. In-magic can handle catalogs, acquisitions, serials control, current awareness, and loan service systems. It also offers a password facility for file security purposes. The major shortcoming of In-magic within the context of developing nations is that it is expensive. D-base, a general-purpose database management software package, allows creation of a database with customized fields, updating, editing, sorting, indexing, printing, and a combination of concepts by using Boolean logic operators.

There is a plethora of micro-based software packages that can be used in specific library functions in developing nations. Ventura and Page Maker may be used for desktop publishing, while LOTUS can be used for statistical purposes. WordPerfect, MsWord, and Windows'95 have been widely used for word processing. Besides micro-based software packages, a number of mini- and mainframe-based automation systems are preferred in developing nations, mainly because they are supplied free to nonprofit organizations in developing countries or because they are bilingual. Such systems include MINISIS, which runs on HP minicomputers. MINISIS has been extensively utilized in Africa, Asia, the Middle East, and Latin America. DOBIS/LIBIS, a bilingual integrated library system, has also been widely used in the Middle East. Recently a new bilingual system, Horizon, which has a vendor in the Arab world, was introduced. The Arabic version was developed by Ameritech Library in cooperation with Arabian Advanced Systems. In addition to the Dynix minicomputer-based and the NOTIS LM8 mainframe-based systems, it has rich functions and features. The Horizon automated library system provides a graphical user interface standards-complaint, industry-leading database management system and a client server processing model that allows the system to operate on an unusually wide range of hardware platforms.^[21]

In selecting software packages for information systems in developing nations, the application for which they would be used as well as the existing software and hardware IT environment should be taken into consideration. The *Datapro Guidelines* for software selection, which

consists of ten logical steps for selecting software for any computing systems, could be adopted. These steps are: determine the requirements, gather information on the existing systems, draw up a short list, perform a detailed evaluation, review previous users' experience, conduct a benchmark, make a final decision, negotiate a contract, install the package, and check the results. These steps need modifications, however, taking into account the unique circumstances prevailing in developing nations. The *Datapro Guidelines* have been criticized for having too little regard for the user and his or her environmental constraints. To solve this problem, Bell recommends that users should be given details of existing systems and the potential users should be allowed to reevaluate their requirements.^[19]

Having selected the hardware and software platforms, library information systems may encounter numerous problems in their procurement and installation. Although the purchase of hardware and software systems from computer dealers in developing nations promises reliable technical assistance in installing, training, providing supplies, upgrading, and procuring hardware and software packages, it is more costly than purchasing them from developed nations. Any problems faced in installation and maintenance may not be easily resolved if there is no local dealer to provide technical support, and the requisite training may not be provided. Consequently, one ends up with delays in the installation of the systems, or in some cases the systems are never installed. Even if installed, breakdowns that are likely to occur may not be resolved due to the lack of spare parts and technical assistance. In the final analysis, it may be more cost-effective in the long run to purchase hardware and software systems from the local market, if available. On the other hand, procurement of such items from industrialized countries may take a long time in processing paperwork, applying for import licenses, using foreign currency, and paying for customs clearance and tax. Referring to her experience in implementing information projects in Yamen, Hutchinson refers to the lengthy bureaucratic and technical obstacles that delayed the arrival of a microcomputer and a mini-computer.^[22] Johnson asserts that procurement invariably takes twice as long as purchasing agents estimate. Procedures for purchasing, tendering for suppliers, and waiting for equipment to be supplied and delivered all add up to the general time frame required. In her experience in Bangladesh, equipment procurement was estimated at 3 months, but it took over a year, as a result of both donor and host country procedures.^[23]

Once acquired, a suitable siting of the hardware may be selected, taking into consideration accessibility, security, visibility, and future expansion of the facility. Some of these factors may be conflicting; for example, accessibility and visibility vis-à-vis security. In view of the difficulty of obtaining replacement hardware in case the system is damaged or stolen, many libraries, including the

University of Dar es Salaam in Tanzania, the Faculty of Medicine of the University of the West Indies in Jamaica, the University of Nairobi in Kenya, and Makerere University in Uganda, have decided to locate equipment in secure offices that are not easily accessible to the public. An equally important problem regarding the location of equipment is a lack of adequate space to house the hardware, users, and staff. To solve this problem, some rearrangement by weeding out the collection and reallocating staff, equipment, and information resources may be done. The installation of IT equipment may also pose problems. In order to expose library staff to the intricacies and issues involved in the installation as well as to impart skills that may be useful in installing and troubleshooting in the future, library staff members responsible for the day-to-day operation and management of the IT system should be fully involved in the installation of hardware and software systems. Citing her experience in Pakistan, Johnson explained that there was only one electrical outlet in a room that was to house two computers and two printers, including one UPS and two stabilizers. The Department of Works staff was called in to add the necessary wiring and fabricate the required bars. The librarian realized how important it was for him to be involved in the design of the electrical plugs since the equipment would be moved in a few months to remodeled headquarters and he did not want to have to go through the same process again. Working with the electricians, the librarian designed modular power bars that would meet both current and future needs.^[23]

Cultural, Organizational, and Other Barriers

Cultural barriers have also inhibited the implementation of IT in developing countries. Chief among them is the language factor, whereby the languages of the developed nations dominate IT products. These languages are not understood by the majority of the people in developing countries. The efforts that have already been made at the international, regional, and national levels to use the languages of developing countries, such as Arabic and Chinese, in documentation and information processing should be continued. Another cultural barrier is the lack of a reading culture. It is no wonder, therefore, that many IT projects have been implemented only to be underutilized. This problem may be addressed through fostering and nurturing a reading habit through the major social and educational institutions such as the family and primary, secondary, and tertiary educational institutions. The provision of adequate reading facilities such as different types of libraries can also play a major role in promoting reading. Other cultural constraints include the time concept or the general slow pace of doing things and the significant role of personal contact and influence that adversely affect the implementation of IT projects.

Other problems related to management include organizational and restrictive, protective control measures. The organizational issue is particularly a problem in documentation or information centers. Such centers are usually affiliated to parent organizations that consist of other divisions or units that are often considered more important than information centers. Indeed, information centers are often considered so unimportant that in some cases they are regarded as support units of the lowest order, and consequently they are often allocated unqualified personnel and inadequate financial and material resources. From the initial planning, efforts should be made to ensure that information centers rank high in the organizational structure of the parent institution. The head of the information center should be on par with the heads of major divisions in the organization and report directly to the chief executive officer. Restrictive control measures practiced by many information centers serve as barriers to easy and convenient access to information. As a result, the target users avoid using information services. There is therefore a need to liberalize procedures that limit access to information, such as a unnecessary filling out of forms, the need to obtain approvals prior to admittance to the library, and limited access to some essential information sources and services.

These problems cannot be changed overnight; nevertheless, they must be taken into account in planning and implementing IT projects. Flexibility, development of realistic schedules, and personal contact and influence must be taken into consideration throughout the planning and implementation of IT projects. Some of the cultural constraints may be overcome through the involvement of local or national human resources in the implementation of IT projects in developing nations. Other major problems and issues, such as the inadequate existing information infrastructure, will be discussed in detail in the entry below on operational issues.

OPERATIONAL ISSUES

Information technology has been applied to a variety of operational functions of library and information services in developing countries. These functions include information retrieval, dissemination of information, information processing, collection development, interlibrary loan and document delivery, and user training. In information retrieval, IT has been utilized in accessing remote online databases, searching CD-ROMs, searching network resources, and developing local databases.

In information processing, IT has been employed in developing bibliographic, referral, numeric, and full-text databases. In interlibrary loan and document delivery, IT has enhanced the efficiency and effectiveness of identifying and transmitting requests, along with supplying and delivering documents. Information technology has also

played a major role in the dissemination of information through current awareness services and selective dissemination of information.

Online Searching

Probably the earliest application of IT to information systems in developing nations was for accessing international commercial online databases. Some developing nations in Latin America have been at the forefront in this regard. The use of DIALOG from Latin America began in September 1975, when the Seccion de Consultas en Bancos de Information (SECOBI) of the Consepcion Nacional de Ciencia y Tecnologia (CONACYT) in Mexico established an account. Besides DIALOG, Latin American institutions also used other online systems, such as SDC, ORBIT, and NLM. In 1979, the Bibliotheca Regionale de Medicina (BIREME) in Brazil established the *Index Medicus Latino-Americano*, submitting citations to NLM from regional publications for inclusion in the larger databases sponsored by the Pan American Health Organization, the World Health Organization (WHO), and the Brazilian government.^[24] The late 1970s and early 1980s witnessed the development of online access in the Middle East and the Far East. Some of the developing countries that pioneered in online searching during this period include: Brazil, Mexico, the Philippines, Hong Kong, Iran, Taiwan, Singapore, the People's Republic of China, Ivory Coast, Saudi Arabia, Senegal, South Africa, Egypt, Tunisia, and Ethiopia.^[25]

A number of reasons have been given for the use of online searching services in developing countries. The principal ones are to access a vast amount of relevant, up-to-date, and accurate information that may be used for development; to augment the poor local information sources; to complement other media, such as CD-ROM when retrospective information is needed; and to search multiple and diverse online databases provided by a particular or different online information service provider(s). In his case study at the Institute of Applied Science and Technology (IAST) of the Republic of Guyana, Bahaa El Hadidy concluded that CD-ROM databases alone cannot satisfy all IAST information needs adequately, and decided that an online search access to international vendors was judged necessary to supplement the use of CD-ROM searching.^[26] Many institutions have opted for online searching in order to consolidate and enhance their access to science and technology activities. This was clearly stated in a document prepared by the National Science Foundation in 1979 on the establishment of the Saudi Arabia National Center for Science and Technology (SANCST). The document asserts that the single most effective thing that SANCST could do was to strengthen Saudi Arabia science and technology activities at that point in their development. It was further pointed out that the most effective way of providing science and

technology information was through online searching for information that would be used for planning research programs, identifying individuals and organizations for consultancy, identifying foreign technology for application in Saudi Arabia, and identifying research designs, methods, and patents.^[27] Bourne has proposed that the use of online facilities can be cheaper than trying to improve the library collection in many locations in developing countries, and adds that despite problems such as poor telecommunications facilities and the expense of direct mail, computer-based reference services could be used to augment local information resources.^[28] Although the importance of online searching in developing countries has been recognized for a long time, many Third World countries are yet to take full advantage of online searching due to a number of constraints. Essential components of information infrastructure such as economic, manpower, cultural, and political, inadequate physical facilities, and poor or nonexistent information policies and plans constitute some of the major factors that have inhibited effective implementation and use of online searching. Highlighting the interdependency of the various elements of information infrastructure, Mahon asserted that without parallel development of not only documentation stores but also the skills in information service development and database and databank development and training, the simple availability of technical access is insufficient.^[29] Many developing countries can hardly afford the initial cost or investment of setting up an online search service. It may also be difficult to meet recurrent costs such as connect time charges, printing and downloading costs, annual subscription fees, staff development costs, and system upgrade charges. Libraries are rarely allocated adequate online searching budgets.^[30] Discussing the problems associated with initial investment and recurrent costs, Brito pointed out that the installation of an online database requires a large initial commitment of funds and must be expected to generate high recurring costs. He further argues that in developing countries a number of factors combine to make online searching highly costly: the use of public telecommunications is usually very expensive in comparison to the cost of living; the unreliability of the public telecommunication systems, frequently interrupting a call, may turn a simple remote database search into an expensive nightmare of repeated unsuccessful attempts; and the inexperience of the infrequent users results in excessive search time, thus increasing the telecommunications costs considerably.^[31]

The question of human resources has also inhibited the effective development of online searching in developing nations. Many information professionals lack skills and experience in automated information retrieval. Training courses, like those offered by online information services providers, are nonexistent in many developing countries. The unavailability of funds also makes it difficult for information professionals to attend online searching

training courses or to participate in pertinent staff development activities. Those who pursue course in online searching through their formal education or special training soon lose online searching skills for a number of reasons. For example, they may not have the opportunity to practice online searching or to sharpen their skills because their institutions do not have an online searching facility. Furthermore, they often lack subject background that is crucial for better understanding the information needs of the users and for formulating an appropriate information search strategy. Even when an online searching facility is available, a number of reasons may account for the underutilization of online searching. Probably the most important factor is the fact that potential users are not aware of the existence and availability of the service. Those who are aware of the potential benefits of online searching neither appreciate its importance in their work nor know how to use online searching services. They also lack online searching information retrieval skills.

Another major reason that partly explains the underutilization of online searching in developing countries is the frustration experienced by users in accessing or using online searching services. Users are often frustrated when they do not obtain adequate, accurate, and relevant information. This is particularly the case with the users interested in literature in developing countries. The bulk of literature included in most online databases understandably has a strong coverage bias of literature from developed countries. To make matters worse, users from developing nations may not have access to desired databases because of financial constraints coupled with other barrier and control measures. For example, access to the *TULSA* database has for a long time been allowed to institutions that also subscribe to the prohibitively costly print *Petroleum Abstracts*. Other common frustrations experienced by users include document unavailability, prohibitive costs, technical difficulties of transmitting full-text or image databases electronically, and delays in receiving documents ordered through interlibrary loan. This problem of delays in interlibrary loan and document delivery services has been clearly highlighted in a recent study conducted in Saudi Arabia. A significant number of respondents complained about document unavailability and document delivery delays. One of the respondents commented that

The citations obtained from these sources are usually not available in the library. They are reports of Laboratory/Institute or theses/dissertations or articles in some periodicals which are not available in library. The time for procurement is long and usually when it reaches the university, the need for it is over, or it is found that it is not very useful.^[32]

This issue has been extensively discussed in the literature on online searching in developing countries. In his study

on delayed online searching in Egypt, Al-Hadidy showed that the elapsed time between the search requests and the output delivery was substantially high, ranging from approximately 20–83 days.^[33] Munn has recognized that the introduction of computer services without library backup is counterproductive in that it raises a user's appetite, and with it the frustration in not satisfying the appetite, thus turning him or her away from information services.^[34]

Although there are numerous problems that have inhibited online access to remote databases, some information systems in developing countries have carefully adopted various temporary and durable alternatives. Such options include submitting and receiving search requests by mail, telex, or fax; using a national government or commercial telecommunications service; accessing online services through telecommunications services of another country; twinning with another institution in the developed world; and establishing full direct access to online databases through such telecommunications services as Tymnet or Telenet (and recently accessing online databases via the Internet). In Egypt, the National Information and Documentation Center (NIDOC) first had access to U.S. online databases through the Georgia Institute of Technology library system. Search queries initially developed at NIDOC were transmitted via telex from Egypt to a U.S. intermediary (at Georgia Tech.), who in turn conducted the online search using the search formulation developed in Egypt, but also exercising the option of optimizing the search strategies online.^[33] In Saudi Arabia, the University of Petroleum and Minerals (UPM) library started using online databases in the United States in 1979 by submitting search requests to DIALOG by telex and receiving search results by mail. Later it had access to DIALOG and ORBIT through Bahrain Telecommunications Company (BATELCO). Government institutions in Saudi Arabia without their own access to commercial online databases can benefit from the online search services of the KACST, the national institution responsible for promoting and encouraging applied scientific research and for coordinating the activities of scientific research institutions in accordance with Saudi Arabia's development requirements.^[35] In China, a connection was initially made via Cable and Wireless (HK) Ltd. through the agency of the China Overseas Building Company Ltd. (COBDC) in Hong Kong in 1980. Users in China were restricted to access by postal request. In 1983 the Institute of Scientific and Technical Information (ISTIC) of China established a data communications link ESA-IRS between Beijing and Rome for access to the databases on the vendor system. This was later extended to link up with the U.S. telecommunications networks Tymnet and Telenet. The following year, ISTIC gained access to DIALOG and ORBIT, and a connection to STN in Germany was made in 1986.^[36]

In spite of the significant options adopted by the various developing country regions to access online databases, only limited access has been achieved by most developing countries, mainly because of financial constraints. Some countries adopted interim measures to alleviate financial constraints. Such steps include seeking technical assistance from international, regional, and national organizations, as well as NGOs. That kind of assistance could be useful in establishing an online search service, including carrying out a feasibility study, procuring and installing hardware and software systems, and providing document delivery services, training, and evaluation. However, self-reliance should be nurtured and fostered throughout the implementation of an online search service so that the recipient institution would eventually finance the entire project.

Other measures that may be taken to solve the problems of funding online searching include income-generating activities and nominal charges. To alleviate the bottlenecks of telecommunications, transitional options such as delaying online access or using satellites for accessing online databases may be useful. In order to promote greater use of online searching, adequate publicity of the service to policy makers and planners, academics, professionals, and other potential users should be repeatedly carried out. It is particularly important to publicize the service prior to, during, and after the launching of the service. Since policy and procedural control measures account for the underutilization of online services, such restrictions on use should be avoided or minimized in order to stimulate and accelerate the use of online services. Over the past decade, information systems have tried to overcome some of the problems associated with online searching by opting for CD-ROM. Online searching is used to supplement CD-ROM when most up-to-date or comprehensive information is needed, when one needs to search multiple databases or different online systems, or when the required retrospective information is not available through CD-ROM searching.

CD-ROM Searching

To many information systems in developing countries, the advent of CD-ROM technology has been a blessing. The advantages of using CD-ROM in developing nations abound. These include access to a massive amount of bibliographic, numeric, referral, and full-text image information, broad user base, user-friendliness, convenience of use, relevance, speed of information retrieval and document delivery, portability, durability, exposure to information retrieval skills, space saving, suitability for resource sharing, image raising, added value services, and development of local CD-ROM databases.^[37] On the other hand, CD-ROM has been subject to a number of problems and criticisms. Some of the major criticisms are content relevance, lack of search software interface compatibility,

lack of funds or allocation of inadequate budget for CD-ROM, costly hardware and networking licensing, technical problems such as head crashes, breakdown of UPS, compatibility problems, manufacturing defects, currency, inadequate retrospective coverage, material and financial resources, document unavailability, inadequate user training and documentation, lack of awareness of what is available and how to access it, lack of computer experience, delays in implementation schedules, inadequate human resources, security problems, slow access time, lack of simultaneous access to multiple databases, ownership issues, end-user misconceptions, maintenance problems, endlessly increasing demands for quantitative and qualitative enhancements, and increasing demand for more and different types of databases.^[38]

In spite of the above problems, many library information systems have implemented CD-ROM projects because the advantages of CD-ROM far outweigh the disadvantages. Prior to implementing CD-ROM projects, institutions should start with conducting a needs assessment or a feasibility study to determine whether there is a genuine need for a CD-ROM project. The feasibility study should also assess the adequacy of the existing IT infrastructure, including the IT environment and material, financial, and human resources. Access to national, regional, and international information network resources must also be assessed and taken into consideration prior to deciding whether a CD-ROM project should be implemented. The potential beneficiaries of the CD-ROM service, the staff of the information system as well as the staff of the computer center who would be involved in the implementation, maintenance, and evaluation of the CD-ROM service, should participate in the needs assessment exercise. In fact, it is important to create a planning committee consisting of representatives of all concerned parties.

Since users and representatives of the various interested parties may not understand CD-ROM technology, it is crucial to provide simple basic information on CD-ROM in a handout or information leaflet format, including the advantages of CD-ROMs and the different types of CD-ROM databases. Potential users may be requested to suggest some pertinent titles. However, such suggestions should be critically reviewed by the information professionals. Users tend to recommend whatever they feel may be relevant to their individual or departmental information needs without taking into account the needs of other users or departments. This may lead to developing biased CD-ROM collections or acquiring specialized databases that may not be heavily utilized.

The data and results of the needs assessment study would be useful in determining whether or not a CD-ROM project should be implemented; how it should be implemented; what hardware and software platforms including databases would be required; the type of human resources that would be needed; the necessary planning,

management, and operational functions and activities; and how the CD-ROM project would be evaluated. The results should also be useful in developing the CD-ROM project vision and project document that may include: short-term, medium-term, and long-term goals and objectives of the project, activities that would be carried out in the planning, management, operation, evaluation, and development of the project. In developing a CD-ROM project document it is quite crucial to set goals, objectives, and schedules that are attainable in light of the immense political, economic, cultural, and technical obstacles that are likely to be encountered in the planning and implementation of the project. In most developing countries, financial factors constitute the single most important factor that would determine whether a CD-ROM project would be implemented successfully. It is therefore important to develop a honed project that would be used to seek funding from the parent organization or from external donor agencies.^[39] A sound methodology on how the CD-ROM project would be implemented, and how the sustainability of the project would be ensured through local institutional support, reporting, monitoring, and evaluation mechanisms should be included in the project document.

Since many information systems in developing countries cannot afford procuring, maintaining, and developing CD-ROM systems, many international, regional, and national organizations, as well as NGOs have financially assisted information systems in developing CD-ROM services. The U.N. Fund for Population Information Activities has contributed to the production and distribution of *POPLINE*; WHO and the Pan American Health Organization (PAHO) have played a key role in the development and distribution of the LILACS database. Other organizations that have contributed to the development of CD-ROM systems and services in developing nations include the World Bank, IDRC, USAID, and the British Council. The EEC (European Union), in cooperation with the Tropical Institute of Agriculture in the Netherlands, has also successfully implemented CD-ROM projects in ACP countries.^[5] Some developing nations, especially the oil-rich countries in the Middle East and the Tiger economies of Southeast Asia have financed the production, implementation, and development of CD-ROM products and services. In Saudi Arabia, the National Standards Organization (SASO) has produced Saudi standards on CD-ROM in cooperation with the Arabian Advanced Systems. Also, KACST CD-NET, a national network of over eighty bibliographic, full-text image, and numeric databases held by KACST, can be accessed by Saudi government institutions.

The needs assessment results are useful in selecting a CD-ROM system. In consideration of the rapid developments in IT, it may be difficult to recommend specific CD-ROM hardware and software components; however, it is advisable to opt for IBM or IBM compatibles or

Macintoshes with a great amount of CPU memory capacity. This is of vital importance because the microcomputer will probably operate in Windows, multimedia, and network environments that demand a lot of memory. Besides memory capacity, the speed of the CPU is important, especially if the machine is to be used for remote access. The major criteria that should be taken into consideration in selecting CD-ROM drives should include reliability, price, manufacturer or vendor's technical support, security, expandability, price, and audio playback capability. Safeguards such as built-in automatic laser read head cleaners, sealed casing, and doors to cover openings are of vital importance. Most of these requirements are met in products of major CD-ROM manufacturers, including NEC, Toshiba, Sony, and Hitachi. Reliability, especially the ability to withstand extremes of temperature, humidity, shock, vibration, and contamination, should be one of the major criteria in selecting CD-ROM drives, as many developing countries face harsh climatic and environmental conditions. The choice of CD-ROM drives for developing countries may pose a challenge. Compton reported that "finding manufacturers to build reliable drives was a headache as was navigating the complex maze of import-export regulations."^[40] The speed criterion is particularly important in selecting CD-ROM drives. As noted above, one of the criticisms of CD-ROMs is that they are slow. If speed is very crucial in the application of CD-ROM in an organization, then fast drives may be used. In selecting CD-ROM drives, serious consideration should be given to the DVD option. DVD drives can read discs containing at least 4.7 gigabytes of data, more than seven times as much as today's CDs. Dual-sided discs would double data capacity. If the information system intends to provide access to CD-ROM databases over a network, CD-NET servers such as the Meridian Data CD-NET server may be used. It is desirable to select a CD-NET server that has substantial expandability and compatibility with most PC local area networks such as Novel, Banyan, Microsoft, and IBM. Regarding the selection of printers, dot matrix and laser jet printers are suitable because of their low cost, simple operation, high speed, and durability. Nonetheless, dot matrix printers produce a high-pitched noise and hence are not the most suitable for public services. Jet printers are quieter, but they cost more and have special requirements. Laser jet printers, though also relatively expensive, are the most suitable for full-image article printing. For routine printing work in CD-ROM systems, dot matrix printers may be the most appropriate because they are less expensive, reasonably durable, and do not have special requirements.

Special hardware may be needed in installing a full-text image database as well as multimedia products. Jukeboxes may be needed for accessing hundreds of discs easily without having to change the numerous discs manually. To provide remote access, remote searching and printing hardware and software may be required. Information

systems in developing nations cannot do much in selecting the CD-ROM retrieval systems, however, until a common CD-ROM search interface emerges, libraries and information centers may circumvent the problem of the lack of a common CD-ROM interface by subscribing to CD-ROM products from the same producer, especially the systems that are user-friendly and well known, such as Wilsondisc and Silverplatter. Moreover, information professionals in developing nations may provide feedback to CD-ROM manufacturers. Such feedback would be used to enhance information retrieval systems in future editions. It is important to select appropriate CD-ROM network software. Whatever system is selected, it should be easy to install and use, allow simultaneous multiple access to the shared CD-ROM-related resources, include E-mail, and support Windows and DOS as clients. Furthermore, the software should also have a good facility of expandability, and should be able to accommodate additional drives to support larger and more diverse sets of information and multiple systems for the network. Finally, it should work well with most popular computer local area networks. Regarding remote access to CD-ROM databases, information systems should opt for reputable communication software packages such as PROCOM or Norton PC Anywhere, and CROSSTALK.

Bearing in mind the needs of the actual and potential users as well as the actual use of the existing resources in various formats, appropriate databases could be selected for acquisition. The major consideration in selecting CD-ROM databases should include: relevance to user needs in terms of subject, geography, language, type of literature, and period coverage. The existence and availability of alternative sources of information at the library, institutional, national, regional, and international levels should also be taken in account, since those resources may be accessed through cooperative resource-sharing programs. Frequency of use of printed sources or online database versions is a useful criterion in selecting CD-ROM databases. Other factors that should be taken into consideration include vendor reliability, licensing and lease terms, alternative price arrangements, and user interface. While subject-specific databases that are not adequately covered in the core databases available in the library information system may be acquired, high usage of such databases cannot be expected. Information systems in developing nations may therefore concentrate on acquiring and maintaining a core collection of heavily used databases. Subject-specific databases may be accessed in other formats or in other institutions through resource-sharing activities. Institutions in developing nations may seriously consider acquiring major CD-ROM databases that have extensive coverage of developing countries. Such databases include CABI, TROPAG, POPLINE, AGRIS, and LILACS. Library information systems in developing countries should also endeavor to produce CD-ROM databases of their local sources of information, especially

unconventional literature such as official publications and unpublished reports.

Although the installation of CD-ROMs is not difficult, information professionals who are not computer-literate may find it perplexing; however, local resources from computer departments in the parent organization or vendors could install CD-ROM systems. It is no longer prudent to fly in consultants from developed countries to install CD-ROMs or to offer initial training.^[41] Having installed the CD-ROM system, initial training may be conducted for the staff who will be directly involved in operating the system. Training should be preferably conducted on-site so that many staff members benefit from it. If training is provided outside the organization, then a person should be trained to train his colleagues. Depending on the level of the trainees, the training program content may include microcomputer basics, hardware, software, MS-DOS, MS-Windows, WordPerfect, installation of CD-ROM databases, troubleshooting, information retrieval, and information marketing.^[38] At the University of Botswana, the CD-ROM training program consisted of the availability and content of CD-ROM databases within the University of Botswana library, bibliographical control of CD-ROM and the CD-ROM marketplace, how to start up CD-ROM, a few search technique basics, and how to find information and get online help. There were also plans to cover operating systems and environments, PC management, desktop publishing, and computerized communications and online searching.^[42] Once the CD-ROM system is operational, it should be publicized and user training activities in groups or individually should be organized; online tutorials, library Web pages, and print materials should be utilized. Apart from utilizing the CD-ROM technology for information retrieval and technical operations, CD-ROM could be utilized to provide value-added services such as current awareness and selective dissemination of information to policy and decision makers, researchers, professionals, and other types of users.

In addition to systems-related user training and publicity concerns, complaints have been aired about document un-availability and delays in interlibrary loan and document delivery as well as staffing. Users in developing countries identify relevant sources of information through searching CD-ROM bibliographic databases only to be frustrated by the fact that their library does not own the actual physical documents. Efforts to obtain such documents through interlibrary loan are hampered by delays due to communications problems as well as personnel constraints.^[43] Library staff would also be adversely affected by the introduction of a CD-ROM service. Not only would they have to deal with the user frustrations mentioned above, but they would also have to study the system and documentation and to practice CD-ROM database searching, which may entail learning different search retrieval systems. They would also have to conduct user

education, offer assistance in information retrieval, and attend to clerical and technical duties, such as fixing printers. Library services and resources have been equally affected by the introduction of CD-ROM systems. Apart from user education, assistance, and interlibrary loan, there may be a significant decline in the use of mediated international online systems. Also, the space problem, which is a perennial problem in many information systems in developing nations, may be exacerbated. The use of print indexes may decline, and consequently cancellation of subscriptions to print indexes and journals in the case of full-text or image databases may follow the introduction of a CD-ROM service.

A number of strategies may be implemented to alleviate some of the major problems arising from the implementation of CD-ROM projects. At the planning stage, some budget provision should be made available to cope with projected increasing demand for more and different types of databases, CD-ROM stations, network costs, jukeboxes, and CD-NET servers. As for system maintenance, staff with sound information technology background, competence, and experience should be recruited. Alternative, a staff member with interest and aptitude in IT should be made responsible and be trained in troubleshooting. Other issues, such as user-friendliness and system slowness, may be addressed at the stage of system selection by selecting fast CPUs and CD-ROM drives. As for document availability and delivery, efforts should be made to subscribe to highly used journals that are indexed in a CD-ROM index. If funds allow, full-text or image databases should be purchased. In the case of projects funded by donor agencies, some budget for interlibrary loan or document delivery should be allocated. Subscription to CD-ROM databases that carry substantive abstracts such as *ABI-INFORM* may be a useful alternative to information systems in developing countries, which may never have access to the physical documents. Regarding staffing problems, many libraries and information systems may not be able to provide additional staff in response to the increasing workload due to the introduction of a CD-ROM service. The existing staff may try to cope if all concerned staff would acquire competencies and proficiencies in CD-ROM searching. Staff members may also be transferred from other library departments to CD-ROM service departments.

Since its advent in the library world a decade ago, CD-ROM has to date proven itself as one of the most appropriate technologies for information storage, processing, and retrieval, and for the dissemination of information in developing nations. Library information systems should therefore exploit the CD-ROM technology in developing appropriate relevant and indigenous CD-ROM databases; however, CD-ROM does not provide the best access to information, which is through network resources such as the Internet and intranet. Library information systems in developing nations should therefore make the best use of

CD-ROMs and at the same time they should strive to provide access to network resources to complement CD-ROM resources.^[43]

Access to Network Resources

The international community and national governments have recognized the imperative of resource sharing through information networks for a long time. It has been argued that the optimal and cost-effective use of the limited resources could be achieved through resource sharing and cooperation within the context of information networks. UNESCO has spearheaded efforts to develop cooperative programs and information networks in developing nations. Recommendation 21 of the UNISIST study report proposes that UNISIST should, among other things, propose guidelines for establishing and managing information networks and help to design a few pilot projects to assess different ways of linking developing countries with UNISIST.^[45] One of the major programs of GIP (General Information Program of UNESCO) is the improvement of access to information through the use of modern technologies, standardization, and interconnection of information systems. One of the subprograms is on the exchange and flow of information through regional and international cooperation among member states and within the organizations of the U.N. system.^[46] Other U.N. agencies, especially the U.N. Atomic Energy Agency through its INIS project, the FAO through its AGRIS program, the WHO, and the UNFPA through its support to POPIN, have contributed to the development of information networks in developing nations. These organizations have developed global information networks with regional, national, institutional, or sectoral nodes. The IDRC through the DEVSIS programs as well as through cooperation with such other donor organizations as UNDP, UNFPA, and UNHCR, has greatly assisted developing nations in developing information networks.

The objectives of implementing information networks in developing nations include the following, as stated in the objectives of the Pan Africa Documentation Information System:

1. Identifying and collecting information resources and creating an efficient system for the utilization of information.
2. Promoting information exchange.
3. Establishing a system that would ensure access to both published and unpublished documents.
4. Providing assistance to member institutions to strengthen their information infrastructures so that they would be able to participate fully in the system by contributing as well as deriving benefits from it. These would include regional, subregional, or sectoral participating centers.

5. Establishing links (systems interconnection) with international information networks, databases, and information and documentation units.
6. Utilizing the most recent technology of data transmission, including telecommunication satellites.
7. Organizing the necessary training programs for users.
8. Establishing technical procedures and standards to ensure the system's compatibility with existing national and international information systems to facilitate information transfer and exchange between them.^[47]

The main functions of information networks have been to explore the needs of information users, to define the field to be covered, to identify all information available on the field, to choose methods that allow for the transfer of information between information centers (standards and systems interconnection), to supply information and documents to users by compiling and publishing directories, union lists, newsletters, and similar publications, to provide technical assistance, and to organize training workshops for information specialists and users. Information technology has been utilized in enhancing most of the functions of information networks. It has been used in identifying and creating information resources through the use of indigenous databases, online and CD-ROM databases, the development and use of common standards and information-processing tools, information dissemination, and promotion of information exchange. Information technology has also been utilized in providing training.

The 1980s and 1990s have witnessed the development of and access to computer networks in developing nations. A few examples of such networks are: GULFNET, Internet,^[48] Fidonet,^[49] and BITNIS,^[48] a network arising between the University of Chile and the National Library of Medicine that permits the consultation of the MEDLARS database via E-mail. In the Muslim world, the International Organization of Islamic States is in the process of developing a network on Islam (OICIS-NET) that will also serve as a gateway to the Internet.^[50]

The World Bank and UNDP have also been involved in promoting the development of computer networks in developing countries. The World Bank, in collaboration with UNDP, OSS/UNITAR, and USAID/WRI-NRICG has developed AFRICA-EIS, an E-mail service provided by the program on environmental information systems in sub-Saharan Africa hosted at the Environmentally Sustainable Development Division (AFTES) of the Africa Technical Department of the World Bank. The objective of AFRICA-EIS, which is open to any interested parties, is to provide a forum for discussion and especially to promote the use of geographical information systems (GIS) and spatial information on environmental issues as a support tool for decision making for natural resource management in sub-Saharan Africa. AFRICA-EIS keeps an archive and an index of issues relevant to GIS issues and

a list of EIS newsletters of the program on environment information systems in sub-Saharan Africa. Through this network, a user can contribute to a conference and request a document. Many African countries have already participated in the network in sharing information. These include Benin, Botswana, Burkina Faso, Ivory Coast, the Gambia, Ghana, Kenya, Lesotho, Madagascar, Mali, Nigeria, Senegal, Mauritania, Mozambique, South Africa, Tanzania, Uganda, Zambia, and Zimbabwe.^[51] The UNDP has also recently launched a network of immense value to developing nations. The Sustainable Human Development Network Program (SDNP), a computer-mediated communication project of the UNDP, addresses issues of information flow by fostering information sharing within developing countries, empowering users, and helping decision makers on issues related to sustainable human development. The project was launched in 1992 with twelve countries in Africa, Asia, and Latin America. To date some twenty countries are or will shortly be in operation with SDNPs. These countries include Angola, Chad, Indonesia, Pakistan, Nicaragua, Honduras, Bolivia, Cameroon, Lebanon, Morocco, Tunisia, Korea, Colombia, Guatemala, Chile, Mexico, India, and Costa Rica.^[52]

Another interesting development in networking is the development of networks through the cooperation of institutions in both the South and the North. A good example of such networks is the PANGIS (Pan-African Network for a Geological Information System) network. The PANGIS network was initiated by ASGA (Association of African Geological Services), with the technical support of CIFEG (International Center for Training and Exchanges in Geology). The network is currently supported by UNESCO, cooperation agencies of French-speaking countries (ACCT and BIET), and the French ministries of industry, foreign affairs, and research and technology. PANGIS uses formats and procedures compatible with the common communication format and exchange modules compatible with PADIS or AGRIS methodologies. The centers were initially equipped with 386 microcomputers and used the CDS/ISIS 2.32 software. A quarterly bibliographic bulletin and a CD-ROM database are produced by the PANGIS network.^[53]

Besides information networks that have been established through international cooperation, some developing nations have developed their own information networks. A good example of such a network is Gulfnet, which was established by the Saudi government in 1985. It is a computer network of academic and research institutions in the Arab world—a store and forward network similar to BITNET. Gulfnet has two major goals: to provide an infrastructure for the exchange of data, information, and messages between scientists and researchers in the Arab Gulf countries as well as to promote informal cooperation and thus promote cooperation in research projects. The Gulfnet Academic Network consists of fourteen institutions: eight Saudi universities, KACST, King Faisal

Specialist Hospital and Research Center, Cooperation Council for the Arab States of the Gulf, Ministry of Health, Islamic Research and Training Institute, Kuwaiti Institute for Scientific Research, Kuwait University, and IBM Kuwait Scientific Center. Gulfnet provides the following information services to its participating centers: accessing international databanks, providing document delivery, maintaining a union list of periodicals held by participating centers, and providing access to a bibliographic and terminology databank and the library online catalog. Other services provided through the Gulfnet communication networks include interactive messaging, file transfer, E-mail, a user directory, access to databases, conference systems, and CHAT, an organized way of providing E-mail and an answering service for answering reference queries. Gulfnet provides access to many computer and medical forums, as well as access to the KACST library information resources and databases such as the CICS DOBIS/LIBIS and dial-up or public data network access to over eighty international databases and eighty-four online CD-ROM databases.^[54]

In implementing information networks, library information systems have faced numerous problems. One of the critical management concerns that has adversely inhibited the effective implementation of information networks in developing countries concerns organizational structure and approach. Most cooperative information networks consist of coordinating units at global, regional, and national levels, which consists of participating centers at a lower hierarchical level. The problem with that kind of information network structure is that the coordinating unit seems to be benefiting more from the network than the participating nodes. Coordinating units tend to be better staffed, better provided with equipment, and alienated from the practical problems prevailing in regional or national participating centers. As a result, participating centers are indifferent or apathetic, since they do not see any tangible benefit from participating in the information networks that do not provide any material, financial, or personnel support. The initial enthusiasm of participating in the network wanes in the failure of regional information networks or their governments to provide the necessary support for effectively implementing information networks at the regional or national node. In order to tackle this problem, the approach should rather be from the bottom to the top. The regional, subregional, or national participating centers should be provided with financial, human, information, and other material resources. Another organizational structure issue related to the implementation of information networks in developing nations is the fact that oftentimes inappropriate institutions are designated as national coordinating centers due to political and other nomenclature factors.

Regarding technical operations of the network, standardization and compatibility of hardware and software systems as well as information-handling tools and

methodologies pose the most significant challenges. It is thus essential that information networks examine existing standards and apply totally or partially standards that are compatible with international standards, such as UNESCO, CCF, UNIMARC, ISBDS, and AACR II. Since these standards do not adequately cover developing nations, standards should be modified to meet local requirements. Reclassification of geographical regions may be necessary. Likewise, manuals should be made as simple, self-explanatory, and accessible as possible.

Another major technical operational constraint faced by information networks is inadequate telecommunications systems. Telephone lines are inadequate, slow, and unreliable. Dial-up services are often very slow, and leased circuits are too expensive. Circuits and bandwidth are often overloaded and the network links may be saturated. A number of alternative options such as the use of microwave networks, installation of X-25, use of packet radio, use of orbiting satellites, or Fidonet technology and the use of CD-ROMs should be explored. Last but not least is the problem of establishing and developing information networks in developing countries because of the widespread lack of awareness of the existence and potential of information networks, and consequently their underutilization. Publicity and user training should therefore be essential components in the planning and implementation of information networks.

Internet Access

In addition to cooperative international and regional information networks, many information systems in developing nations are already connected to the Internet. Many library information systems started using the Internet in the early 1990s. In Latin America and the Caribbean, for example, 1994 marked the year of consolidation or integration of numerous national networks into the global Internet. However, some institutions, such as SAICYT (Sistema Automatiza Informacion Cientifica y Tecnologica, or Scientific and Technological Information Automated System), established connections to the Internet through the JVN Cnet (John Von Newman Computer Network) of Princeton University by the end of 1991. By May 1993, SAICYT was completely based upon the TCP/IP protocol.^[48] In Africa, South Africa was connected to the Internet in 1991, although efforts to establish Internet connection started in 1989.^[56] In the Middle East, some countries, such as Egypt, have had limited Internet access since 1993, whereas the Arabian Gulf countries such as Kuwait and the United Arab Emirates established an Internet connection in 1994/1995. A number of countries in the Asia Pacific region, such as Malaysia, Indonesia, and Taiwan, established an Internet connection in the early 1990s.

There is a wide range of potential benefits of using the Internet in developing countries. The global network may

play a crucial role in tackling the book famine experienced by many libraries in developing nations. Westhuizen argues that the electronic library enables access to electronic journals and books via computer networks through the Internet and by telephone modem.^[56] On the other hand, it has been recognized that due to infrastructural problems, many information systems have not taken advantage of IT, including the Internet. In fact, it has been argued that the Internet may exacerbate underdevelopment. Sanchez-Vegas contends that if accessibility obstacles—funding, ownership, and costs—are not adequately addressed and resolved, then only the elite (within and among countries) will benefit from this immensely powerful information superhighway.^[55] However, it is encouraging to note that in spite of the many problems related to Internet access in developing countries, the Internet has been used for a wide range of purposes. Through Internet remote log-in, some libraries have had access to the most important data and knowledge banks. Ainsworth and Levinson underscored the use of the Internet to solve problems of access to databases and the wealth of information available through the link of information systems. Levinson contends that the Internet offers many national and international library catalogs with strong Latin American collections and that they frequently help with reference interlibrary loan, and collection development. Having established a connection to remote online catalogs, libraries can verify library holdings for interlibrary loan (ILL)/document delivery purposes and the selection of reference sources.^[57,58] Through Telenet connection to bibliographic, referral, numeric, full-text, and image databases, information systems can retrieve and obtain valuable information that can be used for research, reference, document delivery, current awareness, and acquisition purposes.

Library information systems in developing nations can use the FTP (file transfer protocol) of the Internet to download files of documents for ILL or document delivery, current awareness, or the building of an electronic sources reference collection. For instance, the veterinary science library at the University of Pretoria in South Africa uses FTP to build its electronic sources collection, downloading relevant animal health information such as descriptions of various animal breeds onto disk for its students. Westhuizen indicates that through FTP they often find information difficult to obtain or unavailable in the more conventional publication forms.^[56] Probably the most viable application of Internet in developing countries has been E-mail communication. Relevant Internet lists have been used for exchanging relevant and topical information or requesting hard-to-come-by articles. In Africa, for example, many libraries have an E-mail connection. These include the medical library of the University of Zambia, the veterinary library of the University of Zimbabwe, the veterinary faculty of the University of Eduardo Mondlane, Mozambique, the International Livestock Research for

Animal Diseases (ILRAD) now International Livestock Research Institute (ILRI) library in Nairobi, Kenya, and Makerere University in Uganda.

One of the interesting recent developments in Africa is the project of the "African virtual university." The university is a World Bank pilot project that is linking selected African universities to European and U.S. institutions. Recognizing that most libraries are empty shelves and that broken science facilities litter most of the laboratories, the World Bank believes that with planning and commitment, these dilapidated universities could make use of the life-line from cyberspace. As a first step, the World Bank has established a Web site for the new university. It is also encouraging private information technology bodies to provide Internet links to universities and research institutions in sub-Saharan Africa. During the first phase of the \$1.2 million project, Makerere (Uganda), Hailie Sellassie (Ethiopia), Dar es Salaam (Tanzania), Nairobi, Moi (Kenya), Legon, Kumasi (Ghana), and Zimbabwe universities will form an examination faculty for the African virtual university, while the University College, Salway, and the New Jersey Institute of Science will provide lectures and course materials.^[59]

The Internet's conference features have also been exploited for information dissemination. Westhuisen gives a good example of such a conference on animal health. The WINROCK International Livestock Conference held in 1993 had participants in Colombia, Peru, Bolivia, India, and other developing countries as well as in the United States and Europe. The conference continued for several months, with keynote papers being commissioned and contributions being made by a wide range of participants without incurring travel costs. Also, published conference proceedings can be accessed through electronic conference.^[56]

Although there is a wide recognition of the advantages of using the Internet, many developing nations have not exploited the potential of the network due to a number of complex problems. Two major interrelated bottlenecks have hampered access to the Internet resources: lack of reliable good data communications systems and the relatively prohibitive communications cost. Citing the state of communications in Latin America, Cubezas^[48] pointed out the lack of a dependable communication system, while Lawrie, in reference to the situation in Africa, identified poor telecommunications infrastructure as well as prohibitive prices as some of the major factors inhibiting access to the Internet.^[60] Kamaruddin points to the lack of both high-speed data communications facilities, and a direct link to the Internet as two of the obstacles that would hamper Islamic nations from fully benefiting from the services of the OICIS-Net (Organization of Islamic Countries Information Systems Network) project.^[50]

Other problems related to poor communication systems include rigid, time-consuming, and difficult log-on procedures and an overloaded or saturated bandwidth. The

constraints pertinent to prohibitive costs encompass expensive leased circuits and other prohibitive prices. Other issues that inhibit the effective utilization of Internet resources in developing nations include weaknesses of library collections and hence the problems of identifying and obtaining relevant, up-to-date sources, a lack of understanding of the strategic value of information, and easy access to undesirable sources, such as pornography and seditious literature. Kamaruddin claims that OICIS-Net would ensure that its users would be protected to the extent possible from some of the difficulties that have emerged in the Internet, such as an overload of information, a lack of security, and the tendency to use the network to exchange undesirable information.^[50] Some developing nations enact regulations and other control measures that inhibit or limit access to the Internet. Referring to South Africa, Lawrie points out that Internet connection was delayed in South Africa mainly because of telecom regulations that prevented any Internet activity.^[60] In order to alleviate the above problems, some developing countries have adopted a number of options, such as using store and forward E-mail networks such as Bitnet and Fidonet or dial-up link until the time when they would have UUCP or TCP/IP link. Research and academic libraries in the Arabian Gulf region, for example, have been using Gulfnet/Bitnet for E-mail communication, however, such E-mail networks have basic limitations since they are not interactive. Interactive Internet tools such as Gopher, WWW, or WAIS are not available at Bitnet/Gulfnet-only sites. South Africa also used a dial-up Bitnet telelink Fidonet mailing system from 1988 until 1990, when it got a dial-up UUCP link. For institutions that can afford it, the best approach would be to install a high-capacity satellite to enhance international links to the Internet. To tackle the problem of high communication costs, libraries should negotiate with telecommunication companies for fair costs. In order to provide access to indigenous literature, some information systems have developed local databases and made them accessible through networks. The following entry discusses the development and access to indigenous databases.

Development and Access to Local Databases

One of the major shortcomings of IT-based information sources in developing countries is inadequate coverage of information on developing countries. To address this problem, efforts have been made since the 1970s to develop local databases. Highlighting this problem in the foreword of the document *International Cooperative Information Systems*, IDRC-156e, IDRC contends that developing countries need first of all to build mechanisms so that the information that they generate themselves can be retrieved when it is needed for development purposes.^[4] IDRC has therefore been actively involved in assisting developing nations build databases on and in developing countries

that include considerable indigenous literature. In Africa, IDRC has significantly contributed to the development of the bibliographic and referral databases of the Pan African Development Information System (PADIS), the PIDSA (Population Information and Documentation System for Africa), and ILICA (International Livestock Information Center for Africa).

UNESCO has also been at the forefront in assisting developing nations plan and develop national bibliographic agencies and services through the provision of consultancy, equipment, software packages, and training. Examples of UNESCO participation in developing databases in developing nations abound. In Latin America, UNESCO has been instrumental in developing CRESALC—a database of UNESCO's Regional Center for Higher Education in Latin America and the Caribbean, covering Santiago, Chile, Port of Spain, Trinidad, and Caracas, Venezuela. Other U.N. agencies have participated in developing databases, including FAO, which has developed AGRINTER, a regional database located in Costa Rica covering Latin America and the Caribbean contributions to the worldwide database AGRIS; WHO, which has contributed to the development of the LILACS (Literatura de Latinamerica Sobre Ciencias de la Salud) database produced on CD-ROM in Sao Paulo, Brazil by BIREME, the Latin America Center for Information on Health; and the U.N. Environmental Program, which has developed PNUMA, which has regional offices in Mexico City and Kingston, Jamaica.^[61] Besides international organizations, some national institutions have developed local databases. In Saudi Arabia, KACST has developed a number of databases on Saudi Arabia. These include: science and technology database (English), Arabic science and technology bibliographic database (Arabic), manpower database, union list of serials database, current awareness database, science and technology terminology databank (BASM), online library catalog, research project data base, and project review database.^[62]

The rationale for the developing local databases has been to improve access to locally produced information for development. Such information would be useful to individuals and institutions in developing nations as well as those in the North, which are interested in information on or in developing countries. They would not only serve as selection tools, but would also enable users identify the existence and availability of relevant information. Most databases developed in developing nations have been mission-oriented, with the purpose of identifying and delivering information that can be useful in research and development planning and decision making, hence they are concerned not only with scientific and technical information that may be important in decision making, but also with economic, social, and legislative information. In their endeavor to develop indigenous databases, many information systems in developing nations have, however, encountered a number of bottlenecks. Most of the major

problems discussed earlier such as the lack of qualified and experienced staff, budgetary constraints, lack of a reading, documentation, and information culture and hence the underutilization of information systems, and language barriers have all hampered the effective development and use of local databases.

In addition to these problems, issues pertinent to information processing have also posed serious problems. The international information-processing standards, codes, rules, and guidelines do not always adequately meet the requirements of developing nations. Such information-processing tools as the *Anglo-American Cataloging Rules*, *UNISIST Reference Manual for Machine Readable Bibliographic Description*, *UNESCO Common Communication Format (CCF)*, and MARC and UNIMARC formats need to be modified to cater to the requirements of developing nations. This explains why many developing countries have developed their own national MARC formats formats.^[62] Indonesia has developed SINGMARC, South Africa SAMARC, Taiwan CHINESE MARC, and Thailand THAIMARC. In order to overcome problems posed by information-processing tools such as guidelines to bibliographic descriptions and thesauri, many information systems have developed their own guidelines. For example, PADIS and POPIN-Africa have developed the *PADIS Manual for Document Analysis and the POPIN-Africa Guidelines for Bibliographic Description and Analysis of Population and Family Planning*, respectively. Since the preparation of information-processing tools is time-consuming, it may not be wise to expend a lot of effort, time, and human and material resources in developing tools for an individual information system. For example, the development of comprehensive information tools by POPIN-Africa based on the PADIS manual was an unnecessary duplication of efforts. Information-processing tools developed by international or regional information systems should be adopted and tailored to the specific subject or geographical requirements of an information system.

Menou contends that the barrier to the exchange of bibliographic information created by incompatibility among formats was noted from the inception of UNESCO'S UNISIST program, which led to the proliferation of standard formats, giving birth to four groups of formats, somewhat similar yet antagonistic, that were supposed to overcome this barrier. Those geared to universal bibliographic control are best represented by UNIMARC, but such formats are relatively complicated and not very suitable for the management of databases in small, specialized documentation centers. The second group of formats derived from the UNISIST reference manual is more readily usable for the design of specialized national databases. Most international information systems are in line with the UNISIST manual (e.g., RESA-DOC and AGRIS); however, they can be regarded as a third group, as they have to introduce specific features according to their particular types of operation, which do not

necessarily correspond to the requirements of national databases, as well as to changes in the international systems. The last group, the common communication format, has intrinsic complications, and these formats are aligned on the basic organization of data elements found in the first group. Menou concluded that there is no format able to respond to all the constraints.^[64]

Thesauri pose significant problems. Major international thesauri do not adequately cover developing nations in terms of geographical and semantic scope. This shortcoming may be rectified if information systems in developing nations pointed out these weaknesses to the institutions responsible for building and managing thesauri. In order to ensure that different geographical regions and cultures are adequately covered, the organizations responsible for developing thesauri should include representatives from the different geographical regions. For example, the U.N. High Commission for Refugees included members from Africa, Asia, Europe, and Latin America in the International Refugee Terminology Thesaurus Working Group in 1988, when they were involved in compiling the International Refugee Multilingual Thesaurus. It is also important to develop multilingual information-processing tools for developing nations, since different languages are used in the Third World (e.g., English, Spanish, and French). The language barrier is obvious in information-processing formats as well as in information-processing guidelines and thesauri. Fortunately, concerted efforts to address these issues are under way. The Arab world, for example, has been striving toward developing Arabic MARC formats and "Arabizing" other information-processing tools and systems that are crucial for the development of local databases.

Interlibrary Loan and Document Delivery

Access to relevant references identified through searching local databases, CD-ROM, online, and other electronic network resources may be frustrating because the actual documents are not locally available. Many information systems have tried to solve the problems of document unavailability through ILL and document delivery. Cornish contends that CD-ROM stimulates a demand that cannot be satisfied by making the reader aware through extensive bibliographic data of what is not available.^[65] In view of the limited resources available in developing countries, ILL, document delivery, and cooperative acquisition have been recognized as vital possible solutions to the problem of collection deficiencies and document unavailability.

A wide variety of IT has been employed in ILL and document delivery, ranging from rudimentary equipment such as photocopiers to computer networks. Photocopiers have been used to provide current awareness and document delivery services, as was the case of the East Africa Literature Service and the Tanzania Literature Service.

These two services provided photocopies of tables of contents to scientists who selected relevant articles. Photocopies of the selected articles were delivered to the scientists by mail. Telex has also been used in many developing countries, mainly for requesting documents; delivery is through the mail. Requests for ILL are also often submitted by phone. Fax machines are used both for transmission of requests as well as for document delivery. E-mail has also been utilized for submitting requests. In the Arabian Gulf, E-mail requests are submitted through Gulfnet, and documents are sent by mail or through the FTP facility of Gulfnet. Other libraries in developing nations, such as the KFUPM library in Saudi Arabia, submit their requests to the British Library Lending Division through ARTTel (automated retrieval telephone). Besides utilizing IT in transmitting and receiving ILL requests, IT has been used in ILL database management.

Information technology has also played a vital role in developing and enhancing access to location tools such as online catalogs and union lists in machine-readable formats such as magnetic tapes or CD-ROMs. Guerrero points out that IT has improved availability for some of the libraries by creating union catalogs essential for identifying and locating documents. In Latin America, for example, LIBRANUM, a union catalog on CD-ROM, covers holdings in 164 departments of the National University of Mexico and included 500,000 records in 1995. The university union catalog of serial holdings also includes sixty-two other higher education institutions and research centers in the country. The National Library of Venezuela has an online union catalog containing more than 900,000 records, which contains information on monographic and serial holdings.^[66]

Notwithstanding some significant achievements in utilizing information technology to enhance ILL and document delivery services, numerous barriers have impeded the optimal exploitation of IT in interlending and document delivery. Lack of adequate financial, human, and material resources, poor information policies, and inadequate information infrastructure are some of the major problems. Probably the most important problem is the nonexistence or lack of availability of adequate location tools. Ferguson suggests that librarians may overcome this problem through the development of national databases of locally published materials, and cites the example of the National Library of Jamaica whereby the development of a national database has contributed to the growth of ILL activity. Ferguson also advocates participation in sectoral information systems such as INFOTERRA, LILACS, ECLAC, and AMBIONET.^[67] Cornish recommends that union catalogs that take into account uniformity of style, cataloging, practice, and formats should be combined. Since union catalogs are difficult and time-consuming to compile, Cornish suggests an alternative strategy of compiling directories of strengths of collections.^[68]

An equally important issue that librarians have faced in implementing IT is the increasing demand for ILL resulting from identifying citations through searching IT-based systems for which actual documents are not owned by the local library. Barr points out this problem as follows: "It is extremely frustrating if the references are obtained but the documents to which they refer are not available." To overcome this frustration, Barr recommends that information systems in developing nations should try to obtain special funds for document delivery; measures should be taken to combine reference and document delivery of core heavily used journals; and the existing research libraries should be consolidated.^[69] Kanamugire suggests that this problem may be alleviated through the production of CD-ROM products with substantive abstracts, since many libraries and information centers in developing nations do not have easy access to efficient ILL or document supply systems, and further suggests that donor agencies should allocate a budget for purchasing photocopies of references identified through CD-ROM searching.^[70] In another article on the impact of CD-ROM on ILLs, Kanamugire concludes that libraries that decide to offer a CD-ROM bibliographic database search service should anticipate an increase in ILL requests and be ready to respond accordingly to the impact of CD-ROM database searching through providing more human, financial, and information resources. He also suggests that libraries offering CD-ROM index services should seriously contemplate acquiring these journals not only in hard copy, but also in CD-ROM image and microform formats.^[43] Keylard suggests that information systems in developing nations use the facilities of the many CD-ROM producers that offer document delivery for references included in their databases.^[38]

Many problems inhibiting document delivery and ILL in developing countries are caused by the existing poor information infrastructure. Referring to the situation in Latin America, Guerrero points out that insufficient or unreliable postal and other services lead to delays in document delivery or loss of documents.^[66] To overcome the problems posed by inadequate postal services, a number of options have been advanced, but many of them are not viable. Cornish suggests that telefax could be used for requesting documents and that the requested documents could be received by normal mail since transmission of documents by fax would be prohibitively costly. This approach has been adopted by Barbados and Trinidad.^[68] Similarly, Ochs recommends the use of telefax because it is efficient, cost-effective, and provides rapid delivery of documents. She further points out that some telefax machines have a feature for delayed sending, taking advantage of off-peak phone rates, and suggests that in purchasing a telefax machine, one should look for as much memory as possible in order to send a large number of pages on off-peak hours.^[71] Phone lines have also been useful in requesting ILL documents as well as for

receiving documents. However, they are also expensive and unreliable, and because of a lot noise and vibration, they are of low quality. Poor phone lines may lead to a distortion of image documents. Also, fax modems used for transmitting messages have to step down to lower speeds due to poor phone lines. This results in an increased communications cost and poor quality. In the short term, little can be done to improve the quality or cost of phone lines, but in the long run, librarians should continue supporting efforts to improve telecommunications infrastructure and to decrease phone charges. In addition to fax and phone media, another medium that could be used in transmitting and receiving ILL and document delivery requests are computer-based communications systems. However, many information systems have not used electronic media because online delivery is prohibitively expensive and also because of the lack of adequate data communications networks.

In addition to problems pertinent to tools of identification, document unavailability, and infrastructural problems, other key ILL/document delivery obstacles experienced by information systems in implementing IT projects include: behavioral problems, lack of equipment, secrecy and confidentiality, financial constraints, and poor collections. Oftentimes there is no budget for ILL/document delivery activities. Even when there is a budget, hard currency to pay for ILL documents is not easily available. To solve this problem, there should be a fund for document delivery. The British Council has helped many developing countries in obtaining the British Library Document Supply Center photocopy coupons by accepting payment for the coupons in local currency.

Another problem related to finance is the lack of equipment, especially photocopiers. There are insufficient and unsatisfactory photocopying machines, and even if machines are available, shortages of paper and other materials, the unavailability of spare parts, poor servicing arrangements, and frequent power failures adversely affect photocopy services in developing nations.^[69] In order to solve this problem, equipment, especially photocopiers, should be one of the major components in the planning and implementation of IT projects. Also, there should be a budget for paper, toner, and other supplies. Libraries and information systems should charge for photocopy services and use the money collected for purchasing new photocopiers, for buying supplies, and for meeting other photocopy recurrent costs. Since it may be difficult in some libraries to afford a one-time purchase of a photocopier, information systems should negotiate with vendors to procure photocopiers on loan or for payment in installments. Another option of providing a photocopy service when the institution cannot afford purchasing a photocopier would be contracting a photocopier vendor/dealer to provide photocopy service in or near the library. Under such an arrangement libraries may get some discount and some other preferential benefits. The last, but

not least, major barrier to ILL/document delivery in developing nations is behavioral or attitudinal. Graham contends that information professionals are unwilling to become too involved in interlending because of fears of loss, damage, financial commitment, and inconvenience to library's home clientele.^[65] Guerero argues that a major drawback in ILL/document delivery in Latin America is that a few of the larger libraries will have to deal with the great bulk of the demand, which will conflict with the needs of their own users.^[66]

Although interlending has been advanced as a possible solution to the problems of inadequate collections, there are a number of obstacles that limit the effectiveness of ILL in developing nations. Mills contends that borrowing outside their own region is beyond the budgets of many libraries.^[72] Allen argues that ILL is not a practical method, or even generally a legal method, for the provision of textbook material to undergraduate students. The volume of material in demand would be too large for lending libraries to handle, there would be numerous copyright hurdles to overcome, the time factor would be extremely difficult to manage, the physical format, durability, and usability of the copies so supplied would make them difficult for receiving libraries to handle, and the costs, at ruling rates of supply from the major supplying libraries, together with postal or electronic delivery charges, would almost certainly make them as expensive as purchase. He emphasized that the present ILL financial structures militate against its extensive use by developing country libraries and pessimistically concludes that the ability of librarians, however well motivated, to make any meaningful impact on the resources of developing country libraries through ILL is extremely limited.^[71] Many library information systems have therefore focused their efforts on strengthening collection development activities.

Collection Development

Collection development in developing countries is fraught with many difficulties, especially financial ones. Probably no other function of libraries is so adversely affected by the lack of financial resources as that of collection development. Without adequate funds in local as well as hard currency, many libraries have failed to develop or update their information resources. This problem is compounded by the ever-skyrocketing prices of journals and books. Woolston highlighted the problems of price, foreign exchange, lengthy bureaucratic procedures, and the lack of a domestic information industry. Woolston asserts that prices that appear reasonable in, say, the United Kingdom are astronomical in Bangladesh. Worse still, it has to be paid for in hard currency, which may be difficult to come by.^[74] Similarly, Kaungamno, referring to Tanzania's situation, stated that

Probably the most crucial problem facing librarians in Tanzania is the lack of foreign exchange. The local book

industry faces many difficulties, and the absolute dependence on imported books threatens the existence of libraries. Libraries cannot keep their book stocks up to date. The situation has been made worse by inflationary prices all over the world, and it is difficult to get a sufficient number of suitable books.^[75]

Allen clearly highlighted the problem of acquisitions in developing nations as follows:

The essential problem in the developing countries is that libraries do not have the funding to purchase the required resources in sufficient quantities from the developed world publishers. This problem is being exacerbated by the deteriorating economic situation in many developing countries, while the situation of political instability and even total collapse of civil authority in some countries, are only making an already pain situation intolerable. At a time when the librarians of major American universities are debating action to offset the escalating costs of publications, the ability of libraries in the developing countries to acquire even the most essential materials is threatening their operations with extinction.^[73]

Some of the problems of inadequacy of information sources may be solved by making better use of the substantial amount of unconventional literature in the social, natural, and physical sciences produced in developing countries. However, it is extremely difficult to identify the existence of and to acquire such literature because of poor bibliographic control. Unfortunately, unconventional literature is usually produced in limited quantities and stocks are consequently used up as they are produced. Nonetheless, there have been some positive developments in bibliographic control of gray literature over the past two decades. Some donor agencies, especially the IDRC through its DEVSIS programs, has rendered assistance in developing bibliographic databases and collections to some institutions in developing countries, including the University of the West Indies in Jamaica and the PADIS in Africa. Similarly, FAO and UNFPA through their AGRIS/CARIS and POPIN programs, respectively, have significantly contributed to bibliographic control of developing country unconventional literature.

In his study on resources acquisitions and the viability of university libraries in developing countries, Allen advances one viable suggestion that IFLA could implement.

That expert subject committees be established, or the advice of specialist subject associations to select limited numbers of up-to-date text books of recommended additional readings for the support of undergraduate studies in the major disciplines taught in a majority of universities in developing countries, and that negotiations then be undertaken with the publishers of such texts for the production of special editions/printings to be made available to university libraries in developing country libraries at, or near to marginal production costs.^[73]

It would demand considerable effort to convince the academic staff of university libraries in developing countries that the proposal is workable and does not imply intellectual imperialism, while publishers would also need to be persuaded that their commercial interest would not be harmed. Allen also advocated negotiations of a twin relationship between a specific library in a developing country with a specific library in a developed country. He points out that such an arrangement may do much to develop ongoing close relationships that are of cumulative value to both libraries in the partnership.

Libraries in developing nations should also take advantage of international programs that aim at addressing collection development problems. Such programs include the UNESCO coupon and twinning programs as well as the INASP project of the international Council of Scientific Unions (ICSU), which is supported by UNESCO. INASP is a cooperative network of donors and representatives of recipient institutions. It has three immediate objectives: to map, support, and strengthen existing programs involved in the distribution, local publication, exchange, and donation of books, journals, and related materials (e.g., maps and charts, audiovisual materials, software, and CD-ROM); to encourage and support new initiatives that will increase local publication and general access to quality scientific literature, and to identify methods that will permit the ongoing and sustainable exchange and distribution of scientific publications.^[74]

Since it is virtually impossible for developing country governments to allocate adequate budgets for the purchase of books and journals, information systems may also benefit from the numerous institutions involved in donation programs, such as funders who provide funding for other groups to use; donors that donate books for distribution in other countries; senders and suppliers that collect books from donor and send the materials to recipients in other countries, primarily libraries; and distributors—that is, organizations in or acting on behalf of a specific country that collect or solicit donations. At times the solicited donations are in response to requests from receiving libraries for specific titles. An example of such an organization is the Asia Foundation, which distributes an average of 1 million books and journals a year to over 8,000 libraries, schools, universities, research centers, and government agencies throughout the Asia-Pacific region. The British government through its Overseas Book Development Program has played a crucial role in this respect. The British Council also accepts payment in local currency for purchasing British Library photocopy service coupons, which are then used for ordering photocopies of articles or for borrowing books from the British Library Document Supply Center. Books for Africa procures and ships books to indigenous, nongovernmental partner organizations in recipient countries that receive and distribute books to libraries and schools. It handles 500,000 books a year. Ranfurly Library Service (RLS) sends over 700,000

books overseas every year in response to urgent requests. The CTA finances a donated books program through which 44,000 of its own publications as well as an additional 10,000 non-CTA books are distributed annually. The World Bank Volunteer Book Project (WBVS) receives donations of new and used books from schools, universities, libraries, medical schools, and publishers, and ships over 120,000 books annually to several developing countries. The U.S. Information Agency (USIA) sometimes donates collections on an occasional one-time basis. The USIA book programs division also conducts programs to promote the sale and distribution of American books overseas in close collaboration with the book export efforts of the American publishing industry. The books are eventually donated to foreign institutions.

Although some libraries and information centers have benefited from gifts and exchange and other resource-sharing activities, donations and gifts and exchange programs have been criticized on a number of grounds. First, libraries are supplied with materials that are not the most desirable. As a result some key subjects may not be adequately covered, and the collection may not be updated as donations are given on an occasional one-time basis. Mills summed up the problems associated with the reliance on donations for a significant proportion, sometimes the majority, of their book stock, and pointed out that such reliance may lead to collections that are not in keeping with the needs or objectives of their users, since donations depend on what the donors are able to offer. Consequently, collection gaps, unevenness in coverage of subjects, and outdated collections may occur.^[72]

Recently the concept of library twinning has been given special attention by IFLA. IFLA contends that twinning of libraries arises from the need to improve the practice of librarianship across national boundaries.^[77] Nancy John listed, among other things, the following factors as being relevant to information resource sharing: exchange of information about libraries; improved access to published information in both developed and less developed countries; information about new techniques for library management and new technologies for library programs to be made available more widely in developing countries; greater awareness by libraries in developed nations of the issues facing libraries in developing countries; regular international sharing of problems at the operational level; involvement of all levels of library staff in sharing information about their problems and common concerns; and a broader view of the library profession.^[78] Doyle contends that collection development seems to be the preeminent rationale for twinning arrangements with a library from another country and it leads to the acquisition of materials usually difficult or impossible to obtain using conventional methods. Moreover, twinning arrangements in resource sharing and through donation and exchange programs can help and improve delivery and collections.^[79]

To tackle the immense collection development problems, a combination of traditional and innovative methods should be adopted in the acquisition of library materials. Alumni may be requested to support the library, chairs may be established, and the library may be involved in fund raising and income-generating activities. Resource-sharing efforts through ILL or cooperative acquisition have failed due to negative attitudes toward cooperation, personal conflicts, and inadequacies of human and information resources. Institutions should try to acquire U.N. and other intergovernmental publications in their areas of interest. These are often distributed free. Information systems should also acquire indigenous sources of information and use them not only for developing their own collections but also for gifts and exchange purposes. Furthermore, in cooperation with the parent organization, libraries and information centers should promote indigenous publishing, including the use of desktop publishing and online publishing tools.

User Sensitization and Training Issues

Two critical factors in successfully implementing IT projects in developing countries are user sensitization and user training. The UNESCO document Com.74/NATIS/3 highlights the issue of awareness in NATIS objective 2, which states among other things

In many parts of the world, even though information is available in the collections of documentation, library and archives services, the potential users of these facilities are unaware of their existence and the advantages they offer, or the information remains unused because it does not meet the special needs of specific sectors of the community.

The same document further recommends the following:

In order to increase user awareness, appropriate bodies, including universities and other educational institutions should include in their programs systematic instruction in the use of the information resources available in all of the elements of NATIS. It is therefore recommended that: use of libraries should be part of instruction offered from the primary school level onwards so that seeking information becomes a normal part of daily life; the efforts of stimulation of user awareness and user education started within the educational programs should be continued in professional life, and research workers should be encouraged to seek and use the specialized literature which would help them carrying out their research and development programs.^[6]

Another significant UNESCO document, *Education and Training of Users of Scientific and Technical Information: UNISIST Guide for Teachers*, clearly underscores the significance of user training.

In every country, from the least developed to the most advanced, a certain amount of scientific and technological

information—locally produced or of the international origin—is processed and stored in some fashion for the benefit of users. Unless these users know how to find relevant information, the information “machinery” falls short of its main goal.^[80]

Indeed, many information professionals, academics, IT experts, and regional institutions have underlined the importance of user sensitization and training in various regions of the Third World. Syed Salim Agha and Akhtar, in their study on sustaining information systems in developing countries, recommended promotion and marketing of an information system to existing and potential users in order to enhance awareness and use of its products and services.^[17] Likewise, Bell asserted that information systems that are available do not always advertise themselves as well as they might, leaving the service to be discovered by those who want it. He further argued that the lack of use, or underuse of information systems, might relate to lack of user education.^[19] Keylard pointed out that the bulk of users and information professionals are inexperienced.^[38] In the same vein, Paez Urdaneta advocated that one of the objectives of the information implementation strategy in developing countries should be stimulating and increasing the demands.^[81] The need for user sensitization and education in Africa has also been widely recognized. One of the major objectives of PADIS is to organize training courses and seminars for users of the system.^[47]

In the Middle East, Alkoudasi advanced in his proposal for a structure for Arab scientific and technological information and computer networks that one of the major objectives of the envisaged IIP-ARABNET, a network linking willing S & T institutions in the Arab region, should be to enhance the national and regional capacity for information handling and use through, among other things, increasing the awareness and enhancing the capacity of potential users of information and data through the promotion of greater utilization of existing facilities (ENSTINET, KISR, RSS, SSRC, etc.), as well as orienting them toward more effective use of the available services.^[82] In Saudi Arabia, one of the recommendations of the National Science Foundation (U.S.), which conducted a feasibility study in 1977 on the development plan for a national information system for science and technology for the kingdom, recommended among other things that SANCST should train users and libraries in the use of online services.^[27] In the same vein, Saleh Ashoor and Zahir Khurshid conducted a study on user reaction to the online catalog at the University of Petroleum and Minerals Library (the present KFUPM library) in 1985, and identified a training program to maximize the use of the computer catalog as well as an updated manual as two of the major areas needing improvement. They subsequently recommended that there should be a help desk near the terminals staffed by librarians during specified hours to give users instructions on the use of the catalog.^[83]

The objectives of user sensitization and training programs in developing countries include stimulating user awareness and use of IT-based information systems; dispelling the fear of using IT or IT phobia; dispelling misconceptions about the potential as well as limitations of IT-based systems; and imparting basic and advanced information retrieval and life-learning skills. In short, the goal of user training in developing countries should be imparting information literacy skills. The target population of user sensitization and training programs should not only include students, but must also include different types of users, ranging from policy makers, academics, researchers, professionals, and technicians to workers. Referring to online searching, Marghalani identified the need to inform the academic community about the service and recommended that an effective plan to publicize online searching service to all users should be developed.^[84] Planning of user sensitization and training programs should involve all information professionals who would be directly involved in implementing the programs. Concerted efforts should be made to win the support of the organization's senior administrators. Planning and implementing awareness and training programs may be frustrating because of the lack of appreciation of the importance of information, and thus low attendance. Patience, vigilance, vigorous efforts, and flexibility are therefore vital in the planning, organization, and implementation of user sensitization and training programs. Their timing should avoid coincidence with any other major activities taking place in the organization.

In organizing a user-sensitization program, the head of the library/information center could start with enlightening the organization's management on the significance of valuable information resources and services provided by the information system. In doing so, it should be emphasized that these resources are vital for realizing the mission of the organization. This is important to win their support. The chief executive of the organization may be invited to open the event, while heads of departments may be invited to attend as well as to encourage members of their departments to attend. A combination of instructional methods and formats, including group discussions, on-the-spot demonstrations, hands-on practice, seminars, workshops, open house, videos, online tutorials, and library Web page is likely to be more effective than the lecture method. Al Hadidy, in his study on delayed online searches in Egypt, suggested that effective means of user education should include brochures, live demonstrations, and seminars in the user's departments, as well as fliers and posters. Print materials, including flip charts, simple search guides on a particular system, and handouts are useful in giving tips on effective search strategies and techniques.^[33] Users cannot entirely rely on the bulky and too-detailed documentation provided by vendors; simple guides tailored to the needs of the user community are more useful.

In order to enhance user awareness about the existence and availability of information resources and services, library information systems have been involved in compiling and distributing bibliographic listings. These listings include acquisition or accession lists, bibliographies such as topical and geographic bibliographies, pathfinders, and directory information. With the application of IT, many of these bibliographic services have been computerized. For example, POPIN-Africa, a project based in the population division of the U.N. Economic Commission for Africa in Ethiopia used to produce monthly accession lists by using MINISIS CDS/ISIS software packages. POPIN-Africa also published *POPINDEX-Africa* an indexing and abstracting journal, as well as *Country Bibliographies* and the *Directory of African Demographers* out of the POPIN-Africa referral database.

In Saudi Arabia, KACST provides an electronic current awareness bulletin to researchers in the kingdom. The International Livestock Center for Africa in Ethiopia, the Tanzania Literature Service, and the Zambia Literature Service also disseminate information to their participating centers through current awareness and document delivery services based on photocopying and distributing tables of contents as well as supplying desired articles. Information systems have also used library publications such as brief information leaflets and basic guides, as well as detailed library handbooks for user sensitization. These publications are processed by using IT such as word processing and desktop publishing, such as Ventura and Page Maker. Graphic software packages have also been employed in designing publicity posters and brochures. Recently some library and information services have started disseminating information by using library home pages as well as electronic bulletins. Communications technology, especially fax machines, E-mail, and telephones are useful delivery media for disseminating information on IT systems. Special events may also be used to disseminate information. Such events may include an open house, distribution of publications, and demonstrations of IT-based resources and services.

Libraries and information centers in developing countries may take advantage of major events in the library/organization to provide awareness/user training programs. For example, the KFUMP library in Saudi Arabia uses Library Awareness Day, an annual event at which newcomers are introduced to library resources and services while the returnees are updated on the latest developments in the library to invite researchers to conduct comprehensive searches on their special areas of interest. Apart from aggressive publicity that may include the use of posters located in key important areas, announcements in the organization or library newsletter, word of mouth, and electronic bulletins, E-mail, and other electronic communication media may be effective in user sensitization. Offering free refreshments may attract a great number of children and students, while conducting comprehensive

searches in users' fields of interest may lead to a positive response from researchers, faculty members, and other serious researchers. A quiz may also attract positive participation, especially if some prize is awarded. In addition to the activities mentioned above, other items that would be included in a user sensitization program would include demonstration of IT-based information services such as CD-ROM and online searching, access to network resources through national, regional, and international networks such as Bitnet and Internet resources, and searching of online public access catalogs. Publications on IT-based systems may be distributed. Publicity information such as leaflets, fliers, or publicity jackets may be more effective than detailed documentation.

The discussion above have pointed out that for a successful implementation of user sensitization and training programs, management, marketing, communication, teaching, and evaluation skills are desirable. These skills are particularly crucial for public services information specialists who may be involved in the planning, actual implementation, and evaluation of the programs. Unfortunately, however, many public services librarians lack marketing and teaching skills. Worse still, these proficiencies are inadequately covered in many library and information science education or continuing education programs. Information professionals should therefore pursue and participate in professional development programs pertinent to information management, communication, marketing, teaching, and learning.

While the responsibility of organizing user sensitization programs may rest with the information centers or library services, user training programs may be organized and implemented in partnership with the computer services department or any other department interested in offering user training programs pertinent to IT-based information systems. It is important to evaluate user sensitization and user training programs in order to ascertain whether the programs have achieved their objectives. This may be accomplished through analyzing statistics of attendance and observing whether those who participated in user sensitization and training programs use the automated information systems and services more frequently since their participation in user training programs. A simple suggestion form may be distributed to participants during the promotion event to solicit comments and suggestions. After offering promotional events for a couple of years, an evaluation of the overall program may be conducted. A survey instrument may be used to elicit information on the magnitude, frequency, and adequacy of user-sensitization program objectives, planning and organization, content, and methods.

As for the evaluation of user training on IT-based information services, an immediate evaluation may be carried out by using a simple questionnaire instrument to elicit information on whether the patron understood the information presented in the programs—the adequacy of the information provided and the level of confidence attained in

using IT-based systems independently as a result of their participation. The simple questionnaire may be completed and submitted right after the user-training session. A more detailed questionnaire may be administered to participants or nonparticipants after a couple of months to ascertain why nonparticipants who had been identified did not attend and how useful those who attended found the programs.

CONCLUSION

This entry has discussed some major issues pertinent to planning, implementing, and managing IT projects in developing countries. It has contended that IT projects can positively contribute to socioeconomic development, but due to numerous problems, the contribution of information and IT to development has been questionable. Hardly any significant positive impact has been observed. Worse still, IT has often led to the widening of the gap between the rich and the poor within the developing world as well as between the developing and the industrialized countries. It is therefore recommended that developing countries should carefully plan for the implementation of IT projects. While the selection of hardware and software may be primarily determined by the requirements as ascertained through needs assessment, the existing IT environment, including the availability of technical support and cultural factors, should also be given serious consideration.

Although a variety of IT projects have been effectively applied to a number of operations of library information systems such as online searching, CD-ROM searching, and access to network resources, developing countries with poor information infrastructure may like to continue exploiting CD-ROM technology. Nevertheless, CD-ROM should be supplemented by access to other electronic network resources such as the Internet and intranet resources. This entry has also underscored several factors crucial for the implementation of IT projects in developing countries. Such factors include offering aggressive user sensitization, information marketing, and end-user training.

In the future, developing countries will have to apply IT to their various development activities. The question is no longer whether IT should be applied, but how it should be effectively used to solve the many diverse and complex development problems. It is strongly recommended that a strategic plan include the development and refining of new visions and adopt a partnership; a flexible and resourceful approach is vital for implementing successful and sustainable IT projects in developing countries.

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Information Technology Standards for Libraries [ELIS Classic]

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Abstract

Information technology standards, which have been an important part of librarianship in the United States for more than 70 years, are today more important than ever. The environment in which such standards arise grows increasingly complex, as the technical concerns of librarians and archivists intersect with the communities formulating technical standards for computing, networking, and digital publishing. In this entry, the nature of standards and basic aspects of the standardization process are described, key standards-making organizations are identified and their roles are assayed, and the various benefits of information-oriented technical standards are assessed.

INTRODUCTION

With the rise of digital libraries and the emergence of digital documents as the primary means of composition and publication, technical standards have become more important than ever for libraries and other information services. In fact, information technology standards may be viewed properly by librarians and archivists as blueprints for survival, because the interoperability of systems is now essential to the continuation of high-quality library and archival services.

Technical standards have been an important part of librarianship in the United States since 1939, when the American National Standards Committee Z39, the forerunner of the current National Information Standards Organization (NISO), was formed. Today, the environment in which technical standards bearing on libraries arise grows increasingly complex, as the rise of the Internet and the World Wide Web engage a wide array of organizations and interests in the development and use of technical standards, and the technical concerns of librarians and archivists have intersected with those communities formulating technical standards for computing, networking, and digital publishing. So, in the early twenty-first century, organizations like the Internet Engineering Task Force (IETF), International Organization for Standardization (ISO) and the World Wide Web Consortium (W3C) play prominent roles in the development of technical standards that have significant effects on digital libraries and archives, and on digital publishing.

Technical standards “are the basis for making many exciting and empowering things happen – like connecting one system to another, producing files on one system that can be transferred to another, and saving users money when a different manufacturer’s less expensive component can be connected to their system.”^[1] Or, to cite another view, “[w]ithout standards no one can use intelligent machines very effectively, equipment cannot interoperate,

and all the information people are so busy creating would stay locked in files and archives, largely inaccessible.”^[2] Perhaps even more to the point, Lynch has written:

We are beginning to recognize that standards documents are really a form of “public good,” reflecting and recording achievements of intellectual consensus among a broad community of developers, rather than representing acts of individual creative authorship. They serve as a social construct and intellectual record.^[3]

Looking ahead, it is clear that as the desire for more and more interdependence grows, technical standards will only increase in importance. It is also clear that the development of open technical standards like those developed by NISO, ISO, IETF, and W3C are critical factors in the broader advance, penetration, and benefits of information technologies.

THE NATURE OF STANDARDS

What is a standard? How are standards developed? How specifically are information technology standards developed? These are vital questions, because understanding standards and the role of standards requires an understanding of the nature of such specifications and the processes leading to their acceptance.

A number of relevant definitions are available. According to the ISO, a standard is “a document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.” The ISO stipulates further that standards should be based on the consolidated results of science, technology, and experience, and aimed at the promotion of optimum community benefits.^[4]

The general view is that “a standard is the deliberate acceptance by a group of people having common interests or background of a quantifiable metric that influences their behavior and activities by permitting a common interchange.” In addition, it is held that a standard represents the belief of its authors that its specifications will be “understood, accepted, and implemented by the market,” and that standards are formulated with the expectations of substantial effect on the markets that they address.^[5]

The British Standards Institution states that:

... a standard is an agreed, repeatable way of doing something. It is a published document that contains a technical specification or other precise criteria designed to be used consistently as a rule, guideline, or definition. Standards help to make life simpler and to increase the reliability and the effectiveness of many goods and services we use. They are intended to be aspirational – a summary of good and best practice rather than general practice. Standards are created by bringing together the experience and expertise of all interested parties such as the producers, sellers, buyers, users and regulators of a particular material, product, process or service.^[6]

With specific reference to information technology standards, the ISO stipulates that the “purpose of IT standardization is to ensure that products available in the marketplace have characteristics of interoperability, portability and cultural and linguistic adaptability,” and that standards should therefore reflect the following “Common Strategic Characteristics”: repeatability; interoperability; portability; and cultural and linguistic adaptability.^[7]

TYPES OF STANDARDS

There are several types of technical standards, including conceptual and implementation standard and process and product standards. The first type of standard is the conceptual standard. Conceptual standards usually constitute the detailed articulation of a proposal to produce a new technology or induce a revolutionary change in the way in which a process is conducted. For example, the IEEE 802.3 Ethernet standard, which was conceived so that individual computer users might have access to remote facilities such as printers, is rooted in problems of effectiveness and efficiency and predicated on the idea that facilitating communications between computer users and systems resources affords a basis for maintaining high levels of both performance and service at acceptable costs. Although implementation of this conceptual standard led more or less directly to the development of the local area network and an array of technologies necessary to support specific aspects of the service envisioned in the standard, the standard itself is conceptual in nature.

The second type of standard is the implementation standard. Implementation standards are typically evolutionary as opposed to revolutionary in nature, and tend to reinforce existing industry patterns. An example of this type of standards work is efforts aimed at ensuring that a programming language, which exists in various versions, is implemented properly.

Today, the notion of the implementation standard extends to digital document formats, such as the Portable Document Format (PDF) and the OpenDocument Format (ODF). In the case of the PDF, after more than 15 years of proprietary development, Adobe Systems decided in 2007 to release the PDF specification to the Association for Information and Image Management (AIIM), with the understanding that AIIM would work with and through the ISO to establish PDF as an open standard. PDF had become a *de facto* global standard for information exchange and archival storage (and Adobe had already worked within the ISO process to deliver specialized subsets of PDF as standards for specific industries and functions), but the powers-that-be at Adobe decided that the most effective way to continue to advance this particular technology was to make the underlying specification an open standard, so that other developers had a readily available reference standard in implementing PDF writers, readers, and other applications. The standard, ISO 32000-1:2008, specifies “a digital form for representing electronic documents to enable users to exchange and view electronic documents independent of the environment in which they were created or the environment in which they are viewed or printed.” The standard also specifies that “[i]t is intended for the developer of software that creates PDF files (conforming writers), software that reads existing PDF files and interprets their contents for display and interaction (conforming readers) and PDF products that read and/or write PDF files for a variety of other purposes (conforming products).” PDF/Archive (PDF/A) and PDF/Exchange (PDF/X) are ISO standards.

The ODF is a file format for electronic office documents, such as spreadsheets, charts, presentations, and word-processing documents. The specifications were originally developed by Sun Microsystems, in conjunction with its development of an office productivity suite called Star Office, and the standard was further developed by the Open Office Extensible Markup Language (XML) technical committee of the Organization for the Advancement of Structured Information Standards (OASIS) consortium. Based on an XML format originally created and implemented by the OpenOffice productivity suite, the open source version of Star Office, the purpose of the ODF is to establish a basis for the creation and exchange of formatted documents based on open standards and without reliance on any specific application.

The standard was published as an ISO/IEC international standard, ISO/IEC 26300:2006 Open Document Format for Office Applications (OpenDocument) v1.0.

Development of the Open Document Format continues, with the expectation that version 1.2 will be approved by the ISO in 2009. Its importance was reinforced and expanded in 2007, when Microsoft announced that beginning with Microsoft Office 2007 Service Pack 2 native support for the ODF will be included.^[8] Microsoft also released the specifications for the binary document formats associated with Microsoft Office, and indicated that subsequent versions of Office would also include native support for the PDF. At this writing, there is reason to believe that as a result of Microsoft's commitment to ODF, digital documents are about to enter a new and even more productive era, since the use of the ODF as the default format for documents generated under the Microsoft Office productivity suite will enhance interoperability at the document level, presumably in great measure.

A third type of standard is the product standard. Typically, a product standard describes an existing product or service and establishes the characteristics of the product or service as a model for other products of the same type within a specific industry.^[9] Product standards, *de facto* or *de jure*, are commonly derived from products that dominate specific markets; recent examples of *de facto* product standards include the file format supported by a popular computer application like Microsoft Excel or a widely used peripheral device.

Finally, there are process standards, which are concerned with the transformation of a need into a solution, but not with the products that produce the transformation. In other words, process standards are generally device independent specifications. An example of such a standard is ISO 8879: Standard Generalized Markup Language (SGML), a meta-language providing a standard syntax for defining descriptions of classes of structured information and rules to structure information that led to the development of the Hypertext Markup Language (HTML), which is, in its various forms, an SGML document type definition (DTD). Under SGML, a set of DTDs is established, and then segments of a document (e.g., the title statement, the bibliography, or illustrations) are labeled in accord with the DTDs, thus dividing the document into named, logical elements. The advantage of using a standardized language for describing documents in structural terms is that a single source document may be processed by a wide array of applications, where those applications are capable of interpreting SGML, thus liberating the interchange of electronic documents from the realm of specific applications and proprietary document structures. Today, SGML has been superseded by the XML, which is:

... a simple, very flexible text format derived from SGML (ISO 8879). Originally designed to meet the challenges of large-scale electronic publishing, XML is also playing an increasingly important role in the exchange of a wide variety of data on the Web and elsewhere.^[10]

HOW STANDARDS ARE MADE

The process under which standards are made varies from organization to organization, but the development process employed by NISO is, in general terms, representative. New standards are proposed by NISO's Topic Committee as a "work item," when it can be demonstrated that the proposed standard is relevant to NISO's purposes, that its development is feasible, and that it warrants the requisite investment. A proposed work item includes a working group charter, a description of the proposed standard, a suggested timeline for development, and a description of related standards. In the second phase of the process, if the work item is approved, a working group is recruited and then approved by the Topic Committee. (Approval of a work item requires that 10% of the NISO membership votes in favor of the item.) In the third phase, a work plan, timeline, and budget are created and approved by the Topic Committee. The work plan is then implemented, with the plan typically divided into a data-gathering phase and the development of the draft standard. In the fifth phase, assuming support by two-thirds of the working group, the draft standard is forwarded to the Topic Committee, with the recommendation that NISO release it as a Draft Standard for Trial Use or for ballot. If two-thirds of the Topic Committee approve, the trial use period runs from 6 to 18 months. If and when a draft standard secures the approval of the Topic Committee, the Architecture Committee, the majority of the NISO Board of Directors, and the direction of NISO's managing director or a petition from 5 or more voting members of NISO, a standard ballot is issued. Once the standard goes to ballot, there is a 60-day public review period, followed by a 45-day voting period. If a majority of the "voting pool" casts ballots and two-thirds of those votes are in the affirmative, the draft standard is approved. (Comments must be addressed and resolved before the standard is officially published.) In the next phase, the standard is submitted to American National Standards Institute (ANSI) for approval, under a nine-stage process administered by ANSI. Once ANSI approval has been secured, NISO establishes a maintenance agency or a standing committee, in either instance assuming responsibility for changes, clarification, and interpretation.^[11]

THE BENEFITS OF TECHNICAL STANDARDS

Technical standards offer several important advantages. First, the process of developing technical standards affords a structured basis for exchanging relevant ideas and information. In addition, technical standards offer what has been termed a collaborative advantage, meaning that developers, particularly the developers of standards that are prospective in nature, often have a substantial amount of time in which to investigate the implications of a new

standard or a revision of an existing one. Of equal importance, open standards create a more competitive environment, and that usually provides consumers with a wider array of choices and lower prices. For organizations such as libraries and archives, standardization has been a crucial factor in making computing and networking economically feasible.

STANDARDS-MAKING BODIES

Who makes standards? The realm of standards making is a complex one, ironically lacking a high degree of standardization. Industry or interindustry groups, treaty organizations, professional organizations, government agencies, and ad hoc vendor groups each make standards.

On the international scene, the ISO is the primary standards-making body, but other organizations, such as the International Telecommunication Union (ITU) also play important, sometimes crucial, roles in the development of technical standards. The ITU has been engaged in standardization work since 1865, when the International Telegraph Union was established. The ITU became a United Nations specialized agency in 1947. It was renamed the International Telecommunications Union in 1993. An example of an ad hoc vendor group with a long-standing interest in standards making is The Open Group. Originally known as the Open Software Foundation (OSF), it was organized in 1988 for the purpose of standardizing the Unix operating system, and continues as an industry consortium to set vendor- and technology-neutral open standards for computing infrastructure. Another such group is the European Computer Manufacturers Association, which has been active in defining a framework and developing standards for Computer-Aided Software Engineering (CASE).

In the United States, the principal standards-making body is the ANSI, which charts committees and accredits other groups to formulate standards. NISO is one of the bodies that ANSI accredits for the purpose of developing standards in a specific area. Standards of the federal government, not necessarily inconsistent with the standards devised by ANSI and its allied organizations, are developed by the National Institute of Standards and Technology (NIST), with considerable influence from other federal agencies, including regulatory agencies such as the Federal Communications Commission and the nation's largest consumer of goods and services, the U.S. Department of Defense. Some unaccredited standards bodies, such as the IETF and Internet Architecture Board, are also highly influential. The IAB supports the development of documents that define standards for the Internet protocol suite. The IAB has developed these standards in order to coordinate the evolution of the Internet protocols. The majority of Internet protocol development and standardization activities takes place in the working groups of the IETF. Protocols that are to become standards in the Internet go

through a series of steps: proposed standard, draft standard, and standard. Each step in this process involves increasing amounts of scrutiny and experimental testing. At each step, the Internet engineering steering group of the IETF must make a recommendation for advancement of the protocol and the IAB must ratify it for the process to move forward. If a recommendation is not ratified, the protocol is returned to the IETF for review and further development. It is a general practice of the IAB that no proposed standard can be promoted to draft standard without at least two independent implementations and the recommendation of the Internet engineering steering group. Promotion from draft standard to standard generally requires operational experience and demonstrated interoperability of two or more implementations, as well as the recommendation of the Internet engineering steering group.

THE ANSI

The ANSI is a private, nonprofit organization that approves national standards and coordinates a system for voluntary standardization. Founded in 1918, ANSI is also the U.S. representative to the ISO and the International Electrotechnical Commission (IEC). Its membership includes more than 125,000 organizations, including corporations, government agencies, and professional, technical, trade, labor, and consumer organizations.

ANSI is the official U.S. representative to the ISO and, via the U.S. National Committee, the IEC. ANSI is also a member of the International Accreditation Forum (IAF). At the regional level, ANSI is the U.S. member of the Pacific Area Standards Congress (PASC) and the Pan American Standards Commission (COPANT). It is also a member of the Pacific Accreditation Cooperation (PAC) and Inter American Accreditation Cooperation (IAAC). ANSI's mission is:

To enhance both the global competitiveness of U.S. business and the U.S. quality of life by promoting and facilitating voluntary consensus standards and conformity assessment systems, and safeguarding their integrity.^[12]

THE NISO

The NISO is accredited by the ANSI to develop voluntary technical standards for libraries, publishers, and the information industry. Its mission is to foster "the development and maintenance of standards that facilitate the creation, persistent management, and effective interchange of information so that it can be trusted for use in research and learning."^[13] In addition, NISO serves as the expert technical advisory group to ANSI on international standards concerning information sciences, documentation, and libraries developed by the ISO/technical committee 46.

NISO is supported by a number of organizations, ranging from the American Library Association, the American Society for Information Science and Technology and the Modern Language Association to the Library of Congress, Online Computer Library Center (OCLC), the U.S. Government Printing Office, Reed Elsevier, and Recording Industry Association of America. At present, NISO has more than 70 voting members, who assist in the development of new standards and review all the standards developed by NISO.

In addition, the Library Standards Alliance, which has 27 members, has been established in order to provide libraries a role in NISO's activities. The members of the Library Standards Alliance include Boston College, the British Library, Columbia University, Harvard, the Library and Archives Canada, the NIST, Ohio State, Princeton, Stanford, the Universities of Chicago, Florida, Maryland, and Notre Dame, and the World Bank.

Throughout its history, NISO has been concerned with the formulation and implementation of standards that address the needs of libraries and archives, information services, publishing, and the book trade in a series of areas, including information transfer, forms and records, identification systems, publication formats, transliteration, preservation of materials, and library equipment and supplies. Today, NISO's mission includes identifying areas in which standards are needed; developing, writing, and maintaining voluntary technical standards; reviewing and updating current standards; and representing national interests in the development of international standards.

More than 35 NISO standards are currently in print, and a substantial number of other standards are being developed or revised at this writing. Standards produced to date include specifications for bibliographic information interchange, the construction and formatting of indexes, a Common Command Language (CML), interlibrary loan data elements, patron record data elements, and international standard numbering for both books and serials. Each NISO standard is reviewed as a matter of policy after five years in force.

In the past, NISO has been largely reactive in its dealings with the library community, and has not been engaged in the "incubation or early development of standardization efforts." In recent years, however, NISO has begun to work on standards-related activities that go beyond its traditional portfolio of Z39.xx standards and its relationship with ISO. According to strategic plans established in 2005, in the future NISO will be engaged in the development of other outputs, including "recommended practice documents; tools, plugins, or Web services definitions; white papers investigating and educating on new technologies; registries in support of identifiers and other processes; and creation of "living documents" such as wiki sites (with an editorial board)." Under the new framework, another goal is to accelerate the standards-making process by compressing both the

incubation and testing periods for draft standards, so that the process which begins with a concept and culminates in final approval of a standard typically requires less than two years. ("Final approval" in this case is a majority vote of NISO members, not the full consensus needed for approval of an ANSI Z39-track standard.)^[14] Under NISO's previous system, the initial phase of standards development in the NISO environment took two to three years. At the end of this period, a draft of the proposed standard entered into a round of comments and revisions that could take another 12–18 months, followed by a vote of the NISO membership. If the proposed standard was approved, a resolution phase followed, during which the changes necessary to achieve consensus are sought in order to finalize the standard. Finally, ANSI reviewed and approved the new standard prior to publication. It was not unusual for this process to span a period of 5–8 years. This is a formidable task, given that acceptable, useful standards must be clear and reflect consensus, neither of them being qualities that are easily achieved.^[15]

CURRENT NISO STANDARDS

Some of the key NISO standards have been in place for years. Examples include the Information Interchange Format, ANSI/NISO Z39.2, which is the basis for the MARC (Machine-Readable Catalog) record and the standard for serial numbering, ANSI/NISO Z39.9. Of the newer standards, several are likely to be of critical importance, including ANSI/NISO Z39.88, the OpenURL Framework for Context-Sensitive Services, which defines an architecture for an open framework for information services in networked environments; ANSI/NISO Z39.29, which establishes rules, guidelines, and examples for bibliographic references; ANSI/NISO Z39.85, the Dublin Core Metadata Element Set, defining metadata elements for resource description in cross-disciplinary information environments; and ANSI/NISO Z39.93, the Standardized Usage Statistics Harvesting Initiative (SUSHI) Protocol, which defines an automated request and response model for the harvesting of electronic resource usage data within a Web services framework.

THE ISO

On the international scene, about 100 countries have national standards bodies that bring together experts from industry and universities to develop standards. In addition to ANSI, prominent standards-making bodies include Deutsches Institut fuer Normung (Germany), the British Standards Institution, Association française de normalisation (France), Ente Nazionale Italiano di Unificazione (Italy), Nederlands Normalisatie-instituut (Netherlands), Standards Australia, the Standards

Association of New Zealand, Norges Standardiseringsforbund (Norway), Dansk Standard (Denmark), and the ITU. The is the organization that coordinates the activities of national standardization bodies at the international level. Together with the IEC, ISO concentrates its efforts on “harmonizing” national standards all over the world. The results of these activities are published as ISO standards.

ISO has 157 national members, out of the 195 total countries in the world. The ISO’s Central Secretariat, which coordinates the system, is located at Geneva, Switzerland.

There are three categories of membership in ISO. Member bodies are national bodies that are considered to be the most representative standards body in each country. Member bodies are the only members of ISO that have voting rights. Correspondent members are countries that do not have their own standards organization. Subscriber members are countries with small economies. Correspondent and subscriber members are informed about ISO’s work, but they do not participate in standards-making process.

As a matter of policy, ISO standards are developed on the basis of consensus, taking into account the interests and views of manufacturers, vendors and users, consumer groups, testing laboratories, governments, engineering professions, and research organizations. ISO standards are intended to be global solutions that address and satisfy the requirements of industries and consumers on a worldwide basis. Finally, ISO standards are voluntary, and their promulgation is based on the view that international standardization is and should be a market-driven process.

ESTABLISHING ISO STANDARDS

There are three principal phases in the ISO standards development process. In the first phase, the need for a standard is articulated, usually within an industrial sector, and then communicated to a national member body. The national member body then proposes the new work item to ISO. If the need for an international standard is recognized, the technical scope of the proposed standard is defined, usually by a working group of experts from countries interested in the subject matter of the proposed standard.

Once agreement has been reached by the working group on the technical aspects to be covered under the proposed standard, the second phase of the process begins, during which the detailed specifications of the proposed standard are reviewed and revised by representatives of the member bodies. It is during this phase of the process that the consensus building necessary for the eventual approval of the proposed standard occurs. In the final phase of the process, the draft standard is taken to ballot, with formal approval requiring affirmation by two-thirds of the ISO members that have participated actively in the standards-development process and 75% of all members voting on the draft standard. Following formal approval,

the text of the standard is published as an ISO International Standard. (Most standards require periodic revision, owing to factors such as technological evolution, new methods and materials, and new quality and safety requirements. Consequently, ISO mandates that all standards should be reviewed at least once every five years.)

At this writing, ISO has published more than 16,000 standards, including the metric system of units, international stationery sizes, rules for technical drawings, electrical connectors, security regulations, computer protocols, file formats, bicycle components, ID cards, programming languages, international standard book numbers (ISBN), barcode symbology, and RFID. Within the ISO, the ISO/IEC Joint Technical Committee 1, which is maintained in collaboration with the IEC, deals with information technology. The ISO/IEC Joint Technical Committee 1 was formed in 1987 by merging ISO/TC 97 (Information Technology) and IEC/TC 83, with IEC//SC 47B joining later, thereby establishing a single approach to information technology standardization by and for the two parent organizations. Its mandate is to develop, maintain, promote, and facilitate information technology standards in the following areas:

- Design and Development of IT Systems and Tools
- Performance and Quality of IT Products and Systems
- Security of IT Systems and Information
- Portability of Application Programs
- Interoperability of IT Products and Systems
- Unified Tools and Environments
- Harmonized IT Vocabulary, and
- User-Friendly and Ergonomically Designed User Interfaces.

Membership in the ISO/IEC Joint Technical Committee 1 is open to any national body within either of the parent organizations. Other organizations may participate as liaison members. Membership in the ISO/IEC Joint Technical Committee 1 expanded substantially in 2007, immediately prior to the initial vote on Office Open XML as DIS (Draft International Standard) 29500.

ISO STANDARDS RELEVANT TO LIBRARY AND INFORMATION SERVICES

Although the ISO is engaged in the development of standards in many different areas, most of the ISO standards that are applicable to libraries and related information services are standards addressing specific issues in computing and networking. There is, for example, the Linux Standard Base (LSB), a joint project by several Linux distributions under the organizational structure of the Linux Foundation to standardize the software system structure used with the Linux operating system. The LSB, which is based on the POSIX (Portable Operating System Interface) specification, the Single UNIX Specification,

and several other open standards, was submitted for approval as ISO/IEC 23360 in 2008. Another recent example is the PDF. Developed by Adobe Systems for document exchange and in widespread use since the mid-1990s, PDF was officially published as an open standard in 2008, as ISO 32000-1:2008. PDF encapsulates a complete description of a fixed-layout two-dimensional document (and, with Acrobat 3D, embedded 3D documents), including the text, fonts, images, and vector graphics which comprise the document. Last but not least, there is ISO 8879: 1986, which describes the SGML, a format for storing documents together with their logical structure and layout information in a standardized scheme and the basis for the HTML, and which is effectively the precursor of contemporary documents standards, such as ISO/IEC 29500-1-4:2008, which defines a set of XML vocabularies and other conventions for representing word-processing documents, spreadsheets, and presentations, based on the Microsoft Office 2008 applications, and ISO/IEC 26300:2006 Open Document Format for Office Applications (OpenDocument) v1.0, which defines an XML schema for office applications and its semantics in more expansive terms.

An ISO standard more directly relevant to the interests of libraries (and illustrative of the conditions that influence the evolution of technical standards) is ISO 23950, also known as ANSI/NISO standard Z39.50. Designed as a protocol for searching and retrieving information, usually from bibliographic records, Z39.50 specifies procedures and formats for a client to search a database provided by a server, retrieve database records, and perform related information retrieval functions.

Z39.50's design predates the World Wide Web, relying on now largely outmoded connection oriented, program-to-program communication. As a result, substantive work aimed at updating and revising the protocol has been under way since 2000, leading thus far to the development of two new protocols, SRU (Search and Retrieve via URLs) and SRW (Search/Retrieve Web Service), and a synthetic query language, the Contextual Query Language (CQL), intended to support their implementation. (The CQL is a formal language for representing queries to information retrieval systems. The language represents an effort to combine the qualities of more powerful, more expressive query languages such as SQL, PQF, and XQuery with simpler, more intuitive languages, such as the CCL and Google's search syntax.) The suite encompassing SRU, SRW, and CQL was originally called "Z39.50 Next Generation," and then later it was known as "Z39.50 International Next Generation" (ZING). Today, neither designation is used. Development of SRW/SRU/CQL began in 2000. An experimental version, 1.0, was released in 2002, and the first official version, 1.1, in 2004. A minor revision, 1.2, was released in 2007.^[16]

SRU is based on Representational State Transfer (REST), a collection of network architecture principles

that specify how resources are defined and addressed, and enables queries to be expressed in URL query strings. SRW uses SOAP, the Simple Object Access Protocol, a specification for exchanging structured information within the framework of Web services, as the basis for the expression of queries. SRU and SRW address the same information retrieval problems that Z39.50 confronted, each of them relying on XML as their message and results format.^[17]

The OASIS Search Web Services Technical Committee is developing a unifying model for Web-based search and retrieval services that incorporates SRU/CQL and Amazon's OpenSearch, with the expectation that other protocols will be integrated into this model at a later date.^[18] One of the goals of this effort is to lower the barrier to entry for developers through a reliance on existing Web services technologies.

Other, library-oriented ISO standards include: ISO 15511:2003 Information and documentation—International Standard Identifier for Libraries and Related Organizations (ISIL); ISO 9230:2007 Information and documentation—Determination of price indexes for print and electronic media purchased by libraries; ISO/TR 21449:2004 Content Delivery and Rights Management: Functional requirements for identifiers and descriptors for use in the music, film, video, sound recording, and publishing industries; and ISO 11620:2008 Library performance indicators.

W3C

The W3C was established in 1994, as an industry consortium dedicated to building consensus around Web technologies through the creation of relevant standards and guidelines. Tim Berners-Lee, who invented the World Wide Web in 1989 while working at the European Organization for Nuclear Research (CERN), was one of the founders and has served as the W3C Director since its inception.

Since 1994, W3C has published more than 110 such standards, called W3C Recommendations. The goal of the W3C is to maintain and promote "Web interoperability," which means that for the World Wide Web to reach its full potential, the basic technologies must be device and platform independent, vendor neutral, and fully compatible with one another. The W3C works to avoid the fragmentation of the Web by developing and publishing open, nonproprietary standards for Web languages and protocols. According to Berners-Lee:

W3C is where the future of the Web is made. Our Members work together to design and standardize Web technologies that build on its universality, giving the power to communicate, exchange information, and to write effective, dynamic applications—for anyone, anywhere, anytime, using any device.

In 2008, the W3C has more than 400 member organizations from more than 40 countries. As part of its dedication to the internationalization of the Web, the W3C instituted a number of changes to its fee structure in 2005 to encourage participation from organizations in developing countries.

W3C's operations are supported by a combination of dues, research grants, and other sources of public and private funding. The MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), the European Research Consortium for Informatics and Mathematics (ERCIM), and Keio University in Japan, provide administration jointly. In addition, the W3C maintains regional offices around the world, to promote W3C technologies in local languages, broaden its geographical base, and encourage international participation.

A main focus of the activities of the W3C is to make the World Wide Web and its services "available to all people, whatever their hardware, software, network infrastructure, native language, culture, geographical location, or physical or mental ability." Work in areas such as Web accessibility, internationalization, device independence, and the so-called mobile Web is emphasized. (The goal of W3C's Mobile Web Initiative (MWI), which was launched in 2005, is to make Web access from any kind of device as simple, easy, and convenient as Web access from a desktop.) In addition, the W3C is committed to fostering "technologies that enable a more collaborative environment, a Web where accountability, security, confidence, and confidentiality are all possible, and where people participate according to their individual privacy requirements and preferences."

W3C ACTIVITIES

W3C activities are organized into groups: Working Groups (for technical developments), Interest Groups (for more general work), and Coordination Groups (for communication among related groups). The groups, made up of participants from Member organizations, the Team, and Invited Experts, produce technical reports, including Web standards, open source software, and services. These groups also ensure coordination with other standards bodies and technical communities. At this writing, there are currently 23 activities incorporating and managing 77 groups.^[19]

MAJOR W3C ACHIEVEMENTS

W3C's most important achievements fall into four broad categories. First, there are the specifications that relate to digital documents, including Cascading Style Sheets, HTML, the Document Object Model (DOM), XML, and Compound Document Formats. Second, there are the metadata standards, RDF and OWL. These technologies, which have been designed to support the Semantic Web by providing structured descriptions and addressing

ontological issues, respectively, provide a standardized framework for asset management, enterprise integration, and the sharing and reuse of data on the Web.

Third, there are the access-oriented initiatives, including the Web Accessibility Initiative (WAI), the MWI, the Internationalization Activity, and the development of standards supporting multiple, simultaneous modes of interaction. Finally, there are the coordinating efforts aimed at providing the infrastructure necessary to realize the goals embedded in Berners-Lee's notion of the Semantic Web. An example of this sort of activity is the work done by the Technical Architecture Group and expressed in *Architecture of the World Wide Web, Volume One*.^[20]

THE IMPORTANCE OF TECHNICAL STANDARDS IN LIBRARIANSHIP

Standards, which are important to any organization that proposes to connect technologies of different types and made by different manufacturers, are especially important to libraries, because neither libraries nor librarians are able to exercise great influence over the creation or design of the technologies on which so much of their future depends. With the emergence of digital libraries, the reliance on standards has expanded, including not only hardware and software, but also digital documents, metadata, network-based services, and schemes for accounting and management of related information activities. Perhaps more to the point, a generation of documentation has been built on the basis of various digital document formats, including the Microsoft Office formats and the PDF, as well as open HTML and XML, and as we look to the future, there is reason to believe that the work of the W3C in the area of compound document formats will become increasingly important, as various agencies work to make digital documents richer, more informative, and more useful.

In each instance, the key issue is and will continue to be interoperability, which is defined under ISO/IEC 2382 Information Technology Vocabulary as "the capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units." From a systematic perspective, interoperability assumes that the objects of interaction, including metadata, can be exchanged across systems, that as a result an aggregated content layer may be constructed on the basis of resources drawn from a distributed system of digital libraries, and that technological standards enabling different kinds of interoperability, including more traditional approaches geared toward librarian metadata interoperability such as Z39.50, harvesting methods based on OAI-PMH (Open Archives Initiative-Protocol for Metadata Harvesting), and/or Web service-based approaches, constitute a critical dimension in achieving and maintaining this capability.

THE FUTURE

As always, the future is uncertain. However, if recent history is a sign, it is likely that more and more standards bearing on information technology in general and libraries in particular will be formulated and promulgated. The reasons will be many and varied, but in the end the proliferation of standards (and standards-making bodies) will constitute a collective, rational response to the increasing complexity of the information environment, as well as an expression of the need for continuity, both diachronically and synchronically.

It seems reasonable to imagine, too, that the standards-making process itself will be a matter of increasing interest, particularly as the economic benefits of standards in information technology and allied areas are more clearly understood.^[21,22] Such trends will intensify the longstanding debate over the speed and complexity of the standards-making process, especially when it is coupled with the growing sense that the responsibility for maintaining, information technology and library standards has become too diffuse and perhaps too chaotic.

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Information Theory

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Abstract

Information theory “measures quantity of information” and is that branch of applied mathematics that deals with the efficient transmission of messages in an encoded language. It is fundamental to modern methods of telecommunication, image compression, and security. Its relation to library information science is less direct. More relevant to the LIS conception of “quantity of information” are economic concepts related to the expected value of a decision, and the influence of imperfect information on that expected value.

THE FUNDAMENTALS OF INFORMATION THEORY

Information theory traces its origin to technical work done by Claude Shannon of Bell Laboratories, in the late 1940s.^[1] Communication engineers wanted to determine the largest amount of information that could be transmitted when noise on the “channel” (which was, at the time, a cable carrying electrical waves) made the signal at the receiving end different from what was originally sent.

Shannon introduced measures of the amount of information, of the capacity of a channel and of the noisiness of the channel, and by combining them was able to prove important mathematical results relating the “rate of transmission of information” to the “capacity of the channel” and the amount of “noise.”

Unpredictability, Random Variables, and Information

The capacity required to transmit a message, even through a channel which has no noise in it at all, depends on the unpredictability of the characters in the message.

The discussion of unpredictable messages requires the mathematical concept of a “random variable.” An entity is represented mathematically as a random variable when it may take any one of a specified set of values, and, over the long term, the relative frequencies of those alternatives remain steady. The frequencies will then converge to numbers which represent the probabilities of the several alternatives. The choice among them is (subject to these probabilities) not controlled by any known forces, and thus is regarded as random. As an example, the result of a coin toss can be represented by a random variable. In the field of economics, the concept is extended to events that do not repeat many times, and one speaks of “the probability of a nuclear reactor accident” or similar rare events.

A random variable is completely characterized by specifying the allowed set of values, and the probability that it takes on each of its possible values. We can represent this by displaying the alternatives and the probabilities together in an array, as shown in Eq. 1:

$$FairCoin = \begin{bmatrix} .5 & .5 \\ \text{head} & \text{tail} \end{bmatrix}; BiasedCoin = \begin{bmatrix} .8 & .2 \\ \text{head} & \text{tail} \end{bmatrix} \quad (1)$$

The expression in brackets corresponding to the random variable *FairCoin* means that the event “head” occurs with probability 0.5 or 50%. So does the complementary event “tail.” The second expression represents a random variable, *BiasedCoin*, which assumes the value “head” 80% of the time and the value “tail” only 20% of the time.

Equally Probable Alternatives

Shannon showed that the relation between the amount of information in a message and the number of different possible values that the message might have is a logarithmic one. This can be understood in an intuitive way by the following simple argument. Suppose that we have to send a message about which of three alternatives, let us say {A, B, or C} is true. And we also have to send a message about which of some other four alternatives, let us call them {1, 2, 3, 4} is true. For example, suppose we want to specify that we will meet for one of three meals, {breakfast, lunch, or dinner}={A,B,C}, and will do so on one of four days: {Monday, Tuesday, Wednesday, or Thursday}={1,2,3,4}.

Whatever the amount of information required to specify one out of three alternatives is, and whatever the amount of information required to specify one out of four alternatives is, taken together the amount of information that they provide is enough to specify one out of 12 alternatives, as there are $12 = 4 \times 3$ possible combinations. The only continuous

function which has the required property: that it be additive when its arguments are multiplied, is the logarithm.

Therefore, when there are N equally possible alternatives, the “amount of information” required to specify one of them should be related directly to the logarithm of N . Logarithms may be computed to any base. It is customary in communication to compute the logarithm to the base 2. The resulting number is measured in “bits” (binary digits). For example, $\log_2(8) = 3$ bits.

Varying Probabilities and the Entropy Measure

The situation is more complicated when the alternatives are not equally probable, which leads to the very important concept of entropy. The entropy, or amount of disorder, is a concept previously known for physical systems, which Shannon used very effectively in the discussion of messages.

Shannon showed that this unpredictability could be characterized by a numerical function which is called the entropy of the message. The higher the entropy of the message, the longer the string (or the larger the “alphabet”) required to transmit it accurately, and the more “information” it carries.

The entropy is a mathematical function which represents the amount of uncertainty presented by a random variable, in terms of the set of probabilities of the outcomes. If the values of a particular random variable whose name is X are represented by the numbers $1, 2, 3, \dots, n$, and their corresponding probabilities are represented as $p_1, p_2, p_3, \dots, p_n$ then the entire random variable can be represented, in the notation of Eq. 1 as

$$X = \begin{bmatrix} p_1 & p_2 & p_3 & \dots & p_n \\ 1 & 2 & 3 & \dots & n \end{bmatrix}. \quad (2)$$

The entropy of this random variable, $H(X)$ is defined by the equation:

$$H(X) = - \sum_{i=1}^n p_i \log_2(p_i) \quad (3)$$

If a particular alternative cannot occur, the corresponding term in the sum is 0. If, for example, there are 16 alternatives, and each of them is equally likely, then each of the probabilities $p_i = 1/16 = 2^{-4}$. Thus $-\log_2(p_i) = 4$. The whole sum consists of 16 identical terms, each equal to $-p_i \log_2(p_i) = 1/16 \times 4$, and thus the sum (the entropy) is equal to 4. This is precisely the logarithm to the base 2, of the number of equally probable alternatives. It can be shown mathematically that this is the largest value that the entropy can have, when there are 16 possible alternatives. If, for example, one of them were enormously more probable than the others, one of the terms in the sum

would have the value $-(1-\delta)\log_2(1-\delta)$ (where δ is a very small positive number). This number becomes proportional to δ when δ is small, and vanishes as δ goes to zero. At the same time, all of the other terms in the sum vanish because they have vanishingly small probability. So when one of the possible outcomes is nearly certain, the entropy is nearly 0. The entropy formula can be shown to satisfy all other requirements of a “reasonable” measure of the quantity of information, and it is unique, up to a constant factor. We have, in effect, selected that constant factor by choosing to use logarithms to the base 2, rather than to the base 10, or the base of natural logarithms, e .

The Entropy of a String of Characters

The entropy can be defined for any situation in which there is a series of events or symbols, which are determined to some degree, by those that precede them. As a concrete example, we might consider an alphabet containing only the three letters a, b, c . From these 3 letters we can form 9 ($= 3 \times 3$) two letter “words”: $aa, ab, ac, ba, bb, bc, ca, cb, cc$. Similarly we can form 27 ($= 3 \times 3 \times 3$) three letter “words”: $aaa, aab, aac, aba, abb, abc, acb, acc, baa, bab, bac, bba, bbb, bbc, bca, bcb, bcc, caa, cab, cac, cba, cbb, cbc, cca, ccb, ccc$. Thus it would appear that when we specify which one of those three-letter sequences occurs, we have specified 1 out of 27 possibilities. If they are equally likely, then the entropy, or amount of information, will be given (to three decimal places) by $\log_2(27) = 4.755$. On the other hand, if we know in advance that the three letters will form a complete word in the English language, there is only one possibility, and the amount of information conveyed when we see the string cab is, in the sense of information theory, 0. Finally, if we know only that the string will be the whole or a part of an English word, then there are several more possibilities, including acc, bab, bac , and perhaps others. In this case the amount of information conveyed when we see the string is greater than 0, but less than 4.755. Thus, in the sense of Information Theory, the amount of information conveyed by a message is related to the number of possible messages that might have been received.

This concept has been applied, on a character-by-character basis to compute the entropy of the English alphabet, given that the 26 letters (and the space character) are being used to form (possibly meaningless) English expressions. The result is usually given as about 1.5 bits per letter.^[2] (Luenberger^[2] is an excellent introduction for a reader comfortable with elementary algebra, elementary calculus, and elementary probability.)

The Mutual Information in a Pair of Random Variables

When there are two random variables that have some relation to each other, the strength of that relation can be

measured in many ways. Shannon approached this problem by considering the amount of information in the pair of random variables (observed together) and comparing that to the amount of information in observation of each of the variables separately. Specifically, using the definition of entropy as given above, we can calculate the entropy of each variable separately, and of the two variables together. This is somewhat complicated, and example calculations are shown in Table 1.

Combining the information in Table 1, we calculate the Mutual Information $M(X,Y)$ of the two random variables X and Y according to the formula of Eq. 4.

$$\begin{aligned} M(X,Y) &= H(X) + H(Y) - H(X,Y) \\ M(\text{meals}, \text{days}) &= 1.44 + 1.79 - 2.91 \\ M(\text{meals}, \text{days}) &= 0.32 \text{ bits} \end{aligned} \quad (4)$$

This is a relatively weak relationship. A stronger one is shown in Table 2. The mutual information in that case is, in fact, precisely equal to the information about which meal I designate. The joint information is precisely equal to the information about the day on which I meet. This is because, when the day is specified, with these probabilities, the meal is completely determined, and knowing the meal in addition to the day, adds no information. Note that although the day determines the meal, and the meal does not determine the day, the mutual information is symmetric.

This is because, if we want to convey information about the meals, by reporting only the days, we can cleverly choose the “days” to remove the ambiguity. Note that we have moved here from describing a “real world” to a situation where we are trying to exploit the probabilistic relation between meals and days to convey information about one of the two, when it is expressed in terms of the other. So the connection to Shannon theory is to imagine that, for example, we want to tell someone about the day, but the nature of our “communication channel” is such that when we choose a day, the recipient is told the name of a meal, according to the probabilities specified.

The situation in Information Theory has some additional freedom for the sender of the message. I could choose to use the “days” as a kind of code. For example, I might represent the letter P by the code string {Monday, Thursday, Tuesday}. The situation becomes quite complex, and this entry provides only a brief introduction.

The reader may verify, by detailed calculations, that if there is a one-to-one correspondence between the two variables, the mutual information is equal to the information in either of them separately.

Communication and Mutual Information

Being employed by the telephone company, Shannon was concerned with the real-world situation in which the

Table 1 The information in joint variables and in the variables separately.

Case I					
Probabilities					
	Breakfast	Lunch	Dinner	Which day (1)	Logarithms ⁽¹⁴⁾
Monday	10%	30%	10%	50%	−1.00
Tuesday	0%	15%	0%	15%	−2.74
Wednesday	5%	0%	10%	15%	−2.74
Thursday	5%	10%	5%	20%	−2.32
Which meal (2)	20%	55%	25%	100%	$H(\text{days}) = 1.79$
Logarithms (5)	−2.32	−0.86	−2.00	$1.44 = H(\text{meals})$	

The numbers in the cells represent the probability that my lunch meeting falls on each specified meal and day. Let us say that I meet only once per week. Thus there is a 30% chance that the meeting, in a particular week is Monday lunch. There is only a 5% chance that the meeting of the week, for me, is Thursday dinner. Of course these numbers add up to 100% as shown in the lower corner of the table. We can also compute the probability that I meet on each particular day (1), or that I meet for each particular meal (2). These sets of numbers themselves each sum to 100% separately. Using an additional column (4) to record the logarithms (to the base 2) of the “by day probabilities” I have enough information to compute the entropy of the “by day” information. It is 1.79 bits. [Each logarithm is multiplied by the probability to its left, and the products are summed]. This is the amount of information conveyed, or the amount of uncertainty resolved, by determining on which of the 4 days I meet for a meal. Note that although there are four possible days, this amount of information is less than $2 = \log_2(4)$ because the days are not equally likely. Similarly, I could work with the totals in the columns, multiplying them each by their logarithms, and summing the results to yield the entropy of the “which meal” information, which is 1.44 bits. This is less than $1.58 = \log_2(3)$, again because the meals are not equally likely.

Logarithms	Breakfast	Lunch	Dinner	
Monday	−3.32	−1.74	−3.32	
Tuesday	0.00	−2.74	0.00	
Wednesday	−4.32	0.00	−3.32	
Thursday	−4.32	−3.32	−4.32	$H(\text{meals}, \text{days}) = 2.91$
Mutual Information = 1.44 + 1.79 − 2.91 = 0.32				

Finally, we can calculate the information in the array of information about days and meals. To see how this works, we display the logarithms of the probabilities in this small table. Multiplying each logarithm by its corresponding probability, and summing the numbers yields the entropy of the joint distribution. This is the number, 2.91, referenced in the text.

Table 2 A stronger information relation.

Probabilities					
	Breakfast	Lunch	Dinner	Which day	Logarithms
Monday	10%	0%	0%	10%	−3.32
Tuesday	0%	35%	0%	35%	−1.51
Wednesday	0%	0%	45%	45%	−1.15
Thursday	0%	10%	0%	10%	−3.32
Which meal:	10%	45%	45%	100%	H(days) = 1.71
Logarithms	−3.32	−1.15	−1.15	1.37 = H(meals)	

The numbers above could represent the fact that if I send a message such as “Monday” it will **definitely** arrive as “Breakfast.”

Logarithms	Breakfast	Lunch	Dinner	
Monday	−3.32	0.00	0.00	
Tuesday	0.00	−1.51	0.00	
Wednesday	0.00	0.00	−1.15	
Thursday	0.00	−3.32	0.00	H(meals, days) = 1.71
Mutual Information = 1.71 + 1.37 − 1.71 = 1.37				

signals initially sent over a telephone cable could be distorted or affected by “noise,” with the result that the signal received at the other end of the cable is not precisely the one that was transmitted. To address this problem, he defined two concepts: *the rate of information transfer*, and the *capacity of the channel* (or cable) itself.

As suggested above, suppose that we wish to send information as to which specific day we have in mind. But we are constrained to do this not by naming the *day*, but by, instead “transmitting” specific information about *which meal* we ate, and asking the recipient to decode that information, and decide which *day* we mean. To be specific, in Table 3, we show a relationship in which only the day “Tuesday” corresponds to more than one meal. If we avoid “Tuesday” then the message that he receives will be unambiguous. For example, if we want to indicate “Monday” he will receive the message “Breakfast.” And he will know that this corresponds only to Monday. But we have to avoid Tuesday because in that case the message could be either “Breakfast” or “Dinner” and this will introduce ambiguity into the decoding.

We can choose how often we send the message corresponding to each particular day. As we have mentioned above, balancing them equally will transmit the largest amount of information, provided that we never choose Tuesday. This is because Tuesday sends an ambiguous message: the meal might be breakfast or dinner. If we choose among the remaining days in an unbalanced way, we decrease the amount of information that we can transmit.

Using these ideas, Shannon was able to establish his Second Theorem of communication. This expresses the amount of information that can be communicated. The highest possible amount is called the capacity of the channel. In its most fundamental form this is given in terms of maximizing the mutual information, as described above.

$$\text{Capacity} \left\{ \begin{array}{l} \text{When a message} \\ \text{about } X \text{ is received it} \\ \text{terms of signals } Y \end{array} \right\} = \underset{\text{all distributions of } X}{\text{maximum}} M(X, Y) \quad (5)$$

Here, the maximum means that we choose how often each message X is sent, in order to get the best possible communication. Strictly speaking, as was articulated by subsequent research, this is the limiting rate when the source of the message is “ergodic,” which means, roughly, unpredictable, or having maximum entropy when viewed as a sequence of characters in whatever alphabet is being used.^[3] There are many implications of this formula. Some variants deal with the specific case where the values assumed by the variables X and Y are both binary. Other variations take account of the entropy of the message to be sent.

In all real cases the difficult technical problem is to find a scheme for encoding which comes as close as possible to the theoretical limiting rate. This involves considerable ingenuity, and there are many open problems.

In addition to this mathematical and engineering focus of Information Theory, the book by Shannon and Weaver,^[1] included a speculative essay by Weaver on the possible general implications of these results for behavioral sciences in general, and opened other worlds for exploration.

INFORMATION THEORY TODAY

Sixty years later the field of Information Theory, whose central professional society is the IEEE Society for Information Theory, is flourishing. The problem of finding the actual encoding which will come close to the Shannon theoretical limit is a difficult one leading into complex fields of mathematics.

The corresponding methods for the compression of information are part of our everyday lives, especially for users of the Internet. They range from the use of zipped compression to reduce the size of files, to the complex compressions involved in the jpeg and mpeg conventions for static and moving images.

Table 3 Another relation between the intended message (the day) and the code used to represent it (the meal). The entry is the probability that a given message is received, given what message is sent

Intended message	Message received			$P(X)$	$-\text{Log}(P)$
	Breakfast	Lunch	Dinner		
Monday	100.0%	0.0%	0.0%	33%	1.58
Tuesday	50.0%	50.0%	0.0%	0%	0.00
Wednesday	0.0%	0.0%	100.0%	33%	1.58
Thursday	0.0%	100.0%	0.0%	33%	1.58
$P(Y)$	33.3%	33.3%	33.3%	33%	
$-\text{Log}(P)$	1.58	1.58	1.58	100.0%	

Here we represent the fact that if I send the message “Monday” the recipient is certain (100%) to get the message “Breakfast.” Alternatively, we might say that I am “encoding” “Monday” by sending the message “Breakfast.” However (perhaps due to noise in the transmission process, when I encode “Tuesday” the recipient gets the message “Breakfast” 50% of the time and “Lunch” 50% of the time. This introduces ambiguity. We can think of it as noise in the transmission process. If I insist on sometimes sending the message “Tuesday” then I cannot achieve the full channel capacity.

Probabilities $P(X,Y)$

	33.33%	0.00%	0.00%		
	0.00%	0.00%	0.00%		
	0.00%	0.00%	33.33%		
	0.00%	33.33%	0.00%		
				100.00%	
$E(Y)$	1.5850				
$E(X)$	1.5850				
		Note: $1.05850 = \log_2 3$			
Logarithms of $P(X, Y)$					
	1.58	0.00	0.00		
	0.00	0.00	0.00		
	0.00	0.00	1.58		
	0.00	1.58	0.00		
$E(X, Y)$	1.5850				
$M=E(X)+E(Y)$					
$-E(X, Y)$	1.5850				

Progress on the social science side has also been energetic, but has not proceeded in the directions anticipated in Weaver’s essay.

Human Communication

Scholars in the field called Communication (e.g., the National Communication Association, NCA, of the United States) concern themselves primarily with the social contexts and functional roles of communication. In their analysis it is never important to attempt to quantify the “amount of information” that is being communicated. Thus the approaches pioneered by Shannon have only rhetorical impact in that field.

Library and Information Science

In the field of Library and Information Science, it has seemed that one might want to know something about the relation between the “amount of information” and something else, which Brookes^[4] has called the “increase in knowledge.” Brookes proposed that the phenomenon of importance to information science is that the transmission of information *to a suitable recipient* results in an increase in the amount of

knowledge “held by” that recipient. The idea, while often referenced, does not seem to have led to any serious attempt to provide a measurement of either the “amount of information” or the “increase in quantity of knowledge.”

Economics

The third social scientific discipline which concerns itself with information is Economics. In Economics there has been an effective effort to quantify the notion of the value of information. It is clear that information has economic value, since, for example, information about tomorrow’s stock prices could be immediately converted into economic gain. Economic theory has further developed, drawing upon the von Neumann and Morgenstern theory of games^[5] and economic behavior, a concrete way of measuring the economic value of information which is uncertain or noisy, in precisely the way that the channels described by Shannon are.

Utility theory

However, the detailed theory works out rather differently. The essential concept is “utility,” an abstract measure of

worth which behaves in a very specific way with respect to uncertain situations. In particular, the utility measure of an uncertain event, or “lottery,” L , such as

$$L = \left[\begin{array}{cc} p & 1-p \\ A & B \end{array} \right], \quad (6)$$

which is represented by the expression $u(L)$, is required to satisfy the equation

$$u(L) = pu(A) + (1-p)u(B) \quad (7)$$

This equation will continue to be satisfied if the utility is transformed to any new scale of the form: $u_{\text{new}}(X) = b^2u(X) + c$, for any real numbers b and c . This means that the utility is measured on an interval scale, whose zero point and unit of measure may be set at any convenient values.

Utility theory applies to decision makers, who are assumed to be able to (perhaps implicitly) assign a utility value to every situation that they might need to consider. This assignment is called the decision-maker’s “utility function”: $u_{\text{decision-maker}}(X)$. Utility theory is related to observable behavior by the requirement that a “rational” decision maker who values specific situations X, Y , according to a specific utility function for which $u_{\text{decision-maker}}(X) > u_{\text{decision-maker}}(Y)$ will definitely prefer to be in situation X , rather than in situation Y . It can be shown that a decision maker who does not follow Eq. 7 when making decisions about lottery can be systematically caused to make decisions which, over the long run, will reduce his cumulated utility. This is the specific sense in which Eq. 7 is interpreted as representing rationality.

A decision may depend on the current estimates of probability

The application of utility theory for measuring the value of information is made clear by a simple example of a two-fold decision involving an uncertain outcome. Suppose, for example, a decision maker must decide whether or not to carry an umbrella, and assigns the following utilities to the four possible alternative situations:

- A = carry an umbrella and have it rain.
- B = carry an umbrella and not have it rain.
- C = not carry an umbrella and have it rain.
- D = not carry an umbrella and not have it rain.

Specific values for these parameters are shown in Table 4a.

This information can be used to create a graph as shown in Fig. 1a, where the abscissa is the probability that it will in fact rain, and the ordinate is the utility value to the decision maker. The two straight lines on the graph represent the expected utility of the two possible actions, both of which depend on the probability that it will rain. The value of the choice or action “carry an umbrella” is

Table 4a Specific choices for the utility function of a decision maker.

State	Action	
	Not carry	Carry
No rain	0	2
Rain	2	-1

low when the probability of rain is low, but increases as the probability of rain increases. The value of “not carrying the umbrella” is high for low probabilities of rain, and decreases as the probability of rain increases. An important feature of this situation is the value of the probability at which the two lines cross, which we call the “critical probability” for this utility function. According to the principles of utility theory, the decision maker will not carry an umbrella if the probability is less than this value, will carry an umbrella if it is greater than this value, and is indifferent when the probability of rain is equal to the critical value.

Imperfect information can improve the expected utility of a situation

The preceding discussion describes the situation, without any information, or the “prior situation.” Suppose now that the decision maker is offered an imperfect or “noisy” prediction of whether it will rain. We can calculate the expected value of “being in the situation of having this information” and compare it to the expected value in the present situation. The difference can, of course, be interpreted as the “value of the information.” The mathematics is somewhat complicated. To begin with, an imperfect prediction can be imperfect in two distinct ways: failing to predict rain, on rainy days, and predicting rain on days when there is no rain. These two numbers are independent of each other, and both are needed to complete the calculation. We denote the first probability by “ t ” for true alarm or warning, and the second by “ f ” for “false warning.” The information can be summarized as in Table 4b or Table 5.

The second complexity comes in interpreting a prediction which is known to be inaccurate in this way. This is accomplished using Bayes’ rule,^[6] which relates the probability of rain, given the imperfect information, p_1 , to the prior probability of rain p_0 . That equation is given in terms of odds ratios as

$$\begin{aligned} \frac{p_1}{1-p_1} &= \frac{t}{1-t} \frac{p_0}{1-p_0} \quad \text{if the prediction is “rain”} \\ \frac{p_1}{1-p_1} &= \frac{f}{1-f} \frac{p_0}{1-p_0} \quad \text{if the prediction is not “rain”} \end{aligned} \quad (8)$$

For a reasonable weather predictor, the first of the numbers p_1 , found by solving these equations, will be higher

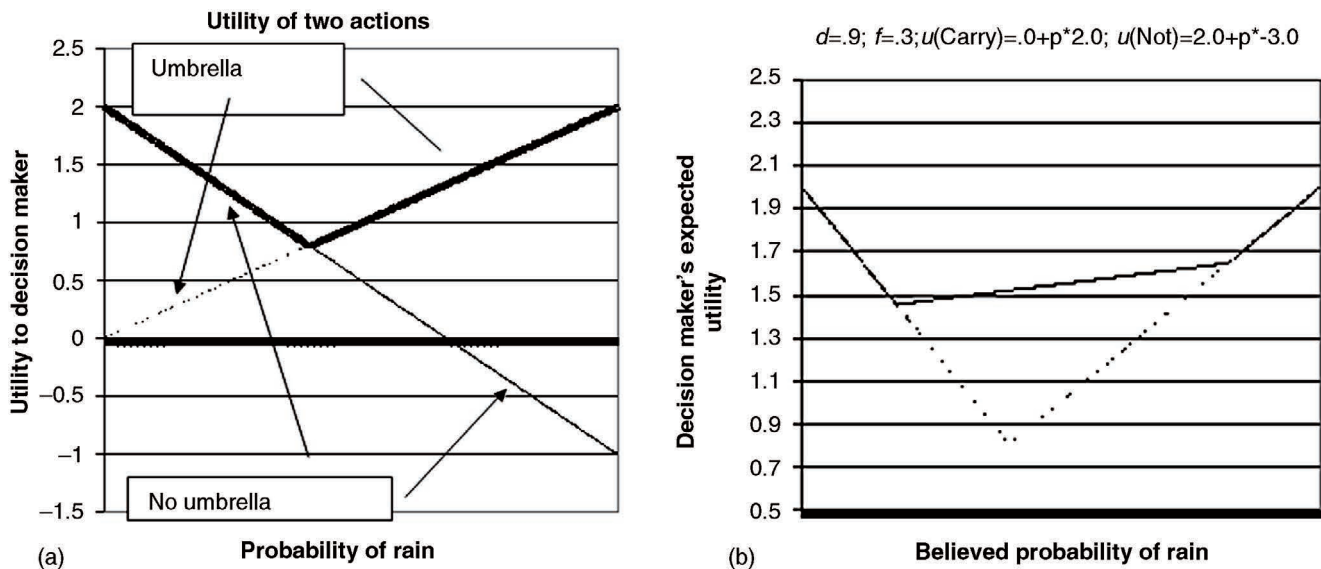


Fig. 1 (a) As the probability of rain increases, the utility of not carrying an umbrella decreases. Correspondingly, the utility of carrying an umbrella increases. In this case they cross at 40%, the critical probability. The decision maker, according to his estimate of the probability, chooses the action corresponding to the higher line. His expected utility, as a function of the probability, never falls below the crossing value. (b) With an imperfect predictor of rain, the decision maker can still improve his expectation, in some situations, but not all. The “bridge” in this diagram shows the higher utility that can be achieved if 1) his estimate is close enough to the critical point; and 2) he makes use of the prediction. The expected utility increase, due to using the prediction is the rational basis for assigning “value” to the prediction. Note that the same prediction will have higher value for a decision maker whose original estimate of the probability is closer to the critical value. This is quite different from entropy measures, which increase as the probability nears 50%.

than the second; that is, it is more likely to rain if the prediction is “rain” than if it is “not rain.” Let us refer to them as p_H and p_L , respectively (H for high; L for low). Having this prediction, the decision maker will then refer to his personal utility diagram. If the result of the prediction leaves the probability below p_C , he will not carry an umbrella. If the result falls above the critical probability, he will carry an umbrella. But the results of these calculations depend on the prior probability estimate: p_0 . If the prior estimate is very low, both P_H and P_L fall below p_C , and he will not carry an umbrella. If the prior estimate is very high, both P_H and P_L fall above p_C , and he will carry an umbrella, with or without the prediction. In those two situations, the information has no value to him, since he will do precisely what he would have done without the information. The value of the information is, therefore, 0.

However, for a certain range of the prior probability, spanning the critical value, the information will cause him to change his behavior. Therefore it has some potential value. The calculation of this value depends on the

principle of expected utility. In particular, it depends on the chance that the prediction is “rain.” This, as we see from Eq. 8, depends on prior estimate of the probability. One might ask: “doesn’t it really depend on the chance of rain?”. But there is no way the decision maker can know the truth. He is restricted to choosing between his prior belief and the available imperfect prediction. In other words, if he buys the information, he will face a lottery where the outcomes are “predictions he receives” and he must compute the probability that each will occur.

$$\left[\begin{array}{cc} \text{probability prediction is “rain”} & \text{probability prediction is not “rain”} \\ p_H & p_L \end{array} \right] \quad (9)$$

Note that for any given belief about p , the probability of rain, the computed probability of the prediction “rain” contains two terms, corresponding to the true and false predictions. Thus:

$$\begin{aligned} p_H &= tp + f(1 - p) \\ p_L &= (1 - t)p + (1 - f)(1 - p) \end{aligned} \quad (10)$$

Table 4b Specific performance characteristics of an imperfect predictor of rain.

Performance of the predictor	Truth	
	Rain	Not
Rain	0.9	0.3
Not	0.1	0.7

Table 5 The accuracy of a prediction of rain.

Prediction	Truth	
	Truth = rain	Truth = not rain
Rain	t	f
Not rain	$1 - t$	$1 - f$

Note that the sum of these two probabilities is 1, since the predictor must make *some* prediction.

The decision maker can then apply Eq. 7, carrying through the calculations. The result is a third line segment on the graph of expected utility, as shown in Fig. 1b. It forms a “bridge” above the intersection at the critical probability. The left-hand end of the bridge falls at the lowest prior probability for which the information has nonzero value. The right-hand end of the bridge falls at the highest prior probability for which the information has nonzero value. The expected value of the information, in units of the decision-maker’s utility, is the vertical distance between the bridge and the higher of the original two lines, at the specific value of the prior probability. For further details see, for example, Hirshleifer and Riley.^[7]

Thus we see that the expected value of the information depends not only on the unreliability of the prediction (that is, on the numbers t and f) but also on the decision maker’s own prior estimate of the probability of rain. While the first two parameters represent the kind of information about uncertainty that is addressed by Information Theory, the dependence on the prior probability is quite a different matter. This complexity has prevented the development of any accepted theory that relates the expected value of information, in a decision situation, to computations of the type introduced by Shannon. Some efforts to develop an alternative to the Shannon formulation are discussed by Renyi.^[8]

Behavior Beyond Expected Utility Theory

The field called Behavioral Economics addresses the many ways in which observed human behavior does not easily fit with the specific assumptions of utility theory. For example, if there is a set of possible situations, then the decision maker should be able to select one of them, or be indifferent among two or more. But experiments showed^[9] that if the set is not small (i.e., contains more than six or seven alternatives) decision makers will report pair preferences that are not transitive, which is inconsistent with the notion that preferences correspond to inequalities relating real numbers (the values of the utility function). Leaders in behavioral economics include Daniel Kahnemann^[10] and Amos Tversky.^[11]

The question of whether the notion of utility can be broadened beyond the formulation given here, to accommodate apparently irrational human preferences, remains open. An interesting discussion, from the perspective of a philosopher, has been given by Nozick.^[12] He proposes that, in addition to economic utility, dealt with as above, human decision makers base their actions on a separate property of actions, which he calls “symbolic utility.” There is no conversion between these two utilities, and so, the model does not make specific predictions about behavior.

The study of behavior in the context of the theory of evolution suggests that actions that do not provide calculable utility gain for the individual decision maker may be the result of complex evolved behavior which has net utility for the genome of which the individual is a particular instance. (“A person is the gene’s way of making a new gene.”) This is an area of intense study, but no irrefutable demonstrations of the principle have been shown, for human behavior. It has been reported that the *Toxoplasma gondii* protozoan affects the brains of infected rodents in such a way as to decrease their innate fear of cats, enabling the parasite to progress to its next reproductive stage, which takes place in cats.^[13] One possible example in humans is infection with the thirst for education, which causes young adults to sacrifice productive and child-bearing years to the pursuit of academic degrees, and thus perpetuate the academy.

SURPRISE AND IDENTIFICATION

There are some relatively new streams of research which show promise of beginning to capture the element of information that is most salient from the perspective of library information science: the degree to which the message received causes a change in what the recipient already knows or believes.

Surprise

The computer scientist Pierre Baldi^[14] has proposed that messages can be judged on a scale which measures their “surprise” value. The analysis is based in part on measures related to the entropy. Specifically, he uses a measure called the Kullback-Leibler^[15] measure, which assesses the difference between one probability distribution and another, when both describe the same basic set of outcomes. The analysis adds the notion of Bayesian updating, as discussed in economics section above. When information is received the recipient is presumed to alter his prior beliefs about the probability distribution, to yield a new distribution. The “distance” (the Kullback-Leibler measure is not a proper metric in the geometric sense, but could be converted to one if needed) of the new distribution from the old is a measure of the “surprise” that the information represents to the recipient.

Identification

The information scientist Rudolf Ahlswede^[16] has developed a line of research that is somewhat dual to classical Shannon theory. He considers the problem of a recipient who knows in advance the list of messages that might be sent and wishes to determine, with at least a specified probability of being correct, which of the messages has, in fact, been sent to him. The capacity of channels,

measured against this criterion, becomes different (and, roughly speaking, higher). At a very superficial level, it appears that this line of thinking might eventually develop into a convergence between the Library/Information Science view of the problem (in which the possible messages are constrained by language, social roles, customs of expression, etc.), and the more rigorous theory which has produced so many striking improvements in the storage and transmission of the messages themselves.

CONCLUSION

In addition to its own practical contributions to our lives, it appears that the most concrete translation of the original hope that information theory might contribute to the social sciences is in the field of economics. However, in that setting, rigorous analysis shows that the value of information is not in any simple way functionally determined by the quantity of information as it was defined by Shannon. Very recent developments may eventuate in a convergence of the problems, but the path to solution is not yet clear.

There are excellent sources on the Web for information about these topics, from many perspectives, and this rich field is very much open for exciting future developments.

SCHOLARLY AND SCIENTIFIC ORGANIZATIONS (WEB SITES)

American Economic Association. <http://www.vanderbilt.edu/AEA/>

American Society for Information Science and Technology. <http://www.asis.org/>

IEEE Information Theory Society. <http://www.itsoc.org/>

Institute for Operations Research and Management Sciences. <http://www.informs.org/>

The National Communication Association. <http://www.natcom.org/nca/>

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Information Use for Decision Making

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Abstract

How should we use information to make good decisions? Historically, the view has been that normatively superior decision making is the product of complex optimization processes that rationally consider and integrate all available information. Such optimization processes are well beyond the capabilities of mere mortals and in many cases are computationally intractable by any means. Fortunately, optimization processes are not always necessary: Less can be more. Simple decision processes—i.e., heuristics—used in the right environments enable fast, frugal, and adaptive decision making that can be as good as, or better than, even the most complex optimization processes. In what follows, we introduce research on ecological rationality and the science of adaptive heuristics. Our review includes 1) a brief history of the study of decision making; 2) a discussion of simple yet computationally precise heuristics, and how, when, and why they lead to superior performance; and 3) examples of how simple heuristics are starting to be used in the information sciences, such as in database literature prioritization or in the development of more user-friendly technologies. Although it may seem conventionally paradoxical, intelligent and adaptive information use often requires that information be ignored.

INFORMATION USE FOR DECISION MAKING

In the modern world, one of the leading causes of death is heart disease. As such it is easy to imagine that many people will search for information on its causes, symptoms, and treatments. But how will they search? One candidate is a keyword search in a search engine such as Google, which as of April 2008 returned about 35,500,000 “heart disease” results in less than 2/10 of a second. This is not only a lot of information, it is too much information. Given the exponential rates of information growth in science and technology this number will likely continue to grow.^[1] Can people with limited knowledge, time, and computational capacities effectively search through vast amounts of information and make good decisions under conditions of high uncertainty? Can a scientific understanding of the cognitive processes involved in human information search and decision making help us improve information technology? In short, we believe the answer to both questions is *yes*.

To begin to illustrate our perspective, consider a recent study conducted by Michael Lee and his colleagues.^[2] Lee et al. compared the performance of a leading research database (i.e., PsycINFO) with the performance of two very different systems, each based on a model of human decision making. The first model was a “rational model” that attempted to combine all information in an optimal (or near-optimal) way. This model was inspired by what has traditionally been regarded as a normative theory of

decision making. Relevance was determined using a Bayesian learning algorithm allowing additive weighting and integration of *all* available information from cues such as authors, journals, keywords (title and abstract), language of the publication, and others. When some cue was associated (or unassociated) with a relevant article the probability that another article with that cue would be relevant (or irrelevant) was updated. Eventually, search was prioritized by selecting articles with “optimal” cue configurations as those of the highest relevance.

The second decision model developed by Lee et al.^[2] for the literature prioritization task used a rather different, perhaps even paradoxical process. In sharp contrast to a rational model, the one-reason decision-making model *ignored* a considerable amount of the available information in order to prioritize choices. This model, inspired by research on simple, adaptive heuristics^[3] used cues for inferring and assigning relevance, as did the rational model. However, in this case cues were first ordered by validity from most strongly associated and relevant to least relevant. Subsequently, a literature search prioritized results by selecting articles based solely on the most relevant cue that discriminated between options (for a more detailed discussion of validity, discrimination, cue ordering, and one-reason decision-making, see *take-the-best* later in this entry). Rather than attempting to integrate and use all possible sources of information, the one-reason decision-making model made choices based on a simple heuristic process (i.e., a rule of thumb), namely it

prioritized results based only on the single most important cue that discriminated.

To assess prioritization performance, Lee et al.^[2] compared both decision-making models (rational, one-reason) with the performance of PsycINFO. As expected, results indicated that all models returned relevant articles at above chance levels. More interestingly, and to some more surprisingly, the one-reason decision-making model consistently outperformed the rational model, which in turn outperformed PsycINFO. These results add to a growing body of evidence suggesting that more complex decision making processes do not necessarily provide superior decision-making performance. Instead, superior decision making can result from simple heuristic processes when used in the right environments.

So how is it possible that a simple heuristic was able to perform so well even when compared to a sophisticated optimization process? Part of the answer is that in our fundamentally uncertain world, simplicity often leads to robustness and efficiency. Heuristics improve performance by ignoring potentially misleading information. Heuristics also confer other benefits as this type of choice process tends to be fast and efficient, relying on radically limited information search and decision rules. As well, in human, animal, and machine cognition, simple decision processes can be fine-tuned and can exploit the fit between our environmental task constraints and our available capacities, such as a human's limited attentional capacity and our adaptive ability to forget.^[4-6] In these ways and others, simple heuristics tend to produce and enable effective, adaptive judgment and decision making in many situations.^[3,7]

In this entry we will review a research program focused on adaptive behavior and cognition—or how simple heuristics, in the right environments, can make us smarter. Our entry will begin with a discussion of the history of decision-making theory and will then turn to issues of adaptive cognition, ecological rationality, and computational models of heuristics. Next, we will provide some examples of a few widely used heuristics. Finally, we close with a discussion of implications for the design of information-rich environments.

Perspectives on Rationality: A Brief History

The emergence of the modern debate on human rationality, or how people make decisions and what qualifies as a good decision, can be traced in large part to the Ages of Reason and Enlightenment (i.e., seventeenth and eighteenth centuries, respectively). During these times logic and careful, justifiable reasoning became highly prized by philosophers, empiricists, and political actors alike. As an example, consider the astronomer and physicist Pierre-Simon Laplace. Laplace's legacy includes seminal contributions to probability theory; however, more important for our purposes, he also provided a description of a fictional

omniscient being that captured the Zeitgeist of the times. This being, known as Laplace's superintelligence, was envisioned as one who would know all the details of past and present and with this knowledge could readily make good choices and predict the future with perfect certainty.^[8]

For many people, Laplace's vision of a decision maker who is omniscient and computationally unbounded may seem like an elaborate fantasy. Yet this fantasy or some version of it is fundamental to much of the research and theory in the modern decision sciences. Some readers will find this surprising, or ironically unreasonable, but models of "rational man" and *homo economicus* are among the most central and influential models used in decision science. According to neoclassical economic theory people behave as if they were *unboundedly rational* and make optimal (but not necessarily perfect) choices as if they had solved a complicated decision calculus.^[9,10] These decisions can be described by optimization processes that reflect people's maximization of their own subjective expected utilities (i.e., personal values) via multiattribute integration calculations. Such theories are at the core of dozens of models of decision making, including modern theories of motivation, attitudes, and moral judgments.^[3,7] However, even if this approach has provided interesting and useful theory, these models often conflict with empirical evidence. Psychological science has clearly demonstrated that this is not how real people with limited resources (i.e., time, attention, memory) use information to make decisions.^[7,10-13] Perhaps even more interestingly, these complicated and time-consuming processes are not even necessarily required for good, adaptive decision making.^[3,7]

In the mid-twentieth century, Herbert Simon^[14-16] introduced his notion of bounded rationality. Simon argued that, among other things, people have only limited time, knowledge, and cognitive resources, and thus human decision makers cannot carry out the types of optimization computations that were (and still are) often assumed to underlie rational decision making. In part in reaction to Simon's notion of bounded rationality, a more modern version of a rational decision maker was developed by some decision researchers. The new theory, characterized by *optimization under constraints*, was once again concerned with a complex optimization calculus that could be used to make rational choices, but in these cases the optimization processes were also subject to any one of a number of constraints.^[17] To illustrate, in some models information search was necessary (i.e., no more omniscience) and so search processes were described and thus carried a cost. However, as a simplifying assumption the information search processes were often described by yet another optimization calculus wherein search was terminated according to the optimal cost-benefit ratio. As the number of constraints increases so too do the computational complexities of the search optimization functions that must be solved, even in simple

decisions. In this way, optimization under constraints can be even *more* computationally demanding than what is required of the unboundedly rational agents. In efforts toward greater psychological plausibility, the optimization under constraints models created in some cases an even more psychologically unrealistic, and computationally unbounded, superintelligent decision maker.^[17]

To be fair, although optimization models are not accurate process models of how real people make decisions, they do in some cases predict people's decisions or tell us about what outcomes or decisions should be favored.^[18–20] For these reasons, optimization models can be valuable tools. Nevertheless, optimization models are *as-if* models of human decision making: Many decision makers behave as if they use optimization processes even though they rely on other processes.^[21–23] Unfortunately, most research focusing on as-if models is essentially uninterested in and ill-equipped to understand the psychological dynamics involved in decision making. Hence, the as-if approach to modeling decision making leaves unanswered at least two crucial questions. First, how do people actually use information to make decisions? Second, given our known cognitive constraints (i.e., our bounded rationality), how is it that real decision processes can approximate and in some cases outperform optimization processes? To answer these questions, we turn to two different but related research programs that study human decision making and heuristics.

In the 1970s, Daniel Kahneman and Amos Tversky developed the *heuristics and biases* research program in cognitive psychology.^[11,24,25] This program was aimed at understanding how people actually make decisions. Toward this end researchers worked to reveal cognitive processes (i.e., heuristics) by focusing on judgment errors and “biases.” However, in order to identify errors one must have normative assumptions (i.e., what is the appropriate standard for an accurate or good judgment), an issue that is not without controversy.^[26,27] In the case of the heuristics and bias approach, it was assumed that human cognition should be compared to a very specific set of rational, normative standards such as the outcomes of optimization processes and logic. Specifically, the heuristics and biases program searches for errors that are evidenced when people's judgments deviate from “an established fact... [or] an accepted rule of arithmetic, logic, or statistics” (p. 493).^[28] Indeed, it has demonstrated rather unequivocally that people do not reason in accord with content-blind logical laws or optimization processes, and that people often use heuristic processes for judgments and decisions.^[10,29] The research and findings on heuristics and biases have played key roles in shaping psychological and behavioral decision making research, contributing to the development of new research fields such as behavioral law and economics.^[24,30]

In spite of its many successes, the heuristics and biases program has its limitations. One of our most serious concerns is that the program has emphasized ways in which

heuristics are associated with errors, which has led some to an interpretation that heuristic use is a problem that needs to be corrected. In this light heuristics are seen as inferior choice processes designed to be used by computationally disadvantaged individuals. In contrast, other research demonstrates that heuristics (e.g., satisficing) are often powerful tools.^[16,31,32] As illustrated by the literature prioritization example in the introduction, in real-world environments these simple processes can enable adaptive decision making, matching or outperforming even the most sophisticated and time-consuming optimization processes.

Ecological Rationality: Computational Models of Heuristics

Consider for a moment a Darwinian inspired perspective on decision making. On this view, the goals and needs of organisms, such as finding food, securing mates, or protecting offspring, may or may not benefit from cognition that is logically coherent. For these organisms, fitness is best served when cognition can be tuned to ecological constraints. An organism's success will rely on the extent to which its cognition and behavior can benefit from and exploit features of its internal and external environment, regardless of how well these processes actually adhere to logical norms. An organism's ability to survive and reproduce depends on the fit between: 1) its evolved and developed capacities, 2) its cognitive processes, 3) and the structure of its natural environment. The analysis of the fit between capacities, processes, and environment is known as the study of ecological rationality.

Understanding the relationship between the mind and its environment serves as a starting point for the study of adaptive behavior and cognition.^[32] This adaptive framework has deep roots in psychology. For example, Herbert Simon has argued that “Human rational behavior is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor” (p. 7).^[16] If one wants to understand how people make judgments and decisions, and why and when these processes work, one cannot examine only processes (as most psychologists do) or only environments (as most economists and sociologists do). Studying how one scissor blade cuts, or fails to cut, does not tell us how, why, or when the scissors will actually work.

In concert with the study of ecological rationality, a second key concept for the research program on adaptive behavior and cognition is the *adaptive toolbox*. This adaptive toolbox is conceived of as a collection of precisely defined cognitive heuristics and other adaptive processes that can be used both consciously and unconsciously (e.g., intuitively) to solve problems in the real world. Organisms use a number of specific tools that are well-suited to certain task environments, not entirely unlike specific wrenches and screwdrivers that are designed for specific chores.

In this way, there is no general all-purpose heuristic (or optimization calculus) that can provide the best solution for every judgment or decision. In contrast, heuristic application is more narrow and constrained, although many heuristics can be used more or less effectively across a range of situations (e.g., a screwdriver can also be used to open a can of paint). Perhaps most critically, by defining heuristics as formal computational models, one can then identify (e.g., via simulations) exactly when, how, and why certain heuristics will succeed or fail. Theoretically, this collection of adaptive heuristics provides a precisely defined, psychologically plausible alternative to as-if optimization models of human decision making.

So how is it that these simple heuristic processes can match and outperform complex optimization processes? The answer has at least two key parts. The first part has to do with computational tractability. Regardless of the extraordinary increases in computing power that we have enjoyed in recent years, for most decisions there simply is no optimization strategy that can be computed.^[3] Optimization, except in radically simplified environments, is largely computationally intractable. Even simple problems turn out to be so complex as to be impenetrable to optimization techniques. This is true of problems that are well-defined such as in games like Chess or Go, as well as for the many ill-defined problems we face in the modern world such as choosing an outfit, a dinner, a career, or a spouse. In all of these cases, heuristic processes are not only valuable but they are absolutely essential.

The second reason heuristics can perform well is that they are robust and reduce the chance of fitting noise in our environment (i.e., overfitting). Because we live in a fundamentally uncertain world, information in our environment (i.e., environmental signals) consists, of both reliable and unreliable content (i.e., noise), or in other words, information that is diagnostic and information that could lead us astray. Particularly in situations that involve high uncertainty, the trick for intelligent decision making is to *ignore* information, such as seemingly informative but ultimately irrelevant information (e.g., past performance of stocks for predicting changes in valuation). If we performed an optimization calculation for every decision that included every regularity from every previous situation, our ability to accurately predict outcomes in new environments would be crippled as it would be based on many kinds of random, non-diagnostic noise. In contrast, because heuristics are simple and exploit cognitive capacities such as our adaptive capacity for forgetting^[4] we can reduce the risk that we will overfit non-diagnostic environmental signals. Moreover, because adaptive heuristics rely on a limited search of the available information there is a good chance that they will avoid most sources of the random noise while still benefiting from a focus on the most reliable sources of information.^[33]

In addition to the performance benefits noted above adaptive heuristics confer at least one more set of

ecologically important advantages: Heuristics can provide *fast and frugal* decision making. Because heuristics can exploit our capacities (both evolved and developed), such as our remarkable capacity for highly accurate recognition memory, the time and energy needed for these decision processes are minimized. Heuristics provide essential competitive advantages (e.g., minimizing time, search, effort invested) whether one is making decisions in the wild or in the boardroom. This frugality may benefit us physiologically as our brain, which is roughly 2% of our overall mass, commonly requires between 15% and 25% of our daily energy and oxygen budget. Even simple acts of deliberative, effortful processing can significantly influence and deplete our energy stores.^[34] In these ways and others simple heuristics tend to enable adaptive decisions in ecological environments.

Heuristic Building Blocks

Advances in the science of adaptive behavior and cognition rely in large part on identifying and modeling exact heuristic processes. These processes are described by dividing heuristics into different building blocks (i.e., subprocesses), often including: 1) *search processes*, 2) *stopping rules*, and 3) *decision rules*, which are composed of either unique processes or nested combinations of other more basic heuristics. Consider the *take-the-best* heuristic.^[34] Take-the-best belongs to a family of one reason decision-making heuristics and has proven itself to be a common and effective decision tool. Take-the-best can be used when one is faced with a choice between two different options. In these cases, take-the-best orders and considers different cues (reasons) for making its decision by selecting the best option with the first cue that discriminates between the options. In simpler language, consider a preference situation in which one is trying to decide which of two colleges to attend. One way you could make a decision would be to focus on only a single factor, the one that seems most important. For some people that might be prestige, and thus when considering both Harvard and say San Francisco State University (SFSU), one would likely pick Harvard. However, if the most important consideration was which school was affordable, you might then select the public school (SFSU) where tuition is far less. In either case, the process is roughly the same and requires only a very minimum amount of search and reasoning. First identify and order the most important cues that you will use to decide and then make your choice based on the first discriminating cue (i.e., the first cue in which one option is clearly better than the other). Indeed, in investigations of real world choices such as the one described above (but also including multiple-cue inference tasks where there are known correct answers such as inferring which of two cities is larger) we see that people often make decisions with simple processes like take-the-best.^[36,37]

More formally, take-the-best is made of three precisely defined building blocks including:

1. *Search rule*: Search through the cues in order of their validity (correlation with criteria). Look up the cue values of the cue with the highest validity first.
2. *Stopping rule*: If one object has a positive cue value and the other does not (or is unknown), then stop search and proceed to Step 3. Otherwise, exclude the cue and return to Step 1. If no more cues are found, guess.
3. *Decision rule*: Predict that the object with the positive cue value has the higher value on the criterion.

Again, each of these rules precisely defines behavior, leads to a testable prediction, and therefore can be computationally modeled or evaluated empirically. Given this precision, researchers have also used mathematical analysis and simulations to tell us about the ecological rationality of heuristics, describing for example the environments wherein take-the-best will perform better and worse.^[38] To illustrate, one can analytically prove that take-the-best is associated with superior decision making in environments that have a *non-compensatory* cue structure. Any time the sum of the cue weights does not add up to the sum of the best (remaining) cue, take-the-best will perform very well. We might imagine a task of trying to model which libraries have experienced a budget growth of at least 10%. In this example we will assume that the ecological validities (i.e., the relative frequency with which a binary cue correctly predicts the criterion) of the cues are one, one-half, one-fourth, and one-eighth, where lending rates of the library are the single most important factor (i.e., more lending is most strongly associated with strong growth), the current size of the library is one-half as important, and location is half again as important. In this case, the structure is non-compensatory because the sum of the cue weights can never add up to (or compensate for) the difference between the first cue (lending rates) and all other cues (Fig. 1).^[39] Even if one finds that another library is larger and is in the perfect location, etc., these factors could not compensate if that library had low lending rates. Findings such as these can tell us both when a simple heuristic will fail and when it will work better than or at least as well as more complex decision processes. These findings also allow for insights into what decision (or inference) should be made as well as what information should actually be used and ignored in the decision-making process.

Two Memory-Based Heuristics

Many heuristics benefit by taking advantage of evolved and developed capacities. In humans, some capacities are more fundamental than others, in the sense that they

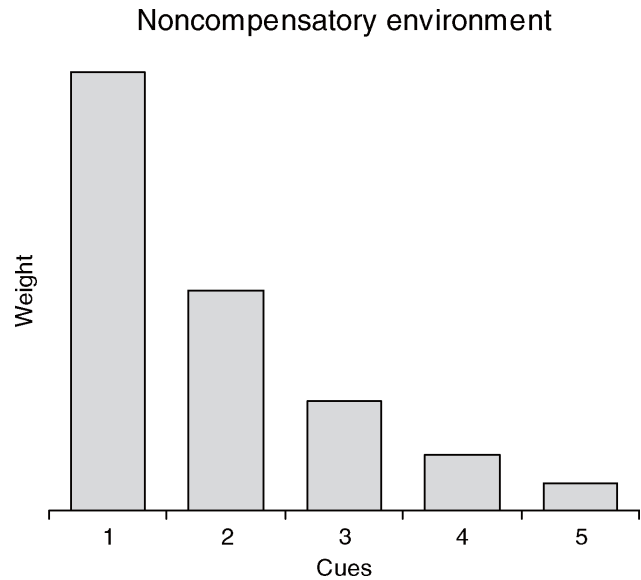


Fig. 1 A noncompensatory environment. In this environment one can see that the first (binary) cue will always make predictions that are always as accurate as any linear combination of all cues.

develop earlier and persist longer. Recognition memory is one such capacity. In many ways our recognition memory is much more sensitive and reliable than the vast majority of other mnemonic processes, something that becomes increasingly apparent as we age. To better appreciate this capacity we invite you to try an exercise: Do your best to recall the names of the seven dwarves from the story *Snow White and the Seven Dwarves*. Although many of us will have trouble recalling these characters' names nearly everyone, or at least most Americans, will immediately recognize them (Can you recognize the seven real dwarves in this list of nine: "Bashful," "Doc," "Sloppy," "Dopey," "Grumpy," "Pudgy," "Happy," "Sleepy," and "Sneezy"). As noted, recognition not only reflects a fundamental aspect of memory, it also provides a powerful cue for adaptive decision making.

Considerable research now demonstrates that when facing a choice people often rely on their recognition, or lack thereof, to help inform their inferences. This heuristic process has been formalized in the *recognition heuristic*, which is modeled as follows: "if one of two objects is recognized and the other is not, then infer that the recognized object has the higher value with respect to the criterion."^[40] The interesting theoretical finding is that sometimes *less is more*, such that ignorance will actually improve our decision making in a variety of environments. Imagine for instance that your task is to select which of two stocks to invest in. One company might be named Coca Cola Company and the other Ameritech. One way to decide between the two companies is simply to invest in the company that is recognized and familiar. If you do this, and thus decide according to the recognition

heuristic, you'd likely select Coca Cola. Although it is a simple strategy that relies largely on one's ignorance, research shows that it can match or outperform "expert" stock portfolios, in certain common environments^[41,42] (for boundary conditions see also Andersson).^[43]

By way of analysis and computational modelling it is possible to understand the conditions in which recognition will be likely to provide good (and not so good) inferences. Research indicates that recognition will lead to good decisions whenever it is correlated with a decision criterion. Consider the task of trying to decide which of two cities is larger (in population), selecting between Detroit and Houghton (MI), for example. In this case, recognition may be diagnostic as cities that have more people are also more likely to be mentioned in the media and have more major sports teams, companies, airports, events, and so on. Bigger cities are therefore more likely to be recognized and not recognizing a city becomes a valuable basis for inference. Of course, recognition does not guarantee that one city is larger than another (e.g., Hollywood, CA, vs. Fresno, CA). However, when there is a strong correlation between recognition and the decision criteria, recognition will tend to provide accurate inferences.

The *fluency heuristic*^[44,45] is a second fundamental memory-based inference process (for a recent review see Kelley).^[46] Considerable converging evidence reveals that fluency, which is roughly defined as our subjective experience of the ease of information processing (cf. availability), often dramatically influences our confidence, judgment, and decision making.^[24,25,47–49] If we again consider the real-world task of selecting stocks we find that people tend to judge that unrecognized companies with names that are easier to read (pronounce) are more likely to be profitable. This is true in laboratory studies and can also be seen in actual stock trading during initial public offerings.^[50,51] Indeed, there is a long tradition of studying fluency and availability. Here we focus on more recent research done within the adaptive framework. Specifically, we have developed the *ACT-R fluency heuristic* that formalized: "If one of two objects is more fluently processed, then infer that this object has the higher value with respect to the criterion" (p. 612).^[4] In this case, fluency is precisely defined as the speed with which declarative memory chunks can be retrieved in the computational cognitive architecture ACT-R. As with the recognition heuristic and take-the-best, the ACT-R fluency heuristic relies on a simple but powerful one reason decision-making process. The critical difference is not whether or not one recognizes some bit of information but how quickly and easily one recognizes it. The more easily one option is recognized the more likely it is to influence our decision, a process that is fundamental to a variety of adaptive inferences. Understanding these processes provides insight into the adaptive nature of our cognitive architecture. More generally, understanding the processes used by one of the most complex and efficient

adaptive devices known—i.e., the human mind—can help enable the design of better innovative engineering and information technology solutions.^[52]

Heuristics, Usability, and Environmental Design

The work of Lee et al.^[2] on search prioritization serves as an excellent example of the potential for using adaptive heuristics to improve information technology. However, this is only one side of the usability issue. Opportunities also exist to study user decision making to further understand the heuristic processes commonly relied upon in database and library type environments. Currently there is a small but growing body of work using process-oriented or otherwise ecologically grounded approaches that may be valuable for future research efforts.^[53,54] For example, some research focuses on variations in human search strategies in database environments^[55] such as differences in the processes of children and adults (Bilal and Kirby, 2002).^[61] In these studies, key results indicate that specific information search strategies can be identified that tend to systematically vary with age. Similarly, there is a somewhat more developed tradition of studying human search behavior in general consumer choices that has begun to explore Internet or database-type environments.^[57–59] These studies have also been successful in identifying search strategies, with some going a step further and identifying stopping rules and the environmental constraints that mediate heuristic selection.^[60] For instance, Browne et al. have started to identify the relationships between environmental factors and search processes, suggesting that there often exists a positive relationship between task complexity, search times, and stopping rules. Similarly, other recent work has used our understanding of human decision-making heuristics to improve human–computer interface design. By eliminating non-diagnostic or highly redundant (correlated) product-attribute information researchers limit the redundant search processes of users, which allows consumers to better cope with information overload effects including the so-called *too much choice effect*.^[62]

There are also a number of other connections between specific heuristics and library and information search behaviors that have yet to be explored. As noted, both recognition and fluency tend to influence everyday choices. In a library environment it is easy to imagine that these heuristics would influence decisions such as which book(s) to order or read (e.g., an author is recognized, an author is more quickly recognized); what search queries to use (e.g., do you recognize any results from these keywords); and when to stop searching (e.g., when further search yields little in the way of relevant recognizable information; stop search when information is no longer easily recognized or fluent). However, these simple connections and the review provided here can only serve as an introduction. There are many other heuristics and aspects of information use and search processes that may prove to

be very influential in the design of user-friendly technology (for a more complete overview see Gigerenzer).^[7,32]

CONCLUSION

There has been considerable focus on the fact that people often use heuristics to make decisions. Fortunately, in the right environment these simple heuristic processes make us smart by simplifying and speeding decisions, and by helping us ignore irrelevant information. In our complex and uncertain world simple heuristics sometimes represent the very best decision making processes available. Whether designing better information technology, better decision support systems, or better decision environments one lesson is clear: Superior decision making does not necessarily require more complex processes. Less can be much more. In these ways and others, the future holds great opportunities and promise for engineering simplicity.

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Informetrics

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Abstract

Informetrics is a subfield of information science and it encompasses bibliometrics, scientometrics, cybermetrics, and webometrics. This encyclopedia entry provides an overview of informetrics and its subfields. In general, informetrics deals with quantitative aspects of information: its production, dissemination, evaluation, and use. Bibliometrics and scientometrics study scientific literature: papers, journals, patents, and citations; while in webometric studies the sources studied are Web pages and Web sites, and citations are replaced by hypertext links. The entry introduces major topics in informetrics: citation analysis and citation related studies, the journal impact factor, the recently defined h-index, citation databases, co-citation analysis, open access publications and its implications, informetric laws, techniques for mapping and visualization of informetric phenomena, the emerging subfields of webometrics, cybermetrics and link analysis, and research evaluation.

INTRODUCTION

In the literature, several definitions have been suggested for *informetrics* and the related fields of bibliometrics, scientometrics, cybermetrics, and webometrics. In this entry, we adopt the definitions suggested by Björneborn and Ingwersen,^[1] where all the above-mentioned metrics are viewed as subfields of *informetrics*. This entry is organized as follows: first, we clarify the terminology and provide a general introduction and then we discuss the major topics of interest in the field (citation studies, theory, visualization, cybermetrics/webometrics, and research evaluation).

TERMINOLOGY AND DEFINITIONS

Informetrics was defined by Tague-Sutcliffe^[2] as “the study of the quantitative aspects of information in any form, not just records or bibliographies, and in any social group, not just scientists.” Brookes^[3] characterized *informetrics* as “a generic term that embraces both biblio- and scientometrics.” To understand Brookes’ definition, we need to define *bibliometrics* and *scientometrics*. Here we use Tague-Sutcliffe’s definitions again, she defined *bibliometrics* as “the study of the quantitative aspects of the production, dissemination, and use of recorded information” and *scientometrics* as “the study of the quantitative aspects of science as a discipline or economic activity.”

The above definitions were published at the time the World Wide Web was just “born.”^[4] Although the Internet had existed for a long time already,^[5] at the time the above definitions were published there were no quantitative studies of Internet-based and Web-based information to the best of our knowledge. Later the definition of *informetrics*

was extended as a result of the Internet and the Web becoming major information sources, and currently *informetrics* is accepted to encompass *cybermetrics* and *webometrics* as well. *Cybermetrics* is defined in Ingwersen^[1] and Björneborn^[6] as “[t]he study of the quantitative aspects of the construction and use of information resources, structures and technologies on the whole Internet drawing on bibliometric and informetric approaches,” and *webometrics* as “[t]he study of the quantitative aspects of the construction and use of information resources, structures and technologies on the Web drawing on bibliometric and informetric approaches.” Fig. 1 illustrates the relation among the different “metrics.”

There is some confusion regarding terminology. Egghe,^[7] for example, provides a similar definition, but he does not differentiate between *cybermetrics* (study of information from *all* Internet applications) and *webometrics* (study of information from the World Wide Web only): *informetrics* is “the broad term comprising all-metrics studies related to information science, including bibliometrics (bibliographies, libraries,...), scientometrics (science policy, citation analysis, research evaluation,...), webometrics (metrics of the web, the Internet, or other social networks such as citation or collaboration networks),...” Glänzel and Schoefflin^[8] use the term *bibliometrics* as a synonym for bibliometrics, informetrics, scientometrics, and technometrics, and at the same time claim that these subdisciplines are not interlinked. In their view, bibliometrics as a field “includes all quantitative aspects and models of science communication, storage, dissemination, and retrieval of scientific information,” i.e., they limit the scope of *bibliometrics* to scientific information. The professional society of informetricians is ISSI, the International Society for Scientometrics and Informetrics, whose mission is to “to encourage communication and exchange of professional

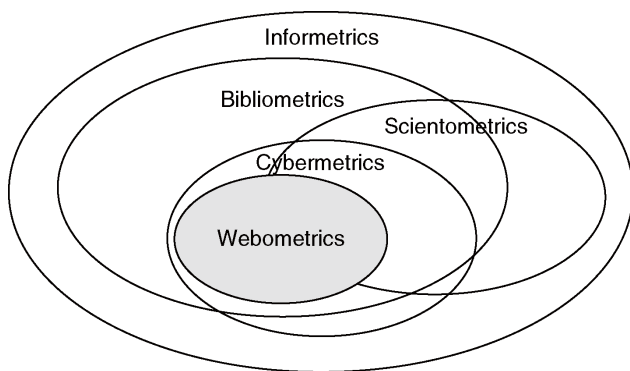


Fig. 1 The relationships between the LIS fields of infor-/biblio-/sciento-/cyber-/webo-/metrics. Sizes of the overlapping ellipses are made for the sake of clarity only.

Source: From Small-world link structures across an academic web space: A library and information science approach, by L. Björneborn. PhD dissertation, Royal School of Library and Information Science, Copenhagen, Denmark, xxxvi, 399, 2004.^[6]

information in the field of scientometrics and informetrics.”^[9] From the mission statement we understand that scientometrics is not considered to be a subfield of informetrics, and there is no indication to the relation of bibliometrics to these two fields. The society does not limit the scope of these fields to scientific information only.

Hood and Wilson^[10] provide a detailed discussion on the use of the different terminologies, their origin and relative popularity in the Information Science subset of databases of DIALOG as of 2000. At that time *bibliometrics* was by far the most popular term, followed by *scientometrics* and *informetrics*. *Webometrics* and *cybermetrics* were not included in their searches. We submitted a variant of some of their searches on September 6, 2008 using

- ISI Web of Science (by Thomson Reuters)—searching for topics, which include title, abstract, author keywords, and keywords plus (keywords assigned based on the reference list), coverage from 1965 and onward
- Scopus (by Elsevier)—the searches were conducted in title and abstract. Keywords in Scopus are assigned both by the authors and by the database, and bibliometrics is one of the database-assigned keywords, therefore keywords were excluded from this search; coverage from 1996 and onward
- Google Scholar—a freely available bibliographic database with unspecified coverage both in terms of time

span and in terms of publications. Here the search term can appear in any part of the publication (depending on what is indexed by Google Scholar)

- Google—currently, the most popular Web search engine indexing Web pages and not necessarily scholarly publications
- Yahoo—currently, the second most popular Web search engine indexing Web pages and not necessarily scholarly publications

The results are presented in Table 1. The numbers of course are not comparable, since the search conditions in the different databases were not identical. Still we see that like in 2000,^[10] in each database the term *bibliometrics* was the most frequent, but the rank order of the other terms varied.

Hood and Wilson state that, the term *bibliometrics* according to most sources was coined by Pritchard^[11] in 1969; however, both Hood and Wilson^[10] and Rousseau (See the entry, “Informetric Laws,” p. 2747) mention a much earlier use of the French term *bibliometrie* by Otlet 1934. *Scientometrics* is the translation of the Russian term “naukometriya,” coined by Nalimov and Mulchenko in 1969. The term *informetrics* comes from the German word “informetrie” and was first proposed by Nacke^[12] in 1979. The term *webometrics* was introduced by Almind and Ingwersen^[13] in 1997. The origin of the term *cybermetrics* is not clear. It should probably be attributed to Isidro Aguillo, the editor of the e-journal *Cybermetrics* (<http://www.cindoc.csic.es/cybermetrics/cybermetrics.html>), founded in 1997.

GENERAL OVERVIEW

The literature related to informetrics is very extensive; in this section we list some review and encyclopedia entries and books on the topic. These references can serve the interested readers as starting points for exploring informetrics.

There are several reviews of *informetrics* and its subfields, including a number of review articles in the Annual Review of Information Science and Technology: the 1989 review by White and McCain of bibliometrics,^[14] a review of informetrics by Wilson in 2001,^[15] the 2001 review of scholarly communication and informetrics by Borgman and Furner,^[16] and a review of webometrics by Thelwall,

Table 1 Relative popularity of the “informetrics family” terminology. The number in brackets in each cell is the rank order of the term in the specific database.

Search term	Web of Science; 1965–	Scopus 1996–	Google Scholar	Google	Yahoo
Informetrics	86 ^[3]	98 ^[3]	3330 ^[3]	62,300 ^[5]	164,000 ^[5]
Bibliometrics	360 ^[1]	284 ^[1]	78,000 ^[1]	1,320,000 ^[1]	846,000 ^[1]
Scientometrics	164 ^[2]	216 ^[2]	13,100 ^[2] (incl. the journal by this name)	164,000 ^[3]	447,000 ^[2]
Cybermetrics	11 ^[5]	12 ^[5]	1250 ^[4] (incl. the journal by this name)	149,000 ^[4]	200,000 ^[4]
Webometrics	62 ^[4]	37 ^[4]	1160 ^[5]	253,000 ^[2]	414,000 ^[3]

Vaughan and Björneborn^[17] in 2005. Most recently Bar-Ilan^[18] published an updated review of informetrics, covering the literature published between 2000 and 2005.

The *Encyclopedia of Library and Information Sciences* also contains several articles related to *informetrics*, please see topical contents list. Russell and Rousseau^[19] discuss bibliometrics and institutional evaluation in the *Encyclopedia of Life Support Systems*' section on science and technology policy.

To this day there is only one textbook dedicated to informetrics, the book written by Egghe and Rousseau.^[20] The full text of the book is available online at <http://eprints.rclis.org/archive/00003297/>. There are a number of additional monographs on informetric topics, including Garfield's book on citation indexing;^[21] Cronin's book on the citation process;^[22] Moed's recent book^[23] on the use of citation analysis in research evaluation; and Thelwall's^[24] book on link analysis, one of the major topics in webometrics.

In order to identify the major journals related broadly to *informetrics*, Wilson^[15] ran the query bibliometric? OR informetric? in 11 databases using DIALOG. Here we ran the query bibliometric OR bibliometrics OR informetric OR Informetrics OR scientometric OR scientometrics OR webometric OR webometrics OR cybermetric OR cybermetrics on the currently existing two major, comprehensive commercial bibliographical databases, ISI's Web of Science (by Thomson Reuters) and Scopus (by Elsevier). Note that in Bar-Ilan,^[18] a much more detailed query was executed on the same databases. The publication year in both databases was limited to 1996 and onward, because Scopus' comprehensive coverage is from 1996 and onward. The journals producing the largest number of items for both databases are displayed in Table 2. Note that there are major differences in the two databases for the ranking of some of the journals. The major reason for this is that Scopus adds keywords, and bibliometrics is one of the keywords used, while WOS indexes only author-assigned keywords and what are called "Keywords Plus": keywords generated from the titles of the references. Many of the articles indexed by Scopus as "bibliometrics" are short items (e.g., letters) in *Nature*. These do not have abstracts, but deal with issues like the impact factor (IF) and citation analysis in general. The query terms do not appear in the title; thus, they are not retrieved by WOS, but these publications are definitely related to informetrics, and are picked up by Scopus because the keyword bibliometrics was assigned to them. In some cases, Scopus retrieves fewer items, than WOS—a paper-by-paper comparison of the two sets reveals that there are some differences between the two sets as a result of the use of the keywords and index terms in WOS, the index keywords in Scopus and the different indexing policies between the two databases regarding book reviews.

The results show that there is a wide interest in the topic, as papers appear both in general science journals

Table 2 Top journals related to informetrics, 1996–2008 based on documents retrieved for the query "bibliometric OR bibliometrics OR informetric OR Informetrics OR scientometric OR scientometrics OR webometric OR webometrics OR cybermetric OR cybermetrics" from WOS and Scopus. For both databases, the 10 most productive journals for the query are ranked and displayed.

Journal Name	Rank in Web of Science (number of documents in journal in parenthesis)	Rank in Scopus (number of documents in journal in parenthesis)
<i>Scientometrics</i>	1 (522)	1 (447)
<i>Journal of the American Society for Information Science and Technology</i>	2 (103)	3 (80)
<i>Information Processing & Management</i>	3–4 (42)	5–6 (39)
<i>Journal of Information Science</i>	3–4 (42)	7 (38)
<i>Research Evaluation</i>	5 (39)	4 (46)
<i>Journal of the American Society for Information Science</i>	6 (35)	9 (24)
<i>Research Policy</i>	7 (31)	8 (26)
<i>Journal of Documentation</i>	8 (29)	10–12 (23)
<i>Current Science</i>	9–10 (18)	29–33 (13)
<i>Medicina Clinica</i>	9–10 (18)	10–12 (23)
<i>Journal of Informetrics</i>	11–12 (16)	10–12 (23)
<i>Nature</i>	165–519 (1)	2 (103)
<i>Journal of the Medical Library Association</i>	19–22 (9)	5–6 (39)

(e.g., *Nature*), in major information science journals (e.g., *JASIST*) and in specialist journals (e.g., *Scientometrics*). In addition to the specialist journals in the area; *Scientometrics*, *Journal of Informetrics*, *Research Policy*, *Research Evaluation*, and *Cybermetrics*, there are several conference series covering informetrics: the Biannual International Informetrics and Scientometrics Conferences of the International Society for Informetrics and Scientometrics (ISSI—<http://www.issi-society.info/>), the Biannual International Conferences on Science and Technology Indicators and the newly established International Conferences on Webometrics, Informetrics and Scientometrics of the COLLNET Research Network (<http://www.collnet.de>). Note that while *Scientometrics* was started in 1978, the *Journal of Informetrics* is a brand new journal; its first volume appeared in 2007.

OVERVIEW OF THE MAJOR INFORMETRIC TOPICS

Citation Studies

As Wilson^[15] claims: "[p]erhaps the largest subfield of informetrics is citation analysis or citation studies." First we need to clarify the difference between citations and

references, because in many cases there is some confusion between the two. We use here the terminology proposed by Price:^[25] “if Paper R contains a bibliographic footnote using and describing Paper C, then R contains a reference to C, and C has a citation from R. The number of references a paper has is measured by the number of items in its bibliography as endnotes, footnotes, etc., while the number of citations a paper has is found by looking it up [in a] citation index and seeing how many others papers mention it.”

Until 2004 there was only a single source for conducting citation studies: ISI's citation indexes: the Science Citation Index (SCI), the Social Sciences Citation Index (SSCI) and the Arts and Humanities Citation Index (A&HCI). These three indexes are accessible now as a single index through the Web of Science tab of Thomson Reuters' Web of Knowledge (<http://apps.isiknowledge.com>). ISI, the Institute of Scientific Information (now owned by Thomson Reuter), was founded by Eugene Garfield. Thus an excellent starting point to understanding citation theory and citation indexing is Eugene Garfield's book^[25] and his Web site (<http://www.garfield.library.upenn.edu/>) containing links and full texts of many works related to the topic. A detailed discussion of “citation cultures” can be found in Paul Wouters' Ph.D. thesis.^[26]

Why should we study and count citations? The basic assumption is that a scientific paper refers to other items because they are relevant to the current study; for example, they provide background, the current paper uses methods described in the referred paper, the current study is comparable/superior to other studies. For a detailed discussion of citation motivations the reader is referred to (pp. 28–30).^[22] To sum up, the basic assumption is that document A refers to document B for positive reasons in the vast majority of the cases and acknowledges the work reported in B. Of course, a reference can be negative as well, but this is the exception and not the rule. If one accepts the above assumption, then citation counts reflect the influence of the paper on subsequent literature. In the scholarly community usually each citation is considered equal; however, citations can be weighted based on the “importance” of the citing document.^[27–29] The weighted approach was proposed by Pinski and Narin,^[30] and a similar method is applied in PageRank, Google's ranking algorithm.^[31]

Of course, there are opponents to the assumption that the influence of a document can be measured by the number of citations it receives. Some of the reasons for criticizing this approach include bias in choosing references, missing references to influential work, and errors in the reference lists.^[32]

The impact factor

One of the most controversial issues in the area of citation analysis is the impact factor (IF). The IF was introduced

by Garfield and Sher,^[33] and it serves as a measure of journal importance. The Journal Citation Reports (JCR) annually publishes the IFs of journals indexed by the ISI Science and Social Sciences Citation indexes. The IF of a journal is defined as the number of citations the articles published in the journal in years $x-1$ and $x-2$, received in year x , divided by the number of articles published in the journal in years $x-1$ and $x-2$. Thus, IF measures the average number of recent citations that an article in the journal receives.

The IF is often misused when it serves as a proxy for the “importance” of articles published in the journal.^[34] Sometimes, articles in a high impact journal are not cited at all, and on the other hand some articles in low impact journals are cited heavily.

Citation practices differ greatly among disciplines,^[35] for example in the JCR category *Medicine, General & Internal*, the highest ranking journal in the list for 2007, *The New England Journal of Medicine* has an IF of 52.589, while the highest ranking journal in the category Information and Library Science, is *MIS Quarterly* with an IF of 5.826. The above example shows that IFs are not comparable across disciplines. In order to compare citation count and IF, the data have to be normalized.^[36–38]

h-index

A newly-introduced indicator to measure scientists is the h-index^[39] proposed by Hirsch. A scientist has h-index h , if he/she published h papers that have been cited h times or more, while all his/her other papers have been cited h times or less. Thus the h-index is a single measure that combines productivity and citation counts. The h-index is dependent on the data source used for collecting information on production and citations,^[40] on the time span used for calculating the index, the number of years the scientist has been active (biased against young scientists), and its characteristic values are discipline dependent. In spite of this, currently there is a huge interest in understanding and modeling the indicator^[41,42] and in proposing variants of the measure, e.g., the g-index proposed by Egghe.^[43] The g-index is the (unique) largest number such that when the articles are ordered by the decreasing number of citations, the top g articles receive (together) at least $g^{[2]}$ citations.

Citation databases

As pointed out above, until November 2004 there was only a single comprehensive source for carrying out citation studies—the ISI Citation Indexes. In November 2004, Elsevier launched Scopus (<http://www.scopus.com>) and Google launched (as a beta) its free service Google Scholar.

Google Scholar enables searching for scholarly literature and also provides citation counts of the items discovered by it. Google Scholar has unspecified coverage both

in terms of the indexed items and in terms of time-span. It has agreement with major publishers and also gathers information by crawling through the Web. Google Scholar was greeted by the scientific community with mixed feelings. For criticism about its performance, the reader is referred to some of the articles published by Jacso,^[44,45] and for more positive impressions the reader is referred to Harzing.^[46] Harzing developed an application called “Publish or Perish” (<http://www.harzing.com/pop.htm>) for carrying out informetric analyses based on Google Scholar data. Although the informetric community is currently quite ambivalent about Google Scholars, scientists, and students use it heavily, as can be seen from statistics provided in:^[47] 73% of the academic institutions examined in the study provided link resolution from Google Scholar results to their online resources.

Scopus is a bibliographical and citation database. It covers more publication sources than the Web of Science and is not limited to indexing journals but also includes some proceedings. The citation data only goes back to 1996, whereas the Web of Science has citation data from 1900 for Sciences, from 1956 for the Social Sciences and from 1975 for Arts and Humanities.^[48] As of September 2008, Scopus indexes 15,000 journal publications,^[49] as compared to 8700 indexed by the Web of Science. Journal indicators based on the Web of Science data are published in the Journal Citation Reports, and other country and discipline specific statistics are provided by the Essential Science Indicators. Freely accessible country and journal indicators based on Scopus data are available from the SciMago Research Group (<http://www.scimagojr.com/>). In October 2008 data from the ISI Proceedings Indexes were merged into the Web of Science.

Co-citation analysis

Co-citation measures the frequency with which two documents are cited together.^[50] Frequent co-citations are interpreted as similarity or co-occurrence of ideas. Co-citation analysis can reveal the core literature for a topic, and then map the structure of the topic.^[50,51] Co-citation analysis was independently introduced by Small^[54] and Marshakova.^[52] Later co-citation analysis was extended to author,^[53–55] and journal co-citation analyses.^[56] Mapping based on co-citation matrices is only one of several available techniques. In the section on visualization, we mention additional data sources for visualization like citation matrices, co-authorship data, and co-word analysis.

Open access

Open access is defined as “free, immediate, permanent, full-text, online access, for any user, web-wide, to digital scientific and scholarly material.”^[57] An interesting question regarding open access publications is whether free access to publications increases the publication’s citation

impact. Several studies showed that electronic access (even if the access is not free) increases citation counts (e.g., Lawrence^[58] and Harnad);^[59] however, some studies (e.g., Anderson)^[60] reached a different conclusion. There are several possible reasons for increased citation counts, including early access (papers are online even before the refereeing process is over), selection bias (authors prefer to publish online their “better” papers), and the ease of access, called the “open access advantage.”^[61] Moed^[62] examined these effects on two sample data sets from Arxiv, a huge open access e-print archive containing nearly half a million e-prints as of September 2008, and found no sign of open access advantage. A similar conclusion was reached by Craig et al.^[63] Harnad^[64] advocates institutional repositories for self-archiving and open access, and promotes mandating archiving of publications in institutional repositories to ease access to scientific publications.

Theoretical Informetrics

There are three famous regularities or informetric laws: Lotka’s law, Zipf’s law, and Bradford’s law.^[15] Lotka’s law^[65] is an inverse square law between the number of authors of scientific papers and the number of publications of each author. According to this law, the number of authors producing two items is about one-fourth of the number of authors producing a single item, and the number of authors producing three items is about one-ninth of those producing a single item, and about 60% of all authors contribute a single item only.

Zipf’s law^[66] has a similar flavor, but instead of authors and publications, it relates to the rank order and the frequency of words in texts. The rank order of a word in a text is the placement of the word in a list sorted in decreasing order of frequency in the text. The law says that if the words in the text are listed in decreasing frequency, then the rank of the word in the list times its frequency in the text is a constant.

Bradford’s law^[67] is called Bradford’s law of scattering, and describes the scatter of scientific literature. He listed the publication sources (e.g., journals) on a specific topic in decreasing order of productivity (productivity is assessed by the number of items on the topic published by the publication source) and partitioned the ordered list into three equal size sets in terms of the number of publications, and showed that the ratio between the number of publication sources in the three zones is about 1: n : n^2 ; i.e., a small number of publication sources (called the “core”) produce a considerable fraction of the publications.

Extensive discussions of informetric laws can be found in additional ELIS entries (see the Topical Table of Contents). These laws are also discussed in the informetrics textbook^[20] and the ARIST review on informetrics.^[15] Egghe recently published a book^[68] where all informetric laws are described in terms of

appropriate Lotkaian functions, thus producing a unified theory based on Lotkaian informetrics.

In addition to studying informetric laws and distributions, the theory of informetrics is also concerned with other issues including modeling growth processes. It should be noted that besides the growth of the scientific literature, older items are usually cited less—they become “aged” and sometimes even obsolete. Well-known, applicable growth models are so-called rich-get-richer models, also known as preferential attachment,^[69] or cumulative advantage.^[70] Examples of such models and studies include works on the evolution of coauthorship networks.^[71,72] Börner, Maru, and Goldstone^[73] proposed a model where both author and paper networks evolve simultaneously. Visualizations of evolving networks are discussed in the next section.

Mapping and Visualization

Many informetric results call for visualization. We have previously seen examples of co-citation analyses that model the structure of scientific topics. Collaboration networks are also best understood through visualization, and visualization techniques also help in gaining insights into evolutionary processes. Here we provide only a number of examples of visualizations. Excellent starting points for exploring the topic are the recent ARIST review on visualization^[74] and Chen’s book on mapping scientific frontiers.^[75] Several studies of citation patterns between journals visualized the resulting structures.^[76–78] Garfield^[79] developed algorithmic historiography that allows studying the origins of a topic and its development over time, and the resulting visualization is called a “historiograph.” Glänzel^[80] studied and mapped coauthorship relations between countries. Maps can also be created based on co-word analysis, i.e., on co-occurrence of words.^[81]

Cybermetrics and Webometrics

Cybermetrics and webometrics are the newest subfields of informetrics. The first webometric/cybermetric studies conducted in the late 1990s showed the applicability of informetric techniques for the Internet in general and specifically for the World Wide Web.^[82–84] Ingwersen^[85] defined the Web Impact Factor (WIF), which corresponds to the Journal Impact Factor, where instead of citations; links pointing to the Web site are counted. More precisely the WIF is the number of pages with links pointing to the given site divided by the number of Web pages in the site. Note that Egghe^[86] warned against drawing a direct analogy between citations and links. Ingwersen used a Web search engine to collect both the number of links and the number of Web pages. However, Web search engines are not very reliable and their coverage of the World Wide Web is far from being

even.^[87–90] Problems of search engine reliability are far from being solved, as can be seen in.^[91]

One way to overcome the problem of search engine reliability is not to use them for data collection, but to use a Web crawler instead. Thelwall developed such a crawler (available from <http://socscibot.wlv.ac.uk/>) and studied extensively the link structure between U.K. universities (for a summary of this work see Thelwall).^[24] He also developed several variants of the WIF that correlated better with actual research performance.

Similarly to the study of citation motivation, it is of interest to understand why academics are mentioned on Web pages^[92] and why links to pages on academic Web sites are created.^[93] Bar-Ilan^[94] created a framework for classifying links between academic sites and applied it to links between Israeli academic Web sites.

Most studies of inlinks to academic Web sites from other academic Web sites found strong correlation between the number of inlinks and research performance. A natural question is whether there is a similar correlation between the number of inlinks to a journal Web site and its IF. Vaughan and colleagues^[95,96] found such a correlation both for LIS and law journals. Link structure of commercial Web sites has been studied as well. In a number of studies carried out by Vaughan,^[97,98] significant correlation was found between the business performance and the number of inlinks.

Vaughan and Shaw^[99] introduced the concept of “Web citation,” which is roughly an appearance of the title of a publication within a Web page (not necessarily as a link). They found good correlation between the number of “regular” citations and the number of “Web citations” in a number of disciplines. Kousha and Thelwall^[100] examined so-called Web/URL citations, where a “Web/URL citation of an online journal article is a Web mention of its title, URL, or both” for a number of disciplines. For all disciplines except psychology they found good correlations between Web of Science citation counts, Google Scholar citation counts and Web/URL citation counts.

Just as the growth and evolution of scientific topics are studied, the evolution of the Web is also a topic of interest for webometrics. Several longitudinal studies were carried out in the webometric context. Scharnhorst and Wouters^[101] proposed a classification of temporal changes that occur to the web graph. Koehler^[102] studied the changes that occurred to a fixed set of pages over time. Bar-Ilan and Peritz^[103] carried out an eight-year study following the evolution of the pages containing the search term “informetrics” on the Web. They showed that besides growth; disappearance and changes to the content of Web pages are nonnegligible processes as well. Disappearance can also be demonstrated by testing URL references in scientific publications.^[104]

More recently there are also webometric studies of Web 2.0, including studies of blogs,^[105] of tagging systems,^[106] and of social networks like Myspace.^[107] With

the widespread use of Web 2.0 technologies, more studies in this direction can be expected in the future.

Research Evaluation

Scientometrics, as defined in the introduction is the study of the quantitative aspects of science. Scientometric studies serve as tools for research policy makers and also help in the evaluation process. Historical aspects of measurement and statistics of science and technology are discussed by Godin.^[108] Etzkowitz and Leydesdorff^[109,110] model the interaction between government, industry, and universities as the “triple helix” for explaining the research system. The recently published *Handbook of Quantitative Science and Technology Research*^[111] provides a state-of-the-art survey of research in this area. What can be evaluated using scientometric techniques? Here we bring examples of evaluations of individual researchers, research units, universities, journals, and countries.

Individual researchers can be evaluated based on their productivity (number of publications), patents, funding, citation counts, the IFs of journals they publish in, and peer review. One of the more interesting questions is how much agreement there is between the quantitative, scientometric measures and peer review. There is a lively debate around this issue in the context of the U.K. Research Assessment Exercise (RAE). Until the 2008 exercise, the distribution of funding for the U.K. universities was decided based on peer review only. In the current exercise, both peer review and bibliometric indicators are considered. Norris and Oppenheim^[112] found high and significant correlations between RAE rankings and rankings based on citation counts for archeology. Weingart^[113] warns that when bibliometric indicators are used for research evaluation, the results can be manipulated. An interesting example of this is Australian science, where funding is mainly based on the number of publications, as a result of which Australia's share of publication increased by 25% between 1988 and 1997, while its citation impact decreased.^[114]

Thus one question is whether to employ peer review or to rely on indicators. Another question is which indicators to use. To illustrate this point, Cronin and Shaw^[115] compared rankings based on citation counts, Web hits, and media mentions. The resulting rankings were considerably different. The data source for computing the indicators is also of importance.^[116]

Also of interest are rankings of universities. There are several rankings, the best known are the Shanghai rankings (<http://www.arwu.org/>) and the rankings produced for the *Times of London* Higher Education Supplement (<http://www.timeshighereducation.co.uk/>). Both these rankings take into account some bibliometric data, but include nonbibliometric measures as well. There are also rankings based on webometric data (<http://www.webometrics.info/>) and also rankings based on pure bibliometric data (<http://www.cwts.nl/cwts/LeidenRankingWebSite.html>). There

are several Leiden rankings demonstrating the variability of the results according to the chosen indicator(s).

When considering the world of science, policy makers are often interested in comparing countries. For example, King^[117] calculated the scientific impact of nations, based on publications counts, citation counts, share of top 1% papers, GDP, normalized citation counts, and financial inputs. The findings indicate that the share of United States is declining and the EU countries are catching up. Glänzel, Schubert, and Braun^[118] studied the productivity and citation impact of the 32 most prolific countries based on ISI data for the years 1990–1998. Zhou and Leydesdorff^[119] concluded that China has become the fifth leading nation in terms of scientific productivity based on data from the Web of Science as of 2004.

Scientometric indicators have considerable weight in decisions regarding the funding and development of science. As can be seen from the above-mentioned studies, there does not exist one “correct” or “perfect” method or indicator for evaluation, but informetricians continue to search for better quantitative indicators for evaluating and forecasting science.

SUMMARY

In this entry, we tried to provide an overview of informetrics and its subfields. It is impossible to cover all areas of interest in the field in such an entry. However, we hope that the interested reader will consult some of the sources mentioned in the references in order to deepen his/her knowledge of the topic.

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Institutional Records and Archives

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Abstract

Modern organizations are exploring holistic approaches to managing records, information, and knowledge. The value and use of institutional records are optimized when records management and archival activities are coordinated and closely aligned according to a common set of goals and principles. Integration of records management and archives functions, along with the adoption of newer conceptual models for managing the life cycle of institutional records, have led to revised methods and best practices. Archival processes for “in-house” records may diverge in some ways from those for collecting repositories. Information professionals are expanding their roles and working collaboratively to manage and preserve electronic records. Societal attitudes about transparency and free access to information are changing the ways that institutions think about their information assets.

INTRODUCTION

As modern organizations become more flexible and managed more laterally, institutions are exploring holistic approaches to managing records, information, and knowledge. Improved conceptual models for managing the life cycle of institutional records are prompting information professionals to expand their roles and to work collaboratively across their organizations. At the same time, new technology solutions designed to manage and preserve electronic records are moving from the planning phase to implementation. Most recently, changing societal attitudes about transparency and free access to information are influencing the ways that institutions think about their information assets. All of these factors are prompting institutional archivists and records managers to find new ways to collaborate and integrate their programs in ways that will better serve their institutions’ goals and mission. This new form of information professional—the archivist-records manager—must develop skills that are not yet routinely covered in many graduate program curricula.

Records management and institutional archives programs are key components in managing the operational, program-specific, and administrative records of active, modern organizations. Contrary to traditional practice, many institutions now believe that the value and use of institutional records are optimized when records management and archival activities are coordinated and closely aligned according to a common set of goals and principles. Using this perspective as a point of departure, the entry provides a summary of the key concepts that inform traditional and newer approaches to managing the life cycle of modern records and highlights ways in which archival processes for “in-house” records may differ from those of

collecting repositories. The focus is on managing the records themselves, rather than the administrative strategies required to establish, staff, fund, and sustain the different types of programs and repositories that fall under the general rubric of institutional or “in-house” archives, such as business archives, museum archives, hospital archives, university archives, etc. Also excluded are discussions of the types of records specific to these repositories (for example, the exhibition-related records typically found in a museum’s archives, or grant-giving records found in a philanthropic organization’s archives). Readers are encouraged to explore more detailed texts about the concepts and standards introduced herein.

The specific topics cover a range of concepts and activities associated with integrated management of institutional records: institutional context, the value of institutional records, conceptual models, appraisal and selection of records, archival arrangement and description, research access to institutional records, and integration of records management and archival functions. The entry concludes with a look at institutional records in the broader information environment and a gloss on some of the issues associated with managing electronic records, which arguably now comprise the most important records produced in modern organizations.

INSTITUTIONAL CONTEXT

An understanding of the nature and value of an institution’s operational and administrative records may be gained through a careful and systematic analysis of the organization’s mission and activities. Both records managers and institutional archivists benefit from this activity

Table 1 Techniques for organizational analysis

To gain an understanding of . . .	. . . these analytical techniques can be used
The wider world in which the organization operates, including the legal and regulatory framework	Environmental analysis
What the organization does and how it carries out its work	Systems analysis, functional analysis, process analysis
The formal structure of the organization, and its values, beliefs, and attitudes	Cultural typology, structural analysis
Existing procedures for creating, maintaining, and using records	Process analysis, records survey
The nature and extent of records	Records survey

Source: Shepherd, E.; Yeo, G. *Managing Records: A Handbook of Principles and Practice*; Facet: London, U.K., 2003; 31.^[1]

because it supports the kind of functional analysis that is central to many of the current trends for managing both paper and electronic records.

Elizabeth Shepherd and Geoffrey Yeo have articulated why an organizational analysis contributes to records management objectives: “(R)ecords managers must analyze the role and responsibilities of the organization, study its structures and working methods, and discover how these have changed during its life. They also need to identify the broader issues that influence the way the organization operates, including its corporate culture and the interests and expectations of stakeholders within the organization and externally.”^[1] They have also compiled a list of analytical techniques for undertaking an organizational analysis (Table 1). The National Library of Australia has published a guide for undertaking an institutional analysis in its highly influential *Designing and Implementing Recordkeeping Systems (DIRKS) Manual* (part two, steps A and B).^[2]

VALUE OF INSTITUTIONAL RECORDS

As a society we value the achievements of prominent and creative individuals, and, as a result, their archives are regularly acquired by special collections and manuscripts repositories. But significant cultural advancements also take place within organizational environments. Therefore, the records of organizations, too, explain and illuminate some of mankind’s greatest achievements.

Value of Institutional Records

The value of institutional records to society and to the parent organization is complex and intertwined (Table 2). Active use of institutional records stimulates institutional memory, preserves knowledge and intellectual property, improves accountability, and provides the larger

Table 2 Value of institutional records

Societal benefits	Contributes to education and the creation of new knowledge Preserves records needed for historical and other research Documents contributions to society Protects legal rights of institutions and individuals Protects ownership of property Documents place and identity in modern society
Business uses	Strategic planning and decision-making Communications, both internal and external Accountability and compliance Organizational continuity Preservation of intellectual property and information assets Protection of legal rights and assets Public relations and advertising Finance Research and development Repository of corporate culture and memory Evidence achievements (both corporate and individual) Evidence of place and identity in modern society

Sources: Cox, R. *Managing Institutional Archives: Foundational Principles and Practices*; Greenwood: Westport, CT, 1992; 4–7 and Goldstein, M.G. The evolving role of in-house business archives: from tradition to flexibility. In *The Records of American Business*; O’Toole, J. M., Ed.; Society of American Archivists: Chicago, IL, 1997; 41–55.

community with a broad historical focus on the organization’s evolution and role in society. The business uses are diverse, ranging from strategic planning to leveraging existing knowledge to documenting achievements. Whether institutional archives are used to document the history of a specific institution, or to enable a scholar to understand important historical trends and events, or to inform individuals of the reasons for certain occurrences in his or her local community, they are vital to a society and its inhabitants.

Categories of Records

Institutional records are often divided into two categories: administrative records and program (or operational) records. These distinctions become important for managing retention of the records and for determining archival value.

An administrative record is “a document that has been preserved because it facilitates the operations and management of an agency, but which does not relate directly to programs that help the agency achieve its mission.”^[3] Administrative records often have shorter retention periods governed by a specific section of the retention schedule. They typically support functions related to

scheduling, coordination of activities, logistics, and lower-level reporting.

Program records “relate to the substantive activities an organization undertakes to accomplish its mission or mandate.”^[4] They typically will have longer retention periods and longer-term value to the organization.

A subset of institutional records may also be defined as vital records that are needed to recover business operations after a disaster or those that “protect the assets, obligations, and resources of the organization, as well as its employees and customers or citizens.” They may also document the delegation of authority and lines of succession.^[5]

CONCEPTUAL MODELS

Institutional records are usually managed through a combination of records management and archival processes. Some of the goals and objectives of these two disciplines are shared, while others are not, leading to professional and operational tensions that may be challenging to resolve.

Life-cycle Concept

Traditionally, records management has been more oriented toward the efficient management of large quantities of records in support of current business operations, while archival programs have focused on preserving permanent records that document organizational history and memory. The records life-cycle concept first introduced by T.R. Schellenberg in 1956 reinforces this division by postulating that records go through a number of distinct

phases: creation, capture, storage and maintenance, use, and disposition. When records reach the disposition phase they are either destroyed or transferred to an institutional archive for permanent retention and preservation. The various attempts at modeling this concept have shown it to be a linear or circular progression, often related to the physical location and care given to paper records. Best practices in both the records management and the archives communities developed around each of the phases of the life cycle. Records management units managed the records during their active and inactive phases, and archives units took charge of the records when their business value was diminished and they were no longer actively used by the organization.^[6]

Continuum Concept

As organizations adopted new, more flexible management structures, and as the challenges of managing electronic records began to be identified and analyzed, the life-cycle concept became unworkable. The structure of electronic records is more logical than physical. Archivists and records managers agreed that records could serve many uses at the same time. The continuum concept (Fig. 1) was therefore developed in the 1980s and 1990s to show that managing records was actually a continuous process in which various elements passed “seamlessly into another.”^[7] Rather than being time-based, the continuum concept recognizes that there are different perspectives to managing records operating at the same time. Records that support current business operations may simultaneously be used to document organizational and collective memory.

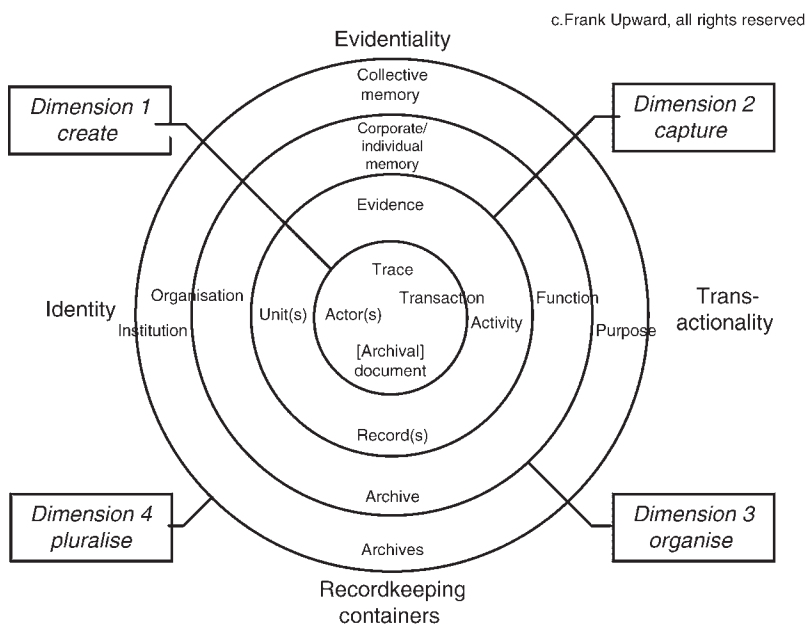


Fig. 1 Records continuum model.
Source: Courtesy of Frank Upward.

APPRAISAL AND SELECTION OF RECORDS

Appraisal is a core activity in both records management and archives management, and it is often thought of as the essence of both professions.

In records management, “appraisal is the process by which an organization identifies its requirements for maintaining records.”^[8] In archives management, appraisal is “the process of determining whether records and other materials have permanent (archival) value.”^[9] Some recent writings on archival appraisal have preferred the term “selection” over “appraisal.”

Appraisal in both contexts is complex and difficult, and a large body of literature is devoted to it. This section will simply introduce concepts and issues related to appraisal that have most relevance to institutional records. Readers are encouraged to consult the sources listed in the bibliography and related entries in this encyclopedia for more comprehensive information.

Records Management Appraisal

In records management, appraisal refers to the often lengthy, complex, and reiterative three-step process required to develop and implement records retention procedures. It is comprised of:

1. Analyzing an organization’s records to determine the proper retention period based on primary values (administrative, fiscal, and legal) and secondary values (evidential and informational).
2. Documenting a retention policy, usually in the form of a records retention schedule.
3. Reviewing, updating, and maintaining the policy.^[10]

Records appraisal is an ongoing activity even after a retention policy is developed and adopted. Newly created records must be classified according to the policy, and new records series may be required as the organization changes. The policy may also be applied to “legacy” records that were created before the policy was adopted. Records creators and records managers continuously make decisions about which records need to be created, how they should be captured in a record-keeping system, how they should be classified for retention, and which ones need special handling for preservation or security.

Archival Appraisal and Selection

The selection of records to be preserved in an institutional archives usually flows from the mission of the individual repository. These selection activities usually focus inward, with a goal of documenting the parent organization. The mission of an institutional archive may articulate several goals, for example: to support accountability, to capture

history, and/or to preserve products and intellectual property. Appraisal decisions will therefore support the defined mandates. Archivists usually also have guidelines for the level of detail desired, or may make selection decisions based on the person or business function that created the records.

Some institutional archives are also “collecting repositories” that accept materials from external sources. For instance, they may collect the family papers of the organization’s founder or attempt to document the reputation and societal impact of the organization as reflected in external publications and media coverage. They may also attempt to document particular research topics related to the organization’s core mission. For instance, the archives of a philanthropic organization may decide to select and acquire materials related to the history of philanthropy.

Traditional appraisal methodologies analyze the content of records, while newer methodologies focus on the context in which the records were created. The methodology selected by an individual repository will, again, be determined by its mission. Repositories with a historical, informational approach may prefer the traditional approaches. Those focused on evidence and accountability, and those that have large volumes of records to manage, will probably prefer the contextual approach. In practice, however, many institutional repositories have hybrid missions and often choose to rely on a combination of both approaches.

Value based on content

Schellenberg’s seminal approach to American archival appraisal defined the primary and secondary values of records. He believed that records should be selected for archival preservation only after their operational value had ceased. Then, only those records that had evidential or informational value that would support historical and other scholarly research should be preserved. Traditional methodologies based on Schellenberg’s model require the archivist to examine the content of the records to determine their value. This traditional approach is often called “bottom-up” appraisal.^[11]

Value based on context

As the bulk of modern-day records increased and more records were created and stored electronically, archival theorists recognized that a new approach was needed that did not require the time-intensive task of inspecting all records. David Bearman, in particular, proposed reverting to provenance as the basis for selection and refined a method of selection based on records functions.^[12] From this approach evolved selection processes based on the record continuum approach. Canadian archivists were particularly attracted by the functional approach. Terry Cook

defined a “macro-appraisal” (or “top-down”) approach based on the function of the records creator, which, in turn led to refinements in functional analysis that emphasized context over content.^[13] American archivist Helen Samuels has applied a functional analysis to university records, and her study has made a strong case for applying this methodology to the records of any type of organization.^[14]

Christopher Baer has drawn on both traditional and newer approaches to develop a model for appraising business records that considers four parameters: the business strategy of the organization, the structure of the organization, the level of informational detail provided in the record, and the elemental purpose and activities (i.e., “function”) supported by the records. This more hybrid approach takes into account both the context and content of records.^[15]

ARCHIVAL ARRANGEMENT AND DESCRIPTION

Most national and international content standards for archival description cover both corporate records and personal papers (Table 3). Working within these frameworks, archivists in active organizations have a unique opportunity to emphasize information about the context, function, and purpose of records, which, in turn, adds inestimable layers of complexity to their meaning.^[16]

- Who created the record (which department and which person of what status within the department)
- Why the record was created (for what administrative purpose)
- What form the record has (minute book, file of correspondence, etc.)
- How it can be found and accessed

Table 3 Selected standards for managing institutional records and archives

Records management, general
ISO 15489:2001 Information and Documentation—Records Management Part 1: General; Part 2: Guidelines http://www.iso.org/iso/catalogue_detail?csnumber=31908 (accessed October 26, 2008)
Requirements for Managing Electronic Messages as Records (ARMA) http://www.arma.org/standards/ElectronicMessages.cfm (accessed October 26, 2008)
The Digital Records Conversion Process: Program Planning, Requirements, Procedures (ARMA) http://www.arma.org/standards/DigitalConversion.cfm (accessed October 26, 2008)
Vital Records Programs: Identifying, Managing, and Recovering Business Critical Records (ARMA) http://www.aria.org/standards/VitalRecords.cfm (accessed October 26, 2008)
Requirements for electronic records management systems
DoD 5015.2-STD Design Criteria Standard for Electronic Records Management Software Applications http://jrtc.fhu.disa.mil/recmgt/standards.html (accessed October 26, 2008)
Model Requirements Specification for the Management of Electronic Records (MoReq2) http://www.moreq2.eu/ (accessed October 26, 2008)
Metadata content and transmission
Describing Archives: A Content Standard (DACS) http://www.archivists.org/catalog/pubDetail.asp?objectID=1279 (accessed October 26, 2008)
Rules for Archival Description (RAD) (revised 2008) http://www.cdncouncilarchives.ca/RAD/RADComplete_July2008.pdf (accessed January 19, 2009)
General International Standard Archival Description, 2d Edition (ISAD(G)) http://www.ica.org/sites/default/files/isad_g_2e.pdf (accessed January 19, 2009)
International Standard Archival Authority Record For Corporate Bodies, Persons and Families, 2d Edition (ISAAR(CPF)) http://www.icacds.org.uk/eng/ISAAR(CPF)2ed.pdf (accessed January 19, 2009)
ISO 23081-1:2006 Information and documentation – Records management processes – Metadata for records – Part 1: Principles http://www.iso.org/iso/catalogue_detail?csnumber=40832 (accessed October 26, 2008)
Minnesota Recordkeeping Metadata Standard http://www.mnhs.org/preserve/records/electronicrecords/ermetadata.html (accessed October 26, 2008)
Metadata Encoding Transmission Standard (METS) http://www.loc.gov/standards/mets/ (accessed October 26, 2008)
Metadata Object Description Schema (MODS) http://www.loc.gov/standards/mods/ (accessed October 26, 2008)
Digital preservation
ISO 14721:2003 Space data and information transfer systems — Open archival information system — Reference model http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=24683 (accessed October 26, 2008)
PREMIS: Data Dictionary for Preservation Metadata, v.2 (March 2008) http://www.oclc.org/research/projects/pmwg/ (accessed June 30, 2009)
PRONOM: The File Format Registry http://www.nationalarchives.gov.uk/pronom/ (accessed October 26, 2008)
ISO 19005-1:2005 Document management – Electronic document file format for long-term preservation – Part 1: Use of PDF 1.4 (PDF/A-1) http://www.iso.org/iso/catalogue_detail?csnumber=38920 (accessed October 26, 2008)

- How it relates to other records (whether there are likely to be more records on the same subject somewhere else)
- When and why were related records destroyed

The arrangement of institutional records according to provenance is particularly important to the researcher for determining point of view and analyzing biases (For instance, correspondence between two mid-level managers about a particular event may be much more revealing than a press release about the same event.). It is also important to know why the records were created, how the records were kept, and what functions and activities they supported.

Arrangement and description of collections that come into collecting archives is relatively straightforward, because each new acquisition usually represents a discrete and independent unit that can be arranged, described, and stored without reference to direct or integral connections to other collections in the repository. Record groups and record series are based solely on the records themselves. Each collection is usually described by its own finding aid.

Records that enter an institutional archives have fundamentally different characteristics, both in the way that they enter the repository and how they have to be arranged and described. Even though archivists strive for the logical and orderly acquisition of new records according to the retention policy, records may also come to the repository in a less planned way, motivated by staff departures, the physical movement of offices, an upcoming anniversary, or the completion of major projects.

The record groups and record series in an institutional archives are usually based on provenance, which means that they will reflect, in part, the organizational structure of the organization. New acquisitions are usually described as additions to existing records series and groups. Many different accessions may be brought together intellectually in a single finding aid.

The systems that institutional archivists use to create and maintain descriptive information about their holdings will vary widely according to the type of organization, the degree of public access afforded to the collections, the amount of information technology support that is available, and the degree to which archivists are compelled to use existing systems rather than acquire new ones specific to archives management. The ideal systems for documenting information about archival collections accommodate many levels of hierarchy that can reflect the context and relationships of and between the records themselves. These systems might take the form of relational databases or they may use text encoding to maintain hierarchical relationships, such as with Encoded Archival Description.^[17] Library bibliographic systems do not provide enough levels of hierarchy to describe archival collections. (See the related entries “Archival Appraisal and Acquisition,” p. 120, and “Archival Arrangement and Description,” p. 130, for more detailed coverage.)

RESEARCH ACCESS TO INSTITUTIONAL RECORDS

While government archives must follow laws and mandates governing public access to information, the policies that determine access to information in institutional archives usually reflect the business nature of the organization and the level of security that is required to protect the organization’s interests. Many organizations have guidelines for handling sensitive information. Legal statutes protecting personal privacy, medical records, and student records also dictate types of information that should be kept confidential.^[18] Most organizations find it necessary to protect access to records related to attorney-client privilege, human resources, and those that contain business or trade secrets. Even nonprofit organizations have sensitive records related to sustaining the organization’s business.

In practice, most business and corporate archives do not exist to provide public access to their holdings. Other types of institutional archives, especially those associated with nonprofit and educational organizations, exist in large part to serve the public interest.

Most institutional archives hold records of interest to the staff of the creating organization, the general public, and the media, and attempts are made to provide the appropriate level of access to each of these groups while maintaining a suitable level of confidentiality and security.^[19] Some records were created for public distribution, and these are usually made available for research as soon as they enter the archives. For the most part, however, the records held by institutional archives were created for internal use, and public research access may be restricted to varying degrees. The policies controlling access may be directives communicated by the executive management of the organization or they may be entrusted to the archivist to determine.

Effective access policies for institutional records will include “clear description of restrictions, time limits on restrictions, procedures for determining restrictions, and a statement regarding lines of administrative authority.” The categories of restriction usually include “open,” “restricted” to staff, and “closed” to all except the office of origin. There is often a general period of restriction (for instance, 10–20 years) and then longer periods for records of extra sensitivity or those whose confidentiality is protected by statute. The policy should state when and how restrictions are placed on records and the lines of authority and procedures for obtaining access.^[20]

INTEGRATION OF RECORDS MANAGEMENT AND ARCHIVAL FUNCTIONS

Practical solutions do not always line up neatly with theoretical models. The goals and activities of records management and archival programs do not always neatly mesh, but their missions should align with the goal of

fostering efficient management of institutional records and leveraging their value. By working collaboratively, records managers and archivists identify areas of conflict and seek productive resolutions.

Records Retention and Archival Appraisal

When managing the records of an active organization, records managers must deal with records in large groups and are intent on destroying records according to policies that are designed, in part, to promote efficiency and to protect the organization. Archivists work to preserve a subset of records consistent with selection guidelines. Sometimes these two organizational goals come into conflict.

In theory, an organization's retention schedule should be a useful tool for guiding archival appraisal, but this is often not the case in practice. Modern-day retention schedules are designed with fewer categories (often called "big buckets") to promote ease of understanding and use. As a result, they usually do not provide enough detail to support archival appraisal. Function-based retention schedules are difficult to apply to unified files of correspondence, or project, case, and subject files, all of which might be of high interest to archivists. They also may not correlate easily with individual office file plans.

Retention schedules may be strongly tied to organizational structure, and retention policies are usually implemented through official departments. But the work in modern organizations is more fluid, with people and information traveling easily across departmental lines. While retention schedules may capture the official flow of documents, they often do not capture the real flow of information. In addition, compliance with retention schedules across a large organization is usually inconsistent, and often the records of the offices of senior executives are not scheduled. These situations lead to gaps in documentation and loss of records at the higher decision-making levels of the organization.^[21]

Because of these inherent tensions between records management and archival appraisal, some records professionals argue that these functions should be separated organizationally. Others contend that the tensions are best resolved by an integrated approach, because the logical road to conflict resolution is through dialogue and compromise, and this happens more easily when both records managers and archivists are members of the same team.

Records Managers and Archivists Working Together

Collaboration between records managers and archivists is becoming essential as more information professionals are recognizing that the continuum model is closer to reality than the life cycle model, especially in the digital age. Archivists should be proactive in bringing their

organizational and preservation skills to the process of records creation and the maintenance of active records, and capture copies of electronic records much earlier than they would paper records. Records managers should understand archival appraisal, be alert to records that meet the collecting policies of the institutional archives, and encourage the creation of authentic and reliable records that will document key organizational functions. Both groups should keep theoretical goals firmly in sight while remaining flexible in their respective areas of control and delivering a unified message to staff in the organization.

INSTITUTIONAL RECORDS IN THE BROADER INFORMATION ENVIRONMENT

The documentation of an institution exists in many forms and is cared for by many units across the organization. The value of institutional records can be leveraged through integrated access to information achieved through strong partnerships between many departments in the organization, including archives, records management, legal, communications, compliance, information technology, and business units. Institutional records can be key components of programs devoted to document management, information management, knowledge management, disaster recovery, digital asset management, intellectual property management (including institutional repositories), and preservation of electronically stored information (including trusted digital repositories).

The technological revolution is providing new opportunities for information integration and collaboration among information professionals. "In this new world of records, archivists must become more involved with records creation and maintenance. Managers, information managers, and systems managers must become more involved with records quality. Archivists, records managers, and information managers must work together to establish standards and procedures before electronic records become the primary media for maintaining the institutional memory."^[22] This prescient statement was published in 1993. Now, years later, information professionals are still grappling with the challenges of capturing and preserving electronic records. Many archivists fear that 25 years of key documentary evidence has been, or will be, lost.

THE CHALLENGE OF ELECTRONIC RECORDS

The amount of electronically stored information in organizations and businesses is growing exponentially. Managing electronic records across an organization is one of the most challenging tasks facing institutional information managers, and it is also the one most easy to ignore for institutions that do not have high risks associated with poor records management, that lack technological

expertise and infrastructure, or whose mission is focused on more traditional functions.

Electronic records are much more fragile and at risk of deterioration and loss than are paper records. Although the concept of the paperless office has yet to reach fruition—and may never do so—the importance and criticality of electronic records has evolved substantially in recent years. At first, most electronic records were considered to be transient; desktop computers were the tools used to prepare a record that was printed on paper and filed. Now, more often than not, the electronic document is considered to be the permanent record, and the paper copies are transient, used for ease of reference and then discarded.

Records managers and archivists have attempted to apply traditional methodologies to electronic records. While this task is challenging enough, it is complicated by quickly changing technological advancements, system and format obsolescence, and the need for new resources to support technology infrastructure, software acquisition and implementation, training, and sustainability. The problem of obsolescence applies to hardware, operating systems, software, file formats, and storage media. Different processes are evolving to address each.

Thousands of people in government, industry, and the academy are working on these problems, from creating conceptual models, to writing standards, to building technology solutions for implementing them, to solving technological obsolescence. National archives programs in the United States, United Kingdom, Australia, New Zealand, Canada, and the Netherlands (to single out just a few) are developing systems and processes to identify, capture, classify, describe, preserve, and provide appropriate access to electronic records. Various international, national, and local agencies are promulgating standards and best practices related to processes, metadata, and digital preservation (Table 3). The information management sector has developed suites of applications to manage electronically stored information, all with limited or mixed success, including systems for document management, digital asset management, content management, electronic record management, and e-mail “archiving.”

Records Management Context

The principal challenges of managing electronic records relate to the computer’s inability to classify records and activate event-driven retention policies. Most systems developed to date require the user to classify records, most often by dragging them into folders that emulate series on a retention schedule. Records managers have therefore been moving toward simplifying retention schedules and reducing the number of records series in an attempt to create systems that can realistically be learned and applied by the entire staff of an organization. Event-driven retention policies pose larger challenges because they usually

require a human to recognize that an event has happened before the retention period can be properly assigned.

Records managers working in collaboration with staff in information technology, legal, and business units have been devising new processes to manage three categories of electronic records: those created and retained in e-mail systems, those produced by enterprise database applications and managed by information technology teams (structured data), and those produced by desktop applications and managed by business units on workstations and shared network folders (unstructured data). Many records managers are experimenting with ways to leverage current technology and train staff in new procedures for managing electronic records according to established policy, including the distribution of directory structures that correspond to official records and training staff to associate more metadata with records created in desktop applications. Other more comprehensive strategies include auto-classification, applying retention rules to records in legacy systems, managing access based on privacy and security requirements, and building records management functionality into enterprise business applications.

Archives Context

Archival functions have been largely ignored by the emerging technologies developed for content management and records management, which have had difficulty appreciating the need for long-term digital preservation strategies and identifying a viable market. As a result, archivists tend to look to governments that have provided mandates and money for developing electronic records solutions, with the hope that systems designed for extraordinarily large repositories will be scalable to smaller ones.

The challenges associated with the archival management of electronic records are many and varied. Archivists are charged with preserving and providing access to authentic and reliable records over a long time (decades, if not centuries). Lacking expertise and resources to ensure long-term preservation and access, archivists have been hesitant to accept electronic records into their repositories.

Leaving aside technological and organizational cultural issues (such as lack of a pressing business need, lack of resources, and lack of motivation) the traditional functions of archival management—accession, appraisal, arrangement, description, access, and preservation—have traditionally required a large degree of human analysis. The continuum model and top-down appraisal methods have been helpful in explaining the archivist’s new role during records creation and in applying appraisal decisions without having to look at the individual records, but much work remains to develop suites of applications that can automate the full range of archival functions. How should computers apply macro-appraisal rules? What new metadata schemas are required? How can computers enhance

the records with value-added description? How will computers review records for appropriate access? These are just a few of the questions being explored.

Need for Collaboration

Successful institution-wide electronic records management requires close collaboration between records managers and archivists, information technology staff, legal staff, and the various business units in an organization. These people bring together the knowledge and skills required to propose institutional priorities and advocate for resources, write requirements for systems, undertake the acquisition and implementation of systems, and carry out training, compliance, data management, and long-term digital preservation.

Records managers and archivists usually control the retention policy and records classification scheme. They also understand the organization's business processes, the nature of the records created by those processes, and the metadata required to support management and access. Records managers routinely train staff in good recordkeeping and are the best equipped to monitor compliance with policies. Archivists know at the time of creation which records are likely to require long-term preservation, and they are knowledgeable about the systems, policies, processes, and results that are required for a viable digital preservation program.

Information technology staff usually controls the system architecture, software acquisition and implementation, data storage, and disaster recovery for systems. They have the knowledge to articulate system requirements in a manner that is understood by vendors and to ensure that software applications have the ability to interact and run in the corporate technology environment. Legal staff provides system requirements for managing legal discovery and for producing electronic records that will stand up in court.

Most important, however, are the business units and end users. Ultimately, if the systems and processes designed for managing electronic records are difficult to use or fail to do what the business unit requires, then they will not be used.

CONCLUSION

Institutional archivists and records managers are evolving into proactive leaders as they bring their knowledge and skills to the task of preserving and integrating access to their organization's knowledge, information, and records. In so doing, they are making adjustments to some of the traditional practices of their professions and adopting a flexible approach to collaboration, all of which require a certain amount of risk-taking. Institutional archives and records management programs are working together to

analyze the institutional context, functions, and business processes that inform the creation of records and then using this information to make informed appraisal and access decisions. Working together, archivists and records managers understand better the uses and values that characterize institutional records and then combine their skill sets to communicate requirements for records creation and management of records over their entire life cycle.

In managing institutional archives repositories, archivists adapt traditional methodologies of arrangement and description to suit the nature of the records in their repository, and they negotiate an access policy that balances open access to records with the business needs of the institution.

At the same time, institutional archivists and records managers must be knowledgeable of standards and best practices for managing electronic records and be proactive in planning and implementing institution-wide systems for managing e-mail, data in enterprise applications, and records created by desktop applications. To this process they bring knowledge of records and business processes, records creation and retention policies, training requirements, and compliance monitoring. They also bring a strong liaison with the creators of records across the institution. Archivists and records managers have an especially important role to play in communicating requirements for digital preservation programs.

The future promises to bring more challenges to institutional archivists and records managers as institutional electronic records are created, transmitted, and retained in many and varied communication devices and stored in data repositories no longer managed by the institution. In addition, many futurists are predicting a greater socialization of information in the coming years, stimulated in part by Web 2.0 technologies. These trends will challenge the ability of archivists and records managers to manage records and will test an institution's real and perceived need for control over its records and information.

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Intellectual Freedom and the American Library Association (ALA): Historical Overview *[ELIS Classic]*

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Abstract

One of the major initiatives of the American Library Association has been to promote intellectual freedom in society. The author of this entry was one of the driving forces of this effort over many years. Though, as Krug noted, intellectual freedom has been understood in many different ways, a simplified definition can be taken as the right to freedom of thought, expression, and access to informational materials of any kind. In this entry, Krug described the long, rich history of librarians' efforts to oppose censorship and assure intellectual freedom for library users.

—*ELIS Classic*, from 2003

INTRODUCTION

At the outset, two myths can be dispelled: 1) intellectual freedom in libraries is a tradition; and 2) intellectual freedom has always been a major, if not the major, part of the foundation of library service in the United States. Both myths, assumed by many librarians, are grounded in the belief that librarians support a static concept of intellectual freedom. Nothing, however, could be farther from the truth.

The attitude of librarians toward intellectual freedom has undergone continual change since the late 1800s when, through the American Library Association (ALA), the profession first began to approach such issues with the semblance of a unified voice. The ALA, however, has never endorsed a uniform definition of "intellectual freedom." Instead, through the council, ALA's governing body, the Intellectual Freedom Committee (IFC), and the Office for Intellectual Freedom (OIF), ALA has promoted a variety of principles aimed at fostering a favorable climate for intellectual freedom but without the limits imposed by a rigid definition. This approach has permitted a broad definition capable of meeting the needs of librarians as they arise.

CENSORSHIP OF PUBLISHED MATERIALS

The catalyst spurring librarians to take initial steps toward supporting intellectual freedom was the censorship of specific publications. "Censorship" in this context means not only deletion or excision of parts of published materials but also efforts to ban, prohibit, suppress, proscribe, remove, label, or restrict materials. Opposition to these activities emanated from the belief that freedom of the mind is basic to the functioning and maintenance of

democracy as practiced in the United States. Such democracy assumes that educated, free individuals possess powers of discrimination and are to be trusted to determine their own actions. It assumes further that the best guarantee of effective and continuing self-government is a thoroughly informed electorate capable of making real choices. Denying the opportunity of choice, for fear it may be used unwisely, destroys freedom itself. Opposition to censorship derives naturally from the library's historic role as an educational institution providing materials that develop individuals' abilities, interests, and knowledge. Censorship denies the opportunity to choose from all possible alternatives, thereby violating intellectual freedom. The library profession has aimed to ensure every individual's freedom of the mind so that society as a whole benefits. Even in this central area, however, the professional position has fluctuated, being influenced by such factors as taste, quality, responsibility, morality, legality, and purpose.

One early incident concerning censorship, involving a substantial number of librarians, occurred in 1924 when the Librarians' Union of the American Federation of Labor reported that Carnegie Libraries fostered "a system under which only books approved in a certain manner may be placed on Carnegie Library shelves and that amounts to censorship and is so intended."^[1] The ALA Executive Board considered the union's charges and offered to enlist volunteers to investigate the claims. Apparently, however, the union did not act on the offer, and the matter was not considered further by the executive board.

In 1934, the association recorded its first protest against the banning of a specific publication, *You and Machines*, a pamphlet by William Ogburn. Prepared for use in Civilian Conservation Corps camps under a grant from the American Council on Education, the pamphlet was denied circulation by the camps' director, who believed it would

induce a philosophy of despair and a desire to destroy existing economic and political structures. Initially, the ALA president and executive secretary wrote a joint letter to President Franklin D. Roosevelt, stating that “[governmental] censorship on a publication of this character written by a man of recognized authority is unthinkable.”^[2] Later the board discussed the banning further and appointed a committee to draft another letter for approval by the ALA Council. The result was a formal request that President Roosevelt “make it possible for the U.S. Commissioner of Education and the Education Director of the Civilian Conservation Corps to direct the educational policies to be operative in these camps and to make available the reading matter essential in a modern program of education.”^[2]

These examples illustrate the association’s wavering position and reflect the ambivalent attitude of the profession as a whole regarding censorship. A review of library literature reveals relatively few articles on intellectual freedom prior to the 1930s, and many of the articles that did appear supported censorship and only quibbled over the degree and nature of it. Typical was the opinion of ALA President Arthur E. Bostwick, whose inaugural address at the 1908 Annual Conference included these remarks:

‘Some are born great; some achieve greatness; some have greatness thrust upon them.’ It is in this way that the librarian has become a censor of literature. . . Books that distinctly commend what is wrong, that teach how to sin and how pleasant sin is, sometimes with and sometimes without the added sauce of impropriety, are increasingly popular, tempting the author to imitate them, the publishers to produce, the bookseller to exploit. Thank Heaven they do not tempt the librarian.^[3]

Given the multiplicity of professional attitudes toward censorship of print materials, it is not surprising that censorship of nonprint media was once viewed as completely outside the concerns of the profession. For example, as late as 1938, the ALA Executive Board believed it was inappropriate to protest when the Federal Communications Commission forced a radio station to defend its broadcast of Eugene O’Neill’s *Beyond the Horizon*.^[4]

The association’s basic position in opposition to censorship finally emerged in the late 1930s, when John Steinbeck’s *The Grapes of Wrath* became the target of censorship pressures around the country. It was banned from libraries in East St. Louis, Illinois; Camden, New Jersey; Bakersfield, California; and other localities. Although some objected to the “immorality” of the work, most opposed the social views advanced by the author.

The initial response of the ALA to the pressures against *The Grapes of Wrath* was the adoption in 1939 of the *Library’s Bill of Rights*, the precursor of the present *Library Bill of Rights*, the profession’s basic policy statement on intellectual freedom involving library materials.

In 1940, 1 year after adoption of the *Library’s Bill of Rights*, the association established the Intellectual Freedom Committee (IFC). (Originally called the Committee on Intellectual Freedom to Safeguard the Rights of Library Users to Freedom of Inquiry, the Committee’s name was shortened by council action in 1948 to Committee on Intellectual Freedom and inverted through usage to Intellectual Freedom Committee.) The 1940 charge to the IFC was “to recommend such steps as may be necessary to safeguard the rights of library users in accordance with the Bill of Rights and the *Library’s Bill of Rights*, as adopted by Council.”^[5] Although the IFC’s role has varied, its main function has been to recommend policies concerning intellectual freedom, especially—but not limited to—matters involving violations of the *Library Bill of Rights*. Although its original statement of authority referred only to library users, in reality the IFC became active in promoting intellectual freedom for librarians and patrons as well. Its diversified role was recognized and formalized in 1970 when the council approved a revised statement of authority:

To recommend such steps as may be necessary to safeguard the rights of library users, libraries, and librarians, in accordance with the First Amendment to the United States Constitution and the *Library Bill of Rights* as adopted by the ALA Council. To work closely with the Office for Intellectual Freedom and with other units and officers of the Association in matters touching intellectual freedom and censorship.^[6]

The original *Library’s Bill of Rights* focused on unbiased book selection, a balanced collection, and open meeting rooms. It did not mention censorship or removal of materials at the behest of groups or individuals. Over the years, however, the document has been revised, amended, and interpreted, often in response to specific situations with general implications. The first change, a 1944 amendment against banning materials considered “factually correct,” was occasioned by attacks on *Under Cover*, an expose of Nazi organizations in the United States, and *Strange Fruit*, a novel about interracial love. Reference to “factually correct” was later dropped, but the directive against removal of materials remained. Opposition to censorship of nonprint media was amended to the document in 1951 because of attacks on films alleged to promote communism. To combat suppression of communist materials or other allegedly “subversive” publications, the association issued its “Statement on Labeling,” which stated that designating materials “subversive” is subtle censorship, because such a label predisposes readers against the materials. Responding to pressures against materials about civil rights activities, a 1967 amendment to the *Library Bill of Rights* warned against excluding materials because of the social views of the authors. In its 1971 “Resolution on Challenged Materials,” the

association counseled libraries not to remove challenged materials unless, after an adversary hearing in a court of law, the materials were judged to be outside the protection of the First Amendment.

Changing circumstances necessitate constant review of the *Library Bill of Rights* and often result in position statements, called *Interpretations*, to clarify the document's application. The most recent *Interpretations* are Access to Electronic Information, Services and Networks adopted by the ALA Council in January 1996 and Intellectual Freedom Principles for Academic Libraries, approved by the ACRL Board in June 1999 and adopted by the ALA Council in July 2000.

Taken together, these documents recognize and explain that censorship of any materials, in any guise, eventually affects the library. The *Library Bill of Rights*, therefore, provides principles on which libraries may stand to oppose censorship and promote intellectual freedom. Referring directly to censorship practices, the *Library Bill of Rights* states that no library materials should be "excluded because of the origin, background, or views of those contributing to their creation" and that materials should not be "proscribed or removed because of partisan or doctrinal disapproval."

On its face, the profession's view of intellectual freedom is a pure one, based on a strict reading of the First Amendment to the U.S. Constitution, which states, "Congress shall make no law . . . abridging freedom of speech, or of the press." Within the limits defined by the United States Supreme Court (e.g., the legal doctrines governing obscenity, defamation, or "fighting words"), the position relies on the extension of First Amendment principles via the Fourteenth Amendment to the states and their agencies, including publicly supported libraries. (Some state constitutions actually provide greater protection for free speech than does the First Amendment as interpreted by the United States Supreme Court, but no state is permitted to provide less protection for these fundamental rights.) In actual practice, the purist position sometimes gives way to compromises by individual librarians, resulting in removal, labeling, or covert nonselection of certain materials.

If followed by librarians and governing bodies, however, the association's policy statements provide an effective means of helping to prevent library censorship. Ideally, application of these policies to materials selection, circulation practices, and complaint handling establishes the library as an indispensable information source for individuals exercising their freedom of inquiry.

FREE ACCESS TO LIBRARY MATERIALS

Access to library collections, and services is another concern of the profession. For intellectual freedom to flourish, opposition to censorship of materials is not

enough. Free access to materials for every member of the community also must be ensured. The ALA first recognized this in the 1939 *Library's Bill of Rights*, which included a proviso that library meeting rooms be available on equal terms to all groups in the community regardless of the beliefs and affiliations of their members.

Another policy on free access emerged from a study of segregation made by the association's Special Committee on Civil Liberties during the late 1950s. One result of the study was a 1961 amendment to the *Library Bill of Rights*, stating that "the rights of an individual to the use of a library should not be denied or abridged because of his race, religion, national origins, or political views." This amendment was broadened in 1967, when "social views" and "age" were incorporated to emphasize other areas of potential discrimination. "Age" was included to resolve a long-standing debate on the right of minors to have access to libraries on the same basis as adults.

In 1971, at the urging of the Task Force on Gay Liberation of the Social Responsibilities Round Table, the association recommended that libraries and ALA members strenuously combat discrimination in serving any individual from a minority, whether it be an ethnic, a sexual, a religious, or any other kind of minority. In 1980, the *Library Bill of Rights* was revised to encompass all discrimination based on "origin, age, background, or views." Interpretations of the *Library Bill of Rights* addressing specific issues that fall under these deliberately broad categories include "Access for Children and Young People to Videotapes and Other Nonprint Formats," "Access to Resources and Services in the School Library Media Program," "Free Access to Libraries for Minors," "Economic Barriers to Information Access," and "Access to Library Resources and Services Regardless of Gender or Sexual Orientation."

Another aspect of the library patron's access to materials was broached in 1970 when the Internal Revenue Service requested permission from several libraries to examine circulation records to determine the names of persons reading materials about explosives and guerilla warfare. The association responded by developing its "Policy on Confidentiality of Library Records," urging libraries to designate such records as confidential and accessible only "pursuant to such process, order, or subpoena as may be authorized under the authority of, and pursuant to, federal, state, or local law relating to civil, criminal, or administrative discovery procedures or legislative investigatory power." The rationale of the policy was that circulation records are purely circumstantial evidence that a patron has taken a book out of the library and that fear of persecution or prosecution may restrain users from borrowing any conceivably controversial materials, for whatever purpose.

The question of library records and the confidentiality of relationships between librarians and library users arose again in 1971 regarding the "use of grand jury procedure

to intimidate anti-Vietnam War activists and people seeking justice for minority communities.” In response, the association asserted “the confidentiality of the professional relationships of librarians to the people they serve, that these relationships be respected in the same manner as medical doctors to their patients, lawyers to their clients, priests to the people they serve,” and that “no librarian would lend himself to a role as informant, whether of voluntarily revealing circulation records or identifying patrons and their reading habits.”

In late 1987, it was disclosed that FBI agents were visiting libraries in what are best described as “fishing expeditions.” Agents generally first approached library clerks and solicited information on the use of various library services (e.g., interlibrary loan, database searches) by “suspicious looking foreigners” and, in some instances, asked to see the library’s circulation records.

A public confrontation between the IFC and the FBI eventually ensued. The IFC stressed the inextricability of First Amendment and privacy rights, as well as the fact that the bureau was requesting that librarians violate not only a professional ethic but also the law in 38 states and the District of Columbia. (As of this writing, there are confidentiality laws in 48 states and the District of Columbia and an attorney general’s opinion supporting confidentiality in two states.) The bureau refused to back away from what it characterized as a program to alert librarians to the possibility that libraries were being used by foreign agents as a place to recruit operatives, that librarians themselves were sometimes targeted for approach by foreign agents, and that valuable material was being stolen by these agents and their operatives. The IFC emphasized, in congressional testimony and in the media, the principle of open access to publicly available information and the central role of libraries in this society as providers of that access.

In the fall of 1989, through a Freedom of Information Act (FOIA) request, the ALA obtained documents from the FBI in which 266 individuals, all of whom had in some way criticized the Library Awareness Program (LAP), were identified as subjects of FBI “index checks.” These documents also suggested that the Library Awareness Program covered parts of the country other than solely New York City, as previously claimed by the FBI.

Early in 1990, the ALA wrote to President George Bush, then director of the FBI William Sessions, and the relevant House and Senate committees, urging that the LAP be discontinued and that the files of the 266 individuals be released to them and expunged from FBI records. Director Sessions responded in March 1990 by defending the program and denying that any investigation of the 266 had taken place, claiming that “index checks” were administrative and not investigative in nature. Subsequently, individuals were urged to make their own FOIA requests, but only one person who filed such a request later reported receiving any information from the FBI.

In addition, the ALA filed yet another FOIA request, which was denied, as was the appeal of that denial, on the grounds that the FBI was in litigation with the National Security Archive (NSA) over the same issue. The FBI promised to give the ALA any information released to the NSA and eventually did so. Nevertheless, the ALA reserved the right to bring suit against the FBI for denying its right of appeal and obstructing a legitimate attempt to gain information under the Freedom of Information Act.

The FBI has never publicly abandoned the Library Awareness Program and may still be conducting it.

Federal agencies are not alone in attempting to make use of library patron records. Local law enforcement officials, journalists, students, parents, fund-raisers, marketing professionals, civil litigants, and politicians have been known to seek borrowing records, registration data, mailing lists, and other information about library patrons. In 1990, a library director in Decatur, Texas, challenged one such attempt in court and won an important victory for library confidentiality policies. In *Decatur Public Library v. The District Attorney’s Office of Wise County*,¹⁷¹ the district attorney, investigating a child abandonment case, subpoenaed the records of all libraries in Wise County, requesting the names, addresses, and telephone numbers of all individuals who had checked out books on childbirth within the previous 9 months, the titles they borrowed, and the dates the materials were checked out and returned. The police had no evidence indicating that the person who abandoned the child might have borrowed library books or otherwise used the library. They were simply conducting a “fishing expedition.”

The director of the Decatur Public Library refused to comply with the subpoena and, with the help of the city attorney, filed a motion to quash it on behalf of the library’s patrons. On May 9, 1990, Judge John R. Lindsey ruled in favor of the library and quashed the subpoena. His decision recognized the library’s standing to assert a constitutional privilege on behalf of its unnamed patrons and clients, affirmed a constitutional right of privacy available to patrons, and held that the state was unable to demonstrate a compelling governmental objective under its police powers or other legitimate function of government to warrant intrusion of those rights.

In 1995, the issue of library user confidentiality again reached the courts in connection with a lawsuit brought by a tobacco company, Brown and Williamson, against the University of California. The company alleged that the University of California at San Francisco library possessed in its collection documents stolen from the company that purportedly showed that the tobacco industry had known of a link between smoking and cancer for many years and had failed to disclose it. The documents had previously been leaked to the press and discussed in congressional hearings at the time the lawsuit was filed. The lawsuit sought not only return of the documents but a list of all library patrons who had access to them and a

description of the nature of those users' research and publications.

The ALA's sister organization, the Freedom to Read Foundation, identified the case as one of extreme importance, with potential to set positive precedent in favor of First Amendment protection for library-user privacy, and filed an amicus brief explaining the crucial link between library confidentiality and First Amendment rights. Although the case ultimately was resolved without reaching the confidentiality issue, the fact that a request for library-user records was made as part of the lawsuit indicates the breadth of circumstances in which a threat to confidentiality may arise.

Through the association's various position statements, the profession has established a code of free access to services and materials for all library users. Opposed to using the library as a means of intimidating patrons, the profession strives to enhance the intellectual freedom of the library user by providing not only all materials requested but also free and equal access to all materials without fear of recrimination for pursuing one's interests.

THE LIBRARIAN AND INTELLECTUAL FREEDOM

Although the profession, through ALA, formulates policies to help ensure a climate favorable to intellectual freedom, the individual librarian is the key to achieving the end result. Adherence to the *Library Bill of Rights* by individual librarians is the only means of effecting the profession's goals. Consequently, the concept of intellectual freedom also considers the individual librarian's intellectual freedom, both in pursuit of professional responsibilities and in personal life. Several agencies within, or closely affiliated with, ALA encourage and protect the librarian's commitment to the principles of intellectual freedom. In relation to support for intellectual freedom, the *Code of Ethics* of the American Library Association, adopted by the ALA Council in June 1995, specifically states: "We uphold the principles of intellectual freedom and resist all efforts to censor library materials."

From 1940 until 1967, most of such activities were centered in the Intellectual Freedom Committee. For many years, the IFC not only recommended policies but also directed a variety of educational efforts, including collecting and publicizing information about censorship incidents, sponsoring censorship exhibits at conferences, conducting preconferences on intellectual freedom themes, and planning complementary programs to further the association's goals regarding intellectual freedom.

One of these complementary programs is the Office for Intellectual Freedom (OIF), established in December 1967. OIF evolved from a 1965 preconference on intellectual freedom held in Washington, DC. That meeting recommended establishing an ALA headquarters unit to conduct and coordinate the association's intellectual

freedom activities and to provide continuity for the total program. The goal of OIF is to educate librarians and the general public on the importance of intellectual freedom, relieving the IFC of this task and allowing it to concentrate on developing policy. The OIF serves as the administrative arm of the Intellectual Freedom Committee and bears the responsibility for implementing ALA policies on intellectual freedom, as approved by the ALA Council. The philosophy of the Office for Intellectual Freedom is based on the premise that if librarians are to appreciate the importance of intellectual freedom, they must first understand the concept as it relates to the individual, the institution, and the functioning of society. Believing that with understanding comes the ability to teach others, OIF maintains a broad program of informational publications, projects, and services.

The regular OIF publication is the bimonthly *Newsletter on Intellectual Freedom*. The Office also prepares special educational materials, (e.g., the *Banned Books Week Resource Kit* and others as need dictates). In addition, OIF works closely with ALA Publishing to develop relevant monographs. Recent titles have included *The Intellectual Freedom Manual, Sixth Edition*, by the Office for Intellectual Freedom (ALA, 2001); *Libraries, Access, and Intellectual Freedom: Developing Policies for Public and Academic Libraries*, by Barbara M. Jones (ALA, 1999); *Libraries, the First Amendment, and Cyberspace: What You Need to Know*, by Robert S. Peck (ALA, 2000); and *Speaking Out! Voices in Celebration of Intellectual Freedom* by Ann K. Symons and Sally Gardener Reed (ALA, 1999). OIF also distributes documents, articles, brochures, and all ALA policy statements concerning intellectual freedom in print and on the Web. As part of its information program, OIF maintains and distributes a banned books exhibit. The exhibit is available for display at national, state, and local conferences, workshops, seminars, and other meetings.

The Office for Intellectual Freedom advises and consults with librarians confronting potential or actual censorship problems. Telephone and letter requests about materials that have drawn the censorial efforts of an individual or group in the community prompt efforts to give appropriate assistance. Another means of assistance established in 1994 is the Intellectual Freedom Action Network, a group of concerned volunteers who have identified themselves as willing to stand up in support of intellectual freedom when controversy comes to their area and to alert OIF to the activities of censorship pressure groups in their communities. The OIF coordinates the Action Network, calling on its members when necessary to write letters, attend meetings, or provide moral support to librarians fighting censorship in their localities.

OIF also coordinates the Intellectual Freedom Committee's relations with other organizations having similar concerns. These include the intellectual freedom committees of the ALA divisions and state library association intellectual freedom committees. Close contact with

nonlibrary organizations, such as the Association of American Publishers, the American Booksellers Foundation for Free Expression, the American Civil Liberties Union, the National Coalition against Censorship, and others, is also maintained.

As ALA's intellectual freedom program developed, the need for an organizational forum through which individual ALA members could participate in intellectual freedom activities according to their varying levels of interest began to be felt. At the 1973 Annual Conference in Las Vegas, the Intellectual Freedom Round Table (IFRT) was organized as the Association's membership, activity program for intellectual freedom. The activities of the round table supplement OIF's education program and offer opportunities for ALA members to become active in the association's intellectual freedom efforts.

The IFRT sponsors three intellectual freedom awards. The annual State and Regional Achievement Award, given by the IFRT since 1984, was revised in 1991. Formerly presented to a state Intellectual Freedom Committee, the award has been expanded to include "state educational media association intellectual freedom committee[s], state intellectual freedom coalition[s], legal defense fund[s] or other such group that has implemented the most successful and creative state intellectual freedom project during the calendar year. The award also may be presented for on-going or multiyear projects." In 1975, IFRT established the John Philip Immroth Memorial Award for Intellectual Freedom, given annually in memory of the cofounder and first chairperson of the round table, "to honor notable contributions to intellectual freedom and demonstrations of personal courage in defense of freedom of expression." Biennially, the IFRT sponsors the Eli M. Oboler Award, presented for the best published work in the area of intellectual freedom.

The Intellectual Freedom Committee, the Office for Intellectual Freedom, and the Intellectual Freedom Round Table are the primary agencies for establishing and promoting the association's positions on questions involving intellectual freedom. In addition, the Intellectual Freedom Action Network supports these positions and responds to controversies on the local level. The element in the association's program in support and defense of intellectual freedom that takes the most aggressive, proactive role, however, is the Freedom to Read Foundation.

Incorporated in November 1969, the Freedom to Read Foundation was ALA's response to librarians who increasingly wanted defense machinery to protect their jobs from jeopardy when they undertook to challenge violations of intellectual freedom. Another primary objective in establishing the foundation was to have a means through which librarians and other concerned individuals and groups could begin to set legal precedents for the freedom to read. The foundation was created outside the structure of ALA and, to ensure its full freedom to act with vigor in

the legal arena, it remains legally and financially independent. But the foundation is closely affiliated with ALA through the ex officio membership of ALA officers on its board of trustees, and through its executive director, who also serves as director of the ALA Office for Intellectual Freedom.

A program of education on the importance of, and the necessity for a commitment to, the principles of intellectual freedom requires assurance that such commitment will not result in reprisals, such as legal prosecution, financial loss, or personal damage. The Freedom to Read Foundation attempts to provide that assurance through financial and legal assistance and legal challenges to restrictive legislation, thereby helping to create a favorable climate for intellectual freedom. Through the provision of financial and legal assistance, the foundation attempts to negate the necessity for librarians to make the difficult choice between practical expediency (i.e., keeping a job) and upholding principles, such as in selecting materials for library collections. Through its various projects and grants, the foundation hopes to establish those principles enunciated in the *Library Bill of Rights* as legal precedents rather than mere paper policies.

Established by the Freedom to Read Foundation, but now formally independent, the LeRoy C. Merritt Humanitarian Fund was created in 1970. The Merritt Fund was established by the foundation's board of trustees in recognition of individuals' need for subsistence and other support when their positions are jeopardized or lost as a result of defending intellectual freedom. This special fund offers short-term, immediate assistance even prior to the development of all pertinent facts in a particular case, whether or not legal action has been taken.

In the combined forces of the Intellectual Freedom Committee, the Office for Intellectual Freedom, the Intellectual Freedom Round Table, the Intellectual Freedom Action Network, and the Freedom to Read Foundation, along with the LeRoy C. Merritt Humanitarian Fund, the library profession has available a complete program to support the practice of intellectual freedom. The profession, however, has not yet achieved the same success in a closely related area, that of the librarian's personal rather than professional intellectual freedom. The question of what support should be given to librarians who suffer professionally because of personal beliefs and actions has been approached in individual cases but has not been fully resolved.

One of the first instances involving potential recriminations in a professional capacity as a result of personal beliefs occurred in the late 1940s, with the advent of "loyalty oaths" and "loyalty programs" designed to ferret out communists and "subversives." The Intellectual Freedom Committee faced the loyalty issue with its Policy on Loyalty Programs, first adopted by the council in 1948 and revised in 1951. When another case arose in Florida in 1969, the Policy on Loyalty Programs was reexamined

and again revised. The last revision, adopted by the council in January 1971, states in part the following:

The American Library Association strongly protests loyalty programs which inquire into a library employee's thoughts, reading matter, associates, or membership in organizations, unless a particular person's definite actions warrant such investigation. We condemn loyalty oaths as a condition of employment and investigations which permit the discharge of an individual without a fair hearing.^[8]

In 1969, another incident arose involving a librarian who lost his position because of actions, based on personal beliefs, taken in his capacity as a private citizen. T. Ellis Hodgin was fired as city librarian of Martinsville, Virginia, shortly after he joined a lawsuit challenging the constitutionality of a religious education course taught in the city school his daughter attended. He also had been active in civil rights efforts. Hodgin's situation sparked a controversy among librarians, resulting in a recommendation from the Intellectual Freedom Subcommittee of the Activities Committee on New Directions for ALA (ACONDA):

The scope of intellectual freedom encompasses considerably more than just the freedom to read. Support must also be rendered to the librarian who is fired for sporting a beard, for engaging in civil rights activities, etc., etc. And he should not have to claim "poverty" in order to receive it.^[9]

The recommendation, however, was not approved as part of the final ACONDA report.

Some concerned librarians responded to Hodgin's plight by organizing the National Freedom Fund for Librarians (NFFL), which collected several thousand dollars to aid him. (When the NFFL disbanded in 1971, its cash balance was sent to the LeRoy C. Merritt Humanitarian Fund.)

Hodgin also appealed to the Freedom to Read Foundation for assistance to defray the financial hardship he suffered when he lost his position. In June 1970, the foundation's executive committee awarded him \$500

for having suffered in his defense of freedom of speech as a result of which he lost his position as a librarian. Inasmuch as it is the obligation of the librarian to protect free speech and a free press through his work as a librarian, it is then particularly appropriate that, when he is deprived of his job because of his own exercise of free speech, the Freedom to Read Foundation assist him in the defense of his freedom.^[10]

A second grant of \$500 was made to Hodgin in January 1971 for the specific purpose of perfecting an appeal of his suit for reinstatement to the U.S. Supreme Court.

The limits of intellectual freedom were again debated by the profession when the case of J. Michael McConnell arose in 1970. The Intellectual Freedom Committee found that McConnell's rights "under the First Amendment have been violated" because he met reprisals for freely expressing his sexual preference.^[11] On that basis, the LeRoy C. Merritt Humanitarian Fund granted \$500 to help defray financial hardship occasioned by his inability to find another job.

The question of how far librarians are willing to extend the scope of intellectual freedom for the benefit of their colleagues was raised anew in 1979 by the case of Utah librarian Jeanne Layton. In September 1979, Layton was dismissed from her position as library director in Davis County after she refused to comply with requests to remove the novel *Americanas*, by Don DeLillo, from library shelves. The following month she filed suit to regain her job.

The suit was supported from the beginning by the Freedom to Read Foundation, but it soon became clear that the legal battle would be a lengthy and very costly one. Both the Intellectual Freedom Committee and the Freedom to Read Foundation designated the case a priority for 1980. The Utah Library Association rallied librarians and others statewide in support. At the 1980 ALA Annual Conference in New York, the Freedom to Read Foundation announced that it would match two dollars for every dollar contributed to Jeanne Layton's defense from June 27, 1980, to December 31, 1980, up to a limit of \$10,000 in matching funds. The response was, in the words of Foundation President Florence McMullin, "nothing short of overwhelming." When the challenge expired, \$6024 had been received, of which \$5000 was matched "two for one" by the foundation. Moreover, Jeanne Layton won her suit and regained her job, and one of her main antagonists was defeated for reelection to the county commission.

Although the question of how far librarians will go to support colleagues in defense of intellectual freedom will always be resolvable only on a case-by-case and issue-by-issue basis, the response to Layton's courageous stand surely indicates that in general the library profession takes its responsibilities on this front seriously indeed.

THE LIBRARY AND INTELLECTUAL FREEDOM

Each aspect of intellectual freedom in libraries that has been discussed to this point has involved library users and their access to all published materials, as well as librarians and their practice of professional or personal intellectual freedom.

One aspect of intellectual freedom remains to be examined: the library as an institution and the nature of its role in social change and education. Continually debated within the profession and the American Library

Association, the issue has been summarized as “neutrality versus advocacy.” In essence, the question is, can libraries, as institutions, advocate social or political causes and still maintain their image as providers of views representing all sides of all questions?

Whenever the question is raised, it initiates further queries. For example, what constitutes advocating a cause—biased book selection, biased displays, prejudicial assignment of library meeting rooms? Or, what constitutes a cause—peace, ecology, democracy? If a library sponsors a display of books on peace, to maintain neutrality must it also sponsor a display on war? The questions are complex, and the answers have shown no uniformity whatsoever. The American Library Association itself has vacillated on the main issue, reaching only a partial resolution in the late 1960s and the early 1970s.

At the 1969 Annual Conference in Atlantic City, the membership and the council debated whether the association should take a public stand opposing the war in Vietnam or opposing deployment of an antiballistic missile system (ABM). It was argued that because political and moral issues are so deeply entangled with education and library issues, institutions such as ALA and libraries are obligated to take such positions. Those who opposed such positions argued in favor of neutrality on questions not directly related to libraries. They argued that intellectual freedom for those librarians opposed to the majority view would be violated if the association attempted to take stands on social and political issues. They further maintained that they had tradition on their side, because the association had always declined to take a stand on issues not directly related to libraries. That argument, of course, was incorrect. The association had previously taken stands in some instances and refused to do so in others.

In June 1921, for example, the ALA Council espoused a very decided position on the question of disarmament after the First World War. In a strong resolution, the council stated the following:

WHEREAS, The members of the American Library Association had full demonstration of the pain and pinch that belongs to war and the increased cost of all necessities, both personal and professional, caused thereby; and

WHEREAS, The exigencies of international conditions brought about by the cost of war is appalling from every standpoint; and

WHEREAS, We believe the example of the United States in this matter will be followed by the other nations;

THEREFORE BE IT RESOLVED, That the American Library Association urge upon the president of the United States and Congress the initiative of a movement leading to a reduction of armament at the earliest possible moment; and be it further

RESOLVED, That a request be made by the members of the American Library Association to their individual congressman for such action and that a record be made of the replies.^[12]

However, in 1928, when faced by a request from the American Civil Liberties Union that ALA adopt “one or more resolutions on civil liberty,” the ALA Executive Board declined, saying the association “does not take actions on questions outside the library and bibliographic field.”^[13] That was similar to the philosophy that prevailed in 1969, when the Vietnam and ABM resolutions failed to pass the council. The question arose again, however, at the 1970 and 1971 Midwinter Meetings and Annual Conferences. After a great deal of debate, the Council voted at its 1970 Annual Conference in Detroit to “define the broad social responsibilities of ALA in terms of the willingness of ALA to take a position on current critical issues with the relationship to libraries and library service clearly set forth in the position statements.”^[14]

In line with this policy, a carefully reworded resolution opposing the war in Vietnam was adopted by the council 1 year later:

WHEREAS, The stated objective of the American Library Association is the promotion and improvement of library service and librarianship; and

WHEREAS, Continued and improved library service to the American public requires sustained support from the public monies; and

WHEREAS, The continuing U.S. involvement in the conflict in Southeast Asia has so distorted our national priorities as to reduce substantially the funds appropriated for educational purposes, including support for library services to the American people; and

WHEREAS, Continued commitment of U.S. arms, troops, and other military support has not contributed to the solution of this conflict;

BE IT THEREFORE RESOLVED, That the American Library Association calls upon the president of the United States to take immediately those steps necessary to terminate all U.S. military involvement in the present conflict in Southeast Asia by December 31, 1971, and to insure the reallocation of national resources to meet pressing domestic needs.^[15]

With approval of the Vietnam resolution, the association seemed to give broader interpretation to the old “library and bibliographic field.” However, this more permissive interpretation still did not resolve the more basic question of whether libraries themselves should follow the course of neutrality or advocacy.

The contradiction was further focused in July 1974, when ALA endorsed the Equal Rights Amendment.

ALA's support for ERA went much farther than its opposition to U.S. military involvement in Southeast Asia. In 1977, the council voted not to hold conferences in states that had not ratified the amendment. In June 1978, the council endorsed the ERA Extension Resolution and, at the 1979 Midwinter Meeting, established an ERA task force charged with assisting and consulting with "ALA Chapters in carrying out the commitment to passage of the Equal Rights Amendment in ways best suited to the individual states."^[16]

The association justified this active support of the proposed amendment, first, by noting the support already expressed by other professional associations "by reason of its beneficial implications for all persons in the American society," and, more specifically, as an outgrowth of ALA's policy requiring equal employment opportunity in libraries, adopted at the 1974 Midwinter Meeting. The resolution in support of ERA noted that "women constitute 82 percent of the library profession." Hence, it was argued, "equal employment required support of equal rights for women."^[17] None of the operative resolutions on ERA addressed themselves to the content of library collections. Opponents of the amendment and pro-ERA advocates of ALA neutrality, however, were quick to argue that library users "have a right to expect the library to furnish them with uncensored information on both sides of this and all other issues. Adoption of advocacy positions and participation in boycotts cannot help but strike a blow at the public's confidence in the fair-mindedness and even-handedness of librarians."^[18]

Yet another aspect of the advocacy versus neutrality conundrum was addressed by the association in 1987 at its annual conference in San Francisco. David Henington, director of Houston Public Library, brought to the IFC for its response and assistance an antiapartheid ordinance passed and implemented by the City of Houston. This ordinance required that all city agencies obtain certification from suppliers of goods and services that they had no affiliates in, and did no business with, the Republic of South Africa. The Houston City Council subsequently voted to exempt both the public library and the city zoo from the requirements of the ordinance. Henington asserted that this requirement was causing serious acquisition problems for the library. Major information services, such as the New York Times Company, the *Wall Street Journal*, and leading publishers, refused to sign such certificates. Some refused because they have reporters in South Africa, one religious group because it has missionaries there, and on principle, in the belief that the free flow of information both into and out of the Republic of South Africa must be defended and enlarged for the sake of those struggling to dismantle the apartheid system there. Because it did not have a copy of the ordinance in hand and because it had received reports of similar ordinances elsewhere, the IFC voted to explore the matter further.

Two ALA members decided that the issue should be taken to the membership at that conference, and they presented a resolution at the membership meeting. The resolution stressed the intellectual freedom implications of this policy and asked that ideas and information be exempted from the laudable goal of enforcing economic sanctions against the Republic of South Africa for its abhorrent apartheid system. A heated encounter ensued between the presenters and other supporters of the resolution and those who saw it as supportive of apartheid and, therefore, racist. The resolution was resoundingly defeated.

At the 1988 Annual Conference in New Orleans, the membership adopted a resolution reaffirming its commitment to Article 19 of the Universal Declaration of Human Rights: "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media regardless of frontiers."

Measuring the Profession's Response

At the present time, the profession uniformly disdains censorship of published materials, print or nonprint. The attitude toward user access is somewhat uniform but contains a great deal of dissent on the question of access for minors to all the materials in a library collection. On the question of the librarian's professional practice of intellectual freedom, there is near agreement that every effort should be made to encourage and protect this aspect of librarianship. The librarian's personal intellectual freedom, on and off the job, presents some points of agreement, but major areas of dissent still exist. The same is true in the area of institutional neutrality versus advocacy.

One conclusion from a review of the history, status, and future of intellectual freedom in libraries is that the American Library Association's positions and programs provide one of the few gauges for measuring the profession's response to the problems of defining, promoting, and defending the concept. The evolving position of the ALA reflects the steady emergence of a philosophy within the entire library community. Although that philosophy exhibits some loose ends, its core grows firmer, based on a history of trial and error and forced response to a continually changing social climate. The philosophy is young, too young to be rooted in tradition, but gradually it has gained recognition as the substance of the total philosophy shaping library service in the United States.

Challenges and Issues Today

The major issues facing libraries today continue to focus on free and open access to information. The ALA continues to support a commitment to the right of unrestricted access to information and ideas, regardless of the communications medium. This commitment was confirmed most recently in regard to the Internet.

In February 1996, the Communications Decency Act (CDA) was signed into law by President Clinton as a way to keep "indecent" material from anyone under the age of 18. The act said that if anyone under 18 was allowed to view "indecent" material, the provider was subject to a fine of up to \$250,000 and/or up to 2 years in prison. The CDA placed librarians and libraries at risk because the term "indecent" was not defined, providing no guidelines for librarians. The ALA filed a lawsuit (*American Library Association v. U.S. Department of Justice*) in February 1996 challenging the CDA's constitutionality. It was later consolidated with, and decided under, a separate suit brought by the ACLU (*ACLU v. Reno*). The lawsuit argued three points: 1) Prohibiting material as "indecent" was unconstitutional because the term was vague and undefined. In addition, the act did not distinguish between the information needs of a five-year-old child and a 17-year-old in college. 2) Congress had not considered alternative ways that parents might protect their own children in their own home, for instance, by using filtering software. 3) The Internet is not a broadcast medium but is more like the print medium in that each person controls what they access.

In June 1996, a lower court declared the CDA unconstitutional. The government appealed, and in June 1997, the U.S. Supreme Court, by a 9-0 vote, held the CDA unconstitutional.

A unanimous Supreme Court decision notwithstanding, Congress went back to the drawing board. The second proposal was the Child Online Protection Act (COPA). In this attempt to circumvent the Supreme Court's CDA decision, Congress made two major changes: the "harmful to minors" standard replaced the "indecent" standard, and the focus was on "commercial" speech.

COPA also established a commission to study the effects of "inappropriate" material on children.

The sponsors believed these changes would save COPA from the fate of the Communications Decency Act, but the Third Circuit Court of Appeals in Philadelphia, the same court which handed down the original CDA decision (subsequently upheld by the Supreme Court), held COPA unconstitutional. The government, of course, appealed to the U.S. Supreme Court, and the Supreme Court heard the case on Wednesday, November 28, 2001.

The government's third attempt to control the Internet is the Children's Internet Protection Act (CIPA). CIPA requires libraries receiving certain types of federal funding to establish Internet safety policies and to use technology that blocks or filters material that is obscene, child pornography, or, when a minor is using the computer, "harmful to minors." This legislation once again puts librarians in an impossible position. Even filtering companies acknowledge that "technology" is incapable of making the fine distinction between legal speech and speech, which falls into these three and is not constitutionally protected.

On March 20, 2001, the American Library Association and several coplaintiffs filed suit, challenging the

Children's Internet Protection Act in the Third Circuit Court of Appeals. The case is scheduled to be heard in early 2002.

In addition to the ongoing debate over the Internet and filtering, there are a number of other issues facing libraries and librarians today. These include:

- Harassment, or a hostile work environment, produced by open access to the Internet.
- First Amendment rights of minors and their free access to information, as well as the attempt by some to mandate protection for minors from materials that may be "harmful to minors."
- Continued requests to libraries for patron records under the Freedom of Information Act. This has been of great concern to librarians in relation to new technology which can track a specific patron's Internet use.

The ALA continues to regularly develop resources to aid librarians in managing and communicating about the Internet. These include the *Libraries & The Internet Toolkit*. For the most current resources and the latest information, see the ALA Web site, which is updated and revised regularly.

CONCLUSION

Although the specific challenges will continue to evolve, the issues and principles remain the same. Librarians and libraries fulfill a unique role in our democratic society. Like no other group, we strive to preserve and protect free and open access to information for all who use our libraries. For, as James Madison explained: "A popular government, without popular information, or the mean of acquiring it, is but a prologue to a farce or a tragedy; or perhaps both. Knowledge will forever govern ignorance; and a people who mean to be their own governors must arm themselves with the power which knowledge gives."

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Intelligence and Security Informatics

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Abstract

The tragic events of September 11, 2001, have had far-reaching effects on many aspects of U.S. society. Six critical mission areas, as suggested in the “National Strategy for Homeland Security” report, have been identified where information technology can contribute to safeguarding our national security. These areas include *intelligence and warning, border and transportation security, domestic counterterrorism, protecting critical infrastructure, defending against catastrophic terrorism, and emergency preparedness and responses*. Intelligence and Security Informatics (ISI) encompasses the development of advanced and socially responsible information technologies, systems, algorithms, and databases for national security related applications, through an integrated technological, organizational, policy-based, and privacy-preserving approach. This entry reviews current ISI research challenges and presents a research framework with a primary focus on knowledge discovery from databases (KDD) technologies. The framework is discussed in the context of crime types and security implications. In addition to the technical discussions, caveats for data mining and civil liberties concerns are also considered.

INTRODUCTION

The tragic events of September 11 have caused far-reaching changes to many aspects of society. Terrorism is one of the most significant threats to national security due to its potential of bringing massive damage to our infrastructure, economy, and people. In response to this challenge, federal authorities are actively implementing comprehensive strategies and measures in order to achieve the three objectives identified in the “National Strategy for Homeland Security” report:^[1] 1) preventing future terrorist attacks; 2) reducing the nation’s vulnerability; and 3) minimizing the damage and enabling recovery from attacks that occur. State and local law enforcement agencies, likewise, are becoming more vigilant about criminal activities, which can harm public safety and threaten national security.

Academics in the fields of natural sciences, computational science, information science, social sciences, engineering, medicine, and many others have also been called upon to help enhance the government’s abilities to fight terrorism and other crimes. Science and technology have been identified in the “National Strategy for Homeland Security” report as the keys to win the new counterterrorism war.^[1] Especially, it is believed that information technology will play an indispensable role in making our nation safer,^[2] by supporting intelligence and knowledge discovery through collecting, processing, analyzing, and utilizing terrorism- and crime-related data.^[3,4] Based on the crime and intelligence knowledge

discovered, federal, state, and local authorities can make timely decisions in selecting effective strategies and tactics as well as allocate the appropriate amount of resources to detect, prevent, and respond to future attacks.

PRIVACY VS. INFORMATION SHARING: A BROADER SOCIETAL ISSUE

To protect the United States from future terrorist attacks, various law enforcement and homeland security agencies must act proactively and collaboratively to thwart planned or future acts of aggression. Most government agencies involved in safeguarding national security create their own databases and other stores of information which relate to potential sources of threats. The sharing of such data stores has been widely proposed as a method for leveraging existing knowledge to better forecast possible attacks. However, these shared databases may be misused, and may violate the privacy rights and civil liberties of innocent citizens. Privacy is the ability of an individual or group to keep their lives and personal affairs out of public view, or to control the flow of information about them. It is considered by many to be one of the most fundamental rights of citizens in a modern society.

More than ever, information technologies have become more prevalent and overreaching in modern day, post-Internet society. Companies, organizations, and governments are using better databases, Internet applications, and information technologies to collect information about

their customers, employees, and citizens. Advanced data mining techniques have also been increasingly used by companies and governments to better understand their customers or citizens. These pervasive and powerful technologies are also beginning to adversely affect individual privacy. How can one tell what kind of data is being collected by whom, and for what purposes? How can one ensure that data are collected and used for, and only for, the intended purposes?

Many information misuses have been reported in popular news sources (e.g., identity theft reported in <http://law.jrank.org/pages/7469/Identity-Theft.html>). In one federal prosecution, the defendants allegedly obtained the names and social security numbers of U.S. military officers from a Web site. The defendants used more than 100 of those names and social security numbers to apply for a Delaware Bank credit card. The fraudulent credit card transaction cost the Delaware Bank millions of dollars in 2000. In another reported case in the Central District of California, a woman pleaded guilty for using a stolen social security number and filing for bankruptcy in the name of her victim. Because (digital) information can be easily collected, copied, transmitted, and (potentially) misused, information collectors' abilities to safeguard the data they collect is even more critical now.

Despite the clear need for maintaining individual privacy, governments and businesses may have reasons for accessing and sharing customer or citizen information. Many previous court cases have supported such uses. For example, in *Davis versus Freedom of Information Commission*, 259 Conn. 45 (2001) The Connecticut Supreme Court declared that the Drivers Privacy Protection Act (DPPA) does not prohibit other government agencies from receiving personal information from the State DMV in the course of their normal government functions. Similarly, in 2002, Nevada's highest court ruled that the incoming and outgoing calls on the public telephones are not considered to be protected information and may be used for other purposes. Clearly, privacy and information sharing will continue to raise serious debates for the foreseeable future.

INFORMATION TECHNOLOGIES AND NATIONAL SECURITY

As part of the post-9/11 national security programs in the United States, six critical mission areas have been identified where information technology can contribute to the accomplishment of the strategic national security objectives identified in the "National Strategy for Homeland Security" report:^[1]

- *Intelligence and warning.* Although terrorism depends on surprise to bring damage to targets,^[1] terrorist activities are neither random nor impossible to track. Terrorists must plan and prepare before the execution of

an attack by selecting a target, recruiting and training executors, acquiring financial support, and traveling to the country where the target is located.^[5] To avoid being preempted by authorities they may hide their true identities and disguise attack-related activities. Similarly, criminals may use falsified identities during police contacts.^[6] Although it is difficult, detecting potential terrorist attacks or crimes is possible and feasible with the help of information technology. By analyzing the communication and activity patterns among terrorists and their contacts (i.e., terrorist networks), detecting deceptive identities, or employing other surveillance and monitoring techniques, intelligence and warning systems may issue timely, critical alerts and warnings to prevent attacks or crimes from occurring.

- *Border and transportation security.* Terrorists enter a targeted country through an air, land, or sea port of entry. Criminals in narcotics rings travel across borders to purchase, carry, distribute, and sell drugs. Information, such as travelers' identities, images, fingerprints, vehicles used, and other characteristics, is collected from customs, borders, and immigration authorities on a daily basis. The collection can greatly improve the capabilities of counterterrorism and crime-fighting capabilities by creating a "smart border" where information from multiple sources is shared and analyzed to help locate wanted terrorists or criminals. Technologies such as information sharing and integration, collaboration and communication, biometrics, and image and speech recognition will be greatly needed to create smart borders across all ports of entry.
- *Domestic counterterrorism.* Because both international and domestic terrorists may be involved in local crimes, state and local law enforcement agencies are also investigating and prosecuting terrorism-related crimes. Terrorism, like gangs and narcotics trafficking, is regarded as a type of organized crime in which multiple offenders cooperate to carry out offenses. Information technologies that help find cooperative relationships between criminals and their interactive patterns are also helpful for analyzing terrorism. Monitoring activities of domestic terrorist and extremist groups using advanced information technologies will also likely to be helpful to public safety personnel and policy makers.
- *Protecting critical infrastructure and key assets.* Roads, bridges, water suppliers, and many other physical service systems are critical infrastructure and are key assets of a nation. They may become the target of terrorist attacks because of their vulnerabilities.^[1] Moreover, virtual (cyber) infrastructure such as the Internet may also be vulnerable to intrusions and inside threats.^[7] Criminals and terrorists are increasingly using cyberspace to conduct illegal activities, share ideology, solicit funding, and recruit. In addition to

physical devices such as sensors and detectors, advanced information technologies are needed to model the normal behaviors of the usage of these systems and then use the models to distinguish abnormal behaviors from normal behaviors. Protective or reactive measures can be selected based on the results to secure these assets from attacks.

- *Defending against catastrophic terrorism.* Terrorist attacks can cause devastating damage through the use of chemical, biological, or radiological weapons. Biological attacks, for example, may cause contamination, infectious disease outbreaks, and significant loss of life. Information systems that can efficiently and effectively collect, access, analyze, and report data about catastrophe-leading events can help prevent, detect, respond to, and manage these attacks.^[8]
- *Emergency preparedness and responses.* In case of a national emergency, prompt and effective responses are critical to reducing the damage resulting from an attack. In addition to the systems that are prepared to defend against catastrophes, information technologies that help design and experiment optimized response plans,^[9] identify experts, train response professionals, and manage consequences are beneficial for both planning and emergency response. Moreover, information systems that facilitate social and psychological support to the victims of terrorist attacks can also assist disaster recovery efforts.

PROBLEMS AND CHALLENGES

Although it is important for the critical missions of national security, the development of information technology for counterterrorism and crime-fighting applications faces many problems and challenges. Currently, intelligence and security agencies are gathering large amounts of data from various sources. Processing and analyzing such data, however, have become increasingly difficult tasks. Treating terrorism as a form of organized crime allows the categorization of these challenges into the following types:

- *Characteristics of criminals and crimes.* Crimes can be geographically diffused and temporally dispersed. In organized crimes such as transnational narcotics, the trafficking criminals often live in different cities, states, or even countries. Drug distribution and sales occur in different places at different times. Similar situations exist in other organized crimes (e.g., terrorism, armed robbery, and gang-related crime). As a result, investigations must cover multiple offenders who commit criminal activities in different places at different times. This can be fairly difficult given the limited resources that most intelligence and security

agencies have. Moreover, as computer and Internet technologies advance, criminals are utilizing cyberspace to commit various types of cyber-crimes under the disguise of ordinary online transactions and communications.

- *Characteristics of crime and intelligence related data.* A significant source of challenge is information stovepipe and overload resulting from diverse data sources, multiple data formats, and large data volumes. Unlike other domains such as marketing, finance, and medicine in which data can be collected from particular sources (e.g., sales records from companies, patient medical history from hospitals), the intelligence and security domain does not have a well-defined data source. Both authoritative information (e.g., crime incident reports, telephone records, financial statements, immigration and custom records) and open-source information (e.g., news stories, journal articles, books, Web pages) need to be gathered for investigative purposes. Data collected from these different sources often are in different formats ranging from structured database records to unstructured text, image, audio, and video files. Important information such as criminal associations may be available but contained in unstructured, multilingual texts and can therefore remain difficult to access and retrieve. Moreover, as data volumes continue to grow, extracting valuable and credible intelligence and knowledge becomes a difficult problem.
- *Characteristics of crime and intelligence analysis techniques.* Current research on the technologies for counterterrorism and crime-fighting applications lacks a consistent framework for addressing the major challenges. Some information technologies including data integration, data analysis, text mining, image and video processing, and evidence combination have been identified as being particularly helpful.^[2] However, the question of how to employ them in the intelligence and security domain and use them to effectively address the critical mission areas of national security (with proper protection of privacy and civil liberties) remains unanswered and requires further research.

AN ISI RESEARCH FRAMEWORK

“Intelligence and Security Informatics” (ISI)^[3,4,10] is a multidisciplinary science with its main objective being the “development of advanced and socially responsible information technologies, systems, algorithms, and databases for national security-related applications, through an integrated technological, organizational, policy-based, and privacy-preserving approach.” ISI has at its core a focus on developing and employing computationally intensive techniques with the goal of increasing current levels of

national security through an integrated approach that takes into account organizational considerations; national security priorities; laws, regulations, and policies; and privacy protection. This next section presents a research framework with a primary focus on knowledge discovery from databases (KDD) technologies, and is discussed in the context of crime types and security implications.

Crime is an act or the commission of an act that is forbidden, or the omission of a duty that is commanded by a public law and that makes the offender liable to punishment by that law. The more threat a crime type poses to public safety, the more likely it is to be of national security concern. Some crimes, such as traffic violations, theft, and homicide, are primarily in the jurisdiction of local law enforcement agencies. Other crimes need to be dealt with by both local law enforcement and national security authorities. Identity theft and fraud, for instance, is relevant at both the local and national levels—criminals may escape arrest by using false identities, or drug smugglers may enter the United States by holding counterfeited passports or visas. Organized crimes such as terrorism and narcotics trafficking often diffuse geographically, resulting in common security concerns across cities, states, and countries. Cyber-crimes can pose threats to public safety across multiple jurisdictional areas due to the widespread nature of computer networks. Table 1 summarizes the different types of crimes sorted by the degree of their respective public influence.^[4] International and domestic terrorism, in particular, often involves multiple crime types (e.g., identity theft, money laundry, arson and bombing, organized and violent activities, and cyber-terrorism) and has the potential to cause enormous damage.

KDD techniques can play an important role in improving counterterrorism and crime-fighting capabilities of intelligence, security, and law enforcement agencies by reducing cognitive and information overload that results from dealing with massive amounts of data. Knowledge discovery refers to the nontrivial extraction of implicit,

previously unknown, and potentially useful knowledge from data. Knowledge discovery techniques promise easier, more convenient, and practical exploration of very large collections of data for organizations and users, and have been applied in marketing, finance, manufacturing, biology, and many other domains (e.g., predicting consumer behaviors, detecting credit card frauds, or clustering genes that have similar biological functions).^[11] Traditional knowledge discovery techniques include association rule mining, classification and prediction, cluster analysis, and outlier analysis.^[12] As natural language processing (NLP) research advances, text mining approaches that automatically extract, summarize, categorize, and translate text documents have also been widely used.

Many of these KDD technologies can be applied in ISI studies.^[3,4] Existing ISI technologies can be categorized into six classes: *information sharing and collaboration*, *crime association mining*, *crime classification and clustering*, *intelligence text mining*, *spatial and temporal crime mining*, and *criminal network mining*. These six classes are grounded on traditional knowledge discovery technologies, but with new approaches added, including spatial and temporal crime pattern mining and criminal network analysis, which are more relevant to counterterrorism and crime investigation. In addition, new research has begun in the areas of privacy-preserving, security-aware data integration and data mining. Although information sharing and collaboration are not data mining per se, they help prepare, normalize, warehouse, and integrate data for knowledge discovery and thus are included in the framework.

Fig. 1 presents the proposed research framework, showing crime types and the six classes of techniques useful for (or showing the promise of utility to) the investigation of the various crime types.^[4] The crime data mining techniques are listed, from bottom to top, in an increasing scale of analysis capability. Note that more serious crimes—those inducing greater public harm—may require a more complete set of knowledge discovery

Table 1 Crime types and security concerns.

Crime types		
Type	Local law enforcement level	National security level
Traffic violations	Driving under influence (DUI), fatal/personal injury/property damage, traffic accident, road rage	—
Sex crime	Sexual offenses, sexual assaults, child molesting	Organized prostitution, people smuggling
Theft	Robbery, burglary, larceny, motor vehicle theft, stolen property	Theft of national secrets or weapon information
Fraud	Forgery and counterfeiting, fraud, embezzlement, identity deception	Transnational money laundering, identity fraud, transnational financial fraud
Arson	Arson on buildings, apartments	
Organized crime	Narcotic drug offenses (sales or possession), gang-related offenses	Transnational drug trafficking, terrorism (bioterrorism, bombing, hijacking, etc.)
Violent crime	Criminal homicide, armed robbery, aggravated assault, other assaults	Terrorism
Cyber crime	Internet fraud (e.g., credit card fraud, advance fee fraud, fraudulent Web sites), illegal trading, network intrusion/hacking, virus spreading, hate crimes, cyber-piracy, cyber-pornography, cyber-terrorism, theft of confidential information	

	Crime Types							
Crime Data Mining Techniques	Traffic Violation	Sex Offense	Theft	Fraud	Arson	Organized Crime	Violent Crime	Cyber Crime
Criminal Network Analysis						X	X	X
Spatial and Temporal Pattern Mining				X		X	X	X
Text Mining		X	X	X	X	X	X	X
Classification & Clustering	X	X	X	X	X	X	X	X
Association	X	X	X	X	X	X	X	X

Fig. 1 A knowledge discovery research framework for ISI.

techniques. For example, the investigation of organized crimes such as terrorism may depend on criminal network analysis technology, which requires the use of other knowledge discovery techniques such as association mining and clustering. An important observation about this framework is that the high-frequency occurrences and strong association patterns of severe and organized crimes such as terrorism and narcotics trafficking present a unique opportunity and potentially high rewards for adopting such a knowledge discovery framework.

Some of these classes of data mining techniques are of great relevance to ISI research. *Text mining* is critical for extracting key entities (people, places, narcotics, weapons, time, etc.) and their relationships presented in voluminous police incident reports, intelligence reports, open-source news clips, etc. Some of these techniques need to be multilingual in nature, including the abilities to employ machine translation and cross-lingual information retrieval (CLIR). *Spatial and temporal mining and visualization* is often needed for geographic information systems (GIS) and temporal analysis of criminal and terrorist events. Most crime analysts are well trained in GIS-based crime mapping tools; however, automated spatial and temporal pattern mining techniques (e.g., hotspot analysis) have not been widely adopted in intelligence and security applications. Organized criminals (e.g., gangs and narcotics) and terrorists often form interconnected covert networks to carry out illegal activities. Often referred to as “dark networks,” these organizations exhibit unique structures, communication channels, and resilience to attack and disruption. New computational techniques including social network analysis, network learning, and network topological analysis (e.g., random network, small-world network, and scale-free network) are needed for the systematic study of those complex and covert networks. These techniques are classified under *criminal network analysis* in Fig. 1.

ISI, CIVIL LIBERTIES, AND DATA MINING

The U.S. Constitution and its Bill of Rights were drafted in part to define and protect the civil liberties of United

States citizens and to set limits on the government’s power. Important civil liberties include freedom of association, freedom of assembly, freedom of speech, and the right to privacy. In the United States, the American Civil Liberties Union (ACLU) is a powerful advocacy group that aims to ensure the protection of free speech, privacy, and other fundamental human rights.

The potential negative effects of intelligence gathering and analysis on the privacy and civil liberties of the public have been well publicized.^[13] There exist many laws, regulations, and agreements governing data collection, confidentiality, and reporting, which could directly impact the development and application of ISI technologies. Intelligence and security agencies and ISI researchers must be aware of these laws and regulations in research and practice. The use of a hypothesis-guided, evidence-based approach in crime and intelligence analysis research can also help assure that privacy is appropriately respected. For example, there should be probable and reasonable causes and evidence for targeting particular individuals or data sets for analysis. Proper investigative and legal procedures need to be strictly followed. It is neither ethical nor legal to “fish” for potential criminals from diverse and mixed crime, intelligence, and civilian related data sources. The well-publicized Defense Advanced Research Program Agency (DARPA), Total Information Awareness (TIA) program, and the Multi-State Anti-Terrorism Information Exchange (MATRIX) system, for example, have been shut down by the U.S. Congress due to their potential misuse of citizen data and impairment of civil liberties.^[14]

However, other initiatives have been maintained, as the catastrophic 9/11 events had a profound impact on the way the U.S. government acts on security concerns. In response to the attacks, for example, the U.S. government enacted the USA PATRIOT Act, created the Department of Homeland Security (DHS), increased security efforts and airports and other ports of call, etc.

The PATRIOT Act expands the government’s ability to examine records on an individual’s activity whether those records are being held by third parties or were acquired by secret searches and/or wiretap surveillance. The Act expands a narrow exception to the Fourth Amendment that

had been created for the collection of foreign intelligence information and also expands another Fourth Amendment exception for spying that collects “addressing” information about the origin and destination of communications. An immediate result of the events of September 11, 2001 was the extraordinarily rapid passage of the USA PATRIOT Act in late 2001. The legislation was passed by the Senate on October 11, 2001 and by the House on October 24, 2001; it was signed by the President on October 26, 2001, with some revisions following in 2005 and 2006. But the continuing legacy of the then-existing consensus and the lack of detailed debate and considerations have created an ongoing national argument as to the proper balance between national security and civil liberties.

FUTURE DIRECTIONS

National security research poses unique challenges and opportunities. Much of the established data mining and knowledge discovery literature, findings, and techniques need to be reexamined in light of the unique data and problem characteristics in the law enforcement and intelligence community. New text mining, spatial and temporal pattern mining, privacy-preserving data mining, and criminal network analysis of relevance to national security are among some of the most pressing research areas. However, researchers cannot conduct research in a vacuum. Partnerships with local, state, and federal agencies need to be formed to obtain relevant test data and necessary domain expertise and feedback for ISI research.

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International and Comparative Librarianship

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Abstract

The concepts of international librarianship and comparative librarianship first appeared under their respective titles in the 1950s, when their literatures were overlapping. During the 1960s, and continuing through the 1980s, much energy was devoted to defining each of them and attempting to distinguish between them. Although clearer definitions were developed during the mid-1970s by J. Stephen Parker and J. Periam Danton respectively, some confusion has persisted. In practice the two fields are often grouped together as “international and comparative librarianship” or “international and comparative library science.” Nevertheless, the two fields can and should be distinguished. This entry attempts to articulate the definition and scope of each, outlines some methodological issues, and surveys the development of the literature.

INTRODUCTION

In today's globalized knowledge society international relations and resource sharing among libraries and the exchange of knowledge among librarians are indispensable. Historically librarianship has had a significant international dimension, dating back to the ancient Library of Alexandria, which maintained a policy of attempting to collect all the world's knowledge. During that time, according to a possibly apocryphal tradition, visiting ships from foreign ports were required to surrender books for copying by the Library's scribes.^[1] This method hardly serves as an example for library cooperation today, but does illustrate that librarianship has an inherently international outlook. During the late nineteenth century this international dimension took on a more meaningful shape in the form of international conferences of librarians, bibliographers, and book lovers, resulting in the establishment of the first international organizations for those groups. International librarianship and comparative librarianship first appeared under their respective names in the 1950s, and their literatures continued to overlap during the 1960s through the 1980s, during which time much energy was devoted to defining each and attempting to distinguish between them. Clearer definitions were developed during the mid-1970s by J. Stephen Parker^[2] and J. Periam Danton^[3] respectively. However, some confusion persists. In practice the two fields are often grouped together as “international and comparative librarianship” or “international and comparative library science.” Nevertheless, the two fields can and should be distinguished. In an attempt to clarify the distinctions, this entry discusses the definition and scope of international librarianship and comparative

librarianship, outlines some methodological issues, and surveys the development of the literature.

DEFINITIONS AND SCOPE

International Librarianship

The origins and early definitions of international librarianship have been articulated by Danton,^[3,4] Parker,^[2] Harvey,^[5] and Keresztesi.^[6] Some recent contributions and further clarifications have been attempted by Sami,^[7] Bliss,^[8] Liu,^[9] and Lor.^[10] However, Parker's definition has been widely cited and it serves as an authoritative point for discussion:

International librarianship consists of activities carried out among or between governmental or non-governmental institutions, organizations, groups or individuals of two or more nations, to promote, establish, develop, maintain and evaluate library, documentation and allied services, and librarianship and the library profession generally, in any part of the world. (p. 221)^[2]

Several key points for consideration are raised by the definition:

1. International librarianship is a field of *activity*, rather than a scientific discipline. This does not, of course, prevent the activities from being studied with scientific rigor. In this case the field may be referred to as “international library science,” particularly as practiced in the United States, where the term “library science” is used to refer to the field as a scientific discipline.

2. The activities are conducted in a *relationship* “among or between” parties at various levels, ranging from individuals to governments. Such activities, among others, include resource sharing, standardization, development aid, political and cultural influences, relations between and/or among national associations, and exchanges of staff, students, and scholars.
3. These parties are located in *two or more nations* (countries). This stipulation raises the question of what is meant by “international.” Strictly speaking, relations between two countries are referred to as “bilateral” and purists would restrict the use of the term “international” to refer to relations between more than two countries,^[6] but in international librarianship this distinction is seldom observed.

This last point requires some elaboration. In the United States the term “international” is often used to mean “foreign,” hence the use of the term “international librarianship” to mean “librarianship in other countries.” This designation is common in the literature, where books bearing titles that include the term “international librarianship” may be, in fact, collections of articles describing aspects of librarianship in countries other than the United States. Such literature has been classified by Harvey as “foreign library science,” which he defined as being “the description of any aspect of library operations in one or more countries other than the author’s own country.”^[11] The notion of “foreign” librarianship has been criticized, notably by Danton,^[3,4] who points out that what is foreign depends on one’s nationality. To illustrate: an article on school libraries in Tunisia written by a Tunisian might be considered by American readers—but not by Tunisian readers—to be foreign librarianship. Conversely, how would American readers classify an article on American school libraries written by a Tunisian? Therefore, the notion of foreign librarianship will always be relative to the nationalities of authors and readers and it would be impossible to delimit the corpus of writings on the subject. Lor^[10] argues that to qualify as a contribution to international librarianship a book or article should not merely describe conditions in another country. There should be an international dimension in terms of relationships between countries, influences of one country on another, etc. In practice this requirement is often ignored. There is some merit in the argument that an author from one country may bring fresh insights to library conditions in another country and therefore the work qualifies to be regarded as a contribution to international librarianship. The well-known book of the Norwegian librarian, Wilhelm Munthe,^[12] on American librarianship is often cited as such an example.

The activities of international organizations are also generally included within international librarianship.^[6,13]

The promotion of library development by UNESCO is an example. Some writers would also include the library and information services of such bodies as part of the scope of international librarianship. However, this does not easily fit within Parker’s definition.

Comparative Librarianship

During the 1960s and 1970s the origins and definitions of comparative librarianship were discussed by various writers, including Foskett,^[13,14] Shores,^[15,16] Simsova and MacKee,^[17,18] Collings,^[19] Harvey,^[11] and Yayakuru.^[20] Having systematically reviewed all prior attempts to define comparative librarianship and delimit its scope, J. Periam Danton in 1973 formulated what remains the most authoritative and appropriate definition of the field to date. He states that comparative librarianship is an

area of scholarly investigation and research (that) may be defined as the analysis of libraries, library systems, some aspect of librarianship, or library problems in two or more national, cultural or societal environments, in terms of socio-political, economic, cultural, ideological, and historical contexts. This analysis is for the purpose of understanding the underlying similarities and differences and for determining explanations of the differences, with the ultimate aim of trying to arrive at valid generalizations and principles. (p. 52)^[3]

Danton, later slightly amended his definition (p. 4).^[4] Both of his contributions emphasize three essential aspects of comparative librarianship:

1. There has to be a “cross-societal or cross-cultural element.” Often this is cross-country or international, but the comparison can be conducted within a single country, provided that the societal, cultural, or ideological differences are such that they can give rise to differences in the nature of the library as an institution. Hence a comparison of public libraries in the German, French, and Italian speaking cantons of Switzerland can legitimately be classified as comparative librarianship, but a comparison of the library use of working class and middle class Britons would not. On this point opinions diverge. While Danton, basing his position on the example of disciplines such as comparative education, comparative law, and comparative sociology, insists on the cross-societal, cross-cultural, or cross-country element, other writers such as D.J. Foskett,^[13] Simsova and MacKee,^[17,18] Sami,^[7] and Lor^[10] open the door to comparisons that are not cross-societal or cross-cultural in scope. The danger of this approach is that, since comparisons are inherent in much empirical research, the greater part of research in library science could be labeled as “comparative librarianship.”

2. There have to be “actual comparisons,” which go beyond mere descriptions or juxtaposition of data. Comparison implies the analysis of the similarities and differences in the sets of data collected.
3. An attempt should be made to explain the observed similarities and differences with a view to building theory.^[4] Thus comparative librarianship is described as a discipline which employs a rigorous scientific methodology, on the pattern of other, older comparative disciplines such as comparative education.

Distinction between International and Comparative Librarianship

As Danton^[4] pointed out, a considerable literature about the definitions of international and comparative librarianship arose more or less at the same time that Parker's definition of international librarianship and Danton's own definition of comparative librarianship appeared. The result is a literature in which there is much discussion but no clear consensus on the distinction between international librarianship and comparative librarianship. Attempts to distinguish between the two have generally taken one or more of the following approaches:

- Hierarchical: comparative librarianship is a species of the genus international librarianship or vice versa.^[9] For example, Harvey subsumes “comparative library science” (along with “foreign library science” and “international institutional library science”) under “international library science” (pp. 296–297).^[11] Krzys, Litton, and Hewitt subsume both “international library science” and “comparative library science” under “world library science.”^[21] Against this it has to be pointed out that attempts to impose such hierarchical relationships are problematic if the concepts belong to different categories: “international” denotes a geographic scope, whereas “comparative” denotes a methodology.
- Study–Activity: comparative librarianship is the scientific study, while international librarianship is the field of professional activity, often conceived in a rather soft and idealistic manner as aiming to promote international understanding and cooperation.^[22] A more rigorous distinction was made by Miles Jackson:

International librarianship is limited strictly to those activities that involve librarianship and all its aspects across national boundaries. It would thereby exclude comparative analysis, but include such activities as exchange of librarians, books, ideas, and the study of the library systems in different countries. . . comparative librarianship should lean on the tradition of comparative studies found in other fields such as political, government and legal studies.^[23]

Against this it should be pointed out that the “activities” included under international librarianship can and should also be subjected to systematic and rigorous investigation.

- Subject–Methodology: international librarianship is the subject field while comparative librarianship is the methodology. Collings states that comparative librarianship is a “scholarly method of investigation.”^[19] Keresztesi has stated that “comparative librarianship is essentially a method of enquiry” (p. 437).^[6] Against this it has to be pointed out that more than one methodology can be used to study international librarianship. Parker describes comparative librarianship as a tool, the most appropriate one, for international librarianship.^[2] However, it is not the only tool.

In practice the terms “international librarianship” and “comparative librarianship” are often used interchangeably or in combination, as in “international and comparative librarianship.” This combination of subject matter is also taught under this name in five of the nine U.S. library schools that offer courses related to international and/or comparative librarianship as surveyed by Liu and Cheng in a book tellingly entitled *International and comparative studies in information and library science*.^[24] Nevertheless, the two can and should be clearly distinguished. Concluding a review of the discussion up until 1977, Danton challenged the profession to stop writing *about* comparative librarianship and to start *doing* it.^[4] In this spirit no new definitions are offered here. Instead, the definitions of international librarianship by Parker and of comparative librarianship by Danton, cited above, are endorsed. In any case, discussions of definitional issues have become less frequent since the 1970s.

METHODOLOGY

International Librarianship

In contrast to that of comparative librarianship, much of the literature of international librarianship lacks methodological rigor. It tends to be descriptive rather than analytical. This is particularly true of the genre of “foreign librarianship,” much of which is anecdotal and based on personal experience. Such publications, however, should not be overlooked as primary source material for more rigorous research, as they may be useful not only for descriptions of particular contemporary situations, but also for what it reveals of the attitudes of the writers. The literature of international librarianship as distinct from comparative librarianship is generally descriptive in nature and derives its data from sources such as

- Literature (both published and unpublished, e.g., government statistical reports, annual reports and Web sites of libraries and other organizations, project reports, autobiographical materials).
- Observation (e.g., study tours, reports by participants in exchange programs, or by aid workers assisting in library development programs).
- Interviews (including telephonic interviews).
- Questionnaire surveys (with increasing use being made of Web-based surveys).

Comparative Librarianship

The methodology of comparative librarianship has been described by a number of authors, with a strong emphasis on methodological rigor. Early contributions by Simsova and McKee^[17] and Danton^[3] are frequently cited, although Parker pointed out that their proposals were largely untested and untried.^[2] Collings distinguished three major types of studies: area studies, cross-national or cross-cultural studies, and case studies, and outlined the primary and secondary sources for such studies.^[19] Harvey put forward a “general comparative research methodology,” comprising 12 stages, starting with a speculative stage and proceeding through description, analysis and comparison and interpretation, correlation and extension, to prediction, the evolution of new theories and the formulation of laws.^[11] This is very much in accordance with the approach of the positivist social science and educational research methodology texts of that period, e.g., Van Dalen,^[25] which emphasized the painstaking assembling of small empirical building blocks in the quest for the holy grail of science: universal scientific laws. Harvey also usefully outlines the research techniques that can be used in comparative librarianship, including “statistical comparisons, problem analyses, trend identification, factorial and analytical approaches, analysis against norms, developmental criteria identification and historical analyses” (pp. 307–308).^[11] Krzys, Litton, and Hewitt put forward an impressive research program for “world librarianship.”^[21] Liu describes a cooperative methodology to conduct cross-country comparisons, involving the collaboration of experts in both countries.^[26] Danton stressed the interdisciplinary nature of comparative librarianship.^[3] This is hardly surprising, considering the cross-national, cross-cultural, or cross-societal nature of such studies.

The basic elements of the comparative method are

- The identification of a research problem. The problem should be of a significant rather than trivial nature. There is more to be learned from a study on the selection of Arabic name authorities in Egypt and Iran than from a study of the shape and size of catalog cards formerly used in these two countries.
- The selection of a suitable theoretical framework. This is important for guiding the subsequent steps.

- The formulation of research questions or hypotheses.
- The selection of two or more systems (or processes, institutions, situations, etc.) for study. There should be sufficient underlying commonality (e.g., in terms of types of libraries, materials, or processes) to make the comparison worthwhile. There is little point in comparing children’s libraries in Norway with young adult services in Wales.
- The collection of data on the systems. The data may be derived from available case studies, area studies, or descriptive studies, such as are typically found in the literature of international librarianship, or they may be collected by means of surveys, interviews, observation, etc., specifically for the purpose of the comparative study.
- The processing, classification, tabulation, and juxtaposition of the collected data. An interesting example of developing a classification scheme for categorizing the data of an international comparative study is found in Rochester and Vakkari.^[27]
- The analysis undertaken to search for patterns of similarities and differences in the sets of data and to reveal their causes, this process being guided by the research questions, or if hypotheses have been formulated, taking the form of the formal testing of these. This is a critical step. If it is missing, the study is not truly comparative.
- The discussion and interpretation of the findings in relation to the theoretical framework in order to further develop and generalize the theory.

LITERATURE AND THEMES

There is a considerable literature on international librarianship, which is difficult to separate from the less extensive literature of comparative librarianship. Much of the literature of international librarianship falls in the category of foreign librarianship: descriptions of library conditions in countries other than that of the author or editor. This ongoing category can be regarded as the wallpaper or background to the literature of international librarianship proper. In this section a necessarily impressionistic overview of themes is presented in a roughly chronological order.

Origins and Early Development

Interest in international librarianship is not a new phenomenon. The American Library Association (founded in 1876) and the (British) Library Association (founded in 1877) engaged in international activities at an early stage. Initially these mainly took the form of representation at each other’s conferences and at those of other national associations, but in the first decade of the twentieth century cooperation between the United States and the United

Kingdom was manifested more concretely in the adoption of the Anglo-American cataloging rules of 1908.^[28] The International Institute of Bibliography, which later became the International Federation for Information and Documentation (FID), was founded in 1895, while the International Federation of Library Associations and Institutions (IFLA) was founded in 1927 in close association with the League of Nations. The early leaders of IFLA were inspired by ideals of world-wide peace and cooperation.^[29] A pioneering work of this period was Wilhelm Munthe's *American Librarianship from a European Angle*, published in 1939.^[12]

The first recorded use of the term "comparative librarianship" occurred in 1954, in two articles by Chase Dane.^[30,31] The early literature on this new field, reviewed by Danton,^[3] exhibited an idealistic and affective dimension, emphasizing its value for enhancing international understanding and also its practical value for furthering library cooperation and development, for example in Dane,^[31] Shores,^[16] and Collings.^[19] As already noted, much energy was expended on largely inconclusive attempts to define the field and distinguish it from international librarianship. Writers on comparative librarianship drew much inspiration from writers on other comparative disciplines, such as comparative education, for example Fraser and Brickman.^[32]

The term "international librarianship" also appears to date from after the Second World War, being used by Peter Havard-Williams in 1959.^[33] As with comparative librarianship, much of the literature of this period reflects normative, moral, or idealistic concerns, such as internationalism, the striving for international peace and tolerance, and international cooperation.

The 1960s and 1970s

In the first decades following World War II the influence of UNESCO was strong and the *UNESCO Bulletin for Libraries*, since discontinued, was an important medium for the field. The post-war emergence of independent states in Asia and Africa aroused much interest among internationally minded librarians^[34] and gave rise to idealistic and ambitious plans for developing national library services. The work of foreign cultural and aid agencies, for example the work of the British Council in developing national library services in former British colonies, featured in the literature, sometimes in descriptive accounts, at other times more critical observations. By that time professionals in developing countries, including Wijasuriya, Lim, and Nadaradha^[35] were warning of the challenges facing the extension of library services to their various countries' peoples. UNESCO's own work in library development in the developing world, which emphasized the importance of libraries for education, was an important theme, as were its efforts to promote the adoption of national information policies in these

countries: primarily the UNISIST (World Science Information System) and NATIS (National Information Systems) programs.^[2,33] UNESCO promoted the international exchange of publications, which was a significant activity for countries lacking foreign exchange. UNESCO's role as a partner and sponsor of IFLA programs was also important. The development of specialized international indexing and abstracting services such as MEDLARS (for medicine), AGRIS (for agriculture) and INIS (for nuclear science and technology) generated much literature of an international character.

The 1960s and 1970s were also years of theoretical reflection on the purpose, scope, and methodology of comparative librarianship; most of the sources cited in the above section on "Definitions and Scope" date from this period. A number of highly regarded comparative studies were published during this period, including a comparative study of public library development in France, Great Britain, and the United States by Jean Hassenforder^[36] and Frank Gardner's comparative study of public library legislation.^[37] Excellent single-country studies, while not strictly part of comparative or international librarianship, also appeared during this period. Those include Ferguson's *Libraries in France*,^[38] which appeared in Clive Bingley's Comparative Library Studies series, and Maack's *Libraries in Senegal*.^[39]

Throughout the post-war period, and particularly from the late 1960s, when IFLA adopted deliberate policies of reaching out to a potential membership outside Europe and North America, IFLA featured prominently in the literature of international librarianship.^[40] The *IFLA Journal* remains an important source of material in the field. IFLA's work in international library cooperation, especially its programs of Universal Bibliographic Control (UBC) and Universal Access to Publications (UAP) were promoted in its publications and in the writings of leaders, such as Maurice B. Line, who wrote dozens of articles promoting UAP. As information and communication technology developed in the 1970s and 1980s "library cooperation on an international scale (p.172)"^[33] became increasingly feasible, and the early notions of cooperation were progressively extended to resource sharing and networking. The MARC format, developed in the United States, soon became an international standardization phenomenon, generating national variants and international cooperation in the development of library catalogs, union catalogs, and national bibliographies. This also stimulated international cooperation in respect to cataloging rules, standards such as the international standard bibliographic descriptions (ISBDs), and the fundamental principles of cataloging, as expressed more recently in the *Functional requirements for bibliographic records* (FRBR) and related principles for authority records.

Other international nongovernmental organizations such as the FID (which was dissolved in 2002) have also

provided forums for international cooperation, discussion, and reflection, adding to the literature, and themselves featuring in it. Beginning in the 1950s various specialized international associations such as IAML (International Association of Music Libraries) and IBBY (the International Board on Books for Young People) were established, as were regional bodies such as ACURIL (Association of Caribbean Research, University and Institutional Libraries), CONSAL (Congress of Southeast Asian Librarians) and SCECSAL (Standing Conference of East, Central and Southern African Library and Information Associations). The growth of international associations has been attributed to greater international awareness following the Second World War, and to the advent of regular, affordable air transportation^[41]—it was no longer necessary for delegates to spend a week or more on board an ocean liner to attend an international conference.

From the 1980s to the Current Scene

In the 1980s and 1990s there was increasing emphasis on the impact of information for development.^[42] In a significant number of developing countries well-intentioned, Western-inspired library development programs had begun to falter. Starting in the 1970s a critical reevaluation of these post-colonial efforts, sometimes referred to as “cultural imperialism” (p. 7),^[13] got under way, as is described, for example, in seminal works such as *The Quiet Struggle: Information and Libraries for the People of Africa*, by Sturges and Neil^[43] and Gassol de Horowitz’s *Librarianship: A Third World Perspective*,^[44] as well as in contributions by younger African librarians such as Kingo Mchombu.^[45,46] During the 1980s questions were increasingly raised about international aspects of education for librarianship. These concerns related to the appropriateness of Western, particularly the United States and British, as well as East European models of content, curricula, and qualifications in developing countries.^[47] Concern was also expressed about the internationalization of library school programs, particularly in the United States.^[8,48]

In spite of the critical questions, a number of governmental aid agencies, particularly those of the United States, Canada, Great Britain, and the Nordic countries, have continued to play a significant role in supporting library development in the developing countries, as have a number of foundations such as the Andrew W. Mellon Foundation, the Carnegie Corporation of New York, and the Bill and Melinda Gates Foundation in the United States, and the Open Society Institute in Europe. These donors increasingly emphasize accountability and the sustainability of projects. This has stimulated programs aimed at capacity building by providing training opportunities for future leaders of the library profession in developing countries, such as those of the

Mortenson Center for International Library Programs at the University of Illinois at Urbana-Champaign, the Goethe Institut (Germany) and the Jay Jordan IFLA/OCLC Early Career Fellowship program of OCLC in partnership with IFLA.

Since the mid-1990s the economic, political, and ethical aspects of the international flow of information, particularly between developed countries and developing countries, have emerged as an important theme. The gap between rich and poor countries is often referred to as the “digital divide.” However, it is not merely digital, as it has significant political, legal, and economic dimensions. Librarians have become increasingly aware of the impact on their institutions and users of decisions on intellectual property and related matters that are taken at international forums such as the World Summit on the Information Society (WSIS), the World Trade Organization (WTO), the World Intellectual Property Organization (WIPO), and in multilateral or bilateral trade agreements between countries.^[49,50] In addition, issues of freedom of access to information and freedom of expression,^[51] and vexed questions of tolerance in multicultural environments have come to prominence at the international level as a consequence of increasing globalization.^[52] Advocacy has become a key activity of IFLA, which represents libraries and librarians internationally, often in partnership with other national and international organizations such as the (US) Library Copyright Alliance, the European Bureau of Library, Information and Documentation Associations (EBLIDA), and Electronic Information for Libraries (eIFL). Only through cooperation and continuous monitoring is the library profession able to ensure representation at the plethora of international meetings and to keep abreast of the huge volume of documentation generated by the international organizations. Currently, most of this documentation is disseminated through the Internet. Globalization has seen to it that the international affairs relevant to library professionals have multiplied to an extent that could not be foreseen by their predecessors. To many practicing librarians much of this may seem remote, but continuing vigilance is called for. It is therefore important to raise awareness of international issues in the profession.

It is an ongoing challenge to ensure that libraries are not taken for granted or ignored in international programs to promote the information society. In recent years the attention paid by UNESCO to libraries as such has decreased in favor of more general information society issues and the use of information technology. However, themes such as documentary preservation, access to knowledge, information literacy, and information ethics fortunately remain on the agenda of UNESCO’s Sector V (Information and Communication) and its Information for All Program (IFAP), while other UNESCO sectors concern themselves with literacy and book development. In all these areas librarians need to cooperate strategically in

advocating for libraries as key agencies in the information or knowledge society.

At the immediately practical level matters such as international bibliographic standardization, international document supply, collection development and services in area studies, and international aspects of human resource development (study abroad, job exchanges, working in foreign libraries, etc.) continue to form part of the literature of international librarianship.

In the 1980s a steady stream of contributions to comparative librarianship developed and this swelled as young researchers discovered a fruitful field for Ph.D. dissertation topics. The problem or thematic approach (in which library types, processes, problems, etc. in two or more countries are compared, as distinct from whole-country comparisons) is predominant. Library education and training seems to be the most popular area, followed by developing countries, school libraries, national information infrastructures (replacing the national information *policies* of the 1980s), various aspects of management (including evaluation, measurement, and statistics), and library and information science (LIS) research. General trends in LIS literature are reflected in that of international librarianship. For example, since the turn of the century the digital divide and issues of access to digital resources, and information literacy have come into prominence. Among developing regions the Far East attracts most attention;^[24] here the number of comparative studies in which various library practices in the United States and China are compared reflects the relatively large number of postgraduate students from China preparing Ph.D. dissertations in the United States.

CONCLUSION

International librarianship is an extensive and growing field of activity with an extensive body of literature. However, compared with that of comparative librarianship, its literature is largely practical, discursive, and descriptive, and lacks a theoretical basis. The literature of comparative librarianship, although smaller, is also growing. Much effort was expended some decades ago on attempts to distinguish between international and comparative librarianship. Although sound definitions for both fields were put forward and logic demands that they be clearly distinguished, the result was inconclusive, and this thread appears to have been abandoned. The practice of combining these two fields in textbooks and library science courses as "international and comparative library science" is pragmatic. Regardless of how the field is conceptualized, it can be expected to remain vital, since in a globalized world all fields of human endeavor have an increasingly significant international dimension. This applies *a fortiori* to librarianship, which serves the

conservation, development, and utilization of all human knowledge without regard to boundaries.

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International Association of Sound and Audiovisual Archives (IASA)

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Abstract

The International Association of Sound and Audiovisual Archives (IASA) was established in 1969 in Amsterdam to function as a forum for international cooperation between archives preserving recorded sound and audiovisual documents. This entry looks at the beginning years of IASA and its growth from nine founding members to an independent organization with a membership of more than 400 members, representing 64 countries.

BIRTH OF IASA

The International Association of Sound and Audiovisual Archives (IASA) was established in 1969 in Amsterdam to function as a forum for international cooperation between archives preserving recorded sound and audiovisual documents. During its 30-year anniversary celebrations, Rolf Schuursma, a founder member and former IASA President, divided its history into three periods, saying: "...Like every organization of this kind, beginning from scratch, IASA has gone through different stages, each with its own qualities and problems ...". Rolf (Schuursma, 1999) identified the stages as:

- *Getting acquainted*, when newly recruited members got to know one another and the membership was growing worldwide;
- *How did we do it*, during which time the membership studied the various ways of collecting, storing, cataloging, access, copyright, and technical matters, and during which time IASA became more professional in its management;
- *Widening the scope*, when IASA received international recognition and began to play a role in the international information field.

But a fourth stage can now be added: *digitization*; with IASA taking the lead by investigating new ways and setting standards to save sound and audiovisual collections, thereby preserving original qualities and enabling easy/easier access.

IASA was founded on August 22, 1969 after a letter of intent to establish a new international organization of sound archives was drafted the previous year and submitted to the *International Association of Music Libraries* (IAML). IASA's beginning was thus directly linked to the IAML.

IAML supported the floundering first few years when IASA lacked infrastructure and resources to host its own conferences. Harald Heckmann of IAML played an instrumental role in finding solutions that would eventually give IASA the independence it needed.

IAML had been officially founded in Paris in July 1951. Its Radio Library Commission which also had a Radio Sound Archive Subcommittee was primarily interested in music recordings. Before IASA came into existence, earlier attempts to unite sound archivists were made. The first initiative came from linguists who, in 1962, formed IALSA, (*International Association of Linguistic Sound Archives*) at a meeting in Amsterdam. Shortly thereafter, IALSA was absorbed by a newly founded organization, the *Fédération Internationale des Phonothèques* (FIP). The inactivity of FIP, however, led to the decline of the organization which practically faded away during the early 1970s.

Rolf Schuursma, at that time from the Archive at the Institute of History at Utrecht University in the Netherlands, remembers that it was Patrick Saul, the then director of the British Institute of Recorded Sound, who invited him to a meeting in Paris to participate as a representative of a spoken word recordings archive. The meeting took place in the *Département de la Musique* of the Bibliothèque Nationale in Paris on September 4, 1968. Seven members attended the meeting. They were IAML members Patrick Saul (Director of the British Institute of Recorded Sound), Vladimir Fedorov (Director of the Department and President of IAML), Dr. Kurt Dorfmueller (Bayerische Staatsbibliothek, München), Dr. Herbert Rosenberg (Director of the Nationaldiskotek in Copenhagen), Dr. Israel Adler (Director of the Jewish Music Research Centre at the Jewish National and University Library in Jerusalem), FIP president, Roger Décollogne (Director of the Phonothèque Nationale), and oral historian, Rolf

Schuursma, Rolf Schuursma from the Institute of History at the University of Utrecht, represented spoken word archives. Dr. Adler was the Chairperson. On September 5, a preliminary letter of intent was drafted to inform IAML of the decision by the meeting to establish a new international organization of sound archives. This letter was submitted by Dr. Adler to the IAML conference held in Washington DC and New York in 1969.

The first IASA meeting took place in Amsterdam at the *Institute of Theater Klank en Beeld (Institute for Theatre Sound and Image)* on August 18, 1969. The meeting was attended by Lou Hoefnagels (Director of the Theater Klank en Beeld), Rolf Schuursma, Patrick Saul, Donald L. Leavitt (Library of Congress), Philip Miller (Rodgers and Hammerstein Archives of Recorded Sound in New York), Dietrich Lotichius (Norddeutscher Rundfunk in Hamburg), Herbert Rosenberg, Claes Cnattingius (Swedish Radio), and Timothy Eckersley (BBC). This group of nine became known as the founding members of IASA. Earlier that year, in March, Rolf Schuursma and Lou Hoefnagels had already begun preparations for the first meeting. Don Leavitt presented the draft constitution for deliberation at the IAML conference in Amsterdam. A joint committee was formed between the Record Libraries' Commission and the newly founded IASA. In principle the roles were clear: IAML was interested only in music recordings and IASA in all recordings. But IAML also represented a branch of librarianship, whereas IASA was a response to the fact that sound recordings were more often held in an archival environment — a separate professional context at least equal to librarianship. IAML was not sufficiently hospitable to the technical challenges in the sound archives, which are most acute in the areas of unpublished recordings, held in archives, rather than published phonograms held by IAML member libraries. It would take a while before full agreement was achieved to avoid overlapping and even competing activities between IAML's Record Libraries' Commission and IASA.

The founding meeting took place on August 22, 1969 with 24 participants. The official name of the new organization was *International Association for Sound Archives*. The first Executive Board was made up by Don Leavitt (President), Patrick Saul (Vice-President), Claudie Marcel-Dubois (Vice-President), Rolf Schuursma (Secretary), and Claes Cnattingius (Treasurer). One of its primary tasks, together with the Record Libraries' Commission, was to prepare a *Directory of Sound Archives*, but this never happened. The concept was later replaced by an IASA *Directory of Member Archives*, first compiled by Ann Briegleb (Head of the Ethnomusicology Archive of the University of California at Los Angeles) in 1978, with an expanded update in 1982, and subsequently by the *Membership Directory*, which is still regularly published.

Initially IASA held joint annual conferences with IAML because of the lack of its own infrastructure and resources. During the Leipzig Conference in June 1970, a decision was taken that IASA should have its own periodical, and this led to the birth of the *Phonographic Bulletin*. The first issue was in A4 format with different shades of green for the cover and lettering and highlighting the IASA logo designed by Rob van der Elzen, a graphic designer with the Film Research Foundation. From Issue no. 16 onward the lettering on the cover was changed to black, and in 1977 the A4 format was replaced by the B5 format. In 1990, the IASA Board decided to publish a separate *Information Bulletin*, originally compiled by Vice-President Hans Bosma, in order to keep the membership more regularly informed about IASA-related activities. The publication was renamed *IASA Journal* in 1993 under the editorship of Grace Koch, with four *Information Bulletins* and two *IASA Journals* per annum being published instead of three *Phonographic Bulletins*. IASA now has its own Web site, and in 2006 the first *eBulletin* was published to keep members electronically informed. Currently, IASA publishes two *Information Bulletins*, two *eBulletins*, and two *Journals* per year, and maintains and updates the Web site regularly. IASA also operates a listserv to facilitate the exchange of information between members.

The joint 1971 IAML/IASA annual conference in St Gallen was a first for IASA in several respects. It was the first conference where IASA had a separate program (put together by Don Leavitt, Claes Cnattingius, and Rolf Schuursma), and the first issue of the *Phonographic Bulletin* (A4 format) (3 issues annually) was launched by Rolf Schuursma and Phita Stern (Utrecht).

By the time the 1972 joint IAML/IASA annual conference took place in Bologna, Italy, IASA had 40 institutional and 37 personal members. IASA's second Executive Board was elected with Timothy Eckersley (President), Claudie Marcel-Dubois, Herbert Rosenberg, and Ivàn Pethes (Vice-Presidents), Rolf Schuursma (Secretary), Claes Cnattingius (Treasurer), and Don Leavitt (Past-President).

Under the leadership of Timothy Eckersley, IASA further expanded its membership. It also became a fully recognized partner of the joint annual conference with IAML in London in 1973.

The election of the next IASA Executive Board in 1975 during the Montreal Conference was of particular significance. Two new members were elected that would help to take IASA decisively on a route to greater independence and recognition: Dietrich Schüller (Director of the Phonogrammarchiv in Vienna) and David Lance (Keeper of the Department of Sound Records of the Imperial War Museum in London). Dietrich Schüller was elected as President, and David Lance as Secretary, with Claudie Marcel-Dubois (Vice-President), Herbert Rosenberg (Vice-President), Rolf Schuursma (Vice-President), Léo

LaCLare (Treasurer), and Timothy Eckersley (Past-President).

The new Executive Board under the leadership of the young and dynamic Dietrich Schüller made dramatic changes to IASA. One of the first was to have midterm meetings to ensure better planning of annual conferences, and to discuss other issues and activities in which IASA had an interest.

The first midterm meeting was in April 1976 in the *Musée des Artes et Traditions Populaires*, Bois de Bologne, Paris, at which the Executive Board agreed to include the *Editor* on the Board. The first Editor was Rolf Schuursma, with Ann Briegleb replacing him as Vice-President. The Executive Board also decided to form committees to look after the specialized interests of the membership. The first committee was the Technical Committee with Dietrich Schüller as Chair, followed by the Copyright Committee under Robért Ternisien. David Lance initiated the formation of National Branches. The first national branches were established in Great Britain, the Netherlands, France and Australia. But several countries were already interested to unite audiovisual archives under one umbrella, something IASA as an association of sound archives did not cater for. Austria, therefore, never officially liaised with IASA, while the original Netherlands IASA branch broke away to form an independent Association of AudioVisual Archives. National branches also wanted to include non-IASA members, which had the potential to weaken IASA. In the early 1980s, following administrative difficulties with IASA International, the French and the Australian national branches broke away to form AFAS (Association française des archives sonores) and ASRA (Australasian Sound Recordings Association) as independent, but still IASA affiliated associations. This situation led to a drop in the number of IASA members, which was, however, compensated soon by the further growth. During the 1980s the IASA constitution was revised several times to reflect the changing nature of National Branches and independent organizations, known as Affiliated Organizations.

The year 1978 was nearly a watershed year for IASA.

During the 1978 mid-term meeting in Vienna, the constitution, which had originally followed the IAML model, was entirely renewed and adapted to the needs and realities of IASA. It was adopted at the Annual Conference in Lisbon. The basic structure is still in place today, with several adaptations to reflect the changing nature of the organization.

At the same conference, a new Joint IAML/IASA Committee on Music and Sound Archives was established to coordinate the activities of both organizations.

The fourth Executive Board was elected with Rolf Schuursma (President), Marie-France Calas (Vice-President), Tor Kummen (Vice-President), Ulf Scharlau (Treasurer),

Ann Briegleb (Editor), and Dietrich Schüller (Past-President). During the 1978 midterm meeting in Vienna, proposed changes to the Constitution were discussed: the election procedure needed to accommodate the entire membership as opposed to suggestions from the outgoing Executive Board, and the Council to be cancelled.

In 1983, Ulf Scharlau and Dietrich Lotichius were responsible for the formation of the Radio Sound Archives Committee for IASA while the Radio Sound Archives Subcommittee of IAML was suspended. In 1993, a name change was proposed at the Helsinki Conference, whereby the word “audiovisual” would be included in IASA to accommodate the breadth of audiovisual collections. The name change was officially accepted during the 1994 conference in Berlin-Bogensee, Germany, and IASA became known as *The International Association for Sound and Audiovisual Archives*.

In 1988, the time was ripe for IASA to hold its first solo conference in Vienna. It was attended by over 100 delegates, which proved the viability of IASA’s independence. During the following years, joint conferences with IAML were replaced by solo events or joint conferences with other audiovisual associations such as ARSC (Association for Recorded Sound Collections), FIAT (International Federation of Television Archives), SEAPAVAA (Southeast Asia-Pacific Audiovisual Archive Association) and ASRA (Australasian Sound Recordings Association).

YEARS OF GROWTH

The late 1980s and 1990s were a time of tremendous expansion of IASA, especially in the establishment of cooperation with UNESCO. Helen Harrison who was a Board member for over fifteen years, was instrumental in establishing the UNESCO Round Table, which later became the CCAAA (Co-ordinating Council of Audiovisual Archives Associations) under the leadership of Crispin Jewitt. The Technical Committee of IASA joined cooperation with Technical Committees of organisations such as FIAT, FIAF (International Federation of Film Archives), IFLA (International Federation of Library Associations) and ICA (International Council on Archives) and eventually formed the UNESCO TCC (Technical Coordination Committee) with George Boston of IASA as chairperson. This body organised the Joint Technical Symposia (JTS), which were and still are one of the most important professional meetings in audiovisual archiving. IASA also became closely involved in the UNESCO Memory of the World programme.

This period was also a fertile one for publications about audiovisual archive matters. Several ‘Special Publications’ were written, including *An Archive Approach* on

Oral History in 1978 and in 1983 Sound Archives: A Guide to their Establishment and Development by David Lance. For UNESCO Helen Harrison wrote the publication AV Archives: A Practical Reader which is still a valuable reference work and regularly accessed on the UNESCO website. This was the result of nearly five years work by a team from the Round Table and led by Gerry Gibson and Sven Allerstrand of IASA. *The Glossary* includes French, German and Spanish terms, as well as English terminology from both sides of the Atlantic. In 1978 Briegleb, Ann & Don Niles compiled the first Directory of Member Archives. The 2nd edition of the Directory of Member Archives was compiled in 1982 by Grace Koch.

With their excellent connections to non-governmental organizations, both Helen Harrison and Dietrich Schüller have boosted the Association's prestige by furthering its application to become a member of UNESCO. This success has enabled IASA to recruit new members from non-Western countries, i.e. countries in Asia, Africa, and South America. Since the end of the Cold War, IASA has gained many new members from the former socialist countries of Middle and Eastern Europe.

During the current decade IASA actively expanded its membership to Africa and South America with conferences held in 2003 in Pretoria, South Africa, and in México in 2006. A partnership between Dietrich Schüller and Albrecht Häfner in particular saw a series of very successful workshops across the world. The Board became truly representative of its international membership with members elected from India, Mexico, South Africa and Canada. IASA is currently respected for taking the lead by setting standards to digitally preserving sound and audiovisual collections.

IASA: THE ORGANIZATION

IASA has members from more than 60 countries, representing audiovisual archives and personal interests that are distinguished by their focus on particular subjects and areas. This includes archives for all sorts of musical recordings, historic, literary, folkloric and ethnological sound documents, theatre productions and oral history interviews, bioacoustics, environmental and medical sounds, linguistic and dialect recordings, as well as recordings for forensic purposes.

Every three years the IASA membership elects the Executive Board to oversee the business of the organization. Various committees, sections, and task forces are responsible for developing the work of IASA, and these serve as important information and discussion conduits in addition to dealing with specific areas of interest.

- The *Cataloging and Documentation Committee* looks after standards and rules, as well as with systems, automated or manual, for the documentation and cataloging of audiovisual media. The IASA Editorial Group, originally convened by Mary Miliano, compiled and edited the *IASA Cataloging Rules*, which is a manual for the description of sound recordings and related audiovisual media. An electronic version is available on the IASA Web site. It is also available in Spanish as *Reglas de Catalogación de IASA (2005 ed.)*.
- The *Discography Committee* deals with standards and recommended practices relating to collections of published recordings. The *National Discography* document provides guidelines on best practices for members who may have a responsibility for establishing national discographies in their countries, who intend to establish such a service, or who may be seeking funding.
- The *Technical Committee* devotes itself to all technical aspects of recording, storage, and reproduction, including new recordings, transfers, and storage technologies. Producing special publications that enable the audiovisual archive community to make educated decisions, is a main concern of the committee. The series "*Standards, Recommended Practices and Strategies*" includes
 - IASA-TC 03, *The Safeguarding of the Audio Heritage: Ethics, Principles and Preservation Strategy*, Version 3, December 2005, (Dietrich Schüller (Ed.)), which has been translated into German, French, Swedish, Italian, Spanish and Russian.
 - The IASA-TC 04, *Guidelines on the Production and Preservation of Digital Objects* (Kevin Bradley (Ed.)). The first edition (2004) is also available in Spanish and Italian. The revised, second edition, substantially enlarged and updated, was released in 2009.
- The *Training and Education Committee*, which had published the results in the *Phonographic Bulletin* of surveys of training for audiovisual archivists, typologies of sound archives, and existing job descriptions, became dormant in the mid-1990s. Recently it was revitalized under the leadership of Vice-President Pio Pelizzari and concerns itself with audiovisual training and education in the educational context, bibliographies of training and education-related publications, as well as concentrated actions in gaining multifunctional training and education material.
- The *National Archives Section* is where members meet to consider issues facing national archives, e.g., acquisition policies, legal deposit, and the management of large collections. Policy guidelines for the *legal*

deposit of sound recordings have been published and are available on the Web site.

- The *Radio Sound Archives Section* handles the special responsibilities of audiovisual archives in broadcasting companies.
- The *Research Archives Section* concerns itself with special issues relating to audiovisual archives whose holdings include collections of recordings originally made for research purposes.

IASA's Technical Committee follows closely the progress of technology, and the association's members can call upon a pool of expertise for help and advice on all technical problems faced by AV archives including digitization and problems arising from the use of computer storage systems for heritage collections. As such IASA has published the following publications in addition to those already mentioned:

- Treatment and restoration of historical audio recordings.
- Standards for International Tape Exchange (1978).
- Role of the Compact Disc (1982).
- Automation of Archive Systems (1989).
- Analogue and Digital Technologies for Restoration and Long-term protection of endangered recorded sound collections.

IASA "Task Forces" report on specific topics of interest to the membership such as selection criteria and endangered carriers. These and other reports will be made available on the IASA Web site as they are completed. In this regard the IASA published the Task Force findings to establish *Selection Criteria of Analogue and Digital Audio Contents for Transfer to Data Formats for Preservation Purpose* (Majella Breen, Gila Flam et al. (Ed.)).

IASA enjoys international cooperation with organizations such as UNESCO and has partnered with organizations such as AFAS, ARSC, IFLA, FIAT, and FIAF. IASA is also a founding member of the CCAAA.

Current membership: 411 members representing 64 countries

- Institutions: 224
- Individual: 184
- Sustaining: 3

Honorary members: The first honorary member was Tim Eckersley in 1980. Current honorary members are Claes M. Cnattingius (Sweden), Gerald Gibson (U.S.A.), Carlo Marinelli (Italy), and R.L. Schuursma (the Netherlands).

APPENDIX

Table A.1 List of IASA Presidents and terms served.

	Term	Name	Institution
1	1969–1972	Donald Leavitt	Library of Congress, United States
2	1972–1975	Timothy Eckersley	BBC, United Kingdom
3	1975–1978	Dietrich Schüller	Phonogrammarchiv, Austrian Academy of Sciences, Austria
4	1978–1981	Rolf L. Schuursma	Foundation Film and Science, the Netherlands
5	1981–1984	David G. Lance	Imperial War Museum, United Kingdom
6	1984–1987	Ulf Scharlau	Süddeutscher Rundfunk, Germany
7	1987–1990	Helen P. Harrison	Open University, United Kingdom
8	1990–1993	Gerald D. Gibson	Library of Congress, United States
9	1993–1996	James McCarthy	National Film and Sound Archives, Australia
10	1996–1999	Sven Allerstrand	ALB, Sweden
11	1999–2002	Crispin Jewitt	British Library National Sound Archive, United Kingdom
12	2002–2005	Kurt Deggeller	MEMORIAV, Switzerland
13	2005–2008	Richard Green	National Library of Canada, Canada
14	2008–	Kevin Bradley	National Library of Australia, Australia

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International Association of Technological University Libraries (IATUL)

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Abstract

The International Association of Technological University Libraries (IATUL) was founded in Düsseldorf, Germany, in May 1955, as an international forum for the exchange of ideas relevant to librarianship in technological universities throughout the world. The IATUL is a voluntary international nongovernmental organization of a group of libraries, represented by their library directors or senior managers, who have responsibility for information services and resources management. Many of the members of IATUL provide services, not only to the teaching and research staff and students of their own university but also to industrial organizations and national research institutions, in their respective countries. The main objective of IATUL is to provide a forum where library directors and senior managers can meet to exchange views on matters of current significance and to provide an opportunity for them to develop a collaborative approach to solving problems. The IATUL is an excellent example of the development of an effective informal international network between libraries of similar type, with a common high level of professional expertise and offering a similar range of services to their users. The IATUL also welcomes into membership organizations that supply services to university libraries, if they wish to be identified with the association's activities. This entry will examine the historical development, membership, organizational structure, activities, and publications of IATUL.

INTRODUCTION

The International Association of Technological University Libraries (IATUL) was founded in Düsseldorf, Germany, in May 1955, as an international forum for the exchange of ideas relevant to librarianship in technological universities throughout the world. The IATUL is a voluntary international nongovernmental organization of a group of libraries, represented by their library directors or senior managers, who have responsibility for information services and resources management. Many of the members of IATUL provide services, not only to the teaching and research staff and students of their own university but also to industrial organizations and national research institutions, in their respective countries. The main objective of IATUL is to provide a forum where library directors and senior managers can meet to exchange views on matters of current significance and to provide an opportunity for them to develop a collaborative approach to solving problems. The IATUL is an excellent example of the development of an effective informal international network between libraries of similar type, with a common high level of professional expertise and offering a similar range of services to their users. The IATUL also welcomes into membership organizations that supply services to university libraries, if they wish to be identified with the association's activities.

HISTORY AND DEVELOPMENT OF IATUL

Dr. E. Hemlin from Chalmers University of Technology, Sweden was the founder of IATUL and also its first president, and, in this capacity, he did much to develop the association. In September 1955, IATUL was recognized as a subsection of the International Library Association's division of the International Federation of Library Associations and Institutions (IFLA). This division no longer exists, and IATUL, as an International Library Association member, now works in association with the IFLA Section of Science and Technology Libraries. In 1990, IATUL was formally affiliated with UNESCO. This affiliation operates now through IFLA. Since 1999, IATUL is also a member of the International Council for Scientific and Technical Information.^[1–3]

In the early years, many of the members of IATUL came from Europe, where there were a number of well-established institutions for technological education. The eighteenth century had seen the founding of some of the earliest "schools" of this type in France, Germany, and Hungary. The first half of the nineteenth century was a period of considerable economic and social growth and development. This period saw the increasing use of steam power for industry, the rapid change from local craft

production to factory-based industries, and considerable improvements in communications. These changes led to an increased need for the provision of technical education and training, resulting in the founding of “trades and craft schools,” and polytechnic institutions throughout Europe. Similar institutions were founded in the United States.^[4] The early members of IATUL came mostly from European universities of technology and from some American institutions. During the last 25 years, there has been a steady growth in IATUL members coming from all parts of the world, resulting in a truly international organization.

At the 16th IATUL Conference, which was held at the University of Twente in the Netherlands in 1995, IATUL celebrated its first 40 years with a special session on the history of the organization. Several papers given at this session by previous board members provide interesting glimpses of the history of IATUL from a variety of angles.^[5–8] The 50th anniversary was celebrated at the 26th IATUL Conference, which was held at the University of Laval in 2005. An extensive display of historic photographs was on display, and the speakers at the conference banquet provided a warm reflection on half a century of service.

MEMBERSHIP

Ordinary and associate membership of IATUL is open to the libraries of universities and other higher educational institutions that offer programs of science and technology. Applications for membership of IATUL shall be addressed to the Secretary of the Association. In addition to academic institutional membership, there are two other types of membership. These are the categories of membership:^[9]

Ordinary membership—available to libraries/information services whose institutions offer masters or doctoral degrees in engineering, science, or technology;

Associate Membership—available, subject to confirmation by the Board, to libraries/information services interested in supporting the aims and objectives of IATUL

Honorary Membership—which the Board may confer upon individuals who have served the Association, or international librarianship, with particular distinction; and

Sustaining Membership—available, subject to confirmation by the Board, to commercial organizations interested in supporting the aims and objectives of IATUL

In an effort to recruit more members from countries and continents outside of Europe, a graduated membership fee structure was adopted at the general meeting in 2005. The new fee structure was based on the UNESCO Scale of Assessments. Libraries in those countries whose current UNESCO assessment is at 0.251 or greater pay the

standard fee. Those libraries in countries whose UNESCO assessment is at 0.250 or below pay a fee of 50% of the standard membership rate.^[10] In 2007, President Maria Heijne reported that there were 241 member libraries from 46 countries.^[11] The IATUL is small enough to allow individual members to develop a close relationship, yet widespread enough to cover the interests of libraries operating in virtually all modern social, economic, and political situations.

ORGANIZATION AND ACTIVITIES

The association is governed by a Board of Directors consisting of the President, First Vice-President, Second Vice-President, Secretary, Treasurer, Immediate Past President, and at least three board members elected by member libraries.^[9] The board meets at least two times each year. Beginning in 2005, the board organizes a regional seminar in conjunction with the fall board meeting. The goals of hosting a regional seminar are to “interact with representatives of local libraries, to share information about developments for technological university libraries, and to create interest for the activities of IATUL.”^[12] The current president of IATUL is Maria Heijne, University Librarian at the Delft Institute of Technology. The IATUL brings its members together by means of meetings, an e-mail list for members, and a Web site. The meetings include conferences, seminars, and regional gatherings. The conferences started as triennial meetings, which then became biennial, and finally, in 1997, annual conferences. During the period of biennial conferences, seminars were held during the year when there was no conference.

Recent conferences:

- The 28th IATUL Conference was held at the Royal Institute of Technology, Stockholm, Sweden in 2007 with the theme *Global Access to Science*.
- The 27th IATUL Conference was held at the Faculdade de Engenharia, Universidade do Porto, Portugal in 2006 with the theme *Embedding Libraries in Learning and Research*.
- The 26th IATUL Conference was held at the Université Laval Library, Québec City, Canada in 2005 with the theme of *Information and Innovation*.
- The 25th IATUL Conference was held at the Library of Krakow University of Technology in Krakow Poland in 2004 on the theme of *Library Management in Changing Environment*.
- The 24th IATUL Conference was held at the Middle Eastern Technical University in Ankara, Turkey in 2003 on the theme of *Libraries and Education in the Networked Information Environment*.
- The 30th IATUL Conference was held at the Katholieke Universiteit Leuven Belgium in 2009 with the theme of *Just for you: Quality through innovation*.

- The 29th IATUL Conference was held at the Auckland University of Technology, Auckland New Zealand in 2008 with the theme of *Digital Discovery: Strategies and Solutions*.

Conferences immediately prior to these most current ones were held in Greece, Norway, Australia, the United States, and South Africa. The scope of the conference themes and venues illustrate the world-wide impact of IATUL. Future plans for IATUL will take the annual conferences to Purdue University in the United States in 2010 and to Warsaw University of Technology in Poland in 2011.

PUBLICATIONS

The first IATUL publications were a series of irregular reprints and publications from 1956 (Number 1) to 1967 (Number 25).^[13] The first regular publications of IATUL were the *Newsletters* (January 1963–November 1965) with about 20 more extensive contributions and innumerable brief reports about the activities of the members. In 1965, the journal *IATUL Proceedings* started publication. Publication started at Delft University of Technology in the Netherlands and was transferred first to Loughborough University of Technology in the United Kingdom during the years 1968–1973, and then from 1974 till 1986 to Chalmers University of Technology, Gothenburg, Sweden.^[14]

From 1987 to 1991, the *IATUL Proceedings* and the *IATUL Conference Proceedings* were merged to form the *IATUL Quarterly* (Volumes 1–5) published by Oxford University Press. Owing to the high costs of publishing the *IATUL Quarterly*, it was decided to cease publication in 1991 and instead to publish the *IATUL News* as a quarterly newsletter, with the aim of providing a timely flow of information to members, together with the annual *IATUL Proceedings (New Series)*, which contains a selection of the papers presented at the IATUL Conferences and Seminars.

From 1996 onward, papers from *IATUL Proceedings* are available on the IATUL Web site at <http://www.iatul.org>. From 1997 to 2006, the *IATUL Proceedings (New Series)* is also distributed in a CD-ROM version; prior to 1997, a print version was produced. For a description of the *IATUL Proceedings* see the article published in 1996 by Elin Törnudd, former president of IATUL—*IATUL as a Mirror of Library Developments Since 1966 as Documented in IATUL Proceedings*.^[6] The *IATUL News*, Editor Nancy Fjällbrant, was published at Chalmers University of Technology from 1992 onward, in two forms: as a print publication from 1992 to 2000, with a parallel Web version available beginning in 1994. At the 2000 General Assembly of IATUL in Brisbane, it was decided to end the printed version of the *IATUL News* at the end of 2000. Distribution of IATUL News moved to mailing lists with archived issues maintained on the organizational Web site. This transition brings about the realization of the IATUL Electronic Publishing Plan that was launched in 1997—

with the aim of publishing all the IATUL publications in electronic form.

CONCLUSION

Although IATUL began as a European centric organization of technological university library managers, the scope of service and participating membership has expanded far beyond the geographical distribution of the original members. The IATUL continues to build membership and service to the engineering and technology library community around the world. The IATUL has recognized that due to variations in university organizational differences, participation by university libraries offering a wide scope of disciplines including engineering and technology needs to be cultivated. This organizational difference is most noticeably present in North America, where participation by universities is greatly encouraged. The forum provided by IATUL for the exchange of ideas relevant to engineering and technological librarianship continues to help enable the library community to meet the challenges of the twenty-first century information needs.

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International Communication Association (ICA)

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Abstract

The International Communication Association (ICA, 1500 21st Street, NW, Washington, D.C. 20036, Tel.: 202-955-1444; Fax: 202-955-1448, E-mail: icahdq@icahdq.org; <http://www.icahdq.org>) is an academic association for scholars interested in the study, teaching, and application of all aspects of human and mediated communication. ICA is an international association with over 4500 members. This entry summarizes its history, governance and administration, past presidents, divisions and interest groups, membership, annual conferences, fellows, awards, links with other communication associations, publications, impact factors and local citation environments of ICA, and references. Much of this material comes from ICA's website, with permission.

INTRODUCTION

ICA is an academic association for scholars interested in the study, teaching, and application of all aspects of human and mediated communication. ICA is an international association with over 4700 members from nearly 90 countries. Since 2003, ICA has been officially associated with the United Nations as a nongovernmental association. The overall purposes of the association are to advance the scholarly study of human communication and to facilitate the implementation of such study so as to be of maximum benefit to humankind. The association seeks to achieve this purpose by 1) encouraging the systematic study of theories, processes, and skills of human communication; and 2) facilitating the dissemination of research through an organizational structure responsive to communication study areas, a program of organizational affiliates, regular sponsorship of international meetings, and a commitment to a program of scholarly publication. This entry summarizes its history, governance, presidents, divisions and interest groups, membership, annual conferences, awards, and journals.

THE EARLY DAYS

The National Society for the Study of Communication (NSSC) was founded in 1950, led by such individuals as Elwood Murray, Paul Bagwell, Ralph Nichols, and Wesley Wiksell, from its parent organization the Speech Association of American (now the National Communication Association) partially to support and encourage the study of communication as a research topic instead of as primarily rhetoric. The first issue of the *Journal of Communication* appeared in 1951. In order to reflect the increasingly more diverse makeup of the society, four

initial divisions were formed in 1968: information systems, interpersonal communication, mass communication, and organizational communication. The NSSC changed its name in 1969 to the International Communication Association. During this period, membership rose from 900 members in 1967 to more than 2000 members in 1971. The first annual convention outside North America was held in West Berlin in 1977. (For a detailed history of the first quarter century of the International Communication Association, see Weaver.^[1] For more detail and references, see http://www.icahdq.org/about_ica/history.asp.)

GOVERNANCE AND ADMINISTRATION

The ICA Board of Directors includes an Executive Committee (the president, president-elect, immediate past-president, and past-president, the president-select-elect, and, ex-officio, the chair of the financial committee—who is the past-past president—and ICA's executive director), the chairs of the divisions and interest groups, two student members, and board members at large representing Africa-Oceania, non-U.S. Americas, East Asia, West Asia, and Europe. This regional (based on United Nations criteria) representation was implemented in 2000 to reflect the increasingly international focus of ICA. Standing committees of ICA include membership and internationalization, student affairs, finance, publications, nominating, and sustainability, as well as committees for each award. The headquarters relocated from Austin, Texas, to Washington, D.C. in 2001, and purchased its own office building in 2006. The full-time staff includes an executive director, a member services director, a publications manager, a communication director, an executive assistant, and a member services associate.

PRESIDENTS

In the year that ICA presidents are elected, they are responsible for determining the theme of the following year's conference. In that following year, the "president-elect" is responsible, working with the executive director, staff, and the executive committee, for selecting a conference theme chair and organizing that year's annual conference, responding to a constant flow of requests, proposals, and administrative matters, and representing ICA. In the following year, the "president" presides over board meetings and that year's annual conference, reconstitutes all the committees, represents ICA, attends to policy and other matters that come before ICA, and presents the presidential address. Table 1 lists the ICA presidents.

DIVISIONS AND INTEREST GROUPS

ICA's principal areas of concern are represented by its divisions and interest groups. These currently include 20 divisions (each maintains a membership of at least 10% of all ICA members) and five interest groups (newly founded sections with at least 20 members). Table 2 lists the divisions and interest groups. Two network analyses of the joint memberships and paper titles in ICA's division and interest groups revealed three underlying dimensions of the groups: mediated/interpersonal, humanistic/scientific, and theoretical/applied.^[2,3]

MEMBERSHIP

ICA's membership hovered around 500 until 1967, to 2000 by 1970, to 3000 after 2001, and by June 2014 included 4700. Some two-thirds are teaching and conducting research in colleges, universities, and schools around the world, while others work in the media, communication technology, business law, medicine, government, and other professions.

As part of ICA's continuing emphasis on increasing internationalization, about half of its committee members and about half of the board of directors are members of non-U.S. universities. Of the 80 countries represented in ICA, the greatest percentages of ICA membership include, at 58% the United States; from 8% to 2%: Germany, the United Kingdom, the Netherlands, Canada, and Australia; and from 1.5% to 1%: Switzerland, Japan, Republic of Korea, Israel, Belgium, Hong Kong, Sweden, and Singapore.

ICA has a triple-tiered dues structure following the United Nations model for A, B, and C countries. Residents of B-tier countries pay 75% of the A-tier price and residents of C-tier countries pay 50% of the A-tier price. These differing fee levels were instituted in 2002 to

Table 1 ICA presidents.

2014–2015	Peter Vorderer
2013–2014	Francois Heinderyckx
2012–2013	Cynthia Stohl
2011–2012	Larry Gross
2010–2011	Francois Cooren
2009–2010	Barbie Zelizer
2008–2009	Patrice M. Buzzanell
2007–2008	Sonia Livingstone
2006–2007	Ronald E. Rice
2005–2006	Jon F. Nussbaum
2004–2005	Wolfgang Donsbach
2003–2004	Robert T. Craig
2002–2003	Jennings Bryant
2001–2002	Cindy Gallois
2000–2001	Joseph N. Cappella
1999–2000	Linda L. Putnam
1998–1999	Howard Giles
1997–1998	Peter Monge
1996–1997	Stanley A. Deetz
1995–1996	Charles R. Berger
1994–1995	Bradley S. Greenberg
1993–1994	Akiba A. Cohen
1992–1993	Ellen Wartella
1991–1992	Mary Anne Fitzpatrick
1990–1991	Margaret L. McLaughlin
1989–1990	Jay George Blumler
1988–1989	Phillip K. Tompkins
1987–1988	L. Edna Rogers
1986–1987	B. Aubrey Fisher (deceased)
1985–1986	Brenda Dervin
1984–1985	Klaus Krippendorff
1983–1984	James A. Anderson
1982–1983	Erwin P. Bettinghaus
1981–1982	Steve Chaffee (deceased)
1980–1981	Everett M. Rogers (deceased)
1979–1980	Gerald R. Miller (deceased)
1978–1979	Frederick D. Williams (deceased)
1977–1978	Robert J. Kibler (deceased)
1976–1977	Richard W. Budd
1975–1976	Mark L. Knapp
1974–1975	Nathan Maccoby (deceased)
1973–1974	Alfred G. Smith (deceased)
1972–1973	Malcolm S. MacLean (deceased)
1971–1972	Ronald L. Smith (deceased)
1970–1971	R. Wayne Pace
1969–1970	Robert S. Goyer
1968–1969	Darrell T. Piersol
1967–1968	Lee Thayer
1966–1967	Frank E. X. Dance
1965–1966	Harold P. Zelko (deceased)
1964–1965	Clarence J. Dover (deceased)
1962–1963	W. Charles Redding (deceased)
1961–1962	John B. Haney
1960–1961	Thorrel Fest (deceased)
1958–1959	Francis A. Cartier
1955–1956	Kenneth A. Harwood
1954–1955	Burton H. Byers (deceased)
1951–1952	Elwood Murray (deceased)
1950–1951	Ralph G. Nichols (deceased)
1949–1950	Paul D. Bagwell (deceased)

Table 2 ICA divisions and interest groups (IG).

<i>Children, adolescents, and the media:</i>	Focuses on the production, content, uses, and reception of both print and electronic media. It strives to be a fruitful intellectual forum for academics from all over the world who study the role of media in the lives of children and young people. CAM's orientation is interdisciplinary and multimethodological.
<i>Communication and technology:</i>	Focuses on information and communication technology in relation to processes of human communication. Specifically it addresses new media, social media, human–computer interaction, computer-mediated communication, mobile communication, “big data,” crowdsourcing, and other technologically mediated social interaction and networking in all contexts and levels of analysis. CAT is not about technology per se, but rather about the interaction with social and personal entities at the micro, meso, and macro level.
<i>Communication history:</i>	Promotes theory, research, and professional education in the history of communication. the notion of “communication history,” in this interest group, pulls together three major areas of research: the history of communication including media history, the history of the idea of communication, and the history of the field of communication.
<i>Communication law and policy:</i>	Is interested in research and analysis of law, regulation, and policy that deals with information, communication, and culture. Defining policy broadly, the division includes within its purview: principles that should or do underlie law and regulation, proposals for new law and regulation, and the programs and institutions through which policy is implemented.
<i>Environmental communication:</i>	Advances research on the interplay of the environment with any level of communication and in any setting. Specific foci include health, risk, and science communication. Also helps members integrate sustainability issues into their teaching and research.
<i>Ethnicity and race:</i>	Is concerned with methodological approaches and research that apply, extend, or develop communication theory and analysis through an examination of race and ethnicity within local, international, and transnational contexts. Advocates for the improved status, representation, and opportunities for underrepresented scholars in communication.
<i>Feminist scholarship:</i>	Is interested in exploring the relationship of gender and communication, both mediated and nonmediated, within a context of feminist theories, methodologies, and practices. Areas include feminist teaching; international commonalities and differences by race, class, and gender; women's alternative media; and feminist cultural studies.
<i>Game studies (IG):</i>	The study of games and the game experience offers opportunities for the study of human communication that involve multidisciplinary approaches that merge the disciplines of conventional communication studies and research, arts and visual design, cognitive studies, computer sciences, cultural studies, engineering social sciences, health sciences, and information design.
<i>Global communication and social change:</i>	Encourages and debates research on issues of production, distribution, content, and reception of communications media at global, “glocal,” transnational, transcultural, international, and regional levels.
<i>Health communication:</i>	Is primarily concerned with the role of communication theory, research, and practice in health promotion and health care. Areas of research include provider–patient interaction, social support networks, health information systems, medical ethics, health policy, and health promotion.
<i>Information systems:</i>	Is concerned with information, language, and cognitive systems. Its central goal is promoting the development of general theories of complex systems and quantitative methodologies for communication research in a variety of domains.
<i>Instructional and developmental communication:</i>	Is concerned with both communication related to any learning environment and communication that transpires across the life span. Its dual goals include promoting the study of communication variables and theory in the instructional process and promoting the study of communication as a developmental phenomenon across the complete life span.
<i>Intercultural communication:</i>	Is primarily concerned with theory and practice of communication between and among different cultures of the world; with comparisons of different communication systems in different cultural, national, or ethnic groups; with other aspects of international communication; and with the relationship between communication and national development.
<i>Intergroup communication (IG):</i>	Focuses on the ways in which communication within and between groups affects social relations. Intergroup encounters occur when social, rather than personal, identity forms the basis for communication. Intergroup communication is often characterized by power inequality, bias, competition, or conflict. Some relevant topics would include prejudice and discrimination, social identity processes, language survival and death, social influence, leadership, communicative shifts and concomitant effects on relationships, computer-mediated communication, linguistic biases, power, terrorism, collaboration, and altruism.

(Continued)

Table 2 ICA divisions and interest groups (IG). (Continued)

<i>Interpersonal communication:</i>	Emphasizes the study of communication processes between people in a variety of settings, including friendship formation, influence, relationship development, small group processes, and family relations, through face-to-face and mediated communication.
<i>Journalism studies:</i>	Is concerned with journalism theory, journalism research, and professional education in journalism, across temporal and geographic contexts. The division seeks to facilitate empirical research and to bring more coherence to research paradigms.
<i>Language and social interaction:</i>	Is concerned with exploring details of human discourse and human interaction. The division sponsors research in language theory, linguistics, pragmatics, semiotics, sociolinguistics, ethnography of speaking, conversation analysis, and related approaches to human social interaction. The primary focus is in interpersonal and group settings, through face-to-face or mediated communication.
<i>Lesbian, gay, bisexual, transgender, and queer studies (IG):</i>	Is concerned with the analysis and critique of sexual systems, discourses, and representations, particularly those which animate, inform, and impinge upon the lives of lesbian, gay, bisexual, and transgender people. Such systems and discourses occur in institutional, community, domestic and intimate contexts, are closely connected to other social and cultural practices (such as nationalism, education or popular entertainment), and play a critical role in the formation and communication of individual and group identity.
<i>Mass communication:</i>	Is primarily concerned with the differential impact of messages transmitted by various mass media, including international exchanges through mass media. Its members develop theory, examine the processes and effects of mass communication, and develop and evaluate policy relevant to mass communication.
<i>Media industry studies (IG):</i>	Promotes research and teaching practice on the history, organization, structure, economics, management, production processes, and cultural forms, and the societal impact of media industries from a variety of theoretical, empirical, and cultural perspectives. Among other things, our members study the relationship between government and industry, the intersection of audience and industry, audiences as consumers, the business of media, production and creative labor, ownership structure, and content diversity from a range of micro and macro-levels
<i>Mobile communication (IG):</i>	Studies the phenomenon of mobility in communication—the intersection of mobility, technology, and culture in human communication. Members apply a wide array of perspectives from historical perspectives to studies on future media innovations, from ethnographic to quantitative empirical approaches, from journalism studies to media effects research. The common ground is state of the art theorizing on mobile communication as well as the discussion of adequate methodology to do so.
<i>Organizational communication:</i>	Seeks to expand our understanding of the processes, prospects, and challenges of communicating and organizing in a global society. Its scholarship articulates concepts and theories to better understand these processes, develops the tools needed to investigate them, and helps to implement the social practices to improve them.
<i>Philosophy, theory, and critique:</i>	Is broadly concerned with theoretical, analytical, and political issues that cut across the various boundaries within the study of communication and its intersections with other modes of studying human interaction.
<i>Political communication:</i>	Is concerned with the interplay of communication and politics, including the transactions that occur among citizens, between citizens and their governments, and among officials within governments.
<i>Popular communication:</i>	Is concerned with providing a forum for scholarly investigation, analysis, and dialogue among communication researchers interested in a wide variety of communication symbols, forms, phenomena, and strategic systems of symbols within the context of contemporary popular culture.
<i>Public relations:</i>	Is concerned with the theory and practice of communication between organizations and specified publics. Research interests include target group analysis, internal/external communication integration, systems analysis, and channel effectiveness.
<i>Public diplomacy (IG):</i>	
<i>Sports communication (IG):</i>	Intends to understand human and mediated communication processes and effects within sports contexts.
<i>Visual communication studies:</i>	Seeks to enhance the understanding of the visual in all its forms—moving and still images and displays in television, video and film, art and design, and print and digital media. Research areas include creation, processing, function, meaning, and critical consequences of visual representation.

Table 3 Membership in ICA divisions and interest groups.

Division or interest group	Percent of all memberships
Children, adolescents, and the media	2.9
Communication and technology	9.8
Communication history	2.7
Communication law and policy	2.9
Environmental communication	2.2
Ethnicity and race in communication	2.3
Feminist scholarship	2.5
Game studies	2.2
Gay, lesbian, bisexual, and transgender studies (IG)	1.2
Global communication & social change	4.5
Health communication	5.6
Information systems	3.4
Instructional/developmental communication	1.9
Intercultural communication	4.3
Intergroup communication (IG)	1.6
Interpersonal communication	3.9
Journalism studies	6.0
Language and social interaction	2.3
Mass communication	10.2
Organizational communication	5.5
Philosophy, theory, and critique	4.2
Political communication	7.6
Popular communication	3.8
Public relations	4.2
Sports communication (IG)	0.0
Visual communication studies	2.5
Total	10785

Note: There are 4500 unique members, and one division or interest group is provided free with membership, but members typically belong to multiple divisions or interest groups. So, the total is the overall total of group registrations (including multiple groups for a person), and the percentage is based on that.

continue the increased emphasis on international representation. Membership categories for individuals include regular, employment exception, student, emeritus, life, and sustaining. Membership categories for groups include family, institutional, and association. Members may join one division/interest group as part of regular dues and may add additional divisions/interest groups for a few dollars.

Table 3 presents the percentage of memberships for each division and interest group. Mass communication has the greatest percentage of memberships as of 2014.

The primary benefits to members of ICA include opportunities to network with colleagues who share teaching and research interests worldwide; access to membership in the divisions and interest groups and their related websites; attendance at annual conferences at member rates with discounted air/hotel/car rates; print or online subscriptions to five professional journals; and access to the annual yearbook at a members-only discount. Other book discounts include several series: Blackwell's *Communication in the Public Interest* and *The International Encyclopedia of*

Communication, Routledge's *ICA-LEA Handbook Series*, and Hampton Press's *ICA Theme Series* (highlighting the primary theme of each year's conference theme sessions), as well as discounted membership in the Communication Institute for Online Scholarship (<http://www.cios.org>). Finally, ICA's website contains the latest information and allows for online registration for conferences and membership renewals; provides the latest information, online access to ICA journals, and the ICA membership directory; and provides access to the ICA online newsletter, published 10 times per year, which includes job listings, association and member news, ICA officer columns, and calls for papers.

ANNUAL CONFERENCES

The ICA annual conference is generally held each year at the end of May when in North America and in June or July when outside of North America. About 1500–2000 scholars come together at this event to learn about the latest research, socialize with colleagues, visit the city, and learn about job opportunities. Submitted papers undergo a double-blind peer review process; in 2005 a record number of 2300 papers were submitted (New York); in 2006, 2000 were submitted (Dresden). Another change to expand the international identity and presence of Caws to increase the frequency of annual conferences held outside of North America from every 4 years to every 3 years, beginning in 2010. Non-U.S. conferences include Berlin (1977), Acapulco (1980), Montreal (1987), Dublin (1990), Sydney (1994), Montreal (1997), Jerusalem (1998), Acapulco (2000), Seoul (2002), Dresden (2006), Montreal (2008), Singapore (2010), London (2013), Fukuoka Japan (2016), and Prague (2018).

FELLOWS

ICA annually recognizes distinguished scholarly contributions to the broad field of communication, as well as service to ICA and other public institutions through fellow status. Currently, there are over 100 Fellows. Meyen^[4] published an insightful "collective biography" based on interviews with 57 Fellows. To some extent, fellows are representatives of dominant paradigms, provide role models, are agents in field's decision-making, and influence perceptions and expectations. They are influenced by the geography of the field's founders and universities, by family background and academic socialization, a shift from the early emphasis on journalism to a more social science perspective, a commitment to field of communication and its symbolic capital, and their interest in service and mentoring and working with graduate students.

AWARDS

ICA presents eight major awards at the annual conference to recognize significant research in and contributions to the field. ICA divisions and interest groups also offer their own awards.

Steven H. Chaffee Career Achievement Award

The award honors a scholar (or small group of collaborating scholars) for sustained work on a communication research problem over an extended period. The selection committee favors research that is original, asks conceptually rich questions, and offers empirically sound evidence. The research must have comprised multiple projects and publications and generated second-generation work among students and other scholars. Rather than recognizing general productivity in the field or contributions to ICA, the award acknowledges sustained and coherent work on a well-focused communication problem central to the communication discipline. Most recipients are members of the discipline and belong to ICA, but other scholars are eligible, regardless of current membership or department affiliation. The winner presents research at the following year's ICA conference.

James W. Carey Urban Communication Grant

This annual prize supports communication research that enhances urban social interaction and civic engagement in an age of global communication. It encourages applied research on the role of city and community at a time when communication technology alters the parameters of the urban landscape. The award is for proposals that feature innovation and creative approaches to reconciling the growing gap between tradition and modernity as suburban sprawl threatens the very nature of urban traditions. This award facilitates research in progress or in the planning stages. It gives priority to projects that study places where traditional modes of communication are being juxtaposed with the new, including the adoption of changes that may have a radical impact. Proposals from developing nations are encouraged.

Outstanding Book Award

The award honors a book published in the previous two calendar years (between January 1 and December 31). The selection committee judges each nominated book on several criteria including the importance of the problem it addresses in the fields represented in ICA and to communication studies as a whole, the quality of writing and argument, and the strength of evidence it presents. The committee will consider all the available book reviews, the reputation of the publisher, and any other submitted evidence regarding the book's quality from independent sources, along with

nominating letters and their own assessment of the nominated books. Most award-winning books address a scholarly audience, but books aimed at a general readership but satisfying the criteria for the prize are also eligible—edited books are not eligible.

Applied Research Award

The Applied Research Award honors a scholar or group of scholars who has or have produced a systematic and outstanding body of research that addresses a significant communication problem of relevance to a public representing one or more groups of stakeholders relevant to a division (s) or interest group(s) of ICA. Individual or collaborative applied research programs that include community engagement, group and organizational interventions, or advocacy and/or political policy work at the local, national, international, and/or global levels are all appropriate candidates for this award. Evidence for quality and public importance can come from conventional publications but also from such materials as technical reports, news media coverage, and testimonials from those making use of the research or those it has affected.

Outstanding Article Award

The award honors an article published in a refereed journal during the previous two calendar years (between January 1 and December 31). Theoretical articles and empirical articles are eligible, as are review articles that effectively redefine a problem. Selection criteria include coherence of argument, quality of conceptual development, and effective use of evidence. The selection committee prefers articles that promise to be influential over time, within particular field of communication and also across fields.

Young Scholar Award

The award honors a scholar no more than 7 years past receipt of the Ph.D. for a body of work that has contributed to knowledge of the field of communication and shows promise for continued development. The selection committee judges the contribution and promise of young scholars based on the strength of published work, including its conceptual foundation and argumentative clarity, on the scholar's productivity at a given career stage, on the rigor of the research produced so far, and on the promise of existing work serving as a springboard for continuing scholarship.

B. Aubrey Fisher Mentorship Award

Initiated in 1988 following the death of its namesake, this award honors outstanding scholars, teachers, and advisors who serve as role models in those capacities and

who have had a major impact on the field of communication. Most importantly, recipients of this award have influenced the discipline through their former students, who themselves are important figures in the communication discipline.

ICA Fellows Book Award

Open to all ICA members, this award recognizes those books that have made a substantial contribution to the scholarship of the communication field as well as the broader rubric of the social sciences and have stood some test of time.

LINKS WITH OTHER COMMUNICATION ASSOCIATIONS

ICA fosters collaboration with other communication associations, including co-sponsoring conferences, and providing affiliate organizational status. Current relations include Asociacion de Comunicacion Politica; Bangladesh Center for Communication Programs; BBC Media Action; Binational Association of Schools of Comm of the Californias; Brazilian Society of Interdisciplinary Studies in Communication; Chinese Communication Association; Deutsche Gesellschaft fur Publizistik-und Kommunikationswissenschaft; Institute of Digital Media and Child Development, Inc.; International Association of Language & Social Psychology; International Association for Media and Communication Research; International Environmental Communication Association; Korean American Communication Association; Media Ecology Association; National Association of Mass Media Researchers; Polish Communication Association; and the Russian Communication Association.

PUBLICATIONS

The annual *Communication Yearbook* (begun in 1977) publishes state-of-the-art literature reviews and articles providing comprehensive syntheses of literature. *Communication Theory* (1991) publishes research articles, theoretical essays, and reviews on topics of broad theoretical interest from across the range of communication studies. *Human Communication Research* (1973) publishes the

best empirical research examining communication processes and effects. The *Journal of Communication* (1969) is a general forum for communication scholarship and publishes articles and book reviews examining a broad range of issues in communication theory and research. The *Journal of Computer-Mediated Communication* (acquired in 2003) is a Web-based journal that publishes scholarship on computer-mediated communication. ICA added a fifth journal, *Communication, Culture & Critique*, beginning 2008; it is an international forum for critical, feminist interpretive, and qualitative research examining the role of communication from a cultural and historical perspective. Beginning in January 2007, the abstracts of the articles of each of the journals are also provided through the publisher's databases, translated into Spanish, Korean, French, Chinese, and German.

IMPACT FACTORS AND LOCAL CITATION ENVIRONMENTS OF ICA JOURNALS

The underlying citations to and from journals, as reported in ISI's Journal Citation Report, are the basis for computing each journal's citation impact factor. Citation Impact Ratings are the ratio of number of citations received to articles in that journal, divided by number of articles published in that journal 2 years prior. Table 4 provides the 2011, 2013, and 2013 5-year ISI journal citation impact factors for the ICA journals.

The article citation data are also the basis for identifying clusters of shared concepts, journals, and authors—one widely used form of bibliometrics, or citation analysis. Leydesdorff^[5] developed a reasonable way to extract what he calls “journal-citation environments” from the otherwise unwieldy matrix of possible citation relations (with over 1700 social science journals, based on data from the *Journal Citation Reports* from the Social Science Citation Index). Leydesdorff instead developed a procedure whereby one can choose any particular journal of interest; the program computes the distribution of citations to, and the distribution of citations from, that journal, and selects only those cited and citing journals that involve at least 1% of the total citations (from or to). Generally, 10–20 or so journals represent nearly all of the citations, so all remaining journals are ignored. The “cited” value represents the local impact in terms of citation volume, while the “citing” value represents “how the relevant journal environment is perceived by the collective authors of a given

Table 4 ICA journal citation impact ratings.

ICA journals	2011 impact factor	2013 impact factor	2013 5-year impact factor
<i>Communication Theory</i>	1.20	1.05	1.99
<i>Human Communication Research</i>	2.08	1.89	2.69
<i>Journal of Communication</i>	2.01	2.08	3.2
<i>Journal of Computer-Mediated Communication</i>	1.78	2.02	4.35

Source: 2013 Social Science Journal Citation Reports.

journal” (p. 25) (see www.leydesdorff.net). There are more detailed citation analyses of communication journals^[6–12]

Based on 2004 data, *Communication Theory* is cited primarily by *Communication Research*, *Journal of Communication*, *Human Communication Research*, and *Communication Monographs*. It also has small (but greater than 1%) citations from *Health Communication*, *Media Psychology*, and *Journal of Health Communication*. However, nearly all of its citations go to *Communication Monographs*, with just a few in its local citation environment to *Journal of Personality and Social Psychology*. As *Communication Theory* was new at the time of the 2004 data collection, this network certainly has expanded since then.

Human Communication Research is embedded in a dense and diverse network of citing journals, including *Journal of Communication*, *Human Communication Research*, *Journal of Broadcasting and Electronic Media*, *Journalism and Mass Communication*, *Political Communication*, and, less frequently, *Critical Studies in Mediated Communication*, *International Journal of Public Opinion Research*, *European Journal of Communication*, *Media/Culture/Society*, *New Media & Society*, and *Harvard International Journal of Press and Politics*. Its citing environment (at least 1%) is far less dense, involving *Communication Research*, *Communication Monographs*, *Journal of Communication*, *Journal of Social & Personal Relations*, *European Journal of Social Psychology*, *Journal of Personality and Social Psychology*, *Psychology Bulletin*, and *Personality and Social Psychology Bulletin*.

The *Journal of Communication* is similar to *Human Communication Research* in being embedded in a dense and diverse journal citation environment. Most frequent citers of *Journal of Communication* articles include *Communication Research*, *Human Communication Research*, *Common Monographs*, *Journalism and Mass Communication*, *Journal of Broadcasting and Electronic Media*, *Critical Studies in Media Communication*, and *Political Communication*. Other direct but less frequent citers in the environment include *Journal of Public Opinion Research*, *Media Psychology*, *Harvard Journal of Press and Politics*, *New Media & Society*, *Media/Culture/Society*, and *European Journal of Communication*. Also like *HCR*, *JOC* cites a few primary journals, including *Communication Research*, *Communication Monographs*, *Political Communication*, *Journal of Broadcasting and Electronic Media*, *Journalism and Mass Communication*, *Human Communication Research*, and *Public Opinion Quarterly*.

CONCLUSION

The International Communication Association is a continually growing organization, in terms of research topics

represented by divisions and interest groups, publications, size and internationality of its members, and relationships with other communication associations around the world. It provides the main academic association for primarily social-scientific approaches to the study, teaching, and application of communication research.

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International Council of Museums (ICOM)

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Abstract

The International Council of Museums (ICOM) is the global nongovernmental organization (NGO) representing the interests of museums, galleries, and related heritage institutions and services and their staff. Legally constituted in Paris as an *Association* in November 1946, ICOM is an independent NGO that represents both museum professionals and museums and related institutions and services, with a total of over 27,000 institutional and personal members in 151 countries. The ICOM's working languages are French, English, and Spanish, though national committees or individuals may use other languages in official meetings provided they arrange or pay for the necessary additional translation services.

ORIGIN AND DEVELOPMENT

The ICOM's history can be traced back to the International Museums Office established by the League of Nations, in Paris in 1927 under the League's International Institute of Intellectual Cooperation. Though legally constituted as an intergovernmental body of delegates appointed by Member States of the League, throughout its existence the International Museums Office operated with considerable freedom, acting very much as though it was a nongovernmental body. In particular, it drew on a very wide range of museum professionals and expertise in carrying out many cooperative studies of best practice and museum promotion and advisory programs, covering different museum and gallery activities, as well as work in other heritage areas, such as natural and historic monuments, sites and their conservation.

For example, its Athens Conference of 1931 examined the restoration of historic buildings, while between 1933 and 1939 the Office undertook a major international study of best modern practice relating to the conservation of paintings. Seven decades later these two are seen to have laid the foundations of modern approaches to conservation and restoration in the respective areas. In the case of the paintings study, the findings and recommendations, published in French and English editions in 1939 and 1940,^[1,2] are still regarded as the foundation of scientific conservation and restoration of paintings, in contrast with the "cleaning" (often accompanied by heavy over-painting) of earlier times. Then, as war clouds gathered, and the devastating effect of the latest advances in warfare became clear from the Spanish Civil War, the Office carried out an urgent study of the protection of monuments and works of art in wartime, preparing a substantial practical manual of guidance,^[3] which also included a proposed draft international treaty on cultural protection (much of which was finally to be adopted after World

War II in the 1954 *Hague Convention on the Protection of Cultural Property in the Event of Armed Conflict*.)

The Office also published an international journal, *Museion*, which soon became a most important channel for international communication about museum developments and emerging practice. In addition, the Office launched a multivolume *Traité de Muséographie* covering best practice on all aspects of museum techniques, including the care and maintenance of collections, and many aspects of display and exhibition work. This series remained incomplete due to the outbreak of World War II. Although International Museums Office was in effect closed down in 1940 with the occupation of Paris, it was not formally abolished until after the war.

In October 1946, the new United Nations Educational, Scientific and Cultural Organization (UNESCO) was formally inaugurated in Paris, and started taking over relevant remaining functions and property of the League of Nations, including the library and other property of the International Museums Office. At the same time there were international consultations about establishing a world coordinating body for museums and museum organizations, and in November 1946 representatives of 14 countries met in the Musée du Louvre, Paris, supported by written representations from a further 13 countries, and resolved to create the International Council of Museums (ICOM) as a nongovernmental international *Association*.^[4]

UNESCO, which had already welcomed the proposal, moved immediately to establish formal relations with the new nongovernmental organization (NGO), and in January 1947 the first contract between UNESCO and ICOM was agreed, providing for ICOM to take over responsibility for the museological library of the former International Museums Office as the UNESCO-ICOM Museum Documentation Centre, as well as much of the advisory and coordination role of the former body.

ICOM quickly structured itself on the basis of the familiar NGO pattern. The membership was made up of small national committees of delegates appointed by the countries represented, typically by the national museums, national associations, or other national bodies (including national governments and ministries in the case of less democratic states). In addition to the officers and governing Council, who were elected from the membership, ICOM established international committees of appointed or invited experts (not necessarily members of ICOM itself). Soon these “museum subject” international committees that dealt with particular subjects, (typically different types of museums or collections) were joined by a growing number of interdisciplinary international committees, established to explore and develop best practice in subjects such as museum administration and training, educational services in museums, or the scientific conservation and restoration of collections and works of art.

When first created ICOM continued to cover the whole range of subjects and institutions for which the International Museums Office had been responsible, but over the next two decades or so areas of activity such as national parks, nature reserves, botanic and zoological gardens, and archaeological and historic monuments and sites came more and more within the scope of other international NGOs—particularly, the International Union for the Conservation of Nature (IUCN) in the case of the natural heritage, and the International Council on Monuments and Sites (ICOMOS) in the case of cultural heritage sites and monuments, a trend that was greatly reinforced when the IUCN and ICOMOS were given a special status in relation to these fields by the 1972 World Heritage Convention.

A much more far-reaching change of ICOM’s structure began in the early 1970s. Though the official membership was restricted to those nominated at the national level (and with a maximum of 15 members in each national committee), ICOM’s triennial General Conferences were open to, and increasingly popular with, the world’s museum professionals generally on the payment of the appropriate “Associate” fee. By the time of the 1971 General Conference in Paris and Grenoble the official ICOM members present and entitled to vote were outnumbered several times over by nonvoting Conference participants, who were vocal in their protests about the membership structure. A joint review of the situation was carried out with the participation of representatives of the nonmembers, and at the next General Conference, held in Copenhagen in 1974, ICOM voted to turn itself into an international “membership” organization.

Consequently, from 1975 any museum professional in any country was entitled to join ICOM, becoming automatically a full member of the national committee. Similarly, the international committees, previously small bodies of no more than 30 appointed or elected experts, were reconstituted as unrestricted bodies open to all the

members of ICOM, with each ICOM member entitled to register their membership in any international committee of their choice. Since this fundamental change in the democratic character of its membership, ICOM has grown very rapidly, from less than 1000 members in the early 1970s to 27,000 members today. At the same time, the ICOM’s original list of eight international committees of no more than 30 members each has grown to 30 committees, some of which now have over 1000 members. As of 2008, ICOM also had 17 International Affiliated Organizations and 5 Regional Alliances.

MISSION

The ICOM’s governing *Statutes* including the definition of a museum were also considerably updated as part of the 1974 reforms. In contrast with the long-standing narrow focus (on collection, research, and communication in relation to collections, specimens, and works of art), a museum was declared to have an explicitly social and developmental purpose. According to this new definition, <http://icom.museum/definition.htm> a museum is

... a non-profit making, permanent institution in the service of the society and its development, and open to the public, which acquires, conserves, researches, communicates, and exhibits, for purposes of study, education and enjoyment, material evidence of man and his environment.

The current version of the Statutes of ICOM adopted in the 2007 General Conference describes the mission and purpose of ICOM as follows:^[5]

Mission. The ICOM is the international organization of museums and museum professionals, which is committed to the conservation, the continuation, and the communication to society of the world’s natural and cultural heritage, present and future, tangible and intangible.

Purpose. The ICOM establishes professional and ethical standards for museum activities, makes recommendations on such issues, promotes training, advances knowledge, and raises public cultural awareness through global networks and cooperation programmes. <http://icom.museum/mission.html>

CORE VALUES

Following the approval of the new *Statutes* the previous year, in 2008 ICOM has adopted and published a wide-ranging statement of core values and the vision for the future in the trilingual *Our Global Vision*.^[6] Key provisions include:

Vision

For a world where the importance of the natural and cultural heritage is universally valued

Values

The ICOM values human creativity and its contribution to understanding the past, shaping the present, and planning the future.

The ICOM believes heritage has an innate humanistic value.

The ICOM values global dialogue based on intellectual, cultural, and social diversity.

The ICOM values transparent dialogue including the cross-cultural understanding of human rights.

The ICOM recognizes museums' social responsibility to engage with public issues of social change.

Following the very significant constitutional and policy developments of 2007–2008, ICOM is now recasting its central program, priorities, and budget to match the current objectives and the medium-term plan derived from them, and is urging its international and national committees to contribute very actively to the new approaches.

MEMBERSHIP

ICOM membership is open to all institutions and individuals approved by the appropriate National Committee as complying with the ICOM definitions of a museum or museum professional respectively in the ICOM *Statutes*, on payment of the appropriate annual subscription. (In countries without a National Committee, membership is regulated and managed by the ICOM Secretariat in Paris.)

In July 2008, ICOM had over 27,000 members, including over 1000 institutional members, organized through 118 National Committees, for which a minimum of five paid-up members are required. In addition, there were 100 members in 33 countries and territories that do not have a national committee, so in total ICOM has members in 151 countries. In order to encourage and assist membership development in less developed countries as indicated by appropriate UN and World Bank indexes, there is a 50% reduction in both institutional and individual subscriptions for such countries.

Although 65 of the 118 National Committees currently benefit from this membership subsidy, the percentage of members assisted in this way remains very low, because in most of these countries the ICOM committees are very small due to the limited number of museum professionals and due to the small number and size of museums. As for the Member States of UNESCO that do not currently have an ICOM National Committee, ICOM seeks to ensure that there is an official national correspondent, usually the national museum, the culture ministry or the UNESCO national commission, which receives regular information and publications from ICOM.

Each ICOM member in good standing is entitled to take a full part in the work of both their own national committee as well as one international committee of their choosing, and they can seek and hold office in either or both. Each is also eligible to be nominated by their national or international committee for the triennial election to serve as President of ICOM or one of the officers of ICOM, or as a member of its governing Executive Council. However, with great variations in the number of members in each country and region, ICOM uses an indirect franchise in order to try to achieve a much more balanced geographical representation at its governance level than would be possible with a one member—one vote system (under which Europe might well take most of the elected positions at each triennial election). Therefore, regardless of their size in terms of membership, in all elections each national and international committee exercises five votes, as determined by the committee's members in advance of the vote. (International Affiliated Organizations have three votes each.) In addition, the chairpersons of each national and international committee and international affiliated organization serve *ex officio* as members of ICOM's Advisory Committee.

National committees elect their own national officers and decide their own program of activities. In some countries, the ICOM National Committee serves as a national museums association, undertaking a wide range of programs, liaison with government on, for example, museum and heritage policy and financing, and activities such as meetings, conferences, and publishing. However, where there is a large, long-established, and well-developed national association, as in the United States or United Kingdom already undertaking much of this work, the ICOM National Committee will typically have a more limited role—for example, concentrating on international rather than domestic affairs and on membership promotion, recruitment, and management on behalf of ICOM internationally.

COOPERATIVE PARTNERSHIPS

The ICOM's key, and longest-established, partnership is with UNESCO; the first formal agreement between the two being adopted less than 3 months after the two organizations were formally established in the Autumn of 1946. For much of the following six decades, ICOM and its work was subsidized directly by UNESCO, and its Secretariat was housed within UNESCO offices. Over the past two decades or so UNESCO's policy toward its former Category A NGOs has changed, with a reduction and finally a withdrawal of operating subsidies and their replacement by opportunities to undertake contract work for UNESCO. More recently because of UNESCO's own office space problems, the ICOM Secretariat had to move out of the free accommodation in the *Maison de l'UNESCO* into rented accommodation nearby.

Historically, ICOM has undertaken leading roles in the research and editing of UNESCO's cultural heritage publications programs, notably the quarterly journal *Museum* (now *Museum International*), and continues to run the UNESCO-ICOM Museum Information Centre (the successor to Documentation Centre, established in 1947). The ICOM has been a close partner in many UNESCO cultural heritage campaigns and initiatives, particularly museum development assistance and staff training programs in many parts of the world. For example, the world's first *Basic Syllabus for Museum Professional Training* was drawn up by ICOM for UNESCO in 1971, while the two bodies continue to work closely together in the new UNESCO/ICOM Museum Training Programme begun in 2004, initially as a part of the UN's proposed Iraq Reconstruction Programme, but later made available more generally with both printed and online resources centered around *Running a Museum: A Practical Handbook* (original editions in English, Arabic, and French, 2005), and a program of UNESCO training workshops run with ICOM participation. For details of the UNESCO/ICOM Museum Training Programme and links to its publications, etc., see UNESCO's Web site.^[7]

ICOM has also been, and remains today, closely involved with a number of UNESCO's most important cultural heritage protection and promotion programs and international conventions, notably

- The 1954 *Convention on the Protection of Cultural Property in the Event of Armed Conflict* ("Hague Convention") of 1954 and its 1954 and 1999 *Protocols*.
- The UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property, 1970.
- The UNESCO Convention for the Safeguarding of the Intangible Cultural Heritage, 2003.

In each case, ICOM is accredited to an advisory body attending their related Intergovernmental Committees.

Other important links with international intergovernmental organizations include a long-standing partnership with the Rome-based International Centre for the Study of the Preservation and Restoration of Cultural Property (ICCROM) ever since its establishment in 1959, and ICOM's status as an NGO accredited to the Economic and Social Council of the United Nations (ECOSOC). Most recently, after several years of informal links and communications, in 2007 ICOM established a formal partnership with the World Intellectual Property Organization (WIPO), and is currently working closely with WIPO's Traditional Knowledge, Genetic Resources, and Traditional Cultural Expressions/Folklore studies in particular.

The ICOM also has close relations with many NGOs. At the national level, there are almost always close links and cooperation with any national museum associations and similar bodies, while a number of the International

Committees similarly have links with other international academic and professional bodies in their various fields of interest.

At the international level, ICOM has always had close relations with the International Council on Monuments and Sites (ICOMOS) since its formation in 1965; the two organizations have mutual observer status representation at each other's conferences and executive councils. There have also been links for some years between some equivalent international committees of the two bodies. In June 2008, it was agreed that this kind of twinning cooperation should be established between all relevant ICOM and ICOMOS international committees.

From 1967 onward, ICOM welcomed and actively supported various initiatives toward international cooperation between the growing number of national federations of Friends of Museums organizations. Since the formalizing of this with the establishment of the World Federation of Friends of Museums (WFFM) as a new international NGO in 1975, ICOM has always been an active partner and enthusiastic supporter of the organization's work and its triennial Congresses. Today the WFFM brings together almost 50 national Friends organizations, and represents an estimated two million individual members of Friends organizations around the world.

In 1995, ICOM and ICOMOS entered into a formal cooperation agreement with two other UNESCO-linked NGOs: the International Federation of Library Associations and Institutions (IFLA) and the International Council on Archives through the establishment of the International Committee of the Blue Shield (ICBS) as a standing joint committee to facilitate professional and technical cooperation and coordination in relation to all kinds of emergencies affecting, or threatening, any kind of cultural property, whether building or site, library, archive, or a museum or art collection. More recently, the four ICBS organizations have been joined by a fifth: the Coordinating Council of Audiovisual Archives Associations (CCAAA).

GOVERNANCE

ICOM follows the fairly standard structure of an Association under the French *Loi des Associations de 1 juillet de 1901*. The ultimate authority is the annual General Assembly, which consists of all individual, student, supporting, and honorary members and the designated representatives of institutional members. However, only those individual members and representatives of institutional members who have been designated as voting delegates by National Committees, International Committee, and Affiliated Organization have the right to vote. The General Assembly adopts and amends the *Statutes*, its own Rules of Procedure, determines the overall policy and program of the organization and the location and themes of the Triennial General Conferences, and approves the budget, rates

of subscription and the audited accounts. Once every three years, the General Assembly also elects the President, other Officers, and the Executive Council.

The President is elected for a 3-year term of office and can be reelected for a second term of the same duration. The President sets the strategic orientations for the activities of ICOM in its capacity as an international organization representing museums and museum professionals. The President represents ICOM in all civil acts and the signature of the President binds ICOM in contracts and agreements with third parties. The President convenes and chairs the meetings of the General Assembly and the Executive Council, and after consultation with the Executive Council as appropriate, also makes appointments to Standing Committees and representatives of ICOM to other bodies, conferences, meetings, etc.

The Executive Council is the decision-making body of ICOM, and consists of a total of 15 elected members: the President, 2 Vice-Presidents, Treasurer, and 11 other members, all elected once every 3 years in the General Assembly, together with the Chairperson of the Advisory Committee as an *ex officio* member.

The Council meets in ordinary session at least twice a year, one of these meetings being held in association with the annual Ordinary General Assembly, at the same time and place. The Executive Council ensures the good management of ICOM, overseeing the various resources of ICOM (financial, human, intellectual, and technical) and their development, safeguarding ICOM's reputation, international esteem, and public regard. The President, Vice-Presidents, and the Treasurer form the Bureau of the Executive Council, which has the power to resolve urgent issues, reporting on any action taken to the full Executive Council as soon as possible.

The Advisory Committee consists of the Chairpersons (or their appointed representatives) of every National and International Committee, Regional Alliance, and Affiliated Organization, and meets at least once a year in ordinary session, around the same date and at the same location as one of the Executive Council meetings. The Advisory Committee advises the Executive Council and the General Assembly on matters concerning the policies, programs, procedures, and finances of ICOM, and may propose amendments to the *Statutes*. It also advises on matters and activities in the general interest of ICOM referred to it by the Executive Council or the General Assembly.

The Chairperson and two Vice-Chairpersons of the Advisory Committee are elected by the membership of the Committee for a 3-year term of office, and may serve two consecutive terms. The Chairperson of the Advisory Committee convenes and chairs the meetings of the Committee, serves as an *ex officio* member of the Executive Council and as the Elections Officer of ICOM and finally, as an *ex officio* member of the Board of all Regional Alliances.

In addition to the Advisory Committee and the National and International Committees, ICOM has a small number of specialist Standing Committees, appointed for 3 year terms by the President after consultation with the Advisory Committee and Executive Council. Each has a specific remit and a membership of around 10 appointed members, with the President and Director General as *ex officio* members in addition.

The Chairperson and members of the Ethics Committee, first established in 1986, are eminent senior members of ICOM. The Committee's mission is to monitor the provisions and application of the ICOM Code of Ethics for Museums (first adopted in 1986 as the ICOM Code of Professional Ethics, and last revised by on the recommendation of the Committee in 2006)^[8] and to advise the Executive Council in relation to the apparent or alleged serious violations of the Code. It also reviews other Codes of Ethics that may be developed by the International Committees concerning their special fields of interest and/or expertise, and reports to the Executive Council and General Assembly on any matters relating to the Code of Ethics or its application that the Committee thinks appropriate.

The Legal Affairs Committee was established in 2002 in the light of the increasingly complex legal and intellectual property matters that are seen to be affecting museums and the work of museum professional. In addition to ICOM members, the Committee is fortunate to have on it a number of distinguished specialist lawyers who volunteer their services to ICOM through the Committee. In addition to acting as an internal advisory body to ICOM, and in particular to the President, Director General, Executive Council, Advisory Committee and International Committees and its component bodies on legal questions relating to their governance and administration, the Committee is mandated to examine on its own initiative the broader environment of evolving legal issues affecting museums, museum professionals, and the wider cultural heritage sector today.

Two of the major issues currently being worked on by the Committee are a review of current trends in intellectual property law and its application so far as these relate to museums and related bodies, and the launching of a system of dispute resolution through mediation rather than court actions over disputes concerning museums, for example, over the ownership or the claim for a return of cultural objects in museum collections. The four Standing Committees each meet once or twice a year in plenary session, but nowadays carry out much of their business throughout the year by electronic communication.

Two other Standing Committees are particularly concerned with ICOM's internal affairs. The Finance and Resources Committee, established in 2002, reviews and advises on longer-term financial and investment policy and practice, while the Standing Committee on International Committees assists the Advisory Committee and

Executive Council in reviewing policy and practice in relation to the establishment and operation of ICOM's International Committees.

The work of ICOM generally, and in particular that of the General Assembly, Executive Council, Bureau and Advisory Committee, is supported by a small Paris-based Operational Secretariat, consisting of the Director General and other staff members of ICOM, and which is the operational centre of ICOM. The Secretariat evaluates, initiates, and manages operational programs and contracts, manages membership, finances, the UNESCO-ICOM Information Centre and ICOM's publications, and promotes the identity of the Organization.

The Director General is the Chief Executive Officer, appointed by the Executive Council, is responsible to the Council for the efficient and effective management of ICOM, for the resources required for the functioning of ICOM and the daily operations of the Secretariat. The Director General also has important responsibilities for promoting the interests of ICOM and communication both externally, to partner organizations, other bodies and the media, and internally, to ICOM's members and committees. On a day-to-day basis, the Director General reports directly to the President of ICOM.

INTERNATIONAL COMMITTEES AND AFFILIATED ORGANIZATIONS

It is through its International Committees that ICOM achieves its major objectives and programs: the exchange of scientific information at an international level, the development of professional standards, and the adoption of rules and recommendations on best practice relating to their areas of specialization and expertise.

All individual members of ICOM (and representatives of institutional members) are entitled to register as full ("voting") members in any one International Committee of their choice, and to seek and hold office in their chosen Committee. In addition, a member may attend meetings of any other Committee (on payment of the required conference fee if applicable). Subject to the *Statutes of ICOM* and the *Model Rules for International Committees*, each is free to organize and run itself as its voting members decide in terms of meetings, research and other programs, committee publications, etc. However, each Committee is expected to hold a professional meeting at least once a year, and in the year of the Triennial General Conference of ICOM that meeting should be held within the overall program of the General Conference.

The 30 International Committees vary greatly in size. Some are small specialist groups with less than a 100 members focusing on a very specific area of museum collections or practices, while other are many times larger. The Conservation Committee (ICOMCC) is so big (with over a thousand members) and so wide in its scope, that in

addition to its participation in the triennial General Conference it organizes a major international scientific conference of its own every 3 years (normally in the year following the ICOM Triennial Conference). Though there is no formal distinction between them, in practice the International Committees can be divided into two categories: those that focus on a specific type of museum or museum collection, and what may be termed as interdisciplinary committees that deal with a specific museum-related discipline relevant to most or all kinds of museum or similar institution.

The following are the 19 types of museum- or collection-based International Committees: CAMOC—Collections and Activities of Museums of Cities, CIMAM—Museums and Collections of Modern Art, CIMCIM—Museums and Collections of Musical Instruments, CIPEG—Egyptology, CIMUSET—Museums and Collections of Science and Technology, COSTUME—Museums and Collections of Costume, DEMHIST—Historic House Museums, GLASS—Museums and Collections of Glass, ICDAD—Museums and Collections of Decorative Arts and Design, ICFA—Museums and Collections of Fine Arts, ICLM—Literary Museums, ICME—Museums and Collections of Ethnography, ICOMAM—Museums of Arms and Military History, ICMEMO—Memorial Museums in Remembrance of the Victims of Public Crimes, ICOMON—Money and Banking Museums, ICMAH—Museums and Collections of Archaeology and History, ICR—Regional Museums, NATHIST—Museums and Collections of Natural History, and UMAC—University Museums and Collections.

The following are the 11 interdisciplinary subject International Committees: AVICOM—Audiovisual, Image and Sound Technologies, CECA—Education and Cultural Action, CIDOC—Documentation, ICAMT—Architecture and Museum Techniques, ICEE—Exhibition Exchange, ICOFOM—Museology, ICOM-CC—Conservation, ICMS—Security, ICTOP—Training of Personnel, INTERCOM—Management, and MPR—Marketing and Public Relations.

National Committees and their members in certain regions of the world are also grouped into a number of ICOM Regional Alliances as follows: ASPAC—Asia and Pacific, ICOM-ARAB (Middle East and North Africa), ICOM-EUROPE, ICOM-SEE (South-East Europe), and LAC—Latin America and Caribbean.

ICOM also has 17 International Affiliated Organizations: AEOM—Association of European Open-Air Museums, AFRICOM—International Council of African Museums, AIMA—International Association of Agricultural Museums, AMOI—Association of Museums of the Indian Ocean, CAM—Commonwealth Association of Museums, HO!E—Hands On! Europe Association of Children's Museums, IACM—International Association of Custom Museums, IAMFA—International Association of Museum Facility Administrators, IAMH—International

Association of Museums of History, IATM—International Association of Transport and Communication Museums, ICAM—International Confederation of Architectural Museums, ICMM—International Congress of Maritime Museums, MAC—Museums Association of Caribbean, MINOM—International Movement for a New Museology, PIMA—Pacific Islands Museums Association, SADCAMM—Southern Africa Development Community Association of Museums and Monuments, SIBMAS—International Association of Libraries and Museums of the Performing Arts.

In recent years, there has been a growing, and welcome, trend for two or more international committees to meet together to consider matters of mutual interest, and also to include other relevant organizations in their annual meetings. With the recent agreement to promote closer cooperation between the International Committees of ICOM and the International Scientific Committees of ICOMOS more joint meetings are anticipated.

ACTIVITIES

The highlight of ICOM's program is the General Conference, held once every 3 years in different parts of the world (most recently Melbourne 1998, Barcelona 2001, Seoul 2004, and Vienna 2007, with the next in Shanghai in 2010), and which typically attracts well over 2000 members.

Though the conference as such lasts 6 days, it is usually preceded the previous week by preparatory meetings of the Executive Council and Advisory Committee as well as meetings of the four Standing Committees, of any *ad hoc* working or project groups, and often of the Boards of the International Committees and Regional Alliances. The Conference begins with an opening ceremony involving the representatives of the host country and the leading partner organizations, including the Director-General of UNESCO or his personal representative. The rest of the opening day is devoted to plenary sessions and discussions on the chosen General Conference theme, led by invited distinguished keynote speakers and expert panels.

Days 2–4 are primarily devoted to sessions of the 30 International Committees, which are open to all registered Conference participants, and it is expected that at least some of these sessions will address the General Conference theme from the perspective of each Committee's specialization and field of expertise. Most Committees also arrange visits to museums or other institutions of particular interest to the Committee's specialist members. During the 3 days, the International Committees also set aside up to half a day for their triennial business meeting. At this all voting members of the Committee (including absent members represented by proxy) consider the administrative and financial reports of its Chairperson, Treasurer, and Board, adopt the forward program of

meetings and activities, elect Officers and Board for the following 3 years, and agree to the preparations for the ICOM General Assembly, including mandating the Committee's voting members on matters to be decided at the forthcoming ICOM General Assembly. In parallel with the 3 days of meetings of the International Committees there is always a large Trade Fair presenting museum and related supplies and services.

Day 5 of the Triennial General Conference is traditionally set aside for whole day study visits, while the final day is the meeting of the General Assembly of ICOM as a whole at which both reports on the past triennial period and proposals for the future policies, programs, and priorities are considered and adopted. Voting for the election of the President, Vice-Presidents, Treasurer, and Executive Council members for the following 3 years takes place throughout the week, and the results of the elections are announced in the General Assembly. Finally, but by no means least, the General Assembly debates, and if it thinks fit, adopts Resolutions setting out ICOM's policies and objectives, or responding to matters of concern. The full texts of the almost 400 General Assembly Resolutions from the founding meeting of 1946 to the most recent (Vienna 2007), available on line,^[9] provide a comprehensive overview of the development of ICOM's policies and objectives, and indeed the changing focus of the principal concerns and priorities of ICOM over more than six decades.

ICOM also organizes important thematic conferences and seminars from time to time, most of which have played a significant role in developing policy and providing advice on professional practice over many areas through the production of conference or seminar publications. Examples have included the review of museum needs in Africa (in Benin, Ghana, and Togo), in Arab countries (in Amman, Jordan), on heritage protection and the struggle against illicit trafficking in cultural property (Tunis), on museums, heritage and tourism (in La Paz, Bolivia), and museum emergency planning and response (Hyderabad, India).

However, while the General Conference is very important, in terms of the total professional impact it is probably fair to say that the annual meetings of the 30 International Committees amount to ICOM's greatest impact on museums and the professional overall. The Committees aim to meet in all parts of the world, usually for a full week or more, with a program including lectures, discussions, and study visits to local museum of special interest. Many of these meetings have developed and promoted important advances in policy and practice.

ICOM has also undertaken many significant campaigns, most notably in relation to the protection of cultural property and the struggle against illicit trafficking in stolen, looted, or otherwise illegally transferred antiquities, works of art, and other cultural property. Recognizing that museums have often been the final destination of such material either directly through dealers or indirectly through

collectors who eventually donate their collections to museums, as long ago as 1970 ICOM adopted a policy statement on the Ethics of Acquisition, and this was further developed in the 1986 ICOM Code of Professional Ethics. The ICOM also works closely with other international bodies, notably UNESCO, but also INTERPOL and the International Customs Union, in this work, and has published a number of *One Hundred Missing Objects* . . . books describing and illustrating typical missing items from particular countries or regions: so far these cover Angkor (Cambodia), Africa, Latin America, and South-East Europe, while “Red Lists” have been published for Afghanistan and Iraq.

PUBLICATIONS AND MEDIA

Since its establishment, ICOM has produced a regular newsletter for members and interested persons: *Nouvelles de l'ICOM/ICOM News* (with a Spanish edition as well since 1999). During its six decades of existence, ICOM has also published a very large number of books and reports, some produced centrally, but the majority have been published by the International and National Committees, most of which have also produced journals or newsletters. A complete catalog of ICOM publications from 1947 to date is available online on the ICOM Web site. For details of the online catalog of ICOM publications, see ICOM's Web site.^[10]

ICOM also moved into new media at a relatively early date, with the launch of both its overall Internet policy and first Web site at the Stavanger General Conference in 1995. Most International Committees and many National Committees have since become very active in this field with their own Web sites (linked to the central ICOM Web site) and electronic publications. One of the long-term aims of the 1995 policy was to seek to establish “dot museum” as a top-level Internet domain controlled by the profession to ensure that only organizations deserving the title should be able to use the domain, and in 2000 Internet

Corporation for Assigned Names and Numbers (ICANN), the controlling body for the Internet, approved the establishment of the new domain.

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International Council on Archives (ICA)

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Abstract

Founded in 1948, the International Council on Archives (ICA) is an international body representing the world community of records and archives managers. Its membership includes national archives administrations, professional associations, archival institutions of regional and local authorities, and private organizations, as well as individual archivists. An independent, nongovernmental, not-for-profit organization, the ICA is headquartered in Paris, France. As the leading international nongovernmental organization (NGO) for archives and archivists, ICA continues to work in cooperation with UNESCO and NGOs in related areas to realize shared objectives.

THE INTERNATIONAL COUNCIL ON ARCHIVES

The International Council on Archives (ICA) is a nongovernmental organization (NGO) bringing together national archive administrations, professional associations of archivists, regional and local archives, and archives of other organizations as well as individual archivists. As the professional organization for the world archival community, ICA has a global network of around 1500 institutional members in 195 countries and territories, and over 270 archivists and records managers as individual members. ICA has its registered office in Paris, France; it is a nonprofit organization set up under French law.

THE BEGINNINGS

The idea for an ICA had long been around. The Institute for Intellectual Cooperation, acting under the aegis of the League of Nations, made the first attempt after World War I by creating a Permanent Consultative Committee on archives in 1931. This committee published the first *International Guide on Archives* in 1934. Several factors contributed to the creation of the ICA in 1948. The first was the choice of Paris as the site of the headquarters of the United Nations Educational, Scientific, and Cultural Organization (UNESCO), which in the immediate post-war years was concerned with promoting NGOs in its field. In 1946, under the influence of an American conservator Chauncey J. Hamlin, an international council for museums (ICOM) had been set up. On a similar model, following the distribution of proposals at the international level in the autumn of 1947, and under the influence and tenacity of Dr. Solon J. Buck, then Archivist of the United

States, a small group of experts met in Paris and agreed on June 9, 1948, to establish an “International Council on Archives,” with the then Director-General of the Archives de France, Charles Samaran, as chairman. Charles Braibant succeeded him in 1950. The first assembly of the Council was held following a meeting of the group of experts in Paris, on August 21 and 22, 1950, at the UNESCO headquarters.

During its first 50 years, ICA functioned more or less as a centralized international organization, thanks to the support of UNESCO with leadership provided by the Paris Secretariat and the national archivists of member countries. (Thanks to the hospitality of the Archives de France, the Paris Secretariat has been housed since 1960 at the Archives nationales, 60 rue des Francs-Bourgeois in Paris.) Its various committees brought together experts in many fields to undertake study and research, prepare, and publish reports on various archival functions and issues as well as provide contents for various meetings including the quadrennial Congress and the International Conference of the Round Table on Archives (CITRA).

The first International Congress on Archives was held in Paris, from August 23 to 26, 1950; it brought together 360 archivists from 35 countries. The first Round Table on Archives was held in Paris in 1954 and, since then, meets every year except on the year a Congress is held.

Archivum, the first official journal of ICA, was created with the publication of the proceedings of the first Congress in 1950. It soon extended its contents to cover, in addition to the proceedings of congresses, the International Archival Bibliography, the International Directory of Archives, archival legislation around the world, and special issues on specific theme, such as notarial archives, municipal archives, etc.

Regional branches and sections were eventually created to allow the active participation of more countries sharing similar conditions: from 1968 to 1982, eight regional branches were created. With the creation in 1976 of the Section of Professional Archivists Associations (SPA) and the Section of International Organizations (SIO), sections brought together professionals sharing similar problems; the creation of the Section of Municipal Archives (SMA) inaugurated a trend away from central government archives which led to the creation of several other sections based on types of archives.

Since its creation, ICA has cooperated regularly with its sister organizations, particularly IFLA, ICOM, and ICOMOS. In this context, it has actively participated in the activities of the International Committee of the Blue Shield of which it is a founding member.

Created in 1996, the International Committee of the Blue Shield (ICBS) is formed by five NGOs: ICA, the Coordinating Council of Audiovisual Archives Associations (CCAAA), the International Council of Museums (ICOM), the International Council on Monuments and Sites (ICOMOS), and the International Federation of Library Associations and Institutions (IFLA) share the mission to work for the protection of the world's cultural heritage by coordinating preparations to meet and respond to emergency situations. Its main objectives are to facilitate international responses to threats or emergencies threatening cultural property and to encourage safeguarding and respect for cultural property especially by promoting risk preparedness. The Blue Shield is the symbol equivalent of the Red Cross used for marking cultural sites to be protected from attack in the event of armed conflict.

1948–1989 THE COLD WAR

Thanks to the ICA, the cold war did not prevail in the archives field. The Council played the unique role of establishing a forum for professional meeting and exchange between archivists from East and West as well as promoting discussion and cooperation beyond political divisions. These exchanges focused on issues of common interest, particularly in three technical areas dealing with microfilm, restoration of documents, and buildings. The ICA developed those exchanges largely with the intellectual and financial help of UNESCO during that period.

The main objective then was to open access to archives to allow historians to compare sources from diverse provenances; the archives of countries and institutions often convey significance beyond their own frontiers and activities; it is notably the case with diplomatic, military, university, and bank archives as much as it is the case with the records of international organizations which can inform on partners and users. In order to improve access, ICA has always promoted cooperation through two different while complementary means:

- *Microfilm reprography* (security, acquisition, and replacement) to complement existing archival holdings, reconstitute incomplete ones, settle or lessen legal dispute; the ICA has thus promoted bilateral agreements to microfilm in order to remedy the absence or the lack of complete textual resources.
- Publication of the *Guides to the Sources of the History of Nations* in three series from 1960 to 1970 to enable researchers to know the sources preserved outside their region by other countries, to identify them, and to promote their processing. Sixty volumes were thus published between 1958 and 1984; they provide an inventory of sources concerning Latin America, Africa, and Asia.

From 1960, during a period when many countries gained their independence and others put an end to their colonial power, priority was given to the development of archives in the new countries with a number of programs created for developing countries and the creation of regional branches to bring them together. A Committee on Archival Development (ICA/CAD) was formed in 1970. It operated the International Archival Development Fund (FIDA), which received major donations for some developing countries (Algeria, Iran, Nigeria, and Yugoslavia). While it enabled seminars and study missions to be held, it was not given the continuous support it needed. Since the beginning of the 1970s, almost all the developing countries have established archival services.

Thanks to its close cooperation with ICA, UNESCO has published a series of archival studies known as the Records and Archives Management Program (RAMP). More than 100 studies dealt with basic professional issues covering records and archives management in areas such as preservation, legislation, archival theory, and practices. They were authored by international experts and published in English, French, and Spanish. They have been valued a great deal, notably by professionals in developing countries. Many of these studies have been reissued on CD by UNESCO in 2008. Although some studies are now dated as a result of technological advances, others remain highly topical. The CD is intended as a working guide of selected RAMP studies and, as such, contains only a limited number of titles. The complete series can be accessed from UNESCO's Web site at: http://unesdoc.unesco.org/ulis/search_form.html.

At the same time, a long-term legal discussion was maintained within ICA to respond to the major and recurrent issue of the unresolved archival legal disputes, inherited from the past. While traditionally, articles dealing with archives were included in treaties during the seventeenth to the nineteenth centuries, no peace treaty was signed in 1945 with the defeated countries; therefore, many issues have never been settled and no systematic effort was made to return archival holdings seized during the hostilities. The archival question was not included in

the independence agreements with the new countries; new States found themselves without documentation for their historic rights.

The building and reconstitution of the archival heritage of those countries whose archives, in great part, are held in repositories of developed countries has been debated many times during meetings of the CITRA. The Declaration of the Executive Board at Guanzhou in 1995 on the settlement of archival claims has recommended to take a pragmatic approach; in cooperation with UNESCO, the ICA has provided a set of legal concepts and principles such as the inalienability and imprescriptibility of public records, provenance, and respect for the integrity of archival fonds, the right of access, and the right of reproduction. In order to make these rights effective and prevent the splitting of archival fonds, UNESCO has recommended the introduction of the concept of shared heritage since 1979.

The Council of Europe has published in 1997 a reference document prepared by the ICA Committee on Archival Legal Matters to facilitate the settlement of archival claims arising from war, military occupancy, and States succession.

With the end of the USSR and of several totalitarian (or repressive) regimes in the world, great masses of archives from police and security units of those regimes appeared and new legal problems emerged, particularly their access; it was urgent to help archivists work in a democratic environment and to reinforce the role and position of the National Archives. It is in that context that the issue of professional ethics was launched in 1992 within the Section of Professional Associations (SPA) generating the ICA Code of Ethics adopted in 1996. At the present time SPA is considering a revision to this Code in the light of a member survey.

The Council of Europe has helped ICA a great deal since 1993 to promote the modernization of archives in Europe through East–West seminars and financial support for expert missions. ICA has also invested greatly in promoting the accessibility of archives. This effort was reinforced in 2000 by Recommendation no. R 13 of the Council of Europe about a European Policy on access to archives and in 2001 on the teaching of history. The Council of Europe has adopted the first intergovernmental standard on the issue and recognized the right of people to know their history as a cultural human right.

ICA TODAY

From an association of directors of national institutions, the ICA has evolved toward a more complex organization bringing together professional associations and individual archivists interested in researching, developing, and sharing their full range of archival expertise. As a result, the ICA has become the professional organization for the world archival community, dedicated to promoting

the preservation, development, and use of the world's archival heritage.

The activities of the ICA complement those of national associations and institutions and continue to be an exclusive source and channel of professional expertise in those regions where national associations do not yet exist.

As the leading international NGO for archives and archivists, ICA continues to work in cooperation with UNESCO and NGOs in related areas to realize shared objectives.

Mission and Values

ICA's current mission and core values were officially adopted in 2004 and 2008. While it continues to focus on the promotion of archives and the role of archivists in achieving high standards of governance and democracy, it makes room for the inclusion of improved records management as a precondition of the creation of authentic, accurate, and meaningful archives.

As stated in the ICA Constitution, the mission of the International Council on Archives is:

to promote the preservation and use of archives around the world. In pursuing this mission, ICA works for the protection and enhancement of the memory of the world and to improve communication while respecting cultural diversity. (Preamble ICA Constitution)

To promote the preservation and use of archives around the world, ICA aims to support the management and use of current records as well as archives and the preservation of the archival heritage, by sharing experiences, research, and ideas on professional archival and records management matters, and on the management and organization of archival institutions. Its objectives are to:

- Encourage and support the development of archives in all countries, in cooperation with other organizations, including international agencies, governmental, and nongovernmental.
- Promote, organize, and coordinate best practice, the development of standards and other activities in the field of records and archives management.
- Establish, maintain, and strengthen relations between archivists of all countries and between all institutions, professional bodies, and other organizations, public and private, wherever located, which are concerned with the administration or preservation of records and archives, or with the professional training of archivists, especially through the exchange of information.
- Facilitate the interpretation and use of archives by making their content more widely known and by encouraging greater access to them.

Therefore, as expressed in its 2008 Strategic Directions, ICA promotes the central role of record-keeping and

archives in protecting the rights of individuals and states, and in supporting democracy and good governance. It works for the effective management of archives from the moment of their creation, the permanent preservation of archives as the documented memory of nations and societies, and the widest possible public access to that memory. It advocates the importance of archives management to policy-makers.

It sees its role as providing opportunities for professional contact, information exchanges, research, and education, which support records and archives professionals and other partners throughout the world. It also endeavors to take a leading part in developing best practices and standards for the records and archives profession.

Its core values were also revised and stated in the 2008 Strategic Directions document. They are expressed in the following statement: "In fulfilling ICA's mission, we strive to uphold the values of equality, diversity, openness, and mutual respect across national boundaries and cultural traditions. We will be as transparent as possible to our members and provide them with full value in return for their contributions (whether monetary or in kind) to the organization."

Definition of Archives

The current evolution of ICA has followed quite closely the extraordinary developments of the profession in recent years. While the English definition of the word "archives" remains focused on materials of enduring value, most archivists, even in the English-speaking world, are also concerned with the management of current records. At the international level, this widening of the focus has never been a problem since the words "records" and "archives" are often used interchangeably; in French, the word "archives" means both current records and records of enduring value.

The Glossary of the Society of American Archivists defines archives as "Materials created or received by a person, family, or organization, public or private, in the conduct of their affairs and preserved because of the enduring value contained in the information they contain or as evidence of the functions and responsibilities of their creator, especially those materials maintained using the principles of provenance, original order, and collective control; permanent records." Other meanings also provide definitions of archives as organizations, buildings, professional discipline, and collection of papers.

More importantly, the archival community has traditionally been more concerned by the recognition of the special character of records and archives as the "Materials created or received by a person, family, or organization, public or private, in the conduct of their affairs" preserved because of the value (not only enduring) of the information they contain or as evidence of the functions and responsibilities of their creator.

Members

From 17 countries in 1949–1950, the membership had grown to 117 countries in 1984 and to 195 countries and territories in 2008.

ICA now has a global network of around 1500 institutional members and over 250 individual members. Its membership comprises public and private archival institutions, associations, and individual members:

- Central archives directorates or national archival institutions: 236 members.
- National associations of professionals: 81 members.
- International associations: 42 members.
- Institutions concerned with, or interested in, the administration or preservation of records and archives, or with archival training and education: 873 members.
- Individuals working in the field of the administration or preservation of records and archives, or of the archival training and education: 258 individual members.

In order to give its members increased opportunities to be involved in projects, the members of ICA can participate in two types of groupings: the regional branches and the sections.

Regional Branches

Through its 13 branches, ICA provides a basis for exchange and common initiatives at the regional level, more closely aligned to specific needs resulting from particular environments. Members of ICA wishing to further the aims of ICA and to strengthen cooperation within a particular geographical area may group themselves into regional branches. The global network comprises 12 regional branches and one regional network; their creation was developed over a period of almost 40 years.

1968 SARBICA (Southeast Asian Regional Branch).

1969 ESARBICA (Eastern and Southern Africa Regional Branch).

1972 ARBICA (Arab Regional Branch).

1975 CARBICA (Caribbean Regional Branch).

1976 SWARBICA (South and West Asian Regional Branch).

1976 ALA (Association of Latin American Archives).

1977 WARBICA (West African Regional Branch).

1981 PARBICA (Pacific Regional Branch).

1982 CENARBICA (Central African Regional Branch).

1993 EASTICA (East Asian Regional Branch).

2000 EURASICA (Eurasia Regional Branch).

2001 EURBICA (European Regional Branch).

2004 NAANICA (North American Archival Network).

Regional branches have separate leadership and programs. For example, PARBICA has its own Work Plan 2008–2010 which is in line with the ICA Strategic Direction. It is

developing a good governance toolkit project which will be translated and adapted in other languages. EURBICA has three ongoing main projects: EURONOMOS, a database providing the European archival legislation online; a methodology to train the trainers in records management; and a European competency model.

Sections

Institutional or individual members of ICA sharing common professional interests or activities and wishing to further the aims of ICA and to strengthen cooperation within their professional competence may group themselves into sections. ICA members may join more than one section. ICA's sections are established along professional interests; they address other types of concerns and stimulate research and information exchange in more specific areas.

There are presently 11 full-fledged sections; two more are provisional until it is demonstrated that there is sufficient interest to give them a permanent status.

- SAE—Section for Archival Education and Training: 43 members.
- SAN—Section on Notarial Records: 8 members.
- SAR—Section on Architectural Records: 21 members.
- SBL—Section for Business and Labour Archives: 100 members.
- SIO—Section for Archivists of International Organizations: 42 members.
- SKR—Section for Archives of Churches and Religious Denominations: 53 members.
- SMA—Section for Municipal Archives: 152 members.
- SPA—Section of Records Management and Archival Professional Associations: 81 members.
- SPO—Section on Sports Archives: 14 members.
- SPP—Section for Archives of Parliaments and Political Parties: 94 members.
- SUV—Section on University and Research Institution Archives: 161 members.
- SLA—Provisional Section on Literature and Art Archives: 6 members.
- SSG—Provisional Section on Sigillography: 10 members.

Each section elects a bureau and draws up its program of activities in cooperation with the Programme Commission of ICA.

Project Committees and Working Groups

ICA also forms committees and groups at various levels to work on specific projects and activities in support of the objectives defined by its Strategic Direction. Expert committees on various specific archival issues created since 1959 were abolished in 2004. They

were replaced by project working groups or ad hoc committees with short and dedicated mandate under the Programme Commission. Only one committee [Committee on Best Practices and Standards (ICA/CBPS)] is currently active as the professional home for the maintenance and development of standards and best practices and related activity within ICA. Building on its strength in the area of archival description, this Committee is currently expanding its scope to cover more aspects of professional activity.

FIDA: International Archival Development Fund

FIDA was set up in 1975 as a means of attracting funds internationally. However, in recent years, difficult financial conditions have limited what has been raised. On a smaller scale, ICA used its own resources to assist small projects, such as expert missions and regional meetings, where matching funds were available locally. (Since 2000, 5% of the dues of all members are set aside for FIDA.) Thanks to the additional contribution by a number of countries, it is able to support new initiatives, particularly training programs in less-developed countries.

Governance

The highest decision-making body in ICA is the Annual General Meeting which meets once a year during the Congress or the CITRA; it consists of delegates from national institutions and associations. Between Annual General Meetings, the government of ICA is in the hands of the Executive Board, which includes chairs of all regional branches and most sections, thus ensuring broad representation internationally and professionally.

The work of the Executive Board is supported by three commissions:

- The Management Commission brings together the ICA President and Vice-President in addition to the President of a Regional Branch, the Secretary General, and the Deputy Secretary Generals; it is responsible for the preparation of Executive Board meetings and making management decisions between meetings of the Executive Board.
- The Programme Commission consists of the Vice-President Programme, who acts as chair, and of members appointed by the Management Commission. It is responsible for the preparation and execution of the professional and technical program; in that capacity, it also monitors the activities of regional branches, sections, and committees.
- The Audit Commission consists of a chair, known as the Internal Auditor, and four members elected by the members of the AGM. It is responsible for the evaluation of the performance of the ICA programs and of its

external and internal communications. It reports to the Executive Board and to the Annual General Meeting.

In addition to these three commissions, the work of the Executive Board is supported by a CITRA Bureau, composed of six elected members and a few ex-officio members to organize the annual International Conferences of the Round Table on Archives (CITRA) and to draw up the CITRA program.

The Secretariat is responsible for the day-to-day operation of ICA's organization, including communications with other ICA bodies and individual members, relations with partner organizations, and administration of ICA's governance meetings. It comprises a small staff based in Paris and is headed by the Secretary General, who acts as the organization's Executive Director.

Elected Officers

Since 2007, the top management of ICA is composed of a President and eight Vice-Presidents. Four Vice-Presidents are elected by the membership for Marketing and Promotion, Programme, CITRA, and Finances; the other four play that role by virtue of their particular function within ICA: host of the forthcoming congress, the chair of SPA, the representative of regional branches and the representative of sections. With the exception of the Vice-President of the CITRA, the elected officers are elected for a 2-year term, which may be renewed.

Budget

ICA has an annual budget of approximately €1,000,000, generated for the most part by dues from the members. The level of dues paid by national archival institutions is calculated on the basis of each country's gross national product as established by the International Monetary Fund. The dues of the associations are fixed according to the number of members. Part of the dues are allocated to the regional branches and the section; another portion provides the basis for the funding of projects approved by the Programme Commission. At the time of writing ICA has just started a review of the criteria used to calculate membership dues and the associated benefits.

ICA ACTIVITIES

Beyond the regular activities of ICA during the Congress, the CITRA and the publications, members are invited to submit projects which further the organization's objectives. The current Strategic Direction document includes six approved objectives, which provide the Programme Commission with a framework to make its decisions about projects submitted by members:

1. Raising awareness.
2. Influencing the development and use of new technologies.
3. Building capacity in the records and archives profession.
4. Strengthening the ICA network.
5. Improving the performance and accountability of ICA.
6. Building partnerships.

Congress

Every 4 years, in a different country, ICA holds an International Congress on Archives which can be attended by all archival professionals. The most recent congress was held in Kuala Lumpur in Malaysia in July 2008 on *Archives, Governance and Development*. The next one will take place in Brisbane, Australia, in 2012 on the theme of *Archives in a Digital Age*.

Previous Congresses presented a wide diversity of themes touching the multifaceted aspects of the profession.

- *1950 Paris*: Records management, micrography, private archives (mostly business archives), and bibliographies on archives.
- *1953 The Hague*: Terminology standardization, documentation, history of art and history museums, training, and public programs.
- *1956 Florence*: New buildings, archival appraisal, and private archives.
- *1960 Stockholm*: National archives, restoration, conservation, and photography; and economic and social history research.
- *1964 Brussels*: Modern methodology for the arrangement of archives.
- *1966 Washington, D.C. (Extraordinary Congress)*: Opening archives to research.
- *1968 Madrid*: Improved access to archives and microfilm policy; history of archives; the Salvage and Restoration of the Italian Archival Heritage after the Inundation of November 1966; and records management.
- *1972 Moscow*: Records management and state archives; new techniques in archives; finding aids for research; and support for archives in developing countries.
- *1976 Washington, D.C.*: The pre-archival revolution; the technological revolution; the revolution in access and use; and the geo-archival revolution.
- *1980 London*: The academic, practical, and popular use of archives; the ICA: its achievement and its future.
- *1984 Bonn*: The challenge to archives: growing responsibilities and limited resources.
- *1988 Paris*: New archival material.
- *1992 Montreal*: The profession of the archivist in the information age.

- *1996 Beijing*: Archives at the end of the century: taking stock and looking ahead.
- *2000 Seville*: The archives of the new millennium in the information society.
- *2004 Vienna*: Archives, memory, and knowledge: <http://www.wien2004.ica.org/fo/index.php>.

While congresses before 2004 mostly consisted of a series of plenary sessions presenting wide-ranging reports on the evolution of the profession or the various aspects of a general theme, the Vienna 2004 Congress and the 2008 Kuala Lumpur meeting were organized along more dynamic lines presenting 10–15 parallel sessions attended by smaller audiences and allowing more direct discussion between the speakers and the audience. About 1200 participants came to the 2008 Congress in Kuala Lumpur to see 326 speakers presenting at 53 workshops and 169 sessions. Topics ranged from audiovisual archiving to indigenous knowledge, and “green archives buildings.” ICA Commissions, Branches, and Sections used the opportunity to hold business meetings and the Annual General Assembly also took place. Many of the papers presented on that occasion are available on the Congress Web site (<http://www.kualalumpur2008.ica.org/en>). A selection of the papers will be published in the Congress *Proceedings*.

Conferences

In the intervening years of the Congresses, since 1954, there is an International Round Table Conference on Archives, also known as CITRA from the French acronym (Conférence Internationale de la Table Ronde des Archives). This is for representatives of national archive administrations, national professional associations, and the Chairs and secretaries of ICA sections. This Conference is accessible by invitation only and deals with strategic professional issues. The 41st CITRA was held in Quebec City in 2007. The papers are usually published in the *Proceedings*. The themes of the two more recent series of CITRA have been Archives and Society from 2001 to 2003 and Archives, Diversity, and Globalization for 2005–2008.

At the outset of Congresses and CITRA meetings, resolutions are usually adopted for the participants to implement in their respective countries.

Regional branches and sections regularly hold conferences and seminars.

Publications

The ICA Web site provides up-to-date information on the upcoming events and activities of ICA's bodies, branches, sections, and working groups (<http://www.ica.org>). It also offers a Resource Centre which contains hundreds of working documents, publications, and standards relevant to archival practice.

Comma, the ICA journal, is a merger of ICA publications *Archivum* (I–XLV), *Janus* (1983–1999), and *CITRA Proceedings*. It is edited in seven languages (Arabic, Chinese, English, French, German, Spanish, and Russian) and is usually published quarterly. Its main function is to disseminate research and discussion papers of interest to the membership of the organization, to the profession as a whole, and external readers. Printed on paper at the beginning, it moved in 2006 to a CD-ROM format. Three CD-ROMs have been published in 2006–2008. The 2008 Congress Proceedings will be published on paper as well as electronically, and it is possible that in the future paper publications will be reintroduced more generally.

Archivum was edited from 1951 to 2000 (no. 45) in five languages (English, French, German, Italian, and Spanish) and usually dealt with only one main subject. *Janus*, another ICA journal published between 1983 and 1999, was responsible for disseminating papers, reports, research work, and discussions of interest to the profession as a whole, mainly emanating from the activities of various ICA bodies. The *CITRA Proceedings* were printed as a separate publication from 1958 to 1999.

The newsletter *Flash* is published by ICA three times a year as a membership benefit. It conveys news on ICA activities and highlights current issues in archives. It can be downloaded from the ICA Web site.

The series *Studies* presents the works of ICA experts in a wide range of fields such as the management of electronic records, authenticity of electronic records, disaster prevention, control of radioactive waste information, and archival legal matters. The 19 *Studies* published are available on CD-ROM and can be downloaded from the ICA Web site.

Many sections and regional branches publish their own journal or a newsletter; most have their own Web site.

Projects

Since the 1990s, the emergence of information technologies has had a considerable impact on the archival profession, particularly for the creation, acquisition, processing, and dissemination of archives. The prevalence of computerized office work practices now requires the intervention of the archivist in the creation of records in the office. In order to ensure the preservation, authenticity, and integrity of records on a long-term basis, the archivist must be involved in all phases of the life of the record.

The new technological context has increased the needs for standardization and system interoperability, particularly in the area of *archival description*. Since the 1990s, ICA has adopted four professional standards (available on the ICA Web site):

- ICA-ISAD(G), the *International Standard for Archival Description* (General), provides guidance for the description of archival records.

- ICA-ISAAR (CPF), the *International Standard Archival Authority Record for Corporate Bodies, Persons, and Families*, provides guidance for the creation of authority record information about creators of archival materials.
- ICA-ISDF, the *International Standard for Describing Functions*, provides guidance for the description of functions of records creators.
- ICA-ISDIAH, the *International Standard for Describing Institutions with Archival Holdings*, provides guidance for the description of holders of archives.

Other projects include the creation of dedicated open source software to facilitate the creation of databases for archival repositories and the exchange of the descriptive data they contain. The beta version 1.0 of *Access to Memory* (A to M) (available at <http://ica-atom.org/>) was launched in 2008, during the Kuala Lumpur Congress to cater for small archival institutions and allow them to publish their finding aids on the Web. It is based on freely available, multilingual open source software.

Terminology has been a long-time concern of ICA since the end of the 1950s. Special glossaries are available for several areas, such as sigillography and preservation. The first general Dictionary of Archival Terminology was published in 1984. A new approach to defining the language of the profession was recently adopted through discussion of the project Archipaedia, which proposed to prepare and publish a multifaceted, multilingual, and multimedia online tool to favor better understanding of archival terminology and practices in as many languages and cultural groups as possible.

The ICA *Code of Ethics* for archivists was adopted by ICA in 1996. It establishes high standards of professional conduct for the archival profession by providing an ethical framework for the guidance of members of the profession.

COOPERATION WITH OTHER ORGANIZATIONS

When other organizations have better expertise than ICA members, archives professionals are encouraged to join those specific organizations, instead of setting up their own group within ICA. For example, members interested in Audiovisual Archives are invited to contact the CCAAA of which ICA is a founding member.

ICA works closely with intergovernmental and NGOs. Most of these organizations are active mainly or partly in the cultural heritage field and/or in information management, business administration or in development of third world countries.

ICA maintains its status as an NGO recognized by UNESCO, with whom it has a Framework Agreement covering areas of joint interest; it regularly participates, as observer, in the meetings of the Information for All Program and has representatives in the various bodies of the memory of the world program. It has consultative status with the Economic and Social Council (ECOSOC of the UN), the International Federation of Library Associations and Institutions (IFLA) and the International Organization for Standardization (ISO) as well as observer status with the World Intellectual Property Organization (WIPO).

Throughout its 60 years of existence, ICA has constantly adapted to new environments and the information revolution. Its network of archival professionals is unique and encompasses the whole world and all facets of society. Facing a constant increase of the uses of archives and the expectations of society, it looks forward with confidence to new opportunities while continuing to work on the ever present problems of insufficient financial and human resources. In order to achieve significant results and encourage solidarity between its members, ICA must find additional allies and marshal energies and talents for the benefit of all its members and to further the cause of archives throughout the world.

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International Council on Knowledge Management (ICKM)

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Abstract

The objective of this entry is to explore the fundamental nature of knowledge management by examining relevant definitions, concepts, instruments, and strategies. It also reports on the development of the International Council on Knowledge Management (ICKM). ICKM is an association located in Vienna. The homonymous conference started in 2004 in Singapore with the launch of the first international conference on knowledge management. The tension between practitioners and academia is neither new nor limited to the field of knowledge management. The ability to bring these communities together will not only bridge the gap between the two worlds but also create the environment needed for the development of any discipline.

INTRODUCTION

Peter F. Drucker^[1] was one of the first researchers to mention the term “knowledge worker.” Since then, several approaches have focused on knowledge management initiatives, all of them pursuing one goal, to leverage the performance of individuals, groups, or companies. Knowledge management is regarded as an interdisciplinary field involving tasks such as learning, innovation, intellectual capital (IC) reporting (human, structure, relationships), and organizational optimization. The main challenge is how to discover, create, capture, share, and utilize knowledge via (social) networks. Knowledge management is not only an IT challenge, but mostly consists of motivating people to share valuable information so that IC of companies can be improved. Bontis,^[2] Edvinsson and Malone,^[3] as well as Sveiby^[4] see IC as the “stock” of knowledge that exists in an organization at a particular point in time. A similar view is described by Nonaka and Takeuchi^[5] who defined knowledge management as managing the stock of knowledge in an organization as it flows over time. Managing this stock remains a challenge, as there is the need to socialize and codify intangible (tacit) knowledge.

There are several various theories of knowledge management. Bonifacio et al.^[6] characterize knowledge sharing and knowledge management as the process of creating, codifying, and disseminating knowledge. They claim that knowledge can be disseminated; however, this approach assumes the existence of an objective epistemology, so that all contextual, subjective, and social aspects of knowledge can be eliminated in favor of an objective and general codification. This is undoubtedly an interesting idea; however, individuals tend to interpret data

immediately after acquiring it. It seems clear that different knowledge can be produced from the same chunk of information contained in different brains, no matter how this information is codified.

It would seem therefore that only information can be disseminated and exchanged and not knowledge. This view is also supported by the school of autopoietic epistemology which states that knowledge is a private, personal matter which is intuitively and strongly linked to a person’s values and beliefs. Explicit knowledge is data and information that enable other people to create their own knowledge via a “structured coupling” process explained by Joia.^[7] There are techniques existing such as sharing knowledge through common experience, through storytelling or microarticles—for all these techniques, the basis is information flow based on text, speech, smell, optics (behavior), or tangibles. This information is then interpreted by our brain according to our context knowledge, previous experiences, instincts, and intuitions. The usage of the terms “knowledge sharing” and “knowledge management” in this entry therefore refers to information exchange processes and various individual interpretations of transferred data. Thus, knowledge is created purely through information transfer and successful or unsuccessful knowledge sharing is a consequence thereof. This point of view has been explained in depth by Barachini^[8] who asserts that knowledge management is performed in human brains only – all the rest is data and information management.

Scientists commonly recognize four types of knowledge:

1. Tangible and individual knowledge, characterized by fact knowledge
2. Tangible and collective knowledge, characterized by rules and written instructions

3. Intangible and individual knowledge, characterized by experience
4. Intangible and collective knowledge, characterized by hidden values and beliefs (society's unwritten laws)

As a result, there exists a distinct difference between tangible and intangible knowledge.

KNOWLEDGE MANAGEMENT CONCEPTS

Senge Approach

According to Peter Senge,^[9] learning organizations are organizations where people continually expand their capacity to create the results they desire, new and expansive patterns of thought are nurtured, collective aspiration is generated, and where learning takes place on an individual as well as collective level.

Managers can detect organizational learning disabilities by utilizing the following five principles:

- I. Personal Mastery: both life and work should be approached “as an artist would approach a work of art”
- II. Mental Models: deeply ingrained assumptions or mental images “that influence how we understand the world and how we take action”
- III. Building Shared Vision: when there is a genuine vision “people excel and learn, not because they are told to, but because they want to”
- IV. Team Learning: team members engaging in true dialogue without assumptions
- V. Systems Thinking: the integrative (fifth) discipline that fuses the other four into a coherent body of theory and practice

These five disciplines should be employed continuously in order to improve existing capacities. Since learning organization theories usually target the same approaches as that of knowledge management, there tends to be a close correlation between learning and managing knowledge.

Senge also mentions innovation management, which is the cornerstone of humankind. The success of innovation management heavily depends on the quality of IC. IC itself is characterized by human relationships, human knowledge, and structural aspects.

Nonaka/Takeuchi's Approach

Nonaka published the SECI model in 1991 (Fig. 1). His spiral model shows how to share tacit and individual knowledge with colleagues.^[5]

The first step, socialization, transfers tacit knowledge between individuals through observation, imitation, and practice. In the next step, externalization is triggered by dialogue or collective reflection and relies on analogy or

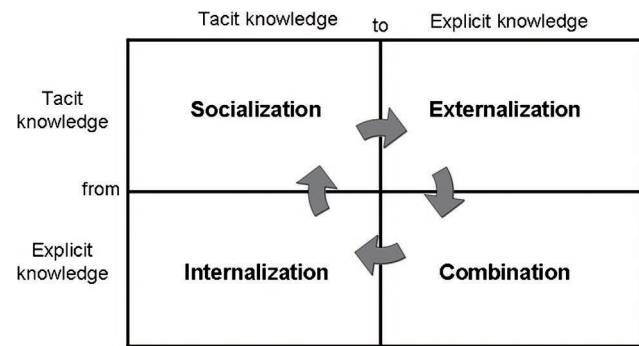


Fig. 1 The knowledge spiral.

metaphor to translate tacit knowledge into documents and procedures. In the third step, combination consequently reconfigures bodies of explicit knowledge through sorting, adding, combining, and categorizing processes and spreads it throughout an organization. Finally, internalization means the process of explicit knowledge transferred into individual tacit knowledge. Possibly, through a phenomenon that Nonaka calls the “knowledge spiral,” knowledge creation and sharing becomes part of the culture of an organization.

In 1997/1998, Tsoukas^[10] theorizes that tacit and explicit knowledge were not two separate forms of knowledge, but rather inseparable and necessary components of all knowledge. Nonaka followed with a slightly enhanced SECI model in 1998 called “Ba.” “Ba” is a convenient place where knowledge can be exchanged. Nonaka pointed out that knowledge is not only produced from individuals, but from interaction between individuals and the surrounding environment. Therefore, the more inspiring the “Ba,” the better the knowledge sharing results will be.

In 2011, Nonaka and Takeuchi^[11] coined the term phronetic leadership. For them, phronetic leadership means mastering the following management principles:

- I. Ability to make judgment on goodness
- II. Ability to create Ba
- III. Ability to see the reality as it is
- IV. Ability to articulate the essence
- V. Ability to exercise political power
- VI. Ability to foster phronesis on others

There is some parallelism between the observations of Senge, Drucker, and Nonaka. Phronetic leadership means pragmatic idealism that is not a contradiction in the eyes of Nonaka and Takeuchi. However, phronetic leadership might be harder to execute in western cultures than in the east because of cultural differences.

Probst/Raub/Romhardt's Approach

Probst^[12] merged a set of connected activities into a framework called the “building blocks of knowledge” (Fig. 2).

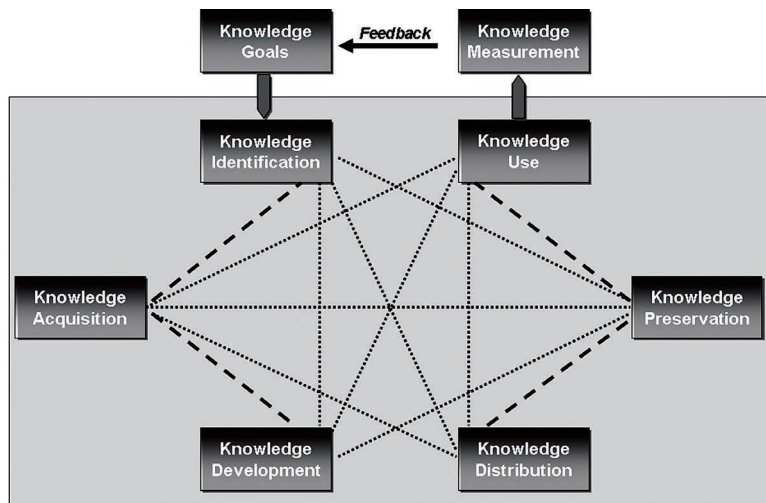


Fig. 2 Framework of the building blocks of knowledge.

This framework is often used to implement knowledge management initiatives in organizations. Senge's and Nonaka's approaches are more oriented toward sociology. Probst's approach is rather a technological one.

Knowledge goals point the way for strategic and operational knowledge management activities. The main focus is to improve competitiveness. Knowledge goals identify current skills and those which might be essential in the future.

Knowledge identification helps to establish whether internal and external knowledge is transparent. Knowledge acquisition has its focus on the external provision of knowledge. Knowledge development focuses on processes that generate new knowledge. Knowledge distribution deals with the transfer of knowledge inside a company.

Knowledge preservation memorizes valuable knowledge while ensuring suitable storage. Knowledge use is focused on the productive adoption of organizational knowledge.

The "knowledge measurement" building block is placed at the end of the process. In this block, the IC is analyzed and evaluated. This results in improvements such as better education, more intensive customer relations, or the need to invest into better infrastructure.

According to the feedback cycle, it is necessary to measure the "intellectual capital variables" in order to focus on target-oriented interventions. The problem is how to identify and measure these variables. Some variables such as fluctuation coefficients are easily measured while others such as tacit knowledge, which cannot be externalized by any of the methods mentioned, remain impossible to measure. Until recently, there was no commonly accepted standard for measuring IC.

INTELLECTUAL CAPITAL REPORTING

Intellectual capital consisting of structural, human, and relationship capital is part of each organization. Equipment,

infrastructure, intellectual property rights, procedures, and processes are regarded as structural capital. Skills and expertise of employees and management are parts of the human capital. The relationship between staff and external parties such as customers, business partners, friends, or teachers represents relationship capital.

Sveiby and Edvinsson^[4] are considered the fathers of IC reporting. They identified methods and as a consequence variables characterizing structural, human, and relationship capital. Similar to accounting balance sheets, measured variables are reported once a year. Skandia and Celemi were one of the first companies in Europe to experiment with IC reports. It is not possible however to map all the different variables into one single value so that they can easily be compared between companies. Barachini^[13] noted in his entry when he presented the business transaction theory that it is not possible to measure tacit individual knowledge since people do not offer knowledge (information) for free. He theorized that people employ "tit for tat" behavior during the information exchange process. This behavior is best explained by trading aspects of the modern portfolio theory. Taking the business transaction theory and the autopoiesis seriously, we can conclude that there will always be a part of knowledge which will remain undiscovered.

The main idea behind an IC report is that financial information reveals much about the past performance of an enterprise but says nothing about its future potential. An enterprise's future potential has much more to do with its IC. Creating transparency within the organization's IC will enable it to manage its intangible resources better, increase its staff's confidence and motivation, as well as impart greater certainty to investors and other stakeholders about its future earnings potential. Reflecting the importance of knowledge as an asset, the IC report outlines the knowledge goals of the company, its knowledge-based capital, its business processes, as well as its products and services.

Deductive Methods	Inductive Methods	
	Structural Model	Process Model
Tobin's Ratio	Skandia Navigator (Edvinsson)	Balanced Scorecard (Kaplan, Norton)
Return on Assets Methode-ROA	Intangible Asset Monitor (Sveiby)	IC-Index (Roos)
Return on Management (Strassmann)	IC-Rating (Edvinsson)	Danish Guideline
Calculated Intangible Value		Intellectual Capital Report (ARCS)
Financial Method of Intangible Assets Measurement-FiMIAM (Rodov, Lelliaert)		

Fig. 3 Selected methods for intellectual capital reports.

National and international accountancy rules increasingly regulate how IC is reported. There are more than 35 intangible asset-measuring models existing. These models basically differ in one aspect. One type of models use inductive methods, the others use deductive methods. Deductive methods evaluate IC by calculating functions expressing monetary values. Inductive methods are score-card oriented. Inductive methods are subdivided into structure- and process-oriented models (see a selection of methods in Fig. 3). Structure-oriented models classify IC into categories and attempt to systematically measure an organization's knowledge assets. Process-oriented models focus on coverage and description of knowledge flows.

Although a wide range of methods for measuring and reporting IC have been developed during the last decade, especially for internal managerial purposes, companies have been reluctant to implement them. Investors are reluctant to invest in IC because of its inherent high-risk nature. Since IC is one of the main drivers of value creation and growth, this negative investment bias is seen as harmful, particularly for research-intensive and innovative enterprises.^[14]

KNOWLEDGE MANAGEMENT INSTRUMENTS

On a formal level, instruments are tools, techniques, or methods. A complete list of all existing instruments of knowledge management would be beyond the scope of this entry. Following the popular framework from Probst (see Fig. 2), we can define at least one instrument per building block. Some of these instruments are supported by IT, web technologies, or social (soft)ware.

Building Block: Knowledge Measure

"Intellectual capital statement" represents coherences between organizational targets, business processes, IC, and organizational profit. One well-known framework used to measure IC is the Austrian Research Center's IC report. This report measures different indicators from structural, human, and relationship capital. Innovation indicators are also integrated (see Fig. 4).

The ARC IC report^[15] is an inductive process-oriented model developed in 1999. Currently, these types of models form the most common representation of IC reports. The German approach provides a similar more practicable model.

The logic of this model combines goals, IC, knowledge processes, and intangible results. The process of acquiring, applying, and exploiting knowledge starts with the definition of specific knowledge goals, which can be derived from the corporate strategy. Knowledge goals define areas where specific skills, structures, and relationships should be established or increased in order to ensure the implementation of a corporate strategy. Derived from these goals, the IC consisting of structural, human, and relational capital is exploited. These intangible resources serve as input for the knowledge production process, which in turn is manifested in the different types of projects or processes carried out in an organization.

The model provides a framework for its adaptation and adoption by other organizations. When applying this

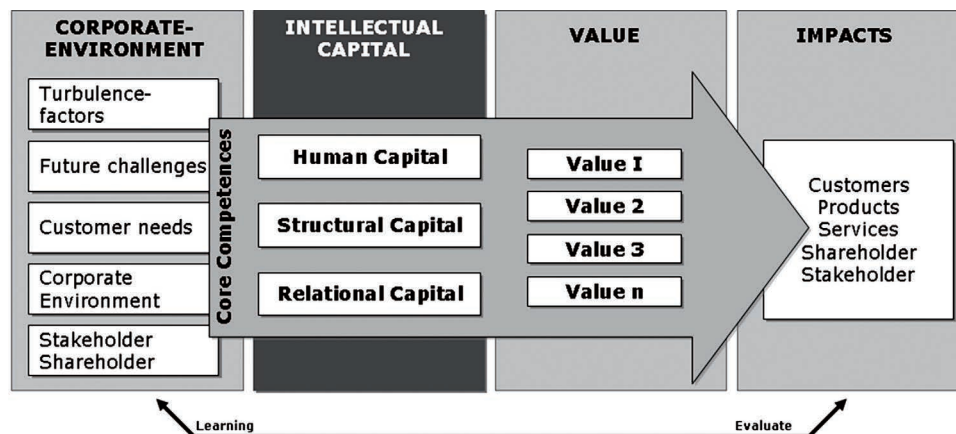


Fig. 4 Structure of the ARC intellectual capital report.

model, organizations have to formulate explicitly the organizational goals relevant for the resources and processes.^[16]

Building Block: Knowledge Identification

Knowledge can be identified by knowledge or data miners. These are software programs that mine the web in order to identify useful chunks of information—a process known as “business intelligence.” Knowledge can also be discovered by a “knowledge café” where people join different tables in order to discuss various topics with various partners.^[16]

Building Block: Knowledge Acquisition

The simplest way to acquire knowledge is by reading a book, studying an encyclopedia, weblog, or communities of practice.

Building Block: Knowledge Development

Knowledge is developed through experience, trial, and error. This means that the practical application of acquired knowledge helps to develop further knowledge.

Building Block: Knowledge Distribution

Knowledge can be transferred by the telling of stories. Not only is the core message transmitted during this process but also all necessary background knowledge and semantics that are needed to understand the core message are relayed by dialogue.

Building Block: Knowledge Preservation

The brain is the body’s primary repository of knowledge. Other sources such as databases on the web, data marts, MySpace, YouTube, Facebook, and blogs represent information stores.

Building Block: Knowledge Use

The techniques mentioned in the other blocks are combined and used in organizational processes so that the performance of individuals or groups is enhanced.

Information sharing is the cornerstone of knowledge management. Existing IT, referred to as social ware, helps people to share information and collaborate in an optimal fashion. Knowledge management is the management of this information flow, getting the right information to the people who need it so that they can act on it in due time.

Today many companies are using social ware to optimize collaboration and to improve results. Cultural and social problems however may occur during the collaboration process.

INTERNATIONAL COUNCIL ON KNOWLEDGE MANAGEMENT

For knowledge management as a discipline to succeed, a specialized body of knowledge, theory, hypotheses, observations, and problems must be formulated, tested, and applied. As the early activities in knowledge management were mainly dominated by practitioners and commercial activities, academicians and researchers saw the need for building the foundation for sustainable and solid research and development in this area. This effort started when a number of universities around the world started to offer graduate degrees in knowledge management. Given the interdisciplinary nature of knowledge management, it is also important to bring people from different but related disciplines to contribute to the development of the knowledge management profession. The absence of a scholarly professional body with the goal of advancing knowledge management as a discipline was the main motive for the formation of the International Council on Knowledge Management (ICKM). ICKM is an association that is based in Vienna.

The first ICKM conference started in 2004 in Singapore with the objectives of promoting knowledge management practices as well as bringing researchers, academics, and practitioners together to exchange ideas and share information. Since then, the conference became a great success and continues to move from one continent to another. Unfortunately, ICKM is not a trademarked word. Other organizations are using this name to arrange conferences with similar content.

ICKM council and ICKM series of conference came about as a result of one-person effort that started back in 1998. Dr. Suliman Hawamdeh who is currently a professor at the University of Texas founded the Information and Knowledge Management Society (iKMS), the organization behind the organization of the first ICKM conference in Singapore 2004. Dr. Hawamdeh was the founding director of the knowledge management program at Nanyang Technological University in Singapore and he is the editor in chief of the first refereed journal on knowledge management—the Journal of the Information and Knowledge Management. His vision is to create a scholarly and professional body with an international presence to promote and advance the iKMS profession.

While iKMS remained as a local Singapore-based KM association, it continues to support the ICKM council and the ICKM series of conferences. Professor Hawamdeh, the founding chair of the International Conference on Knowledge Management, continues the general chair duties and delegated the organization aspects to local organizers who manage the event as a nonprofit event with the objective of bridging the gap between academia and practitioners. ICKM is a platform for leading international forum for researchers and practitioners who come together to exchange ideas, share research findings, and network. Although all participants may openly and freely present

ideas and theories, the proceeding, which is published as a book and part of the book series Innovation and Knowledge Management and edited by professor Hawamdeh, is limited to peer-reviewed papers, an approach that should guarantee high scientific quality with practical implications. Key individuals who played an important role in the successful organization of ICKM conferences so far include Patrick Lambe, Martyn Laycok, Franz Barachini, Sam Chu, Waltraut Ritter, and Adeline du Toit.

CONCLUSION AND FUTURE TRENDS

We have presented three well-known concepts of knowledge management and discussed the different perspectives of knowledge management and IC reporting. Furthermore, we have presented instruments that are subject of investigation in conferences as the ICKM.

Knowledge management itself can be seen as bringing the right knowledge to the right people in due time so that IC can be improved. The problem is how to motivate people to share information. Appropriate rewarding schemas do exist, but they are not widely used in companies because it is too difficult to measure the value of information and the value of individual contributions. Much more research is needed in rewarding schemas.

Other obstacles for knowledge sharing are the divide between rich and poor and the divide between educated and uneducated. Cultural differences also hamper knowledge sharing. We are convinced that there is a need to develop performance measurements for corporate social responsibility and to combine this with shareholder value. Substantial research is needed in this area and we hope that the international conference on knowledge management will go a long way to stimulate such objectives.

If we accept knowledge as being a very private personal affair, then we recommend concentrating more research efforts toward neuroscience and neurobiology. In particular, the influence of emotions on knowledge sharing seems to be evident.

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International Federation of Library Associations and Institutions (IFLA)

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Abstract

The International Federation of Library Associations and Institutions (IFLA) is the leading international body representing the interests of library and information services, their staffs, and users. The International Federation of Library Associations and Institutions is an independent, nongovernmental, not-for-profit organization, registered in The Hague as an association under the law of the Netherlands. Founded at an international congress in Edinburgh, Scotland, in 1927, it has become the global voice of the library and information profession.

INTRODUCTION

The International Federation of Library Associations and Institutions (IFLA) is the leading international body representing the interests of library and information services, their staffs, and users. The International Federation of Library Associations and Institutions is an independent, nongovernmental, not-for-profit organization. It was founded at an international congress in Edinburgh, Scotland, in 1927, as the International Federation of Library Associations, a federation of national library associations. Prior to World War II the orientation of the association was strongly European; eight of the nine presidents who served during IFLA's first 50 years were from Europe, and the majority of IFLA congresses were held in European cities. After the war, IFLA's membership expanded and in the 1970s special efforts were made to expand the membership to developing countries. The first of a series of presession seminars for librarians from developing countries was held in 1971. In 1976 a Division of Regional Activities, comprising three regional sections, for Africa, Asia and Oceania, and Latin America and the Caribbean, was established to serve members in the developing regions, where regional offices were subsequently set up. IFLA's first conference outside Europe and North America was held in Manila, the Philippines, in 1980. IFLA's first President from Africa, Kay Raseroka, from Botswana, served from 2003 to 2005;

the second, Ellen Tise, from South Africa, was elected to serve from 2009 to 2011.

In 1976 IFLA extended membership to libraries and related institutions and changed its name by adding "and Institutions," but left its well-known acronym unchanged. During the past three decades, IFLA has become the global voice of the library and information profession, and library leaders from many countries have served as president (see Appendix A).

MISSION

The statutes of IFLA (its constitution) state that the purposes of the federation shall be to: promote high standards of delivery of library and information services; encourage widespread understanding of the value and importance of high-quality library and information services in the private, public, and voluntary sectors; and represent the interests of members throughout the world. IFLA's mission, therefore, is to promote high standards of service by issuing guidelines to best practice and standards of provision, through international advocacy to persuade decision makers and opinion formers of the importance and relevance of libraries in the digital age, and to work for an estimated 690,000 librarians and information workers worldwide.

CORE VALUES

The statutes also state IFLA's core values:

- The endorsement of the principles of freedom of access to information, ideas, and works of imagination, and freedom of expression embodied in Article 19 of the Universal Declaration of Human Rights.
- The belief that people, communities, and organizations need universal and equitable access to information, ideas, and works of imagination for their social, educational, cultural, democratic, and economic well-being.
- The conviction that delivery of high-quality library and information services helps guarantee that access.
- The commitment to enable all members of the federation to engage in, and benefit from, its activities without regard to citizenship, disability, ethnic origin, gender, geographical location, language, political philosophy, race, or religion.

These represent values and beliefs but also, especially in paragraph (d), ambitious aspirations. The mission and the core values form the basis of the federation's worldwide activities.

MEMBERSHIP

The federation is primarily an organization of members, relying upon them both for the bulk of its income and most of its professional input. There are two main categories of voting members: national association members and institutional members. National associations of library and information professionals, of library and information services, and of educational and research institutes within the broad field of library and information science, are enrolled as national association members. Institutional membership is designed for individual library and information services and all kinds of other organizations within the library and information sector. In addition, international organizations within the federation's sphere of interest may join as international association members. In 2008, there were 1224 voting members from 139 countries. Together, these associations and institutions represent the vast majority of the world's librarians and other library staff. Voting members are entitled to nominate and vote for candidates for the post of IFLA president and for places on the federation's governing board.

Individual practitioners and students in the field of library and information services may join as personal affiliates and student affiliates, respectively. They do not have voting rights, but they are able to nominate and vote for places on the standing committees of the professional sections. They provide invaluable contributions to the work of the federation, by serving on those committees and by contributing to the professional programs. In 2008 there

were more than 300 personal and student affiliates in membership. National association members pay membership fees according to a graduated scale, based on the size of their operating expenditure. This helps ensure a reasonably equitable scale of fees.

For institutional members there is a system of differentiated fees based on the UNESCO scale of assessment. Personal affiliates pay a flat fee calculated so that it covers the expenses of administration and the benefits such as publications. For student affiliates there is a lower rate.

CORPORATE PARTNERS

The IFLA corporate partners' scheme enables a wide variety of companies in the library and information industry to have regular and direct contact in a variety of ways with the international library community. In return for financial and "in-kind" support, they receive a wide range of benefits, which may be negotiated on a flexible basis to suit individual needs. Corporate partners include publishers, subscription agents, software producers, and distributors of library furniture and equipment. Long-term relationships have been developed with a number of companies. For example, OCLC of Dublin, Ohio, U.S.A., offers the Jay Jordan IFLA/OCLC Early Career Development Fellowship Program. Every year up to six fellows from countries with developing economies travel to OCLC headquarters for 4 weeks to participate in an intensive program of lectures, seminars, and mentoring. They also visit a number of libraries and relevant organizations in North America, the Netherlands (where they visit IFLA Headquarters), and Germany. Depending on the level of financial support, companies are listed as Gold, Silver, or Bronze Corporate Partners.

RELATIONS WITH OTHER BODIES

Over the years, IFLA has established good working relations with a variety of international organizations whose interests, at least partly, coincide with those of IFLA. This provides an opportunity for regular exchange of information, formal representation at meetings and, in some cases, the award of grants, the mutual approval of statements, and other initiatives. For example, IFLA holds

- Formal associate status with UNESCO.
- Observer status with the United Nations.
- Associate status with the International Council of Scientific Unions (ICSU).
- Observer status with the World Intellectual Property Organization (WIPO).
- Observer status with the International Organization for Standardization (ISO).
- Observer status with the World Trade Organization (WTO).

UNESCO formally approved

- The Public Library Manifesto, a document summarizing the aims and key missions of public libraries with the role to serve as a reference for anyone who can contribute to the progress of public libraries throughout the world.^[1]
- The School Library Manifesto, which argues that school library services are so vital that they should be provided equally to all members of the school community, regardless of age, race, gender, religion, nationality, language, and professional or social status. The IFLA/UNESCO School Library Manifesto urges governments, through their ministries responsible for education, to develop strategies, policies, and plans that implement the principles of this Manifesto.^[2]
- The Internet Manifesto, proclaiming that unhindered access to information is essential to freedom, equality, global understanding, and peace.^[3]

All of these documents were drafted by IFLA sections. The common role of these manifestos is to advise and influence local, regional, and national governmental bodies in matters of library development. Funding has been received from UNESCO and other sources to distribute and promote the manifestos around the world. Guidelines for the provision of both public libraries and school libraries have been developed to supplement the manifestos and to help promote higher standards of service in these sectors. More recently the development of a set of IFLA/UNESCO Internet Manifesto Guidelines was funded by UNESCO and the Swedish International Development Cooperation Agency (Sida), and a series of workshops has been held in various parts of the world to promote their implementation.

The federation has offered consultative status to a number of nongovernmental organizations (NGOs), whose interests coincide with those of IFLA. This is often on the basis of mutual recognition. These arrangements include the International Publishers Association (IPA), the International Council on Archives (ICA), and the International Council for Scientific and Technical Information (ICSTI). This status facilitates the exchange of documents and mutual representation at each other's congresses. In some cases it has resulted in more tangible and practical outcomes. The IFLA and the IPA have, for example, set up the IFLA/IPA Steering Group to examine issues of mutual interest such as metadata, the legal deposit of electronic materials, and digital object identifiers.

In 1996 IFLA also collaborated with other NGOs to found the International Committee of the Blue Shield (ICBS) whose mission is to collect and disseminate information and to coordinate action in emergency situations where cultural heritage is threatened. The name was chosen because the 1954 Hague Convention for the Protection of Property in the Event of Armed Conflict specified use

of the blue shield for marking cultural sites to give them protection from attack in the event of war. In addition to IFLA, the NGOs within the ICBS are the International Council on Archives (ICA); the International Council of Museums (ICOM); and the International Council on Monuments and Sites (ICOMOS). In 2005 the Coordinating Committee of Audiovisual Archives Associations (CCAAA) joined ICBS. These international NGOs have joined together to provide the concerned authorities and professionals with expertise and guidance in cases of armed conflict and natural disasters that affect cultural heritage. They are also working together to organize risk preparedness at an international level and encourage its development at a local level. By 2008 national Blue Shield committees had been set up in 12 countries: Australia, Belgium, Benin, Brazil, Czech Republic, France, Italy, Former Yugoslav Republic of Macedonia, the Netherlands, Norway, Poland, and the United Kingdom; plans were afoot to set up such committees in a number of other countries.

THE IFLA WORLD LIBRARY AND INFORMATION CONGRESS

IFLA is clearly much more than just a congress. Nevertheless, IFLA's annual World Library and Information Congress (known until 2003 as the IFLA General Congress and Council) is its flagship event. At a gathering held in a different city each year, upward of 3000 delegates gather to exchange experience, debate professional issues, see the latest products of the information industry, conduct the business of IFLA, learn about the library and information infrastructure of the host country and to experience its culture. An important side benefit of attending the IFLA congress is the ability to renew and expand professional friendships from across the world. Every year IFLA's Governing Board selects the region in which the congress is to be held 3 years hence. A feasibility study is conducted by IFLA's professional conference organizer (PCO) and a shortlist of suitable venues in that region is drawn up. From these the Governing Board selects the winning city on the basis of criteria that include the geographic spread of the congress; the congress and exhibition facilities available; logistics, including ease of transportation and the availability of hotels in all price ranges; support from the local profession; and support from the government and other agencies. Each congress is arranged by a four-way partnership consisting of IFLA, an IFLA-controlled limited liability company based in the United Kingdom, the PCO, and a National Committee.

Each congress has a distinctive theme to which the various sessions, including plenary sessions, guest lectures open sessions, and workshops are expected to contribute. In recent years the IFLA congresses have been held in the following venues with the following congress themes:

- 2004, Buenos Aires, “Libraries: Tools for Education and Development.”
- 2005, Oslo, “Libraries—A voyage of discovery.”
- 2006, Seoul, “Libraries: Dynamic Engines for the Knowledge and Information Society.”
- 2007, Durban, “Libraries for the future: Progress, Development and Partnerships.”
- 2008, Québec City, “Libraries without borders: Navigating towards global understanding.”

In 2009, the IFLA congress will take place in Milan with general theme “Libraries create futures: Building on cultural heritage” and in 2010 in Gothenburg with theme “Engaging, Embracing, Empowering.” The 2011 congress will be held in San Juan, Puerto Rico, with a theme still to be announced.

A substantial trade and technical exhibition is arranged during the congress. The number of exhibiting companies and organizations usually exceeds 100. International Federation of Library Associations and Institutions Sections and other professional groups often arrange specialist workshops or seminars immediately preceding or following the congress. The venue for such satellite events is often in the same city as the congress itself or in some other location in the region.

Congress hosts sometimes link their own congress with the IFLA event in order to strengthen national participation. Other national, regional, or specialist professional groups often take the opportunity to economize on their members’ travel costs by arranging their own regular meetings in connection with an IFLA congress, which many of their members could be expected to attend. The IFLA congress often tends to have an invigorating effect on the profession in that country.

The congress is usually held in the third or fourth week of August. The congress itself lasts 5 days, but it is preceded and followed by business meetings of the Governing Board, its committees, and the committees of IFLA’s professional units. For members of these bodies the event may last up to 9 days. Starting on Sunday afternoon and continuing until Thursday morning there is a full program of guest lectures, professional sessions, and poster sessions. Around 400 papers on a wide spectrum of topics are presented in nearly 100 professional program sessions that are scheduled in six parallel slots, at two of which simultaneous interpretation is offered in IFLA’s seven languages. Around 100 posters are also presented in seven languages. Library tours offer participants the opportunity to visit libraries in the host city and other cities nearby. Receptions and cultural performances are held during the evenings. Embassies often host receptions for their own nationals and invited guests. International Federation of Library Associations and Institutions has a close relationship with the Conference of Directors of National Libraries (CDNL), an independent body, which holds its annual meeting during the congress week.

Building on the initiative of Denmark in 1997, most of IFLA’s congress hosts have established special funds to support participants from developing countries. A variety of congress participation grants, with varying eligibility requirements, are on offer. These are usually announced on IFLA’s Web site 6–8 months before the relevant congress.

In addition to the annual congress a wide range of professional meetings, seminars, and workshops are held around the world by IFLA’s professional units and core activities. Two other regular major international conferences are held under the auspices of IFLA: the five-yearly International Congress of Medical Librarians (ICML) will hold its 2009 congress in Brisbane in July 2009, and the biennial International Conference on Interlending and Document Supply (ILDS) will convene in Hanover, Germany, in October 2009.

GOVERNANCE

The governing structure of IFLA was revised in 2008, when revised Statutes and Rules of Procedure (regulations) were adopted. While the essential structure remained largely unchanged, greater flexibility was achieved by moving detailed provisions concerning professional units such as division and sections from the Statutes to the Rules of Procedure.

A description of the structure which will be in place from 2009 follows (see Fig. 1).

President

The president is the chief representative of IFLA and is expected to provide it with professional leadership. Among the formal duties of the president are the chairing of the meetings of the General Assembly and the Governing Board. The President is elected by the total voting membership by postal ballot and first serves a term of 2 years as president-elect, followed by 2 years as president. The president may serve for only one term. See Appendix A for a list of all past presidents.

General Assembly

The General Assembly, known until 2008 as the Council, is the highest organ of IFLA. It determines its policies and priorities. The voting members in good standing (that is, those who have paid their membership fees in full) constitute the General Assembly, which meets annually during the congress. Although voting in elections is by postal ballot, under Dutch laws decisions of the General Assembly have to be taken at these meetings. However, non-binding consultations are held by postal ballot on important issues. Voting members not able to be directly represented at a General Assembly meeting may arrange to have their vote

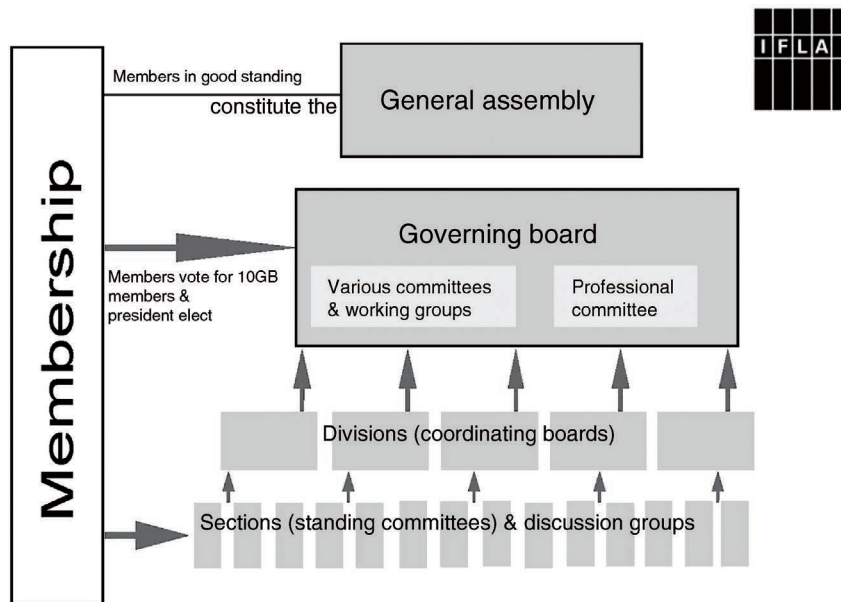


Fig. 1 IFLA organization chart.

exercised by proxy. Personal affiliates of the federation may attend the General Assembly as observers, but may not vote. Representatives of other organizations and other persons may be invited to attend as nonvoting observers. Observers may speak at General Assembly meetings at the invitation of the chair or with the permission of the chair. The International Federation of Library Associations and Institutions has a system of vote allocations which ensures that national association members have a majority vote in the General Assembly. At present, institutional members have one vote each, while international association members have five. National association members have an allocation ranging between 8 and 40, according to the membership fees they pay.

Governing Board

Over 1200 voting members are entitled to attend and vote at General Assembly meetings and to take part in postal ballots. The statutes, therefore, provide for a Governing Board of more manageable size to be responsible for the managerial and professional direction of the federation, within guidelines approved by the General Assembly. The Governing Board consists of: the president; the president-elect; ten members elected by postal and/or electronic ballot; the members of the Professional Committee, the chair of the Management of Library Associations Section and up to three co-opted board members. The Governing Board meets at least twice a year, once at the time and place of the annual congress. Other business may be conducted by post and electronic mail. The statutes provide for an Executive Committee with delegated executive responsibility to oversee the direction of the federation between meetings of the Governing Board. The Governing Board has the power to establish other committees.

Professional Committee

The Statutes provide for a Professional Committee that is responsible for coordinating the work of all the units within the federation responsible for professional activities, policies, and programs. This committee consists of a separately elected chair, a representative, usually the chair, of each of the five divisions of IFLA, together with three members of the Governing Board, elected by that board. The Professional Committee meets at least twice a year, once at the time and place of the general congress.

PROFESSIONAL UNITS

Much of the professional work of the federation is carried out by professional units known as sections and (from 2009) special interest groups, which replace the units formerly known as discussion groups. These are coordinated by divisions, which are in turn represented on the Professional Committee.

Divisions

The Governing Board is responsible for establishing a series of divisions, whose role is to promote and coordinate the work of IFLA in broad categories representing the aspects of the interests of the profession. Divisions coordinate the work of sections, special interest groups (SIGs) and core activities. However, the routine administrative work formerly carried out by divisions was reduced in 2008 and in terms of the new statutes their former coordinating boards, consisting of the chairs and secretaries of the sections belonging to the division, have been replaced by leadership forums. The chair of each division has a seat

on the Professional Committee. As from 2008 there are five divisions: Library Types, Library Collections, Library Services, Support for the Profession, and Regions

Sections

Sections are the primary focus for the federation's work; they are grouped as follows in the five divisions:

- Library Types (for example, academic and research libraries, law libraries, biosciences libraries).
- Library Collections (for example, government information and official publications, rare books and manuscripts, newspapers).
- Library Services (for example, reference and information services, library services to multicultural populations).
- Support for the Profession (for example, management and marketing, education and training, library buildings, and equipment).
- Regions (Africa, Asia and Oceania, Latin America, and the Caribbean).

All IFLA members are entitled to register for sections of their own choice. Once registered, voting members have the right to nominate and elect specialists to the standing committee of the sections for which they are registered. The standing committee is the key group of professionals who develop and monitor the program of work of their section and prepare its sessions at the annual congress. Sections receive annual subventions from central funds with the approval of the Professional Committee. They are also able to apply for additional funds to carry out specific projects, such as the preparation of best practice guidelines, the compilation of a directory, or the conduct of a survey. Often such projects are published in the IFLA publications series. Each section publishes a newsletter for its members. They are usually published twice a year and may be made available to other interested persons. The contents are also usually published on IFLA's Web site. Some of the newsletters contain substantial professional articles. Most sections also have an electronic mailing list. There are, as of 2008, 45 sections. The Professional Committee has the power to approve a proposal to create a new section or to disband an existing section.

Special Interest Groups

In 2001 IFLA's Round Tables were disbanded, the relevant groups becoming either sections or discussion groups. Starting in 2009 the latter will be replaced by special interest groups (SIGs). SIGs are less formal groupings, which cater for aspects of library and information services that do not require the establishment of a section because they deal with matters that may be of highly specialized or potentially short-lived interest. SIGs are normally linked to

a sponsoring section. To establish a SIG, interested members petition a relevant section. If sufficient members express interest, the sponsoring section agrees, and certain criteria are met, the Professional Committee approves the establishment of the SIG. As of 2008 IFLA had eight discussion groups that were expected to become SIGs. They include discussion groups on such topics as e-learning, agricultural libraries, quality issues in libraries, and new professionals. A substantial number of other groups was waiting to submit petitions as well. Although SIGs do not receive regular funding from central sources, they are eligible to apply for finance to carry out projects. They run sessions as part of the general congress. Most also have an e-mail discussion list.

Regional Activities

Three regional sections—Africa, Asia and Oceania, and Latin America and the Caribbean—make up the Division of Regional Activities. All IFLA members located in these regions are automatically registered for the respective regional sections free of charge, in addition to other sections for which they may choose to register. The three regional sections are concerned with all aspects of library and information services in their regions. They promote IFLA activities and work closely with all IFLA's professional units, IFLA core programs, and with the respective IFLA regional offices.

Core Activities

Between 1973 and 1997 IFLA established six core programs to provide leadership and a focal point for work on strategic issues of common concern to library and information services around the world. In the following decade financial pressures and management changes in several of the libraries hosting core programs forced a rethinking of these programs. They were renamed core activities, the new designation implying less permanence and a greater openness to change than before.

Several of the older programs had continued for some years and were thought to have achieved as much as they could. Consequently three were closed down during 2001–2003: Universal Dataflow and Telecommunications (UDT), Universal Bibliographic Control and International MARC (UBCIM), and Universal Availability of Publications (UAP), with the Office for International Lending. Responsibility for the international interlending vouchers scheme was taken over by IFLA Headquarters.

Universal Bibliographic Control and International MARC was replaced by a new group formed by a partnership between IFLA and the Conference of Directors of National Libraries (CDNL) to form an Alliance for Bibliographic Standards (ICABS), subsequently renamed IFLA-CDNL Alliance for Digital Strategies (ICADS).

The National Library of Portugal took over the UBCIM's UNIMARC activities.

With the exception of the Advancement of Librarianship in the Third World Program (ALP), hosted in the University Library of the University of Uppsala, Sweden, the core programs were hosted and supported by major national libraries, which provide staff, accommodation, and support services. Such support in kind is supplemented by grants-in-aid from library associations, institutions, and aid agencies, particularly in the Nordic countries, as well as by project funding from foundations and aid agencies. The International Federation of Library Associations and Institutions itself provides on-going support from its Core Activities Fund, to which most major national libraries contribute. Since 2004 IFLA has had six core activities, which are described below.

Action for Development through Libraries (ALP) core activity

ALP was established in 1986 as the Advancement of Librarianship in the Third World Program. In 2004 it was renamed Action for Development through Libraries, but it retains its acronym and remains at the University Library of Uppsala, Sweden. The mission of ALP is to further the library profession, library institutions, and library and information services in the developing countries of Africa, Asia and Oceania, and Latin America and the Caribbean. Its goals are to assist in continuing education and training; to support the work of library associations; to promote the establishment and development of library and information services to the general public, including the promotion of literacy; and to introduce new technology into library services. ALP also acts as a catalyst within IFLA for the federation's activities in developing countries. Cooperation with a wide range of organizations within and outside the federation is a feature of ALP. ALP works through a planned program of activities in close cooperation between its office at Uppsala University, Sweden, IFLA's Regional Offices, the Division for Regional Activities, the three Regional Sections, and other partners. Activities include scholarships and attachment programs, conferences, seminars and training workshops, pilot projects, publications, and databases. ALP also administers grants from various foundations and aid agencies to enable librarians from developing countries to attend the IFLA general congress. During the period 2005–2009 ALP received substantial project funding from the Swedish International Development Cooperation Agency (Sida). A major contribution in-kind is made by Uppsala University, which hosts the ALP Office. Recent examples of projects undertaken by ALP are a Workshop entitled "Model of community information services in indigenous villages," held in Bolivia, Ecuador and Peru in May–June 2005, and an "International workshop on Information Literacy," held in Bangladesh in 2008.

Preservation and Conservation (PAC) core activity

PAC was established in 1986 with the mission to encourage best practice in preservation and conservation of library material internationally by publishing guidelines to good practice, running practical workshops, and persuading decision makers to give higher priority to preservation and conservation issues. Unlike the other IFLA Core Programs, PAC was established in a decentralized way with an international center and a series of regional centers responsible for their own policies and priorities.

The International Center has been hosted by the Bibliothèque nationale de France in Paris since 1992 and there are regional centers respectively located in Washington (Library of Congress), Caracas (Biblioteca Nacional de Venezuela), Rio de Janeiro (Fundação Biblioteca Nacional de Brasil), Santiago (Biblioteca Nacional de Chile), Port of Spain (National Library and Information System Authority of Trinidad and Tobago), Porto-Novo (National Library of Benin), Cape Town (UCT Libraries, South Africa), Tokyo (National Diet Library), Canberra (National Library of Australia), Moscow (Library for Foreign Literature) and Almaty (National Library of Kazakhstan). The International Center in Paris (Bibliothèque nationale de France) acts as the Regional Center for Western Europe, Middle East and Africa. Recent projects undertaken by PAC include an International Conference on "Newspapers Collection Management: Printed and Digital Challenges" held in Santiago, Chile, in April 2007 and the publication of "IFLA Disaster Preparedness and Planning: A Brief Manual" by John McIlwaine, in 2006.^[4]

The roles of the centers are defined in a working agreement between IFLA and each center. Each center is, however, independent and acts according to the needs identified in its region. Together these centers form an international network. The directors meet annually for working sessions to coordinate the programs. Apart from the substantial contributions in-kind provided by the host libraries, funding is received from IFLA's Core Activities Fund, project finances from agencies such as UNESCO, and the sale of publications. PAC publishes *International Preservation News*, which appears three times a year.

Committee on Copyright and Other Legal Matters

The Committee on Copyright and Other Legal Matters (CLM) was established in 1996 to advise IFLA with respect to copyright and intellectual property, economic barriers to the acquisition and use of library materials, trade agreements affecting library services, disputed claims of ownership of library materials, authenticity of electronic texts, subscriptions and license agreements, and other legal matters of international significance to libraries and librarianship. The Committee operates through a committee which is representative of all regions of the world

and includes invited resource persons. It cooperates with several important partner organizations with complementary missions: Electronic Information for Libraries (eIFL), the European Bureau of Library, Information and Documentation Associations (EBLIDA), the World Blind Union, and the (U.S.) Library Copyright Alliance.

The Committee's focus is on international activities and in recent years CLM has participated actively in meetings of the World Trade Organization (WTO) regarding the General Agreement on Trade in Services (GATS) and the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS); at UNESCO, including meetings during 2001–2005 on the UNESCO Convention on the Protection and Promotion of the Diversity of Cultural Contents and Artistic Expressions (popularly known as the Convention on Cultural Diversity); and at the World Intellectual Property Organization (WIPO). Through written and oral interventions, collaboration with like-minded NGOs, and advocacy with representatives from member states, CLM achieved some notable successes for libraries in respect of such issues as the WIPO development agenda, traditional knowledge, and limitations and exceptions for libraries and for the visually impaired. The latter issue is an example of CLM's collaborative work: collaborating with IFLA's Libraries for the Blind Section, IFLA's national association members, and the World Blind Union (WBU) in persuading national governments to add to their national copyright laws provisions from WIPO's model copyright law that would improve access to information for print-disabled people. An important CLM activity has been raising awareness in the library community and providing guidance to the profession on issues with implications for library collections and services, for example, on copyright of digital resources.

Committee on Freedom of Access to Information and Freedom of Expression

The Committee on Freedom of Access to Information and Freedom of Expression (FAIFE) promotes freedom of information through libraries to improve the quality of life of individuals and groups. It tackles censorship of library materials; ideological, economic, political, or religious pressures resulting in limitations on access to information in libraries; and restrictions on librarians and other information specialists who provide reference and other information services. FAIFE empowers librarians and library users by promoting intercultural and interreligious tolerance, extending access to health information and combating corruption.

FAIFE attempts to monitor the state of intellectual freedom within the library community worldwide. In doing so it depends on networking and partnerships. For example, FAIFE is a member of various international intellectual freedom bodies such as the International Freedom of Expression Exchange (IFEX). In response to

violations of freedom of expression, and only once these have been confirmed from independent sources, IFLA may issue press statements, which can be found on the IFLA Web site.

Research and publications form an important part of FAIFE's advocacy work. Since 2001, FAIFE has annually published a unique *World Report* based on international data collection that provides an overview of how libraries around the world are tackling barriers to freedom of access to information and freedom of expression. Seven reports have appeared to date and the most recent, the IFLA/FAIFE World Report 2007, is entitled *Access to Libraries and Information: Towards a Fairer World*.^[5]

FAIFE supports IFLA policy development by conducting research and drafting policy statements and guidelines on various aspects of intellectual freedom in libraries. A good example is the *Internet Manifesto*, which has thus far been translated into 19 languages, and the complementary *IFLA/UNESCO Internet Manifesto Guidelines* funded by UNESCO.^[6] These have been workshopped and promoted in various parts of the world. This illustrates a recent shift in FAIFE's work: there is now more emphasis on raising the awareness of the library profession of freedom of information issues through educational seminars, workshops, and professional programs at IFLA's annual congresses and less on reacting to violations.

IFLA-CDNL Alliance for Digital Strategies

In 2003, when the UBCIM core activity was terminated, the National Library of Australia, the Library of Congress, the British Library, the Koninklijke Bibliotheek, and the Deutsche Nationalbibliothek agreed to participate in a joint alliance together with the Biblioteca Nacional de Portugal (responsible for the UNIMARC core activity), IFLA and the Conference of Directors of National Libraries (CDNL) to assure ongoing coordination, communication, and support for key activities in the areas of bibliographic and resource control for all types of resources and related format and protocol standards. This new alliance was known as the IFLA-CDNL Alliance for Bibliographic Standards (ICABS). In 2008 ICABS changed its name to ICADS, IFLA-CDNL Alliance for Digital Strategies, signaling a shift of emphasis away from "legacy systems" of bibliographic control such as the International Standard Bibliographic Descriptions (ISDN), toward digital library development and management, with three broad themes: creating and building digital collections (including digitization, Web archiving, and digital archiving); managing digital collections (including digital ingest, storage, and preservation); and accessing digital collections (digital resource discovery and digital rights management). IFLA-CDNL Alliance for Digital Strategies works through a coordinated Web presence based on the Preserving Access to Digital Information (PADI) site of the National Library of Australia, and

though an annual program of events at the IFLA congress. The Secretariat of ICADS is currently maintained by the British Library.

UNIMARC

The Universal MARC (UNIMARC) standard format for machine-readable catalogs was originally created by IFLA to facilitate the international exchange of bibliographic data. It was developed and promoted by the former UBCIM core activity under the supervision of the Permanent UNIMARC Committee (PUC), which had been formed in 1991. When UBCIM was terminated in 2003, the IFLA UNIMARC Core Activity was established with the responsibility for the maintenance and development of the UNIMARC format.

The purpose of the UNIMARC core activity is to coordinate activities aimed at the development, maintenance, and promotion of the UNIMARC format, now a set of four formats, Bibliographic, Authorities, Classification, and Holdings and related documentation, through the Permanent UNIMARC Committee. In this connection it cooperates with relevant professional units of IFLA as well as with the International Organization for Standardization's Committee ISO TC46, the international agencies for standard numbers such as ISBN and ISSN, and various other international bodies. The IFLA UNIMARC core activity is hosted by the National Library of Portugal in Lisbon.

ADVOCACY

IFLA has a long history of advocacy in the field of library and information services with a focus on promoting the development of librarianship and library services worldwide through interlinked activities relating to international library cooperation, the development and dissemination of best professional practice and stimulating and assisting library development in developing countries. The emergence of the CLM and FAIFE core activities heralded a stronger advocacy focus, on the themes of Equity (fair and sustainable legal and economic relationships between the creators, intermediaries and users of information) and Freedom (freedom of access to information and freedom of expression), respectively. IFLA's advocacy became more prominent in the buildup to the World Summit on the Information Society (WSIS) in 2003–2005, with an emphasis on a third theme: Inclusion: the role of the library in the Information Society and the role of the library as an agency of social inclusion. The latter theme was emphasized in various events and actions, including a presummit Conference organized by IFLA and the Biblioteca Alexandrina just before the Tunis Summit in Alexandria, Egypt, on the theme "Libraries: the information society in action." Here IFLA showcased success

stories illustrating the role of libraries in the Information Society. At the end of the presummit IFLA launched its *Alexandria Manifesto on Libraries, the Information Society in Action*.^[7] Thanks to intensive and sustained advocacy work by IFLA and its allies the WSIS outcome documents contained some very favorable language concerning the role of libraries in the Information Society. Since 2005, IFLA has continued to follow up the WSIS advocacy work, by monitoring the Internet Governance Forum and participating in the WSIS action line facilitation and consultation meetings held annually in Geneva. In 2006 IFLA set up a working group, designated as the President-elect's Information Society Working Group (now the President's Information Society Working Group), to keep abreast of progress in respect of the action lines and other important issues (such as Internet governance) arising from WSIS, but not limited to it. The work of this Working Group is closely aligned to the presidential theme of IFLA's 2007–2009 President, Claudia Lux, "Libraries on the agenda!"

In its advocacy at international bodies such as UNESCO and WIPO, IFLA's internationally representative membership lends it a unique credibility when it states the concerns and interests of the library profession.

LANGUAGES

The IFLA has seven working languages: Arabic, Chinese, English, French, German, Russian, and Spanish. The federation's policy is to provide a simultaneous interpretation service in these languages for the major sessions at the annual general congress. For this purpose IFLA has built up a team of volunteer interpreters who are skilled in the language of librarianship and information work. At its congresses the language of the host country is sometimes also used, if it is not one of the official working languages. Congress papers are also translated into the working languages, subject to the resources being available. Other meetings and seminars may also require the use of some of the working languages for translation or interpretation. Many IFLA publications appear not only in the seven official languages, but also in other languages. For example, the IFLA/UNESCO public library guidelines are available on IFLA's Web site in 21 languages, and the IFLA/UNESCO school library guidelines in 17. For many of these translations IFLA gratefully relies on volunteer translators and, more recently, on the language centers referred to below.

HEADQUARTERS

The IFLA Headquarters is headed by a secretary general, appointed by the Governing Board, who is responsible for the strategic and operational direction and financial

management of the federation, within the policies established by the General Assembly and the Governing Board. The secretary general has the right to attend and participate, in a nonvoting capacity, in all meetings of the General Assembly, the Governing Board, and the Professional Committee. The IFLA Headquarters consists of a small team of full- and part-time staff, based at in the Hague. It is hosted by the Koninklijke Bibliotheek (the Royal Library of the Netherlands), which provides the office space and the infrastructure.

Regional Offices

IFLA has established three regional offices: for Africa, Asia and Oceania, and Latin America and the Caribbean. Their regions correspond to those of the regional sections. The regional office for Africa is hosted by the University of South Africa in Pretoria, South Africa, the office for Asia and Oceania is hosted by the National Library Board of Singapore, while the office for Latin America and the Caribbean is hosted by the Biblioteca Pública do Estado do Rio de Janeiro, in Rio de Janeiro, Brazil. A regional manager heads each office. They receive modest funding from IFLA's central funds, but they also receive substantial support from their host organizations. They work closely with the regional sections and with the core activities to promote the work of IFLA in their region and to ensure that the needs of their region are reflected in the federation's policies and priorities. The International Federation of Library Associations and Institutions also has three language centers, for French (for Africa), Russian, and Arabic. The IFLA Center for Arabic Speaking Libraries and Information Institutions is hosted by the Bibliotheca Alexandrina, in Alexandria, Egypt; the IFLA French Language Center for Africa is hosted by the Central Library of Cheikh Anta Diop University, in Dakar, Senegal; and the IFLA Russian Language Center is hosted by the Russian State Library, in Moscow, Russian Federation. The regional offices are concerned with communication and recruitment tasks.

IFLA on the Internet

IFLA has had a presence on the Internet since 1993. It consists of a Web site, formerly called IFLANET (<http://www.ifla.org>), and a set of electronic mailing lists. It was initiated within the UDT core program in 1993 and hosted by the National Library of Canada (now Library and Archives Canada). From 2001 to 2008 it was hosted by the Institut de l'Information Scientifique et Technique (INIST), in Nancy, France. It is now administered by the IFLA Headquarters. As an essential tool for all those active in the work of the federation, it includes general information about IFLA, including all the professional units, details of future congresses, the papers presented at the general congress, lists of members and corporate

partners, complete publications and electronic collections, and reports on technologies and issues facing contemporary libraries. Use of the IFLA Web site has been increasing rapidly. In 2007 it logged an average of almost 290,000 visits per month. During 2008 the IFLA Web site was redeveloped and thoroughly updated, to convert it from a repository of documents to a multipurpose communication tool. The new site is based on a modern open-source content management system (Drupal). It provides clear and efficient navigation, an attractive Web presence for each of IFLA's professional units, and a range of Web 2.0 functionality, including blogs, wikis, and forums, to enable IFLA members to communicate, interact, and work together in innovative and flexible ways. Its design takes into account the seven official languages as well as the requirements of visually handicapped and bandwidth-challenged users. Because of the new site's higher demands on resources and hosting possibilities, it will be housed at another Web hosting company.

In 2008 there were 61 electronic mailing lists, including IFLA-L, a general electronic forum; LIBJOBS, a mailing list for librarians and information professionals seeking employment; IFLAPARL, the mailing list of the Section on Library and Research Services for Parliaments; and UNIMARC-DIS, a forum for those using or interested in the UNIMARC cataloging formats.

PUBLICATIONS

The results of the research, projects, and other activities of the federation's professional units are reflected in its publications. *IFLA Journal*, which covers the latest developments on the international library and information scene, is published quarterly by Sage Publications. Each issue provides current information on the federation, together with articles selected to reflect the many aspects of the international library and information profession.

The reports to the General Assembly of the President and the Secretary General are published annually in *IFLA Journal*, while a formal annual report is published separately. The *IFLA Directory* appears biennially. It provides information about the composition of IFLA's main steering bodies such as the Governing Board and the standing committees of all IFLA sections as well as other organizational information, including the Statutes and Rules of Procedure. The membership directory no longer appears in the *IFLA Directory*. Instead, it is now accessible online on the IFLA Web site.

IFLA produces a major series of monographs, *IFLA publications*, published on its behalf by K. G. Saur Verlag of Munich, Germany. Six titles are usually published each year, and they are available for separate purchase or by subscription as an optional addition to the membership fee. Recent titles include:

- Newspapers collection management: printed and digital challenges.^[8]
- Information Literacy: International Perspectives.^[9]
- Library Management and Marketing in a Multicultural World.^[10]
- Networking for Digital Preservation—Current Practice in 15 National Libraries.^[11]

The *IFLA Reports Series* consists of reports on congresses, surveys, and other studies, which do not warrant monograph publication. They are available for individual purchase. Recent titles include: *Guidelines for Library Services for Young Adults*^[12] and *Guidelines for Libraries of Government Departments*.^[13] In addition to this series, Saur also publishes the *IFLA Series on Bibliographic Control*.

Conclusion

From its modest beginning in 1927 as a kind of club of library associations and directors of major libraries in Europe and North America, IFLA has developed into a worldwide network of library associations, libraries, and librarians, exchanging information, developing guidelines to good practice, and influencing the world’s decision-making bodies in the service of libraries and their users.

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APPENDIX

Table A.1 IFLA conferences, venues, and presidents.

Session	Year	Venue	President	Proceedings
			I. G. A. Collijn 1927–1931	
1	1928	Rome		I
2	1929	Rome, Florence, Venice		I
3	1930	Stockholm		II
4	1931	Cheltenham		III
			W. W. Bishop 1931–1936	
5	1932	Berne		IV
6	1933	Chicago and Avignon		V
7	1934	Madrid		VI

(Continued)

Table A.1 IFLA conferences, venues, and presidents.
(Continued)

Session	Year	Venue	President	Proceedings
8	1935	Madrid and Barcelona	M. Godet 1936–1947	VII
9	1936	Warsaw		VIII
10	1937	Paris		IX
11	1938	Brussels		X
12	1939	The Hague and Amsterdam	W. Munthe 1947–1951	XI
13	1947	Oslo		XII
14	1948	London		XIII
15	1949	Basel		XIV
16	1950	London		XV
17	1951	Rome	P. Bourgeois 1951–1958	XVI
18	1952	Copenhagen		XVII
19	1953	Vienna		XVIII
20	1954	Zagreb		XIX
21	1955	Brussels		XX
22	1956	Munich		XXI
23	1957	Paris		XXII
24	1958	Madrid	G. Hofmann 1958–1963	XXIII
25	1959	Warsaw		XXIV
26	1960	Lund and Malmö		XXV
27	1961	Edinburgh		XXVI
28	1962	Berne		XXVII
29	1963	Sofia		XXVIII

Session	Year	Venue and theme	President	Proceedings/Annual
			Sir Frank Francis 1963–1969	
30	1964	Rome <i>Index Cumulatif/</i> <i>Cumulative Index, 1928–1964</i>		XXIX XXX
31	1965	Helsinki		XXXI
32	1966	The Hague <i>Libraries and Documentation</i>		XXXII
33	1967	Toronto <i>Library Service for a Nation</i> <i>Covering a Large Geographical Area</i>		XXXIII
34	1968	Frankfurt am Main <i>Books and Libraries in and Industrial Society</i>		XXXIV

(Continued)

Table A.1 IFLA conferences, venues, and presidents.
(Continued)

Session	Year	Venue and theme	President	Proceedings/ Annual
35	1969	Copenhagen <i>Library Education and Research in Librarianship</i>	H. Liebaers 1969–1974	IFLA Annual 1969
36	1970	Moscow <i>Lenin and Libraries</i>		1970
37	1971	Liverpool <i>The Organization of the Library Profession</i>		1971
38	1972	Budapest <i>Reading in a Changing World</i>	P. Kirkegaard 1974–1979	1972
39	1973	Grenoble <i>Universal Bibliographic Control</i>		1973
40	1974	Washington <i>National and International Library Planning</i>		1974
41	1975	Oslo <i>The Future of International Library Cooperation</i>	E. Granheim 1979–1985	1975
42	1976	Lausanne <i>IFLA</i>		1976
43	1977	Brussels <i>Libraries for All: One World of Information, Culture and Learning</i>		1977
44	1978	Strbské Pleso <i>Universal Availability of Publications</i>	E. Granheim 1979–1985	1978
45	1979	Copenhagen <i>Library Legislation</i>		1979
46	1980	Manila <i>Development of Libraries and Information Systems</i>		1980

(Continued)

Table A.1 IFLA conferences, venues, and presidents.
(Continued)

Session	Year	Venue and theme	President	Proceedings/ Annual
47	1981	Leipzig <i>The Role of National Centres in National Library Development and in International Library Cooperation</i>	H.-P. Geh 1985–1991	1981
48	1982	Montreal <i>Networks</i>		1982
49	1983	Munich <i>Libraries in a Technical World</i>		1983
50	1984	Nairobi <i>Basis of Information Services for National Development</i>	H.-P. Geh 1985–1991	1984
51	1985	Chicago <i>Libraries and the Universal Availability of Information</i>		1985
52	1986	Tokyo <i>New Horizons of Librarianship towards the 21st Century</i>		1986
53	1987	Brighton <i>Libraries and Information Services in a Changing World</i>	H.-P. Geh 1985–1991	1987
54	1988	Sydney <i>Living together: People, Libraries, Information</i>		1988
55	1989	Paris <i>Les Bibliothèques et l'information dans l'économie hier, aujourd'hui et demain</i>		1989
56	1990	Stockholm <i>Libraries: Information for Knowledge</i>	H.-P. Geh 1985–1991	1990
57	1991	Moscow <i>Libraries and Culture: Their Relationship</i>		1991

(Continued)

Table A.1 IFLA conferences, venues, and presidents.
(Continued)

Session	Year	Venue and theme	President	Proceedings/ Annual
			R. Wedgeworth 1991–1997	
58	1992	New Delhi <i>Library and Information Policy Perspectives</i>		1992
59	1993	Barcelona <i>The Universal Library: Libraries as Centres for the Global Availability of Information</i>		1993
60	1994	Cuba <i>Libraries and Social Development</i>		1994
61	1995	Turkey <i>Libraries of the Future</i>		1995 ^a
62	1996	Beijing <i>The Challenge of Change</i>		
63	1997	Copenhagen <i>Libraries and Information for Human Development</i>		
			C. Deschamps 1997–2003	
64	1998	Amsterdam <i>On Crossroads of Information and Culture</i>		
65	1999	Bangkok <i>On the Threshold of a New Century: Libraries as Gateways to an Enlightened World</i>		
66	2000	Jerusalem, Israel <i>Information for Cooperation: Creating the Global Library of the Future</i>		
67	2001	Boston, Massachusetts <i>Libraries and Librarians: Making a Difference in the Knowledge Age</i>		

Table A.1 IFLA conferences, venues, and presidents.
(Continued)

Session	Year	Venue and theme	President	Proceedings/ Annual
68	2002	Glasgow/Edinburgh, Scotland, United Kingdom <i>Libraries for Life: Democracy, Diversity, Delivery</i>		
69	2003	Berlin, Germany <i>Access Point Library: Media—Information—Culture</i>	H. K. Raseroka 2003–2005	
70	2004	Buenos Aires, Argentina <i>Libraries as Tools for Education and Development</i>		
71	2005	Oslo, Norway <i>Libraries—A voyage of discovery</i>	Alex Byrne 2005–2007	
72	2006	Seoul, Korea <i>Libraries: Dynamic Engines for the Knowledge and Information Society</i>		
73	2007	Durban, South Africa <i>Libraries for the future: Progress, Development and Partnerships</i>		
74	2008	Quebec, Canada <i>Libraries without borders: Navigating towards global understanding</i>	Claudia Lux 2007–2009	
Future Conferences				
75	2009	Milan, Italy <i>Libraries Create Futures: Building on Cultural Heritage</i>		
76	2010	Göteborg, Sweden		
77	2011	San Juan, Puerto Rico		

^aIFLA Annual was discontinued and replaced with the Biennial IFLA Council Report. IFLA Annual 1995 was the last issue published.

(Continued)

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International Federation of Television Archives (FIAT/IFTA)

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Abstract

The International Federation of Television Archives (FIAT/IFTA) is an international association of archives holding television programs and production material. Formed in 1977, it was initially made up of the archives of major broadcasting organizations, but grew to encompass national archives, technology companies, academic institutions, and others. Its main aim is information exchange, which it achieves through annual conferences, regional and specialist seminars, publications and its Web site. It cooperates with other international associations in its field and with UNESCO and attempts to draw attention to the historic importance of the audiovisual heritage throughout the world and to the dangers to its continued preservation. The recent growth of digital technologies and outlets has revolutionized the possibilities for television archives and brought a host of new concerns to FIAT/IFTAs agenda.

INTRODUCTION

The International Federation of Television Archives (formally titled *Fédération Internationale des Archives de Télévision*—commonly abbreviated to FIAT/IFTA) is, in its own words, “an international professional association established to provide a means for cooperation amongst broadcast and national audiovisual archives and libraries concerned with the collection, preservation and exploitation of moving image, and recorded sound materials and associated documentation” (source: FIAT/IFTA Web site home page). The means for cooperation include an annual conference, regional seminars, publications, and an online forum. Full members are organizations holding archives of television programming, while other bodies with an interest in the field, including commercial, industrial, and academic interests, are affiliated.

FOUNDATION AND CONSTITUTION

The International Federation of Television Archives was founded in Rome in 1977 by the heads of the archives of four broadcasting or audiovisual organizations: INA (Institut National de l’Audiovisuel-France), RAI (Radiotelevisione Italiana), the BBC (British Broadcasting Corporation), and the first German public channel, ARD. Statutes governed by French law were drawn up and members sought from around the world, although the bulk of the membership was, at first, and has largely remained European. Part of the reason for the establishment of the new organization was the failure of these broadcasters, despite the extensive nature of their holdings, to be accepted as equal members of the only existing forum for moving image archives, the *Fédération Internationale des Archives de Film* (FIAP). This

was, and remains, an organization of national film archives and cinémathèques, dedicated to establishing and enforcing exacting preservation and usage standards, and the industrial and commercial nature of much of the work of television archives, even those run by state or semi-state broadcasters, did not meet their criteria.

Nonetheless, the establishment of an international professional body dealing with the concerns of the program archives of television companies was a need felt in many countries and its foundation in the late 1970s was timely and reflected a crucial development stage of these archives. As with the archives of cinema output, television archives were formally established only when the medium had developed to a stage where a need for repositories of its history was felt—unfortunately too late to avoid the loss of crucial material from its formative years. In television, much early broadcast material was transmitted live, so there was nothing to keep anyway, and this transitory feeling worked against the establishment of archives. The earliest material to be collected was that which had been shot specially on film, particularly news and magazine program material, and, although the technology existed to record live output on film (telerecording or kinescope) from the late 1940s onwards, it was expensive and sparingly used, especially as copyright restrictions meant that anything other than the strictly factual was unlikely to be needed for rebroadcast—the main reason for keeping it in a broadcaster’s archive. When videotape was introduced in the late 1950s it revolutionized production but not archiving. It was expensive and, crucially, reusable. Most archive departments, which were actually really film libraries, did not even get control of it until the mid-1970s, as it required intricate machinery to replay, and thus remained the responsibility of engineering departments, whose priority was the next production rather than the last one.

At least, this was the case in Europe, where FIAT/IFTA was formed, and where most state broadcasting institutions followed the lead of the oldest and most prestigious broadcaster, the BBC. In the United States, the home of the largest TV production sector, the situation was different. Much more material survived because of the needs of syndication and different time-zones, and because much of the production in entertainment and drama was on film, through established Hollywood production companies. It is significant that the earliest and longest established American members of FIAT/IFTA were the New York-based news divisions of the three main networks, CBS, NBC, and ABC, whose concerns were the nearest to those of the European broadcasters.

In its first decade, then, FIAT/IFTA was composed mainly of state broadcasters from European countries. In most cases, these were the only broadcasters in those countries, as commercial competition was not a full reality everywhere until the 1990s, even in many areas that were not part of the Communist bloc, such as the Scandinavian countries. The United States was represented by the network news companies and, apart from Japan, Korea, Canada, Australasia and a handful of intrepid South Americans (most notably, Brazil), there was little representation from the rest of the World. In many places, especially Africa and parts of Asia, television itself was barely established, let alone its archives.

The constitution of the organization set up an Executive Council of 12 to run the organization, plus a President, all to be elected by the General Assembly, which is held every 2 years. The Federation also has a General Secretary and a Treasurer, chosen from the ranks of the Executive Council. All these officers must be employees of Full Member organizations (there are also associate and individual member categories) and give their time for free, though the organization can, and has, employed individuals for specific tasks. The main funding comes from members' subscriptions, though industry sponsorship has played an increasing role since the early 1990s. All the presidents to date have been heads of major European broadcasting or national archives, and the post has been held by the BBC, RAI, NRK (Norway), ORF (Austria), INA, and the Netherlands Institute for Sound and Vision.

CONFERENCES

From the very beginning, the Federation's main focus has been its annual conference, held in a different country each year. The financing of these events has traditionally fallen to a combination of the host member organization or organizations and the Federation itself, though sponsorship from television technology manufacturers, most notably Sony, and income from exhibition stands has become increasingly important. Though there is no hard and fast rule, a tradition has been established that one conference

in every four should be held outside Europe. Paris and Lisbon have been the venue for three conferences each, as has Italy, where RAI has always hosted, but in different cities, while London and Madrid have each held two conferences to date and the emerging television nations in Eastern Europe have also been prominent, with conferences held in Sofia (Bulgaria), Bogensee (near Berlin), and Budapest in the 1990s. Venues outside Europe have included Rio de Janeiro, Montreal, Tokyo, Washington, D.C., Santiago de Chile, New York and Beijing.

The annual conference is an opportunity for members to discuss mutual questions of interest, in formally structured plenary sessions with published papers, in workshop groups and, of course, in social gatherings. In the earliest years, the conference programs tended to be built around standing areas of concern, though later they came to be themed. It is fair to say that, in the first decade of FIAT/IFTA's existence, the main focus was on the members getting to know how others tackled similar problems to their own, whereas later the main focus became external pressures, particularly technological change and commercial opportunities. The main responsibility for the conference program falls to the Federation's commissions, established by the Executive Council to conduct research into specific areas of interest and to prepare the conference program. Like the Executive Council, the commissions are made up of volunteers with relevant experience from the membership, and chaired by a representative from the Council.

THE FIRST COMMISSIONS AND THEIR CONCERNS

The first three commissions to be established were the Documentation Commission, dealing mainly with issues of how to catalog moving image material; the Technical Commission, concerned with issues of broadcasting technology as they affected archives; and the Training Commission. Their reports made up a considerable volume of the early annual conferences and their documents, including the Documentation Commission's Minimum Data List (a standardized guide to what information must be documented about holdings—rather in the vein of later metadata standards like the Dublin Core) and the Glossary (a guide to useful television archive and technology terms in different languages) were regularly updated and distributed. One of the earliest technical issues to face FIAT/IFTA was the obsolescence of video formats, though this was a problem which emerged slowly.

The earliest focus for the Technical Commission was film preservation, but this was an issue already well covered by FIAF and the emphasis soon shifted to the greater problems posed by video. At the end of the 1970s, as FIAT/IFTA was being formed, the first broadcast video format, 2" Quadrex, was being replaced by the 1"

broadcast standard and portable camera formats, such as U-matic. Toward the end of the 1980s, manufacturers ceased to support the older technology, while large numbers of newer formats were about to be introduced, and it became clear that the central issue for television archives was how to ensure the preservation of material held on obsolete formats. This problem encompassed issues of standards for transfer, choice of new formats, maintenance of obsolete machinery and skill bases, making financial cases for transfer programs, selection on grounds of commercial value and cultural significance, and the particularly acute problems faced in developing countries—issues which stretched beyond the remit of the Technical Commission. Representatives of companies from the electronics manufacturing industry made up a panel at a FIAT/IFTA conference for the first time in Turin in 1991 and faced a hostile reception on this issue. It was, however, clear that their commercial imperatives demanded the regular introduction of newer formats and the phasing out of the old, and that what was needed was an ongoing dialog between the archives and the manufacturers, for which FIAT/IFTA has provided the main forum ever since.

MEMBERSHIP

In the early 1990s, membership of FIAT/IFTA spread more widely with the establishment of new commercial broadcasters in many countries and the growth of television around the world. The newer members were able to set up with the most recent (and increasingly cheaper) broadcast technologies and didn't (yet) face the problem of legacy collections on obsolete formats. Many of them didn't even know what a piece of film looked like. They had plenty to learn from other members about the establishment of archives, but their experiences of setting up from scratch also brought a fresh perspective to the organization.

Another area of membership growth was cultural organizations with responsibility for the preservation of television material. These followed either the model of the few national audiovisual archives with television operations, such as the British Film Institute or the Library of Congress, or that of the national organization with responsibility for the archives of the state broadcaster, such as INA. Some of them assumed preservation responsibilities, while others, like the Hungarian National Audiovisual Archives, offered a public access service. In the Netherlands, the creation of the Netherlands Institute for Sound and Vision (Beeldengeluid) from the merger of the archive of state broadcaster NOB and several government organizations, saw a new FIAT/IFTA member formed from several old ones. Some of these organizations were seen as a response to the economic problems of format obsolescence and the growing demand for public and academic access to historic material. Their growing significance in

FIAT/IFTA was reflected by the passing of the Presidency, traditionally held by a broadcasting organization, first to INA and then to Beeldengeluid.

INTERNATIONAL COOPERATION

The International Federation of Television Archives has been involved in international cooperation with other associations of audiovisual archives through the UNESCO Round Table of Audiovisual Archives, later renamed the Coordinating Council of Audiovisual Archive Associations, whose other members were initially FIAF, the International Association of Sound Archives (IASA) and the audiovisual sections of the International Council on Archives (ICA), and the International Federation of Library Associations. These have more recently been joined by the Association of Moving Image Archives and the Association of Recorded Sound Collections (ARSC), both mainly North American organizations, and the South East Asia-Pacific Audiovisual Archives Association. As well as information exchange and the coordination of training activities, the main practical outcome of this cooperation has been an irregular series of events under the banner of the Joint Technical Symposium, which have considered matters of audiovisual technology of common interest and which have been held in Paris, London, and Toronto. The International Federation of Television Archives also held some experimental joint conferences with IASA (Berlin, 1994) and IASA and ARSC (Washington, D.C., 1995).

Another outcome of this international cooperation has been some regional seminars which have been held in parts of the world where specific basic help has been required, particularly Africa, Latin America, South Asia, and Eastern Europe in the early 1990s. These have often been arranged in cooperation with the other associations, IASA being the most regular partner, and the venues have included Tunis, South Africa, the Caribbean, and Egypt. The International Federation of Television Archives has also aimed as far as possible to help archivists from distant or disadvantaged countries to attend its conferences, often using specially sought sponsorship, the most successful partnership being with the Organisation Internationale de la Francophonie, a French organization which has paid for delegates from French-speaking countries in Africa and elsewhere to attend conferences in Europe.

CHANGING EMPHASES

Changes in television structures and archive practices have been reflected over the years in changes to the FIAT/IFTA commission structure. In 1993, the first new Commission since the founding of the Federation was launched. This was the Programming and Production Commission, which was established to investigate issues

concerning the reuse of archival content and programs in the broadcast environment and public cultural spheres and to organize conference events considering program content. It was founded in the context of the expansion of the use of archive programming through repeat channels, public screenings, video releases, and an increasing number of programs about television history or using television archive material in a historical context. The commission produced two important documents: Selection Guidelines (for preservation purposes) and a video on misuses of archival material. The commission also organized the FIAT Award for the best use of archive material in a new program. The first award was given in 1994 (to Danmarks Radio) and thereafter became an annual highlight of the conference. Programs were nominated by members and screened at the conference, with members voting for the winner. This enabled delegates to consider different ways of reusing archival content in new programs and conference sessions and workshops were arranged featuring the producers of shortlisted programs.

Another growing aspect of the work of television archives considered by this commission was the sale of footage between broadcast companies. Strategies for publicizing these services ranged from presence at conferences to placing catalogs online, and FIAT/IFTA provided platforms for both furthering these developments and discussing the best strategies for success, often in collaboration with another international partner, the Federation of Commercial Audio-visual Libraries (FOCAL International).

Then, in the late 1990s, the Documentation Commission and the Technical Commission were merged, prompted by the convergence of recording and documentation technologies in the growing digital environment. From this merger came the Media Management Commission, considering all questions concerning of growing digitization and its effect on archives. The feeling grew that, with television production becoming tapeless, the broadcast company archivist needed to be involved with the documentation and preservation of material before transmission rather than after, or risk being cut out altogether. Rapidly digitizing companies such as Swedish Television (SVT) were at the forefront of this development and metadata issues were the key focus. A metadata guide by prominent FIAT/IFTA member, Annemieke de Jong of Beeldengeluid, became a key text and was translated into several languages with financial assistance from the Federation. However, many felt that traditional preservation issues were being overlooked because of the commission's emphasis on new technologies and, in 2007, a Preservation and Migration Commission was established to take over the role of the old Technical Commission and to reestablish the question of format problems on the FIAT/IFTA agenda. This problem had become particularly acute in developing countries, which lacked the resources for large-scale transfer programs, but was also still very much a live issue for even the most advanced organizations, as

there were still question marks over the viability of certain formats and over the best future strategies.

DIGITAL DEVELOPMENTS

By this time, FIAT/IFTA had itself entered the digital age, with its Web site (<http://www.fiatifta.org>) containing the papers from all its conferences and regional seminars, as well as all other key documents, a list of members and a forum for the online discussion of television archive questions or for those seeking advice. This, however, relies, as FIAT/IFTA always has, on hosting by the key member organizations linked to the Presidency or General Secretaryship.

The Federation had also itself been at the forefront of developing digital technologies. One of the best examples of the sort of cooperation between members which could be fostered by providing a platform for meetings was the Euromedia project, a successful bid by several FIAT/IFTA members, including Sudwestrundfunk of Germany, ORF, SVT, and the BBC, plus some German and Austrian technology providers, for European Union funds to develop a prototype digital asset management system. The progress of the system was regularly demonstrated at FIAT/IFTA conferences in the late 1990s and one of the technology companies, Tecmath of Germany, became a sponsor of the FIAT/IFTA Award. Other EU-funded projects with FIAT input followed, including the BIRTH project, a Web site featuring clips of early television productions, and Presto Space, a film and video preservation project.

THE CULTURAL AND ACADEMIC APPROACH

Television and its history is now the subject of academic study in many schools and universities and this too has been reflected in the developing FIAT/IFTA commission structure. The Television Studies Commission was established in 1999 to consider aspects of the academic study of television, using archives, and in particular to address the question of access to archive holdings. This had previously been the domain of the national archives and bodies such as INA, which have a long tradition of making their holdings available for study and to as wide a public as possible, whereas broadcasters had maintained their archives for their own uses and, in many cases, resisted demands to make them available for study, while others were accessible only to those with good contacts within the company. The main argument against allowing academic access had been the expense of copying materials, but cheap digital technologies have opened up wider possibilities, and many major broadcasters now include making material publicly and academically available as part of their digitization programs. The Television Studies Commission has also sought to introduce the results of academic work to the FIAT/IFTA membership, mainly

through conference sessions, and the increasing academic awareness of the value of television archives was reflected by the fact that the 2006 conference in Madrid, Spain, was hosted by a university rather than a broadcaster.

Public access to television archive material for cultural purposes is now a major aspect of the work of television archives. DVD releases of popular titles can be a lucrative commercial prospect, public or academic viewing of archival material through digital technology is available at such venues as the Bibliothèque Nationale in Paris or the BFI's Mediatheque in London, and many broadcasters now have plans to make their archives available online, both commercially and as a public service. Television history is now of interest to both the public and the academic community, for both nostalgic and sociological reasons, and its practitioners require access to the archives in order to tell it.

CONCLUSION

Television archives have had to adapt to changing television production techniques and changing recording technologies throughout their relatively brief period of existence. Now that the medium is mature enough to have its own history, to be regarded as a cultural phenomenon and thus be the object of academic study, and to have ever increasing outlets and demands for its past product, the archives have never had greater opportunities. Digital technologies have increased the possibilities for exploitation, but bring with them familiar problems in terms of ensuring long-term preservation and dealing with format obsolescence, on a greater scale than before. The requirement for an international forum, provided by FIAT/IFTA, will continue to be felt and to grow.

International Organization for Standardization (ISO)

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Abstract

ISO (International Organization for Standardization, <http://www.iso.org>) is the leading organization for the production and dissemination of consensus-based and globally relevant standards which provide a growing support to companies for becoming and remaining competitive in world markets. It is the world's largest developer and publisher of International Standards. The organization is a network of the national standards institutes of 157 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system. As a nongovernmental organization it forms a bridge between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. Therefore, ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society. This entry comprises three main sections: a general introduction to ISO and standards; an overview of ISO technical committee ISO/TC 46, Information and documentation, and an article by the Chair of ISO/TC 46 on "Managing information in a changing age."

DISCOVERING ISO

ISO (International Organization for Standardization, <http://www.iso.org>) is the leading organization for the production and dissemination of consensus-based and globally relevant standards which, in the context of globalization of trade and many other issues, such as the environment, security and health, provide a growing support to companies for becoming and remaining competitive in world markets. ISO is the world's largest developer and publisher of International Standards.

The organization is a network of the national standards institutes of 157 countries, one member per country, with a Central Secretariat in Geneva, Switzerland, that coordinates the system.

ISO is a nongovernmental organization that forms a bridge between the public and private sectors. On the one hand, many of its member institutes are part of the governmental structure of their countries, or are mandated by their government. On the other hand, other members have their roots uniquely in the private sector, having been set up by national partnerships of industry associations. Therefore, ISO enables a consensus to be reached on solutions that meet both the requirements of business and the broader needs of society.

ISO'S NAME

Because "International Organization for Standardization" would have different acronyms in different languages ("ISO" in English, "OIN" in French for *Organisation internationale de normalisation*), its founders decided to give it also a short, all-purpose name. They chose "ISO", derived from the Greek *isos*, meaning "equal". Whatever the country, whatever the language, the short form of the organization's name is always ISO.

Why Standards Matter

Standards make an enormous and positive contribution to most aspects of our lives. Standards ensure desirable characteristics of products and services such as quality, environmental friendliness, safety, reliability, efficiency and interoperability—and at an economical cost.

When products and services meet our expectations, we tend to take this for granted and be unaware of the role of standards. However, when standards are absent, we soon notice. We soon care when products turn out to be of poor quality, do not fit, are incompatible with equipment that we already have, are unreliable or dangerous. When products, systems, machinery and devices work

well and safely, it is often because they meet standards. And the organization responsible for many thousands of the standards which benefit the world is ISO.

What Standards Do

ISO standards:

- Make the development, manufacturing, and supply of products and services more efficient, safer, and cleaner.
- Facilitate trade between countries and make it fairer.
- Provide governments with a technical base for health, safety and environmental legislation, and conformity assessment.
- Share technological advances and good management practice.
- Disseminate innovation and accelerate the time-to-market of products and services derived from such innovation.
- Safeguard consumers, and users in general, of products and services.
- Make life simpler by providing solutions to common problems.

Who Standards Benefit

ISO standards provide technological, economic, and societal benefits.

- For businesses, the widespread adoption of International Standards means that suppliers can develop and offer products and services meeting specifications that have wide international acceptance in their sectors. Therefore, businesses using International Standards can compete on many more markets around the world.
- For innovators of new technologies, International Standards on aspects like terminology, compatibility, and safety speed up the dissemination of the innovations and their development into manufacturable and marketable products.
- For customers, the worldwide compatibility of technology which is achieved when products and services are based on International Standards gives them a broad choice of offers. They also benefit from the effects of competition among suppliers.
- For governments, International Standards provide the technological and scientific bases underpinning health, safety, and environmental legislation.
- For trade officials, International Standards create “a level playing field” for all competitors on those markets. The existence of divergent national or regional standards can create technical barriers to trade. International Standards are the technical means by which political trade agreements can be put into practice.

- For developing countries, International Standards that represent an international consensus on the state of the art are an important source of technological know-how. By defining the characteristics that products and services will be expected to meet on export markets, International Standards give developing countries a basis for making the right decisions when investing their scarce resources and thus avoid squandering them.
- For consumers, conformity of products and services to International Standards provides assurance about their quality, safety and reliability.
- For everyone, International Standards contribute to the quality of life in general by ensuring that the transport, machinery and tools we use are safe.
- For the planet we inhabit, International Standards on air, water, and soil quality, on emissions of gases and radiation and environmental aspects of products can contribute to efforts to preserve the environment.

The ISO Brand

• *Democratic*

Every full member of ISO has the right to take part in the development of any standard which it judges to be important to its country's economy. No matter what the size or strength of that economy, each participating member in ISO has one vote. Each country is on an equal footing to influence the direction of ISO's work at the strategic level, as well as the technical content of its individual standards.

• *Voluntary*

ISO standards are voluntary. As a nongovernmental organization, ISO has no legal authority to enforce the implementation of its standards. ISO does not regulate or legislate. However, countries may decide to adopt ISO standards—mainly those concerned with health, safety, or the environment—as regulations or refer to them in legislation, for which they provide the technical basis. In addition, although ISO standards are voluntary, they may become a market requirement, as has happened in the case of ISO 9001 quality management systems, or of dimensions of freight containers and bank cards. ISO itself does not regulate or legislate.

• *Market-driven*

ISO only develops standards for which there is a market requirement. The work is mainly carried out by experts from the industrial, technical, and business sectors which have asked for the standards, and which subsequently put them to use.

• *Consensus*

ISO standards are based on international consensus among the experts in the field. Consensus, like technology, evolves and ISO takes account both of evolving technology and of evolving interests by requiring a

periodic review of its standards at least every 5 years to decide whether they should be maintained, updated or withdrawn. In this way, ISO standards retain their position as the state of the art.

- *Globally relevant*

ISO standards are technical agreements which provide the framework for compatible technology worldwide. They are designed to be globally relevant—useful everywhere in the world.

HOW TO RECOGNIZE AN ISO STANDARD

In paper form, an ISO standard is published in A4 format, which is itself one of the ISO standard paper sizes. It may be anywhere between a four-page document and one several hundred pages' long. ISO standards are also available as electronic downloads and many are available as part of a collection on CD or in handbook. An ISO standard carries the ISO logo and the designation, "International Standard".

THE SCOPE OF ISO'S WORK

ISO has more than 17,000 International Standards in its current portfolio. ISO's work program ranges from standards for traditional activities, such as agriculture and construction, through mechanical engineering, manufacturing and distribution, to transport, medical devices, information and communication technologies, and to standards for good management practice and for services.

EXAMPLES OF THE BENEFITS STANDARDS PROVIDE

Standardization of screw threads helps to keep chairs, children's bicycles, and aircraft together and solves the repair and maintenance problems caused by a lack of standardization that were once a major headache for manufacturers and product users.

Standards establishing an international consensus on terminology make technology transfer easier and safer. They are an important stage in the advancement of new technologies and dissemination of innovation.

Without the standardized dimensions of freight containers, international trade would be slower and more expensive.

Without the standardization of telephone and banking cards, life would be more complicated.

A lack of standardization may even affect the quality of life itself: for the disabled, for example, when they are barred access to consumer products, public transport and buildings because the dimensions of wheelchairs and entrances are not standardized.

Standardized symbols provide danger warnings and information across linguistic frontiers.

Consensus on grades of various materials gives a common reference for suppliers and clients in business dealings.

Agreement on a sufficient number of variations of a product to meet most current applications allows economies of scale with cost benefits for both producers and consumers. An example is the standardization of paper sizes.

Standardization of performance or safety requirements of diverse equipment makes sure that users' needs are met while allowing individual manufacturers the freedom to design their own solution on how to meet those needs.

Standardized computer protocols allow products from different vendors to "talk" to each other.

Standardized documents speed up the transit of goods, or identify sensitive or dangerous cargoes that may be handled by people speaking different languages.

Standardization of connections and interfaces of all types ensures the compatibility of equipment of diverse origins and the interoperability of different technologies.

Agreement on test methods allows meaningful comparisons of products, or plays an important part in controlling pollution—whether by noise, vibration, or emissions.

Safety standards for machinery protect people at work, at play, at sea. . . and at the dentist's.

Without the international agreement contained in ISO standards on metric quantities and units, shopping and trade would be haphazard, science would be unscientific and technological development would be handicapped.

WHAT'S DIFFERENT ABOUT ISO 9001 AND ISO 14001

The vast majority of ISO standards are highly specific to a particular product, material, or process. However, ISO 9001 (quality) and ISO 14001 (environment) are "generic management system standards." "Generic" means that the same standard can be applied to any organization, large or small, whatever its product or service, in any sector of activity, and whether it is a business enterprise, a public administration, or a government department. ISO 9001 contains a generic set of requirements for implementing a quality management system and ISO 14001 for an environmental management system.

Generic standards can be applied to any organization. In recent years, new ISO management system standards have been developed and are now being rolled out worldwide. They include: ISO 22000 (food safety), ISO 28000 (supply chain security), and ISO/IEC 27001 (information security).

WHY CONFORMITY ASSESSMENT IS IMPORTANT

“Conformity assessment” means checking that products, materials, services, systems, processes, or people measure up to the specifications of a relevant standard or specification. Today, many products require testing for conformity with specifications or compliance with safety, or other regulations before they can be put on many markets. ISO guides and standards for conformity assessment represent an international consensus on best practice. Their use contributes to the consistency of conformity assessment worldwide and so facilitates trade.

WHAT “INTERNATIONAL STANDARDIZATION” MEANS

When the large majority of products or services in a particular business or industry sector conform to International Standards, a state of industry-wide standardization exists. The economic stakeholders concerned agree on specifications and criteria to be applied consistently in the classification of materials, in the manufacture and supply of products, in testing and analysis, in terminology and in the provision of services. In this way, International Standards provide a reference framework, or a common technological language, between suppliers and their customers. This facilitates trade and the transfer of technology.

ISO’S ORIGINS

In 1946, delegates from 25 countries met in London and decided to create a new international organization, of which the object would be “to facilitate the international coordination and unification of industrial standards.” The new organization, ISO, officially began operations on February 23, 1947, in Geneva, Switzerland.

WHO CAN JOIN ISO

Membership of ISO is open to national standards institutes most representative of standardization in their country (one member in each country).

- Full members, known as member bodies, each have one vote, whatever the size or strength of the economy of the country concerned.
- Correspondent members pay reduced membership fees. They are entitled to participate in any policy or technical body as observers, with no voting rights.
- Subscriber members also pay reduced membership fees. They are institutes from countries with very small

economies that nevertheless wish to maintain contact with international standardization.

Although individuals or enterprises are not eligible for membership, both have a range of opportunities for taking part in ISO’s work:

- Individuals may be selected by national member institutes to serve as experts on national delegations participating in ISO technical committees
- Individuals and enterprises may provide their input during the process of developing a national consensus for presentation by the delegation. This may be done through national mirror committees to the corresponding ISO technical committee
- International organizations and associations, both nongovernmental and representing industry sectors, can apply for liaison status to a technical committee. They do not vote, but can participate in the debates and the development of consensus.

There is a range of opportunities for taking part in ISO’s work.

How the ISO System Is Managed

All strategic decisions are referred to the ISO members, who meet for an annual General Assembly. The proposals put to the members are developed by the ISO Council, drawn from the membership as a whole, which resembles the board of directors of a business organization.

ISO Council meets twice a year and its membership is rotated to ensure that it is representative of ISO’s membership.

ISO’s operations are managed by a Secretary-General, which is a permanent appointment resembling the chief executive of a business enterprise. The Secretary-General reports to the ISO Council, the latter being chaired by the President who is a prominent figure in standardization or in business, elected for 2 years.

The Secretary-General is based at ISO Central Secretariat in Geneva, Switzerland, with a compact staff which provides administrative and technical support to the ISO members, coordinates the decentralized standards’ development program, and publishes the output.

How the ISO System Is Financed

ISO’s national members pay subscriptions that meet the operational cost of ISO’s Central Secretariat. The subscription paid by each member is in proportion to the country’s Gross National Income and trade figures. Another source of revenue is the sale of standards.

However, the operations of ISO Central Secretariat represent only about one-fifth of the cost of the system’s

operation. The main costs are borne by the member bodies that manage the specific standards development projects and the business organizations that provide experts to participate in the technical work. These organizations are, in effect, subsidizing the technical work by paying the travel costs of the experts and allowing them time to work on their ISO assignments.

HOW ISO DECIDES TO DEVELOP A STANDARD

ISO launches the development of new standards in response to sectors and stakeholders that express a clearly established need for them.

An industry sector or other stakeholder group typically communicates its requirement for a standard to one of ISO's national members. The latter then proposes the new work item to the relevant ISO technical committee developing standards in that area. New work items may also be proposed by organizations in liaison (see below) with such committees. When work items do not relate to existing committees, proposals may also be made by ISO members to set up new technical committees to cover new fields of activity.

To be accepted for development, a proposed work item must receive the majority support of the participating members of the ISO technical committee which, amongst other criteria, verifies the "global relevance" of the proposed item—this means that it indeed responds to an international need and will eventually be suitable for implementation on as broad a basis as possible worldwide.

WHO DEVELOPS ISO STANDARDS?

ISO standards are developed by technical committees, (subcommittees or project committees) comprising experts from the industrial, technical, and business sectors which have asked for the standards, and which subsequently put them to use. These experts may be joined by representatives of government agencies, testing laboratories, consumer associations, nongovernmental organizations, and academic circles.

Proposals to establish new technical committees are submitted to all ISO national member bodies, who may opt to be participating (P), observer (O) or nonmembers of the committee. The secretariat (i.e., the body providing the administrative support to the work of the committee) is allocated by the Technical Management Board (which itself reports to the ISO Council), usually to the ISO member body which made the proposal. The secretariat is responsible for nominating an individual to act as chair of the technical committee. The chair is formally appointed by the Technical Management Board.

Experts participate as national delegations, chosen by the ISO national member body for the country concerned.

National delegations are required to represent not just the views of the organizations in which their participating experts work, but those of other stakeholders too. National delegations are usually based on and supported by national mirror committees to which the delegations report.

According to ISO rules, the national member body is expected to take account of the views of all parties interested in the standard under development. This enables them to present a consolidated, national consensus position to the technical committee.

International and regional organizations from both business and the public sector may apply for liaison status to participate in developing a standard, or to be informed about the work. Such "organizations in liaisons" are accepted through voting by the relevant ISO committee. They may comment on successive drafts, propose new work items or even propose documents for "fast tracking," but they have no voting rights.

At the end of 2007, there were 3093 technical bodies in the ISO system, including 201 ISO technical committees. The focus of the technical committees is specialized and specific. In addition, ISO has three general policy development committees that provide strategic guidance for the standards' development work on cross-sector aspects. These committees ensure that the specific technical work is aligned with broader market and stakeholder group interests. They are:

- CASCO (conformity assessment)
- COPOLCO (consumer policy)
- DEVCO (developing country matters)

These may recommend the development of new standards for their stakeholder groups, which are then submitted to the approval process described above, or in the case of CASCO, develop new standards itself.

HOW ISO STANDARDS ARE DEVELOPED

The national delegations of experts of a committee meet to discuss, debate and argue until they reach consensus on a draft agreement. The "organizations in liaison" also take part in this work. In some cases, advanced work within these organizations means that substantial technical development and debate has already occurred, leading to some international recognition and in this case, a document may be submitted for "fast-track" processing. In both cases, the resulting document is circulated as a Draft International Standard (DIS) to all ISO's member bodies for voting and comment.

If the voting is in favor, the document, with eventual modifications, is circulated to the ISO members as a Final Draft International Standard (FDIS). If that vote is positive, the document is then published as an International Standard.

Every working day of the year, an average of seven ISO technical meetings takes place around the world. In between meetings, the experts continue the standards' development work by correspondence. Increasingly, their work is carried out by electronic means, which speeds up the development of standards and cuts travel costs.

- *Public access*

Most ISO members have some form of public review procedures for making proposed work items and draft standards known and available to interested parties. The ISO members then take account of any feedback they receive in formulating their position on the proposed work item or on the draft standard.

Draft standards are also available for sale to interested members of the public who can provide input through the ISO member in their country. The public can purchase International Standards through the ISO or through ISO's national members.

- *Consensus*

Because ISO standards are voluntary agreements, they need to be based on a solid consensus of international expert opinion. Consensus, which requires the resolution of substantial objections, is an essential procedural principle. Although it is necessary for the technical work to progress speedily, sufficient time is required before the approval stage for the discussion, negotiation and resolution of significant technical disagreements.

"Consensus" is officially defined (in ISO/IEC Guide 2) as "general agreement, characterized by the absence of sustained opposition to substantial issues by any important part of the concerned interests and by a process that involves seeking to take into account the views of all parties concerned and to reconcile any conflicting arguments." The definition notes, "Consensus need not imply unanimity."

- *Voting*

For a document to be accepted as an ISO International Standard, it must be approved by at least two-thirds of the ISO national members that participated in its development and not be disapproved by more than a quarter of all ISO members who vote on it.

- *Appeals*

ISO national member bodies have the right of appeal to a parent technical committee on the decision of subcommittee, to the Technical Management Board on a decision of technical committee and to the ISO Council on a decision of the Technical Management Board. Appeals may relate to procedural, technical, or administrative matters.

- *Review of International Standards*

All International Standards are reviewed at the least 3 years after publication and every 5 years after the first review by all the ISO member bodies. A majority of the P-members of the TC/SC decides whether an International Standard should be confirmed, revised or withdrawn.

ISO DELIVERABLES

In addition to International Standards, ISO can also offer other forms of normative agreements for situations where speedy publication is important, has developed a schematic representation of the different types of deliverable available. These include:

- ISO/PAS Publicly Available Specification
- ISO/TS Technical Specification
- ISO/TR Technical Report
- IWA International Workshop Agreement

ISO'S INTERNATIONAL PARTNERS

ISO collaborates with its partners in international standardization, the International Electrotechnical Commission (IEC) and International Telecommunication Union (ITU). The three organizations, all based in Geneva, Switzerland, have formed the World Standards Cooperation (WSC) to act as a strategic focus for collaboration and the promotion of international standardization.

ISO has a close relationship with the World Trade Organization (WTO) which particularly appreciates the contribution of ISO's standards to reducing technical barriers to trade.

ISO collaborates with the United Nations (UN) Organization and its specialized agencies and commissions, particularly those involved in the harmonization of regulations and public policies, such as:

- CODEX Alimentarius, on food safety measurement, management, and traceability.
- UN Economic Commission for Europe (UN/ECE), on the safety of motor vehicles and the transportation of dangerous goods.
- World Health Organization (WHO), on health technologies.
- International Maritime Organization (IMO), on transport security.
- World Tourism Organization (WTO-T), on the quality of services related to tourism.

In addition, ISO cooperates with UN organizations that provide assistance and support to developing countries, such as the United Nations Conference on Trade and Development (UNCTAD), the United Nations Industrial Development Organization (UNIDO), and the International Trade Centre (ITC).

ISO's technical committees have formal liaison relations with some 580 international and regional organizations.

ISO has reinforced its links too with international organizations representing different groups of stakeholders, including:

- World Economic Forum (WEF)
- Consumers International (CI)
- World Business Council for Sustainable Development (WBCSD)
- International Federation of Standards Users (IFAN)

Lastly, ISO also collaborates regularly with the major international organizations for metrology, quality and conformity assessment.

ISO'S REGIONAL PARTNERS

Many of ISO's members also belong to regional standardization organizations. ISO has recognized regional standards organizations representing Africa, the Arab countries, the area covered by the Commonwealth of Independent States, Europe, Latin America, the Pacific area, and the South-East Asia nations. The regional bodies commit themselves to adopt ISO standards as the national standards of their members.

ISO TECHNICAL COMMITTEE ISO/TC 46, INFORMATION AND DOCUMENTATION

Improving the production, classification and organization of documents and data is essential to avoid wasting human and financial resources.

—Catherine Dhérent
Chair, ISO/TC 46 (2006–2008)

Within ISO, technical committee ISO/ISO/TC 46, *Information and documentation*, has the responsibility for standardization of practices relating to libraries, documentation and information centers, publishing, archives, records management, museum documentation, indexing and abstracting services, and information science.

The Secretariat of the committee is held by AFNOR, the ISO member for France, and the national standards bodies of 34 countries participate in its work: Armenia (SARM), Australia (SA), Austria (ON), Bulgaria (BDS), Canada (SCC), China (SAC), Czech Republic (CNI), Denmark (DS), Egypt (EOS), Finland (SFS), Germany (DIN), Iran, Islamic Republic of (ISIRI), Ireland (NSAI), Italy (UNI), Japan (JISC), Kenya (KEBS), Korea, Republic of (KATS), the Netherlands (NEN), New Zealand (SNZ), Norway (SN), Poland (PKN), Portugal (IPQ), Russian Federation (GOST R), South Africa (SABS), Spain (AENOR), Sri Lanka (SLSI), Sweden (SIS), Switzerland (SNV), Thailand (TISI), the former Yugoslav Republic of Macedonia (ISRM), United States (ANSI), Ukraine (DSSU), and the United Kingdom (BSI). Another 39 countries have observer status.

In addition, the following organizations have liaison status with ISO/TC 46:

- International Documentation Committee, International Council of Museums (CIDOC)
- International Confederation of Societies of Authors and Composers (CISAC)
- International Digital Object Identifier System Foundation (DOI)
- European Association of Science Editors (EASE)
- European Commission (EC)
- International Atomic Energy Agency (IAEA)
- International Council on Archives (ICA)
- International Council for Scientific and Technical Information (ICSTI)
- International Federation of Library Associations and Institutions (IFLA)
- International Federation of Science Editors (IFSE)
- ISSN International Centre
- International Telecommunication Union (ITU)
- International Network for Terminology (TERMNET)
- United Nations (UN)
- United Nations Conference on Trade and Development (UNCTAD)
- United Nations Economic Commission for Europe (UN/ECE)
- Universal Postal Union (UPU)
- World Intellectual Property Organization (WIPO)

Established in 1947—the year that ISO began operating—ISO/ISO/TC 46 has 94 ISO International Standards in its current portfolio and 23 documents under development.

The following titles and short descriptions of the committee's subcommittees (CS) and working groups (WG) conveys a more detailed idea of the scope of its standardization work:

- WG 2, *Coding of country names and related entities*
- WG 3, *Conversion of written languages*
- WG 4, *Terminology of information and documentation*
- WG 5, *Archive boxes*
- SC 4, *Technical interoperability*
Standardization of protocols, schemas, etc., and related models and metadata for processes used by information organizations and content providers, including libraries, archives, museums, publishers, and other content producers.
- SC 8, *Quality—Statistics and performance evaluation*
Standardization of practices relating to the collection of statistics and performance indicators for information organizations and content providers, e.g., libraries, archives, museums, and publishers.
- SC 9, *Identification and description*
Standardization of information identifiers, description and associated metadata and models for use in information organizations (including libraries, museums,

and archives) and the content industries (including publishing and other content producers and providers).

- SC 11, *Archives/records management*
Standardization of principles for the creation and management of documents, records, and archives as evidence of transactions and covering all media including digital multimedia and paper.

In addition, SC 11 participates in a joint working group on document management application issues related to PDF/A files with SC 2, *Application issues*, of ISO/TC 171, *Document management applications*, and ISO/TC 42, *Photography*.

Over the past few decades, numerous standard tools have been conceived in the professional area on an international scale for identifying, classifying, finding, and exchanging all types of documents. These standards have been conceived in a context where the stability of the form of the document in space and time was controlled and where the use of computerized systems was centralized and dedicated to one type of application.

The production of electronic documentation and the transformation of structured, paper based business practices into automated work processes can in many instances lead to a loss of control, accountability, and structure in the electronic business environment. Providing guidance to facilitate records and information management in this context is a significant area in which ISO/TC 46 can contribute in the framework of its market environment.

With the production of electronic documents and the possibilities of exchanging digitized multimedia information on telematic networks, the traditional reference points for document maintenance have been dimmed, obliging the profession to question certain practices. The exchange of information is becoming generalized and concerns all sectors of activity; it is no longer about producing individual standards for the single sector of libraries and documentation, but to integrate in a process of multisectorial standardization, or risk being marginalized.

Adoption of open and generic standards has become imperative under these circumstances. If there is little immediate general demand, the whole realm of organization and individuals involved in formation is concerned by the work of ISO/TC 46 (libraries, archives, museums, document centers, publishers, producers, rights managers...) and to this effect, the economic impacts are real.

In this context, the following objectives have priority in the work of ISO/TC 46:

- Optimize the interoperability of systems related to archives, libraries, and museums.
- Take into account in standardization all the stages constituting the life cycle of a document (production, encoding, identification, management, diffusion, preservation) to assure the compatibility and coherence of the standards among themselves.

- Promote records management as a means to establish control and accountability in business environment.

EMBLEMATIC ISO/ISO/TC 46 STANDARDS

As the means to present, to classify, to sort, to display, to contextualize, to manage, to preserve... and finally to use the information in all industrial and intellectual areas, ISO/ISO/TC 46 plays a very important political and economic role. This becomes obvious when considering the use of some standards developed within ISO/ISO/TC 46, such as:

- ISO 3166, *Codes for the representation of names of countries and their subdivisions*. This is an essential example: the standard is used for internationalization of information as well as legal and diplomatic questions, on the Internet, e-business, and in many other contexts.
- Other standards such as: ISO 639, *Codes for languages* (developed by a joint working group of ISO/TC 37 and ISO/ISO/TC 46/SC 4), or ISO 690, *Bibliographic references—content, form and structure*, are universally used. (This standard is developed in a joint working group of ISO/TC 37 and ISO/ISO/TC 46/SC 4).
- For identification numbering, especially for the management of the rights of authors, producers, publishers, and so on. Any book, audiovisual work, textual work, music, film video, or sound recording has to be identified. The relevant standards for international numbering, such as the International Standard Book Number (ISBN), are developed by ISO/TC 46.
- For records management, which is a discipline that needs to be practiced by every organization in the world. Without appropriately managed records and the information and accountabilities they bring, organizations would not survive. The standard that covers this essential management process was created in ISO/TC 46.

THE MARKET FOR ISO/TC 46'S STANDARDS

The market served by ISO/TC 46 is characterized by a high degree of interdependence. Market players include for-profit (such as commercial businesses, system vendors, and publishers) and nonprofit institutions (such as libraries, documentation centers, archives, and museums). Increasingly there is convergence between the for-profit and the non-for-profit players as organizations assume multiple roles—often both supplying services to another institution and also the end user or consumer. The market is also moving to encompass the broader business environment as organizations become increasingly aware of the need to control, manage and effectively utilize their records and other forms of information.

Information and documentation supports the following information supply chain:

1. Creators of information (e.g., individuals within business, authors, performers)
2. Producers, distributors, and managers of information (e.g., publishers, printers, film and recording producers, booksellers, bibliographic networks, records management professionals, and archivists)
3. Organizers and providers of information to end users (e.g., librarians, booksellers, record sellers, museums, records managers, and archivists)
4. Preservers of information (e.g., archives, libraries, and museums)

The organizations and institutional groups dependent on ISO/TC 46 standards have overlapping responsibilities in the supply chain, but taken together represent the creation, dissemination, management, preservation, and consumption of documented information in all media: print, audio, visual, digital, etc.

STRUCTURE OF THE MARKET: SUPPLIERS/ MANUFACTURERS

- *Creators of information*

Creators include all public and private organizations and especially public agencies, and also the authors, editors, writers, compilers, performers, musicians, and all others originating information content. Most often this constituency is represented through professional organizations, such as authors' collectives, rights organizations, professional societies, etc. It also includes both individuals within businesses and the business organizations themselves that are required to create and maintain records of their activities.

- *Producers, distributors, and managers of information*
Producers and distributors include publishers (primary and secondary), distributors and information aggregators, and information intermediaries of information. These businesses serve primarily the end user providers of information products, such as booksellers, record stores, and libraries. Included are publishers in the commercial trade book sector; publishers focusing on the scholarly and scientific markets; medical and reference publishers; corporate business information providers; and producers of sound recordings and videos for all markets.

The book publisher market alone is huge. Standards applied by suppliers and manufacturers are critical to the effective functioning of the consumer part of this market.

Managers of information include all business organizations that are required, often by law, to have adequate frameworks in place for the protection and management

of their information resources. It also includes archival institutions with responsibility for ensuring the management through time of archival resources.

STRUCTURE OF THE MARKET: CUSTOMERS

- *Organizers and end user providers*

Organizers and end user providers describe a step in the information supply chain in which produced information "packages" are conveyed primarily to end users or consumers. The activities include organizing and providing access that enables end users to find information, then supplying the information products that satisfy their needs. The principal institutional groups that are the suppliers of organization of and access to information are libraries, archives, museums, and product sellers (on or off-line, for all media).

The customers for this information are the end users. The organization and supply process requires standards to enable services across institutions, including standards for data elements, protocols, search types, data formats, object descriptions, object classification, language codes, country codes, specification of access and security rules, and other forms of metadata. The organizers and suppliers may also need standards to acquire information objects such as product numbers, acquisition metadata. To enable various technologies to be used in organizing and delivering information, specialized software is created that follows the above standards.

- *Archives and preservation*

There is a large market segment that has responsibility for archiving and preserving information for use by future generations. These range from preservation and conservation laboratories housed in most large libraries and archives, to records management departments associated with many organizations, to sound and film archives maintained by associations and other organizations, to formal government and nongovernment archives. These groups have special needs for making information sustainable, be it printed, electronic, sound, or image media, and are dependent on a variety of suppliers for critical components in the archiving process. Standards are essential for trying to carry out the work in a cost effective and consistent manner.

MAJOR FACTORS IMPACTING THE MARKET

Some of the main evolutions and market trends that will have an impact on the development of the information and documentation field are the following:

- Major technical evolution from creation, distribution, and storage of information in paper form to electronic

form, and transformation of business processes from controlled paper-based activities to uncontrolled electronic processes.

- Convergence of media into multimedia information objects, making the creation, manufacture, organization, dissemination, and storage of information objects more complex.
- Increase in distance-learning initiatives and computer-based training developments that require new standards and challenge the information distribution mechanisms used today.
- The increasing dependence on and intersection with Web standards that are developed outside the TC and even outside ISO.
- Need for best practice-type guidelines in place of formal standards where media are new and sound standards cannot yet be developed.
- Pressure for shorter time scales for development of standards with parallel pressure to s that they are globally accepted.
- Increasing dependence on outsourcing by various segments of the community, requiring standards to be in place to be able to outsource efficiently and confidently.
- Growing interest in ISO 9001 quality management and development of related standards tools to make it effective across the many facets of the information and documentation area.
- Increasing need for statistics methodologies and standards for use with this diverse and not easily quantified market, to be used to support budgets and growth.
- Multilingual research in a Web environment.
- Some aspects of knowledge management and information management in a shared environment.
- Definition of the best devices for preservation of the collections in archives, libraries and museums.

BENEFITS EXPECTED FROM THE WORK OF ISO/TC 46

The benefits of standards in the information community are enormous but not easy to quantify. They include especially:

- Interoperability of information systems and resource hosts
- Cost savings through increased competition
- Better delivery through more choice
- Increase of universal access to information
- Assurance of protection to rights holders
- Preservation of cultural heritage
- Better management of information
- Sound bases for development of enabling supporting systems

- More accountable business practices.

ISO/TC 46'S OBJECTIVES

Based on the above considerations and on the multidisciplinary and the multiapplicability of standards developed by ISO/TC 46, the committee has defined the following objectives:

Scope

- To ensure the creation of timely and appropriate standards governing all facets of information and documentation.
- To ensure interoperability and harmonization among systems concerned with information and documentation.
- To adapt standards in a proactive way to emerging media or techniques, based on continuing observation of emerging market needs.
- To facilitate and encourage the effective and accountable operation of systems and processes associated with information and documentation.

Quality

- To ensure consistency among standards that deal with different facets of information and documentation and consistency with the other ISO standards.
- To encourage comprehensive input from all types of bodies concerned with information and documentation, including libraries, publishers, archives, business organizations, public sector bodies, museums, vendors, systems vendors, W3C, etc.
- To improve the worldwide representation of experts on the committee.
- To finalize and publish standards in a timely fashion to ensure focus and coordinated efforts, and avoid obsolescence.

Adoption

- To encourage the private and public sectors in the use of existing ISO standards and show the value of using ISO standards.
- To be responsive to the needs of potential standards users to ensure that standards are optimized in terms of usability and relevance.

(More information on ISO/TC 46, including its membership, contact details, business plan, work program and list of published standards can be accessed on the ISO Web site <http://www.iso.org>. Click on "Standards development" and then on "List of technical committees.")

MANAGING INFORMATION IN A CHANGING AGE

(This text was first published in the April 2008 issue of *ISO Focus* magazine <http://www.iso.org/isofocus> which featured various aspects of ISO's standardization work for information and document management.)

Information and document management is a crucial part of the daily functioning of any organization. It plays an important role in ensuring their performance and security, as well as promoting efficient relationships between them. However, creating, finding and communicating the most relevant information to the audiences who really need it through the most appropriate and simple means, is no easy feat. Which results in many people complaining that information is too widely spread, not easy to find, identify or criticize.

Several ISO technical committees are working to respond to these challenges, by addressing issues from the identification to the preservation of the content and of metadata, by way of their production and organization. This is especially true of course, for the electronic formats of information. Here the available support is often more fragile than the worst and most acid of papers. We need strong best practices to preserve electronic data and documents in the middle and long terms.

A widely recognized basic ISO standard which addresses this issue is OAIS (Open Archive Initiative Standard). It was originally proposed by the aerospace industry, anxious to maintain permanent access, understanding and reusability of the huge amounts of data it produces (and requires), which can span decades or even centuries.

The purpose of this general model is to establish a system for archiving information (both digitized and physical), with an organizational scheme composed of people who accept the responsibility of preserving information and making it available to a designated community.

This model must now be completed by other users, which explains why Web archiving experts recently

launched a new standard project on the identification of data packets during their transfer to a virtual archive in the context of OAIS.

This identification is in fact crucial for exchanging data adequately, and for managing intellectual and economic rights. In fact, it is necessary to identify all elements of information in the greatest detail, so as to deal in the most appropriate manner with the rights of authors, producers, and publishers, while at the same time providing exactly what the public requires.

We are now able to identify even the smallest part of an author's work, which though it can be made available to all interested parties (on the Web for instance), still ensures a fair retribution and acknowledgement of its author. At the same time, there is also an ongoing attempt to identify authors, producers, publishers, and others, a more delicate task, as it involves the description of individuals rather than their work.

The improvement of the production, classification, and organization of the main documents and data is also essential to avoid wasting of human and financial resources. It is the aim of the records management standards to help institutions better produce the information needed to prove their rights and obligations towards their stakeholders.

It would be fruitful experience for ISO to first coordinate the management of its own documentation in relation with that of its national bodies. The great challenge is to identify what must be preserved, for what purpose and for how many years and where? We must not waste time nor money. It is crucial that we immediately provide the right information to the right person.

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International Records Management Standards ISO 15489 and 23081

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Abstract

The first international standard on records management, ISO 15489, was issued in 2001, followed in 2006/2007 by standards on Metadata for Records, ISO 23081. This entry outlines the history of the development of these standards and provides an overview of their contents. The impact of the records management standards is discussed followed by an assessment of the strategic uses of such standardization work.

INTRODUCTION

The International Standard on Records Management ISO 15489: Information and Documentation, Records Management, was formally launched in Montreal in November 2001. It consists of two parts: Part 1: General and Part 2: Guidelines. The Standard has been endorsed for adoption for a further period of 5 years, and is now due for review in 2011. Following the publication of the Records Management Standard, the Committee charged with establishing and administering records management standards (ISO TC 46 SC11) has issued further standards, most notably ISO 23081 on Metadata for Records, and its accompanying Guidelines for Implementation. Other work on developing technical reports as ancillary documents to support the implementation of specific aspects of the standard is underway.

This entry discusses the ISO 15489, Records Management Standard in terms of its history, development, and contents. It then discusses the history, development, and content of ISO 23081, Metadata for Records. The entry concludes with an assessment of the impact of the standards and a consideration of the strategic uses of such standardization work.

Background to the Development of ISO 15489

Within the Australian recordkeeping community, the requirement for a standard on recordkeeping was identified in 1992 emerging from discussions on implementing quality systems in compliance with requirements in the ISO 9000 series of standards. What constituted good recordkeeping to support quality management? It is noteworthy that this question first arose from the private sector, rather than the government sector most commonly identified with formalized recordkeeping. Answering that question engaged the Australian recordkeeping

community in 5 years of collaborative work between 1992 and 1997, a period of intense creativity and rethinking in the Australian recordkeeping community, culminating in the publication of AS 4390-1996, the Australian Standard on Records Management.^[1] This Standard was issued in six parts, each covering a major functional area of recordkeeping.

In 1997, following a suggestion to the International Standards Organization to adopt the Australian standard as an international standard, a ballot was held internationally across the participating national standards organizations. The results were sufficient to adopt the Australian standard as an international standard in a fast track process, but because considerable interest in the document had been evidenced in the process of balloting and some divergent views raised, it was determined that a more appropriate outcome would be to form an international project to establish consensus in the content of a Records Management Standard.

Work commenced on internationalizing the Australian standard in 1998 using the existing Australian work as the base document for development. The existing six-part structure was merged into a single document for consideration. Considerable debate and discussion ensued in the next few years.

Some of the concepts and content of the Australian standard were thought to be specific to the national practice. Different methodologies for achieving specific recordkeeping outcomes were posited as equally valid. Initial attempts to create a set of appendices to the document outlining jurisdiction specific practices resulted in a document which was unmanageably large and cumbersome. The decision to separate the broad principles into Part 1: General and the more particular methodological approaches into Part 2: Guidelines overcame this impasse. As work progressed on Part 2, the more methodological approaches, consensus on approach was achieved as similarities were emphasized rather than differences.

EVOLUTION FROM THE BASE AUSTRALIAN STANDARD

Of particular note in the formative discussions was the need to gain consensus on the definition of record, which was strongly articulated in the Australian work as “evidence of business activity.” This articulation was the result of a number of years of extensive and introspective discussion in the Australian recordkeeping context, and was a view that was vigorously defended in the international sphere. The conceptual alignment of the Australian view to the European notions of a singular conception of record/archive created an interesting alignment of interests and something of a dichotomy in the international English-speaking records community, in which U.K.- and U.S.-based colleagues advocated a distinct difference between records and archives. The Australian view of recordkeeping, a very broad conceptual approach providing a framework consistent with the records continuum view, encompassed records in all contexts including their archival manifestations. This provided ground for much discussion. In the end, a compromise position on this was adopted which gave ground to the notion of a separate “records management” regime.

Other views were staunchly defended, including the strong emphasis on records being closely linked and aligned to the organizational functions and activities that resulted in their creation. The process of records classification was particularly controversial, but the close connection between functions and activities, the role of records and the importance of the central concept of provenance in interpreting records prevailed over alternative views which suggested that more library-oriented approaches to classification be adopted. Similarly controversial was the Australian concept of appraisal which expanded the traditional notion of appraisal from a process of evaluating the disposal and retention requirements for records into a broader notion encompassing defining what records were determined for creation/capture. This could not be reconciled. Appraisal therefore is not specifically mentioned as a process within the standard, but rather the two concepts—“determining documents to be captured into a records system” and “determining how long to retain records”—are independently addressed.

A tension in traditions of recordkeeping needed to be articulated and resolved. The traditional approach to records management in the United States supported primarily “post-action” controls. That is, records management controls were applied after the business action was completed. In contrast, the document being discussed for international adoption articulated a “pre-control” framework, where control of documents as records from the time they were received into an organizational framework, both prior to and during the conduct of the business action. This pre-action framework was more aligned to the European traditions of recordkeeping.

Work on the internationalization of the standard was taking place in the late 1990s in an environment where the management of electronic records as business enablers was really only beginning. Countries were at different stages in their attempts to control the proliferation of information in the workplace. Tensions were apparent between paper-based processes and the need to rethink those processes into an electronic world.

Much of the initial work in the development of the ISO 15489 came from establishing mutual understanding across language and cultural barriers and establishing a strong community respect for the views of diverse traditions and approaches to recordkeeping. The close alignment of records and archives in European countries with little distinction between the two created both an opportunity for knitting a closer conceptual bonding of records in all environments, but at the same time, a barrier to achieving the work in hand. It is possibly unfortunate in the longer term that the introduction of a new term “records management” into many non-English speaking countries seems to have undermined the conceptual unity in the European view. This conceptual unity was very present in the Australian notion of recordkeeping, but unable to be sustained at the time.

CONTENT OF THE STANDARD

ISO 15489 Part 1: General,^[2] following introductory matters (Sections 1–3) contains:

- Statements outlining the organizational benefits of records management (Section 4).
- Clear requirements to locate and contextualize records management within the organizational and regulatory environment (Section 5).
- Concise statements of the responsibilities for records, including strong statements that recordkeeping roles are implicit in the activities of all employees, overall responsibility for programs and resources reside with management layers within organizations, while specific responsibility for establishing systems, frameworks and implementation reside with recordkeeping professionals (Section 6).
- Characteristics of records programs, records and records systems are outlined, including high level statements on their requirement to ensure that records survive as long as they are needed, which may be beyond the boundaries of specific technological applications implemented to manage records (Section 7).
- A high level statement of a methodology to achieve records management within an organization (Section 8).
- Records management processes including creation, retention, registration, classification, storage and handling, access and security, tracking, location, and implementing disposition (Section 9).

- Monitoring and auditing requirements (Section 10) and
- Training requirements (Section 11).

Perhaps the section of the standard of greatest strategic reach is that defining the characteristics of records. Section 7.2, which owes a debt to the InterPARES 1 research project,^[3] clearly identifies the distinction between records and other types of information resources in terms of their defining characteristics of authenticity, integrity, reliability, and usability.

ISO 15489 Part 2: Guidelines,^[4] broadly follows the structure of Part 1 of the Standard, providing greater detail on the methodological approach known as “Developing and Implementing Records Systems” (Section 3). It echoes the structure of Section 9 of Part 1 of the Standard in expanding on the specific processes of recordkeeping (Section 4), and in expanding on requirements for monitoring and auditing (Section 5), and training (Section 6). Part 2 contains two annexes which map between the Guidelines and the general requirements in Part 1.

ISO 23081, Metadata for Records

The second suite of standards to emerge from the international standards committee on Records Management is ISO 23081: Information and documentation, Records Management Processes, Metadata for Records. This standard also exists in two parts: Part 1 being “Principles” (published in 2006)^[5] and Part 2 is “Conceptual and Implementation Issues” (published in 2007 as a technical specification but being proposed as an international standard).^[6]

Recordkeeping metadata is of key importance in managing records in the electronic world. Articulating the recordkeeping requirements for metadata positions the recordkeeping community to contribute strongly to an emerging technical dialogue defining the behavior and characteristics of electronic information. The goal of articulating recordkeeping metadata is to ensure that particular resources can act as authoritative evidence of business action in the electronic world. This involves records being sustainable over application system boundaries in ways that render them able to be used and interpreted for as long as they are required. The conceptual stance of the metadata standard is to provide a unifying framework for the management of metadata about records regardless of their location, or age, or custody. Thus, it addresses records in all domains of action, including current operational systems, but stretching to records in archival repositories. Recordkeeping metadata, while by no means restricted to electronic records, none the less has a greater immediate and strategic impact in the electronic world.

BACKGROUND TO THE DEVELOPMENT OF THE STANDARD

Recordkeeping metadata was first addressed in research projects, that of the University of Pittsburgh (U.S.) project “Functional Requirements for Evidence in Recordkeeping,” 1993–1996,^[7,8] and following that Monash University’s (Australia) project “Recordkeeping Metadata Standards for Managing and Accessing Information Resources in Networked Environments Over Time for Government, Commerce, Social, and Cultural Purposes,” 1998–1999.^[9] Using these projects as a basis, a number of recordkeeping metadata element sets were developed for specific jurisdictional purposes.^[10–12] This was an area that was suited to an international standardization process seeking uniformity across requirements to enable vendor uptake and incorporation into application systems for records. In Australia, as various local jurisdictions adopted variations from the metadata standards established, forming a cohesive specification was seen as particularly desirable. There will always be a need for local and tailored implementation specific variables in recordkeeping metadata. The Australian Standards development community created generic models and high level guidance in these areas at the same time as the international community was working on the principles for recordkeeping metadata. The two sets of work were merged, with the Australian work being incorporated into Part 2 of the international standard.

CONTENT OF THE METADATA STANDARD

At the level of an international standard, the nature of the guidance provided to the implementing community is different from that applicable within a specific jurisdiction or domain. Thus the International Standard on Metadata for Records defines a framework and principles within which specific jurisdictions can further define their implementation guidelines. It positions recordkeeping metadata in relation to metadata from other closely related information disciplines and purposes—for example, information resource discovery, e-commerce, preservation and rights management (Section 7).

Part 1 of the Metadata for Records standards outlines the principles involved in defining records metadata. It adopts the following model of recordkeeping (Fig. 1) to illustrate the concepts:

The standard then outlines the requirements for recordkeeping metadata to fulfill the requirements outlined in the ISO 15489, International Standard on Records Management (Section 9.2). While the standard restricts its scope to the business environment implicit in the domain of records management, the models and principles it outlines applies to records regardless of their age,

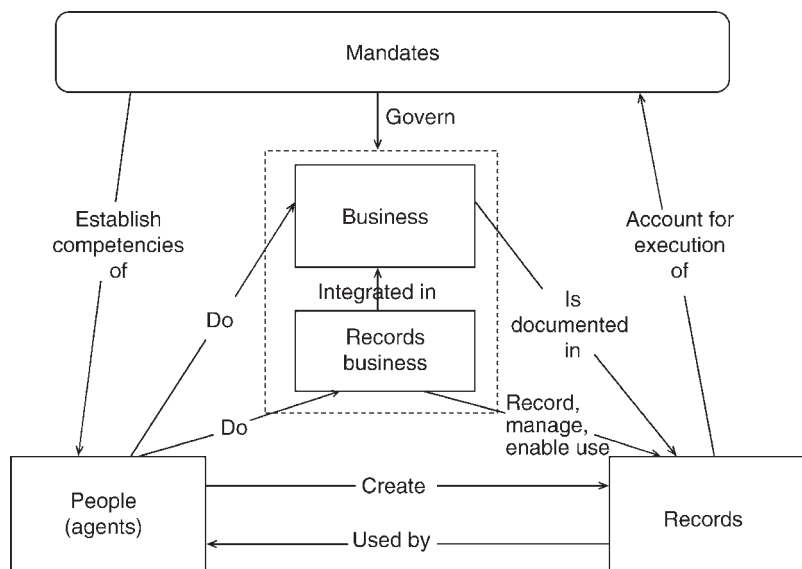


Fig. 1 Main metadata types and their relationships. This model provides a conceptual approach to managing records in their context. Records are conceptualized as existing within a web of relationships to people (agents, structures), business (functions and activities), and mandates (legislation, authorizing competencies, policies, delegations). This view enables metadata to be identified for each of these separate entities and linked together via relationships, rather than having to be encompassed within the notion of the record itself. In metadata terms, this allows many different implementation options to be explored and articulated as suits the capacity and technological capability of the implementation site.

Source: From ISO 23081-1,^[13] Derived from Figure 2: Recordkeeping and Figure 3: The Business Context, included in Mckemmish.^[14]

format, or location, thus acting as a unified recordkeeping model for metadata in all environments.

One of the most important concepts outlined in the standard is the distinction between:

- Metadata assigned at the point of capture of a record into a management system which defines its context of creation and its structural and technical properties at a specific point in time.
- Recordkeeping process metadata which continues to accumulate as business and recordkeeping actions take place on the record (Section 5.2).

This notion is a powerful means of communicating the characteristics of records required to be addressed in the electronic world. It also distinguishes recordkeeping metadata from some other types of metadata in emphasizing the continual accumulation of metadata and requirements for automatic capture of this metadata as opposed to manual methods of “cataloging” or attributing user specified metadata.

Part 2 of the International Standard on Metadata for Records focuses on the conceptual and implementation issues involved in implementing recordkeeping metadata, covering issues such as developing schemas (Section 10), organizational variables in implementation and requirements for managing recordkeeping for metadata itself (Section 11). It provides guidance on implementing recordkeeping metadata in a relational way managing multiple entities and their continuing relationships over time or alternatively by “flattening” the multiple entities into fewer or even a single entity (Section 6.3). The notion of aggregation and aggregation levels required to manage records is discussed with a standardized scheme established to identify equivalence of aggregations across different implementations and to assist in implementing

recordkeeping interoperability (Section 7.1). A generic recordkeeping metadata model (Fig. 2) for defining specific types of elements required to manage records is introduced and elaborated (Sections 8 and 9).

Impact of Records Management Standards

A formal study of the impact of the ISO 15489 has been undertaken studying its uptake and impact in the United Kingdom^[15,16] In that research, the organizational context, circumstances, and size of the organization were determined to be a key determinant in the uptake and influence of the Standard on organizational behavior.

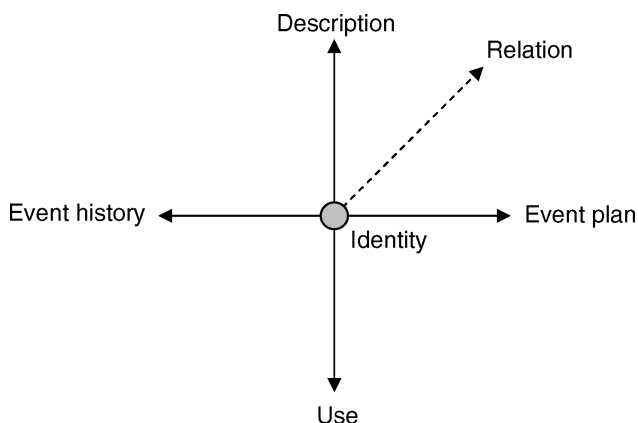


Fig. 2 Generic metadata model for managing records.

Source: From Figure 6 in *ISO/TS 23081-2: Information and Documentation, Records Management Processes, Metadata for Records, Part 2: Conceptual and Implementation Issues*; International Standards Organisation: Geneva, Switzerland, 2007, Section 8.1.^[17]

However, other less precise measures exist to attest to the importance of records standard in the international context. The quantity of international sales of the ISO 15489 standard are reputed to rival the quantity of sales of the ISO 9000 suite.^[16]

Every year, more countries join the community of developers actively participating in the Committee meetings to determine the scope, direction, and development of the Standards. In November 2007, over 120 active participants were registered within the international standards committee, representing over 26 individual countries, with a further 12 countries registered as “observers” to the Committee.^[18] The Standard has been translated into over 10 languages, and representatives of each continent (with the exception of South America) are active participants. The Euro-Centric nature of ISO development and the English-speaking origins of the original ISO 15489 work has been superseded by a truly international community.

Role of Standards

Establishing standards is often a two-edged sword. On the one hand, codifying a body of practice to ensure it is carried out consistently vies with the other view that codifying practice means stifling innovation. The process nature of the ISO 15489 and the breadth of vision of the ISO 23081 standards attempt to mitigate against the evils of the latter. However, in aspiring to standards that enable rather than restrict, some frustration about lack of precision results.

Standards serve multiple purposes. In recordkeeping, our standards can be viewed from any one of the following perspectives:

- *As a place marker:* In this role, the standards setting work clearly articulates the concepts of recordkeeping, its importance and its specific characteristics. This acts as a clear delineator of recordkeeping from other methods of managing information. It stands in contrast to homogenizing views that everything is just information and that particular disciplines are merely guarding their professional domain in not accepting such a homogenized view. Similarly, it acts as a clear statement to others outside the recordkeeping profession who, for a variety of reasons, wish to restrict the scope of records practice to those areas applying only to paper-based records, to disposal and retention or to compliance issues.
- *As a set of facilitative tools:* The standards established in this domain have been adopted and adapted by a number of specific jurisdictions and by individual organizations seeking to achieve best practice. In adopting the frameworks and principles, the requirements for more and further definition and attention to specific aspects of recordkeeping have been identified,

creating an ongoing tide of development fuelling a process of continuing improvement.

- *As a means of profession building:* Providing international standards which set out clearly an area of specialized practice enables profession building. Once standards exist they can be cited by organizations and in other standards. They act as means of professionalizing the practice of recordkeeping. This is particularly important in the electronic environment where the homogenizing effect of generic information management has undermined the records’ specific tasks in systems design and organizational consciousness. The standards act as strong statements from which individual practitioners can launch their claims to attention within organizations, as well as provide guidance on how to achieve the required outcomes.
- *As a means of improving practice:* The recordkeeping standards have been defined to be slightly ahead of practice. They have an agenda-setting role rather than just documenting the status quo. This is an important role of standards, but must be done knowingly and with a clear strategic vision.
- *As a means of achieving a significant mass:* The fact that these recordkeeping standards are international standards creates a worldwide community advocating and requiring the same outcomes. Records practitioners are a small group relative to other professional groupings in information management. Achieving international consensus increases the power of an individual disciplinary requirement, enabling a much greater degree of influence to be exerted. This can be seen in the impact in the vendor community developing software to manage records. The consolidated international market is big enough to have an effect in product direction and outcomes required, where individual fragmented smaller groups may never achieve sufficient strategic leverage.

CONTINUING WORK

The work of the ISO TC 46/SC11 Committee charged with developing international standards in recordkeeping is continuing. A further standard published is ISO 23310-2006, Information and Documentation: Guidelines for Standards Drafters for Stating Records Management in Standards, a standard geared to ensuring the appropriate inclusion of recordkeeping requirements into other standards.

Work is progressing on developing standard or technical reports on Work Process Analysis for Recordkeeping, Digitization, defining long-term retention requirements of electronic records, digital records conversion and migration. A recent strategic decision to move the Records Standards family into a Management Systems Structure is designed to enhance the status, impact, and coherence of the records standards.

CONCLUSION

The development of international standards for record-keeping has created a community of practitioners that extends worldwide, bridging language barriers. The impact of the work is evident in the adoption of the Standard into multiple jurisdictions and an increased international coherence in practice. Work continues within the standards development community to produce the next generation of standards and guidance to support implementations.

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International Records Management Trust

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Abstract

The significance of reliable and trustworthy records for public sector accountability and effectiveness, and the impact on citizens' rights when they are not managed, is far greater than is often realized. Records are the clearest and most durable evidence of the organization's operations, decisions, and activities. They are the underpinning factor in good governance. The International Records Management Trust (IRMT), a UK-registered charity governed by a board of trustees, exists for the sole purpose of supporting lower-resource countries in tackling the issues involved in managing public sector records as an essential national resource.

The IRMT was created in 1989 in response to a global study that documented widespread and progressive deterioration in the management of public sector records. It has always emphasized the significance of well-managed records for protecting and supporting citizens' interests as the evidence base for national and international development. It works with governments around the world to strengthen records systems as a basis for improved services for citizens; effective resource management; open, accountable, and transparent democracies; and national historical identity. From the time of its establishment, the IRMT has been committed to working with records professionals and their governments to find and apply new solutions for managing official records. In an environment of rapid administrative and technological change, it has become ever more important to find new solutions to protecting records as evidence.

INTRODUCTION

International efforts to reduce poverty, control corruption, strengthen democracy, and increase openness all depend on an evidence base of authentic records. In the rapidly evolving digital information environment, there are growing expectations for using information to support openness and digital development. However, information benefits are not automatic. The digital information created and held in IT systems is highly vulnerable; its value as evidence can easily be diminished or lost. An information governance/records management framework is essential to protect the availability and integrity of this evidence and to ensure that it provides a reliable evidence base for meeting development goals. The International Records Management Trust (IRMT) works with governments to help build this framework.

The IRMT is unique in its attention to the close relationship between records and good governance. A UK-registered charity governed by a board of trustees, the IRMT, was created in 1989 in response to a global study involving visits to several dozen lower-resource countries across the world where it was observed that records systems were weak and in many cases had decayed into informality. In some countries, information had become so difficult to retrieve that government operations relied increasingly on memory. In the paper environment, the loss of control of information integrity and of access to information resulting from weak record keeping had

created an open door for corruption, misuse of resources, and abuse of citizens' rights.

Managing records efficiently will not, in itself, halt corruption, protect citizens' rights, and bring about good governance, but development goals cannot be achieved without trustworthy evidence. There are now great hopes that digital government will provide solutions, but the speed with which information technologies are being adopted around the world is not being matched by the skills and infrastructure needed to manage the records they generate, with the result that the accurate information needed to support economic growth, the rule of law, and initiatives aimed at supporting transparency and accountability are undermined.

Over the last two and a half decades, the IRMT has worked with governments around the world to strengthen paper and digital records systems as a basis for improved services for citizens, effective resource management, and increasingly accountable and transparent democracies. The IRMT's program of work is funded by grants and contracts from national and international development agencies that have included the World Bank, the UK Department for International Development, the Commonwealth Secretariat, the Canadian International Development Research Centre, and the United Nations Development Program.

The IRMT works continually to identify new ways of collaborating with governments, international agencies, and records professionals to articulate the requirements

for managing records as evidence and to apply international good practice to meet local requirements in support of evidence-based governance. The IRMT employs core staff in London, works with a large team of international consultants, and liaises with a range of professional associations, consultancy firms, academic institutions, and NGOs to define strategies and deliver its portfolio of records and information management projects. It draws on its wide-ranging field experience and extensive international network of professional contacts to assist records professionals and government stakeholders from lower-resource countries in building awareness, capacity, and effective solutions. Its projects are described on its website: <http://www.irmt.org>. All of its products can be downloaded free of charge.

ORIGINS OF THE IRMT

Between 1984 and 1988, the University of London, through the Institute of Commonwealth Studies and the Department of Information Studies, and with funding from the Leverhulme Trust, carried out an extensive field study of the management of government records across 32 countries in Africa, the Caribbean, and Asia. The aim was to identify capacity requirements as a basis for developing a relevant program of studies for international records and archives students. The study revealed a largely unrecognized but internationally significant issue—an extensive breakdown in public record keeping across the several dozen countries visited. It resulted in a new approach to educating records and archives professionals at University College London. It also led to the establishment of the IRMT in 1989 as a nonprofit vehicle for addressing the conditions that were observed.

While specific conditions varied from country to country, the overall result was the loss of control of records, and the consequences for governments were broadly similar. The study made it clear that legal and organizational structures were not in place to manage official documents, that officials could not locate the information they needed to take decisions, that vast quantities of closed records with no ongoing value were being kept in government offices at great expense, and that national history and heritage were not being protected or preserved (Fig. 1).

The study considered the causes of this situation. It reported that the countries visited lacked national strategies, policies, frameworks, and systems for managing the official records needed to support national evidentiary requirements and that the status of the records profession was low or very low in virtually all of the countries visited. Although the national archives had statutory responsibility for official records, they were isolated from the management of public administration, often playing little or no role in managing the current records that were essential for delivering government functions and protecting citizens' rights and that would one day become historical archives. Because they focused almost exclusively on the historical archives created in earlier decades, the national archives were seen as largely irrelevant to the government operations, and governments allocated them very sparse resources for delivering their work. Records professionals were not trained to tackle these challenges. The breakdown of records systems that resulted from this situation had significant consequences for governments and for citizens in terms of opportunities for fraud, corruption in procurement, a lack of evidence for protecting civil and human rights, and difficulties in managing financial and human resources.



Fig. 1 Weak records systems meant that officials could not locate the information they needed to take decisions.

Much of the IRMT's early work was focused on developing practical approaches to bringing order to the vast backlogs of unmanaged records that had built up across government agencies due to the lack of controls. Offices and corridors were piled high with stacks of records, many of them inactive. The volume was so great that it was not uncommon to find staff surrounded by piles of files, sometimes even sitting on files, or with files filling the space under their desks. Whole offices were out of use because they were crammed with inactive files. The Head of Civil Service in one country described the situation as "walking on files." Not only did it become increasingly difficult to find information needed to deliver government functions, but the situation represented a serious security risk and an open door for corruption.

The IRMT developed a methodology for bringing order to this information through hands-on workshops, where records professionals and students began the task of sorting, assessing, structuring the records, and, where it was legally appropriate, destroying paper files with no ongoing value. It also developed assessment tools and training materials geared to defining the regulatory frameworks and control systems and building the practical skills needed to establish sustainable controls.

By the mid-1990s, the rapid growth of information technology was creating an awareness of the value of information and opportunities for its use. Governments and international development planners hoped that technology would solve the information problems that had become so widespread, and international investment in computerizing government functions and improving Internet connectivity began on a large scale. Crucially, virtually no attention was given to addressing the major new challenges of capturing and preserving fragile digital information created by computerized systems as reliable evidence. As technology had an increasing impact on the way that records were created, used, and stored, the IRMT committed itself to supporting the transition from paper to digital records as the basis for delivering government operations and enabling accountability.

Over the last two decades, the trend toward digital governance has expanded steadily, with government business and communications being routinely delivered electronically, personal computers becoming the norm, large-scale computerized systems being introduced to support the management of key state functions and resources, and scanned images being regarded as an effective alternative to paper copies. The crucial function of managing the fragile digital records that were created was not recognized as an essential component of this process, and this remains a largely unrecognized risk for the delivery of the digital development agenda. Finding new means of highlighting the issues and of integrating them into digital development planning remains a central focus of the IRMT's work.

SIGNIFICANCE OF DIGITAL RECORDS AS EVIDENCE FOR GLOBAL DEVELOPMENT GOALS

The unparalleled growth of information and communications technologies (ICTs) worldwide offers tremendous new possibilities for effective governance and social inclusion. There is a new level of global awareness of the value and power of information for economic development and for eradicating extreme poverty. The Open Government Partnership is committed to the goal of making information open to citizens as the foundation for empowering civil society, with an emphasis on Right to Information and Open Data. At the same time, the UN is preparing for the Post-2015 UN Development Agenda aimed at eradicating poverty and transforming economies. In May 2013, the Report of the High-Level Panel of Eminent Persons on the Post-2015 UN Development Agenda noted, "We need a transparency revolution so citizens can see exactly where their taxes, aid and revenues from extractive industries are spent. We need governments that tackle the causes of poverty, empower people, are transparent, and permit scrutiny of their affairs."

Delivering these goals will require reliable evidence of what governments plan, do, and spend. Just as in the paper environment, in the digital environment, achieving poverty reduction, controlling corruption, building accountability and transparency, and supporting citizen engagement will require authentic and reliable records. Digital records will be needed to provide the basis for defining and delivering day-to-day operations, including budgeting, planning, monitoring, and evaluating, as well as for management controls, including regulations, standards, audits, and investigations. In the new context of openness, digital records will be essential to efforts to make information available to citizens through Right to Information/Freedom of Information or Open Data Initiatives, which will be meaningful only if reliable evidence is available and can be accessed.

At present, in the digital environment, the requirements for protecting, preserving, and making this evidence available are not in place in many countries worldwide. There is a significant risk that the evidence needed to support development goals will not be available, authentic, and trustworthy unless these risks are mitigated.

VULNERABILITY OF DIGITAL RECORDS AS EVIDENCE

Electronic media deteriorate, software changes, and hardware becomes obsolete. Valuable records and data can be difficult to retrieve after a few years or even after a few months. Digital information can easily be manipulated, deleted, fragmented, or lost, leaving critical gaps and

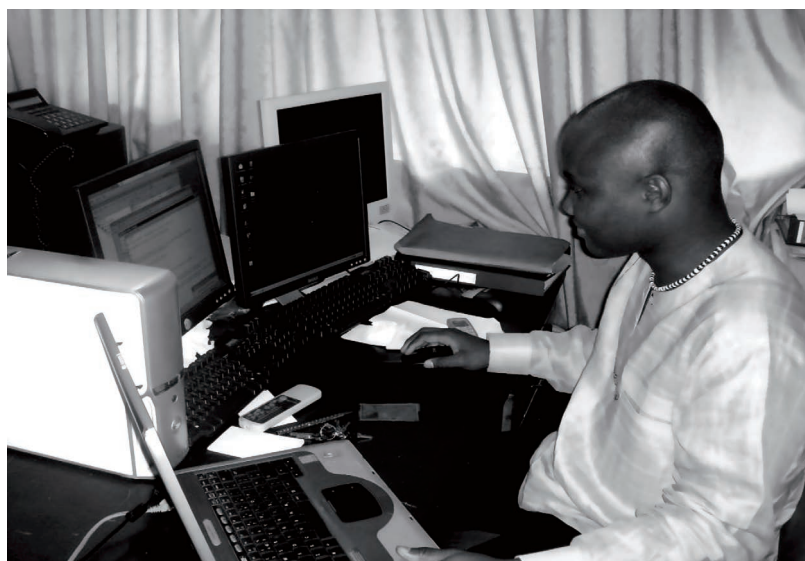


Fig. 2 Digital information can easily be manipulated, deleted, fragmented, or lost.

resulting in misguided policy, misdirected funding, cover-up of fraud, and weak data and statistics. Weak records systems can make it difficult if not impossible for citizens to prove unequal or unjust treatment or to challenge human rights violations. It can undermine their ability to make an informed contribution to the governance process. Laws that give citizens the right of access to government records are of little use if records are not created in the first place or cannot be found when needed (Fig. 2).

The ability to ensure that digital records are available and can be trusted depends upon having an effective records management strategy that defines the goals, principles, policies, processes, and roles needed to ensure effective and efficient use of records as evidence for governance. Records management is essentially a risk mitigation strategy that makes it possible to avoid or address gaps in the framework for managing records in relation to development goals. Defining a records management strategy is especially important for lower-resource countries, where governments continue to depend heavily on paper but are keen to introduce the benefits of information technology and open data as rapidly as possible, often with almost no capacity or resources for managing records systems. In the same way that it is vital that information security controls are in place, a records management framework is vital as a basis for achieving development goals.

The records profession, which is a coherent worldwide community of practice dedicated to protecting the availability and integrity of evidence through time and across technology change, has defined answers to the issues involved in establishing and maintaining control of records as reliable evidence. The community has reached a broad agreement on the continuum of controls required to support the capture, classification, disposition, preservation, access, and security of the records. These controls are defined in detail in international standards, which work

together to provide evidence that records are reliable and accurate. The controls cannot be achieved piecemeal but require a unified records and information governance framework. Internationally accepted records standards tend to be applied differently in different countries, but the core requirements are universal and are relevant in all regions of the world.

Many governments have not yet recognized the importance of building the framework of laws, policies, structures, standards, systems, procedures, and skills needed to capture, preserve, and make digital records accessible in a reliable form through time. Development planners often do not realize that ICT systems contain digital records but lack the full functionality needed to protect and preserve them. The growing international body of standards and good practice is largely unknown to the ICT and development environments, and it has not been adapted to meet the requirements and circumstances of lower-resource environments. These gaps need to be bridged if fragile digital records are to survive and provide essential evidence.

THE IRMT'S WORK

The IRMT is unique in its commitment to strengthening public sector records management in relation to the governance process. Its three program areas (development research, education and training, and consultancy services) work together to support this purpose. The IRMT's long-term objective is to raise international awareness of the importance of managing evidence in the digital environment and to support countries in lower-resource environments in building capacity to introduce effective and appropriate strategies for managing digital records. Drawing on its track record of success, extensive field experience, network of globally recognized experts, and close



Fig. 3 The IRMT emphasizes the importance of teamwork and capacity building.

partnerships with records professionals across the world, the IRMT works to help facilitate and share new solutions to the global challenges of managing records as evidence in the transition to the electronic environment (Fig. 3).

The IRMT's work falls into three interrelated program areas. It studies the relationship between records management and public sector management in order to define means of strengthening effective government; it develops capacity building resources that it makes freely available internationally; and it provides consultancy support to help sustainable legal and regulatory frameworks, policies, systems, procedures, and facilities. Its programs and projects are, therefore, informed by a continuous cycle of research, education and training, and the application of its findings and products in practical situations.

The IRMT has identified key elements of success in building sustainable programs for managing records as evidence, and these feature in all its projects. They include the following: linking records management directly to governance functions; taking an integrated approach to the management of records across all media from creation to destruction or long-term preservation; ensuring that all projects are practical, relevant to local circumstances, and sustainable; emphasizing the importance of teamwork; and building ownership and awareness alongside capacity.

The IRMT also recognizes the importance of working closely with key government stakeholders and with partner organizations, including professional associations, consultancy firms, academic institutions, and NGOs to define strategies, structures, and programs for managing records in support of evidence-based governance and national and international development. It also works with national archives in many countries and with a range of international organizations, particularly the International Council on Archives and its regional branches, the Association of Records Managers and Administrators International, and national bodies, such as the UK Information

and Records Management Society. It also has worked in partnership with such international bodies as the International Federation of Accountants, Transparency International, and the Commonwealth Human Rights Initiative.

Development Research

Over the last 15 years, the IRMT carried out a series of research projects aimed at understanding the relationship between records management and governance, particularly in the transition to the digital environment. The premise has been that if digital information is to provide the basis for informed decision-making, effective service delivery, and tackling corruption through increased transparency, it must be reliable and trustworthy over time. The IRMT makes its research findings available internationally, uses them as the basis for developing education and training programs, and works with governments to apply the findings practically.

The IRMT's research projects have examined the practicalities of introducing records management to support international and national development priorities, focusing on key aspects of accountability, transparency, and openness, including the Right to Information and Open Data. Since the management of money and people is fundamental to all of these issues, the IRMT has given particular attention to financial and personnel records, in both the paper-based and electronic environments. The research projects, which have run almost continuously since 1998, have included the following: *From Accounting to Accountability: Managing Accounting Records as a Strategic Resource* (1999); *Evidence-Based Governance in the Electronic Age* (2001–2004); *Integrating Records Management Requirements into Financial Management Information Systems (FMIS)* (2005–2006); *Investigating and Addressing the Requirements for Building Integrity in Public Sector Information Systems in the ICT Environment* (2006–2008); and *Aligning Records Management*

with *E-Government/ICT, Freedom of Information, and Poverty Reduction in East Africa* (2010–2011).

The IRMT also recognizes the need to monitor and measure records management frameworks, processes, and capacity in relation to the transition to the digital environment, and it draws on its research to produce assessment tools that include a gap analysis tool for assessing records management functionality in ICT systems, a high-level E-Records Readiness Tool for assessing capacity for managing electronic records and information, and a Records Management Capacity Assessment System for a more in-depth evaluation. The tools are linked to international records management standards. The IRMT is presently working to develop a Rapid Diagnostic Records Management Risk Assessment Tool.

All of the research reports and associated assessment tools can be downloaded from the IRMT's website free of charge.

Education and Training

The IRMT is committed to supporting education and training as a primary goal. Between 1996 and 2000, working with the International Council on Archives and other professional bodies, it developed the Management of Public Sector Records Study Program with the aim of helping to build core records management skills in countries where appropriate and relevant educational tools were hard to obtain. The material was intended to serve as an input to taught or distance learning courses, as a resource for conducting workshops, and as a tool for self-study. It also has provided the basis for strengthening staff capacity within local institutions. In fact, the material has been used more widely than originally expected, serving small communities across better-resourced countries, for instance, in Canada and Australia, and governments in transition, for instance, Estonia.

The study materials were distributed in hard copy to national archives and training institutions in 60 lower-resource countries with assistance from the Association of Records Managers and Administrators International. They also have been available on the IRMT's website since they were launched in 2000, with hundreds of thousands of downloads, free of charge, by educators, institutions, and individuals. The program has contributed to the development of new educational programs in countries including Uganda, Zimbabwe, Eritrea, and Tanzania. There is also a Spanish adaptation of some of the material, in two volumes, which was developed by the National Archives of Uruguay, and which also may be downloaded without charge.

The study program covers all phases of the records life cycle/continuum, as well as the application of records management principles and practices to financial, human resource, and legal and judicial records. There are about 4000 pages of training materials, including 18 teaching/

study training modules, case studies, good practice procedure manuals, and an educators' resource kit. While the material addresses public sector record-keeping issues, it can also be used in the private sector.

In 2009, the IRMT released a second set of modules that aimed to begin the process of building records management capacity in the digital environment. The material included five modules, six case studies, and a set of good practice indicators for integrating records management in ICT systems.

In 2013 and 2014, at the request of UNESCO, the IRMT collaborated with the International Council on Archives to develop a digital preservation curriculum. It provided a draft outline of the contents of the curriculum and prepared two detailed modules: *Managing Metadata to Protect the Integrity of Records* and *Understanding Digital Records Preservation Initiatives*.

Although the core issues covered by the study material have not changed, the IRMT recognizes the urgent requirement to continue developing up-to-date study material to address evolving technological requirements and goals for openness.

Consultancy Services

For two and a half decades, working with dozens of governments and dozens of international institutions around the world, the IRMT has delivered numerous projects to improve records and information management in support of governance objectives. It works with governments to help build the effective laws, policies, systems, procedures, and capacity for creating and managing trustworthy and accessible records needed to protect citizens' rights, improve services for citizens, demonstrate accountability and transparency, and protect the national historical memory. The IRMT's projects are designed to strengthen local professional capacity and build awareness of the significance of records as evidence among government officials.

The IRMT's consultancy services support both paper and electronic records systems, particularly in relation to financial management, human resource management, legal and judicial management, healthcare management, land management, decentralization, and access to information. For instance, they seek to strengthen records control systems in public financial management to reduce opportunities for fraud, corrupt procurement, and money laundering; to strengthen controls in the areas of payroll management; and to eliminate ghost workers and the retention of workers past statutory retirement age. In this way, they strengthen the Financial Information Management Systems and Human Resource Information Systems, which are trustworthy only if the information they contain is accurate.

The projects can involve addressing government-wide requirements or sector-specific needs. Some last for only a few weeks, for instance, an analysis of records

management requirements. Others are delivered over a number of years where there is a need to build a sustainable infrastructure for records management across government. Longer-term projects can include establishing appropriate legal and institutional arrangements; developing clear management responsibilities and performance criteria; drafting policies, standards, and practices; implementing new systems; and building appropriate new skills.

CONCLUSION

For 25 years the IRMT has been committed to strengthening evidence-based governance to support the goals of

improved services and resource management and to underpin accountable and transparent democracies. It has sought to build awareness of the significance of records as evidence among government officials and development planners; to support capacity building for records professionals; and to help develop innovative, appropriate, and practical solutions to records and information management problems. Most significantly, the IRMT has sought, in all of the countries where it has worked, to contribute to the well-being of citizens, whose rights and entitlements and ability to hold their governments accountable depend on the availability of accurate and reliable evidence.

International Society for Knowledge Organization (ISKO)

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Abstract

The aims, tasks, activities, and achievements of the International Society for Knowledge Organization (1989–) are presented. ISKO is that group of scholars and practitioners who feel responsible for questions pertaining to the conceptual organization and processing of knowledge, the scientific bases of which lie in knowledge drawn from the fields of logic, organization science, psychology, science theory, informatics, semiotics, linguistics, and philosophy. It aims at giving advice in the construction, perfection, and application of such organizational tools as classification systems, taxonomies, thesauri, terminologies, as well as their use for indexing purposes and thereby for the retrieval of information. Events leading up to the founding of ISKO in 1989 are described. The aims and objectives of ISKO according to its statutes are mentioned, as well as its organization, its biennial international conferences with their proceedings volumes, and the establishment of a further conference series and a textbook series. The drive and success of coordinators in establishing chapters in many countries is reviewed as well. The activities of the chapters (mainly by their own meetings and conferences) and subsequently their publications during the past years are also included. The idea and structure of ISKO's official journal—*Knowledge Organization*—is explained, and ISKO's Web site is given. Finally, the need for the Society is discussed, and its possible future is considered.

DEFINITIONS AND FORERUNNERS OF ISKO

One of the antecedents of ISKO was the establishment of the journal *International Classification* (IC) in 1974. It was edited by the entry author and published by K.G. Saur Verlag, Munich. With this journal, “classification” was understood as a multi-meaning word that includes the following concepts: 1) classification in the sense of “classification system” i.e., a system of classes arranged in hierarchical or faceted order; 2) classification in the sense of classifying, i.e., establishing a system of classes; 3) classification in the sense of classing, i.e., relating the classes of a classification system to objects or subjects of reality; and 4) classification in the sense of classification science, i.e., relating to this field of study and its activities. Another forerunner of ISKO was given by the founding of the German Classification Society on February 12, 1977, meant to study the philosophical and methodological foundations of classification and its application in many object- and subject-oriented fields of knowledge. It was chaired by the entry author from 1977 to 1986. This Society comprised members from library and information science, linguistics, philosophy, commodity science and some other sciences, and also statistics and mathematics. The non-mathematically oriented members based their understanding of knowledge on concepts as “units of knowledge” which means that any concept can be defined as a “synthesis of essential characteristics stated about any kind of a referent and needing a term or another kind of designator.”^[1,2] The mathematically oriented members of

the Society which grew from a single representative (Prof. Dr. Hans-Hermann Bock) in 1977 to almost 100 members after 12 years, did not use the conceptual approach but a formal approach to their numerically or statistically oriented understanding of classification.^[3] Thus it happened that the Society of some 200 members was dominated all in short order by the 100 mathematicians which were more strongly represented at the elections for the Executive Board in 1989. At this junction the conceptually oriented half—on the advice of Dr. Robert Fugmann—decided to leave and establish a new Society and thus, ISKO was founded on July 22, 1989. This decision had been supported by the members of the consulting editorial board of *International Classification*. In addition, it was intended to soar above the national level and to approach and include interested colleagues from other countries. At the founding meeting it was decided not to use any longer the term “classification” in the name of the new society but “Organization of Knowledge,” as this had already been used in two publications on this field of classification as titles of books by H.E. Bliss (1932/1933). To simplify the name of the new society the direct translation from the German “Wissensorganisation,” namely “Knowledge Organization” was preferred and accepted worldwide to the astonishment of its inventors. The founders of ISKO were (in alphabetical order) Dr. Ingetraut Dahlberg, Dr. Robert Fugmann, Dr. Alfred Gerstenkorn, Dipl.Bibl. Barbara Kelm, Prof. Dr. Norbert Meder, Mrs. Padmini Raj (India), Prof. Dr. Winfried Schmitz-Esser, Dipl. Vw. Ingeborg Stoltzenburg, Dipl.Ing. Rudolf Ungvary

(Hungary). Therefore three nations were represented, a necessity for the founding of an international society in Germany. Thereafter the journal *IC* became the official organ of ISKO and was renamed into *Knowledge Organization* subsequently.

AIMS AND TASKS

ISKO was conceived to function both on a national and international level as the connecting link between any and all institutions concerned with conceptual questions pertaining to the organization and processing of knowledge. It is meant to serve in assembling all colleagues, mainly from the information science fields working on problems related to the conceptual organization of knowledge, the scientific bases of which lie in the methodical knowledge from the fields of logic, organization science, psychology, science theory, informatics, semiotics, linguistics, and philosophy (particularly epistemology). According to its Statutes, ISKO has set itself the following tasks:

Awaken and support an understanding for the practical and heuristic usefulness of such an organization of knowledge, propose on a national and international level the exchange of information and experience of scientists and practitioners in this area, especially by giving advice in the construction, perfection, and application of such organization tools as classification systems, thesauri, terminologies, nomenclatures, as well as the syntactical tools going with them; observe internationally the progress made in this work; concentrate on major points of this knowledge field in special working groups, hold regular meetings in order to support these activities.^[4]

It is also stated in the Statutes that the Society will collaborate with other groupings, associations, and institutions pursuing similar aims, if in line with its goals. It aims at promoting and carrying out studies, research work, conferences and other categories of scientific cooperation, as well as disseminating knowledge for research workers, scientists, and the general public through its publications. The last sentence of its Preamble says: "Thus, responsibility and initiative to make this society their worldwide forum lies in the hands of the personal members collaborating in their concern for knowledge organization in common efforts, refraining therefore from pursuing their subjective interests and respecting the postulates of integrity and truth, mutual recognition and assistance."

ORGANIZATION

ISKO's *Executive Board* (EB) consists of seven members and one ex-officio-member, the chair of the *Scientific Advisory Council*. This latter Council has up to 21

members and advises the EB. The necessary Secretarial work of the Society is accomplished by ISKO's *General Secretary* (this is at present Dipl.Vw. H. Peter Ohly, Bonn, Germany). *Membership Assemblies* take place every 2 years together with the biennial international conferences in even years. The *President* of ISKO and its EB is elected every 4 years. *National Chapters* are founded with the help of *National Coordinators* whenever there are at least 10 ISKO members in one country. Such chapters can establish their own statutes. Their conferences should take place every odd year. They receive a small part of the general membership fee for their own expenses. Here is the list of ISKO's presidents so far: Dr. Ingetraut Dahlberg, Frankfurt (1989–1996), Prof. Hanne Albrechtsen, Copenhagen (1997–1998), Prof. Clare Beghtol, Toronto (1998–2002), Prof. Ia C. McIlwaine, London (2002–2006), Prof. Maria José Lopes Huertas, Granada (2006–). In the first years the sessions of the Executive Board were concerned among others also with the elaboration of *Bylaws to the Statutes*, such as one for the organization of Chapters and other ISKO Bodies.^[5] One Bylaw for Conferences and one for the General Secretariat had been worked on but never published. Chair of the *Scientific Advisory Council* was Prof. Dr. Winfried Schmitz-Esser (1989–2006). He was succeeded in 2006 by Alexander Sigel.

ISKO'S INTERNATIONAL CONFERENCES

After one year of existence ISKO organized its first International Conference at the Technical University of Darmstadt, Germany, August 14–17 1990, entitled *Tools for Knowledge Organization and the Human Interface*. It assembled almost 200 participants from 25 countries, 60 papers were presented, edited by Robert Fugmann and published in the new series *Advances in Knowledge Organization*.^[6] The conference in 1992 on *Cognitive Paradigms in Knowledge Organization* took place at Madras, India,^[7] the next, in 1994, was held in Copenhagen, entitled *Knowledge Organization and Quality Management*,^[8] in 1996 the fourth one, entitled *Knowledge Organization and Change*, took place at Washington, D.C.^[9] Now back to Europe, the 1998 conference, entitled *Structures and Relations in Knowledge Organization*, took place at Lille, France.^[10] The sixth conference, entitled *Dynamism and Stability in Knowledge Organization* took place at Toronto.^[11] The next one, entitled *Challenges in Knowledge Representation and Organization for the 21st Century. Integration of Knowledge across Boundaries*, took place at Granada, Spain.^[12] The eighth conference, entitled *Knowledge Organization and the Global Information Society*, took place at London, England^[13] and the ninth international ISKO conference, entitled *Knowledge Organization for a Global Learning Society*, took place at Vienna, Austria.^[14] In 2008, ISKO held its tenth

conference on *Culture and Identity in Knowledge Organization* at Montreal, Canada, August 5–8, 2008. It will hold its 11th International Conference in Rome, Febr. 23–26, 2010, its topic: *Paradigms and Conceptual Systems in Knowledge Organization* <http://www.iskoi.org/rome2010/>

HISTORICAL DEVELOPMENTS AND EARLY CHAPTER ACTIVITIES

Version 2 of a 1992 leaflet of ISKO^[15] (a version 4 was published in)^[23] gives an account of the early development of ISKO. By that time a number of coordinators were already active in the following countries: Austria (Dr. G. Budin), Brazil (Prof. Dr. Ulf Baranow), Canada (Prof. Nancy Williamson), Denmark (Mrs. Hanne Albrechtsen), France (Dr. Jacques Maniez), Hungary (Dr. Maria Domokos), Italy (Dr. Giliola Negrini), Japan (Prof. Yukio Nakamura), Nigeria (Mr. Emmanuel Adimorah), Portugal (Mrs. Ines Lopes), Russia (Dr. Eduard Sukiasyan), and Spain (Prof. Dr. Emilia Curras). International Society for Knowledge Organization Chapters have been established so far in Bulgaria (Mr. Peter Petrov), Germany (Prof. Winfried Goedert), India (Prof. Krishan Kumar), and Slovakia (Mrs. Pavla Stancikova). At this time, ISKO had about 400 members in over 40 countries. National conferences with international participation were held in 1991 in Bratislava, Slovakia (papers were published in a separate volume),^[16] Varna, Bulgaria (18 papers were published in one-page form in *Knowledge Organization* 1992, except for the papers).^[17,18] Russia's chapter held its three conferences: the first one on *Problems and Tendencies* 1993, and a second one in 1995 on *Linguistic Problems in KO*, both at Moscow. A third one was held in combination with the annual Crimean conference in 1997. Short versions of the 1993 papers were published in *Knowledge Organization*^[19] together with two papers.^[20,21] It should be mentioned, however, that the growth of ISKO in Eastern and developing countries was fostered in the years 1989–1996 by the fact that members from such countries with low incomes had to pay a rather reduced membership fee. The journal was sent to such countries in bulk and was distributed by the coordinators or chapter heads. In these years, there were about 50 ISKO members in India and some 30 members in China.

In 1993 a series of European conferences was planned on subject topics, such as Environment, Medicine, Agriculture, etc., but only one of them could be realized so far, it was the First European ISKO Conference at Bratislava, Slovakia, September 14–16, 1994 on *Environmental Knowledge Organization and Information Management*. Its 45 papers were edited by Pavla Stancikova and I. Dahlberg in another series *Knowledge Organization in Subject Areas*, Vol. 1, 1994.^[22] A further international Research Seminar on a methodological problem took place at Warsaw, September 13–15, 1995 on *Compatibility*

and *Integration of Order Systems*. Its 20 papers were edited by I. Dahlberg and Krystyna Siwek.^[23] The volume also contains an *Annotated Bibliography on Compatibility and Integration of Order Systems* by I. Dahlberg as well as the *Recommendations* of the participating ISKO members and the members of the Polish Society for Professional Information (TIP). In 1993, a series of *Textbooks for Knowledge Organization* was started with vol. 1 by Robert Fugmann: *Subject Analysis and Indexing. Theoretical Foundation and Practical Advice*.^[24] A second volume followed in 1995 by Hemalata Iyer on *Classificatory structures: Concepts, Relations and Representations*.^[25] A third volume was planned to be written by Eduard Sukiasyan on *Universal Classification Systems*. Unfortunately after 1996, these series were discontinued. From then on too—regrettably—the ISKO members of countries with low income had to discontinue their membership.

PRESENT CHAPTER ACTIVITIES

Three months after the founding of ISKO, a **German Chapter** was founded on October 6 in Frankfurt. It considers itself as successor of the non-numerical part of the *German Classification Society* (see above), although—ironically—most of the librarians stayed with the mathematicians as a section of their own, so far. Chairmen of the German Chapter since 1989 have been Prof. Winfried Goedert, Dr. Peter Jaenecke, Prof. Dr. Hans Czap, and Peter Ohly. At present there are 75 members including members from Austria, Switzerland, and the Netherlands as well as one Honorary Member, Dr. I. Dahlberg, since 2001. The proceedings volumes of the biennial conferences are available.^[26–34] In addition there exists a discussion list (wiss-org), a Web site (wiss-org@gesis.org) and an irregularly appearing newsletter. Also in pursuance of the aims of the Society, working groups had been established from the very beginning with the aim to publish results in a series called *Recommendations for Knowledge Organization*. In the interim, the work was suspended. The first recommendation was published by the WG on Content Analysis, entitled *User Evaluation of Information Systems*.^[35] Further WGs became active on University Education in KO, Cognition and KO and Universal Classification. At present new WGs are established ad hoc on demand.

Though the **Italian chapter** (chair Dr. Giliola Negrini) started its activities much earlier after the founding of ISKO, it was only in 1990 that G. Negrini arranged for a conference on *Documentary Languages and Databases* in Rome, December 1990. Although it was not co-organized by ISKO, but held in the spirit of ISKO, therefore its proceedings volume was included in the series *Advances in Knowledge Organization*.^[36] In an e-mail of November 20, 2007, Claudio Gnoli reported: “On the initiative of Giliola

Negrini (National Research Council), who collaborated with Dahlberg applying her Systematifier model to documentation in various sectors and organized four scientific events in Rome with printed proceedings “(see bibliography^[37–39]). In 2004, coordination was taken over by Claudio Gnoli (University of Pavia), and a national chapter was formed, currently including about 25 people and some institutions. The chapter organized annual meetings at Milan Bicocca University, as well as specialized events on the organization of local knowledge and of philosophical knowledge, all with online proceedings (<http://www.iskoi.org>). Several research projects are active within the chapter, including integrative level classification (<http://www.iskoi.org/ilc/>), relations between object and bibliographic classifications (<http://www.iskoi.org/bagpipes/>) and cooperation with GRIS (Subject Indexing Research Group).”

In **Spain**, Prof. Dr. Emilia Curras organized in 1992 the first ISKO Meeting in combination with a meeting of FID/CR, the Classification Research Committee of the Federation Internationale de Documentation. A year later, the Spanish Chapter was formed and a conference was held in November 1993 on *Knowledge Organization in Documentary Systems*, with the support of Profs. Javier Garcia Marco, Miguel Angel Esteban, and Rosa San Segundo. Subsequently, J. Garcia Marco started a journal called *Scire, Knowledge Representation and Organization*, appearing twice a year with a scientific board and peer-reviewed contributions. He published in it the papers from this and later conferences. A second ISKO-Spain national congress took place in 1995 and a third one in 1997, all these conferences took place in Madrid.^[40–42] In 1998 the Chair of ISKO Spain went to Prof. M.J. Lopez-Huertas. The proceedings’ volumes of the next four conferences are available.^[43–46] From 2007 on, the Chair of ISKO Spain went to Prof. Rosa San Segundo.

The **Polish ISKO Chapter** started from the participation of Polish colleagues in the First European ISKO Conference on Subject Areas (see above), held at Bratislava 1994. A year later, the ISKO-TIP Research Seminar on Compatibility and Integration of Order Systems was held in Warsaw, which helped to bring the interested colleagues together from the whole country. It was, however, not until 2006 that a new Polish coordinator was elected, Prof. Wieslaw Babik from the Institute of Information and Library Science of the Jagiellonian University in Cracow, that the former Polish ISKO members were reassembled and newcomers added so that a group of 23 members was formed and the National ISKO Chapter could start its work in 2007. A plan for a number of activities for the years 2006–2010 is being proposed. It organized panels on *What is knowledge organization?* at Cracow and Katowice in June 2007 and also a Session during the 9th Forum of the Polish Society for Scientific Information in Zakopane (September 25–28, 2007) entitled: *The role of knowledge organization in information exchange and development of professional information services for education, science*

and culture for the knowledge society. Information on the Polish ISKO activities were published in two renowned Polish scientific journals and Web sites were designed and created. Twice a year an electronic bulletin *ISKO in Poland News* is issued.

The **French ISKO Chapter** was established after the Warsaw Research Seminar of 1995. Before that time, Prof. Jacques Maniez was ISKO Coordinator for France, however the participation of Mrs. Danièle Degez in Warsaw helped to assemble existing French ISKO members and to form the Chapter in 1996. Dr. Widad Mustafa el Hadi who had already attended the first International Conference of ISKO, Darmstadt 1990, was elected Chairperson, Danièle Degez as Deputy Chair, and Jacques Maniez as Treasurer. In November 2000, the French chapter was granted the nonprofit legal organization status. Since that time, ISKO France organized biennial conferences, known as Journées ISKO-France. The first one took place in Lille, 1997.^[41] Until 2007, six biennial conferences have taken place. They are now called *ISKO-France Conferences*. Their topics and venues were as follows: *Indexing in the Era of the Internet* (Lyon); *Information Filtering and Automatic Summarization in Networks* (Paris); *Knowledge Organization Conceptual Approaches* (Grenoble); *Knowledge Organization and User-Oriented Strategic Watch Information Systems* (Nancy); *Knowledge Organization in the Information Society* (Toulouse). The proceedings volumes are available.^[47–52] Chairpersons of ISKO-France were Dr. Widad Mustafa el Hadi (1996–1999), Prof. Dr. Jean-Paul Metzger, (1999–2005), and Prof. Dr. Stéphane Chaudiron, University of Lille (2005, reelected 2007). In June 2006 the French ISKO Chapter coorganized *La Semaine de la Connaissance*. This “*Knowledge Week*” gathered all French Societies concerned with knowledge and linguistic issues.

In **England**, Dr. Steve Pollitt had been active as coordinator ever since 1994, but unfortunately a serious illness lead to his early death. Much later, the **British ISKO Chapter** finally was planned in London, on February 7, 2007, in a preliminary meeting hosted by John Lindsay at Kingston University. A Web site was designed and an invitation to join ISKO UK was widely disseminated. Its inaugural meeting was held on March 26, 2007. Vanda Broughton, lecturer in the School of Library, Archive, and Information Studies (University College London) was voted chair, Bob Bater, a consultant in the field of knowledge organization was elected Vice-Chair, and Aida Slavic as Treasurer. Mrs. Broughton wrote:

Starting with ten members, the chapter quadrupled its membership by December 2007, attracting an interesting mixture of academics, researchers, information consultants and practitioners in equal parts. Membership at the end of 2007 stands at 42, including two honorary members, Brian Vickery and Jean Aitchison, pioneers in knowledge organization in the United Kingdom. The

popularization of ISKO in the United Kingdom was achieved through a series of London meetings organized around topics of interest. One type of meeting organized under the banner 'KOnnecting KOMmunities' was held in May with the expressed purpose of providing a forum for knowledge managers and taxonomists in nonacademic sectors. This gave us an opportunity to share experiences and interests in a formal discussion, followed by the opportunity for social networking. It was very apparent that KO practitioners in industry and government suffer from relative isolation and greatly welcomed the opportunity to meet and exchange views with others. The second, September meeting, entitled *Tools for knowledge organization today*, was a half-day themed conference, consisting of three talks on the subject of knowledge organization standards and was attended by an audience of over 50. The third was another KOnnecting KOMmunities meeting under the heading *Ranganathan revisited: Facets for the future* with two talks from the academic and research point of view on facet analysis, and three presentations of information organization and retrieval solutions based on facet analysis. This meeting was attended by more than 80 people. Further meetings are planned for 2008. The first ISKO U.K. biennial conference will be held in 2009.

The **Indian ISKO Chapter** was established right after the first ISKO Conference in Darmstadt at which a number of Indians were present, among them Dr. Mohinder Satija, GND University, Amritsar, who became India's ISKO Coordinator and Prof. Krishan Kumar, University of New Delhi, who took over the Chair of ISKO India. On January 7, 1994, an ISKO Seminar was held in Bangalore together with the DRTC and the Institute of Information Studies. A report by Mr. Sukhdev Singh and Dr. K.N. Prasad on the four papers given was published in ISKO News 16.^[53] In 2005 coordinatorship went to Prof. K.S. Raghavan, DRTC Bangalore, and Prof. A. Neelameghan became its president. As of December 6, India has 21 ISKO members. Recently, in September 2007, DRTC in association with ISKO and some other institutions organized an international conference on *the Future of Knowledge Organization in the Networked Environment* (IKONE 2007). Papers were published in a preconference volume, edited by K.S. Raghavan.^[54] He wrote that the biggest challenges in the next 5 years would be: to build KO schemes and hide them from the user; to design and implement education and development in KO; to understand "human needs" and what these needs are derived from; what are the factors that influence the mental reference model? And finally, to build methodologies for KO. At present the following three research projects are being pursued: Revision of Colon Classification; A bilingual thesaurus for classical Tamil Studies; and Work on defining, categorizing, and developing a taxonomy of lateral relationships, including multilingual multicultural contexts.

The **Brazilian ISKO Chapter** was officially created on October 31, 2007. It has now 34 members, all of them are

PhDs and act as professors and researchers in the KO branch. It is officially located at the Department of Information Science of Sao Paulo State University (UNESP) in Marilia—Sao Paulo. Its President is José Augusto Chaves Guimaraes. He wrote that the first congress of the Brazilian ISKO Chapter will take place in Joao Pessoa, Brazil, in October 2009. He outlined the major research themes of his Chapter as follows: Epistemological foundations of KO; Interdisciplinary dimensions of KO; Terminological tools in KO; KO and cultural memory; KO and domain analysis; Technological background of KO; Social aspects of KO (education, professional acting, ethics, etc.) and he mentioned that the Brazilian ISKO Chapter is deeply attached to the Working Group 2—Knowledge Organization and Representation—of the Brazilian Information Science Research Society (<http://www.anci.org>).

ISKO's Nordic Chapter was founded on November 8, 2007 in Copenhagen. It covers Sweden, Denmark, Norway, Finland, Iceland, and the Faroe Islands. Its Chair is held by Mikkel Christoffersen with Birger Hjørland (DK), Hanne Albrechtsen (DK), and Per Nystroem (SWE) on the Board. So far, 22 people have expressed interest in the chapter. A Web presence will be established soon and a conference is being planned in Sweden in 2009.

ISKO's U.S. Chapter had been planned to be established in 1994 at a conference in Urbana Ill., organized by Prof. Pauline Atherton. Prof. Hemalata Iyer from the University of Albany had been the coordinator and had invited her colleagues in the United States. However, the strong voice of one person present at that meeting (which I attended too) sufficed to prevent the chapter from realization. Recently, Prof. Richard P. Smiraglia wrote^[55] that at the 2007 *North American Symposium on Knowledge Organization* (convened at the University of Toronto, a general assembly voted for the creation of the **North American Chapter of ISKO**. A standing committee will bring forth bylaws and organize a second symposium for the summer of 2009. He also gave a survey on the papers of this Symposium and indicated that 13 of the papers can be found in the Web. It should be mentioned that Prof. Nancy Williamson of the University of Toronto had been active as ISKO Coordinator of Canada since the early 1990s and assembled around her the Canadian ISKO members, although an official Chapter had never been created there. She is well known to the ISKO community for her many excellent reports in our journal, also on the international ISKO conferences. At the ISKO Conference in Vienna, 2006, therefore, she was elected second Honorary ISKO member.

THE JOURNAL KNOWLEDGE ORGANIZATION

As stated above, this journal was started in 1974 as *International Classification*. It appeared in the first years only twice a year, later on three times and became a quarterly from 1980 onward. The journal is "devoted to Concept

Theory, Classification, Indexing, and Knowledge Representation.” It contains a section for articles, for reports, for news in the field of classification/knowledge organization, book reviews, and a current bibliography in systematic order with an author index. From 1974 to 1996 all sections were edited and compiled by I. Dahlberg. From 1997 to 1998 it was edited by Charles Gilreath, Florida with Hanne Albrechtsen for ISKO News, Werner Bies for Book Reviews and Gerhard Riesthuis for the current bibliography. In 1999 it was edited by Clare Beghtol, from 2000 to 2004 by Hope Olson and from 2004 on by Richard Smiraglia. In the meantime, the ISKO News Section was dropped because of the ISKO Web site, but resumed by Hanne Albrechtsen in 2007. The book editor W. Bies was succeeded by Michèle Hudon and later-on by Clément Arsenault. The bibliography section of G. Riesthuis was—after his very helpful work from 1997 to 2006—succeeded by I.C. McIlwaine. The issue 1999/4 contains a systematically arranged bibliography of all ISKO publications of the past 10 years, compiled by Gerhard Riesthuis with the help of Winfried Schmitz-Esser. It comprises altogether 1148 titles from proceedings volumes, as well as from the journal. The Classification System for Knowledge Organization Literature, according to which the titles have been arranged, is placed on pages 192–201, followed by the outline of the Information Coding Classification. An author index has been added. Unfortunately there were severe backlogs during the years since 1999 due to the fact that the designated editor (after Ch. Gilreath) could not start his work immediately and gave up finally because of health reasons. Prof. Smiraglia’s diligence succeeded in having it on schedule again by 2008. His own sincere interest in this field has given the journal a new attraction, especially by his editorial of the last issue of 2005 with his question: “What exactly is knowledge organization?”^[56] A kind of an answer was meant to be provided by the article in the next issue (2006/1) *Knowledge Organization: A New Science?*^[57] which also tries to outline future tasks of this new (old) science (see the section “An Age-Old Activity and Its Future Possibilities”).

THE ISKO WEB SITE

The ISKO Web site is <http://www.isko.org/contact.html>. Under this address one will find the following entries: About ISKO, Join ISKO, *Knowledge Organization* journal, ISKO Events, ISKO Chapters, ISKO People, ISKO Publications, and Contact us.

AN AGE-OLD ACTIVITY AND ITS FUTURE POSSIBILITIES

The huge volume in which the Russian scholar, Eugen Shamurin^[58] described the past 3000 years of attempts to

develop instruments for the ordered collection of written material shows an interesting development from rather primitive lists of terms over elaborated schedules in the middle ages and the later centuries until the many classification schemes of the nineteenth century, of which some are still in use today, like the *Dewey Decimal Classification* and its younger offspring, the *Universal Decimal Classification* since in many revised editions. In the twentieth century, the Indian mathematician and librarian S. R. Ranganathan (1892–1972) enriched the field of classification with numerous new ideas, as well as practical advices especially by categorization of concepts—his so-called facet analysis—well described in his *Prolegomena to Library Classification* of 1967.^[59] His ideas were taken up by the British Classification Research Group already in 1959 and used in the elaboration of many special classification systems, as well as for the revision of the *Bliss Classification*. In Germany, the biologist Martin Scheele used the same approach for the organization of knowledge in biology^[60] and the author of this entry used it for the construction of an entirely new universal system, her fully faceted *Information Coding Classification*,^[61] which is not based on disciplines, as all the other universal systems, but on general objects of reality, having by this an ontological basis as described in Dahlberg^[62] and Dahlberg^[63] The essential new aspect governing ISKO and its adherents are the possibilities lying in the more exact ways of system building by concept analysis. As it was said above, a concept is a knowledge unit because it refers with its concept elements (characteristics) to the necessary properties which can be stated on a referent. Thus, the characteristics resulting from such statements are the (knowledge) elements which create the relationships between concepts (identity, similarity) and can be used for system and structure building. Already Linné had known this who constructed his ingenious schemes for animals and plants on their anatomic properties. From all of this, it should also be understood, that knowledge organization differs essentially from knowledge management, see the critical remarks by J. Essers and J. Schreine.^[64] See also work by Kasten.^[65]

We are confronted today in the Internet search engines with the difficulty of retrieving information just by names and terms without considering their conceptual relationships. Any approach ignoring and failing to use the indispensable conceptually linked methodology will go astray and engross the jungle of “knowledge” in the Web or in his/her own files. But it is very hard to convince newcomers of the need for conceptual interrelationships. Millions of dollars have been wasted already for projects of people who think that computers can do automatic indexing. R. Fugmann has shown this very clearly^[66] long ago. A paragon of systematic and definition-based organization of concepts is the UMLS, the Unified Medical Language System of the National Library of Medicine in Bethesda, Maryland. It should hopefully serve as a model for the elaboration of concept systems of other subject fields as well.

Apart from this, the tasks of today, for which ISKO stands, should be seen in the collaboration of classificationists with terminologists and experts from the subject fields in question, in order to elaborate in possible future *Institutes for Knowledge Organization* the concept systems for each known subject field and area. This then would result in the necessary order of our concepts and their terms which can be visualized in adequate schemes and used to the benefit of all those who need to understand the relationships which link up human knowledge to a whole. Any single item in isolation, i.e., without its connection to other items cannot be understood, this has already been stated by the German theologian and philosopher Paul Tillich.^[67] But the systematization of concepts is not an easy job, as Dagobert Soergel had stated in his first book of 1969 that "systematizing knowledge should occupy the same scientific rank as any original research work."^[68] It is therefore hoped that such a new approach to our age-old science of classification should now be recognized and taken up as an absolute necessity for the organization of our knowledge and the subsequent understanding of what we actually know.

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Internet Genres

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Abstract

Rhetoricians since Aristotle have attempted to classify communications or documents into categories or “genres” with similar form, topic, or purpose. This entry surveys research on genre as it relates to Internet documents. The entry briefly presents the concept of genre in general, and then reviews the evolution and emergence of genres on the Internet. It concludes with an examination of the possible use of genre for improving information access on the Internet, with specific discussion of the issues in developing taxonomies of genre and automatically recognizing document genre.

INTRODUCTION

Rhetoricians since Aristotle have attempted to classify documents into categories or “genres” with similar form, topic, or purpose. (In this entry, we adopt a broad definition of document as “signifying objects,”^[1] meaning something that serves as evidence, regardless of the particular medium or form.) Numerous definitions of genre have been debated in the applied linguistics community,^[2,3–7] while other groups have struggled with similar notions, such as discourse or document types, for example, in SGML.^[8] This entry, for example, is an instance of the *encyclopedia article* genre, commonly used to communicate the state of knowledge in a field. Other common genres include *letters* and *memos*, *project team meetings*, and *TV sitcoms*, all immediately recognizable by their typical purpose and characteristic form. In this entry, we provide a brief review of the concept of genre in general, drawing primarily on the cultural perspective of the New Rhetoric school,^[4,9] before addressing the theory and applications of genre for digital documents found on the Internet.

Genres define classes of similar documents. Such a categorization can be made on different bases and approaches to defining genre have focused on different aspects of documents (see Breure^[10] for a review of the development of the concept). Some genres are defined primarily in terms of the physical form, such as a *booklet* or *brochure*; still others in terms of the document form, such as *lists* or *directories*; while other genres are defined by purpose or function, such as a *proposal* or *inquiry*. However, most genres imply a combination of purpose and form,^[2] such as a *newsletter*, which communicates “the news of the day,” including multiple short articles and is distributed periodically to subscribers or members of an organization.

There is a close relation between the terms “genre” and “text type.” Lee^[11] distinguished between them by

suggesting that the term “genre” is often used for definitions based on external criteria, such as purpose, while “text type” is used for definitions based on internal criteria, such as form, but goes on to conclude that genre can be used “to describe most of the corpus categories we have seen.” (Moessner^[12] makes the same distinction.) For the purpose of this entry, we will use the term genre as including aspects of both form and purpose.

Campbell and Jamieson^[2] suggested that genres arise as responses to recurrent communicative situations. Given a recognized need to communicate (i.e., a purpose^[13]), individuals will typically express similar social motives, themes, and topics in a communication with similar physical and linguistic characteristics (i.e., form), that is, they will communicate in a recognized genre. Miller^[6] argued that the situations that give rise to the use of genres are social situations and that the process of creating genre is one of typification, as similarities in situations are recognized. If the typification is useful, the use of the genre becomes routine. She further argued that genres must accomplish a recognized social function and criticized the labeling of *environmental impact statements* as a genre because they did not meet this criterion, but rather had multiple conflicting motives.

Swales^[7] similarly viewed genres as “a system for accomplishing social purposes by verbal means.” He suggested analyzing documents in terms of their exhibited characteristic moves, defined as “a functional unit, used for some identifiable rhetorical purpose.”^[14] For example, Swales^[7] analyzed the *introduction*, *methods*, *results*, *discussion*, and *conclusion sections* of research articles as well as briefly touching on other research process genres, such as *abstracts*, *presentation*, *theses*, and *grant proposals*. Following Swales’s^[7] approach, researchers have described other scientific genres such as *research paper abstracts*,^[15] and *discussion sections*,^[16] *grant proposals*,^[14] *posters*,^[17] and other *visual presentations at scientific meetings*^[18] and *French thesis defences*.^[19]

Researchers have examined as well as journalistic genres such as *news*,^[20,21] *editorial letters*,^[22] and *magazine covers*,^[23] and genres from the commercial world, such as *business letters of negotiation*,^[24] *letters of application for jobs*,^[25] *Chinese sales letters*,^[26] *environmental impact statements*,^[27] *building reviews*,^[28] and *philanthropic direct mail*.^[29]

THEORY: DOCUMENTS AND GENRE

Viewed from the perspective of the reader of a document, identification of a document's genre makes the document more easily recognizable and understandable, thus reducing the cognitive load of processing it.^[30] Because we drew on the *encyclopedia article* genre in writing this entry, for example, a reader should be able to more quickly determine the purpose and content of our communication and begin to evaluate its contribution. The form of the article gives hints to its meaning and appropriate uses. Similarly, following the form of the genre of a *research article*, *letter of application*, *parking ticket*, or *bank statement* makes the corresponding documents easier to recognize, to assess, and to use. This effect has been demonstrated experimentally: Vaughan and Dillon^[31] found that readers of a Web newspaper that followed genre conventions reported better comprehension, usability, and ease of navigation than readers of a purported newspaper that did not. Knowledge of genres can similarly help creators of documents by providing a known form for achieving a communicative purpose. Rather than having to innovate in all aspects of a document, a writer can reuse the form of a familiar genre to achieve their purpose. Teaching of genres is thus seen as an important aspect of teaching language and communication, for example, in elementary,^[32] second language,^[33] and English for Special Purposes^[34] education.

In addition to helping senders and recipients singly, knowledge of genres can also facilitate interaction, since multiple communications may be performed in a recognizable pattern, what Bazerman^[35] called a "genre system." In other words, recognizing that a communication is of a particular genre may suggest the form expected for the reply. Swales^[36] similarly defined a "genre chain" as a sequence of documents of different genres on a given topic. Examples include the sequence of *examination* and *cross-examination* in a trial, or the cycle of *article submission* to a journal or conference, *reviews*, *final acceptance* or *rejection letters* and publication. In each case, knowledge of the genre system provides information about how to proceed with the interaction. For example, Tardy^[37] examined the genre system of research funding, identifying an interlocking set of genres such as a *research agency's mission statement* and *program information*, *informal meetings with program officers*, *applications*, *panel reviews*, and *decisions*. Antunes, Costas, and

Dias^[38] analyzed genres related to electronic meetings. Features of a genre may enable their use in a genre system: for example, page numbers in a *technical paper* make it possible to more precisely cite concepts or quotations from the paper, thus binding the paper into the literature.

For genres to be of aid in communication though, they must be shared across the members of particular discourse communities.^[7] Thus, genres are socially situated. Teachers and rhetoricians have acknowledged that learning about genres, and through genres, is learning how to participate in a community (e.g., Chapman, M.L.^[32]). On the other hand, a genre may be unfamiliar or hard to understand for someone outside of the community. In fact, recognition of a particular genre is one sign of membership in a particular community (one needs only to witness the uncritical citing habits of college students who are not able to distinguish a popular Web genre from a serious scholarly one). Indeed, Freedman and Medway^[39] suggest that incomprehensible genres may even be used deliberately to defend positions of privilege. Thus genres are not only a type of discourse but are themselves embodiments of social or communicative events.^[40]

Leveraging the situated character of genres, Yates and Orlikowski^[41,42] proposed using them as a lens into organizational practices. Studying organizational discourse as examples of genres, anchors, and situates the investigation in a way that other approaches could not because each genre has within it the information for how it should be interpreted within a particular discourse community. For example, Yates, Orlikowski, and Okamura^[43] contrasted the explicit and implicit structuring of genres in the introduction of a new communications system, and Schryer and Spoel^[44] examined genres as a way to understand professional identity formation of medical students and of midwives.

To capture these social elements, Orlikowski and Yates^[42] introduced the notion of a "genre repertoire," that is, the set of genres in use within a community. They noted that different communities use different genres in their communication, and use common genres with different frequencies. (Hengst and Miller^[45] refer to this situation as the "pervasive heterogeneity" of genres). These differences provide one source of insight into the communicative (and other) practices of the community. For example, a community of social scientists and computer scientists can be distinguished by the frequency of use of different paper genres, as well as the paucity of computer programs and program documentation created in the former, reflecting different modes of research.

Of course, the reality of documents and genre is not as clear-cut as the theory above suggests. First, not all communications or documents are necessarily generic. For example, Swales^[7] ruled out conversation as a genre, arguing that the concept only applies to completed texts. Pieces of text or unfinished texts may not be generic. As well, if genres are formed in response to recurrent

communicative needs, then communications in novel (or even relatively novel) situations may also not be generic. This circumstance may describe large portions of the communication taking place via the Internet (and so of the documents found there). Even in typified circumstances, an author may deliberately or inadvertently fail to reproduce the necessary form of a genre, again producing a non-generic document. Finally, the relation amongst genres in a genre system is rarely linear; in any given situation, there may be a set of appropriate responses.^[34]

Furthermore, the boundaries between genres are often fuzzy and documents may show considerable variation in form even within a genre.^[12,46] As a result, it may be helpful to think of genres defined by exemplars and documents as being more or less good examples of a genre rather than attempting to draw firm boundaries. As well, as Orlikowski and Yates^[42] point out, some communications use multiple genres simultaneously, such as a *proposal* embedded in a *memo* or a *book chapter* in a *book*, along with *table of contents* or *index*. Other documents might have some mixed attributes, e.g., *bibliography* that is also an *index to a document collection*. As a result, the mapping of documents to genre may be one to many. This mixing of genres is likely to be particularly problematic for digital documents, which can have multiple forms of presentation.

Further complicating the study of genre is the fact that knowledge of genres tends to be quite tacit and situated in use. Being able to recognize or use a genre is typically knowing “how to go on”^[47] in a particular situation rather than formal articulable knowledge. The genre analyses cited above are research contributions precisely because they required research to uncover the hidden regularities in the documents. In practice, an individual may recognize and be able to use a document, while being unable to articulate a name for its particular genre or to say how they know what it is or which particular features are important for defining the form. When tested out of context, users may find genre hard to apply. For example, Santini^[48] had 135 users to classify the genre of 25 Web pages and found high levels of agreement on only a handful of documents, while others attracted as many as four equally popular labels. Similarly, in a study with 102 Web pages, Rosso^[49] found a wide variety of genre terms^[49] when three users were asked to pick their own labels. On the other hand, in a study with 257 users and 55 pages, he obtained a reasonable level of agreement (70%) when the choice was restricted to one of 18 terms, again suggesting that genre can be recognized more easily than produced.

INTERNET GENRES

We now turn our focus to genres of digital documents found on the Internet. The Internet and in particular the World Wide Web provides a particularly interesting

setting in which to study the use and development of genres for several reasons. First, the capabilities of the new medium have led to the development of many new genres of communication. Space limitations preclude a comprehensive review of the development of the Internet from the Advanced Research Project Agency Network’s (ARPAnet’s) four computers in 1969 to the immense and nearly ubiquitous network of today, but we note that the increased functionality of the Internet has been paralleled by an explosion in Internet genres. In particular, the technology of the Web extends the notion of a document—and thus the notion of genre—because Web pages can provide functionality in addition to information. Indeed, some Web pages are more comparable to computer interfaces than to conventional paper documents. As a result, functionality may be important in understanding genres on the Internet. Furthermore, the rapid development of this medium suggests a high level of experimentation with potential genres. Bearman,^[50] for examples, notes the rapid evolution in what he refers to as “forms of material” in electronic media in general.

Second, since many Web sites are open to the public, many examples of Web communication are easily available for study. Furthermore, because there is no central management of the Internet or the Web, there is no explicit management or enforcement of genres of communication, as might happen in the introduction of a communication system in a corporate environment.^[51] Instead, individual Web developers individually choose how to present their information, drawing on their understanding as members of a community, what Orlikowski et al.^[51] called implicit structuring (in this case, from the point of view of the Web page developer rather than the recipient of the communication). Yates and Sumner refer to the “democratization of genre production” as “communities evolve increasingly well-defined genres to better support their particular communicative needs and work practices.”^[52] However, even in this free-for-all, mutual acceptance of genre is important to enable communications. Yates and Sumner^[52] argue that on the Web, genres help in both the production and consumption of documents because genre adds “fixity” in a medium that does not otherwise distinguish very well between text types (say, a *book* and a *post-it*).

Finally, there are many communities meeting on the Web, bringing experiences with different genres and using the Web for many different purposes. The Web is sometimes used for direct communication where someone with a Web server “delivers” a document to members of a known community by giving them a URL. For example, some academics use the Web to communicate with colleagues by publishing their own papers, and with students by publishing syllabi and assignments. Another example of communication within a predictable community is computer companies announcing new products, publishing catalogs, or providing troubleshooting tips online for

their customers. However, in many other cases the audience is unpredictable. Unlike the Usenet or electronic mail groups, there is no clear separation of communities into different channels of communication (as is the case for journals or talks given at conferences, for which the audience is likely to have shared interests).

Indeed, it seems a stretch to say that there is a single Web community at all. Instead, the genre repertoire reflected in a collection of Web pages will be the result of interactions within and among multiple communities. In some cases, a genre may act as a type of boundary object,^[53] providing a common point of contact between different groups.^[39] In others, this mixing may lead to genre confusion, meaning that there is a practical need to understand the way genres enable communication. For example, organizations have used the Web to publish information such as *product brochures*, *annual reports*, *country, state, and city home pages*, *government agency press releases*, etc. These organizations tend to use familiar genres when putting information on the Web. However, a person happening to reach a document on one of their Web sites has a good chance of being outside the community in which that genre evolved. As a result the document may be confusing and the communicative purpose lost.

Evolution of Genres

To understand the evolution of genres on the Web, we draw on studies of how predigital genres have evolved over time. Drawing on Giddens^[47] structuration theory, Orlikowski and Yates^[42] argued that, "People produce, reproduce and change genres through a process of structuring." As members of the community draw on their knowledge of a genre repertoire to communicate, they reinforce the use of these genres, making them more appropriate or legitimate for use in the given situation. For example, by creating an order entry Web page that draws on the genre of a paper order form, a designer reinforces the appropriateness of the order form genre for this type of communication, making its use in future situations more likely. In other words, the set of genres in use (i.e., the genre repertoire) is both a product of and a shaper of the communicative practices of a community.

Orlikowski and Yates^[42] suggested that in a new situation (such as in the introduction of a new medium such as the Internet) individuals will typically draw on their existing genre repertoires, reproducing genres they have experienced as members of other communities. For example, Görlach^[46] notes the emergence of new genres, such as the *cooking recipe*, that draw on early genres, in this case the *medical recipe* (though he uses the term text type rather than genre). However, people are also free to modify a genre and communicate in a way that invokes only some of the expected aspects of a form. If these changes become repeatedly used (i.e., typified), they too may

become accepted and used together with or instead of existing genres, thus extending or altering the genre repertoire. Because the definition of genre relies on social acceptance, it is impossible to define the exact point at which a new genre emerges from the old one. Acceptance may take many years. However, after some period of coexistence, the new combination of form and purpose may become generally recognized and even named as a separate genre. As well, genres may be accepted in different communities at different rates. The emergence of distinctive new genres would be one sign of the formation of a new community with new communicative practices.

Take, for example, the *academic journal article*, a distinctive genre with the communicative goal of reporting research results and establishing a researcher's credentials and reputation. Journal articles have moved nearly intact to the Web and can be found in many online databases and on publishers' Web sites as well as, on the Web sites of individual authors. These documents are often identical to the paper versions, an example of a reproduced genre (literally reproduced, as in many cases, the Web versions are simple scans of the paper form). However, in a few cases, the form of the journal article has begun to change to take advantage of the possibilities of linking or embedding information. For example, citations in papers may be hyperlinks to the referenced articles. In part to enable easier searching of results, some journals now require *structured abstracts*, a particular genre of *abstract* with a distinctive form. Some publisher sites allow users to comment on papers, enabling more interactive follow-up discussion. Such documents are examples of adapted genres. Even more interesting is the emergence of forms other than journal articles for reporting research results, such as *datasets*, *software*, or other products of research, all examples of emergent genres. For example, researchers in genetics may publish *gene sequences* in a variety of specialized databases that can substitute in some case for a journal publication.^[54] Similar efforts are underway in other disciplines, meaning that the eventual form used for reporting research may bear only passing resemblance to the self-contained 20- to 25- page articles of today.

Related changes are already visible at the level of *journals*. For example, while paper journals are often reproduced on a Web site, there are now journals that publish only online editions, which need not conform to typical page limits or even have volumes at all (an adapted genre). There are suggestions that the increased use of online databases for finding articles (either by topical search or citation indexing), as opposed to subscribing to a handful of specific journals, is blurring previously distinct publications into "the literature."^[55] As a result, the need for individual journals with distinct missions and readerships may be reduced, as is the utility of the genre itself. Similarly, the widespread use of *working paper* archives and of general search engines that cover such "grey literature" (*working papers*, *conference papers*,

etc.) may blur the boundary between these genres and journal articles and thus lead to hybrid or novel genres. (Indeed, such a shift may have already happened in disciplines that value *conference papers* on par with *journal articles*, reducing the distinction between the purposes of these genres).

These emergent genres may be immediately accepted or, more likely, there may be a transition period during which the limits of the genre are renegotiated. For example, the *electronically distributed journal article* is still in transition.^[56,57] It is being used, but this adapted genre is not yet completely accepted or considered legitimate for all purposes (e.g., as evidence for a tenure case) by the academic community as a whole. As well, modifications of genres that are parts of genre systems may require corresponding changes to the rest of the system. For example, changes in citation habits will be necessary before page numbers can be dropped from the *technical paper* genre. Such interdependencies between genres will tend to slow the adoption of a new genre.

Internet Genres

While many genres have been reproduced more-or-less faithfully, as in the example of *journal articles*, the Internet has seen the rise of a few novel genres. In a study of 1000 Web documents, Crowston and Williams^[58] were able to identify documents of many familiar genres and of a few genres that seemed to be new to the Web, such as the *hotlist*. A specific example of a novel genre is the *home page*. As early as 1996, Furuta and Marshall^[59] noted the emergence of this genre as a result of the specific affordances of the Internet. While Bates and Lu in 1997 suggested that the *home page* genre was still inchoate,^[60] soon after Dillon and Gushrowski^[61] found that the features of *personal home pages* seemed to have stabilized rather quickly. The *Frequently Asked Questions (FAQ)* document emerged as a distinct genre on the Usenet and was then translated to the Web. An AltaVista search done by Crowston and Williams^[58] indicated approximately 170,000 Web pages with FAQ in their title (a search in 2007 with Google finds more than 16 million such pages).

Other authors have identified a variety of Internet specific genres. Some have to do with particular communications media used on the Internet, such as *e-mail message* or *Weblogs*. Gains^[62] analyzed small collections of *business* and *academic e-mail messages*. He suggested that e-mail as a whole has too many uses to be considered one genre and that the business e-mails analyzed “appear to follow the normal conventions for standard written business English,” suggesting that they did not include new genres. On the other hand, he noted that *academic e-mail messages* had some conversational features and suggested that the collection might include new genres of communications. Gruber^[63] analyzed contributions to two *academic mailing lists* as forming a single genre with

features of *academic letters* and *scholarly publication* as well as of oral communication. (It should be noted that these analyses were carried out when the medium was still novel to many users.) More recently, Barron^[64] analyzed the properties of *unsolicited commercial e-mail* (UCE or “spam”). She noted similarities between *spam* and other promotional genres, with moves such as capturing attention, establishing credentials, introducing the offer, and multiple moves soliciting a response. She noted differences though, such as the need to capture attention to get the message opened and the inclusion of offers to unsubscribe the recipient.

A more recent innovation is the *Weblog* or *blog*. Based on an analysis of a random sample of 203 blogs, Herring et al.^[65] characterized *blogs* as a “hybrid genre that draws from multiple sources” both off-line and Internet. They distinguished several types of *blogs* with different forms and purposes as well as distinct origins. They characterized most of their samples as *journal blogs*, which they suggested draw on the form and purpose of *diaries*, since they report the writer’s feelings rather than other content. A few were *filter blogs*, providing pointers to other content of interest and perhaps deriving from the earlier Web genre of *hotlists* or, they suggest, from the off-line antecedent of *letters to the editor*. Other types of blogs identified include *community*, *travel*, *memory*, and *communications blogs*, though these were rare in their sample.

Other authors have analyzed particular genres of documents commonly appearing on the Internet, such as the *personal home pages* mentioned above,^[59–61,66] *Web resumes*,^[67] *Internet advertising* (“netvertising”),^[68] and *online encyclopedias*.^[69] Howard^[70] went as far as to claim the existence of a “Web vernacular”, a particular form of Web page that was expected and so copied by commercial developers.

Still others have examined non-textual documents, such as *audio loops* (short sound sample),^[71] *multimedia*,^[72] and *databases*,^[73] as well as mixed media such as *PowerPoint presentations*.^[74] Exploration of genres of digital documents therefore blends at some point into the study of non-textual genres. The discussion above can be extended to such documents. For example, we can see the recreation of genres of music (e.g., *pop song* or *concerto*), even as the medium shifts from LP to CD to MP3, as well as adaptation of the genres of *television shows* to take advantage of the increased functionality (and decreased screen size) as they move from broadcast TV to Web distribution.

Genre Classification

While we do not have a list of all of the genres on the Internet (nor is it clear that such a thing is even possible), there is a substantial body of work categorizing genre in printed documents and some work studying them on the

Internet. Many attempts to develop a categorization of genres have been top-down, that is, they analyzed a set of documents based on theoretical principles or according to a priori classifications. A key difference in these efforts is the number of genre categories distinguished. Many studies of Web pages have used fewer broader categories: for example, zu Eissen and Stein^[75] used only eight genres (*help*; *article*; *discussion*; *shop*; *portrayal, non-private*; *portrayal, private*; *link collection*; and *download*). At the other extreme, Görlach^[46] offered a catalog of some 2000 genre (or text type) terms, which is intended to be an exhaustive list of the terms used in English. Somewhere in between, Lee^[11] categorized documents in the British National Corpus (BNC) into 70 genres or subgenres (with some document assigned more than one genre). However, he notes that the genre terms used were “meant to provide starting points, not a definitive taxonomy,” for example, grouping *textbooks* and *journal articles* as *academic texts* that can be further distinguished by medium.

If the classification includes more than a handful of terms, it is useful to group together similar terms and necessary to deal with terms of different levels of generality.^[11] For example, *social science papers* might be grouped with *computer science implementation papers*, *biology research papers*, and so on as examples of *academic papers*. These genres share some similarities, such as a title, abstract, and bibliography, but differ in other particulars, such as the expected section headings, types of arguments or evidence. Many organized lists of genres are structured as single hierarchies. Fig. 1 shows a small section of the hierarchy of genres of Web documents identified by Crowston and Williams.^[58] *Advertisements* and *announcements* are both examples of *declaratory document* genres; *classified advertisements* are a special kind of *advertisement*, and so on. Similarly, *social science papers*, *computer science papers*, and *biology papers* might be seen as examples of a more general genre of *research papers*, which are in turn examples of *papers* or *articles*.

An advantage of a hierarchy is that it avoids the need to predetermine the level of detail needed in the classification. Depending on the circumstances, we can consider genres at any of these different levels and different levels

might be more or less useful for different purposes. Of course, there is no guarantee that convenient and well-known terms will exist for all levels of the hierarchy. A second criticism of traditional hierarchies is that they rely on a single organizing principle, which may not be useful or appropriate for all cases. Harrell and Linkugel^[5] note that there are multiple bases on which such a classification could be constructed. To overcome this problem, Kwaśnik and Crowston^[76] suggested using the faceted-analysis approach, following the example of previous genre-identification studies such as Päivrinta,^[77] Tyrväinen and Päivrinta,^[78] and Karjalainen et al.^[79] who looked at the management of enterprise documents, and Kessler, Nunberg, and Schuetze^[80] who sought to identify a limited set of facets for communicative purposes. Crowston and Williams^[58] based their classification of genres on the *Art and Architecture Thesaurus*,^[81] which is also a faceted classification overall.

The previously discussed classification schemes can be described as top-down or *a priori*. Though this approach is quite common in conventional settings, given the communal nature of genres, a top-down approach to classification seems problematic. As genres are socially constructed, different social groups using documents with similar structural features may think about them and describe them differently (i.e., as different genres, though perhaps similar text types^[11]). While many genres may be widely shared, even more will be local to particular groups. Documents may be of genres that are not necessarily vetted by traditional schemes, particularly documents that come out of domain-specific work. Furthermore, while genres have always been conceptualized as dynamic, Dillon and Gushrowski^[61] point out that genres are no longer necessarily “slow-forming, often emerging only over generations of production and consumption...” Thus, a static typology of genre or document forms may not be sufficient to describe the emerging and dynamic genres in use on the Internet. It seems important instead to capture users’ own language and understanding of genres.

Some researchers have attempted to identify genres bottom-up through user studies. Dewe, Karlgren, and Bretan^[82] asked users to provide lists of genres found on the Web and received 67 responses. They noted though

<declaratory document genres>	
Advertisements	
Classified advertisements	Short paid announcements appearing in a periodical sorted according to the good or service being offered or requested
Announcements	Printed or published statements or notices that inform the reader of an event or other news
Custom 404 page	A Web page announcing that the requested Web page could not be found on the server
News bulletins	
Press releases	Official or authoritative statements giving information for publication in newspapers or periodicals

Fig. 1 A section of a hierarchy of document genres.

Source: Crowston, and Williams.[[104]]

that users tended to conflate genre and topic. Nilan, Pomerantz, and Paling^[83] surveyed 242 Web users in person and via the Web about their purpose in searching the Web, the genre of document expected and the actual document found, and collected 1335 example pages; genres could be assigned for 1076, giving a total of 116 genres. They then grouped the genres given, first following the plan of the *Art and Architecture Thesaurus* and second based bottom-up on the user responses. The second classification was much broader and shallower than the first, and some genres were classified in multiple locations, suggesting that there may be difference between genres in use and formal structured knowledge. Freund, Clarke, and Toms^[84] developed a list of 16 genres based on interviews with users and analysis of document repositories in a particular organization. They found that the 16 genres covered about 75% of documents randomly sampled from the repositories.

APPLICATIONS OF GENRE IN INFORMATION SCIENCE

In this final section, we discuss how ideas about genre might be applied to system design. Researchers have addressed a variety of information systems design questions, such as the use of genre to design electronic meeting systems^[38] or to guide assembly of output documents from a content management system, for example, creating training documents by reusing content from operations manuals.^[79,85] We will focus on one particular question likely to be of interest and importance to information scientists, namely how genre metadata might be used to improve information access on the Internet.

A significant problem in information access is that topic alone is not enough to define an information problem. Different users may require different solutions for seemingly similar topics because the situation (or context) of the user determines not only what topics are requested and what strategies are invoked in searching and evaluating output, but also what types of resources are considered relevant and useful. For example, “methods for learning mathematics” (a topic) will be construed differently by a student, by a parent, and by a classroom teacher because of their different information-use situations. Indeed, even the same user may require different information at different times.

Although we know that it is important to understand the situation of the user, the actual representation of situations and then their implementation in a system remains a difficult problem. Our efforts to create user profiles, universal situation grammars, and so on suffer from limitations of scope to specific domains and lack of extensibility and flexibility. However, in a study using Text Retrieval Conference data, Karlgren^[86] found significant differences in style between documents judged relevant and not relevant,

suggesting that non-topical metadata can be helpful. In particular, inclusion of genre information as non-topical characteristics of the documents might be useful as a signal to their purpose and so fit the user information need. For example, a university professor looking for information about computer database systems for the class that she teaches would most likely be interested in documents of educational genres (e.g., *syllabi*, *assignments*, *class notes*). On the other hand, when working on a research paper in the database area, the same professor would more likely appreciate scholarly work (e.g., *research papers*, *annotated biographies*, *calls for papers*). The relevant documents for these two searches would be quite different, even though the topic and query keywords might be nearly the same.

Explicit identification of genre seems likely to be particularly important for large digital collections (the Web being the largest) because—unlike earlier collections of documents comprising a limited set of genres (e.g., a document database containing primarily *journal articles*)—these collections contain documents addressing a diversity of discourse communities with a diversity of genres (e.g., *journal articles* but also *magazine articles*, *hot lists*, *memos*, *home pages*, *class syllabi*, etc.). A user searching such a diverse document collection by topic will likely receive some documents of relevant genres along with many documents of irrelevant genres—a low precision result—even if all retrieved documents conform to search specifications regarding the topical content of the document. This analysis suggests that one way to exploit genre information is to create specialized search engines that retrieve only documents of a particular genre. This approach has already been followed by several systems, such as Indeed for *job listings*, CiteSeer and Google Scholar for *academic articles* and various Google specialized searches for *blogs*, *books*, *business addresses*, *news articles*, *patents*, *product sales pages*, and *source code* (but excluding those specialized by media, e.g., searches for images or video).

A second way to use genre information is to enrich queries with information about expected genres of the results, for example, as a form of relevance feedback.^[86,87] Because most genres are characterized by both form and purpose, identifying the genre of a document provides information as to the document’s purpose and its fit to the user’s situation, which can be difficult to assess otherwise. When medical information is sought, identical keywords might retrieve a *newsletter*, a *personal home page*, a *journal article*, or a hospital’s *patient-information site*. A person searching for one of these genres is unlikely to be satisfied by the others.

Knowledge of the form of genres can also help in the process of matching documents to queries. For example, an *FAQ* document is divided into question and answer pairs (indeed, documents of many genres have a form with repeated subpieces). Requiring search terms to be found in

the same question-answer pair (or subpiece) may reduce spurious matches or false drops.

Once a search is completed, document genre may be useful to improve the accuracy of relevance judgments made to rank order search results. It has been noted that some genres are less likely to be relevant for the majority of search tasks. This implies that certain Web pages could be promoted or demoted in the ranked results if their genre were known. For example, it has been claimed that most searchers are not interested in retrieving *personal home pages*,^[88] so the latter could be moved down the results list by request. Bretan^[89] suggested using genre to group search results while Freund, Clarke, and Toms^[84] suggest filtering results.

Finally, a one-size-fits-all approach to summarizing or evaluating Web documents is likely to misrepresent many documents when confronted with diverse genres. For example, a *newspaper article* can often be summarized by the first few paragraphs of the document, but such an approach will not work for a *home page* or *FAQ*.^[90] Rehm^[91] analyzed the necessary components for a document to be an *academic home page* as a prelude to extracting information for further processing.

Automatic Identification of Document Genre

For genre to be useful in large-scale systems, techniques will be needed to automatically assign genre to large collections of documents. Researchers have tried numerous approaches to automatic genre identification; a sampling of studies is shown in Table 1. This work has used statistical (e.g., regression or discriminant analysis) or machine learning techniques (e.g., decision trees or support vector machines) to classify documents into genres based on features in the documents (Sebastiani^[92] has reviewed these techniques). Comparing the algorithm's assignment to the known genre measures the success of the classification. Table 1 presents accuracy, though the some authors compute both precision and recall. For example, Freund, Clarke, and Toms^[84] suggest that for filtering, higher recall might be preferred even at the cost of lower precision, to ensure that all documents of a given genre are presented to the user.

Document features that have been suggested for use in genre recognition include counts of specific words or of closed-class words (e.g., days of the week), counts and ratios of parts of speech, word and sentence length, layout features,^[93] punctuation,^[94] URLs, and HTML tags,^[95] and even the level of spelling and typing errors in the document.^[96] There has been a trend toward the use of larger and more comprehensive feature sets, from which the machine learning techniques can pick useful subsets. Which features are useful and necessary is still a topic for research. For example, Dewdney et al.^[93] suggested that presentation features alone were sufficient to recognize genre, while Ferizis and Bailey^[97] found that POS tagging

was not needed for genre recognition; since it is computationally expensive, avoiding these features may be desirable. Dong et al.^[98] found that more features increased recall but decreased precision, and that including more types of features improved both.

For statistical analysis or machine learning to be successful requires a large set of categorized documents to use as a training set. Creating such corpuses is time-consuming, so early studies used preexisting ones, such as the Brown corpus, which includes 500 samples (802 documents) in 15 text categories (*press reportage; press editorial; press reviews; religion; skill and hobbies; belles lettres; miscellaneous U.S. government and house organs; learned; fiction general; mystery and detective fiction; science fiction; romance and love story; and humor*). However, this corpus is not very suitable for the purpose as the average of 30 samples per genre is small for training and the categories mix topics and genres. More recent studies have created corpuses that are more focused and often larger (as large as 5–10 thousand pages with hundreds of examples of each genre). A concern here is the diversity of the documents included. Techniques applied to a corpus that includes only particular genres will yield more precise results than would be obtained with a more diverse sample.

Another key issue is number of genres to be recognized. Most studies have used small number of categories (from 4 to a maximum of 32, with a median of 10 in the studies in Table 1), which is small compared to the hundreds found in the user studies and general Web surveys reviewed above. Experimenters have examined fewer genres because increasing the number to be detected reduces precision and demands a larger corpus for training. But as Boese^[99] noted, definitions of broader categories have been “softer” to include more documents and so very broad categories may be less useful to users or for the information access systems discussed above. Another concern is that the design of classification interacts with the features chosen. Grouping together documents with similar purposes but dissimilar structural features (i.e., genres as opposed to text types) may be useful for users, but creates problems for automatic classification. With a faceted classification, different techniques could be used to recognize individual facets.^[100] Researchers have experimented with recognizing speech acts in e-mail,^[101] a document's degree of expertise, detail, and subjectivity,^[102] or positive and negative tone in reviews.^[103]

CONCLUSIONS AND OUTLOOK

The research reviewed in this entry suggests that genre provides a useful lens for examining Internet documents. First, knowing the set of genres in use by a target audience can help ensure that information presented is easily understood and used. As well, there seems to be good potential

Table 1 Studies of automated classification of documents by genre.

Study	Techniques	Features	Corpus	Typology	Results
Karlgren and Cutting ^[105]	Discriminant analysis	20 linguistic features, such as adverb count, character count, first person pronoun count, type/token ratio	Brown corpus	Brown corpus categories	52% accuracy overall; grouping all fiction together improved accuracy to 65%
Kessler, Numborg, and Schütze ^[80]	Logistic regression and neural nets	55 features including structural, lexical, character-level, and derivative cues	Brown corpus	Three part classification of 6 genres: reportage; editorial; scitech; legal; nonfiction; and fiction; plus “brow” (popular, middle, upper-middle, and high) and narrative (yes or no)	“Good results” for reportage and fiction but not for other genres. Only small difference between using surface and structural cues
Dewe et al. ^[82]	Classification rules	40 features including lexical, textual, and genre specific features	Own corpus of 1358 Web pages	11 genres: informal/private; public/commercial; searchable indexes; journalistic material; reports; other running text; FAQs; link collections; asynchronous multiparty correspondence; and error messages	90% accuracy on first split; 66–75% on remaining decisions
Wolters and Kirsten ^[106]	k-nearest neighbor classification, Relational Instance-Based Learning (RIBL); learning vector quantization; Instance Based Learning (IBL)	100, 500, or 1000 lemma features and 54 part of speech tags	Limas corpus, a collection of 500 German documents modelled on the Brown corpus	33 categories taken from the Deutsche Bibliographie (not all genres); but experiments run with fewer: academic texts from humanities and from science and technology; press texts; fiction; politics; law; and economy	75–100% precision in assignment, but each genre done is separately that the corpus provided too little material for training
Stamatatos et al. ^[94]	Regression and discriminant analysis suggest that regression works better than other techniques with a small number of training instances	22 features: token-level measures (e.g., word counts) and outputs from NLP processing (e.g., number of noun phrases detected, average length of a noun phrase)	Own corpus of 250 modern Greek documents, 25 of each genre	10 genres: press editorial; press reportage; official documents; literature; recipes; curricula vitae; interviews; planned speeches; and broadcast news, scripted	82% accuracy overall. Press editorial and press reportage often confused
Dewdney et al. ^[93]	Support Vector Machine (SVM), decision tree and naïve Bayes	323 word features and 89 presentation features: closed-class words, parts of speech, word and sentence length, punctuation, layout features	CMU corpus of 9750 documents	7 genres: advertisement; bulletin board; frequently asked questions; message board; radio news; Reuters newswire; television news	89% accuracy. Presentation features alone were sufficient to classify genre
Lim et al. ^[95]	Tilburg Memory Based Learner (TiMBL)	329 features in five sets: URL, HTML tags, token information, lexical information, and structural information	Own corpus of 1224 Web pages	16 genres: Dewe et al.’s ^[82] taxonomy, plus product specifications and image collections, and splitting public and commercial homepages in two, and reports into research reports, official materials and informative materials	74% accuracy in assignment; improved slightly with optimal subset of features. Could not reliably determine genre for input pages and other
Bisant ^[107]	Neural network with hidden layer, decision trees, SVM	89 features including part of speech and characters. Analysis shows 25 are not useful	Own corpus of 5000 e-mails and Web pages	10 genres: advertisement, business correspondence, data entry forms, e-mail administration, e-zine, friend correspondence, Internet chat, news, notices, and technical data	86% overall accuracy using neural nets with considerable variation. Decision trees are 79% accurate. Notices confused with news

(Continued)

Table 1 Studies of automated classification of documents by genre. (*Continued*)

Study	Techniques	Features	Corpus	Typology	Results
Boese ^[99]	Bayes Net, decision trees, logit boost, bagging	Considered 1600 features: style, form, content. Narrowed to a set of 78	Own corpus of 343 Web pages	Developed classification of 115 genres but used 10 for experiments: abstract; call for papers; FAQ; how-to; hub/sitemap; job description; resume/CV; statistics; syllabus; and technical paper	91% accuracy using logit boost and 78 features
Freund et al. ^[84]	SVM light	"Bag of words," but no structural features	Own corpus of 800 documents (about 50 per genre) drawn from repositories in a single organization	16 genres (manuals; presentations; product documents; technotes, tips; tutorials and labs; white papers; best practices; design patterns; discussions/forums; cookbooks and guides; engagement summaries; problem reports; technical articles) developed within a specific organization	81–97% recall, but lower precision
Stubbe et al. ^[96]	Decision trees	Hand selected sets of genre-specific features: form, vocabulary and parts of speech, complex patterns, level of typing errors	Own corpus of 1280 Web pages, 40 of each genre	32 genres in 8 broad classes: journalism, literature, information, documentation, directory, communication, nothing	78% accuracy at first level; 72% at second level with considerable variation
Dong et al. ^[98]	Naïve Bayesian	5, 20, or 100 features from form, content, and functionality	Corpus of 1280 Web pages; 170 of 4 genres (3 from Santini, M. ^[48]) plus 600 random pages	genres: FAQ; news; e-shopping; personal home pages	86–92% accuracy (precision). Precision improved by fewer features, but recall by more. More types of features improved both

to incorporate genre metadata in information access systems. However, to realize these benefits, more research is needed. First, we do not as yet have a fully articulated set of data that reveals what genres various target groups recognize nor for what tasks they find documents of specific genres useful. Second, while genre recognition has improved, it is still limited in the number of genres that can be detected reliably. These two research agendas interact, as better knowledge of the genres in use will inform our attempts to recognize and use them in future Internet systems.

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Internet Search Tools: History to 2000

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Abstract

The early history of Internet search systems was quite diverse, and went through several stages before settling into the more mature recent environment of a few major search engines. The authors note: "From the early beginnings of Telnet, File Transfer Protocol (FTP), Archie, Veronica, and Gopher to the current iterations of Web search engines and search directories that use graphical interfaces, spiders, worms, robots, complex algorithms, proprietary information, competing interfaces, and advertising, access to the vast store of materials that is the Internet has depended upon search tools."

INTRODUCTION

Finding information on the Internet and the World Wide Web (WWW) has always been somewhat like trying to find a needle in a haystack. An added dimension to the haystack metaphor is that the Internet environment is a dynamic collection of information. Changes occur almost every second. New pages are added. Old pages are deleted or altered. From the very beginning of the World Wide Web (WWW), search tools were needed to create order and provide an interface that allowed users to retrieve current documents while at the same time deleting inactive sites. Search databases and indexes could not be static; neither could the interface that served as the public relations instrument for the product. The tools of Internet searching emerged from the simple and modest beginnings of research and graduate school projects to the highly competitive and highly secretive proprietary corporate environment. As search tools evolved, they changed not only how people find information, but also how they viewed the world of the twenty-first century.

The Internet grew out of a need to connect computers at one location to computers at other locations, thus creating a globalization of shared resources. The early iterations of shared data were basic but grew rapidly as more and more computers became connected. Connectivity led to an information base that multiplied and evolved exponentially. This information base ultimately became unwieldy, and some of the early Internet pioneers began to see the necessity for both an organizational scheme and a method for accessing what was available. Each new tool provided more order, and in general an improved searching mechanism. From the early beginnings of Telnet, File Transfer Protocol (FTP), Archie, Veronica, and Gopher to the current iterations of Web search engines and search directories that use graphical interfaces, spiders, worms, robots, complex algorithms, proprietary information,

competing interfaces, and advertising, access to the vast store of materials that is the Internet has depended upon search tools.

THE BEGINNINGS

What we now know as the Internet had its origins in the early 1960s by several visionary thinkers who understood the value of having computers linked to one another and being able to share information. Most applications were in the scientific and military fields at that time. Early developers included J. C. R. Licklider from MIT, who proposed a global network of computers in 1962. Licklider moved to the Defense Advanced Research Projects Agency (DARPA) and became the head of the project in late 1962. Leonard Kleinrock from UCLA developed the theory of packet switching that later became the basis for Internet connections. An MIT professor, Lawrence Roberts, connected two computers via telephone lines in 1965. Roberts became part of DARPA in 1966 and developed the plan for ARPANET. In 1969, the U.S. Department of Defense changed the name of DARPA to the Advanced Research Projects Agency (ARPA).

The purpose of ARPA was to develop and maintain automated communication methods that would operate in an emergency. As a result, ARPANET, a distributed communications network capable of communicating with multiple computer platforms, was born in 1969. Ultimately, these multiplatform and multichannel methods became known as the transmission control protocol and Internet protocol (TCP/IP), which for the most part defines the Internet as it is now configured today. Data are encoded and transmitted between computers via the common format TCP/IP provides. TCP/IP protocol was first proposed by Bob Kahn at BBN Technologies, a division of GTE, and further developed by Kahn and Vint Cerf at Stanford.

The National Science Foundations (NSF) extended its network in the 1980s to increase international educational and research opportunities. This network used NSF computers for data storage, file transfer, and E-mail. NSFnet evolved into what is now known as the Internet. It incorporated the TCP/IP format. As the Internet grew, there became an increasing need for better tools to access and organize information. Using FTP information could be shared between computers. File transfer protocol enables a user to obtain files of text, executable programs, graphics, movies, sound files, and other information, but early restrictions of FTP sites allowed only short names with little description about content. Files were often named README, INDEX, NOTICE, ABOUT, and other variations. These file names were typically capitalized, so they appeared in a more prominent position in a list of entries. There were thousands of FTP sites across the world, but each site was a collection of files that were not searchable. A user would have to visit each FTP site and browse through the files to hopefully discover relevant information. Archie, Veronica, Gopher, Wide Area Information System (WAIS), and others were the early search tools of the Internet—the first attempts to provide more order and searchability. Although these early tools are still accessible today, they were developed prior to Web browsers and have generally been replaced by more popular Web search tools.

Archie

In 1990 Alan Emtage, Peter Deutsch, Bill Heelan, and others created the oldest search engine at McGill University in Montreal. At the time, there was no World Wide Web, and files were scattered over a vast network. These files were stored and retrieved via FTP. The transfer of publicly available information has been one of the most widespread uses of the file transfer capability on the Internet. Institutions and organizations throughout the world provide openly accessible file transfer sites with information that anyone can obtain. Archie short for “archives,” was a manually indexed system for exchanging these types of files, particularly the very popular anonymous FTP sites, which were repositories of files that anyone could access. Archie was a search tool for finding things in FTP space based on keywords.

Prior to Archie, a system administrator set files up on a computer called an FTP server. Those files could then be retrieved by someone else by connecting to the files via an FTP client following specifications set forth in FTP protocol. These files were generally shared by sending an E-mail alerting others of the location of the files or by posting a message to a listserv or discussion forum. Archie used a script-based data gatherer to retrieve listings of anonymous FTP files. It then made these files accessible by indexing them. The result was a method of organizing files into accessible listings, but Archie servers generally contained only a small portion of available information.

Gopher

Gopher was developed at the University of Minnesota in 1991. It was named Gopher after the University’s mascot—the Golden Gopher—suggesting a user “go for” information. Gopher was designed to be an easy, menu-driven way of finding online information. Mark MacCahill, project leader, described the program as “the first Internet application that my mom and dad could use.” Gopher did not require any knowledge of computer architecture or UNIX to use. Gopher was like FTP except that it retrieved plain-text documents rather than files, having no images or hypertext. In a gopher system, typing or clicking on a number that represented the document on a menu accessed a hierarchically structured list of documents. Menu entries were more descriptive than FTP sites. Gopher searched through files and resources in a variety of formats—text, Telnet sites, WAIS databases, and a wide range of other data—in order to find online information.

Gopher was popular for several years, especially at universities, because it provided a way to share text files from all over the world. Gopher was a step toward the WWW hypertext transfer protocol (HTTP). Ultimately with the advent of hypertext links, hypertext markup language (HTML), and a graphical browser—Mosaic and later Netscape—the Web quickly transcended gopher. Most gopher text files were eventually transferred to Web documents, but many original file structures still exist on university servers. A gopher client program is needed to run gopher. Public gopher sites are available via Telnet without the client program, however. To explore an example of gopher information hierarchy, go to the gopher menu at the University of Minnesota at: <gopher://gopher.tc.umn.edu:70/11/Other%20Gopher%20and%20Information%20Serves>. The major limitation of Gopher was burrowing through all the sites to find needed information. Like FTP files, Gopher needed keyword searching to access information more effectively.

Veronica

The usability of Gopher was further enhanced by the development of Veronica at the University of Nevada at Reno. Fred Barrie did most of the programming. Veronica stands for very easy rodent-oriented netwide index to computerized archives. Rodent-oriented refers to the way in which Veronica works with the Internet’s gopher systems. Veronica searched public-access gopher menus using keywords in much the same way as Archie searched FTP sites. Veronica retrieved a list of entries from various gopher sites throughout the world and enabled a user to browse entries from a newly created single menu composed of entries related to the search query. Like Archie, however, the major drawback of Veronica was that it searched only file names, not the contents of files.

Jughead

Jughead, an acronym for Jonzy's universal gopher hierarchy excavation and display, is another gopher search service that works in a way similar to Veronica. Rhett "Jonzy" Jones developed Jughead in 1993 at the University of Utah. Jughead allowed keyword searching throughout all levels of a gopher menu rather than moving from one menu level to another. Jughead did little to improve upon Veronica, which lends credence to the belief that it was invented primarily to round out the comic-strip characters rather than providing much new in terms of searching software. Jughead did, however, allow Boolean "and, or, not" searching and recognized truncations using an asterisk after the root of a term.

WAIS

The WAIS was developed by Brewster Kahle at Thinking Machines Corporation of Cambridge, Massachusetts, in collaboration with Apple Computer, Dow Jones, and KPMG Peat Marwick. It was developed at about the same time as Archie, in the early 1990s. WAIS was a system for organizing information into databases that could be searched using commands known as natural query language. The WAIS software performed keyword searches of databases and refined searches based on relevancy as determined by an algorithm—a series of steps or formulas designed to retrieve information by indexing data based on "weighting." The intent was to give more relevant documents a higher score or weight based on the search query. The WAIS search engine processed a search by retrieving a relevance-ranked list of documents. Each document was given a score from 1 to 1000 based on how well it matched the search expression. A search could be executed in the form of a question, through natural language, or by use of specified fields. To use WAIS effectively to find information, files and data in every site needed to be indexed, which was not the case. After the introduction of Mosaic and Netscape, WAIS was eventually used as a back end search engine for HTTP servers to find everything from relative hyperlinks to image references.

Search Tools: The World Wide Web and the Next Generation

When Tim Berners-Lee developed HTTP, the basis for graphical interface to the Internet, the WWW was born. The WWW changed the face of the Internet so much that the words Web and Internet became almost synonymous. HTML, the standard coding language for viewing and linking documents, allowed users to move from document to document by simply clicking a link. HTML also provided access to graphical representations and images. Telnet, FTP, Archie, and Gopher required knowledge of how to navigate nonintuitive interfaces.

A variety of databases that could be described as search tools were developed for the WWW. When the Web was in its infancy, Lynx was the browser of the day. Lynx was a text-based interface in which a user entered a specific address of a known page and began to "surf" through information by following links. It was possible at the time to navigate through the available information because the Web was relatively small. In 1992, the number of hosts or servers storing sites had just grown to over 1,000,000; in January 2000, that figure had grown to more than 72,000,000. With the introduction of Mosaic early in 1993 and its offshoot Netscape—graphical user interfaces or Web browsers—the Internet became more accessible, and individuals with personal computers took notice.

While Gopher was an improvement over the capabilities of Archie, it was essentially a table of contents that provided access to downloadable files. Veronica and Jughead advanced that technology, making gopher files searchable, but the Web offered users the ability to display text, graphics, illustrations, sound, video, voice, and other forms of information. Search tools depended on interfaces and the technology that created search engines, human-indexed subject directories, and other more user-friendly means of accessing information from the Internet. As search tools improved, easier, more intuitive modes of navigating the Internet and transferring information became readily available. With improved access to information, the WWW and Internet grew in staggering proportions.

Search Engine Technology: Robots, Spiders, Wanderers, Crawlers, and Indexers

Modern search engines are indexed databases of Web pages compiled by powerful programs called robots (also called bots, spiders, wanderers, or crawlers). Robots are a key component in Web search technology. They can perform a variety of tasks very quickly and efficiently, such as indexing, statistical analysis, maintenance, mirroring, and discovering new resources throughout the Internet. In addition, robots can be programmed to do one or several of these operations. In the early days of robots, bandwidth was at a premium and the seemingly tireless bots created a drain on server loads. During the minutes after the O. J. Simpson verdict, the CNN site was so overloaded it was virtually inaccessible.

Robots are basically software programs that work by retrieving documents using HTTP to request a specific Uniform Resource Locator (URL)—essentially the "address" to a Web page. Robots do not actually go anywhere. More accurately, they establish a connection with another server and compile the information about specific URLs or Web documents. The Internet search engine that uses a robot is essentially a program that searches documents for specified keywords and returns a list of the documents in which the keywords were found. A typical

search engine works by sending out a request through a robot program that retrieves as many documents as possible. The robot moves through the Web surveying pages and indexing most of the words on publicly available sites. Most robots begin by searching an active page with a variety of links, following the links on the page to other pages and other links.

Another program, called an indexer, then reads these documents and creates an index based on the words contained in each document. By systematically exploring all links on a starter page and following those links, the spider tracks a large number of pages in the database and creates listings based on keywords. Every search engine uses different information from the Web sites to create its database. For example, some will use just the title and the first 20 words of the Web page. Others may go further, examining links and headers on a page. Consequently, the databases of search tools contain a variety of differing information, sometimes collected from the same sites. The spider will later return to sites to check for changes, adding and deleting content as necessary. A critical measure of a search engine is how often it refreshes its database to remove dead links and add revised pages.

When a query is sent to a search engine, the engine scans the database and matches keywords and phrases from the query with those in texts of collected Web sites. Every search engine has its own proprietary algorithm that ideally retrieves meaningful and relevant results for specific queries or searches. It is precisely these distinctly different and secretive programs for displaying a retrieval set that offer more variations and options to finding information on the Internet.

The Wanderer

The Wanderer, the first program to automatically traverse the Web, was created by Mathew Gray and is described by some as “the mother of all search engines.” The Wanderer was the first autonomous robot program designed to search the Internet for Web pages to track the growth of the Web. At first, the Wanderer only counted Web servers, but before long it started capturing URLs. The resulting database of URLs was dubbed Wandex. The Wanderer was contentious when it was first introduced because the early version of the software created a noticeable slowness across the entire network. The Wanderer’s bot program often accessed the same pages hundreds of times during the same day. The Web robot was a significant innovation, however, because it automatically combed through Web documents at a speed fast enough to maintain a current database that included new pages, updates, and revisions as well as renamed and relocated documents. While the Wanderer used a single bot program, search tools eventually began using multiple bots or spiders that perform different tasks. This was the beginning of the automated Web searcher.

ALIWEB

ALIWEB, created in October 1993 by Martijn Koster, was an early project designed to index the contents of Web servers. The name ALIWEB is derived from the name Archie-like indexing of the Web. It is unique because it is the hypertext equivalent of Archie. Unlike the Wanderer, ALIWEB does not have a Web-searching robot. Webmasters posted information for each page in order to have them included in the database. While this allowed the creators of Web pages to describe and index their own sites, it also required that they maintain a special ALIWEB file on their server. ALIWEB then used a robot to search for these special files, compiling them into an index. The disadvantage of this system is the most Web page developers either did not bother or did not understand how to create the special indexing file required, and therefore very few pages were submitted to the Internet utility. The major difference between ALIWEB and other search engines is that the typically proprietary information about how the robot worked was posted on the Internet by Koster. This allowed other programmers to modify future robots to perform additional tasks, such as finding additional Web pages and gathering information from the text of those pages. It even became possible for individual users to configure their own spiders to find sites about specific topics and automatically retrieve the information from those sites.

THE UNIVERSITY CONNECTION

Jumpstation

Many Internet search tools had their origins at the graduate schools of various major universities. In 1993, after Mathew Gray’s Wanderer unleashed the first bot program, three search engines powered by “robots” made their debut. Jumpstation was a weekend project created by Jonathan Fletcher at the University of Stirling in Scotland. Jumpstation gathered information about the title and header from Web pages, matching keywords in a linear fashion as it went. As the Web grew, the system slowed gradually before coming to a halt.

World Wide Web Worm

The WWW worm—started by Oliver McBryan at the University of Colorado—indexed only titles and URLs that it visited. The worm was first publicly available in February 1994. By following the hypertext links on Web sites, the worm took advantage of indexing sites that were “worthy” of a link by another site—an early system of referral using linking structures. On the downside, the worm also relied on the authors of Web pages for

descriptive titles and other information about a site. At the time, few authors were sophisticated enough to use metatags and other more current Web designs that provided titles or descriptions. Consequently, Web sites with little or no descriptive information could not be retrieved.

The Repository-Based Software Engineering (RBSE) Spider

The repository-based software engineering (RBSE) spider was developed and operated as part of the NASA-funded repository based software engineering program at the Research Institute for Computing and Information Systems, University of Houston, Clear Lake, by David Eichman. The search tool employed a robot that could go beyond the title and URL to index the text within Web pages. RSBE used two robots—one robot for finding and compiling URLs and a second for retrieving and indexing documents based on actual content. In addition, RBSE improved searching by implementing a primitive ranking system based on relevance. The search results for its predecessors, Jumpstation and the WWW worm, were posted in the order they were found, so often the results were often irrelevant.

EINet Galaxy

Another early search tool to emerge during this time was the Enterprise Integration Network—EINet Galaxy. EINet was the first Web search directory that could be browsed or searched. Launched in January of 1994, EINet Galaxy combined WWW and WAIS technologies, compiling information into a hierarchical list of sites organized by subject categories. The original prototype was associated with the DARPA-funded Manufacturing Automation and Design Engineering (MADE) program, intended to explore technologies for providing large-scale directory services in support of electronic commerce.

EINet's directory was created and maintained by humans, as opposed to the robots used by search engines. As one of the original "search directories," EINet originated categories that are fairly common in more modern search tools. The original Galaxy index arranged information under nine topics: arts and humanities, business administration and management, engineering and technology, general and interdisciplinary information, leisure and recreation, science, government, social sciences, and community. Each URL that was added to the site was submitted to EINet, then reviewed by editors specializing in subject areas. The search directory generally retrieved higher-quality Web sites that were more relevant, but also had a database of far fewer sites because they were cataloged by hand. EINet was purchased in 1998 by GoTo.com and merged with Fox/News Corporation in May 1999.

Yahoo!

In April of 1994, two electrical engineering Ph.D. candidates, David Filo and Jerry Yang from Stanford University, started a guide of personal interest Web pages that became quite popular. The guide began as a humble Web site named "Jerry's Guide to the World Wide Web." It was a student project that was a small collection of their favorite Web pages. When the collection began to become unwieldy, Filo and Yang broke the links into categories, then later subcategories. There was no business plan or calculated design to become a major publicly traded corporation. Filo and Yang were trying to create something that would make finding information on what was at the time a very small WWW. The guide became popular by word of mouth and E-mails to friends who then told others. As it continued to grow, Filo and Yang changed the name to Yahoo! which stood for "yet another hierarchical officious oracle." They chose the name as a reference to themselves as a couple of "yahoos," a term originating from Jonathan Swift's *Gulliver's Travels* that referred to a boorish, foolish class of people.

It was Filo and Yang's "foolishness" that led to one of the premier search services on the Internet. The database of categorized links first resided on Yang's computer, "akebono," a hierarchically organized list of 14 broad categories covering subjects such as business and economy, computers and the Internet, entertainment, and health. By following the hierarchy, a searcher could click down the subject areas from the main subject areas to thousands of deliberately chosen Web sites. As Yahoo! grew, a simple search engine was added, which was stored on Filo's computer, "konishiki." Filo and Yang developed customized software that allowed them to efficiently locate, identify, and edit documents stored on the Internet.

All of Yahoo's entries are categorized using human editors, so it is not really classified as a search engine, but as a searchable directory. Yahoo! discovers new Web pages primarily by submission by authors or others who submit a new URL for review. What sets Yahoo! apart from other search tools is its browsable hypertext classification structure combined with an editorial review of Web sites. It was originally designed to have intuitive paths to information. Yahoo! actually created only a brief description, title, and URL for each page it displays, then links to the actual page. As such, it is not possible to search the actual text of a Web page, but the classification system by which the sites are cataloged generally leads users to higher-quality documents.

Due to its popularity, Yahoo! executed more searches than many of the other search tools of its time. As such, it was in a better position than its competitors to gather information about what people were searching and what they were interested in. Yahoo! used this information to cater to emerging trends and launch affiliate sites based on interests, trends, and geography. Gathering information

about what users search and, more important, how they executed their searches was a key to designing better search tools from the very beginning, and it continues to guide development.

WebCrawler

In early 1994, students and faculty from the department of computer science and engineering at the University of Washington gathered at an informal seminar to talk about the Internet and the WWW. WebCrawler was an idea that emerged from one of these seminars. Brian Pinkerton created a single user application that found information on the Internet as a research project. Pinkerton was then persuaded by fellow students to develop a Web interface. WebCrawler was the first full-text search tool on the Internet. Not only did it capture URLs like other robots, but WebCrawler's robots could capture information and links from the entire text of Web pages. In addition, the robots indexed pages using past results to direct future results using both new URLs and old URLs that were already a part of the WebCrawler index. Pinkerton's search tool worked on the assumption that links would have information relevant to the subject matter of the original Web document.

WebCrawler was released to the public on April 20, 1994, with a database containing about 6000 servers on the Web. As WebCrawler became more popular, it began to overload the network at the university. By October 1994, Web Crawler was receiving an average of 15,000 queries per day. Although a number of companies had tried to ease the load on the servers by investing in server equipment, by March 1995 Web Crawler was so popular that it became unusable during the day. It became obvious that the University of Washington could not financially support the project on its server without additional funding by outside advertising. Due to the potential conflict of interest that soliciting advertising revenue might cause, WebCrawler was sold to America Online (AOL) on March 29, 1995. AOL began to run the service on its own network as AOL NetSearch. Excite Inc. bought WebCrawler from AOL in November 1996, adding the service to its other search products, Excite, WebCrawler, City.net, and Magellan. About a year after WebCrawler was first introduced, Lycos, Infoseek, and Opentext emerged. These three new competitors all improved on WebCrawler's basic functionality.

Lycos

John Leavitt's LongLegs program provided the basis of Lycos. Michael Mauldin led a team from the Center for Machine Transition at Carnegie Mellon University that began development work on Lycos in May 1994. Lycos's name was based on the Latin term *Lycosidae lycosa*, the family name of a ground spider that hunts at night by

chasing down prey rather than using a web. Similarly, Lycos's spider program gathered URLs at night. When it became available for public use on August 12, 1994, Lycos had a catalog of 54,000 documents. By January of 1995, the catalog expanded to 1.5 million documents. Lycos was licensed by Microsoft for its Microsoft Network in April 1995. The partnership was one of many by Carnegie Mellon that allowed use of Lycos but retained ownership of the search tool. In June 1995, however, CMG@Ventures purchased Lycos, forming a new company, Lycos, Inc. Mauldin received a minority take in the company that began providing advertising space to the emerging corporate market on the internet. By November of 1996, Lycos had indexed over 60 million documents.

Excite

Architext was started by six Stanford graduates, Joe Kraus, Graham Spencer, Mark Van Haren, Ben Lutch, Martin Reinfried, and Ryan McIntyre, in June 1993 in a garage in Cupertino, California. The six wanted to design a software product that would help manage the vast amount of information on the WWW. The original software combined search and retrieval with automatic hyper-text linking, subject grouping, and automatic abstracting. Using statistical analysis of word relationships based on proximity and co-occurrence of terms, the team designed software that searched more sufficiently. It would not be publicly available until December of 1994. By that time, the original six members of the Architext team secured \$500,000 in venture capital money from Kleiner Perkins Caufield & Byers and Institutional Venture Partners to launch the product. Architext evolved into the Excite search tool in October of 1995. The company quickly established itself, signing exclusive distribution agreements with Microsoft Network and Netscape. The company officially changed its name to Excite, Inc., and went public with an initial offering of 2 million shares of stock at \$17 per share. By January of 1999, Excite, Inc. would have more than 700 employees worldwide.

Infoseek

Infoseek was founded by Steven Kirsh, founder of Frame Technology and Mouse Systems, and a team of high-tech industry professionals in January 1994. Infoseek's engine was based on Yahoo! and Lycos, and became available on March 26, 1995. Infoseek was a little more user friendly and had added features such as UPS tracking, news, and a directory. It searched the last four weeks of Usenet News and allowed natural language searching. Infoseek initially used a spider to index the full text of Web sites, but later added a human-organized directory. What launched Infoseek into the public market was the move it made with Netscape. Netscape first used Yahoo! as its default search engine, but in December of 1995, Infoseek paid Netscape

to have Infoseek as the default search engine when the program starts.

Infoseek also signaled the beginning of commerce-based tools by taking advantage of advertising via the Web. At that time, Infoseek appointed Robin Johnson, the former senior vice president of corporate development at Time Inc. as the new president and CEO. Johnson's background in the advertising-supported publishing industry was a perfect mix for a popular Internet search tool with approximately 5 million hits per day. Infoseek became the first search tool to support itself through third-party advertising using the cost per thousand model (CPM). The pricing model was intended to apply an advertising rate that was similar to the pricing model used by print publications. Magazines base their ad rates on the number of subscriptions or the estimated number of people who will see the ad. Infoseek created a model that was similar in that it based its price on the number of viewings that a advertising banner would receive. Infoseek charged a set price for the assurance that an advertisement would be accessed or appear 1000 times. Infoseek was also the first search tool that allowed advertisers to target their audience by linking ads to specific search terms.

Infoseek attempted to combine electronic results and the editorial recommendations for Web sites with a third component, high-quality advertising and sponsorships. Four years after it was founded, Infoseek became a predominant force in the online information management industry, publicly traded on the NASDAQ and ranking as one of the most highly trafficked single Web domains. In 1999, Infoseek Corporation combined with Walt Disney's Buena Vista Internet Group to form a new Internet company, go.com.

AltaVista

AltaVista began as an experiment to test new server hardware and searching software by Digital Equipment Corporation (DEC) that could run programs about 100 times faster than other existing computers. Using a very fast spider to gather documents, developers created a full text index of the Web and Usenet. Alta-Vista also provided software to support high-volume access to the information. The name AltaVista was a juxtaposition of "alto" from Palo Alto and "vista." Ultimately, it became "AltaVista," meaning "the view from above." As a search tool, AltaVista became publicly available in December 1995. In the summer of 1996, it replaced Open Text as Yahoo!'s official search engine, and was soon one of the top search tools, using innovative features and, more important, speed. Run on the DEC network, AltaVista could handle millions of hits per day without slowing down.

One of the innovative features was natural language searching, allowing queries using phrases as well as keyword searches. AltaVista searched with words such as *what*, *the*, *as*, and *etc.*, and retrieved results without

getting all the pages containing those words. Advanced search features included both Boolean searching and a results ranking query box that retrieved results when the words appeared in the title of a Web page. AltaVista also allowed developers of Web sites to add and delete URLs from the index, and they could search for sites that linked to a particular URL. AltaVista included a tips section to help the user make a better, more efficient search. The tips periodically changed, so each time the user accessed tips, he or she could view a new tip. Other search tools soon implemented similar "help" and "tips to searching" menus. AltaVista was also one of the first search tools to offer multilanguage searching capabilities, and later introduced the translation feature, Babelfish.

Inktomi

Inktomi began as a research project at the University of California at Berkeley by Eric Brewer, assistant professor of computer science, and Paul Gauthier, a Ph.D. candidate in computer science. The name Inktomi is derived from a Plains Indians myth about a spider that brought culture to people. Brewer and Gauthier developed highly effective technologies during their research that were used to power search tools such as HotBot and Yahoo!. Using parallel processing consisting of 100 or more standard-issue workstations lashed together, Inktomi pioneered a fast search engine service that could search over 100 million Web documents in the space of 250 milliseconds. Each of the computers processed information from the Web independently before collating the information together as a single result. After posting their search engine on the Web, Brewer and Gauthier raised about \$27 million in investment capital, including \$2 million from Intel, before becoming a publicly traded corporation in June 1998. In July 1998, Yahoo! dropped AltaVista as its search engine in favor of Inktomi.

Northern Light

Like so many other search tools with humble beginnings, Northern Light began in the basement of an old mill building in Cambridge, Massachusetts. The search tool was released for public use in August 1997. Northern Light, named after the 1851 Clipper ship with a new design and technology that made it faster than its competitors, had two major innovations that were supposed to make it better than other search tools. Northern Light organizes query results into custom search folders by subject, type, source, and language specific to that search. The folders can be used to refine or give context to a search. For example, a search for lesson plans retrieves the first 20 relevant hits. It also retrieves various folders such as class notes and assignments, mathematics, teachers and teaching, middle school, and elementary school. The folders can be used to refine or give a context to a search to help retrieve highly

relevant sites. The second innovation was the Northern Light's special collection, an online database of full-text journals, books, magazines, newswires, and reference sources that were accessible for a nominal fee of \$1.00 to \$4.00 per article.

Google

Google was developed in 1998 by two 26-year-old Stanford computer science graduate students, Sergey Brin and Larry Page. Google was named after a derivative of the word *googol*, a term coined by Milton Sirota, a nephew of American mathematician Edward Kasner. It represents the number 1 followed by a 100 zeros. The commercial Google site was launched as <http://www.google.com> in September 1999 with the help of \$25 million in funding from Sequoia Capital and Kleiner Perkins Caufield & Byers. Page and Brin pioneered the analysis of link structure as a determinant in the order of a retrieval set. Google's algorithm is based on the idea that a Web site that is linked to by others should hold a higher ranking than a site that has few referring pages. This means the quality or importance of a site is a determinant of the relevancy within a search query. Indexing a site is similar to citation indexing in that each page is assigned a value that is calculated by how many other pages refer to the page and how important the linking pages are. Even before Google was launched, it had 2 million views per day, largely by word of mouth.

METASEARCHERS

MetaSearchers, also called parallel or multiple search engines, are a group of search tools that produce a single integrated retrieval set from a query that is sent to several search engines and search directories simultaneously. A metasearch tool must contain three components: a dispatch mechanism, interface agents, and a display mechanism. Choosing search engines for a specific query is the function of the dispatch component. The interface agents then translate a query into the format required by a specific search engine or directory. When the results are retrieved from the various search tools, the display mechanism merges them. Sometimes the results are sorted or ordered either as a ranked list or as a site-by-site display. The more efficient metasearchers eliminate or reduce duplicate and inactive links.

SavvySearch

In March 1995, an ambitious student at Colorado State University (CSU), Daniel Drillinger, developed and launched SavvySearch as a public metasearch service. SavvySearch began as a project for the class "Introduction to Artificial Intelligence." The project evolved into

Dreilinger's master's project and needed four dedicated workstation computer systems at the CSU computer science department to keep the program operational 24 hours a day. The original SavvySearch service directed queries to a subselection of 19 search tools and resources. Soon the service began adding more search tools and resources, such as Usenet, and access to software and shareware. In November 1998, the search service had expanded its user-selected metasearch service to include more than 200 search tools, including specialty collections such as Scour.net and image finders from Yahoo, Lycos, and AltaVista. SavvySearch also incorporated a topical or subject-based access to other collections as well as a capacity to employ Boolean search queries for advanced searching. The ability to select and customize the metasearch process distinguished SavvySearch from other later metasearchers. Savvy Search was acquired by CNET on October 14, 1999.

Metacrawler

In the spring of 1995, Eric Selburg, a student at the University of Washington, created Metacrawler as his master's degree project. Metacrawler takes the search query that it is given and forwards it to all the big search engines. AltaVista, Excite, Infoseek, Lycos, WebCrawler, and Yahoo! MetaCrawler gained so much popularity when it was publicly released that it was mentioned in a cover article by *Forbes* magazine. Other search engine companies didn't approve of Meta Crawler because it only showed the search results of each engine and left out the advertising banner that pops up when the engine is accessed, meaning not as many ads were reaching the intended audience. MetaCrawler was changed so that the intended ads would be shown above each engine's results.

AskJeeves

AskJeeves was the creation of a venture capitalist, Garret Gruener, and a chief technology officer, David Warthen. Using natural language technology combined with a knowledge database and human editors to find Web sites that answered commonly asked questions, AskJeeves maintained a site that provided answers instead of large retrieval sets of sites. In April 1997, AskJeeves was publicly available for searching. More recently, AskJeeves has purchased Direct Hit, a technology that accesses information based on sites that are popular in similar searches. What distinguishes AskJeeves in the evolution of search tools is the concentration on human evaluation to determine the relative worth of Web sites for particular queries.

THE FUTURE

Although many search tools began in universities and graduate institutions, eventually they moved to the now

common advertiser-driven business model backed by venture capital. Within this business model, search tools provided free, unlimited access to their database while at the same time having a vested interest in maintaining a user/customer base that would increase ad revenues. Publicly owned companies selling stock and highly influenced by standard business and marketing practices have created a commercial environment in which search tools try to operate as a viable business model. Mergers and acquisitions have become common as the individual search tools group together to survive and attract more users.

Currently, the WWW is estimated at more than a billion publicly indexable sites. The “invisible” or “deep Web” contains as many as 550 billion additional sites. As of August 2000, the Open Directory Project listed 351 different search tools. That number will most likely continue to grow as more specialized search tools appear and new iterations of existing tools enhance access to information. One of the major weaknesses of the major search tools such as Yahoo!, AltaVista, Google, Northern Light, and FastSearch is that they do not index a large amount of the information available on the Web. The search tools of the next generation will require more and more integrated approaches to search technologies. Natural language, categorization, and meaning-based processing as well as information extraction, link analysis, multimedia and graphical retrieval systems, and additional value-added features will be integral to search tools designed to handle a variety of different queries. Visual, non-text-based representations of retrieval sets will allow users to graphically view relationships between documents and sites differently than the current text-based sets. Interfaces will continue to become easier to use as designs continue toward creating portals and one-stop searching to maintain a customer base that feeds the advertising stream.

More significant will be the ability for the searcher to interact with search tools to reformulate and refine queries. Metadata using the extensible markup language (XML) and resource description framework (RDF) will generate a more sophisticated and precise tagging system. The XML can provide contextual information, such as where the site was generated from, when, by whom, and other profile information. As this is further developed, searchers will have the ability to recall terms and information from previous queries. They will also be able to interact intuitively with the search interface to specify or eliminate specific kinds of contents. Queries will be customizable and have the ability to maintain criteria used in past searches. Searchers will also have the ability to add context to search terms similar to what can be done using Zapper’s Intellizap, or they can choose a context term or phrase to refine a search, such as they can in Oingo. Link structure, made popular by Google, and traffic popularity, such as that from DirectHit, will continue to drive search tools toward better accuracy and precision searching. Other search tools will develop indexes based on referral

sites from the Web community at large, like that of the Open Directory Project.

Another future dimension of Internet searching is the invisible or deep Web—the information from sites that are not typically indexed by search tools. There are as many as 550 billion sites in the deep Web as compared to little over a billion indexed sites. The information in these sites is more refined and in-depth. Currently, approximately 85% of Internet users use search tools for finding information. The basic search methodology and technology will need to evolve further in order to retrieve the vast amount of information that is beneath the surface of the Web. One thing is certain in the history of search tools—they will change and evolve, especially as the Internet continues to expand toward higher-speed access. Multimedia is growing so rapidly that search tools are becoming conduits for providing information in a variety of formats. Also, as access to the Internet expands globally and internationally, multicultural/multilingual searching will become more than a feature; it will be a necessity. Internet search tools will be essential keys to the Internet’s evolution to a truly “World” Wide Web.

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InterPARES

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Abstract

This entry presents the International research on Permanent Authentic Records in Electronic Systems (InterPARES) project, an international multidisciplinary research endeavor that, since 1998, has sought solutions to the issue of long-term preservation of the authenticity of digital records. The entry outlines the goals of the four phases of the project, its membership, methodology, principles, activities, and products, and discusses its conceptual findings—specifically, the concepts of record and of authenticity—and its methodological findings regarding archival appraisal, preservation, and description—specifically, requirements for trusted record-making, record-keeping and records preservation systems, development of systems for managing authentic digital records that meet those requirements, and their implementation in a scalable way in resource-limited organizations. The entry concludes by outlining the present direction of the project and providing a glimpse of its future.

INTRODUCTION

InterPARES stands for International research on Permanent Authentic Records in Electronic Systems. It is a multinational collaborative research project pursuing the goal of developing the theory and methods necessary to ensure that digital records produced in databases and office systems, as well as in dynamic, experiential, and interactive systems, in the course of artistic, scientific, and e-government activities can be created in accurate and reliable form and maintained and preserved in authentic form for the use of those who created them and of society at large, regardless of technological obsolescence and media fragility.

With the financial support of the Social Sciences and Humanities Research Council of Canada, the University of British Columbia (UBC), the United States National Historical Publications and Records Commission and National Sciences Foundation, UNESCO's Memory of the World Program, and several other agencies and organizations around the world, the InterPARES project began in 1998 under the direction of Luciana Duranti, establishing its headquarter in Vancouver, Canada, at the UBC School of Library, Archival and Information Studies, and it has developed through four phases: 1998–2001, 2002–2006, 2007–2012, and 2013–2018. Over the years, it has involved investigators from numerous countries in five continents: Canada, the United States, Australia, New Zealand, the Netherlands, Belgium, the United Kingdom, Ireland, Sweden, Norway, Germany, France, Spain, Croatia, Russia, Ukraine, Italy, Turkey, China and Hong Kong, Japan, Singapore, Korea, Malaysia, Mexico, Brazil, Cuba, Argentina, Peru, Chile, South Africa, and many more.

INTERPARES METHODOLOGY

The research methodology has been based on the principles of “interdisciplinarity, transferability, open inquiry, and multimethod design.” The project is interdisciplinary in the measure in which its goal and objectives can only be achieved through the contribution of several disciplines, among which are archival science, diplomatics and records management; computer science and engineering; jurisprudence and law; music theory, composition, and performance; film theory, production, and description; dance and theater theory; geography; chemistry; archaeology; and several other hard and social sciences. In fact, in order to analyze the nature, characteristics, behavior, relationships, and process of creation of the records produced in the course of artistic, scientific, business, and e-government activities, it is necessary to gather a deep understanding of not only those activities, their purpose, their phases and the component actions, their by-products and their structure, and their context but also their technological environment and their use. In addition, to analyze the results of the case studies, methodologies developed in the context of a variety of disciplines are needed. Among these are text analysis, diplomatic analysis, statistical analysis, visual analytics, digital forensics, etc.

The ultimate goal of InterPARES is archival in nature, in that the project is concerned with the development of trusted record-making and record-keeping systems, and of preservation systems that ensure the authenticity of the records under examination over the long term. This implies that the work carried out throughout the project in the various disciplinary areas must be constantly translated in archival terms and linked to archival concepts,

which are the foundation upon which the systems intended to protect the records are designed. However, upon completion of the research, the archival systems need to be made accessible and comprehensible to records creators, organizations and institutions, service providers, IT experts, and disciplinary researchers. In other words, the research outcomes must be translated back into the language and concepts of each discipline and profession that needs to make use of them. In light of these, it was essential at the outset of the research to examine the key archival concepts that are at the core of the InterPARES research so that each field could identify the corresponding entities within its own body of knowledge.

The InterPARES research questions have epistemological roots in the humanities, specifically in diplomatics and archival science. However, the investigators involved in each research activity identify the perspective(s), research design, and methods that they believe to be most appropriate to their specific inquiry. The reason for this openness is that InterPARES is conceived to work as a “layered knowledge” environment, in the sense that some research work will build upon knowledge developed in a variety of other research projects on similar and different issues, and some will explore new issues, study entities never examined before, and develop entirely new knowledge. Each case study, as well as each of the other research activities, is carried out using the methodology and the tools that the dedicated investigating team considers the most appropriate for it. The methods used are surveys, case studies, modeling, prototyping, diplomatic and archival analysis, visual analytics, and text analysis.

INTERPARES PRINCIPLES

A few principles have guided InterPARES research through the years. The first is that technology cannot determine the solution to the reliable and accurate creation of digital records or to their authentic preservation over the long term: “organizational needs” define the problem and “archival principles” must establish the correctness and adequacy of each technical solution. A corollary of this principle is the idea that solutions to the digital records challenges are inherently “dynamic,” because of the continuing change of technology and therefore of the issues that it raises, and “specific” to the cultural, disciplinary, administrative, and legal situations in which digital records are generated, because of the contingent reasons why records are produced and kept. The second principle is that preservation is a “continuous process that begins with records creation.” Accordingly, the development of solutions to the issue of long-term preservation is dependent upon the development of guidance for the proper creation and maintenance of records that can be preserved. The third principle is that, given the fact that we cannot

preserve digital records as physical entities, but only the ability to reproduce them, we cannot verify on the records at hand their authenticity; rather, we must develop methods of records creation, maintenance, and preservation that allow us either to presume the trustworthiness of the records till proof to the contrary is established or to infer it from the integrity of the system in which the records were created and kept overtime and the chain of their custody.

INTERPARES ACTIVITIES

In order to achieve the goal of developing a body of theory and methods for digital records, InterPARES, researchers focused their initial efforts on the identification of “what constitutes a record” in each type of system being examined and in each context, and of “what record in each system and context has the force of an original.” They also studied large bodies of literature in a variety of disciplines for the purpose of defining “what a reliable, accurate, and authentic record” is in the arts, science, law, business, and administration. On this basis, they developed the requirements for the design of “a trusted record-making system,” “a trusted record-keeping system,” and “a trusted record preservation system,” using primarily modeling and the diplomatic analysis of the results of several case studies. Then, they developed “methods and procedures for the creation, maintenance, appraisal, selection, and disposition, and long-term preservation of authentic digital records,” as well as several products that could be and still are autonomously used.

At the end of the second phase of InterPARES, the need was felt to demonstrate that the findings and recommendations resulting from the research activities of the first two phases (1998–2006) were implementable in all kinds of organizations in a scalable way. Thus, the third phase of the project focused on enabling public and private archival organizations and programs with limited resources to preserve over the long-term authentic records that satisfy the requirements of their stakeholders and society’s needs for an adequate record of its past. It did so by building on the products and conceptual and methodological findings of the first two phases.

INTERPARES PRODUCTS (1998–2006)

The products of the first two phases of InterPARES were a *Framework of Principles Guiding the Development of Policies* for records creating and preserving organizations; *Guidelines for Making and Maintaining Digital Materials* for individuals and small communities of practice; *Guidelines for Digital Preservation* for archival institutions; *Authenticity Requirements* for records systems; a *Template for Analysis* of digital records; principles and criteria for adoption of *File Formats, Wrappers, and Encoding*; a

Model of the Chain of Preservation (COP) based on the lifecycle concept; a *Business-Driven Recordkeeping Model* based on the continuum concept; and a *Terminology Database*, including a glossary, a dictionary, and ontologies. These products are posted on the InterPARES website (<http://www.interpares.org>); and published in two books: Luciana Duranti ed., *The Long-term Preservation of Authentic Electronic Records: Findings of the InterPARES Project* (San Miniato: Archilab, 2005. Available online at <http://www.interpares.org/book/index.cfm>) and Luciana Duranti and Randy Preston eds., *InterPARES 2: Interactive, Dynamic and Experiential Records* (Roma: ANAI, 2008. Available online at <http://www.interpares.org/ip2/book.cfm>). The products are also discussed in articles published in a dedicated space by the journal *Archivaria*;^[1] and in writings published in a variety of venues, some of which are listed among the references and bibliography, while others can be found or cited on the project website: http://www.interpares.org/ip1/ip1_dissemination.cfm?proj=ip1 and http://www.interpares.org/ip2/ip2_dissemination.cfm?proj=ip2.

INTERPARES 1–2 CONCEPTUAL FINDINGS (1998–2006)

The InterPARES project does not study digital preservation in general, but it focuses its research on the long-term preservation of the “authenticity” of digital “records.” Thus, among the key findings of the first two phases are the concept of record in the digital environment and the concept of authenticity.

The Concept of Record

In the digital environment, an entity captured as a record presents the following characteristics: 1) a stable content; 2) a fixed form; 3) explicit linkages to other records within or outside the digital system, through a classification code or a naming convention; 4) an identifiable context; 5) five persons (i.e., an author—the physical or organizational person issuing the record, a writer—the person responsible for the record content, an originator—the person responsible for the electronic account or space where the record is made and/or saved, an addressee—the person for whom the record is intended, and a creator—the person in whose records accumulation the record exists) involved with its creation; 6) an action, in which the record participates or which the record supports either procedurally or as part of the decision-making process; and 7) formal elements, attributes, and digital components. Three of these characteristics require further explanation, that is, stable content, fixed form, and the distinction among formal elements, attributes, and digital components.

Stable Content and Fixed Form

Stable content is defined as the fact that the data and the message in the record are unchanged and unchangeable, meaning that data cannot be overwritten, altered, deleted, or added to. Fixed form means that the binary content is stored so that the message it conveys can be rendered with the same presentation it had on the screen when first saved (even if the digital presentation is different, as is the case with a record received in Word and saved in PDF). In complex dynamic and interactive systems, fixed form is a more articulated concept and involves a distinction between the “stored record” and the “manifested record,” the latter being the one we see on the computer screen. If the same content can be presented on the screen in several different ways in a limited series of possibilities, we may have either a different view of “the same stored record” having stable content and fixed form (i.e., different documentary presentations, as in the case of statistical information rendered as a pie chart, a bar chart, or a table), or “several manifested records” with stable content and fixed form derived from the same stored record. In addition, the concept of fixed form may be linked to that of “bounded variability,” which exists when there is no stored record, but only stored content data, form data, and composition data that are quite separate and only connected by a query when a user searches the system. In these cases, changes to the form of the manifested record are limited and controlled by fixed rules, so that the same query or user interaction always generates the same result, and we have different views of different subsets of content, due to the intention of the author or to different operating systems or applications (pp. 47–52).^[2]

Formal Elements, Attributes, and Digital Components

A “formal element” is a constituent part of the record’s documentary form as shown on its face. Formal elements may be extrinsic, when they determine the appearance of the record and influence its capability of reaching its purposes; or intrinsic, when they convey the action in which the record participates or to which it is linked, and its context. Extrinsic and intrinsic elements of form are listed and described in the *Template for Analysis* mentioned among the InterPARES products (see http://www.interpares.org/book/interpares_book_j_app01.pdf).

Strictly related to the concept of formal elements is the concept of “records’ attributes,” which are the identifying characteristics of each given record or of a record element in it. An attribute may manifest itself as one or more elements of form. For example, the name of the author of a record is an attribute, which may be expressed as a letterhead or a signature, both of which are intrinsic elements of documentary form, that is, record’s elements. In addition to attributes that manifest themselves in the form

of the record, that is, on the face of the record, as record's elements, every record has attributes that are implicit in other parts of the record, such as the name of the creator or of the medium, but in digital records they are also expressed, albeit outside the documentary form. Because of this, they are mostly transparent to the user and manifest themselves as metadata included in either a record profile, a topic map, or other digital entity linked to the record.

In addition to all these, with electronic records, we also have to differentiate formal elements and attributes from the record's digital components. A "digital component" is a digital object that is part of one or more digital records, including any metadata necessary to order, structure, or manifest content, and that requires a given preservation action. For example, an e-mail that includes a picture and a digital signature will have at least four digital components (the header, the text, the picture, and the digital signature). Reports with attachments in different formats will consist of more than one digital component, whereas a report with its attachments saved in one PDF file will consist of only one digital component. Though digital components are each stored separately, each digital component exists in a specific relationship to the other digital components that make up the record. Each digital component requires one or more specific methods for decoding the bit stream and for presenting it for use over time. The bit stream can be altered, as a result of conversion for example, as long as it continues to be able to fulfill its original role in the reproduction of the record. All digital components must be able to work together after they are altered; therefore, all changes need to be assessed by the creator for the effects they may have on the record.

Record Trustworthiness

In the case of the concepts embedded in the record quality of trustworthiness, the definitions adopted by the InterPARES team were not derived from traditional archival theory. The team used the definitions developed by a previous research project, commonly known as the UBC-MAS project (pp. 23–30),^[3] in the context of which "reliability" is the trustworthiness of a record as a statement of fact, that is, its ability to stand for the facts it is about, while "authenticity" is the trustworthiness of a record as a record, and refers to the fact that a record is what it purports to be and has not been tampered with or otherwise corrupted. Reliability is the exclusive responsibility of the record creator and is assessed on the basis of the completeness of the record, the authority and capacity of its author, and the degree of control exercised on the creation process. "Accuracy," a concern introduced in InterPARES research by science scholars, can sometimes be subsumed under the concept of reliability and refers to the exactness and correctness of content, mostly dependent on the competence of the author and the controls on the process by

which data are recorded and transmitted through space (i.e., between persons, systems, or applications) and time (i.e., when stored offline or when the hardware or software used to process, communicate, or maintain it is upgraded or replaced). Different from reliability, authenticity and accuracy are the responsibility of both the creator and the preserver as these depend on the controls exercised on the processes of transmission of the record across space or time.

Finally, "authentication" was defined as a declaration of authenticity, resulting either by the insertion or the addition of an element or a statement to a record. To make a distinction between authenticity and authentication was considered important because governments have been legislating about the use of digital signatures and other similar devices as means of maintaining authenticity. The team wanted to emphasize the theoretical principle that authenticity is a property of the record that accompanies it for as long as it exists, while authentication is a means of proving that a record is what it purports to be at a given moment in time.

The researchers did not elaborate further the concept of reliability, but tried to elucidate the concept implied in the definition of authenticity by dividing it into two components: identity and integrity. "Identity" refers to the attributes of a record that, together, distinguish it from other records. These attributes include the names of the persons concurring in its formation (i.e., author, addressee, writer, originator, and creator); its date(s) of compilation, transmission, and filing; the naming of the matter or action in which it participates; the expression of its relationships with other records; its digital and documentary presentations; and an indication of any attachment(s). These attributes may be explicitly expressed in a formal element of the record or in metadata related to the record or may be implicit in its various contexts.

"Integrity" is the wholeness and soundness of a record. A record has integrity if it is intact and uncorrupted, that is, if the message that it is meant to communicate in order to achieve its purpose is unaltered. This means that a record's physical integrity, such as the proper number of bit strings, may be compromised, provided that the articulation of the content and its required elements of form remain the same. Integrity may be demonstrated by evidence found on the face of the record, in metadata attesting to the responsibility for the record over time and to its technological changes, or in one or more of the record's contexts.

While in traditional archival theory, following jurisprudence, records that are relied upon by their creator in the usual and ordinary course of business are presumed authentic, with records in digital systems, the presumption of authenticity must be supported by evidence that a record has not been modified or corrupted in essential respects during transmission and maintenance. To assess the authenticity of a record, the preserver must be able to

establish its identity and demonstrate its integrity by observing the existence of certain conditions. These conditions are authenticity requirements and are used by the prospective preserver to guide the assessment of the authenticity of the records during the process of appraisal. The Authenticity Requirements developed by InterPARES can be found on the InterPARES website (http://www.interpares.org/book/interpares_book_k_app02.pdf) and in the first InterPARES book (pp. 204–219).^[4]

Many of the concepts developed by InterPARES 1–2 were incorporated in the discipline of modern diplomatics, and these are discussed in detail in the entry “Diplomatics” of this Encyclopedia.

INTERPARES 1–2 METHODOLOGICAL FINDINGS (1998–2006)

It appeared quite clear to the InterPARES researchers that the team’s understanding of the concepts of record and authenticity had a strong impact on the process of appraisal, which is inevitably influenced by the fact the objects to be selected for continuing preservation are not physical units but linked digital components whose continuing meaning is provided by attributes and whose trustworthiness relies on metadata and on unbroken control both on their transmission through time and space and on the processes of their creation, maintenance, and preservation.

Appraisal

Contrary to the archival tradition, with digital records, “authenticity” has to become one of the values assessed by the appraiser because, in the absence of an original, the future users of digital records will have only the word of the record preserver as the basis for trusting the records they will use as sources. Thus, the role of the appraiser becomes that of a neutral third party who acts as the inspector first and the warrantor later of the authenticity of the records that will be preserved.

In addition, the researchers found that several activities extraneous to traditional appraisal methodology have to be introduced in the appraisal process. Although it has been accepted for decades that archivists and records creators have to participate jointly in records scheduling for retention and disposition and that, with digital records, such an endeavor must occur as soon as possible in the life of the record, insufficient emphasis has been put by the archival community on the necessity of “monitoring” the records identified for permanent preservation on a regular basis in order to ensure that the inevitable ongoing changes of the technological environment of both the records and the creating office, and consequently of the business and documentary procedures of the creating office do not alter the records, their interrelationships, and their relationships

with the business processes to the point that a new appraisal is warranted. Monitoring is a key activity also with respect to a new concern for the appraiser: “feasibility of preservation.”

Feasibility of preservation was never a preoccupation with records on traditional media, but preservation of digital records is a very complex activity, requiring technological competence and resources that sometimes are not accessible to archival programs and institutions. Thus, the appraiser must assess the records in light of the present and future capability of the archival program or institution to preserve them. As a consequence, the appraiser may advise the creator to make certain technological choices that make the records preservable or may postpone their acquisition till such a time when preservation is feasible.

In addition, in digital systems, a record may be created for one purpose, and then subsequently used for different purposes and by different persons. Any appraisal decision should consider all uses of the record, simultaneous and sequential, by different users and by the same users, and be aware of the business processes behind them. This is necessary in order to make an informed decision about what to preserve, as well as to be able to dispose effectively of all possible copies of the records that have not been selected for preservation.

The use of records or information within records by different business processes may be desirable from the creator’s standpoint in terms of providing a degree of interoperability among the creator’s information and record systems. In such situations, the preserver should advise the creator that metadata attached to records used by many business processes must identify each relevant business process. This is critical for the creator because it ensures the authenticity of the records by establishing their identity and integrity in each context. It is also critical for the preserver who must understand all contexts in which the records were used in order to effectively undertake appraisal and also to meet the requirements for maintaining authenticity for any records acquired into the preservation system.

Preservation

In light of the principle that it is not possible to preserve an electronic record, but only the ability to reproduce it, InterPARES established that preservation of electronic records involves creating authentic copies of the records of the creator. The authenticity of these copies is guaranteed by 1) a controlled process of migration of the records acquired from the creator to the archives technological environment; 2) the accurate documentation of any change that the records undergo during such process and every time that the archives technological environment is upgraded; 3) the implementation and monitoring of privileges concerning the access, use, and reproduction of the records within the archives; 4) the establishment of

procedures to prevent, discover, and correct loss or corruption of records; 5) the establishment of procedures to guarantee the continuing identity and integrity of the records (i.e., their authenticity) against media deterioration and across technological changes; and 6) if authentication of individual records is required, the existence of rules determining responsibility for and means of authentication.

The person responsible for all these activities, the designated records preserver, has to take physical and legal custody of the records of the creators, protect them, and ensure continuous access to them. Be it an outside organization or an in-house unit, the role of the designated preserver should be that of a “trusted custodian” for a creator’s records. To be considered as a trusted custodian, the preserver must

- Act as a neutral third party, that is, demonstrate that it has no stake in the content of the records and no reason to alter records under its custody, and that it will not allow anybody to alter the records either accidentally or on purpose
- Be equipped with the knowledge and skills necessary to fulfill its responsibilities, which should be acquired through formal education in records and archives administration
- Establish a trusted preservation system that is capable of ensuring that accurate and authentic copies of the creator’s records are acquired and preserved

The authentic copies of the creator’s records are kept by the trusted custodian in a trusted preservation system, which should include in its design a descriptive system and a retrieval system. This trusted preservation system must also have in place rules and procedures for the ongoing production of authentic copies as the existing system becomes obsolete and the technology is upgraded. It should be noted that the simple fact of reproducing records in the preserver’s preservation system does not make the result an authentic copy. Such designation must be provided by the preserver’s authority.

A sustainable preservation strategy requires close collaboration between a records creator and its designated trusted custodian. It is the preserver’s responsibility to take the initiative in collaborating with the creator to establish acquisition and preservation procedures and in advising the creator in any records management activities essential to the preserver’s acquisition and preservation activities.

Archival Description

The InterPARES researchers have agreed that, no matter how careful the preservation procedures and how trusted the records custodian, ultimately, to all future users, the most important source of the authenticity of the records is “archival description.”

It has always been the function, either explicit or implicit of archival description, to authenticate the records by perpetuating their administrative and documentary relationships, but, with digital records, this function has moved to the forefront. In fact, as original digital records disappear and an interminable chain of nonidentical reproductions follows them, the researchers looking at the last of those reproductions cannot find in it any information regarding provenance, authority, context, or authenticity.

The authentication function of archival description is different from that of a certificate of authenticity because it is not simply an attestation of the authenticity of individual records, but a collective attestation of the authenticity of the records of an archival “fonds” (defined as the whole of the documents made or received by one creator and accumulated for action or reference) and of all their interrelationships as made explicit by their administrative, custodial, and technological history, the scope and content, and the hierarchical representation of the records aggregates. Also, it is different both from the identity and integrity metadata attached to individual records, which are part of the record itself and are reproduced time after time with it, and from the additional metadata attached to records aggregations (e.g., file, and series) identifying them and documenting their technological transformation. The unique function of archival description is to provide a historical view of the records and of their becoming while at the same time presenting them as a universality in which each member’s individuality is subject to the bond of a common provenance and destination. Never before archival description has had such a key function in the preservation of records.

INTERPARES 1–2 CONCLUSIONS (1998–2006)

The InterPARES project began in 1999 to find a solution to the problem of the long-term preservation of the authenticity of digital records. In its first phase, it focused on the preservation function, but the findings of its research identified the need for a holistic approach that looked at preservation as an integral part of records creation, maintenance, use, and dissemination through time. For this reason, the second phase of the project began with the analysis of the entities being created in complex systems, while still live and often incomplete, in order to understand their nature, characteristics, behavior, and use. Among the results of this analysis, there is a new diplomatic theory for interactive and dynamic records and a new archival theory of preservation, along with methodologies supporting their application.

However, the second phase of the project made it clear that, although the body of concepts, principles, and methods developed through scientific research constitutes the essential foundation and framework of best practices, any solution to digital preservation problems is situation

specific and must be devised by preservers taking into account 1) the cultural, administrative, legal, and functional context in which they operate; 2) the nature and characteristics of the organizations producing the digital material to be preserved; 3) the typology of the material produced and its documentary and technological features; 4) the limitations imposed by the available financial and human resources; 5) the organizational culture of both the producer of the material and the preserver; and 6) access to educated professionals or educational programs and resources. Furthermore, while the conceptual and methodological findings of InterPARES are equally applicable to larger and smaller organizations and programs, archives with limited resources, which often have the greatest need for assistance, will find the outcomes of the research difficult to apply without specific directions on how to move forward. Thus, a third phase of InterPARES began in 2007.

INTERPARES 3 (2007–2012)

The third phase of InterPARES aimed to translate the theory and methods of digital preservation drawn from the previous research into concrete action plans for existing bodies of records that are to be kept over the long term by archives—and archival/records units within organization—endowed with limited resources. It developed detailed knowledge on 1) how general theory and methods can be implemented in small- and medium-sized archives and units and become effective practices; 2) what factors determine the type of implementation that is appropriate for each body of records in each context; and 3) what skills professionals will require to conduct such operations.

InterPARES 3 Activities

InterPARES 3 comprised a research component, involving short-term and long-term projects (including case studies and general studies); an education and training component that consisted of carrying out, in the context of the research projects, apprenticeships, activities credited as part of coursework, etc.; and a knowledge-mobilization component, in the form of workshops, seminars, colloquia, policy manuals and other publications, public lectures, etc., that met the needs of both academic and community partners.

InterPARES 3 Methodology

InterPARES 3 carried out “action research,” that is, collaborative and pragmatic research directed toward producing solutions that were directly useful to a group of people. The research subjects were coparticipants and stakeholders in the process: jointly with academic researchers,

they defined research objectives and goals, co-constructed research questions, pooled knowledge, and developed solutions and performance tests that implemented specific strategies.

The two primary research methods were prototype development and ethnographic research. Prototype development was user-centered, collaborative prototyping exploring the interplay between theory and practice by using proof-by-demonstration through three major iterative stages: concept building, system building, and system evaluation. Ethnographic research was conducted by creators of records, their users, and archivists, who, together, formed a community of practice—the archival environment—for which social interaction created meaning and defined values. The researchers placed themselves within an archival environment to gain the cultural perspective of those responsible for records through observation of the environment with detailed description, extensive interviewing, and analysis of documentation. The researchers were divided in national teams because of their shared belief in the fundamental importance of juridical and cultural contexts in addressing each real situation. The research was structured in general studies and case studies.

The general studies were of four types: those carried out by one national team or a group of teams for the benefit of all teams (e.g., Annotated Bibliography of International Standards, E-mail Preservation); those in which all teams took part (e.g., Terminology Database); those conducted by a team that was useful for that team only (e.g., Annotated Canadian Standards); and those conducted by a group of teams sharing contextual characteristics for its own benefit (e.g., Electronic Protocol Register, procedurally required in Brazil, Italy, and Spain).

The case studies were of three types: those dealing with specific groups or types of records, those dealing with record/information systems, and those dealing with policies. The case study process was guided by a case study flow chart, which ensured that all steps were followed in the correct order, and was concluded by a final report. Each document produced in the course of a case study was structured as to form and content on the basis of a template used for all case studies. All the documents supporting the research can be found on the InterPARES 3 website: http://www.interpares.org/ip3/ip3_products.cfm?cat=2.

InterPARES 3 Key Findings

Among the many findings, the most important were management related. The case studies demonstrated that, if it is important to develop, learn, and teach how to use the structural features of an application or a system, it is even more important to understand the spirit behind those features; instead, in most cases, the training of users of acquired new applications and systems emphasizes details

of use rather than general philosophy. Users who are not acquainted with archival principles and methodologies may—intentionally or unintentionally—appropriate an application or a system “unfaithfully” more easily than records professionals. Unfaithful appropriations are likely to happen frequently with digital tools that are developed by IT experts outside the organization that will use them and often without consulting archival professionals. Interpretive flexibility or lack of it may, therefore, determine acceptance or rejection.

The case studies also showed that, when the technology is tailored to the organization, it is common to design systems primarily focused on the codified, explicit organizational knowledge because managers favor the knowledge that is incorporated in organizational artifacts like processes, structures, documents, and technology. Thus, management reporting systems, decision support systems, and electronic records management systems, are all focused on the identification, collection, and dissemination of this knowledge type. Rather, managers should foster a more complex form of organizational capital, one where a core competency for implementers requires *know-how*, the particular ability to put know-what into practice.

InterPARES 3 Products

All case and general studies are available on the InterPARES 3 website: http://www.interpares.org/ip3/ip3_products.cfm?cat=1. On the basis of the findings of these studies, InterPARES 3 developed, in addition to a variety of annotated bibliographies and the *Terminology Database*, reports on *Keeping and Preserving E-mail*, *Open Source Records Management Software*, *Criteria for Open Standard File Formats*, *Acquiring and Preserving Digital Records in Small and Medium-sized Archives*, *Digital Preservation Cost-Benefit Models*, *File Viewers*, *Metadata Application Profiles*, *Organizational Culture*, *Organizational Policy*, *Public Sector Audit Reports*, *Guidelines and Recommendations for E-mail Records Management and Long-Term Preservation*, and *Guidelines for the Long-term Preservation of the Protocol Register* (http://www.interpares.org/ip3/ip3_products.cfm?cat=1).

However, the product that best embodies the findings and recommendation of InterPARES 3 is represented by the teaching modules for in-house training programs, continuing education workshops, and academic curricula meant to form archival professionals who are competent not only to preserve over the long term the documentary heritage in digital form but also to ensure the accountability of organizations and institutions through the protection of the accuracy and authenticity of the digital information they produce. The InterPARES education modules, called “Digital Records Pathways: Topics in Digital Preservation,” were cosponsored by the Section on Archival

Education (SAE) of the International Council on Archives (ICA). Therefore, in addition to being accessible from the InterPARES website (ip3_canada_gs12_education-modules_digital-records-pathways.zip), they are also accessible on the ICA-SAE website, accompanied by a video that describes them and their use (<http://www.ica-sae.org/>).

By the time, the third phase of InterPARES was reaching its conclusions, new issues related to the authentic long-term preservation of electronic records were coming to the forefront, primarily related to the increase of records creation, maintenance, and/or preservation on the Internet and on the cloud, and to the trustworthiness of the online networked environment. Thus, a new phase of InterPARES began, called InterPARES Trust.

INTERPARES TRUST (2013–2018)

The goal of this research project is to generate the theoretical and methodological frameworks that will support the development of integrated and consistent local, national, and international networks of policies, procedures, regulations, standards, and legislation concerning digital records entrusted to the Internet, to ensure public trust grounded on evidence of good governance, a strong digital economy, and a persistent digital memory. The focus is on the relationship between organizations (both not-for-profit and for-profit) and given client groups (citizens, customers, readers, students, etc.), with client groups being concerned about the degree of “trust” they can place on records generated and/or stored and accessed on the Internet and organizations being concerned about establishing and maintaining that trust. The same themes are also addressed within the context of organization to organization and client group to client group relationships. This research will develop new knowledge on digital records kept on social media and in the cloud and on methods for identifying and protecting the balance between privacy and access, secrecy and transparency, the right to know, and the right to oblivion in globally connected networks. It will propose law reform, and other infrastructural reform, model policies, procedures, and practices, and functional requirements for the systems in which Internet providers store and manage digital records.

The partnership conducting this research comprises universities and organizations, national and multinational, public and private, in North America, Latin America, Europe, Africa, Australasia, and Asia. It also includes a “Transnational Team” comprising international organization like UNESCO and the World Bank. The list of the partners is available at <http://interparestrust.org/trust/aboutus>. The academic researchers have expertise in archival science, records management, diplomatics, law, information technology, communication and media, e-commerce, health informatics, cybersecurity, information

governance and assurance, digital forensics, computer engineering, and information policy. The empirical knowledge for this research comes from the researchers who are members of the professions having the highest stake in the questions being asked, for example, law and law enforcement, journalism, records management, finances, health, etc.

InterPARES Trust Activities

The project is divided into five research domains and five research cross-domains. The research domains are as follows: 1) *Infrastructure*: this domain considers issues relating to system architecture and related infrastructure as they affect records held in online environments. Examples of areas to be investigated include types of cloud and their reliability; types of contractual agreements and their negotiation, coverage, flexibility, etc.; costs, upfront and hidden; etc. 2) *Security*: this domain considers records issues relating to online data security, including security methods (encryption, sharding, obfuscation, geographic location); data breaches; cybercrime; risks associated with shared servers; information assurance; governance; audits and auditability; forensic readiness; risk assessment; and backup. 3) *Control*: this domain differs from the security domain in its focus on the management of digital material in online environments. It addresses such issues as authenticity, reliability, and accuracy of data; integrity metadata; chain of custody; retention and disposition; transfer and acquisition; and intellectual control and access controls. 4) *Access*: this domain researches open access/open data; the right to know/duty to remember/right to be forgotten; privacy; accountability; and transparency. 5) *Legal*: this domain considers issues such as the application of legal privilege (including the issue of extra-territoriality); legal hold; chain of evidence; authentication of evidence offered at trial; certification; and soft laws (in particular, UN standard-setting instruments)—mapping, scope, potential impact, and constraints.^[5]

The research cross-domains are as follows: 1) *Terminology*: this cross-domain is concerned with the ongoing production of a multilingual glossary; a multilingual dictionary with sources; ontologies as needed; and essays explaining the use of terms and concepts within the project. 2) *Resources*: this cross-domain is concerned with the ongoing production of annotated bibliographies, identifying relevant published articles, books, etc., case law, policies, statutes, standards, blogs, and similar gray literature. 3) *Policy*: this cross-domain considers policy-related issues emerging from the five research domains; for instance, it covers policy issues pertaining to the development and implementation of the “infrastructure” or “security” standards, or as the facilitator for the implementation of laws. In general, it addresses record-keeping issues associated with the development and implementation of policies having an

impact on the management of records in an online environment. 4) *Social issues*: this cross-domain is concerned with the analysis of social change consequent to the use of the Internet, including but not limited to the use/misuse of social media of all types, trustworthiness of news, data leaks (intentional or accidental/force majeure) consequences, development issues (power balance in a global perspective), organizational culture issues, and individual behavior issues. 5) *Education*: this cross-domain is concerned with the development of different models of curricula for transmitting the new knowledge produced by the project.

Within each domain and cross-domain, studies are carried out by multidisciplinary teams. The entire list of studies can be found on the website of the research project: http://interparestrust.org/trust/about_research/studies. Examples of studies are contract terms for cloud-based record-keeping services; ensuring trust in storage in infrastructure-as-a-service; retention and disposition in a cloud environment; modeling preservation as a service for trust; metadata, mutatis mutandis: design requirements for authenticity in the cloud and across contexts; models for monitoring and auditing of compliance in the flow from registration to archives in e-register; evaluating metadata description schemas of cultural heritage organizations in electronic environments for interoperability; comparative analysis of implemented governmental e-services; standard of practice for trust in protection of authoritative records in archives; assessment of privacy-preserving and security techniques for records management in cloud computing; the use of cloud services for records management in international organizations; security classification of records in the cloud; open government, open data, and big data on the management of digital records online; comparative analysis of the role of the records manager in an open government environment in the United Kingdom, Scotland, and Sweden; social and ethical foundations of preservation of digital historical-cultural heritage; developing model cloud computing contracts; identifying privacy concerns and attendant issues in cloud computing; putting the “fun” back in “functional”; social media use in government; and plurality and policy: designing for trust in the digital age.

The findings of the many studies carried out in the first 4 years will be the foundation on which the research team, in the final year of the project, will build the international conceptual and legal framework for the long-term preservation of authentic records in a networked online environment.

CONCLUSION

The InterPARES Project began in 1998 and is scheduled to close in 2018. It is quite possible that InterPARES Trust will not be the last phase of the project as technological

development will continue to challenge our ability to maintain and verify the trustworthiness of electronic records. Whatever the case will be, the theory, methods, and practices developed by InterPARES, which are already embedded in the disciplines of records and archival management and diplomatics, will continue to support digital record-keeping and preservation for many years to come.

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Abstract

Information Schools (“iSchools”) address the relationship between information, technology, and people. This is characterized by a commitment to learning and understanding the role of information in human endeavors. The iSchools take it as given that expertise in all forms of information is required for progress in science, business, education, and culture. This expertise must include understanding of the uses and users of information, as well as information technologies and their applications. As of 2008, twenty-one iSchools in the United States and Canada have joined the “iCaucus,” a forum in which iSchools’ deans collaborate to further their collective interests through focused events such as the “iConference” and resources of broader interest such as the iSchools Web site.

ORIGINS

In 1988, Toni Carbo, dean of the School of Library and Information Sciences (now the School of Information Sciences) at the University of Pittsburgh, formed the “Gang of Three,” including her decanal colleagues at Syracuse University’s School of Information Studies (Donald Marchand) and Drexel University’s College of Information Science and Technology (Richard Lytle). Within the next couple of years, the dean of the School of Communication, Information, and Library Studies at Rutgers University (Richard Budd) joined the group, making it a “Gang of Four.” The Gang grew out of informal conversations at a meeting of the Association for Library and Information Science Education (ALISE). Each of the schools offered graduate Library and Information Science (LIS) and a variety of “other” programs, including undergraduate information science (IS), telecommunications, journalism, etc. The objective was to share information and to foster the development of a community of colleagues addressing such questions as “How do you explain IS to your provost?” The Gang met informally into the mid-1990s.

In 2001, the group was reconstituted under Toni’s leadership at a meeting in Pittsburgh. Participants included deans from Syracuse University (Raymond von Dran), Drexel University (David Fenske), the University of Washington’s Information School (Michael Eisenberg), and the University of Michigan’s School of Information (John King). With that meeting, the “Gang of Five” was formed.

Beginning in 2003, Gang membership grew with the addition of deans from the Graduate School of Library and Information Science at the University of Illinois, the School of Information and Library Science at the University of North Carolina, the College of Information at Florida State University, the School of Informatics at Indiana University, and the School of Information at the

University of Texas, bringing it to the “Gang of Ten.” By this point, the informal name was becoming unwieldy and a bit inappropriate, particularly as continued growth was anticipated. Through the leadership of deans John King, the late Raymond von Dran, and Michael Eisenberg, the group’s agenda became more focused on building a sense of identity and community among the “information schools,” or “iSchools.”

Typically, the group met twice per year. Meetings, hosted by one of the deans, included private discussions among the deans as well as open conversations with faculty of the host school, and usually an informal reception or lunch. During the deans-only sessions, the agenda focused on challenging administrative, programmatic, and planning issues, in addition to the continuing interest in explaining IS better to our non-IS colleagues. The sessions also provided an opportunity to learn about the curriculum and research of each school. An early goal was to nurture the development of a critical mass of faculty across the schools to undertake collaborative research.

The group was formally named “the iSchools Caucus” (more casually referred to as the iCaucus), and its membership grew rapidly with the addition of:

- The School of Communication, Information, and Library Studies
Rutgers University (rejoining)
- The School of Information
University of California, Berkeley
- The Donald Bren School of Information and Computer Sciences
University of California, Irvine
- The Graduate School of Education and Information Studies
University of California, Los Angeles
- The College of Information Sciences and Technology
Pennsylvania State University

- The College of Computing
Georgia Institute of Technology
- The School of Library and Information Science
Indiana University
- The College of Information Studies
University of Maryland
- The Faculty of Information
University of Toronto

And in 2008, two more institutions joined:

- The Heinz School
Carnegie Mellon University
- The School of Information Systems
Singapore Management University

As a board member of the Computing Research Association (CRA), King introduced the iSchools Caucus to the CRA IT Deans Group, founded in 2000 at the Snowbird meeting and chaired by Peter Freeman (Georgia Tech). In 2008, the name of the CRA group was shortened with majority approval to the “CRA Deans” group. The CRA Deans group provides a broad forum for leaders of IT schools, colleges, and institutes to share experiences, strategies, opportunities, and concerns. It illuminates issues and seeks common ground leading to a coherent and unified voice for the academic and research communities, and to the general public. A substantial majority of the iSchool deans have joined the CRA Deans group in order to assure that information-related issues are appropriately reflected in the group’s evolving agenda.

MOTIVATION

The emergence and evolution of iSchools was triggered by the explosive growth in digital information. In a 2003 study,^[1] Peter Lyman and Hal Varian estimated that about 5 exabytes (5×10^{18}) of new information was generated in 2002 worldwide, with a growth rate of about 30% per year. They note that 5 exabytes “is equivalent in size to the information contained in 37,000 new libraries the size of the Library of Congress book collections.” A 2007 study by IDC^[2] concluded that the worldwide production of information in 2006 exceeded 161 exabytes, increasing at a compound annual growth rate of 57%. While only a small fraction of this information is accessible online (<2% by some estimates), it still represents an enormous and increasing amount of information that presents major challenges (and opportunities) in information management, access, and preservation.

Marcia Bates defines “the *domain* of information science [as] the universe of recorded information that is selected and retained for later access,” and posits that

applied IS is “primarily concerned with the form and organization of information, its underlying structure, and only secondarily with its content.”^[3] Add to this the study of human use of information and the design and development of the technological tools to utilize information, and an understanding of the domain of the iSchools emerges. Bates succinctly states these through three driving questions:

- What are the features and laws of the recorded-information universe? (physical question)
- How do people relate to, seek, and use information? (social question)
- How can access to recorded information be made most rapid and effective? (design question)

The iSchools are interested in the relationship between information, technology, and people. This is characterized by a commitment to learning and understanding the role of information in human endeavors. The iSchools take it as given that expertise in all forms of information is required for progress in science, business, education, and culture. This expertise must include understanding of the uses and users of information, as well as information technologies and their applications.

(From the iSchools Web site <http://www.ischools.org>, 2008.)

POSITIONING

The “identity debate” has a long tradition in information studies and it influenced the formation of the iSchools as a group. It takes on many forms and has multiple dimensions. Wanda Orlikowski and Suzanne Iacono^[4] argued for a theoretical focus on IT artifacts and laid out five relevant conceptualizations:

- Tool view (e.g., a productivity enhancer).
- Proxy view (e.g., surrogate measures such as return on investment).
- Ensemble view (e.g., technology embedded in a socio-economic system).
- Computational view (e.g., models and algorithms).
- Nominal view (e.g., studies of broad impacts such as outsourcing).

Ron Weber^[5] posited, “the identity of a discipline is established through the contributions it makes to theory.” He went on to suggest that he could find “only one class of phenomena for which theories sourced from other disciplines seemed deficient—namely, phenomena associated with building conceptual models and designing databases.”

Another facet of the identity discussion has been the attempt to draw boundaries. Izak Benbasat and Robert Zmud^[6] summarized some of this line of thought as placing claim on three necessary and sufficient criteria: a central character, distinctiveness, and temporal continuity. They argued that a dominant design for the information systems discipline “has yet to be realized” and that this hinders the field’s legitimacy. They affirmed the centrality of the IT artifact, placing the notion in a broad context including understanding capabilities and practices, human behaviors, usage, and impacts.

Robert Galliers^[7] pushed back on Benbasat and Zmud, arguing that boundaries and disciplinary cores emerge naturally as a field evolves. In IS, forces shaping this evolution include such topics as the digital divide, globalization, and IT in the developing world, resulting in a broadening of the locus of study to include societal, policy, and ethical issues. He suggested adopting a “transdisciplinary” perspective on the field of IS. Table 1 adapts Galliers’ characterization for IS to the domain of the iSchools.

DeSanctis^[8] reflected on the increasing pervasiveness of information technology, observing that “knowledge and creative use are no longer the sole domain of specialists.” This has shifted the dominant functional role of information professionals from development to leadership and support, and put many in strategic business positions. As information professionals take on these new roles, technical skills must be supplemented with new competencies in human relations and organizational effectiveness. As DeSanctis observed, “the institutional paradox for IS is that the domain has become of interest to many faculty groups yet the sole purview of none.” While, perhaps, not the *sole* purview, this is, most certainly, the *primary* purview of the iSchools. Rather than focusing on a bounded “domain,” DeSanctis argued for a “focus on the questions” and observed that these have historically generated excitement and impact in IS.

Daniel Robey^[9] continued the call for a “more flexible identity for IS” that avoids “the lure of a dominant research paradigm.” He suggested a pursuit of “pragmatic legitimacy” that casts IS as a “valued partner in intellectual exchanges with our external constituents: the governing bodies, business executives, university officials,

and scholars from other disciplines who are the key actors in IS’s organizational field.”

John King and Kalle Lyytinen^[10] acknowledged that the IS field lacks a theoretic core and has been “haunted by feelings of inadequacy” for 30 years. They proposed an alternative model for establishing legitimacy, grounded in three drivers:

- Salience of issues studied.
- Production of strong results.
- Maintenance of plasticity.

They offered an alternative view of the core of the discipline as a “market of ideas” where the IS field is defined as “the study of the design and management of information and associated technologies in organized human enterprise.” Rather than accepting the argument that theory should provide the foundation, they suggest, rather, that theory “to the extent that it has a role, is in the service of producing strong results.”

King^[11] sums up this discussion of identity, observing that iSchools

straddle the academy’s ancient engagement with information and the contemporary challenges of ubiquitous information affecting all aspects of society.... The [iSchool] movement is emergent; its equilibrium can only be found in an essential tension among competing visions in a world of rapid technical and social change. [iSchool] identity is elusive and will remain so for the foreseeable future.

EMPOWERMENT

Studying at an iSchool immerses students in this dynamic and emerging “iField,” where they confront the issues, opportunities, and challenges of an information society in the twenty-first century, in all their richness, controversy, and ambiguity. The iField addresses the fundamental issue of harnessing the incredible flow of information for the betterment of humanity.

The iField also empowers people in other fields to create, find, store, manipulate, and share information in useful forms. It may be unique in that, despite its elusive core, its subject, information, is at the heart of what individuals, organizations, and societies need in order to advance human endeavors, from acting to zoology. The iField’s most visible and viable outcome is the delivery of the right information at the right time to the right people in the right form.

ORGANIZATION

The iSchools were founded as a consortium to establish broad recognition of the iField and its importance to

Table 1 IS as a transdisciplinary domain.

	Disciplinary	Trans-disciplinary
Boundary	Organization	Society
Central artifact	IT	People/information
Focus	Inward	Outward
Scope	Narrow	Broad
Reference disciplines	Org-behavior, Computer science, etc.	IS, LIS, telecommunications
Properties	Defined	Emergent
Inter-disciplinary	A threat	An opportunity

society. In this role, they sought to position a group of academic institutions to identify, clarify, and speak to the major issues, challenges, and driving questions at the nexus of information, technology, and society. While a relatively small number of universities took the lead in establishing an organization with this goal, those who share the goal and contribute to its achievement go far beyond the small collection of organizers. The defining characteristics of iSchools (whether iCaucus members or not) include:

- An interest in the relationship between information, technology, and people.
- A commitment to learning and understanding the role of information in human endeavors.
- A recognition that expertise in all forms of information is required for progress in science, business, education, and culture.
- A belief that this expertise must include understanding of the uses and users of information, as well as information technologies and their applications.

The collective efforts of the iSchools (e.g., the iConference, the Web site, and special projects) are managed by the iCaucus. Members of the iCaucus pay an annual fee and have one vote on iCaucus decisions. The iCaucus charter specifies its membership criteria. Candidate memberships are reviewed by a membership committee and voted on by the full iCaucus membership. While not rigid, iCaucus members are expected to have substantial sponsored research activity, to engage in the training of future researchers (usually through an active, research-oriented doctoral program), and a commitment to progress in the information field. Each iSchool's representative to the iCaucus (usually a dean) is expected to report to the chief academic officer of the parent institutions.

The iSchools sponsor the iConference as a forum for faculty, students, and researchers to share their work and to develop their extended network of colleagues. The conference runs 3–4 days and the program typically includes a doctoral colloquium, poster and paper sessions, panels, roundtables, and social events. The first iConference was held at Penn State in September 2005.^[12] Subsequent iConferences were hosted by the University of Michigan and UCLA, with the 2009 iConference being hosted by UNC Chapel Hill.

VISION

As a relatively straightforward example, consider an iSchool's approach to information assurance, an issue of contemporary salience, for which we seek to produce strong results while adapting to changing conditions. When viewed as a technological issue, scientists and

engineers are likely to focus on topics such as cryptography, steganography, public key infrastructure, and intrusion detection, or, in other words, technical areas in which they are likely to have significant interest and expertise. The same set of issues viewed from the perspective of librarians may be more likely to draw attention to questions of identification, authentication, provenance, and access. A social scientist, on the other hand, may focus on issues of confidentiality, authentication, privacy, and integrity. So who is right? Clearly, they all are. Information assurance is a multidisciplinary problem with extraordinarily complex and interrelated technical, policy, and social challenges. An iSchool provides the venue that enables scholars from a variety of contributing disciplines to leverage their individual insights, perspectives, and interests, informed by a rich, "transdisciplinary" community.

But transdisciplinary collaboration is not a natural act. Not only does each discipline bring to the table a set of values, goals, models, economics, and ethics that have evolved slowly and in relative isolation over an extended period of time within their discipline, but also they must interact with and respond to the interests of external bodies. These are not always aligned in ways that foster rapid agreement.

- Values—some will argue that strength is derived from information access, while others contend that power is founded on information control.
- Goals—some argue for increasing safety and security by way of imposing limits and locks, while others opine that justice and accountability are advanced through dialogue and debate.
- Models—some see information access primarily as a societal responsibility, where others view it dominantly as a business opportunity.
- Economics—information is expensive to create and publish, but cheap to replicate and distribute.
- Ethics—some argue that ethics are trumped by the realities of the real world, while others rebut that they are motivated by that very same world.

The complex interaction among the disciplines, when allowed to play out in an iSchool, provides a rich environment for the education of information professionals. Exploiting the very tensions that arise among the various constituencies enriches the creative insight of each. Among the issues feeding such creative dialogue are topics such as:

- Intellectual property rights and its relation to fair use.
- Open, extensible systems as an alternative to proprietary, closed designs.
- Access to publicly funded information balanced against legitimate security requirements.
- Assuring ethical public policy when the need for expediency feels overwhelming.

- Recognizing the need for both selective government secrecy and accountability through open records.

While the resolution of these issues is ultimately expressed in society's evolving social contract, the iSchools serve a vital role by:

- Preparing the next generation of information professionals.
- Informing the relevant social and political structures regarding the implications and use of information technologies.
- Assuring that debates surrounding the development of policy and law are properly informed by sound scholarship.
- Advising society of the potential consequences of policy alternatives.
- Interpreting opportunities and implications of policy alternatives.
- Remaining, themselves, engaged students of a highly dynamic landscape of change.

So what is an iSchool in the twenty-first century? Informed by decades of debate and responding to exceptionally rapid changes in technology and uncertainty in public policy, iSchools foster the development of an intellectual space where true interdisciplinarity plays out. In so doing, they introduce a range of challenges to traditional university structures and practices regarding organizational boundaries, promotion and tenure policies, doctoral education, research legitimacy, etc., as they create an environment where issues of information are addressed systematically, regardless of disciplinary heritage or presumed "ownership." In this way, iSchools respond to the salient issues of the time by stressing the production of strong results. They are in a constant state of adaptation within their core competencies, while building necessary bridges among disciplines. The iSchools recognize that the near-term future will be shaped largely by industry, so their applied research agenda is strongly influenced by these emerging needs and directions. But the iSchools lead industry and government in the study of timeless, recurring, theoretical questions, and educate the next generation of information professionals who will shape the future of a global information society.

RECOGNITION

Von Dran was a dynamic and powerful force in both the development of the School of Information Studies at Syracuse University and the formation of the iSchools movement. In his own words,

Information schools are advancing a common notion that it's *information*, and not simply the technology, that is the

driver. The information field must harness a number of disciplines and approaches that critically affect the relevance, timeliness, accessibility, and quality of information. These schools bring together the various aspects of technology, management, policy, and usability, among others, for the benefit of people everywhere.

In his honor, the iSchools have established an award to recognize others who have demonstrated Ray's commitment to excellence and leadership. The award is presented at the iConference and includes a monetary award and an opportunity for the award winner to share his or her vision of the challenges and opportunities confronting the information profession to conference participants.

ACKNOWLEDGMENT

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Israel: Libraries, Archives, and Museums

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Abstract

This entry presents three cultural institutions—libraries, museums and archives—in Israel, against the backdrop of the international Jewish Diaspora and the establishment of the State of Israel in 1948, as an immigrant absorbing nation, where foreign powers previously ruled (the Ottoman Empire until 1917 and the British Mandate from 1917 to 1948). In this historical and governmental context (with its legislative, municipal, social and cultural ramifications), the entry traces the development of these three institutions and paints an up-to-date portrait of their current situation.

INTRODUCTION

After the failure of the rebellion against the Romans and the fall of Jerusalem in 70 C.E., many Jews were dispersed to foreign lands and only a few remained in *Eretz Yisrael* (The Land of Israel), living under rulers who changed several times over the centuries. From 1517 until 1917, Eretz Yisrael was part of the Ottoman Empire. Following World War I, the British received a mandate to rule in Eretz Yisrael, which continued until May 15, 1948 (as a result of a United Nations decision made in November 1947) (see Fig. 1).

Modern Israel is a country that absorbs Jewish immigrants. It developed primarily through five waves of pre-State immigration, which brought some 450,000 immigrants to Israel from 1882 to 1948 and a mass immigration from Eastern Europe and the Arab countries after the Holocaust and the establishment of the State of Israel. The Jewish population has grown from 649,000 in 1948 to 5,567,000 in December 2008.^[1,2]

The Arab sector in Israel numbers 1,487,000 people, who are 20.2% of Israel's population. There are also 319,000 non-Jewish immigrants and 200,000 foreign workers, who are not citizens, living in Israel.

This entry will survey the development of libraries, archives, and museums in the State of Israel and present a current portrait of these cultural institutions.

LIBRARIES

Historical Perspective

During the years when there was no autonomous Jewish rule in Eretz Yisrael, libraries existed in synagogues and study houses (*Beitei Midrash*), as well as private collections. In the nineteenth century, non-Jewish communities

also maintained libraries in Eretz Yisrael, mainly in Jerusalem. These were owned by foreign institutions and mainly contained books about Eretz Yisrael for the use of archeologists, historians, and tourists. There were also theological collections and devotional literature in monastery and church libraries.

The first library in Eretz Yisrael to include secular literature was the one established in the Jewish hospital in Jerusalem in 1854, which received a delivery of books in several languages, sent from Paris. In 1870, the first agricultural school, Mikve Israel, was founded, including a library that began with 300 volumes and grew to approximately 3000 by the end of the century.

The last quarter of the nineteenth century saw the opening of the first secular public libraries in Jerusalem (the Montefiore Book Collection in 1874), Rishon Lezion (1883), Jaffa (1886), Safed (1891), *Sha'ar Zion* Library in Jaffa (1891), the Abravanel House Library in Jerusalem in 1891 (which later became the National Library), Petah Tikva (1892), Zichron Yaacov (1895), Hadera (1899), and Sejera (1902).^[3] During the period of the British Mandate, there was not one Jewish town or village in the Land of Israel that did not have a library of some type, although many were unable to maintain an uninterrupted existence.^[4] These libraries were established, first and foremost, because the ideology of the Jewish national revival movement strove, among other things, to create a society with modern goals for education and cultural creativity.^[4] Other contributing factors were the tradition of study and the unique status of books in Jewish culture. The Enlightenment Movement led to the development of cultural and educational institutions and the establishment of Hebrew newspapers. Indeed, the founders of many libraries in Israel were teachers and groups of educated people.

The nineteenth century also saw, for the first time, the establishment of libraries as part of *educational institutions*, though some of these also served the general public.



Fig. 1 Map of Israel.

Source: CIA *The World Factbook*.

During the 1890s, libraries were set up in schools for the first time, in Petah Tikva, Gedera, and Sejera. The collections in these school libraries reflected the education that the schools provided and educational trends at that time. They generally included religious literature and, sometimes, secular Hebrew literature. In some libraries, French literature was also included.

The General Federation of Labor of the Hebrew Workers in Eretz Yisrael, or *Histadrut* partially

compensated for the lack of the autonomous municipal governments that were responsible for the establishment of public libraries throughout the Western world. The *Histadrut* concerned itself not only with workers' interests but also with the provision of culture, and regarded libraries as a basic component of social, educational, and cultural life. Among other things, the *Histadrut* set up workers' libraries in many urban communities, mainly beginning in the 1920s and 1930s. Earlier instances of this phenomenon involved small workers' associations that set up small "workers' clubs" and "reading rooms" in the late nineteenth and early twentieth centuries.

In 1892, the Jerusalem bureau of the B'nai B'rith organization set up the Abravanel House Library. This library initially contained *belles lettres* as well as theoretical and scientific literature and soon adopted the goal of amassing *all* Hebrew works and material pertaining to the Jews of Eretz Yisrael, some of which had also been published in foreign languages. Hence it gave priority to books on Judaism and rare books, and issued appeals to Diaspora Jewry to establish depositories for the books of the Jewish people.

It was thus, at the initiative of a few individuals, that the nucleus of the National Library of Israel was formed. The first to call for the creation of a national library that would amass books in the areas of Judaism and the Land of Israel came from Rabbi Yehoshua Heschel Levine of Volozhin, whose article on the topic appeared in the Jerusalem periodical *Havatzelet* in 1872. The Hibbat Zion movement in Odessa also advocated the creation of a national library. Among those active in this connection was a Hibbat Zion member Dr. Joseph Chazanowicz of Bialistok, who, after visiting Eretz Yisrael in 1890, decided to devote his life to the collecting of books. During 30 years of activity he collected 16,000 books, many of them rare, and transferred them to the Abravanel House Library.^[5]

In 1920, the library was acquired by the World Zionist Organization and, for the first time, a professional librarian, Dr. Shmuel Hugo Bergmann, was appointed as its director.^[6] In 1925 with the establishment of the Hebrew University, the first university in Eretz Yisrael, it was decided that the library would serve as a national and university library. The library also served as a public library, open to all, thus filling a void that had previously existed in Mandatory Eretz Yisrael.

The National Library

Since its establishment, *The Jewish National and University Library* has served a threefold purpose. It is the national library of the State of Israel, the national library of the Jewish people, and the central library of the Hebrew University. However, there are plans to change this and the process of reestablishing the national library as an organizationally and financially independent body has



Fig. 2 National Library of Israel.
Source: National Library of Israel.

begun. A law passed in November 2007 delineates the transition process and the goals of the National Library. In accordance with the law, the National Library has been as a public-service corporation since June 2008 but remains a subsidiary of the Hebrew University. When the transition process is complete, within 3 years, it will no longer be a subsidiary of the Hebrew University but rather an independent organization known as the National Library (Fig. 2).^[7]

The library serves as a depository for all books published in Israel. In 1953, the first legislation was passed requiring that a copy of all publications be submitted to the National Archive, to the Knesset (parliament) Library, and to the National Library. In 2000, the law was expanded to include publications that are not printed on paper. The library also collects material about Israel, the Jewish people, and Judaism, as well as material written in Hebrew script and in other Jewish languages (Yiddish, Ladino, etc.) from every place and time. In addition, it has collections of rare Judaica and Hebraica, manuscripts and incunabula amassed from all corners of the world. The library also contains one of the largest and best-organized collections on Arab and Islamic subjects in the Middle East.

The library contains over 5 million books and periodicals, as well as many thousands of items in special collections, such as manuscripts and archives (see the section on Archives), maps, and music recordings. Most of the collections are in closed stacks. The library also has about 11,000 manuscripts, 9000 of them in Hebrew and the rest in Arabic. The library's Paleography Project is conducting research on the codicology and paleography of dated medieval Hebrew manuscripts. The library also houses the Institute of Microfilmed Hebrew Manuscripts, which has undertaken to collect microfilm copies of all Hebrew manuscripts extant in public and private collections. Over 60,000 items, representing 90% of known Hebrew manuscripts, are already available to scholars.

Among the library's special collections are the Depository Collection of the United Nations, which contains publications of the United Nations and documents of the League of Nations; the European Union Depository Collection.

The Jewish National Library publishes the *National Bibliography (Kiryat Sefer)*, an annotated bibliography that contains entries for all works on Israel, Jews and Judaica, published in Israel and abroad. The library also publishes a bibliography of periodical literature called *Index of Articles on Jewish Studies (RAMBI)*, which covers journals and periodicals from all parts of the world.

Another research tool prepared by the library is a retrospective bibliography of books printed in Hebrew characters, *The Bibliography of Hebrew Books, 1472–1960*. It also provides online links to two other indexes: The Index to Hebrew Periodicals and the Index to Hebrew Israeli Newspapers, which are prepared by other Israeli libraries. The library has begun a digitalization project that includes making the library's collection of Jewish marriage certificates, manuscripts of the Mishna and Talmud, ancient maps of Jerusalem, official records of Jewish communities, the Einstein archive and historical Jewish and Israeli newspapers, etc. available to all on its Internet site: jnul.huji.ac.il.

Academic Libraries

When the State of Israel was proclaimed in 1948, it had two universities: the Technion Israel Institute of Technology, founded in Haifa in 1924, and the Hebrew University of Jerusalem, established in 1925, on Mount Scopus. Since then, six additional universities have been established: the Weizmann Institute of Science (1949), Tel Aviv University (1953), Bar-Ilan University (1955), the University of Haifa (1963), Ben-Gurion University of the Negev (1966), and the Open University (for distance education, 1976). Today there are also 30 academic and regional colleges, including some private institutions, and 25 teachers'

training colleges. In recent years many colleges have been upgraded and have begun to grant academic degrees.

The Israeli universities do not use a uniform library model. Whereas the University of Haifa and Ben-Gurion University have one central library, other universities, for example, Bar-Ilan University and the Technion, have many departmental libraries. Others, like the Hebrew University, also have large division libraries.

Interuniversity cooperation

In 1969, the government established the Israeli Standing Committee of the National and University Libraries (SCONUL), a voluntary forum for discussing problems of policy and planning. SCONUL initiated an interlibrary loan system among the universities and set up a group of committees to deal with cataloging, acquisition, reference, periodicals, and circulation.

In 1979, the Hebrew University developed a library automation system (ALEPH) that was adopted as the software program of the university libraries in Israel. The Grants Committee of the Israel Council of Higher Education has also contributed to this by subsidizing the university libraries' participation in ALEPH. Today, all the catalogs of the universities and the majority of the colleges in Israel are on the ALEPH network. The *Israel National Catalog* currently lists over 8 million books, periodicals, and audiovisual items in 65 university, college, and specialty libraries. The catalog uses MARC format and ALEPH-500 software. All Unicode characters are supported.

In 1998, the university heads established a consortium framework, the Israel Center for Digital Information Services (MALMAD). MALMAD's main function is the acquisition, licensing, and operation of information services for all the Israeli universities. It makes databases, directories, and digital journals available to the universities.^[8]

Public Libraries

In the 1960s, just 15 years after the establishment of the State of Israel, there was an attempt to change the educational system in order to promote social equality and integration in the new society, which included immigrants from various cultures. In this context, the government began to address the issue of public libraries.

In 1962, a Department of Libraries was created in the Ministry of Education for the purpose of encouraging public libraries, which more than half of the communities lacked. Furthermore, few of the existing libraries met the criteria for proper service in terms of collections, opening hours, and staffing.

In 1975, the Knesset passed the Libraries Law which did not mandate the establishment of a public library in every town but did set criteria for recognizing a library as

"public" and the resultant eligibility for some degree of funding from the national budget. The law also established the Council for Public Libraries, which advises the minister regarding implementation of the law and submits its own proposals to him.

When the development of the libraries began, there was a gradual but steady increase in the percentage of registered readers using public libraries. In 1985, 25% of all residents of the state were registered in libraries. Since that time, there has been an ongoing, gradual decline in the number of readers and in 2007 approximately 16% of residents are registered in public libraries.

In 2007, all Israeli public libraries together circulated 8.7 million items and 3 million users visited their reference rooms; of these, 900,000 were Internet users. (Information from the Department of Libraries, Ministry of Science, Culture and Sport.) As of today (2008), there are 212 administrative library units in Israel, which together encompass 862 service points (including all branches). The library units include 44 regional libraries and 50 urban units located in community centers. Another 120 have a double function, serving as both regional and school libraries; of these, 80 libraries operate in elementary schools and 40 in high schools. The regional libraries, which began in the 1960s, are now being transformed to conform to a new organizational conception, adopted in 2006. Instead of having a small library in every town or village, larger libraries are being formed to serve several communities, alongside central libraries that serve not only the public but also an educational institution.

A vast majority of the libraries' current collections are in Hebrew, even though Israel is an immigrant society. For many years, a melting-pot conception of immigration prevailed in Israel. A survey done in 1980, found that only 11% of all the collections in the public libraries included material in foreign languages, and most of it was not in dynamic collection.^[9]

During the 1990s, a different concept of immigration developed in Israeli society and it came to be understood that immigrants have an inner need to preserve their mother tongue and cultural heritage. In the library field, this was manifested in a greater emphasis on materials in languages spoken by the immigrants living in a given community. To aid the libraries in this regard, a central library for Russian was set up in 1989 to provide libraries throughout the country with long-term loans of books in Russian. There are also central libraries for books in French, established in 1986, and Spanish, established in 2003.

Most libraries do not have nonbook collections. Only a few libraries have audio or video collections, but in the last decade libraries have begun to make computers available to the public, offering multimedia materials, games, and access to the Internet. Currently, computer stations are available in half of the libraries (see Figs. 3 and 4).

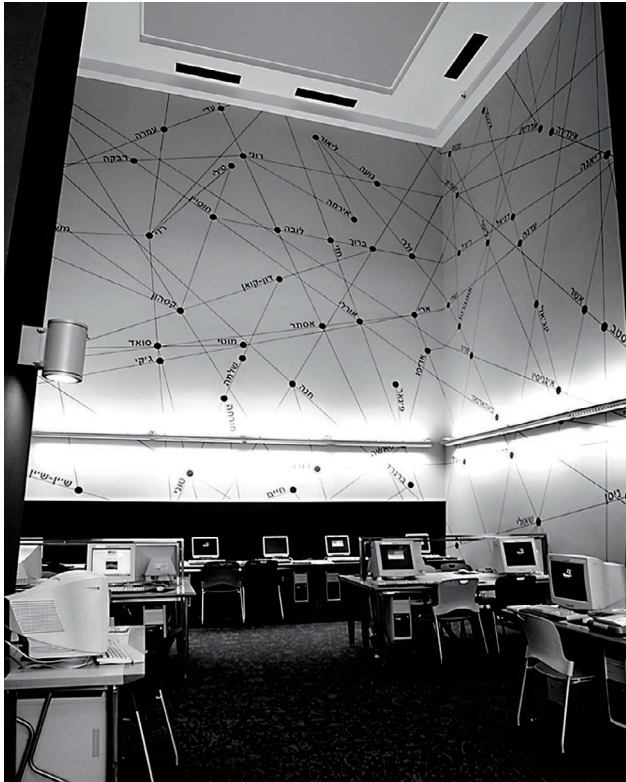


Fig. 3 Computers in Holon Mediatheque (Public Library).
Source: Central Library in Holon.

Funding of the Israeli public libraries is the responsibility of the local governments, which determine their budgets, and there are substantial differences in amounts allocated by the different local authorities. In addition, the libraries receive some support from the Ministry of Culture, though the proportion of its budget allocated to libraries has declined over the years and was about 10% of the total budget for libraries. On July 16, 2007, the Knesset passed a law that set a scale for the gradual increase in the State's budgetary allocation for the libraries, beginning in 2008. In 2008, the proportion of the libraries' budget allocated by the government rose to about 15%. By 2013, the State should be funding half of the libraries' budgets. Over the past 25 years, 70% of libraries in the urban communities have resorted to collecting fees for subscriptions to lending services. This source constitutes 5% of the libraries' budget. The new law makes receiving the higher allocation conditional on discontinuing the collection of subscription fees. Most libraries did indeed stop collecting fees as of January 2008. This is probably the reason for the increase of approximately 20% in the number of readers and circulation in 2008.

The Israeli Center for Libraries

In the 1960s, a decision was made to learn from the Scandinavian model of a public library system. This led, in 1965, to the creation of the Center for Libraries that



Fig. 4 Seating Area in Holon Mediatheque (Public Library).
Source: Central Library in Holon.

provides central services to the libraries. The Center provides central cataloging services to public and school libraries in Israel (now in electronic form), publishes professional literature and tools for librarianship. It also offers an array of courses, and training; organizes annual conferences; serves as the Israeli representative of ISBN; and provides consultancy services to libraries on the management, architecture, equipping, and furnishing of libraries, as well as supplying products and services for the encouragement of reading.

School Libraries

During the first years of its existence, Israel absorbed massive waves of immigration, and the focus in those years was on the establishment of a school system. For a long period, many schools had only a small number of books or small library collections. Only in the 1970s, with the increased awareness of the importance of school libraries, did the creation of school libraries begin.

In 1988, the Department of Libraries of the Ministry of Education and Culture assumed responsibility for dealing with school libraries and this led to the intensified cultivation of existing libraries and establishment of new libraries in the schools that still lacked them. The findings of a survey done by the department in 1993–1994 showed a substantial increase in the number of school libraries in Israel, with libraries functioning in 87% of the high schools and 83% of the elementary schools. During 1992–1994 an average of 66 new libraries were established each year.^[10] Since the early 1990s, the concept of the library as a “resource center” has developed and there has been a countrywide effort to make the libraries into resource centers.

Today, there are a total of 2414 elementary schools in Israel (in the educational streams of all sectors, including small, private ultraorthodox schools) and 1941 high schools.^[11] Currently, 20% of the elementary schools still lack libraries, as do 10% of the high schools. Undoubtedly, the situation of the high school libraries is better than that of the elementary school libraries, although more books are lent for free reading in the elementary schools reflecting the decline in reading as students get older and the greater emphasis that elementary schools place on encouraging reading.

The Ministry of Education’s regulations require that there be a librarian in every high school but not in every elementary school. Therefore, elementary school principals can decide whether or not there will be a librarian in their school and what the scope of the librarian’s activities will be.

Special Libraries

In Israel approximately 600 special libraries are operated by government agencies, institutes and research centers, hospitals, museums, banks, corporations, and enterprises.

One special library is the *Library of the Knesset*, which began to operate in 1950. Its main role is to serve the members of Knesset and support the legislative process. To this end, it includes an *Information Center*, which was set up in 1973, and prepares surveys on various subjects, at the request of members of Knesset and their aides or of the various Knesset committees and bureaus. In the framework of the *Freedom of Information Law* (1998), which stipulates that it is the right of every Israeli citizen or resident to receive information from a public authority and defines information as “any information that exists within a public authority and is written, recorded, filmed, photographed or computerized,” the library provides citizens with information on the activities of the Knesset and its committees, on bills presented and laws enacted. The information is provided by means of telephone, mail, fax, and the Knesset’s Internet site (<http://www.knesset.gov.il>), which is operated by the library.

Medical libraries are a prominent group of special libraries. At present, there are approximately 80 medical libraries in Israel of various kinds. Israel has four medical schools (at the Hebrew University, Tel Aviv University, the Technion, and Ben-Gurion University), each with its own large medical library. In addition, all hospitals have medical libraries, some are large but others employ only one person. Twenty-two of the medical libraries are organized into two regional networks, centered around university libraries. The network began its operation in 1975, aiming to promote interlibrary cooperation based not only on the sharing of resources but also on specialized biomedical information and professional skills. The academic medical school libraries are responsible for coordinating the work of all the medical libraries in their region.^[12] The consortium of medical libraries fills the following functions: 1) joint purchase of online data bases and e-journals; 2) interlibrary loans—supplying documents and scientific publications to libraries, using the same software for transmitting documents; and 3) holding seminar days and training sessions.

Another special library is that of the Standards Institution of Israel, which has an extensive standards and technical documentation library (<http://www.sii.org.il>), where the Israeli standards and specifications are collected in both electronic and print formats. There is also a vast collection of foreign standardization documents, including international standards, as well as guidebooks and databases in the field.

The Arab Sector

The Arab sector accounts for 20% of the population. They live in 123 settlements and consist of five different groups: Moslem Arabs (58%), Moslem Bedouins (15.4%), Christian Arabs (15%), Druze (8.8%), and Circassians (2.8%). Eight mixed towns or cities are home to 35% of the Arab

population while the remainder live in exclusively minority towns (88) and villages (35).

Academic and research libraries

Five universities—the University of Haifa, Hebrew University, Tel Aviv University, Ben-Gurion University and Bar-Ilan University—offer studies in Middle Eastern and Islamic Studies and Arabic language and literature. Each of these universities maintains large academic collections of literature and books in Arabic to serve the academic departments.

The University of Haifa has a large Arab student population and its library is used by Arab teachers and high school students in the region. Therefore, it has a policy of building a more comprehensive collection of Arabic books on all subjects.^[13] It also has a collection of children's literature in Arabic.

Israel also has three colleges for training Arab teachers: the Academic Center for Training Arab Teachers (part of Beit Berl College), the Arab College in Haifa, and the Islamic College in Baka al-Garbia. Each of these has a library that provides resources for instruction. Not many books in Arabic are published in Israel, a small amount of fiction and a few scholarly works. Therefore, the librarians have to travel to the annual book fair in Cairo, where they can order books that have been published in Egypt, Jordan, Saudi Arabia, Kuwait, Morocco, and Sudan.

There are also research institutes in related fields, among the better-known ones being the Harry S Truman Research Institute for the Advancement of Peace and the Moshe Dayan Center for Middle Eastern and African Studies, both of which maintain collections of books, periodicals, and daily newspapers from Israel, the West Bank, and Arab countries.

There are other institutions in Israel that, though not part of universities, conduct research on the Middle East and maintain collections in Arabic. These include the Givat Haviva Institute for Advanced Studies, which includes the Jewish-Arab Center for Peace that houses an information center includes several dozen items in the field of Middle East studies, including files of newspaper articles published in Israel and various Arab countries, etc. Use of this collection, which offers items in Arabic as well as Hebrew and English, is open to all, but it is used mostly by lecturers, doctoral candidates, college students and high school students working on term papers, including many students from the nearby settlements of Wadi Ara.

Public libraries

During the Mandatory period there were no public libraries for Arabs. Until Israeli educational patterns began to influence the Arab sector, religious organizations played an important role in promoting reading and libraries among the literate elite of this sector. The Moslem

Religious Endowment (*waqf*) still maintains two libraries, in Jerusalem and Jaffa. Their collections consist mainly of Moslem religious and legal literature.^[13]

In the Arab sector, too, the Histadrut played an important role during the pre-State era and the two first decades of statehood. The Arab Department of the Histadrut established 47 clubs in villages of the Galilee and central Israel, each containing 500–3000 library items.

After 1948, the Arab libraries were almost exclusively initiated and operated by Jewish authorities, mixed municipalities, the Histadrut, the Prime Minister's Office, the Department of Libraries of the Ministry of Education and Culture, and other Jewish and Arab organizations.^[13]

The development of modern libraries by the Arab community itself began in the 1970s. This reflected social, political, and educational changes that encouraged the creation of library services in the Arab and Druze sectors. During the 1960s, the Ministry of Interior encouraged the development of municipal self-rule in Arab communities and they began to change. A vast improvement in Israeli communication and transportation systems gave Arab villages access to neighboring urban centers. The combination of high population growth and high unemployment impelled the younger generation to seek employment outside the villages. There was also a growth of light industry and commerce in the villages, in addition to agriculture. Young people went to the universities, and new political power centers began to develop in the villages.

Today, there are 56 independent public libraries in the Arab settlements, 12 libraries that are branches of regional libraries and 5 libraries in mixed settlements. Seventeen Arab towns still do not have libraries. About one-third of the libraries in the Arab sector are located in schools and serve as combined libraries. Indeed, most of the library users in the Arab sector are children and teenagers.

School libraries

Before the British Mandate, there were only a few Arab schools in Eretz Yisrael, supervised by the Turkish Ministry of Education. The British authorities regarded the educational advancement of the Arabs in Eretz Yisrael as an important goal. The public school system was designed mainly for the Moslems, while Christians had missionary schools. The British Mandate's efforts, however, lagged behind the Arab population's growth rate, so that many children still received no education.^[14]

The Compulsory Education Act of 1949 obligated parents to enroll children in school and led to a great improvement in the Arab sector's educational level. In Israel today, there are 417 Arab elementary schools and 202 Arab high schools. Recent years have seen an impressive growth in the number of school libraries in the Arab sector, reflecting the encouragement of increased awareness among the school administrators, especially in the Druze sector. At present, 70% of the elementary schools

have a library and 84% of the high schools. Their collections are smaller than those in the Jewish sector because most Arab libraries were established more recently and have not yet acquired a large stock of books. In addition, they tend to limit their collections to material directly related to the curriculum and do not purchase many fiction books. Moreover, it is difficult to obtain material in Arabic, since it must be ordered from foreign countries. Most is ordered from Jordan (this is also affected by the political situation in the region). Most of the collections in these libraries are in Arabic (71–83%), with only a small proportion in Hebrew.

Professional Education

Until the first school of librarianship was established in Israel in 1956, an Israeli could only become a professional librarian by going to Europe or the United States for training. Under the directorship of Shmuel Hugo Bergmann (1920–1935), the National Library sent workers abroad for training and sometimes employed immigrant librarians who had been trained in their home countries. During 1936–1947, the library profession came to be regarded differently. Fewer people went abroad for training, instead receiving short courses at the workplace as well as on-the-job training.^[15]

In 1956, the first library school was set up as an academic department at the Hebrew University of Jerusalem, the School of Library, Archive and Information Studies, which was closed 3 years ago.

In 1973, the Department of Library and Information Studies was inaugurated at the University of Haifa, where training courses had been provided since 1971. Today this is a small department that offers a postgraduate diploma as well as a librarianship track within the framework of a general B.A.

The following year (1974), Bar-Ilan University opened a department of librarianship, known since 1999 as the Department of Information Science, which has become the largest department in Israel, offering B.A., M.A., and Ph.D., degrees. The areas of specialization it offers are

For the M.A., degree: Organizational Information Services and Knowledge Management; Information Technology; Information Specialization in Cultural and Educational Institutions; and Social Information.

B.A.: Web Technologies; Information studies.

In addition, there are three teachers' colleges that offer nonacademic programs in Librarianship and Information Studies: Beit Berl College (Kfar Saba), Oranim College (Haifa), and David Yellin College (Jerusalem).

There are currently two relevant professional organizations: the Organization of Israeli Librarians was set up in 1952, and its members are mostly librarians of public and school libraries. The Association of Special Libraries and Information Centers in Israel (ASMI) was founded in 1966, and mainly encompasses academic libraries, special

libraries, and information centers. These two professional organizations have decided to merge into one organization and the merger will occur during 2009.

MUSEUMS

Historical Perspective

In Israel today, there are approximately 200 museums involved in the collection and display of art-objects in a wide range of cultural areas: archaeology, history and heritage, art, anthropology, folklore, and Judaica, as well as nature, science, and technology.

The first museums were established under the Ottoman regime. Between 1848, when the first museum was opened in Jerusalem, and 1917, 30 museums were opened in Eretz Yisrael. Most of the museums and collections established in the late Ottoman period were located in either monasteries and churches or schools and research institutes.

The establishment of the museums was influenced by eighteenth century Europeans' growing interest in Middle Eastern archaeology and the settlement of European subjects in Eretz Yisrael and the opening of foreign consulates, which opened educational and cultural institutions. These institutions began to collect archaeological findings and set up museums, although most were not open to the general public.

Meanwhile, the national movements in Europe, including the awakening of the Zionist movement, led to the establishment of Jewish museums in Europe and the United States. Although these expressed the desire to be integrated into the general community,^[16] they also led to recognition of the importance of Jewish culture and efforts to establish national museums in Eretz Yisrael.^[17]

In this spirit, Yosef Hazanovitz proposed establishing a Jewish national library, including a museum and, in 1895, he began collecting portraits of Jewish personalities.

In 1906, the *Bezalel National Museum* was established by Boris Shatz, as part of the Bezalel School of Art that also he founded, and began to collect works by Jewish artists, archaeological relics and local ethnographical artifacts of Jews from Middle Eastern countries. The 1930s marked a milestone in the development of museums, as result of German Jews' arrival in Eretz Yisrael, bringing with them artistic trends and collections that were not present previously. During that period, works by Jewish artists, Dutch paintings from the seventeenth century, and French paintings from the nineteenth and twentieth centuries were acquired and the museum collection of graphic arts was started. After World War II, it became a repository for many art objects belonging to people who had been killed during the war. These collections formed the foundation for the collections of the Israel Museum, which was founded in 1965.

The 1970s and 1980s were a vital period of growth during which new museums of many types were established.^[18] During this period, more than 80 heritage museums and sites were established in *moshavot* (rural towns) and *kibbutzim* throughout the country, to commemorate the nation-building, pre-State era.^[19] Many of them were established through local initiative and later gained public recognition and support.^[20,21] This trend continued into the 1990s, when museums became progressively more interactive and began to rely less on collections of objects.

The interactive trend is evident in both science museums, such as Bloomfield Science Museum in Jerusalem, and historical museum, such as those in Ein Shemer and Yifat. In addition, art museums that are also based less on a collection and more on changing exhibits of contemporary art were founded in Herzliya, Tefen, and other places.

Museums in Jerusalem

A large concentration of museums is located in Jerusalem. Some of them were established during the Mandatory period (1917–1948), some in the period after the establishment of the State in 1948 and the rest in the 1970s.

During the British Mandate, the following, mostly archeological, museums were established or refurbished: *Greek Orthodox Patriarchate Museum* in the Old City of Jerusalem; *The Museum for Islamic Art* on the Temple Mount in the Old City (1923), which is dedicated to Islamic artistic traditions and craftsmanship and the *Franciscan Biblical Museum*, on the Via Dolorosa in the Old City (1902) which houses archeological artifacts that were excavated by Franciscan archeologists.

The Rockefeller Museum was founded outside of the Old City walls in 1938, with a donation from John D. Rockefeller, Jr. It was designed by the British architect Austen Harrison, who combined concepts of Western architecture with Eastern influences. The museum still exists and is now managed by the Israel Museum. Its archeological displays are arranged chronologically; most were unearthed during Mandatory period excavations, including those at Megiddo, Samaria, Beit Shean, Lachish, Jericho, Ha'i, Tel Beit Marsis, Beit Shemesh, and Gezer.

The largest and most important museum in Israel, *The Israel Museum, Jerusalem* was dedicated in 1965. The museum, which is currently (2009) undergoing extensive renovations, has important collections in the fields of archaeology, ethnography, and Judaica, in addition to Israeli and world art. The archeological displays are arranged chronologically, beginning with the pre-historic era and continuing until medieval times. It includes a hall display of the cultures of neighboring countries and the religion and ritual of the Biblical world.

The Judaica and Jewish Ethnography Wing preserves Jewish ritual objects from Jewish communities around the

world, including two synagogues, one from Italy (seventeenth century) and one from Germany (eighteenth century) that were moved to the museum in their entirety. The museum's Judaica collection is one of the largest in the world and it includes important manuscripts, including the Rothschild Miscellany, the Birds Head Haggadah, and the Cassuto Pentateuch.

A separate building, The Shrine of the Book, houses the Dead Sea Scrolls, which were accidentally discovered in a cave at Qumran (near the Dead Sea) in 1947, and were written by the Essenes during the Second Temple period (second century B.C.E. to the first century C.E.) (see Figs. 5 and 6).

It is interesting to note that other than the Israel Museum's Judaica collection and several small collections in small museums (the Ein Harod Museum of Art and the Italian Synagogue in Jerusalem), most Judaica collections are located outside of Israel, in hundreds of Jewish museums around the world.^[20]

Since the 1970s, Jerusalem is again seeing a period of growth and the construction of new museums. *Tower of David—Museum of the History of Jerusalem*, at the Jaffa Gate to the Old City, presents the story of Jerusalem throughout the 4000 years of its history and the central events of each period, with emphasis on the city's importance to the three major monotheistic religions. It is



Fig. 5 The Shrine of the Book, Israel Museum.
Source: The Israel Museum.



Fig. 6 The Shrine of the Book, Israel Museum.
Source: The Israel Museum.

housed in the Citadel and includes carefully tended, internal archaeological garden.

The *L. A. Mayer Museum* for Islamic Art was opened in 1974 and consists of nine galleries, staged in chronological order, displaying the beliefs and art of Islamic civilization. *The Bible Lands Museum*, Jerusalem, (1992) focuses on biblical history through ancient Near Eastern art, from the dawn of civilization through the early Christian era. The museum illustrates the culture of all the people mentioned in the Bible from Egypt eastward, across the Fertile Crescent to Afghanistan, and from Nubia, north to the Caucasian mountains.

Art Museums

In addition to the art collection of the Israel Museum, there are other art museums and many small galleries. The most prominent art museum is the *Tel Aviv Museum* that was founded in 1932 at the initiative of the city's mayor at the time. Meir Dizengoff, who acted to collect outstanding works by Jewish and non-Jewish artists. The museum's Israeli and international collection incorporates a wide range of the paintings, sculptures, drawings, and prints from the impressionist, postimpressionist, modern and contemporary periods. The collection of Israeli artists includes a representative cross-section from the earliest days of Israeli art up to the works of today's current artists. The museum's changing exhibits feature both group and individual shows of Israeli and international artists.

Other art museums include: *The Haim Attar Museum of Art Ein Harod*, which is one of the oldest and largest museums in an agricultural settlement, founded in 1938. The museum building is an architectonic creation that is adapted to the conditions of the local natural lighting and blends into its surroundings. The collections are representative of Israeli art, with emphasis on artists from the

Kibbutz Movement, and Jewish folk art from many Jewish ethnic groups.

The *Haifa Art Museum* was founded in 1951 and primarily deals with Israeli art. *The Museum of Israeli Art* in Ramat Gan was founded in 1987 and is located in a former industrial building that was converted into a museum while preserving its former character. The display is based on changing exhibitions devoted solely to Israeli art of many genres, painting, sculpture, photography, cinema, design, and graphic arts. There is a sculpture garden next to the museum.

In addition to the many galleries, there are also museums that are dedicated to the work of a single artists, for example the *Nachum Gutman Art Museum*; the *Manne Katz Museum*, Haifa; the *Janco-Dada Museum*, Ein Hod devoted to the works of Marcel Janco; and the *Rubin Museum* located in the former Tel Aviv home of painter Reuven Rubin, one of Israel's pioneering modern artists, whose paintings give expression to the life and landscape of Israel.

Archaeological Museums

Many museums in Israel are devoted to local archaeology and most of them focus on findings from an adjacent excavation site. One example is the recently opened *Masada Museum* that displays findings from the rebellion against Rome and the fall of Masada.

Other Israeli museums feature broad archaeological collections. In addition to the *Israel Museum* and the *Rockefeller Museum* (see above), there is the *Eretz Yisrael Museum* with more than 100,000 artifacts and the *Museum of Prehistory of the Hula Valley* at Kibbutz Maayan Baruch in the Upper Galilee with a large collection of more than 120,000 prehistorical findings and ethnographical exhibits from around the world, which illustrate the lifestyle of early humankind.

There are also many artifacts in the collections of small museums in smaller towns throughout the country.

Historical Museums

Throughout Israel there are many historical museums devoted to telling local stories of the people, settlements and organizations which played a role in settling the land and establishing the State.

Many museums concerned with the history of Jewish settlement in Eretz Yisrael are found around the country, some located in the historical buildings where the activities represented actually occurred. In these museums, the emphasis is on the settlement's nascent period, as expressed in a historical collection of documents, photographs, and artifacts from the local material culture including agricultural implements, clothing, and toys. *The Tower and Stockade Museum* at Kibbutz Hanita in the Galilee displays not only to the history of the kibbutz but

also the Zionist enterprise of the tower and stockade (*homa u'migdal*) settlements.

The largest historical museums are *Rishon Lezion History Museum* and *The K'han Museum* in Hadera, which has the largest collection of artifacts from the history of early Zionist settlement. Located in an agricultural building from the Ottoman period, the K'han Museum houses archival documents as well as objects, household utensils, furniture clothing, and decorative objects, as well as agricultural implements and medical instruments from different communities. Many cities, towns, and rural settlements have "Founders Rooms."

The Ministry of Defense Museums' Unit brings together a dozen museums that have a joint collection of many thousand artifacts representing the history of the Jewish defense forces in Eretz Yisrael and their development from the beginning of the *Hibbat Zion* movement (1880s) through the modern military development of the Israel Defense Forces. The Defense Ministry museums include *Beit Hashomer*, Kfar Giladi; *Beit Hagedudim*, Avihail; *Hapalmach Museum*, Hagana Museum, *Ha'etzel Museum*, and *Lechi Museum* in Tel Aviv; and the *Clandestine Immigration and Naval Museum* in Haifa.

The unique *Herzl Museum* in Jerusalem offers information about Theodor Herzl and his Zionist vision for the State of Israel.

Since Israel is a country that has absorbed immigrants from many countries, museums have been established to tell the story of these different communities. Examples include the *Babylonian Jewry Heritage Center* in Or Yehuda, the *Rabbi Shalom Shabazi Yemenite Jewish Heritage House* in Rosh Ha'ayin, and the *Memorial Museum of Hungarian Speaking Jewry* in Safed.

Holocaust heritage museums

Several museums have been established in Israel to document the memory and terrifying stories of the Holocaust perpetrated by the Nazis against the Jews during World War II. This category includes the *Yad Vashem Museum*, *The Ghetto Fighters' House—Itzhak Katzenelson Holocaust and Jewish Resistance Heritage Museum*, *Yad Mordechai Museum*, *Massuah Interactive Educational Museum* at Kibbutz Tel Yitzhak, and the *Diaspora Museum*.

Yad Vashem Museum in Jerusalem was established in 1953, in accordance with the provisions of Holocaust and Heroes' Remembrance—Yad Vashem Law. The Museum now resides in new building that was designed by architect Moshe Safdie and includes an impressive display using many different types of media to depict events during the Holocaust in chronological order, with emphasis placed on human-personal stories. Yad Vashem houses a documentary archive of the Holocaust (see the section on Archives). The museum includes the Hall of Names where the names of the individual victims are stored as well as

other unique memorial sites: the Valley of the Communities, the Children's Memorial, and The Hall of Remembrance.

Ghetto Fighters' House—Itzhak Katzenelson Jewish Resistance Heritage Museum at Kibbutz Lohamei Hagetaot in the Western Galilee was founded in 1949 by a community of Holocaust survivors, members of the Jewish underground in the ghettos of Poland and veteran of partisan units. The exhibitions include the background of the Jewish communities before the Holocaust and the Jewish resistance during the Holocaust.

Beit Hatefutsoth—The Nachum Goldman Museum of Jewish Diaspora in Tel Aviv was established in 1978 to convey the story of the Jewish people from the time of their expulsion from the Eretz Yisrael 2500 years ago to the present. The museum is unique because the exhibits are arranged by topic, rather than chronologically.

Science and Nature Museums

Israel has two relatively small science museums: one in Haifa, the *National Museum of Science, Technology and Space*, founded in 1984, and the *Bloomfield Science Museum* in Jerusalem. These museums emphasize understanding scientific principles rather than collections.

There are several small museums devoted to nature, agricultural, and local history at locations throughout Israel, including *Beit Ussishkin Nature Museum* at Kibbutz Dan in the Upper Galilee and *Yigal Alon Museum of Man in the Galilee* which focuses on the landscape of the Galilee during different historical periods. Among its exhibits is an ancient boat, dated from the first century C. E., known as the "Jesus Boat," which was discovered on the shores of the Sea of Galilee in 1986.

The Arab Sector

The Arab sector still lacks significant museums, despite several attempts that have been made, some in cooperation with the Ministry of Culture's Museum Department, to establish some. These attempts have been made in Uhm El-Fahm, Shefaram and the Druze Museum in Jat-Yanuch. There are also small, private exhibitions, which are not recognized as museums, in Ussifiya, Daliyat-El-Carmel, Shibli, and elsewhere.

Official Recognition of Museums

In Israel today, there are approximately 200 museum-like institutions but only 53 are officially recognized according to the Museums Law of 1983, which established a procedure for official recognition of museums. Recognition of a museum entitles it to financial support from the State, via the Ministry of Culture. A recognized museum is required to meet professional standards regarding the employment of professional staff members, proper preservation of

displays, record keeping, descriptive and photographic records of the exhibits, and making information about them available to the public. This law states that a museum's management is to be granted freedom of action, as long as it complies with its bylaws and budget.

The Ministry of Culture, through its Museums Department, works to ensure that recognized museums comply with the law and regulations, guides museums through the process of receiving recognition and advises museums in the process of being established. By law, a 21-member public board of directors advises the heads of ministry's Museum Department on matters of policy and budgetary allocations to recognized museums. In addition, some museums receive funding from municipalities. The remainder of the budget is covered by independent income and contributions from the private sector.

In 2005, there were 3,110,393 visits to the 53 budgeted museums. Of these 21% were guided tours for pupils. In addition, 23,299 teachers took in-service training courses given by museums.^[22]

Professional Education

Two Israeli universities have diploma programs in Museology. At Haifa University the program is part of humanities faculty and meets 2 days/week for 1 year while the Tel Aviv University program is in the arts faculty and meets 1 day/week for 2 years.

ARCHIVES

The Archives Law and the State Archives

The beginning of legislation regarding archival material dates to the period of the British Mandate and dealt with keeping court files (1935). After the establishment of the State (1948), the Antiquities Ordinance (1935) protected books and manuscripts produced before 1700. The preservation of newer materials was covered by the Archives Law in 1955. This law establishes arrangements for all archival material existing in Israel, with particular emphasis on official material (from government ministries, the Knesset, the judiciary, government corporations, and local authorities). According to this law, the system is headed by the State Archivist, who is appointed by the Prime Minister and manages the Israel State Archives, established in 1949. The State Archivist is responsible for implementation of the law. One function of the State Archive is to receive for deposit all archival material dating from before the establishment of the State, from government institutions and local authorities that have ceased to exist and from all government institutions and local authorities that are inactive and which have value for permanent preservation. An additional function, related to the first, is supervision of the archival arrangements in

state institutions and local authorities. This is the source of the legal requirement that none of the aforementioned institutions may dispose any material, except in accordance with the guidelines and regulations. Any person may use material deposited in the State Archives, dependent on limitations related to its type and period of closure. In order to ensure the preservation of archival material in the possession of individuals, which has value for the study of the past, the people, the state, or society, the State Archivist manages a register, based on the declaration given by the person who owns or possesses it. In order to protect the individual's rights, the Archivist is not permitted to read this material without the agreement of the person who owns or possesses it. The law permits taking archival material out of the country only if the Archivist is permitted to read and copy it or if he waives this requirement.^[23,24]

Regulations for the practical implementation of the Archives Law were added later: regulations regarding transferring archival material to storage; regulations regarding the management of public archives (see below); regulations regarding use of archival material deposited in the archive, including those with limited access rights; regulations usage fees and regarding the disposal of archival material by state institutions and local authorities.

The State Archives fulfills the functions enumerated in the law using a structure that includes the following departments: Research and Public Services, Supervision and Training Unit, Preservation and Restoration Laboratory, Audio-visual Department, Information and Registration Department, Computerization Department, Division for State Documents, Memorials and Official Publications and Repository. The archival material deposited in the National Archive includes 40,000 linear meters (43,744 linear yards) of shelves with 3,750,000 files; 1500 movies and videos; 150,000 photographs and negatives, and 10,000 audio recordings. One million documents have been digitalized and half of them can be accessed via the Internet. The aforementioned audiovisual material has also been digitalized. There is a computerized registry of all paper materials on the record group and subrecord group levels and of 70% on the file level. A portion of this computerized system is accessible to readers in the reading room. In 2004, the State Archives adopted the International Standard for Records Management (ISO 15489) and is preparing to develop a comprehensive program for managing and preserving electronic records. The program is being adapted to Israel's unique needs. (<http://www.archives.gov.il/ArchiveGov> Information received from Assaf Tractinsky, head of the Information and Records Department of the State Archives.)

Branch Archives

There are also archives that are branches of the State Archives. The most important of these is the *I.D.F.* &

Defense Establishment Archives, which was established in 1948 and includes, in addition to materials from these institutions, documentation on the underground organizations that preceded the establishment of the State, the Jewish volunteers who fought in the world wars and a collection on Jewish soldiers beginning in the nineteenth century. This archive includes approximately 9 million files; audiovisual documentation (approximately 10,000 videos recordings, approximately 65,000 audio recordings, and approximately 500,000 photographs and negatives), maps, drawings, and digital documentation. Approximately 5 million pages of declassified, scanned documents are accessible to readers in accordance with the Archives Law, 50 years after their creation. Since security, the military, and society in Israel are closely intertwined, information related to the fields of the education, culture, medicine, economics, religion, and the law can be found in this archive. (Information received from Mihal Tzur, Manager, *I.D.F. & Defense Establishment Archives*.)

Other branch archives of the National Archives are the *Ben Gurion Heritage Institute Archives* at Sde Boker, *The Yitzhak Rabin Center for Israeli Studies Archives*, and the *Menahem Begin Heritage Foundation Archives*.^[25,26]

Municipal Archives

Although the Archives Law allows the depositing the archives of local authorities in the State Archives (see above), the State Archivist's policy was to develop special local archives in the older cities and towns, in order to develop local heritage. Not only administrative materials from the local authorities are deposited in these archives but also the archives of institutions, organizations, economic corporations, and individuals who were active there. The archives also house photographs, city publications, announcements, posters, and maps. Local authorities maintain 54 historical archives with the most important being in the three largest cities.^[27]

The Jerusalem City Archives was established in 1963. The earliest material in the archive dates from the mid-eighteenth century and belongs to the Sephardic Community Committee record group. The municipality, itself, was established only in 1863 by the Ottoman authorities. There is a small amount of material remaining from that period, beginning from 1892 (records of city council decisions). From the British period (1917–1948), there remains continuous documentation of the city council and various municipal departments. This sequence continues after the establishment of the State of Israel, when Jerusalem became its capital. From the years following 1948, the archive also includes documentation of the city's mayors, deputy mayors, councilors, the bureaus of the city managers and their deputies, and various advisors to the mayor (a total of 502 subrecord groups and series). The archive also houses 53 record groups for various institutions that

have closed such as the Jerusalem Community Committee and the City Committee; 15 archives of neighborhood committees and 89 from schools that have ceased to exist. In addition, there are 93 economic archives and personal archives of professionals (architects, engineers, accountants), educators, artists, authors, and rabbis. The total size of the historical archive is 4000 linear meters (4374 linear yards) of shelves. There is a computerized archival management system. The municipal archive is also responsible for the city's records management. (Information received from Michael Mahler manager of the Jerusalem City Archives and Menahem Levin, the former manager of the city archive.)

The Municipal Archives Tel-Aviv—Yafo houses material beginning with the establishment of the Ahuzat Bayit Association in the 1906 and minutes of the Yafo Community Committee from 1896 to 1898. The historical archive was opened to the public in 1971. It was preceded by the municipal records center. Today there are two branches of the municipal archive department. There are 38 record groups in the archive for city departments, archives of the cultural, sports, and commercial organizations, etc., including the files of 28 mayors, deputy mayors, members of the city management and councilors and 11 record groups of personal archives and private documents. Furthermore, it houses collections of municipal publications, posters, and maps. The total shelf length is 1500 linear meters (1640 linear yards). There is a computerized system for recording and retrieving information. The photographic collection is digitalized.^[28] (Information received from Ziona Raz, manager of the The Municipal Archives Tel-Aviv—Yafo.)

The Haifa City Archives was founded in 1977 and includes 2000 linear meters (2187 linear yards) of shelves. The earliest material is from the Hebrew Community Committee and neighborhood committees in 1920s, with city council records starting in 1926. Most of the material comes from the municipality and its institutions but there are also 45 private archives from individual and institutions that are valuable for the history of the city. The archive is also responsible for managing municipal records. (Information received from Mihal Hankin, manager of the Haifa City Archives.)

Public Archives

The Archives Law recognizes “public archives,” which are defined as “an archive that is owned or managed by a non-profit organization and recognized by the government as a ‘public archive,’ in an announcement published in the Official Record.”^[29] There are 17 public archives that have been recognized on the basis of this definition. (Additional information on the most important may be found below.) According to the Regulations regarding Arrangements for Managing Public Archives, a public archive can be recognized if it has bylaws that define its

purposes and missions; the conditions for permitting study and use of the material and if the archive has the organizational and financial necessary to develop its activity. The managers of public archives must submit an annual report to the State Archivist. The public archive category includes historical, administrative, and documentary archives, the archives of political movements and memorial organizations. Each of the public archives has a library to supplement the archival collection. In addition to books on the subject, they also include collections of newspapers and periodicals, which contain some unique and rare copies.^[30]

The Central Archives for the History of the Jewish People, Jerusalem (CAHJP) was founded in 1939 by the Historical Society of Israel for the purpose of reconstructing an unbroken chain of historical documentation that reflects the collective past of the Jewish people. It was reorganized in 1969. The collection includes 6000 linear meters (6561 linear yards) of shelf space of material gathered from 1600 archives of communities, organizations, and individuals; 9 million frames of microfilmed documents; 2000 lists of documents and files concerning Jews held by in other archives; 12,000 photographs; 8000 publications; 1 million newspaper clippings; and 12,000 books and publications on Jewish history. The archive includes materials from the entire Jewish Diaspora.^[31]

The Central Zionist Archives (CZA) (Fig. 7) was established in Berlin in 1919 and serves as an historical archive of the World Zionist Organization, the Jewish Agency, the National Funds, and the World Jewish Congress, documenting the growth of the Zionist movement around the world, from its beginnings in the 1880s. When the Nazi rose to power in 1933, the archive was moved to Jerusalem. Since then it has acquired the function of the being the historical archive of the new Jewish settlement in Eretz Yisrael. In parallel, it was decided to

systematically collect the personal archives of leaders of the Zionist movement and the pre-State Jewish settlements. It also continued to collect books, periodicals, and photographs. When the State was established in 1948, many files from the Jewish Agency and National Committee, whose functions were transferred to ministries of the new government, were deposited in the CZA. The rapid growth of the collections and the poor storage conditions led to the decision to build a special building for the CZA, the first of its kind in Israel. It was dedicated in 1987. In the 1990s, CZA undertook computerize its collections and a massive effort began to enter the titles of thousands of files and other collections into the computer. Since then the CZA has scanned over 14 million documents, 350,000 photographs, 90,000 maps and settlement plans, 26,000 posters, and 1,200,000 cards containing genealogical information, and 1600 sound recording. The CZA is currently adapting a Web-based document management system to manage its data- and image-base with the intention of making its records available to the wider public. The archive houses 10,000 linear meters (10,936 linear yards) of archival material divided into approximately 400 organizational record groups and 1200 personal archives. There are 500,000 photographs, 50,000 maps and plans, more than 18,000 posters and flyers, and 13,000 newspapers and periodicals. In cooperation with the Hebrew University, the archive manages the *Steven Spielberg Jewish Film Archive* that includes more than 3000 film and video titles. In addition to the customary services to scholars and other interested people, it is notable that CZA has developed a genealogy department and educational activities.^[32,33] (Information received from Rochalle Rubinstein, deputy manager of the CZA.)

The Yad Vashem Archives was established in 1953, as part of the Holocaust Martyrs' and Heroes' Remembrance Authority. Its purpose to document the history of the



Fig. 7 The Central Zionist Archives.
Source: Central Zionist Archives.

Jewish people during the Holocaust period, preserving the life stories and memories of each one of the 6 million who perished and transmitting the heritage of the Holocaust to coming generations. Gathering materials for the archive began in 1946. It is the world's largest collection of materials related to the Holocaust, with 62 million documents, more than 268,000 photographs, tens of thousands of testimonies dictated, recorded or videotaped by Holocaust survivors in Israel and abroad. There are also several thousand original film titles including raw materials, cinema newsreels, amateur movies, propaganda films, and more. The Hall of Names is designed to remember the Jewish victims in the Holocaust as human beings and individuals. It currently includes more than 3 million names, gathered from more than 2 million Pages of Testimony and other lists of victims. Yad Vashem has scanned all of the Pages of Testimony and photographs, and has computerized systems to locate and retrieve information.^[34]

The Labor Archives was founded in 1932 by the Histadrut. Since 1982, it has been part of the *Pinhas Lavon Institute for Labor Research*. It was founded for the purpose of gathering archival material from all Histadrut institutions and from individuals and organizations that were active in Eretz Yisrael from the beginning of the twentieth century. Its record groups include ones for material originating in the Histadrut, its institutions, organizations, and departments; political organizations related to the labor movement; youth movements from the labor sector; the Labor Movement overseas; archives of the Workers Councils and of individuals, for a total of 170,000 files. There are also departments of oral testimony, photographs (approximately 50,000), in addition to a collection of approximately 10,000 glass negatives taken by the photographer Avraham Suskin and a collection of photographs (approximately 500,000) from the newspaper *Davar*, videos, and posters.^[35] (Information received from Alexandra Tumarinson, manager of the Labor Archives.)

The Jabotinsky Institute in Israel was established in 1933 for the purpose of gathering documents, publications, and photographs related to Ze'ev Jabotinsky and the Revisionist Zionist Movement. The archive holds 366 personal archives of leaders of the Revisionist Movement, including that of Ze'ev Jabotinsky and 188 archives relating to all branches of the movement and its institutions, in Israel and abroad, including the New Zionist Organization (N.Z.O), the Beitar Youth Movement, the National Labor Federation, etc. Additional collections include oral documentation (550 files of testimony and 1000 recordings), approximately 35,000 photographs, 150 films and videos, 300 flags, and several hundred stamps. There is a computerized system to search and retrieve the aforementioned information.^[36] (Information received from Masha Zolotarevsky and Amira Stern, manager of the Archive.)

Kibbutz Movement Archives are a special type of public archive where materials originating in the central institutions of the five movements, each with its own ideology,

of economically and socially collective settlements in Eretz Yisrael and the State of Israel. Several of the movements merged and this process is evident in the organization of their archives: *Yad Tabenkin Archive* at Efal, *The Takam* (United Kibbutz Movement) *Archive* at Hulda and *The Hashomer Hatzair* (Young Gard) *Archive* at Givat Haviva, as distinguished from the *Kibbutz Hadati* (Religious Kibbutz Movement) *Archive* at Kvutzat Yavne.^[37–41] (Information received from Milca Har-Tal, Yad Tabenkin Archive.)

The common denominator of these archives is that, in addition to administrative record groups, they include the archives of the movements' allied youth movements, in Israel and overseas, as well as the relevant political parties, educational institutions, personal archives, publications, and journals. Each of these archives has a computerized archive management system that includes work stations for employees and the public. Most of the collections are computerized.

The archive that has gathered the largest collection is that of Yad Tabenkin, because of its position in the merged movement. Founded in 1957 as the archive of *Hakibbutz Hameuhad* ("The United Kibbutz," 1927–1980), it was housed at Ein Harod. In 1975, it was moved to Hakibbutz Hameuhad's seminar center in Efal, where it is part of an educational-research complex. With merger of Hakibbutz Hameuhad and *Ihud HaKvutzot veHaKibbutzim* (Union of the Kvutzot and Kibbutzim, see below) and the establishment of the United Kibbutz Movement in 1980, material generated in the new movement was divided between Yad Tabenkin and the United Kibbutz Movement Archive at Hulda (see below). This arrangement continued until 2000, when *Hakibbutz Ha'artzi* (The National Kibbutz) joined the United Kibbutz Movement to form The Kibbutz Movement. Since then, all material created by the new organization has been deposited at Yad Tabenkin, which has 543 record groups and subrecord groups, 240 personal archives, and 2500 linear meters (2734 linear yards) of files. In addition, there are approximately 100,000 photographs, 1600 posters, and 2000 audio recordings. The archive is in the process of digitalizing its documents and photographs. *The Takam Archive* at Hulda was founded in 1963 and incorporated the archives of *Hever Hakvutzot* ("League of Kvutzot," 1925–1951) and the *Ihud HaKvutzot veHaKibbutzim* (1951–1980). Until 2000, materials from some departments of the United Kibbutz Movement were deposited here but since then, no new material has been added. The archive has 919 linear meters (1005 linear yards) of shelf space.

The Hashomer Hatzair Archive at Givat Haviva was founded in 1937 at Kibbutz Merhavia and belongs to *Hakibbutz Ha'artzi* of Hashomer Hatzair. In 1982, it was transferred to Givat Haviva and became part of the movement's *Yad Ya'ari* ideological and documentation center. It includes 2680 linear meters (2930 linear yards)

of shelf with approximately 200,000 photographs, approximately 1000 posters, 3220 audio and/or video recordings and the approximately 600 flags and other museum-type exhibits.

The Kibbutz Hadati Archive was founded in the 1976 and includes administrative material from the movement dating from 1931 and other materials related to religious Zionism, going back to 1917. In addition, to material from the movement offices, other affiliated institutions deposit material in this archive, which houses 7000 administrative files, 3200 files of collections, 16,800 photographs, and approximately 1500 audiovisual items.

The Jewish National and University Library (see above) includes five archival departments: The *Albert Einstein Archives*, which includes scientific, public, and personal material that was transferred from Princeton to the National Library in 1982 (also includes rare material on Sir Isaac Newton). The *Manuscripts and Archives Department* was founded in 1968 (previously, from 1923 to 1968, archives were cataloged as Judaica). In 2006, the manuscripts were separated from the archive, which became the Archives Department, which incorporates 450 personal archives of intellectual leaders of the Jewish world, including Martin Buber, S.Y. Agnon, and Else Lasker-Schüler. It also houses archives of living people including author A.B. Yehoshua and poet Haim Gouri, plus 40 archives from institutions and settlements and 300 collections of various types. (http://www.jnul.huji.ac.il/eng/col_special.html, Information received from Rachel Mashrati, Archives Department, The Jewish National and University Library.)

The Music Department began operations in the 1964 and its importance increased in 2000 when the law requiring mandatory deposit of publications was expanded to include audiovisual materials. It is divided into two sections: the department itself and the National Sound Archives. The Department houses collections of notated Jewish music from the sixteenth century to the current day; 225 personal archives of Jewish and Israeli composers from the last century; 25 archives from musical institutions, and other relevant research materials. Recordings of Jewish music of all types and of other ethnic groups in Eretz Yisrael (Arab Moslems, Christian communities, Circassians, and Druze) are deposited in the National Sound Archives. The collection began in the 1920s and includes 30,000 hr of recordings. In addition, there are 10,000 hr of the ethnographic documentation, 15,000 hr of commercial recordings, and 5000 that were deposited by the Israel Broadcast Authority. (Information received from Dr. Gila Flam, manager of the Music Department and National Sound Archives, The Jewish National and University Library)

The newest archive is *Israeli Internet Sites Archive*, an experimental attempt to preserve copies of Internet sites in their entirety.

Archival Science as a Discipline and Profession

Until the middle of the twentieth century, Israeli archival science inherited the traditions that the first archivists brought from Germany and was also strongly influenced by the British (H. Jenkinson) and American (T. Shellenberg) schools, which were accepted during that period. Only in the late twentieth century and the early twenty-first century were echoes of new streams of thought, such as the social value of archives and the influence of the macroappraisal theory and practice. Despite the existence of programs for educating archivists and the work of certified licensed archivists, the law does not require someone to have professional certification, in order to manage an archive. Either an academic diploma or 5 years of experience is considered sufficient.

Educating Archivists

During the 1950s, archivists were educated through on-the-job training. In 1960–1961, the Hebrew University held the first course for certified archivists. Beginning in the early 1970s, these courses became part of the Hebrew University School of Library, Archive and Information Studies. Until its closure in 2003, this was the only institution in the country that granted a diploma or master's degree in the profession.

The Information Science Department of Bar-Ilan University teaches several individual courses that deal with archival science.

Parallel to the university programs, the National Archives, the civil service commissioner, municipalities, the Israel Archivists Association, and the Kibbutz Movement also hold courses for archivists and records managers. Each course is designed for different sector working in the field of archives. These courses train people on a practical level. In the 1990s, at the initiative of the State Archives and the Israel Archivists Association, three colleges: Max Stern Academic College of Emek Yezreel, Beit Berl Academic College, and David Yellin College of Education began to offer programs at the bachelor's degree level toward a certified archivists diploma.^[42]

PROFESSIONAL ASSOCIATIONS

The first attempt to organize an archives association was in 1951 but the Israel Archive Association (IAA) was not founded until 1956. Its members included both representatives of archives and individual members but only institutional members were permitted to sit on the Board of Directors until 1982 when permission was given for individual members to join the board. This trend gained strength as the number of individual members grew and in 1993, IAA became an organization consisting solely of individual members with elected institutions and the

current name, Israel Archivists Association, was adopted. Throughout its existence, the Association's primary activity consisted of professional in-service training courses on various levels and professional ranking of its members. It is a member of the International Council on Archives and members of the IAA have served as officers and committee members of the international organization. The Association sponsors three publications: an annual professional journal *Arkhiyyon, Meida* ("Information") a quarterly review, and *Studies in Archives*, which publishes transcripts of lectures from seminar days. The IAA has an Internet site in Hebrew.^[43] (Updated to 2007 by Zohar Alufi, Chairperson of the Israeli Archives Association.)

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Japan: Libraries, Archives, and Museums

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Abstract

This entry provides an overview of information services in Japan, with separate sections on libraries, archives, and museums. Libraries and collection of documents have a long history in Japan, based on a fundamental respect for written information and knowledge. Archives in Japan are divided into three main groups: public archives, university archives, and private archives including business archives. The history of modern museums in Japan dates back to the time of the Meiji Restoration. After examining the historical evolution of libraries, archives, and museums, the author discusses current trends and activities such as professional education, professional associations, digitization projects, and cooperative efforts.

GENERAL ORIENTATION

Consisting of over 3000 islands, Japan is an East Asian archipelago located in the north Pacific. It lies to the east of the People's Republic of China, North Korea, South Korea, and Russia. With over 127,704,000 residents, Japan is the 10th most populous country in the world and is a member of the United Nations, G8, and the OECD (Fig. 1).

HISTORICAL INTRODUCTION

It is difficult to say exactly when libraries first appeared in Japan. There must have been some collection of documents even before any library came into existence. In the sixth and seventh centuries A.D., the advent of Buddhism promoted an influx of Chinese classics and the arrival of scholars, as well as the growth of Japanese academic and publishing culture. With this, the importation of documents and the practice of archiving grew to significant proportions. The Bureau of Books and Drawings (*Zushoryo*), a government organization in charge of document storage in the ancient period, can be seen as early as 702, when it appeared in the *Taihoryo* (Taiho Code of Laws) that was promulgated in that year.

In addition to government repositories, it is generally known that, even in the ancient period, a number of institutions made their archival collections open for public

consultation. These included the *Untei* library of Isonokami no Yakatsugu, thought to have existed at the end of the Nara era in the second half of the eighth century AD, and the Kobaiden of Sugawara no Michizane, at the end of the ninth century. Regrettably, neither of these collections has survived. In the medieval period, many repositories were created for temples or by samurai families. These include the Ashikaga School, known for its precious collections that still survive (there are various theories as to the date of its creation, but it was revived in the middle of the fifteenth century) and the *Kanazawa Bunko* repository, established in the mid-thirteenth century (Fig. 2).

Historians suggest that the development of Japan's modern libraries, archives, and museums emerged following the 1868 Meiji Restoration. The first museum was established in 1872, when the institutional system of the Meiji government was consolidated. In the same year, the *Shojakukan* Library was set up inside the Museum (*Hakubutsukan*). Hisanari Machida, the inaugural curator, envisioned a museum with a large-scale library on the model of the British Museum, which he saw while studying in Britain. The main collection of the *Shojakukan* Library consisted of works from the former *Shoheizaka Gakumonsho* school. The Museum and the *Shojakukan* Library were initially under the jurisdiction of the Ministry of Education, which had only been established the previous year. They were subsequently transferred to the Ministry of Home Affairs. Some museums were then transferred to the jurisdiction of the Ministry of



Fig. 1 Map of Japan.
Source: CIA World Factbook.^[1]

Agriculture and Commerce, the Imperial Household Agency, while others were transferred back to the Ministry of Education in 1874.^[2] In the early years of the Meiji era, museums were divided into two types: those connected to the Ministry of Home Affairs, and those connected to the Ministry of Education, respectively. The first of these was initially known as the Imperial Household Museum, which later became the Tokyo National Museum, while the latter was the National Science Museum.

The collections of the *Shojakukan* Library, Japan's first governmental public library, remained under the jurisdiction of the Ministry of Internal Affairs but were moved first to the Asakusa Repository and then to the Cabinet Library. Meanwhile, the Tokyo *Shojakukan* Library, established by the Ministry of Education using the buildings of the former *Shojakukan* Library in Yushima, started to build a new collection from 1875. This then moved to the Imperial Library. After the Second World War, its jurisdiction was transferred from the Ministry of Education to the National Diet (Japan's Parliament), whereupon it became the National Diet Library (NDL). The books from the *Shoheizaka Gakumonsho* school that we find in the NDL today are books that were released to accompany the transfer of stacks during the Meiji years.^[3]

In terms of maintaining public repositories, a "record compiling clerk" was appointed among the administrative officials in the *Dajokan* (Department of State) in 1868. The *Dajokan* system was reformed in August 1871, and a Records Bureau that would "oversee the work of documentary record compilation" was set up in the Main Office of the *Dajokan*. In the following year, 1872, a Records Division and a History Division were set up within the Records Bureau.^[4] This marked the beginning of Japan's documentary administration. After subsequently passing through various different guises (such as the Records Department of the Clerical Bureau in the *Dajokan* and the Records Division of the Cabinet Clerical Bureau), in 1885 it became the Cabinet Records Bureau, and again in 1893 the Records Division of the Cabinet Clerical Office.

Thus, while it would appear that a system for central management of official documents was initially developed, this gradually shifted to a system of decentralized management. In July 1942, the Records Division of the Cabinet Secretariat passed its administrative work to the General Affairs Division of the Cabinet Secretariat, whereupon a document management institution with the word "Records" in its title disappeared from the state bureaucracy. Under the Constitution of Japan, the National Archives of Japan was finally launched in July 1971, having previously been the General Affairs Division of Prime Minister's Agency Secretariat and the General Affairs Division of the Prime Minister's Secretariat.^[5]

The remainder of this entry will provide an introduction to contemporary Japanese libraries, public archives, and museums will be introduced individually.



Fig. 2 Ukiyoe by Utamaro, copyright Keio University.

LIBRARY AND INFORMATION PROFESSIONS, SYSTEMS, AND SERVICES

Legislation Concerning Libraries

The library is called “*toshokan*” in Japanese. The “*Toshokan-rei*” (the Library Decree) was issued for the first of the kind as an Imperial decree in 1899. This law was totally reformed to “*Toshokan-ho*” (the Library Law), enforced in 1950, after WWII. The basis of the new Library Law was the Social Education Law, and thus it stipulated that public libraries be tax-supported, free of charge and required, and the law required librarians adequate to meet the information needs of the community. In addition, the Library Law allows that a library can be established by anyone, not only by public organizations.

Under the Library Law, a public library is defined as a facility established by a municipal government or non-profit foundation. In 2007 there were approximately 3000 public libraries under local governments and 20 libraries under nonprofit foundations. The qualifications to become a professional librarian are regulated by law. Librarians must be college graduates who have taken certain accepted library science courses.

With respect to legislation regarding other kinds of libraries, the National Diet Library is regulated by the National Diet Library Law (enacted in 1948). University libraries are legally based on “*Daigaku Setchi Kijun*” (University Establishment Standards, enacted in 1956), under “*Gakko Kyoiku-ho*” (School Education Law, enacted in 1947). School libraries are based on the School Library Law (enacted in 1953), which is also under the School Education Law.

Copyright Law is another aspect of legislation concerning libraries. The origin of Copyright Law in Japan dates back to 1899, although the law was revised in 1970 and 1978 in response to the advent of new audiovisual materials. It allows libraries to provide photocopy service to a maximum of half of a book if more than 50 years have passed since the author has passed away. Along with the increase in quantity of library services, it is now controversial whether libraries should accept public lending rights in the face of complaints from the viewpoint of protecting authors' rights.

NDL and Information Services

The NDL is the national library belonging to the Diet (Japan's Parliament), established in 1948. As the legal depository library, the library acquires all kinds of materials published in Japan to preserve them for the national cultural heritage. Taking advantage of this library collection, NDL provides various services such as compiling the Japanese National Bibliography, reference service to the members of the Diet, providing a reading room for the public, interlibrary loan, and Internet services to

remote users. In addition, NDL offers a bibliographical database of digital talking books and Braille books and imperative services for visually disabled users. NDL has three facilities: the Tokyo Main Library, the Kansai-kan (a new facility in the Kansai region), and the ILCL (International Library of Children's Literature, also opened in 2002). The Tokyo Main Library comprises the Research and Legislative Reference Bureau, Administrative, Acquisitions, Bibliography, Public Services, Reference and Special Collections Departments, together with the Detached Library in the Diet. The *Toyo Bunko* (Oriental Library) and 26 branch libraries in the executive and judicial agencies also report to the NDL.

The origins of the NDL date back to the Imperial Library, established in 1872 under the Ministry of Education. The Lower House Library and House of Peers Library, established in 1891, were later incorporated, and the three libraries became the NDL during the Occupation era. The NDL was opened to the public in 1948, and later moved to the current Main Building adjacent to the National Diet in 1961. The NDL has 923 staff members, a 2.5-billion yen book budget (FY 2007), and a collection of 8.6 million books and 11 million serials items (FY 2005). The Library has also been acting as the Japanese National Centre for ISSN since 1976 and as the Asia Regional Center for the IFLA Preservation and Conservation since 1989.

The NDL promotes digital library projects as one of its priority areas (Fig. 3). Through the NDL Web site (<http://www.ndl.go.jp>), the following digital services are open to public: 1) Rare Books Image Database; 2) Digital Library from the Meiji era (1868–1912, 1912–1926); 3) Web Archiving Project (WARP) which collects and preserves Web sites and online periodicals on the Internet; and 4) Digital Archive Portal, which provides access to Japanese digital information; and cross database searching is now possible for NDL-OPAC, etc.

Academic and Research Libraries

Japan's first modern university was the University of Tokyo, which was founded in 1877. It became the foundation of the imperial system of higher education in pre-World War II Japan. Some faculty libraries were built in the same year. The UT main library was built in 1892 and rebuilt in 1928 after the Great Kanto Earthquake, with aid of the Rockefeller Foundation and others. In addition to other public universities, private universities, such as Waseda University and Keio University, were officially approved under the University Order, enacted in 1918. After World War II, the higher educational system was dramatically reformed. More and more citizens were able to pursue a higher education, unlike the pre-war situation, when universities existed only for the privileged elite. Today 50% of high school graduates go on to a university or junior college.



Fig. 3 Photo of NDL, Kansai-kan.

During the 1960s and 1970s, a number of universities (mostly private) expanded their enrollment with Japan's rapid economic growth. "*Daigaku Setchi Kijun*" (University Establishment Standards) by the Ministry of Education contributed to maintaining a certain quality among new university libraries. Many more universities built main libraries with open-shelves and free access for graduate students.

University libraries' catalogs were mostly automated and networked in the 1980s. The NACSIS (the National Center for Science Information Systems) was established by the Ministry of Education in 1986 to create the academic information network. The automation of libraries was accelerated by NACSIS, particularly from the perspective of technical services to OPAC preparation. NACSIS was reorganized in 2000 as the NII (National Institute of Informatics). NII provides the following services online for researchers and academic libraries:

1. NII is primarily a research laboratory with more than 80 information science researchers and 60 staff.
2. Webcat (http://webcat.nii.ac.jp/webcat_eng.html) is the online union catalog of the books held nationwide by university libraries. This system is linked to the national interlibrary loan system.
3. The GeNii (NII Scholarly and Academic Information Portal) offers databases in partnership with more than 270 academic associations, including some full-text information.

In terms of legislation, the National University Corporation Law was revised in 2003, and former national universities have now gained corporate status. Since 2004, all universities must be evaluated at least once every 7 years by a quality assurance agency certified by the agency now known as the Ministry of Education, Culture, Sports, Science and Technology (MEXT) (Table 1).

Public Libraries

Public libraries are quite common in Japan, being established in each city (local community with a population over 50,000) and in 50% of all towns and villages. The average public library holds 110,000 books, and lends 200,000 volumes per year. On average, each Japanese citizen borrows about five books in a year from a public library. Public libraries are especially popular with younger people, such as students preparing for college entrance exams, and with children accompanied by mothers who use the children's corner, situated conveniently near the entrance. Bunko, small voluntary libraries for children, usually run by parent groups, are quite popular at the neighborhood level. Meanwhile in larger cities, services providing business information, legal information, and medical information are popular (such as at the Tokyo Metropolitan Central Library or Chiyoda Public Library) (Fig. 4).

Although public library service was quite limited before WWII, the number of public libraries greatly increased during the 1960s and 1970s. *The Management*

Table 1 Statistics of university and junior college libraries (as of 2006).

	Number of libraries	Number of acquired books per year	Number of books borrowed	Number of students
National	297	1,559,000	6,854,000	628,945
Public	122	433,000	1,772,000	127,860
Private	919	4,775,000	19,938,000	2,102,402
Total	1,338	6,767,000	28,564,000	2,859,207
Junior College	256	328,000	1,236,000	202,197

Source: Statistics by JLA.

of *Public Libraries in Medium and Small Libraries*, published in 1963 by the Japan Library Association (JLA), emphasized the importance of services for smaller local libraries. Since then the network of prefectural libraries and small branch community libraries has grown steadily. Following the economic downturn in the 1990s many public libraries have been affected by legislation supporting a Designated Manager System (*Shitei Kanrisha Seido*) or PFI (Private Finance Initiatives). The private sector has become involved in libraries' services and operations. It is thought that the policy has caused a degradation of services, which goes against the spirit of the Library Law, however more and more local governments have adopted the policy as the central government has cut its budget for public facilities (Table 2).

School Libraries

The Japanese School Library Law, enacted in 1953, required every school (grades 1–12) to establish a school library as a reading and learning center, and to employ a teacher-librarian (*shisho-kyoyu*), with a supplementary provision that stated that “the placement of a teacher-

librarian is optional for the time being.” Many schools did not have teacher-librarians for nearly 50 years until 1997 when the supplementary provision was revised to require all schools with 12 or more classes to employ a teacher-librarian by March 31, 2003. According to Article 5 of the School Library Law, a 10-credit training program for teacher-librarians can be administered by colleges, universities, or boards of education in compliance with the Minister of Education, Culture, Sports, Science and Technology (MEXT). Since 1997, many schools have started to employ teacher-librarians, however, in most cases schools have asked existing teachers to obtain the teacher-librarian certificate through intensive summer courses rather than appoint new teacher-librarians. In many cases, the teacher-librarian remains a full-time teacher and his or her teaching responsibilities are not reduced despite being appointed as a teacher-librarian.^[6] However, an increasing number of schools employ clerical staff in school libraries (collectively called *gakko-shisho*) who generally manage collection development, circulation, and many other business practices. Computers were introduced into school libraries in the 1980s. According to a MEXT survey, nearly 40% of primary and



Fig. 4 Yamaguchi City Library, photo by Urushibara.

Table 2 Statistics of public libraries.

	Number of libraries	Number of full time staff	Number of books borrowed	Number of holding
2002	2,711	15,284	546,287,000	310,165,000
2003	2,759	14,928	571,064,000	321,811,000
2004	2,825	14,664	609,687,000	333,962,000
2005	2,953	14,302	616,957,000	344,856,000
2006	3,082	14,070	618,264,000	356,710,000

Source: Statistics by JLA, 2006.

lower secondary schools, and 70% of upper secondary school libraries have automated catalogs. Table 3 shows some statistics on school libraries in Japan.

Special Libraries

In 2007 the membership institutions of the Special Library Association consisted of 560 libraries belonging to local and central governments, private companies, and research institutes. Despite the fact that about a quarter of these libraries are small, one-person libraries, special libraries provide diverse and unique collections and services. Many of their services are accessed primarily online.

The followings are major special libraries in various fields.

Science and technology

The Japan Science and Technology Agency (JST, <http://www.jst.go.jp/EN/index.html>) was reorganized in 2003, absorbing a former organization known as JICST (1957–1996); it is now providing various services such as J-STAGE, an electronic journal support system, photocopying service, and translation services. JST services are used broadly by research libraries and natural science researchers both domestically and abroad.

Medical sciences

The IMIC (International Medical Information Center, http://www.imic.or.jp/about/outline_e.html) is located in Tokyo, and is the national document supply center of medical information. It succeeded the Kitasato Memorial Medical Library of Keio University in 1972, collecting and disseminating highly sophisticated medical information.

Table 3 Average holdings of public school libraries as of December 2005.

Primary school	7,312 volumes
Lower secondary school	9,040 volumes
Upper secondary school	21,771 volumes

Source: Statistics by MEXT.

Business

JETRO (Japan External Trade Organization) Business Library (<http://www.jetro.go.jp/library/>) used to be a government agency before it was reorganized as an independent administrative agency (IAA) in 2004. It has offices in Tokyo and Osaka, and provides business information on a country-by-country basis for the advancement of Japanese trade.

Another JETRO library is at the IDE (Institute of Developing Economics) Library (<http://www.ide.go.jp/English/Library/>), located near Tokyo, with collections on economics, politics, and social issues of regions in Asia, Middle East, Africa, Latin America, Oceania, and Eastern Europe.

Braille library

The Japan Braille Library (Nihon Tenji Toshokan, <http://www.nittento.or.jp/>) is a social welfare corporation, founded in 1940 by Kazuo Homma (1915–2003). It produces 3000 volumes of Braille and recorded books yearly, and provides a free recorded books service. In 2004, it started Internet service of DAISY contents. There are also more than 200 Braille libraries and public libraries that make Braille books available to the public in Japan.

Art and museum library

Following the 1986 IFLA conference in Tokyo, the Japan Art Documentation Society (<http://www.soc.nii.ac.jp/jads/eng/index.html>) was established by curators and librarians in 1989 to meet the needs of museum libraries. In 2004 the ALC (Art Libraries' Consortium) was founded by eight museums in Tokyo. They have a cross-searchable online-public access catalog.

Japanese studies

The Japan Foundation is a renowned foundation among Japanese studies scholars, offering various cultural exchange programs, Japanese language teaching, and library service. The JFIC (Japan Foundation Information Center, <http://www.jpf.go.jp/e/jfic/lib/index.html>) is in Tokyo and there are two other libraries in other parts of Japan. It also operates 18 JF libraries outside Japan, which function as gateways to Japanese language and culture.

Digital Library Collections and Services

The digital library dates back to the 1980s with the advent of CD-ROM. During the 1990s, the focus of discussion moved from electronic publishing to “digital library” or “electronic library” on the Internet. In the 2000s, some larger public, university, special libraries began offering rare book images, institutional academic documents, and books with expired copyright protection. In addition to the digital library created by the National Diet Library as mentioned above, the following libraries also offer digital library collections to public.

The University of Kyoto Library started its digital library (<http://edb.kulib.kyoto-u.ac.jp/minds-eu.html>) in 1998, and contains images of rare books registered as national property, some texts of the university’s publisher, theses, and a repository of articles and reports published within the campus. EDMC (Great Hanshin-Awaji Earthquake Disaster Materials Collection, <http://www.lib.kobe-u.ac.jp/eqb/e-gallery.html>), created by Kobe University Library in 1995, is a one-of-a-kind digital gallery on its Web site, containing invaluable records and images with a risk management perspective.

IPDL (Industrial Property Digital Library, http://www.ipdl.inpit.go.jp/homepg_e.ipdl) was created in 2000 by The Japan Patent Office. Patents, utility models, trademarks, and design can be searched on the Internet, and the patent gazettes and other industrial property information can be accessed at the reference library of the National Center for Industrial Property Information and Training.

Aozora Bunko (Blue Sky Library, <http://www.aozora.gr.jp/#main>) is the digital library that is the best-known among the general public; it was created by Eiji Noguchi in 1997 and now contains thousands of copyright-expired Japanese books (mainly in literature).

Education for Library and Information Science

Currently, there are five types of library and information science (LIS) education offered at colleges and universities in Japan.

- Librarian (*shisho*) training provided by more than 250 colleges and universities, during the regular academic year and as an intensive summer program.
- Teacher-librarian (*shisho-kyoyu*) training provided by more than 100 colleges and universities, during the regular academic year or as intensive summer programs.
- Undergraduate LIS majors offered by fewer than 10 colleges and universities.
- Master-level LIS programs offered by eight colleges and universities.
- Doctoral level LIS programs offered by six colleges and universities.

These courses or programs produce approximately 12,000 qualified *shisho* and 12,500 qualified *shisho-kyoyu* every year. The majority are trained at an undergraduate level. The knowledge and skills held by graduates of these programs are quite diverse while, employment opportunities for full-time librarians in 2007 were quite limited.

The legal basis of Japanese LIS education was established by The Library Law (enacted in 1950) and The School Library Law (enacted in 1953). Formal LIS education programs are given mainly by colleges or universities in compliance with the MEXT, as training programs for librarians of public libraries and teacher-librarians of school libraries. Courses, credit units and other guidelines are specified by Ministry rules. There is no formal education system in place for information professionals in academic and special libraries. The certificate for *shisho*, which was intended for public library professionals, is considered the basic requirement for other types of library professionals in Japan.

The first comprehensive program for library education at the university level was established in 1951 at Japan Library School of Keio University, under the auspices of the American Library Association. According to MEXT, 13 colleges and universities offer Intensive Summer Courses of formal librarian training, while seven offer correspondence training courses.

In the area of continuing education in LIS, The Graduate School of Library and Information Science at Keio University established a new course for library workers in 2004, in order to give them opportunities for continuing education. Some other colleges and universities, such as Tsukuba University or the University of Tokyo are also establishing new tracks for continuing education at the graduate level, while the vast majority of librarians in Japan have a bachelor’s degree, there will be more librarians with master’s degrees in LIS in the future, especially in academic libraries. MEXT, National Diet Library, Tokyo Metropolitan Library, and some other major libraries also offer various staff training programs throughout the year.

One of the biggest issues in education and training for librarianship in Japan is how to strengthen the profession and to improve the status of librarians in society. Based on the shared understanding of current problems in LIS, the Library and Information Professionals and Education Renewal, a 3-year research project to study LIS education systems and curricula in Japan, proposed two areas for reform. They include: 1) The introduction of an independent LIS examination as a formal quality-assuring mechanism for overall education of information professionals; and 2) provision of an integrated curriculum for information professionals overall.^[6–8]

Professional Associations

According to *Library Year Book* 2007, there are about 90 national associations, councils, or societies related to

libraries. Among them, the JLA is the largest and most comprehensive association in the field of libraries in Japan, representing all types of libraries and related organizations in Japan.

JLA (*Nihon Toshokan Kyokai*, JLA, <http://www.jla.or.jp>) was founded in 1892, and promotes the development of libraries and librarianship in Japan. Its activities have been supported by member librarians throughout Japan for over a century. JLA consisted of 5100 individual members and 2600 institutional members as of 2006. JLA has been a member of IFLA since 1929. The mission of JLA consists of four basic policies: 1) to be the national information center for all libraries and librarians in Japan; 2) to be an education, training, and career development center for librarians; 3) to cooperate with, and coordinate all kinds of libraries and library organizations; and 4) to promote and support international relations activities with libraries and librarians around the world.

The all-Japan Library Conference is held annually in different cities around the nation, and is hosted by a prefectural library and regional communities. There are six divisions (Public Libraries, University Libraries, Junior College Libraries, School Libraries, Special Libraries, and Education), and about 25 committees and working groups (Library Policies, Library Management, Copyright, Intellectual Freedom, Preservation and Conservation, International Relations, Services for the Handicapped, Library Services for Children, etc.). JLA started publishing its monthly organ, *Library Journal* (*Toshokan Zasshi*) in 1907. It also publishes an average of 20 new monographs each year, as well as *Libraries Today* (*Gendai no Toshokan*, a quarterly), *Basic Subject Headings*, *Guide to Japanese Reference Books*, *JLA Librarian's Glossary*, *JLA Librarians Handbook*, *Library Year Book*, and *Statistics on Libraries in Japan*.

The following is a list of some leading associations related to libraries in Japan:

1. Japan Medical Library Association: JMLA (*Nihon Igaku Toshokan Kyokai*). Founded in 1927, it became a nonprofit organization in 2003 (<http://wwwsoc.nii.ac.jp/jmla/index.html>).
2. Japan Association of Private Universities Libraries: JAPUL (*Shiritsu Daigaku Toshokan Kyokai*): Founded in 1938. Membership in 2006 was 496 private university libraries, covering approximately 91% of total number of private universities in Japan (<http://www.jaspul.org/>).
3. Japan School Library Association: JSLA (*Zenkoku Gakko Toshokan Kyogikai*). Founded in 1950, it is the most comprehensive institute in the field of school libraries (<http://www.j-sla.org.jp>).
4. Japan Special Libraries Association: JSLA (*Senmon Toshokan Kyougikai: Sentokyo*). Founded in 1952, it publishes the Directory of Special Libraries, Japan (<http://www.jsla.or.jp/eng/index.html>).
5. Japan Association of National University Libraries: JANUL (*Kokuritsu Daigaku Toshokan Kyokai*). Founded in 1954, it is a membership organization comprising mainly libraries of national universities in Japan, totaling 92 libraries and library facilities (<http://wwwsoc.nii.ac.jp/anul/index-e.html>).

ARCHIVES

Overview of Japan's Archives Today

In Japan today, a large number of archives exist as physical entities, irrespective of whether they are independent organizations or not. Not only do these contribute to affairs in a variety of sectors, including academia, culture, government administration, and business, but they also preserve precious historical materials. In Japan, however, there is no system of central management for working documents in record centers, archives, or the like, either in the public or the private sector. Instead, a system of decentralized management by each department creating documents is preferred. As a result, archives on an organized level have not developed on a scale commensurate with Japan's national strengths in culture or economy, and many remain quite small. A system of public archives for documents not in current use has been created in order to guarantee public access to information (a founding principle of democracy in Japan). This comes along with the Act on Access to Information Held by Administrative Organs (1999), which guarantees access to documents in current use. An overview of present situation in Japan will be introduced below with a focus on public archives that have been established and are broadly perceived by the public as centers for access to documents not in current use.

The National Archives of Japan

The National Archives of Japan were established in July 1971 as a body affiliated with the Prime Minister's Office. Later renamed the National Archives of Japan in April 2001, it functions as an Independent Administrative Institution with the mandate to ensure the appropriate preservation and use of public documents, which are regarded as important historical materials designated for deposit by government institutions.

The holdings of the National Archives of Japan are broadly divided into: 1) public documents of state institutions, starting with the *Dajokan* after the Meiji Restoration; and 2) the Cabinet Library, mainly consisting of ancient Japanese and Chinese classical books passed down since the archives of the Shogun during the Edo era. As of March 31, 2007, its holdings consisted of 625,996 public document files and 479,500 ancient and classical books. Of these, 99.7% have been cataloged in a database, which

can be accessed via the Internet (<http://www.archives.go.jp/>). In fiscal 2006, the Archives received 29,420 visitors. The institution employs a staff of 42 regular employees and about twice that number of nonregular employees. The main office is inside Kitanomaru Park (next to the Imperial Palace in Tokyo), while there is also a Tsukuba Annex in Ibaraki Prefecture and the Japan Center for Asian Historical Records in Chiyoda Ward, Tokyo. The total floor area of the three buildings is about 6900 m² (Figs. 5 and 6).

One of the branch facilities of the National Archives of Japan is the Japan Center for Asian Historical Records. This is Japan's first full-scale digital archive specializing in public documents on the relationship between Japan and surrounding countries in the modern and contemporary eras (<http://www.jacar.go.jp/>). It houses some 12.5 million images of public documents and documents archived by the Imperial Army and Navy, the Ministry of Foreign Affairs and the National Archives of Japan up to 1945. These are provided in digital form, in both English and Japanese. Over the past 5 years or so, the Center has received more than 3 million access requests from both Japan and abroad.

The main activities undertaken by the National Archives of Japan, including this Japan Center for Asian Historical Records, can be summarized under the following six headings:

- Promoting digital archiving.
- Strengthening training systems for national and local government personnel.
- Participating in and contributing to international public archive activities.
- Locating and providing information on the location of historical public documents, etc.
- Conducting surveys and research activities aimed at raising the level of public archive activities.

- Creating a database and providing data on Asian historical materials.

Meanwhile, in cooperation with the Cabinet Office (the body with jurisdiction over the National Archives), research aimed at introducing an intermediate repository system is being vigorously pursued, as well as research on the transfer of public documents created using electronic recording media. The aim in doing so is to promote smoother transfers of public documents from the various government ministries and agencies.

Public Archives of Local Authorities

As of April 2007, there were approximately 1800 local authorities in Japan, but of these, only 50 authorities maintain public archives. Specifically, public archives are maintained by just 30 out of 47 prefectures, 7 of the 15 cities designated by government ordinance and, of the other authorities, 13 municipalities. As for the others, in many cases, a division in charge of public documents manages public documents based on a predetermined number of storage years, as stipulated in file management ledgers, etc.

The first local authority to create public archives was Yamaguchi Prefecture in 1959. Public archives generally come under the jurisdiction of the General Affairs Department or the Board of Education, and the scale is invariably small, with a staff of fewer than 20 (including both regular and nonregular employees). Each local authority undertakes its own personnel management of archivists. Despite a somewhat difficult administrative and funding environment, local public archives are gradually increasing in number, at the rate of one or two a year.



Fig. 5 Photo of National Archives of Japan, Main office.



Fig. 6 Photo of Stacks of National Archives of Japan.

College and University Archives

At the start of the twenty-first century there were about 700 colleges and universities in Japan. Of these, mainly large colleges and universities with long histories vigorously moved to create college and university archives starting in the 1980s in connection with the publication of university histories. A survey of college and university archives conducted by the Japan Association of College and University Archives of Japan in 2003 attracted responses from 84 colleges and universities. From this, we may assume that at least 84 colleges and universities maintain college and university archives.

University archives in some cases have focused on the collection and classification of historical and other materials related to the personal archives of the founders—particularly in the case of private universities. Recently there has been a growing interest in the management and preservation of university management documents that are no longer current.

Corporate and Other Archives

In many cases, archives kept by private companies have been established in connection with the compilation of company histories and they have sometimes been part of special libraries. Since the 1970s, there has been a progressive trend in Japanese industry to compile and publish company histories. As a byproduct, business archives have been accumulated and archive organizations created. However, this creation of corporate and other private-sector archives is highly sensitive to the economic

environment. After peaking about 1990 at about 140, business archives started to decline along with a decline in the compilation of company histories. Today the number has fallen to about 100. Moreover, there are hardly any private-sector organizations that hire business archivists as specialist professionals. The majority of these private-sector archives belong to the Business Archives Association (BAA), which was established in 1981.

Laws Governing Archives

Two laws directly related to archives have been enacted in Japan. The Public Archives Law was enacted in 1987 and came into force a year later, while the National Archives Law was enacted in 1999 and took effect in 2000. A brief overview of these two laws will be given below.

On the problem of information disclosure, which is closely related to archive activities, the Information Disclosure Law (or, to use its formal title, the “Act on Access to Information Held by Administrative Bodies”) was enacted in 1999 and came into force in 2001. Some commentators have pointed out that this law is incomplete, in that it only deals with aspects of the disclosure of public documents. They are calling for the enactment of a Public Documents Management Law (tentative name) to address these problems.

The Public Archives Law

The purpose of the law is to stipulate necessary matters related to public archives, in awareness of the importance of archiving public documents and records as historical

materials and making them available for use. The law consists of seven articles, and is said to have a strong tone of moral guidance. Among these seven articles, there are rules to the effect that the government should strive to furnish or facilitate the funds needed by local authorities to set up public archives, and that, in addition to a president, special research officers, and other necessary officers should be appointed. As for the necessity of special research officers, however, Article 2 of the Supplementary Provisions states, as "Exceptions to the Provision regarding Special Research Officers" that special research officers do not need to be appointed to public archives for the time being.

The National Archives of Japan Law

This is an organizational law for the National Archives of Japan (established as a department of the Prime Minister's Office in 1971), enacted upon its conversion to an independent administrative institution. It consists of 16 articles, which provide for the title, purpose, and scope of operations of the National Archives of Japan as an independent administrative institution undertaking activities based on the regulations in the Public Archives Law. They also provide for the appropriate preservation and use, of public documents. In this law, the term "government documents and records" is used to mean government documents and other records excluding those in current use by organs of the state. As the scope of its operations, meanwhile, the law provides that the National Archives of Japan shall preserve and make available for public use governmental documents and records that are of importance as historical materials. To that end, the National Archives is mandated to gather, classify, and provide information, provide professional and technical advice, conduct research and give training.

Archive-Related Societies and Associations

Academic societies

There are two academic societies related to archive studies, namely the Records Management Society of Japan (established in 1989) and the Japan Society for Archival Science (JSAS) (established in 2004). The Records Management Society of Japan was established with the intention of diffusing and disseminating the concept of record management in Japan, mainly among librarians, archivists, filing consultants, and other people with interest in the management of documents in current use. Its present membership is around 300. It holds a Research Convention combined with its Annual Conference, and publishes the semi-annual *Record Management (Journal of the Records Management Society of Japan)* as a peer-reviewed journal. Besides this, it is currently lobbying hard for the enactment of a Public Documents

Management Law. Internationally, it enjoys a close relationship with the Tokyo branch of the American Records Management Association (ARMA).

The JSAS was formed by researchers in the archives field and in the field of historical studies. Some of its leading members have studied overseas and have expert knowledge of innovative trends in archival science around the world. As such, there are now increasing cases of research activities conducted jointly by JSAS, many of whose members are interested in documents not in current use (based on the theory of lifecycle of records) and the Records Management Society of Japan, which is principally concerned with documents in current use. The outcome of such research has occasionally been published. Besides holding research presentations twice a year, the JSAS also publishes the annual *Journal of the Japan Society for Archival Science* as a peer-reviewed journal. It, too, has about 300 members, the majority of whom are archive-related researchers and postgraduate students. The principal focus of its activities is on establishing and diffusing archival science in Japan. For the time being, this involves an effort by its core members to consolidate and develop the foundation for a course majoring in archival science at the Graduate School of Gakushuin University in Tokyo.

Associations and organizations

Japan Society of Archives Institutions (JSAI): This is a national organization of institutions for the preservation and use of archives, etc., established in 1976. It consists of institutional members and individual members who work for them. Initially, it had about 160 institutional members and 270 individual members, and was the only organization in Japan that promoted the archive movement. As a result, it has undertaken a broad range of survey and research activities, communication and coordination activities, and others fundamental to this movement. Now that archives have achieved a degree of diffusion and establishment in Japanese society, however, related academic associations have been formed while institutions and organizations for communication and coordination have also been established. Furthermore, the public archives of local authorities, which used to serve in promoting activities, have become somewhat passive owing to the constraints on local government finances. JSAI holds an annual convention, at which features research presentations and training programs, in addition to the general meeting for its operational management. It publishes the journal *Records and Archives* (annual), of which 17 had been issued by March 2007.

Business Archives Association (BAA): This is a national organization concerned with business archives, which was established in 1981. In recognition of the social and historical value of business archives, the association's purpose is to conduct surveys and research on the gathering,

preservation, and management of business archives, and to improve practice in these areas. According to BAA's regulations, its operations include publishing journals, holding research meetings, touring-related institutions, and nurturing business archivists (business archive managers). It also promotes international exchange between Japan and China. Its publications include the occasional research bulletin *Kigyo to Shiryō (Business and Archives)*. Its membership initially consisted of 55 institutional members and 20 individual members, but today these have increased to about 100 institutional and 60 individual members.

Japan Association of College and University Archives: This association was formed in 2005, when existing liaison groups responsible for college and university history in East and West Japan merged. At the time, its membership consisted of 83 universities and 40 individual members. The purpose of its activities is to provide a forum for information exchange, to promote research on college and university history, and to work for improvement in practice among its members. Its day-to-day activities are still conducted separately by its predecessor organizations, i.e., the East Japan Branch and the West Japan Branch, and the association's only collective activity is its yearly national convention.

Systems of Education and Training

Systems of education and research in universities

It would be fair to say that the training of archivists in Japan is still in the process of being established. Many people who have worked as archivists are involved in managing archive materials in addition to their historical research, and the amount of this archival work has increased. Consequently, as of 2007, there were no faculties or departments of archival science in Japanese universities. The only course that exists on archival science is offered by the Faculty of Cultural Information Resources at Surugadai University. Starting in April 2008, Master's and Ph.D. courses majoring in archival science were to be set up in the Graduate School of Gakushuin University. However, there is no undergraduate course that allows students to major in archival science. In Japan, therefore, archival science is not taught as part of library information studies in the departments of undergraduate faculties or graduate schools, as is the case in other countries.

Systems of on-the-job training

To compensate for the lukewarm attitude of Japanese universities toward archival science, on-the-job training programs are essential. Training programs that are held on a regular basis every year and the programs that are considered authoritative are those of the National Archives of Japan and the National Institute of Japanese Literature. Besides these, there are isolated training programs offered

by public archives and others in various parts of the country.

Training programs of the National Archives of Japan: The National Archives of Japan is planning to offer five different training programs for employees and related personnel already working in archives. These training programs may be broadly divided into two types:

1. Training aimed at developing archive literacy, with 1 day of on-the-job observation and 3 days of training aimed at ordinary non-specialist personnel involved in records management work in public institutions; and
2. Programs designed to train as archivists selected staff who need greater expertise because they are working as specialists in records management in public institutions. The latter will be divided into elementary grade (1 week), intermediate grade (4 weeks), and advanced grade (3 days). The non-specialist training is to be given to about 60 trainees every year and the specialist training to about 70. Training will be delivered by lecturers selected from universities, administrative bodies and others, in addition to the archivists of the National Archives of Japan. The style of training basically is done through classroom sessions in the main office of the National Archives of Japan. The trainees of intermediate grade are required to complete a final paper equivalent to graduate or master thesis in universities.

Archives College programs: Workers in the field are familiar with the name of the "Archives College," a term applied to archives management seminars offered by the National Institute of Japanese Literature. This Institute is a part of the National Institute for the Humanities in the Inter-University Research Institute Corporation. This training consists of a long-term course and a short-term course, the former lasting for 6 weeks divided into two phases and held at the National Institute of Japanese Literature in Tokyo. The short-term course lasts for 2 weeks and is held in regional locations. The fixed capacity of trainees is 35 for both long-term and short-term courses, and lecturers are invited from other universities, etc., besides the full-time instructors of the National Institute of Japanese Literature. Graduate students majoring in archival science are permitted to take part in the long-term course.

MUSEUMS

Modern Museums in Japan

National museums *hakubutsukan* and *bijutsukan*

The history of modern museums in Japan dates back to the Meiji era. In 1872, an exhibition was organized under the name of the Museum of the Ministry of Education of the Meiji government. The exhibition was opened at the

Taiseiden Hall in *Yushima Seido* with a view to making preparations for the Vienna World Exposition to be held the following year. As a result, an identity was given to the museums as exhibition-oriented facilities housing and exhibiting *hakubutsu*, meaning in Japanese, a variety of domestic articles to encourage new industries. The Japanese word for museum, *hakubutsukan*, literally means a house collecting various objects. *Hakubutsukan* has come to have a meaning different from the original word in the European languages.

When the first National Industrial Exhibition was held in 1877, the arts and crafts products were displayed in what was called *bijutsukan*. Since then, the Japanese *hakubutsukan* together with *bijutsukan* has been used to refer to art museums. During the late nineteenth century the *hakubutsukan* museums began to collect and show traditional cultural artifacts, although initially other kinds of products were also displayed. The Tokyo National Museum has kept the name *hakubutsukan* in Japanese even though it is a museum of fine art. It is currently under the Agency for Cultural Affairs which reports to the ministries in charge of internal affairs (Fig. 7).

Another type of institution which was called the “educational *hakubutsukan*” museum was set up under the control of the Ministry of Education with the goal of presenting learning materials related to natural science, such as samples of plants, stones, or rocks. This museum has grown into the current National Museum of Nature and Science, Tokyo. In the meantime, museums with increased emphasis on research activities were established under the control of the Academic and International Affairs Bureau of the Ministry of Education. These museums are the National Museum of Ethnology, Osaka, and the National Museum of Japanese History. These state-run museums have been reorganized as independent

corporations since 2001. As of 2007, the reorganization and consolidation of the museums were as follows:

The National Institutes for Cultural Heritage (Independent National Agencies) consist of the

- Tokyo National Museum,
- Nara National Museum,
- Kyoto National Museum,
- Kyushu National Museum,
- National Research Institutes for Cultural Properties, Tokyo and
- National Research Institutes for Cultural Properties, Nara.

The National Museums of Art (Independent National Agencies) include

- the National Museums of Modern Art, Tokyo, and Kyoto,
- the National Museum of Western Art,
- the National Museum of Art, Osaka, and
- the National Art Center, Tokyo.

National Institutes for the Humanities (Inter-University Research Institute Corporations) include

- the National Museum of Ethnology,
- the National Museum of Japanese History, and
- the National Institute of Japanese Literature.

Hakubutsukan and *Bijutsukan* Museums run by local governments, foundations, and private companies

After the first museums were founded by the Ministry of Internal Affairs, local governments founded various types



Fig. 7 Main Gallery of Tokyo National Museum, copyright, TNM Image Archives.

of museums and organized exhibitions and fairs showing both contemporary products and antiquities. Most of them, however, were exhibitions of articles or products with only a few that developed into full-scale museums. The Ministry of Education set up museums for educational purposes. This encouraged the foundation of such museums in regional cities, but this initiative was short lived. In the 1910s, “popular” museums were opened and in the latter half of the 1920s, many provincial museums were founded for the promotion of local education. Both types of museums were strongly supported by nationalist movements. Apart from these, it should be noted that there were also private initiatives to create museums, such as the Attic Museum founded in 1921 by Keizo Shibusawa (now the Institute of the Study of Japanese Folk Culture, Kanagawa University) and the Japan Folk Crafts Museum founded in 1936 by Muneyoshi Yanagi. In 1897, the Old Temples and Shrines Conservation Law was promulgated. Prompted by this law, temples and shrines preserved collections of ancient artifacts to show to the public.

In the field of fine art, the Tokyo Metropolitan Museum was founded in 1926 as the first local government-run *bijutsukan* museum. This museum is the predecessor of both the Tokyo Metropolitan Museum and the Museum of Contemporary Art, Tokyo. In 1917, a foundation-run museum was founded: Okura Shukokan Museum of Fine Arts, an institution that collected Asian fine artworks.

As for private museums, in 1930 the Ohara Museum of Art was opened as the first Japanese museum featuring Western art. In 1952, Bridgestone Museum of Art was opened to the public. These museums are now managed by foundations. Some private enterprises also run their own museums, an example being the Printing Museum in Tokyo (2000) established by Toppan Printing Co. A survey shows that there are a total of about 900 corporate museums in Japan.

Following the examples of the Library Decree (1899) and Revised Library Decree (1933), efforts arose to establish a museum decree. Such efforts were given added impetus when the Museum Promotion Society (renamed Japanese Association of Museums in 1931) was set up. However, it was not until 1951 that a museum law was promulgated. It came into force the next year, and was based the principle of the Fundamental Law of Education under the new constitution. Museums are now under the control of the Lifelong Learning Bureau of the MEXT.

The museums under the law are classified as below:

1. Registered museums meet specified requirements such as the employment of curators and storage of reference materials. The public museums of local governments are under the control of local education boards and are outside the control of MEXT. As for museums set up by corporations, the law covers only those established by special corporations such as the Japanese Red Cross Society and religious corporations.

2. The museum-equivalent institutions operate similar to museums. In the museums established by local governments, those authorized by heads of the local governments are included.

Museums not covered by the law are:

3. Museum-like institutions. A 2005 survey showed that the total number of museums was 5614.
 - Category (1): 865 museums (126 run by prefectures, 344 by wards and cities, and 263 by towns and villages).
 - Category (2): 331 institutions (national two, prefectural 26, ward- and city-run 94, town- and village-run 12).
 - Category (3): 4418 institutions (national 127, prefectural 266, ward- and city-run 1919, town- and village-run 1166).

Statistics show that the overwhelming majority of institutions are in Category (3) and the ones covered by the museum law, Categories (1) and (2), are about one-fifth of the total (source: Social Education Survey Report 2005 published by the MEXT).

University museums

As of 1999 there were 145 university-run museums around Japan, including facilities called reference rooms or historical materials rooms, and botanical gardens. The time-honored examples to note in this regard are the Agricultural Department Museum of Hokkaido University (founded in 1882), Tsubouchi-Memorial Theater Museum of Waseda University (1928), and Meiji University Museums including the Criminal Museum (1929). Various departments of the state-run universities including the imperial universities have been collecting samples and reference materials in many fields. In 1995, the Science Council, an advisory board to the Minister of Education, submitted a report encouraging the establishment of museums in the universities. Tokyo University, the first among the national universities, established a multidisciplinary museum in 1997, as the successor to a university museum opened in 1961 with 6.5 million items and reference materials). This was followed by Kyoto University (multidisciplinary museum in 1997, 2.5 million pieces) and Kyushu University (multidisciplinary museum in 2000, 6.5 million items).

Many arts universities also include museums. For example, Musashino Art University founded in 1966 an art reference materials library, which includes a museum. In 1999, Tokyo University of Fine Arts and Music opened a museum, which keeps art objects collected over a long period extending to before the foundation of Tokyo Art School, the predecessor of the university (founded in 1887). The art objects were once stored in a university

library and then in the art reference materials facility along with music-related reference materials.

Professional Staff and Museum Libraries

Professional staff

The Museum Law provides that registered museums must employ professional staff, *gakugei-in*. The Japanese term used for curator, *gakugei-in* literally means a person in charge of *gaku* or learning and *gei* or art. “*Gakugei-in*” do not have exactly the same significance of curators, keepers, or conservators in the European languages. The number of the curators totaled 2898 in 865 museums as of 2003, which is 3.4 curators per museum on average. Combined with the staff of the museum-equivalent institutions, the total number of them amounts to 3827 in 1196 museums (3.2 curators per museum on the average). The museum-like institutions are far more poorly staffed with 2397 curators in 4418 museums (0.5 curators per museum on the average).

The museums, in principle, must be provided with the professional staff other than the curators. However, the Japanese curators in the museums are commonly forced to perform various other functions as well. Most museums tend to employ librarians, educators, conservators, registrars, and other professional workers. At present, staff strength is slowly increasing, but remains far below the required level. A few of the museums, mostly national museums, are staffed with full-time workers specialized in library management and information system construction. In most cases, the library of the museums is managed by a part-time librarian.

Museum libraries or art libraries

In the area of museum libraries, development of those in fine art museums has been most remarkable.

The first full-fledged art library in Japan was founded in 1930 by the Imperial Fine Arts Academy (now National Research Institute for Cultural Properties, Tokyo). Then, the Library and Museum of Musashino Art University (1966) and the art library of Tokyo Metropolitan Art Museum (1976) followed suit. Tokyo National Museum built the independent Research and Information Center* in 1984. The establishment of these museum libraries was followed by

- Yokohama Museum of Art* (1989),
- Aichi Arts Center (1992),
- Tokyo Metropolitan Museum of Photography* (1995),
- Museum of Contemporary Art, Tokyo* (1995, which inheriting the reference materials collected by Tokyo Metropolitan Art Museum),
- Hyogo Prefectural Museum of Art (2002),
- National Museum of Modern Art, Tokyo* (2002),

- National Museum of Western Art* (2002),
- Museum of Modern Art, Hayama (2003) and
- National Art Center, Tokyo* (2007).

In spite of the different characters of these museums, the seven museum libraries* above have organized an art library consortium, presenting, via Internet, a cross-search service of their own books, magazines, etc. (<http://lalc.opac.jp>)

Museum-Related Societies and Associations, and Education and Training Systems

Societies and associations

The Japanese Association of Museums, a nationwide professional body (about 1900 institutions and individuals) was organized in 1928 initially as the Museum Service Promotion Society. This association aims at promoting lifelong learning activities, and at conducting investigation and research for the development of museums. It publishes a monthly journal *Museum Studies*. There is another association called the Japanese Association of Zoos and Aquariums (membership of 160 organizations). In the art-related field, the Japanese Council of Art Museums (membership: 350 museums) was founded in 1951, and the Japan Association of Art Museums started its activity in 1982 with membership of 120 museums. The former association has as its purpose the exchange of information and professional training; it is composed of the national, public, and private art museums. The latter has membership of the public art museums with the main purposes of coordinating traveling exhibitions and encouraging art-related activities.

As for societies, the Museological Society of Japan has about 360 members, and publishes the *Journal of the Museological Society of Japan* twice a year. In 1995, the Japan Museum Management Academy was set up, and had a membership of 400 individuals and 40 organizations. The academy publishes the *Annual Bulletin of Japan Museum Management Academy*. In this connection, the Japan Society for Exhibition Studies (about 500 members) was established in 1982. The society publishes a semi-annual journal *Tenjigaku*. Founded in 1989, the Japan Art Documentation Society (about 300 individual members) is engaged in library- and archive-related activities, with emphasis placed on promotion of museum documentation services. The society has an official annual journal, *The Bulletin of the Japan Art Documentation Society*.

Education and training systems

To become a curator requires completion of a number of credit units in university curatorship courses or

successfully passing a national examination. In fact, 99% of the qualification is dependent on the credits obtained by university courses: 12 units from 8 subjects. The number of the units needed to become a curator is less than that for a librarian. The need for improvement of curator education has been pointed out repeatedly.

At present, more than 200 universities in Japan have curatorship courses. About 10,000 students receive the qualification annually. However, only about 400 have been employed per year in recent years. As mentioned above, museums, and museum-similar institutions in particular, are not staffed with the required number of curators. To solve this problem, it will be necessary to improve the basic abilities of curators. In this connection, there have not been university faculties or departments specializing in curatorship, as is the case with librarians. Improvement in the quality of curators is a serious problem, which should include programs at the graduate level.

With regard to training of museum workers, professional courses include a nationwide 3-week course for museum workers by the National Institute for Educational Policy Research; a 1- to 4- week (period variable with the fields) course for the archeologists offered by the National Research Institute for Cultural Properties, Nara; a training course (2-year course of 1 week a year) for historical and ethnological staff by the National Museum of Japanese History; and a 2-week training course for curators of the museums in charge of conservation by the National Research Institute for Cultural Properties, Tokyo.

Problems Concerning Museums

Computerization and evaluation of management

Since opening to the public in 1977, the National Museum of Ethnology, Osaka, has had an artifact catalog database system and video system "videothèque," which are well known around the world. From the mid-1990s, many museums built up in-house computer systems. Today, the museums provide data on their collections via Internet. However, a nationwide collection search system has not yet been realized. This may be because most of the museums tend to stress exhibitions and to think little of collection building and cataloging. According to a survey conducted by the Japanese Association of Museums, 53% of museums record nearly all the data in an accession register, and 22% of them keep a so-called "collection catalog," which covers all the data (source: "Comprehensive Survey Report of the Museums of 2004).

The administrative reform starting in the 1990s influenced and attracted considerable interest from museums. In response to this reform movement, the Japan Museum Management Academy was founded. Since 2001, the national *hakubutsukan* and *bijutsukan* museums have been reorganized as an independent national agency.

The revision of the Local Autonomy Law in 2003 provides for the use of a designated administrator in the services of local governments. According to this law, 93 museums (as of 2005) decided to consign part of their work to a private company or nonprofit organization. Some people say such changes may damage the regular service level that the museums have so far maintained. More museums are going to introduce evaluation systems by themselves or by third party to enhance the restructuring. For example, Asahiyama Zoo of Asahikawa City has for 10 years monitored the remarkable renovation of its unique animal viewing system. Opened in 2004, the Twenty-first Century Museum of Contemporary Art, Kanazawa, features contemporary art, which is considered hard to appreciate by many people. Both zoo and museum together these two have succeeded in attracting more than 1.5 million guests per year although they are in the less populated local cities. Paying close attention to users, the two institutions are highly evaluated for their management abilities.

Movements toward revision of the Museum Law

In 2007, MEXT published a report for the revision of the Museum Law, in which the Ministry points out advances in registered museums and enhancement of education for curators. As mentioned above, the registered museums and museum-equivalent institutions are now only about one-fifth of the total institutions. The Ministry seeks to create a legal framework to improve as many institutions as possible, raising their status to the registered-museum level. In the area of curatorship, MEXT will try to enhance the ability of curators. In this context, curators will be qualified in fundamental curatorship when finishing the essential courses in university, regular curatorship when achieving the training course in a graduate program, and superior curatorship after a period of work in museum.

When the museum law was enacted more than 50 years ago, there were about 200 museums. Now, the number of museums has reached more than 5600. Furthermore, the Fundamental Law of Education, revised in 2006, puts great value on the lifelong learning principle. The important role of museums is once again being discussed. The registration standard of museums will be based mainly on abilities required for "management," "collection," and "communication," with reduced emphasis on the period of open days per year, one of the former registration standards. With respect to the requirements for curators, more emphasis will be placed on communication-related ability than the conventional abilities of research and exhibition. In addition, the national museums (Independent National Agencies), university museums, and non-profit private museums, which are not covered by the Museum Law, will be taken into consideration to be treated like

registered museums. The cooperative network of museums in Japan is being realized.

CONCLUSION

Libraries and document collection have a long history in Japan, based on a fundamental respect for written information and knowledge. Today almost all cities have public libraries. Japanese university and college libraries have also seen substantial improvements in technology, networking, and new library construction in recent decades. Economic growth also brought development of special libraries. User interest is now mainly directed toward the Internet and electronic resources and this has spurred library development of digital searching and storage.

The history of modern museums in Japan dates back to the time of the Meiji Restoration. The museums were initially set up to organize exhibitions for display of various articles. For this reason, the activities of the museums focused mainly on "organizing exhibitions" rather than building and management of collections. This characterized Japanese museums (in particular museums of fine art), curators, and museum specialists. Against this background, librarians, conservators, educators, and other specialists have been progressively staffed for individual sectors. Furthermore, reforms are underway for making collection databases, opening data to the public, and introducing the IAA system and third party management evaluation.

Archives in Japan are divided into three main groups: public archives, university archives, and private archives, including business archives. It was not until the late twentieth century that archival legislation, academic societies on archival studies, and training systems for experts engaged in the operation of archives were developed in Japan, and new development is still underway. Interrelationships among archival institutions are based on the decentralized administration system and there is no unified base or central management organization for implementing archival policies. Digitized archival materials are provided online on a large scale by the Japan Center for Asian Historical Records.

In Japan today, the fruits of the progress in information technology is becoming increasingly widespread among libraries, museums, and archives. The pace of digitization is remarkable, and development of digital libraries, digital archives, and other digital projects have become common. Under these circumstances, professionals in this field in Japan also recognize the need for links between museums, libraries, and archives (otherwise known as "MLA partnership"). Nationwide networks that include the principal institutions are already being formed by the curators of museums, libraries, and archives. There are now plans to go further in forming and consolidating MLA partnership as a reciprocal relationship that will embrace all of these

and transcend boundaries between different types of institutions. In our opinion, the main issue to be resolved before this can be realized, however, is the problem of who should take leadership. Japan's library sector should take the initiative to bring about cooperation and coordination. But the JLA, which would normally be expected to take the lead in the MLA partnership, does not have enough capacity to achieve this. The National Diet Library has its own institutional issues that prevent it from taking national leadership on this agenda. Resolving this issue is of immediate concern to everyone working in data storage and search services in Japan.

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Kazakhstan: Libraries, Archives, and Museums

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Abstract

This entry describes the development and present situation (as of 2007) of information institutions and practices in Kazakhstan, primarily the histories and cultural roles of libraries, archives, and museums, and the education, status, and activities of information workers.

INTRODUCTION

This entry describes the historical development and current conditions of libraries, archives, and museums in Kazakhstan. Early institutions and practices in the region were Islamic, and later Russian imperial and Soviet influence is also still evident in educational philosophy, scientific practice, and institutional structure. Today institutions face the challenge to modernize and globalize information practices in a multiethnic, multilingual state.

Kazakhstan is in the middle of the Eurasian land mass (Fig. 1). Bounded by China to the east, Russia to the north and northwest, the Caspian Sea to the southwest, and Turkmenistan, Uzbekistan, and Kyrgyzstan to the south, it is the ninth largest country in the world (2.7 million km²). The desert, steppe, and mountain ecologies have supported nomadic pastoralists, trade cities of the Silk Road, and settled agriculturalists. At 15.3 million citizens, it is the least densely populated Central Asian state. The development of rich oil, gas, and mineral resources makes Kazakhstan the wealthiest Central Asian republic, second to Russia among the former Soviet republics.

History

By 1500 B.C.E. horse-herding nomads were inscribing petroglyphs at Tamgaly (Fig. 2). Several cultural traditions later marked the region's inhabitants: the Scythian or Saka presence from the eighth to the third centuries B. C.E., the spread of Islam from the seventh century C.E., the Mongol incursion in the thirteenth century, the Persian-influenced Timurid dynasty from the fourteenth century, the rise of the Turkic Uzbeks in the fifteenth century, and the entrance of Russia from the eighteenth century. The Muslim philosopher Al-Farabi (ca. 870–950) is said to have founded a library in his birthplace Otrar

that rivaled ancient Egypt's Alexandria. The Mongol forces of Chingiz (Genghis) Khan (ca. 1162–1227) later destroyed Otrar and other localities. Many of these places were rebuilt under Chingiz Khan's descendant Amur Timur (Tamerlane) (1336–1405), including the mausoleum of the Sufi poet Khoja Ahmed Yasavi (1106–1166) in Turkistan. In the fifteenth century the Kazakhs emerged as a distinct cultural and linguistic group from the Uzbek confederation of Timur's descendant Abu'l-Khayr Khan (ca. 1412–1468). The appellation *Kazakh* is most commonly translated as “free, independent.” Other proposed etymologies include from Old Turkic *qazgac*, “to gain”^[1] or from a Turkic term used to describe splinter groups.^[2] In the early seventeenth century the Kazakh khanate split into three competing *zhus* or hordes. External threats from Mongol Oirats and Dzungars in the eighteenth century led Kazakhs under Ablai Khan (1711–1781) to turn to China and Russia for recognition and protection.

By the nineteenth century the Russian Empire had established settlements across the north including Uralsk (Oral), Semipalatinsk (Semey), and Ust-Kamenogorsk (Oskemen) and a frontier outpost in the south, Fort Vernyi (Almaty). Colonizing Russians disrupted Islamic influence in the region, in part by establishing Russian-language libraries adjunct to their military installations in the region, which served increasing numbers of immigrating Slavs.^[3] Soviet-era historians describe this as a period of enlightenment when individuals such as Chokan Valikhanov (1835–1865) (descendant of Ablai Khan), Ibrai Altynsarin (1841–1889), and Abai Kunanbayev (1845–1904) (Fig. 3) aspired to spread the benefit of books and reading among Kazakh people. More recent histories note uprisings against the Russians during this time that suggest the beginnings of Kazakh nationalism.



Fig. 1 Republic of Kazakhstan.

Source: Adapted from *CIA World Factbook*, <https://www.cia.gov/library/publications/the-world-factbook/geos/kz.html>

Well into the nineteenth century Kazakhs were a people of oral tradition, and when imperial Russia required literacy from Kazakh elites it was in Russian.^[4] In 1918, the new Soviet state found Central Asians to be largely illiterate and early literacy campaigns focused on primary education—the Kazakh region reached acceptable levels of literacy in the 1930s.^[5] Russian was the main language and written Kazakh was converted from Arabic and Latin into a modified Cyrillic script. Authors who wrote on

Kazakh themes or in the Kazakh language were sometimes exiled or executed, including poet Saken Seyfullin (1894–1938) and linguist Akhmet Baytursynuly (1873–1938).

During the Soviet era of the twentieth century (1918–1991), the region became increasingly collectivized and urbanized. The Communist government required nomads to adopt more sedentary animal husbandry and industrialized methods of agriculture. Cities developed into centers



Fig. 2 Petroglyphs at the Tamgaly World Heritage Site outside of Almaty.

Source: Photograph by Kristopher D. White.

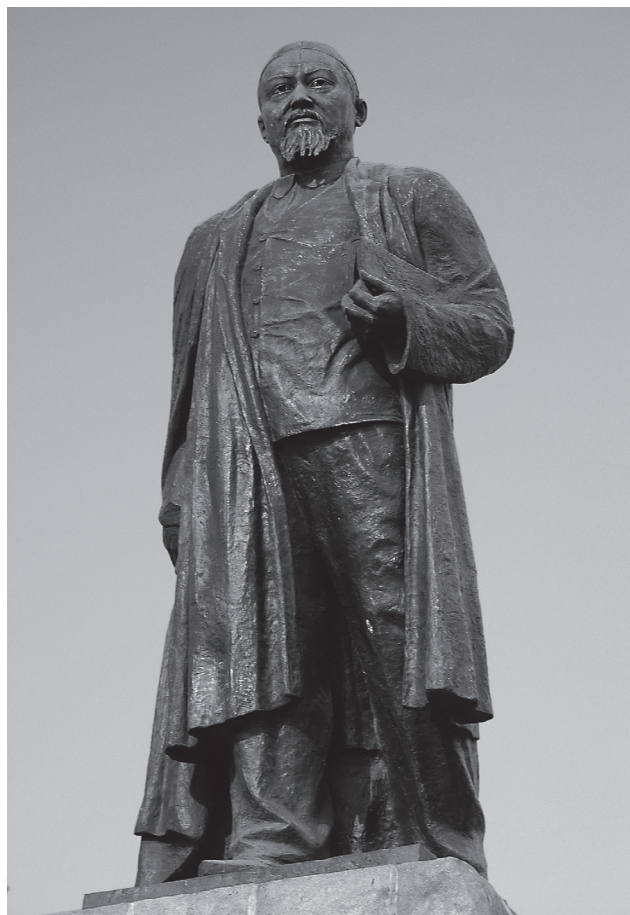


Fig. 3 Abai Kunanbayev, seminal Kazakh author. Statue at the Republican Palace performance hall in Almaty.

Source: Photograph by Kristopher D. White.

of economic and cultural life, supporting urban institutions such as schools, hospitals, libraries, museums, and book and newspaper publishers. When the single Turkistan Autonomous Soviet Socialist Republic proved difficult to administer, Central Asia was divided into smaller republics in 1923 and 1924, and boundaries were redrawn again several times. Immigrants came from other Soviet Republics as internal exiles, war refugees, or developers of virgin lands, and forced migrations of Koreans, Crimean Tatars, Germans, and others also populated the area so that by the 1960s ethnic Kazakhs had become a minority group.

Present Day

Kazakhstan was the last state to declare independence from the Soviet Union on December 16, 1991. The country is organized into 14 administrative units known as *oblasts*, plus the two city units Astana and Almaty, the present and past capitals. The government recognizes over 130 ethnicities in the country; 2006 figures estimate

9 million Kazakhs, 4 million Russians, 450,000 Ukrainians, 433,000 Uzbeks and 250,000 each of Uighurs, Tatars, and Germans. Religions include varieties of Islam (60%), Christianity (30%), and others such as Judaism, Hinduism, and Buddhism. The monetary unit is the tenge (KZT), valued at roughly 120 tenge to the U.S. dollar in September 2007. President Nursultan Nazarbayev has led the country since 1989 and may run for re-election indefinitely: recent legislation limits future presidents to two consecutive 5 year terms. Power is concentrated in the executive branch of the government, and national companies manage physical infrastructure and much of banking and industry. In an effort to enter the top 50 of the world's most competitive nations,^[6] President Nazarbayev has urged the development of an information society, supported by national research and development funds and manifested in projects such as the IT City recently established near Almaty.

The constitution identifies Kazakh as the state language (Article 7.1); authorizes government institutions to use Russian as equal to Kazakh (Article 7.2); and states that everyone should be able to enjoy their native language and culture (Article 19). Primary education may be in Kazakh or Russian, according to local circumstance, and in some urban areas parents may choose to enroll their children in either a Kazakh or Russian track. Government-mandated basic education curricula allot approximately 30% of teaching time to languages and literature.^[7] The majority of Kazakhstanis are at least bilingual, in Russian or Kazakh and a second language—Kazakh, Russian, or one of the minority native languages (e.g., Uighur, Ukrainian, Uzbek), and many are also proficient in other languages that are increasingly part of required school curricula (e.g., English, Mandarin, Korean, and Japanese).^[5,8] Literacy rates, which government statistics have reported as over 99% since independence, usually do not specify the language(s) in which literacy is assessed. The government's pursuit of a "sovereign (Kazakh) identity" may bring about a shift to the Latin alphabet for the Kazakh language within the next 15 years.^[9]

Publishing is a highly controlled activity in Kazakhstan, regulated by the AIC, the Agency of the Republic of Kazakhstan for Informatization and Communication.^[10] In 2006 the government recognized 314 sociopolitical, 1029 informational, 198 advertising, 172 science, 28 women's, 41 youth, 39 children's, and 37 religious media outlets in Kazakhstan. In 2007, 29 large book publishers reported operations in Kazakhstan, including specialty publishers of children's, legal, and reference works. At least in quantity, print publishing in Kazakhstan lags behind comparable EU states^[11] and the demand for Kazakh language materials in particular exceeds supply.^[12] As for booksellers, this entry's authors have observed that in cities, large chain-style bookstores are replacing book sales from corner kiosks and used dealers.

LIBRARY AND INFORMATION SCIENCE PROFESSIONS, SYSTEMS, AND SERVICES

History

Soviet-era libraries were organized in a hierarchy from the central research collections, down through regional university, college, institute and academy libraries, to public libraries in a variety of locations including factories, plants, trade unions, culture centers, and schools.^[13] Research libraries maintained broad and deep collections for the restricted use of scientists; university libraries provided approved knowledge to students; and public libraries worked toward universal literacy and the transfer of party policy and practical knowledge to the working classes.^[14] Following both Islamic and Russian-adopted European traditions, libraries emphasized preservation of key authoritative texts over dissemination of newer knowledge. Technologically, Soviet libraries fell behind their western counterparts beginning in the 1960s due to slow development of civilian telecommunications infrastructure and personal computers.^[15]

Legislation Concerning Libraries

Two government ministries supervise libraries. The Ministry of Culture and Information^[16] oversees more than 3500 national, regional and public libraries, and the Ministry of Education and Science^[17] is responsible for approximately 7500 school, university, professional, academic, and scientific-technical libraries. Some government agencies and research institutes maintain separate libraries, such as agriculture, health, and physics. From the Soviet era Kazakhstan continues the National Book Chamber that is responsible for state bibliographic control and cataloging, statistics on print publications, and ISBN and ISSN assignment.^[11]

Specific laws governing libraries and legal deposit have been drafted, but have not yet been adopted. In the meantime state libraries are regulated by standards approved in an order of the Ministry of Culture and Information from 2002.^[18] Legal deposit is regulated by the 1991 Soviet-era Law On Print Media and Other Mass Media Outlets, amended by the Kazakhstani parliament in 1995.^[11] Library legal deposit is entangled with regulations requiring deposit of all printed matter to “authorized agencies” that could be used to suspend publications and printers.^[19] Other relevant laws include On Informatization (2003), On Science (2001), On Mass Media (1999), On Culture (1996), the Patent Law (1999, amended 2007), On Trademarks, Service Marks, and Appellations Of Origin (1999), and On Copyright and Neighboring Rights (1996, amended 2004, 2005). The copyright law, which does not address fair use, has been analyzed as more attuned to Kazakhstan’s future international relations than its current

domestic situation,^[20] and as detrimental to information dissemination efforts in education and publishing.^[21] In practice, the unauthorized reproduction and translation of print and electronic works for nonprofit and commercial purposes is declining in situations where education about intellectual property issues is provided and laws are enforced.

National Library and Information Services

Kazakhstan has several national libraries. The predecessor of the oldest National Library^[22] was conceived by the Vernyi Municipal Council in 1910, and has had a series of prominent directors,^[23] from politician and statesman Uraz Dzhandosov (1908–1938) through Murat Auezov—Orientalist–philologist, diplomat, and descendant of Mukhtar Auezov (1897–1961), the author famous for his studies of the works of Abai. In 1931, this library became the State Public Library of the Kazakh SSR, with depository responsibility, and was renamed the National Library in 1991. In 2006 the library reported 280 employees and holdings of 5.8 million items. Collecting focuses on social studies, culture, art, literature, and linguistics. The library building, designed in 1971, is 30,000 m² and since 2006 is undergoing major renovation.

In 2004 the National Academic Library^[24] opened in Astana under the direction of R. Berdigaliyeva, formerly director of the National Library in Almaty. The Astana facility combines traditional library service with new communication and information technologies, as in a virtual reference service. A variety of electronic and some print resources are available.

A third national facility opened recently in the new Presidential Center of the Culture of the Republic of Kazakhstan^[25] in Astana. This library’s mission is to bring together materials on Kazakh history and culture from around the world, and to organize and preserve the materials for serious scholarship.^[26] The library is 15,000 m², with holdings of 700,000 items including the collections of the previous Saken Seyfullin Regional Universal Scientific Library and the first UN depository in Central Asia.

The National Libraries encourage the technological informatization of Kazakhstan’s public regional libraries in various ways. Multimedia collections are beginning; CD-ROM and Web-based resources are being introduced, as well as electronic document delivery, and a domestic automated library system, the Republican Automated Library Information System (RABIS) is underway. Development is progressing as quickly as budgets can provide infrastructure installation and sustained staff training.

Public Libraries

Public libraries are organized into a hierarchy from national to village libraries, and by categories of children’s, juvenile, special needs (blind and deaf), oblast

universal research, municipal, and rural libraries. The ministry estimates 9 million users annually, including 4 million reader accounts—public libraries operate on a subscription system in which a modest annual fee (300 tenge in 2006) secures privileges for facility use and borrowing. Service hours typically fall within the standard Monday to Friday 40 hr work week. Stacks may be open if space allows.

Public libraries continue to play an important role in supporting universal, lifelong education, and promoting national identity. Recent outreach programs have promoted the library as a center for ecological information and for village development. The “Library Capital” conference is held annually since 2001 at a regional library to advance regional innovation and develop local government support. Each conference produces a document of best policies and practices that is afterwards applied throughout the republican library network.

Kazakhstan also has a number of other institutions for general readers, sponsored by foreign embassies, multinational and nongovernmental organizations and cultural associations, and supported by membership fees, such as the British Council libraries.^[27] Library materials typically promote the language or purpose of the supporting agency. Such collections may close and open with economic and political changes—for example, a “new” American Corner at the Central Scientific Library, opened in 2006, reinvigorates a collection of books donated in the early 1990s.

Academic and Research Libraries

The Ministry of Education and Science^[17] exercises centralized control over all aspects of the educational process beginning from preschool. Higher education begins with undergraduate training or study at the 181 colleges and universities (51 public and 130 private) attended by nearly 1.3 million students in 2005–2006. In its education strategy for 2005–2010, the government is working out procedures for accreditation so as to harmonize the quality of grading with the terms of the Bologna process.^[28] In efforts to bring Kazakhstan into line with international standards, many universities are in transition from 5-year *diplom* to 4-year baccalaureate programs, and from highly structured program requirements to a more flexible credit system.^[29] Graduate departments exist in 72 universities and 70 research institutes, and were attended by 4700 postgraduates and 303 doctoral students in 2005. Graduate level education is also in flux, with Master’s and Ph.D. programs offered alongside *aspirantura* and *candidatskaya* degrees. The terminal Soviet degree, the *Doktor Nauk*, once paved the way to positions in one of the approximately 30 academies of sciences, the premiere research institutions in the Kazakh SSR. Since independence, foreign aid has increased the status of universities

and their teaching professors vis-à-vis research academies and their members.^[30,31]

Academic and research libraries are typically open only to members of their institutions (at national or oblast facilities, credentialed scholars) during the standard work week. Closed stacks and fee-for-service, on-site use of print and electronic resources are the norm. Electronic cataloging has been introduced, and institutions with large collections face generations of work to convert card catalogs, as well as the items they describe, to electronic formats.

Research libraries

The Central Scientific Library^[32] is the main research library for scientists and scholars in the country. (In Russian, “scientific research” connotes the entire range of scholarly activity, from poetry to physics.) Founded in Almaty in 1932 as the Kazakh affiliate library of the Academy of Sciences of the USSR, it currently holds over 5.3 million volumes in its main facility and 16 affiliate libraries throughout Almaty and the republic. Collections span the arts and sciences, including the largest foreign languages collection (850,000 items) in Central Asia. The main facility of 37,000 m² is undergoing a major renovation from 2006. Director K. Abugalieva manages a staff of about 300.

The Republican Scientific-Technical Library (RNTB),^[33] headquartered in Almaty, was created in 1960 to support scientists, engineers, innovators, and researchers. In 1966–1976 a centralized system of the country’s regional scientific-technical libraries was developed, which now includes several Almaty locations and 12 regional libraries. Combined holdings of 23 million items include patents, dissertations, and standards. The total staff of 447 is headed by General Director-RNTB Director K. Urmurzina. RNTB uses IRBIS, a mid-1990s Russian automated library system inspired by UNESCO’s CDS/ISIS package.^[34] O. Kvochkina, head of RNTB’s Center for the Development of Libraries, also manages the Information Consortium of Kazakhstan.^[35]

University libraries

The Scientific Library^[36] of Al-Farabi Kazakh National University (KazNU)^[37] supports the leading higher educational institution of the republic (annual enrollment: 15,000). Established in 1934, this largest university library in the country holds over 2 million items at various campus facilities and in 1962 was designated the scientific-methodical center for libraries of educational institutions.

The Scientific-Technical Library^[38] of the Kazakhstan National Technical University^[39] (annual enrollment: 12,000) was also created in 1934, with the 8500 volume collection of the Semipalatinsk Geological Technicum Library. It has become the most important university



Fig. 4 The KIMEP Library.
Source: Photograph by Leslie Champeny.

technical library for the Almaty area with 1.3 million current holdings. In recent years the library has been able to add facilities, collections, and computing capacity with the support of the U.S. Agency for International Development (USAID).

Notable among private universities is the new library at the Kazakhstan Institute of Management, Economics and Strategic Research (KIMEP)^[40] that was completed in 2006 (Fig. 4). KIMEP, an English-language university offering social science and business education to over 3000 students, has been fortunate to be able to combine its heritage as the former Communist High Party School with over a decade of strong international support to produce a four-floor facility with open stacks for 100,000 books and 7-days-a-week study space.

School Libraries

Public education is mandatory and free. Preschool for children aged 5 and 6 was recently reformed, and basic education is divided into three grade levels: 1–4, 5–9, and 10–11. School libraries are managed by an oblast administrator responsible for oversight of proper materials to support approved curricula throughout the region. The position of school librarian is a recognized degree specialty. Funding is at discretion of the school principal, and many schools encourage additional support from parents including the purchase of textbooks.

Special Libraries

Medicine and law (like library science) are undergraduate professional degrees. Law schools and law offices

maintain their own resource collections. Legislative decisions are first published in a government register, and commercial indexes can be purchased on CD or subscribed to online. The Ministry of Health^[41] information resources focus on pharmaceuticals, and medical schools maintain their own libraries. Business does not yet appear to support corporate libraries, although there is a keen appreciation of information as a competitive advantage and a marketable product. More common is for well-established libraries to be offered specialized resources in exchange for providing space and staff to maintain services—for example, the National Library in Almaty hosts a collection of oil and gas information resources funded by an international petroleum company.

Digital Library Collections and Services

Libraries are eager to possess digital technologies and collections. International support for digital library development since the mid-1990s is beginning to show results. For example, UNESCO's 2004 training in Greenstone digital library software enabled the Human Rights Digital Library launched in 2006 at the National Academic Library. Collections of locally produced electronic documents are beginning to appear online at some of the larger libraries, including digitized rare manuscripts and musical recordings.

Librarianship and Information Science as a Discipline and Profession

Considering the relatively recent development of mass literacy in Kazakh society, and the decades of Soviet censorship that followed, it becomes apparent why jobs like



Fig. 5 Kazakhstani librarians continuing their education.

Source: Photograph by Leslie Champeny.

journalist, publisher, and librarian might be low in security and status. The librarian (and wife of Lenin) Nadezhda Krupskaya (1869–1939) is a model who represents the essential role of libraries in education and nation building. Those within the profession recognize the erudition, technical expertise, and multilingual abilities required. It is difficult to attract individuals with this skills set to entry-level positions at low wages, and equally difficult to retain their services after they develop the skills on the job. Library-flavored information science hardly exists, although there are excellent mathematicians, linguists, computer scientists, and business information systems experts.

Regarding professional education, in 1934 the first Regional Kazakh Library College was formed, and the undergraduate degree in library science and bibliography is currently offered at three institutions. Required courses cover the history of the book, bibliographical theory and description, user issues, library management, collections (*fond*) and information resources, and automated library systems; specialized disciplines include documentation, networks, bibliography of Kazakhstan, standardization, information culture, and library marketing. In 2001 a postgraduate course on Librarianship, Bibliography Science, and Book-Science was developed and in 2004 a graduate program opened at a state university. Continuing education for professional librarians is available through the major libraries, often in conjunction with international development support organizations (Fig. 5). In 2000 the Eurasia Foundation and the Open Society Institute funded

the Centre for Professional Development of Library Workers at the RNTB.^[42]

As for professional associations, the Library Association of the Republic of Kazakhstan (LARK) (founded in 1997) brings together workers from a variety of libraries, offering occasional lectures and information on opportunities for participation in international organizations. National and scientific-technical libraries can join appropriate regional organizations. Major libraries regularly send participants to meetings sponsored by international organizations.

ARCHIVES AND ARCHIVAL SCIENCE

History

Archives were started by the Inner Bukeev horde around 1795. The present archival system derives from the USSR. In 1921 the first central archives was founded in Orenburg, the capital of Kazakhstan's predecessor state, the Kyrgyz Autonomous Socialist Republic. Aleksandr Mikhailov was its first director. The capital of Soviet Kazakhstan moved twice, to Kzyl Orda in the mid-1920s and to Almaty in 1929. Because of these moves, as well as several border realignments, some document collections remain in archives in Russia or other Central Asian countries, and others were lost. Nevertheless, Kazakhstan's archives include original documents from as early as 1733 on the khanates, on Kazakh accession to the Russian

empire, and on other state activity prior to and during the Soviet period.

Kazakhstan followed the usual Soviet model for state archives. In addition to the Central State Historical Archives, there was a Central State Archive of the October Revolution and Socialist Development (founded 1931), and these were combined in 1957 into the Central State Historical Archives of the Kazakh SSR. Regional archives were also opened during the 1920s. The 1940s–1950s brought improvements in archival processing and storage including a laboratory devoted to microfilming, preservation, and restoration, despite sporadic funding and support for training. Central archives for film, photographs and audio recordings, and for technical and scientific documents opened in 1974. By 1989 there were 20 oblast archives, including regional branches.

The Communist Party had its own parallel network of archives in Kazakhstan. Before the Revolution, the Central Committee of the Russian Social Democratic Party maintained collections in various cities. In 1920, the Russian Council of the People's Commissars (SNK) created a special body for the collection and study of documents relating to the October Revolution. A year later the Party created a special office to archive material in the *gubernia* (forerunner of the oblast). In 1943, Kazakhstan's central Party archive in Almaty became part of the Institute of the Party's History of the Central Committee. By 1980 there were 20 Party archives throughout Kazakhstan with around 200 employees.

Legislation Concerning Archives

By treaty Kazakhstan became the successor to the Kazakh SSR archives in 1992 but it did not pass any law regarding state archives until 1998. Between 1992 and 1998 a number of Ministry decisions and Presidential edicts ensured that the existing archives survived, though with minimal support. The 1998 law (with amendments from 2001) provides the legal framework for the current organization of Kazakhstan's archives. This law states that the items in the national archives collections are an inimitable part of the historical and cultural heritage of the people of Kazakhstan, and that the collections encompass all documents that have a bearing on the history and identity of the nation regardless of legal ownership. The law also created restricted archives for the security of the nation within the Ministry of Defense, the Interior Ministry's Committee of National Security, the Agency on Fighting Economic Crimes and Corruption, and the Agency for the Protection of the President. Most of the material in restricted archives is inaccessible but the Ministry of Defense archivists will process requests for information on persons who were politically repressed or regarding people in World War II. The 1998 law further authorizes the national archives to seek and retrieve originals or copies of items of national

significance to Kazakhstan from foreign archives, and the central- and oblast-level archives have retrieval agreements with Russian, Korean, German, Turkish, Egyptian, and other archives.

National Archive System

In 1992 the Communist Party archives became the Central State Archives of Recent History, and in 1994 the Presidential Archive. This archive remains in Almaty and is the most advanced in Kazakhstan with climate control and some electronic cataloging. The current director is V. Shtempel.

Archival activity is supervised by the Ministry of Culture and Information. On the national level the ministry's Committee of Information and Archives (originally the Committee for Managing Archives and Documentation) manages the National Center for Archeography and Source Identification; Central State Archive for Scientific and Technical Documentation; Central State Archives; Central State Archive of Film Documents and Audio Recordings; Science and Technical Center for Document Management and Archival Activity; State Repository Collection of Document Copies; and the National Archives of Kazakhstan. The current and fourteenth head of the Central Archives is B. Zhanaev.

Government archives are organized by *fond* (collection), *opis* (register), *delo* (file), and *list* (page). In 2003, the National Archives had approximately 13.6 million documents and was growing at a rate of half-a-million documents a year. The national archival collection included 1,090 fonds in the presidential archives, 144 fonds in the scientific-technical archives, 284,700 records in museums and libraries, and 10,900 audiovisual records.

Oblast and Municipal Archives

In 2006 Kazakhstan had 16 oblast-level departments of archives and documentation, 36 oblast filial archives, and 166 regional and municipal archives. Regional archives are subordinate to the national Committee of Information and Archives. Administratively, they are branches of the regional governments. The oblast archives include all media in one collection. They are tasked with being repositories of nationally important documents of local origin and inputting this information into Kazakhstan's unified document accounting system. All of these archives have published guides and aids to their collections; mount local exhibits of archival documents; and provide technical and organizational leadership in document retention to local organizations and government agencies. They are the repositories of employment and other business documents of the oblast.

Archival Work

All documents that have national value are part of the national archive system, no matter their origin, location, or format. Examples are legislation, construction project drafts, technological patent licensing, machine readable and audiovisual documentation, and historic and cultural documents. The state archives must maintain a catalog of this material, with the help of the sources of the items. The documents originating in private or other government agencies must be kept and cataloged for the national archival system. The Committee of Information and Archives has produced rules for the handling of documents and defining the length of retention. If a legal entity (e.g., corporation) ceases to exist, certain documents must be organized and delivered to the oblast or city archives (e.g., employment documents, records of board meetings).

The National Archives is actively pursuing document preservation and the retrospective conversion of paper documents into other media. The State Insured Collection of Document Copies of the National Archives Collection has prepared over 1.6 million frames of microfilm, restored over 12,000 pages of faded text and converted into digital format over 818 photographs, 172 films and 1,350 photographic documents.

In 2006 the government developed its 2007–2009 archival development plan. It announced that its archives would work to become ISO 15489-certified by the end of 2009. The plan notes that current conditions in some archives are not yet compliant with existing national requirements, due to lack of a single unified electronic information system and limitations of older infrastructure.

Kazakhstan initiated efforts in 2002 to develop electronic archives. The Presidential Archives became the first to introduce an electronic holding system and a program to digitize existing holdings. The archives' database shows partial holdings, and as of 2004 the archivists still operated the database for the client. Problems with the rate of digitization, storage, and integration of new document formats were reported in 2006. In the same year the government formed a working group towards creating an "electronic government" by 2009 that included archivists to examine issues regarding the introduction of a nationwide system of electronic archives.

Print and electronic publishing activity

Since 1987 the Center of Scientific and Technical Information on Document Handling and Archival Activity has published a national quarterly. The Central State and oblast-level archives publish periodically, including *The Archival Herald* (Karaganda Oblast, since 2000) and *The Archivist* (Kostenai Oblast, since 2002). An independent monthly covering document management and archives, *Deloproizvodstvo v Kazakhstane*, began publication in 2007. Under the auspices of UNESCO's HeritageNet program, several CDs of archival documents were produced,

including *Kazakhstani Chronicle* (2000), a short history of Kazakhstan from the National Library's collection of newspaper articles 1913–1937, and *The Electronic Archive of Kazakhstan* (2002), 168 pages of archival documents from the seventeenth and eighteenth centuries.

The Central State Archives Internet site^[43] published legislation and regulations pertaining to archives and their use, a list of the oblast-level archives and their publications and other basic information. Closed temporarily in June 2007 for lack of funding, the government's 2007–2009 plan includes a new or upgraded site. The Presidential Archives Web site^[44] includes contact information, a small history, description, and rules on the use of the collections, and its semiannual bulletin. Archive Web sites of Eastern Kazakhstan Oblast^[45] and Kostenai Oblast^[46] include full texts of the laws and regulations governing archives, and descriptions of the collections and services offered.

Access and Use

Access and use of the archives are guaranteed to all. The Committee of Information and Archives has created detailed rules for access. Documents judged to contain state or commercial secrets or that would violate the privacy of an individual have restricted access. The managers of individual archives may judge original documents as too fragile or valuable to be given to a researcher and may substitute copies.

Committee rules state that researchers should present an official letter from their sponsoring organization. University students should present a letter from the rector of their school asserting the necessity of the archival documents for the student's research. Independent researchers must prove their identity and complete an application form to the proper archive. Permission is typically valid for 1 year or one stay in Kazakhstan. A change in the area of research requires a reapplication. There is a daily limit on the number of registers that may be used and an annual limit on photocopying. Visitors are provided free consultation, have access to any automated catalogs, may bring in their own documents and avail themselves of a translator's services.

Archival Science as a Discipline and Profession

In 2007, the Kazakhstan Central State Archives Web site listed 12 colleges and universities that offer programs appropriate for work in archives, sometimes combined with document management programs. Working archivists must be certified periodically by the Committee for Information and Archives. Government-mandated continuing education is frequent, and has recently focused on compliance with the changing labor code and the administration of documentation transition to the Kazakh language.

Archivists may belong to the Society of Archivists of the Republic of Kazakhstan. Kazakhstan is also a member of international organizations on archives including the International Council of Archives, the International Federation of Information and Documentation, the International Association of Sound Archives, and the International Federation of Television Archives.

In sum, the role of documentation in Soviet society cannot be overstated, and made archiving an essential profession. However, the resulting “document explosion” has made the archivist’s task extremely difficult. The status of archiving as a profession also suffers from the Soviet reputation for altering documents. Similar to libraries, archives have difficulty attracting and retaining talented employees.

MUSEUMS AND MUSEOLOGY

The history of museums dates to 1832, when Vladimir Dal (1801–1872) (who would become Russia’s first lexicographer) was sent to the Russian military outpost at Orenburg. Dal took an interest in the nature and culture of the region and reportedly opened a museum of zoology and botany, and some of his collections now reside with the Central State Museum in Almaty. Today the Ministry of Culture and Information reports more than 150 museums throughout Kazakhstan, primarily regional, historical, and ethnographic, fine arts, and biographical memorial institutions; unique topics including mining and rice cultivation. The ministry estimates that 20,000 exhibits and events have been presented in recent years with an attendance of approximately 1 million.

National Museums

There are six national museums. The Central State Museum^[47] is one of the largest museums in Central Asia, with permanent and rotating exhibits on natural history and cultural heritage. The museum opened in 1931 in Almaty’s Cathedral in Panfilov Park, incorporating collections of the Cossak Army and the Republic Anti-religious Museums. In 1985 it moved to its current facility of 17,577 m², where it can display about one-tenth of its 200,000 item collections. A journal *Kazakhstan Muzeileri* (“Kazakhstan Museums”) has been published since 2002.

The Kasteyev Arts Museum^[48] was named for the first major national artist Abylkhon Kasteyev (1904–1973) in 1984. The museum originally opened as the National Art Gallery in Almaty in 1935 with an exhibit celebrating 15 years of the Kazakh SSR. In 1936 the State Tretyakov Gallery and the A. Pushkin State Museum of Fine Arts in Moscow donated approximately 200 works. In 1939 the gallery was named after the Ukrainian writer Shevchenko on the 125th anniversary of his birth. In 1976 the gallery and the Museum of Applied Art moved to a new building

of 19,400 m² with ample storage space, photo laboratory, large exposition halls, and climate control. It owns about 22,000 Kazakh, Russian, European, and Asian fine art showpieces including paintings, graphic works, sculptures of popular arts and theatre, and decorative art.

Of special interest to librarians, the Republican Book Museum was opened in Almaty in 1978. It has six halls for exhibitions of the history of Kazakh writing and book printing as well as modern publications in Kazakhstan. Holdings include 5,123 rare original manuscripts, ancient books and drawings, and 45,000 other books, periodicals, booklets, emblems, and charts (Fig. 6).

The State Museum of Popular Musical Instruments was created in 1980 in a beautiful nineteenth-century wooden building in Almaty’s central park. The collection displays instruments from Kazakhstan and around the world including the personal *dombras* (a long necked, two-stringed instrument similar to a lute) of famous Kazakh poets and composers such as Abai.

The State Gold and Precious Metals Museum was founded in 1990 as the main repository of Kazakh jewelry from the earliest time up to present. It annually replenishes its collection with unique showpieces.

The newly established State Museum of Archeology and Ethnography^[49] is in the Presidential Centre in Astana. This museum is charged with the material and technical, managerial, scientific-methodical, and financial backing of studies of the country’s national cultural heritage and current development. Its collections include the Berelskaya and Buzuk archeological items, and gifts given to the Head of State.

Other Museums, Galleries, Zoos, and Preserves

Each oblast has a museum that includes science and natural history-themed exhibits, and several academies of the natural and physical sciences operate small museums. Notable is the Geology Museum in Almaty, which offers an interactive computer show demonstrating different geological processes. KazNU reports museums for its departments of paleology, archeology, and biology. In Semipalatinsk, site of former Soviet nuclear testing grounds, the state medical academy maintains a teaching collection of malformed fetuses that is said to be unforgettable.^[50]

Oblast museums present exhibits of regional history or ethnography. In addition to the World Heritage sites of Tamgaly and the Yasavi mausoleum, the Ministry of Culture and Information supports several other historical and cultural reserves, and large-scale digs at 32 sites of ancient settlements, burial grounds, and tumuli were performed in 2005. Biographical memorial museums are numerous, as are monuments, statues, and commemorative plaques on buildings associated with prominent persons.

Many oblasts also operate art museums for their regions, and there are numerous art galleries in urban centers. Four zoos (and three circuses) operate in



Fig. 6 The Republican Book Museum in Almaty.
Source: Photograph by Leslie Champeny.

Kazakhstan. Nine national nature preserves protect over 70 plant and 129 animal endangered species.

Museology as a Discipline and Profession

Museums are valued primarily as cultural and historical centers, and are responsible for the organization of scientific research to elucidate and preserve Kazakhstan's national heritage. Archaeological and ethnographic work is especially important given the relatively recent development of written history. Perhaps even more than libraries, museums have become a tool for promoting national identity locally and internationally, as in the organization of exhibitions such as *Of Gold and Grass: Nomads of Kazakhstan*,^[51] which recently toured the U.S. Professionals in the discipline may be found in research and consulting positions in museums, historical and cultural centers, specialized schools and colleges, governmental management bodies, and tourist organizations.

Regarding education for curators and museum administrators, museology was a certified undergraduate degree in the USSR, usually offered from a department of archaeology or history. Current educational paths to museum work are the designated specialties Culture Studies, Archaeology and Ethnic Studies, and Museums and Preservations of Artifacts, offered at three state universities. The curriculum includes organization of museums, conservation and reconstruction of historical artifacts and culture, regional studies and research, organization of regional studies museums in secondary schools and colleges, expertise and consultation on culture in government, and creation of historical sites tourist routes.

Regarding professional associations, the National Committee of the International Council of Museums assists the country's leading museums to enter into cooperation with

international institutions such as the British Museum, Russian State Library, and Hamburg Ethnographic Museum.

CONCLUSION: TOWARDS THE FUTURE

Kazakhstani librarians of a certain age often reminisce about the old days of economic and job security, when they were part of the largest network of information institutions on earth, and the sharing of knowledge among the republics was well regulated and reliable. With the departure of Russian economic and administrative support, interorganizational cooperation declined for a time as each institution struggled to maintain its own resources. With the encouragement and support of the international community, information professionals are beginning to rebuild the network of relationships that will be required to support information sharing practices such as interlibrary loan.

Ambivalence remains about how to build on the Soviet legacy while at the same time acknowledging, and then solving its problems. The call to forge a new national identity is one proposed solution, and many information institutions have responded, as in recent library projects *Til Oneri* ("Language is the foundation of everything"), *Shanyrak* (history, cultural traditions, and customs), and *Atamura* (the revival and preservation of national musical heritage). Language issues already affect the daily decisions of information workers from catalogers to programmers and publishers, and policy changes will further complicate decision making at all stages of the information cycle, for example, regarding production formats, organizational schemes, and selection of items for preservation. The focus on informatization is another solution, perhaps less politically charged at present, but also more expensive.

Institutions will have to upgrade infrastructure, import technologies, retrain staff, and improve organizational operation to participate fully in the global information society. Given Kazakhstan's regional economic dominance, it is to be hoped that the political will exists to implement the necessary changes.

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APPENDIX 1

Table A.1 Timeline

Century	Event	Year
15 th B.C.E.	Horse-herding nomads at Tamgaly	
8 th –3 rd	Scythian Saka in region	
B.C.E.		
8 th C.E.	Islam introduced	
9 th –10 th	Al-Farabi (870–950) builds library in Otrar	
12 th	Khoja Ahmed Yasavi (1106–1166) retires to underground cell in Turkistan	ca.1163
13 th	Chingiz Khan (1162–1227) sacks Otrar	1219
15 th	Amur Timur (1336–1405) dies in Otrar; Kazakh khanate later emerges from his descendants' rule	
17 th	Kazakh khanate splits into three <i>zhuz</i>	
18 th	Ablai Khan (1711–1781) allies with Russia against Mongol threats	
19 th	Fort Vernyi established	1854
	Abai Kunanbayev (1845–1904) writes Kazakh poetry	
20 th	Kazakhs protest conscription into Russian army	1916
	Bolshevik Party takes control of Kazakh <i>Alash Orda</i>	1919
	Turkistan Autonomous SSR split into Central Asian republics	1923–1924
	Kazakhstan becomes full-fledged Soviet Socialist Republic	1936
	Great Patriotic War; Stalin deports undesirables to region	1941–1945
	Soviet nuclear tests begin near Semipalatinsk	1949
	Kruschev declares virgin lands campaign	1954
	First manned space launch from Baykonur	1961
	Republic of Kazakhstan becomes independent state	1991

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Kenya: Libraries, Museums, and Archives

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Abstract

This entry traces the evolution, development, and growth of information systems in Kenya, especially noting the importance of Information Communication Technology in propelling economic development. The authors provide a historical overview of libraries, archives, and museums, outlining patterns and trends through precolonial to post independence. Topics covered include: national, public, academic, special, and school libraries; Kenya National Archives and Documentation services and the regional record centers; National Museums of Kenya, regional museums; and sites and monuments of national and international importance. The legal framework upon which these institutions were established and operate is highlighted. The entry also identifies some key personalities who have made an impact in the fields of librarianship, archival services, and museology in Kenya and discusses the role of professional associations in the development and growth of these institutions.

INTRODUCTION

Kenya is an Eastern African country that is bordered by Ethiopia to the north, Somalia to the northeast, and Sudan to the northwest, Uganda to the west, and Tanzania to the south, with the Indian Ocean providing the southeast border. The Equator runs through the center of the country. The climate varies from the humid tropical areas in the coastal region to a cool Mediterranean climate in the highlands in the Southwest. The majority of the terrain is made up of low plains covering about three-fourths of the country. Kenya boasts of a spectacular variety of wildlife. These include elephants, lions, giraffes, zebras, buffalos, and other wild beasts, which attract tourists to Kenya (Fig. 1).

Kenya is comprised of people of all races and religions, and includes over 42 different tribes. A large percentage of the population lives in the rural areas in small settlements where they raise crops and livestock for a living. Many of these farmers also hold part-time jobs to add to their income. However, each year, many rural Kenyans move to towns to find jobs. Most of the urban population work in factories, stores, supermarkets, government

offices, or carry out business. Kenyans, who move to cities, must adjust to the fast pace of life in the cities and regular work schedules.

The British colonial government ruled Kenya from 1895 until the country attained independence in 1963. During this time they influenced political, social, economic, and cultural life in Kenya. However since independence, the indigenous leaders have emphasized the African heritage of the nation. Politically, Kenya is a republic which adopted its constitution in 1963. The constitution grants its people the fundamental human rights such as freedom of speech, freedom of expression, freedom of association, intellectual freedom, and religion. Kenya is headed by a president elected by the people through democratic elections every 5 years.

While initially Kenyan children were not required by law to attend schools, the current trends dictate that the government be more forceful on school attendance. Although educational opportunities have continued to expand, the demand for education at all levels has outstripped the available educational institutions. Kenya has over 13,000 primary schools, over 4000 secondary schools, several middle-level colleges, 7 public universities,



Fig. 1 Map of Kenya.

Source: CIA World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/ke.html>.

and over 10 private universities. As the literacy levels grow, albeit slowly, the need for information in the country has also grown.

The field of library and information is relatively young in the country. Most of the supporting legislation for libraries, archives, and museums were enacted in the 1960s. However there has been a significant growth in the number of libraries and information centers in the past decade and this can in part be attributed to the importance attached to education by individuals and the government. There has been an increase in the number of universities, middle-level colleges and schools. The publishing and book industry is still not fully developed and the reading culture in the country struggles to flourish. If well utilized, the National Archives should therefore become a very important basis for national planning and development. The Archives provides key linkages with the past, present, and future of Kenya.

LIBRARIES

Historical Background

The first library known in Kenya was established in 1887 by the European missionaries at Frere town near Mombasa. The establishment of modern libraries in Kenya can be traced to the early part of 1900s. At that time the creation of libraries was closely linked with the establishment of the British colonial rule and the subsequent arrival

in Kenya of European settlers and Indian traders. In an effort to propel economic development in the newly colonized areas, the colonial government identified the need to have a literate society. Although the history of libraries in Kenya cannot be divorced from the establishment of colonial rule and subsequent settlement of Europeans and Indian traders, library development is also closely linked to the growing political awareness of Africans following World War II. The war awakened a spirit of nationalism that preceded the agitation for self-government by patriotic Africans. After World War II Africans realized that their development lay in the European type of education which in turn required access to information.

The libraries that existed before 1945 were mainly set up to serve the interest of the white settlers and the Indian traders. The literacy level among the foreigners was higher than that of the indigenous Kenyans. This entry traces development of libraries and the growth of library profession in Kenya from precolonial period to date. The history of libraries in Kenya can be approached from three historical periods namely: precolonial, colonial, and postcolonial.

Precolonial period: During this period, there were no records of libraries existing in Kenya. This was mainly due to the fact that information was passed from one person to the other through oral traditions and art. These practices inhibited the growth of libraries. The only library on record during this period is said to have existed at Kilwa on the east coast and it served a small literate class of the community.

Colonial period: This is the period when missionaries began to appear in the East coast of Africa and set up a mission at Frere town. In 1887 they established a small library which was meant to be used by the new converts. However, in 1902 the *East African Standard* newspaper, which had been established by Mr. Jeevanjee, set up a news library which stocked reference books and manuscripts for use by the staff.

The High Court of Kenya Library was also established in Mombasa in 1902, but it moved its headquarters to Nairobi in 1905. It had a rich collection of reading materials on law. Later in 1935, a new building was completed in Nairobi which to date houses an important library that serves the judges of the High Court, magistrates, and advocates.

Other libraries established between 1910 and 1932 included Kenya National Assembly library and National Museum library in 1910, and the National public health library (now located at Kenyatta National Hospital) in 1911. The Attorney General's library was established in 1914 and Kenya Agricultural Research Institute library in 1927.

Library development followed racial patterns prevailing at that time. In 1903 that the philanthropic Asians founded the Seif Bin Salim public library in Mombasa. The collection, which was biased toward

Indian literature, was later acquired by Kenya National Library Service (KNLS) in 1975. In 1928, Lady Macmillan established a lending library for the white settlers in Nairobi. This library, which was named in memory of her husband, opened its doors in 1931. The Desai Memorial library was established in 1942 by the Indians providing the third public library in Kenya. Nevertheless, none of the established public libraries served African interests.

It was during this period that the colonial government realized the importance of ensuring that the colony was financially self-sufficient. Which meant the involvement of the Africans in the governance of the colony and this required that Africans be educated and be provided with the relevant information resources.

As a result of this that two kinds of libraries developed. First were special libraries to assist in exploiting natural resources of the colony. These included the Departments of Forestry and Agriculture libraries established in 1905 and 1907, respectively, and the National Assembly Library formed immediately after the first sitting of the Kenya Legislative Council in 1907. The second were public libraries including the Seif Bin Salim, Desai Memorial, and the Macmillan Memorial library. In 1948 Elspeth Huxley proposed the establishment of the East African Literature Bureau to produce and distribute literature to African libraries.

After independence: The 1960s were a turning point in the development of libraries in Kenya. The Macmillan Library was handed over to Nairobi city council and opened to all Kenyans. It became the first ever free and open public library in Kenya. Following the recommendation by the East African Library Association and by the British council library consultant, Sydney Hockey, the parliament enacted the Kenya National Library Service Act in 1965 (Chapter 225), of the laws of Kenya. The KNLS became operational in 1967 inheriting the resources and programs of the East African Literature Bureau.

Several government departments and private companies have continued to maintain libraries to support their ministerial and organizational programs. The desire by the government to embrace information in development planning saw the establishment of District Information Documentation Centers (DIDCs) in all districts headquarters. As per District focus circular 1/86 and Provincial Administration circular Ref. OP 16/174/11/23 of September 1984. The objectives of the DIDCs were to provide information to the District planning unit, District Development committees, individuals, and organizations involved in planning; collect and preserve the local statistics; support the planning, monitoring, and evaluation of development projects in the districts; strengthen the district capacity in the management of its activities. However accessing information is still constrained by the Official Secrets Act.

Legislation

Library and information service in Kenya is influenced by several legislations. Some of these laws were enacted during the colonial period while others were passed after independence. These laws have undergone several revisions to cope with changing trends in the field. These include the following:

Books and Newspapers Act (Chapter 111): This legislation can be traced back to 1906 and has undergone amendments in 1960, 1962, 1980, 1987, and 2002. This act serves as the legal deposit law of Kenya. The Act provides for comprehensive collection of all information materials produced in Kenya to enable proper bibliographic control and preparation of National bibliography.

Public Archives Act (Chapter 19): The Public Archives Act was established in 1965 and later revised in 1990 to become the Public Archives and Documentation Service Act. The purpose of the act is to establish the National Archives as a public archive and provide for the preservation of public archives and records.

KNLS Board Act (Chapter 225): This Act was enacted in 1965 and revised in 1969, 1970, 1984, 1988, and 2008. Through this Act, the KNLS board was formed and given the responsibility to “promote, establish, equip, manage, maintain, and develop libraries in Kenya as a national library service.” This Act empowers the board to advise the government, local authorities, and private sector on all matters regarding library development.

Science and Technology Act (Chapter 250): This law was enacted in 1977 and was revised in 1979, 1980, 1986, and 2000. The purpose of the Act is to promote scientific research and technological development in Kenya. Through this act, a mechanism was established to ensure that all matters of scientific and technological activities were available to the government. National Council of Science and Technology, which coordinates activities of all major research programs, was a product of this Act.

Industrial Property Act (Chapter 509): This Act was enacted in 1989. The goal of the act is to promote inventions and innovative activities in order to facilitate acquisition of technology through models and industrial designs. It also aims at protecting intellectual property through patenting.

Copyright Act (Chapter 130): This Act was established in 1966 and amended in 1989. It makes provision for copyright in literary artistic works, audiovisual works, sound recordings, broadcast, and for connected purposes.

The legislation discussed above covers the entire information field, from innovation and production (Copyright Law, Science and Technology, and Industrial property Act), to accessibility (Books and Newspapers Act, and Public Archives Act), to establishing and developing libraries (KNLS Act). The government of Kenya recognizes the need to develop an Information Communication Technology (ICT) legal framework that will act as a

catalyst for responsiveness and growth in the ICT sector for the benefit of all Kenyans.

Types of Libraries

National library

KNLS serves a dual role of public and national library. The National Library division was established in 1980 in recognition of the need for bibliographic control in Kenya. Some of the services provided include:

- Production of Kenya National Bibliography, Kenya Periodical Directory
- Legal depository center
- Centre for World Bank, UN publications, and IMF collections
- Issuance of International Standard Book Number to Kenyan publishers
- Interlibrary programs
- Rare collections (manuscripts and books out of print with research value)
- Online databases
- Government publications
- Africana and Kenyan publications

Public libraries

Libraries that provide public library service in Kenya include KNLS, Macmillan Library, and several cultural centers (embassy-sponsored libraries). The major public library service provider is KNLS, which has established 54 branches countrywide by 2008. Thirty-nine of these are community-based libraries developed in partnership with the local communities. The Macmillan library has four branches which are run by the city council of Nairobi.

Various embassies have cultural centers which are opened to the public, e.g., the American Cultural Centre, the Iran Library, and the British Council Library, among others.



Fig. 2 Camel library.

The KNLS has a wide network of libraries covering all the eight provinces in the country. Services provided include:

- Adult and junior lending.
- Advisory library services.
- Bulk lending of books to lending institutions.
- Technical assistance on library development to interested government and private institutions.
- Internet service in some of the branch libraries.
- Interlibrary lending, community information services, which include HIV/AIDS information service.
- Repackaging indigenous information.
- Service to the visually challenged persons.
- User education and outreach services including motorized (four mobile trucks and several motor bikes) and nonmotorized mobile library service (donkey and camel), book box service, and cupboard library service in schools (Figs. 2 and 3).
- The library also offers special services to children such as story telling, reading, and writing competitions, games, drama, and cultural activities among others.

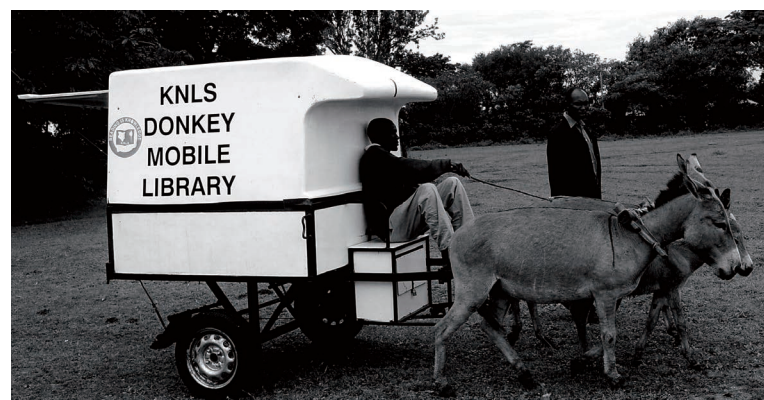


Fig. 3 Donkey library.

Source: <http://www.knls.or.ke>.

Academic libraries

Academic libraries include university and college libraries. The demand for higher education in Kenya has resulted in the proliferation of institutions of higher learning. Currently, Kenya has over seven public universities with well-equipped libraries in the main campuses and in colleges spread in various parts of the country. These include Nairobi University, Kenyatta University, Jomo Kenyatta University of Agricultural Technology, Moi University, Egerton University, Maseno University, and Masinde Muliro University of Science and Technology. There are several private universities with sizeable libraries; among these are Baraton University, Daystar University, United States International University, Kenya Methodist University, Kabarak University, Kiriri Women University, and African Nazarene University among others.

The Kenya Commission for Higher Education requires all universities to establish a library managed by professionals before being awarded a charter. Universities therefore place libraries high in their development priorities. Many middle-level colleges and institutes offering certificate and diploma courses have continued to maintain admirable libraries to support their academic programs (Fig. 4).

Specialized research libraries

Research libraries have been developed in Kenya to support scholarly research in various fields. The oldest being Kenya Forestry research library, Kenya Agricultural Research Institute, an agri-based research institution, the high court library and Ministry of Agriculture library established in the 1900s. Others include:

- International Livestock Research Institute, which undertakes research on animal diseases.

- The Kenya Medical Research Institute, a human diseases research center.
- Kenya Industrial Research Development Institute.
- Kenya Institute of Public Policy Research Analysis, African Medical Research Foundation.

Other major centers for specialized research include international missions such as World Bank, UNESCO, UNICEF, UNEP, WHO, Bakhita documentation center, and Nongovernmental organizations resource and information centers among others. The Government Reference library housed at the Kenya National Archives and Documentation Service (KNA&DS) and the Museum library also serve as research libraries.

Other special libraries

Many businesses and public organizations such as hospitals, research laboratories, law firms, government departments and agencies maintain their own libraries for the use of their employees in doing specialized research related to their work. These libraries may or may not be accessible to members of the public. Some of these libraries in Kenya include the Central Bank of Kenya Library, Unilever library, Capital Market Authority library, National Assembly library, Kenya Bureaus of Standards, and Kenya National Bureau of Statistics. In addition, the Kenya Broadcasting Corporation has the richest collection of Audio-Visual Material of which a majority are gramophone records in East Africa. Most government departments and agencies also have libraries. Government libraries vary from ministry to ministry in terms of size, budgets, and personnel. While many ministries provide generous library support, others provide lukewarm support. For example, the ministries of agriculture, health, and planning have supported their libraries very well. However, inadequate government schemes of service and the lack of political goodwill from the political leadership have led to mass exodus of the professional librarians



Fig. 4 Margaret Thatcher library, Moi University.
Source: <http://www.mu.ac.ke>.

from many government libraries to better paying institutions especially the private sector libraries.

School libraries

Although some public and private primary and secondary schools have functional libraries, most public schools do not have adequate libraries. Only a handful of public schools can afford to employ professional librarians. Nevertheless, well-stocked school libraries are common features of private schools. These libraries also offer computer facilities for their learners. They remain accessible to the elite population who are able to afford the high tuition fee required. High performing secondary schools maintain well-equipped libraries. Mangu high school, Alliance girls and boy's high schools, Starehe boys and girl's centers, and Precious Blood School are good examples. Several have also employed qualified librarians to facilitate provision of efficient and effective library service to the school community.

With the introduction of Free Primary Education by the government in 2003 and free secondary education in 2008, respectively, public schools now receive a book budget. This might be a starting point toward school library development in both public primary and secondary schools in Kenya.

Education for Library and Information Science (LIS)

The need for trained manpower in Kenya can be traced to the 1950s when the Royal Technical College (now Nairobi University) was established. The college provided employees with in-service training in basic library skills. Later, the City and Guilds (a United Kingdom-based correspondence education program) started offering library courses through correspondence. These courses led to the award of certificates in librarianship. Library employees were encouraged to take these British correspondence courses organized by the Library Association of the United Kingdom. As libraries in East Africa developed, it became apparent that highly trained personnel at the senior professional levels were needed. In 1964, therefore, the East African School of Librarianship was established as a regional school located at the Makerere University in Uganda. The school offered non-professional library assistant courses. However, the curricula for the library training have changed tremendously over time.

In 1971, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) developed the concept of harmonization as a basis for the training of information professionals. In the same year, the Kenya Library Association (KLA) appointed an education subcommittee to study the need for manpower in LISs in Kenya. In 1973, KLA facilitated the establishment of certificate programs in library and records management at the Kenya

Polytechnic. This training began in 1974 through a partnership of the UNESCO and the KLA. This was a 1-year certificate course which ran for 3 years. Prior to this, the only institution that had the mandate to offer library education was the East African School of Librarianship at Makerere University in Uganda. It offered nonprofessional library assistant certificate and much later diploma and postgraduate courses.

Training in LIS in Kenya is presently in various levels namely certificate, diploma, higher national diploma, undergraduate degree, and postgraduate (Master's and Doctorate) degree.

Certificate and diploma: These are accredited by

- National polytechnics—Kenya Polytechnic University college, Mombasa Polytechnic and Eldoret Polytechnic.
- Technical training institutes—Kenya Technical Training College, Railway training Institute, Sigalagala training Institute, Siaya Institute of Technology, among others.
- Private colleges—Kenya School of Professional Studies, Nairobi North college, Technical Institute of Management, among others.
- Universities—Nairobi University, Egerton University.

Undergraduate and postgraduate degree

- Moi University was the pioneer in the establishment of undergraduate training in LIS in Kenya in 1988.
- Kenyatta University.
- Kenya Methodist University.
- Egerton University.

Professional Associations

Kenya Library Association remains the single professional body that advocates for library professional standards in Kenya. It is a neutral professional association whose origin dates back to 1956 when the East African Library Association was formed. It draws its membership from all stakeholders in the field of information including librarians, documentalists, archivists, information specialists, record managers, and other interested persons.

In 1971, the Standing Conference of African University Librarians of East African met in Addis Ababa where UNESCO developed the concept of harmonization as a basis for training of information professionals (UNESCO, 1994, 2). KLA has continued to agitate for professional standardization and is heavily involved in all matters of library development and participates in forums where library education curriculum is being discussed.

It collaborates and partners with other international bodies for the benefit of its members. It is a member of International Federation of Library Association (IFLA) and Commonwealth Libraries Association (COMLA).

KLA major achievements are

- Hosting IFLA conference in 1984. This was the first time for IFLA conference to be held on the African soil and was attended by over 2000 delegates.
- Holding successful annual conferences over the years.
- Hosting COMLA and International Association of Agricultural Librarians and Documentalists conferences in 1983.
- Hosting Standing Conference of East and Southern African Librarians conference in 1998.
- Setting up a Web site through the assistance of International Network for Availability of Scientific Publications.
- Promoting reading culture through Children Reading Tents where it targets marginalized communities, peri-urban poor, slums, and people of low economic status.

In 2006 KLA celebrated a Silver Jubilee where personnel in library and information profession were recognized and given awards. These were

- Ralph Opondo—the first African city librarian in Kenya.
- Nathan Fedha—the first African chief archivist in Kenya.
- John Ndegwa—the first professional in LIS and the first university librarian in Kenya.
- Dr. Wanja Thairu—the first female Ph.D. in LIS in Kenya.
- Professor Ojiambo—the first male Ph.D. in LIS in Kenya.
- Jacinta Were—the first lady chairperson of KLA and member of International Federation of Library Associations and Institutions Board.
- Ruth Thomas—pioneer indexer and committed supporter of KLA.
- Jafred Musisi—a committed supporter of KLA who successfully lobbied to bring the first IFLA conference to Kenya (the first IFLA meeting in Africa).
- Late William Umbima—longest serving editor of KLA.
- Ann-Marie Kinara—pioneer documentalist in agricultural information in Kenya.
- Late Francis Otieno Pala—first chief librarian in KNLS.

KENYA NATIONAL ARCHIVES AND DOCUMENTATION SERVICE

“A nation without a past is lost and a people without a past is a people without a soul”—*Sir Seretse Khama (1980)*

Archives serve not only contemporary (often transient) needs but also the possible needs of researchers in the far distant future. They preserve the past to enrich the future.

Preserving the past, documenting heritage, and making it accessible to the public are the core function of the KNA&DS, which is a department within the office of the Vice President and Ministry of State for National Heritage and Culture.

Historical Background

Archives service in Kenya is a relatively recent development. Throughout the colonial era, which lasted from 1895 to 1963, there was no major effort on the part of colonial administration to preserve public records in Kenya. Between 1903 and 1948, these records were vulnerable to climate and theft owing to the quality of accommodation and storage then available—i.e., early colonial offices buildings were of corrugated iron and wood, which offered neither protection nor security. Many government officials were more concerned with destruction of records that appeared to hinder their work by clogging and congesting registries; such “unneeded” records could conveniently provide scratch paper. Apart from accidental destruction of public records, it is possible that there was unauthorized massive destruction contrary to official local and Colonial Office instructions. In 1910, Governor Percy Giroudi stressed the importance of preservation of public records for posterity by issuing a *Confidential Memoranda* on local official instructions on the destruction to *Provincial and District Commissioners*.

Fires also accounted for some of the destruction of colonial records in Kenya. For example, in September 1905, a fire broke out and destroyed some Government offices and Indian shops in Nairobi. The fire of September 1939 is another case, which involved a fire that burned down government facilities. The 1939 fire mysteriously broke out at night and destroyed the Government Secretariat Offices on the site presently occupied by the Prisons Headquarters in Nairobi. This unfortunate event had very disastrous effects on the records of the Central Government, especially those relating to the earlier days of colonization of Kenya by Britain. Fortunately the government was able to function through the generous cooperation of members of the public and other government departments. As Sir Walter Harragin, the then Acting Governor, admitted in the Legislative Council of November 14, 1939 in the Legislative Council Debate:

Since the war broke out, the government has had to cope with many and difficult problems. Its task has not been made easier by the fire at the old secretariat which resulted in the loss of the many valuable government records as well as most, though not all of the current files. The Secretary has however, been able to carry on reasonably efficiently, thanks to the cooperation of other government departments and of the members of the general public in supplying copies of correspondence with Government.

Following this calamity, no attempt was made to develop some “new records,” which could conveniently supplement the partially destroyed archives. Furthermore, the administration persistently showed the same lack of concern as before. The continued unauthorized destruction of public records arose from sheer neglect; in fact such records had been allowed to deteriorate to the point where massive destruction was inevitable. In some instances, the shortage of paper in district offices resulted in earlier records being sacrificed. One case in point occurred on June 8, 1948 when the District Commissioner, Kitui petitioned the Provincial Commissioner, Central Province for permission to use earlier files for preparing rough drafts, adding that he would salvage file covers and fasteners for future use. But surely, saving file covers and fasteners at the expense of public records was absolutely indefensible.

Despite the setbacks described above, as early as 1948 there was clearly widespread concern and dismay among the highest echelons of the colonial administration in the East African territories (Kenya, Uganda, and Tanganyika) over the haphazard accumulation of public records and their inevitable fate if they were not properly cared for.

In the three territories, it had become apparent that overcrowded conditions were creating a pressing need for more storage. Construction of accommodation for public records would not, in the long run, provide an adequate solution. Meanwhile, the uncontrolled destruction of documents had become the inevitable option taken in the absence of a suitable archival agency to which public records could be transferred. With this realization in mind, the Governors of Uganda, Kenya, and Tanganyika and the Administrator of the newly created East African High Commission embarked on high-level discussions aimed at finding a common solution to the preservation of the public records in their respective territorial jurisdictions. This process began in March 1948, when the Governor of Uganda Sir John Hall, wrote to the Governor of Kenya proposing the establishment of an archive service, either as an offshoot of the Central African Archives Service (which had been established in Southern Rhodesia) or as a common service within the auspices of the East African High Commission.

However this recommendation was not immediately implemented due to procrastination and long bureaucratic delays within the service. Finally in May 1952, the Deputy Chief Secretary, C.H. Hartwell, issued a proposal entitled “Accommodation, Equipment, and Staff for Central Government Archives in the New Secretariat.” In this document, he reviewed the progress made in the preservation of public records since the 1939 Secretariat fire. Hartwell asserted that following this fire, the problem of keeping closed files had not become acute. He warned that it would become a major problem within a few years unless early arrangements were made to address these issues. The thrust of Hartwell’s proposal was focused on the accommodation of public records in Nairobi. He was much less

concerned with preservation of those records in Provincial and District offices where they were stored in appalling accommodation. At a later meeting which was held on June 18, 1952, Bingley, the then government archivist, confirmed that “approximately 16,000 ft² was reserved for archives.”

Following the June meeting, the Chief Secretary issued a circular to all heads of departments, first, informing them of government decision to establish an archives service. Secondly, inviting the Heads of Departments to state “whether they wished to store their records in the Central Archives and, if so, give approximate estimates of the area required.” Before all Departmental Heads could adequately react to the Secretariat circular, political events intervened. On October 20, 1952, *The War of Liberation* prompted the colonial government to declare a state of emergency. Consequently, although the interdepartmental consultations were at an advanced stage with regard to planning for the allocation of accommodation for the housing of public records in the new secretariat office complex (the present Jogoo House “A”), these plans were shelved indefinitely.

The *War of Liberation* affected the development of archives services in various contradictory ways. From 1948 to 1953 (apart from the above-mentioned abortive interterritorial consultations and the cosmetic Kenyan government departmental proposals), virtually nothing meaningful was done to initiate suitable measures for the custody, care, and preservation of public archives, or to introduce proper records management programs within government offices. In 1954, at the height of the *War of Liberation*, however, the colonial administrators suddenly declared that emergency measures should be taken to preserve records of importance which had accumulated over a period of nearly 60 years of colonial domination.

In realizing the prevailing records management problems in public offices in Kenya, the government appointed the first archivist in 1956. The first consolidated plans for a uniform approach to records management in Kenya can be traced back from 1956 when an Archival Circular was issued. Before then, different departments approached their records keeping practices in their own way. Thus, the records management practices of the Provincial and District Commissioners and those of the attorney general and other departments of the colonial regime in Kenya differed from each other and from the practices of the local governments and private companies.

During the years 1975 and 1976, the Department of Kenya National Archives witnessed great changes particularly in its expanded activities. These included the collection, recording, preservation, and conservation of all valuable documents and data for national reconstruction, planning, and development. Some of the materials found in the National Archives of Kenya include many of central and local government records of both colonial and postindependence period. There is a wide collection of

private and public records concerning socioeconomic and cultural activities of national significance and importance.

In order to provide more comprehensive documentation of the social, economic, technological, political, and cultural aspects of African traditional ways of life, additional information has been collected through the recording of oral traditions. Today, this rich oral collection and a well-maintained archival department form the Kenya National Archive, which has become the central national memory system. It now provides valuable resources for planners and administrators, as well as serving the needs of researchers and educators from Kenya and from abroad. If well utilized, the National Archives should therefore become a very important basis for national planning and development. The Archives provides key linkages with the past, present, and future of Kenya.

Legal Framework

Circular No. 1 of 1956 on the implementation of the archival service was issued together with the Rules and Regulations under which the Archivist was to operate. Paragraph 10 of these rules and regulations provided that the government departments should prepare schedules for the disposal of "...files and documents existing or accruing in the department which are considered to be valueless..." In the same circular, the departments were asked to proceed with the scheduling of their records for the preservation and destruction with adherence to the general principles set out in the Archives Rules and Regulations.

The Kenya National Archives was established by an act of parliament, The Public Archives Act of 1965, which took effect on January 25, 1966.

There shall be established, constituted, and maintained a public department to be known as the Public Archives Service for which there shall be appointed a Chief Archivist, and such other staff as may be necessary for the purposes of this Act.

[Section 3 (1)—Establishment of Public Archives Service]

The Act was later revised in 1990 to become The Public Archives and Documentation Service Act, Chapter 19 of the Laws of Kenya. There was a slight amendment in this Section 3 (1) to rename the Public Archives Service to the KNA&DS. Besides the renaming, the position of the Director was created instead of that of Chief Archivist. Notable was also inclusion of Section 5A, that distinctly set up the National Documentation Service and outlined its major roles of which empowered the section to select, collect, process, house, control, and preserve all bound documents created by any government ministry or department.

Records Disposal Act, Chapter 14 of the Laws of Kenya

Circular No. 2 paragraph 6 "Disposal of Records" Section (i) stated that:

"In order to deal quickly with the accumulated backlog of non-current records, the Cabinet authorized the immediate transfer to the Archives of Records dated earlier than 31st December 1945."

This was later developed into The Records Disposal Act in 1962 to take control of the haphazard destruction of public records, in addition to giving guidelines on the kind of records that are to be destroyed.

Other legislation

The *Books and Newspapers Act Chapter 111* names the KNA&DS as a Legal Deposit, in addition to the KNLS and The University of Nairobi Library.

Composition of KNA&DS

The department has seven divisions:

1. Records Management Service.
2. Archives Management Service.
3. National Documentation Service.
4. The Conservation Section.
5. The Audiovisual Archives Section.
6. The Microfilming Section.
7. Support Division (General Administration).

The *Records Management Service* is decentralized with five provincial record centers:

- *Nairobi Records Centre*: Established in 1980 and serves four provinces Nairobi, Eastern, North Eastern, and Central Provinces.
- *Nakuru Records Centre*: Established also in 1980 to serve Rift Valley Province, right from the South to the North Rift.
- *Mombasa Records Centre*: Established in 1981 to serve Coast Province.
- *Kakamega Records Centre*: Set up in 1982 to serve Western Province.
- *Kisumu Records Centre*: Inaugurated in 1989 to serve Nyanza Province.

The main purpose of this service is to provide guidelines to public offices on proper records management practices. This is implemented through developing file classification schemes as well as file retention and disposal schedules. A Provincial Archivist is in charge of each of these activities.

The Archives Management Service is centralized at the department's headquarters in Nairobi. Its main purpose is to provide preservation of public archives (microfilming, storage, audiovisual, and conservation) and access facilities (search room) of the same materials. Efforts have been made to computerize archival lists and catalogs. Users are able to access both manual and online catalogs on archival holdings.

The department has embarked on a digitization project with the purpose of long-term preservation of archives as well as increased accessibility of archival holdings. *The Repository* houses the records within the department. *The Search Room* is the "heart" of KNA&DS as it is the central point from where all the other departments are linked. It has facilities for searching the databases. Any user of the holdings—be it the microfilms, the library books, the records in the repository, etc.—has to pass through this section for the materials to be recalled. Holdings must be used to justify being maintained and thus the strategic importance of the search room.

National Documentation Service (NDS) supplements archival materials with publications. In addition, it facilitates establishment of information resource centers/documentation link centers in public offices. The NDS has six distinct sections:

- The Government Publications Section.
- The Murumbi Africana Collection.
- The Staff Library.
- The Legal Deposit Library.
- The General Publications Section.
- The Periodicals Section.

The Conservation Section has state-of-the-art equipment for conservation purposes. The major role of the department is to restore damaged specimens. In order for information to be available, it has to be preserved and conserved. The department also offers advisory services on the best practices for preservation and conservation of information resources across formats—print, digital, microfilm, etc.

The Audiovisual Archives Section houses a rich collection of still photos on Kenya's heritage; it also houses audiotapes and tape reels about Kenya. All these have information about the rich Kenyan heritage.

The Microfilming Section concentrates on converting print documents to digital formats. Notable are the Kenyan Dailies—the Nation, the Standard, and the Kenya Times. The section has also started digitizing the Murumbi Africana Collection—the rich collection of the late Joseph Murumbi, onetime Kenyan vice president.

Support Division (General Administration): The KNA&DS is headed by a Director, who has two deputy directors; reporting to the deputy directors are the Provincial Archivists and the Heads of the various sections mentioned above.

In addition the KNA&DS maintains an Art Gallery which is one of the major attractions. It has artifacts from throughout Africa. The majority of this collection was bequeathed to the department by the late Joseph Murumbi.

Migrated Archives

When independence was attained on December 12, 1963, the former colonial masters left the country taking public records with them. They argued that these records were created in their tenure, so they were owned by British government. In the *Independence Instruments* (Great Britain, 1962) there was no mention that Britain should hand over to the new Kenya Government "all public archives and records." This very unfortunate omission could have been an oversight or it may have been a deliberate attempt to do away with the records that could provide evidence as to the extent of human rights abuses against Africans during colonial rule. Since independence there has been concerted effort to get those records from Britain. Some have already been received, but others have not and the process is ongoing.

Interministerial cooperation is of great importance to the success of the KNA&DS particularly in the reacquisition and repatriation of Kenya's migrated archives and also in the formation of national information policies and strategies for information collection, preservation, and dissemination. Some of the Ministries involved include: Ministry of Foreign Affairs, Office of the President, Ministries of Finance and Planning, Ministry of State for National Heritage, and the Office of the Attorney general.

Other Kinds of Repositories

Most institutions in Kenya manage their archival repositories privately. However, the Kenya Ports Authority's archives are managed with the help of the KNA&DS. Others like the National Museums of Kenya have their autonomously functioning archives.

Many companies and financial institutions also have archives, which are managed independently.

Finding AIDS

The National Archives has two kind of finding aids: manual catalogs and online databases. Each department has a database. For example, the library has an NDS database

running on CDS/ISIS Automation Software. Other databases include:

- An AV database.
- An archive database for records management.
- The JNL database for journals.
- The DOCA 9 for court records.
- A microfilm database.

Cooperation

The department is trying to cooperate with librarians, documentalists, and information specialists in other fields with an aim of adopting modern techniques of storage, retrieval, and conservation.

The department has ventured into partnership with several organizations such as:

1. The Kenya Anti-Corruption Commission, with the purpose of enhancing effective records management since records are the cornerstone to accountability and transparency, a factor underpinning good governance and ensuring corruption free nation.
2. The Murumbi Trust Foundation, which has assisted in the refurbishment of Murumbi Art Gallery Exhibition. Because of this renovation, the department has been able to attract many more viewers to the gallery.
3. The FORD foundation, with the purpose of improving the management of audiovisual records, in terms of capacity building and provision of equipment.
4. Professional bodies, both regional and international bodies such as:
 - International Council on Archives (ICA).
 - Eastern and Southern Africa Regional Branch of ICA (ESARBICA).
 - Association of Commonwealth Archivists and Records Managers (ACARM).

Through interaction with these bodies, the department is able to keep abreast with current trends in the profession.

Training Institutions

Most of the training of Kenyan archival professionals was initially done in India and the United Kingdom. University training of information professionals in Kenya and especially in the archival field is in its relatively “early” stages. Archival training was first offered at Moi University where the Faculty of Information Sciences was inaugurated in 1988; the first students in Archival studies graduated in 1992. However, due to the increased demand for information workers in this area, even private tertiary colleges are now taking the cue and are offering archival courses in their curriculum. The following is a brief summary of this training in Kenya.

Moi University was the pioneer institution in Kenya for archival training at the undergraduate degree level. It offers programs in Librarianship, Archival Studies, Publishing and Book Trade, and Information Technology. The students specialize in their chosen field during their final year(s) of study. There is also postgraduate training in these same fields and both M.Phil. (Master of Philosophy) and M.Sc. (Masters in Science) Programs in Records and Archives Management are offered. The former is for those students with a background in information science and the latter for those who are interested in an archives and records management career and already hold a graduate degree in another field.

Kenyatta University has a postgraduate program—M. Sc. in Records and Archives Management. Most of the staff members at the National Archives have completed, or are in the process of completing this program.

Egerton University trains graduates in information work and among the units is archives and records management.

Kenya Polytechnic is a public institution. It was the pioneer trainer of information workers in the country but at “lower” academic levels offering certificates and diplomas. Currently, it has a Higher National Diploma in Records Management, Ordinary Diploma, and Certificate in Records Management.

Sigalagala Training Institute is also a public institution training at both Diploma and Certificate levels.

Kenya School of Professional Studies—Inoorero Centre is a privately owned tertiary institution that trains archival and record management workers at Higher National Diploma, Diploma, and Certificate level. Its affiliate School of Professional Studies, Thika Road, trains at diploma and certificate levels. It also offers Degree training through distance learning in collaboration with UNISA—University of South Africa.

Railway Training Institute is a college that trains information workers at both diploma and certificate levels. Among the units is archives and records management.

Personalities who contributed to records management in Kenya

- *Sir Percy Girourd*, 1910—He issued the first circular toward streamlined records management in Kenya.
- *Derek Charman*—He was the first archivist.
- *Nathan Fedha*—The first African archivist.
- *Joseph Murumbi*—while in the archives council of 1977/1978 had good ideas for the running of the archival service. Apart from that his rich collection of manuscripts, books and, artifacts is still housed within the KNA&DS. He also requested Professor Bethwel Ogot of University of Nairobi to outline strategic projections, functions, and resources necessary to sustain and develop an archive service.

- *Professor Bethwel Ogot*—He consulted a number of leading authorities on the subject, particularly works of Sir Hillary Jenkinson and wrote a well-documented paper which was later used by Murumbi to gain support for the establishment and development of archives from the Kenyatta cabinet.

In conclusion, it is important to note that there is a general realization of the role of records for good governance. Despite the sorry state of the archival service in the “earlier” years, currently there have been concerted efforts to improve on the same.

MUSEUMS AND MUSEOLOGY: NATIONAL MUSEUMS OF KENYA

The concept of museums in Kenya (and Africa as a whole) is a foreign import. While sacred and ritual artifacts were kept in the courts and palaces and homes of Kings and Chiefs, in practice these were for ritual purposes only and each object had its meaning. Objects were never collected. The first museums in Africa started in the early nineteenth century and were colonial institutions created to display African cultural and natural heritage in order to entertain and amuse an elite group of Europeans. In addition, much of African heritage occupies large spaces in some of the biggest museums around the world.

Historical Background

The history of the National Museums of Kenya (NMK) dates back to 1910 when a museum was established in Nairobi by the then East Africa and Uganda Natural History Society (currently the East African Natural History Society). The membership consisted mainly of colonial settlers and naturalists who collected artifacts and specimens for their own enjoyment and study, but also with the goal of making a critical scientific examination of the East African environment. The Society needed a place to keep and preserve their collections of various specimens, and this necessitated the establishment of a museum. Its first site was at the present Nyayo House which soon became too small. A larger building was constructed in 1922 where the Nairobi Serena Hotel stands.

It was not until 1929 that the colonial government set aside land at the Museum Hill and construction work started at the current site. The new building was officially opened on September 22, 1930 and named Coryndon Museum in honor of Sir Robert Coryndon, onetime Governor of Kenya and a staunch supporter of Uganda Natural History Society. On the attainment of independence in 1963, it was renamed the National Museums of Kenya. Since the 1960s, NMK has expanded its services and assets to include regional museums, and has acquired

under its jurisdiction sites and monuments which the government has set aside as monuments of national heritage. Each of the Regional Museums has its own identity and develops its own programs. The museum has also established collaborations, research, and development programs, such as the Institute of Primate Research and Research Institute for Swahili Studies in East Africa.

Before the Museums Act 2006 became operational, it is important to note that from its humble beginnings, the Museum grew into a research institution of international repute, which boasted over 20 research departments, various museums, sites, and monuments open to the public; these are spread across the country's eight provinces.

NMK Legislation

The NMK was initially established as a corporate body under the Ministry of National Heritage, drawing its mandate from two Acts of Parliament: the National Museums of Kenya Act (Chapter 216) and the Antiquities and Monuments Act (Chapter 215) both passed in 1983. These Acts have been reviewed and have been merged into what is known as the Heritage Bill 2006, which was recently passed into law by Parliament.

In the early years of its development, the NMK established itself as a research institution of great international repute, especially in the field of paleontology where the search for human origins yielded some remarkable finds resulting in the famous collections of hominid and other fossils. However the period of the 1980s was characterized by a low level of activity in the public domain. Little was done to draw attention to the research carried out by the museum and its relevance to the public it served. At the time besides exhibitions and a modest school education service, little else was done to encourage the public to visit the museum. Public criticism emerged, centered on the fact that the results of scientific research, leading to many useful discoveries and breakthroughs, were hardly communicated to the public. The token activities in the area of public programming included activities such as guided tours, lectures, and slide talks, and these programs tended to dwell more on the objects than on the contexts which they represent. This resulted in the view of the museum as a boring stuffy place full of old relics.

Presently, the NMK is a state corporation established by an Act of Parliament, the Museums and Heritage Act 2006. NMK is a multidisciplinary institution whose role is to collect, preserve, study, document, and present Kenya's past and present cultural and natural heritage. This is for the purposes of enhancing knowledge, appreciation, respect, and sustainable utilization of these resources for the benefit of Kenya and the world, for now and posterity.

In addition, NMK as the custodian of heritage in Kenya manages Regional Museums, Sites, and Monuments of national and international importance alongside priceless collections of Kenya's living cultural and natural heritage.

Nairobi Museum

Nairobi Museum is the flagship Museum managed by the NMK. The newly expanded and refurbished museum opened recently with double the exhibition space, brand new exhibitions, and a new name: The Nairobi National Museum. It has as its slogan, *The Place of Discovery*.

The new museum reflects the repositioning of the NMK as the country's dynamic heritage management institution. In an effort to portray a vibrant and enjoyable place for experiencing cultural heritage, the NMK undertook a re-branding exercise that has seen the Nairobi Museum become a one-stop shop.

Through the years, the NMK has grown to become one of regional and international importance. The museum has become a leading center of excellence, housing some of the finest museum collections and exhibits on the continent. Over the years, the NMK was faced with the challenge of justifying its relevance to the public and the need to generate revenue. NMK begun to recognize the need to become more responsive to demands and the changing needs of its wider public without losing sight of its mission.

Thus these demands have required that the museum redefines its vision and become responsive to the current needs of society in order to remain relevant. NMK recognized that sustainable support depends on the museums' contribution to national development through addressing issues that affect its communities. NMK thus has attempted to change its image of "static exhibit showcases of the past" which it acquired from its Eurocentric history. Its goal has been to move toward a more dynamic contemporary image, departing from the outdated view that museums exhibit "old relics," and instead creating a place where people from all walks of life meet and have dialogue on various socioeconomic issues. In 2002, the NMK with support from the European Union (EU) embarked on a refurbishment and expansion effort known as the "Museum in Change" program. This program was funded by €8 million donated by the EU within the framework of National Museums of Kenya Support Program. These funds were used for the renovated and expanded exhibition space in Nairobi Museum which was completed at the end of 2007. The program work which begun in 2002 has resulted in the development of an institutional strategic plan for public programming 2005–2009, the basis upon which NMK is evaluating its policies.

With the expansion of its mandate and with the dynamic environment in which it operates, the NMK had to redefine its operations to become more responsive to the changing circumstances. In order to keep abreast with changes in the environment in which it is operating, the NMK has developed programs that promote cultural dynamism in order to build a sense of nationhood and belonging.

Regional Museums

In terms of the management of heritage within the country, the NMK continues to expand its regional Museums network and prepare many of its important sites for listing on the prestigious World Heritage List as well and the list of endangered sites. The regional museum network serves as a means for the NMK to reach a wider segment of the population. While most of the research and collections are concentrated at the NMK headquarters in Nairobi, the regional museum network also provides galleries and sites for interpretation of various aspects of the country's heritage. This regional concept was developed in the 1980s in accordance with UNESCO guidelines to bring museums to the people and it is meant to cater for the needs of the population in regions away from the Capital Nairobi. Two of the first purpose-built regional museums are located in the west of the country, in Kisumu and Kitale, and have exhibition on natural and cultural history of the region. Some of the regional museums established in historic buildings can be found in Lamu, Malindi, Mombasa, Meru, Karen, Kabarnet, and Kapenguria. Other museums opened their doors to the public in Gede, Narok, Gilgil, Nakuru, and Loiyangalani.

The main aim of all regional museums is the presentation of Kenya's natural and cultural heritage, with special programs to create awareness for the preservation and sustainable utilization of the country's heritage. The regional museums furthermore specialize in particular areas of interest relevant to the regions they serve. Some regional museums have live displays of reptiles and fish, while others have traditional homesteads of the communities in the region.

Apart from regional museums, the NMK has developed over the years a number of sites and monuments and equipped them with interpretation and visitor facilities. The coastal region has many of these sites located in ruined Swahili settlements that date from the thirteenth to seventeenth centuries A.D.; examples include the Takwa, Gede, Mnarani, and Jumba La Mtwana Ruins. Three military monuments are open to the public, Siyu Fort on Pate Island, Lamu Fort on Lamu Island, and the world famous Portuguese-built Fort Jesus on Mombasa Island.

Three religious monuments can be visited:

- The Portuguese chapel in Malindi from the time of the Portuguese supremacy over the Indian Ocean trade.
- The architecturally unique Kongo Mosque, on the beach in Diani, South Coast, which is still in use by the local community.
- Krapf Memorial Site, an interpretation of early Christianity in East Africa, is the first Christian church in Kenya, completed in 1848, when missionaries endeavored to ensure abolition of the slave trade. Related to the latter subject is Shimoni Cave on the South Coast, a community program in conservation of a historically important cave and in tourism development.

Numerous other sites are under the custodianship of NMK but are not yet open to the public. One of them is Mtwapa Ruins, a large ruined Swahili settlement that was included on the World Monuments List of most endangered sites in 2004.

Karen Blixen Museum

This museum was once the home owned by the Danish author Karen Blixen and her Swedish husband, Baron Bror von Blixen Finecke. Located 10 km from the city center, the museum belongs to a different time period in the history of Kenya, and its architecture is typical of the kind of homes built by European settlers in the early years of the twentieth century. The house and the farm at the foot of the Ngong Hills gained international fame with the release of the movie *Out of Africa* an Oscar-winning film based on Karen's autobiography by the same title. The popularity of the film prompted the opening of Nairobi's Karen Blixen Museum.

The house was sporadically occupied until purchased in 1964 by the Danish government and given to the Kenyan government as an independence gift. The museum was opened to the public in 1986. Many pieces of furniture that Karen Blixen sold to Lady McMillan on her departure were reacquired and constitute part of the exhibition in the museum. The museum house remains a serene environment that seems to belong to the past, surrounded by a tranquil garden and indigenous forest, with a splendid view of Karen Blixen's beloved Ngong Hills. Whereas most regional museums have a good proportion of both foreign and local visitors, the Karen Blixen Museum generates most of its revenue from international visitors.

Fort Jesus Museum

Fort Jesus was built in 1593 by the Portuguese to solidify their power on the East African Coast, but the fort changed hands several times between the Portuguese and the Omani Arabs. The British also used the fort as a prison during the colonial period. Today it is a national monument and a popular museum, which displays ancient artifacts of the coastal life. It also holds a conservation laboratory, a gift shop, and a cafeteria. Part of the museum is in the Old Law Court, which holds a research library, coastal archeology department, and a regional center for archeological study.

Lamu Museum

One of the oldest towns along the East African Coast is Lamu town, located on Lamu Island north of Malindi. This Swahili town is said to have been founded around the tenth century. It used to be a very busy port in the eighteenth and the nineteenth centuries. The Old Fort in the center of the town built in 1812 is today a cultural

center. The town has numerous Museums such as the Swahili House Museum, the German Post Office Museum, the Lamu Fort Environment Museum, and the Lamu Museum. The Lamu Museum occupies what used to be the District commissioner's house, a house originally built for Queen Victoria's consul, Jack Haggard. This museum houses a rich collection of ethnographic material from the Swahili, Orma, and Pokomo ethnic groups. Also on display are the traditional Swahili crafts such as the Siwa (side-blown horn), furniture, and jewelry. The Island town of Lamu can only be approached by boat. It served as a prison from 1910 to 1984, and was used by both the British colonial regime and the Kenya government, before it was handed over to the NMK in 1984. Efforts to turn the Fort into a museum were started with technical and financial assistance from Swedish International Development Agency. From its inception, the museum had environmental conservation as its general theme; Lamu Fort is basically a community center for the people of Lamu old town.

Lamu World Heritage Site

However, the crown jewels of NMK's assets at the coast are:

- *Lamu World Heritage Site*: In December 2001, Lamu Old Town Conservation Area was inscribed on the UNESCO's World Heritage List to protect and conserve its rich and unique cultural and architectural heritage, as a major contribution to the development of humankind. NMK has six assets in Lamu Old Town, which is the oldest surviving Swahili town of the entire East African coast and Indian Ocean islands. The operation of Lamu Museums is—more than anywhere else—very much intertwined with the lives of the people and the activities of the local authorities.
- *The Miji-Kenda Kaya forests* which were listed on the World Heritage List at the 32nd Committee of the World Heritage Convention in Quebec, Canada, July 2008.
- *Fort Jesus* which has also been proposed for World Heritage listing. It is expected that Fort Jesus and Mombasa Old Town Conservation Area will soon be declared a World Heritage Site, because this important site represents the millennium-old human history of the East African coast. At various points in time, the Portuguese, Omani Arabs, the British, the Baluchis, and the Indians were present at one time or another in Fort Jesus.

Archeological and Paleontological Sites

Kariandusi, Olorgesailie, and Koobi Fora: Kenya is home to some of the most renowned paleontological/archeological sites in the Great Rift Valley. Both

Olorgesailie and Kariandusi sites represent the Acheulian Culture of the Early Stone Age. Koobi Fora in Sibiloi National Park is a mixed World Heritage Site and home to important early hominid finds. Visitor facilities in these Rift Valley sites include an interpretation gallery and accommodation facilities. All NMK sites are very strategically located and offer often breathtaking panoramic views of the surrounding landscape at the bottom of the Rift Valley.

Thimlich Ohinga: In Kenya's Lake Victoria region is Thimlich Ohinga Cultural Landscape, nominated by the World Monuments Watch into the list of the 100 most endangered sites for the period 2000/2001. Thimlich Ohinga is a fine example of a complex of dry stone wall enclosures and is sometimes referred to as the Great Zimbabwe of East Africa; it represents the same indigenous building technique in the form of circular interconnected defensive structures.

Historical sites

Kapenguria Museum: While some sites and monuments are reminders of the colonial period (old Provincial Commissioner or District Commissioner offices or residences), other sites evoke the country's political history and mainly the struggle for independence. Two sites (Kapenguria and Lokitaung) are prisons where the founding fathers of the nation were detained, while two other sites (Lodwar and Maralal) are residential houses where the first president, Mzee Jomo Kenyatta, was kept in isolation after his release from prison and before they signed the declaration of independence.

Uhuru Gardens: Uhuru Gardens in Nairobi is the park where the first flag was raised by the first president on the night of independence. Currently, a "Heroes and Heroines Square" is being developed there to commemorate all those who contributed to the liberation and nation building.

Education for Curators and Museum Administration

For continuous capacity building in the various fields in the museum, the NMK together with other stakeholders in the region started an international nongovernmental organization previously known as Program for Museum Development in Africa (PMDA) dedicated to the preservation, management, and promotion of cultural heritage in Africa through a program of training and development support services.

Since its inception in 2000, PMDA, now known as Centre for Heritage Development in Africa (CHDA), has become recognized for the quality and innovative character of its training and development support programs and activities that it provides to professionals and institutions responsible for movable and immovable heritage in

English-speaking sub-Saharan Africa. CHDA works in close collaboration with the University of Nairobi and is supported in its programs and activities by funding and technical partners throughout the world.

For its future activities, CHDA intends to pay special attention to ensuring the better utilization of museum collections for public programs and to making museums play a positive role in the lives of children.

Because of its diverse and strategic roles, the NMK plays host to a number of regional and international programs as well as collaboration projects. Some of these are Africa 2009 Program, Koobi Fora Field School, a joint program with the Rutgers University in New Jersey.

Professional Associations

International Council of African Museums

Of special note, is the establishment of the International Council of African Museums (AFRICOM), a professional association that brings together museum and heritage professionals in Africa and is housed within the NMK. The AFRICOM Program was born as an outcome of the Encounters "What Museums for Africa? Heritage in the Future" organized by ICOM in Benin, Ghana, and Togo in November 1991. The aim of the encounters was to address the role and the relevance of the museum for the African continent. The African professionals drew up a program addressing issues considered as priorities. In September 1992, this program was adopted by the General Assembly of ICOM within its Triennial Programme of Activities for 1993–1995 at ICOM's General Conference in Quebec. Its major objective was to develop exchanges among professionals of the continent and outside of Africa, and to consolidate the regional professional networks.

AFRICOM was created to help the continent promote the development of museums and museum-related institutions in Africa in the context of global development and to promote the development of professions on which museum activities are built, strengthen collaboration and cooperation among museums and its professionals in Africa, promote participation of all components of the society in the protection and enhancement of cultural and natural heritage among other activities. Membership is mostly African but museum professionals and partners around the globe are encouraged to participate in its activities.

International Committee of Museums

Other museum professional bodies include the International Council of Museums (ICOM), which brings together museum professionals from all over the world. ICOM is different from AFRICOM and it is more committee-oriented depending on one's professional specialty. For example, those responsible for marketing and public

relations (MRP) within the museum would be members of the MPR committee of ICOM.

Societies

The NMK also plays host to various societies that work closely with the institution to either raise funds for projects within the various museums or to increase public awareness of the heritage of Kenya or bring together those with a particular field of interest. Some of these include:

- Kenya Museum Society
- Malindi Museum Society
- Friends of Fort Jesus
- Kenya Prehistory Club

Museology as a Discipline and Profession

From the discussion above, it is clearly evident that NMK is a diverse and complex organization with a broad mandate and a wide range of activities. However there is a need for continuous capacity building in the area of museum training which until recently was not seen as the kind of knowledge needed to manage a museum. It must be noted that African museums were largely founded during the colonial era to house artifacts that were collected out of curiosity by colonists, who often assembled these collections as a means of trying to understand African culture and customs which were believed to be “backward” and “primitive.”

With museums burgeoning all over the world, there was need for the identification of a clear role for museums in society and there gradually developed a body of theory and practice which is known as museology. Museum professionals were nearly always trained in a discipline related to a particular collection, and therefore they had little understanding of the museum as a whole, its operation, and its role in society. As a result, the practical aspects of museum work, for example, conservation and exhibition development were achieved through borrowing from other disciplines and other techniques, whether or not they particularly met the requirements of the museum and its public. This is still the case in Kenya as there are no local universities or educational institutions offering Museology as a discipline. The only disciplines offered that may be closely related include anthropology and archeology. To study museology, African museum professionals have to apply to universities outside of the African continent thus making this a great challenge for museums in terms of capacity building. It is also difficult for museologists to work in isolation as they may need the expertise of other specialized disciplines in the development and curation of exhibitions.

On the other hand, through collaboration with other institutions and partners, Kenyan museums have been able to send some staff on exchange programs that

culminated in extensive projects that brought together people from different disciplines to develop significant exhibitions and programs. For example, in 2006, the NMK in collaboration with the British Museum were able to host an exhibition of the Hazina (Treasures). For this exhibition, a huge collection of artifacts from the East African region that are held by the British Museum were brought to Kenya for the very first time. Other important collaborations include the Koobi Fora Field school which is organized in partnership with Rutgers University in New Jersey, United States. Students from the United States and local students come together to acquire skills in hominid collections. The University of the Western Cape and The University of Cape Town in South African saw a gap in museum training on the continent and designed a postgraduate course for African professions titled the African Programme for Museum and Heritage Studies in Africa.

Key Contemporary Issues, Access, Preservation, and Educational Role

On October 15, 2005, the museum was partially closed, launching a project for a major expansion supported by the EU. The year 2008 marked an extraordinary milestone for the NMK as the institution began a historic transformation with the opening of the New Nairobi Museum.

The end result was the opening on July 14, 2008 of a state-of-the-art facility with new exhibitions and larger exhibition galleries as well as a new visitor center. The museum also features an array of new visitor amenities including restaurants and shops that will make the museum a one-stop shop.

Essential to the transformation of the Nairobi Museum are the goals of increased accessibility to the collections for students, scholars, and the public and enhanced collaboration and interdisciplinary work across all departments and collaborators.

The new and renovated museum offers greatly enhanced flexibility for viewing, studying, and interacting with the collections while providing dynamic museum experiences for visitors and establishing an innovative new model for object-based learning.

Outstanding Personalities

1. Sir Arthur Loveridge—first paid museum curator in 1914
2. James Maikweki—first African curator
3. Louis and Mary Leakey—renowned paleontologists
4. Richard and Meave Leakey—renowned paleontologists
5. Dr. Mohamed Isahakia—first Black African Director General, NMK
6. Rev. Kenneth St. Aubyn Rogers—founder of the East African Natural History Society (Now Nature Kenya)

Museums the world over are reexamining their traditional responsibilities to society. New demands are constantly being placed on museums to be accountable and relevant to the communities that they serve. In Kenya, this process of “new” museology is heightened by the sociopolitical changes that are taking place. In order to survive, the NMK is working hard to shake off its former static, “don’t touch” image to be more participatory, user friendly, and sensitive to its visitors.

The NMK remains committed to the development of arts and culture in the country and continues to work with the other stakeholders in the study of our modern and contemporary collections, in keeping with the transformation shaping museums around the world. NMK must be seen to endeavor to contribute to developing national consciousness by unifying the country using its collections to sensitize Kenyan people to economical, social, and political issues.

The NMK also continues to present diverse and enlightening programming that offer new opportunities and challenges to our curatorial, education, programming staff who must draw on their creative talents and utilize the great resources at NMK. At the same time, the prospect of working in partnership with institutions outside the NMK represents another exciting opportunity for the NMK.

CONCLUSION

Kenya is well aware of the fact that the world has changed to an information-driven economy. Major stakeholders have taken various steps to include information in every sector of development. In view of increased demand for library and information services, the KNLS has adopted the community-based library initiative which aimed at accelerating library development in the country. The major public, academic, and special libraries in Kenya are embracing ICT in their operations and service delivery.

There is a general realization of the role of records for good governance. Despite the sorry state of the archival service in the “earlier” years, currently there have been concerted efforts to improve on the same.

The NMK remains committed to the development of arts and culture in the country and continues to work with the other stakeholders in the study of our modern and contemporary collections, in keeping with the transformation of museums around the world. NMK must be seen to endeavor to contribute to developing national consciousness by unifying the country using its collections to sensitize Kenyan people on all fronts economical, social, and political.

The dissemination of information in Kenya relies too much on the printed word, which is not accessible to all Kenyans. The press, libraries, museums, archives, various information centers, and broadcasting services

cannot really satisfy the information needs of Kenyans. The ICTs have become central to information dissemination. In the government’s Vision 2030 development strategy, the country plans to introduce digital villages in both urban and rural areas by 2030. This will facilitate easy and faster information flow, thus propelling economic development. The government of Kenya must formulate favorable policies that would encourage the use of ICT. It is important to note that LIS schools in Kenya have embraced the use of ICTs and introduced them in the curriculum.

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Knowledge

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Abstract

Among Western philosophers, the study of knowledge emerged in ancient Greece, under the definitive influence of Plato and Aristotle. Plato's *Theaetetus* immortalized the view that knowledge consists of justified true belief, and this view has come to be called "the traditional analysis of knowledge." This entry outlines the traditional analysis, and presents a formidable threat to it: the Gettier problem.

INTRODUCTION

Human knowledge naturally falls into various categories: empirical (or, a posteriori) knowledge, nonempirical (or, a priori) knowledge, knowledge by description (a kind of propositional knowledge), knowledge by acquaintance (a kind of non-propositional knowledge), and knowledge of *how* to do something. Empirical knowledge depends for its evidence, or justification, component on sensory experience, whereas nonempirical knowledge depends for its evidence component solely on what Kant called "pure reason" or "pure understanding." Although current understanding of the distinction between a priori and a posteriori knowledge stems largely from Kant,^[1] earlier variations on the distinction are found in Leibniz and Hume. Knowledge of physical objects serves as a standard example of empirical knowledge, whereas knowledge of logical and mathematical truths provides a typical instance of nonempirical knowledge. Knowledge of logical and mathematical truth seems not to depend on sensory experience for its evidence component.

Bertrand Russell^[2,3] famously distinguished between propositional knowledge by description and non-propositional knowledge by acquaintance. Knowledge by description includes knowledge *that* something is the case, whereas knowledge by acquaintance includes direct non-propositional awareness of something, and does not necessarily include knowledge that something is the case. We shall focus on the traditionally required components of propositional knowledge that something is the case: belief, truth, and justification.

Belief

Propositional knowledge requires belief, but belief does not entail knowledge. We cannot know, for example, that pomegranates are red without believing that they are red. Propositional knowledge is belief that satisfies the *truth*

condition and the *justification*, or evidence, condition for knowledge.

Philosophical controversy arises over what exactly beliefs are, and yields two prominent views: a *dispositional view* and a *state-object view*. The dispositional view implies that beliefs are just *dispositions to act in a certain way*, and receives support from Charles Peirce and Gilbert Ryle, among others. According to this view, believing that the food before me is deadly is just to be disposed to act toward it in a manner appropriate to its being deadly. Identifying beliefs with dispositions to act gives beliefs a practical function that they might otherwise lack. If beliefs are just dispositions to act, then beliefs will figure centrally in the motivating forces of actions; and they evidently do.

The view that beliefs are just dispositions to act must confront a serious problem. We often invoke beliefs, including their propositional objects indicated by a "that"—clause, to explain why we do what we do. We say, for instance, that I ate the pomegranate *because* I believed that I was hungry and that eating it would satisfy my hunger. The dispositional view implies that I ate the pomegranate because doing so was part of a disposition of mine to behave in certain ways. This view fails, however, to account for the role of the relevant propositional *content* in my behavior: namely, the belief-content that I was hungry and that my eating the pomegranate would satisfy my hunger. We typically explain actions in ways that rely on the propositional contents of beliefs, but the dispositional view of belief does not allow for this. It omits propositional contents, and thus precludes the central role of such contents in the explanation of actions.

The *state-object view* of belief seems more promising than the dispositional view. It implies that belief requires a special relation between a person and an *object of belief*. It thus distinguishes a person's *state* of believing and an object of belief, that is, what is believed. On this view, to believe that pomegranates are red is to be related in a special way to an object of belief. The objects of belief,

according to a prominent view from Frege, are *abstract propositions*, which are nonphysical entities that exist independently of anyone's thinking of them. They are similar to numbers and other mathematical objects as represented by Platonists. The special relation of believing, according to many philosophers, is a *propositional attitude* that involves some degree of confidence toward a propositional object of belief. Endorsed by Frege,^[4,5] Russell,^[6] and Moore,^[7] among others, this view aims to make sense of how two persons can believe *the same thing*: for example, that pomegranates are red. Each person has *access* to one and the same abstract proposition, and each can have the attitude of believing that proposition.

A familiar problem concerns the supposed realm of abstract, nonphysical propositions, which many proponents regard as eternal, infinite in number, and accessible by an act of the human mind. Philosophers with physicalist inclinations have doubts about the existence of such a realm, and they regard the supposed special relation of believers to that Platonic realm as unacceptably mysterious. They demand a view of the intersubjectivity of belief that adds to its intelligibility and plausibility without increasing mystery.

Seeking to avoid mystery, some philosophers, including Rudolf Carnap^[8] and Quine,^[9] hold that the objects of belief are *sentences*. We need to distinguish between a sentence *token* and a sentence *type*. A sentence token is a physical sentence resulting from someone's speaking or writing, whereas a sentence type is the abstract class of all such sentence utterances or inscriptions that have the same form. Each utterance of "It is red," for instance, is a member of the abstract class of all such utterances, and is thus a token of that sentence type.

If the objects of belief are sentence tokens, the belief relation between a person and an object of belief is relatively straightforward, since physical occurrences can be intelligibly related to in various ways, for example, causally. There is, however, a difficulty for this view: if the objects of belief are inscriptions and utterances, a person not now related to such tokens does not now believe *anything*, since there is no object of belief for that person. This is a real problem, given the familiar position that there can be beliefs in the absence of physical inscriptions and utterances.

One might seek refuge in the view that the objects of belief are sentence *types*. Even if a person is not now related to an inscription or utterance, an abstract sentence-type can still be the object of belief so long as the person has a belief relation to it. Still, many philosophers will wonder whether abstract sentence-types actually exist. If they do, can a person have a belief relation to such an abstract entity, and what kind of mechanism or process is at work between the two? In addition, can a person have a belief relation to an abstract type without having a similar relation to a physical token of that type? If not, why

should we hold that the presumed role of abstract sentence-types is ineliminable?

We should mention a traditional view on the objects of belief suggested by Aristotle, certain medieval scholastics, classical modern philosophers such as Descartes, Locke,^[10] Hume, and Kant, and contemporary thinkers such as Noam Chomsky^[11] and Jerry Fodor.^[12] This view entails that the objects of belief are *mental, or psychological, propositions*, rather than abstract propositions. That is, they are the *thoughts* we think as we live our lives. Of course, we can *express* our thoughts in words or in some other manner, but typically our thoughts are not expressed at all. Mental propositions belong to the mental life of an individual and have no existence apart from that life. The mental-proposition view avoids problems involving a realm of Platonic objects that exist independently of us and our thoughts. Since mental propositions are psychological particulars in the mental life of a person, the belief relation between a person and an object of belief is not obviously troublesome. Improving on the sentence-object view, the mental-proposition view allows that the objects of belief can be expressed in various natural languages, and may even be altogether unexpressed.

Many philosophers will press the issue of what exactly mental propositions, or thoughts, are. In addition, they will ask how we can account for the evident fact that some people believe *the same thing*, if mental propositions are the private thoughts of an individual. They will also ask how there can be verbal communication between individuals if thoughts are private? Wittgenstein^[13] may have had such a worry in his famous discussion of private languages.

We have contrasted dispositional and state-object views of belief, because belief is a necessary component of propositional knowledge. Two other necessary conditions for such knowledge merit comment: truth and justification.

Truth

I know that all pomegranates are red only if it is true that all pomegranates are red. If there are pomegranates that are not red, but are walnut black, then I do not know that all pomegranates are red. So, knowledge requires truth. It is false, then, that astronomers before Galileo *knew* that the sun moves around the earth. Since it is false that the sun moves around the earth, no one *at any time* knows that the sun moves around the earth. Of course, one might believe, even justifiably believe that the sun moves around the earth, since neither mere belief nor justifiable belief requires truth. Even so, propositional knowledge without truth is impossible, according to the traditional conception of such knowledge.

The question of what truth is does not ask what the standards are for discerning truth. Our standards for discerning truth concern our ways of *finding out* what is true

and what is not true. The question of what truth is, in contrast, concerns the nature of truth, or what constitutes truth. We might rephrase the question as: what does it mean to say that something is true? Someone could know what it means to say that something is true, but lack a standard for finding out whether a particular proposition is actually true. We shall note three approaches to truth that philosophers have proposed for capturing the truth condition of propositional knowledge: correspondence, coherence, and pragmatic theories.

Correspondence

Many philosophers, including Moore, Russell, and the early Wittgenstein, have held, in the tradition of Aristotle that truth consists in a *correspondence relation* between truth-bearers that state something and features of the actual world. According to a correspondence theory, true statements represent how the world is in virtue of their “corresponding” to some aspects of the actual world, that is, to some actually existing situation. This is an account of what constitutes truth, not of how we tell whether a statement is true.

A key issue concerns the exact sense in which a true statement, such as, “The earth orbits the sun,” *corresponds* to reality. It is difficult to capture the pertinent sense of correspondence, and thus no exact account of correspondence has come to be shared by philosophers. Correspondence is not literal “picturing” of the world by true statements, because many true statements are not literal pictures of what they are true of. Consider true statements that are negative (“It is not the case that the sun orbits the earth”), or true statements that involve unrealized conditions (“If the sun explodes, life on earth will cease”), or true statements about nonempirical matters (“Nothing can be both a triangle and an octagon”). Such truths do not literally picture what they are true of, or what makes them true. It is unclear, in addition, how exactly they “correspond” to what they are true of. Proponents of a correspondence theory must identify the kind(s) of correspondence that obtains for true sentences, including those just mentioned.

Mackie^[14] and others have endorsed the following “simple” view of truth, in the light of problems concerning the nature of correspondence: to say that a statement is true is to say that whatever in the making of the statement is stated to obtain does actually obtain. This view has affinities with Aristotle’s position that truth is a statement of what is that it is or a statement of what is not that it is not. Mackie opposes Ramsey’s^[15] “redundancy” view of truth, which states that the predicate “is true” is eliminable because it adds nothing to a statement to which it is applied. On the basis of the simple view, Mackie denies that the statement that *P* is true is just a re-affirmation of the statement that *P*. According to the simple view, truth is a distinctive relation, as identified by the simple view,

between a statement and an actual situation. A statement that does not ascribe truth thus does not necessarily ascribe the truth relation in question. The simple view is a minimal correspondence theory in virtue of its characterizing truth as a relation between a statement and an actual situation.

Alfred Tarski’s^[16] “semantic approach” to truth is a correspondence theory, according to some philosophers. This approach offers the following principle not as a definition of truth but as a necessary condition that must be met by any acceptable definition of truth: *X* is true if and only if *P* (where “*P*” stands for a declarative sentence, and “*X*” stands for an expression that refers to *P*.) Accordingly, the sentence “All pomegranates are red” is true if and only if all pomegranates are red. What follows “if and only if” in Tarski’s necessary condition connotes an existing situation to which the pertinent true sentence is appropriately related. Various philosophers have thus understood Tarski’s necessary condition as specifying a correspondence requirement on truth.

Even if we had an adequate explanation of the correspondence definitive of truth, we would still face a difficult epistemological question in combining a correspondence approach with a claim to knowledge. How can a person *know* that a correspondence relation actually holds between a statement and the world? In particular, how can a person be *justified* in believing that such a relation holds? If truth is correspondence, then to know that a proposition is true, a person must know that a correspondence relation obtains. Are we thus required to compare a proposition with the way the world is and thereby determine that the proposition corresponds to the world? In that case, to show that we have the knowledge in question, we apparently need an independent means of access to the way the world is. Some philosophers contend that we lack such a means of access, and thus hold that a correspondence theory of truth raises insurmountable problems when joined with claims to knowledge. Even so, a correspondence theory of truth does *not* entail that a person must *know* that the correspondence relation obtains. It entails rather that a statement is true simply because the correspondence relation does obtain, even if no one knows that it obtains. The correspondence relation definitive of truth is not offered as a knowledge-dependent and relation.

Coherence

A coherence theory of truth aims to characterize truth without reliance on talk of correspondence relations. In short: to say that a statement is true is to say that it “coheres” with a specific comprehensive system of statements. The fact that a set of statements is suitably interconnected or systematic (i.e., “coherent”) is thus offered as being definitive of truth. This approach to truth has been endorsed by Spinoza among others,^[17] and it is

offered as capturing what is constitutive of truth, and not only as a test of truth. Logical implication is the strongest kind of coherence, and some proponents of the coherence theory appeal to it to illustrate the kind of coherence that characterizes truth. These proponents typically regard the system of mathematical truths as being a standard coherent system yielding truth.

Proponents of a coherence theory must explain what exactly coherence is and what kind of comprehensive system a true proposition must cohere with. Their key assumption is that truth is a comprehensive system of interconnected statements or propositions. Their position thus does not define truth in terms of a correspondence relation between propositions and the non-propositional world, but rather in terms of systematic interconnectedness of propositions. Even so, many philosophers deny that every person's set of beliefs constitutes a truth-making system in virtue of systematic coherence. Many people have logically inconsistent sets of beliefs, and it is not plausible to hold that all the members of an inconsistent set of beliefs are true. A similar problem arises for the view that a particular community's set of believed propositions qualifies as a true-making system. In addition, it would not help to restrict the view to propositions agreed on by all the members of a community. We can imagine another community all of whose members agree on numerous opposite propositions. Of course, both sets of accepted propositions cannot be true.

A defensible coherence theory seems to need the requirement that the relevant comprehensive set of propositions must be intimately connected in some way with actual states of affairs. Otherwise, truth and knowledge will neglect the way the world actually is. So, it appears that coherence among propositions or beliefs is inadequate by itself for the sort of truth required by knowledge. Such coherence by itself may have nothing to do with what is factual, as we can see from a case of obviously far-fetched but coherent science fiction. Proponents of a coherence theory of truth must explain, then, the essential connection between coherence and how things are. The formulation of this explanation is a serious problem facing coherentism about truth.

Pragmatic value

Pragmatism about truth entails that to say that a proposition is true is to say that it is useful in a certain way. Pragmatist theories of truth emerge from William James^[18,19] and John Dewey,^[20] although Charles Peirce^[21] deserves credit for founding the philosophical movement called "pragmatism." James and Dewey emphasized that the kind of usefulness definitive of truth is not identical with what we ordinarily call "usefulness." The common theme of the pragmatist approaches of James, Peirce, and Dewey is that truth consists in a certain kind of validation of ideas, and that such validation

determines the "pragmatic" value of an idea. Even so, the resulting notion of cognitive usefulness, or validation, is not satisfactorily explained by Peirce, James, or Dewey. They sometimes seem to identify truth with a kind of verification. Specifically, they seem to hold that any proposition suitably conducive to a unified, or coherent, account of our experience qualifies as true. They evidently assume that such conduciveness to a unified account is constitutive of truth.

Some philosophers fault pragmatism about truth for confusing matters of justification (or, warrant) and matters of truth. They challenge pragmatists to explain why *false* propositions cannot have pragmatic value in virtue of their being useful in unifying our experience and even being accepted by all inquirers. The challenge for pragmatists is to give an account of the alleged necessary connection between what is pragmatically valuable, in virtue of verification, and what is factual. We ordinarily allow for validated beliefs that are, unknown to inquirers, not actually true. The history of science offers cases illustrating this point. Many comprehensive theoretical systems, including the Ptolemaic model of the universe, in fact include false propositions. So, it's unclear how to defend the view that cognitive usefulness is definitive of truth. Pragmatists have not offered a convincing case for a necessary connection between what has pragmatic value and what is factual.

Justification

Some true beliefs result just from lucky guesses and thus fail to qualify as knowledge. A groundless guess might be true, and even be believed by a person, but still would not be knowledge. Knowledge requires not only that a belief condition and a truth condition be satisfied, but also that the satisfaction of the belief condition be "properly related" to the satisfaction of the truth condition. This is one general way to characterize the justification condition for knowledge. *Epistemic*, or *cognitive*, justification is the kind of justification appropriate to true beliefs that qualify as knowledge. More specifically, a knower must have an *adequate indication* that a known proposition is true. Such adequate indication may be understood as *evidence* indicating that a proposition is true; we then have a traditional view of justification as evidence, as suggested by Plato and Kant, among others. This view entails that true beliefs qualifying as knowledge must be based on justifying reasons, or evidence.

Justified beliefs can be false, and this view is *fallibilism* about justification. It allows, for instance, that astronomers before Galileo could be *justified* in holding that the sun moves around the earth, even though their position is *false*. Justifying support for a proposition need not be such that necessarily if the justifying proposition is true, then the justified proposition is true too. *Inductive* justification does not logically entail a proposition

thereby justified. It obtains when, if the justifying support is true, then the justified proposition is *probably* true to some extent. In addition, epistemic justification is typically *defeasible* in that justifying support for a proposition for a person can cease to be justifying for that person when that person acquires additional evidence. Your justification, for example, for thinking that there is a large flower display in the corner of the museum can be defeated by new evidence acquired upon your noticing that a holographic image of a flower display is being projected into the corner.

According to many epistemologists, our beliefs about the external world, including our beliefs about household physical objects, are justified nondeductively, probabilistically, fallibly, and defeasibly. There is, however, a skeptical problem that confronts such claims of justification. This problem takes the form of a regress argument that prompts the question of whether, and if so how, we are justified in holding any belief entailing the existence of an external world *on the basis of other beliefs*.

An example will help. While strolling along the Pacific Ocean, we decide that surfing would be refreshing, but that the risks of surfing are serious today. Our belief that surfing is dangerous today receives support from other beliefs we have. We believe, for instance, that: 1) local weather reports predict dangerous ocean waves in our area today; 2) there are formidable waves already in our sight; and 3) the local weather reports and the presence of the formidable waves are reliable indicators of dangerous waves in the very near future. Our belief that surfing now is dangerous gets support from our belief that (1), (2), and (3) are true. Other beliefs we have will provide support for (1), (2), and (3) for us, thus, continuing the chain of inferential justification. Part of the support for (1) might be that (4) we talked with our friends about today's weather reports. Part of the support for (2) might be our belief that (5) we apparently see formidable waves nearby. Our support for (4) and (5) might be likewise inferential; so, the chain of inferential justification continues.

Skeptics will ask how our allegedly justifying beliefs for a belief in an external object are themselves justified. If they are justified by still further beliefs, how are those beliefs justified? We seem faced with an endless regress of required justifying beliefs, and such a regress seems too complex to employ in our actual everyday reasoning. So, we have a couple of options: either to accept the skeptical conclusion that inferential justification is unavailable or to explain how to handle the threatening regress. Epistemologists have offered three prominent approaches to the regress problem: coherentism, foundationalism, and contextualism.

Coherentism

Epistemic coherentism implies that all justification is inferential in virtue of "coherence relations" among

beliefs. Inferential justification, according to epistemic coherentism, ends in a system or network of beliefs with which the justified proposition coheres. Epistemic coherentism, being a coherence theory of justification, is not a coherence theory of *truth*. Coherentism about truth, as noted previously, aims to specify the meaning of "truth" or the essential nature of truth. A coherence theory of justification, in contrast, seeks to explain the kind of justification appropriate to knowledge.

Epistemic coherentists must explain, first, what kind of coherence is essential to justified belief, and, second, what kind of belief system a justified belief must cohere with. Many coherentists acknowledge logical entailment and explanation as typical coherence relations among beliefs. Explanatory coherence relations obtain when some of one's beliefs explain why some other of one's beliefs are true. My belief that it is thundering outside, for instance, might effectively explain the truth of my belief that my cat is running for cover. Of course, not just any belief system will confer epistemic justification, since some belief systems, such as those consisting of science-fiction propositions, are clearly erroneous and thus unable to confer epistemic justification.

According to the *isolation objection*, epistemic coherentism entails that one can be justified in believing empirical propositions that are incompatible with, or at least improbable given, one's total empirical evidence, includes one's non-propositional, sensory experiences. Such sensory experiences are non-propositional, and thus cannot be included in a belief system that confers justification. Epistemic coherence theories make justification depend just on coherence relations among propositions one believes or accepts, and therefore neglect the evidential significance of the non-propositional contents of nonbelief sensory states. Proponents of coherentism have not offered a cogent answer to the isolation objection.

Foundationalism

Epistemic foundationalism states that epistemic justification has a two-tier structure, given that some instances of justification are non-inferential, or foundational, and all other instances of justification are inferential, or non-foundational, in deriving ultimately from foundational justification. This structural view occurs in Aristotle's *Posterior Analytics* as a view about knowledge, and it receives an extreme statement in Descartes's *Meditations*, where it joins with the assumption that foundations of knowledge must be certain. Foundationalism is represented, in one form or another, by Russell,^[22] Lewis,^[23] and Roderick Chisholm,^[24] among many others.

Versions of epistemic foundationalism differ on the explanation of non-inferential, foundational justification, and on the explanation of how justification is transmitted from foundational beliefs to non-foundational beliefs. Some foundationalists, following Descartes, have assumed

that foundational beliefs must be indubitable or infallible. They embrace *radical* foundationalism, the view that foundational beliefs must be certain and that such beliefs must guarantee the certainty or the truth of the non-foundational beliefs they support. Such foundationalism is now unpopular, because very few, if any, of our perceptual beliefs are certain, and the beliefs that might be candidates for certainty (e.g., the belief that I am now conscious) are insufficiently informative to guarantee the certainty or the truth of our highly specific inferential beliefs concerning the external world, including beliefs from physics, chemistry, and biology.

Modest foundationalism, favored by most contemporary foundationalists, implies that foundational beliefs need not possess or yield certainty and need not deductively support justified non-foundational beliefs. A *non-inferentially justified, foundational* belief is a belief whose epistemic justification does not derive from other beliefs, regardless of whether the *causal* basis of foundational beliefs includes other beliefs. Modest foundationalists have characterized non-inferential, foundational justification as: 1) self-justification; 2) justification by nonbelief, non-propositional experiences; or 3) justification by a reliable nonbelief origin of a belief. Recent proponents of self-justification have included Chisholm^[24] and Ducasse,^[25] who hold that a foundational belief can justify itself, apart from any evidential support from something else. In contrast, proponents of foundational justification by nonbelief experiences reject literal self-justification, and hold, following Lewis,^[23] that foundational perceptual beliefs are justified by nonbelief sensory or perceptual experiences (e.g., my nonbelief experience involving seeming to see a pomegranate) that either make true, are best explained by, or otherwise support those foundational beliefs (e.g., the belief that there is, or at least appears to be, a pomegranate here). Proponents of foundational justification by reliable origins claim that non-inferential justification depends on nonbelief belief-forming processes (e.g., perception, memory, and introspection) that are truth-conducive to some extent, in virtue of tending to produce true rather than false beliefs. Such *reliabilism* invokes, as a justifier, the reliability of a belief's nonbelief origin, whereas the previous view invokes the particular sensory experiences underlying a foundational belief. Modest foundationalists typically agree that non-inferential justification can, at least in most cases, be defeated upon expansion of one's justified beliefs.

Foundationalists must explain the necessary and sufficient conditions for non-inferential justification and for the transmission of justification from foundational beliefs to inferentially justified, non-foundational beliefs. Modest foundationalists acknowledge nondeductive connections that transfer justification, but they have not reached agreement on the exact nature of such connections. Some modest foundationalists hold that a kind of "inference to a best available explanation" can account for transmission of

justification in many cases. The belief, for example, that there is a red pomegranate before me can, in my current circumstances, provide a best available explanation of various foundational beliefs about my perceptual inputs. This, however, is a controversial matter among contemporary foundationalists.

Contextualism

Wittgenstein^[26] suggested a central thesis of contextualism with his claim that "at the foundation of well-founded belief lies belief that is not founded." If Wittgenstein is claiming that at the foundation of justified beliefs lie beliefs that are unjustified, we have an alternative to coherentism and foundationalism. According to contextualism, in any context of inquiry, people simply assume (the acceptability of) some propositions as starting points for inquiry.^[27] These "contextually basic" propositions themselves lack evidential support, but can nonetheless support other propositions. Contextualists emphasize that contextually basic propositions can vary from social group to social group and from topical context to topical context, for example, from moral inquiry to physical inquiry. What functions as an unjustified justifier in one context need not in another context.

Contextualists must explain how epistemically unjustified beliefs can provide epistemic justification for other beliefs. They need to avoid the implausible view that just *any* unjustified belief, however obviously false or contradictory, can yield justification in certain contexts. If just any unjustified proposition can serve as a justifier, we shall be able to justify any proposition we want. Even if we typically take certain things for granted in certain contexts, this does not underwrite the view that there are unjustified justifiers. The things typically taken for granted may actually be supportable by good reasons. If they are not, we need some way to distinguish them from unjustified beliefs that cannot transmit justification to other beliefs. Contextualists must explain, then, how an unjustified belief, but not just any unjustified belief, can confer inferential justification on other beliefs, but they have not reached agreement on the needed explanation.

Some recent philosophers have rejected the traditional justification condition for knowledge. Some of these philosophers recommend a *causal theory of knowing* according to which you know that *P* if you believe that *P*, *P* is true, and your believing that *P* is *causally produced and sustained* by the fact that makes *P* true. One can develop such a causal theory in various ways, but one will need to give special attention to knowledge of universal propositions. Perhaps I know, for example, that all encyclopedia entries have been written by humans, but my believing this seems not to be causally supported by the fact that all encyclopedia entries have been written by

humans. It is doubtful that the latter fact produces any of my beliefs. We need, in any case, a careful explanation of how a causal theory can account for knowledge of such universal propositions.

Fourth Condition

Contemporary epistemologists have no widespread agreement on what precisely the key components of knowledge are, even if there is a considerable agreement that knowledge requires justified true belief. Traditionally, many philosophers held that justified true belief is logically sufficient as well as necessary for knowledge. This is a minority position now, owing mainly to “Gettier counterexamples” to this view. Edmund Gettier^[28] published a challenge to the view that if you have a justified true belief that *P*, then you know that *P*. One of Gettier’s counterexamples is:

Smith and Jones have applied for the same job. Smith is justified in believing that (a) Jones will get the job, and that (b) Jones has ten coins in his pocket. On the basis of (a) and (b) Smith infers, and thus is justified in believing, that (c) the person who will get the job has ten coins in his pocket. As it turns out, Smith himself actually gets the job, and he happens to have ten coins in his pocket. So, although Smith is justified in believing the true proposition (c), Smith does not know that (c).

Gettier-style counterexamples are cases where one has a justified true belief that *P* but lacks knowledge that *P*. The Gettier problem is the challenge of finding a modification of, or an alternative to, the traditional justified-true-belief analysis that avoids Gettier-style counterexamples. After four decades of vigorous research, contemporary epistemologists have not produced a widely accepted solution to the Gettier problem. Even so, many epistemologists take the main lesson of Gettier-style counterexamples to be that propositional knowledge requires a fourth condition, beyond the justification, belief, and truth conditions. The importance of the Gettier problem stems from the importance of our having a precise understanding of the nature, or the essential components, of propositional knowledge. A precise understanding of the nature of knowledge requires a Gettier-resistant account of knowledge.

CONCLUSION

Our familiar concept of knowledge resists easy analysis, but it does have some identifiable components. We do well, however, not to demand more precision of this concept than is available. Philosophers, in particular, will benefit from attention to that lesson.

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Knowledge Creation and Use in Organizations

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Abstract

The entry provides an overview of knowledge creation and information use within the organizational context. It is claimed that research focusing on these issues has developed since the 1990s within library and information science (LIS). Research on information use within organizational settings belongs to the research field of information behavior and information seeking and has gained attention in research focusing on information needs and uses of different professions and tasks and recently on outcomes or effects of information. Research on knowledge creation, in turn, is related to the multidisciplinary field of knowledge management (KM) and has been more focused on within the field of organization theory and management studies. In this entry, first, the distinctive nature of the concepts of information and knowledge is highlighted, and the main types of organizational knowledge are presented. Information management (IM) and KM as the fields of LIS and their research traditions are discussed. Research on information use is reviewed by placing the emphasis on information use environments in particular. Moreover, a model of organizational information use that includes knowledge creation is examined, and the Japanese models of knowledge creation are presented. These models are compared to highlight their potential relationships. After that, an alternative framework will be presented as a theoretically consistent foundation to understand knowledge creation in organizational settings. Finally, future research trends are outlined.

INTRODUCTION

Knowledge creation and use within organizational settings is quite a recent phenomenon in library and information science (LIS) research but emphasized by multidisciplinary research on knowledge management (KM) since the mid-1990s. However, the conceptual base of KM research has caused quite a deal of debate about the legitimacy of KM as a research field of LIS. This debate is based on the terminological confusion related to the concepts of information and knowledge. For example, often the concepts of information use, knowledge use, and knowledge utilization are used as synonyms. It has even been argued that the phenomenon that is referred to as KM in other fields of science refers to information management (IM) in LIS.^[1] To avoid the terminological confusion in this entry, the foci are on the creation of knowledge and the use of information within the organizational context. First, the differences of the concepts of information and knowledge are examined, and the main types of organizational knowledge are outlined. Second, the research traditions of IM and KM are discussed. Third, research on information use and the idea of information use environments and a model of organizational information use that includes knowledge creation are examined. Fourth, the Japanese models of knowledge creation are shortly reviewed. This is followed by a comparison of these models to indicate their main relationships. After that, an alternative framework is presented as a theoretically

consistent foundation to understand knowledge creation in organizational settings. In the “Conclusion,” some future research trends are outlined as well.

CONCEPTIONS OF INFORMATION AND KNOWLEDGE

Information and knowledge are closely related concepts. However, they are not synonyms. Research on LIS has widely utilized Claude Shannon and Warren Weaver's^[2] information transfer model, which treats information as a entity that can be transmitted through a channel. This is called an objective view of information. From the cognitive viewpoint, in turn, knowledge refers to something that resides in human mind. In this conception, knowledge is an outcome of information that is interpreted and internalized and thus becomes a part of the person's existing knowledge structure.^[3] This implies that internalized information also gives a new shape or form to the person's knowledge structure. In fact, the etymology of the word information as “informatio” in Latin refers among other things to the act of giving a form to something (Capurro and Hjørland,^[4] p. 351). From the cognitive viewpoint, this refers to learning, too. This is called the subjective view of information. Moreover, in LIS, information has been defined as information-as-thing (referring to, e.g., a document), information-as-process

(referring to becoming informed), and information-as-knowledge.^[5]

Knowledge is often understood to consist of explicit, implicit, and tacit elements. In the mid-1990s, the Japanese researcher Ikujiro Nonaka and his colleagues' theory of knowledge creation, the so-called SECI model, popularized the Hungarian scientist Michael Polanyi's^[6] identification of the tacit nature of knowledge.^[7,8] Tacit knowledge is the most intangible and very personal form of knowledge in organizations and thus difficult to articulate and formalize. However, many authors argue that tacit knowledge is understood too superficially in the conceptions of KM^[9] when actually referring to implicit knowledge.^[10,11] It has even been claimed that Nonaka has misused the concept of tacit knowledge as Polanyi's idea of *tacit knowing* refers to the most personal knowledge that cannot be expressed verbally.^[1]

The concept of organizational knowing and its management is based on the assumption that information and knowledge are something social by nature. For example, the constructionist viewpoint regards knowledge as a social construct assuming that tacit knowledge is manifest in organizational practices. Knowledge creation and innovation can be viewed as "a generative dance" and an outcome of the interplay of knowledge and knowing.^[12] Moreover, it has been claimed that cognition and action are inseparable that makes articulation of tacit knowledge unnecessary.^[11] Knowledge can also be viewed as a collection of processes that allow learning to occur and knowledge to be internalized within a social community.^[13] This view relates to the idea of a community of practice as "groups of people informally bound together by shared expertise and passion for a joint enterprise—engineers engaged in deep-water drilling, for example, consultants who specialize in strategic marketing, or frontline managers in charge of check processing at a large commercial bank... Instead of being composed primarily of people working on their own, they often exist within larger organizations"(Wenger and Snyder,^[14] pp. 139–140).

Even the five types of organizational knowledge, namely, embrained, embodied, encultured, embedded, and encoded, are claimed to be insufficient to account for knowledge as a social process.^[15] Moreover, it has been suggested that the evolution of knowledge forms a social learning circle: through the codification of shared experience, personal knowledge can become proprietary knowledge or the intellectual capital of an organization. Once externally scrutinized, this knowledge becomes public, while widely internalized, it turns to common sense.^[16] The assumption that knowledge exists in human minds makes it hard to manage causing much debate about the relevance of the concept of KM. Therefore, we can claim that the management of people is crucial when aiming at the management of knowledge and information as a resource. Thus the structure of an organization among

other enabling factors becomes the main focus of managerial activities when aiming at enhancing knowledge creation throughout the organization and beyond its borderlines.^[17]

RESEARCH TRADITIONS OF IM AND KM

Research on IM and KM are quite recent phenomena in LIS. IM research has its roots in the beginning of industrialization,^[18] though widely applied in practice as information resources management (IRM) since the 1970s as an outcome of introducing and utilizing computers and automatic data processing to manage paperwork in public enterprises. KM research has its roots in the visions of information society and knowledge-based economy^[19], which strives for innovations. Innovations, in turn, are based on knowledge creation. The multidisciplinary field of KM research emphasizes the enhancement of an organization's innovative capability and the ability to create new knowledge and has gained wider interest since the mid-1990s. KM research can be viewed, for example, as four different discourses, namely, a neo-functionalist, a constructivist, a critical, and a dialogic discourse. The main argument in this view is that the nature of knowledge including its tacit dimension is understood differently in these four research traditions. The neo-functionalist discourse treats tacit knowledge in a separable form from explicit knowledge, and similarly does the critical discourse, which treats tacit knowledge as power. The constructivist discourse, in turn, does not separate tacit from explicit knowledge and comes close to Polanyi's idea of tacit knowing, and the dialogic discourse treats tacit knowledge as deeply internalized consisting of normalizing judgments.^[20]

In LIS we can make a clear difference between research on IM and KM. Research on IM is most interested in the use of information technology (IT) and information systems (IS) to manage organizational information resources. Besides different discourses, we can identify multiple research traditions within the multidisciplinary field of KM, for example, IT and management information systems (MIS), organization theories, and education science and learning theories. The first research tradition refers to the use of IT and IS to manage organizational information and knowledge and, thus, comes very close to IM within LIS. The second KM research tradition understands information and knowledge as social phenomena by nature and aims at enhancing organizations and their environments to support knowledge creation, also often called as knowledge construction or generation. The second research tradition has its roots in organizational theory and social and educational sciences, whereas the first tradition is based more on the computer science's point of departure. Also LIS has two research traditions, that is, the social sciences and humanities-based library science, or

information studies, and information science that is more oriented toward computer and information processing and cognitive sciences. Therefore, we can view KM as a field of LIS from these two ontological and epistemological viewpoints too.

From the LIS viewpoint, it is important to increase understanding of information and knowledge as resources due to their partly intangible nature. This development is supported by the resource- and knowledge-based views of an enterprise (e.g., Barney^[21], Grant^[22], Penrose^[23]) and the idea of organizational learning.^[24] As the value of information and knowledge resources is difficult to estimate in economic, quantitative terms,^[9] it is necessary to have a holistic view of how to combine human, technological, and structural factors in a unique manner to prolong strategic capability and sustainability. The core capabilities are created through activities consisting of values and norms, skills, and managerial and physical systems,^[25,26] and knowledge creation occurs by combining people's distinct characteristics with a particular set of activities.

RESEARCH ON INFORMATION USE

With regard to LIS, rigorous research on information seeking and use focusing on library collections and users' interaction with them was initiated in the late 1930s.^[27] Besides involving library users, these studies have later focused on information needs and uses of professionals such as scientists, engineers, managers, or civil servants. Quite often, these studies have been based on the positivist survey tradition typical in sociological research of the Chicago School in the United States. This system-oriented view is based on the conceptualization of information as an entity. An opposite, user-oriented view^[28] is based on the conceptualization of information as a process and as knowledge. In other words, information is regarded as a construct that is subjectively created in the mind of its user (see, e.g., Todd^[29], Savolainen^[30]). Moreover, the phenomenon of information use can be viewed from the macro and micro perspective. In this entry, the focus is placed on the macro perspective by examining the ideas presented by Robert S. Taylor and further elaborated by Chun Wei Choo.

Information Use Environments

Within LIS, Robert S. Taylor's research on information use is perhaps the most well known. Taylor's^[31] point of departure is complementary to the system-oriented, technology-driven, and content-driven views of IS design. Taylor states, "These conventional approaches need to be tempered and informed by a third approach that looks at the user and the uses of information, and the contexts within which those users make choices about what

information is useful to them at particular times. These choices are based, not only on subject matter, but on other elements of the context within which a user lives and works" (Taylor,^[31] p. 218). This means that the environment where information is used impacts on information flows and uses and also determines the criteria used to assess the value of information.

Taylor defines information behavior as the sum of activities through which information becomes useful and states that information behavior differs in different groups. The elements of information use environments are the following: sets of people, which include professions (e.g., lawyers, engineers, social workers), entrepreneurs, special interest groups (e.g., hobbyists), and special socioeconomic groups (e.g., elderly); problem dimensions, which refer to typical problems for these groups; work settings and embedded factors that refer to influencing attitudes toward information, information flows, and types and structures of required information; and problem resolution assumptions. Taylor suggests that his model is applicable to a variety of contexts. He claims that the final determiner of information value is the user who is in a particular context and develops criteria on information value from that context.^[32] Furthermore, he points out that it is important to take into account that different sets of people perceive information differently, which means that information may have different interpretations according to the context, and in the processes by which it becomes useful. Therefore, better understanding of the less rational factors affecting decision processes should be gained too.

General Model of Organizational Information Use

Chun Wei Choo^[33] has applied Taylor's model of information use environments, Dervin's^[30] situation-gap-model of sense making, and Kuhlthau's^[34] information search process, which includes the affective dimension, to a general model of information use within organizational settings. Choo's idea of information use embraces information seeking covering the thoughts, feelings, actions, and the environment in which these are played out. He contends that organizations use information on three arenas: to make sense of the environment in which they operate, to create or generate new knowledge, and to make decisions. Choo's thesis is that these interconnected processes provide a holistic view of organizational information use and form the essence of a knowing organization. The three modes of information use of a knowing organization consist of sense making based on the idea of an enacting organization,^[35] knowledge creating based on the idea of a learning organization,^[36] and decision making based on the idea of a rational organization.^[37]

Choo's model is concerned with information use at three stages: information needs, information seeking, and information use. For Choo, information seeking (as a part of information behavior) is a human and social process

through which information becomes useful. This assumption is based on Taylor's conception of information use as the individual making a choice or selecting messages from a larger pool to attend to or to act on. Information use implies the selection and processing of information in order to answer a question, solve a problem, make a decision, negotiate a position, or understand a situation. This also makes the relevance of information important and refers to the pertinence of information as a term used to describe the capability of information content to satisfy more personal information needs. Pertinence, a concept also incorporated in Kuhlthau's information search process model, integrates cognitive and affective needs and addresses demands of a particular situation in which the information need emerges.

In Choo's model, the definition of information uses is based on Taylor's^[31] classification of the types of uses as follows: enlightenment referring to the development of a context or making sense of a situation; problem understanding; instrumental; factual; conformational; projective; motivational; and personal or political use. These different types of uses are generated by the need perceived by users in particular situations. The model also highlights constructed, situational, and dynamic properties of information use.

Moreover, Choo examines information use in organizational sense making, knowledge creation, and decision making. In sense making, information is used to reduce ambiguity and to develop shared meanings for taking collective actions. However, organizations also maintain a certain level of information equivocality and accommodate a diversity of interpretations. In knowledge creation, Choo draws on three types of organizational knowledge: explicit, tacit, and cultural, and on Nonaka's SECI model and its extension, as well as on Normann and his colleagues^[38,39] (see also Huotari and Iivonen^[17]) ideas on knowledge processes as the basis for organizational knowledge creation. He describes information needs, seeking, and use on knowledge creation through cognitive needs, affective responses, and situational dimensions. For Choo, knowledge creation includes the modes of knowledge conversion (SECI; Nonaka and Takeuchi^[8]), knowledge building,^[25] and knowledge linking (e.g., Wikström et al.^[39]).

KNOWLEDGE CREATION

It is widely accepted that knowledge creation is a social phenomenon, but theoretical research of this phenomenon is quite limited. The examination of Choo's model of organizational information use in the previous section also highlights phenomena related to knowledge creation. The Japanese models of knowledge creation provide further insights about knowledge creation within organizational settings. The most well-known among these models were

presented by Ikujiro Nonaka and his colleagues Hirotaka Takeuchi, Ryoko Toyama, and Noboru Konno during the 1990s and the beginning of this millennium.

Nonaka has criticized the notion of the organization as an information processing system and, instead, stressed a holistic and dynamic view of the organization that creates new knowledge through interaction. Nonaka and his colleagues' views are based on the idea of the social nature of information and knowledge and the dynamic nature of the organization, its activities, and the environment. They state that "Knowledge creation is a continuous, self-transcending process through which one transcends the boundary of the old self into a new self by acquiring a new context, a new view of the world, and new knowledge. . . knowledge is created through the interactions amongst individuals or between individuals and their environment. . . An individual (micro) influences and is influenced by the environment (macro) with which he or she interacts" (Nonaka et al.,^[40] p. 8). With the organizational knowledge creation, they mean ". . . the capability of a company as a whole to create new knowledge, disseminate it throughout the organization, and embody it in products, services, and systems" (Nonaka and Takeuchi,^[8] p. viii). Nonaka and his colleagues' models of organizational knowledge creation are shortly reviewed in the following sections.

SECI Model

One of the first models of knowledge creation is the so-called SECI model or the SECI process, which is based on the notion of conversion of knowledge between its tacit and explicit types through four phases: socialization, externalization, combination, and internationalization. Though the SECI model has been criticized, it is also widely used to describe the social aspects related to knowledge creation.

The SECI model implies spirals from one ontological level to the next, for example, from the level of an individual to the level of a group. Nonaka and Takeuchi drew on the ideas of tacit knowledge suggested by Polanyi and the idea of mental models. In addition, tacit knowledge consists of technical elements and know-how. In socialization, the members of a work community share and transfer their experiences in tacit form when working together in practice or when socializing in an informal manner and thus create new tacit knowledge. Interaction is crucial at this phase and face-to-face interaction enhances socialization, which can occur beyond organizational boundaries. In externalization tacit, personal knowledge is converted by articulating it to explicit form by using, for example, metaphors, analogies, mathematical formulas, or models. This is seen as a critical phase in the knowledge creation process because the externalized, conceptualized knowledge forms the basis for new knowledge to be created. Communication is essential and group work techniques

can be utilized. At the combination phase, new, externalized knowledge is combined with the existing explicit knowledge. Techniques, methods, and means, including modern ICT, of interaction can support communication. This phase can also be used to operationalize concepts, for example, a vision into business or product concepts. In the internalization phase created, new explicit knowledge is converted to tacit knowledge. At this phase, all people involved in the knowledge creation process reform what they have already known. This is related to learning by doing as they internalize the created new knowledge to become a part of their daily activities and embedded in organizational routines. Interaction and collaboration of the members of the work community are essential and, for example, self-organizing teams or work groups can enhance internalization.

Models of Organizational Knowledge Creation

The SECI model was further developed by Nonaka and Takeuchi toward a model of organizational knowledge creation involving a wider range of issues and ontological levels, that is, the individual, the team or group, the department or the division, the organization, and the networks, and the definition of the factors that enable knowledge creation. This model consists of five phases, namely, sharing tacit knowledge, creating concepts, justifying concepts, building an archetype, and cross-leveling knowledge. Nonaka and Takeuchi define the enabling factors as organizational intention, that is, “an organization’s aspiration to its goals” (Nonaka and Takeuchi,^[8] p. 74), autonomy, fluctuation and creative chaos, information redundancy, and requisite variety. Moreover, they stress flexibility in acquiring, interpreting, and relating information and claim that love, care, trust, and commitment enhance interaction, communication, and knowledge creation.^[8]

As knowledge creation is essential to sustain an organization’s innovative capability and strategic position in the marketplace, it must be in line with the strategic vision and goals set. The unified model of knowledge creation presented by Toyama, Konno, and Nonaka^[40] incorporates into the knowledge vision the SECI process, the shared context of knowledge creation called Ba, and the knowledge assets. The knowledge vision directs the relations of these three main elements and defines what kind of knowledge should be created at different sectors of activity and also how the organization and its knowledge base are developed with time. The knowledge vision also defines the values and norms that are used to determine how created new knowledge is assessed and valued, that is, how important new knowledge is for gaining the strategic goals.

The idea of Ba is based on the concept of Basho introduced by the Japanese philosopher Kitaro Nishida in the 1920s. Ba refers to time, space, and place where

information is interpreted to become knowledge. Locationality and simultaneous incorporation of space or place and time and mental state of mind are typical for Ba; in other words, Ba can be an office, a virtual space for working, and the state of mind. By localizing and activating organizational members to interaction, Ba enables knowledge conversion from tacit to explicit and from individual to collective. Moreover, by transcending the boundary between micro and macro for interactions at different levels, Ba can amplify the knowledge-creating process.

The SECI model and the four types of Ba, namely, originating, dialoguing, systemizing, and exercising, are linked, and they interact to create knowledge assets of four types. Experimental knowledge assets consist of shared tacit knowledge that is based on organizational members’ and stakeholders’ shared experience and thus are difficult to conceptualize, copy, or imitate. Conceptual knowledge assets are based on symbolic and conceptual models, for example, product and brand characteristics. Systemic knowledge assets consist of organized explicit knowledge that is easy to store and transfer in digital IS. These knowledge assets are most visible, and they can be protected by patents. Routine knowledge assets consist of tacit knowledge that is embedded in organizational activities and practices. These knowledge assets include daily organizational routines, working culture, and climate. These four types of knowledge assets form the basis for the knowledge-creating process.

COMPARISON OF THE MODELS OF ORGANIZATIONAL INFORMATION USE AND KNOWLEDGE CREATION

The strength of Choo’s model is the holistic view provided by integrating in an interdisciplinary manner the previous research findings, theoretical models, and frameworks. The Japanese models provide a holistic and unique approach to knowledge creation within organizational setting. All models examined provide a macro perspective of organizational phenomena and pursue to incorporate information use to a wider context including the physical place and the mental state of the information user. In the Japanese models, the macro perspective is an extension of the micro perspective whose interaction is embedded in the processes of knowledge creation. Choo’s model focuses on organizational knowledge creation as one of the three aspects of organizational information use. In Nonaka and his colleagues’ model of organizational knowledge creation, in turn, the knowledge assets provide inputs for the knowledge creation processes and are their outcomes too. In the Japanese models, information use is related to interaction and communication through which information is interpreted into knowledge and embedded in practices. These models are based on the assumption of the collective and dynamic nature of organizational

knowledge creation and the transfer of individual knowledge to collective knowledge. These aspects are included in Choo's model through Robert S. Taylor's conception of the information use environments, as sets of people, work settings, problems dimensions, and their resolution assumptions, which are embedded in the context and provide a collective platform to interpret information. This context is very collective in nature and provides the criteria for judging the value and usefulness of information. In Nonaka and his colleagues' models, the essence of knowledge creation is based on the conversion of tacit and explicit knowledge through interaction between the individual, the organization, and its environment. This aspect is evident in the concept of Ba, which is the collective and shared context of knowledge creation where information is interpreted to become knowledge and create the four types of knowledge assets.

The strategic orientation of these models differs. In Choo's model, the strategic aspect is embedded in the idea of a knowing organization, which uses information through the interconnected processes of sense making and enacting the environment, creating knowledge through learning, and making decisions. In these processes, uses of information are characterized as constructed, situational, and dynamic. In Nonaka, Toyama, and Konno's model, the knowledge vision directs the three elements, namely, the SECI process, the Ba, and the knowledge assets, of organizational knowledge creation.

Alternative Framework to Understand Knowledge Creation

The model of organizational knowledge creation presented by Chun Wei Choo and the Japanese knowledge creation models reviewed in this entry have both their strengths and weaknesses. Nonaka's and his colleagues' models are the most well-known in the Western countries, but their work has been criticized, too. Besides critique toward the use of Polanyi's concept of tacit knowing, the fact that their ideas are culturally bound has been under scrutiny. Choo's idea of the knowing organization has not been under scrutiny to such an extent, though it is evident that it is demanding to indicate how consistent the model's conceptual basis is.

As an alternative to these models, a novel framework of knowledge creation is shortly presented by the authors of this entry. It is based on hermeneutic phenomenology, which provides a theoretically and conceptually consistent foundation for understanding the phenomenon of knowledge creation.^[41] By introducing a novel way to conceptualize the collaborative nature of knowledge creation, the framework clarifies the conceptual vagueness of research on KM. Thus, it also contributes to the debate on the relevance of the concept of KM as a field of LIS. The point of departure is hermeneutic phenomenology and Hans-Georg Gadamer's idea of hermeneutic

conversation.^[42,43] This allows examination of knowledge creation, which is started by defining the concept of a human being and focusing on the human existence in interaction—constantly creating and simultaneously being created when living in the world—and not on the concept of knowledge as such. In other words, the framework provides a definition of a human subject as a creator of knowledge, contrary to the models presented in this entry, in which the definition is taken for granted. Moreover, contrary to previous research on knowledge creation, this framework provides a thorough definition for the concept of interaction^[41] (see also von Krogh^[44]).

The thesis of this novel framework is that the conceptualization of interaction is dependent on the conceptualization of a human being. Knowledge creation is examined in the following three areas: structure of the interactive event as the hermeneutic cycle involving distanciation, anticipation, correction, and reassessment; construction of the human experience in interaction consisting of the temporal dimensions of past, present, and future; and modes of being in interaction, such as reflective, critical, and open ones (see also Suorsa^[45]). In this framework, interaction is regarded as a communal and shared experience, which demands total presence in the course of events. It is claimed that the framework's hermeneutic circle and phenomenological conceptualization of a human being provide a defined and coherent structure for understanding the event of knowledge creation as a future-oriented, conscious act of interaction.^[41]

CONCLUSION

This entry aimed at providing an overview of information use and knowledge creation within organizations. The examination was placed on the context of KM research in order to indicate how information use relates to knowledge creation within organizational settings. Choo's model of organizational information use and Nonaka and his colleagues' models of organizational knowledge creation were shortly reviewed and further compared to highlight their potential relationships. It can be concluded that these models are based on the ideas of the social and dynamic nature of knowledge and knowledge transfer from the individual to the collective through knowledge conversion between its tacit and explicit types. These models relate to the LIS and KM research traditions based on the social and educational sciences and organization theory, rather than to the computer and IS and cognitive sciences.

However, as the conceptual vagueness of research on KM has been a concern in LIS, a framework based on phenomenological hermeneutics is finally introduced by the authors of this entry as a theoretically consistent foundation to understand and clarify the conceptualization of the phenomenon of knowledge creation in organizational

settings. In this framework, the foci are on the conceptualization of a human being and interaction as the major elements of knowledge-creating events.

Future Trends

The phenomena addressed by research on KM seem to some extent emerge in the research agenda of LIS. As pointed out recently, research interests in information use and outcomes, effects, applications, or impacts of information have been increasing steadily.^[27] These should be linked with the aspects of knowledge creation or construction. Research on collective practices of information use and knowledge construction could be increasingly emphasized. Furthermore, research on the use of new Internet-based technologies including applications of social media and web 3.0 may extend the scope of inquiry toward strategic knowledge creation and information use within networked organizational settings at the global level. Moreover, introducing novel, ontologically and epistemologically consistent interdisciplinary, or even cross-disciplinary models and frameworks would be fruitful for investigating and further understanding this multidimensional organizational phenomenon.

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Knowledge Discovery in Data Streams

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Abstract

Knowing what to do with the massive amount of data collected has always been an ongoing issue for many organizations. While data mining has been touted to be the solution, it has failed to deliver the impact despite its successes in many areas. One reason is that data mining algorithms were not designed for the real world, i.e., they usually assume a static view of the data and a stable execution environment where resources are abundant. The reality however is that data are constantly changing and the execution environment is dynamic. Hence, it becomes difficult for data mining to truly deliver timely and relevant results. Recently, the processing of stream data has received many attention. What is interesting is that the methodology to design stream-based algorithms may well be the solution to the above problem. In this entry, we discuss this issue and present an overview of recent works.

INTRODUCTION

Knowing what to do with the massive amount of data collected has always been an ongoing issue for many organizations. Today, data are not just ingredients for churning out statistical reports, but are the basis of supporting efficient operations in many organizations. And to some extent, they provide the competitive intelligence needed to survive in today's economy. Since data can be potentially so important, it becomes increasingly difficult to refrain from collecting any data available. The effect of this is that organizations are overloaded with information.

Data mining has been touted to be the solution (or perhaps, the killer application) to the problem of information overloading. It is supposed to replace the human in performing the laborious task of sieving through data and to report only important results. In one sense, data mining technologies have created many successful stories and have in the recent years, gained research and industry interests. Yet, it does not seem to deliver the impact^[1] in terms of penetrating every aspect of life or systems (compared to, for example, the Internet).

There are many reasons for a lack of impact—such as human factors, technical issues, or a combination of both. On the technical issue, we believe conventional data mining algorithms (and hence their products) were designed with two wrong assumptions. First, it assumes that the data are static in all aspects. Second, it assumes that the execution environment where the algorithm runs is stable with abundant resources (e.g., memory or computing power). The reality however is that both assumptions do not hold in the context of the problems that we are trying to address.

First, most conventional data mining algorithms operate on a snapshot of the data. The data may be collected and stored in a data warehouse where during data mining, is assumed to remain static even though new data could have arrived, or parts of the snapshot may no longer be valid. And throughout the lifetime of the algorithm's execution, this snapshot is assumed to be a reflection of the real-world situation. In addition, the data are assumed to be constantly available while the algorithm runs, i.e., there is some unbound or huge storage space for the snapshot where the algorithm can read as many times as it needs. While this may not appear to be an issue, real-world data are often many times larger. And we are not talking about scientific data here.

In a single day, Centrelink, Australia's welfare agency, has more than 11 million page requests in their Web logs; Telstra, Australia's largest telecommunications company, produces 15 million mobile call records; American supermarket chain WalMart records 20 million sales transactions; and Google handles 150 million searches. For such massive amount of data, it would be difficult, if not impossible, to generate any results in useful time by running off-the-shelves algorithms—even when unbounded memory, storage, and CPU time are available. This is because existing algorithms are simply not designed to do so.

The other problem with conventional data mining algorithms is that they all assumed an execution environment with all the resources they need, and that all resources are available until the execution terminates. Although such assumption is common in other applications, data mining algorithms cannot have such luxury by the sheer amount of time it needs to complete a task. In some cases, this may be ongoing as data keep arriving. Hence, data mining

algorithms must be aware of the conditions of the host environment (e.g., unavailability of host, reduced resources, etc).

This awareness is becoming very important in today's computing paradigm. Conventionally, data mining is considered a specialized technology available to a limited number of organizations. They were often operated in a controlled and centralized environment, where the analysis involved an expert user. The conventional process of knowledge discovery follows a strict sequence and algorithms ran in batch modes. Nevertheless, progress in other technologies changed the paradigm.

Advancements in data storage and acquisition technologies, wireless and mobile technologies, the Internet, and smaller computing devices all contributed to this change. Huge amount of data can now be collected from multiple sources; wireless and mobile technologies created pervasive computing; the Internet gave rise to connectivity; and as a result, users can work across different devices. Most important of all, these technologies generate enormous amount of data that demand ongoing and real-time analysis.

For a while, data mining researchers overcame the problem by developing faster algorithms and incorporating

interactively into the knowledge discovery process. But the amount of data continues to grow exponentially compared to the efficiency of the algorithms. The gap between data mining and the real world enlarges. Very recently, the database community has recognized that the existing database approaches (including data mining) are no longer suitable for handling this class of data that arrives continuously at a very high rate. Because of its continuity, they are called data streams.^[2] New algorithms for processing and mining streams were proposed.^[3,4] In particular, the mining of stream data does not require a complete snapshot. All results are reflected as soon as possible when data arrive, and it can operate in host environments where resources are scarce. Despite the limited resources, the algorithm is able to compute very quickly using a small amount of CPU cycle. This speedup and lower resource consumption come at the price of lower accuracy in the results; but the error is maintained at a user-acceptable level.

To give a clearer picture of what we have discussed so far, Fig. 1 shows a timeline of a sequence of events occurring during data mining. The same data are analyzed by both conventional algorithms (in the upper half of the

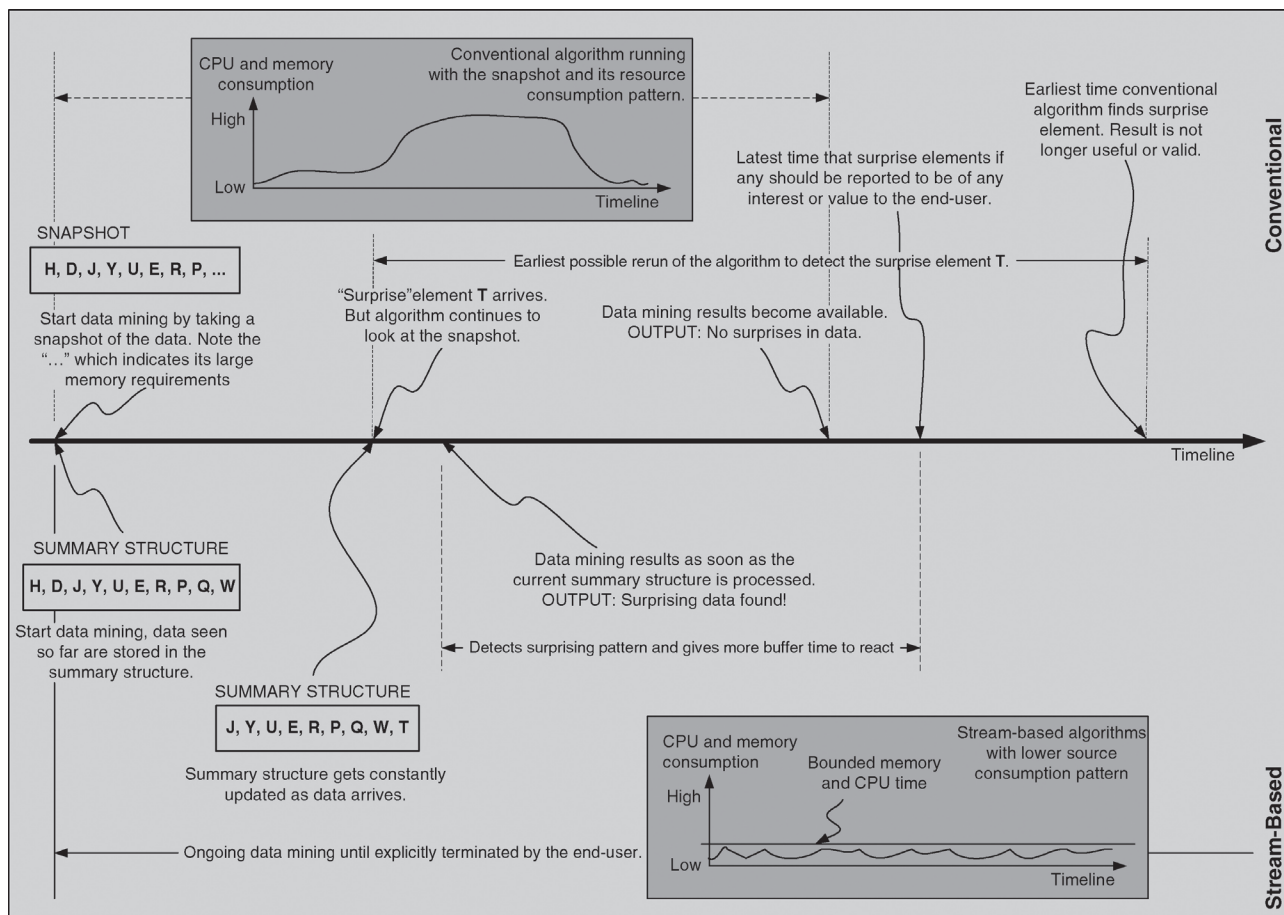


Fig. 1 A comparison between conventional data mining algorithms and the new stream-based algorithm by looking at the sequence of events happening in the data. Also shown are two graphs depicting their resource consumption pattern.

figure) and stream-based algorithms (lower half). We first illustrate the example for the case when the conventional algorithm is used. Our hypothetical problem here is that we are interested in looking for interesting patterns. An interesting pattern in this case is defined as the occurrence of a symbol which we denoted as **T** in the Fig. 1.

As in the conventional case, a snapshot of the data is taken when the user begins data mining. In our example, the snapshot contains the symbols {**H, D, J, Y, U, E, R, P, ...**}. Once the snapshot is read, the algorithm begins processing using some sophisticated search technique which at some point in time, will usually consume a large amount of memory and CPU cycles as the graph at the top of the figure shows. During execution, data continue to arrive (usually at a rapid rate). In the snapshot approach, this newly arrived data may be stored somewhere until the next analysis is commissioned. As illustrated in our example, the interesting element was missed and the algorithm reported an outdated or invalid result.

To capture the interesting element, the next run of the algorithm can only start after it arrives and is captured in the snapshot. In real life, this would be impossible—because it is impractical to start instances of the algorithm at a regular intervals due to resource availability, and neither does it make sense to have a human observe the incoming data. Even if the element is captured in the snapshot, conventional algorithms may take too long to produce the results (recall that they operate in batch mode) rendering the discovery useless, or there is insufficient time to react.

On the other hand, the lower half of Fig. 1 illustrates what happens when stream-based algorithms are used. In this case, in place of the snapshot is a summary structure which holds only a subset of what a snapshot would contain. And once started, the algorithm constantly updates the summary structure whenever data arrive (so that it has the best picture of all data seen so far); but the size of the structure will always be bounded as shown in the second graph. Also, the CPU cycles consumed is much lower albeit with some possibility of error.

The error probability is generally outweighed by the overall benefits. We see that once the interesting element is detected, the algorithm is able to output this result usually before its value expires. This happens most of the time and is thus more useful. In the conventional case, the chances of missing the interesting pattern or finding it too late is very much higher due to a batch mode operation. Given the improved results and lower resource requirements, data stream techniques are popular in some unique data mining applications.

CHALLENGES IN DATA STREAM MINING

Applications that generate and/or consume data streams are found mainly in novel applications in the recent years.

This includes customer relationship management (CRM) applications,^[5,6] Web click streams,^[7,8] financial markets^[9,10] that retailed products on the Internet, telecommunication systems,^[9,11,12] and sensor networks.^[13,14] The data records generated by these systems are usually referred to as *transactional data streams*, and its data objects are often referred to as *transactions* or *data instances*.

Compared to traditional data sets, data streams are characteristically unique. First, it is unbounded in size compared to traditional data sets that are saved on storage devices limited by their capacity. Consequently, the infinite amount of data that needs to be consumed by any analytical algorithm is also limited by the amount of physical memory on the computing device. Since there is no persistent storage facility in that sense, algorithms have to process the data streams in an online fashion and in the order in which it arrives. This is where the challenges lie when designing algorithms for data streams—the order in which data objects arrived can neither be controlled nor can the algorithm have random access to the data. This gave rise to the well-known “one pass” requirement concept that is virtually nonexistent in algorithms for mining traditional data sets. Given these challenges,^[5,15] states that any knowledge discovery application in data streams should therefore meet the following criteria.

- **Transactions should be quickly processed in constant time:** As data streams are high in volume and are continuously generated at a high rate, it is impractical to revisit previous transactions or work through some data structures since then the processing time would be a function of some variable and thus, unreliable in high load situations.
- **Memory consumption should be independent of the stream size:** If the data stream is unbounded then no amount of memory would be sufficient. Algorithms for mining data streams therefore have to keep in mind that any design should utilize memory in a fashion that does not grow proportionally to the size of the data stream over the time.
- **Online access to data mining results:** In conventional algorithms, as in the scenario discussed earlier, the analyst would wait for the algorithm to complete before obtaining the results. In contrast, data streams are continuous and therefore, the algorithm does not terminate. While the algorithm is running, it is necessary that the user can have real-time access to the latest or intermediate analytics produced.
- **Analytics should reflect the state of the data stream:** Given that the analytics produced at any instance is a reflection of the data stream in the same instance, such a system should be capable of adapting to the changes in the data stream and produce the relevant analytics as discussed in the previous criterion. Preferably, the

system should also be capable of retrieving results at any instance of the data stream.

- ***Analytics should be a good approximate to actual results:*** In theory, the actual results would correspond to the results of conventional data mining algorithms been applied to a snapshot of the data stream been stored on a disk that is unbounded in size. While this exact result is often not necessary in data stream applications, the estimate produced under the above constraints should be a good reflection of the actual result. Otherwise, the analytics would be meaningless.

As a consequence of the above requirements, existing algorithms are no longer appropriate in the data stream setting. First, the assumption that data is available at any-time and that they can be read multiple times violates the “one pass” constraint. Second, the algorithms are not design to enable real-time queries. Therefore, changes in the underlying data stream could possibly invalidate the results. Unless human intervention takes place to rerun the analytics, existing algorithms do not have the means to automatically detect the changes and produce an updated set of results. These conventional algorithms include Apriori and FP-Tree in association analysis; k -means and k -centroid methods in clustering; and ID3 and C4.5 in classification.

Data Stream Management Systems

Of course, it would do injustice to the conventional data mining algorithms for not fulfilling the various data stream constraints since they exist in the context of a larger system such as a database management system (DBMS). When we take a system view to the problem, we see that the conventional algorithms were built on the legacy of DBMS design, where data queries are executed over a data store. On the other hand, data streams simply invalidated this mode of operation since it is infeasible to load the data stream into a data store, and have the queries executed in a similar fashion. This motivated the need for a data stream management system (DSMS),^[7,16] where the query operations and the relevant analytics have to be redesigned accordingly. The uniqueness of a DSMS can be effectively characterized by the following attributes.

- In a DSMS, data appear in transient streams and may not be stored persistently. This is in contrast to conventional databases, where data are placed in some storage device and retrieved through the execution of a query. Data objects in a transient stream however are processed in memory and discarded as soon as it was processed.
- In conventional database systems, the execution of a query will produce the exact result and the operation does not have a real-time constraint. Data stream

systems, however, have execution constraints such as processing cost and time. Hence, the results provided by the DSMS are usually an approximate.

- In data stream systems, a query is often not seen as a one-time operation. In other words, once executed, it runs continuously against the changing data stream and produces results (and updates) until the operation is cancelled by the analyst. In the current database environment, once the exact answer is obtained, the operation ceases. In the event that the data has changed, the operation is not executed until invoked by the analyst.
- In current database systems, data can be stored in any granularity and later retrieved for further operations. Again, this contrasts data stream systems, where data objects arrive at their finest granularity and only the summary of it is stored. With the DSMS, there is no way that the analyst can retrieve the original data objects in the data stream.
- In traditional database systems, performance can be optimized through a query plan that exploits the storage pattern of the physical database. This is not possible in data stream systems since the underlying stream is unpredictable. Therefore, query plans in DSMS are often hard to design in advance.

Suffice to say, these characteristics justified the need to reconsider how a data stream system is built. Unlike existing database systems, the DSMS requires a different set of techniques and operations. The essence of any data stream systems, given the difficult requirements, is the summary structure as discussed in our example. Therefore, the problem of designing a DSMS revolves around the techniques of summarizing the data to facilitate similar database queries on the data stream.^[16–18] In the sections that follow, we shall review some of these techniques.

Histogram

Histograms has been one of the most popular data reduction techniques.^[7,19] They use binning methods to approximate data distributions to minimize the information to be stored. The distribution of values in a bucket usually have a uniform spread assumption, i.e., the values are assumed to be at equal distance from one another. Hence, one only needs to store the minimum and maximum value, and the number of values in each bucket; and that provides a good summary about the original data values. For those values in the bucket, they can be easily approximated with good accuracy by the above arrangements.

We present some of the common histogram techniques^[20,21] below. In all these variants, data is partitioned into a certain number of β disjoint buckets (or intervals) B_j ($1 \leq j \leq \beta$); and the data distribution is represented as $T = (v_1, f_1), (v_2, f_2), \dots, (v_d, f_d)$, where v_i denotes a distinct value in T and f_i denotes the corresponding frequency.

- **Equi-width histograms:** Partition the data distribution into buckets such that the number of data points v_i in each bucket B_j is approximately uniform to the other buckets.
- **Equi-height histograms:** Partition the data distribution into buckets based on the summation of the frequencies. Generally, this value is the same for every bucket.
- **Maxdiff (Max difference) histograms:** Partition the data distribution such that the differences in frequencies between adjacent bucket boundaries are maximized.
- **V-optimal histograms:** If n_j is the number of entries in the j th bucket, $\bar{f}_j$ is the average frequency of that bucket, and $f_{j,k}$ is the frequency of k th entry in the j th bucket, then this technique partitions T such that $\sum_{j=1}^{\beta} \sum_{k=1}^{n_j} (\bar{f}_j - f_{j,k})^2$ is minimized. In other words, $\sum_{k=1}^{n_j} (\bar{f}_j - f_{j,k})^2$ is the variance of the j th bucket. Hence, a V-optimal histogram is the one with the least (smallest) variance of all histograms with the same number (β) of buckets.
- **Compressed histograms:** First store the most n ($n < \beta$) frequent values in n singleton buckets. The remaining values are then partitioned into $(\beta - n)$ buckets using equi-width or equi-height histograms.

Wavelet Transformation

Another technique for data summarization stems from a linear signal processing technique called discrete wavelet transformation (DWT).^[15,19] With DWT, one can transform a set of numerical values into a set of wavelet coefficients of the same length. The wavelet coefficients are then reduced by retaining only those values that are above a user-specified threshold. This creates a sparse representation that is well-suited for data reduction. The Haar wavelet is one of the simplest algorithms used in summarizing data streams.

Assume a data set $D = \{x_1, x_2, \dots, x_n\}$ with the size of $n = 2^k$. Then, the wavelet tree can be obtained as follows:

1. Let the original data set (also called input signal) be at level 0 in a wavelet tree.
2. At level 0, each pair wise average and difference of adjacent data points (x_{2i}, x_{2i+1}) is computed to produce the coefficients for level 1. Thus, $s_{0,i} = C \times (x_{2i} + x_{2i+1})$ and $d_{0,i} = C \times (x_{2i} - x_{2i+1})$; $0 \leq i \leq n/2$, where C is a predefined proportionality constant. The values $s_{0,i}$ constitutes a “smooth” (low-frequency) version of the signal, while the values $d_{0,i}$ represent the high-frequency content.
3. At level 1, the value of $s_{0,i}$ is used to compute the next level by repeating the previous step. This would give a smoother version of the signal, $s_{1,i}$ and $d_{1,i}$; $0 \leq i \leq n/4$.

4. The above is performed repeatedly at each level i to get the averages and differences at level $i + 1$ until the top level is reached, which has only one average and difference.
5. Finally, the coefficients are represented in a hierarchical form, including the average value at the top level, and the different values at all remaining levels.

Because the compressed wavelet coefficients can be used to easily reconstruct the original data set, they are often used to approximate queries^[22,23] and in data mining, for burst detection.^[14]

Sampling

In statistics, the idea of sampling is that a set of random samples is often a reflection of the original data set and thus captures the underlying characteristics using less resources. Therefore, sampling is a good way to summarize the data in question, or to process large databases.^[24,25]

Since most sampling techniques are applied on data sets with finite sizes, the unbounded stream makes sampling more challenging than it appears to be. In the data stream context, Viter's work becomes the fundamental solution to this problem. In Vitter,^[26] Viter introduced a number of algorithms to sample N records (without replacement) from a pool of N records, where the value of N is unknown a priori. Viter's algorithms were used by others^[27–29] with various degree of success.

To conclude our discussion of data stream systems, we briefly list some of the relevant projects undertaken in this area.

- **Aurora (Brown/Massachusetts Institute of Technology (MIT))** is a DSMS built for monitoring data streams. In Aurora (<http://www.cs.brown.edu/research/aurora>), the data streams are generated from sources such as sensors, satellites, or stock feeds. The DSMS tracks the data from numerous streams to detect abnormal activities and also produces summary (aggregation and reduction) and correlation reports.^[30]
- **STREAM** (<http://www-db.stanford.edu/stream>) is a DSMS project at Stanford University that investigates memory management issues, query processing,^[31] and algorithm design for mining data streams.^[32]
- **Cougar** (<http://www.cs.cornell.edu/database/cougar>) is a project by Cornell University to investigate query operations in sensor networks.^[33]
- **Hancock** is a project by AT&T. The project investigates the building of a domain-specific language, i.e., Hancock, to compute evolving profiles of their customers over telecommunication streams, stock market transaction streams, and credit card transaction streams.^[9,11]

- **NiagaraCQ** is a project at OGI/Wisconsin (<http://cs.wisc.edu/niagara>) focused on studying continuous queries over Internet XML streams. The project was motivated by the observation that many Web queries shared similar structures. The project exploits this observation to group queries in an attempt to reduce computational and I/O cost.^[34]
- **TelegraphCQ** is a Berkeley project (<http://telegraph.cs.berkeley.edu>) to develop a DSMS for querying in sensor networks. Much of the research issues investigated focuses on designing algorithms to run continuous adaptive queries over the data stream generated by the sensor network.^[35]
- **Traderbot** is a Web-based financial search engine (<http://www.traderbot.com>) that evaluates (both one-time and continuous) queries over real-time streaming financial data such as stock ticks or news feeds.^[7]

KNOWLEDGE DISCOVERY IN DATA STREAMS

So far, we have given an overview motivating the need for data stream applications; discussed the challenges that such applications face; and also the issues surrounding the design of data stream management systems, in which data mining facilities are a part of. In this section, we present some of the data mining algorithms designed for data streams. In doing so, we will provide the necessary background for the reader to compare the differences in the design of such algorithms against their conventional counterparts, and to appreciate how the data stream constraints are incorporated so as to develop other data stream algorithms in future data mining tasks.

Frequent Pattern Mining

Let $I = \{x_1, x_2, \dots, x_n\}$ be a set of items where $X \subseteq I$ is an itemset or pattern. Further, let $D = \{t_1, t_2, \dots, t_N\}$ be a database of transactions, where $t_i \subseteq I$ and N is the number of transactions in D . Given the minimum support $s \in (0, 1)$, a pattern X is a frequent pattern (or frequent itemset) if the support of X , i.e., $\text{supp}(X) = |\{X \subseteq t_i \in D\}|/N$, satisfies $\text{supp}(X) \geq s$.

The problem of frequent pattern mining in a transactional database is to find all frequent itemsets in D with respect to the given minimum support threshold s . Apriori is one of the most famous algorithm that is often used to uncover all frequent itemsets from transactional databases. By using Apriori, the number of times to scan a database can reach k or $k + 1$ times, where k is the size of the largest frequent itemset. This approach quickly becomes a significant issue in mining very large databases where the cost to scan databases is very expensive and time-consuming. To reduce mining cost, feature selection,^[36,37] parallel computing,^[38,39] and sampling^[25,40] has been used.

Among them, sampling is often the preferred technique by virtue of its simplicity.

Generally, once the load is shed to a manageable level where processing the incoming sampled stream is possible under the available processing resources, we can perform one of the three common frequent pattern mining activities.

Frequent item mining

Frequent item mining arose out of a variety of applications including network management systems, search engines, telephone call records, etc., where each generated instance corresponds to an item. In most of these applications, there are two issues to be addressed: 1) to find the top k frequent patterns; and 2) to optimize memory consumption during discovery. Most of the literature has solution in memory optimization through optimized counting techniques.

Let us consider an example of this problem in network management systems. In Demaine,^[41] an Internet Service Provider may be interested in monitoring a data stream of Internet Protocol (IP) packets to find the top k user's IP addresses which consume the most bandwidth. Such a query changes over time and given the speed at which IP packets are potentially generated in a large multiuser setting, this is where a one-pass frequent item mining algorithm is needed. The Simple algorithm proposed in Demaine^[41] (and also in Karp^[42]) was designed for such problems. Each transaction is seen to contain one data object, which in this case is the IP address, and the objective is to find those IP addresses which consume a certain amount of bandwidth (i.e., the threshold).

In the Simple algorithm, an array K of size $\lceil 1/s \rceil$ is used to count the frequent IP addresses, where s is the minimum threshold. Each element in the array K contains two fields: the item label (IP address) and the frequency count. When a new item arrives in the stream, look for it in K and increments the frequency count by 1 if found or otherwise, insert the item into K and initializing the frequency count to 1. Since K stores much lesser items than N , the number of unique items seen in the stream so far, K can become full. When that happens, the algorithm decreases the frequency count of all items by 1 and for those whose frequency value is zero, they are removed from the array. Clearly, the items in k at any time would be the superset of those frequent items since K 's size was determined by $\lceil 1/s \rceil$.

This straightforward algorithm is a good example of a design for data stream applications. The array size is bounded and fixed regardless of the size of the incoming data stream. In terms of memory consumption, the array size is very small compared to the memory utilization by conventional algorithms. Also, each incoming item in the stream only needs to be looked at once and the processing takes place on a fix time bounded by the maintenance of K against the incoming item. On the drawback, while the top

K frequent items are obtained at anytime against the latest state of the data stream, we observe that this algorithm is unable to accurately provide the actual frequency count from K . While the items in K is guaranteed to be the top K frequent items, the frequencies recorded is at best an approximation.

Frequent pattern (or itemsets) mining

Applications that generate transactional data streams are candidates for frequent pattern mining. These include Web click streams, e-commerce recommendation systems, and financial markets to name a few. Generally, the solutions for finding frequent patterns in data streams are extensions from algorithms for finding frequent items. Hence, most of these techniques are memory optimization methods. Needless to say, the memory issue is far more challenging in frequent pattern mining (compared to frequent item mining discussed in the previous section) due to the exponential increase of patterns to be tracked when the number of items increased linearly. As a result, it is difficult to determine the memory consumption in advance and thus force some research to estimate memory usage empirically.^[29,43,44]

The Lossy Counting-based algorithm reported in Manku^[29] was one of the first piece of work for frequent pattern mining in data streams. The algorithm uses a summary structure D containing a set of entries of the form (set, f, Δ) , where set is an itemset, f is the approximate frequency, and Δ is the maximum error probability. The data stream is divided into buckets of equal size w and processed in batches. Suppose the main memory contains β buckets, then Manku and Motwani's^[29] algorithm maintains D as follows.

For each entry in D , f is updated by counting the occurrences of set in the current batch. A new itemset is inserted into D if its frequency in the current batch of buckets satisfies $f \geq \beta$. An entry $(set, f, b_{\text{current}} - \beta)$ for the new itemset is thus created in D . Periodically, the entries that satisfy $f + \Delta \leq b_{\text{current}}$ are deleted from D . To ensure that the transactional stream is efficiently processed, the algorithm uses a number of implementation techniques. Specifically, there are three modules—the buffer, the Trie, and SetGen. The buffer repeatedly reads a batch of transactions into the available main memory while the Trie is used as the physical representation for D . The SetGen module operates on the current batch of transactions to find frequent itemsets. To handle variable sized transactions and to avoid explicit enumeration of all subsets in a transaction (which is extremely expensive), the algorithm uses a rule that a subset will be enumerated if and only if it occurs in the Trie or its frequency in the current batch exceeds β . This is why the algorithm needs as much memory as possible to process the data stream in batches.

The inherited drawbacks of Lossy Counting aside, the first drawback of Manku and Motwani's^[29] work is that to

reduce the number entries in D , β must be large since a small β value results in a large increase in the number of entries placed into D . Secondly, all available memory is used for buffering the transactions and hence, D has to be made a disk-based data structure. As a result, there is a major impact on the performance. Consequently, the solution is suitable only in situations where queries and analysis of the data streams are pseudo real-time. Later works however, e.g., Yu^[43] and Jin,^[44] did make improvements to this limitation.

Time changing frequent pattern mining

Given that data streams are constantly changing the state of the database, the patterns discovered at one instance may no longer be the ones that are frequent in the next instance. Unfortunately, most algorithms find all frequent itemsets and hence, process the data stream in batches. In other words, the transactions are buffered and the discovery takes place on the buffered transactions. When the next set of transactions overflow the buffer, it triggers the algorithm to replace the existing frequent patterns with the ones recently discovered. In this mode of operation, real-time processing is absent and results are not timely. In situations where the patterns can change quickly over time, the buffer approach fails.

FP-Streaming^[45] is an example of an algorithm that finds frequent patterns with respect to the time parameter. The frequent patterns obtained by a query is time-sensitive in the sense that the analyst can query for frequent patterns between arbitrary time intervals. Central to the algorithm is the maintenance of a data structure call FP-Stream which is an extension of the FP-tree structure.^[46] FP-Stream includes two components: a pattern tree and a tiled-time window. Instead of representing transactions like FP-tree, the pattern tree stores patterns where each node in the pattern tree represents an itemset including all items from the root node to the current node. The tiled-time window at each node maintains the frequency count of the corresponding itemset at different periods of time. The FP-Stream structure is maintained over the lifetime of the data stream.

Over a period of time T , the frequency of a pattern is counted. Since the pattern may be frequent in one time period T_i but not in a longer period T_j ($T_i \subset T_j$), the logarithm tiled-time window is used to store the frequencies of a node at different granularities of time. For example, the frequency of a pattern X would be stored as $f(n, n); f(n-1, n-1); f(n-2, n-3); f(n-4, n-7)$, and so on. Hence, the number of levels at each node is relatively small ($\log_2(n) + 1$). Next, the data stream is divided into batches of transactions $B_1, B_2, \dots, B_n, \dots$, where B_n is the latest batch. Patterns are computed whenever a batch B_i arrives. Each pattern is used to find a node in the pattern tree and the frequency updated in the tiled-time window. At the node, the frequency counts are shifted to the next window

to make space for the update or if all the windows are full, merging of the counts occur before saving the latest count.

Given that the above has to be done for all possible patterns, memory consumption is a concern and so the algorithm does housekeeping of the pattern tree from time to time. This is done by deleting the older tiled-time windows toward the tail end if a delete condition is satisfied. This delete condition is used in conjunction with the Apriori property to further limit the level of consumption in main memory.

The strength of this algorithm is its ability to answer queries about the frequent patterns between any two time instances. The answers to the queries are much more precise at the expense of a much higher processing cost and memory cost. As a result, it is difficult to consider FP-Streaming an online algorithm where real-time responses are required from high speed data streams. Nevertheless, this work forms the basis for mining patterns under time-changing conditions. Subsequent works addressed the various aspects of this issue include the use of sliding windows in Chang^[47] and Chang^[48] for better real-time analysis; finding the difference in patterns of two data streams;^[49] and finding temporal patterns.^[50]

Clustering

Clustering is the process of partitioning a group of records into subgroups (or clusters) such that the data points in each group are similar to the other points in the same group but are different to the data points in the other groups.^[51] Clustering algorithms predominantly fall into two main techniques. The *partitioning* method, where k partitions are predefined and the objects are then placed, based on greedy heuristics, into a partition based on some objective function. The other approach is the *hierarchical* method, where the algorithm works either in a top-down or bottom-up approach. In the top-down approach, all data objects are initially in one cluster and in each iteration, the algorithm divides the clusters into smaller clusters. In the bottom-up approach, each data object started as a cluster and up iteratively merged until the desired number of clusters is reached.

The nature of data streams presents three key challenges clustering algorithms: 1) the compactness of the representation; 2) incremental process of new data objects; and 3) clear identification of outliers. The first challenge meant that the clusters must be representable in a form that is independent on the size of the growing data stream. The second challenge meant that clustering algorithms must be capable of placing a newly arrived data object quickly into a cluster. In other words, the similarity function must depend on the comparison of all data objects. Finally, the last challenge is the need to quickly identify outliers. This is more difficult than it appears to be due to the fact that an outlier at some point in time may form a new cluster in the

future. In the sections that follow, we review some of the algorithms for clustering data streams.

CluStream and variants

Probably the most representative algorithm for clustering data streams is CluStream first reported in Aggarwal.^[52] CluStream was designed to address the issue of discovery over evolving data streams. To address this problem, two novel concepts were proposed: 1) the use of microclusters which is an extension of the feature vector in BIRCH;^[53] and 2) the pyramidal timeframe.

Essentially, the microcluster is some sort of summary structure for the atomic cluster obtained from the online component of CluStream. It maintains statistical information about the data points assigned to the cluster which is used to compute the centroid. A micro-cluster is defined as a $(2d + 3)$ tuple $(\overline{CF2^x}, \overline{CF1^x}, CF2^t, CF1^t, n)$, where d is the dimension of data points. $\overline{CF2^x}$ and $\overline{CF1^x}$ are the sum and squared sum of the data values for each dimension in the cluster respectively and both are vectors of d entries. Correspondingly, $CF2^t$ and $CF1^t$ are the sum and squared sum of the time stamps; and n is the number of data points assigned in the cluster.

The pyramidal timeframe is a table that stores snapshots (at different time instances) of the microclusters. Periodically, a snapshot is taken to capture the set of microclusters in existence. As the snapshot becomes “older” overtime, less space is allocated to store information about the microcluster at that time instance. That is, the longer the snapshot of the microclusters exist in the pyramidal timeframe, the more space is allocated and hence, the microclusters are further summarized by merging the information that two microclusters contain. The algorithm in CluStream that uses the above concepts is given below.

1. Initially, CluStream clusters off-line from an initial set of data points to create the initial q -clusters.
2. After that, the online component kicks in. When a new data point arrives, it will be clustered into one of q clusters and the corresponding microcluster updated. The new data point may end up as a new cluster to reflect the evolution in the data stream. In order to get more space for new clusters, the old ones may be deleted if they are identified as outliers, or two old clusters may be merged.
3. Periodically, a snapshot is taken to capture the set of q microclusters, and that is stored in the pyramidal timeframe. The old snapshot is deleted (if the pyramidal timeframe is full), or the latest snapshot is “aged” to the next slot before inserting the new snapshot in the latest slot.
4. The off-line component is used each time a query is made. The answer to the query will come from the

summary information held in the pyramidal time-frame and the q clusters.

The design in CluStream allows the algorithm to store the status of the data stream at different time instances and thus allow interesting queries to be issued. For example, given two different time instances, we can compare the differences in the clusters formed to understand how a particular cluster has evolved and potentially identify the data item(s) that caused the change.

The CluStream framework was later utilized in Ong^[54] to cluster categorical data streams. Named SCLOPE, the algorithm was derived from three previous works namely, CLOPE,^[55] CluStream, and FP-tree.^[46] In SCLOPE, a categorical data stream is divided into windows. With each window, the online component is utilized to construct a FP-Tree for all transactions appearing in the window similar to the algorithm proposed in Han^[46] but with additional information about each branch of the data structure. From the constructed FP-Tree, SCLOPE groups the similar paths, i.e., those branches sharing the same prefix in the FP-Tree into microclusters. Since each branch represents a set of similar transactions and that overlapping branches are more similar than those that do not, the effect is similar to clustering as observed in CLOPE. Once the local microclusters are created, the off-line component is applied to cluster them into global clusters using the CLOPE algorithm.

Another variant of the CluStream algorithm is the StreamCluCD algorithm. This algorithm is designed based on the Lossy Counting algorithm discussed in Manku.^[29] In this algorithm, each cluster is represented by a histogram (for all m attributes), which are used to compare the similarity of a new record to the cluster. When a new data object arrives, it is compared with the histogram to determine the best cluster for the data object. The cluster's histogram is then updated to reflect the new data object. If no cluster fits, the data object becomes a new cluster if the space constraint, controlled via the ϵ and s parameter in the Lossy Counting algorithm, is not violated. The drawback of this algorithm is in the sensitivity of the objects chosen as the initial clusters.

k -Median

An alternative approach to CluStream is based on approximation algorithms to cluster the data points in metric space.^[32,56–59] k -Median is one such notable algorithm, where the sum of the distance from each data point to its closest assigned median is expected to be minimized.

Let $\omega = (N, dist)$ be a metric space, where n is a ground set and $dist : N \times N \rightarrow \mathbb{R}^+ \cup \{0\}$ be a distance function. Further, let M be a median set and Y be the data set that we want to cluster into k clusters, where both are the subsets of N . Then for all data points $x \in Y$, we

denote $ASG(x, M) = \min_{m \in M} dist(x, m)$ as the closest member of M to x , and denote $AD(x, M) = dist(x, ASG(x, M))$ as the assignment distance of x under the set M . Using these notations, the cost function of k -median problem can be defined as

$$\phi^Y(M) = \sum_{x \in Y} AD(x, M) \quad (1)$$

Thus, the objective of k -median is to find a set M that can minimize the cost function $\phi^Y(M)$. The k -median problem can be further divided into two subproblems: continuous k -median and discrete k -median. We call continuous k -median if the set M is chosen from space N , which means it is not limited in Y . Otherwise, we call discrete k -median, i.e., M is chosen from Y .

To cluster stream data, bicriterion (a, b) approximation algorithms are often used. In this approach, the produced set M has at most $a \times k$ medians and the cost function for that M is no more than b times the cost of the optimal solution. An algorithm for k -median problems was introduced in Guha^[32] and Guha,^[56] where the algorithm builds clusters (using the bicriterion) incrementally and hierarchically. Like SCLOPE, the algorithm processes the stream in batches of data points, each fitting the primary memory. The algorithm is summarized below.

Let m be the size of memory, k be the given number of expected clusters. This algorithm can be summarized as follows:

1. Let m be the number of data points that can be held in primary memory. Upon receiving m data points, the algorithm clusters them into $2k$ points, i.e., $a = 2$. These points are called *intermediate medians* and are weighted by the number of data points assigned to it.
2. The algorithm reiterates the step above until it has $m^2/2k$ data points from the data stream, where it will cluster the m first-level medians into $2k$ second-level medians. Each median in the $2k$ new intermediate medians is also weighted by the total number of data points assigned to it.
3. Maintaining at most mi -level medians and on seeing m data points, the algorithm generates $2k(i + 1)^{\text{th}}$ -level medians with the weight of each new median as the sum of the weights of all intermediate medians assigned to it.
4. When users request the result, the algorithm clusters all intermediate medians into k final medians.

This approach was later improved by Charikar^[58] and Mishra,^[59] where the accuracy of the approximation factor b is enhance and the memory is better utilized. Babcock et al.^[57,60] later extend the solution to work in a window model rather than processing them in batches. The advantage of these algorithms is that they can process the data stream in limited space, and the clusters are represented in

a compact manner—it only requires the set of medians to be recorded. On the down side, these algorithms are extensions of the k -median and thus find hyper-spheres as clusters. Additionally, it is not clear how these approaches can be extended to categorical data streams.

Classification

In contrast to clustering, the objective of classification is to build a model that can be used to predict the class (or missing attribute value) of a future data object whose class (or the value of interest) is unknown. Generally, classification is a two-step process.

In the first step, as known as learning, the model is built from a set of training samples, where the class of each sample is known in advance. In the second step, the model constructed by the algorithm by learning from the samples are used to predict future objects.^[61] Typically, the learning models are represented as classification rules, decision trees, or some mathematical function. Classification using decision trees has been well-studied and many algorithms were developed.^[62] Classification using the Bayesian^[63] network is a technique based on statistics. There are also techniques in machine learning and neural networks.^[61,64–66] In the sections that follow, we review the data stream variants that were built on the foundations of these classic algorithms.

Very fast decision tree (VFDT) construction

VFDT^[67] builds a decision tree for classification based on the Hoeffding bound. The initial state of the decision tree consists of only one single leaf node, i.e., the root node. As data points arrive, the tree is built iteratively (starting from the root) by replacing the leaf nodes with decision (or test) nodes. To do this, statistics about the data points are stored at each leaf node. The statistics include the counts n_{ijk} representing the number of data points of class label k reaching that leaf node when the attribute j receives the value i .

The decision on whether a node is to become a test node depends on two factors—whether there are enough data points at the leaf node, and whether the selected heuristic evaluation function, e.g., C4.5 or the Gini index, supports the split. If both criteria are met, the node is changed into a decision node and one of the available attributes is selected as the test condition. This is done throughout the lifetime in processing the data stream. The significant strength of VFDT is the time cost to evaluate the heuristic evaluation function each time a data point arrives at a leaf node. VFDT minimizes this cost by evaluating the function using only those data points since the last evaluation. This is further capped by using the minimal number of such points using the Hoeffding bound before deciding to split a leaf node.

One weakness of VFDT is that it assumes the underlying stream to have a stationary distribution.^[67] And if the

datapoints are buffered on disk, performance takes a hit as the data points are read at random.

VFDT for continuous attributes

An extension of VFDT is reported in Gama^[68] for continuous attributes. Named VFDTc, a decision node has only two descendent branches and the splitting test is a condition of the form $\text{attribute}_i \leq \text{cuttingpoint}$. Therefore, the two descendant branches correspond to the values of *true* and *false* as returned by an evaluation of the condition.

To identify the cutting point, a vector representing the distribution for the data points reaching a leaf node is maintained, and for each continuous attribute, a binary tree is maintained. Each node in the binary tree contains three fields. The first is the node identifier, which is also the value i of the attribute. The other two are vectors of k dimensions, where k corresponds to the number of classes. Each time a data point reaches the leaf, all its binary trees are updated. From these binary trees, the information gain of a given attribute can be computed. Hence, the best attribute with its best cutting point can be found.

On the drawback of this algorithm, this approach is computationally expensive due to the amount of work needed to create metadata for identifying the split. Also, VFDT does not work well on data streams where concept drifts occur.

Concept-adapting VFDT

Where concept drifts occur in the data streams, the decision tree constructed by VFDT quickly becomes outdated and so, the prediction accuracy on new data objects drops significantly over time. To address this problem, Hulten et al.^[69] proposed an extension of the VFDT. Called concept-adapting VFDT (or CVFDT), the decision is built from at most n data points. And unlike VFDT where only leaf nodes are required to store sufficient statistics, the decision nodes in CVFDT must also maintain sufficient statistics.

To maintain concept drifts, the CVFDT algorithm periodically scans the decision nodes and for those nodes whose sufficient statistics suggest some new attribute that would be a better candidate for the test condition, an alternative subtree starting at that node is created. Over time, as the new subtree becomes more accurate than the older one, the old subtree is replaced. Hence, there can be more than one subtree rooted from the same internal node in CVFDT. In this case, there are instances when CVFDT actually maintains them simultaneously.

Ensemble classifiers

The classifiers that we have discussed thus far built a single model to predict every possible outcomes in the data stream. The issue with this approach is the implicit

assumption that the training data and the testing data shared a similar distribution. While this assumption is arguably reasonable, it contradicted with the assertion that a data stream's distribution and its characteristics do evolve over time. Consequently, it was argued in Wang,^[70] Fan^[71,72] and Gao^[73] that a better model is to have a number of classifiers working on the same data stream where the results among the classifiers are combined to give a prediction. This led to the development of a generic framework to discover concept drifting data streams using weighted ensemble classifiers.

In Wang et al.'s^[70] framework, the set of classifiers may be a combination of models, e.g., decision trees, Naive networks, Ripper, etc., learnt using different techniques or algorithms. The ensemble of classifiers will build the top k -classifiers that can learn with the best accuracy. To do so, the data stream is processed in "chunks." When a chunk of data points arrives, a new classifier is created for that chunk. At the same time, the same chunk is used to update the weights of the older classifiers. The weight of each classifier is updated based on the expected error of that classifier in predicting the data points in the new chunk. Often, this weight is inversely proportional to the error value. The top k -classifiers that gave the most accurate prediction are chosen into the ensemble.

This approach has the advantage that it can produce a better prediction than the single classifier approach.^[67] The disadvantage lies in the complexity of maintaining the set of k classifiers. Furthermore, the results are often sensitive to the size of the data chunk and the number of classifiers in the ensemble. Given that different types of classifiers are picked in the ensemble, trying to identify the proper parameter is often not easy—especially when the data stream is concept drifting.

StreamMiner

StreamMiner^[71,72,74] is a classifier system that can detect and learn changing in data streams automatically. The system relies on the decision tree model. There are two types of changes that StreamMiner can learn: concept drift and distribution drift.

Different from other learning systems, StreamMiner does not need the labeled data in new data stream immediately. It only needs when the change is detected. To identify the change, it bases on statistically estimated loss measures. In detail, firstly, the model based on the decision tree is built from a training data set. When processing new stream data, the system compares the statistical value at each leaf in the tree to detect the change. Let dt be a decision tree constructing from training data set D ; and S be a data stream. Each instance in S is classified by a unique path from the root to some leaf node. Assume that n is the number of instances classified by leaf ℓ ; and N is

the size of the data stream seen so far. The statistics at leaf ℓ is defined as

$$P(\ell) = \frac{n_\ell}{N} \quad (2)$$

Clearly, the sum of $P(\ell)$ overall leaf nodes in the tree dt is equal to 1, i.e., $\sum P(\ell) = 1$. The $P(\ell)$ describes how the instance space of the stream S is shattered among the leaf nodes solely based on attribute test results of the given decision tree dt . It does not consider either the true class labels or attributes that are not tested by dt . Now the statistical difference between the training data set D and the stream data S can be identified. This value will be reflected in $P(\ell)$ as follows

$$PS = \frac{\sum_{\ell \in dt} |P_S(\ell) - P_D(\ell)|}{2} \times 100 \quad (3)$$

where

$PD(\ell)$ is statistics at leaf ℓ on the training data set D

$PS(\ell)$ is statistics at leaf ℓ on the data stream S .

This PS is called the *error rate* or *guessed loss* of the model on the new stream data. Therefore, this approach does not need the labeled data in the data stream for identifying the change. Instead, it compares statistical difference at each leaf node in the model. If this PS value is much higher than an application-specific tolerable maximum value, a small number of data records in the new data stream is chosen to investigate their true class labels. This means, only after "guessing" there are some changes in the data stream that the model may not be suitable, the system needs to identify true labels of some samples in the new streaming data. With these true class labels, the true loss of current decision tree is statistically estimated. If this value is also higher than the tolerable maximum value, the decision tree should be reconstructed by using the same true class labels sampled in the previous step. This system has been tested and used for credit card fraud detection applications.

CONCLUSIONS

It might appear to some readers that data stream problems are very much restricted to a few application domain and thus, the solutions may not deliver an impact on a larger scale. For example, it is probably easier to see the value of a clustering algorithm on any data applications over a clustering algorithm in the data stream environment that is restricted to only a few specific applications. In our opinion, this view does not do justice to the solutions brought about by data stream problems.

Regardless of the application, we are witnessing an exponential growth in the amount of data to be processed. And that has kept the data mining and database

community working on better algorithms to process the larger volume of data. If we consider the bigger picture of data analytics, the larger data set affects not just analytical times but also the ease at which the analytics can be presented and interpreted by the analyst. Since it has been known that data mining is an iterative and interactive process, the analyst will require multiple runs of the algorithm with different parameters. Consequently, the exact results may not be paramount during analysis, and improvements in the level of interactivity between the algorithm and the analyst is often preferred.

In other words, the analysis of data usually begins with the analyst forming a hypothesis and so, the algorithms are run with parameters to obtain analytics that verifies that hypothesis. In most cases, this process would involve fine tuning of the algorithm's parameters as the analyst tries to zero in on the results. Therefore, the intermediate results during the process serve more to give directions to the analyst rather than giving the answer to the hypothesis. If so, the analysis would be more productive if the analyst's chain of thoughts are not broken, and that the analyst does not have to wait for the algorithm.

This is where the techniques brought about by data stream problems can be useful. Since data stream algorithms process data far more quickly than conventional algorithms and give an estimate in real time, the level of interactivity is much higher between the algorithm and the analyst within the same time period. Therefore, we argue that the analyst is likely to zoom in on the right results far more quickly than using conventional algorithms.

It is on this basis that we believe data streams algorithms might be the way future data mining algorithms are developed. The amount of data will continue to grow larger although they might not necessarily become data streams. However, when the data set is sufficiently large, the benefits of data stream techniques will no doubt become useful.

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Knowledge Management

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Abstract

Knowledge management (KM) is defined as a deliberate and systematic coordination of an organization's people, technology, processes, and organizational structure in order to add value through reuse and innovation. There is a lack of consensus on clearly defining KM partly due to the multidisciplinary origins of the concept, ranging from organizational science, to cognitive science, to library and information science. Core management concepts include the notion of difficult to articulate tacit knowledge, documented tangible or explicit knowledge, organizational learning as encapsulated in the form of best practices (successes) and lessons learned (failures), and preservation of this content in an organizational memory system. The knowledge processing life cycle then consists of creating new knowledge; capturing existing knowledge; contributing knowledge for reuse by others; documenting knowledge; reconstructing, refining, and sharing knowledge; and continually evaluating the value of each knowledge resource in order to decide whether to keep it in circulation or to retire it from "active duty." The Nonaka and Takeuchi knowledge spiral model is used to illustrate how knowledge is transformed from one form to the other. A brief historical overview of KM is presented to show the evolution from a management fad to a scholarly discipline of study and research. Finally, the emerging roles for information professionals in this field are briefly described, outlining some of the key roles such as chief knowledge officer, knowledge manager, content editor, and knowledge journalist.

INTRODUCTION

This chapter provides an overview of knowledge management (KM), both as a scholarly discipline and a professional field of practice. Key terms such as "knowledge" and "knowledge management" are defined. Core concepts such as intellectual capital, lessons learned, best practices, and value-added knowledge reuse are introduced and defined. Key stages in the knowledge processing cycle are defined and described. A brief historical chronology of KM is outlined to show the multidisciplinary roots and the evolution that has taken place to date. The emerging roles for information professionals in KM are presented, and the links to information studies are emphasized. The primary goal of this chapter is to illustrate how KM that rests on a solid foundation of information management emerges as a stronger and more rigorous field of study and practice.

DEFINITION OF KNOWLEDGE MANAGEMENT

There is no universally accepted definition of KM. Part of this stems from the fact that there is a lack of consensus in defining knowledge. A sample dictionary definition of knowledge is

"the fact or condition of knowing something with familiarity gained through experience or association; acquaintance with or understanding of a science, art, or

technique; the fact or condition of being aware of something; the range of one's information or understanding (e.g., answered to the best of my *knowledge*); the circumstance or condition of apprehending truth or fact through reasoning; the sum of what is known: the body of truth, information, and principles acquired by humankind; cognizance, awareness, learning."^[1]

It is useful to view the knowledge in KM as being composed primarily of experiential knowledge that is highly subjective in nature. This can be contrasted with information which, although subject to different interpretations, is typically thought of as having a more neutral and verifiable nature. The same dictionary defines information as

"knowledge obtained from investigation, study, or instruction; intelligence, news data or facts; the attribute inherent in and communicated by one of two or more alternative sequences or arrangements of something (as nucleotides in DNA or binary digits in a computer program) that produce specific effects c 1: a signal or character (as in a communication system or computer) representing data 2: something (as a message, experimental data, or a picture) which justifies change in a construct (as a plan or theory) that represents physical or mental experience or another construct."^[1]

Other definitions from the KM literature include the following:

"Knowledge is a subset of information: it is subjective; it is linked to meaningful behaviour; and it has tacit

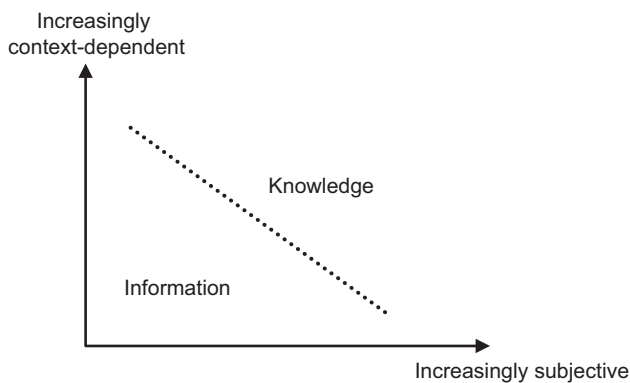


Fig. 1 Key attributes of knowledge assets.

elements born of experience”(Leonard and Sensiper,^[2] p. 113).

Knowledge is always recreated in the present moment. Most of us cannot articulate what we know. It is largely invisible, and often comes to mind when we need it to answer a question or solve a problem.^[3]

“Knowledge is a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices and norms” (Davenport and Prusak,^[4] p. 5).

A typical example of information would be to read the listings of movies being shown on a given week, reading the reviews, and consulting the times and places the film will be showing at. An example of knowledge would be calling on a friend who has, in the past, demonstrated an uncanny inverse relationship with respect to likes and dislikes: if this person liked a movie, experience has shown that I would hate it and vice versa. Knowledge is also brought into play in making a decision to drive or take public transport, given the time of year, possibility of inclement weather, and the rapid trend analysis that concludes that it was never possible to find parking in time to see a movie being shown downtown.

A key point is that not all information is of value to a given individual, group, or organization. A knowledge asset is defined as knowledge that is of value, which is more context dependent and more subjective in nature, as illustrated in Fig. 1.

The Multidisciplinary Nature of Knowledge Management

There is a great diversity to be found in KM definitions. This is due to the multidisciplinary nature of the field. In fact,

Table 1 Diverse disciplines that contribute to knowledge management

1.	Organizational development, organizational science, organizational learning
2.	Cognitive science, individual learning, mental models
3.	Linguistics and computational linguistics
4.	Information technologies such as knowledge-based systems, document and information management, electronic performance support systems, and database technologies
5.	Information and library science, classification, taxonomy
6.	Technical writing and journalism
7.	Anthropology and sociology, sociograms, social network analysis
8.	Education and training
9.	Storytelling and communication studies
10.	Collaborative technologies such as CSCW and groupware, as well as intranets, extranets, portals, and other web technologies

most definitions appear to provide only one piece of the KM definition puzzle, as they are heavily influenced by their particular discipline. Table 1 lists some of the different disciplines that have contributed to and that make use of KM.

Here are a few sample definitions from the business perspective:

Knowledge management is a business activity with two primary aspects: treating the knowledge component of business activities as an explicit concern of business reflected in strategy, policy, and practice at all levels of the organization and making a direct connection between an organization’s intellectual assets—both explicit (recorded) and tacit (personal know-how)—and positive business results.^[5]

Knowledge management is a collaborative and integrated approach to the creation, capture, organization, access, and use of an enterprise’s intellectual assets.^[6]

“There is much more to knowledge management than technology alone. Management is a business process” (Sarvary,^[7] p.95).

Some definitions from the cognitive science or knowledge science perspective are as follows:

Knowledge—the insights, understandings, and practical know-how that we all possess—is the fundamental resource that allows us to function intelligently. Over time, considerable knowledge is also transformed to other manifestations—such as books, technology, practices, and traditions—within organizations of all kinds and in society in general. These transformations result in cumulated (sic) expertise and, when used appropriately, increased effectiveness. Knowledge is one, if not *the*, principal factor that makes personal, organizational, and societal intelligent behavior possible.^[8]

Some sample definitions from the process/technology perspective are the following:

Knowledge management (KM) was initially defined as the process of applying a systematic approach to the capture, structuring, management, and dissemination of knowledge throughout an organization to work faster, reuse best practices, and reduce costly rework from project to project.^[9–11]

APQC^[12] defines KM as systematic approaches to help information and knowledge emerge and flow to the right people at the right time to create value.

Some “people-oriented” definitions are as follows:

“Knowledge management is not seen as a matter of building up a large electronic library, but by connecting people so they can think together” (McDermott,^[13] p.104).

“Most executives seem to understand that knowledge is highly people-based, but they are stuck with an investment model that is geared primarily toward technology implementations” (Ruggles and Holtshouse,^[14] p. 86).

Wiig^[13] also emphasizes that given the importance of knowledge in virtually all areas of daily and commercial life, two knowledge-related aspects are vital for viability and success at any level. These are knowledge *assets* that must be applied, nurtured, preserved, and used to the largest extent possible by both individuals and organizations and knowledge-related *processes* to create, build, compile, organize, transform, transfer, pool, apply, and safeguard knowledge—must be carefully and explicitly managed in all affected areas.

“Historically, knowledge has always been managed, at least implicitly. However, effective and active knowledge management requires new perspectives and techniques and touches on almost all facets of an organization. We need to develop a new discipline and prepare a cadre of knowledge professionals with a blend of expertise that we have not previously seen. This is our challenge!” (Wiig^[8]).

The Intellectual Capital Perspective

The focus of Intellectual Capital Management (ICM), on the other hand, is on those pieces of knowledge that are of *business value* to the organization—referred to as intellectual capital or assets.^[15] While some of these are more visible (e.g., patents, intellectual property), the majority consists of know-how, know-why, experience, and expertise that tend to reside within the head of one or a few employees.^[16,17]

KM is often characterized by “pack rat” approach to content: “save it, it may prove useful some time in the future.” Many documents tend to be warehoused, sophisticated search engines are then used to try to retrieve some of this content, and fairly large-scale and costly KM systems are built. KM solutions have proven to be most successful in the capture, storage, and subsequent dissemination of knowledge that has been rendered explicit—particularly lessons learned and best practices.

ICM is characterized by less content—because content is filtered and judged and only the best are inventoried (e.g., the “top ten”). ICM content tends to be more representative of peoples’ real thinking (contextual information, opinions, stories) due to its focus on actionable knowledge and know-how, resulting in less costly endeavors and a focus on learning (at the individual, community, and organizational level), rather than on the building of systems.

It is essential to identify that knowledge is of value and is also at risk of being lost to the organization, through retirement, turnover, and competition. The best way to retain valuable knowledge is to identify intellectual assets and then ensure legacy materials are produced, and subsequently stored in such a way as to make their future retrieval and reuse as easy as possible.^[18] These tangible by-products need to flow from individual to individual, between communities of practice (CoPs) members, and, of course, back to the organization itself, in the form of lessons learned, best practices, and corporate memory.

The knowledge capture and transfer approaches described here thus help to

- Facilitate a smooth transition from those retiring to their successors who are recruited to fill their positions
- Minimize loss of corporate memory due to attrition and retirement
- Identify critical resources and critical areas of knowledge so that the corporation “knows what it knows and does well—and why”
- Build up a toolkit of methods that can be used with individuals, with groups, and with the organization to stem the potential loss of intellectual capital

Knowledge management is often mistakenly perceived as a process of documenting knowledge held in people’s minds, then storing or archiving this knowledge.^[19] In fact, it is better to view KM in a broader context, one that encompasses all the processes used to generate value from knowledge-based assets. Knowledge management is facilitated by technology and by the culture of an organization. A good way of defining KM is

...the deliberate and systematic coordination of an organization’s people, technology, processes and organizational structure in order to add value through reuse and innovation. This is achieved through the promotion of creating, sharing and applying knowledge as well as through the feeding of valuable lessons learned and best practices into corporate memory in order to foster continued organizational learning. (Dalkir,^[20] p. 3)

CORE KNOWLEDGE MANAGEMENT CONCEPTS

Kransdorff^[21] coined the term “corporate amnesia” to refer to the loss of accumulated expertise and know-how

due to employee turnover as people take what they know with them when they leave. The costs of employee turnover to the organization have been well documented (e.g., separation costs, recruitment and selection costs, training of replacements, initial lack of productivity of new hire, and the loss of productivity of co-workers during the transition). Far less research attention has been paid to the cost to the firm of losing know-how that resides within the minds of individual employees who depart. In an era of knowledge workers, learning organizations and service economies individuals are increasingly responsible for value creation. Although many organizations have succession plans in place, the process usually involves transferring know-how from the departing employee to their successor, but the whole process has to be repeated again for the next departure. Organizations need to “capture” this know-how and transfer it to a stable, easily accessible, cumulative knowledge base—an organizational memory—to retain and make accessible valuable knowledge gained through the experiences of all knowledge in a continuous and uninterrupted manner.

Organizations need to effectively manage their organizational memory in order to prevent the loss of essential knowledge, particularly knowledge that resides predominantly in the heads of their knowledge workers (“tacit knowledge”) and less in documents, procedures, and other tangible forms (“explicit knowledge”).^[22] More often than not, it is this difficult to articulate “know-how” that is of greatest value in organizational competitiveness and viability and which represents the vast majority of experiential know-how. Fig. 2 shows how the metaphor of an

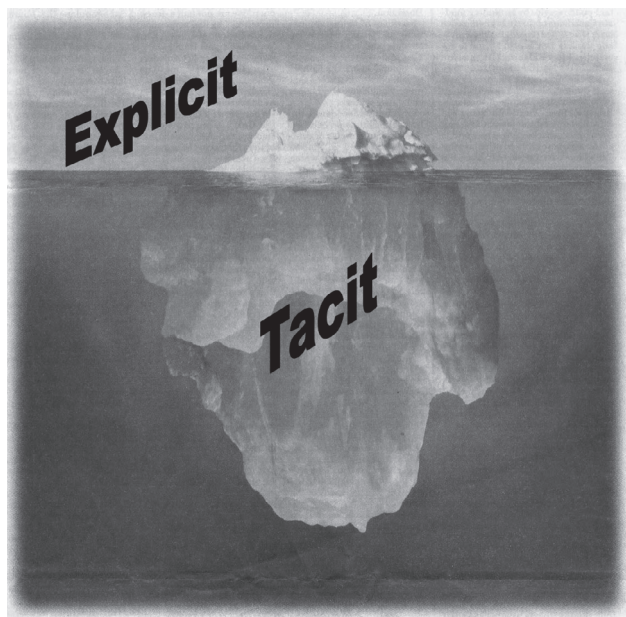


Fig. 2 The iceberg metaphor used to show the respective proportions of tacit and explicit knowledge.

iceberg is often used to depict tacit and explicit knowledge forms.

The National Aeronautics and Space Administration (NASA), for example, has publicly admitted that the knowledge of how to put a man on the moon has been lost.^[23] The lessons that were learned and the innovations that were sparked cannot be found in the collective organizational memory of NASA. This means that NASA’s organizational memory cannot be used as a resource to plan a more effective mission to send another manned flight to the moon or to Mars. A well-designed and well-managed organizational memory does not only combat corporate amnesia, but it ensures knowledge continuity—the effective transfer of know-how among peers and to future generations of knowledge workers. A better understanding of the nature of organizational memory, what it should include (content), how it can best be retained (technological containers), and how the accumulated lessons learned and best practices can be used by newcomers (connections) will help mitigate the cost of lost, forgotten, or untransferred knowledge and know-how.

Organizations today face escalating risks of losing strategic knowledge and know-how and face incredible difficulties in recruiting and retaining skilled employees. Many industries face astounding rates of high and constant turnover. In addition, we are experiencing a demographic pressure as baby boomers are rapidly approaching the retirement age, which means that a “critical mass” of knowledge will literally walk out the door over the next 5–10 yrs. Approximately, 11,000 baby boomers are turning 50 yrs old every day.^[24] In the Canadian federal government, for example, 15,000 civil servants are expected to retire within the next 5 yrs.^[25] In the United States, more than 50% of the government workforce will be eligible for retirement by 2004.^[28] Other vulnerable include organizations high technology companies with very high turnover rates and the military or banking, where constant turnover is the norm given rotational postings. Since 2007, “...the total, the number of people not in the labor force rose by 12.6 million (16%) from the fourth quarter of 2007 to the fourth quarter of 2013.”^[27] The aging of the workforce is a trend that does not show any signs of slowing down: “America is getting older, a trend that will undoubtedly continue to have a profound impact on the labor market going forward.”^[28]

The most successful organizations will state that their two greatest assets are the people who work for them and the knowledge they possess. The imminent turnover signals a potential for the loss of valuable accumulated knowledge and know-how in the form of the competence and expertise possessed by the departing individuals. This valuable knowledge and know-how exists in both formal and tangible forms, such as documents, but also in less visible forms—often referred to as tacit or difficult to articulate knowledge. Particular emphasis must be placed on the tacit form as this often resides within a given individual or group and is therefore more

easily and completely lost when the people leave the organization.^[29]

The typical technological tools used in KM are some form of centralized database system, an intranet or web portal to access the database content, as well as other organizational knowledge, some type of messaging system (typically e-mail and discussion groups), some content management tools to organize the knowledge resources (e.g., content management software, taxonomy software), and some form of collaborative software (e.g., virtual meeting tools, groupware).

The essential elements that go into organizational memory include best practices, which are innovations or improved practices, processes and so forth; together with the flip side of the coin: lesson learned, outcomes that were not desirable, or errors that should not be repeated. By carefully capturing, documenting, organizing, and making available accumulated experiential knowledge in the form of best practices and lessons learned, KM can provide a framework within which we can process knowledge throughout its useful life cycle.

Knowledge management typically addresses three levels within an organization: the individual, the group, and the organization. Organizational memory resides at the level of the organization, and this is the preservation layer of KM. Innovation and knowledge creation occurs at the individual level, while knowledge dissemination and sharing occur at the group level. In KM, groups of a particular nature, called “communities of practice”, are often a key element in ensuring that valuable knowledge flows or moves around appropriately. These CoPs are essentially thematic networks of like-minded individuals who share a common purpose, a common professional zeal, and agree to mutually help out one another to achieve some strategic goals for the organization.^[30,31]

Szulanski^[32] introduced the notion of knowledge “stickiness” to refer to knowledge that was difficult to move around and thus could provide little in the way of value to individuals, groups, or the organization as a whole. The knowledge processing cycle is used to describe the various stages a particular knowledge resource goes through during the course of its “life span” within an organization.

THE KNOWLEDGE PROCESSING CYCLE

Nonaka and Takeuchi described how knowledge was disseminated and transformed as it made its way around an organization in their knowledge spiral model.^[9] Essentially, knowledge is created by an individual, who has an innovative idea, for example, but remains initially tacit. This innovation or idea is typically shared only with trusted friends and colleagues at first (“socialization”). With time, others may be aware of the innovation, and the knowledge may be transformed from its tacit state to

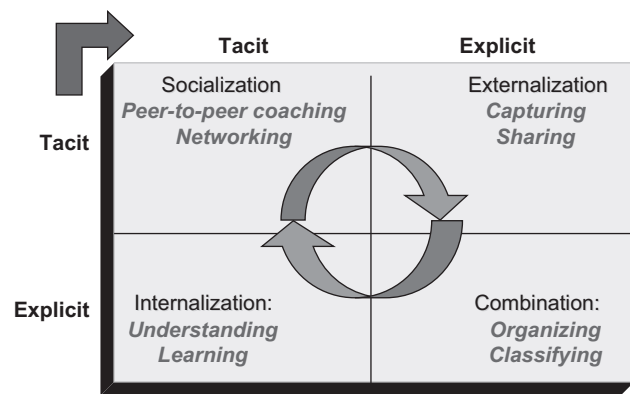


Fig. 3 The Nonaka and Takeuchi knowledge spiral model of KM.

an explicit one (“externalization”), by documenting it in the form of text, audio, or other formats. Once explicit, it is easier to disseminate more widely and to preserve in an organizational memory system. At this stage (“combination”), the content may be better organized and reworked (e.g., addition of an abstract or executive summary). In the final stage (“internalization”), explicit knowledge once again becomes tacit as an individual learns, understands, and “buys into” a knowledge resource (e.g., sees its value and decides to apply this new knowledge). The knowledge resource then continues cycling through the four quadrants in a “knowledge spiral.” Fig. 3 outlines the major stages in the Nonaka and Takeuchi KM model, as knowledge is transformed, disseminated, and applied within an organization.

As knowledge resources circulate throughout an organization, value can be added at each step. A more detailed view of what happens to knowledge as it undergoes transformation from tacit to explicit and back again is provided in the form of a knowledge life cycle. The first stage is to either capture existing knowledge (e.g., already existing in tangible form such as project reports, conference reports, or other documents) or to create knowledge that does not yet exist in documented form (e.g., by interviewing subject matter experts to document a particular procedure). This knowledge resource can then be contributed or made available for reuse by others. Knowledge is then codified by the addition of sufficient descriptive information about both the content and the format it is in (e.g., metadata describing theme, whether it is a text or also available as a short video clip). At this point, knowledge is further refined by sanitizing (removing all sensitive information that may identify a person, place, or event or other confidential content) and reconstruction (e.g., recombining or synthesizing in a new version). Contributions that have been refined and reconstructed are then subjected to a selective filtering process, and those that are deemed to be valuable are made available for knowledge sharing.

Table 2 Key steps in a knowledge processing cycle

Step number	Description
1.	Knowledge capture
2.	Knowledge creation
3.	Knowledge contribution
4.	Knowledge codification
5.	Knowledge refinement (including sanitize) and reconstruction (e.g., synthesis)
6.	Knowledge selection—filter contributions
7.	Knowledge sharing and pooling
8.	Knowledge organization and access
9.	Knowledge learning and application
10.	Knowledge evaluation and reuse or divest (e.g., destroy, archive)

Knowledge sharing involves the pooling and distribution of valuable content, either globally (e.g., a “broadcast” mode) or selectively (e.g., targeted to specific users, communities, or based on user profiles, and subscriptions). The knowledge is better organized (classified using a taxonomic scheme), and access is typically provided through an intranet or portal interface. These valuable knowledge resources are then learned and applied by knowledge workers. Each knowledge resource is evaluated periodically in order to ensure continued relevance and to decide whether to discard or to archive at the appropriate time. Table 2 lists the key phases in knowledge processing that occurs during the useful life cycle of a knowledge resource, such as a best practice or lesson learned.

A more recent review of existing KM life cycle models^[33] compared and contrasted the different approaches. A number of different terms were found to be used for essentially the similar types of knowledge processing activities. The result of this analysis led to the formulation of a holistic KM life cycle model with seven core steps: *identify, store, share, use, learn, improve, and create*. One of the major advantages of this framework is that it builds upon existing frameworks and adds in the notion of double loop learning in order to capture the nonsequential or cyclical nature of knowledge processing. The key KM objectives of reuse for efficiency are also complemented by the goals of learning to continually improve, at the individual, group, and organizational levels.

HISTORY AND EVOLUTION OF KNOWLEDGE MANAGEMENT

Knowledge and management are concepts that have obviously been around for some—the combination, “knowledge management,” however, is fairly recent. The emergence of communication technologies that create real-time networks such as the Internet, intranets, e-mail, and so forth has made KM easier to implement.^[34]

A number of management theories have contributed to the definition of KM. Two KM gurus were responsible for establishing the field as a serious target for scholarly study: Peter Drucker,^[35] who coined the term “knowledge worker” and who wrote about KM from a management perspective in the 1970s, and Nonaka and Takeuchi, who wrote the seminal book *The Knowledge Creating Company* in the 1990s.^[9] Others such as Peter Senge^[36] and Chris Argyris^[37,38] have focused on the “learning organization” and cultural dimensions of managing knowledge. By the mid-1980s, the notion of knowledge as an asset became more widely adopted. Early pioneers in information technologies from artificial intelligence and expert systems at Carnegie Mellon University (CMU) and Digital Equipment Corporation (DEC) developed hypertext and groupware tools that allow information to be better shared and organized. Knowledge management-related articles began appearing in prestigious journals such as the *Harvard Business Review* and *Organization Science*, and a number of foundational books were published such as *The Fifth Discipline* and *The Knowledge-Creating Company*. Table 3 illustrates the major milestones in KM history.

In 1989, the International Knowledge Management Network (IKMN) was founded in Europe and was joined by the U.S.-based Knowledge Management Forum in 1994. Businesses began implementing KM solutions in earnest in the 1990s. At first, projects tended to be technological implementations, mostly portals and knowledge repositories. This was followed by a wave of “people-not-technology” emphasis that led to the popularity of thematic networks or CoPs. A third wave emerged as knowledge workers, much like information workers, found themselves faced with “content overload” that in turn led to a number of content management, knowledge organization, or taxonomic classification projects to make the knowledge more readily accessible to users.

Table 3 Major milestones in KM history

Year	Source	Event
1980	DEC, CMU	XCON Expert System
1986	Dr. K Wiig	Coined KM concept at UN
1989	Consulting firms	Start internal KM projects
1991	HBR article	Nonaka and Takeuchi
1993	Dr. K Wiig	First KM book published
1994	KM Network	First KM conference
Mid-1990s	Consulting firms	Start offering KM services
Late 1990s	Key vertical industries	Implement KM and start seeing benefits
2000–2003	Academia	KM courses/programs in universities with KM texts
2004–present	Professionalization of KM	Professional certification in KM, master’s and PhD degrees in KM conferred by universities, and KM job titles in a broad range of sectors

With the new millennium, KM faded a bit from public view, likely due to disappointment as expectations were raised too much by “KM hype” and focusing too much on technologies that were largely left untouched. Practitioners and researchers came to the realization that converting theory into practice was more challenging than previously thought. Some of the missing elements were ensuring that KM was not being done for KM’s sake, but that there was a clear link to organizational objectives and that all participants saw value in KM (e.g., incentives for knowledge sharing). By 2004, the field had finally shaken its burden of being yet another management fad. Organizations appreciated the holistic nature of KM and paid attention not only to tools but to organizational culture requirements for successful KM solutions.

In parallel, the nature of work evolved, with collaboration becoming the default rather than the exception, not only for our professional lives but for social interactions and learning objectives. Knowledge sharing with a group of trusted peers has become the de facto way of working, learning, and living. Knowledge management found itself in tune with these changes, which greatly facilitated its adoption as a philosophy, a mindset, a strategic perspective, and a way of interacting to create, share, and use valuable content.

Knowledge management today is being taught in top universities around the world, typically in business, computer science, education, and information studies departments. Doctoral students are completing PhD theses on KM topics. International conferences are being held around the world, with both practitioner and researcher tracks. A number of consortia and KM professional organizations have been established. The number and type of KM journals has also changed. While at first publications were primarily authored by KM tool vendors and practitioners, there has been a significant shift to more scholarly venues and publications that represent KM research rather than KM project mandates. Along with the proliferation in the number of journals, there has also been increasing specialization (e.g., *International Journal of Nuclear Knowledge Management*), more interdisciplinary journals (e.g., *Interdisciplinary Journal of Information, Knowledge and Management*), and more emphasis on international KM (e.g., *International Journal of Knowledge Management*). Up until about the year 2000, only non-peer-reviewed journals were available (e.g., *KMWorld*, *Knowledge Management Review*). Some of the major peer-reviewed KM journals available today are shown in Table 4, ordered by the first year of publication.

KM is found in all vertical industry sectors (e.g., banking, pharmaceutical), in all sizes of organizations (including volunteer-run associations with less than ten full-time employees), profit and nonprofit organizations, and organizations with a strong hierarchical structure (e.g., the U.S. military was one of the early pioneers of KM). Organizations today are defined and staffing KM positions. KM

is increasingly perceived as an element that cuts across organizational structures, projects, and silos—it enjoys a status similar to that of “quality assurance” or “ethics” and it has become a critical element of organizational viability. KM is no longer something interesting to explore—it has become subsumed in the way in which individuals, groups, and organizations work, learn, and remember.

EMERGING ROLES FOR INFORMATION PROFESSIONALS

The KM field has transformed from one led primarily by consultants and other KM practitioners to a bona fide discipline, with a distinct body of knowledge. This has been paralleled by the growing number of academic programs that offer KM as compared to the predominately private sector training that had been the only way to learn about KM up until now.^[39] TFPL^[40] is a specialist recruitment, advisory, training, and research services company

Table 4 Major peer-reviewed knowledge management journals

Journal title	Year founded
<i>IBM Systems Journal</i>	1962
<i>Journal of Managerial and Organizational Learning</i>	1970
<i>International Journal of Management Information Systems</i>	1984
<i>Journal of Organizational Change Management</i>	1989
<i>Knowledge and Process Management</i>	1996
<i>Journal of Knowledge Management</i>	1997
<i>Journal of Management Studies</i>	1997
<i>Journal of Knowledge Management Practice</i>	1998
<i>Journal of Intellectual Capital</i>	2000
<i>E-Journal of Organizational Learning and Leadership</i>	2002
<i>Journal of Information and Knowledge Management (JIKM)</i>	2002
<i>Electronic Journal of Knowledge Management</i>	2003
<i>International Journal of Knowledge, Culture and Change Management</i>	2003
<i>Knowledge Management Research and Practice</i>	2003
<i>An Interdisciplinary Journal of Storytelling Studies</i>	2004
<i>International Journal of Nuclear Knowledge Management (IJNKM)</i>	2004
<i>International Journal of Knowledge Management</i>	2005
<i>Knowledge Management for Development Journal</i>	2005
<i>International Journal of Knowledge Management Studies</i>	2006
<i>Interdisciplinary Journal of Information, Knowledge and Management (IJKM)</i>	2007
<i>Knowledge Management and E-Learning: An International Journal</i>	2009
<i>International Journal of Knowledge Management and Information Technology</i>	2012
<i>The Online Journal of Applied Knowledge Management</i>	2013

with offices in London focusing on KM, library and information management, records management, and web and content management. Since 1987, TFPL has worked with organizations in both public and private sectors to help them develop and implement knowledge and information strategies and to recruit and train information and knowledge leaders and their teams. TFPL has drafted a KM skills and competencies guide to provide a clear and practical overview of KM skills and competencies that draws on the practical experience of organizations in a wide range of sectors and with varying approaches to KM.

In general, these KM skills include

- Time management to use their time and energy effectively for acquiring
- Knowledge (spending all day surfing the net is probably counterproductive)
- The use of different learning techniques to absorb key knowledge and learning quickly
- Effective skills of advocacy and inquiry to present knowledge to, and gather knowledge from, others
- Informal networking skills to build one's influence to gain access to people with knowledge
- Resource investigation skills
- Effective IT skills for recording and disseminating information
- Skills of cooperative problem solving
- Open dialog skills
- Flexibility and willingness to try new things and take educated risks
- Active review of learning from mistakes, risks, opportunities, and successes

The TFPL KM skills map^[41] is based on an extensive international research. The project team contacted over 500 organizations involved in implementing KM and identified the roles that they had created, and the skills that were needed in those roles, and the additional skills that were required across the organization. These key skills included an understanding of the KM concept—the philosophy and theory—and an awareness of the experience of other organizations in developing KM solutions and approaches an understanding of, and the ability to, identify the business value of KM activities to the organization, an appreciation of the range of activities, initiatives, and labels that are employed to create an environment in which knowledge is effectively created, shared, and used to increase competitive advantage and customer satisfaction.

KM roles are quite diverse and include such categories as senior and middle management roles: chief knowledge officer who ensures that KM goals are in line with organizational strategies and objectives; chief learning officer who ensures that the organization acts like a learning organization, improving over time with the help of accumulated best practices and lessons learned; and knowledge managers who are typically responsible for the acquisition

and management of internal and external knowledge. Other roles include

- Knowledge navigators, responsible for knowing where knowledge can be located, also called knowledge brokers
- Knowledge synthesizers, responsible for facilitating the recording of significant knowledge to organizational memory, also called knowledge stewards
- Content editors, responsible for codifying and structuring content, also called content managers; researchers, writers, editors—roles involving capturing and documenting knowledge
- Web developers, electronic publishers, intranet managers, and content managers
- Learning-oriented roles such as trainers, facilitators, mentors, and coaches—including those with responsibility for developing information and knowledge skills
- Human resources roles with specific responsibility for developing programs and processes that encourage knowledge-oriented cultures and behaviors
- Knowledge publishers, responsible for internal publishing functions, usually on an intranet, also called webmasters, knowledge architects, knowledge editors
- Coaches and mentors, responsible for assisting individuals throughout the business unit or practice to develop and learn KM activities and disciplines
- Help desk activities, including the delivery of KM and information related to training, also called knowledge support office

KM professionals require a multidisciplinary skillset that consists of such competencies as finding, appraising, and using knowledge, being able to reformulate questions, navigate through content, evaluate the relevance of content, filter out what is not needed, and synthesize from diverse sources in order to apply the knowledge (e.g., to make a decision). Last but not the least, they must contribute to the recording of such valuable experiences to organizational memory systems.^[42]

CONCLUSION

Knowledge management has assumed a greater priority due to the demographic pressures created by retiring baby boomers. Retirement en masse means a loss of valuable knowledge and know-how that has been accumulated by experience over the years. All organizations, regardless of type of industry, size, country, and so forth, will have to face the issue of knowledge continuity. Knowledge continuity is analogous to business continuity: while the latter targets data loss prevention due to disasters, the former targets knowledge loss due to turnover in personnel. Valuable knowledge must not only be preserved and transferred to future workers but also transferred across geographical

and temporal boundaries due to the fact that work today is spread out over networks that may extend beyond organizational boundaries. Knowledge management is the discipline and field of practice that will equip us with the necessary tools, processes, and skillset to ensure that knowledge reaches all knowledge workers so that they can carry out their work more efficiently and more effectively.

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Knowledge Management Systems

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Abstract

Knowledge management systems (KMS) are loosely understood as a type of information technology (IT) to support organizational knowledge management (KM) work. The challenge here is to understand first what KM is and then figure out how it can be supported by IT. This entry first provides a review of KM work and the critique it received. Then KMS are defined and analyzed through various well-used theoretical frameworks. The major challenges KMS are facing today are discussed and the entry ends with some hints on what may lie ahead.

INTRODUCTION

Knowledge management systems (KMS) refers to a class of information systems (IS) that is used to enhance knowledge and information transfer within an organization and to manage organizational knowledge.^[1] Although this statement seems straightforward, it is rather difficult to define what a KMS is, since it is still unclear exactly what should be included in the concept of knowledge management (KM). What is the difference between knowledge and information and can computer applications really deal with knowledge? Some have argued that computers can only process data, and certainly not knowledge.^[2] What, then, is a KMS and what role does it play in KM work? Before we can talk about *systems* for KM, we need a shared view of KM itself.

Is KM an emerging new discipline of its own or is it a topic that runs across several existing scholarly discourses? Throughout the years, there have been advocates of both positions. There are also commentators arguing that organizations have always been practicing KM-related activities so there is essentially nothing new to KM. This is no uncommon phenomenon but something that happens whenever new terminology is introduced. In the 1980s, Cronin asked whether information management had something new to offer or if it was just a new label for librarianship.^[3] Twenty or so years later, people ask the same thing about KM and KMS.

Whilst several voices claim that there is no consensus regarding what exactly knowledge management is or how it differs from information management, Davenport and Grover in their editorial comment on the 2001 Special KM issue of *Journal of Management Information Systems* (JMIS) concluded that KM as a *practical* phenomenon was here to stay but that *formal research* on the topic was lacking.^[4] A couple of years have passed since Davenport and Grover made this observation and today it is fair to say that KM has established itself as a research topic, as

reported elsewhere in this encyclopedia. Davenport and Grover continued by observing that IT support for KM, i.e., KMS, was seen as a useful but far from required resource by practitioners and scholars alike.

In the following text, we shall first look briefly at the history of KM and KMS before turning to the various theories underpinning this field. Thereafter, some of the most well-cited frameworks for KMS found in the IS literature are introduced to help the reader see what *types* of KMS are available. The ontological aspects of KMS are touched upon before finally discussing the challenges KMS are facing today.

ROOTS OF KM

It can be debated when and where KM started, since it depends on what discipline you examine. A large number of fields have clearly influenced the emerging KM discourse—e.g., sociology, human resource management, organization science, and IS research to name but a few. Many commentators would probably hold organizational learning as the one discipline that has had the perhaps most profound effect on the KM field.^[5,6] When it comes to KMS, though, the IS discipline has taken a leading role, since the development, implementation, and use of systems to informate and automate are central to the IS field.^[7]

Tiwana^[8] places the roots of KM in the 1950s management literature, whereas Maier^[6] traces the first instances of KM back to the studies of societal application of knowledge in the late 1960s and early 1970s. However, it was not until the late 1980s, through the writings of, e.g., Sveiby and Lloyd^[9] and Wiig,^[10] that the phenomenon started to receive more widespread attention. Nonaka and Takeuchi's book "The Knowledge Creating Company"^[11] is also an early landmark in organizational KM

literature and one of the most cited sources with almost 10,000 references in Google Scholar.

What propelled the development of KM as a new research discipline was the growing emphasis on knowledge work and knowledge workers as the primary source of productivity as opposed to assets such as land or capital.^[11] This view paved way for the knowledge-based perspective of the firm^[12] that suggests that the tangible resources of an organization generate value dependent on how they are combined and applied, which in turn depends on the organization's knowledge. This knowledge is deeply permeated in culture, procedures, routines, systems, and minds of the individual employees.

In the introduction of their 2001 paper, Alavi and Leidner note that it is not the existence of this knowledge per se that matters, but the ability to apply it and put it to use. To that end, advanced information technologies can be instrumental in effectuating the knowledge-based view of the firm by systemizing, enhancing, and expediting large-scale knowledge management.^[13]

CRITIQUE OF KM

Knowledge management as a research discipline has also received critique. Some have argued that it is no more than yet another exemplar in a long list of management fads that have come and gone over the years.^[2,14] In his critical analysis of KM, Wilson concludes:

[Knowledge management] is, in large part, a management fad, promulgated mainly by certain consultancy companies, and the probability is that it will fade away like previous fads.^[14]

Much of this skepticism stems from the fact that many consultancy firms and software vendors simply seemed to have renamed their old services and products, replacing the term "information" with the term "knowledge." Therefore, says Wilson:

[T]he confusion of 'knowledge' as a synonym for 'information' is one of the most common effects of the 'knowledge management' fad.^[14]

In addition to the fad debate, the KM discourse was also criticized for being "technology-driven." Comparing and contrasting the KM literature to that of organizational learning (OL), Swan et al. found that although the two disciplines are concerned with the improvement of organizational performance through knowledge development, i.e., human issues, only the OL literature focused on humans whereas the KM literature was predominantly occupied with tools and techniques.^[5] The emphasis on information technology in the KM literature resulted in people being marginalized to either "inputs to KM [...]"

or as constraints on its effectiveness [...]" (p. 673).^[5] Swan and colleagues argue that much of the richness of human relations is lost when KM is reduced to merely technology.

This distinction between technology-oriented and human-oriented approaches has a long tradition in organization science and goes back to at least the early 1980s. However, a more holistic understanding of KM that encompasses both these stances has developed, and much of the turf wars from the late 1990s have now abated.

THEORETICAL FOUNDATION

Much of the epistemology used in KM literature has been influenced by the separation of knowledge in a tacit and an explicit component. The notion of tacit knowing is attributed to philosopher Michael Polanyi but was introduced to the KM discourse by Nonaka and Takeuchi.^[11] Interestingly, the commonly used tacit-explicit distinction is not directly derived from Polanyi's work. Most commentators see explicit knowledge as knowledge that has been captured and codified into manuals, procedures, and rules, and is easy to disseminate. Tacit knowledge, on the other hand, is then knowledge that cannot be easily articulated and thus only exists in people's hands and minds, and manifests itself through their actions. In contrast, Polanyi does not make such a distinction. Instead, he envisions tacit knowing as the backdrop against which all understanding is distinguished.

While Polanyi speaks of tacit *knowing*, i.e., the verb, as a backdrop against which all actions are understood, Nonaka and Takeuchi use the term tacit *knowledge*, i.e., the noun, to denote particular type of knowledge that is difficult to express. This view has been criticized but due to the strong influence of Nonaka and Takeuchi's writings on the knowledge management discourse, this interpretation has been widely adopted. Amongst the critics are Tsoukas, who argues that tacit knowledge is *not* explicit knowledge internalized. Instead, tacit knowledge is inseparable from explicit knowledge since "[t]acit knowledge is the necessary component of all knowledge" (p. 14).^[15] According to Tsoukas the two are so inseparately related that to even try to separate the two would be to "miss the point." There had perhaps been less confusion had Nonaka instead used the term "implicit knowledge."

Tsoukas recognizes that the dichotomy between tacit and explicit knowledge and the taxonomies derived from this duality have advanced our understanding of organizational knowledge by showing its multifaceted nature. However, such typologies also limit our understanding by the inherent formalism that accompanies them. "The conceptual categories along which the phenomena are classified must be assumed to be discrete, separate, and stable. The problem is that they hardly ever are" (p. 14).^[15]

The tacit–explicit dichotomy has also taken other expressions. Choo suggests a differentiation between tacit, explicit, and cultural knowledge,^[16] and Spender suggests, in addition to tacit and explicit knowledge, individual and collective knowing.^[12] Blackler speaks of embodied, embedded, embrained, encultured, and encoded knowledge.^[17] Yet another derivative is the distinction between the community view and the commodity view. The community view sees knowledge as socially constructed and inseparable from the knower, whereas the commodity view holds knowledge as a universal truth, and as facts and collectable objects.^[18] Though several other ways to classify knowledge exist and have been suggested, they all, more or less, build on the tacit–explicit dichotomy.

DEFINITION OF KM SYSTEMS

Whereas most people agree that data and information may exist outside humans, supporters of the community view of knowledge have argued that knowledge can never be separated from the knower and thus never stored digitally.^[2,13] Computer support for knowledge management would thus be, in a sense, impossible. How can we then talk about KMS?

KMS is often employed as a catalyst or enabler of KM but such implementations should not be carried out without careful coordination with the required people-oriented activities needed. Alavi and Leidner note that while KM initiatives may not *require* tools, IT can certainly support KM in many ways, in particular in firms where the ratio of *knowledge workers* is high.^[13] Schultze defines a knowledge worker as someone who interacts knowledgeable with information and sees information not only as something derived from knowledge but as something that changes knowledge.^[19] There is thus a tight relationship between information and knowledge and it seems that any knowledge work needs to be supported by information technology.

As stated in the introduction, a KMS is an IS and IS and knowledge systems are thus not radically different; instead, there is a subtle yet important difference in the *attitude* towards and the *purpose* of the systems. Whereas an IS processes information without engaging the users, a KMS must be geared towards helping the users to understand and assign *meaning* to the information.^[13] The value of any given piece of information resides in the relationship between the information and the user's knowledge. This means that design of KMS should be based on an understanding not only of the information per se, but also of the context where the user develops the information need, and the analysis of the usage of the same information once it has been obtained and interpreted by the user.^[20]

Following Alavi and Leidner,^[13] a KMS should thus be understood as *a particular class of information systems*

developed specifically to support organisations in their attempt to create, codify, collect, store, integrate, share, and apply knowledge.

KMS THEORY

The theoretical foundation underpinning KMS vary considerably and are not easily detected but we can get a reasonably good picture by looking at Schultze and Leidner's classification of theoretical perspectives in KM-related IS research. Having reviewed six leading IS journals and thoroughly analyzed nearly 100 articles from 1990 to 2000, Schultze and Leidner showed that a vast majority or 70% belonged to the Normative Discourse, 25% could be labeled as Interpretative Discourse and only a handful of papers represented a Critical (or Dialogic) Discourse.^[21]

According to Schultze and Leidner's analysis, the normative discourse, which is characterized by a strive towards consensus from an a priori understanding of what the research problems are, typically assumes progressive enlightenment and increasing rationalisation, management, and control. IS research representing the normative discourse are thus concerned with "codification, normalisation of experience and the search for law-like relationships" (pp. 216–217).^[21] Much of the research focus on problem solving, and it creates "a problem space that can be decomposed in a logical, top-down fashion" (p. 221).^[21] Although both the research topics and the way knowledge is operationalised show great diversity, a common metaphor used within the normative discourse is that of knowledge as an asset. Researchers in this category typically view knowledge as a key driver of organizational efficiency and performance. Amongst the theories underpinning normative research, Schultze and Leidner mention innovation diffusion theory, absorptive capacity theory, and management cognition theory (p. 222).^[21]

The interpretative discourse, which also opts for consensus but from an emergent understanding of the organizational situation, emphasizes the social aspects of organizational life that has not been rationalized or systematized. IS research representing the interpretative discourse thus aims "to create a coherent, consensual, and unified representation of what the organisational reality is 'actually' like" (p. 217).^[21] and is typically targeted on work situations and organizational practices. Knowledge is therefore studied indirectly via its role in organizational transformation and how it is supported by various types of KMS. In this discourse, knowledge, technology, and organisational practice are all seen as socially constructed and dynamic, and the theories upon which interpretative research rests include organisational learning, communities of practice, activity theory, and bricolage (pp. 224–225).^[21]

It is evident that almost all KM-related IS research is consensus-oriented. There are, however, also those who apply a dissensus-oriented approach. Although Schultze and Leidner treat critical and dialogic as two separate discourses, I shall here use the critical discourse label to include both these perspectives, since both understand struggle, conflict, and tension as natural organizational states. Seen from this perspective, organizations are “sites of political struggle and fields of continuous conflict” (p. 217)^[21] and the objective of the research is thus to show that there is no coherent reality but different forms of domination and distortions. KMS (and other IT tools) are thus not to be understood as neutral, according to this perspective, but should be seen as instruments to make invisible work visible or to actively change social conditions. Schultze and Leidner call for more research in the critical discourse since this perspective allows the highlighting of the social inequities underpinning the distinction between service and knowledge work and the examination of contradictions in managing knowledge.^[21] The direct implications for KMS, however, are less obvious.

TYPES OF KMS AND ITS APPLICATIONS

As we saw earlier, many vendors tried to repackage their applications under the KM label at the end of the last millennium and a list of different KMS can therefore be made arbitrarily long. Instead of presenting a list of software that not all would agree upon, and, in addition, soon would be dated, it is more useful to examine three of the most referenced classification schemes for KMS and let them define the *various types of applications* that are possible. The frameworks are Hansen et al.’s *Codification vs. Personalization* from *Harvard Business Review* in 1999,^[22] Hahn and Subramani’s *Knowledge Residence and Level of Structure* from ICIS 2000,^[23] and finally Alavi and Leidner’s scheme from MISQ in 2001.^[13]

Codification vs. Personalization

An early framework for KM work (and hence for KMS to support that work) is found in Hansen et al.’s well-referred article from *Harvard Business Review*. Based on their studies of management consultancy firms, and implicitly building on Nonaka’s dichotomy of explicit and tacit knowledge, Hansen et al. divide knowledge management efforts into two different strategies; codification and personalization.^[22]

Companies where the KM strategy centers on codifying and storing knowledge into databases for easy dissemination and retrieval is said to follow a codification strategy. In such companies, computers have a central role in the strategy, as carriers of knowledge. Hansen et al. point to Ernst and Young as a company following

a codification strategy. Knowledge is harvested and coded into documents or other “knowledge objects” as an informant called them (p. 108),^[22] and these are thereafter stored in electronic repositories for later retrieval. Even though the codification process is laborious, Ernst and Young has dedicated staff members doing nothing else but codifying knowledge into documents—this approach allows for scaling up since the repositories are accessible for all employees worldwide and available around the clock. Once the object is put into the repository it can be used over and over again at a very low cost, provided it does not have to be modified. Companies using the codification strategy thus typically deal with problems where the same solution can be applied many times. The “economics of reuse” is what motivates the KM efforts in these companies, and the KMS used are typically document management systems and databases.^[22]

In contrast, when knowledge is tied to the individual that developed it and thus cannot be stored in a database, it has to be shared through face-to-face interactions. The role of the computers is thus to facilitate communication between people. Companies with this approach are said to follow a personalization strategy, and Hansen et al. mention McKinsey as a company in this category. In their company, knowledge emerges out of dialogues between individuals and their IT focus is thus to enable interactions between employees. Part of McKinsey’s KM strategy is to move people between offices to expand their networks. Even though face-to-face meetings are unequalled for sharing tacit knowledge, space and time distances may sometime prevent people from physical meetings. McKinsey thus engage e-mail and video conferencing equipment to communicate and allow employees tap into the expertise of their peers. Companies following a personalization strategy typically deal with unique problems that do not have clear solutions and where customized answers must be provided. In “experts economics” knowledge is tacit and cannot be systematized and made efficient. Instead, these companies charge much higher prices, and KMS used are expert finder systems and communications software.^[22]

Hansen et al. stress that companies should not try to combine these two strategies but, based on their business strategy, select one as their main KM strategy and merely use the other as a complementary strategy.

Knowledge Residence and Level of Structure

Adding another dimension to the tacit–explicit dichotomy, Hahn and Subramani present a framework for KMS by looking on the one hand at where the knowledge is said to reside (i.e., in artifacts or in people) and on the other hand to the extent to which knowledge is said to impose or

require an a priori structure. These axes form a two-by-two matrix hosting four different classes of KMS.^[23]

- One is where the system manages knowledge artifacts that has an inherent structure or where the system imposes a structure on the artifacts. Formal document repositories and data warehouses belong to this class.
- A second class also requires an a priori structure but manages links to knowledgeable people. A competence database intended to let employees find colleagues with specific skills falls into this class.
- A third class does not impose any structure in particular and assumes that knowledge is codified into artifacts. Intranets where Web pages and documents are found through full-text indexing search engines belong to this class.
- Finally, a fourth class again requires no structure but provides means for employees to identify and communicate with local experts. Discussion forums and e-mail Listservs are systems in this class.

Hahn and Subramani identify three interesting challenges regarding KMS. First, balancing information overload and potential useful content involves the size and diversity of both the users and the content. When the knowledge resides in artifacts, more items means higher chances of being able to find what you need. Also when human resources are required, more users increase the possibilities of finding a knowledgeable coworker. The down side is that more information also means more unrelated or useless information, and more users typically generate more interactions and more e-mails, which blurs the picture. For the same reason is diversity useful, and no problem in highly structured environments, but when structures and shared vocabularies are lacking, diversity can easily get overwhelming.^[23]

Second, balancing additional workload and accurate content addresses the issue of keeping KMS updated. Highly structured environments require considerable efforts to ensure the appropriateness of the structure, and this work often comes on top of the employees' ordinary work tasks. In more loosely structured systems motivation to share knowledge often comes in the form of higher social status. The downside is that those who contribute and earn a reputation may end up being occupied answering people's questions and helping colleagues instead of doing their jobs.^[23]

Third, balancing exploitation and exploration means being aware of the fact that reliance on existing solutions only may result in a competency trap.^[24] A system that supports the exploitation of existing knowledge may provide short-term benefits but in the long run be detrimental to the organization. At the same time, a system preoccupied with generating new knowledge may prevent organizational members from learning and adding to the collective experience that exists in the organization.

Hahn and Subramani suggest the KMS should consider including agent technology, collaborative filtering methods, advanced visualization tools, in order to address the above challenges.^[23]

Alavi and Leidner's Scheme

Without suggesting an explicit framework, Alavi and Leidner in their review of the literature discussing applications of IT to knowledge management efforts, identify three common approaches: Coding and sharing of best practice, Creation of knowledge directories, and Creation of knowledge networks [¹³, p. 114].

Coding and sharing of best practice is one of the most common applications of KMS, according to Alavi and Leidner. The term "best practice" is typically used to refer to a superior or exemplary practice that leads to superior performance. By collecting and codifying stories that mediate such practice, organizations can build KMS that stores and disseminates these experiences within the organization.

Creation of knowledge directories forms a second common class of KMS. Knowledge directories are also known as expert finder systems and aim at mapping the internal expertise of the organization. Alavi and Leidner report that 74% of the respondents in Gazeau's survey believed that their organization's most useful knowledge was not available in explicit form. When knowledge cannot be codified into artifacts, creating knowledge directories allows organizational members to benefit from the knowledge by being able to find and subsequently talk to the knowledgeable coworker.

Creation of knowledge networks is the third commonly used approach to KMS. Applications to first identify and then bring together (virtually or face-to-face) people from the same community of practice or those who share an interest has proven useful in many organizations. Ford Motor Company found that by sharing knowledge in networks the development time for cars was reduced by 33%. Online forums belong to the technology used in this approach.^[13]

We have seen that KMS can either be used to support a commodity view of KM, where the explication of knowledge is assumed not only to be possible but also necessary, or a community view of KM, where the implicit nature of knowing puts people in focus. The success of KMS (as with most IS) depends on the extent of use, which in turn depends on a number of factors. In their concluding discussion, Alavi and Leidner point to a set of research questions concerning the application of IT to KM. In sum, they ask what effect an increased breadth and depth of knowledge via KMS would have on organizational performance; how to ensure that knowledge in an KMS can be modified (if necessary) prior to being used, and how these modifications too can be captured; how anonymized knowledge in a KMS can be trusted; and what are the quality and

usefulness factors of KMS.^[13] The answers to many of these questions are still pending.

ONTOLOGICAL ASPECTS

It has often been argued that only individuals can think and act—not organizations. At the same time, as human beings we are social creatures and we tend to seek, and benefit from, each other's company. Inputs from colleagues and the surrounding context greatly affect our ability to create and use knowledge because the individual and the collective interact in fruitful ways. Focusing primarily on how new knowledge emerges, Nonaka and Takeuchi stress the fact that knowledge creation initiates from the individual but is a process that moves through expanding communities of interaction, crossing group, division, and, finally, organizational boundaries.^[11] Other scholars have made similar comments about other KM processes.

Still, IT support for KM has traditionally focused on organizational-wide systems, possibly due to the acknowledged fact that the usefulness of a KMS grows exponentially with the size of the organization. Much of the IS research has thus had a macro-level focus, but also applications supporting organizational learning and organizational memory are common in the KMS repertoire. The challenge associated with organizational KMS is that individuals often have to provide input without getting much back in return. This problem, often referred to as the maintenance problem seriously threatens the quality and usefulness of these systems.

Another category of KMS are the groupware systems targeting smaller subsets of the organization, typically aiming for management. This category includes various types of Decision Support Systems (DSS). Many KMS in this category can also be related to the field of Computer-Supported Collaborative Work (CSCW). Typical applications here include Helpdesk applications and expert finder systems within specific subgroups. The maintenance problem continues to be a challenge also at this level.

When it comes to the individual, there has—until recently—not been equally much support. Some argue that this situation is about to change. One of the problems here is that not all of the applications used at an individual level are officially labeled KMS. For example, the information retrieval (IR) field has provided the knowledge worker with search engines and other tools to help locate information, but not all would agree that a search engine is a KMS. Another noticeable trend is the growth of social media. These applications exploit the individual-collective relationship and are able to provide the individual with added value through the actions of the collective relationship and vice versa. It will be interesting to follow this development to see whether social media will provide a means to avoid, if not solve, the maintenance problem.

THE KMS CHALLENGES

A number of KMS challenges can be identified in the KM literature. One issue is that of dispersion of work. It is argued that knowledge workers are increasingly dispersed—spatial as well as contractual.^[25] Organizational members work outside the physical boundaries of the firm and/or change positions within the firm, often including geographical changes. This, it is argued, makes them less exposed to colleagues with similar functional skills.

There is also the contractual dispersion, i.e., the provisional nature of employment and the higher level of partial or temporary involvement in the firm that many knowledge workers experience. In addition, many are engaged in virtual teams that often reorganize and have high turnover rates. This dispersion of work requires KMS that allows for effective sharing of the latest knowledge.^[25,26]

Another issue is the shorter product and process life cycles in today's organizations.^[26] This compresses the time window for capturing the lessons learned and knowledge created in the process and leaves the knowledge workers with little time to document and save their experiences. At the same time knowledge becomes obsolete much quicker. KMS need to be able to deal effectively with these circumstances.

The above concerns can be seen as aspects of a larger and overarching challenge, i.e., how to keep KMS updated and current. While many of today's organizations expect KMS to become major catalysts for innovations in terms of the ways in which businesses can be organized and conducted, there is plenty of IS research that indicate that such systems often fail when implemented in everyday knowledge work. In response, a distinguishable issue in KMS research is how to support knowledge work with IS in a successful way. It has been found that although the systems work technically and should function well in theory, they remain unused by the organizational members.^[27] Following this, the development of systems with the capacity to bridge the knowing-doing gap in organizations has been recognized as a significant area of KMS research.

However, the imbalance between the desire for accurate content and the workload required to achieve this still appears to be a critical problem, leading to systems of little use for organizations in their knowledge application processes. It has been suggested that the problem stems from the fact that the requirements for KMS are fundamentally different from those of other types of IT and are thus not covered by existing IS design theories.

Markus et al. have identified three primary differences.^[28] First, knowledge work processes requires that expert knowledge is adapted and/or contextualized to specific local conditions. Decision support systems and executive IS do not provide system features that can handle

expert knowledge or contextualize translation rules. Resulting from this, DSS and expert systems inhibit creative problem finding and solution generation. While expert systems manage general expert knowledge, they fail to support contextual knowledge and the flexibility needed for process emergence. Second, these types of systems are all specifically designed for a known type of user, e.g., managers. Being designed for a particular type of user community, these systems are not well adapted to emergent work processes characterized by shifting user types having varying knowledge requirements. Third, knowledge workers have access to many different types of systems but since these systems often are isolated and not integrated into work practice, knowledge workers tend to manage their systems rather than getting the job done.

To circumvent these problems, it has been suggested that KMS should be integrated with or build into already existing applications since key to a successful KMS is to facilitate usage.^[29] As knowledge work requires creativity in order to produce idiosyncratic and esoteric knowledge, knowledge work practice is untidy compared to operational or administrative business processes. Hence, KMS must be able to go beyond written instructions and official task descriptions, thus appreciating exceptions not only as something inevitable but as a necessity. Consequently, KMS must not be isolated but should be integrated into work practice. For the purpose of avoiding situations where knowledge workers manage their systems rather than getting the job done, developers must recognize sociotechnical issues associated with disparity in work and benefit. In this way, KMS capable of attracting a critical mass of users can be developed. In addition, paying attention to unobtrusive accessibility and the adoption process may deepen developers' understanding of how support systems can be better integrated with both the day-to-day tasks of knowledge workers and their performance of the tasks.

CONCLUDING SUMMARY

In the 1990s there was a rather heated debate whether or not KM was a fad but this seems to have abated. Now, there is consensus that KM—at least as a pragmatic issue—is here to stay. With knowledge replacing economy of scale as business driver and with increasing portion of knowledge workers in today's organizations, knowledge management, and the need for IT support for it, is not likely to go away.

The strong focus on technology that we witnessed in early KM work has been compensated for and practitioners and researchers alike now have acknowledged that knowledge cannot exist outside the mind of a human being. Cultures that encourage and motivate individuals to share, combine, and reuse knowledge are recognized as equal, if not more, important as IT, even amongst technologists. IT

is still likely to continue to play an important part, not as driver and single success factor but as catalyst, facilitator and enabler of social networks, virtual meeting places, and new discussion forums. One of the general lessons learned is that technology is important and useful but it should not be the driving force in KM work.

Several commentators have pointed to the fact that KMS in the late 1990s were discrete, stand-alone systems not aligned with the organizations' business processes. Such systems had to be explicitly attended to on top of ordinary tasks, thus adding to—not facilitating—the work to be carried out.^[29] Newer KMS appear to be better integrated with existing business infrastructure and enterprise applications, thereby allowing employees to seamlessly apply organizational knowledge in whatever work they are engaged. However, there is still a need for development and research in this area.

On the theoretical side, no core theory on knowledge management has yet been developed, and KM may still be understood as an “umbrella construct,” i.e., a broad and somewhat unclear label that is used to contain a whole variety of loosely connected issues.^[30] Without a clear theoretical focus, some commentators argue, the original concept risks being eroded until it has no value and collapses, as researchers explore divergent paths and build isolated islands of knowledge. Spender^[31] has argued strongly that KM and KMS research need a core theory that distinguishes them from other fields but at the same time is narrow enough to allow laypeople to recognize and understand what is and what is not a KMS. Not much work is currently to be found along such lines.

In their editorial introduction to the 2003 special issue on KM and IT in *IT and People*, Gray and Meister argue that KMS researchers are facing a bigger problem than did researchers of earlier organizational phenomena, since knowledge is neither new nor physically present and there is thus nothing concrete to point to. An independent core theory of KM and KMS is therefore needed, they argue.^[32]

However, several future scenarios are possible. If the development towards more knowledge work continues, we may end up in the scenario predicted by Davenport and Grover where “every industry will view itself as knowledge-intensive [^[4], p. 4]. If everything is KM, will the concept then still be meaningful, and if every application is a KMS, will the term be useful? At the other end of the spectrum lies a scenario where KM becomes so diversified and scattered that for this reason is pointless to talk about KM and IT support for it. Where we will end up remains to be seen.

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Knowledge Management: Early Development

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Abstract

Knowledge management (KM) as a business concept, though it had earlier antecedents, evolved in the late 1980s. It sprang from the combination of the recognition of the importance to a firm of its information and knowledge assets, and from the appearance of the Internet and the recognition of the utility of the Internet as an information and knowledge sharing tool, particularly for geographically dispersed organizations. KM has gone through four stages:

1. An emphasis upon the new technology, the Internet, and upon the development of “best practices” or “lessons learned.”
2. An increased recognition of human and cultural factors, and upon the development of “communities of practice” to facilitate the sharing of information.
3. An increased recognition of the importance of designing the systems for retrievability, and the importance of data design and taxonomies.
4. An emphasis upon extending KM systems beyond the parent organization to include, for example, vendors and suppliers, customers, users, alumni, etc.

KM has exhibited remarkable staying power and growth in a fashion that is dramatically different from other business enthusiasms of the late twentieth century.

INTRODUCTION

This entry is a discussion of the historical origin of the phrase/concept called “Knowledge management (KM).” While KM is a recent development of information and communication technology (ICT) becoming integrated with business practice and intellectual capital (IC), it should not be ignored that the capture and passing on of “knowledge” is an ancient practice. In that sense, KM could be traced at least as far back as the thirteenth century and the Dominican Order’s development, manufacture, and promotion of concordances for organizing and accessing knowledge within the Bible.

The use of the term “knowledge management” is a surprisingly recent phenomenon, becoming common and part of the professional vocabulary only in the mid-1990s. The earliest print reference appears to have been used first in the context of library and information work. Marchand,^[1] then Dean of the School of Information Studies at Syracuse University, coined it in the 1980s as a descriptor for the final level in his stage hypothesis of information systems development.^[2] However, the term, as presently used, appears to have been re-coined more or less anonymously somewhere among the major accountancy and consulting firms. The earliest reports seem to be from McKinsey & Co. Brook Manville, the first Director of Knowledge Management at McKinsey, reports that

McKinsey launched an internal study whose title included the phrase knowledge management in 1987 (Manville, personal communication, 2007). Prusak, another acknowledged pioneers of the field, in a very corroborative and independent communication, reports that Ernst and Young started using the term in 1992, and that McKinsey & Co. was using it “a bit earlier - 1988?” (Prusak, personal communication, 2007).

In the article entitled “Where Did Knowledge Management Come From” written in 1999, Prusak described KM as originating “about 7 years ago,” i.e., in 1992, and describes what appears to be the first conference organized specifically on the topic of KM, held in Boston in the spring of 1993, as “a good milestone to mark the beginning of the knowledge management time-line.”^[3] The conference, organized and sponsored by the Center for Business Strategy at Ernst and Young, was held at the Four Seasons Hotel (Prusak, personal communication, 2007).

BACKGROUND

While KM as it is known today came out of the consulting world, the concepts of managing knowledge can be traced back to earlier works in the fields of government intelligence and policy management. Early works often cite

Organizational Intelligence: Knowledge and Policy in Government and Industry by Wilensky.^[4] In his book, Wilensky discussed the value of the “Knowledge Expert” as being the primary source of reliable information in the “Intelligence Field” of the government. So it should not be ignored that KM did have roots inside of other disciplines that are not directly related to the technology consulting firms.

KM, as the term is understood today however, did arise basically in the consulting world, and it was they that publicized it. The consulting firms quickly realized the potential of the intranet flavor of the Internet for linking together their own geographically dispersed knowledge-based organizations. They then quickly realized that the expertise they had gained was a product that could be marketed and sold to other organizations. That product needed a name, and the name chosen was knowledge management. In his article on where KM came from, Prusak in fact felt it appropriate to say “some skeptics may believe that consultants developed knowledge management to replace declining revenues from the waning re-engineering movement.”^[3] The two enthusiasms are related in that both were driven by increased ICT capabilities, but the timing, though convenient for the consulting firms was driven not by their convenience, but by the straightforward dynamics of ICT capability growth. The KM was dependent upon the Internet, while pre-Internet ICT already enabled the major restructuring of an organization’s work flows and processes. In a sense, KM also has roots in the implementation of supply chain management (SCM) software and business process re-engineering (BPR) as well as the more recent development of enterprise resource planning (ERP). IT development has always had a pattern, an oft repeated pattern, of growth from addressing more structured data to addressing less tractable, less well structured, or comparatively unstructured data. Remember that text processing was at one time called “string handling,” because to people brought up on handling numeric data, text was most conveniently thought of, not as words, but as a string of symbols to be manipulated. In that sense, SCM and BPR and ERP to KM, is simply a logical and predictable progression.

DEFINITION

A good functional and illustrative definition of KM and how it developed is the equestrian metaphor of “by the intranet out of intellectual capital.”^[5] By this definition, KM has two parents, the enthusiasm for and the appreciation of IC, and the development of the Internet and its offspring, intranets and extranets. The IC is essentially a name given to the recognition of the importance of information and knowledge. It represented the awareness that as Drucker (Hibbard (p. 46)^[6]) put it:

We now know that the source of wealth is something, specifically human knowledge. If we apply knowledge to tasks that we obviously know how to do, we call it productivity. If we apply knowledge to tasks that are new and different, we call it innovation. Only knowledge allows us to achieve those two goals.

Indeed Drucker is clearly one of the intellectual fathers of KM. His *Post-Capitalist Society* which appeared in 1993, is about the shift from capitalism to the knowledge society. Almost one full page of an 11-page index is devoted to knowledge or knowledge phrases such as knowledge workers, yet the phrase knowledge management is surprisingly absent.^[7] The early use of the phrase knowledge management is sometimes attributed to Drucker, but at this point it appears to be still unsubstantiated. Given Drucker’s stature and his emphasis on knowledge and knowledge workers it is almost inevitable that such an attribution would arise. It may be noted however that while Drucker did, carefully, claim a first for the phrase “Knowledge Worker,” he does not appear to have made any similar claim for the phrase “Knowledge Management,” and he was certainly active and involved well into the time frame in which he might well have, and likely would have, made such a claim if he thought it warranted.

It is beyond the scope of this entry to pursue the development of the IC in detail, and that is covered elsewhere.^[8–10] However, a brief review of the development of IC is vital to understanding the origins and development of KM.

A pioneer in the KM field was Sveiby.^[11] His book *The Invisible Balance Sheet* (1989) was a key work in the development of thinking about IC. His principal point was precisely that the important assets of an organization did not show up on the balance sheet, and that in thinking about a company’s assets one should think, as it were, in terms of an invisible balance sheet. From that starting point, his writings morphed smoothly and rapidly into KM. The work of Robert Buckman at Buckman Laboratories^[12] and Hubert St. Onge at the Canadian Imperial Bank of Commerce^[13] were key players in operationalizing the concept and in popularizing IC. Perhaps most important in bringing the concept of IC to the business community was Stewart’s^[14] article in *Fortune* magazine, “Intellectual Capital, Your Company’s Most Valuable Asset.”

The first blush of enthusiasm for IC centered on quantifying and measuring it.^[15,16] Surely if it was so important, it needed to be measured. As the difficulty of measuring such an amorphous commodity as information, much less knowledge became apparent to the business community the enthusiasm for, or at least the publication of articles about, IC subsided. Then the Internet emerged. The business world realized that the Internet could be used to link an organization together. This was the take-off point for KM.^[8,9] KM was first defined as having two components (Fig. 1).

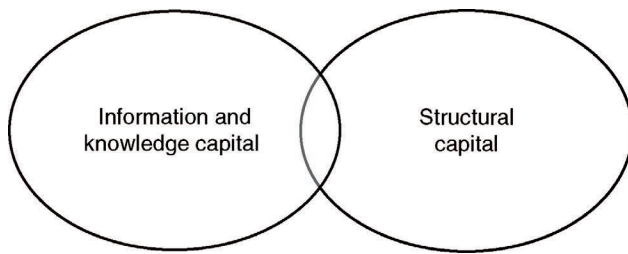


Fig. 1 Early conception of KM.

Information and knowledge capital was the organization's information and knowledge, but including the informal and unstructured, the implicit and tacit, as well as the formal.

The structural capital was the mechanisms in place to take advantage of the information and knowledge capital, the mechanisms to capture, store, retrieve, and communicate that information and knowledge. The phrase that has emerged that largely represents what was meant by KM's structural capital, is content management (CM), or its variant, ECM, electronic content management. As they are now used, these phrases are typically used in the context of the software packages used to facilitate CM or KM.

The transition from IC to KM is clearly seen in Peters 1992 book *Liberation Management*.^[17] Peters has four chapters specifically entitled "Knowledge Management Structures (KMS)" (I–IV: Taking Knowledge Management Seriously; Getting Physical; Knowledge Bases, Expert Systems, Computer Augmented Collaboration; and Developing and Tapping Expert Power in the Hierarchy-less Organization), almost 10% of a very large book. The KMS phrase rapidly withered away in favor of the simpler KM, but Peters was clearly writing about KM as it was becoming to be understood.

Applications of Internet technology were soon extended beyond intranets, the use of the Internet within an organization, to extranets that would still be private, but were used to connect an organization with its suppliers and customers. The consequence of this development was an expanded definition of KM to include the customer's knowledge and input, customer capital (Fig. 2).

The inclusion of customer capital was also not unrelated to the popularity of TQM, total quality management, in which responding to customer need and demand was a key element.

Concurrent with IC, sharing the same etiology, and very much reinforcing IC was the notion of the "Balanced Score Card."^[18] The idea behind the balanced score card was that traditional financial reporting was too narrow in its outlook, and that in effect Sveiby's "Invisible Balance Sheet" should be added to a company's "score card" to make it balanced. In particular the concern was that the traditional balance sheet focused only on the present and on the past, with no thought to the future. Using only traditional financial indicators, if the current balance sheet

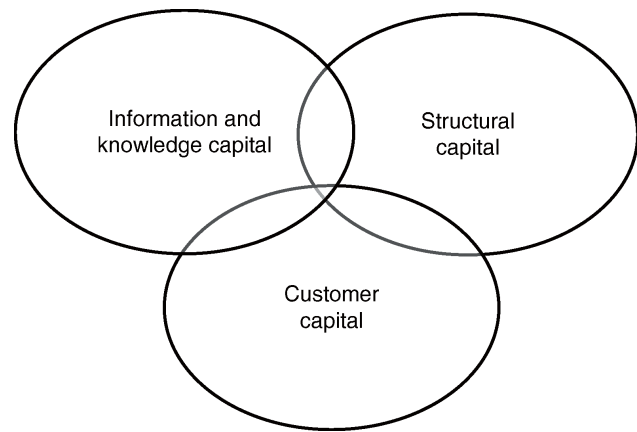


Fig. 2 Expanded conception of KM.

looks good, but for example customers have begun to defect to the competition, there is nothing to reveal that the situation is in fact not healthy. The exposition of the balanced score card recognized the difficulty of measuring IC per se, recognized its importance, but principally sought other non-financial indicators such as product quality, turnover or churn, or customer satisfaction, that would indicate an organization's health and sound positioning, and that were better indicators of likely future performance (Fig. 3).

It is very similar to the graphic above with the "customer capital" component replaced by "social capital." It is now assumed that customer capital is included in all of the above, the infrastructure extended to include the customer, the knowledge resources including the customer, and the social capital embracing the relationships not just within the organization, but with the customer (and the supplier to whom one is a customer) as well.

The concept of knowledge management continued to expand, most particularly by incorporating the notion of "the learning organization." Senge's^[20] *The Fifth Discipline, the Art and Practice of the Learning Organization* appeared in 1990 and had established something of a cult following, but had not made a major impact in the business world, but with KM it meshed perfectly. The thesis of the learning organization is that what ultimately creates and distinguishes a successful organization is its success in creating and sharing information and knowledge; in short, its success at learning. The obvious corollary is that to be successful, an organization must create a culture that fosters learning.^[21] One can say, in brief summary that the concept of the learning organization focuses on the creation of knowledge, while KM, as it was originally construed, focuses on the acquisition, structuring, retention, and dissemination of that knowledge. What then happened to KM is that the term was expanded to include the concept of the learning organization.

Similarly, a fit was quickly perceived with Nonaka and Takeuchi's^[22] work on tacit knowledge and how to

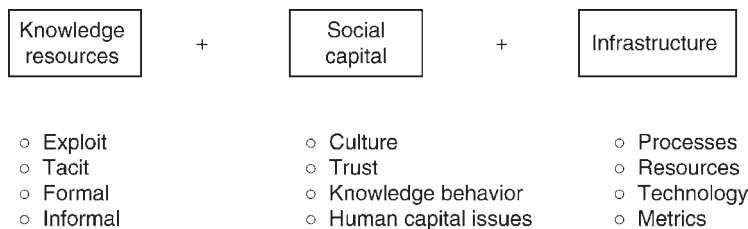


Fig. 3 Another version of the KM trinity.
Source: From Prusak.^[19]

discover and cultivate it (*The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, New York, Oxford University Press, 1995). Nonaka's work was an obvious way to point out that KM was not just about explicit and structured knowledge, but also about how to retain, find, and share knowledge that was difficult to make explicit and that resided in people's heads, tacit knowledge. Nonaka's name became the token for that recognition. While the KM literature generally speaks of explicit and tacit knowledge, it is in fact more useful, as Keen and Tan^[23] point out, to think of three categories of knowledge, explicit, implicit, and tacit. Explicit knowledge is then that knowledge or information which has been captured in some explicit form, a procedures manual, or a database for example, implicit knowledge being that knowledge or information which has not been captured in some explicit form, but potentially could be, while tacit knowledge is that knowledge, like how to knead dough (the example Nonaka most famously used) or how to ride a bicycle, that cannot be fully captured in explicit form.

Both Senge's and Nonaka's work were not only about the human factors of KM implementation and use; they were also about knowledge creation as well as knowledge sharing and communication.

More recently,^[24] KM is described as a structure supported now by five columns, i.e., with five major constituents (Fig. 4).

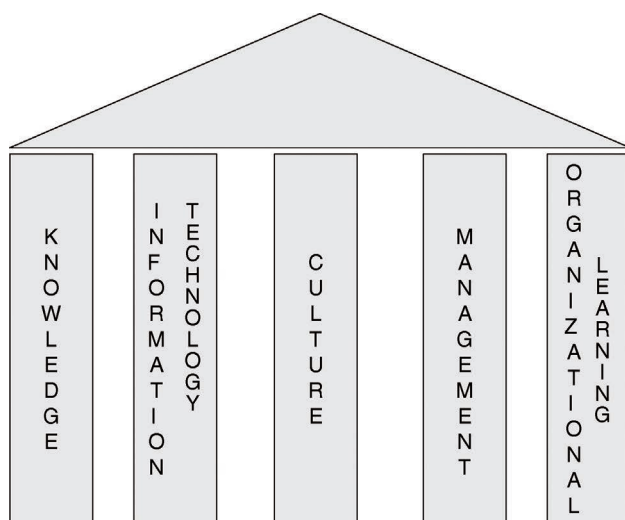


Fig. 4 KM with yet more components.

We can reflect briefly for a moment on whether the Parthenon-like image of the structure is an unintended homage to KM as the latest temple to which the consultants lead the faithful.

Another way to look at the origin and development of KM is to view it as a series of stages.

STAGE 1

The initial stage of KM was driven primarily by IT, information technology. That first stage is well described with an equestrian metaphor as “by the Internet out of IC.” Organizations, particularly the large international consulting organizations, understood quite well that their stock in trade was information and knowledge, that often the left hand as it were had no idea what the right hand knew, and if they could share that knowledge—then they could avoid reinventing the wheel, underbid their competitors, and make more profit. When the Internet emerged, they realized that the intranet flavor of the Internet was an almost God given tool to accomplish that knowledge coordination and sharing. The first stage of KM was about how to deploy that new technology to accomplish those goals.

KM exploded in visibility in the business community because those large international consulting organizations, also realized quickly that many of their customers shared exactly the same problems, and that the expertise they were building for themselves could also be a product, an expertise, that they could purvey to those customers. A new product needs a name and a theme or rationale. The name for their new product was knowledge management, and the theme/rationale justifying it was *intellectual capital*, a theme which coincidentally had emerged as a hot topic in the business literature only a few years earlier, and which provided a wonderful rationale for the importance of KM. The first stage might be described as the “If only Texas Instruments knew what Texas Instruments knew.” stage, to revisit a much quoted aphorism.^[25] The hallmark phrase of Stage 1 was first “*best practices*,” to be replaced by the more politic “*lessons learned*.”

STAGE 2

The second stage of KM added recognition of the human and cultural dimensions. The second stage might be described as the “If you build it they will come is a

fallacy” stage. It was soon recognized that “If you build it they will come” is a recipe that can easily lead to quick and embarrassing failure if human factors are not sufficiently taken into account. As this recognition unfolded, two major themes from the business literature were brought into the KM fold. The first was Senge’s work on the learning organization, and the second was Nonaka and Takeuchi’s^[22] work on tacit knowledge and how to discover and cultivate it (both mentioned above). Both were not only about the human factors of KM implementation and use; they were also about knowledge creation as well as knowledge sharing and communication. The hallmark phrase of Stage 2 was “*communities of practice*.”

Much attention in Stage 2 focused on the World Bank. Under Wolfensohn’s administration the World Bank emphasized knowledge as their most important product, not the loans per se or the direct consequences of the projects supported, but rather the knowledge created by and shared from those projects.^[26,27] The centerpiece of their emphasis on KM was their very deliberate development of communities of practice (COPs) specifically designed to encompass experts external to the bank.^[28] At the same time, Denning’s^[29,30] work on storytelling as a technique to sell KM, focused on the intangibility of knowledge and the consequent frequent intangibility of KM results, and therefore the resulting need to justify KM by telling stories or anecdotes of results achieved, and then projecting “what if” consequences of further deployment of KM. Most of the storytelling examples centered on applications at the World Bank.

The Conference Board started organizing meetings on the subject of KM in 1997 (the first conference was entitled “Organizational Learning”). That first meeting was populated overwhelmingly by IT people. A good marker of the shift from the first to the second stage of KM, is that for the 1998 Conference Board conference (now called “Knowledge Management/Organizational Learning”), there was a noticeable contingent of attendees from HR, human resources, departments, and by 1999 HR was the largest single group. The year 1997 was also the first KMWorld conference, and can be seen as marking a certain coming of age of KM and its recognition as an important development to be paid attention to.

STAGE 3

The third stage is the awareness of the importance of content, and in particular an awareness of the importance of the retrievability and therefore of the importance of the arrangement, description, and structure of that content. Since a good alternate description for the second stage of KM is the “it’s no good if they don’t use it” stage, then in that vein, perhaps the best description for the third stage is the “it’s no good if they can’t find it” stage, or perhaps “it’s no good if they try to use it but can’t find it.”

If one peruses the content of the 1999, 2000, and 2001 KMWorld conferences, one can see the

emergence of Stage 3 clearly. At KMWorld 2000 a track on content management appeared for the first time and at KMWorld 2001 in October/November content management was the dominant track, constituting the largest cluster of topics in the conference. That third stage that emerged is well described as the *taxonomy/content* stage.

Another bellwether is that TFPL, a major UK consulting group, in a report of their October 2001 CKO (Chief Knowledge Officer) Summit reported that for the first time taxonomies emerged as a topic, and it emerged full blown as a major topic.^[31] The hallmark phrases emerging for the third stage are *content management* (or enterprise content management) and *taxonomies*.

STAGE 4

Starting roughly in 2003, a fourth stage of KM began to emerge. This stage is the awareness of the importance of information and knowledge external to the organization.

The inclusion of information and knowledge external to the organization is not new to KM, one need only think of the World Bank applications mentioned above. That being said however, the overwhelming emphasis of KM to date has been to mobilize and make accessible the organization’s information and knowledge. The most basic mantra of KM, is still the stage one mantra, “if only Texas Instruments knew what Texas Instruments knew”; the classic metaphoric example of what KM is all about, making *an organization’s* knowledge more useable and more productive.

The KM’s traditional emphasis upon just an organization’s internal knowledge can be best illustrated by quoting two of the most frequently quoted and used definitions of KM:

(Ponzi,^[32] attributed to Ruggles^[33]) Knowledge management is a newly emerging interdisciplinary business model dealing with all aspects of knowledge within the context of the firm, including knowledge creation, codification, sharing, learning, and innovation. Some aspects of this process are facilitated with information technologies, but knowledge management is to a greater degree, about organizational culture and practices.

(underlining added)

(Gartner Group^[34]—now Gartner Inc.) A discipline that promotes an integrated approach to identifying, capturing, evaluating, retrieving, and sharing all of an enterprise’s information assets. These assets may include databases, documents, policies, procedures, and previously uncaptured expertise and experience in individual workers.

(underlining added, Quoted in Malhotra^[35])

The mainstream KM mindset up until now of focusing only on the firm's or the organization's or the enterprise's information and knowledge assets could hardly be clearer. Note that while Ruggles is an individual author, and may be expressing a more particular view, the Gartner Group is a major high profile consulting firm, and their definition is in effect a description of the product, KM consulting, that they are offering, and in this their product description they are limiting KM to "an enterprise's information assets."

Several threads have converged to drive this emphasis upon including or providing access to external information:^[36]

- The extension of intranet-based KM systems to extranet-based systems. (Indeed a good name for Stage 4 might be the "Extranet stage of KM.") A logical extension of intranet-based KM is to build an "extranet" so that persons outside the organization, vendors, suppliers, dealers, major customers, etc. can be included. This has proceeded slowly however, as security, particularly for for-profit corporations is a major concern. It was precisely this lack of a need to be concerned about competitive information that allowed the World Bank to so quickly move into extranet-based COP. However as security techniques have improved, the willingness of corporations to extend COP onto extranets so as to incorporate the knowledge of "outsiders" has correspondingly increased.
- Concern about the knowledge about to be lost as post-war baby-boomers are beginning to hit retirement age. Corporations are beginning to realize that KM, in the form of retiree involvement in their COPs, is a powerful tool to address this issue.
- A repeat of the same broadening phenomenon that occurred with MIS, Management Information Systems, the realization that the information constituting the bulk of the information needed for managerial decisions lies near the top of the managerial decision making pyramid, and is typically external contextual information, not the organization's internal information. That same awareness is rapidly developing in the KM world, the

awareness that much of the key information needed for critical decisions lies outside the corporation or organization, and that the ideal KM system should provide appropriate links to the world outside the organization.

- *Globalization*: The increasing awareness that most organizations can no longer just think of themselves as a national company, and that they must compete globally or be overtaken by those who do, is now almost unquestioned received wisdom. The first corollary of this realization is that globalization requires knowledge about the external environment in spades. And furthermore, to avoid information overload, this external information should be gathered, organized, and made available in some coherent fashion.
- *Competitive intelligence*: Hard on the heels of the recognition of an increasingly global marketplace has come the awareness that you do not know where your competition will be coming from, and that to be adequately alert requires a conscious planned effort to acquire competitive intelligence on a global front, and that just attending the standard trade shows and chatting in the corridors will no longer suffice.

The result of these factors is a greatly increased emphasis upon external information. It should also be noted that another emphasis emerging simultaneously is that of the importance of situating information and knowledge in context. This is in fact another facet of the same evolution, the awareness that the importance, the usability, and the value of information is a function of how it relates to other information. New knowledge derives from the combination of information, either the juxtaposition of existing information, or the addition of new information to existing information.

SUMMARY OF THE FOUR STAGES OF KM

Stage 1: "by the Internet out of Intellectual Capital"

Information Technology
Intellectual Capital

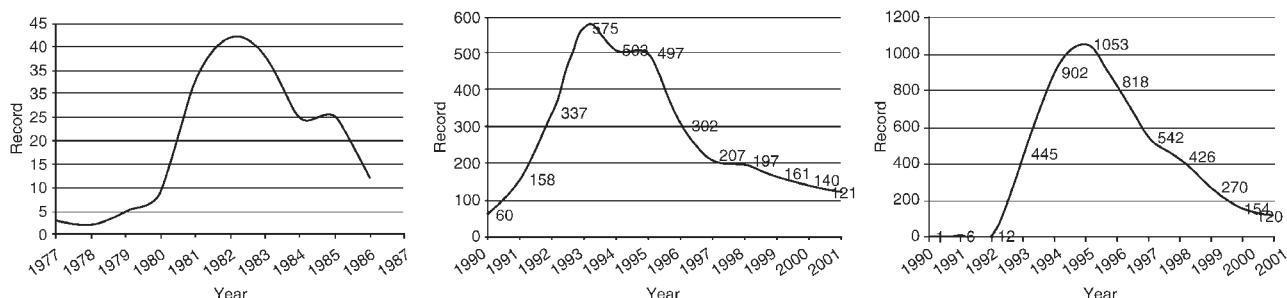


Fig. 5 Bibliometric representation of business hot topics. The Lifecycle of Quality Circles, 1977–1986;^[37] Total Quality Management, 1990–2001;^[38] Business Process Reengineering, 1990–2001.^[38]

Source: From Abrahamson.^[37]

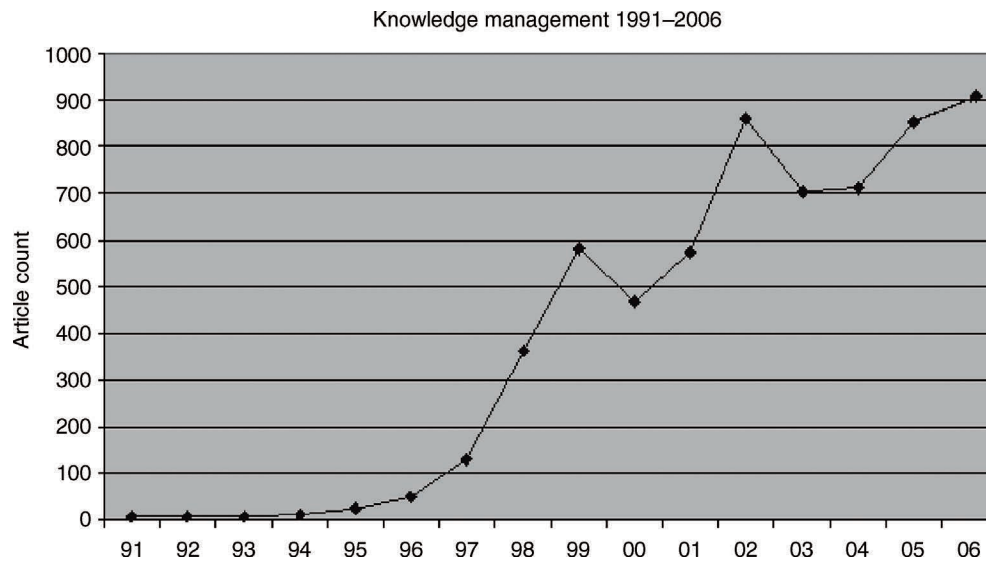


Fig. 6 Bibliometric representation of KM.

The Internet (including intranets, extranets, etc.)

Key phrases: “*best practices*,” later replaced by the more politic “*lessons learned*.”

Stage 2: Human and cultural dimensions, the HR, Human Relations, stage

Communities of Practice

Organizational Culture

The Learning Organization (Senge), and

Tacit Knowledge (Nonaka) incorporated into KM

Key phrase: “*communities of practice*.”

Stage 3: Content and retrievability

Structuring content and assigning descriptors (index terms)

Key phrases: *content management* and *taxonomies*.

Stage 4: The Extranet stage

External information

Key phrases: *globalization* and *competitive intelligence*.

Note that new stages do not replace earlier stages, they merely add an emphasis to aspects of KM that though there were inadequately recognized previously.

The KM clearly appears to be uniquely different from other business enthusiasms and fads, to use a blunt term, of the late twentieth century. Above are simple bibliometric graphs (the number of occurrence of the term per year in the titles of articles in the business literature) for “Quality Circles,” “Total Quality Management,” and “Business Process Re-engineering.”^[37] Notice how similar the pattern is (Fig. 5).

The profile of KM however is dramatically and fundamentally different (Fig. 6).

It is clear that KM is now in a pattern uniquely its own, first the typical 4- or 5-year burst of explosive growth, but since then a pattern of stable mature growth – not a pattern of boom and bust, but a pattern of boom and continuity.

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Knowledge Organization System Standards

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Abstract

This entry presents an overview of the standards for different types of knowledge organization system (KOS). Their development history and the principles within them are described. Standards for thesauri receive most attention, since other types of KOS are less standardized. The arrival of the Internet, enabling simultaneous access to multiple disparate systems and resources, caused a major reorientation of standardization efforts in the last decade, towards interoperability goals. Current initiatives address two main needs: interoperability between KOSs, and data exchange between one vocabulary application and another. The prospects for bringing the standards together are discussed.

INTRODUCTION

After considering the basic definitions of knowledge organization systems (KOSs) and standards, this entry is structured chronologically. First it deals with thesaurus standards in the twentieth century, then standards for other types of KOS in the same century, after which it moves on to developments in the twenty-first century. The principles embodied in the standards are described, and the reasons for a change of emphasis at the turn of the century. The prospects for bringing the differing standards together are briefly discussed, before conclusions are drawn.

WHAT IS A KNOWLEDGE ORGANIZATION SYSTEM?

Gail Hodge's explanation (p. 1)^[1] is widely quoted:

The term *knowledge organization systems* is intended to encompass all types of schemes for organizing information and promoting knowledge management. Knowledge organization systems include classification and categorization schemes that organize materials at a general level, subject headings that provide more detailed access, and authority files that control variant versions of key information such as geographic names and personal names. Knowledge organization systems also include highly structured vocabularies, such as thesauri, and less traditional schemes, such as semantic networks and ontologies. Because KOS are mechanisms for organizing information, they are at the heart of every library, museum, and archive.

To this it is worth adding that the most common reason for organizing information is so that you can find it again. Thus information retrieval is a key motivation for the design and application of KOSs, and a driver for most of the relevant standards.

In this entry, most attention will be given to thesauri, because for them we have well-developed standards with a good user base. The standardization scenario for classification schemes, subject heading schemes, and name authority lists will be discussed in less detail. Semantic networks and ontology standards will be mentioned only in passing, partly because they are dealt with elsewhere in this encyclopedia, and partly because they may have functions other than knowledge organization or information retrieval.

WHY STANDARDIZE?

According to BS 0, *A standard for standards* [12], Part 1 p. 4], a standard is a “document, established by consensus and approved by a recognized body, that provides, for common and repeated use, rules, guidelines, or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.” Important benefits are said by the same source to be “improvement of the suitability of products (including services) and processes for their intended purposes, prevention of barriers to trade and facilitation of technological cooperation.”

But not everyone agrees on the need for standards. Ralph Waldo Emerson is usually credited with the famous line in support of innovation: “If a man write a better book, preach a better sermon, or make a better mousetrap than his neighbour, tho' he build his house in the woods, the world will make a beaten path to his door.” Thus progress in all fields requires that innovators continually enhance and differentiate their products, sometimes in contravention of the norms. On the other hand, conformity with standards often makes it easier for a new component to plug into an existing assembly, where it will be understood and accepted by existing users. This tension between

innovation and standardization can be seen throughout the history of KOS development, with no end in sight.

For KOS development and use, the potential advantages of standards compliance include

- Good practice guidance speeds up the development process.
- Off-the-shelf software may be available for building and maintaining KOSs.
- KOS-savvy users will understand the conventions used in format and display.
- Systems administrators and developers may find it easier to implement KOSs in applications such as search engines, cataloging, and content management systems.
- Searches across multiple systems, networks, and resources are much easier if the same indexing language applies to all of them.

The advantages of departing from the standards can include

- Opportunity to meet special user requirements in a particular domain.
- Opportunity to exploit a new technology that needs a different sort of vocabulary.
- Freedom to use existing vocabulary construction software that fails to comply with the standards.
- Untrained users may be more comfortable using a product that does not embody sophisticated conventions—even if performance is inferior.

Plainly there are pros and cons. This entry will show that in some respects the standards are widely taken up; in other respects diversity reigns.

THESAURUS STANDARDS IN THE TWENTIETH CENTURY

Prehistory

A standard rarely falls from a clear blue sky. The story usually starts with an exemplar of some new form of technology; then other specimens appear; then the need to standardize is perceived; then work begins to obtain consensus on the required features of future specimens. Sometimes one of the early exemplars is so widely received that it is adopted as an ad hoc standard. In all cases consensus is vital to ensure take-up of the eventual standard.

In the case of thesauri, original development was stimulated around the time of the Second World War by society's need (especially in the scientific and business arenas) to store and retrieve increasing volumes of documentary resources. While some researchers and

practitioners continued to pin their faith on classification, especially the emerging ideas for faceted classification, other pioneers were attempting term-based indexing approaches. Thus the systems of Uniterms and Zatocoding were developed by Mortimer Taube and Calvin Mooers respectively. N. Roberts^[3] provides an excellent account of their work, together with that of Luhn, Bernier, Crane, Whelan, Joyce, Needham, and others in the late 1940s and through most of the 1950s. All used the term “thesaurus,” but none had come up with a fully satisfactory working model.

The first fully operational thesaurus, according to Krooks and Lancaster^[4] as well as Roberts,^[3] was developed for the E. I. Du Pont Nemours and Co., Inc. in the United States. Stemming from this model a succession of vocabularies was developed in the ensuing decade, the most influential being the *Thesaurus of Engineering and Scientific Terms (TEST)*^[5] in 1967. According to Aitchison and Dextre Clarke^[6] *TEST* embodied most of the standard features visible in alphabetically organized thesauri for the next 30 years. Apart from the thesaurus itself, Appendix 1 of *TEST* gave a set of rules and conventions for thesauri that formed the basis of the first national and international standards, and are still traceable in today's versions of these. (For a synopsis of these, see “Principles embodied in the thesaurus standards” on page 4.) The rules have subsequently been augmented somewhat for techniques not used in *TEST*, such as facet analysis or classified displays.

Early Guidelines

But before the “official” standards were issued, several other sets of guidelines were published by bodies influential in the information management research community. According to Krooks and Lancaster,^[4] these included

- Committee on Scientific and Technical Information (COSATI) *Guidelines for the development of information retrieval thesauri* (1967).^[7]
- Educational Resources Information Center of the US Department of Education (ERIC) *Rules for thesaurus preparation* (1969).^[8]
- United Nations Educational, Scientific and Cultural Organization (UNESCO) *Guidelines for the establishment and development of monolingual scientific and technical thesauri for information retrieval* (1970, revised 1971).^[9]

Study of these guidelines suggests that the authors were often aware of each other's efforts. Commonly the examples used in one of them are borrowed in some of the others. (See Krooks and Lancaster^[4] for an analysis of the sharing of examples.)

Notably absent from all of them is any guidance for multilingual situations.

National and International Standards Emerge

In 1972, the German Standard 1463 was published, followed in 1974 by publication of both the international standard ISO 2788 *Documentation—Guidelines for the establishment and development of monolingual thesauri*^[10] and the American national standard ANSI Z39.19 *American National Standard Guidelines for thesaurus structure, construction and use*.^[11] All of these documents drew heavily on the already published guidelines and milestone thesauri described above. And all were broadly compatible with each other. ISO 2788 was then widely adopted as a national standard in countries such as Britain, Canada, France, Germany, and Spain. In some cases the national standard incorporated adaptations such as translation into the national language. For example the British Standard BS 5723 based on ISO 2788 and published in 1979 incorporated additional examples and procedures for dealing with compound terms (but when the 1985 editions of ISO 2788 and BS 5723 were published, they had become identical).

Interestingly, the 1974 edition of ISO 2788 acknowledged that a thesaurus could be defined either in terms of its structure or its function, as follows:

- In terms of function, a thesaurus is a terminological control device used in translating from the natural language of documents, indexers, or users into a more constrained “system language.”
- In terms of structure, a thesaurus is a controlled and dynamic vocabulary of semantically and generically related terms which covers a specific domain of knowledge.

Although these definitions have been revised in later editions, and the house rules of most standards bodies nowadays frown on such a dual definition, most thesaurus practitioners today would recognise the validity of the basic principles behind the words, and the importance of clarifying what a thesaurus is *for* as well as what is in it.

It was not until 1985 that ISO 5964 *Documentation—Guidelines for the establishment and development of multilingual thesauri*^[12] came out, the first standard to deal with cross-language issues. It followed the same principles and conventions as ISO 2788, but extended them and provided practical examples of how to deal with the complexities when exact matches between the scope of terms in different languages are hard to find. ISO 5964 too has been adopted as a national standard in several countries. BS 6723, for example, is identical to ISO 5964.

Sector Specific Standards

All of the national and international standards are of the “guide” type rather than the “specification” type. That is to say, they give broad and general information about a

subject, rather than setting out detailed requirements with procedures for checking conformity to the requirements. (See BS 0^[2] for more discussion of types of standards.) They are not backed by legislation that requires anyone to follow them in whole or in part. And they allow considerable room for discretion on the part of users, with no bar on optional extension. In practice, few published thesauri abide by the standards in every detail, and many have additional features compatible with the spirit of the standards. Sometimes one particular thesaurus enjoys such popularity in a given sector that its variant features become “standard” for all other thesauri in the same sector.

For example, the vocabulary *Medical Subject Headings (MeSH)*^[13] has become a classic in the medical field. The first edition was published in 1960, well before *TEST* had established the thesaurus rules and conventions. Nowadays *MeSH* is often considered to be a thesaurus, even though it began life as a subject headings scheme and departs significantly from the thesaurus standards. One of its key features is a set of “Tree structures” with an elaborate expressive notation which is not required by the standards. (For example, the concept of Meningitis is represented by the notation C10.228.228.507, and that of Bacterial meningitis by C10.228.228.507.280). Later in the 1960s and 1970s Elsevier built its own medical vocabulary *Master List of Medical Terms (MALIMET)* in a completely different style. Such was the popularity of *MeSH* and the pressure from users that when *MALIMET* was overhauled in 1988, one of the major enhancements was incorporation of a notation comparable to that of *MeSH*, and the vocabulary was renamed *EMTREE: The Life Science Thesaurus*.^[14]

Another trend-setter is the *Art & Architecture Thesaurus (AAT)*^[15] first published in 1990 on behalf of the Getty Art History Information Program. Its distinctive features include the rigorous application of facets, and the use of “guide terms” (rather than node labels as advocated by the standards) to structure the extensive hierarchies. The *AAT* has been hugely influential in its sector, adopted and adapted by countless museums and galleries around the world, where facets and guide terms are accepted as the norm.

Popular vocabularies like *MeSH* and the *AAT*, perhaps also the *Thesaurus of ERIC Descriptors*^[16] in the educational field and *Macrothesaurus*^[17] for industrial and economic development are often considered in their particular sectors as standards in their own right.

Successive Updates

ISO 2788-1974 was updated in 1986. Some of the changes were cosmetic, such as collecting up all the definitions, abbreviations, and other conventions previously scattered through the text, into separate clauses at the start. Original content (not foreseen in *TEST*) was added on how to

organize systematic displays, especially using facet analysis, and more examples of all kinds of displays were incorporated. Another significant substantive change was to adopt the rules for compound terms that first appeared in BS 5723:1979. Filling 32 pages rather than just 13, the 1986 edition^[18] is altogether more helpfully laid out and more definitive in its recommendations.

Z39.19 was updated twice in the last century—in 1980 and again in 1993. The foreword to the 1993 edition^[19] explicitly acknowledges that successive updates have built on the precursor guidelines mentioned above as well as the two editions of ISO 2788. This tendency towards convergence is reassuring for the user community of any of the standards.

Principles Embodied in the Thesaurus Standards

As explained above, the basic principles were set out in Appendix 1 of *TEST*. Over the decades they have been refined, augmented, and articulated in different ways, but the following essentials have survived:

- In a thesaurus, each concept is represented by a “preferred term” or “descriptor” (although optionally a language-independent code or notation may be used as the unique, unambiguous identifier of a concept). Each term may have only one meaning.
- Since in normal language several different terms may often be used to represent the same concept, each of these “non-preferred terms” or “nondescriptors” is provided as an entry point, guiding the user to the corresponding preferred term. A formal “equivalence relationship” is established between the preferred and non-preferred term.
- In a multilingual thesaurus, all the languages should have equal status and no language should be regarded as dominant. As ISO 5964 puts it in Clause 12.2, “every preferred term in one language should be matched by a corresponding term in the other language(s).”
- Since in normal language the same term may often take several different meanings, a means of disambiguation is necessary. A qualifier in parentheses should be added to the ambiguous term before it can be admitted as a preferred or non-preferred term. ISO 2788:1974 gives the example of thesaurus terms “beams (structural)” and “beams (electromagnetic)” to distinguish between two concepts that could be described by the same natural language term. The qualifier is treated as an integral part of the term.
- Where further clarification of the underlying concept is needed, a scope note may be provided. The scope note does not form part of the term. From ISO 2788:1974 a scope note example for “copper alloys” is “alloys in which copper is the principal constituent.”

- As well as the equivalence relationships mentioned above, a thesaurus should explicitly recognize hierarchical and associative relationships between concepts.
- The hierarchical relationship is often called broader/narrower, and most commonly applies when the two concepts are generically related, for example “dogs” are generically related to “mammals,” since every dog is a kind of mammal. The 1974 edition of ISO 2788 also admits some part-whole relations as hierarchical, for example between “botany” and “biology,” where botany is a part rather than a kind of biology. The 1986 edition further admits as hierarchical the instance relationship, for example between “Himalayas” and “Mountain regions.” (The Himalayas are neither a kind nor a part of a mountain region, but do represent an instance.)
- All of the standards show signs of difficulty in defining the associative relationship. Often it has a negative definition, as any relationship that does not qualify as hierarchical or equivalence. (For example, an associative relationship may be established between “teaching” and “training,” or between “transportation” and vehicles.) But underlying this fuzziness is a clear understanding that the function of this relationship is to guide users to terms that could usefully supplement or replace the one they first thought of. The subjectivity of this function causes difficulties in setting hard and fast rules. Successive editions of the standards provide increasingly copious examples, and further elucidation is provided in Milstead^[20] and Dextre Clarke.^[21]
- Thesaurus displays should follow well-established conventions for scope note and relationship tags, the most widely used ones in English being SN (Scope Note), USE (Use), UF (Use For or Used For), BT (Broader Term), NT (Narrower Term) and RT (Related Term). Use of these conventions results in entries of the following form:
 - Age discrimination
 - SN: Unfair treatment of people on the basis of their age, especially where it concerns older people.
 - UF: Ageism
 - BT: Discrimination
 - NT: Age discrimination at work
 - RT: Older people

French and German equivalent tags are established in ISO 5964.

Differences between the Standards

It is hard to find great differences in principle, apart from the enhancements at each update. Successive editions of Z39.19 have more pages and are organized differently from ISO 2788 and its variants. But the most noticeable substantive differences are:

- Z39.19 tends to be more prescriptive. For example, the 1993 edition gives rules for reciprocal scope notes, and for dealing with trademarks, neither of which are mentioned in ISO 2788.
- Unlike ISO 2788, Z39.19 has an index, a more elaborate table of contents, and a more extensive glossary.
- There are small differences in the definition and recommendations for handling compound terms.
- There is a difference of emphasis concerning the various forms of display recommended.
- Z39.19-1993 makes no mention of facet analysis or any form of classified display.
- Z39.19 has been updated more often.

Weaknesses in the Standards at the Turn of the Century

Inspired by the ground-breaking thesauri of the 1960s, the national and international standards were conceived in a print-oriented era and had barely adapted to exploit the opportunities of the electronic medium. Z39.19-1993 was the furthest ahead, incorporating a clause on computer-based thesaurus management systems. But all of them were written for a print-oriented audience and none of them had any advice on formats or protocols for data exchange. The only available standard applicable to data exchange formats was ISO 2709:1996 *Information and documentation. Format for information interchange*,^[22] based on the MARC format developed and maintained by the U.S. Library of Congress.

The MARC format was commonly used by libraries, as its principal application was for exchange of bibliographic records. But the module for “authority records” (i.e., for thesauri and other types of authority list)^[23] inherited features required for bibliographic data, making it cumbersome when applied to thesauri. MARC was (and still is) a sensible format to use when exchanging data with users of library management systems already adapted to the bibliographic format, but tends to impede exchanges with any other user community. Something else was needed for wider applicability.

A second form of weakness lay in the extent of implementation. Most respectable published thesauri in the 1990s claimed to follow one or other of the standards, but on close inspection most of them departed from the standards to some degree, for example in following the rules for compound terms. Comparison of almost any selection of published thesauri shows huge disparities in general layout and philosophy. In the 1990s, furthermore, a breed of vocabularies called “taxonomies” was emerging, a clear sign that the thesaurus model was proving either unsatisfactory or just not well enough understood for widespread adoption.

Plainly all of the national and international standards for thesauri needed to be overhauled.

STANDARDS FOR OTHER TYPES OF KOS IN THE TWENTIETH CENTURY

The reason is not entirely clear, but somehow the urge for national or international standards has barely extended to other types of KOS. Certainly there has been some standardization, but within the user communities of a particular KOS rather than across the boundaries. The situation with respect to ontologies is described in another entry of this encyclopedia, and the present discussion will be limited to classification schemes, subject heading schemes, and name authority lists.

Classification Schemes

The use of classification in organizing knowledge goes back to at least the third century BC, well before the establishment of the first national standards bodies. The *Dewey Decimal Classification (DDC)*, probably the most widely used classification scheme today, was first published in 1876. By the end of the last century it had seen 21 printed editions in English, plus 13 abridged editions, plus many translations into other languages, plus regular electronic updates; and we should not forget the countless local adaptations made by libraries with special collections. Within its community, the *DDC* is often seen as a standard in its own right, despite the coexistence and potential conflicts of so many versions.

The *Universal Decimal Classification (UDC)* and the *Library of Congress Classification (LCC)* too have august histories, with multiple versions in diverse libraries. Both are discussed elsewhere in this encyclopedia. Suffice it for present purposes to note that some members of the consortium that maintains and publishes the *UDC* are national standards bodies, and so the *UDC* has the status of a national standard in countries such as Spain and the United Kingdom.

And there is no way of counting the diversity of other classification schemes in use today, each with its own adaptations for particular subject areas, contexts, and user communities. There are usually very good reasons for differentiation. While in the past some dreamt of a scheme so universal that it could be applied to every library, that dream is now largely discredited.

If we accept that there will always be a need for different ways of organizing subjects, could we at least agree on the principles of classification, to which all the schemes would conform? Even here there are difficulties, stemming from the diverse origins of the different schemes. For example, the ideas of faceted classification expounded by S. R. Ranganathan and H. E. Bliss, further developed by the Classification Research Group and embodied in today's *Colon Classification* and the second edition of the *Bliss Classification*, are widely accepted as very sound and full of promise for electronic applications. The

maintenance agencies of the major schemes such as *DDC* and *UDC* have for years been adopting what they can of faceted principles into successive updates. But a practical problem stems from the huge volume of existing collections that have been indexed with earlier editions of the schemes. The user libraries face difficulties and much expense in switching to a new way of doing things, however superior in principle, because it becomes more cumbersome to retrieve items in their heritage collections. Hence much resistance to changes that are too sweeping, even when those changes bring convergence with other schemes.

Subject Heading Schemes

The scenario for subject heading schemes is dominated by the very widely used *Library of Congress Subject Headings (LCSH)*. Arguably *LCSH* is the standard, leaving nothing more to be said. However, few libraries use the whole of the *LCSH*; most add headings devised for their own audiences/collections; and not a few may be lax in applying the *LCSH* rules for combining headings in precoordinated strings. (For those unfamiliar with the different types of KOS, the provision of precoordinated strings is one of the key features distinguishing a subject heading scheme from the other types. Although in recent years *LCSH* has adopted some of the display conventions that apply to thesauri, its strength is still the provision of subject headings, whether uncoordinated or precoordinated.) In practice, diversity abounds. It is another illustration of the general observation that when a standard is not backed up by some legislation or monitoring authority, there is always a tendency to diverge in practice.

Name Authority Lists

Rather than national or international standards, again what we see are standardizing initiatives within particular communities. In some cases, such as the German National Library's *Personnamendatei (PND)*^[24] the approach has simply been to build an authority list with such a wide scope that it becomes a standard in its own right, without needing accreditation by an external standards body. In other cases guidelines have been drawn up to serve common needs when an organization is developing its own authority lists. These include

- IFLA *guidelines for authority records and references*,^[25] serving library associations worldwide.
- ICA/CDS *International Standard Archival Authority record for corporate bodies, persons, and families*,^[26] for archivists.
- *NCA rules for the construction of personal, place, and corporate names*,^[27] again for archivists but extending to place names as well as people and organizations.

All of them aim to combat the confusion that arises when one entity (a place, person, organization, etc.) is known by several different names. All support unique identification, usually by a single consistent name, and enable linkage of variant and alternative names to the appropriate entity.

THE TWENTY-FIRST CENTURY BRINGS CHANGE

The arrival of the desktop computer in the 1990s had exposed weaknesses in the standards, as well as opportunities for more effective exploitation of KOSs. The arrival of the Internet highlighted those opportunities and brought a step-change in the need for interoperability, both between one vocabulary and another, and between vocabularies and their applications. The scenario at the turn of the century was one in which new styles of vocabulary were bursting on the scene, new forms of technology inspired innovative applications, new user expectations were driving performance, and widespread budgetary restrictions imposed a new requirement for end-users to take on (or manage without) the tasks previously undertaken by trained intermediaries. Networking was the name of the game, driving the demand for interoperability.

Whereas the twentieth-century standards had addressed issues affecting the construction and use of any one KOS, interoperability was now needed to help us overcome the barriers between one KOS and another. A 2006 state-of-the-art review on *Terminology Services and Technology* from the Joint Information Systems Committee (JISC)^[28] highlights two key requirements for KOSs (see pp. 7 and 8, respectively):

- Mapping is a key requirement for semantic interoperability in heterogeneous environments.
- Interoperability requires commonly agreed standards and protocols.

The challenge and the opportunity was recognised, not only by the committees responsible for the existing KOS standards, but by some new players in the standards world, notably the World Wide Web Consortium (W3C). The ensuing initiatives will be described in these two groups:

Emerging standards for data exchange	Evolution of existing KOS standards
ADL Thesaurus Protocol	IFLA Guidelines for multilingual thesauri
Zthes	ANSI/NISO Z39.19-2005
SKOS (Simple Knowledge Organization Systems)	BS 8723
	ISO NP 25964

EMERGING STANDARDS FOR DATA EXCHANGE

ADL Thesaurus Protocol

The Alexandria Digital Library (ADL) was one of the first to take up the challenge of developing a protocol^[29] to support navigating and live querying of online thesauri. It is a lightweight protocol for accessing monolingual thesauri, especially those modeled on ANSI/NISO Z39.19. It is based on XML and the Hypertext Transport Protocol (HTTP), the basic transport mechanism for the World Wide Web. The protocol defines XML structures for describing the thesaurus as a whole as well as “brief” and “fuller” term formats. The brief format consists of preferred or non-preferred term. The fuller format comprises term; notes (with a specification of type); hierarchical (BT/NT), associative (RT), and equivalence (USE/UF) relationships. A list element provides a wrapper for a list of terms, and a hierarchy element a wrapper for presenting a hierarchy of terms. Wrapper elements also exist for all interactions and an error element allows for the reporting of errors to the client. The following stateless services are defined

- Getting general information about the thesaurus.
- Downloading a list of all terms.
- Searching the thesaurus using full term, keyword, or regular expression matching.
- Getting terms higher or lower than the current term in the hierarchy, to a specified number of levels.

These provide convenient methods for getting information for hierarchical displays or for extending searches to include all narrower terms. HTTP bindings for the abstract protocol are explained and examples given, facilitating implementation as a Web service.

Zthes

Zthes^[30] was originally developed as an application profile of Z39.50 *Application Service Definition and Protocol Specification*^[31] to enable exchange of thesaurus data. At its heart is a model which represents a thesaurus as a database of interlinked terms (in contrast with the SKOS model, which is based on concepts rather than on terms). Thus each individual term in a thesaurus, whether preferred or non-preferred, is represented by a record in the database. Term records consist of an initial part describing the term itself (with information such as its unique identifier, scope note, etc.), together with subrecords (that is, named sections within the main record) briefly describing related terms. The primary means of navigation from one term to another is by searching for the unique identifiers of the terms related to the first one.

The Zthes abstract model can be represented in XML. A single Zthes document in XML format consists of a

wrapper element plus a sequence of term elements, each of which represents a single thesaurus term composed of the elements described in the abstract model.

Additional specifications show how Zthes-compliant thesauri may be accessed using the Search and Retrieve by URL (SRU) protocol.^[32] This is a Web-based information retrieval protocol designed as a successor to the older protocol, Z39.50. It provides a simple means for expressing search requests, encoding them in URLs, sending them to servers and getting back results in a well-defined XML format.

The Zthes Profile for SRU provides the set of specifications prescribing the use of SRU to navigate remote thesauri. An SRU server conforming to this profile can expose its thesaurus to any conforming client, enabling its use in many applications.

Development of the Zthes model and specifications has been heavily reliant on inputs from interested organizations and individuals, without the backing of a standards authority. The outputs are freely available on the Web.

SKOS

Since this section was written, the 2005 Working Drafts of the SKOS Core Vocabulary Specification have been superseded by 2008 versions. More information is available at <http://www.w3.org/TR/skos-reference/>. The name SKOS^[33–36] refers to a program of work on developing specifications and standards to support KOS use within the framework of the Semantic Web. SKOS aims to work for a wide range of KOSs, such as thesauri, classification schemes, subject heading systems, and taxonomies. It does not deal with their construction, just with data sharing and exchange. As appropriate for the Semantic Web, the SKOS specifications are built upon the Resource Description Framework (RDF), which in turn is an application of XML.

Originally funded by the European Commission as part of its Semantic Web Advanced Development (SWAD) project in 2002–2004, SKOS is now backed by the Semantic Web Deployment Working Group of the W3C. As a standards organization with worldwide membership, W3C applies rigorous consultation and approval procedures, aiming to bring SKOS forward from a set of working drafts to the eventual status of W3C Recommendation. Unlike ISO and its family of national standards bodies, W3C makes its standards and other documentation freely available over the Web.

SKOS is designed as a modular and extensible family of languages. The main components are as follows:

- *SKOS Core* is the basic specification of a common data model for sharing and linking KOS. In contrast with Zthes, it is based on a concept-centric view of the vocabulary, where primitive objects are not terms, but abstract concepts represented by terms. Development work was substantially influenced by BS 8723-2,

resulting in a good level of compatibility between the underlying models for both of these. The first Public Working Draft of SKOS Reference^[35] was published on January 25, 2008. It is accompanied by several guidance documents, lists of use cases, etc.

- *SKOS Mapping* will address interoperability by providing a vocabulary to express matching of concepts from one concept scheme to another. This part of SKOS was developed in the SWAD-Europe project and has not yet been adopted by W3C, but is maintained informally by SKOS editors.
- *SKOS Extensions* is intended to provide for features of KOSs beyond the most basic ones. For example it will support subclasses of the thesaurus hierarchical relationship (commonly known as BT/NT) such as generic, partitive, and instancial (commonly known as BTG/NTG, BTP/NTP, BTI/NTI, respectively). Like SKOS Mapping, active development of this part awaits completion of SKOS Core as a W3C Recommendation.
- *SKOS API* is a Web Service Application Programming Interface (API), designed to provide access to thesauri and other simple KOSs via the Web.^[36] It defines a core set of operations for programmatically accessing and querying a thesaurus. While intended for Web service calls, the API itself remains independent of such concrete implementation details. It could also be capable of adaptation to formats other than SKOS Core.

A recurring question in discussions on SKOS development work is the depth to which SKOS should attempt to model the different vocabulary types. If the modeling is relatively superficial, it is easier to accommodate a wide range of KOS types and hence allow easy data exchange within a wide community. If the modeling goes deeper and imposes semantic constraints on encoded data, it will enable more powerful reasoning about the type of information indexed with or retrieved by the KOS. At present the weight of opinion seems to favor the former approach, in order to keep things as simple as possible.

EVOLUTION OF EXISTING KOS STANDARDS

IFLA Guidelines for Multilingual Thesauri

Although the International Federation of Library Associations (IFLA) had never published its own thesaurus standard, it has taken a long-standing interest in the international standards. In 2002 it set up a working group to update and enhance the content of ISO 5964. A draft report^[37] was circulated for comment in April 2005, carrying a large number of up-to-date multilingual examples to supplement the existing ones. Largely the draft builds

on the long-established principles of ISO 2788 and ISO 5964, but one radical departure is to define a “nonsymmetrical thesaurus” as a “multilingual thesaurus in which the number of descriptors in each language is not necessarily the same and also the way descriptors are related to each other can be different for the different languages.” This contrasts with the approach of BS 8723-4, which considers such a situation as a case of mapping between two or more different thesauri.

The target date for publication of the final version of the guidelines is 2009. There is every prospect the outcome will feed into the development process for ISO 25964.

ANSI/NISO Z39.19-2005

In November 1999 National Information Standards Organization (NISO) organized a workshop to investigate “the desirability and feasibility of developing a standard for electronic thesauri.” Among its conclusions were that a new standard “should provide for a broader group of controlled vocabularies than those that fit the standard definition of ‘thesaurus’,” and that, “the primary concern is with shareability (interoperability), rather than with construction or display.” (See full report at http://www.niso.org/news/events_workshops/thes99rprt.html).

Following the meeting an advisory group was assembled and the eventual outcome was publication of the 2005 edition of Z39.19, *Guidelines for the construction, format, and management of monolingual controlled vocabularies*.^[38] The change of title reflects its extension to cover lists (such as drop-down lists), synonym rings, and taxonomies, as well as thesauri. Some other significant changes were:

- Make the text clearer for untrained users, giving the reasons behind the rules and more explanation of the basic principles of vocabulary control.
- Include display formats for electronic as well as print media.
- Cater for browsing and navigation applications as well as keyword searching.
- Consider Web applications as well as the traditional ones.

Despite the original aspiration to address interoperability concerns, however, the revised standard stops short of embarking on cross-database search issues, multilingual situations, or data exchange formats and protocols.

BS 8723: Structured Vocabularies for Information Retrieval

The international standards ISO 2788 and ISO 5964 (which are identical to BS 5723 and BS 6723) came up for their quinquennial review in 2000. Members of the BSI

committee took the view that revision was long overdue. Rather than attempt to establish an international working group, they opted to work first on the British Standards, which would later be offered up to the international community. And so work began on BS 8723, requiring a complete overhaul of the monolingual and multilingual standards, bringing them together and addressing the interoperability needs discussed above.

Over the next 7 years, the standard was published progressively in five parts as follows:^[38–43]

- BS 8723: Structured vocabularies for information retrieval—Guide
- Part 1: Definitions, symbols, and abbreviations (2005)
- Part 2: Thesauri (2005)
- Part 3: Vocabularies other than thesauri (2007)
- Part 4: Interoperability between vocabularies (2007)
- Part 5: Exchange formats and protocols for interoperability (2008)

Part 2 is effectively an update of ISO 2788 and BS 5723, covering monolingual thesauri and adding:

- Clearer guidance on applying facet analysis to thesauri.
- Some changes to the perennially challenging rules for compound terms.
- More guidance on managing thesaurus development and maintenance.
- A functional specification for software to manage thesauri.
- A general expectation that people will use the thesaurus electronically, as well as in print.

Apart from the rules for compound terms, the principles in the earlier standards remain intact, only they have been reexpressed to apply more intelligibly in the electronic era.

Part 3 covers completely new ground, for the following vocabulary types:

- Classification schemes
- Business classification schemes for records management
- Taxonomies
- Subject heading schemes
- Ontologies
- Authority lists

None of these is covered in the same depth as thesauri. The standard does not, for example, explain how to build a new classification scheme. With interoperability needs in mind, the thrust was to compare and contrast the essential elements of each of these vocabulary types. The aim was to provide enough description of these types of tool so that an information technology developer would be able to implement them interoperably with other vocabularies. An exception was made for the clause on taxonomies, which does also incorporate guidance on general good

practice, particularly on the issues around designing and using taxonomies for Web browsing and navigation.

Part 4 deals with mapping between vocabularies. It addresses the common scenario enabled by today's networks, where a query expressed in one vocabulary needs to be applied to multiple resources indexed with a variety of different vocabularies. By treating a multilingual thesaurus as a special case of mapping between vocabularies, it effectively updates ISO 5964 and BS 6723 as well as extending their scope considerably.

Part 5 establishes a data model for monolingual and multilingual thesauri, and also a format based on XML for exchanging data. The model and format provide for all the thesaural features described in Parts 2 and 4—not just the commonly used features but also sophistications such as classified arrangements with facet names and characteristics conveyed in node labels. So much original work had to be done on the model and schema that the final document has number DD 8723-5 and its status is Draft for Development. In line with good practice for XML, a namespace has been established for the XML schema at <http://www.bsigroup.com/resources/standards/bs8723/>. A development Web site at <http://schemas.bs8723.org/> shows examples of encoding as well as providing a discussion forum to encourage user testing and feedback, and transformations between alternative formats.

ISO 25964

Following publication of BS 8723, a project named ISO NP 25964 has been established to adopt it as an International Standard.^[44] The standards bodies of 11 member countries, including the United States, are participating in the work. The target date for completion is late 2010. There is every hope that the eventual standard, ISO 25964, will complete the development work begun in BS 8723, integrate inputs from the IFLA Guidelines, and generally bring the whole international community together.

PROSPECTS FOR RESOLVING THE DIFFERENCES BETWEEN STANDARDS

The differences between ISO 2788, ISO 5964, BS 8723, and the forthcoming ISO 25964 are irrelevant for this discussion, since the underlying set of principles is constant. The documents are simply evolving in step with the context in which they are applied. Backwards compatibility is rarely a problem. Comparing this family with ANSI/NISO Z39.19, the main differences are in scope and presentation. Each of them covers some aspects that the other does not, and the content is organized in different ways. Any differences of principle are quite hard to spot. The recommendations for applying facet analysis do differ, and to a lesser degree those for compound terms. In general, however, the areas of conflict are minor and there seems

no harm in the coexistence of these standards. Perhaps there is even some benefit, as coexistence allows working groups in different geographical zones to learn from each other and build stepwise on each other's shoulders.

More serious are the differences between the data exchange formats expressed in MARC, Zthes, SKOS, and DD 8723-5. In theory there could be big interoperability gains if everyone would use the same format. But in practice this is very hard to achieve, since each of these corresponds to a different context and set of needs. The future probably lies in developing transformations between these formats, so that a vocabulary expressed in one of them can readily be converted to another.

The biggest challenge of all lies in the coexistence of a huge variety of individual KOSs and types of KOS. Some of these have been around for a very long time, without need of accreditation by any standardizing body, and have large user constituencies. There seems little prospect of bringing them all together under one set of principles and practices. The best hope of overcoming the barriers seems to lie with mapping.

CONCLUSIONS

- At the level of national and international standards bodies, thesauri have attracted more sustained attention than any other form of KOS.
- Several different national and international standards for thesauri coexist, without causing significant compatibility problems.
- For classification schemes, most standards work has been within the user communities of particular schemes, the major challenge being to accommodate successive updates without impeding retrieval of data classified using earlier versions.
- While thesaurus standards in the twentieth century have done much to encourage common approaches to construction, they have not addressed the major semantic interoperability problem inherent in the proliferation of hundreds (perhaps thousands) of different individual KOSs.
- Arrival of the Internet and other networks has highlighted the need for interoperability, both at the semantic level and at the data exchange level. To address these needs, the main approaches now being explored are mapping, for semantic interoperability, and standard formats and protocols for data exchange.
- Initiatives such as SKOS, Zthes, and ADL are now yielding a range of standard formats and protocols.
- The recently published British Standard BS 8723 addresses both the mapping challenge and the exchange format needs, but would benefit from more development work.
- The international project ISO NP 25964 offers the opportunity for participants from the major national standards bodies in 11 countries to take the BS 8723

work forward and integrate contributions in an enhanced international standard for KOS construction, management, and interoperability.

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Knowledge: Tacit and Explicit

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Abstract

This entry explores the differences between tacit and explicit knowledge. Tacit knowledge is defined as a form of knowing that cannot be expressed. Organizational theory has been particularly concerned with tacit knowledge as a part of an effort to identify and utilize the unique knowledge that is distinctive to successful organizations.

The distinction between tacit and explicit knowledge was popularized by the works of Polanyi^[1] on personal knowledge. Tacit knowledge is the knowledge that cannot be expressed; it is unknown to the knower, however actionable, either through automatisms (for swimming, in Polanyi's examples), or more or less deliberately. As codification is achieved by means of abstraction, tacit knowledge is usually opposed to explicit knowledge for being "not codified" or "escaping representation." Categorizing knowledge and the act of knowing into different forms is a practice as old as civilizations. The act itself, of declaring that there is a "knowledge" that is *not* embodied in the traits of a ruler, is *not* coming from a god or a mystical source, is an act of culturally forming a civilization. Archaic societies associated knowledge with either a gift of their gods, an unexplainable trait of a mystic ruler (sorcerer, priests, and the like), and in shamanic societies, knowledge was considered an independent realm, access to which was synonymous with loss of consciousness and abusive use of drugs.

As many rational myths accompanied mystical explanation(s) of the existence of knowledge in archaic societies, they also accompanied the formation of the role of knowledge in civilization. As we will see in this entry, the Greeks, circa 220 B.C., came up with extraordinary labels to differentiate between the practicality of the swordsman's know-how, which they labeled *métis*, and the wisdom of the city ruler, which they labeled *phronesis*. Were they trying to please both? Is it just that each stage of civilization is bringing its new categories of knowing, to please rulers, priests, artisans, slaves, and workers? Is engineering merely an adaptation of the Greek concept of *techné*? Or is there a real science in the art of knowing?

In the first section, we will investigate whether there is strong evidence in support of knowledge transformation. If tacit and explicit knowledge forms are anything else than a mere "social categorizing," then "implicit learning" must be supported by scientific evidence. In the second section, we investigate known knowledge transformation,

between the tacit and the explicit, the individual and the collective. Building on propositions by Nonaka,^[2] we propose an integrative framework showing the different forms that knowledge can pass through when being applied, used, and mobilized. In the two last sections of this entry, we end up questioning if knowledge can, *by any means*, be represented? Therefore, we suggest that as knowledge escapes representation, the production of an actionable model of knowledge transformation shows little evidence, and abundant mythology. This mythological questioning concludes our investigation, as we question knowledge as a mere artifact of behavior, or truly essential to survival; and if, ultimately, knowing—tacitly or explicitly—can be separated from being by means other than abstraction or social categorization.

WHEN GREEK PHILOSOPHERS WANTED TO GET RID OF THE ORACLES...

Many societies made distinctions between what is known and can be transcribed, and what is believed to be known, but impossible to transcribe, express, or qualify. In archaic societies, what was impossible to express or explain was usually considered an act of gods, oracles, or mystical artifacts. Ancient Greek scribes and philosophers were the first to elaborate a non-religious pragmatic distinction between the tacit and the explicit by opposing the hard-to-imitate practical knowledge of the astute fisherman or the cunning of the hunter with knowledge captured and stored in scriptures. Detienne and Vernant, in their 1974 study of cunning intelligence, identified four generic categories used in ancient Greece: the *phronesis*, a form of unarticulated social wisdom learned through experience, which we would call "tacit knowledge" today; the *techné*, the codified or non-codified procedural knowledge of craftsmen; the *episteme*, the art of abstraction and generalization, which corresponds to contemporary collective and explicit

knowledge; and finally, the *Métis*, the non-codified knowledge of short-cuts, cunning, and oblique strategies.

Episteme can be defined as universal knowledge that we share and circulate, that we teach and preserve, and that is commonly understood by firms as their “culture,” recipes, rules of thumb, know-how, etc. *Episteme* is knowledge *about* things, the opposite of *phronesis*, which is the result of experience and social practice. *Phronesis* is singular, idiosyncratic, and assumed to be difficult to share. It is personal, and has profound meaning only for the individual who has lived the experience. This non-scientific, practical, contextual knowledge is generated in the intimacy of lived experience. It is acquired by trial and error, through organizational and environmental learning, and is generally very difficult to analyze or test. Its intuitive content renders it difficult for organizational science to grasp.

Greek society had an in-depth understanding of the precise societal roles that could be played by the three above forms of tacit knowledge: *phronesis* was built through councils, management of the cities, estates, and large organizations; experience and seniority was used to select organizational members who accumulated this form of social implicit learning over time. *Techne* was the tacit knowledge, the know-how, of the workforce, the builders, and the artisans. *Métis* was the know-how of the warriors, fishermen, and military commanders.

Little is known about the motivations of Socrates, Heraclitus, and contemporary philosophers and scribes in introducing such distinctions. Detienne and Vernant^[3] see in this categorization the reflection of a Greek society that liked to ordinate and rule all matters of status, prerogatives, and social claims. Another hypothesis might well be that Greek philosophers, by making explicit the different categories of knowledge, and above all, knowing, might have fought the over-arching authorities of oracles and rulers. Stating that knowledge can be accessed by its simple production, by means of abstraction, social wisdom, or basic cunning, is not it already asserting that the way of oracles lacks of adequate grounding?

Information technologies could well be the modern “oracles” that trigger, twenty centuries later, a re-flourishing of studies of tacit knowledge. The rise of electronic data interchange, and its rapid globalization, generated optimistic expectations of a new era of a globally codified knowledge, moving assets, endless combinations of technological systems. Of course, the ease of knowledge codification with information systems has been since challenged. This codification of industry, craftsmanship, medical, or managerial practice has become the source of growth of the new capitalism. However, if knowledge is being codified in larger quantities on larger scales, most human learning remains implicit, hard to codify, to replicate or to digitalize.^[4]

IN THE PURSUIT OF EVIDENCE OF KNOWLEDGE TRANSFORMATION

Implicit learning means learning without being aware of what is being learned.^[5] Linguists carried out the first studies concerning the unconscious acquisition of complex information at the end of the 1960s. Other works in the field of perceptual learning have highlighted the existence of implicit rules and patterns of individual perception, of which people have no awareness. In other words, complex information is acquired with little awareness of the context in which it happens. Human learning can proceed with rare, infrequent, discrepant stimuli, and still deliver forms of valid learning from imperfect, scarce, and unstable knowledge. This characteristic of human learning was expressed 2000 years ago by the Latin proverb “*Intelligenti Pauca*”—intelligence (here the capacity to make sense of things and to learn) proceeds from the slightest of things.

The implicit nature of human learning is also ambiguously temporal. Most human sense-making is retrospective, i.e., people access and formalize perceptions after they have occurred; yet, it is impossible for a human being to determine which part of his or her learning was anterior or posterior to a single given event. In other words, learning is more analogically related to biological growth, than to systems, processes, and machines. As one cannot see the lawn grow, one cannot contemplate his or her own knowledge “growing.” Accordingly, although they have consistently tried over several decades, both social and engineering sciences have been unable to establish any form of correlation between information and knowledge. The amount of information possessed by an individual is not a predictor of the validity, range, and depth of the knowledge that this individual will be able to produce. Reversibly, the amount of knowledge, wisdom, social experience that is possessed by an individual does not constitute a predictor of the quantity of valid information this individual will produce. There is, simply said, no correlation between information and knowledge. A little information can produce a very valuable knowledge. Large quantities of codified, refined, dispatched information can produce very poor knowledge. Hence, there are neither pyramids nor hierarchies between data, information, and knowledge. Several pieces of data put together *do not* systematically produce information. Interpreted information, senses attributed to information, and data do not systematically produce a chunk of knowledge.

This hierarchy between data, information, and knowledge is a powerful post-modern myth. Modernity was about advancing positive science in the service of general welfare, and human, social and technological progress. The core belief that a society could unilaterally advance its societal knowledge also belongs to the myth that societal progress is cumulative, predictable, and can be attained through layers or steps. Human, societal, and

technological progressions are neither linear, nor fairly balanced on a positive scale along history timelines. Some ancient societies, for example pre-Socratic Greece or Qin China in 220 B.C., were more advanced and learned than many societies that followed them. As post-modern societies have become more and more dependent upon the processing of very large amounts of information, the belief that data and information are scalable into proportional advances in knowledge has become the new social contract, the veracity of which being rarely questioned.

Definitions of knowledge and information have followed different paths, until they collided in management studies. For Polanyi,^[1] knowledge is an activity that he describes as the process of knowing. For Wiener,^[6] information is a structure that precedes the activity of knowing, while Shannon^[7] saw information as the original disorder from which knowledge is generated by discovering or crafting messages from the articulation of chaotic information. Wiener's perspective led to distinguishing information from rules, reasoning, and treatments that can be applied to it, and was the foundation stone of cybernetics.

KNOWING IS EXPERIENTIAL

One factor that could support the lack of correlation between information and knowledge lies in the fact that most human cognition is experiential; either we look forward, or we look backward. As Gavetti and Levinthal (p. 113)^[8] put it, "cognition is a forward-looking form of intelligence that is premised on an actor's beliefs about the linkage between the choice of actions and the subsequent impact of those actions on outcome." Foreknowledge of potential outcomes develop with experience, not related with age, but more so related to similarities in patterns and design of the complexity of the situation being apprehended.^[9,10] People naturally rate the outcomes of their predictions according to their results, either positively or negatively. This experiential wisdom generates itself "rules of thumb" and experiential memory that can be contrary to rational models or individual mental models.^[11]

For Polanyi,^[1] most of this experiential knowledge is unknown to the beholder. Polanyi differentiates knowledge that is explicit to us, that which is modifiable and transmittable in a formal and systematic language, from tacit knowledge, which is personal, difficult to convey, and which does not easily express itself in the formality of language. Polanyi's principal argument is that tacit knowledge demonstrates the lack of pertinence of Gestalt psychology. Whereas Gestalt psychology argues that all images are contained in nature, Polanyi wants to demonstrate that human beings acquire knowledge through their engagement in the creation and organization of their own experiences. Thus, by distinguishing knowledge that is

acquired and developed through behavior, and knowledge that is acquired, stored, and transformed through cognition, Polanyi opened a vivid debate, opposing the behaviorist and cognitive perspectives on knowing.

Founded in Kantian psychology,^[12] the cognitive dimension of tacit knowledge refers to patterns that serve as a basis for the perception of, and interaction with, the external world. Thus, it is only on a selective basis that we accept information to which we are exposed, staying faithful to our own pre-established cognitive patterns. This phenomenon is known as "perceptual filtering."^[13] This approach has been exhausted by managerial studies of knowledge in the workplace, noticeably by Nonaka^[2] who introduced a dynamic perspective on knowledge creation, based on its explicit vs. tacit, collective vs. individual dimensions.

EXPLICIT AND COLLECTIVE KNOWLEDGE

Explicit and collective knowledge is all the knowledge a community can tell it knows. Several authors use the term "objectified knowledge" to suggest that this knowledge is considered as objective by the community that shares it. In a positivist understanding, science is a collective and explicit knowledge, though this conception has been challenged by Kuhn, in the *Structure of Scientific Revolutions* or by Feyerabend^[14] in *Against Method*. For these authors, scientific knowledge is embedded in "paradigms" that are constituted by both scientific discoveries that are commonly acknowledged as valid, and beliefs on the state of the paradigm. Thus, for these authors, scientific researchers should challenge (scientific revolutions) existing paradigms in order to help science progress.

In the organizational body of knowledge, patents, corporate written rules and procedures, organizational charts, and management decisions that are produced, acquired or applied by an organization are all part of the explicit and collective body of knowledge. Patents, for example, are the articulation, embedded in written format, of the technical know-how of the firm. The purpose of making knowledge explicit and collective can be to disseminate this knowledge to others, to inform people about recent management decisions, to implement new programs and procedures within the organization, or to signal to the "external environment" the organizational purpose and positions, i.e., prices signal to the competitors and partners of the organization the market value of the services or products offered by the organization. All explicit and collective knowledge is not systematically explicit or collective in the first place. Rules that are informal and ephemera can become permanent and explicit through institutionalization.^[15] Organizational ceremonies^[16] can also become explicit rituals, and progressively stand for permanent rules.

EXPLICIT AND INDIVIDUAL KNOWLEDGE

We can approach individual and explicit knowledge from two perspectives: the sociological and the technological. From an elementary sociological view, we would say that everything that becomes conscious to us becomes part of our individual explicit knowledge, i.e., we discover that we belong to a certain group of people in the organization, as commercial middle managers for example. As soon as we become aware of this belonging, we acknowledge explicitly in our behavior what has become a “fact.” Spender^[17] uses the term “conscious knowledge” to express this type of knowledge.

The other side of individual and explicit knowledge is what we will call our known-expertise, not to betray precedent findings on expertise that clearly state that the essence of expertise lies in the tacit understanding of rules that are unknown to the beginner or non-expert. The example of the chess masters used by De Groot^[18] or Newell and Simon^[19] clearly illustrate this point. However, some types of expertise have solely an explicit purpose. The diploma and the titles of doctors have the purpose of communicating the reliability of his or her services. It may as well have the purpose of stating a social and power position, as unveiled by Foucault^[20] in his study of the “statutory knowledge” of doctors in the history of medicine. This type of explicit and individual knowledge, with the purpose of “declaring,” has been termed “declarative knowledge” by Polanyi.^[11] Positioning and social role-play consequently form a major part in the transformation and exposure of individual and explicit knowledge.

TACIT AND COLLECTIVE KNOWLEDGE

Managers elaborate informal task forces that work on critical issues in parallel to—not instead of—formal structures. These “collateral organizations”^[21] often crystallize in the course of action. People gather to deal with a specific problem, and naturally gather again when a similar problem arises. “Web of complicities” allows organizations to deal obliquely with delicate tasks when formal and explicit processes seem to fail. In the *Challenger* disaster, NASA engineers progressively assimilated the Thiokol rubber joints defaults as acceptable. Although measures were explicitly showing unreliable performances, it became tacitly accepted that this imperfection was within the boundaries of “normal” and “acceptable” risks.^[13] Studies in organizational crises and disasters underline the socially constructed nature of knowledge.^[4] Knowledge, in this perspective, is the result of various social constructions,^[22] and consequently adopting different forms and states according to its different points of observation. For Berger and Luckmann, individuals are

born in a “social construction,” from which we learned to assimilate, to articulate the stimuli around us to formulate our language. Likewise, Lave and Wenger^[23] assert that people in organizations belong to “communities of practice” where they share a practical knowledge, learning collectively and tacitly their trade.

Many trades are thus learned tacitly and collectively. Masonry apprenticeship is a learning-by-doing and by-seeing-others-doing-it process. The tacit and collective know-how of cathedral builders has become legendary. As cathedrals were sometimes built over three or four centuries, generations of cathedral builders—many of whom were illiterate—transmitted from fathers to sons a know-how of achieving complex tasks, without the knowledge or reading and writing. Commitment and faith in supra-ordinal goals were part of the process. Tacit and collective knowledge can also be a guarantee of organizational operational safety. The “collective mind” of flight deck operators^[24] permits highly complex organizational tasks to be achieved with very few accidents. This “organizational mentality” or “organization mind”^[25] relies upon a tacit understanding that do not necessitate explication. Thus, technical knowledge is often acquired through repetitive tasks, the know-how of which is difficult to communicate. Scribner^[26] explains how tacit knowledge is held collectively by workers in a commercial dairy (warehouse order packers, delivery drivers, inventory takers). This tacit and collective know-how is difficult to imitate, and can procure valuable technological rents, allowing the firm to develop an “appropriability regime.” Many times we say “we know” to express assumptions that seem to be common sense, while in fact we only express the output of a tacit and collective learning^[27] or things we have learned by traditions whose origins have been forgotten.^[28] Many elements of our knowledge are gathered without awareness from others while we socialize.^[2,29] We assimilate assumptions that are not ours, and personalize or rationalize them, so to give them our “signature.” Then, we would eventually say, “It’s common knowledge” or “it’s common sense.”^[17]

TACIT AND INDIVIDUAL KNOWLEDGE

As Polanyi^[30] put it, “We know more that we can tell.” First, there are many stimuli that we notice without being aware of noticing them. We learn without the awareness of what is being learned.^[31] We cannot communicate what we learn, thus, we are the only one to be the receiver of this “knowledge.” Second, we do not always learn systematically or intentionally. There are many things that we have learned “incidentally,”^[32] because we had the luck to encounter an unexpected learning experience, or because we were focusing on another task, and something else was to be learned in this task that we did not expect. In the routine of repetitive tasks, we may also acquire a

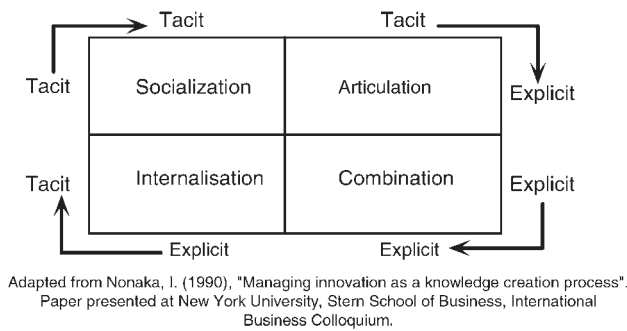


Fig. 1 Transitions from tacit to explicit and vice versa.

tacit knowledge concerning the improvement of our task. This "procedural knowledge"^[26] is difficult to share, and when somebody replaces us at our task, the know-how is difficult to transmit. As termed by Spender,^[17] a large part of our knowledge is "automatic knowledge." We do not know where it comes from, we cannot tell that we know, though "it's here" and "it works." We encode without awareness of encoding.^[33] We act mindlessly and instinctively, relying on an "animal knowledge" made of erratic reactions, or impulsive, based on feelings, smells, guts, like animals do.^[34] We often rely on a "practical knowledge,"^[28] which we are not able to isolate, define, or describe, for we acquired it through mindless and automatic practice. Some elements of our knowledge were constructed unconsciously, by serendipity, that is to say by luck, by imagining a body of knowledge that does not rely upon the noticing of stimuli, but is solely the work of our mind. All this heterogeneous, and rather mysterious, body of knowledge is our "tacit and individual knowledge."

ARTICULATING THE TACIT WITH THE EXPLICIT

It would be misleading to state that the four above types of knowledge are independent of each other, and constitute separate and idiosyncratic bodies of knowledge. The dynamics of knowledge is a continuous, either deliberate or unconscious, movement, exchange, transformation of

one type of knowledge into another, and back and forth. To express the speed of these transformations and shifts, a suggestive analogy would certainly be close to the notion of electrical frequencies. We have, unfortunately, no clues to know if, in the human brain, these four types of knowledge are processed in parallel or sequentially. Researching the epistemological and ontological dimensions of knowledge, Nonaka^[2] synthesized the four kinds of transitions between explicit and tacit dimensions of knowledge (Fig. 1). As Nonaka compiled it from different authors (Piaget, Teece, etc.), a specific mode of transition exists for each transformation. For example, tacit knowledge circulates through socialization, i.e., we learn tacit behaviors and rules, by interacting and observing other people. This tacit knowledge (i.e., the baker's know-how in preparing bread) can be articulated in more explicit rules (i.e., by using different sets of measure in all various conditions of the process to identify rules that are used tacitly by the baker) and then become explicit knowledge. This explicit knowledge can then be combined with other elements of explicit knowledge. For example, two software programs can be merged. The new set of instructions is a combination of formerly separated sets of instructions included in the software. When we face an explicit set of knowledge, we have then to integrate it into our behavior and practice. We achieved this task through practice of the explicit rules, techniques, scientific findings, etc. We internalized our tacit knowledge and made it ours, transforming it into the elements of explicit knowledge.

Using various precedent findings,^[1,17,30] we developed the precedent matrix by integrating the individual and collective dimensions. We finally identified eight forms of transitions in an integrative framework to analyze the different shifts between knowledge types (see Fig. 2). We use these eight forms of transitions as to identify, describe, and explain when and how they occur in the studied organizations. For example, we would identify an "appropriability regime" between the knowledge of engineers—planning and executing the construction of the Guinean plant—and newcomers to the plant. In another example, managers would gather various uncertain or ambiguous stimuli and build a tacit understanding

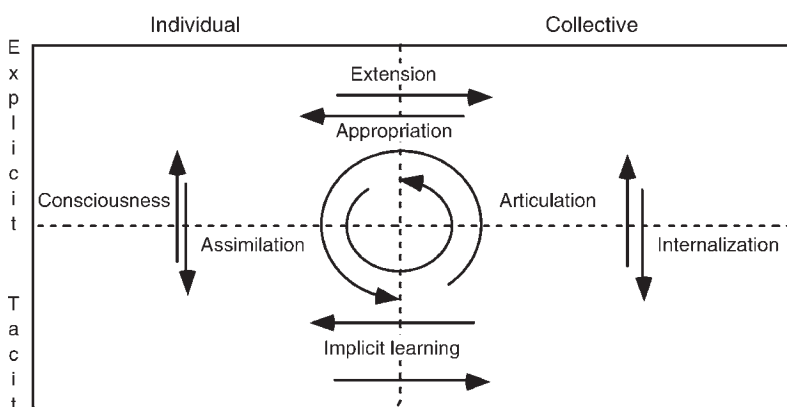


Fig. 2 An integrative framework to analyze transitions of knowledge types.

of the situation. They would share this understanding by socialization (tacit and collective knowledge) and would learn implicitly to organize this knowledge. Finally, by meeting together and “putting things on the table,” they would articulate all their tacit knowledge in one explicit and collective form of knowledge. The elaboration of the following matrix involved extensive reviews of the literature, as to confirm by different sources the validity of each transition. The terms “extension,” “appropriation,” “internalization,” and “assimilation” are used by Nonaka.^[2] The term “implicit learning” seemed to be more adequate to

enclose the whole process of socialization, gathering tacit and implicit stimuli and automatic knowledge^[17] that are involved in the process of transition from individual–tacit knowledge to collective–tacit knowledge. The term is used by Reber.^[5]

The next step of the elaboration of the matrix was then to compile all precedent elements into one single matrix. This enlarged and completed matrix (see Fig. 3) contains both succinct descriptions of various types of knowledge *within* a specific knowledge type, and all the above eight transitions (see next page). The matrix is presented here as

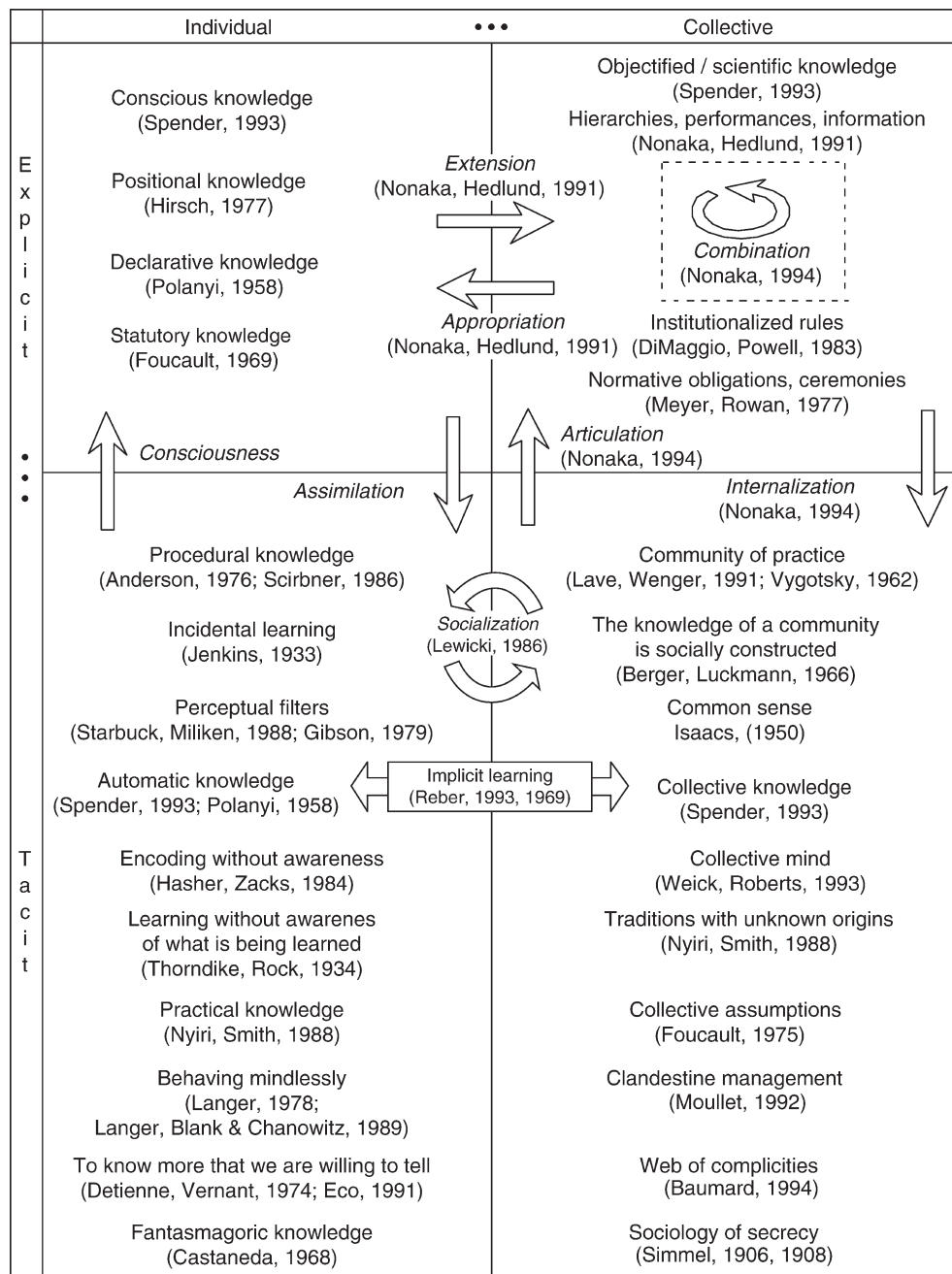


Fig. 3 An augmented and completed matrix of knowledge modes.

Source: From Baumard.^[4]

a guideline to read the case descriptions. It was used accordingly in the data analysis process to verify the validity of findings with precedent works, and eventually come back to more empirical work to avoid bias.

CAN MODELS EXPLAIN THE TRANSFORMATION OF KNOWLEDGE?

Can we replicate this implicit learning with a mathematical model? How would it translate? Implicit learning, i.e., the production of tacit knowledge, is a process that applies unconscious schemata and interpretation schemes to an on-going flow of stimuli, either perceived with full awareness, or perceived automatically without the awareness of the perceiver. One can consider that a complex system, e.g., organizational or organic, mechanical or biological, digital or analogical, is also treating or interpreting various stimuli in its different parts or sub-systems, without necessarily informing the other components. In fact, the historical evolution of the architecture of computers has been driven by the growth of parallel-process design, which implies that some operations, such as graphical outputs, are taken care of by different processors.

Organizations, alike, are processing large amounts of information in their different sub-systems, without the awareness—mutual or asymmetric—of other components. Unlike machines, however, these interpretations are not archived, stored, or systematically accounted for in registers, although members of organizations try their best to develop routines that capture their experience and can be eventually revised when their learning becomes ineffective.^[35] Learning in organizations is very dispersed; so dispersed, indeed, that several authors have challenged the idea that learning could fit in any fashion a category labeled as “organizational.” Noteworthy was the effort of Sandelands and Stablein^[25] who proposed that organizations ought to have a “mind” of themselves, for the results achieved by organizations out-measure individual achievements. However, because organizations comprise a category that is so varied and ambiguous, the extent to which human output can be attributed to an organization, or to an organized action, is difficult to assert. It is hence conceivable that organizations are merely temporary categories that exist in people’s imagination, according to their purpose, their intended level of outreach or discretion, their expectations and the framing of events, contexts and people that create the most comfortable and actionable setting. In this perspective, Morgan^[36] proposed that organizations are products of metaphors, which people use to explain their intended action, or lead other people to conform to an ideal-type of action that they wish will take form. Such metaphors can be machines, like Frederick Taylor’s scientific management; organisms, like the neo-institutionalists’ vision of organizations as biotopes of living organisms in symbiosis or adversity; brains like Wiener’s

cybernetics,^[37] etc. Morgan coined the term “imaginisation” to suggest that the boundary between action and knowledge is nothing other than an academic one: action is knowledge, and knowledge is action.

Indeed, cognitive science has long identified knowledge as symbolic representations stored in the brain,^[38] but Morgan suggested that what we label actions and what we label knowledge are the same reality, put in two differently imagined categories. Yet, imagination, as Morgan sees it, is still a representative form. Following Morgan, one can agree that knowledge is embodied into organizational structures, and that, accordingly, organizational structures might be projections of human knowledge. But following this path, if we admit that knowledge is partly embodied into people, we cannot assert that people are the exact projections of their knowledge. Von Krogh and Roos^[39] noted that most academic and business evocations of knowledge are directed by an epistemology that sees knowledge as a representation. This “representationist” bias fails to capture two phenomenon: (1) knowledge’s propensity for its autonomous development,^[4] i.e., the fact that representation never captures exhaustively the knowledge it addresses combined with the fact that knowledge continues to grow, within individuals, within organizations and groups, without any form of control, and, eventually, awareness, of its beholders and (2) knowledge being transformed, and acted upon, outside of the realm of representation; swimming being a striking example of an action based on a knowledge that escapes representation while being applied.^[40]

There are several examples of forms of knowledge that do not require any form of representation to be applied; and do not require a tight coupling between application and output to generate learning. Lave and Wenger^[23] identified “communities of practice” as such a phenomenon. Representation may take place, but most of the learning is acquired by mimicking, listening, intuitively adapting to peers in sharing a practice. Apprentice masons and midwives are examples. Weick and Roberts^[24] note that high reliability organizations depend upon a “collective mind” shared by operators, as they conduct perilous and complex tasks. Once again, this collective mind made of mindful interactions, of mutual awareness, of tacit and implicit behavioral coordination does not require a representation to be efficient. On the contrary, excessive efforts to represent and codify high reliability organizations through checklists and normative rules, may increase the risk of failures and accidents.

LITTLE EVIDENCE, ABUNDANT MYTHS

Hence, most theories about knowledge creation in organizations are merely fantasies, which reflect more the observers’ rational myths and beliefs, than capturing how knowledge is produced and transformed in organizations. As Starbuck put it, “scientific rationality is a fantasy that appeals us aesthetically, but it violates its own rules,

distorts our observations, and extrapolates incomplete knowledge to ridiculous extremes.”^[41] Among those fantasies, some are long lasting, displaying a strong congruence with widely shared practices. For example, it is assumed that learning is achieved through the application of knowledge; hence asserting that knowledge comes to human awareness through its application. This perspective on learning has led to the differentiation of information and knowledge, by stating that knowledge is produced through the application or experimentation of information to a given context, hence defining knowledge as “applied information.” Unfortunately, experimental evidence is still lacking to demonstrate a linear causality between knowledge, its application and learning. While Argyris and Schön^[42] stated that human beings improve awareness through “double-loop learning,” i.e., learning about their learning through observing the gaps between the outputs of their “theory in use” and their on-going actions, Van de Ven et al.^[43] provided evidence that disruptive innovations are not the outputs of an action–reaction chain of events. In other words, disruptive inventions are not the result of either single-loop or double-loop learning. They occur through the use of knowledge that clearly escapes scientific explanations. While one can agree that knowledge is both created and preserved through its application, it is impossible to observe a direct correlation between the application of knowledge and an increase in learning, and therefore, the continuation or improvement of knowing. A possible explanation for this lack of evidence may be found in the fact that most knowledge transformation is tacit, much alike a young swimmer who discovers the automatic coordination of his members in an indescribable “flowing” movement. In fact, the tenets of the autopoietic theory of knowledge maintain that “knowing is effective action, that is, operating effectively in the domain of existence of living beings” (p. 29).^[44] Such a perspective defends the idea that knowledge creation is self-contained, and hence cannot be projected on any other dimensions than personal perception.

Fundamentally opposed to the idea that knowledge is a commodity, codified or not, Maturana and Varela (p. 74)^[44] “admit knowledge whenever we observe an effective (or adequate) behavior in a given context, i.e., in a realm or domain which we define by a question (explicit or implicit).” Hence, inspired by Polanyi’s automatic knowledge, defenders of this perspective reject the idea that knowledge pursues a purpose or an object. They sum it up nicely: “All doing is knowing and all knowing is doing.” (p. 27)^[44]

IS KNOWLEDGE MERELY A TEMPORARY ARTIFACT OF BEHAVIOR?

Hence, Maturana and Varela underline a phenomenon long known by behaviorists: the tendency of human beings to exaggerate their aware participation in the

production of knowledge and learning. Behaviorists have asserted that such misperceptions are driven by the tendency of scientists to give exaggerated attention to consciousness, instead of making behavior the points of their attacks. When doing so, it is rather clear that the link between problems and solutions, knowledge and its application, acting and learning, is rather shallow, ambiguous, irrational and often, political. Starbuck^[45] observed that people are mostly “action-generators.” Captured in the flow of actions, escalating their deeds to emerging behaviors, people have sets of solutions and sets of problems; and they try to match the available solutions with the available problems, aiming at maintaining a satisfying congruence and consistency as an acceptable level. Organizational politics ask people to be “solutions providers,” while organizational belief in rationality asks them to display themselves as “problem solvers.” In such a dialectic tension, knowledge becomes alternatively a repertory of solutions to fix random flows of problems, or an invented solution to fix an unsolved problem.

Moreover, most learning is biased by the expectations of rewards and incentives that people know of, or imagine. People tend to adopt behaviors that they believe will trigger rewards, or eventually display those behaviors, even if not much learning is involved. Accordingly, people engaged in “placebo interactions”;^[33] engaging in behaviors, knowledge production and exchange, learning activities that pursue the goal of maintaining vital on-going social interactions, whatever the usefulness, meaningfulness, productivity of those behaviors and knowledge. Of course, organizations favor behavioral control over cognitive efficiency, because behaviors are observable, measurable, and therefore can be used as a sanction/reward platform. It is hard to imagine Tolman^[46] rewarding his rats for their cognitive performance, congratulating them for the accuracy of their cognition; yet, Tolman by rewarding their behaviors learned much about their cognition. This is much the same as organizations that reward behavior, aiming at producing efficient cognition among their members. Tolman hence discovered that rats possess “cognitive maps,” i.e., they register the most efficient path towards the promised reward, and reapply it when they recognize a similar situation. But only 36% of Tolman’s rats had correct maps,^[47] which beats a random choice between all the possible paths, but does not reassure scientists regarding whether a rat sense of smell would simply outbid its sense of orientation.

IS KNOWLEDGE REALLY ESSENTIAL TO SURVIVAL?

Another widespread fantasy states that human beings have progressed in society and survivability through their superior knowledge among all living species. The accumulation of knowledge is, indeed, a unique property of human

beings; however, science has not reached a sufficient level of investigative power to demonstrate that other species do not accumulate knowledge in other forms than thoughts, representations, and physical embodiments.

The fact that human beings are fully aware of the importance of their procedural and abstract knowledge leads them to attribute to knowledge all kinds of sources of superiority. While, in fact, people survive in spite of gross errors of perception, repeated throughout their personal and collective history. Starbuck and Mezias^[48] wondered if people in organizations had accurate knowledge of objective facts concerning their environment, and decided to investigate. They found that managers have erroneous perceptions that can range from 30% to 300% of objective values, on such common information as their company size, the volume of the sales, or what their company does. Hence, knowledge theorists have tended to attribute exaggerated causal and explanatory power to cognitive phenomena, often forgetting that the human ability to adapt, while being fully ignorant, may well be the main source of their resilience and organizational performance. Cognition follows behavior, as much as behavior follows cognition; but when they happen simultaneously, in such an intertwined organic relation, it is rather difficult to determine which one commands the other, and on which occasion. As Starbuck (p. 357)^[47] put it: “Behaviorists have long maintained that cognition is only a subcategory of behavior and subject to the same laws as other behavior. (...) Certainly, behaviorists have had little success in demonstrating that behaviorist theories explain complex cognitive behavior, and behaviorist psychology has not subsumed cognitive psychology.”

IS “KNOWING” TRULY SEPARABLE FROM “BEING”?

Indeed, the variability of preferences, and the volatility of aspirations over time and according to contexts, makes it difficult to generalize *ex ante* normative rules of cognition. Prior experiences influence how stimuli are selected and perceived, and in turn, new stimuli can revise previous experience. A new and scarce configuration of data may well become the new model, while all sets of previous models can no longer handle new stimuli. Hence, both models and stimuli are in real life interchangeable. A new stimulus can carry a whole model, and models in turn, turn into old and prior stimuli. The fallacy about explicit knowledge lies in the fact that data, information, knowledge, models, and stimuli belong to a configuration that is so unified, that any attempt to disaggregate them turns their properties into an artificial reduction. This integrated perspective on knowledge owes much to Gestalt psychology. In 1922, in his book *Nature and Human Conduct*, the American philosopher Dewey^[49] identified two forms of knowledge: *knowing how* (that gleaned through habit and intuition) and *knowing about* (which implies reflection

and conscious appreciation)—practical knowledge and constructed knowledge. Dewey theorized that both learning through practice, and generalizing from practice, form a single, unique continuum. Disaggregating or sequencing the phenomenon of *knowing* from experiencing, acting, doing, or being, is empirically impossible. Such divisions or abstractions are indeed quite recent in the knowledge-studies literature. Early studies focused on understanding why such a disaggregation could not, or *should not*, be attempted.

For a better appreciation of the agonies of interpreting practical knowledge we have to return to the nature of experience, as expressed in the tenets of Gestalt psychology. For Christian von Ehrenfels, founder of the movement in the 1890s, actions of a complex order are carried out by being divided into relatively routine tasks, each of these able to be executed without recourse to thought or conscious reflection. Here we find the source of Taylorism, which turned human endeavor into a “division of chores” (chores that become automatism) and opened the way for assembly line production. The central idea of Gestalt psychology is that our perceptual experiences do not emerge as a result of the conscious or unconscious application of rules or concepts to data received from our sensory receptors, but that these experiences come from an immersion in a perceptual environment in which the information we perceive already carries meaning. Perception is then an indivisible holistic structure, uniting our lived experience and the experience we are in the process of living, and it is through continually looking back on our experience that we construct a repertory of perceptual structures.

Gestalt psychology raises the question of recognition, which is little studied in management. It explains how we can recognize a person instantaneously by their physiognomy even from some distance, even though we may not be able to precisely make out their features. Recent research on organizations’ cognitive maps is not so far from this concept, while having little relation with Tolman’s rats. This capacity for recognition would allow us to automatically take appropriate action in a given situation, without having to make an effort to analyze and decide what approach to apply. The Gestalt psychologists’ argument is that our sense-making capacities are indivisible from a physiological–psychological whole, which embraces both thought and perception.

PUTTING KNOWLEDGE BACK WHERE IT BELONGS

It is in our everyday learning, in the development of our practical knowledge, that these automatisms are deployed. At least this was the central argument advanced by Merleau-Ponty^[50] in 1941, in a veritable defense of practical knowledge. Through practice we acquire patterns of behavior—skills such as walking, running, and speech—

which we can then call up spontaneously. In 1966, Polanyi^[30] continued this study of tacit knowledge by looking at similar kinetic phenomena. We learn how to swim, to co-ordinate our movements, to float, in the context of the experience itself, and “we know more than we can express.” For Merleau-Ponty, these patterns become “a part of us.” It was in the repetition of practice that Merleau-Ponty saw the true nature of human learning.

The valuation of cognition results is itself problematic, as people do not have absolute rules to value knowledge. In fact, most informational behavior of human beings is somehow “positional,” in Hirsch’s terms.^[51] People seek to gain information that allows them to gain a positional perspective, i.e., to position their own past experience in relation to the new one, while asserting their own position towards the new situation. Information superiority is hence more a theoretical construct than an organizational reality. People do not see information as having absolute superior value, but rather an immediate, practical leverage for their on-going programs. Rather than challenging the information being used and articulated in on-going programs, people favor collateral and *ad hoc* organizations, which would leave their main programs untouched, and their deeds unchallenged.^[20] Programs emerge from action-generation, and in turn, learning follows the emergent paths of action. In essence, most human knowledge is therefore conjectural, and implicitly collated in the face of action dilemmas. As social researchers, we are all working under the assumption that our efforts at generalization, explanation, and rationalization of management are an urgent need for organizations. What the case tells us is not to forget the unsaid, the unreadable, the erratic, and the mutable in our genuine assumptions. It seems that we blind ourselves from conjectural knowledge and forms of intelligence that proceed obliquely. As Detienne and Vernant put it, “there has been a prolonged silence on the subject of the intelligence of cunning” and the powerful reason behind that silence may well be a “concept of Platonic Truth, which has overshadowed a whole area of intelligence with its own kind of understandings,” and “has never really ceased to haunt Western metaphysical thought” (p. 318).^[52]

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Latent Semantic Indexing

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Abstract

Latent Semantic Indexing (LSI) is a proven successful indexing and retrieval method. This method is based on an automated, mathematical technique known as singular value decomposition (SVD). Given a large information database, LSI uses SVD to create a “semantic space” of the document collection where both terms and documents are represented. It does this by producing a reduced dimensional vector space in which the underlying or “latent” semantic structure in the pattern of word usage of the document collection emerges. Similarities between terms, terms and documents, or documents in the document collection are then based on semantic content not on individual terms. This ability to extract meaning of terms and documents has given LSI success in many different applications.

INTRODUCTION

This entry describes and explains the concepts and theories related to a well known and highly successful automatic information retrieval and analysis technique known as Latent Semantic Indexing (LSI). Given a large information database where the text is heterogeneous and the vocabulary varies, documents and terms in the database are indexed by an underlying or “latent” semantic structure in the pattern of word usage defining the documents. This characteristic of LSI is what gives the technique its name.

Prior to LSI, most information retrieval systems matched words in a user’s query with words in documents contained in the collection being searched. This approach frequently returns irrelevant information while failing to retrieve other relevant documents because people use a tremendous diversity in words to express the same concept. LSI uses a mathematical approach known as the singular value decomposition (SVD) which produces a vector space with single vector representations for each unique term and document in a given document collection. Given the vector space, LSI then uses a dimension reduction technique to produce a “semantic space” that yields improved indexing of documents based on semantic content. Relationships among documents are based on the representation and meaning of the words they contain, and relationships among terms are based on their semantic effect on all the documents in which they occur. LSI uses this reduced dimensional vector space to induce similarities among documents that may or may not contain the same terms and among terms that may or may not occur together in a document. These similarities are based upon

the meaning or semantics of word usage for the entire document collection.

This entry outlines the history of LSI and discusses the basic mechanics behind the algorithm. There is a high level description of the mathematical background for LSI, a short explanation of the computational technology, and a summary of current applications and issues involved with the use of this technique.

OVERVIEW OF LSI

History

There is an ever increasing flood of information generated by a growing number of sources. In order to make use of this information it must be organized into a manageable state where relevant and meaningful items can be accessed and correlated. The large volumes of data involved necessitate a technology that is capable of automatically indexing and retrieving desired information in a timely fashion.

Traditionally, lexical matching was used for retrieving information from a document database or collection. Lexical matching consists of matching words in a user’s query with words in the documents contained in the collection. This technique proves to be inaccurate as it often times retrieves irrelevant results for a given query while failing to return other relevant documents that do not contain exact term matches. The problem is linked to variability in vocabulary and word usage. There is a tremendous amount of diversity in the language or words people use to describe a single concept. This is known as synonymy.

Research shows that two people will pick the same term for a given object less than 20% of the time.^[1] Synonymy can lead to poor recall in queries where the ratio of the number of relevant documents retrieved to all the relevant documents that exist in a document collection is low.^[2,3] Related information may not be retrieved because the concept in a given query is not expressed using the same words as in the documents. People may also use the same word to express several different concepts or meanings. This is known as polysemy and can lead to poor precision in queries where the ratio of the number of relevant documents in the set of documents retrieved is low.^[2,3] Irrelevant information could be retrieved because a word might be used differently in a document than it is in a given query, essentially misunderstanding the context in which the word was used. An ideal retrieval system would have both high precision and recall for any given query.

In 1988, a group at Bell Communications Research (Dumais, Furnas, and Landauer) as well as Deerwester from the Center for Information and Language Studies at the University of Chicago and Harshman from the University of Western Ontario first published a new approach to indexing and retrieval known as “Latent Semantic Indexing” which used an automated technology to overcome term-matching retrieval problems.^[2,4] They originally set about to develop a solution for helping people find desired services in the Bell System Yellow Pages. Users had trouble finding services due to the fact that their searches or queries used many more words (with similar meanings) than were used to index the information in the document collection.^[1] This group chose to overcome the term-matching retrieval deficiencies by using a statistical approach to organize documents in a collection into a semantic structure better suited for retrieval. This approach developed into what is now LSI. Large document collections, consisting of large amounts of text, were automatically analyzed to induce knowledge about the relationships among terms and documents such that the retrieval system could identify when a user’s query words meant about the same as the words the system used for indexing.^[5] This approach exploited the concept that the content of a document is not based on its individual words, but rather that there exists some underlying or “latent” structure in the pattern of word usage. LSI attempts to estimate this latent structure and eliminate the noise that is present due to variability in word choice. Indexing of documents in the document collection is based on the estimated latent semantic structure. As a result, the similarity of documents is not determined by the exact words they contain but on the semantic content.^[6]

LSI is considered a variant of the traditional vector space model (VSM). The vector space model was developed to handle text retrieval from a large information database with heterogeneous text and varied vocabulary. One of the first systems to use a traditional VSM was the System for the Mechanical Analysis and Retrieval of Text

(SMART).^[7] Among the notable characteristics of the VSM is the premise that the meaning of documents can be derived from its components. The underlying formal mathematical model of the VSM defines unique vectors for each term and document. Queries are performed by constructing a vector to represent the query and then compare this query representation to the representation of each document in the vector space.^[8] LSI uses a reduced dimensional VSM. Query-document similarities are then based on concepts or similar semantic content.

Basic Mechanics of LSI

LSI is a fully automatic technique for extracting and inferring the meaning of terms and documents. Prior to the development of LSI, these tasks involved significant human intervention. To obtain the “latent” structure of the document collection, LSI processes a large collection of machine-readable text that consists of multiple documents. No human dictionaries, semantic networks, grammars, syntactic parsers, or morphologies are used; therefore, no preconceived knowledge about the physical word, word order, syntactic relations, or morphology is incorporated in the processing. Only raw text separated into documents is taken as input. Documents are a predetermined size of text such as paragraphs, collections of paragraphs, sentences, book chapters, books, etc. depending on the application. These documents are parsed into terms, which are the individual components that make up a document. Typically, terms are words, but they can be phrases or concepts, also depending on the application. The terms and documents are organized into a single large matrix which is then processed using the SVD matrix decomposition technique.

The SVD produces a vector space from the document collection, which is considered the “semantic space,” where vector representations for both terms and documents are produced simultaneously. Within this “semantic space,” the meaning of a term is represented as the average effect that it has on the meaning of documents in which it occurs.^[5,9] Similarly, the meaning of a document is represented as the sum of all the words it contains. Each term and document is represented by a single vector, with each vector having a certain number of elements or dimensions in the vector space. The SVD allows for the adjustment of the representation of terms and documents in the vector space by choosing the number of dimensions. This controls the number of parameters by which a word or document is described. Usually the number of dimensions is much smaller than either the number of terms or documents, but still is considered a large number of dimensions (typically 200–500 dimensions). This reduction of dimensionality is the key to sufficiently capturing the underlying semantic structure of a document collection. It reduces the noise associated with the variability in word usage and causes minor differences in terminology to be ignored.^[2]

Selecting the optimal dimensionality is an important factor in the performance of LSI. The conceptual space for a large document collection needs more than a few underlying independent concepts to define it, but the semantic space is overly distorted by using too few dimensions.^[4] Using full dimensionality regenerates the original data matrix and provides no semantic grouping of terms and documents, considering every term and document to be unique in meaning.^[6] On the other hand, using a low number of dimensions is undesirable as it does not produce enough differentiation between terms and documents. Essentially too many terms and documents would be considered identical in meaning. Optimal dimensionality is what gives LSI its powerful retrieval effectiveness. For a pictorial representation of the effects of dimensionality in the semantic space and its relation to success of LSI in a word knowledge test, see Landauer.^[15]

The difference between the traditional VSM and the reduced dimensional VSM used by LSI is that terms form the dimensions (the axes) of the vector space in the traditional VSM and documents are represented along those dimensions. Therefore, since the terms are the axes of the vector space in the traditional VSM, they are orthogonal (90°) to each other, causing documents that do not contain a term in a user's query to have a similarity of zero with the query. The result is that terms have their own unique independent meanings. In LSI, however, the dimensions are derived from the SVD not the terms themselves. These derived dimensions are orthogonal, but terms (as well as documents) are vectors in the reduced dimensional space. Terms no longer have unique meaning on their own, nor are they independent. Terms get their meanings from their mappings in the semantic space. The location of the term vectors reflects the correlation of the term's usage across documents in the collection, thus, it carries all of the term's senses (all the different ways in which the term has been used).^[5,10]

In this reduced dimensional vector space produced by the SVD, the closeness of terms and documents can be determined by examining the position and proximity of term and document vectors. Terms close to one another in the reduced dimensional space will be considered to have similar meaning regardless of whether or not they appear in the same document. Terms could be considered dissimilar in meaning because they are far away from each other in the vector space even though they occur in the same document. The closeness of documents is determined by the overall pattern of term usage for the document. Documents can be similar to each other, having close proximity in the vector space, regardless of the specific words they contain.^[6,9] The position of terms and documents in the vector space serves as a "semantic indexing." Users' queries are projected into the vector space, and documents in the neighborhood of the projected query are returned in ranked order, with the most similar document being first. The nearby documents need not share any terms with the

user's query since the location of the query in the vector space is determined by the underlying semantic structure of the document collection, patterns of term usage across documents.^[2]

MATHEMATICAL BACKGROUND

LSI consists of four basic steps.

Assembling the Term–Document Matrix

Given a large collection of text, documents are first preprocessed. Oftentimes, documents must be filtered to remove unwanted information. Documents might contain graphical images, tables, charts, etc. that may need to be removed. There are also unnecessary tags and features that help identify how the documents are organized or formatted which may need to be omitted because they add no semantic content to the document. Stemming and stoplisting might also need to be applied to the words in the documents. Stemming is the removing of suffixes to reduce a word to its root form. Stoplisting is simply the filtering of words that have little or no value to the semantic content of the documents, such as "the," "a," "of," "about," etc.^[3] With stemming and stoplisting, there is always a risk of losing valuable information.

The cleaned documents are then processed to construct a term-by-document matrix. The columns of the matrix stand for the documents and the rows represent terms. Often, with smaller document collections the number of terms is greater than the number of documents. However, as the volume of information increases and the document collections become larger, the opposite (more documents than terms) is more frequently the case. Initially each column of the matrix contains zero and nonzero elements. Each nonzero element or cell of the matrix is the frequency with which the term occurs in a document. The term-by-document matrix is considered sparse because it contains many more zero elements than nonzero elements. Each document in the collection tends to only use a small subset of terms from the entire unique term set. Usually about 1% or less of the matrix entries is nonzero.^[3]

Weighting Elements of the Term–Document Matrix

The second step of LSI is to apply a local and global weighting function to each nonzero, term–frequency entry, in the term-by-document matrix in order to increase or decrease the importance of terms within documents (local) and across the entire document collection (global). Terms that best distinguish particular documents from the rest of the documents in a collection are the most important; therefore, a weighting function should give a low weight to a high frequency term that occurs in many documents

and a high weight to terms that occur in some documents but not all.^[8] Applying a weighting function generally improves retrieval performance. The local and global weighting functions for each cell are usually directly related to how frequently a term occurs within a document and inversely related to how frequently a term occurs in documents across the collection, respectively. For a more detailed description on different types of local and global weighting functions, see Dumais.^[6] A common local and global weighting function that dampens the effect of large differences in term frequencies within a document and that takes the distribution of terms over all documents is log-entropy. The local weighting function of log is defined as $\log(tf_{ij} + 1)$, and the global weighting function of entropy is defined as

$$1 + \sum_j \frac{p_{ij} \log_2(p_{ij})}{\log_2 n}$$

where $p_{ij} = tf_{ij}/gf_i$, tf_{ij} = term frequency of term i in document j , and gf_i = the total number of times that term i appears in the entire collection of n documents. It has been found that log-entropy gave the best retrieval results, 40% over raw term frequency, on several standard document collections.^[6]

Producing the Reduced Dimension Vector Space

Given a rectangular term-by-document matrix A , A can be decomposed into the product of three other matrices using SVD.^[11] Thus the SVD of matrix A is

$$A = T * S * D^T$$

where T is an orthogonal matrix, D is an orthogonal matrix, and S is a diagonal matrix. The first r , where r is the rank of A , columns of the orthogonal matrix T contain r orthonormal eigenvectors associated with the r nonzero eigenvalues of $A * A^T$, and the first r columns of the orthogonal matrix D contain r orthonormal eigenvectors associated with the r nonzero eigenvalues of $A^T * A$. The first r diagonal entries of S are the nonnegative square roots of the r nonzero eigenvalues of $A * A^T$ and $A^T * A$, and are in decreasing order. The columns of matrix T are known as the left singular vectors, and the columns of matrix D are known as the right singular vectors. The nonzero diagonal elements of S are known as the singular values.^[11,12] The rows of matrix T correspond to the term vectors, and the rows of matrix D correspond to the document vectors. The SVD simply rerepresents matrix A using orthogonal indexing dimensions.^[10]

If only the k largest singular values and their associated singular vectors are kept then the SVD of A is truncated to

$$A_k = T_k * S_k * D_k^T$$

which is the reduced dimension SVD. The matrix A_k is the best or closest (distance is minimized) rank k approximation to the original matrix A .^[12,13] The matrix A_k is created by ignoring or setting equal to zero all but the first k elements or columns of the term vectors in T , the first k singular values in S , and the first k elements or columns of the document vectors in D . A pictorial representation of the SVD of term-by-document matrix A and the best rank- k approximation to A can be seen in Fig. 1.^[12,14] The k -dimensional vector space, where the rows in T_k are the term vectors and the rows in D_k are the document vectors, is the foundation for the semantic structures LSI exploits. By reducing the dimension from r to k , extraneous information and variability in type usage (referred to as “noise”) that is associated with the database or document collection is removed. Reducing the dimension is what captures the important underlying semantic structure of terms and documents. Terms similar in meaning are “near” each other in k -dimensional vector space even if they never co-occur in a document, and documents similar in conceptual meaning are near each other even if they share no terms in common.^[12]

The best selection for the number of dimensions to use in the space remains an open question. In practice, the choice for k is much smaller than the number of terms or documents in the term-by-document matrix and usually depends on empirical testing. As described earlier, too few dimensions or too many dimensions result in poor performance. For large datasets, empirical testing shows that the optimal choice for the number of dimensions ranges between 200 and 500. Currently there exists no theory to explain this observation nor is there any method to accurately predict optimal dimensionality.^[5,15] There are however a few techniques mentioned in Dumais^[10] for estimating k .

Querying in the Reduced Dimension Vector Space

Since both term vectors and document vectors are represented in the reduced dimensional vector space, similarities between two terms or two documents or a term and a document can be computed. Most often the cosine

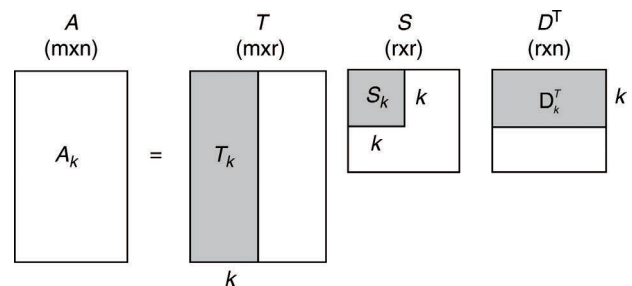


Fig. 1 Diagram of the reduced dimensional SVD for the term-by-document, $m \times n$, matrix A .

(which is the angular distance between two vectors) is used as a measure of similarity because of its relation to the dot-product criterion and its effectiveness in many information retrieval applications.^[4,10,15] The dot product of two vectors $\mathbf{u}$ and $\mathbf{v}$, where $\mathbf{u} = (u_1, u_2, \dots, u_n)$ and $\mathbf{v} = (v_1, v_2, \dots, v_n)$, is the sum of each element in $\mathbf{u}$ multiplied by the corresponding element in $\mathbf{v}$, so $\mathbf{u} \cdot \mathbf{v} = (u_1v_1 + u_2v_2 + \dots + u_nv_n)$. Thus, term-term, document-document, and term-document similarities are easy to compute. New vectors for new terms and/or documents can be added to the existing space by a process called *folding-in*. This same process is used to project queries into the vector space. A query is treated as another “document,” and the query vector is located at the weighted average of its component term vectors or at the centroid of the component term vectors in k -dimensional space. Then the query vector is compared to document vectors to find the most similar documents. The documents corresponding to cosines greater than a certain threshold are ordered by their nearness to the query vector and returned as the results of the querying process.^[12]

For a thorough description on the mathematics supporting LSI refer to Deerwester,^[4] Berry^[12] and Martin.^[14]

LSI Example

To illustrate the capability of LSI a very small example is presented here. A small document collection consisting of book titles and authors is shown in Table 1. There are 13 documents in the collection, and the terms are words appearing at least twice in the document collection. There are 13 terms, shown in boldface in Table 1. The corresponding term-by-document matrix is found in Table 2. The entries in the matrix are all zeros except for the cells corresponding to terms found in each document. Those cells are the frequency with which the term occurs in the documents. Even though this is a small example, the matrix is still sparse with approximately 22% of the matrix cells being nonzero. In this example, only the term frequency is used for the local weighting function, and no global weighting function is applied. If the term-by-document matrix is decomposed using the SVD and term and documents vectors are obtained, the dimensionality of the vector space can be reduced to two dimensions. Of course, two dimensions are never used in practice with large document collections, but for this small collection and for the sake of visually illustrating LSI only two dimensions are used here. The two-dimensional vector space for this document collection can be seen in Fig. 2. If a user wants to find documents related to the query “Henry Ford,” a vector corresponding to the query can be projected into the vector space, as seen in Fig. 2, and then the query vector can be compared to the document vectors by computing the angle between it and all the document vectors. The cosines between the query vector and all the document vectors produce a list in decreasing order. The documents

Table 1 Book titles and authors found on Amazon.com (terms are in boldface).

Label	Titles and authors
D1	<i>A Guide To Style: A Manual for Business and Professional Women</i> by Iris P. McMillan
D2	<i>Art Models 2: Life Nude Photos for the Visual Arts</i> by Maureen Johnson and Douglas Johnson
D3	<i>Open Business Models: How to Thrive in the New Innovation Landscape</i> by Henry Chesbrough
D4	<i>Legendary Model A Ford: The Complete History of America's Favorite Car</i> by Peter Winnewissee
D5	<i>The Automobile (Inventions That Shaped the World)</i> by Robyn Conley
D6	<i>Legends of the Open Road: The History, Technology, and Future of Automobile Design</i> by Gabriella Belli
D7	<i>The House of Klein: Fashion, Controversy, and a Business Obsession</i> by Lisa Marsh
D8	<i>The Art of Fashion Draping</i> by Connie Amaden-Crawford
D9	<i>Costume and Fashion: A Concise History (World of Art)</i> by James Laver, Amy De LA Haye, and Andrew Tucker
D10	<i>The Art of the Automobile: The 100 Greatest Cars</i> by Dennis Adler
D11	<i>The Lady Mechanic's Total Car Care for the Clueless: A Manual for Car Owners</i> by Ren Volpe
D12	<i>Everything Women Always Wanted to Know about Cars; But Didn't Know Who to Ask</i> by Lesley Hazelton
D13	<i>Henry's Lady: An Illustrated History of the Model A Ford (The Ford Road Series, Vol. 2) by Ray Miller and Glenn Embree</i>

corresponding to the highest cosines are deemed most relevant to the query “Henry Ford.” The top five documents deemed relevant to the query, which are those documents with cosines greater than 0.95, can be seen in Table 3. Notice that the top document is about the Ford model A and that the top five documents are all about cars or automobiles even though the book titles for D11, D12, and D5 contained none of the query words. The document corresponding to D5, *The Automobile (Inventions That Shaped the World)* by Robyn Conley, is definitely relevant to “Henry Ford,” one of the first to mass produce automobiles which shaped the world. Another observation is that of all the relevant documents returned only one contains both of the query terms. If the cosines are computed between the query vector and the document vectors based on a lexical matching then only cosines for D3, D4, and D13 are computed and returned. Of course, D13 is deemed the most relevant in lexical matching, but obviously some relevant documents are missed, such as D5 *The Automobile (Inventions That Shaped the World)* by Robyn Conley.

Using this small example, a new document can be added to the existing vector space by *folding-in*. If a new document, “Fashion (*Oxford History of Art*) by Christopher Breward,” labeled D14 is to be added to the semantic space, the document vector is projected into the vector

Table 2 Term-by-document matrix with the term frequencies corresponding to the book titles found in Table 1.

Terms	Documents												
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13
Art(s)	0	2	0	0	0	0	0	1	1	1	0	0	0
Automobile	0	0	0	0	1	1	0	0	0	1	0	0	0
Business	1	0	1	0	0	0	1	0	0	0	0	0	0
Car(s)	0	0	0	1	0	0	0	0	0	1	2	1	0
Fashion	0	0	0	0	0	0	1	1	1	0	0	0	0
Ford	0	0	0	1	0	0	0	0	0	0	0	0	2
Henry	0	0	1	0	0	0	0	0	0	0	0	0	1
History	0	0	0	1	0	1	0	0	1	0	0	0	1
Lady	0	0	0	0	0	0	0	0	0	0	1	0	1
Model(s)	0	1	1	1	0	0	0	0	0	0	0	0	1
Open	0	0	1	0	0	1	0	0	0	0	0	0	0
Road	0	0	0	0	0	1	0	0	0	0	0	0	1
Women	1	0	0	0	0	0	0	0	0	0	0	1	0

space at the centroid, or weighted average, of its constituent term vectors, which are “art,” “fashion,” and “history” in this case. Fig. 3 shows the new document being placed in the existing vector space for this small book title example. Notice its placement, at the centroid of the vectors corresponding to “art,” “fashion,” and “history.” The new document vector, D14, is near D2, D7, D9, and D8 which are all about artwork and fashion.

COMPUTATIONAL TECHNOLOGY

The automatic computation of the reduced dimensional vector space for a term-by-document matrix derived from a given document collection is a nontrivial calculation. Given a large term-by-document matrix A where there are more terms than documents, the SVD computation becomes a problem of finding the k largest eigenvalues

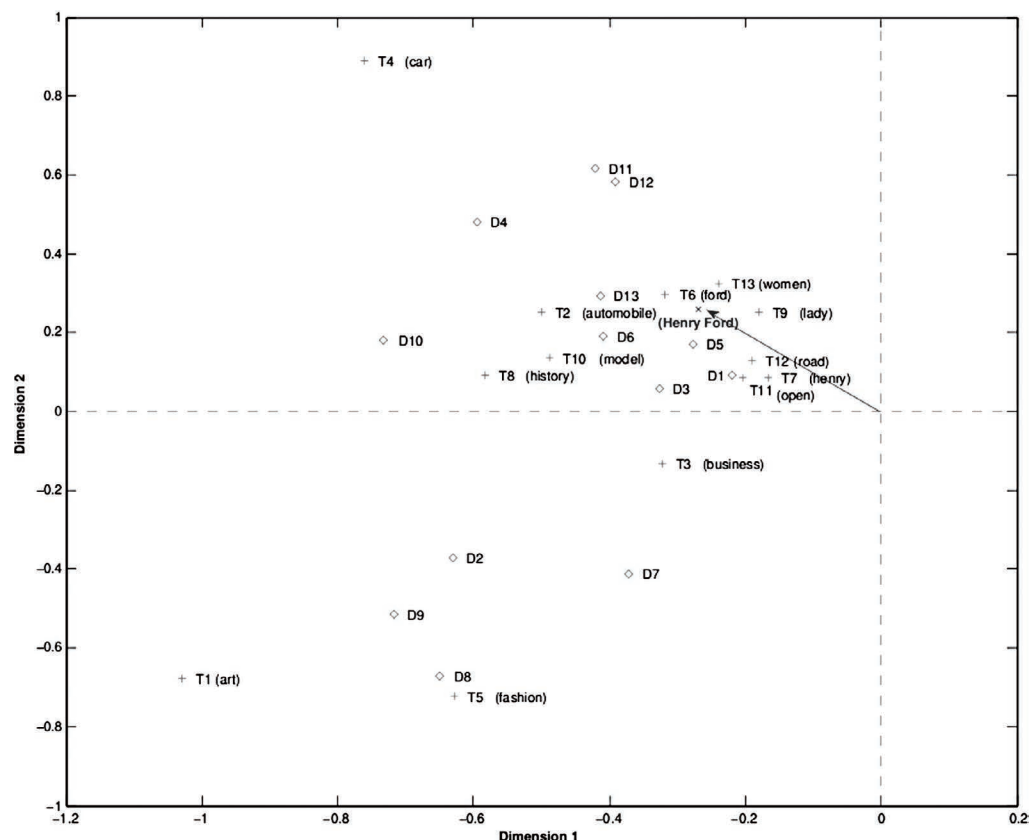


Fig. 2 The two-dimensional vector space for the book titles found in Table 1 with the vector corresponding to the query “Henry Ford.” Legend: Diamonds are documents found in Tables 1 and 2 with the labels D1-D13. Crosses are terms found in Tables 1 and 2 with the labels T1-T13 along with the actual word.

Table 3 Results for the query “Henry Ford” using a cosine threshold of 0.95.

Document	Cosine
D4: <i>Legendary Model A Ford: The Complete History of America's Favorite Car</i> by Peter Winnewis	0.9960
D13: <i>Henry's Lady: An Illustrated History of the Model A Ford</i> (The Ford Road Series, Vol. 2) by Ray Miller and Glenn Embree	0.9882
D11: <i>The Lady Mechanic's Total Car Care for the Clueless: A Manual for Car Owners</i> by Ren Volpe	0.9795
D12: <i>Everything Women Always Wanted to Know about Cars; But Didn't Know Who to Ask</i> by Lesley Hazelton	0.9780
D5: <i>The Automobile (Inventions That Shaped the World)</i> by Robyn Conley	0.9768

and eigenvectors of the matrix $B = A^T A$. Finding the eigenvectors and eigenvalues of B produces the document vectors and the singular values (the nonnegative square roots of the eigenvalues of B). Then the term vectors are produced by back multiplying. If there are more documents than terms, then computing the SVD is reduced to finding the k largest eigenvalues and eigenvectors of $B = A^T A$. In this case, finding the eigenvectors and eigenvalues of B produces the term vectors and the singular

values, and the document vectors are produced by back multiplying. To summarize, given the symmetric matrix B , which is created from the sparse input matrix A , the objective is to find the k largest eigenvalues and eigenvectors of B . Thus, the SVD computation is based on solving a large, sparse symmetric eigenproblem.^[11,16]

Currently the technology most often used to compute the SVD is based on the Lanczos algorithm. The Lanczos algorithm, which is an iterative method, is proven to be accurate and efficient in solving large, sparse symmetric eigenproblems where only a modest number of the largest or smallest eigenvalues of a matrix are desired.^[11,17] The Lanczos algorithm, used to compute the k largest eigenvalues and eigenvectors of B (described in the previous paragraph), actually approximates the eigenvalues of B .^[18] In using finite-precision arithmetic, the basic Lanczos procedure suffers from the loss of orthogonality among Lanczos vectors, which lead to the eigenvectors of B . Currently the best option for remedying the problems associated with finite arithmetic is to use selective reorthogonalization of the Lanczos vectors, which is known as the “Lanczos algorithm with selective reorthogonalization.”^[16,17] The Lanczos algorithm with selective reorthogonalization has made it computationally possible to produce a reduced dimensional vector space for a large document collection. With the growing amount of information available, the

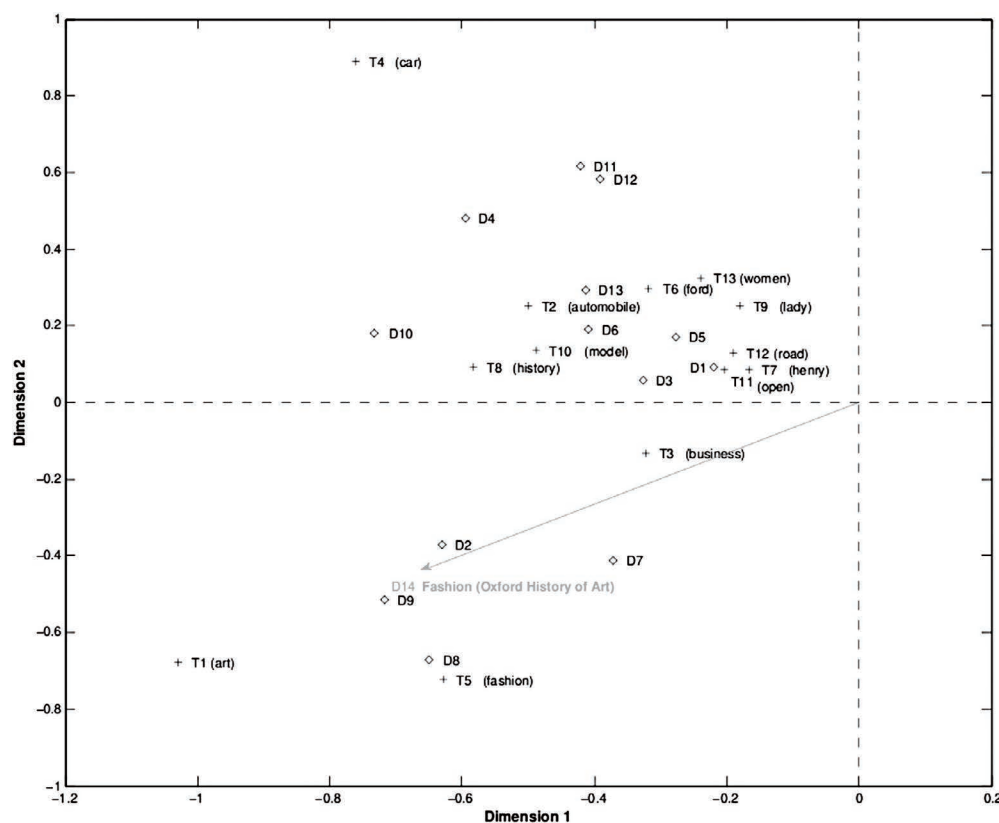


Fig. 3 The two-dimensional vector space for the book titles found in Table 1 with a new document, D14 “Fashion (*Oxford History of Art*) by Christopher Breward,” folded-in the semantic space.

computation of the SVD is manageable with current computer architectures (including clusters and symmetric multiprocessors) and the advent of a highly parallel Lanczos algorithm.^[18]

ISSUES AND LIMITATIONS

There are some known issues and limitations with LSI, and a few of the most important ones are described here.

The Value of Word Order

Given a document collection, as documents are automatically read and terms parsed the implicit word order is ignored. The meaning of terms and documents is desired and achieved with LSI without concern for word order or syntactic structure. In some applications, this disregard of word order might result in incompleteness or error.^[9] However, LSI performs amazingly well at characterizing the semantics of a given document in a document collection despite the fact that syntactic information is not considered.

Computational Challenges

There are computational challenges associated with calculation of the SVD. The time and storage required to compute the SVD of a document collection correspond to the overall size of the collection, the amount of information or raw text. Larger document collections require more computation time to create a vector space as well as more storage to store the vectors. As document collections grow these scalability issues increase. There are a few solutions available for handling document sets of increasing size. One solution can be found in Martin^[19] where out-of-core capabilities for the SVD computation are explored. Another solution is the parallel SVD algorithm that is described in Berry.^[18]

Updating

As information is constantly being generated there is often a need to add new documents and terms to an existing vector space. In the simple case, new items are projected into the vector space based on the relationships between the set of term and document vectors used in the vector space creation by a process called *folding-in* (described earlier). However, the addition of new documents can change the relation among terms, and this change is not reflected in the vector space when using the *folding-in* process. As new documents are added, there is a point at which the vector space needs to be recomputed, especially for large collections with rapidly changing content. It has been found that recomputing the vector space only changes the underlying semantic space significantly if

the document collection has changed by about 20% or more.^[5] Recomputation of the SVD can be costly as described in the previous section, but the out-of-core and parallel capabilities described in Berry^[18] and Martin^[19] make recomputation more feasible. A computationally less expensive algorithm known as *SVD-Updating* has also been developed.^[12,20] However, to date there is no optimal way to add information to an existing reduced dimensional vector space which directly and accurately affects the underlying latent semantic structure of the collection that is as accurate as recomputing the k -dimensional vector space with the added information.

APPLICATIONS

Over the past two decades, LSI has been tested and employed in a wide range of problems and applications. LSI has been successful as an automated, practical tool for constructing representation of meaning. The book *Handbook of Latent Semantic Analysis* describes and demonstrates an assortment of research and applications for LSI (also known as Latent Semantic Analysis or LSA). LSI has made it possible to build a computational model for many semantic problems.^[21] There are three main categories of applications for LSI. They include information retrieval and analysis, cognitive psychology, and educational applications.

Information Retrieval and Analysis

LSI originated as a technique for improving information retrieval^[4] and has been shown to improve retrieval performance by up to 30%, being able to match user's queries to documents of the same or similar meanings without having terms in common and rejecting irrelevant documents that have many terms in common with the query.^[6] As an information retrieval technique, LSI's capabilities have been utilized to help users locate information, learn from the information, and use the learned information from online manuals. LSI-based tools can automatically present information that is adapted to an individual user's background knowledge and levels of expertise.^[21] LSI has been extended to cross-language information retrieval where users can query in one language and retrieve documents in another. The classical cross-language information retrieval method creates a multilingual semantic space by using dual-language documents, where a dual-language document is the same version of a document in two different languages concatenated together. Then other documents from the two languages are folded-in, and queries in one language can find matching documents in another language. This method has shown promising results.^[10,22] An extension to this cross-language LSI method has been developed and explored using a technique that maps a semantic space in one language into a

semantic space of another to allow for multiple (more than two) languages to be represented in one semantic space.^[23] This extension has allowed for creating of Hindi, Arabic, Swahili, and English multilingual space.^[10]

Recent work^[24] has applied LSI to the task of spam filtering. They compared the classification performance of the traditional VSM and LSI using text-based feature sets from the de-facto spam filtering system SpamAssassin.^[25] In classifying e-mail messages as spam or not spam, they demonstrated that a surprisingly large amount of truncation (or low-rank) for the SVD is often possible without a significant loss in classification performance. Although performance can greatly depend on feature (text) extraction strategies, LSI-based spam filtering has been demonstrated to be significantly better than the standard approaches offered by SpamAssassin.

Cognitive Psychology

LSI has been used for research in the field of cognitive theory, testing theories of cognition and trying to better understand the development of the human mind. Landauer and Dumais were the first to attempt to use LSI to build a psychological theory of meaning. They tried to build a system that acquires something similar to human knowledge, which in their case was a human child. LSI was able to acquire English vocabulary at a comparable rate to the vocabulary growth of an American child.^[15] This led to LSI being explored as a tool for assisting human vocabulary acquisition. Research in modeling a child's semantic memory with LSI has been explored with some success.^[21] In research conducted by Kintsch, a comprehension model incorporating LSI has been shown to accurately represent word meanings despite the fact that a word might have multiple meanings and multiple senses (for example *horses run* and *colors run*).^[21] Many more cognitive theories and processes have been explored and modeled using LSI and are described in Landauer.^[21]

Educational Applications

LSI has been used in many educational applications. LSI has been used to help to develop educational, interactive Web-based applications. Intelligent tutoring systems need to be able to capture meaning in text. Some examples of tutoring applications using LSI are the following: 1) iSTART, which helps students to better self-explain by teaching them reading strategies; 2) AutoTutor, which helps students learn a certain subject by engaging with a computer tutor; 3) Knowledge Post, which supports online learning and collaboration; and 4) Summary Street, which helps teach children how to compose a written summary of a subject by having students write summaries and giving feedback, automatically coaching them.^[21] One of the most successful educational applications using LSI is the Intelligent Essay Assessor (IEA).^[26] IEA is a full-scale

grading system that has been used commercially to score the adequacy of the content of millions of expository essays for important exams with as high a reliability as two human graders. Again please see *Handbook of Latent Semantic Analysis* for more on these applications.

CONCLUSION

Initially LSI was introduced as a technique to improve information retrieval. It makes use of a mathematical technique to create a semantic space for a document collection in a completely automatic fashion. LSI uses SVD to overcome vocabulary mismatch problems, the variability in word usage, by reducing the dimensionality of the vector space produced by SVD. The dimension reduction causes term and document vectors in the vector space to drop unimportant detail, thus, achieving optimum levels of similarity. Therefore, relevant documents can be identified and retrieved from a document collection even when the documents contain no words presented in the user's query. This dimension reduction step is what captures the underlying semantic structure of terms and documents and what has given LSI its success in many different applications.

While LSI has been used and tested in many different research and application areas with varied success, there still remain issues to be addressed or investigated. Computational issues are still a challenge for large and rapidly changing document collections, especially since the amount of information to be managed continues to grow.

Two decades after its conception, LSI is being used in many different areas other than informational retrieval with promising results. Its capabilities in information retrieval have increased. LSI has great potential for future applications and projects.

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Latinos and U.S. Libraries: History

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Abstract

A circumstance that has greatly impacted library services in the United States has been the increased presence of ethnically and linguistically diverse user populations. Central in this development is the Latino community, now the largest minority group in the nation. This entry provides a historical overview of the development of library and information services to the Latino community and the development of Latinos as library professionals. It highlights key policies, initiatives, organizations, and leaders who were instrumental in the development of services to this community and in the recruitment of Latinos to the profession.

INTRODUCTION

Libraries like other institutions are shaped by social, political, and cultural forces. Therefore, a history of library services must consider the social context of that time and how it fashioned its direction. A circumstance that has greatly impacted library services in the United States (U.S.) has been the increased presence of ethnically and linguistically diverse user populations. Central in this development is the Latino community, now the largest minority group in the nation. This entry provides a historical overview of the development of library and information services to the Latino community and the development of Latinos as library professionals.

The history of Latinos in the U.S. as library users and as library professionals prior to the late 1960s has not been well documented. Nevertheless, it is known that before the development of modern Latino library collections there were community libraries established by *mutualistas* (mutual aid societies) during the first part of the twentieth century for this community.^[1] It is also known that Spanish-language newspapers, such as *El Clamor Publico*, *Regidor*, and *La Voz de la Mujer*, were important vehicles for the exchange of news, information, and opinions and that by 1939 there were over 400 Spanish-language newspapers in the southwest.^[2] Finally, it has also been documented that Latino literary historiography is not a recent phenomenon, but has existed for several hundreds of years.^[3] The work by Padilla (1971) is among the few that provides an extensive review of Latino bibliographic history extending back to 1848.^[4] However, more on these early years needs to be investigated and recorded. It was not until the late 1980s that the Library and Information Science (LIS) literature began to document and to discuss issues related to information services for the Latino community.

The Civil Rights Movement of the 1960s, along with other political changes, created an environment where

questions of library services to ethnic communities began to receive attention. Legislation such as the Federal Government's Library Services Construction Act (LSCA) of 1964, the Civil Rights and Economic Opportunity Acts of 1964, and the Elementary, Secondary, and Higher Education Acts of 1965 made funds available for programs and services aimed at underserved communities.^[5,6] It was mainly during this time that library services targeting the Latino community were mainstreamed.

LATINOS IN THE UNITED STATES

The history of the Latino population in the United States is diverse, complicated, and important to know in order to better serve this community. In recent years the role of the Latino community in changing the demographic landscape of the United States has received much discussion. It is estimated that between 2005 and 2050, the Latino population will triple in size and will account for most of the nation's population growth. There were 42 million Latinos in the U.S. in 2005 and this number is expected to rise to 128 million by 2050.^[7] These estimates do not count the number of undocumented Latinos who live and work in the United States. Clearly Latinos represent a key economic, political, and cultural force in the U.S., but they are also culturally, demographically, and geographically diverse. The largest group is people of Mexican origin (64%), followed by Puerto Rican (9%), Central American (7.6%), South Americans (5.5%), Cuban-American (3.4%), and then Dominican (2.8%).^[8] They come from as many as 20 countries, speak various languages, and sometimes share very little in common with each other. Differences are apparent not only by country of origin, but also by generational status, language preferences, and socio-economic class. The information needs of a first-generation Spanish-speaking Latino will be very different

than those of a third-generation monolingual English-speaking Latina.

In addition to being a growing and diverse population Latinos are also a young community. The average age of a Latino male is 27 compared to an overall average of 35. Contradictory to popular belief more Latinos are U.S. born (60%) than foreign-born (40%).^[8] A final interesting demographic trend is that although Latinos have tended to reside in southern and western regions of the states most recently states such as Arkansas, Georgia, and South Carolina have seen a tremendous growth in their Latino populations. The geographic distribution of the Latino community is changing and expanding and libraries in impacted communities need to be prepared to meet the needs of these new members.

IDENTITY LABELS

The demographic profile of the Latino community highlights the diversity within the community. For this reason, it is important for libraries to learn as much as possible about the Latino community in their service area before making investments in collections, programming, services, publicity, and staffing.^[9] Along with this task is the need to learn about the identity politics of that particular community. Terms such as "Latino" and "Hispanic" are often used interchangeably to generally refer to this population, but it is important to understand the semantics of such words. Latino is employed as a generic descriptor for people from Latin American descent. While the term Hispanic, instituted by the federal government, refers to Spanish-speaking people residing in the U.S., this term is often criticized for excluding those who are not Spanish-speaking, as well as for stressing Spanish ancestral origins over indigenous and other racial influences which make up the Latino heritage. Both terms (Latino and Hispanic) are somewhat problematic in that they group together people from many geographically and culturally diverse regions. A number of other labels have been applied to this ethnic group by the literature, such as Raza, Spanish-speaking, Spanish-surnamed, Latin, Spanish, Latin American, Hispano, and Chicano/a. Arguments have frequently been presented for the advantages of one over the other.^[10,11] Libraries need to be sensitive to the identity politics that certain labels carry for sectors of this community as they provide services to them. Preferred terms usually reflect local preferences and may differ by generational status, age, class, as well as other variables.

LATINOS AND LIBRARY SERVICES

The Civil Rights Movement set in motion a process that brought ethnicity into the forefront of many societal

discussions. Racial minority students across the United States began to demand courses and studies depicting their ethnic heritage and contributions to U.S. society. The growth of these programs stimulated the development of library collections in these areas, including collections reflective of the various Latino populations.^[5] At that time the American Library Association (ALA) was not known to be a bastion of support for library services to Latinos.^[12] Although ALA lagged behind mainstream America in efforts aimed at addressing the needs of Latinos it eventually established the Committee on Library Services to the Spanish-Speaking in the mid-1970s. In 1978 *Library Journal*, published the "Guidelines for Library Services to the Spanish-Speaking" by Yolanda Cuesta and Patricia Tarin.^[13] In 1988 ALA also adopted the policy, "Guidelines for Library Services to Hispanics" which was prepared by the Library Services to the Spanish-Speaking Committee of what was then called the Reference and Adult Services Division, now the Reference and User Services Association.^[12]

The development of library and information services to the Latino community called not only for the creation of guidelines and targeted initiatives; it also necessitated the establishment of collections and access tools. The growth of collections would not have been possible without the founding of Latino focused publishers and book distributors such as Arte Publico Press (1979), the Hispanic Book Distributor (1980), and the creation of other collection development tools. For instance in 1973 REFORMA (The National Association to Promote Library and Information Services to Latinos and the Spanish-Speaking) began publishing its newsletter which included book reviews of interest to the Latino community.^[14] By 1994 *Library Journal* started "En Espanol" a semi-annual review of Spanish-language books. A more recent event has been the partnering of ALA and the Guadalajara International Book Fair. For the last 10 years this partnership has awarded librarians who work in the area of Spanish-language acquisitions funds to attend the Fair. Finally in 2002 *Criticas: An English Speaker's Guide to the Latest Spanish-Language Titles* began to be published. *Criticas* is a monthly review of Spanish-language books produced by *Publishers Weekly*, *Library Journal*, and *School Library Journal*.

As the collections grew so did the need for access tools. There were certain tools like the *Chicano Thesaurus* and *COMEXAZ* (Comite de Mexico y Aztlan) that were useful across a variety of library settings. The *Chicano Thesaurus*, a subject-heading guide used to organize Latino collections and to make searching easier was first published in 1979. *COMEXAZ*, a newspaper monitoring and indexing service established in 1972, ceased service in 1980.^[1] Both of these tools were instrumental in increasing access to Latino materials. There were other access tools, to be discussed, created to meet the needs of particular types of libraries as well.

LATINOS AND PUBLIC LIBRARIES

Services to the Latino community within public libraries began mainly as services to the Spanish-speaking. There have been many initiatives targeting the various sectors of the Latino community throughout the United States since the late 1960s. An early effort aimed at the Puerto Rican community was the New York Public Library's South Bronx Project implemented in 1967 with federal funds under the direction of Lillian Lopez. In 1970, the Cleveland Public Library initiated Project Libros.^[6] Project Libros was funded by a Library Services and Construction Act grant through the State Library of Ohio and ran until 1978. In Albuquerque, New Mexico, the Model Cities Neighborhood Library, also a federally funded project, was opened in 1973 to provide services to predominately Mexican American communities. In 1978, El Centro (The Center), a Brooklyn Public Library bilingual center was opened in the Williamsburg Branch Library. In New Jersey, the Newark Public Library inaugurated a model program in 1979 to reach New Jersey Latinas/os which lead to the founding of La Sala Hispanoamericana, a permanent program for the Latino community.^[12] In Florida, La Rama Hispanica Branch was opened in the heart of Little Havana in 1978 to serve the Cuban community.^[13] Also during the late 1970s in California the Los Angeles County Public Library established Project LIBRE (Libraries Involved in Bilingual Reading Education) and the San Francisco Public Library established the Latin American Library.^[15] Although many of the outreach programs and services were launched during the height of the civil rights era there have also been recent programs. For example under the leadership of Martin Gomez, the Serra Cooperative Library System implemented the highly successful "Latino Services Project" from 1982 to 1984.^[12] California's Partnerships for Change established in 1989 is credited for revitalizing library services to ethnic communities across the state and in 1996 the Library Service to Hispanic Immigrants of Forsyth County, North Carolina was established.^[12] In 1993, Project Colorin-Colorado was started in Miami-Dade Public Library System to create and perform special programs in libraries to celebrate Hispanic Heritage Month. The San Antonio Public Library instituted the Lea Por Vida (Read for Life) program in 1995, a joint project with the WIC (Women, Infants, and Children) program to combine health education with an introduction to library services. These programs vary in focus, but all provided culturally relevant collections and programs and hired bilingual and/or bicultural staff. However, these projects in public libraries were developed with special funding, such as LSCA grants, and were never fully integrated into ongoing budgets, causing the projects to be weakened or eliminated over time.

In recent years public libraries have seen a dwindling in government funding causing them to seek out other sources of capital. A current example is WebJunction's

Spanish-Language Outreach Program funded by the Bill and Melinda Gates Foundation. This program, piloted in 2004, helps equip local library staff with knowledge and resources to reach out to Spanish-speakers in their communities and to increase their access to technology.

Central to public library initiatives was the development of collections to meet the needs of the Latino community they served. In general, public libraries focused on the development of Spanish-language collections to serve the Spanish-speaking patron, which is different than developing collections with a focus on the Latino experience. Latino focused collections remained for the most part removed from the community located in institutions of higher education. It was not until the mid and late 1970s that a few of such collections began appearing in public libraries while such collections were created in academic libraries in the late 1960s.^[11] One of the earliest resources established in a public library was the Chicano Resource Center of the Los Angeles County Public Library (1976) located in East Los Angeles, the heart of the Latino community.^[11]

Although a wide range of models to improve public library services to Latinos were implemented during the late 1960s and early 1970s the development of an appropriate indexing system to ensure access to Spanish-language information or to information by or about the Latino community had been ignored. Libraries soon came to the realization that greater savings would be generated by the use of an appropriate bilingual, Spanish, or culturally relevant subject indexing system. Early on the Alameda County Library in northern California began the development of Spanish-language subject headings based on a scheme called *La Lista de Encabezamientos*.^[16] Another effort to develop Spanish-language access to library materials was the California Spanish-Language Database, also known as Hispanex (Hispanic Information Exchange), which was initiated in 1977. It originated as a joint request by the East Bay Cooperative and the Oakland Public Library (now combined and known as the Bay Area Library and Information System) for LSCA funding to develop a union catalog of their Spanish-language books with subject headings in Spanish.^[17] The English/Spanish subject headings created for this catalog were published in a publication entitled *Bilindex: A Bilingual Spanish-English Subject-Heading List: Spanish Equivalents to Library of Congress Subject Headings* in 1984.^[18] The goal of this work was to provide authorized Spanish equivalents for English Library of Congress Subject Headings.

Although many efforts targeting the Latino community have occurred in the last few decades a study carried out in 1994 identified areas of weakness for public libraries. Reynaldo Ayala and Marta Steifel Ayala conducted a project sponsored by REFORMA and funded by the W.K. Kellogg Foundation to evaluate the then current state of public library services to the Latino community in the United States. The findings were published in a report

entitled *The Report Card on Public Library Services to the Latino Community: Final Report*.^[12] They highlighted that the demand for services, especially for Latino children, was growing, but lamented the fact that there were so few Latino librarians, only 1.8% of all librarians at that time.

LATINOS AND SCHOOL LIBRARIES

The advent of bilingual education legislation (Bilingual Education Act of 1968 and 1974) and program implementation changed the face of school library services. Bilingual education programs made funds available for the purchase of bilingual or Spanish-language materials for school libraries. However, what became evident was that traditional jobbers provided little assistance in locating bilingual and/or ethnic materials for schools. Therefore new distributors, such as Las Americas and Bilingual Education Services, came about to fill these particular needs.^[19] Publishers like Arte Público Press, Piñata Press, Lectorum, and Children's Book Press have also been helpful in seeking out quality materials produced by non-mainstream publishers.

Advocates for services to Latino children and youth have stressed the importance for children to have access to reading materials that portray their cultural heritage in a positive manner. Dr. Isabel Schon, Director of the Barahona Center for the Study of Books in Spanish for Children and Adolescents, has been a leader of this campaign. She has led an active career dedicated to research in the area of materials for children and young adults and continues to provide reviews and recommended reading lists for children and adolescents.

As the availability of Latino themed children's books grew book awards were instituted to encourage creativity and quality works. The Pura Belpré Award was established in 1996 by REFORMA and the ALA Association of Library Services to Children. This award is presented to a Latino/a writer and an illustrator whose work best portrays, affirms, and celebrates the Latino cultural experience in an outstanding work of literature for children and youth. Awards are given for narrative and illustrations, with honored books in each category. This award is named after Pura Belpré, the first Latina librarian of the New York Public Library. Belpré was a children's librarian who enriched the lives of Puerto Rican children in the United States through her storytelling, writing, and dissemination of Puerto Rican folklore.^[20] The Tomás Rivera Mexican American Children's Book Award was established in 1995 by the Southwest Texas State University to encourage authors, illustrators, and publishers to produce books that authentically reflect the lives of Mexican American children and young adults in the Southwestern regions of the United States.^[9] In 1993, the National Consortium of Latin American Studies Programs bestowed the first Américas Award for Children's and Young Adult Literature. The

Américas Award is given in recognition of U.S. works of fiction, poetry, folklore, or selected non-fiction published in the previous year in English or Spanish that authentically and engagingly portray Latin America, the Caribbean, or Latinos in the United States.^[20]

An additional program that has furthered attention to library and information services to Latino children has been the instituting of El Día de los Niños/El Día de los Libros (Children's Day/Book Day). This is a celebration of children, families, and reading held annually on April 30th. The celebration emphasizes the importance of literacy for children of all linguistic and cultural backgrounds. This event is the brainchild of nationally acclaimed children's book author Pat Mora, who proposed it in 1996. This national event has been funded by a series of grants from the W.K. Kellogg Foundation, and most recently Target. The Association for Library Service for Children continues to increase public awareness of the event in libraries throughout the country in collaboration with REFORMA, a founding partner of the event.

The demise of funding for school libraries throughout the United States, particularly in low-income communities has weakened the momentum of developing strong collections to meet the needs of Latino children. Other legislations like California's 1998 Proposition 227, which ended bilingual education and Proposition 187 in 1994, which denied undocumented immigrants social services, health care, and public education, furthered damaged the quality and quantity of services available to Latino children in public schools.

LATINOS AND ACADEMIC LIBRARIES

The development of collections and services to meet the needs of Latinos began in the academic setting. Precursors to what is known today as "Chicano collections" were Latin American and Southwest collections, such as the Genaro Garcia Library and the Eugene Barker Texas History collection at the University of Texas.^[3] Initiatives targeting the Latino student population had existed since the late 1960s, but the Ethnic Studies Heritage Act of 1972 provided funding for higher education institutions to increase their course offerings in ethnic studies.^[13] This led to a greater demand for Chicano/Latino studies collections and services. Often libraries were established as a result of student initiated efforts.^[21] The development of Chicano/Latino library collections within academia was difficult because this area of study was not perceived as a legitimate discipline by some institutions.^[1] The establishment of Chicano focused publishing houses, such as Quinto Sol, assisted in the production and availability of literature for and about the Latino community.^[2] Although challenging, the work of pioneering academic librarians such as Richard Chabran, Francisco Garcia, Lillian Castillo-Speed, Nelida Perez, and Margo Gutierrez, to name a

few, lead to what today are considered highly valuable Chicano/Latino primary source and reference collections and libraries.

The path towards instituting these special libraries was set by the Chicano Studies Library at the University of California, Berkeley and the Chicano Research Library at the University of California, Los Angeles, both established in 1969. In 1970, the Chicano Studies Collection, at Arizona State University, the Colección Chicano at California State University, San Diego and the Chicano Reference Library at Stanford University were soon after founded. Following the lead of these trailblazing institutions many universities across the United States introduced Chicano/Latino focused collections throughout the 1970s. For instance, the Centro de Estudios Puertorriqueños is an outstanding collection on the study and interpretation of the Puerto Rican experience in the United States. It was established in 1973 to support the Center for Puerto Rican Studies at the City University of New York.^[6] Other collections established during this decade were the Colección Tloque Nahuque, University of California, Santa Barbara, 1971; the Chicano Studies Collection, University of Texas, El Paso, 1971; the Mexico and Southwest Collection, California State University, Fullerton, 1972, now renamed the Chicana and Chicano Resource Center;^[1] the Mexican American Library Program, University of Texas, Austin, 1974; and the National Chicano Research Network, University of Michigan, 1977.

Similar to public libraries academic libraries also encountered a need for appropriate and relevant access tools. However the problem of indexing in academic libraries was more complicated. It was assumed that Latino students within higher education institutions were fluent English speakers so the rationale for special indexing system was harder to articulate. However, it was the development of Latino/Chicano Studies that required the organization of subjects according to proper concepts within the framework of the discipline.^[16] In early 1977, a pilot project to index 17 Chicano serial titles was coordinated by Richard Chabran along with Francisco Garcia and Roberto Trujillo. Nine libraries in four Southwestern states cooperated in the indexing project. During the development of this indexing scheme for Chicano serials the Committee for the Development of Subject Access to Chicano Literature was formed. In 1979, the Committee published the *Chicano Thesaurus for Indexing Chicano Materials*.^[15] It was the intention of the *Chicano Thesaurus* to provide more culturally sensitive and accurate descriptors than those from traditional controlled vocabularies. The *Thesaurus* used a combination of English, Spanish and Calo (slang) words or descriptors to approximate natural language.^[18]

Another early tool created to provide access to serials was the *Chicano Studies Library Serials Collection* of 1978. This work included citations for over 400 serials available in the Chicano Studies Library at the University

of California, Berkeley. This was the beginning of *The Chicano Periodical Index*. The early volumes of this index covered only Latino journals, while more recent ones cover periodical literature beyond Chicano/Latino Studies and other types of works such as books and poetry. In 1989 it changed its name to the *Chicano Index*.^[22] It eventually became available in machine readable format creating the *Chicano Database* and first released in 1990 on CD-ROM under the leadership of Lillian Castillo-Speed.^[18] In 1996 the database went online as an RLG product and in 2007 it became available via OCLC First Search. It is to date the only electronic research tool that focuses solely on indexing Chicano/Latino related materials and includes most of the small publications that came out during the late 1960s and 1970s.

Another significant access tool is the *Hispanic American Periodical Index* established in 1977 by Barbara Valk at the UCLA Latin American Institute.^[22] Although primarily an index of Latin American literature in more recent years it has included articles on the experience of Latinos in the United States. The *Spanish Speaking Mental Health Research Center Database* was established in 1975 and was the first searchable Latino focused database. This database ceased publication in 1990 and eventually its records became part of the *Chicano Database*.

LATINOS IN THE PROFESSION

The growth in collections and services for Latino library users created a need to prepare librarians to serve this community. The shortage of qualified librarians to serve this population can be attributed to both the small numbers of Latinos who enter the LIS profession and to the paucity of appropriate courses in library programs. The latest available statistical report of the Association of Library and Information Science Education (2004) stated that Latinos continue to be under represented in terms of earning a master's degree in Library Science. The report revealed that only 146 Latinos graduated with a master's degree in Library Science or in Information Science for the 2002–2003 academic year. This was from a total of 5762 graduates. Hence, Latinos continue to represent less than 3% of MLS degree recipients in the United States.

During the 1970s two programs were instituted to train qualified students to provide library services to Latinos. In 1968 Elizabeth Martinez, Jose Taylor, and David Barron formed a Los Angeles-based group called the Committee to Recruit Mexican American Librarians. A few years later in 1972 Patrick Sanchez worked with this group to establish the Mexican American Institute of Library Science at the California State University at Fullerton (1972–1975).^[13,14] This program was funded by the California State Library's Minority Recruitment and Advancement Program. This was the first time a library school program was aimed at training Latina/o librarians with specialized

course work and seminars and by providing financial aid to participants. The second program, established by Dr. Arnulfo Trejo, was the Tucson-based Graduate Library Institute for Spanish-Speaking Americans at the University of Arizona (1976–1979).^[23] These programs produced an impressive number of Latino librarians, many who went on to become leaders within the profession such as Martin Gomez, Luis Herrera, Salvador Güereña, Liz Rodríguez Miller, José Aponte, and Margo Gutiérrez. These programs were funded by soft money and ended after a few years. Although programs like these have not been reproduced, in 2001 the University of Arizona School of Information Resources and Library Science received an Institute of Museum and Library Services grant to create the Knowledge River Institute, a master's degree program to attract Native Americans and Latinos into the LIS field.^[13] Also, in 1997 the Spectrum Initiative, the brainchild of then ALA Director Elizabeth Martinez, was implemented to recruit applicants and award scholarships to minorities, including Latinos, for graduate programs in LIS.^[24]

The development of such recruitment efforts would not have been possible without the perseverance and dedication of many librarians who believed that services to the Latino community needed to be improved. The work of these individuals was often carried out via various national and local organizations. Some of the earliest of such organizations were the California-based Asociación de Bibliotecarios Chicanos, established in 1975 and Bibliotecas Para La Gente, established in 1978 in the San Francisco Bay area. The American Library Association established the Chicano Task Force of the Social Responsibilities Roundtable, and the Committee on Services to the Spanish-Speaking of the Reference and Adult Services Division.^[23] Many of the locally based organizations eventually became chapters of REFORMA, the first national association dedicated to the improvement of the full spectrum of library and information services for Spanish-speakers and Latinos in the United States.

REFORMA was established in 1971 by a group of Latino/a librarians at an ALA conference in Dallas, Texas. Leading the group were founding members Dr. Arnulfo Trejo and Elizabeth Martinez. Dr. Trejo served as president of the organization for the first 4 years.^[14] REFORMA was established to pursue the ideals of reforming libraries' lack of outreach to Spanish-speaking people, to create better library services to that community, and to recruit bilingual/bicultural librarians.^[12] At the time REFORMA was established it was called the National Association of Spanish-Speaking Librarians in the United States. It went on to change its subtitle to the National Association to Promote Library Services to the Spanish-Speaking and then to the National Association to Promote Library and Information Services to Latinos and Spanish Speaking in recognition that not all Latinos are Spanish speaking and not all Spanish speakers are Latinos. Over the years REFORMA has grown

to a national organization with 26 chapters located across the United States and Puerto Rico. Chapters function autonomously, working through their local library systems, state library associations, and local organizations to achieve local and national objectives.

In 1982 the REFORMA National Scholarship Program was instituted to be awarded annually to Latinos who are candidates for library school.^[14] In addition, many of the chapters have also established scholarships given to local LIS students who have demonstrated an interest in serving the Latino community. As an indicator of REFORMA's maturity it held its first national conference in Austin, Texas in August 1996, its second conference in Tucson, Arizona August 2000 and the third in El Paso, Texas September 2008. Although struggling during its initial years REFORMA has blossomed into a sophisticated and vital organization.

In addition to recruitment, professional development has also been an issue for serving the Latino community. In an effort to address this weakness, Dr. Arnulfo Trejo established the Trejo Foster Foundation for Hispanic Library Education (TFF) in 1992. The TFF has sponsored bi-annual, educational institutes to bring together leaders, practitioners, and students in the library and information fields to discuss and advocate for issues, policies, and practices that affect Latino communities. The Foundation provides support to finance research, seminars, workshops, and other activities that promoted and enhanced library education for Latinos. It is best known for its various educational institutes such as, the "Status of Hispanic Library and Information Services: A National Institute for Educational Change" (July 1993), "Latino Populations and the Public Library" (November 1995), "Hispanic Leadership in Libraries" (August 1997), "Library Services to Youth of Hispanic Heritage" (March 1999), "Bridging Borders: Building Hispanic Library Education in a Global Perspective" (July 2001), "Memoria, Voz, y Patrimonio: The First Conference on Latino/Hispanic Film, Print, and Sound Archives" (August 2003) and "Salud Se Puede: Health Information for Hispanic/Latino Populations" (July 2007).^[25] These institutes were funded through a variety of public and private sources as well as in partnership with other institutions.

CONCLUSION

The history of library services to the Latino community reveals advances in many areas. There have been vast improvements brought upon by the work of many dedicated individuals and organizations over the years. However, many of the issues that plagued librarians during the 1960s continue today. There is still a shortage of Latino librarians, a need for more curriculum development in library science programs to prepare future librarians to meet the needs of this community, and the need for more

collections that reflect the Latino community. Nevertheless, the accomplishments of the last few decades should be applauded and recognized.

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Law Firm Librarianship

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Abstract

Law firm libraries differ from their municipal law library and academic law library counterparts in clients served, projects researched, and challenges faced. That law firms are profit-driven businesses influences the skills needed for a law firm librarian to succeed as well as how the library operates. As with all libraries, digitization continues to influence key aspects of law firm library practices.

INTRODUCTION

Law firm libraries vary from their law school library counterparts in that the stakes are much different at a law firm. Law firms are a business whose product is advice and counsel. Millions of dollars and hundreds of billable hours can ride upon discovering the missing piece of information or identifying the ideal expert who will help win a trial. Experienced law firm librarians work behind the scenes researching the facts and figures necessary for the attorney's practice and, ultimately, the client's success.

Law firm librarians provide these research services in the high-pressure environment that is a law firm. There are deadlines to meet for various trials, several corporate transactions taking place all at once, and additional nonresearch responsibilities to juggle, as well. A good law firm librarian has the ability and preparation necessary to meet these demands. Lawyers know the law, but law firm librarians support them with everything else. In many ways, the digital age has made research easier considering the vast amount of information now readily available online. However, analog skills are still necessary for a law firm librarian to perform well.

ORGANIZATION OF LAW FIRM LIBRARIES

Law firm libraries are organized in various ways depending on the size of the firm, the number of staff members, the number of offices, and the location of the offices. The libraries can range from having one solo librarian at a small firm to multiple librarians with a support staff at a large firm.

For firms with several offices, there can be a centralized library located in the firm's main office or library staff located within each office to provide onsite assistance. The staffing of a library in each office depends on the size

of that office and perceived need of support. For firms with international offices, the domestic library can support the needs of the foreign offices. However, because of differences in time zones and languages, many international offices will have their own libraries and librarians who can be consulted during their normal working hours.

Within a large law firm library, there can be a mixture of professional, paraprofessional, and administrative positions. Described here are the possible positions at a large law firm library and their corresponding responsibilities:

- **Library Director** (also called Library Manager, Information Manager, or Chief Librarian): The library director oversees the operation of the firm-wide library system and is in charge of vendor contract negotiations, annual budgets, long-range planning, and staffing. The library director also serves as the liaison to the firm's executive committee and typically reports to the executive director of the firm. At some firms, the library director is also in charge of the departments that handle knowledge management, competitive intelligence, records management, conflicts, and docketing.
- **Research Manager** (also called Assistant Library Director): Research managers usually head one of the individual offices. Their responsibilities include supervising the research librarians and administrative staff at their location as well as managing their own budget. They also oversee collection development including the selection of materials for acquisition and cancellation. Research managers often conduct research in addition to their administrative duties.
- **Research Librarian** (also called Research Specialist or Reference Librarian): Research librarians focus on conducting high-quality and cost-effective research for the attorneys, legal assistants, and support staff of the firm. They often have additional nonresearch responsibilities such as maintaining various library guides, evaluating new products, and providing training. Gen-

erally, the research librarian does not have any supervisory responsibilities.

- **Electronic Services Librarian:** Electronic services librarians are in charge of database and password management, library intranets, attorney training, and evaluation of new online services.
- **Embedded Librarian:** An embedded librarian works for a specific practice group. The librarian is usually situated on the same floor as the practice group, provides targeted research, and attends practice group meetings. This role is becoming more common in larger law firms.
- **Legislative/Regulatory Librarian:** Legislative/regulatory librarians research governmental materials and agencies and often compile legislative and regulatory histories.
- **Research Assistant:** Research assistants typically handle document retrieval and interlibrary loan requests. They can also assist the librarians with research projects.
- **Library Assistant** (also called Library Technician): A library assistant can have a variety of responsibilities, including placing book orders, routing periodicals, shelving books, processing invoices, filing loose-leaf materials, and retrieving books and articles from outside libraries.
- **Filer/Shelver:** Filers keep library materials up-to-date by filing loose-leaf supplements and pocket parts. They also reshelve books and periodicals. Many large law firm libraries outsource the filing services.
- **Cataloger** (also called Technical Services Librarian): Catalogers manage the cataloging and classification of library materials. They can also oversee the circulation system of the library. Many firms outsource the cataloging services.

For midsize law firms, there is often a library manager, a research librarian, and one or two library assistants. The library manager will handle the administrative tasks such as contract negotiations and budgets but will most likely do research as well. Smaller firms often have a solo librarian without any support staff. Working in a small law firm library can be a challenging position as the librarian handles all administrative responsibilities related to the library and its collection in addition to conducting research.

SERVICES AND USERS

A law firm library is a department of the law firm. As with other private business libraries, the law firm library focuses on the business of the firm it serves. That business is providing legal services to clients. The law firm library serves the information needs of both lawyers and staff. In a large law firm setting, there are both legal and

nonlegal staff. The legal staff consists of equity partners, junior or nonequity partners, and associates. The attorneys are supported by legal assistants or paralegals, project assistants, and case assistants.

A law firm's nonlegal staff includes the administrative personnel found in various departments such as accounting, human resources, and information technology. This is similar to any corporation. Departments that may be unique to a law firm include a business development department, conflicts department, and docketing department. Law firm librarians support the firm and all its departments by providing research, document retrieval, interlibrary loan, training, and maintenance of the library collection.

Research

Research librarians in a law firm library must provide research service in a cost-effective and timely manner. In many instances, the firm bills the client for the librarian's time and database charges.

Librarians have the ability to sort through a great deal of information, paring it down into a manageable amount, and ultimately providing only the most relevant documents to the requestor. They organize and summarize the results of their research. Research projects are usually wide-ranging and cover a variety of topics. The research librarian must be adept at switching gears because no two requests are quite the same. A typical day may have a law librarian doing background research on an expert witness, identifying intellectual property owned by a company for due diligence purposes, and finding Securities and Exchange Commission company filings precedent. Many projects are deadline sensitive in a law firm, and a librarian is often called upon to juggle multiple research projects at a time. It is usually a fast-paced work environment.

Examples of research projects in a law firm library include:

- Assembling a dossier on a particular company including biographical information on officers and directors, a listing of recent acquisitions or divestitures, major news stories, and stock quotes
- Cite checking a case to determine whether it is still "good law"
- Compiling a legislative history to discover the intent of specific law
- Creating media alerts to monitor current business of a client
- Determining state of incorporation and principal place of business for companies
- Identifying statutes or administrative agency regulations
- Looking for secondary source materials, such as legal treatises, law review, or bar journals

- Obtaining background on expert witnesses (biographical information, media, publications, and prior testimony) or identifying potential experts in a particular academic field
- Identifying all the intellectual property (copyrights, domain names, patents, and trademarks) owned by a company
- Searching for particular language in company Securities and Exchange Commission filings (e.g., how they disclose to investors that they are subject to pending litigation)
- Finding information to assist the business development department in preparing a bid for work from a new or existing client
- Assisting the conflicts department in determining whether an existing client may be on the other side of a legal matter
- Identifying case information for a lawsuit to aid the docketing department in obtaining pleadings from the court
- Researching the background of potential new vendors for the IT department

Research Desk/Triage System

A large law firm may have multiple research librarians who work on research and document requests. The workflow may be managed through a centralized research intake or triage system. The librarian managing the research desk assigns the projects, while keeping in mind deadlines and cost constraints. Reference interviews are conducted to determine the best and most cost-efficient manner to conduct the research. Good communication skills come into play as the librarian negotiates deadlines, discusses parameters of the research, and provides cost estimates. Other firms may use a decentralized or less formal intake system.

In addition to taking and assigning incoming research and document requests, the librarian also receives questions from patrons wishing to conduct their own research. The librarian will make suggestions on which sources the patron should consult and in what format.

Document Retrieval and Interlibrary Loan

The library can obtain copies of articles, patents and patent file histories, technical papers, dissertations, standards, and conference proceedings. Although technology and the Internet have made many documents, especially those from government agencies, readily available electronically, there is still a need for materials not online or owned by the law firm library. Firm librarians work with university, public, government, and other law firm libraries to obtain documents as well as legal and nonlegal books. Interlibrary loan in law firms is often done by e-mail and

telephone as many requests must be filled quickly, often within hours.

Firm Intranet and Knowledge Management Systems

The library contributes to the firm intranet by maintaining a library services page. Attorneys and staff may access the library catalog, sign up to receive newsletters, and obtain pathfinders or library guides for particular areas of law. These pathfinders may address current developments or link to primary law materials, online treatises, and periodicals.

Law librarians often are advisors in creating the firm's knowledge management system. They create the organizational taxonomy of terms used in such systems allowing the attorney to search for internal work product and drafting tools for both litigation and transactional documents.

Training and Orientation

Law librarians provide library orientation for new associates as well as attorneys hired from other firms, known as lateral hires. They introduce the new attorneys to the firm's library and its services, focusing on the attorney's specific practice area. These sessions are often done one-on-one.

Newly admitted attorneys coming from law school are comfortable in the new digital era, but may not be aware of all the databases and sources the library can offer them. Lateral hires might want to be assured that they will have access to a source that they had at their prior firm. If the library does not currently own the resource, the librarian may offer alternatives. Orientation is a good time to let new hires know what the library can offer and to remind them of the informal yet practical "Google Rule" where if they are looking for something on the web or some other source and cannot find it after 10 minutes, they should contact the library. The librarians often have access to additional resources and can locate information in the quickest and most cost-effective manner.

Maintenance of Collection and Library Catalog

The library maintains an electronic catalog of its materials. In turn, the technical services or library operations staff manages the catalog. They are responsible for serials check-in, routing, and processing of new materials. The library routes a variety of print and electronic periodicals to support the firm's business and practice areas. Increasingly, current awareness is electronic-only via e-newsletters, RSS feeds, or e-zines that are pushed to the desktop or mobile device.

In today's environment, librarians must develop and maintain library collections keeping in mind not only what the best resources are, but also the optimal format for their users in this hybrid era of print and digital materials. Electronic subscriptions often involve license negotiation,

determining whether a separate per user license will be needed or whether the firm will have IP authentication. Librarians also monitor billing and passwords/logins for each resource.

COLLECTIONS

For the most part, the digital age has made for an ever-shrinking library footprint. The traditional image of a law firm library with rows and rows of reporters, statute volumes, and treatises has evolved into the modern, digital universe with the same information only a keystroke, mouse-click, or touch-screen away. Some law firms have almost completely eliminated paper collections while others still have books, but fewer and fewer of them each year.

Current federal and state statutes, regulations, and case reporters are available via services such as Lexis-Nexis, Westlaw, and Bloomberg Law. These are the same materials that formerly occupied the most space in a law firm library. These vendors and others such as HeinOnline also provide access to collections of law reviews, law journals, newspapers, trade journals, etc.

Some items still found on library shelves are current awareness materials such as newspapers and journals. There are also specialized dictionaries (medical, scientific, technical) and practice guides meant to bring an attorney up to speed on the topic in question. However, many of these books and periodicals are also converting to digital media via the migration to e-books and online subscriptions.

Searching these materials online is more time- and space-efficient than hunting through indexes and bookshelves. However, many online services are moving from command language and Boolean searching to more nebulous, search engine type searching, or what can be described as changing from searching to browsing.^[1]

While the accessibility of current materials is essential for a law practice, historical materials are also extremely important when researching precedent or legal intent. The extent to which historical materials are available online varies. This is where interlibrary loan comes in. Law school libraries at research institutions will have deep collections of historical materials unavailable digitally.

EDUCATION

Law firm librarians can have JDs or MBAs, but ideally have a master's degree in library science (MLS). A library science degree provides librarians with not only research skills, but more importantly the ability to interact with patrons who range from the highest ranking equity partners to case assistants. Knowing how to conduct a reference interview—identifying intent and pinning down what information the requestor truly needs—is an essential aspect of performing well in a law firm setting.

Depending on the practice areas or size of the firm, other areas of knowledge are useful. A science or technical background will be prized in an intellectual property practice. A background in finance is advantageous when working with a private equity/venture capital practice. Foreign languages are helpful at international firms with offices throughout the world. Because research projects are wide-ranging and diverse, the more knowledge and intellectual curiosity the law librarian has, the better.

PROFESSIONAL ASSOCIATIONS

There are several associations for librarians that support professional development at national, international, or local levels. The American Association of Law Libraries (AALL), the Special Libraries Association (SLA), and Strategic and Competitive Intelligence Professionals (SCIP) are the most relevant to law firm librarians. These organizations are useful not only for networking purposes, but also to keep up with best practices in research, to keep abreast of trends affecting libraries, and not least, to advocate for librarians.

Like other professional organizations, they publish trade journals, track membership, disseminate information via social media, and lobby government. Members gather at annual or semiannual meetings for workshops and seminars on topics such as copyright issues in libraries, technical services, or digital collections. They are essential for continued professional development.

TWENTY-FIRST CENTURY CHALLENGES

In the last 25 years, the law firm librarian profession has undergone dramatic changes primarily as a result of the rise of the Internet and a shift from a reliance on print resources to an ever-growing dependence on electronic resources. This trend will persist and will present numerous challenges to law firm librarians as well as librarians in academic, public, and special libraries.

One of the biggest challenges facing all librarians is how to best manage their library collections, which consist of both print and electronic resources. As more titles are made available in electronic formats, librarians have to decide which format best serves their attorneys. In some instances, the decision is made to obtain both the print and electronic versions of materials, but this can be expensive as a result of legal publishers bundling the print and electronic products together at a high cost. According to the 2015 AALL Biennial Salary Survey & Organizational Characteristics, law firms spend an average of 69.2% of their information budget on electronic resources.^[2] While that percentage is already high, it will likely continue to rise in the near future as publishers offer less print material in favor of electronic resources.

Electronic resources pose their own challenges. While electronic databases provide users with the ability to do sophisticated searching of full-text materials, each product has its own platform and search syntax. Not only do librarians have to become experts in using each product, they have to be able to instruct the attorneys in how to best use the databases. Another challenge is determining whether the library should obtain an enterprise license or individual seat licenses for the electronic resource. Fortunately, there are electronic resource management tools that allow the library to track usage of databases to determine if there is sufficient use of the electronic databases to justify their costs.

The realm of e-books is also proving to be a challenge. More and more attorneys are asking for e-books that they can read on their mobile devices, tablets, e-readers, and desktop computers. There are some publishers providing access to e-book collections through subscriptions, but there are also ways to buy an individual e-book directly from a publisher. Unlike print books, once an e-book is purchased, it can be difficult to circulate to the end user due to license restrictions. E-books will continue to become more prevalent in the years ahead as librarians determine the best way to implement this technology.

Another challenge arising from the increase in electronic resources relates to attorney training. Law firms have attorneys with varying levels of comfort with technology. Training sessions have to be customized to accommodate differing degrees of skill. Many databases are being redesigned to be more Google-like in their search functionality, although this brings its own challenges for librarians and attorneys adept at doing more sophisticated searching.

Compliance with copyright laws has always been a challenge in the library world, and the increasing use of electronic resources has only magnified this issue. Many databases have strict license agreements for their electronic materials. The librarian is often asked to obtain an electronic copy of an article, standard, or book on behalf of an attorney. It is the librarian's responsibility to make sure that the license agreement is not violated once the material is shared with the attorney. However, once the item has been given to the attorney, it is difficult for the librarian to keep track of how the document is being used and/or distributed. Many law firms have document management systems that are designed to share materials internally. These document management systems can be especially problematic in terms of copyright compliance as users can unwittingly post copyrighted materials.

In addition, obtaining materials through interlibrary loan is becoming more difficult as libraries are replacing print materials with electronic versions. The license agreements for these electronic resources prohibit the lending library from sharing the materials with people outside of their organization. As a result, libraries will be limited in what they can share with other libraries, which will make it harder for libraries to obtain articles and books through traditional interlibrary loan methods.

Budgeting is a perpetual challenge for libraries including law firm libraries. The rise of electronic resources and the unpredictable nature of their costs have made it progressively more difficult to plan an annual budget and to stay within the budget from year to year. In addition, cost recovery in law firm libraries is becoming more problematic. According to the 2016 ALM Law Librarian Survey, 71% of the Am Law 200 firms reported recovering 40% or less of their online research costs.^[3] A growing number of firms are beginning to consider database costs as overhead and are no longer attempting to recoup those expenses from clients.

Another challenge relates to outsourcing. Some library services, such as filing of loose-leaf treatises and cataloging, are often outsourced. However, the concern is that research services could also be outsourced. While this type of outsourcing has not yet spread throughout the law firm community, the threat is still an ongoing consideration.

CONCLUSION

Whether working in a small, midsize, or large law firm, the law firm librarian's main responsibility is to support the research needs of the firm's attorneys, legal assistants, and administrative staff. The librarian's knowledge of a wide variety of resources, both print and electronic, and ability to produce quality research in a timely and cost-effective way is a valuable asset to the firm. The library often cooperates with the other departments in the firm including the business development, information technology, conflicts, human resources, and accounting departments. These collaborations with the administrative and legal staff help the library maintain its status as a highly regarded and much used department in the firm.

Even though the law firm librarian profession is undergoing significant changes and is facing numerous challenges, it continues to be a dynamic and fulfilling career. The demanding deadlines and the stimulating research projects give law firm librarians a unique work environment not typically found in other types of libraries. It is important that law firm librarians strive to demonstrate to the attorneys and executive committees at their firms that the library is a vital contributor to the overall success of the firm. By doing this, law firm librarians can ensure the continued longevity of this type of librarianship.

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Law Librarianship

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Abstract

This entry presents a current picture of law librarianship in the United States, with some international coverage, through discussion of three major types of law libraries: those supporting legal education, law firms, and the public. The primary mission of the law school library is to meet the information needs of the faculty and students of the institution it supports. Beyond support for the core functions of legal education and research, the specific missions of law school libraries vary depending on the size and missions of law schools of different types. Law firm libraries combine the atmosphere of research with the stimulations of big business. Law firm librarians help lawyers clarify and refine their research projects and provide timely and cost-effective solutions for those projects. The term “public law library” refers to all law libraries that are not affiliated with either law firms or law schools. In this category are found county public law libraries, court libraries, state law libraries, state and federal agency law libraries, and bar association and subscription law libraries.

INTRODUCTION

Law librarians work in various legal settings, including law schools, private law firms, and public law libraries of a variety of types. The profession is bound together by law librarians’ expertise in working with legal materials, and for many law librarians by their work in direct support of legal professionals or students training to become lawyers. Many law librarians, especially in law school libraries, hold graduate degrees in law as well as in library science; some have graduated from library schools with specialized programs in law librarianship.

Law is a profession that is heavily dependent on ready access to the current texts of primary source legal materials—statutes, court decisions, and administrative regulations and decisions—issued by a variety of law-making authorities. The job of the law librarian has always been to obtain and organize the primary source materials, as well as published commentary on the law, and the indexes and other finding tools needed to use them. Because the primary sources of law have long been available in full-text electronic formats, law librarians are also highly skilled in working with electronic sources and in choosing appropriate information formats to meet the needs of users at specific types of libraries. This entry discusses the practice of law librarianship in three major types of law libraries: law school or academic law libraries; law firm or private law libraries; and public law libraries, which include court libraries, state law libraries, state and

federal agency law libraries, bar association and subscription law libraries, and other libraries open to the public.

LAW SCHOOL LIBRARIES

Introduction

The primary mission of the law school library is to meet the information needs of the faculty and students of the institution it supports. In addition to their role in educating future lawyers, law schools are the major producers of scholarly literature in law and rely on academic law libraries to provide the resources and support needed for research and publication. Beyond support for the core functions of legal education and research, the specific missions of law school libraries vary depending on the size and missions of law schools of different types. Differences among law schools result in differences among their libraries in collection size and composition, staffing and services offered, and additional clienteles served. In the United States, libraries at publicly supported law schools are likely to provide a fuller range of services to local or state attorneys than are libraries at privately funded law schools, while libraries at urban law schools are more likely than others to provide services to the general public. The range of services an academic law library provides to others than its own students and faculty depends also on its proximity to law firm libraries or public law libraries,

established to meet the needs of firms, courts, practicing attorneys, or the public. The presence of large numbers of a law school's own graduates in the area also normally results in greater library services for the local bar.

Organization and Administration

In the United States, the professional degree in law, the Juris Doctor, is attained after three years of study and training beyond the baccalaureate degree. Lawyers are educated in separate schools or colleges within the university, rather than in departments of graduate schools or other units. Law schools are normally housed in their own physical facilities and a law school's control over its physical plant is among the factors considered by the American Bar Association (ABA) in its accreditation processes.^[1]

These factors, in addition to the specialized nature of legal collections, have contributed to U.S. law school libraries' traditional administrative autonomy from the larger library systems at their universities.^[2,3] Only a handful of the libraries at the nearly 200 law schools accredited by the ABA are administered directly through their university library systems. The ABA standards require that the law library have sufficient autonomy to direct the growth and development of the library collections and that the dean of the law school and the library director determine law library policies in consultation with the faculty.^[1] In practice, therefore, the budgets of most academic law libraries are administered as part of the law school's budget rather than as part of the overall budget of the university library. If the law library budget must be justified to a higher authority than the law school dean, it is typically the dean or the dean and law library director together who defend the budget at the university level. Similarly, the law library director normally hires and supervises law library staff without involvement by the university library and is responsible for all typical library operations and services, including selection, ordering, cataloging, and processing of library materials.

Although there are a number of variations in internal administrative structure among law school libraries, most U.S. law school libraries are organized traditionally in some form of division between technical and public services, with an administrative unit, often consisting of the law library director, an associate director, and administrative staff to provide support for the library's operations.^[4] Variations on the basic organizational model depend on the size of the law school, the number of library staff, and the ratio of professional librarians to support staff members. Increasingly, organizational structures also depend on the role played by the library in supporting the law school's use of information technology and other media. Some law schools place significant overall responsibility for technology within the library's jurisdiction; others

maintain separate units for law school technology, which may support the specialized needs of the library as well.^[5]

As a practical matter, the traditional autonomous administration of academic law libraries at U.S. universities is affected by a number of factors, including the widespread implementation of university-wide library information systems, and the need to develop new structures to share costs and access to common databases and other forms of networked information on university campuses.^[6] As space tightens, law libraries also increasingly share remote storage facilities for less-used materials with other campus libraries. Law librarians at some universities are included in the shared ranking and job security systems for librarians at all campus libraries. As the forms of legal publication move from print to electronic formats, requiring less in the way of manual filing and other labor-intensive means to be kept current, some of the long-standing justifications for separate law library processing staffs are called into question.

In a number of countries outside the United States, law is taught as an undergraduate subject, and law libraries are likely to be less autonomous than in the United States. In the United Kingdom, for example, only about a third of law library collections are housed in locations separate from collections in other subjects, and the law faculty typically does not have direct control over budget and policy.^[7]

History and Development

The history of academic law libraries is closely tied to the history of the development of formal legal education within the university setting. In the United States, the College of William and Mary lays claim to founding of the first professorship in law and the beginnings of a small collection of law books within the confines of the college library in 1779.^[8] The Harvard Law Library, now the largest academic law library in the United States, was established in 1817. Yet, until the primary locus for legal education moved in the late nineteenth century to the university from the law office, where aspiring lawyers clerked and read the law under the tutelage of established practitioners, few law school libraries (other than Harvard's) compared in size and breadth of collections with bar association libraries or membership libraries developed to meet the needs of the practicing bar.^[9,10]

With the changes in legal education that followed the appointment of Christopher C. Langdell (a former student librarian) as dean of the Harvard Law School in 1870, the perceived role and importance of the academic law library changed significantly. Under Langdell's case method of instruction (which was adopted at law schools throughout the United States), reading, analysis, and application of the law found in selected court opinions became the focus of the law school classroom, and the books containing the opinions took on new prominence as the sources of legal

knowledge.^[11] Langdell's focus on the importance of the judge-made law in published cases may have initially limited the breadth of academic law library collections, but in the twentieth century the importance of other sources of domestic, foreign, and international legal authority (statutes, administrative regulations and rulings, treaties, and other international agreements) broadened the scope of the law library's collections of primary source research materials. The entry of commercial publishers such as the West Publishing Company into the legal publishing market increased the amount of primary source material available for lawyers to use and for law libraries to collect, as well as the variety of finding tools needed to enable lawyers and other researchers to locate sources of legal authority and to evaluate their usefulness. The solidification of the university law school's role in educating lawyers also contributed to an expansion of the secondary literature in law. Spurred by the establishment of the *Harvard Law Review* in 1887, law professors and law students began writing and editing articles for publication in reviews and journals typically published at the law schools themselves. Although initially consisting primarily of doctrinal articles aimed in large part at the needs of practicing lawyers, the early law reviews became the locus of the most important scholarly literature in law, which would grow to be a significant component of academic law library collections. The increasingly scholarly emphasis of law school faculty writing (in journals, monographs, and treatises) also led to pressures on law school libraries to collect domestic materials beyond the strictly legal and to make at least selective forays into collecting materials of foreign jurisdictions.

The history of academic law libraries in the twentieth century was characterized by: growth in numbers of law schools (and law libraries) as the value of a legal education was seen to extend beyond traditional legal practice; the challenges posed in collecting and preserving growing amounts of primary source materials; the expansion of the scope of collections to include nonlegal materials; the effects of globalization on the need for access to foreign and international legal materials, and staff skilled in using them; the dramatic impacts of information technology on collections and services in the last quarter of the century; and the development of academic law librarianship as a professional specialty. These and other topics are treated briefly in the following sections of this entry and more exhaustively in the literature of the field. In addition, articles about the history and development of individual law school libraries can be found in the journals of law librarianship, which are noted below.

Standards and Statistics

The collections and services offered by the modern academic library, as well as other aspects of its operation, are influenced by the standards developed by legal education's external accrediting bodies and other

agencies. In the United States, nearly 200 law schools are accredited by the ABA through its Section of Legal Education and Admissions to the Bar. In nearly all states, graduation from an ABA-approved law school is a prerequisite for taking the bar examination and qualifying for a license to practice law. As part of its approval and ongoing review processes, the ABA promulgates standards for law school libraries and gathers extensive statistical data about libraries at approved schools. The law library standards speak to such matters as administrative structures, personnel and services, and collections.^[1] Each approved law school (and its library) is visited and reevaluated at seven-year intervals. Library data from the ABA's annual questionnaires for law schools are compiled annually into comparative tables and made available to law school deans and library directors. Although distribution of the compiled questionnaire data is limited, some data appear in the annual *ABA/LSAC Official Guide to ABA—Approved Law Schools*.^[12] Selected comparative data about law school libraries also appear in unofficial guides to law schools^[13,14] and are available from 1998–1999 to date through the Association of Research Libraries.^[15] Comparative data from the ABA questionnaires for the years 1969–1993 can be found in the 1970–1994 annual volumes of *Law Library Journal*.

The Association of American Law Schools (AALS) is a membership organization for law schools, which promulgates standards in the forms of bylaws and associated regulations for its members' libraries. The AALS library regulations are similar in coverage to the ABA standards.^[16] The AALS reviews its member schools in conjunction with reaccreditation visits by the ABA. Standards for university law libraries in the United Kingdom have been promulgated by the Society of Legal Scholars.^[17]

Law School Library Collections

The core collections of all law school libraries include the primary sources of legal authority produced by the major branches of government: reported court opinions (or cases), statutes enacted by legislatures, and executive or administrative materials (regulations and quasijudicial rulings). Academic law libraries in the United States typically include comprehensive collections of primary materials from the federal government and from each of the 50 states in print or electronic formats. Although the states each have their own legal systems, each is a "common law" legal system in which much of the law has developed historically through judicial decisions and written opinions. Under the common law, decisions from courts outside the jurisdiction where a case is being heard will not control the results in the case but can be cited and used as the basis for lawyers' arguments, and can influence the court's decision. As a result, U.S. law school libraries often collect materials from common law jurisdictions outside the United States, such as England, Canada, and

Australia, even if they do not generally collect foreign law materials. Because controlling judicial precedents for a current case may be found in cases as old as the jurisdiction itself, law school library collections of primary source materials are usually deep in their coverage, as well as broad.

Reported decisions, as well as legislation and administrative law materials (each of which grew in importance during the twentieth century) provide the raw materials for legal research and make the law library into the lawyer's laboratory that Dean Langdell emphasized at Harvard.^[18] Finding the law applicable to a research problem, however, becomes increasingly difficult as the body of potential useful material grows in volume and complexity. In addition to primary materials, therefore, law library collections include large holdings of secondary materials—treatises, journals, encyclopedias, and a number of specialized publications written to guide the researcher through the law on a topic, as well as indexes, digests, and other more typical finding tools. Some secondary sources are designed primarily for practicing lawyers and serve to organize and provide access to the body of primary authorities on a topic, providing little in the way of detailed analysis or evaluation; others, including the journal articles and monographs produced by law professors and other legal scholars are more analytical, critical, and prescriptive in their approaches.

Because the legal researcher usually needs to have the most up-to-date version of the law, as well as to be certain that an apparently applicable case has not been overturned by a higher court, or that a statute has not been amended, repealed, or found to be unconstitutional, legal publications rely on a variety of means for regular supplementation and updating. Historically, new court opinions and statutes have been published as quickly as possible in pamphlets that are eventually compiled into bound volumes. Some materials have been published in loose-leaf formats so that pages with new information could be easily added as those with older information were replaced and discarded; other sets that require less frequent updating may provide supplemental materials in "pocket parts" inserted inside the back covers of the volumes. Although the bodies with the authority to make law (courts, legislatures, and agencies) have themselves published the materials they issue in official versions, official publication has always been slow and usually lacking in sophisticated finding tools. Beginning at least in the late 1800s, commercial publishers in the United States competed for lawyers' (and law libraries') dollars with their own versions of primary source materials, which were likely to be published before the official versions and linked to the publisher's own finding tools and other products. As a result, academic law libraries have typically offered several commercially published versions of court reports and other important publications, as well as the official versions. Most U.S. law school libraries also

have depository status for federal documents and maintain substantial selective collections of government documents, some of which also are duplicated in commercial publications.^[19]

While the common image of a large library reading room surrounded by rows of book stacks packed with neatly arranged volumes is still accurate for most law school libraries, the impact of electronic databases and the Internet on legal research and the law library has transformed the ways in which lawyers and law students conduct research. As one observer noted in 2007: "The debate about whether print or electronic resources are better for legal research ended essentially because the consumers of the resources made a decision. . . . Faculty, attorneys, and law students voted with their feet, and their feet led them to the computer terminal."^[20] The advantages of full-text electronic access to the materials of law for research are apparent, and large databases of primary source materials have long been commercially available to lawyers and law.^[21] The potential size of the law market created significant competition between the two major database suppliers, which led to rapid expansion of the databases to the point where retrospective coverage of important U.S. primary sources is essentially complete. The major database vendors have also viewed law schools as important areas of competition for future users of their services, and have generally provided low-cost access to the databases for law school faculty and students, as well as training in the use of the products for research. The two major databases, LexisNexis and Westlaw, now provide law students and faculty 24 hr access using personal equipment within the law school building or from home. In addition, the World Wide Web has increased the direct availability of primary source U.S. legal materials over the Internet, both through new Web-based commercial services, on official sites offered by courts and government agencies, and through open access sites, such as Cornell Law School's Legal Information Institute.^[22]

The growth in sources for accessible online legal information first allowed many law school libraries to reduce their holdings of duplicate copies of court reports and other heavily used sets of primary source materials in their print collections. Secondary legal materials, including large retrospective journal and treatise collections, and finding tools are also available in electronic formats, leaving law school librarians with ongoing decisions about choices of appropriate formats for their user communities and whether to bear the costs of providing information in multiple formats.^[23]

As increasing accessibility of legal information in networked electronic formats continues to make local availability of large print collections less important to legal researchers, the distinctiveness of individual academic law library collections is increasingly dependent on their current and retrospective collections of secondary sources and foreign law materials.^[24,25] Collection

development in academic law libraries is normally based on a written plan, required by the ABA^[1] that must take into account the importance of electronic formats, the needs of faculty researchers for specialized nonlegal materials, the extent to which the library serves constituencies beyond its own faculty and students, and the library's proximity to and ongoing relationships with other libraries on its campus and beyond.^[26,27] Academic law libraries' interests in cooperative collection development have been major factors in the development of regional consortia of law libraries.^[28]

Historically, major foreign and international law collections were developed only at the largest academic law libraries and were supported by lawyer-librarians who immigrated to the United States from foreign countries.^[29] During the latter half of the twentieth century, U.S. legal scholars' increased interest in foreign and international law and the law schools' efforts to recruit visiting scholars and students from outside the United States led a broader range of law schools to devote significant resources to their foreign and international law collections. As interest in foreign and international law expanded, academic law libraries faced major challenges finding qualified staff to manage and support growing collections, and obtaining the financial resources to develop and maintain them.^[30-32] In foreign and international law, as for domestic law, academic law librarians produced major bibliographic works and research texts to support the efforts of scholars.^[33,34] To support research in foreign law, the American Association of Law Libraries (AALL) publishes the *Index to Foreign Legal Periodicals* (1960-). Greater access to legal information worldwide on the Internet has also been enhanced by the Free Access to Law Movement and the activities of legal information institutes throughout the world collaborating through the World Legal Information Institute (WorldLII).^[35,36]

Many academic libraries maintain at least small rare books collections both to support research and to demonstrate the importance of the historical record to the development of the law. Morris L. Cohen is the major figure in American rare law books librarianship and is the author of the *Bibliography of Early American Law*^[37] and other works in the field.^[38,39] In most law school library collections, materials old enough to suggest their classification as rare books are shelved in open stacks, leading to academic law librarians' ongoing concerns with preservation of print materials.^[40] As more primary legal research materials are issued primarily or exclusively in electronic formats, academic law libraries have been challenged to define their roles in both preserving and authenticating digital legal information.^[41,42]

Because many of the core primary source materials of the law library (court reports, volumes of statutes, journals, etc.) have been published as serials, and are to some extent self-organizing by numbered volume and date, organization by subject classification was a relatively

late development for law library collections. Subject organization became increasingly important with the growth of a significant secondary literature for law and the growing need to organize foreign and international legal materials. The first fully developed Library of Congress (LC) schedule for legal materials (KF for U.S. law) was published in 1969. Since that time, schedules have been completed for all foreign jurisdictions and international law. While many academic law libraries still do not classify all U.S. primary source materials, most use the LC schedules to organize their treatise and monograph collections, and collections in foreign law.^[43] Because of the need for frequent supplementation and updating, as well as the nature of the materials themselves, primary sources, finding tools, and many secondary sources are noncirculating in most academic law libraries. The need for ready access to information housed in large, complicated collections makes sophisticated collection management systems essential to the successful operation of the academic law library.

Law School Librarians

Nearly all academic law librarians in the United States hold master's degrees in library or information sciences; reference librarians and administrators typically hold law degrees in addition to their credentials in librarianship. The ABA standards for law schools and the membership requirements of the AALS state that the law library director should have both law and library degrees, and the ABA standards require that the director hold an appointment on the law school faculty.^[1,16] Depending on practices at individual law schools and, in part, on whether they teach in the law school, other law librarians may also have some kind of faculty status.^[44]

Within the law school curriculum, law-trained librarians typically provide formal or informal instruction in legal research techniques and the literature of the law. Legal research courses take a variety of forms: most programs focus on introducing the sources of law and legal research to first-year law students; some law schools offer advanced legal research courses in either United States or foreign and international law as electives in the upper-class curriculum.^[45] Law school librarians have also figured prominently in the writing of the standard legal research textbooks, a number of which have gone through several editions.^[46-49] A listing of the major law librarian textbook writers—Robert C. Berring, Harry Bitner, Morris Cohen, Frederick C. Hicks, J. Myron Jacobstein, Roy M. Mersky, Miles O. Price, and William R. Roalfe—serves as well as a list of some of the major figures in modern academic law librarianship in the United States.

In part because of law library directors' usual status as members of law school faculties, academic law librarians as a group have been major contributors to the professional and scholarly literature of law librarianship.^[50] Most of that literature is published in such specialized

journals as *Law Library Journal* (1908–) and *Legal References Services Quarterly* (1981–) in the United States; *Legal Information Management* (1970–) and *Australian Law Librarian* (1993–); *Canadian Law Library Review/Revue canadienne des bibliothèques de droit* (1970–) published abroad; and the *International Journal of Legal Information* (1973–), as well as in publications sponsored by the AALL and other law library organizations outside the United States. Some law library literature is published in more general journals of library and information science; and some is also published in scholarly journals of law, bar association journals, or other specialized legal periodicals. *Legal Information & Technology Abstracts* is a Web journal providing access to legal information scholarship.^[51]

The importance of the law degree as a credential, the faculty status accorded to academic law library directors and other librarians, and the tendency to write for legal audiences all provide evidence of the strength and durability of the academic law librarian's connections with the legal profession. The history of the development of academic law librarianship in the twentieth century indicates that, through the 1950s, many head librarians at U.S. law schools did not hold library degrees and those who did have both law and library degrees thought of themselves primarily as lawyers and then as librarians. Because of the positions of influence that academic law librarians have traditionally held within the profession, it is possible that the emphasis on "law" in law librarianship hindered the overall development of law librarianship as a profession.^[10,52] As noted above, however, the law school accreditation standards now emphasize the desirability for library directors to hold both degrees and the need for qualified staff in all positions; there are now few directors who do not hold advanced degrees in law and librarianship, and few law librarians who are not professionally educated in library and information science.

A number of U.S. schools of library and information science offer specialized courses for prospective law librarians in legal research, law library administration, and information policy. In recognition of the need for specialized law library training within the context of graduate education in librarianship, the AALL has established Guidelines for Graduate Programs in Law Librarianship^[53] and maintains an online list of accredited graduate programs in library science that offer law library courses.^[54] The University of Washington Information School has offered a specialized program in law librarianship since 1939.^[55]

Like librarianship generally, both law librarianship and the academic law library specialty are overwhelmingly female in composition. Studies of the role and status of women in the profession have noted historical disparities in salaries between male and female law librarians, as well as the disproportionate numbers of males in academic library directorships.^[56,57] Some studies have indicated a

continuing trend toward gender balance between males and females in academic law library directorships but not a distribution proportionate to the numbers of women working in academic law libraries.^[58,59]

Professional Associations

The primary professional association for U.S. law librarians is the AALL, which was founded in 1906 at the annual meeting of the American Library Association.^[60–63] American Association of Law Libraries' stated purpose is to promote and enhance the value of law libraries to the legal and public communities, to foster the profession of law librarianship, and to provide leadership in the field of legal information. Its current membership of over 5000 includes law librarians and related professionals affiliated with law firms, corporate legal departments, courts, and government agencies, as well as with law schools.^[64,65] The AALL provides law librarians opportunities for professional development through its annual meeting programs, educational workshops, and institutes; provides scholarships and grants for members requiring assistance to further their formal education or to attend AALL educational programs; supports an active publications program; and provides placement services.

Throughout its history, AALL and its members have been involved in public policy activities, focusing on issues of national information policy, copyright, and public access to legal information.^[66] Since 1990, the association's Government Relations Office has monitored legislative, judicial, and regulatory activities, and represents the views of AALL through congressional testimony and legal briefs, frequently working in concert with other library associations and information policy groups.

Since 1976, AALL has encouraged the creation of special interest sections (SISs), organized by subject matter or professional specialty (e.g., foreign, comparative and international law, technical services), or by type of library. The Academic Law Libraries SIS was established in 1979 and serves as an umbrella organization for all law school librarians, sponsoring educational programs, providing discussion forums and workshops for directors and middle managers, and publishing a newsletter. The AALL also has a number of local and regional chapters in which academic law librarians are active participants.^[67]

Academic law librarians have played significant roles in the development and activities of AALL. Over half of AALL's presidents were affiliated with law school libraries at the time they served, and all of the major figures in academic law librarianship in the United States have been heavily involved in AALL activities. Many prominent and historically significant academic law librarians have been profiled in AALL publications.^[68–73] Biographical information about academic law librarians can also be found in occasional directories published by AALL;^[74] information about academic law library directors can be found in

the annual *Directory of Law Teachers* published by the AALS.^[75] Memorials for deceased law librarians, which normally include biographical information and personal reminiscences, are published in *Law Library Journal*,^[76,77] as well as in the publications of other law library organizations.

The International Association of Law Libraries (IALL)^[78] was founded in 1959 through the efforts of a special committee of the AALL led by former AALL president William R. Roalfe, who became IALL's first president. Since its founding, IALL has provided a significant focus of professional activity for academic law librarians interested in substantive areas of international and comparative law and research, and a forum for cooperation among academic law schools and their libraries.^[79,80] The IALL publishes the *International Journal of Legal Information* and sponsors annual educational conferences.

U.S. academic law librarians are also active in national legal organizations. The AALS includes a section on law libraries and maintains a standing committee on libraries and technology. The law libraries committee of the ABA Section of Legal Education and Admission to the Bar is charged with periodic review of the accreditation standards relating to law libraries and the law library sections of ABA questionnaires. Law school library directors frequently serve as members of ABA/AALS site evaluation teams established for law school accreditation reviews, and are usually represented on the ABA accreditation committee and on the AALS membership review committee, as well as on the committees devoted primarily to library matters.

Outside the United States, there are a number of other national and regional associations of law librarians, which provide venues for professional activity and continuing education for academic law librarians, as well as for their colleagues in other types of law libraries.^[81,82] A list of known law library organizations (some of which may not be currently active) includes: Arbeitsgemeinschaft für Juristisches Bibliotheks- und Dokumentationswesen/ Association for Law Librarianship and Documentation in German-speaking countries; Association Belge des Bibliothécaires et des Documentalistes Juridiques (Belgium); the Association of Swiss Law Libraries/Association des bibliothèques juridiques suisses—Vereinigung der juristischen Bibliotheken der Schweiz; the Australian Law Librarians Association; the Bahamas Association of Law Libraries; the British and Irish Association of Law Librarians; the Canadian Association of Law Libraries/ Association canadienne des bibliothèques de droit; the Caribbean Association of Law Libraries; the Consortium of Legal Resource Centers and Legal Information Specialists (Central and Eastern Europe); the Law Librarians' Group of Malaysia; the New Zealand Law Librarians' Group; the Nigerian Association of Law Libraries; the Nordic Law Librarians' Group; the

Philippine Group of Law Librarians; the Organization of South African Law Libraries/Organisasie van Suid-Afrikaanse Regsbiblioteke; Red de Bibliotecas de Derecho y Ciencias Jurídicas (Argentina); the Russian Association of Law Libraries/Assotsiatsiia Iuridicheskikh Bibliotek; the Scottish Law Librarians' Group; and the Turkish Platform of Law Librarians/Türk Hukuk Kütüphanecileri Platformu.

Twenty-First Century Roles

In the twenty-first century, like other institutions, the law school library faces a variety of challenges from the impacts of technology and globalization, as well as from continuous change on all fronts. In many ways, the law library's long-standing mission remains similar to what it has been, while the means to accomplishing that mission have changed. The responses of academic law libraries to a changing environment can be seen both in the increased attention given to building stronger collections in foreign and international law and in non-law materials, and in efforts to improve access to digital information through electronic publication projects.^[83,84] In addition, many academic law librarians have taken leadership roles for general technology development and implementation within their law schools.^[5]

Yet, because technology-based solutions to information storage and technological advances in information access and retrieval serve to provide ubiquitous access to information, they can be characterized as challenging the future value of the library as a physical place. If books are less important to legal research, and if students (and faculty) prefer to work with online information sources, why should law schools devote significant areas of their physical plants to collections of books? If the Internet makes legal information readily available through any wired or wireless network, why should any space at all be used for a library? How important will an institution historically centered on the acquisition and preservation of print information be in an increasingly digital information environment in which less information is acquired in physical formats? Is the role of the law librarian so tied to the law book and to physical library collections that the profession itself is no longer relevant to the information needs of law faculty and students? What kinds of new skills will be needed?^[85,86]

Conclusion

In light of these and similar questions, it will be essential for law librarians to think hard about core values and the services they and the law library itself provide.^[87,88] Is the law library a place only for the storage of books for students to study and perform research, or does the law school library provide an important (or perhaps the only) shared space in the law school where students can

work and learn collaboratively with each other and with faculty, and to work with librarians to develop legal information literacy skills? What must the profession of law librarianship do to continue to grow, and to foster the new leadership it will need to meet the difficult challenges it faces?^[89] It is likely that the future of the academic law library will be shaped in large part by law librarians' answers to questions like these, as well as on the library's ability to reshape its role in a new information environment.

LAW FIRM LIBRARIES

Introduction

“[A] law office library combines the student atmosphere of research with the stimulating activity of big business.”^[90] The business is a law firm, providing legal advice to clients. The library exists to meet the research needs of the law firm's lawyers. The librarians try to anticipate those research needs so they can: 1) help lawyers clarify and refine their research project; and 2) provide a timely and cost-effective solution for that research project. Historically, the firm used the library space and library collection to impress clients, opposing counsel, and potential hires; the leather bindings, full shelves, large writing surfaces, and comfortable chairs suggested success and wisdom to clients and opposing counsel. Today, the librarian solves information problems unconstrained by a physical library collection.

In 1956 a law librarian described her role as “to keep happy anywhere from 35 to 125 lawyers, whose diversified interests may cover anything from having ‘235 U.S.’ delivered at once to ascertaining all the stops on the New York subway system and the Hudson Tubes to New Jersey or to producing a speech delivered in the Maritime Provinces. . . .”^[91] More than 60 years later the librarian's role still includes fact gathering and document retrieval from many time zones. Law librarians use hundreds of online sources to research legal topics unknown in 1956, gather information about companies engaged in global commerce and monitor activities of competitors. In addition, the librarian negotiates contracts and license agreements with information vendors, outsources some library tasks, and creates systems that let a less highly paid person find basic information that once required a professional librarian.

Customers, Users, and Owners

The law firm library serves two groups of customers: 1) the firm's lawyers; and 2) the employees supporting the lawyers—paralegals, law clerks, secretaries, records center, accounting department, etc. The first group includes partners or shareholders—the owners of the firm. The

second group of employees often request information for the partner(s) and are the most direct users of the library. This means that often the heaviest users of the library are those with the least political clout or influence when it comes to spending money on the library. The customer base tends to be more homogenous than the clientele is in public libraries. Customers in the law library are part of the legal service industry—even if they are relatively new to it. Typically, all have college educations and over half of the customers have law degrees.

The primary customer of the law firm library is the individual attorney seeking a solution to an information problem. That attorney either contacts the librarian directly or through an intermediary—a secretary, a paralegal, or another attorney. These delegated reference/research requests often pose the greatest challenge because the messenger is not the requester and may not have a full understanding of the problem. Often the requesting attorney is unavailable for clarification. So, the librarian seeks to discern the intent of the attorney through the messenger to first understand the information request and then to complete the request within the constraints defined by the attorney.

Often, the key decision makers in the firm seldom use the library directly, because they are too busy working directly with key clients. They delegate research work and receive synthesized research results in the form of memos of law. They often do not realize the extent to which the library supports their information needs and can easily feel like the library does nothing for them personally.

Some libraries provide service directly to the firm's clients:

- Document retrieval requests
- Monitoring legislative activity
- Researching case law
- Finding statutes on a particular topic
- Compiling a chart of state statutes on a particular topic
- Doing business research on a competitor, etc.

Sometimes the request comes through the responsible attorney and sometimes directly from the client. The library contributes directly to serving the client and thus building and maintaining the client relationship.

One customer type, the summer law clerk, or summer associate, hopes to work as an associate at the firm. The summer clerkship serves as an extended job interview—where the firm continues to evaluate the clerk and the clerk assesses the firm as a potential employer, rather than a job where work is produced.

The large law firm hires summer clerks with the expectation of offering them jobs. The firm has already invested significant amounts of money to find and entice the law student to come to work for the summer. A significant part of the clerk's job during the summer involves legal

research. However, because most summer clerks have minimal research skills, they start their summer worrying about their ability to find the right answer. The librarian serves as bibliographic/research instructor and nonjudgmental resource for the frightened, stressed clerk. This role of research consultant enables the librarian to make the firm more attractive to the clerk by helping to improve the clerk's research skills. In addition, the librarian can also evaluate the overall effectiveness of the clerk and the likelihood of their success as an associate.

Services

Most libraries provide staffing during the firm's normal business hours, 8:00 A.M.–5:00 P.M., Monday–Friday. The global economy forces lawyers to extend their hours and librarians change their service hours accordingly: opening earlier and staying open later to provide assistance during the time when most lawyers are in their offices. Law firms with multiple offices and librarians in multiple time zones provide extended coverage to the entire firm through telephone and e-mail. Some firms are testing instant messaging to communicate with users and ways to best send documents to personal data assistant (PDAs).

Reference services include the traditional quick reference and bibliographic instruction services that answer questions such as: “Do we have?” “Where is it?” “How do I?”

In research, the librarian answers the question: “Can you find the statutes and/or the cases on the following issue(s)?” “I’m meeting this person tomorrow, what can you get me to inform me about their business?”

Research provides an opportunity for the librarian to add value to the basic answer by synthesizing from many sources the solution to the lawyer's information problem and by making personal/professional observations about implications and possible interpretations of the research.

Business briefing book preparation involves locating, selecting, compiling, and summarizing information about a company. This form of research has grown in importance because law firms face intense competition for quality clients. The briefing book enables the lawyer and the firm's marketing professional to identify the client's needs that the firm can best meet. It also gives crucial background information so that the lawyer can demonstrate the firm's understanding of the unique challenges facing a business owner.

Access to information

The Catalog. Catalogs began as a simple list of the books owned by the firm. As the collection grew, the catalog evolved, first to a card catalog and then to an online catalog. The quality of cataloging correlates with the resources available to the librarian. Namely, the better-funded the library the more effective the catalog access to

the material in the library's collection—both physical and virtual. As librarians worked through the process of cataloging their collections, they allocated significant resources to building a detailed inventory of their collections. This was done by either assigning a significant portion of a staff member's time to the project, or by contracting out the project to a third-party service. Law firm library catalogs continue to evolve to provide access to books on the library shelves, electronic subscriptions available online through the Web, or in CD-ROM towers and “free” resources on the Internet.

Law librarians use Web technology to provide access to information by building and maintaining the library page on the firm's intranet or building and maintaining the firm-wide intranet. The intranet includes links to answers to commonly asked questions such as “how do I . . . find a translation service, find a zip code, find a case.” It also organizes online research resources, whether fee-based or at no additional costs, by the ways the library's customers think of them. The organization could be by practice area, by geography, etc.

Librarians apply their skills of collecting and organizing externally produced information to internally created information and build knowledge management systems. Lawyers use these systems to find prior work product so that they can customize a solution to a client's problem. “Work product” could be a research memorandum on a point of law, an agreement for a purchase or sale of a company, or a response to a request for proposal from a potential client.

Interlibrary Loan. As a way to provide access to materials not in their library—whether not owned or not on the shelf, law firm librarians built interlibrary loan (ILL) systems as soon as there were two librarians in the same city. These systems function more informally than academic and public systems. Law firm librarians use phone calls and e-mails to expedite requests that must be filled within hours, not days or weeks.

Current awareness

Current awareness services include paper-based services: clipping articles from newspapers, routing newsletters, routing photocopied tables of contents of periodicals, maintaining a vertical file of continuing legal education (CLE) opportunities, as well as electronic-based services: subscriptions to electronic newsletters, and creation of customized electronic newsletters that are either e-mailed or posted on the firm's intranet.

The physical routing of material uses route slips. Generally the priority on the route lists is by seniority in the firm. But, in some libraries it is adjusted to reflect the need to know, political clout, or circulated in straight alphabetical order. The alphabetical approach includes a periodic reversal of the list or randomizing it so that everyone is

reminded of the need to promptly read the current-awareness material. This system saves subscription costs by sharing a subscription but increases lost opportunity costs if important information is delayed when one of the individuals does not promptly read their mail. In that instance a person further down the list may not get the weekly item for many months.

Increasingly, current awareness is electronic only—whether as e-newsletters, e-zines, RSS feeds, or customized regular searches of commercial databases that are pushed to the customer's desktop or PDA.

Cite checking

Cite checking validates citations in a brief or memo by looking up each cited source and comparing the proposition for which it is used or any quotations against the original source, and confirming that the case or statute has not been overturned or superseded.

CLE provider, credit tracker

Continuing legal education is mandatory in 43 states.^[92] To keep their licenses active lawyers must complete a designated number of CLE hours within a specified time. Librarians organize events, teach courses, and maintain systems to track the credits earned and needed. Tracking CLE becomes an element of knowledge management systems when librarians track the subject matter of what was taken and by whom so that others can consult with the attendee.

Training includes the overview orientation to the library, its collection, and services. Training can also include the traditional bibliographic instruction of how to use available information. These sessions may be in small groups, but most often they are one-on-one, provided just in time, when the lawyer needs the training. New technologies expand the just-in-time training; enabling librarians to develop self-paced computer-based instruction, or to train remotely by viewing the user's computer screen.

Conflict checking

Conflict checking involves searching the firm's internal databases for clients who might be on the other side of a legal matter. The ethical code for lawyers precludes representing two sides in the same dispute. Further, without specific waiver from the client, the law firm may not represent a client in one proceeding and oppose the client in another matter. Librarians build the systems to search internal records for existing clients and external sources to identify the corporate structures to properly name all the affiliates of a company.

Impact on Other Units within the Firm

The library's research resources and skills aid the marketing department by finding the information for responding to requests for proposal. Current awareness services include alerting the human resources department to new developments; the accounting department for currency exchange rates and accounting standards; and the facilities department with comparisons on equipment, space allocation in other industries; and new standards for office equipment.

How Does the Library Achieve the Organization's Goals?

The library achieves the firm's goals by first understanding the goals of the firm; second by aligning the library activities with the firm's goals. Typically that means encouraging cost-effective research and applying ongoing and rigorous cost-control efforts—only buying information that is likely to be used and canceling and discarding that which is not used.

Recent Developments

Five recent developments impact law firm libraries. First, the information explosion and the Internet have increased the online availability of more cases, more statutes, more regulations, more news sources, and different search engines. These developments make clients wonder why, if everything is available for free on the Internet, they should have to pay extra for information. Clients often are not aware that online sources are purchased by the firm.

The second factor is the growth of branch, or other offices. In the 1980s and 1990s law firms expanded their markets by opening offices in other cities to better serve an existing client or to serve a developing area. With the branch office, came the need for a library and the challenges of managing remote services. Sometimes the solution was to staff the branch library, sometimes to depend on the central office.

Third, the changing and expanding roles of professional law firm staff impacts the law library. For example, the office manager evolved to a firm administrator and then to an executive director. With each change, the individual assumed greater responsibilities in governing the law firm. That role change demands that the librarian think and act in a more business-like manner. Librarians' roles also evolved to assume greater responsibility for information collection, organization, and reuse. About one-third of law librarians now have nontraditional roles: supervising the records center or the conflicts checking department, the firm intranet, CLE, or knowledge management.

The fourth factor is the increasing number of law firm mergers involving firms that already have librarians. While the merger increases the resources available for information

problem solving it also may create overlapping skill sets in the library staff and displace some of the staff.

Fifth, the “google-ization” of research expectations. Not only the younger customers but also the older ones now believe they should be able to find the answer themselves by just typing words into a search box.

Principal Concepts—Alternative Interpretations

In the law firm, significant numbers of the library’s customers are the partners or shareholders who own the firm—and the library. The law firm, while it exists to serve clients, must also make a profit by providing quality client services in cost-effective manner to clients who will pay their bills. The traditional law firm bill includes an hourly rate and disbursements, money the firm spent while doing the client’s work, for example, court filing fees, long distance charges, etc. Hourly rates are calculated using the costs of having the firm open, using factors such as rent, utilities, salaries, benefits, etc. The two biggest factors are how much profit the partners want for a given level of work and what they think the market will bear. In recent years, clients have been asking for predictable pricing. Predictable pricing is where the client knows in advance what the work will cost.

In each of these two billing models, the librarian contributes to the firm’s bottom line by promoting the most cost-effective research possible. In addition, law firm librarians record the time they spend on reference and research projects. By recording their time, the firm can bill the client for their time—just like lawyers’ time. Even if the time is not billed to the client, it enables the firm to analyze the cost of servicing the client.

Time

Law firm work is always driven by deadlines: court filing deadlines, contract acceptance deadlines, etc. The Internet has compressed time and magnified its importance. Clients work in multiple time zones around the world. The firm itself may have offices in multiple time zones. When communication went at the speed of the mail, the client did not expect an immediate answer by return mail. While there was never enough time to research every possible nuance, there was time to reflect on the advice to be provided. Now, with clients expecting a call back from someone within 30 min and an answer within hours instead of days, time is in even shorter supply. The successful law firm uses the skills of law librarians to get higher quality answers faster and cheaper than lawyers themselves can supply.

Technology

Law firm libraries were one of the first departments in the firm to apply technology. While accounting first applied

technology to crunch numbers for billing clients, the library used technology to solve information problems and thus led in introducing technology to the rest of the firm. The library first had stand-alone terminals for online research. Later, libraries used spreadsheets to manage budgets, word processors to summarize research results, and database programs to manage serials and create online catalogs. Now, the computers—but now desktops and laptops—include word processing, spreadsheets, Internet browsers, and access to CD-ROMs, access to subscription databases, and time-entry programs.

Budgeting and planning

For many years libraries operated without budgets or forecasted spending. They spent as much as they wanted or needed. As law firms continued to become more business-like, librarians adopted budgeting techniques to track and forecast their expenditures. The budgeting and planning reflect the business acumen of law firm management and the pressures facing law firms’ profitability. Over 80% of law firm library budgets goes to electronic resources.^[93] Almost 90% of the print budget is spent on keeping the library current and up-to-date. Some firms treat flat-priced online research contracts as part of overhead; others try to recover the cost through charge-backs to clients. Sometimes the income from charge-backs is treated as an offset to the library budget and other times it goes in a separate category.

As part of for-profit organizations, librarians must address tax and accounting issues like sales tax, property tax, and capitalizing versus expensing items, and then, if items are capitalized, track the depreciation. For multilocation libraries, sales and property taxes can mean that taxes are paid on an item when it is shipped to one location for processing and then taxed again as personal property at the ultimate location.

Physical Arrangement/Space

Design also communicates what activities matter. Firms that view their primary stock in trade as their knowledge and intellectual capacity like to show off their libraries and configure space so that clients can see lawyers at work.^[94]

Constrained by the space available, law firm librarians seek to arrange the collection in an overall useful fashion. The traditional configuration used broad topical areas. Cataloged and classified collections are arranged in call number order. Some firms use satellite libraries (subsets of the collection or duplicates of selected subject matter titles on other floors near significant practice group members). A centralized or consolidated collection is easiest for the staff to maintain. Satellite libraries, because they put the books closer to the lawyers, are easiest for the customer.

The satellite library does not encourage coming to the central library or asking a librarian to conduct a research project for the attorney.

Seating type

The number of study spaces ranges widely—from one per every ten attorneys to one to twenty or more. Lawyers tend to do research with several books open to different cases or statutes, so they can more easily compare the language in each. This means that each study space, whether a table or carrel, has a larger work surface than in other libraries. Many libraries have physically downsized, making extensive use of hybrid collections and compact shelving to house the physical collection. Instead of built-in carrels, they use modular furniture to permit using the space for other functions.

Collections

Collections range from less than 10,000 volumes to more than 70,000 volumes. Libraries collect both external and internal information sources. The external sources include hard copy and electronic materials. “Hard copy” includes the traditional hardbound texts, treatises, court reporters, statutes, etc. Most of the hard copy books are supplemented with a paperbound pamphlet inserted in the back of the book; others are loose-leaf—binders with loose pages that can be replaced with updated text. The collection may also include microforms, audio, video, CD-ROMs, and other electronic media via Web, dial-up, or leased line. Internal sources include memoranda of law files, brief banks, and opinion letters written to clients. Some libraries use podcasts or MP3 players to distribute CLE programs.

Libraries have a core collection of the primary and secondary materials in the jurisdiction(s) in which the firm practices. Primary materials are the law itself: statutes, regulations, and cases. Secondary materials explain the primary materials. Finding materials provide means to locate the primary and secondary materials.

Libraries physically expanded in the 1980s as many law firms moved to new space. New libraries were designed to double the size of the collection every five years. However, in the 1990s the collection growth rate slowed and even began to shrink. Causes for this reversal include: expensive real estate leases that made justifying housing books difficult when many of the primary sources of law are also available electronically; and the continuing codification of American law, namely, more reliance on statutes and regulations than on case law. This codification in turn enabled a new work, the handbook that compiled the most relevant statutes, regulations with minimal commentary into one or two volumes. This provided the perfect desk reference for the attorney to find a quick answer while on the phone with a client.

Serials

Serials comprise about 90% of the titles in a law firm library. Serials control systems range from manual ones, such as Kardex files, through specially adapted, created computer files such as word processing documents, spreadsheets, or databases to integrated serials, circulation, acquisition, and catalogs. Some libraries record invoice number and amount for each item, in addition to keeping a copy of the invoice and sending a copy of the invoice to accounting.

The nature of law, as an ever changing discipline, requires that the materials be updated constantly so that the most recent information is available to the lawyers. Publishers address this problem with different approaches, for example, pocket parts (pamphlets inserted in the back of books). The pocket part is arranged like the parent volume and includes new law, case analysis or commentary by chapter, and section or page number of the parent volume. The researcher reading the main volume must check the pocket part for newer information. When the size of the pocket part becomes too large to go into the back of the book it may become a freestanding supplement shelved after the book or the publisher may recompile the complete title into a new edition. Another approach is loose-leaf services. Binder volumes are updated by a package with instructions of which pages to remove and discard and which new pages to insert. Because the revised material is integrated into the text, the researcher saves time. Typically, loose-leaf services cost more than pocket parts both in dollars to the publisher and in the time to file the updates.

Many law firm librarians have stopped binding law journals and other legal periodicals. They reason that they are less likely to lose the entire volume—one issue may be off the shelf, but the other three issues are still on the shelf. In addition, the pressure for space savings and cost controls impels the decision not to bind materials that probably will be discarded in five years or less. The availability of electronic full-text and images of the journal further reduces the need to dedicate lineal feet to little used materials.

Collection development policies

Most collection development policies are informal and unwritten. They generally “support the immediate information needs of the practitioners” in that particular firm. Thus, one library that does extensive appellate work may have a historical collection of proposed regulations, extensive legislative histories, and old editions of significant treatises. Another firm will have a different collection with little historical material because of the nature of their work.

Generally, the library seeks to have core materials to support the practice. The largest libraries define core materials to include multiple treatise titles on the same subject to give alternative views of the issues. Law firm libraries usually rely on academic and court law libraries to maintain extensive historical collection of earlier versions of statutes, regulations, or treatises. These materials are of interest to the legal scholar tracing the development of the law but are seldom used by the practitioner.

Demand drives the number of copies of works held in the collection. If a set is frequently used in a lawyer's office, the librarian acquires multiple copies of the title. In recent years as space constraints and budget limitations loomed, especially when coupled with the ability to retrieve documents from various electronic sources, the number of duplicate copies has shrunk.

The collection is primarily legal information. However, the trend is to include more nonlegal information because the practice of law now requires research in other areas. In addition, the nonlegal materials help the lawyers understand their clients better.

The reverse of acquiring, reviewing for continued supplementation, and/or discarding also varies widely. Decisions range from the librarian acting alone to heavy lawyer involvement in the process. The heavy involvement can vary from lawyers physically coming to the library to look at the materials, to lawyers reviewing compilations of the materials with notations indicating costs and frequency of use. In other scenarios, the librarian surveys when the renewal comes due and/or reviews the complete subject matter at one time.

The retention policy varies from keeping permanently to keeping only the most recent few years of newsletters or law journals. Librarians, limited by space, are cognizant of alternative sources for the information. Citation patterns indicate the heaviest use of most materials is within two years of publication.

Classification

Law firm libraries use many approaches to cataloging and classification. Most generally follow the LC classification with local variations to reflect the firm's practice. For example, the LC classification puts pension materials in the labor area, but for many firms the pension practice focuses on tax aspects so these materials are reclassified into the tax area. The degree to which the collection adheres to the LC scheme is often driven by the maturity of the library.

However, for smaller firms that have not had the money and people to manage their resources, the collection may lack an inventory, a catalog, or a classification scheme. Books are arranged in the manner that reflects the most vocal and important of the library users—probably by their practice preference. Thus, if one person takes the book off the shelf and another returns the book—especially if some

additional books have been taken in the interim—the first book may not be reshelfed in the same relative place.

Circulation Systems

Law firm libraries, unlike public or academic libraries, can show people in the firm who has the book checked out. This improves the use of the collection because the attorney is able to find who has the book at any hour and can call or go to their office to use the book. Circulation systems range from a notebook for the title, date, and initials of the attorney taking the book, to small cards and pockets with the cards completed and left in a box at the library entrance. Another method uses oversized cards in the book, which are to be left on the shelf in place of the book. A few of the largest libraries now have systems with bar code readers or radio frequency identification (RFID) tags that integrate the circulation records with the online catalog.

Unfortunately, there is no security in a law firm library, except within the office itself. In other words, any time the office is open, so is the library. This means it is easy to walk out of the library without properly signing out the book. These “not on shelf/not signed out books” slow the lawyer's response to the client. Efforts to find the needed information for the lawyer include office searches, contacting the likely users of the book by phone or e-mail, broadcasting e-mail to the entire firm, borrowing the book, or replacing it.

Staffing

Staff sizes range from one solo librarian to staffs of 20 to 50, reflecting the size of the firm, the nature of the practice, the location of the firm, and the ability of librarians to prove their worth to the firm's bottom line. On an average, there is one professional librarian for every 22 attorneys.^[95] Many law librarians work in a solo shop with little or no clerical support. Most do not have the opportunity to bounce ideas off a peer during the normal workday. The solo librarian can achieve that professional interchange through participating in the local, regional, and national professional associations, and by regularly planned lunches with colleagues from other firms.

Positions in the law firm library include professional, paraprofessional, technical, clerical, and administrative. The title manager, director, supervisor, or simply librarian indicates who is responsible for managing the library. The title reference librarian denotes one who focuses on providing reference and research answers. This person may also have special expertise in one or more subjects, for example, tax, trademark, patents, immigration, labor, or business. Regardless of title, the actual responsibilities for each staff member cross the traditional functional activity lines because there is usually not enough work to keep a single function position busy for a 40 hr week.

Librarians report either to a library committee, usually comprised of partners or associates, or to a library partner, the firm managing partner, information services director or the executive director/chief operating officer. Increasingly, the librarian's performance review includes how closely aligned the library is with the firm's business objectives.

Education

A master's in library science (M.L.S.) is the entry-level professional degree. A significant number of law firm librarians also have law degrees. Law firms tend to be practical in orientation, so demonstrated skill and experience can substitute for the M.L.S. With more nonlegal research being done in the firm, an additional master's degree in business, science, or technology can increase the value of the librarian to the firm.

Clerical, technical, or paraprofessional positions typically require a Bachelor of Arts (B.A.) degree or, significant demonstrated experience. These nonprofessional positions may include library network support, such as maintaining the library's portion of the technology network, maintaining the firm's intranet page, etc.

Continuing education

Law firm librarians find opportunities for continuing their education in local, regional, and national programs. The AALL's annual meeting typically draws one-third to one-half of the law firm members of the Association. In addition, AALL offers workshops in different cities. Local or regional chapters supplement the offerings of the national / education opportunities as well: the Association of Legal Administrators has chapters in almost every city and also offers many telephone conference programs. The Special Libraries Association and general library associations also provide opportunities for continuing professional education.

Finally, each of the largest legal publishers presents programs on topics related to private law firm librarians.

Experience and skills

The AALL 2005 Salary Survey reported that, on average, law firm librarians have held their current positions for 7–8 years.^[96]

History

Lawyers rely on information—statutes passed by legislatures, written opinions from judges, and commentaries or treatises written by scholars or practitioners. The solo practitioner in the 1800s, as now, might have survived with very few books. As lawyers joined together forming law firm partnerships, their book collections grew. As the

number of lawyers in the firm increased, the book collection grew as well. At around 50 lawyers, the book collection—and the information needs—becomes so large and so complex the firm hires a librarian.

One of the earliest law firm librarians, Elizabeth Finley,^[97] began her career in New York in 1921. In 1961 she was the first law firm librarian to serve as president of AALL. Through the 2007–2008, a total of five law firm librarians served as president: Jack S. Ellenberger 1976–1977, Carolyn P. Ahearn 1991–1992, Mark E. Estes 1992–1993, and Kay M. Todd 1993–1994.

Future

Law librarians will work more outside of traditional roles and the physical confines of the library in the future. They will pay greater attention to customer service by attending to what the customers value, not just what the customers say they want. They will translate their customers' needs to publishers to create customized information products. These customized information products will enable customers, to retrieve more quality information for themselves.

Challenges

A current trend in law firm recruiting is to hire more attorneys with three to five years of experience and fewer recent graduates. These attorneys come to the firm with expectations of library service from their old firms that differ from the services available in their new firm. This challenges librarians to create ways to break the habits and expectations of these experienced new attorneys and convert them into loyal customers.

The law firm librarian's customers range in age from mid-20s to 70-plus. Generally, each of these generations has vastly different levels of comfort and skills in using technology to solve information problems. The youngest attorneys tend to be the most comfortable with technology while the oldest tend to be the least adept with it. The youngest technologically savvy attorney expects Web-like searching and has poor legal research skills. The older attorney has better research skills, but limited computer skills. This challenges librarians to balance the demands for hard copy materials with the demand for desktop, Web-based research tools, etc. Librarians also need new technology skills to keep up with the younger attorneys.

Time constraints on getting/using information

The demands of clients require faster than ever turnaround times from attorneys. This challenges some tenets of traditional collection development practices. Namely, libraries do not need to own everything if a book can be borrowed quickly. Attorneys often do without the information because they cannot wait the one to two hours

required to borrow the book. Librarians must revise collection development policies and ILL procedures to provide timely access to information within limited budgets.

Proving the return on investment value

The decision makers in law firms seldom use the library. Therefore, the librarian must build the case that money spent on information resources earns a significant return on investment. Librarians must track usage of library resources and the time spent on reference and research projects for clients and firm projects. These firm projects include preparing the business dossiers for business development and designing and maintaining information resource systems. The librarian must report these statistics in a concise and meaningful way that demonstrates that the library saves the lawyers' time, and makes them more productive and the firm more profitable.

Confidentiality

While some firms emphasize the confidentiality requirement by requiring employees to sign a confidentiality agreement, the employee is bound by the same ethical standards that apply to lawyers: namely, to not disclose confidential information to people outside the firm. Nondisclosure includes the seemingly innocent remark of what a client plans to do in a future transaction. With publicly traded companies, this sort of breach could subject the librarian to federal insider trading laws as well.

The firm, in order to protect itself against conflict of interests posed by one or more attorneys or staff who worked for another firm or company adverse to a client, erects ethical or confidentiality walls. These ethical walls are intended to keep the attorney from seeing any part of the client's file without prior clearance. The librarian, as knowledge manager, who knows when someone has researched a similar topic or issue, may inadvertently put two attorneys together to talk about a research result that could violate the ethical wall. The challenge then is to integrate the barriers of ethical walls into the knowledge management system.

PUBLIC LAW LIBRARIES

Introduction

The term "public law library" refers to all law libraries that are not affiliated with either law firms or law schools. In this category are found county public law libraries, court libraries, state law libraries, state and federal agency law libraries, and bar association/subscription law libraries. Clientele, funding, and governance are the main differentiating factors between these entities. Collections, staffing and credentials, facilities, teaching methods and

responsibilities, national standards, and advocacy and public outreach are all important characteristics that make public law libraries quite different from those in law schools and law firms.

Public law libraries are a major component of the justice system, as they provide the information necessary for litigants to access the courts. In fact, they have been referred to as the first rung in the ladder to justice.^[98] They generally differ from academic and law firm libraries in that they are funded by the public in order to serve the public. Although there are many variables and more than a few exceptions to this statement, the public's right to access the law that it is required to follow is the principle that supports the existence of public law libraries. The rapid growth in the number of self-represented litigants, the escalation of the costs of maintaining library collections at a time of decreasing resources, changing competencies required of staff and directors, and the harnessing of technology to accomplish the library's goals are all elements of the public law library in the first decade of the twenty-first century.

Customers

The public law library, by definition, is generally designed for use by the public. Courts have seen an astonishing growth in the number of people who are involved in some kind of litigation or court action and not represented by legal counsel. Statistics vary across the United States, with over 75% of divorce cases having at least one party proceeding "pro se" (without an attorney) known as "pro per" in California, and close to 85% in landlord/tenant matters.^[99] A Legal Needs Study that was conducted in Montana in 2005 determined that there were over 207,000 unmet legal needs each year for a state with a population of less than 920,000 people.^[100] The loss of funding for legal services resulting in fewer legal aide attorneys is one factor that is driving this trend. There also is the perception that disagreements previously settled by family, friends, and the parties simply talking out the issues are now better solved in court, fueled by the media and television shows like Judge Judy.^[101]

As law librarians are committed to providing access to legal information, it quite naturally has fallen on them to take on an important role and growing responsibility to serve the unrepresented. Although the basic tools of legal research, such as statutes, opinions, and legal forms, have always been available, law librarians are finding themselves more involved both institutionally and individually in providing resources to assist this major portion of their customer base. Everything from collection development, staff training and retention, and Internet presence and other technologies has changed in order to accommodate the demands of these customers.

Most self-represented litigants have not studied the law, are not familiar with many of the Latin and archaic

terms still used by courts (such as *stare decisis* and *res ipsa loquitur*), and have little experience with the judicial system. These clients come into the law library with significant disadvantages. It is difficult for them to understand the materials that have been developed for attorneys to navigate the legal system. They often do not have access to the Internet unless it is at their public law library. The mothers among them frequently cannot find affordable child care and therefore must bring their young children with them. These factors have driven significant changes in how public law libraries do their business. Self-Help book collections are being moved so that they are more available near the entrance to the library, Web information is being produced to include forms and explanations of court procedures, and reference and access services librarians are receiving special training on the difference between legal information and legal advice,^[102] how to assist difficult and angry people, and how to assist those who do not speak English. Many law librarians are now partnering with public libraries to assist the courts with the significant increase in unrepresented litigants. The hope is that if reference staff at public libraries can be expert navigators on court and law library Web sites, they will become important community partners in our effort to provide access to justice systems and ease the burden on court staffs.

Public law libraries have frequently assumed the role of legal resource center for the practicing bar. Although large law firms may have their own in-house librarian, sole practitioners and firms of fewer than 100 attorneys (82% of all private practice in the United States according to the ABA)^[103] do not have significant law libraries and rarely have librarians to provide legal research and reference service. When these legal professionals cannot find what they need through subscriptions to online databases, they rely on their public law library for research. Judges, law clerks, and judicial assistants use their county and state law libraries. Legal counsel to state and federal agencies and public defenders also rely on the resources of public law libraries.

Law firm libraries and law school libraries have defined user populations, for which they establish their policies, collection development, and staffing priorities. Public law libraries have challenges provided by an infinite variety of customers. In a one-hour time frame the library could be serving a high school debate student, an appellate judge, an angry father who is about to lose visitation rights, someone in state government who needs access to the federal regulations on water quality from 10 years ago, a bankruptcy attorney, and a visiting law professor from another state or country. This diversity makes the management of the public law library interesting and challenging, and it requires nimble administration.

Governance and Funding

Most public law libraries are governed by a board of trustees, similar to a general public library. Usually, the

members of the board are stipulated by statute or ordinance, and are chosen to represent the constituent's interests for services and resources. However, it is not at all unusual for the trustees themselves to be infrequent users of the library. For example, many state and Supreme Court law libraries are governed by the state's supreme court justices. These officials rarely do their own research, as they have law clerks for that purpose; thus, they infrequently come into the library. Their most common need for assistance is when they need access to statistics, published humor, or quotations for teaching or addressing the public.

County law libraries are generally established by statutes or ordinances, where their funding mechanisms are laid out, but they can also be governed by local bar associations. In some instances, this has led to charges of conflicts and cronyism, since, although the library is supported by either filing fees or taxes paid by the public, only lawyers can decide what materials are to be purchased and what staff should be hired. Recently, county law libraries have been scrambling for funding, as formulae for the sharing of court filing fees have changed dramatically. In Florida, for example, funding dropped precipitously in 2004 when the state legislature reconfigured how filing fee revenues would be distributed.^[104] This was a decision made by authorities far removed from the affected program, who generally can afford attorneys for personal and business use.

The exception to this scenario is the private, subscription law library. The oldest law library in the United States, Jenkins Memorial Law Library, is supported by the dues structure into which its members pay.^[105] These libraries generally allow nonmembers (the public) on-site access for a nominal daily fee. Other prominent, historical law libraries of this character include the Social Law Library (Boston), the New York Law Institute (New York City), the Library Company of the Baltimore Bar, and the Cincinnati Law Library.

In searching for additional funding, many other public law libraries have taken on part of the character of the subscription law library. By offering special services to dues-paying members, the King County Law Library in Seattle and the Sacramento Public Law Library have generated both more revenue and a loyal customer base.^[106]

Most state law libraries are funded through appropriations from their state's general fund. Usually they are not allowed to keep any revenue that is derived from activities such as photocopying and document delivery. When it is legislators who make the ultimate decision as to what funding will be available to the library, the user is even further removed from the process. For this reason, some law librarians ask especially sympathetic users, such as the self-represented, to testify at their appropriations hearings.

State and federal agency law librarians, including those who work for legislators and attorneys general, are also

funded from appropriations made by legislative bodies. In most other respects, however, these libraries are organized and operated like law firm libraries. They rarely serve the public, and have a defined user base consisting of the attorneys and other employees of the agencies. They also tend to have small collections and only one librarian.

Services

Public law libraries provide most of the services that other kinds of law libraries offer. However, they rarely conduct in-depth research for customers, and the teaching they do is frequently more of the informal, “teachable moment” variety. They spend considerable time and resources developing finding guides and explanations to legal process and procedure which can be placed on their Web sites.^[107,108] They work with public libraries and state library associations to train public librarians on how to use their Web sites and when to refer patrons to the law library.

The issue of legal information vs. legal advice, or the unauthorized practice of law, is a hot topic for many public law librarians.^[109] There is considerable effort to make reference librarians more comfortable in teaching and working with pro ses.^[110] Basically, the standard has been established that questions that begin with phrases such as “Can I? Where is?” and “What is?” can be answered, as they are fact based. Questions that begin with “Should I?” cannot be answered, as they involve giving legal advice as to what action should be taken.

State, court, and county law libraries are frequently asked to host tours and informational sessions for students of high schools, trade schools, and colleges, for visiting librarians and scholars, and for other kinds of groups. Court librarians generally conduct in-depth orientation sessions for new law clerks and court employees. They offer brown bag, lunchtime classes on a variety of subjects such as legislative process and intent, state-specific tax resources, and using the library’s electronic licenses.

County law libraries frequently have evening and weekend hours. Most court libraries are open only during standard, business hours. Many court and county law libraries also provide access at any time for attorneys who practice before the court. The attorneys generally sign in with a security guard. After hours, however, there is no staff present in the library, and therefore no reference assistance. This is controversial, and has been challenged by independent paralegals and self-represented litigants. Most federal court libraries only allow access to their libraries if the researcher has an active case before the court, no matter what time it is.

The “Ask the Librarian” button that many libraries provide on their Web sites^[111] may feed into a 24/7 system in which other law libraries participate. The Los Angeles County Public Law Library’s Web site has this information:

24/7 Chat Reference: Click on the ‘Ask Now’ icon to be connected to a reference librarian using real-time chat software. This is a service of the Metropolitan Cooperative Library System, so your question will not necessarily be answered by a Los Angeles County Law Librarian. Reference questions are answered by librarians from California’s County Public Law Libraries, and LA County librarians provide some hours of coverage in answering law questions.^[112]

Many court libraries will order multiple sets of the same title for all judges in their jurisdiction, and have them drop-shipped to the judges by the publisher. These libraries frequently purchase and maintain the collections that are held in judges’ chambers. This can involve a significant commitment on the part of library management when the chambers’ collections are located in other cities, because it requires a staff member to travel to another site. Maintaining chambers collections can be a significant matter, as law books generally have at least annual updates. Loose-leaf services may have to be updated as often as once a week, and court staffs rarely understand why the weekly releases cannot be ignored.

Some state law libraries design and manage the Web site for the entire judicial branch of government. Others take their court’s opinions and appellate briefs, and place them on the Internet.^[113] These services keep the library in the management loop of the branch, and contribute law librarians’ hopes that others will have high opinions both of their competencies in the digital age and their commitment to serve the public.

Almost all public law libraries circulate their collections. Some allow any citizen in their jurisdiction to check out materials. Others check out items just to court staff and attorneys. Some will provide circulation to members who pay for the privilege. Public law libraries also provide ILL service for materials in their collection that circulate. Similar to other libraries, law libraries generally will not send titles that have been published out of state in the current year.

Document delivery is a major service of public law libraries, and is almost always fee-based. Many public law libraries derive significant income from providing such transactions. The King County Law Library (Seattle) charges \$20 per citation for documents up to 20 pages long, with a \$5 discount for subscribers. If the citation is incorrect and has to be researched there is an additional \$10 charge.^[106] The Jenkins Memorial Law Library (Philadelphia) charges \$25 for rush deliveries, which does not include costs.^[114] Although photocopying and then mailing, faxing, or sending via an overnight delivery provider were acceptable delivery systems until recently, more and more of the law library’s clients now want their information delivered in a digital format. Judges and litigants like the convenience of taking something that comes to them electronically and merely cutting and pasting relevant text into the legal brief or opinion that is being

written. This is easily done if the information is retrieved from a Web site or from an electronic product. If it is from a print source, the information can be easily digitized and e-mailed with most state-of-the-art copiers. Library management prefers this kind of delivery because it cuts back on envelope preparation and postage expenses. Most public law libraries want to provide and deliver requested information at the time and in the format that is required by the customer. Scanning technology has helped significantly with these libraries' missions.

Other services offered by many public law libraries include the rental of conference rooms, notary publics, free Internet access, custom cataloging for small law firms, and customized research, including expert witness background reports. Today's public law libraries are scrambling for revenues to support their operations. Unlike law schools, which must have law libraries for accreditation, public law libraries are increasingly under attack from those who make funding decisions. Lawmakers at local and state levels ask why the public should support a legal research facility that is used by one special interest group—the legal profession. They have to be shown and convinced not only that lawyers do serve the legislators' constituents, but that more than half of the libraries' users are nonlawyers. The other main purpose for providing such extensive services is to generate a loyal customer base. Public law libraries are run like businesses, and work on many of the same challenges as the commercial sector, including market analysis and client development.

Collections

Some of the largest law libraries in the United States are public law libraries, such as the Los Angeles County Public Law Library and the Social Law Library in Boston. Other county law libraries are very small, with only one or two staff members and collections of less than 50,000 volumes. Suffice to say, there is no average size or average collection. However, the AALL has approved Standards for both appellate court libraries^[115] and county public law libraries.^[116] These standards are annotated, which gives guidance and support to staff, directors, and library boards of trustees.

A strong core collection for a county public law library will have legal materials from its home state, including a complete collection of the published decisions of the state's courts and current and superseded state and local court rules. It will have a state digest, a citation service, and other significant state court publications such as annual reports, court commission findings, and statistical analyses. For legislative materials, it will have current (and if space permits older) statutory compilations, current session laws, the state constitution and its various historical versions, as well as published debates and proceedings of constitutional conventions. It will hold local, county, and municipal codes, charters, bylaws, and ordinances for

the area it serves. If available, the library will have the state's administrative code and published decisions of state agencies, as well as the opinions of the state's attorney general. If there is a state legal encyclopedia the library will hold it, as well as significant state-oriented legal treatises, practice materials, and legal periodicals and newspapers.

For federal law, the library should have at least one set of reporters for the decisions of the United States Supreme Court, as well as a digest for finding those opinions. It will have at least one version of the *United States Code* and the published decisions of the U.S. District Court, U.S. Court of Appeal, and U.S. Bankruptcy Court for its jurisdiction. The library will also have the *Federal Register* and the *Code of Federal Regulations*, and a citation service for these reports and codes. For general U.S. publications, it will have units of the National Reporter System and the digests to go with those reporters. It may have current statutory compilations for contiguous states, and will have a national legal encyclopedia. General legal forms will be available, as well as a broad selection of legal periodicals with an index for finding articles, and other reference tools such as legal dictionaries, legal quotations compilations, and the Martindale-Hubbell law directories. Restatements of the Law, *Uniform Laws Annotated* and *American Law Reports* will be held. A collection of general legal and self-help titles on subjects of interest to the public and the self-represented litigant must generally be held very near the reference desk and/or entrance to the library.

The titles above will be available in print or electronic format, and sometimes both. State, appellate court, and large urban law libraries will hold all the above materials as well, in addition to full runs of most legal periodicals, all major treatises and loose-leaf services, treaties with other countries, significant foreign and international law collections and a strong collection of secondary materials, in particular, see the Los Angeles County Law Library.^[117] Public law libraries serve a broad client base, and their customers' comfort with digital media covers a wide spectrum. The AALL Standards make another point: "While online technology will provide a fundamental baseline for research platforms of future law libraries, certain print collections will always be needed and should be retained as part of the libraries holdings as a balance against countless deficiencies inherent in today's electronic media."^[116]

Many public law libraries are selective U.S. Government depositories. Unlike academic libraries, which usually segregate their government documents in separate collections that are not integrated into their general subject matter collections, most public law libraries catalog their government publications using the standard LC classification system and integrate them into the rest of the collection. Thus, documents emanating from the Internal Revenue Service can be found with commercially published titles such as the *Standard Federal Tax Reporter* and the *Tax*

Management Portfolios. Most state Supreme Court libraries also are depositories for the State Justice Institute. All publications that have been funded by the Institute are distributed to these libraries so that there is greater dispersion of the research for use by state judiciaries.

Public law libraries are running out of shelf space. Most have been in existence far longer than either law firm libraries or the majority of law schools. Many are in older courthouses which have no additional room for library growth. Actually, the court often is looking at the library to give up space for new judges and court staff. Fortunately, solutions are easier to come by now than they were 20 years ago. Public law libraries are turning to cost-effective digital solutions, such as HeinOnline^[118] and Law Library Microform Consortium Digital^[119] to replace long runs of legal materials. The preeminent legal databases, LexisNexis and Westlaw, provide access to most primary materials and many legal periodicals, but are too expensive for public law libraries to use for the purpose of replacing print. Each search carries a price tag. However, the vendors of these databases have begun offering public research subscriptions that are free to the public, by pairing public access to the databases with the contracts for print subscriptions that the library continues to retain. The public work stations are appreciated by the self-represented and solo practitioners, and their availability has been a marketing tool for the public law libraries.

Facilities

There is a wide spectrum to consider when discussing the physical plant of the public law library. The gamut runs from those libraries owning their own buildings to those having only one or two rooms in an old courthouse. In some states, notably California, the county is required to provide space, utilities, and janitorial service for operation of the library.^[120] Some county law libraries have branches located throughout the county. Court and state law libraries are located in their courthouse, which is ideal for serving court employees and those customers who have business before the court. Many county law libraries have been forced out of the courthouse, both due to their escalating needs for shelf space and the increasing requirements for space for new judges. This makes the library harder to find and less convenient to use, as it is no longer near the clerk of court's office and may not have suitable parking.

Twenty years ago, public law libraries worried about having enough seating space. Many had as many tables and study carrels as law school libraries, as well as private briefing rooms for the use of visiting judges and those with long term research projects. Now, however, fewer people access the public law library physically and more use the library's resources from the Internet. The library's ability quickly to e-mail materials and have books delivered overnight has also changed the user dynamics. As a result,

public libraries are not as anxious about having a certain number of desks and chairs available.

Collections for public law libraries do not have to be justified by the number of volumes held. Rather, it is access and ease of delivery that govern collection development decisions. The libraries have had to remodel to accommodate the public access computers now provided as well as special collections that should be shelved close to the reference desk. In the 1980s and 1990s, computers were difficult to install in older facilities constructed before anyone knew that wiring would eventually be required. Now, however, many of these libraries have gone wireless, which has solved many of the challenges posed by remodeling for technology in an historical building with granite walls that are a foot thick.

Staff and Education

Public law libraries tend to have fewer staff than law school libraries and more than firm libraries. There is a very wide range, however, and an average cannot be stated. More than two-thirds of public law library directors have at least an M.L.S., and 22% have a law degree.^[121]

Public libraries are increasingly looking for employees who bring to the information center skills and experience beyond those needed in the traditional library setting. Automation, Web services, and networking specialists are in high demand. Unfortunately, like the rest of the public sector, the library can rarely afford to pay computer specialists what they would earn in the private sector. People with marketing, public relations, and adult education talents are also highly valued.

Employees of most public law libraries are bound by both the ethical standards adopted by the AALL^[122] and whatever confidentiality policies have been adopted by their governing bodies. Court-based libraries have very strict rules concerning the absolute confidentiality of all matters that are before the court. These rules can involve which law clerks are checking out which books, which clerk is being trained on using specific libraries of electronic databases, and even conversations overheard in the elevator. This can indicate which judge is writing the majority opinion. Inadvertent divulgence, in turn, can affect financial markets, the well-being of corporations, and personal lives. Training all staff, not just those working in public services, must include these privacy issues.

Technology

Most public law libraries now have integrated library systems, public Internet stations that allow access to the Web, electronic licenses to legal materials, and copiers that allow for digitizing and e-mailing materials. Technology is no longer the extreme challenge it was a decade ago. After significant staff realignment, physical reconfigurations, and staff training in a plethora of digital

competencies—from HTML mark-up to negotiating electronic licenses, the public law library now has folded technology into its business plan and daily operations.

Connections

Connections and networking in the larger legal community are critical for the public law library's image and continuing presence. Bar associations, legal services and legal aide groups, judicial entities, civic associations, and advocacy organizations all are valued partners for the library. Both print and broadcast media are cultivated to help the public know what services the library offers. Other libraries, such as public libraries and the information centers for other public agencies, are consulted and also joined for cooperative ventures.

Law Librarians usually belong to the AALL. Those in the public sector join AALL's State, Court, and County Law Libraries Special Interest Section. They also generally belong to the AALL chapter for their city or region of the country. It is from these groups that the librarians receive most of their continuing education, professional guidance and mentoring, and have opportunities for networking specific to law librarianship. They frequently also join their state library associations.

Challenges

All law libraries are challenged by the popular notion that everything is available on the Internet, for free. Even when it is the library that has created and posted the information, there is little appreciation by the general public, as well as those decision makers who hold the purse strings, of what it takes to make the available information on the Web site. Another concern of public law librarians is that, although much primary law (statutes, court opinions, and regulations) is available on the Web and consequently relied on by the public, it has neither the authority nor the authenticity attached or guaranteed. Secretaries of State are beginning to jettison their print versions of administrative rules and codes in favor of digital versions that can be accessed from the Web sites. There is little appreciation outside of the library world of what this can mean in the future.^[123] The permanent preservation of born-digital legal materials is another concern of the profession.^[124]

The continuing escalation of prices of legal materials has been a problem for all law libraries for years. Those book budgets that have not been routinely raised to accommodate book inflation have been decimated. The serial nature of the law collection, which is based on the continuation and updating of most of the items, means that those books that cannot be updated are no longer of worth and generally have to be removed from the collection.

Another concern of public law librarians is that, as more and more of their services are provided to customers who do not actually walk into the library, there could be a

perception that fewer and fewer people are actually using the library. Statistics are somewhat more difficult to collect for validation purposes. It is known that clients without legal training, whether they are pro se litigants, students, or citizens who want to know what their rights are, require significantly more time to assist because of their unfamiliarity with legal materials.

Conclusion

Providing a balanced collection and competent staff to serve the wide variety of people who use the public law library is a significant challenge. Clients may be attorneys or judges, but they could just as likely be angry, confused or desperate lay people who have every right to access the law but just do not know how. The public law librarian is committed to providing access, but cannot interpret the law or suggest legal advice. Managing the public law library requires a delicate balancing act.

Public law libraries are challenged by trying to manage their facilities in an entrepreneurial fashion when they are significantly restricted by government barriers. Continuing price increases have forced many public law libraries to cut back on their collections. Subscribing to electronic databases does not help with budgeting, since they are as expensive as their print counterparts, if not more so. Nevertheless, the public law library with nimble management continues to be a vital and valued part of the judicial system.

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Law Literature and Its Users

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Abstract

This entry introduces the legal system of the United States by describing the branches of government that create the laws of a civilized society. These sources of law are interrelated and must be understood in order to find answers to legal questions. The law has characteristics that impact the work of the researcher, including the division of law into primary and secondary authority, the doctrine of precedent, the need for both stability and change in our laws, and the multiplicity of sources of the law. The types of legal materials are then described, along with examples followed by a section on legal publishing and the formats of legal information. Finally, the entry concludes with a description of various types of users of legal information.

INTRODUCTION

In a very real way, the law is nothing more than words. But it is really more than that; these words articulate the policies and rules that govern our behavior. These words are published in print and digital format, and they are accessible at libraries and through commercial and free sources on the Internet.

The diversity of sources of the law contributes to the complexity of answering even simple legal questions. Over time, sophisticated research and finding tools were created—first in print and then electronically—to help locate this vast body of legal information. An understanding of the interconnectedness of legal materials will aid in the use of these multiple sources of law.

This entry will describe our legal system in basic terms, followed by a discussion of the sources of law and the characteristics that influence its use. The next section covers some basic information about the publication of legal information and the various commercial and governmental entities that make legal information available. Although most people now access legal information in electronic form, we will also cover print sources.

Primary authority, secondary authority, and finding tools make up the legal literature. Each has a special role in legal research. And because everyone creates and/or is subject to our laws, we will address how citizens, lawyers and other legal professionals, law students, and the general public navigate the legal system.

THE LEGAL SYSTEM

The law comes from the legislative, executive, and judicial branches of government. The law is designed to shield citizens from both tyranny and lawlessness, to protect freedom, and to enable society to conduct its affairs. Our

legal system is complex because in the eighteenth century the founders wanted to distribute the power of lawmaking in a balanced way so that no one part of government could take complete control. Our legal system in the broadest sense is composed of branches of government with powers to make, interpret, and enforce the law. It also includes a legal profession responsible for advising government and representing litigants in their conflicts with the government or others.

It is important to note that the U.S. Constitution^[1] created a federal system. Some powers are centralized at the federal (national) level, and some powers in the hands of the states. And within individual states there are cities and counties that have lawmaking powers—some more than others. In the United States, we also have Indian tribes that have a certain amount of sovereignty due to both treaties and federal legislation. Thus, the law on any particular subject can come from one or more governmental units. As we will see in the following, this raises some special challenges for the legal researcher.

We use the word law in many senses. Some legal literature contains the law—the legislation, administrative regulations, and court decisions we live by. But we cannot understand the literature of the law until we understand how law is created, and by whom.

The legal system of the United States is called a common law system. In a pure common law system, the law is derived from the decisions of judges when specific cases come before courts. Under what we call “precedent” (or *stare decisis*), judges are to follow those earlier decisions so there is consistency among these decisions. Other countries, such as Germany and Japan, are called civil law countries; their legal systems rely on codes or constitutions. It should be noted, however, that in the United States, law is also created by the executive and the legislative branches of government as described in the following. Although we call the United States a “common law”

country, as we will see in the following, one begins his or her research not with cases, but with legislative and administrative codes. And one state, Louisiana, is based on civil law because of the influence of the French Napoleonic Code.^[2]

SOURCES OF LAW

In the democratic form of government in the United States, the power to make law is not centralized. For example, copyright law is governed by federal law because of an explicit delegation in the U.S. Constitution, “To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries. . .,” U.S. Constitution, Art. 1, Sec. 8. On the other hand, creation of laws to regulate families and domestic relations are historically a matter for the states. This is reinforced by the tenth amendment, which states that “[t]he powers not delegated to the United States by the Constitution, nor prohibited by it to the states, are reserved to the states respectively, or to the people.” U.S. Constitution, Amend. X. As a general matter, legislative bodies pass laws with broad application to everyone. They do not decide disputes between individual parties; this is done by judges. This distributed model of lawmaking among various branches of government and at all levels of government makes it essential that the researcher understand all of the sources of law and their interrelationships.

Discussion of the sources of law in this entry is necessarily generalized, since different levels of government in the United States (federal, state, Indian tribe, city, county) may have slightly different specific relationships. For example, the state of Nebraska has a unicameral legislature, not a bicameral (house and senate) legislature like all other states. The Nebraska legislature’s homepage includes an excellent explanation of their one-house legislative system.^[3] So although we will use the federal government as an example of lawmaking in the United States, the concepts described in the following apply at every governmental level.

Constitutions and Charters

Our legal system was created by the Constitution of the United States as the supreme law of the land. The U.S. Constitution is a single document, but it is also the basis for the vast body of laws that make up the American legal system. As a legal document, a constitution or charter creates the form of government and allocates power to the various branches of that government. For example, the U.S. Constitution created three branches of government, each of which has specific duties and responsibilities. Some of these responsibilities involve making or interpreting the law.

All branches of government must be certain that their work does not violate the constitutional framework. In that sense, all lawmaking activities must conform to the requirements of the constitution. No branch of government can change its own lawmaking responsibilities unless such changes are constitutional. A reallocation of power among the branches of government can only happen if the charter or constitution is amended or changed. However, many legal disputes are between the branches of government (Congress vs. the executive branch, for example), or between the federal and state or local governments (federalism issues).

There are constitutions at all levels of government, but in cases where a state constitution conflicts with the U.S. Constitution, the latter is always supreme.^[4]

Legislative Branch

The legislative branch of government has the authority to make, amend, and repeal laws of general application. This power is granted by a state or federal constitution or charter. Many legislatures meet once a year to consider new laws that should be enacted. Legislative bodies propose new or amending legislation, hold hearings before committees with jurisdiction over certain subjects, debate the merits of proposed laws, and vote to pass or reject those proposed laws. The constitutions in about one-half of the states provide for the people to make laws directly through the initiative and referendum processes. For an excellent book on this subject, see Williams,^[5] also published as issues 3 and 4 of volume 26 of *Legal Reference Services Quarterly*.

As part of the checks and balances in our form of government, the president of the United States or a state governor has to agree to these new laws or veto the passed legislation. Administrative agencies, part of the executive branch, are often granted lawmaking powers by statute, which is called “enabling legislation.” The laws passed by administrative agencies are called “rules” or “regulations.” In some cases, courts void agency regulations when they conclude that the agency acted outside the boundaries of its delegated authority. Furthermore, the judiciary can limit application of legislation and regulations if the scope exceeds the powers granted by the Constitution or charter that formed the government.

Judicial Branch

The judicial branch of government includes the court system, which adjudicates disputes. Judges are either appointed or elected to serve in trial and appellate courts at all levels of government. Their job is to enforce legal rules by hearing cases from parties who cannot agree on the solution to their own conflicts (civil cases), or who are being charged with criminal activity that represents a violation of a federal or state statute.

Each court has jurisdiction,^[6] or the “power, right, or authority” to take action over certain types of cases. Courts also have rules of procedure that must be followed. Normally there is a trial court level, usually an intermediate appellate court, and finally the highest appellate court (or court of last resort). An appellate court is a court having jurisdiction to hear appeals (a request to a higher court to overturn the legal ruling of a lower court) and to review the trial court procedure. Legal terms have been defined by the American Bar Association on their website.^[7]

Judges decide cases at all levels, but in most jurisdictions, only appellate court decisions are published and made available to the public. Cases can be appealed from the trial court to an appellate court to review issues of law; an appellate court must accept the facts as determined at trial. Thus, trial courts handle the vast majority of disputes; only a small proportion of cases are reviewed by a higher court.

Judges can interpret legislative enactments, can declare legislation in violation of the constitution unconstitutional, can decide issues of law based on common law (non-statutory) principles, and may review administrative decisions and rules. Judicial decisions can have wide precedential impact, as the rule of the case may be applied in later similar circumstances involving different parties.

Executive Branch

The executive branch of government is charged with implementing and enforcing the law, as well as operating of the government. Chief executives—the president or a governor—actually have limited power to create law through executive orders. Administrative agencies—the primary lawmaking entities of the executive branch—are created either by the executive (often through “Reorganization Plans”^[8] or by legislation to implement government policy).

The role of the executive branch of the federal government in lawmaking was quite limited until the 1930s when Congress, due to the Great Depression, created several new independent, regulatory agencies. Added to the more traditional executive agencies (i.e., the Department of State or the Treasury), the body of regulations that governs behavior of our citizens has grown tremendously in our complex society. Essentially, when Congress creates a law, say, to clean the air, some governmental agency is put in charge of making this happen. Every government with an executive branch (i.e., city, county, state, Indian tribe, or federal) has administrative agencies responsible for the implementation of its initiatives and priorities. The implementation of governmental policy will be through the issuance of rules (regulations), and often through interpretations of those rules.

Administrative agencies have broad powers, but when power is delegated by legislation, it is constrained by the

legislative branch. And because the agencies are part of the executive branch, the president may restrain the power of agencies. For example, there usually is much less regulation of business by the Federal Trade Commission during Republican than Democratic administrations. Furthermore, in cases of arbitrary and capricious action on the part of an agency, its regulations can be reviewed by the judicial branch. Again, we see the checks and balances of lawmaking as outlined by the U.S. Constitution at work.

International Law

Public international law governs relations among nations and as such regulates a wide range of transnational activities. Agreements between and among nations, normally called treaties, can govern a nation’s behavior in the international sphere. For example, the United States might sign a treaty about the treatment of prisoners taken during wartime (the Geneva Convention^[9]) or governing the use of space for various purposes (the Outer Space Treaty^[10]).

The executive has the power to sign treaties with the advice and consent of the Senate.^[11] Again, we see the checks and balances that disperse power throughout the branches of government.

Common Law

Our system of law in the United States is based on the common law system of England. Before the American Revolution, the customary laws of England formed the basis of the laws in the United States. These customs were the rules that governed behavior, ordinarily determined by a judge hearing a specific case before the court. Once the U.S. Constitution was written, it took many years for the young federal and state governments to enact their own laws. During that time, when conflicts or disputes arose, they were often settled by courts that applied common law doctrine. Today things are much more complex: the legislative, executive, and judicial branches of our federal, state, and local governments create the laws that govern our rights, obligations, and behavior.

An example of a common law rule is the no-longer-held view that when a woman married a man she gave up her individual legal status.^[12] Before judicial opinions and state legislation changed this common law doctrine in the early twentieth century, a married woman did not have individual legal standing and, for example, could not bring a lawsuit, hold property, nor sue her husband.

It is not unusual for a federal or state legislature to adopt judge-made law. At the same time, it is not uncommon for Congress or state legislatures to pass laws that have the effect of overturning judicial decisions, which is fine unless such legislation violates federal or state constitutional law.

CHARACTERISTICS OF THE LAW

Several characteristics of the law influence the use and interpretation of legal information and profoundly affect the tasks of the legal researcher. An understanding of these factors will help researchers understand the complex nature of the law, and learn to effectively use legal research tools.

Primary and Secondary Authority

All law and law-related information is classified in one of two ways. Either the information is the law or it is not. Primary materials contain the law, which is found in legislative enactments, judicial decisions, administrative rules, regulations and decisions, and in international treaties or agreements. Because these materials are “the law,” we say they must be followed and therefore represent primary authority. Researchers need to rely on the law when answering legal questions, so the researcher’s main task is to locate relevant primary authority.

Secondary authority discusses, evaluates, criticizes, or otherwise comments on the law. They analyze and synthesize legal doctrine, analyze policy, refer extensively to primary authorities, operate as finding aids to locate legal information, and are a great source for summaries, special terminology, and context of specific legal subjects.

This classification of legal information drives the research process. Secondary sources can help lead the researcher to appropriate and relevant primary materials when the primary materials themselves may be hard to search or are otherwise elusive. Understanding what types of legal materials can be relied upon to answer legal questions is essential to understanding the function of law in our society. Here, the interrelationships among the law created by different branches of government also come into play. The researcher must know, for example, which primary authority to rely on when the holding of a court decision in Connecticut appears to conflict with a Connecticut statute.

Precedent

Another characteristic of the law is that the doctrine of precedent applies to judicial opinions.^[13] *Stare decisis*, a Latin phrase, means let the decision stand. This doctrine of precedent requires a judge to apply the same reasoning in deciding a current case as that which was used in previous cases coming from higher courts in that jurisdiction involving the same facts and legal issues. Among the forms of primary materials, judicial opinions are issued from several levels of courts within the federal, state, city, county, and Indian tribal governmental structures. The theory underlying the doctrine of precedent is that society, through its legal rules, should treat people the same if they

are similarly situated. Thus, legal researchers look to past court decisions to find out how similar cases would be decided today.

Judicial opinions are either mandatory (binding) or persuasive authority. The rules established in judicial opinions *must* be followed by courts when they are mandatory authority. The rule of the case is mandatory in courts in that same jurisdiction at a higher level. So, for example, in a current case dealing with the standard of review in the licensing of a limousine driver, the Oregon Court of Appeals must follow the rules established in earlier cases dealing with this same subject decided by the Oregon Supreme Court. But an Idaho Supreme Court does not have to follow a rule made by the Oregon Supreme Court. That is, Oregon Supreme Court cases are not mandatory authority in Idaho courts.

As a general matter, appellate courts at the same level, in the same jurisdiction, will say they follow earlier decisions from their court involving the same facts and issues. Using the same example as earlier, the Oregon Court of Appeals is likely to follow earlier decisions from that court involving the same facts and issues. However, because it is the *same* court—rather than a higher court—it really is not compelled to do so.

The rule of the case is clearly the linchpin to the determination of the authority of the case—whether it is mandatory or merely persuasive. The rule of the case is the legal rationale or reasoning used by the judge in making a determination of who wins and who loses in the dispute before the court. Lawyers often disagree about the rule in the same case, throwing into controversy whether that case is mandatory, and whether the rule must be followed by the current court.

Persuasive authority is just that—rules established in court opinions that *may* be used by lawyers to persuade a court to adopt a certain ruling in a case. Cases outside the line of mandatory authority are merely persuasive. For example, an Idaho court will never *have* to follow the rule of a case from Oregon, but the Idaho court might like the Oregon rule and decide to apply it in Idaho.

This theory of precedent is important because a researcher needs to cite the strongest possible authority for any proposition. The weight of authority of a court decision—that is, is it mandatory or persuasive authority—is relevant to the search for case law and to an evaluation of those research results. The doctrine of precedent guides our research and requires that the huge body of judicial opinions decided since the establishment of our country must be available to the researcher. We do not discard old court decisions because a 200-year-old opinion might still reflect the rule of law in a particular area of law.

Stability and Change

There is great tension in the legal system between the need for stability of law so that outcomes are predictable, and

the need to change in order to reflect the world we live in today. The doctrine of precedent, discussed earlier, makes it clear that the legal system looks to earlier court decisions to help determine how a case should be decided today.

But what if the world changes and the old rules no longer work? As we discussed earlier in this entry, in nineteenth-century America under common law rules, when a woman married, her legal status as an individual was merged with her husband. She could not bring a lawsuit because she was not considered an individual under the law.^[12] Obviously, this rule is very out of balance with our current society. So, how did this rule change? The subject—the legal status of a married woman—is a matter of state law. The rule changed because legislatures (through new laws) and courts (through their opinions) reviewed the reasons for the rule, found that those reasons violated public policy, and created new rules that did not disable the legal rights of a woman who married.

The rules we live by in our society—the law—must be able to change. But if societal rules were in a constant state of flux, we would neither know how to act nor be able to predict the consequences of our behavior. A society without rules is anarchy.

This characteristic of the law—that it needs to be predictable, yet flexible—has important consequences for legal research. First, you must have access to the most current sources of law. Second, you must also have access to older sources of law. Third, you must understand that law exists within the context of current societal norms and values. Understanding research in economics, sociology, psychology, history, politics, medicine, technology, and natural science—in short, all disciplines—helps a legal researcher appreciate forces that might operate to change the laws.

Multiplicity of Sources

The final characteristic of the law that impacts legal research is the sheer number of sources. On the federal level, all three branches of government make laws. In addition, every state, Indian tribe, city, and county has lawmaking powers. And in most cases, states, Indian tribes, cities, and counties have a legislative branch, a court system, and an executive branch. All have lawmaking responsibilities and powers.

When a person wants to know what the law is on a certain subject, there is very rarely one source to look to for the answer. A researcher may have to research federal, state, and local law (at the city and county level we use the term “ordinances”) to advise a client on, say, a land use question that involves federal and state wetland legislation and interpretative court decisions, and city/county ordinances. Furthermore, we are not likely to know whether a legislative act, a court decision, or an administrative rule will be dispositive. This means that a legal research

project must be planned carefully, and that the researcher must understand how all the sources of law fit together.

TYPES OF LEGAL MATERIALS

In order to understand the literature of the law, knowledge of the types of legal materials created is essential. Each type plays a role in solving legal problems. Many legal materials are available in print and electronic formats. Because many electronic legal materials are based on the original print sources, understanding the patterns of print publication of the different types of materials can aid in the use of these documents in electronic form.

All legal information can be divided into two types—primary and secondary sources. Primary sources contain the law—the rules we live by. Secondary sources are *about* the law. What follows is necessarily an abbreviated overview of legal materials. Legal research textbooks are a rich source for further investigation.^[14–24]

Primary Sources

The law is contained in several different types of primary source material. Constitutions and charters, statutes, judicial opinions, administrative rules and decisions, and treaties are sources of the law. Each of these types of law derives their force from the powers delegated through the document that forms the government, such as the U.S. Constitution, a state constitution, or a city charter.

Constitutions and charters

As mentioned earlier, a constitution or charter creates the form of government and allocates power among the various branches of government. The checks and balances established in the federal constitution create complex interrelationships among the executive, judicial, and legislative branches of government. These relationships are important to remember when trying to solve legal research problems, since they affect the relative weight of the authority.

Statutes or codes

Once laws are passed, they are numbered sequentially by legislative session and made available as “slip laws.” A slip law is, simply, a single legislative act. These laws are chronologically published, and eventually organized by date in a compilation called “session laws.”

Because these session laws are not arranged by subject, they are time-consuming and awkward to use when a researcher wants to know the current law in a particular subject area. In order to make it easier to find the current law on any particular subject, the session laws are codified by the jurisdiction (i.e., federal, state, or local), which means they are arranged by subject. These “codes” or

“statutes,” as they are commonly called, are normally created by the government. They have excellent indexes and tables of contents to facilitate finding relevant laws. Most of these codes are published in both print and electronic formats by the government, but almost always also are published unofficially by commercial publishers. Whether published by the government or commercial publishers, the text of the code or statutes is identical, and both are considered reliable sources of the legislation.

Because the role of judicial opinions is often crucial to understanding how legislative enactments should be interpreted, commercial publishers created annotated codes. An annotated code includes the code itself, plus “annotations” that reference the history of the law, secondary materials that refer to the law, and cases that interpret the law. These annotated codes save the researcher a lot of time, since legislation, court opinions, and secondary sources on a particular subject are all gathered together in one resource.

Codes and annotated codes are updated by the session laws in order to be current. These updates occur at least once a year, but there is a trend to integrate the language of the session laws into the codes or statutes several times a year. Both Westlaw and LexisNexis update their digital versions within weeks after the passage of a new federal or state act.

The checks and balances incorporated into our form of government are evident as we look at the interrelationships between legislation, the constitution, the judiciary, and the executive. Legislation can be enacted on nearly any subject as long as it is within the grant of power by the Constitution. Legislation can change judicial interpretations of statutes or change a common law rule relied upon by a judge. Legislation can create or eliminate administrative agencies, as well as grant or eliminate power to implement the purposes of the legislation. At the same time, legislative enactments also are subject to the checks and balances of the Constitution so that no one branch of government would have all lawmaking power. In the famous decision *Marbury v. Madison*, 1 Cranch 137 (1803), the Supreme Court made it clear that the Court was the final arbiter as to whether a statute was constitutional.

Citation to codes or statutes is the shorthand reference lawyers use to refer to specific sections of a law. Citations to statutes or codes will ordinarily look like this: 28 U.S.C. § 1291 (2006). In this example, 28 is the title number of the law, U.S.C. is the abbreviation of the source of the law (*United States Code*), § 1291 refers to the section of the code containing your specific language, and 2006 refers to the year the USC was published. See the standard manual for citing legal materials for further explanation (*The Bluebook*, rules 12 and 13^[25]).

Judicial opinions

Court opinions are issued directly by a judge or panel of judges through an official court website. The first appearance

of a court opinion is called a slip opinion. Eventually, the opinions from that court are gathered together and published in a court report, or reporter. At this point, the slip opinion will be given a permanent citation. On the state level, as a general matter only decisions from appellate courts are published. And of those, fewer than half of the states publish their appellate court opinions in print under government auspices. The rest have contracted out this distribution of court opinions (unofficial reports) to a commercial vendor.

Court opinions are organized by jurisdiction, so, for example, all the decisions of the Washington State Supreme Court will be found in the official government publication called Washington Reports. One commercial publisher—West Publishing Co.—gathers appellate court opinions from several different states into what they call regional reporters. For example, the opinions of the Washington State Supreme Court can also be found in the Pacific Reporter, a series that includes cases from Washington and 13 other western states.

Most series of court reports number hundreds or thousands of volumes. Subject access to court opinions is through full text word searching in databases containing court opinions (free from government websites, and for a fee from publishers such as Westlaw, LexisNexis, and Bloomberg Law). The West key number digest system (available in print and on Westlaw) provides a comprehensive subject index to all state and federal cases. In addition, virtually all secondary tools analyze and cite freely to judicial opinions.

Citation of court opinions follows this form: *Princeton University Press v. Michigan Document Services, Inc.*, 99 F.3d 1381 (6th Cir. 1996). The names of the parties come first in the citation, followed by the volume number of the reporter where the opinion can be found (99), the abbreviation of the reporter containing the opinion (F.3d for *Federal Reporter* 3rd series), and the first page of the opinion (1381). The parenthetical contains the abbreviation for the court that decided the case and the year the opinion was decided. In the aforementioned citation, this case was decided in 1996 by the United States Court of Appeals for the Sixth Circuit. More details and other examples can be found in the standard work on legal citation rules, *A Uniform System of Citation*, commonly known as *The Bluebook*, rule 10.^[25]

Administrative decisions, rules, and regulations

An executive or administrative agency has two types of lawmaking power. One has characteristics of legislation, and the other has attributes of the way courts work. Writing rules and regulations to implement the mandate of the legislation to create clean air is one kind of lawmaking done by administrative agencies. The rule-making process is governed by the Administrative Procedure Act (5 U.S.C. §§500 et. seq. 2012), legislation that requires, among other

things, an opportunity for public notice and comment before rules and regulations can be finalized.

In addition, some administrative agencies have what is called quasi-judicial power. That is, agencies can interpret their own rules and regulations in a specific conflict between the agency and a citizen or organization. The resulting determination in this specific conflict is called an administrative decision or opinion. It is enforceable, and in certain cases the opinion can be reviewed by a court of law in the judicial branch of government.

Citation to agency regulations and agency decisions can be found in *The Bluebook*, rule 14.^[25]

International law

To solve legal problems with international issues requires consultation of treaties and other international agreements, as well as the relevant customary law. Decisions of international tribunals will also be relevant to many questions with international ramifications.

International legal research is unique and requires knowledge of many different sources of law than are used to research American legal issues. A good, current research guide will help the novice locate and use the needed materials.^[26] A new book on this topic by Winer, Archer, and Louis-Jacques would also be a great place to start.^[27]

Citation to international resources can be found by consulting *The Bluebook*, rule 21.^[25]

Secondary Sources

Information resources that discuss, evaluate, or otherwise comment on the law are called secondary sources. In some cases, secondary sources such as treatises and law review articles are cited by attorneys to support their arguments, and by judges in their opinions. Secondary sources are particularly important to the process of research as they can help shape the sources consulted by the researcher and help make the research more efficient by citing relevant primary authority. The many types of secondary sources play different roles in the research process. The following section describes the major types of secondary sources and explains where they are most useful. Someone who is researching a topic he or she is unfamiliar with should begin with secondary sources.

Books

There are several types of books published for legal researchers. Many are still available only in print, but more and more are available in digital format from legal publishers like Thomson-Reuters, LexisNexis, and Bloomberg Law, or nonlegal publishers like Oxford University Press and Cambridge University Press. Few recently published books are available at low cost or free through the Internet. At this point, some historical legal works are being

digitized by the Google Book Project. Gale's "Making of Modern Law" and HeinOnline's "Legal Classics" databases include many important eighteenth and nineteenth century legal works.

Citation to books and non-periodical literature is governed by *The Bluebook*, rule 15.^[25]

Scholarly treatises. The scholarly treatise is one of the most useful types of law books. These works are often written by legal academics, and reflect years of research and expertise in an area of law. There are one volume and multivolume treatises. Most are updated at least once a year, but some titles may be updated several times per year. The object of these works is comprehensive analysis and synthesis of legal doctrine in the subject matter of the book. They cite heavily to primary legal materials and other relevant secondary materials. For the novice legal researcher, they can be overwhelming since they cover their topic in great depth. Examples of scholarly treatises are the multivolume work, *Environmental Law* by Professor William H. Rodgers and *Cohen's Handbook of Federal Indian Law*, a comprehensive one-volume work. Both were originally published several years ago and are supplemented on an annual basis.

Monographs. Single-volume legal works on a narrow topic are called monographs. They can have a historical or current focus. They are authored by law professors and often rely heavily on footnotes and citation to legal primary and secondary sources. Most of these works are not updated at all. *Most Humble Servants: The Advisory Role of Early Judges* written by Professor Stewart Jay is an example of a legal monograph.

Practice materials. As the generic name suggests, these books are primarily written by and for lawyers. They tend to be very practical, rather than scholarly treatments of the subject. The best ones are updated at least annually, and may include sample forms and checklists. They also cite heavily to primary materials and other useful sources. A two-volume work written for Washington State practitioners, *Creditors' Remedies—Debtors' Relief*, authored by Professor Marjorie D. Rombauer, is an excellent example of the type of a secondary source written especially for lawyers.

Student texts. There is a whole genre of books published to help law students succeed in law school. These works cover the spectrum from glorified outlines to substantive one-volume works covering a specific law school course, like contracts or property. The latter, called Hornbooks, regularly cite to primary and other secondary legal materials as they summarize and synthesize the law. *McCormick's Evidence*, 7th edition, was published in 2014 and would be a great resource not only for students but also for the researcher who has no background in the

law of evidence. These works are usually updated with the publication of a new edition every few years. However, some have annual supplementation.

Books for the layperson. As is true in any specialized field, a wealth of publications can be found designed to fill the layperson's information needs. Do-it-yourself books in law abound as well. *How to Do Your Own Divorce*, *The Renter's Legal Guide*, and *Write Your Own Will* are examples of the types of books published to help the non-law-trained person with legal problems. Nolo Press specializes in law books for the layperson.^[28] Many people act on their own behalf or become pro se litigants because meaningful access to the legal system is not available. Books about the law that explain legal rights in a clear way can be very useful to those who want a basic understanding of the law.

Legal periodicals

There is an abundance of legal periodical literature in law of four distinct types. Periodical literature has been added to Westlaw and LexisNexis since the early 1980s, but the vast majority of academic law review articles have been digitized and are available on HeinOnline, a subscription database. Since the digitization process scanned articles using the pdf format, the materials in the HeinOnline databases look exactly like the print volumes with the added enhancement of full text searchability.

Access to this vast body of literature is through full text searching of the digital files as well as use of legal indexes such as H.W. Wilson's *Index to Legal Periodicals*, EBSCOHost's *Legal Source*, and Gale/Cengage Learning's *LegalTrac*. These indexes may be available on Westlaw and/or LexisNexis, as well as directly from the publishers.

Citation to periodical literature in law can be found in *The Bluebook*, rule 16.^[25]

Academic law reviews. Law is the only discipline in which articles written by law professors, attorneys, and other scholars or practitioners are selected, edited and published in student-run journals called law reviews. Every American law school has a general law review, and most have several specialized law reviews. For example, the University of Washington School of Law has a general law review called the *Washington Law Review* which publishes articles on all legal topics, and several specialized journals: the *Washington International Law Journal*, the *Washington Journal of Environmental Law & Policy*, and the *Washington Journal of Law, Technology & Arts*. Law schools subsidize their law reviews, so subscription rates are very low, at least compared to the journals published commercially for profit.

Published one to eight times per year, articles and student comments published in law reviews analyze and

synthesize the law. These works are heavily footnoted with references to all types of legal information and can be very helpful in the early stages of a legal research problem. Most articles are in the 30–60 page range.

Today, some journals are published only in digital form and are available through institutional, open access, digital repositories. More and more law schools are making all of their journals available on the school's website, and one can expect this will be the rule, rather than the exception, in the not too distant future.

Bench and bar journals. Periodicals published by judges' and lawyers' associations are generically called bench and bar journals. They may be published as frequently as monthly, or only annually. Virtually all the content is written by legal practitioners and judges. *The Colorado Lawyer* is an example of a state bar association's publication. The articles tend to be short and practical. They cite to relevant primary and secondary legal materials, but not comprehensively.

Membership in the bar association or judge's organization is usually required in order to receive copies of these journals. Many current issues are available in electronic form on the organization's website. Some titles are available through Westlaw, LexisNexis, and HeinOnline.

Commercial journals and newsletters. By far the most common delivery of scholarship in most other disciplines, commercial journals are far more rare in the legal literature. There are some; but they tend to be directed toward the legal practitioner. The articles are not very long, but most include reference to primary legal authority. The journals (called commercial journals because they are published by for-profit publishers) usually cover very specialized subjects of law. They are expensive, often costing several hundred dollars for an annual subscription. *The Intellectual Property and Technology Law Journal* published by Aspen (Wolters Kluwer) is an example of a commercially published journal.

Legal newsletters are very common in law and are often published to notify legal practitioners about current cases, legislation, and administrative actions that impact a specific legal subject. Most of these are commercially published, although a few are written and distributed by non-profit legal organizations. Most newsletters are available online. Good examples of newsletters are those issued by Bloomberg BNA (formerly the Bureau of National Affairs, or BNA). A comprehensive list of all legal newsletters can be found in the annual *Legal Newsletters in Print*.

Legal newspapers. Of course, information about the law can be found in nearly any type of newspaper. However, legal newspapers that specialize in legal content regularly make specific reference to legal authority, including citations, so the references can be found by the researcher. There are two national legal newspapers, and several

city/regional legal newspapers written for members of the legal profession. The *National Law Journal* and the *American Lawyer* cover legal issues nationwide, while the *Los Angeles Daily Journal* focuses on local and regional legal news. They cover very recent legal developments, analyzing various sources of law, policy, and other related disciplines. Most are published weekly or monthly. They are available through subscription in print, microform, and electronically.

Looseleaf services

As the law became more complex, practitioners needed access to all sources of law on a particular subject. Since most primary legal materials are published by jurisdiction and not by subject, a lawyer who practiced labor law needed to have access to federal and state legislation on labor law, federal and state cases on labor law, and all administrative activities related to labor law at the state and federal level—virtually thousands of volumes of law books.

In the 1940s, legal publishers created looseleaf services that included primary legal materials on one subject. An example is Bloomberg BNA's *Labor Relations Reporter*. This reporter includes all primary legal materials about labor law—statutes, court decision, administrative materials—along with checklists and analysis. Multivolume and updated on a weekly basis (and now available electronically by subscription), looseleaf services are some of the most sophisticated legal research tools published. Today, these “looseleaf services” are published online, and most users get the contents in digital, rather than print, format.

A comprehensive list of looseleaf services in law can be found in *Legal Looseleafs in Print*, published in a new revised edition annually.

Legal encyclopedias

Legal encyclopedias summarize and synthesize the law from judicial opinions and some federal statutes. The encyclopedias are organized by legal subject from A to Z and include analysis and citation to primary and secondary sources. There are two national encyclopedias, *American Jurisprudence 2d* (Am. Jur. 2d) and *Corpus Juris Secundum* (C.J.S.). These are a great source for an overview of a body of law, and they include references that cite cases, statutes, and other authority.

Commercial publishers have also created legal encyclopedias for some states. These can be very useful when dealing with issues of state law.

Legal encyclopedias are updated annually. In addition to print, they can be found in LexisNexis or Westlaw.

ALR

American Law Reports (ALR) include selected court/judicial opinions with an accompanying annotation or

essay summarizing the case law in all state and federal jurisdictions. The analysis is comprehensive as to the very narrow point of law which is the topic of the annotation. Updated annually in print, this set is also available electronically through a subscription to Westlaw.

Restatements

The American Law Institute (ALI) meets regularly to offer, in the form of the Restatements, general principles—and sometimes *recommended* principles—of law that are primarily driven by judicial decisions. The Restatements themselves are secondary authority, that is, they do not come from any governmental unit. However, when a state court adopts a particular Restatement, that principle becomes part of the primary authority—the law—within that jurisdiction. If many states adopt the language of a Restatement—sometimes with modifications, we should add—the Restatements help understand the general rule among the states. The Restatements are updated once a year in print and are also available by subscription on Westlaw and LexisNexis.

Citators

One of the most interesting research tools created in law is a method that permits a researcher to find out whether the rule of a specific judicial opinion (case) is still good law. Since a court ruling can be appealed to a higher appellate court, over time the rule of the case can be eroded or solidified by later court decisions. The first citator was created by Frank Shepard in 1873. Eventually, his work allowed the lawyer to check the authority of every published case from all jurisdictions in his Shepard's Citations series. Frank Shepard's surname became a verb, as all lawyers were taught to “Shepardize” all cases before relying on them.

Shepard's Citations are published by LexisNexis. Although still available in print, today Shepard's is typically accessed as part of a subscription to LexisNexis. Not only is Shepard's online easier to use than the print, but it is also much more current. To compete with Shepard's, Westlaw created KeyCite in 1997. KeyCite is an electronic-only citator and available only on Westlaw by subscription.

KeyCite and Shepard's Citations both operate also as integrated research finding tools. Once a legal citation to one relevant case or statute is known, these sophisticated electronic systems can lead the experienced legal researcher to many other relevant cases, statutes, regulations as well as many types of secondary authorities.

Case digests

The publication of court opinions chronologically by jurisdiction inspired the creation of another important secondary

source in the late 1800s—the West Digest System (sometimes called the “Key Number”) system. Subject access to court cases is facilitated by this gigantic outline of case law. Legal editors at West Publishing Company (now a Thomson Reuters affiliate) read each court decision and write a short summary of the various points of law made in the court’s opinion. Each summary is called a headnote, and each headnote in every case is assigned to a topic and key number in the West outline of the law. The headnotes, organized by a subject of law and then keyed to a specific point of the outline of that body of law, were then compiled in digests. It is easiest to think of the West key number digest system as a subject index to court opinions. The digests are organized by jurisdiction (individual states, regional groups of states, and by levels of federal courts).

Now, available electronically by Westlaw subscription and in print, the digest system provides controlled vocabulary subject access to all federal and state court decisions.

LEGAL PUBLISHING

Since branches of governments make the laws through legislation, judicial opinions, and administrative rules and decisions, you might expect that the government would disseminate and publish them. But you would be wrong. Some governmental units published their court opinions and legislation, but until recently, many others did not. And even when governments published their law, the materials were often published with a long lag time. Of all the types of legal information sources, administrative regulations are the only type that has typically been published by the government at the federal level, and sometimes by many states, without resort to a commercial publisher.

The role that commercial (for-profit) publishers have played in the distribution of the law and the creation of legal research finding tools has been critical to the success of the legal system and the legal profession. For example, at the federal level only the decisions of one court—the U.S. Supreme Court—historically were published by the government. Until the digital revolution of the late twentieth century, all other federal court decisions were published only by commercial publishers.

Commercial publishers add value to the basic legal information they produce by including case summaries, annotations, indexes, and other finding aids. They also create new tools that assist the researcher in connecting different types of legal information on the same subject. Legal literature is rich in tools that synthesize and analyze legal information and reference other relevant materials.

In the United States, historically there were over three dozen publishers who produced a wide variety of legal research materials for law of all kinds. The consolidation of the legal publishing market in the mid-1990s that resulted in three international corporations controlling the

publication of virtually all American legal materials, both primary and secondary, changed the face of American legal publishing forever. For the most comprehensive history of the legal publishing industry in the United States, see Svengalis.^[29] As of 2014, Thomson Reuters (Canadian), Reed-Elsevier (British-Dutch), and Wolters Kluwer (Dutch) accounted for the vast majority of the worldwide sales of legal information. In 2010, Bloomberg L.P., a New York mass media corporation, acquired the Bureau of National Affairs, the next to the last major, independent American publisher.

Issues in legal publishing today center around the consolidation of the market and the transition from print research tools to electronic databases. Inflation rates in legal literature have been three to four times the regular rate of inflation for the past 25 years. Stagnant budgets in law libraries of all kinds, combined with the availability of new research tools, have added to the stress all law libraries are under in this early part of the twenty-first century. Publishers’ experimentation with economic models that create the profit needed for the vendor, but at prices law libraries can afford, has been the predominant feature of the past decade.

Vendors who had an historical print business in legal publishing have faced this century with different issues than those whose primary products were electronic only. Digitization of the law by the governments that make the law—and making the law free on the Internet—have led to a proliferation in the number of companies creating new information products for the legal marketplace.

At this point, legal publishing is widely dispersed, but the tools most commonly relied on by the legal profession are still published by the historically large commercial vendors—most notably LexisNexis and Westlaw—whose electronic databases and print publications have proven to be reliable, current, and authentic.

Will only the best of the legal research tools come to the surface after some years of experimentation? Or will legal researchers of the future continue to have an unlimited number of research tools from which to choose?

FORMATS OF LEGAL INFORMATION

Primary legal materials—court opinions, statutes, and administrative rules and decisions—have been available in the United States for over 100 years in print. Published both by government and commercial groups, a sophisticated group of legal research tools emerged to aid the lawyer in researching a legal problem for a client. When laws enacted by legislatures were organized solely by the date they were passed into law, governments and commercial publishers created codes—current legislation organized by topic, rather than by date. When court opinions were published in sets by jurisdiction (Washington State, federal, U.S. Supreme Court, for example) and then by

date, enterprising publishers created massive subject indexes to all published court reports. When there were so many cases published on a particular area of law that it was hard to understand what rule to apply, practitioners and law professors wrote articles and books synthesizing and analyzing the doctrines. Finding aids such as legal encyclopedias, periodical indexes, scholarly treatises, Shepard's Citations, and the West Digest system were created to help lawyers locate relevant authority quickly.

Methods were needed to keep these print materials up to date. The pocket part supplement was created to update the work in the main volume. It slipped inside the back cover to remind users to update the main work. If the supplemental materials were so large that the pocket part would not fit in the back of the book without breaking the book spine, a free-standing paperback pamphlet supplement was used. Later books were published in binders that allowed old, outdated material to be removed and new material to be added. Looseleaf services, comprehensive as to one subject, were published and updated on a weekly or monthly basis with new material filed and older material discarded.

However, digital information and the Internet have changed the world of legal research completely. Mead Data Central introduced the first database of legal information in 1973 called LEXIS.^[30] For the first time, state court opinions were full-text searchable. No longer were lawyers limited to the indexes and tables of contents created by book editors to locate relevant information. Now a researcher could locate opinions written by a particular judge or find all cases on a specific topic. Revolutionary!

Within a few years, the major print publisher of American legal materials, West Publishing Company, introduced Westlaw to the legal profession. In the 1980s and 1990s, Westlaw and LexisNexis (as it is now called) worked to add content and sophisticated search features to their aggregated databases. The vendors urged buy-in from law firms by providing programs which allowed law firms to charge their clients specifically for computer-assisted legal research (CALR). And these vendors provided a significant discount to law schools who subscribed to their services for their students and faculty. Significant discounts were also negotiated with courts that contracted with Westlaw and LexisNexis.

A huge change occurred in the mid-1990s when governments started to publish their documents and other content on the Internet in digital form, free to all users.

By early in the twenty-first century, flat rate contracts for commercially published legal electronic content were standard in academic, law firm, court, and county law libraries. And most of this content was bundled at discounted prices, often taking into account the print subscriptions to the same material. E-book contracts to license the content of legal monographs were available from some publishers.

Today, most governments publish and distribute the law from courts, legislature, and executive agencies in digital

form on the Internet—at all levels of government. Their collections of legal information are rarely historically comprehensive. Furthermore, the navigational tools and access to this information vary tremendously from one website to another. While these free government websites are often excellent for access to current legislation, and court opinions, and administrative agency regulations and decisions, they lack the sophistication (and of course cost) of the commercially available research databases such as Westlaw, LexisNexis, and the recent competitor, Bloomberg Law.

Not all print tools have transitioned comfortably into the electronic environment. Many legal materials are still not in electronic form^[31] and even if they are, they often lack the functionality of the print materials. In particular, a legal research tool (i.e., treatise, monograph, code, or statute) with a hierarchical arrangement that relies on the context of the previous or following material can be very hard to read and understand when only in electronic form.^[32]

It is small wonder that law libraries that have a lot of print have been pressured on the budget side when trying to provide legal information in both print and electronic formats. With regards to primary authority from the legislative, judicial, and executive branches, today most law libraries receive this in digital format. Treatises, on the other hand, are still primarily acquired in print. With law reviews now accessible on HeinOnline and an increasingly number of law schools making their journals available for free (with articles in .pdf), more and more law libraries are canceling their print subscriptions to law school journals.

Two other important issues stand out in this time of transition to electronic materials. The first is how to handle the preservation of legal information that is born digital—and never has a tangible, print equivalent. After nearly 20 years of born-digital information being published and disseminated on the Internet, the amount of this information that is no longer available at all is staggering. The problem is that no one knows how much legal information is really gone forever. Many organizations have identified this as an important problem, but only piecemeal solutions have been offered to date. The American Library Association's Government Documents Roundtable^[33] and the Government Documents Special Interest Section of the American Association of Law Libraries^[34] both have strong interests in fugitive and born-digital government publications. And many academic law libraries are creating permanent digital repositories of important materials, primarily their law reviews and articles published by their faculty.

The Legal Information Preservation Alliance (LIPA) is working on several projects to preserve print and born digital legal information.^[35] Another consortium of law libraries and other legal agencies—perma.cc—is acting to preserve the content of links to the open web which are cited in legal documents.^[36]

The second problem relates to the authentication of legal information. Although most legal information is now published on the web by the issuing government agency, most official websites disclaim the legal authority of what they include on the website. Sometimes, the user is referred to a print product. In many cases, there is no print equivalent. The American Association of Law Libraries (AALL) took the lead in the concern about this topic and published a ground-breaking paper, *State-by-State Report on Authentication of Online Legal Resources*, in 2007.^[37]

As a result of this advocacy, the National Conference of Commissioners on Uniform State Laws appointed a drafting committee and approved for enactment in all states a new uniform law called the Uniform Electronic Legal Material Act (UELMA). UELMA was approved by the Conference in 2011, and to date 12 states have enacted its provisions. This law has three purposes: 1) to guarantee the authenticity of legal documents produced by our governments, 2) to preserve this same legal material in perpetuity, and 3) to provide for permanent public access to these legal materials.^[38]

USERS

Our society was founded on the principle that the rules we live by—the law—must be accessible in a real way to everyone. Branches of governments create the laws, but until recently have not consistently made these laws available. The very best legal research tools for locating primary and secondary legal authority historically were available through commercial publications and databases, and often at high cost. This is one of the reasons that law libraries—especially those open to the public—are important.

Many people are interested in the law. Lawyers, judges, paralegals, and law librarians use legal information to answer questions for clients and library users every day. Law students learn how to search for legal information and how to apply the rules they find to specific problems. Students of all kinds—K-12 to graduate students—have questions about the law that are raised in their classes or through what they learn from their friends, parents, news, TV shows, or the Internet. Members of the public care about how the law applies to their daily lives, and some attempt to represent themselves in family law, landlord-tenant, or other disputes.

Ideally, primary sources of law—court opinions, statutes, administrative agency regulations and decisions, and treaties—would be widely available, in both print and digital format. However, a person's interaction with just the primary material is likely to be quite unsatisfactory because of the complexity of our legal system and the different levels of governments involved in the most simple questions. Reading a single statute and several cases interpreting that statute will rarely answer a legal question.

And the publications that contain the law itself do not necessarily refer to all of the types of legal materials that might be relevant to a specific inquiry.

These factors make the process of legal research complex, even for sophisticated lawyers or judges. Thus, each group of people who use legal literature will interact with legal resources in different ways, potentially using very different research tools in the process.

Lawyers

Members of the legal profession arguably are the most intense users of legal information. Most legal research tools have been designed to be used by lawyers who need very current and comprehensive information. A lawyer needs to be able to locate and understand applicable sources of law to address clients' issues, and be aware of the research tools he or she can use to answer those issues.

Do all lawyers regularly do legal research? No. Law firms are no different than other organizations. There are different responsibilities for different levels in the hierarchy. Size of the law firm also matters. A lawyer in a solo or small firm is more likely to do legal research throughout her career than a more senior lawyer in a large multinational law firm. Newly hired lawyers, usually called associates, handle more of the research done in large law firms. The more senior the lawyer in a large firm, the more likely they are to be finding and keeping clients and advising clients based on the research done by more junior lawyers. A senior lawyer is also much more knowledgeable about what the law is in narrow, specialized areas of legal practice. While the more experienced lawyer must keep that knowledge current since the law is always in flux, their expertise means they do not resort to the use of legal research tools very often.

In a similar vein, law clerks hired to work for judges for 1- to 2-year terms perform most of the research to support the work of the judge. Over time, judges develop a wide expertise in the matters that come before the court. And lawyers who are advocates before a judge provide written briefs and other filings that contain the research on which their legal position is based.

Law school faculty are lawyers. Part of their job is to write and publish scholarship in areas of their expertise. Many do their own legal research. And many use law librarians and/or hire research assistants who are current law students.

In law practice, legal research is also performed regularly by law librarians and paralegals. These professionals often do research which is outside the expertise of a practicing lawyer. Perhaps information is needed for statistical or economic data or other nonlegal topics. Or a highly specialized database or resource that is not familiar to the lawyer may be consulted.

Law librarians in court, county, academic, and firm law libraries (many of whom have law degrees) work directly

with lawyers to acquire and manage the legal resources needed to perform research, and to plan and arrange training on research tools for lawyers. The national professional association for law librarians, the American Association of Law Libraries, has an excellent website that includes information on education and careers in law librarianship.^[39] For an example of a special program to train lawyers who want to be law librarians, see the University of Washington Information School's website.^[40]

Successful legal research by lawyers and other professionals requires a research plan or design that takes into account the financial resources of both the client and the firm. Unless the area of law is very familiar to the researcher, secondary sources are very likely to be used early on in the research process. Research in books, periodicals, and/or encyclopedias will give an overview of the topic, help identify and clarify the issues, identify terminology that will help locate other relevant materials, and analyze and synthesize different sources of law over time on the topic.

The smart and efficient legal researcher will then select from a wide array of print and electronic research tools to begin the search for the primary materials that respond to the legal question. Many times, cases, statutes, and other relevant primary legal materials are identified initially from secondary sources. Armed with a more thorough understanding of the area of law and citations to specific primary materials can shorten the research project significantly.

The lawyer with expertise is more likely to consult comprehensive, current publications like online databases, looseleaf services, or government Web pages to be sure her knowledge is still current.

Every research project is different. If we knew the answer to the question, legal research would not be necessary! A few studies have been published that survey how lawyers actually do legal research. You will find a list with an abstract of each study in the appendix to this entry.

Overall, lawyers and other members of the legal profession use the widest possible array of legal information tools—from the large subscription databases (Bloomberg Law, LexisNexis, and Westlaw) to print treatises to the free and low-cost information found on the Internet. In recent years, in order to reduce the cost of research and even the playing field as between solo practitioners and large law firms, many state bar associations license a comprehensive legal database for all of their members. For example, the Casemaker database has been licensed for use by all members of the Washington State Bar Association, while Fastcase is the research database available to members of the Oregon State Bar.

Tools that permit lawyers to locate the most current statute on a particular subject, to easily determine if relevant judicial opinions are still good law, to have all important and current information on a particular subject, and to know the relevant law they have found is authentic and

official are essential if lawyers are to carry out their ethical obligations to their clients.

Law Students

The legal literature created specifically for law students is that which is centered around the courses offered in most law schools. Outlines, Nutshells, and Hornbooks are published specifically to help law students learn the material for their classes. These works range from simple outlines to one-volume works like those in the West Hornbook series. These materials can also be useful for lawyers researching in an area of law with which they are unfamiliar, and, to a lesser extent, for members of the public who are trying to understand a body of law.

Law students for the most part read the law as it is published in casebooks for each of their courses. Many legal subjects taught in law school are based primarily on judicial opinions. Some courses, such as tax and commercial law, rely more heavily on statutes. So the first exposure law students have to the law is not to read relevant cases and statutes directly from the primary legal materials (i.e., court reporters and codes) themselves.

This practice of excerpting primary material and repackaging for law students is one of the main reasons why courses in legal research are taught in all law schools. Otherwise, students would not be exposed to the array of research tools they will need when they begin practicing. Student use of the legal research tools created for lawyers is pretty minimal unless the student takes a seminar course in which he or she must write a paper, writes an article as part of their membership on the law review, fulfills an analytical writing project required by many law schools, or works in a clinic or law firm while in law school. Even for students who must research and write a significant paper, limited exposure to the vast array of legal information resources available is the norm. Legal research courses offered in the first year, and advanced research courses during the second or third year of legal education, introduce students to many more of the available practitioner tools.

Access to LexisNexis, Westlaw, and Bloomberg Law for all students and other members of the law school community is negotiated in a flat-rate contract with the vendors and paid from the law library budget. The educational discount is significantly lower than commercial rates. The vendors provide professional staff from their offices and hire law student representatives to train and work with students, faculty, and librarians at each law school.

Several smaller legal databases such as Loislaw, VersusLaw, Fastcase, and Casemaker may also have educational contracts to which many academic law libraries subscribe.

There are several challenges in providing law students with the legal literature they need to succeed as a law student and then as a practicing attorney. Research tools

are changing all the time, and proficiency using one tool today does not mean proficiency forever. Right now a bewildering array of legal research tools are available, making the choice of any specific tool more complex. Does the free government court website have the coverage I need, or do I need to use a large and comprehensive commercial database? Do I need to use sources other than LexisNexis or Westlaw? How can I evaluate the information found on the Internet?

The Google generation thinks it knows how to use electronic databases. But their LexisNexis, Westlaw, or Bloomberg Law searches must yield comprehensive yet precise results, and most law students find their generic Internet search skills are not adequate to the task. All of these challenges have as their backdrop the need for law students to understand the sources of law and the role that secondary legal literature plays in their research projects, as well as the need to critically evaluate what they find.

Public

Continuous and permanent access to legal information is at the heart of a democratic society. The Internet has made widespread distribution of the law a reality for anyone with an Internet connection. But lawyers and law librarians know that just adding judicial opinions or new statutes and administration regulations to the Internet does not create equal access to justice.

Members of the public who need to write papers or do presentations for class or other organizations have benefited tremendously from the large amount of legal material on the Internet. Together with libraries that provide access to books and journals on many law and law-related subjects, many people who wish to understand an area of law can do so. However, the lay person who decides to do their own legal research for their own legal problem can face many obstacles. The person who represents herself is called a pro se litigant.

While the wide array of primary legal information distributed for free through government websites is to be applauded, access to the *words* of the law is not enough for people who do not understand the sources of law, the types of materials published, and how the characteristics of law impact anyone trying to find an answer to a legal problem. A judicial opinion available on the Internet may have been overruled (i.e., changed) by a higher court. But the low-cost or free source on the Internet usually will not note this change. And if a person reads this case and thinks the rule of the case governs their problem because they do not know about the overruling decision, easy access to this judicial opinion is misleading, to say the least.

Many organizations are very concerned about the issue of the self-represented or pro se litigant and about the growing number of people who simply cannot afford the legal services they need. State bar associations, law libraries, publishers, and legal aid groups are widely involved in

the Access to Justice movement. To address these concerns, many organizations have created in-depth resources to help the pro se litigant navigate through the legal system and perform the legal research necessary to answer for his or her problem. But such a person must work hard to locate and understand how to use relevant materials.

Websites and print resources abound that can assist the self-represented litigant. One of the best general sites is the Nolo Press website which includes definitions of legal terms, summaries of types of legal problems, forms, and books on common legal issues.^[41] The Maryland State Law Library maintains a really excellent website for pro se litigants in Maryland that should serve as a model for other states.^[42] The National Center for State Courts has a resource guide for self-represented litigants that links to various projects in all 50 states.^[43]

The best advice to a member of the public who is interested in doing legal research is to direct them to secondary sources that explain the legal system, the interplay of the various sources of law, and the publications containing legal information. Critical evaluation of Internet sites that include legal materials is a very important skill to master.

Law libraries open to the public can be found in many counties and many law schools. Legal research texts, various websites, and even this entry can give members of the public the overview and background they need to successfully research a legal issue. A good example of a basic research guide was written by the Legal Information Services to the Public Special Interest Section of the American Association of Law Libraries.^[44] While members of the public need access to the law itself (the primary legal materials), they also need resource guides that are specific to the subject matter or court they must understand. In particular, the many books written specifically for lay people about the law can be most helpful. And the texts written for students who are studying the law—nutshells, outlines, and West's Hornbook series—can be very useful as well.

CONCLUSION

Legal literature, once the domain of the commercial publisher, is now found in a vast array of different sources—free and expensive; print and electronic. Any one type of legal information, such as the current legislative code for the state of Washington, can be located in different print and electronic sources. Understanding the legal system, the sources of law, the interplay of those sources, the characteristics of legal information within our legal system, and the nature of legal publishing provide the essential knowledge needed to use and understand the legal literature of our time.

The law changes constantly, and the challenge for any legal researcher is to find the most recent rule of law

affecting a specific problem. Since the research tools themselves are undergoing constant reinvention, the legal researcher also needs to be a lifelong learner who is willing to keep up with the new technology and the changes in favorite legal research tools. Methods of access to legal information will continue to change, but the underlying framework of our government and the decentralization of lawmaking are constants that will continue to bring stability to the process of legal research. Legal literature is shaped by these principles, and users must continue to demand high-quality, reliable legal research tools.

APPENDIX: HOW LAWYERS CONDUCT LEGAL RESEARCH

Research to Locate Studies and Descriptions Written by Carissa Vogel

Cohen, M.L. Research habits of lawyers. *Jurimetr. J.* **1968–1969**, 9, 183, 189–192.

Abstract (focusing on the above cited pages): Cohen briefly discusses three surveys conducted from 1965 to 1968 on the research habits of lawyers. The first survey Cohen discusses is one he conducted in 1968 looking at 25 small law offices in Philadelphia. This survey was focused on the materials contained in the firms' law libraries. Next, Cohen discusses an interview survey of 100 lawyers undertaken by the Missouri Bar. Cohen notes the results and the Bar's interpretation of the data it collected. Lastly, Cohen reviews a survey of 500 lawyers that he conducted in Philadelphia in 1965. He discusses the resources most often used by lawyers and the kinds of law being researched.

Cole, C.; Kuhlthau, C. Information and information seeking of novice versus expert lawyers: how experts add value. *New Rev. Inf. Behav. Res. Stud.* **2000**, 1, 103.

Abstract: This entry presents the results of a pilot study of 15 lawyers at various stages of their career. Concepts of task, information, and information seeking as viewed by novice and expert lawyers are examined in order to concentrate on adding value to information collected for a client or case. The authors develop a four-point arc related to value adding and suggest that it can be used by novice lawyers trying to understand and solve task-related problems. The entry was presented at the *Third International Conference on Information Needs, Seeking and Use in Different Contexts*, Goteborg, Sweden, 2000.

Estes, M. Law librarianship research needs survey. *PLL Perspectives*. November–December **1991**, 3 (2), 11–14.

Perspectives is a newsletter from the Private Law Library section of AALL. The table of contents for all the issues can be accessed through <http://www.aallnet.org/sis/pllis/newslett/newsletter.asp>. Visit your nearest law library for articles which are not yet available online.

Gilliland, K. Abstract, the research habits of lawyers. *Law Libr. J.* **2003**, 95, 719, 722–723.

Abstract: Gilliland describes her research grant project, which tabulated and analyzed the data collected in a 1995 survey by Morris Cohen, Penny Hazelton, and Patricia DeGeorges "to test some of the basic assumptions of librarians about how lawyers do research." Gilliland mentions findings regarding online usage, concerns about the quality of legal research, and how often lawyers sought out a librarian's assistance when facing unfamiliar legal issues.

Haruna, I.; Mabawonku, I. Information needs and seeking behavior of legal practitioners and the challenges to law libraries in Lagos, Nigeria. *Int. Inf. Libr. Rev.* **2001**, 33, 69.

Abstract: Several findings are included in this entry which examines the information needs and information-seeking behavior of lawyers in Lagos, Nigeria. The need to know the latest decisions of superior courts is the greatest professional information need for many lawyers. Other lawyers say they need to find recent legislation and to learn about local and international legal conferences. In this study, the library was identified as the most heavily consulted information resource, but most lawyers claimed the library does not fill its role in meeting the information needs of lawyers. The entry includes recommendations made on the basis of these findings.

Hazelton, P.A. Compilation, surveys on how attorneys do legal research. *Perspective*. January **1993**, 1 (2), 53.

Abstract: This compilation of citations to journal articles is at the end of an article by Hazelton on advanced legal research courses. The compilation includes cites to articles on legal training, lawyering skills, and two articles on the research habits of lawyers.

Innes, H.J. The evolution of the traditional: novice lawyer information seeking in a CALR world, <http://capping.slis.ualberta.ca/cap07/HeatherInnes/litreview.html> (last visited October 4, 2007).

Abstract: This website contains a review of studies on the information behavior of lawyers. Innes examines studies performed in England, Nigeria, and Canada, specifically, a survey by the Canadian Department of Justice (Operation Complex) and a follow-up survey by Mark Vale published by the Canadian Legal Information Centre. Additionally, Innes discusses studies by Kuhlthau and Tama on novice versus expert researchers and by Wilkinson on lawyers' preferred sources of information. Lastly, Innes reviews the history and the trends in the use of computer-assisted legal research.

Kuhlthau, C.C.; Tama, S.L. Information search process of lawyers: a call for "just for me" information services. *J. Doc.* January **2001**, 57, 25, 28–38.

Abstract: Prior studies by Kuhlthau based on the model of the Information Search Process (ISP) provide the basis

for her ongoing research. This study reviews the information-seeking tasks of lawyers in order to learn how they use information and to understand the role of mediators in the process of information seeking and use. The authors conclude that lawyers are often involved in complex tasks that require a constructive process of interpreting, learning, and creating. The study participants preferred printed texts over computer databases to accomplish these complex tasks primarily because computer databases required specific requests. "Just for me" services are explored as a way to help lawyers deal with complex information needs.

Leary, M.A.; Cooper, W.L. Research needs of outstate Michigan lawyers. *Mich. Bar J.* **1981**, 60, 641.

Abstract: This entry presents the results of a 1981 survey of 1592 Michigan lawyers whose offices were in counties without large public law libraries. The purpose of the survey was to find out the lawyers' requirements for 34 kinds of research material and to learn how they accessed the material. The goal of the survey was to discover the availability and the need for resources. The researchers found that Lexis and Westlaw were needed the least and that the Michigan Statutes Annotated was needed the most. Additionally, the respondents accessed their own libraries and other libraries (public, county, and university) for sources, like law reviews, court rules, and magazines. The authors make recommendations for improving access including improving funding for county libraries, increasing accessibility to resources in the State Law Library, and making use of technology for producing faster and cheaper documents.

Leckie G.J.; Pettigrew, K.E.; Sylvain, C. Modeling the information seeking of professionals: a general model derived from research on engineers, health care professionals, and lawyers. *Lib. Q.* **1996**, 66 (2), 161.

Abstract: This entry studies the information-seeking behavior of engineers, health care professionals, and lawyers. From their study, the authors create an original model of information seeking applicable to all professionals. The entry presents in detail the general model and its components. The entry concludes with suggestions as to the potential usefulness of the model.

Maine Bar Association. The survey: who we are, what we think. *Me. B. J.* **2007**, 22, 78–83.

Abstract: This entry presents the highlights of a survey on the services offered by the Maine Bar Association. The entry did not cite how the survey was presented, who was given the survey, or how many bar members responded. Most of the information in the entry focuses on who uses Casemaker and how they use it.

Marke, J.J. New study: how lawyers use the library, *N Y Law J.* November 21, **1995**, 214 (98), 5.

Abstract: This entry presents highlights from a 1995 survey conducted to determine how lawyers perform research. The questionnaire was sent to 1500 randomly

chosen alumni from five law schools. Responses were received from more than 440 people. The researchers wanted to find out what resources were used, how often they were used, where information was accessed, and the purposes for the research. Marke relates 20 highlights of the findings.

Palmer S. If you can't beat 'em, train 'em: how lawyers conduct legal research. *Leg. Inf. Alert.* January **2006**, 25, 1.

Abstract: This entry reviews the findings of the 2004–2005 American Bar Association Legal Technology Survey Report on lawyers in offices of 50 or more and suggests the uses of training to boost results. Palmer divides the entry into sections on survey results and training for legal sources and nonlegal sources. Palmer also suggests how to conduct effective training for lawyers in large firms.

Panel Discussion. Historical development of the American lawyer's library. *Law Libr. J.* **1968**, 61, 440, 458–460 [discussing three surveys conducted in Missouri (1966) and Pennsylvania (1965, 1968)].

This panel discussion briefly mentions these studies. More complete coverage of the surveys can be found in *The Research Habits of Lawyers* by Morris Cohen.

Sanders Reach, C.; Ikens, L.; Palmer, S.; Stine, S. *2007 ABA Legal Technology Resource Center Survey Report Online Research*; American Bar Association: Chicago, IL, 2007.

Abstract: In 1990, the ABA started to survey law firms on their technology usage. Since 2001, the survey changed to look at lawyers exclusively. The survey was sent to 28,018 ABA members in private practice: the researchers received 1876 responses. The findings were published in the Online Research section report (this volume), which represents one in a series of five volumes published annually. The Online Research volume includes a short trend report describing the general information gathered from the surveys. The rest of the volume contains graphic representations of the survey questions, covering everything from electronic budgets to the use of fee-based online legal research resources.

Reusch, R.T. *Patterns of legal research in North Dakota: a Survey.* *N. D. L. Rev.* **1985**, 61, 383.

Abstract: This entry explains the results of a 1984 survey conducted to determine how North Dakota attorneys use and acquire legal information and to figure out if North Dakota attorneys need a legal research assistance program. The survey was mailed to 1150 people, all members of the North Dakota State Bar Association who had addresses in North Dakota. A copy of the original questionnaire is included in the Appendix of the entry. The researchers received 505 responses. Reusch discusses the results of the survey, includes tables representing the results, and concludes that North Dakota needs an assistance program that provides services like affordable computer research services.

Speer, L. Private law libraries survey. *PLL Perspectives*. November–December 1989, 1 (2), 5.

Perspectives is a newsletter from the Private Law Library section of AALL. The table of contents for all the issues can be accessed through <http://www.aallnet.org/sis/pllis/newslett/newsletter.asp>. Visit your nearest law library for articles which are not yet available online.

Wilkinson, M.A. Information sources used by lawyers in problem-solving: an empirical exploration. *Libr. Inf. Sci. Res.* 2001, 23 (3), 257.

Abstract: More than 150 practicing lawyers were interviewed about their information-seeking behavior. The results demonstrated to the author that legal research should not be considered as the only information-seeking behavior of lawyers as has been assumed in past research. Administration of their law practices, for example, was identified as constituting a problem-solving, information-seeking activity. The study analyzes whether lawyers seek to solve problems through formal or informal means, whether they are likely to look to sources inside or outside their organization, and whether the lawyer's gender or size of practice influences the type of information resources sought. The model for information-seeking behavior of professionals as posited by others is analyzed and modifications are suggested that create a new model.

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Learning and Information Seeking

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Abstract

The purpose of this entry is to present and analyze the relationship between learning and information seeking. The analysis draws on research studies on information seeking set in educational contexts and is framed in theories of learning, mainly constructivism. Themes of the entry are based on five dimensions of the relationship between learning and information seeking: 1) seeking information for learning purposes; 2) learning information seeking; 3) teaching information seeking; 4) learning from information; and 5) reshaping conditions for information seeking and learning through information and communications technologies (ICTs). Conclusions are that the fields of learning and information seeking draw nearer to one another partly due to educational ideas based in constructivism and partly due to the development of digital tools that reshape conditions for learning in postmodern society. This development contributes to the transformation of the professional role of librarians, implying an emphasis on the pedagogical aspects of the profession. Future prospects for information seeking research and practice linked to learning may involve strengthened interests in the cognitive authority and expertise of information as well as information sharing through communicative interaction.

INTRODUCTION

The topic of this entry is the central relationship between learning and information seeking, where information seeking is seen as a condition for learning to take place. Our point of departure is that learning and information seeking are intimately intertwined in a constantly ongoing human activity. For purposes of research, education, and professional practice the fields of learning and information seeking have been divided into separate disciplines and occupational fields. As a human activity, learning and information seeking are inseparable and mutually shape each other.

A massive amount of empirical research on information seeking is set in learning contexts and is directed at students' information seeking for learning assignments. With few exceptions, the vast majority of such studies are restricted to an interest in information seeking and do not direct specific attention at the wider aspects of the learning processes or outcomes, which form the purpose as well as the result of the information seeking under study. During the last decades, societal developments in information and communication technologies as well as the globalization of economies have dramatically changed conditions for learning and information practices, with tools for online information seeking accessible worldwide. The Internet and other digital media have brought the world into classrooms and libraries implying immediate access to abundant amounts of information, and changing conditions for the ways and whats of teaching and learning. Traditional ways of teaching and

learning are substituted by inquiry-based methods, involving students in independent information seeking and use. One consequence is an increased emphasis within librarianship on teaching information skills to all kinds of users, especially students at all educational levels, from elementary school to undergraduate education. Librarians' expertise in information seeking together with the expansion of their professional domain into teaching contributes to reshaping the view of librarianship, where an emphasis on the pedagogical aspects of the profession is emerging. This in turn has contributed to an increased interest in the relationship between learning and information seeking. In this entry the topic of learning and information seeking is viewed as a range of interconnected dimensions pertaining to

1. Seeking information for learning purposes—associated with the common practice of information seeking related to carrying out learning tasks in formal educational contexts as well as in work-life or everyday life. In this respect, information seeking is strongly linked to the notion of lifelong learning.
2. Learning information seeking—a notion closely connected to the concept of information literacy, implying learning how to critically seek, evaluate, and use information in purposeful ways for various problems or situations.
3. Teaching information seeking—reflects the perspective of learning information seeking, and is a matter of interest in the field of information literacy education.

4. Learning from information—may be associated with information use rather than seeking, implying a range of various aspects such as understanding the contents of information sources, critically evaluating and relating sources to one another as well as to the topic of a task.
5. Development of information and communication technologies (ICTs)—changes in the conditions for information seeking and learning, reinforcing the connections, and interdependence between these two areas of human practice.

The aim of this entry is to present and analyze aspects of the relationship between learning and information seeking, taking into account the various dimensions listed above. The entry is based in theories of learning and in research on issues of learning and information seeking.

KEY CONCEPTS

Learning is nowadays one of the most frequent concepts used in more or less all social practices—both formal and informal. It is closely related to notions of communication and knowledge but also to meaning-making. Learning is generally seen as contextual and as an integration into a community of practice in which social actions are identified. It is a social activity in which the learner uses sensory input and constructs meaning out of it. Learning involves language, and language and learning are inextricably intertwined.

Information seeking—the concept of information seeking is well established in Library and Information Science (LIS). However, the term “information practices” is currently being used for including new perspectives on the concept, implying that information seeking can only be understood as embedded in the practices in which it takes place. In this entry, the terms “information seeking” and “information practice” will be used interchangeably to denote information seeking practices related to learning. It is worth underlining that related to learning information use is of particular interest, as an extension of information seeking.^[1] Research of concepts, contexts, and practices of information seeking is the object of interest of ISIC: the Information Behaviour Conference where information seeking related to learning has lately gained ground.

STAKEHOLDERS, ASSOCIATIONS, AND INSTITUTIONS

It appears that until the early 2000s the interest in pedagogical issues was greater within the professional practice of librarianship than within the research communities of information seeking. One example of this is Donald Case's survey of information seeking research,^[2] devoting

very scarce space for studies of information seeking set in learning contexts. This may be contrasted to the abundant literature in professional journals, especially those targeted at academic and school librarianship, on the topic of students' information seeking, and often linked to interests in information seeking and learning.

School and academic librarians are central agents in the field of learning and information seeking. A range of professional organizations devote considerable interest to issues of teaching and learning information seeking and use. Two such organizations in the United States are the Association of College and Research Libraries (ACRL), the largest section of the American Library Association (ALA), which publishes the journal *College and Research Libraries*, and the American Association of School Librarians (AASL), also a section of the ALA. AASL, the most important professional association for school librarianship, publishes one print journal, *Knowledge Quest*, and an online research journal, *School Library Media Research*. In these publications, topics of learning and information seeking appear frequently. There are similar professional associations in other parts of the world, for instance, the Australian and New Zealand Institute for Information Literacy (ANZIIL), and, in the Nordic countries, the Nordic Forum for Information Literacy (NordINFOLIT), all with a common interest in advocating information literacy education. An informative Web log on information literacy is located at <http://information-literacy.blogspot.com/>. The International Association of School Librarianship with the research journal *School Libraries Worldwide* is yet another example. The mentioned associations and networks combine a strong interest in the relationship between learning and information seeking, and strive to link professional interests with research communities through conferences, seminars, and publications.

The Center for International Scholarship in School Librarianship (CISSL) at Rutgers University (<http://cissl.scils.rutgers.edu/>) is an international research and scholarly centre that examines the dynamics and impacts of school libraries on student learning, and has a strong interest in learning and information seeking.

FOCUSING LEARNING THEORIES FOR UNDERSTANDING “LEARNING AND INFORMATION SEEKING”

Studies of how and what individuals learn while seeking information either in an educational setting such as a classroom or a library, through books or through the Web, depend on theoretical assumptions about teaching and learning. These assumptions are based in epistemology and raise issues such as What is knowledge? Where is knowledge? How is knowledge created? What is knowledge about?

Theories of Learning

Basically, three main theoretical assumptions—or waves—underpin the late history of learning. Before we outline constructivism which, in its different forms, is the most current in research today, we shall comment briefly on the other two waves. The first wave—*behaviorist theory*—corresponds to an empirical tradition founded in the assumption that learning is based on physical experience and that individuals tend to repeat behavior linked to positive experiences of satisfaction or reinforcement. B.F. Skinner^[3] was a particularly influential scholar in this tradition, claiming that only behavior itself—not inner processes such as thinking or reflection is considered as available for study. Human learning is seen as a change in external, observable behavior, while cognitive activities are considered unavailable to scientific observation. Research based on behaviorist theory claims that reality is observable and that there is objectivity in all empirical data. The golden age of behaviorist theories of learning lasted until the end of the 1950s.

Cognitive theory—the second wave—challenged behaviorist theory as the dominant paradigm with its restricted application of scientific methods. The main argument was that people are not “programmed animals” that merely respond to environmental stimuli; people are rational beings who actively participate in learning, and whose actions are a consequence of thinking. During the 1960s cognitive-oriented researchers became interested in what takes place in the mind of the learner. Changes in behavior were still observed but only as indications of what occurs in the learner’s mind. Cognitive theory focuses on inner mental activities—opening the “black box” of the human mind is therefore a valuable and necessary contribution to understanding how people learn. Research interests are directed at the exploration of mental processes such as thinking, memory, knowing, problem solving, and information processing. Knowledge is seen as schema or symbolic mental constructions and learning is defined as changes in a learner’s schemata. Cognitivism was strongly inspired by the emerging computer technology, viewing humans as processors of information.^[4]

Constructivism—The Third Wave to Understand Learning

Towards the end of the 1980s a third wave—Constructivism—partly replaced cognitive theory. Today constructivism represents one of the major ideas in education and has been characterized as the dominant philosophy of learning. It proposes that learners need to build their own understanding of new ideas, and that information emerges within these built constructs rather than exists in the external environment. John Dewey^[5] is often cited as the philosophical founder of this approach. Its implications for how teachers teach and learn to teach are enormous. The constructivist approach to teaching and

learning—and also to information seeking—is based on a combination of a subset of research within cognitive psychology and a subset of research within social psychology.

Constructivism embodies two major perspectives, cognitive constructivism, and social constructivism. These perspectives are different in emphasis, but they also share many common views about teaching and learning. Widespread interests in the theory of constructivism have led to a debate between those who emphasize the individual cognitive structuring process and those who emphasize the social context of learning. While Jean Piaget^[6] is considered the major theorist among the cognitive constructivists, Lev Vygotsky^[7,8] is the major theorist among the social constructivists. The core of different theories related to social constructivism goes back to Vygotsky’s cultural historical theory of human development propounded in the 1920s and early 1930s. Standard discussions of the difference between Vygotsky and Piaget place a crucial distinction in the proximal locus of cognitive development. For Piaget, individual children construct knowledge through their actions in the world: to understand is to invent. In contrast, the Vygotskian claim is that understanding is social in origin (see further discussion in Wertsch^[9]). According to Vygotsky,^[8] “Every function in the child’s cultural development appears twice: first, on the social level, and later, on the individual level; the first, between people (interpsychological), and then within the child (intrapsychological).” He claims that this development principally takes place through a form of apprenticeship learning.

Cognitive constructivism

Jean Piaget’s theory of cognitive development suggests that humans cannot be “given” information which they automatically understand and use, they must “construct” their own knowledge. They have to build their knowledge through experience. The role of the teacher is to provide a classroom full of interesting things to encourage students to construct their own knowledge and to develop their ability to explore phenomena in the world. The classroom should offer students the opportunity to construct knowledge through their own experiences. There is less emphasis on directly teaching specific skills and more emphasis on learning in meaningful contexts. Piaget’s ideas concerning active construction, structuring knowledge, and stages of development, have been drawn on for some time in education and especially, during the last decades in the ongoing integration of ICT in education.

Constructivist approach to information seeking research

Some major work has been done on information seeking and learning using constructivist approaches. Carol Kuhlthau’s studies and her ISP model is a prominent example of

information seeking research framed in a constructivist view of learning with an emphasis on individual learners. Kuhlthau articulates information seeking as a process of construction and she emphasizes that her research is directed at intellectual access to information and ideas, implying a close relationship to learning. The model adopts the user's perspective of the information seeking process, and thus places the user as the central actor, constructing meaning through the process.^[10] Kuhlthau's model has been highly influential in LIS research as well as in professional practice.

Limberg studied the interaction between information seeking and learning in the context of upper secondary school using a phenomenographic approach.^[11–13] Phenomenography has a linkage to cognitive constructivism and constitutes a theoretical strand for framing research on information seeking and learning. Similar to cognitive constructivism phenomenography has human experience as its object and investigates people's experiences of phenomena in the world.^[14] From a phenomenographical standpoint the world exists and different people construe it in different ways. The main focus is on the qualitatively different ways in which people experience something or think about something, e.g., photosynthesis or information seeking. Besides Sweden, where a phenomenographic approach has been adopted for studying the interaction between information seeking and learning,^[11–13] phenomenography is also being frequently used among information literacy researchers in Australia and the United Kingdom.^[15–19]

Social constructivism

Lev Vygotsky's claim that social learning precedes development is linked to his focus on the connections between people and the context in which they act and interact through shared experiences. According to Vygotsky, humans use cultural tools, such as speech and writing, to mediate their social environments. Initially children develop such tools in order to function socially as ways of communicating needs. Vygotsky claims that the internalization of these tools leads to higher order thinking skills. For Vygotsky culture provides the child with the cognitive tools needed for development.^[7] Today such tools also include electronic means of information access.

There are some general principles of learning that are derived from social constructivism. These principles are

- Learning is an active process in which the learner uses sensory input and constructs meaning out of it. In the learning process the learner compares new experience with knowledge constructed from previous experience, resulting in the reinforcement or adaptation of knowledge. Knowledge is not a fixed object; the individual constructs it through experience with the object of study.

- Learning is constructing meaning and systems of meaning. Shared meanings develop through negotiation in the learning environment, leading to the development of common or "taken-as-shared" knowledge. According to a constructivist view, knowledge is not "about" the world, but rather "constitutive" of the world.
- Learning involves language, and language and learning are inextricably intertwined.
- Learning is a social activity. It is intimately associated with our connection with other human beings. It takes place within some sociocultural setting. Social interactions within the learning environment are an essential part of this experience and contribute fundamentally to individual knowledge construction.
- Learning is contextual. We learn in relationship to what else we know, to our beliefs, our prejudices, and our fears.

Situated cognition and situated learning

Vygotsky's theories, and those of other developmental psychologists, form the foundation for the concepts of situated cognition and situated learning. Constructivists view cognition as situation-bound and socially distributed rather than as decontextualized tools and products of the mind. It is not possible to separate cognitive tasks from social tasks, because all cognitive tasks have a social component. Thinking is both physically and socially situated and problem tasks can be significantly shaped and changed by the available tools and the social interactions that take place during problem solving. Situated cognition emphasizes apprenticeship, coaching, collaboration, multiple practices, and articulation of learning skills, stories, and technology. Applied to information seeking, this means a variety of ways of seeking and using information linked to various practices. It further implies a wide variety of ways of learning how to seek and use information related to various tasks, tools, and situations.

The concept of situated learning means that knowledge is situated and is partly a product of the activity, context, and culture in which it is used. Situated learning occurs when students work on authentic tasks in real-world settings. Knowledge cannot be taught in the abstract; it can only be constructed in context. Jean Lave^[20] states that learning is a function of the activity, context, and culture in which it occurs, in contrast with most classroom learning which tends to be abstracted from context. Toward the beginning of the 1990s Jean Lave^[21] and Etienne Wenger^[22] developed a model of situated learning proposing that learning involves a process of engagement in a "community of practice." Their basic argument is that communities of practice are everywhere; at work, at school, in the home, or

associated with our civic and leisure interests. The sustained pursuit of a shared enterprise gives rise, over time, to these communities. The concept of “community of practice” has had a huge impact on both research and practices of learning—both formal and informal.

A sociocultural view of learning and information seeking

Parallel to the development of the concepts of situated cognition, situated learning, and community of practice, sociocultural theory has developed and has become a powerful and competitive paradigm in today’s landscape of social and cultural sciences. The core of the sociocultural theory is rooted in Lev Vygotsky’s view of learning as communicative interaction, and it has gained in significance in learning and information seeking research during the last decade. James Wertsch,^[9] one of the main scholars in this research field developed Vygotsky’s theory in relation to contemporary issues and argues, as Vygotsky did, that human mental functions are inextricably situated in social, cultural, institutional, and historical contexts. From a sociocultural standpoint language is seen as the most important cultural tool available to man. It is through communication that sociocultural resources are created, but it is also through communication that they are carried forth.

Sociocultural theorists view learning as integration into a community of practice in which social actions are identified. Learning is seen as the process by which individuals are introduced to a culture by more skilled members. As this happens they “appropriate” cultural tools through their involvement in the activities of this culture.^[23] This implies that the contents of learning (e.g., subject matter of learning assignments), the contexts in which people act (e.g., school, undergraduate education, specific course or discipline, work-life), and the cultural tools (e.g., the Web, Google, databases, journals, textbooks) people have available, must be taken into account in the understanding of what characterizes productive learning. A sociocultural perspective has been increasingly applied in recent studies of information seeking and learning^[24–26] as well as in information literacy research.^[27–30]

Summary

The constructivist paradigm has led us to understand how learning and information seeking may be facilitated through certain types of engaging, constructive activities. This view of learning and information seeking emphasizes meaning-making through active participation in socially, culturally, historically, and politically situated contexts. A crucial element of active participation is dialogue in shared experiences. Situated collaborative activities, such as modeling, discourse, and decision-making,

are necessary to support the negotiation and creation of meaning and understanding.

Theories of Learning in Information Seeking Research and Practice

It is worth pointing out that very few studies on information seeking in learning, or in other contexts, have framed their research within a theoretical perspective of learning. Case’s survey of research on information seeking^[31] lists a number of theories applied in information seeking studies; among the disciplines most frequently used during the last 30 years are sociology, communication, and psychology. Exceptions to this statement have been mentioned above as examples of information seeking research framed in theories of learning.^[10–13,24–26] In a wider perspective we see that constructivism has influenced information science, for instance in the theory of sense-making. However, sense-making has not been specifically linked to learning. Such wider theoretical applications of constructivism go beyond the scope of this entry. A qualified prediction is that constructivist theories of learning will be increasingly applied in future research on information practices, given the growing interplay between information seeking and learning in ICT environments.

While constructivist theory is only beginning to be utilized to frame research in information seeking, the experiences and observations of school and undergraduate education during the last decades, suggest that constructivist ideas have strongly influenced practices in education and librarianship during this period, shaping teaching and learning in ways that engage students in active information seeking for independent, inquiry-based learning. Constructivist views of learning have, thus, contributed to the increased interest in the relationship between learning and information seeking.

INFORMATION SEEKING FOR LEARNING PURPOSES

The issue of information seeking for learning purposes is tied to the context of students’ carrying out learning assignments implying independent information seeking for finding, selecting, evaluating, and using a variety of information sources to construct meaning about some particular knowledge content. Research questions related to such practices concern how students seek, select, and use information for their tasks. How do task requirements interact with students’ information seeking? How do students experience information seeking for learning assignments? Research studies have focused on students’ *searching* behavior that is on their interaction with online information systems and digital tools, as well as on their information *seeking* behavior, that is the series of searches related to the same learning assignment.^[32]

Over the years, thousands of empirical studies have been carried out on students' information seeking in contexts of formal learning at all levels of education, from elementary school to undergraduate levels. Only a few of these take the learning context into close account. Vakkari^[33] criticizes typical studies of university students searching for information without framing these activities within their contexts of learning assignments.

As pointed out above, information seeking for learning purposes characterizes ways and means of learning in classrooms throughout the world in contemporary society. Textbooks and library collections have been replaced by information accessible online, where the World Wide Web is the main resource for access to information, and is widely used in schools and universities all over the globe. Independent learning through active information seeking, however, has a longer history than the World Wide Web. Student-centered learning linked to information seeking is clearly influenced by the constructivist view of learning, which allocates great responsibility for knowledge construction to learners and their exploration of the world through various information resources. Before the breakthrough of the Internet when students were required to seek information independently for their school tasks, information resources were restricted to local collections, where teachers and librarians exerted control over what was available for students. In those days the crucial problem tended to be to find and retrieve any sources relevant for students' various tasks. Librarians and teachers would spend a lot of time building up collections suitable for school curricula and instructional units. In the Internet era corresponding activities of collection building take the form of collections of links to approved information resources or recommended Web sites, hosted by libraries or other knowledge institutions. It is hard to deny that the breakthrough of the Internet has brought dramatic qualitative changes to education and conditions for learning. It is not just a matter of quantities of information but of new ways of interacting with and communicating via digital tools, opening up the walls of classrooms, libraries, and school buildings.

Learning Tasks

A critical issue of information seeking related to learning is the character of the learning tasks that students work with. The concept of task is germane to information seeking in educational and learning contexts. Nevertheless, this area of research does not often present itself as task-based. It seems that the task is more or less implicit in information seeking studies set in learning contexts.

Particular conditions shape the practice of information seeking related to learning tasks in formal education. Two such conditions are that they are always imposed,^[34] and that they are related to the intended learning outcomes of various contents as well as to abilities. The intended learning outcomes are formulated by teachers and ideally

expressed in the goals of an assignment. A typical attribute of learning assignments is that students' work and their mastery of subject matter and various competences, such as information seeking, are subject to assessment by teachers. This indicates the importance of an ever-present norm in education, expressed in assessment and evaluation. This norm implies that there are poorer or better ways of understanding and managing a particular phenomenon, with reference to the cognitive authority^[35] of teachers, curriculum, science, and academia. This necessarily is a critical feature of information seeking related to learning tasks.

Students' Information Seeking

One issue, discussed both in research and in teachers' and librarians' professional practices is that students tend to adopt a restricted fact-finding approach to information seeking for learning tasks. Students' intentions and ensuing approaches tend to be focused on finding enough information and then writing up a report for submission in due course. This is found to be typically linked to learning assignments and shaped within the discursive practice of school.

Since the mid-1990s intensive interest has been devoted to studies on students' information seeking in digital environments, especially the Web. Findings from such studies indicate that students exhibit great self confidence in their own ability to search the Web and find what they are looking for. In spite of this, according to the teachers and librarians as well as to the researchers involved, students' information seeking seems neither adequate nor effective for the purposes of their school-related assignment. Young people seem to be more successful in information seeking for their personal interests and for everyday life. This indicates differences between the cultural practices of school and of students' leisure time and may imply a gap between information practices developed inside and outside school, which in turn might complicate efforts of learning and teaching the critical abilities required for information seeking and use.

A British research group^[36] recently studied the information expertise of the "Google generation," that is those born after 1993. Main questions were whether or not young people are searching for and researching content in new ways, different from the ways that existing scholars carry out their work, and whether this is likely to shape their future behavior as mature researchers. The study was commissioned by the British Library and Information Systems Committee (JISC, U.K.) with the aim to inform and stimulate discussion about the future of libraries in the Internet era. JISC's activities support education and research by promoting innovation in new technologies and by the central support of ICT services. Findings partly confirm previous studies of students' information seeking practices, indicating shortcomings among students both as regards their use of digital tools and search operators and

particularly as regards students' ways of assessing and evaluating information—or rather their lack of conscious and systematic evaluation of information. Students' primary evaluation criterion is the topicality of content. Conclusions drawn from this study, as well as from similar studies, are that they highlight the importance of teaching and learning how to critically evaluate and assess information, related to various contexts and situations.

University students' information seeking has been investigated within a framework of learning theories about differences in learning styles^[37,38] as well as differences between undergraduates' epistemological beliefs.^[39] Findings indicate that different study approaches influence both search strategies and reflective judgment on information sources.

LEARNING AND TEACHING INFORMATION SEEKING

"All information-seeking behaviour is learnt, nothing is innate," according to Wilson.^[40] Linked to constructivist theory of learning information seeking can be viewed as an object of learning, which may be constructed and reconstructed into various shapes or ways of understanding related to the different contexts and situations in which it is carried out.

A constructivist approach to learning emphasizes, as described above, authentic, challenging projects in professional practices that include students, teachers, librarians, and experts in the learning community. Its goal is to create learning communities that are more closely related to the collaborative practice of the real world. In an authentic environment, learners assume responsibility for their own learning, they have to develop metacognitive abilities to monitor and direct learning and performance. When people work collaboratively in an authentic activity, they bring their own framework and perspectives to the activity. They can see a problem from different perspectives, and are able to negotiate and generate meanings and solutions through the activity itself. From this viewpoint it is counterproductive for teachers to make all the vital decisions about what is to be learned and how it should be learned and to be the sole dispenser of information without involving students in the decision process. To then assess students' abilities in constructing knowledge seems to miss the point. In other words, guided instruction is suggested, placing students at the centre of the learning process, and providing guidance and concrete teaching whenever necessary.

Learning Information Seeking

The notion of fact-finding is a widespread way of understanding information seeking, implying searching for facts with the aim of finding correct answers to specific questions, such as: "How many casualties were caused by car

traffic in Sweden in 2006?" or "What are the colors of the South African flag?" However, learning assignments in education as well as in work-life often concern highly complex issues, such as "How can we reduce global warming?" or "How does gender affect work-life in Germany?" Research as well as professional experience show that the notion of information seeking as fact-finding is too restricted in relation to complex questions.^[12,24,41]

Information seeking linked to inquiry-based assignments insists on information *use* rather than seeking and finding, and requires critical and conscious evaluation and analysis of sources for the purpose of constructing meaning through information. Forming an understanding of information seeking and use appropriate for complex learning assignments thus involves examining the way users interpret information for meaningful learning. Christine Bruce emphasizes the interdependence of information use and learning and proposes the term *informed learning* for "engaging in information practices in order to learn" or "engaging with the different ways of using information to learn."^[16] Constructivist ideas about guided instruction in collaborative work on authentic learning tasks form an appropriate theoretical foundation for understanding this type of learning, and has implications for teaching.

Teaching Information Seeking

The idea of information seeking behavior as learned further suggests that education can support people in developing suitable ways and means of seeking and using information. This concerns teaching information seeking practices for learning purposes. Teaching information seeking has a long history with a background in library skills instruction (bibliographic instruction) from the first half of the 1900s, later to be succeeded by information skills instruction from the 1970s. Library skills (bibliographic instruction) tended to encompass knowledge about the use of libraries and its various tools such as catalogs, indexes, and various reference tools (bibliographies, abstracts). Library skills instruction corresponds to what is sometimes called the bibliographic paradigm in LIS, based on the structure and order of collections of documents. The concept of information skills implies less focus on documents, and encompasses instead a wide range of information resources, such as lectures, texts, pictures, field studies, interviews, etc. going beyond the walls of libraries or information centers. An influential model in this tradition is the Big6 Skills (<http://www.big6.com/>) model first presented in the 1980s and since then widely developed and marketed.^[42] Models of information skills instruction tend to be framed in a cognitive view of learning, emphasizing ways of thinking, and mental models.

Since the early 1990s the concept of information literacy has replaced earlier concepts such as information skills or library skills for labeling the art of purposeful and adequate information seeking related to a task or a problem. There

are large numbers of definitions of what constitutes information literacy, which will not be dwelt upon in this entry. Nevertheless, in the context of this entry we wish to draw attention to the links between, on the one hand, learning information seeking, and on the other, the concept of information literacy. The relationship between information seeking and information literacy is inherent in the notion of learning and teaching information seeking. Information literacy implies mastering appropriate ways of seeking and using information for various purposes, and as emphasized above, this ability is an object of learning. In this respect, the interest in the practice of teaching information seeking for information literacy is simultaneously related to a long-term interest in pedagogical issues within librarianship and to the specific condition that contemporary information and communication technologies provide (See the entry, "Information Literacy," p. 2421).

Constructivism has important implications for teaching and of course for scaffolding information seeking. Teaching is not viewed as the transmission of knowledge from the enlightened to the unenlightened; constructivist teachers do not take the role of the "sage on the stage." Instead, constructivist teachers create a context for learning in which students may become engaged in interesting activities that encourage and facilitate learning. The teacher may often guide students as they approach problems, may persuade them to work in groups to think about issues and questions, and support them with encouragement and advice as they tackle problems, adventures, and challenges rooted in real-life situations that are both interesting to the students and satisfying in terms of the result of their work. If learning is based on prior knowledge, then teachers must take that knowledge into account and provide learning environments that exploit inconsistencies between learners' current understandings and the new experiences before them. This challenges teachers, since they cannot assume that all students understand something in the same way. Further, students may need different experiences to advance to different levels of understanding. These constructivist ideas apply equally to different teaching areas, including information seeking.

LEARNING FROM INFORMATION

As mentioned above, the majority of research studies in the area of information seeking and learning restrict their interest to information seeking, not taking learning outcomes into account. However, since the mid-1990s there are examples of studies where the object of research is to explore the interaction between information seeking and learning, including an interest in studying students' learning outcomes related to their information seeking and use.^[12,24,25,41,43] These studies have adopted either a cognitive constructivist or a social constructivist view of learning as a theoretical framework. The research object

of such studies concerns the major question about what characterizes the complex links between information seeking, information use, and knowledge formation, that is the transformation of information into knowledge.

Information Seeking and Learning Outcomes

Findings from such studies identify various approaches that students adopt in information practices for learning purposes. Related to complex learning tasks, a fact-finding approach is found to coincide with a poor learning outcome, characterized by fragmentary pieces of knowledge. Approaching information seeking as analyzing and scrutinizing information for understanding a complex issue, for finding different perspectives, and for identifying values and hidden motives in information sources corresponds with sophisticated learning outcomes. High-quality learning outcomes are characterized by students' abilities to argue coherently about an issue, to discuss matters from different perspectives, and to make consistent inferences based on substantial factual knowledge. Conclusions drawn from these studies are that there is a close relationship between the quality of information seeking and use and the quality of learning outcomes.

Information Use as Text Transport

Observations in practice as well as in various studies of students' information use related to ICT for learning assignments concern the issue of "copy and paste." Learning outcomes as represented in students' papers indicate the common practice of moving text from information sources to students' own texts, sometimes also slightly transforming the original texts through deleting or adding a few word, making the text "their own." Occasionally this text transport is seen as plagiarism by educators. However, studies on students' ways of using information sources to produce their own texts show that the transport and transformation of text may constitute practices developed among students in order to deal with their writing tasks as best they can. The studies also indicate that this practice is part of the discursive practice of school, where copying and memorizing text is a long-standing tradition. The findings indicate that the art of using other people's texts for producing one's own text is an ability that requires purposeful learning, and that teaching this ability needs to be better developed.^[24,25,44]

We conclude that this aspect of information use for producing new text is worthy of further research as well as considerations for ways of changing practice.

Critical Features for Meaningful Learning Outcomes

Studies of the relationship between the quality of information seeking and use and the quality of learning outcomes identify a range of critical features, that is qualities that

make a difference, for meaningful learning. These features relate to various dimensions of learning tasks. It seems essential that learning assignments are based in researchable questions, meaning inquiry-based assignments built on questions that are appropriate for examining complex issues, neither simple fact-finding questions, nor very broad and unspecified topical questions. For meaningful learning it is further underlined that various aspects of information practices should be observed throughout the learning process, implying a shift from an emphasis on information skills instruction toward a stronger accent on the critical use of information. It is considered as vital that the interactions between teachers and librarians on the one hand and students on the other focus strongly on the knowledge contents of an assignment; researchers found that the interaction in information use for learning is often directed at order and procedure rather than at the process of understanding and constructing meaning through information use. Meaningful feedback through assessment on various dimensions of tasks, including aspects of information practices, is further underlined as necessary for supporting meaningful learning.

Learning and Information Seeking Shaped by School Practice

A sociocultural view of information seeking and learning sheds light on the interplay between the described practices of information seeking and learning. We may assume that authentic exploration of complex tasks in school settings is contrary to the tradition of schooling. The limitations and shortcomings of information practices and learning outcomes observed in a number of studies set in school contexts may be explained by the idea that information seeking and learning are shaped by the discursive practice of school, where the traditional mission has been to deliver “the right knowledge” and for students to learn “the right answers.” Studies that take the entire process from task initiation to learning outcomes as their research object, observing information practices embedded in the learning task, contribute to multifaceted understandings of the intricately interwoven process of learning and information seeking. The different strands of information seeking and learning shed light on each other. Through the identification of important critical features required for meaningful learning to occur, these studies imply that the discursive practice of school may be reshaped through reflective and conscious ways of designing, shaping, and managing situations for authentic learning.

CONCLUSIONS

Our presentation of learning and information seeking is founded on the view that these strands of human activity are inextricably intertwined, mutually shaping each other.

The analysis has shown that current constructivist theories strongly influence learning and information practices, emphasizing the perspective of students or users. These changes of practice currently contribute to a gradual change within librarianship underscoring the pedagogical aspects of the profession. The analysis also suggests that there is a powerful potential in the use of learning theories for framing studies of information practices. This development strongly interacts with ICT technologies and practices.

Based on these conclusions we propose that ideas for future research will need to explore concepts such as the reshaping of the authority and expertise of information, information sharing, and the professional role of librarians. All three topics are related to further innovation in ICT, and the development of new digital tools for information use and learning.

In postmodern society individuals are allocated great responsibility for their own active choices. This means that public institutions, such as libraries and schools, are in a process of transformation from controlling knowledge processes to supporting people’s own decision-making about where to find information and how and what to learn. One implication of this change concerns the view of expertise, the authority of knowledge, and the control of information constituted by the new digital tools and media, especially the Internet. Authority issues currently receive much attention not only in information science but also in other fields, including education, human–computer interaction, and computer science. The essence of cognitive authority^[35] is that people primarily depend on others for ideas as well as for information outside the range of direct experience. The concept of cognitive authority provides an important framework for understanding the basis on which information users decide whether a particular information source is credible or not, and we anticipate further exploration in matters of the authority of information as essential for issues of knowledge, learning, and information at all levels of society.

It is obvious that new digital tools for information seeking and learning change the form, the content, and the infrastructure for learning in our society. New tools, such as those associated with the concept Web 2.0, which allow the production, interaction, and sharing of information, blur the boundaries between producers, mediators, and consumers of information and knowledge. Relevant research questions to investigate may concern how students handle the issue of formal expertise and control of information in Web 2.0 tools, and how people in current and future online environments—such as Web 3.0—create trust and reflect upon authority.

Another anticipated research area concerns *information sharing*. Our view is that research on collaborative information seeking and learning is of vital importance for further understanding of the essence of learning and information seeking in postmodern society. We see

information seeking and learning as firmly embedded in work and other social practices. This view intertwines work practice with information practice and information technologies. The social and collective aspects of human knowledge and experiences involve both information seeking on a collective level, and the relationship between people and the sharing of other people's knowledge and experiences. From this perspective we see a mutually shaping relationship between information and collaboration practices and the tools developed for the purposes of communication and knowledge sharing. A central issue is how can learning by sharing information be developed and supported in the future?

It has been repeatedly pointed out in this entry that the intensified interest in the relationship between learning and information seeking, caused by constructivist theories as well as the development of ICT, has contributed to reshaping the occupational practice of librarianship, emphasizing the pedagogical aspects of the profession. The research topics suggested above about the shift from authority and control of information to sharing responsibilities of authority and expertise with users reinforce the changing professional role of librarians, and need further exploration through research. Web 2.0 tools constitute a heated issue in current librarianship. Research questions that need further exploration in relation to this topic concern the characteristics of librarians' expertise in relation to users' information seeking and learning in Web 2.0 environments, as well as the characteristics of the negotiation of the professional expertise of librarianship in relation to other knowledge professions such as teachers and journalists.

These are but a few ideas for future research in the dynamic field of learning and information seeking. We want to conclude by insisting on the potential for understanding information practices through further examination of the multifaceted and intricate relationship between learning and information seeking.

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Libraries

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Abstract

People have recorded information in many ways for many centuries. The media used for these activities have changed with social circumstances and technological developments, as have the opportunities and means to collect and organize recorded knowledge. As a result, libraries have taken many forms over time, moving most recently from primarily paper-based collections to collections that house a wide range of media and experiment with new technologies. Library services have evolved also, and they now engage multiple communities, including children, young adults, and a wide range of educational, governmental, and corporate organizations. Library missions, however, have remained relatively constant: identifying, collecting, organizing, and providing access to materials with personal or social value.

While generally defined as a collection of materials organized so that they may be easily identified and used by an individual or group, libraries have actually taken many forms over time, reflecting the cultures in which they are embedded and propelled by technological innovations and social currents. The commonalities that have survived these changes pertain to collection, organization, and mission, however, even these continue to produce lively discussion.

LIBRARIES OF THE ANCIENT WORLD

In ancient times, merchants and farmers recorded their activities, accounts, possessions, and experiences using materials that needed to be preserved and organized in order to record events and construct meaning. Examples of these include early Sumerian clay tablets dating from 3000 B.C. that contain pictorial representations and, eventually, more standardized symbols; <http://www.upenn.edu/museum/Games/cuneiform.html>).^[1] Excavations conducted at Ugarit, Syria have unearthed deposits of tablets, thought to date close to 1200 B.C., that appear to have served palace and temple as well as personal record keeping purposes.^[2] Another palace collection, the Royal Library of Ashurbanipal, included thousands of tablets dating from the seventh century B.C. The subjects presented in these, found in northern Mesopotamia, ranged widely, including religious texts, poetry, royal decrees, and incantations.^[3] There is some evidence of purposeful collection and subject organization, and the collection is now housed at the British Museum (http://www.britishmuseum.org/research/research_projects/ashurbanipal_library_phase_1.aspx).

Historical records provide more information concerning the famous Royal Library of Alexandria. Assembled both

thoughtfully and aggressively, the collection is believed to have been the largest of its time. The library's contents mirrored the subjects that characterized Greek literature during this period, and works in other languages were frequently copied and translated in order to broaden the scope of the collection. In addition to its unmatched size and scope, this library is notable for the presence of both a cataloging system that provided some degree of subject access and the presence of designated librarians.^[3–5]

As the Roman Empire expanded, few libraries flourished. Those that did so relied on the interests of a small group of powerful leaders and wealthy individuals who moved parts of the plundered Greek collections that interested them to locations of their choosing. In some cases, these libraries appear to have been open to scholars and members of the literate public; however, with the sacking of Rome and decline of the empire most were destroyed or abandoned. The literature they contained, including materials once housed in the Greek libraries, was lost to those who did not live in the Byzantine and Moslem empires.^[6]

MEDIEVAL LIBRARIES

Within the disordered society that followed, the preservation of information was often more explicitly linked to the power of memory than to the security of shelves and buildings. Common cognitive frameworks likened experiences and facts to objects that could be stored in imagined rooms containing categorical or symbolic pointers that facilitated recollection through visualization. Memory-making was a recognized craft, with tools and techniques that were specifically taught and particularly valued within the monastic culture for public use in sermons and personal meditations. Imaginative literature,

including stories, poems, and popular histories, were similarly stored and restored in memory as they evolved through retelling.^[7]

The traditional libraries of this period were typically created and maintained by religious orders. Their collections, often mixtures of scrolls (rolled pieces of paper or papyrus) and codices (an early form of the book, with pages cut and bound together), were usually modest and stored in chests or cupboards with little need for special attention or finding aids. Larger collections accumulated in religious and commercial settings, and in these situations, physical subdivision was typically used to indicate variations in use or topic. Physical descriptions were also sometimes recorded, and a degree of subject classification occurred in some of the larger libraries, including the collections housed at Christchurch, Canterbury, and Durham Cathedral in England.^[8] The value of the collections varied. Reading, and consequently, transcription, was emphasized within the Benedictine order. In some instances, the act of transcription was connected to religious experience.

RENAISSANCE AND EARLY MODERN LIBRARIES

The expansion of trade, the rediscovery of classical literature, and the formation of secular political states combined to contribute to a decline in the relevance of small monastic libraries and the emergence of more familiar modern models. The first, the extensive private library, was directly associated with the concentration of wealth that characterized the Renaissance period. These libraries housed collections created by the Renaissance rulers and commercial princes, including the Laurentian Library commissioned by the Medici pope Clement VII and the personal library of the Duke of Urbino. A royal library may be found today at Windsor Castle (<http://www.royalcollection.org.uk/default.asp?action=article&ID=21>).

The intellectual and artistic awakening that characterized the Renaissance also propelled and transformed university education, almost doubling the number of universities functioning in Europe.^[9] The curricula at the famous universities that were already in place, including the University of Bologna, the University of Paris, and Oxford and Cambridge Universities, were also developing rapidly; and these changes, as well as new pedagogical methods, increased the influence and size of university libraries. The growing availability of printed books also favored larger collections, the appointment of librarians, and the development of printed catalogs.

The national libraries that emerged toward the end of this period were typically created for custodial as well as educational purposes. In many cases, their contents were drawn from the private collections of monarchs, scholars, and statesmen, including Charles the V of France, whose

personal library is linked to the founding of the Bibliothèque Nationale, located in Paris. The Royal Danish Library was built similarly upon gifts from Frederick III of Denmark, and the Vatican Library benefited from the attention of popes Nicholas V and Sixtus IV in the fifteenth century. The British Museum Library was likewise partially assembled from collections owned by the family of Sir Robert Cotton and the Old Royal Library of the English sovereigns. The United States Library of Congress benefited similarly from the collections of President Thomas Jefferson and the scholar Peter Force. Many smaller libraries today benefit from contributions of time and funds from library benefactors. The Placitas Community Library in the U.S. state of New Mexico provides an example of a library that has been created by community members and is staffed primarily by volunteers.

Municipal and town reference libraries also offered limited collections for public use in European cities as early as the sixteenth and seventeenth centuries. However, their contents are reported to have been typically limited to materials of moderate interest. As in the case of the national libraries, the collections were often bequeathed, rather than purposely purchased, and not frequently tended by librarians. Private and circulating libraries were, in contrast, more stable and provided materials of considerable interest.^[3]

NINETEENTH CENTURY LIBRARIES

By the midpoint of the nineteenth century, remnants of each of these models could be easily seen in the libraries that provided services in the United States. Proprietary and subscription libraries, such as the Library Company of Philadelphia, the Boston Athenaeum, and the Charleston Library Society were already well established and provided reading materials, including popular texts and fiction, to their members and subscribers. Mercantile and mechanic's libraries also housed collections intended for the use of young men entering business, commercial tradesmen, and aspiring artisans. In 1850, contemporary reports indicated these libraries numbered over 100, and their joint collections were thought to be in the range of 600,000 volumes.^[10] Although fewer in number today, several of these libraries, including the Boston Athenaeum, continue to provide services on a subscription basis. Technical and business libraries are also a common feature and vital factor within the business and technical communities.

Writers also link Edward Everett and George Ticknor's continental education and familiarity with the great university libraries of Europe to the establishment of the first major public library in the United States in the city of Boston. The influence of the Boston Athenaeum is also evident. Of the members of the Joint City Council

Committee appointed to consider this question and the five citizens appointed to the first Board of Trustees, the mayor, four of the appointed trustees, and five of the City Council members were Athenaeum proprietors. New perspectives concerning the value of workingmen, social and intellectual mobility, and the importance of social harmony and prosperity to an emerging nation provided additional contextual impetus.^[11,12]

Education also figured prominently in the words of those who favored the establishment of public libraries in the United States.^[13] By mid-century, the public school movement, led by Horace Mann, Henry Barnard, and others had gained substantial momentum, and the benefits of extending public education provided a persuasive argument for the establishment of equally public libraries. The growing prominence of an international scientific community based on the premise of collective advancement, acculturation issues related to an increasingly urban and immigrant population, and modern concepts related to the values of democracy and moral stewardship also pointed to a need to extend basic scholarship and educational opportunity. By the end of the nineteenth century, children's reading rooms had been opened in Brookline, Massachusetts, Minneapolis, and Denver. Publicly supported school libraries followed slowly, although in some states, including New York, funds were allocated for this purpose.

MODERN LIBRARIES

Although these categories sometimes overlap, modern libraries typically fall into one of four groupings: school, academic, public, and special.^[6,14] School library media centers are usually located within primary and secondary schools. Their collections are diverse, including children's and young adult materials intended to support classroom activities and curriculum development. School library media centers are also often technology intensive. Their services are intended to be an integral part of their school's instructional process, and their programs contribute through reading guidance and technology instruction to the personal, social, and intellectual development of the students in their schools.

Academic libraries maintain collections and provide services that further the purpose and mission of the higher education institutions to which they belong. Their collections and services are geared to promote faculty research, teaching excellence, and student learning. In recent years, academic libraries have taken advantage of new technologies through contract arrangements that allow them to purchase and provide journals, books, and other materials in electronic format directly to dorms, faculty offices, and student's homes. They also teach technology courses that introduce students to electronic classroom resources, and they often participate in shared acquisition arrangements

through university library consortia that provide some relief from rapidly rising journal prices.

Public libraries in the United States are generally tax-supported institutions with service areas that usually coincide with city and county boundaries. In other cases, public libraries are operated as special district libraries. In both cases, public libraries play a crucial role in their communities, providing services intended to meet the social, educational, and recreational needs of the people residing in their service areas. Their collections typically span the interests of all age groups. Public libraries often produce educational programs, such as the National Endowment for the Humanities Picturing America programs that bring great American art directly to schools and libraries across the United States (<http://www.neh.gov/news/archive/20080227.html>). Public libraries also forge an important link between communities and local, state, and federal government agencies by assuring access to governmental documents and providing access to information about government rules and regulations. In the United States, public, academic and school libraries share a common professional association in the American Library Association (ALA), founded in 1876.

Special libraries vary considerably, but are generally defined by a special purpose and clientele. They are common in business and industry, government, nongovernmental organizations, and associations. Special libraries generally have deep coverage of narrow subject areas of interest to their parent organization, with restricted coverage of other subject areas. Common examples of special libraries are law libraries, medical and hospital libraries, corporate libraries, and museum and research institute libraries. Government agencies, especially at the Federal level, have many specialized libraries as well. Examples of special libraries in the United States include the American Medical Association Library, the Fashion Institute of Technology Gladys Marcus Library, the John F. Kennedy Museum and Library, the Newberry Library (an independent humanities research library), the National Air and Space Museum Library, and the Mayo Clinic Libraries. They are alternatively referred to as information and knowledge centers.

Special libraries are usually funded by their parent organization to meet the needs of that organization. In private industry, the staff and resources are evaluated on the basis of their contribution to the bottom line, as well as their contributions to research, development, and operations. In 1909, special librarians in the United States founded their own association apart from the ALA, and called it the Special Libraries Association.

LIBRARY FUNCTIONS

The tasks required to provide access and services in most of these libraries are generally organized around a set of

core functions typically referred to as technical services, public services, and management. The first of these, technical services, is associated with the identification, assessment, procurement, cataloging, classification, preparation, and maintenance of the materials that constitute the collection. At this time, many of these activities are aided by automation systems and cataloging utilities. Public services include reference services, bibliographic instruction, reader's advisory assistance, community programming, and other services where library staff interact directly with those who use the library. Management functions include marketing, planning, financial management, and human resources development.

The size of these libraries and the content and complexity of their collections typically determine the size and stratification of the staff that performs these activities. However, in most cases there is at least one individual whose duties include some portion or combination of those listed under the heading of *Librarian* once developed for *Dictionary of Occupational Titles* as follows:

Maintains library collections of books, serial publications, documents, audiovisual, and other materials, and assists groups and individuals in locating and obtaining materials: Furnishes information on library activities, facilities, rules, and services. Explains and assists in use of reference sources, such as card or book catalog or book and periodical indexes to locate information. Describes or demonstrates procedures for searching catalog files. Searches catalog files and shelves to locate information. Issues and receives materials for circulation or for use in library. Assembles and arranges displays of books and other library materials. Maintains reference and circulation materials. Answers correspondence on special reference subjects. May compile list of library materials according to subject or interests, using computer. May select, order, catalog, and classify materials. May prepare or assist in preparation of budget. May plan and direct or carry out special projects involving library promotion and outreach activity and be designated Outreach Librarian (library). May be designated according to specialized function as Circulation Librarian (library); Readers'-Advisory-Service Librarian (library); or Reference Librarian (library).
—Source: <http://www.occupationalinfo.org/10/100127014.html> (accessed October 10, 2001)

In the United States, the title *Librarian* is generally reserved for individuals who hold a Masters degree from graduate programs accredited by the ALA. These programs also provide continuing education workshops that introduce new concepts and techniques to currently practicing librarians. Other staffing levels are paraprofessionals and library aids. These individuals perform many duties that are critical to library operations, including shelving, interlibrary loan, circulation, and basic reference activities.

Librarians and others who work in traditional libraries also receive support from a network of professional

associations that represent their interests, facilitate the development of professional standards, create public forums, and provide continuing education materials and opportunities. Most countries have professional library associations, as do many states and provinces. The International Federation of Library Associations and Institutions (founded in 1927) attracts members from a wide range of nations and provides similar services at the international level.

LIBRARY BUILDINGS

Library buildings vary in design and construction. They generally include spaces for their collections, electronic work stations, meeting rooms, staff work rooms, and public reading areas. New building and renovation projects tend to be ongoing, and annual data places the number of public library projects completed in the United States between July 1, 2007 and June 30, 2008, at 183 and the number of new academic libraries at 30. In the case of academic libraries, project costs for new libraries ranged from \$6,190,300 to \$92,000,000. New public library project costs ranged more widely, including project costs close to \$250,000 and \$64,000,000.^[15] Although many communities in the United States enjoy and are proud of libraries built with support from the Carnegie Foundation at the turn of the century,^[16] new libraries and renovation allow libraries to create spaces for the electronic services, children's programs, and community activities, while making their facilities more accessible in terms of the design standards provided in the Americans with Disabilities Act at 28 CFR Part 36, as revised July 1, 1994 (<http://www.ada.gov>). New buildings also provide opportunities to experiment with designs and incorporate modern "green" building materials, often with striking and award-winning architectural results (<http://www.oclc.org/pallas2.tcl.sc.edu/nextspace/010/advocacy.htm>; <http://www.ala.org/ala/mgrps/divs/llama/llamaawards/aiaalibrarybuildings.cfm>).

LIBRARY NUMBERS

While it is difficult to determine the number of entities currently providing library services due to variations in reporting procedures, information related to library operations is typically collected and periodically reported. In the United States, these data are currently provided through a cooperative arrangement between the Institute of Museum and Library Services and the National Center for Education Statistics. The most recent information available places the number of academic libraries in the United States in 2006 at 3617 with holdings estimated at over 1 billion items.^[17] The number of public libraries in 2006 exceeded 9000 with the number of library visits estimated at 1.4 billion and the number of circulation

transactions at slightly over 2 billion.^[18] Similar figures indicate that the number of public schools with library media centers in 2000 approached 77,000, representing 92% of U.S. public schools.^[19]

Similar data are collected for European libraries by LIBECON, an organization funded by the Directorate General for the Information Society of the European Commission within the 5th Framework Programme for Research. Other sources include surveys administered by UNESCO and nationally available statistics. A 2003 synthesis of data collected from these sources by the International Federation of Library Associations provides the following estimates based on service points, which are defined as any library in which a service for users is provided in separate quarters, whether it is an independent library or part of a large administration unit (http://www.uis.unesco.org/ev.php?ID=5622_201&ID2=DO_TOPIC). The data were developed using the numbers most recently reported by each country in the data set used for calculation (see Table 1).

RECENT DEVELOPMENTS AND THE TWENTY-FIRST CENTURY

As libraries developed over many centuries from a very small number to hundreds of thousands, the media they employed to record information also grew and changed significantly. In the early days and over a period of centuries, collected knowledge moved from clay tablets to papyrus to parchment to paper. More recently, over just a few decades, libraries have become homes for audio recordings, games, interactive educational materials, videos, and many other forms of digitized information that can be downloaded and accessed using computers, smart phones, and other devices. There have also been remarkable changes in library services, and many people are now using libraries differently, especially young people who have grown up surrounded by digital media.

Recently, the changes in media have focused on the concept of digital libraries, a term that became popularized

among librarians in 1993 with the publication of a special issue of the *Journal of the American Society for Information Science*. The digitized collections to which the term refers have grown in number for over a decade, and they include small projects such as the historic photographs in the South Carolina Georgetown County Library Digital Library (<http://www.gcdigital.org/browse/index.php#brookgreen>) and large collections, such as the award winning Valley of the Shadows digital library developed by the Institute for Advanced Technology in the Humanities at the University of Virginia (<http://valley.vcdh.virginia.edu>). Both of these collections are of general interest to students and adults who enjoy exploring historical documents. Personal music digital libraries are also popular, and collections of this type fold easily into and extend the traditional purposes of libraries: the identification, collection, and organization of materials in a way that makes information easily available.^[20]

In some cases, the items in digital library collections are originally created in electronic format. In others, the accession of an item involves scanning a physical object into memory and editing the image as needed to produce the highest possible quality. Additional steps include describing the properties and content of the image (adding data about the information resource, known as metadata, for effective retrieval); creating backup copies; and planning for the preservation of the image as systems, software, and standards change over time.

Many traditional “brick and mortar” libraries have also been transformed by these developments, and most are actively adding digital content, including audiovisual material, electronic journals, Web pages, and databases, to their collections for use both on their premises and at remote locations. Downloadable digitized books, self-service functions (such as book renewals and interlibrary loans), and electronic reference services delivered through e-mail or instant messaging offer patrons new levels of convenience and effectively extend these libraries, too, beyond their physical confines.

Innovative libraries are also using a wide range of Web 2.0 technologies, including social networking platforms, podcasts, mashups, and gaming to maintain the centrality of their positions within their communities and foster interactive learning. Building on the popularity of MySpace, Flickr, Wikipedia, and YouTube, these libraries have developed new forms of library programming that extend the walls of traditional libraries and enrich their interiors with opportunities to create knowledge and foster digital learning in an environment that matches busy lifestyles and connects people to people around the world. Digital media and learning is of particular interest to the John D. and Catherine T. MacArthur Foundation (http://digitallearning.macfound.org/site/c.enJLKQNiFiG/b.2029199/k.94AC/Latest_News.htm), and libraries such as the Kankakee Public Library in Illinois are exploring these new library technologies (<http://www.kankakee.lib.il.us/>).

Table 1 Libraries serving the public.

Region	Public	Education	School	National	Total
Library service points					
Africa	797	266	51	15	1,129
Asia	37,063	6,909	29,992	66	74,030
North America	20,081	11,460	78,773	50	110,364
South America	3942	17		32	3991
Oceania	—	—	2	—	2
Europe	205,336	10,161	164,436	178	380,111
Total	267,219	28,813	273,254	341	569,627

Source: Data from UNESCO and Libecon. See http://www.ifla.org/III/wsis/wsis-stats4pub_v.pdf.

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Library and Information Science

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Abstract

Library and information science (LIS) is an interdisciplinary domain concerned with the creation, management, and uses of information in all its forms. Emerging from parallel developments in libraries and in information science, the field now encompasses diverse activities that are part of the information transfer cycle—such as the creation, instantiation, communication, acquisition, organization, management, regulation, preservation, distribution, and use of information. This entry traces the development of LIS from its beginnings in thinking about libraries and the growth of library science as a field. It then explores the nature of information science and the interweaving paths of the two—which eventually encountered the field of communications. The entry concludes with current trends and emerging areas in the field that present both challenges and opportunities in terms of defining LIS as a vast, interdisciplinary area.

INTRODUCTION

Library and information science (LIS) is an interdisciplinary domain concerned with the creation, management, and uses of information in all its forms. Taught in colleges and universities at the undergraduate and graduate levels and a subject of research in both industry and academia, LIS brings together a variety of theoretical approaches. Its focus is on representations of information—the documentary evidence of civilization—as well as on the technologies and organizations through which information becomes accessible.

The research domain is young, beginning in the late 1960s and early 1970s, but its roots lie in the nineteenth century. As can be seen in Fig. 1, LIS represents the intersection of library science, information science (originally called documentation), and communications. The first, library science, has sought to solve the problems of organizing and providing access to collections of materials. The second, information science, seeks to understand the properties of information and how to manage it. Aspects of the field of communication, always a facet of the first two, became interwoven with both as library science and information science matured and increasingly intersected with one another.

The field of LIS can be characterized as “user-focused.” The concern is not just for the isolated information artifact—for example, data, reports, books, video, and museum objects. Instead, the social, technical, and cultural systems that structure recorded knowledge, making it available and useful to the people who want or need it—or even happen upon it—are considered. Historically LIS

has focused on technical systems, such as cataloging and classification, as well as organization systems such as the development and management of collections and user services. Legal systems that structure information access such as licensing, intellectual property rights, and information policy are central to the domain, particularly in the current information landscape that relies heavily on digital information and Internet technologies. LIS researchers also study ways in which the use of indexes, citations, and other bibliographic information can reveal such things as the relationship between disciplines, networks of scholarship, and the value of information in decision-making. LIS encompasses research on the social and cultural contexts of information, considering implications of race, ethnicity, class, gender, and sexuality for information creation, transfer, and use. Such questions lead beyond the initial concerns of the field, demonstrating the flexibility of LIS to meet the changing role of information in society.

The LIS domain extends to the structures of the institutions that make information available and usable—such as libraries, archives, and museums, whose primary purpose is collecting, preserving, organizing, and making useful information and cultural artifacts. The field also includes systems—such as information resource management—within business and organizations.

LIS grew out of philosophies of the Enlightenment. Its foundations were built in the United States in the late eighteenth and throughout the nineteenth century. Thomas Jefferson, James Madison, and other founders viewed both libraries and information as important to the new democracy. The Library of Congress was established in 1800

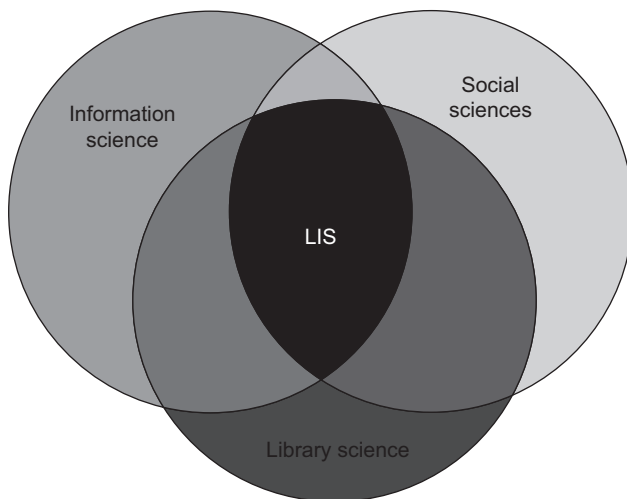


Fig. 1 The domain of LIS.

during the administration of John Adams; article 1, section 8 of the Constitution established copyright protection to “promote science and the useful arts.” Government support for the U.S. mail system, including roads over which the mail was carried, and for national surveys (including the Lewis and Clark expedition) are among the ways in which the new federal government promoted the creation and dissemination of information.

During the nineteenth century, scientific discovery and exploration grew rapidly, fueled by government subsidies and industrial growth. The U.S. government published 100,000 different titles between 1774 and 1881,^[1] and the Government Printing Office printed 41 million copies of their publications by 1894. Research universities and library collections grew exponentially. Between 1850 and 1875, local communities and philanthropists created 2240 public libraries.^[2]

FOUNDATIONS: 1880–1960

Library Science

Libraries are collections of recorded knowledge, organized for use. Libraries may exist in buildings of bricks and mortar or as digital collections held in the memory of one or more connected computers. Whatever the form or format, libraries are intended to provide access to cultural and scientific materials for an audience—for users who will take that information for enjoyment, increased understanding, or as the basis for creating new information.

The nineteenth century was a productive period for the development of tools for organizing information. These included William Frederick Poole’s (1821–1894) *Index to Periodical Literature*, begun in 1848, and several important indexing and abstracting services, among them *Index*

Medicus (1879) and *Engineering Index* (1896). The *Library of Congress Classification* and *Dewey Decimal Classification* systems were developed in the late nineteenth century to help manage the growth of library collections. By the early twentieth century, the Library of Congress published catalog records from their collections for use by other libraries, a practice that encouraged standardization in library practice and contributed to the possibilities of automating library work.

In 1887 library science took the first step from education by apprenticeship—the usual way one gained occupational competence in nineteenth century America—to an academic area within higher education. Melvil Dewey (1851–1931) created the School of Library Economy at Columbia University in 1887.^[3–4] At its inception, library science focused on history and bibliography—the description and classification of recorded knowledge. (These areas remain the primary focus of library science in many countries, particularly those countries formerly associated with the Soviet Union.) The academic field did not begin to develop until the Carnegie Corporation funded two critical studies on the quality of library science education. The second of these, *Training for Library Service* (1923), by Charles C. Williamson (1877–1965), is often credited with bringing about the changes necessary for library science to become a mature academic field.^[5]

In 1926 the Carnegie Corporation provided funding to create the Graduate Library School (GLS) at the University of Chicago. It was the first such program to offer a doctoral program and played a significant role in opening the field to change during the 1930s. Library science became more interdisciplinary and began to develop deeper theoretical foundations and more substantive research. The GLS faculty included Pierce Butler (1884–1953), Douglas Waples (1893–1978) and, for a time, Bernard Berelson (1912–1979) who received his doctoral degree from the GLS in 1941. These three applied various methods from the social and behavioral sciences to the examination of libraries. Their differing views were widely influential, partly because of their doctoral students and partly because of their research, including *The Library’s Public* (1949), of which Berelson was a principal author. The monograph was one of seven resulting from a significant social science investigation known as *The Public Library Inquiry*.

Two of those Chicago graduate students became faculty colleagues at Western Reserve University. Dean Jesse Shera (1903–1982) and Professor Margaret Egan (1905–1959) played a critical role in bringing the bibliographic history of library science together with communication. In a classic 1952 article,^[6] they argue that bibliography has a social purpose: an approach they called “social epistemology.” Bibliography does not exist for a small group of users, but is the way in which graphic communications move through society and contribute to shaping that society.

Information Science

Information Science is concerned with information itself and its representations—what information is; how to represent it; how to understand its functions; how it is used; and how to design systems to organize, classify, and retrieve information. Noted information scientist Harold Borko stated, it “is that discipline that investigates the properties and behavior of information, the forces governing the flow of information, and the means of processing information for optimum accessibility and usability.”^[7]

The history of information science embodies technological developments, notably those in computing, theoretical advances in mathematics and finding ways to measure information, and innovations in retrieving information for research and scholarship. Historically, much of the work of information science was concerned with scientific, technical, and medical information.

Belgian lawyer Paul Otlet (1868–1944) is credited with identifying the field of documentation, a term more commonly used in Europe and the precursor to the phrase “information science.” With his colleague Henri La Fontaine (1854–1943), Otlet founded the Institut International de Bibliographie in 1895 and created the multilingual *Universal Decimal Classification* (1905). Both were created to provide universal access to all recorded knowledge, to support Otlet’s ambition to promote world peace.

It was not until the founding of the American Documentation Institute (ADI) in 1937 by Watson Davis (1896–1967) that the field began to coalesce in America. Prior to its founding, developments in information science were primarily the result of individual invention, such as the Hollerith punch cards for sorting data or independent organizations, and work of scholarly societies like the American Chemical Society. Originally a service organization with particular interest in microform technology, ADI’s membership began with representatives from the government, professional societies, and foundations concerned about similar problems in information management. With a particular interest in scientific communication, ADI fostered collaboration among its members and sponsored research. In 1952, ADI also became a professional society by admitting individual members.

Most of the early developers of documentation and information science had a background in science and industry, and were involved in trying to solve problems of managing large amounts of data and information resources, often for the government. A driving force for their work was scientific research and development during and after World War II, with the attendant growth in the publication of scientific information. The military and defense industries provided significant funding not only for technical but also theoretical research in information storage and retrieval.

Information science historians often credit two researchers with post–World War II advances in their field. The first, Vannevar Bush (1890–1974), described his conception of the memex system, outlined in *As We May Think*.^[8] The system, based on microform technology, was intended to make human knowledge easily and widely accessible. Contemporary scholars note that Otlet promoted many of Bush’s ideas earlier, but it is Bush who has received most of the credit for anticipating the development of the World Wide Web and other contemporary technologies.

The second was Claude Shannon (1916–2001), whose 1948 paper *A Mathematical Theory of Communication*^[9] provided the foundation for information scientists seeking to quantify information and to understand its properties. His book, written with communications researcher Warren Weaver (1894–1978), also entitled *A Mathematical Theory of Communication*,^[10] became the basis for significant research and change in social science work in communication. The field of LIS expanded well beyond these original models as it embraced the field of communications in its broader forms.

Communications

Literacy, book history, reading—tools for communicating history, culture, and information—have always been inextricably connected to libraries. By the late nineteenth century, librarians were considering their role in communicating with users, not just conserving materials. At the first American Library Association conference in 1876, for example, Samuel Green (1837–1918), then director of the Worcester Free Public Library, presented a paper entitled “The Desirability of Establishing Personal Intercourse and Relations between Librarian and Reader in Popular Libraries.”^[11] As early as 1910 librarians conducted studies of the types of books their users were reading; such studies became common in both the United States and Europe.

Both library science and documentation were historically thought to be related to communication, but communications research did not begin to mature until the 1940s. Histories of communication frequently mention the contributions of University of Chicago Professor Douglas Waples’ studies of reading conducted in the 1930s and 1940s. One of the areas of research in The Public Library Inquiry was *The Effects of the Mass Media* (1949)—a study on what was happening to popular taste and its effects on book reading and other library-related matters.

In 1955, Western Reserve University created the Center for Documentation and Communication Research with an explicit intention to bring those two disciplines—information science and communications—together. Allen Kent (1921–) became associate director of the Center, performing important experiments in information

retrieval before moving to the University of Pittsburgh (1963) where he established the Department of Information Science in 1970. It would not be until the 1960s and 1970s that researchers began significant research representing communication, library science, and information science linked together.

EMERGENCE OF LIS

LIS theory and research coalesced over the last 40 years of the twentieth century. It was a time of rapid technological development that made more complex both managing information and making it accessible. In the early 1960s, works like Marshall McLuhan's (1911–1980) *Gutenberg Galaxy* (1962) and Fritz Machlup's (1902–1983) *The Production and Distribution of Knowledge in the United States*, (1962) spurred public imagination about the role of information in society. The problems of classifying and organizing data, of creating tools for retrieval, and of designing them so they could be used became the concern of many other researchers disconnected from the LIS community. Responses by a number of the U.S. and European library schools to this implicit challenge became important to LIS development.

In the early 1960s, two U.S. LIS schools developed research centers: the Library Research Center at the University of Illinois (1961) and the Institute of Library Research at the University of California (1964). Each provided research opportunities for faculty and student. At the University of Sheffield, England, the Centre for Research in User Studies (CRUS) within the Postgraduate School of Librarianship and Information Studies (1976) provided a similar foundation.

Federal funding for doctoral studies in LIS and for research in both LIS increased dramatically beginning in the 1960s. Over less than a decade, the profile of LIS faculty shifted dramatically with an increasing number holding doctoral degrees and actively engaged in research.^[12]

Some of the leading post–World War II information scientists left government, business, and industry for faculty positions in LIS. Besides Allen Kent's association with Case Western and Pittsburgh Universities, other examples are Robert Hayes (1926–), president of Advanced Information Systems joining the University of California at Los Angeles's faculty, Pauline Cochrane's (1929–) move from the American Institute of Physics to Syracuse University (1966), and F.W. Lancaster's (1933–) recruitment to the University of Illinois in 1970 after experience with the Cranfield Experiments (1962) and the *MEDLARS Evaluation Project of the National Library of Medicine* (1965–1968).

Cross-disciplinary faculty teaching was equally enriching to LIS programs. Stanford University communications professor William Paisley taught, for example, at

Berkeley's School of Librarianship. Doctoral students from Syracuse University's newly named School of Information Studies took advantage of computer scientist Gerald Salton's lectures at Cornell University.

Most significant for what LIS has become today was not, however, the addition of information science to the library science curriculum, but LIS's shift away from a focus on libraries and scholarly communication to one on information. Research ranged from that on information retrieval to the accuracy of reference service. Throughout the 1970s many of the schools, formerly considered "library schools" added the word information to their name and broadened their curricula. In 1968, the American Documentation Institute became the American Society for Information Science. In 1970, a U.S. Government agency, The National Commission for Library and Information Science, was formally charged with research and policy regarding the two.

Robert S. Taylor (1919–2009), who in 1972 became dean of what is now the School of Information Studies at Syracuse University, led the evolution of LIS from a library-centered field to one that revolves around the cycle of information transfer (see Fig. 2). In this model, LIS is concerned with all of the processes and institutions that finally make recorded knowledge available and accessible. These include not only the publication of scholarship and creative works, but also information storage and retrieval and libraries as a medium of distribution. Information transfer depends, for example, on social policy, including copyright law and censorship activities; it depends on the design of buildings or websites and user education to make information easy to use, and on the coding and formatting of electronic materials so they might be retrieved. The adoption of this new model was not immediate and has not been adopted by all LIS schools, but it represents what LIS has become as a domain.

The use of information and its users has become a central concern of the domain in the process of this shift.

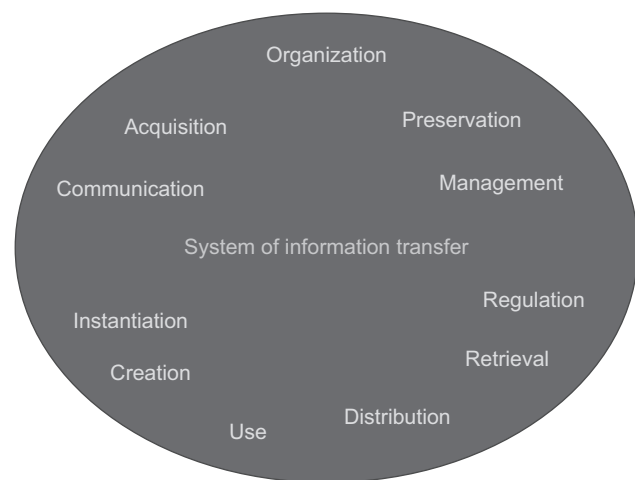


Fig. 2 The information transfer cycle.

Research of communication scholars like Paisley and Brenda Dervin (1938–) and their students became increasingly important to LIS research. Dervin and Nilan's seminal 1986 article^[13] identified the shift in LIS research, building on Taylor and Paisley, to widespread concern about information needs, seeking, and use. This more theoretically grounded research has led LIS education toward its user focus.

A particularly rich example of this change is the work of information behavior researchers who are both interdisciplinary in their theoretical approaches and also in the community of scholars with which they associate. Their work is presented at Information Seeking in Context (ISIC) conferences as well as in information science journals such as the *Journal of Documentation* and the *Journal of the American Society for Information Science and Technology*. This research stream has matured well beyond Shannon and Weaver through the work of such theorists as T.D. Wilson (models of information behavior), Brenda Dervin^[13] (evolving sense-making theory), and Carol Kuhlthau^[14] (information search process). Chun Wei Choo has provided one integrated model of information behavior research.^[15]

As the field became more theoretically grounded, interdisciplinary ties among researchers were strengthened. One important way that these linkages have been expressed is through the institutional structuring of LIS education, with some LIS programs being housed in schools or colleges of education or communication. For example, in 1982 Rutgers Graduate School of Library and Information Studies merged with the School of Communication Studies and the Department of Urban Journalism to form a new School of Communication and Information. Currently, there are approximately 15 accredited LIS programs following similar institutional models as part of education or communication schools and colleges. These interdisciplinary mergers are often controversial from a domain perspective, though they can serve to highlight some of the shared values across LIS and sister disciplines. In terms of LIS and communication fields, there are particular synergies to be found between LIS and journalism, both of which share a mission of training professionals according to an ethical code; value access to information; and are highly responsive to a rapidly changing information technology landscape.

Equally important, as the field has become more theoretical, LIS research has become cumulative and deeper, utilizing a diversity of theories and methods that were not historically emphasized in the discipline. For instance, the inclusion of theoretical approaches from critical studies, cultural studies, ethnic studies, and gender studies has helped LIS researchers approach domain-specific problems from new perspectives. These perspectives serve important functions in privileging under-represented voices in the field, surfacing counter narratives, and revealing the ideological commitments undergirding LIS

technologies and practices as in Hope Olson's^[16] work on gender and classification.

Shifting away from libraries as the center of LIS research and education did not remove libraries from the domain. Library and information science is built on such areas as cataloging, classification, and collection development that derive from library research, theory, and practice. Libraries, both virtual and concrete, are critical repositories of information in all forms. At the same time the shift in LIS programs starting in the 1970s has highlighted longstanding tensions between library science and information science. The signature for librarians is their code of ethics that emphasizes a commitment to intellectual freedom, resistance to censorship, user privacy, and equity of access to information. Information science, with its roots in business and industry, is without such a commitment. Some librarians express concerns that LIS has abandoned them by removing libraries from their center and, in the process, abandoning professional norms. Of particular concern is whether LIS programs adequately prepare students for practice in libraries.

LIS educators historically have sought to analyze and improve professional practice in libraries. That has not diminished today, although important developments of research in information retrieval, human–computer interaction, and other such areas may be invisible in day-to-day practice. Most visible and immediately important to librarians is work such as that of Kuhlthau (1937–)^[14] on the information search process of users. Notable also are the strong contributions to the practice of reference, including the work of Dervin and Dewdney,^[17] Durrance's many works on community information needs and services, and most recently analyses of the return on investment in public libraries carried out by Jose-Marie Griffiths and Donald W. King (1932–).

The growth of the Internet and of digital collections have reinforced the continued importance of libraries to LIS. They also made LIS an increasingly attractive target of opportunity for disciplines outside LIS. In 1996 the National Science Foundation (NSF) awarded the first round of four-year grants under its “digital library initiative.” The purpose of NSF was to “dramatically advance the means to collect, store, and organize information in digital forms, and make it available for searching, retrieval, and processing via communication networks—all in user-friendly ways.” The initiative, lasting eight years, along with a similar joint effort of NSF and the Joint Information Systems Committee in the United Kingdom, advanced research in LIS, stabilized the domain, and enhanced collaborations outside traditional LIS schools.

Federal funding for LIS in the 1960s and 1970s helped transform LIS in the United States by spurring research and doctoral study. Similarly, funding in the 1990s later contributed to expanding the domain of LIS and provided strong incentives for other disciplines to take up problems in LIS. Andrew Abbott's 1988 study, *The System of*

Professions,^[18] remains one of the most cogent sociological analyses of the challenges LIS has faced.

In 2005 a group of university programs in LIS, informatics, computer science, communications, and public policy formed the “iSchools caucus” which governs the iSchools organization, currently over 55 member schools, internationally. The website of the caucus refers to their focus on “iField,” an academic area of study and professional preparation in the intersection of technology, information, and people. Almost two-thirds of caucus members offer a program to prepare librarians that is accredited by the American Library Association. The focus of the iSchools, however, is on the broad domain knowledge of LIS. The iSchools reflect a movement to rebrand LIS as an “information” field, which remains widely debated in the field. Some librarians and library researchers fear that the rebranding represents a move toward higher status corporate partners, potentially marginalizing the position of libraries as a public good and threatening the core mission of service in the profession.

THE PRESENT

Throughout LIS’s history of creating and establishing itself, scholars have debated such questions as how to define information and communication and whether there is evidence that the related fields are truly converging. These questions are beyond the scope of this entry. Despite the debates, LIS teaching and research continues to expand into newly developing areas of information organization and use. Among those areas of expansion are discipline-specific applications of informatics—for example, medical informatics, social informatics, and community informatics—the study of design, application, and use of information technology within specific domains. Another domain-specific area of development is data curation—the management of data through the information transfer cycle including data creation, management, preservation, and use. The fields of application are new, but essentially replicate in new disciplines approaches that historically were applied to libraries, and information retrieval research is now addressing issues in digital humanities that raise new questions about ontologies and retrieval of text.

CONCLUSION

The field of LIS began in the United States; it grew initially out of the interaction of library science and information science. Although the development of LIS in countries outside the United States has been constrained by different educational systems, scholars particularly in the Nordic countries and Britain have conducted significant LIS research, notably in the Department of Information Studies

at Sheffield University (England) and the Danish Royal School of Library and Information Science. Within the past two decades, both Finnish and Norwegian universities have created schools and departments apart from library education devoted to information science.

In the United States, a wide range of Federal agencies, foundations, and businesses now support LIS research. These reflect the new questions being raised in both teaching and research within the domain. In early 2015, a conference sponsored by the Institute of Museum and Library Services focused on “Re-visioning Library and Information Science Education.” Bringing together leaders from the multiple domains of LIS, the conference considered trends shaping LIS and LIS education such as the growth of digital content, social media, search tools, big data, mobile technologies, diversity, and globalization. This conference reflects a strong commitment within LIS to “not only keep pace, but take the lead.”^[19]

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Library and Information Technology Association (LITA)

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Abstract

The Library and Information Technology Association (LITA) is a division of the American Library Association (ALA), established in 1966. Through publishing, programs, training, national conferences, and strategic partnerships, LITA educates, serves, and reaches out to its members, ALA members and divisions, and the entire library and information technology community through the promotion and implementation of library automation and technology.

INTRODUCTION

The Library and Information Technology Association (LITA) is a division of the American Library Association (ALA). The division began in 1966 as the Information Science and Automation Division (ISAD) and became LITA in 1972. LITA's mission statement, adopted in May 1999, begins with its strategic mission "to educate, serve, and reach out" to the library community through the use and promotion of information technology. LITA celebrated its fiftieth anniversary in 2016.

LITA VISION

As the center of expertise about information technology, LITA leads in exploring and enabling new technologies to empower libraries. LITA members use the promise of technology to deliver dynamic library collections and services.

LITA MISSION

LITA educates, serves, and reaches out to its members, other ALA members and divisions, and the entire library and information community through its publications, programs, and other activities designed to promote, develop, and aid in the implementation of library and information technology.

FUNCTION STATEMENT

LITA is concerned with the planning, development, design, application, and integration of technologies within the library and information environment, with the impact of emerging technologies on library service, and with the effect of automated technologies on people. Its major

focus is on interdisciplinary issues and emerging technologies. LITA disseminates information, provides educational opportunities for learning about information technologies and forums for the discussion of common concerns, monitors new technologies with potential applications in information science, encourages and fosters research, promotes the development of technical standards, and examines the effects of library systems and networks.

MEMBERSHIP

LITA membership (Table 1), like any organization, has increased and decreased over the course of its existence. Although LITA was established in 1966, members were not able to join until 1967. Initial membership started at 2334 people, and LITA membership peaked in 1993 with 5802 members. LITA's membership, like all the other ALA divisions, has been in decline since the early 2000s.

GOVERNING STRUCTURE

LITA is governed by a Board of Directors headed by the president (Table 2). In addition to the president, the Board includes the vice-president/president-elect, the immediate past president, the LITA/ALA councilor (representative of LITA on ALA's governing council), and seven directors at large. Ex officio members include the executive director (Table 3) of the division, the chair of the Bylaws and Organization Committee, and the chair of the Financial Advisory Committee.

The Executive Committee of the board is composed of the president, the vice-president, the past president, the LITA/ALA councilor, and one director chosen by the board each year, with the executive director being an ex officio member. The Board of Directors meets virtually and at every ALA Annual and Midwinter Conference, as

Table 1 Information Science and Automation Division/
Library and Information Technology Association membership

Date	Total membership
2014	2,900
2013	3,116
2012	3,258
2011	3,444
2010	3,412
2009	3,587
2008	3,916
2007	4,338
2006	4,106
2005	4,054
2004	4,414
2003	4,611
2002	4,735
2001	4,910
2000	4,757

does the Executive Committee. In addition, the Executive Committee meets virtually every spring and in-person in the fall near the ALA headquarters in Chicago, IL. The functions of LITA are carried out by approximately 50 committees and interest groups, most of which conduct business and hold meetings virtually, as well as at every ALA Conference.

HISTORY

Early Years

LITA's history, through approximately 1973, was delineated in the first edition of the *Encyclopedia of Library and Information Sciences*; the entry was entitled "Information Science and Automation Division (ISAD)." Going back to its earliest incarnation as the autonomous and unaffiliated "Coalition on Library Automation (COLA)" in the early 1960s, the group that would lay the foundation for today's LITA grappled with an issue that is still with the division today, that is, interest in technology runs across existing ALA divisions and types of libraries. From its inception, LITA has maintained a balance of service to other divisions, the library technology, and vendor community, and the ALA membership as a whole. To that end, LITA has consistently worked to develop and maintain a flexible, adaptable structure that focuses on facilitating education and information exchange to help those interested in the use of computer technology in library and information-related organizations to better perform their work.

In the same year as the retirement of ISAD's first executive secretary, 1973, then division president Ralph Shoffner appointed an Objectives Committee chaired by Stephen Salmon, ISAD's first president, to determine whether the division should continue. Concluding that the division's functions warranted continuation, new

Table 2 Information Science and Automation Division/
Library and Information Technology Association presidents

Date	Name
1966–1967	Stephen R. Salmon
1967–1968	Joseph Becker
1968–1969	Russell Shank
1969–1970	Robert M. Hayes
1970–1971	Richard DeGennaro
1971–1972	Jesse H. Shera
1972–1973	Ralph M. Shoffner
1973–1975	Frederick G. Kilgour
1975–1976	Henriette B. Avram
1976–1977	Joseph A. Rosenthal
1977–1978	Maurice J. Freedman
1978–1979	Susan K. Martin
1979–1980	Barbara E. Markuson
1980–1981	S. Michael Malinconico
1981–1982	Brigitte L. Kenney
1982–1983	Carolyn M. Gray
1983–1984	Kenneth Dowlin
1984–1985	Nancy L. Eaton
1985–1986	Lois M. Kershner
1986–1987	Raymond DeBuse
1987–1988	William Gray Potter
1988–1989	Sherrie Schmidt
1989–1990	Carol A. Parkhurst
1990–1991	Jo-Ann Michalak
1991–1992	Paul Evan Peters
1992–1993	Walt Crawford
1993–1994	Tamara J. Miller
1994–1995	Nancy K. Roderer
1995–1996	Michele Dalehite (née Newberry)
1996–1997	Thomas W. Leonhardt
1997–1998	Linda D. Miller
1998–1999	Barbra B. Higginbotham
1999–2000	Michael J. Gorman
2000–2001	Sara L. Randall
2001–2002	Florence J. Wilson
2002–2003	Pat Ensor
2003–2004	Thomas Wilson
2004–2005	Colby Riggs
2005–2006	Patrick Mullin
2006–2007	Bonnie Postlethwaite
2007–2008	Mark Beatty
2008–2009	Andrew K. Pace
2009–2010	Michelle Frisque
2010–2011	Karen Starr
2011–2012	Colleen Cudy
2012–2013	Zoe Stewart-Marshall
2013–2014	Cindi Trainor Blyberg
2014–2015	Rachel E. Vacek
2015–2016	Thomas Dowling
2016–2017	Aimee Fifarek
2017–2018	Andromeda Yelton
2018–2019	Bohyun Kim

objectives were created that highlighted ISAD's programs, advisory services, publications, discussion groups, and standards promotion; the group's objectives were then revised accordingly.

Table 3 Information Science and Automation Division/Library and Information Technology Association executive directors

Date	Name
1967–1973	Don S. Culbertson
1973–1986	Donald P. Hammer
1987–1995	Linda J. Knutson
1996	Lillian Lewis (acting)
1996–2001	Jacqueline Mundell
2001–2015	Mary Taylor
2015–	Jenny Levine

Following the restatement of purpose, and with the approval of the membership, ISAD changed its name to the Library and Information Technology Association. Various early division periodical publications were subsumed in 1973 into the referred *Journal of Library Automation (JOLA)*. In 1982, the journal's editors selected a new name more reflective of the name change of the division and *JOLA* became *Information Technology and Libraries (ITAL)*; Table 4). A *LITA Newsletter* was published from 1979 to 2000. Issues from Spring 1995 to Summer 2000 were published electronically, with issues from Winter 1997 to Summer 2000 being available only in electronic format. An abbreviated supplement, *LITA Notes*, was published as part of *ITAL* from 1997 through March 2000. The *LITA Newsletter* editors included Pat Barkalow, Carol Parkhurst, Walt Crawford, Gail Junion-Metz, and Martin Kalfatovic. Since 2000, the LITA news function has been subsumed by the divisional website and blog, as well as periodic electronic mailings to the membership.

With the goal of greater member participation in the division, and with objectives and a name change firmly in place, LITA underwent a major reorganization in 1984–1985. Many of the committees were restructured, and LITA went back to its COLA discussion group roots to encourage the creation of varied interest groups. Ten or more LITA members could petition to form an interest group in a library/information technology topic; if the

interest group's formation was approved—and the vast majority are to this day—by the LITA Board, the group can elect officers, organize discussions, put on programs, create publications, and perform other educational and information exchange functions. New interest groups are formed and disbanded on a regular basis; at any given time, 15–20 interest groups are active in the division. This model reflects the ever-changing landscape in information technology.

Another major initiative that began in the late 1970s/early 1980s is the provision of sponsored awards and scholarships that support achievement and study in library and information technology. Stemming from this time period are the LITA/Gaylord Award for Achievement in Library and Information Technology, LITA participation in the multidivisional Hugh C. Atkinson Memorial Award, and the LITA/Computer Library Services, Inc. (later the LITA/GEAC) scholarship to encourage entry into the library automation field.

High demand for workshops and face-to-face discussions also led to the creation of National Conferences in the 1980s and 1990s. These large-scale multiple-day gatherings involved presentation of papers, vendor exhibits, workshops, and computer demonstrations. The national conferences in Baltimore (1983), Boston (1988), and Denver (1992) were well attended and financially successful.

The Internet Era

Trends within the LITA division can be tracked along with those throughout the other divisions, libraries, and even the world at large. These trends and influences include the decline of the spending power of libraries, an increasingly rapid pace of change in technology, the growing attention to empowering diverse population groups, the advent and spectacular growth of the Internet as a worldwide network, the rapid improvements in computing power, and a resulting exponential increase in the amount of available electronic content.

As it became clear that no area of libraries—and no type of library—would be untouched by information technology, and, therefore, that most library organizations became concerned by technology topics, LITA shifted its focus and identity to leadership in the more advanced use of technology in libraries and other related organizations. The 1990s also cemented the role of systems librarians—degreed professionals with added expertise in hardware, software, networks, and computing—establishing LITA as the logical division for these professionals' participation. LITA also emerged as a home for a growing number of information science and IT professionals who are not librarians.

In 1996, the supposed last LITA National Conference was cosponsored by the Library Administration and Management Association division and held in Pittsburgh,

Table 4 *Journal of Library Automation/Information Technology and Libraries* editors

Date	Name
1968–1971	Frederick G. Kilgour
1972	A.J. Goldwyn
1973–1977, 1980	Susan K. Martin
1978–1979	William D. Mathews
1981–1983	Brian Aveney
1984–1989	William Gray Potter
1990–1995	Thomas W. Leonhardt
1996–1998	James J. Kopp
1999–2004	Dan K. Marmion
2004–2007	John Webb
2007–2011	Marc Truitt
2011–2017	Robert Gerrity

Table 5 LITA National conference/national forum venues

LITA National conference/national forum	
Date	Place
1983	Baltimore, Maryland
1988	Boston, Massachusetts
1992	Denver, Colorado
1996	Pittsburgh, Pennsylvania
1998	Oakland, California
1999	Raleigh, North Carolina
2000	Portland, Oregon
2001	Milwaukee, Wisconsin
2002	Houston, Texas
2003	Norfolk, Virginia
2004	St. Louis, Missouri
2005	San Jose, California
2006	Nashville, Tennessee
2007	Denver, Colorado
2008	Cincinnati, Ohio
2009	Salt Lake City, Utah
2010	Atlanta, Georgia
2011	Columbus, Ohio
2012	Louisville, Kentucky
2013	St. Louis, Missouri
2014	Albuquerque, New Mexico
2015	Minneapolis, Minnesota
2016	Fort Worth, Texas
2017	Denver, Colorado

Pennsylvania. Despite good attendance and feedback from participants, the expenses and the 3-yr planning cycle of the endeavor led LITA to determine that this was not the best method for continuing its own major conference. In 1998, LITA had its first annual National Forum. Taking place in Oakland, California, the more focused format was an immediate success. Education opportunities, attendee satisfaction, divisional revenue, and the development of training opportunities through regional institutes and preconferences continue to make LITA Forum a popular annual event (Table 5).

LITA became an early supporter of the move to encourage diversity in the library profession by creating the LITA/OCLC and LITA/Library Systems and Services, Inc. minority scholarships in Library and Information Technology. Additional awards and scholarships created in the 1990s have included the LITA/Ex Libris Student Writing Award, the Frederick G. Kilgour Award for Research in Library and Information Technology (jointly sponsored by LITA and OCLC), and the LITA/Christian Larew Memorial Scholarship (sponsored by Baker & Taylor). The LITA/Library Hi Tech Award (sponsored by LITA and Emerald Press) rewards innovation and scholarship in library technology. Awarded each year, these competitive awards not only engage the partnership of sponsors, but give a meaningful leg up to new professionals and reward those most active in library technology. The LITA/Brett Butler Entrepreneurship Award (sponsored by LITA and Gale) was retired in 2009.

LITA was also a pioneer among library associations in the area of electronic communications. An electronic edition of the *LITA Newsletter* was first published in 1995. The first electronic-only serial publication by a division of ALA, Telecommunication Electronic Reviews (TER), appeared in 1994 and spawned many imitators. In 2009, LITA retired TER in favor of community-based blog and wiki communication platforms. LITA garnered the thanks of ALA members at large by originating Internet rooms at ALA conferences, setting up and managing the Internet rooms at seven ALA Annual and Midwinter conferences from 1993 through 1996.

In 1996, the LITA website, <http://www.lita.org>, was created, as was the LITA electronic discussion list, LITA-L. In 1998, LITA created an online jobs list—"Jobs in Library and Information Technology" that has been heavily used by job posters and job seekers since then.

Twenty-First Century

With the advent of weblogs, social software, and group-edited wiki sites, LITA established an online presence for open participation and discussion of library technology issues with its LITA Blog (litablog.org) in 2005 and LITA Wiki (wikis.ala.org/lita) in 2006. Many of the members instrumental in establishing a foothold with these technologies established the Blogs, Interactive Groupware Wikis Interest Group (BIGWIG). In 2008, BIGWIG launched Your BIGWIG (yourbigwig.com) and established itself as the leading social software discussion group within ALA. BIGWIG hosted the extremely well attended Social Software Showcase, an "unconference" that occurred both virtually and physically at every ALA Annual Conference. However, as more structure for social technology was needed within LITA, and as other divisions, roundtables, committees, and interest groups embraced social software, BIGWIG's purpose had been served, and in 2011, the interest group retired.

In 2009, ALA had also created a new tool called ALA Connect (connect.ala.org), which was intended to be the centralized space where both unofficial and official ALA groups are able to work together online. This content management system, built on the open-source Drupal platform, greatly impacted LITA. Having multiple web-based tools for different purposes can be helpful, but managing content and having working spaces across a blog, wiki, website, and within ALA Connect seemed to be a few too many places. It became unclear on each tool's purpose. It was decided in 2011 that the LITA Web Coordinating Committee would manage the Blog and Wiki. Then in 2012, the Wiki was retired and LITA members were encouraged to use ALA Connect as a workspace for all committee and interest group business.

ALA Connect has also served the LITA Board and Executive Committee as a place to organize and share meeting notes, vote on issues, and engage with the

community in new ways. Posts can be marked as public or private, and users can add comments, attachments, create polls, make meeting time requests, or even chat, all within ALA Connect. It has significantly helped make more accessible the intuitional memory of LITA's digital presence.

During the mid-2000s, capturing and then immediately sharing the digital recordings of speakers, board meetings, and major events like the Top Technology Trends, the President's Program, or keynote speakers at the LITA Forum became extremely important to LITA. Travel to conferences was financially challenging for many people at this time due to library travel funds being reduced or cut completely. Consequently, the desire to participate virtually (such as watching a live stream while discussing the event through a Twitter backchannel) was increasing. Many of LITA's educational events were streamed live, or were recorded and made available at later times. Jason Griffey, LITA Board Member (2011–2014), was the primary source for audio and video equipment, provided the recording expertise and posted the digitized events for LITA for most of the past decade.

During the late 2000s, LITA's online presence continued to expand. LITA engaged and informed current and potential members on social media sites like YouTube, Twitter, and Facebook. Additionally, more educational opportunities were being created for virtual consumption. Perhaps the most significant online transition was that of LITA's peer-reviewed journal, *Information Technology and Libraries (ITAL)*, which moved from a print format to a free journal with unrestricted online access. The transition to being an open-access journal took approximately 2 yrs, between 2010 and 2012. Embarking on an e-publishing model only has helped ensure the long-term viability of *ITAL* by making it more accessible, more current, more relevant, and more environmentally friendly. *ITAL* continues to feature high-quality articles that have undergone a rigorous peer-review process, but it also expanded content to include more case studies, commentary, and information about topics and trends of interest to the LITA community and beyond. Although many LITA members helped with the open-access transition, key people included Kristin Antelman, Bob Gerrity, Maurice York, and Michelle Frisque.

Over the past 15 yrs, almost all the divisions of ALA experienced financial challenges and saw a trend of flat or declining membership, and LITA was no exception. In 2012, the LITA Financial Strategies Task Force was established under President Zoe Stewart-Marshall (2012–2013) to reexamine existing financial strategies and revenue sources for the Division and identify strategies based upon a sustainable infrastructure to allow LITA to continue to provide valued networking and educational opportunities by and to its members. Their final report, full of short-term and long-term recommendations, was presented to the Board in early 2014. Later that year,

under President Cindi Blyberg (2013–2014), the Financial Advisory Committee was established. Many of the recommendations will continue to be reviewed and implemented in years to come.

In addition to creation of the Financial Advisory Committee, other changes were made to LITA committees in the 2000s and early part of the decade. In 2008, the Assessment and Research Committee was formed to work with other LITA groups to assess progress against the strategic goals through the collection and assessment of data and feedback. This committee, like many others, originally started out as a task force that was charged to conduct research and present a final report to the Board with future recommendations.

In 2012, a Metadata Standards Committee was established that has appointed membership from LITA, the Association for Library Collections & Technical Services, and the Reference & User Services Association. In 2014, the Board voted to disband both the International Relations Committee and the Technology and Access Committee because much of the work of these committees was being done at the ALA level, and these committees had been created at a time when there was not as much focus on these topics in libraries.

Later in 2014, president Rachel Vacek saw the need to help LITA streamline, improve branding, and more effectively communicate across LITA's virtual presence and proposed to the Board a committee to help with these efforts. In October 2014, the Communications and Marketing Committee was created. To compliment these communication efforts, the Web Coordinating Committee also hired a blog manager, Brianna Marshall, who along with a dozen dedicated blog writers, have a goal to revitalize LITA's blog and social media presence. In a short few months, organic reach and engagement had explosive growth and positive feedback from members and non-members alike.

STRATEGIC FUNCTIONS AND MAIN PROGRAMS

In 1998–1999, under the presidency of Barbra Buckner Higginbotham and the leadership of president-elect and future ALA president Michael Gorman, LITA went through a process of reexamining its strategic directions, resulting in a sharpened and renewed focus on educating, serving, and reaching out. Many LITA activities fulfill more than one of these objectives that help LITA maintain its status for IT leadership within ALA in particular and libraries in general.

Under the initial leadership of president Colby Riggs (2004–2005), the LITA Board of Directors approved its first detailed strategic plan for the years 2005–2008. Establishing the Mission, Vision, and Function of the division, the plan set a tactical objective to fulfill its strategy to educate, serve, and reach out, established in the late 1990s.

President Michelle Frisque (2009–2010) and the LITA Board led the creation of LITA's second ambitious strategic plan for the years 2008–2011 that focused on the organization, innovation, training and continuing education, collaboration and outreach, and advocacy and policy. Input was gathered through surveys, open forums, and the LITA Town Meetings at ALA Midwinter conferences. From 2013 to 2015, the work of the LITA Board focused on four goal statements from the previous Strategic Plan. The division's principal focus on education, publishing, and networking remained the same, but other ideas including collaboration, advocacy, and infrastructure were incorporated. These concepts have been central to the Board's and the membership's work over the past several years and reflect the LITA gestalt.

EDUCATION

In the area of education, LITA presents 15–20 programs at every ALA Annual Conference on a wide variety of technology-related topics, such data management, linked data, web analytics, search engine optimization, user experience, digital libraries, graphical information systems, and languages like Python or XML. Popular programs, such as Top Technology Trends, the Ultimate Debate, and the President's Program draw large crowds and are immensely popular. In addition, two preconferences are scheduled along with every Annual Conference, allowing more in-depth presentations of specific topics. Such day-long workshops are also sometimes presented as regional institutes, as previously noted, often in partnership with other associations and agencies. The annual LITA National Forum is perhaps the most popular educational venue.

However, despite all success of the in-person educational offerings, the advent of new technologies has also given LITA the opportunity to create new strategies for virtual education, unconstrained by time and place. These strategies have created numerous opportunities for members and nonmembers alike. Webinars and online courses taught over the course of multiple weeks and utilizing Adobe Connect, a web conferencing platform, have become increasingly popular and have become a great revenue-generating avenue for LITA to explore more and expand.

LITA's publications have long served as a source of excellent education in library and information technology. In addition to the open-access periodical, *ITAL*, almost since its inception, LITA has published monographic works of great value to the library and information technology community, and many LITA members are active in library science publishing. A drop-off in the production and profitability of monographic publishing has led LITA to focus on the publication of brief, practical, useful handbooks—*LITA Guides*—for the use of technology in

libraries and related institutions. *ITAL* continues to attract serious scholarly additions to the field of library automation, digital libraries, systems, and web technology.

SERVICE

Of course, the efforts listed under the function of education can also be considered part of LITA's service objective. The LITA website has become the focus of LITA's provision of services to the library and information technology community. In addition to the previously mentioned online "Jobs in Library and Information Technology" site, LITA has drawn on the expertise of individual members and subgroups of LITA to provide information and recommendations on a variety of subjects.

In addition to the resources available on the main LITA website, the library and information technology community continually benefits from virtual activities of LITA members. Most conference activities are actively blogged and tweeted by participants, not only creating a record of the activity, but a forum in which those not in attendance can be updated and participate in topical discussions.

LITA has sponsored one or two LITA members almost every year to participate in ALA Emerging Leaders program. The Emerging Leaders program is designed to develop the next generation of library leaders from across the country to participate in problem-solving workgroups, network with peers, gain an inside look into ALA structure, and have an opportunity to serve the profession in a leadership capacity. By sponsoring ALA Emerging Leaders, LITA has an opportunity to help create new leaders while benefiting from the participation of that new leader in the work of the division. Projects are approved by the Board and have focused on service to LITA through creating documentation, workflows, orientation materials, and new programs, as well as providing recommendations on branding, collaborations, and web tools. These emerging leaders have been instrumental to moving forward new ideas and needed change within the organization, and continuing to support this valuable initiative has been a priority of the LITA Board since the programs' inception in 2007.

OUTREACH

LITA's outreach objective is aimed at "a broad membership, new professionals, systems librarians, library administrators, and vendors." Of course, many of the projects mentioned above are also efforts to reach out. In addition, LITA works closely with ALA's Office for Information Technology Policy and is a member of other related organizations, such as the Coalition for Networked Information and EDUCAUSE.

LITA is also involved with the creation, promotion, and endorsement of newly developed standards and maintains a close working relationship with the National Information Standards Organization. New initiatives aimed at more technical audiences, such as Code4Lib, and administered by groups such as the Digital Library Federation also include the participation of many LITA members and volunteers.

FUTURE DIRECTIONS

LITA will continue other efforts to make use of electronic communication practices, social software use, and online education and publication to support organization activities. “Virtual membership” and participation on committees continue to increase, and many groups within LITA conduct business between meetings via virtual methods. LITA’s web presence—website, blog, ALA Connect, and social media channels—will continue to be the home of new educational efforts and useful material for LITA members. LITA is also an eager partner with ALA in its efforts to improve virtual membership and participation, including online communities, e-commerce functions, and social networking. LITA will also continue to partner with ALA in finding solutions to technology challenges such as net neutrality, E-Rate, broadband, copyright, and open access to digital content.

Moving forward with the development of a new strategic direction under the leadership of president Thomas

Dowling (2015–2016), LITA will continue its theme of educating, serving, and advocating, even if the tactics in doing so change. Continued recruitment to the division of nonlibrarians, other divisional members, and professionals new to the field will be vital in moving forward. LITA is a division whose direction comes from its leaders and staff, but whose strength comes from its volunteer membership.

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Library Anxiety

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Abstract

Library anxiety is the negative, overwhelming feelings and emotions often experienced when needing to use a library that was first studied by Constance Mellon in 1986. She identified four sources for the students' anxieties: 1) the relative size of the library; 2) not knowing where resources were located; 3) not knowing how to begin library research; and 4) not knowing how to proceed with library research. Earlier studies had begun to investigate library interactions from the users' viewpoint, and the widespread recognition of Mellon's findings invigorated further exploration of this particular phenomenon. The development of the Library Anxiety Scale enabled quantitative measurements among large groups of students in the United States and abroad. Researchers using the LAS found five factors of library anxiety and identified characteristics and antecedents most closely associated with this occurrence. Knowing which groups of users are most at risk and developing the most appropriate approaches for intervention and alleviation are important steps to efficient library service to all.

INTRODUCTION

"A former Olympic silver medalist, known to be fearless in her sport, was a college student in a library session I taught. Afterwards she confided to me, 'I really recognized myself when you spoke of library anxiety. I've always been scared of libraries.' She was unafraid to perform in front of the whole world but afraid of libraries, a perfect illustration of how fear can be an individual and very personal construct." (Personal experience of the author, January 2014.)

Library anxiety is the feeling of being overwhelmed, intimidated, nervous, uncertain, or confused when using or contemplating use of the library and its resources to satisfy an information need. It is a state-based anxiety that can result in misconceptions or misapplications of library resources, procrastination, and avoidance of library tasks. Public service librarians have long noticed this type of behavior, and pioneering studies of the reference interview process and users' perceptions of libraries and librarians provided impetus for theoretical development. In 1986, Constance Mellon published her seminal study in which she compared her own analysis to similarities found in the education and psychology fields on math and test anxiety, and coined the term "library anxiety." Librarians and researchers were quick to recognize it as a distinct phenomenon of library user behavior.

Development of the Library Anxiety Scale (LAS) by Sharon Bostick in 1992 enabled researchers to measure this phenomenon quantitatively and explore the factors and characteristics of library anxiety among a broad population. It was discovered that library anxiety and its debilitating effects are found among all levels of undergraduates, graduates, and doctoral students, as well as among students

in different countries. Some researchers have looked at library anxiety within the context of the information seeking process (ISP) and its respective cognitive and emotional aspects as defined by Carol Kuhlthau in her ISP model. Since the publication of Mellon's grounded theory, a knowledge base for understanding the characteristics of those affected by library anxiety, and its factors, antecedents, and outcomes has been developed, but there still remain many questions and areas for further research and exploration.

HISTORY AND THEORETICAL BASIS

Historically, the research of public service librarianship focused on measurements of system interactions, circulation statistics, patron demographics, and policy developments without much investigation into library user experiences. By the late 1960s, theoreticians began calling for librarians to think about services from their users' perspective. Issues raised for consideration included patron's cognitive state when thinking about an information need, the question-negotiation process of the reference interview, causes of user frustration when seeking information, and why patrons might decide not to seek assistance at all. A greater emphasis on communication and interpersonal skills training for librarians and attention to the social dynamics of the user community were suggested in order to increase understanding and lessen both librarian and user frustration. Many factors later recognized as components of library anxiety surfaced in pioneering studies of the 1970s. These included the perception of librarians as being preoccupied or rude, and patron reluctance to ask for help for fear of ridicule by librarians. One study

found that 65% of the students would not ask a librarian for assistance with their specific need because they did not want to disturb the librarian, felt their questions were too basic, or had experienced dissatisfaction with a previous librarian interaction.^[1] Such findings help explain the conclusion of another study that up to half of all patrons leave the library without obtaining the book they are seeking.^[2] Yet researchers continued to decry the significant lack of user studies among the literature, particularly behavioral research into how people interact with information and libraries. By the early 1980s, information increased in complexity and availability, and became more crucial in people's everyday lives. Libraries were employing new automated and computerized systems and patrons were faced with the challenges of learning to cope in this rapidly changing environment. New theories and methodologies were needed to research how people react with information, which was obviously more complicated than just "getting it" or "having it."^[3]

Brenda Dervin and Michael Nilan reviewed the literature on research of information needs and uses from 1978 to 1986 and note a subtle but noticeable change in the epistemological approaches of library and information researchers. They perceive a gradual shift to the inclusion of more varieties of measurements and methods; from the strictly traditional scientific approach that measures user interaction with information through quantitative means, to more alternative approaches that recognize information as constructed by humans whose behavior can and should be measured through qualitative as well as quantitative methods. Calling this shift a "quantum and conceptual leap" in the field, they encouraged more researchers to take up their challenge to invent "new ways of looking at users and linking systems to them."^[4]

MELLON'S GROUNDED THEORY OF LIBRARY ANXIETY

Like many public service librarians, Constance Mellon had long noticed the anxieties and hesitations many students displayed when using the library. She felt a more efficient library instruction program would help alleviate the problem, but had to convince skeptic faculty and administration of the need. For 2 years, she analyzed the journals of over 6000 first-year English composition students in which they recorded their process and emotions as they conducted research for their term papers. Entries from these journals were analyzed using the constant comparative method by which recurrent themes were discovered. Mellon found that 75%–85% of her student participants described their initial library encounters in terms of anxiety and fear.

Terms like *scary*, *overpowering*, *lost*, *helpless*, *overwhelming*, *confused*, and *fear of the unknown* were used

repeatedly by the students. She noticed a striking similarity to research in math and test anxieties, and felt that this new phenomena should also be considered within the anxiety framework. Mellon called her grounded theory "library anxiety."^[5]

Mellon identified four sources for the students' anxieties: 1) the relative size of the library; 2) not knowing where resources were located; 3) not knowing how to begin library research; and 4) not knowing how to proceed with library research. Embarrassment over their lack of competence drove their anxieties deeper; it seemed that all the other students knew what to do in the library and only they did not. They felt their lack of library skills was shameful and were afraid to reveal their inadequacies, or "look dumb," by asking a librarian for assistance. She states that students became so overwhelmed and "anxious about having to gather information in a library for their research paper that they are unable to approach the problem logically or effectively."^[6]

Professionals in library and academic fields have successfully used libraries for many years and may not remember or realize how intimidating the institution can be for many people. Mellon stresses that librarians and educators must acknowledge library anxiety as a common, legitimate phenomenon, and create encouraging and successful experiences for the students in order to alleviate the anxiety. She notes that students' anxieties lessened after encounters with professional librarians and encourages more personal contact between librarians and students to help them see the library as truly relevant to their academic needs with friendly and helpful professionals to assist them.^[5]

THE ISP

Two years after the publication of Mellon's seminal study, Carol Kuhlthau began publishing results of her groundbreaking investigations into the emotional aspects of research. The two studies do not indicate any influence of one on the other, but similar methodologies were used and parallel results were found. Kuhlthau based her epistemology primarily upon ideas of personal construct theory. She developed a model of six stages of the ISP and describes the emotions, thoughts, tasks, and actions typical of each. Kuhlthau identified stages 3 and 4 of the ISP, exploration and formulation, as critical from the seekers' emotional perspective. She found the exploration stage, when seekers are looking for general information about their topic in order to broaden their own understandings and construct new knowledge into their already existing knowledge, as fraught with increasing feelings of doubt, uncertainty, and confusion. The users often become discouraged and, especially at this stage, their sense of inadequacy may be so heightened that they abandon their task altogether. By the next stage, formulation, the users have

succeeded in breaking through the threatening doubts of their earlier explorations and managed to focus their topic and the information they retrieve.^[7] These anxious feelings found in the ISP, especially at the information exploration stage, strengthen Mellon's findings of the highly emotional experiences of many students when conducting library research.

Librarians had long observed behaviors of library anxiety and knew anecdotally that it existed, but no one before Mellon had so precisely studied and labeled it. Recognition of Mellon's theory generated numerous discussions and studies of the influence of library user behavior, library graphics, bibliographic instruction, and the ISP on library anxiety. By 1992, a reliable instrument was developed to measure library anxiety quantitatively.

BOSTICK'S LIBRARY ANXIETY SCALE

Influenced by Mellon's research identifying library anxiety, Sharon Bostick developed the LAS in order to discover whether the phenomena could be measured quantitatively. It is a questionnaire consisting of 43 Likert-type statements relying on self-reporting by the participants and tested an internal consistency of 0.80 using Cronbach's alpha coefficient. Through her study, Bostick identified five dimensions of library anxiety:

1. *Barriers with the staff*: Feelings by students that the librarians and library staff were preoccupied or unapproachable for assistance
2. *Affective barriers*: The "not knowing what to do in the library" situation first identified by Mellon
3. *Comfort with the library*: The physical comfort level students felt in the library building
4. *Knowledge of the library*: Knowing where things are located and how to find their way around in the building
5. *Mechanical barriers*: The perceived reliability and ease of using the library's printers, photocopiers, computers, etc.^[8]

In subsequent studies, reliability measures of the complete LAS have been as high as Cronbach's alpha 0.92,^[9] and independent measurements of each of the five dimensions all confirm the scale's reliability. Since the advent of more online, electronic and offsite library resources and services, there have been calls and attempts to modify the LAS to better reflect this new environment. The Multidimensional Library Anxiety Scale (MLAS) integrates online research attitudes and the principles of Kuhlthau's ISP into the original LAS, specifically for measuring library anxiety and perceptions among doctoral students.^[10] Most subsequent quantitative studies use the LAS, MLAS, or modified versions of either.

JIAO AND ONWUEGBUZIE QUANTITATIVE STUDIES

Through their prolific studies using the LAS, Anthony J. Onwuegbuzie and Qun G. Jiao have identified many of the characteristics and situations of students most at risk for library anxiety; demographic patterns, learning preferences, personality traits, study habits and behavioral characteristics most closely associated with library anxiety; and the relationship between social interdependence and library anxiety. Participants in their studies include undergraduates, graduate and doctoral students, and results indicate that library anxiety is found among all segments of these populations—it is not a phenomenon limited to first-year students and novice researchers. Jiao and Onwuegbuzie conducted much of their research by surveying large groups of students using the LAS and one or more other instruments that measure behavioral or demographic characteristics. They were thus able to identify major factors associated with each of Bostick's five dimensions of library anxiety as well factors relating to library anxiety in general.^[11]

Major factors associated with high levels of library anxiety include

- A non-English native language
- Working full- or part-time while studying
- Not being a frequent visitor to the library
- Being a high achiever
- Displaying high levels of perfectionism
- Not receiving library instruction
- Negative self-perception in scholastic competence, intellectual ability, creativity, and social acceptance
- Low cooperative attitudes in group tasks
- Poor study habits

Another important finding is that library anxiety is a state-based anxiety, an independent phenomenon from trait anxiety, meaning that being affected by library anxiety does not necessarily indicate having a high-anxiety personality.

Onwuegbuzie, Jiao, and Bostick gathered findings from several studies into three categories of antecedents that interact to determine the overall level of library anxiety:

- Dispositional—particular personality traits
- Situational—the environment of the particular stimulus
- Environmental—the demographic factors

This is illustrated in their model of conceptualization of antecedents of library anxiety in Fig. 1.^[12]

INTERNATIONAL STUDENTS IN US INSTITUTIONS

Studies involving international students in American universities consistently show their levels of library anxiety to be much higher than their American peers. International

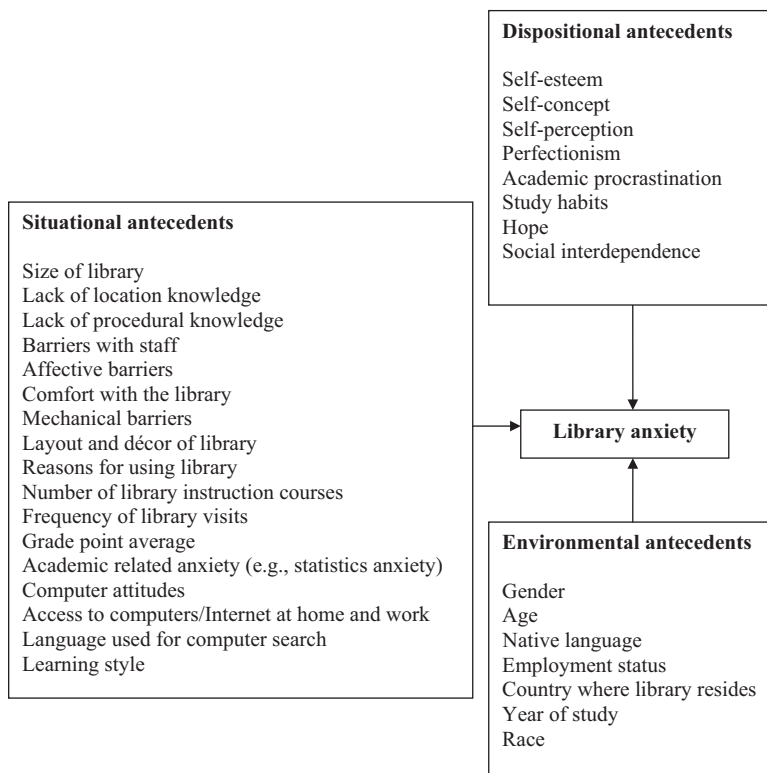


Fig. 1 Conceptualization of antecedents of library anxiety.

students visit the library more frequently and are more likely to participate in library instruction sessions than American students, so their anxiety is not related to those factors nor do they result in avoidance behavior. But there are many cultural differences, communication barriers, and challenges using English-language resources and search strategies with which these students must cope in their new environment. They often arrive with erroneous beliefs about the functions of American academic libraries such as the purposes for using the library and types of services offered, which may be very different from what they are used to in their home countries. Multiple sessions of information literacy instruction were shown to help alleviate library anxiety in one study.^[13] But while there are many studies of international students' library behavior, only a few focus on library anxiety among this population. More research is needed to further identify the specific antecedents and develop mechanisms to help alleviate their anxieties.^[14]

INTERNATIONAL STUDIES

Academic libraries worldwide vary greatly in their organization, cultures, philosophies, function within their institutions, user expectations, and interaction styles with their patrons. Until the early 2000s, nearly all studies of library anxiety were performed in American universities and institutions. Based on the research of Mellon, Bostick, Jiao,

Onwuegbuzie and others, researchers began exploring library anxiety outside of the United States, and results indicate that it is indeed an international phenomenon. Studies performed in England, Israel, Kuwait, Malaysia, Sudan, Canada, Poland, and China^[15–22] show that while cultural differences do exist, students worldwide are affected by similar anxieties when using their academic libraries. Researchers used translations and modifications of Bostick's LAS in order to better reflect local culture. Analysis in each study produced slightly different factor groupings than the American studies, and the findings suggest that although library anxiety may be an international phenomenon, cultural context must always be considered when studying and measuring it.

INTERVENTIONS

Libraries engage in many proactive strategies to help educate their users and bring in new ones. They may not consciously be seeking specific mechanisms for reducing library anxiety, but with enough careful thought and planning, each individual effort can make a difference. Onwuegbuzie, Jiao, and Bostick categorize procedures into three types of approaches: library facilities and resources management, library instruction, and mediated informational services. Within each category, they place specific intervention strategies that address the various dimensions of library anxiety.^[23]

Library facilities and resources: This category includes all the strategies that librarians and library managers employ to make their facility and resources as user friendly and welcoming as possible, ensuring a pleasant atmosphere within the physical compound that will encourage the patron to return often and without hesitation. It directly addresses the third factor of library anxiety identified by Bostick, “comfort with the library,” and can help alleviate Bostick’s fourth factor, “knowledge of the library,” and the fifth, “mechanical barriers.” Strategies in this category include effective library signage and graphics, logical space and furniture arrangements, library tours, in-library computing labs, laptop stations and wireless availability, laptop lending, small group workrooms, coffee bars and snack areas, efficient document delivery systems, and fully functioning library consortia.

Even in this age of electronic library collections that enable users the convenience of accessing many resources and materials online, students still value the library building as a learning and study space. Outreach efforts to bring them into the library and help them become comfortable with staff and the facilities often include methods not formally associated with academic libraries. Toward the end of the term and during final exams for example, many libraries offer extended hours as well as free healthy snacks and other study-break treats known as stress busters—therapy dogs, free massages, origami and crafts corners, meditation, etc. Throughout the academic year, libraries also hold events including concerts, dances, poetry readings, contests, displays of student research, and exhibits targeted to student interest, all designed to raise library awareness, interest, and comfort levels.^[24–26]

Library instruction: This category includes all types of information literacy instruction—teaching users how to identify an information need, locate, evaluate, and use information effectively and ethically. It directly addresses the cognitive obstructions that Bostick termed “affective barriers.” Most instructional strategies, however, involve professional library staff, and this librarian/patron interaction can also help alleviate Bostick’s first factor, “barriers with staff.” Academic libraries today see instruction as one of their primary tasks, and they perform this through numerous ways such as classroom instruction; online tutorials; drop-in workshops; print and online help guides, and through multimedia technologies such as television broadcasts, webcasts, streaming video, and podcasts. Targeted outreach and marketing campaigns to raise student awareness of library resources and services, “putting a familiar face with the place,” are also being used. Studies on the impact of bibliographic instruction on library anxiety show that in-person instruction can significantly reduce library anxiety among college students.^[27–29]

Mediated informational services: This category includes the traditional reference services such as mediated reference assistance at the reference or information desk, active reference roving, and individualized information consultation,

but also includes chat reference services, reference through instant messaging, email, and online social network services.^[30] Successful interactions with staff will help alleviate the “barriers with staff” factor, but depending on the content of reference or information query, the interaction may help dissipate any of Bostick’s five factors.

The best strategies and procedures are secondary, of course, to a friendly, patient, welcoming, and effective library staff. The most efficient services and instruction devoid of any warmth solidifies preconceived perceptions of the rude and uncaring librarian and an intimidating institution.^[31]

CONCLUSION

“Of all forms of academic-related anxiety, library anxiety appears to be the most common.”^[32] When Constance Mellon published her breakthrough study in which she systematically identified library anxiety two decades ago, practicing librarians finally had a name for the behavioral phenomenon they had observed for years. The library environment has experienced rapid change during this time, but the hesitations, inhibitions, confusion, and lack of self-confidence students often display when using or contemplating use of the library for an academic need are still in evidence. Various epistemological approaches and theories have been used to explore and explain this area of library and information user behavior. Through the use of Bostick’s LAS and other research methods, library anxiety has been studied quantitatively among large heterogeneous groups of students, and prominent characteristics and antecedents of students most at risk for library anxiety have been identified. Studies of international students in American universities and research conducted outside the United States indicate that while cultural variations exist library anxiety is a global phenomenon.

Research of college students in academic libraries dominates the literature. Library anxiety among other populations, including people with disabilities, who are homeless, have immigrant status, or are elderly, and among other institutions such as public and school library users still need to be explored. In an age demanding information literate citizens, library anxiety research and understanding can be integrated into current information literacy initiatives and help shape information policy decisions.

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Library Architecture and Design

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Abstract

A survey of the evolution of library architecture and interior design during the latter half of the twentieth and early twenty-first centuries focuses on the change from libraries primarily designed to hold paper collections, sometimes used only in the library, to libraries primarily designed to provide access to technology, digitally stored information, and research and learning spaces. The societal changes that led to the growing role of libraries as places for building community, collaborating, and engaging in independent learning are also discussed. The major components of the design process for libraries are discussed, and the design impacts on the core areas of the library are described.

The past several decades have brought about radical changes in all types of library buildings, driven primarily by technical and cultural/societal changes. Libraries have been changing over the centuries as the formats for inscribing and preserving the written record of human history have changed, and as the concept of public libraries developed alongside the earlier concept of private libraries. Seen from that perspective, the evolution of library design in the twentieth and early twenty-first century does not seem revolutionary, although the speed with which it has taken place may be unprecedented. The changes are the result of several factors: changes in the format of materials, changes in the audience for libraries, and changes in the role libraries play in the community at large.

The current transition is driven by the increasing dominance of various means of electronic storage of materials, the demand for easily accessible computers for library patrons, and a declining emphasis on physical collections as the primary purpose for the library building. The changes are deeper than that, however, and respond to a range of developments in the social and economic environment that would have required adjustment under any circumstances. It may well be that the advent of the digital age, contrary to the early fears that it would destroy the library, actually saved libraries from having to choose between their missions to store the world's knowledge and their need to provide their supportive communities with the services they demand.

IMPACT OF TECHNOLOGY

Design of library buildings during the nineteenth and much of the twentieth century tended to focus on the need to hold the growing physical collections that resulted from

the mass production of books and periodicals. A thorough discussion of this type of library architecture can be found in Schell's "Buildings, Library," in the 1970 edition (volume 3) of *Encyclopedia of Library and Information Sciences*.^[1] Beginning with the post-World War II era, that classic design, often referred to as the Carnegie rectangle, was challenged by the increased presence of various types of technology, each creating their own demands: microfilm, with its need for darkened space for viewing; various forms of media, each needing appropriate equipment to use; and copy machines, requiring spaces to store paper and handle financial transactions. Computers, which first appeared in the workrooms of libraries as tools for managing the paper resources, moved out to the public areas of the library, beginning with online catalogs, and the computers became sources of information for library staff and patrons. This change has escalated rapidly, requiring libraries to bring electrical and network connections to large public spaces, and putting pressure on spaces designed to hold stacks and readers that frequently had minimal power and network connections available. Meanwhile, the paper collections continued to grow, and in many libraries traditional reader space was sacrificed to make room for collection growth.

The changes required by technology had an impact on all types of libraries, but in many ways, the smaller public and school libraries were initially better able to adjust, not being burdened by the need for comprehensive archival collections. Many had moved toward providing more media equipment for patron use and encouraging more active patron engagement in various programs. The school libraries that became part of elementary and secondary school design were often viewed as teaching libraries, and frequently served as media centers. Public libraries built smaller branch libraries closer to their users than the

larger central libraries, and responded to the popularity of their children's collections and the growing demands of young adult patrons with specially designed spaces more suited to housing children's and young adults' books, media, and computer equipment. These newer buildings were more likely to incorporate better power and network connectivity in their design, although the breadth of need was not at first anticipated.

The growth of public computer installations in research libraries, both public and academic, continued alongside the growth of their collections, leading library planners to face decisions about how to develop new, flexible, highly wired space in buildings poorly suited to that purpose. For librarians, the choice sometimes seemed to be between their collections and the needs of their changing mission. The solutions varied according to the availability of other space, the resources of the libraries, and their missions. A variety of solutions developed, including the development of separate undergraduate libraries, much less focused on archival collections and often located in the older original libraries, allowing the large collections and technologically demanding resources to move to new facilities. Another trend has been the development of storage facilities for the less-heavily used collections, sometimes serving multiple institutions, such as the Washington Research Library Consortium's storage facility in the DC area. One technology that helped libraries with collection growth was the development of compact shelving for less-heavily used collections, which began in Europe and Japan before moving to the United States in the 1960s.^[2] These movable stacks can compress collections into approximately one half of the space otherwise needed, but installation of compact shelving into many extant library buildings is impractical because of the need for heavy load-bearing floors.

The recent development of radio frequency identification technology for tagging books has enhanced the possibilities of storage of collections, including the use of robotized facilities, such as the stacks in the University of Nevada Las Vegas Library, where the automated book retrieval system is across from the Circulation Desk and can be viewed through a large glass window (see Fig. 1).

IMPACT OF CULTURAL CHANGES

Changes in the culture have also created new demands on libraries. The growth of the free public library and the impetus given to that by the large-scale construction of Carnegie libraries in the early twentieth century initiated those changes as the size and diversity of the population expecting access to libraries and the resources they provide began to grow. In the past 15 years, public libraries, often with significant support from foundations such as the Bill and Melinda Gates Foundation, have become primary



Fig. 1 Automated book retrieval system, library, University of Nevada, Las Vegas.

Source: Photograph by Paul Brokering, <http://www.paulbrokering.com>. Used with permission of photographer.

vehicles for providing public access to computing for those who do not have such access readily available. Libraries serving large immigrant populations have also begun providing books, periodicals, and services in languages frequently used in their service area, which creates new collections and service space requirements. For academic libraries, there has been a rapid growth in the student population and, in recent years, an increasing emphasis on international studies, resources, and students. Libraries which previously collected only in English are called upon to collect materials in other languages, and provide access to them. Changes in the methods of instruction have had a significant impact on what kinds of library space students desire, as the use of online courses and supplemental materials grew and the emphasis on group projects expanded.

An extremely important aspect of cultural change that is driving the evolution of library architecture is the

emergence of the library as a place for community. This is most pronounced in public libraries, where library as a meeting place for various community groups and as a provider of information-related and special population programming has taken on a very important role. Public libraries devote considerable space and staff to serving children, usually in specially furnished areas designed to attract children and their parents (see Fig. 2), and to areas designed to appeal to their young adult users, often needing a place to study, do research, and be with friends in a safe space when not in school. In many ways, this population is much like the academic population of users in academic libraries.

The role of libraries as spaces for community is an increasing focus on academic campuses, where the end of the “quiet study only” library and the emergence of the library coffee shop have created a sense of the library as the place for “academic community,” as opposed to the social community spaces in student centers or the recreational community spaces in gyms and recreation facilities. Since the Leavey Library opened at the University of Southern California in 1994, there has been a trend to build Information Commons or Learning Commons, each designed slightly differently but all having in common very large, technologically intensive space which seeks to meet the student need for computers and assistance in using those computers and the information they deliver in highly visible and social space.

Many students prefer to work in very public spaces, and want to be within view of someone who can help them, and they will congregate in heavily traveled areas

where they can see and be seen. The degree to which these common areas include such things as paper collections, lounging areas, group study areas, and specialized technology environments varies from library to library, and the ultimate evolution of these spaces remains to be seen.

University campuses still may contain specialized libraries that are often quite different from the central library, although the effects of technology and differing expectations of students have similarly affected their design. The most common examples are law school libraries and music libraries.

A growing trend is to build multipurpose facilities that house more than the library. For many public libraries, this consists of a cluster of community spaces, including recreational space, municipal offices, performance space, and the public library. Examples include the Asker Public Library outside of Oslo, Norway, which combines an art gallery, theater, and restaurant, and the Largo Public Library in the heart of that Florida city’s Central Park. Combined public and school libraries are also popular. Combined public and university libraries are also emerging, such as the libraries of San Jose State University and the City of San Jose and the combined Royal Library, National Library of Denmark and Copenhagen University Library (see Fig. 3).

Community college libraries are often colocated with other learning facilities, such as counseling and tutoring centers, and sometimes share their buildings with various student services like registration and financial aid. Academic libraries, such as the library of the University of Otago in New Zealand, are creating spaces to share with



Fig. 2 Children’s area storytime, Lexington public library northside branch.

Source: Photograph by Frank Doring. Used with permission of Lexington Public Library.



Fig. 3 The new building (“Black Diamond”) of the Danish Royal Library, viewed from the south-east, taken in 2005.

Source: Wikipedia. Photograph by Thue. Image released into the public domain by its author, Thue. This applies worldwide: http://en.wikipedia.org/wiki/File:Den_Sorte_Diamant_1.jpg, accessed December 28, 2008.

the Instructional Technology Divisions, with Centers for Teaching and Learning, and with various student services such as Writing Centers and English as a Second Language (ESL) tutors. Some academic libraries are linked to student unions, such as the Johnson Center at George Mason University. In all cases, the mix of facilities is driven by the local needs of the environment, and ideally by the perception of librarians as to what services students need that can be best colocated in their libraries.

Whatever the combinations, the realities of different missions, user base, collection priorities, specialty areas, and hours and services present significant challenges and call for careful planning and a great deal of diplomacy and flexibility. The rewards can be substantial, both in cost savings and better services to library users and the communities.

Libraries have always emphasized security, but until recently the biggest concern was keeping collections safe from theft. The very concept of libraries as places where all the users have equal access to the information they provide has created another security requirement: keeping the patrons of the library secure. The growth of large homeless populations has made this a particularly difficult issue in large downtown libraries, but there are few libraries that have not had to deal with this issue. Locations of service desks and computer clusters are driven by the need for visibility, and small nooks and private spaces need to be in areas where traffic regularly passes.

Other impacts on libraries and therefore their buildings have been related to equal access and services for disabled patrons, which has been both enhanced and made more complex by the many technologies available to assist them. Power wheelchairs allow increased mobility, but

their size usually exceeds that of manual wheelchairs and should be taken into consideration in sizing of aisles.

A fairly recent trend in library architecture and interior design has been the emphasis on sustainable design, also known as greening the library. Librarians and architects share an interest in using building materials that emphasize recycled and environmentally friendly components, and design focused on energy conservation and effective use of materials that will not need frequent replacement. Meeting the challenge of greater natural light and showcasing the activities within a library to passers-by without energy loss is a particular challenge, and has led to some of the more creative design solutions, such as can be seen at the Phoenix Central Library.^[3] Interior designers seek finishes and furniture that are made from recycled materials, such as old tires or seatbelts, and from renewable resources such as cork and bamboo. Construction companies are developing more environmentally friendly ways of excavating the site and reusing or disposing of materials used in the building process. Some campuses, such as Emory University in Atlanta, have committed to building all new structures and renovations using the guidelines of sustainable design. Libraries increasingly seek to be certified by the Leadership and Energy Environmental Design Green Building Rating System (LEED) at one of the four levels: certified, silver, gold, or platinum, and calls for proposals for designing and constructing their facilities where evidence of LEED-certified team members and methodology is a requirement.

The rise in popularity of coffee shops as parts of libraries began in the 1990s, and has become an expected part of almost all new or renovated academic library planning and many public libraries. This trend arose as librarians realized the futility of keeping food and drinks entirely out of their libraries, and tried instead to contain some of the possible damage by encouraging use of covered containers, providing adequate trash facilities, and specifying certain areas where a ban on food and beverages will be enforced—often around computers. The prevalence of food and beverages in the library has particular impact on the selection of interior finishes and furniture, as they must be able to handle beverage and food stains and be easily cleaned. Provision for waste disposal and recycling also needs to be made.^[4]

MAJOR COMPONENTS OF THE DESIGN PROCESS

The architecture of the modern library is clearly evolving from the old Carnegie boxes of earlier centuries, and we see in recent library design a number of solutions to the changes outlined above. The keys to successful library planning in the twenty-first century are careful analysis of the needs of the population to be served and their expectations, a building program that is informed by an awareness

of future trends and how they might impact on the building being designed, recognition that one cannot anticipate everything that the library will become, a firm commitment to flexibility of space and furnishings, and deep library staff involvement in the planning process. These qualities will be seen in each aspect of the final design, and take specific form in each aspect of the plan.

The Master Planning Process

Involvement of librarians in the architectural decisions of library buildings needs to begin early and continue throughout the process, culminating in the occupation of the new space. Often that planning process begins with a survey of the user community to determine their interests and needs. Under ideal circumstances, the library building is part of a master plan for related spaces around it, which recognizes the need for common traffic control, security, and parking facilities. For large libraries or library systems, there is often a master plan that considers their overall development, and anticipates changes in spaces of buildings that are not part of the original plan.

Developing the Building Program

The core document in a library's design process is the library building program. This may be developed by the library in conjunction with planning consultants or the architectural design team, or both. A well-prepared library staff begins preparation long before this process with internal discussions of what the library needs, where the library anticipates change, and what the library staff dreams of in their new facility. Imaging the future sessions are often used during this process.

The programmers will work closely with staff, asking them to describe their current space and think about how they would like their new space to work. Careful attention is given to adjacencies, which areas need to be next to which, importance of public access, and special furnishing, equipment, and security needs. This document is often described as the bible for what comes afterward, and it is essential that the final document is thorough and looks toward the future.

Consulting with External Experts

External experts are often employed to bring their perspectives and knowledge to the project. Most commonly consulted are library building consultants, structural engineers (often part of the design team), Audio-Visual (AV)/Media Specialists, Acoustical Consultants, Security Consultants, Library Move Management Consultants, and Way-finding/Signage Consultants. The need for each of these varies with the library under design.

One specialized area of knowledge that cannot be neglected is knowledge of the building regulations related

to access and safety. These tend to vary by geographic location, and failure to plan for them can be very expensive. In addition to the usual requirements for power, plumbing, and structural integrity, there are regulations related to emergency egress and disabled access.

Impact of Library Architecture on the Community

Although the usability of the building on the inside is the primary consideration, planners need to recognize and be sensitive to the importance of the appearance of the library in its environment. It is not uncommon for the library to be one of the largest buildings in the area, and a beautifully designed library can enhance the area around it, make a statement about the organization to which it belongs, provide a centerpiece for a larger cluster of buildings, and serve as a beacon to the community. Dramatic public libraries like the main library in Salt Lake City and the recently opened Seattle Public Library become destinations and objects of pride for the cities. On a smaller scale, public libraries seek to reflect their communities, such as the Spanish Spring Library in Nevada with its Native American design and interior treatments-based images in the nearby environment.

Aesthetics, Display Space, and Signs

Geoff Freeman, architect for many innovative library buildings, has talked about the increased expectations for "immeasurables that only a library can provide." These include how the spaces feel, "how they attract, and how they stimulate and inspire as well as give pause for reflection and focus." These immeasurables are considerations in all stages of the library's design, and are key to the interior design.^[5] Good interior design will have a significant impact on the library's aesthetics and will impact the behavior, use, and security of library buildings. Library patrons will welcome opportunities to offer their opinions on the types of furniture that are used and the color palates that are chosen. It has become common to ask furniture companies to provide sample furniture that can demonstrate how well it holds up to use and gives patrons opportunities to comment on comfort and "look and feel." This can help create excitement about the new space, and assure the planners that they have correctly interpreted their patrons' needs.

The important consideration of traffic flow can be much enhanced by use of appropriate finishes that help identify and guide patrons through the various spaces of the library. Good signage is also essential, and use of technological methods for delivering information, such as video and computer screens, is becoming common.

In addition to the buildings and furnishings, libraries often have important display space and large empty walls inviting installation of art. The selection and purchase of art for libraries has the potential to develop good

partnerships with art departments and the local arts community, and possibly attract financial support. There are also the practical aspects of design, such as budgeting for, and coordinating, receptacles for recycling and trash during the overall building design.

Construction

Newer methods of design and construction of buildings, such as design/build construction and guaranteed maximum price construction, have tended to blend the entire process, making it much more interactive between planners and builders. Working with such projects varies greatly from the earlier model of buildings planned and designed and then turned over to the contractors for bidding and construction. More than ever, it is essential that all members of the team remain informed, involved, and available during this process, although the involvement of librarians will lessen as the process continues, but iterative decision making continues throughout, and unexpected compromises or pleasant surprises can have a major impact on the final building.

DESIGN IMPACTS ON CORE AREAS OF LIBRARIES

This process will not result in a group of identical libraries because the strengths, expectations, and ambitions of each library vary in important ways. Nevertheless, there are specific factors that apply to the major areas of the library: public service areas; teaching, training, and meeting space; individual and group work space; collections space; specialized collections and services areas; staff space; technology support areas; and building support and security.

Public Service Areas

The increasing complexity of library resources and the concomitant education and training required by those providing assistance to library patrons have led to reorganizations of these services, a trend which continues to evolve. Factors, which impact on the architecture of the library, include a variety of solutions as to size and placement of service desks, increasing provision for small group work and individual consultation, and technologically sophisticated teaching and learning spaces. Some libraries have a variety of public service desks, often characterized by the type of assistance being given: security enforcement, general information, research assistance, technology assistance, and circulation of materials. Others have only one combined desk, and some have eliminated the traditional reference desk. The degree to which professional assistance is available at service counters varies considerably, with some libraries trending toward most professional

librarian assistance delivered in consultation rooms and offices, with service desks staffed with trained assistants who have various specializations, including technology. Some libraries are experimenting with roving assistance rather than centralized desk assistance, and self-check-out equipment is being provided for routine circulation transactions. The nature of the community of users and their service expectations need to be carefully and realistically analyzed to determine how public service areas should be designed. Desks that can be reconfigured as needs change will provide maximum flexibility.

Teaching, Training, and Meeting Space

Libraries have long recognized that there are substantial efficiencies in teaching groups of patrons rather than teaching the same thing to one patron at a time, but often lack dedicated and appropriate teaching space in which that instruction can be scheduled. There is also a growing need for training space for library staff, and spaces for offering training on various technologies to the library's patron groups. For many patrons, the first contact with a library may be through attendance at a class, training session, or public event in the library's space, and there is strong evidence to suggest that they are much more likely to return once they have seen the richness of the library's resources. Newer libraries are dedicating much more space to these functions, which is partially enabled by the lessening pressure of physical collection growth. These spaces vary according to their purposes and availability of technology, but common characteristics are provision of an installed computer base with presentation technology, multipurpose rooms that can be used with or without computers at each workstation, and attractive public meeting space for conferences, media presentations, performances, and various types of meetings. Recent improvements in wireless technology and the growing downsizing of computers make flexibility easier to achieve, and reliance on laptops, which can be installed in the furniture and made accessible on an as-needed basis, is becoming more common. The location of teaching space is ideally very visible and easily reached from outside of the library, but the large dimensions of that space and need for technology also must be considered.

Individual and Group Work Space

A substantial and outspoken group of library patrons still come to the library to find quiet spaces for reading and study. Planning in advance for areas designed to meet their needs is essential, and needs to be done in a way that does not discourage library use by patrons seeking other kinds of space. Libraries can designate specific areas for quiet study, sometimes creating special rooms for that purpose. They can also utilize furniture types and overall environments to encourage quiet, taking advantage of

stacks that can act as sound buffers, specifying more remote areas for quiet study, using sound absorbing materials such as upholstery and carpet, and providing individual study carrels with high panels on both sides. Some libraries have installed white noise technology in their buildings to lessen the impact of various sources of noise.

For many library users, especially students, the library is seen as a place to meet with groups, work together on projects, and practice presentations of their work, almost always with technology near at hand and often with whiteboards or other space for posting their work in progress. Student demands are likely to include needs for multimedia creation, collaborative computer use, digitizing equipment, color printers, and places to plug in personal electronic devices. Information and Learning Commons are usually designed with these users in mind, as are the proliferation of group study rooms and various types of media-equipped rooms (see Fig. 4). Design of these spaces will continue to evolve as technology develops; the trend toward smaller devices with more connectivity will surely impact how those spaces are configured and furnished. For maximum flexibility, careful

thought needs to be given to provision of raised floors, wiring channels, and dropped ceilings.

In general, libraries need to provide a variety of types and configurations of seating, including classic library tables and chairs, carrels of various types, computer pods, group study tables, lounge furniture, and possibly benches or booths. Patrons tend to adapt what is provided to their needs, and so furniture which can be moved and reconfigured should be considered. There is a large contingent of people who prefer working in a busy and very visible environment, preferably with lots of natural light. Taking advantage of windows and traffic patterns can help planners meet this need.

As a general rule, all of the library should be accessible to disabled patrons, but there may be a section of seating which provides various assistive technologies. Throughout the library consideration should be given to providing seating that can meet the needs of patrons with special needs.

Space for Collections

Libraries need a variety of shelving configurations for differing types of collections, including less-immediately accessible space for seldom-used materials and a mix of shelving for collections that need to be associated with equipment required to access the information they contain. Common shelving configurations include standard stacks, compact shelving units, folio stacks, reference stacks, atlases and maps, browsing materials, and media. Consideration should be given to the possibility that space now configured for a particular collection (reference, for example) may shrink, grow unexpectedly, or be relocated, or that the total amount of shelving will be reduced in order to create space for new needs.

Specialized Collections and Service Areas

Specialized collections include children's collections, media collections, maps, government documents, and archives and special collections. Each of these has unique requirements for storage and use of materials, and some of them may offer independent service points. Shelving which is appropriate for the children's collection is different from that for other book collections, and may include media storage. Seating in these areas is also unique to children's needs, as are many of the interior design features. Some of the other collections are primarily different in their shelving requirements, but media collections may be in unique space in order to meet the equipment, security, and assistance needs of those collections.

Archives and special collections have unique needs for security, service, and appearance, and are often in a space



Fig. 4 Georgia State University Learning Commons.
Source: Photograph by Visko Hatfield. Used with permission of Visko Hatfield and Leo A. Daly, Architects.

separated from the rest of the library. There is a trend toward greater visibility of these collections, as exemplified by the housing of the King's Library (King George III's collection) in a smoked glass tower at the British Library, visible from the main entrance hall and various areas of the library.^[6] As archival and special collections make increasing use of digital technologies, it is reasonable to assume that users of the digitized materials in these collections may also migrate into the common public areas, creating additional service requirements and greater demand to see the original materials from which these images are derived.

Staff Areas

Staff spaces need to be highly configurable and flexible. The nature of library work has been evolving for many years, and that evolution probably has not been completed. The trend is to a more open architecture, with fewer private offices and more readily rearranged furniture and equipment. Shared small conference rooms for consultation are often provided. Space that can be repurposed for technology and/or individual or online patron assistance may supplant space now used for the decreasing traditional physical processing of materials. Staff spaces should also allow for the highly collaborative, teamwork approach to modern library work, and for the realities of today's workforce, which may include working parents, disabled employees, and staff working a large variety of schedules. Security of staff, their personal possessions, and library equipment and supplies must be an important consideration. Absolutely essential is a pleasant staff lounge with appropriate equipment for employee use. Some libraries provide a private space for nursing mothers.

Technology Support Areas

The growth of the use of technology in all areas of the library will likely continue to expand the staffing of these areas, and the need for various kinds of equipment for such activities as digitizing collections, designing Web pages, managing online systems, equipment repair and updating, and multimedia creation and viewing. Design of that space will need to allow for intense power and network connections, careful security, specialized spaces for any equipment needing constant environmental control, and collaborative work spaces, including room for groups to work on a common screen. The exact nature of this space continues to change as the technology changes, and more compact equipment may lead to differing space and heating, ventilating, and air conditioning needs. It is particularly important that these areas are built as flexibly as possible, with easy upgrading of power and connectivity needs.

Security and Building Support Spaces

The open nature of libraries creates unique needs for security, and heavy usage provides a substantial challenge to maintaining the facility. In addition to control gates at exits, planners may control entrance to the library. Workstations open to all users may be placed in locations close to staffing and security points. Building managers and custodians need accessible and strategically placed facilities.

CONCLUSION

Fortunately for library planners, there are many prominent and innovative architects and interior designers who are interested in designing library buildings and renovation projects, including a number of firms that have groups of library specialists. Libraries are one of a small group of public buildings that still offer the challenge of creating an important space for a large community, and their design is a matter of great interest to the communities in which they are built. Libraries today are characterized by large, light-filled spaces, showcasing their contents and services and featuring welcoming facades. Often their design needs to be part of an overall master plan for the area in which they are built, and which fits with the overall architectural vocabulary. There are so many notable new library buildings that it is difficult to provide a selected list; there are numerous lists of notable library buildings, including the annual Architecture issue of *Library Journal* and the Design Issue of *American Libraries* and a wide variety of articles on new buildings in library and higher education literature, as well as in local and campus newspapers. The Web pages of libraries in the process of new or renovated buildings also provide a wealth of information. A brief list of books that are valuable resources for understanding the evolution of library architecture and the continuing requirements of library buildings appears below.

Winston Churchill said: "We shape our buildings; thereafter they shape us." At the heart of the evolution of library buildings is the evolution of library services and staff, and library planners will often discover that by the time they occupy their new space, their needs would have already changed in various ways. The familiar admonition to think outside of the box applies especially to the process of designing libraries, as does the need to recognize that the perfect library has yet to be built.

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Library Architecture: History

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Abstract

The history of library architecture goes back to the third millennium before Christ. Library architecture has been closely related to the development of library collections and their materials: from the clay tablets and papyri of temple libraries to the stately interiors of noble and royal libraries and the rationally organized stacks of the twentieth century research libraries. However, in the twentieth century and around the millennium many libraries have also developed into multipurpose or multispace cultural and public centers. Important steps in the development of the modern library have been: Gabriel Naudé's *Advice* from 1627, the library visions of the Age of Enlightenment, the open access of the public libraries, and the opening of the library space of the twentieth century. Around the millennium physical library space is challenged by "the library without walls."

There is a close connection between the development of books and media and the development of library architecture and interiors. Existing library buildings, historical libraries, and library projects can be seen as expressions of the politics of culture, knowledge, and information of different societies and historical periods from the first written documents to the digital challenges to the physical library space.

CLASSICAL, MONASTIC, AND ROYAL LIBRARIES

The history of library buildings goes back to the third millennium before Christ, where clay tablets were kept in rooms in palace compounds in Mesopotamia. In Egypt, papyrus scrolls were kept in both palace and temple libraries. In China, bamboo slips, panels of silk, and paper scrolls were stored in libraries. In Greece and Rome, the standardization of simple alphabets leads to the growth of popular literacy, and along with the democratization of the reading process public library buildings occurred. Often these public libraries were constructed as parts of public meeting places in the communities such as public baths, stoas, forums, and basilicas. In the third century after Christ the codex form increasingly came into use. Examples of library buildings from this period are the great library in Alexandria, the library in Ephesus in The Middle East, and the library in Timgad in North Africa. The Trajan's Forum with Bibliotheca Ulpia was built as a twin library with colonnade facades around the Trajan Column, which could in itself be read as a library document. Here the library was connected to a coherent urban space.

In the middle ages libraries were related to monasteries and cathedrals. There was a close connection between the writing of documents in a scriptorium and the collection of

documents in an armarium. In the ideal plan for the abbey of St. Gall from c. 820 there was a two-storeyed library building with a scriptorium below and a library above. Often the reading took place in stalls with chained books. Still existing libraries of this type are the Corpus Christi College in Oxford and The Hereford Cathedral Library. A more spacious example is the Bibliotheca Maletestiana in the city of Cesena in Northern Italy with lecterns in a row from 1452. Universities and university libraries were established in the thirteenth century along with the growth of commerce and towns and the beginning secularization of knowledge. At the University Library in Leiden (Fig. 1) readers were placed at lecterns with chained books that were divided into seven sciences: theology, literature, philosophy, mathematics, law, medicine, and history.

Typically collections from the Renaissance period included books, art, antiquities, religious relics, and objects of geology and natural history. Often these early encyclopedic collections with various categories had the character of a Cabinet of curiosities or Wunderkammer. The arrangement of objects could also be defined as a memory theater. Later collections were divided into more specialized archives, libraries, and different kinds of museums.

The art of printing gradually changed the amount of documents from the fifteenth century and influenced the selling, collecting, and lending of books. A few libraries were opened to the public, and the chaining of books became more seldom. The first comprehensive theory of library organization was formulated in 1627 by the Renaissance physician and librarian Gabriel Naudé in his *Advice* from 1627. Naudé was the librarian of the French Cardinal Mazarin and created his library. His theory was characterized by Renaissance humanism, emphasizing thorough and comprehensive studies. It presented all-round guidelines not only for arranging library collections,

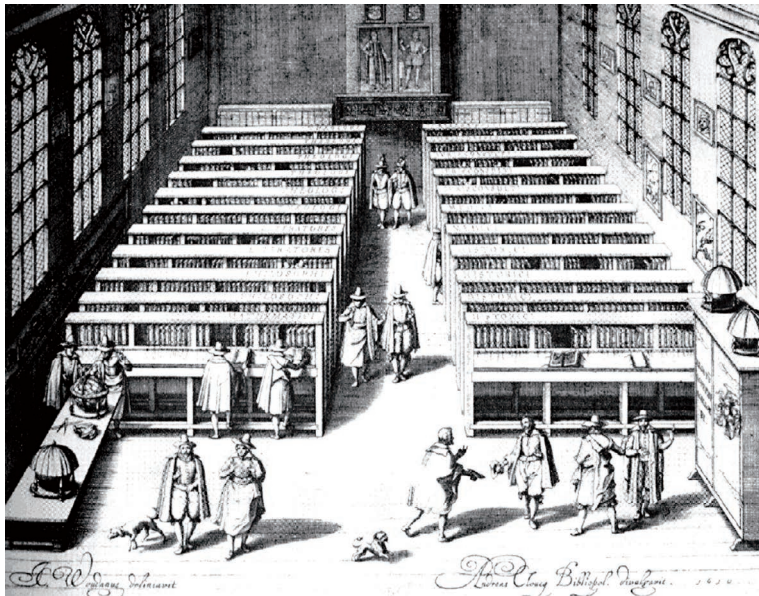


Fig. 1 The University Library in Leiden in 1610 with chained books, divided into seven sciences.
Source: Carlssons.

but also for furnishing and equipping library premises and making them accessible to the public. He introduced modern principles such as open access, representing opposite viewpoints in the collection and professional order. He recommended a practical design of the library and preferred a quiet location, possibly near a beautiful garden. He praised contemporary libraries of Sir Thomas Bodley in Oxford, of Cardinal Borromeo in Milano and the Augustin brothers in Rome for their open access. The library of the Medici in Florence was “beautiful and admirable.”

The long hall of the Medici Library, designed by Michelangelo 1523–1571, was a Renaissance library with rows of lecterns, flanking the central aisle. The architectural experience was shaped by the steady rhythm of corresponding lecterns and windows. The books were stored permanently at the lecterns. Therefore the reader had to move from one lectern to another to read different books. Another important Renaissance library of the same type was the Sansovino Library in Venice with its impressive façade at Piazza San Marco. The library building was begun by Sansovino in 1536 and completed in 1591 by Scamozzi.

The hall or Saal library developed together with the Baroque and Rococo styles in the seventeenth and eighteenth centuries in monastic, noble and royal libraries, with their stately interiors and distinguished collections. In these libraries both the collection and the interior served representative purposes of the owner or patron. Books were typically stored in shelves along the walls, impressing the viewer with the extent of the collection. Fine examples are the Hofbibliothek from 1726 in Vienna with its huge Prunksaal at the size of a cathedral with Baroque frescoes, showing Glory with a pyramid in the middle, the Monastic Library of Wiblingen in Germany from 1757 with its symbolic sculptures, and the

Benedictine Abbey Library at Admont in Austria with its collection and interior in white and gold. Experimental geometrical forms have the Wolfenbüttel Library from 1710 and the Radcliffe Camera in Oxford from 1749. The Herzogin Anna Amalia Library from 1766 in Weimar is interesting because of its almost oval library within the library.

Also in the oriental tradition, libraries represented places of learning and contemplation. The contemporary Tinayi Ge Library in China, built 1561–1566 by minister of the Ming dynasty Fan Quin, was placed in a garden with a small pool, connected to a lake, not only for recreation, but also to avoid fire. The building around a small yard has double eaves and gable roofs. The library was divided into six parts, corresponding to the idea, that the earth was formed in six parts. The collection of books had labels such as Gentle, Respectful, Modest, Sun, Moon, Time, Dragon and characters, referring to Chinese music.

THE ENLIGHTENMENT AND THE GRAND LIBRARY DESIGN

In the age of the enlightenment a new notion of public libraries arose against the background of an expanding readership and a growth in the number of published books and scientific, literary, and political journals. The ideas of the enlightenment were expressed in a series of grand utopian projects. The French enlightenment architect Étienne-Louis Boullée envisaged a universal library in a grand design in 1784. Boullée’s library project was called the *Bibliothèque du Roi* (Fig. 2). Before the French revolution the king and the state were so closely intertwined that one could interpret the *Bibliothèque du Roi* as an institution in which the state began to assume responsibility for providing books to the people. Like the French

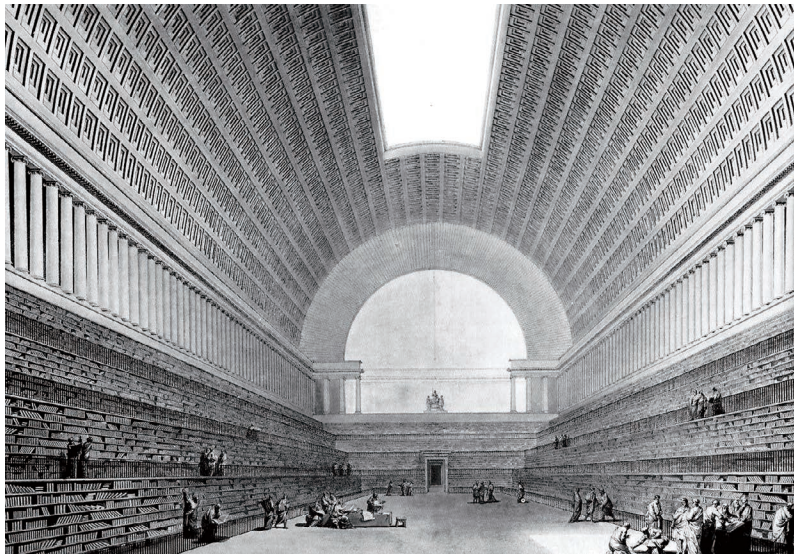


Fig. 2 Étienne-Louis Boullée's utopian library project from around 1780.
Source: Arkitekturmuseet.

encyclopedia it should gather, order, and disseminate all available knowledge. Boullée's revolutionary library project was a manifesto for the kind of building that would promote access to knowledge and educated thinking—the prerequisites for an enlightened and critical public discourse. It acquired significance as the model for a series of grand library buildings of the nineteenth century, and gave libraries and other cultural institutions a new, hitherto undreamt centrality in the urban landscape.

At the same time educational parks were established such as the Woerlitz Park at Dessau in Germany with both examples of agricultural cultivating methods and a small library building with agricultural and horticultural literature. Visitors could bring the library's books with them to the park, both enjoying and being educated by the surroundings. In Beverwijk in the Netherlands, the female writer Bethje Wolff built a small hut with a library in her garden (Fig. 3). This decentralization of the dissemination

of knowledge was possible because of the easier access and transportation of smaller books.

The library visions of Étienne-Louis Boullée inspired the grand library design of the nineteenth century.

In 1850 Henry Labrouste finished his *Bibliothèque St. Genevieve* in Paris. He conceived the building as a monument over the history of civilization and knowledge. The exterior was covered with plates, showing inscriptions of names of 810 names of international authors, philosophers, and scientists from Moses to the Swedish chemist Berzelius in chronological order, almost like a catalog in stones. Thus the building itself became a document, a book. The interior of the building had iron columns and decorative iron arches over the vast reading room one story above ground level. In 1875 Labrouste finished a new building for the *Bibliothèque Nationale*. In the reading room, 16 iron columns carried 9 domes of faience and glass. Murals were painted with wooden motives with blue skies. In Copenhagen, J.D. Herholdt designed a new University Library in 1855–1861 with elegantly slim iron columns and a tunnel vault, painted in pastel colors. Fine examples of the library architecture of the industrial age are also the cupola of the British Library in London from 1857 by Panizzi/Smirke and the Library of Congress in Washington from 1897 by Smithmeyer and Pelz. The reading rooms were panoptically arranged, respectively radial and concentric. Many public institutions from this period were built as panopticons, where you could supervise the building from its center. The Library of Congress also had a monumental staircase, which was a new representative element in library architecture.

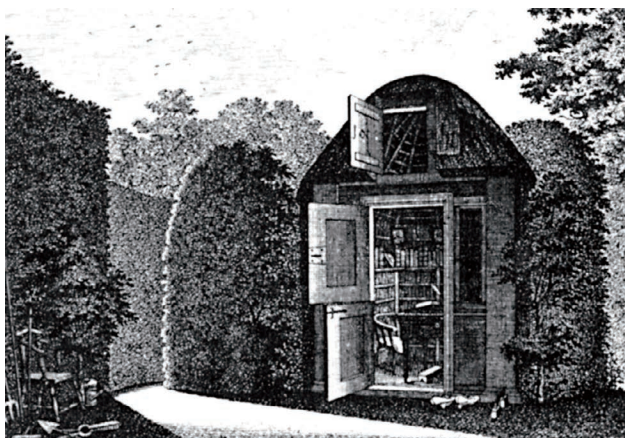


Fig. 3 Bethje Wolff's library hut in natural surroundings also from around 1780.
Source: Carlssons.

THE ANGLO-AMERICAN MODEL

In the course of the nineteenth century a more publicly oriented form of library developed in England and in the

United States. The “free public library” had its roots in places that served simultaneously as bookshops, subscription libraries, readers’ associations, and literary salons. In both countries the social background for the development of the new public library movement was the mass industrialization and urbanization of the nineteenth century. An important conception was the library’s central role in education, enlightenment, and democracy. The ideal was that library materials should be available to all, regardless of class, race, origin, language, or education. These libraries were often founded and funded by private patrons of culture and education (Fig. 4).

In terms of architecture and interior design library buildings became steadily grander, more numerous and more prominent as features of the cityscape, with monumental facades in historical styles, often including classical elements that expressed the enlightenment tradition. Whereas the reading room had been the central feature of the classic European libraries, the lending department now became the most important room of the library. At the same time the introduction of new technology and the

increase in the number of users, including women and children, led to greater specialization in the use of space.

Women and children were by no means unknown in the subscription libraries. Special women’s reading associations were organized and special departments were established in the public libraries, which served as respectable public meeting places for women and reflected the Victorian segregation of the sexes in all sorts of contexts, from schools to public beaches. Women’s reading rooms tended to be furnished in a more homely style, with carpets, polished furniture, curtains, fan palms, and fireplaces. By the end of the nineteenth century special library rooms with appropriate furniture were established for children in both England and the United States. Many large libraries had both academic and public sections.

Serving a larger public, libraries began to organize their space and their methods of distribution more strictly and professionally. Lending to larger numbers of people meant standardizing classification, arrangement and marking of books and routinizing library procedures, including those for borrowing and returning. Advanced systems were introduced for physical transport of books and information both inside and outside the new libraries. The big American public libraries developed all-purpose systems involving small carts for moving books around internally and horse-drawn vehicles, later superseded by cars, for external transport. At the same time extensive systems of branch libraries and deposit stations, mobile libraries, traveling libraries, and book distribution boxes were developed.

In several American cities, including Boston, Chicago, New York, Detroit, and Indianapolis, striking new free-standing buildings were erected to house the libraries. Boston Public Library was built between 1887 and 1895 as a “people’s palace” by the architects McKim, Mead, and White. The facade and parts of the plan were clearly inspired by the *Bibliothèque St. Genevieve*, which in turn had been inspired by Boullée’s projects. This inspiration was evident in both the exterior and the interior: in both the main facade and in the placing of the large reading room, Bates Hall, on the first floor. Divided into Bates Hall, with its scholarly literature and donated special collections, and Lower Hall, with its public book collection, the library integrated elements of both the scholarly libraries and the modern public libraries. Book ordering was automated, with the orders delivered by pneumatic post to the stacks, whence the books were transported in little wagons by miniature electric railway. The library moreover had 10 ancillary branches and a total of 17 lending facilities.

While these large library buildings were built as compact “boxes” in classical or renaissance style, or in the special style dubbed “renaissance classicism” that referred to the classical cultural tradition, the architect Henry Hobson Richardson built a number of libraries in free Mediaeval style, with especially Romanesque elements

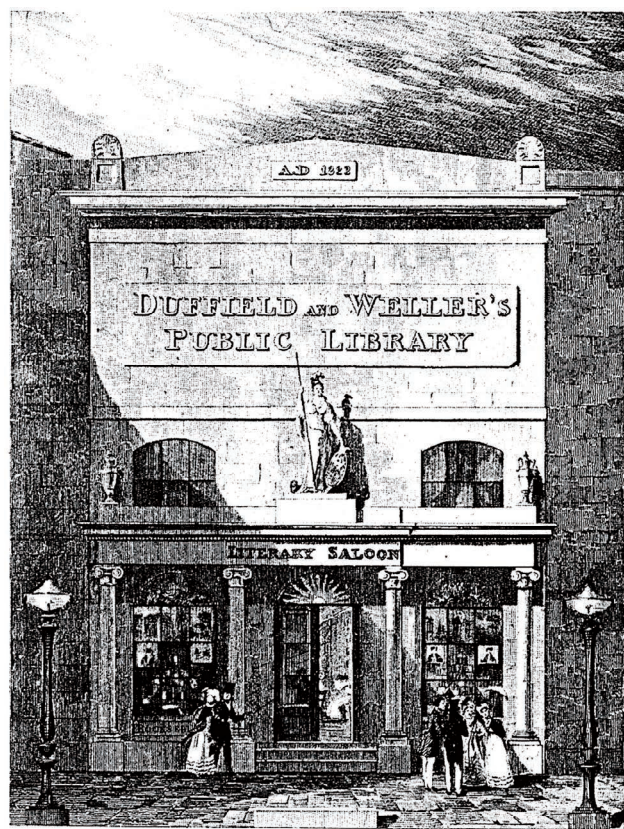


Fig. 4 Duffield’s and Weller’s Public Library and Literary Salon was founded in Cheltenham in 1822 as a bookshop, subscription library, and literary salon. It was not until the late nineteenth century that larger and more monumental public library buildings were erected in cities in England and America. Copperplate from circa 1850.

Source: Dr. Hauswedell & Co.

such as the Winn Memorial Library (1877–1878) and the Crane Memorial Library (1880–1883). The exteriors of these buildings were expressive and rustic, with rough-hewn stone, solid round arches, high gables, and asymmetrically placed turrets; inside, however, logic reigned, with the rooms all following in orderly sequence. Richardson's style was associated internationally with the Anglo-American library model and can be seen as the prototype for early Scandinavian public buildings, including the Dickson Public Library from 1897 in Gothenburg in Sweden and the Bergen Public Library from 1917 in Norway.

In addition, the Scottish–American steel magnate Andrew Carnegie funded no fewer than 2509 libraries throughout the English-speaking world. These libraries, built as miniature temples of knowledge, belong to a distinctive category of their own. To begin with Carnegie supported a plethora of charitable initiatives. In his essay *The Best Fields for Philanthropy* he listed seven fields: universities, libraries, hospitals, public parks, meeting and concert halls, public baths, and churches. But the best gift that could be made to a local community, he argued, was a public library.

In the first decades of the twentieth century some libraries were built as high-rise buildings as for example the John Crerar Library in Chicago (1920) and Yale's Sterling Memorial Library (1930), which provided an effective means of storing and transporting an ever-growing number of books. The John Crerar Library had a central location in Chicago next to the Chicago Public Library. It occupied premises from the 6th to the 14th floor, with reading rooms on the top two floors and each floor containing roughly 110,000 books.

In the interwar period library architecture and design were simplified and modernized. A good example can be seen in Los Angeles' all-white Art Deco main library, built by Bertram Goodhue in 1926. The exterior reflected both Indian and Mexican elements, which were combined with symbols of knowledge from Western cultural history. Inside, the cupola of the big central rotunda was decorated in 1927–1932 with murals depicting themes from California's history through the ages. Four different panels illustrated, respectively, the discovery of California, the Spanish mission, the Americanization of the state, and the founding of Los Angeles. At the top of the building's pyramid-shaped roof a gilded hand held a man-sized torch in turquoise terracotta—The Light of Learning—to express the library's mission of enlightenment.

OPEN ACCESS

The introduction of “open shelves” or “open access” around the turn of the last century was an important and much-discussed prerequisite for the development of modern public libraries. Open access heralded a whole new

form of library space, but gave rise to great debate and was usually introduced in several phases.

In the United States, open shelves in the modern sense were introduced from 1890 onwards, with the libraries in Boston and Cleveland leading the way, while in England they appeared for the first time in 1894 at the Clerkenwell Public Library in north London. In Denmark, they were introduced in 1902 with the establishment of the State Library in Aarhus, where the reading room was equipped with a special lending department. In 1909, a 1:1 model library, that was presented at a national exhibition and was intended as a prototype for future library buildings, was equipped with open shelves. The library was built in conjunction with a public meeting hall and served as a working model during the exhibition period. In England, only 70 out of 550 public libraries had open shelves in 1910, but from 1916 onwards open access became the norm. Thus the development was almost synchronous in North America, England, and Scandinavia.

Internationally the introduction of open access gave rise to heated debate. Advocates of the new system emphasized that it was a democratic, public-minded initiative that allowed borrowers to choose books on a more informed basis. Opponents put forward a great many arguments: there was a greater risk of theft or of books being misplaced and becoming impossible to re-locate. They also criticized lazy librarians who were bound to stay at their desks and not bother to help borrowers. There was a danger indeed that librarians would become redundant and perhaps be paid lower wages. There was a debate as to whether open shelves were more educational, since they allowed borrowers to orient themselves (though only among books that were not lent out) or whether, on the contrary, the closed-stacks system was better, because it forced borrowers to search systematically in the catalogs.

This discussion was accompanied by a number of compromises between open and closed shelves, usually in the form of gates at the counter or shelves protected by wire netting. Special book “cages” with wire netting were developed, that allowed the borrowers to see the backs of the books displayed with the relevant number or short text. In the Deichman Library in Oslo a special “cage” was set up in the youth department, so that children and young people could point out to the librarian the books stacked behind the net (Fig. 5). The Town Hall library in Copenhagen (built 1905) with shelves protected by netting offers a good example of the transitional methods adopted at the time. The introduction of open shelves was accompanied by a panoptic organization of the library, in which the librarian was placed at a counter at the center of a fan-shaped arrangement of bookshelves. This enabled him to survey the entire room so that he could assist borrowers in their searches and counter any problems with misplaced books or theft. The panoptic arrangement of libraries culminated in the 1920s.

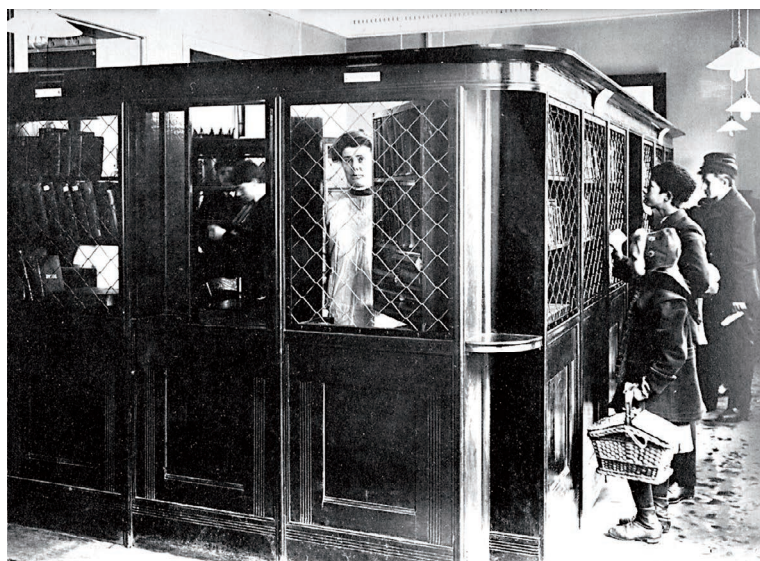


Fig. 5 Book cage in the Youth Department of the Deichman Library in Oslo from around 1900.
Source: Aschehoug.

To serve the growing library readership efficiently a modern counter was introduced that became the centerpiece of the panoptic arrangement of furniture. This type of counter incorporated a number of practical functions relating to lending and correspondence and could be used in many types of premises, serving the borrowers as they passed to and from the open shelves. Gradually it became necessary to extend the library's initially rather small office area, and some of the pressure on the many functions of the counter was relieved.

Open access was thus an important part of the creation of a new library space in which the borrowers could walk freely about the premises, browse among the shelves, and chat with one another. They could find and read the books they were looking for, but they could also stumble on something unexpected. These possibilities were important aspects of a new type of library and a new library identity that the room itself both expressed and helped to create. This new openness would later be related to the open, flowing, and transparent space of modernist architecture. Borrowers were no longer bound to present their wish lists to a librarian behind a closed counter. Borrowing was simplified by replacing long forms with the simple method of stamping a loan card.

THE LIBRARY AS A TEMPLE OF KNOWLEDGE

With the open-shelf system, new library technology and the standardization of library routines for cataloging, classifying, and lending books, an international model was created that had a crucial influence on the development of the physical design of public libraries in the first half of the twentieth century. An important aspect of this library model was the almost standard division into an adults' lending library, a reading room and a children's lending library/reading room.

Both in terms of architecture and interior design the many Carnegie Libraries—often quite small, yet monumental and temple-like in appearance—became highly influential internationally, offering model planning solutions for libraries of various types and sizes. Andrew Carnegie's secretary James Bertram drew up a set of guidelines in his *Notes on the Erection of Library Buildings*. Here he set out six practical planning solutions for libraries of various sizes, which with suitable advice could be freely adapted by local architects to meet local needs. A feature common to all these plans was a flight of steps at the center of the building, leading up to an elevated ground floor with a reading room on one side, an adult library with a centrally placed counter in the middle, and a children's library on the other side. Together, the steps and columns emphasized the loftiness of knowledge (Fig. 6).

The ideal form of the classical "temple of knowledge," "temple of enlightenment," or "temple of books" involved a symmetrical ground plan, shaped like a "butterfly" with the entrance and the adult lending library representing the body in the middle axis, and the adult reading room and children's library forming the "wings." The form could be compact like a basilica with a central nave, with the wings folded into the body, or the wings could be spread out to form a T-shape. Often the middle axis served to connect the library building with its surroundings. This classical monumentality was further underscored by the high steps that led up to the entrance, often with columns. The symmetrical design continued into the front hall and on into the adult lending library, culminating in the counter or librarian's desk, which commanded a view of the whole room.

The main catalog with its record of the library's holdings was likewise placed on the middle axis, and frequently a clock embellished the center of the end wall as well; these features symbolized order—in both time and



Fig. 6 Carnegie Library in Decatur, Alabama, built 1903.
Source:<http://www.plannersweb.com/publicbldgs/LIB-DecaturAL.html>.

space—in the library’s comprehensive collections. The ground plan of the building, its interior design and furnishings and the arrangement of the books all served to express objectivity, stability, and solidity.

The “trinity” formed by the division into adult lending library, reading room and children’s library became the archetypal plan of the temple of knowledge. From the outside, the ground plan and the building itself could be read as forming a secularized temple of enlightenment and the interior a secularized basilica, based on the model of the mediaeval church with a nave and aisles. Thus the temple of knowledge was at the same time sacred and secular, both in terms of architecture and interior design. Moreover, the three types of library rooms were distinct in terms of function, codes of behavior, and the identity of the librarians who served in them. The distinction between the three types, however, was stronger in Europe than in America.

The adult lending library was the central room of the public library. It usually took the form of a symmetrical gallery with high windows or top lighting. This arrangement emphasized the loftiness of the room and the many meanings of light. With its open shelves the adult lending library represented the library’s intention to reach out to the great reading public, to whom it offered professional guidance and modern methods of lending. The borrowers could search and browse freely among the shelves and it was possible to converse normally. The ideal librarian of the adult lending department was seen as an active communicator of culture, with special experience and skills in choosing the collection of books.

The reading room was the place for enlightenment, concentration, and reflection, and often included special rooms for study. It was also associated with reference work, which in its modern form was an important part of the identity of the library profession. With rules enjoining users to converse in low voices and move around quietly, it was also the room with the most regulated behavior. It

contained a collection of practical, informative reference books designed for purposeful study. Newspapers could also be read here if there was no special newspaper room. Newspaper reading harked back to the recreational reading rooms, often designed to be social places where the public could take shelter in the warmth. Although newspapers played an important role in the political arena, the perusal of newspapers did not enjoy the same high status in the library world at the time, with its lofty ideology of enlightenment, as did the use of reference books. Moreover, newspaper reading could disturb the peace and concentration of the reading room. Often newspapers were stored in tall reading stands, which precluded barely tolerated users from sitting down, getting comfortable, and wiling away the hours.

Finally, the children’s library was oriented toward the reading, education, and enlightenment of the coming generation. Initially, libraries simply provided special shelves with books for children. Later, special children’s rooms were introduced, which in larger libraries were further divided into a lending department and a reading room. Although the children’s library was the liveliest and freest room, it was furnished in the same style as the adult library, albeit on a smaller scale. However, the children’s library was often specially decorated and in some cases equipped with a story-telling space for reading aloud.

Among the qualities of the temples of knowledge were their recognizability, regularity, clear functional division, spaciousness, and airy premises with good high ceilings. It is somewhat paradoxical, however, that the public library as a supremely democratic institution should become associated with a relatively closed and pompous style of building.

The Stockholm City Library offers a good example of the way in which the temple of knowledge was architectonically refined. It was designed by the Swedish architect Gunnar Asplund and built between 1924 and 1928. The simple geometric ground plan consisted of a circle inscribed in a quadrangle, corresponding to the central cylindrical building which rises above the four wings. The monumentality of this cylinder corresponded to the cupola of the British Library and the cupola of the Library of Congress in Washington. The building had four virtually identical facades. From the entrance hall one ascended a long, narrow “scala regia” which lead like a dark passage to the great, light lending room, formed as a rotunda with two circular book galleries, containing Swedish and international fiction, poetry, and drama. Non-fiction, which was considered the highest form of educational literature, was placed in two halls in the side wings; here you could find reference books and borrow scholarly or technical works on different subjects. The division of books into different subject areas, and the amalgamation of reference and lending collections, were novelties in librarianship.

PUBLIC LIBRARIES IN CENTRAL EUROPE

In Central Europe the closed-stacks system remained the rule in public libraries right up to the decades after World War II. A German survey of library buildings in 1930, *Der Volksbüchereibau*, explained the reasoning behind the closed system and illustrated its use in German public libraries. It was alleged that the English “Freihandbibliothek” (“free-hand library”) deprived readers of the opportunity for individual, qualitative, in-depth enlightenment that was the hallmark of the German public library’s educative tradition. It was criticized that in the English open-access library the reader did not engage directly with a librarian. German public libraries in the Weimar period retained their closed stacks with sober dispatch rooms for ordering and borrowing books. Whereas the adult lending room was the main room in the Anglo-American and Scandinavian open-shelf libraries, the closed stacks, often with several dispatch rooms attached, were given pride of place in the German public library buildings of the time.

It is interesting to note that the first public libraries with open shelves in Germany were introduced in Bremen in 1939 and in Hamburg in 1940 under the Nazi regime. The Nazis were eager to have a public-minded and effective library service in which they fully controlled the contents, just as they recognized the benefit of using mass media such as film and radio for propaganda purposes. After World War II, the Amerika Gedenkbibliothek, established in West Berlin in 1954, was equipped with open shelves that served as a model for public libraries in post-war democratic Germany.

In Austria the social democratic workers movement introduced large-scale buildings of public housing in “Red Vienna.” These great buildings consisted of numerous small apartments that were designed to solve the city’s housing problems, but at the same time included a number of communal facilities such as kindergartens, public baths, and libraries that reflected the ideological emphasis on health and culture. The libraries in these Viennese apartment blocks were generally the same size as an ordinary apartment and furnished as reading rooms without direct access to the actual books. Reflecting the ideological and political significance of knowledge, the library in Sandleitenhof had the following inscription on the wall: “Bücher haben uns in die Sklaverei gebracht. Bücher werden uns wieder befreien.” (“Books have enslaved us. Books should liberate us again”). The Viennese workers’ libraries are interesting because they were conceived as part of an overall cultural-political plan that embraced all aspects of leisure: health, body culture, reading, adult education, enlightenment, and political activities. The Viennese apartment block libraries exemplified politicized institutions, as did, to an even greater extent, the Soviet workers’ clubs, which were dominated by Communist Party propaganda, but which were also at the beginning an arena for experiment in architecture and interior design.

RUSSIAN EXPERIMENTS

After the Russian Revolution in 1917, libraries were seen as an important prerequisite for creating a new socialist society in the Soviet Union. The Russian constructivists contributed to a number of projects in this regard, ranging from utopian cultural centers built in soaring avant-garde style to practical proposals for the design of “workers’ clubs” that were conceived as breeding grounds for the new culture. For the Soviet Union’s exhibition pavilion at the World Exhibition in Paris in 1925 the artist and designer Alexander Rodchenko had set up a model of such a workers’ club. The idea behind the project was that after a long day’s work the worker could relax with some politically enlightening reading, chess and good fellowship in simple proletarian surroundings without bourgeois carpets, polished furniture, or curtains. The club was furnished extremely austere with a long narrow table and chairs, shelves for journals and magazines, a chess table with seating for players, a blackboard and photographs of Lenin. One wall could be used for slide shows. Rodchenko’s proposal was never put into practice and never exhibited in the Soviet Union.

One of the most experimental library projects in the 1920s was Ivan Leonidov’s 1927 model for a Lenin Library or Lenin Institute of Librarianship in Moscow, which together with Tatlin’s tower and El Lissitzky’s Proun room became one of the icons of Russian constructivism. The Institute was conceived as the Soviet Union’s collective information center with space for 15 million books, 5 reading rooms with seating capacity for 500–1000 people, and an institute of librarianship. The project also included a balloon-shaped planetarium and flexible auditoria. The library would be automated, with systems for transporting books horizontally and vertically. As a building complex, it was composed of various soaring geometrical shapes with plenty of potential for expansion. The materials to be used were glass, steel and concrete, and the library would be connected with the city via the metro and aerodrome, and with the world at large via a large-scale radio station. It was also an interesting novelty to conjoin a working library with an institute of librarianship. Leonidov’s “information architecture” without doubt constituted the most advanced library project in the interwar period. Quite how advanced it was, can be seen if one compares it, for example, with the main libraries in Los Angeles and Stockholm from the same period. Leonidov’s library, on the other hand, was never actually built.

Leonidov also developed open plans for cultural centers and “clubs of a new social type,” in which film and radio would function as “living newspapers.” His projects were criticized for being too utopian, and he was charged with “left deviationism.” Leonidov’s advanced projects, in which the library was seen as a universal communications center in an experimental information architecture of iron

and glass constructions anticipated present challenges to the traditional library space.

In 1928–1939 the Lenin Library in Moscow, designed by Shchuko and Gelfreikh, was erected in Moscow as the national library of the Soviet Union. This was a far more traditional and classical building than that envisaged in Leonidov's project. The entrance was constructed with pillars in polished black granite bearing a frieze of workers and peasants. The library interior, which served traditional library functions, was designed in the same historic style as the Moscow metro stations of the same period, with polished stone floors, pillars, circular chandeliers, and coffered ceilings.

THE SCANDINAVIAN MODEL

During the interwar years a new type of Scandinavian library arose, that reflected the growth of the welfare state, the cultural movements and the modern architecture of the time. It was less monumental and more oriented toward ordinary everyday life than the temples of knowledge. The hallmark of the Scandinavian model was its combination of modernistic experiment with traditional library design.

International modernism was first introduced in library architecture by Alvar Aalto's library from 1935 in Viborg/Viipuri in Finland, which at that time was Finland's second largest city. The building consisted of white cubic shapes with a large entrance in glass, but also had inner organic features. The library was set in a park, and Aalto envisaged the white walls being brought alive both in summer and winter by the shadows of the park's trees.

From the entrance one went up to the lending library, where the counter stood as the culminating point, modeled as a small mountain of the Finnish landscape, at the end of a symmetrical staircase. The sunken part of the lending library offered a new interpretation of the classic gallery library. Natural and traditional light wooden materials were used extensively, and the wooden ceiling in the lecture hall was organically folded. The idea was to distribute the sound in the long auditorium and thus make the room more democratic, with everyone being able to hear everyone else. Aalto later designed several libraries.

Nyborg Public Library was one of the last new libraries to be built in Denmark in the interwar period, and with its combination of tradition and modernity it represented in several ways a synthesis of Scandinavian cultural politics and library architecture of the period. The library was designed by Erik Møller and Flemming Lassen and was completed in 1939. It consisted of two red brick wings, joined by a low glass passage, which formed the entrance to the library and its garden, and like a greenhouse united the exterior with the interior. The simple entrance was markedly different from the grand steps and high doors that characterized the temple of knowledge.

The library's various functions were carefully designed with regard to both overall unity and the needs of the individual user. The interior was designed especially for Nyborg Public Library with the assistance of furniture designer Hans J. Wegner. Chairs, tables, bookshelves, and wall panels were made of sycamore wood. The free-standing shelves projected out from the walls, allowing a view through the windows to the town's houses and canals (Fig. 7).

This open, user-friendly architecture and design brought the library closer to everyday life. With its accommodating form, it was a break with the monumental tradition of the time and became an example of a new type of library architecture where easy access, freedom of movement, spacious rooms, and the use of light wooden furniture were expressions of democratization and public enlightenment. The Scandinavian model with its open, informal, and familiar-looking library buildings, often of high architectonic quality, became an inspiration for library architecture in the following decades.

FLEXIBILITY, FUNCTIONALITY, AND MODULARITY

After World War II library buildings expanded, influenced by the ideas of modernist architecture and rational planning of space and functions. Modernism influenced library architecture in the direction of the sober and down-to-earth: "No columns, no pillars, no arches, no ornament, no contrived monumentality" as the architectural historian Nikolaus Pevsner put it. After the war there was a movement toward library environments that were "light, spacious, and informal." Library space became even more open and transparent. In urban planning, these modern libraries became part of the new cultural centers of the suburban landscape.

Another aspect of modernism in library architecture, but also as a consequence of a new rationality in library planning, was the development of modular systems with structural columns. These systems made massive load-bearing walls unnecessary and at the same time they made flexible interior functions and furnishings possible. Walls were temporal and could be removed according to changing needs and functions. The idea of the module was twofold: to ensure that the bookshelves could be located anywhere in the library (providing flexibility) and to position the structural columns so they would not interfere with the spacing of bookshelves (providing functionality). The keywords of library planning in the decades after the war became flexibility, functionality, and modularity.

Much attention was paid to standards of space and furnishing. Needs of space for staff and users were defined. As seminar-style teaching became more common, it seemed important to merge study space with book storage space in libraries with educational purposes. The

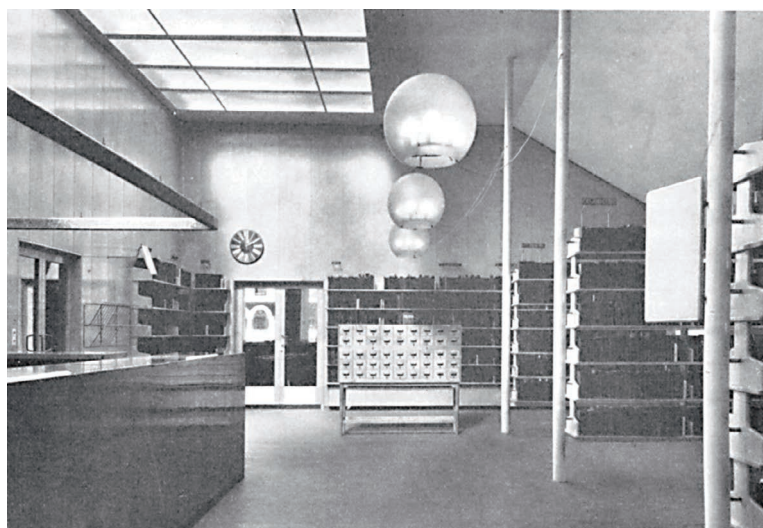


Fig. 7 The interior of Nyborg Public Library from 1939 with light sycamore panels and almost floating free-standing shelves.

Source: Folkebibliotekernes Bibliografiske Kontor.

ideals of library service and design were to create inviting and pleasant as well as efficient interiors, combined with well-organized and coordinated architectural elements. While the ideals were very attractive and progressive, the buildings themselves—with consistent ceiling heights, large floor-plates, and artificial lighting—tended to become monotonous. Rectangular buildings and furnishings became typical with the book as “the real library module.”

An artistic and minimalistic version of the modular library in glass and steel is the Martin Luther King Jr. Memorial Library in Washington DC, designed by Ludwig Mies van der Rohe and completed in 1972. A special and elegant expression, that is only modular in its architectural expression, is The Beinecke Rare Book & Manuscript Library from 1963 at Yale, designed by Gordon Bunshaft from Skidmore, Owings, and Merrill. A six-story above-ground tower of book stacks is surrounded by a rectangular windowless building with walls made of a translucent marble, which transmit subdued lighting and provide protection of the historical collections from direct light. The marble wall makes the building look quite different from the outside and from the inside.

An almost futuristic example of library architecture from this period is The Marin County Civic Centre in San Rafael in California from 1960, designed by Frank Lloyd Wright and containing public administration, library, and auditorium. The grand tunnel-like arches make the center look both classic and modern. Worth mentioning in this context is also the extension of The Boston Public Library from 1967 to 1971 by Philip Johnson, built in the same pink granite as the historical building and repeating the architectural elements in simple and abstract forms. The extension houses the circulating parts of the library. With its massive walls, it is often compared to a mausoleum. The “half-moon” windows and “rounded columns” are almost post-modern. The Exeter Library in New Hampshire by Louis I. Kahn from 1967 to 1972 has some of the

same monumentality with square form and brick piers. In the inner space, the reading room is a central hall encircled by balconies with books and study alcoves. The reading room is overlooked through giant circular openings in the interior screen walls. The light comes from above through a diagonal cross of concrete. All constructions and materials are visible.

In Berlin, the State Library from 1967 to 1978 by Hans Sharoun represents the period of late-modern architecture, but not the modular thinking. On the contrary the State Library like the nearby Berlin Philharmonic Hall, also by Sharoun, are examples of modern expressionistic architecture, going back to alpine and crystalline architectural visions from Sharoun’s youth in the early decades of the century. The exterior of both buildings is covered with aluminium plates, colored yellow. Inside the State Library the reading room is located on the third floor, with triple floor height of 9 m. Hanging mezzanines with sharp edges are part of the inner complex constructions. Books are delivered from a closed-stack system by request.

SPECTACULAR LIBRARIES AS PUBLIC PLACES

Around the turn of the millennium new tendencies in library architecture and design have occurred. The development of new media and digital information technology has challenged the traditional library with different visions of “the library without walls,” but it has not weakened, rather apparently heightened international interest in the library as a physical space.

Especially, a series of grand metropolitan libraries has been built around the millennium. Almost as “icons” these “new downtown libraries” as well as museums and other spectacular buildings have become a parameter in the competition between great cities of branding themselves and attracting the creative and wealthy classes. However, the intentions are also to revitalize the inner districts of the

metropolitan areas. The post-modern architectural expressions, interiors, media collections, and organization of these highly visible buildings may vary. Typically libraries develop as multiuse public spaces, where collections of books and other materials are important, but in connexion with educational, cultural, and social activities. Often libraries are defined as “third places” in society between home and work. In some of these initiatives the experience economy plays an important role. In other contexts the significance of the library as a place of retreat and reflection is emphasized. The concept of “open access” and “open space” has thus become even more important in library architecture.

Whereas the decades of modular libraries were dominated by ideals of systematic planning, also for the future, the millennium period is characterized by rapidly changing functions and experiments. The architectural styles go from classical symmetrical buildings with columns and decoration, almost like the historical Carnegie libraries, such as the new libraries in Chicago and Nashville, to the deconstructed colosseum of the library in Vancouver and the ice pack of glass and steel that marks the library in Seattle.

Especially the new public library of Seattle from 2004, designed by architect Rem Koolhaas of the Dutch firm OMA (Office for Metropolitan Architecture) has been discussed as example of the new iconic library architecture. The history of Seattle’s main library is in itself a show-case of the development of twentieth century library architecture at the same site in downtown Seattle. A Central Carnegie Library was opened in 1906 as a typical temple of knowledge in Beaux-Arts design. It was replaced in 1960 by a modular library in five stories in international style that contained special facilities such as a drive-in service window, where patrons who ordered books in advance could pick them up without having to get out of their cars. The library from 2004 is an 11-story crystalline building with striking appearance among the high-rise office buildings of the area. The glass and steel net is the skin around the inner floating platforms. At ground level you find the Microsoft auditorium and on the third floor the open “living room” with several activities including reading. From here the escalator will take you to the “mixing chamber” with a computers and professional help, and you can continue to the four-story “book spiral,” where the non-fiction collection is placed in a continuous series of shelves according to the Dewey Decimal System, without breaking the collection up onto different floors or sections. On Level 10 you find quiet areas of reading, local history, and administration. As an ideal the library design tries to combine fixed and flexible functions.

The iconic status is corresponding to other spectacular downtown library buildings such as Chicago, Denver, Las Vegas, Los Angeles, Nashville, Salt Lake City, and San Francisco, trying to be part of the experience economy, to

create multiuse public spaces and to anchor community development of inner city areas.

In a smaller scale the public library of Cerritos, south of Los Angeles near Disneyland, is an example of an experience and learning library, where each room of the library tells a story. Already outside the library you are met by futuristic sounds, old films, or public announcements. Inside the ground floor is organized around a “Main Street” with palm trees. To your right you find “The Old World Reading Room” with soft carpet on the floor, a fireplace, chandeliers, and dark wooden shelves with old editions, inviting you to sit down and read. To your left is the spectacular children’s library with an entrance of over-size children’s books, saltwater aquarium, a dinosaur reconstruction, a lighthouse, and a changing sky. Moving through Art Deco-shelves of the central book collection or proceeding up the escalator you will reach the twenty-first century level in futuristic design with computer stations and study rooms. This postmodern library design represents the opposite of the modular library other more minimalistic tendencies around the millennium.

Also in Europe a series of spectacular libraries have been built. In Paris the Bibliothèque Nationale de France was erected 1988–1995, designed by Dominique Perrault. The library is situated in a former industrial wasteland at the banks of the Seine. The four corner towers of the building can be interpreted as open books with symbolic meaning, and the inner courtyard with trees can be experienced in relation to Naudé’s thoughts about the importance of library gardens and Labrousse’s painted artificial landscapes. Around the garden specialized libraries are arranged on mezzanine levels with deliverance from the towers, that are housing stacks and administration.

In London the British Library near St. Pancras Station was begun in 1982 and opened in 1997, designed by Sir Colin St. John Wilson. Red brick materials and colors are corresponding the old station, but the modernism of the new library building is contrasting the Neo-Gothical Hotel and Station. The library is situated in central London. The portico, the piazza, and the amphitheater connect the library with the surrounding urban space. The building has four floors below ground. The exhibition galleries with easy general access are located at two floors at ground level and the three top floors contain reading rooms with daylight. The library is crowned by a roof garden.

In Copenhagen “The Black Diamond” was built as an extension to The Royal Library as part of the creation of a new harbor promenade with several cultural activities and institutions. It was designed by the architects Schmidt, Hammer, and Lassen and opened in 1999. The name refers to the sharp prismatic edges and its surface of black granite and glass, reflecting the water of the harbor. The black surface is contrasting the inner open spaces with reading rooms in light wooden materials in Scandinavian style. From the wave-like balconies of the central foyer, that cuts into the building as a 24-m high atrium, there is a

panoramic view over the harbor. The seven floors of the building contain not only traditional library functions such as the four reading rooms, but also a concert hall, exhibition galleries, bookshop, café and restaurant. A small Jewish Museum, designed by Daniel Libeskind, has been integrated in the old red brick library cathedral from 1906, designed by Hans J. Holm.

Other examples of metropolitan libraries are the Main Library of Amsterdam by Jo Coenen from 2007 with multimedia and multiuse space and the main Library of Vienna by Ernst Mayr from 2003, built over the underground system. A special experiment in library architecture is the Library of the Delft University of Technology by Mecanoo from 1993 to 1997, where the roof of the library is transformed into a green campus. The futuristic design makes the library look like a landed spaceship. The Madrid Regional Documentary Center by Mansilla + Tunón from 1994 to 2002 is an example of adapted reuse of historical industrial architecture, in this case a former brewery.

GLOBALIZATION

Another important issue of library architecture around the millennium is globalization, both of communication networks and access to information, but also of library architecture and design. Especially in Japan, China, and South East Asia new library buildings are expanding and experimenting with the possibilities of new information technologies. Some of these buildings are built in regional styles, but often they are representing the same “monumental futurism” as the library buildings of the west. In 2003, the international library organization IFLA published *New Library Buildings of the World*, that is an international survey of spectacular new library buildings, documenting this development, where library architecture is becoming increasingly international.

An interesting example of Japanese library architecture is the Sendai Mediatheque, designed by Toyo Ito and completed in 2000. This “mediatheque” complex combines a library, an art gallery, and a media center of visual images. The open space building is defined by three elements: “plate,” “tube,” and “skin.” The “plates” are the six horizontal squares, representing the different media, connected by the 13 vertical “tubes” with flow of information, energy, water, light, and sound.

The “skin” is the outer layer, separating indoors and outdoors of the building. The glass façade is facing the main street, making visual contact possible both from the outside and the inside.

In China some of the new library buildings are reflecting regional architectural traditions such as the National Library from 1987 and the Peking University Library from 1998. The Shenzhen Library 1998–2003 is designed by the Japanese architect Arata Isozaki. It is a



Fig. 8 The Bibliotheca Alexandrina at the Mediterranean Sea.
Source: webmaster@nile.co.za.

cultural center that also contains a concert hall. The large open spaces have visible constructions and hanging escalators.

One of the most ambitious cross-continental and cross-cultural library initiatives is the new library of Alexandria. The Bibliotheca Alexandrina was designed by the Norwegian drawing office Snøhetta and opened in 2002. The library is sited by the water front avenue in the same district, where Greco-Roman remains were uncovered in 1996, and overlooks the Mediterranean Sea. As the ancient Egyptian image of the sun the library concept is a circular building, inclined toward the sea and submerged into a pool of water. The wall is of Aswan granite with calligraphy, inscriptions and signs from alphabets and civilizations from all over the world. The ideals of the library are both to combine history with the present and to connect different cultures, languages and parts of the world (Fig. 8).

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Library Automation: History

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Abstract

This entry provides a review of the history of developments in library automation in the United States. It discusses four contexts within which library automation should be seen, and does so within each of six time periods: 1) pre-1945; 2) 1945–1960; 3) 1960–1975; 4) 1975–1990; 5) 1990–2008; and (6) post-2008. In each time period, it reviews the societal context and the information technology context, and then two library contexts—technical services and information services.

INTRODUCTION

This entry provides a review of the history of developments in library automation in the United States (It is based in part on an earlier one: Hayes^[1]). It discusses four contexts within which library automation should be seen, and does so within each of six time periods: 1) pre-1945; 2) 1945–1960; 3) 1960–1975; 4) 1975–1990; 5) 1990–2008; and 6) post-2008.

Two of the contexts are external to libraries. One is the societal context, including publishing and the perceived role of libraries. This context is important for understanding the development of library automation because it is the environment within which libraries function. The other is that of the information technologies, the hardware and software that are the tools used in library automation.

Two of the contexts are internal to libraries. They include its management and technical services, on the one hand, and information services, on the other. For the purposes of this entry, “technical services” include those library operations involved in management of the materials acquired by the library: the processes in acquisition itself, in cataloging and classifying, in preservation and conservation, in collection control, including circulation. “Information services” include reference services, instructional services and guidance in use of the library’s collections, and access to databases and other electronic materials and services, both within the library and through the Internet.

The timelines for these contexts all interact and affect each other, and the discussion will highlight some of the interactions. Of special importance were developments in the commercial, industrial, and consumer sectors in society of parallels to those in the library and information science sectors. In many respects, though almost unheralded, developments of automation in libraries served as means for demonstrating the feasibility of their application in the larger arena. A specific example was the leadership of the

National Library of Medicine in proving the feasibility of high quality typographic output from computers, thus demonstrating that computer-controlled photocomposition was feasible. The use of online reference data services was first demonstrated in libraries and then found great acceptance in industry. As we proceed through this history, those kinds of interactions should be evident.

Also of special importance has been the effect of technological capabilities upon not only what could be done but upon the very perception of how to do it. This was evident in the early years, when the limits of punched card technology as well as the means for logical processing it embodied largely determined how people thought about using technology.

PRECURSORS OF LIBRARY AUTOMATION: PRE-1945

Although automation in libraries, as one normally thinks of it, is a phenomenon of the last 50–60 years, it is of value to recognize that there are precursors. Three of them represent elements of continuing importance.

First, Charles Coffin Jewett, as Librarian and Assistant Secretary of the Smithsonian Institution visualized a union catalog of the libraries in the United States. In 1852, he proposed the use of “stereotype plates” as the means for maintenance and production of such a union catalog^[2] (A stereotype plate is a metal plate containing a raised image of a page of type or engraving from which prints can be made). Clearly this represents an early stage in the development of automation, but it is more than that since it also represents the theme of cataloging as one of continuing importance that arises during each of the subsequent time periods.

Second, Dr. John Shaw Billings, head of the Library of the Surgeon General’s Office (which in 1956 metamorphosed into the National Library of Medicine, as will be

discussed later) was credited by Herman Hollerith with the basic idea of punched cards as means for data processing. According to Hollerith, Billings said to him, "There ought to be some mechanical way of doing this job (i.e., processing 1880 census data), something on the principle of the Jacquard loom, whereby holes in a card regulate the pattern to be woven."^[3] And indeed, Hollerith developed such a punched card system which was then used for the data processing of the 1890 census. His company, Tabulating Machine Company, later became IBM, and the Hollerith card dominated data processing throughout the world for 50 years. The punched card represents one stage, perhaps the first stage, in the development of means for data processing as a theme in this review of the history of library automation.

Third, microphotography dates from 1839 and was seen, from at least the early 1850s, as a means for preservation of library materials.^[4] In the ensuing 100 years and more, microforms (whether as microfilm, microcards or microfiche, aperture cards, or other forms) were increasingly used by libraries not only for preservation but as a means for acquisition and compact storage of materials, newspapers in particular. Microforms thus represent another continuing theme: developments of alternative means for publication and for acquisition and storage of library materials. In 1938, Eugene Power founded University Microfilms to serve as such a publisher.^[5] In 1943, Power and Watson Davis established the National Microfilm Association as means for furthering development of microforms for publication and for managing and using document collections.

Even earlier, in 1937, Watson Davis was instrumental in establishing ADI (American Documentation Institute, in 1963 renamed American Society for Information Science, ASIS, and in 1999, ASIS & Technology, ASIS&T) which was one of the professional societies instrumental in the development of library automation.^[6] Other professional societies key to that development were the Association for Computing Machinery, founded in 1947,^[7] and the Library and Information Technology Association (LITA, but originally Information Science and Automation Division, ISAD, of the American Library Association), founded in 1966.^[8]

EXPLORING THE POTENTIAL OF COMPUTERS: 1945–1960

Societal Context

During this entire 1945–1960 period, the United States was the dominant economic power in the world and the major producer of scientific research publications. The reason is evident: It was the only major country that had not suffered catastrophic losses during World War II. Its economic infrastructure was intact, as was its academic superstructure. Fortunately, it used its economic power

wisely, as best represented by the Marshall Plan that made U.S. resources available for the rebuilding of Europe and the Far East. From the standpoint of science information, at the beginning of this period (say 1948–1950), the United States produced more than 50% of the world's scientific publications.

From the time of Vannevar Bush, as the Science Advisor to the President, the needs for information in science and technology provided a continuing rationale for development of automated information management systems. Indeed, this period started with his frequently cited article, "As we may think."^[9] In a very real sense, it foretold virtually everything we have since seen in the developments presented here. Much though that article has been cited, however, a far more important document is the earlier 1945 report of the Office of Scientific Research and Development (OSRD) of which he was chairman. It urged that there be continued support to scientific research after conclusion of World War II and by doing so led to what in 1950 became the National Science Foundation and the National Institutes of Health.^[10]

Of specific relevance to this history, the OSRD report identified many of the continuing themes that have been important to library automation. It says, "It seems probable that use of cataloging and sorting devices now available in the form of business machines and microfilm technique might go far to improve present methods of searching the literature and making bibliographies."^[11] Indeed, by the end of the period from 1945 to 1960 the realization of that conjecture was well underway.

This was the period of the cold war, reaching its peak in the Korean War and the Cuban Missile Crisis. So there was a continuing emphasis on the needs for information services to support U.S. national defense. As the Cold War became more intense, the intelligence community—CIA (Central Intelligence Agency), National Security Agency, the intelligence arms of each of the branches of the Armed Services—required means for assembling, storing and retrieving, and analyzing massive amounts of data; their needs, more than any others, supported the development of computer hardware and software.^[12]

One of the most critical events came toward the end of this period—the launching of Sputnik by the Soviets in 1957—which shocked the military, industrial, and scientific establishment of the United States.^[13] The demands for automated systems reached a crescendo as a result of Sputnik and led directly to some of the most crucial developments in automation of libraries. The National Science Foundation launched its Office of Science Information Service to support development and implementation of automated systems and to sponsor the necessary research; of special importance was its funding of the automation of indexing and abstracting services, such as Chemical Abstracts Services.^[14–16]

It is also important to note that, consistent with the recommendations of the OSRD, health care and related

research became a priority of the federal government. The National Institute of Health, established in 1930 by the Ransdell Act, was greatly expanded, becoming the National Institutes of Health and encompassing many individual institutes.^[17]

During this period, publishing was much as it always had been. Composition was essentially manual. Though there were a few experiments with use of computer technology, they were completely outside the mainstream of commercial publishing.

The form of publication was simply print, using the traditional means for doing so. Xerographic means for duplication were just beginning to have an impact toward the end of this period. And the computer as means for publishing simply had not yet arrived.

Where then were libraries during this period? Indeed, there was increasing recognition of the importance of libraries, both as part of the activities referred to above and independent of them. Of great significance was the Library Services Act (later expanded into the Library Services and Construction Act) which, among other things, fostered the creation of library networks that have been of vital importance as automated systems became important to libraries.^[18] By the Medical Library Act of 1956, (Miles;^[19] Public Law 84-941, August 3, 1956:^[20] An amendment to Title III of the Public Health Service Act, the National Library of Medicine Act, placed the Armed Forces Medical Library under the PHS, and renamed it the National Library of Medicine) the Surgeon General's Library (first created in 1840) became the National Library of Medicine. At the end of this period, the National Library of Medicine launched its efforts to automate the production of Index Medicus.^[21]

In 1862, Congress had created the library of the Department of Agriculture, and in 1961 it too became a national library. (The "Organic Act of 1862", which established the Department of Agriculture, clearly identified the need for a library within it, and the first librarian was appointed in 1867. Over the years, the Department of Agriculture Library became, de facto, a national library but it was not officially designated as the National Agricultural Library until 1962, when "Memorandum No. 1496" of the Secretary of Agriculture did so).

All of these were clear recognition of the importance of libraries.

Information Technology Context

It is with a sense of shock that one compares the nature of the technology during that 15 year period with what we have today. At the beginning of it, data processing meant punched-cards and key-operated accounting machines (such as cash registers), with punched-tape (like teletype tape) as the "common language" for communication among such machines.^[22] Computers were limited in capabilities, in numbers, and in applications. While

computers were viewed as large and fast at the time, their capabilities were exceptionally limited.^[23]

The first computers for application in business and similar operations (among which would be included libraries and information services) appeared in the early 1950s, and "main-frame" computers became widespread by the end of the period. But all of that equipment suffered from the lack of adequate means for input, storage, display, and output of data. Punched cards and punched tape were the only means for input, and they operated at data rates roughly equivalent to 10 characters per second—the speed of teletype! Vacuum tubes (cathode ray tubes or CRTs, as they were called) and then, later, magnetic cores were the means for storage of operating programs and data while immediately being processed; but both were exceptionally expensive and limited in capacity—60,000 bytes would be a big internal memory! For large-scale data storage, there were magnetic tapes and magnetic drums—each slow and with inherent limitations in the ways they could be used. For display, there were the most primitive CRT units, with low resolution and presenting only limited amounts of data. And the means for output were punched card tabulators, with uppercase only fonts and operating again at the equivalent of 10 characters per second. Thus, even though the computers were fast, there wasn't much they could do, given the limited internal memory; they were inherently limited by capabilities for storage of large files and the slow speed of input and output.

However, during this 1945–1960 period technological developments of profound importance were taking place. Specifically, at the beginning the electronic components were essentially vacuum tubes. But the invention of the transistor in 1948 led rapidly to supplant vacuum tubes in computers and then the integrated circuit, first created in 1958, would become the basis for central processing units and make microcomputers possible (For a history of the transistor, see PBS's Web site).^[24]

There was one other event of immense importance to technological development at the end of this period. In a talk at Cal Tech in 1959, Richard P. Feynman, the great physicist of our times, said,

I want to talk about the problem of manipulating and controlling things on a small scale . . . all of the information that man has carefully accumulated in all the books in the world can be written in this form in a cube of material one two-hundredth of an inch wide . . . Why can't we make (computers) very small . . . For instance, the wires should be 10 or 100 atoms in diameter, and the circuits should be a few thousand angstroms across. . . . If (computers) had millions of times as many elements, they could make judgments. . . . They could select the method of analysis which, from their experience, is better than the one that we would give to them.^[25]

Nanotechnology, based on that talk, is today the crucial basis for the future of computing technology.

Library Technical Services Context

During this period, there was at best slow progress in development of automation for internal, technical processing in libraries. Of course, there were the highly successful uses of microfilm in management of circulation records, especially in public libraries, and there were efforts to use punched-card equipment for that purpose.^[26] There were similar efforts to deal with serial records, again using punched-card equipment. For the core technical service functions—acquisition and cataloging—while there were efforts, the problems were great, especially with respect to the number of data entries involved and the overwhelming costs in converting them to machine-processable form.

Two among the experiments, each by Ralph Parker, were of historical interest. The first was his effort in 1930 at the University of Texas. He told the story about wanting to try using a punched-card system for circulation control. The then library director, Don Coney (later to become Director of Libraries at the University of California, Berkeley) said, “OK. Here’s \$300 but use it wisely.”^[27] The second was his effort, at the University of Missouri, to initiate an evolutionary approach to an integrated library records system.^[28]

By the end of this period, the Council on Library Resources (since 1997, the Council on Library and Information Resources; The merger of the Commission on Preservation and Access and the Council on Library Resources (CLR)^[29] became official on May 30, 1997 when the Board approved the new enterprise, the Council on Library and Information Resources, CLIR) had begun to play crucial roles in successive stages in development of library automation;^[30] they were of special importance in providing support to the National Library of Medicine in its effort to automate the production of *Index Medicus*^[31] and to the Library of Congress in its first explorations of the use of computer-based systems.^[32] More generally, they were concerned with alternative means for producing catalogs and making catalog data available.

In that respect, one of the important attempts to apply computers for access to catalog data was the production of book-form catalogs, especially for union catalogs. It’s worth noting again the historical efforts of Charles Jewett to use stereotypes for the production of a national union catalog, as referred to above.^[33] In Los Angeles, the County Library system experimented with the use of punched-card equipment for its own union catalog,^[34] and there was a similar effort in the 1950s in Seattle, Washington, at the King County Library System (“The King County Library System has embraced each new wave of technology over the years,” said KCLS Director Bill Ptacek. “Our first catalog was produced from IBM punch cards in the 1950s. . .”^[35]). While those efforts were essentially dead-ends in the context of later developments, they were important steps in the general progress.

Information Services Context

Given the requirements for information storage and access, focused especially in the intelligence community, computers were seen as a potential means for meeting them. Despite the limitations during this period, the expectations were that the technologies would steadily improve, so there were many efforts to solve the technical and theoretical problems in this field.

But at the beginning of this period, the methodologies for information retrieval were largely based on physical matching of search criteria with document data. In this vein, Calvin Mooers had developed Zatocoding as a means for using edge-notched cards, and Mortimer Taube had developed implementations of his Uniterm concept.^[36,37] The Intellofax system at the CIA did much the same thing, using punched card equipment, and Hans Peter Luhn at IBM developed a set of similar approaches.^[38] In a real sense, this focus on physical matching reflected the very nature of punched card logical processing which was based on direct connection by wires on a plugboard.

It is of interest to note that, at that time, even the attempts to apply computer technology to the tasks in retrieval started with physical matching of search criteria with document data, using optical coincidence. In particular, the Rapid Selector (the realization by Ralph Shaw, at the National Agricultural Library, of the Memex of Vannevar Bush) used optical matching; the Minicard system, developed by Eastman Kodak and the Magnavox Company for the intelligence community, similarly used optical matching; even the Western Reserve “Searching Selector,” developed by James W. Perry and Allen Kent, used an electronic counterpart of such matching.^[39]

The point is that those early developments had not yet recognized the capabilities of the computer for complex processing of recorded symbols, so it was not until the end of this period that the techniques of modern computer-based retrieval began to appear.

There was one development toward the end of this period, made operationally possible by use of computer technologies that deserves special recognition. That was the creation of the *Science Citation Index* by Eugene Garfield and his associates at the Institute for Scientific Information. It truly revolutionized the means for indexing of the literature of science, placing it in the hands of the users of that literature through their citations.^[40]

BEGINNING TO BRING COMPUTERS INTO LIBRARIES: 1960–1975

Societal Context

In retrospect, although it was not evident at the time, there was a steady reduction in the cold war conflict between the United States and the Soviet Union. The tensions were still

there, and the cold war conflict would periodically bubble up and then simmer down. But the focus moved into Vietnam and a real war.

The needs in the intelligence community continued, of course, but there was something else, more fundamental and ultimately revolutionary that had become the driving force for automation of information activities. That was the transition of the United States and, at a much slower pace, other industrialized countries, from being “industrial” economies to being “information” economies. Today that transition has impact on every component of our economy and our society, but it was during this period that the changes began to become evident. The report by Marc Porat on the information economy of the United States,^[41] clearly identified what was happening and the fact that by the mid-1970s over 50% of the nation’s workforce was engaged in information work.

It is important to note that, although many see the appearance of the information economy as something created by and driven by information technology, the cause is much more fundamental. It is the imperative in development of the society that has created it and the technology merely feeds and serves that imperative, making it possible, yes, but not causing it. In any event, the information economy, whatever the cause, was the driving force for developments in library and information science during this period.

Of course, the importance of science information continued to be recognized. The Department of Commerce established NTIS as one means to improve dissemination of scientific and technical information. The National Academy of Sciences repeatedly reviewed the status of developments and recommended increased efforts.^[42,43]

During this period, the processes of publishing were revolutionized, as computer-based photocomposition completely replaced the former manual methods. And xerography became a fact of daily life in business of every kind. From the standpoint of this history, though, the important development in publishing was the onset of electronic formats, as represented by the creation of databases, initially as a result of efforts by the U.S. federal government.

Information Technology Context

During most of the 1960–1975 period, computing was centered on large main-frame computers. In fact, what was called “Grosch’s Law” (named after Herbert R. J. Grosch) governed most of the decisions about computing installation.^[44] It stated that “computing power goes up as the square of the cost,” the implication of which is crystal clear: the bigger the better! During this period, the University of California developed the MELVYL system, initially visualized as a centralized university-wide library service in the spirit of Grosch’s Law.

In parallel, there was extensive development of networks among computers, starting from the work of the University of California, Los Angeles (UCLA) Western Data Processing Center (literally the first such network)^[45] and expanding into Advanced Research Project Agency Network (ARPANET), of the Department of Defense,^[46] and National Science Foundation (NSF) super-computer network.^[47] Together they became the backbone of today’s Internet (now supplemented by all of the commercial communication networks).

In 1962, Dr. Leonard Kleinrock published the basic principles of packet switching, the technology underpinning the Internet. The birth of the Internet then occurred when his host computer at UCLA became the first node of the Internet in September 1969.^[48] Of course, as we will see later, the impact of the Internet has been profound, not only on libraries but on the entire world.

Library Technical Services Context

It must be said that, even near the end of this period, there were at best mixed feelings in the library community about the use of the information technologies. Some librarians regarded it as a meaningless diversion of funds and efforts.

“In sum, our experience with the computer in library operations has been one more replay of The Emperor’s New Clothes, and what we were led to believe were distant mountains laden with gold, available merely by boring a drift in the slope, turn out, upon close inspection, to be the hairy buttocks of the well-fed computer industry. And from such a source we have gotten exactly what we should expect.”^[49]

But, during this period, despite such views by some librarians, there were increasing efforts to at least experiment with the use of library automation. A context of special importance in doing so were efforts to establish cooperative networks among libraries. Each of the states, under the stimulus of the Library Services and Construction Act, created its own state library network, intended to include public, academic, school, and special libraries together. Washington State, in particular, established the Washington Library Network (WLN) as an automated union catalog system for the northwest region of the United States.^[50]

In parallel, OCLC (originally Ohio College Library Network, then Online Computer Library Network, later simply as the term OCLC itself) was established by Fred Kilgour in Dublin, Ohio.^[51] And the Research Library Network (RLIN) was created as a part of the Research Library Group. Each was intended to serve on a national basis as means for dealing with the generic issue of retrospective conversion of catalog records, a dominant concern in the effort to introduce automation in academic libraries.

Cooperation in the area of cataloging was made possible because of the crucial contribution of Henriette Avram, at the Library of Congress, in establishing the Machine Readable Cataloging (MARC) format as the de facto national standard for exchange of catalog data; without that, it would have been intolerably difficult. Avram^[52–54] So, using the MARC format, WLN, OCLC, and RLIN could serve as economic solutions to the catalog conversion task, and automated systems to support cataloging and catalog access could be developed within institutions. At about the same time Stanford University developed the BALLOTS system; it later became the basis for the RLIN national bibliographic database system. IBM developed DOBIS for the University of Dortmund, in Germany, as an online catalog system.^[55]

In parallel, modules began to be developed at individual libraries to support other aspects of internal, technical services—circulation and collection management, serials records, and support to acquisitions. An example was the Leuven Integraal Bibliotheek Systeem (LIBIS) at the Catholic University of Leuven, Belgium. Although that was not in itself a United States development, IBM negotiated the right to market it with the DOBIS catalog system, as a quasi-integrated product.^[56] In 1971, Béla Hatvany founded Computer Library Services, Inc. to provide a minicomputer based library application, focused on circulation control.^[57]

Perhaps the first of the efforts to produce a truly integrated system was at Northwestern University and it became the basis for NOTIS, the commercial version.^[58] Roughly in parallel, was the Southwest Academic Libraries Cooperative Mechanization Project and the University of Chicago Library Data Management System. Each started in the late 1960s.^[59]

Information Services Context

As a result of all that had occurred during the 1945–1960 period, the production and distribution of bibliographic, indexing, and abstracting databases became a reality rather than merely a speculation. All of the research and technical development had come to fruition during the period 1960–1975, and with great success. Of special importance were the online services for access to the reference databases (such as Chemical Abstract Services, ERIC, and Medline). DIALOG was created by Roger K. Summit in 1966^[60] and ORBIT by Carlos Cuadra in 1967–1968,^[61] for example. Bibliographic Retrieval Services (BRS) was created in 1968 at State University of New York, Albany, and library OPACs (online public access catalogs) were developed by many individual libraries for access to catalog databases. Less dramatic but still important was the implementation of Interlibrary Lending (ILL) services by OCLC and RLIN.

COMPUTERS ARE ACCEPTED BY LIBRARIES: 1975–1990

Societal Context

This was a most remarkable 15 years! At the end of it, there was the end of the Cold War with the disintegration of the Soviet empire. The effects of these international events for library automation are less tangible, perhaps, but are very real. In particular, the separate republics of the former Soviet Union became independent countries each of which has needed to deal with the information revolution. And beyond them, other countries of Central and Eastern Europe which had functioned under the stultifying effects of Soviet-style communism faced similar needs. The Soros Foundation^[62] and the Mellon Foundation^[63] each saw library automation as a valuable tool for bringing the libraries of those countries into support of modern social and economic development. They each began their funding of such developments.

During this period, publishing continued essentially unchanged, though with steadily increasing concern about how best to deal with the impact of electronic formats (which, as will be seen, became virtually a crisis situation in the next period).

During this 1975–1990 period in the United States, funding problems for both public and academic libraries were real and in some cases catastrophic. University libraries experienced 10–20% budget reductions each year for 5 years and more. But the prices of materials sky-rocketed; journals, in particular, escalated in cost at 15–20% per year during this period. Yet, in the face of the economic travails, the use of both public and academic libraries grew dramatically. The information economy requires the kinds of resources and means for information access that libraries and only libraries provide.

Information Technology Context

During the first 30 years or so of this history, the decisions concerning computer acquisition, as said above, were based largely on Grosch's Law: Bigger is better! But something happened toward the end of the 1970s that was a fundamental revolution. The microcomputer—the PC and the Apple Computer Macintosh—totally reversed the law: Smaller is better! The new law was “Moore's law” (named after Dr. Gordon Moore, cofounder of Intel) which states that the capabilities of microprocessors double every 2 years.^[64] The result is that today, one can hold in the palm of the hand more computing power than even the largest of main frames of two decades ago. The result has been a distribution of computing power that puts the PC, laptop, or palmtop in the plane seat, the police car, the

fire engine, the personal auto, as well as in virtually every home and office.

The revolution in information technology is far greater than just the computer itself, though it indeed is the centerpiece. Increases in telecommunication capacity in some respects equal those in computer capacity. Whereas 50 years ago, we were limited to 10 characters per second (roughly the equivalent of 100 baud), today we have data rates 10,000 times greater for use in our own homes. Whereas 40 years ago we had CRTs with minimal capability, today we have displays with resolutions virtually the equivalent of the printed page and screen capacities that permit the most beautiful images imaginable and the ability to observe in real time the operation of the heart or the brain of a human being, in living color no less. Whereas 50 years ago we were happy to have 6000 bytes of internal memory, today we can have almost unlimited numbers of megabytes. And whereas 30 years ago the means for mass storage of data were limited in capacity and unbelievably slow, today we have gigabytes of capacity with rapid random access.

What a revolution it has been!

Library Technical Services Context

During this time period, the bits and pieces that were created by individual institutions were replaced by integrated library systems (i.e., systems including the full range of functions in both technical services and reader services), commercially available and with the support of highly qualified professional staffs. They were operational on both main frames and personal computers; they functioned in both stand-alone and "client-server" modes; they served every type and size of library; they functioned well in any country of the world.

The NOTIS and DOBIS/LIBIS systems were the first of the products of this kind, but during the 1975–1990 period, the number of integrated library systems steadily grew. An inventory of them for each year since the early 1980s is available online at Integrated Library Systems Report.^[65] These commercial systems differ in their means for software implementation, in the hardware they will use, in the services they will provide, in their pricing. But, in essence, they each provide essentially the same coverage of the technical services operations.

Information Services Context

The effects on information services during this period were dramatic. The availability of OPACs in virtually every library made the resources of the library and, in most cases, of the world readily available. The availability of CD-ROMs brought a wealth of materials into the library, not only available but in processable form. The Internet and the World Wide Web began to provide means

for online communication and access that would change the entire information economy.

COMPUTERS AS INTEGRAL TO LIBRARIES: 1990–2008

Societal Context

And this also was a most remarkable period! In the United States, the continued progress in development of the Internet led the Clinton administration to identify the need for a national and then international "global information infrastructure." For the first time, "information" beyond simply science information had explicitly become an identified priority in national policy.^[66,67]

This period has seen a virtual revolution in the extent to which information resources are used throughout the U.S. society. Today, massive amounts of data are generated, transmitted, and consumed. The cellular telephone is ubiquitous. The Internet is growing in use at a phenomenal rate—doubling in use every 3–6 months! The entertainment and amusement industries are exploding. The publishing of books and magazines has grown similarly. Indeed, the "super bookstores" proliferate at an almost unbelievable frequency, and one of the success stories of the Internet was "amazon.com" as an online bookstore.

During this period, there was almost a revolution in publishing. As a result of the transfer of advertising budgets to the Internet, newspapers found themselves in serious financial difficulties.^[68] Journals increasingly moved into electronic distribution. Even electronic books began to appear, although print continued to be the overwhelming means for distribution of books.

The spectacular growth off the Internet during this period did lead to the "dot-com mania" of the mid-1990s which came to a resounding crash in March 2000. The investment frenzy created billionaires, literally over night, and the crash then wiped out many of them. In the 8 years since then, though, the Internet as an investment vehicle has essentially recovered. Google went public in 2004 and since then has sky-rocketed. And the shares of other Internet companies have also done well.^[69]

One other societal event needs to be included here, since it has had dramatic and devastating effects upon libraries. The catastrophe of the September 11, 2001 attacks, the ensuing wars in Afghanistan and Iraq, the continuing and growing tension in the Middle East, all have led to the diversion of federal funds from domestic needs to military needs. The resulting deficits have cascaded into state and local economies, with one result being that funding for libraries, both public and academic, has been significantly curtailed. And there appears to be no end in sight.

Information Technology Context

During this period, the information technologies continued to develop based on Moore's law. The capacities and speeds continue to double yet the costs stay the same or even decrease.

One development that could have significant impact on publishing, book distribution, and libraries is "print on demand," in which material is printed and bound at the time of delivery to the purchaser.^[70-72] The value for the publisher and for book distribution is that large inventories are not needed, so storage costs, handling costs, and accounting costs are eliminated, and there is no loss from unsold copies. The value for the library is instant delivery.

Library Technical Services Context

The commercial integrated library systems continued to be the basis for library automation, essentially little changed from those developed and marketed during the prior period. The major impact of automation of libraries, though, was on the print journals, which are rapidly disappearing, and replacement of them by electronic access, via the Internet.

During this period, the fact that services provided by WLN, OCLC, and RLIN were duplicative, without any essential differences, led to OCLC becoming the surviving agency. The merger of WLN into OCLC occurred in 1998-1999;^[73,74] that of RLIN into OCLC, in 2006.^[75] The result is the effective realization of a union catalog for the United States as envisioned by Charles Jewett over 150 years ago.

Major research libraries began participating in joint efforts to digitize their collections of materials no longer in copyright.^[76]

Information Services Context

The impact of the Internet search engines, Google especially, on information services was immense during this period. The first of the tools underlying the search engines, called Archie, appeared in 1990. It was followed by Gopher, Veronica, and Jughead, in 1991. They searched in file names and menus, but not in content. WebCrawler and Lycos, in 1994, were the first to provide for content searches. And then the number of content search engines exploded.^[77] There were, as of April 24, 2008 over 130 organizations providing these generic Internet services.^[78] Table 1 shows just a sample of the range of search engines now available, sequenced by date of their initiation and showing an Internet source for each date.

The database services continued but now as part of the Internet. A listing of database services providers includes 87 organizations. It is of more than passing interest to note the extent to which these organizations are now not based in the United States. This surely reflects the extent to which the information economy has become a global phenomenon. Just as an example, Dialog was acquired by Knight-Ridder in 1995; then, in 1997, Knight-Ridder merged with Marketing Analysis and Information Database and the new corporation became The Dialog Corporation; in 2000, the Thomson Corporation acquired the database service operations from The Dialog Corporation; in 2008, Thomson and Reuters merged.^[79] In much the same vein, Wolter Kluwer, a Netherlands based company acquired Ovid in 1998^[80] and then Silver Platter in 2001.^[81] Beyond the Internet commercial search services and database access services, academic and public libraries throughout the United States developed Internet "online reference desks" and library-based research guides

Table 1 A sample of currently available search engines.

Lycos	1994	http://en.wikipedia.org/wiki/Lycos
Yahoo!	1994	http://en.wikipedia.org/wiki/Yahoo!
MetaCrawler	1994	http://en.wikipedia.org/wiki/Metacrawler
AltaVista	1995	http://en.wikipedia.org/wiki/AltaVista
MSN	1995	http://en.wikipedia.org/wiki/MSN
Ask Jeeves	1996	http://en.wikipedia.org/wiki/Ask.com
(now Ask.com)	1996	http://en.wikipedia.org/wiki/Ask.com
HotBot	1996	http://en.wikipedia.org/wiki/HotBot
Dogpile	1996	http://en.wikipedia.org/wiki/Yahoo!
Mamma	1996	http://en.wikipedia.org/wiki/Mamma.com
Google	1998	http://www.google.com/corporate/execs.html
Ixquick	1998	http://en.wikipedia.org/wiki/Ixquick
AllTheWeb	1999	http://en.wikipedia.org/wiki/AlltheWeb
Teoma	2000	http://en.wikipedia.org/wiki/Teoma
Turbo10	2000	http://en.wikipedia.org/wiki/Turbo10
Vivisimo	2000	http://en.wikipedia.org/wiki/Vivisimo
SearchHippo	2001	http://www.searchhippo.com/about.php
Wisenut	2001	http://en.wikipedia.org/wiki/WiseNut
A9.com	2004	http://en.wikipedia.org/wiki/A9.com
Gigablast	2004	http://www.forumpostersunion.com/showthread.php?t=355
Myriad Search	2005	http://en.wikipedia.org/wiki/Myriad_Search

for specific subject areas. The University of Illinois “online reference collection”^[82] and the Internet Public Library (maintained by a consortium of information science academic programs)^[83] are two specific examples, but there is a broad range of other libraries using a variety of software tools.^[84]

THE FUTURE FOR COMPUTERS IN LIBRARIES: POST-2008

It is the year 2008, at the time of writing this. It is very difficult to make predictions, especially about the future, but the discussion of this sixth and last time period is about the coming years rather than past years.

Societal Context

The revolution that has resulted in the “information economy” will continue, and the pace will accelerate in other countries of the world as well as in the United States. The facts are that information products and services have become a world-wide phenomenon. It has been estimated that it is a trillion dollar market, and the United States today is the dominating supplier. The Internet is the means for access as well as a manifestation of the information economy.

What is the future of publishing, especially in the light of what is happening with the information technologies? In particular, what will happen to publication in print formats? While there is clear evidence for a shift in journal publication from printed issues to on-demand publication of articles, there is no evidence of comparable shift of monograph publication in the same way. Therefore, for libraries, it is necessary to plan for continued acquisition of book materials in print form. See, for example: “. . . experts predict that elementary and high school textbook sales will jump by 35%, to \$3.5 billion, from 1996 through 2001. College textbook sales are expected to zoom 40%, to \$3.47 billion, over the same span.”^[85]

Digitized imaging is a form of publication that will be of increasing importance. It has become a powerful tool in research of all kinds. It is the basis for publishing of materials such as maps and will probably replace print as the means for publication of them. Academic libraries, especially, should plan not only for management of digitized images but for serving as significant sources for publication of them.

So, what will happen to libraries? There are persons who forecast their demise, in the perception that they will be replaced by the wealth of resources becoming available through the information technologies; such voices have been heard for at least the past three to four decades. It is a fact that during the past decade libraries have faced enormous economic pressures; they have had to operate within the constraints of reduced budgets even while the

costs of acquisitions—especially of journals—have been escalating at exponential rates of 15–20% per annum. At the same time, they have needed to make continuing investments in automated systems and to deal with the array of computer-based forms of publication.

The likely picture, though, is very different from that of those who wish to get rid of libraries. Libraries are essential and will continue to be so in the foreseeable future. Instead of being overwhelmed by technologies, they have absorbed them, made them economic and effective, and served as the basis for testing and proving them. It is also a fact that the effect of electronic information resources was to increase not decrease the use of the library. The various forms of publication are complementary and mutually supportive rather than being substitutes for each other. The use of any of them leads to increased use of the others, and the library serves as the agency for access to all of them.

There is every expectation that the library will continue not only to exist but to thrive and to play its historic leadership role in the coming decades. Underlying that expectation is the view that, while electronic publication will be increasingly important, it will not replace print in the foreseeable future. And libraries will be the means of access to both print and electronic formats.

Information Technology Context

During the more than 60 years the computer business has continued to grow at a phenomenal rate. Each year the capabilities have increased, the effectiveness and even efficiency have increased, the pervasiveness in our society has increased.

Of that more than 60 year history, though, the most spectacular gains have been made within the past 30 when “microprocessors”—computers on chips—became the basis for the hardware. The first microprocessors were breathtaking innovations and they revolutionized not only the design of computers but their use throughout our world.

Will the process continue? In a recent book,^[86] Michael Malone poses that question and concludes that the answer is Yes, saying that, while there are absolute barriers in the laws of physics, there are still means by which the process can continue. Most important among them are those that relate to the software, in which future developments may have even greater impact than we have seen to date from the hardware.

Library Technical Services Context

The integrated library systems operational and commercially available today surely meet the needs in technical services. They are well proven and there is now extensive experience in their use.

Having said that, the role of technical services themselves in libraries for the coming future is problematic. Acquisition of journals is now a matter of negotiation with the publishers and consolidators, in which large numbers of electronic journals are dealt with as a package. Processing becomes nonexistent for those journals, since they are available, under the negotiated arrangements, directly online from the publisher or consolidator. Acquisition of books and special collections, on the other hand, is likely to continue if, as predicted above, printing continues to be the primary means for book distribution. Even given that, one can visualize the library with the equipment and online access necessary to use print on demand. The impact on technical processing in such cases could be profound.

With respect to cataloging, the situation already has had a significant impact. Increasingly, the national bibliographic database maintained by OCLC serves not only as the source for cataloging data but as the OPAC. Here the effect on technical processing is even greater.

Information Services Context

The implications are that library services to patrons will become increasingly important and that staff will be shifted from internal operations to direct services.

First among the direct information services is the Internet. Indeed, the pace in growth of the use of the Internet is likely to continue on into the future, though with likelihood of significant slowing in perhaps 5 years. Access to the Internet will continue to be important for academic roles. It is important to note, however, that while the Internet was highly academic in its origins and orientation, those uses, while growing, will do so at a substantially more limited rate and are already very small in comparison to the commercial uses.

The crucial point is that the widening scope of information resources increases the importance of the information services. In this respect, it is important to recognize that the library is more than simply a collection of materials, valuable though that is and will continue to be. It is also more than simply a means for access to those materials and the information contained in them, again valuable though that is and will continue to be. The library is the agency that serves as the means for selection. It does so when acquisition librarians make decisions about what materials are worth adding to the collection. It does so when reference librarians help patrons in locating and selecting from the wealth of resources those that will meet needs. It does so when library-based information specialists select from retrieved information and analyze the results.

The library is also a means for users to learn how to manage information resources. Library services in teaching are therefore of special significance, and the increasing wealth of resources adds greatly to their importance.

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Library Consortia in Europe

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Abstract

In the professional literature the term “consortium” covers a great diversity of cooperative situations and experiences according to the different contexts and times in which it was developed. In this entry the term “consortium” will accordingly be discussed with its meaning restricted to structured cooperative activities aimed at acquiring and administering electronic information resources in European countries. More exactly, this definition here includes consortium initiatives in which the main program is focused on activities related to the purchasing of electronic licenses (academic journals, databases, etc.) and handling access to, and archiving of, the collections acquired. Recently library consortium initiatives have shown increasing attention to new issues of major interest for future developments: among these, long-term preservation of electronic resources (including noncommercial publications and institutional repositories), digitalization programs, acquisition of backfiles, etc. Regarding types of libraries, it should be kept in mind that the development of consortia for electronic resource sharing has so far spread chiefly among university libraries, and research and higher education communities. There are also some cases of direct, active involvement of national libraries. One can, however, note almost everywhere the growing involvement of public libraries in consortial activities. This entry focuses on the territory that forms the European Union (currently 27 countries) and some countries which, while not officially a part of this organization, are found within its geopolitical area. The countries of the former Soviet Union have not been included in this study.

INTRODUCTION

In the professional literature the term “consortium” covers a great diversity of cooperative situations and experiences according to the different contexts and times in which it was developed. The ideals and practice of library cooperation were progressively affirmed during the last century, giving rise to a considerable variety of activities and organizational forms with various names, often related to the most fashionable cultural trends or suggested by new technologies and innovative models developed in business contexts. This explains the popularity in the past of such terms as system or network, used to refer to cooperation initiatives in the library sphere. Clearly, these terms denote fairly precise concepts, and were in most cases used to focus attention on organizational models, technologies, and services set at the center of a particular cooperation initiative.

Use of the term “consortium” became established in the North American library lexicon in the 1960s^[1] and indicates forms of structured cooperation focused primarily on resource sharing and cost reduction. In some European countries use of the term in library contexts has very remote origins. In Italy, for instance, the word “consorzio” has, with changing fortunes, been used in the area of public libraries throughout the twentieth century. The “Consorzio delle biblioteche popolari milanesi” set up in Milan in 1903^[2] under the impetus of the social reform

movements of the times in order to promote literacy among the working classes is probably one of the oldest cooperation experiments to use this term in a library context.

In some European languages consortium has a fairly precise meaning in legal terms: it indicates a union of people, of public and private institutions (in Italian) or union of banks (in German),^[3] with a specific legal structure. The reference to specific legal structures means that in Europe the word consortium takes on different meanings in different countries, engendering some misunderstandings in professional communication. With some approximation, we may say that the difference in use of the word among European librarians chiefly concerns the differing extent of legal formalization of the assemblage called a consortium.

However, more recently, under the influence of Anglo-American experience, the word consortium has tended to take on a broader meaning, no longer linked with particular legal formulas. It is, however, clear that the favor the term has met with on the international librarianship scene in the last 15 years is chiefly associated with its use in the area of cooperation initiatives pertaining to the acquisition and management of electronic information resources (i.e., e-journal collections, data bases, and full text access services). Indeed, currently in the language of European librarians the word consortium chiefly indicates cooperation initiatives born under the impulse of the “academic

journals crisis” (a term indicating the continuing rise in subscription prices that is particularly impacting the university and research sector), and the greater availability of collections and publications in electronic format.^[4,5] In this area, too, most consortia are actively engaged in or support broader-range actions, such as the search for alternative models of academic communication, or the action by library organizations to support nonrestrictive copyright provisions. Use of the term “consortium” in the sense we have here sought to clarify is attested by many conferences on the theme and by articles that have appeared in authoritative specialized journals.^[6,7] See the European ICOLC annual conferences that have taken place regularly since 1999 in various countries. In this entry the term “consortium” will accordingly be discussed with its meaning restricted to structured cooperation activities aimed at acquiring and administering electronic information resources in European countries. More exactly, this definition here includes consortium initiatives in which the main program is focused on activities related to the acquisition of electronic licenses (e-journals, databases, etc.) and handling access to and archiving of the collections acquired. It should be noted that recently library cooperation initiatives have shown increasing attention to new issues of major interest for future developments: among these, long-term preservation of electronic resources (including noncommercial publications and institutional repositories), digitalization programs, and the acquisition of backfiles and important historical collections by commercial publishers.

Regarding types of libraries, it should be kept in mind that the development of consortia for electronic resource sharing has for the above-mentioned reasons so far spread chiefly among university libraries, and research and higher education communities. There are also some cases of direct active involvement by the national libraries. One can, however, note almost everywhere the growing involvement of public libraries in this type of consortial activities. Regarding the contents, we must keep in mind that attention is currently focused on international academic publishing (primarily in the scientific and medical disciplines) which, as is well known, is essentially in English. Publications in the fields of humanities and social sciences in the other, European languages, are seldom available in electronic format. In fact, with the exception of the United Kingdom, publishers in Europe are in general still reluctant to make the transition to e-format, among other reasons due to the limited dimensions of the market in the different linguistic areas.

THE CONTEXT

This entry focuses mainly on the territory that forms the European Union (currently 27 countries) (Initially, the European Union consisted of just six countries: Belgium,

Germany, France, Italy, Luxembourg, and the Netherlands. Denmark, Ireland, and the United Kingdom joined in 1973, Greece in 1981, Spain and Portugal in 1986, Austria, Finland, and Sweden in 1995. In 2004 the biggest-ever enlargement took place with 10 new countries joining: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia, and Slovenia, followed, in 2007, by Bulgaria and Romania.) and some countries which, while not officially a part of this organization, are found within its geopolitical area (Iceland, Norway, Switzerland, Serbia, Bosnia Herzegovina, Albania, and Montenegro and also the EU candidate countries: Croatia, Turkey, and the former Yugoslav Republic of Macedonia.). We are dealing, then, with a territory smaller than the United States but one with a much higher population and one that is characterized by an extreme cultural and linguistic diversity—there are 23 official languages just in the 27 countries of the European Union—as well as by very different socioeconomic situations. The countries of the former Soviet Union have not been included in this study, both because their context is not easily comparable due to the strong political and economic differences that are still evident in Europe and because the available documentation regarding the present topic appears rather scarce. Nevertheless, interesting developments are evident in most of these countries, particularly in Russia, where several initiatives are supported by EU programs (i.e., Russian Information Library Consortium [RILC]),^[8] and by foreign foundations (i.e., National Electronic Information Consortium [NEICON]),^[9] which involve a large number of state and university libraries, public libraries, and research and special libraries.

We cannot, however, allow to pass unobserved an important historic event which took place in Europe at the beginning of this new century: the enlargement of the European Union in 2004 and, subsequently, in 2007 which resulted in 12 new member states scattered throughout an area ranging from the Baltic Sea to the Mediterranean. This peaceful “geopolitical revolution” has enormously enriched the diversity of the cultural heritage of the European Union as well as posed new challenges for the future of the Old Continent. In the current transition phase we should note the effort made by the new member countries to overcome the economic and social gap that divides them from the rest of the European Union and the progress that they have made on various levels, including technological innovation and reform in their educational systems.

In general, we can say that in Europe the level of commitment to electronic resources in the libraries reflects the differing degrees of economic development mentioned above, since to the traditional gap between North and South Europe we now must add the disparity between East and West. In reality, the picture is more complex than it appears at first glance. Observing more carefully the current initiatives in the library field, it appears instead the

case that this simplistic schematization does not always reflect the evidence; examples of advanced consortia for the management of electronic resources are visible in the South as well as the North, and in the East as well as the West, demonstrating once again the differences between different regions of the same country.

The cases of Spain, Italy, and Slovenia are fairly indicative in this regard. In Spain the Catalan consortium^[10] is quite an advanced organization, but is also rather atypical of the general position of libraries in those countries; in Italy, on the other hand, consortium activities are chiefly concentrated in the center and north, confirming the existing gap between these areas and the south of the country.^[11] In Slovenia, however, the development of programs for library cooperation is comparable to the situation of the most advanced European countries.

In fact the degree of progress and modes of implementation of consortium initiatives in the various countries depends on both current investment policies to develop the information society applied by the various countries and numerous factors of a social, historical and cultural nature that have brought the emergence and establishment of library cooperation practices specific to each context. It is clear that in countries where library cooperation is not well rooted, organizing consortium initiatives face a much harder (and especially more uncertain) task than in Britain or other countries of Northern Europe with more deeply rooted traditions in this field of activity.

Looking at the scene of cooperation initiatives in progress, one has the impression that the gap between the different countries has been shrinking in recent years. And indeed over the last 15 years there has been a considerable increase of cooperation in all European countries. Probably, as far as EU territory is concerned, the special programs launched by the European Commission to promote technological cooperation among libraries have not been entirely without influence in creating conditions favorable for this trend.^[12] Over and above the concrete results for which they may have been responsible in terms of services and technological applications, these programs have over the years offered libraries in the various European countries the chance to collaborate on joint projects, promoting the exchange of experience and development of cooperation practice, also among archives and museums. Among the recent noteworthy developments is the *European Digital Library*, a long-term program, wide in scope, which involves national libraries and numerous important libraries, archives, and museums of many countries, in a joint efforts to promote access to Europe's cultural heritage. Another relevant initiative promoted by the European Commission deals with scientific and scholarly communication, aiming to support new approaches and economic models to foster better access to scientific information online (including academic journals) and to preserve research results digitally for future generations.

In addition to these factors, however, a decisive role is played by the policies pursued and administrative mechanisms and structures through which the resulting programs are activated. If, concerning policies for implementing an information society, some similarities of intentions and general objectives can be discerned, not just among EU member countries (which as we know move in concert in this area) but more generally in all European countries, there are instead considerable differences in terms of instruments and operational programs. Regarding the latter aspect, one of the main factors directly influencing library cooperation models is the structure of the political and administrative system in the individual countries. This factor relates to autonomies and the degree of decentralization of the different national models, which vary considerably in Europe. Obviously, the German federal order based on the autonomy of the *Länder*, which have specific powers in the sector of culture, education, and research, presents different opportunities and conditions for cooperation than more centralized systems, such as the French. A somewhat similar system is that of Switzerland, with a specific feature represented by the official languages of the various cantons on which the federal organization is based. In the case of Spain, founded on administrative devolution to the regions (*comunidades autónomas*), practical aspects of library cooperation (e.g., funding) are more reminiscent of Germany than of Italy, even though the system is closer to the latter country. Without dwelling further on this point, we may take it for granted that the political and administrative system has no little influence on the levels (and aims) of cooperation, and that developing a national consortium in Belgium—where the institutional pattern is based on representation of the two communities (French and Flemish)—is a much more complex matter than in France or United Kingdom, despite their greater size.

OVERVIEW

To provide an overview of the picture, we shall take a quick, panoramic look, moving from West to East, at the consortium experiences that in our view best represent the problems associated with the current stage of development of these initiatives. Thereafter we shall analyze and compare some components of consortium organization, with an eye to identifying features common to the various experiences.

The Nordic countries—Finland, Sweden, Norway, Iceland, and Denmark—represent one of the areas where library cooperation practice is most widespread. With common historical backgrounds and cultural roots (with the exception of Finnish, all the languages spoken in the area are from the same linguistic family), the five countries maintain solid collaboration relationships and have developed major library cooperation programs, some of which also gather together the Baltic countries. Among

these the Nordic Council for Scientific Information (NORDINFO), closed in 2004, developed a broad range of projects and activities for 30 yr. One of the larger cooperation programs in the region is Northern/Baltic Union Catalogue of Serials (NOSP), in which 1300 libraries from Denmark, Iceland, Sweden, Finland, Estonia, Latvia, Lithuania, the Faroe Islands, and Norway, take part. This solid basis for common work and mutual exchange does not prevent the individual countries from displaying their own peculiarities in the development of consortium models. One common feature of the Nordic experience is the role that the national libraries play in organizing cooperation and the various degrees of centralization in solutions adopted. Among these consortia FINELIB, based at the Finnish National Library, is a model with a high degree of centralization but also a high level of participation in decisions, ensured by a fairly elaborate structure of governing bodies. This consortium currently comprises over 100 university, research, and public libraries. FINELIB's programs include the negotiation of electronic licenses and other activities in the sphere of electronic resources sharing. Among these should be mentioned the project NELLI, a national portal for access to licensed resources management based on a common user interface.^[13]

In Sweden, the main consortium initiative has been pursued by BIBSAM, the department of the Royal Library that coordinates cooperation and development activities at national level.^[14] BIBSAM carries out various programs of activities to support the Swedish university and research library network, underpinned by central funding. It also has a fund to support access by libraries to electronic resources. Though not a consortium, BIBSAM acts like one, and in recent years has negotiated many agreements with publishers and suppliers of electronic information on behalf of libraries, and supported the implementation of this program both financially and technically.

In Norway, a wide range of cooperation programs have been developed by BIBSYS, the major academic library network. Most of the consortium initiatives for electronic resource sharing are handled by the ABM, the Norwegian Archive, Library and Museum Authority, which negotiates licenses at a national level.^[15]

In Denmark, consortium agreements were initially handled directly by the university libraries; subsequently, some agreements with major scientific publishers were amended into national agreements with support from the Denmark Electronic Research Library Project (DEF), a major cooperation program supported by the National Library Authority, which embraces a wide range of projects and activities, including creation of a high-speed network connecting the largest university libraries, the central purchase automated library systems, the digitization of relevant collections, license management, and portals.^[16]

In Iceland, the cooperation programs are handled by Landskerfi bókasafna (the Iceland Library Consortium);^[17] regarding e-licenses, agreements have been

reached with a major supplier of electronic services by the Steering Committee on Access to Electronic Material, the consortium organization supported by the National and University Library of Iceland in Reykjavik.

On the European scene, Great Britain is regarded as the most advanced model in terms of innovation in library services and development of advanced forms of cooperation. Helped by a language which is by now almost universally known, experience from that country is often regarded as a reference point. Established practice in the area of cooperation and the activism of relevant bodies at the national level are yielding good results in the digital age too. On the other hand, we must keep in mind that there is a strong position of autonomy among both universities and territorial units, resulting in a path to cooperation that seeks to balance the various requirements of coordination and decentralization. Consortium initiatives in Britain are numerous at both the national and the regional level and in all library sectors. In the university research library sector, one of the most well-established consortia is Consortium of University Research Libraries (CURL) (Research libraries in the British Isles) which provides a wide range of projects and activities involving a large number of research and academic institutions. The main organization operating in the field we are considering, however, is Joint Information System Committee (JISC),^[18] set up to promote the development of electronic information in U.K. universities. JISC supports many projects concerned with education and research based on information technologies, and has set up synergies and alliances with various organizations operating in the information sector. Among projects launched by JISC, we should mention JANET, the United Kingdom's education and research network; and NESLI2, which follow the original National Electronic Site License Initiative (NELSI),^[19] founded in 1995, the consortium regarded as one of the main reference models beyond the United Kingdom as well. This consortium's operational structure is in the hands of two external bodies: the "managing agent"—a private company with the task of handling negotiations of electronic licenses—and a computer center in Manchester which provides technical support. A Journal Working Group membership provides advice and support on developing priorities and license negotiations according to the JISC collection strategy. JISC supports a wide range of initiatives in the academic information domain, among them cooperation projects on digital repositories (i.e., SHERPA) and the long-term preservation of digital publications.

In Ireland, on the other hand, consortium initiatives in the field of electronic resources, mainly between university libraries, are informal in character. Of these, the consortium for the acquisition of electronic periodicals, under the supervision of the Conference of Heads of Irish Universities (CHIU), involves most higher education institutions in the country.^[20]

In Germany, as we already mentioned, the federal structure determines that cooperation is principally at Länder level, but there are also national programs funded by the Deutsche Forschungsgemeinschaft (the German National Research Council). Since the 1970s, various cooperation programs have been developed (some of them bringing several Länder together) to create union catalogs. Activities associated with acquiring electronic resources have given rise to a variety of cooperation forms. Only the Friedrich Althoff Consortium in Berlin-Brandenburg has the legal status enabling it to act as a corporate nonprofit body. In the other Länder, consortia “are represented by an individual library (e.g., Baden Württemberg) or a central institution such as the Bayerische Staatsbibliothek, or the Hochschulbibliothekszentrum NRW in North Rhine-Westphalia.”^[21] Ways of funding consortia also differ considerably, even if the main sources are the Länder governments within whose jurisdiction, as we have said, the libraries fall. In some cases the consortia are funded directly by participating libraries, but in the majority of cases they receive substantial subventions supplied by the Länder. There is an emerging need for programs to bring all the Länder together into a national strategy; since 2004 considerable attention has been focused on negotiating national licenses of important digital collections.^[22] Further, there is a significant initiative by the leaders of the German consortia, who in 2000 founded an association subsequently joined also by the consortia from Austria (where a cooperation scheme at the national level has been developed as well, Konsortien in Österreich) and Switzerland: this body, German, Austrian and Swiss Consortia Organization (GASCO), is intended to develop joint strategies for acquiring and handling publications, creating the conditions for activating action plans at the supranational level.^[23]

The tendency to converge toward a national strategy, or at least to create synergies with programs and instruments operating in different sectors, is emerging with various patterns and orientations in many countries in Central Europe. This is the case of the Dutch consortium—the UKB Association—in which 13 university libraries participate along with the Royal Library and the Library of the Royal Dutch Academy of Science.^[24] UKB is supported by contributions from the participating libraries. Its activities are focused chiefly on negotiating electronic licenses with major publishing groups, with which it has reached numerous agreements. The UKB Association in recent years has enlarged its objectives and strategies within a broader vision including academic publishing output of the learned societies and digital repositories. These developments take advantage of a strong tradition in library cooperation, in which important programs like PICA, a library network very active in central Europe and now comprised in OCLC, have matured.

One interesting national library cooperation program has been developed in Switzerland, despite the intrinsic difficulty of achieving an objective of this type in a

country structured in 26 states (cantons and sub-cantons) where three language communities (German, French, and Italian) coexist. The first consortium aggregates emerged at the local level, since the universities are financed by the cantons. Subsequently, in 1988, thanks to the commitment of the conference of university rectors, the Consortium of Swiss Academic Libraries (Konsortium der Schweizer Hochschulbibliotheken), partially funded by the federal government, was established. At present the consortium (with about 50 libraries, including the Swiss National Library), in addition to the acquisition of electronic licenses, is developing into other sectors, among which is a project for electronic archiving. The consortium’s organizational structure—which also provides for potential members from among public and research libraries—is based on a central office and a fairly elaborate governing structure, at the top of which is the conference of university rectors.^[25]

The linguistic and cultural barriers and the complications due to the political administrative system have to date still not been overcome in Belgium, where the libraries of the French and Flemish language communities organize separate consortium initiatives. The consortium program of the universities and research institutes of the Flemish area come under the Vlaams Overlegorgaan inzake Wetenschappelijk Bibliotheekwerk—WOWB (Flemish Research Libraries Council)^[26]—and the Flemish Ministry of Education, which supports the e-resource acquisition project Elektron.

The e-resource-sharing initiative of Francophone university libraries come under a nonprofit body, the BICfB: la Bibliothèque Interuniversitaire de la Communauté Française de Belgique, established in 2000 under the auspices of the country’s conference of Francophone university rectors.^[27]

At the end of the 1990s various consortia programs were developed at the local level in France. A major example is COUPERIN, a consortium initially promoted by a group of six university libraries, including Strasbourg University Library. This initiative had a noteworthy success and, thanks also to the support of the presidents of the universities, has expanded rapidly to become national in its dimensions. In 2007, COUPERIN had 212 members among university, higher education, and research libraries. Supported by the group of universities that provided the resources in the initial stage of development, today COUPERIN enjoys ad hoc support from the French Ministry of Education. The success scored in the license negotiating sector is forcing this consortium to broaden its mission and its programs and to integrate its digital collection development and management policy within the framework of a national strategy. To meet these new challenges, COUPERIN recently reinforced its structures and established collaborations and alliances with other consortia and agencies, including ABES, the major library network of the country.^[28]

Consortium experience under way in the countries of southern Europe is highly diverse, even in more culturally homogeneous areas where Romance languages are spoken. In the Iberian Peninsula, much of consortium activity aimed at electronic resource sharing started with the new Millennium, though since the 1980s Portugal and Spain have secured remarkable growth of library services and also a considerable development of cooperation activities. The turning point in Spanish interlibrary cooperation came in 1996 with the creation of the consortium of university libraries of Catalonia CBC (Consorti de Biblioteques Universitaries de Catalunya), later followed by other initiatives in Galicia (Bugalicia), the Madrid region (Madroño) and Andalusia (CBLA). On the basis of the regional decentralization typical of the Spanish system, the consortia are financed by the universities and/or the local government (*comunidades autónomas*) to which they belong. Consortium activities concern acquisition of electronic resources and, in the case of Galicia and Catalonia, also the development of other bibliographical utilities.^[29,30] The Catalan consortium represents one of the most advanced model in South Europe: it is a legal entity with solid institutional ties (the National Library of Catalonia is also a member), supported by a funding mechanism based on the contribution of the local government and equipped with dedicated infrastructures and staff. Thanks to the common technological platform used by participating libraries (the consortium was born as a library automation network), this organization shows great potential in terms of integration of resources and development of value-added services.^[31]

In 2004, a national consortium has been established in Portugal with the support of the government. The program is called B-ON: Biblioteca do Conhecimento Online (Library of Knowledge Online). This initiative includes 50 participants—universities and research libraries—and provides access to several important e-journal collections which should expand significantly during the current year.^[32]

In Italy initiatives to share electronic resources began to appear only in the late 1990s and are currently located chiefly in the center and north of the country. Of the three most important consortium activities, two are led by university computing consortia—CILEA in Milan and CASPUR in Rome—nonprofit organizations that supply computing services and, in the electronic information sector, act as intermediaries on behalf of the associated libraries. The third, Interuniversity Cooperation on Electronic Journals (CIPE), in the center and north, includes important universities, such as Padua, Bologna, Florence, and Pisa.^[33] In Italy for a long time there was no real national strategy in the area of electronic information, though the three consortia mentioned come together in Italian National Forum on Electronic Information Resources (INFER)^[34] a voluntary inter-

consortium forum that also undertakes awareness activity to develop cooperation in the area of access to digital information. Since 2007 a more consistent national approach has begun in the form of CARE, an interconsortium program established by the Conference of Italian University Rectors (CRUI).^[35]

A country which differs in a number of ways, in terms of both historical experience and geographical location, from the Mediterranean European countries we have just covered—though sharing deep cultural roots with them, as well as EU membership—Greece today presents a very interesting experience of library consortia in Europe. Born on the initiative of a group of universities, including Thessaloniki, and with the support of European Commission technological library programs, Hellenic Academic Libraries (HEAL) Link currently includes more than 30 institutions of higher education plus the Athens Academy and the National Library. The sphere of activities of this program—which is supported by central government funds—is wider than the electronic licensing negotiation, including also other projects ranging from production of the union catalog to operational standards and staff training.^[36]

In the transition phase toward a free market economy and a democratic government that characterizes their recent history, the countries of Central and Eastern Europe have made a considerable effort to reach the development of the West and to align their legislation with EU standards. In this context we can note the reforms realized in the field of library legislation and copyright and the current investments for a more extensive use of technology in the management of information—a fundamental condition today to develop the sharing of library resources. In this process (one not always free of obstacles) the countries of Eastern Europe have been able to rely on the support and encouragement of various governments and international organizations such as the Council of Europe, and above all specific programs designed by the European Union and by public and private nonprofit organizations. Regarding the development of the consortia in particular we should note the action carried out by the European Union through various programs including TEMPUS and the programs undertaken by the Open Society Institute (OSI), a branch of the Soros Foundations. Among the EU programs deserving of particular mention we should include Central and East European Licensing Information Platform (CELIP),^[30] supported by the European Union and developed by European Bureau of Library, Documentation and Information Associations (EBLIDA),^[37] an organization for the library associations of different European countries with the aim of raising awareness of the issues regarding copyright and the management of electronic licenses. The action of the Soros Foundations, carried out through eIFLnet (Electronic Information for Libraries) has been on a larger scale and more systematic. Created in 1999, eIFL is active in numerous countries throughout Europe, Asia,

and Africa; its principle aim is to provide support and assistance for the access to electronic resources "by library users in transition and developing countries."^[38] Its activity is concentrated on the organization of consortia in various countries, and in this context has realized an agreement with important aggregators and publishers for access to the collection of electronic periodicals made available by this provider. eIFL has been particularly active in the countries of Central and Eastern Europe, in the Balkans, and in the countries of the ex-Soviet Union, where thanks to this program access has been made available to the electronic resources in many university institutes in countries with economic difficulties; in several cases it has been possible to give considerable aid for the development of national consortia in the formative stages.

The Baltic countries in the last few years have made important progress in the field of library cooperation and automation. We should note that the three principal consortia founded in these countries have a legal basis and a relatively solid organizational structure. Perhaps also due to their limited geographical dimensions the Baltic countries have been able to work more easily toward a larger picture of national cooperation. Among these countries Estonia appears the most advanced from a technological point of view, as the data on the use of the internet and the availability of personal computers in the homes demonstrate. The activities of library cooperation based on the use of IT in Estonia refer mainly to the ELINET network,^[39] which also includes a task force that collaborates with eIFL on programs for the acquisition of electronic licenses.

In Latvia, the cooperation activities on a national level are mainly concentrated in a central agency, Culture Information Systems (Kultūras informācijas sistēmas),^[40] which also oversees the acquisition of electronic resources in collaboration with eIFL.

In Lithuania, too, eIFL collaborates with the principal national consortium (recently formed) for the acquisition of electronic resources, Lithuanian Research Library Consortium (LIMBA),^[41] which began operating in 2001.

Poland, on the other hand—the largest in size and population among the ten most recent states to enter the European Union—does not have a strong tradition of library cooperation. Nevertheless, in line with recent trends in IT, a greater vitality is visible in this area as well, and several programs have arisen both in the cataloging sector (e.g., NUKAT, the central catalog of academic libraries, located at Warsaw University and of which 58 libraries are members) and in hardware/software acquisitions and electronic publishing. In the latter field we should mention the development of several consortia, such as the Poznan Foundation of Scientific Libraries, the Consortium of Wrocław Libraries, and the Górnolaskie Consortium of University Libraries. The Poznan Foundation—the only Polish consortium to have a legal basis—was founded in 1996 and includes today ten universities and two public libraries.

The Foundation, initially oriented toward the acquisition and management of library automation systems, since 1999 has overseen the eIFL project on the national level, specifically the acquisition of electronic resources; in addition, since 2001 it has participated in the Digital Library of Wielkopolska project, which provides access to the oldest Polish works held by different libraries.^[42]

Launched in the early 1990s (i.e., before the division of Czechoslovakia) the Czech and Slovak Library Information Network (CASLIN), has been^[36] split into different library networks in the two countries, according to the new political situation. In the Czech Republic, the main program for electronic resources named Uniform Information Gateway (UIG),^[43] currently attracts the largest number of libraries and provides simultaneous searching in different local and international bibliographic resources and full text information.

In Slovakia, too, access to electronic resources is provided by several different initiatives, among which the most important is LIBNET,^[44] the consortium, managed by the National Library, realized in the context of eIFL.

Library cooperation in Hungary takes place in the environment of three main networks: Mokka (The Hungarian Shared Catalogue); VOCAL (Cooperative Cataloguing Program) and KozelKat (Common Electronic Catalogue). Electronic resources sharing initiatives are being carried out by the Hungarian Electronic Information Service (EISZ) a national electronic service consortium sponsored by the Ministry of Education.^[45]

Slovenia can boast of a consolidated practice of interlibrary cooperation at the national level, the principal infrastructure of which is the national library network Co-operative Online Bibliographic System and Services (COBISS) which counts 240 libraries as members. Cooperation for acquisition and the management of electronic resources has been developed principally by Consortium of Slovenian Electronic Collections (COSEC),^[46] with 210 libraries of various types as participants. Founded in 2003 in the context of the eIFL program, the consortium has developed as a program of the National and University Library, and has acquired several electronic licenses. In Croatia the principal cooperation initiatives in the field of electronic resources have as their reference point the Croatian Academic Research Network (CARNET)^[47] university network and the eIFL program. Founded with the principal aim of providing support for the implementation of IT in libraries, CARNET has acquired the licenses of several important data bases, primarily in the scientific and medical fields. In addition to the programs for the acquisition of electronic collections, we should mention the formation of various buying clubs for specific disciplines.

In spite of the dramatic events that have shaken this region, a certain amount of activity is visible in the field of shared management of electronic collections in almost all the countries of ex-Yugoslavia, above all due to the

initiatives supported by eIFL, which is quite involved in this area. There are several consortia currently operational or in the set-up phase in Bosnia and Herzegovina, Kosovo, Albania, and Macedonia. In Serbia, KOBSON (Serbian Library Consortium for Coordinated Acquisition)^[48] at the National Library in Belgrade has operated since the end of the war.

In Romania, the relevant activity in the field of electronic resources sharing (which involves a number of university, research, and public libraries) has its main reference in the Biblioteca Centrale Universitara in Bucharest.^[49] In Bulgaria, several initiatives have arisen in the domain of electronic resources, among which primarily Bulgarian Information Consortium (BIC),^[50] a consortium with a legal basis supported by eIFL.

Turkey, on the other hand, has demonstrated significant capacity and initiative; since 2000, Anatolian University Library Consortium (ANKOS)^[51] has been operational. It is a program at the national level which has rapidly gathered together 40 universities and research institutions, quite a large number considering that Turkish higher education consists of 49 state and 20 private universities. ANKOS is an open consortium to which one may adhere by subscribing to at least one of the current license contracts. Currently ANKOS provides access to a number of important collections of periodicals and data bases. Contracting and shared management of electronic licenses is the central aim of ANKOS, which is administered by a steering committee and secretariat located at the Middle West Technical University of Ankara.

CONCLUSION

After this rapid excursus through the most significant consortium experiences in the various European countries, we can briefly turn our attention to the main trends under way, and draw a few conclusions.

Currently, cooperative resource-sharing initiatives are concentrated in the area of university libraries, even though there is a slowly strengthening trend to involve other types of libraries as well. Many consortia are focusing their attention on negotiating electronic licenses, while other initiatives, chiefly in Northern Europe, are aimed at broader objectives and seek to integrate electronic resource-sharing activities into broader-scope national programs; in several cases (e.g., the Nordic and Baltic countries and some Eastern countries) national libraries and other central agencies are coming to play an important role.

In organizational terms, it should in the first place be noted that the bulk of the consortia operating in European countries have no real legal basis, and have structures that might be called "light." Frequently they are supported by a logistical structure provided by one of the partners, or else make use of an existing central structure (an example here

being the model of the Nordic countries). In other cases the services are outsourced (e.g., the NESLI model). On the other hand, the governing systems of these bodies seem fairly developed and often complex, although they still do not dispel the impression of being rather fragile and transitional structures.

The majority of the consortia can rely on substantial ad hoc government funds, or else receive incentives and logistical support from central bodies, whereas cases of entirely self-financed activities are fairly limited. The availability of central funds is certainly a determining factor for the success of a consortium; at least as much as the administrative political system in which the consortium is set in terms of dimension and strategies.

As regards objectives, a growing concern of most consortia is to extend their sphere of activities to cover other functions including portals and common user interfaces, archiving and repositories. One practically universal need is to move the initiatives toward a national strategy, in some cases including even a transnational dimension.

Among the programs that operate in this perspective eIFL—already mentioned above—is the one which can count the greatest quantity of means and partners. On a smaller scale and with more limited objectives there are also several initiatives of a regional character in operation. Among these we have already mentioned German, Austrian and Swiss Consortia Organization (GASCO), the alliance of library consortia of the German language area. Another is Southern European Libraries Link (SELL), which has been founded as an association that primarily carries out activities of monitoring and information exchange at the level of the library consortia of the southern area.^[52] Regarding the exchange of experience, an important instrument of communication has been gradually developing in the last few years: the European meeting of ICOLC (the E-ICOLC Annual Conference), which periodically brings together consortium managers, academics, and operators in the sectors of electronic publishing in order to discuss issues of common interest.

In conclusion, albeit with a considerable variety of strategies and operational modalities, European consortium experiences show a number of affinities and, most recently, convergent approaches. These tendencies are bound to accelerate chiefly in the countries of the European Union in the near future. On the other hand, we must keep in mind that despite the differences that may exist, the European countries we have referred to in this entry share not just a common heritage of historical events and deeply rooted principles and values but also, as far as the member states of the European Union are concerned, common policies and rules covering a wide range of economic and social matters, associated in a single political project which in the short to medium term will be taking further, decisive steps forward.

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Library Fundraising and Development

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Abstract

Fundraising and development are activities new to the academic library scene, although as this entry illustrates, certain kinds of charitable giving have existed in universities and public institutions for many decades, if not centuries. Although some of the largest private universities in the United States have endowments that date back two or more centuries, few institutions of higher education have been involved in fund-raising in a serious manner for more than two or three decades. The great fortunes made in the Industrial Revolution enabled the establishment of a culture of philanthropy toward social institutions unknown elsewhere, or at any other time. With the attention of Andrew Carnegie, libraries became the focus of giving for a segment of America's wealthy, although for a number of decades this giving remained relatively restricted to public libraries.

HISTORY OF DEVELOPMENT IN ACADEMIC LIBRARIES

U.S. Phenomenon

Although some significant fund-raising and development programs have been established elsewhere in the world, two factors have caused academic library development to be largely a phenomenon of the United States: most of the early universities in the United States were private, and in this century tax laws have favored charitable giving by private individuals, foundations, and corporations. One of the very early library donors was Thomas Jefferson, who gave his collection to the Library of Congress and also ensured that the University of Virginia was established with a proper library for its role and mission.

A more recent philanthropic gift that made a significant difference not only to its own institution but to academia throughout the nation was the gift of Harry Elkins Widener's collection to Harvard, after the young man became a casualty of the Titanic. His mother, determined that her son would be remembered at least at his alma mater, was persuaded by the Harvard administration that a building carrying her son's name would perpetuate his memory; she would surely be pleased today to know that her son's name continues to be known worldwide wherever there is scholarship.

Private universities and colleges in particular have taken advantage of the human desire for immortality by raising funds from wealthy alumni or friends to build buildings—and few things are more tantalizing than to have “your” building be the one that represents our cultural heritage, the place where all students congregate to meet and study, and where faculty pursue their research.

The History of the Literature

The first edition of the *Encyclopedia of Library and Information Science*, published nearly 30 years ago, reflected the issues of the profession at the time, most naturally. A perusal of the index of the work finds very little reference to the topics that occupy so much of the time of so many academic library directors these days—external funding, the donor base, and gifts of cash, books, or bequests. In the 1960s and 1970s, academic institutions were in a significant period of financial recovery, going from postwar poverty to the riches of the National Defense Education Act and the country's instinctive desire to outthwart the Soviet Union by producing better educated and qualified graduates. The trickledown effect shaped academic libraries, which saw incredible growth for several decades following the war. Massive buildings were constructed; suddenly everyone could have a college degree, and many new universities were created. Money was not an issue, but the effective growth, management, and operation of our libraries were concerns. More than a generation of library administrators grew up with values that reflected a culture of growth and wealth; friends' groups were fine, but they were a frill. Of more concern was the perceived information explosion, which was said to double the size of research libraries every 16 years—a statistic that was unrealistic even at the time and turned out to be without foundation.

Therefore, it is not surprising that in the first edition of this encyclopedia just two articles summarize the extent of coverage of development: William Vernon Jackson's “Funding: Library Endowments in the United States”^[1] and Sarah L. Wallace's “Friends of Libraries”;^[2] both of these articles cover *all* types of libraries. As a result, although Jackson's description of the size and purpose of

endowment funds in academic libraries is fairly extensive, in today's terms, there is little attention paid to the process of *acquiring* these funds (the development process).^[1] Similarly, the discussion of the history of academic library friends' groups is quite helpful, but otherwise, does not touch on operational issues of major concern to university and college libraries of the twenty-first century.^[2]

This limited view of academic library fund-raising is not surprising. The role of the academic library as the "heart of the university" has changed significantly in the past three decades. As the financial constraints on both libraries and universities grew after the 1970s, it became more inevitable that the libraries that were once held apart from the fray of seeking funding outside the university would have to face this new and sometimes unwelcome activity. "The view of the library as a special preserve, protected from the rough-and-tumble of the business world, is fast disappearing."^[3] Two major new functions have been introduced in academic libraries in the past decades—systems/automation and development. In both cases, another unit of the university is considered to be the focus of the specialty, requiring the library to define its plans and policies according to standards set elsewhere in the institution and forcing the library director to take on a role not envisaged by librarians just a generation ago.^[4,5]

Despite the very many changes that have affected our universities and colleges in the past 30 years or so, the character and functions of friends' groups have not changed significantly. What *has* changed is the number of libraries with friends' groups, despite the discussion of the negative aspects of these support groups. In 1990, more than 50% of university libraries had friends' groups, compared to 20% of comprehensive and college libraries and only 5% of community college libraries.^[6] A survey of 196 college libraries one decade later showed that of the friends' groups that existed, half of them had been formed in the 1990s, suggesting that the need for external support had grown sufficiently pressing that even smaller institutions have by now been affected.^[7] Their governance, programs, and missions remain relatively stable.

The areas that have changed most significantly in the past decade have been the establishment of the role of development director for libraries; the intrusion of the institutional capital campaign into the library's way of doing business; and the role of the university or college librarian in development.

The Development of Development

An examination of the progression of activity and sophistication of library development over the past three decades is useful in permitting an understanding of the current activities of academic libraries.

In the 1970s, relatively few libraries engaged in what was at that time typically termed "public relations." As noted above, general social policy and economic well-

being placed libraries in a beneficial financial situation. In these years, prior to double-digit inflation, and with a significant influx of funding, librarians felt as though the world was their oyster. At Harvard, for example, a large portion of the materials budget came from the payout from its large endowments; when inflation began to eat into this payout, the Harvard library administrators were to be shocked to discover that they would need to depend more heavily on university funding, or raise more money, to support the materials budget to which the faculty had become accustomed.

Rather than engaging in the acquisition of external funds, librarians focused on the extent to which they could enlarge their resources (read "collections") by soliciting gifts of excellent collections from private collectors.^[8] However, by the end of the decade, it had become clear that the halcyon days of the 1960s and 1970s were about to disappear and that academic librarians would have to use more ingenuity, as well as external resources, to maintain the kinds of collections and services that their users had come to rely on.^[9] Lynden noted that several of the efforts to obtain outside monies included: appointing staff members whose specific duties were to seek funds from external sources; including the library in the capital campaigns of their parent institutions; turning away from federal funding toward alumni, corporation, or local foundation support; and increasing publicity about the library by printing special annual reports, creating friends of the library newsletters, and developing other annual fund literature.^[9] It should be emphasized that these techniques are described as being novel and unusual means of addressing budgetary problems—only 21 years ago—because they are in such common use today.

The 1980s saw a significant increase in development activity in not-for-profit institutions. Development offices were created, and capital campaigns began to be the single most significant way that universities used to increase their endowments and build their infrastructures. In the library world, a review of the literature shows an increase in publishing material about development and fund-raising, although a book of interviews with library leaders, published in 1988, shows that almost without exception, these leaders did not yet consider development to be an important part of their role and of the library's activities. One exception was Eastman, who said "Put to the test, a lot of library directors indicate that public relations and fund-raising are "soft" areas, not real library functions. In the years ahead, they may pay quite a price for that attitude."^[10] Although not targeting any specific type of library, another author wrote about donors and prospects for libraries in a blunt and outspoken manner that would have been unheard of 10 years earlier.^[11]

With the 1990s came a sudden expansion of the literature on academic library development and a geometric increase of the number of libraries engaged in development efforts.

The golden age for higher education in the United States was the 1950s and part of the 1960s. We began to see a downturn in funding in the 1970s that accelerated in the 1980s. True to form, we have seen an explosion of development activities in academic libraries since the early 1980s and in public universities during the 1990s.^[12]

Hood continues by identifying the various development-oriented groups that were created since 1980 to assist librarians and directors of library development with fund-raising issues; among these are Friends of the Library U.S.A. (FOLUSA), Development Officers of Research Academic Libraries (DORAL), and the Academic Library Advancement and Development Network (ALADN). All these groups hold annual meetings and sponsor listservs.^[12]

Although the literature discussing academic library development began to increase significantly in the 1990s, most of what was published remained in the “how I did it good at my institution” category. Despite some public complaint about a lack of research or theoretical structure, the literature tended to reflect the structure and problems of each author’s institution.^[13] The very newness of the field accounts for this lack of theory and reliance on practice. However, because each institution is unique and its advancement programs are designed to serve its own needs, the advice given in the literature should be regarded as examples, rather than as a prescription for every library to follow.

Recently published articles are building on the knowledge gained through the practice of a generation of librarians and development officers. Wedgeworth links fund-raising done by academic libraries to the better established field of professional public relations, indicating that despite differing organizational structures or goals, the process of identifying and developing constituencies is essentially the same.^[14] Surveys of librarians have begun to be published, giving the field some quantitative and qualitative data on which to make decisions in this area. Particularly useful is the survey of academic libraries done by Hoffman, Smith, and DiBona; it is an excellent example of basic research into fundamental issues, identifying factors that allow libraries to succeed or fail in fund-raising.^[15]

THE LAY OF THE LAND: THE ENVIRONMENT OF ACADEMIC LIBRARY DEVELOPMENT

As we enter the twenty-first century, the higher education sector is raising more money than ever before, and academic libraries are increasingly included in this effort, either because the library director aggressively forces the library to be inserted into the institutional effort, or because the academic administration expects it. At this writing, more than 20 universities are engaged in

multiyear comprehensive or capital campaigns with goals of \$1 billion or more; in most of these cases, the library is identified with specific goals and a dollar target.

In earlier years, libraries experienced some fluctuations in the numbers of support organizations; these structures grew during periods of financial constraint and shrank when there was ample funding.^[12] However, the downturn in support for higher education in the 1980s and 1990s has seen an explosion of development activities and support groups, which appears to reflect a fundamental change in the way that many libraries are organized and supported. The growing body of literature on library development is a direct result of the establishment of library development offices, with the attendant organizational structures and changes in roles (see below).

The more wealthy and larger a library is, the more likely it is to be engaged in development activities.^[14] As in so many areas, success breeds success; the larger and wealthier academic libraries seem to command the bulk of foundation and government grants.

The Library Within the Institution

The politics of the campus

As noted above, the view of the library as a special preserve, to be protected and shielded from the everyday concerns of the business world, is disappearing rapidly. Each institution handles this situation slightly differently, depending on its resources, goals, and priority of the library within the research and educational functions. Librarians must attempt to persuade university officers not only that libraries need external sources of funds but also that they are worthy of the effort required to find those funds in the same manner as do the schools and colleges of the university. At almost every institution, the library faces some barriers:

- No one ever graduated from the library.
- There is a perception that it is difficult to raise funds for libraries.
- The library is everyone’s second priority (their first being their own office or academic program).

Centralized versus decentralized development

Of primary importance is the organizational structure of development within the university at large. Such structures can be centralized, decentralized, or hybrid; each model has its advantages and disadvantages. With a centralized structure, all development staff report to, and are usually located in, the central institutional development office. Often, every development officer is asked to keep the library’s needs in mind when talking with potential donors. This approach is ineffective for the library; development officers tend to focus on the “sexier” academic

programs unless the university administration has made the library a specific high priority—a rather unusual circumstance.

With the decentralized model, each unit of the university handles its own development process. The library would need to create its own development positions and would retain control of its entire fund-raising planning and structure. This sounds appealing, but a major disadvantage lies in the lack of communication with the central development structure and its typical special support of areas such as planned giving, corporate support, prospect research, and special events staff.

The hybrid model, in which the library development staff are responsible just for library fund-raising but also have a formal relationship with the central development office, is likely to achieve the best results for the institution. No matter where the development officer reports, whether to the library director or to central development, the communication links between the two departments are likely to be healthy and more productive. The relationship of the library with the development office is key to its ultimate success; if the development office is not supportive of library goals, the effort to gain resources for the library will be significantly impaired.^[7]

The role of the library director

A rule of thumb is that people give to people, and the corollary for library development is that the library director plays a key role in ensuring the existence and success of the library's fund-raising efforts. A director who is uninterested in development, or who doesn't recognize the significance of external support, or who is reluctant to "schmooze" or to ask donors for gifts, is unlikely to be the leader of a successful fund-raising effort. At least one expert states that it is not necessary to hire a fund-raiser with a sizable track record because the success of fund-raising depends on the leader of the organization rather than on the fund-raiser.^[13]

Whether this statement reflects reality may be subject to argument; however, there is no question that the role of the library director needs to be that of a leader—to define the library's goals and level of involvement in development, and to be the face of the library in meeting its supporters. Most library administrators entered their field without recognizing that they might at some point be required to ask people for money, a task that many people find extremely difficult. There is little solid tradition, and certainly no formal education in our degree programs, to allow librarians to approach development and marketing with comfort.^[5] One suspects that in the next decade or two, library and information studies programs will incorporate fund-raising as part of administration courses. Current job listings for academic library directors are increasingly calling for

fund-raising responsibility, making it obvious to aspiring directors that this new function will take up some portion of their time.

Access to donors

A major issue on many campuses, and one that can be a considerable barrier to the library's fund-raising success, is the access that is provided to the donors. In most institutions of any size, a centralized database tracks alumni, friends, donors, and other supporters of the institution.

Many institutional development professionals feel that the university library presents a real challenge in garnering support. They argue that the colleges have a ready-made constituency in their graduates, whereas the library offers no degree and has difficulty building a loyal base of support.^[16]

It has already been pointed out that several institutional barriers exist for academic libraries wishing to raise external funds. Access to the institution's alumni and supporters is critically important to the library, yet in some instances these people, who potentially have more interest than any other group, are off limits to the library, usually unless they "self-identify," or come forward on their own as supporters of the library.

These barriers are foolish. No college or university is able to tap all of their alumni, neighbors, and other supporters, and finding in the library another possible attraction for the university's community should be regarded as a positive asset. At the very least, the library should be given access to those alumni who are nondonors, by presenting them with other options for supporting their alma mater.^[17] Indeed, when several members of a family attended a university, they might be alumni of different schools or colleges and can, therefore, contemplate a family gift to the library rather than trying to determine which of their schools should be the beneficiary of a family donation. Similarly, alumni of a reunion class all used the library, no matter what their major or school was; they can all support a gift to the library. The University of Pennsylvania has had great success in appealing to fiftieth reunion classes to focus their reunion gift on the library.

In some cases, universities are unwilling or unable to change their mode of assigning responsibility for donors. But in those cases in which the library is able to gain access to the university's constituency, its development officer is also likely to be able to "manage" donors when a case has been made that the donor is appropriately the supporter of the library. Sometimes the donor self-identifies; in other cases, another supporter has led the library to the donor; in yet other circumstances, the membership of the friends of the library leads to managed prospects and major gifts.

DEVELOPMENT TOOLS, SMALL TO LARGE

Successful library development involves a numbers of approaches, several of which are described here. These tools should be regarded as building blocks. It is not necessary for a library to participate in a capital campaign, but if it has not established a group of donors (friends of the library) and engaged in annual fund and major giving programs, any attempt to launch a capital campaign is unlikely to succeed. The small gifts and donors inevitably lead to larger gifts and more donors, and should not be ignored.

Friends of Libraries

Whether to have a friends' group or not is a question that has been under discussion for decades, for various reasons. The earliest such groups were formed in California in the 1890s, although they were not called by that name. The first "Friends of the Library" group was founded in Paris in 1913, as a support group for the Bibliothèque Nationale, with a branch of that group formed in Berkeley, California, in 1930. The first academic friends of the library was established at Harvard in 1925, followed within a few years by similar groups at Columbia, Yale, Princeton, and Johns Hopkins.^[2] This author's experience at Johns Hopkins brought her into frequent contact with the three surviving charter members of that group, all of whom continued to be very supportive of the library and very proud to be charter members.

At their very best, friends' groups provide resources for the libraries with which they are associated, and form the basic building block of the library's constituency. Because the library has no natural constituency as do the academic schools, it should be able to use the friends to attract people who like libraries, enjoy books, and value the education they received. In its turn, the library staff and development officer can use the members of the friends to identify people who, with additional cultivation, may be prospects for major gifts, planned gifts, or bequests. The funds raised by the friends can be used to support special events, newsletter production, staff to coordinate and manage the friends' group, and resources for special collections or other library functions.

Much of the cultivation of the friends group is very long term. Considered in the time frame of the present, with its priorities and constraints, cultivating a friends' group could seem to be an unwise use of resources, bringing little return. The utility of a friends' group has been a topic of discussion because some librarians believe that friends, or volunteers, take up too much time and often have a tendency to micromanage.^[2] There is no question that fostering a successful friends' group does take time, and given the wrong people in volunteer slots, micromanagement can be a problem. In a recent discussion, library

directors within the Association of Research Libraries learned that some of their colleagues intend to eliminate their friends' groups to focus entirely on the smaller group of supporters that provides them with major gifts.^[18]

However, this author's experience suggests that those people who are now major or planned giving donors often started out as \$10 or \$15 annual fund donors and members of the friends' group. With few other formal mechanisms available to the library to create its list of prospects, having a group of several hundred people as supporters is not at all unwelcome. Some of these friends can and should become members of the library's external advisory council or visiting committee (addressed below). The long-term benefits to be gained by attracting potential donors and obvious annual fund supporters to the library cannot be overemphasized.

Friends' groups are typically multifunctional, although which particular functions are the purview of any single group depends on local circumstance. Friends of libraries are usually (but not always) library supporters, and program events featuring books and authors are traditionally used to attract members. These groups also offer financial support, and as such constitute one of the elements of the library's fund-raising program. If the library's special collections are particularly strong, the group may focus its attention there, and the special collections staff may take on the role of managing the friends' activities. In a few universities (the University of Maryland is an excellent example), the friends group has one major meeting each year, but it is a black-tie affair with a distinguished speaker, and seats are available at a fairly high price.

According to Thompson and Smith,

College friends' groups will continue to flourish where they are embraced by the library administration, supported by the development staff, and honored by the community in which they reside. College libraries fortunate enough to have strong friends' groups will find these organizations are a means to continue strengthening the research and service they are able to provide to their constituencies.^[7]

Annual Fund

With or without a friends' group, academic libraries are increasingly involved in their institutions' annual fund drives. As with friends' groups, the annual fund drive carries with it both advantages and disadvantages. Like the friends' group, it is a high cost and relatively low contribution program, but also like the friends' group, it is likely to be very worthwhile over time. Libraries with long-standing friends' and/or annual fund programs can bring in considerable amounts of money each year, depending, of course, on the size of the alumni base, the dues assessed, and other factors. One observer suggests that revenues of \$25,000 annually are a reasonable

expectation; evidence suggests that larger libraries are typically able to bring in revenues of \$250,000 or more annually.^[6,13]

Most university or college annual funds allow donors to specify an area of the institution to which they wish their funds to be targeted. Even without a check-off box dedicated to the library, alumni and friends have the opportunity to give to the library, and many of them do so. Given the obstacles faced by the library as described above, the annual fund can provide access to the university's donor pool, permitting those who have an interest in the library to "self-identify" and, therefore, giving the library development officer a rationale for visiting them.

Annual funds are typically unrestricted, current-use funds. In some institutions, these gifts are taxed by the administration to fund unfunded priorities. Where possible, the library should attempt to retain the entirety of these gifts; if nothing else, the director is able to tell the donors that their gifts are fully supplemental to the library's budget. Donors like to feel that their dollars are making a real difference to the program that they are supporting. They rail at underwriting administrative costs and also dislike the notion that their monies are being used by the university for budgetary relief.

Libraries can carry on annual fund programs without having friends' groups; it is more difficult to define a friends' group without assuming that this group is an analog of the annual fund giving for the library, but it can be done. As we will see below, libraries are most likely to succeed in their fund-raising efforts when their friends' and annual fund programs are linked.

Major Gifts

The next step after the unrestricted, current-use giving programs for libraries is the major giving arena. Development professionals and librarians disagree in their definitions of major gifts, particularly as applied to libraries. When the development office defines a major gift as any six figure gift or more, it can be difficult for the librarian to argue that book fund endowments should be part of the library's major gifts program. However, unlike almost any other area of the university, the library can make excellent use of the payout from a \$10,000 or \$25,000 endowment. When that payout is \$500 or \$1250 annually, the library can purchase materials that are of benefit to the institution's students and faculty—and this can be very attractive to potential donors. An alumnus giving \$1000 annually can often be persuaded to increase that gift to \$2000, thereby creating a \$10,000 endowment over a 5-year period.

Once it is determined that the library should embark on a major gifts program, the library administration will need to clearly identify and describe the library's needs and its fund-raising goals. The central development office is likely to require annual targets for each university unit,

and the library's development officer should use this requirement as an occasion to plan the year—how many prospects will be visited? Which potential donors will be asked to consider a gift and at what level? What special events and programs will be held?

Armed with the list of names from the friends of the library and from annual fund giving, the library director and the director of development are then able to do the research necessary to determine which donors are capable of larger gifts and should be visited. Vast quantities of public data are available to give the fund-raisers guidelines regarding the possible size of gift that any particular donor might be able to consider.^[11] For example, libraries have an unusually high proportion of "never married/no kids" supporters—one demographic element that ranks high in the list of interesting characteristics of suspects and prospects. Elderly couples with many children and grandchildren, on the other hand, may be loyal library supporters but are unlikely to have the wherewithal to make a major gift to the library.

Unlike other areas of the university, libraries tend to receive a large number of gifts in kind. Someone moving out of a house to an apartment is likely to give the library very nice books that are not worth more than \$1 or \$2 each and that the library does not need to add to its general collections. A gift in kind of this nature can not be called a major gift, and the library should probably take as little time to process and handle these gifts as possible. Not to be overlooked, however, are the gifts in kind that represent truly important additions to the collection, and perhaps even special collections. A single book worth over \$100,000 can enhance the library's collection considerably and is just as valuable as a gift in cash of the same quantity to the library's fund-raising goals.

Planned Giving

"Estate planning, deferred giving and planned giving are the names commonly given [this] important area of fund raising."^[19] After a decade of a bull market, with the increasing number of senior citizens, and in a country where charitable giving is still supported by tax incentives, planned giving is an ideal tool for library development. In many circumstances, people are able to consider significant gifts by using vehicles such as bequests or charitable remainder unitrusts. The library will not see the funds immediately in most cases, so shouldn't count on supporting positions or even accomplishing an immediate building project. However, in the short run, these gifts count toward annual and campaign goals, and in the long run, the library will benefit significantly from the generosity of these donors.

Planned giving is a complex area; many universities have central staffs of planned giving experts to ensure that these gifts are structured appropriately and that the university is taking advantage of all the tools available to it.

A recent publication for librarians, although not totally focused on libraries, is very important in laying out all the options and considerations for not-for-profit institutions and their supporters.^[20]

Capital Campaigns

Institutional capital or comprehensive campaigns were mentioned earlier as vehicles by which many libraries are drawn into fund-raising. Indeed, colleges and universities began to embrace the campaign as a fund-raising tool in the 1970s, and by the early twenty-first century many universities seem to be perpetually in "campaign mode." Given this environment, libraries tend to participate in campaigns, together with the friends of the library, annual fund, and major giving programs that have heretofore sustained it.

The library director's active engagement with the planning of the campaign is key to the success of the library within that campaign. It is not unusual for universities to hire consultants to assist them in planning a campaign, and these consultants usually do a feasibility study to determine the state of readiness of the university's community for a campaign. Ensuring that a community understands what philanthropy is, and is ready to engage in such an activity in support of the university, is an important element of this study.^[21] Library participation at this stage in the development of a campaign can bring visibility to the library, so that the university administration and the consultants alike recognize the library's existence (not to be taken for granted!), needs, and potential donors.

Once it has been determined that a campaign is appropriate and likely to bear desirable results, the university/library will identify the institutional needs and priorities, associate dollar figures with these needs, and develop a pyramid chart that indicates how many gifts at each level the library requires to meet its goals. Matching the size and focus of the gift with the appropriate benefactor is a simple follow-up step if all the necessary research and planning has been accomplished. One expert says

Giving is a habit. Has your annual support grown over the last three years? Are the numbers of volunteers at least stable? Does at least half of your support come from a few large donors? Are your contributors thanked and informed on what happens to their gift? If these questions cannot be answered in the affirmative, you need to review and take corrective action before launching a campaign.^[21]

Because capital campaigns are more likely than the other tools to be run at the university level, much library activity will be dictated from above. What is the overall goal of the campaign and the goals for each university unit? How long will the campaign be? How many years will the campaign be in silent phase—it is usually thought that at least 50% of the goal needs to be in hand or

identified before the campaign goes public? What will the kickoff consist of? Will there be constituency (read 'library') kickoffs as well? At what level will the president of the institution participate and support the individual units of the university?

The appropriate goal for the library will be determined in much the same way as is the goal for the university at large. The consultants' feasibility study should take into consideration the number of library supporters and their capacity for giving. Some larger university libraries in the 1990s engaged in campaigns with goals of \$20 million or more; Harvard University Library's goal was \$76 million and was successfully reached.

Despite the doubts of librarians, campaigns do succeed, and they succeed in building a future for the library. This author, 5 years after the commencement of the campaign at Georgetown, suddenly found that payout from recently established endowments was making a real difference to the total library budgeting process. The campaign, even at that time, had worked to provide the library with the additional funds it so needed to appropriately support the teaching and research programs of the university.

FUTURE OF DEVELOPMENT

The future of development requires some consideration here. Technology is now able to insert itself into the development process and not only to provide lists and reports. It is now possible to use the Internet as a communications device with donors. Also, the previous narrative has identified some issues that clearly will need to be addressed by librarians involved in the areas of development and fund-raising.

Development on the Web

With the increased ability of universities and colleges to carry out transactions on the Web, libraries are beginning to use their home pages to publicize the opportunities for giving or for joining the friends of the library, and in some cases they are able to accept credit card numbers to pay for friends' dues. An advocate suggests that most nonprofit organizations should move to a Web-centric communications model, as being just an update of communication by telephone.^[22] This approach clearly has tremendous implications for the future.

In considering the use of the Web, libraries need at first to determine where in their website there should be mention of giving, or of the Friends of the Library. A brief assessment of ARL libraries' home pages shows widely varying practices. About one third of the libraries have placed some reference to giving or the friends on their home pages; another large group (perhaps 50%, although this is a moving target) refer to library support, but not on

the library's home page; and about 15% carry no reference to giving or support at all.^[23]

Websites can be used to great advantage in various ways. Libraries can recognize major donors by devoting pages to the donors and their gifts. Electronic plaques, online pledges, e-mail to the friends of the library support staff, signing up to attend events, and remote access to the library's information structure are only a few of the possibilities that the Web presents.^[22]

However, the future is not here yet. To design a total development program around the Web would assume that all our donors are online and that it is easy for colleges and universities to gain access to the e-mail addresses of their alumni and friends. Neither assumption is accurate at this date, and one should anticipate that traditional means of communication will gradually mingle increasingly with Web communications until a critical mass of our population is Web-familiar and our own systems for keeping up with e-mail addresses are more sophisticated than they are now.

Theoretical and Philosophical Bases for Fund-Raising

As mentioned above, the library field lacks literature on the theoretical and philosophical foundations of fund-raising. With additions to the literature such as that of Hoffman, Smith, and DiBona, this situation is gradually being rectified.^[15] Typically, library literature begins to cover a specialty with pragmatic articles and treatises, moving only later to analytical and philosophical discussion. Library fund-raising is just now at the point where the doers and thinkers are starting to contribute to the philosophy of the profession, and that trend should continue in the future.

Institutionalization of Fund-Raising

Several experts have suggested that until fund-raising is seen as a "regular" part of library services, it will not be regarded as a part of a library's operating expenses.^[6] Just as information technology was initially not considered a full part of the library organization, structure, and activity, neither is fund-raising in today's library world. Without the full incorporation of these functions within the library, either by assigning responsibility for development to existing staff or by hiring development staff, the fund-raising program will always be seen as separate, and perhaps only temporary. Experience shows that a development structure is not at all temporary, and to gain the most from this function, it needs to be perceived as a permanent partner within the library organization.

Surveys indicate that the factors of success for a library development program are the age of the program itself; the size of the donor pool; the level of involvement of the library director; the amount of time that is able to be

devoted to development, by the library director, by the director of development, and by other library staff; the type of institution, because private colleges and universities still raise more money than do public institutions; having a friends group that is part of the annual fund process; adopting high monetary goals; and maintaining a strong and positive connection to the central development office.^[15]

The best protection the library can have...is the institutionalization of the fund-raising process...While research, cultivation, solicitation and recognition will still be the fundamentals of the fund-raising process, its incorporation into the broader efforts of library management to improve the library's visibility, tell the library story, set a vision for the library of the future, and gain support from key constituencies is likely to result not only in successful fund-raising campaigns but also in a more effective organization.^[14]

CONCLUSION

Library fund-raising and development have become a part of many librarians' everyday lives. Once considered foreign territory, an area inappropriate for librarians to wander, development is now incorporated into the process of ensuring that our libraries have sufficient resources to provide necessary support to the students and faculty of our universities. Literature that once was sorely lacking is becoming a standard commodity of the tables of contents of journals and of the book lists of library publishers.

The changing world of higher education has made it almost imperative for librarians to be fully engaged in the process of fund-raising and development. Fighting the old adage that "it is impossible to raise money for libraries," an increasing number of academic libraries participate in their institutions' campaigns with impressive goals or conducting their own major gifts programs.

Libraries need to build constituencies and define directions that make it clear to those both inside and outside the university what payoff results from investments in the university's library. Each library director will have to work with his or her community, development office, potential and actual constituency, and administration to identify the best way in which to supplement increasingly scarce resources. Development, the library world's newest special function, serves as the means to insert the library's interests into the overall institutional goals.

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Library Leadership and Management Association (LLAMA)

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Abstract

This entry outlines the history of the Library Leadership and Management Association, a division of the American Library Association, from its establishment as the Library Administration Division in 1957 through the celebration of its 50th anniversary in 2007 when it was the Library Administration and Management Association to its recent name change in 2008. It includes details about its mission and vision, organizational structure, programs, publications, and awards.

INTRODUCTION

The Library Leadership and Management Association (LLAMA) is a national organization, one of 11 divisions of the American Library Association (ALA). The mission of LLAMA is to encourage and nurture current and future library leaders, and to develop and promote outstanding leadership and management practices. Personal, organization, and corporate members number more than 5000 and represent all types of libraries. Members include library workers at all levels as well as those who support libraries. Division-wide committees include Budget and Finance, Continuing Education, Financial Advancement, Leadership Development, Marketing Communication, Membership, Mentoring, Organization, Program, Publishing, and Strategic Plan Action Committee as well as committees devoted to Cultural Diversity Grants, Recognition of Achievement, and a Web site Advisory Board.

There are seven sections to address major areas of interest: Buildings and Equipment (BES); Fund Raising and Financial Development (FRFDS); Human Resources (HRS); Library Organization and Management (LOMS); Measurement, Assessment, and Evaluation (MAES); Public Relations and Marketing (PRMS); and Systems and Services (SASS). Several less formal discussion groups are comprised of Assistants to the Director, Diversity Officers, and Women Administrators; other groups are comprised of members who are interested in issues related to Dialog with Directors, Middle Management, Library Storage, Education, Government Affairs, and Research.

The Library Leadership and Management Association is well known for its conference and pre-conference programs at the ALA Annual Conference as well as for regional institutes. In addition to these continuing education events, the Division produces publications and awards related to its mission and goals.

ORIGINS AND HISTORY OF LLAMA

The ALA was organized in 1876 and incorporated in 1879. The American Library Association included such standing groups as the Large Libraries Section, the Library Administration Committee, the Library Architecture Committee, etc. Following several years of study, the ALA reorganized in 1956/1957. While some divisions continued, others were established and more clearly delineated as the type-of-library and type-of-activity or function structure characteristic of ALA today. The Library Administration Division (LAD) formed to focus on general personnel administration, library organization, buildings and equipment, financial administration, insurance, public relations, statistics, relations with library governing bodies, governmental relations, legislation, and friends groups.

The mission of LAD was the general improvement and development of all aspects library administration, at all levels of administration in libraries, and for all types and sizes of libraries. Preexisting ALA groups transferred to LAD included the Federal Relations Committee (created 1923), Library Legislation Committee (1923), Public Relations Committee (1923), Friends of Libraries Committee (1929), Insurance for Libraries Committee (1929), Buildings Committee (1932), Equipment Committee (1931), Statistics Committee (1936), and the Board on Personnel Administration (1936).

The Library Administration Division had specific responsibility for

1. Continuous study and review of the activities assigned to the division and of the changing developments in those activities.
2. Conduct of activities and projects within its areas of responsibility and stimulation of the development of these activities in libraries.
3. Synthesis of the activities of all units within ALA that have a bearing on the type of activity represented.

4. Representation and interpretation of these activities of libraries in contacts outside the profession.
5. Stimulation of the development of librarians engaged in its type of activity and stimulation of participation in appropriate type-of-library divisions.
6. Planning and development of programs of study and research in those areas of activity for the total profession.^[1]

The broad focus, along with the other major restructuring within ALA, provided something of a *tabula rasa* for the new type-of-activity division. In addition to reconciling and coordinating the activities of the other committees that had been cobbled together to form it, LAD needed to coordinate with other existing type-of-library divisions to clarify and refine their respective areas of responsibilities. Early on, there was a LAD Committee on Recruitment with subcommittees devoted to recruiting for children's librarians, for school librarians, and for college and university librarians, as well as for cataloging and classification. Similarly, the Division's LOMS Section had committees devoted to statistics for school libraries, for public libraries, and for college and university libraries, as well as a statistics coordinating committee. The BES Section also formed committees based on types-of-libraries, as did the Public Relations Section.

While these reflected the past, there were also committees being formed to deal with urgent and emergent issues. The LOMS Advisory Committee on USOE Statistics was formed even as the plans for the ALA reorganization were being finalized. (See also Appendices 1 and 2, listing the Division Presidents and Executive Directors.) In 1958, the Government Relations Section established a Copyright Revision Committee to deal with anticipated activities and actions occurring during the 1960s and 1970s; and, in 1961, that Section became ALA's Legislation Committee. In 1959, LAD formed its Advisory Committee for the Library Technology Project. This ALA project was announced that year and, although its initial interests were in such mundane items as supplies and machinery, automation developments and applications quickly came to the fore throughout ALA, its divisions, and the profession at large.

The Friends of Libraries Committee, established in 1929 as an ALA committee and a foundation committee of LAD in 1957, was active within PRMS for many years. At ALA Annual Conferences, audiences were delighted to hear such significant luncheon speakers as Sir Edmund Hillary, mountaineer and explorer (1962); Clifton Fadiman, author, editor, and radio/television celebrity (1967); Alex Haley, author of 'The Autobiography of Malcolm X' (1968); Helen Hayes, first lady of the theatre (1969); Rep. Julian Bond, State of Georgia (1970); Erich Segal, author of "Love Story" (1971); and William Blatty, author of "The Exorcist" (1972). In 1979, members formed Friends of Libraries USA (FOLUSA) and incorporated as an

independent organization in 1984. It is a national leader in library support and advocacy.

Given the broad responsibilities from its inception, LAD encountered criticism as it sought to define itself through its interests and activities. In the early 1960s, there were concerns expressed that its growth and influence had extended beyond its proper sphere, encroaching upon the provinces of other divisions. These concerns were referred to the ALA Committee on Organization (COO).

The ALA COO report on the place of the LAD in the ALA structure conclusions:

1. Some assignments to LAD have dealt with matters other than purely administrative, and some have been limited to a single type of library.
2. While there may have been too broad a definition of LADs field of responsibility, there is evidence that some divisions have been giving too narrow and literal an interpretation of their own fields of responsibility.
3. The dual principle in the reorganization theory, i.e., type-of-library as against type-of-activity, has not been followed perfectly. Perfection may well be impossible, since the logic upon which the principle is based is not absolutely flawless.
4. Under the reorganization, the type-of-activity divisions seem to feel they are faring well. Since they are new, there is some reason to believe that where no fixed patterns of thought have existed, groups have been able to work well, but that where there were older fixed patterns of thought, it has been difficult for the group to adjust to the new pattern of organization. The new type-of-library divisions which emerged in the reorganization are as creatively active as type-of-activity divisions.
5. The reorganization principle stated thus: "Matters concerning one kind of library activity or service in two or more kinds of libraries are the responsibility of a type-of-activity division; and, conversely, matters concerning two or more kinds of activities in one type of library are the responsibility of that type-of-library division," is sound. This is the principle which has not altogether been followed in the assignment of projects.
6. Statements from the divisions seem to offer no evidence that such drastic action as the dissolution of LAD is required to resolve the dissatisfactions which have been expressed to COO.
7. Despite its complexity, the present organizational pattern of ALA is basically sound and deserves to be given at least 10–15 years of wholehearted support before a radical reorganization is considered. The framework exists within which to solve specific organizational problems, other than those of personality conflicts.

RECOMMENDATIONS OF ALA COO

1. The LAD should be retained as a division of the ALA, subject to the conditions outlined in the recommendations which follow.
2. Certain modifications in the scope of LADs activities should be achieved by:
 - a. Revision of LAD's statement of responsibility to clarify and limit the phrases "library administration in general" and "library organization."
 - b. Greater care in the assignment of projects or programs to divisions, particularly those involving expenditure of a significant amount to money.
 - c. Further study and reassessment of certain activities now being carried on in LAD about which question has arisen and which are possible candidates for reallocation to another division.
3. The committee urges the adoption of a policy within ALA which will encourage the individual divisions to conduct as many and as varied activities as they can, giving due consideration to monetary costs and the activities of other divisions or associations.
4. The committee recommends that the Executive Board and staff find some specific means of reviewing activities and assignments promptly and if possible before their inception, to assure as far as possible a judicious decision in making the assignment.
5. Some study should be given by the Membership Committee, the committee on Constitution and Bylaws, and other appropriate officers or agencies to proposals received from various sources that LAD membership be on a different basis than in other type-of-activity divisions.^[2]

ANNUAL CONFERENCES, PRE-CONFERENCES, AND INSTITUTES

At the ALA Annual Conferences, LLAMA typically offers both pre-conference and conference programs for continuing education. These address current administration, management, supervision, and leadership issues as well as current trends and "hot" topics. A review of programs can trace the changing emphases over the years. In the early years, particularly contemporary programs covered the Library Services Act (1957); Copyright Law Revisions and Libraries (1959); Standards in Library Technology (1959); Physical Requirements for Bookmobiles (1960); and Urban Renewal and the Library (1961).

In the 1960s, developments in a couple areas were the focus of programs as well as having an impact on the organization. Library automation, particularly of circulation functions, prompted such programs as An Administrative Look at Circulation (1963); Library Circulation Systems—from Hand Charging to IBM (1964); The

Prospect and Hardware for Computerized Circulation Systems (1966); Circulation Automation—Anti-Blue Sky: Practical Thoughts About Systems Planning (1967); Library Equipment Institute: Charging Systems (1968); Architectural Requirements of Circulation Services (1968); and Criteria for Evaluating a Library Circulation System (1972). Throughout these attentions paid to circulation automation, libraries were concerned about getting books back to ensure initial thoroughness of the database and tighter inventory control, so there were programs like Rx for Book Recovery—Practices to Obtain the Return of Books (1962); Security Methods Used to Forestall Book Thefts (1965); and Circulation Security Systems (1973). Similarly, there was interest in The Essential Role of the Circulation Librarian (1969) and The Role of the Circulation Librarian in Book Selection, Public Services, and Book Preservation (1970). For LLAMA, along with RUSA STARS, the future of resource sharing is now of increasing importance: Circulation + : Redefining Access (1989). These developments and interests were similarly reflected in the Division's magazine, *LA&M*, over the years.

The interest in circulation was also reflected organizationally. As early as 1958, within ALA, an Ad Hoc Committee on Circulation Services was formed "to prepare a statement of field of interest, to suggest an organizational attachment, and to provide continuity for the group while it is considering organization."^[3] There was an initial recommendation for a Circulation & Reserve Services group to become part of the Resources & Technical Services Division. Circulation roots grew quickly in LAD—a Circulation Discussion Group was established in 1961; a Circulation Controls Committee in LOMS (1962); and in 1966, the Division established its Circulation Services Section, renamed Systems and Services Section (SASS) in 1983 as it broadened its scope to cover management of other library systems.

Buildings and equipment issues have also been among the original interests of the Division. Selecting and working with architects, the library building process, space, remodeling, and retro-fitting are on-going concerns and the focus of various activities even beyond conferences, preconferences, and institutes—publications and awards are built around them, as well. Current regional institute curricula include various topics in building projects, administration and management, diversity, HRS, and PRMS. Topics and details, including presenters, are available at the LLAMA Web site

Long, over-arching interests in better statistics have also been reflected in programs, organization, and other activities of the Division. These interests have been the focus not only of ALA units but also of governmental agencies, particularly those dealing with educational institutions. The ALA Statistics Committee, established in 1936, was one of the original Association-wide committees incorporated in the foundation of the LAD in 1957.

The section dealing with LOMS started with separate committees devoted to college and university library statistics, public library statistics, school library statistics, and a statistics coordinating committee. By 1975, there were additional LOMS committees for state libraries, for reference services, for technical services, and for nonprint media. Eventually, a separate Statistics Section was formed to pull together and coordinate activities related to statistics, their collection and use.

Outside the library profession, the National Center for Education Statistics (NCES), located within the U.S. Department of Education is the primary federal entity for collecting and analyzing data related to education. The Higher Education Act requires the completion of data surveys for institutions participating in any federal student financial assistance programs. The Higher Education General Information Survey Series was designed to provide comprehensive information on various aspects of postsecondary education in the United States and its territories. The Integrated Postsecondary Education Data Systems is now the core postsecondary education data collection program for NCES. There is a library component that includes library resources, physical facilities, staffing patterns, salaries and wages, number of employees, level of educational attainment, current expenditures, and learning resource centers.

The Division also offers national conferences and regional institutes for continuing education. Historically, its institutes have addressed both general and specific management and administration issues. Human Resources issues have always been central to the Division's mission and are prominent in continuing education offerings: recruitment, training, and retention; organizational culture and effectiveness; team building; leadership development and staff appreciation; diversity; group decision-making; and, conflict management.

Increasing attention was devoted to leadership development. The Personnel Administration Section (PAS, now HRS), formed a Staff Development Committee in 1975. In 1982, midwinter planning sessions were begun, with leadership development as one of their goals. By 1986, a mentor program was implemented; 2 years later, LOMS formed a Leadership Discussion Group. In 2003, with the support of a grant from World Book, Inc., Library Administration and Management Association (LAMA) designated 10 new members as Leaders of the Pack—part of a 3 year program to develop new leaders. Beginning in 2006, LAMA took advantage of the ALA-wide Emerging Leaders program. Given the recurrent attention to and discussion of the centrality of leadership issues, an amendment to change the name to the LLAMA was put on the 2008 Spring Ballot and won overwhelming membership approval.

There are other continuing education activities. Among these have been some courses designed to support the Certified Public Library Administrator program. In 1996,

the executive boards of LAMA and the Public Library Association approved development of this post-MLS program of professional development for public librarians. The Association of Specialized and Cooperative Library Agencies quickly approved the proposal as well. "The focus on identifying and certifying competencies in both professional and preprofessional staff dates back to LAD's earliest days." Most recently, many of ALA's divisions have been working to develop competencies for the Library Support Staff Certification Program. More information on both these programs is available at the Web site of the ALA Allied Professional Association.

PUBLICATIONS

The Library Leadership and Management Associations quarterly magazine, formerly known as *Library Administration and Management (LA&M)* and now as *Library Leadership and Management (LL&M)*, is available to members online at the Division's Web site. The Division news blog, *Leads from LLAMA*, is also at that site. The Division has produced a number of monographs. Current titles include:

- Outstanding Public Relations: 60 Years of the John Cotton Dana Award*, by Amy Shaw and Peter Deekle.
- New Supervisors in Technical Services: A Management Guide Using Checklists*, by Emily Bergman and Andrea Kappler.
- Growing Leaders from Within — A Practical Guide for Recognizing and Developing Leadership Skills in the Library*, by the LAMA HRS Section.
- Risk and Insurance Management Manual for Libraries*, by Mary Breighner, CPCU, and William Payton; Jeanne M. Drewes, general editor.
- Fundamentals of Library Supervision*, by Joan Giesecke and Beth McNeil.
- Checklist of Library Design Considerations*, 4th Ed. by William W. Sannwald.
- Powerful Public Relations*, Ed. by Rashelle S. Karp
- Building Blocks for Planning Functional Library Space*, Ed. by the LAMA BES Facilities Committee
- Practical Strategies for Library Managers*, Ed. by Joan Giesecke
- Scenario Planning for Libraries*, Ed. by Joan Giesecke.
- Staff Development: A Practical Guide*, 3rd Ed., by Beth Avery, Terry Dahlin and Deborah A. Carver.

AWARDS

The Library Leadership and Management Association administers one of ALA's most prestigious awards, the John Cotton Dana Public Relations Award. Sponsored by H.W. Wilson since 1946, it honors outstanding library

public relations efforts. In recognition of their achievement, John Cotton Dana award winners receive a cash development grant of \$5000. The awards are presented at an elegant reception, hosted by H.W. Wilson, held during the ALA Annual Conference.

The Library Leadership and Management Association BES administers two biennial awards, given in alternate years. The American Institute of Architects Awards, co-sponsored by ALA and the AIA, encourage excellence in the architectural design and planning of libraries. Awards for distinguished accomplishment in library architecture by an architect licensed in the United States are made for any library in the United States or abroad. The ALA/International Interior Design Association (IIDA) Library Interior Design Award, cosponsored by ALA and the IIDA, honors excellence in library interior design and promotes examples of extraordinary design reflected through innovative concepts.

The Diana V. Braddom FRFDS Scholarship is available to library staff from all types of libraries to support learning new fundraising skills, enabling them to increase funding to their libraries from public, private, and corporate sources. The Scholarship was begun in 2001.

The Library Leadership and Management Association Cultural Diversity Committee's Cultural Diversity Grant is awarded to LLAMA members or units in support of the creation and dissemination of resources that will assist library administrators and managers in developing a vision and commitment to diversity, and in fostering and sustaining diversity throughout their institutions. The Committee, formed in 1991, established a Diversity Fund in 1994 and the grant in 1997.

The PRMS Section's first "Swap and Shop," a program that displays library public relations and promotional materials from hundreds of libraries of all sizes and types, was held in 1974. Judges select Best of Show winners based on content, originality, design, format, and effectiveness.

The LLAMA/YBP Student Writing and Development Award Contest, begun in 1998, is for students enrolled in a graduate program in library and information studies. Applicants submit essays on an announced theme. The winning submission is published in an issue of the Division's quarterly magazine. The author also receives a travel grant, funded by YBP, Inc., to be used to attend the ALA Annual Conference, where he/she is recognized at the LLAMA President's Program and the first meeting of the LLAMA Board of Directors.

CONCLUSION

Starting its existence as the LAD in 1957, to acknowledge the development of interests and activities that had taken place during its first two decades, the name changed to the Library Administration and Management Association.

The next three decades led to yet another name change, to the Library Leadership and Management Association, in 2008. The Division has targeted other professional organizations with which to establish partnerships in creating new leadership programs and opportunities. These programs reach out to staff at all levels and in all types of libraries to meet the needs of individual members as well as the organizations in which they serve.

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Colleagues at the ALA headquarters have been very helpful and supportive in this and other endeavors devoted to the history of LLAMA. In particular, I thank Karen Muller in the ALA Library and Lorraine Olley in the LLAMA office. Other LLAMA members working on aspects of the history who merit special mention are Robert F. Moran, Jr., and Gregg Sapp, with whom I worked on documenting and writing about the first 50 years of LLAMA.

APPENDIX 1

Table A.1 Division presidents.

1957	Louis M. Nouris, St. Louis (MO) Public Library
1958	Katherine Martin Stokes, Western Mich. University, Kalamazoo
1959	Margaret Mary Klausner, Public Library of Stockton & San Joaquin Cty, CA
1960	Archie L. McNeal, University of Miami, Coral Gables, FL
1961	Ralph Blasingame, Jr., Pennsylvania State Library, Harrisburg
1962	Louise F. Rees, Michigan State Library, Lansing
1963	Keith Doms, Carnegie Library, Pittsburgh, PA
1964	Herbert Goldhor, University of Illinois, Urbana-Champaign
1965	Hoyt R. Galvin, Charlotte (NC) Public Library
1966	Charles F. Gosnell, New York University Libraries, New York City
1967	Eileen Thornton, Oberlin (OH) College Library
1968	John F. Anderson, San Francisco (CA) Public Library
1969	Julius R. Chitwood, Rockford (IL) Public Library
1970	James H. Richards, Jr., University of Wyoming, Laramie
1971	Lester L. Stoffel, Suburban Library System, Western Springs, IL
1972	Grace P. Slocum, Enoch Pratt Public Library, Baltimore, MD
1973	W. Joseph Kimbrough, Denver (CO) Public Library
1974	Herbert F. Mutschler, King County Library System, Seattle, WA
1975	Paxton P. Price, St. Louis (MO) Public Library
1976	Ernest Di Mattia, Jr., Ferguson Library, Stamford, CT

(Continued)

Table A.1 Division presidents. (*Continued*)

1977	Richard L. Waters, Dallas (TX) Public Library LAD becomes LAMA
1978	Donald E. Wright, Evanston (IL) Public Library
1979	Dale B. Canelas, Stanford (CA) University
1980	Mary A. Hall, Prince George's County Mem'l Lib, Hyattsville, MD
1981	Carolyn A. Snyder, Indiana University Libraries, Bloomington, IN
1982	David R. Smith, Hennepin County Library, Minnetonka, MN
1983	Nancy R. McAdams, University of Texas, Austin, TX
1984	Gary E. Strong, California State Library, Sacramento CA
1985	Ronald G. Leach, Indiana State University, Terre Haute, IN
1986	Betty W. Bender, Spokane (WA) Public Library
1987	Ann Heidbreder Eastman, Virginia Tech., Blacksburg, VA
1988	Maureen Sullivan, Yale University, New Haven, CT
1989	Dallas Y. Shaffer, Monterey County Public Library, Salinas, CA
1990	Susanne Henderson MacTavish, General Electric Company Lib. Gaithersburg, MD
1991	Susan E. Stroyan, Illinois Wesleyan University, Bloomington, IL
1992	James G. Neal, Indiana University, Bloomington, IN
1993	Carol F. L. Liu, Queens Borough Public Library, Jamaica, NY
1994	Donald E. Riggs, University of Michigan, Ann Arbor, MI
1995	John J. Vasi, University of California, Santa Barbara, CA
1996	William W. Sannwald, San Diego (CA) Public Library
1997	Charles E. Kratz, Jr. University of Scranton, Scranton, PA
1998	Thomas L. Wilding, University of Texas, Arlington, TX
1999	Carol L. Anderson, State University of New York, Albany, NY
2000	Jeanne Thorsen, King County Library System Foundation, Issaquah, WA
2001	Joan Giesecke, University of Nebraska-Lincoln, Lincoln, NE
2002	Linda Dobb, Bowling Green State University, Bowling Green, OH
2003	Paul Anderson, University of Delaware, Newark, DE
2004	Virginia Steel, Washington State University, Pullman, WA
2005	Catherine Murray-Rust, Colorado State University, Fort Collins, CO
2006	Andrea Lapsley, Colorado State University, Fort Collins, CO

(*Continued*)**Table A.1** Division presidents. (*Continued*)

2007	W. Bede Mitchell, Georgia Southern University, Statesboro, GA
	LAMA becomes LLAMA
2008	Molly Raphael, Multnomah County Library, OR
2009	Gina J. Millsap, Topeka & Shawnee County Public Library, KS
2010	Gail A. Kennedy, University of Kentucky, Lexington, KY

APPENDIX 2

Table A.2 Division secretaries/ executive directors.

1957–1960	Hazel B. Timmerman
1960–1968	Alphonse F. Trezza
1968–1973	Ruth R. Frame
1973–1979	Jordan M. Scepanski
1974–1979	Donald P. Hammer
1979–1985	Roger H. Parent
1985–1989	John W. Berry
1989–2001	Karen Muller
2001–2007	Lorraine H. Olley
2007	Kerry Ward

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2. Highlights of the Midwinter Meeting Council, Executive Board, and PEBCO. ALA Bull. **1964**, 58 (March), 196–205.
3. The American Library Association. Committees Ad Hoc on Circulation Services. ALA Bull. **1959**, 53 (January), 896.

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BIBLIOGRAPHIC NOTES

1. Aspects of the history of LLAMA are detailed to a greater degree in the 50th anniversary issue of *Library Administration & Management* **2007**, 21(3), 109–123. Included there are titles of programs and articles, organizational structure and growth, timelines, staff, etc. The LLAMA Web site.
2. <http://www.ala.org/ala/mgrps/divs/llama/llama.cfm>, also includes significant information about the history of the Association. Various ALA newsletters and conference programs contain a wealth of detail that can be used to trace the development of this and other ALA divisions.

Library of Congress Classification (LCC)

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Abstract

The Library of Congress Classification (LCC), originally designed for classifying the Library's own collection, is now used in a wide range of libraries, both in the United States and abroad. This entry recounts its history and development from its genesis to the present time, leading up to an explanation of LCC structure, tables, and notation. It then considers the system's potential for wider application in the online age, through speculation on using LCC as a tool for (a) partitioning large files; (b) generating domain-specific taxonomies; and (c) integrating classification and controlled subject terms for improved retrieval in the online public access catalog (OPAC) and the Internet. Finally, analyzing both its strong and relatively weak features, it addresses the question of whether in its current state LCC is in all respects ready for playing such roles.

INTRODUCTION

The Library of Congress Classification (LCC), developed for the Library's own use, has been adopted by so many other libraries that it has become one of the most widely used classification systems, particularly among large academic and research libraries in the United States and around the world. Several major factors have contributed to its wide acceptance:

1. Its wide-ranging and thorough coverage.
2. Its continuous revision.
3. Its dependability (in respect to maintenance) through its support by the Library of Congress (LC).
4. Its flexible, very hospitable, and expandable notation (i.e., its book numbering or labeling system).
5. Its base in literary warrant (the term "literary warrant" in the context of library classification indicates that new topics are added to the schedules as they are needed to reflect the subject content of the literature or materials being cataloged or classified).
6. The wide accessibility of its schedules, in both electronic and print versions.
7. The fact that LCC class numbers, as well as *Library of Congress Subject Headings* (LCSH), appear on almost all LC cataloging records and many records in OCLC's (Online Computer Library Center's) WorldCat. Further considerations may be that the system holds promise as one of the important elements in new systems to improve retrieval on the Internet and in the online public access catalog (OPAC).

To date, LCC has been applied primarily in the library environment, where, traditionally, its notation has

provided a sequence for the shelf-ordering of library materials. Even in this role, LCC has had an information retrieval function; generations of library users have relied on classification as a means of locating wanted material on shelves or have used shelf browsing as one of the ways to discover related resources. A major question posed by this entry is whether, given modern searching amenities, LCC can also play a significant role in the future information environment. Many believe that it can. We turn first to clues from LCC's history and development.

BACKGROUND

The history of what was eventually to be LCC can be said to have begun in April 1800, when the American legislature was preparing to move from Philadelphia to the new capital city of Washington, D.C. A congressional act passed at the time provided \$5000 "for the purchase of . . . books . . . for the use of Congress and the said city of Washington." A second act, in January 1802, called for the appointment of a librarian by the nation's president; soon thereafter, President Jefferson appointed John Beckley, then Clerk of the House, as the first Librarian of Congress.^[1]

For the next several years, the collection was not classified in the current sense of the term; rather, books were arranged by size and, within size groups by accession number. Such an arrangement was fairly common at the time; and was used in many libraries for much of the 1800s. However, before Congress moved to Washington, its members used Benjamin Franklin's Library Company of Philadelphia. That library, ever since 1789, had been using a subject-based classification system for its

holdings, a system based in part on a work by Francis Bacon published in 1605 and also on another work by Jean le Rond d'Alembert published in 1751.^[2]

The first LC catalogs, published in 1802 and in 1804, reflected the collection's size and its accession order arrangement. The 1808 catalog, however, revealed added categories for some bibliographic forms, and the 1812 catalog showed that the Library had by that time moved toward arranging books by subject, following the system used by the Library Company of Philadelphia.^[3]

The next change was dramatic. In August 1814, when the War of 1812 was still raging, British soldiers set fire to the Capitol, and most of the Library's collection, which by then had grown to about 3000 volumes, was destroyed. Subsequently, Thomas Jefferson offered to sell Congress his personal library of 6487 volumes. The books arrived already classified by a system Jefferson had devised himself, a system also based on the work of Bacon and d'Alembert. Jefferson's system provided for 44 main categories with many subcategories. His scheme, with many changes made for practical rather than theoretical reasons, remained in force almost until the turn of the next century.^[4] By that time, in spite of another disastrous fire in 1851 that destroyed two-thirds of the collection,^[5] the LC collection had grown to at least 800,000 items.^[6]

However, despite the fact that there were only minor changes in the library's approach to classification from Jefferson's time until the end of the century, developments during that period were not without influence on the library's future role in both classification and subject cataloging. One was the gradual change in opinion on the role of the library. Early in the century, under the direction of librarians J. S. Meehan (1829–1861) and J. G. Stephenson (1861–1864) and under the oversight of the Congress's Joint Committee on the Library, the library was viewed as merely a service agency for Congress. Its collection was narrow in scope, and little used. That picture changed through the influence of Ainsworth Spofford, who was Librarian of Congress from 1864 to 1897 and who served the library in various positions from 1861 until 1908. Spofford believed that there should be a national comprehensive collection available not only to members of Congress but to the general public and directed both the library's acquisitions program and its lending policies to that end.^[7,8]

Development of the Library of Congress Classification

The next chapter in LCC's history was again rooted in a move, this time, in 1897, to the magnificent building it still occupies. The move itself, plus the size and continuous rapid growth of the collection, demonstrated that the Jefferson-based classification was no longer

adequate for the Library's needs. The collection by that time was approaching a million items. John Russell Young, then Librarian of Congress, was in agreement with J. C. M. Hanson and Charles Martel (head of the catalog division and chief classifier, respectively) that reclassification was necessary. After an investigation that found extant schemes unsuitable for the library's use for one reason or another, Hanson and Martel concluded that a new classification should be developed using Charles A. Cutter's *Expansive Classification*^[9] as a guide to the order of classes but with a modified notation. Young, who died suddenly in January 1899, was succeeded by Herbert Putnam, who also strongly supported reclassification. After much consultation and deliberation, the decision was made in 1900 to proceed with the development of an entirely new classification scheme. Work on the new classification began in 1901. The notation question was resolved by the choice of capital letters for main classes, with numerical expansion for subtopics and with gaps in the sequence left for future development. Hanson's 1901 proposed outline shows the use of only single letters for main classes, but his 1903 outline shows that he had moved to using double letters for major subclasses. The latter change was significant, because it greatly increased the hospitality, i.e., the expansion potential and ability to accommodate new subjects, of the new LCC system.^[10,11]

As work began on the classification, each subject class was developed by specialists in the subject at issue who worked under the general direction of Hanson and Martel.

For all the classes, Martel worked out a "common arrangement pattern" which he referred to as his "seven points." The first six points covered general materials; the seventh was for specific subdivisions of the topic at issue. Martel's seven points^[12] included

1. General form divisions: periodicals, societies, collections, dictionaries, etc.
2. Theory. Philosophy.
3. History.
4. Treatises. General works.
5. Law. Regulation. State relations.
6. Study and teaching.
7. Special subjects and subdivisions.

This pattern, used whenever applicable, brought a degree of unity to the classification as a whole that would probably not have been achieved without it.

The separate schedules were published (in individual print volumes) as they were completed. Although some schedules took decades to be finished, all of them except Class K (law) had appeared by 1948. (The final Law schedule, Religious law, was published only recently, in 2004.)

The separate development of individual schedules meant that, unlike most other classification systems, LCC was not the product of one mastermind. The schedules that make up the classification were (and are) developed, published, and maintained separately; indeed, LCC has been called “a coordinated series of special classes.”^[13] This aspect of the system, each separate schedule prepared by experts in the subject area of the class being developed, lessened the homogeneity and predictability of the system as a whole. On the other hand, to quote Richard Angell, former chief of the LC Subject Cataloging Division, the system was “praised for the freedom allowed in each schedule for development according to its subject field’s own intrinsic structure.”^[14]

Once a schedule was published, work began almost immediately on its revision; this was necessary in order to accommodate new topics, new relationships, and terminological changes that are continually found in new material being cataloged. Additions and changes are communicated to the library community through *Library of Congress Classification (LCC) Weekly Lists*.^[15] Another source of such information is the Gale Research Company’s publication *SuperLCCS*,^[16] the yearly issue of each schedule contains the entire class or subclass incorporating additions and changes for the past year.

It bears noting here that, until the mid-1990s, the LCC schedules existed mainly as print products. Maintenance and revision remained basically manual tasks that were extremely labor-intensive and therefore both costly and slow. The conversion of LCC to electronic form became imperative. Work began in 1993 and was completed in 1996. For several reasons, the conversion to electronic form, which was done using the *USMARC* (now called MARC 21) *Classification Format*,^[17] was an especially important development for LCC. That the change greatly improves internal operating efficiency goes without saying. For one thing, it enables much more efficient production of the print schedules. More important, it not only enables LCC to be consulted online but allows it to be part of new and powerful search tools.

Print versions of the schedules are still being produced as the extent of revisions dictates. However, the electronic version, *Classification Web*,^[18] which includes a full-text display of the entire LCC plus correlations between LCC and LCSH, is in essence up to date and is heavily used.

Because all classes—there are 21—are constantly being revised as the LCC editors strive to keep abreast of the times, by now (2008) most schedules have undergone thorough revision at least once, and for some schedules many times. In total, whether consulted electronically or through the 41 volumes of the print version, LCC functions as a general, well-maintained, and comprehensive library classification scheme.

LCC STRUCTURE AND NUMBERING SYSTEM

Because LCC is largely an enumerative system, i.e., a system that lists numbers for complex as well as single subjects, the classification as a whole requires little number building. The extensive author tables in Class P (literature) and the form tables in Class K (law) are the most noticeable exceptions.

As was the case at its beginning, LCC main classes are denoted by one capital letter, and subclasses are represented by two or three capital letters followed by the Arabic numbers 1–9999 treated as integers. To provide for expansion there are gaps left between integers, and the integers may be expanded decimally where needed. They can also be expanded by Cutter numbers, a system originally invented by Charles A. Cutter, which uses a combination of a capital letter and one or more Arabic numerals, read decimally. For general use, Cutter numbers are available in multiple versions with different levels of details, for example, the *Cutter-Sanborn Three-Figure Author Table*.^[19] In its classification, both for item numbers and when further subdivision is needed under topics, the Library of Congress uses a much less elaborate table that is based on Cutter’s scheme.^[20] The resulting letter–number combinations are referred to as “Cutter numbers.” The use of that table is indicated by instructions and/or tables appearing where applicable throughout the schedules.

Within individual schedules, there are many internal tables, using numerals or Cutter numbers that apply only to specific segments of the classification. The extensive tables for schedules K (law) and P (literature), however, appear in separately published volumes. In addition, a few tables, published in *classification and Shelflisting*,^[21] are used throughout the system.

In sum, although LCC began as an enumerative rather than a faceted classification, over the years, it has moved gradually toward faceting, through the increasing use of tables. Furthermore, the system is not rigid: Its notational system can be expanded in more ways than one to accommodate new and developing subject matter. In other words, both LCC’s notation, and the classification itself, are remarkably hospitable to changes in what is known and written about.

The following details, discussion, and examples give substance to the brief description just provided.

LCC MAIN CLASSES, SUBCLASSES, AND DIVISIONS

The following list shows LCC’s main classes with their alphabetical designations. Discussions of main classes, subclasses, divisions of subclasses, and LCC’s numbering system follow the list:

A	General works
B	Philosophy. Psychology. Religion
C	Auxiliary sciences of history
D	History (general) and history of Europe, Asia, etc.
E–F	History: America (Western hemisphere)
G	Geography. Maps. Anthropology. Recreation
H	Social sciences
J	Political science
K	Law
L	Education
M	Music
N	Fine arts
P	Language and literature
Q	Science
R	Medicine
S	Agriculture
T	Technology
U	Military science
V	Naval science
Z	Bibliography. Library science. Information resources

Main Classes

The rationale for the arrangement of LCC's main classes was explained by Charles Martel, one of the persons responsible for the original planning and supervision of the development of the system. Class A, general works, not limited to any particular subject, leads the scheme. It is followed by Class B, containing philosophy and religion, which sets forth theories about human beings in relation to the universe. The next classes (C–G history and geography) in the sequence cover such concepts as the human abode and the source of humanity's means of subsistence, humans as affected by and affecting their physical milieu, and the mind and soul of humanity in transition from primitive to advanced culture. The next group, Classes H–L, deals with the economic and social evolution of human beings. Classes M–P (music, fine arts, and language and literature) concern human aesthetic and intellectual development. Viewed in large groups, it can be seen that Classes B–P taken together form the group of the philosophical–historical and philological sciences, while the second large group, Classes Q–V, embraces the mathematical–physical, natural, and applied sciences. Bibliography, which in many libraries may be distributed throughout different subject classes, shares the same class (Z) with librarianship and information resources.^[22]

Subclasses

Each of the main classes, with the exception of E and F, is divided into subclasses that represent disciplines or major branches of the main class. Class Q, for example, is divided into the following subclasses:

Q	Science (general)
QA	Mathematics
QB	Astronomy
QC	Physics
QD	Chemistry
QE	Geology
QH	Natural history (general)—Biology (general)
QK	Botany
QL	Zoology
QM	Human anatomy
QP	Physiology
QR	Microbiology

Divisions

Each subclass is further divided into divisions that represent components of the subclass. For example, the subclass chemistry has the following divisions:

<i>QD</i>	<i>Chemistry</i>
1–65	General Including alchemy
71–142	Analytical chemistry
146–197	Inorganic chemistry
241–441	Organic chemistry
415–436	Biochemistry
450d–801	Physical and theoretical chemistry
625–655	Radiation chemistry
701–731	Photochemistry
901–999	Crystallography

Each of the divisions, in turn, has subdivisions (often called Martel's seven points) that specify different aspects of the subject, such as form, time, place, and more detailed subject subdivisions. In many schedules, the progression of subject provisions still mirrors these seven points, which were described above. The exception is point 5 (Law. Regulation. State relations. Legal topics). Legal matters, which had been scattered in different classes in earlier schedules, were moved to the law (Class K) schedules at the time they were being completed.

NOTATION (NUMBERING SYSTEM)

As mentioned earlier, the LCC uses a mixed notation of letters and Arabic numerals to construct call numbers. Main classes are represented by a single letter, for instance, K (law), N (fine arts), and Q (science). Most subclasses are represented by double or triple letters, for instance, QD (chemistry), DJK (history of Eastern Europe), and KFF (law of Florida). Classes E and F, the earliest classes to be developed, have not been divided into subclasses.

Divisions within subclasses are represented by Arabic numbers from 1 to 9999 (as integers) with possible

decimal extension, and/or with further subdivision indicated by Cutter numbers (as noted above, a system originally invented by Charles A. Cutter^[23] and modified for use with LCC, using a combination of a capital letter and one or more Arabic numerals).

The call number is completed by an item number based on the main entry (author or title) in the form of a Cutter number plus, in most cases, the year of publication. There are two common patterns of LC call numbers; they differ in the fact that in the second pattern the class number includes a topical extension expressed by a Cutter number.

1. Class number:
One, two, or three capital letters
Whole number 1 through 9999
Possible decimal extension
Item number
Cutter number based on main entry
Year of publication, as required
2. Class number:
One, two, or three capital letters
Whole number 1 through 9999
Possible decimal extension
First Cutter number based on term for topic, place, or form
Item number
Second Cutter number based on main entry
Year of publication, as required

The following examples show typical forms of LC call numbers:

1. SD131.S29 2005 *Forests in landscapes: ecosystem approaches to sustainability*, by Jeffrey Sayer and Stewart Maginnis; assisted by Michelle Laurie. 2005
Class number
SD (two capital letters) Forestry
131 (whole number) General works
Item number
.S29 (Cutter number based on author's name Sayer)
2005 (Year of publication)
2. DJK7.75.V57 2005 *Virtual Slavica: digital libraries, digital archives*, edited by Michael Neubert. 2005
Class number
DJK (three capital letters) History of Eastern Europe
7.75 (whole number with decimal extension of whole number) Electronic information resources
Item number
.V57 (Cutter number based on the title: Virtual. . .)
2005 (Year of publication)
3. HD9651.9.D8 N3513 2007 *Nylon and bombs: DuPont and the march of modern America*, by Pap A. Ndiaye; translated by Elborg Forster. 2007
Class number
HD (two capital letters) Industries. Land use. Labor
9651 (whole number) Chemical industries

.9 (decimal extension of whole number) By firm
.D8 (Cutter number expansion for further subdivision) DuPont

Item number

.N3515 (Cutter number based on author's name) Ndiaye
2005 (Year of publication)

4. N6512.5.P6 D67 Pop art and the contest over American culture, by Sara Doris. 2007

Class number

N (one capital letter) Fine arts
6512 (whole number) United States. Twentieth century
.5 (decimal extension) Special aspects or movements
.P6 (Cutter number for further subdivision) Pop art

Item number

.D67 (Cutter number based on author's name) Doris
2007 (Year of publication)

An LC call number may contain no more than one or two Cutter numbers. Call numbers for certain types of maps and atlases, however, may contain an additional letter-number combination that appears to be a third Cutter number but is actually an extension of the class number.

An important characteristic of LCC notation is that it is not hierarchical beyond the class/subclass level. Thus, in contrast to the notation for Melvil Dewey's *Decimal Classification*, LCC notation does not reflect all the general/specific relationships that are inherent in the scheme itself. There has been some criticism of LCC's nonhierarchical notation on this basis.^[24] However, in some respects, the absence of notational hierarchy can be viewed as an advantage for LCC. For one thing, most of its class numbers are thereby relatively brief and are thus easily manageable for shelving or other purposes. For another, in part because hierarchical relationships are largely ignored in the notation, LCC is remarkably "hospitable": provisions for new subject matter can be easily added to the system.^[25] This is a most important consideration in light of the rapid increase in world literature, both in the number of "pieces" and the range of subject matter, disciplines, and genres that are represented. Further details and explanations of the LCC notation can be found in *Classification and Shelflisting Manual*.^[26]

LCC'S POTENTIAL IN THE FUTURE ONLINE ENVIRONMENT

Early in this entry, it was stated that a major question facing those interested in LCC is whether it can play an important role in tomorrow's information environment.

At this time, mid-2008, there is considerable debate on the matter even within the library sector of the information professions. Some claim that library classification has had its day. On the other hand, there are those who believe that, quite the contrary, there are many areas and operations in the current information environment in which the use of a classification scheme that is kept up to date—as are both the Dewey and the LC schemes as well as some others—could make a significant contribution. These beliefs spring from three sources: First, awareness of the huge size and amorphous nature of the world's current store of accessible information; second, the observation that there are many specialized interest areas that would benefit from custom-designed organization schemes; and third, doubts that, with currently available search options, retrieval from the Internet is as thorough and as efficient as it could be. Three areas in which classification could make a positive contribution are noted below.

Partitioning Large Files

In recent decades, the Internet has seen an extraordinarily rapid growth. It now contains an enormous, hardly imaginable, heterogeneous store of electronic resources. Increasingly, many libraries and research institutions, recognizing the richness and overwhelming quantity of information available on the Web, have incorporated selected Web resources into their local online systems or portals. As time passes, with the rapid growth and phenomenal proliferation of electronic resources, it is becoming more and more apparent that effective means are needed to organize what the Internet has to offer. In addition to providing keyword searching, major holders of online resources, as well as Web resource providers themselves, have turned to directory or hierarchical schemes as means of categorizing and organizing their resources for access (e.g., a library-based system that uses LCC for this purpose is Cyberstacks on the Iowa State University Web site).^[27]

Furthermore, recent developments in taxonomy and ontology indicate an increasing interest in a directory or categorical approach to organizing Web resources. This is a logical development; after all, classification was devised in the beginning as a response to the need for organizing large bodies of material. If such interest should continue, database managers and system designers may find that existing schemes based on hierarchical structures are promising candidates for serving as organizational models. Where LCC could make a particular contribution is in its detailed and specific provisions, its broad range of coverage, and its ease of access. Those who turn to classification as a way to manage huge databases are likely to try broad subject divisions first. Thus, the broad main classes, in whatever scheme they choose, would be a logical and effective way to start. But, as time goes on, if and when database or Web managers see a role for finer and

finer topical divisions, they will find they have already been worked out and are at hand.

Generation of Domain-Specific Taxonomies

The existence of topical collections—special libraries being a case in point—shows that people involved in different fields of work have long found it productive to use collections of materials narrowly focused on their domains. Knowledge, it seems clear, is becoming more and more specialized. The usefulness of such collections may be enhanced if they are categorized by a scheme that does justice to the areas at hand. LCC may be of considerable help in this respect. Because it has been developed and maintained by subject specialists, LCC has sometimes been viewed from a theoretical standpoint as a scheme lacking an overall coherent and logical structure. However, from another perspective, this apparent weakness is a source of strength. The specialists responsible for a given area in a classification scheme are in a better position than generalists to keep the schedules for that area in conformance with current notions of how topics within it are either interrelated or related to other areas previously thought to be outside that area's bounds. The result of the departmentalized approach of LCC is that individual classes or parts of the scheme—such as the classifications of law, religion, art, and cartographic materials—are fully and painstakingly developed to the point that they can either be adopted as stand-alone specialized schemes or can serve as models for developing such schemes. Classification modules or miniclassification schemes with special foci can also be built on the basis of LCC to meet the needs for effectively organizing Web resources and digital libraries in specific subject areas. Where more details are needed in a particular situation, say to represent multitopics or subtopics, the basic structure of LCC could be extended to suit special situations and purposes. Another advantage is that specialized schemes based on LCC could be interoperable among one another within the main LCC structure. The availability of tools such as *Classification Web*^[28] greatly facilitates such operations.

LCC and LCSH as a Combined Retrieval Tool

Finally, there is promise in a vehicle that would map LCC captions against terms in LCSH.^[29] The goal is to create a merged search term system that would serve as a hidden cross-reference chain. In such a system, when a user submitted a search term the system response would include all the items that matched his or her search term in either LCSH or LCC, as well as all the items that were linked to that term in either system's cross-reference structure. If the users wanted to refine the search, they could be offered options such as “associated topics?,” “narrower topics?,” or “broader topics?.” Such a system for merging classification captions and controlled subject vocabulary mapped

each against the other has great potential for improving information storage, discovery, and retrieval. One of its advantages would be that it would link synonyms through the already existing references from lead-in terms to the “preferred term.” Another and more important advantage is that it would offer a searcher two approaches to his or her chosen topic. This duality is possible because classification and subject headings complement each other. A subject heading or descriptor, along with its cross-reference apparatus, represents a particular topic treated from all aspects. On the other hand, classification of a topic places it among related topics treated from the same perspective or within the same discipline. Traditionally, each approach has a specific function in information storage and retrieval. Used together, they can improve both effectiveness and efficiency. The Library of Congress has already taken steps toward such a system. In LCSH, many headings are editorially linked to specific LC class numbers. In addition, under each LC class number in *Classification Web*,^[30] the user can find up to 10 LC subject heading strings that are closely associated in the LC catalog. Implemented in a search vehicle, the gain in discovery and retrieval power would be tremendous. Were such the case, LC access provisions could have an even wider retrieval role to play in the future than they have had in the past.^[31]

Library of congress classification in the future

One of the aims of this entry was to consider the questions of whether, first, there are roles LCC might reasonably play in the wider information environment, and second, whether LCC in its current state (mid-2008) is ready to do so. The first question was addressed in particular above, under the heading “LCC’s Potential in the Future Online Environment.” It is the second question that is addressed now (mid-2008). To answer this question we propose to begin with taking a new look at some of the criticisms that have been levied against LCC in the past.

Criticisms and Problems

Guidelines

One aspect that caused concern in the past was how few official guidelines there were respecting subject analysis in general and the application of LCC in particular. With the publication of *Classification and Shelflisting Manual*, 2008 Ed^[32] this concern has been largely addressed.

National bias

A more fundamental concern was that the classification reflected a national bias. Because the Library was founded as a library *for* members of U.S. Congress, its early concentration on U.S. materials during the 1800s was natural. Over the past century, however, the collection has become

more and more general because many outside libraries are now contributing new classification numbers through SACO (a subject authority cooperative program). As a result, the subject scope of LCC is continually expanding at the same time that its national bias is decreasing.

Multitopical works

Another concern, a problem LCC shares with many other classification schemes, is its paucity of provisions for multitopical works. The problem is rooted in the still-prevailing limit of one class number per work, a rule that was appropriate when a primary function of classification was to determine the order of volumes on shelves. In the online age, however, the one-number-per-work limit holds only in the sense of designating a prime class number to indicate where a work is best shelved. With a change in policy, this problem could be easily solved: Assigning a class number for every significant topic covered in a work could be as much taken for granted as assigning multiple subject headings.

Obsolescence

A serious issue common to all classification systems is combating obsolescence, in other words, keeping systems up to date. The Library of Congress has a firm policy of continuous revision of its classification, a process that often involves moving topical provisions from one part of the schedules to another. This fact puts the Library in an uncomfortable position: it must balance the need for timely revision of its classification with the contrary need to maintain the system’s stability because relocations within the schedules entail an often overwhelming amount of work for participating libraries.

There is a particular factor bearing on reclassification that cannot be ignored. Creating new classes or subclasses or divisions, or revising existing provisions to any extent, is the most intellectually challenging and time-consuming work in all of librarianship. It is therefore the most costly and may thus be hindered for budgetary reasons. Should more use be made of LCC in the future, there remains the matter of the expense entailed in ensuring that revision of the classification keeps pace with the times, that, in a more timely way than was allowable when knowledge was not expanding so fast, it is able to reflect new knowledge without distortion and without burying the old.

LCC Strengths and Potential

Strengths

LCC has been hailed as a system that has proved to be practical and widely accepted. In Arthur Maltby’s words,

"It is a triumph for pragmatism."^[33] Its merits were enumerated at the beginning of this entry and are repeated more briefly here: It is very widely used; its coverage is wide-ranging and thorough; it is continuously revised; it has the support of the Library of Congress; its notation is terse, flexible, and expandable, and it is widely accessible in both electronic and print versions. That it is time-tested should give prospective users the confidence that the bugs, so to speak, have had time to work out. And the fact that each schedule was developed and is maintained by subject specialists rather than by generalists ensures the validity of its coverage. Therefore, to the extent that LC's continuous maintenance policy is not behind schedule due to budgetary constraint, the system is kept up-to-date and additions and changes are communicated to the cataloging community in a timely fashion. Furthermore, the availability of the online version of LCC has improved both its accessibility and its ease of application.

On the purely practical side, because LCC is a largely enumerative system, there is little number building, making the scheme relatively easy to use. And because LCC notation is compact, there is less likelihood of error when LCC numbers are assigned or input as search keys.

In sum, LCC, originally designed specifically for the Library's own collection, has become a comprehensive and hospitable classification used by many other large libraries. Furthermore, in recent years the Library of Congress has made a great effort to communicate with those who use LCC. Both its records and information about its policies are made easily and widely available, a demonstration of LC's sense of responsibility toward its user community.

CONCLUSIONS

In 2008, we are now in a different information age from when classification was used primarily for shelf-ordering and for browsing: the Internet, information databases, and OPACs (online public access [library] catalogs) are currently the primary search vehicles for those searching for topical information. Thus, new questions are being asked about classification itself and about LCC in particular. Among them are:

Is classification dead as an approach to searching?

The answer is no, not, at least for broad partitioning. Witness Google's many subdivisions by type of material covered. There is now a Google Books, a Google Business, a Google Earth, a Google Health, and a Google Scholar among the 20 search choices offered for those who access Google's search system.

Does LCC have the potential for playing a wider retrieval role in the future than in the past?

The answer here is yes. Three possible and specific new applications were described in an earlier section of this entry.

Is LCC as it stands ready to play wider roles?

The answer is: there is considerable potential. An encouraging fact for LCC overall is that in recent times there seems to have been an increasing interest in a directory or categorical approach to organizing Web resources. If such interest should continue, database managers and system designers may find that existing schemes based on hierarchical structures are promising candidates for serving as organizational models. Where LCC, as well as other comprehensive classification schemes, such as the Dewey Decimal Classification and the Universal Decimal Classification, could make a particular contribution is in its detailed and specific provisions, its broad range of coverage, and its ease of access. The broad main classes, in whatever scheme is chosen, would be a logical way to start. But if, as time goes on, if and when database or Web managers see a role for finer and finer topical divisions, they will find they have already been worked out and are at hand.

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Library of Congress Genre/Form Terms for Library and Archival Materials

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Abstract

Library of Congress Genre/Form Terms for Library and Archival Materials (LCGFT) is a multidisciplinary thesaurus that provides indexing terminology to describe what works *are*, rather than what they *are about*. Traditionally, access to genres and forms of works has been provided with subject headings, which poses two problems: first, subject headings are by definition more properly restricted to the topic of a work, and second, the rules for application of subject headings often treat forms secondarily to the topic, thereby limiting access.

This article will explain the differences between subjects and genres and forms, and put LCGFT in the context of other vocabularies that provide genre/form access. The development of LCGFT is a large undertaking, and the project management will be described. The majority of the entry will elaborate on the principles upon which LCGFT is built (the choice of authorized terms and the syndetic structure) and the application of terms. Finally, the article will outline developments in the provision of access to characteristics of works and expressions that are closely related to genre and form: musical medium of performance, intended audience, characteristics of creators and contributors, and time period of creation.

INTRODUCTION

Library of Congress Genre/Form Terms for Library and Archival Materials (LCGFT) is a unified, cohesive, multidisciplinary, easy-to-use controlled vocabulary that is built on twenty-first century principles of thesaurus construction. Independent of *Library of Congress Subject Headings* (LCSH), LC's best-known vocabulary, LCGFT builds on some of the principles that have made LCSH so popular while seeking to provide access to what a work *is* instead of what it *is about*.

In development since 2007, LCGFT remains a work in progress. Fundamental decisions regarding the scope and structure of the vocabulary and the application of terms have been made, but are subject to policy shifts as the thesaurus grows and more experience is gained with assigning the terms. The project's background, context, and management are outlined below, followed by a discussion of the characteristics of LCGFT and its application.

BACKGROUND AND CONTEXT

Before explaining the characteristics of LCGFT, it is important to understand what genres and forms are, and how they differ from subjects. *American Heritage* defines genre as "a category of artistic composition, as in music or literature, marked by a distinctive style, form or content."^[1] Traditionally, genre is most

closely associated with works of the imagination, as is evident by the definition of genre supplied by Martha Yee in *Moving Image Materials: Genre Terms*: any recognized category of fictional works which is characterized by recognizable conventions, that is, a group of works all of which tend to explore the same themes and use the same plot formulae, character-types and icons.^[1]

The major genres are often part of the collective consciousness of a society. When one thinks of Westerns, for instance, one thinks of the desert southwest, sagebrush, cowboys and Indians, cattle rustling, and shootouts. Other well-known genres include action, adventure, horror, romance, and thriller.

Form, on the other hand, is defined by Yee as "any recognized category of works characterized by a particular format or purpose."^[2] The introduction to the *Moving Image Genre-Form Guide* further elucidates that form is "separate from [a work's] actual content, not necessarily implying a particular narrative construction."^[3] Therefore, form relates to organization or format (e.g., atlases, poems), length (haiku, short films), original publication parameters (periodicals, television programs), technique (3-D films, animated television programs), and purpose (educational films, proclamations).

The subject of a work, on the other hand, is the topic being discussed or depicted. A work may be a war film (the genre) that is animated (the form), and be about World War II (the subject). In some ways, genre and form are closer to descriptive cataloging than to subject

analysis, but access to them has traditionally been provided as part of controlled subject vocabularies.

Two major multidisciplinary English language vocabularies that provide both subject and genre/form access are *Sears List of Subject Headings*^[4] and *Library of Congress Subject Headings*.^[5] Both include main headings that describe genres and forms (e.g., **Directories**; **Pastoral poetry**; **Short stories**), but sometimes restrict those headings' use. In LCSH, for instance, form headings may not be assigned to individual works of fiction, although they may be assigned to collections. An individual play may be assigned a form heading only if it includes a topical aspect (e.g., **Detective and mystery plays, American**), or if the play is of a highly specific form (e.g., **Carnival plays**).^[6]

The rules are slightly less stringent in *Sears*, wherein any literary form heading can be assigned to collections by multiple authors, but "Headings describing the major literary forms (such as **Drama**; **Fiction**; and **Poetry**) and the headings for the major forms of a national literature (such as **Irish drama**; **Russian fiction**; and **Italian poetry**) are never assigned to an individual work or to a collection by a single author." Scope notes indicate that some minor literary forms and genres such as **Ballads**; **Fables**; **Horror fiction**, etc., may be applied to individual works, but headings for these minor forms that are qualified by nationality or language are not eligible for assignment to individual works.^[7]

These policies may make it difficult for users to find all of the literary works of interest to them (e.g., love stories by American authors), because most of the literary works in library collections are separately published.

In both LCSH and *Sears*, the primary means of indicating form is to append a form subdivision to the end of a topical subject heading instead of using a form heading. Using *Sears*, for example, an encyclopedia of the American Civil War would be assigned **United States—History—1861–1865, Civil War—Encyclopedias**, while in LCSH the heading would be **United States—History—Civil War, 1861–1865—Encyclopedias**. In both cases, the form of the work is **—Encyclopedias**, and is treated secondarily to the topic. This is opposed to the thought process of many users, who are more likely to think of the form first, as indicated by the common question, "Do you have any encyclopedias about the Civil War?"

Another issue with using general subject vocabularies that include headings for genres and forms is that the form headings are generally coded in the 150 and 650 fields of the MARC 21 formats for authority and bibliographic data, respectively. These fields are defined as being for topical terms, that is, for subjects, not genres or forms.^[8] In libraries that follow the general practice and code form headings in the 650 field, users search for genres and forms by doing a subject search. The display mixes the two, as can be seen in this example using LCSH:

Horror stories.

Horror stories—Dictionaries.

Horror stories—History and criticism.

Horror stories—Themes, motives, etc.

Horror stories—United States—History and criticism.

Horror stories, American.

Horror stories, American—History and criticism.

Horror stories, German.

Users looking for works that *are* horror stories have to know to select the headings that are not subdivided, such as **Horror stories**, and **Horror stories** qualified by a nationality (e.g., **Horror stories, American**). The rest of the headings in this list denote works *about* horror stories, that is, horror stories as the subject matter.

In 1979, the Machine-Readable Bibliographic Information committee (MARBI) of the American Library Association ameliorated this situation by defining the 655 field for genre/form terms in the MARC 21 bibliographic format, and some libraries chose to use it for form headings authorized by general subject vocabularies.^[9] However, the associated authority fields, 155 (for the heading) and 455, 555, and 755 (for references) were not defined until 1995.^[10] These fields made it possible for computers to distinguish between subjects and genres and forms, thereby enabling separate searches for the two, once data was encoded in the 155/655 fields.

Many English language controlled vocabularies are devoted to providing genre/form access to materials in a specific discipline or to specific types of materials. Examples include *Guidelines on Access to Individual Works of Fiction, Drama, Etc.* (GSAFD), which primarily includes terms describing literary works, but also includes some terms for major genres of radio and television programs and films; the *Radio Form/Genre Guide*; the *Moving Image Genre-Form Guide* (MIGFG); *Moving Image Materials: Genre Terms*; and *Controlled Vocabularies for Use in Rare Book and Special Collections Cataloging*, a suite of vocabularies developed and maintained by the Bibliographic Standards Committee of the Association of College & Research Libraries' Rare Books and Manuscripts Section.

Some discipline-specific vocabularies include subject headings along with headings describing genres and forms. The *Thesaurus for Graphic Materials* (TGM) is used to describe still-image media and formats such as photographs, cartoons, and pictorial ephemera. Formerly published in two parts, one dedicated to subjects and the other to genres and formats, TGM was merged into a single vocabulary in 2007.^[11] The *Art & Architecture Thesaurus* (AAT) is a comprehensive vocabulary that is used to describe all aspects of art, architecture, decorative arts, material culture, and archival materials.^[12] The *AFS Ethnographic Thesaurus* includes terminology from folklore, ethnomusicology, cultural anthropology, and related fields.^[13] Finally, *Medical Subject Headings* (MeSH) covers terminology in the area of the health sciences.^[14]

All of these discipline-specific vocabularies make important contributions to genre/form access. They generally are most useful to libraries, museums, and archives that have extensive nonbook or special collections because the vocabularies enable deep, granular analysis of the materials. The exceptions to the general rule are GSAFD and MIGFG, which have been adopted by many public and general academic libraries, and MeSH, which is used not only in specialized medical libraries but also in universities that offer degrees in the health sciences.

Unlike *Sears* and LCSH, specialized vocabularies generally do not distinguish between individual works and collections in their rules for application, making the cataloging treatment more even. However, each specialized vocabulary has its own syntax and rules for application, which can sometimes cause collocation problems within a catalog. Take for example an academic library that uses MIGFG for its film collections, GSAFD for literary works, and LCSH for nonfiction, including film and literary criticism. A user writing a thesis about the relationship between modern detective novels and films of the same genre would probably want to view a sampling of films, read a sampling of novels, and also read published criticisms and histories of each. They would have to know three different syntaxes to find relevant materials:

Detective and mystery films—History and criticism

[LCSH; film criticism]

Detective and mystery stories—History and criticism

[LCSH; literary criticism]

Mystery—Feature

Mystery—Short

[MIGFG; films]

Mystery fiction

[GSAFD; novels]

When it comes to providing access to genres and forms, therefore, most libraries have been left with two choices. Use LCSH or *Sears*, which usually subordinate genre and form to the topic and also put restrictions on the assignment of headings, or use multiple specialized vocabularies for different types of media, which requires users (and catalogs) to master multiple syntaxes.

LCGFT seeks to address this problem by creating a multidisciplinary vocabulary with a standard syntax that allows for more consistency within catalogs while also bringing genre and form to the forefront. Both aims simplify search and discovery. Since it uses a modified form of LCSH syntax, users who are already familiar with LCSH (or *Sears*, which also employs a modified form of LCSH syntax)^[4] do not have to learn a new way to search. Furthermore, terms from LCGFT may be applied to individual works as well as to collections. The overall impact of LCGFT is increased access to many categories of works that formerly were at best difficult to find, or at worst,

hidden from users despite the fact that they were fully cataloged.

PROJECT MANAGEMENT

Since 2007, the year in which the first genre/form terms were approved, the Policy and Standards Division (PSD) of the Library of Congress has collaborated with the library community to develop LCGFT.

To allow for an orderly rollout of terms, LCGFT is being developed discipline by discipline. As of this writing, the vocabulary includes terminology for cartographic materials, law materials, moving images (films and television programs), nonmusical sound recordings (primarily radio programs), literature, music, art, and religious materials, as well as “general” terms—those terms that do not fit into a specific discipline, such as dictionaries, encyclopedias, and handbooks. Other projects, including newspapers, and science, have also been suggested and may be undertaken after the current projects are completed.

There are three major benefits to the orderly rollout. First, it provides predictability. When the project for a specific discipline is finished, all of the major terms in that discipline are available for use, thereby ameliorating the confusion that would result if terms for poetry, for example, were available before terms for fiction. Second, it allows developers to adjust policies incrementally as issues are discovered and resolved, meaning that a policy shift might affect a few dozen terms instead of hundreds. This minimizes the negative impact of revisions on catalogs, librarians, and users. And finally, the orderly rollout allows for effective collaboration.

PSD is spearheading the development of the vocabulary, but relies heavily on three groups for assistance: LC’s librarians, who provide their subject and format expertise; the general library community, which comments on public discussion papers that are posted on LC’s website; and last but not least, organizations with an interest in particular disciplines.

To date, PSD has formally partnered with four organizations, each of which has developed a thesaurus in its area of interest with the goal of incorporating the thesaurus into LCGFT. PSD’s first partner was the American Association of Law Libraries, which provided terms for legal materials. The Music Library Association and the American Theological Library Association also agreed to assist PSD in developing terms for music and for religious materials, respectively. In 2008, the Subject Analysis Committee (SAC) of the Association for Library Collections and Technical Services (ALCTS), a division of the American Library Association, formed the Subcommittee on Genre/Form Implementation (SAC-SGFI), which was charged with helping to facilitate two-way communication between PSD and the cataloging communities with an interest in genre/form terms. SAC-SGFI took on the task

of developing vocabularies for literary works and for general terms. Finally, the Art Libraries Society of North America partnered with LC to develop terms that describe works of art.

Each project is considered complete when the terms from that discipline are implemented at the LC. That does not mean, however, that the list of terms is closed. Proposals for new and revised genre/form terms, which appear on tentative lists and are vetted for inclusion in LCGFT, may be submitted by Library of Congress catalogers and participants in the Subject Authority Cooperative Program (SACO) of the Program for Cooperative Cataloging (PCC). Also, as noted above, the lessons learned in later projects may require that authorized terms, references, or scope notes from earlier projects be modified or cancelled from LCGFT.

AUTHORIZED TERMS

Library of Congress Genre/Form Terms for Library and Archival Materials includes terms for works and expressions as defined in *Functional Requirements for Bibliographic Records*.^[15] That is, the authorized terms indicate the intellectual or artistic expression, not the manifestation—the physical characteristics—of the item. For instance, in LCGFT, the word “film” refers not to reel-to-reel motion picture film (a physical carrier) but to works that were originally recorded on motion picture film, on video, or digitally. This policy allows for collocation of all of the manifestations of a work under a single term, instead of requiring the user to search separately under every possible carrier type.

To be eligible for LCGFT, concepts must indicate the genre or form of a work or expression, and not refer explicitly to any other closely related characteristics: intended audience; ethnicity or nationality of the creator (s); setting, including the time period depicted; time period of creation; popularity of the work (e.g., best sellers); and, in the case of music, the medium of performance (e.g., flute, tenor voice). Also excluded from the thesaurus are terms that are already provided elsewhere in the bibliographic record, including language and date and place of publication or production. However, these characteristics may be included implicitly in the meaning of the term, such as in the term **Actualities (Motion pictures)**, which refers to a specific form of short, unedited, silent films from the early days of cinema.^[16]

At the time of this writing, there are a few practical exceptions to these policies, particularly in relation to children and people with disabilities as intended audiences. However, the intent is to remove terms such as **Children's films** and **Films for the hearing impaired** from LCGFT when there is another place to code that information. For more information, see the Related Developments section, below.

Terms are based on literary warrant. This means that there are works or expressions to which the terms can be assigned, and also that the terms are included in reference sources appropriate to the term. Each authorized term consists of a word or phrase that represents a single concept, and is always presented in natural language order to facilitate searching (e.g., **Outtakes**; **Remote-sensing maps**). Parenthetical qualifiers are used occasionally to distinguish between and among homonyms when it is not reasonable to construct an adjectival phrase due to common usage (e.g., **Thrillers (Motion pictures)**; **Thrillers (Radio programs)**; and **Thrillers (Television programs)**).

While there are parallel terms in LCGFT—such as the three terms for thrillers—the preference is to avoid them within a single discipline wherever possible. For instance, there are terms for specific types of maps (e.g., **Topographic maps**; **Physical maps**), but similar terms for topographic atlases, physical globes, and the like do not exist. Since by definition an atlas is a collection of maps, and a globe is nothing more than a spherical map, the appropriate term **Atlases** or **Globes** is assigned (i.e., postcoordinated) with the genre/form term for the type of map. Therefore, a road atlas is assigned two postcoordinated terms: **Road maps** and **Atlases**. Likewise, in the area of literature, there will not be a term such as the term *Fantasy short stories* does not exist. Instead, there are two terms, **Fantasy fiction** and **Short stories**.

The preference is to establish terms in English, but terms from other languages are permitted under two circumstances: when no English term for the concept exists and the foreign-language term has been borrowed into English, and when the concept is unique to the language of the work being cataloged and cannot be found in English-language reference sources. For example, **Heimatfilme** are German films and are known by the German word in the English-speaking world.^[16]

Although LCGFT includes some very specific terms (e.g., **Coutumes**, a form of French medieval customary law^[16]), the policy is to prefer more general terms. The general terminology makes cataloging simpler, since most artistic and literary works provide only the broadest indication of genre and form. Overly specific terminology would in many cases require catalogers either to guess at the appropriate term or to read/view the entire work. Relatively general terms also serve users' needs, particularly with regard to artistic and literary works. General terms collocate more works and serve as a form of readers' advisory, while defining terms too narrowly would separate similar works from each other and require users to look in multiple places for works of interest to them.

In addition, subject matter is excluded from the terms to the extent possible, considering that genre can sometimes be inextricably linked to subject matter in literary and artistic works. Recall that *American Heritage* defines genre as “a category of artistic composition, as in music or

literature, marked by a distinctive style, form or *content*” [emphasis added].^[1] The line between genre and subject can be fuzzy, as indicated by the initial inclusion in LCGFT of sport-specific films (e.g., **Football films**). In 2012, PSD and LC’s Motion Picture, Broadcasting, and Recorded Sound Division decided to remove those types of terms from LCGFT. They were originally included because they already existed in LCSH as form headings. However, further analysis made it clear that films focused on a particular sport may fall into one of many genres, including, but not limited to, suspense films, thrillers, comedies, or romances. A single plot element (i.e., the depiction of a sport) does not, therefore, constitute a genre. Instead, the sport is the subject.^[17]

The distinction between form and subject is generally easier to codify than the distinction between genre and subject. By definition, form designates the format or purpose of the work, independent of the content.^[3] Therefore, LCGFT will not include terms such as *Science periodicals*, preferring instead the term **Periodicals**. The topic, science, is indicated with a subject heading. There are some apparent exceptions to this, such as **Legal maxims**, but by definition legal maxims are quite different from general maxims. Legal maxims are statements of established principles of law,^[16] while a general maxim is a “succinct formulation of a fundamental principle, general truth, or rule of conduct.”^[1]

STRUCTURE

The guiding principles for the structure of LCGFT are contained in ANSI/NISO standard Z39.19-2005, *Guidelines for the Construction, Format, and Management of Monolingual Controlled Vocabularies*,^[18] which is followed as closely as is practical.

Equivalence Relationships

Synonyms of the authorized terms are provided in Used For (UF) references, as are alternate forms of the authorized term itself, including inverted forms. The UFs provide additional entry points into the vocabulary and lead users to the authorized terms. Some typical examples of UFs are as follow:

Film auditions
USE Screen tests

Laws, Session
USE Session laws

Hierarchical Relationships

The hallmark of a thesaurus is the use of hierarchical relationships.^[19] In LCGFT, every discipline has a

“broadest” or “top” term that serves as the collocation point for all of the terms from each discipline (e.g., **Cartographic materials; Literature; Motion pictures**). Except for the broadest terms, every authorized term in LCGFT must have at least one broader term (BT). The terms exhibit the class/class member relationship: each narrower term (NT) must by definition be part of the group defined by the BT. The hierarchical relationships of the term **Comedy films** are illustrative.

Comedy films

BT Motion pictures

NT Dark comedy films

NT Parody films

Comedy films is the class and **Dark comedy films** and **Parody films** are the class members. All parody films are comedy films, as are all dark comedy films. On the other hand, only some comedy films are dark comedies or parodies. Likewise, all comedy films are motion pictures, the broadest term in the film hierarchy.

While most terms belong to only one hierarchy, terms may occasionally belong to multiple hierarchies if appropriate. A good example is **Oral histories**, which has the BTs **Discursive works**, **Filmed interviews** and **Interviews (Sound recordings)**.

The general preference is for flatter, rather than deeper, hierarchies, corresponding to the desire for more general terminology. As of this writing, the deepest hierarchy has four levels, as exemplified by the relationships for **Loran charts**.

Loran charts

BT Nautical charts

Nautical charts

BT Maps

Maps

BT Cartographic materials

Cartographic materials

[broadest term]

Associative Relationships

The ANSI/NISO standard defines associative, or Related Term (RT), relationships as “terms that are neither equivalent nor hierarchical, yet the terms are semantically or conceptually linked to such an extent that the link between them should be made explicit in the controlled vocabulary, on the grounds that it may suggest additional terms for use in indexing or retrieval.” The standard goes on to say that terms exhibiting the

associative relationship may be from the same hierarchy or from different hierarchies.^[20]

A slightly more stringent approach is taken in LCGFT, where related terms are generally in the same discipline, and thus have the same “broadest term,” but they should not be related to each other if they are in the same subhierarchy. For example, **Inspirational radio programs** and **Religious radio programs** share the same BT, **Radio programs**, the broadest term for the discipline, and may be RTs. **Christian radio programs** and **Radio sermons** also share a BT, **Religious radio programs**, but may not be RTs because the shared BT is not the broadest term for the discipline.

As a matter of practicality, terms may not display an associative relationship if they begin with the same word or word stem because the terms generally file near each other, making an explicit RT relationship superfluous. Although one might consider Western novels, films, radio programs, and television programs to be conceptually linked, they alphabetize one after the other and thus RTs are unnecessary.

Scope Notes

Scope notes (SN) are provided to assist users in knowing if the term covers the materials in which they are interested and also to help catalogers maintain consistency in the way that terms are assigned to works. Typically, scope notes are provided if users may be unfamiliar with the term, or if the term is defined in multiple ways in reference sources, making it necessary to explain how it is defined in LCGFT. Since most general users of libraries probably do not know what a concordat is, it is defined as follows:

Concordats

SN Agreements between a government and the Roman Catholic Church.

Scope notes are also included when it is necessary to define one term in contrast to another. These are called contrasting scope notes, and appear on both of the terms being defined. Since the difference between disaster films and survival films may not be immediately apparent, definitions are provided as follows:

Disaster films

SN Films that feature a man-made or natural calamity that places people in imminent danger. For films that feature individuals or groups struggling for their lives in a harsh setting see Survival films.

Survival films

SN Films that feature individuals or groups struggling for their lives in a harsh setting. For films that feature a

man-made or natural calamity that places people in imminent danger see Disaster films.

Most terms in LCGFT do not have scope notes because the meanings of the terms are self-evident. Sometimes terms are part of the collective consciousness, or their meanings are clear without a note (e.g., **Administrative regulations; Christmas films; Documentary television programs**). In some cases, notes are not provided because doing so could unduly limit the term’s usefulness. Let’s say, for example, that a scope note for the term **Detective and mystery films** listed five characteristics indicative of such a film but an individual film exhibited only three of those characteristics. The term could not be applied to that film, even if it would be obvious to anyone viewing it that it was in fact intended to be a film of that genre. Not including a scope note therefore allows the cataloger to apply the principle of “I know it when I see it,” instead of having to apply case law to creative works.

APPLICATION

The rules for assigning terms from LCGFT are straightforward: one term is assigned to bring out each genre or form applicable to a work or expression; the terms are not subdivided; and other vocabularies are used to describe other aspects, such as subject matter.

As discussed earlier in the section on authorized terms, each LCGFT term represents a single concept. The significant genre/form aspects of a work or expression are brought out by assigning multiple terms in separate fields, not by combining terms through the use of subdivisions. An atlas that includes both topographic and physical maps is therefore assigned three terms: **Topographic maps; Physical maps; and Atlases**.

In the case of moving image works, where the manifestation being cataloged may differ dramatically from the original release parameters, the LCGFT policy states that the original parameters should be used if known. A DVD of a two-hour long three-dimensional adventure film originally released in theaters, for example, is assigned the terms **Action and adventure films** along with **Feature films** (defined as films at least 40 minutes in length)^[16] and **3-D films**. In addition, the rules for the application of genre/form terms for moving images state that the term **Fiction films** should also be assigned.^[21] The fact that the manifestation is a DVD is represented in the descriptive portions of the bibliographic record rather than through a term from LCGFT.

If that DVD also includes a fifteen-minute behind-the-scenes documentary on the making of the film, and the documentary is considered significant to the users of the library or archive, then the LCGFT terms **Documentary films** and **Short films** may also be included, along with

Nonfiction films.^[21] In the same way, interviews with the actors may be brought out with the term **Filmed interviews** and **Nonfiction films**.

DVDs are sometimes manifestations of television programs. According to LCGFT policy, the original release parameters should be observed, here, too. A DVD containing season 8 of a popular animated sitcom should be assigned **Situation comedies (Television programs)** and **Animated television programs**, along with **Fiction television programs**. Likewise, a DVD of a suspenseful made-for-TV movie should be assigned the terms **Made-for-TV movies; Thrillers (Television programs);** and **Fiction television programs** because the work was originally intended to be broadcast on television.

As of yet, there are no rules governing the number of genre/form terms that may be assigned to an individual resource. Generally speaking, the goal is to assign a term for each genre and form that is considered significant for the users. The preference is therefore to assign more specific LCGFT terms rather than fewer terms that are more general. Assuming that full access is considered necessary for the users being served, a compilation of legal instruments that includes contracts, affidavits, charters, and legal memorandums will generally be assigned a specific heading for each of those forms: **Affidavits; Charters and articles of incorporation; Contracts;** and **Legal memorandums**. The BT of each of those terms is **Legal instruments**, which, although valid, generally would not be assigned unless access to the specific forms in the compilation was not considered necessary.

The option to choose the level of access necessary for an individual user population—the scalability of the vocabulary—is made possible by the strict hierarchies in LCGFT. Librarians and archivists can choose how narrowly the genres and forms should be assigned. There is one exception to this principle, though: the broadest terms within a discipline should rarely—and perhaps never—be assigned to a resource. The exception is when a record is being created for a collection of disparate works of multiple genres and/or forms to which more specific terms cannot be assigned.^[16] Therefore, narrower terms are preferred.

So far, all of the discussion of application has related only to genres and forms. Subjects are equally as important in leading users to resources that are of interest to them. LCGFT is intended to be used in conjunction with subjects, not as a replacement for them. Subject headings should continue to be assigned according to the rules for the subject vocabulary being used. To show how this is done, let's expand upon a few of the examples given earlier.

An atlas that includes topographic and physical maps of the states of the United States, with the purpose of comparing the states to each other, could be assigned the array:

650 #0 \$a U.S. states \$v Maps.
655 #7 \$a Topographic maps. \$2 lcgft
655 #7 \$a Physical maps. \$2 lcgft
655 #7 \$a Atlases. \$2 lcgft

A popular animated sitcom that depicts children's experiences in elementary school could be assigned these *Sears* subject headings and terms from LCGFT:

650 #7 \$a School children. \$2 sears
650 #7 \$a Elementary education. \$2 sears
655 #7 \$a Situation comedies (Television programs) \$2 lcgft
655 #7 \$a Animated television programs. \$2 lcgft
655 #7 \$a Fiction television programs. \$2 lcgft

The suspenseful made-for-TV movie that depicts a woman being stalked would be assigned this array of LC subject headings and LCGFT terms:

650 #0 \$a Stalking \$v Drama.
655 #7 \$a Made-for-TV movies. \$2 lcgft
655 #7 \$a Thrillers (Television programs) \$2 lcgft
655 #7 \$a Fiction television programs. \$2 lcgft

Finally, the compilation of legal instruments discussed above might have high-tech firms based in Virginia as its collocation point. The array, using LCSH and LCGFT, might be

650 #0 \$a High technology industries \$z Virginia.
655 #7 \$a Affidavits. \$2 lcgft
655 #7 \$a Charters and articles of incorporation. \$2 lcgft
655 #7 \$a Contracts. \$2 lcgft
655 #7 \$a Legal memorandums. \$2 lcgft

Or, if less specific genre/form access is determined to be adequate,

650 #0 \$a High technology industries \$z Virginia.
655 #7 \$a Legal instruments. \$2 lcgft

RELATED DEVELOPMENTS

The genre/form projects triggered a reexamination of other LC subject headings that provide access to what something is instead of what it is about. Treated as form headings in LCSH, these subject headings are neither genres nor forms and are thus excluded from LCGFT. However, they remain valuable access points that indicate intended audience (e.g., **Children's poetry**), ethnicity, nationality, or other characteristic of the creator(s) (**Short stories, Swazi; Italian fiction; Airline pilots' writings**),

and time period of creation (**Renaissance drama**). In the case of music, the medium of performance is also vitally important, and in LCSH is sometimes provided in dedicated headings (**Flute and accordion music**) and other times is described with hybrid headings that contain both the genre or form and the medium(s) of performance (**Trios (Bagpipe, hurdy-gurdy, continuo)**).

There was a pressing need to determine how access to these characteristics will be provided going forward, since headings of this type are most prevalent in the disciplines of literature and music. Once the LCGFT terms for literature and music are fully implemented, none of the form subject headings should be used to describe what a work or expression *is*. In the discipline of literature, the form subject headings will continue to be valid, but will be assigned only to works about the “form.” For music, subject headings such as **Trios (Bagpipe, hurdy-gurdy, continuo)** will be cancelled from LCSH since they exist solely as form headings, and are never used as subjects (i. e., for works *about* trios for bagpipe, hurdy-gurdy, and continuo).

The Music Library Association (MLA) and LC’s Policy and Standards Division closely examined various options for provision of medium of performance and determined that the best approach was to create a separate thesaurus for those terms. MLA and PSD partnered to develop the *Library of Congress Medium of Performance Thesaurus for Music* (LCMPT), the initial terms for which were approved in 2014.

Since medium of performance is neither a subject nor a genre or form, it was determined that these terms should not be coded in the 6xx block of the bibliographic record. Instead, MARBI approved an MLA proposal requesting that the 382 field, which was originally defined for the *Resource Description and Access* (RDA) medium of performance element, be made repeatable and used for both RDA and LCMPT—for description and for access, respectively.^[22] The hope is that in the future the RDA instructions and the rules for application of LCMPT can be coordinated so that one instance of the field can serve both purposes.

In 2013, MARBI also approved a separate proposal for MARC 21 authority fields for medium of performance vocabulary: field 162 for the authorized term and 462, 562, and 762 for references.^[23]

The SAC Subcommittee on Genre/Form Implementation (SAC-SGFI) and PSD examined the necessity of access for intended audience creator/contributor characteristics, and made two MARBI proposals for new fields. The proposals were approved by MARBI in January 2013.

The first proposal provided for intended audience through the creation of field 385 in both the bibliographic and authority formats. In the authority format, the field will be available for use in work and expression records.^[24] These fields will not only permit access to works for age- or educational-level groupings, but also to

disability, occupational, gender, and ethnic groups, among others, thereby providing much more specific access than is currently available in library catalogs.

The second proposal was very similar to the first. It requested field 386 for creator/contributor group categories. Now approved for use in bibliographic records and in authority records for works and expressions,^[25] it will also provide more access than was traditionally available in library catalogs.

In early 2014, PSD was authorized to develop another new controlled vocabulary, entitled Library of Congress Demographic Group Terms (LCDGT). Terms from LCDGT will be assigned to bring out the creators/contributors and the intended audiences of works and expressions^[27] and will be assigned in the 385 and 386 fields in bibliographic records and in authority records for works and expressions. The first 400 demographic group terms were approved in June, 2015.^[28]

It can also be important to access resources by the time period in which they were created. To that end, SAC-SGFI submitted a proposal that requested new coding for the existing field 046 (Special Coded Dates) in both the bibliographic and authority formats and for field 648 (Subject Added Entry—Chronological Term) in the bibliographic format. In the case of the 046 field, subfields for the beginning and ending date of the original publication of an aggregate work were approved. In field 648, the first indicator was defined to enable the cataloger to indicate whether the field is being used to convey the time period depicted or the time period of creation. The 046 and 648 fields may both be provided in a single bibliographic record, or one may be preferred over the other.^[26] In either case, the fact that the resource being cataloged is an anthology of works from the Renaissance can be brought out as an access point. The next step is to determine best practices for the use of the new coding, and that conversation has just begun.

CONCLUSION

Genres and forms are often part of the collective consciousness of a society, and it is essential to provide access to them. Traditionally, access has been provided through subject analysis, but that practice poses both intellectual and technical problems. *Library of Congress Genre/Form Terms for Library and Archival Materials* (LCGFT) is a discrete vocabulary dedicated to terminology for genres and forms of works and expressions, and is intended to work in conjunction with subject vocabularies and descriptive elements to provide users with a full understanding of those works and expressions. The discussions surrounding LCGFT have also led to further developments in the access to other pertinent data, including musical medium of performance, the

characteristics of the creators and contributors and the intended audience, and the time period of creation of the work or expression.

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Library of Congress Subject Headings (LCSH)

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Abstract

Development of *Library of Congress Subject Headings* (LCSH) began in 1898 and the first edition was published in parts between 1909 and 1914. LCSH has undergone many changes over the years, so today's vocabulary—the most widely used subject vocabulary in the world—is quite different from what its initial developers envisioned. This article provides overviews of the current features of LCSH and the application of headings. It then discusses and evaluates several policy revisions made since the 1970s to take advantage of technology and to simplify cataloging. A final section describes several adjustments to LCSH that are being planned and executed, including those intended to increase LCSH's viability as linked data.

INTRODUCTION

Library of Congress Subject Headings (LCSH) is the most widely used subject vocabulary in the world. It is the model for many other vocabularies in English and other languages, and has been translated numerous times.^[1] As of the beginning of 2017, it included over 342,000 individually established headings,^[2] but catalogers can create untold more by combining main headings and subdivisions in specific ways.

This article will explain LCSH's scope, heading syntax, and syndetic structure before exploring several major policy changes that have occurred since the 1970s. When taken as a whole, those changes are so dramatic that the LCSH that entered the twenty-first century is quite different from the vocabulary that the initial developers envisioned over 100 years ago. Finally, the article will discuss current initiatives to take advantage of twenty-first century technology, including the need to make LCSH more viable as linked data.

SCOPE

LCSH is a multidisciplinary vocabulary that includes headings in all subjects, from agriculture to history, to education, literature, and military science. Ethnic groups, historical events and movements, building names, geographic features, and scientific theories are just some of the categories of headings represented in LCSH. LCSH is not complete unto itself; however, names of persons and corporate bodies, jurisdictions and quasi-jurisdictional entities, and titles can generally be assigned as LC subject headings, but are established in the LC/NACO Name Authority File (NAF) according to instructions contained in *RDA: Resource Description and Access* (p. xv).^[2]

There is no attempt at comprehensiveness. Subject headings are proposed as needed for new cataloging, due to literary warrant; a heading must be needed to describe a work before it can be proposed for inclusion. Every month, hundreds of proposals for new headings are vetted and approved by cataloging policy specialists in the Library of Congress' Policy and Standards Division. The specialists ensure that the proposals conform to the rules and structure of LCSH, including heading format, provision of references, and scope notes. The rules are contained in two sources: the introduction to LCSH^[2] and the *Subject Headings Manual* (SHM).^[3] An overview is provided below.

HEADINGS

LC subject headings may consist of a single word or a phrase. A one-word heading is usually a singular or plural noun. Singular nouns generally denote abstract concepts (e.g., *Philosophy*) while plural nouns typically indicate tangible objects that can be counted (*Restaurants*).

Phrase headings usually consist of an adjective and a noun and may appear in natural-language order (e.g., *Constitutional history*) or as an inverted phrase (*Literature, Modern*). Natural language is preferred with exceptions for certain categories of headings, such as those qualified by nationality (*Art, Swiss*) and some geographic headings (*Michigan, Lake*).

Other phrase headings include the conjunction "and," which may indicate topics that are almost always treated together (e.g., *Bolts and nuts*) or topics with a reciprocal relationship (*Culture and law*). Phrase headings may also consist of prepositional phrases (*Student evaluation of teachers*).

Headings sometimes include a parenthetical qualifier that clarifies the meaning of the heading. In the case of

Plates (Engineering) and *Plates (Tableware)*, the qualifier distinguishes among homonyms, while the qualifier in *Cooking (Peanuts)* provides context.

REFERENCES

Cross-references guide users to authorized headings that are of interest to them and are provided in the authority records for the headings. LCSH includes five types of cross-references: broader/narrower terms; related terms; see references, see also references, and general see references.

Broader and narrower terms (BT and NT) are reciprocal, meaning that they work in both directions. One can find a list of all of the established narrower terms under the entry for the broader term, and also find the broader term listed in the entry for the narrower term. The references are hierarchical, and each NT is a part of the concept represented in the BT. BT/NT references exhibit three types of relationships.

In a class/class member (a.k.a. genus/species) relationship, each of the narrower terms (the class members) is a member of the larger group: geriatricians and pediatricians are members of the class called *Physicians*.

Geriatricians
BT Physicians

Pediatricians
BT Physicians

Physicians
NT Geriatricians
NT Pediatricians

In the whole/part relationship, the each of the narrower terms is part of the whole: the endocardium and heart valves are parts of the heart.

Endocardium
BT Heart

Heart
NT Endocardium
NT Heart valves

Heart valves
BT Heart

The instance relationship brings together under one concept (the broader term) the individually named exemplars of that concept: Borax Lake and Donner Lake are both lakes in California.

Borax Lake (Calif.)
BT Lakes—California

Donner Lake (Calif.)
BT Lakes—California

Lakes—California
NT Borax Lake (Calif.)
NT Donner Lake (Calif.)

Some LC subject headings do not have a broader term. These “orphans” fall into one of several defined categories, including headings that are the broadest topic within a hierarchy, family names, and headings for geographic regions.

Related terms (RTs) are associative references and link two headings that are related to each other, but not hierarchically. Instead, they are mentally associated to such an extent that the alternative heading might be of interest to the user. The references are reciprocal and therefore appear in both entries. When one thinks of boats and boating, one often thinks of sailing.

Boats and boating
RT Sailing

Sailing
RT Boats and boating

See references, indicated with the notations UF (Used For) and USE, provide links from synonyms and alternate forms of the heading to the authorized heading. Two of the most common alternate forms are inversions to bring a significant word into the initial position and variant phrasings or spellings of the heading. Like BT/NT and RT references, UF/USE references are reciprocal.

Callirhoe
UF Callirrhoe (Plants) [alternate spelling]
UF Mallows, Poppy [inversion]
UF Poppy mallows [common name synonym]

Callirhoe (Plants)
USE Callirhoe

Mallows, Poppy
USE Callirhoe

Poppy mallows
USE Callirhoe

Two other classes of cross-references alert users to whole categories of headings instead of to an individual heading.

See also (SA) references appear under authorized headings, and point either to subdivisions that may be relevant to the user's needs, or to headings that employ different wording. The SA reference under *Bombing, Aerial* indicates that the subdivision—*Aerial operations* is assigned after headings for individual wars. The example provided, *World War, 1939-1945—Aerial operations*, helps users who search under *Bombing, Aerial* but who are specifically interested in bombing during the Falkland Islands War to understand that they may find materials of interest under the combination *Falkland Islands War, 1982—Aerial operations*.

Bombing, Aerial

SA subdivision—Aerial operations under individual wars, e.g., *World War, 1939-1945—Aerial operations*

The reference under *Heat* points to headings that begin with the word “thermal.” *Thermal analysis, Thermal batteries*, etc., do not have a formal relationship to the heading *Heat*, but may nonetheless be of interest to the user.

Heat

SA headings beginning with the word Thermal

General see references are not headings but provide information on consistently used terminology and sometimes replace UF references to individual headings. The following example indicates that LC subject headings for mountains never include the abbreviation “Mt.” Instead, the word “Mount” should be searched.

Mt. . . .

USE subject headings for place names that include the word “Mount,” e.g., *Fuji, Mount (Japan)*

General see references may also provide information about subdivisions. The general see reference *Office, Resignation from* indicates that the subdivision—*Resignation from office* is used under personal names. Therefore, the heading *Nixon, Richard M. (Richard Milhous), 1913-1994—Resignation from office* may appear in the catalog. (For more information on subdivisions, see below.)

Office, Resignation from

USE subdivision Resignation from office under names of individual persons

SCOPE NOTES

Scope notes also appear in some records for LC subject headings. Scope notes (SN) help users understand the meaning of the heading, and help catalogers assign the

heading consistently. Some scope notes, such as that for *Accessory apartments*, define only one heading.

Accessory apartments

SN Here are entered works on apartments that are subordinate in size, location, and appearance to their companion principal units.

Other scope notes contrast two or more closely related or somewhat overlapping headings and are reciprocal—they appear in all of the headings being defined. Here, there may be confusion over the difference between *Alpine regions* and *Alps Region*.

Alpine regions

SN here are entered works on higher regions of mountain systems that lie above the timberline and below the level of permanent snow. Works on the area that surrounds and includes the Alps are entered under Alps Region.

Alps Region

SN here are entered works on the area that surrounds and includes the Alps. Works on higher regions of mountain systems that lie above the timberline and below the level of permanent snow are entered under Alpine regions.

A third type of scope note provides instructions on application and are chiefly intended for cataloger use, but also assist users in finding materials of interest to them.

Depressions

SN Subdivided by date and, if worldwide, may be further subdivided by country, city, etc., for example, *Depressions—1929—United States*; *Depressions—1929—Illinois—Chicago*

SUBDIVISIONS

LCSH is a *pre-coordinated* system: catalogers combine main headings with subdivisions in order to include multiple concepts in a single heading, thereby “pre-coordinating” headings for the user. It is also *post-coordinated* because two or more subject headings are often assigned to an individual work. The headings within a single bibliographic record may exhibit both pre- and post-coordination: multiple headings may be assigned (post-coordination) and each heading may be subdivided (pre-coordination).

In traditional online catalogs, users generally browse the subdivided headings alphabetically, as was done in card catalogs. Users of those catalogs must have at least a basic understanding of the structure of LCSH so they can formulate effective left-anchored searches. In the new

generation of online catalogs and discovery systems there is usually an option to treat each LCSH subdivision as a separately indexed and displayable facet, allowing users to combine pieces from various subject headings. Faceting precludes the need for users to understand LCSH's structure, but also removes the context that subdivisions provide. Regardless of whether a catalog provides traditional left-anchored browsing of subject headings or a faceted interface, it is important to understand the types of subdivisions and the role that each plays within a subject heading string.

There are four categories of subdivisions: topical, chronological, geographic, and form.

Topical subdivisions limit the main heading to a particular subtopic (e.g., *Religion in public schools—Law and legislation*; *Theaters—Stage-setting and scenery*; *Virginia—Antiquities*).

Chronological subdivisions limit the heading to a particular period of time and are often preceded by the topical subdivision—*History*. They usually consist of a date span, and may include a descriptive phrase (e.g., *Furniture—Japan—History—Edo period, 1600–1868*; *Libraries—History—To 400*; *Philosophy, American—20th century*; *United States—Foreign relations—2001–2009*).

Geographic subdivisions limit a heading to a particular place, and are derived from authorized headings for jurisdictions and quasi-jurisdictions established in the NAF as well as geographic features established in LCSH. Only headings representing topics that can exist in a particular place, or that can be discussed in relation to a place, may be subdivided geographically. They are indicated with the notation (May Subd Geog). For example, the heading *Hotels* may be subdivided geographically, as indicated by the entry:

Hotels (May Subd Geog)

The following combinations are therefore possible:

Hotels—Egypt—Cairo.

Hotels—Europe.

Hotels—Finland.

Hotels—United States.

The combinations in the above example demonstrate the principle of indirect subdivision. Regions larger than countries, including continents, are used directly after topics, as are names of countries. For places within a country, the name of the country is interposed before the name of the place. There are three exceptions to the general rule: Canada, the United States, and Great Britain. For those countries, the provinces, states, and constituent countries, respectively, are assigned without first assigning the country. The name of the province, state, or constituent country is interposed before the name of a local place.

Hotels—Alberta.

Hotels—Alberta—Edmonton.

Hotels—England.

Hotels—England—London.

Hotels—Florida.

Hotels—Florida—Miami.

Some topical subdivisions can also be subdivided geographically. Geographic subdivision is always provided as far to the end of the heading string as possible. If the main heading and the topical subdivision can both be geographically subdivided, the geographic subdivision is assigned after the topical subdivision; if only the main heading can, the subdivision is interposed. This can sometimes lead to random-looking orders of subdivisions, as shown in this example.

Authorized headings:

Automobiles (May Subd Geog)

Automobiles—Accounting

Automobiles—Batteries (May Subd Geog)

Headings with geographic subdivision:

Automobiles—Batteries—Wyoming.

Automobiles—Wyoming.

Automobiles—Wyoming—Accounting.

Topical, geographic, and chronological subdivisions indicate the topic of the material being cataloged. Form subdivisions are quite different and indicate what the material is: a dictionary or an encyclopedia, for example. They almost always appear as the last element of a subject heading string (e.g., *London (England)—Guidebooks*; *English language—Dictionaries*; *United States—History—War of 1812—Encyclopedias*).

Free-Floating and Pattern Subdivisions

Some subdivisions are specifically established for use under a particular heading and are printed in LCSH, but most [*heading*]—[*subdivision*] combinations are created by catalogers in building-block fashion according to rules provided in the SHM. The topical, form, and chronological subdivisions that can be added to headings are called free-floating subdivisions.

The SHM includes lists of free-floating subdivisions that may be assigned to particular categories of headings as needed. There are, for instance, lists of subdivisions that are used under names of persons, classes of persons, and bodies of water. Each list is self-contained and is prefaced with a statement indicating the types of headings to which the subdivisions in the list may be appended.

Free-floating subdivisions may be combined with headings fitting the category, as long as they are appropriate and there is not a conflict. For example, the subdivision—*Navigation* may be assigned under bodies of water so the

heading *Mississippi River—Navigation* may be assigned, although it is not specifically established and thus does not appear in LCSH. The subdivision —*Psychology* may be used under classes of persons, so one would expect that it can be used under *Children*, a class of persons. However, the combination *Children—Psychology* is a UF reference to *Child psychology*, so there is a conflict and *Child psychology* is used instead. Finally, some free-floating subdivisions that are technically valid under a particular heading are intellectually inappropriate. For example, the subdivision —*Coronation* may be used under names of persons, but it would not be appropriate under *Washington, George, 1732–1799* because Washington was inaugurated, not coronated.

Pattern subdivisions are a special type of free-floating subdivision and are assigned in the same manner. The difference is in the way they are established. Free-floating subdivisions appear in lists but may not ever be established under particular headings. Pattern headings appear in lists, too, but are also established after the “pattern” heading, which is a heading that is representative of the category. *Corn* is the pattern heading for the category Plants and Crops, for instance, so all of the subdivisions authorized for use under headings for plants and crops are established under *Corn*. Because the subdivided heading *Corn—Harvesting* is established, the headings *Spinach—Harvesting*, *Tomatoes—Harvesting*, and numerous others can also be created. In this way, subdivisions are established only once but are used many times.

Multiple subdivisions are another type of free-floating subdivision. They appear in LCSH under individual headings and are indicated with square brackets and the abbreviation “etc.” as in the example *Future life—Buddhism, [Christianity, etc.]*. The subdivision suggests the creation of analogous subdivisions, which are free-floating. Due to the multiple, *Future life* may be subdivided by any religion (e.g., Christianity, Islam, Judaism).

ASSIGNMENT OF HEADINGS

Headings are assigned to represent the overall contents of the work; LC practice is to assign headings only for topics that comprise at least 20% of the work.^[4] Some works are adequately cataloged with only one subject heading. Others may be assigned a maximum of 10 in order to bring out complex or compound topics that cannot be expressed with a single heading.

Headings assigned to a work are as specific as the work itself. A general work on chemistry would be assigned the heading *Chemistry*, while a work on optical isomers, a concept in chemistry, would be assigned *Optical isomers* and not the broader heading. Likewise, an encyclopedia of the ethnic groups of Africa would be assigned the relatively general heading *Ethnology—Africa—*

Encyclopedias, while a work on the marriage customs of the Xhosa people from South Africa would be entered under the more specific *Xhosa (African people)—Marriage customs and rites—South Africa*.

More information on these general principles, and also the rules on heading assignment for specific types of materials, is provided in the SHM.^[3]

LCSH'S PAST AND PRESENT

LC subject headings and the policies governing their application have developed over more than one hundred years. LCSH's core vocabulary was the 1895 American Library Association publication entitled *The List of Subject Headings for Use in Dictionary Catalogs*. LC acquired copies of the ALA publication and interleaved them with blank pages. Beginning in 1898, headings that were assigned by LC catalogers were checked off, and new or revised headings were written on the blank pages. Those headings became the first edition of *Subject Headings Used in the Dictionary Catalogues of the Library of Congress*, which was published in parts between 1909 and 1914 and was kept up to date by supplements and by new editions. The vocabulary acquired its current title in 1975, when the eighth edition was published as *Library of Congress Subject Headings*.^[5]

Many generations of librarians have maintained LCSH as theories of vocabulary construction have come and gone, knowledge of users' information-seeking behavior has increased, and technology has changed. The vocabulary therefore reflects the varied philosophies of the times and of the catalogers who have contributed headings (p. viii).^[5] Variations in the formulation of headings can usually be attributed to policies in force at the time the headings were created. As Richard S. Angell phrased it in the introduction to the 6th edition, “The list is the product of evolutionary forces, among them the growth of the Library's collections, semantic change, and varying theories of subject heading practice over the years. As a consequence the list is, at any point in time, an accurate reflection of practice but not a complete embodiment of theory.”^[6]

Some existing headings were revised to reflect new “theories of subject heading practice,” but revisions were quite labor intensive in the days of the card catalog and had to be carefully considered. In many libraries, cancelled headings were erased from cards, new headings typed, and the cards refiled; at LC, new card sets were ordered and filed as superseded ones were pulled.^[7]

Large changes were massive undertakings due to the sheer size of LC's main catalog. The cancellation of the outdated heading *European War, 1914–1918* in favor of *World War, 1914–1918*, for example, was postponed until the card catalog was closed in 1981, meaning that cards would not need to be revised, but—perhaps most importantly—tens of thousands of cards filed between *European. . . and World. . .* did not have to be shifted.^[7]

The adoption of an automated system for LCSH in 1985 dramatically changed LC's ability to revise the vocabulary. Headings and references could be updated more easily, making it feasible to adopt some elements of thesaural structure. The past three decades have been a time of significant change for LCSH as technological advances have impacted every aspect of vocabulary development and maintenance. The utilization of twenty-first-century technology promises to bring further notable alterations in the way that LCSH is maintained and assigned.

This section will explore the ways that LCSH has changed over time by highlighting several watershed policy decisions. Some of the revisions occurred in the 1970s, but the pace of change significantly increased after 1985.

Scope

For most of LCSH's first hundred years, its scope was determined by LC's collections, which are strong in the humanities and social sciences; coverage of those disciplines is therefore particularly deep in LCSH. On the other end of the spectrum, coverage of medicine and agriculture is less granular. LC maintains relatively superficial collections in those areas, because each has a U.S. national library dedicated to it: the National Agricultural Library and the National Library of Medicine, respectively.

During the 1980s, advances in technology made it feasible for LC to routinely accept proposals for new and revised headings from other libraries. As a result, the Cooperative Subject Cataloging Project was born in 1983.^[8] It was renamed the Subject Authority Cooperative Program (SACO) in 1994,^[9] and is now a formal arm of the Program for Cooperative Cataloging (PCC).^[10] Any library able to meet the contribution requirements may join SACO and propose headings needed for their own cataloging, and there are dozens of active members. Since member libraries collect in areas that LC does not, they are able to add depth and breadth to LCSH.

The growth of SACO has helped to provide more balance in LCSH, which has been charged with having an American or Western bias. One of LCSH's most vocal critics is Sanford Berman, who opined in 1971:

"In the realm of headings that deal with people and cultures—in short, with humanity—the LC list can only 'satisfy' parochial, jingoistic Europeans and North Americans, white-hued, at least nominally Christian (and preferably Protestant) in faith, comfortably situated in the middle- and higher-income brackets, largely domiciled in suburbia, fundamentally loyal to the Established Order, and heavily imbued with the transcendent, incomparable glory of Western civilization."^[11]

LC's collections have traditionally emphasized American and Western European topics, and LCSH reflected that focus. More recently, LC has stressed the acquisition of materials published in developing countries,^[12] and that

has likewise influenced the types of headings entering LCSH. In addition, SACO members regularly propose headings for geographic features and topics that are significant in other parts of the world, including those for ethnic groups, languages, historical periods, etc.

While SACO proposals clearly benefit LCSH overall by removing some of the inherent bias caused by the collection policies of a single library, they bring a different type of unevenness to the vocabulary. Since most SACO members are in the United States, the American bias of LCSH is in some ways increasing with regard to locally significant headings (e.g., ethnic groups, geographic features), even as ever-growing numbers of headings that are locally relevant to other countries are added. In addition, since proposals are driven by literary warrant and thus by collection development policies, some American SACO members with large local-interest collections propose numerous headings of local significance, while other SACO members are not as active in that respect. This leads to unevenness in coverage, even within the United States.

Heading Currency

Headings in LCSH are based on the terminology used in the work being cataloged and on language employed by reference sources at the time the heading was proposed.^[13] The assumption is that the terminology employed there will be most familiar to those who will look for materials on that subject. However, the English language and societal attitudes evolve constantly, so older headings need to be revised to the current terminology.

Some headings become outdated due to language shifts over time. For instance, the heading *Livestock factories*, which was added to LCSH in 1980, was revised to *Factory farms* in 2008. The heading *Cellular telephones* was approved in 1998 and revised in 2009 to the more common and informal *Cell phones*. While the traditional preference has been for scientific and formal terminology, as befits a large research library,^[14] LCSH is used in all types of libraries and also on the Semantic Web. It therefore behooves LC to move toward less formality when possible. No example is clearer than the 2007 deprecation of the heading *Mensuration* in favor of its commonly used synonym, *Measurement*.

Some biased language results from contemporary scholarship. Reference sources from decades ago were often politically incorrect by today's standards, particularly when naming groups of people, including indigenous ethnic groups, and languages. In some cases, obviously pejorative headings have been cancelled from LCSH (e.g., *Yellow peril*). Others have been revised to reflect contemporary terminology. For instance, the heading *Cripples*, first included in 1919, was revised in 1957 to *Physically handicapped*, and then again in 2002 to *People with disabilities*, the latest iteration reflecting the preferred "people first language" that emphasizes the person and not the disability.^[15]

Not every situation is this cut-and-dried, though, and names of ethnic groups pose particular problems. Some members of a group may consider the term used in the heading to be pejorative because it is the “colonialist” or ethnocentric name. That same term may have been adopted by other members of the group, who use it with pride. In those cases, general encyclopedias are consulted and the heading is based on the terminology found there, on the principle that it is probably the terminology that most users will employ.

Because of such disagreements, and because it is impossible to comprehensively review LCSH, it is unlikely that all of the headings will ever be considered completely current and unbiased. However, LC’s attempts to remedy the problems have not gone unnoticed. Stephen A. Knowlton analyzed actions taken on the 225 headings that Berman considered problematic in 1971. Knowlton found that by 2005, 88 had been changed as suggested and 54 were revised to partially reflect Berman’s views. Knowlton concluded, “It appears that bias in subject headings, while a continuing source of concern, has been addressed in a serious manner by the compilers of LCSH. The main biases found in this study are the persistence of the assumption that unglossed religious headings refer to Christian topics, and [the continued existence of] unglossed terms related to United States history and geography, which may simply be confusing to users outside the U.S.”^[16]

Heading Syntax

Although natural-language headings are preferred, inverted topical headings (e.g., *Conjunctivitis, Infantile*) have always existed. Headings were inverted in three situations: when users were considered more likely to search under the noun instead of the adjective denoting language, ethnic group, or nationality; when it was desirable to bring the noun into the first position so the phrase heading would file with other headings beginning with the noun; and when the noun was also an independent heading and the adjective qualified it.^[17] The result of the inversions can be seen in the following array of headings:

Bridges
Bridges, Aluminum
Bridges, Arched
Bridges, Long-span

In libraries with large card catalogs, users might have had to walk quite a distance to follow references, so proximity was a service. Inverted headings are not nearly as useful in modern online catalogs, in particular because they can hinder keyword phrase searching. A user who searches for the phrase “long-span bridges” will not retrieve any works with the subject heading *Bridges, Long-span* and may therefore remain unaware of many pertinent works.

In 1983, the policy on inversion was updated so that most new headings are established in natural-language order. There are now only nine categories in which inverted topical headings are established.^[18] In terms of the number of new headings, the most common category is those that are qualified by ethnic group, language, or nationality (e.g., *Masks, Yoruba*; *Ballads, Hindi*; *Coins, Russian*).

Due to the policy revision, headings for similar concepts are sometimes formulated differently (e.g., *Toxicological chemistry* but *Chemistry, Forensic*). Existing inverted topical headings that do not fall into one of the nine categories are eligible for revision as time and workload permit.^[18] In 2008 and 2009, for example, the inverted headings for types of bridges, including those above, were revised to natural-language order, as were inverted headings qualified by a religion.

Revision of the inverted headings causes some tension. Most librarians probably agree that inverted headings inhibit access to some extent, but there is lack of agreement over whether the headings should be revised. Some see such revisions as “change for change’s sake.” Furthermore, lack of a global update capability in some integrated library systems makes it difficult for libraries to revise the headings locally. This fact illustrates the point that LCSH is used in so many libraries that even small adjustments in headings or policies can lead to upheaval. It can therefore be politically difficult to make adjustments, even when there is consensus that the adjustments are desirable.

Reference Structure

Early editions of LCSH were chiefly lists of authorized headings, arranged alphabetically. There were *see* references to the heading from synonyms and from some other terms that were not precisely synonymous with the heading, but there were not any hierarchical references. There were *see also* references, however, which were made to more specific subjects or to an application of the subject, and to “subjects which suggest themselves as likely to be of interest to the user” (pp. 13–14).^[17]

The second category of *see also* references involved very subjective judgments. Mary K. Pietris, a chief of the former Subject Cataloging Division when those guidelines were in force, put it this way: “If you were establishing the heading *Swimming*, should *Lakes* be a *see also* reference, because people often swim in them?”^[17] Two examples from the 5th (1948) edition^[19] are illustrative.

Irrigation

see also Alkali lands; Dams; Drainage; Dry farming; Reservoirs; Sewage irrigation; Water-storage; Windmills
refer from (see also) Agricultural engineering; Agriculture; Civil engineering; Drainage; Engineering; Hydraulic engineering; Reclamation of land; Reservoirs; Soils; Waste lands; Water-storage; Water-supply

Ocean currents

see also Bottle-charts; Guinea Current; Gulf Stream; Kuroshio

refer from (see also) Hydrography; Navigation; Ocean; Physical geography

Note that the references varied in specificity (e.g., *Engineering* in general and various specialties of engineering are all references for *Irrigation*). They also mixed types of entities, as can be seen in the see also references to both bottle-charts (a type of map) and individual named currents from *Ocean currents*.

The existing structure had become unworkable by the 1970s, leading LC staff to want to update it to a more thesaurus-like system.^[7] Several LC staff members attended a meeting sponsored by the Council on Library Resources (CLR) in 1982, which recommended that LC “edit the LCSH see also structure so that true hierarchical relationships are made explicit and both broader terms and narrower terms can be distinguished and retrieved.”^[20]

Planning for the automated subject system was underway by then, so LC was finally able to make the change. Proposals for new headings first included BTs and RTs in 1985, and hierarchical references first appeared in the 11th (1988) edition.^[21]

Although BTs, NTs, and RTs are characteristics of thesauri, their inclusion in LCSH did not make LCSH a true thesaurus. For instance, LCSH includes numerous synthetic headings (e.g., *Animals in motion pictures*), which are generally undesirable in thesauri.^[22] LCSH is therefore best described as a controlled vocabulary—a list of terms, each of which has an unambiguous, unique, and nonredundant definition and has been explicitly enumerated (p. 5).^[22] Since LCSH is not a thesaurus, the staff who developed its hierarchy did not consider themselves bound by the strict rules of thesaurus construction^[7] and LCSH’s structure is still imperfect when weighed against the ANSI/NISO standard for monolingual controlled vocabularies. An examination of three practical decisions made in the 1980s highlights the ways that LCSH differs from a thesaurus.

The first decision was to programmatically generate the BT and RT references from the references already present. When a heading appeared as both a *see also* and as a *refer from* (see also) reference in the same entry, as *Water-storage* does in the entry for *Irrigation* above, the heading became an RT. Other references were converted into BTs and NTs.^[23] This was an imperfect but necessary approach—imperfect because the new structure was predicated on the previous arbitrary system; necessary because it was impractical to intellectually reevaluate every existing heading to assign references. There have been efforts over the years to evaluate the references that were generated, but many still have not been reviewed for accuracy.

The second practical decision was to allow some categories of “orphan” headings, including headings that represent the broadest topic in a given category (e.g., *Science*), headings for geographic regions (*Europe*, *Western*) and family names (*Myers family*). Since they do not have obvious BTs, these headings’ lack of hierarchy is perhaps reasonable. Another category consists of inverted headings when the BT would match the first word or the entry phrase of the heading; the inversion allows for proximal browsing and the BT was therefore considered superfluous (*Painting*, *French* files after *Painting*, so the BT *Painting* is not made). Among other categories of orphans are certain ubiquitous prepositional phrase headings such as those in the form *[topic] in literature* (e.g., *Librarians in literature*), which were not provided with a BT in order to contain the size of printed editions of LCSH.

“Orphans” are generally not connected to any other heading in LCSH. This is detrimental in the linked data world, which is predicated on relationships. LC’s cataloging policy specialists have therefore added BTs to categories of headings as time permits. For instance, in 2012 the BT *Newspapers* was added to headings of the type *[nationality or language] newspapers* (e.g., *Albanian newspapers*).

The third practical decision with far-reaching implications involves BTs for headings that combine two concepts with either a preposition or the conjunction “and.” In each case, the BT reflects the second part of the heading. A BT reflecting the first part of the phrase heading was considered unnecessary because the phrase heading would be filed after the heading representing the first part. For example, *Art in education* and *Communication and education* each have the BT *Education*. Since the phrase headings are filed after *Art* and *Communication*, respectively, BTs from those two headings are not made.

This policy sometimes leads to references that violate the general policies for hierarchical references. For example, the BT for *Physicians as authors* is *Authors*, which follows the policy on prepositional phrases and accurately represents a class/class member relationship. On the other hand, the BT for *Children of celebrities* is *Celebrities*, which follows the policy on prepositional phrases but is intellectually invalid. Children of celebrities are not (necessarily) celebrities.

The LC staff who maintain LCSH continue to refine the syndetic structure of the existing headings. The structure of new headings conforms to thesaurus construction guidelines to the extent practical, given that new headings must be compatible with the legacy data.

Subdivisions

According to the ANSI/NISO standard on monolingual controlled vocabularies, pre-coordinated strings composed of a heading and one or more subdivisions exhibit three benefits. They provide a way to locate highly specific

information without having to search each term separately, group closely related terms together, and describe complex topics (p. 37).^[22]

The benefits of pre-coordination are clear, but the complexity and expense involved in assigning such headings cannot be denied. Since the 1970s, LC has made numerous policy changes in an effort to reduce the complexity and cost of subdivision practice. The 1990s were particularly active in this regard, due in large part to the implementation of recommendations made in 1991 by the LC-sponsored invitational Subject Subdivisions Conference (familiarily called Airlie House or the Airlie House Conference) and also the impact of automation.

This section briefly addresses three significant pre-Airlie House activities regarding subdivision policy, and then examines how the Airlie House recommendations were implemented by LC.

Pre-Airlie House Actions

Free-floating and pattern subdivisions: Every subdivision had to be specifically established with the heading for which it was intended to be assigned until 1974, when LC created lists of pattern and free-floating subdivisions.^[24] There were two primary benefits to the new practice. It decreased the average time and expense of cataloging a work at LC because fewer proposals were necessary. Catalogers in other institutions were also able to provide original subject cataloging more readily because they could combine headings and applicable subdivisions without waiting for LC to establish a specific combination.

Geographic subdivision: LCSH originally employed two methods of geographic subdivision. Some topics were subdivided directly by city (e.g., *Art—Paris*) and others were subdivided indirectly through the country (*Reformation—France—Paris*) (p. 2-3).^[17] To simplify practice and provide more predictability for users, in 1974 LC began to move toward always using indirect geographic subdivision. In November 1976, indirect geographic subdivision became standard for all topical headings.^[25]

Subject Cataloging Manual: Subject Headings: The SCM:SH, which described policies for proposing and assigning headings, was originally an in-house manual for LC catalogers, but library school faculty who taught LCSH and catalogers who wanted to follow LC policy lobbied LC to publish it. LC agreed, and the preliminary edition was published in 1984.^[26] The manual has gone through several editions and was retitled the *Subject Headings Manual* (SHM) in 2008. It is kept up to date with quarterly updates. In 2013, the Policy and Standards Division began to provide it freely on LC's website, and it is also available through Cataloger's Desktop, LC's subscription-based online documentation service.^[27,28]

Publication of the SCM:SH was significant because "For the first time, 'outside' catalogers were able to read

the same memoranda, or instruction sheets, available to LC catalogers, and thus acquire the opportunity to become more consistent and improve the quality of the LCSH strings that they assigned to original-cataloging records for the bibliographic utilities."^[29]

Airlie House Recommendations

The first Airlie House recommendation was to standardize the order of subdivisions for topical (not name or geographic) headings to *[topical]—[geographic]—[chronological]—[form]*.^[30] The suggested order was adopted in 1992, with some variations to permit the inclusion of a topical subdivision.^[31,32] There was community disagreement, though, over whether the standard order would best serve the user in certain areas, such as art, literature, and history, so headings in those categories were not updated.^[8] There is still progress being made, however; in 2008, for example, the placement of chronological subdivisions in architectural headings was revised to remove an exception to standard practice.^[33]

The placement of the geographic subdivision had the most impact on the overall order of subdivisions, and policies were adjusted to improve consistency. Previously, if the work prompting a proposal for a topical heading did not have a geographic focus, there was no provision made for geographic subdivision. Another proposal to add geographic subdivision would be made when warranted. This meant that many headings for which geographic subdivision was intellectually reasonable could not be so subdivided. This led to unpredictable orders of subdivisions, so since 1992 all proposals for topical headings and topical subdivisions that could have a topical orientation do include provision for geographic subdivision.^[31,34] In addition, existing headings have been marked (*May Subd Geog*) on a case-by-case basis.^[8]

To enable more headings to follow the standard order of subdivisions, LC also cancelled 79 topical subdivisions used under names of places in favor of the more common *[topic]—[geographic]* formulation (e.g., *[place]—Industries* was revised to *Industries—[place]*).^[8]

LC programmatically generated over 78,000 "validation records" between 2007 and 2012 in response to the Airlie House recommendation that the authority file should contain records for *[topical heading]—[topical subdivision]* combinations, although the combinations would remain free-floating. Validation records are based on headings used over 20 times in LC's bibliographic database, the assumption being that frequently-used headings are probably formatted correctly.^[35] The records contain all of the subdivisions—topical, geographic, chronological, and form—used within a particular heading and are chiefly intended to enable computer validation of subdivided headings. They may also be searched in Classification Web, LC's subscription-based vocabulary service,^[36] and are freely available through LC's authorities

website.^[37] They are also included in LC's Authorities & Vocabularies linked data service,^[38] from which they may be freely downloaded in a variety of formats.

The conference also requested that relationships between headings and topical subdivisions be coded (pp. 7–8).^[30] This goal was partially realized in 1999 when authority records for the free-floating and pattern subdivisions were created; each record includes a MARC 21 “subdivision usage” field 073,^[39] which lists the SHM instruction sheet(s) in which each subdivision appears. The other half of the relationship is provided by 072 “subject category code” fields that appear in authority records for the headings and contain the number of the instruction sheet into which the heading falls.^[40] In the following example, the 072 and 073 fields link the heading, *Greybull River (Wyo.)*, with an appropriate subdivision —*Water rights*.

```
072 #7 $a H 1145.5 $2 lcsb
151 ## $a Greybull River (Wyo.)
073 ## $a H 1145.5 $z lcsb
180 ## $x Water rights
```

Subject policy specialists began to experiment with adding 072 fields to select proposals for new headings in 2012, and it quickly became clear that there are several challenges to full implementation. They will be addressed below, in the section on future directions.

The conference also made three recommendations regarding chronological subdivisions. First, it suggested that chronological subdivisions should relate to the content of the work and not to its publication date. In response, LC cancelled almost 200 subdivisions that were established under specific headings and referred to publication date. The second recommendation was to remove phrases from chronological subdivisions (e.g., revise *United States—History—Civil War, 1861–1865* to *United States—History—1861–1865*). LC partially implemented the recommendation by removing phrases from over 100 chronological subdivisions.^[8] Third, the conference recommended that the pros and cons of using free-form chronological subdivisions be considered (pp. 8–9).^[30] LC decided not to move in that direction. As stated in a 2010 report,

“LC has decided not to pursue the use of free-form date subdivisions, which would exactly correlate to the chronological focus of a work, instead of using general century subdivisions, which are generally much broader. Using free-form date subdivisions would inhibit collocation of like works since works on the same historical period may differ in the beginning and ending dates of coverage. In addition, free-form date subdivisions would be much more time consuming and difficult to apply since catalogers would have to closely examine each work to determine its exact chronological coverage, which might in fact be vague (e.g., the United States during the Progressive Era)” (p. 5).^[33]

Airlie House also recommended that LC investigate implementing a separate subfield for form subdivisions (pp. 9–10).^[30] LC consulted with the Subject Analysis Committee of the Association for Library Collections and Technical Services (part of the American Library Association), which agreed that it would be feasible to establish and assign a separate subfield code. Subfield \$v was approved by the Machine-Readable Bibliographic Information Committee (MARBI) in 1995 and implemented by LC in 1999.^[8]

To assist catalogers and provide for machine manipulation, Airlie House recommended that LC investigate including in authority records for geographic headings, the form in which the heading would be used as a geographic subdivision (p. 10).^[30] Like the subfield \$v used in the MARC 6XX fields, this recommendation required action by MARBI, which approved the 781 linking field in 1992.^[8,41] LC implemented the field in 1996, and entered into a cooperative project with OCLC to programatically add 781 fields to existing records for geographic names that were already established in the NAF. That project, in which over 83,000 name authority records were enhanced, was completed in 2006. A similar project to add 781 fields to geographic LC subject headings, undertaken in cooperation with Northwestern University, was completed in 2003 (p. 31).^[11] (There are some geographic name and subject headings that by policy cannot be used as geographic subdivisions. In those cases, a 781 field is not added, but a 667 field is. The note reads, “This heading is not valid for use as a geographic subdivision.”)

Finally, Airlie House recommended the simplification of subdivisions by removing “overly fine distinctions,” combining lists of free-floating subdivisions, and increasing consistency in syntax. The conference considered the changes to be “of such importance that they should be made in spite of possible disruptions to existing databases” (p. 10).^[30]

In response, the lists of subdivisions used under groups of Indians, domestic animals, and literary authors were merged into the lists for ethnic groups, animals, and personal names, respectively, and three other lists were discontinued outright. Finally, some lists were shortened by removing subdivisions that were specific to a particular heading and were therefore not actually free-floating.^[8,42]

There were also many dozens of changes to individual subdivisions. By 1996, over 75 subdivisions with similar meanings but different syntaxes were merged or discontinued. For example, the subdivision —*Terms and phrases*, which was used under legal topics, was merged into the subdivision —*Terminology*, which was used elsewhere in LCSH. The wording used in over 60 subdivisions was updated (e.g., the subdivision —*Preventive inoculation* was revised to —*Vaccination*). Over 250 [heading]—[subdivision] combinations were replaced by phrase headings, and 35 subdivisions were cancelled altogether.^[8] LC continues to examine subdivisions on a case-by-case basis

and revisions are made as necessary regardless of their impact on existing databases (p. 5).^[33]

FUTURE DIRECTIONS

LCSH is a living system that adapts (albeit slowly at times) to social and technological changes, so LCSH at the turn of the twenty-first century is quite different from that which was envisioned at the dawn of the twentieth. This section will address some additional adjustments that are being planned and executed to bring LCSH further into the twenty-first century's linked data world.

RDA: Resource Description and Access, which was implemented by LC in 2013, has already impacted the scope of LCSH. Until mid-2013, new headings for individual fictitious and legendary characters, mythological beings and deities, and named animals were established in LCSH; they are now established in the LC/NACO NAF because under RDA, those entities are considered to be persons.^[43] As the RDA Steering Committee continues its work relating to concepts, objects, events, and places, additional adjustments to LCSH will probably be necessary.

Also already impacting LCSH is the development of three new vocabularies by LC and several partner organizations. One of them is *Library of Congress Genre/Form Terms for Library and Archival Materials* (LCGFT), a multi-disciplinary thesaurus of terms that represent what something *is* rather than what it is *about*.^[44]

In some disciplines, most notably literature and music, LC subject headings have been used to describe both what something *is* and what it is *about*. For example, a collection of haiku would be assigned the subject heading *Haiku*, while criticism of haiku would be assigned the subject heading *Haiku—History and criticism*. In the future, a work that is haiku will be assigned a term from LCGFT, while criticism will continue to be assigned the subject heading. [For more information, see the article on LCGFT.] Some subject headings that are assigned only to works *of* a particular form are likely to be cancelled in the future.

An open question is whether LCGFT will eventually supplant LCSH form subdivisions, which could then be cancelled. Many of the form subdivisions previously used to describe cartographic materials (e.g., the subdivision *—Maps, Comparative*) have already been cancelled in favor of the corresponding genre/form term, but other form subdivisions remain valid.^[45]

The *Library of Congress Medium of Performance Thesaurus for Music* (LCMPT), which consists of terminology to describe the instruments, voices, etc. used in the performance of musical works, was implemented in early 2014. Terms are assigned in MARC 21 bibliographic field 382 and in the 382 field in authority records for works and expressions.^[46]

LCSH includes thousands of headings that describe the form and/or mediums of performance of musical works, such as *Bass clarinet and piano music* and *Sonatas (Trumpet and piano)*. Most of those headings are only used to describe works *of* music, not works *about* it, and will be cancelled after LCGFT terms for music are implemented alongside the medium of performance terms.

Some LCSH form headings describe the intended audience or creator of the work (e.g., *Children's stories*; *Airline pilots' writings*). Since they do not represent a form or genre, they are outside the scope of LCGFT, but they will no longer be assigned to works of literature after LCGFT terms for literature are implemented. The access they provide is nonetheless important, so in early 2014 LC's Policy and Standards Division was authorized to develop *Library of Congress Demographic Group Terms* (LCDGT). The terms in LCDGT are based primarily on LCSH's headings for classes of persons and ethnic groups, with some modifications, and are assigned to bring out the creators/contributors and the intended audiences of works. Terms are eligible for assignment in MARC 21 fields 385 (for audience) and 386 (for creators/contributors) in bibliographic records and in authority records for works and expressions.^[47]

Traditionally, a cataloger describing a sonata for clarinet and cello that was composed by an American woman would assign only the subject heading *Sonatas (Clarinet and cello)*. Now, catalogers can use LCMPT to explicitly indicate the mediums of performance (clarinet and cello), LCGFT to indicate the form (sonata), and LCDGT to indicate the characteristics of the creator (an American woman).

When these three vocabularies are fully implemented, LCSH will be more true to its title and describe the topics of works, as opposed to describing both forms and topics.

The 072 project, which was briefly discussed as an outcome of the Airlie House recommendations, shows promise for simplifying the application of LCSH. Machine-matching the 072 fields in authority records for headings to 073 fields in the authority records for free-floating subdivisions will allow both the automatic suggestion of subdivisions appropriate to the heading that is being assigned and the dynamic validation of full heading strings. When combined with the coding that indicates whether a heading may be geographically subdivided and the 781 linking fields in records for geographic headings, it should also enable the automatic generation of full heading strings on the Semantic Web. This last outcome is essential to the success of LCSH in the linked data environment, and particularly in BIBFRAME, which is intended to replace MARC.

Adding 072 fields to subject authorities is not straightforward; with few exceptions, the lists include subdivisions that cannot in fact be assigned to every heading fitting the category. For example, H 1100, Classes of Persons, includes some subdivisions that apply only to headings for occupational groups and types of employees, and

others that may be used only under sex and age groups. Since there are no headings under which all of the subdivisions in H 1100 may be used, records for the classes of persons headings cannot be enhanced.

This raises questions about the future of subdivision practice because the exceptions add complexity for catalogers and make reliable computer manipulation impossible. To rectify the situation, should some lists be cancelled? Each [heading]—[subdivision] combination that is currently free-floating would have to be individually established. Since some of the problematic lists are those that were merged, should they be split again? Should the lists remain essentially intact, but problematic subdivisions be removed and established under specific headings as needed? Or is there some other option?

Multiple subdivisions (e.g., *Asceticism*—[*Buddhism, Hinduism, etc.*]) must also be addressed. They are not headings but are coded as if they were, so in linked data they are treated as authorized headings. Should they be cancelled, requiring that all subdivisions that would formerly have been authorized by the multiple be individually established? Should MARC be modified to include coding indicating that the “heading” is in fact not a heading at all? Or should programming be developed that will allow computers to recognize multiple subdivisions based on their unique syntax?

CONCLUSION

Since the 1970s, LCSH has undergone numerous policy changes, many of them made possible by technological advances. To maintain LCSH's standing as the most widely used vocabulary in the world, LC staff and their constituents throughout the world not only must use technology as a tool to adapt to changing circumstances, but also must adapt LCSH to technology. Twenty-first-century questions and challenges need to be confronted head-on, while the work that was begun in the last century—adding headings for new concepts, updating existing terminology, and refining the syndetic structure—must also continue.

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Library of Congress: History

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Abstract

The Library of Congress occupies a unique place in American civilization. Established as a legislative library in 1800, it grew into a national institution in the nineteenth century. In the first decades of the twentieth century, soon after it moved from the U.S. Capitol into its own spacious building, it became a leader among national libraries and one of the largest libraries in the world. Since World War II, it has become an international resource of unparalleled dimension. With the creation of the National Digital Library in the mid-1990s, it began to assume a new educational role.

INTRODUCTION: THE LIBRARY OF CONGRESS TODAY

The Library of Congress has grown immensely in size and influence since its sesquicentennial year in 1950, when the eminent librarian S. R. Ranganathan noted both its good fortune to have the U.S. Congress as its “godfather” and its role as “perhaps the most influential of the national libraries of the world.”^[1] Since 1950, its collections and staff have tripled and its annual appropriation has soared from \$9 million to \$613 million in fiscal year 2008. With collections totaling more than 138 million items, a permanent staff of nearly 3700, and national and international services unmatched in scope by any other research library, the Library of Congress is one of the world’s leading cultural institutions.^[2]

The diversity of the Library of Congress is startling. Simultaneously it serves as a legislative library and the major research arm of the U.S. Congress; the copyright agency of the United States; a center for scholarship that collects research materials in many media and in most subjects from throughout the world, with 460 languages represented in its collections; a public institution that is open without charge or restriction to everyone over the age of 16 and serves readers in 20 reading rooms; a government library that is heavily used by the executive branch and the judiciary; a national library service for the blind and physically handicapped; an outstanding law library, international in scope and service; one of the world’s largest providers of bibliographic data and products; a center for the commissioning and performance of chamber music; the home of the nation’s poet laureate; a national folklife center and veteran’s history project; a national center for promoting reading with affiliates in all 50 states and the District of Columbia; the organizer of the annual National Book Festival; the sponsor of exhibitions and of musical, literary, cultural, and educational outreach programs that reach across the nation and the world; a

major worldwide research center for the preservation and conservation of library materials; and, as its research base, more than 60 million manuscripts, 12 million photographs, and the world’s largest collections of maps, atlases, printed music, recorded music, motion pictures, and television programs.

Yet another new and important function had emerged by 2000, when Librarian of Congress James H. Billington informed the U.S. Congress that during the past few years the library had become a world leader in providing high-quality, free educational material in the revolutionary new world of the Internet.^[3]

More than 13 million items from the library’s American history collections (and those of its institutional partners) are available on the library’s Web site (<http://www.loc.gov>). The site also provides access to the library’s exhibitions, catalog data, and legislative and copyright information. With more than 93 million visits and 614 million page views in 2007, the site is among the most visited of all U.S. government Web addresses.

The library occupies three massive structures on Capitol Hill, near the U.S. Capitol. The Jefferson Building, opened in 1897, is a grand monument to civilization, culture, and American achievement (see Fig. 1 for a photograph of the Jefferson Building). The handsome, functional Adams Building opened to the public in 1939. The modern Madison Building, completed in 1980, is by far the largest of the three structures. Construction of storage facilities for paper-based collections continues at Ft. Meade, Maryland, an hour north of the library; more than 2 million items are now located in the first two modules. In 2007, the library opened a \$155 million, 45-acre state-of-the-art audiovisual conservation center and home for its massive motion picture collections in Culpepper, Virginia. About 2 million researchers, scholars, and tourists visit the Library of Congress each year, and millions more use its bibliographic records, collections, and services through the Internet.



Fig. 1 Until 1897, when the Thomas Jefferson Building opened to the public, the Library of Congress was located in the U.S. Capitol. The monumental Jefferson Building evoked national pride and provided space for the development of national library services.

Photo credit: Lisa Whittle.

Since its creation, the Library of Congress has been part of the legislative branch of the American government. Although it is recognized as the *de facto* national library of the United States, it does not have that official designation. Nevertheless, it performs most functions carried out by national libraries elsewhere, and has become a symbol of American democracy and faith in the power of learning.

The broad nature of its goals and ambition are reflected in its recently adopted mission and vision statements.

The library's mission is to make its resources available and useful to the Congress and the American people and to sustain and preserve a universal collection of knowledge and creativity for future generations. We will foster a free and informed society by building, preserving, and providing resources for human creativity, wisdom, and achievement. We continually strive to place these resources at the fingertips of the American people, their elected representatives, and the world—for the mutual prosperity, enlightenment, and inspiration of all.^[4]

THE GROWTH OF A NATIONAL INSTITUTION, 1800–2000

How did a library established by the legislature for its own use become such an ambitious, multipurpose institution? Two points are clear: 1) the expansion of the Library's functions derives from the expansion of its collections; and 2) the growth of the institution is tied to the growth and ambitions of the United States itself. The development of the Library of Congress cannot be separated from the history of the nation it serves. Nor can it be separated from the philosophy and ideals of Thomas Jefferson (1743–1826), its principal founder.

The Library of Congress was established as the legislature of the young Republic prepared to move from

Philadelphia to the new capital city of Washington. On April 24, 1800, President John Adams approved legislation that appropriated \$5000 to purchase "such books as may be necessary for the use of Congress." The first books, ordered from London, arrived in 1801 and were stored in the U.S. Capitol, the library's first home. The collection consisted of 740 volumes and three maps.

On January 26, 1802, President Thomas Jefferson approved the first law defining the role and functions of the new institution. This measure created the post of Librarian of Congress and gave Congress, through the Joint Committee on the Library, the authority to establish the library's budget and its rules and regulations. However the 1802 law made the institution more than just a legislative library; the appointment of the Librarian of Congress was to be a presidential responsibility. The law also permitted the president and vice president to borrow books, a privilege that, in the next three decades, was extended to most government agencies and to the judiciary.

Three developments in the library's early history permanently established the institution's national roots. First, the Library of Congress was created by the national legislature, which took direct responsibility for its operation. Second, the Library of Congress was not only the first library but also the first national cultural institution of the U.S. government. Finally, in 1815, the scope of the library's collection was permanently expanded. The ideals, intellectual curiosity, and pragmatism of Thomas Jefferson were the key to this transformation.

Jefferson believed that the power of the intellect could shape a free and democratic society. It is not surprising that he took a keen interest in the Library of Congress and its development while he was president of the United States from 1801 to 1809. Throughout his presidency, he personally recommended books for the Library, and he appointed the first two Librarians of Congress. In 1814,

the British army invaded the city of Washington and burned the Capitol, including the 3000-volume Library of Congress. By then retired to Monticello, Jefferson offered to sell his personal library, the largest and finest in the country, to Congress to replace the destroyed collection. In 1815, Congress approved the purchase of Jefferson's 6487 volumes for \$23,940.

The library that Jefferson sold to Congress not only included over twice the number of volumes that had been destroyed, but it also expanded the scope of the library far beyond the bounds of a legislative library devoted primarily to legal, economic, and historical works. Jefferson was a man of encyclopedic interests, and his library included works on architecture, the arts, science, literature, and geography. It contained books in many languages, including French, Spanish, German, Latin, Greek, and Russian. Jefferson believed that the national legislature needed ideas and information on all subjects and in many languages in order to govern a democracy. Anticipating the argument that his collection might be too comprehensive, he argued that there was "no subject to which a member of Congress may not have occasion to refer."^[5]

The acquisition by Congress of Jefferson's library provided the rationale for the eventual expansion of the library's functions. The Jeffersonian concept of universality is also the rationale for the comprehensive collecting policies of today's Library of Congress. Jefferson and his friend and successor as president, James Madison (1809–1817) believed that democracy depended on the mutual support of "liberty and learning." The vast collections and varied services of the Library of Congress are founded on this belief.

The Library of Congress grew slowly but steadily after the purchase of Jefferson's books. A separate law department was approved in 1832, along with an appropriation to purchase law books under the guidance of the chief justice of the United States. Yet even as the library was beginning to grow, it appeared that the Smithsonian Institution might become the American national library. During the early 1850s, the Smithsonian's talented and aggressive librarian, Charles Coffin Jewett, tried to move the institution in that direction and turn it into a national bibliographical center. Jewett's efforts were opposed, however, by Smithsonian Secretary Joseph Henry, who insisted that the Smithsonian Institution focus on scientific research and publication. In fact, the secretary favored the eventual development of a national library at the Library of Congress, which he viewed as the appropriate foundation for such a government-wide institution. On July 10, 1854, Henry dismissed Jewett, ending any possibility that the Smithsonian might become the national library. Moreover, 12 years later, Henry readily agreed to the transfer of the entire 40,000-volume library of the Smithsonian Institution to the Library of Congress.

The Library of Congress suffered difficult times during the 1850s. The growing division between North and South

hindered the growth of government institutions. Furthermore, a serious fire in the Capitol building destroyed about two-thirds of the library's 55,000 volumes, including two-thirds of Jefferson's library. Congress responded quickly and generously: in 1852 a total of \$168,700 was appropriated to restore the library's rooms in the Capitol and to replace the lost books. However no plan was set forth for expanding the collection or the library's services. This philosophy was in keeping with the conservative views of Librarian of Congress John Silva Meehan (1829–1861) and Senator James A. Pearce of Maryland, chairman of the Joint Committee on the Library, who favored keeping strict limits on the institution's activities.

A few years later, the library lost several collection-building functions, further impeding its progress toward the comprehensive collection that Jefferson had favored. In the 1830s and 1840s, it had begun distributing public documents to institutions throughout the United States, and exchanging books and documents with foreign institutions on behalf of the U.S. government. A joint resolution of Congress in 1857 transferred responsibility for public document distribution to the Bureau of Interior and responsibility for international exchange of books and documents to the Department of State. Moreover, in 1859 all U.S. copyright activities were centralized at the Patent Office, which meant that the Library of Congress and the Smithsonian Institution no longer received the copies of books and pamphlets deposited for copyright that had been sent to each institution since 1846.

Ainsworth Rand Spofford and the National Library

The person responsible for transforming the library into an institution of national significance in the Jeffersonian spirit was Ainsworth Rand Spofford, a former Cincinnati bookseller and journalist who served as Librarian of Congress from December 31, 1864 to July 1, 1897 (see Fig. 2 for photographs of Spofford in the early and late stages of his Library of Congress long career). Spofford accomplished this task by permanently linking the legislative and national functions of the library, first in practice and then, through the reorganization of the library approved by Congress in 1897, by law. He provided his successors as Librarian of Congress with four essential prerequisites for the development of an American national library: 1) firm, bipartisan congressional support for the notion of the Library of Congress as both a legislative and a national library; 2) the beginning of a comprehensive collection of Americana; 3) a magnificent new building, itself a national monument; and 4) a strong and independent office of Librarian of Congress. Spofford had the vision, skill, and perseverance to capitalize on the Library of Congress's claim to a national role. Each Librarian of Congress since Spofford has built upon his accomplishments. Each has shaped the institution in different ways,

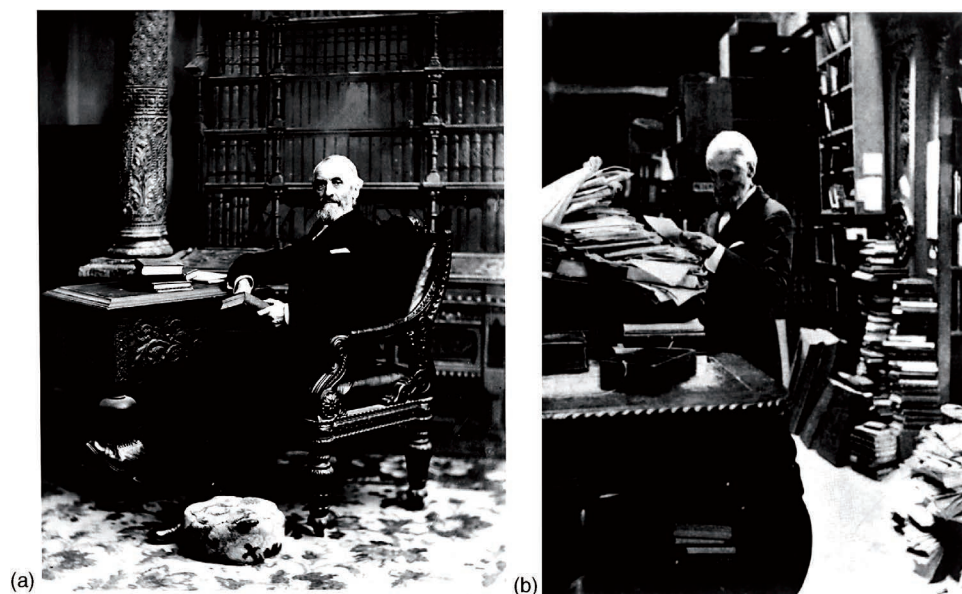


Fig. 2 (a) Ainsworth Rand Spofford, Librarian of Congress from 1864 to 1897, transformed the Library of Congress into a national institution that served the American public as well as Congress. The centralization of copyright at the library and the construction of the Jefferson building were his two greatest achievements. (b) Librarian Spofford at his desk in the badly overcrowded Library of Congress room in the U.S. Capitol in 1896, a year before the Library moved into its own building across the street from the Capitol. Photo credit: Library of Congress.

but none has wavered from the Jeffersonian belief that the democratic form of government depended on a comprehensive base of knowledge and information.

The idea of an American national library that Spofford revived had been languishing since Jewett's departure from the Smithsonian in 1854. Spofford and Jewett both recognized the importance of copyright deposit in developing a comprehensive collection of a nation's literature, yet there was a major difference in their views relating to a national library. Spofford never envisioned the Library of Congress as the center of a network of American libraries, a focal point for providing other libraries with cataloging and bibliographic services. Instead, he viewed it, in the European model, as a unique, independent institution—a single, comprehensive collection of a nation's literature to be used both by Congress and the American people. Congress needed such a collection because, as Spofford paraphrased Jefferson, “there is almost no work, within the vast range of literature and science, which may not at some time prove useful to the legislature of a great nation.” It was imperative, he believed, such a great national collection be shared with all citizens, for the United States was “a Republic which rests upon the popular intelligence.”^[6]

Immediately following the Civil War, American society began a rapid transformation that saw the expansion of the federal government. Spofford took full advantage of the favorable political and cultural climate and the increasing national confidence, to promote the library's expansion. He always believed that the Library of Congress was the national library and he used every

conceivable argument to convince others, particularly the Joint Committee on the Library and the rest of Congress.

In the first years of his administration Spofford obtained congressional approval of six laws or resolutions that ensured a national role for the Library of Congress. The legislative acts were: 1) an appropriation for the expansion of the Library in the Capitol building, approved in early 1865; 2) the copyright amendment of 1865, which once again brought copyright deposits into the library's collection; 3) the Smithsonian deposit of 1866, whereby the entire library of the Smithsonian Institution, a collection especially strong in scientific materials, was transferred to the library; 4) the 1867 purchase, for \$100,000, of the private library of historian and archivist Peter Force, establishing the foundation of the library's Americana and incunabula collections; 5) the international exchange resolution of 1867, providing for the development of the library's collection of foreign public documents; and 6) the copyright act of 1870, which centralized all U.S. copyright registration and deposit activities at the library.

The centralization of copyright activities at the library was Spofford's most impressive collection-building feat. The first U.S. copyright law was approved in 1790, but the practice of depositing items registered for copyright protection in libraries for the use of the public was not enacted until 1846, when the newly established Smithsonian Institution and the Library of Congress obtained the privilege. The Library of Congress received single copies of deposits from 1846 until 1859, and, thanks to Spofford, the practice began again in 1865. Enforcement was a problem, however, and Spofford

decided he needed the authority that would come from centralizing all registration and deposit activities at the library, consolidating functions then performed at the Patent Office and by the district courts. The copyright law of 1870 ensured the continuing development of the library's Americana collections, for it stipulated that two copies of every book, pamphlet, map, print, photograph, and piece of music registered for copyright be deposited in the library.

In its 1876 survey of the libraries of the United States, the U.S. Bureau of Education listed the rapidly growing Library of Congress and the Boston Public Library as the two largest libraries in the United States, with approximately 300,000 volumes apiece. By 1897, when the library moved from its overcrowded rooms in the Capitol into its spacious new building, its collections ranked first among American libraries in size and scope. Over 40% of its 840,000 volumes and at least 90% of its map, music, and graphic arts collections had been acquired through copyright deposit. Important items deposited through copyright included Civil War photographs by Mathew Brady and what today are considered the earliest motion pictures.

The copyright privilege not only built the library's collections, it also helped determine the direction of their growth. When the Library of Congress moved into its new building, separate custodial units were established for the special collections formed primarily through copyright deposit: maps, music, and graphic arts. Spofford's successors as Librarian of Congress hired subject specialists to develop these and other collections and persuaded Congress to begin appropriating substantial funds for the purchase of research materials for all collections. Today, copyright is still one of the Library's major acquisitions sources, but between the years 1865 and 1897, it played a crucial role in the development of the Library of Congress into a national institution.

The copyright law of 1870 had another major effect: it forced the construction of a building for the Library. Spofford foresaw this result almost immediately. In his 1871 *Annual Report*, he suggested that a separate building would be needed because of the increased receipts resulting from the new copyright law. The next year he presented a plan for such a building, initiating a task more challenging than he anticipated, and one that dominated the rest of his career as Librarian of Congress. In his 25-year struggle to make the building a reality, Spofford enlisted the support of many powerful public figures: congressmen, cultural leaders, journalists, and even presidents. The speeches and statements he elicited usually endorsed not only a separate building, but also the concept of the Library of Congress as a national library. In 1886, Congress finally authorized a new structure directly across the East Plaza from the Capitol. After further delays, construction began in earnest in 1889 and the new building, opened to the public in 1897, was immediately hailed as a

national monument. Now called the Thomas Jefferson Building, this imposing structure in the style of the Italian Renaissance, with its grand Main Reading Room at the center and exuberant interior decoration throughout, is an incomparable symbol of the importance of books and learning and their close relationship to democracy.

Spofford also deserves primary credit for creating the library's tradition of broad public service. In 1865, he extended the hours of service, so that the library was open every weekday all year long. In 1869, he began advocating evening hours, but this innovation was not approved by Congress until 1898. Finally, in the mid-1880s Spofford began lending books directly to the citizens of the District of Columbia if an appropriate sum was left on deposit, a procedure that ended in 1894, when preparations were started for the move into the new library building.

In 1896, just before the actual move, the Joint Committee held hearings about "the condition" of the library and its possible reorganization. The hearings provided an occasion for a detailed examination of the institution's history and functions and for a review of what new services the library might perform once it occupied the spacious new building. The American Library Association sent six witnesses, including future Librarian of Congress Herbert Putnam from the Boston Public Library and Melvil Dewey from New York State Library. Members of Congress listened with great interest to the testimony of Putnam and Dewey, who argued that the national services of the library should be greatly expanded. Dewey believed that the Library of Congress now had the opportunity to act as a true national library, which he defined as "a center to which the libraries of the whole country can turn for inspiration, guidance, and practical help, which can be rendered so economically and efficiently in no other possible way."^[7] Testimony at the 1896 hearings greatly influenced the reorganization of the library, which was incorporated into the Legislative Appropriations Act approved February 19, 1897, and effective on July 1, 1897. All phases of the library's activities were expanded and new administrative units were established.

Growth of Library Services

President William McKinley appointed a new Librarian of Congress to supervise the move from the Capitol and implement the new reorganization. He was John Russell Young, who held office briefly, from July 1, 1897, until his death in January 1899. A journalist and former diplomat, Young worked hard to strengthen both the comprehensiveness of the collections and the scope of the services provided to Congress. He honored Jefferson's influence on the library, placing Jefferson's books in a special room and commissioning a report on the Jefferson library that was published in the library's 1898 *Annual Report*.

Young used his diplomatic ties and experience to enlarge the Library's collections. In February 1898, for

example, he sent a letter to U.S. diplomatic and consular representatives throughout the world, asking them to send “to the national library” newspapers, journals, pamphlets, manuscripts, broadsides, and “documents illustrative of the history of those various nationalities now coming to our shores to blend into our national life.” He also asked for other categories of research materials, broadly described as “whatever, in a word, would add to the sum of human knowledge.”^[8] By the end of 1898, books and other materials had been received from 11 legations and 7 consulates.

Young skillfully guided the administrative reorganization. He made many important professional appointments, including Thorvald Solberg, the first register of copyrights, and catalogers J. C. M. Hanson and Charles Martel, who began reclassifying the collections after nearly a century of reliance on the classification scheme Thomas Jefferson provided to the library along with his books. Young also inaugurated what today is one of the Library’s best known national activities: library service for the blind and physically handicapped. In November 1897, the library began a program of daily readings for the blind in a special “pavilion for the blind” complete with its own library. In 1913, Congress stipulated the deposit in the library of the embossed books produced by the American Printing House for the Blind, and in 1931 a separate appropriation was authorized for providing books for the use of adult blind residents of the United States.

Herbert Putnam, Young’s successor, was appointed by President McKinley in the spring of 1899 and served as Librarian of Congress for 40 years, until the autumn of 1939 (see Fig. 3 for a photograph of Putnam in 1900). Asked to characterize the Library as he neared the end of his long career, Putnam penned the phrase “Universal in

Scope: National in Service.” If Spofford’s major contributions were the creation of a national collection and obtaining the building, Putnam was the librarian who did the most to extend the library to the American people. He created a systematic program of widespread public use that exists to this day, opening up the collections to scholars, the public, and other libraries. The first experienced librarian to serve as Librarian of Congress, Putnam established a working partnership between the Library of Congress and the American library movement. Rather than serving merely as a great national accumulation of books, a national library should, he believed, actively serve other libraries, as well as researchers and scholars.

In the quarter century before Putnam took office, a new structure of scientific and scholarly activity had evolved rapidly in the United States. Professional schools and new universities offering graduate work were established; numerous professional associations and societies came into existence; and the federal government became an active supporter of education, research, and scientific activity. By 1900, the age of the great library had arrived in America, characterized by huge book stacks, scientific cataloging and classification, and full-time professional staffs. The library’s new building symbolized this age and, as the first American library to reach 1 million volumes, the Library of Congress became the leader among American libraries. Putnam’s imaginative and decisive actions were approved by both the Joint Library Committee and the professional library community. Under his leadership, in 1901, the first volume of a completely new classification scheme, based on the Library’s own collections, was published; access to the Library was extended to “scientific investigators and duly qualified individuals” throughout the United States; an interlibrary loan service



Fig. 3 (a) Herbert Putnam, Librarian of Congress from 1899 to 1939, organized the library’s collections and services in the Jefferson Building and initiated bibliographic and loan services to libraries. This photographic portrait by Frances Benjamin Johnson was taken in 1900. (b) Librarian Putnam with young readers in the Main Reading Room of the Library of Congress about 1910.

Photo credit: Library of Congress.

was inaugurated; and the sale and distribution of Library of Congress printed catalog cards began.

The interlibrary loan system was an especially radical step, for it signaled the institution's transition from a national storehouse of books to a national laboratory for promoting the use of its collections. It required special legislation by Congress and approval was by no means assured. When asked to defend his position that books should be sent outside the District of Columbia, the Librarian explained that the risk was justified because "a book used, is after all, fulfilling a higher mission than a book which is merely being preserved for possible future use."^[9] It was a telling statement about the openness of American libraries and the spirit of cooperation that would weld them into a strong community. Moreover, Librarian Putnam's extension of the Library's classification and cataloging schemes to the rest of the nation helped "democratize" knowledge, nationally and internationally. It established bibliographic standards and encouraged cooperative endeavors among librarians and scholars. This sharing of the Library's "bibliographic apparatus," as Putnam called it, helped to systematize and communicate information about intellectual activity in America and propelled the Library of Congress into a position of international leadership among research institutions.

The development of the Library's collections into a nationally useful resource took many forms. To aid historical research, Putnam felt that the national library "should be able to offer original sources" about the national life. In 1903, he persuaded his friend and supporter, President Theodore Roosevelt, to issue an executive order that transferred the papers of many of the nation's founding fathers, including George Washington, Thomas Jefferson, and James Madison, from the State Department archives to the library's Manuscript Division. In 1904, the Library began publishing important historical texts from its collections, such as the *Journals of the Continental Congress*. Putnam felt the publication of such manuscripts was "not perhaps so much a service from us as a library as a duty from us as the custodians of original sources for American history."^[10]

As American influence and interests continued to expand in the twentieth century, Putnam looked abroad to build the Library's collections, boldly applying Jefferson's dictum that no subject was beyond the possible concern of Congress or the American people. The librarian was especially farsighted in acquiring research materials about other countries and cultures. In 1904, he purchased a 4000-volume library of Indica, explaining in the library's annual report that he "could not ignore the opportunity to acquire a unique collection which scholarship thought worthy of prolonged, scientific, and enthusiastic research, even though the immediate use of such a collection may prove meager."^[11] In 1906, he acquired the famous 80,000-volume private library of Russian literature owned by G. V. Yudin of Siberia, even sending a staff member to Russia to supervise the packing and shipping

of the books. The Schatz collection of early opera librettos was purchased from a German collector in 1908. Large and important collections of Hebraica, as well as Chinese and Japanese books, were also acquired. By 1926, the Library had obtained appropriated funds to send a permanent representative to Europe, stationed in Paris, to assist with acquisitions by developing contacts with dealers, collectors, scholars, and learned institutions.

In one notable instance, Congress took the initiative in building the Library's collections. In December 1929, despite the stock market crash 2 months earlier, Congressman Ross Collins of Mississippi proposed the purchase for \$1.5 million of the 3000-volume collection of early books assembled by collector Otto F. Vollbehr, which included one of three perfect existing vellum copies of the Gutenberg Bible. Congressman Albert Johnson of Washington, in the debate in the House of Representatives, maintained that "even if times are hard," Congress should purchase the collection because "it is all for the United States of America which is going to live we hope for thousands of years." Testifying before the Senate Library Committee, Putnam added his endorsement to the enthusiasm expressed by the House of Representatives. He reminded the committee that in 1815, the government paid Thomas Jefferson nearly \$24,000 for his library, and "in proportion to the resources of the country that sum was not much short of the million and a half" asked for the Vollbehr collection. Moreover, "what was true of that purchase is certainly true of the one before you. It would form "a most admirable substratum for a (greater) national library."^[12] The purchase was approved in 1930.

The Library's foremost function—support for legislative activities—was strengthened in 1914 when the Legislative Reference Service was established as a separate administrative unit. Its creation was a natural development in the Progressive era, when many people in business and public life advocated the "scientific" (and Jeffersonian) use of information to solve problems. Specialized library units for legislative research were established in several states, notably Wisconsin, during the first decade of the 1900s. Putnam responded to this movement and to hearings held by Congress under the leadership of Representative John M. Nelson and Senator Robert M. LaFollette of Wisconsin by creating the library's own Legislative Reference Service in 1914. The next year, he reported that the new service was anticipating questions from Congress on conservation bills, the merchant marine, the government of the Philippines, immigration, convict-made goods, railroad securities, federal aid in road making, publicity in campaign contributions, and a national budget system.

The Library as a Cultural Institution

While enhancing established functions Putnam also moved the library in new directions. The Library of

Congress Trust Fund Board Act of 1925, which enabled the institution to accept gifts and bequests from private citizens, was the major vehicle for the librarian's innovations. This legislation, which created a new cultural role for the library, was inspired by a proposal from private citizen, Elizabeth Sprague Coolidge. She offered an endowment to the library for promoting the appreciation and understanding of music, and to pay for a concert hall within the library building that would support the commissioning of new works of music and provide the chief of the Music Division with a generous honorarium. Prominent individuals such as James B. Wilbur, Archer Huntington, John D. Rockefeller, Gertrude Clarke Whittall, and many others soon joined Mrs. Coolidge as Library of Congress benefactors. In particular, Gertrude Clarke Whittall's donation of five Stradivari instruments and the funding for concerts at which they could be played helped establish the library as a patron of the arts. This new private funding through the Trust Fund allowed the Library to establish chairs and consultantships for scholars and a consultantship for poetry, which by 1986 had evolved into the Poet Laureate Consultant in Poetry.

Putnam was careful in defining the use of the support the library received through the Trust Fund. Private funds were to serve a limited role and were intended to supplement, not replace, the annual government appropriation. His vision for the Library's cultural and educational role and its development established the precedent for the valuable private sector support that the Library of Congress receives today.

Putnam embraced the library's symbolic role as a cradle of Jeffersonian democracy in 1921, when he arranged for the nation's two most precious documents—the Declaration of Independence and the Constitution—to be transferred to the library from the State Department. In 1924, the documents went on permanent public display in a specially designed “Shrine” in the library's Great Hall. The library transferred both documents to the National Archives in 1952. The Library of Congress still holds, as one of its greatest treasures, Jefferson's handwritten draft of the Declaration of Independence. In his book *The Epic of America*, published in 1931, historian James Truslow Adams paid tribute to the Library of Congress “as a symbol of what democracy can accomplish on its own behalf ... founded and built by the people, it is for the people.”^[13]

The rapid expansion of the Library's collections and services during Putnam's 40 years as Librarian naturally required increased space. Additional book stacks within the Jefferson Building were built in 1910 and 1927. Legislation to acquire land for a new structure was approved in 1928, and the Annex Building (today the Adams Building) was authorized in 1930. Construction was delayed during the Depression years, but the classically simple, rectangular structure, chiefly intended for book storage, was completed in 1938 and opened to the public in 1939.

The Library of Congress as a democratic institution and repository of American cultural traditions was a concept that captured the imagination of Putnam's successor, writer, lawyer, and poet Archibald MacLeish. Appointed by President Franklin Roosevelt in 1939, MacLeish served as Librarian of Congress until the end of 1944, when he became assistant secretary of state. An advocate of U.S. involvement in World War II, MacLeish used the office of Librarian of Congress imaginatively to speak out on behalf of democracy. He urged librarians to become “active agents” of the democratic process, and criticized his fellow intellectuals for their failure to defend American culture against the threat of totalitarianism. He became the most publicly visible Librarian of Congress in the history of the office.

Paying tribute to Jefferson's concept of liberty and self-government, in 1941 Librarian MacLeish dedicated the South Reading Room in the Adams Building to the library's principal founder. At MacLeish's request, artist Ezra Winter decorated the Jefferson Reading Room with four murals that drew their themes from quotations from Jefferson on the subjects of freedom, labor, the “living generation,” education, and democratic government. MacLeish also established a “democracy alcove” in the Main Reading Room, where readers could find “the classic texts of the American tradition,” including the Declaration of Independence, the Constitution, the Federalist Papers, and other writings of American statesmen. When in 1943, the Library commemorated the bicentennial of Jefferson's birth, MacLeish noted that “if ever a library had a single founder, Thomas Jefferson was the single founder of the Library of Congress.”^[14] An annotated catalog of the books in Jefferson's personal library by bibliographer E. Millicent Sowerby was undertaken (it was published in five volumes between 1952 and 1959), and the library started microfilming its collection of Jefferson papers in the same year.

Thanks to MacLeish's personal interests and contacts, during his librarianship the Library of Congress established new and enduring relationships with American writers and scholars. Other highlights of the fruitful MacLeish years were the development of Library-wide objectives; an administrative reorganization so thorough that it lasted for more than three decades; the creation of a rotating consultantship in poetry; and fellowship programs for young scholars. The librarian extended Jefferson's rationale to foreign materials, asserting, in his “Canons of Selection” in the 1940 *Annual Report*, that the library should acquire the “written records of those societies and peoples whose experience is of most immediate concern to the people of the United States.”^[15] Indeed, World War II's most important effect on the Library was to stimulate further development of its collections about other nations.

Postwar Expansion

Librarian MacLeish resigned in 1944 and, in 1945, President Truman named assistant librarian Luther H. Evans, a political scientist, as Librarian of Congress. Evans served until 1953. To justify his ambitious proposals in fiscal year 1947 to expand the Library's collections and services, Evans emphasized Jefferson's "doctrine of completeness and inclusiveness." The challenges of the postwar years meant, to Evans, that "no spot on the earth's surface is any longer alien to the interest of the American people." He believed that the major lesson of World War II was that "however large our collections may now be, they are pitifully and tragically small in comparison with the demands of the nation." He described the need for larger collections of foreign research materials in practical, patriotic terms, noting that in the years leading up to the war "the want of early issues of the *Voelkische Beobachter* prevented the first auguries of Naziism," whereas during the war, weather data on the Himalayas from the Library's collections helped the Air Force.^[16]

The acquisitions, cataloging, and bibliographic services of the Library grew during the Evans years, but not as rapidly as the librarian would have liked. He believed that the Library of Congress should actively serve all libraries, but an economy-minded postwar Congress balked at his expansionist plans. Evans's leadership and energy helped to compensate for the lack of large budget increases, however. His strong personal interest in issues such as copyright and intellectual freedom strengthened the Library's involvement in each of these areas.

A new Library of Congress commitment to international librarianship and cultural affairs was one of Evans's major contributions. The Library of Congress Mission in Europe, organized by Evans and director of acquisitions Verner W. Clapp in 1945, acquired European publications for the Library and for other American libraries. The library soon initiated automatic book purchase agreements with foreign dealers around the world and greatly expanded its agreements for the international exchange of official publications. It organized a reference library in San Francisco in 1945 to assist the participants in the meeting that established the United Nations. In 1947, a Library of Congress Mission to Japan provided advice for the establishment of the National Diet Library.

Evans's successor as Librarian of Congress was L. Quincy Mumford, who was director of the Cleveland Public Library in 1954, when President Eisenhower nominated him. During his 20 years in office, Mumford guided the Library through its most intensive period of national and international expansion. In the 1960s, the Library of Congress benefited from increased federal funding for education, libraries, and research. Most dramatic was the growth of the foreign acquisitions program, an expansion based on Evans's achievements a decade earlier. In 1958, the library was authorized by Congress to acquire books

by using U.S.-owned foreign currency under the terms of the Agricultural Trade Development and Assistance Act of 1954 (PL 480). The first appropriation for this purpose was made in 1961. The next year the library established acquisitions centers in New Delhi and Cairo to purchase publications and distribute them to research libraries throughout the United States. This, however, was only the first step.

In 1965, President Lyndon B. Johnson approved a Higher Education Act, which, through its Title IIC, directed the Library of Congress to acquire, insofar as possible, all current library materials of value to scholarship published throughout the world, and to provide cataloging information for these materials promptly after they had been received. This law came closer than any other legislation to making Jefferson's concept of comprehensiveness part of the Library's official mandate. The new effort was christened the National Program for Acquisitions and Cataloging (NPAC). The first NPAC office was opened in London in 1966 and expanded rapidly. By the end of the twentieth century, the library had six overseas offices, as well as cooperative acquisitions arrangements with booksellers and libraries around the world.

Shared acquisitions and cataloging made international bibliographic standards imperative. The crucial development took place in the mid-1960s: the creation of the Library of Congress Machine-Readable Cataloging (MARC) format for communicating bibliographic data in machine-readable form. This new capability for converting, maintaining, and distributing bibliographic information soon became the standard format for sharing data about books and other research materials. The potential for worldwide application was immediately recognized, and the MARC format structure became an official national standard in 1971 and an international standard in 1973.

The preservation and conservation of library collections became an important concern of research libraries in the 1960s. In 1967, the Library of Congress inaugurated a pilot project to study techniques for the preservation of deteriorating or "brittle" books—volumes disintegrating because they were printed on acidic paper. Today, the Library's Preservation Office administers what has become the world's largest library research and conservation laboratory and shares techniques with the library community.

Amid the rapid growth of collections, computer and preservation methods, there took place the most recent serious public debate about the dual legislative and national roles of the Library of Congress. The Library of Congress has played a leadership role in the American library community since 1901; however, its first responsibility, as part of the legislative branch of the American government, always has been to support the reference and research needs of the American national legislature.

The National Library Debate

In 1962, at the request of Senator Claiborne Pell of the Joint Library Committee, Douglas Bryant, associate director of the Harvard University Library, prepared a memorandum on “what the Library of Congress does and ought to do for the Government and the Nation generally.” Bryant urged further expansion of the library’s national activities and services, proposals endorsed by many professional librarians, and suggested several organizational changes. He also said it would be “desirable” to transfer the Library to the executive branch of government. Mumford replied to the Bryant memorandum in his 1962 annual report, strongly defending the Library’s position in the legislative branch and stating his opposition to the suggestion that the Library’s name might be altered to reflect its national role: “The Library of Congress is a venerable institution, with a proud history, and to change its name would do unspeakable violence to tradition.”^[17]

The debate continued in the professional library community. The fiscal retrenchments of the 1970s and Congressional reemphasis on the library’s legislative services under the provisions of the Legislative Reorganization Act of 1970 made increased national library aspirations impractical. The new law changed the name of the Legislative Reference Service to the Congressional Research Service and expanded its functions, placing increased emphasis on policy research and analysis and on direct services to both individual members of Congress and congressional committees.

Before he retired in 1974, Librarian Mumford witnessed the authorization by Congress of the construction of a third Library of Congress Building and, in 1971, the beginning of its construction. In 1975, President Gerald R. Ford nominated historian Daniel J. Boorstin, previous director of the Smithsonian Institution’s National Museum of History and Technology (now the National Museum of American History), to be the twelfth Librarian of Congress. Boorstin was confirmed by the Senate and took the oath of office on November 12, 1975, in a ceremony in the Library’s Great Hall.

Reorganization and New Technology

Boorstin immediately faced two major challenges: the need to review the Library’s organization and functions and, pending the forthcoming expansion into the James Madison Memorial Building, the lack of space for both collections and staff. In 1976, he created a Task Force on Goals, Organization, and Planning, a staff group that conducted, with help from outside advisers, a 1-year review of the Library and its role. Many of the task force’s recommendations were incorporated into a subsequent reorganization. The move into the Madison Building, which began in 1980 and was completed in 1982, relieved administrative as well as physical pressures, and enabled

Librarian Boorstin to focus on what he deemed most important: the strengthening of the Library’s ties to Congress, and the development of new relationships between the Library and scholars, authors, publishers, cultural leaders, and the business community.

The Library of Congress grew steadily during Boorstin’s administration, with its annual appropriation increasing from \$116 million in 1975 to more than \$250 million in 1987, even though budget restrictions slowed growth severely in 1985 and 1986. Similar to MacLeish, Boorstin relied heavily on his professional staff in technical areas such as cataloging, automation, and preservation of library materials. However he took a keen personal interest in collection development, copyright, in book and reading promotion, in the role of the Library of Congress in American life, both in practical terms and symbolically, and in the library as “the world’s greatest Multi-Media Encyclopedia.” Boorstin’s style and accomplishments increased the visibility of the library to a point where, in January 1987, a *New York Times* reporter, discussing Boorstin’s decision to retire as librarian, called the post of Librarian of Congress “perhaps the leading intellectual public position in the nation.”^[18]

Boorstin’s successor, historian James H. Billington, was nominated by President Reagan and took the oath of office as the thirteenth Librarian of Congress on September 14, 1987. Billington instituted his own 1-year review of the library’s functions through an internal Management and Planning (MAP) Committee, a review that also included regional forums in nine cities. The result was a major administrative reorganization based on goals identified through the MAP study. Convinced that the Library of Congress needed to share its resources more widely throughout the nation, he instituted several projects to test new technologies that might provide for direct access by libraries and schools to the library’s collections and data bases. The experimental American Memory project, for example, provided electronic copies of selected collections of American history and culture to schools and libraries. A 2-year pilot project providing online access to the library to the 50 state library agencies began in 1991.

Envisioning a new educational role for the Library, Billington began strengthening the library’s cultural programs and established its first Educational Office. Recognition of the crucial importance of private funds in building and sustaining national outreach projects led to the creation of a Development Office in 1988, and the establishment, in 1990, of the James Madison Council, a private sector support body consisting mostly of business executives and entrepreneurs. In fiscal 1991, Billington obtained a 12% budget increase for the library to help make its collections more accessible. In 1992, however, in response to a series of thefts and discoveries of vandalism, the library was forced to undertake new security measures that restricted access to the collections.

In his budget presentation to Congress for fiscal year 1993, Billington emphasized how the Library of Congress was becoming an important catalyst for the educational, competitive, and creative needs of our nation. The complexities of the information age were most apparent in the librarian's discussion of new electronic technology. This new technology should, Billington stated, be applied to a Jeffersonian purpose, enabling the library to "increase the knowledge available to Americans in their local communities—in schools, colleges, libraries, and private sector research enterprises, from Florida to Alaska." Thus, "even those Americans far from great universities and the most affluent schools and libraries can still have access to the best of the nation's heritage and the latest in up-to-date information." Technology makes this possible; the library's strategy envisions bringing an "electronic library rapidly from concept into initial operation."^[19]

In 1994, the Library made its bibliographic records and selected items from its Americana collections available electronically, and the institution began establishing what is now a multitiered presence on the World Wide Web. The same year Congress approved the Library's 5-year National Digital Library (NDL) program. Through a combination of private and government funding, the NDL program began digitizing historical materials from more than 70 American history and culture collections in the Library and collecting them from 33 other research institutions. The program made those digital collections available, free of charge, on the library's American Memory Web site.

Thus began a new era in service and accessibility to the library's collections. The library increasingly became a leader among large institutions making collections freely available via the World Wide Web. Its Web site, with sections devoted to its own collections, catalogs, and online exhibitions, as well as to legislation from Congress and information from the U.S. Copyright Office, has become one of the most frequently used in the world.

The Library of Congress at 2000

In testimony before Congress in January 2000, Billington told the legislative branch appropriations subcommittee that the Library of Congress had become a leading—if not the leading—provider of high-quality, free educational material in the revolutionary new world of the Internet.^[20] Moreover, a National Academy of Sciences report about the library's role in the electronic age, *LC21: A Digital Strategy for the Library of Congress*, commissioned by Billington in 1998 and released in July 2000, called on the library to greatly increase its resources and leadership capabilities to develop a digital strategy for the next century. The librarian accepted the report's conclusion and soon obtained additional appropriations for its implementation.

A historian of Russian culture, Librarian Billington took a special interest in using the library and its resources to encourage the development of democracy in Russia and in Central and Eastern Europe after the collapse of Communism in the early 1990s. Congressionally approved projects included a parliamentary assistance program for Central and Eastern Europe (1990–1996) and, beginning in 1999, the Russian Leadership Program to bring young Russian civic, political, and professional leaders to the United States to observe American democracy and business firsthand.

The Library of Congress commemorated its Bicentennial throughout 2000. The Bicentennial Steering Committee chose "Libraries-Creativity-Liberty" as the major theme because it encompassed the library's ambition to promote creativity in the preservation, organization, and sharing of recorded knowledge as well as the key role all libraries play in connecting knowledge and information to citizenship in a democracy.

Major bicentennial projects looked to the library's future. They included: 1) "Gifts to the Nation," a high-visibility, privately supported initiative to acquire for the library's collections significant items identified by its curators and specialists. Thanks in large measure to support from the library's James Madison Council, "Gifts to the Nation" resulted in 384 separate gifts totaling \$109.8 million; 2) the launching, with a \$1 million gift from Madison Council members, of a project to reconstruct Thomas Jefferson's personal library; 3) the honoring, as Library of Congress "Living Legends," of 84 individuals selected for their significant creative contributions to American life; 4) "Local Legacies," a grassroots initiative developed through congressional offices and local organizations that documented America's cultural heritage at the turn of the millennium; and 5) on April 24, 2000 (the library's 200th birthday), the launching of "America's Library," a new Web site for children and families. As 2000 came to a close, Librarian Billington made two additional announcements: the library had achieved its bicentennial goal of mounting 5 million digital items on its American Memory Web site, and the Madison Council chairman John W. Kluge's gift to the bicentennial was an unprecedented gift of \$60 million to establish a Kluge Center for Scholars and a Kluge Prize in the Human Sciences.

PERSPECTIVES ON THE LIBRARY'S DEVELOPMENT, 1800–2000

The Library's Legislative and National Roles

The library's initial organization act of 1802 gave the president the authority to appoint the Librarian of Congress—even though the library was a legislative branch agency. The Congress did not vote itself the power to confirm the president's choice as Librarian of Congress

until 1897, on the verge of the move into the library's first building. There is no fixed term for a Librarian of Congress, but when the Senate gained the power to confirm the president's choice in 1897, a "balance" was struck; since then—when the office of librarian also gained the considerable power and independence it holds today—in effect the job has become a lifetime appointment.

The legislative and national functions of the Library of Congress are truly "dual" only in the sense that direct services to Congress receive priority. In all other respects, the legislative and national functions are each inherent parts of the Library's fabric. In 1962, in his response to the Bryant memorandum, Librarian of Congress L. Quincy Mumford (1954–1974) observed, accurately, that Congress had "recognized the national responsibilities of the Library in a way that matters most—with understanding and consistent support."^[21] Historically the pattern has been for the library to grow in stages, often with legislative and national functions alternating in emphasis. Naturally there also have been periods of retrenchment, but on the whole the expansion of the institution has been remarkably steady.

The Library of Congress and American Librarianship

The Library of Congress did not provide direct services to the library community until after its first building opened in 1897 and until the administration of Librarian of Congress Herbert Putnam (1899–1939). Under Putnam's leadership, however, libraries and librarians became a major Library of Congress constituency—second in importance only to Congress itself.

Through the years, the relationship between the library and the American library community—while close—has not been necessarily close-knit and at times both rocky and controversial. In the digital age, the relationship has changed radically since librarians across the country no longer need to rely on centralized technical services from the Library of Congress—as they did from the first decade of the twentieth century until near the end of the century. From the 1980s onwards, other libraries increasingly drew on other massive databases for bibliographic information and began to access collections directly on the World Wide Web; the Library of Congress remained an enormously important supplier of bibliographic data, but it was much less the acknowledged leader of the American library community than it was in the first half of the century.

The International Role of the Library of Congress

World War II not only stimulated the growth of the library's international collections, but also a new international role for the institution, one first fully envisioned by Luther H. Evans, Librarian of Congress, 1945–1953. As

the twentieth century came to a close, it was clear that the Library's international activities were increasing, not only for the benefit of libraries but also for Congress, the nation, and institutions around the world. New electronic resources began to make it easier to share the institution's unparalleled international collections. Moreover, a world role for the Library of Congress was advocated by the two scholarly public servants who served as Librarian of Congress during the last 25 years of the century: historians Daniel J. Boorstin (1975–1987) and James H. Billington (1987–).

For Boorstin, the evolution of the Library's international role was natural:

Our country has been peopled with immigrants from all over the world. How could we pretend to make a truly national library for our United States unless we collected in the languages that millions spoke when they arrived—and still arrive on our shores? In the United States, of all the nations on earth, our *national* library (like our people) must be *international*.^[22]

Billington, in a booklet published to accompany a new exhibit, *World Treasures of the Library of Congress*, echoed the theme:

We at the Library of Congress are as proud of our international collections as we are of our American collections . . . The Library of Congress is the largest and most inclusive library in the world, and it is truly an international institution.^[23]

The Library's Educational Role

In the mid-1990s, Librarian of Congress Billington began advocating a new educational role for the library, one that would take full advantage of the institution's new presence on the World Wide Web and the success of the Library's National Digital Library program—which Congress endorsed and supported.

At the beginning of a new century, when the interdependence and complementarity of all types of educational and cultural institutions is increasingly recognized, Billington's efforts to exploit new electronic technologies and educational partnerships, governmental and private, indeed pointed to a greatly enhanced educational role for the Library of Congress in the century ahead.

Librarian Billington's determination to extend the reach and influence of the Library of Congress is very much in the ambitious tradition of his predecessors. Alone among the world's great libraries, the Library of Congress still attempts to be a universal library, collecting materials of research value in almost all languages and media. It continues to be guided by Thomas Jefferson's belief that

democracy depends on knowledge and that all topics are important to the library of the American national legislature and therefore to the American people and indeed to all people.

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Library Portals and Gateways

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Abstract

Libraries have had web presences since the introduction of the World Wide Web. Providing access to information provided by the library has been attempted through various means throughout the years but no method has been as popular or pervasive as the uses of library gateways and portals. Development of gateways and portals in libraries has been affected by many factors many of which have been outside the direct control of libraries or librarians. Both the history of library practice in this area and these external factors have had a substantial impact on the state of library portal and gateway development today.

INTRODUCTION

In standard English, the literal meaning of “gateway” is a passage that is or may be closed by a gate.^[1] In architecture, a portal refers to a door or gateway usually of stately or elaborate construction. In the early- and mid-twentieth century, an obsolete meaning of portal^[2] was rejuvenated by science fiction writers to describe the concept of transference from one place to another via technological, and sometimes mysterious, means. From the complex intersection of these various definitions, the use of both gateway and portal within the information professions has developed to signify some type of single point of entry to a world of information resources.

Ever since the introduction of library Web sites in the early 1990s, the understanding of what a gateway is has remained fairly constant. In contrast, what constitutes a portal has progressively evolved in the relatively short period of time that libraries have been providing services via the Internet. In the early days of the World Wide Web (1994–1998), portal and gateway were used interchangeably. Both were used to refer to any Web site that provided some type of organized access to resources on the web.

As technology has developed, the use of these terms has diverged and both terms have become more specific. Current usage of gateway refines the original meaning to specifically refer to a Web site that attempts to present an end user with a comprehensive and related set of resources associated with a distinct subject area. This is in contrast to a portal which is a Web site that presents an end user with a comprehensive and related set of resources associated with the specific interests of the individual. Further complicating matters, portal also has a specific, technological meaning derived from its use in computer science. Portal in technological contexts normally refers to the specific technologies used to implement the services which provide customized information to an end user. When used in this sense, the emphasis is on the underlying

software that implements the retrieval of information for display rather than the specifics of the information content presented to the end user.

One of the drivers behind library adoption of portal technology has been the desire to build communication mechanisms that mirror the collaborative and interactive use of traditional libraries^[3] in the context of Web-based delivery of services. To accomplish this, a portal must provide components that lead a user to a set of information which is customizable to the individual interests of the user while being sensitive to the role of the user within the organization.^[4]

Library portals are able to accomplish this through several features and functions. These include:

1. Single user authentication and authorization to resources within the portal.
2. Providing access multiple sources of information.
3. Facilitating a basic level of automated personalization based on the characteristics of the user.
4. Personalizing the selection of resources displays as well as the look-and-feel of the interface.
5. Incorporating a consistent access interface to the diverse information resources available via the portal.^[5]

TYPES OF PORTALS

Conceptually, gateways all tend to be similar. The major differentiating factor is their focus. Most gateways in academic libraries are focused on subject or discipline, but gateways in libraries can also be designed for specific user communities (undergrads, engineering students, tweens, seniors, etc.) or by an area of interest such as mystery book club members, community action counsel members, etc.

Portals are much more difficult to classify mainly because portals can be used in a wide variety of contexts and types of organizations. Therefore, different types of portals technologies have developed and each tends to fulfill the information needs of the end users in a different way. Even so, a common thread found in all portal definitions is an understanding that the main goal of a portal is to gather, share, and disseminate information from disparate sources through an easy-to-use, integrated interface.

Sites that serve as a generalized entry point to the Internet for the public, such as Yahoo!®, MSN, and Lycos are often referred to as “horizontal portals” given the broad array of resources and services they provide.^[6] While portals of this type may provide individual options for customization, their primary function is to offer generalized services from diverse sources in a single, consistent interface. In addition to search services, this type of portal usually provides an integrated set of standard services such as news feeds, stock market information, entertainment, as well as value-added services such as an e-mail account, chat, instant messaging, and personal calendaring. By combining unique information sources and distinctive sets of services, portals of this type hope to become “sticky” to their users. That is, these sites hope to have significant inherent appeal that promotes a desire in people to repeatedly return to the site. Because of this goal, horizontal portals are usually designed to be “destination sites” that deliberately attempt to keep users within the confines of the portal, interacting with its content, rather than providing “gateway services” that lead to content on other sites.

While most library portals are “public portals” their primary function is to connect people with information regardless of where that information may actually be located. Consequently, library portals often have more in common with “vertical portals,” also known as “vortals,”^[7] than with horizontal portals. Vortals differ from horizontal portals in that they provide focused content and gateway services for specific, and oftentimes niche, audiences. Given that the content and services of a library portal are typically aimed at a specific community, such as the population of a local governmental jurisdiction, a particular institution, or organization, library portals tend to model the design patterns associated with vortals more so than the models associated with horizontal portals.

Nevertheless regardless of orientation, all of the portal types identified so far can be classified as “information” or “content portals.”^[8] Portals of this nature have been called “first-generation portals”^[9] in an effort to distinguish them from more sophisticated systems such as “knowledge portals” which support the full range of tasks a knowledge worker performs on a day-to-day basis. Many libraries and information agencies have internal portals in the form of a “corporate” or “enterprise portal.” These portals are not

available to the general public as they provide staff within the organization with operational information and assistance to perform their jobs more effectively.

Traditionally, corporate portals tended to focus on either collaboration support or knowledge work support and were classified as either a “collaboration portal” or “decision processing portal”^[10] depending on their primary purpose, but this distinction is fading rapidly. Collaboration portals, not surprisingly, focus on providing groupware tools such as e-mail, threaded discussions, and instant messaging functions as well as access to traditional work products such as reports, meeting minutes, and memos. Decision processing portals focus on providing access and tools that allow for better decision making based on organizational information. In a library, a typical application in a decision processing portal would be data mining tools that could be used against a wide variety of data collected in the library. For example, data mining could be used to discover patterns within circulation data that could be used to inform collection development practices.

A further factor differentiating corporate portals from traditional library portals is that corporate portals often provide life cycle management of corporate records (similar to a repository), auditing tools to provide insight into how the portal is being used, expert directories which are generated based on inferred or explicit declarations of expertise, and other tools to locate knowledge and experts within an organization.^[11]

Within this overall environment of portals, the gateways and portals libraries have provided for public use are generally differentiated into three general types:

1. Customizable e-resource portals, primarily focused on providing access to external resources such as commercial databases and full-text products.
2. Integrated web service portals, which also include features such as content alerting services and some collaboration tools, such as reference chat.
3. Metasearch systems that contain portal features.^[12]

This differentiation of portal types is reflective of both the development of portal technology as well as the evolution of information gateways within libraries.

Most library portals before 2004 were of the first type, customizable e-resource portals. Although some libraries, such as Cornell University, provided nascent integrated web service portals, the web services were often narrowly focused. For example, the Cornell University’s My Library system provided a convenient dashboard of limited services such as a new book request and a content awareness notification for new books in the catalog.^[13]

Since 2004, much of the development of portals in libraries has been focused on building integrated resource discovery systems based on metasearching.

TECHNOLOGY AND STANDARDS USED IN LIBRARY PORTALS

Several technological standards are used within library portals to deliver content and services. Some of these protocols are specific to portals (such as JSR—Java Specification Request—168 and Web Services for Remote Portlets [WSRP]) while others are used in a more broad technological arena. The most essential of these standards for portals include:

- **Java Specification Request (JSR) 168**—The Java Portlet Specification (JPS) defines a programming model for developing “portlets,” the user selectable interface components that are used within a portal for accessing content or services, in the Java programming language. The JPS V1.0 (JSR 168) provides for a basic programming model that includes such things as:
 - *Package formats* for defining methods for combining portlets into a single application that is installed on the portal server.
 - *Portlet data models* which provide mechanisms to the portlet for storing information related to content rendering, session status information, and persistent data.
 - *Portlet modes* which provide a vehicle for a portal to communicate with the portlet and tell it what tasks should be performed to generate content.
 - *Window states* that define the amount of space on a web page that will be permitted for the content generated by the portlet.

Work on providing additional functionality, such as the ability to transform the content of portlet requests and responses on the fly, is ongoing in the development of the successor protocol, JSR 268.^[14]

- **LDAP**—the Lightweight Directory Access Protocol is a protocol for accessing information in directory servers. Most often, these directory servers are used to provide authorization and authentication information for the portal. Information in LDAP is stored hierarchically, in a tree structure, with finer levels of granularity being achieved as one traverses down the tree.^[15]
- **NCIP**—the Circulation Interchange Protocol (Z39.83) defines the transactions required to support circulation activities among library systems. Some of the services supported by the protocol include patron and item inquiry as well as the ability to check-in, check-out, renew, hold, and reserve materials.^[16]
- **OAI-PMH**—the Open Archives Initiative Protocol for Metadata Harvesting is a mechanism for the widespread exchange of metadata between a content provider and a portal. Based on a client/server model, “data providers” are systems that expose the metadata

related to their content whereas “service providers (SPs)” (also known as “harvesters”) make requests of the data providers to retrieve (harvest) the metadata related to their collections.^[17]

- **OpenURL**—the OpenURL standard is a syntax for creating metadata and/or identifiers about an information object. OpenURLs are used in place of static URLs to provide the opportunity for the requesting service to provide additional metadata or contextual information at the time of the information request in order to locate the most appropriate resource, given the users’ current environmental context. The primary use of this technology in libraries is to direct users to appropriate, accessible copies of materials, given their current patron status and location within the organization (i.e., student, faculty, remote borrower, etc.).^[18]
- **RSS**—defined variously as “RDF Site Summary,” “Really Simple Syndication,” and “Rich Site Syndication” is an XML-based data format used to publish information about a provider’s content. Primarily used to indicate the availability of new content from an information resource, a “feed” or “channel” typically contains either the full text of a data item or content summary information with a link to the full text.^[19]
- **Shibboleth**—is an architecture for federated identity-based authentication and authorization. It provides a mechanism for the secure exchange of information about credentials for users within a group of systems linked together in a common federation. With Shibboleth, single point authentication and authorization can be provided for all users for all services within the federation without each SP having to maintain local user identification and password information for each member of the federation. Based on a client/server model, identity providers (IdPs) in a Shibboleth federation supply user information to SPs who are responsible for interpreting the credentials returned. The SPs use this information to provide access to content as appropriate for the credentials that have been presented.^[20]
- **SRW/U**—The Search/Retrieve via the Web or URL Service protocol builds upon the Z39.50 framework by providing a streamlined, web-based mechanism for searching databases via a standard search and retrieve service. Based on the CQL query language, SRW provides both Simple Object Access Protocol (SOAP) and URL-based request mechanisms through three operations,
 - *Explain*—provides the mechanism for an SRW/U client to retrieve a description of the features and facilities available on an SRU/W server.
 - *Search/retrieve*—allows the client to submit a search request and retrieve the results from the server that match the request.
 - *Scan*—provides the ability of a client to browse an index of terms on a server.

SRU and SRW differ only in the way they are implemented. In SRU, the request to the server is transmitted via a URL using HTTP as the transport mechanism, an architecture known as representational state transfer (REST). The results returned are XML-based, but it is assumed they will be used for display purposes. SRW on the other hand is SOAP-based and both the initial query and the result set are returned as XML data streams. Any available transport mechanism can be used for the request and response. Furthermore, no assumptions are made about the use of the returned result set.^[21]

- WSRP—is a protocol designed for interacting with presentation-oriented web services on remote portlets. JSR 168 and WSRP are complementary technologies. In a typical environment, JSR 168 is used to define a portlet application and WSRP is used to define the actual operations of the portlet. This division of labor promotes application portability and therefore is common in environments where Java is not the only language used for building portlets. With operations defined via WSRP, portlet functionality can be harmonized across a diverse application development environment including, e.g., Microsoft's .NET framework.^[22]
- Z39.50—was introduced in 1988 as the first network-based transfer protocol for bibliographic information. Based on a client/server model, Z39.50 provides a rich set of operations (such as search, retrieve, sort, and browse) as well as extensive database schemas that cover a wide variety of bibliographic and other data. This extensive functionality allows for great flexibility in searching and retrieving results from remote databases, but it is also one of the major impediments to Z39.50 implementation. Because of the complexity of functionality within Z39.50, vendors offer varying levels of support for the full Z39.50 protocol and no vendor completely supports the entire specification. Nonetheless, use of the Z39.50 protocol is ubiquitous in library automation; however, it is slowly being replaced by newer technologies that are easier to implement, such as SRU/W.

HISTORY OF PORTALS AND GATEWAYS IN LIBRARIES

The conceptual basis of portal functionality can be traced back to the decision support systems (DSS) of the 1970s, which provided support for decision making by staff in specific situations where expert advice was required. In the 1980s, these DSS systems were expanded and enhanced to create executive support systems (ESS) which contained many of the functions now found in portals.^[23] By the early 1990s, systems were being considered and prototyped in libraries that would extend ESS-like functionality to

scholarly work. As noted at the time, a “scholar’s workstation” would benefit the end user substantially as “errors in transcription of bibliographic citations could be reduced, reference works consulted directly from the workstation, and literature searches conducted and recorded without a trip to the library in some cases” (p. 269).^[24]

In 1994, David Filo and Jerry Yang brought Yahoo! online and made it available to a worldwide audience via the Internet.^[25] Originally designed as a way to keep track of their personal interests on the Internet, at the time of its introduction it was the first major site to introduce the concept of a gateway by using categorization (and subcategorization) for linking to Internet-based resources. As such, it provided the model for subsequent development of gateway sites.

The quick success of Yahoo! demonstrated the utility of the gateway concept. In October 1994, the Berkeley Public Library Index to the Internet, known today as the Librarians’ Internet Index (LII), made its debut on the web, having been migrated from an earlier life as a “gopher” bookmark site.^[26] The LII was not originally intended to be a gateway for the general public but as a gateway for librarians who wanted to learn more about resources available on the web. As such, the LII was an important factor in focusing the attention of libraries and librarians on the potential for Internet-based services.

In 1995, an enterprising group of graduate students in the School of Information and Library Studies at the University of Michigan developed the Internet Public Library (IPL) as a mechanism for exploring issues related to libraries, librarians, and librarianship in the newly emerging environment of the Internet.^[27] In a model similar to the effect Yahoo! had on Internet gateways in general, the IPL set the course for future development of library gateways.

At the time however, few of the scholarly resources libraries have traditionally collected, such as books and journals, were available via the Internet. Most of what were referred to as “electronic resources” were still delivered on CD-ROM. Consequently, until 1997 most library Web sites functioned more as informational sites describing the resources and services available in the library and less as gateways to scholarly resources.

In 1997, things changed significantly for two reasons. Yahoo! once again introduced a service that had an important effect on expectations about information dissemination. With the introduction of My Yahoo!, many Internet users were introduced to the idea that content could be customized to their particular areas of interest. With the number of Internet users rapidly expanding, customized portals were seen as an ideal technological solution to the problem of meeting the diverse needs of a broad audience. Concurrently, traditional print publishers began to see the great economic potential of providing vast quantities of electronic content, mainly derived from legacy printed materials, to libraries.

By the end of 1998, with the explosion in the number of Internet sites and the greatly expanded inventory of scholarly databases and full-text resources online, it became increasingly evident that the use of gateways as the sole mechanism for providing guidance to appropriate information resources was being stretched to its limits. As noted in the January 1999 report of the Cornell University Library gateway focus group,

the Gateway presents networked resources and services but it does nothing to simplify the complexity of today's information scene. . . users appreciate the richness that the gateway offers for all subjects, but they yearn to have a more personal space. If they cannot 'rearrange the furniture' in the entire system, at least they would like a little corner to themselves where they can dictate how important certain resources are based on their own needs.^[28]

Portal technology specifically designed for libraries became available in late 1998 when developers at North Carolina State University (NCSU) released the first version of the "MyLibrary" software. The debut of a portal for library-specific use came at an opportune time. Within a short period of time, libraries at California State Polytechnic at San Luis Obispo, Charlotte Public Library, Cornell University, Los Alamos National Laboratory, Mississippi State University, University of Toronto, University of Utah, University of Washington, and Virginia Commonwealth University (VCU) had all introduced some level of customizable services for their library patrons under the rubric of a "My Library" service, some using the software developed at NCSU, but many developing their own.

However, after this initial flurry of activity, development of library portals floundered^[29] due to three different factors. The first was that many libraries hesitated about adopting portal technology due to early reports of less than overwhelming success in capturing the attention of library patrons with portals. In detailing the status of the first-year review of VCU's My Library implementation, the authors of the report noted that only 12% of the active accounts in the system had logged in more than 21 times in the prior 6 months.^[30] At the third-year review, VCU reported just slightly 4% of the potential user population was actively using the My Library portal functions.^[31] A comparably low level of portal adoption was also reported at NCSU^[32],^[33] and University of Washington.^[34] Two of the recurring themes in these reports related to the difficulty people had with customizing the portal to their information needs and the difficulties subject-based categorization created for undergraduates who needed to search across a broad range of material. In 2006, researchers at the University of Illinois at Chicago noted that the difficulty in using discipline-specific portals had not gone away or been alleviated in a substantive manner.^[35]

The second factor inhibiting the adoption of portals was linked to work that was being done to position the library catalog as a portal to the Internet. Much of the impetus for this movement can be traced to the "Bicentennial Conference for Bibliographic Control in the New Millennium," where there was a great interest expressed by some segments of the library community in reinvigorating and repurposing the library catalog as a portal to the Internet. Thomas^[36] discussed the pros and cons of this approach at the conference, noting that a major issue in transforming the catalog to function as a portal is that while portals are deficient at providing the depth of information a library catalog does, a library catalog does not provide the immediate and extensive coverage a portal does. In effect, the two technologies work to achieve different end results.

The third, and perhaps most influential, factor that inhibited adoption of local portal technology was associated with activities by the Association of Research Libraries (ARL) on what would become known as the "Scholars Portal." In September 1999, ARL and Online Computer Library Center (OCLC) hosted a meeting on strategic issues in academic libraries. From this meeting arose a consensus that libraries were in danger and ran a very real risk of being circumvented by commercial information services. An issue highlighted by the group was that because libraries tend to focus on local solutions, their Web sites do not provide an effective entry point for accessing the broad array of web resources available.^[37] Jerry Campbell, then Dean of Libraries at the University of Southern California, was one of the early proponents for the development of a collaborative research library web presence.

To put this idea into practice, a working group (the ARL Scholars Portal working Group) was established in late 2000 with two guiding principles directing the work of the group:

- "First, that access to disparate electronic resources and services can be improved through integration, both within a single institution and across multiple institutions,
- Second, that efforts to effect such integration should leverage work already being carried out in ARL libraries."^[38]

To begin the process however, the group had to focus on an initial goal. After discussions, the decision was made to develop a "super discovery tool" that would incorporate results from licensed, commercial content, as well as open access material, drawn from a broad range of subject areas and institutions. In spring 2001, the working group conducted an environmental scan to see if the technology was available to develop the super discovery tool, and after reviewing over 30 products, they determined that it would be possible to implement the initial concept. In

early 2002, the project made a significant move forward when a core group of libraries (University of Southern California; University of California, San Diego; Dartmouth College; University of Arizona; Arizona State University; Iowa State University; and University of Utah) signed on to the Scholars Portal Project (SPP) and began working with the selected vendor (Fretwell-Downing) to implement the project.

While the final results of the ARL Scholars Portal Project did not meet the initial goals, the importance of the project in terms of library portals was the momentum it gave to the newly emerging concept of “federated search” and the routine integration of services in the web presences of libraries. An example is the formation of the ARL Metalib Portal Implementation Group (ARMPIG) in 2003. This group of ARL libraries (including Boston College; Florida Center for Library Automation; Harvard University; Massachusetts Institute of Technology; Northwestern University; University of Iowa; University of Maryland; University of California, Berkeley; University of California, Davis; and Washington State University among others) had partnered with another vendor (Ex Libris) to implement goals similar to the SPP, but with different software. This diversity of approaches within the ARL community provided a catalyst for much of the creative thinking that emerged on how to further develop library portals using federated search technology as its base.

Additionally, the Library of Congress stepped into the picture through the formation of the Library of Congress Portals Applications Issues Group (LCPAIG). Released in late 2003, the report on portal application functionalities for the Library of Congress^[39] was a significant signal to the library community that the concept of a portal based on federated search technology was a reality and something all libraries needed to seriously consider.

In approximately the same time frame, researchers at the Joint Information Systems Committee (JISC) in the United Kingdom were investigating methods for making discipline-based information more accessible in their Subject Portals Project (SPP). The goal of the SPP was to enhance resource discovery by developing a series of collaboratively developed, subject-specific portals focused specifically on the requirements of end users located within the higher education community.^[40] By late 2001, the first phase of the project had provided a prototype for combining Z39.50 federated searching with traditional selection processes in three disciplinary areas: social sciences; science, engineering, and technology; and health and life sciences. In early 2004, the second phase of the project came to a close with the launch of the integrated research portal that also now included subject areas in the arts and humanities.^[41] Of particular note in this project is its demonstration of the feasibility of collaborative selection across a diverse group of institutions as well as the possibility of combining traditional selection processes found in gateways with federated searching.

By 2005, portals based on federated searching were an accepted, if not universally appreciated, fact of life. Many in the library community were of the opinion that while “the online catalog will continue to function as the principle tool for access control of the library’s physical collections, the federated searching portal will ultimately serve as the library’s principal web gateway to digital resources.”^[42]

However, not all were convinced^[43] of the viability of federated searching in the long run, noting the problems inherent in the Z39.50 protocol and many issues related to vendor cooperation or lack thereof.

This shift in focus, along with other environmental changes such as the rapid adoption of both Google and Google Scholar^[44] for resource discovery as well as the increased adoption of campus-wide portals^[45,46] has taken some attention away from library portals as ends unto themselves. Increasingly, libraries view the library web presence, whether a portal or gateway, as just one component of their strategy to meet information needs.^[47]

CURRENT ISSUES

The impacts of portals in libraries, if one uses a review of the literature as a basis, reached its peak in the period from 2001 to 2004. Since then, discussion of portals as a distinct subject has declined and there are several factors that undoubtedly have influenced this trend.

One of the most persistent problems is that the library community has never come to an agreement on a single definition of what portal means in the library context. While a common understanding, at least in principle, of gateways has existed since the late 1990s, the same has not been true for portals. For example, when asked to define a portal in 2002, five separate ARL libraries responded with divergent definitions of a portal including

- An environment that fits specific needs.
- An interactive gateway to resources and services.
- A gateway to digital resources and services providing a high level of seamless integration including a feature-rich tool kit that enables use along the entire scholarly communications spectrum.
- Services and tools that facilitate the discovery, retrieval, and management of information from various resources in an integrated fashion while taking into account personalized needs in doing research and creating knowledge.
- A multidimensional scholarly environment.^[48]

In the intervening time, no universally accepted, single definition has taken hold.

A further complicating factor is that a review of the literature makes it clear that most library portal efforts

have not achieved wide-scale adoption rates. In part, this may be due to the relative lack of resource integration, which is a defining characteristic of a portal. As Detlor and Lewis have observed, “many would argue that most library gateways are not portals at all, but rather collections of irregularly-shaped windows facing out in the same general direction” (p. 89).^[49] It has been argued that this perception has taken hold because many library portals have been implemented in such a way that they do not “shield the user from the differences of the target resources or link them together” (p. 113).^[50] Detlor and Lewis^[51] have argued that because of this, and other deficiencies, library Web sites should not be referred to as portals.

Even if these preceding issues were to be resolved, library portals have been criticized as having the potential to create service gaps among certain segments of patrons. These criticisms are somewhat paradoxical because while a lack of robust personalization and recommendation tools on library portals^[52] have been noted as significant deficiencies, Crawford^[53] has noted that features such as these can actually create problems and service gap issues for the library patron such as:

- Differential service—because many patrons will not take the time to customize their view of the library portal, they may inadvertently create an environment where they receive less than optimal service because they do not use the portal.
- Solipsism—where the patron receives a biased or otherwise unbalanced profile of the information landscape because their interests have been too narrowly focused or precisely defined.
- Irrelevance—because of low adoption rates, the library portal suffers from neglect and fails to deliver all of the information resources that it should for a particular user.

In spite of these issues and notwithstanding the low adoption rates of library portals, libraries continue to investigate new approaches to providing relevant library resources and services by taking advantage of portal-like features and services but adopting them to new service contexts and technological developments. This shift in focus is being driven by changing patterns of information resource use as well as the realization that some older approaches to information dissemination may no longer be relevant.

This last issue is demonstrated by recent research which indicates that one of the reasons that subject gateways and MyLibrary-like portals are not adopted by undergraduate students is because they do not find them useful. Undergraduate students find Web pages specifically constructed to highlight resources and services for individual courses far more useful than generic subject guides.^[54]

Societal forces have affected trends in library science. The shift “to the user as the driving force behind library services, not the Platonic ideals of information organization” (p. 22)^[55] has led some libraries to experiment with the integration of library services through portlets into external services such as Facebook and My Space.^[56] This is not a surprising development as Strauss noted back in 2002 that “libraries would best serve their users by building portal pages, channels, and cameos rather than portals themselves” (p. 36).^[57]

CONCLUSIONS

As has been the case with many other technological developments, a potential downside to further exploration of the possibilities of integrating portal technology into systems developed outside the library is whether libraries have the resources and ability to implement these new services on a wide-scale basis. It has been noted that with “the relative scarcity of professional literature on campus portals, it does not appear that library participation in campus web portals is a primary concern among academic librarians” (p. 156).^[58] Yet there is not any conclusive research that explains why this is, so it is not clear if the issue is true lack of interest or some other reason that has not been articulated.

In either case, the long-term viability of extensive local development of portlets and other types of applications of this nature is debatable. Except for projects like the SPP at JISC and the LII, collaboration on portal development has not occurred on a wide-spread basis throughout the information professions. As Campbell has noted, “letting a thousand flowers bloom, it turns out, has always been easier than cultivating a garden” (p. 16).^[37] He warned that failure to create collective web presences and services for research could well mean that research libraries would essentially become invisible in the glut of Internet sources. Some would say that this has already occurred with the ubiquitous use of Google and Google Scholar as mechanisms for locating scholarly and reference-level information.

But as Jascó has noted,^[59] Google Scholar does not provide a comprehensive level of resource discovery, so there is still a place for developing portal and gateway functionality to meet many information-seeking needs. Because it is evident that the single box search strategy used by Google is popular with scholars, students, and librarians in addition to the general public, development of library-specific portals (as opposed to portlets for use in other applications) will increasingly focus on making finding items simpler by leveraging Web 2.0 technologies and features to provide patrons with functionality to tag items, retrieve items through tag clouds, discover items for additional and further reading, automatically correct spelling mistakes in search terms, suggest alternative search terms, and use more sophisticated mechanisms for serendipitous discovery such as dynamic facet-based browsing.

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Library Publishing Initiatives: North America

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Abstract

Library publishing refers to the set of services provided by libraries to support the creation, dissemination, and preservation of original content such as eJournals, monographs, scholarly websites, and gray literature. It encompasses a rapidly evolving range of initiatives taking place in academic, research, and public libraries.

INTRODUCTION

“Library publishing” is a rapidly evolving subfield of publishing, concentrated largely in the academic and research sector. It has arisen and matured in response to demands for publishing platforms and service infrastructures to support the production and dissemination of scholarship in myriad forms, including websites and eJournals, conference proceedings and technical reports, databases and mapping interfaces, gray literature and electronic theses and dissertations. It has also emerged in the middle of a volatile marketplace where the concept of “information-as-commodity” is at war with the concept of “information-as-public-good”. As such, it has entered contested terrain, as exemplified by the high level of attention it is receiving in the publishing realm today.

The stakes in the broader field of academic publishing are high, and debates concerning the viability and appropriateness of different models—commercial, non-profit, academic, collaborative—are unresolved. This entry will begin by briefly defining library publishing. It will then situate this emerging publishing subfield in its historical context, documenting the broader spectrum of academic publishing practices that have helped to inspire and shape its development to date. Building from this framework, it will describe the current range of library publishing programs and activities in North America, including the methodologies that characterize this domain and the debates and “hot topics” that surround this set of activities.

DEFINING “LIBRARY PUBLISHING” IN AND BEYOND THE ACADEMY

“Library Publishing” is a term increasingly applied to the activities libraries undertake as they work with authors to prepare, disseminate, and preserve content. Library publishing is largely digital in nature (though some libraries provide print-on-demand services for some works). The term is usually used to denote a library’s attention to

production processes (e.g., editing, copyediting, layout/design, certification/review, rights management, branding, distribution).

In 2013, as one of its initial projects, the Library Publishing Coalition collectively formalized a definition of “library publishing” in the academic sphere as follows:

The LPC defines library publishing as the set of activities led by college and university libraries to support the creation, dissemination, and curation of scholarly, creative, and/or educational works.

Generally, library publishing requires a production process, presents original work not previously made available, and applies a level of certification to the content published, whether through peer review or extension of the institutional brand.

Based on core library values and building on the traditional skills of librarians, it is distinguished from other publishing fields by a preference for Open Access dissemination and a willingness to embrace informal and experimental forms of scholarly communication and to challenge the status quo.^[1]

Academic and public libraries, as well as a handful of historical societies and archives, report their interest and growing work in this area. Academic libraries have focused primarily on scholarly research products; public libraries generally work with local authors in their communities. Most research and documentation to date has focused on the work of academic libraries; where possible, we will provide information about the role public libraries are beginning to create in this emerging field as well.

Libraries focus on an identifiable core set of publications, as follows.

Electronic Journals

Most library publishing programs anecdotally cite eJournals among their first publishing service offerings.

Academic libraries work with individuals, departments, and organizations on and beyond their campuses to produce eJournals. Usually these eJournals arise when a faculty member (or graduate/undergraduate students in collaboration with a faculty member) approaches the library for help in launching a new journal or to transition a print journal to digital form. The scholar typically provides the topical focus, editorial board, and handles solicitation, peer review, and copy editing of articles. The library partner often provides the technical infrastructure and production know-how: hosting the journal using (or building) platforms such as the Public Knowledge Project's (PKP) Open Journal Software (OJS) and bepress' Digital Commons; providing layout/design advice; managing the copyright process (often using Creative Commons licenses); and disseminating the journal (most often through some form of Open Access publication). eJournals have matured in a range of forms and formats, including text-based journals (e.g., the hundreds of journals published using OJS); journals emphasizing the use of the digital medium to transform scholarship (e.g., *Southern Spaces*); and journals that provide scientists with mechanisms for publishing their datasets and databases along with the research findings drawn from them (e.g., *Elementa*).^[2-4]

Monographs

Libraries publish scholarly, literary, and educational monographs in digital and print (typically print on demand) versions. The disciplinary interests of the university, the library, and/or the publishing program's advisory board frequently drive the editorial program for monographs. Some focus on specific disciplines, or geographical areas. Others concentrate on publications created by faculty at their institutions. A range of publishing models has emerged in this area, from lightweight systems that eschew some traditional scholarly monograph publishing process like peer review (e.g., The University of Nebraska-Lincoln's Zea E-Books imprint) to more traditional programs, often in collaboration with a university press (e.g., the *Signale* series, a joint endeavor of Cornell University Press and Cornell University Library).^[5,6] Public libraries have also become involved in monograph publishing, typically focusing on the creative output of their local communities (e.g., the Provincetown Public Library, which plans to publish novels, short fiction, poetry, and other works through its Provincetown Public Press).^[7]

Scholarly Websites

Another core set of library publishing examples has derived from faculty/library partnerships on scholarly websites. These have often been grant-funded endeavors, and they include a wide range of publication types,

including archives of primary research materials with topical focus (e.g., Valley of the Shadow, D-Scribe); database-driven websites, often with GIS/mapping components (e.g., SlaveVoyages.org); and collections of websites (e.g., Human Rights Web Archive).^[8-11]

Electronic Theses and Dissertations (ETDs)

Libraries have been hosting and distributing ETDs through their institutional repositories for many years. ETDs represent an important component of the university's original research output. They are typically text-based documents, though they may include audiovisual elements, datasets, or other supplementary materials. Many institutions require deposit of ETDs, a subject that has received attention and criticism from some who claim that offering open access to students' research may make it difficult for them to secure book contracts with academic publishers.^[12]

Gray Literature

Preprints, technical reports, teaching materials, and other unpublished or informally published works are often referred to as gray literature.^[13] While gray literature often documents important and timely information, it typically falls outside the scope of traditional publishing channels. Libraries support its collection and distribution through institutional or disciplinary repositories. The eprint repository arXiv is an early and significant example of a library rising to the challenge of providing access to a large corpus of gray literature for a set of disciplines.^[14]

Conference Proceedings

As part of their efforts to preserve and disseminate the research output of their campuses, some libraries offer conference publishing services. The level of service varies based on the needs and capabilities of the library, but may include hosting presentation recordings, preparing formal publications, and even facilitating the process of submission and review of papers. Some libraries use a full-service software such as Open Conference Systems (OCS), which manages everything from creating a conference website, to coordinating registration, to soliciting and reviewing papers.^[15]

Data

New data management mandates, and the increasing recognition of data as a valuable scholarly product, have led many libraries to consider or implement data hosting as part of their institutional repository or as a standalone service. The Purdue University Research Repository (PURR), for example, provides metadata, DOI assignment, and storage for data such as "spreadsheets,

instrument or sensor readings, software source code, surveys, interview transcripts, or images and audiovisual files.”^[16]

Textbooks

As part of a broader push to encourage adoption of Open Educational Resources (OERs) and ease financial burdens on students, some libraries support the publication of original textbooks developed by their faculty. The SUNY Open Textbook Initiative, for example, plans to publish fifteen open textbooks in a range of disciplines.^[17]

Appendices and Supplemental Content

Libraries partner with content creators and publishers (such as university presses) to host supplemental content, often consisting of digitized archival material, audio and video files, and other media. Examples, cited by Raym Crow in his 2009 study of university press and library collaborations include the University of Nebraska’s *Journals of the Lewis and Clark Expedition Online* and Pennsylvania State University’s *Times of Sorrow and Hope*.^[18]

Digitized Out-of-Print Books and Print on Demand of Out-of-Print Materials

In addition to publishing original monographs, libraries also provide print on demand or digitization services for out-of-print books. For example, the library at the University of North Carolina at Chapel Hill offers print on demand for books originally published by the UNC Press through the “DocSouth Books” project.^[19]

HISTORY OF PUBLISHING IN ACADEMIC LIBRARIES

Over the last few decades, faculty and students across a variety of disciplines have explored the use of digital technologies to create and disseminate their research. From campus to campus, the details differ but the trend has been consistent—in many cases, these researchers have found strong support for their efforts by partnering with their campus libraries.

University and college libraries have provided the technical infrastructure and staffing necessary to facilitate many early experiments in digital scholarship, from hosting eJournals to collaborating with researchers to create digital archives, handcraft “one-off” Web creations, and produce frameworks for database- and GIS-oriented websites. In the process, libraries have also engaged in activities that mark an extension of the traditional library roles, including managing peer review processes, editing, providing design/layout services, and facilitating

discovery through search engine optimization. Some of this work has been funded through grants (campus, government, and foundation-based), but much of it has been offered as an extension of the Library’s traditional mission of collecting, disseminating, and preserving content.

Very few talked about the earliest of these experiments and forays as “publishing”; more often, these projects were discussed under the term “scholarly communications.” This nomenclature began to change around 2008, not least due to the publication of two key reports, one by Ithaka S&R and another by the Association of Research Libraries (ARL).^[13,20] The Ithaka S&R report, *University Publishing In A Digital Age*, drew clear conclusions regarding the need for presses and libraries to collaborate in order to propel the scholarly communication field forward. And the ARL report, *Research Library Publishing Services: New Options for University Publishing*, provided the first in-depth analysis of publishing services offered by academic libraries and perhaps the first “official” definition of library-based publishing as “the organized production and dissemination of scholarly works in any format as a service provided by the library.”^[20]

Other studies reinforced both this definition and the importance of these emerging library-based publishing endeavors. In particular, the seminal, IMLS-funded “Library Publishing Services: Strategies for Success” project and report demonstrated the active development and implementation of publishing services in a range of academic libraries, from small liberal arts colleges to premier research institutions.^[21] Among the key findings, more than half (55%) of those surveyed either already had or were developing library publishing services. Of these, almost all (90%) cited their desire to “contribute to change in the scholarly publishing system” as an impetus for their work in this area.^[21] The study also showed that most programs were operating in relative isolation from one another, and it documented the need for a central space where librarian-publishers could meet, work together, share information, and confront common issues. The report encouraged the development of a framework that could help library publishing services mature into a cohesive field of practice.

The “Strategies for Success” project laid a strong foundation for further action. Prompted by the results of this project, Educopia hosted a conversation in May 2012 between three library Deans who shared an interest in advancing the emerging field of library publishing: James Mullins (Purdue University), Martin Halbert (University of North Texas), and Tyler Walters (Virginia Tech). As an outcome of that conversation, in June 2012, a proposal was drafted to create a community-driven organization—the Library Publishing Coalition (LPC). Representatives from 18 major libraries and consortia vetted the vision outlined in that proposal in July 2012, and the revised proposal was released to prospective participants in August 2012. More than 50 academic libraries formally

joined the project team before the project kicked off in January 2013.

Through seed support from the Educopia Institute and participating libraries, the Library Publishing Coalition (LPC) project (2013–2014) is now engaging practitioners to design an organization to support an evolving, distributed, range of library publishing practices. The project is about studying, documenting, and evaluating how best to structure this community-led initiative to promote collaboration and knowledge sharing in the field. The project will result in an organization (launch date set for 2014) and a set of services that include an annual forum, a Directory of Library Publishing, training and education offerings, and a documentation hub.

The evolution of library publishing in universities and colleges is closely tied to the broader academic publishing environment and the seismic shifts and “crises” that have plagued it over the last thirty years.

ACADEMIC PUBLISHING AND THE “CRISES”

From roughly the late 1600s to the 1970s, there was an established order to academic publishing. Creators (the author-researchers, usually ensconced in tenure-track or tenured positions) worked with publishers (mostly University Presses and non-profit scholarly societies, who practiced “publishing” in a service-oriented manner) to produce two main forms of written scholarship: monographs and journals. Publishers served as gatekeepers, editors, and disseminators of scholarship, and they engaged networks of scholars to ensure the merit of each publication they issued. Academic libraries purchased these works, catalogued, organized, and provided access to them, and preserved them for future generations of researchers.

The unsettling of this relatively healthy system, and the resulting articulation of “crisis” can be traced back to at least the 1970s (notably, an economically volatile moment for Western markets). Conventional wisdom today cites two main culprits as the causal agents in this “crisis”: the shift from print- to digital- modes of communication and the consolidation and infamous “bundling” practices in the journal publishing market. However, this rather narrow view neglects other interwoven and critical factors that contributed to what some theorists have referred to as a “living dead” academic publishing arena.^[22] These other factors include the proliferation of publications and increase in research specialization, the popularization of ranking systems based on research output and citations, and a lack of ready public/subsidization funding to enable libraries (or enough researchers) to acquire the content.^[23] We briefly describe some of these below as part of the historical context that has prompted the emergence of library publishing and helped to inform its service orientation over the past decade.

An early factor contributing to the atmosphere of “crisis” came in the form of mimeograph technologies. In particular, the availability of the Xerox machine (popularized in the 1960s) enabled researchers to make a copy of any portion of a journal for a fraction of its cost. This presented a challenge for societies, which depended upon subscription revenues from *both* libraries and individuals to cover their publication costs. Rather than subscribing to a full journal or purchasing a book, a researcher could now visit the library, make copies of the individual articles or segments he/she needed from any journal or book the library maintained, and take those copies home. For researchers, this marked a major improvement in their ability to gather diverse literatures; for University Presses and society publishers, this marked a pain point as units purchased decreased.^[23]

This early challenge was compounded by an increase in disciplinary specialization in the 1960s–1970s (e.g., “physical geography” subdivided into five subdisciplines: geomorphology, climatology, biogeography, soil science, and Quaternary environmental change). With disciplinary specialization came new (competing) societies and journals, which fractured the subscription and membership base for longstanding societies. This also presented an early challenge to the collections budgets for academic libraries, which had to expand their journal collections to encompass the new titles demanded by their researchers.^[24]

The crisis mentality continued to grow—along with scholarly output—as higher education rankings and citation impact measures grew in stature and popularity during the 1970s. Although promotion and tenure already encouraged publication through its inclusion as one key measure of an Assistant or Associate Professor’s performance evaluation for tenure and promotion to full professor, the degree of attention given to publishing in higher education rankings—both for disciplinary departments and across the university—heightened the “publish or perish” pressure. With increased supply (journal articles), more journals rose to fill the increasingly specialized disciplinary spaces. And libraries’ acquisitions expenditures continued to grow to keep pace with the increased academic output.

Another “crisis” snowball came in the form of industry consolidation and market concentration practices, as publishers bought out the weakened societies, and then applied a powerful new market strategy—journal “bundling”—to improve the return on their investments. Bundling practices began with the so-called “Big Deal,” in which libraries promised to maintain their print subscriptions for a number of years in order to rent electronic access to digitized journals, and expanded over time to bundled eJournals. The major conglomerates—Elsevier, Taylor & Francis, Pearson, Wiley—all have their roots in early academic publishing (of the top 12 academic publishers, only Thomson was founded after 1900), and they largely control the journal industry.^[25]

The steep pricing increases for journals (e.g., 600% between 1984 and 2002 for science journals) forced academic libraries worldwide to struggle to meet local user demand for these increasingly expensive journals. Libraries responded by cutting other materials—especially books/monographs—which shifted the immediate crisis onto the shoulders of the University Presses, which primarily published scholarly monographs and edited volumes, and depended upon library-based purchases of those books to meet their basic production costs.^[26]

Although there is much debate about these and other causes (and culprits), most players agree today that the established order of academic publishing has been shaken. In the emerging, increasingly digital, publishing landscape, there is a mix of old and new voices—both within the academy (faculty, students, administrators, university presses, libraries, IT divisions, research centers) and beyond it (societies, nonprofits, commercial publishers, consortia). The groundwork laid by these players today will provide the foundation for the next generation of scholarship—making this a critical moment for scholarly communications.

It is also a critical moment for the Library as an institution. As documented by Walters and Skinner in the 2011 ARL report “New Roles for New Times,” academic libraries are demonstrating the value that information managers (librarians) bring to the full lifecycle of scholarly communications, including digital content production, dissemination, and preservation.^[27] Academic libraries are uniquely positioned to help their parent institutions advance their core missions of producing, sharing, and preserving new knowledge in the digital realm and within this evolving publishing landscape.^[27] Providing services that support scholars’ growing needs in these areas is mission-critical for the Library. Arguably, it is also crucial for the health of the research communities it supports.

ACADEMIC LIBRARY PUBLISHING TODAY

Libraries have a core role on university and college campuses, where they often provide information services to every academic program and department on campus. They are viewed as sources of authoritative information, and they have staff members who are knowledgeable in many aspects of information management, including the creation and hosting of systems designed for its preservation and dissemination. In this context, library publishing services are emerging in a number of forms and in a range of institutional contexts, usually in direct response to faculty and student requests.^[28]

As campus demands for publishing services increase, libraries are formalizing activities that they previously undertook as either grant-based projects or with seed funding from operations budgets.^[28] Where a university press is present (which is now only in about 100 of the

2500 U.S.-based colleges and universities, as one measure), collaborations between the press and library are becoming more prominent, especially on digital publishing activities. In nearly a fifth of these institutions, the university press is being reframed as a formal partner of the library, including through the merging of the university press with the library (see, e.g., Purdue University, University of North Texas, Penn State, Utah State, Syracuse, and Oregon State). Despite the different forms library publishing activities have assumed to date, these programs share a growing commonality of philosophy and approach combining traditional library values and skills (such as a concern with long-term preservation, expertise in the organization of information, and commitment to widening access) with lightweight digital workflows to create a distinctive “field” of publishing activity. As attention to additional content types increases (e.g., “Big Data” and “small data” and everything in between), the value of information management skills in publishing and preserving this content will likewise increase.

Among the emergent focal areas of libraries is hosting a suite of digital publishing services for faculty, staff, and students in support of the research, learning, and engagement goals of the institution. The products disseminated are often (but not always) open access, and they generally include both peer-reviewed electronic publication types such as eJournals and scholarly monographs, and less formally reviewed materials such as technical reports and database-driven websites. Some library publishing programs also include a particular focus on experimental forms of scholarly communication, such as the products of digital humanities research. These new forms of scholarship often involve multimedia components and require innovation in software platforms. Publication of all of these content types requires the establishment of workflows that add value to the raw material.

Missions and Motivations

Publishing has emerged as a strategic service area as libraries identify unmet needs and dissatisfaction with existing processes. Karla Hahn’s 2008 study noted that “library-based publishing programs are pragmatic responses to evident needs, not services in search of clients.”^[20] Libraries receive direct requests from faculty and students who lack sufficient resources within their home departments. Additionally, libraries recognize the value of content that is not published through traditional channels (e.g., gray literature, data, scholarly websites); the need for an alternative to traditional publishing models in response to problems with the current system (e.g., escalating journals prices, restrictive author agreements); and the opportunity to complement existing publishing services on campus, which may have different audiences, goals, and models. Finally, libraries are invested in supporting their stakeholders throughout the academic process.

Methodology and Practices

The LPC project team launched a survey of library publishing practices in Spring 2013, focusing primarily on North America. More than 110 academic libraries provided responses regarding their publishing practices, ambitions, and collaborations. The responses were edited and compiled for publication in the 2014 “Library Publishing Directory,” which provides the first comprehensive view of the publishing support and services offered today by a broad range of academic libraries. A number of important findings regarding current practices in the field emerged from the data collected. Some of that data is reported here, along with findings from previous surveys of the field.

Core Services

Libraries have decades of experience in building, implementing, and maintaining technical infrastructure for digital content. Maintaining the Institutional Repository or publishing platform used to host publications is the basic level of service provision for library publishers.

Other core publishing services build on libraries’ traditional strengths, including facilitating access, discovery, and preservation. In a *Library Journal* interview, Charles Watkinson described libraries’ “strong focus on enriched and standardized metadata, the leveraging of digital repository systems, and integration with other library services, especially those concerned with research data management and special collections.”^[29] The LPC survey supported this description. More than three quarters of respondents said that they provide metadata (85%) and digitization (78%) services, cataloging (67%), DOI assignment (42%), ISSN registration (40%), Open URL support (28%), and analytics (62%). Other services, such as author advisory on copyright (78%) and other subjects (32%), and other types of training (66%), build on librarians’ strengths as educators and advocates.

A smaller, but still substantial number of libraries offer services that support the editorial and production processes that are hallmarks of traditional publishing. These include peer review management (29%), copyediting (23%), typesetting (20%), print-on-demand (16%), and graphic design (42%). Finally, some libraries support business model development (13%), budget preparation (6%), and contract and license preparation (28%).

Organization and Staffing

Library publishers range in size and stature from prominent, well-staffed, institutionally based groups (e.g., Michigan’s MPublishing, Columbia’s Center for Digital Research and Scholarship) to collaborative units across multiple campuses (e.g., the California Digital Library’s eScholarship service) to small programs with great

impacts (e.g., programs at Pacific University and Illinois Wesleyan University). Currently, there is no dominant model for the organization of publishing services in libraries. In many institutions, services are distributed across multiple library units or even across campus. The lead unit varies dramatically (from Scholarly Communications, to Technical Services, to Special Collections). Staffing also varies widely, but the LPC survey demonstrated that operations remain lean. Libraries reported between .1 and 8 full-time equivalent in library staff who are directly involved in publishing services. Many libraries also employ graduate and undergraduate students to support their publishing activities.

Business Models

Libraries support publishing efforts primarily through their operating budgets, though, as Karla Hahn previously reported, libraries typically rely on at least two funding streams, which include “grants, charge-backs to units or organizations, royalties and licensing fees, print-on-demand revenue, and other forms of sales of some kind.”^[20] Because libraries show a strong preference for open access models—95% report being focused mostly (48%) or entirely (45%) on Open Access—most do not rely on subscription or sales revenue to support the bulk of their activities. Libraries are experimenting with a number of ways to make their publishing operations sustainable. Some libraries sell content (either at-cost or for a profit) through e-commerce sites like Amazon.com, through publishing platforms like Tizra and Bibliolabs that support payment, or through their own websites in digital and print-on-demand formats. Libraries are also establishing partnerships with other libraries, non-profits, scholarly societies, and others in order to effectively share resources and distribute costs.

Partnerships and Collaboration

Libraries collaborate with a range of internal and external partners in order to sustain, expand, and enhance their publishing services. Internally, libraries routinely work with individual faculty and students across campus, with specific departments or research centers, and university presses. Library and university press partnerships have been explored in detail, most notably in a 2009 Scholarly Publishing and Academic Resources Coalition (SPARC) report, which offered case studies and considerations for collaboration.^[18] These partnerships range from libraries digitizing backfiles of university press titles to cooperating on the publication of original monograph series.

Externally, libraries work with scholarly societies, non-profits, faculty on other campuses, individual libraries and library consortia, and others. Notable examples of external partnerships include the eJournal *Elementa*, a collaborative endeavor of the non-profit BioOne and five academic

institutions and the Open Folklore Project a collaboration of the American Folklore Society, the Indiana University Libraries, and the IU Digital Library Program.^[30,31]

Maturity

While publishing services have recently attracted much attention, libraries report that they have been offering these services from as early as 1960. According to the recent LPC survey, 10 libraries began publishing in 1999 or before, 14 started between 2000 and 2004, 39 between 2005 and 2009, and 25 since 2010.

HOT TOPICS AND DEBATES

A range of experiments, frictions, and open questions has emerged as this young field defines its boundaries. A few of those are discussed here.

ESTABLISHING CREDIBILITY AND IDENTITY

While library publishing endeavors in some cases resemble traditional scholarly publishing operations, they frequently offer a distinct set of core services, embrace an expanded range of content types, and pursue a different set of goals. These differences prompt reflection on what publishing means in a new scholarly communications landscape. For example, libraries frequently disseminate original content such as ETDs, scholarly websites, and data sets, which do not undergo the processes of editing and review that remain the hallmarks of scholarly publishing. When publishing eJournals, monographs, and other traditional content types, operate with digital-only, Open Access models, and produce on a very small scale. Like other Open Access publishers, libraries are actively working to establish the credibility of their publications and encourage widespread uptake from both content creators and other publishers. Some have objected to the use of the term “library publishing” because it may be used “to ghettoize what’s happening” in libraries, further hindering efforts to be taken seriously by other publishers and the academy.^[32]

Scholarly Publishing and the Academy

The idea that the academy could or should reclaim ownership of the publishing process has generated significant debate in the scholarly and publishing communities. Debates have centered on both the desirability and feasibility of colleges and universities replacing or competing with commercial publishers.^[33] Barriers to achieving significant change to the current scholarly publishing system include the relatively small scale of campus-based publishing operations and the reluctance of scholars to change

their publishing practices (often due to promotion and tenure considerations). A 2012 CLIR/DLF-funded report argued, “If libraries are searching for transformation in scholarly publishing, small, individual efforts will not meet that goal. Collaborative efforts between institutions and with their presses may actually build a critical mass.”^[34]

Relationships with University Presses

As more libraries and university presses explore collaboration, partnerships, and/or administrative ties, there has been discussion of the nature of these relationships and the benefits and challenges of bridging the gaps between the distinct strengths of each. In the 2009 report on library and university press collaborations, Raym Crow noted that, “As their roles continue to evolve, the boundaries separating the activities of the library and the press have become less distinct.”^[18] Libraries have adapted to meet changing scholarly practices and to demonstrate their value to the research enterprise, while presses have responded to changes in publishing, most notably the shift from print to digital. While many examples of successful collaborations exist, a range of tensions and obstacles make this a fraught area. Challenges include the different business models of libraries and presses (the former operates primarily through subsidies, while the latter relies substantially on sales revenue), and structural issues (e.g., reporting lines within universities, and evolving models of collaboration at both system- and campus-based levels).

Sustainability

Libraries operate with a different set of financial expectations from traditional commercial publishers and university presses. Financial support comes primarily from the library’s operating budget. Library publishing services may not be required to turn a profit or even recoup their costs, and the majority does not directly charge content creators for services. Many libraries work with streamlined digital-only or digital and print on demand models that reduce some of the costs of traditional publishing (e.g., maintaining an inventory, investing heavily in marketing). But costs in staff time and technology remain substantial. Particularly given libraries’ preference for Open Access publication, how will libraries ensure that publishing services remain viable in the long-term? Where does money come from to expand services, hire new staff, or invest in new technologies?

CONCLUSION

Over the last few decades, library publishing has evolved from involvement in Institutional Repositories and *ad hoc* digital projects to a full set of services that support the

publication of a range of content types. It has gained traction as a response to the needs of authors and library users and as an outgrowth of libraries' traditional skills and their commitment to supporting scholarship. Today, it is clear that "library publishing" is a meaningful term, one that denotes a growing area of scholarly communication activity.

As this work continues to expand, libraries—like all “publishers”—will continue to confront a difficult and rapidly changing publishing landscape. Libraries today are working to articulate clearly their value proposition and business model(s), and demonstrate how the services and models they offer can help stabilize the scholarly publishing ecosystem. As part of this work, they are also cultivating and strengthening their relationships with each other, as well as with other stakeholders in this space, including scholarly societies and university presses. These strategic alliances will help to ensure that the overall scholarly communication apparatus is able to continue evolving at pace with the research and knowledge produced across academia.

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Encyclopedia of

Library and Information Sciences, Fourth Edition

Volume 5

From: *Library Science in the United States:
Early History* To: *Philosophy of Science*

Encyclopedia Edited By

John D. McDonald

and

Michael Levine-Clark



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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable. Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

They acknowledge and thank the Taylor & Francis Group editors, Claire Miller and Rich O'Hanley, as well as Susan Lee, who passed away at the early stages of the preparation of this edition, and more recently, Alexandra Torres, who supported and kept the editors and authors on track over the course of the years of work on this edition of the encyclopedia.

The editors thank the authors who wrote and revised entries, and the huge number of reviewers who refereed the entries. Without their dedication, expertise, and willingness to share their knowledge with others, there would be no encyclopedia. They also wish to thank the Editorial Advisory Board for their advice, suggestions of topics and authors, their hours spent writing or reviewing for the final edition. They also wish to thank the previous editors, Marcia Bates and Mary Niles Maack, whose organization and structure for ELIS-3 provided an excellent blueprint for ELIS-4.



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Library Science in the United States: Early History

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Abstract

The narrow purpose of this entry is threefold: 1) to identify the key events and players in the origin and early development of the discipline of library science in the United States (and perhaps North America more generally, but certainly not Europe, much less India, other than to mention its origins in Germany); 2) to describe the intellectual foundations and history for the discipline of library science as developed at the University of Chicago's GLS; and 3) to briefly identify the knowledge and skills as well as values associated with this emergent field. Strictly speaking, therefore, it is not a discourse on computer science, informatics, information science, information studies, or for that matter, the history of librarianship nor books and libraries; neither is it a history of literary endeavors, printing, writing, or scholarly communication per se, but rather it is an introductory orientation to a highly specialized field of knowledge.

INTRODUCTION

Library science has its origins in early nineteenth century Germany, notably as *bibliothekswissenschaft*. Despite the fact that thousands of Americans studied in Germany before the World War I, Schrettinger^[1] and Schmidt^[2] are unknown or forgotten today; elsewhere, someone might answer the provocative question: “whereas Germany hugely influenced US universities, almost all disciplines, and university research, what was the German influence on library science in the United States?”^[3] The narrow purpose of this entry is threefold: 1) to identify the key events and players in the origin and early development of the discipline of library science in the United States (and perhaps North America more generally, but certainly not Europe, much less India, other than to mention its origins in Germany); 2) to describe the intellectual foundations and history for the discipline of library science as developed at the University of Chicago's GLS; and 3) to briefly identify the knowledge and skills as well as values associated with this emergent field. For a detailed chronology of significant events in education for librarianship rather than a discussion of three major thematic elements, see Appendix A.

In other words, the scope of this entry covers only the field as it developed in the United States: as the profession of library economy first, with a strong emphasis on efficiency in library techniques due to the influence of Melvil Dewey at the New York State Library in Albany. In the later nineteenth century and into the first quarter of the twentieth century, the field also adopted certain overtones of the Social Gospel movement as librarians viewed themselves as “apostles of culture”^[4] and the field embraced the cult of efficient and scientific management under the influence of F. W. Taylor and Charles McCarthy.^[5]

Importantly, though, the outdated nineteenth century natural history worldview based upon Enlightenment ideas: “Let's see what's there and we'll record it,” did not survive as the principal means of knowing, but that heritage or genealogy is still occasionally present and or at least lamented in some quarters.

In what I wish to call its protohistory, library science then, evolved out of a library apprenticeship or a silent reading on one's own like the early study of law. Indeed, many practitioners adopted a kind of intuitive approach until Melvil Dewey's school at Columbia College appeared on the scene in the last decades of the nineteenth century Wiegand^[6]—as a side note, most early programs of librarianship were affiliated with academic or public libraries and provided their students with firsthand, practical experience with, and knowledge of, these library collections; given this American pragmatism (i.e., the practical problem solving orientation of their teachers and their students), it is not surprising that these programs produced little, if any, research per se, unless the compilation of descriptive, annotated bibliographies counts as research.

Certainly, this early kind of “library science,” with its emphasis on applied workability and scientific knowledge, was based on a notion of American exceptionalism, which is “the idea that America occupies an exceptional place in history, based on her republican government and wide economic opportunity” Ross.^[7] In other words, library science then was one of those rather American social sciences which began coalescing in the late nineteenth and early twentieth centuries as part of the move to professionalize vocational activities and as such would include dairy science, management science, military science, mortuary science, political science, and even creation science/intelligent design today. In the early twenty-

first century, the term is still used interchangeably with librarianship, library and information science, and perhaps even information science, but there are important semantic differences. So, this entry will define what library science meant to a group of practitioners and professors after the turn of the twentieth century.

In Chicago during the late 1920s, a group of local librarians rallied for something more substantive than the existing institutionally based library programs after the appearance of the highly influential C. C. Williamson Report of 1923, which argued for dividing library clerical tasks from professional ones. Education for the latter, Williamson argued, should take place in universities where instructors would hold higher academic degrees and have had prior teaching experience. Hence, a so-called advanced or “Graduate Library School” was established at the University of Chicago to meet the Association of American Universities’ standards, and which imbued a more exact meaning to this previous hollow phrase.

By “library science,” they now meant the scientific study of the intersection of books and people.^[8] In other words, attention shifted away from a library economy and its focus on institutional structures and processes to the user of the library—as an aside, American glossaries may have dropped the phrase “library economy” in the late 1920s, but *bibliothéconomie* remained in French with its equivalents in other Romance languages.

Notably, the first Graduate Library School faculty at Chicago, under the leadership of George Works, embraced the twin concepts of original, independent research and promoted the publication of the results of their investigations (notably, diffusion via books in the “Studies in Library Science” series and in refereed articles in journals such as the *Library Quarterly*). Carleton B. Joeckel’s *The Government of the American Public Library* of 1935, part of this SLS series, is particularly noteworthy for drawing upon political science for its theoretical orientation; according to some international reviewers, this work “at once placed American library research on a higher plane. . . [and, as a result, it] received the James Terry White Award in 1938 for ‘notable published writing.’”^[8]

In January 1931, the school published the first issue of *The Library Quarterly*, a double blind refereed “journal of investigation and discussion in the field of library science,” edited by William M. Randall, who was assisted by a distinguished international advisory board. Rather than serve as a news magazine like the extant publications, the *LQ* was intended to strengthen the scientific underpinnings of the profession by stressing the social significance of the library rather than its internal operations and by publishing “exploratory rather than merely descriptive articles.”^[8] To understand this new conception of research, one need only read the lead article: C. C. Williamson’s “The Place of Research in Library Service.”^[9]

The journal was edited at the University of Chicago until Stephen Harter (PhD, Chicago) at Indiana University took over in October 1990; John Richardson at UCLA served as editor from 1994 to 2003; next, Wayne Wiegand and John Bertot of Florida State University served as coeditors from 2003 to 2008; and from October 2008 to the present, John Carlo Bertot and Paul T. Jaeger serve as coeditors.

LQ, though still respected, has long since lost its absolute preeminence in the field with the rise of such scholarly journals as *College and Research Libraries* (1939), *Journal of Documentation* (1945), and the *Journal of the American Society for Information Science and Technology* (formerly *American Documentation*, 1950). Nonetheless, to understand more fully the role and contribution of the journal over time, one should consult Arthur P. Young’s 2006 *LQ* article which identifies *LQ*’s leading contributors (i.e., Howard Winger and Lawrence Thompson), the most cited authors (i.e., Don Swanson and Abe Bookstein), and the most cited articles (see his top thirty list presented as table five) between 1956 and 2004.^[10]

KNOWLEDGE AND SKILLS (OBJECTS OF STUDY)

The essential skill provided by librarians, curators, archivists, and others is the provision of information, especially via organized collections of reading materials. Hence, how one might best provide this information is the main problem. Concomitantly, the dual mission of this field is to ensure the preservation of such materials (thus, the leading intellectual question is: what should you save, if you can’t save everything?) and then delivering access to these materials (hence, the main intellectual question is: how to best do so, given the variety of formats and technologies?). Therefore, these are the two primary theoretical questions which one must answer.

Historically, these skills demanded a knowledge set related to bibliographical access control: 1) bibliographical description (aka rules for cataloging) and 2) bibliographical arrangement (aka systems for classification) as well as infrastructural concerns (such as the proper administration and management of complex institutions); furthermore, the desire for more scholarly librarians, ones capable of creating new knowledge about the interaction of books and people, required the use of statistical techniques and interpretive models (drawn from history or cultural anthropology, in particular).

Once highly valued by bibliographers and librarians in the nineteenth century, the compilation of bibliographies (even rigorous or systematic annotated ones) came to be viewed as merely the parent of real research, as merely the first step prior to solving a research problem. At Chicago, Waples’ graduate courses in research methods drew upon interdisciplinary sources including history (i.e., of books,

libraries, and printing), psychology (i.e., of the patron, reader, or user's information seeking behavior), and sociology (i.e., a rigorous and systematic community analysis or needs profiling is necessary prior to building diverse, useful or viable collections of materials for library users). Now the classic methods textbook, Waples' 1939 *Investigating Library Problems*, with its emphasis upon the validity and reliability of evidence, served several generations of graduate students. In essence, this text and his course inspired the confidence of young researchers to conduct research independently; to communicate and thereby share their findings; pursue adaptive, critical, and reflective thinking; undertake logical problem solving; and respect for the diversity of opinions. Library science would not develop its own unique methodologies until the introduction of a kind of statistical bibliography, also known as bibliometrics or citation counting, until the 1950s. And even so, that is still debated by some writers who attribute its true origins to psychologists in the early 1900s; clearly, though. E. Wyndham Hulme coined the phrase "statistical bibliography" in 1922–1923 and such work appeared in the *Bulletin of the International Institute of Bibliography* as early as 1911. This point is important to those who hold that to be considered a discipline, library science must have its own unique methods.

To achieve what Harvard University had done for law and what Johns Hopkins University had done for medicine, then a true "library science" would have to be offered at the graduate level. There would be no place for the holder of a high school degree or some mere technical/trade school curricular orientated worker (which would produce a technician who knew how to do something, rather than a professional who also knew why do something in the first place by investigating the philosophical underpinnings of such actions). In other words, what some graduate educators sought was a diagnostician of professional tasks, not a mere mechanic suited to routine library clerical tasks.

So, in the mid-1920s onward, the American Library Association's Board of Education for Librarianship, influenced by the Williamson Report, mandated a set of admissions requirements to accredited programs of librarianship. One of the explicitly, stated entrance requirements now included a college degree (commonly held in English literature, American history, or a western European foreign language—a social science major, if present, was rather more common than the natural or physical science backgrounds of the small remainder of applicants). This stance is well articulated in Pierce Butler's *Introduction to Library Science* and Douglas Waples' *Investigating Library Problems* which taken together, established an epistemological stance toward our activities—with a good science and good practice, things should take care of themselves.

As expressed in Butler's *Introduction*, the scope of library science covered the sociological problem (e.g., the role of books in society), the psychological problem (e.g.,

the psychological motive for reading among individuals or the effect of reading on the reader), and the historical problem (e.g., the literary history of scholarship). By the 1990s, increased interest was paid to the distinction between tacit and implicit knowledge as well as the difference between declarative (i.e., know what) and procedural (i.e., know how) knowledge.

The relationship between the empirical knowledge as generated by GLS faculty and its doctoral graduate students and the practical knowledge which could be applied by practitioners is most clearly demonstrated in their Annual Library Institutes beginning in 1936. Topics are those of pragmatic interest to practitioners and cover such topics as book selection (1939), acquisition and cataloging (1940), and reference service (1943). For more thematic issues, one can consult the list of these annual institutes through 1951 in Appendix B.

TYPES OF LIBRARIES (INSTITUTIONAL INFRASTRUCTURES)

Early education for librarianship in the late nineteenth century possessed a strong applied or pragmatic work orientation due to its being situated within the institutional framework of a local public or academic library. At the University of Chicago, the new appointed faculty members, except for Pierce Butler who came from the Newberry Library and Harriet E. Howe, a peace offering to American Library Association, were not library practitioners. Rather they held degrees in various academic disciplines including education (Howe and Works), educational psychology (Waples), ecclesiastical history (Butler), linguistics (Randall), and philological studies (Wilson). Nonetheless, they continued to teach about types of libraries: college (Randall and Wilson); public (Wilson and Joeckel), and school (Waples).

GLS graduates also played an important role in shaping American education for librarianship, as they became deans and directors there and in the other leading programs across the nation: Bernard R. Berelson at the University of Chicago; J. Periam Danton at UC, Berkeley; Raynard Swank at UC, Berkeley; Jesse Shera at Case Western Reserve University; and Ralph Shaw of Rutgers University.

Later in the 1950s, library science programs, such as those at the University of Michigan and the University of Illinois, downstate at Urbana-Champaign (and populated with GLS alumni including Thelma Eaton, Herbert Goldhor, Rose Phelps, and Mary A. Lohrer), would shift their curricular emphasis from types of libraries to library services (which would include functional activities such as abstracting and indexing, acquisitions, cataloging and classification, collection development, outreach to underserved populations, programming, reader's advisory, and reference work). Most recently, the curriculum has shifted yet again, this time to the role of information in society.

VALUES

As articulated in Butler's *Introduction*,

a scientist always selects the field of his observation. In his eyes not all facts are of equal importance. He does not devote his days to the endless multiplication of his sensual perceptions in the hope that perhaps something new will come to his notice. . . . His professional ambition would prefer that his name should be used to designate a new theory than any number of previously unrecorded species. His concern is, first of all, functional significance. He has also a perverse curiosity about the unexplained.^[11]

In the narrowest institutional terms, Butler's classic work helped the library profession understand the mission of an Advanced, Graduate Library School, serving as an aspirational document of what the GLS's goals and objectives were. Concomitantly, Waples research methods textbook is a companion piece on how to undertaking reliable and valid social science research. Waples recommends that a would-be researcher focus on stating a research problem, examine the validity of evidence, draw an adequate sample to ensure reliability, and pay attention to sources of evidence.^[12] Basically, Waples' text offered readers a structured way of thinking about the field of library science.

Many thoughtful writers today suggest that library science has been shaped by an instrumental, positivistic social science during its Chicago years. Despite later claims of being value-free or neutral (which necessarily arise when talking about the need to build balanced collections of library materials, at least if one wishes to be respectful of the diversity of different points of view and provide these different perspectives on socially controversial matters), a complex constellation of values exists (namely, the perceived need for preservation and the concomitant access services for library users and their right to know as well as equity of access; literacy is foundational for the preceding, but not numeracy per se; rights to privacy and free speech, contextualized inside a democratic society, often associated with a liberal or advanced capitalism). In short, many of us believe that it is better to be informed than ignorant because access to information reduces social inequities.

One of the best examples is the *Public Library Inquiry* of 1949^[13] which posits the American public library as a democratic institution, responsible for social equalization. Many librarians would agree with the following belief statement (aka articles of the Library Faith): that the act of silent reading of nonfiction as well as fiction is desirable; libraries should avoid censorship and support intellectual freedom by offering a balanced or unbiased collection of authoritative or at least credible materials, be public, free of direct use fees; furthermore, these cultural nonprofits are good or desirable while large, for-

profit companies are bad (if not, lazy or even evil)—or simply put, many librarians would respect intellectual property rights (but support the notion of fair use within the bundle of copyrights), yet oppose the increasing “commodification” of information, a term which dates to the 1970s.

Controversy exists about the proper role of pure versus applied problem solving; see, for example, Works' cooperative research agenda proposal.^[14] Likewise, Butler initially argued for a strongly interdisciplinary approach, drawing upon the three academic disciplines of history, sociology and psychology.^[11]

Like other research university disciplines, though, original, independent research in the form of a dissertation or thesis is still expected, if not valued, as is the desirableness of seminars, or scholars' workshops, over large classroom lectures (although popular, asynchronous online courses as offered by some LIS programs may be cited as a counterexample). Despite some antagonism at the outset and continuing today because one's research agenda may be set by the agency or philanthropic organization, nonetheless, the role of extramural funding is significant in research universities (note that the Chicago GLS got its start from the Carnegie Corporation with a one million dollar grant); and in situ, may explain, at least partially, the rise of the I-school movement.^[15] Perhaps someone else should write on its origins in the research university because it is out of scope for this entry on library science. Certainly, a recent tension has emerged between two models—the scholarly professor and the research professor. Early on, the former model, aka the “lone wolf” model (i.e., an independent scholar working alone in the library/archives writing a monographic volume, published by a leading university press) dominated the discipline of library science. Later, the field witnessed a shift to the other model, which may have begun with the introduction of information science into the more traditional library service programs in the 1960s and 1970s. At this time, another group of individuals, largely from mathematics (such as Robert M. Hayes) and the physical sciences (such as Don R. Swanson) were hired into library science programs, and with them came an interest in extramural funding, a strong sense of the need for collaboration, a major role for microfilm and computer technology including punch cards, and a rather ahistorical approach to the profession. They called themselves information scientists (note that one rarely encounters a library scientist).

Perhaps the rise of superior Soviet technology in the late 1950s (notably, the successful launch of Sputnik, the first man into space, as well as the first ICBM), caused the U.S. Congress to pass the National Defense Education Act of 1958 and in turn caused the federal government to spend even more on competitive research grants in higher education, benefiting the information science types in library programs; certainly, there is also evidence of the Cold War, the National Science Foundation, and Big

Science before these events, however, which could also explain the large-scale U.S. federal grant making.

Doug Raber's *The Problem of Information: An Introduction to Information Science*^[16] brings a strongly humanistic orientation to the discussion of representation of information, relevance, and the value of semiotics. Likewise, the library science field has embraced the inclusion of archival sciences in the 1980s and informatics (not to be confused with computer science) in the 1990s. Since computer science focuses on algorithmic solutions to improving the speed and space domain of computation, library science stresses the more humanistic interests (or, the people aspects) in the intersection of science, technology and society.

Philosophically speaking, library science researchers believe that things can be measured; on the other hand, that may well beg the more fundamental question of what cannot be measured. The differing methodological orientations have caused the discipline to divide into two camps at times: the “quals” versus the “quants.” The desire for universalistic abstraction (rather than mere descriptive chronologies of the local library^[17] can be cited as a model in this regard) has been problematic even in the historically oriented side of the house. In any event, however, the fundamental unity in library science lies in the rigorous, spirit of inquiry as articulated at Chicago. The following example from the 1930s of Leon Carnovsky's spirit of inquiry is illustrative: while walking on the Midway with Wilson, Carnovsky challenged on the vendors hawking an expensive cigarette lighter called the everlasting match. “See here, Mister, there is something wrong with that assumption. If one match is everlasting, why get three?”^[8] By the mid-to-late 1930s, Butler had begun to recognize a possibly fatal flaw in the GLS approach mainly that of scientism, the overly narrow focus on only the quantifiable aspects of the field. He wrote on this topic in 1941 and again in 1951; by then, he had become absolutely convinced that

there was no room for humanistic concerns in this new world view. Although [Butler] believed that the GLS's ‘highest intellectual achievement was the establishment of library science on a sound basis in a few areas,’ the humanistic side of librarianship had been displaced by practitioners of a narrow objectivity. Librarianship had, in fact, been replaced by a pseudo-science in Butler's opinion. Ideas were supplanted by facts, or even worse, by mere data. The field risked becoming truly anti-intellectual, lost in ‘the simplicity of its pragmatism.’^[11]

CONCLUSIONS

“Within the recent past, librarianship had placed a heavy emphasis upon tradition and custom as a way of doing things.”^[11] Yet, many of these earlier works by bibliographers and librarians were viewed as “too practical and

obvious to merit” attention in a research-oriented environment like the American university,^[8] nonetheless the introduction of a library economy, similar to home economics or domestic science, by Melvil Dewey and other events in 1876 are two of the important watershed events in the history of library science. In addition, the establishment of the Graduate Library School at Chicago was a pivot watershed event in the establishment of a real library science in the United States and the subsequent professionalization of education for librarianship. At Chicago, early writers

described library science ‘as the science of the care and use of books both for the control of knowledge already in existence and for the discovery of new knowledge through researches in books themselves or with books in connection with other sources of information’...Waples, as acting dean, in 1931 defined research in library science as ‘extending the existing body of knowledge concerning the values and practices of libraries in their many aspects, and including the development of methods of investigation whereby significant data are obtained, tested, and applied.’^[8]

The affiliation of a program with a research oriented university like the University of Chicago imparted a more theoretical dimension to librarianship; the key players and staunch supporters of this movement include the early GLS faculty such as George Works, William M. Randall, Douglas Waples, and Pierce Butler (at least until near the end of his life, when he began to have grave doubts). GLS alumni, such as Herbert Goldhor, also played a role in the adoption of social science research methodologies.^[19] In short, I have argued that the American notion of library science is largely a creation of the GLS at Chicago. I have not intentionally ignored other library science programs, or Shera's foundation of a new kind of school at Case Western Reserve University, where the introduction of graduate studies in what became known as documentation led eventually to the idea of an information science. Simply, these ideas are out of scope for the purposes of this entry.

More recently, writers, notably John Budd,^[20] have remained optimistic about the role of hermeneutical phenomenology (“which combines a kind of realism with understanding of the dynamics of human action and perception”) which brings a sense of intersubjectivity to combat the repressive aspects of scientism in library science.

Whether ‘books’ was too narrowly understood [at Chicago] to mean the codex rather than the ‘generic book,’ thus ignoring scientific report literature and giving rise to the new intellectual discipline of information science, is outside the scope of this article (although there appears to be evidence for this hypothesis).^[8]

The introduction of library automation in the 1960s buoyed the field.

Likewise, information studies (a recently emergent dimension) seems to offer the softer intersection of information resources, information technology processes, and user needs. Yet, the recent discussions of a humanistic I-school seem strongly reminiscent of this library science as understood by the University of Chicago and their being situated in large research universities will influence much of their research agenda. Of course, only time will tell if this “school of thought” holds up. Certainly, the intellectual history of specific programs is yet to be written; a notable one would look at the aggressive expansionism at Berkeley by Danton followed by the underestimated intelligence and strategic shrewdness of Ray Swank.^[3]

More than ten years ago, a fellow encyclopedist observed that

although research in library science has come a long way, it still has not reached the maturity of other disciplines. . . [and struggles with] an academically imposed inferiority complex and linguistic dilemmas on the meaning of research for an applied and service field^[18]

and it is hard to disagree with his assertions. In fact, the continuing relevance of a “library science” to an information society remains an open question and Blaise Cronin has provocatively asserted that “there is, and can be no such thing as ‘library science.’”^[21]

ACKNOWLEDGMENTS

This work benefited from the comments of two anonymous reviewers as well as one of the editors, Mary Niles Maack. In addition, I greatly appreciate the fact that Larry Olszewski; Boyd Rayward; John Budd; and Michael Buckland answered my questions, contributed ideas as well as took the time to read and comment on an earlier draft of this entry.

APPENDICES

A. CHRONOLOGY OF SIGNIFICANT EVENTS IN EDUCATION FOR LIBRARIANSHIP

1870s

1879, May: Melvil Dewey suggests a “librarians’ college” which would be attached to a normal school with a considerable library.

1880s

1883, August: Dewey proposes school of library economy at Columbia College.

1886, July: Dewey announces his school will open in October at Columbia College.

1887, 5 January: First class in library economy offered at Columbia College.

1888: Dewey argues for correspondence courses in special library and small library services (hence, first distance education program).

1889: First class graduates from Columbia College; school transferred to New York State Library in Albany on 1 April; August: Annie C. Moore argues for special training of children’s librarians.

1890s

1890, June: Pratt Institute, Brooklyn offers its first class in cataloging followed by library economy courses.

1891: Drexel Institute started offering library economy courses.

1893, September: Armour Institute Library Class first term under direction of Katharine L. Sharp in Chicago.

1895: First separate course in government publications offered by F. Jackson at Armour Institute.

1897: Transfer of the Armour Institute to University of Illinois, Urbana.

1898, August: New York State Library’s Library School offers specialized instruction for law, medical, education, and engineering librarians.

1900s

1901: Carnegie Library of Pittsburgh establishes Training School for Children’s Librarians; Western Reserve proposes library school.

1902, August: Four year library training class announced by Simmons College, Boston.

1903: New York Public Library establishes training class; Western Reserve receives endowment for library school from Andrew Carnegie; American Library Association’s Committee on Library Training recommends correspondence work offerings

1905: Melvil Dewey suggests that only three schools are needed: one at Albany, one in Midwest, and another at the University of California; University of Washington offers their first annual summer school for library training; Syracuse University establishes Library School; Andrew Carnegie tells library school class serve that “nowadays professionally trained people are needed.”

1906, June 16: First MLS (*honoris causa*) degree conferred at SLS, Albany.

1907: Library School faculty from various schools met for the first time at Asheville, NC, American Library Association Convention (ALA).

1910s

1911: Roundtable of Library School Instructors formed in ALA.

1915: Association of American Library Schools founded.

1919: University of Texas establishes School of Library Science; September: Andrew Keogh (Yale) argues that academic librarians need advanced library training; Charles C. Williamson publishes ground-breaking *Some Present-Day Aspects of Library Training*.

1920s

1922: Charles C. Williamson transmits "Training for Library Work" to Carnegie Corporation.

1923: Williamson's *Training for Library Service* appears in print; ALA's Executive Board appoints Temporary Library Training Board.

1924: ALA establishes Board of Education for Librarianship with Carnegie Corporation assistance.

1925: Tse-Chien Tai's "Professional Education for Librarianship," PhD dissertation, University of Iowa.

1926: Carnegie Corporation funds the first Graduate Library School at the University of Chicago, which offers first summer institute for Library Science; the Albany Library School and NYPL Library School merge and transferred to Columbia University.

1927: GLS at Chicago appoints George Works first dean; ALA launches Curriculum Study under the direction of W.W. Charters.

1928, Fall: GLS at Chicago admits students working toward PhD degree.

1929, April 12: George Works resigns as Dean of Chicago GLS.

1930s

1930: First PhD in library science: Eleanor Upton's "A Guide to 17th Century Materials in the Reports of the Historical Manuscripts Commission of Great Britain to Date" at University of Chicago.

1932: Louis Round Wilson appointed dean of Chicago GLS.

1933: Publication of Pierce Butler's *An Introduction to Library Science*; ALA Board of Education for Librarianship establishes qualitative Minimum Requirements for library schools.

1936: Two major studies appear: Ralph Munn's *Conditions and Trends in Education for Librarianship* and Ernest J. Reece's *The Curriculum in Library Schools*.

1940s

1942: Louis Round Wilson retires as Dean of Chicago GLS.

1943: Publication of Metcalf, Osborn, and Russell's *Program of Instruction in Library Schools*.

1946: Publication of Joseph L. Wheeler's *Progress and Problems in Education for Librarianship* and J. Periam

Danton's *Education for Librarianship*; ALA Council establishes Library Education Division.

1947: Harriet E. Howe moves the University of Denver program from a BLS to a one year MLS degree; Florida State University sends library science educators throughout the state in automobiles.

1948, 1 August: ALA's BEL suspends accreditation of library schools; University of Illinois and University of Michigan offer PhD program in library science.

1949: Twenty-seven of the thirty-two accredited schools adopt the new MLS degree (or in process of doing so); publication of Bernard Berelson's *Education for Librarianship*.

1950s

1951, July: ALA adopts new *Standards of Accreditation* making MLS entry level degree.

1952: Columbia University offers Doctor of Library Science.

1956: Western Reserve University offers PhD degree.

1959: Robert M. Hayes at UCLA teaches first course ever on information storage and retrieval; University of California at Berkeley offers PhD degree; ALA Council adopts Standards and Guidelines for Undergraduate Programs in Library Science.

1960s

1960: Rutgers University offers PhD degree.

1961: *Journal of Education for Librarianship* established; publication of Sarah Vann's *Education for Librarianship Before 1923*.

1962: ALA appoints Commission on a National Plan for Library Education.

1965: U.S. Office of Education establishes position of Library Education Specialist; NDEA Institute funds made available for school librarianship; HEA, Title II Part B provides funds for institutes and fellowships.

1966: ALA establishes Office for Library Education; UCLA establishes two year MSIS degree program.

1968: ALA's COA establishes subcommittees on undergraduate and graduate standards for accreditation.

1970s

1970: ALA Council adopts Library Education and Manpower policy (so-called Asheim statement); Publication of Hal Borko and Robert Hayes' *Education for Information Science* and C. Edward Carroll's *The Professionalization of Education for Librarianship*.

1972: ALA's COA establishes revised *Standards for Accreditation*; Jesse Shera's *Foundations of Education for Librarianship*; UCLA establishes two-year MLS degree incorporating MSIS degree.

1974, School of Information Studies, Syracuse University, established.

1975: Publication of Charles Churchwell's *The Shaping of American Library Education*.

1980s

1980: Publication of *The Conant Report: A Study of the Education of Librarians*.

1982: Publication of Richardson's *The Spirit of Inquiry, the GLS at Chicago, 1921–1951*.

1983: AALS changes name to Association for Library and Information Science Education.

1986: ALISE and ALA celebrates 100 years of education for librarianship in New York City.

1988: ALA executive Board endorses joining the National Council on Accreditation of Teacher Education as a specialty organization for the purpose of accrediting first professional degrees for school library media specialists.

1989: Library and Information Science Distance Education Consortium formed; Graduate Library School, University of Chicago, closes.

1990s

1990: ALA Executive Board appoints a Special Committee on Library Closings.

1992: *Standards for Accreditation*, 1992, adopted by the Council of the American Library Association; ALA president-elect, Marilyn Miller, announces Project Century 21, a major research and study project for the development of library and information science education.

1993: Columbia University, echoing its 1889 action, once again closes its School of Library Service.

1996, School of Information, University of Michigan, established.

2000s

2001, iSchool, University of Michigan, established.

2002, School of Information, University of Texas at Austin, established.

2005, First conference of i-School Community at Pennsylvania State University.

Sources: Updating John V. Richardson Jr. et al., *Chronology of Significant Events in Education for Librarianship, 1879–1986* (Chicago, IL: American Library Association Standing Committee on Library Education, 1987); John V. Richardson Jr. with Jane B. Robbins, reprint ed., *In Education for the Library/Information Professions: Strategies for the Mid-1990s*, edited by Patricia G. Reeling (Jefferson, NC: McFarland Publishing, 1993), pp. 73–76.

B. Annual Library Institutes Held in the GLS at Chicago, 1936–1951

Volume Number	Title of Institute	Dates of Institute	Volume Editor	Publication Date
1	Library Trends	3–15 August 1936	Louis R. Wilson	March 1937
2	The Role of the Library in Adult Education	2–13 August 1937	Louis R. Wilson	December 1937
3	Current Issues in Library Administration	1–12 August 1938	Carleton B. Joeckel	April 1939
4	The Practice of Book Selection	31 July–13 August 1939	Louis R. Wilson	February 1940
5	The Acquisition and Cataloging of Books	29 July–9 August 1940	William M. Randall	December 1940
6	Print, Radio, and Film in a Democracy	4–9 August 1941	Douglas Waples	February 1942
7	Reference Function of the Library	29 June – 10 July 1942	Pierce Butler	1943
8	The Library in the Community	23–28 August 1943	Leon Carnovsky and Lowell Martin	June 1944
9	Library Extension: Problems and Solutions	21–26 August 1944	Carleton B. Joeckel	1944
10	Personnel Management in Libraries	27 August–1 September 1945	Lowell Martin	1946
11	Library Buildings for Library Service	5–10 August 1946	Herman H. Fussler	1947
12	Youth, Communication, and Libraries	11–16 August 1947	Frances Henne, Alice Brooks, and Ruth Ersted	1949
13	Education for Librarianship	16–21 August 1948	Bernard Berelson	1949
14	A Forum on the Public Library Inquiry	1949	Lester Asheim	1950
15	Bibliographic Organization	24–29 July 1950	Jesse J. Shera and Margaret E. Egan	1951
16	Librarians, Scholars, and Booksellers at Mid-Century	1951.	Pierce Butler	1953

Source: John V. Richardson Jr., *The Spirit of Inquiry: The GLS at Chicago, 1921–1951*. Foreword by Jesse Shera, ACRL Publications in Librarianship, No. 42, American Library Association, Chicago, IL, 1982, p. 173.^[8]

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Library Technical Services

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Abstract

The entry describes the key functions of library's technical services (TS) components. It traces the history and the major developments that affected the evolution of TS. The entry highlights the progression of cataloging-related standards and the way technology impacts the current workflow and expectations for staff expertise.

INTRODUCTION

Technical services (TS) usually refers to the combination of the acquisitions, cataloging, and collections management functions of a library into one unit or department. Acquisitions are used to refer to the functional department responsible for all aspects of obtaining materials libraries acquire for their collections. Cataloging is used to refer to the functional department responsible for all aspects of describing, assigning subject headings, and classifying to ensure that users can find the materials they need. Cataloging also encompasses authority control or the process of authorizing and verifying author/title/subject headings contained in bibliographic records and ascertaining their usage in the established form. Collections management entails physical processing and preservation of the materials libraries have obtained and cataloged.

While “the technical services are as old as libraries, the technical services unit is a development of the past forty years”^[1] and that places the development of Technical Services Departments in the 1930s. Donald Coney presented the first published examination of the unit organization of technical processes in 1938.^[2] The isolation of TS in a separate division is a function of size more than a change in attitude toward the services—first a separate unit is established to handle cataloging, then one for acquisitions, later serials, and, finally, all of them together as a separate division with its specialist head.^[1]

ACQUISITIONS

As libraries grew in size, so did the need to ensure that the materials could be acquired and then found by the libraries' patrons. Historically, the acquisitions decisions were done by the Head Librarian and the actual ordering done by the clerical staff, but with the ever-increasing size of the collections and budgets, this became impractical and a

specialized department in libraries was established. The unit was often originally called the order department, but that name was gradually replaced by acquisitions to reflect the broadening duties that could often include gifts, exchanges, mail services for the entire library, bindery, serials check-in and control, government documents, budget and financial control, and purchasing of all types of equipment for the library. With the advent of electronic resources, many purchase decisions are often negotiated through purchasing consortiums formed to help individual libraries obtain the best possible prices for their member libraries.

The organization of acquisitions unit varies greatly depending on the size and scope and mission of the library. In special libraries and very small specialized schools or colleges, the acquisitions unit typically collects in great depth only in the area of specialization of the organization, school, college, or business the library supports.^[3] Special libraries generally do not have sufficient financial or space resources to collect or retain vast collections of materials but instead buy or borrow materials as needed to support the research needs of the organization at that moment, which may frequently change and evolve rapidly and therefore have smaller acquisitions units. As most purchasing/accounting organizations, they also adhere to standard accounting practices developed by the American Institute for Certified Public Accountants (AICPA), which insist that ordering, receiving, and payment functions are done by separate individuals in the organization to help avoid fraud, theft, or embezzlement.

In academic libraries, acquisitions units are often organized by the material types to be ordered, usually breaking into either a monographs units, a serials or continuations unit, and/or periodicals or journals unit and further subdivided by the country or region of the world where the materials being requested originate from and can be obtained if the library collects in a large number of languages. In addition to the Head Librarian who

originally made collection decisions, faculty members were consulted regularly to give input on purchase requests of materials in their specific subject areas of expertise. With the growth in the size of collections, it usually now falls to a team of subject specialist bibliographers to do collection development. The bibliographers determine the scope and nature of what the library collects. Bibliographers then make specific recommendations as new books get published or new subject disciplines added to the area of studies of the academic institution to ensure necessary books and materials are added retrospectively if necessary to support the new curriculum and the research mission of the university. Depending on the library, collection development may not always fall within the TS department. Collection development is sometimes a stand-alone department or even a part of the reference department since there is a strong component of outreach to faculty involved in making collection development decisions. Once materials have been selected by the subject bibliographers, generally acquisitions units order materials also ensuring that they adhere to standard accounting practices of the AICPA. In some organizations, purchasing functions may be part of the larger organizations procurement or accounting departments but with the increased specialization required by the growing electronic nature of library materials; this is not something most procurement or accounting departments are desirous or are capable of handling and the library purchasing functions are generally a part of the library whether they are an academic, public, or special library. Unlike other library departments, acquisitions are often staffed by paraprofessionals with accounting experience. The need for the formerly ubiquitous position of acquisitions librarian is rapidly deteriorating, suggesting the deprofessionalization of acquisitions.^[4] With the proliferation of online purchasing tools and software, acquisitions personnel are also expected to be computer savvy and familiar with the software purchasing systems used by the library.

Public libraries purchase materials of general and widespread interest, information, and enlightenment to all people in the communities they serve, and the materials strive to represent a broad range of views to ensure that the communities they serve have access to information to help them know more about themselves and their world; supplement formal study or encourage informal education and reading; improve job-related skills; stimulate participation and interest in world and community affairs; and provide access to variety of opinions. They provide access to materials of varying reading levels and languages depending on the community's needs to generally support educational, civic, and cultural activities.^[5]

Public libraries TS departments are usually centralized and offer standardized materials throughout their system and depending on the library system may offer local branch libraries the ability to buy specialized materials in

various languages to better serve local populations reading interests.

While very small libraries might be able to handle individual ordering with vendors and publishers, most academic and public libraries deal with vendors who provide book approval plans, such as Baker and Taylor, YBP, among others, and subscription vendors such as EBSCO, WT Cox, and Prenax in addition to direct ordering for titles not handled by these vendors. Subscription agents handle the renewals and any missing issues claims for the thousands of journals and standing orders for the library to ensure the library receives all periodical issues for which it has paid. Libraries use subscription vendors to help them keep track and handle subscription renewals and increasingly complex issues regarding handling electronic journals.

Libraries work with approval plan vendors by setting up a profile indicating the types and categories of materials the library wishes to obtain, and as materials are published meeting those criteria, the approval vendor automatically ships those materials to the library. Those books are reviewed by the subject specialist bibliographers for approval and can be returned to the vendor if the bibliographer does not feel the book is of sufficient quality or subject interest for the library. If libraries cannot afford to collect everything in certain categories, they can sign up with approval plan vendors to have their bibliographers/subject specialist librarians regularly look at the bibliographic information about newly published books either on what were called approval slips or increasingly in an online bibliographic system where they can mark and select only those books the library would like to buy from them, and the approval vendor then sends only the selected books.

As with the other areas of the libraries, acquisitions procedures and processes started changing in the late 1960s and 1970s with the purchase of automated and integrated library systems and the acquisitions processes streamlined and improved by the adoption of automation and standards, which allowed libraries to send orders using electronic data interchange (EDI) and to be billed and to pay vendors electronically in return. While the trend toward computerization of acquisitions records has been strong since the 1970s, many acquisitions procedures were not done online until the advent of the web-based services and electronically available journals and books. In addition, the growth and development of new TS-related products and services from vendors meant the increased need for cataloging and acquisitions to work together in order to make accurate bibliographic information appear on orders transmitted to vendors and thus ensure libraries gets shipped the correct item. The inter-reliant workflow between acquisitions and cataloging signified a trend toward blurring of the traditionally separate cataloging and acquisitions units that made up the TS department of the library.

CATALOGING

Cataloging is the process of describing materials for the purpose of compiling inventories and providing organized access to the collections. Relative to the movement of materials within TS, cataloging usually follows the receipt of ordered books in acquisitions. There are two types of cataloging: original and copy. Original cataloging entails the creation of the bibliographic description from scratch. Cataloging has three components: description, subject analysis and classification, and authority control. Descriptive component includes recording the attributes of an item: its author, title, publisher, the number of pages, its size, etc. This component allows the user to find and identify a book, by the author's name, the title, edition, size, etc. Subject analysis and classification are considered the intellectual elements of cataloging. Subject analysis entails determining the subject matter of the item and assigning corresponding subject headings from a controlled vocabulary, such as Library of Congress Subject Headings, Medical Subject Headings from the National Library of Medicine, or a variety of other thesauri, depending on the cataloging rules of a particular country. Classification of materials is done according to their discipline and topic, and is, therefore, closely tied to subject analysis. There are two main classification schemes in the United States: Dewey Decimal Classification (DDC) and Library of Congress (LCC). The DDC system is primarily used by public libraries, whereas LCC is preferred by academic and research libraries. The cataloger assigns a classification, or call number, in correlation with the subject headings. The call number serves a dual purpose: it determines the place of a book on the shelf and it collocates books on the same topic next to each other.

Authority control is the process that is applied to both descriptive and subject analysis parts of cataloging. It ensures the consistency and correctness of names and subject headings entered into bibliographic description. It also functions as a collocation and disambiguation device in the library catalog. Through authority control, the works written by the same author under different pseudonyms will be gathered in a single search due to behind-the-scenes cross-references; Multilanguage translations of a book or a musical piece will be brought together. By the same token, conflicting entries, such as common names, will be distinguished from each other through specifying information, for example, date of birth, death, etc.

Copy cataloging, which became possible with the practice of shared cataloging, represents the process of using the bibliographic record of an item created by another library to describe the same item held in the local collection.

Most TS departments perform both types of cataloging. However, the ratio between original and copy cataloging depends on the type of the library. Libraries holding a lot of unique materials have a substantial proportion of their

cataloging done as original, whereas libraries with mainstream materials rely heavily on copy cataloging.

The distinction between original and copy cataloging determines the requirements for skills and education of personnel. While the relative ease of copy cataloging permits employment of paraprofessional staff, original cataloging is still considered the domain of professional catalogers with a master's degree in Library Science, although shrinking resources and increased workload create a trend of employing cataloging assistants for original cataloging as well.

In addition to cataloging itself, cataloging units also perform database (or catalog) maintenance. This is done in order to keep the catalog accurate by reconciling data conflicts, correcting mistakes, and reflecting changes in regards to cataloging. Larger libraries often have database maintenance as a separate section.

Cataloging has a rich history. Throughout the centuries, it underwent major transformations following changing needs of the society and advances in technology. The earliest known compilation of a catalog of a collection was completed in 1558 and was called the Catalogue of Bretton Monastery Library.^[6] In 1759, the Trustees of the British Museum expressed the desirability of a catalog and further suggested in 1807 that a separate alphabetical catalog for each collection be compiled as well as a general classed catalog.^[7]

In 1841, one of the founding fathers of modern cataloging Sir Anthony Panizzi, keeper of the printed books at the British Museum, published his *Rules for the Compilation of the Catalogue* where he considered the same problems of choice and form of entry, description, cross-referencing, and filing order that are repeated in codes to the present day. In the United States, Panizzi's ideas were taken up and modified by Charles Coffin Jewett, librarian of the Smithsonian Institution, who needed standardized rules in order to accomplish his plan of collecting bibliographic data and making it available for printing individual library catalogs.^[8] He compiled the very first United States' code of cataloging rules that was issued in 1853. In 1876, Charles Cutter's *Rules for a Printed Dictionary Catalog*, the dictionary catalog, was becoming the dominant form.^[9] His rules went through four editions between the first in 1876 and 1904, and increased in coverage and were a major influence over later codes.^[8]

At the dawn of the twentieth century, the LCC, the principal cataloging agency, began selling library catalog cards. This caused a much greater degree of consistency in library catalogs and ushered in the era of copy cataloging. Up to that moment, libraries were responsible for creating their own original descriptions of the materials in their collections; thereafter, they gained a choice of buying those descriptions from the LCC. In 1908, the *Anglo-American Cataloging Rules* were first published and were called that because of the cooperation between the British and American catalogers, and were the offspring of Cutter,

plus accommodation to the LCC practice.^[10] Seymour Lubetzky, who was working at the LCC at the time, wrote *Cataloging Rules and Principles*, in which he suggested the requisites of a new code.^[11] Within the next 7 years, he also presented two revised codes that eventually became the basis for the AACR.^[12,13] In 1967, two versions of the *Anglo-American Cataloguing Rules* were published, a North American text and a British text.^[14] Finally, in 1978, the rules were published in one version as *Anglo-American Cataloguing Rules, second edition* (AACR2).^[15] The AACR2 was adopted by the LCC, the National Library of Canada, the British Library, and the Australian National Library in January 1981.^[16] There were subsequent revisions to the second edition that were published in 1988, 1998, and 2002.^[17]

The major developments in the area of cataloging and bibliographic retrieval of the twentieth century can be characterized first of all as a period of growth and development of productivity. The adaptation and use of technology and standards such as machine-readable cataloging (MARC), based on ISBD's (International Standard Bibliographic Description) eight areas of description, has enabled libraries to standardize and share bibliographic records. In addition, with the dawn of the computer and the start of the information age, libraries began to either develop their own internal library software systems or increasingly started buying them from the growing numbers of library software vendors such as GEAC, CLSI, among a number of other early pioneering library software vendors.

The twentieth century was also marked by the development of bibliographic networks, such as Online Computer Library Center (OCLC) and Research Libraries' Network (RLIN). In 1967, the Ohio College Library Center developed a computerized system in which the libraries of Ohio academic institutions could share resources and reduce costs.^[18] In 1977, the Ohio members of OCLC adopted changes in the governance structure that enabled libraries outside Ohio to become members. In 1981, the legal name of the corporation became Online Computer Library Center, Inc.^[19] RLIN started in 1974 as a competitor to OCLC and was focused primarily on research libraries and specialized research collections, like art, law, etc. The development of these bibliographic utilities contributed to the rapid growth of copy cataloging and resource-sharing among libraries nationwide.

The natural outgrowth of shared cataloging was the establishment of cooperative programs by the LCC. During the 1970s, LC initiated NACO and CONSER programs. NACO stands for the Name Authority Program Component for the Program for Cooperative Cataloging (PCC) that was developed by the LCC in order to share the name authority work previously done only by the LCC. Through this program, participants contribute authority records for names, uniform titles, and series to the LCC Name Authority File.

An individual institution may join this program or a group of libraries with a common interest may form a funnel project to contribute records via a coordinator. Participants agree to follow a common set of standards and guidelines when creating or changing authority records in order to maintain the integrity of a large shared authority file. This file helps the global library community work more efficiently and effectively, allowing it to maximize its resources.^[20]

CONSER began in the early 1970s as a project to convert manual serial cataloging into machine-readable records and has evolved into an ongoing program to create and maintain high-quality bibliographic records for serials. In keeping with its evolution, the name was changed in 1986 from the CONSER (CONversion of SERIALS) Project to the CONSER (Cooperative ONLINE SERIALS) Program. In October 1997, CONSER became a bibliographic component of the PCC.^[21]

Building on the success of NACO and CONSER, in 1995, LC established the PCC that subsumed NACO and CONSER as two of its four components. The primary goal of PCC is to cooperatively enhance the timely availability of bibliographic and authority records by cataloging more items, producing cataloging that is widely available for sharing and use by others, and performing cataloging in a more cost-effective manner.^[22]

The third component of PCC deals with contribution of bibliographic records for monographs in all formats and is called BIBCO. The fourth and final component of PCC—Subject Authority Cooperative Program (SACO)—deals with subject authority.

The SACO was established to provide a means for libraries to submit subject headings and classification numbers to the LCC via the PCC.^[23]

The emergence of digital materials expanded the field of information standards. In addition to MARC, which was devised for print format, there appeared standards for the description of digital materials, such as Dublin Core, Metadata Encoding and Transmission Standard, and some others. Local Integrated Library Systems (ILS) acquired web interfaces, and library catalogs evolved from being accessible strictly from designated terminals to become available on the Internet.

The beginning of the twenty-first century was marked by a trend toward mergers and acquisitions in the area of TS. In 2006, two major library networks and union catalogs, OCLC and RLIN, merged into one company—OCLC. This move created a single bibliographic database and cemented OCLC's role as the leader in shaping TS practices in acquisitions and cataloging. ILS vendors continued the acquisition trend reducing the library software market to a few major companies. In competition to proprietary systems, emerging on the scene are open-source applications, such as Koha and Evergreen. While integrated library systems have front-end (i.e., public) and back-end (i.e., nonpublic) modules, the implementation

of the new ILS and their upgrades, as well as library-wide training and documentation, often rests on TS.

The advent of the Internet in the 1990s had a major impact on the work of library services. It brought on a sharp division of publications into print and online formats with print being quickly replaced by the Internet-based matter, especially in the area of periodicals but increasingly electronic books as well. Cataloging services and tools migrated online and became available through such LCC's instruments as Cataloger's Desktop and Classification Web. However, the exponential growth of electronic resources created a cataloging dilemma for TS. Shrinking library budgets, increased volume of work, and the rising cost of cataloging spurred a trend toward simplification and streamlining of descriptive cataloging rules. The emergence of large online aggregations of electronic books and journals created the alternative to catalog access methods to the resources, for example, A–Z lists and databases, thus raising a national debate about the diminishing role of the catalog and cataloging itself as the conduit to the collections.^[24–30]

At the same time vendors, publishers, and intermediaries entered the TS scene offering bulk cataloging, acquisitions services, and outsourcing of authority control. In 2004, in the article entitled “Taking the drudgery out of book acquisitions,” which appeared in *Library & Information Update*, talks about the services of a book supplier whose services now include online searching of item record databases; browsing of databases that include sample pages, contents, online ordering using EDI, order management, shelf-ready stock with OPAC-ready records, automated alerts for items that based on your libraries profile may be of interest to your library.^[31] Major book vendors, such as YBP, and others began bundling their primary business—the book trade—with cataloging and materials processing, thus offering a replacement for services that traditionally were carried out by library's TS. While providing a faster turnaround time and, in many cases, reducing the cataloging, authority control, and processing costs, outsourcing earned its skeptics. The downside of outsourcing is primarily tied to the quality of services provided by vendors and the need by TS to maintain quality control processes in order to uphold the standards and ensure the accuracy of records. When new libraries are being started, they generally use outsource vendors to provide them with opening day collections to fill the library on their opening day with wide-ranging and popular books available to the public.

With the increasing use of the Internet since the mid-1990s, many journals transitioned to electronic formats. Libraries began offering numerous article databases with varied interfaces, which felt cumbersome to both librarians and users, especially when compared to the relative ease and accuracy of Google searching. In order to resolve this issues, starting in the late 1990s and early 2000s Roy Tennant and others suggested federated searching (also

known as metasearching) as the solution.^[32] The principle of federated searching, which ultimately proved too limiting and slow,^[33,34] was searching multiple sources from a single point. The development of web-based Google Scholar and problems with Federated Searching led to calls for a development of a resource that could compete with Google.^[34]

The emergence of online materials introduced a new function to TS—administration and management of electronic collections. Libraries moved from subscribing to individual print journals to subscribing to e-journal aggregations, abstract and indexing services, and article databases. Online materials spurred the development of new technologies, such as tools for linking between the citation and full text via OpenURL or Digital Object Identifier, and for managing electronic resources. The issues of management, access, and licensing of electronic materials created the need for specialized positions on professional and paraprofessional levels. Many libraries introduced the job of an electronic resources librarian, or its variants, and dedicated the support staff to this function. These positions commonly deal with administration of licensing agreements, resolution of access issues, and maintenance of databases at the root of the access tools, such as the knowledge base of a link resolver and an electronic resources management system (ERMS). The principles of ERMS as a management tool for electronic resources were developed by Digital Library Federation. They encompass listing and descriptive; license-related; financial and purchasing; process and status; systems and technical; contact and support; and usage functions.^[35] A rapid growth of digital materials encoded in non-MARC metadata created parallel virtual collections and thus separate silos of information for many libraries.

Library information technology developers created the first generation of enterprise Google-like search engines, which became known as discovery interfaces. They began to emerge in 2002 with AquaBrowser from Medialab Solutions, capable of cross-searching the library's diverse collections, such as digital libraries, databases, and the catalog. It was about 2006 when this software genre saw Primo from Ex Libris and Encore from Innovative Interfaces, Inc. launched. In 2007, an open-source option VuFind became available. In 2009, Serials Solutions, EBSCO, OCLC, and Ex Libris all made announcements they would combine the next-generation interface technologies with large bodies of content into one single index^[36] allowing access to more results much faster and with better deduplication and relevancy ranking than federated searching.^[37,38] Implementation of such systems significantly increased users access to full-text articles as well as to web resources.^[32]

The new discovery products provide a more modern, web interface, broader approach to discovery, and access to social networks. Discovery interfaces incorporate newer tools such as tagging, integrated social features,

easier search and navigation, and relevancy-ranked results.^[36]

The library catalog has been changing with the times as well. Bringing Amazon-like experience to the library, many bibliographic records now have links to the online table of contents, publisher and author information, and reviews. The evolution of the web into an interactive experience with user-generated content left its mark on the public face of the catalog. Main problems with the traditional online catalog was that it did not include the deeper content of its collections such as the contents of its periodical collections, local digital and special collections, which were cataloged using systems outside of the traditional integrated library systems. Library patrons did not understand the entire library's holdings were no longer in the library catalog, and their interfaces were text-based and dated in comparisons to the Internet search engines.

A new generation of catalogs emerged, such as Endeca and OCLC's WorldCat Local, that provide faceted browsing and navigation of results similar to the Internet search engines. Legacy library catalogs became capable of displaying images of book jackets, sending text messages, integrating users' input through book reviews and recommendations, and tagging using non-LCC, community-generated terms.^[36]

As the nature of the work changed, the name TS and the units within TS have begun to change as well. Cataloging has changed to names such as Bibliographic Assess, Metadata Services, Metadata and Digital Library Services, while TS name has changed to such things as Collection Support Services, Materials Acquisitions Processing Services, and Collection Access and Management Services.^[39]

The opportunities provided by the electronic information exchange increased national and international cooperation between libraries in the arena of shared cataloging.

The report produced by the IFLA Study Group on Functional Requirements for Bibliographic records (FRBR)^[40] contains a description of the conceptual model (the entities, relationships, and attributes), a proposed national-level bibliographic record for all types of materials, and user tasks associated with the bibliographic resources described in catalogs, and other bibliographic tools.^[41] Aiming to conceptualize the entire bibliographic universe, the FRBR report introduced the new vocabulary to describe bibliographic entities. Such terms as "work, expression, manifestation, item" as well as user tasks defined as "find, identify, select and obtain" influenced the bibliographic lexicon. The next set of cataloging rules, Resource Description and Access (RDA), the successor to AACR2, uses FRBR terminology and its user-centric approach in its contents.^[42]

The work on adapting *Anglo-American Cataloging Rules* to the new digital world began in 2004 by Joint Steering Committee, and initially as AACR3, the next revision of AACR2. As the work progressed, it appeared that the existing standard could not accommodate the

changes in publication models of the twenty-first century. The cataloging community comments to the early drafts demonstrated that the proposed changes were not sufficient. This led to the shift to a new approach in devising a new cataloging standard, and the new name RDA: Resource Description and Access was adopted in 2005. The scope of RDA is defined as "a set of guidelines and instructions on formulating descriptive data and access point control data to support resource discovery."^[43] RDA was conceived as a content standard with the following features: rules that are easy to use and apply; it is designed for an online, networked environment; provides effective bibliographic control for all types of media; presents a logical structure based on internationally agreed principles (e.g., FRBR, FRAD); compatible with other standards, and is of use beyond the library community.^[44]

The first draft of RDA, followed by the comments period, was issued in November 2008. The new cataloging standard sparked a dynamic discussion within the profession. The comments provided by the cataloging community reflected a wide range of views: from the appreciation for inclusion of FRBR/FRAD data models and the collaboration with publishing community, to sharp criticism on the lack of clarity and failure to address the needs of special formats' cataloging, such as maps and moving images.^[45] The revised text, based on the feedback, was finalized in June 2009. RDA was released as an online subscription product, named the RDA Toolkit, in June 2010.^[46] Three national libraries—the LCC, the National Library of Medicine, and the National Agricultural Library—as well as the broader constituency, conducted a testing process that ran from October to December of 2010. As the result, the recommendation from the testing group was to continue improvement of RDA and postpone its implementation until 2013.^[45] Subsequently, RDA implementation day was set by the LCC for March 31, 2013, when it became the new cataloging standard.

The emergence of RDA with its expanded scope and a new model triggered changes in MARC format, previously designed to support AACR2. In order to accommodate RDA, the number of MARC fields and codes was increased, the rules for mandated, repeatable, and nonrepeatable fields evolved to allow more flexibility, and the terminology was augmented or changed.^[47]

MARC has been serving the library community since the 1960s, providing the structure for bibliographic data. However, as a format designed for libraries, MARC became a constraint on the use of bibliographic data interchange between publishers, vendors, and a broader networked community. MARC is principled on the concept of a record, thus making each description a discrete and closed data set, enabling vast duplication of data, and disabling relationship between the entities encoded in the record. In order to break down the insulation of the bibliographic data from the networked information exchange, as well as within MARC corpus itself, in 2011, the LCC

announced Bibliographic Framework Initiative to redesign the underlying structure of the data description.^[48] The following year (2012), the new data model for bibliographic description, named BIBFRAME, emerged.^[49] As described by the LCC, “instead of bundling everything neatly as a ‘record’ and potentially duplicating information across multiple records, the BIBFRAME Model relies heavily on relationships between resources (Work-to-Work relationships; Work-to-Instance relationships; Work-to-Authority relationships). It manages this by using controlled identifiers for things (people, places, languages, etc.).”^[50] A limited number of libraries—among them LCC, Cornell, Princeton, Stanford, and National Library of Medicine—are currently testing the BIBFRAME model. At this point, there is no target date for the implementation of the BIBFRAME environment.^[50]

The changes occurring in TS with the advance of technology, network environment, and new standards have altered the requirements for staff skills set. Modern-day catalogers and acquisitions specialists need to understand the mechanics of EDI, know not only the current bibliographic format and other metadata schemes (e.g., Dublin Core for cataloging digital libraries), but be prepared for their replacements in the rapidly changing environment. In addition to technical skills, TS staff need to be flexible, open to change, and be willing to learn.

COLLECTIONS MANAGEMENT

Despite the rapid growth of digital resources since the advent of the Internet, print materials continue to play an important role in library functions. In many libraries, processing, and mending of print resources is in the purview of TS; it is the final step in the acquisition-to-shelf cycle of materials movement. While there are variations in the order of processing steps, a typical workflow is designed as follows: once the books and print periodicals arrive in the library, they are received, cataloged (i.e., an electronic record describing the item’s physical and subject attributes has been created in the local system), and then the items go to the materials processing section. There, items are stamped with a property stamp, indicating the ownership of a book, a date due slip is pasted for circulation to note when an item is due back in the library after the checkout, a call number (or classification number) label is affixed so that the item is shelved in the logical order, and, finally, a barcode linking the physical piece with its electronic record in the catalog is attached to the book. Additionally, processing may entail adhering Mylar covers, security beepers, and reinforcement of publisher’s binding. Regular binding of periodicals and monographs is usually contracted out to a binding facility.

Collections management, along with other spheres of the library, has been impacted by the technology. In addition to

now routine barcodes and security devices, Radio Frequency Identification (RFID) entered the library scene. While having the potential of replacing barcodes and tattle-tapes by combining their functions, RFID has been slow to spread. Despite the convenience with inventorying, shelving/retrieving items, and detecting and tracking theft, the considerations of patrons’ privacy, as well as the cost, prevent this technology from broad adoption by library community.

As electronic information exchange ties the processes of libraries and their book vendors closer, the latter began expanding their services into materials processing, leveraging the information they receive from libraries and bulk cataloging services, such as OCLC WorldCat Cataloging Partners (formerly PromptCat). If a library outsources its materials processing, the books come back with the full set of processing elements, such as classification labels, property stamps, barcodes, etc.

CONCLUSION

Historically, TS have been the behind-the-scenes backbone of the library. Today, more than ever they play a crucial role in the delivery of user services by providing support to information search and retrieval tools and access to online materials.

The current trends in automation, development of new library standards, evolution of the OCLC library network into a major tool for universal bibliographic control that provides access to the collections of libraries, museums, and other cultural institutions worldwide, make the work of individual TS department’s part of global information network. In addition, adoption of the native Internet tools, such as faceted browsing, user-created content, and integration of social media, by libraries signifies a continuing trend toward user-centric and interactive interfaces.

TS, especially cataloging departments, are undergoing major changes. The implementation of RDA and development of new data model, BIBFRAME, will test the viability and robustness of the new library standards.

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Linguistics and the Information Sciences

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Abstract

Linguistics is the scientific study of language which emphasizes language spoken in everyday settings by human beings. It has a long history of interdisciplinarity, both internally and in contribution to other fields, including information science. A linguistic perspective is beneficial in many ways in information science, since it examines the relationship between the forms of meaningful expressions and their social, cognitive, institutional, and communicative context, these being two perspectives on information that are actively studied, to different degrees, in information science. Examples of issues relevant to information science are presented for which the approach taken under a linguistic perspective is illustrated.

INTRODUCTION

Linguistics is the scientific study of language, where language is generally taken to be *natural language*, spoken by human beings and acquired informally from one's parents, siblings, and community. Natural language is contrasted with written language, which must be learned formally; artificial languages, which are intentionally designed for some purpose such as intercultural communication; and formal languages, like those of computer science, mathematics, and logic, which are designed to express abstract meanings in well-defined ways. To the extent that these other types of language resemble natural language in their structure or use, a linguistic perspective may be relevant to understanding them. Linguistics has a long history which can be traced to ancient sources such as the *Ashthadhyayi* of Panini, an Indian grammarian of the fifth century B.C.E., or the invention of the Phoenician and Ugaritic alphabetic orders approximately 1000 B.C.E.,^[1] but its modern practice is largely based on the structuralism of Ferdinand de Saussure^[2] and Leonard Bloomfield,^[3] the anthropological perspective of Edward Sapir,^[4] and the formal perspective of Noam Chomsky.^[5–7]

Natural language is a highly complex phenomenon, and consequently the field of linguistics has a great deal of internal structure, with largely separate subfields for specific areas of linguistics. At the same time, linguistics has close interactions with fields such as psychology, anthropology, sociology, computer science, education, and communications, thus many applied and “hyphenated” areas of linguistic study are found as well.

The aim of this entry is to explain the organization of linguistics as a field, to identify some of its main points of interaction with the information sciences (broadly construed to include the full spectrum of studies focused on information technology and its uses, from technical research and development to applied social science, including

information retrieval, information seeking behavior, information policy, human–computer interaction, etc.), and to provide indications of where and how linguistic approaches might benefit the information sciences. The organization of this entry is as follows. The next section describes the structural subfields of linguistics, describing the questions that each addresses. The third section treats hybrid subfields of linguistics, whose questions are not strictly about language structure but which deeply involve either external context or application of some sort. The fourth section identifies a number of linguistic issues in the information sciences. The final section offers some general conclusions. Computational linguistics, Natural Language Processing (NLP), and information retrieval are not discussed in any depth in this entry. Instead, emphasis is placed on the range of questions addressed in the field of linguistics and their relevance to the information sciences.

STRUCTURAL SUBFIELDS OF LINGUISTICS

Although linguistics is small relative to other fields, in terms of the number of people working within it, linguists tend to specialize, so that their work specifically addresses one or more subfields; few linguists consider themselves “generalists.”

A major focus of linguistics is language structure, and linguistics is a largely structuralist field, in the sense that it concerns itself with categories of entities and their relations to one another. Other philosophical orientations exist in the field, notably the Cartesian mentalism of Chomsky which posits innate cognitive structures governing language, but other philosophical movements shared among social science and humanities fields, such as the postmodern turn, have not had a strong impact on linguistics. Moreover, in actual practice, structuralist forms of inquiry and analysis, as laid out by Saussure and Bloomfield, are

fundamental to most forms of analysis in the field. In some sense this is inescapable, at least in so far as human languages have regular patterning, and that patterning is shared among different speakers of a language. It is tempting to treat the language as an object unto itself, independent of the speakers or their contexts, however it arises.

Linguistics is typically taught starting from a “core” of its structural subfields, characteristically organized in terms of analytic “levels” of structure (not unlike the “layer-cake” model of the organization of WWW protocols and standards, see below). At the lowest level, linguistics considers the sound structures of human languages: which sounds are possible in a language, and what sequences of sounds are possible, their articulatory mechanisms, acoustic perception and patterns of relationship with other sounds. This is the domain of *phonetics* and *phonology*. One level above this is the structure of words, and the patterns of relationship among word structures that take meaning into account. This is the domain of *morphology* and the study of the *lexicon*. At one level above this, linguists consider the arrangement of words into well-formed utterances (i.e., those accepted as “grammatical” by a native speaker). This is the domain of *syntax*. The study of the meanings of these utterances, how they are built from the meanings of their parts, together with the meanings of words themselves, comprise the study of *semantics*. Beyond this, linguists recognize a level of *linguistic pragmatics*, which deals with the ways in which linguistic expressions are used, such that conventional or contextual meaning can differ from literal meaning.

A characteristic common to all of these levels is a property sometimes called “duality of structure.” Originally, this term described Saussure’s notion of the arbitrariness of the linguistic sign, i.e., that forms of words in any language have no necessary relationship to their meaning, and that sounds and meaning are arbitrarily associated. The principle is more general than this, however, as it can be seen that units at each level of structure are essentially independent. Lower levels of structure (e.g., sounds) may be referred to in higher levels of structure (e.g., morphemes, words) but the patterns that obtain at each level have no necessary relation to those of the other levels, and a similar arbitrariness of relation between all different levels of language structure can be observed. In the following subsections, the major structural subfields of linguistics are described. The following section details some of the more important hybrid areas of linguistics, ending with its more applied subfields.

Phonetics and Phonology

Phonetics is the study of the sounds of languages, their articulatory and perceptual properties, and patterns of regularity found therein. Phonetics is thus concerned with the material reality of language sounds, and is not concerned

with what makes the sounds of languages meaningful. Phonetics makes extensive use of instrumentation, such as audio recording, spectral and other forms of acoustic analysis, and x-ray and video recording. Phonology is the study of the sound systems of languages, where differences in sound that carry meaning in a language are considered. To illustrate the difference in these two levels of analysis, consider the sounds represented by the letter *p* in English words like *pot* and *spot*. In *pot*, where the *p* is the first sound in the syllable, speakers of most dialects of English will produce a short burst of air (“aspiration”) immediately after the release of the lips (symbolized [p^h]), whereas in *spot*, no aspiration is produced (symbolized [p]). There is a phonetic distinction between these two sounds or *phones*, but speakers of English nonetheless recognize these as the “same” sound. In another language such as Hindi, a difference between the two phones is enough to yield entirely different words, e.g., [p^hal] “fruit” and [pal] “instant, moment.” Hence in Hindi, the phones [p^h] and [p] correspond to distinct phonemes /p^h/ and /p/, whereas in English, both phones correspond to the single phoneme /p/.

Phonetics and phonology illustrate an important principle in linguistics, namely that of *etic* (as in “phonetic”) and *emic* (as in “phonemic”) levels of description of a phenomenon. The etic level is what is empirically observable in a given instance, whereas the emic level is what is perceived by the native speaker of a language to be distinct. This distinction is maintained most robustly at the level of sound structure, but is found at other levels of structure as well.

Phonology is concerned with matters beyond the existence of categories of sounds used to describe the utterances of languages. It is also concerned with regularities of patterning that exist in sounds. These patterns include *phonotactics*, the sound sequences that can occur in a language (e.g., English permits words like [spat] “spot,” but not [vpat] or [fpat], although these may be possible in other languages), and *phonological processes*, in which the juxtaposition of two words may result in a sound sequence that the words would not have exhibited independently (e.g., /kænt/ “can’t” + /yu/ “you” yields [kænsu] “can’t you”). Phonological processes sometimes depend on the identities of the specific forms to which they are attached, in which case they are referred to as *morphophonemic processes*. Phonological theories sometimes make a distinction between the two types of patterns, such that phonotactic patterns are governed by constraints (extrinsic conditions on what can or cannot occur in a language), whereas phonological processes are handled by *rules*, which are understood as cognitive or descriptive processes that transform one sequence into another. Current phonological theory tends to follow the approach of Optimality Theory^[8] in conflating the distinction, regarding both types of patterns as the consequence of a common set of constraints. The reasons for this are somewhat

technical, and the interested reader is referred to discussion in the relevant literature for further explanation.

Morphology and Lexicon

Morphology concerns the structure and forms of words, and patterns in their relations to one another. The lexicon is the store of words of a language, hence morphological patterns have a lot to do with the lexicon, but not all patterns in the lexicon are morphological. A morpheme is considered to be the most basic meaningful unit of language: it is a form–meaning pairing which ceases to be meaningful if it is subdivided further. As in sound structure, we may speak of an emic and an etic level in morphology: morphemes are realized as different specific variants (known as “morphs”) in one context or another. For example, in English the word *card* is a singular noun referring to a stiff piece of heavy paper, which can be expressed in the plural as *cards*, for multiple stiff pieces of paper; similarly, the noun *winch* refers to a mechanical device for pulling or raising something, also in the singular, whose plural is *winches*. In contrast to these two, the noun *mouse*, meaning a small rodent, has the plural *mice*. All three types of plural exhibit regularity in the sense that there are other exemplars with the same characteristics: *shoe~shoes*, *peach~peaches*, *louse~lice*. All three patterns, adding [-z], adding [-ez] and changing the stem vowel, are alternant morphs of the plural morpheme. Of these, the plural morph in which the stem vowel changes is the less common pattern, and one readily finds examples where it could be expected to occur but does not: *spouse~spouses*. Irregularities in morphology of a language are common, and typically the reasons for it are historical in nature, concerning the evolution of the lexicon and its relation to sound change, etc. The vowel-changing plurals were once the dominant pattern in Old English, for example, but most of the pattern was lost in the Great Vowel Shift between Middle and Modern English (between 1200 and 1600 A.D.) which radically altered the pronunciation of most English vowels.

Languages differ in terms of the kind of morphological patterns they exhibit. On the one hand, languages show morphological *inflection* if words change form based on their grammatical function (subject, object, etc.); Latin, Greek (ancient and modern), and Finnish are three such languages. *Derivational* morphology, on the other hand, derives words of one category (such as nouns) from those of another (such as verbs). Languages may be *analytic*, having separate morphemes for clearly separate functions, or *synthetic*, where a single morpheme may simultaneously serve otherwise unrelated functions. Languages like Turkish tend to be more analytic, while Inuit (an Eskimo language spoken in Nunavut, Canada) and Onondaga (a Native American language of New York State) are more synthetic. Languages whose words are often composed of long sequences of analytic morphemes are said to

be *agglutinating*; Turkish and Tamil are examples. Some languages, such as Mandarin Chinese, are said to be nearly entirely lacking in morphology.

Beyond morphology, many other linguistic patterns exist in the lexicon. Relations between languages, via lexical borrowing, are often observable in the lexicon, and sometimes languages borrow from their own past, resulting in entire classes of archaic words. Such lexical items may also systematically differ in *register*, i.e., their appropriateness for formal or informal circumstances; this is common in *diglossic* languages such as Arabic, Greek, Tamil (spoken in South India), and Sinhala (spoken in Sri Lanka), in which spoken and written forms of the language are structurally highly divergent.^[9] Other lexical patterns revolve more closely around meaning: homonymy (words with identical meanings, e.g., *bird* and *avian*), antonymy (opposite meanings, e.g., *hot* and *cold*), hypernymy (a similar but more general meaning, e.g., *songbird* and *bird*), and hyponymy (a similar but more specific meaning, e.g., *songbird* and *sparrow*) are some of these patterns.

Syntax, Semantics, and Pragmatics

The arrangement of words into larger units, namely phrases and sentences, is the domain of syntax. Traditionally, morphology and syntax taken together were known as “grammar”; this term is currently dis-preferred by linguists. For several decades, syntax has held a dominant position in linguistics, due largely to the influence of Noam Chomsky and his approach to syntax known as *Generative Grammar*. Basically, the generative approach seeks to explain properties of language as manifestations of *linguistic universals*, which are regarded as properties of a uniquely human language faculty, distinct from other cognitive capacities. Since *Universal Grammar* (UG), as it is sometimes called, is held to be a universal human species characteristic, its effects are expected to be equally manifest in all languages. The differences among languages are regarded as interactions between UG and a child learner’s linguistic experience. Variants of this theory are employed by people working in other formal frameworks such as *Lexical-Functional Grammar*,^[10] *Relational Grammar*,^[11,12] and *Head-Driven Phrase Structure Grammar*.^[13,14]

Generative grammar and the theory of UG have been controversial since first being proposed in Chomsky’s 1955 dissertation. A number of current alternative theories adopt somewhat different starting assumptions. For example, Cognitive Grammar,^[15] while it emerged out of one branch of Generative Grammar in the 1970s,^[16] regards properties of language as emergent from more general cognitive principles, such as iconicity,^[17] metaphor,^[18] and embodiment.^[19] Closely allied to this are a range of approaches that can broadly be considered *Functional* approaches to grammar, represented by various authors

such as Croft,^[20] Fillmore and Kay,^[21] Givón,^[22] and Hopper and Traugott.^[23] As the label suggests, functional approaches to syntax seek to explain the construction of sentences based on their function, e.g., for communication. Functionalism is often contrasted with *formalism*, where by “formal” what is meant is an emphasis on form, as in the sense of formal logic.

Functional accounts of language syntax often make appeals to principles of linguistic semantics and/or pragmatics (such appeals are rarer in the generative literature). Linguistic semantics is the study of the meanings of natural language expressions, while pragmatics refers to the real-world uses of utterances that are often not reflected in their literal meaning. For example, the utterance “Can you pass the salt?” is literally a yes/no question about the addressee’s ability to perform an act. A semantic analysis of the sentence would be expected to account for how this meaning is obtained from the component words and their combination into phrases; such analyses tend to emphasize formal, set-theoretic interpretations, which employ various forms of logic to state meanings and their relations to linguistic forms.^[24]

Conventionally, the same utterance is used as a request to the addressee that s/he perform an act. A pragmatic analysis must account for how the utterance’s conventional meaning differs from its literal meaning in this systematic way. Austin^[25] approached this problem from the perspective of *speech acts*, observing that certain types of utterances explicitly perform conventional acts, under the right circumstances (e.g., “I promise to answer,” “I sentence you to 5 years in prison”) and analyzed all utterances as operating under an implicit “performative” of some kind, even if it is not linguistically present. Grice^[26] opted for a different approach, in which he invoked a general *cooperative principle*, according to which people in a conversation assume that others in the same conversation are being cooperative, and they tailor their contributions accordingly. Utterances that are apparently noncooperative on the surface are permitted if they rationally lead to one or more *implicatures*, i.e., nonliteral interpretations that are the real communicative intent of the speaker. Both the speech acts approach and the Gricean approach remain influential in contemporary linguistics.

Discourse Analysis

Linguistic structure does not end with the sentence, but rather, sentences can be seen to be structured at yet higher levels. These are collectively known as “discourse,” and the branch of linguistics that addresses structure beyond the sentence is known as Discourse Analysis. Discourse Analysis is characterized by two main foci of interest: longer texts, whether as written texts or oral performances, and dyadic or multiparticipant conversations. The former focus is best represented by *Text Analysis*, while the latter

is known as *Conversation Analysis*. Text Analysis primarily addresses how texts function as units, their internal structure in terms of narrative units and/or rhetorical acts, and the role of sentence-level grammar in contributing to that structure (via discourse markers, emphasizing and topicalizing constructions, etc.). Similarly, Conversation Analysis addresses the characteristics of conversations that permit them to function as units, examining turn-taking mechanisms, sequencing of speech acts, and cross-cultural and gender differences in the ways conversation unfolds. A third branch, known as Critical Discourse Analysis, applies the tools of both Text Analysis and Conversation Analysis to social criticism. For example, one might examine the use of passive constructions to mask the agency of powerful actors (e.g., the government, the army, etc.) in the news reportage of war or other political events. This in combination with observation of other linguistic strategies can be used to expose and examine the ideologies of different societal actors as encoded in their communications, and how such ideologies relate to the actors’ stakes in the current events of the day.

HYBRID SUBFIELDS OF LINGUISTICS

Historical Linguistics and Language Classification

Modern linguistics is very much shaped by the awareness that languages are not static, and that change in historical time affects language in numerous ways. The study of language change is known as Historical Linguistics. One of its main methods is the *comparative method*, in which languages hypothesized to arise from a common ancestor are compared, typically by comparing words with similar form and meaning in the different languages (called “cognate forms” or “cognates”), to ascertain the degree and nature of relationship among the languages. The outcome of this is typically a language classification, in which groups of languages are said to be related across splits in the language group at different time depths. The best known example of this, and the longest established language family, is the Indo-European language family, members of which are spread over the entire globe, with members as diverse as Albanian, Dutch, English, French, German, Greek, Italian, Russian, Spanish, etc., in the European branch, and Assamese, Bhojpuri, Farsi, Gujarati, Hindi-Urdu, Kashmiri, Marathi, Punjabi, Romani, Sinhala, Tajik, etc. in the Indo-Iranian branch. Subfamilies are also recognized, such as the Germanic languages, represented by Dutch, English, and German in the above list. These share structural properties not shared by the other languages of the Indo-European family, in particular a series of consonant mutations known as “Grimm’s Law,” in which Proto-Indo-European voiceless stop

consonants became fricatives in Germanic, such as the /p/ ~ /f/ correspondence in *padre* (Spanish), *pater* (Latin) ~ *father* (English), *vater* (German).

The genetic groupings provided by the comparative method are the main source of information for most language classifications, such as those used in library cataloging (see the discussion of ISO 639-3, below). A major challenge for the comparative method is lexical borrowing, and most languages with any degree of contact with other languages at all in their history exhibit borrowing to some extent. Some historical linguists see borrowing or *diffusion* of linguistic features as an important mechanism in language change that leads to *areal* features, i.e., linguistic features that are shared among languages in a geographic region, where there may be no common linguistic ancestor.^[27,28] Hence, classifications based on geographic distribution sometimes make more sense than genetic ones.

A similar problem for classification is raised by *Pidgin* and *Creole Languages*, which are mixed languages, having structural features of two or more languages, which arise in circumstances of intense and usually deeply unequal contact among speakers of different languages. Most of the creoles known today arose during the colonization of the Americas and other regions by European powers, and hence they tend to be mixed forms of European, African, and indigenous languages of the colonized areas. Pidgin languages are used only as second languages for contact between people who have no other common language, such as the Chinese Pidgin English once used in Hong Kong. Pidgins only tend to exist in the initial stages of contact, but when speakers of the contact community intermarry without having a common first language, a Creole may develop. Many of the Creole languages in existence today, from West Africa to the Caribbean, to Hawaii, and the Indian subcontinent, arose in this way during colonization. The specific challenge for historical linguistics is that the mixed character of Pidgin and Creole languages makes it difficult to assign ancestry as would normally be done in linguistic comparison. Also, it may be difficult to tell when a language has gone through a Pidgin and/or Creole stage in its past. For example, most Pygmy communities in Africa today speak one form of Bantu language or another, but it is unlikely that they originally spoke languages from this family before contact with other speakers of Bantu languages. Hence, some of the differences between the languages spoken by the Pygmy people and other Bantu languages might be attributed to a process of creolization, at some point in their past.

These things being said, “genetic” classifications, that is, classifications based on language ancestry, are the main type of classification of language discussed in linguistics. While areal features of languages (across language families) are sometimes recognized, they are generally treated as secondary to historical, ancestral relationships.

Sociolinguistics and Psycholinguistics

Sociolinguistics is the study of language in its social context, and two general areas are recognized within it: “macrosociolinguistics” and “microsociolinguistics.” Macrosociolinguistics is typically concerned with national communities and their composition, and the individual and community-level attitudes and discourses that bear on language policies, whether implicit or explicit; and *language planning*, the employment of governmental or institutional resources to promote certain language uses (e.g., in education, commerce, or the media). Microsociolinguistics is more concerned with phenomena at the individual level, such as linguistic variation across speaking styles, circumstances of use, occupations, ethnicities, and other subnational groups. Within microsociolinguistics, there are two main areas of study: interactional sociolinguistics, which overlaps greatly with conversation analysis, but also includes intercultural communication (at the individual level), and language variation and change, or urban dialectology, which examines contemporary historical patterns in language change, typically on a generational time scale.

Psycholinguistics is the study of language in relation to cognition, the brain, and the mind. Its main areas are speech perception, sentence processing, language deficits, and language acquisition. Of these, the last is probably the dominant area of inquiry, and it is described in a separate subsection below. Speech perception primarily concerns auditory processing. Sentence processing tends to focus on the syntactic parsing and semantic interpretation of sentences by human subjects, to illuminate the cognitive mechanisms involved. Language deficits, such as aphasia (a loss of the ability to produce and/or comprehend language) and anomia (inability to access common words) are studied for similar reasons, as well as for what they reveal about the organization of language processing in the physical material of the brain itself. Written language processing is not studied much within the field of linguistics, for reasons that have to do with the field’s emphasis on spoken communication, which is more of a human universal than written communication.

Language Acquisition and Applied Linguistics

While language acquisition has a central place in Generative Grammar and other linguistic theories, its study is specialized and typically requires training in psychology, especially developmental psychology. Two general areas are recognized: acquisition of a first language by children, or *first language acquisition*, and acquisition of a second language by bilinguals, whether adults or children, or *second language acquisition*. First language acquisition is generally studied by developmental psychologists and psycholinguists, and a large literature on this has been generated, both for English and for other

languages. Second language acquisition tends to be studied by language educators and psycholinguists. It is a matter of much theoretical debate and empirical study to what extent these two processes can be compared.

Computational Linguistics and NLP

Computational linguistics and NLP, both of which are treated in other entries in this encyclopedia, are considered to be part of linguistics; at the same time, the training of linguists and computational linguists/NLP researchers may have relatively little overlap. Principally this is because, at least historically, computational linguistics is mostly practiced by people with engineering, rather than linguistic, training, and the research agendas are set from within an engineering perspective (e.g., the aim of the European *Verbmobil* project was to build a portable speech-to-speech translation system), rather than from within the goals of linguistic theory (e.g., explaining language acquisition, change, or evolution). More linguists are becoming involved in NLP projects through the development of *language resources*, i.e., dictionaries and text corpora for use in NLP tasks.

LINGUISTIC ISSUES IN THE INFORMATION SCIENCES

Linguistics is relevant to the Information Sciences in a number of ways. On a basic level, much of what we call “information” is encoded in human language of some form: textual documents, audio and video media with spoken language soundtracks, logs of computer-mediated communication, etc. Many of the levels of linguistic structure or interdisciplinary approaches to linguistic analysis could potentially illuminate what is informative about the material artifacts and processes studied in the Information Sciences. Moreover, the material processes by which information is handled, exchanged, archived, etc. share with human language their fundamental patterns of structural arbitrariness along with their embeddedness within a community of users. In this way, informational processes are fundamentally linguistic: whether human languages are involved or artificial languages, whether for encoding sounds, images, or arbitrary sensor data, or for manipulating computers or other automatic systems, all of these systems involve a representation with multiple levels of arbitrary structure, meaning there are potential levels of analysis which parallel those used in linguistics. The observed structures are governed by social conventions, much as the structures of language are.

To make these parallels more explicit, consider the oft-cited “layer cake” for Web technologies. From the lowest level upward, there are various physical media for internetworking (cables, microwave signals, etc.) upon

which low-level protocols such as Transmission Control Protocol/ Internet Protocol (TCP/IP, used by most Internet applications) and Asynchronous Transfer Mode (ATM, used in high-speed networks for simultaneous use of voice, video, and data) are operated. On top of these, there are applications protocols such as Hypertext Transfer Protocol (HTTP, used by Web browsers and servers), which is used to transfer Web pages between server and client. The Web page itself is composed in either Hypertext Markup Language (HTML) or eXtensible Markup Language (XML), which is further extended via annotations in the Resource Description Framework (RDF, the metadata definition language for the Semantic Web), etc. Each of these layers represents a level of structure whose organization and interpretation are independent of those of neighboring levels. Hence Web-based communication is structured in the same way as natural language, with relatively independent levels whose operation is nonetheless important to the levels above and below for overall system functionality. Further like linguistic communications, the Web protocols are defined and elaborated by the community structures they are embedded within, much as languages are constituted and developed in the interactions of people in a speech community. Although these protocols may be defined through a formal standards process, yet again as in human language the participants in the process do not exercise equal power to influence the outcomes. The way that the protocols are ultimately used, or what protocols are adopted, is profoundly influenced by the economic and institutional power of large players such as Microsoft, just as language policy and planning outcomes are shaped by populous or economically powerful speaker groups.

A few of the ways in which the circumstances of information technology resemble those involving human language areas are discussed in more specific terms below, focusing on issues that bring language and information-related concerns particularly close together.

Semantics and the Web

The “Semantic Web” is a technology research and development project aimed at addressing information management issues with the current World Wide Web, in which the goals of search, data interoperability, and “intelligent” applications are foregrounded. Central to this project is the development of standard formats for the definition, interchange, and use of metadata, i.e., the data used to describe documents, resources, and other material by describing authors, subject, title date of publication, etc. The Semantic Web metadata formats are characterized as encoding “semantic” information about documents and resources on the Web. Unfortunately for this project, there is a three-way systematic ambiguity in the sense of “semantic” that is intended. The following senses of semantics can be distinguished:

1. *Information retrieval (IR)*. Semantics in IR is focused on the concept of *relevance*, which is generally defined as an aboutness relation that holds of a document and its content. This aboutness relation is generally represented by metadata and/or keywords, whether from a controlled vocabulary or extracted from full text. Document semantics associates a document with its content, with other documents with similar content, and with queries.
2. *Formal logic*. Semantics in formal logic is defined in terms of the *truth conditions* of an expression, i.e., the conditions that need to hold in the world for that expression to be true. Semantics in this sense concerns the propositional content of expressions, their composition from constituent parts of the expression, and the inferences that can be licensed from them logically.
3. *Linguistics*. Semantics in linguistics is concerned with the meanings of natural language most generally. In addition to aboutness, compositionality, and inference, linguistic semantics recognizes and studies the dependence of linguistic meaning on the external social context and the complex historical dialectic between literal meaning and pragmatic inference.

Different technologies developed for the Semantic Web primarily address the first two senses of semantics. The RDF metadata interchange language and its associated syntax RDF/XML most directly address document semantics in the IR sense. They achieve the function of associating documents or resources with metadata labels that are intended to reflect their relevance to queries and other documents. The metadata definition languages RDFS and OWL, as well as the processors defined for them, most directly address the logical sense of semantics, by defining the inferences that are licensed when particular metadata elements are present. As yet, no Semantic Web technology directly addresses the broader linguistic semantics of documents and/or metadata. The Web 2.0 system feature that comes closest to this is “folksonomy” tagging, which is the provision for allowing users to apply uncontrolled metadata items that are not formally differentiated. According to proponents, tagging allows users’ own semantics to “emerge” from the contexts in which they apply tags, making formal controlled vocabularies unnecessary.

However, this latter perspective owes more to complex systems than linguistics, and it does not fully engage with the social processes involved in the informal standardization and norming in language. In the complex systems model of emergent behavior, individuals are more or less equivalent agents, and complex collective behaviors are a consequence of these simple actors conforming to simple rules. Linguists would typically recognize the actors’ behavior as likely to be heterogeneous and anything but simple. Different people may have different meanings for

the same terms, or different meanings for a term in different contexts. Complex self-referential deixis can be involved (e.g., the tag “to read” implicitly references the person who applies the tag), as can cultural, political, and other interpretive frames. People enter into the tagging activity with different levels of knowledge, expertise, power, etc., and consequently are not equivalent actors in the construction of a consensus semantics. Hence, the semantics of a large group of people tagging resources on, e.g., a social book-marking site such as del.icio.us is more likely to involve an averaging or bleaching of individual differences and a predominance of hegemonic meanings than the emergence of complexity envisioned in the “emergent semantics” perspective.

A linguistic perspective on the Semantic Web project would emphasize the social and usage-based aspects of metadata. In terms of the already existing technologies, we could ask to what extent particular RDF vocabularies are used according to their defined intent, or whether their application to particular resources and documents has altered their meaning in some way. For example, the Dublin Core metadata set is widely used in a range of applications, including the import/export of user profiles on social network/journal sites such as LiveJournal. In particular, the dc:title item is used to indicate text labels for a broad range of things, including personal interests, community names, etc., most of which were not envisioned in the original Dublin Core standard. It thus appears that the range of usage available for dc:title has been extended in a way much like the historical extension of word meanings. Note that this has consequences for logical semantics, since the extension affects the inferences one can make based on the content of dc:title. In terms of design recommendations, a linguistic perspective on document semantics would instruct us to anticipate that meanings may depend in complex ways on social and historical context, and to avoid attempting to codify semantics rigidly. A useful area to explore for technical development would be the design of mechanisms that permit meaning to be negotiated on the fly, much as humans are able to negotiate meaning, through comprehension checks and the application of pragmatic inference.

Language Categorization

Another area of linguistics that has special relevance for the Information Sciences is the area of language classification. As mentioned above, the primary classifications used by linguists are historical “genetic” classifications. These classifications do not necessarily reflect other important aspects of a language’s ethno-historical background that might be relevant for other purposes, such as its writing system, literary heritage, or available technical vocabulary. A recent development in language classification is the 2006 adoption of a new standard under the auspices of the International Standards Organization

(ISO), ISO 639-3, managed under the registration authority of SIL International, a nongovernmental organization that performs consulting services on linguistic issues, and which is closely associated with various Christian missionary organizations. ISO 639-3 supplements the older ISO 639-1 standard, which provides 180 two-letter codes, and the ISO 639-2 standard, which provides approximately 400 three-letter codes. In contrast, ISO 639-3 has three-letter codes for 7863 known languages. The importance of ISO 639 comes from its targeted adoption in libraries and archives (where ISO 639-2 is now widely used) and Web technologies (where ISO 639-1 is more commonly used) as a means of identifying languages by using fixed codes, where names and other identifications can be ambiguous. The rationale for the revised ISO 639-3 standard is that neither earlier standard can adequately represent the complete range of human languages that might be used either in writing or in spoken media.

The codes in the new standard represent a superset of the earlier 639-2 codes. The largest change in the standard is the addition of more than 7000 languages, based on the entries of the *Ethnologue*,^[29] a publication of SIL International cataloging the world's languages, their locations, linguistic characteristics, and speaker populations. While the *Ethnologue* is generally regarded as the most respected and complete authority of this type, its selection as the basis of ISO 639-3 is not neutral with regard to certain linguistic issues. Hence, adoption of ISO 639-3 in libraries or other contexts where languages need to be differentiated implies tacit acceptance of the *Ethnologue*'s sometimes controversial language classifications.

At a most basic level, there appears to be little agreement among linguists on the number of living human languages. Estimates vary from a low of 2000 to a high of 8000 or more, and the *Ethnologue* is positioned toward the high end of this range. A related issue concerns the identification of distinct languages where speakers of those language varieties would not necessarily recognize them as distinct; in these contexts, *Ethnologue* classifications (and by extension ISO 639-3) tend to be language “splitters,” based on a criterion of mutual intelligibility. One case that exemplifies this is that of Quiché (Mayan) in Guatemala, where the *Ethnologue*, and by extension ISO 639-3, counts 69 distinct languages. Quiché speakers on the other hand tend to prefer recognition of a single Quiché language, fearing that recognizing multiple Quichéan languages would fragment their cultural and political identity. A similar situation holds for various Germanic varieties in Germany (e.g., Bavarian, Swabian), which most speakers would probably classify as dialects of German, for reasons of national identification, even though these are linguistically closer to Allemanic and Swiss varieties spoken nearby. Splitting language identities in these and other circumstances is politically charged, hence the maintenance of the ISO 639-3 technical standard is one with a complex political dimension.

In some notable cases, identification goes in the other direction (lumpers), such as in the case of Mandarin Chinese, whose reported 800 million native speakers is a statistical anomaly, being many times larger than the typical language population of 10,000–50,000 native speakers, and several times larger than the nearest large language. This number probably over-reports the native Mandarin-speaking population by insufficiently distinguishing related varieties of Chinese.

The fundamental problem that remains to be addressed in the maintenance of the standard is the potentially inconsistent application of criteria that establish a speech variety as a language, dialect, or other speech variety. In the past the process of modifying language codes in the *Ethnologue* has been treated as a largely editorial one, whose consequences mainly affected SIL International's book-keeping on its language development projects. Maintenance of ISO 639-3, however, is a formal standards process whose authority is established by international treaties among participating governments, and which is required to be open to submissions from a range of different interests. In the 2007 changes to ISO 639-3, 395 changes were approved, including 76 “retired” codes, 59 new language codes, and 176 updates (meaning name changes, etc.), representing a 5% change in the available codes. It is unclear whether the reasons for addition/retirement of ISO 639-3 codes represent the application of the same linguistic criteria in all cases.

Language in Information Policy

In recent years, language has emerged as an important area in information policy, for a number of reasons. One fairly salient reason is the continued management of the Domain Name System (DNS), under which numerical Internet Protocol addresses are associated with natural language mnemonic identifiers, by the Internet Corporation for Assigned Names and Numbers (ICANN), under contract from the U.S. Commerce Department. This system uses a 7-bit ASCII encoding for names of Internet hosts that natively supports only U.S. English names. Since native-language naming is a central touchstone for Internet governance, numerous governmental and non-governmental organizations pressured ICANN for a number of years to adopt some form of multilingual standard for domain names. This pressure culminated at the United Nations World Summit for the Information Society in Tunis, 2005, where ICANN agreed in principle to open Internet governance to participation by a wider range of organizations, and to consider expansion of the DNS. In 2006, the formal adoption by ICANN of Punycode, a 7-bit variable-width encoding of the Unicode character set, permitted domain name registrars in some domains to begin offering domain names in a broader range of languages, known as Internationalized Domain Names (IDNs). These policies were further expanded in 2008.

The basic function of the DNS is much the same as that of Semantic Web metadata: to disambiguate the reference of certain mnemonic expressions used in an electronic information system. These mnemonics are intended as a human convenience: they are not required for the Internet itself to function, and their only value is that they might mean something to people. Peculiarly, at least from the perspective of human languages, both DNS identifiers and Semantic Web metadata are required to be globally unique, something that is never the case in natural languages. While this requirement is obviously instituted for the convenience of computer processing, in reality, global uniqueness is a fiction that can only be maintained under the closed-world assumption that everything worth reasoning about can be enumerated and contained within one fixed system. This assumption of a Platonic ideal universe rapidly becomes difficult to implement when it is transferred to a shared information network with inputs from multiple sources in multiple social contexts. It also becomes politically oppressive when taken to its logical conclusion, forcing everyone and everything to access the reference of any Internet host or any ordinary expression through a centralized authority. While national governments and other groups often engage in formal efforts to standardize natural languages, such efforts typically have little impact on the native-speaking public. Ordinary language use, a fundamental human experience, and arguably a fundamental human right,^[30] needs to be responsive to the changing context and experience of speakers' everyday circumstances. The failure of the DNS to naturally accommodate naming in languages other than English, and the requirement that the reference of names be globally fixed for the system to function, are thus failures of the system design to properly address its human interface goals.

What is at stake in both the DNS and the Semantic Web is actually the extension of property rights to language (the "commodification" of language), a much broader trend encompassing trademarks, copyrights, and other forms of "intellectual property." Requiring global uniqueness creates a property system wherein prospectors can claim potentially valuable territory, and develop it to extract rents or turn a profit, as in the case of certain two-letter domain names (actually ISO 3166-1 country codes), such as .tv (Tuvalu, used for "television"), .ad (Andorra, used for "advertising"), and .cd (Democratic Republic of the Congo, used for "compact disc"). While something like this property system has arguably existed for some time in the case of copyright, trademark, and other forms of intellectual property, the manifestation and interpretation of such intellectual property systems is not the same across cultures,^[31] and such an extensive property system has never been created before for reference, a far more basic linguistic function than, e.g., literature or invention. A linguistic agenda for research and development in the DNS would examine the manner in which DNS entries

are actually used, the purposes to which they are put, and the dynamic nature of referential meaning in the context of information technology use.

Computer-Mediated Communication

Another area of the study of information in which linguistic approaches have been actively adopted is computer-mediated communication (CMC). Currently, the primary use of the Internet remains human-to-human communication over computer media, most of which involve text. Consequently, most uses of CMC make heavy use of written language, and hence linguistic means of analyzing text and language are relevant to the study of CMC. However, studies of CMC have only slowly gathered acceptance within the field of linguistics, mainly because of the primary status accorded to spoken over written communication. Since many of the initial questions around CMC concerned differences between speaking and writing, or features of spoken language appearing in written CMC, linguists have tended to neglect or disregard linguistic studies of CMC as being less than central to the concerns of the field. At the same time, it is becoming clearer to many researchers that some forms of CMC, such as instant messaging and short-messaging (SMS) via cell phones, communication on Weblogs, and social networking sites, are developing into primary modes of interaction for some purposes. As this awareness develops, and as the full range of linguistic phenomena relevant to CMC become recognized, study of CMC is gradually gaining acceptance within linguistics.

Studies of CMC from a linguistic perspective have focused on a broad range of phenomena, of which four general categories might be recognized: register and genre effects, interactional dynamics, cognitive processing constraints, and language contact phenomena. The earliest CMC studies, e.g.,^[32] generally address register and genre effects; these studies tend to consider CMC types such as e-mail, chat, and discussion boards and ask how they differ from writing and/or speech, noting in particular a divergence between informal written CMC modes such as e-mail or chat and that of standard written language. Later studies in this vein^[33] have tended to interpret such observations from the perspective of genre theory, rather than as deterministic effects of the medium. Different CMC modes also tend to have different kinds of constraints, e.g., on message length, and may be favored by different communities of users. Consequently there are different structural adaptations that are found in different modes, such as chat (which is exchanged synchronously, when the users are logged in at the same time) and e-mail (which is exchanged asynchronously). Even superficially similar communication modes, such as chat within MUDs or MOOs (a kind of text-based multiplayer game environment) and Internet Relay Chat (a general real-time chat system) can show sharply different structural adaptations

of language, because of the different communities of users that frequent those systems.^[34]

Within the area of interactional dynamics, probably the first area to receive extensive study was that of gender,^[35] although studies of flaming, trolling, and other antisocial behaviors followed. Other aspects of interactional dynamics, such as turn-taking in various CMC modes, the coherence of extended interactions, and social network effects on the distribution of languages or linguistic variants, have also been studied. Building on much of this work is a body of design and experimental work, in which various parameters of CMC are manipulated. In the experimental tradition, the effects of these manipulations are studied in controlled experiments to identify medium effects on task performance in different contexts.

Finally, a group of studies has attempted to address an issue unique to the international context of the Internet, namely the effects of language contact among speakers of different languages using CMC. This contact is perhaps less obvious to speakers of English than it is to speakers of almost any other language, who are typically confronted with English in most of their online activities. At times, speakers of other languages have responded to the perceived dominance of English, e.g., in the case of Brazilian members of the social networking service Orkut who visibly used their Portuguese language in public fora as a political statement, much to the consternation of some English-speaking members. Most studies in this area are individual case studies, often of small-scale settings.^[36] There have been a few attempts to survey languages used on the Internet more generally,^[37] but this has not been done yet in any comprehensive way.

CONCLUSION

Linguistics is a discipline that inhabits an interdisciplinary problem-space with many points of intersection, realized and unrealized, with the field of information studies. Its primary mode of investigation is structural analysis, although the modern practice of linguistics uses methods informed by many other disciplines. In addition, linguistics has broad applicability to information studies, where it can contribute insights that unite the contextual aspects of information use (e.g., cognitive, social, and cultural context) with concerns about the structural manifestations of information.

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Linked Data

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Abstract

In the evolving world of data on the World Wide Web, there are many standards that are used to provide better data with more context and meaning in the Semantic Web. Linked Data standards must be followed in order to fully utilize Semantic Web technologies by creating a web of data that can be interpreted by both human and machine. This entry provides an overview of what Linked Data means and the basic best practices for implementing Linked Data, as well as a quick survey of how Linked Data is being used in libraries.

INTRODUCTION

Simply put, Linked Data refers to publishing data on the web that links to other data on the web. In the traditional World Wide Web, documents were linked to other documents, but individual pieces of data were not linked to anything. Linked Data is the mechanism that is used to create links between individual pieces of data in order to provide richer information about things and concepts.

This entry will give an overview of how the Web environment is evolving to allow for the linkage of pieces of data rather than only documents, the basic principles that should be followed to create Linked Data, the benefits of implementing Linked Data, and the ways that Linked Data can be created. It will conclude with a brief overview of some Linked Data projects underway in libraries.

OVERVIEW OF LINKED DATA

Tim Berners-Lee first coined the phrase “Linked Data” in 2006 when talking about the design of the Semantic Web. According to Berners-Lee, “The Semantic Web isn’t just about putting data on the web. It is about making links, so that a person or machine can explore the web of data. With Linked Data, when you have some of it, you can find other, related, data.”^[1] He has also been quoted from the Library of Congress in an overview of the BIBFRAME project as saying:^[2]

The realization [behind creation of the Internet] was, “It isn’t the cables, it is the computers which are interesting.” The Net was designed to allow the computers to be seen without having to see the cables. The [World Wide Web] increases the power we have as users again. The realization was “It isn’t the computers, but the documents which are interesting.” Now you could browse around a sea of documents without having to worry about which computer they were stored on. Now, people are making another

mental move. There is realization now, “It’s not the documents, it is the things they are about which are important.”

While they are closely related, Linked Data and the Semantic Web are two separate ideas. To distinguish between the two ideas, it has been said that the “Semantic Web is defined as a ‘web of data’; a web created for computers linking data that is structured in such a fashion that computers do most of the linking.”^[3] Linked Data is the set of standards and technologies that are used to build the relationships between individual pieces of data. Data linked in this fashion can be described as “structured, reusable, machine-actionable, and interrelated.”^[4]

PRINCIPLES OF LINKED DATA

For many years, data has been published on the web in a human-readable format. Linked Data builds upon this structure by publishing data on the web according to a set of standards that make the data both readable by humans and also formatted in a standardized way for a computer to interpret the meaning and context of the data. This makes it possible for both humans and computers to identify related data on other sites that can provide a wealth of information about a thing or an idea, as well as to disambiguate between data that may share the same name.

Tim Berners-Lee has said that there are four principles that must be followed in order to create Linked Data. These principles are as follows:^[1]

- Use URIs (Uniform Resource Identifiers) as names for things.
- Use HTTP (Hypertext Transfer Protocol) URIs so that people can look up those names.
- “When someone looks up a URI, provide useful information, using the standards (RDF*, SPARQL).”
- “Include links to other URIs, so that they can discover more things.”

All four of these principles need to be followed in order to provide true Linked Data. A majority of information on the web currently follows some of these principles, but not all of them. These principles build upon the general architecture of the World Wide Web by taking web documents and marking them up using common standards in order to provide structured data that is open and reusable by others as well as linked to data housed on other websites.^[5]

Use URIs as Names for Things

The first principle of Linked Data is to use a URI to identify individual “things.” These URIs are different from URIs that are used to identify documents on the Web since they represent an individual piece of data rather than the location of a full document. Linked Data URIs can not only be used to identify real objects, such as a person, place, or thing, but they can also be used to identify a concept or an idea. Without a unique URI to identify something, it can be difficult for humans and nearly impossible for computers to always disambiguate ideas correctly.

A URI consists of a string of characters identifying a domain name and the unique file path of the item being described. A URI identifies a reference to a resource rather than providing a file name or location of a resource. The location of a resource is denoted by a URL, or Universal Resource Locator, which links to a specific document on the web.

HTTP URIs

Users must be able to look up the data represented by a URI through the HTTP. This protocol is the foundation for communication via the World Wide Web. Other forms of unique identifiers on the Web are to be avoided if they cannot be looked up via HTTP, such as a URN (Uniform Resource Name) or DOI (Digital Object Identifier). There are two main reasons why HTTP URIs are necessary for Linked Data. These are as follows:^[5]

1. “They provide a simple way to create globally unique names in a decentralized fashion, as every owner of a domain name, or delegate of a domain name owner, may create new URI references.”
2. “They serve not just as a name but also as a means of accessing information describing the identified entity.”

Since HTTP URIs can be accessed by both humans and computers, a method of content negotiation is used for the web server to return either an HTML-coded document for a person to read or RDF (Resource Description Framework) data for the computer to interpret. According to the World Wide Web Consortium (W3C), HTTP content negotiation means that the web server is able to make a decision based upon the information available and the

Web Client’s preferences in order to deliver the type information needed by the user in order to make the data human or computer accessible.^[6]

Use Linked Data Standards

The primary standard used to encode Linked Data is RDF in its various forms (e.g., RDF/XML, N3 Triples, Turtle, JSON-LD). These Linked Data sets are then queried through SPARQL (SPARQL Protocol and RDF Query Language). The building block of RDF is the triple, a set of three URIs or literal values denoting a property held by the resource being described. The three parts of a Linked Data or RDF triple can be defined as follows:

1. Subject—a URI identifying the resource to be described
2. Predicate—a URI from a specific domain or vocabulary creating a relationship between the subject and object
3. Object—a URI or literal value (e.g., string, number, date) describing the subject

There are two main types of triples that can be created with this structure: a literal triple or a linked triple. A literal triple will contain a data string, number, or date as the object describing the subject, such as describing the name of a person or the date of an event. A linked triple consists of three URI references relating the subject URI to the object URI through a predicate URI. The URIs for the subject and object can either be in the same domain or different domains. Links to different domains are used in a triple to link multiple websites, which then creates the web of data. A single triple describes one aspect of a resource and many triples linked together describe multiple aspects of a resource. For example, if the object being described is a book, there can be multiple triples linked to the resource describing its title, publishing information, extent, creators, etc.

The information that is provided when a URI is looked up needs to be further information and context in order to disambiguate between different concepts with the same name that can be interpreted by both human and computer. For instance, if the thing that is being represented by a URI is “Mercury,” there needs to be other data retrievable from the URI in order to know whether the item is the chemical element, the planet, the automobile, or one of the many corporate bodies with that name.

When data is structured according to the RDF standard, it becomes possible to query that data using SPARQL. When SPARQL was first implemented by the W3C in 2008, it was “designed for use at the scale of the Web, and thus enables queries over distributed data sources, independent of format.”^[7] This would lead to providing richer results that would cost less since a single query could be used to search multiple data stores.

Link to Other URIs

The final principle of Linked Data is to link to URIs from different domains in order to connect the full web of data. Data is not considered true Linked Data until it has been linked to sites outside of the current domain or web server. These external links are generally used as the predicate and object of an RDF triple. Links like this can be one of three types:^[5]

1. “Relationship Links point at related things in other data sources, for instance, other people, places or genes. For example, relationship links enable people to point to background information about the place they live, or to bibliographic data about the publications they have written.”
2. “Identity Links point at URI aliases used by other data sources to identify the same real-world object or abstract concept. Identity links enable clients to retrieve further descriptions about an entity from other data sources. Identity links have an important social function as they enable different views of the world to be expressed on the Web of Data.”
3. “Vocabulary Links point from data to the definitions of the vocabulary terms that are used to represent the data, as well as from these definitions to the definitions of related terms in other vocabularies. Vocabulary links make data self-descriptive and enable Linked Data applications to understand and integrate data across vocabularies.”

BENEFITS OF LINKED DATA

There are many formats that can be used to publish data on the Web. Heath and Bizer say that some of the benefits of using Linked Data for publishing on the Web include the following:^[5]

- “A unifying data model. Linked Data relies on RDF as a single, unifying data model. By providing for the globally unique identification of entities and by allowing different schemata to be used in parallel to represent data, the RDF data model has been especially designed for the use case of global data sharing. In contrast, the other methods for publishing data on the Web rely on a wide variety of different data models, and the resulting heterogeneity needs to be bridged in the integration process.”
- “A standardized data access mechanism. Linked Data commits itself to a specific pattern of using the HTTP protocol. This agreement allows data sources to be accessed using generic data browsers and enables the complete data space to be crawled by search engines. In contrast, Web APIs are accessed using different proprietary interfaces.”

- “Hyperlink-based data discovery. By using URIs as global identifiers for entities, Linked Data allows hyperlinks to be set between entities in different data sources. These data links connect all Linked Data into a single global data space and enable Linked Data applications to discover new data sources at run-time. In contrast, Web APIs as well as data dumps in proprietary formats remain isolated data islands.”
- “Self-descriptive data. Linked Data eases the integration of data from different sources by relying on shared vocabularies, making the definitions of these vocabularies [retrievable] and by allowing terms from different vocabularies to be connected to each other by vocabulary links.”

Other benefits as described by Lampert and Southwick are as follows:^[8]

- “An opportunity to connect distributed sets of structured data about ‘things’.”
- “The more structured the data are, the more actions that can be performed on the data.”
- “Open data relieves the frustration of accessing data that cannot be used due to formatting or restriction in silos [...] and it allows the data to not only be discovered on the open Web, it can be delivered for use, reuse, or [...] to help bridge applications and systems.”
- Data are reusable and break out of their silos.

PUBLISHING LINKED DATA

In order for data providers to understand if they are providing true Linked Data, Tim Berners-Lee created a five star model that can be followed:

- 1 star—“Available on the web (whatever format) but with an open license, to be Open Data”
- 2 stars—“Available as machine-readable structured data (e.g. excel instead of image scan of a table)”
- 3 stars—“As^[2] plus non-proprietary format (e.g., CSV instead of excel)”
- 4 stars—“All the above plus, Use open standards from W3C (RDF and SPARQL) to identify things, so that people can point at your stuff”
- 5 stars—“All the above, plus: Link your data to other people’s data to provide context”^[1]

Another way that this five star data model for evaluating data can be understood is as follows:

- 1 star—Data structure
- 2 stars—Licensing
- 3 stars—Format
- 4 stars—Identifiers
- 5 stars—Data linking^[9]

Many different methods have been discussed to create Linked Data. A simple process can be described in three steps:^[10]

1. "Assign URIs to the entities described by the data set and provide for dereferencing these URIs over the HTTP protocol into RDF representations."
2. "Set RDF links to other data sources on the Web, so that clients can navigate the Web of Data as a whole by following RDF links."
3. "Provide metadata about published data, so that clients can assess the quality of published data and choose between different means of access."

Different checklists for publishing Linked Data have also been created. Some questions that must be answered in order to create Linked Data include the following:^[5]

- "Does your data set links to other data sets?"
- "Do you provide provenance metadata?"
- "Do you provide licensing metadata?"
- "Do you use terms from widely deployed vocabularies?"
- "Are the URIs of proprietary vocabulary terms dereferenceable?"
- "Do you map proprietary vocabulary terms to other vocabularies?"
- "Do you provide data set-level metadata?"
- "Do you refer to additional access methods?"

If the answer to all of these questions is "yes," then the data has been created according to all of the Linked Data standards. If one or more of the answers is no, then things must be corrected in order to make the data truly linked.

Creating a Linked Data Application

In order to create a basic Linked Data application for use on a website, there are a few steps that must be completed. First, data sources that contain relevant data about the items to be described need to be identified in order to retrieve useful information to represent the items. Once this data is identified from other sources, it should be downloaded into a local Linked Data RDF store so that it can be used and consumed on a local level. The final step is to query and retrieve this information when needed from the local data store so that it can be displayed for the users of the website.

While that can be a relatively simple way to implement a Linked Data application, the data in the RDF store will need to be updated and refreshed periodically in order to maintain the completeness and accuracy of the data. This can be achieved by crawling the data from the external sources on a regular basis to find new or changed data or an "on-the-fly dereferencing pattern" can be used to dereference URIs at the same time that the Linked Data application requests the information. The latter method will provide the most up-to-

date information, but it could also be a slower method since URIs from many different domains would need to be queried when the user requests the data.^[5]

LIBRARY LINKED DATA

Some Linked Data initiatives that are underway in libraries worldwide as of this writing include the Library of Congress' Bibliographic Framework Initiative (BIBFRAME – <http://bibframe.org/>) and the European Linked Open Data Project (<http://pro.europeana.eu/linked-open-data>). Both of these library-centric initiatives are working to take existing library data and transform it into a Linked Data model that will help library data to be more shareable and accessible on the open web.

The Library of Congress started the BIBFRAME project "to re-envision and, in the long run, implement a new bibliographic environment for libraries that makes 'the network' central and makes interconnectedness commonplace."^[2] This model is being explored "to provide a pattern for modeling both future resources and bibliographic assets traditionally encoded in MARC 21."^[2] This is said to be achieved by working toward two objectives: "1) enable far more integration of existing bibliographic resources and 2) create a roadmap for moving forward toward refinement, redevelopment or development of alternative approaches."^[2]

In addition to the emergence of Linked Data, there is also the movement toward Linked Open Data in libraries, archives, and museums. While there can be restrictions on the use of Linked Data, Linked Open Data is data created with an open license that can be downloaded and repurposed, with or without attribution, depending on the licensing terms in use by the data creator.

The European Linked Open Data Project has been a work in progress for several years, with the first datasets being released as Linked Open Data in February 2012. In a 2011 paper presented at the International Conference on Dublin Core and metadata applications, it was said that.^[11]

With data.europeana.eu we are making a first version of the Europeana metadata set available as Linked Open Data. It includes data from those providers who have opted for their data to be published in the public domain. Anyone can now obtain descriptive metadata about Europeana resources by downloading the dumps, dereferencing HTTP URIs, or executing SPARQL queries against a dataset that follows the Europeana Data Model (EDM). The tools and scripts we developed for this purpose are open source and can freely be re-used or extended by others.

CONCLUSION

Linked Data has the potential to break down data silos by creating methods and best practices for providing data

from a host of different sources to users of websites using Linked Data. This will allow for sharing common metadata standards, reutilizing existing controlled vocabularies, and the integration of additional sources of data to a website's existing data source.

With more cultural heritage institutions starting to experiment with Linked Data, metadata in libraries, archives, and museums could vastly change in the future. The vast amount of data that libraries hold can be a great addition to the Linked Data environment, making it possible for other institutions and websites to reuse library data in many different ways.

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Lithuania: Libraries and Librarianship

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Abstract

The entry is devoted to the present situation (2001–2006) of libraries in Lithuania, a Baltic state that regained independence from the Soviet Union in 1990. The author describes general features of the historical and modern context that formed and influenced the Lithuanian library sector and presents the characteristic features, achievements, and problems of the public library network, academic and research libraries, and networks of school and special libraries. The institutions educating library and information specialists and conducting research and the professional organizations of librarians are introduced. The entry is a general introduction to modern Lithuanian libraries.

INTRODUCTION

The Republic of Lithuania has a complex political history ranging from a medieval Polish-Lithuanian State to a neglected, nineteenth century province of the Russian Empire. Its cultural history and heritage are equally complex. Its modern cultural and information institutions are the result of this history and of the mixed traditions inherited from different peoples and historical periods.

This entry provides a broad introduction to libraries in Lithuania since 1990 when the independence of the country was restored. These years were rich in events ranging from the Soviet Union blockade (lasted 74 days from April 20 to July 2, 1990, when Soviet Union stopped all provision of oil, fuel and raw materials demanding to revoke the Act of the Re-Establishment of the State of Lithuania from March 11, 1990) to unprecedented economic growth and a changing political and cultural scene.

One of the goals that unites different types of libraries is providing information services to various segments of Lithuanian society and ensuring wide national and international access to information and cultural materials for the sake of the progress and development of a democratic society. Another goal is preserving and making sense of the rich cultural heritage during a period of intensive change in modern Lithuanian society. The range of information and cultural institutions pursuing these goals is broad, but space limitations do not allow us to introduce them all. Therefore, we will confine our discussion to the library sector, leaving out other providers of information products and services.

Definitions

Lithuania—(Lithuanian: *Lietuva*), officially the *Republic of Lithuania* (Lithuanian: *Lietuvos Respublika*), is a northern European country situated along the south-eastern

shore of the Baltic Sea, sharing borders with Latvia to the north, Belarus to the southeast, and Poland, and the Russian exclave of the Kaliningrad Oblast (county) to the southwest (see Fig. 1). It has a population of 3,575,439 (2007 estimate); 83.6% are ethnic Lithuanians, with minority groups that include Poles, Russians, and Belarusians.^[1]

Library system. The totality of networks of various library types that perform a variety of functions in service of the same local or national community and are governed by unified legislative, economic, and organizational principles.

Library network. A group of libraries that perform the same social functions for a typical group of users, based on the same principles and supported by a professional guidance center.

Library sector. The whole library sector can be treated as a broad social system based on a common legislative foundation, consisting of several interwoven organizational networks pursuing specific but complementary goals and using educational, professional, technological, and research resources provided by other, closely associated, societal systems. The entry will treat all of these components at an introductory level providing a snapshot of the present situation.

HISTORICAL CONTEXT

Discussing East European nations in their historical context is complicated by the changing political, military, economic and ethnic composition of the region. The Lithuanian case is further complicated because ethnic Lithuania has two parts: Lithuania Minor (the left bank of the river Nemunas that was mainly under the control of German states) and Great Lithuania. This division is important for cultural history, because Lithuania Minor played a huge role in the development of Lithuanian

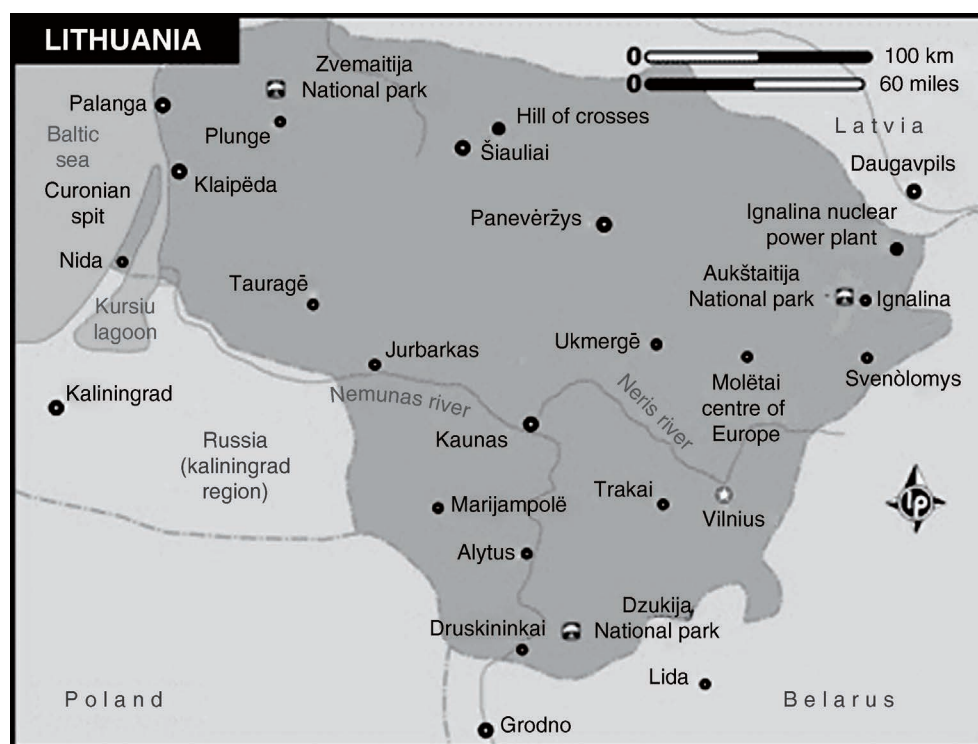


Fig. 1 Map of Lithuania.

culture, literacy, book publishing, and education. Lithuanian history may be divided into the following three periods:

- *Fourteenth to eighteenth century*—formation of the state, its expansion, and decline.
- *End of eighteenth to start of twentieth century*—partition of the state and survival under Tsarist Russia, rise of a national movement.
- *Twentieth to twenty-first century* (since 1918)—first independence period; Soviet period; second independence period.

Each of these periods can also be characterized by specific cultural features and developments in the media, book and library history.

The first period (fourteenth to eighteenth century) is characterized by the formation of the Lithuanian super-state, the late adoption of Christianity at the end of the fourteenth century, the Union with Poland and military conflict in the West (with the Teutonic Order), East (with Russia), North (with Sweden), and South (with Turkey). The militarization of the state and the geopolitical situation inhibited cultural development. However, the first libraries (mainly in monasteries) were established during this period, the first private book collections were built by Lithuanian aristocracy and rulers and the first printing houses were established. Lithuanian script was created and the first Lithuanian book was published in 1547 in Lithuania Minor; subsequently, publishing in the

Lithuanian language expanded. The first library for a Lithuanian college at Prague University was created in 1397. Vilnius University Library began in 1579 as a Library of the Jesuit Academy.^[2] The eighteenth century saw the development of the libraries of educational institutions and churches and the rise of the first ideas of public access to libraries.

During the second period (eighteenth to twentieth century) the Polish-Lithuanian state, including the Grand Duchy of Lithuania, ceased to exist and was divided among Tsarist Russia, Prussia and the Austro-Hungarian empire (last division in 1795). The largest part of ethnic Lithuania belonged to Tsarist Russia, and Lithuania Minor—to Prussia. Lithuanian libraries suffered great losses together along with the rest of Lithuanian culture. However, there were also developments significant for libraries. Vilnius University played a significant role in the education of Lithuanian authors and scholars writing in different languages, but also in Lithuanian. The first scholarly works related to library work and bibliography were created by a number of scholars of Vilnius University (Groddeck, Lelewel, Bohatkiewicz). The first course in bibliography was taught at Vilnius University in 1828–1831 by Bohatkiewicz. In 1831, after a insurrection against Tsarist rule, Vilnius University was closed, so its library ceased to exist as a university library.

From 1864 to 1904, Lithuanian script was banned, affecting the development of literature, education, publishing, book trade, and other spheres of life. During this period, the role of Lithuania Minor increased, because it

served as a source of literature in the Lithuanian language for Great Lithuania. Literature produced there and in other regions was smuggled in and gave rise to a cultural phenomena known as “book carrying.” The first communal library was established in Šiauliai (1850–1864); Vilnius Public Library was opened in 1867. Once the ban was lifted, the first legal Lithuanian libraries began to appear in parishes, educational institutions, and societies. Vrublevskis Public Library was opened in 1912 (later included in the Library of the Academy of Science), and the first bibliographies of Lithuanian publications appeared.

The Baltic states emerged from the political turmoil caused by the First World War. The first independence period (1918–1944) was most important for the development of libraries. The National Library of Lithuania (NLL) was founded in 1919 in Kaunas, then the provisional capital of Lithuania, as the Central State Library of Lithuania. The Bibliographic Institute was established at Kaunas University Library and started publishing the national bibliography (1928–1944). The system of public libraries was created, the first courses for librarians were organized and the Lithuanian Librarians’ Association was established in 1931. The Law on State Public Libraries was adopted in 1936.

Soviet rule, from 1940 and after World War II, distorted the role of libraries and diverted their natural development to a different direction. Collections were destroyed and their renewal controlled, the functions of libraries changed and the Lithuanian Librarians’ Association, which has been closed by the Germans, was not recreated until 1989. The libraries mainly served as ideological institutions; however, the actual needs of life demanded certain services. The Soviet period saw the expansion of mass libraries and the creation of the State System of Information Support for industry and other branches of the economy. The Book Chamber, established in 1945, took over compiling the current state bibliography and started work on a retrospective national bibliography. The State Republican Library performed the role of the main support center for all libraries and functioned as a national library. In 1949, it started the journal *Bibliotekų darbas* (Library Work) (changed title to *Tarp knygų—In the World of Books*—in 1991). In 1949, Vilnius University admitted the first students to the program of library science and bibliography. Despite being under tight ideological control, Lithuanian librarians managed to accomplish significant work in preserving the cultural heritage. Gudauskas^[3] has provided a more detailed picture of the history of Lithuanian libraries.

Modern Context

The second independence era, which began in 1990, is as controversial from the point of view of library development as the Soviet period. Rather than having an ideological press, market forces, the problems of a young

developing state, and the advent of new information and communication technologies influenced the library system. The factors that have had the greatest impact on library development include

- *A changing market for books and information products*: almost 500 publishers produce more than 4200 titles a year (p. 4–5);^[4] information production is more diverse with regard to media and form; local digital information products compete with those produced internationally.
- *A saturated and more competitive mass media and entertainment market*.
- In 2005 *computer penetration* was 31.10% and the *Internet penetration* was 15.45%,^[5] but in 2007 it was already 35.9 % (usage growth in 2000–2007, 443.0%).^[6]
- *The educational level of Lithuanian population*: 16.1% of the population had higher education; in 2006, more than 199,000 students studied at Lithuanian universities and colleges and more than 514,000 in secondary schools.^[7]
- *The policy of successive Lithuanian governments in education, culture, health, and research areas*: expenditure on education per student/pupil is one of the lowest in Europe (pp. 97–98);^[8] the same can be said about health and culture.

Since 1992, there has been strong interest in creating an Information Society. The Information Society Development Committee under the Government of Lithuania was established in 2002. It takes care of the development and implementation of information technology and communications and is also concerned with ensuring equal access to the information infrastructure by various social groups, seeking to prevent excluding anyone from participation in information society and providing access by developing the required competence. The Committee also expands the services of e-government and ensures the progress of e-democracy.^[9]

THE LIBRARY SYSTEM OF LITHUANIA

Legal Foundations

The legal foundations for access to information and the institutions providing information and ensuring its preservation in various forms are set out in the Constitution of the Republic of Lithuania. Article 25 of the Constitution guarantees that “Human beings must not be hindered from seeking, receiving and imparting information and ideas”; article 42 obliges the State to “support culture and science, and [...] take care of the protection of Lithuanian historical, artistic and cultural monuments and other culturally valuable objects.”^[10] The right to receive information and

express oneself is mainly ensured by the *Law on provision of information to the public*^[11] that deals mainly with mass media activity. Other public and private institutions are important in guaranteeing these rights and their implementation.

Since 1990 a number of laws have been passed to regulate state and private institutions concerned with the preservation of the cultural heritage and creating or delivering information products and services. Several of these laws deal with library and information service: *the Law on libraries, the Law on documents and archives, the Law on museums, and the Law on provision of information to the public*. Another category of laws regulates certain aspects of information activity and has a direct impact on libraries and other information mediators: *the Law on copyright and related rights, the Law on legal protection of personal data, and the Law on the right to get information from the state and municipal institutions and others*.

The rapid development and diffusion of information and communication technologies has stimulated the creation of laws regulating new relations and activities, e.g., *the Law on information society services, the Law on electronic communications, the Law on electronic signature*. These laws apply to libraries as providers of Internet services, creators of digital information and mediators of access to the products created by commercial and public providers.

The *Law on libraries* was adopted in 1995 and revised June 15, 2004. It establishes the system of Lithuanian libraries, relations between libraries, rules of establishment, financing and administration of libraries, building library collections and their structure and principles of service. According to the law, printed matter and any other documents must be accessible to everyone free of charge regardless of their authorship or their political and ideological orientation. A library ensures this accessibility as an institution of culture, education and information.^[12] Other laws and legal acts support this role of libraries. For example, the *Law on copyright and related rights* ensures their right to lend copyrighted works (in the case of educational and scientific libraries without remuneration) and to reproduce them for preservation purposes and for the personal needs of their users. The law also defines usage and reproduction of digital (electronic) documents through libraries. To some extent it also regulates the ownership and usage of the databases created by libraries, e.g., electronic catalogs.^[13]

Types of Libraries and Their Management

Libraries in Lithuania can be classified according to two main criteria:

1. Foundation and ownership
 - a. State libraries (founded by state institutions, local authorities, etc.). Their collections constitute state property and a joint library collection of Lithuania

based on the general information system and standards.

- b. Nongovernmental libraries (founded by private companies, political, professional, religious or other nongovernmental organizations or individuals).
2. Functions and community served
 - a. General libraries that serve the information needs of the readers of all professions, diverse levels of education, different ages and social or cultural background living within the boundaries of a certain territory. The following libraries belong to the group of general libraries:
 - (i) The National Library (the main public research library)
 - (ii) County public libraries
 - (iii) Municipal public libraries
 - b. Special libraries that satisfy the special needs of a certain served community by building specialized collections answering these needs (education, research, manufacturing, etc.)
 - (i) Special governmental libraries (serving a specialized sector, e.g., medicine, agriculture, etc.)
 - (ii) Libraries of research institutions
 - (iii) Academic libraries of higher educational institutions
 - (iv) School libraries
 - (v) Libraries of other institutions and organizations (hospital, prison, corporate, etc.)^[12]

Five libraries with exceptionally valuable collections have the status of “libraries of national significance.” They serve as consultation centers for their networks. There is a special line in the budget of the national government to finance the National Library and the libraries of national significance (except Vilnius University Library). These libraries are also officially designated to receive legal deposit copies of documents. According to this decision

“creators of the public information in 2 days after publication of the print-runs of at least 100 copies of non-secret documents (books, periodicals, microforms, audio and visual, cartographic, video, electronic, and printed in the script for blind) deliver legal deposit copies free of charge”^[14]
to

1. National Martynas Mažvydas Library of Lithuania (2 copies)
2. Vilnius University Library (1 copy)
3. The Library of the Academy of Science of Lithuania (1 copy)
4. Lithuanian Library for the Blind (1 copy of all documents for the blind including large print and audio documents)
5. Technical Library of Lithuania (1 copy of standards, technical documentation and patent documents)^[13]

Kaunas County Public Library as a second national archive also receives a legal deposit of the same type of materials that are sent to the National Library. Together with other specialized libraries (like the Lithuanian Medical Library and Lithuanian Agricultural Library) they coordinate acquisition and overall Lithuanian library collection-building in specific subjects and document types.

The Ministry of Culture of the Republic of Lithuania is authorized to regulate state administration of all libraries in Lithuania. The Library Council (currently consisting of 11 members delegated by the community of librarians and the Minister of Culture) is an advisory body, which helps to formulate the strategy of library development and library policy, define the principles of library financing, and establish the need for library education and research. The Ministry of Culture manages the NLL and the Library for the Blind and, through the state funding, directly influences the network of public libraries. Other networks of libraries are managed by other governmental departments. Among them is the Ministry of Education and Science, which is responsible for the largest network of school libraries and also takes care of academic libraries.

Martynas Mažvydas National Library of Lithuania

Since May 30, 1989, Martynas Mažvydas National Library of Lithuania has been the principal public and research library of Lithuania, according to the *Law on Libraries*. It performs all the functions of a national library:

- Serves as a national archive of all publications and ensures preservation of Lithuanian printed heritage and Lituanica (publications related to Lithuania and Lithuanians published abroad).
- Is the center of the national bibliography and publishing statistics and the center of coordination of consultation and research on library methods.
- Serves as an information center for social sciences and humanities, the center of allocation of ISBN, ISMN, and ISSN, and the center for the Lithuanian Integrated Library Information System (LIBIS).
- Serves as a Parliamentary Library (since 1991).

The NLL participates in international library activity and belongs to 11 international library associations. It has been a member of International Federation of Library Associations (IFLA) since 1992. It offers a variety of services for different groups of readers: provides the Lithuanian population with access to all its collections and seeks to widen this access through digitization; informs the public about the items in the collections through its Online Public Access Catalog (OPAC) ensures access to Lithuanian and foreign databases; promotes reading, Lithuanian culture and publications. The NLL also serves other Lithuanian libraries: collects library statistics and information about libraries in Lithuania, disseminates this information, participates and

supports the union catalog of Lithuanian libraries, creates standards for library and information work, publishes library literature and organizes courses of professional development. The performance of these tasks is ensured by 537 employees, including 389 professional librarians.^[15]

According to its annual report, in 2006 NLL had a collection of 6,912,266 physical items, 15,845 registered users, 151,116 visitors and circulated 2.2 million documents.^[15] A detailed article on Martynas Mažvydas National Library of Lithuania was published in ELIS in 2003.^[16] Some of the main functions and new projects (e.g., digitization initiatives, participation in the European Library and TEL-ME-MOR project) of this library are especially important for information policy, publishing activity, development of information services in general as well as for the other libraries in the Republic. A short overview of these functions is presented here.

Production of national bibliography and current information on publications. The NLL has performed the functions of the national bibliographic agency since 1992 when the former Book Chamber of Lithuania was reorganized into a Bibliography and Book Science Centre of the NLL. This Centre is responsible for the accumulation and preservation of the national archive of publications that appear in Lithuania: books, periodicals, printed music, cartography, audiovisual documents (since 1997), and electronic resources. This work is carried out on the basis of legal deposit. The Centre catalogs the legal deposit copies, produces current bibliographies of the documents and their component parts (*Bibliografijos žinios*—The Bibliographical News, *Knygos*—Books, *Straipsniai*—Articles, *Serialiniai leidiniai*—Serials, *Garso dokumentai*—Sound Recording Documents, *Lietuvos bibliografinės priemonės*—Lithuanian Bibliographical Tools), and compiles the database of authority records. Bibliographical records are prepared and accumulated at the National Bibliographic Data Bank, which is available on the Internet (see <http://www.libis.lt:8082/>). The legal deposit acquisitions also serve as a basis for *Lietuvos spaudos statistika* (Lithuanian Publishing Statistics). The Centre informs the public of new publications in a weekly bulletin and compiles an e-bulletin of forthcoming books. This task is accomplished as part of the activity of Cataloging in Publication (preparation of a cataloging record for forthcoming publications).

The Centre includes the Department of the Retrospective Bibliography of the National Press, which works on the bibliographies of Lithuanian publications from 1547 to 1940 irrespective of the publishing place and on publications in Lithuania irrespective of language. In relation to this work, the Department carries out extensive book research and coordinates its activities with other research libraries in Lithuania. The Retrospective Bibliography consists of several series and databases devoted to Lithuanian books, serials, articles in Lithuanian periodicals,

books in other languages published in Lithuania and small press publications.

LIBIS. The NLL started library automation work in 1985 when a special department was established to create and implement computerized library systems. In 1995 the Ministry of Culture and the government began work on the Integrated Library Information System (it was actually launched in 1996), and in 1998, the LIBIS Centre was established to ensure the implementation and development of the system in Lithuanian libraries. The system is based on original LIBIS software, which was designed by Lithuanian company *Sintagma*, and is used to create the National bibliography database and the Union Catalogue of Lithuanian Libraries — which in turn helps to integrate access to the libraries in Lithuania. The system is fully developed with all the functional modules. It is continually upgraded and the Centre helps the libraries maintain and upgrade the system regularly.

At the beginning of 2007, the LIBIS system was used by

- National Lithuanian Library
- Five out of five county libraries
- Sixty out of sixty municipal public libraries
- One university department for educational purposes
- Seven research and special libraries
- Ten museum libraries^[17]

The standards developed by the NLL ensure the interoperability of LIBIS and other computerized library systems used by Lithuanian libraries. Since 2002, the users of the libraries operating LIBIS have been issued a unified user's card that allows the user access to library services provided by all LIBIS libraries.

Library statistics. According to the change in the *Law on Libraries* from 2004 (article 8.5.14), the National Library has the function of collecting and analyzing Lithuanian library statistics, a function previously the responsibility of the Ministry of Culture. All libraries have to provide an annual statistical report of their activity for the NLL. The Library Science Centre is directly responsible for this task and uses it for monitoring the library situation, planning the assistance to public and other libraries and disseminating it to policy and decision makers as well as to the libraries. Since 2004, this material has been available electronically through the Web site of the NLL.^[15] In 2006, the paper forms of the statistical reports were changed to electronic ones and are available to the libraries through the NLL LIBIS Library Statistics module.^[18] On the basis of this data, the NLL publishes statistical reports and reference material about Lithuanian libraries.

Public libraries today

In 2006, the public library network consisted of five county public libraries (governed by the regional

Table 1 Number of libraries in Lithuania in 2001–2006.

Year	Number of libraries	Public libraries among them
2001	3677	1497
2002	3571	1405
2003	3406	1393
2004	3133	1377
2005	3020	1371
2006	2975	1372

Source: Compiled from the library statistic sources produced by the Ministry of Culture and the NLL.

administrations) and 60 municipal public libraries with 1312 branches in the towns and villages all over Lithuania (governed by local authorities). Although it is the second largest library network in the country, it reaches the widest public. The achievements and the drawbacks of the development of Lithuanian libraries can best be demonstrated by the present situation of public library system. The following Table 1 shows the number of public libraries and the total number of libraries in recent years.

The number of public libraries in the country is gradually diminishing due to the closure of small branches, integration of school and public libraries and reorganization of library networks. There are 4 public libraries per 10,000 people at present. This density is similar to that of other Baltic states and higher than in other European countries [e.g., 2.5 libraries per 10,000 people in Finland in 2006 (Calculated from Finnish Public Library Statistics at [In 2002, the government of Lithuania adopted a program of modernization of Lithuanian Libraries for 2003–2013.^{\[19\]} In 1999, Lithuanian librarians had begun preparing a long-term program for the development of libraries with the intention of changing the attitude towards libraries that had prevailed for a decade while maintaining the existing level of support for libraries \(p. 9\).^{\[20\]} The program was developed after carrying out a detailed analysis of library work in the Republic, which proved that the situation of Lithuanian libraries \(especially public libraries\) was much worse than in the average European country, even in neighboring countries, such as Latvia and Estonia. The library collection was out of date, the services poor, the funding inadequate and the possibilities to develop inhibited by inadequate premises and lack of technology. Despite the adequate number of qualified staff, the libraries could not serve the changing needs of the population. The program of modernization mainly obliges the central and local governments to create adequate conditions for library work and to ensure that the necessary material and economic basis for their activity exists. Its purpose is to develop and renew the Lithuanian](http://tilastot.kirjastot.fi/Default.aspx?pageId%4Statistics/Default&StatisticsTypeId%41&ScopeTypeId%4101&Years%42006&ScopeItemIds%41.))]. However, it seems that the number of public libraries stabilized in 2004–2006. This might be a result of the implementation of the program of modernization of libraries.</p>
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National Library, county and municipal public libraries, and the Lithuanian Library for the Blind, i.e., a group of general libraries in the cultural sector. The following goals are to be achieved in 10 years:

- To ensure Lithuanian inhabitants the possibility of acquiring the knowledge and qualifications that would enable them to adapt to the rapidly changing conditions of life and work and to compete successfully in world markets.
- To eliminate the inequalities within information infrastructures in the cities and provinces and provide equal conditions of information technology usage to all the inhabitants for any social and public needs.
- To create in the libraries the necessary conditions for collecting, preserving and disseminating to the public the objects of national, cultural and scientific heritage and to ensure access to the library collections.

The priorities that needed greatest attention were the renovation of the library collections and acquisition of databases, a vast program for building and renovation of library buildings and intensive computerization of libraries.^[19] Another element of this vision was the development of professional competence in libraries.^[21] The program not only established goals and priorities, it also included the analysis and calculation of the required investments over 10 years and annually. The program is financed by state and local authorities as well as through different specialized programs and foundations, but it places responsibility on the librarians and library management for reaching these goals.

In addition to this overarching library development program, the following long-term projects were and still are directed towards public libraries: development of LIBIS, “Computerization of Libraries,” and “Development of Public Internet Access Points network” (funded through European structural funds and PHARE—EU assistance instrument abbreviation for original name *Poland and Hungary: Assistance for Restructuring their Economies*—especially in rural areas).

Since 2002 when the Program began, there have been gradual improvements in public libraries due to restructuring of the state capital investment with emphasis on the cultural sphere. The most visible changes are related to library buildings and computerization. Eight libraries, among them County public libraries in Klaipėda and Panevėžys (Fig. 2), municipal public libraries in Utena, Šakiai, Radviliškis, Varėna, Šilutė, and others have been built anew or renovated. Many more are undergoing reconstruction. This is a promising start, and some checks are built into the cultural policy that should prevent the cutting of financing, although librarians still fear that new priorities could reverse the present trend.

The progress in computerization of libraries can be expressed in the following figures: in 2004, computers

and the access to the Internet were available in one-third (327) of public libraries. As a result of several programs and projects, by 2006, already half of the public libraries (650) offered access to computers and, out of these, 535 were connected to the Internet.^[15] Since the beginning of 2006, according to the policy of the Ministry of Culture, access to the Internet in public libraries is to be free of charge. Before that, most of the libraries provided the use of the Internet free of charge for a certain limited time and charged a fee for additional time. Now libraries provide public access not only to the Internet, but also to an increasing number of databases: two national and 11 international in 2006 (the full list can be found on <http://www.bibliotekos.lt>).^[22] Most of the public libraries have created Web sites that provide information about the their services and have also started providing some services online (mainly access to OPACs and “Ask the librarian” service).

However, the situation is not without problems. In many libraries, especially those in cities, hardware and software are old. Eighty-one percent of librarians think that their computer literacy skills are too low, and 68%



Fig. 2 Panevėžys County G. Petkevičaitė-Bitė Public Library: Catalogue terrace. Picture by Virginijus Benašas.

Source: Courtesy of the journal *In the World of Books*.

say their skills are nonexistent. Therefore, they are not able to help or instruct readers. These problems still require serious attention and that will be addressed not only through the ongoing projects but also through a new project prepared by the Ministry of Culture, the National Library, and the Bill and Melinda Gates Foundation "Libraries for Innovation."^[23]

The changes in the areas of library collection and readers are more problematic, because their assessment is more controversial. The acquisition of materials is financed partly by the Ministry of Culture (according to the number of inhabitants in the served territory) and partly by municipality ([12], article 6). Although financing is increasing slightly, it is still significantly lower than in neighboring countries and inadequate from any point of view. The allocated resources can buy only one quarter of the new books per 1000 users recommended by IFLA. The budget is secured by law, but its reduction by the authorities on various levels is still a threat.^[24]

The increasing funding cannot stop the decrease of the library collection. The discarding of old publications is greater than acquisition of new ones. The decrease in itself is not a great danger since the collections of public libraries inherited from the Soviet period were too large and did not satisfy the new information needs of their communities. However, the inadequate funding, the increasing prices of publications, demand for the new electronic resources and the need to assess and balance the hybrid collections inhibits efforts to raise the quality of the collections (p. 3).^[25] More than 80% of collections in peripheral libraries consist of publications older than 10 years.^[24] The decreasing and poor collections of the libraries do not provide a great incentive for users, and the number of users is decreasing slowly but surely. However, the number of visitors to all libraries is growing, and the number of visitors to the public libraries is fairly stable (Fig. 3).

This could be the result of the new services and the role of the library as a cultural and public center of the

community. On the other hand, the number of users may be diminishing because of the introduction of fees for the unified library card. The introduction of a variety of fees in the libraries is indicated as a reason for the decrease of public library usage in the discussions of the issues (p. 5);^[24] (pp. 17–18).^[26] Fifty-one percent of the population use libraries. Non-users participating in one of the surveys mentioned that they do not use libraries because of poor collections (23%) and the lack of required information (7%).^[27]

A third place is an easily accessible, inexpensive, pleasant place where one feels welcomed and comfortable, meets friends and relaxes. A 2005 study of a library as a third place, conducted among users and non-users in different towns and villages, revealed that libraries are usually compared to a school or university and hospital or clinics. Thus, libraries are treated as places visited because of necessity and obligation. They are not perceived as relaxing spaces for leisure. On the other hand, some of the respondents compared a library to a church or a cathedral, thus, identifying them as spiritual and sacred spaces.^[28]

Public libraries are closely involved in the life of the communities. This involvement sets the general attitude towards libraries in the country and ensures that the next generation of users comes to the library. At present, public libraries still face a gigantic task: in Lithuania 35% of inhabitants between 16 and 74 years of age have not read a book, and 2.5% indicate that they do not read newspapers. (This answer may indicate the discontent of serious readers with the contents of Lithuanian newspapers E.M.)^[27]

The results of the recent study of public libraries in Lithuania have confirmed that the greatest achievement of the independence period is implementation of a new conception of libraries that equals the best international models of the public library. Future development will be defined by the clear cultural policy and modernization

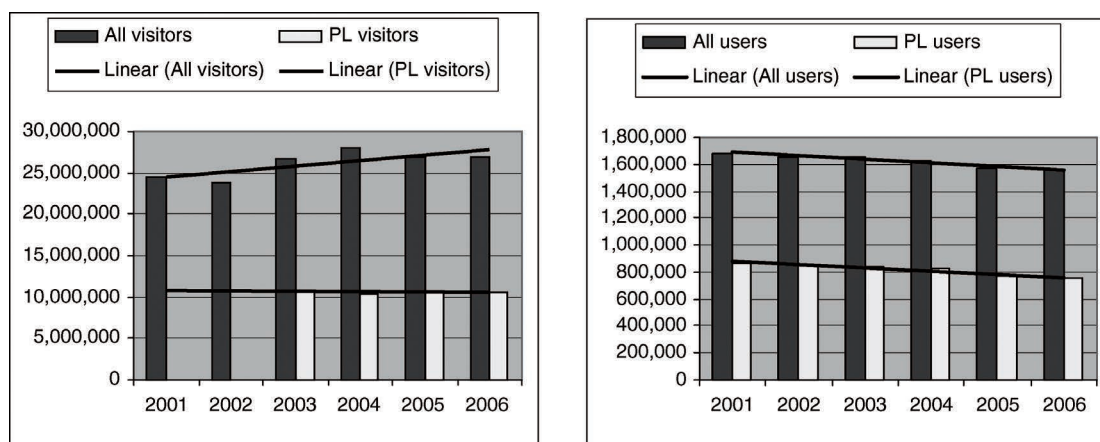


Fig. 3 The numbers of visitors and users to all libraries and public libraries in 2001–2006.

Sources: Statistikos departamentas^[17] and *Lietuvos nacionalinė biblioteka*,^[15]

strategies of central and local governments. The professional community will influence the governmental decisions, but its greatest role is seen in the development of modern information services, increase of professional competence and cooperation between all types of libraries on international and national levels (pp. 15–16).^[20]

School libraries

In 2006, the largest network of libraries (1593) belonged to the Ministry of Education and Science. The category of school libraries includes 1339 primary and secondary school libraries and 76 libraries of professional schools, 41 libraries of higher education institutions (governmental and private), and 137 libraries of other educational institutions.^[15] This network has lost 111 libraries since 2005, mainly due to the continuing reorganization of schools. There are also 150 public library branches that are integrated with school libraries.^[15]

Service levels and conditions of school libraries throughout Lithuania are very unequal. Some meet the highest standards of library work (e.g., Šiauliai Julius Janonis Gymnasium Library, Library of “Verdenė” school in Panevėžys, Šventupis secondary school library in Šiauliai, A. Brazauskas secondary school in Kaišiadorys, etc.), while others just manage to struggle with basic access to educational literature. This depends on the policy of local authorities and school management and the support they provide. The problems these libraries face are the same as those of other types of libraries: shortage of financing for acquisition, difficulties with provision of access to a range of materials, computers, and electronic resources, unsuitable premises and equipment.

Previously, school libraries that had creative staff could take advantage of the competitions and initiatives started by the Open Society Fund for the development of school libraries. In 1999 and 2000, the Educational Change Fund of the OSF announced a call for applications in the areas of “Modernization of the libraries of educational institutions” and “The dissemination of the work models of a modern library” and financed 50 projects for school libraries.

Many school libraries now actively take part in various projects, such as annual Nordic Library Week organized by the Nordic Council of Ministers (Fig. 4) or “Be Friends with a Book. Discover the Lithuanian Book,” initiated in the summer of 2007 by the Ministry of Education and Science in cooperation with the Ministry of Culture.

However, the greatest problem is the lack of professional competence in this sphere. A recent study initiated by librarians and undertaken by the Ministry of Education and Science has shown that 25% of the libraries do not have proper staff (if any). Those employed in school libraries are overworked and underpaid and lack possibilities of professional development as well as guidance and support. Most of them (46.5%) have pedagogical education, 33.9% are educated librarians, and 7% have only



Fig. 4 Nordic Library Week in Šventupis secondary school library.

Source: Courtesy of Šventupis school in Šiauliai.

secondary education.^[29] The competence level, and especially computer or information literacy, is recognized as a most important issue in school libraries. In 2002, the Minister of Education and Science approved the Standard of Computer Literacy for School Librarians.^[30] At present the competence levels in school libraries are crucial as these libraries are involved in the implementation of MOBIS (The Information System for School Libraries—a part of LIBIS). Special courses for training the staff working with this system are organized by the Centre of Professional Development for Teachers.

Academic and research libraries

In addition to other laws regulating library work, academic and research libraries, like school libraries, are dependent on the legislation relating to education, higher education and research. The reforms of these spheres on the national and European level (Bologna process), the growing international cooperation and the access to European and international financing have influenced their present situation. However, most of the achievements, and especially the problems, are in line with other libraries. Although they have fewer libraries than any other network, these libraries are among the most active participants in advancing librarianship in accordance with modern developments.

The network of academic libraries includes 19 libraries at universities and higher education institutions (16 public and 3 private) and 22 libraries at university colleges. There is also a small group of purely research libraries: the Library of the Academy of Science of Lithuania and eight libraries of research institutes. For a long time, academic and research libraries (except for the small libraries in research institutes) were mainly valued for their

collections. One can say that this network is still most burdened with both the worst and the best of the heritage of bygone eras. The Library of the Academy of Science (see <http://www.mab.lt/eng/index.html>) and Vilnius University Library (see <http://www.mb.vu.lt/titulinis>) (Fig. 5) have the status of national significance. Both have rich collections of international interest and play important roles in the system of libraries in general. These two libraries are housed in historical buildings that do not correspond to the requirements of modern libraries. The same may be said of most of other academic libraries. Even when housed in newer buildings, they suffer from a lack of space that prevents open access to the collections, so most still operate closed stacks. This is understood by librarians and many parent institutions. The first academic library (in Kaunas University of Medicine) has recently moved into a new building; others plan construction of new premises or renovation (Vilnius University Library, Šiauliai University Library, Klaipėda University Library, Vilnius Pedagogical University Library). However, the costs of library buildings are high, and the progress in this sphere is slow.

Academic and research libraries are taking a multi-dimensional approach to ensure innovative services for their readers. Academic libraries exploit the possibilities provided by European Union programs, the Open Society Institute (and local OS Fund), Nordinfo, and other funding agencies as well as EU structural funds or governmental projects. In 1997, they established the Lithuanian Academic Library Network (Lietuvos akademių bibliotekų tinklas—LABT), which is driven and coordinated by Lithuanian Academic Libraries Directors Association (LABA) and Kaunas University of Technology. The LABT is an integral part of the LIBIS, though using different software (namely, ALEPH, Metalib, SFX produced by Ex Libris Group). It also has become a part of a wider program of the Ministry of Education and Science, “Information Technologies for Science and Studies” (for 2001–2006). The Network has grown to 75 participating libraries and has expanded its tasks. At present they are as follows:

- Automation of libraries by uniting them into a solid network.
- Rendering of virtual services.
- Accumulation of e-resource bases.
- Creation of a solid search system with unified user interface.
- Ensuring quality links between library e-catalogs and e-resources.^[31]

The LABT develops the multilevel Information System of Lithuanian Research and Studies (publications databases, electronic thesis and dissertations information system) and conducts two big projects financed by EU structural funds: the Lithuanian Virtual Library (see <http://www.lvb.lt>) and Collection and Presentation of Electronic Documents for Lithuanian Science and Studies.

Academic and research libraries have also created the Lithuanian Research Libraries Consortium (see Professional associations and unions), which negotiates licenses and access to the databases with a variety of providers on behalf of its members. At present all the libraries provide access to the international databases relevant to Lithuanian researchers and students. A full list of databases available to Lithuanian users is found at the site of the Consortium (<http://www.lmba.lt/db/angl/index.htm>).

Despite the rapid development of the infrastructure, increased access to the computers and the Internet provided by the universities and the libraries, and the development of online services, some of the problems persist: academic libraries cannot compete with other organizations offering more attractive work environments and salaries to ambitious professionals (especially, working in the areas of ICT, computers and information systems). Furthermore the funding for acquisition is entirely inadequate, and providing user-centered service is inhibited by old premises and outdated library equipment. Academic libraries are confronting these issues as they look for ways to overcome barriers that inhibit them from becoming more modern and relevant for research and studies.



Fig. 5 Vilnius University Library, Reading Room for Humanities.

Source: Courtesy of Vilnius University Library.

A more detailed account of Lithuanian academic libraries is presented by Pupelienė.^[32]

Networks of special libraries

Certain categories of state libraries are classified as specialized libraries. Among them are libraries with delegated responsibility for special library networks:

- Technical Library of Lithuania is responsible for 21 technical libraries and also has its own branches in the largest cities: Kaunas, Klaipėda, Panevėžys, and Šiauliai. It is a library of national significance. (see <http://www.tb.lt>).
- Lithuanian Library of Medicine is responsible for 38 libraries of health institutions and has six branches in clinics and research centers in Vilnius, Panevėžys, and Klaipėda (see <http://www.lmb.lt/>).
- Lithuanian Agricultural Library takes care of 8 agricultural libraries. (see <http://www.zub.lt/>).

These major libraries were established during the Soviet period and have faced significant changes since 1990. The Technical Library of Lithuania (Fig. 6) is one of the largest in the country (it owns 38,554,600 items), and its unique collections are of great importance to the industry and research. It was the first library to create a Business Information Centre (in 1992) and is now building a specialized collection to serve business information needs. It is also a center of information about national and international standards. Since 1999, the Centre of Patent Information (a depository library of Lithuanian, foreign, and

international patent documents) has been one of the most important functions of the library. The Technical Library is one of the most active supporters of professional librarians' movements and associations.

The Lithuanian Library of Medicine serves the needs of medical researchers, practitioners, and students. It collects medical, biological, psychological, and related literature; some of great historical value. It is a depository library for World Health Organization documentation and a member of the Global Environmental Library Network.

The Lithuanian Agricultural Library "acquires, manages, preserves, and disseminates publications and other documents covering science and technologies of the agricultural sector and related branches of economy." It takes part in the creation of a unified information system for agriculture and an information system for agricultural science. In addition, it functions as a national focal point for AGRIS/CARIS—the system of the International Food and Agriculture Organization.

Among special libraries are 16 museum libraries and 4 libraries of cultural institutions that serve the needs of professional communities in the respective organizations. They fall under the care of the Ministry of Culture.

The Lithuanian Library for the Blind (Lietuvos aklųjų biblioteka—LAB) has a special status as a general public library catering to the needs of people with visual impairments. It also publishes talking books, periodicals and materials in Braille and print. Besides the central library in Vilnius, LAB has five branch libraries in different towns of Lithuania (Kaunas, Klaipėda, Panevėžys, Šiauliai, and Ukmergė) (see <http://labiblioteka.lt/english.html>).

Though the publics served by these libraries are rather limited from the point of view of numbers and the professional needs served, their information services are of great value to the respective spheres of the economy. They are regulated and financed by ministries or state agencies and also participate in common projects and programs of libraries.

RESEARCH AND EDUCATION FOR INFORMATION

The main institution for LIS research and education is the Faculty of Communication at Vilnius University. It carries on the tradition begun at that University in the nineteenth century by famous scholars of that period—Lelewel, Bohatkiewicz, and others—of teaching and studying bibliographic and library work in the cultural context. This tradition was broken for a long time, and it was not until 1940 that the academic department for LIS-related research opened. It functioned in Kaunas and Vilnius universities led by Vaclovas Biržiška (1884–1956) (Fig. 7), a serious scholar of bibliography, the founder of the current national bibliography. In 1949, Vilnius University started an undergraduate program for librarians. It grew and



Fig. 6 The courtyard of the Technical Library of Lithuania.
Source: Courtesy of the Library.



Fig. 7 Vaclovas Biržiška.

matured under the leadership of Lev Vladimirov (1912–1999) (Fig. 8), one of the renaissance figures on the landscape of Lithuanian LIS. He was director of Vilnius University Library, director of the Dag Hammarskjöld library of the United Nations in New York, author of the only monograph in Lithuanian on universal book history, a reformer of LIS education and a visionary who foresaw the computerized future of information work. In 1991, the departments of Journalism and LIS, previously situated in the Faculty of History, established the Faculty of Communication and developed a number of undergraduate and graduate programs with a common core of communication and information disciplines (see <http://www.kf.vu.lt>). The Faculty also participates as a leading partner in the professional development of working librarians.

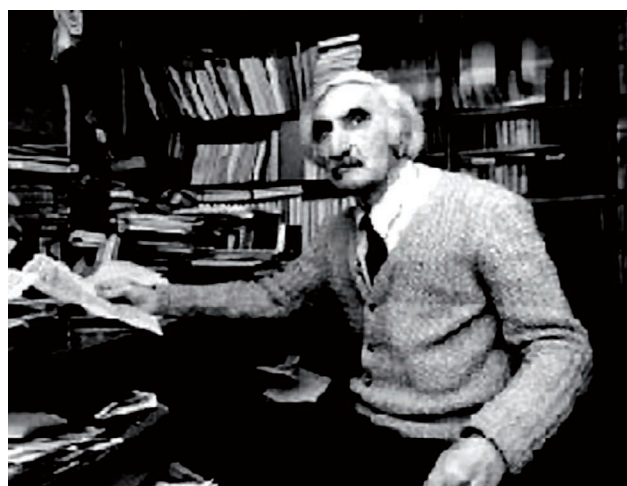


Fig. 8 Levas Vladimirovas.

The Faculty of Communication at Vilnius conducts the only doctoral program in Communication and Information Science in Lithuania. Since 1991, 35 students have received a doctoral degree, of which 30 defended their theses in LIS topics. The Faculty was led by a team of researchers in LIS and cognate disciplines—Audronė Glosienė, Arūnas Augustinaitis, Renaldas Gudauskas and others. Recently, Domas Kaunas, the first correspondent member from the Faculty, was elected to the Academy of Science of the Republic of Lithuania. The Faculty also publishes the scholarly journals in LIS: *Knygotyra* since 1961 and *Informacijos mokslai* since 1990 when *Knygotyra* was divided into two separate publications catering to two major directions of LIS (and broader Information and Communication Science), one based on a humanities perspective, the other on social science.^[33]

LIS research is also conducted by the National Library. Currently, it monitors the general situation of Lithuanian libraries and carries out a number of research projects, such as, *The Public Libraries and Their Image* (2005) and *The Image of a Librarian* (in 2006). It also has a strong tradition in reading research. Other academic and research libraries conduct research in the areas of book science, book and library history and bibliography (Library of the Academy of Science, Vilnius University Library), as well as participate in such projects as TEMPUS (1995–2001), EU DEDICATE on distance education information courses (Library of Kaunas University of Technology in 1998–1999), PERINE, pedagogical and educational research information network (Library of Kaunas University of Technology in 2002),^[32] or the EU PHARE project BIBLIONOVA on development of information skills in a learning region (Šiauliai University Library and Klaipėda University Library in 2004).

Library education is also offered at the Department of Librarianship (Faculty of Social Sciences at the Klaipėda University). This department was established in 2001 (studies in Lithuanian Philology and Librarianship started in 1995) to educate librarians for the Northwest regions of Lithuania where the shortage of professionals was felt acutely, especially in school libraries. At present the Department offers several on-campus and distance study options in librarianship (one of them in combination with Lithuanian philology). It also conducts research in the area of academic librarianship, library management, and bibliotherapy.

However, the efforts of LIS departments have not solved the problem of the shortage of professionals. The numbers of librarians graduating with degrees from Vilnius University has diminished and, moreover, young professionals bypass libraries that are not attractive from the point of view of salaries, career, or working environment in comparison to alternatives in the private sector or other fields of the public sector. Broad information and communication competence allows LIS graduates to compete with other specialists on the labor market.

The professional development of librarians is under the auspices of the Lithuanian Centre of Professional Development of Cultural Workers. It organizes courses and seminars for the librarians on relevant topics. In 1999–2004 an Integrated Training Centre for LIS Specialists in Lithuania functioned as part of an initiative on training centers of the Open Society Institute. The Centre was run collectively by the Faculty of Communication (Vilnius University), the National Library, Klaipėda University Library, Vilnius A. Mickevičius County Library, and the Baltic Computer Academy, and it was a successful attempt at cooperation in competence development of professional librarians. In addition, competence development is a part of the most of the projects, that libraries participate in. Librarians also take advantage of possibilities offered by various agencies (Open Society Institute, European Commission, Nordinfo, etc.). In 2006–2007, several university libraries raised the competence of their staff through the Leonardo da Vinci mobility program, “Digital competence and information dissemination in libraries.” Library associations and libraries themselves monitor the level of competence of the staff and changes in the environment and seek to address the emerging needs, using various means.

PROFESSIONAL ASSOCIATIONS AND UNIONS

According to library statistics, 6469 librarians worked in Lithuanian libraries in 2006.^[15] Their number is decreasing with time, e.g., in 2004, there were 7797 librarians. About half of librarians have professional library education. Professional self-consciousness of librarians was beginning to revive in Soviet Lithuania long before the reestablishment of independence. It manifested itself in the circumvention of ideological limitations and regulations in everyday library work and in attempts to organize the professional community. Discussions of the revival of the librarians’ professional organization were started as soon as circumstances permitted, and the Lithuanian Librarians’ Association (LLA) was reestablished on June 29, 1989. Since then, the Association has been an integrating force for all librarians. Specific problems and situations in various libraries lead to the formation of other associations (Lithuanian Academic Library Directors’ Association, Lithuanian County Public Libraries’ Association, Lithuanian Municipal Public Libraries’ Association, Lithuanian College Libraries’ Association). At present the LLA unites more than one third of librarians (2400), and it is still growing. Its main aims are

- To raise the reputation of librarians in Lithuanian society.
- To represent the social and professional rights of its members.
- To initiate and provide in-service training of librarians.
- To petition Lithuanian government and authorities for better recourses and equipment for libraries.

- To gain experience in the world practice of librarianship.
- To ensure the utmost professionalism in its members.^[34]

The Association works through its local chapters in libraries and forms the working groups. In 2005–2007 they were: Library Policy and Fundraising; Continuous Education; School Libraries; Public Libraries; Seniors; Financial Control and Commission of Ethics. The LLA is responsible to its members and organizes the Annual Conference for the members.

The LLA is actively involved in a variety of policy making and lobbying activities: exemptions from copyright for libraries, library renovation and modernization, librarians’ salaries, etc. At present it sees collection development as the most acute problem. Therefore, at the end of 2006, together with the Seimas (parliamentary) Committee for Education and Science, it organized a national conference in the Seimas to discuss the problems of acquisition and collection development with MPs, representatives of the President, and Government. Recommendations were drawn up and the initiative to announce the Year of Reading in 2008 emerged from this initiative.^[35] Since 2001, the LLA has conducted the annual National Week of Lithuanian Libraries, which aims to make libraries visible in society and communities and to unite librarians from all types of libraries. Since 1993, awards and titles of the Best Librarian of the Year have gone to 15 librarians from different libraries all over Lithuania. The LLA initiates various projects and helps libraries take part in various programs. In 2007, together with Utena A. and M. Miškiniai Public Library, the Lithuanian County Public Libraries’ Association, and the Lithuanian Municipal Public Libraries’ Association it has won the award for the best project of public relations of Lithuanian public organizations, namely, the portal of Lithuanian Public Libraries (<http://www.libraries.lt>).

The LLA also actively participates in international projects and develops contacts with similar foreign organizations. In 1990, the LLA was readmitted to IFLA. It cooperates closely with library organizations from other Baltic States, organizing the Congresses of Baltic librarians on a rotational basis (eight so far have been organized). Strong ties with Nordic librarians manifest themselves in common meetings and occasional congresses. Bilateral agreements with library associations from other countries (e.g., Great Britain, Russia, Byelorussia) signify mutual interest in each other’s experience. The LLA also takes part in different international projects. Some of these were especially important for lobbying activities and general understanding of entirely new problems for Lithuanian libraries, e.g., copyright for libraries (CECUP—Central and Eastern European Copyright User Platform); licensing of digital resources (CELIP—Central and Eastern European Licensing Information Platform).

Others address the needs of the partners, e.g., the establishment of Martynas Mažvydas library of the Lithuanian community of Sovetsk (Kaliningrad, Russia).

Both directions of LLA activity help achieve the aims of the Association and channel the efforts of librarians to the achievement of common goals.

The Consortium of Lithuanian Research Libraries (see <http://www.lmba.lt/>) has a different direction, but it also serves the needs of all Lithuanian libraries. Its main aims are

- Promotion of the creation of virtual libraries, preparation and implementation of advanced technology and innovative projects in the libraries.
- Subscription to electronic databases for Consortium members and other libraries.
- Coordination of the acquisition of foreign periodicals among research libraries.

The Consortium has 38 member libraries of various types. It is supported by the Ministry of Culture, the Ministry of Education and Science (the acquisition of databases is partly financed by ministries), Open Society Fund (Lithuania) and Open Society Institute, British Council Lithuania and other agencies. Its main activity is negotiation of licensing agreements with the providers of online databases, organization of their deployment, and control of usage. Its efforts extend beyond its 38 members and benefit other libraries and their users. It organizes seminars and training for librarians, participates in eIFL.net consortium and is a member of EBLIDA (European Bureau of Library, Information and Documentation Associations). It regularly informs the librarians in Lithuania of its activities and news about work with databases.^[36] It also disseminates expertise and examples of best practices of licensing and working with digital resources to librarians of other countries (Russia, Georgia, Byelorussia, Kyrgyz, Lebanon, Jordan, etc.)

CONCLUSION

The Lithuanian library sector at present functions as a modern, open, user-oriented and professional system comparable to other library sectors in Europe. In the 17 years since the restoration of independence, there has been a dynamic development of new services, expertise, and models. Equally important are the activities of professionals who participate in shaping the libraries of the future in Lithuania. The catalysts for this transformation include the changing society, the economy, and the arrival of new concepts and technologies, as well as the strong commitment of librarians to fulfill their professional obligations. The international professional community, various funding agencies, and international bodies also supported these changes. The role of funding agencies, especially the Open Society Fund (Lithuania) and the

Open Society Institute were essential in stimulating the creativity of librarians and in some cases these agencies also helped by drawing the attention of authorities to the importance of libraries. In addition, international bodies, such as the Nordic Council of Ministers, Nordinfo and the European Commission, helped to create international networks, and taught Lithuanian librarians to work together with partners from other cultures, and adapt their models and experiences to Lithuanian conditions. Close partnerships with librarians from the Nordic countries have influenced the directions of development of Lithuanian libraries. While adopting the best international practice, Lithuanian librarians have also preserved the best local traditions. The community of Lithuanian librarians still needs to go a long way to overcome the inertia of the central and local government, not only in their habit of severely underfunding libraries but also in treating libraries as inefficient and unnecessary appendices to the country's economy. This is an especially difficult but most urgent task. The future of libraries will mainly depend on the policies and strategies adopted and implemented by the government as well as on the energy and attention of librarians devoted to library users' needs and to the development and expansion of innovative, high quality services that span physical buildings and virtual spaces.

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Abstract

The Louvre evolved from the castle fortress of Philippe-Auguste in 1190 to a royal residence occupied by French monarchs until Louis XIV moved to Versailles in 1678, and finally in 1793, into the national museum of France. Under both royal and republican governments, the museum has enriched its collections and enhanced its building program culminating in the creation of the Grand Louvre, begun under François Mitterrand in the 1980s and finished under Jacques Chirac in 1996. The Louvre is considered the finest example of a universal survey museum in the world and is visited by millions of tourists and scholars annually.

The Louvre evolved from the castle fortress of Philippe-Auguste in 1190 to a royal residence occupied by French monarchs until Louis XIV moved to Versailles in 1678, and finally in 1793, into the national museum of France. Today, considered the finest example of a universal survey museum in the world and visited by millions of tourists and scholars, the Louvre has become what its founders intended when they preserved and enriched its collections during the period of the French Revolution and the First Empire (1789–1815). Under subsequent governments, whether royal or republican, the museum has continued to add to its collections and to enhance its building program, resulting in the realization of the Grand Louvre, which began under François Mitterrand's presidency in the 1980s and later culminated in Jacques Chirac's presidency in 1996 with the architectural additions designed by I.M. Pei. "The Louvre was the prototypical public art museum," according to art historian Carol Duncan. "By the end of the 19th-century, every western nation would boast at least one important public art museum."^[1]

THE EARLY LOUVRE

The evolution of the Louvre has been subject to the changing needs of the French state. First, it served as a square fortress positioned on the right side of the Seine to defend against attacks from the English to the north. Archeological evidence of the original castle and its moat was discovered during construction work for the Grand Louvre. Under the reign of Charles V (1364–1380) and his architect Raymond du Temple, the palace was raised and terraces were added as it was incorporated within the defensive walls of Paris. François I (1515–1547) chose to transform the Louvre into more of an Italian Renaissance palace with additions designed by Pierre Lescot, notably the Hall of the Caryatids. More importantly, François I

had amassed a fine collection of paintings at his residence of Fontainebleau including several works by Leonardo da Vinci, who died at Amboise in 1519. Works by Raphael, del Sarto, and Fra Bartolomeo, among others, would form the basis of the collections for the Louvre Museum.

Building continued under François I's successor, Henri II (1547–1559) and his widow Catherine de Medici, who in 1564 ordered the construction of the Palais des Tuileries, which would be joined to the Louvre. Under Henri IV (1568–1610), the first Bourbon king, the Grand Gallery was built and the collections enriched, while artists and craftsmen were invited to live and work in the palace. Under Louis XIII (1610–1643) and his architect Jacques Lemercier, the palace was enlarged and the imposing Tower Clock Pavilion was constructed. During Louis XIII's reign, Cardinal Richelieu added to the royal collections, and upon his death in 1642 his property, the Palais Cardinal, passed to the king and became known as the Palais Royal, situated directly behind the Louvre.

Cardinal Mazarin ruled as regent for Louis XIV until his death in 1661 and worked to enrich the royal collections. When Mazarin died the Louvre became the beneficiary, receiving works by Correggio, Raphael, Veronese, Titian, and Holbein, among others. Louis XIV's astute minister, Jean-Baptiste Colbert, purchased many fine works for the royal collection. The Sun King's architect, Louis Le Vau, was responsible from 1661–1670 for major additions to the Louvre, including completion of the north and south wings of the Cour Carrée, the Cour de la Reine, the Apollo Gallery, the Arts, Marsan, and Marengo pavilions, and with Charles Perrault and Charles LeBrun, the building of the Colonnade. In 1678, when the work on the Cour Carrée had been completed, Louis XIV chose to move himself and his royal court to Versailles, where he would remain until his death in 1715. The Louvre then served as the home of artists and academics, where they

would remain until 1793, when the Louvre would become the national museum of France.

The royal collection was no longer centralized after Louis XIV's move to Versailles, but the 1709–1710 inventory listed 2000 paintings. By the time Louis XV (1715–1774) had become king, many paintings from the royal collection were exhibited in the private homes of aristocrats, but in 1725 the Academy of Painting and Sculpture held its first exhibition in the Salon Carrée. These exhibitions at the Louvre would be held annually from 1737 to 1848.^[2]

In keeping with Enlightenment ideas on the role of the state in the arts and sciences, a movement developed to transform the Louvre into a great palace of the arts. The Count d'Angiviller, curator of the royal Cabinet des Peintures, sought to increase the royal collection and in 1774, with the ascension of Louis XVI (1774–1793), worked to increase acquisitions for the proposed museum and to undertake architectural improvements. These acquisitions included not only early works from Italy and France but also contemporary French paintings from the annual salons and a large number of seventeenth-century Dutch and Flemish works. D'Angiviller aimed to create a museum that would reflect national pride and royal glory, as well as one that would address the needs of a larger public who were interested in viewing great works of art. The average annual expenditure on the Louvre in the early 1780s was approximately 100,000 livres, while d'Angiviller spent one million livres on increasing the royal collection over a 15-year period.^[2,3]

FRENCH REVOLUTION AND NAPOLEONIC ERA

The advent of the French Revolution in 1789 led d'Angiviller, and many others loyal to the king, to flee into exile, but plans for the Louvre Museum escalated, even as the new republican government faced challenges from every side. Decrees were passed by the National Assembly to make the Interior Ministry, under Jean Roland, responsible for safeguarding the national collections, defining the role of the national museum, and creating a commission for the selection of artworks. The confiscations by the republican government of art works that had belonged to the church, the crown, the émigrés, and those who had been imprisoned or executed, amounted to a windfall for the museum. By the time the Louvre Museum opened officially on August 10, 1793, as many as 537 oil paintings and 124 marble and bronze sculptures, and other objects, were displayed in the Grand Gallery, all of which the public could visit three times a week free of charge; the other days were reserved for artists and special guests.^[4,5]

As the revolution within France led to the Napoleonic wars with other western European monarchies, the legally decreed confiscations of artworks, as well as books and

manuscripts, increased dramatically. The first manifestation of this policy became clear with the arrival in Paris of seven convoys of paintings taken from Belgium in 1794. An inventory of each convoy was made upon its arrival, and each painting was identified. Gilberte Emile-Mâle, who served as head of restoration services for the French national museums from 1971 to 1981, documented in some detail the contents of each of the seven convoys from Belgium, as well as indicating the current location of each painting wherever possible. Included in these works were pieces by Rubens, Van Dyck, Jordaens, Van Eyck, Teniers, de Lairese, and other lesser-known Dutch and Flemish artists; they had been taken from churches and city halls in Antwerp, Brussels, Bruges, Lille, Dunkerque, and St. Omer.

Later convoys would arrive from Italy, Austria, Germany, and Spain, all heralded by public announcements in the press, so that by the time the artworks arrived in Paris, the public was eager to view them at the museum. For example, the third convoy of Italian artworks in 1798 amounted to a treasure trove of 45 cases of fine art, books and manuscripts, and natural history materials loaded onto wagons, 25 of which contained the cases of paintings and sculptures, and a special wagon to display the bronze horses taken from St. Mark's in Venice. A special song composed for the occasion proclaimed, "Rome is no more in Rome/ it is all in Paris."^[3,4]

In addition to the foreign confiscations, artworks from Versailles and from the abolished Royal Academy of Painting and Sculpture were sent to the Louvre. In 1797 the Apollo Gallery was opened, and by 1799 half of the Grand Gallery had been renovated and filled with Flemish and Dutch paintings. By 1801, the Italian works were arranged in the remaining half of the Grand Gallery.^[2]

Napoleon's influence became ever more evident, thanks to the careful acquisitions of artworks from conquered countries. Both the Louvre Museum (at that time called the Musée Central des Arts) and the Bibliothèque Nationale had sent experts, armed with lists of items to be confiscated, to accompany the military units engaged in combat. As a result of a plebiscite in 1802, Napoleon was named Consul for life, and in 1804, by another plebiscite, he was made Emperor. The First Empire, which would last until 1814, had begun.

The name of the museum was changed to the Musée Napoleon in 1803 and its first director was Dominique Vivant-Denon, an artist and writer who had participated in Napoleon's Egyptian campaign. Napoleon appointed the architects Charles Percier and Pierre-François Fontaine to make extensive improvements to the museum, including the division of the Grand Gallery into nine sections with skylights installed to enhance viewing, as well as the creation of an imposing new staircase. Under Denon's supervision, the museum's collections continued to increase as acquisitions followed military victories in Germany and Spain.^[2]

With Napoleon's final defeat and forced abdication in 1815, many of the artworks exhibited at the museum were returned to their countries of origin. The representatives from those countries, who met at the Congress of Vienna in 1814–1815 to address how best to control Napoleon's power and influence, had decreed this repatriation of valuable cultural items. However, many of the foreign acquisitions remained at the museum due to bureaucratic obstruction and clever diplomacy. For example, of the 506 paintings confiscated from Italy, 249 were returned, 248 remained, and 9 had mysteriously disappeared.^[5]

The Napoleonic wars had greatly increased artistic activity across Europe, and spurred the development of subsequent national museums based on the successful model of the Louvre. Just as its founders had intended in 1793, the museum had become a great cultural institution, and Paris had become the art capital of the western world and would remain so until the mid-twentieth century.

NINETEENTH-CENTURY DEVELOPMENTS

The museum, once again renamed the Musée Royal, grew more slowly after the Bourbon Restoration in 1815, because the period of great military glory and acquisitions had ended with Napoleon's downfall. However, under Louis XVIII (1815–1824) and Charles X (1824–1830), both brothers of the executed Louis XVI, Napoleon's building projects continued, including the Rohan Pavilion. Count Forbin replaced Denon as director of the museum in 1816, serving in that position until 1836. Paintings transferred from the Palais du Luxembourg replaced those that had been repatriated in 1815, and three halls of the Grand Gallery were filled with French artworks. During the Restoration period, the Egyptian section of the museum was opened on the first floor of the Cour Carrée and the future Department of Sculptures was inaugurated.^[2]

Following the Revolution of 1830 and the ascension of Louis Philippe (1830–1848) of the Orléans branch of the royal family, work on the Assyrian Halls proceeded, but not much more was accomplished until Louis Napoleon gained power through a plebiscite in 1848, much like his uncle had before him. He was named Emperor and ruled as Napoleon III from 1851 to 1870. Under his architects, Joachim Visconti, Hector Lefuel, and Felix Duban, the New Louvre (now called the Musée Imperial) was constructed around the Place Napoléon. The Flore Pavilion and the western section of the Grand Gallery were demolished and reconstructed, while the parallel buildings on the north and south sides of the Carrousel area were built and connected to the new wing on the new rue de Rivoli. The Musée des Souverains was established on the first floor of the Colonnade to display the former splendor of the Valois and Bourbon dynasties.^[2,6]

Following the Franco-Prussian War during the period of the Commune in 1871, the Palais des Tuileries was set

afire, which destroyed the Marsan Pavilion, the western section of the Galerie Napoléon, and the library. The Tuileries Palace was not rebuilt, but reconstruction of the other areas continued from 1871 to 1878.^[2]

With the fall of Napoleon III after the French defeat in the Franco-Prussian War, and the establishment of the Third Republic (1870–1940), a period of relative calm ensued. This hiatus allowed for gradual embellishments to the museum and for the acquisitions of important nineteenth-century artworks. A gallery of living artists was established in 1886 at the Orangerie Museum nearby, which would later contain a large collection of Impressionist paintings. In 1900, the Hall of States, later called the Hall Rubens, was completed. In addition, the Musée des Arts Décoratifs was opened in 1905. In 1914 work began on the second floor of the Mollien Wing, but the advent of World War I necessitated closing the Louvre for the duration of the war. From 1926 to 1939, the director of the museum was Henri Verne, who set about reorganizing exhibitions and restoring artworks. The Impressionist paintings were transferred from the Orangerie and installed on the top floor of the Colonnade, while eighteen new halls were opened on the third floor of the Vieux Louvre.^[2]

CHANGES AFTER WORLD WAR II

In anticipation of certain war and a Nazi invasion, a massive exodus of valuable artworks from the Louvre to the provinces began in 1938 and continued into 1939. In preparation, the Department of Paintings, under the direction of René Huyghe, was divided into sectors; each painting in a sector was packed and labeled according to its destination. Five châteaux between Le Mans and Louvigny and eighty warehouses in the provinces had been requisitioned to receive the artworks.^[7] Despite the Nazi confiscations of private collections and museums during the Occupation, the paintings from the Louvre were saved and returned in 1945. A number of unclaimed recovered works from private collections also found a temporary home in the Louvre, which assumed responsibility for them as long as they remained unclaimed. In some cases, that could be forever, if there were no living heirs to claim them.^[8]

The opening of the Grand Gallery in 1947, featuring some improvements that originally had been advocated by the artist Hubert Robert in 1796, contained artworks from the Italian and Spanish schools. Meanwhile, the Impressionist paintings were moved yet again, this time to the nearby Jeu de Paume, where they would remain until their transfer in 1986 to the new Musée d'Orsay across the Seine.^[2,4] The Daru, Mollien, and Denon Halls were reopened in 1949 and, under the new curator for paintings, Germain Bazin, the artworks from the French school were returned from the Petit Palais.^[2] The new sculpture rooms in the Flore Wing, which would later be connected to the Grand Gallery,

opened in 1960, and in 1968 those collections dated after 1848 were transferred to the Musée d'Orsay. The Richelieu Wing, which had been the home of the Ministry of Finance, was inaugurated as part of the museum in 1981, the same year that President François Mitterand set forth his impressive plans for the Grands Travaux.

Other internal changes were underway as well at the Louvre in the 1980s. In 1987, the director of the Musées de France, Hubert Landais, asked Michel Laclotte, head of the Paintings Department at the Louvre, to assume the role of director of the museum. Three administrators who worked under the supervision of the Musées de France had previously filled that position. With the appointment of Laclotte, the director's position conferred greater decision-making authority and staff support. Pierre Rosenberg, who later became museum director himself, assumed the duties of head of the Paintings Department. Under Laclotte's management, museum personnel would be involved in the changes necessary to transform the old Louvre into the new Grand Louvre.^[6,9]

THE GRAND LOUVRE

Mitterand's ambitious building program included the modernization of the Louvre, making it the Grand Louvre, and new buildings for the Bibliothèque Nationale de France, the Opéra de la Bastille, and the great arch of La Defense. The Grand Louvre project, which began in 1982 and was completed during Jacques Chirac's presidency in 1996, amounted to a series of dramatic architectural innovations, the most prominent being that of I.M. Pei's great glass pyramid as the central entrance to the museum. Pei enjoyed a reputation as an innovative architect, and his renovation of the National Gallery in Washington, D.C. offered proof that he could successfully modernize a museum located in an older building, or in the case of the Louvre, an ancient building. The immensity of the Grand Louvre project demanded careful planning, budgeting, and consideration of the urban aspects of the museum, such as parking, situated as it is in the historic heart of Paris. It was a matter of

conceiving and overseeing the development of the Domaine Nationale du Louvre et des Tuileries in view of creating an original cultural complex of museological character which will be called the Grand Louvre, as well as providing for the integration of this complex into its environment.^[6]

Like the Eiffel Tower, Pei's glass pyramid, widely admired now, was a hotly debated topic when it was proposed in the early 1980s. Some critics feared that such a structure would destroy the aesthetic appearance of such a beloved and historic structure as the Louvre. However, the idea of a pyramid was actually appropriate because the museum's Egyptian collection was one of the best known

in the world. In addition, the glass tower provided much-needed light into the entrance hall, which is situated directly below it, connected by an escalator. In effect, the pyramid literally opened up the museum and made it a more welcoming venue for its millions of visitors. The large space created beneath the Cour Napoléon allowed for the addition of various shops and services, including a conference hall, an auditorium, a bookstore, and a cafeteria. In 1993, after the Finance Ministry was relocated and the Richelieu Wing became available, it was possible to use one of the glass-covered courtyards to display the famous Marly horses, great marble sculptures that had once graced the gardens of Marly-le-roi under Louis XIV. In addition, the Passage Richelieu was transformed into a public space to link the new section of the Louvre with the Place du Palais-Royal across the street.^[2,6] Thus, public access to the museum was facilitated, while at the same time providing an attractive window into the museum.

The traditional boundaries between the seven sections of the museum which housed the collections were maintained, but access to the collections was centralized at the main entrance in the Cour Napoléon. The collections are divided into the archeological sections (antiquities) and the four sections of art ranging from the Middle Ages to mid-nineteenth century (graphic arts, decorative arts, painting, and sculpture).^[6] These sections include: Oriental Antiquities, Egyptian Antiquities, Greek Antiquities, Etruscan Antiquities, Roman Antiquities, Arts of Islam, Sculptures, Objects of Art, Paintings, and Graphic Arts.

While it is generally agreed that the Grand Louvre is a grand success, with the number of visitors increasing every year, such good fortune has led to some budgetary problems. The French government spent \$1.1 billion between 1987 and 2002 on architectural improvements, which led to greater public access and the necessity of increasing the museum staff. While part of the museum's budget is dependent on the government, other sources of income derive from entrance fees, special exhibitions which draw the largest crowds, and related services within the museum complex. In addition, private funds are raised for specific projects, such as the new Mona Lisa Gallery, financed by Nippon Television of Japan, and the construction of a new wing for the Louvre's large collection of Islamic art, the funds for which were donated by a Saudi prince. Even for those who cannot visit the Louvre in person, it is possible to view its treasures via the Internet (<http://www.louvre.fr>) and to purchase the excellent scholarly catalogs that accompany special exhibitions.^[4]

The Louvre also will exist in other locations outside of Paris. The Louvre-Lens, in the Nord-Pas de Calais region of France, is expected to open in 2010, while the Louvre Abu Dhabi, designed by Jean Nouvel, is scheduled to open in 2012 or soon thereafter. The government of Abu Dhabi is willing to pay France \$747 million in exchange for using the "Louvre" name as well as for loans of artworks, special exhibitions, and management advice.^[10] The evolution of

the Louvre from a fortress to a royal residence and finally to one of the greatest museums in the world is a tribute to the many visionaries who worked to make it such a success. The government of the first French republic took it upon itself to ensure that the national museum would reflect the high ideals of the early days of the Revolution of 1789 and allocated sufficient funds to preserve and enrich its collections. That they did so, while dealing with ongoing conflicts both inside and outside of France, is a tribute to their determination to transform the Louvre into a public symbol of French culture. Other visionaries were needed to have the courage to make radical, if beneficial, changes to what, by the 1980s, had become a hallowed national institution. One of the oldest museums in Europe, the Louvre's collections encompass artworks from the earliest civilizations to those of modern times, truly a universal survey museum of the highest order.

As Carol Duncan has stated: "The importance of the Louvre for other national galleries and as an international training ground for the first community of professional museum men is everywhere recognized."^[1] Perhaps President Charles de Gaulle's culture minister, André Malraux, said it best in speaking to the National Assembly on December 14, 1961. Explaining why it was important to appropriate funds for the preservation of France's historical monuments, such as the Louvre, he said that such monuments represented the highest aspirations of their time, that they were "the greatest dreams of France," which would serve to provide hope and courage to future generations of French citizens.^[11] The Louvre continues to pursue this mission as it expands to serve an ever-increasing public.

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Machine Readable Cataloging (MARC): 1961–1974 [ELIS Classic]

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Abstract

The MARC Program of the Library of Congress, led during its formative years by the author of this entry, was a landmark in the history of automation. Technical procedures, standards, and formatting for the catalog record were experimented with and developed in modern form in this project. The project began when computers were mainframe, slow, and limited in storage. So little was known then about many aspects of automation of library information resources that the MARC project can be seen as a pioneering effort with immeasurable impact.

—*ELIS Classic*, from 1975

INTRODUCTION

Many words have been written on the subject of the Machine-Readable Cataloging (MARC) Program: the events that led to the pilot project, the development of the format, the operational Distribution Service, the influence of MARC on standardization, and the impetus it gave to library automation projects and to the creation of networks here and abroad. This article serves to gather together all aspects of the national and international MARC system.

Much of what follows has been fairly well documented in many published reports, journal articles, etc., and therefore this article relies heavily on that material. A Bibliography based on the article's main headings has been included for those readers who wish to explore any aspect of MARC in greater depth.

BACKGROUND, 1961–1965

The Library of Congress's (LC) investigations of the possibility of using automated techniques for its internal operations began in the late 1950s. As a result of the interest generated by these investigations, the Librarian of Congress requested a grant from the Council on Library Resources (CLR) for a study to determine the feasibility of applying automated techniques to the operations of LC. The study, published in 1963,^[1] recommended that a group be established to design and implement the procedures required to automate the cataloging, searching, indexing, and document retrieval functions. A systems staff was assembled in the Office of the Librarian to proceed with the recommendations. During this same period, motivated by the increasing attention given to automation in libraries, CLR awarded a contract for a study of the possible methods of converting the data on LC cards to machine-readable form for the purpose of printing

bibliographical products by computer. The report of the study^[2] was the subject of a conference held at LC in January 1965, under the sponsorship of LC, the Committee on Automation of the Association of Research Libraries (ARL), and CLR. Participants included representatives from universities, research agencies, government agencies, and private industry. The conferees concluded that:

1. Availability of machine-readable catalog records produced and distributed by LC would help those libraries that have automated systems.
2. The machine-readable record should include all the data presently available on LC's printed card, plus additional information to produce a multipurpose record.
3. Agreement by a broad segment of the library community on the elements to be included in the record was most desirable, and the design of the record at LC was probably the best means of achieving standardization.

Three LC staff members were assigned to the task of analyzing cataloging data from a machine processing point of view. A report,^[3] issued in June 1965, was reviewed by over 150 LC staff members and their comments were issued as a supplement to the report. Comments were also elicited from many representatives of the library community.

The report was discussed at a conference supported by CLR and held at LC in November 1965. The enthusiasm generated at this meeting again demonstrated the desirability of LC becoming the distribution source of machine-readable records. As a result, LC sought funds from CLR to conduct a pilot project and in December 1965 received a grant to test the feasibility and utility of the distribution of cataloging data in machine-readable form from LC to user libraries. The project was named MARC, for *machine-readable cataloging*.

MARC PILOT PROJECT, 1966–1968

Planning for the pilot project began early in January 1966. CLR funds were used for contractual support: 1) to develop procedures and programs for the conversion, file maintenance, and distribution of MARC data, as well as programs to use the data at the participating libraries; and 2) to assist in the evaluation of the project. Participants in the pilot project were invited by LC, and from the 40 libraries that responded affirmatively, 16 were chosen. Selection was based on type of library (special, government, state, university, public, and school), geographic location, availability of personnel, equipment, funds, proposed use of MARC data, and willingness to evaluate the utility of the data and prepare written reports. It was thought that for the project to provide the most useful information, different types of libraries and geographical areas should be represented. The first (types of libraries) was a valid decision; the second (geographical areas) is questionable.

The participants selected were: Argonne National Laboratory; Georgia Institute of Technology; Harvard University; Indiana University; Montgomery County Public Schools; Nassau (County) Library System; National Agricultural Library; Redstone Scientific Information Center; Rice University; University of California Institute of Library Research, Los Angeles; University of Chicago; University of Florida; University of Missouri; University of Toronto; Washington State Library; and Yale University. By February 1966, the LC staff assigned to the project was prepared to call a conference of the participants for the purpose of describing: 1) the concepts, objectives, schedules, functions, and requirements of the experiment; 2) the operation at LC; 3) the MARC format; 4) the materials to be sent weekly to participants; and 5) the content of the reports expected from the participants. The February meeting was considered the official opening of the pilot project. [The pilot project format, later in the life of the project, was called MARC I to differentiate it from the distribution format (MARC II), which was designed later.]

LC set for itself the herculean task of completing within eight months the design of procedures and computer programs required both for the LC operations and for the participants. The MARC I format had to be stabilized by April 1966 to begin programming. Consequently, the time spent in analysis and design was severely limited and the form of material was restricted to book materials.

The first distribution was to begin in September 1966. Actually, the first test tape was mailed in October and the weekly service began in November.

The months following the initial distribution were hectic for all. The computer programs provided to participating libraries were not, in all cases, error free and had to be modified; the participants were busily engaged in writing

their own tailor-made programs; and LC was learning better production methods “on the job” to reduce the large number of incorrectly edited and inadequately verified records. The load on the telephone lines between the participants’ locations and Washington, District of Columbia, was heavy from November 1966 through the next several months.

The pilot project had originally been scheduled to end in June 1967. This termination date, however, seemed unrealistic. Setup time had taken longer than anticipated at the participating libraries and, with June as a cutoff date, there could be little operational experience. LC stated at the midwinter meeting of the American Library Association (ALA) in January 1967 that the pilot would be extended. (LC made arrangements to hold MARC meetings during ALA conferences as a vehicle of communications with pilot participants.) During the next six-month period, it became obvious that MARC served a useful purpose and, encouraged by the enthusiasm of the library community, LC announced at the June 1967 ALA/MARC meeting that a full-scale operational MARC Distribution Service was in the planning stages. The pilot project would continue through June 1968 while the operational system was being planned and implemented. The pilot service was extended to four additional participants—California State Library, Illinois State Library, Cornell University, and the State University of New York Biomedical Communications Network.

The participating libraries experimented with card catalog and book catalog production, current awareness listings, filing arrangement by computer, etc. Not all participants were successful in mounting an operational system but, nonetheless, all cooperated to the fullest in reporting back to LC the pros and cons of each aspect of the project. In particular, the need for timely receipt of data and quality of records was stressed.

Part of the rationale for the pilot project was the test of a machine format under operational conditions in order to design a next generation format based on the experience gained. In addition to the substantive evaluation of the MARC I format provided by the participating libraries, an important event occurred during the project which exerted a strong influence on the design of MARC II. The interest expressed by the British National Bibliography (BNB) in mounting a UK/MARC Pilot Project and the many visits from foreign librarians directed thinking toward a standard communications format suitable for interchanging bibliographic data, not only from one organization (LC) to many, but also among organizations, perhaps crossing national boundaries.

The philosophy behind MARC II was the design of one format structure (the physical representation on a machine-readable medium) capable of containing bibliographic information for all forms of material (books, serials, maps, music, journal articles, etc.) and related records (name and subject reference records, etc.). The

structure, or “empty container,” the *content designators* (tags, indicators, and subfield codes) used to explicitly identify or to additionally characterize the data elements, and the *content*, the data itself (author’s names, titles, etc.), are the three components of the format. It was recognized that under ideal conditions the universe of material would be studied at one time for a more coordinated approach to the assignment of content designators. However, those responsible knew the magnitude of such a task, the time required, and the need for specialists to be involved. Consequently, to make progress in the near term, it was decided to handle one form of material at a time, beginning with books.^[4]

LC staff held many meetings discussing the book format contents and content designators. The intent was to provide a multipurpose record “rich” enough in detail to allow inclusion or exclusion of data elements based on the user’s needs. The resultant MARC II format for books reflects the consensus of a large number of librarians and systems personnel.

Another significant outcome of the pilot project was the design of an extended character set for roman alphabet languages. At the onset of the project, a character set was specified based on the work in progress by the Library Typewriter Keyboard Committee of the Resources and Technical Services Division of ALA. Once the pilot was in operation, LC, in consultation with the National Agricultural Library and the National Library of Medicine, turned its attention to the development of an extended character set to cover all the major roman alphabet languages as well as the romanized forms of nonroman alphabets.

In December 1967 a meeting funded by CLR was held at LC for the purpose of discussing the MARC II format and the proposed character set. This meeting was particularly significant since the participants, based on shared experiences in the pilot project, were setting the framework for an operational MARC system that would have wide implications for the entire library community and the future of automated library systems.

At the conclusion of the pilot project in June 1968, LC had distributed approximately 50,000 machine-readable records for English language book materials. All concerned were a little wiser than at the onset of the experience. LC had learned a great deal about the procedures and the funds needed to convert cataloging data to machine-readable form. The participants realized the complexities inherent in applying the computer as a tool for library operations and the requirement for management support, time for implementation, and funds. All organizations were aware of the close cooperation required between computer and library personnel for a successful project.

A project report^[5] was published in 1968 describing the experiences of LC and participating organizations, the expanded character set, and the MARC II format.

MARC DISTRIBUTION SERVICE, 1968–

From June 1967 through June 1968, LC staff, in addition to concentrating on the MARC II format design and the expanded character set, were engaged in the redesign of the procedures and programs for the operational MARC Distribution Service. The pilot project was officially terminated in June 1968, and from July through March 1969 LC shifted over to a period of testing the new procedures and programs.

During this practice period, a proposal was written by LC to the Information Science and Automation Division of ALA recommending that a series of workshops (which became known as the MARC Institutes) be held throughout the country for the purpose of briefing library staffs on the MARC II format, LC procedures, and the uses of MARC data by libraries during the pilot project. The first institute was held in Seattle, Washington, in July 1968. This series continued for several years and was attended by over 2000 individuals.

The first *Subscriber’s Guide to the MARC Distribution Service* [which later became *Books: A MARC Format*^[6]] was published in August 1968 so that institutions planning to subscribe to MARC would have the necessary information for programming. The *Guide* was followed by a test tape in the fall of 1968 to provide the means of checking user programs.

In March 1969 the operational system was launched covering all English-language monographs cataloged by LC including titles acquired through the National Program for Acquisitions and Cataloging (NPAC). (Initially, only United States imprints were distributed but this was rapidly expanded to include all English-language monographs.) The distribution cycle was weekly, and approximately 1000 records appeared on each MARC tape.

Before the actual implementation of the distribution service, a great deal of interest was generated in MARC procedures. Consequently, in 1969, LC issued, through ALA, the first edition of the *MARC Manuals*.^[7] This publication contained the *Data Preparation Manual: MARC Editors*, the *Transcription Manual: MARC Typists*, the *Subscriber’s Guide to the MARC Distribution Service*, and *Computer and Magnetic Tape Unit Usability Study* (an analysis to determine which computers and peripheral devices could be used to process MARC tapes).

Because of hardware limitations and time and funding constraints, the new MARC system was designed as a batch tape system composed of four subsystems: input, file maintenance, retrieval, and output. The programs within each subsystem were generalized, data independent where possible, table driven where the characteristics of the data were known (i.e., validation of tags across forms of material), and parameterized to the extent possible to

allow the specification of unique requirements (e.g., output formatting).

From the beginning of the design phase, LC staff recognized that the system would require updating to use disk as the storage medium and to provide for online correction. (In the LC environment, online input of new records is not desirable but there is a definite need for on-line correction and verification to reduce the volume of paper work and expedite the processing of records). In 1971, work was begun on the Multiple USE MARC System (MUMS) to provide on-line capability and on the redesign of the MARC input and maintenance system.

In accordance with the original plans to specify MARC formats for forms of material other than books, LC published formats for serials^[8] and maps^[9] in 1970, films^[10] in 1971, and manuscripts^[11] in 1973. The music and sound recordings format is in draft form at the time this is written and should be published in 1975.^[12] In the design of all formats, LC worked with other organizations that had expert knowledge of the material concerned.

The distribution service has been expanded as funding permitted. Distribution of records for films began in 1972, and for serials, maps, and French-language monographs in 1973. The present services represent approximately 105,000 records per year. If the service is expanded to include books in other romance languages and in German late in 1974, the total record count will reach approximately 150,000 annually. As of summer 1974, the database totaled approximately 500,000 records. The present service is available in several forms. These include: 1) all MARC records; 2) books (All) covering records for English-language monographs including titles acquired through NPAC, titles in all languages in the Cataloging in Publication (CIP) Program, and French-language monographs; 3) books (English) as described in books (All) above, but excluding the French-language records; 4) films, covering motion pictures, filmstrips, transparencies, slide sets, and other projected materials, in all languages; 5) maps, covering records for single and multisheet thematic maps, map sets, and maps treated as serials, in roman-alphabet languages; and 6) serials, covering all serials receiving printed card cataloging, including romanized records for titles in nonroman alphabets. Records for books (English) and films can be purchased in annual cumulations. Test tapes for all services are available for experimental purposes.

In 1973, LC suggested to the Resources and Technical Services Division/Reference and Adult Services Division/Information Science and Automation Division (ALA RTSD/RASD/ISAD) Committee on Representation in Machine-Readable Form of Bibliographic Information (MARBI) that a MARC advisory committee be formed to work with LC regarding changes to the various MARC formats. The MARBI committee decided it would be the MARC advisory committee, and LC was asked to prepare a paper^[13] proposing how such a committee would operate in relationship to the MARC Development Office (MDO).

The LC proposals and recommendations were adopted by the MARBI committee during its meeting at the 1974 ALA midwinter meeting.

The term "change" includes additions, modifications and deletions of content data (in both fixed and variable fields), and content designators made to the format as well as additions, modifications, and deletions made to the tape labels. The changes under consideration fall into five categories: 1) changes resulting from a change in cataloging rules or systems, 2) changes made to satisfy a requirement of LC, 3) changes made to satisfy a subscriber's request, 4) changes to support international standardization, and 5) changes made to expand the MARC program to include additional services.

Guidelines have been established to handle the above categories of changes and a time period set for the MARBI committee, working through the MARC users, to react to a proposed change. LC agreed to notify MARC subscribers two months prior to including any change in the MARC Distribution Service.

LC plans to continue to expand MARC until all of LC cataloging (approximately 250,000 titles annually) is encompassed within the MARC system. (Since LC redistributes all changed records and, in addition, each CIP record is updated at least once to a full MARC record, the actual number of records distributed is significantly larger than the number of titles cataloged and included within the scope of MARC at any time.) In certain nonroman alphabets this extension may mean romanization. Equally as important as the bibliographic records is the availability of name and subject authority records. The procedures to input subject records and to maintain the files have been operational for some time. The design of similar procedures for name records, as well as distribution procedures for name and subject records, began in 1974, and it is hoped that in 1975 the library community will have these records for processing in their local systems.

Although the primary advantage of the distribution service is considered to be the cost savings resulting from centralized cataloging and from centralized editing and transcription of machine-readable records, another by-product of MARC is often overlooked. It is impossible to estimate the resources (people and time) saved by national and international organizations implementing automated systems through the use of MARC publications. The LC language and country codes and character sets have been widely adopted, and the various MARC editorial and transcription manuals adapted to local needs. Thus, through the efforts of a dedicated LC staff, significant cost savings have been effected throughout the world.

RETROSPECTIVE CONVERSION, 1968–

With the assurance of an ongoing MARC Distribution Service, libraries throughout the country began to discuss

and, in some instances, to plan the conversion of their existing catalogs. Such uncoordinated conversion activities would result in costly duplication of titles in machine-readable form. Any future amalgamation of the multiple databases into a single unified national database would entail a formidable task of human editing to make the name and subject headings assigned by many libraries consistent with authorized forms.

Since LC was also interested in the conversion of its retrospective records, it appeared timely to investigate the feasibility of a large-scale centralized conversion of retrospective cataloging records and their distribution to the library community.

In 1968 a proposal was submitted to CLR for a feasibility study to be conducted by LC. Recognizing the far-reaching significance of a centralized conversion effort, CLR responded immediately by providing funds. The responsibility for the conduct of the study which was dubbed *Retrospective Conversion* (RECON) was assigned to a working task force. An advisory committee composed of members of the library profession was appointed to provide guidance for the study. Both groups included representatives from LC as well as from other organizations.

A report^[14] published in 1969 described the work performed during the feasibility study and stated the major conclusions reached and recommendations made by the task force. The task force examined in detail: 1) the hardware and software required for a large-scale conversion; 2) existing LC files to select the one most suitable for conversion; 3) the rationale for setting priorities for conversion, and how best to accomplish the job; and 4) the costs of hardware, software, and manpower for a conversion project.

As a result of its investigations, the task force arrived at the following conclusions:^[14]

1. The MARC Distribution Service should be expanded to cover all languages and all forms of material as rapidly as resources and technology allow. There should be no conversion of any category of retrospective records until that category is being currently converted.
2. Conversion of some portion of retrospective records to machine-readable form should be an early goal for library automation efforts.
3. Conversion for a national bibliographic database requires standardization of bibliographic content and machine format. Standards for conversion of retrospective records should be the same as those for current records.
4. The highest priority for retrospective conversion should be given to records most likely to be useful to the largest number of libraries. As nearly as possible, subsequent priorities should be determined by the same criteria.
5. Large-scale conversion should be accomplished as a centralized project. Decentralized conversion would

be more costly and unlikely to satisfy requirements for standardization. The project should be under the direction of the Library of Congress.

Based on these conclusions, the task force recommended that conversion should take place in reverse chronological order, by language, using the LC Card Division record set, which is arranged in sequence by date. Each record would be compared against the LC Official Catalog for updating purposes.

The order of conversion should be: 1) English-language monograph records issued from 1960 to date, 2) Romance- and German-language monograph records issued from 1960 (this conversion would not begin until MARC had been expanded to include these languages), and 3) English-language monograph records issued from 1898 to 1959. Every effort should be made to convert items 1) and 2) within four years.

An initial method of conversion was prescribed and it was proposed that further studies be initiated to determine: 1) the best means of obtaining standard records for items not represented in the LC Official Catalog to build a complete national bibliographic data store, and 2) the feasibility of establishing a national union catalog by recording holdings of libraries in the data store.

The task force further recommended that an implementation committee be established to investigate sources of funds for a detailed system design for a large-scale conversion effort and the initiation of a pilot project to test the proposed conversion system.

The implementation committee was never formed. However, LC took the initiative and proposals were submitted to CLR and the U.S. Office of Education (OE) to augment the resources committed by LC with additional funds required to support both a pilot project and the continuation of the activities of the working task force. Both CLR and OE responded positively and in August 1969 the RECON Pilot Project was initiated, with the additional funds designated for the studies by the task force and the travel expenses of both the task force and the advisory committee.

The pilot project conducted by LC covered five major areas:

1. Conversion techniques postulated in the RECON feasibility report were tested in an operational environment by converting English-language monographs cataloged in 1968 and 1969 but not included in the MARC Distribution Service. (Many of the 1968 titles were formerly distributed to the participants of the MARC Pilot Project in the MARC I format.)
2. Procedures and programs to implement format recognition were developed. (Format recognition is a technique for the automatic assignment of tags, indicators, subfield codes, and fixed fields to machine-readable bibliographic records.)

3. Problems associated with the conversion of records in other languages and cataloged according to other conventions and cataloging rules were analyzed for their effect on a conversion effort.
4. The state of the art of input devices for a large conversion effort was monitored. This included the testing of two devices in a production mode.
5. Microfilming techniques and their associated costs were studied to determine a best method for copying the sections of the LC Card Division record set. Microfilming was suggested because the record set is a "high use" file that cannot be withdrawn in whole or in part for any substantial period of time.

The pilot project continued for two years (August 1969–August 1971) and is fully documented in a report^[15] published in 1972. The findings of the project are briefly summarized below.

1. Format recognition applied to unedited records is a practical computer technique, eliminating the need for human editing prior to keying. The costs for keying and proofing for format recognition remain approximately the same as for processing records fully edited by humans. However, applying format recognition in place of human editing does effect a cost reduction of approximately 12% in manpower costs.
2. The magnetic tape selectric typewriter, currently in use, was found to be as cost efficient as any other off-line device given the requirements for easy accommodation of variable length records and an expanded character set. Cathode ray tube terminals were also investigated for use in an on-line mode for corrections. Only one device was available with the expanded character set. The results of testing direct-read optical character readers (OCR) to convert LC cards to machine-readable form were negative; no device could perform adequately.
3. Filming all cards in a given series of the Card Division record set against a form and reproducing hard copy proved to be the most efficient method of producing source documents. The desired subset of records would then be selected for conversion.
4. Processing of older catalog records and those in foreign languages is more complex than processing current English-language records for books, and therefore conversion costs will be higher.
5. The lowest RECON unit cost that can be anticipated for a record processed by format recognition is approximately \$3.06. (Projected costs were based on the MARC Pilot and Distribution Service experience because RECON was an experiment rather than a production effort. Time was expended on testing devices, alternative methods, etc., and consequently there was no basis for determining accurate cost projections.)

Approximately 58,000 records were converted during the pilot project. The 1969 titles were distributed free of charge to MARC subscribers in 1971 and the 1968 titles were made available through sale.

The most significant technical achievement of the pilot project was the development and implementation of the format recognition process. Automatic identification of the data elements of machine-readable records had been tested in other organizations, namely the Institute of Library Research at the University of California, Berkeley, and the Bodleian Library, Oxford. However, LC was the first to attempt to assign the content designators (i.e., tags, indicators, and subfield codes) and the fixed fields for a full MARC II record by program. The cataloging source data are transcribed from left to right and from top to bottom. (The source document is either an LC-printed card or a MARC worksheet.) The data are input as fields, which are detected by the program because each field ends with a carriage return, and each field continuation is indicated by a carriage return and tab. The title paragraph is the only field where the program is given an additional clue in the form of a delimiter (a special character used to separate units of data) separating the title, edition, and imprint. The format recognition program searches first for the collation statement, which is easily located and always present. Once the collation statement is found and identified, the fields preceding and following collation are analyzed and identified separately using a variety of clues, such as first characters present and punctuation. The first pass of the program provides gross identification (in most instances only a partial tag is provided) and the remainder of the process is a reexamination of each field to provide final and complete tags, indicators, and subfield codes. After each variable field is fully identified, the data are scanned for information required to set the fixed fields. Tables of keywords consisting of items such as U.S. cities, foreign cities, geographical names, meetings, and honorary titles associated with personal names are used for matching purposes to aid in the identification of a variable field, or a data element within a field, as well as providing, in some instances, the information needed to fill in a fixed field.

Format recognition is currently used for the processing of English- and French-language monographs. Additional keyword lists will be built for other languages as the MARC service is expanded. The program has been operational since May 1971. RECON records were processed to test the technique in a production environment until January 1972. At that time, satisfied with the results, LC proceeded to use the technique for the processing of current MARC records.

Concurrent with the RECON Pilot Project, the task force considered certain basic issues of retrospective conversion that were of national scope. The studies, with conclusions and recommendations, were reported in a publication^[16] in 1973. Underlying all the work performed

was the reaffirmation of the importance of a coordinated retrospective conversion activity to keep duplication of effort to a minimum and to achieve a high degree of compatibility among records.

The special studies involved four areas that are described along with the findings of the task force.

1. There have been many attempts made and a great deal of effort expended to determine a subset (hereafter referred to as level) of the MARC format that would still allow a library using it to be part of any future national network. A level of a MARC record can be distinguished by differences in: 1) the data content of a record, and 2) the extent to which its contents are separately identified. Upon agreement as to the use to be made of machine-readable cataloging records, two or more parties can define a level of the MARC format to satisfy that use. The task force was concerned with the creation of machine-readable records for national use, i.e., either the recording of holdings to a national union catalog or the distribution of cataloging information in machine-readable form to library networks, systems, or individual institutions. The task force concluded that level of MARC records can be defined for each of these functions. Since the union catalog function is well defined, a level of less completeness than the full MARC could be determined. However, the record for the distribution function must satisfy the needs of diverse installations and applications and, consequently, must be the fullest MARC record.
2. A large pool of machine-readable bibliographic records exists. Since MARC is still limited in its coverage, there is the potential of using this pool of records to accelerate the building of a national database and to reduce the duplication of input with a resultant cost savings. The task force undertook to investigate representative machine-readable databases and to assess their potential for this purpose. The study indicated that the per record cost of converting non-MARC records to MARC, comparing them with the records in the LC Official Catalog (to ensure consistency and completeness), and updating their contents, approached the per record LC/MARC cost. However, if the record was similar to an LC/MARC record in terms of fullness of catalog entry, format, and character set, i.e., a high potential record, then comparing only its access points with the LC Official Catalog record and updating those access points when required, would result in a conversion cost estimated to be in the order of one-half of present LC/MARC conversion costs.
3. The National Union Catalog (NUC) serves two major functions: the provision of cataloging data and a finding list for the locating of a title. With the advent of LC/MARC and the proliferation of library automation projects, it was logical for the task force to consider the implications of a national union catalog in machine-readable form. On-line access to a national union catalog did not appear to be likely in the near future. Attention was consequently turned to the automatic production of the NUC in book form or microform. This mode of production would relieve humans of the drudgery of preparing the catalogs, make the information more rapidly available, and provide the facility for additional access points to the data. The task force selected the register/index as the optimum format for NUC. This type of catalog is composed of a register of complete bibliographic entries arranged in numeric sequence according to a number assigned to each entry when the register is prepared. The register is never cumulated. The indexes are derived from the register entry and contain a brief bibliographic entry and the register number. The indexes are cumulated at predetermined intervals. This format has the advantage of providing several points of access without having to print the full bibliographic record more than once. The task force concluded that the cost of the automated system with its associated advantages would not exceed the cost of the present manual system, and the cost of producing the quinquennial would be significantly reduced. In addition, the database might eventually form the basis for an on-line network of regional bibliographic centers.
4. Experience in the RECON Pilot Project indicated that a large-scale conversion project as projected in the RECON feasibility study demanded far more resources (staff, space, and funds) than there is hope of obtaining. To convert chronologically by language as recommended in the feasibility study, on a lesser scale, would be too slow to satisfy those libraries requiring machine-readable records for their automation efforts. Therefore, the task force examined alternative strategies, hoping to arrive at a means of more rapidly responding to the needs of libraries, but concluded that there was no perfect solution to the problem, since preferences for languages, dates, and forms of material are dependent on the type and size of library involved. Systematic conversion, i.e., orderly conversion by language and date, has the advantage of allowing the user to predict with reasonable certainty what is in machine-readable form. It has the disadvantage that users may wait for long periods of time before desired records may be available. Conversely, nonsystematic conversion (based on some criterion such as all records in a given bibliography) might have the advantage of more rapidly converting records desired by a larger number of organizations, but it would have the disadvantage that, without querying the database, the user cannot predict which titles are in machine-readable form.

The task force concluded that LC should concentrate on going forward as rapidly as possible to convert all of its current cataloging to machine-readable form and that an agency, established expressly for the purpose of a large-scale retrospective activity, should undertake to convert the retrospective LC records that are most in demand and be responsible for adapting records from libraries other than LC for inclusion in the national database. (Initially, these records might be those ordered from the LC Card Division most frequently.) The task force recommended that since the problem of retrospective conversion is of concern to all of the nation's libraries, the National Commission on Libraries and Information Science (NCLIS) might be the appropriate agency to determine a course of action and explore sources of funding to implement a national program.

To date, no central agency has been established nor has NCLIS taken any express action concerning retrospective conversion. LC, when resources permit, continues to convert retrospective titles selected from the Card Division as well as MARC Pilot records that were not converted during the RECON Pilot Project. (The MARC Editorial Division, responsible for the conversion of MARC records, is geared to peak load conditions. When the volume of records diminishes for any period of time, the gap is filled in by converting retrospective titles.) These records are distributed as part of the MARC service.

There is continuing interest in a centralized conversion activity. The concern of the participants in a series of meetings^[17] sponsored by CLR is one manifestation of this interest. The purpose of these meetings is to seek a means of exchanging machine-readable records among organizations until such time as a national service may exist to perform this function centrally. The records under consideration are of two types: 1) records converted from LC cataloging copy not included in the MARC Distribution Service (i.e., either items cataloged prior to the MARC service for a particular language or form of material or records not yet within the scope of MARC), and 2) records representing titles not cataloged by LC. The emphasis here is placed on all records, both retrospective and prospective, being converted by organizations other than LC. As progress is made on the automation projects of individual institutions and as regional networks evolve, it is an accepted fact that institutions will be doing local conversion. The excessive cost of duplicate conversion that will result if machine-readable data are not shared, as well as the problems of an inconsistent data base, can only be resolved if a single organization assumes the responsibility and has the resources for building a national data base.

INFLUENCE OF MARC ON STANDARDIZATION

Libraries acknowledged the importance of standardization long before MARC came into being. Machine

systems, however, showed the need for an extra measure of conformity over what had been apparent in the past. What appears in the printed record is human readable, not bit configurations representing characters or codes or explicitly identifying content data. Variations in the placement or the formatting of words, paragraphs, and numbers in the printed record are not too damaging to the initiated, but can be intolerable to efficient machine processing. The interest of libraries in the computer for library operations was increasing in the 1960s. The availability of cataloging data in machine-readable form supplied by LC, the need to input cataloging data locally (data not within the scope of MARC or titles not cataloged by LC), the possibility of sharing these locally generated records, the potential for using computer programs across organizations to reduce the high cost of designing and writing software, and the need for hardware capable of handling large character sets were all factors that put increased emphasis on the establishment of and conformity to standards.

The impetus given to standardization by LC/MARC is doubtless one of its most important results. The establishment of bibliographic standards did not happen chronologically but in many instances overlapped, i.e., the development of a new standard might begin while a proposed standard was in the process of adoption. Consequently, reporting of the standards cannot be made in strict chronological order.

Format for Information Interchange

During the operation of the MARC Pilot Project, BNB personnel visited LC to investigate the possibility of a UK/MARC Pilot Project. At a later date, when BNB decided to proceed with its MARC project, its staff worked with the MARC staff on the MARC II format in an effort to satisfy the requirements of both agencies. This cooperation had long-term effects. Both agencies recognized the future implications of an interchange format and the importance of two major publishing countries agreeing on a standard. Not only would it be possible to exchange machine-readable records between the United States and the United Kingdom, but the way would be open for other countries to follow the lead and develop their own MARC projects. This possibility was particularly interesting to LC because of NPAC, where LC uses the descriptive cataloging as given by other countries in the program, adding or modifying main and added name entries, subject headings, etc., to the record as necessary. The entire process is a manual operation using printed records. The potential exists for updating machine-readable records from countries in the program and thus reducing the cost of conversion at LC.

Recognizing the worldwide impact of sharing machine-readable records, LC and BNB, in addition to being active in their respective national standards organizations, in

1969 submitted the then proposed American National Standards Institute (ANSI) format and its equivalent, the proposed British Standards Institute (BSI) format to the International Organization for Standardization (ISO). The MARC projects in the United States and Great Britain and the developing ANSI, BSI, and ISO standards created the environment for many countries (including Australia, Canada, Denmark, France, Germany, Italy, Japan, Latin America, Norway, and Sweden) to begin to plan for and implement their own national MARC system. (In addition to national libraries and bibliographies, many organizations based outside of the United States, such as UNISIST, the International Labor Organization, Information Services in Physics, Electrotechnology, Computers and Control, and the International Atomic Energy Agency, have adopted or recommended adoption of the format structure.)

The MARC format *structure*, as a vehicle for information interchange, was adopted in the United States by the three national libraries, ALA, ARL, the Committee on Scientific and Technical Information (COSATI), the Educational Resources Information Center (ERIC), the Association for Scientific Information Dissemination Centers (ASIDIC), and others. The format structure became an ANSI standard in 1971^[18] and an international standard in 1973 [ISO 2709–1973 (E)].^[19]

International Standard Bibliographic Description

In 1969 the International Federation of Library Associations (IFLA) convened an International Meeting of Cataloguing Experts. Since the Paris Principles had set the framework for an international cataloging code, it seemed appropriate to call an international meeting to discuss the next step, a standard bibliographic description. A working paper^[20] prepared by Michael Gorman of the BNB, with the support of a United Nations Educational and Scientific Organization (UNESCO) grant, demonstrated the difference in the order of data and in punctuation patterns of various national bibliographies (NUC represented the United States bibliography). A working party was selected to draft an international standard bibliographic description for monographs. An international standard bibliographic description would provide a standard set of descriptive elements in a standard order using standard punctuation to separate the elements. Such a description would facilitate: 1) the comprehension of the description in printed form regardless of language, and 2) the automatic recognition of elements of the description for machine identification. The first published draft of the International Standard Bibliographic Description (ISBD) was issued in 1971, followed by the first standard edition in 1974.^[21] [A recommended ISBD for serials was also published in 1974.^[22]]

Content Designators

The ISBD for monographs, the ISO standard format structure for bibliographic interchange, Kaltwasser's paper^[23] concerning universal bibliographic control, and the ever-increasing number of national MARC formats were all positive steps toward international cooperation. Problems remained, however. One of the significant areas of nonstandardization among national MARC formats was in the assignment of content designators to elements of information in the machine-readable records. Accordingly, IFLA established, under the auspices of the Committees on Cataloguing and Mechanization, an international Working Group on Content Designators. The Working Group held its first meeting in Grenoble, France, during the 1973 IFLA conference. Obstacles in the way of agreement on content designators include: 1) diverse functions of the bibliographic agencies, 2) lack of an internationally accepted cataloging code, 3) lack of agreement among different bibliographic communities on organization of data content in machine-readable records, and 4) lack of agreement as to the functions of content designators.

The Working Group realized that the issues concerning data organization and functions of content designators could be resolved (subsequently agreement on these points was reached in a meeting in Brussels in February 1974) but that the lack of an internationally accepted cataloging code and the dissimilarities in the functions of different bibliographic services were areas over which it had no control.

Encouraged by the fact that it has been possible to work around these differences in the formulation of the ISBD, the Working Group proceeded to adopt the concept of a SUPERMARC^[24,25] as an international system for exchange, leaving the various national systems as they now exist. Each country would have an agency that would translate its own machine-readable records into the format of the SUPERMARC system; likewise, each agency would translate SUPERMARC records into its own national format.

The international machine-readable record was divided into functional blocks (e.g., intellectual responsibility block, descriptive block, subject block). There was unanimous agreement that the descriptive block would follow the ISBD, and it is this block where agreement on content designators and content is most likely possible.

It is recognized that the content and consequently the content designation of certain blocks is dependent on cataloging codes and practices. Therefore, the best that can be hoped for in the near term is agreement on content designation at a level of specificity less than that presently used by national systems. For example, the intellectual responsibility block contains names of persons and organizations associated with the work described. In national systems, each type of name may be further expanded to multiple levels of subtypes and subfields coded in a variety of ways. In the international record, the expansion may

be limited to indicating personal, family, corporate, and conference names; and primary, alternate, and secondary responsibility.

The concept is a record composed of two principal parts: 1) the identification of the item (descriptive block modeled after the ISBD), and 2) all other elements making up the bibliographic record, e.g., headings, subjects, and classification numbers. This will allow the user to accept the descriptive block for inclusion in his system and provide the option of using or discarding the other elements of information.

Work on this international standard is still underway. It is hoped that agreement will be reached on a standard set of content designators by the IFLA meeting in 1975.

Other Activities

The expanded roman-alphabet character set designed by LC was adopted by ALA, has been used in information systems throughout the world, and is the basis for the current work in progress in ISO/TC46/SC4/WG1, Character Sets for Documentation and Bibliographic Use. The acceptance of a character set for bibliographic use, indicating marketability to hardware vendors, led to the manufacture of a typewriter sphere, a print train, and several cathode ray tube terminals.

Country of publication codes and language codes originally established by LC for the MARC Pilot Project and, based on experience, modified for the MARC Distribution Service have also been accepted as the codes for several systems. Although these codes have not been adopted as ANSI or ISO standards, they do have an impact on current standardization activities.

The challenge to the individuals involved in standards setting is great. Much remains to be accomplished. Progress has been made, however, and it appears that "International MARC" may become a reality.

MARC USERS

Use of MARC at the Library of Congress

The main thrust of LC's bibliographic automation program during the years 1966–1970 was the distribution of MARC data. In terms of LC, MARC up to 1974 covered approximately 40% of LC's total cataloging effort.

In 1970, sights began to turn inward, and MDO was established in the Processing Department to concentrate on automating the functions concerned with technical processing. (Before June 1970, staff responsible for MARC, RECON, etc., was part of the Information Systems Office (ISO), organizationally situated in the Office of the Librarian. At the same time that MDO was established, ISO was transferred to the Administrative Department.) An article describing the automation

programs of the Processing Department was published in 1972.^[26] The program can be considered to have a three-pronged approach: 1) expansion of the MARC Distribution Service, 2) design and implementation of a core bibliographic system,[†] and 3) products and services for LC and the library community. It is principally in item 3) that the MARC data base is used at LC at this time. Several of these projects are briefly described below.

Book Catalogs

1. The Main Reading Room catalog consists of records included in MARC (books and serials) and records input especially for the project. Catalogs have been produced, via computer printer, arranged by call number, author, title, and subject for use in LC. Plans include the general distribution of the catalogs in this form as well as photocomposed issues at a later date.
2. The Science Reading Room file is also composed of MARC records (books and serials) in addition to records input specifically for the project. Computer-printed catalogs have been produced for use in LC.
3. The catalog of *Films and Other Materials for Projection* for the last quarter of 1972 and the first two quarters of 1973 was produced from the MARC films database in 1974. This catalog is issued in two sections in one volume: 1) title main entries and added author entries, and 2) subject added entries. "See" and "see also" references are included.

All machine-produced book catalogs and other bibliographic listings are arranged by means of a program called Library Sort Key Edit (LIBSKED). This program was designed to implement the new LC filing rules^[27] formulated by the Technical Processes Research Office of the Processing Department.

Printed Cards

MARC records are input to the Card Division's automated system to compose and print LC cards, complete with overprinted headings, for use in the LC catalogs. On-demand production of cards for film and map titles in response to orders from subscribing libraries or for cards that are out of stock is operational, but on-demand production for all orders (approximately 40,000 per day) for which there is a MARC record cannot be implemented until quantity limitations imposed by the present capabili-

[†]This includes automation of the Order Division functions and the Process Information File (PIF) which are presently in various stages of operation, implementation, and design. The Core Bibliographic System includes the use of LC name and subject authority records to produce book catalogs as well as linking them to MARC records as a cataloging aid. Several ongoing operational projects, such as the building and maintenance of the subject heading file, are modules of this activity.

ties of the offset press and accompanying cutting and collation equipment are resolved. Consequently typeset cards are still being prepared for MARC titles through the Government Printing Office.

MARC Retriever

The MARC database is being used more and more frequently in LC as a bibliographic reference to supplement the card catalogs. The machine-readable records provide access via fields not used as headings in the card catalogs, and the richness of the MARC format offers new possibilities for the retrieval of information.

The MARC Retriever was originally seen as a research tool to promote the use of the MARC data base in new and unexplored ways. This experimental mode is still of interest in LC but, in addition, the system is used operationally for many purposes in LC as well as to provide special searches to outside organizations. The Retriever allows the user to search the contents of any variable field, subfield, or fixed field, as well as any specific tag, indicator, or subfield code value.

Recent searches include: 1) monthly lists of books on Africa, Mainland China, Latin America, Eastern Europe; 2) books in translation; 3) children's books in translation; 4) serials in French published in France, Belgium, and Canada; 5) railroad maps; 6) maps of East Africa, Kenya, Tanzania, and Uganda; 7) CIP records in history, LC class schedules E and F; 8) Festschriften; 9) atlases published in 1972; and 10) books about Africa containing statistical information.

The records retrieved are arranged and printed according to the user's specifications. The sort may be on author, title, subject, classification, date, etc. Output may be printed in card or list form, with the amount of information displayed (short form or full record printout) a user option.

Other Uses in LC

The LC Division for the Blind and Physically Handicapped selects pertinent records from the MARC files for inclusion in its system for the production of bibliographic tools, e.g., printed cards and book catalogs for such items as talking and braille books.

As the scope of MARC expands and as the ongoing projects such as the automation of the PIF become operational, more and more use will be made of MARC at LC, both for technical processing and reference.

MARC is now searchable on-line by LC card number within LC. Access to the file will be expanded to include author/title and title only search keys. Preliminary catalogers will be able to search the MARC file as well as the PIF to determine whether the item in hand is already in the collection or requires cataloging; the Card Division will be able to search for titles for which printed cards were ordered but for which the LC card number was not given; and the Catalog Publication Division will be able to search

for items reported by NUC libraries to ascertain if the reporting record is a title already covered by LC cataloging so that holdings can be posted to the proper record.

Plans include making the MARC file accessible by the Reference Department and expanding searching capabilities, as well as the eventual two-way linking between the authority records (name and subject) and each bibliographic record where the name or subject or both were used. This linking will enhance the present book catalog production system as well as provide the means to use the MARC files as a cataloging aid.

Use of MARC by Subscribers

At present (March 1974) there are 74 organizations subscribing to the MARC services. (The last MARC Survey was conducted in the spring of 1972 and the results published later in that year. The subscriber figures cited in this section have been updated to reflect the current situation.) The 74 subscribers purchase the following subscriptions:

MARC, Complete	13
MARC, Books (All)	28
MARC, Books (English)	19
MARC, Films	4
MARC, Serials	12
MARC, Maps	3

This list can be further subdivided within the category MARC, Complete. For example, there are 13 complete subscriptions and three map subscriptions, meaning that 16 map subscriptions are actually in force. Dividing the subscriptions in this manner results in the following:

Books, Foreign	41
Books, English	70
Films	17
Serials	25
Maps	16

Since an organization may order more than one type of service, the actual number of individual subscriptions as given above total 169. The subscribers are made up of 18 commercial enterprises, 23 organizations outside the United States (one of these has been previously counted with the commercial enterprises), and the remainder divided among large research, college and university, state, special, and national libraries and library centers. Institutions are difficult to identify accurately since any one institution may perform the functions of another type, e.g., a university library may act as a center, serving, in

addition to itself, several other organizations. Therefore, it is not possible to derive an accurate tally of subscribers by type of library. The subscribers discussed above are considered primary users. All of the commercial vendors and library centers as well as some of the organizations in the other categories of users provide services to other institutions. These latter institutions are considered secondary users of MARC data and, according to LC's best estimates, total approximately 1500.

There are difficulties inherent in any presentation of MARC uses. This difficulty is in part created by the tendency of library functions to overlap. For example, the search/select function is not an end unto itself but instead may be a component of a system to print catalog cards or of an SDI system. There are also various levels of the use of MARC data, depending on the mix of manual and automated processing. MARC records are, in some cases, simply used as a source of bibliographic information with the rest of the processing purely manual, or MARC records become an integral part of an automated system. Some systems are wholly dependent on MARC; in others, MARC is some percentage of the total database. There are systems that are totally batch oriented, others are partially batch oriented and partially on-line, and still others operate principally in an on-line mode. These various differences in systems do not affect the function performed, e. g., looking up a title to find where it is located, regardless of how the system is designed or how the files are organized.

The following discussion of MARC uses attempts to avoid the problems described by addressing MARC uses in general terms and not probing into individual systems.

The majority of uses of MARC data fall into the technical processing area. This is not surprising, since before the reference function can be served adequately, items must be put under bibliographic control. Furthermore, it is in technical processing that the professional librarian needs to be relieved of performing repetitive tasks or supervising others in the performance of such tasks. However, the reference function is somewhat satisfied by SDI services, LC's MARC Retriever, and the searching of index files of author, title, and subject.

Current MARC tapes are used for selection purposes by printing out the records and routing them to persons responsible for selecting materials for acquisition, or by comparing the tapes against stored profiles and printing the records that match. Printed indexes are also prepared from the MARC files (weekly or cumulative) and made available for selection.

To the extent that MARC records are available for items to be ordered, manual bibliographic searching is eliminated, and the MARC records selected are used to produce the orders and associated documents and the records are added to the institution's in-process or master file.

MARC records are used in the production of catalog cards and book form catalogs. Book catalogs have appeared in dictionary form, register/index form, or as separate author, title, and subject catalogs (or any combination thereof). The level of sophistication of catalog production varies greatly. The production forms include computer line printing, photocomposition, and microform.

A bibliography in microform, called *Books in English*, is produced by merging BNB/MARC records with relevant LC/MARC records. A catalog of English-language acquisitions of a university library and affiliated institutions is also produced by selecting appropriate records from these two databases.

Shared cataloging systems with access to LC/MARC and locally input cataloging records by LC card number and/or search keys are also in operation. (The Ohio College Library Center is the most advanced system at this time providing this type of service.) Member libraries search the files for a specific record. If the record is in the file and if the cataloging data is acceptable to the institution, printed cards in the format and quantity desired by the institution are sorted (prearranged in a filing sequence) and prepared off-line for the selected record. If the record is not available, the member library inputs the locally cataloged record that then becomes available to all other participants and the printed cards are prepared from the locally input record. In some systems, records can also be output on tape for any library desiring its cataloging data in machine-readable form. The on-line posting of the locations of the requesting library and the use of this file for interlibrary loan is also in operation.

The production of catalog cards remains the most popular operation, although in many instances card production is not the *raison d'être* of the system. The production of book preparation materials (bookcards, pockets, and spine labels), as well as circulation cards, is a useful by-product of some systems.

In one system the MARC record is used as a bibliographic source, and agency subject terms, call numbers, etc., are added. The entire MARC file is maintained as a composite database, and a subset of the file relevant to the specialization of the organization is selected by such criteria as LC class numbers or subject headings, added to the records in the system not included in MARC, and both types made available on-line to participating libraries. A full free text search is provided with a modified Key-Word-in-Context (KWIC) display for titles, series names, conference names, corporate names, publishers' names, and subject headings. Additional on-line searching capabilities include other names, LC call numbers, LC card numbers, international standard book numbers, Dewey Decimal numbers, local library card numbers, and local library location indicators. This sophisticated searching capability is in addition to the production of several library products, e.g., current awareness listings and book catalogs.

CONCLUSION

MARC is an assemblage of formats, publications, procedures, people, standards, codes, programs, systems, equipment, etc., that has evolved over the years, stimulating the development of library automation and information networks.

Any discussion about MARC in particular involves discussing library automation in general. Progress in the field is evident. There is a definite advance from the automation of discrete functions toward the automation of modules leading to integrated systems. Emphasis is being placed on the implementation of on-line systems and the use of one system to provide services to many other organizations.

Library automation activities in 1974 appear to fall into the following categories:

1. Institutions are automating their technical processing functions and, as a by-product, providing services, e.g., cards and listings, to other organizations.
2. Institutions are automating a particular aspect of their service, e.g., book catalog production, and as a by-product their procedures and programs are used to produce a like product for another organization.
3. Institutions are creating automated systems designed principally as a bibliographic center to provide services, e.g., printed cards and union catalogs, for other organizations that do not intend to automate.

Libraries have passed through an era of much talk but few results into the 1970s where the automation of library operations is no longer a promise but a demonstrated success. Faced with economic realities, the availability of bibliographic information in machine-readable form and the possibility of sharing these resources through computer technology, there is an increasing awareness that standardization, nationally and internationally, is the sine qua non of the information system.

The benefits that accrue to a library and its clients from the establishment of and the conformity to standards are many. Products from different sources will mesh. Records from different libraries will be interchanged. Machine systems will be more easily developed and shared. Union catalogs will be possible without costly editing for consistency, thus facilitating interlibrary loan. Cost of local changes to catalog records will be minimized. It will be advantageous for vendors to manufacture hardware to handle the requirements of libraries. The process of ordering, cataloging, etc., will be more uniform. Therefore, less searching and bibliographic verification will be necessary and duplication of effort will be avoided. Networking will be facilitated. Various databases will be accessible through the use of standard protocol. Service to the user will be improved, and that is really what MARC is all about.

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Machine Readable Cataloging (MARC): 1975–2007

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Abstract

This entry describes the development of the MARC Communications format. After a brief overview of the initial 10 years it describes the succeeding phases of development up to the present. This takes the reader through the expansion of the format for all types of bibliographic data and for a multiple character scripts. At the same time a large business community was developing that offered products based on the format to the library community. The introduction of the Internet in the 1990s and the Web technology brought new opportunities and challenges and the format was adapted to this new environment. There has been a great deal of international adoption of the format that has continued into the 2000s. More recently new syntaxes for MARC 21 and models are being explored.

The Machine Readable Cataloging (MARC) format, developed in the late 1960s as an electronic carrier of traditional library cataloging data, became the cornerstone for the transformation of library catalogs from card to computer and for a new era of shared cataloging, union catalogs, and integrated systems in libraries. Today it is used around the world, with new users still joining its data exchange environment, even as the basic structure of the format is being brought forward into new models.

This entry sets the context with a short review of the initial development of MARC, highlighting its innovative design and advanced character set developments. The period of expansion of the format, of character sets, and of implementation options and systems are described. With the 1990s, the Internet, Web, and Unicode presented new challenges for the format's user community with many process changes. The convergence on MARC 21 internationally is described followed by recent developments in syntax variation and modeling. A more detailed history of the format is found in McCallum.^[1]

MARC DEVELOPMENT PERIOD

In the early 1960s, libraries in North America and in Europe began to experiment with the application of the computer to library processes. This was at the beginning of the computer explosion which was fueled by the introduction in 1964 of the IBM 360—the machine that brought computers out of the universities and research labs and into the business world. It was an environment of large mainframe machines. It was before the personal computer, and even before common deployment of cathode ray tube terminals and networking of installations. For more detail on the MARC 21 development period see Henriette D. Avram's classic article "Machine-Readable Cataloging (MARC) 1961–1974" reprinted in this edition

of the *Encyclopedia of Library and Information Sciences*. It contains an excellent detailed description of the format development process from the 1960s through the early 1970s and an extensive bibliography. The following section is only a brief overview of that period, which provides the context for later developments described in this entry.

MARC Pilot Project

Following several investigations of the potential uses of computers in libraries,^[2,3] the MARC project was launched by the Library of Congress in January 1966 with a focus on getting cataloging data that had been typed onto cards for decades, into computers from which multiple forms of access could be provided. The project had to work with several unique characteristics of bibliographic data. One involved lengths. In the 1960s fixed length data formats were standard, yet bibliographic data elements could vary considerably in length. Titles alone could be one character to hundreds of characters long; descriptions that might be detailed or brief created great variation in the content size of records; and files of records could be quite large, requiring records for descriptions of millions of items in larger libraries. In addition, flexibility was needed as records were often updated and different subsets of the data in the record were used for different applications that the records had to support—circulation, finding, requesting materials from stacks, acquisitions. At a more microlevel, was the need to accommodate data in many languages, including some transliterated from non-Latin scripts, and that required several special alphabetic characters and many diacritics that were not in the standard Latin alphabet ASCII character set. ASCII is a basic Latin alphabet set. It contains 94 graphic characters including upper and lower case Latin alphabet letters A–Z, numbers 0–9, common punctuation marks, and a few symbols. It

was first approved as an American National Standard in 1968.^[4]

The MARC pilot project was carried out from 1966–1968, led at the Library of Congress by an early computer expert Henriette D. Avram, who had been a programmer at the National Security Agency where computers were essentially developed in the 1950s. The pilot involved 16 libraries of various types—universities, research institutes, and public. The focus of the pilot was to develop a format for the bibliographic record that would enable the distribution of cataloging data in machine-readable form via magnetic tape from the Library of Congress to libraries across the country.^[5] By the end of the pilot, the structure and basic data tagging for an initial MARC format were drafted and testing had begun.^[6–8] Within a few years as networks and terminals became viable, several of these early pilot participants and institutions became important figures in advancing library automation using the standard MARC record, including Yale's Frederick Kilgour who moved to Ohio and founded the OCLC bibliographic network, and the Universities of Toronto, Washington, and Columbia that led the founding of the UTLAS, WLN, and RLG networks, respectively. The OCLC was originally named the Ohio College Library Center, but as it became national in the 1980s and global in 1999, changed its name to Online Computer Library Center; RLG was the Research Libraries Group that grew out of a consortium of Harvard, Yale, Columbia University and New York Public Library and was merged with OCLC in 2006; WLN was originally the Washington Library Network in Washington state, which became the Western Library Network as it expanded and was finally absorbed into OCLC in the late 1990s; and UTLAS was originally the University of Toronto Library Automation System, which was purchased in the 1990s by Auto Graphics Canada. Not only was cataloging shared through these networks but large union catalogs were built from the cataloging activities that supported growing national and international interlibrary loan programs.

MARC Character Encoding

The MARC pilot project also spearheaded development of an extended Latin alphabet character set to be used to supplement the standard ASCII characters for MARC data.^[9] The set was characterized by its content model that encoded diacritics separately from the base character that they modified, depending on display devices to position the diacritics correctly. Precomposed characters were not feasible for library data since the combinations that occurred in large libraries's multilingual data were both extensive and not always predictable. The Library of Congress worked with the computer industry on devices for displaying and printing the extra characters and diacritics correctly, with mixed success, since most computer devices only handled precomposed alphabetic character

and diacritic combinations. The extended Latin character set eventually became an ANSI standard: *Extended Latin Alphabet Coded Character Set for Bibliographic Use* (ANSEL) (ANSI Z39.47).^[10]

MARC Features

Briefly, the MARC format structure is composed of a short introductory fixed length (36 byte) segment, called the Leader; followed by a Directory giving the tag, length, and starting character position of each of the record's data content fields; followed by the data content fields themselves. The innovative features of the MARC format structure that supported the characteristics of the MARC record indicated above were the following.

The information in the Leader made the format self-defining. It included the record's length, which meant a record was not constrained to fixed lengths as was common at the time. If record content was brief, the record was brief, thus the size of the total file was no larger than necessary. The Directory was a "table of contents" and avenue into the record that enabled variable length data content fields within the record—a title field for a one character title was only one character long. It allowed easy addition or deletion of fields, and it enabled rapid access to fields needing update or to subsets of fields needed for a specific application.

The data content fields were identified by tags in the Directory and are further defined by two positions at the beginning of each, called indicators, and by subdivision of the data into specifically identified subfields within a field. The tagged fields, indicators, and subfield structures enable the format to be responsive to the need in library applications to carry and identify highly parsed, structured data, show relationships among data, and even assist with sorting. Fields and subfields easily accommodate the many different data elements needed to describe special aspects of diverse types of resources (Fig. 1).

The innovative structure for the MARC record became first an American standard, *Information Interchange Format* (ANSI Z39.2)^[11] in 1971, and then an international standard, *Format for Information Exchange* (ISO 2709)^[12] in 1973.

The MARC format was developed as an exchange format, without the expectation that it would also serve as an internal format for systems serving end users. Exchange has essentially been its use over the years, but with some qualifications. The way data elements are parsed is important to preserve when passing data to an internal format, so that the parsing can be reconstructed when the data needs to be transformed into MARC again for communication to another system. Therefore internal systems have tended to retain some aspects of the record since data is transferred so frequently. The MARC content designation (tags, subfields, indicators, coded data) also became vocabularies that catalogers learned across the library community,


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050002500106082001500131100003500146245005200181
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Fig. 1 Record for the book *The dressmaker* by Elizabeth Birkelund Oberbeck, published in New York by Henry Holt, and Co. in 2006. The record has a link (via a URL) to a description of the book supplied by the publisher. Complete MARC 21 record (author, title, edition, and publisher part in bold): (Graphic substitutions: # for blank; \$ for subfield identifier; % for end of field character; @ for end of record character).

becoming a *lingua franca* for the discussion of record components. The metadata-rich MARC record contains data to support indexing and other functions, in addition to end-user displays, thus the communications record continued in the terminal and personal computer eras to be important for interchange between systems.

MARC FORMAT FAMILY AND SYSTEM DEVELOPMENT

After the initial implementation period of the 1960s and early 1970s the MARC format underwent dramatic development and up-take in the late 1970s and early 1980s. The advances in the technology for online systems and access were the catalyst. By 1975, roughly 60% of the records produced annually by the Library of Congress were available as MARC records, with the number increasing rapidly as format requirements for new forms of material were implemented.

Family of Formats

By the mid-1970s the MARC Bibliographic format^[13] was a suite of coordinated specifications for not just books but also serials, maps, films, music, sound recordings, and manuscripts. The next advance was development of a format for records for the standardized forms of names and for subject thesauri that appear in bibliographic records, the MARC Authority format.^[14] Then in the early 1980s, there was interest in integrating holdings and other data into library catalogs. Thus the MARC Holdings,^[15] MARC Classification,^[16] and MARC Community Information^[17] formats were developed by special interest groups. The Holdings format contains sufficient detail to indicate to a user the volumes and issues of a serial held by

an institution and to support serial check-in systems that needed to predict expected issues and generate claims for serial issues that are overdue from the publisher. It is a companion to the bibliographic format, and in fact was developed according to a model that allows the holdings data to be contained in separate holdings records or embedded in bibliographic records. The Classification format supports the online transmission and use of common classification schedule files, including the Library of Congress Classification and the Dewey Decimal Classification. The most unusual format was the one for community information data, which allows a library to integrate information about public events and community services into a bibliographic database. It was used in public library settings but Web sites have largely replaced it for that original purpose.

With the auxiliary formats completed, a review of the Bibliographic formats for the various forms of material took place in the late 1980s, when the Bibliographic format had just reached 20 years of use. While the core data elements of each bibliographic type, such as names, titles, and publishers had been kept consistent across the Bibliographic formats, they also contained many data elements that were “form of material specific.” After extensive discussion with the user community, the Bibliographic formats were integrated into one, eliminating earlier designations of field validity by type of material. This new freedom and flexibility enabled the format to be more readily responsive to changes in resource media and technology, especially for accommodating the description of electronic and modern multimedia material. At the same time some simplification of the format was attempted, although the main counter to any simplification was and is the persistent need to parse and structure bibliographic data in order to support complex and diverse retrieval options for systems and, ultimately, end users. Libraries serve a varied clientele and while a majority of their end users may not have complex needs, librarians provide services to both the generalists and specialists.^[18]

Record Use and System Developments

In the 1970s, with a known data standard and a critical mass of bibliographic records in that standard, libraries first experimented with producing focused automated systems that took the records and used them, for example, for card printing, circulation control, book catalog printing, book preparation (binding labels, book pockets, etc.), or current purchase awareness lists. The bibliographic networks mentioned above, OCLC, RLG, WLN, and UTLAS, were established to facilitate record sharing and build union catalogs that they used to support automated interlibrary loan. The Library of Congress achieved a distribution service for all of its cataloging records and its related subject and name authority files in MARC format, while also developing an internal online catalog. By 1980,

several other libraries had developed online catalogs and during the 1980s, the local system development that started in the previous decade led to widespread availability of vendor software for library processing and online catalogs.

The success of a few vendors of bibliographic systems attracted more development, until the marketplace offered large and small systems with a variety of differences and special features—and a broad price range. The MARC communications format provided a record rich with data that system engineers used for innovative applications, retrieval programs, and user interfaces, but it did not dictate internal system design. MARC data within a system will usually be carried in an internal format or configuration that is efficient for the system hardware or platform, but highly compatible with the communications format. Inevitable transitions from a locally developed system to a vendor system or from one vendor system to another would take place over the next decades in libraries, but this migration has been eased by the standard data format all systems could export and import.

As more libraries obtained online catalogs, interest turned to retrospective conversion of older bibliographic data. Libraries wanted to consolidate all holdings in a single online catalog and retire their card catalog. Thus many retrospective conversion projects were undertaken in the 1980s resulting in an explosion of records in the automated bibliographic “universe,” and in particular, in union catalogs like OCLC and RLG. Even the Library of Congress undertook the conversion of its retrospective file of over 5 million records, a project that had been explored by the Avram team beginning as early as 1968.^[19] While early conversion of the Library of Congress’s very large catalog could have been valuable to later conversion projects of the nation’s libraries, the bibliographic networks contributed greatly to reducing the cost of later conversions by making the records converted by one library available to other libraries.

Character Set Expansion

In the 1980s, MARC also went beyond the initial Latin character sets when one of the major networks, RLG, developed a MARC-based bibliographic system that allowed input and search of data utilizing standard character sets for Arabic, Cyrillic, Chinese, Greek, Hebrew, Japanese, and Korean scripts (with over 16,000 characters in the Chinese, Japanese, and Korean set).^[20,21] The RLG staff did ground breaking work on the Chinese, Japanese, and Korean set—work that predated Unicode by over 10 years, and in turn contributed to the eventual development and refinement of the present day global Unicode set.^[22] Extending script capabilities in MARC was followed by the development of non-Latin capability in OCLC and several vendor systems.

INTRODUCTION OF THE INTERNET AND WEB

Since 1990 the technology has made enormous advances that both open new uses for the MARC record data and are pushing MARC into new directions. By 1990, the personal computer (rather than a “dumb” terminal) was well established, as was the development of the infrastructure for the Internet for the United States, supported by the National Science Foundation. Libraries had been using proprietary networks to build and exchange MARC records for two decades but now there was a much easier environment for sharing. Computer specialists rapidly explored the new possibilities by developing protocols that produced Web technology, which took aggressive advantage of the Internet. There were two immediate challenges at first for MARC, one was establishing new exchange patterns that enabled and enhanced the flow of records between systems. The other was the adaptation of the record to accommodate the new forms of materials such as electronic publications and Web sites.

New Interchange Options

One new interchange pattern was the widespread implementation of a search and retrieval protocol, called ISO 23950: “Information Retrieval (Z39.50): Application Service Definition and Protocol Specification.”^[23] This is a machine-to-machine protocol developed by the library community and originally standardized in the United States as ANSI/NISO Z39.50,^[24] then later becoming an ISO standard. It enabled local systems to retrieve records in the MARC communications format from remote sites in response to normal local system searches—records that could be formatted for the local system’s end-user displays or immediately used in a variety of ways including incorporation into a MARC-based online catalog. This was a significant improvement over day or longer delays for a download of a MARC record from a bibliographic network. While Z39.50 is still used extensively around the world because of its widespread implementation, the new technologies since 2000 have spawned a simpler, more streamlined version of that protocol, called SRU, *Search/Retrieve via URL*.^[25] The SRU has many of the same characteristics of Z39.50 but uses an XML syntax structure.

The new interchange options also meant that in the 1990s, batch distribution of MARC records via physical media such as tape almost completely disappeared. The replacement was the batch electronic transfer protocol FTP (File Transfer Protocol). This simple protocol continues to be heavily used in 2008 for transfer of MARC records. Another simple download protocol with slightly more flexibility became an option in the early 2000s, the Open Archive Initiative’s Protocol for Metadata Harvesting (OAI-PMH).^[26] This protocol again enables

easy exchange of full communications format records, and is used with MARC in its XML forms described below.

Electronic Resources

For the second challenge in the Internet era, the adaptation of the MARC record to accommodate the description of new forms of material such as electronic publications and Web sites, the format has had to address several major issues, the most prominent being the need to provide Internet linking to actual resources from the bibliographic record that described the resource. In 1993, even before the now-common Uniform Resource Locator (URL) addressing scheme was completely defined, a field in the MARC format was detailed to contain pathway components for accessing digital resources from a MARC record. That field eventually became the container for the resource's URL. For several years this linking field was adjusted at least annually as the Internet and Web environment matured and became more standards-based. Partly due to the distrust for the persistence of the URL, the community was cautious about adding the URL subfields to other fields. It was clearly important, however, to begin to link out for information that would expand on or supplement that in the MARC record. Thus a subfield for a URL was added to Bibliographic format fields such as the ones for contents notes, summary notes, citations to Archival Finding Aids, citations to additional forms of items, and bibliographical or historical data notes, among others, and the URL linking subfield continues to be added to other relevant fields as uses are identified. The modern MARC-based catalog is thus able to retrieve material comprehensively, integrating access to descriptions for both physical and electronic resources. For electronic material, it can bring to the end user the resources themselves and related resources from a variety of locations.

Other changes to the MARC format as more electronic material required bibliographic description have been addition and adjustment of coded data for the various electronic formats to assist retrieval, additional data for preservation aspects of digital and digitized material, and the addition of copyright status information to assist with issues when digitizing analog material. Partly to accommodate Web resources, the concept of the serial was redefined resulting in the addition of “integrating” resources as a basic form in the MARC record and date types for creation and modification.

Unicode

In the 1990s, the question of using Unicode (which became the ISO standard ISO 10646, *Universal Multi-Octet Coded Character Set (UCS)*^[27]) rather than the original MARC character sets (Latin characters and seven other scripts as described above and commonly referred to as “MARC-8”). The MARC-8 contained over 16,000 characters but the

Unicode set that emerged from the computer industry in the 1990s had a global goal to accommodate all scripts and today contains over 100,000 characters. The MARC community therefore elected to cease development of additional scripts for the MARC-8 set and start working toward the implementation of Unicode with MARC. The first step was to map all of the MARC-8 characters to Unicode so that institutions would eventually be able to convert their data. Then rules and conventions for using Unicode in a MARC exchange record were established, such as the use of Unicode's UTF-8 encoding, definition of character counts, and the marking of a record as Unicode encoded. Unicode specifies three encoding forms of which UTF-8 (UCS Transformation Format 8) is one. Unicode characters in UTF-8 can be represented in a single octet or a sequence of two, three, or four octets, depending on the character's code point. The UTF-8 encoding for Unicode was selected for use with MARC 21 records because the characters in the ASCII repertoire part have UTF-8 encoding identical to ASCII encoding. The UTF-8 is also used in many other applications outside the library community for the same compatibility with ASCII. Finally the community turned its attention to enabling use of all Unicode characters yet still preserving interchange with those using only MARC-8. Thus in 2007 two techniques for conversion of full Unicode records to MARC-8 records were established, one that drops unknown Unicode characters when moving data from Unicode to MARC-8, and another that preserves a reference to the characters that do not exist in MARC-8 so that reconversion or suitable substitutions can be made. The development of these techniques was assisted by modern Internet communications that allowed MARC users from around the globe to participate in the discussion. By 2008, systems were implementing Unicode rapidly and cataloging agencies were beginning to look past the scripts supported by MARC-8 to additional scripts such as those found in Southeast Asia and the Indian subcontinent.

INTERNATIONALIZATION

While ISO 2709 provided a fundamental standard for the structure of the MARC format, its flexibility with respect to tagging allowed its use with differently defined sets of data tags as needed according to other data models. For example, ISO 2709 only specifies tags as three character numeric, but does not designate the semantics of any tag number. Therefore a number of similar but different national MARC formats were designed and implemented around the world in the 1970s and 1980s, primarily on a national basis, such as CAN/MARC in Canada, UKMARC from the British National Bibliography, IberMARC from Spain, SWEMARC from Sweden, and FINMARC from Finland, to name a few. Some of these formats were very similar to MARC 21 but adapted data

fields to suit their national cataloging norms. All of these formats used ISO 2709 for their structure, choosing the same options within the standard that MARC 21 had used, but they often defined different tags for the data fields and different parsing of the data into subfields.

Some of the questions and issues that either united or divided developers of the emerging MARC formats and created this diversity were the following. Fields chosen and subfields defined might vary depending on the purpose of the tagging—for indexing, for special processing, for display or print, for sorting, even for ISBD punctuation. The *library* functions of the record also influenced content designation; functions such as acquisitions and circulation had special needs. The cataloging rules used by an institution could require different heading structures, for example, or special notes, and the subject heading and classification systems used could have specific parsing requirements. Different organizations used different data models for bibliographic data, preferring, for example, to chain together parts of a total description, creating linked dependent records, rather than putting the parts together in one record, creating independent records as with MARC 21. Attempts were made during this period to bring the different MARC formats together with umbrella formats like the IFLA UNIMARC Format^[28] and the UNESCO Common Communications Format^[29] that could be used as bridges for international exchange but that model was more suitable to batch environments which began to disappear rapidly in the 1990s with the Internet advances in communications.

Convergence

Several factors encouraged the harmonization of these various national formats.^[30] One was the movement to vendor rather than locally developed systems that came about in the 1980s and 1990s. As vendors began to saturate the home markets they started looking for external markets, becoming international companies. The different formats in each country hampered this internationalization, and vendors often responded by limiting format offerings, with MARC 21 being the most prevalent format supported, or charging institutions extra for retooling a system for a different format. This extensive use of MARC 21 occurred partially because a number of the system vendors originated in the United States that used MARC 21 as the national format, or, if the vendor came from another country, it wanted to introduce its system into a MARC 21 market, such as the United States market. The large numbers of libraries, strong standards orientation, common language, and the availability of Library of Congress cataloging in MARC 21 since 1969 made the United States an especially fertile vendor market and country for vendor development. The large networks such as OCLC were another major influence on MARC standardization. In the 1990s, there were several of these large

networks in the United States, all MARC 21-based, and they provided services to other countries. With the consolidation of several of these into OCLC, the impetus to use MARC 21 was strengthened.

In the 1990s, the decision by South Africa and Canada to move from national formats to using MARC 21, if appropriate harmonization changes could take place, was an important event. In the case of South Africa, which had used a UNIMARC-like format for almost two decades, a careful cost-benefit study recommended a shift to MARC 21 in order to be able to take advantage of MARC 21-based records and systems and to be able to join international cooperative cataloging programs. For Canada, the Canadian and the United States formats were so similar that it was hard to justify their differences. That harmonization led to the establishment of the name MARC 21 for what was before USMARC and CAN/MARC.

A number of countries have adopted MARC 21 or changed to it from national formats over the last decades; for example, Poland, Switzerland, and Brazil adopted MARC 21, and Australia changed to it from AUSMARC and Sweden from SWEMARC. Since 2000, harmonization processes have taken place between MARC 21 and the British UKMARC and German MAB formats bringing a significant body of users to a common format. International interest in MARC 21 has led to the development of a number of translations of the format, especially of the concise version. The Bibliographic format has been translated into a diverse number of languages, including Arabic, Catalan, Czech, Finnish, French, German, Hungarian, Italian, Korean, Norwegian, Persian, Portuguese, Russian, Serbian, Spanish, and Swedish.

Maintenance

Maintenance of the MARC 21 format was traditionally centered at the Library of Congress, as the agency that led its development. This is still the case but the format changes are in response to the input from the whole community of users. Today any user may submit a proposal for change that is then processed and posted on the MARC 21 Web site^[31] for review, and various groups hold discussions and forward their recommendations. The primary review body has become one established under the auspices of the American Library Association, Machine-Readable Bibliographic Information (MARBI), whose meetings also include representatives from multiple user constituencies, such as several national libraries that use MARC 21, the other United States national libraries, representatives from special material associations and committees, such as music and maps, and representatives from record and system vendor communities. The discussion and votes at these twice-yearly MARC advisory committee meetings and from the Internet provide guidance for the Library of Congress, Library and Archives Canada, and the British Library to make final decisions on changes.

OTHER RECENT DEVELOPMENTS

The MARC 21 format is still being adopted in various countries and by institutions around the world. However, explorations are taking place to leverage the data elements of MARC and the millions of MARC records in the bibliographic universe to new platforms. Current efforts revolve around syntax flexibility, data modeling, and element retagging.^[32]

Syntax

An additional development in the 1990s has been the attempt to separate the MARC data elements from the MARC structure (ISO 2709) to enable representations of the highly developed MARC data elements in other syntaxes. The development of the Internet and the Web technology in the early 1990's rapidly increased the real-time interaction of people, institutions, and applications in the computer environment. Computer specialists thus became much more interested in universal data markup standards that have the possibility to be read, understood, and displayed by any computer system. Initially this took the form of markup for display, epitomized by HTML (Hyper-Text Markup Language), which is an implementation of a more generalized structure standard, Standard Generalized Markup Language (SGML).^[33] The SGML is a structure with rules for tagging data, roughly comparable to ISO 2709. The SGML, while somewhat complex, seemed to have traction in the computer community by the mid-1990s. The Library of Congress thus convened a small group of MARC experts and SGML experts to investigate using the SGML markup structure as an alternative to ISO 2709 with the MARC data elements. At that time several attempts had already been made to define MARC in SGML so those experiences were a component of the discussion.

The ISO 2709 structure of the MARC record was innovative and forward looking—and carefully adapted to the characteristics of bibliographic data—but it was not adopted outside the library community and is not a

suitable markup for full text of documents, such as books. ISO 2709 was optimized for records composed of many shorter variable length data elements to which random access is desirable, whereas SGML initially targeted full text markup, focusing on sequential access to data.

Following guidelines specified by this experts group, the Library of Congress had two MARC in SGML formats written, one that combined the elements from the MARC Bibliographic, Holdings and Community Information formats and another the elements from the Authorities and Classification MARC formats. These SGML formats, called Document Type Definitions (DTD) in the SGML environment, took the approach of including context in the name of each element, which resulted in both long names and a large number of elements—thus very large DTDs. While the DTDs had some significant advantages over the ISO 2709 formats, such as the validation attributes that could be built into the DTD enabling machine-driven “self-validation” of records, by the time experimentation began to take place the computing environment had developed a simpler derivative of SGML, called eXtensible Markup Language (XML).^[34] The original MARC SGML DTDs were converted into XML DTDs later. Besides being simpler, XML could also be specified as an “XML schema” in addition to a DTD. While XML schemas do not have the validation attributes of the DTD, they are themselves written in XML which has other processing advantages. XML has achieved broad adoption by the Web and the computing environments, which means many generalized tools that manipulate XML data are available.

Based on the experience with MARC in SGML and several other models for MARC in XML that took a streamlined approach producing a very brief XML schema, the Library of Congress prepared an XML schema for MARC in 2003 that the community has found very useful and timely.^[35] This schema, called MARCXML, enables MARC data to be easily translated into an XML structure for manipulation or for exchange using interchange protocols that either require or prefer to carry XML structured data (Fig. 2). For example, the SRU search protocol prefers XML and the OAI-PMH record distribution protocol requires it.

```
<datafield tag="100" ind1="1" ind2=" " >
  <subfield code="a">Oberbeck, Elizabeth Birkelund.</subfield>
</datafield>
<datafield tag="245" ind1="1" ind2="4">
  <subfield code="a">The dressmaker /</subfield>
  <subfield code="c">Elizabeth Birkelund Oberbeck.</subfield>
</datafield>
<datafield tag="250" ind1=" " ind2=" " >
  <subfield code="a">1st ed.</subfield>
</datafield>
<datafield tag="260" ind1=" " ind2=" " >
  <subfield code="a">New York :</subfield>
  <subfield code="b">Henry Holt and Co.,</subfield>
  <subfield code="c">2006.</subfield>
</datafield>
```

Fig. 2 Bold segment of the MARC 21 record in Fig. 1 with MARCXML syntax (author, title, edition, and publisher part only).

A pathway into XML appears not to be single threaded, but the library community will be able to use the new structures for MARC where applicable along with the classic structure until there is a clear way forward. The prior convergence of MARC formats to MARC 21 in the classic structure will be highly useful as MARC evolves into new structures.

While these structures are still under development and adoption, another technique for markup, called RDF (Resource Description Framework) is also being explored. The RDF makes it possible to mix XML data elements from different schemas in one “package,” a flexibility that could prove useful to libraries as they interact with the broader cultural community.

Modeling

There has been a strong focus on more rigorous information modeling over the last decade. A conceptual model for bibliographic data was completed by the International Federation of Library Associations and Institutions in 1997 and published as the *Functional Requirements for Bibliographic Records* (FRBR).^[36] At a simplified level, FRBR defines a four tier hierarchy for elements of document description—*work* (the most general), *expression*, *manifestation*, and *item*—and identifies the entities and relationships that are appropriate for each. Over the decades, the bibliographic universe has devised various methods to bring together for the library patron different editions, performances, versions in different media, etc., anticipating that the patron is often seeking a work, not necessarily a particular version or manifestation of a work. The FRBR analysis thus supports new approaches for presenting bibliographic search results to users that bring materials of potential interest together, making them easier for the user to peruse. The Library of Congress commissioned a mapping of all the MARC 21 data elements onto the FRBR model, *Functional Analysis of the MARC 21 Bibliographic and Holdings Formats*^[37] in order to enable experimentation. This was followed by explorations by various organizations of presenting bibliographic search results in a FRBR form from MARC records.^[38]

While the MARC 21 record can accommodate data brought together following a number of models, the record content model that is used almost universally is the unit record that in FRBR terms describes a manifestation. In a unit record, a bibliographic resource is fully described in one record and, while there may be references and linkages to other resources or entities described in other records, a fully understandable presentation can be made from the unit record since the names and titles of related entities are also contained in it. Many internal files hold the MARC-based record data in unit form but others take a more relational approach internally. The focus on the unit record by MARC 21 users also relates to the multiple uses of the bibliographic record. Union databases attach holdings to specific manifestations of a work, and catalogers need to be able to carry out copy cataloging for specific manifestations. Given the advantages to the end user of some aspects of the FRBR model and the expectation that it may be fundamental to newer cataloging rules, investigations will continue to assure that systems are able to use and share FRBR-based entity-relationship analysis.

Related Developments

MARCXML brings some advantages of the XML environment to MARC 21 but leaves the MARC data elements somewhat bound by the same constraints that MARC data now have in the MARC 2709 environment after many years of constant adjustment and augmentation. The MARCXML simply changes the structure, not the fields, indicators, subfields, and coded values of MARC 21. Therefore a next logical step is to remodel and retag the MARC data and explorations have taken place in that area also. In 2003, the Library of Congress introduced for public review the Metadata Object Description Schema (MODS),^[39] an XML schema that is much simpler than MARC and repackages some of the MARC data that had become scattered in MARC 21 because of its development over time.^[40] MODS has a strong affinity to MARC 21, however, so that for most records little is lost in the transformation from MARCXML to MODS (Fig. 3). The MODS is more oriented toward XML data models so it is especially useful for the descriptive metadata component of “wrapper” formats that bundle together the descriptive

```
<titleInfo>
  <nonSort>The</nonSort><title>dressmaker</title>
</titleInfo>
<name type="personal">
  <namePart>Oberbeck, Elizabeth Birkelund.</namePart>
  <role><roleTerm>creator</roleTerm></role>
</name>
<originInfo>
  <place><placeTerm type="text">New York</placeTerm></place>
  <publisher>Henry Holt and Co.</publisher>
  <dateIssued>2006</dateIssued>
  <edition>1st ed.</edition>
</originInfo>
```

Fig. 3 Bold segment of the MARC 21 record in Fig. 1 with MODS syntax (author, title, edition and publisher part only).

metadata, technical and administrative metadata, and the actual digital resources themselves, such as the Metadata Encoding and Transmission Standard (METS).^[41]

SUMMING UP

MARC has achieved worldwide use as a format for the exchange of bibliographic data, and thus served as a facilitator of global library cooperation. It was a key component in the library environment to standardize in order to stimulate, rather than stifle, innovations in the systems for end users and record sharing networks. Today its innovative structure, while still serving in most venues, is beginning to transform into new data structures that take better advantage of the newer Web technologies. Already MARC is available in XML forms and additional syntaxes will be offered for MARC data. However, the enormous body of MARC 21 records and MARC-21-based systems will assure that format interchangeability will remain an important component of new environments.

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Makerspaces in Libraries

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Abstract

From the advent of hackerspaces and Fab Labs to the rise of the maker movement, makerspaces, and their integration with library practice, an underlying societal shift toward embracing the active do-it-yourself culture of “making” seems fundamental to the increase of makerspaces in libraries. This entry explores the concepts of makerspaces generally, building from a historical background to examine theoretical and practical underpinnings of the movement. A timeline is presented tracing early implementations of makerspaces in both public and academic libraries, and rationales for their integration into library practice examined. A seemingly natural combination, makerspace in libraries offers a framework by which shared core library and community values such as equitable access to information, resources, and opportunity for lifelong learning can be reconciled and amplified. Alignment with a number of broader national educational initiatives is enhanced, including efforts focused on closing learning gaps in science, technology, engineering, math, and the arts; support for the active production of knowledge and information products is increased, yielding deep learning and engagement on the part of library users. Adoption and implementation of makerspaces in libraries is widespread and growing, enabling libraries worldwide to realize evermore central roles in their communities.

INTRODUCTION

As libraries around the world evolve to meet changing needs of the communities they serve, the adoption of makerspaces in libraries is increasingly seen as core to library practice. Broad overlap exists between the missions and core values of libraries and makerspaces. Both intrinsically enable and provide equitable access to a diverse set of resources in the service of education, learning, and by extension the greater public good. Libraries and makerspaces are fundamentally about knowledge creation, achieved through a combination of self-directed and peer-to-peer engagement and collaboration around shared resources in an open environment. Consider the long-held mission and core practice of libraries articulated in a way that just as easily describes makerspaces:

[t]he mission of a library is to improve society through facilitating knowledge creation in the community. . . . Good libraries build services (and the collection is one of many). Great libraries build communities.^[1]

The following sections explore what is meant by “makerspace” and the root word “maker,” examining whether makerspaces in libraries is a natural next step in the practice of librarianship or a radical new departure. Building from a brief historical and theoretical background of the undercurrents driving the adoption and integration of makerspaces in libraries today, the practice is framed against enduring values of librarianship and established with appropriate theoretical underpinnings.

Rationales for the potential incorporation of makerspaces in libraries are considered, including the potential for increased alignment and support for K-12 and lifelong learning objectives, innovation and entrepreneurship, and career development. Finally, a number of resources are provided to enable exploration and use in further development of the practice of makerspaces in libraries.

MAKERS, THE MAKER MOVEMENT, AND THE RISE OF MAKERSPACE

In the premiere issue of *Make* magazine, February 2005, founder Dale Dougherty coined the term “maker” as a deliberately generalized way to describe the new publication’s customers. Rather than “users” or “patrons,” the term “maker” would soon become associated with a sense of curiosity and intellectual adventure. The publication served as a touchstone for the rapidly growing maker subculture: a community of individuals with an interest in *making* things as opposed to merely *consuming*. An extension of do-it-yourself (DIY) culture, in the subsequent year over 22,000 makers converged on the San Francisco Bay Area for the first ever “Maker Faire”—clearly, the public’s interest was caught. The following year saw the number of attendees triple over two separate events, and by 2014 Maker Faires attracted a total of 781,000 attendees to 135 designated events worldwide in celebration of making.^[2]

The grassroots movement catalyzed around the words “make,” “maker,” and “making,” began to be referred to

as the “maker movement.” An “umbrella term for independent inventors, designers and tinkerers,”^[3] the phrase refers “broadly to the growing number of people who are engaged in the creative production of artifacts in their daily lives and who find physical and digital forums to share their processes and products with others.”^[4] The words “maker” and “making” derive from the underlying verb “make” and are themselves literal terms; Roslund and Rodgers explain

Makers are people who do things to improve the world around them. If something is broken, they try to fix it. They try to find solutions to problems. Someone who likes to build new things or use tools or materials in new ways can be considered a maker. Anyone who has ever had an idea for a new invention and then made that idea a reality is a maker. Makers love to create, tinker, and play with the world and the resources around them. They also love to share their experiences with others.^[5]

Makers are fundamentally experiential learners, actively engaged and solving problems, posing questions, and making decisions. In combination with more traditional library resources, such as supporting print and digital resources, the value of makerspaces in libraries becomes clear; whether K-12, higher education, or life-long, makerspaces directly enable learning. Halverson and Sheridan^[4] point out that “educators and researchers have been talking for decades about the role of making in learning,” suggesting that Papert’s learning theory of constructionism, which places production-based experiences at the core of how people learn, fundamentally undergirds learning and the maker movement generally. Blikstein^[6] agrees, adding experiential education and critical pedagogy to comprise three theoretical pillars on which the foundation of digital fabrication and “making” in education is based; going further to point out that “the ideas behind this movement are at least a century old,” tracing the root of the idea that education should be more connected to real world objects and experiences back to John Dewey and others.

Making is an overarching term that encompasses a wide range of activity. Prior to the popular use of the terms making and makerspace, broad categories of maker activity grew under the names of “hacking” and “fabbing.” The emergence of community “hackerspaces” and “Fab Labs” (Fabrication Laboratory), each a specialized type of makerspace, served growing communities, with one of the first independent hackerspaces, the German *c-base*, opening its doors in 1995.^[7] Although the terms hackerspace and Fab Lab are often treated as being synonymous, each refers to distinctly differing constructs despite appeal to often overlapping interests and communities of practice. Each is a type of makerspace, with hackerspaces defined in broad strokes as “community operated physical places where members can meet and work on projects.”^[8] In practice, membership and activities

at hackerspaces tend to be largely focused on repurposing hardware, working on electronics, and programming rather than broad-based fabrication.

The concept of the Fab Lab grew out of a popular class at the Massachusetts Institute of Technology (MIT) named “How To Make (Almost) Anything.”^[9] In 2001, the Fab Lab program, and eventual international network, began as an educational outreach program funded by the National Science Foundation for the newly established Center for Bits and Atoms at the MIT Media Lab.^[10] Rather than repurposing or programming with existing components, a Fab Lab is a space designed specifically around enabling individuals to personally manufacture physical items from source materials. Focused on enabling its users to bring their ideas to life by means of personal digital fabrication, resources are comprised of “off-the-shelf, industrial-grade fabrication and electronics [sic] tools, wrapped in open source software and programs.”^[11] Typical equipment in a Fab Lab might include laser cutters, computer numerical controlled milling machines and lathes, 3D printers, and other rapid prototyping equipment. With the ability to make almost anything, the perspective of a Fab Lab user quickly changes as recognition begins to dawn: literally *each and everything in the manufactured world around us has in some way been made*. Curiosity piqued, wonder as to exactly how starts to become unavoidable; household items become objects of close scrutiny, reverse engineering, redevelopment, and reuse. Recognizing the potential of the deep project-based learning and engagement enabled by access to such an environment, in 2008 Stanford University started building Fab Labs in cooperation with K-12 schools worldwide as part of the FabLab@School project.^[6]

With hackerspaces numbering today over 1200 worldwide,^[12] and Fab Labs in the hundreds,^[13] in 2011 Dale Dougherty and Dr. Saul Griffith^[14] proposed the audacious *MENTOR Makerspace* program to the Defense Advanced Research Projects Agency of the US federal government. With a goal of “reaching 1000 high schools over 4 years,” the program was part of an initiative “aimed at introducing new design tools and collaborative practices of making to high school students.” Intended to not only to bring a more diverse group of young people into careers such as scientist, engineer, or programmer, the goal of the proposed program was to address a recognition that “one of the biggest challenges we face as a nation is the decline in our ability to make things.”^[15] Awarded in 2012, the term “makerspace” quickly became mainstream as “countless museums, schools, community centers, and libraries announced plans to build digital fabrication and ‘making’ facilities.”^[6] Across the United States and Europe, technology-oriented makers began to come together to pursue interests including electronics, robotics, and 3D printing, supported by these makerspaces.

As the practice grew, the term “makerspace,” a deliberate blend of the word “maker” with “space,” quickly became accepted as the broad overarching term—a general

term, inclusive of the earlier, more specialized spaces such as Fab Labs and hackerspaces:

A makerspace is a physical location where people gather to share resources and knowledge, work on projects, network, and build. Makerspaces provide tools and space in a community environment—a library, community center, private organization, or campus. Expert advisors may be available some of the time, but often novices get help from other users (emphasis added).^[16]

MAKERSPACES IN LIBRARIES: A TIMELINE

In 2011, Lauren Smedley and colleagues, under the direction of Sue Considine, Executive Director at the Fayetteville Free Library (FFL) in New York State, were forging a new path for libraries and the maker movement. Recognizing the dual opportunity of outreach and support for lifelong learning and engagement, the FFL's "Fabulous Laboratory" was launched, making the FFL "Fab Lab" the first makerspace created by a public library.^[17] Other public libraries quickly followed suit; first movers and notable early adopters included

- Steve Teeri, in partnership with the local Mt Elliot Makerspace, launched the Detroit Public Library's HYPE (Helping Young People Excel) Makerspace in April 2012. With the goal of supporting the community by creating "interesting, inventive, and productive citizens who make a difference,"^[18] the space set out to inspire young adults "through the spirit of invention, creativity, learning, and do-it-yourself (DIY) culture."^[19]
- Bill Derry and director Maxine Bleiweis boldly carved out space in the midst of open bookstacks to create the Westport Public Library Makerspace, opening "a place for creation, collaboration, innovation and entrepreneurship"^[20] on July 2, 2012.
- Andrea Saenz, First Deputy Commissioner for the Chicago Public Library, was instrumental building on a successful 2009 launch of its YouMedia teen digital learning space,^[21] itself an early form of makerspace in libraries. Based largely on the HOMAGO framework of Muzuki Ito et al., and focused "on art, digital media, making and STEM (science, technology, engineering and math) projects," Chicago's first free and publicly accessible makerspace opened the doors of its Maker Lab July 2013.^[22]

At the same time, similar development was ongoing in academic libraries across the United States:

- Lisa Kurt, Emerging Technologies Librarian, and director Tod Colegrove, of the DeLaMare Science & Engineering Library at the University of Nevada, Reno, made news in July 2012 with the launch of 3D

printing and scanning as a service of the academic library.^[23] Notably, the library went on to be named one of the "Most Interesting Makerspaces in America" in 2014 by *Make* magazine.^[24]

- Also in 2012, the library at the University of Mary Washington, in collaboration with their College of Education and Division of Teaching and Learning Technologies,^[25] converted an unused classroom into its ThinkLab makerspace: "if you can DREAM it you can MAKE it."^[26]
- Adam Rogers, Emerging Technologies Librarian, planned and launched^[27] the Hunt Library Makerspace January 2013 on the fourth floor of the James B Hunt Library at North Carolina State University: supporting "students, faculty, and staff in learning about emerging technologies and bringing their creations to life."^[28]

A survey of libraries conducted near the end of 2013 indicated that makerspaces had already gained significant and increasing traction in libraries around the world. In response to the question, "Does your library provide a makerspace or similar space?" of 143 respondents across 30 states in the United States and librarians from seven other countries, 42% (58) of the respondents answered yes, with another 36% (51) answering they were planning to do so in the near future. Fully 78% of the respondents indicated they either already provided makerspace or were planning to do in the near future. The majority of individuals participating in the survey, 51% (73), indicated they were from public libraries, academic libraries as the next largest group at 36% (51). Overall, nearly half indicated their makerspace was less than a year old, with 11% (16) indicating that their space had existed for more than 2 years.^[29]

RATIONALE: CORE LIBRARY VALUES, STRATEGIC ALIGNMENT

The membership of a library, much like that of a makerspace, are typically users of a wide range of highly individualized information resources. In addition to directly enabling self-directed learning and innovation, makerspaces in libraries are proving to be hotbeds of collaboration, co-learning, and acquisition of twenty-first-century literacies. Librarians and libraries adopting and integrating makerspaces into practice worldwide need look no further than the Core Values of Librarianship as articulated by the American Library Association to be able to recognize and articulate an underlying rationale for their incorporation and use. Of the 11 values identified, over half appear to resonate in support of makerspaces (emphasis added):^[30]

- *Access:* equitable access to information resources regardless of technology

- *Democracy*: an informed citizenry through free and equal access to information [and by extension, information resources and appropriate technology needed for that access]
- *Diversity*: providing a full spectrum of resources and services
- *Education and lifelong learning*: promoting the creation, maintenance, and enhancement of a learning society
- *Intellectual freedom*: upholding and resisting efforts to censor library resources
- *The public good*: libraries, and the access we provide is a fundamental institution that should not be outsourced or privatized
- *Service*: professional development of co-workers as well as community members, maintaining and enhancing our own knowledge and skills
- *Social responsibility*: contributing to solving the critical problems of society, support for efforts to help inform and educate the people

As libraries continue to explore the possibilities and impact of incorporating makerspace in service of their core mission, the potential significance is becoming clear. Makerspace is first and foremost about active and participatory learning, whether self-directed or guided; its incorporation yields potentially immediate improvement in alignment with overarching learning, discovery, and engagement missions of libraries. That potential has been repeatedly identified by the New Media Consortium (NMC) in its annual environmental scan. The *NMC Horizon Report 2015 Library Edition* goes further, stating

The turn of the 21st century has signaled a *shift in the types of skillsets that have real, applicable value in a rapidly advancing world*. Creativity, design, and engineering, or in a word — invention — has become the hallmark of innovation on campuses across the globe... During a time when academic libraries are undergoing significant transformation, *the addition of makerspaces is solidifying the library's position as a hub where students and faculty can access, create, or engage in hands-on projects across departmental lines* (emphasis added).^[31]

The overall goals and concept of makerspace as described in the *Makerspace Playbook* further amplify the potential:

By helping schools and communities everywhere establish Makerspaces, we expect to *build your Makerspace users' literacy in design, science, technology, engineering, art, and math...* We see making as *a gateway to deeper engagement in science and engineering but also art and design*. Makerspaces share some aspects of the shop class, home economics class, the art studio and science lab. In effect, a Makerspace is a physical mashup of these different places that allows projects to integrate these different kinds of skills (emphasis added).^[32]

Table 1 Top 10 technology/activities most commonly reported in library makerspaces worldwide.

Technology or activity	% of All respondents
Computer workstations	67%
3D printing	46%
Photo editing	45%
Video editing	43%
Computer programming/software	39%
Arts and crafts	37%
Scanning photos to digital	36%
Creating a Website or Online Portfolio	34%
Digital music recording	33%
3D Modeling	31%

Source: From Burke.^[29]

Whether “building users’ literacies across multiple domains” or serving as “gateway to deeper engagement,” the outcomes speak to core library values. With resources and opportunities like those found in a makerspace, the environment is rich with possibility to build user literacies across a wide range of new media. A subset of the findings of a global survey, Table 1 details the top 10 most commonly reported technologies or activities in library makerspaces.^[29] Consider the diversity: from computer workstations, photo and video editing, 3D modeling and printing to arts and crafts or music recording. Where else could an individual reasonably expect to access such a breadth of access to technology—complete with opportunity and encouragement to acquire and practice such potentially emergent literacies?

Library support for educational and learning objectives may derive further benefit from an apparently remarkable alignment between makerspaces and a number of broader national educational initiatives. In 2015, a survey conducted by the Maker Education Initiative^[33] found at least half of makerspaces surveyed reporting alignment with the following:

- Science, Technology, Engineering, and Mathematics, STEM (as illustrated at ed.gov/stem), 94% of sites indicated alignment
- STEM + Art = STEAM (stemtosteam.org), 89%
- Technology education (ed.gov/connected), 79%
- Media education, 57% (no url provided to illustrate the initiative)
- Twenty-first-century Community Learning Centers (www2.ed.gov/programs/21stcclc), 51%

Given the breadth of access to resources, and alignment with national K-12 and lifelong learning initiatives, it is becoming plain that makerspaces in libraries can provide an environment rich with opportunity. Beyond cultivating interest and engagement across STEAM disciplines among individuals in the K-12 pipeline, the makerspace environment can at the same time enable parents and communities to actively develop life and career skills.

Information, media, and technology skills develop as a direct result of user engagement with makerspaces in libraries. Innovation and entrepreneurship are also proving to be natural outcomes; similarly, creativity, critical thinking, problem solving, communication, and collaboration seem to fall out naturally—top skills and values sought after by employers today. Clearly, the incorporation of makerspaces with libraries offers potential benefit in the strategic alignment of the library with goals and objectives of both the parent organization and the greater community. Further, alignment and affiliation with broader educational initiatives, perhaps in cooperation with community makerspaces external to the library, can benefit the entire community. Arguably, the traditional role of the library has been to encourage and enable the creation of knowledge; rather than conflicting, makerspace in libraries is in direct alignment with traditional roles.

Makerspaces and libraries are clearly distinct entities; their similarities are nevertheless striking.^[34] To begin with, makerspaces and libraries are fundamentally constructivist learning spaces; places where members of the community have equitable access to materials and resources that might not otherwise be available to them—indeed, that they may have never even considered to be within reach. A by-product of shared community access, libraries, and makerspaces both serve to reinforce and build community among their membership. One-on-one guidance and mentoring is more the norm than the exception in both libraries and makerspaces; when combined with their fundamentally interdisciplinary nature, an environment alive with creativity and knowledge creation results. Individuals from across a wide range of interests, social backgrounds, and expertise, share access to a limited set of resources in both makerspaces and libraries, including each other. The resulting creative abrasion and collaboration, with appropriate support and encouragement, virtually ensures an environment of continuous and ongoing innovation. Together, makerspaces in libraries can truly be more than the sum of their parts.

CONCLUSION

Throughout history, libraries have adapted and evolved to better meet the needs of their communities, adopting and incorporating technologies along the way. The turn of the twenty-first century finds many libraries embracing an underlying societal shift toward making as opposed to merely consuming, moving away from a largely exclusive focus on the collection of knowledge artifacts that have ranged from papyrus scrolls through the print codex to e-books and other digital resources. As the practice of librarianship continues to evolve, increasing support for the active creation of knowledge and knowledge artifacts—in a word, *making*—by members and communities of the library is becoming standard practice. Examples

might include print or electronic documents and databases being actively created and/or accessed by means of computer workstations, software, and printers; photo, video, and 3D scans or models similarly being created, edited, and remixed across a variety of media; or computer programming taking place next to arts and crafts projects. As information becomes increasingly fluid, across not only media but technologies, enabling knowledge creation among individuals and communities of practice becomes an ever more valued and central role of the library.

Implementation of makerspaces in libraries is widespread and increasing, with libraries worldwide realizing an ever more central role in the communities they serve. With the growing number of individuals identifying with DIY “maker” culture finding community in makerspaces around the world, libraries have recognized an opportunity to reconcile the shifts with core library values. Makerspaces in libraries were born and are flourishing, resonating with corresponding values of the organization and greater community. With knowledge creation a by-product of both the consumption and production of information and tangible products, the advent and integration of makerspaces into libraries promises a depth of opportunity—enabling deeply personal learning and engagement even as it transforms the library’s support for innovation and entrepreneurship. As libraries continue to explore and develop the practice, makerspaces in libraries is yielding benefits that go beyond strategic alignment: improved support for K-12 and lifelong learning initiatives, transformative opportunity to develop information, media, and technology skills, and enhanced community are all natural outcomes.

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Management of Very Large Distributed Shared Collections [ELIS Classic]

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Abstract

Large scientific collections may be managed as data grids for sharing data, digital libraries for publishing data, persistent archives for preserving data, or as real-time data repositories for sensor data. Despite the multiple types of data management objectives, it is possible to build each system from generic software infrastructure. This entry examines the requirements driving the management of large data collections, the concepts on which current data management systems are based, and the current research initiatives for managing distributed data collections.

INTRODUCTION

Scientific data collections are being assembled that contain the digital holdings on which future research is based. The collections are assembled by researchers from multiple institutions, and then accessed by all members of a scientific discipline. The data collections are massive in size, comprising hundreds of terabytes of data (a terabyte is a thousand gigabytes) and tens of millions of files. The software infrastructure that manages these collections must provide not only traditional digital library services, such as indexing, discovery, and presentation, but also preservation services to ensure authenticity and integrity. The types of material in the collections range from digital simulation output generated by scientific applications, to observational data taken by experiments, to real-time sensor data streams from thousands of sensors. Thus the management of scientific data collections requires the integration of capabilities from multiple disparate communities: data grids for sharing data, digital libraries for publishing data, persistent archives for preserving data, and real-time sensor systems for automating the creation of collections.

The challenge is made more difficult by the fact that large data collections are inherently distributed. The collections may reside on multiple storage systems with a copy on disk for interactive access and a backup copy on tape for long-term preservation. Their assembly may involve collaborators from multiple institutions, with both the sources of the collection coming from multiple sites and the users of the collection located at multiple sites. To effectively mitigate risk of data loss, data collections are distributed across multiple types of storage systems located at geographically separated locations. All of these reasons force scientific data collections to build upon software systems that are capable of managing distributed data.

In this entry, we give some examples of large scientific collections, examine the fundamental principles on which distributed shared collections are based, describe data management infrastructure that is in production use today, and close with a description of the next generation of data management software that is currently under development.

SCIENTIFIC DATA COLLECTIONS

Researchers that generate large scientific data collections include seismologists, high-energy physicists, astronomers, and educators. Seismologists manage observational data about the propagation of seismic waves through the earth crust, and generate very large simulation output data sets to predict the effect of earthquakes. An example is the Southern California Earthquake Center (SCEC),^[1] which has stored over 165 TB of simulation output, comprising more than 3.5 million files, with more than 70 researchers collaborating on the creation of the SCEC collection.^[2] The SCEC project is now proposing the generation of more than a petabyte of data (a petabyte is a thousand terabytes) from higher resolution simulations of seismic waves generated by an earthquake on the San Andreas Fault in Southern California.

The BaBar high-energy physics project^[3] replicates experimental data taken at the Stanford Linear Accelerator in Palo Alto, California to researchers in Lyon, France at the Institut National de Physique Nucleaire et de Physique des Particules. The project has replicated more than 700 TB of data, moving up to 5 TBs of data per day between the sites. When the CERN accelerator becomes functional, related high-energy physics projects will generate a petabyte of data per year.^[4]

The largest data sets in the future may come from the astronomy community. The Large Synoptic Survey

Telescope^[5] will take images of the sky every 3 days to detect near-earth objects such as asteroids, starting in 2013. More than 100 PB of images will be archived. Current astronomy sky surveys are measured in the tens of terabytes in size. The 2-Micron All Sky Survey comprises 12 TB of images aggregated across 6 million 2 MB files.^[6]

The National Science Digital Library^[7] organizes scientific educational material that is posted on Web sites. The URL of each item is registered into a central repository at Cornell University. An archive, comprising over 70 million Web pages, has been assembled by crawling the Web sites. The archived Web pages are aggregated into containers and stored on both tape and disk to provide an alternate retrieval location when the original Web site is not available.

The Real-time Observatories, Applications, and Data management Network (ROADNet)^[8] manages real-time sensor data streams from more than 4,000 sensors. Data is streamed from seismic sensors, environmental sensors, coastal lidar systems, remote cameras, and oceanographic sensors into object ring buffers, and then archived for later use. The sensor streams can be queried to identify relevant data, and then correlated with other data streams. The 4,000 sensor data streams come from multiple independent projects, but rely upon common software infrastructure to facilitate use by researchers.

Each of these collections is distributed across multiple storage systems, located at different institutions, with the local infrastructure managed by local administrators. The fundamental underlying principle that is used to manage the data is that of a shared collection. Software infrastructure is installed at each site that makes it possible to name, organize, and access the data as if it were stored on a local resource. The software infrastructure has to provide a uniform name space for identifying the files, manage access controls across multiple independent institutions, manage replication of the files onto multiple types of storage systems, manage checksums to ensure data integrity, manage descriptive information about each file, and provide uniform access mechanisms to data stored on multiple types of storage systems (disk, tape archives, binary large objects in databases, database tables, and object ring buffers for sensor data). The software technology that does this is called a data grid.^[9]

DISTRIBUTED DATA MANAGEMENT PRINCIPLES

The preservation community bases their data management on the principles of authenticity and integrity.^[10] Authenticity is an assertion that the provenance (attributes about the creation of the data) is preserved. This includes the concept of “chain of custody”; that operations on the data have only been performed by authorized archivists. Integrity is an assertion that the preservation environment has

not compromised the data; that the bits have not changed. It is not sufficient to show that the data are uncompromised, one must also show that the data correspond to the original deposition into the collection with an unbroken chain of control, and that the data can be interpreted and manipulated even after the original creating application is gone. The latter implies the need to manage technology evolution. A preservation environment insulates the records from changes occurring in the technology used to support the collection.

The same principles apply when assembling distributed shared collections. The origin of the scientific data must be tracked to assign academic credit, provenance information is needed to guide the use of the data, and the integrity of the data must be maintained. Shared collections use descriptive metadata organized in a central catalog to manage provenance information. However, management of integrity in a distributed environment is much harder. There are multiple risks that must be mitigated: media corruption such as a disk crash or broken tape; operator error such as data overwrites on both disk and tape; systemic vendor error such as bad microcode in a tape drive; natural disaster such as fire or flood; and malicious users. These are compounded by the unavailability of systems due to network outages and remote maintenance periods. Any problem that occurs in the distributed environment is treated as a problem of the data grid, instead of the remote resource.

The additional principle that is needed is the concept of infrastructure independence.^[11] The properties of the shared collection are managed independently of the capabilities of the storage systems where the data reside. The three main categories of properties that must be managed for shared collections are data virtualization, trust virtualization, and management virtualization. Data virtualization manages the naming, access, and manipulation of data independently of the type of storage system. Trust virtualization manages authentication and authorization independently of the remote administrative domains. Management virtualization characterizes and automates the application of management policies independently of the remote institutions. Through these three virtualization mechanisms, one can access distributed data, control who is allowed to use the data, and verify that the authenticity and integrity have been preserved even for data located on another continent on a storage system managed by a separate institution. Because the virtualization mechanisms are automated by software infrastructure, very large collections can be maintained with a minimal amount of labor support. The goal is software that can evaluate assessment criteria, track whether each file in the system has been correctly managed, and initiate recovery procedures while maintaining audit trails of all operations applied to each file. Such an environment can institute management policies that mitigate the risk of data loss through replication and synchronization within a data grid, and federation between independent data grids.

Note that infrastructure independence implies the ability to add new technology over time, and migrate a collection from obsolete technology onto new technology. The ability to manage data distributed across multiple types of storage systems is the same ability that is needed to manage technology evolution for preservation environments.

Data Virtualization

Data grids implement logical name spaces that are used to identify not only the files, but also the users of the system and the components of the system. Typically, three name spaces are controlled by data grids:

1. Distinguished name space for users. The identity of the archivists, or curators, or users is managed independently of the remote storage system or administrative domain. Users of the system authenticate their access based upon the authentication system implemented by the data grid.
2. Logical name space for files or digital entities. The digital entities that are registered into the shared collection may be files, binary large objects, database tables, URLs, SQL command strings, or remote directories. Any organization that is imposed on the distributed data is expressed as a structure on the logical file name space such as a collection hierarchy.
3. Logical name space for storage systems. Multiple physical storage systems may be identified through a single logical storage resource name. This makes it feasible to support collective operations across storage systems, such as automated data replication (writing to a logical resource name causes a copy to be made at each of the associated physical storage systems), load leveling (a copy is made at the storage system with the most space left), or caching (a copy is made on a disk cache associated with a tape archive).

Given these three logical name spaces, access controls can be asserted as constraints between the logical user name space, the logical storage name space, and the logical file name space. When data is migrated onto new resources within a data grid, neither the file name nor the access controls change. The data grid associates provenance information with the logical file name, ensuring that authenticity can be preserved. The data grid associates system-level metadata such as checksums, audit trails, replica location, access controls, file size, and creation time with the logical file name, ensuring that integrity can be tracked over time. Data grids use a central metadata catalog to hold both the provenance and system-level metadata.

Data grids are implemented as peer-to-peer software servers, with a software server installed at each storage system where the data reside. The software server

manages the mapping from the logical file name to the physical file residing on the storage system for access, and the mapping from the access protocol desired by the user to the access protocol used by the storage system. Part of infrastructure independence is the ability to use your preferred access protocol to retrieve data from legacy systems that are unable to process modern protocols. Data grids support access by C library calls, Unix shell commands, Perl/Python/Windows load libraries, workflow systems, grid portals, Web browsers, digital libraries such as DSpace^[12] and Fedora,^[13] and Web service description languages (WSDL) across all storage systems where the software servers reside.

Data grids act as middleware, enabling the execution of the file-based and metadata-based operations required by data management applications. It is not sufficient to provide just the POSIX I/O operations supported by disk file systems (open, close, read, write, seek, stat, sync, etc.). Operations required for authenticity and integrity assurance, and network latency management are also needed. Since data grids manage distributed data, multiple levels of aggregation are needed to minimize the impact of the network latency caused by the finite speed of light. This is done by aggregating files before movement over the wide area network, aggregating metadata before movement and loading into a metadata catalog, and aggregating I/O commands into remote procedures that are executed at the remote storage system. In each case, the number of messages that are sent over the wide area network is minimized. This not only improves response time, but also improves scalability, enabling the manipulation of 1000 files at a time.

Trust Virtualization

The management of access controls at remote sites is possible if the data grid owns the data that are stored at each remote site. This means that data are written onto the remote storage system under an account that corresponds to the data grid. Persons accessing the data grid authenticate their identity to the data grid system. The data grid then checks whether they are authorized to perform the desired operation. If so, the data grid accesses the remote storage system on behalf of the user and performs the operation. Thus the data grid software servers must also map from requests made by a user to allowed operations on data that are stored under a data grid account. The trust virtualization mechanisms provide an additional level of authentication beyond the security mechanisms employed at each site. A desired impact is the ability to create a single sign-on environment. Once the user has authenticated their identity to the data grid, they can perform authorized operations on data anywhere within the data grid. They do not need to authenticate their identity at each remote storage system.

The data grid technology used to support each of the above application examples is the Storage Resource Broker (SRB), developed at the San Diego Supercomputer Center (SDSC).^[14] Each of the capabilities listed above is supported by the SRB, and is in production use. SRB data grids are typically implemented as federations of multiple independent data grids. Each data grid manages a local metadata catalog and multiple storage systems. Federation is the controlled sharing of name spaces between two or more data grids. A trust relationship is established between two data grids and the data grid administrators decide which of the name spaces will be shared. Different types of federation are then possible:^[15]

- Peer-to-peer data grids. None of the name spaces are shared. Instead a person can only access public data within the remote data grid.
- Central archive. Each data grid replicates a copy of their data onto the central archive, including both the files and the provenance metadata.
- Master-slave data grids. All data that reside in a slave data grid are distributed from the master data grid.
- Chained data grids. A data grid administrator pulls data and metadata successively from one data grid in a chain to the next. This is typically used in international collaborations that are managing replicas on different continents.
- Deep archives. The goal is to build a preservation environment that cannot be seen or accessed from a publicly accessible data grid. The approach requires the creation of a staging data grid between the public data grid and the deep archive. The administrator of the staging data grid pulls data from the public data grid to the staging data grid. The administrator of the deep archive then pulls data from the staging data grid into the deep archive. The result is that the identity of the deep archive administrator, the location of the deep archive, and the content of the deep archive cannot be seen from the public data grid.

Management Virtualization

The ability to automate the application of management policies in a distributed environment is critical to the ability to manage very large collections. As the size of collections grow, the validation of integrity and authenticity becomes onerous. Since a data grid is composed of storage systems in which failures might occur at any point in time,

both authenticity and integrity must be periodically reassessed, and recovery operations implemented to correct identified problems. Examples include replacement of a replica if a remote storage system crashes, validation of audit trails to prove that only the authorized administrators performed selected operations, and verification of checksums. Each time a problem is identified, the data grid should initiate the required management policy for recovery.

The automation of management policies is an active area of research. The approach taken by the integrated Rule-Oriented Data System (iRODS) under development UNC and UCSD^[16] is to differentiate between institutional policies, the management infrastructure needed to implement the policies, and the underlying data grid infrastructure that interacts with the remote storage system.^[17] Table 1 shows the additional levels of virtualization that are required.

Each community specifies the assessment criteria they use to validate properties about their data collections. Assessment criteria might be driven by measures of trustworthiness such as those proposed by the Research Libraries Group and the National Archives and Records Administration.^[18] The assessment criteria are mapped onto sets of persistent state information that can be compared to desired values. An example is assessment of risk mitigation against data loss, by requiring at least two copies of each file be stored on two different storage systems. The persistent state information for each file would need to include the number of copies and the location of each copy.

Each assessment criterion is maintained by management policies that control what can be done with the files. The management policies are mapped onto sets of rules that control the execution of the remote operations at each storage system. An example is a rule that automatically creates a replica of any file written to a specified collection. The capabilities needed to implement the management policies are mapped onto a set of remote microservices. Each microservice corresponds to a set of operations performed at the remote storage system. The rules are executed by a rule engine, and the resulting persistent state information is stored in a database. Data grid technology provides the infrastructure independence needed to deal with multiple types of databases and storage systems.

The choice of rules to apply is driven by a combination of the identity of the person requesting an operation, the collection that is being manipulated, and the storage

Table 1 Characterization of management policies and corresponding infrastructure

Data management environment	Conserved properties	Control mechanisms	Remote operations
Management functions	Assessment criteria	Management policies	Capabilities
Data management infrastructure	Persistent state	Rules	Remote microservices
Software infrastructure	Database	Rule engine	Storage system

system where the data resides. The ability to apply different rules for each operation means that operations required by the data grid administrator can be controlled independently of the operations that might be performed by a public user. The rules can be applied at the time of the requested operation, or deferred for later execution, or executed periodically to validate an assessment criterion.

Management virtualization requires the definition of three more logical name spaces. Within the iRODS system, logical name spaces are also provided for

- Rules—new versions of rules can be added
- Microservices—new versions of microservices can be added
- Persistent state information—additional persistent state information attributes can be added

By adding simultaneously the triplet of {rule, microservice, persistent state}, it is possible to control the evolution of the rule management system itself. New capabilities can be added and executed in parallel with old capabilities, since each new capability can reference a different set of rules, microservices, and state information. A metarule can be written that controls the migration of a collection from an old set of management policies to a new set of management policies.

A second desired capability is improved control of federations of data grid. Under the SRB data grid, authentication was done by the home data grid, but authorization was done by the remote data grid. In a rule-based environment, when data is replicated onto a second data grid, the controlling rules and microservices can also be replicated, implying that it is possible to build a federation environment in which the home data grid remains in control of how their files may be used, even then they are shared with other data grids.

Rule-based systems are optimized by minimizing the number of rules that are applied. This in turn requires defining the correct level of aggregation of remote operations into microservices, and the correct set of microservices for aggregation into capabilities. Microservices that only implement the basic POSIX I/O operations are too low a level for use by a data grid administrator. The number of commands that would need to be executed for a file-level operation become excessive. Fortunately, the operations supported by data grids provide a strong template for deciding how to aggregate operations. Within the SRB data grid, multiple levels of aggregation are used within each of the logical name spaces:

The SRB data grids support identification of users as an individual entity, as a member of a group, or as a member of a data grid within a federation. Storage resources can be referenced as single storage systems, or as a compound resource such as a disk cache in front of a tape archive, or as a cluster across which load leveling is done. Files can be manipulated as individual files, or after aggregation

- | | |
|-----------------------|--|
| • Users | {Single user, group, federation} |
| • Users | {Single user, group, federation} |
| • Resources | {Single storage system, compound resource, cluster} |
| • Files | {Single file, container, directory} |
| • Metadata | {Single attribute, hierarchical table, collection} |
| • Management policies | {Single capability, set of capabilities, nested rules} |

into a physical container, or recursively in a logical directory hierarchy. Metadata attributes can be manipulated as single attributes defined by a user, or through a hierarchical table structure that implements a snowflake schema, or as a collection containing multiple files. Management policies also have multiple levels of aggregation as rules controlling a single microservice, or a set of microservices, or in a recursive-nested hierarchy of rules and microservices.

By building microservices that manipulate each level of granularity, it becomes easier to map operations within the data grid to management policies. Analyses have been made of the capabilities required for the NARA Electronic Records Archive,^[19] and their mapping onto rules that can be implemented in the iRODS environment.^[20] The mapping identified over 170 rules that would be used to control either operations on records, or the manipulation of structured information. More than 200 persistent state information attributes were identified that were needed to express the results of applying the rules. A similar mapping has been made of the RLG/NARA assessment criteria for trusted digital repositories to iRODS rules and microservices. The assessment criteria comprised about 105 rules for the tracking of trustworthiness. Together, these two assessments provide a definition of the minimal rule set needed to manage distributed shared collections.

A second approach toward quantifying the required management policies for distributed shared collections is to examine the policies requested by production users of the SRB data grid technology. A generic set of 15 rules were identified that would allow each data grid administrator to implement the specific control policies they desired. These rules are primarily for the management of shared collections and include

- Administration—controlling the creation and deletion of users and collections
- Storage selection—controlling how physical resources are selected within a given logical resource name
- Data access—controlling the additional steps performed when data is read from a collection
- Data write—controlling the additional steps performed when data is added to a collection
- Transport—controlling the number of parallel I/O threads to use when moving data

- Deletion—controlling the operations performed when data is deleted

Thus it is possible to build the simple rule environments that meet the needs of today's production shared collections.

DATA MANAGEMENT TECHNOLOGIES

Many of the multiple data management systems currently under development have made explicit choices for the integration of management policies into their software systems. It is worthwhile to examine how their management policies have been implemented, and whether it is possible to integrate each of the approaches into a common system. Three notable systems are the Logistical Distribution Network,^[21] LOCKSS—Lots of Copies Keep Stuff Safe,^[22] and the Semantic Grid.^[23]

The Logistical Distribution Network uses the Internet Backplane Protocol to manage data at the block level. A file is broken up into multiple blocks, with the blocks distributed to multiple remote storage systems. The blocks are migrated between storage systems based on demand to keep the data close to the user. The blocks can also be replicated to support load balancing. A Logistical Distribution Network is designed to make very efficient use of the network bandwidth, and move data at rates approaching the network bandwidth using a single data stream. An interesting integration effort is the porting of data grid technology on top of a Logistical Distribution Network, with the data grid providing interoperability with archives and databases.

The LOCKSS system replicates data at the file level, assuming an authoritative source for the original ingestion of data into the system. The system is used to support data downloaded from publishers. Access control policies are implemented as modules controlling access for data received from each publisher. Integrity is managed by federating with preferably at least six other sites that have also downloaded the same files. A voting protocol between sites that have downloaded the same material is used to verify that each site's copy is authentic. This minimizes risk that operations by a local administrator have compromised the integrity and authenticity of files in a collection. Again, a research topic is the integration of a LOCKSS system with rule-based systems for automating application of additional management policies.

The Semantic Grid uses logical relationships between semantic terms to reason on inferred attributes about independent data collections. The logical relationships are organized in ontologies for each scientific domain. Semantic Grids apply the reasoning to data stored in multiple data grids to improve discovery of the desired data. An example of this is the integration of inference engines with SRB data grids, in a product called S-SRB.^[24]

SUMMARY

Data management systems are rapidly evolving from single site collections into distributed environments in which the data are stored across multiple systems. The initial SRB data grid technology supported shared data collections and provided the essential virtualization mechanisms needed to manage and manipulate distributed data for digital libraries and persistent archives.^[25] The next generation of rule-based data management systems will automate the application of management policies, minimizing the amount of labor needed to build and maintain a shared collection. Rule-based systems have the attraction of being able to manage their own evolution, directly associate allowed operations (microservices) with individual files or collections, and apply access controls even in federated environments. Given the expected emergence of data format description languages that will characterize structures in data, rule-based systems will be able to apply access controls on structures within files, enabling the automated redaction of data files. The drive for the creation of rule-based systems is coming from the massive collections that will appear in the next 5–10 years. Without rule-based data management systems, the labor requirements for assessing integrity and authenticity will not be possible to sustain.

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Managing an Information Business

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Abstract

This entry provides an outline that may be used to assist an information specialist who is contemplating going into business. It focuses on the management process, as well as emphasizing strategic details that are often overlooked by librarians as they expand their sites into a new dimension.

INTRODUCTION

The skill set required to be a successful entrepreneur is different from the ability to explore the intricacies of scholarly research or the detailed skills of indexing, cataloging, and other technological proficiencies. The librarian in a corporate or academic setting has only to think about the work at hand and the attendant concerns that challenge day-to-day duties, but a librarian in the competition of the business world has to perform many additional tasks that are far removed from the searching and disseminating of information. The realization that mundane duties are an integral part of being self-employed takes on important significance and may require some introspection before changing direction from employee to employer.

The following competencies are vital for success:

1. The ability to schedule time to include office details as well as professional production.
2. The character to develop the mental toughness to withstand adversity.
3. The aptitude to set priorities without getting buried in mundane details.
4. The stamina and the drive to survive the first year in business.
5. The resources to call for assistance, if needed, and the independence to stand alone.

MANAGING TIME

The organization of time should include completion of work on hand, business development, follow-up, technical reading, meetings, networking, social engagements, personal downtime, and the flexibility to ride the tide of the unexpected.

You may want to construct your work week on a calendar, first notating all activities that are preplanned such as meetings, appointments, classes, and research. Allow part of each day for production, preferably allocating the same

hours to regulate a schedule. Then fill in the rest of the week with other duties such as clerical, e-mail, telephone responses, etc. Each specific task is then accounted for even though the time spent may change.

Another method of managing time is to set up the week like a budget, but instead of using numbers, use hours as the unit of calculation.

Example—Working a 50-hour week

25 hours—work in progress
5 hours—marketing/business development
5 hours—e-mail, telephone, correspondence etc.
5 hours—meetings
3 hours—professional reading
2 hours—networking
5 hours—clerical (accounts payable, ordering supplies, reviewing mail, billing your accounts, etc.)

Try to keep phone calls short, covering the salient points of the conversation with direct questions or responses, and personal calls should be kept to a minimum. When working with a new client, request the best time to return calls or whether they would prefer to be contacted through e-mail. Many people prefer calls early in the day, others in late afternoon. Keep a profile sheet online with client preferences and, until it is committed to memory, have it open whenever you are on the phone. A good program to use is ACT; it is simple and inexpensive, with all the features built in for ready reference. Becoming overwhelmed with minor details is a common error of the single business owner. As soon as it is economically possible after the business has been opened, consider hiring a part-time person to do the routine clerical work and save your time for the professional duties.

The economic reality of employing a clerical assistant is that it maximizes the value of your production. Professional income may range between \$50 and \$100 per hour. Clerical wages usually fall between \$15 and \$25 per hour. The more work an office assistant can accomplish, the more time the professional is free to earn the income commensurate with their skill level.

Local centers of education are the best sources for recruiting office personnel because guidance teachers and career instructors are available for references and suggestions. Writing a job description is essential, clearly stating responsibilities, skill level, salary, and hours.

Try to avoid spending time worrying about a business situation over which you have no control. Excessive concern is counterproductive because energy is sapped by negativity. If a contract has been lost to a competitor, get as much information as possible as to the reason for the decision, so that errors become a learning experience.

Vigilantly scrutinize for burnout and loss of creativity. If time gets out of control, step back and reassess the productivity level, paying particular concern to deadlines and job satisfaction.

The business of information is dynamic in its structure, and there will always be changes in the process of building a foundation for success.

UNDERSTANDING PRIORITIES

Setting priorities can be exclusive and personal. At the outset, it would seem that work is scheduled in the order in which it was received, but this logic is not necessarily best for business. If a large and loyal account wants special treatment, that request should be honored. Rush jobs might take priority, particularly if there is extra compensation attached to the task. When a new account that has the potential for continued business asks for a quick turnaround, that request can be honored. Trying to please everyone is impossible, but the ability to please most people comes with experience. Do not be afraid to ask questions that will make your job easier.

Every job requires a reference interview, basic in our profession. When developing a business, is it more profitable to seek one or two large accounts, or should priority be given to the expansion of a large and possibly diverse client base? The decision depends on the comfort level of the owner. Some professionals leave a job only to become a consultant for their former employers and the fact that they have a ready-made client fosters a false sense of security. That company can relocate, hire another associate, restructure their management responsibilities, merge with a competitor, go out of business, or institute a combination of changes that unfortunately do not include their independent consultants. It is a safer business practice to vend your services to a number of different users and cultivate a list of references that can be cited whenever there is a call for services. Rarely should priority status be given to a job as a favor to a friend. You have no friends in business, only professional acquaintances.

The following suggestions summarize considerations for establishing production priorities:

- Which account is most loyal?
- What work is for a new account?
- Which account has consistently come forth with repeat business?
- What requests were on the books first?
- What job is the largest in terms of gross dollars?
- What work will bring in the greatest margin of profit?
- What work will take the longest or shortest time to complete?
- Can any of the work be delegated?

There are other types of priorities that come under consideration when starting a business. The appearance of your workplace demands attention, particularly if you plan to entertain clients. A home office should have the look and feel of an office outside your residence. Surroundings make a difference in how you perceive yourself, and you want to feel like a successful owner. Even if the area is small, or if you have to share space, segregate your furnishings so that the room or part thereof is designated exclusively for business use. If your office is private, adequate file space, seating, and lighting should be in place before the door is open for business.

Setting priorities requires logical thinking, personal preferences, evaluation, and organizational understanding.

WHEN THE CASH FLOW GETS CLOGGED

The definition of cash flow is the money that actually is received in the office. Billing, accounts payable, and contract assignments are all promises of money earned, but until it is in the bank, it cannot pay bills, salaries, utilities, or any of the other expenses that are inherent to running a business.

If \$5000 per month is billed, if ordinary expenses run \$4000 per month, and if \$3500 per month is paid in, there is a negative cash flow of \$500 per month. Simply stated, this is why a reserve is essential.

A small business may often be on the verge of bankruptcy because the owner is not alert to financial planning. Suggestions to help you to maintain solvency are as follows:

- When starting your business, have enough ready cash on hand to sustain your lifestyle for at least 1 year.
- Have enough ready cash to pay basic office expenses for at least 1 year.
- Be aware that most accounts do not pay on time—that is, within 30 days.
- Be aware that even though you might want to add interest to your billing after 30 days, you probably will not be able to collect it.
- Good work and prompt delivery are not always followed by rapid payment. Corporations earn millions of dollars by not paying their bills on time.
- It might be necessary to engage a collection agency. Agencies work on a contingency basis and usually

charge between one-third and one-half of the money collected.

- Never work without a purchase order or an authorization in writing signed by someone in authority. You have no friends in business. The number on the purchase order may be needed to track payments to your company.
- As a nonessential service provider, payment to a library consultant is not a priority for the corporate account. The longer a company keeps its money and invests what it keeps at even a nominal rate of interest, the more money it earns at the expense of the small contractor.

Eventually, however, the payment comes through. To expedite cash flow:

- Bill immediately upon the completion of a job. Make this clerical work a priority.
- Ascertain the recipient of the invoices—phone number and e-mail.
- If payment is a day past 30 days, send a second notice.
- Two weeks later, send a third notice (return receipt requested).
- When you build up a reserve in your corporate account, put any excess that is not needed for monthly expenses into an interest-bearing instrument or a money market account. Do not let it sit without drawing some interest.
- Establish a line of credit with your bank, in case of emergency.
- Pay bills on the last day of the month.
- If possible, save purchases for the end of December or the beginning of January. Most companies clear their payables by the end of the year, and the best buys on equipment and supplies are during the start of the new year.

To expedite the flow of cash into a business account, there are a few strategies that produce results:

- Establish a FedEx account and have clients use your number to send payment.
- Request direct deposits from the client's bank directly into yours.
- If a check has to be mailed, request second-day air delivery.
- Request a wire transfer of funds.
- Pick up the check personally if the location is within easy driving distance.

INVESTMENTS

The disposition of money must be included as a major part of any business plan. However, investing is not to be confused with speculation. Whatever amount is put to

work in a safe haven, the principal should be risk-free. Whether interest rates are low or high, the extra earnings can compound into a considerable sum at the end of the year. To maximize earnings, checks should be deposited into a savings account as soon as they come in.

Arrange to transfer funds into a checking account on an "as-needed" basis. The most efficient way to accomplish this transfer is to have both the savings account and checking account in the same bank, making sure to ascertain the length of time needed to be able to use the proceeds.

When there is enough available money in the account to sustain the business for 2 or more months, it is time to purchase other types of investments. Bank Certificates of Deposit yield more interest than a savings account, but if you redeem before maturity there will be a penalty. These short-term instruments have a fixed maturity date and the interest is fixed at the time of purchase.

If you have accumulated \$10,000 or more, U.S. treasury bills are safe, readily available, and generally provide a higher yield than Certificates of Deposit. These bills are issued by the U.S. government and can be bought through a commercial bank or brokerage house. The percent of interest given to investors is controlled by the Federal Reserve Open Market Committee, which meets at least once every 3 months. Interest rates are pegged downward, usually by one-quarter of a percentage point at a time, to stimulate the economy and conversely, the rates are increased when there is a danger of inflation.

The manipulation of the prime rate is an economic control that is perceived to work. When interest rates go down, the cost of borrowing becomes cheaper, more projects are expanded, new equipment is purchased, more people are put to work, and as purchases are made, the economy flourishes. When interest rates rise, goods and services become more expensive, buying may be curtailed, and the economy slows.

People have a tendency to think that investing is only for those with high incomes, but even a modest investment is a beginning. Translate earnings into practical purchasing. If you received only \$20 the first year, that could buy \$20 worth of copy paper, part of a lunch tab with a client, money toward your phone bill, or other purchases of importance. Money earned is working for your benefit.

Federal government securities, such as Federal National Mortgage Association or Government National Mortgage Association, yield more than certificates and bills, and the rate is fixed for a longer period of time. These instruments are safe and pay interest monthly or quarterly, depending on your particular investment and can be readily sold if the invested principal is needed. There is a plethora of advice that is given in the name of "reliable information," and much of it will benefit the sales representative more than it will the investor. Banks or large brokerage houses employ their own researchers to help both customers and representatives, and even though

a commission is charged on each transaction the advice that is received is well worth the payment.

MARKETING

Marketing is the strategy and the resultant action of promoting a business. The difference between advertising, selling, and marketing is:

- Advertising is when there is a purchase of airtime, print space, billboards, or other types of promotion to display a product or service.
- Selling involves person-to-person contact. If someone calls about your service, if a casual meeting leads to a work assignment, or if persuasion will increase the scope of a contract, these are the circumstances that create a selling experience.
- Marketing is spreading the word that you are in business and that you are the best at it. Marketing demands confidence. To convince others that the service you provide is essential, you have to truly believe in yourself. Put very simply, when you go to the store and are given a sample of a product, that is marketing. When the person who gave you the product starts a sales talk, that is selling. When you get a coupon for the product, that is advertising.

Asking for a recommendation from a satisfied client is a simple marketing tool, as is giving a lecture or demonstration, or hosting a booth at a conference. Somewhat more difficult is cold calling or using mailing lists. The average positive response is from 2% to 5%, and it takes a tremendous number of contacts to produce a worthwhile return. With electronic communication becoming ever more important to business promotion, developing a website and keeping it current is excellent for marketing a new venture. Business cannot succeed unless your potential clients know about your work.

Professionals often make the mistake of thinking that, because they are lucky enough to start a business with one or two promised accounts, their services will always be needed. In the brokerage business, an often-quoted maxim is “you are only as good as your last trade.” To paraphrase the adage, “a good reputation must be constantly renewed.”

Marketing takes a lot of time and careful planning. In a niche business, services rendered do not appeal to a huge market. When you plan your campaign, the first workable solution might be the methodology of contacting the obvious customers and most likely users. Then stretch your imagination to explore and identify other markets where competitors have not yet saturated the field.

Networking is essential. There will always be colleagues promoting allied endeavors where you may be able to dovetail your expertise. Talk to people—anyone.

Let them know you are in business. Even if they can never become an account, they might have a friend or relative who is waiting to be shown your talent. Talking to seat-mates on planes and trains is ideal for this type of conversation.

Try to market every day, even if only one new contact is developed. This effort keeps the name of the company in front of the potential audience so that you will be recognized. Think about brochures and business cards, and how to coordinate the color scheme and legend with your website. Keep it simple, attractive, and uncluttered.

The world of commerce is constantly changing, sometimes for the better and sometimes into stagnation or recession. When you plan for difficult times, the good times take care of themselves. The core of planning is keeping alert to opportunities to spread the word about your services and to follow up on all leads that might be fruitful. Keep a record of names, places, e-mail, and results of every conversation. Rejection will come followed by discouragement, but let discouragement build determination and let that determination become the driving force toward your goal.

Train yourself to be alert to new developments and innovative technologies, not only in the profession of librarianship, but more so in the broader outlook of the global economy. Imagine how you can service new clients by employing the most modern methodology and technical acumen to your work. The more you expand your depth of knowledge, the more prestige you bring to your talent.

HIRING AND FIRING—THE PEOPLE PROBLEM

Unless you expect to be a self-employed solo librarian, the time will come when help will have to be hired, either to take care of some of the routine work, to assist you on special projects, or to add another dimension to the company. When you retain more people, there is always the possibility that you will be forced to fire an employee who has proved to be unsatisfactory. Hiring and firing are both difficult and even traumatic because there are no guarantees that the right decision was made.

Hiring

Have a clear idea of where help is most needed, and write a job description that is detailed and simple to read. Put the duties in priority order according to importance to the company and according to the skill level at which you expect the person to operate. State number of hours per week, hourly or weekly wage, whether the job is temporary or permanent, holidays, vacation time, benefits, and whether you are willing to support working on a flexible schedule. Include training, if any.

Hours of interviewing will not produce the perfect candidate, and a resume is descriptive only of education and experience. Working with someone is the only way to ascertain if each personality blends with the other.

It is recommended that a telephone interview be conducted first to find if your candidate speaks clearly, responds literally, and understands your requirements. Write out questions that are relevant to the job and record the answers for later evaluation. Also grade your overall impression of the applicant. When the phone interview agrees with the personal interview, that person should be strongly considered.

When hiring someone for office detail, the writing of a clear and concise e-mail message takes on new importance. If you are out of the office on an assignment or at a conference, it is essential for client relations to have someone who can be responsive to the needs of your accounts and be able to convey any messages necessary to continue business in your absence.

Training someone with potential may be preferable to hiring someone with experience. As long as the candidate is intelligent, flexible, willing, and has no personality problems that will interfere with performance, honing the skills and teaching priorities will create an adaptive and eager employee. The argument against training is that it takes too long to bring someone up to speed. This is fallacious thinking because the most loyal and dedicated employees are those that come up from the ranks, regardless of the nature of the company.

If possible, hire on a 3-month trial basis. At the end of that time, meet with the candidate and discuss problems or revisions in the job description; then both of you can make a determination if the job and job performance has been satisfactory and whether the relationship should continue.

Many people, especially those who are well educated, become disenchanted with their work because they are not given enough responsibility. If you have hired correctly, there should be a gradual assigning of more difficult duties so that your own workload can be relieved of some managerial obligations. Be secure enough in your own ability to disengage the minor details of running an office.

When you are in a small office, it may be tempting and almost natural to become friends with your co-workers. DON'T. You have only one role—that of boss or supervisor. You are not a buddy, confessor, family counselor, banker, or broker. If you mix up your own job description, the boundaries get blurred and you lose control, discipline, and importance.

Firing

If you find that a mistake has been made in hiring, cut your losses quickly. Letting someone go for cause is most difficult because you have to be cautious not to infringe on the human rights that dominate today's personnel regulations.

Years ago, a person was generally given a week or two to finalize the work at hand before leaving the company, but giving a long notice time builds up more resentment as the days pass. Now, it is preferable to speak in a private conference, explain the reason for the decision, and then say good-bye. Keep it simple. Keep it professional. Above all, do not argue and do not change your mind.

Expect a challenge to your decision and be prepared. Rehearse in your mind what you are going to say and keep to the scenario. Even though you may not have an answer for every possible question, you are still the boss and the buck stops at your desk. Do not be persuaded to award a second chance because in the long run it will not work, the same difficulties will surface and you will be faced with firing the same person twice.

Surprisingly enough, even though a person has been let go, they may give you as a reference when applying for another job. This is a real dilemma. You do not want to compromise your integrity by glossing over inadequacies; yet, you cannot leave yourself open to any legal action. The law only requires you to say that the person worked for you during the time that is stated on the application. After that you do not have to commit to any other information. The standard questions are "Was the work satisfactory?," "Would you hire this person again?," "What was the reason for the separation?," and "Were there any glaring problems?" Be evasive on all the above.

CONTRACTS

Of all the bits of knowledge associated with starting a business, the least familiar to librarians is arguably working with the details of contracts. Many jobs will be sealed with a handshake or even an okay over the phone. Many others will require a contract, defining the scope of work in explicit detail, and some will only need a letter of confirmation.

Whatever the parameters of the job, regardless of the person or corporation who requested the services, each deliverable should be stated in clear language. It should be a policy decision never to work without a purchase order or something in writing authorizing you to proceed. A formal contract may not be necessary, but the authorization should contain at minimum the scope of work, total payment amount, start date, terms of payment, and who will sign off on the work. If the contract is large, it should also state what is not covered (i.e., indexing but not abstracting, research but not a synopsis, editing but not proofreading, copy cataloging but not original cataloging). The services of an attorney might be worthwhile to ensure that you are properly protected.

In spite of careful scrutiny of the terms of the contract, you might be asked to do work that is beyond that to which you originally agreed. At that time, you will have to decide whether to ask for an additional fee. The request

could involve nothing more than a small item that will make the deliverable better. Four questions to be answered: “Will the additional work earn more business?,” “Is it worth doing for public relations?,” “Will there be a sterling recommendation at the completion of the job?,” and “Is the account taking advantage of my lack of business experience?”

If there is any doubt about how to proceed, imagine what IBM would do. When you are in business, it is incumbent upon you to conduct your business like a chief financial officer. When figuring the cost of a job, there are several components to be considered before arriving at a total. Estimate the time it will take to complete; add any staff or clerical time; and estimate cost of travel, FedEx, subsistence if going out of your commuting range, overhead, margin of profit and 5% to 10% of the entire cost for contingencies. Whether the charge is 5% or 10% can depend on whether the work is for a new account or one with a prior business history; whether the work is difficult or detailed, where there could be a substantial margin for error; whether there is a strong possibility of hidden expenses; or whether the account have made prior requests for additional work at no cost.

If a contract requires an addendum, you can:

- Prepare the revisions yourself and submit the changes for approval.
- Request that the account write the revisions and submit them to you for approval.
- Submit the change order to your attorney and have the attorney review it for approval.

If you believe that working with contracts will be a large part of your business and if the nature of your business does not vary substantially from job to job, it might be preferable for an attorney to prepare a boilerplate contract for you to use and modify as needed. Then you can be relatively sure that most of the essential points will always be covered.

Government contracts can be the most difficult to understand, and bidding on government jobs is extremely competitive, regardless of the protestations that they want to cater to women and minority vendors. It can take months to get an award and payments are slow. However, government contracts are large, and there is money to be made if you are careful when drawing your estimates. Sometimes an on-site visit is required, and sometimes a bond has to be posted. Proof of insurance is always required. Before you take the time to develop a proposal for any contract, weigh the risk against the rewards. There is no greater personal satisfaction than in growing a successful business. No detailed and difficult assignment that has ever been completed for an employer compares with the gratification you get when that first check is deposited into your own business account. There is no greater thrill than in seeing one of your ideas transform from a thought

into a reality—without committees, without meetings, without administrative delays. By working your own business, you may be giving up security and gaining independence. You change from a worker into an entrepreneur, from an “extra” into a star, from one of the crowd to one of a kind.

There will be jealousies and joys, loneliness and laughter, and the worst and the best of the commercial world. It takes courage to be a success.

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Marketing Library and Information Services

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Abstract

After introductory remarks on the definition of marketing, the evolution of library and information services (LIS) marketing is explained. The authors then describe how marketing was applied to LIS over the years. Marketing is also related to other concepts used in the management of LIS. Finally the role of professional associations in diffusing marketing theory is portrayed and the importance of education addressed. The entry ends with a reflection on the future of marketing for LIS.

INTRODUCTION

It is widely admitted that libraries and archives have for a very long time suffered from their image and visibility problems. This is probably why many librarians and archivists now see marketing as a very important topic; for example, in a survey conducted in Canada in 1997,^[1] 84.4% of the respondents answered that marketing is important or very important for library and information services (LIS). Similar results were observed earlier in the United Kingdom.^[2]

Many also think that marketing is a new issue for LIS, something that only emerged during the last three decades. Although marketing was more formally introduced in the profession after the 1970s it is interesting to know that in North America at least, librarians adopted marketing techniques as early as 1876, as Kleindl (a marketing professor, illustrated how libraries at this stage were innovative in many marketing strategies: segmenting and targeting clientele, using publicity, direct mail, streetcar signs, telephone solicitation, banners, etc. The twentieth-century library, the progressive library, would throw its doors open to all and encourage them to come in and join in the building of a community cultural center)^[3] and Renberg (who traces history of marketing since 1876 and goes till formal marketing starts taking place in 1970, confirms the occurrences of terms such as, advertising in 1896, management in 1897, outreach in 1903, and extension work in 1909, in library literature, mainly in public libraries)^[4] demonstrated in their articles.

However, what is true about marketing in general is the confusion concerning the concept itself. Most people seem to see marketing only as the equivalent to advertising or promotion: they do not see “what’s below ‘the tip of the iceberg.’” To use this analogy, what is below the surface in marketing theory includes important strategic components

such as evaluating the needs of the customer; planning the various elements of the mix in order to answer those needs; and periodically evaluating the results. While this is the most commonly accepted framework of marketing, over the years, marketing activities have expanded from being assigned to one designated “marketing department” to becoming an overall organizational function. This, in turn, requires the involvement of everyone in the organization, and thus it becomes integral to the philosophy of the whole organization.

MARKETING REDEFINED

Marketing has been defined and explained in many ways by different marketing authors. Though the definitions given by the American Marketing Association (AMA) and The Chartered Institute of Marketing (CIM) have been widely accepted over the years, but are redefined time and again. The National Association of Marketing Teachers, a predecessor of the AMA, adopted what seems to be the first official definition of marketing in 1935:^[5] “Marketing is the performance of business activities that direct the flow of goods and services from producer to consumers.” The AMA adopted the 1935 definition in 1948, and in 1960 when the AMA revisited the definition it was decided not to change it. This original definition stood for 50 years, until it was revised in 1985, as: “Marketing consists of individual and organizational activities that facilitate and expedite exchange relationships in a dynamic environment through the creation, servicing, distribution, promotion and pricing of goods, services, and ideas.” Again in 2004, the AMA the definition was revised to read: “Marketing is an organizational function and a set of processes for creating, communicating and delivering value to customers and for managing customer

relationships in ways that benefit the organization and its stakeholders.”

Examination of these three definitions reveals a change of focus over the time. The first definition of marketing embraced all the business activities involved in getting commodities of all kinds, including services, from the hands of producers and manufacturers into the hands of the final consumers. It focused significant attention on the distribution functions. The 1985 modification of the definition was a significant one, turning attention squarely toward the managerial tasks. The emphasis was put on how the individual organizational processes, marketing and developing the strategic dimensions of marketing activities.

In 2004, while there is still an emphasis on process—that is fundamental to marketing—one can see the transition in the focus areas: the use of the words “value,” “managing customer relationships,” and “stakeholders” being brought to the center stage in this definition. Gupta^[6] contends that this definition sets many new dimensions to marketing concept—the emphasis is on that:

- Marketing serves as the overriding philosophy in conducting marketing task in the organization as a whole.
- It is a set of processes; process involves interactions among people, technology, methods, procedure, environment, and material (information or information sources in case of libraries), by which any offer comes to the customer.
- Value is the basket of benefits or utilities which a user or customer gets while using a product or service. Value is clearly communicated to customers so that it can be understood easily.
- A long-term relationship is developed among customers and marketers through deep understanding, reciprocal dependency, and mutual trust.
- Relationship is substantially beneficial to both the parties. From the organization’s point of view, relationship is a tactical issue, but for customers, it is just a communication process.

Thus, the 2004 definition not only extends managerial dynamics but also goes on to delimit marketing to a singular focus on the individual customers, stakeholders, and the organization.

Similarly, CIM defined marketing in 1976, as, “Marketing is the management process which identifies, anticipate and supplies customer requirements efficiently and profitably.” CIM proposes to redefine marketing in 2007,^[7] as

The strategic business function that creates value by stimulating, facilitating, and fulfilling customer demand. It does this by building brands, nurturing innovation, developing relationships, creating good customer service and

communicating benefits. By operating customer-centrally, marketing brings positive return on investment, satisfies shareholders and stake-holders from business and the community, and contributes to positive behavioural change and a sustainable business future.

While there are differences between the definitions given above it is important to state that definitions of marketing change as a result of environmental changes, or because our knowledge of the subject improves, or indeed through a combination of these two reasons. Marketing as a subject or discipline is therefore evolving as explained by Cooke et al.^[8] What is important to remember is the notion of managing the exchange process between an organization and its publics with a view to developing relationships between both the parties is at the heart of marketing. It involves philosophical thinking, strategic outlook, and operational tactics for LIS, thus clearly putting marketing above simple advertising, promotion, or public relations part of marketing.

ORIGIN AND HISTORY OF LIS MARKETING

Early Marketing Efforts in Libraries (Prior to 1920)

Historically, one can easily find the roots of library marketing in the attempts to extend opening hours of libraries in the United States during last quarter of the twentieth century and in efforts to make books available in locations outside the library building. Samuel Swett Green advocated marketing the library through reference services in his article, “Personal Relations between Librarians and Readers,”^[9] which appeared in 1876 in the *American Library Journal* (later known simply as *Library Journal*). Green also spread his message through the American Library Association (ALA) conferences and meetings. Somewhat later, portable libraries were introduced in the Light-House Establishment and these were provided to all light vessels and inaccessible offshore light stations in an attempt to meet out the reading needs of the community residing in distant locations. The books were carefully selected from a list of books of a good quality appropriate to the families who would use them.^[10] Melvil Dewey and others advocated for traveling libraries which were small rotating collections that provided a means for extending library service to rural areas. These small libraries (usually from 30 to a 100 books) were located in a post office or store with a volunteer acting as the caretaker of the collection.^[11] Such initiatives that also took place in other countries (India, Canada, France, etc.) can be considered as concrete marketing efforts.

John Cotton Dana

was a pioneer in what we now call public relations, marketing, and other promotional activities. He was an early practitioner of needs assessment, defining target

audiences, goal setting, planning, and evaluation that could be quantified. He saw performance in numbers and in customer satisfaction. If readers liked a service he made sure others knew about it. If he added a new service—like creating separate children's libraries or business libraries—he made sure everyone had an opportunity to learn of it. He used newsletters, pamphlets, posters, flyers, exhibits, newspaper announcements and speeches to groups, and special events to publicize library events and encourage library use. He urged librarians to better understand their institutions from the patron's perspective—to put themselves in the worlds of actual and potential users.^[12]

(Reference^[12] has bibliography of publications about Dana, important ones include works by John Cotton Dana^[13] and Mattson and Eldredge.^[14]) He emphasized for specialized libraries for special kind of users and the concept of special libraries came in the beginning of the twentieth century that led to formation of Special Libraries Association (SLA) in 1909. Dana became the founder President of the SLA and later he became President of ALA. ALA started a Public Relations Award in his name in 1946. It is also important to note that to further the idea of outreach, the SLA in cooperation with other library associations organized numerous activities to celebrate "Library Week" during June 26–July 01, 1916.

Thus, during this period, the books themselves were considered the product, and place was emphasized for utilizing library services through space utilities, extended opening hours, and mobile library services. The open access system started which allowed users the freedom to move around the collection and make their own selection of material to consult on the premises or to borrow. Similarly, librarians started using terminologies related to communication, viz., advertising, publicity, and exhibit. Such development was limited to public libraries. Work related to compilation of bibliographies, documentation, and user-based services started taking place in libraries in early twentieth century, as librarians became more proactive and shifted their focus to individuals and their specific information needs.

From Publicity to Promotion (1920–1969)

By the 1920s the library movement had started in many countries. Many national and international professional associations (including IFLA, 1927) came into existence during this period and their work improved the overall situation of libraries and librarianship world over. There is evidence that special libraries, school libraries, and other libraries started taking keen interest in marketing-related activities.

During this period, a series of articles appeared in the SLA's magazine *Special Libraries*. Special library and information professionals themselves started taking interest in marketing their services by highlighting the

importance of promotion through exhibitions. In addition to the widespread use of displays, special librarians used public relations to attract help from the authorities and institutions; they also engaged in extension activities and in many other aspects of marketing that served to strengthen library–user relations. Some other themes addressed in *Special Libraries* include Selling the Special Library Idea; how can we sell ourselves to our organization; budgeting; in inside publicity and exhibit and exhibits.

Several books on specific aspects of marketing were also published during this period, including a 1921 manual by W. A. Briscoe entitled "*Library Advertising: 'Publicity' Methods for Public Libraries, Library-Work with Children, Rural Library Schemes*"; this book also had a chapter on the cinema and library in 1921.^[15] This work foreshadows some of the strategies advocated even today, such as targeting library newsletters at different groups, and having tie-ins with films.

Ranganathan's famous *Five Laws of Library Science*^[16] was published in 1931. The Five laws have been discussed in the light of marketing by many authors. Interestingly, these laws can be said to be relatively well aligned to marketing theory. From these laws logical corollaries are derived that can be directly related to marketing. (See Table 1 below.) The reader (sometimes called the customer) is king, and is the focal point of the library; thus the whole organization (resources, services, facilities, rules and regulations, procedures) becomes customer focused. As the table below demonstrates, each of these laws has important implications in regard to basic marketing strategies.^[17]

T. D. Wilson finds that although user studies started around 1948 they did not become a hot topic in LIS until the 1960s (Wilson considers that the "starting point of user studies to be the individual information user who, in response to some perceived 'need' engages in information-seeking behaviour."^[18] Although linked to marketing because of the interest in a better customer knowledge, in many cases user studies merely describe information habits and do not explain the decision-making process behind information strategies. In order to evaluate service vis-à-vis outcome performance, new measurement techniques began to be developed in the 1950s. The bibliography by Atkin^[19] and the survey by Nobel and Layzellward^[20] cover much of the literature published on performance measurement during 1950–1970. However the concept of customer satisfaction broadened and changed by the 1970s.^[21] (Nahl mentions that library managers started acquiring an understanding of how the user-centeredness can be embedded in the culture of services via strategic and operational management and summarizes eleven user-centered principles). Prior to this time, it would be fair to say that service provision was professionally determined and system centered rather than customer driven. As a result, the measurement of

Table 1 Five laws and marketing implications.

The law	Actions to be taken	Marketing implications
Books are for use	Optimum use of resources, facilities, and services.	Acquiring appropriate information material and ensuring sufficient resources and services are available for the use of users. Convenient location, effective signage, and longer opening hours; helping hands for using resources and services.
Every reader his/her book	Meeting users need satisfactorily	Collecting and interpreting information, understanding the needs of users, and matching with the organizational resources.
Every book its reader	Reaching out to users	Publicizing value and benefits, promotional campaign, advocacy, public relations, personal communication, etc.
Save the time of user	User benefits and preferences	Repackaging information into appropriate form, availability of information when they need. Ensuring quality of services and offerings.
Library is a growing organism	Adapting to future user needs	Mobilizing resources, dealing with uncertainty about future user needs, new services, new customer groups, new environment, etc.

performance has shifted from input to output: books borrowed, articles photocopied, items consulted, demands met, market penetration, and more subjectively perceived satisfaction.

In conclusion, between the 1920s until the early 1970s, aside from special libraries most libraries, archives, and information services did not see much, if any, need to market their products and services. Most marketing-related documentation in the field of librarianship had been presented under such labels, as user needs, user training, performance measurement, and economics of information, and efforts toward promotion, public relations, selling, and related concepts.

Library Marketing: The Formal Beginning

At the end of the 1960s, the world famous marketing author Philip Kotler and his colleague, Sidney Levy, published a landmark paper entitled: "Broadening the Concept of Marketing"^[22] In this 1969 paper Kotler and Levy suggested new avenues for marketing in nonprofit organizations. This marked a change among the marketing specialists who had previously considered marketing mainly as the field of commercial organizations. In the 1970s, marketing in nonprofit organizations and the associated areas of public sector and social marketing received a lot of attention. At the same time, LIS managers witnessed a kind of formalization process concerning the marketing of LIS. Indeed a number of important trends occurred in marketing of LIS during the last three decades.

First, the concept of "marketing mix" emerged and became the most popular concept in LIS marketing. The marketing mix is commonly referred to the four Ps of marketing—product, price, place, and promotion. This is a simple, yet effective means of considering the key elements necessary and the emphasis to be placed on each, in order to effectively implement any marketing strategy. The mix still provides a useful framework for thinking about ways in which an organization's marketing strategy is implemented. Writings related to pricing or charging fees for library services also started to appear, thus the

pricing aspect of marketing started getting attention in library and information centers.

Within the last 5 years the library community demonstrated a growing interest in marketing information products and services. Nevertheless, the approach to marketing in the LIS field continues to be characterized by a high degree of fragmentation. Surveys of information needs, wants, use, and satisfaction are important kinds of knowledge for a library and represent an element of marketing. However, the LIS approach has often been limited to disseminating information about library services and programs; this represents only a single aspect of marketing, and ignores product, pricing, and distribution activities. The majority of marketing-related work done in libraries has concentrated on one (or at best a couple), of these elements of marketing, and need to be melded into a coherent marketing program that is integrated into the organizational structure of the library. In 1977, the Library Association of the United Kingdom published the first simplified text which was entitled *Marketing the Library*.^[23] In this work, by A. Yorke, he affirms that libraries and marketing are compatible and explains similarities which do exist between a library and most other organizations irrespective of the field of activity in which they are operating; Yorke also attempts to show how the library should try to organize itself and its activities from a marketing point of view and looks into future.

In 1981, Blaise Cronin^[24] compiled a famous set of marketing papers for the Association of Special Libraries and Information Bureaux (ASLIB). This book covered topics such as marketing myopia; broadening the concept of marketing; marketing for nonprofit organizations; and strategies for introducing marketing into nonprofit organizations. It also reprinted quality papers published over library marketing during last two decades. It was only in the 1980s that marketing of services started to attract the attention of information professionals. The difference between products and services were repeatedly highlighted and finally the features of the service category (intangibility, inseparability, heterogeneity, and perishability) were established. The new three Ps—people, process, and physical evidence—became equally important;

writers who discuss these new three mix consider a range of aspects concerning marketing of services and also reflect on how they interact with each other. However, there is a continual debate whether the marketing mix is relevant in the present. Sueli Ferreira in her paper “4Ps Concept in LIS Literature”^[25] addressed the extension of the marketing mix in library literature during 1975–1995: she concluded that although “the four Ps can be an important tool to help librarians to understand information agencies as a ‘business’, librarians need to overcome the concept and go out of the four walls of the information agencies to guarantee the future of these organizations.”

Another significant trend noted during 1980s is the combining of strategic planning and marketing. In 1983, Wood wrote an article “Strategic Planning and the Marketing Process: Library Applications,”^[26] in which she stressed providing programs which support the library’s mission. She considered that libraries must consider adopting business concepts, such as marketing and strategic planning, if they were to survive the challenges of the 1980s. In the following years Wood expanded her article into a full-length book *Strategic Marketing for Libraries: A Handbook*.^[27] In her introduction, she noted that the combination of marketing and strategic planning “promotes not only strength in the short run, but also the kind of long-term viability needed to work towards each organization’s vision of the future.” Darlene Weingand also published a monograph entitled *Marketing/Planning Library and Information Services*^[28] in which she integrated the ideas of planning and marketing. She emphasized that marketing and planning must be integrated if either is to be effective. Marketing and planning should be integral functions within a library and marketing and planning must be combined in to a “unified whole.” Throughout the book, Weingand stressed that “to be effective, the marketer must understand his environment, must design the products and services the environment needs, must monitor and evaluate their use, and then must build on this process for future planning.” According to her, marketing is a managerial process that must be carefully formulated and thought out. There are many other works which deal with marketing–planning combination in libraries.

In the 1990s the question of quality services in libraries became an important issue in library literature, a problem intimately linked to marketing. SERVQUAL,^[29] a tool to measure quality based on survey methods, became the model for the profit sector but the instrument was not fully applicable in the nonprofit sectors such as LIS. Starting from this model, the American Association of Research Libraries (ARL) developed an adapted instrument called LibQUAL+, and later WebQUAL. The tool was used widely in North American libraries as well as in other contexts, and it has become a useful marketing tool for library managers.

Later librarians began to consider relationship marketing, that is, integrating marketing with customer services

and quality into one stream. Relationship marketing is based on a motion of establishing trust and cooperation with known customers. As a library operates routinely with a known set of customers, this concept is seen as very important for the marketing of LIS. A library also operates on trust. Essentially, it is based on the idea that when a client walks into the library, he trusts that the service provider will find the material or information that he needs. The library in turn, trusts that the client will return the items he borrows within the specified borrowing period.

Table 2 gives a cluster of marketing and related themes that have been covered in literature in the last three-and-half decades. The table is not a complete list of terminologies that were first used during a given decade, but is indicative of trends that have occurred and can thus help to understand the scope of marketing and the way it has changed over the years.

With the impact of technologies and other environmental changes, the role and concept of library services is changing very fast. The range of services that take place outside the physical library is expanding due to the new technology, and it is likely to expand further. Additionally, the scope of some services has become nearly unlimited. Some forms of service can be offered almost as easily around the globe as around the town. Libraries serve and will serve far beyond their walls. All business activities may be seen through marketing lenses. Marketing in case of libraries is necessary to offer benefits to users want, reduce barriers to use and access, persuade and inform the users, and carefully plan to satisfy users’ needs effectively. “Marketing is so basic that it cannot be considered a separate function within the library. Marketing is a central dimension of the entire library. It is the entirety of the library’s operations and services seen from a point of view of its final result, that is, from the customer’s point of view.”^[30]

ROLE OF ASSOCIATIONS

Library associations, both at national and international level have played a vital role in popularizing, promoting role of libraries, their present and potential services, resources, and facilities for the benefit of the community at large. And also in developing their member’s marketing skills, and providing them with support.^[31] (Reference [31] is an extensive review sponsored by IFLA covering areas such as conceptual framework, LIS marketing practices around the world, role of library associations, education, research and training for library marketing, excellence in marketing, literature review, databases, etc., 47 contributors from more than 40 countries have contributed for the volume.) Rigorous efforts have been made by international, national, and regional associations for popularizing marketing through establishing separate sections,

Table 2 Changes in marketing themes.

1970–1980	1981–1990	1991–2000	2000–
• Product development • User free • Information brokers • User charges • Market analysis • Information economy • Information utilities • Economic modeling • Pricing • User education	• Marketing products and services • Mega trend marketing • New technology and marketing • Segmentation • Marketing communication • Strategic marketing • Marketing planning • Marketing strategy • Online services • Fee-based services • Fund raising • Fee or free • Information • Marketing through physical environment • Global marketing • Environmental scanning • Library identity • Marketing through your story • Mission statement • Marketing audit	• Costing and pricing • Service quality • Market value • Electronic information service marketing • Positioning • Advocacy • Marketing campaign • Marketing library online • Meaning use and value • Information marketplace • Marketing public relations • Marketing services and products • Part-time public relations • Future-driven marketing • Relationship marketing • Marketing 101 • Savvy marketing • Publicity through Web design • Marketing: A total solution • Product designed and testing	• Performance measurement within marketing frame • Marketing your expertise • Marketing yourself • Think like a business act like a library • Visible librarian: Asserting your value with marketing and powerful public relation and advocacy • Designing brochures • Shy librarian: Marketing and PR • Develop and market a winning collection • Develop and market a winning collection • Card campaign • Focus group • @ your library campaign • Virtual reference • Realistic Marketing • Marketing through blogs

e.g., Management and Marketing Section at IFLA, Advertising and Marketing Section at SLA, Public Relations and Marketing Section at ALA, Publicity and Public Relations Section at Chartered Institute of Library and Information Professionals (CILIP). These associations organize various programs and activities, they issue publications, and they recognize the best practices through awards, etc.

In its programs and activities, the Special Library Association (<http://www.sla.org>) has been giving increased attention to marketing. The SLA Management Division gives training and publishes bibliographies on marketing from time to time, and the SLA Advertising and Marketing Division has a discussion list on the subject (sla-dam@lists.sla.org). Similarly, at the IFLA 2001 Annual Congress in Boston, the ALA launched “@your library”—a new advocacy Campaign for the World’s Libraries. Through this bold initiative IFLA and over 25 national library associations who have embraced the campaign are able to make ALA’s collective and individual accomplishments better known across the world. ALA has also published many useful texts on marketing area.

In Britain, CILIP’s Publicity and Public Relations Group, which was established in 1983, works to make

library and information professionals aware of the value of marketing and PR and also offers a platform for sharing ideas and experiences. CILIP has produced various publications and organizes an annual conference with training workshops and other events; it also produces publicity and promotional material, and rewards excellence in libraries through “*Public Relations and Publicity Award*” (recently renamed as the “PPRG Marketing Excellence Awards”).

Launched in 1997, the IFLA Marketing and Management Section (<http://www.ifla.org/vii/s34/somm>) is made up of library professionals who either work actively in marketing and management in their libraries or teach these techniques to future librarians. Members of this section, who come from countries throughout the world, are working to develop a conceptual basis for marketing in libraries; they also formulate guidelines to teach management and marketing, and they aid LIS professionals throughout the world in their efforts to promote the broader acceptance of marketing. The section also organizes annual conferences and training programs, and it issues publications, including a newsletter. In order to recognize best practices in marketing of library and information sector worldwide, the section created the IFLA International Award in 2001. The work of IFLA’s Marketing and

Management Section illustrates the internationalization of the concept of marketing LIS.

EDUCATION FOR LIS MARKETING

A large part of being an effective librarian involves being an effective marketer. Many successful librarians concede that, as one climbs the organizational ladder, the relative importance of technical skills declines while that of marketing skills increases. Therefore, library schools have realized the need to add a focus on acquiring marketing skills along with the regular quantitative and technical skills in their course curricula. UNESCO confirmed the importance of education when it published in 1988 the "Guidelines for the teaching of marketing in the training of librarians, documentalists and archivists."^[32]

Marketing has been identified as one of the areas of competency that is important for professionals in library and information science in the United States and Canada. However, marketing is not a major area of focus in graduate LIS education. It is certainly the case that library and information science programs must fulfill the role of graduate programs in general, with regard to presenting the theoretical and practical in a range of content areas. In Canada, marketing/advocacy/public relations courses are offered in all seven information science schools. The content of these five LIS marketing courses is comparable to a great extent. However, in regard to objectives, readings, and assignments, there are some distinctive priorities. One course includes an advocacy component affirming the idea that, "advocacy is essentially the marketing of an issue." Finally, an assessment of the state of development of a "public relations and advocacy" course in the seventh LIS school is underway.

In the United Kingdom, management is still strongly represented in the curriculum, with marketing sometimes mentioned as one of the topics covered in a management module. A few specific marketing modules exist. There have been some changes during recent years within the marketing curriculum, reflecting developments in the field. For example, customer relationship management, relationship marketing, and aspects of Internet marketing are now more likely to be taught. CILIP conducts short-term training programs on different aspects of library marketing.

In India, the need for education in marketing LIS was felt in early 1980s. Although marketing was widely discussed in literature, conferences, and many training programs started during 1980s, the inclusion of marketing in the curricula was slow as the University Grants Commission (UGC) Model Curriculum did not lay much emphasis on marketing. Nonetheless some universities and institutions have recognized the need for inclusion of the topic in their syllabi. For example, the University of Bangalore has a full paper on Marketing LIS whereas

University of Delhi has half paper on marketing LIS and in the National Institute of Science Communication and Information Resources (NISCAIR), the topic of marketing of information products and services is covered under the paper on Information Products and Services. However, the role of Indian Institute of Management (IIM), Lucknow in training for LIS is significant. It offers short-term courses for top- and middle-level librarians of all kind of libraries.

In Pakistan, only a few large public, special, and university libraries make use of certain public relations tactics. A course on marketing was first introduced in 1995 by the Course revision Committee of the UGC, but prior to 2002 books on LIS marketing were not included in the list of recommended books. In the year 1999, Islamia University implemented the curriculum recommendations. The University of Punjab introduced the elective course in Marketing of LIS and was made a core course in 2002. In 2001, Sindh University of Hyderabad also started Marketing of LIS course as core course in 2001. Another university, Bahaudin Zikriya University in Multan, has adopted the curriculum of University of Pakistan in 2004.

In France, although marketing is present as a topic in the syllabi of most of the universities, little time is devoted to the study of marketing, and lectures are often given by faculty in fields other than library science. However the topic of marketing is not often offered in continuing education programs given to library or documentation professionals. However, at the national school of library and information science in Lyon (ENSSIB: École nationale supérieure des sciences de l'information et des bibliothèques), there is an online course on marketing strategy available for heads of libraries and documentation services.

In Estonia, among the institutions that prepare information professionals, library marketing is currently being taught both in the curricula of Department of Information Science in Tallinn Pedagogical University and the curricula of Department of Librarianship and Information Studies in Viljandi Culture Academy. In Norway, marketing component in library syllabi is different from university to university. There is very less part of "marketing" or "public relations" or "communication" in curriculum.

These examples from several countries demonstrate that education for marketing among library and information professionals is more and more part of the curricula. However, most of the time it remains an option and is not a core, required topic.

CONCLUSION

Although the idea of marketing LIS is not new, and some progress has been made in the past, more efforts have to be made if we want to see better marketing of a wide range of LIS. In recent years there has been a kind of overconfidence in information technologies, and many

LIS professionals believe that these new technologies will provide a way to make LIS more visible. It is true those technologies are important and librarians, archivists, and other information professionals need to make effective use of technology in order to improve the services to users. Library and information managers need to realize that these technologies are broadening the market and therefore provide immense opportunities to them to offer services and products at the global level. To effectively reach this broadened group of potential users, it becomes imperative that positive attitudes toward marketing be part of the organizational culture of libraries. LIS managers must be aware of and sensitive to marketing in every aspect of acquisition, digitization, sharing of resources, access and delivery, and services to the users. Without a marketing orientation, a high-tech library or information service would not necessarily be successful.

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Mathematics Literature: History *[ELIS Classic]*

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Abstract

One of the objectives of the information disciplines is to study the universe of recorded information—that is, to study the documentary products of domains of human activity—and to come to understand such bodies of literature as social and historical phenomena in and of themselves. Schaefer reviews the history of mathematics from ancient times, and discusses the forms of mathematics literature, and their transformations, through time.

—ELIS Classic, from 1976

INTRODUCTION

The investigation of the literature of mathematics may be placed in perspective by relating the development of the literature to the development of mathematics itself. Throughout the long history of mathematics, the records and communications of mathematicians have taken a variety of forms, depending not only upon the state of the art, but also upon the information needs and the technology at a given time. For these reasons, this description of mathematics literature will begin with a brief survey of mathematics history.

For convenience in discussing the subject, mathematics history will be divided into eight chronological periods, from the prehistoric period to about 1940. The period of contemporary mathematics, which began about the time of World War II, and the literature dating from that time will be discussed in detail in the second half of this article. These historical divisions are only approximations, of course, since ideas tend to overlap and intermingle with the passage of time. They are intended simply as an aid in analyzing the characteristics and accomplishments of mathematics at various stages in history.

THE LITERATURE TO 1940

Prehistory

Knowledge about mathematics in prehistoric times is based largely on conjecture. However, it is generally believed that during that time two general concepts began to emerge from the phenomena of the physical world: quantity and form. The concept of quantity is thought to have started from attempts to compare collections of objects by counting and slowly evolved into a variety of primitive number systems. These number systems became more extensive as exchange and barter

became important. The concept of form probably began as primitive art, with woven patterns in cloth and ornamentation on pottery and buildings. The mathematical aspects of form did not emerge until later; what we would now call geometric figures were simply decorative designs at the time.

5000 B.C. to 600 B.C.

There are sufficient records extant to provide a picture of the mathematics of the early civilizations of the Near East, since the Babylonians wrote on almost indestructible clay tablets and the Egyptian papyrus stayed well-preserved in the dry climate of northern Africa. The quantitative needs of early societies had increased to the point where it was necessary to develop general methods for calculation and to record these methods for future use. The earliest evidence of organized mathematical knowledge seems to indicate the existence of an Egyptian calendar in 4241 B.C. and possibly a Babylonian one before that. By 3000 B.C. the Sumerians had a workable mercantile arithmetic, and texts from the Third Dynasty of Ur (2100 B.C.) indicate a well-developed number system. Texts from the First Babylonian Dynasty show that by 1950 B.C. an elementary algebra had been established. The Babylonians also had a geometry, consisting of formulas for simple areas and volumes, and including recognition of the rule for triangles that is now called the Pythagorean theorem.

The earliest Egyptian source still in existence is the Ahmes Papyrus, written in 1650 B.C. (This is commonly referred to as the Rhind Papyrus, named after A. Henry Rhind, the nineteenth-century English archaeologist who brought the manuscript to England.) This is a practical handbook containing methods of solving types of linear equations, material on unit fractions, mensuration techniques, and problems in elementary series. It may be considered a compilation of the established mathematical

knowledge of that time, since the scribe Ahmes stated that he was copying an earlier work that had been written about 1800 B.C.

Knowledge of early Chinese and Indian mathematics of this period is comparatively poor, since these peoples wrote on bark or bamboo, which was susceptible to decay. The burning of all existing books and the burying alive of all protesting scholars by order of the Emperor Shi Huang-ti of the Ch'in Dynasty in 213 B.C. is another reason why there are so few records from this period in Chinese history. Nevertheless, transcriptions of several ancient treatises have been preserved, among them the "Chou-pei," a dialog concerning astronomy and mathematics. This work, which was written shortly before 110 B.C., contains material on mensurational geometry, the computational principles of the Pythagorean theorem, some elementary trigonometry, and a discussion of instruments for astronomical measurements. Even less is known of Indian mathematics of this period. All that can be said is that there is evidence of a workable number system and an elementary geometry.^[1]

The outstanding feature of all pre-Hellenic mathematics is the complete absence of deductive reasoning. Knowledge was derived from trial-and-error methods, and successful results were recorded and passed on to succeeding generations as formulas. Mathematics before 600 B.C. was merely a tool in the form of disconnected, simple rules derived from experience and immediately applicable to daily life. Mathematics as an organized, independent, and reasoned discipline did not exist until the blossoming of Greek civilization.^[2]

600 B.C. TO A.D. 400

Thales of Miletus (ca. 640 to ca. 546 B.C.), the founder of the Ionian School, is credited with being the first person to speculate about the rules of mathematics. By demonstrating that certain statements of geometry followed logically from previous ones, he contributed to the third phase in the development of mathematics: a science studied for its own sake.

One of the members of the Ionian School was Pythagoras (ca. 570 to ca. 500 B.C.). He later founded his own school at Crotona, a town of Magna Graecia, that contributed greatly to number theory, the theory of music, astronomy, and geometry. Pythagoras was the first to insist on assumptions (axioms or postulates) as the basis for proof, and he offered the first proof of the theorem about right angles that bears his name.

Another interesting figure of this time was Zeno of Elea, a philosopher of the early fifth century B.C., who taught that motion or change of any kind is only apparent. He posed four paradoxes that could not be solved by using the mathematical tools available in his time. His

contribution to mathematics was that he planted an idea that 2000 years later resulted in the development of calculus.^[1]

The study of mathematics, through the influence of Plato and Aristotle, achieved the status of a philosophical science second to none. Their development of logical principles and axiomatic methods put mathematics on a foundation that was considered unshakable until the twentieth century. Attempts to solve some of the famous geometric construction problems that arose during this period, and that remained unsolved until modern times, gave rise to a host of new discoveries.

Probably the most famous figure of this period was Euclid (ca. 300 B.C.), whose greatest contribution was the 13-book treatise, the *Elements*. The *Elements* incorporated all the essential accumulated mathematical knowledge of the time, organized into a system logically deduced from a single axiomatic foundation. The works of Euclid were so comprehensive that they superseded all previous writings, and it is probably for this reason that very few pre-Euclidean Greek manuscripts were preserved.^[3]

During the Alexandrian period, from about 300 B.C. to A.D. 400, Western civilization underwent a change. Greek culture mingled with that of the Orient, and the mathematical center of the Western world shifted to Alexandria. Greek mathematics reached its peak with the flourishing of the School of Alexandria. Two important figures connected with the school were Archimedes of Syracuse (287 to 212 B.C.) and Apollonius of Perga (ca. 260 to ca. 210 B.C.). Archimedes, an astronomer, physicist, and applied and speculative mathematician, made major contributions to number theory, algebra, and geometry. Apollonius, called "the great geometer" because of his important contributions to synthetic geometry, wrote eight books on conic sections, of which seven have survived intact.

After Apollonius, Greek mathematics began its decline, along with the rest of Greek civilization. For the next 600 years, only two important writers stand out among the minor ones. Ptolemy (Claudius Ptolemaeus, ca. A.D. 85 to ca. 165) wrote a comprehensive treatise on astronomy, the *Almagest*, which extended computational mathematics to plane trigonometry and the beginnings of spherical trigonometry. About a century later, Diophantus of Alexandria (ca. A.D. 275) wrote the *Arithmetica*, a milestone in the development of number theory. This work was a blend of Greek and Oriental mathematics, and six of the books have survived.

A.D. 400 to 1400

With the end of Greek civilization, the center of mathematical activity shifted to India, Central Asia, and the Arabic countries.

The Hindus achieved significant results in algebra and arithmetic, but by far their most important contribution

was the development of the numeration system we use today: a place system based on 10 and including a symbol for zero.

Perhaps the greatest contribution of the Moslems was preserving the continuity of mathematical thought. They translated most of the important Greek and Hindu manuscripts into Arabic and spread them in their travels throughout the Arab world. However, two Moslem scholars of this period deserve mention. The first is Mohammed ibn Musa al-Khowârizmî (ca. 825), who wrote two significant books, one on arithmetic and the other on algebra. Only the second still exists in the original Arabic, but both were translated into Latin in the twelfth century. The title of the first in translation is *Algorithmi de numero Indorum* (literally “Al-Khowârizmî on Indian numbers”), which is the source of the term “algorithm.” The second book is entitled *Al-jebr al-muqabala* (literally “Restoration and Opposition”), and by latinization the key word in the title became “algebra.”

There was no mathematical progress in Europe during this time. Throughout the period of the Roman Empire and until the fifteenth century, the language of instruction in Europe was Latin. Despite their contributions in many other areas, the Romans did not produce any significant mathematics and they had carried to Europe only that of Greek mathematics that had practical applications. The only noteworthy Roman mathematician was Boethius (ca. 475 to 524), whose works included an arithmetic, *Institutis arithmetica*, a geometry, *Geometry*, and a treatise on music (considered to be a part of mathematics at that time). His texts were considered authoritative by the European monastic schools and were widely used until the twelfth century.^[1]

It was not until the latter part of the eleventh century that the Greek mathematical classics started to filter into Europe. As trade and travel expanded, the Europeans came into contact with the Arabs of the Mediterranean area and the Near East and with the Byzantines of the eastern Roman Empire, from whom they learned about the Greek works. During the twelfth century the mathematical works that had been translated into Arabic a few centuries before were translated into Latin.

The next few hundred years were a time of absorption of the Greek and Arabic mathematics; mathematical creativity did not resume until the fifteenth century. The emerging European civilization, which had seemed so promising with the founding of the first universities in the thirteenth century, was postponed by the Hundred Years’ War (1337 to 1453) and the Black Death (1347 to 1351).^[2]

The Fifteenth and Sixteenth Centuries

In response to the increasing demands of astronomy, navigation, trade, and surveying, mathematics of this period was concerned principally with computation. The leading

mathematician of the fifteenth century, Johannes Müller (1436–1476), was also an astronomer and he wrote *De triangulis omnimodis*, the first treatise to be devoted solely to trigonometry. The foremost scientist of this age, Leonardo da Vinci (1452–1519), was concerned with the application of geometry to the physical sciences and also to art. His writings on perspective are contained in his *Trattato della pittura* (1651), compiled by some unknown author.

There also occurred during this period two events that laid the groundwork for future mathematical developments: the invention of movable-type printing and the beginning of writing in the vernacular.

The first printed books on mathematics were a commercial arithmetic that appeared in 1478 and a Latin edition of Euclid’s *Elements* that appeared in 1482. Of greater mathematical significance was the publication in 1494 of *Summa de Arithmetica*, by Luca Pacioli. This book was written in Italian and was a complete summary of all arithmetic, algebra, and trigonometry known at that time.

Robert Recorde (ca. 1510–1558), called “the father of English mathematics,” published four books on mathematics, written in English: *The Ground of Artes*, an arithmetic; *The Castle of Knowledge*, the first English exposition of the Copernican theory in astronomy; *The Pathwaie to Knowledge*, an abridged version of Euclid’s *Elements*; and *The Whetstone of Witte*, an algebra, in which the equality sign “=” appears for the first time.

The Seventeenth Century

As part of the scientific explosion of the seventeenth century, mathematics experienced a period of growth unparalleled until modern times. The practical demands of society, the spread of education, and the general intellectual climate of the time contributed to this growth. The number of people engaged in mathematical activity became so large that only a few of the outstanding creative mathematicians and their major works can be mentioned.

John Napier (1550–1617), the Scottish contemporary of Galileo, published *Mirifici Logarithmorum Canonis Descriptio* (1614), in which he set forth the theory of logarithms.

Rene Descartes (1596–1650), the philosopher-scientist, sought to demonstrate that all scientific investigations are related and the key to that relation is mathematics. One of the appendixes to his famous *Discourse on Method* (1537), entitled “La Geometrie,” was the first publication of analytic geometry. In it, Descartes applied methods of algebra to geometry, enabling him to settle some previously insoluble classical problems.

Pierre de Fermat (1601–1665) is credited with inventing analytic geometry independently of Descartes,

with conceiving the tangential approach to differential calculus before either Newton or Leibniz were born, and with being one of the creators of the mathematical theory of probability. He is probably best known, however, for his work in number theory. Fermat published only a few papers; most of his results are known through letters he wrote to friends and from notes he made in margins of books.

Much of the work of Gerard Desargues (1593–1662) was eclipsed during his lifetime by Descartes' writings. But two centuries after his death his treatise on conics, *Brouillon project d'une atteinte aux événements des rencontres du cône avec un plan* (1639), was republished and he is considered the founder of modern projective geometry.

Another Frenchman, Blaise Pascal (1623–1662), did work in geometry (*Essay on Conics*, 1640) and also was the cocreator with Fermat of probability theory.

One of the most significant contributions of the seventeenth century was the invention of differential and integral calculus, which led to the development of analysis, one of the three major branches of mathematics. (Algebra and geometry are the other two.) Calculus may be characterized as the gateway between elementary and advanced mathematics; a knowledge of calculus is essential to any real understanding of physics and related branches of technology and a prerequisite to the study of analysis. As is the case so often in mathematical creativity, calculus was developed independently in England by Isaac Newton (1642–1727) and in Germany by Gottfried Wilhelm von Leibniz (1646–1716). This fact engendered one of the most bitter partisan feuds in mathematical history, with admirers of each man hurling charges of plagiarism at the other.

Newton's first publication involving his calculus was his famous *Philosophiae Naturalis Principia Mathematica*, 1687 (*The Mathematical Principles of Natural Philosophy*). His later monographs on the subject are: *De Analysis per Aequationes Numero Terminorum Infinitas*, 1669 (*An Analysis by Means of Equations with an Indefinite Number of Terms*); *Methodus Fluxionum et Serierum Infinitarum*, 1671 (*Method of Fluxions and Infinite Series*); and *Tractatus de Quadratura Curvarum*, 1676 (*Quadrature of Curves*).

Leibniz's results, as well as the development of his ideas, are contained in hundreds of pages of notes made from 1673 on, but never published by him. In 1684 he began publishing a few papers on calculus in the journal *Acta Eruditorum* and in 1714 he wrote *Historia et Origo Calculi Differentialis*, in which he gave an account of the development of his own thinking on the subject.

In addition to the expansion of mathematical content and activity, this period is significant for developments that occurred with respect to communication among mathematicians. Prior to the late sixteenth century, mathematics was created by individuals and small

groups headed by one or two prominent leaders. The results were communicated orally, through personal correspondence, and occasionally written up in texts—first in manuscript form and later as printed books. As more people began to participate in mathematical research, the desire for exchange of information and for the stimulus of meeting others with the same intellectual interests resulted in the founding of scientific societies. These societies were important not only in making possible direct contact and exchange of ideas, but also because they supported journals, which eventually became the accepted medium for publication of new research results. The oldest mathematical society still in existence is the Mathematische Gesellschaft in Hamburg, Germany, founded in 1690 as the *Kunstrechnungsliebende Societät*, and continued (1790–1876) as the *Gesellschaft zur Verbreitung der Mathematischen Wissenschaften*. Its publications were entitled *Jahresbriefe* or *Jahres-Berichte* or *Berichte* from 1723 to 1878 and its current journal is entitled *Mitteilungen*, 1873–.^[4]

Another seventeenth century development was the establishment of Royal Academies, subsidized by the rulers of the time. These academies sponsored research and also supported journals, in which they published the results of their research.

Eighteenth Century

Calculus dominated mathematical development in the eighteenth century. Research in this new theory took two directions: extension and application of calculus to other parts of mathematics and to physics, and examination of its logical foundations.

Research during this century was carried on mainly by the Royal Academies. The most prominent academies were at Berlin, London, Paris, and St. Petersburg. Prior to 1800, universities played only a minor role in research and the great mathematicians were attached to the academies.

Leonhard Euler (1707–1783), who was attached to both the Berlin Academy and the St. Petersburg Academy during his career, was the most productive mathematician of the century. He wrote about 900 books and papers, including works on mechanics, music, and astronomy, as well as mathematics. Euler is considered the creator of analytic mechanics (as opposed to the older geometrical mechanics), based on his achievements in establishing calculus as a purely analytic theory. His *Mechanica* (1736) is a major contribution to the analytical foundation of mechanics. Euler's texts on mechanics, algebra, mathematical analysis, analytic and differential geometry, and calculus of variations were standard works for a 100 years or more. Three landmark texts in calculus are: *Introductio in Analysin Infinitorum* (1748), the first connected

presentation of calculus and elementary analysis; *Institutiones Calculi Differentialis* (1755); and the three-volume *Institutiones Calculi Integralis* (1768–1770).

French mathematics held a position of superiority during the eighteenth century and some of the important works from that country are: *Traité de dynamique* (1743) and *Reflexions sur la cause générale des vents* (1747), by Jean d'Alembert; *Mécanique analytique* (1788) and *Théorie des fonctions analytiques* (1797), by Joseph Louis Lagrange; *Eléments de géométrie* (1794) and *Essai de la théorie des nombres* (1798), by Adrien-Marie Legendre; and *Feuilles d'analyse appliquée à la géométrie* (1795), by Gaspard Monge. An important work which, like its author, bridges two centuries, is the five-volume *Mécanique céleste* (1799–1825), by Pierre Simon Laplace. This work reviewed, unified, and greatly extended all previous work of Newton, d'Alembert, Euler, Lagrange, and Laplace, himself, in the fields of probability and celestial mechanics.

1800 to 1940

The modern area in mathematics is considered to have begun with Carl Friedrich Gauss (1777–1855), the German mathematician who dominated nineteenth century mathematics. He contributed to almost every branch of mathematics, but is perhaps best known for his work in the theory of numbers, represented by his monumental *Disquisitiones Arithmeticae* (1801).

With the beginning of the century, mathematical creativity began to increase exponentially, and by 1900 had produced about five times as much original mathematics as had been accomplished in all previous ages.^[1] Every major branch of mathematics underwent profound changes in terms of expansion of subject matter and the opening of new fields as well as the extension of older ones. Consequently, mathematics became so vast a subject that mathematicians were forced to confine their efforts to one major branch: algebra, geometry, or analysis. It has been said that Gauss was one of the last men to know the subject as a whole.

Algebra, which previously was little more than generalized arithmetic, was liberated from its dependence on arithmetic and became abstract, with wider applications, during this period. Early work in this area was done by the Irish mathematician William Rowan Hamilton (1805–1865) and the German mathematician Hermann Grassmann (1809–1877). Important works of Hamilton are *Lectures on Quaternions* (1853) and *Elements of Quaternions* (1866), and of Grassman, *Die Lineale Ausdehnungslehre* (1844). England was the center of this nineteenth-century algebra with its geometric applications under the guidance of Arthur Cayley (1821–1895), the originator of matrix theory, and James Joseph Sylvester (1814–1897). Cayley's writings are found in his *Collected Mathematical Papers*, 13 volumes, Cambridge University

Press, 1889–1897. Sylvester, who taught at Johns Hopkins University from 1876 until his return to England in 1884, published in various journals. He is also important for having initiated research in pure mathematics in the United States and for founding the first American mathematics journal, the *American Journal of Mathematics*. Also in the field of algebra, work was done in the theory of groups, notably by Felix Klein (1849–1925) in Germany, and by Marius Sophus Lie (1842–1899) in Norway. Both men published widely in journals and Klein also wrote books on the theory, history, and teaching of mathematics. Two of his books are *Famous Problems of Elementary Geometry* (1895; English translation 1930), and *Elementary Mathematics from an Advanced Standpoint* (2 vols., 1907–1908; English translation 1932–1940). Another man working in algebra at this time was the French mathematician Évariste Galois. One of the more romantic figures in mathematics history, Galois was killed in a duel in 1832, shortly before his twenty-first birthday. His unpublished notes, that were later deciphered and revised, turned out to be the theory of groups, the foundation of modern algebra and modern geometry.^[1]

In the field of analysis, three men are acknowledged to be the founders of the theory of complex functions: Augustin Louis Cauchy (France, 1789–1857), Bernhard Riemann (Germany, 1826–1866), and Karl Weierstrass (Germany, 1815–1897). Cauchy was a prolific writer, whose over 700 papers covered all branches of mathematics. His first significant paper in complex function theory was “Mémoire sur la théorie des intégrales définies,” read to the Paris Academy in 1814. The paper considered his most important was “Mémoire sur les intégrales définies prises entre des limites imaginaires,” written in 1825 but not published until 1874. Riemann's doctoral thesis of 1851, “Grundlagen für eine allgemeine Theorie der Functionen einer veränderlichen complexen Grösse,” is a basic paper in complex function theory. Weierstrass did not publish his results at the time he first achieved them. His research became known only in the late 1890s when he published his collected *Werke*. Also in analysis, the theory of elliptic functions was developed by Niels Henrik Abel (Norway, 1802–1829) and Carl Gustav Jacob Jacobi (Germany, 1804–1851). The paper that contains Abel's famous theorem was first submitted to the Academy of Sciences in Paris in 1826 for publication in its journal. The manuscript was either disregarded or mislaid, however, and it was not published until after Abel's death, in 1841. A key work in elliptic functions is Jacobi's book *Fundamenta Nova Theoriae Functionum Ellipticarum* (1829).

Developments in geometry affected not only that field, but all the branches of mathematics. Early in the century, three men in different countries all published consistent non-Euclidean systems of geometry, each independently of the other two. In Russia, Nicolai Lobachevsky (1793–1856) published a series of journal articles between 1829

and 1837. In 1840 he published a book in German, *Geometrische Untersuchungen zur Theorie*, in which he lamented the slight interest shown in his writings. His *Pangéométrie*, published in 1855, was a completely new exposition of his geometry. In Hungary, Janos Bolyai (1802–1860) wrote a paper entitled “The Science of Absolute Spaces,” which was published in 1832. And in Germany, Bernhard Riemann, in 1886, published “Über die Hypothesen, welche der Geometrie zu Grundeliegen” (On the Hypotheses Which Lie at the Foundation of Geometry). This paper was based on a lecture he had delivered in 1854 to the faculty at Göttingen. These men showed that the axioms of Euclid were not self-evident truths, as had been assumed for centuries, and that consistent geometries built on other axioms were possible. This idea produced fundamental changes in notions of physical and mathematical space, and the axiomatic method that pervades all modern mathematics is one of the consequences of this discovery.^[2]

The formalistic treatment of algebra and the abstract axiomatic approach to geometry triggered an interest in logic and foundations of mathematics. This interest was redoubled when George Cantor (1845–1918) first published his controversial theory of sets. Cantor’s theory is spread over numerous papers that appeared in *Mathematische Annalen* and the *Journal für Mathematik* from 1874 to 1897. The first significant mathematical studies of logic were *The Mathematical Analysis of Logic* (1847) and *The Laws of Thought* (1854), both by George Boole (1815–1864). In 1884, Gottlob Frege (1848–1925) published *Die Grundlagen der Arithmetik*, which stimulated efforts to unify logic and mathematics.^[1]

As mathematics expanded and changed during the nineteenth century, so too did the agencies for the propagation of results. First, the universities participated in research, the writing of textbooks, and the systematic training of mathematicians. The dominance of the royally supported academies began to decline at this time and research became an important function of the universities.^[2]

Second, there was a vast increase in the number of journals. The first purely mathematical journal, *Annales de Mathématiques Pures et Appliquées*, was started in France in 1810; it ceased publication in 1831. *Crelle’s Journal*, the oldest mathematical journal still in existence, began in 1826. Among the numerous other titles are the *Mathematische Annalen* (Germany, 1868–), the *Acta Mathematica* (Sweden, 1882–), and the *American Journal of Mathematics* (1878–), the first mathematical journal in the United States.

Finally, another type of agency that has promoted mathematical activity since the nineteenth century is the national professional society. With the exception of the Wiskundig Genootschap, founded in Amsterdam in 1778, most national societies did not appear until the second half of the nineteenth century. The oldest of the major national societies is the Moskovskoe Matematicheskoe

Obshchestvo (Moscow Mathematical Society), organized in 1864. Some others are the London Mathematical Society (1865), the Societe Mathématique de France (1872), the American Mathematical Society (1894; founded in 1888 as the New York Mathematical Society), and the Deutsche Mathematiker-Vereinigung (1890). These societies hold regular meetings at which papers are presented and each sponsors one or more journals.

Occasional international meetings of mathematicians took place during the nineteenth century, but the first of the present series of international congresses of mathematicians was held in 1897. The congress has met regularly every four years since 1900, except for interruptions caused by the two World Wars. The *Proceedings* of each congress have been published, usually by the mathematical society of the sponsoring country.^[4]

In 1900, at the International Congress of Mathematicians assembled in Paris, David Hilbert (1862–1943) lectured on mathematics in the new century. Hilbert, who had just published his now-famous *Grundlagen der Geometrie*, a complete revision of Euclid’s *Elements* using modern axiomatic methods, outlined 23 unsolved problems, a challenge for the new century. Hilbert’s insight was so accurate that every one of these problems has led to important new results, but even he could not foresee how mathematics would expand in the 1900s.

The phenomenal growth rate that began in the 1800s continued, with mathematical knowledge doubling every 15 or 20 years. Quantity, however, is not the chief feature of twentieth century mathematics. One of the outstanding characteristics of mathematics of the present century is a fundamental trend toward unity; for an abstract axiomatic treatment of mathematics as a whole.^[5] As a result of Boole’s work and the recognition of formal axiomatics that followed the discovery of non-Euclidean geometries, interest in the logical foundations of mathematics began to spread rapidly. The most notable successor to Boole’s initial efforts in mathematical logic is the *Principia Mathematica*, a monumental two-volume work that appeared during the years 1910–1913. In this work the philosopher-mathematicians Bertrand Russell (1872–1970) and Alfred North Whitehead (1861–1947) attempted to express all of mathematics in a universal logical symbolism. This goal of finding a single consistent set of axioms upon which all mathematics could be based was proved unattainable in 1931 when Kurt Gödel (1906–) published “Über formal unentscheidbare Sätze der *Principia Mathematica* und verwandter Systeme I” (On Formally Undecidable Propositions of *Principia Mathematica* and Related Systems; English translation 1965). Another important book of Gödel’s is *The Consistency of the Axiom of Choice and of the Generalized Continuum Hypothesis with the Axioms of Set Theory* (1940; rev. ed. 1951). Gödel demonstrated that in any axiom system broad enough to contain all the formulas of a formalized elementary number theory, there exist

theorems (formulas) that can neither be proved nor disproved within the system.^[6]

Having accepted the fact that mathematics is not provably consistent from within, mathematicians continued to explore their own branches of the subject. Algebra has become far more general than it has ever been before, and similar tendencies toward abstraction in geometry have led to advances in the field of algebraic geometry and the hybrid field of differential geometry (a synthesis of geometry and parts of analysis). Analysis itself has become more generalized, linked with both algebra and topology. The methods of algebraic topology, which began to be a major field of investigation at the end of the nineteenth century, have become the basis for a newer field, homological algebra.^[7]

The desire to consolidate and simplify previous results can be seen throughout mathematical history; Euclid's *Elements* was an example of this tendency. In the twentieth century, another attempt was begun in the 1930s to integrate all contemporary mathematics within a single framework by a group of French mathematicians writing under the name of "Bourbaki." The work of this group will be discussed in the next section of this article.

During and after World War II, mathematical thinking penetrated the sciences and technology at an ever-increasing rate. In the decades since the war the methodological and conceptual tools of mathematics have been utilized by the social sciences as well.

A measure of the growth and volume of the modern world's utilization of mathematics is given by the estimates that show that of all the mathematicians who ever lived, over 80% are alive today. The U.S. Office of Education, which publishes statistics on the number of degrees granted each year, reports 250 doctorates in mathematics in 1955, 660 in 1965, and predicts 1840 in 1975.

More original mathematics has been produced since the end of World War II than in all previous history. Over 1200 journals publish mathematical articles, of which more than 12,000 were reviewed in the first six months of 1975 by *Mathematical Reviews*.^[8]

It is this literature—the literature since the end of the War—that is the subject of the following section.

THE CURRENT MATHEMATICS LITERATURE

Introduction

As a working hypothesis for its studies on mathematical information exchange, the American Mathematical Society's Committee to Monitor Problems in Communication considered the current mathematics literature to be publications that are reviewed in *Mathematical Reviews*.^[9] This seems to be an acceptable definition for our purposes, also, since *Mathematical Reviews* is the principal abstracting journal of mathematics and covers the world literature in the field. The current literature may

be further defined as that which forms the content of graduate education and represents present-day research interests. Mathematics that is studied at the elementary, secondary, and collegiate levels is a consolidation of results and ideas from the earlier periods of mathematical history and, therefore, does not satisfy the definition of current mathematics. The literature of mathematics below the graduate level is found in the form of textbooks and can be easily located in general bibliographies, indexes, and publishers' catalogs.

Another class of materials that will be omitted from our discussion is mathematical literature for the layman: popularizations, mathematical games and recreations, and so forth. Again, the standard bibliographic tools can be used for locating information about this type of literature.

In the discussion that follows, the mathematics literature is divided into two categories: the primary literature and the secondary literature. After a general description of the types of publications in each category, specific titles are cited as illustrations of the various types.

The Primary Mathematics Literature

The current mathematics literature is chiefly serial in nature. The principal medium for the dissemination of mathematical information is the journal, followed by the book series, including series of monographs, proceedings of symposia, and translation series. The least common form of publication is the nonserial book. In this group are found dictionaries, handbooks, mathematical tables, directories, histories, collected papers of individual mathematicians, and Festschriften. Because of the way the nonserial literature is used, it will be dealt with in connection with the secondary literature.

The broad headings used to classify entries in *Mathematical Reviews* gives an indication of the subject coverage of the literature. The current literature reflects a wide variety of research activity, ranging from traditional topics, such as geometry, to more recent topics, such as homological algebra. The increasing penetration of mathematics into other disciplines is evidenced by literature dealing with the biological and behavioral sciences, in addition to the traditional applications in the physical sciences.

While a reading knowledge of French, German, Italian, and Russian is useful to the mathematician, English has recently become the dominant language in world mathematical circles. For example, in the German journal *Mathematische Annalen*, the percentage of papers in English rose from approximately 5% in the mid-1930s to nearly 20% in the mid-1950s, and to 55% in the mid-1960s.^[7] Most countries with an academic tradition produce at least one mathematical periodical that is internationally recognized. English language abstracts of many articles from these periodicals appear in *Mathematical Reviews*. (A small number of *Mathematical Reviews* abstracts are still written in French, German, and Italian,

however.) The American Mathematical Society also has an active translation program, notably in the area of Russian mathematics, about which more is said later.

Mathematics literature is issued by three general categories of publishers: societies, universities and academies, and commercial houses. All three groups issue both serial and nonserial publications, covering both basic research and applied mathematics. It is not the case in mathematics, as in many subjects, that research is published by institutions and practical applications of the research are reported by the commercial press. There are instances where mathematical societies place their publications in the hands of commercial houses, but this is for the purpose of administrative convenience; Bell of London, for example, is the publisher for the Mathematical Association. Again, unlike the case in other sciences, there are few publications issued by the U.S. government that are of value to mathematicians. The only such publication abstracted in *Mathematical Reviews* is *The Journal of Research of the National Bureau of Standards. Section B: The Mathematical Sciences*.^[10] The National Science Foundation does not publish mathematics under its own name, but gives financial support to other mathematical publications, especially for translations of foreign-language works. An interesting example of such cooperative publishing is a three-volume survey of mathematics that was translated from the Russian: *Mathematics: Its Content, Methods, and Meaning*, edited by A.D. Aleksandrov, A.N. Kolmogorov, M.A. Lavrent'ev, and translated by S. H. Gould and T. Bartha (Russian edition 1956; American edition 1963). A National Science Foundation grant enabled the American Mathematical Society to translate and publish this work, which subsequently received wider circulation by being reissued by the M.I.T. Press.

Journals

The history of scientific journals, as noted earlier, began with the formation of scientific societies and academies in the seventeenth century. These first journals, such as the *Philosophical Transactions of the Royal Society* (London, 1665), contained both mathematical and scientific articles. During the eighteenth century, when journals had become the accepted medium for publication of research, they increased in number. By the nineteenth century they had become more specialized. The *Annales de Mathématiques Pures et Appliquées* (France, 1810–1831) was the first journal devoted solely to mathematics. The *Journal für die reine und angewandte Mathematik*, founded in Germany in 1826, and usually referred to as *Crelle's Journal* (after its founder), is the oldest mathematics journal still in existence.

The number of mathematical journals vastly increased with the establishment of national mathematical societies in the second half of the nineteenth century. Today most countries have national societies that publish at least one

journal. The oldest and largest U.S. society, the American Mathematical Society, publishes six journals.

In addition to national societies, there are a number of societies of a specialized nature that issue journals. Two examples of this type of society are The Mathematical Association of America and the Society for Industrial and Applied Mathematics.

The Mathematical Association of America is concerned primarily with collegiate-level mathematics and teaching, and publishes three journals: *The American Mathematical Monthly*, a journal containing original and expository articles at the undergraduate and beginning graduate level; *Mathematics Magazine*, which is similar in content to the *Monthly*, but focuses at a somewhat lower level; and *The Two-Year College Mathematics Journal*, established in 1970 by the commercial firm of Prindle, Weber, and Schmidt, but published since the fall of 1974 by the association. This journal features articles, book reviews, and problems of special interest to students and teachers in two-year colleges.

The Society for Industrial and Applied Mathematics (SIAM) publishes eight journals in the area of applied mathematics: *SIAM Journal on Applied Mathematics* (formerly the *SIAM Journal*); *SIAM Journal on Control*; *SIAM Journal on Theory of Probability and Its Applications*, which is a translation of the Russian journal *Teoriya Veroyatnostei i Ee Primeneniya*.

Universities also began to issue journals in the nineteenth century. The first mathematical journal in the United States was the *American Journal of Mathematics*, founded in 1878 by J.J. Sylvester when he was a professor at Johns Hopkins University. Currently, many universities with strong mathematics programs, in the United States and worldwide, publish journals; some are general in nature and some are specialized. Two examples from the United States are the *Duke Mathematical Journal* (general) and the *Notre Dame Journal of Formal Logic* (specialized).

Until recently, commercial houses have played a more important role in journal publishing in Europe than in the United States. For example, Springer-Verlag of Germany publishes *Mathematische Annalen* and *Mathematische Zeitschrift*, while in England Pergamon Press publishes *Topology, an International Journal of Mathematics*. In 1960, Academic Press of New York inaugurated an impressive program of publishing journals devoted to special areas of mathematics. Currently it issues the following titles: *Journal of Mathematical Analysis and Applications*; *Journal of Algebra*; *Journal of Differential Equations*; *Journal of Combinatorial Theory*; *Journal of Functional Analysis* (articles in French and English); *Journal of Approximation Theory* (German and English); and, *Journal of Multivariate Analysis* (German, French, and English).

As the foregoing remarks indicate, the current journal literature covers a broad range of topics, is produced by

several different types of publishers, and is issued in all of the modern languages, although English has become the dominant language of mathematical research. Many important foreign language journals are now being translated into English on a continuing basis. (The latest index volume of *Mathematical Reviews* lists the journals in translation that are abstracted in that publication.)

In quantitative terms, the journal literature has experienced the same rapid growth that typifies all scientific and technical literature in general. The latest index issue of *Mathematical Reviews* lists approximately 1200 journals that contain mathematical contributions. Since space does not permit describing them all, the journals published by the American Mathematical Society have been selected for discussion. The publications of the society have been chosen as examples because they illustrate the variety of journals that are available. The society not only issues six journals under its own name, but it publishes translations of foreign journals, it has cooperative agreements with other mathematical societies, and it subsidizes several journals published by universities and other organizations. Furthermore, most of the general comments about the society's journals are applicable to the journals of other national societies.

Of the six journals published under the society's name, two are devoted solely to the results of original research. They are: *Transactions of the American Mathematical Society* (1900–) and *Proceedings of the American Mathematical Society* (1950–). Both of these journals, which are issued monthly, cover all areas of pure and applied mathematics. Ordinarily, longer papers are published in the *Transactions* and shorter ones in the *Proceedings*. A strict editor-referee system, which ensures the highest level of excellence of the papers, makes these among the more prestigious journals in which to publish.

The *Bulletin of the American Mathematical Society* (1891–) is the official journal of the society. A bimonthly publication, it contains reports of the meetings, financial reports, and miscellaneous other material of interest to professional mathematicians. It also contains the full texts of many invited addresses at meetings, long survey articles by invited authors, reviews of advanced mathematics books, and a department of research announcements.

Notices of the American Mathematical Society (1954–) is published eight times a year, primarily to transmit the programs of meetings of the society. It contains author abstracts of all contributed papers for meetings, announcements of research in progress, personal notes, and other news items.

Two journals of the society are devoted to research in special areas. They are: *Mathematics of Computation* (formerly *Mathematical Tables and Other Aids to Computation*, 1943–), which is a quarterly devoted to advances in numerical analysis, the application of computational methods, mathematical tables, high-speed calculators,

and other aids to computation; and *Journal of Differential Geometry*, a publication that began in 1970.

Three journals of Russian translations are currently published by the society. They are: *Soviet Mathematics-Doklady* (bimonthly), which is a translation of the entire pure mathematics section of the *Doklady Akademii Nauk SSSR*, consisting of short reports of current research in the former Soviet Union. It provides a comprehensive, up-to-date survey of what is going on in Soviet mathematics. *Mathematics of the USSR-Sbornik* (monthly) is a translation of *Matematicheskii Sbornik*, which is published by the Moscow Mathematical Society and the Academy of Sciences of the USSR. It deals with current research in all fields of mathematics. The third journal is *Mathematics of the USSR-Izvestija* (bimonthly), which is a translation of *Izvestija, Matematicheskaja Serija*, published by the Academy of Sciences of the USSR and dealing with research in pure areas.

The society also published *Chinese Mathematics-Acta*, a translation into English of *Acta Mathematica Sinica*, which was published from 1960 until 1966 by the Academia Sinica, Peking, People's Republic of China. Until the publication is resumed in Peking, the latest available volume is Vol. 9 (1967).

The American Mathematical Society has entered into cooperative agreements with other mathematical societies, both in the United States and abroad. In the United States, one of the forms this cooperation takes is joining in the support and publication of a number of mathematical journals. It shares with the Johns Hopkins University the publication of the *American Journal of Mathematics*, and it assumes responsibility for the technical editing of the *Quarterly of Applied Mathematics* of Brown University. The society also contributes to the financial support of a number of other mathematical journals. These include, at present, the *Canadian Journal of Mathematics* and the *Rocky Mountain Mathematical Journal*. It also provides editorial services for the *Journal of Symbolic Logic*, a publication of the Association for Symbolic Logic.

Book Series

Mathematical Reviews abstracts books as well as journals, so the headings referred to previously give some indication of the subject coverage of this form of literature. However, books generally do not deal with the latest developments on the frontiers of research. The nature of book publishing is such that older, more established topics are dealt with, usually in an expository manner.

As is the case with journals, books are published by societies, universities and academies, and commercial houses. This is true both in the United States and abroad.

Once again, the American Mathematical Society plays an important publishing role. Its several book series are typical of the kinds of material found in this category and provide good examples for discussion. The society

publishes 13 book series, including several series of monographs, proceedings of symposia, and translation series.

The society's three monograph series are *Memoirs of the American Mathematical Society*, *Colloquium Publications*, and *Mathematical Surveys*. *Memoirs* (1950–) is the longest of the monograph series. It contains research tracts of the same general character as the papers published in the *Transactions*. *Colloquium Publications*, a monograph series that began in 1905, is the oldest of these series and contains the syntheses of recent and older mathematical work prepared by outstanding research mathematicians. *Mathematical Surveys* covers fields of current interest, each volume giving a brief survey of a subject and an introduction to its recent developments and unsolved problems.

The four series of proceedings are: *Proceedings of Symposia in Pure Mathematics*, which contains lectures from symposia and summer institutes sponsored by the society; *Lectures in Applied Mathematics*, which contains a series of lectures given at the summer seminars sponsored by the society; *SIAM-AMS Proceedings*, which contains lectures from symposia and summer institutes in applied mathematics, sponsored jointly with the Society for Industrial and Applied Mathematics; and *Lectures on Mathematics in the Life Sciences*, a recent series dealing with the mathematical aspects of biology.

Society translations include one monograph series and five translation series. They are: *Translations of Mathematical Monographs*, which is a series translated chiefly from the Russian; *Selected Translations in Mathematical Statistics and Probability*, published by the society for the Institute of Mathematical Statistics; *Translations Series I and II*, translated from the Russian and other Eastern European and Oriental languages; *Proceedings of the Steklov Institute of Mathematics in the Academy of Sciences of the USSR*; and *Transactions of the Moscow Mathematical Society*. These last two series are cover-to-cover translations of two Russian series.

The monographs and other serials of the American Mathematical Society may be characterized as advanced research-level publications. To meet the need for expository presentations at the collegiate and graduate level, The Mathematical Association of America publishes two important series. The *Carus Mathematical Monographs* is a series of books in pure and applied mathematics, each written by an authority in the field. The scope of this series also includes historical and biographical monographs. The *MAA Studies in Mathematics* is a series devoted to recent developments in mathematics. Each volume is a collection of reprints of short papers on a given topic by several authors.

Some important foreign series that should be mentioned are:

Cambridge Tracts in Mathematics and Mathematical Physics, a monograph series published by Cambridge

University Press since 1905. The purpose of this series is to provide introductions to modern topics in mathematics. While the books are not intended for specialists, they cannot be considered elementary in the conventional sense.

Ergebnisse der Mathematik und ihrer Grenzgebiete is issued by a commercial publisher, Springer-Verlag of Berlin. Each volume in this monograph series may be described as a state-of-the-art treatment of an individual topic. The treatment of a topic is exhaustive, bringing together and relating results that previously were scattered throughout the literature, primarily the journal literature. Of immeasurable value to the researcher is the extensive bibliography, arranged chronologically, which appears at the end of each volume. German and English are the languages in which these books are published.

Lecture Notes in Mathematics is another Springer publication. This series attempts to report quickly new developments in mathematical research and teaching. The type of material in this series includes preliminary drafts of original papers, lectures on a new field, or presentations of new perspectives on a classical field, and papers from seminars. Each volume is devoted to a single topic and the language may be German, French, or English.

No discussion of the primary mathematics literature would be complete without mention of the works of a nonexistent Frenchman named Bourbaki. Nicolas Bourbaki is the collective pseudonym used by an informal corporation of French mathematicians, numbering from 10 to 20 at any one time. This anonymous society is writing a comprehensive treatise on mathematics, starting with the most general basic principles and to conclude, presumably, with the most specialized application. The treatise, whose general title is *Eléments de Mathématique*, is a survey of all mathematics from a sophisticated point of view. The Bourbaki presentation of each subject is systematic and thorough, often including an historical review of the subject and a set of exercises. The Bourbaki gadgetry includes inserts constituting a set of directions on the proper use of the treatise, foldout sheets that summarize important definitions and assumptions, and a dictionary for each book that serves also as an index to “Bourbachique” terminology. The project, published by Hermann of Paris, got under way in 1939 and over 30 titles of this monumental work have appeared to date. The number of volumes is somewhat larger, since many of the earlier titles have been revised and issued as second and even third editions. The influence of this series is equalled only by the amount of apocryphal stories about Bourbaki, most of them perpetrated by the members of the group.^[11]

The Secondary Mathematics Literature

The secondary mathematics literature is not extensive. Indeed, when compared with the bibliographic tools and

services of other sciences, it is somewhat meager and even primitive. Sophisticated information systems, based on computer technology, have been employed by other disciplines for some time. However, the establishment of machine-readable databases, and the use of the computer to assemble and compose indexes, are very recent developments in mathematics. Within the last five years some new tools and services have resulted from the utilization of new technology, and they are discussed later in this paper.

In examining the secondary literature it might be helpful to view it in terms of the information needs of mathematicians: current awareness (what are the latest developments in a particular field of interest?); day-to-day specifics (is there a solution of this problem? what is the meaning of this foreign term?); and retrospective (what has been written on the history of this topic?).

The need to be informed about recent developments and publications is met by the traditional abstracting and reviewing journals and by the newer current awareness services. Day-to-day needs are met by information contained in monographs, treatises, and reference books, such as dictionaries and mathematical tables. Retrospective needs are satisfied by indexes, collections of reviews, and by bibliographies found in monographs and treatises.^[12]

Current Awareness Needs

By the middle of the nineteenth century the number of mathematical journals and the scattering of mathematical articles over a number of more general periodicals made it difficult for the individual to keep informed, and in 1868 the first mathematical abstracting journal, *Jahrbuch über die Fortschritte der Mathematik*, was founded. Its success was only partial because of a substantial time lag and it ceased publication in 1934. The literature from that time to the present day is covered by the following abstracting journals: *Zentralblatt für Mathematik*, founded in 1931; *Mathematical Reviews*, founded in 1940; and *Referativnyi Zhurnal Matematika*, founded in 1953. A number of specialized abstracting journals have also appeared in recent years: *Statistical Theory and Method Abstracts* and *Computer Abstracts* are two examples.

Mathematical Reviews, published by the American Mathematical Society, is undoubtedly the most valuable English-language publication for locating current mathematical literature. It is international in scope, covering about 1200 journals of every mathematical specialty and every language in which mathematics is written. A special attempt is made to cover the mathematical activities in the USSR and the countries within its sphere of influence. Selected books and other nonserials as well as journals and series are reviewed. Books of a popular nature or below the level of graduate education are not usually included.

Entries from other abstracting and reviewing services are reprinted in *Mathematical Reviews*. They are: *Applied Mechanics Review*, *Computing Reviews*, *Electrical and Electronics Abstracts*, *Mathematics of Computation*, *Operations Research*, *Physics Abstracts*, *Referativnyi Zhurnal Matematika (Mehanika, etc.)*, *Statistical Theory and Methods Abstracts*, and *Zentralblatt für Mathematik*.

In addition to the American Mathematical Society, about 30 other national mathematically oriented societies sponsor *Mathematical Reviews*. The publication was initiated in 1940 with funds granted by the Carnegie Corporation of New York, and over the years it has received support from the National Science Foundation, the Rockefeller Foundation, the American Philosophical Society, and the Alfred P. Sloan Foundation. It is presently facing an uncertain future, due to the recent withdrawal of National Science Foundation and private foundation funding.

The reviews are written by approximately 2000 mathematicians who are experts in the subject areas of the original papers. The reviews, which are critical in nature, describe and evaluate the subject content of the original paper, often reproduce factual data and the steps of proofs, and relate the results to previous works.

Mathematical Reviews is published monthly in two annual volumes, with a separate index issue for each volume. The reviews in each volume are numbered consecutively. Some idea of the exhaustiveness of this work is given by the fact that in the first six months of 1975 (Vol. 49), 12,217 reviews were published.

Reviews in the monthly issues are currently arranged under 61 headings, in accordance with a subject classification scheme developed in 1970. Minor revisions are constantly being made in the scheme, based on literary warrant.

The index volumes include: an author index; a reprinting of the subject classification mentioned above; abbreviations of names of journals abstracted; a list of journals in translation; transliteration of Cyrillic employed by *Mathematical Reviews*, the Library of Congress, and selected abstracting journals; errata and addenda; and, since Vol. 45 (January–June 1973), a subject index. This subject index is a classified one, arranged according to the American Mathematical Society subject classification scheme. Briefly, this scheme consists of the main headings used to arrange the reviews in the monthly issues, which have been further subdivided into more specific subheadings, and to which code numbers have been assigned. Each review in the subject index is listed under the classification code numbers that have been assigned to it. The review is listed under the name of the author of the original paper and reference is to the number of the review.

Periodic cumulative author indexes are also published and are discussed later in this paper.

Zentralblatt für Mathematik und ihre Grenzgebiete is published in Berlin by Springer-Verlag, with editorial

offices at Deutsche Akademie der Wissenschaften and Heidelberger Akademie der Wissenschaften (both in Berlin). Like *Mathematical Reviews* it is international in scope, has signed abstracts of the literature in various languages (chiefly German and English), is arranged in classified order (using the American Mathematical Society scheme at the present time), and has author indexes. It also has separately published cumulative author indexes.

Since late 1973 *Zentralblatt* has been gradually changing over to the use of author abstracts in an effort to satisfy the demand for more rapid and comprehensive information about mathematical research. This procedure, according to the publisher, is intended to lead to a certain degree of differentiation and complementation between the mathematical reviewing/abstracting journals. The journal has advised authors that an abstract should not be a short summary, but should comply in size and form with a normal review (although criticism is not expected) and may be written in English, French, or German. If authors' abstracts can be published within 10 weeks of receipt, as *Zentralblatt* hopes to do, this will be a great improvement over the time lag of many months that now exists.

Referativnyi Zhurnal has been issued since 1953 by the Akademiya Nauk SSSR, Institut Nauchnoi Informatsii, Moscow. It is a major abstracting journal for the world's literature in most branches of science and technology.

Referativnyi consists of several series, designated *svodnyi tom* (joint volume), each devoted to an individual branch of science or technology. The number and titles of the series have varied over the years. A series, or joint volume, is made up of chapters that are issued as separate periodicals with their own titles, and designated *vypusk RZh* (section of the *Referativnyi Zhurnal*). The mathematical series is titled *Referativnyi Zhurnal Matematika* and consists of three chapters: General. Mathematical logic. Theory of numbers. Algebra. Topology. Geometry.-Mathematical analysis.-Numerical analysis. Probability theory and mathematical statistics. Cybernetics.

Bibliographic information in *Referativnyi* is listed in the original languages following the Russian entry. There is a monthly author index.

As the volume of literature has steadily increased, the abstracting and reviewing journals have found it increasingly difficult to remain current. For example, the number of abstracts in *Mathematical Reviews* has been doubling every eight or 10 years, and presently there is a time lag of up to two years before an article or book is reviewed. The active researcher must depend largely on personal communications among members of invisible colleges, according to procedures that differ from those of ancient times only in the media of communication and travel.^[12]

As noted above, the publisher of *Zentralblatt* is hoping to improve the currency of that journal by the device of authors' abstracts. The American Mathematical Society,

as a by-product of converting the database of *Mathematical Reviews* to machine-readable form, was recently able to offer two new current awareness services.

The first service, the Mathematical Title Service, provides lists of titles in all areas of mathematics, based on detailed interest profiles of the subscribers. This service originally started in 1968 as an experiment in automatic dissemination of information, was then called the Mathematical Offprint Service, which supplied offprints of articles. Articles that satisfied the subscriber's interest profile were mailed to him on a continuing basis, along with title listings of articles in which he indicated a peripheral interest. However, this service was discontinued because it could not be made self-supporting, and it was replaced by the Mathematical Title Service.^[13]

The second service was a biweekly alerting journal, *Contents of Contemporary Mathematical Journals*, started in 1969, which reprinted the tables of contents of about 240 mathematical journals. In 1972 the title was changed to *Contents of Contemporary Mathematical Journals and New Publications*, when the scope of the journal was enlarged to include books and other separately published materials. (This type of publication had formerly been announced in the *Notices*.) In early 1974 the format of *Contents* was completely revised. It no longer reproduces title pages of journals, but is a listing of the material (articles, books, collections, etc.) that has been received in the editorial offices of *Mathematical Reviews* during a specific period of time and that is to be eventually reviewed. The material is arranged in classified order according to the major sections of the American Mathematical Society subject classification scheme. In each issue there is also an author index and a list of the journals represented in the issue. The increased coverage is an advantage of this new publication, but the information is not as prompt as formerly, since the materials must now be processed before *Contents* is printed. It remains to be seen whether this factor, plus the harder-to-use format will reduce the usefulness of this publication.

Day-to-Day Needs

As noted earlier, the least common form of literature is the nonserial publication. This category includes dictionaries, handbooks, mathematical tables, and directories, which are used to answer specific questions. It also includes indexes, bibliographies, and expository materials (histories, essays, collected papers of mathematicians, etc.), which meet retrospective needs and which are discussed later in this section.

There are relatively few reference books that answer day-to-day specifics. The mathematician is usually required to locate such information in treatises or other nonserial publications. The types of reference books that

are available, together with some representative titles, can be dealt with briefly.

The dictionary is one of the more useful types of reference tool available to mathematicians. Mathematical dictionaries are often encyclopedic in nature, presenting condensations of mathematical concepts, not merely word definitions. *Mathematics Dictionary*, by Glenn and Robert James, is an example of this type. Another kind of dictionary is the bilingual or multilingual one, of which the *Russian-English Dictionary of the Mathematical Sciences*, by Lohwater and Gould, is an example. Dictionaries of special terms represent still another type; e.g., *Dictionary of Statistical Terms*, by Kendall and Buckland.

The *Mathematical Handbook for Scientists and Engineers*, by Korn and Korn, *Tables of Series, Products and Integrals*, by Ryshik and Gradstein, and the *Combined Membership List of the American Mathematical Society, The Mathematical Association of America, and the Society for Industrial and Applied Mathematics* are examples of handbooks, mathematical tables, and directories, respectively.

Retrospective Needs

The situation with respect to retrospective needs is similar to that for day-to-day needs. Again, the difficulty lies partly in the lack of adequate reference sources and search systems. Mathematics is substantially behind other sciences not only in the preparation of quick reference materials but also in the compilation of indexes, bibliographies, and expository materials, such as encyclopedias and historical studies. And again, as is the case with respect to day-to-day needs, treatises and monographs are used as supplements to, or substitutes for, reference books. As noted earlier, treatises and monographs usually contain extensive bibliographies, and mathematicians tend to use these sources, rather than more general, separately-published bibliographies.

The American Mathematical Society has again taken the lead in attempting to correct this situation. From time to time it publishes comprehensive indexes and collections of reviews in specialized areas.

The cumulative indexes published by the society are: the *20 Year Author Index of Mathematical Reviews, 1940–1959*, (Vols. 1–20); *Author Index of Mathematical Reviews, 1960–1964*, (Vols. 21–28); and *Author Index of Mathematical Reviews, 1965–1972*, (Vols. 29–44). It is interesting to note that the first two cumulative indexes cover 25 years in four volumes and contain 156,000 reviews. The latest index covers eight years in four volumes and contains 127,000 reviews.

The Index to Translations, (1966) is a cumulative author and subject index to material published in three of the society's translation series: *Translations Series I*; *Translations Series II*; and *Selected Translations in Mathematical Statistics and Probability*. In 1974 a second

volume of the *Index* was published, covering the years 1966 through 1973.

The volumes of reviews published by the society are: *Reviews of Papers in Algebraic and Differential Topology, Topological Groups, and Homological Algebra*, containing reviews that appeared in *Mathematical Reviews* from 1940 through 1967; *Reviews of Papers on Infinite Groups*; *Reviews of Papers on Finite Groups*; and *Reviews of Papers in Number Theory*. These last three volumes contain reviews that appeared in *Mathematical Reviews* from 1940 through 1973. The reviews in all of the volumes are arranged in classified order and each volume has an author index. Of special interest are the forward citations given at the end of many reviews. These citations take note of any references made to the article at a later date by a review or reviews in the collection. The advantage of a review volume of this type is that it brings together in one location material that previously had to be searched in several volumes. One must bear in mind, however, that only reviews that appear in *Mathematical Reviews* are included.

CONCLUSION

Mathematics has conformed to the general pattern of explosive exponential growth that typifies all of the sciences. The unprecedented demands made upon mathematics by contemporary society have resulted in an increase in the number of mathematicians and a corresponding increase in the mathematics literature. From 1868 (the year the first abstracting journal was founded) until 1966, the literature grew from approximately 40,000 to about 430,000 titles.^[14] If the estimated 2.5% annual rate of increase continues, the total should exceed 620,000 by the end of the 1970s.

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Medical Library Association (MLA)

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Abstract

The Medical Library Association (MLA) aspires to be the association of the most visible, valued, and trusted health information experts working to enhance the quality of health care, education and research throughout the world. MLA fulfills its mission and goals through its continuing education, credentialing, professional recognition, research, publications, and international programs. The association also offers career services and advocates on behalf of its members through the association's public relations program and governmental relations programs. This entry explains how MLA serves its members, the profession, and society through its programs and services.

INTRODUCTION

The Medical Library Association (MLA), a 501(c)3 not-for-profit educational association, is a leading advocate for health sciences information professionals worldwide. Through its programs and services, MLA provides life-long educational opportunities, supports a knowledgebase of health information research, and works with a global network of partners. The association also promotes the importance of quality information for improved health to the health care community and the public. The association's organizational structure includes a board of directors, committees, a variety of task forces, sections organized by special subject interests and areas of responsibilities, ad hoc special interest groups (SIGs), representatives to allied organizations such as the National Information Standards Organization, and affiliated chapters representing the United States and parts of Canada. MLA aspires to be the association of the most visible, valued, and trusted health information experts working to enhance the quality of health care, education, and research throughout the world.^[1] This entry explains how MLA serves its members, the profession, and society through its programs and services.

PROFESSIONAL AND MEMBERSHIP RECRUITMENT

Founded on May 2, 1898, by four librarians and four physicians, MLA is the second oldest special library association in the United States. The Association of Medical Librarians (as it was known until 1907) was founded "to encourage the improvement and increase of public medical libraries." More than a century later, MLA has grown to a professional organization of about 4000 members including 3300 health sciences librarians and 670 health

sciences libraries and institutions in the health information profession. MLA also has international members from 56 countries in addition to the United States and Canada.

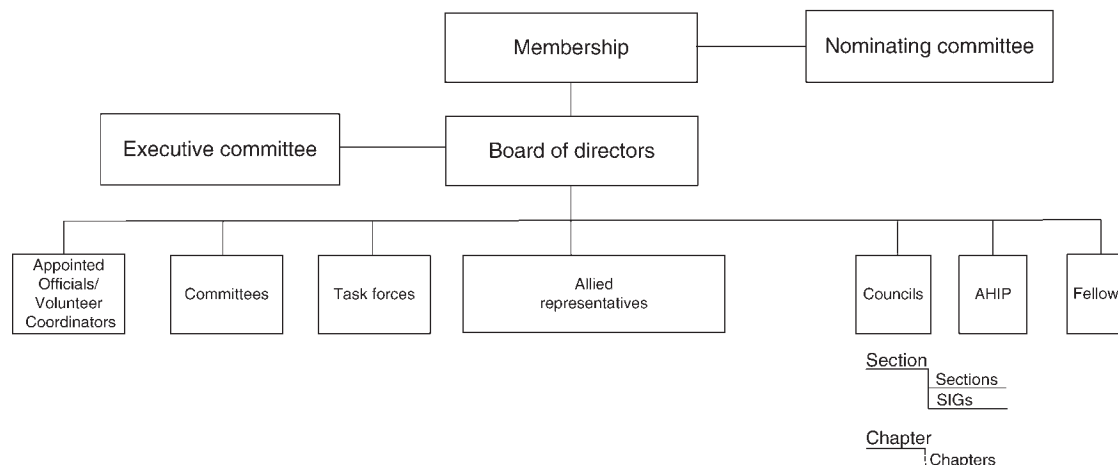
Working through its organizational structure (Fig. 1), the association continues to assist librarians with the exchange of health sciences books and periodicals (the MLA Exchange is one of the founders' earliest and most important projects) and to develop a variety of programs and services to serve the needs of health information specialists.

Demographically, MLA is comprised primarily of white females, in their 50s with master of library science (MLS) degrees, who are employed in hospital settings. This description is based upon data from the Hay Group/MLA 2008 Salary Survey.^[2] Thirty-nine percent of MLA's members are employed in hospital libraries, 34% in academic medical centers, and 27% in other settings such as pharmaceutical companies. Eighty-nine percent of the membership is white, 3% Asian, 2% African-American, and 3% Hispanic or other backgrounds. In 2008, the median annual salary for a health sciences librarian was \$60,000 and the average annual salary, \$65,796. Between 2002 and 2008, actual wage rates of health sciences librarians were slightly higher than projected by CPI data.

Membership recruitment and retention is becoming more challenging for a variety of reasons for both the national association and affiliated chapters. The majority of health sciences librarians who entered the profession in the 1970s after the passage of the Medical Library Assistance Act are now retiring. Downsizing and consolidation in the health care industry have resulted in fewer health sciences libraries and fewer health sciences librarians. Although a record number of new members have joined MLA since 1997, these members do not offset those who are leaving the association due to retirement or change in profession. The Membership Committee continues to work to recruit members into the association.



Medical Library Association Structure Chart

**Fig. 1** MLA structure chart.

To meet the challenge of recruiting people into the profession, MLA established the Professional Recruitment and Retention Committee in 2006. The committee has developed initiatives to recruit an increasingly diverse group of people into the profession of health sciences librarianship. Through a series of awards from the National Library of Medicine (NLM) (<http://www.nlm.nih.gov>) and the South Central Region of National Network of Libraries of Medicine (<http://nnlm.gov/scr/>), MLA began a program to recruit people from diverse cultural backgrounds into health sciences librarianship. Through the awards, MLA was able to increase the number and stipend amount of GSLIS scholarships and develop career materials, in both English and Spanish, to inform students about opportunities in the profession. MLA is also actively involved with NLM, in the American Library Association's Spectrum Initiative. MLA launched its mentoring Web site (<http://www.mlanet.org/mentor/>) in 2003, to link people in the profession with interested students and other professionals and developed a "recruitment into the profession" DVD (http://www.mlanet.org/career/career_vid.html).

PROGRAMS AND SERVICES

MLA fulfills its mission and goals through its continuing education, credentialing, professional recognition, research, publications, and international programs. The association also offers career services and advocates on behalf of its members through the association's public relations program and governmental relations programs. In 1994, MLA adopted the Code of Ethics for Health

Sciences Librarianship (<http://www.mlanet.org/about/ethics.html>). The code describes the goals and principles for ethical conduct for its members in relation to society, their clients, their institutions, the profession, and themselves. MLA promulgates practice standards for membership segments such as hospital librarians and chiropractic librarians and promotes research in the provision of information for quality health care.

LIFELONG LEARNING

Medical practice, research, and technology continue to change at a breathtaking pace. Supporting and promoting lifelong learning opportunities for health sciences librarians to meet these future challenges has been a major priority of MLA for almost 50 years. Lifelong learning includes both MLA's continuing education and credentialing programs. These have recently been combined with MLA's research programs to form the Center of Research and Education (CORE) Program. The history of the programs since the 1970s is described in detail in the first edition of the *Encyclopedia of Library and Information Science (ELIS)*^[3] and in a supplement published in 1977.^[4]

Continuing Education

Major changes occurred in the continuing education (CE) program during the 1990s due to the costs involved in administering the program, the need to more quickly incorporate new trends and topics into the course offerings, and the demand to make educational opportunities more

accessible using new technologies. Today, CE courses are no longer designated as core or basic courses and new perspective courses, but are organized by areas of knowledge and skills needed by health sciences librarians as described in the Educational Policy Statement of the MLA: Competencies for Lifelong Learning and Professional Success (<http://www.mlanet.org/education/policy/>).^[5]

Courses are offered at the association's annual meeting and by chapters at their annual meetings. Also, MLA's annual meeting schedule frequently includes symposia on important topics, such as scholarly publishing and leadership development. The course approval process (<http://www.mlanet.org/education/cech/cedevelop.html>) is a rigorous one, and course evaluations are carefully considered by the Continuing Education Committee (CEC). Contact hours are awarded to course participants based upon the number of hours students are in class.

The MLA CEC and headquarters staff worked together to establish MLA's Educational Clearinghouse (<http://cech.mlanet.org>), an online listing of continuing-education opportunities, from a variety of sources that support the core competencies deemed necessary and appropriate for health sciences librarians in their professional development. The Educational Clearinghouse has proven to be an effective resource in furthering health sciences librarians' professional development. Currently information about over 200 courses is available through the clearinghouse. MLA is also working with the National Training Center and Clearinghouse (NTCC) (<http://nnlm.gov/ntcc>), part of the National Network of Libraries of Medicine (NN/LM), to add the NTCC's courses and tutorials to MLA's Educational Clearinghouse.

The kinds of courses offered, both in subject matter and in format, have also changed. The increasing number of courses about Internet applications reflects the tremendous change in the practice of health sciences librarianship over the past 10 years. Courses such as searching the Web for quality health information, developing Web-based CE courses, negotiating licenses for electronic journals and databases, expert searching, and consumer health have been offered. MLA also continues to address the challenge of offering quality and affordable professional development opportunities to people both regionally and at their desktops. MLA's first teleconference in 1996, "The Role of the Library in Accreditation," was received by over 100 sites in the United States and Canada and was seen by about 1300 people. MLA now offers Webcasts to both groups and individuals and provides access to a number of Web-based courses and tutorials on a variety of profession-specific topics.

The demand for Web-based courses continues to increase, and this demand will prove challenging for small associations with few staff and fewer financial resources. To meet this demand, MLA also partners with graduate schools of library and information sciences; supports development of specialty specific Web-based courses; provides

access to Web-based courses from other providers; and develops less costly, local opportunities for CE including independent learning opportunities and discussion groups. Success in effectively using new technologies in this area is essential for the continued success of MLA's continuing education program. Since 2008, MLA has provided hosting services for e-learning courses to encourage the development of these important learning formats.

MLA's move into distance education has increased participation in the association's continuing education program over 700% from 1990 (1,245 participants) to 2008 (9,210 participants).^[6,7]

Specialist credentials

In 2000, MLA established a specialist program in consumer health (CHIS), developed for health sciences librarians as well as other librarians working in the area of consumer health. The program consists of basic and advanced courses on various aspects of consumer health (<http://www.mlanet.org/education/chc/>) taught by health sciences librarians. The program was introduced in 2001 at the "The Public Library and Consumer Health" Conference cosponsored by MLA, the Public Library Association, and the National Library of Medicine. By 2008, almost 400 librarians had received the CHIS credential.

Credentialing and the Academy of Health Information Professionals

MLA has the oldest ongoing recognized credentialing program in the library profession. MLA established the Academy of Health Information Professionals (AHIP) (<http://www.mlanet.org/academy/>) in 1989 to encourage individual professional growth and lifelong learning in health sciences librarianship. The academy replaced a test-based certification program that had been in place since 1973. Since health sciences librarians work with physicians, nurses, and allied health workers who require licenses or certifications and recertifications to continue to practice in their chosen professions, health sciences librarians also felt a need to seek additional credentials beyond the MLS as a way to document their continuing education and demonstrate continued competency in their profession. Today, admission to the Academy is based upon educational qualifications, documented knowledge in established knowledge and skills or competencies areas, and professional contributions through teaching, publishing, or holding leadership positions in the association and its units.

Membership in the Academy is open to both MLA members and nonmembers. Over 1000 health information professionals belong to the academy at one of five levels: provisional, member, senior, distinguished, or emeritus member. Data from the 2008 Hay Group/MLA Salary Survey^[2] indicated that academy members were better compensated than nonmembers, but more analysis is

needed to establish a cause and effect relationship. MLA, through its Credentialing Committee and mentorship program, continues to simplify the application process to encourage membership in the Academy as part of an individual's lifelong learning program.

ADVOCACY

MLA plays a strong advocacy role on behalf of its members to demonstrate the value of quality health information to society and the role that health information professionals play in producing and managing that information. This is achieved through the association's professional recognition, governmental relations, and public relations programs.

Professional Recognition

The grants and scholarships program (<http://www.mlanet.org/awards/grants/>) and the awards program (<http://www.mlanet.org/awards/>) remain strong components of MLA's professional recognition program. At the close of 2008, endowment funds for this purpose represented 44% of the association's total assets.

Grants and scholarships

MLA offers a variety of scholarships and grants administered by the Grants and Scholarships Committee. These stipends assist qualified students, including minorities to attend graduate schools of library and information sciences and enable practicing health sciences librarians to take advantage of opportunities for continuing professional development. This program also enables recipients to attend meetings and conferences and do research important to the practice and progress of the profession.

For example, in 2001, MLA established the Lindberg Research Fellowship, honoring Donald A.B. Lindberg, M.D., director of the National Library of Medicine (NLM), in recognition of his significant national and international achievements at NLM, the world's largest medical library. This research fellowship, given annually, strives to provide a more formal structure for supporting research activities that will benefit the health information sciences by strengthening the knowledge base of information research and improve the practice of health sciences librarianship.

Awards

The awards program, administered by MLA's Awards Committee, honors superior individual achievement in specific areas of health sciences librarianship including hospital librarianship, collection development, history or philosophy of the profession, chapter programs, education,

research, governmental relations, and distinguished public service. Named in honor of distinguished health sciences librarians such as Estelle Brodman, Lois Ann Colaanni, Eileen Cunningham, Louise Darling, Janet Doe, and Lucretia McClure (<http://www.mlanet.org/awards/honors/fellows/>) and honorary members and sponsored by MLA corporate partners important to health sciences libraries, awards are given annually. MLA also honors those who have made outstanding and sustained contributions to the advancement of the purposes of MLA through fellowships and honorary memberships.

Governmental Relations

MLA's governmental relations program (<http://www.mlanet.org/government/>) addresses national information issues and policies that affect the health sciences library community. The association testifies before Congress on a regular basis on the importance of the National Library of Medicine to the provision of clinical and scientific information that supports medical education, research, and, ultimately, improved patient care. MLA has published position papers on a number of issues including fair use, copyright, scholarly publishing, open access, patient safety, and distance education. The association also works in coalition with the other major library associations such as the American Association of Law Libraries and the Special Libraries Association on issues of mutual concern in copyright and scholarly publishing. MLA will continue to partner with other organizations to address information access issues as they continue to evolve in this very complex digital environment.

Public Relations

MLA began a major public relations effort in 1996 to help promote the association's Centennial Celebration in 1998. Today, the program focuses on assisting MLA members and other health sciences information professionals to market their expertise and services both to their institutions and to outside publics. MLA provides a number of advocacy resources (<http://www.mlanet.org/resources/index.html>) including posters for librarians to use in their institutions to heighten awareness of the value of the services provided by the medical libraries and librarians. The association has designated October as National Medical Librarians Month (<http://www.mlanet.org/resources/nml-month/index.html>) to help members promote their services to their institutions and users.

Deciphering MedSpeak publications

The public relations program also aims to create awareness of the health sciences library and information profession through several outreach initiatives to consumers. Distribution of consumer health information such as the

Deciphering Medspeak series, in both English and Spanish (<http://www.mlanet.org/resources/medspeak/>) provides general and disease specific health and Web site information to the public in a simple format, creating awareness of the profession and assisting the public.

Health information literacy

MLA's health information literacy initiative began in 2003 with the appointment of a Health Information Literacy Task Force that studied how health sciences librarians could put "information" into health literacy initiatives, resulting in a number of resources (<http://www.mlanet.org/resources/healthlit/>). This work continued through 2008 with a major health information literacy research project funded through a contract with NLM to study health providers' perceptions of health information literacy and develop a curriculum to support these initiatives in the hospital. With the Pew Internet and American Life Project, MLA members also developed a user's guide to finding and evaluating health information on the Web (<http://www.mlanet.org/resources/userguide.html>) and other consumer resources.

MLA will continue to use its public relations program as an advocacy tool for the profession by addressing the needs of specific membership segments such as hospital librarians or academic medical center librarians. Members increasingly recognize the important role public relations can play in the perceived value of the library and librarian to the institution and to the community.

CREATING AND COMMUNICATING OUR KNOWLEDGE

Research

Part of MLA's mission is to promote research in information management and the profession. Several of the association's grants and scholarships provide stipends for those interested in doing research that will contribute to the profession's body of knowledge. In 2007, MLA published a revision of its research policy statement. The Research Imperative (http://www.mlanet.org/research/policy/policy-of_toc.html).^[8] The revised statement encourages new directions for the association's research program. In 2008, MLA, working through its Research Section, adopted a research agenda to guide the association and its members in research efforts. In addition, MLA sponsors research studies in areas that will help the profession. For example, the MLA Benchmarking Network (<http://www.mlanet.org/members/benchmark/>) offers hospital, academic, and specialty health libraries an opportunity to learn more about benchmarking, compare data, establish best practices, and identify and work with a benchmarking partner. Hundreds of health sciences libraries nationwide participate. Other

studies including MLA's Vital Pathways Project for Hospital Librarians (<http://www.mlanet.org/resources/vital/>) deal with the compensation, the value of information services to institutions' bottom lines, and new roles for health sciences information professionals (<http://www.mlanet.org/research/index.html>). MLA also posts presentations and posters presented at the association's annual meetings on MLANET and has developed a member area on the Web site, the CORE Toolbox, where members can exchange ideas, research, and other helpful information. The association will continue to partner with other organizations to provide research data and resources that will assist health sciences librarians and the public.

Publications

The association's publications program, accomplished through the work of the *JMLA* and *MLA News* Editorial Boards and the Books Panel, encourages and publishes research in health sciences librarianship, provides texts for those studying to be health sciences librarians, provides authorship opportunities for health sciences librarians, and provides consumer health materials for the public. The venerable *Journal of the Medical Library Association (JMLA)* (<http://www.mlanet.org/publications/jmla/index.html>) published almost continually under several names since 1902, was one of MLA's first regular publications. The journal has been made freely available electronically since January 2000 over *PubMed Central (PMC)*, a digital archive of life sciences journal literature developed and managed by the National Center for Biotechnology Information (NCBI) and NLM. In 2006/2007, NLM, working with MLA Headquarters, made the full-text archives of the journal from 1902 freely available online through PMC, putting into practice MLA's support of open access. This is an excellent resource for the study of health information sciences and the management of knowledge-based information.

A Handbook of Medical Library Practice^[9] was one of the first texts published by MLA in the association's book publications program and went through four editions over a 40-year period. The handbook was succeeded by *Current Practice in Health Sciences Librarianship*,^[10] a multivolume series completed in 2001. Until about 1990, all association publishing was centralized at MLA headquarters. In 1990, MLA began working with a series of copublishers to produce a number of noteworthy books and other resources, adding to the research base of the profession (<http://www.mlanet.org/order/index.html>). This includes *The Medical Library Association Guide to Managing Health Care Libraries*,^[11] recognized as "the new gold standard in health sciences library textbooks."^[12]

During the 1990s, MLA expanded its publishing program (<http://www.mlanet.org/publications/>) to include DocKits and BibKits. These publications are collections

of documents or bibliographies of resources about specific topics and are published in-house. MLA also publishes materials in compact disc and digital formats to make information more widely available. Other components in the program are house publications (annual report, Directory, MLA-FOCUS) and *MLA News* (<http://www.mlanet.org/publications/mlanews/>). Experimentation with alternate formats will continue for the foreseeable future as the association continues to convert print products into electronic ones and develop new digital products and services.

Professional Networking

Since associations were one of the early ways in which people of common interests came together, it is not surprising that associations have adopted an increasing variety of social networking tools for the benefit of their members. The association's Web site, MLANET (<http://www.mlanet.org>) provides MLA with a global reach and reveals the richness of our resources and the expertise of our members as never before possible. MLANET not only provides organizational information about MLA, the Web site also provides member networking services; acts as a resources gateway; contains career, educational, and recognition information; and provides online access to research, standards, and publications.

For many years, MLA has supported MEDLIB-L (http://www.mlanet.org/discussion/medlib_l_faq.html), a discussion list that has over 2100 member and nonmember participants. The list is used for interlibrary loan, reference, announcements, and other items that help health sciences librarians in their daily work. MLA headquarters

staff also support more than 100 discussion lists, blogs, wikis, and other social networking tools for association units and provides space on MLANET for section and chapter Web sites. Most recently the association has supported blogs, wikis, and RSS feeds for various association units to improve communications and collaboration.

MLA's annual meeting (<http://www.mlanet.org/am/index.html>) (Fig. 2), held annually in May, continues to be the top face-to-face professional networking event for the profession. It is an opportunity to present and discuss papers, posters, applied research, and important issues in health sciences information management. The event gives MLA members and affiliated professionals a chance to share ideas, hear from experts, see the latest products, network, and socialize. MLA has actively begun to push annual meeting content out to members who can't attend through a variety of social media tools.

BUILDING A NETWORK OF GLOBAL PARTNERS

MLA works actively to serve health care providers and the public through a global network of members and partners who share expertise and resources. Some of the programs already mentioned support this goal through collaborations among the association's sections and chapters, other library associations and organizations, and the international library and information community. In the international arena, MLA is a longtime active member of the International Federation of Library Associations and Institutions (IFLA) and supports the International Congress on Medical Librarianship (ICML) held every 4–5 years around the world. MLA's global initiatives are a part of



Fig. 2 MLA's annual meeting is the premier event in the health information sciences profession.



Fig. 3 2007/2008 MLA President Mark E. Funk, AHIP (center, back row), with members of the South African National Health Information Partnership at the 2007 IFLA Conference and Exhibition in Durban, South Africa.

the association's Librarians without Borders® program (<http://www.mlanet.org/resources/global/>) that includes a sister library initiative, a world-wide e-library training program, and the T. Mark Hodges International Service Award program. MLA also has bilateral agreements with the Canadian Health Libraries Association/ABSC, the German Working Group, the European Association of Health Information Libraries, the Association for Health Information and Libraries in Africa (AHILA), and the Korean Medical Library Association (KMLA) and connects with health sciences librarians throughout the world (Fig. 3)—a truly global organization.

In 2006, MLA assumed management of the Association for Library and Information Science Education (ALISE) strengthening our ties with the library education community. Founded in 1915 as the Association of American Library Schools, ALISE provides a forum for library educators to share ideas, to discuss issues, and to seek solutions to common problems. MLA members also formally represent MLA at a number of other allied organizations (<http://www.mlanet.org/about/leaders/allied.html>).

CONCLUSION

MLA continues to work actively to recruit people into the health sciences information profession, to promote and support lifelong learning, to advocate on behalf of the profession, to create and communicate the profession's knowledge, and to build a network of global partners to serve the member, the profession, and society. For example, the association is working on several future challenges for the profession concerning roles of the health sciences librarian, including the Vital Pathways Project for Hospital Librarians and the Health Information

Literacy Research project. The association is also furthering the concept of evidence-based medicine through the support of conferences and publications in this area. Future challenges for MLA as for many other associations are in the areas of membership recruitment, technology, finances, outside competition, and environmental impacts. Keeping up with new technologies to provide programs and services is a tremendous challenge for a small association. However, MLA continues to be a vital organization after more than 100 years of operation. One of the major reasons that the association was founded was to provide for an exchange of materials among its membership. Today, the MLA Exchange is transmitted electronically among 900 subscribers and has become just one of many programs and services that MLA provides for its membership. MLANET, MLA's Web site, is the association's face to the world, enabling a librarian in India to teach MLA's health literacy and health information literacy concepts to medical staff and librarians from Australia and Asia to participate in its Web-based courses. There has never been a more exciting or challenging time to be a librarian or a library association staff member.

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Medical Literature: History [ELIS Classic]

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Abstract

One of the objectives of the information disciplines is to study the universe of recorded information—that is, to study the documentary products of domains of human activity—and to come to understand such bodies of literature as social and historical phenomena in and of themselves. Beatty discusses the rich history of medical literature from ancient times to the mid-twentieth century. Forms of bibliographic control, such as *Index Medicus*, are also covered.

—ELIS Classic, from 1976

INTRODUCTION

The earliest extant piece of medical literature is a Sumerian clay tablet that contains medical recipes. This tablet, approximately 4 × 7 inches and made of baked red clay, probably dates from about 2100 B.C. It is written in Sumerian cuneiform and contains 15 prescriptions but no supernatural elements. The Code of Hammurabi, from approximately the same time, includes some regulations on medical practice and penalties for failure to produce a cure.

Many of these clay tablets, or rather in most cases fragments of clay tablets, were in the collection of King Assurbanipal of Assyria who lived in the seventh century B.C. The British Museum has over 30,000 of these, several hundred of which are medical. Many drugs, plants, and minerals are referred to in medical prescriptions, and some tablets also contain incantations. One series of these tablets was used for letters from the royal physician, Aradnana, to King Esarhaddon.

The papyri from Egypt, most of which were written around 1500 B.C. (although their contents in some cases include much older material), present interesting examples of the early medical literature. The oldest of these, written about 1900 B.C., was discovered by Sir Flinders Petrie in 1889 at Kahun. The Kahun Papyrus is now at University College in London. A transcript and English translation by F.L.I. Griffith was published in 1898. Three pages in length, this papyrus deals with gynecological material.

A major surgical papyrus, the Edwin Smith, dates from about 1600 B.C. and was obtained at Luxor in 1862 by Edwin Smith, an American. The papyrus itself is at the New York Academy of Medicine; a translation and transliteration of it was published by James H. Breasted in 1930. This roll is a little less than 16 feet long, 1 foot wide, and has writing on both sides. The 17 columns on the front describe 48 cases, most of which involve injuries to the head, chest, or spine. The five columns on the back contain charms unrelated to the material on the front.

The most famous of these medical papyri is the Papyrus Ebers, written about 1550 B.C. This was discovered about 1860 and acquired at Thebes by Georg Ebers in 1873. Most of the material in it comes from a much earlier period, perhaps as far back as 3000 B.C. The Ebers is the only papyrus extant that is complete. The roll was originally 68 feet long, a foot wide, with 108 columns of 20 lines each. It was later cut into pages and bound as a modern book. This is now in the University Library at Leipzig; a translation by Ebbell was published in London in 1937. The text consists primarily of 877 prescriptions, one of which contains 37 ingredients. Frequently occurring items include opium, hellebore, salts of lead and copper, and blood, excreta, and viscera of animals. The last section describes the treatment of tumors.

Also from about 1550 B.C. is the Hearst Medical Papyrus, named for Mrs. Sophie B. Hearst who gave the money for the excavations that produced it. This papyrus is preserved at the University of California. The scroll contains 18 columns and is incomplete. It consists of a formulary (apparently used by a practicing physician) quite similar to parts of the Ebers Papyrus. Both papyri probably came, at least in part, from the same source. The Hearst Papyrus also contains descriptions of three methods for uniting bones. A translation into German and a transliteration by Wreszinski appeared in 1901.

The Berlin Museum has a papyrus of 15 columns dealing with childbirth and infants, which also dates from about 1550 B.C. This was translated into German by Erman in 1912. The British Museum in 1860 purchased the London Medical Papyrus, which was written about 1350 B.C. In 1912, Wreszinski published a German translation of this. Wreszinski also published in 1912 German translations of the Berlin Medical Papyrus and the Brugsch Maior Papyrus. Both of these are preserved in Berlin. They date from about 1300 B.C., and the former contains some 200 prescriptions. The Chester Beatty Papyrus, with eight columns extant, concerns diseases of the anus and

was probably written around 1200 B.C. Jonckheere published a French translation in 1947.

The Babylonian Talmud includes considerable material on anatomy and surgery, although this is mostly embedded in statements about the law. Tumors of the lungs, diseases of the liver, and diphtheria are also mentioned. Amputations, trephining, and other surgical procedures are referred to briefly. The Old Testament contains many regulations dealing with public health and hygiene. The isolation and care of individuals with contagious diseases, and the prohibition of certain foods (with logical overtones of preventing sickness) form the bulk of this material.

EARLY GREECE, INDIA, AND CHINA

Items of medical and surgical treatment appear in Homer, mostly in the *Iliad*, but the Greek medical literature itself did not actually begin until Alcmaeon of Crotona, a younger contemporary of Pythagoras and the most famous Greek physician before Hippocrates. Only a few fragments of Alcmaeon exist. He is credited with the discovery of the optic nerve, knowledge of the trachea, and the belief that the brain was the central organ of intellectual activity. Other pre-Hippocratic authors of importance include Anaxagoras, who wrote of the dissection of animals and recognized the lateral ventricles of the brain, Empedocles, who was the first to formulate the theory of the flux and reflux of the blood from and to the heart, and Diogenes of Apollonia, whose small book on the heart became the outstanding anatomical work in the Hippocratic Corpus and exerted considerable influence.

The Hippocratic Corpus is a large collection of medical writings, some credited to Hippocrates but most of which were probably written by pupils or even later authors. These range from medical textbooks and reports of investigations, through lectures for medical students all the way to works obviously intended for laymen. The works that are generally attributed to Hippocrates include the three books of Epidemics; Regimen in Acute Diseases; Airs, Waters, and Places; Fractures; Joints; Wounds of the Head; Ancient Medicine; Prognostics; and Prorrhethics. Hippocrates is best known for his careful clinical observations and for his reporting of his failures as well as his successes. The first printed complete edition of the works of Hippocrates appeared in a folio at Rome in 1525. This Latin text was based on manuscripts in the Vatican. The first Greek edition was published by Aldus in 1526, and is one of the most beautiful productions of Hippocratic material. Other outstanding editions include Froben's printing at Basel in 1538 of Janus Cornarius's carefully edited text, the 1588 Venice edition by the Junta with both Greek and Latin texts, and the beautiful Vienna edition of 1743–1749. The 10-volume edition by Littré, which was originally published in 1839–1861 and reprinted in 1961–1962, is basic. English translations are available by Francis

Adams (first printed in 1849 and reprinted in 1964) and by W.H.S. Jones and E.T. Withington, in four volumes, in the Loeb Classical edition (1923–1931). The first French translation was done at Lyons in 1555, the first Spanish one in Madrid in 1757–1770, and the first German edition in Altenburg in 1781–1792.

While the Greek medical literature lies in the main stream of our own heritage, this was not the only area of such activity. India and China both made substantial contributions to the medical literature. Susruta wrote one of the major works in the Sanskrit literature, and one that is especially important in such surgical matters as extraction of cataract, caesarean section, lithotomy, and plastic surgery. Over 760 medicinal plants are mentioned. Charaka, another Hindu writer, produced a medical treatise around 400 B.C. This was translated into Arabic and Persian in the tenth century A.D., and an English translation was published in 1949 (six volumes).

Pien Ch'iao (Ch'in Yüeh), who flourished in the first half of the fifth century B.C., supposedly wrote the *Nan Ching*, a medical treatise of 81 chapters, in which he developed the theory of the pulse. This became one of the most popular Chinese medical works, has had many commentaries, and was translated into German. The *Nan Ching* was based in good part on an even earlier work, the *Huang Ti Nei Ching*, which was probably written about 1000 B.C. Chapters 1 to 34 were translated into English by Ilza Veith in 1949.

Among the Greeks that came after Hippocrates was, of course, Aristotle, whose dissections of animals added much to the basic medical literature. The best edition of his works was a Greek-Latin text in five volumes published in Berlin in 1851–1870. An English translation edited by J.A. Smith and W.D. Ross was published in 12 volumes by Oxford, 1908–1952. A son-in-law of Hippocrates, Polybos, wrote *On the Nature of Men* around 400 B.C., and this became the main source for the theory of the four humors. Diocles of Carystos, called the “second Hippocrates” in Athens, shortly thereafter wrote the first work entitled *Anatomy* and the first work on medical botany.

A pupil of Aristotle, Menon, wrote an important book in verse that summarized the pathological views of the predecessors and contemporaries of Hippocrates. A student's notebook based on this work and dating from about A.D. 150 was found in Egypt and provides an important link to a truer perspective of the Hippocratic doctrines.

Nacandros of Colophon in Ionia used both prose and verse for his works on drugs, poisonous animals, and prognostics. He was the first to speak of the therapeutic use of leeches. Aldus published his *Theriaca et Alexipharmaca* in Greek in 1499. A Latin translation appeared at Cologne in 1531 and a French translation came out in 1568. Another Greek writer on drugs, Servilius Damocrates of Athens (fl. A.D. 60–80), attempted to provide a safety feature in his prescriptions by couching them in iambic trimeters. In this way any careless changes

in the numbers made by the copyists could be detected. This can be looked on as an early form of the check digit used in some computer programs.

The works of the Greek medical writers, Erasistratus and Herophilos, of the Alexandrian School (flourished around 300 B.C.) were caught up in the destruction of the Alexandrian Library under Theodosius the Great. Some fragments of their texts and comments on their work have been preserved in the writings of Galen and others. Erasistratus was among the first physicians to discard the humoral theory, and his experimental work has led some to call him the founder of physiology.

Apollonios of Citium, around 100 B.C., wrote a commentary on Hippocrates' *On Articulations* that has survived in a ninth century A.D. manuscript illustrated with figures that probably date from even earlier times.

Specialization occurs in Greek times, and Demosthenes Philalethes (fl. A.D. 60) wrote an important work on ophthalmology that was a major source for many years. Manuscripts were still being made of this in the fourteenth century.

The work of Xenocrates of Aphrodisias appeared around A.D. 70. This was a major source for Pliny's *Natural History*, which had a profound and far-reaching effect in the medical literature as well as in many other areas.

At about this same time Pedacius Dioscorides, a Greek army surgeon, wrote his *materia medica*, which was to be widely used for 1500 years. This work, describing some 600 medicinal plants, survives in a beautifully illustrated manuscript written about 512 and preserved in the National Library at Vienna. The first Latin edition was printed at Colle in 1478, and Aldus produced the first Greek text in 1499. This is a typically beautiful Aldine production but is of great rarity. An Italian translation was printed in Venice in 1542, German in Frankfurt in 1546, and Spanish in Amsterdam in 1555.

The first major text in obstetrics and gynecology was written by Soranus of Ephesus (A.D. 98–138). His acute observations and excellent teaching ability are evident in his accounts of obstetric manipulations and of infant hygiene and nutrition. His writings were later the sources for Rösslin's *Rosengarten* (1513) and Raynalde's *Byrthe of Mankynde* (1545). Soranus gave sources for his quotations, one of the first writers to do this with any consistency. Most of his works have been lost, although his text on gynecology has survived in Greek and an English translation was made by Temkin in 1956.

LATIN AND GREEK MANUSCRIPTS

The earliest scientific medical work to be written originally in Latin was the *De Re Medicina* of Aurelius Cornelius Celsus, a layman. The eight books making up this compilation were based on Hippocrates. It became one of the most frequently produced medical publications,

although it was barely noticed either by Celsus's contemporaries or the medieval commentators. The first printed edition appeared in Florence in 1478. Over 105 editions of Celsus have been printed. In addition to the Florentine, which is quite rare, important editions were produced in Milan in 1481, in Venice in 1524, by the Aldine press in 1525, and by the Elzevirs in 1657. The Loeb Classical Library published a three-volume English translation by Walter George Spencer in 1935–1938.

Pliny produced his *Historia Naturalis* in the first century A.D. Three books of this deal with medicine. Many manuscripts and early printings of this exist. The first printed edition appeared in Venice in 1469.

Galen, second only to Hippocrates among the authors of Greek medical literature, lived from A.D. 130–200. Galen's writings—nine books on anatomy, 17 on physiology, six on pathology, 14 on therapeutics, and 30 on pharmacy—provided standards in medicine for over a thousand years. Much of his work has not been available in English until recently. In fact, his *On Medical Experience* was unknown until 1931 when a manuscript of it was found in Istanbul and translated from the Arabic into English by Walzer (1944). A major English translation was made by Margaret T. May of his *On Usefulness of the Parts of the Body*, which was published in two volumes in 1968. Galen's other major anatomical work, *On Anatomical Procedures*, has been translated in two parts, the first by Singer in 1956 and the second by Duckworth in 1962. Rudolph Siegel has translated substantial portions of Galen's work in his volumes, and Paul W. Harkins translated *On the Passions & Errors of the Soul* in 1964. Much of Galen's work was preserved only through the medium of Arabic translations.

The first Latin edition of Galen's works to be printed was done in 1490 in Venice where the first Greek edition, in five volumes, was printed by Aldus in 1525. Conrad Gesner did a Latin translation in 1562. The best text was the Greek-Latin edition done by Kühn at Leipzig (20 volumes, 1821–1833). A reprinting began in 1964.

China continued to produce medical works of importance. The most famous was the *Shang Han Lun* (*Essay on Typhoid*) published in A.D. 217 and written by Chang Chung-ching, the "Hippocrates of China." Hua T'o (Yüan), ca. A.D. 190–265, wrote medical and surgical works that were also translated into Japanese. Huang Fu (Shih An), ca. 215–282, wrote widely, and his most famous treatise, *Chia-i-Ching*, on acupuncture, became the basis for all future works on this subject.

From the fourth through the seventh centuries a number of Greek compilers performed valuable services for the medical literature by gathering many manuscripts and commenting on them. These compilations provide us today with our only knowledge of many writers.

Oribasius (325–403) was the first of these. His two encyclopedias preserved much material that would otherwise be lost. A Latin edition of his works was printed at

Basel in 1557. The best edition is a French translation by Bussemaker and Daremberg (six volumes, Paris, 1851–1876). Oribasius carefully explained Galen's doctrines, preserved many of his writings, and did much to establish the supremacy of Galen in the medical literature for the next thousand years. Oribasius also wrote a four-volume work, *Euporista*, designed to present reliable medical information to the laity.

Aëtius of Amida (502–575) compiled the *Tetrabiblion*, which contains many valuable quotations. Froben printed a Latin translation by Montanus and Cornuarius at Basel (1533–1535, 1542).

Alexander of Tralles (525–605), another compiler, included some of his own observations on worms and vermifuges in his compilations, and so could be called the first parasitologist. The first printed edition appeared at Lyons in 1504. The best text is the Greek-German edition produced by Puschmann at Vienna (1878–1879). This was reprinted at Amsterdam in 1963.

Paul of Aegina (625–690) wrote an *Epitome* in seven books that included many of his own valuable writings on lithotomy, tonsillectomy, amputation of the breast, and the first clear description of lead poisoning. The Aldine Press produced a Greek edition in 1528, and a Latin translation was done in Paris in 1532. Francis Adams, under the auspices of the Sydenham Society, made an English translation in three volumes (1844–1847).

Medical writing appeared in Spain in the seventh century: three books of Isidore of Seville's massive encyclopedia dealt with medical subjects. Shortly thereafter in England the Venerable Bede wrote on bloodletting and the rehabilitation of sufferers from aphasia.

ARABIC WRITINGS, SCHOOL OF SALERNO, AND LATE MANUSCRIPTS

Major developments in the Middle Ages took place in the Arabic literature and at the School of Salerno just south of Naples. The ebb and flow of religious and military struggles had led to the establishment of a medical school at Jundishapur in Persia in the middle of the eighth century. The need for texts produced both translations and original writings. Hunain ibn Isabq Al-Ibadi made translations of Hippocrates, Galen, Oribasius, and others from Greek into Arabic and so helped to preserve the works of these writers during the destructive times that had settled on Europe. Among the Arabic authors to make substantial contributions to the literature were Rhazes (860–932) who gave the first accurate descriptions of smallpox and measles. His major work, the *Al-Hawi* or *Continents*, was compiled posthumously from notes made by his students. The ninth book of this was used as a basis for therapeutics for several centuries; one of the revisions of it was done by first printed edition, by Britannicus at Brescia in 1486, ranks not only as an important work in the history of the

medical literature but also as (at 22 pounds) the heaviest of the medical incunabula.

The location of pieces of the medical literature can sometimes come as a surprise. Two leaves of a twelfth-thirteenth century manuscript of Rhazes were found in the twentieth century by J. Christian Bay as he was preparing a sixteenth century volume for rebinding. The Rhazes material had been incorporated in the covers of the newer work.

The “Prince of Physicians,” Avicenna (980–1037), included many of his own original observations in his major work that codified all medical knowledge known at that time. This publication, the *Canon*, became the standard text for many years and was used in European and Asian universities for five centuries. The original Arabic version was printed at Rome in 1593, the first of many Latin editions was printed in 1472, and an edition in Hebrew appeared at Naples in 1491. However, much of Avicenna's work has not been printed, and very little is available in English.

The leading textbook of surgery during the Middle Ages was the *Altastrif* written by Albucasis (936–1013), a native of Zahra near Cordova. This was based on the work of Paul of Aegina. An excellent Arabic-Latin edition was done by Channing at Oxford (two volumes, 1778). Portions of this have been translated into English by Spink (1937).

Another major contributor growing from the Arabic conquests was Moses Maimonides (Rabbi Moses ben Maimon) who lived from 1135 to 1204. Born at Cordova, Maimonides became court physician to the sultan at Cairo. Maimonides's *Aphorisms* was his most popular medical work, but he wrote on many subjects including poisons, personal hygiene, and asthma. His list of drug names in Arabic, Greek, Persian, Berber, and Spanish was of great importance. The Arabic manuscript for this list was not discovered until 1932. Maimonides did his writing in Arabic but the books were immediately translated into Hebrew. English translations of his works by Munter, Rosner, and Danby have been appearing since the 1950s.

The preservation of Greek and Latin works in Arabic was an outstanding contribution of this period. The gradual retranslation back into the original languages began as early as the eleventh century. Constantinus Africanus, a native of Carthage working at Salerno and Monte Cassino, translated many of the manuscripts of Hippocrates and Galen out of Arabic and also helped to make the works of Rhazes and Avicenna known to the physicians of Western Europe. Other well-known translators of a slightly later date were Gerard of Cremona and Michael Scotus.

The School of Salerno, which flourished between 1050 and 1200, not only provided a home for many translators such as Constantinus but also itself contributed important works to the literature. The poetic handbook of domestic medicine known as the *Regimen Sanitatis Salernitanum* is the most famous of these; over 100 manuscripts of this exist in European libraries and more than 500 editions

have been printed. Many of the major works produced at Salerno are contained in the twelfth-century Breslau Codex, which was discovered in 1837.

A new form of medical literature, “consilia,” sprang up in the fourteenth and fifteenth centuries. These took the form of medical casebooks or clinical records. Some of these were written in the form of letters from a physician to his student or colleague. The consilia of Alderotti, a thirteenth-century physician of Bologna, became widely known.

In the three centuries immediately preceding the invention of printing from movable metal type, several manuscript works became especially well known. Lanfranc of Milan completed his major text on surgery in 1296. This was translated into English about 1380 and became the first important surgical work to appear in that language. The first printed version was supposedly done at Venice in 1490 but no copy of it has been found. However, a French translation at Lyons in the same year does exist. An English edition was printed in 1565. Other important surgical works were written by Theodoric, Henri de Mondeville, and Guy de Chauliac. Mondeville incorporated illustrations of separate organs and full-length pictures in his manuscripts.

Mondino de Luzzi of Bologna wrote a practical manual of anatomy that was completed in 1316 and served as the only textbook of anatomy for use in medical schools until well into the next century. The first printed edition appeared at Pavia in 1478. Over three dozen editions and translations of this popular work were eventually published. Charles Singer produced an English translation in 1925.

One of the most popular surgical works of this period was the *Chirurgia Magna* written in 1363 by Guy de Chauliac. The Bibliothèque Nationale alone has 14 manuscript versions; 43 French editions, 16 Latin, five Italian, and four Dutch editions are known. It was also translated into English, German, Italian, Spanish, Hebrew, Provençal, and Catalan.

Major medical writers in England included Gilbertus Anglicus (ca. 1166–1230), who had studied at Salerno, and John of Gaddesden (1280?–1361), who wrote the *Rosa Anglica*, *Practica Medicina a Capite ad Pedes* in 1314. When this was edited by Nicolaus Scyllatius Siculus in 1492 it became the first printed medical book by an Englishman. Many manuscript and printed versions of the *Rosa* still exist.

The first pharmacopoeia in the modern sense appeared in the middle of the fifteenth century. The *Compendium Aromatorium* by Saladinus de Asculo of Tarento, was used by apothecaries for centuries. It also served as a model for all of the early pharmaceutical textbooks.

EARLY PRINTED WORKS

With the invention of printing from movable metal type in the middle of the fifteenth century the medical literature

underwent a rapid and widespread growth, much more so than many other disciplines. The earliest example extant of such printed medical literature is the top half of a purgation calendar printed at Mainz in 1457. These calendars gave the best dates for bleeding and purging, were very popular, and were apparently worn out by their users. The Mainz Kalendar was printed with the same Gutenberg types used for the Thirty-Six Line Bible. It was discovered in 1803 and is now in the Bibliothèque Nationale.

Another popular form of the early printed medical literature was the “Pestblätter.” These tracts, giving advice on treatment of the plague, were issued throughout Europe; originals and facsimiles are housed in many current collections. The printed tracts are descended from a manuscript form, one of the earliest representatives of which was written by John of Burgundy in 1365.

A fascinating off-shoot of medical printing, in production approximately from 1493 to 1683, is known as the anatomical fugitive sheet. Manuscripts of a medical nature had gradually been making more use of illustrations in the centuries just before the modern type of printing started. When this much faster method of production became available a flood of these sheets, most of which were designed for the curious layman, poured from presses in many countries. These sheets were generally on good quality soft, rather thick paper, and measured about 30 × 40 cm (some were substantially larger). A central anatomical figure was usually surrounded by a descriptive text and often a decorative border. The illustrations were done either by woodblock or copperplate. The earliest sheets were printed in black; colors were soon introduced. The first texts were generally in Latin, but vernacular versions rapidly appeared. Simple skeletons formed the earliest subjects (frequently in the rather distorted, almost frog-like, patterns of the manuscripts). There were sheets of a single male or female figure, of the “Adam and Eve” plates, and then of the *Tabulae* originally produced by Vesalius in 1538. The Vesalian sheets were plagiarized and edited at a great rate.

Most of these fugitive sheets were single, although some consisted of two sheets with the second containing most of the descriptive text. The Vesalius set ran to six sheets, and a variation on this by Walter Ryff was composed of 10. Superimposed flaps were used to show different levels of the viscera. A pregnant uterus was frequently one level of these flaps, and the fetus in these representations was often in the cowering “see no evil” position. As this form of publication became more sophisticated, as many as a dozen or more such flaps would be used. These reached their peak in the work of Remmelin in the seventeenth century.

Anatomical illustrations also appeared in the early printed medical books. A major example is found in Johann de Ketham’s *Fasciculus Medicinae*. This collection of short treatises was first printed in Venice in 1491 with rather primitive woodcuts. However, the beautiful

figures in the 1493 edition were probably done directly from a dissection. Ultimately 33 editions were published, and it was translated into several languages. Singer translated it into English in 1925 and a facsimile of the 1493 edition was printed in 1963.

The book usually referred to as the first printed medical book is really a general encyclopedia with a chapter on medicine. Adolf Rusch of Strassburg printed the *De Sermonum Proprietate, seu de Universo* of Rabanus Maurus probably in 1467. Book 18, Chapter 5, deals with medicine; it was translated into English by Jessup in 1934. The earliest printed medical books included the following titles. The “*Speculum Vitae Humanae*” by Rodericus Zamorensis was printed by Sweynheym and Pannartz at Rome in 1468. Pliny’s *Historia Naturalis* was printed by Johannes de Spira in Venice in 1469, and in Rome in 1470 by Sweynheym and Pannartz. Gulielmus de Saliceto, professor of surgery at Bologna in the middle of the thirteenth century, was especially popular in medical incunabula with several of his works appearing in the 1470s. Two editions of his *De Salute Corporis* were printed in 1470. Albucasis’ *Liber Servitoris*, translated by Simon Januensis, was printed by Nicolas Jenson in Venice in 1471. In that same year Jenson also printed one of the most popular works from the School of Salerno, Nicholas’s *Antidotarium*. The *Opera* of Joannes Mesue, Junior, was produced in two versions by Clemens Patavinus at Venice in 1471.

In April 1472 the first medical work in German, the *Regimen Sanitatis Deutsch*, was printed by Johann B  mler. This was translated into many languages and appeared in about 250 editions. The first printed medical book in Italian was by Gulielmo de Saliceto, *La Ciroxia Vulgarmento Fata*, done by Filip di Pietro at Venice in 1474. This is also very likely the first printed work on surgery. The first French book, as might be expected, was Guy de Chauliac’s *Chirurgia Magna*, printed at Lyons in 1478. Pediatrics achieved its first printed work in the form of the *De Infantium Aegritudinibus et Remediis* by Paolo Bagellardi, done at Padua in 1472. The first work in ophthalmology was published a year earlier in Ferrara, *De Oculis Eorumque Aegritudinibus et Curis* by Benvenuto Grassi. Casey Wood translated this into English in 1929.

The first practical medical dictionary to appear in print was the *Aggregator Paduanus de Medicinis* by De Dondis done by Rusch in 1480, although fragments exist from Simone de Cordo’s *Synonyma Medicinae seu Clavis Sanationis* printed at Ferrara in 1471 or 1472.

The John Rylands Library in Manchester has the only known copy of the first medical book printed in England. This was written by Canutus (Knutsson), Bishop of Arusiens, and is entitled *A Litil Boke the which Traytied and Reherced many Gode Things necessities for the...Pestilence*, and published by William Machlinia at London in 1485. Machlinia produced new versions in 1488 and 1490, the latter claiming some fame as being

the first English book with a title page. Wynkyn de Worde published an edition of this in 1510. William Caxton printed the second English medical book, *Governayle of Helthe*, in 1489, and de Worde later reprinted this.

The rapid spread and increasing numbers of medical books produced by the development of modern printing makes it necessary from now on to be much more highly selective.

The earliest printed herbal, the grandfather, so to speak, of a major class of medical works, was the *Herbarium* of Apuleius Barbarus (the “Pseudo-Apuleius”) printed at Rome in 1481. The contents of this herbal dated back to the fourth century. Gunther produced a modern English translation at Oxford in 1925. A manuscript herbal of considerable interest, written by the Aztec Indian physician Martinus de la Cruz, and translated into Latin by another Aztec, Juannes Badianus, in 1552, is housed in the Vatican Library. A beautiful color facsimile, with translation into English by Emily Walcott Emmart, was published at Baltimore in 1940.

Many intriguing medical works called “olas” were written on the leaves of talipot palms in Ceylon and neighboring areas between 1400 and 1750. Most of these contained prescriptions, some were primarily magical, and a few had illustrations.

THE SIXTEENTH CENTURY

Vesalius was the earliest outstanding contributor to the medical literature after the invention of modern printing. He performed his first public anatomy at Bologna in 1540 (when he was just 26 years old), and the notes made on that occasion by one of his students, Baldasar Heseler (five or six years older than his teacher), were translated into English by Eriksson and published at Stockholm in 1959. Vesalius’s major work, *De Humani Corporis Fabrica Libri Septem*, was printed by Oporinus at Basel in 1543. This monumental work, the first scientific text in anatomy, is one of the classics in the development of the medical literature. Vesalius based his work on his own dissections, and questioned many of the statements made by Galen that had been widely accepted and used for almost 1500 years. No English translation of the complete *Fabrica* has yet appeared, although a handsome facsimile was produced at Brussels in 1963. The “muscle men” plates by Calcar, a pupil of Titian, are works of both art and science. An epitome was issued the same year, and a corrected and expanded edition of the *Fabrica* came out in 1555. An English translation of the *Epitome* by Lind was published in New York in 1949.

The Vesalian plates were plagiarized far and wide. Thomas Geminus, both a surgeon and an engraver, persuaded Henry VIII to underwrite the publication of his *Compendiosa*, which was based on Vesalius. The copper plates, engraved by Geminus, marked this as the first

illustrated textbook published in England. Nicholas Hyll printed it at London in 1545, an English translation by Nicholas Udall appeared in 1553, and Charles O'Malley produced a facsimile of Udall's translation in 1959.

Important contributions to the publication of anatomical information were made by Eustachius in his *Opuscula Anatomica* printed at Venice in 1564. He had completed 38 copper plates for another book, but was prevented by death from publishing it. These plates disappeared for 150 years; they were finally discovered by Lancisi and published as the *Tabulae Anatomicae* at Rome in 1714.

Eucharius Rösslin, a physician at Worms and Frankfurt-on-Main, compiled the first printed textbook for midwives from the earlier work of Soranus of Ephesus. This *De Swangern Frauen und Hebammen Roszgarten*, illustrated by woodcuts, was printed in 1513 at Strassburg. It became widely used, went through at least 40 editions, and was translated into Dutch, Czech, French, Latin, and English.

The first medical book by a medical man to be originally written and printed in English was the *Breviary of Health* by Andrew Boorde. This was published by Middleton at London in 1547, and five more editions had appeared by the end of the century. The *Breviary* was an important contribution to family medicine despite the facts that Boorde was the model for the term "A Merry Andrew," left as one of his aphorisms the true statement, "Myrth is one of the chiefest thynges in Physicke," and died in the Fleet Prison.

In 1530 appeared the major poetic contribution to the medical literature, Girolamo Fracastoro's *Syphilis, sive Morbus Gallicus*. This was printed by do Sabbio at Verona, and went through over 100 editions, being translated into Italian, English, French, German, Spanish, and Portuguese. Fracastoro's poem recognized the venereal cause of syphilis, gave the disease its name, and referred to mercury as a remedy.

The first major text in physiology, the *De Naturali Parte Medicinae* by Jean Fernel, was printed at Paris in 1542. The original edition is rare but later editions from France and Italy are more common. Fernel also wrote important contributions on pathology and therapeutics, as well as mathematics and astronomy.

An original thinker by the name of Philippus Aureolus Theophrastus Bombastes von Hohenheim, better known as Paracelsus, shot across the medical scene in the first half of the sixteenth century. He did much to change the emphasis in medicine to a more chemically oriented viewpoint, and advanced the availability of the medical literature by writing in his native German rather than Latin. Ambroise Paré, the great surgeon, was increasing his accessibility in the French medical literature. Until medical works became available in the vernacular, the spread of medical knowledge was considerably limited.

A German work holds an important place in the development of the ophthalmological literature. Georg

Bartisch, the founder of modern ophthalmology, had his *Ophthalmouoleia, das ist Augendienst* published at Dresden in 1583. This book, well-illustrated with woodcuts, makes use of the overlays found in some of the anatomical fugitive sheets. A facsimile was issued in 1966.

Paré, who made his name as a military surgeon and the royal surgeon to four kings of France, wrote up his discovery of a new method of treating wounds (rather than the previously used boiling oil) in 1545. This went through several editions and was translated into Dutch and English. A handsome folio edition of his complete works appeared at Paris in 1575. A facsimile of the best French edition (Lyons, 1585) was reprinted in 1962. Paré's works were translated into Latin (1582), marking acceptance by the conservatives, and into English, by Thomas Johnson, in 1634. German, Dutch, and Japanese translations were also published. Several of Paré's works contain striking illustrations of surgical instruments and prostheses.

The literature of plastic surgery received its first major contribution from the pen of Gaspare Tagliacozzi of Bologna. His *De Curtorum Chirurgia per Insitionem*, published at Venice by Bindoni in 1597, has become a classic. This was issued in a pirated edition the same year. Despite the importance of Tagliacozzi's work, both Paré and Fallopius spoke out against him, and the Church dug up his body and reburied it in unconsecrated ground.

Although there was an increasing number of original contributions by contemporary authors, the classical writers were not forgotten. The first English translation of Hippocrates, done by Peter Lowe, was published in 1597. An excellent Latin translation of Hippocrates' *Aphorisms* was produced by François Rabelais.

The first book on pediatrics to be written in English was published in 1545 when *The Boke of Children* by Thomas Phaïre appeared as an addendum to an English translation Phaïre had made of the *Regimen Sanitatis Salerni*. Many later editions of the *Boke* were published, and it was reprinted in 1955.

In bringing the medical literature of the sixteenth century to a close, we may note the earliest medical works printed in America. The first of these, Francisco Bravo's *Opera Medicinalia*, was published in Mexico in 1570. Only three copies of this are now known. The *Summa y Recopilacion de Cirugia* by Alphonso Lopez de Hinozoso, the first important surgical work produced in the Americas, was published in 1578 with a second edition in 1595. The first text in anatomy was Farfan's *Tractado Brebe de Anothomia y Chirurgia*, printed in 1579.

THE SEVENTEENTH CENTURY

The outstanding medical book of the seventeenth century, and one of the classics of all time, was William Harvey's *Exercitatio Anatomica de Motu Cordis et Sanguinis in Animalibus*, often called simply the *De Motu Cordis*. This

small volume, in which Harvey announced his discovery of the circulation of the blood, was published by William Fitzer at Frankfort in 1628. A few copies were printed on heavy paper, and these have become top prizes in the book-purchasing efforts of both institutions and individuals. Important editions were produced at Padua in 1643 and 1689; Rotterdam in 1648, 1654, 1660, 1671; London, 1660; Bologna, 1697; Leyden, 1736; Glasgow, 1751; and Edinburgh, 1824. Dutch and English (1653, 1673) translations have been made. A modern translation by Kenneth Franklin came out in 1957. Harvey is one of the few medical authors who has not only had a bibliography of his works compiled (by Geoffrey Keynes) but has had it go into a second edition. Several manuscripts important to Harvey's work have recently been translated and printed by Gweneth Whitteridge, Kenneth Franklin, and others.

The "first of the great English surgeons," Richard Wiseman, had his *A Treatise of Wounds* published in London in 1672. Copies of this are in the British Museum and the National Library of Medicine. Wiseman's *Severall Chirurgicall Treatises*, published in 1676, another important work, went through many editions.

The "English Hippocrates," Thomas Sydenham, emphasized careful and detailed observations. Among his outstanding contributions to the medical literature were his work on gout, *Tractatus de Podagra et Hydrope*, published at London in 1683, and books on hysteria and fevers. His complete works, published in Amsterdam (1683) and London (1685), went through many editions and translations. The best English translation was done by R.G. Latham in 1848–1850. Sydenham's medical notes and observations were printed at Oxford in 1845 as *Anecdota Sydenhamiana*. Sydenham wrote his works in English and had them translated into Latin so that they could achieve a wider circulation. Several of his manuscripts have recently been described and work is continuing on these, especially on the relationships between Sydenham and John Locke.

One of the most fascinating English medical authors of this period was Nicholas Culpeper. His writings were especially popular with apothecaries and laymen although he was a classical scholar. The first, *Pharmacopoeia Londinensis*, was published in 1618 by the College of Physicians (a facsimile was produced in 1944). Since this was in Latin, the information it contained was not accessible to most people. Culpeper translated it into English as *A Physicall Directory* in 1649, and aroused the unforgiving wrath of the College. When the second edition came out in 1650, Culpeper translated it also (1653), and this was rapidly spread both legally and piratically over many countries. An edition printed in Boston in 1720 probably has title to being the first full-length medical work to be produced in the colonies. Culpeper's *A Directory for Midwives*, London, 1651, was so popular that by 1777 it had been reprinted 17 times.

In 1651 Francis Glisson produced his *De Rachitide, sive Morbo Puerili, qui Vulgo The Rickets Dicitur* in London, and Culpeper promptly translated it into English. Culpeper's most famous work was probably his herbal, *The English Physitian*, which appeared in three editions its first year (1652); 14 more came out before 1700, and over 100 editions have been printed.

Culpeper's appeal through his herbal, anti establishment translations, and lively style has been long lasting. As recently as 1910 he was the subject of a story by Rudyard Kipling.

The seventeenth century saw the first major work on vital statistics by John Graunt, Edmund Halley, and Sir William Petty. The Italian, Sanctorio Sanctorius, wrote up his careful studies on the physiology of metabolism based on experiments on himself using a steelyard balance. His *De Statica Medicina*, first published in Leipzig in 1614, went through at least 20 editions and several translations. In his commentary on the first book of Avicenna's *Canon* (1625), Sanctorius described his development and use of a thermometer and a pulse-clock in both text and picture.

The first major work in medical jurisprudence was published in a nine-volume set, 1621–1661, at Rome and Amsterdam. The *Quaestiones Medico-Legales* was written by Paolo Zacchias, a Papal physician, who may be looked on as one of the founders of this field.

Another "founder" of a field was active appeared at the same time. In 1623 the first important work on tropical medicine appeared, the *Tratado de las Siete Enfermedades* by Alexo de Abreu, printed at Lisbon. Abreu's text contained the first accurate descriptions of yellow fever and amebic hepatitis.

Although Francis Glisson had been a member of a committee selected to write a book on rickets, most of the medical literature produced up to this time had been the work of individuals (as Glisson's book eventually turned out to be). In the seventeenth century scientists began to assemble in societies for the purpose of presenting papers and exchanging information. This development had a profound and far-reaching effect on the production of medical literature by giving birth to the concept of important, stable, scientific periodicals.

The Royal Society of London was formally organized in 1660, and began publication of its *Philosophical Transactions* on March 6, 1665. This journal, still being published, has had the honor of printing many substantial contributions to the medical literature by such authors as Lower, Hooke, Leeuwenhoek, Cowper, Cheselden, Priestly, Hunter, and many others, as well as important work by relatively unknown individuals (e.g., smallpox inoculation by Timoni and Pylarini). Over 80 papers printed in the *Philosophical Transactions* have merited a place in the *Garrison-Morton Bibliography* of contributions to the history of medicine.

Other societies in different countries were also formed at this time. The Collegium Naturae Curiosorum was founded in Germany in 1651 and produced the first volume of its *Miscellanea Curiosa sive Ephemeridium Medico Physicorum Germanorum* in 1670.

The earliest periodical with some medical material to be printed in France was the *Journal des Scavans*, which began on January 5, 1665, and is still being published. Nicolas de Blegny's *Nouvelles Découvertes sur Toutes les Parties de la Médecine* ran from 1679 to 1683; this was the first medical journal in the vernacular although it had a separate Latin version as well. Early medical periodicals in both the seventeenth and eighteenth centuries were often translated into other languages and had several editions of some or all of their volumes.

The first medical journal in English, *Medicina Curiosa*, had its first issue (of two) out on June 17, 1684. The only other English medical journal of the seventeenth century was the *Hippocrates Ridens*, which was born and died in 1686. The *Acta Medica et Philosophica Hafniensia* was printed in Denmark from 1673 to 1680.

Prior to the appearance of the periodical, current medical information was usually transmitted by letter. One physician would include clinical observations in a letter to a colleague who would then reply with comments and questions. A particularly important letter might be circulated by its recipient among his colleagues so that the information could reach a wider audience. This could in turn provoke additional letters back to the original writer.

Other manuscript sources of medical literature included student notebooks which were often retained by the graduate for later consultation while in practice. This was particularly true of the North American colonists who attended medical school in Great Britain or on the continent and returned to the colonies to practice. Some of these notebooks were indexed for easier location of information.

Manuscript compilations of prescriptions would also serve as medical works, especially in the absence of printed materials. These would sometimes be used both in the clinical work of the practitioner and as a textbook for his apprentices.

The North American colonies, later to become the United States of America, saw the first glimmerings of medical literature in the seventeenth century. The first such document printed in the colonies was *God's Terrible Voice in the City of London* by Thomas Vincent, an account of the plague in London in 1665. This 31-page booklet was printed at Cambridge in 1668 by Marmaduke Johnson. The American Antiquarian Society at Worcester has a copy.

The first piece of medical literature to be written and printed in this country was Thomas Thacher's *A Brief Rule to Guide the Common-People of New-England how to order themselves and theirs in the small pocks or measles*, printed by John Foster at Boston in 1678. This broadside, 17 × 12 5/16 inches, exists in only a single copy, which is at the

Massachusetts Historical Society. Benjamin Harris at Boston printed in 1694 a 129-page book by John Olwer entitled *A Present to be Given to Teeming Women*, a copy of which is held by the New York Academy of Medicine Library.

The first medical book published in South America was the *Dos Tratados*...by Francisco Figueroa, which appeared at Lima in 1616. No copy of this is known to exist today.

THE EIGHTEENTH CENTURY

One of the classic works appeared just before the end of the century. On May 14, 1796, Edward Jenner, a pupil of the great John Hunter, performed his first vaccination for smallpox. In June 1798 his classic, *An Inquiry into the Causes and Effects of the Variolae Vaccinae*, was printed in London by Low. Jenner described in it his 23 successful vaccinations, and also presented what is probably the first mention of anaphylaxis. A second edition was published in 1800 and a third in 1801. The book spread with almost the same rapidity as the disease itself. Ashley and Brewer reprinted the second edition at Springfield, Massachusetts, in 1802, and it appeared at Hanover (1799), Vienna (1799), Lyons (1800), Lisbon (1803), Pavia (1800), Haarlem (1801), and Madrid (1801). Later it reached Russia and Australia. Facsimiles have been printed at Milan (1923), Denver (1949), and London (1966). LeFanu produced a biobibliography of Jenner in 1951.

The outstanding English surgeon of this century was John Hunter, who was the one individual primarily responsible for placing the field of surgery on a scientific foundation. Hunter had been a pupil of both Cheselden and Pott, and had also studied with his older brother, William. John Hunter's most important book was his *A Treatise on the Blood, Inflammation and Gunshot Wounds*, first published in 1794 shortly after his death. This appeared in three more editions at London and in three editions at Philadelphia (the first by Thomas Bradford in 1796). French and German translations were produced before the end of the century.

Hunter's *Observations on Certain Parts of the Animal Oeconomy* was first published in 1786 with a second edition in 1813. A German translation appeared the same year. Hunter's detailed work in comparative anatomy and his own skillful operative procedures did much to raise the level of surgery.

His *A Treatise on the Venereal Disease* was published at London in 1786 and was most popular. Many editions and translations were produced.

Hunter not only had an excellent museum at his home but also his own private press, which produced his three most important books. He contributed to the periodical literature by papers in the *Philosophical Transactions*, but despite these publications much of his work was still in manuscript form at his death. His brother-in-law,

Everard Home, used this material for his own lectures and writings and then destroyed many of these valuable items.

John's older brother, William, made a major contribution to the medical literature in the form of the *Anatomia Uteri Gravid Tabulis Illustrata*, one of the finest anatomical atlases ever published. This was printed by John Baskerville in 1774 with 34 life-size copper plates and text in both Latin and English. The Sydenham Society reprinted it in 1851. Baskerville's only other medical publication had appeared 12 years earlier, *Virtues of Cinnabar and Musk Against the Bite of a Mad Dog* by J. Dalby.

The most outstanding eighteenth century English contribution to anatomy was made by the surgeon-anatomist William Cheselden in 1733 with publication at London of his *Osteographia, or the Anatomy of the Bones*. This covered all human bones as well as many of those in animals. Accuracy in the illustrations was achieved by using a camera obscura, devised by Cheselden. A facsimile of the *Osteographia* was printed in 1968.

Cheselden's *The Anatomy of the Human Body* was first published in 1713 when he was 25. Thirteen editions of this popular work had appeared by 1792; two American editions were published (1795 and 1806) and a German translation appeared in 1790.

Another anatomist who used careful measurements and mechanical assistance in the production of an atlas was Bernhard Siegfried Albinus, a pupil of Boerhaave. According to one report Albinus spent 24,000 florins on the illustrations (by Jan Wandelaar) for his atlases, the most important of which, *Tabulae Sceleti et Musculorum Corporis Humani*, was published at Leyden in 1747 with English editions in London, 1749, and Edinburgh, 1777.

Percival Pott made many substantial contributions to the surgical literature on ruptures, injuries of the head, fistulas, fractures, hydroceles, amputations, and cataract. These monographs frequently appeared in many editions and were often translated. Pott was also known for his work on curvature of the spine, cancer of the scrotum, and tumors.

James Lind produced his classic work, *A Treatise of the Scurvy*, in 1753. He described his experiments with citrus fruit in combatting this major problem for navies, explorers, and commercial sailors. Lind gave credit to previous writers on the subject, but it was his book and continued efforts that ultimately led to the control of this problem. The treatise was reprinted in 1953.

The first English text on dermatology, *De Morbis Cutaneis* by Daniel Turner, was printed in London in 1714. A pharmacological classic, William Withering's *An Account of the Foxglove and some of its Medical Uses*, was published at Birmingham in 1785. A facsimile edition was printed at London in 1949. The first English historian of medicine also appeared in this century, John Freind, whose 2-volume work, *The History of Physick; from the Time of Galen to the beginning of the sixteenth century*, was published at London in 1725–1726. Freind planned

out this history while he was in the Tower of London on a charge of high treason.

Another major work in the history of medicine appeared just 4 years later in France. Daniel LeClerc's *Histoire de la Médecine* ranks as the first major work in its field, one that is still consulted today. Although the first edition had appeared in French in 1696 and a translation into English was printed in 1699, the 1729 French edition is the best.

Kurt Sprengel's monumental 5-volume *Versuch einer pragmatischen Geschichte der Arzneykunde* was printed at Halle, 1792–1803. This has been a foundation stone for many later works in the history of medicine.

The outstanding physician of the eighteenth century, Hermann Boerhaave, published many works himself on clinical medicine, physiology, and chemistry, and substantial commentaries were produced by his students, especially Gerard van Swieten. Boerhaave's works, the most important of which were the *Aphorismi et Cognoscendis et Curandis Morbis in Usum Doctrinae Domesticæ* (first edition, Leyden, 1709) and the *Elementa Chemiæ* (first edition, Leyden, 1732), appeared in many editions and translations.

One of the all-time medical classics was published in 1761 at Venice. This was Giovanni Battista Morgagni's 2-volume *De Sedibus et Causis Morborum per Anatomen Indagatis Libri Quinque*. With this monumental publication Morgagni became the founder of modern pathological anatomy. Morgagni, professor of anatomy at Padua, correlated his findings at autopsy with the clinical records of some 700 patients. An English translation, done by Alexander in 1769, was reprinted in 1960.

A much smaller book, although also a medical classic of considerable proportions, came out the same year at Vienna. This was Leopold Auenbrugger's *Inventum Novum ex Percussione Thoracis Humani ut Signo Abstrusos Interni Pectoris Morbos Detergendi* in which he described his discovery of percussion. The *Inventum Novum* did not catch on until Corvisart produced his French translation in 1808, which led to percussion achieving its role of major importance. Forbes did an English translation in 1824; this was reprinted in 1936.

Medical publication began in earnest in the North American colonies that later became the United States. Pamphlets were an important feature of the early years of the century with the pamphlet war over smallpox inoculation taking place in the 1720s and 1730s and involving such individuals as Cotton Mather, Zabdiel Boylston, William Douglass, and Benjamin Franklin. Pamphlets also appeared on other communicable diseases and medical problems. Much of the early medical literature was printed in newspapers.

Cadwallader Colden wrote many pamphlets and texts, including his *Treatise on Wounds and Fevers* (printed about 1765—no copy is known today), which became a standard authority for many years. Thomas Cadwalader wrote his *Essay on the West-India Dry-Gripes* in 1745. It

described lead poisoning from rum. John Lining wrote important papers on metabolism and yellow fever.

In 1765 a classic work in medical education appeared, John Morgan's *A Discourse upon the Institution of Medical Schools in America*. This small book set the pattern for medical education in this country and had a considerable influence in other countries as well.

Four years later Samuel Bard wrote his *A Discourse upon the Duties of a Physician*, the first book on medical ethics in the North American colonies. It preceded Thomas Percival's important contribution by 25 years. Bard also wrote (1771) another major work, *An Enquiry into the Nature, Cause and Cure of the Angina Suffocativa* (one of the earliest accurate descriptions of diphtheria). The first colonial publication on medical history, Peter Middleton's *A Medical Discourse, or an Historical Inquiry into the Ancient and Present State of Medicine*, was published in 1769.

John Jones, drawing heavily on the writings of earlier English surgeons, produced the first surgical book published in the colonies in 1775. His *Plain Concise Practical Remarks on the Treatment of Wounds and Fractures* went through four editions and was the standard guide used during the Revolution.

One of the physicians who signed the Declaration of Independence, Benjamin Rush, was a prolific contributor to the literature of medicine and several other fields. Of importance were his *An Account of the Bilious Remitting Yellow Fever* (1794) and *Directions for Preserving the Health of Soldiers* (1778).

Two major medical works by laymen appeared in the last decade of the century. One of these, Mathew Carey's *A Short Account of the Malignant Fever, lately prevalent in Philadelphia* is an important description of yellow fever that was frequently reprinted and was translated into French and German. The other, a 2-volume set, was Noah Webster's *A Brief History of Epidemic and Pestilential Diseases*, 1799.

The first medical publication in Canada was the *Direction pour la Guérison du Mal de la Braie St. Paul*, published at Quebec in 1785, and the earliest general medical treatise produced in the Americas was Juan Manuel Venegas' *Compendio de la Medicina: ó Medicina Practica* from Mexico in 1788.

Books on home medicine were produced in the colonies just as they were in many other areas of the world. The first completely American offering was Dr. John Tennent's *Every Man His Own Doctor: or, the Poor Planter's Physician* (1734), which went through several editions and was widely used. Popular also were colonial reprints of Culpeper's *The English Physician* (Boston, 1708) and William Buchan's *Domestic Medicine* (over 30 American editions between 1771 and 1815).

The physician, in the early days of the United States, who wanted to write an article for publication in a medical journal had to look either outside the country or to a

nonmedical journal. England and France were favorites among the foreign countries. In fact it was a translation of a French medical journal, *Journal de Médecine Militaire*, whose first volume was published in New York around 1790 as the *Journal of the Practice of Medicine and Surgery and Pharmacy in the Military Hospitals of France* that has a tenuous claim to being the first medical journal published in the United States. Among the nonmedical journals in the United States favored by physicians for their medical articles were the *Memoirs of the American Academy of Arts and Sciences*, *American Museum*, *Philadelphia Monthly Magazine*, and the *Royal American Magazine*.

The first truly indigenous American medical journal was the *Medical Repository* whose first issue appeared on July 26, 1797. This was printed in New York by T.&J. Swords, and edited by Samuel Latham Mitchill, Edward Miller, and Elihu Hubbard Smith. This quarterly journal, the brainchild of Smith, the youngest of the three, met with immediate success and continued publication through volume 23 for 1824. Important articles that appeared in the *Medical Repository* included John Otto's "An Account of an Hemorrhagic Disposition Existing in Certain Families" [6, 1–3, (1803)], the first (American) description of hemophilia, and John Stearn's report of the first use of ergot in childbirth [2d Hexade, 5, 308–309 (1808)]. Outstanding authors whose articles were printed in these pages also included Philip Syng Physick, Benjamin Rush, Benjamin Waterhouse, and Noah Webster.

Transactions of various medical societies appeared sporadically in Europe. Early British medical journals (strictly speaking) included the *Foreign Medical Review* (1779–1880) and the *London Medical Journal* (1780–1800). The first substantial representative of this group was the *Medical and Physical Journal of London* (a continuation of the *Medical Facts and Observations*), which lived from 1799 to 1814. Much of its content consisted of translations and comments on articles from foreign journals.

The first major French medical journal was *Le Journal de Médecine, Chirurgie et Pharmacie*, which was published from 1754 to 1794 and 1801 to 1817. The *Gazette de Médecine* appeared under a variety of titles from 1761 until 1792. The *Gazette de Santé* began in 1773 and continued until 1829 when it became the *Gazette Médicale de Paris*. The *Journal General de Médecine, de Chirurgie et de Pharmacie* ran from 1796 to 1830.

Germany's first medical journal, from Leipzig, was the *Deliciae Medicae et Chirurgicae* which began in 1703 but lasted only until 1705. The *Natur und Medizin Kunst und Literature Geschichte* was published at Breslau from 1717 to 1729. The first major German medical journal was the *Acta Medicorum Berolinensium* which ran from 1717 to 1731. The first surgical journal to appear in Germany was Richter's *Chirurgische Bibliothek* (1771–1797). A semi-weekly journal, Hartenkeil's *Salzburger medicinisch-chirurgische Zeitung*, had enough material to keep going

from 1790 to 1842. The first established journal in medical history was edited by the scholarly Sprengel; the *Beiträge zur Geschichte der Medicin* lasted from 1794 to 1796.

The first major medical journal produced in Italy was the *Giornale per Servire alla Storia Ragionata della Medicina di questo Secole* which was printed in Venice from 1783 to 1790.

THE NINETEENTH CENTURY

Among the English medical books of this century to make a lasting impression on the medical literature must certainly be counted Henry Gray's *Anatomy, Descriptive and Surgical*. The first edition of "Gray's" was published in 1858, just three years before the author's early death from smallpox at 34. John W. Parker & Son published the first two editions (the only ones seen by Gray), and Henry Carter drew the illustrations. The first American edition was published in 1859, and the two countries have regularly produced separate editions since then (current editions, both for 1973, are the thirty-fifth in England and the twenty-ninth in the United States.)

One major feature of the nineteenth century was the appearance of the specific monograph, a trend which has increased in the present. An outstanding example of this was James Parkinson's *An Essay on the Shaking Palsy*; the original account of this eponymous disease was published by Whittingham and Rowland in London in 1817. The American Medical Association printed a facsimile in honor of the book's centennial, and Dawsons printed another facsimile in 1959. This essay has been twice reprinted in the journal literature (1922 and 1937–1938), and a German translation appeared in 1912.

A good example of the growing emphasis on journal publication is presented by the career of Sir James Paget who died in 1899. His name is memorialized in two diseases, and both of the original descriptions appeared not in book form but in journal articles. "On Disease of the Mammary Areola Preceding Cancer of the Mammary Gland" was printed in *St. Bartholomew's Hospital Reports* in 1874. "On a Form of Chronic Inflammation of Bones (Osteitis Deformans)" appeared in the *Medico-Chirurgical Transactions* in two papers (1877 and 1882). The *Reports* from St. Bartholomew's are an outstanding representative of this form of medical literature. Seven volumes of Paget's manuscript casebooks, another important facet of the literature, are in the Medical College Library at Bart's.

The French Revolution held up the publication of Philippe Pinel's *Traité Medico-Philosophique sur l'Aliénation Mentale ou la Manie* from 1792 until 1801. When this classic was finally published it created a great impetus for improvements in the treatment of the insane. An English translation appeared in 1806.

The invention of the stethoscope not only led to Laennec's *De l'Auscultation Mediate* in 1819, one of the most influential books of the century, but it also became the first "give-away" gimmick to accompany the sale of a book. Laennec's set (the first edition was in two volumes) had four more French editions, two printings in Belgium, seven English editions (the first in 1821), four printings in the United States (the first two in 1823), three German editions, and an Italian edition. The original French version was reprinted in 1962.

Claude Bernard, the founder of experimental medicine, published many of his important research reports in the burgeoning journals, but his *Introduction a l'Étude de la Médecine Experimentale*, first published at Paris in 1865, probably ranks as one of the most stimulating works in the medical literature. This edition was reprinted in 1949, and an English translation was produced in 1927.

The founder of scientific medicine in Germany was Johannes Peter Müller who, while primarily a physiologist, also had substantial interests in biology, comparative morphology, and pathology. Müller's two-volume *Handbuch der Physiologie des Menschen für Vorlesungen* (Coblenz, 1834–1840) was translated into both French and English. He founded the *Archiv für Anatomie, Physiologie, und wissenschaftliche Medicin* in 1834, a respected vehicle for many important papers over the years.

The most important German work on the history of medicine yet produced was written by Heinrich Haeser. The first edition of his *Lehrbuch der Geschichte der Medicin und der Volkskrankheiten* was published at Jena in 1845, and a three-volume third edition came out in 1875–1882.

The age of modern medicine was ushered in by *Die Cellularpathologie* of Rudolph Virchow in 1858. This was reprinted in 1966 and was translated into English (1860) and French (1861). Virchow, who was active in politics, anthropology, and history as well as medicine, was the founder of the *Archiv für pathologische Anatomie*, still known as *Virchow's Archiv*.

As a final example of the German medical literature of the nineteenth century the pioneering work of Wilhelm Conrad Röntgen may be cited. Röntgen never even wrote a book on X-rays, and his classic contribution took the form of a 10-page article in a rather obscure journal. Reprints of this article (which first appeared in 1895) are among the most expensive (per page) items in the history of the medical literature.

One of the major Russian contributions to the medical literature, Pavlov's *Lectures on the Work of the Principal Digestive Glands*, was published (in Russian) at St. Petersburg in 1897. A French translation appeared in 1901 and an English version in the following year.

During the nineteenth century medical literature in the United States was blossoming quickly and in many areas. Caspar Wistar wrote the first text in anatomy, the

two-volume *System of Anatomy*, which was published in 1811–1814, Robley Dunglison's textbook of physiology came out in 1832. Benjamin Smith Barton's *Elements of Botany* (1812) was the first book on materia medica and therapeutics, and Jacob Bigelow's three-volume *American Medical Botany* (1817–1820) achieved a considerable renown.

The first general pharmacopoeia was produced by the Massachusetts Medical Society in 1808, and 12 years later—also in Boston—appeared the first pharmacopoeia of the United States. The first Dispensary was published in 1833. The first substantial textbook of surgery was John Syng Dorsey's *Elements of Surgery* which came out in 1813.

Samuel Bard wrote the first textbook in obstetrics, *Compendium of the Theory and Practice of Midwifery*, in 1807. William Dewees has credit for the first United States texts in pediatrics (1825) and gynecology (1826).

The United States produced several classics in the literature of medicine during this century. In 1812 Benjamin Rush wrote his *Medical Inquiries and Observations upon the Diseases of the Mind*, which was not only the first American book in that field but also ranks as a landmark in its subject. In 1833 William Beaumont's *Experiments in Digestion* describing his investigations on Alexis St. Martin, the half-breed who miraculously survived a point-blank gunshot wound, was published. A British edition was published in Edinburgh in 1838. A German translation appeared in 1834. A facsimile of the 1833 edition was produced in 1929. In 1850 and 1854 the two volumes that composed Daniel Drake's *A Systematic Treatise, Historical, Etiological, and Practical, on the Principal Diseases of the Interior Valley of North America* were printed. In 1859 the first of six editions of Samuel David Gross' *A System of Surgery* was published, two volumes that did much to raise the level of American surgery both practically and in the eyes of the rest of the world. Among Gross's several monographs, the *Elements of Pathological Anatomy* and *A Practical Treatise on the Diseases, Injuries and Malformations of the Urinary Bladder, and Prostate Gland, and the Urethra* each went through three editions. William Osler published his *Principles and Practice of Medicine* in 1892, a textbook that set a standard for single-author works of this type. "Osler" went through many editions and was translated into a wide variety of languages.

The first United States medical journal after the *Medical Repository* was the *Philadelphia Medical Museum*, founded by John Redman Coxe, which ran through seven volumes between 1804 and 1811. This form of medical publication spread rapidly with the first medical journal appearing in Massachusetts in 1806 (*Medical and Agricultural Register*), in Maryland in 1808 (*Baltimore Medical and Physical Recorder*), in Ohio in 1822, Connecticut in 1823, and South Carolina in 1825. The first medical journal to appear west of the Mississippi was the *St. Louis Medical and Surgical Journal*, which began in 1843 and

continued for many years; and the first on the West Coast appeared in 1856, the *San Francisco Medical Journal*, which lasted for only one issue. The *Pacific Medical and Surgical Journal*, also from San Francisco, began in 1858 and was the first West Coast medical journal to be successful.

David Hosack and John W. Francis edited the *American Medical and Philosophical Register* through its four volumes (1810–1814), producing a second edition of the first volume, a practice that was fairly common at that time.

As medical journals became more accepted by both readers and authors as a means of transmitting medical information, important articles began to appear and important journals began long runs. Ephraim McDowell's report of his classic ovariectomy was printed in the *Eclectic Repository and Analytical Review* [7, 242–244 (1817)]. William Beaumont's first report on his studies of St. Martin's stomach appeared in the *American Medical Recorder* [8, 14–19 (1825)]. The author was erroneously given as Joseph Lovell, the surgeon general, but this mistake was corrected later in the same volume.

The *American Journal of Science*, which early contained much material of medical interest, was founded in 1818 by Benjamin Silliman and continues to this day.

The *Philadelphia Journal of the Medical and Physical Sciences* was founded by Nathaniel Chapman in 1820 as a patriotic response to Sydney Smith's slur earlier that year in the *Edinburgh Review*, "In the four quarters of the globe, who reads an American Book? or goes to an American play? or looks at an American picture or statue? What does the world yet owe to American physicians or surgeons?" This quotation appeared on the title page of Chapman's journal for several years, and the journal itself became in 1827 the renowned *American Journal of the Medical Sciences*, still published today. Its first editor, Isaac Hays, was one of the leaders in American medical journalism.

The early American medical journals contained many articles on meteorological conditions, fevers, and surgical procedures. Later, translations of articles (either summarized or complete) from the foreign journals often appeared. News items took up many pages, and editorials—sometimes of a vitriolic nature—showed the use of the medical journal as a platform for individual, institutional, or sectarian controversy.

The *Boston Medical Intelligencer* was founded in 1823 by Jerome F.C. Smith as this country's first weekly medical journal. In 1828 it was merged with the *New England Journal of Medicine and Surgery* (which had begun in 1812) to form the *Boston Medical and Surgical Journal*. This, one of the leading medical journals in the country, changed its title in 1929 to the *New England Journal of Medicine*, and now occupies one of the highest positions in medical journalism throughout the world.

The first sectarian journal, the *Medical Advocate*, was founded by Samuel Thomson in 1827 to promote the Thomsonian (Botanical) System.

Among the important American medical journals that did not have long lives was the *Transylvania Journal of Medicine and the Associate Sciences* which ran from 1828 to 1839 and included many important papers.

The first American homeopathic journal, the *American Journal of Homoeopathia*, began and ended publication in New York in 1835.

The *Journal of the American Medical Association* began its weekly appearances with Volume 1, Number 1, for July 14, 1883. American medical journals were now being published by a wide variety of commercial concerns, specialty and geographical societies, and by hospitals and medical schools.

The first medical journal to be published in Canada began at Quebec in 1826. The *Journal de Médecine de Quebec* was printed in both French and English although the contents of the two sections were different. This quarterly lasted for two years. The first English-language journal was the *Montreal Medical Gazette* which began in 1845. Medical journalism had spread over most of the country by 1911, when the *Canadian Medical Association Journal* came out with its first issue.

English periodical medical literature was roused out of its quiet existence in 1823 by the appearance of Thomas Wakley's *Lancet*. Wakley believed in responsibility and progress in medical practice, education, and journalism, and the *Lancet* provided an effective platform for his often outspoken comments and aggressive approaches. He backed his beliefs by court appearances as both a plaintiff and a defendant. He even carried his programs into Parliament and was able to lead reform movements in several areas. During his controversial career Wakley kept the level of contributions in the *Lancet* high and it became deeply respected not only in Great Britain but also throughout the world. Of the contributions listed in "Garrison-Morton," 117 were printed in the *Lancet*. The authors included such names as Lister, Simpson, Snow, Horsley, and Fleming.

In 1857 saw the beginning of the other major weekly medical journal in England, the *British Medical Journal*, the official publication of the British Medical Association. The "BMJ" has long maintained a worldwide reputation as an outstanding publication. Lister, Tait, Wells, Osler, and Manson are among the authors who wrote the 122 papers listed in "Garrison-Morton."

The *Edinburgh Medical Journal*, under a variety of titles, had a distinguished career for a century and a half. The *Practitioner* has been making important contributions since 1868 and still holds a respectable position. The *Dublin Journal of Medical and Chemical Science* began publication in 1832 and continues today as the *Irish Journal of Medical Science*.

In 1846 the first issue of the *Australian Medical Journal* appeared, although it ceased publication the following

year. After several other medical journals entered the field the present *Medical Journal of Australia* was formed by an amalgamation in 1914.

The birth and growth of specialty medical journals has been a phenomenon primarily of the nineteenth and twentieth centuries. They have developed at different rates in different countries and their story is too long and detailed for this article. Accounts and pertinent references will be found in the books cited at the end of this entry.

In France the *Archives de Médecine et de Pharmacie Militaires* had a useful career from 1815 to 1882. The *Archives Generales de Médecine* ran from 1823 to 1914, making notable contributions under the editorship of Trousseau. The *Comptes Rendus* of the Academie des Sciences and the Société de Biologie, beginning in 1835 and 1849, respectively, and are still being published. They have carried many important medical papers.

In addition to the journals founded by Müller and Virchow, Germany was the source of many other important titles. *Pflüger's Archiv für die gesamte Physiologie* began publication in 1868; *Langenbeck's Archiv für klinische Chirurgie* in 1861; *Wiener medizinische Wochenschrift* in 1851; *Münchener medizinische Wochenschrift* in 1854 (as *Arztliches Intelligenz-Blatt*); *Berliner klinische Wochenschrift* in 1864; and *Deutsche medizinische Wochenschrift* in 1875. These journals are all still making worthwhile contributions to the literature.

Among the early major Russian medical journals was the *Moskowye Medizhinskaja Gazeta* 1866–1878, the *Wojenao Medizinske Journal* (*Military Medical Journal*) 1823–1907, and the *Wratsch* (*Physician*).

THE TWENTIETH CENTURY

The medical literature of the middle twentieth century has become essentially a journal literature. Articles in journals are now the standard method of announcing discoveries, new methods, and even new hypotheses. Speedy publication, wide circulation, and lower cost have all emphasized the journal over the book. This trend was evident toward the end of the previous century, and could be demonstrated in this century by such items as Joseph Goldberger's first major publication on pellagra in 1920. This was a 109-page report that most probably would have been published as a book earlier, but in the twentieth century it appeared as a journal article.

The book portion of the medical literature showed two major trends in the twentieth century. The first was toward the comprehensive and detailed set, of which the German Handbücher are good representatives. The 12-volume *Handbuch der speziellen pathologischen Anatomie und Histologie*, edited by Henke and Lubarsch and published by Springer at Berlin, 1924–1952, was typical. Another facet of this trend is the multiauthored set, such as Duke-

Elder's *System of Ophthalmology* in 15 volumes. This began in 1958 and Volume 14 appeared in 1972.

The second was a continuation of the trend toward the highly specialized monograph. A classic of this century, Felix d'Herelle's *Le Bacteriophage*, published at Paris in 1921, exemplifies this trend. In the first half of the century this type of monograph could have also been represented by a two-volume one-author work such as Henry Head's *Aphasia and Kindred Disorders of Speech*, published by the Cambridge University Press in 1926. This is still in such demand that a reprint was produced in 1963.

Reference works of several varieties were frequent additions to the medical literature of the twentieth century. These could be works that keep reappearing, such as David Bergey's *Manual of Determinative Bacteriology*, first published at Baltimore in 1923 and now in its eighth edition, or a single-appearance publication such as the World Health Organization's (WHO) *Bibliography of Yaws 1905-62*, printed at Geneva in 1963. The publication program of WHO has made many worthwhile contributions to the medical literature.

Popularizations of scientific medical work for the layman, although not new to the medical literature in this century, have been much more frequent. These serve a variety of valuable purposes.

But essentially this has been the century of the medical journal, and the proliferation and variety of these publications has been remarkable. Journals are now dealing with highly specialized subjects, and the rise and fall of research and clinical fashions can be traced in the corresponding births, mutations, and deaths of the journals.

Whether the journal will remain the chief form of the medical literature for the rest of this century and into the next is an unpredictable matter, although some trends at present suggest that it may not. The printing of separate fascicles of a journal for each separate article has been tried experimentally. Related to this trend is the publication of only an abstract or a tightly shortened version of the article with the storage of the full text in a central location to which readers may write for full copies if they are interested. The medical newspaper is another new phenomenon in the literature.

Medical journals have appeared in microfiche rather than the traditional printed form. So far these have not been too successful, but as a new generation of readers comes along this form of publication may spread.

The audio side of the audiovisual approach has also entered the medical literature. More than a few journals are now available on tape. This is true of the digest type of publication as well as the full-length article variety. The audio method seems to have met with more favorable reader acceptance than the visual.

Books, too, are changing their format. The programmed-learning text with its columns, boxes, and variously sized and shaped pages, is a common sight. The next step is already being taken experimentally, the computerized

nonprinted text. In this case the text of a book (most logically a multiauthored handbook) is stored in a computer and never printed as a whole. When one of the authors wants to bring his section up to date he displays it on the terminal page by page, makes additions, deletions, or corrections, and sends it back to the storage unit. When a reader wants a more permanent copy than the terminal display, he asks for the page(s) he wants to be printed out and sent to him.

The medical literature is now in a state of flux, even more so than it has been in the past. What shapes it will have in 25, 50, and 100 years no one can predict. The only certainty is that it will continue to exist in some form or forms—because both the readers and the authors need it.

BIBLIOGRAPHIC CONTROL

Within 50 years after the invention of printing from movable metal type the medical literature had grown to the point where a bibliography was felt to be needed. Symphorien Champier accordingly compiled his *De Medicinæ Claris Scriptoribus*, which was printed at Lyons in 1506. Champier listed the books in five divisions: ancient medical writers; philosophical medical writers; ecclesiastical writers on medicine; Italian medical writers; and French, German, Spanish, and English medical writers. Dates were infrequently given, and little other information was included beyond author and title. A rough author and subject index was included in the table of contents.

It was 84 years before a bibliographic work showing substantial improvements appeared. (Conrad Gesner never completed the medical volume of his monumental *Bibliotheca Universalis*.) Paschalis Gallus produced his *Bibliotheca Medica* in 1590 at Basel. Again the text was broken down by languages. The bulk of Gallus's text dealt with writers in Latin, and this is a practical annotated list arranged alphabetically by the given name of the author. Gallus's volume was the first general bibliography of medicine arranged by authors with adequate bibliographic information.

The next year Israel Spach published his *Nomenclator Scriptorum Medicorum* at Frankfurt. The text was arranged in a minutely classified format with alphabetical subject and author (given names) indexes. The individual entries contained fairly complete bibliographic information.

Johannes-Antonides der Linden made several substantial improvements in the editions of his *De Scriptis Medicis*. These included practical use of type size and spacing for increased legibility and easier location of information. Although he retained the alphabetical arrangement of authors by given names (really a logical contemporary approach because surnames were not yet widely used), Linden added information to his entries and brought his bibliography close to a modern production. The first edition appeared in 1637 at Amsterdam, and two later ones came out in 1651 and 1662.

In 1686 Linden's work was revised and considerably enlarged by Georg Abraham Mercklin, who took an important step by including for the first time some articles from the periodical publications of the learned societies that were just springing into formation.

In 1679 Martinus Lipenius published his *Bibliotheca Realis Medica* at Frankfurt am Main. He was able to include a large amount of material by using a two-column format in a large quarto volume. Lipenius also used letter headings for each column as a guide to the searcher. The text was arranged by subjects with the authors arranged alphabetically by given name. Many cross references (primarily subject, but some author) were given throughout the text. There was an index for authors, commentators, et al.

Further steps were taken by Cornelius à Beughem who, in 1681 at Amsterdam, published his *Bibliographia Medica et Physica Novissima*. This publication circumvented one of the problems brought on by the increasing outpouring of the medical literature by limiting its coverage to material published within a specific time span, roughly 1651 to 1681. The text was arranged by authors.

In 1696, also at Amsterdam, Beughem produced his *Syllabus Recens Exploratorum in Re Medica*, which covered the periodical literature, mostly from the transactions of various learned societies. In both of these pioneering publications Beughem made improvements in accuracy and detail.

The first "giant" in medical bibliography appeared in the eighteenth century. Albrecht von Haller had compiled a nine-volume work, *Elementa Physiologiae Corporis Humani*, at Lausanne, 1757–1782, in which he listed and annotated many of the publications in that broad field. This was, in a sense, a warm-up for his four major bibliographies. The first of these, *Bibliotheca Botanica*, two volumes printed at Zurich in 1771–1772, contained much medical material. The botanical volumes were quickly followed by the *Bibliotheca Chirurgica*, two volumes, Bern, 1774–1775; the *Bibliotheca Anatomica*, two volumes, Zurich, 1774–1777; and the *Bibliotheca Medicinæ Practicae*, four volumes, Basel, 1776–1788. These were arranged by broad subject, and then chronologically. Many of the items listed had abstracts. There was an author index.

Wilhelm Gottfried Ploucquet initiated the concept of the cyclical bibliography, and his arguments for and against this solution make interesting reading in the introductions to his publications. His first basic set was the *Initia Bibliothecae Medico-Practica et Chirurgica* in eight volumes, printed at Tübingen (as were all his works) in 1793–1796. A four-volume supplement, *Bibliotheca Medico-Practica et Chirurgica*, was printed in 1799–1803. A combined set, with new material, *Literatura Medica Digesta*, appeared in 1808–1809, in four volumes, and one supplemental volume was produced in 1813, the year before Ploucquet's death. Ploucquet was able to put so

much material in the *Literatura* because he used smaller type than previously and a three-column format. All of his works were arranged by subject, and included many journal articles as well as books, pamphlets, and dissertations. Unfortunately, he had no author index.

Between 1830 and 1845 Adolph Carl Peter Callisen produced, at Copenhagen, thirty-three small volumes of his *Medicinisches Schriftsteller Lexicon der jetzt lebenden Aerzte*. . . . This mammoth undertaking provided an author list of books and journal articles printed roughly between 1750 and 1830. This, the last major one-man medical bibliography, made a useful complement to the work of Ploucquet. Callisen's set was reprinted in 1962–1965.

The next outstanding figure was John Shaw Billings who lived from 1838 to 1913. Billings not only realized the bibliographic needs of the users of the medical literature but was able to work out practical publications to meet these needs and workable methods to produce the publications. The first volume of the *Index-Catalogue of the Library of the Surgeon-General's Office* appeared in 1880. The series was to have 60 more volumes before it ceased in 1961. This set (in five series) covered the books and articles in the collection at the Surgeon-General's Library, providing an author and subject approach to the former and a subject approach to the latter. Using typographic aids and a two-column format, Billings was able to make a vast amount of material easily accessible.

The first series of the *Index-Catalogue* included 16 volumes printed between 1880 and 1895; the second series of 21 volumes ran from 1896 to 1916; and the third series of 10 volumes appeared from 1918 to 1932. The fourth series, which went only through "M," was printed in 11 volumes between 1936 and 1955, and the fifth series of three volumes was printed in 1959–1961. The complete set ranks as a major contribution to the bibliographic control of the medical literature, and will serve as a lasting memorial to Billings's imagination, perseverance, and ability. Lack of money and the rapidly increasing flow of the literature eventually made the approach of the *Index-Catalogue* no longer feasible.

Billings envisioned a frequently appearing series as a current supplement to the foundation of the *Index-Catalogue*. The first monthly issues of this supplement, which was called the *Index Medicus*, were printed in 1879. These issues covered primarily articles from selected medical journals although some other material was also included. The text was classified, and the only indexes were the annual author and subject listings. Robert Fletcher assisted Billings with the production of the *Index Medicus* just as he did with the *Index-Catalogue*. A carefully worked-out team handled the processing of the materials and information.

The *Index Medicus* ran into financial difficulties at the end of the century (Ser. I, Vols. 1–21, 1879–1899), and sufficient income was not generated again until the Carnegie Institute helped out and made possible the continuation of this valuable tool (Ser. II, Vols. 1–18, 1903–1920; Ser. III,

Vols. 1–6, 1921–1927). With the third series the *Index Medicus* became a quarterly and took on a subject arrangement with an annual author index.

The American Medical Association produced a similar index with its *Quarterly Cumulative Index to Current Medical Literature* (Vols. 1–12, 1916–1926). The drain on finances and growing production time led to an amalgamation of this with the *Index Medicus* to form the *Quarterly Cumulative Index Medicus* (Vols. 1–60, 1927–1956) which had authors and subjects arranged in an easy-to-use dictionary format. The Surgeon-General's Library (going through an evolutionary series of names) began a *Current List of Medical Literature* during World War II that continued until 1959 and was particularly useful for the period 1952–1959.

With the demise of the *Index-Catalogue* and the *Quarterly Cumulative Index Medicus* a restructuring of the bibliographic mechanism was needed. The coverage of books was taken care of by the Army Medical Library (now the National Library of Medicine) with a sequence of annual and quinquennial catalogs leading up to the *Current Catalog* which began in 1966. Journals were indexed in the “new” *Index Medicus* which began in 1960. This appears in 12 monthly issues and a bound annual cumulation of several volumes.

The mechanization project at the National Library of Medicine that developed along with the new *Index Medicus* under the direction of Frank B. Rogers led eventually to the computerized MEDLARS (*Medical Literature Analysis and Retrieval System*) program, which has speeded up the production of the *Index Medicus* and made computerized searching of the literature a reality, has also led to the development of Medline (the on-line computerized program that provides access to the National Library of Medicine's data banks) and to a variety of related programs. Some of these services have been made available in England, Sweden, and other countries. A greatly enlarged and improved Medlars II program has just been put into operation. An experimental program with the use of a satellite for the communication of medical information has been successfully tried out by the library. The State University of New York has developed a broad computerized program that provides bibliographic control for and access to a vast amount of the medical literature.

Abstract journals have provided another approach to the medical literature. Karl Christian Schmidt initiated *Schmidt's Jahrbücher der in- und ausländischen gesamten Medicin* in 1834. The *Jahrbücher* met such a great need that they continued through 336 volumes until 1922. The Germans developed a network of bibliographic journals based on the Zentralblätter or Berichte in the different

subject areas that provided brief abstracts, through their annual compilations (*Jahresberichte* or *Jahrbücher*) to the review journals usually titled *Ergebnisse*. The major English-language abstracting journal is the *Excerpta Medica* series which began in 1947 and has grown considerably. Indexing or abstracting journals are also found in France, Russia, Japan, and many other countries.

CONCLUSION

The bibliographic control of the medical literature in the Americas has been greatly assisted by such works as the *Epitome de la Biblioteca Oriental i Occidental, Nautica i Geografica* of Antonio de Leon published in Madrid in 1629, the *Historia Bibliografica de la Medicina Española* of Antonio Hernandez Morejon (seven volumes, Madrid, 1842–1845; reprinted in 1965), and the *Biblioteca Hispano-Americana* (1493–1810) of Jose Toribio Medina (six volumes, Santiago de Chile, 1898–1907). Francisco Guerra's *American Medical Bibliography 1639–1783* (New York, 1962), which includes newspapers, broadsides, and almanacs as well as books, pamphlets, and journal articles, is a major bibliographic work, and Robert B. Austin's *Early American Medical Imprints: A Guide to Works Printed in the United States 1668–1820* (1961) is invaluable in its area.

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Metadata and Digital Information [ELIS Classic]

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Abstract

The range of metadata activity over this last decade is both extensive and astonishing, and substantiates metadata as an integral part of our digital information infrastructure. This entry begins with a brief history of metadata relating to digital information, followed by an overview of different metadata types, functions, and domain-specific definitions. Next, the family of standards comprising a metadata architecture are defined, followed by an overview of metadata generation processes, applications, and people: this latter section gives particular attention to automatic metadata generation approaches. The following section explores four key metadata models. The conclusion summarizes the entry, highlights a number of significant metadata challenges, and notes efforts underway to address metadata challenges in the new millennium.

INTRODUCTION

Today one can hardly talk about digital libraries, data repositories, and many aspects of the library 2.0/web 2.0 environment without mention of *metadata*. This is because metadata is a crucial part of these digital information systems. Metadata describes information and its context and associations; it is integral to the operation and function of any system preserving and supporting discovery, access, and use of information. Metadata is also a necessary component of physical information systems, such as the traditional library card catalog. In this context, bibliographic records (an equivalent of *descriptive metadata*) represent library holdings and facilitate resource discovery and use.

The first article on “metadata” appearing in the *Encyclopedia of Library and Information Science (ELIS)* was published in 2002,^[1] under the title, “Metadata and the World Wide Web.” This work was revised and republished in 2003.^[2] These noted entries define metadata, compare metadata to library cataloging, describe concepts for discussing metadata, and review different methods for generating metadata.

Metadata developments have matured considerably since these first *ELIS* entries were published, and a number of initially ambiguous aspects surrounding the topic are more fully understood. For example, when the term metadata was first being explored in the library community, via digital library and World Wide Web (web) development, there were efforts to distinguish metadata from library catalog data, including MACHine Readable Cataloging (MARC) bibliographic data. Today, library catalogers and digital library professionals generally agree that MARC bibliographic data is metadata, and that the family of MARC formats—bibliographic, authority control, and

so forth^[3,4]—all have a place within metadata discussions. Another sign of growth is that metadata-related development and inquiry has expanded well beyond National Information Standards Organization (NISO) and the International Standards Organization (ISO) metadata standards to include ontologies,^[5,6] the Semantic Web,^[7] annotation,^[8] and social computing/web 2.0 developments relating to tagging and folksonomy.^[9,10] In short, our perception and comprehension of metadata has been influenced by time and the evolution of technology and information practices requiring metadata.

This encyclopedia entry considers the evolution of metadata and presents a fresh perspective on this topic. The rest of the entry is organized by the following section headers: “Metadata: Origin and History” covers the origin and history of metadata relating to digital information; “Defining Metadata” explains the different types and functions of metadata and presents a series of domain-specific definitions for metadata; “Metadata Standards” defines the family of metadata standards that comprise a metadata architecture—these include data structure standards, content value standards, data communication standards, and syntax standards; “Metadata Generation” reviews metadata generation, processes, applications, people—giving focused attention to automatic approaches; “Metadata Models” explores several key metadata models; and the “Conclusion” summarizes the entry, and highlights several significant metadata challenges being faced in this new millennium.

METADATA: ORIGIN AND HISTORY

The etymology of metadata draws from the classical Greek prefix *meta*, which means “after, behind, or higher;”

and the from Latin word *data*, plural for datum, which means “a piece of information” or “something given.”^[11] Metadata is, in essence, a piece of information generated *after* the object of focus has been produced; and the information given is at a higher level (more abstract) than the object.

Metadata, as an information concept, is known to have first been used in the late 1960s by individuals in the statistics/database community, and it has been recollected that it was a standard word by the 1970s, although references are difficult to find. The first known reference appears in *An Infological Approach to Data Bases*, a doctoral dissertation completed in 1973, by Bo Sundgren, at the Statistiska Centralbyren (pp. 104–105).^[12] This work also includes the concept of *metainformation* and articulates distinctions between the real-world phenomena; information about phenomena; and data representing the information describing the phenomena; the last conception is referred to as meta-metadata in today’s information systems.

The most frequent historical reference given for *metadata* is for a marketing brochure, printed for Jack E. Myers, representing a MetaModel and company products. References credit Meyers with coining the term *metadata* in 1969,^[13] and in 1986 METADATA® was registered as an United States trademark for The Metadata Company (<http://www.metadata.com/>), where Meyers is a principal. Meyers is known to have legally contested the use of term *metadata* by others. However, his ownership claims have been successfully refuted, given the publication of *An Infological Approach to Data Bases* and the longstanding historical use of this term in the statistics community.

Today, the term metadata has been steadfastly integrated into our information culture, and it is generally, although not exclusively, associated with digital information. Evidence of growth includes the increase in people engaged in metadata work in the library and other information intensive environments, such as scientific research centers. As part of this growth we see professional titles like *metadata librarian* and *metadata specialist*. The body of scholarly research on metadata is also expanding; in fact there are two fairly new scholarly journals targeting metadata: *The International Journal of Metadata, Semantics and Ontologies* (<http://www.inderscience.com/ijms>) published by Inderscience Publishers, and *Journal of Library Metadata* (<http://www.tandf.co.uk/journals/>) published by Taylor & Francis. Additionally, the number of books on metadata continues to grow yearly, with very recent notable publications by Riley and Foulonneau,^[14] Zeng and Qin,^[15] and Liu.^[16] Finally, a factor of growth is the Dublin Core Metadata Initiative (DCMI) (<http://www.dublincore.org/>), which has been flourishing since 1995, promoting the Dublin Core Metadata Element Set (DCMES),^[17] an open, interoperable, interdisciplinary metadata standard. The

DCMI and metadata initiatives in the education, science, government, industry, and other communities have been a major force bringing metadata issues to the forefront of library and information science, and demonstrate the wide reach and complexity of this topic.

DEFINING METADATA

Definitions for metadata have been influenced by both the objects to which the metadata is being applied, and the functions it is intended to support. The most often uttered and most inclusive definitions for metadata are *data about data* and *information about information*. Although *data* and *information* can have distinct meanings,^[18] these terms are frequently used interchangeably, and it is not uncommon for metadata to be also defined as *information about data*, or even *data about information*. What makes these definitions high-level is that the “information” or “data” being described connotes an *abstract object*—that is “anything perceivable or conceivable,” as defined in the ISO/IEC (International Organization for Standardization/International Electrotechnical Commission) 11179-1: 2004, Metadata registries (MDR)—Part 1: Framework (p. 4).^[19]

The earlier *ELIS* metadata entries give attention to the unbounded nature of an object as “any *entity, mode or form*” to which metadata can be applied, ranging from “information resources, such as a monograph, newspaper, or photograph—to activities, events, persons, places, structures, transactions, relationships, execution directions, and programmatic applications.”^[1,2] The ways in which people work with and understand information varies enormously across disciplines, cultures, and societal strata, and it follows that their conception of the information object varies as well.

Library and information science is primarily concerned with metadata for *information resources*—the types of *objects* housed in libraries, repositories, museums, archives, and other types of information centers. In this environment, metadata is frequently defined as “structured data about data.”^[20,21] The structured metadata is gathered to form a *metadata surrogate*—a “stand in” for the real resource akin to a bibliographic surrogate.

Metadata surrogates are usually comprised of *descriptive metadata*, which is metadata that supports resource discovery. Detailed, more granular metadata definitions, beyond data about data, emphasize types (or classes) of metadata and the associating functional aspects, such as describing, preserving, and contextualizing information (see Table 1).

Although literature confirms there is no single agreed upon typology of metadata types or functions, metadata discussions promote similar and overlapping labels and definitions (pp. 20–22).^[22] Further, more granular

Table 1 Examples of metadata types, functions and properties

Type of metadata	Function supported	Metadata property (element)
Descriptive metadata	Resource discovery; selection; access	^a Creator; title; subject
Preservation metadata	Resource management	Resolution; density; fixity
Provenance metadata	Lifecycle management; authentication	^a Creator; date created; date modified
Contextual metadata	Awareness; comprehension; interpretation	Date created; temporal data; arrangement (placement of an object in relation to other objects)
Technical metadata	Use; access	System requirements; format
Rights management metadata	Access; reproduction; use/re-use	Rights

^a A metadata property that can be labeled as more than one *type* of metadata is multifunctional.^[22] The Dublin Core property *creator* is identified as “descriptive metadata” because it helps with discovery and “provenance metadata” because it helps with lifecycle tracking; creator is, therefore, a multifunctional property.

definitions are important because they provide insight into the functional aspect of metadata and the way in which different communities work with and understand metadata. The following community-oriented definitions illustrate this point more concretely:

- The *library community* emphasizes *descriptive metadata*; that is “metadata that serves the purposes of discovery (how one finds a resource), identification (how a resource can be distinguished from other, similar resources), and selection (how to determine that a resource fills a particular need, for example, for the DVD version of a video recording)” (pp. 210).^[23,24]
- The *digital geospatial and environmental science communities* have consistently stated that “Metadata or ‘data about data’ describes the content, quality, condition, and other characteristics of data” (p. 1),^[25] providing a definition reflecting needs of associated with digital geospatial and similarly related materials.
- The *business community* highlights metadata for *machine processing* and *user activities*, and adheres to two main metadata classes: *technical metadata* describing database information and machine driven tasks; and *business metadata* supporting input/output tasks overseen by humans (p. 12).^[26]
- The World Wide Web Consortium (W3C) emphasizes the *computing potential* of metadata for growing the Semantic Web, and defines metadata as “machine understandable information for the web” (W3C Metadata and Resource Description: <http://www.w3.org/Metadata/>).

- The social networking and web 2.0 environment promotes the use of the term tag/tags/tagging instead of metadata. Definitions for these terms underscore the functional aspect of tags as “keywords” for *describing, classifying, finding, and sharing* information.^[27]

These more descriptive definitions show a range of activities and functions metadata supports (e.g., retrieval, preservation, and machine processing). The range of definitions also provides insight into the complexity of this topic, and helps explain why, in many respects, the high-level definition of *data about data* is the accepted unifying definition, despite its generality.

METADATA STANDARDS

Metadata generally involves standards. The degree to which standards apply varies tremendously, depending on the object of interest, available technology, and community overseeing the metadata activity. Metadata activities in the library and information community are supported by a series of standards that comprise a metadata architecture. These include: *data structure standards*, *content value standards*, *communication standards*, and *syntax standards*. Although different aspects of these types of standards are generally integrated in a single metadata package, they are reviewed separately here to emphasize specific functions. Many instances of the standards reviewed here are endorsed by agencies, such as the American National Standards Institute (ANSI), National Information Standards Organization (NISO), International Organization for Standardization (ISO), Internet Engineering Task Force (IETF), and the World Wide Web (W3C), and designated by an identifier often consisting of numbers or numbers and letters.

Data Structure Standards

Data structure standards are the most familiar metadata standard. A data structure is essentially a list or container of explicit properties (elements). A data structure standard names and defines the *semantic categories* representing the information system’s metadata. These semantic categories are most often referred to as *metadata elements*, although *metadata facets* are also becoming common. Most recently, the Dublin Core community has been promoting the term *metadata properties* in an effort to align metadata activities with the Semantic Web.

The DCMES, version 1.1 (here after referred to as the Dublin Core) is among the most internationally and interdisciplinary recognized metadata data structure standards. The Dublin Core and is defined as “a vocabulary of 15 properties for use in resource description,”^[17] and is endorsed by the ISO (ISO 15836-2003), ANSI/NISO (ANSI/NISO Z39.85-2007), and the IETF via a request for comment (IETF/RFC 5013-2007). Examples of Dublin

Core properties include *creator*, *title*, and *subject*. An example for the property “creator” from the Dublin Core, 1.1, is provided in Example 1.

Example 1: Characteristics for the Dublin Core Metadata Property *Creator*

Term Name: Creator	
URI:	http://purl.org/dc/elements/1.1/creator
Label:	Creator
Definition:	An entity primarily responsible for making the resource.
Comment:	Examples of a Creator include a person, an organization, or a service. Typically, the name of a Creator should be used to indicate the entity.

Data structure standards are fairly equivalent to data dictionaries developed for databases and frequently include additional information about the use and application of metadata properties. For example, a data structure standard may recommend a *public label*; confirm property *cardinality*—if the metadata property is repeatable; declare property *obligation*—is property required, recommended, or optional; and list legal content values or standards for a property.

Data structure standards have been developed for a wide range of domains. Examples include following:

- *Metadata Object Description Schema* (MODS)^[28] for digital library resources.
- *Visual Resources Association Core Categories* (VRA Core)^[29] for visual resources.
- *Encoded Archival Description* (EAD)^[30] for electronic finding aids.
- *Data Document Initiative* (DDI)^[31] for social science research data.
- *Federal Geographic Data Committee/Content Standard for Digital Geospatial Metadata* (FGDC/CSDGM)^[25] for digital geospatial resources.
- *Ecological Metadata Language* (EML)^[32] for ecological research data.
- *Institute of Electrical and Electronics Engineers/ Learning Object Metadata* (IEEE/LOM)^[33] for digital learning objects.
- *PREservation Metadata: Implementation Strategies* (PREMIS)^[23] for preservation information about any digital object.
- *Darwin Core* (DwC)^[34] for specimen collections and the geographic occurrence of species.

The immediate above list includes only several of the hundreds, and potentially thousands, of metadata schemes that function as data structures. The widespread availability and increased sharing of schemes represents a maturity in metadata development; and it is simply *best practice* to

first consider if a scheme (or schemes) fulfilling project needs has already been developed when embarking on any new initiative requiring metadata. Among incentives for adopting, and potentially modifying, existing metadata schemes are the desire to support interoperability and avoid duplicative efforts. Supporting this trend are *application profiles*,^[35] which are data structures composed of defined properties from established standardized schemes. The DCMI has developed the Singapore Framework^[36] to standardize the creation and documentation for application profiles.

Content Value Standards

Content value standards contain words, names, and symbols connoting meaning. Common types of content value standards include *subject heading lists*, *thesauri*, *classification systems*, *taxonomies*, *ontologies*, and *name authority files* (for people, places, geographical jurisdictions, and other named entities). Content value systems containing concepts used for topical, domain, or intellectual representation are increasingly referred to as knowledge organization systems (KOS).^[37]

Values are drawn from content value standards and paired with properties to complete a metadata record; hence, the common notion of property/value pairs. For example, the Harley–Davidson Web site as a *digital resource* has various properties, such as title, subject, and date. These properties are defined in the Dublin Core, and assigned values to construct a metadata record. Example 2 presents a fragment of a Dublin Core metadata record showing *Library of Congress Subject Headings* (LCSH)^[38] values in XML for the Harley–Davidson Web site.

Example 2: Fragment of a Dublin Core metadata record showing *LCSH* values in XML for the Harley–Davidson Web site

```
<dc:subject xsi:type="dcterms:LCSH" >Harley-Davidson
motorcycle </dc:subject>
<dc:subject xsi:type="dcterms:LCSH" >Harley-Davidson
motorcycle-Collectibles</dc:subject>
```

Content value systems are neither available nor desirable for every property defined in every metadata scheme; and the freedom to create content values via tagging is part of the appeal and success of folksonomies. In fact, one may argue that a folksonomy presents a de facto content value standard via sharing and aggregating agreed upon tags.

Data Communication Standards

Data communication standards are the encoding or markup language that wraps around the property/value pairs in the metadata record. Data communication

standards permit metadata records to be stored, searched, retrieved, and exchanged with other information systems. The prescribed system of punctuation that is part of the International Standard Bibliographic Description (ISBD), and the other ISBD formats that have now been consolidated,^[39] is an example of a pre-Web data communication standard. Developed in the late 1960s, with the eye toward supporting computer exchange of bibliographic data, the prescribed punctuation separates designated areas of description, such as resource “title” and “statement of responsibility.”

Data communication standards commonly used today for encoding metadata include MARC bibliographic format (ISO 2709/ANSI/NISO Z39.2), which incorporates ISBD; eXtensible Hypertext Markup Language (X/HTML; W3C WD-xhtml2-20060726); and XML (W3C REC-xml-20060816). Example 3 presents a MARC bibliographic record with core properties and the XML Dublin Core equivalent for the same metadata.

Example 3: MARC Bibliographic Record and Dublin Core XML Metadata Record for Berners-Lee’s book *Weaving the Semantic Web*

MARC Bibliographic record	Dublin Core XML record
100 1 Berners-Lee, Tim.	<dc:creator>Tim Berners-Lee </dc:creator>
245 10 Weaving the Web / \$c Tim Berners-Lee with Mark Fischetti.	<dc:title>Weaving the Web </dc:title>
260 [San Francisco]:\$b HarperSanFrancisco,\$c 1999.	<dc:publisher>HarperSanFrancisco </dc:publisher>
300 xi, 226 p. ;\$c 25 cm.	<dcterms:created>1999</dcterms:created>
650 0 World Wide Web.	<dcterms:extent>xi, 226 p. and 25 cm </dcterms:extent>
700 1 Fischetti, Mark.	<dc:subject xsi:type=“dcterms.LCSH”>World Wide Web </dc:subject> <dc:contributor>Mark Fischetti </dc:contributor>

Syntax Standards

Syntax standards are not stand-alone standards designated by an identifier, rather they are integrated each of the standards reviewed, and guide metadata creation and encoding. For example, syntax standardization may dictate element ordering for data structure standards; value structuring for value content standards; and grammar for communication standards. (The word *element* is used in this section instead of property, given that *property* is not as familiar a concept across all metadata communities.)

These aspects of syntax standardization are further explained below:

- *Element ordering*: Data structure standards may include element ordering recommendations or specifications, such as the author/creator element should (or must) always precede the title element. Familiar bibliography standards, such as the American Psychological Association or the Chicago citation style have an element ordering syntax in the way bibliographies citations are constructed; and these standards integrate a grammar syntax (defined below) via prescribed punctuation. There are many data structures, such as the Dublin Core, that do not have a standardize element ordering protocol; however initiatives using such schemes may determine their own standard approach to organizing metadata elements.
- *Value structuring*: Content value standards may include value structuring requirements. For example, *LCSH* has a protocol for constructing subject heading strings [topic—period subdivision]; or [topic—geographical subdivision]. Similarly, the *Art & Architecture Thesaurus*^[40] has a protocol for building faceted strings. The Library of Congress Name Authority Headings (<http://authorities.loc.gov/>) includes syntaxes for named entities following the *Anglo-American Cataloging Rules*.^[41] For example, personal name is structured with the surname, followed by forename (e.g., Picasso, Pablo). There are also syntax standards to help with content values that may not necessarily be taken from a controlled vocabulary. One example is the W3C Date and Time Formats,^[42] a subset of ISO 8601, which recommend the syntax of YYYY-MM-DD for dates and other content syntaxes depending on available date and time information.
- *Grammar syntax*: Communication standards embody a grammar syntax for producing valid encoding. An obvious example is the way in which XML angle brackets are created with a “<” to represent the start of encoding a metadata element, and then use a “/>” to represent closure. Example 3, above, illustrates both MARC and XML encoding syntax. The core of the MARC bibliographic record includes tags (the three digit numbers), delimiters (a dollar sign: \$), and delimiter codes (often lower case letters). The Dublin Core metadata record presents an example of XML grammar, with angle brackets as well as prescribed punctuation.

Standards, as reviewed here, are integral to many aspects of metadata. It is useful to keep in mind that metadata standards are discussed and labeled in many ways, and generally “a said standard” includes multiple aspects or types of standards. A case in point is the *Anglo-American Cataloging Rules*,^[41] which is often labeled as a *content standard*, integrating aspects of a data structure, content

syntax, and encoding syntax (the encoding follows ISBD punctuation). The most important aspect of any standard is that they enable metadata to be used more effectively supporting functions (e.g., resource discovery, management, or authentication); and, at the foundation level, standards guide metadata generation.

METADATA GENERATION

Metadata generation is the act of creating or producing metadata, and can be generated via different processes, applications, and classes of people.^[43]

Metadata Generation Processes

Metadata is generated via manual, automatic, or, a combinatory approach. Manual metadata generation necessitates human engagement (e.g., metadata professionals, content creators, and technical assistants); automatic metadata generation involves the use of machine processing; and the combinatory approach integrates both manual and automatic methods.

An overview of metadata generation processes

It is nearly impossible to find an example of metadata produced entirely by manual means, given that metadata is fairly well rooted in the world of electronic and digital information. In fact, it is commonplace that metadata generation activities include some reliance on technology and programmed algorithms. For example, an application requiring manual metadata input may link to external standards and automatically generate and validate encoding. The OpenSource Metadata Framework (OMF) Template (Example 4) for Linux software and software documentation presents an example, with the last button saying “xmlify.”

Automatic metadata algorithms are frequently in place recording the date the digital object was created or modified, who created the object or its metadata (depending on login information or work station accessed), and size of the object; although, authors and application users are often unaware of these algorithms. The only example of a purely manual metadata approach is the process of *hand-written* labeling, indexing, or cataloging.

Similarly to the near absence of purely automatic metadata generation, most automatic processes require some human involvement to, at the very least, initiate the operation. At minimum the human may need to point the application to a resource identifier as required with DC-dot (<http://www.ukoln.ac.uk/metadata/dcdot/>). Humans are frequently involved in some aspect of metadata evaluation when automatic processes are used, given known shortcomings of machine processing (e.g., limited capabilities to disambiguate among concepts).

Automatic metadata generation approaches

Recognizing that metadata generation generally involves a mix of manual and automatic methods has prompted the metadata community to pin-point areas where human engagement is essential, and where automatic processes should dominate. For example, it does not make sense for a human to manually reproduce resource identifier, such as a URL, when it could be automatically harvested from a Webpage; and the automatic approach is less prone to errors than the manual approach. As part of an effort to advance the development of metadata generation applications, the DCMI Tools Community has prepared a glossary [draft]^[43] defining specific types of automatic metadata generation approaches, which are further articulated here.

- *Derived metadata*: Metadata automatically generated according to system designed (pre-programmed) profiles. For example, a system program may automatically derive metadata values for “date created,” “date modified,” or “resource size.” Profiles can be designed to automatically populate a metadata record with default values, such as “rights access,” or “creator” information.
- *Metadata extraction*: Metadata generated by running automatic indexing algorithm against resource content. For example, term frequency algorithms are used to extract and determine subject keywords; and automatic detection of noun phrases may help extract values for other metadata properties, such as “author,” “date,” and “title.” Semi-structured metadata, determined by the fairly consistent placement of metadata values (e.g., title, keywords, and author names) within document content, can also be extracted.
- *Metadata harvesting*: Metadata is automatically gathered from existing metadata sources, regardless of whether it was originally generated via automatic or manual means. Metadata can be harvested from a range of sources (e.g., a resource header, metadata registries, or database). Metadata harvesting is a key aspect of the Open Archives Initiative (OAI) (<http://www.openarchives.org/>), an electronic pre-print service. Extraction of semi-structured metadata from document content has an element of harvesting.

There are multiple approaches for generating metadata; and the method selected depends on a host of factors. Chief considerations include the type of objects being represented (e.g., online conference proceedings, personal photographs, a scientific data set); the environment where the metadata will be hosted (e.g., a digital library, scientific repository, or personal account on a social networking site); who is creating the metadata; available financial and human resources for the task; and the complexity of and intellectual requirements associated with the underlying schemes and standards used. All of these factors together

have a direct bearing on the type of application selected for generating metadata.

Applications

The range of applications supporting metadata is extensive. The previous *ELIS* entry covered this topic by identifying templates, editors, generators, and document editors. Although these intellectual distinctions are still applicable, these concepts are used interchangeably and inconsistently by application developers and users alike. Another way to view the range of metadata applications available is to consider the context in which they are used, including how they are marketed. Four contexts considered here

include: 1) tools designated specifically as metadata applications; 2) library management systems (LMS); 3) content management systems (CMS); and 4) daily use applications.

- *Metadata applications*: The growing need for metadata has motivated the development of applications specifically labeled as metadata tools. These applications generally provide templates for manual metadata input, and permit manual editing once the metadata is generated. Many of these applications automatically link to property definitions; list acceptable content value standards or even values for selection; and automatically generate XML or other desired encoding, as illustrated with the “xmlify” button in the OMF

Top of Form	
creator	
Person or organization primarily responsible for creating the intellectual content of the resource	
First Name	
Last Name	
Email	
	add creator
maintainer	
Person or organization responsible for publishing the resource in its current form	
First Name	
Last Name	
Email	
	add maintainer
contributor	
Person or organization not specified in a CREATOR or MAINTAINER	
First Name	
Last Name	
Email	
	add contributor
title	
The name given to the resource by the CREATOR or MAINTAINER	
	add title
date	
The date on which the resource was made available in its current form	
	add date
version	
A string or number that distinguishes the current revision of the resource from other revisions	
Version Identifier	
	add version
keywords	
The topic of the resource. Typically, this element employs keywords that summarize the subject or content of the resource. (one word or phrase per line)	
	add keywords

Example 4: OpenSource Metadata Framework (OMF) Template

description A textual description of the content of the resource (e.g., an abstract, contents note) add description	
type The category of the resource add type	
format Details about the implementation of the resource Mime Type add format DTD add format	
identifier A specification of a unique ID by which the resource may be identified and from which the resource may be retrieved. (e.g. a URL or URN) add identifier	
source A specification of any previous or alternative publication of the resource in its current form (e.g. a larger work from which the resource is extracted, such as a chapter taken from a book). SOURCE may include a URL, ISBN or similar device add source	
language Language(s) of the intellectual content of the resource add language	
relation A URL that points to the IDENTIFIER element of another resource. Each instance of RELATION links the resource to other resources of similar domain or style add relation	
coverage A description of the resource's intellectual scope Geographic Distribution Kernel Architecture OS add coverage	
rights An indication of the copying policy under which the resource is distributed License Type License Version License Holder First Name Last Name Email add rights	
xmlify Bottom of Form	

Template (Example 4). The Berkeley Web Template CGI script for EAD finding aids (<http://sunsite3.berkeley.edu/ead/tools/template/>), and the hCard Creator (<http://microformats.org/code/hcard/creator>) for hCard Microformats Wiki 2.0 (<http://microformats.org/>) (a standard used to represent people, companies, organizations, and places) are examples of these more manually driven metadata applications.

There are metadata applications supporting a greater degree of automatic processing, such as DC-dot and Metatag Extractor (<http://www.hooverwebdesign.com/tools/metatags.php>). These applications automatically harvest metadata from the resource's source code. Additionally, DC-dot extracts resource content where harvesting proves insufficient and also includes a template for manual editing.

- *Library management systems (LMS)*: As libraries have engaged in metadata generation, library software has integrated the support for metadata standards. Examples include Innovative Interfaces Inc.'s Metadata Builder (http://www.iii.com/products/metadata_builder.shtml), which supports the creation for both Dublin Core and the EAD metadata; and CONTENTdm (<http://www.contentdm.com/>), which supports Dublin Core, VRA Core, and newly created metadata schemes and vocabularies. There are also a number of open source LMS, such as Greenstone Digital Library Software (<http://www.greenstone.org/>), supporting many of the metadata functions found in commercial products.
- *Content management systems (CMS)*: CMS require metadata for content management. Ektron (<http://www.ektron.com/web-content-management-solutions.aspx>) includes basic metadata properties such as title, keywords, language; and this software can be programmed to assign default keywords. IBM Lotus Quickr Web (<http://www.ibm.com/developerworks/lotus/library/quickr-web-services/>) automatically generates date created, last modified timestamps, and identifier metadata to maintain server activities. Similar to LMS, there are many open source CMS that support metadata. Additionally, many CMS integrate taxonomy plug-ins to improve metadata quality. Synaptica® (<http://www.synaptica.com/djcs/synaptica/>) from Dow Jones Client Solutions is among one of the more popular plug-ins for developing and managing taxonomies.
- *Daily use software*: Although this is rather a "catch-all" category, it is the case that anyone working on any type of computer interfaces with some form of metadata generation software, whether or not they are aware of it. Examples include software people use daily to arrange information captured on their iPods, palms, cell phones, and other mobile devices. The AMeGA Report,^[44] produced to address Section 4.2 of the *Library of Congress Bibliographic Control*

Action Plan,^[45] analyzed metadata generation features and functionalities embedded in software people use to create content daily (e.g., Microsoft Word, Adobe, Dreamweaver, and Moveable Type), and found that several metadata elements supported by these applications easily map to the Dublin Core. Finally, and perhaps the most obvious daily use applications supporting metadata generation underlie social networking activities. For example, Flickr (<http://www.flickr.com/>) and Delicious (<http://delicious.com/>) support folksonomic tagging and the generation of metadata, a good portion of which aligns with Dublin Core properties.^[10]

Classes of Persons

Among the classes of persons involved in metadata generation, are professional metadata creators, technical metadata creators, content creators, and public metadata creators.

- *Professional metadata creators* include catalogers, indexers, and other individuals who have had formal education or official on-the-job training to learn about metadata standards and issues; and they generally work in libraries, archives, publishing houses, and formal information agencies. This class of persons is known as third-party metadata creators because they produce metadata for content created by other individuals. Professional metadata creators have the intellectual capacity to make sophisticated interpretative metadata-related decisions, work with classificatory systems and other complex content value systems, and have some theoretical understanding of metadata. Given expert knowledge, the professional's greatest contribution may be evaluating metadata, managing metadata generation activities, or helping to develop tools that facilitate effective and expedient metadata production.
- *Technical metadata creators* include data in-putters, paraprofessionals, and other individuals who generally have had basic training, but have not participated in a formal structured or certified educational program. Technical metadata creators are also third-party metadata creators, and generally not assigned the same degree of responsibility as a metadata professional; however, they may take on more sophisticated tasks over the duration of their work-life.
- *Content creators* are individuals creating metadata for intellectual content they have authored. There are many types of content creators—authors of text, photographers, creators of video—amateurs, professionals, and the average citizen.

Authors of scientific publications regularly engaged in metadata generation in the pre-Web environment by writing abstracts, identifying keywords, and even assigning

classificatory indicators when submitting their work via peer-review channels. The online peer-review process has maintained these author metadata requirements. An example is the Association of Computing Machinery/Special Interest Group (ACM/SIG) Proceedings Templates (<http://www.acm.org/sigs/publications/proceedings-templates>), which require authors to select “categories and subject descriptors” from the *ACM Computing Classification Scheme*.^[46]

The content creator metadata environment is thriving today via developments such as the OAI, institutional and specialized repositories (e.g., GenBank, <http://www.ncbi.nlm.nih.gov/Genbank/>, for gene sequences), and social networking sites, where people create metadata to share photographs (e.g., Flickr), bookmarks (e.g., Delicious), news (e.g., Blogs), and news about oneself (e.g., Facebook, <http://www.facebook.com/>).

- *Public metadata creators* include community or subject enthusiasts who create metadata for a resource authored by other individuals. A subcategory of public metadata creators includes *users*—people creating metadata by annotating content they have used, and sharing their insights.

During the very early years of the Web, 1995–1999, people created lists of hyperlinks for topics they were passionate about (e.g., travel, sports, cooking, pets, politics, and entertainment), resulting in personal subject gateways. These personal undertaking included basic metadata: title, creator, and sometimes an annotation. While these types of Web sites are still visible, public metadata creators have generally turned to social networking sites to share favorite Web sites, tag information, blog, or annotate information.

Public metadata creators help build collective knowledge through their efforts, and are increasingly being accommodated in reputable information systems. For example, WorldCat (<http://www.worldcat.org/>), a service connecting more than 10,000 libraries worldwide, has introduced a user tagging option. This service allows users to manage bibliographic records and enhance resource discovery for other WorldCat users. The Steve project (<http://www.steve.museum/>), a partnership between leading museums and the general public, is another important example exploring how social tagging can enhance access to museum collections and further engage visitors.^[47]

Professional catalogers and metadata experts are not able to handle the sheer volume of information being generated today; and it is not feasible to ask these highly skilled and paid individuals to create metadata for every digital object, particularly when there are other individuals and applications to help with the process. It is, therefore, encouraging to see the increased functionalities in metadata application and more and more people engaging in metadata generation.

METADATA MODELS

The increase in metadata generation has encouraged the development of metadata models supporting interoperability, data reuse, and more intelligent packaging of metadata. This section reviews four key models gaining acceptance in the metadata community, although there are many additional models.

Arguably the most simplistic model impacting metadata developments is the Resource Description Framework (RDF).^[48] RDF is a simple model for rendering metadata instances into simple discrete and explicit statements (Example 5). The overriding goals of RDF are to impose structure, facilitate the unambiguous and consistent expression of semantics, and support more intelligent use of Web data. RDF underlies the Web Ontology Language Overview^[49] and Simple Knowledge Organization System^[50]—two key specifications for developing the Semantic Web.

RDF statements are frequently referred to as *literals* or *triples*, and include a subject, predicate, and object (Example 5); these statements can be visually represented via RDF graphs (Fig. 1).

Multiple RDF statements can be made about the same object. Additionally, RDF supports an iterative process, whereby an “object” of one RDF statement could be the subject of another RDF statement. A statement illustrating iteration might say that the “subject” *Harley-Davidson motorcycle* (from *LCSH*) (which is the “object” in Figure 1), has a “predicate” *identifier* (the LC control number) with the “object” (meaning the *value*) 85058931 (see Fig. 2).

RDF was initiated as a model that does not necessarily need to be expressed in XML. However, RDF implementation is supported by series of additional specifications addressing the syntax, vocabulary, and semantics for creating RDF/XML statements that permit metadata to be shared. Conceivably, once an RDF statement is made about an object on the Web, that statement (a metadata

Example 5: RDF triple

Subject	Predicate	Object
The subject (meaning the resource) http://www.harley-davidson.com	Has a predicate (a Dublin Core property) The “dc.subject”	Containing object (a value; and in this case an <i>LCSH</i> value) “Harley-Davidson motorcycle”

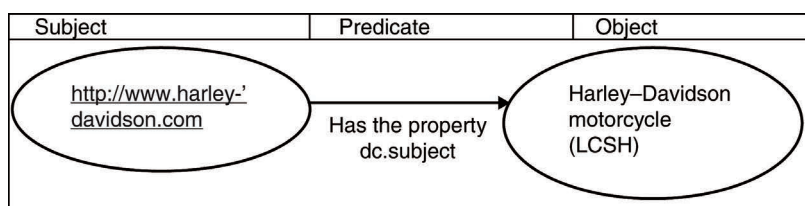


Fig. 1 RDF graphical representation for the triple in Example 5.

instance) can be reused again and again, although more development is needed to truly share and reuse RDF renderings.

Another model increasingly being discussed in the metadata community is the Functional Requirement for Bibliographic Records (FRBR),^[51] published by the International Federation of Library Associations and Institutions. A body of research has advanced knowledge about the bibliographic object and the notion of the *work*^[52,53] in our online library catalogs. Building on these advancements, the FRBR model includes four entities: *work*, *expression*, *manifestation*, and *item*. The partitioning of bibliographic data (or metadata) following FRBR allows for data reuse; more sophisticated linking of entities; and a richer descriptive environment. The model is still heavily conceptual, although there are instances of FRBR implementations, most notably OCLC's Fiction Finder (<http://fictionfinder.oclc.org/>).

FRBR's foundation work predates the Web; and, yet, it is extremely applicable to the digital world, where resources are copied and modified rapidly, and the reuse of bibliographic data is an important goal. FRBR presents library users with an opportunity for gaining a greater understanding of the bibliographic universe from where they gather sources; and, in the long run, FRBR could prove extremely cost effective, not only for users making important links among resources, but by eliminating duplicative metadata efforts. These goals have inspired additional FRBR efforts relating to name and subject authority data.

The Metadata Encoding and Transmission Standard (METS)^[54] is another model being used in the digital library/repository environment. METS is a framework for packaging descriptive, administrative, and structural metadata within an XML framework, and wrapping that metadata around a digital resource. As digital initiatives began to proliferate toward the end of the 1990s, the need for different types of metadata standards supporting

different functions became increasingly evident. This need led to interest in developing a consistent way to package resource metadata drawing from different standards—a goal that was further motivated by the need to enable greater interoperability and reuse of the resource and its associated metadata. The Making of America-2 (MOA-2) (<http://sunsite.berkeley.edu/moa2/>), a Digital Library Federation project, formalized these ideas and created a XML/document type definition (DTD) for packaging metadata; and these efforts progressed to form what is today METS.

METS has the following seven key sections: 1) *METS header* for describing the object; 2) *descriptive metadata* linking to external metadata (e.g., a MARC bibliographic record or a Dublin Core record, representing the object, but stored elsewhere), and internal descriptive metadata enriching external descriptions; 3) *administrative metadata* documenting creation, source, and rights information both externally and internally; 4) *file section* listing all files comprising the digital object; 5) *structural map* outlining the resource's arrangement and linking to the object's content; 6) *structural links* recording hyperlinks between sections of an object's content; and 7) *behavior* documenting and pointing to executable behaviors associated with the METS object's content, or code for initiating an operation.

The Dublin Core Abstract Model (DCAM)^[55] is among the more recent metadata models. The DCAM incorporates RDF and has been developed to advance the metadata development, and to bring metadata activities more in-line with the Semantic Web initiative. Two key principles underlying DCAM are: 1) a resource can be any type of discrete entity (as discussed above in "Defining Metadata" section), and 2) metadata can be created for any object. The DCAM asserts that a metadata record can include one or more metadata statements; and a simple RDF statement is an acceptable metadata record. This approach differs from traditional notions of a bibliographic cataloging, where a metadata record includes multiple property/value pairs. The DCAM is "object centered," and the emphasis is on cataloging objects (e.g., words, numbers, discrete entities) at the most discrete level, so that the object and metadata are reusable. The majority of metadata work is resource centric—with resource referring to an entire Web site, or the types of entities collected by libraries, albeit digital (e.g., books, reports, photographs). Implementing metadata within the

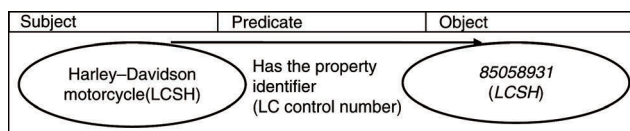


Fig. 2 RDF graphical representation for the "subject" *Harley-Davidson motorcycle* (an LCSH heading).

DCAM requires a new, more object-centered perspective for metadata. DCAM is in its infancy, but the approach may transform metadata activities to a new level.

CONCLUSION

Metadata is a dynamic topic and has evolved considerably since the initial *ELIS* metadata entry was published in 2002.^[1] This current entry stands as a new article, with fresh coverage of the earlier topics (e.g., the definition of metadata and metadata generation), and greater attention to metadata models. This entry provides new facts uncovered on the history of metadata; presents an overview of different metadata types, functions, and schemes; provides a series of domain-specific definitions for metadata; and discusses the various types of standards comprising metadata architectures.

The remarkable growth in metadata activities has been extremely positive, resulting in greater access to information and better documentation. However, like many developments, this growth has not been without challenges. Determining how to generate metadata (emphasizing an automatic or manual approach), and who to involve in the process (professionals, technical assistants, content creators, the public), presents metadata quality and workflow challenges. Striving for interoperability and sharing metadata can pit local metadata needs against higher level goals. And, perhaps the most exciting challenges stem from the goal of *metadata reuse*. Those engaged in metadata activities debate if metadata should be generated for every discrete object and if a more globally linked Semantic Web is achievable. Efforts underway, such as the Dublin Core Singapore Framework^[12] guiding application profile development, and the National Science Digital Library Metadata Registry (<http://metadataregistry.org/>), for sharing metadata schemes, provide a means for addressing several metadata reuse challenges. These efforts will, no doubt, continue to evolve through evaluation and use. And, as metadata progresses, new challenges will undoubtedly surface, and new solutions will be sought.

It is clear that metadata is an ubiquitous topic and an integral part of our digital information infrastructure. Education, the arts, science, industry, government, and the many humanistic, scientific, and social pursuits that comprise our world have rallied to develop, implement, and adhere to some form of metadata practice. There is ample evidence showing that metadata has touched nearly every discipline and societal sector coming into contact with digital information. The goals are similar across the board—to facilitate the preservation, discovery, access, and sharing of digital output. In closing, the range of metadata activities over this last decade are both extensive and astonishing, and presents an unprecedented

opportunity to share information and knowledge as we move forward in this millennium.

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Metam Markup Languages: SGML and XML

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Abstract

Current global communication of people and software applications over the Internet is facilitated by the use of markup languages. This entry introduces the principles and different types of markup, and the history behind the current markup languages. The basis of most of the modern markup languages is the Standard Generalized Markup Language (SGML) or its restricted form Extensible Markup Language (XML). Both of them are metalanguages that are used to define specific markup languages for specific application areas. The entry describes the markup techniques used in SGML and XML, gives examples of their use, and briefly describes some representative SGML and XML applications from different domains. An important factor in the success of XML has been the possibility to reuse markup vocabularies and combine vocabularies originating from different sources. The entry describes the concepts and methods facilitating the reuse of names from earlier defined vocabularies.

INTRODUCTION

Markup languages have become an important means to communicate information on the Internet. On November 2014, Google search markup language derived more than 29 million hits, mentioning on the first pages, for example, the following languages:

- Standard Generalized Markup Language (SGML)
- Extensible Markup Language (XML)
- HyperText Markup Language (HTML)
- Emotion Markup Language
- Chemical Markup Language
- Graffiti Markup Language
- Music Markup Language
- Geography Markup Language
- Systems Biology Markup Language
- Theological Markup Language
- Election Markup Language
- Fountain: A markup language for screenwriting

The list clearly shows the diversity of application areas where markup languages have been developed. This diversity is an important reason for the fact that not only information specialists but also many application domain specialists face the need to understand the principles of markup languages. The first two on the list, Standard Generalized Markup Language and Extensible Markup Language, better known by their acronyms SGML and XML, respectively, are not languages for a particular application domain but *metalanguages* that are used as a basis to develop markup languages for various domains. From the languages of the list Emotion Markup Language, Chemical Markup Language, Graffiti Markup Language, Music

Markup Language, Geography Markup Language, Systems Biology Markup Language, Theological Markup Language, and Election Markup Language are XML-based languages. HyperText Markup Language instead, also known as HTML, is a markup language older than XML and based on SGML, the “mother language” of XML. The last in the list of languages represents markup languages that are not based on SGML or XML.

The markup techniques in the contemporary markup languages are intended primarily for computers. Markup as a technique to add information to documents is, however, older than computers and originally intended for human use only. This entry first introduces different types of markup and provides a classification of the types. A brief history of SGML^[1] is then provided, examples of the most important SGML applications are given, and reasons for the evolution of XML^[2] from SGML are described. The markup in SGML and XML is intended to indicate two different structures in documents: a logical structure and a physical structure. The markup techniques to indicate those structures in documents are described and some examples are given. Neither SGML nor XML provides a predefined markup vocabulary, instead they include a definition capability to describe markup vocabularies for particular application areas. The vocabularies carry semantic information to the human users of the languages. The definition mechanism is introduced briefly, the topic is covered more extensively in another entry of the Encyclopedia. XML-based languages have been developed for various domains. This sectoral development has been facilitated not only by XML but also by the XML family of languages developed at the World Wide Web Consortium (W3C), the organization coordinating web technology development. At the end of the entry, a

classification of the XML family of languages is introduced and some representative languages are briefly described.

MARKUP TYPES

Markup can be divided into different types based on its function. Fig. 1 describes a taxonomy of markup types. At the highest level, markup is divided into two categories: markup intended for human use and markup intended for computer use. Each of these categories is further divided into subcategories. The principles of the markup types, shown in Fig. 1, are described in the following text.

Markup for Human Use

Markup has been the traditional editing technique used in text publishing. Copy editors have added special marks as instructions *for typesetting* a manuscript to be printed. This kind of markup can be called *presentational* because it is intended to inform the typist about the intended external presentation of the text.

The term “markup” is in some sources used also to cover those notations in documents that are intended *for human reading* to make the text understandable. This type of markup has been divided into *punctuational* and *presentational*.^[3] As an example, consider a situation where I want to communicate to my friend Mary Lynn, a proposal to meet her the same day at the statute by Henry Moore in front of the Toronto City Hall, known by Torontonians as The Archer. Text written in haste either by hand on a piece of paper, or by a mobile phone, might first look something like this:

```
April22HiMaryLynnLetusmeettoday4pmatThe
ArcherAiri
```

By punctuational markup I can make this text more readable:

```
April 22 Hi MaryLynn! Let us meet today
4 pm at The Archer. Airi
```

Punctuational markup includes spaces, commas, and other punctuation marks facilitating the separation of words and other syntactic units in text. In addition to the punctuational markup, I might want to use presentational markup to make the text still clearer to read:

```
April 22
```

```
Hi MaryLynn!
```

```
Let us meet today 4 pm at The Archer.
Airi
```

Here the presentational markup includes an empty line, beginning of text from a new line, and indentation. In a longer text presentational markup might include page and list numberings, underlinings, and so on.

Markup for Computer Use

The markup intended for computers has to be formal and systematic. The term “markup language” refers to a language with formal syntactic rules for markup. The markup can be regarded as metadata adding some information to some primary data, often intended for human perception. The early markup languages were developed for text processing systems to instruct software the way the content should be formatted. For example, in a UNIX operating system environment the message to Mary Lynn might have been written in the following way:

```
April 22
.sp 1
Hi Mary Lynn!
.in 5
Let us meet today 4 pm at The Archer.
Airi
```

Here the markup consists of the formatting commands informing the *nroff* text editor how to print the text. The

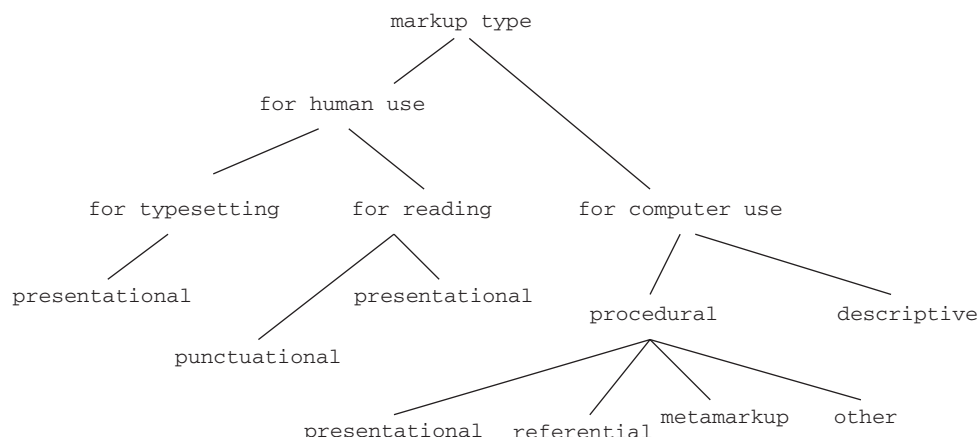


Fig. 1 Taxonomy of markup types.

first nroff command on the second line instructs the text processor to leave one line of blank space and the second command on the fourth line instructs the processor to indent the following text by five white spaces. Also the space in the beginning of the last line represents markup, because in nroff, a line beginning with spaces is an instruction to begin the text on a new line. This kind of markup for a computer software is called *procedural*. Procedural markup is tied to a particular function in software processing, like in the earlier example where .sp 1 is tied to the line skipping function.

Procedural markup can be used for different types of processing instructions, and accordingly divided into subtypes. The procedural markup intended for formatting is *presentational*. Other subtypes of the procedural markup are referential and metamarkup.^[3] *Referential* markup is used to inform the processor to replace a reference by some value. For example, in some Scandinavian text the strings ä and ö might be intended to be replaced by the text processor by the letters ä and ö, respectively. *Metamarkup* includes notations for defining markup rules for a particular application area. The definitions in XML represent metamarkup and some of them will be considered later in the entry.

The formatting instructions given by means of procedural markup as earlier are embedded into the content of the document; changing the formatting requires changing the document. For two kinds of formatting, two documents with the same primary content have to be written. An alternative to the procedural markup is *descriptive* markup describing the structural components of the document without specifying the processing to be performed on them. Different software applications can then process the structure in their own ways. For the purposes of printing or displaying, the format can be attached as a separate *stylesheet* document.

Fig. 2 shows the previous message written by means of descriptive markup. The markup consists of tags of the form <...> and </...>. The tags indicate the beginning and end of the structural components in the message and give also names to the components. A structural component starts by a tag of the form <...> and ends with </...>. The markup does not refer to the external presentation of the message.

Even though procedural and descriptive markup can be seen as alternative types of markup, it is, however, not rare that a particular markup serves both purposes at the same time. The HTML mentioned in the beginning of the article and familiar to many readers is an example of a language where descriptive markup is used to describe the structure of the external presentation of a document. In such a case, descriptive markup is also presentational.

The principle of descriptive markup has been an important facilitator in the evolution of the current information networks where people, organizations, and computers are connected to each other globally. The widespread

```
<message>

<begin>

<date>April 22</date>

<salute>Hi Mary Lynn!</salute>

</begin>

<main_content>

Let us meet today 4 pm at The Archer.

</main_content>

<end>

<salute>Cheers,</salute>

<sender>Airi</sender>

</end>

</message>
```

Fig. 2 An example of descriptive markup.

adoption of the principle was initiated with the open standard called SGML.^[1]

BRIEF HISTORY OF SGML

The problems related to the automated text processing of documents with embedded formatting instructions were identified in the 1960s. As early as 1967 in a meeting of the Canadian Government Printing Office, William Tunnicliffe pointed out the importance of the separation of information content of documents from their format and called for “generic coding” of documents instead of “specific coding”.^[4] The idea of generic document coding was an important feature in the language Charles Goldfarb, Ed Mosher, and Ray Lorie invented in 1969 at IBM. The ideas of the language were published in the 33rd annual meeting of the American Society for Information Science in 1970.^[5] The language was first called Text Description Language. In his article in the ACM SIGPLAN/SIGOA conference in 1981, Goldfarb adopted the term *Generalized Markup Language* (GML, nicely referring also to Goldfarb-Mosher-Lorie) for the language developed at IBM and the term “descriptive markup” to the document coding style in GML.^[6] In the same article, Goldfarb emphasized the importance of rigorous markup: the markup should be rigorous facilitating systematic, automated processing of sets of documents of certain types.

The principle of descriptive markup evolved at the time when programming language community started pointing out the difference between procedural and non-procedural programming. In the non-procedural programming, the idea was to give a prescription for solving a problem without showing *how* it is solved.^[7] Similarly, descriptive

markup is intended to describe the structure of a document without indicating *how* the parts of the structure should be processed. Different processing functions can be attached to the structure, either in the software or in separate specifications. The principle of descriptive markup was implemented in the SCRIBE system even before the implementation of GML.^[8] The first implementations served well as a proof-of-concept, but for broader adoption of the principle it was important to find an agreement of standardized rules for descriptive markup. The work toward such rules started in a committee of the International Organization of Standardization (ISO). The first chair person of the committee was Charles Tunncliffe and the concrete development work was done primarily by Charles Goldfarb. The work resulted in *Standard Generalized Markup Language* (SGML), accepted as an ISO standard 8879 in 1986.^[11] The markup in Fig. 2 is an example of SGML markup. To support rigorous markup SGML included the capability to define markup languages by means of *Document Type Definitions* (DTDs). Thus SGML could be used as a *metalanguage* to define special markup languages for special needs as *SGML applications*.

SGML APPLICATIONS

In the 1980s, the definition capabilities of SGML were used, in particular, to define special markup languages for publishing industry, technical documentation, and electronic humanistic texts. Table 1 shows some important SGML applications.

DocBook was developed by private companies especially for authoring and publishing books and articles.^[9] Currently, the DocBook schema is maintained by OASIS (Organization for the Advancement of Structured Information Standards, <http://www.oasis-open.org/>). The development of markup languages for technical documentation was activated strongly by the US Department of Defense under the Continuous Acquisition and Life-Cycle Support (CALS) initiative.^[10] The purpose was to support the weapon system acquisition and life-cycle management. The markup needs of electronic humanistic texts differed from the needs of book publishing and technical documentation. A consortium called Text Encoding Initiative (TEI) was established in 1987 to develop and maintain methods for encoding humanistic texts in electronic

form. SGML-based TEI guidelines were published in 1994, including, for example, markup vocabulary for prose, verse, drama, and dictionaries.^[11]

The most popular SGML-based markup language was born in 1991, when Tim Berners-Lee and Robert Cailliau designed the World Wide Web (WWW) at European Organization for Nuclear Research (CERN).^[12] The language was called HyperText Markup Language (HTML),^[13] and it was used in the new innovative application to present hypertext documents interlinked to each other on the Internet. In HTML, the SGML-based declarative markup also serves as procedural markup to instruct the web browser in the document presentation and in opening new web pages.

The adoption of WWW expanded rapidly in the beginning of the 1990s. New kinds of businesses evolved, based on the connectivity of people all over the world and connectivity of software applications. A great deal of new business ideas were tested on the web, only a few of them were, however, commercially successful. Drawbacks in the business did not prevent the expansive growth of the Internet. At the end of the century, the number of computers connected to the Internet exceeded a hundred millions.

FROM SGML TO XML

The amount of information resources on the Internet started quickly expanding after the invention of WWW. A rich variety of people and software applications were connected to each other through WWW and had, at least in principle, access to huge information resources with textual and multimedia content. The communication of the applications was, however, often hindered by the differences in the representation of data. This was a great barrier for effective use of the Internet, particularly for business purposes. It became urgent to find some common rules for representing information and information structures within Internet and for exchanging information between applications over the Internet. SGML basically offered such rules, but the rules of SGML were too complicated for the needs of the Internet. One of the problems of SGML was the difficulty of building software supporting SGML in general, not only a particular SGML application like HTML. The development of a restricted form of SGML for the purposes of the Internet

Table 1 Some SGML applications.

SGML application	Main purpose	Developing organization
DocBook ^[9]	Book and article publishing	First private companies, later OASIS
CALS DTDs ^[10]	Technical documentation, life-cycle management of weapon systems	US Department of Defense
TEI ^[11]	Electronic encoding of humanistic texts	TEI Consortium
HTML ^[13]	Publishing hypertext documents on the WWW	European Organization for Nuclear Research (CERN)

communication started in the mid-1990s by a group of people. A goal was to simplify the language so that the design and implementation of software for it would not be too tedious. The W3C established in 1994 took responsibility for the development work and published the first version of the restricted form of SGML by the name Extensible Markup Language (XML) 1.0 in 1998.^[12]

Compared to SGML, the number of rules in XML is clearly smaller, and its character set and resource identification mechanisms are planned for use on the Internet. Text in XML documents is encoded for computers using the Unicode character set. Unicode is intended to serve as a character set for representing textual data for computers written in any natural language of the world, independently, for example, of the writing direction of the language. The markup concepts and the DTD mechanism of XML are inherited from SGML. The descriptive markup in Fig. 2 is an example of XML markup as well as of SGML markup. A great deal of the SGML applications are currently also available as XML applications. For example, the markup recommendations of the TEI are available also for XML encoding. For web publishing, there is the Extensible HyperText Markup Language (XHTML)^[14] that facilitates the use of HTML tags by following the rules of XML. For the latest HTML version called HTML5, XHTML syntax has been defined along with the HTML syntax.^[15]

MARKUP TECHNIQUES OF XML

The XML is intended to support computerized use, exchange, and processing of information in documents, especially on the Internet. A goal in the XML development has been to keep it as stable as possible. During the years, some needs for changes have, however, evolved and therefore a new version XML 1.1 was published in 2004.^[16]

The XML specification of W3C describes the markup rules for XML documents and also partially the behavior of a software module capable to deal with the features common to all XML documents. The module is called an *XML processor*. It is used to read XML documents and check that they follow the rules defined in the

specification. In case a DTD is attached to the document instance, the XML processor may also check that the markup follows the constraints in the DTD. XML processor thus performs the parsing of the document. Therefore, an XML processor is often called also an *XML parser* or an *XML validator*.

The XML processor is not an independent piece of software but a module working for a software application. After the parsing the structural components are forwarded to the application. For example, web browsers like Internet Explorer and Mozilla include an XML processor as a component. By opening a file with the filename extension .xml, the XML processor of the browsers checks that the file follows the markup rules of XML and informs about possible errors. Both of the browsers show the file in a pretty-printed form as shown in Fig. 3.

Figs. 2 and 3 showed an example of marking up the logical structure of an XML document. Besides the logical structure, an XML document has a physical structure. The two structures and the corresponding markup are described as follows. At the end of the section, a concise introduction to the DTD capability of XML is provided.

Logical Structure

Even though the markup vocabularies of different XML-based languages differ from each other, there are some common rules all *well-formed* documents have to follow. The logical structure of every XML document is a hierarchy of *elements* indicated by explicit markup. The beginning of an element is shown by a *start-tag* of the form `< ... >` and the end by an *end-tag* of the form `</ ... >`. Both tags include the *name* of the element. Element names provide a capability to add semantic information to the structural markup. The text in Fig. 2 is an example of a well-formed XML document. The element names in the markup of the example were chosen such that they tell something about the meaning of the elements to a human reader. The outermost element is called *message* and the element has three *child elements*: *begin*, *main_content*, and *end*. The element called *message* is the *parent element* of the three child elements and also the *root element* of the document. The element

```
- <message>
  - <begin>
    <date>April 22</date>
    <salute>Hi Mary Lynn!</salute>
  </begin>
  <main_content>Let us meet today 4 pm at The Archer. </main_content>
  - <end>
    <salute>Cheers,</salute>
    <signature>Airi</signature>
  </end>
</message>
```

Fig. 3 The pretty-printed format of the markup text of Fig. 2 in Mozilla browser.

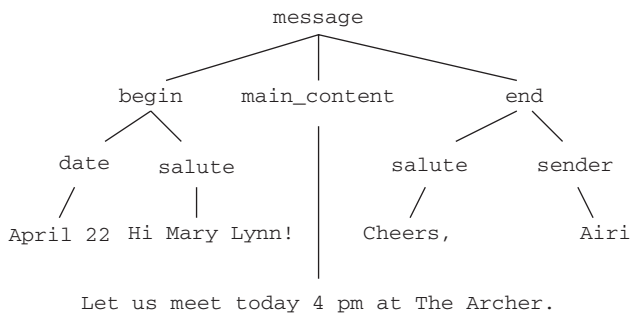


Fig. 4 Graphical representation of the tree structure of the example in Fig. 2.

begin is the parent of two child elements: date and salute. The element end is the parent of two child elements: salute and sender. Graphically, the logical structure of the document is shown in Fig. 4. In the pretty-printed form of web browsers (as shown Fig. 3), the hierarchic structure is utilized by allowing the user to unzoom or zoom branches in the tree structure. The minus character preceding the begin-tag indicates that the element has child elements and the child elements are presented on the screen. By clicking the character -, the child elements will be hidden and the minus character will be replaced by the plus character +.

The text between the start-tag and the end-tag of an element is called the *content* of the element. All elements having the same name in a document belong to the same *element type*.

The markup consisting of tags adds to the text the hierarchic structure and gives names to the structural components. A further means to add information to elements is the use of *attribute specifications*. An attribute specification can be added to the start-tag of an element, after the element name. For example, one might use an attribute to indicate that the content of the element main_content is English:

```
<main_content xml:lang="en">Let us meet
today 4 pm at The Archer.</main_content>
```

Since the capability of presenting content with various natural languages has been found important in XML, a predefined attribute `xml:lang` has been defined to identify the language in which the content of an element is written. The prefix `xml` indicates that the name `xml:lang` is a reserved name from the XML specification. The values of the attribute have to be given by the codes defined by the Internet Engineering Task Force (IETF).^[17] In the example, the attribute specification indicates that the content of the element is in English. The example shows that there are two different techniques for providing a piece of data in XML elements: as element contents and as attribute values.

Physical Structure

Each XML document has actually, in addition to the logical structure, also a physical structure. Also the physical structure has to be indicated by markup. The physical structure of an XML document consists of units called *entities*. Each document has a special text entity called *document entity* or *root entity*. All entities referred to directly or indirectly from the root entity are regarded as parts of the physical structure of the document. The entity mechanism can be utilized to include non-textual data in a document. Thus in its physical structure an XML document may be a multimedia document having along with textual parts other forms of data, for example, audio or video data. For example, we might add to the message of Fig. 2 a reference to the photo of the sender by means of the attribute photo.

```
<sender photo="airi-image">Airi
</sender>
```

The attribute value "airi-image" is the name given to the entity elsewhere in the document.

Another type of an entity is a named piece of text introduced in an *entity declaration*. In other parts of the document, an *entity reference* is then used to refer to the text piece, in the same way as macros are used in many programming languages. For example, by giving the name W3C to the text piece

```
"World Wide Web Consortium"
```

we can refer to the text by the entity reference `&W3C;`. The symbol `&` starts the entity reference and the semicolon ends it. In processing the document, the XML processor replaces the reference by its value before transmitting data to the application. All entity references in XML documents represent procedural referential markup, not declarative markup. Entities provide an important means to include non-textual data to documents and to support consistency and reuse of the textual content.

Document Type Definitions

The previous sections described what kind of markup is used to indicate the logical and physical structure of a document. Extensible Markup Language also provides metamarkup capabilities to define markup languages for specific domains by means of DTDs. A DTD defines the grammar for the documents of a type. Fig. 5 shows a DTD for a message. The first line shows that the document type is called message and the last line closes the definition. The DTD describes the element types used in the documents of the type message, their names, and the way the documents are structured from elements. Altogether, eight element types are defined. Each of the lines beginning by the word ELEMENT is a grammar rule defining the structure of an element type. The name of the element type is given after


```

<!DOCTYPE message [
<!ELEMENT      message      (begin, main_content, end)>
<!ELEMENT      begin        (place?, date, salute)>
<!ELEMENT      place        (#PCDATA)>
<!ELEMENT      date         (#PCDATA)>
<!ELEMENT      salute       (#PCDATA)>
<!ELEMENT      main_content  (#PCDATA)>
<!ELEMENT      end          (salute, sender*)>
<!ELEMENT      sender       (#PCDATA)>
]>

```

Fig. 5 A Document Type Definition.

the word `ELEMENT` and the structure of the elements is given between parenthesis after the element type name.

The first element type definition in Fig. 5 defines the root element `message`. A message is defined to consist of three elements: `begin`, `main_content`, and `end`. The `begin` element always contains a `date` and `salute`, in the beginning possibly a child element called `place`. The optionality is indicated by the question mark. The notation `#PCDATA` is used to indicate that an element consists of character data, without having any child elements. The element called `end` first has a `salute` and then possibly `sender` elements. The repetition of zero or more times is indicated by the symbol `*`. Fig. 2 showed a message following the constraints defined in the DTD. It is called a *valid document* of the type `message` because it is well-formed and follows the rules expressed in the DTD.

COMBINING MARKUP LANGUAGES

A significant factor in the success of XML has been the idea that the work done in an environment for developing markup vocabularies and software can be reused in another environment without being forced to reinvent well-understood concepts and structures. Combining markup vocabularies from two different environments has required solving two problems: identification problem and name collision problem.

Identification Problem

If concepts defined in an environment are intended to be reused and shared in other contexts, there is a need for the unique identification of the original definitions.

Name Collision Problem

When earlier defined names are adopted from two different contexts, it is possible that the same name is used with different meanings.

These two problems have been solved by means of the *XML namespace* mechanism.^[18] A namespace consists of a set of names having a unique identifier. The names may be

defined, for example, in a DTD, but no constraints have been set to the way the names are described and defined. For the unique identifier instead, there are formal syntax rules, the identifier has to be given by using the syntax of the Uniform Resource Identifier (URI).^[19] The most common form of a URI reference is the Uniform Resource Locator (URL) used in the WWW to refer to resources available on the Internet. For example, the URL `http://www.w3.org/` is the address of the main page of the W3C site. A URI reference can also be a Uniform Resource Name (URN) intended for persistent identification of resources to remain the same even when the resource becomes unavailable. As namespace identifiers, URIs are always considered as identifiers of abstract resources. The definitions of the names may be available on a particular Internet site, but the namespace identifier is not regarded as the address of the site even though the format would be that of the URL. For example, if people at the University of Jyväskylä agree of a set of names and “`http://jyu.fi/names/`” as its identifier, the identifier can be used whether there is something on the web address or not.

In case of namespaces intended for widespread use, the developing organizations may provide some information on the address of the namespace identifier. For example, the W3C has published the URI “`http://www.w3.org/1999/xhtml`” as the identifier for the element and attribute names in the XHTML language and on the page at `http://www.w3.org/1999/xhtml` some information about the specifications where the XHTML names are defined.

As mentioned earlier, reusing names requires solving parallel with the identification problem also the name collision problem. In XML documents the name collision of element and attribute names is avoided by means of qualified names. A qualified name consists of two parts: a namespace name as a prefix and a local part. The namespace name is identified in the document by a URI reference, but the name used as the prefix can be chosen locally. Fig. 6 shows an example how a message could be markedup using TEI element names. Instead of choosing own element names like in Fig. 2, the TEI standardization work is utilized. The name `tei` used locally for the TEI namespace is introduced by the namespace declaration:

```

<message xmlns:tei = "http://www.tei-c.org/ns/1.0">
<tei:opener>
<tei:date>April 22</tei:date>
<tei:salute>Hi Mary Lynn!</tei:salute>
</tei:opener>
<main_content>
Let us meet today 4 pm at The Archer.
</main_content>
<tei:closer>
<tei:salute>Cheers,</tei:salute>
<tei:signature>Airi</tei:signature>
</tei:closer>
</message>

```

Fig. 6 A document using names from the TEI namespace.

```

<message xmlns:tei = "http://www.tei-c.
org/ns/1.0">

```

The name is associated with the URI identifying the TEI namespace. The element names *opener*, *date*, *salute*, *closer*, and *signature* are taken from the TEI namespace.

XML FAMILY OF LANGUAGES

The simplicity of XML has encouraged active development work around XML, including both software development and development of XML applications and related languages. Where SGML has been primarily in use as a format for documents intended for human readers, for example, in the form of HTML documents, the use of XML has extended toward data interchange between software applications.^[20] Development of XML-based markup languages has been going on in various standards development organizations. For example, the OASIS (<http://www.oasis-open.org/>) has coordinated the standardization for health care and business needs.

Probably the most important standards developing organization is the W3C (<http://www.w3.org/>). The organization was founded in 1994 to coordinate and support international, open development of technologies related to the web. W3C publishes technical reports called *W3C Recommendations*, which are considered to define web standards. The Recommendations and their preliminary versions are published at <http://www.w3.org/TR/>. During the first 16 years of XML, W3C has developed a family of languages and published Recommendations for over 50 XML-related languages. The intent has been to specify syntactic and semantic rules either for some specific kind of XML data or for data to be used together with XML data for a specific purpose. A web portal maintained by the

author of the entry since the year 2000 provides a classification of the languages, and it shows for each language its standardization phase, related specifications, and links to the W3C technical specifications.^[21] The classification is introduced and some of the languages in each class are briefly described as follows.

Four main categories on the basis of their purpose have been identified in the XML family. The first category consists of the different versions of XML itself. The other three categories are called XML accessories, XML transducers, and XML applications:^[20,21]

XML accessories are languages that are intended for wide use to extend the capabilities specified in XML. An example of XML accessories is the *XML Schema* language extending the definition capabilities of XML DTDs. XML Schema allows the use of a variety of data types, for example, boolean, float, int, date, and their validation in conforming software. In addition to a number of built-in data types, the schema designers may define user-derived data types. XML Schema definitions can be written using XML syntax, but other presentations are possible, too. When using XML syntax, the schema is an XML document that can be processed by general XML software.

XML transducers are languages that are intended for transducing some input XML data into some output form. Examples of XML transducers are the style sheet languages Cascading Style Sheets (CSS) and Extensible Stylesheet Language (XSL) intended to produce an external presentation from some XML data, XSL Transformations (XSLT) for transforming XML documents into other XML documents, and XML Query Language (XQuery) for querying collections of XML data both locally and on the web, be it physically stored in XML or viewed as XML via middleware. A transducer language is associated with some kind of processing model that defines the way output is derived from input. From the four example languages, CSS does not have XML syntax while the rest of the languages have.

XML applications are languages that define constraints for a class of XML data for some special application area. As mentioned earlier, XML accessories and XML transducers are often XML-based languages and thus also XML applications. The languages in the XML applications category can be further divided into four subcategories according to the application area:

Non-textual forms of data: The character data of markedup XML are usually shown to the human reader as text. Non-textual data like graphics or voice are attached to the document as external entities. There are, however, also markup languages available to present non-textual data by means of markedup text. In the XML family of W3C such

languages are, for example, Synchronized Multimedia Integration Language (SMIL) for multimedia documents, Scalable Vector Graphics (SVG) for vector graphics, and Voice Extensible Markup Language (VoiceXML) to enable access to the web using spoken interaction.

Web publishing: The languages in this group are intended to replace the SGML-based HTML gradually by XML-based representation formats. The most important language in this group is *XHTML*, reformulation of HTML in XML. The latest version of HTML, called *HTML5*, has been defined with two syntaxes: one in HTML and the other in XHTML. Extensible Hypertext Markup Language is a content language aimed at many kinds of devices in addition to laptops and workstations, including TV screens of various sizes, hand-held computers, and portable phones. Therefore, there are several variants of the XHTML markup and also a possibility to embed other markup within XHTML to facilitate displaying non-textual markedup data by browsers. Current browsers already support the use of markup beyond XHTML. For example, Google Chrome, Safari, and Firefox browsers allow combining XHTML and SVG markup.

Semantic Web: To facilitate more effective use of resources on the web, W3C has started to develop rules for adding semantic metadata to the web. Important languages developed for the purpose are Resource Description Framework (RDF) to describe resources, RDF Vocabulary Description Language (RDF Schema) to define RDF vocabularies, and Web Ontology Language (OWL) for publishing and sharing ontologies.

Web communication and services: There is a great need to facilitate secure exchange of data and services between software agents of the Internet. W3C has developed a number of markup languages for the purpose. For example, *XML-Signature* defines syntax and processing rules for XML digital signatures. It is intended to provide integrity, message authentication, and signer authentication services for data. Simple Object Access Protocol (SOAP) is a lightweight XML-based protocol for exchange of information in a decentralized, distributed environment. Web Services Description Language (WSDL) can be used to define web service interfaces and functionalities so that services needed for a particular situation can be automatically accessed and chained with other services.

CONCLUSION

The interconnectivity of people, computers, software agents, organizations, and services on the web is enabled

by hundreds of different markup languages, either based on SGML or its restricted form XML. The web users do not necessarily have any need to be aware of the markup. Understanding the principles of markup techniques and markup languages is, however, essential to all information specialists. Also for application domain experts involved in the development of markup languages for the particular domain, it is important to be aware of the possibilities and constraints of markup techniques.

Why XML has been so widely adopted? Some kind of markup is always needed in digital documents to enable automated processing of documents. Compared to other kinds of markup techniques XML provides several benefits. Some of the important benefits are summarized here. First, like SGML, XML is a metalanguage enabling definition of special vocabularies and document structures for various application domains. Rigorous markup using specified vocabularies facilitates automated processing of documents of certain types. For example, it is possible to develop information retrieval tools where the queries are expressed using the terminology of the particular domain. Second, SGML and XML are open standards supporting long-term accessibility of information in data assets of organizations. Information in SGML and XML documents is not accessible by a particular software application only, but by diverse software. And if necessary, the markup is readable also to human individuals. Third, compared to SGML, XML is simpler and provides stronger support for programming. Thus, it has encouraged the development of a great number of software for processing XML data. Last, SGML was developed to be used as a document format, for example, for technical documents and publication industry. XML can be used for the same purposes but also, and is probably used more, as a format for data exchange between software applications. This feature supports interoperability of software applications.

The entry first introduced and classified different types of markup emphasizing the importance of the invention of descriptive markup. Three major milestones in the development of the markup languages were described. First, the development and standardization of the rules for descriptive markup in SGML. Second, the birth of the most important SGML application called HTML for the language of the WWW. Last, the development of XML to support more effective communication on the Internet. An overview of the markup techniques and definition capabilities in XML was given. XML-related development work has been a huge collaborative effort in many standards developing organizations. The sectoral standardization has benefited substantially from the development work of the W3C that has resulted in not only XML but also the namespace mechanism to facilitate combining and reuse of markup vocabularies and over 50 other XML-related standards. The XML family of languages was introduced, and some representatives of the languages were briefly described.

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Mexico: Libraries, Archives, and Museums

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Abstract

This entry offers a general introduction to the different types of Mexican libraries, museums, and archives, with an emphasis on libraries and related subjects such as serials, book production, and library schools. Literature was consulted and direct data was gathered from Web sites and through telephone interviews of knowledgeable library professionals. Data used in this entry is not all recent. Therefore, it is used mainly as an indicator of the general status of Mexican information development.

GENERAL BACKGROUND

Mexico is a large country, whose official name is Mexican United States, a federal constitutional republic. It is politically divided into 31 states and a Federal District (Mexico City). Its government is presidential with a constitutionally strong Congress and a supreme court. The president is elected for a non-renewable 6-year term and appoints the cabinet. The country's legislature is based on a bicameral Congress: 128-member Senate, and a 500-member Chamber of Deputies, elected for a 3-year term.^[1] States provide some funding for education and libraries, as well as setting some of the educational requirements, but policy-making is generally centralized by the federal government. For example, the Ministry of Public Education provides funding and direction, in different levels, to all types of libraries, except special ones. Mexico, as a country, has more than 100 million inhabitants; it is certainly the most populated nation in the Spanish-speaking world. Covering a territory a quarter of the size of the United States of America (U.S.), its economy ranks number 14, according to its Gross National Income, and it ranks number 7 in terms of tourism.^[2,3] Mexico is the second largest economy in Latin America. It is a country in an intermediate advanced stage of development with a positive economic performance that is closely linked to the American economy. The official concern in dealing with poverty persists and the per capita income has gone up, although poverty and inequality rates continue to be elevated.^[2] Libraries are a crucial service to enhance information development of the country, whether at schools or in the workplace. Therefore they are assumed to be a means to bridge the socio-economic gaps in Mexican society. This entry provides a general description of the libraries, providing a historical introduction, a brief account by type of library, and a description of related subjects, such as book and serial publishing, among other library and information subjects. Museums and archives are also included as repositories

for the collection and preservation of culture whose roles complement that of the libraries. The general goal is to give the international reader a general picture of the range of library institutions, stressing their contemporary developments.

HISTORY

Locations for the reproduction, transmission, and promotion of information existed in Mexico well before the Spaniards arrived in 1519. The Aztecs had library-like institutions called Amoxcalli, the house of the Amoxtli, the pictographic codices that recorded economic, social, and political life in this central Mexican Kingdom. This was also the case of other indigenous cultures with urban centers, such as the Maya. Some of the existing codices are preserved, mainly in European institutions, since few Amoxtli works escaped the burning and destruction of the Spanish missionaries in their quest to convert locals to the Catholic Church. The most famous existing codex is the Borgia. It originally included five parts^[4] that are now scattered in different European libraries and museums. Libraries in the sense of the western world developed in Mexico after the Spanish Conquest. The first Spanish settlers founded some of the earliest libraries in temples and seminaries, where collections had basically religious books. One of the first books brought to the American continent was a breviary *Libros de Horas* by Jerónimo de Aguilar, the interpreter of the leading conqueror Hernán Cortés. Cortés's party was shipwrecked but managed to save the book in 1511.^[4] It is estimated that two decades later there were more books in Mexico because by 1534, the cathedral had officially a library and its own printing press. The first printing press was brought to Mexico from Seville by Jacobo Cromberg, along with the printer Juan Pablos, in 1539. It also became the first printing press in all of the Americas. An early newspaper was published

that consisted of loose sheets with news of New Spain and was distributed at the beginning of the sixteenth century by Sigüenza y Góngora. The first book to be printed, on the other hand, a religious book, was the *Brief and more compendious Christian doctrine...* (Breve y más compendiosa doctrina Cristiana...) by Zumárraga that is now lost but is recorded in the *Acts of Indias* (Actas de Indias) in the General Archive of Indias in Seville, Spain. These two works made Mexico the first country to publish in the Americas.^[5]

The key political position of colonial Mexico, as the crown colony of New Spain, offered the opportunity to import recently edited books from Spain by transatlantic Spanish travelers. Mexico, for example, was one, if not the first, to receive a copy of *Don Quixote* by Miguel de Cervantes, the equivalent of Shakespeare in the Spanish-speaking world. Members of religious groups played an important role in creating libraries, such as Eguiara y Eguren, a religious scholar and author of the first national bibliography on the continent (1755). These groups founded libraries primarily in Mexico and also in colonial America. The colonial libraries were basically for Spaniards and not for Indians or *Mestizos* (inter-racial people with one Spanish and one Indian parent), who were deprived of education or any formal school training. This library/educational discrimination began to change after Mexico's independence (1810) movement^[5] when public institutions were decreed to be for the entire population. Mexico was in turmoil during the first half of nineteenth century, with constants revolts and conflicts with European countries and the United States, resulting in the United States gaining more than half of Mexico's territory. Other than the creation of the National Library (1867) and the legal deposit (1812), this was a period of minor library development. Later, when the Republic was consolidated during the Porfirio Díaz regime (1876–1910), libraries were officially open to anyone, but illiteracy was high—only 10% of the population could read. This limited access to written culture continued up to the Mexican Revolution, 1910–1919. After this long internal conflict, libraries began to evolve, and had some initial success with the Vasconcelos public library program that started in 1921,^[6] discussed in the public libraries' section of this entry. The decades from 1920 to 1960 were a formational period, with some additional basic library institutions being created, such as the first library school and the library association. The significant library development that occurred after 1970 is described in the following sections of the entry (see Appendix 1).

ACADEMIC LIBRARIES

Mexico has, basically, four types of academic libraries: state university libraries, technological institution libraries, teacher's institutions libraries, and private university

libraries. The first three groups, as may be expected, are financed by government, either federal or state, and seldom by municipalities (counties). The total number of universities varies according to the consulted source. The National Association of Universities and Higher Education Institutions, or ANUIES (Asociación Nacional de Universidades e Instituciones de Educación Superior) that includes mainly state universities, and some technological institutes and a few private ones, reports 127 public and 263 private higher education institutions.^[7] However, the total for all types of institutions, small and large, is 1482 according to statistics from the National Institute of Statistics and Geography, or INEGI (Instituto Nacional de Estadística y Geografía).^[8,9]

State University Libraries

This first group includes the best academic libraries. They belong to the 45 state higher education institutions that are normally the largest in every state and in the Federal District, i.e., Mexico City.^[7] There is one state university per state, except in seven, where there are two higher education institutions, and Mexico City, which has several.^[7] All of them are autonomous: they can take their own academic and organizational decisions, unlike other higher education institutions in the other categories. State universities provide undergraduate education to 2,528,664, i.e., 36.9%^[7,8] of the national student population. Libraries in these institutions are affiliated under the National Council for Library Matters of Higher Education Institutions, or CONPAB (Consejo Nacional para Asuntos Bibliotecarios de Instituciones de Educación Superior) that includes, as full members, 41 members and 8 guest academic libraries whose parent organizations cannot be fully defined as universities.^[10] The academic libraries of Mexico City, such as the Autonomous National University of Mexico, or UNAM (Universidad Nacional Autónoma de México) and the Metropolitan University, or UAM (Universidad Metropolitana) are not included, apparently because of their overpoweringly large size and overwhelming influence. Most state universities have a library system that includes a main library, and one per faculty or cluster of faculties or research centers with a director general. This is reflected in the large number of CONPAB libraries, with 713 units. Few universities have fully centralized services. Those that do are newer, i.e., founded after the 1970s. Generally, CONPAB libraries have centralized acquisitions, collection development, and technical services. The larger academic libraries usually belong to the older and larger universities, such as UNAM, regarded as a special case because of its enormous size (see Fig. 1). It is the oldest university in Mexico and one of the oldest in continental America with nearly one-third of a million students, 299,723. Slightly more than half are undergraduate, 167,891; one-third is high school, 107,482; and the rest are postgraduate students.^[11] The research output is strikingly higher than any



Fig. 1 UNAM Central Library, Mexico City—by Adolfo Rodríguez.

other institution in the country, with 35% of the scientific output, as measured by the number of refereed journal articles. This academic performance makes UNAM number 150 among the 200 best research universities, according to the British newspaper *The Times Higher Education Supplement* assessment of 2008.^[12] UNAM's research activities are dependent on a good library and information service. Including special libraries, UNAM has 142 libraries, with over six million volumes and has the largest library budget for serials, monographs, and electronic resources in the nation. This amount is probably the equivalent of 50% of the total national budget of academic libraries in Mexico. After the National University, the two other large universities are the Universidad de Guadalajara with 195,116 students and 162 libraries,^[13] and the Universidad Autónoma de Nuevo León, with an enrollment of 126,000 students and 80 libraries,^[14] both located in the two other major cities. Their library systems are also well-funded and well-organized. The rest of the state universities have, in general, large library collections, and hold—like the metropolitan universities of the three major cities—important rare, special, and historical collections; they usually have more professional librarians than other type of libraries.

Besides their own institutional budgets, state university libraries are generally financed through the Integral Program for Institutional Support, or PIFI (Programa Integral de Fortalecimiento Institucional), in addition to their own institutional budgets.^[15] PIFI is managed by the General Directorate of Higher Education under the Ministry of Public Education, or SEP (Secretaría de Educación Pública), which uses the funds to set university policies and determine priorities for state-financed higher education. It provides funds on competitive bases to different academic functions, but it has a special fund for academic libraries. Since its inception under a different name in

1980, PIFI has played a decisive role in increasing library collections; acquiring electronic resources, computer equipment, and information technology; training personnel; and furnishing libraries. The challenge that libraries have with these funds is that there is an annual competition for their projects and the money may or may not be awarded, making funding erratic. Librarians do not know if they can count on the funds for the following year. Some changes have been planned to make tri-annual allocations, but, so far, these have not been fully implemented. State university libraries that have been able to attract the most funds, either from PIFI, or from their parent organizations, are UNAM (most successful), and those from the universities in the states of Colima, Jalisco, Ciudad Juárez, Veracruz, Quintana Roo and the Yucatán. In addition there are about 20 other State University library systems whose organization, funding and services are very good. The best accredited universities, included in the previous figures, are grouped in the Mexican Consortium of Universities, or CUMex (Consortio de Universidades Mexicanas), a body created by SEP, that includes 17 institutions. The library systems of CUMex members generally match the academic excellence of the universities in which they are found, and receive some special funding as a reward for their accreditation achievements (see Fig. 2).

Technological Institute Libraries

Technological institutes total 242, the first having been founded in 1949, plus the large National Polytechnic, or IPN (Instituto Politécnico Nacional),^[16] located in Mexico City. IPN is to technological institutes as UNAM is to universities; it was the first and is the largest technological higher education organization in Mexico with 142,861 students. It has 72 libraries, including specialized ones that



Fig. 2 Universidad Veracruzana Library, Boca del Rio, Veracruz—by Ulises Buendía.

serve faculties and research centers in its different campuses. IPN library and information services are larger and better than those of any other technological institution in Mexico, but certainly of a smaller library size when compared against those of UNAM, its State University Library counterpart. Technological institutes, on the other hand, as their name implies, cater mainly to science and technology disciplines, basically engineering, and, to a lesser extent, to management subjects. Technological institutes, originally modeled on the IPN structure, but in an independent network, are run by a centralized directorate in Mexico City under the umbrella of the Ministry of Public Education that provides all the funding and generates library policies at the national level. The network includes engineering, marine, forestry, and agricultural institutes. Their libraries, or information centers, as they are called, have similar information services, including the same type of buildings across the country. Their library development is fairly good, but their budgets are low and their information technology lags behind that of the state university libraries.

There are, in addition, two types of technological universities: technological and polytechnic. Both are newcomers on the Mexican education scene. The first technological universities were founded in 1991.^[17] Each of them receives joint funding from the state where it is located and from the federal government. Degrees are of the 2-year college level, called “Técnico Superior Universitario.” The current number 65 centrally coordinated from their headquarters in Mexico City. Their total enrollment was 66,660 students nation-wide in 2006,^[18] and several had fewer than a thousand learners. The academic structure is a hybrid because they aim to provide, at least by name, technological training with university-based education to support the productive and service

sectors. In most states, they are located in cities with no traditional universities—only 30% are in state capitals. The polytechnic universities, on the other hand, are an even newer development within the national education system. They were created to compliment the technological universities, so that college students could pursue higher education following 2 years of college. To date, they number 22 and their funding is awarded in similar proportion by federal and state governments. Libraries at these universities are in the process of basic development with small spaces, usually a classroom-type accommodation, limited budgets and few professional staff. However, there are some exceptions, such as the polytechnic university libraries of Santa Catarina in Nuevo León and in Aguascalientes, with excellent facilities.

Teachers’ Institution Libraries

There are 457 teacher’s Institutions, usually called *Normales*.^[19] In addition, pedagogical and education studies are offered at state and private universities, but their library resources are included under the corresponding type of institution. There are four types—the oldest date from the 1800s. The first one was founded in 1823, and a handful more was created in the following decades, but the rest was founded in the twentieth century. They are in most state capital cities and tend to be well-established. The second type or generation of pedagogical *Normales* is from the previous century, when several were founded outside the state capitals, and even in the rural areas. The third type is the higher education *Normales*, whose studies are equivalent to undergraduate degrees. The fourth group is comprised of a fairly new network of 76 state pedagogical universities (Universidades Pedagógicas) with 206 sub-sites in major urban centers. The universities were

started in 1978 when the National Pedagogical University, or UPN (Universidad Pedagógica Nacional) the primary leading institution, was created in Mexico City. Library services at the generally older teachers training institutions range from good to fairly good, while second-generation *Normales* and pedagogical university libraries have poorer development, with smaller collections and less organization. The state UPN's libraries are normally housed in classroom-like facilities with basic information services, except the one in Mexico City that has good library premises and good services.^[20] The Pedagogical University sub-sites do not have libraries as such, except for some minor book collections. Teacher's Institution Libraries do not, in general, subscribe to electronic information sources, nor have access to information technology, except for computer and Internet access. In addition, there are more pedagogical and education studies at state and private universities, but they are included under their corresponding type of institutions.

Private University Libraries

Private university libraries vary dramatically according to the size of their parent institutions. According to the Ministry of Public Education, there are 667 institutions of this type. There are a handful of large private universities, over 100 medium-sized, private universities; and over 500 small ones.^[21] The large private institutions are, in general, excellent. Their libraries are well-funded and provide excellent information services. An example is the Technological Institute of Higher Education Studies in Monterrey, or ITESM (Instituto Tecnológico de Estudios Superiores de Monterrey). ITESM is the largest private university with a national network of 33 campuses, each with a library. The largest are in Monterrey, Mexico City, and Guadalajara. Other large private universities with excellent libraries include Anahuac with 10 campuses, University of Monterrey (Universidad de Monterrey), Ibero-American University (Universidad Iberoamericana) with 5 campuses outside the national capital, plus other universities with outstanding library services, such as University of the Americas (Universidad de las Americas, Puebla), Valle de México, Technological Autonomous Institute of Mexico (Instituto Tecnológico Autónomo de México), and Panamerican, among others. The private institutions in the second tier are mid-sized. They are normally affiliated with the Federation of Private Mexican Institutions of Higher Education, or FIMPES (Federación de Instituciones Mexicanas Particulares de Educación Superior),^[22] a national association that includes 114 institutions. That is about 17% of the private universities, according to the FIMPES Web site. The rest of the private institutions range from the common one-school centered program to the more than two-faculty larger programs. These smaller and newer private universities struggle to have and maintain library services. Their collections and

services tend to be minimal and the institutions seldom hire a librarian for their libraries. The Ministry of Public Education regulates their creation and their awarding of university degrees but fails to regulate minimum library standards. The focus of the small institutions, as it is also true for the majority of private universities, is teaching. The faculty members at the small institutions seldom do research, so libraries are not a priority.

In total, academic institutions comprise 1482 libraries, out of the more than 2000 estimated learning centers of all types. State university and large private universities provide the largest library budgets, the fastest growing information collections, and offer the most innovative provision of services. They are also the main customers of international vendors, the leaders in acquisition of technological equipment, and the libraries with the best Internet infrastructure among all types of academic libraries.

PUBLIC LIBRARIES

After the Mexican Revolution of 1910–1919, Jose Vasconcelos, the first minister of public education (1921–1924), created a nation-wide public library program. His dream was to take books to every town in Mexico, and his administration created around 2500 libraries with small holdings that included classic works of literature and technical books.^[23] Following his service as minister of public education, he became the first director of the central public library, Biblioteca Mexico, in Mexico City. Many of Vasconcelos' public libraries unfortunately disappeared, in part due to the limited education system and the high illiteracy rate in the country. Five decades later, public libraries entered their second golden period, from the late 1970s up to the present. A strong well-financed federal government strategy to organize public libraries began in 1978, under Guadalupe Carrión, as public libraries' director. In addition to a national plan to develop a library system, the first 5 years focused on reorganizing libraries at a national level, including a study conducted to assess public libraries, and developing indicators and parameters for building, equipping, and creating library collections, as well as completion of a national plan to develop a library system. Additionally, a major achievement was the training of about 500 public library staff members, with a well-organized and intensive full-time 3-month library program offered in three regional centers in the country: Durango, Mérida, and Querétaro.

In 1983, based on the seminal planning work of the previous 5 years, the National Program of Public Libraries was officially announced by the current President and the Minister of Public Education in turn, who appointed Ana María Magaloni as director general. Under the auspices of this program, a strong national public network was created in the next 5 years.^[24] The department became the General



Fig. 3 Municipal Public Library, Tlaltetela, Veracruz—by Edna Zamora.

Directorate of Public Libraries, or DGB (Dirección General de Bibliotecas), currently managed by the National Council for Culture and the Arts, or CONACULTA (Consejo Nacional para la Cultura y las Artes) of the Ministry of Public Education. The Directorate finances and manages 7211 public libraries with 36.5 million books. The library system is the largest in Latin America, even larger than that of Brazil, whose population is double that of Mexico. The network has a central public catalog for all holdings of public libraries in the country, using the Dewey Decimal System and the Anglo-American Cataloging Rules. The library staff of the public library network includes 10,485 people, whose library training is, unfortunately rather limited. Only 43 have library technical training, 111 have undergraduate degrees, and only two have master's degrees in library science.^[5] However, the general directorate has had library professionals on its staff since its inception in 1978. Perhaps, this fact has been crucial to achieving the current success of the public library network.

Public libraries are grouped into three types: state, regional, and municipal libraries. Their size and services are closely related to their network status. There is a public library in every town with more than 5000 inhabitants. Libraries also vary in size and services from those in the urban centers, which are better equipped, to those in rural towns and villages, where Internet access is almost nonexistent (see Figs. [3–5]).

Public libraries are set up by a joint agreement among the three government tiers. The federal government central office, in Mexico City, is in charge of creating library policies, collection development, acquisitions and technical services. State governments pay for the construction or adaptation of buildings, and the municipal/county

authorities, in turn, hire staff and pay for staff salaries. The program has been successful, especially in those states where their governments invest more in the library network, such as is the case in Veracruz and Chiapas. All 31 states and the Federal District have a central public library that is generally large and well-equipped, with good information services. In most cases, these libraries are in charge of the state public library networks, house the state directors, and provide centralized technical services.

Providing Internet access in public libraries has been a major task for most governments at all levels. In 2002, the Bill and Melinda Gates Foundation donated 30 million dollars to Mexican public libraries. The funds were to equip 1500 public libraries with 1–10 computers, train personnel, and introduce the Internet. This grant was the second given outside the United States, after Chile, by the Bill and Melinda Gates Foundation. The Mexican federal government matched the gift with 40 million dollars. Additionally, more libraries were equipped with computers and Internet access with more federal and state funds, and now 38% of the libraries have computers. Some states provide extra funds to promote Internet access, such as the State of Veracruz, with the recent launch of an ambitious program to provide computers to public libraries and to build regional central public libraries, whose constructions showcase modern architecture. The Bill and Melinda Gates Foundation gave their annual 2008 Access to Learning Award to Veracruz for its innovative efforts to connect people from rural and remote communities with the services provided by 20 all-terrain buses converted into mobile-classroom units. They provide information services, free access to computers, and satellite Internet. Veracruz also provides free access to



Fig. 4 Municipal Public Library, Tlacotalpan, Veracruz—by Edna Zamora.

some commercial information databases in their public libraries. The state of Chiapas does this as well, and offers the additional benefit of making the databases open to any remote user within its geographical limits.

The federal CONACULTA Directorate of Libraries is housed in the large, beautiful, seventeenth century historic premises of the Ciudadela, along with the Biblioteca Mexico main public library, as it was originally called, later renamed Biblioteca Vasconcelos. It hosts public library network services and a collection of 250,000 volumes and will soon have additional new premises. A new state-of-the-art building will soon re-open (it opened for a few months, then closed for further construction) at the former Buenavista railroad station in Mexico City.^[25] The

building, more than 475,000 sq. ft, has a striking modern architectural design, with glass, steel, and concrete playing key roles to create a building that will either be adored or despised, depending on people's artistic perception. A special feature is a botanical garden that gives a natural touch to the building. The design was the result of an international contest with over 592 architects' proposals from all over the world.^[25] The library has an auditorium, meeting places, a bookstore, cafeteria, and plenty of room for stacks and services. It is certainly the largest public library in Mexico and in Latin America. User demand is expected to be high, because it is conveniently located next to the new suburban train station, designed to serve most citizens living North of Mexico City.



Fig. 5 Municipal Public Library, Monterrey, Nuevo León.

The Universidad de Guadalajara in the western part of the country has also broken ground on a larger public state library. Since 1861, the University has managed the state public library Juan Jose Arreola. It holds a rich collection of 400,000 historical books and documents. The current building in downtown Guadalajara dates from 1959. However, the collections have outgrown the facility and the new library (43,000 m²/462,848 sq. ft) will have room for more collections and newer services. The library will be the central unit of a large grand cultural complex that will also include convention facilities. It is planned to open in 2010.

SCHOOL LIBRARIES

School library policies are generally managed by the Sub-Ministry of Basic Education (Subsecretaría de Educación Básica)^[26] of the Federal Ministry of Public Education, its 31 state counterparts, and the Federal District. Most, if not all pre-elementary, elementary, junior high, and high schools, have some sort of book collections, even those in remote rural schools. The books may be in a bookcase or in wooden or cardboard boxes, or whatever container is available in the less well-equipped institutions.^[25] The Ministry of Public Education has created different programs in the past to provide complementary reading materials to schools. Two of the latest are *The books of the corner* (Los Libros del Rincón), a program that provided between 150 and 300 titles of selected literary materials to every school over 4 years beginning in 1986.^[27] This program was superseded by another one that started in 2002, as part of a general reading plan called *Towards a country of readers* (Hacia un país de lectores) that included the *Classroom library* (Biblioteca de aula) program. Its aim is to stock every kindergarten and elementary school classroom with books at the beginning of each school term. In the last 5 years, a staggering figure of over 200 million volumes was given to libraries and classroom collections, making almost nine volumes available to each school child, for the 23 million pupils who attend school. The book stocks include about 50% literary works, and the rest of the books provide general information to support school teaching programs. The titles distributed varied from 218 provided to pre-elementary schools (that received a total of 57 million volumes) to 514 titles provided to elementary schools (that received 78 million volumes), and 488 titles given to junior high schools, who, in turn (that got almost 30 million volumes). These figures also include 51 bilingual titles in Spanish and local indigenous languages.

The book stocks were selected with the participation of teacher focus groups from most states. The program also includes a library training program with a manual on how to organize library materials, how to create library activities and promote reading, plus a set of posters, flyers, and

television and radio programs. The teaching staff who runs the program number more than 6000, and include some who work in libraries.^[28] As a general comment, book budgets are seldom available for libraries or schools themselves. Material acquisition is centralized in SEP headquarters. Public libraries, on the other hand, support schools' information demand with their open role as community information centers, where buildings and services are more broadly and better structured. Public libraries, in general, tailor their information services to better serve students rather than the average citizen, defining themselves as places for those studying in the elementary education system.

Another library-related action is the federal government's free textbooks program for children that gives a set of books to schools, including those in private institutions, since 1958, although, in the beginning, it did not cover every school and the number of book titles was limited.^[29] The total number of volumes distributed in 2007 was a staggering 54,279,051 volumes.^[30] A subsidized and free textbook program also exists for high schools (Libros de Texto Gratuitos para Secundaria 149.480.757).^[29] The aim is to help students have and/or acquire their required readings. These book programs complement library services, although, as some critics say, it limits information literacy, because kids do not have to search for additional information beyond the compulsory textbook readings. However, this challenge is more due to the prevalent teacher-oriented pedagogical approach than to the free textbook programs. Teachers normally lack extensive reading habits themselves, which sometimes limit the potential academic impact of their classroom book collections and school libraries.

The reading programs in schools and libraries must overcome the limited reading habits of children, and, as stated, of teachers themselves, because basic education tends to be based on rote repetition, where the only source of information is usually the teacher. Teachers who fail to promote reading habits at the time when children learn to read and write waste part of the economic resources devoted to the school library sector. As a result, pupils finish school with limited or no information skills, posing a challenge at subsequent educational levels, where teachers or professors ought to be filling the information competencies gap. School information literacy challenges are reflected in the reading habits of society if one takes as a reading indicator the low number of bookstores, that only total around 1452 in the whole country.^[30]

SPECIAL LIBRARIES

Most of these libraries can be grouped into four clusters: 1) science and technology libraries, financed by the National Council of Science and Technology, or

CONACYT (Consejo Nacional de Ciencia y Tecnología); 2) research institute libraries, part of university research centers; 3) government libraries, mostly part of the ministries; and 4) special libraries that are part of private sector industries, service corporations, and/or museums, among other organizations. In the national directory of libraries published by CONACYT in 1976 special libraries were well-documented. Unfortunately this directory has not been updated, in part because these libraries lack an association or a central organization that could promote a directory. Current special libraries can be estimated at between 500 and 600, including academic specialized collections attached to universities. According to García,^[31] Mexico ranks second in the total number of special libraries, after Brazil in Latin America. According to Carrión,^[32] special libraries have had excellent development in recent decades. Their collections, funding, and professional staff are among the best. However, libraries, in the traditional sense of holding large printed collections and having purpose built buildings, have been decreasing in the last decade to give room to special information services that rely heavily on electronic sources and require fewer staff.

CONACYT has played an important role in special libraries expansion. The Council was founded in 1970 to foster, among other roles, the national research system, with the corresponding goal of creating a national information network. With such a mandate, the 1970s were a decade of increased special libraries creation. CONACYT intensively promoted library training, extending the benefit to university libraries. A special program was set up to send graduate students to study library and information science abroad, especially in the United States. The program lasted 5 years, and achieved the goal of training around 60 MLS professionals (1974–1979). Those who accepted positions in libraries pioneered a period of organization of special and academic libraries, especially outside Mexico City, where professional librarians were in great demand. In conjunction with the graduate program, a library technical staff program operated from 1973 to 1979. The training, involving a two-semester full-time study scheme, was excellent because it included all the subjects required to organize and provide library services. Participants from every state were invited, with the aid of a student CONACYT grant, to attend the program, mainly hosted by the National School of Librarianship and Archives, with a summer version offered once in Ciudad Juárez and Puebla. About 200 library staff personnel participated in the program. A contribution of the trained staff was the implementation of the first basis for a library organization outside Mexico City, where there were virtually no professional librarians, becoming the backbone of library development in those areas. The following sections include more information on special libraries by sub-type.

Science and Technology Libraries

This group of special libraries is closely related to the National Council of Science and Technology. The Council funds 26 basic science and science and technology research centers and their libraries, plus two social sciences institutions: El Colegio de México, and the Mexican unit of Latin American Faculty of Social Sciences, or FLACSO (Facultad Latinoamericana de Ciencias Sociales). This nation-wide science and technology library network subscribes jointly to electronic sources, and organizes an annual library meeting. The larger libraries are those of the Center for Scientific Research and Graduate Education of Ensenada, or CICESE (Centro de Información Científica y Educación Superior de Ensenada), the Research Center of Applied Chemistry, or CIQA (Centro de Investigación en Química Aplicada), and El Colegio de México, a social science think tank that has the largest bibliographic collection in Latin America. Some of these research centers have postgraduate programs focused on research training. Similar social science institutions focusing on local studies are replicated in some states. These institutions generally have good libraries not necessarily supported by CONACYT funding.

Research Institute Libraries

Research institute libraries that serve research communities/centers are also outstanding. UNAM, the national university, produces a great proportion of the national research output, an activity that relies on important specialized collections. Its special libraries number 52, of the total of 142 libraries.^[33] Their collections are in paper and in electronic format, and their library staff also number among the best. Additionally, most of the state universities also have special libraries, although fewer than UNAM. The better research institute libraries belong to the five larger universities from Guadalajara, Nuevo León, Puebla, Veracruz, and Universidad Metropolitana in Mexico City. As stated, the IPN, as discussed above, is the largest technological institute. It has 12 special libraries that support different areas of research. Another center with an excellent library is the Center of Advanced Studies and Research, or CINVESTAV (Centro de Investigaciones y de Estudios Avanzados), a center that was formerly part of the National Polytechnic Institute. At a national level, it probably has the largest science and technology collection housed under one roof, and includes some branch libraries in the regional research centers. The Postgraduate College of Chapingo (Colegio de Posgraduados de Chapingo), a specialized agricultural institution that networks with related institutions from other states, has the largest library in its field in Mexico. Private universities do not normally have special libraries, except for ITESM in business information, because, as mentioned, they are mainly teaching institutions with no research or minimal research output.

Government Libraries

Government libraries are, as might be expected, part of ministries, larger government official organizations, and part of federal and state departments. Many of the libraries have leading collections in their fields, such as those in the Foreign Relations Ministry (Secretaría de Relaciones Exteriores), and at the Treasury Ministry Library (Secretaría de Hacienda). The Mexican Congress Library, with legal deposit status, also has a good collection. Another is the National Institute of Anthropology and History, housing an outstanding collection, the largest in this field. Some of the government energy companies have research centers, normally with independent legal status, such as the Mexican Petroleum Institute, or IMP (Instituto Mexicano del Petróleo) that holds the major collection in the country on petroleum-related subjects, and the Institute of Electrical Research Institute (Instituto de Investigaciones Eléctricas) also an excellent information center with the best collection, resources and services in electricity, and secondarily in other energy subjects. A third library on atomic energy is the Institute of Nuclear Research (Instituto de Investigaciones Nucleares).^[34] Government statistics on population (census), geography, and macro-statistics are provided by the INEGI, originally founded in 1925. It recently received independent legal status from the government to ensure objectivity in its data gathering. It is in charge of the national census and with collecting most types of socio-economic data. INEGI has a network of 46 information centers, plus 560 deposit libraries. Health science libraries are well-developed, thanks to the Mexican Social Security Institute, or IMSS (Instituto Mexicano del Seguro Social). The IMSS has the largest public health network, serving employees and workers from the private sector. It has some of the largest hospitals, clinics and health care facilities, and its 57 libraries are often the only sources of medical information in the smaller cities. The Institute subscribes on a nationwide basis electronic sources, so that each center has similar access to information sources. The Ministry of Public Health has about 15 good libraries that serve the specialized research institutes (mostly based in Mexico City) conducting medical science research in fields such as oncology, genomics, nutrition, and children's health, among other fields. The judiciary system also has special library units in the different states, in the so-called Culture House (Casa de Cultura), along with the Supreme Court library in the national capital.

Private Libraries

The private sector, i.e., industry, service corporations, and businesses, among others, has fewer special libraries. Data about these libraries is difficult to obtain, but it can be said that some, not all, of the large corporate companies have libraries at their headquarters. The Mexican economy is

dependent on foreign corporations, mainly from the United States, and secondarily from European nations. Therefore, the branches located on Mexican soil seldom have information centers or libraries because these services are provided from the headquarters located outside Mexico. Additionally, the advent of electronic services has helped companies to reduce the number of private special libraries because it is now easier to transfer information across borders using seamless Internet and World Wide Web services. Those companies with libraries are mainly in the three largest cities, and, to a lesser extent, in the rest of the country. Some of the best examples are the libraries of the capital's newspapers: *Reforma*, *Excelsior*, *El Financiero*, and *La Jornada*; those in consulting firms, such as Mackenzie; in large law firms and major banks, and in companies like Grupo Condumex, which has a rich collection of historic Mexican publications.

NATIONAL LIBRARY INSTITUTIONS

The national duty of preserving the country's intellectual and cultural heritage is divided among several institutions. The main ones include the National Library that was founded in 1867, although the first law that unsuccessfully attempted to create it dates back to 1846. The first legal deposit decree to help the National Library to collect publications is from 1812, with successive updates since then up to the most recent one in 1991.^[35] The National Library was a government run institution up to 1929, when responsibility for it was turned over to the National University (UNAM) that manages and houses it in the main campus. The National Library also became part of the Institute of Bibliographic Research, or IIB (Instituto de Investigaciones Bibliográficas) in 1967. The IIB is divided into two departments, one for the National Library itself, devoted mainly to monographs, and the second for the National Serials Collection (Hemeroteca Nacional de México). The Institute has 26 researchers who are in charge of the national bibliography and other research programs. The two collections are housed in separate units within the same building. They were originally in a former Agustín temple in the historical center of Mexico City until 1979, when a new building was constructed to house them. The Library and the serials collection have the richest bibliographic jewels of the nation: incunabula from Mexico and Europe, unique Mexican monograph copies, and archives and manuscripts from Mexico's colonial period, i.e., fifteenth century, to publications of the twentieth century. These rare and special collections are probably the most important in the former New Spain vicerey cities of Latin America. The National Library collection numbers over 2,286,292 books and documents, including music records, videos, plus the reserved collections. The Library has, as it may be expected, closed stacks, but the study rooms are open to researchers and to the general

public. It also offers source cataloging to editors and publishes the national bibliography *Mexican Bibliography* (Bibliografía Mexicana), and allows the public to search their online catalog, called Nautilo. The serials library has two collections: the oldest, including titles from 1722 to 1916, and the contemporary titles. In recent years, it has been converting newspapers from several Mexican cities into digital format. The current digital collection has nine million images to date. This will be a major news source for researchers who live outside the national capital. Both institutions, unfortunately, lack the authority and resources that would be needed to guide acquisitions, technical and library service development for the rest of the libraries at the national level, as is the case in similar institutions in other countries. Their role is mainly to safeguard the national printed materials.

Other libraries use the term “National,” such as the central library of the National Polytechnic Institute (Instituto Politécnico Nacional) that specializes in science and technology materials, as well as the library of the National Institute of Anthropology (Instituto Nacional de Antropología). However the term does not really comply with their institutional roles, because they, again, lack a national library leadership or coordination role in their subjects of interest. The Library of the Mexican Congress (Biblioteca del Congreso, 1935) is also a legal deposit center. Its collection covers all subjects and includes rare books from 1511 to 1930, plus 66 manuscripts. In addition, Mexico also has similar organizations that preserve and collect movie reels at the Filmoteca (Films House), and government official archives at the General Archives of the Nation, described in the Archives section. Some Mexican states also have similar institutions.

VIRTUAL/DIGITAL LIBRARIES

Most, if not all, of the virtual libraries have been developed at universities. Only a few libraries include all four elements of the virtual library concept: electronic resources, digitization of materials, software infrastructure, and virtual library services. Most state university libraries and private university libraries subscribe to electronic databases but not all have federated search capabilities. Digitization of collections, mainly historical materials or non-copyrighted materials, is conducted at perhaps 25–30 institutions, including universities and research centers. The principal collections are UNAM’s nearly 40,000 digitized theses, Universidad de las Américas (Puebla)’s historical collections, Universidad Veracruzana’s historical archives and institutional journals, and the rare archives being digitized at the Universidad Autónoma de Ciudad Juárez, among other collections. In addition, the National Library and the National Serials Collection are undertaking, as stated, the digital conversion of microfilmed national newspapers to

digital formats. In terms of software, the first institution to acquire a federated search engine in Mexico and Latin America was the Universidad Veracruzana, in 2003. They also purchased virtual reference software (QuestionPoint),^[36] again making it the first library in the Latin American region to do so. Currently about 20 institutions have a search engine and fewer than that offer virtual reference services. The UNAM has worked on the development of an in-house meta search engine, called Hermes, that so far, is just for institutional use.

Repository management software, Personal Digital Libraries has been developed by the Tecnológico de Monterrey, but its use seems to be losing ground with the increased adoption of Dspace, the program created by the Massachusetts Institute of Technology. Another repository management software that is also used, but to a lesser degree, is Greenstone, developed by the New Zealand Digital Library Project at the University of Waikato, using UNESCO funding. A related open access journal repository, the Network of Scientific Magazines from Latin America, the Caribbean, Spain, and Portugal, or REDALyC (Red de Revistas Científicas de América Latina, el Caribe, España y Portugal), started in 2003, was created by the Autonomous University of the State of Mexico, UAEM (Universidad Autónoma del Estado de México). The system includes journals from Latin America, the Caribbean Region, Spain, and Portugal. It currently hosts more than 550 titles in all social and scientific areas with electronic holdings of 100,000 peer-reviewed articles in Spanish, Portuguese, and English. According to REDALyC’s official statistics, 70,000 articles are downloaded daily, a good indicator of success.

LIBRARY EDUCATION

Mexican library schools have graduated around 4500 librarians: 4300 with undergraduate degrees, 270 with master’s degrees and 15 with doctorates. This means that most professionals working in libraries do not hold a library degree. Those with library degrees work mainly at university and special libraries, because, as stated, school and public libraries seldom have professionals on their staff. There are 11 library and information science programs (see Appendix 2). The first school was founded as early as 1924, but it had its difficulties and closed. Later on, in 1945 was founded what is now the oldest running library School in Mexico City: the National School of Librarianship and Archives (Escuela Nacional de Biblioteconomía y Archivonomía) under the sponsorship of the Ministry of Public Education.^[37] The second oldest library school is at the National University (UNAM), also located in Mexico City (1956). These two were the only library schools until 1970, when new library schools were created in the succeeding years. Most institutions offer undergraduate programs, only three offer the master’s

degree, and just one, UNAM, offers a doctoral program (since 1998), the first one in Spanish-speaking Latin America. Among the programs, four offer distance education degrees, three undergraduate, and one offers a master's degree. Library schools and programs are basically located in the three major cities, except for four programs located in the rest of the country (see Appendix 2). Most schools include the name "library science", except for three that include the terms "documentation", "information science" and "knowledge management and information". Dissertations are required at some of the institutions. Several of the library schools lack a full-time faculty or have a minimum number of professors, except for UNAM, ENBA, SLP and Toluca that have more consolidated faculty. There are also library technical programs at the high school and college level in Mexico City. The newest at the college level, Técnico Superior Universitario, started in 2008 and is offered by the Universidad Veracruzana. Students in this program earn a library technical training certificate in 2 years. Continuing education is a common way to train professional staff. Courses are offered by library associations, the University Library Research Center, or CUIB (Centro Universitario de Investigaciones Bibliotecológicas) at UNAM, and some major libraries.

CUIB is the largest library research center in Latin America, founded in 1981, with a publishing output of 127 books, and the leading library journal in Mexico, as well as the best and largest library collection, and 25 full-time researchers, most of them with a doctorate and recognized by the National System of Researchers of the National Council of Science and Technology. Universities offer in-house "diplomados," informal training programs for their staff, which cover basic library subjects and run for some months.

ACCREDITATION—CROSS-BORDER HIRING OF LIBRARIANS

Although there are few librarians in Mexico, there are a number of librarians who cross the border to work in U.S. libraries. Their degrees are unfortunately not recognized by U.S. libraries because they do not come from library schools with American Library Association accreditation. Librarians who come from the United States and Mexicans who have graduated from library schools in America face the same challenge in Mexico. Their degrees are not fully recognized. Mexicans have the option of undergoing a long process to get government certification that includes complicated paper work from the Mexican Foreign Relations and the Public Education Ministry, and the National University's curriculum review. Most professionals avoid the process—even those who work at academic institutions, where the recognition of foreign library degrees is important for tenure. Librarians who immigrate

to the United States normally have to complete a master's degree in the library school field if they want to have the appropriate credentials required by the American library profession. This means that there is an international opportunity to create a library school accreditation agreement between Mexico, the United States and Canada. It would certainly benefit Mexican library school graduates, who could work on either side of the border with an accredited degree. Obviously this task is not easy, because library school programs may need to be aligned and recognized as comparable, that is, they may need to be similar, at least in the basic subjects that are the essence of library schools and information science. The North American countries, Canada, the United States, and Mexico, could follow the pattern of the European Bologna process, which is unifying library school education programs across Europe. Another alternative would be to recognize the accreditation process used in each of the countries.

Accreditation in Mexico is fairly new. The official external evaluation body, the Inter-institutional Committees for the Evaluation of Higher Education, or CIEES (Comités Inter-Institucionales de Evaluación de la Educación Superior) was created in 1991, and the Council for the Accreditation of Higher Education, or COPAES (Consejo Nacional de Educación Superior) dates from 2001. COPAES relies on professional associations, i.e., guilds, or what we call "College of Professionals" to conduct the whole process. Institutions whose programs undergo the evaluation can receive more federal funding and other benefits from the Ministry of Public Education. Library schools and the Mexican Library Association have been slow in pushing for a full accreditation program beyond the evaluation review that they currently undergo. The body that could potentially play the role of accrediting agency for library schools is the National Librarians Guild or CNB (Colegio Nacional de Bibliotecarios), the professional librarian guild in the country. Unfortunately, it is a small organization, currently without the means to fully undertake this role, crucial to increasing the quality of library education in Mexico. There is an accredited library school, the UAEM. However, it received its certification from a social sciences organization; therefore it is not a library body. In conjunction with our library associations, the North American Free Trade Agreement (NAFTA) provides the opportunity to create an accreditation system for the three countries, the United States, Mexico, and Canada, or at least to establish some type of recognition for North American cross-border degrees.

THE U.S. PATTERN

Library science and its practice in Mexico are based on U.S. library principles. For example, university libraries in Mexico use the U.S. Library of Congress Classification

system, while public libraries use the Dewey Decimal System, and all libraries that have a bibliographic organization use Anglo-American Cataloguing Rules. There are reasons for these facts: the first librarians to get training went to the US to get their degrees in the early 1920s, and into the seventies, when Mexico established an ambitious library program for academic librarians that launched library development. There were, as mentioned earlier (See Special Libraries section), several tens of scholarships being granted to students to go to the United States to obtain a master's degree in library science or information science. The main library schools that received these students were the University of Texas at Austin, and later the universities of Syracuse, Cleveland, and Denver. The last major group, 23 people, to get a library master's degree at a U.S. library school (University of Wisconsin at Milwaukee), was financed by the ITESM. In addition to these programs, the US has also granted scholarships to several students through the Fulbright program. An institution that additionally has played a key role in promoting library principles is the Benjamin Franklin Library, the official information center of the United States Embassy in Mexico City. Inaugurated in 1942, this was the first public library created by the American government outside the United States, and of the few full-sized libraries to remain after recent government downsizing. Many professionals, mainly from Mexico City, had their first library experiences at this library, either as reference assistants or student assistants. Some later became professional librarians, by getting scholarships to obtain a degree in the United States. Between the 1960s and the 1970s, the Franklin Library was one of the best public libraries in Mexico City, and thus a model followed by other institutions in the capital of the country.

SERIALS

The text of this section is an extract from a paper devoted to serials by the author.^[38] The oldest circulating serials in Mexico date back to the 1800s, such as *Bulletin, Mexican Society of Geography and Statistics* (Boletín, Sociedad Mexicana de Geografía y Estadística) (1839, ISSN 0188-1442), *Medical Newspaper of Mexico* (Gaceta Médica de México) (1864, ISSN 0016-3813), and *Yearbook of the National Astronomic Observatory* (Anuario del Observatorio Astronómico Nacional) (1881). However, the first serials appeared in Mexico in the 1700s, such as *Literary Newspaper of Mexico* (Diario Literario de México) (1766), *Mercury Flyer* (Mercurio Volante, the first medical magazine in America) (1772–1773), and *Varied Issues on Science and Arts* (Asuntos Varios sobre Ciencias y Artes) (1772–1773). These serials were the first in the American continent.^[39] The International Standard Serial Number Agency (ISSN) reports 3431 Mexican periodicals,^[40] although it is estimated that there are

at least twice as many, due to the fact that many periodicals lack ISSN registration.^[41] Journals are, in general, published by state universities and by national research centers financed by the government (usually the federal government). Subject coverage of journals is wide, covering most disciplines and subjects. However the strength is in the social sciences and the humanities, where 60% of the production is published.^[41] There is also a significant number of cultural periodicals, like those from other countries. Mexican serials are the best sources for updated academic and scientific information because they publish the best output of researchers and writers. Electronic journals are emerging in good numbers; with some now only published in electronic versions. Library serials number about 10 depending on how one classifies them; several titles have appeared only for short time spans (see Appendix 3).

In terms of comics and magazines, Mexico has a significant number of these, with large audiences. Some of the most popular titles can reach nearly a million copies per week.^[42] These periodicals play an important role in fostering reading habits among those who have only a few years of schooling, and even among those who did not have the chance to attend school. Comics are also a huge export to the United States, where Hispanic communities also love to read cowboy and soap opera style stories. As it may be assumed, these serials are the business of private companies who publish numerous titles covering a variety of topics.

Newspapers, on the other hand, have a market usually divided into four tiers according to the geographical locations where the papers are published, a fact that correlates with the importance of the newspapers. First are the dailies from Mexico City. They dominate the market, because of their broader coverage and a good nation-wide distribution system, in addition to being the news agencies for smaller papers. Second in importance are the dailies from the two other major cities, Guadalajara and Monterrey. Both locations have succeeded in distributing their papers to the rest of the major cities. Third are the papers from the medium-sized cities, usually state capitals. They tend to have a distribution limited to the state borders and normally have good publishing facilities. Finally, the fourth tier of newspapers consists of the local community dailies. These periodicals are simple and modest, covering political subjects and local topics relevant to their communities. Many of them struggle to survive with limited resources. Some of the local papers are part of national editing companies, relying on their editorials for in-depth articles. Editing of newspapers from the first three tiers has improved over time. Currently, titles from the largest cities are edited electronically and posted on the Web, some publishing full articles and others putting out only summaries of their main news in their Internet versions.

BOOK PUBLISHING

As stated in the first section of the paper, Mexico was the first country in America to have a printing press in the sixteenth century. This means that Mexico probably has the greatest number of American incunabula that is found at the national library and at some university libraries. Nowadays publishing is an important economic activity, and it is one of the most important in the Latin American region. The other countries that also have a good production are Colombia and Argentina that compete in production. The Mexican book trade is mainly based in Mexico City, where most of the big American and European publishing houses have subsidiaries, plus national companies. After the Spanish civil war several editors migrated to Mexico and contributed to strengthen this industry. Mexican book production covers most subjects but the main output is devoted to basic education, where most of the volumes are printed, according to the statistics of the National Chamber of the Mexican Publishing Industry, CANIEM (Cámara Nacional de la Industria Editorial Mexicana). The country produced 18,682 titles in 2006 according to CANIEM. The production is devoted mainly to basic education (22%), literature (14%), science and technology (12%), and the rest to other subjects, including children books that stand out with 10% of the total publishing output. In terms of copies, basic education gets almost half of the total output with 47.3%, and children books get 20% of all the copies printed. The rest of the production is scattered in the several subjects, such as literature, languages, and philosophy, and psychology. Most of the printing production is, on the other hand, represented by reprintings of titles with 58.6%, new titles by 32.4%, and reeditions with 9%. This amounts 109 million copies.^[30] The main costumer for publishers is the Mexican government with the free textbook program, and the acquisition of books for school libraries that was described in the section in earlier sections of this paper.

INFORMATION VENDORS

The proximity to the United States has made Mexico an attractive place for some American and other information vendors to set up offices. For some vendors, like EBSCO and OCLC, after Brazil, Mexico is the second largest library and information market. Companies that have established regional offices, in addition to the two corporations just mentioned, are Swets, Aleph, and Cengage. Other major international companies have local offices to cover the national market. The local information industry has steadily evolved in the last two decades. Business information is a thriving sector, growing faster than information services to the academic community. Information aggregators tend to focus on business information. Some

were originally Mexican start-up companies that were later acquired by major overseas companies, such as Infolatina, that was bought by an American information aggregator. Some important information companies in the country are Mercamétrica (directories), IBCON (directories), El Financiero (financial information), and Reforma (syndicated news). Information services are also provided by chambers of commerce. Several of these organizations offer information services to companies and the government. Computer-integrated library systems, on the other hand, probably represent the larger segment in Spanish-speaking Latin America. The most popular one continues to be the Automated System for the Integration of Libraries of the University of Colima, or SIABUC (Sistema Integral Automatizado de Bibliotecas de la Universidad de Colima) created by the University of Colima, which has given away 1500 copies of the software in Latin America, according to a report provided by the institution. This software is nearly free; it requires just a minimum fee of fewer than \$2000 for the original acquisition. Additionally, there are at least four companies that have created integral library systems for sale and distribution in Mexico and throughout the region, such as Altair and Janium.^[43,44]

LIBRARY ASSOCIATIONS

Library associations date back to 1924, when the first one was founded. The first library conferences were organized in 1927 and 1928. This early association experienced difficulties, not becoming a formal association until 1954, then gaining legal recognition 2 years later, when it adopted the official name of the Mexican Association of Librarians, or AMBAC (Asociación Mexicana de Bibliotecarios, Acción Civil). AMBAC is recognized as the national library association and is headquartered in Mexico City. Since 1956, it has run the largest library conference, an event that became annual in 1977. The conference includes a major vendor exhibition, and its proceedings have been an important source of library literature for many years. It also publishes a quarterly newsletter *News from AMBAC* (Noticiero de AMBAC) that is the oldest continuously published library serial in the country (see Appendix 3). The association has subject sections, with current ones in arts, reading, national information policies, public libraries, school libraries, and information literacy. AMBAC formerly had geographical sections in some of the Mexican states, but they became independent associations when a tax reform affected the fiscal management of AMBAC. The states with associations are Baja California, Chihuahua, Jalisco, Michoacán, and Yucatán. In recent years, AMBAC has been trying to create geographical sections again, but Nuevo León is the only one in existence so far, although three more are in the

process of formation. AMBAC does provide some support to the local library associations who continue to view it as their parent organization. The split with state associations has meant that AMBAC membership has not grown and still numbers about 500.

The second most important professional association, although small, is the CNB founded in 1979 in Mexico City. This body only includes librarians who have obtained a university degree. The CNB has, by law, the right to advise government and to conduct evaluation and accreditation processes in library schools because guilds are officially bodies that represent their professional discipline. In addition to CNB, there is the National Council of Library Affairs of Higher Education Institutions, or CONPAB-IES (Consejo Nacional para Asuntos Bibliotecarios de Instituciones de Educación Superior), described in the university libraries section. Some other associations have existed previously, like the Association of Libraries and Institutions of Higher Education and Research, or ABIESI (Asociación de Bibliotecas e Instituciones de Educación Superior y de Investigación), created in 1967, and disbanded in the 1990s. This association's main contribution was the publication of the interlibrary loan code and a set of library standards that are still quoted in the literature. Other short-lived associations, in existence for fewer than two decades have been in the fields of agriculture: the National Association of Agricultural Librarians ANBAGRO (Asociación Nacional de Bibliotecarios Agrícolas); government: Association of Librarians of Governmental Institutions of Mexico, or ABIGMAC (Asociación de Bibliotecarios de Instituciones Gubernamentales de México); and in the field of biomedicine: the Association of Librarians in Biomedicine, or BIBAC (Asociación de Bibliotecarios en Biomedicina), among other bodies. The life and activity of state associations is linked to the size of the library profession in the Mexican provinces, where, unlike in Mexico City, professional librarians are just a handful. The arrival of new library schools in some of the states may foster a local library association development. Generally, library associations and some leading library systems host annual library conferences on general and specialized subjects. These programs are probably the second, if not the premiere, conference offerings in Latin America (see Appendix 4).

INTERNATIONAL LIBRARY COOPERATION

With the most visible international activities, academic libraries lead in collaboration. The most extensive cooperation activity is with U.S. organizations, and to a lesser degree with Latin American and European countries. Mexican border universities often have strong collaborative ties with their counterparts on the other side of the border. For example, the Universidad Autónoma de Ciudad Juárez has borrowing agreements with New Mexico State University

and with El Paso Community College, and the CICESE in Ensenada, Baja California, has cooperative agreements with the La Jolla Scripps Research Institute in San Diego. In addition to the academic institutions, the Mexican Library Association has strong links with its international counterparts from Latin American, under the International Federation of Library Associations and Institutions, as well as the principal U.S. library associations that include the American Library Association, the Special Libraries Association, and REFORMA (who have opened paths for cooperation), as well as some state organizations. Cooperation takes the form of visiting speakers attending annual conferences, facilitation of workshops, staff exchanges, and materials exchange. Seal produced an excellent paper documenting U.S.–Mexico collaboration.^[45] The best communication venue for U.S.–Mexico cooperation is the FORO, Transborder Library Forum, where some Canadians have also participated, the meeting that began as an annual event in 1991 became, after a decade, a bi-annual conference.^[46] It alternates between Mexico and the United States. The FORO was originally organized as a reaction to the NAFTA agreement to strengthen the relationships among border libraries. One of the FORO's byproducts is the multilateral interlibrary loan project between U.S. universities and central Mexican institutions, with the Franklin Library playing a key role facilitating the shipment of bibliographic materials by diplomatic pouch.

ARCHIVES

Like libraries, archives began, in the western sense, after the Spanish conquest of Mexico. Archives were formed during the colonial era in monasteries and churches where registration births, deaths, and property transactions took place. Civic life was directed, in many ways, by the Catholic Church until the nineteenth century. The best source of Mexico's colonial history is the Archives of Indies in Seville, Spain, where the most important records of colonial life are stored. The government had split from the Catholic Church in 1855, creating the national birth registry, when Benito Juárez, then president and a great political reformer, opened the registry office in Veracruz, and the first birth certificate was issued to his daughter in 1859. Several archives of churches and religious groups passed to other government organizations or to especially created archival institutions. The main archive is the General Archives of the Nation, or AGN (Archivos Generales de la Nación), located at the former Lecumberri Prison in Mexico City, where cells now hold different sections of the file collection. The AGN is the leading organization in archives policies and filing standards, with its own organization scheme followed by several archives in the country. Most states have an archive system or structure that coordinates those in the municipalities. Among them

are the property offices in each city. They make copies of their documentation to be sent to the state capital's general archives. A similar pattern is followed by birth registries. The new law on information transparency is improving, and will continue to improve, archives, because all government ministries, departments, and official bodies, including public universities, have to include organized archives and make them available to the public via the Web. The body in charge of implementing policies and supervising the legal implementations is the Federal Institute of Information Access.

There are several historical archives located in the large urban centers, mainly those with a colonial past. A survey conducted in 2007 by the Association to Support the Development of Archives and Libraries, or ADABI (Asociación de Apoyo al Desarrollo de Archivos y Bibliotecas en México, AC) identified 142 archives, but this number only corresponds to those that have printed inventory catalogs. The survey classified them in the following categories: 75 parochial archives, mainly from the Catholic Church; 53 state and county archives (included historical and administrative archives); and 14 historical archives covering colonial, independence and revolution materials.^[47] The 12 most important private archives are in Campeche, Mexico City, Oaxaca, Puebla, Tamaulipas, and Yucatán. One diocesan archive was reported in the State of Guerrero, in the Southwestern part of the country. Presumably, the archives reported in this study are well-managed, if it is assumed that those who answered have organized archives. However, the total number of historical archives throughout the country may be 3 times this figure. Another study attempting to identify how modern archives were in terms of their organization and storage estimated that 67% of them have a budget that is lower than \$25,000 and 10% have budgets of fewer than \$100,000 annually. Additional findings were that 85% of the archives have internal regulations and security measures, and 29% have temperature and humidity control systems, and 85% have computers. Most of the archives, 85%, are open to the public. The results of the study are, in general, positive.^[48] There are three archive associations, included the one mentioned above, ADABI. This association organizes conferences and meetings and is probably the largest. Two other are the Mexican Association of Libraries and Institutions with Old Collections, AMBIFA (Asociación Mexicana de Bibliotecas e Instituciones de Fondos Antiguos), and the Mexican Association of Private Archives and Libraries, AMABPAC (Asociación Mexicana de Archivos y Bibliotecas Privados, AC). All of these associations have Web sites with membership information. Only two academic institutions offer undergraduate archives studies, they are the National School of Librarianship and Archival Science, or ENBA (Escuela Nacional de Biblioteconomía y Archivonomía) and the Universidad de San Luis Potosí. The first is the older one and has 862 graduates, while the second has just started awarding baccalaureate degrees in archives or records management.

MUSEUMS

Like other institutions discussed in this entry, the organization, collections and economic resources of the 1137 Mexican museums are closely related to the size of the city where they are located. Mexico City ranks number one, with the largest number of museums and with most of the best collections, followed by Guadalajara and Monterrey. The rest of the state capitals have an average of four museums, plus those in the rest of each state outside these capitals. Museums have increased substantially since the beginning of the last century (1907) when there were 38, according to the Mexican Association of Museum Professionals, or AMProm (Asociación Mexicana de Profesionales de Museos).^[49] It is also estimated that 60% of the museums are devoted to anthropology and history, 25% to fine arts, and 10% to science and technology, plus other subjects, including children's museums, accounting for about 1%. Along with the classical twentieth century concept of museums, there are also zoos, aquariums, and natural reserves that are not discussed in this paper.

Museums are created and managed by different bodies, including the federal, state, and municipal governments, communities, the private sector, and companies or individuals. The National Institute of Anthropology and History, or INAH (Instituto Nacional de Antropología e Historia),^[50] is probably the largest organization that manages museums, 244. It groups museums into six main categories:

1. National museums have country-wide collections and are located in Mexico City. The largest and the best INAH museum is the Anthropology museum that holds some of the most valuable collections of Mexican indigenous cultures.
2. Regional museums cover more than one state and are located in different parts of the country. A good example is the Museum of Cultures (Museo de las Culturas) in Oaxaca.
3. Local museums that are in historical buildings or that hold different collections, such as the Customs House of Ciudad Juárez (Ex-Aduana).
4. Community center museums, such as the outstanding Convent of Tepoztlán (Ex-Convento de Tepoztlán).
5. Community museums hold collections, usually of archeological artifacts, valued by communities.
6. In situ museums whose collections are in archeological sites, where artifacts and information are derived from the same grounds. The most outstanding ones are Chichen-Itza, the Teotihuacan Pyramids, and Uxmal.

The states with the largest numbers of museums, outside Mexico City, include Jalisco with 54 (where Guadalajara is the capital), Veracruz with 18, and Chiapas has the largest number of community museums, 35.

The second organization managing museums is the CONACULTA. This federal governmental body manages 132 museums and galleries. The best are in the Palace of Fine Arts (Palacio de Bellas Artes). Another federal organization that takes care of museums and art galleries is the National Institute of Fine Arts, or INBA (Instituto Nacional de Bellas Artes).^[51] It has some excellent museums like National Museum of San Carlos; the Museum of Modern Art and the Tamayo Collection. Private museums run by individuals, companies, and foundations are generally small, however, there are some fine examples of good-sized collections and notable buildings, such as the bank BANAMEX and the Franz Mayer Museum.

Some of the best museums in Mexico City for the general tourist, regardless of the body that manages them, are the mentioned National Museum of Anthropology, Modern Art, Tamayo, National Museum of Fine Arts (Museo Nacional de Arte), and the Papalote (a children's interactive science museum). Smaller thriving museums of interest in the capital include the Frida Kahlo, the Dolores Olmedo Museum that houses Riveras' works and the largest collection of Kahlo's paintings, and the private Franz Mayer Museum for the decorative arts. Guadalajara, the second largest city, also offers some good museums of interest to the outside visitor such as the Regional Museum of Guadalajara and the Popular Arts Museum (Museo de Artes Populares). Guadalajara has undertaken a project to build a Guggenheim museum. A group of private investors paid for a two million dollar feasibility study and the state government financed a call for an architectural building design contest. The planned premises are in a beautiful canyon rim in the outskirts of the city. This initiative may have behind it the idea of competing with Monterrey, located in Northern Mexico, where a cultural corridor has been created in the heart of the city flanked by first class museums, making it the second

cultural capital in the country. Its most outstanding museums and galleries are the Contemporary Art Museum, or MARCO (Museo de Arte Contemporáneo), the Museum of Mexican History (Museo de Historia Mexicana), and the Glass Museum (Museo del Vidrio), each housing excellent collections. The rest of the state capitals have fewer collections of smaller size and less financial support. Although there are some that are outstanding, such as the described archeological museums of Oaxaca and Veracruz (see Fig. 6).

Additionally, Mexican archeological sites number in the thousands, and they are certainly living museums. If the sites are lumped together with historical places, the number is 110,442. The challenges of cataloging them are great: 60% are cataloged or are in process, and 173 of them are open to the public, with nearly 10 million visitors per year.^[50] The top archeological sites are Mayan—Tulum, and Palenque in addition to those listed—plus the Zapotecan Monte Alban and Mitla in Oaxaca, the Totonaca site Tajin in Veracruz, and the Aztec Temple Mayor in Mexico City, and finally, the Olmec culture, the earliest known Mexican civilization, that dates back to 3000 years ago with the Tres Zapotes site.

A great feature of Mexican art is the muralist plastic movement that took place after the Mexican Revolution (1921), a time when Mexican identity was redefined. It was basically a nationalistic movement that focused on the indigenous people and on criticism of Spanish and foreign influences. The best-known include David Alfaro Siqueiros, Diego Rivera, José Clemente Orozco, and Juan O'Gorman, among others. Locations with murals in Mexico City by these muralists and those of their followers include the National Palace (Palacio Nacional), the Palace of Fine Arts (Palacio de Bellas Artes), the Central Library at UNAM, and the San Ildelfonso Museum (Museo de San Ildelfonso), among others. There are also murals in the rest of the states.



Fig. 6 Museum of Anthropology, Xalapa, Veracruz—by Héctor Nava.

The best, normally the larger museums, have libraries, such as the National Museum of Art, or MUNAL (Museo Nacional de Arte), Interactive Museum of Economy, or MIDE (Museo Interactivo de Economía), the Museum of Light (Museo de la Luz), and the National Museum of Anthropology (Museo Nacional de Antropología) in Mexico City, and the Museum of Mexican History (Museo de Historia Mexicana) in Monterrey. It is estimated that about 50 museums have libraries. The most outstanding is the large National Library of Anthropology and History attached to the museum of the same name, mentioned in the Special Libraries section of this entry.^[52]

Professionals working in museums have degrees in other fields, because there are very few options to get a university degree in this specific subject. The only public university that has a related program for museum professionals at Baccalaureate, Master and Doctorate is UNAM. The studies are in history of art. Additionally, one private university offers a program in the same field and two more on cultural promotion. None of these programs are specifically designed for museum management, but do give the basic background in art. Another option for museum staff is training through courses and workshops organized by the museums themselves and universities and are mainly held in Mexico City.

CONCLUSIONS

This overview of libraries, museums, and archives is just a snapshot because it is difficult to portray the country that

is large and has great differences between big and small cities, as well as between urban and rural regions. In conclusion, Mexico has some of the best libraries in Latin America; however, their development is uneven. In terms of growth and quality of library services, state university libraries and large private higher education institutions are in the leaders. However, at the bottom are several smaller public and private academic institutions that lag behind. Special libraries are also among the best libraries with good budgets, collections, and professional staff, but several companies fail to provide information services as part of their organizational structure. The public library system is the largest in Latin America and its growth and improvement has been indeed, a major achievement in the last 25 years. Its collection development is centralized in Mexico City but buildings and staff are the responsibility of the states and the municipalities. School libraries on the other hand, are few, considering the large number of primary and secondary education schools in Mexico, but the government has invested heavily in creating classroom collections, distributing more than 200 million volumes in the last 7 years. Because the number of librarians is inadequate, the country would benefit from more library school graduates. The national information institutions, such as the national library, and the national serials collection have good bibliographic treasures of colonial and contemporary Mexico, but their leading role is limited. There are many museums in Mexico, most of them are devoted to anthropology due to the great interest in pre-Columbian history. The largest number of museums is concentrated in Mexico City and the two other major cities

Appendix 1: Library Chronology

Year	Event
1400	Amoxcalli-Aztec codex (Amoxltli) libraries
1511	First book arrives in Mexico from Europe
1539	First printing press
1555	First book printed in Mexico—Alonso de Molina <i>Vocabulario en lengua castellana y mexicana</i>
1788	Opening of the first public library—Turriana Library
1790	First copyright law
1790	Foundation of the first Museum of Natural History
1790	Foundation of the National Archives—Archivo General de la Nación (Original name: Archivo General de la Nueva España)
1825	Foundation of the Mexican National Museum
1867	First decree to create the National Library—Biblioteca Nacional
1882	National Institute of Statistics, Geography, and Informatics (Originally as Dirección, Geografía y Estadística, DGE)—Instituto Nacional de Estadística, Geografía e Informática
1910	Opening of the National Museum of Archeology, History, and Ethnography (formerly known as the Mexican National Museum)
1921	First Department of Public Libraries, Ministry of Public Education—Dirección de Bibliotecas Populares
1922	First public library building—Biblioteca Pública Cervantes
1924/1954	Mexican Association of Librarians—Asociación Mexicana de Bibliotecarios, AC
1939	Foundation of the National Institute of Anthropology and History
1940	The National Museum of Archeology, History, and Ethnography changed its name to National Museum of Anthropology
1945	National School of Library and Archive Sciences—Escuela Nacional de Biblioteconomía y Archivonomía
1956	Opening of the UNAM Central Library Building—Biblioteca Central UNAM

(Continued)

Appendix 1: Library Chronology *(Continued)*

Year	Event
1957	First national library conference—Jornadas Mexicanas de Biblioteconomía, organized annually since 1974
1970	Foundation of the National Council of Science and Technology (An early funding body for special and university libraries)—Consejo Nacional de Ciencia y Tecnología
1970	Labor unions take power at academic libraries, and at universities in general
1972	First library science master's degree—UNAM
1975	First academic library building of a technological institute—IT Saltillo
1978	First Mexican integral (mainframe) library system—LIBRUNAM, UNAM
1983	First release of the library software SIABUC (Most popular free library software)—Universidad de Colima
1984	Foundation of the National Council for Academic Libraries—CONPAB-IES, Consejo Nacional de Asuntos Bibliotecarios de Instituciones de Educación Superior
1988	First librarian to get a Ph.D. (From the United States)—Jaime Pontigo
1999	UNAM Ph.D. program started—UNAM
2003	Mexican Information Literacy Standards are approved for higher education

Appendix 2: Library Science Schools

School	Address	Phone/Fax
El Colegio de México, AC Maestría en Bibliotecología	Camino al Ajusco 20, Pedregal de Santa Teresa, Del. Magdalena Contreras, 10740 México, DF http://www.colmex.mx/	(55) 5449-9909 5449-3000 x2113 Fax: 5645-4584
ENBA—Escuela Nacional de Biblioteconomía y Archivonomía	Calz. Ticomán 645, Col Santa María Ticomán, Del. Gustavo A. Madero, 07330 México, DF http://www.enba.sep.gob.mx/	(55) 5329-7176 5329-7181
Licenciatura en Biblioteconomía ITESM—Instituto Tecnológico de Estudios Superiores de Monterrey Maestría en Ciencias de la Información y Administración del conocimiento	Eugenio Garza Sada 2501, Col. Tecnológico, Edif. CEDES, Semisótano 1 64849 Monterrey, NL http://www.ruv.itesm.mx/portal/promocion/oe/m/mik/	01800 112-2832
UACH—Universidad Autónoma de Chihuahua	Av. Universidad S/N, Cd. Universitaria, Apartado Postal 744, 31240 Chihuahua, Chih. http://www.ffyluach.mx Fax: 414-4932	(614) 413-3449
Licenciatura en Ciencias de la Información UANL—Universidad Autónoma de Nuevo León	Av. Alfonso Reyes s/n, Ciudad Universitaria, 66450 San Nicolás de los Garza, NL http://www.dsi.uanl.mx	(81) 8376-0620 8376-0780 Fax: 8352-5690
Lic. en Bibliotecología y Ciencias de la Información UASLP—Universidad Autónoma de San Luis Potosí	Álvaro Obregón 64, Col. Centro, 78000 San Luis Potosí, SLP http://www.uaslp.mx	(444) 818-2522 818-9025 Fax: 818-2521
Licenciatura en Bibliotecología e Información UNACH—Universidad Autónoma de Chiapas Licenciatura en Bibliotecología UNAM—Universidad Nacional Autónoma de México	Calle Canarios y Av. Central S/N, Col. Buenos Aires, Delegación Terán, San Cristóbal de las Casas, Chis. http://www.unach.mx Circuito Interior, Ciudad Universitaria, Delegación Coyoacán	(961) 615-1101 College degree (55) 5622-1881

(Continued)

Appendix 2: Library Science Schools (*Continued*)

School	Address	Phone/Fax
Licenciatura en Bibliotecología y Estudios de la Información	04510 México, DF http://www.unam.mx http://www.filos.unam.mx/POSGRADO/biblio1.htm	Master degree and Doctorate (55) 5616-6823
Maestría y doctorado en Bibliotecología y Estudios de la Información		
UAG—Universidad Autónoma de Guadalajara	Av. Patria 1201, Lomas del Valle, 3 ^a . Sección, 45110 Zapopan, Jal. http://www.uag.mx	(33) 3648-8767
Lic. en Ciencias de la Información		
UAEM—Universidad Autónoma del Estado de México	Av. Universidad Esq. Paseo Toluca s/n, Cerro de Coatepec, Ciudad Universitaria,	(722) 213-1407 Fax: 213-1533
Licenciatura en Ciencias de la Información Documental	50110 Toluca, Estado de México http://www.uaemex.mx/	

Appendix 3: Library Science Serials

Title	Editor	Frequency	Address
Biblioteca Universitaria: Boletín Informativo de la Dirección General de Bibliotecas ISSN 0187-750X	Dirección General de Bibliotecas—Universidad Nacional Autónoma de México (UNAM)	Semestral	Biblioteca Central Circuito Interior, Ciudad Universitaria, Coyoacán 04510. México, DF informa@panoramx.dgbiblio.unam.mx http://www.dgbiblio.unam.mx/
Bibliotecas y Archivos ISSN 0185-0083	Escuela Nacional de Biblioteconomía y Archivonomía	Every 4 months	Calz. Ticomán 645, Col. Santa María Ticomán, Gustavo A. Madero, 07330. México, DF biblarch@enba.sep.gob.mx http://www.enba.sep.gob.mx/
Boletín Informativo de ASAR	ASAR, A. C.	Every 4 months	Calle 66, No. 3204, 31410. Chihuahua, Chih. Tel. (614) 411-3672
Hemera—Revista de Ciencias Bibliotecológicas y de la Información ISSN 1665-5834	Hemera	Semestral	Apartado Postal 23-098 BO. San Juan 16001. México, DF Tel. (55) 1509-0554/044 55 2695-8002 http://hemera.galeon.com/
Infobila (Database)	Centro Universitario de Investigaciones Bibliotecológicas, UNAM		Torre II de Humanidades, pisos 12 y 13, Ciudad Universitaria, Coyoacán, 04100. México, DF http://www.cuib.unam.mx
Información, Producción, Comunicación y Servicios ISSN 0188-5847	Infoconsultores, S. C.	Quarterly	Michoacán 30, Desp. 6, Col. Hipódromo, Cuauhtémoc, 06100. México, DF infoconsult@spin.com.mx
Investigación Bibliotecológica: archivonomía, bibliotecología e información ISSN 0187-358X	Centro Universitario de Investigaciones Bibliotecológicas, UNAM	Semestral	Torre II de Humanidades, pisos 12 y 13 Ciudad Universitaria, Coyoacán, 04100. México, DF http://www.cuib.unam.mx
LIBER: Revista de Bibliotecología. ISSN 0188-5847	AMBAC, A. C.	Quarterly	Ángel Urraza 817-A, Colonia del Valle, Benito Juárez 03100. México, DF liber@servidor.unam.mx http://www.ambac.org.mx
Memorias-Jornadas Mexicanas de Biblioteconomía	AMBAC, A. C.	Quarterly	Ángel Urraza 817-A, Colonia del Valle, Juárez 03100. México, DF Tel. y fax: 1152 (5) 5575-3396 http://www.ambac.org.mx
Noticiero de la AMBAC ISSN 0001-186X	AMBAC, A. C.	Quarterly	Ángel Urraza 817-A, Colonia del Valle, Benito Juárez, 03100. México, DF Tel. y fax: 1152 (5) 5575-33-96 ambac@solar.sar.net http://www.ambac.org.mx

Appendix 4: Library Science Conferences

Conference name	Place	Date	Organizing institution
Amigos http://www.udla.mx/amigos	Puebla, Pue.	February (Biannual)	Dirección de Bibliotecas, Universidad de las Américas
Coloquio Internacional de Bibliotecarios http://www.fil.com.mx/cultura/prog04/rub_prof.htm	Guadalajara, Jal.	November/ December (First and last week)	Coordinación de Bibliotecas, Universidad de Guadalajara
Coloquio sobre Administración y Liderazgo en Información http://www.uv.mx/bvirtual/coloquio/	Veracruz, Ver.	September (Third week)	Unidad de Servicios Bibliotecarios y de Información, Universidad Veracruzana
Conferencia Internacional sobre Bibliotecas Universitarias http://www.dgb.unam.mx/conf2004.html	Mexico, DF	October (First two weeks)	Dirección General de Bibliotecas, UNAM
CUIB Coloquio Internacional de Investigación Bibliotecológica y de Información cuib.unam.mx/eventos.htm	Mexico, DF	September	Centro Universitario de Investigaciones Bibliotecológicas, UNAM
Congreso Nacional Bibliotecas Públicas http://dgb.conaculta.gob.mx	Site varies	August– September	Dirección General de Bibliotecas, CONACULTA
Encuentro sobre Desarrollo de Habilidades Informativas http://www.uacj.mx/bibliotecas/Online@2000	Juarez, Chih.	October (Second week)	Dirección General de información y Acreditación, Universidad Autónoma de Ciudad Juárez
En línea.mty.itesm.mx/ Foro Transfronterizo de Bibliotecas	Monterrey, NL U.S.A./ Mexico	October March	Instituto Tecnológico de Monterrey, Campus Eugenio Garza Sada Organizing institution varies
http://www.uach.mx/foro/es/Interf@ces	Site varies		
http://www.ucol.mx/interfaces/	Colima, Col.	November	Universidad de Colima
Jornadas Mexicanas de Biblioteconomía http://www.ambac.org.mx/	Site varies	May	Asociación Mexicana de Bibliotecarios, A. C.
Foro Social de Información, Documentación y Bibliotecas http://www.fsdyb2006.inforosocial.org/	Site varies	September (Biannual)	Círculo de Estudios sobre Bibliotecología Política y Social (México) y el Grupo de Estudios Sociales en Bibliotecología y Documentación (Argentina)
Reunión Anual CONPAB http://www.conpab.uaslp.mx/default1.htm	Site varies	Site varies	Consejo Nacional para Asuntos Bibliotecarios de las Instituciones de Educación Superior
Reunión Biblioteca de Ciencia y Tecnología IPN	Mexico, DF	August	Instituto Politécnico Nacional
Reunión de Bibliotecarios de la Península de Yucatán http://www.uady.mx/	Merida, Yuc.	October	Dirección de Bibliotecas, Universidad Autónoma de Yucatán

of Guadalajara and Monterrey, and there are some good museums in smaller cities. Archives are probably more evenly distributed throughout the country. Their development varies from very well organized and preserved ones, to small not well-preserved or well-organized archives with scarce resources.

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Modeling Documents in Their Context

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Abstract

This entry describes notions and methods for analyzing and modeling documents in an organizational context. A model for the analysis process is provided and methods for data gathering, modeling, and user needs analysis described. The methods have been originally developed and tested during document standardization activities carried out in the Finnish Parliament and ministries. Later the methods have been adopted and adapted in other Finnish organizations in their document management development projects. The methods are intended especially for cases where the goal is to develop an Extensible Markup Language (XML)-based solution for document management. This entry emphasizes the importance of analyzing and describing documents in their organizational context.

INTRODUCTION

Documents serve in organizations as an important means for communication, as a vehicle in work processes, and as organizational memory. Often they are also needed as evidence of the activities in the work processes. The creation and utilization of documents is currently strongly technology-dependent. Documents are created as *digital* documents and software applications are needed to find documents and information available in them. Information in digital documents is lost if the documents cannot be found, if they cannot be presented to human perception, or if they cannot be understood. Understanding the meaning of documents requires, not only understanding the content of the documents, but also understanding at least to some extent the structure of the documents as well as the context where the documents have been created. The importance of the contextual information has been often pointed out especially in the work done on records management and archival research (e.g., McKemmish^[1]).

Many enterprises have begun major projects to turn their electronic document management (EDM) environments into environments with more standardized information structures and more effective and secure utilization capabilities. Developing systematic management of digital documents in an organization always requires some kind of standardization, that is, agreeing upon rules for the ways information is presented in documents, in particular, how the content of the documents is structured from information items. If the structure is indicated in the documents in a formal way, software applications can be used to process the documents as a collection of information structures. One approach to indicate the structures in documents is to use some markup language. Extensible Markup Language (XML) is the metalanguage currently widely used to define markup languages for particular

needs and to present information in documents in the particular markup language.^[2,3] XML is a restricted form of the older markup language called Standard Generalized Markup Language (SGML^[4]). XML was developed to offer special support for documents to be distributed over the Internet. The huge number of XML-related development activities initiated after the publication of the first version of XML as a recommendation of the World Wide Web Consortium (W3C) in 1998 shows that XML is becoming a kind of *lingua franca* for the data of the Internet.

In EDM reengineering and standardization projects of organizations, a profound analysis of the document management in the environment is needed. In such an analysis, current documents and document management practices are studied and described and new document structures and document management practices are proposed. It should not be restricted to analyzing document structures and describing them by more or less formal models. To be able to gather the important contextual information, analysis and description of the whole environment is needed. The primary concern in the analysis may be in the documents produced within the organization. EDM development can however also be important in cases in which there is little internal document production. For example, libraries interested in improving the quality of their digital library services need rather profound analysis concerning both the primary documents created outside the library and the secondary documents created within the library, which contain meta information about the primary documents. A library can also participate in an EDM development project as an expert on reader needs. For example, in the document standardization activities of the Finnish Parliament and ministries, the Library of Parliament has provided valuable information about readers of documents and reader needs.^[5]

This entry describes notions and methods for analyzing and modeling documents in an organizational context. The methods have been originally developed and tested during document standardization activities carried out in the Finnish Parliament and ministries. The implemented standards in the environment concern a major portion of the Finnish parliamentary documents. Later the methods have been adopted and adapted in other Finnish organizations in their document management development projects. The methods have been earlier introduced in Tiitinen–Salminen,^[5–10] and experiences of use cases have been reported in Salminen–Nurmekselä.^[11–16]

EDM CONCEPTS

In EDM development and document standardization, organizations are interested in documents as a means of information management: a means to cluster, organize, store, and transfer information. In particular they are interested in using computers and the digital form effectively. There is therefore a need for associated hardware and software to process the data of documents and to present the content for human perception. When the notion of information is understood according to the sense-making theory of Dervin^[17] as “the sense created in a situation, at a specific moment in time and space by a reader” (where Dervin means a human reader), then the information in a document is always subjective. In this entry, the following characteristics are regarded as essential to a *document*:

- It is intended for human perception, to be understood as information pertaining to a topic.
- It has content and one or more external representations.
- The content consists of parts, parts consist of symbols, parts are structured to support human understanding.
- It is stored on media.
- It can be identified and handled as a unit.

Additional characteristics of a *digital document* are

- The content is stored on digital media.
- The document is associated with hardware and software that can identify from the digital content the symbols and the structure of the parts and produce from them external representation to be perceived by humans.

Electronic document management in an enterprise does not concern documents only. Fig. 1 shows the major EDM components. There are basically two types of entities in an EDM environment: activities and resources. An *activity* is a set of actions performed by one or more actors. The *resources* are of three different types: actors, documents and related metadata, and systems. An *actor* is an organization or a person. *Systems* consist of devices,

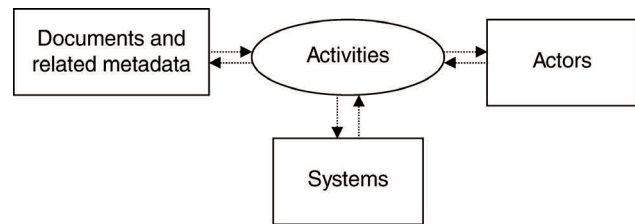


Fig. 1 Components of an EDM environment.

Source: Adapted from Methodology for document analysis, by A. Salminen. In *Encyclopedia of Library and Information Science*, Marcel Dekker, Inc., New York, 2000.^[9]

software, and data used to support the performance of activities. Out of all the recorded data in an environment, documents are those possessing the characteristics listed above. The *metadata* describes the content, structure, and context of documents.^[18] The contextual metadata includes, for example, information about the actors, activities, and systems in the EDM environment. The broken lines in Fig. 1 show the information flow between activities and resources. Resources are regarded as information repositories in which the information produced in an activity can be stored or from which information can be taken and used in an activity. Information needed and produced during activities is stored in documents and in the related metadata, in the heads and experience of people, in the organizational culture, and in systems. *Information* is thus anything that can be stored in a repository and used in an activity, or that can be produced by an activity and stored in a repository to be later used in an activity (probably in some other environment). In relationship to documents and systems, actors are called *users*. The EDM environments in which a specific organization or person is involved may be quite complex, and the information in an activity making sense to a human actor often comes from many different sources.

XML STANDARDIZATION

Some kind of document analysis is needed in all major document management improvement efforts. Especially SGML/XML standardization has shown to be in some cases a complicated and demanding task. It may take several years, cause tremendous costs, and lead to various effects in the implementing organization as well as in its relationships to other organizations.^[11,12,19] On the other hand, also reasonably fast implementation cases have been reported during the last years.^[16,20] Experiences in the standardization of the Finnish parliamentary documents have shown the importance of careful analysis of the whole document management environment in the beginning of the standardization.^[11,12]

XML as Document Format

SGML and XML offer means for defining and representing information as *structured documents*. Compared to SGML, XML has a smaller set of rules, less optional features, and the referencing mechanism is planned especially for referencing to Internet resources. The logical structure of an XML document is described as a hierarchy of named elements and the elements are indicated by explicit markup. Elements can be associated with attributes to add semantic information. Both SGML and XML are metalanguages, not specifying a specific markup vocabulary or document structure but allowing the definition of specific markup languages for specific purposes.

A characteristic feature to structured document management is that the structure definitions, document instances, and layout specifications can be managed as separate content items. When XML is adopted for structured documents, the structure definitions are called *XML schemas*. Various definition languages have been developed for describing the schemas. Most important of them are the *Document Type Definition* (DTD) mechanism introduced as a part of the XML language^[2,3] and the XML Schema language.^[21]

Standardization Levels

Development and implementation of specific XML-based languages is part of the multilevel standardization activities going on around the world. Three major interrelated levels of those activities can be identified:

Universal standardization. At this level general rules for wide use for different application areas are developed. The universal standardization activities are coordinated by W3C. Examples of the universal specifications are the XML Linking Language (XLink) intended for describing links between resources^[22] and XSLT intended for describing transformations of XML documents.^[23] The development work on XML itself is part of the universal standardization activities.

Sectoral standardization. At this level rules for the purposes of a specific sector or application domain are defined. The rules are built on top of the universal rules and they are not necessarily intended to be implemented as such but to be used to tailor further specifications at the local standardization level. The developer is often a consortium of organizations of a specific sector but it may also be a person or a single organization, for example, a software company. W3C and ISO have also published specifications for specific purposes. For example, W3C has developed the XML-based XHTML for Web publishing,^[24] and the Text Encoding Initiative (TEI) Consortium participated by

several humanistic organizations has published guidelines for encoding electronic texts for scholarly research.^[25] The original TEI guidelines were originally based on SGML, later the guidelines have been adapted to XML.

Local standardization. At this level rules for a specific environment are developed. The standardization does not concern documents of the environment only, it concerns also the work of people, technology to be used for working with documents and for using documents, and the ways people of the environment collaborate with each other.

At all levels standardization is a continuing process. The changes in information technology, in organizations, and in business opportunities cause needs to update earlier specifications and to develop new ones. Furthermore, since the specifications are dependent on other specifications, changes in one specification cause needs to change other specifications.

An Example of Local Level Standardization

The SGML/XML standardization of documents produced in the Finnish parliament and ministries is an example of local level standardization. The standardization was initiated by a document analysis carried out in a project called RASKE. The term RASKE comes from the Finnish words “Rakenteisten AsiakirjaStandardien KEhittäminen” meaning the development of standards for structured documents. The methods developed in the project have later been called as RASKE methods. The project was commenced in spring 1994 by the Finnish Parliament and a software company in cooperation with researchers at the University of Jyväskylä.^[6] The Ministry of Foreign Affairs, the Ministry of Finance, the prime minister’s office, and a publishing house also participated in the project.

Starting the standardization was motivated by document management problems in the Finnish Parliament and government, for example, incompatibilities of systems, disturbing inconsistencies in the document contents, uncertainty concerning the future usability of the information in the archived digital documents, and unsatisfactory retrieval techniques.^[6] The document analysis concerned four domains: the inquiry process, national legislative work, Finnish participation in European Union legislative work, and the creation of the state budget. Preliminary DTDs were designed for 21 document types, including, for example, government bill, government decision, government communication, private bill, special committee report, budget proposal, and communication of parliament.

The work of the RASKE project during the period from 1994 to 1998 has been followed by several projects in

which selected companies have developed and implemented SGML or XML solutions for a specific subset of documents.^[11,12,26] The first implemented document repository in SGML form was the archive of laws and statutes, which was published by the Ministry of Justice in 1997. In parliament, the application of SGML started in 1998, and the Ministry of Finance prepared the budget proposal for 1999 in SGML form. The budget proposal is now created in XML format and the transfer from SGML to XML has started also in the parliament. All of the parliamentary documents are available to all citizens on the Internet free of charge.

THE ANALYSIS PROCESS

The analysis as part of EDM development in an organization, often including more or less formal document standardization, has multiple goals:^[8]

Understanding the domain and the role of documents on the domain. The document management environment may be a complex network of organizations, people, activities, and documents related more or less to each other. The development work is often at least partly outsourced. Understanding the complex domain may be difficult even to people who have worked in the environment for a long time. The technology experts and consultants may be unfamiliar with the domain, the terminology used there, and the ways people work on the domain. The analysis should offer tools for gaining the understanding.

Communication support. The development process may take several years of cooperation by in-house workers in various units of the organization and consultants. The analysis should help to find a common understanding of the domain.

Understanding the needs of the actors. To succeed in document standardization, the requirements of organizational actors as well as person actors should be carefully analyzed and taken into account in the new solutions.

Support the design of document and metadata schemas. EDM development usually includes schema design for documents or for metadata or for both. The document schema design requires knowledge about current document structures and needs for changes. The metadata schema design again requires wide knowledge about the document management practices in the environment and needs for metadata related to content, structure, and context of documents.

Support the redesign of document production. Major development efforts including document standardization often lead to the redesign of the way documents are produced. For being able to implement effective

document processing practices the old practices have to be understood.

Support the specification of requirements for new software systems. The implementation of new solutions often requires new software systems. The document analysis should provide information for specifying the requirements for the software.

Provide documentation for user training. Especially if XML and the structured document approach is adopted, the document authors need understanding of the rules constraining the authoring as well as understanding the needs for the rules. In case of a complex collaborative document production process, each author should also understand his or her role in the whole process. Well written analysis documentation can be used for user training.

A model for the document analysis process is shown in Fig. 2. The circles depict activities, also called *phases*, and the arrows show the control flow specifying the order for starting the activities. The small black circle indicates that all of the following three activities can be started either in parallel or in any order.

The analysis process starts by defining and describing the domain to be analyzed. The domain is an activity whose document management the standardization and improvements will concern. An example of an analysis domain could be creation of the state budget or paper machine manufacturing. Fig. 2 does not explicitly show iteration in the analysis. Once the domain has been defined, any of the subsequent phases may, however, reveal a need to correct or extend previously created models and descriptions. Basically all of the activities may thus proceed to some extent in parallel until the report of the analysis is finished. The domain definition is followed by process modeling, document modeling, and role modeling. Process modeling is used as a means of

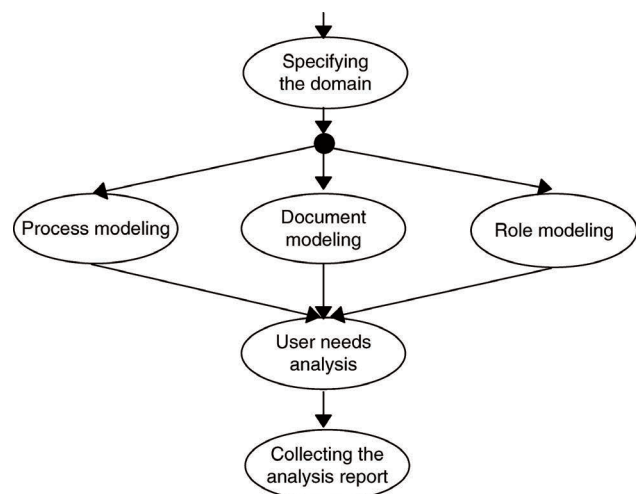


Fig. 2 A model for the document analysis process.

identifying smaller activities on the domain, the organizations responsible for them, and the documents created or used in those activities. Document modeling covers the description of document types, their life cycles, their contents, and relationships to each other. In role modeling the most essential document users are identified and their document management activities are described. The user needs analysis studies the needs concerning future document management. At the end of the analysis process, the analysis report is collected and extended on the basis of the descriptions and models produced in earlier phases. The report includes suggestions for future improvements in document management.

DATA-GATHERING METHODS

An extensive amount of data have to be collected during the document analysis phases. The ways in which the data was gathered in the RASKE project can be divided into three categories: project council meetings, literal sources, and interviews.

Project Council Meetings

A council comprising the analysts and representatives from the document support departments of the organizations involved was set up. At council meetings, the work products of the analysis were evaluated and discussed. These discussions were found to be an effective way of gathering information concerning current document management, requirements for the future, and additional data sources.

Literal Sources

The major literal sources can be divided into the following types:

- Reports of earlier projects and working groups in the EDM area. Considerable activity had taken place during the previous year or two. The reports listed a number of problems and needs.
- Printed documents in the analysis domain. Example documents were copied and carefully analyzed.
- Existing written rules and standards concerning documents. Some of the rules were expressed in statutes, some were instructions given by ministries, and some were more informal instructions. For example, there were written instructions for drafting government bills.
- Systems manuals and instructions. Knowledge about current systems is important in identifying the benefits and problems in them.
- General literature describing the domain. In case of legislation, extensive literature is available.

Interviews

The interviews were divided into the following two types:

- Informal interviews with experts in the domain. Interviews were conducted with people working with documents in the organizations. The interviews were supported by charts and other outcomes of the analysis. The domain experts were mostly chosen by the project council.
- Structured user interviews. People using the documents in the domain either within or outside the subject organizations were interviewed to ascertain their requirements concerning document management. The interviews followed structured questionnaires. The goal of the interviews was to obtain more information about the work and tasks done in the user roles and about the needs associated with those roles. The basis for the design of questionnaires was the sense-making theory.^[17] The user needs were connected to situations in the work of the respondents.

MODELING METHODS

The RASKE modeling methods have been chosen from different methodologies and tailored for the purpose of document analysis. XML Schema language and the DTD mechanism have been used as methods for describing detailed document structures. Elm graphs^[27] and similar graphical presentations available in XML schema editors have been used for graphical descriptions of document structures. The most important origins of the other modeling methods were in the object-oriented analysis (OOA) methodology,^[28] in information control nets (ICNs),^[29,30] and in role modeling.^[31] One of the most important requirements for the modeling methods was the clarity of notions and models. Except for the formal XML schemas, the models are primarily intended to support communication and understanding of the area by human readers, only secondarily for computers.

Domain Definition and Process Modeling

The domain definition includes the identification of the activity whose document management the improvements will concern and the identification of the major organizational actors of the activity. Process modeling is used as a means to identify smaller activities, organizations responsible for them, and documents created or used in those activities. Variants of ICNs are suitable for describing relationships between activities, actors, and documents.^[29,30] Basically, ICN models are process models showing a set of *activity* objects, a set of *resource* objects separated into input resources and output resources, mappings indicating the control flow among the activities, and

mappings indicating the information flow. An activity may further be described as an ICN. Figs. 1 and 2 already introduced special variants of ICNs. Fig. 1 showed only one activity circle and but no control flow. Fig. 2 instead showed only the control flow and no resources or information flow. Also, the ICNs used in the domain definition and in the process modeling are special variants of more general ICNs.

Organizational framework

As an ICN, an *organizational framework description* consists of an activity and a set of organizations as input resources. The organizational resources are used in the activity, and their participation can be regarded as an information flow to the activity. Fig. 3 depicts the organizational framework of the domain “creation of the state budget.” In the graphical representation, the broken arrows from the organizations to the activity indicate the information flow. They are labeled by identifiers and associated with phrases briefly describing the tasks of the organizations in the activity. Hierarchic relationships of organizations are indicated by nested rectangles.

It is important in modeling EDM to know the relationships subsisting between the major activities, actors, and documents. The document output model and document input model show the business activities of the domain as a process and the organizational actors of those activities.

The output model shows the documents produced in the course of the activities, and the input model shows the documents used in the activities.

Document output model

A *document output model* consists of a set of activities which are subactivities of the activity of the whole domain, a set of organizations as resources, and a set of document objects as output resources. In the organizational framework model the participating organizations were indicated as sources of information flowing to the domain activity. In the document output model, explicit information flow is shown only to documents. Organizations can be regarded as input and output resources at the same time. While performing their activities, organizations are not only sources of information; those working in the activities increase their experience and expertise and thus the organizations also increase their information resources. This information flow is not explicitly indicated in the document output model, however. In the graphical representation, organizations performing an activity are listed in the upper part of the activity circle.

Fig. 4 shows a document output model for the creation of the state budget. In Fig. 4 the names of the document types produced in the relevant activities are indicated along the broken arrows. The number in parenthesis following budget proposal refers to different versions of the

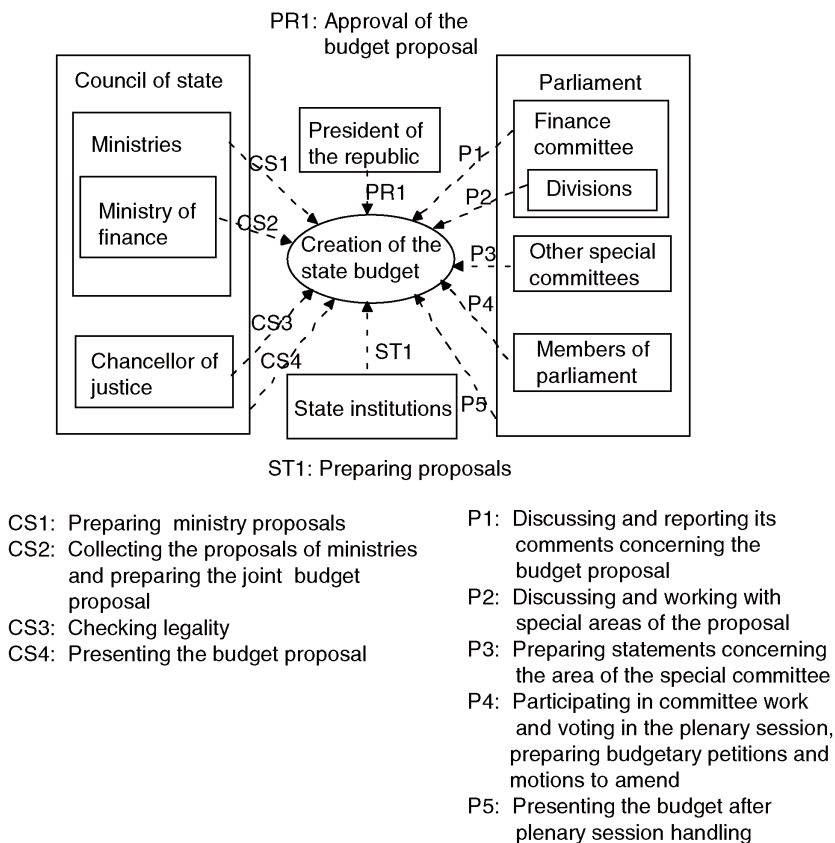


Fig. 3 Organizational framework for the creation of the state budget.

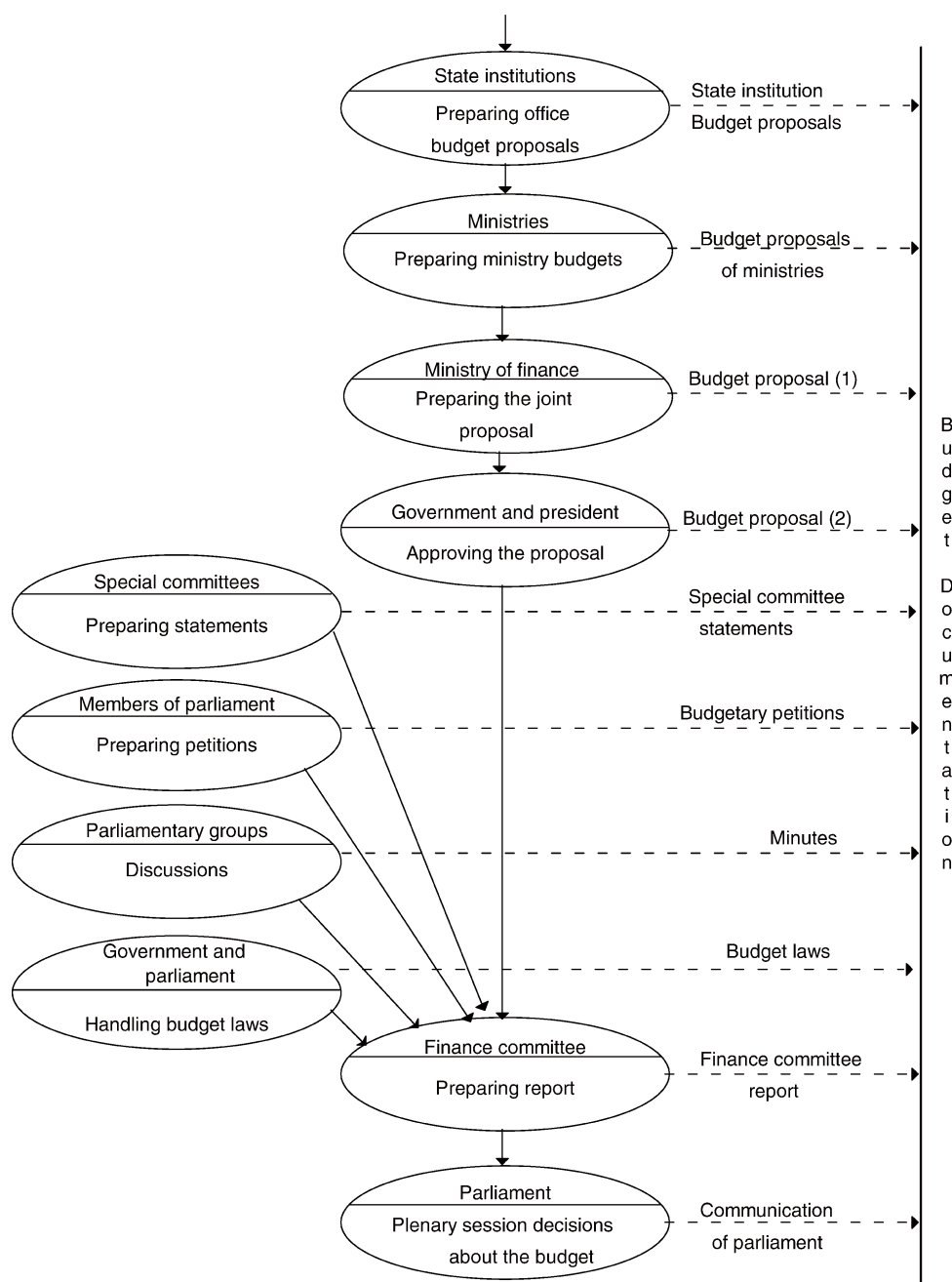


Fig. 4 Document output model for the creation of the state budget.

same document object. The vertical balk line on the right represents the documentation created during an actual work process. Basically the organizations appearing in a document output model are the same as those in the organizational framework figure. For the sake of simplification, some of the organizations may, however, be left out if their tasks are clear. Others may emerge in the course of process description. For example, in the document output model of Fig. 4, the chancellor of justice and divisions occurring in the organizational framework model of Fig. 3 have been omitted whereas the discussions of

parliamentary groups have been added. The selection of the correct level of abstraction in the process models is important. The purpose is not to describe all the special cases and details.

In the RASKE project, the document output models were found very useful in the user needs interviews in orienting the respondents to the domain. The models were sent to the interviewees before the interviews, and during the interview the respondents were able to comment on the models and indicate their own place in the model.

Document input model

A *document input model* is otherwise similar to the document output model except that instead of showing the documents produced by the activities, it shows the major documents used in the activities. In the processes analyzed in the RASKE project, the repository of the documents used was much larger than the documentation created during the process. In general, the documentation used in an activity by an organization depends on the information needs of the people working in that activity. Document input models are therefore designed after the user needs interviews.

Document Modeling

The document output model shows the document repository created in the domain. Document modeling is used to give more detailed information about a chosen subset of the document types in the repository. Document modeling may also concern new types not appearing in the current repository. Document modeling is divided into three phases:

- Object modeling
- State modeling
- Content modeling

The origins of object modeling and state modeling are in the object-based modeling methodology OOA of Shlaer and Mellor.^[28] Many of the techniques of OOA are also included in the Universal Modeling Language (UML).^[32] In object modeling, document objects are identified and described, and their relationships to each other are described in a *document-relationship diagram* (D-R diagram). The dynamic behavior of a document object over time is described in a state model. In content modeling, the structure of documents is analyzed. In case of the XML adoption, content modeling may include the design of preliminary schemas. Much of the modeling of the three phases takes place in parallel and iteratively. Each of the phases is described below.

Object modeling

In object modeling, a *document object* is an abstraction of a set of documents. An important question to be answered is: What are the real-world documents (or the sets of information) to be modeled as a document object? In the document analysis of standardization projects, the goal is to describe the information in units corresponding as closely as possible to those useful for the organization's performance in future document management systems. In current document management practices, however, the partition of information into documents does not necessarily best support information management.

A short textual description is provided in the object model for each document object class. The document objects and their relationships to each other are described graphically in a D-R diagram, corresponding to the information structure diagram of OOA. Fig. 5 shows the D-R diagram for documents created during the creation of the Finnish state budget. In the example, the standardization covers three documents: budget proposal, finance committee report, and communication of parliament. In the diagram, the document objects of the standardization domain are depicted by white rectangles, the external documents by shadowed rectangles. A one-to-one relationship is depicted by a single arrowhead, a one-to-many relationship by a double arrowhead. A conditional relationship is indicated by the letter C.

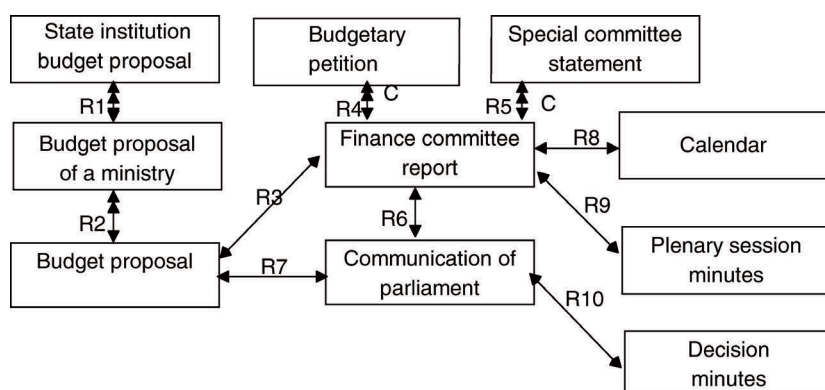
State modeling

In state modeling, the dynamic behavior of document objects over time is described by the *state transition diagrams* of OOA. State transitions diagrams of UML can also be used.^[32] A state transition diagram is a behavioral model showing the behavior of a specific document object over time. The activities shown in the diagram change the values of some attributes of the object. Examples of the diagrams can be found in Salminen,^[7] Salminen.^[8]

Content modeling

The main purpose of content modeling is to specify the hierarchic structure of the documents in the development domain. The RASKE content modeling methods are intended especially to support XML schema design. In the first stages of the modeling, the major components of documents in a class are described in a *document component description*. The relationships of the components to the components of documents in other classes are described in a *reuse table*.^[7] The reuse table is intended for analysis of the current reuse of structural components and for showing new possibilities for reuse. A reuse table is defined for each document object. The collection of reuse tables included in the content model is a way of showing the dependencies of different document types.

Most of the modeling in document analysis usually describes the current situation. In the identification of document objects, however, the analysis should be able to anticipate future needs. Grouping information into document objects may differ from current practices and some of the document types may be totally new. Also, detailed content modeling should take into account the requirements for future EDM. The XML offers a formal language with which to define the detailed structure of document content by a schema. XML authoring tools are available for creating and testing the schemas, and also for showing the schema graphically. Elm graphs^[27] were used for graphical descriptions in the RASKE project.



- R1: Budget proposal of a ministry is based on state institution budget proposals
 R2: Budget proposal is created on the basis of budget proposals of ministries
 R3: Finance committee report concerns the budget proposal
 R4: Possible budgetary petitions of parliament members are taken into consideration during the preparation of the budget committee report
 R5: There may be one or more special committee statements included in the finance committee report
 R6: Communication of parliament is created on the basis of the finance committee report
 R7: Communication of parliament is a reply to the budget proposal
 R8: Finance committee report is mentioned in the parliamentary calendar
 R9: Finance committee report is mentioned in the plenary session minutes
 R10: The decisions about the budget, included in the communication of parliament, are mentioned in the decision minutes

Fig. 5 A D-R diagram.

Role Modeling

In role modeling the use of documents by actors is modeled by role objects. A *role object* is an abstraction of the document management needs, tasks, and responsibilities of a group of people. Among existing object-oriented modeling methods, the method of Gottlob et al.^[31] is flexible enough to describe role hierarchies where a user can play different roles at the same time and where roles can evolve. Fig. 6 shows part of the role hierarchy for the document repository created during the creation of the state budget. Role types are depicted by circles. The role types are connected by arrows to the user class, or to the role types whose objects may take on that role. A person as a user of the repository is considered both as an instance of the root type and as an instance of each role type for which that person qualifies. A user in the *organization* role uses documents in the activities of an organization; for example, as a worker in the organization. The use of documents in a *person* role is not necessarily related to any organization. On the other hand, a user may also be in a person role and organization role at the same time. For example, a user may be at the same time be a client of a public library and a citizen needing information preparatory to moving to another country. The double circle around the organization role indicates that a user

may have roles in different organizations at the same time. For example, a person working in the Finnish Parliament as a member of parliament can also be a minister in the Ministry of Finance. During ministerial vacations, a person may take on the role of several ministers at the same time.

With respect to a domain, roles can be divided into internal and external. The users in *internal roles* perform activities in the domain process, whereas the users in *external roles* use documents in some other activities, either in organization roles or as private persons. In the document analysis of companies, all the user roles may be organization roles. Documents created in the public sector are, however, intended for the public and their users may be in a person role not representing an organization in the use situation. Person roles can be classified in different ways; for example, citizen, student, immigrant, senior citizen. The clients of public libraries are typically in person roles while using documents.

Role modeling produces textual descriptions of roles—the way documents are used and the purpose of use. The relationship between document objects and role objects is described in a *document-role relationship table*.^[7] In the table the columns are labeled according to document objects and the rows according to role objects. The letters in the table indicate the type of activity performed by a role object in respect to a document object.

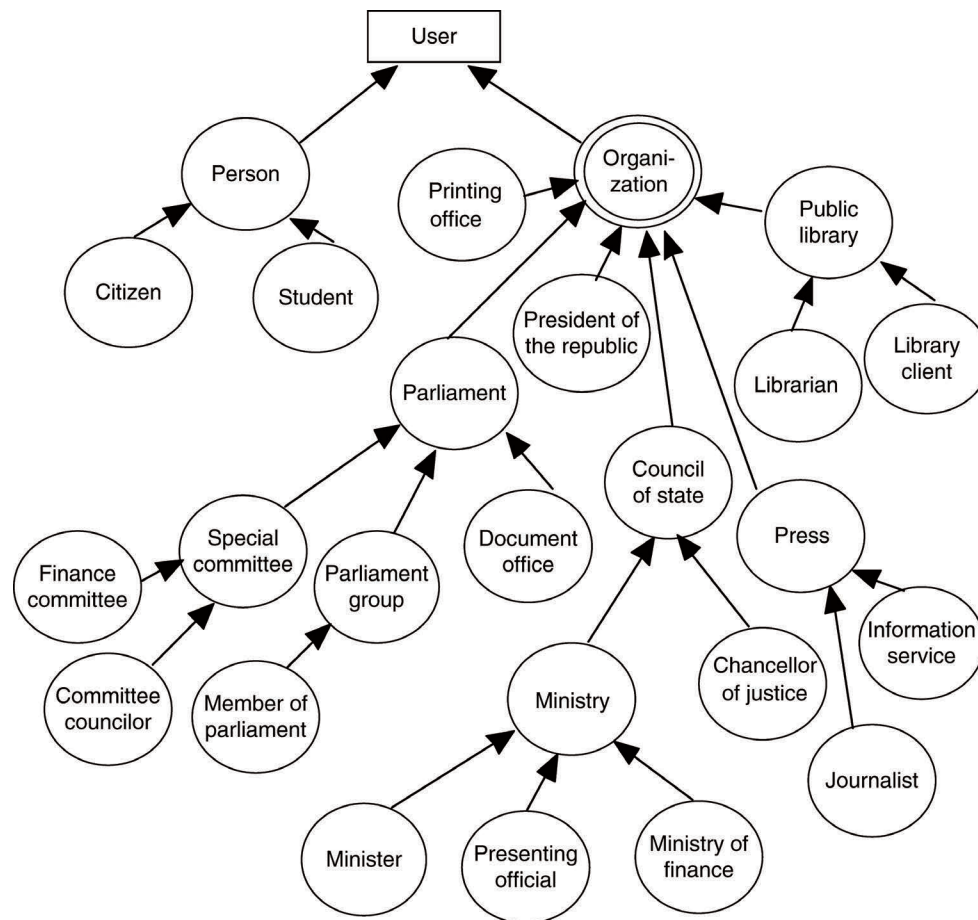


Fig. 6 A part of the role hierarchy for the creation of the state budget.

USER NEEDS ANALYSIS

User needs analysis should cover the document management needs of the individuals and organizations: documents, their use, the systems by which they are used, and the relationships of users. Some of the needs of participating organizations are a starting point for the analysis. More data about the needs of organizations is then collected from literal sources, in the project council meetings, and by the informal domain expert interviews. Needs concerning individuals and groups of persons are part of the needs of the organizations.

Data about the needs of persons are collected by user needs interviews. Structured questionnaires were used in the interviews in the RASKE project. In the questionnaires, data from the following areas were collected:

- Organization and tasks of the organization.
- Personnel tasks in the domain.
- Situations in which documents were used in the domain process and outside the process.
- Documents and information produced and needed in the above situations.
- Systems and databases used in the situations.
- Problems and needs.

The use of documents was associated with specific situations in the work of the respondents on the basis of the sense-making theory.^[17]

The user needs interview analysis produces corrections and extensions to the models created in phases started earlier, especially to the outcomes of role modeling. The analysis of the problems and needs is divided according to the document management components—systems, documents, work processes, and interrelationships between actors. The problems and needs of people in different roles are introduced in the final report, which also includes the above-described models and suggestions for improvements in the different document management activities of the organizations.

CONCLUSION

Nowadays documents are mostly authored using information technology. The use of digital data as information in activities of organizations may, however, be impaired by unintegrated and inconsistent solutions. After storing information in nonstandardized ways, probably for three or four decades, the document management environment of an organization may be

extremely complicated. To improve the utilization of digital media, careful analysis of the environment is needed. The analysis should cover all the components of document management: documents, their users and use, and the business processes in which the documents are used. The information gathered by the analysis provides valuable information about the context and structure of the documents in the environment. In case of using XML, the structural information can be utilized by XML software, for example, in information retrieval. The contextual information, for example, about the business processes where documents are created, should also be provided as accessible metadata to the users. In Lyytikäinen,^[33] we have suggested using the analysis models as contextual metadata and using them as graphical interfaces for information retrieval.

This entry introduced concepts and methods for analyzing documents in their organizational context: A model for the analysis process and methods for data gathering, modeling, and user needs analysis. The methodology was developed and tested in the RASKE project where the goal was to improve the management of Finnish parliamentary documents by standardization. The use of the methods is however not limited to standardization projects. For example, some of the models included in the methodology have been used as a new means to visualize metadata related to European legal documents in Web repositories.^[34] The visualization is intended to help the users of European legal information to cope with the complexity of the legal domain in Europe, and to better locate information from correct sources. Similarly, in other application domains and EDM development efforts, the methods introduced in this entry offer means to describe the complex environment and thereby support for improvements.

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Moldova: Archives, Museums, and Libraries

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Abstract

The present territory of the republic of Moldova was part of the Principality of Moldavia, currently a province of Romania. This territory was annexed by USSR in 1940 and remained under Soviet dominance until 1991, when the country declared its independence from USSR. The establishment of cultural and educational institutions such as libraries, archives, and museums dates back to the early 1800s. The modest beginnings were followed by a period of development during the interwar period. After the country was annexed by USSR in 1940 and until 1991, when it became independent, the Soviet dominance took its toll on all of these institutions. Restricted access to information and rigid censorship became the norm and libraries, archives, and museums were turned by the communist regime into political propaganda tools aimed at supporting the government ideology. Today, these institutions are undergoing a slow process of modernization by opening their collections to the general public, by refocusing their missions, and by redefining their goals. While government financial support remains scarce, new legislation is being adopted in an attempt to align Moldovan libraries, archives, and museums with international standards.

INTRODUCTION

Moldova occupies the area between Romania to the west and Ukraine to the north, east, and south, bordered by the Dniester and Prut rivers (see Fig. 1). With a population of 4 million, two-thirds of Moldovans are of Romanian descent. Other ethnic groups are of Ukrainian, Russian, and Bulgarian origin. The Romanian and Moldovan languages are almost identical and the two countries share a common cultural tradition,^[1] which became the subject of a severe Sovietization process in the aftermath of World War II.

HISTORICAL BACKGROUND

The eastern part of the Principality of Moldova was annexed to the Russian Empire under the name of Bessarabia following the Russian-Turkish war of 1806–1812. During the period from 1812 to 1918 the political and legal status of Bessarabia underwent several changes: from a provisional autonomy to a Russian province (gubernie). Upon the dissolution of the Russian Empire the first Parliament of Bessarabia, the Country's Council, voted Bessarabia's union with Romania, on March 27, 1918. The interwar period of development and prosperity

for Bessarabia ended on June 28, 1940, when, following the Molotov-Ribbentrop pact, Romania was forced to cede Bessarabia to the USSR. On August 2, 1940, USSR established the Moldavian Soviet Socialist Republic (MSSR), which included a part of the territory of Bessarabia and some districts on the left bank of the Dniester River. During World War II, on July 26, 1941, Romania got Bessarabia back, for a short while. In August 1944, Bessarabia was occupied by the Red Army troops and was again integrated into the USSR.

As a consequence of the perestroika, on August 31, 1989 MSSR's Parliament adopted a law regarding the use of languages in the country's territory. The Romanian language written with the Roman alphabet was declared the official language of the republic. Previously, Russian had been the state language as an attempt of Russification of the majority Romanian population.^[2] During the Soviet period the Romanian language was written with the Cyrillic alphabet.^[3] After the attempted Moscow Putsch Moldova declared its independence from the USSR on August 27, 1991 and in December of that year joined the post-Commonwealth of Independent States along with most of the former Soviet republics. In September 1990, the Parliament of Transnistria (a strip of land between the Dniester River and the Ukraine) unilaterally declared independence from Moldova. Neither Moldova's



Fig. 1 Map of Moldova.

Source: CIA World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/md.html>.

government nor any other UN-member country has recognized Transnistria's independence. Currently, Moldova aspires to join the European Union. To a great extent, Moldova's recent history has been shaped by its having belonged to the Soviet Union which has left a long-standing legacy in regards to the country's social, political, economic, and cultural life. Today's archives, museums, and libraries in Moldova are a reflection of this legacy.

ARCHIVES

Currently, archives activity in the Republic of Moldova is supervised by the State Archives Department (Serviciul de Stat de Arhivă) of the Republic of Moldova. It is the successor of the Archives Section of MSSR's Board of People's Commissioners (Secția Arhivelor a Comisariatului Norodnic) of the Ministry of Internal Affairs (1944–1963) and of the Division of Archives (Direcția Arhivelor) of the Soviet/Council of Ministers of MSSR (1963–1991). Archives activity is governed by the Law Regarding the Archival Collections of the Republic of Moldova (adopted on January 22, 1992 and amended on July 7, 2005), the Regulation of the State Archives Collection (Regulamentul Fondului arhivistic de stat) approved by Government Decision on May 27, 1992, the Regulation of the Public Archives Collection (Regulamentul Fondului arhivistic obștesc), approved by Government Decision on May 30, 1995, and by other legislative and normative acts of more limited coverage.

This legal framework provides for ensuring the conditions of conservation of archival documents and access to them in accordance with international standards. Access to documents is free, once the archives reached repositories at the national level. In general, restrictions on access to documents containing classified information expire after 25 years, restricted access to documents concerning citizens' rights is maintained up to 75 years, and restricted access to marriage records is maintained up to 100 years from the date the document was issued.

Ensuring the physical integrity of documents and access to archival materials in state-controlled archives is difficult due to a series of factors such as: lack of storage space and reading rooms, insufficient equipment, and staff training, under-qualified personnel, inadequate practices that prevent the creation of digital repositories, and most importantly, a lack of managerial strategy and vision at the national level.

The principle of provenance guides all archival activity throughout Moldova. The State Archives Department is responsible for providing centralized record description and inventory. Permanent records are housed by two historic repositories—the National Archives and the Archives of the Social-Political Organizations of the Republic of Moldova—and by specialized central local archives subordinated to national governmental bodies such as the Ministry of Defense, Ministry of Foreign Affairs, Ministry of the Interior, Department of Information and Security, Academy of Sciences, Ministry of Culture, Weather Institute, etc. Intermediary records are preserved in departmental archives or in territorial archives at the municipal and district level. Permanent and intermediary archival institutions oversee the current archives of various institutions, which constitute the source for new records to be transferred to government-level repositories. Guidelines, rules, and regulations

ensure the uniform processing of records beginning with their creation. The *Guidelines to Standard Documents and to Retention Periods for the Public Administration, Institutions, Organizations and Businesses in the Republic of Moldova*^[4] is such a guide, published both in Romanian and Russian.

The National Archives of the Republic of Moldova—NARM (Arhiva Națională a Republicii Moldova) constitutes the country's main historical archives and has its origins in the archives of the Governor of the Bessarabia Region, established in 1815 as the first central provincial archives responsible for gathering and preserving the historical archives of the province.^[5] However, the foundations for theoretical and practical research of historical documents were laid only at the end of the nineteenth century by the Scientific Commission on Archives of the Bessarabia Province,^[6] which was active during the period 1898–1918 and published three volumes of papers. The first historical archives in Chișinău was created within the State Archives only in 1918, after the union of Bessarabia with the Kingdom of Romania. The State Archives in Chișinău were successful in bringing together and organizing collections of historical documents^[7,8] it supported the establishment of the journal *Arhivele Basarbiei* (Bessarabia's Archives) (1929–1938)^[9,10] as well as the publication of several valuable collections of medieval documents.

In 1945, after World War II, the Archives of the Bessarabia Province (most of them moved to Romania during the war and returned to Moldova in 1954) and part of the central archives of the Soviet Socialist Autonomous Republic of Moldova (republic situated on the left bank of the Dniester River during 1924–1940 as part of the Soviet Socialist Republic of Ukraine), most of which were destroyed during the war,^[11,12] were merged and constituted the State Central Historical Archives (Arhiva Istorică Centrală de Stat) of the Socialist Soviet Republic of Moldova and the State Central Archives of the October Revolution and Socialist Construction (Arhiva Centrală de Stat a Revoluției din Octombrie și a Construcției Socialiste) of the Socialist Soviet Republic of Moldova. Those two institutions merged in 1958 to create the State Central Archives of MSSR.^[13] Today's NARM was created in 1990 by joining the collections of the State Central Archives with those of the State Central Archives for Audio-Visual Documents (Arhiva Centrală de Stat pentru Documente Foto-Fono-Cinematografice), established in 1977.^[14,15]

National Archives of the Republic of Moldova preserves all the historical archives (administrative, legal, ecclesiastical, economic, cultural, etc.) of the Bessarabia Province from 1812 to 1944 (except for those transferred to the Odessa Regional Archives,^[16] to Cernăuți in Ukraine, and to some other archives in the USSR, as well as collections still in Romania); all of the archives of MSSR, including the Presidential archives and those of

the Parliament and of the Government; civil records up to 1910 (most of which were microfilmed by the Genealogical Society of Utah); and privately donated materials and collections.

The oldest documents date from the end of the fifteenth century. The volume of paper-based documents amounts to almost one million items. In addition, the photo collection numbers about 150,000 negatives, the audio collection consists of over 5000 magnetic tapes, the movie collection consists of over 15,000 movies, and the insurance companies' records represent about 10 linear meters (33 linear feet) of microfilm. The research library contains about 60,000 books and collections of periodical publications, some very rare, dating mostly from the nineteenth and twentieth centuries. All of the materials have inventories and other finding aids, but most of them are in the Russian language which makes research very difficult for non-Russian speaking scholars. It is only after Moldova's independence in 1991 that finding aids in the Romanian language began to be compiled. Some finding aids have been published in Russian or Romanian.^[17–21] The NARM is situated in a building specifically constructed in 1964 to serve as an archive and it has 13.5 linear km (44,300 linear feet) of storage space.

National Archives of the Republic of Moldova has a branch in the city of Tiraspol, created in 1976, especially for archived materials focusing on institutions in this particular region situated on the left bank of the Dniester River. In 1988, the collections amounted to 696 archival items. The Transdniester secessionist authorities have turned this branch into the Central State Archives of the Moldovan Republic of Transnistria (Arhiva Centrală de Stat a Republicii Moldovenești Nistrene) and it is no longer supervised by the central authorities in Chișinău.^[22]

The Archives of the Social and Political Organizations of the Republic of Moldova (Arhiva Organizațiilor Social Politice ale Republicii Moldova)^[23] ensures the preservation of the public archival contents. It was created in 1991, after the nationalization of the Archives of the Communist Party of MSSR and it preserves, in addition to the archives, various other collections of nongovernmental organizations of the Soviet era and the period after Moldova's independence, such as professional associations, trade unions, etc. This is achieved as a result of bilateral agreements between the Archives and these associations and organizations. The Archives has more than half a million items (about 9 linear km/29,528 linear feet), inventories, and other finding aids in Russian and Romanian. The building, which dates from 1978 was purpose-built as an archive and is considered to be the most successful example in Moldova of a building for the preservation of archival materials.

The specialized central archives subordinated to national government offices or agencies are still being organized and they are undergoing gradual implementation of national archival procedures for conservation and

access. The most frequently used, both by historians and by the general public, are the Archives of the Civil Registry (Arhiva registrelor de stare civilă) which acts as an agency of the Ministry of Information Development (Ministerul Dezvoltării Informaționale). It preserves birth, death, and marriage records for the 1911–1944 period, and more recent records for some territorial and administrative regions which no longer exist.^[24]

Collections of valuable historical documents are to be found in institutions of national significance all over the country, such as the National Library, the Academy of Sciences of Moldova, and many others. The public broadcasting corporation “TeleRadio-Moldova” and the movie studios “Moldova-film” have significant AV archives of historical importance.

Corporate or organizational archives such as those belonging to universities, academies, religious establishments, and NGOs are generally young or very young and contain documents created during their current activity. Their collections, being recent, are not of historical value at the moment.

Territorial archives, including the municipal archives in Chișinău, Tiraspol, and Bălți and the archives of regional administrative divisions (*raioane*), host paper-based documents of the local administrations and businesses from the Soviet era and from the post-1991 period. The preservation of materials in these archives is very inadequate, since their budgets depend on the local administrations.

There are no electronic archives or online finding aids in Moldova. Storage, preservation, and access of digitally born documents are addressed by the Law Regarding Electronic Documents and Digital Signatures (Legea cu privire la documentul electronic și semnătura digitală) adopted on June 15, 2004.

Although, the first article on archival theory in the Romanian language was written by an archivist from Bessarabia,^[25] Moldovan archival science has inherited only the theory, methodology, and managerial practices in place in USSR, some fundamental rules, regulations, and practices in use during the Soviet continue to be in force today. At the same time, during the years after Moldova’s independence, institutional, and personal contacts with Romanian archivists have resumed and knowledge transfer and exchanges of experience have taken place to the benefit of Moldovan archivists. Representatives of Moldovan archives have attended events organized by the International Council on Archives or by archives within the Commonwealth of Independent States, but implementation of their recommendations is not widespread among Moldovan archivists, who are not very familiar with the content of the recommendations. Most Moldovan archivists are francophone and they have participated in several international training sessions on archival practices organized by the French National Archives.

In 1995, the State University of Moldova established a Department of Archival Studies in the Faculty of History, with a group of 10 students per academic year. Four years later the department was shut down. The curriculum followed the model of library education in the Russian Federation and in Romania based on a textbook published locally in 1997.^[26] Many Moldovan archivists received their degrees from the Institute of History and Archival Studies in Moscow or from the School of Archival Studies in Bucharest. This educational system has also been discontinued. Therefore, currently there is no archival education at the graduate level in Moldova. Clerks for secretarial/clerical work in archives are being trained only at the equivalent of an undergraduate level.

There is no professional association for archivists in Moldova. In 1997, the “Paul Gore” Genealogical, Heraldry and Archives Society was established under the patronage of the National Archives of Moldova.^[27] The society organizes various scientific activities such as conferences, symposia, and exhibitions. The society gives the “Ioan Halippa” annual award and every other year the “Paul Gore” award recognizes outstanding research and contributions to the field of genealogy, heraldry, archives, and auxiliary sciences. Another professional association is the Society of Historians-Archivists in Transnistria, established in Tiraspol in 1999.^[28]

In 1998, the periodical *Pergament—Anuarul Arhivelor Republicii Moldova* (Parchment—Yearbook of the Archives of the Republic of Moldova) started being published by the State Department of Archives, the National Archives and Archives of the Social and Political Organizations. This periodical publishes legislation and regulations in the field, finding aids, archival documents, research studies in archives, and auxiliary sciences as well as book reviews.

In 1994, the Republic of Moldova joined the International Council on Archives. Moldova’s archival heritage is under the patronage of the country’s UNESCO National Commission and ICOMOS National Committee.

MUSEUMS

Beginning in 1812, in the aftermath of the Russo-Turkish War, Bessarabia’s development took place in a new historical context imposed by Czarist Russia that did not favor the national assertion of Bessarabians of Romanian origin. This period of Russian domination in Bessarabia’s czarist history offered few opportunities for the development of the national culture but illustrates a great need for training models. It is significant because of the efforts of the society to search for methods of safeguarding and preserving the province’s cultural heritage (mainly of archaeological and historical vestiges) and establishing a positive attitude towards the past and its legacy.

The awareness of preserving cultural assets had existed in Bessarabia's society over several centuries and during the early nineteenth century it resulted in the creation of major collections of archeology, history, and antiquities and in the organization of various exhibitions of agricultural, industrial, ethnographic, and art objects. The first public museum was the Zoological, Agricultural, and Crafts Museum, established in 1889 as a result of the Exhibition of Agriculture and Industry which took place the same year in Chişinău. The mission of the museum was twofold: "scientific and practical, to contribute to the development of natural sciences, and to increase the farmers' awareness about the latest developments in the field of agriculture."^[29]

Between 1903 and 1905 the museum building was erected in Moorish style, and it was inaugurated on April 30, 1906. Member of all social classes enjoyed the exhibits that highlighted their culture by displaying different kinds of artifacts related to several disciplines such as ethnography, archaeology, history, and numismatics. Donations had a decisive role in developing the museum collections until 1918. The education of the general public was seen as the museum's primary responsibility. The museum was made available to the public under a program that provided access "to local residents from 11 A.M. to 2 P.M. on Sundays, and to those visiting from other places and to groups any day at any time."^[30] Until 1918, the museum was visited annually by about 25,000 visitors.^[31] The second museum in Bessarabia was the Museum of Agricultural and Natural Sciences opened on November 1, 1914 in Tighina (Bender). This first group of museums of natural sciences and ethnography fostered scientific research in these particular fields and boosted the development of a core group of a local scientific elite.

The nineteenth century is known in European museum studies as the century of national museums. Due to the vicissitudes of history, Romanians in Bessarabia could not showcase their history in national museums. However, during the mid-nineteenth century there was a general increase in interest in the country's past and history, which generated interest in collecting and establishing various cultural associations and scientific societies focused on studying the nation and its past through documents and monuments of historical significance. The activity of the members of the Scientific Commission of Bessarabia's Archives (Comisia Ştiinţifică a Arhivelor din Basarabia), of the Historical-Archaeological Religious Society of Bessarabia (Societatea Istoric-Arheologică Bisericească din Basarabia), of the Society for Research of the Dniester Region (Societatea de Cercetare a Ținutului Nistean) resulted in the emergence of the concept and design of a museum of archeology.

Despite the fact that these ideas were not implemented, because of the antinationalist policy promoted by the Russian government, they represent an important step in development of attitudes regarding museums. They show

an interest in such institutions, as evidence of the awareness of the need to preserve antiquities and to create a national museum of history. Russian czarism could not allow the establishment of national museums in the subordinated provinces. But taking into account the development of museum studies, the development of history as science, and the spiritual needs of the society, czarism imposed a unique concept for history museums highlighting the history of the church (or "church museums").

The establishment of the Church Museum (Muzeul bisericesc) in 1906 in Chişinău is directly connected to the activity of the Historical-Archaeological Religious Society of Bessarabia, founded in 1904. According to its bylaws the mission of the Society was "to collect written documents with religious character, church books, icons, objects of worship; to research archeological and religious materials kept in various state institutions and private collections; in order to create a museum aimed at preserving church antiquities."^[32]

This museum remained active until 1940. The creation of the Church Museum meant "a very clear manifestation of the Bessarabians' religious memory. Through this museum the religious thinking and church life continued to preserve their identity in Bessarabia's space within the context of the Russian Empire's imposing uniform religious activities."^[33]

The emergence of public museums is one of the most important events in Bessarabia's cultural life during the mid-nineteenth century. Museums were seen as an important factor in the development of national consciousness. They were necessary to preserve traditional values in a society threatened with losing its historical memory. During this period, museums managed to occupy a particular place in social consciousness, the same place as other institutions that preserve human memory such as archives and libraries. Nonetheless, public museums of this period only partially reflected the national culture and society and could not meet the national aspirations of the local population.

Bessarabian museums of the early twentieth century followed the managerial and organization principles of the late nineteenth century Russian museums intermingled with the individual character and structure of their own collections. Until 1918, the development of museums in Bessarabia was mostly of a spontaneous nature, as a reaction against all kinds of factors aimed at cleansing the Romanian population's national identity by the Russian authorities. There was no specific body to coordinate museum activity, the government's role being solely that of recording the existence of such institutions. Museum activity largely relied on private initiative. Prior to World War I there was no specific legislation targeting museum operations.

After the 1918, the unification and the creation of a unitary Romanian state (as a result of which Bessarabia joined Romania), the new Romanian government adopted

several pieces of legislation regarding the development of museums in Greater Romania. In April 1932, the Law for the organization of public museums and libraries was adopted, representing the main legislative act that governed the development of these institutions during the interwar period. According to this law, the government became the sole body invested with control over all museums and charged with ensuring the integrity of Romania's museum patrimony. The law defined the scope of the "cultural goods" concept, museums' goals, objectives and their mission and also stipulated the establishment of a Council of Museums, which was to approve the creation and/or closing of museums, to coordinate their activities and operations. Through this law all museums received the status of scientific research institutions. The Zoological, Agricultural and Crafts Museum in Chișinău became the National Museum of Natural History and it was to act as "an institution of scientific research in which all disciplines dealing with natural science were to find their place."^[34] In 1926, the first issue of the museum's journal was published: *Buletinul Muzeului Național de Istorie Naturală din Chișinău* (Bulletin of the National Museum of Natural History in Chișinău). According to Decree-Law No. 3783 of November 1937 the National Museum of Natural History in Chișinău became Bessarabia's Regional Museum (Muzeul Regional al Basarabiei), with the mission "to gather and study materials documenting Bessarabia from the standpoint of its natural sciences, anthropology, and history. The museum was to become an institute of rigorous scientific research at the regional level and also a central archives and collections repository."^[35]

During this period museum scientists engaged in research in the field of natural sciences, conducted archeological digs, and participated in ethnographic explorations which contributed to increasing the museum's holdings. During the interwar period, as during the previous period, Bessarabia's Regional Museum continued to remain the most prominent museum in Bessarabia. During the 1918–1940 period, new museums were established such as: The Antiquities Museum of Cetatea Albă (1919), which published its own journal, *Buletinul Muzeului Cetății Albe*; the Fine Arts Museum in Chișinău (1939), two museums of history of religions in Ismail and Bălți, and the Economic Museum in Bender.

After 1944, when Moldova was incorporated into the USSR, museum history entered a new stage which changed not only the role and significance of museums, and the principles of museum organization and activity but also the concept of museum per se, i.e., the essence of museums as institutions. During the communist period a new approach to museums was implemented: museums were turned into political schools of mass education and indoctrination, they became part of the communist ideological machine. They acquired political-cultural attributes. This process became manifest mostly through the creation

of new institutions such as "historical-revolutionary" museums, memorial museums, and antireligious museums.

For many decades, the main method in guiding exhibition activities in museums was the organization of thematic exhibitions while the main criterion for assessing museum activities was the ideological content of the activities they organized. Museums were expected to reflect in their exhibits the achievements of the socialist construction and the superiority of communist lifestyle. In spite of this requirement, museums did not have in their collections items specific to Soviet efforts, which started only in 1917. Therefore, museum objects removed from exhibits were replaced by enlarged texts and slogans, symbols of the communist doctrine.

A new phenomenon in Moldovan museum history was the establishment of antireligious museums, museums of "scientific atheism," in which atheism became a state religion, one of the main components of the communist state ideology. In addition to promoting "scientific atheism," in their instructional and educational activities, museums were required to reflect events of political importance in the nation's life: congresses of the Communist Party, elections of the Supreme Council of the USSR, various V.I. Lenin jubilees, anniversaries of the October Revolution, commemoration of significant events in the history of the USSR, etc. Museums were designed as political stages for socialist events, as powerful weapons of political education, and as a means for illustration and dissemination of the communist doctrine. Despite the museums' efforts to escape the ideological constraints, they remained ideological institutions forced to abide by the communist party's directives, turned into Marxist-Leninist propaganda tools.

Beginning in 1944, when Moldova was incorporated into the Soviet Union, museum activity was coordinated by MSSR's Board of People's Commissioners. In 1946, the institution was called the Council of Ministers of MSSR. In 1953, the Ministry of Culture of MSSR was created, and museums were placed under its jurisdiction. This system of coordination of museum activities remained in place without major changes until 1991. The ideological and propagandistic aspect of museum activities remained the major mission of museums throughout the Soviet regime. According to the communist ideology "museum should occupy a prominent place in promoting the Communist Party policy, thus contributing to building the Marxist-Leninist consciousness and ensuring the quick transition from communism to socialism."^[36]

During the Soviet regime the Moldovan museum scene was marked by the emergence of a new category of institutions: "museums of the birthplace region" (muzeul ținutului natal), featuring collections of local history, natural sciences, ethnography, and art. The name of this kind of museum kept changing during the Soviet period: in 1940 it was called the Republic Museum for the Study of the MSSR Region (Muzeul Republican de Studiere a Ținutului al RSSM), in 1957 it was called the State

Museum of History and Study of the Birthplace of MSSR (Muzeul de Stat de Istorie Și Studiere a Ținutului al RSSM), in 1983 its name changed to the State Museum for the Study of the Birthplace of MSSR (Muzeul de Stat de Studiere a Ținutului al RSSM). This period was characterized by a significant growth of the number of museums. In 1985, their number amounted to 83.^[37]

This period is also significant for the emergence and development of memorial museums, aimed at featuring cultural and political personalities of particular importance in Russia's and the Soviet Union's history and culture while such important personalities at the local level were completely ignored. Leaders of the national cultural, artistic, political movement, or figures that opposed the communist regime were ousted and their contributions to society were completely neglected. A museum network was established nationwide, but there was no variety in their profiles and collections. The Soviet totalitarian system imposed from top down a common vision, a similar museum display regardless of the museum's profile, aimed at highlighting Russia's progressive role in people's life, and at featuring the achievements of the Soviet republics to the well-being of the masses throughout the USSR.

This led to a distortion of national history and culture. During the Soviet regime RSSM, as a simple administrative-territorial subdivision of the USSR, did not have her individual history and therefore there was no museum of national history. During this period, there was a unique history—that of the USSR—that identified itself with the history of Russia. Museums were perceived by public consciousness as agencies of communist propaganda. Particular attention was paid to promote revolutionary ideas. The number of history and revolutionary museums increased through the 1980s and they remained the most important category of museums every Soviet republic had to have. During this period there was no specific museum legislation since everything was coordinated by the omnipotent communist party.

Moldova's independence and sovereignty in 1991 has produced radical changes on the social, economic, and cultural arena. The process of democratization of institutions included museums as well. A characteristic feature of the development of museums after 1991, during the transitional period was to reduce their number. The national revival of Bessarabian Romanians, the democratization of public life, and the new social and political conditions all dictated the closure of political museums and memorial museums devoted to Soviet heroes. At the same time there was a drastic decline in museum visitors. Today there are 70 museums in Moldova, with three national museums: the National Museum of Ethnography and Natural History (originally opened in 1889), the National Art Museum (1939), and the National Museum of Archaeology and History (1983). These are also state museums, as well as local or institutional museums. In December 2002, the Museum Law was approved.

The national association of museographers is called Museion. In 1998, the National Museum of Ethnography and Natural History participated in a European competition—the European Museum Forum—where it received an award. Since 1995, the State University of Moldova, Faculty of History and Psychology, Department of Museum Studies, has prepared specialists for museums. There is a specialized museum journal, and since 1992, two museums have published their own journals: the National Museum of Archaeology and History of Moldova has published *Tyragetia* and the National Museum of Ethnography and Natural History has published the *Buletinul Muzeului*, both journals containing a section for Museum Studies. Since 2005, two museums—the National Museum of Archaeology and History and the National Museum of Ethnography and Natural History have a dual subordination: the Ministry of Culture and Tourism and the Academy of Sciences. Currently, museum activity is focused on researching and establishing a national museum patrimony, on reintegrating in the local circuit the national history and cultural values to reflect the nation's identity and to educate future generations of visitors. Along with the depoliticization of Moldovan museums this will represent radical changes in the development of museums and museum studies in the country.

LIBRARIES

The first public library was established in Chișinău in 1832, as a result of an act issued by the Russian Empire. It began as a very modest private collection of 428 volumes. Bessarabia's civil governor asked neighboring Romania for support to increase the library's holdings, but rigid censorship rules imposed by the czarist regime allowed only 36 volumes to cross the border to be added to the library's collection.^[38] For more than a century, the library was moved from one building to another and during the interwar period it occupied several rooms in the City Hall. In 1944, the Central Library of the Moldovan Soviet Socialist Republic was created through the merger of this first public library in Chișinău and the Central Library in Tiraspol.^[39,40] In 1961, the library moved into a purpose-built construction where it has continued to operate as the National Library of the Republic of Moldova (NLRM). In 1986, NLRM acquired a second locale in its immediate vicinity, the building of the former Theological Seminary which today hosts the fine arts and the multimedia collection.

In 2007, Moldova reported a total of 2931 libraries: 1383 public libraries (including NLRM and the National Library for Children), 1453 school libraries, 21 college libraries, 16 academic libraries, 27 medical libraries, 8 agricultural libraries, 20 technical libraries, the Library of the Science Academy, the Parliament Library, the Office for Intellectual Property Library, one trade

union library, and one library for the blind. In 2007, a total of 3,148,000 new items were added to these libraries' collections, out of which 1,457,000 (46.28%) were in Romanian, the country's official language. More than 87% of the libraries are in rural areas.

Statistics indicate that in 2007 there was a total of 1,952,080 active library users, of which 853,400 are under 16 years of age.^[41] This shows that almost half of the country's population uses libraries despite the dated collections, and even though most of the books are still in Russian and despite the traditional library services often reduced to provision of reading space in old reading rooms. Though the financing of libraries is insufficient and their book stacks are replenished slowly, the number of visits is constantly growing. More than 10 million (10.2 million) people visited libraries in 2005, 3% more than in 2004.^[42] Moldova has a very high literacy rate of 96%.

National Library of the Republic of Moldova is the premier library of the country, directly subordinated to the Ministry of Culture and Tourism.^[43] National Library of the Republic of Moldova coordinates the project of a shared cataloging system, SIBIMOL, jointly funded by the Ministry of Culture and Tourism and the Soros Foundation for an Open Society, aimed at automating library operations and services by establishing local and interregional networks with shared catalogs, linking them to the NLRM's central catalog, and later making them accessible via the Internet. As of January 2006, NLRM's online catalog contained records for over 140,000 books, 7500 serials, and 21,500 articles from Moldovan periodicals, as well as 1600 AV materials. As of January 1, 2007, NLRM's collections amounted to 2,510,254 items (2,160,941 books and periodicals, 25,624 AV materials, 136,484 graphic documents, 61,142 music scores, 214 manuscripts, and 1885 e-documents). In 2006, NLRM reported 11,654 active users who borrowed 588,720 documents.^[44]

Under the Library Law, seven copies of every national publication are to be deposited with the National Library, which then distributes them to other libraries. A "Legal Deposit" department was set up in 1999 to supervise this system and make it work better. In fact, because of the recession, publishers are not honoring their legal obligation, and are depositing 1–4 copies, if any. This makes it impossible to keep a full collection of all the books published in Moldova, and to collect the data needed for the books-in-print catalog. National Library of the Republic of Moldova makes a serious effort to promote its collection and new acquisitions through a series of events: the annual National Book Fair, musical and arts events, literary meetings, lectures, exhibitions, etc. It also does research in a number of fields (history of books, etc.), organizes colloquia and symposia, and produces numerous bibliographies and publications on library science, such as the *National Bibliography (Exteriorica)*, *Culture in Moldova*, *The National Calendar*, and *The Bibliological*

Bulletin. In 1992, NLRM began issuing the quarterly *Magazin Bibliologic* which is distributed to libraries throughout the country to support all librarians' continuing education.

The National Library for Children (NLC) was established in 1944 with an initial collection of 10,000 volumes. Today its collections amount to 260,000 items, including audio-visual materials. Forty-seven percent of its collections are in the Romanian language. The library reports 12,000 users per year.^[45] In 1997, NLC became a member of the International Board on Books for Young People.^[46] The library has earned a national reputation by organizing the annual Children's International Book Fair.^[47]

The Chişinău Municipal Library (CML) is one of the largest and most dynamic in Moldova. It was established in 1877 with a collection of 8073 volumes. By 1932, its collections consisted of 110,000 volumes, 93,800 of them in Russian. In 1941, the library was destroyed by fire. In 1944, it was reestablished by the Soviet authorities under the name of Central City Library. In 1991, it became the Chişinău Municipal Library.^[48] Currently, its collections amount to one million volumes. Every year 150,000 patrons use the library's 31 reading rooms. In addition to print materials, CML offers access to electronic books and online databases. One of the branches of CML is a special library, The Public Law Library, situated in a downtown remodeled building equipped with state-of-the-art technology that allows access to legal databases including LexisNexis.^[49] Chişinău Municipal Library issues several periodical publications among which is the monthly *Bibliopolis*.

Among special libraries, the Scientific Medical Library (SML) has engaged in a partnership with the North Carolina South East Area Health Education Center. Scientific Medical Library serves as the library of the State Medical and Pharmaceutical University of Moldova. It also acts as the National Medical Library of Moldova. The library collections contain 1,200,000 books, almost all in Russian and very dated. International statistics situate Moldova in the last place in Europe in terms of library expenditures per capita. Unlike Denmark where the governments spends 64.27 Euros per person, in Moldova library expenditures amount to 0.35 Euros (about half a dollar).^[50] In 2006, the partnership brought to SML 10,000 medical books and periodicals in English. In addition, the program provided free access to four medical databases.^[51] Other special libraries include the Library of the Parliament, established in 1978, with a collection of 11,400 books and 112 periodical titles. The Science and Technology Library was established in 1969 in Chişinău. In 2003, the library reported a collection of 13.5 million volumes.^[52] The Library of the Academy of Economic Sciences was established in 1991. It currently holds 330,000 volumes and provides access to online resources. It serves as repository of publications issued by the International Bank for Reconstruction and Development.^[53]

The Library of the State University of Moldova, established in 1946, is one of the largest government-sponsored academic libraries, with two million volumes. The Library of the Alecu Russo State University in Bălți is the only academic library in Moldova that operates in a purpose-built building. The library harbors more than 1 million items and it is the most modern government-funded academic library in Moldova, providing access to electronic databases and e-books. The library also serves as a regional repository for publications issued by the World Bank. Among private universities, the Free International University of Moldova, situated in Chișinău, is the most prominent. Established in 2002 along with the university, the library provides remote access to electronic resources and virtual reference, organizes conferences, publishes conference proceedings and is strongly engaged in the implementation of modern information technologies.

Moldovan library collections are dated and mostly in Russian.^[54] Most new books have been donated. Romania has been a major donor. Several public libraries in Romania have developed a sister library program through which they have endowed Moldovan public libraries with Romanian books. Under its Library Support Program and in cooperation with various international organizations, the Soros Foundation has funded a series of programs to support the acquisition of various books and publications: foreign books, subscriptions to international journals, participation in the Pushkin Project. Agencies run by other countries fund the acquisition of foreign publications only. The Alliance Française, for example, contributed books in 1999, under its "100,000 Books for Moldova" program. In the same way, the German Embassy has opened a German-language reading room at CML. The Soros Foundation Moldova supported school libraries with reference materials that helped establish resource centers in elementary and high schools nationwide. In October 1997, librarians in resource centers from the 18 schools attended a 2 day seminar with the motto "Books and Information for Education." The issues covered concerned the role of the school library in school life, the value of reading and its importance for students, use of international standards in library activity, and document classification.^[55]

Penetration of the new information technologies into Moldovan libraries is very slow. Because of the country's economic situation, the 1994 Library Law and the Library Support Program, launched in 1998, have done little to improve the financial situation or technical infrastructure of libraries, despite the claim for modernization and vision for the future.^[56] Currently, there are 1653 computers for library staff in the entire library system in Moldova (an average of 1.77 computers per library) and only 1126 are connected to the Internet. There are 892 public terminals out of which 737 have Internet connections. Most of these public stations are to be found in academic libraries: 417 computers, 380 with Internet connection.^[41] It is also mostly the academic library sector that provides access to

foreign databases purchased through a multicountry consortial system, supported by Electronic Information for Libraries (eIFL.net), a nonprofit organization that advocates for the wide availability of electronic resources by library users in transitional and developing countries. The eIFL Direct Moldova consortium comprises 16 major libraries: 10 academic, 3 public, and 3 special libraries.^[57]

The National Book Chamber (NBC) was established in 1957 and is responsible for compiling the National Bibliography (books and periodicals, analytical bibliography) and keeping the ISBN and ISSN distribution records. Set up under the Soviets, the Chamber was linked directly to the government through the Publishing Activities Committee, to which it was answerable. Today, it reports to the Ministry of Culture and Tourism. In 2007, NBC celebrated 50 years of existence. An entire issue of *Magazin Bibliologic*^[58] was dedicated to this event. A monograph also highlights the institution's achievements during this period.^[59]

Librarians of all kinds belong to the Library Association of the Republic of Moldova (LARM), established in 1992 and a member of IFLA (International Federation of Library Associations and Institutions) member since 1994. Occasionally LARM representatives attend international library meetings, book fairs, etc.

Library science education began in 1960 at the State University of Moldova, Department of Library Science, Information Assistance and Archival Studies which offers undergraduate and graduate degrees.^[60] Some 25 students graduate every year but after graduation not all of them choose to work in libraries or archives because of the low pay. Librarians also attend professional development courses provided by the Center for Continuing Education in Librarianship, established in 2001 with funding from the Soros Foundation's Training Program. The Center was funded for 3 years and currently is diminishing its activity for lack of financial reasons. The Soros Foundation also covered courses and grants for librarians at specialized institutions abroad and attendance of international conferences. Moldova's Library Law adopted in 1994, with amendments in 2001, 2003, and 2005,^[61] specifies the legal status of libraries and includes detailed provisions on library collections within the context of automation of services and digitization of documents. The Library Law also stipulates the role and activity of the National Library Council, that acts as an advisory board on library issues to the Ministry of Culture and Tourism.

Moldova's cultural policy priorities were outlined in the national program "Development and Protection of Culture and the Arts in the Republic of Moldova, 1997–1998," extended to 2000–2005. In November 2005, the *Program on the government's activities for 2005–2009*, named "Modernization of the country — welfare of the people," was initiated, followed by the *Program on the development of the regions, 2005–2015* entitled "Moldovan Village." These programs include a variety of

objectives targeting the cultural and educational field such as: the protection of the local cultural heritage; the restoration, and development of the regional houses of culture, libraries, and museums, and “e-culture” that introduce the new forms of promoting culture through electronic media in different sectors of the national culture. In order to implement some provisions of these programs, in 2006 the Ministry of Culture and Tourism elaborated the drafts of several important normative documents and laws: a draft of the Strategy on the Development of a National System of Libraries.^[62] It is still to be approved.

In addition to writing long-term programmatic documents, Moldova’s policy makers need to substantially support the cultural and educational sector, to contribute to the development of the infrastructure that would facilitate a faster penetration of the new information and communication technologies that would bring progress in every citizen’s daily life. The Moldovan information society is still to come.

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Moving Image Indexing

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Abstract

Several types of moving images are available now, and each has its own indexing needs. In addition, a number of levels of indexing are necessary, depending on the type of image, the type of collection, and the needs of users. In information science, work on providing indexing to the various levels has largely to do with finding ways to recycle text created for other purposes in the processes of production, in order to point to individual shots, sequences, scenes, or chapters. Such text recycling needs to happen automatically, through the application of algorithms developed for this purpose, since indexing at the various levels by humans is prohibitively expensive in most circumstances. Multilingual indexing is an issue in the context of retrieving images in a networked environment. Another issue is access to moving images using indexing approaches other than subject indexing. Tagging of images by users is prevalent in the networked environment, and a discussion of its usefulness is included. Finally, there is some speculation on what the future of moving image indexing might bring.

INTRODUCTION

The term “moving images” is actually a misnomer, since moving images are actually still images that give the illusion of movement when they are displayed in rapid order. For 35 mm film, such as that projected in movie theaters, the rate is 24 images/sec, and for video, the rate is 30 images/sec (the video frame rate actually varies considerably, depending on various technologies and standards). Early attempts at making moving images resulted in a number of intriguing technologies and gadgets such as the thaumatrope, phenakistiscope, zoetrope, praxinoscope, and so on, and today people still enjoy the simple magic of flip books, kaleidoscopes, and animated gifs, along with moving images made using highly sophisticated digital technologies. The first public projection of moving images on film took place in France in 1895. Now, over a 100 years later, many technologies for making moving images are available. Home video cameras are practically a household staple, and even young children learn not only to use them but also to edit their work on computers using software that is easier to use than a word processor.

Large collections of moving images have built up in local, national, and international institutions and in the homes of private collectors. Compared to methods for providing access to books and other text materials, methods for providing access to moving images remain relatively undeveloped. Historically, the landscape of collections of still images, moving images, and sound has been characterized by ad hoc organization. This began with museum collections of paintings, prints, and drawings, and continued through the building of collections of

photographs in libraries and archives, and later with moving image and sound collections in studios, libraries, and archives of all types.

Since most formal information was historically consigned to books, all other types of materials came to be considered as special collections, and emphasis was placed on developing cataloging and classification systems for organizing printed materials. Those responsible for the management of audiovisual collections of all types were left to develop their own methods for organization of these collections. For collections of art images, the methods developed by managers of such large and important collections as those at Harvard and Princeton came to be borrowed elsewhere, but essentially, each collection was organized in isolation, its methods based on practical issues and with specific goals in mind, usually to support scholarship in art history.

With some exceptions such as cinémathèques, national broadcasters in some countries, the UCLA Film and Television Archive, and the National Audiovisual Institute (Institut national de l'audiovisuel, INA) in France, moving image collections still suffer from levels of organization insufficient to serve useful purposes. In the studios, very little organization occurred until a pressing need developed. The same is true of the television networks, where emphasis has always been placed on the present and the future. With time and the development of technologies not even dreamed of when the production of movies and television programs began, owners of large collections of audiovisual works are coming to realize the importance of archival materials as heritage materials, cultural witnesses, and for their important commercial value.

Perhaps the main force driving the progress now rapidly being made in developing methods of organization in recent years has been the arrival of the World Wide Web. The possibilities of networking collections, providing remote access to them, broadening the use of collections, exchanging metadata, and serving a much broader user base are very great. Such possibilities were early recognized in the information science community, and a great deal of work has already been accomplished in addressing the new issues arising from the existence of the Web. Along with this, increased awareness of the immense complexity of developing and coordinating standards of all types, providing for interoperability, access to very large masses of documentation, and preserving digital materials has taught us that a great deal more work needs to be done if we are to achieve the performance levels we so desire from networked systems.

In this entry we focus on issues in indexing moving images so that users with a broad variety of needs can find them. Providing remote access to collections greatly increases the number of potential users. More importantly, it creates new possibilities for using materials. Indexing used to be targeted to specific groups of users. However, in the new environment, the managers of collections cannot even know who will come and use their collections if they provide access to the broad internet community. We discuss the various levels of access, the relationship between text and image, multilingual indexing, indexing other than subject indexing, image tagging, and look briefly at the future of moving image indexing.

LEVELS OF ACCESS

Interestingly, if problematically, there is no consensus on the terminology used for these levels of access in the literature of moving image management. This literature includes the areas of information science, computer science, film studies, literature, popular culture, and cultural studies. The most widely used general term for managing moving image collections is “asset management,” a vague, unfortunate term suggesting financial or banking activity and reflecting the preoccupation of the commercial movie studios. However, since it is now deeply implanted, there is no point in trying to control its use. Section, chapter, sequence, scene, and shot are used diversely in various contexts, with meanings sometimes overlapping or outright jumbled. Thus in discussing these issues it is useful, at least until the terminology becomes stable, for authors and others to define clearly what they mean. Various kinds of users need various levels of access to moving images. This needs to be taken into account in building information systems and in providing indexing to their content. Here we discuss levels of access from the point of view of information organization for providing access to users of collections of audiovisual materials.

The notions of *ofness* and *aboutness*, propounded in seminal articles on the subject of picture indexing by Sara Shatford^[1,2] and Karen Markey,^[3,4] arise from work by the art historian Erwin Panofsky in the area of interpretation of works of art. Panofsky^[5] describes three levels of interpretation of images, which he calls pre-iconographic, iconographic, and iconologic. The first level (pre-iconographic) refers to primary or natural subject matter, requiring familiarity with objects and events for interpretation. The second level (iconographic) refers to secondary or conventional subject matter, requiring familiarity with specific themes and concepts for interpretation. The third level (iconologic) refers to tertiary or symbolic subject matter, the meaning of which is derived from complex manipulations impossible to elaborate completely. The levels described by Panofsky have been widely adapted to picture indexing, although the process of interpretation involves a number of inconsistencies. Since the practice applies mainly to art images, we will not discuss it further here. However, it illustrates the notion of levels of access, a concept very much present in indexing moving images.

The levels of access range from whole productions such as movies, through various divisions of such documents, down to individual images or frames from them. A helpful way to contextualize the levels is to define them using the *Rules for Archival Description* (RAD),^[6] useful for describing materials down to the item level. For moving images, additional levels need to be added to reflect the granularity required to index moving images in some contexts:

<i>RAD levels:</i>	Fonds
	Series
	Subseries
	File
	Item
<i>Additional levels:</i>	Chapter
	Scene
	Sequence
	Shot
	Frame

In between the most general level of indexing (in the case of movies, generally the Item level in the RAD hierarchy, although in some cases this could be the series or subseries level) and indexing individual frames, movies can be divided at a number of levels: there are the main divisions such as the “chapters” found on commercial DVDs; each chapter is composed of a number of sequences or scenes, these in turn composed of shots, made up of individual frames. Videos and television programs can have similar divisions, or different divisions, depending on the nature of each work. In the case of television programs, a situation comedy, for example, can be divided by season, episode, and thence as a movie, with sequences, shots, and frames. In contrast, a current events program might have

an introduction, a kind of table of contents (roster of what the individual segments will be), the segments themselves, each an individual production, and some concluding material, along with previews of the next week's show.

The level at which a collection needs to be indexed depends on its users and the type of material it holds. For collections that include films along with other types of materials, the most general level is likely what is needed. A research collection will want to offer more detailed information, both in the cataloging and the indexing. A television archive needs tight control over specific information about the production issues. In some cases, individual shots, even individual frames, need to be indexed.

Item-Level Indexing

At the highest, most general level, moving images can be treated as if they were books, for example, in the collection of a public library that offers DVDs of movies to its users. Methods for organizing collections at this level are available through chapters created for this purpose in the *Anglo-American Cataloguing Rules* (AACR2R), presently being replaced by the development of the *Resource Description and Access*^[7] rules. Other tools such as Yee's^[8] work on moving image cataloging, the *Compendium of cataloging practice for moving image materials*,^[9] and the revision of *Archival Moving Image Materials: A Cataloging Manual*^[10] offer methods targeted more specifically to moving image collections. These offer rules for providing access points such as author (director), title, the principal players, and so on.

In mixed collections, it is arguably more useful to provide subject access via the same controlled vocabulary that is used for other types of materials such as books. At this level of indexing, this is often perfectly adequate. However, in collections that house only moving images, many in-house controlled and uncontrolled vocabularies can be found. The work of harmonizing these in a networked environment is best accomplished by adopting metadata standards that will foster interoperability. The Association of Moving Image Archivists (AMIA),^[11] one of the most important players in the movement to better organize moving image collections jointly with the Library of Congress, is building a union catalog to offer access to moving image collections worldwide. This service is called Moving Image Collections (MIC)^[12] and offers portals notably for cataloging and metadata resources and for preservation resources.

Chapter-, Scene-, and Sequence-Level Indexing

At present, these ever-finer levels are mainly found in a production context, notably for finding existing materials to be recycled in new productions. If access at these levels were made more universally available, the systems would of course find new users, because they would permit levels

of analysis, comparison, and synthesis of content that are not readily available now. Since the names of chapters are already defined in the context of commercial DVDs, they can be readily included in cataloging records to provide a kind of table of contents for users.

Within each chapter, however, analysis of the scenes, and within these the sequences, are not so readily provided. As we noted, there is not even consensus on the terminology for these divisions. What some call a "scene," for example, is called a "sequence" or even a "shot" by others. Still, a great deal of work is going on in computer science to detect divisions automatically. In general, this works well for shots, although certain types of images confuse the detection algorithm, such as explosions, during which the image content from frame to frame is so different. At the other extreme are cross-fades, in which one scene so slowly becomes another as to fool the algorithm into thinking the scene is continuous. Such problems are relatively minor, however, and with time more sophisticated algorithms will take them into account and a perfect score will be achieved.

Scene and sequence detection are not so simple, however, since they are logical divisions with no easy cues for algorithms that work on the pixels in the image to detect. However, at least with scripted productions, we can imagine algorithms that make use of the script, coding used by editors, and other such documentation, to identify automatically and accurately where there is a scene or sequence change. For the moment, however, human indexers must do this work.

Shot-Level Indexing

Shot-level indexing or shot-by-shot indexing provides a level of access that is very useful in a number of situations. It can be vaguely compared to back-of-the-book indexing, in that users could identify a concept, object, event, or person they wanted to see, look it up in the index, and be led to images of it. If shot-level indexing were available, filmmakers, researchers, film and other historians, students, even the general public would all be able to make good use of it. However, all indexing by humans is expensive and time consuming, so shot-by-shot indexing is carried out at present only if there is a payoff that can justify the cost at the other end, or if it is absolutely necessary in order for users of a collection to be able to do their work. At present there are two principal cases of this, and each has its own needs: stockshot libraries and television newsrooms.

Stockshot libraries are built by recycling material (called outtakes) that was shot for some purpose but never used in the final product. They can be the rejected takes of a shot that did get used, shots the editor simply decided not to use in the final cut, even sometimes material that is shot for stock because a cameraperson on location noticed something nearby that was not part of the shoot, but that

he or she felt would be useful material for the stockshot library. Interestingly, in stockshot libraries the shots do not yet have a context. This is provided by the preceding and following shots once they are edited into a production of some kind. Thus the shots need to be indexed as individual entities unrelated to anything else. The only useful way to do this is simply to name the persons, objects, or events seen in the image.

Television newsrooms represent the other case in which shot-by-shot indexing is necessary, this time for the functioning of the newsroom. News events tend to grow, over the period of a day (a gala event), a few days (a factory fire), weeks (an election campaign), months (weather), or years (a war), building on what has already happened. Newsrooms usually have trained searchers on location in the newsroom, who need to be able to hunt down material in a matter of minutes, sometimes even seconds. Because the material usually (but not necessarily) has to do with previous events that are part of the story, there is context. At a primary level, the indexing can be carried out like that of a stockshot library, that is, particular to individual shots. In addition, however, other layers of indexing can be added, for example to relate the shot to its neighbors in the day's shoot, to the events of the previous day, to the story at large, or in a more global context, such as with links to other stories that are related in some way.

In addition, a trend is emerging that will extend in the coming years the pool of moving images cataloged and indexed at the shot level. Large collections gradually being digitized and coming on line will make available many more moving images that can be recycled in other contexts. An interesting example of this is the Institut national de l'audiovisuel (National Audiovisual Institute, INA) in France.^[13] Created in 1975 following the breakup of the national broadcaster (Office de radiodiffusion télévision française, ORTF), INA became the official repository for French radio and television when the legal deposit for these was applied starting in 1995. As of 2007, INA had 130 km of shelving space filled with radio and television programs, covering 60 year of radio and 50 year of television. INA's collection is now the largest digitized audiovisual collection in the world. Much of it is already online, and the rest is gradually becoming available.

INA has long practiced shot-level indexing of its collections, but now that the moving image is available online, a mutation is occurring. Instead of simply maintaining their traditional role as audiovisual documents, these take on the additional role of containers from which fragments can be taken for use elsewhere. In this emerging context, today over half of INA's 250 document professionals have taken on editorial duties, packaging these fragments in new ways. Thus the coherence of the original document becomes a single layer of a much more complex process whereby the shots they contain become new resources as they are reconfigured in new uses.

Accompanying this process, new metadata is created to document the new context.

We can expect to see this kind of activity become universal practice as other large national collections become available online, offering direct access to the moving image. Use of such collections will probably increase considerably because the shot-level metadata will make useful material easy to find in a number of different contexts. Similarly, the potential user base will be greatly broadened because the networked environment offers the possibility of worldwide sales.

Frame-Level Indexing

At the finest, most specific level individual frames need to be indexed, usually in specialized situations such as for scientific or forensic purposes. For example, indexing describing specific objects and their movement might be used in the case of scientists wishing to study the eruption of a volcano, popcorn popping, cell division, and so on. Forensic uses include the Zapruder film of the assassination of U.S. President John Kennedy, determining the cause of the the space shuttle Challenger exploding, or analysis of the planes crashing into the twin towers of the World Trade Center in New York on September 11, 2001.

This level is also of interest to filmmakers, especially animators, who through their work become intensely aware of the content of each image, how much the image needs to move to ensure that the eye is fooled into seeing natural movement. Norman McLaren famously pointed out that the important part is what happens between the frames.

TEXT AND IMAGE

A great deal of research is going on in computer science, attempting to teach computers to recognize objects and people with a view to generating the indexing automatically. There is some hope that eventually techniques will be developed that will permit this to happen, but progress is slow. Even with still images, the technique of identifying one or more key images, then asking the system to "find me more like this" often yields results that are so off the mark as to be amusing. Only in highly controlled situations are any usable techniques available. However, with so many researchers working on the various problems connected with boundary detection, object recognition, perspective, proportions, spatial relationships, and so on, there is hope that eventually the complexities of these problems will be modeled adequately and that these so-called "low-level" techniques (statistical manipulation of pixels to generate semantics) will make a significant contribution to moving image retrieval. In the best systems, these will work in conjunction with the "high-level" techniques (humans attaching semantic information to images). The discourse in the literature of computer

science in this regard most often sees text as a messy problem to be eliminated in favor of fabulous computer techniques that will do the job much better. However, when we consider indexing both still and moving images for storage and retrieval, it quickly becomes clear that text and image are inextricably linked.

We need to use words to retrieve images, and words will remain an important contributor to retrieval strategies. Text is indeed the messy problem computer science researchers identify, but to eliminate it would be to throw the baby out with the bathwater. Text will always be necessary for retrieving images for the simple reason that a great deal of information useful in retrieving images from databases is not available from the images themselves. What is the name of that river in the background? Who is this actor hiding in a pumpkin costume? Is this an actual street scene of the Liberation of Paris or a reenactment? Is that really the campus of Harvard University as it says on the plaque, or is it another campus, or a studio set? What street is that church on? In what city, in what country? Documentary material especially needs text to explain the content of the image. Why is that man crying? How did that child lose its leg? Why is that dog so happy? Where are all those people going? What's going on here?

Using text to get at images is a different problem from that of using text to get at text. In the latter case, direct searches on useful terms can be conducted. The software simply looks for a match. As another layer of search capacity, text queries can be filtered through vocabulary management tools such as a thesaurus or classification to get at other text representations associated with the search string.

With images, however, a cognitive transfer takes place. The indexer looks at the image, and identifies what are the indexable objects. This is akin to assigning meaning to people and objects we encounter in everyday life. We feel a need to identify anything that comes into view, and we use words to do it. Walking along the street, we see a siamese cat approaching and say to ourselves something like, "oh, that's a Siamese cat." If we cannot name the object directly, we are puzzled, and fish through our minds for what it might be if we do not recognize it, and what it is called if we do. We do so in order to satisfy our need to be able to slot everything into some kind of category and thus resolve the discomfort. If we are not able to identify the object or to find some kind of explanation for it, we might erroneously decide it is something else, or ask another person to explain what it is. In extreme cases, fear takes over and we panic.

The phenomenon of dealing with unfamiliar reality is often used as a premise in films about people transported to another century or to another planet. The everyday reality is so different from what they know that the characters need to climb a steep learning curve just to be able to function. When objects or other subject matter are not identifiable, as in fantasy films or with special effects,

usually it is because the characters do not yet know what they are either, and in due time an explanation will be given to both the characters and the viewers. A similar situation involves a special culture (say, *Star Trek*) with its own language and conventions, which are known to aficionados but not necessarily to outsiders.

In practice, however, and with ordinary images from everyday life, naming objects is quite easy and direct. Indexers do not need to agonize over finding the best indexing terms, because indexing involves simply naming the persons, objects, or events being portrayed. Things may have more than one name, but if a list is made, the pool of readily available names for an object is quickly exhausted. When all the useful terms are attached to images, the images are retrieved using any of the terms assigned. A number of studies have shown that professional indexers and ordinary users assign the same terms to images of everyday, easily recognizable people, objects, and events. We wouldn't expect an untrained person to be able to index a book adequately, so why are untrained people so good at indexing pictures? The explanation seems to lie in the nature of the material. The objects are common to everyone's reality, and they do not have more than a few names, so that they are easily identified and named. This phenomenon probably explains, at least partly, why Web sites such as Flickr, YouTube, and MySpace work so well. Users find things readily because the useful keywords to assign to them are obvious. Indexing a book, however, involves a lot of synthesis, interpretation, grouping, and so on. In short, it is rigorous intellectual work.

We note in passing that the same indexing approach used for pictures applies to sound. We hear something, and want to know what it is. Once we have attached a name to it, the issue is resolved and we are satisfied. If we cannot name it, we seek help in identifying it. Libraries of stock sounds use the same indexing approach as libraries of stock images, that is, either categorizing the sounds into useful themes or attaching useful keywords to the sounds, or both.

Interestingly, since images are representations of objects and not the objects themselves, we can be easily fooled. Decors in movies, for example, can be shot on location or constructed as sets, or filming can take place in a location that is not the location represented. Thus, in indexing some collections of moving images, provision needs to be made for the real location and the represented location, the real time at which the image was shot and the represented time. Viewers' minds can also be stretched somewhat with representations of the characters. However, the representation of well-known people in movies has to fall within boundaries to which viewers can suspend disbelief. Sounds, of course, can also be faked, and in fact this practice is widespread in movies, to the point where the profession of a Foley artist is to do just that. Again, the database structures of systems that manage this kind of

information may need to take this into account, depending on their users and the needs of their users.

Recycling Text

Because of the high costs in both money and time when indexing is created by humans, efforts in information science research are focused on finding ways to reuse text that was created for other purposes in the processes of producing moving images. This involves recycling useful keywords and attaching them to individual shots. An obvious example is the use of closed-captioning subtitles, created for the deaf and for people with hearing loss. These transcribe, more or less faithfully, everything that is said by anyone on or off camera. In some subtitling and closed-captioning systems, additional sound information needed to understand the action is indicated, for example that a telephone is ringing or that there is a knock at the door, not seen in the image. Additional cues advise who exactly is speaking, that someone is not speaking but singing, that sound is coming from a radio, loudspeaker, or other device, what someone is thinking, and so on. When connections are made between closed-captioning text and the corresponding image, a user who remembers a snippet of dialogue can very quickly get to the image during which the dialogue was recited.

Note, however, that the text of closed-captioning has to do with the spoken word. It does not describe the image. Another technology, audio description, adds a special sound track for users of moving image materials who are blind or who have some vision loss. A describer recites text that offers descriptions of what is happening in the image. Users can already decode the story to some degree by following the dialogues and other sound information, but the audio description text uses words to describe aspects of the image that are essential for understanding the action. From the point of view of moving image indexing research, we might say that audio description text complements the closed-captioning text, in that the audio description indexes the image and the closed-captioning indexes the sound.

These two examples give an idea of the potential of recycling text created for other purposes in indexing moving images. There are many, many other kinds of text produced in the process of making moving image documents, and the challenge is to harness these in a way that automates the process of indexing. Other useful texts include the shooting script broken down for the shoot, in which all the decors, props, costumes, accessories, lighting, weather, and so on are described, the editor's logs, created early in the process to help the editor identify individual shots, producer's notes, director's notes, and camera reports.

As is the case with the creation of every other kind of information, moving image production is rapidly moving to a digital environment. Although it is doubtful whether

moving image production will ever be entirely digital, it will come very close to that goal. The dream of mining for indexing terms the computer systems used to manage all the textual information needed to make a film is a worthy one. If techniques for parsing and tagging text identified as useful for indexing the image are applied to existing text, and links made from it to the corresponding image, systems that offer access to individual shots can be built.

MULTILINGUAL INDEXING

In the context of globalization, multilingual indexing of moving images is becoming more and more important, even unavoidable. The use of collections that are searchable via the Web can be greatly increased if people all over the world can find them using their own language. The notions that everyday objects are common to everyone's reality, and that they do not have more than a few names at most, can be exploited to automate the indexing of still and moving images in many languages, once they have been indexed in one language, theoretically any language.

We hasten to add that automatic translation of the names of objects is not the same problem as automatic translation of continuous text. In the latter case, the typical messiness and sometimes outright anarchy of natural language offer considerable challenges, and automatic translation of continuous texts has not yet been modeled well enough to give satisfying results, except in highly controlled situations. However, work on these problems continues apace, and progress is steady. In the case of automatically translating the names of objects, the correspondence between languages is much more direct, and there are no grammatical or idiomatic issues to resolve.

Interestingly, it is not even necessary to index each collection in multiple languages for multilingual indexing of moving images to come about. What is needed is online bilingual or multilingual dictionaries, thesauruses, and other vocabulary management tools such as classifications, ontologies, authority lists, semantic maps, and so on. A sample scenario of how searches could work is this: a system could filter through an automatic translator a query made in any language, put the term sought into all other languages available, with each language search the participating databases locally, gather and compile the results, and return the images to the user. One of our studies in this area^[14] filtered queries in English and French through eight freely available Web translators, to test how accurate they were in producing a correct term in the other language. The poorest performer of the eight still got the correct answer 72% of the time.

Since objects can have more than one name, a method to measure the success of the correspondence between languages needed to be developed. We used a bilingual dictionary. If the term the automatic translator came up with in response to a query from the source language was

one of those listed in the dictionary for the term in the target language, we considered the translation successful. There is good reason to believe this will work well using any languages; however, empirical research that tests across the various families of languages is necessary to prove this conclusively.

What is missing to make automatic multilingual queries possible is infrastructure in the form of online tools and metadata. The online tools involved are the multilingual vocabulary management tools mentioned earlier. A number of these are already available, but not necessarily in multiple languages or with interoperable structures. With time, various interested parties, many of whom are outside the realm of information management, will develop these and put them on line. When that happens, they will be available to exploit.

Exploitation of such tools will be made possible through metadata infrastructure. This involves common or standardized description tools and methods, layers of metadata to make them interoperable, query languages and programming that can exploit the content, and user interfaces that make the behind-the-scenes activity transparent to the user. Available standards and recommendations such as the Dublin Core Metadata Initiative (DCMI), Simple Knowledge Organization System (SKOS), Material Exchange Format (MXF), JPEG2000, and the Resource Description Framework (RDF) are the kinds of tools such a metadata infrastructure needs to include. However, these are not yet mature enough or implanted widely enough to make the dream of universal access to moving images come true.

INDEXING OTHER THAN SUBJECT INDEXING

In information science, the term “indexing” commonly refers to subject indexing. However, more broad definitions of the term include any indicator or other way to point to something, aptly illustrated by the index finger, the finger used to point, apparently the origin for the term. In indexing moving images, a number of access points other than the subject are especially useful in narrowing down long lists of images returned in response to a query. For example, if only a particular type of shot will do, the user might as well specify this in the original query, thus eliminating shots that do not conform and increasing the pertinence of those that do. Such a search strategy supposes that the shots have been indexed using such access points. Following is a discussion of some of these.

Camera angles: How the camera is looking at the object of interest in the image is often important, and sometimes critical. Ready examples of this include aerial views, close-ups of faces, or satellite images. A number of relatively standardized lists of types of shots are available, reflecting terminology in various national and other contexts, and any of these can be used as an authority list.

Alternately, codes can be derived from such lists. By attaching these to records of individual shots, access by camera angle becomes available to the user.

Colors: In some kinds of collections, for example specialized collections of any kind of object such as cars, museum objects, clothing, animals, and so on, colors can be critical for the searcher. Dominant colors can be indexed fairly easily using standardized lists, although this can become complicated by the great number of nuances possible. In each situation, a decision on the limits of this needs to be made. Interestingly, in the low-level approaches to indexing, color is one thing searching algorithms can calculate easily, so that in hybrid systems words do not have to be used to provide indexing of colors. For example, the system can calculate the number of pixels within a range of color codes, and return images in which the desired color is dominant.

Time periods: As we noted earlier, there is real time (when the shot was actually taken) and represented time (in scripted productions, when the action takes place). Thus a shot might be taken in 2005 but the action in the film takes place in 1724. If both these dates are indexed, searches on the date become available to the user. Some time periods we might wish to represent are not so precise, so that coding for more vague periods such as the seasons of the year, various moments in a day, or various historical groupings of a number of years is also useful. At the other extreme, sometimes very precise times, including a fraction of a second on a particular date also need to be expressed. A number of coding systems are available for expressing these, for example, the tables available at the end of the Universal Decimal Classification (UDC), which provide for all such cases and more, thus offering a controlled vocabulary that can be used for this purpose.

Geographic spaces: Similarly, there is real location (where the shot was actually taken) and represented location (in scripted productions, where the action takes place). Thus a film might be shot in Argentina but the action in the film takes place in Ireland. Again, separate fields in a database to represent these concepts will allow users to search on either. And again, a number of code lists are available, including a UDC list. Such lists are particularly useful since they permit the expression of political entities (e.g., country names and regions within a country) but also take into account geographical features which cross political borders, such as rivers, mountain ranges, and so on. With the global positioning system (GPS), it is also possible to generate coding to pinpoint precise locations.

Emotion: Indexing human emotions represented in moving images can be helpful to some users, although such indexing is rather hazardous because of the ambiguity involved. It is not always clear to the indexer which emotion is being expressed, especially if there is not enough context. However, in collections where such indexing is desirable, imperfect indexing is still much

better than no indexing at all. As with every other kind of indexing, use of some kind of controlled list is desirable, even if it is an in-house list.

Lighting conditions: Whether a shot is taken indoors or outdoors is often significant. Indoors, some description of the degree of luminosity, even broad categories can be helpful, such as very bright studio lighting at one extreme and dim lounge lighting at the other. Outdoors, weather conditions are often useful to describe. Particular times of day can be covered using time period coding, but this does not cover weather and lighting conditions. The sky can be black at high noon because a thunderstorm is about to break. Managers of individual collections will need to decide what level of detail is appropriate. In general, however, a simple, controlled list of lighting conditions is probably enough.

Other indexable special conditions: A number of special conditions are indexable, again for their value in eliminating shots that do not meet such a requirement. These include underwater material, images taken by satellites or shot from space, images shot using infrared cameras or heat-detecting cameras, images reconstituted using computer technology, or anachronistically altered images modified to include a present-day person alongside people long since deceased. Other categories include images using special effects or images shot with special equipment such as fisheye or panoramic lenses.

In addition, we can imagine any number of kinds of special collections of images, for example, images of only mushrooms, stones, cars, types of screws, or furniture. Or collections of microscopic images of diseases affecting cells, forensic photographs, technical aspects of spacecraft or bridges or roofing, and so on. In these cases, the indexing problems will be centered around specialized vocabularies for describing the image content and the level of indexing required.

IMAGE TAGGING

Much has been made of the now rather hackneyed expression “Web 2.0,” referring to services available in the context of the evolution of the World Wide Web. Nevertheless, services associated with this concept have been at the heart of the “democratization” of information management, based on the principle that information belongs to everyone and should circulate freely. From the point of view of access to information, this means that technology is loosening the grip of the controllers of information and making it available to everyone. From the point of view of indexing information, this notion challenges the “stranglehold” professionals have on how information is organized and managed. For better or worse, a number of phenomena have sprung up in this context and are now broadly practiced, including communal writing in the form of wikis, building communal classification

structures in the form of folksonomies, and journalism in the form of blogs. The phenomenon that concerns us here is user-based indexing, commonly referred to as tagging.

Professional indexers strive for rigor and consistency, and users of the work they produce depend on these qualities in order to do their own work. The practice of indexing both still and moving pictures by untrained persons results in varying quality of indexing. Whether user tagging should even be called indexing or not is open to debate. In discussing the issue, it is important to distinguish among various types of images, because each type has its own indexing needs. For indexing purposes, it is convenient to divide the vast world of images into three categories: art images, documentary images, and “ordinary” images. For our purposes here, the same categories can be used for moving images, although a number of additional useful categorizations are available for these latter.

Art images are interpreted, analyzed, and discussed at length. Thus it is easy to argue that specialized skills are required for indexing them. Indeed, specialized skills are necessary even for looking at them and understanding them. Large bodies of scholarship can build up around even a single painting. Biographical information about artists is often included as part of the discussion. Controversies develop and generate much additional documentation. From an information management point of view, systems for still art images have been constructed mainly to support museums and art history programs in universities, and the way art images have been indexed reflects this perspective. Since the discussion of the levels of interpretation of still art images is outside the scope of this entry, suffice it to say here that historically they have been indexed at an intermediary level of interpretation, avoiding naming individual objects as we find with documentary images and ordinary images. However, now that the relatively recent networked environment has become available, the need to name individual objects in art images is more pressing than ever. In addition, in order to assist scholars, there is a need to gather all the material, whether it be textual, still or moving images, or sound, so that rather complex information systems are needed to manage information about art. Moving images in the form of art films, films about art, films made by artists, and films about artists form part of this corpus and are subject to the needs arising from the same kind of complexity.

However, documentary images are not subject to such needs. The indexing for documentary images involves identifying persons, places, and events by name, and offering explanations that help interpret the image. Although we usually associate documentary images with current events, political, or news items, in the broader sense family photos and videos also fit into this category since they chronicle the same type of information, albeit on a more local, more circumscribed scale. It is easy enough to see the value of indexing such images for those who participated in the event, be it family members or

members of a social group, and indeed, these may be the ones best qualified to do the indexing. Similarly, the filmmaker and crew of a documentary may be the ones best equipped to identify and explain the content of the image, since they are so intimately associated with making arrangements for the shoot, are witness to the event, and have made the decisions about exactly how to capture it on film or video.

“Ordinary” images include pictures of animals, flowers, everyday objects, generic scenes, and so on. Examples of the use of ordinary images include illustration, decoration, or as teaching aids in a variety of contexts. Ordinary images can include anything that can be photographed, and the photographer is the “author” or creator of the image. However, in opposition to the situation with art images, the author or creator of an “ordinary” image is not usually important or significant to the user. In general, ordinary images can be indexed by anyone, based on the notion of access to a common reality, since the indexing activity consists of naming the persons, objects, or events in the image. As we mentioned earlier, several studies have shown that untrained users pick the same indexing terms as professional indexers for such images.

For purposes of managing collections of images, it is helpful to note here that the three categories of art, documentary, and “ordinary” images are not necessarily mutually exclusive. For example, an ordinary image can become part of a work of art if an artist decides, for example, to paste a magazine photo of a cup of coffee into a collage. A photographer might think she is merely documenting a person or an event but the resulting photograph is so perfect as to be considered art, or with time become famous for some reason never intended at the outset. In other cases, an image might belong to more than one category simultaneously, for example stock footage of office workers (“ordinary” images) might be sold to makers of corporate videos but for the family and friends of such workers (or actors) the footage also documents their lives (documentary images). We can also imagine the same piece of material ending up in an art film (art images).

Whatever the type of images, the problem remains in using a controlled vocabulary to do the indexing. However, for images other than art images, it is not much of a problem. If we remember that the basic function of indexing is to point to something, then we need also to remember that there can be more than one way of pointing to something. If a number of users add their own tags to images, the possible names for any object are soon covered, and any of the names will retrieve the image. The main function of a controlled vocabulary is to gather synonyms and variants and select a single term for indexing each concept. The reason we bother to do this is largely associated with technology. In the case of controlled vocabularies, the arguments for using them are still sound, but if the technology available skirts the problem they are

designed to solve, do we still really need them? As an example, PREserved Context Indexing System (PRECIS) indexing fell by the wayside as computer technology developed because the complexities involved in using the system were no longer necessary. PRECIS made use of software to construct indexing strings and to shunt the strings so that each key term could appear as the entry point in an alphabetical list. However, PRECIS indexing was developed to produce print indexes. Since databases can be searched on any field, it became unnecessary to permute the indexing strings to make available all the entry points to them.

Another discussion in this context is the use of a thesaurus to index ordinary and documentary pictures. The rise of the thesaurus as an indexing tool was largely to do with arranging into semantic networks the vocabulary of specialized areas of endeavor. The notion of using a thesaurus to index a general collection of still or moving images goes against the idea of the thesaurus as a tool for managing the vocabulary of particular areas of endeavor, and supposes the existence of a general thesaurus. Surprisingly, the idea of building a thesaurus for anything that can be photographed is not so farfetched as it seems. A number of moving image collections have built such a tool for indexing their collections. A published thesaurus, the *Thesaurus for Graphic Materials*, was built for indexing documentary and ordinary still images, and is widely used for indexing both still and moving images. A few thousand terms seem to be enough to make such a tool useful, since term creation in this thesaurus and a number of in-house thesauruses seems to level off after a few thousand words.^[15]

Another question is how many terms should be attached to each image. As Dizard (2004)^[16] puts it, “a picture is worth a thousand words, but which ones?” This is another question related to technology, and the reason for determining limits had to do with the amount of work involved in managing information systems. The point here is that there are no longer technical or managerial reasons for limiting this number. A number of studies have shown that one, two, or three terms are often enough, but this of course depends very much on individual images and on user needs. Today, the answer to the question of how many indexing terms to use is: as many as are useful.

Ultimately, the issue of indexing both still and moving images is economic. The cost of professional indexing is inevitably high, so it seems reasonable to reserve it for art images. For documentary and “ordinary” images, the implicit argument is that indexing by nonprofessionals is better than no indexing at all, also that it is “good enough.” In addition, maintaining the tools used for such indexing adds to the costs. Since indexing ordinary and documentary pictures involves attaching names to persons, objects, and events, tagging these with keywords might well be good enough. In the end, it is a moot point, since tagging is free. If costs were involved, it is doubtful whether much tagging would occur at all. Finally, since the term tagging

is associated with the practice, purists can easily distinguish between what is “properly” indexed and what is merely tagged.

THE FUTURE OF MOVING IMAGE INDEXING

By using automated techniques and by exploiting text created for other purposes, shot-level access to moving images could become readily available. How this will happen exactly is a matter of conjecture. We note, however, that already computers can easily detect when a new shot is starting because there is a radical change in the image content from one frame to the next when this happens.

Thus a production can automatically be divided into individual shots. We note that distributors of movies in DVD format usually provide chapter divisions with identifying names, allowing users to readily access individual parts of movies. Television programs also have logical divisions, and these are provided in television archives. For example, a current events show will have a number of reports, each cataloged separately and related to the whole. Thus the problem of automatically identifying the useful divisions of moving image productions is already solved. Automatically attaching indexing terms to these divisions is the next problem we need to address.

As we noted in the section on “Shot-Level Indexing,” some situations use shot-level indexing by humans. How to attach keywords (synonymous for our purposes with tags and indexing terms) to sections of moving image productions and to individual shots automatically has to do with recycling existing text in a digital environment. As we noted in the section on recycling text, a number of text sources created for other purposes in the processes of production are available. Techniques used in linguistics such as shallow parsing can identify nouns and noun phrases. These are known to be the parts of speech indexers use to represent moving images at the shot level with verbs, adjectives, and adverbs appearing only rarely.

At some point in the not too distant future, production of moving image documents will be nearly entirely digital. It is already largely so. Imagine, then, large modular production databases which house not only the image and the editing information, but also virtually all the text created during the production processes. Imagine further extending the functions of such production databases to include archiving the material. By mining the text modules, parsing the text, and attaching keywords to the corresponding images, all these activities being stages of executing an algorithm, we can imagine indexing individual shots, sequences, scenes, and chapters automatically.

In addition, the work being done in this area by computer science researchers will eventually come to fruition. Because of the immense complexity involved in automatically identifying objects and relationships among them,

then attaching semantic information to them, such work is largely experimental and poorly performing at present. However, the day will come when the low-level approaches and the high-level approaches will be usefully combined in hybrid systems that will most likely offer the best performance for retrieval of moving images. We can imagine attaching smart user interfaces to such systems so that they will be able to suggest search strategies using one or the other approach, dynamically, depending on contextual information.

If we add to this equation improved infrastructure that permits the ongoing deposit online of movies and television shows, as well as vast quantities of home video, along with the possibility of downloading all this and viewing it on computer screens, the picture broadens further. We can imagine Web-based systems that search all this material, along with its indexing metadata added automatically via the low-level and high-level approaches, including text in many languages, returning precise results to users of such systems. When that day comes, users will be able to get answers to questions that today cannot even be asked, and a new horizon of possibilities for study and use of the planet’s visual heritage will appear.

CONCLUSION

This entry has tried to explain some of the issues surrounding moving images. Although large collections of these have been built since moving images first appeared on film in 1895, methods for organizing such collections remain largely undeveloped, at least when compared to methods for text collections. Apart from their relative recency, moving image collections are not organized so well because they have a number of very different characteristics and thus are not amenable to the same kinds of techniques.

We noted that a number of levels of access need to be provided, depending on the context of the collection and the needs of its users. These range from relatively simple cataloging of DVDs of commercial films to frame-by-frame analysis in scientific and forensic contexts. In some conditions, nonsubject access points are sometimes more useful than subject indexing terms, and a number of these access points are available for moving image documentation. Although a great deal of research in automating the indexing process using low-level approaches is being conducted in the field of computer science, the relationship between text and image is an essential one that will persist. Thus the research in information science focuses on automating the generation of indexing terms from text created for other purposes during the processes of producing moving image documents.

In a global environment, multilingual indexing is an issue gaining prominence, and work on learning to exploit online vocabularies in many languages contributes to automating the highly desirable provision of access to

moving image materials in many languages. The development of Web-based tools of many types, including controlled vocabularies, semantic networks, and bilingual and multilingual dictionaries and thesauruses will foster the acceleration of success in this area.

The need for building systems that can interact with other systems in a networked environment is the strongest force driving the work on information management systems for moving images. Necessarily complex, such systems involve a great deal of thought, planning, discussion, and development. The need to exchange information rapidly and efficiently means that the more interoperable individual systems are with other networked systems, the easier it will be for those involved to accomplish their work. Such goals are eminently worth striving for.

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RELATED ORGANIZATIONS AND ASSOCIATIONS

1. American Society for Information Science and Technology, Special Interest Group on Visualization, Images, and Sound (SIG VIS).
2. The Association of Moving Image Archivists (AMIA).
3. Audiovisual Roundtable of the American Library Association (ALA).
4. The Coordinating Council of Audiovisual Archives Associations (CCAAA).
5. International Federation of Film Archives (FIAP).
6. International Federation of Library Association and Institutions, Audiovisual and Multimedia Section (IFLA AVMS).
7. International Federation of Television Archives (FIAT).

Multilingual Information Access

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Abstract

This entry describes the process by which systems can be designed to help users find content in a language that may be different from the language of their query. The discussion of the relatively narrowly construed technical issues that are often referred to as Cross-Language Information Retrieval (CLIR) is situated in the context of important related issues such as information-seeking behavior, interaction design, and machine translation.

INTRODUCTION

The central thesis of Tom Friedman's book *The World is Flat* is that we now live in a world in which technological innovation is creating opportunities for more seamless global interaction than has heretofore been possible.^[1] It is important to recognize that "technological innovation" encompasses far more than mere technical innovation—equally important is our ability as a society to learn to productively use the technical capabilities that we can create. This entry examines one such technology: helping users to find information in ways that "flatten" language barriers. In keeping with what is emerging as common usage, we refer to this challenge as Multilingual Information Access (MLIA).

This word "multilingual" can be used in many ways, so let us start by saying what we mean. A multilingual collection is a collection of documents that contains more than just a single language (e.g., English and Chinese). These documents may each contain just one language, or some of the documents might contain words from more than one language. Our interest is in helping a searcher to find the documents that they seek, regardless of the language in which they are expressed. For simplicity, we will assume in this entry that documents are expressed in writing and stored as e-text (i.e., as digital sequences of character codes), but similar approaches have been applied to scanned documents and spoken word collections, and might in the future also be applied to visual languages (e.g., American Sign Language).

Who needs MLIA? We can envision at least two user groups. Perhaps the most obvious is so-called polyglots—people who are able to at least read (and perhaps write) more than one language. For example, more than one billion people who know at least some English are native speakers of some other language. Polyglots can benefit from MLIA in at least three ways: 1) they can find

documents in more than one language with a single search; 2) they can formulate queries in the language(s) for which their active vocabulary is largest; and 3) they can move more seamlessly across languages over the course of an information-seeking episode than would be possible if documents written in different languages were available only from different information systems. Monoglots (those who know only a single language) form a second important group. For example, many Americans can read only English, while many citizens of China can read only Chinese. Those populations essentially live in different worlds, worlds that MLIA can help to bridge.

MLIA always involves Cross-Language Information Retrieval (CLIR), in which queries in one language are used to find documents in another. When the user cannot read the document language, some form of translation service will usually be needed. This might be as simple as automatic translation of short snippets, or as complex as on-demand translation by a subject matter expert. There are, however, also cases in which adequate results might be presented without translation. For example, someone who knows only Japanese might search a collection of newspaper photographs that are indexed using only English terms and still easily recognize which of the resulting photographs would best meet their needs.

The remainder of this entry is organized as follows. The next section places MLIA in historical perspective and explains (or at least interprets) how and why modern techniques for MLIA evolved in the way that they did. The section "Cross-Language Information Retrieval" then describes the present state of the art for CLIR, the key technical capability in all MLIA applications. The section "The Rest of the Story" builds on that, broadening the coverage to address interaction design and information-seeking processes. Finally, "the entry" concludes with a brief survey of the present state of practice and elucidation of some important open questions.

A BRIEF HISTORY OF MULTILINGUAL INFORMATION ACCESS

Gaining access to information in unfamiliar languages has always been an important problem. The intense technological competition that was emblematic of the Cold War in the second half of the twentieth century created a substantial demand on both sides for translation of scientific and technical papers. After some early, and rather disappointing, experiments with automatic translation, the United States National Research Council recommended in 1966 that basic research continue, but that the work of people, rather than machines, provide the principal means for making foreign-language information accessible for the foreseeable future.^[2] This recommendation fostered the development of a part of the information industry that focused on translating scientific and technical literature and indexing those translations. Journal articles and so-called gray literature (e.g., technical reports) were translated either prospectively or on demand by a number of organizations, and the World Translations Index (and its predecessors) evolved to provide the needed indexing service for speakers of English.

The economic growth and linguistic diversity of Europe in the second half of the twentieth century provided the impetus for the second major innovation, the development of multilingual thesauri. Oard and Diekema surveyed the genesis of this work, from the first published report (in 1964 from Germany) through publication of the current (1985) version of ISO Standard 5964, which recommends techniques for construction of multilingual thesauri.^[3]

Substantial reliance on human translation and thesaurus-based indexing were good choices at the time, but three key events dramatically changed the opportunity space. The most obvious was the end of the Cold War, which resulted in substantial changes in national investment strategies. The International Translations Centre ceased operations in 1997 with the publication of the last volume of the World Translations Index, citing declining demand for their services that resulted from increasing adoption of English as a lingua franca for scientific communication and from declining funding for information science more generally.

The second key event was the rise of the World Wide Web, and in particular the widespread adoption of Web search engines such as Lycos, AltaVista, and Google. Furnas et al. had remarked on what they referred to as the “vocabulary problem” in human–system interaction, observing that “new or intermittent users often use the wrong words and fail to get the actions or information they want.”^[4] Although the fuzzy-match full-text search capabilities of the 1990s-era Web search engines were far from perfect, experience with that technology began the process of incrementally shifting expectations away from

intermediated thesaurus-based search and toward end-user “natural language” search.

The third event, which attracted far less attention at the time, was a remarkable payoff from the investments in basic research that the National Research Council had recommended. Earlier approaches, based on hand-coded rules, had proven to be problematic because the rules could interact in ways that were difficult to anticipate. As a result, at some point adding additional rules in an effort to improve things could actually reduce translation quality. In 1990, a group at IBM Research first published a radical new technique based on one simple idea: machines can learn to translate by using statistical analysis to identify regularities in large collections of translations that were generated by people.^[5] Importantly, as more examples are provided, translation quality improves. This “data-driven” approach, which came to be called statistical Machine Translation (MT), is thus well matched to a networked world in which assembling ever-larger collections is increasingly tractable.

These three events, unfolding together in the last decade of the twentieth century, came together to transform both the need for, and the opportunities to provide, automated techniques to support multilingual information access by end users. The spark that ignited the process was a 1996 workshop at an information retrieval conference in Zurich.^[6] Early techniques were limited by their reliance on online bilingual dictionaries, but techniques based on statistical machine translation were soon introduced. As described in the next section, this ultimately yielded fuzzy-match full-text search capabilities that accommodate language differences between the queries and the documents remarkably well. End-user search requires more than just accurate ways of finding documents that may be useful, however. Equally important, the user must be able to recognize those useful documents, understand their contents, and (sometimes) draw on that understanding to progressively improve their queries; the section “Conclusion” addresses those issues.

CROSS-LANGUAGE INFORMATION RETRIEVAL

The core capabilities that enable MLIA are indexing and query processing for CLIR. Indexing proceeds in three stages: 1) language and character set identification; 2) language-specific processing; and 3) construction of an “inverted index” that allows rapid identification of documents which contain specific terms. Sometimes the language in which a document is written and the character set used to encode it can be inferred from its source (e.g., *New York Times* articles are almost always written in English, and typically encoded in ASCII) and sometimes the language and character set might be indicated using metadata

(e.g., the HTML standard used for Web pages provides a metadata field for specifying the character set). In other cases (or to confirm an initial guess), a very simple form of content analysis can be used to identify those boundaries languages and character sets. The usual approach is to count the frequency of character sequences, and then to guess the language based on similarity to counts computed in the same way for documents written in a known language. For example, the first sentence in this paragraph would yield the following 3-byte sequences: “the”, “he”, “e c”, “co”, “cor”, “ore”, etc. The technique is easily extended to accommodate multibyte character encodings by counting bytes rather than characters. Language and character set classification using this technique is remarkably accurate (typically well over 95%) for any text that is at least as long as a typical paragraph, so language switching within a single document can sometimes also be detected using this technique.

Once the language and character set are known, the character set can be converted to a standard representation (often Unicode) and two types of language-specific processing are then typically applied: 1) tokenization to identify the terms that could be indexed; and 2) stopword removal to identify terms that need not be indexed (for efficiency reasons). For English, tokenization typically involves splitting on white space and then using rule-based techniques to remove common endings (so-called “stemming”). Identifying “word” boundaries is more complex in “freely compounding” languages such as German, Finnish, and Tamil, and in “unsegmented” languages such as Chinese. Of course, the spoken form of every language exhibits this same tendency to run words together without pauses, so techniques similar to those used in speech recognition for identifying words can be used to identify. The basic idea is to draw on two sources of evidence: we can know most of the words that exist in the language (using a dictionary), and we can guess which word sequences might make sense (e.g., from statistical analysis of word usage). Using these ideas together would tell us that the word “Washington” found in a German document might (from the dictionary) be segmented as “was,” “hing,” and “ton,” but (from usage statistics) that such a segmentation would be unlikely to be correct—in this case we would therefore index the unsegmented word “Washington.”

The inverted index used in CLIR is similar in structure to an inverted index used in any information retrieval system, but the information stored in that index may be different. Conceptually, an inverted index includes two parts: 1) a lookup table stored in fast main memory that can be used to rapidly find the “postings” for a specific term (i.e., identifiers for all documents containing that term); and 2) The postings file, which (because of its size) must be stored on the (much slower) hard disk. One of the most important advances in information retrieval system design in the past decade was the widespread introduction

of automatic compression techniques for the postings file. Because these techniques are tuned to achieve the greatest compression for the most common terms, stopword removal is no longer essential as an efficiency measure in monolingual applications. In CLIR, however, deficiencies in the translation technique can sometimes yield inappropriate results for translation of very common words. Stopword removal is therefore still common in CLIR applications.

The most obvious distinguishing feature of CLIR is that some form of translation knowledge must be embedded in the system design, either at indexing time or at query time. Essentially, three approaches are possible: 1) translate each term using the context in which that word appears to help select the right translation; 2) count the terms and then translate the aggregate counts without regard to the context of individual occurrences; or 3) compute some more sophisticated aggregate “term weight” for each term, and then translate those weights. Somewhat surprisingly, while the first two of these work about equally well in many cases, term weight translation is typically not competitive.

If the user will ultimately require a machine-generated translation, and if that translation is always into the same language, then a strong case can be made for translating every term in context at indexing time. In its simplest form (which is often adequate), this essentially amounts to simply running a full machine translation system as a preprocessing step prior to building the inverted index. Efficiency arguments against this approach would be hard to make: a translation system fast enough for responsive interactive use at query time would also be fast enough to process every document in all but the very largest collections at indexing time.

When full translation is not needed (e.g., for polyglot users), or when translations into many different languages may be needed to serve a linguistically diverse population, indexing documents using the terms in their original language is typically the preferred system architecture. In this case, considerable efficiency improvements can be obtained by translating term counts rather than term occurrences. The basic approach, first discovered by Pirkola^[7] (SIGIR, 1998), is to count every possible query-language translation of each term as having been found in the document. Subsequent refinements resulted in further improvements from using translation probability for individual terms to estimate partial counts^[8] and from aggregating translation probabilities for synonymous terms.^[9] Regardless of the details, the key idea is to compute “term weights” in the query language rather than in the document language. Many of the commonly used term weighting formulae give more weight to rare terms than to common terms, which comports well with the way professional searchers are trained to enhance the precision of their search using terms that they expect will be highly specific. Since specificity is a feature of the query, it

makes sense that computing term weights in the query language would work well.

Among all of the advances in CLIR, none has had anywhere near as large an effect as accurate translation probabilities. The best reported results for systems that lack any notion of translation probability (often called “dictionary-based” techniques) are in the range of 70–80% of what would have been achieved using queries written in the same language as the documents. (These results are normally reported as an average across many topics. The most commonly reported search quality statistics in the CLIR literature is “average precision,” which is designed to emphasize the density of relevant documents near the top of a ranked list where most searchers are expected to focus their attention.) The best reported results for systems that use translation probabilities well is closer to 100% of what would have been achieved using same-language queries.^[9] It is worth taking a moment to consider what that means—today, we can build systems to search French documents that work (approximately) equally well regardless of whether the query is written in French or in English! Of course, for any specific query the system might do better with French or with English, but on average over repeated use the best systems that can be built today do about equally well in CLIR or monolingual applications.

The key question, therefore, is how to obtain sufficiently accurate translation probabilities. It turns out that this problem was solved for us as one part of statistical MT.^[5] The key idea behind statistical MT is that a machine that knows very little about language (e.g., just how to recognize a word) can learn to recognize (and later replicate) patterns of language use by counting what happens in very large collections of examples of language use. Specifically, we give our machine an enormous collection of examples of actual translations (e.g., “man in the moon” and “l’homme dans la lune”) and ask it to find the most common alignments of individual terms (e.g., “man” and “l’homme” in this case, but “l’humanite” for “man” in “the evolution of modern man”). If the examples from which the machine learns are representative of the cases to which it will later be applied, the translation probabilities learned by the machine can be quite useful. A full MT system contains additional processing stages, but for CLIR it is often sufficient to simply use the learned translation probabilities directly (with some pruning to suppress the effect of relatively rare random alignments).

THE REST OF THE STORY

There is, however, quite a bit more to the search process than simply automatically creating best-first rankings of documents that the user might wish to examine. Three key questions arise: 1) can people learn to formulate effective queries?; 2) can people recognize useful documents in the

result set?; and 3) can people adequately understand the contents of those documents to meet their information needs? Research on these topics is still in its infancy, and moreover we can reasonably expect that as translation technology improves the answers to these questions may change. There will be, therefore, substantial scope for important Library and Information Science research on these questions for some time to come.

The most tractable of these questions at present turns out to be the second one: people seem to be remarkably good at recognizing useful documents using even relatively poor translations. In 2001, the Cross-Language Evaluation Forum (CLEF) started an annual interactive track (iCLEF) to foster research on these questions. In that first year, the focus was on interactive assessment of topical relevance using machine translation. Representative users (in this case, university students) were presented with a written topic statement in a language they knew well (e.g., English) and a set of news stories in some other language that they did not know at all (e.g., Spanish) that had been ranked by a CLIR system and then automatically translated back into the language of the topic statement. Topical relevance judgments made by native speakers of the language in which the news stories were written were used as a gold standard. On average (over several users, each working on several topics), the searchers who did not know the document language agreed with the native speakers about as often as two native speakers would be expected to agree with each other.^[10]

Together, those studies indicate that recognizing relevant documents using automatic translation of short summaries or of entire documents is usually not a particularly difficult task. Considerable scope remains, however, for future research on optimally combining the technology for summary generation and translation, for analysis of specific cases in which present technology is not meeting user needs well, and for determining how best to present those results to the user (e.g., as several lists or as a single integrated list).

The third challenge, translating documents well enough that the user can understand their contents, is exactly the goal for which automatic systems for machine translation are optimized. Translation quality can be measured in two ways: 1) an “intrinsic” evaluation in which we ask how similar an automatic translation is to something that a human translator would actually create; or 2) an “extrinsic” evaluation in which we ask how well the reader can accomplish some task using the translation. Intrinsic evaluations provide an important way of assessing incremental progress in the design of machine translation systems, but extrinsic evaluation sheds more light on the ability of present translation technology to meet user needs in multilingual information access applications.

The iCLEF 2004 user studies provided an initial extrinsic evaluation of translation quality, measuring the user’s ability to answer factual questions when searching a large

collection of news stories in an unfamiliar language. The results of those studies indicated that (on average, across users) only about 70% of the questions could be answered at all, and that (on average, across users and answered questions) only about 70% of those answers were correct. Considering both factors together, those factual questions were answered correctly about half the time.^[11]

Jones et al. took this approach further, measuring the utility of an improved machine translation system across four source types (newspaper stories, text-only discussion groups, automatically transcribed news broadcasts, and automatically transcribed talk shows) using a reading comprehension test. They reported about 80% accuracy for answers to factual questions, but only about 50% accuracy for answers to questions that called for some degree of abstract reasoning.^[12] From this we can conclude that present machine translation technology can satisfy some user needs, but that further improvements in translation quality will be needed before broadly useful multilingual access applications can be fielded.

The first of the questions posed at the start of this section, whether people can learn to formulate effective queries, is at this point the one we know the least about. The reason for this is simple—to learn very much about this would require long-term studies of real users performing real tasks. But before that can happen we must develop and field real systems capable of supporting those tasks, and those systems don't yet exist. Some insights have begun to accumulate from anecdotal reports of user experiences during structured user studies that have implications for system design. For example, sometimes searchers will recognize a useful term in a translated document and add it to their query, which will only work well if translation of documents and queries are implemented in a consistent manner (which was not the case in early systems). It also seems to be a good idea to inform users when no translation is known for a query term. It is not yet clear how far to take this idea of informing the user—should we show them the translated query? All possible translations for each query term? Alternate translations for some of the terms in a summary or a full document? Perhaps soon we will begin to see studies using Google's new MLIA capability (described below) that will begin to shed light on some of these questions.

CONCLUSION

Adoption of MLIA capabilities in deployed systems seems to have been far slower than the progress on the underlying CLIR technology would support. Deficiencies in current MT systems are undoubtedly a limiting factor in many cases, although applications intended for use by polyglot users would naturally be less affected by those deficiencies. Some cases may reflect a chicken-and-egg paradox: MLIA is needed only for large multilingual

collections, but collection development policies in many cases predate the availability of these techniques. Web search would seem to be a natural first mover in MLIA (after all “World-Wide” is the Web's first name!), but there too adoption has been slower than the technology base would support. One commonly cited limiting factor for Web search engines has been the challenge of developing a suitable business model for monetizing MLIA. Regardless of the cause, it seems clear that developing a broader experience base with MLIA techniques will be an important next step.

In May, 2007, Google introduced a rudimentary MLIA capability by coupling query translation (to search Web pages in a different language) with document translation (to translate the result list, and individual results). Such an approach can be easily “bolted on” to any Web search engine since Web search engines typically already include automatic language identification and language-specific processing. (Indeed, Yahoo announced a similar service for German users in 2005, although apparently without much success.) Similar techniques have been used for CLIR research by modifying freely available information retrieval systems that had originally been designed for monolingual applications (e.g., Lucene), and at least one freely available system includes provisions for easily incorporating translation probabilities (Indri's “weighted structured queries”). Some degree of adoption is now also becoming evident among commercial providers of search services. For example, Autonomy now offers cross-language search capabilities (e.g., for enterprise search by multinational corporations).

These emerging capabilities are first steps in the direction of developing a richly multilingual information ecology that could support the next generation of research on information-seeking behavior in such settings. The few studies that have been conducted in recent years have typically focused on single information systems, relatively narrowly scoped collections, and, of necessity, users who have no prior experience with any MLIA application. As more users gain access to a broader range of increasingly capable systems, richer and more nuanced study designs will become possible.

Some open issues remain with regard to the technology base as well. For example, development costs for language-specific processing depend on the number of languages that must be accommodated, but the overall value of processing a specific language varies with the importance to the user of the languages that might be written in that document. With hundreds of written languages in use around the world, a point of diminishing returns may be reached beyond which the development costs for language-specific processing can no longer be justified. In such cases, a simple alternative is to count character sequences (in the same way as for language identification) and then simply index those character sequences. While this works reasonably well for monolingual applications in

which the query and the document are written in the same language, how best to integrate translation capabilities into such an architecture is presently less clear.

Another open research question in MLIA is how best to present results from different languages. The challenge in this case arises because present systems for ranking documents in decreasing order of probable utility rely on relative relevance" scores that lack an absolute meaning. The consequence is that we can reasonably hope to determine whether one French document is a better match to the query than another French document, but determining whether an English document is a better match to that query than some French document requires that we create some way of comparing English scores with French scores. Progress on this problem has to date been rather disappointing, with merged result lists often being far less satisfactory than the best single-language result set. Presenting several ranked lists, one per language, is possible, but that approach does not scale well as the number of languages grows.

Result set presentation is a special case of the more general issue of interaction design, for which the research to date has just started to scratch the surface. When first introduced, things that are new are often patterned on things that are already well understood. Newspapers, for example, initially resembled the pamphlets that had preceded them. Later, when newspapers first started providing content on the Web, it resembled a printed newspaper. So it should be no surprise that Google's first try at MLIA looks like, well, Google. New capabilities tend to create their own dynamics, however, with new users bringing new needs, which drives development of new technologies, sometimes ultimately resulting in something that would have been difficult to imagine at the outset. MLIA has progressed far enough at this point for us to begin on that path, but not nearly far enough for us to yet predict where that path will lead us.

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Museum Accreditation Program

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Abstract

For nearly 40 years, the American Association of Museums' Accreditation Program has formally recognized museums' commitment to excellence, public accountability, high professional standards, and continued institutional improvement. Accreditation serves as the museum field's quality assurance and self-regulation.

The Museum Accreditation Program of the American Association of Museums (AAM) formally recognizes museums' commitment to excellence, accountability, high professional standards, and continued institutional improvement. Its purpose is to strengthen individual museums and the entire profession by promoting ethical and professional practices in individual museums and the museum community. Accreditation serves as the field's primary vehicle for quality assurance and self-regulation.

The program assesses how well each museum achieves its stated mission and goals and meets the standards and best practices generally accepted in the museum field. It employs a standardized process of self-study and peer review that incorporates multiple perspectives to ensure balance and fairness. This process draws on the collective wisdom of the field, gathered from participating museums, peer reviewers and the Accreditation Commission, a nine-member, independent and autonomous body that administers the program, and renders all decisions regarding accredited status.

Accreditation offers the following benefits: it certifies that a museum meets the Characteristics of an Accreditable Museum as set forth by the Accreditation Commission, certifies that it has undergone a rigorous process of self-assessment as well as review by its peers, signifies that the museum fulfills its obligations to the public as set forth in its mission and recognizes the institution's commitment to excellence, accountability, high professional standards, and continued improvement.

The accreditation program reflects the diversity of the museum field, accommodating museums' variety in disciplines, from art centers to zoos; budget sizes, from less than \$100,000 to \$150 million and above; governance types—private, nonprofit, or public—and collecting status, including museums that do not own collections.

After submitting an application, a museum spends a year completing a self-study questionnaire. With Accreditation Commission approval, two peer reviewers conduct a site visit and submit a report, after which the

commission votes on accreditation. Peer reviewers are selected from comparable institutions, but with differing areas of expertise targeted for the museum undergoing accreditation. Museums already accredited undergo a subsequent review, or reaccreditation, every 10 years.

In June 1971, 16 museums became the first to be granted accreditation by the AAM. This was a milestone in a process that had begun in 1906, when museum directors came together at the American Museum of Natural History in New York to found AAM and initiate what has become a century-long discussion about developing museum standards and measuring museum performance. Plans for museum accreditation began in earnest in 1967, when President Lyndon B. Johnson asked the U.S. Federal Council on the Arts and Humanities to study the status of American museums and recommend ways to support and strengthen them.

The council enlisted AAM's assistance, and in 1968 the association established a committee to study the idea of an accreditation program for museums. Based on AAM's input, on November 25, 1968, the council issued "America's Museums: The Belmont Report," which stated: "it is urgent that the American Association of Museums and its member institutions develop and agree upon acceptable criteria and methods of accrediting museums." One year later, AAM authorized the Accreditation Committee to define the methods for establishing a program. On June 4, 1970, the committee presented "Museum Accreditation: A Report to the Profession," which outlined the basic principles and framework for AAM's museum accreditation program. Only at that time were the first applications accepted.

Over the years the program has been refined, emphasizing different issues that reflect the issues current to the museum profession: education and program evaluation (1980s), collection management (1990s), and ethics (2000s). Starting in 1986, museums have had to produce collections management policies. In 1996, AAM issued *Characteristics of an Accreditable Museum*, and the

following year an institutional code of ethics was required of any museum seeking accreditation. In 2005, AAM revised its standards, self-study questionnaire, and eligibility criteria. See the AAM Web site: <http://www.aam-us.org/museumresources/accred/index.cfm>.

Accreditation review is voluntary; museums can apply or withdraw at any time. The process is collaborative,

involving a dialogue among a museum's staff, governing authority and program staff; the peer reviewers; and the Accreditation Commission. It is also confidential; information provided by museums, and all correspondence and reports, is shared only with program staff, peer reviewers, and the commission.

Museum Architecture and Gallery Design

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Abstract

This entry reviews the history of the architecture of museum buildings in the Western world (Europe and the United States) where the museum as an institution originated. After a brief history of the institution, chronological sections are dedicated to the pre-eighteenth century when the gallery as a room type emerged in France and Italy, the eighteenth century during which basic architectural and spatial requirements of museums were begun to be worked out, the nineteenth century when the museum as a building type was developed, and the twentieth century and beyond when initially modernist museums rejected the nineteenth-century ideal types and at the turn to the current century eclectic and unique architectural designs, so-called signature buildings, became synonymous with museum architecture.

The museum as a distinct building type developed in such European countries as, for example, France, Germany, Italy, Spain, and the United Kingdom, as well, from the eighteenth century onwards, in countries outside Europe. The museum offers spaces for the assembly, display, study, appreciation, and storage of both natural and man-made objects. Typically, the former are taken out of their natural context whereas the latter are removed from their original purpose, either by chance or deliberation, respectively have never been put to any intended use. Again other objects, ranging from works of arts to dioramas, for example, are created specifically for a museum setting.

Historically, the museum derived from institutions of knowledge generation and learning. Architecturally, it stems from the former and also from spaces that housed collections of objects and artifacts. Accordingly, a museum accommodates the functions and activities of collecting, ordering, exhibiting, and commemorating, each determining aspects of its architecture. Over the course of time the form of the museum as an institution changed as its purpose broadened from being a private place of studying and learning to one that displayed objects amassed in the pursuit of wealth or expert scholarship to becoming a public institution visited by both experts and the general public for aesthetic enjoyment and educational purposes.

HISTORY OF THE INSTITUTION

Etymologically, the word museum stems from the Greek word *museion* which referred both to places of mythological religious worship and institutions of learning. The former were dedicated to the nine muses, goddesses and children of Zeus and Mnemosyne, the goddess of memory.^[1] Such places of worship, with or without a shrine, were typically set in nature like, for example, on a hill

called *museion*, opposite of the Acropolis in Athens, on Mount Helicon, on Mount Parnassus, and at Pieria below Mount Olympus, the birth place of the muses. The ancient Greek word also referred to institutions of learning and knowledge such as, for example, the *museion* in Alexandria that was established in the third century B.C. for scholars of the local academy.^[2]

Regardless of this shift in the meaning of the word “from the religious and ethical to the intellectual,”^[3] both types encouraged the contemplative withdrawal into the realms of either pastoral nature or a study. Spatially, the former was unconfined, whereas the latter was locatable in two ways. First, as an institution that surveyed and ordered the cultural resources of the city or society of which it was part; second, and more specifically, as the physical space where learning took place.^[4] Thus, the museum as “simultaneously an open and a closed concept” (p. 62)^[4] determined the development of the institution.

When pondering the universe a medieval scholar may have retreated, for example, into a studio (study). Comparably, *Kunstschrank* (studiolo or art cabinet), *Wunderkammer* (curiosity cabinet), and library accommodated for scholarly study collections of typical, rare, and unique objects and artifacts. These spaces became increasingly popular when during the sixteenth century taxonomy and classification emerged as strategies to grasp a world that, from the European point of view, expanded rapidly due to increased overseas trade and political, later also colonial and imperial, relationships with countries on other continents. Often located in domestic buildings, rooms for collections mediated between the world and the home, the public and the private (p. 69).^[4]

By the beginning of the seventeenth century the museum had moved from the studio to the galleria, “a space through which one passed, in contrast to the static principle of the spatially closed study” (p. 69).^[4] The

galleria as a room in which to display a large numbers of objects marked an important beginning of the museum as a distinct building type.

During the eighteenth century foundations of the early modern museum were laid with its twofold emphasis on an educational function and the aesthetic appreciation of the exhibits. The art historian Ernst Gombrich (1909–2001), for example, identified *prodesse* and *delectare*, to “profit and delight,”^[5] as the two main tasks of the early modern museum. The modern museum emerged when two earlier types of display, the treasure and the shrine, combined to form “the depository and the didactic display” (p. 456).^[5] The treasure, for example, royal collections, bolstered the social standing of the owner by overwhelming visitors with a wealth of objects (p. 452),^[5] whereas the shrine exhibited selectively objects that were “not simply rare but unique” (p. 453).^[5] When such collections were increasingly opened to the public, the treasure was transformed into a depository of “specimens to illustrate the rise of the arts” while the unique objects in the shrine now illustrated the end point of a “road to perfection” (p. 456).^[5] In short, the formation of a canon of Western art was decisive for the concept of the modern museum.

From the nineteenth century onwards, the museum became not only more visible within the public realm of the modern city but was increasingly accessible to the public at large, even if it was not always held in public, for example, municipal ownership. The latter was, in the twentieth century, often seen as a direct expression of the social function of the museum. For example, the museologist Alma S. Wittlin (1899–1990) argued in the mid-twentieth century for a shift away from the museum as an expert institution that was also accessible to an educated public towards an educational experience geared primarily at the general public. Wittlin stressed that the modern public museum should value, both primarily and equally, the two tasks of providing enjoyment and education.^[3]

Since its inception, the modern museum has oscillated between a didactic exhibition dictated by a canon or any other story and the display of exhibits for pure aesthetic contemplation. In the early twentieth century, many museums began to widen their purpose with public and educational outreach programs, which by the latter part of the century were complemented with entertainment oriented towards consumers and donors alike, and other events in an attempt to alleviate shortfalls in, especially, public funding and to counter charges of elitism. Nevertheless, museums are even today often surrounded by an aura of the extraordinary. This is not only expected by many visitors and donors, but is the tangible result of the “conflicting demands of the civic and hermetic notions” (p. 71)^[4] of the museum. The latter two have determined the historic development of this essential institution of Western culture and continue to influence concepts of the contemporary museum as it has been adopted worldwide. Museum architecture likewise operates between

potentially conflicting expectations. On the one hand, it should serve the museum as an institution that is dedicated to the exhibition and preservation of the objects in its custody. On the other hand, architects often wish to inscribe into the urban fabric with strong and powerful architectural images the importance of the museum as a civic institution.

HISTORY OF THE BUILDING TYPE

The double roots of the museum in collections of objects and in institutions of learning and knowledge have determined the development of museum architecture. From the former derived the gallery, a typical exhibition room of a museum, whereas the latter influenced the development of the general building type. Museum architecture touches primarily on solutions regarding the display of objects, the organization of exhibitions spaces and the increasingly complex functions of a museum, and the relation of the museum building to the wider built environment. Changing architectural styles were not always of great influence on the development of the building type. Similarly, while the foundation of national and other large museums were crucial for the history of the institution, their architecture was not necessarily of equal importance.

Pre-eighteenth Century

Already European antiquity knew of spaces dedicated to art works like the pinacotheca on the Acropolis in ancient Athens where paintings were displayed in order to honor the gods. Both Vitruvius (fl. later first century B.C) in the *Ten Books on Architecture* and Pliny the Elder (A.D 23 or A.D 24–79) in his *Natural History* referred to spaces like, for example, arcaded perambulatories that also accommodated sculptures or mural paintings.^[6] Vitruvius explained that because of their at times considerable length such spaces were often decorated with landscape murals and sculptures. Moreover, they were reserved for the domestic architecture of dignitaries with civic obligations, thus the art works were part of a decorative iconographical program focusing on the owner of the house.

During the Renaissance art was begun to be looked at, and accordingly collected, as art. One of the earliest examples of an architectural space created specifically for art exhibits was the Belvedere statue court (Cortile delle Statue) that the architect Donato Bramante (1443 or 1444–1514) designed for the Vatican during the papacy of Julius II (1503–1513).^[7] Located to the north of the Belvedere courtyard (Giardino della Pigna), statues were accommodated in niches along the perimeter walls, among them the famous Laocoön group that had been found in Rome in 1506. That the latter was placed in a direct sightline with the adjacent Belvedere Villa may indicate that one goal was to achieve the best possible display of

the sculptures (p. 66).^[7] While still open to the elements, the court was a marked improvement over the prevailing outdoor displays of ancient sculptures in gardens, loggias, and on terraces.^[8,9]

With centrally planned rooms and arcades like perambulatories, Antiquity furnished Renaissance architects with two types of spaces upon which rooms for sculptures and other works of art could be modeled. The top-lit, domed rotunda of the Hadrianic Pantheon (ca. A.D. 118–125) in ancient Rome was one model to which museum architects resorted time and again. It probably inspired the circular and top-lit building of the painter Peter Paul Rubens (1577–1640) in Antwerp where his collection of ancient sculptures was displayed (p. 112).^[8,9]

Arcaded spaces were evoked in the gallery, a room type of lasting importance for museum architecture. Nowadays, the word refers either to a separate room for a defined group of objects, or to a building dedicated to a class of objects or temporary exhibitions of, for example, contemporary art. Historically, the word gallery referenced a type of room, more long than wide, that in its modern appearance originated in France.^[10] Initially functioning as entrance halls and connecting corridors, galleries were used from the mid-fifteenth century onwards to accommodate collections of, for example, antlers, natural objects, or paintings (see appendix: Verzeichnis der im Text besprochenen Galerien).^[10] While they derived from ancient arcaded perambulatories as described by Vitruvius, they were enclosed to better suit the northern European climate. Ideally, they were lit by windows on both long sides, but where that was impossible landscape paintings substituted for the view of the surrounding environment.

Galleries developed into a standard element of European palace architecture, but it was in Italy from the sixteenth century onwards that they were also begun to be used for sculptures and paintings, not least due to the excellent provision of light between and opposite the exhibits (p. 3).^[3] A prominent example is the nearly 300 ft long gallery in Sabionetta designed ca. 1583–1584 by the Italian architect Vincenzo Scamozzi (1548–1616). It was initially decorated with frescoes of mercenaries, then redecorated with a collection of antlers, celebrating the hunting privilege of the owner, and finally used to exhibit a collection of ancient statues (p. 52).^[10] The Antiquarium in Munich was commissioned by Albert (Albrecht) V of Bavaria (1528–1579) for his sculpture collection.^[11] The tunnel-vaulted gallery that was rebuilt after its destruction in World War II was designed between 1569 and 1571 by Jacopo Strada (1515–1588), built to a plan amended by Bernhard and Simon Zwitzel, assisted by Wilhelm Egckl (ca. 1520–1588), and from 1586 onwards decorated by Friedrich Sustis (ca. 1540–ca. 1599) (p. 103).^[8] It was located on the ground floor of the new building with the library of Albert V on the upper level. Both these examples illustrate that works of art or any other exhibit displayed in these early galleries were typically integrated

into a decorative program whose iconography aimed at glorifying the gallery's owner (p. 60).^[10]

The conceptual origin of the museum in places of learning and knowledge influenced the beginnings of a distinct building type for the institution. Latest from the sixteenth century onwards contacts of European societies with those on other continents and an increasing awareness of the material heritage of earlier periods of European history resulted in a fascination with collecting unique, rare, and unusual objects and artifacts. Wunderkammern (curiosity cabinets) and Kunstkammern (art cabinets) encapsulated in visible and tangible form the known universe in order to allow scientific inquiry and study.^[12] One of the earliest purpose-designed buildings for a collection of this kind was Albert V's new Marstall in Munich which also housed the Kunstkammer. Shortly before he worked on the Antiquarium, discussed above, Egckl had built in 1563–1567 this new edifice (later the Alte Münze) around an open quadrangle with arcaded, open corridors that gave access to the rooms on each level. The art chamber's content was displayed on tables, in cupboards, and hung from the walls in large galleries that stretched around the courtyard on the third level. Rooms for valuable objects were separated in the corners of the quadrangle.^[13,14]

Possibly the world's oldest, purpose-designed public museum building was begun in 1679 and opened in 1683 in Oxford, England, for the Ashmolean museum; today it accommodates the Museum of the History of Science. The museum's origin was a universal collection of natural objects and artifacts that Elias Ashmole (1617–1692), an antiquarian, had donated to the University of Oxford after it had originally been amassed by the naturalist John Tradescant, the older (1590–1638), and his son. Installed on the top floor of the new building, the display was supplemented with a lecture room on the ground floor and laboratories in the basement. The building, whose design has been ascribed to either Thomas Wood (1664 or 1665–1695) or Christopher Wren (1632–1723),^[15] is of oblong, rectangular shape which ensured gallery proportions for the exhibition space.

Eighteenth Century

At the outset of the eighteenth century one of the earliest architectural plans for a new museum known to us was published in a 1704 essay on an ideal "rarity chamber" for a universal collection of art, curiosities, and natural objects.^[16] Art historians have ascribed the pamphlet to the scholar and architect Leonhard Christoph Sturm (1669–1719) (p. 104),^[8] (p. 114).^[9,17] More recently it has been ascribed to Paul Jacob Marperger (1656–1730).^[18] This pamphlet stands in the tradition of writings about curiosity cabinets, art cabinets, and museums that, in the case of the German-speaking countries, for example, stretches back to the 1565 publication *Inscriptiones vel tituli teatri amplissimi* by Samuel van Quiccheberg

(1529–1567); a book written in close connection with the establishment of the *Kunstkammer* in Munich (p. 336).^[17,19] The 1704 essay was illustrated with a plan that showed the ground floor of a three-storey, rectangular building surrounded by a botanical garden, an orangery with foreign plants, and a small zoo of foreign animals. The design of the museum is one of the earliest that assigned separate rooms to different classes of exhibits instead of mixing them in one gallery (p. 114).^[9] The relation between exhibition spaces and exhibits was also addressed by recommending a restrained interior decoration that would not conflict with the exhibits. The character of the objects should determine the display which should follow the principles of conservation, good visibility, scientific order, and aesthetic effect (pp. 336–338).^[17]

Other ideal museum designs followed. In 1759, Count Francesco Algarotti (1712–1764) described a proposed new museum for Saxony as “a square building with a large courtyard and in each range a Corinthian loggia and one room on either side of it. These eight galleries lead into four corner rooms, each lit by a small dome. A large dome is above the centre of each range lighting the principle room behind the loggia (p. 104).”^[8]

The scheme combined galleries along the four sides of a courtyard, each of them divided into two separate units by centrally located rooms. The latter were modeled on the Roman Pantheon and accessible through a columned portico or “Corinthian loggia” as the count had called them (p. 114).^[9]

This courtyard plan was for a long time a favorite model for ideal museum designs. A variation inscribed into the larger square a Greek cross with a central room at the crossing of the four arms which, in turn, lead to the circumferential galleries and thus creating four smaller courtyards within the larger quadrangle. This addition increased both gallery space and rooms to accommodate different museums and related institutions like libraries in a single building. For example, the designs with which Jacques-Pierre Gisors (1755–1818) and François-Jacques Delannoy (1755–1835) won in 1778–1779 the Prix de Rome competitions of the French Académie d’Architecture followed this model. Likewise, Étienne-Louis Boullée (1728–1799) designed an ideal museum in 1783 that adopted the basic pattern of a Greek cross inscribed into a square. Envisioned as a multifunctional institution including an art museum, a natural history museum, a print room, a library, and a national monument with statues of French heroes underneath the central dome, the boldness of Boullée’s undecorated architecture and its gargantuan size has proved attractive to many architects ever since. Jean-Nicolas-Louis Durand (1760–1834), another French architect, developed this type of ideal museum into a more practical solution. His *Précis des leçons d’architecture* (1802–1805) included a general design for a museum that was adaptable in size and exact configuration to varying circumstances.^[20]

Throughout the eighteenth century important architectural developments also happened on the smaller scale of exhibition spaces and galleries, especially with regard to, first, the relationship between the conceptual order of the displayed objects and the spatial order of the exhibitions rooms, and, second, the architectural settings of exhibits within individual rooms. The first point arose because the integration of objects into decorative schemes may have become overlaid with conceptually ordered displays that emphasized, for example, thematic, formal, and aesthetic principles. The exhibition of sculptures in the gallery spaces of the Villa Albani in Rome, commissioned by Cardinal Alessandro Albani (1692–1779) in the 1740s and completed in the 1760s to a design by architect Carlo Marchionni (1702–1786), was organized along iconographic-thematic principles. These were conceived by art historian Johann Joachim Winckelmann (1717–1768) who grouped together sculptures of the same subject matter (p. 114).^[9] Thus the architectural divisions of the exhibition spaces into a sequence of larger and smaller rooms acquired a new importance as the thematic groups of exhibits occupied separate spaces. Beside the art historical logic of such displays, the architecturally interesting issue is the relationship between the spatial sequence of rooms in a gallery or a museum, and the ideal order—formal, aesthetic, thematic and, later, chronological,—in which the exhibits were displayed and, presumably, to be viewed. The plans of the gallery (1767–ca. 1780) at Newby Hall, Yorkshire, England, and of the Museo Pio-Clementino (from 1770 onwards) at the Vatican are exemplary illustrations of this important architectural-museological issue. Both buildings are of vast difference in scale, the English gallery being an annex to a private house whereas the Roman example was an instrument of Papal power with regard to size and ambitions. Nevertheless, architecturally speaking, both buildings center on a circular room in which important exhibits were shown.

Newby Hall’s gallery stands in the tradition of small, private art galleries, a distinct British contribution to museum architecture.^[21] The architect Robert Adam (1728–1792) extended the main house with a gallery for antique sculptures. The focus was a Pantheon-like rotunda—similar to a circular top-lit sculpture gallery Adam had designed for Kedleston Hall (1758–1763), Derbyshire, England—that was flanked at either side by a square room, a symmetrical arrangement that made the circular room to the center of the plan while the small size of the entire extension kept subtle this hierarchy.

This was different in the case of the Museo Pio-Clementino that was added to the Vatican by the architects Michelangelo Simonetti (1724–1787) and, later, Giuseppe Camporesi (1763–1822). To the irregular site the architects responded with a series of spaces, each of a distinct geometric form like, for example, a Greek cross, a rotunda, a hexagon, squares, and rectangles, that wrapped around the east, north, and west side of the Belvedere

sculpture court. The new range was originally entered at the north-west corner of the Belvedere courtyard (Giardino della Pigna). From there visitors moved upwards on a grand staircase, built to a design by Simonetti, and towards one of the most impressive rooms of the new museum, the rotunda where sculptures of deities were exhibited. All other art works were arranged thematically in the following galleries. Because the museum was a linear, though irregular sequence of rooms, the conceptual relationship between the latter and the exhibits was both a curatorial and an architectural issue. For example, with the addition of the new galleries, the Belvedere statue court, that had also been remodeled by Simonetti in 1773, was now located at the end of the concourse, accordingly it could be considered either as the highlight of the museum or as its appendix.

The Museo Pio-Clementino was also remarkable for the period design of the interior of the galleries whose neoclassical style alluded to a unity between the ancient exhibits and their contemporary architectural setting. The latter aimed at evoking broadly classical antiquity including original antique Roman mosaics on the floor of, for example, the Rotunda room. A comparable idea of a period setting for exhibits also determined the short-lived Musée des Monuments Français that existed from 1796 until 1816. There the painter Alexandre(-Marie) Lenoir (1762–1839) amassed medieval funeral monuments and other, mainly religious objects that were displayed in a chronological order in a thirteenth-century monastery in Paris.^[8] In this case the exhibition spaces were not consciously designed as period rooms but were in a building from the same period as many of the exhibits; thus the latter and the architectural setting interacted particularly closely with each other.

During the eighteenth century some of Europe's best-known museums were founded, some in existing buildings, others in newly erected ones. The Musei Capitolini in Rome was opened to the public in 1735, followed by the Galleria degli Uffizi in Florence in 1743, though the origins of both museums go back much further. The British Museum, the world's first publicly owned museum, was founded in 1753 by an act of Parliament that acquired for the nation the collection of Hans Sloane (1660–1753) that comprised both objects that illustrated natural history and artificialia. The museum opened in Montagu House, a seventeenth-century manor house in Bloomsbury, London, in 1759. In Vienna the Kaiserliche Gemäldegalerie was established in the Upper Belvedere palace (1717–1724) designed by Johann Lukas von Hildebrandt (1668–1745) in 1781. Before that some of the paintings had been displayed in the adapted Stallburg, a stable from before the mid-seventeenth century.^[22]

The Louvre in Paris that opened in 1793, occupied a royal palace whose origin stretched back to the twelfth century. Already during the seventeenth century works of arts were shown in the Louvre, for example, the Académie

Royale de Peinture et de Sculpture's annual exhibition in the Grande Galerie that had been built between 1595 and 1610 as a connecting corridor. From the mid-eighteenth century onwards these shows were located in the Salon Carré. These two spaces became the germ cells of the Louvre when it was reconceived towards the end of the eighteenth century as the nation's premier museum for works of art. Architecturally, the Louvre is an example of a palace adapted to its new purpose, but regardless, the interior of its galleries influenced many later museums. Already in 1789 top lighting had been installed in the Salon Carré, arguably one of the best light provisions for picture galleries. The painter Hubert Robert (1733–1808) depicted in 1796 also the Grande Galerie with skylights, a proposal that was possibly derived from a ceiling design in a Boullée design for a national library (1784). The gallery, however, had to rely on high sidelighting until 1938 (p. 109).^[8] A new grand staircase leading to the galleries and the neoclassical redecoration (1805–1810) of the Grande Galerie by the architects Charles Percier(-Bassant) (1764–1838) and Pierre-François-Léonard Fontaine (1762–1853) were probably inspired by the Museo Pio-Clementino.

New museum buildings were, for example, erected in St. Petersburg, Russia, in Kassel, Landgraviate of Hesse-Kassel, Germany, and in Madrid, Spain. The Kunstkamera (1718–1734) in St. Petersburg housed both Peter the Great's royal collections of natural and artificial objects, and the library of the Academy of Science.^[23–25] The Baroque design by the architect Georg Johann Mattarnov (died 1719) consisted of two oblong, three-storey tall wings to either side of a tower. At the far ends smaller rooms were located followed by galleries in the eastern wing and the library in the western one. The central tower accommodated an anatomical lecture theater and observatories that included a wooden globe (Germany, sixteenth century) with a painted map of the world on the outside and one of the firmaments on the inside. Conceptually, the Kunstkamera stood still in the tradition of curiosity cabinets.

This was also the case in Kassel where the enlightened ruler Landgrave Frederick II (1720–1785) commissioned the Museum Fridericianum (1769–1779), one of the earliest purpose-designed public museum buildings in continental Europe. It combined art galleries with ones exhibiting artifacts, including cork models of famous buildings, and a library.^[26] The architect was Simon Louis du Ry (1726–1796). Today, this museum is best known as one of the venues of Documenta, the international exhibition of contemporary art.

In 1785, Juan de Villanueva (1739–1811) began to design a new natural history museum in Madrid which, before its inauguration in 1819, was already rededicated as art museum and later named Museo Nacional del Prado. The neoclassical design is based on an additive architectural design principle whereby suitable geometric forms

are selected according to the different functions of various rooms and then brought together in a formal overall composition much like, for example, Durand's schematic museum design. In Madrid, a long, narrow gallery spans between two square end pavilions that is bisected in the center by a perpendicular gallery. The main entrance was in one of the end pavilions from where visitors passed through a skylit circular rotunda. The museums in St. Petersburg, Kassel, and Madrid were physically separated from the palaces of their founders thus making visible their foundation in ideas of the Enlightenment, even though they all were of royal, imperial, or courtly origin.

This was different in the case of museums outside Europe that began to be established in the eighteenth century. Often, they were part of exploratory or colonizing efforts. For example, in North America one of the earliest collections of plant specimen and natural objects was founded by the Charleston Library Society, South Carolina in 1773,^[27,28] obviously driven by the wish to become familiar with the flora and fauna of the new continent. Other museums were part of the attempts to establish a new society by transplanting elements of the European ones. That museums like, for example, the American Museum in Philadelphia—founded from scratch by Pierre Eugene du Simitière (1737–1784) in 1782 and sold upon his death (p. 7)^[28]—were considered to be part of the new society speaks about their popularity. Purpose-designed buildings were apparently erected only in the next century when, for example, the Pennsylvania Academy of the Fine Arts in Philadelphia occupied in 1806 new premises in which a collection of plaster casts was exhibited. The brick cube with a shallow dome, slightly protruding corners, and a door way above which a carved American eagle hovered was designed by John Dorsey (ca. 1759–1821) in a Federal style.^[29]

Nineteenth Century

While during the eighteenth century the architectural basics of the museum as a distinct building type were developed, the next century saw their perfection and widespread application.

Architecturally, the century began with three buildings that inspired museum architecture for years to come: the Glyptothek (1816–1830, restored 1972), a sculpture gallery, and the (Alte) Pinakothek (1825–1836, restored 1945), a painting gallery, both in Munich, Bavaria, to designs by Leo von Klenze (1784–1864), and the (Altes) Museum (1823–1830, restored 1960s, sculptures and paintings) in Berlin by Karl Friedrich Schinkel (1781–1841). The Glyptothek was characterized by an exceptionally well-conceived unity between architecture and exhibits, and a chronological display that was mirrored architecturally in a rigidly set route through suites of galleries around a courtyard. Period rooms dominated the settings of sculptures that stood, for example, in rows

along walls as to outline the silhouettes while emphasizing the axes of the rooms, were placed as focal points at the end vistas through galleries, or were the center point of individual rooms.

The Altes Museum intertwined skillfully the public realm with the museum space. Schinkel designed a free-standing cube facing the Berlin Stadtschloß (demolished 1950) across the open space of the Lustgarten. A broad stair approaches a screen of double-height columns behind which the entrance is located, a master piece of spatial complexity that, in its original form, led visitors into the building with one flight of steps, took them out again with the next after which the top landing was reached that, from underneath the roof, directed the gaze back towards the city beyond the columns, a view that is now altered by glass panes placed between the columns. Inside, this view was matched by the sublimity of a domed, top-lit, double-height rotunda with a column-supported gallery on which sculptures stood. To either side of this room galleries wrapped around two open courtyards offering strictly sequential routes on each floor.

The Alte Pinakothek revolutionized the spatial organization of galleries. (Fig. 1) The lower floor of the long and narrow building with two slightly protruding end wings was primarily for scholars and offered offices, a library, a print room, and storage space. The publicly accessible upper floor organized circulation spaces and galleries in three parallel bands. A narrow loggia ran from east to west along the southern length of the building. The main band arranged top-lit galleries of slightly different lengths in a rhythm of a-b-a-c-a-b-a that singled out subtly the center-most room. U-shaped cabinets for small paintings opened towards the northern façade in the third band. This arrangement was overlaid with a network of possibly routes that connected axially the galleries with each other in order to mirror in plan the chronological display by schools, while a multitude of north–south links allowed for sudden cross moves, “the spice of museum visits” (p. 138).^[9]

Thus early in the century two principle museum plans were available. One, following Durand's ideal museum plan, organized exhibition spaces around one or two courtyards with usually a central, architecturally highlighted space. The other plan was a long, shallow building, typically with projecting pavilions in the center and at both ends. Both types utilized the compositional Beaux-Arts method and were also influential regarding their architectural styles, usually neoclassical or versions of Renaissance styles which, in turn, had revived Greco-Roman architecture. Moreover, they set standards for a civic monumentality of museum buildings. Often, the latter were elevated by broad flights of stairs leading to main entrances in facades that evoked either ancient temples or palatial edifices as exemplified in the forecourt of the new British Museum (1823–1848) by Robert Smirke (1786–1867).

The two basic types differed regarding land use, expendability, and lighting. The courtyard model made

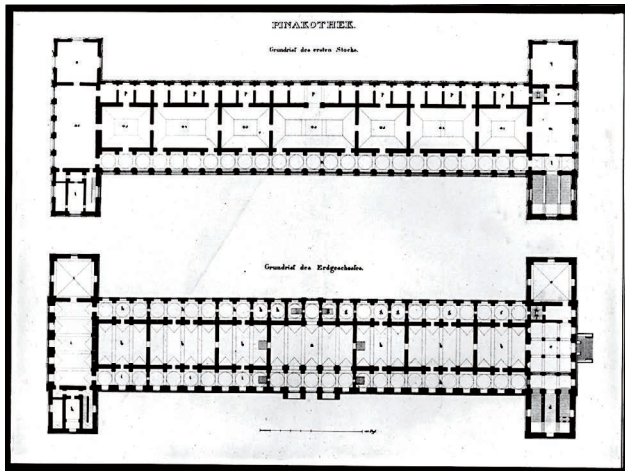


Fig. 1 Leo von Klenze (1784–1864), floor plans of the lower level (bottom) and upper level (top) of the Alte Pinakothek Munich as inaugurated in 1836. The main entrance is at the right end of the lower level. The upper level shows the division into three parallel bands of exhibition rooms and circulation spaces. **Source:** Photograph courtesy of Bayerische Staatsgemäldesammlungen, Alte Pinakothek Munich, Germany.

efficient use of building plots and adding new courts created more galleries. The free-standing, shallow buildings of the other type assured both good light supply on the long sides of, for example, a painting gallery, and excellent light penetration of the interior. The latter became less important with the increased use of iron and glass lanterns from the eighteenth century onwards. That top lighting was beneficial to display works of arts antiquity already knew. The principle had also been employed to light the niches (*gabinetti*) of the remodeled Belvedere statue court (1773) and in some galleries of the Louvre. The Dulwich Picture Gallery (1811–1814), London, by John Soane (1753–1837), another fine English example of a small art gallery, and the Pinakothek, that proudly displayed lanterns on the roof, were successful modern applications of roof lanterns to exhibition spaces. Until then, galleries had mainly been lit through conventional windows or clerestory windows that provided diagonal light from high above.^[30]

At the beginning of the century, only very few European cities like, for example, London, Paris, Rome, and Vienna, were the location of important, even national, museums. By the end of the century, the number of museums had multiplied as the example of the United Kingdom shows. To the 59 museums that existed in 1850, 259 more had been added by 1914 (p. 136).^[31] Museums were also established on continents and in countries that were in contact with or colonized by Western powers like, for example, India (Indian Museum, Kolkata, 1814, whose origin goes back to the Asiatic Society of Bengal from 1784), Brazil, (Royal School of Fine Arts, today Escola Nacional de Belas Artes, Rio de Janeiro, 1816, that exhibited a painting collection),

and Japan (Museum of the Ministry of Education, today the Tokyo National Museum, 1872).

Architecturally consequential was the adaptation of museum buildings to three developments—growth, specialization, and spatial concentration—that affected museums during the later century. Individual museums grew because with the adoption of didactic displays, chronological or thematic, the need to expand arose as any conceptual order could always be made more comprehensive if allegedly existing gaps in a collection were filled (p. 457).^[5] As a response to this growth but also to the increasing separation of individual disciplines in the sciences and the humanities, many museums began to specialize by focusing on select classes of objects. Museums exhibiting together natural objects and man-made artifacts continued to exist, although often older universal collection were dissolved as the dispersal of the Danish Royal Kunstkammer (1650) between ten different museums shows.^[31] Regardless, the museum complex, a spatial concentration of different types of museums in the immediate vicinity of each other, gave new spatial form to the idea of a universal collection.

A prime example of these interconnected developments is the Victoria and Albert Museum in London, one of the many museums established from mid-century onwards that were dedicated to the applied arts, their role in modern production, and their relationships with the sciences.^[32] A predecessor was the Parisian Hôtel de Cluny that had opened in 1843 with an exhibition of Medieval and Renaissance everyday objects in historicizing settings. Rooted in the contemporary debate about the relationship of the arts and the sciences in an age of capitalism, one goal of these museums was the education of artisans, workers, and citizens in the aesthetics and production of modern commodities. Today's Victoria and Albert Museum was founded as the Museum of Manufactures the year after the 1851 Great Exhibition of the Works of Industry of All Nations in London, opened on its current site as the South Kensington Museum in 1857, and received its current name in 1899. From its inception onwards, the museum was closely allied with a government-initiated school of design.

The museum's early architectural history was intertwined with the rise of iron as a new structural material. Initially, the museum occupied a prefabricated structure, clad with corrugated metal, whose iron and glass roof hovered visibly over the interior spaces. This utilitarian building was elevated to architecture proper in 1862 by two iron and glass exhibition courts that borrowed from church buildings their internal arrangements of central naves flanked by side naves. Another possible source was the iron and glass structure that covered the exhibition court of the new Oxford University Museum (begun 1855), completed 2 years earlier by the architects Thomas (Newenham) Deane (1828–1899) and Benjamin Woodward (1816–1861).^[33] In Oxford, the iron structure was

integrated into a Victorian Gothic building, in London it was designed in a northern Italian Renaissance style.

This pointed towards a second aspect of the Victoria and Albert museum's architecture viz. that it was a sequence of increasingly formal buildings. The next extension from 1869, another Italianate design by the engineer Francis Fowke (1823–1865), added traditional elements of museum architecture such as, for example, an open courtyard and a temple-like entrance pavilion that included one of the first refreshment rooms ever installed in a museum.

The architecture of this type of museum was integral to its educational mission. In the Oxford University Museum, that hosted science departments, ornaments on structural details were derived from plant forms and shafts of columns were hewn from various British stones. In London, the exterior featured artistically designed terracotta panels, and the interior, for example, mosaics portraying famous artists and murals by Frederic Leighton (1830–1896) depicting the industrial arts at times of war and peace.^[34] Instructive decorations had long been a feature of contemporary museum buildings. For example, in the loggia of the Munich Pinakothek murals by Peter (Joseph) von Cornelius (1783–1867) presented the history of painting as a preparation for the true art inside the galleries. In museums of applied art and sciences such details matured from decoration to practical demonstrations of contemporary skills and proclamations of the anticipated merger of arts and sciences. The envisioned renewal of this cooperation was not confined to the small scale of symbolic architectural details, but was also made visible with the museum complex on the larger scale of the modern metropolis.

Specialization did not reject the universal museum as a means to both explore and interpret the world (p. 61).^[4] Rather, this idea shifted to a spatial concentration of different museums and educational institutions in the immediate vicinity of each other. In London, the Victoria and Albert Museum was complemented by the Museum of Natural History and the Science Museum. The former was an offspring of the British Museum, housed in a German-Romanesque building (1872–1881) by Alfred Waterhouse (1830–1905). The latter had originally been part of the Victoria and Albert Museum, but was separated in 1909 when the older museum expanded into a new building (1899–1909) by Aston Webb (1849–1930) (p. 131).^[9] This cluster in South Kensington comprised also teaching and bibliographical institutions like, for example, the Royal School of Mines, founded in 1851, and the Imperial Institute from 1887, an information brokerage on and for the British Empire. Comparable clusters were formed in other cities. In Vienna, the Naturhistorische Museum (1871–1889) and the Kunsthistorische Museum (1871–1891), both designs by Gottfried Semper (1803–1879) and Carl von Hasenauer (1833–94), faced each other in front of the Hofburg in a symbolic juxtaposition of the arts and nature, respectively, natural sciences. In Berlin, the museum island, a concentration of mainly

art museums to the north of the Altes Museum, originated in the idea of Friedrich Wilhelm IV of Prussia (1795–1861) to establish a centre of the arts and the sciences that encompassed the neighboring university founded by Wilhelm von Humboldt (1767–1835) in 1810.

Clusters of museums and educational institutions were also an important element of town planning and planned urban expansion. In 1847, Benjamin Disraeli demanded that vast cities like London needed a forum or Acropolis of cultural institutions that would ennoble “the metropolitan mass.”^[35] This was echoed, with a different pitch, in the early 1880s by Thomas Cogan Horsfall (1844–1932), director of his own Manchester Art Museum (1877–1953), who proposed to bring with art museums beauty to urban quarters, especially to working class areas.^[36] This town planning aspect stretched back in modern times at least to the eighteenth-century Museum Fridericianum that stood proudly on a new public square in Kassel. The grounds for the new Glyptothek and the new Pinakothek in Munich had been outside the city limits, while the South Kensington Museum on the edge of London initiated calls for cheap public transport (pp. 29–30).^[32] These contributed to the opening of a station in South Kensington in 1868 by the Metropolitan Railway.

The educational aspect of museums fell on particular fertile ground in the United States where, as already noted, early natural history museums, for example, had a practical role in the settlement efforts. Similarly, the educational and training benefits of art museums were emphasized over collecting art for purely aesthetic enjoyment (p. 37).^[32] Accordingly, many museums were initiated by historical societies, libraries, art schools, and colleges, occasionally in collaboration with a private donor. For example, at Yale College, Newhaven, Connecticut, the Trumbull Gallery was named after architect, artist, and diplomat John Trumbull (1756–1843) who had given the art and designed the Greek Revival style building (1831–1832, destroyed 1901) (p. 24).^[29] After the South Kensington model of art education and training in combination with a museum had become known widely, for example, through the 1876 Centennial Exposition at Philadelphia (p. 38),^[32] comparable museums began to appear in the United States. In Boston, MA, for example, the Museum of Fine Arts that was chartered in 1870 moved into its first building in Copley Square in 1876. The architects, John Hubbard Sturgis (1834–1888) and Charles Brigham (1841–1925) designed a Neo-Gothic brick building (1870–1876, enlarged 1879 and 1890, destroyed) that, while differing in style, took its cues from the London predecessor including, for example, decorative façade panels, instructive interior elements like decorative cast iron stairs, and the installation of entire historic rooms as a backdrop for period exhibits (pp. 29–30).^[32]

Within a matter of years the museum had grown out of its premises and, together with changed ideas about museum display that put greater focus on the aesthetic

aspect of exhibits and collections; this made necessary a move to another site. Even though the new building, a Beaux-Arts design by Guy Lowell (1870–1927), was only begun in 1906, the plan sums up nineteenth-century thinking about museum buildings. The formal forecourt with projecting wings and the classical style speak of the civic monumentality more pronounced than the old building. The master plan evolved around three design principles: The larger building is composed from smaller units, some with their own entrances, for individual departments and collections, a differentiation between levels according to usage with the public galleries on the upper level and services for scholars on the lower—an idea that von Klenze had already introduced in the Munich Pinakothek—and oblique light through windows as the major light source supplemented by skylights (pp. 41–42).^[29]

Twentieth Century and Beyond

The two basic museum types of the nineteenth century never disappeared from the repertoire of possible museum buildings. As late as 1923 the Beaux-Arts inspired plan was considered to be standard.^[37] The National Gallery of Art (1936–1941), Washington, D.C., by John Russell Pope (1873–1937), proved that the oblong, shallow building was also transferable to a different period and tasks. Many early twentieth-century museums were mergers and variations of these two types (pp. 38–41),^[29] though they were faulted for formalism in plan and elevation. For example, the placement of windows according to style rather than to lighting needs was criticized as was the fact that different functions like moving through a gallery and sojourning in front of an exhibit were not separated spatially. Many museum ideas of especially the first half of the twentieth century aimed to overcome such alleged functional deficiencies with contemporary, modernist designs that would also embody the *Zeitgeist*.

With “The Museum of Tomorrow” (1929) the architect and planner Clarence Stein (1882–1975) adapted the museum to American metropolitan architecture by designing a skyscraper that would accommodate better both growing collections and the different needs of scholars and the general public.^[38] Scholarly collections were placed in galleries along the perimeter of the octagonal building, while public galleries spanned across a central courtyard like spokes of a wheel. Different geographical areas and historical periods were assigned to individual floors that, vertically stacked, made the tower expressive of the conceptual order but created also a rigid spatial sequence. A comparable correspondence determined the ideal museum the architect Le Corbusier (Charles-Edouard Jeanneret, 1887–1965) produced in 1929 for the Mundaneum, a world institute of bibliographical information.^[39] A pyramid accommodated a spiral of three parallel naves that wound downwards and symbolized the “chain of knowledge.” Both examples drew on the

Outlook Tower (1895 onwards), Edinburgh, Scotland, of the biologist and city planner Patrick Geddes (1854–1932), a civic museum that embedded local history into widening geographical areas on each lower floor, an idea Geddes had transferred to a design for an outlook tower in a skyscraper when he visited the United States in 1923.^[40]

Stein and Le Corbusier’s ideal museums made visible Modernism’s comprehensive claim to understanding and designing the totality of modern human life; an assumption that was rooted in a progressive view of history as leading inevitably to Modernism. Modernist museum architecture rejected historical models for the building type, but often adopted the spatially fixed, didactic route through an exhibition. The Museum of Modern Art in New York, that was founded in 1929 and moved in 1939 into a new building to a design by Philip L. Godwin (1885–1958) and Edward Durrell Stone (1902–1978), told the birth of Modernism as a chronological sequence of modern art movements, one following the other, similar to the suite of galleries that mirrored this narrative; a spatial dogmatism that was adhered to as late as 1984 when the architect Ieoh Ming Pei (born 1917) expanded the museum. Similarly the Solomon R. Guggenheim Museum (1943–1959) in New York by Frank Lloyd (Lincoln) Wright (1867–1959) where visitors walk down a ramp that circles around a central atrium. Changing exhibitions are mounted in bays along the perimeter wall. Upward- or downward-directed views across the circular space towards other exhibition cabinets are possible, cross moves are not.

The opposite idea of maximum spatial liberty for both curator and visitor guided the “Museum for a Small City” (1942) by German–American architect Ludwig Mies van der Rohe (1886–1969), a design for a one-storey glass box underneath a flat roof and very few permanent interior installations. The potential difficulties such a museum space poses is demonstrated by Mies van der Rohe’s Neue Nationalgalerie (1962–1968) in Berlin where the hall for temporary exhibitions on the upper entrance level suffers from an oversupply of light due to its four all-glass walls. Already at the time of the inaugural exhibition in 1968 floor-to-ceiling curtains were employed to control the flow of light. This reduced the building’s transparency which, however, is important for the experience of the space. Consequently, nowadays, the upper-level exhibition hall is mostly used as a grand foyer for the rather cramped permanent exhibition on the lower floor of the building. Regardless, the “museum without walls” (p. 53)^[29] developed into an important type of exhibition space for the twentieth century.

Yet it was not the ideal museum envisioned as a modernist glass box but the windowless, artificially lit, so-called white box that liberated the arrangement of a display from almost all architectural restraints. Already the Victoria and Albert Museum had experimented in the 1850s with gas lights to extend the opening hours into

the evenings. The collection of the New York Museum of Modern Art was one of the first that was displayed in white boxes, electrically lit, and without direct visual connection to the outside. Not all of these boxes were of purist design. The Yale University Art Gallery (1951–1953), Newhaven, CT, by the architect Louis I(sador). Kahn (1901–74) had a windowless southern façade towards the street that was balanced with a windowed northern façade. Inside, art objects were exhibited under exposed concrete ceilings. Kahn's other two museums, the Kimbell Art Museum (1966–1972), Forth Worth, Texas, and the Yale Center for British Art (1969–1977), Newhaven, broke up progressively the ideal modernist box. The interior of the museum in Texas was covered by narrow vaults, sliced open along the apex in order to let natural light brush down the inner curved surfaces. The second of Kahn's Newhaven projects works with covered atrium spaces that act as light wells and more traditional top lighting.

Flexible, nondetermined exhibition spaces were seen as an opportunity to redefine the relationship between the exhibits, their creator, and the visitor as it was envisioned in exemplary manner by the "open museum" concept of Pontus Hultén (1924–2006), director (1973–1981) of the Musée national d'art moderne, a part of the Centre national d'art et de culture Georges Pompidou in Paris.^[41] The architects Renzo Piano (born 1937) and Richard Rogers (born 1933) realized this idea with a building (1971–1977) that sports its structural systems and technical infrastructure on the outside—color-coded as if it were a machine—while the inside offered, at least initially, open plans on the exhibition floors accessible through purely functional entrances on ground level.

Already earlier museums had avoided overly representative entrances, or abandoned them entirely. The brief flight of stairs up the main entrance at the east end of Munich's Pinakothek was inconspicuously located which was perhaps a pointer to the museum's rational provision of various paths through the exhibition. The few steps at the 1909 building of London's Victoria and Albert Museum invited without much intimidation into a space possibly outside of the most visitors' everyday life. The New York Museum of Modern Art could be entered unceremoniously by slipping directly inside from the pavement. The entrances of the Centre Georges Pompidou were equally functional, but regardless of all attempts to popularize museums, the building was criticized as an element of an urban renewal project that also demolished Les Halles, a nineteenth-century wholesale market. This criticism was part of the postmodern questioning of the dominance of modern architecture to which museum architects responded by citing historic museum buildings, proposing to rescue historic buildings by installing museums, and developing alternative architectural models for the institution.

The turn to historic museum buildings is exemplified by the Neue Staatsgalerie (1977–1984) in Stuttgart,

Germany, designed by the architects James (Frazer) Stirling (1926–1992) and Michael Wilford (born 1938). The building relied on traditional suites of galleries, referenced historical lighting principles like, for example, the ones used in Soane's Dulwich Picture Gallery, and was organized around a circular, open courtyard modeled on the rotunda of Berlin's Altes Museum. A public path cuts through the rotunda and thus balances any possible monumental or even so-called elitist reading of this space. Historic museum architecture was also cited in the Sainsbury Wing (1987–1991) of the National Gallery, London, by Robert Venturi (born 1925), John Rauch (born 1930), and Denise Scott Brown (born 1930) that replaced a modernist design that had attracted public condemnation by Prince Charles. Now a staircase in the tradition of the Museo Pio-Clementino and the Louvre rises to the upper floor with traditional top-lit galleries.

The use of existing buildings for museums added a new civic dimension to the institution as the older structures may have been monuments or had otherwise an important function for a community. Some of the many museums and galleries designed in Italy by the architect Carlo Scarpa (1906–1978) after the end of World War II in Europe preserved from final destruction ruined monuments of the country's history. In Verona, Scarpa carved the Museo Civico di Castelvecchio (1958–1965) out of an old castle by cutting occasionally even through historic walls in order to achieve a symbiotic relationship between the building and the exhibits. Later in the century, the reuse of buildings became more common that had not originally been intended for museums. Between 1980 and 1990, 13 museums were established along the embankment of the river Main in Frankfurt, Germany, to form a Museumsufer. Some occupied new buildings, some refurbished and enlarged historic private homes like, for example, the villa of the Museum für Angewandte Kunst (1982–1984) that was extended with white cubes by the architect Richard (Alan) Meier (born 1934), and the Deutsches Architekturmuseum (1979–1984) that the architect Oswald Matthias Ungers (1926–2007) designed as a house within a house. The scale was mostly domestic so as to match the art works in the case of art museums and to not disturb the urban design pattern of the embankment. From 1980 to 1986 the Paris train station Gare d'Orsay (1898–1900, architect Victor(-Alexandre-Frédéric) Laloux [1850–1937]), was transformed into the Musée d'Orsay by A.C.T. Architecture (Renaud Bardon (born 1942), Pierre Colboc, and Jean-Paul Philippon). The architect Gaetano Aulenti (born 1927) created the interior design for the exhibition of nineteenth-century art and applied art. While in this case the age of the building and exhibits corresponded, former industrial buildings were also attractive because of the contrasting environment they offered, for example, to contemporary installation artists. One of the earliest examples is the Neue Hallen für Kunst in Schaffhausen, Switzerland, a disused textile

factory (1912–1913) that the artist Urs Raussmüller remodeled from 1982 to 1983. Another abandoned industrial building, the monumental Bankside power station (1946–1970, architect Giles Gilbert Scott [1880–1960]) in London was transformed by the architects Jacques Herzog (born 1950) and Pierre De Meuron (born 1950) into the Tate Gallery of Modern Art (1998–2000). While the upper levels offer more conventionally sized gallery spaces, the gigantic former turbine hall challenges artists to conceive site-specific artworks on a scale previously unknown.

Architects also aimed at integrating new museums into cities in ways that made them less monumental. The architect Hans Hollein (born 1934) designed the Städtisches Museum Abteiberg (1972–1982) in Mönchengladbach, Germany, as an urban landscape that avoids most references to traditional museum buildings. Hollein conceived a three-level building that is entered from a platform on top of the highest level. Underneath, two levels of galleries follow a drop in the terrain ending at a museum garden at the lower end of the site. Manifold openings allow for views from the outside into the museum and vice versa, thus connecting directly the building with the urban environment. References to the city's industrial past in the architectural design establish another, more conceptual relationship. While this museum in Germany tried to overcome architecturally expressed civic monumentality, apparently perceived as intimidating, in favor of public accessibility, a later design by Hollein went a step further. In 1990, the architect won a competition for planning a Guggenheim Museum in Salzburg, Austria, whose three floors were to be cut into a mountain within the city limits and lit solely by transparent cones on the latter's top. The design did away with visible architectural links between the museum building and the urban environment and thus seems to question the validity of the historically important conceptual link between the city and the museum as a civic institution. This development, however, did not prevail as the possibly most famous museum of the later twentieth century, the Museo Guggenheim in Bilbao, Spain, is proudly displayed within the city's urban fabric. Like other branches, realized or planned, the Bilbao museum is part of a global expansion of the New York Guggenheim museum. On the local and regional level the museum was essential to a master plan to regenerate economically both the city and the Basque region. The museum's building, an assemblage of titanium sails and waves, was constructed between 1992 to 1997 to plans by the architect Frank O(wen). Gehry (born 1929).

The extraordinary architecture and the economic success of the completed project in Bilbao initiated many new museum buildings at the turn from the twentieth century to the twenty-first. Many institutions commissioned spectacular architectural designs—whose production was helped by ever more sophisticated computer-aided design software—that would function as signature buildings. For

example, the Milwaukee Art Museum, Wisconsin, asked architect and engineer Santiago Calatrava (born 1951) to design an extension that would increase the museum's visibility. The Quadracci Pavilion (1994–2001) is an engineering feat with two moveable wings that shade the vaulted glass roof of the 90 ft tall foyer, one of the mainly non-exhibition spaces that were added to the museum. A signature building with generous foyer space was also the goal of the Akron Art Museum, Ohio, that opened in 2007, after the architecture firm Coop Himmelb(l)au of Wolf D. Prix (born 1942) had won a competition in 2001. A three-storey hall is the heart of the extension that makes little gestures towards the old museum in Akron's former post office (1899). Many recent museum buildings feature such central foyer spaces whose size exceeds what is required for circulation purposes. These spaces cater to the needs of the museum as an economic institution as they help to control numerous visitors to blockbuster exhibitions, offer architecturally exciting environments for donor receptions, and generate possible rental income from private and business functions. Thus the signature building has changed the appearance of museum architecture by emphasizing, sometimes dramatically, a space that, however, has been an element of the museum building at least since Durand drew a circle at the center of his ideal museum plan and Schinkel realized the rotunda in the Berlin Museum.

CONCLUSION

Museums are institutions that are deeply rooted in Western civilization. A specific building type began to emerge the moment when the meaning of the museum changed from primarily being a private study to an exhibition space that was publicly accessible. During the eighteenth century architecturally fundamental question about the spatial organization of the museum were worked out, that the nineteenth century perfected in ideal types of museum buildings. The early twentieth century was dominated by a modernist reaction against these ideal museum types, whereas in the later century and the twenty-first century unique signature buildings inscribed visibly into the urban fabric the changed economic condition of museums.

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Museum Collecting and Collections

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Abstract

Collecting is a central activity to museums. Object-based learning is the underlying principle that museums use to tell their stories to the public through different media such as exhibits, programs, classes, books, and activities. Collecting in museums is usually directed by curators who conduct research, create new knowledge, and present their work through publications, exhibits, and programs. Traditionally, there has always been a tension in museums between saving objects primarily for research versus using objects in educational programs. In recent decades, this tension has become more complicated as a result of other trends relating to changing demographics, new laws, and evolving ethics. In the future, these trends may change how museums build collections.

INTRODUCTION

Museums today come in many sizes, specializations, and perspectives. Most major cities boast of having a number of museums. Art, history, and natural history museums are the most common types. They usually have well-developed audiences and constituents who know what kinds of experiences to expect when they enter the hallowed galleries. In recent decades, many cities, large and small, have developed children's or family museums. To paraphrase Peter Sterling, former director of the Indianapolis Children's Museum, "Children's museums are the only museums defined by audience rather than by subject." Beyond these well-established museums, many different, sometimes quirky, kinds of museums have been opened that focus on the collecting passions of a dedicated and usually wealthy founder or a passionate core group of supporters.

Without doubt, there are more museums and probably more kinds of museums than ever before. Today, over 3,000 of the estimated 17,500 museums in the United States are accredited by the American Association of Museums (AAM), the national organization that sets the standards for professionalism in the field. In addition, there are many other smaller museum organizations that have developed out of regional interests (Colorado Wyoming Association of Museums, CWAM; Mountain-Plains Museum Association, MPMA) or subjects (Museums West Consortium; Association of Science - Technology Centers, ASTC). All of these organizations strive to define practices that assure excellence in collecting practices and collection care, to support a positive working environment for staff, and to provide enjoyable and enriching experiences for visitors.

HISTORY

The idea of museums that provide educational benefits to the public can be traced to the Age of Enlightenment of the seventeenth century. Before that time, royal and noble houses sometimes accumulated objects that reflected the interests and accomplishments of the great names of the time. The collections might have provided personal satisfaction for the owner and have been shared with other royals and nobles, but educating the masses, certainly was not the purpose. Collections and their care were subject to the continuing interest and power of the owners. These collections have sometimes been called "cabinets of curiosities" to denote their rather whimsical and personal origins.^[1] Yet, it was precisely this curiosity about the exotic world being discovered by European explorers that started the museum movement which we know today.

Early American museums were part of this "cabinet of curiosities" tradition. Thomas Jefferson, Benjamin Franklin, and Charles Wilson Peale, among many others started personal collections, many of which became the founding collections of the great museums in Boston, Philadelphia, New York, and other early metropolitan areas.

THREE AGES OF MUSEUMS

In thinking about museum collecting in America since the beginning of the Republic, three "great ages" of museum evolution can be described: the age of collection, the age of exhibition, and the age of education. The first great age of this scheme, the "age of collecting," was part of the larger age of exploration that emanated from Europe. The New World, as it was called by the Europeans who came

here (understanding that it was not new to those people and cultures that were already here), was the source of great wonder, danger, and opportunity for the Europeans who came and saw a very different world from the one to which they were accustomed. The same wonder, danger, and opportunity must have faced the American cultures that were already here. However, that part of the story is beyond the scope of this entry.

Exploration and collecting go together. Many of the ocean going vessels that left Europe to traverse distant oceans and contact different peoples in search of trade and riches brought back examples of the exotic. Yet the quality of the accumulated collections depends on the training of the collector. Many cultural and natural history objects were picked up by the sailors and passengers on the early voyages to America. The first settlers undoubtedly obtained items from the indigenous people they encountered along the eastern coast. However, it is the rare item that has survived the last three centuries intact and with any information about its origins. During the same period, however, there were individuals who sought to systematically collect and document the new and exotic world in which they were living. These early scientists intended that their work and the objects they collected would be preserved for future generations.

Natural history included the rocks, minerals, fossils, plants, and animals of the new country. The indigenous peoples encountered along the way also were seen as part of nature. Many explorers primarily were interested in the potential wealth that might be obtained from finding gold or silver. Only slightly less important, but often forgotten today, were the riches offered by trees and plants that might have medical, ornamental, or commercial uses. Although economic opportunity may have been the main concern, many of the early expeditions included a scientist who recorded the country through which the expedition passed and the people met along the way. As these ventures expanded across the continent, natural historians were there recording new species with their drawings, descriptions, and preserved specimens. Frequently, artists were part of such expeditions to record the new finds. The works of Mark Catesby and John James Audubon are part of the early naturalist/artist tradition just as the images of Karl Bodmer and Le Page du Pratz recorded the people and customs they encountered. Recently, an excellent new version of Prince Maximilian's travel journals, written while exploring the American West in the early 1830s,^[2] has been published. This fine edition also includes excellent illustrations by Karl Bodmer who accompanied the Prince. The Prince and the artist also collected natural history specimens as well as clothing, tools, weapons, and other objects from the American Indian cultures they encountered.

The great age of exploration and collecting continued throughout the eighteenth and nineteenth centuries. In

many institutions, systematic collecting continues today. Many great museums, especially in the seafaring countries of Europe, were founded in the age of exploration to care for and to present the odd and curious relics to local audiences. Oxford University's Ashmolean Museum, founded in 1683, was the first institution in Europe to call itself a museum.^[3] Within this period, wealthy benefactors, sometimes private individuals and corporate capitalists, as well as government agencies sponsored expeditions of discovery and collecting on the North American continent and beyond. As earlier generations of nobles gained a degree of status and fame from their personal collections, so too did the new rich of the Industrial Revolution and the nascent oil industry, gain from their philanthropy toward collecting and the founding of museums to care for their efforts. The names of Carnegie, Rockefeller, Morgan, Field, and others left lasting legacies for this country by founding some of the great museums that still benefit the public today.

This age of collecting and exploration was a heady time for scientists. The entire world was before them. The extraordinary quantity and variety of natural history specimens being collected around the world, required explanation and some means by which all of the rocks, plants, animals, and other humans could be understood. Many of these objects and the people from distant lands were beyond the experience and the understanding of those whose world view was based on the Bible and local tradition. New ideas based on the observations of geologists such as Sir Charles Lyell and naturalists exemplified by Gregor Mendel and Charles Darwin were converging to revolutionize thinking and the way the world was understood. Naturalists and scientists collected, described, curated, and communicated their finds to other scientists who appreciated their descriptions and systematic organization of the natural world. The revolution of evolution had begun. Decision makers in government and commerce also understood the value to these new discoveries; perhaps not in scientific terms but for their potential economic and political impact. Exhibits of this period often were limited to displays of organisms or objects arranged to illustrate the systematic relationships between the specimens.

The second great age of collecting in museums might be thought of as the age of exhibition and dioramas. Perhaps its roots can be traced to the World Fairs of the late nineteenth and early twentieth centuries. The first World Fair was actually the Great Exhibition of Industry of All Nations held in London in 1851.^[3] World Fairs offered an opportunity to bring together the wonders of the industrial world to mass audiences in England and the United States. Major advances in science and technology were presented by the European countries along with the natural history oddities, archaeological exhibits, and exotic races and cultures displayed for the edification and amusement of the public.

In planning America's signature World Fair, the World's Columbian Exposition of 1893 in Chicago, great effort was expended in showcasing past and present cultures from around the world. Frederic Ward Putnam, the director of the anthropology exhibits, and his trusty assistant Franz Boas, sought out, borrowed, and purchased collections of antiquities. George Dorsey, future curator of anthropology at Field Columbian Museum, was sent to South America for collections. Collections representing the Cliff Dwellers of the American Southwest were presented as were W.K. Moorehead's incredible collection of Hopewell artifacts from prehistoric Ohio. Even peoples were on exhibit, not only on the carnival-like Midway, but also next to the anthropology building where Boas encamped a group of Kwakiutl from British Columbia to shock visitors with their savage "cannibal dance." Not to be outdone, the Smithsonian Institution's National Museum mounted its own exhibits featuring the work of Frank Hamilton Cushing among the Zuni Pueblos of New Mexico.

Although the newly appointed University of Chicago anthropologist Frederick Starr supported the educational goal of presenting ancient American cultures through displays, he also had an ulterior motive. He planned and expected that at the end of the Exposition, those massive and valuable collections would come to the Walker Museum of the University of Chicago and thereby be under his control. A good plan from his perspective, but it was not to be. Putnam had lobbied for his vision of a great city museum and influential Chicagoans bought into his plans. Merchant Marshal Field, encouraged by his friend, lumber baron Edward Ayers, gave 1 million dollars to found a museum that became the Field Museum of Natural History. Other Chicago museums, The Museum of Science and Industry (housed in the Fine Arts Building from the World's Fair), the Newberry Library, and the Chicago Academy of Sciences were based on or inspired by the ideals, collections, and architecture of the Columbian Exposition. As varied as these institutions are, as an outgrowth of the Columbian Exposition, their benefit to scientific research, the economic life of Chicago, and the entertainment and education of the public are immeasurable.

Eleven years after the Chicago Fair, St. Louis presented the Louisiana Purchase Exposition. The St. Louis anthropology exhibits topped those in Chicago; it gave new meaning to the concept of "living dioramas."^[4] To justify its imperial adventures, the United States brought in dozens of natives from the Philippines to demonstrate the progress the government had made in educating their colonized dependents. A school for Indians of the United States was installed to exemplify the progress made in raising the savage indigenes up the ladder of progress, and an Indian Olympics was held to complement the International Olympic Games. Pygmies were brought from the Congo Free State, and Frederick Starr was sent to the

Japanese island of Hokaido to bring back a group of Ainu. Although St. Louis did not gain a great museum, the U.S. National Museum was only too eager to incorporate the magnificent displays into its own collections.

In addition to the many scientists who contributed to these memorable fairs, so too did many artists and technicians apply their skills. Alexander Phimister Proctor, a promising young sculptor, was awarded a commission to create some of the massive animal sculptures in the White City of the Exposition. His background as a western outdoorsman brought an authenticity to his work that served him throughout his long career. Artists such as Carl Akeley and Louis Agazziz Fuertes helped design and create fantastic dioramas for Chicago's new museums. Perhaps for the first time in history, dioramas of entire life scenes, sometimes actual, other times contrived, provided a three-dimensional view into the past that made the viewer feel that they were actually seeing the past. The important point is that the idea of re-creating life behind glass—a permanent record of a particular habitat complete with appropriate plants, animals, insects, and all, or a detailed reconstruction of an activity or scene from an ancient culture—was new and exciting both to the public and to the people who were doing the work. Just as we think of the heady excitement of the early days in Silicon Valley and the computer industry, so were the early days of exhibit development also an exciting and invigorating time. Very talented and dedicated individuals envisioned and created museum environments that have educated and entertained generations of viewers.

While the American Museum of Natural History in New York and Chicago's Field Museum were among the earliest to develop this new approach to museums, they were not the last. From coast to coast, the trend to build larger, more detailed dioramas grew. The Hastings Museum of Natural and Cultural History (Nebraska), the Denver Museum of Nature and Science, and the Los Angeles County Museum of Art are examples.

During the years in which the art of the diorama was being developed, collecting did not stop. However, there was a shift in purpose. Much early scientific collection and exhibition was connected to explorations of evolutionary theory. Scientists looked at rocks and under them to find evidence that either supported or refuted Darwin's new approach to understanding the visible world. In fact, scientific collecting continued to develop in sophistication as did other aspects of science. New techniques of preservation, photography, and eventually, film and audio recording, immensely increased and improved the work of scientists in the field. To the scientist, objects are data. As field work produced more and better data, old theories had to be revised and new theories were developed to explain what the scientists were seeing. First and foremost, science is based on observation. As the number of scientists conducting fieldwork increased dramatically, perhaps exponentially, the need to study, store, and explain their

work became more important. The need to systematically organize the increasing collections also became more important. From the earlier focus on specimens in evolutionary research emerged attempts to present the data in its historical context. Thus, the diorama emerged as a way to provide context for specimens.

The age of exhibition, like the age of collecting, has evolved. Advances in computer technology have dramatically improved dioramas but at the same time, signaled their potential demise. In the late 1960s and early 1970s, one of the new terms heard in museums was the “immersion environment.” Perhaps Walt Disney should be given credit here. To say that Disney added new life to static dioramas is an understatement. His revolutionary vision created entire environments which engaged multiple senses and provided a wide range of sensory rich, realistic but safe experiences. That he was able to make it work on such a grand scale represents both genius and great organizational skill. His determination to recreate a version of history or the future that entertained and educated, has come to be known as “edutainment.” The success of Disney’s vision is evidenced by the large paying audiences that have made a trip to the various Disneylands around the world nearly as important as a religious pilgrimage.

While the Disney phenomenon has been viewed by many museum professionals with varying degrees of skepticism, possibly tinged with jealousy,^[5,6] there is no doubt that Disney changed the public’s standards for the kinds of experiences that they expect. Museums have responded by borrowing some of the ideas and techniques from Disney, and merging them with the museum’s mission to present accurate information about nature and culture. In the conflict between entertainment and education, museums usually side with education, but more often today, they

attempt to merge the two. The comfortable compromise is the “immersion concept” which strives to put the visitor in the environment with all of its sights, sounds, and, sometimes, smells. Mechanical and computer technology added movement and change to such displays that could not have been provided in earlier decades.

The rain forest exhibit at the Milwaukee Public Museum, a leader in exhibit design for decades, also led in this new direction. The environment was so rich in detail that it is impossible to absorb the entire experience in one trip. This exhibit had two other characteristics that would soon be developed by others. First, there is a reconstruction of a field station within the exhibit so that the visitor can see not only the “natural” environment of the rain forest, but also the “cultural” environment of human activity. In 2002, the Draper Museum of Natural History opened as the fifth museum of the Buffalo Bill Historical Center in Cody, Wyoming, and the first natural history museum built in the United States in the twenty-first century. One of the philosophical underpinnings of that museum is that today, it is no longer possible to separate natural history from human history. They are so intertwined throughout the world that even the concept of nature untouched by human activity is perhaps a relic of the nineteenth century (Fig. 1).

The second imaginative introduction of the Milwaukee Public Museum’s rain forest exhibit is that one can enter and explore on at least two levels of the massive gallery: the floor level and the forest canopy level. Today, this may seem a small point, but at the time, providing an immersion experience on one level was a novel experience, letting people experience the environment from a totally different vantage point was simple yet brilliant. Providing a second distinct viewing experience had significant implications and major challenges for the design of the space.



Fig. 1 Beginning in the late nineteenth century, museums used dioramas to interpret and convey information. The Milwaukee Public Museum created many lifelike and dynamic exhibits such as this buffalo hunt.

Source: Photo courtesy of RB Pickering.

Seeing from many directions required much more detail in this artificially produced environment so that, in fact, it did not look artificial.

Innovations in computer technology also may hasten the end of the diorama as we know it and change the role of objects in museums. So too, the increased ease and availability of travel for larger segments of society, has caused the question to be asked, "Why do we need to build a diorama of a distant place on the planet when people can now go there?" Dioramas are both labor and cost intensive. Every tiny element, a leaf, an insect, or a blade of grass, in a diorama is either completely artificial or has been treated so that it will look natural for decades. The expertise to make dioramas is expensive. Moreover, natural history documentaries made for television or massive IMAX screens can provide much more information, empathy, and impact than can a static diorama. These converging trends are causing museums to rethink the concept of what dioramas and the immersion environment might provide. The computer gaming industry has demonstrated that building a virtual environment is both engaging to the audiences and it need not be limited to either a specific location, such as a museum; it does not even have to be limited to reality!

The age of exhibition may not be at an end but it is evolving into the third age—the age of education that includes access to information and experiential learning. Innovative computer technology already can create virtual objects and environments. Will it replace the museum's need for real objects and physical environments? There is no "right" or obvious answer to that question at this time. In fact, there is no single answer. We are currently living through this change and the results will not be known until the public and museums around the world decide, and put their support behind that which they find most engaging. However, there are some trends worth watching. Many museums are rapidly placing collections online for distant learners. They are developing virtual versions and simulations of real exhibitions. Museums recognize that creating an exhibit, especially traveling or temporary exhibits, is very expensive. Even if the exhibit travels over a period of months or years and goes to four to six cities, eventually, the exhibits are dismantled and disappear. Computers now offer the opportunity to simulate the exhibit in perpetuity and also provide a depth of detailed information, sources, and images that could not be included in a real exhibit. Technically, creating a virtual exhibit is already possible and being done. There is no doubt that virtuals provide a lasting record. The more important question is, "Will the public care?" Will virtual exhibits be sought out and seen by the public in the same way that visitors now return to museums to see real objects or works of art that are important to them? Again, we do not know the answer but many within the museum field are concerned about the answer.

Museums have always been populist institutions, although to varying degrees. The idea that the museum

exists for the public's benefit, education, and enjoyment has been important for a very long time. For much of the twentieth century, and certainly all of the nineteenth, museums did little to influence or mediate the experience other than to provide objects and labels. The Field Museum, so innovative in its work on dioramas and collections research, also was an innovator in public education. Its education department was established in 1922 to offer classes, lectures, field trips, and a wide range of programs for different audiences. Even more impressive, as early as 1912, Field Museum's Harris Loan Program was established to provide artifacts, specimens, and audiovisual material to Chicago area schools. Access to collections became an important part of the museum experience very quickly.

At least since the 1890s, it has been recognized that access to collections provides excellent learning opportunities for teaching and learning. At the same time, using collections for teaching potentially damages the actual specimens and over time will destroy the specimens. Flowers^[7] wrote eloquently about this internal tension. Over 100 years later, this concern still has not been completely resolved, but there are more innovative solutions than in earlier times. Most museums maintain permanent collections for research. Whether the collections are rocks, bird skins, or clothing and textiles, the use of these collections is governed by rules or guidelines. For many museums, the list of people with access is internally restricted to research and collections staff who have the authority and responsibility for those collections. Researchers from outside the institution who have a legitimate reason to work with the collection, have a specific plan of research, and appropriate credentials, usually are granted access. A person from off the street may get access to research collections but not without significant effort.

Over the decades, many education departments have established "education collections" which are available for teaching people of all ages, but primarily for children. Restrictions apply here, too, but access within educational programs does provide children and adults the ability to closely observe and sometimes to touch specimens under the direction of education staff. This kind of access to collections has sometimes been contentious between the curatorial and collections, and education staffs. The reasons for the disagreement are obvious. Curators and collections staffs are responsible for the physical care and long-term preservation of the objects or works. Curators may have actually collected the specimens, and feel proprietary toward them. Understandably, such curators are willing to give access only to those who they trust will treat the objects with the same degree of care and respect.

Educators tend to focus on the audience and the benefit that access provides. That is not to say that educators do not share collections concerns with curators and collections professionals. They do. By working with curators

and collections professionals, education departments have been able to obtain specimens that are representative of the subject and can be used in programs. For example, a paleontologist may have hundreds of examples of a common fossil. After evaluation, the curator may decide that some examples are redundant, i.e., they do not provide any different information from other specimens. These may be transferred to the education department for use in programs. For objects that are more delicate than a fossil, such as an example of Lakota bead work or an ancient pottery vessel, educators have also come up with acceptable practices. The object may be secured in an appropriate container so that the audience can handle the container but not the actual piece itself. A high-quality reproduction of the object may also be produced or purchased so that it can be handled instead of the actual specimen. Educators can usually be counted upon to find ingenious ways to provide effective hands-on experiences for audiences without sacrificing important objects.

As valuable as education collections are, they may have inherent problems. Educators sometimes complain that the objects they are given are essentially, "too good to throw away, but not good enough for the permanent collections." Educators do not want to teach with inappropriate or substandard material. They recognize that to do so diminishes the educational experience and essentially disrespects the audience. One innovative solution to this dilemma has been to eliminate completely the education collection and to create a "use code" for all objects in a permanent collection. One method has been to use the colors of the traffic light to signify appropriate use. For example, a "red code" means that the object is rare, delicate, and important for research. Therefore only curators and collections professionals may handle it and the only appropriate uses are research and exhibition. A "yellow code" means that other museum staffers who have had training in handling collections may handle the object. Yellow code objects are used in teaching situations as long as the educator and collections staffs agree on a safe method for handling. A "green code" means that an object can be handled and may eventually have to be discarded because of wear. For this category, education departments may purchase a number of examples of this kind of item and use them over time, replacing damaged ones as they go. The Children's Museum of Indianapolis began this practice in the late 1980s. For example, as many as Ten copies of a particular musical instrument such as an mbira or a drum might be purchased for use in children's programming. One example would be assigned to the permanent collection and be labeled "red" while the others would carry the "green" code and be used in programs. As one instrument was damaged another "green" one would take its place. In this way, all of the objects would be documented and tracked within the same collections management system, permanent collections built and maintained and yet, use of appropriate objects in programs facilitated.

CURRENT TRENDS AFFECTING COLLECTING

Museums, their collections, and their reasons for collecting are a reflection of society as a whole. Many trends that are part of our changing culture also impact museums. Knell^[8] provides excellent European perspectives on contemporary and future collecting in museums. By their inherent nature, museums tend to be fairly conservative indicators of change, but change comes, nevertheless. It may not be possible to say how museums will collect or what they will collect in the future but there are some trends worth watching.

A globally significant trend is the rise of the digital age and its amazing ability to provide often instantaneous access to collections around the world. Today, even an armchair hobbyist can have access to images and information that only a few decades ago were available only to top specialists in the field. This is a great advance but not without risks.

Just as the exhibits departments struggle with the competition to their exhibits from computers, television documentaries and other forms of entertainment, and education available today, so too do museum educators struggle with how to compete with the ever-widening number of leisure activities and educational opportunities for the public. No one would dispute that more people now have more access to information around the world than at any time in human history. Therefore, the role of the museum as the presenter of information through objects would seem to be diminishing. Yet, a great deal of the information that is available is unmediated; meaning that the veracity or trustworthiness of the information is not assured. Moreover, the experience of seeing or touching authentic objects cannot be replaced, at this time. Perhaps museums will have an expanding role in providing reliable information about the wide range of subjects presented by museums.

A debate currently within the museum world is to what extent does putting images and data from collections on the Web diminish or increase the role of the museum? Certainly, access to data online reduces the need to visit a particular museum. At the same time, many in the museum world believe that once distant audiences see the virtual image, they will want to come and see the real object or a work of art for themselves. In this sense, putting collections on the Web is a grand advertisement for the real thing. This debate rages (if it can be said that any debate rages in the museum world) as this entry is being written. New audience research will determine how the public is deciding if the virtual is an acceptable substitute for the real.

Although the United States of America is a young nation by world standards, many of our museum collections have now been curated for 100 or more years. Many objects, whether an artist's sketch or a garment made from leather, beads, and hair were not made to last forever; their

makers had a shorter term plan in mind. Museums have the responsibility of caring for these collections for our children's children's children—essentially, in perpetuity. If these collections are, in fact, going to survive and be available for research and exhibition for future generations, then conservation of these old collections will become an increasing challenge and cost to museums. The cost of caring for old collections is connected to the cost of making new collections. Many of the great natural history museums have been collecting plant, animal, and geological specimens for a very long time. Today's curators are adding to those collections. Old or newly collected, the collections staff must care for and properly store all of these objects (Fig. 2).

From the perspective of the curator who collects specimens, there are some significant changes that impact collecting today. There are many more laws that restrict the process. The curator, as a representative of the

museum, must be knowledgeable about the appropriate laws and make sure that the museum complies with all applicable laws. A museum that does not follow the law loses credibility, and very likely, its audience and its financial support. Individuals and museums that do not follow the laws are liable to legal action.

As the principal collectors in the museum, curators often determine what will be collected. Research interests have changed over time. In earlier generations, a natural history curator might have focused on the systematic study of a group of plants or animals. Today, a natural history researcher might be delving into DNA rather than looking at bones or feathers. Although those old collections of bones or feathers may yield the DNA needed by contemporary researchers,^[9] they can be used to answer new questions. A hundred years ago, an anthropologist might have been out in the field acquiring objects from people in a culture that the anthropologist was sure would be extinct very soon. Perhaps he would have collected some oral histories and stories, too, but museums wanted objects. Today, the anthropologist is more likely to be working with tribal peoples to better understand the objects that were collected. As a result of Native American Graves Protection and Repatriation Act (NAGPRA), the anthropologist may work with federally recognized U.S. tribes to return important sacred and ceremonial objects to the tribe. An art curator today may continue to focus on past periods of artists and art styles and yet, the late nineteenth and the twentieth centuries spawned an explosion of new artists whose contributions and places in history are yet to be determined.

That curators have a central role in collection development is unmistakable, yet the training of curators is another trend that will affect museums in the future. A concern commonly voiced within anthropology and history museums is that for more than a generation, graduate schools have tended to diminish the importance of material culture studies, i.e., working with and researching real objects, (archaeologists sometimes call this “reading” objects) and have emphasized theory and the intellectual aspect of research. While this trend makes considerable sense for creating the next generation of college professors, it means that the skills for handling, studying, and understanding objects are not being transferred to the next generation of curators. Museums and their curators also are interested in the latest theories and the innovations of research, but we also have the collections in our care. If new curators do not have advanced skills in collections-based research and the ability to discriminate between genuine versus modified or fake objects, then the museum and, in fact, the entire public suffers.

While curators direct the building of collections from the inside of the museum, collectors and donors sometimes direct collecting from the outside. Many great collections have been assembled in virtually every collecting field by dedicated and wealthy individuals. Private



Fig. 2 Older objects, especially those made from perishable materials, will need consistent care to preserve these treasures for future generations. Cheyenne (Tsistsistas) cradle, ca. 1880; wood, tanned hide, glass beads, brass tacks, tin cones, porcupine quills, horsehair.

Source: NA.111.61 Photo courtesy of the Buffalo Bill Historical Center.

collecting and collecting for museums can be quite different.^[10] However, the history of museums exemplifies how the two merge. Often as they approach the end of their lives or perhaps just the end of their interest in one collecting area, they look for a museum to care for their collections. Many times, this opportunity is a great benefit to the museum. Collectors frequently have more money to spend on acquisitions than do most museums. When the museum and collector work together, the relationship can be very beneficial to all parties including the public who will have access to the once private collection.

The ethics of collecting is evolving rapidly and impacts virtually all areas of collecting and research. The international movement to redress grievances related to art and other possessions stolen by the Nazis is a very visible example but there are others. From stolen religious icons to objects looted from national museums during the Iraq war, museums often find that they are being offered cultural treasures through dealers and donors. Today, the ability to establish clear title and to demonstrate that objects were legally sold and legally obtained by the museum is expected. A museum that does not diligently research such high profile works may find itself in legal difficulty and risk a public relations disaster.

The American NAGRPA law, various United Nations treaties, and laws from individual countries that strive to put control of cultural objects back into the hands from which they were taken are having an increasing impact on museum ethics. These laws pertain to objects, yet their importance is that they redefine the relationship of cultures; usually an indigenous one and a dominant, if not an imperial one. Returning objects does not negate past wrongs but it may well provide a reorientation of respect and responsibility between cultures. Numerous volumes have come out in recent years that explore various aspects of collecting cultural artifacts and relations between museums and indigenous peoples.^[11–14]

As positive as these new ethical positions are, they have their extremist proponents too. For example, archaeology explores past cultures and helps this and future generations understand more about how human beings evolved and cultures developed across the world. Archaeology strives to be the scientific and objective way of looking into past cultures. Outside of science, every culture has its own traditions and stories about their origins, their own past, and perhaps their relationships with their neighbors. As previously dominated cultures assert themselves, they also promote their own versions of their histories and sometimes diminish or dismiss the scientific view provided by archaeology. This perspective is understandable, but if taken to an extreme, it refutes archaeology as a legitimate discipline.

While curators direct collecting in many ways, there are cultural trends outside the museum that pertain.^{[15], [16]} For most of the history of this country, the museum-going majority was Euro-American in ethnicity. Laws and

practices often eliminated opportunities for racial minorities to take advantage of museums. Cost of admission impacted all poor people regardless of ethnicity. Those restrictions do not apply so much today but there is another aspect of ethnicity that does. The impact of increasing ethnic and cultural diversity is seen in schools, in the workplace, and in churches. Changing demographics also impacts museums. Does every ethnic group have the same museum experience that has evolved in Euro-American museums for more than a century? Do all cultures value the museum experience in the same way, to the same extent? Forward thinking museums will engage their audiences in providing answers to those and other related questions. Together, museums and their audiences will find the answers that work for them. One impact of greater audience diversity is clear; visitors want to see their own histories. For museums of art, history, and anthropology, satisfying an increasingly multicultural audience will require more efforts toward representing cultures that reflect our current society. Alternatively, communities that have felt marginalized or excluded may choose to create their own museums. The Smithsonian's new National Museum of the American Indian and the proposed National Museum of African American History and Culture are prominent examples.

In addition to ethnic differences in perspectives on museums, generational differences also contribute to the changing museum environment. Tom Brokaw's book, *The Greatest Generation*,^[17] presented extraordinary acts performed by ordinary people during World War II, both at war and at home. Those who were fortunate to return at all, came home, changed out of their uniforms, and built their lives and this country. A couple of characteristics are worthy of note in the museum context. That generation understood personal sacrifice. Many were committed to making their own lives and the world a better place. They joined organizations, volunteered their time, and gave and raised money for all kinds of public causes. Some members of that generation also were significant collectors of paintings, historical documents, firearms, and many kinds of objects that interest museums.

As that generation passes, many of those collections are being offered to museums. Portions or entire estates are being given to museums as a perpetual memorial to the collector or benefactor. Many museums are also directly benefited from the volunteers who came to museums to learn and to give back to society. As this incredible generation passes, museums, and perhaps our entire society, become poorer for it. There is a critical question as to the philanthropic interests and patterns of giving by subsequent generations. Will the baby boomers and their children be as generous with their time and money? The answer is critical to museums and society in the future.

Beyond demographics, there are psychographics—the interests, needs, and wants that determine the choices people make. Demographics may be thought of as descriptive

of an audience while psychographics may be predictive of interests and behaviors. Today's researchers in museums are interested in both. Will the generation now entering kindergarten have the same interests as their grandparents? Will they want to go to a specific place to learn about dinosaurs, ancient cultures, and the art of previous generations? The answers are not readily apparent, but to be successful, museums will have to continually struggle to be relevant and engaging to each new generation.

CONCLUSION

Collecting and preserving objects or works of art and providing access to these collections are the core activities of museums. Over the last three centuries, museums have seen the purposes and techniques of collecting and storing objects change dramatically. Yet, the purpose of collecting—creating new knowledge through research and presenting that knowledge to the public—is still pivotal to the future of museums. New technologies have not only impacted how things are collected, technology now allows the collecting of data that was virtually invisible to former generations. The digital revolution is recasting the opportunities to access the storehouse of knowledge that museum collections represent.

Museums are sometimes thought of as rather quiet, unchanging places where few things happen fast, if at all. There may have been a time when that was true; it is not any longer. To continue to be valued by the public, museums will continue to evolve through internal efforts and external pressures and needs. Museums will continue to reflect what is important to the culture of which they are part. As those cultures evolve, so too will the museum.

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Museum Computer Network (MCN)

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Abstract

The museum information professional's association, the Museum Computer Network (MCN), was organized in 1967 during the early years of computerization in museums. Throughout its history MCN has provided conferences, news, and networking opportunities to its members. Through a discussion of key points in the group's development and current activity, the 40 year history of the association is briefly explored.

INTRODUCTION

The Museum Computer Network (MCN), formed in 1967, is a professional association that supports the greater museum community by providing continuing opportunities to explore, implement, and disseminate new technologies and best practices in the field. MCN draws its members from the ranks of museum staff who manage museum Web sites, network infrastructures, visitor services systems, and museum collection management and registration systems.

MCN provides professional development and educational opportunities through its annual conference. A Web site and the MCN-L listserv provide members opportunities to communicate throughout the rest of the year.

This entry offers a brief history of the organization from its inception in the late 1960s through the present.

ORIGINS

In 1965, the New York University (NYU) established the Institute for Computer Research in the Humanities (ICRH) under the leadership of computer scientist Dr. Jack Heller. During its first years of operation, the ICRH developed automation tools for NYU's library and completed the first electronic indexes of the *Répertoire International de Littérature Musicale (RILM)* and the *Revista Filología Española*. Working with the Dag Hammarskjöld Library, Heller created a suite of programs he called the *General Retrieval and Information Processor for Humanities Oriented Studies (GRIPHOS)*.

Heller and the ICRH came to the attention of staff at the Metropolitan Museum of Art in late 1966. Within the next few months, ICRH developed processes for Carl C.

Dauterman to analyze porcelain in the Met's collection and had begun exploring a project to create an electronic index of the Met's *Bulletin*. During a visit to the museum, Heller met registrar William D. Wilkerson, who introduced him to the challenges of recording information about the Metropolitan's collections and instigated the series of meetings that was to follow.

In the spring of 1967, directors from 15 New York area museums met to explore ways Heller's work could be used beyond the Met. With funding from the New York Council of the Arts and the Old Dominion Foundation, the consortium formed the MCN to create a prototype system for a shared museum data bank. The administrative committee for the project, chaired by Wilkerson, selected Everett Ellin as its first executive director.

The project recruited curators and registrars to develop a data dictionary that would accommodate the diverse methods used to describe museum collections. The resulting tagged record format allowed for the description of individual objects with separate records for artist biographical information and reference citations. Heller's GRIPHOS system provided the information storage, search, and retrieval infrastructures for the records.

MCN and the Metropolitan Museum of Art, with funding from IBM, organized the first U.S. conference on the topic of museum computing in April 1968. This would be the first of many promotional efforts by Ellin, who was concerned about the growing information crisis in America's museums. In an appendix to the American Association of Museum's (AAM's) influential *Belmont Report*, he described MCN's vision for shared national and international museum data banks that would not only improve museum management practices but also would provide unprecedented access for researchers. Because of the expected costs, MCN

advocated for a single network that would handle data for all the museums across the country.

INCORPORATION AND GROWTH

In June 1969, Jack Heller resigned his position at NYU and accepted a position at the State University of New York (SUNY) at Stony Brook. The original grant funding for the MCN pilot project ended in 1970. Of the original 15 partners, only the Metropolitan Museum and the Museum of Modern Art continued to catalog their collections using computerized methods and their own operating funds.

In 1972, the MCN was formally incorporated in the state of New York with David Vance as its first president. An “administrative committee” was comprised of representatives from institutions who had been involved in MCN’s formation. Museums could join to receive consultation and advice about computerization projects or as full members with access to MCN software and hardware resources.

In addition to a change in funding structure, this transition marked a change of what kind of “network” MCN represented. Originally conceived as a physical computer network, MCN was to become part of a growing professional network of related cultural heritage computerization projects. Museum Computer Network would be one of the cofounders of a related group known as the Museum Data-Bank Coordinating Committee, which sought to find connections and opportunities for sharing work among a variety of museums including archeology, ethnography, history, natural science, and art museums.

Museum Computer Network was able to attract a number of large institutions as members, allowing it to continue operations and development of the GRIPHOS system. Especially important was the decision by Robert G. Chenhall to select the MCN/GRIPHOS system for the Arkansas Archaeological Survey, which encouraged other statewide surveys to take a similar path.

During this period, MCN began to regularly host annual conferences. Initially the conferences focused on issues relevant for GRIPHOS users, however, over time the conferences attracted representatives from other museums who had not yet implemented a computerized system.

In 1974, David Vance and the MCN office joined Jack Heller at SUNY-Stony Brook.

FROM INSTITUTIONS TO INDIVIDUALS

Toward the end of the 1970s, the operating systems found on IBMs mainframe computers were quickly becoming obsolete, foreshadowing the end for GRIPHOS, which had been tightly tied to those operating systems.

This tight integration had already limited the adoption of GRIPHOS in environments that used non-IBM

hardware, a problem for museums which often relied on local university computing centers. Updated packages and user manuals continued to be released, but fewer MCN members were able to support the GRIPHOS software. Vance and Heller worked on migrating GRIPHOS to emerging minicomputers in 1981, but these efforts were soon overshadowed by the microcomputer revolution.

The computer revolution which was changing the business world in the 1980s was reflected in the rapid changes occurring at MCN as well. Cheaper desktop computers along with more accessible software made incorporating computers into their operations more realistic for some museums. This caused the increase in MCN’s activity which was evidenced in the composition of *Spectra*. A different audience was looking to MCN for advice on computerization, and for an affinity group of like-minded museum professionals.

While some longtime MCN members continued to advocate for the centralized approach that the organization had been founded upon, museum computerization efforts were increasingly localized with little demand for the large mainframe systems of the 1970s. With dwindling support, the GRIPHOS system was officially retired in 1979.

During MCN’s “mainframe” period, only institutions could be members of the organization. Reflecting the change to personal computing, the organization opened up membership to individuals for the first time in 1981. The organization soon attracted a broad spectrum of the museum community using a variety of different approaches to automating their collections.

The MCN Board decided the time had come to make major changes in MCN’s structure, some of which were precipitated by funding cutbacks at SUNY-Stony Brook. The State University of New Yorks withdrawal of support meant MCN could no longer afford to pay its longtime staff member and president, David Vance. Vance stepped down as president in early 1986 and was replaced by Ron Kley. The board created a new model of a short-term volunteer president working alongside a grant-funded executive director.

Throughout the 1980s, MCN moved further away from the original vision of a centralized system, choosing instead to emphasize the development of data standards that would allow the exchange of museum information between systems that met local needs. These efforts retained the spirit of the original network, without forcing museums to adopt a single application or hardware platform.

CONSORTIUM FOR THE COMPUTER INTERCHANGE OF MUSEUM INFORMATION

Museum Computer Network continued to envision a structured flow of information between museums and at the end of the 1980s received grants from the National

Endowment for the Humanities and the Pew Trust to create the Computer Interchange of Museum Information (the CIMI project).^[1] Headed by David Bearman, the project brought together a group of museum professionals and network industry staff.

Computer Interchange of Museum Information became an independent entity and produced the CIMI Standards Framework in 1993. The Framework recommended the standard fields which could later be used for interchange of information between museums and served as the basis for several test projects. Throughout the 1990s, the CIMI group continued their endeavors; among the members were the Getty Information Institute, the Canadian Heritage Information Network (CHIN), the Eastman Kodak, the Smithsonian, the Museum Documentation Association in the U.K., and of course, MCN.

CONFERENCES AND COLLABORATIONS

Since the first conference in 1968 MCN continued to produce its annual conferences, sharing information on the challenges, and successes of introducing technology into the museum environment. In 1979, MCN held the first conference to which people outside of the group of MCN institutional members were invited. This approach brought in new attitudes and new life into the organization.

Conferences were held in cities all over North America, usually at museums or facilities where members worked. The 1980 conference hosted the first public presentation of the Report of the North American Planning Conference, held at SUNY-Stony Brook that year.

The 1985 meeting was hosted by Dr. Jaime Litvak King of the University of Mexico, and included demonstrations on microcomputers, software, and Apple Mac hardware. The meeting featured preconference workshops for the first time.

Delegates at MCN's annual meeting in Pittsburgh in 1992 welcomed a surprise visitor—presidential hopeful Bill Clinton. Clinton spoke with MCN members who were so impressed that the fall 1992 *Spectra* included a list of delegates who had shaken his hand. Bill Weinstein was the record holder at four handshakes.

San Diego was the setting in 1995 when MCN and the International Conference on Hypermedia and Interactivity in Museums (ICHIM) held a joint conference which kicked off many of the archiving and online efforts of the next several years. Museum Computer Network's president at the time, Leslie Johnston, initiated a relationship with the Smithsonian Institution's archives to store MCN's records, where they are still kept.^[2] Museum Computer Network's Web site went online shortly thereafter.

Museum Computer Network continued to forge informal alliances with professional organizations and to produce conferences in conjunction with these groups.

Among the collaborators and conference hosts were the CHIN, the Association of Moving Image Archivists (AMIA), the Northeast Documentation Conservation Center (NEDCC), the National Initiative for a Networked Cultural Heritage (NINCH), and numerous others. Museum Computer Network is also an official affiliate organization of the AAMs.

U.S. CONGRESS

The Internet and World Wide Web were expanding rapidly during the early 1990s, and the U.S. Congress was moving to begin regulating and codifying the use of what it termed the "Information Superhighway." The High Performance Computing and Communication Act of 1991 (the Gore bill) led to the introduction of legislation proposed in Congress to support government information and cultural efforts on the Internet.

Early versions of the legislation did not mention museums specifically. Including museums in information superhighway legislation became a priority for Diane Zorich, President of MCN in 1994. Zorich's efforts and the efforts of many others on behalf of the museum community were successful in August of 1994 as stated in a *Spectra* article from the Summer 1994 issue. *Spectra* reproduced AAMs entire announcement, written by Michael Roark from their Government and Public Affairs office. "The Senate Commerce Committee today voted to guarantee the nation's 8000 museums a place in the National Information Infrastructure under the Communications Act of 1994. Museum images, texts, programming, and personnel will soon be accessible to highway travelers." The gist of the bill, according to Roark, was to deregulate sectors of telecommunications industries in exchange for industry support for schools, libraries, hospitals, and museums.

PUBLICATIONS

Information about MCN's activities was first published in the *ICRH Newsletter* along with updates about the progress of the GRIPHOS project which appeared in *Computers in the Humanities* and *Museum News*.

After David Vance relocated to Stony Brook in 1974, he wrote the "MCNews" column that appeared in *Spectra*, the newsletter for the Center for Contemporary Arts and Letters. By 1983, *Spectra* was entirely dedicated to news about MCN activities. The publication schedule was sometimes sporadic but generally followed the quarter system. In 1986, 2600 issues were mailed to 41 countries while *Spectra* was still being distributed at no charge. Issues with literature reviews, featured articles, and conference reports were often done on an extremely low budget, but always with professional editors publishing the

sought-after journal. By 1987, organizational focus shifted towards expanding services and working with the AAMs on cooperative ventures. Consequently, the Board decided to expand *Spectra* contents and begin charging for subscriptions. In 1996, the newsletter underwent a complete redesign and by 1999 with the departure of longtime editor Suzanne Quigley, it moved away from MCN news completely. Guest editors organized *Spectra* between 1999 and 2002, when it was self-described as “not a scholarly journal, but rather a community-based current awareness publication focusing on issues and projects of interest to museum information professionals.” The new millennium was celebrated with a special small format issue guest edited by Steve Dietz and Scott Sayre featuring thoughts and prophecies from 75 colleagues.

By 2002 rising production costs far out-distanced MCN’s subscribers’ and sponsors’ capacity to pay for them; and the Board reluctantly suspended *Spectra*. The Board’s hope was that the journal would eventually be revived on the MCN Web site, but competition for limited resources has not permitted its return.

Spectra’s suspension occurred at a dark time for volunteer organizations and membership associations in particular. The “dot com” boom was over, and the tragedies of September 11, 2001 had just occurred. The U.S. economy was experiencing a downturn wherein nonprofit organizations, including museums everywhere, suffered. Non-profits’ budget cuts translated into fewer members for MCN and fewer travel dollars for members.

INTERACTIVE AND ONLINE

The computer ubiquity envisioned for businesses in the 1970s gradually became reality in the 1990s, with the wider availability of personal computers, access to e-mail, and the Internet. Various programs were founded around the country, such as the Electronic Frontier Foundation; the Museum Informatics Project at the University of California, Berkeley; and NINCH. The Getty Art History Information Project launched their Web site and the Networked Access initiative. Museum Computer Network members quickly embraced new technologies which were becoming more and more affordable for smaller institutions not supported by universities or other large entities. The 1990s were a time of growth and expansion for MCN.

The International Conference on Hypermedia and Interactivity in Museums began to hold conferences which focused on the presentation and Web tools in the international museum community. Also in 1996, MCN created their first Internet home page and a discussion list; many museums’ Web pages were launched, and thousands of Web pages from all over the world began to come online. In the late 1990s, MCN continued developing its own Web site,^[3] which was completely overhauled in 2005.

ANSWERS CHANGE, QUESTIONS REMAIN THE SAME

Over the last 40 years, cycles and recurring themes have occupied the MCN Board. Most of the plans centered around continuing to produce the high-quality conferences and publications for which MCN was well known; and to foster greater member involvement in planning and programs. Board of Directors’ strategic planning retreats dealt with these key issues every few years. Each time the focus of the organization shifted slightly, but the premises of supporting the use of technology in museums and supporting museum information professionals did not.

As evidenced in *Spectra* over its 28 year history, desperate straits were always balanced by periods of optimism and growth. Expenses for MCN’s ventures increased dramatically over the years and funding was nearly always an issue. Several different management models were tried during MCN’s lifetime, including a full-time Executive Director, a part-time Program Director, and various management companies performing administrative duties. Currently, MCN’s administrative functions are managed by McPherson Clarke, a Canadian association management company.

MCN TODAY

Governance

Since its incorporation in 1972, MCN has had a volunteer Board of Directors, usually composed of 12 people. Each director is elected for a term of 3 years, and may serve two terms in succession. Directors are expected to contribute to MCN’s programs throughout their terms and to participate in several committees, such as Communications, Leadership Development, Membership, Finance, and Marketing. Directors meet monthly by phone and twice a year in person. The Executive Committee handles many of the organization’s immediate concerns and is composed of the board officers. The President, Vice President/President-Elect, Treasurer, and Secretary form the Executive Committee. The Treasurer and Secretary are appointed from the Board of Directors, serving a renewable 1 year term. The Vice President serves in that capacity for 1 year and as President for 1 year. The Past President also serves 1 year in an advisory capacity.

Over the years, the bylaws have continued to develop and change. Museum Computer Network bylaws are available in the About Us section of the Web site.^[4] The latest strategic plan is also available in the About Us section of the Web site.^[5]

SIGs and Chapters

In 1997, MCN created the mechanism to form Special Interest Groups (SIGs) with the establishment of the SIG

Charter.^[6] Each SIG provides a forum for MCN members to pursue specific subjects while MCN as a whole focuses on its members' more general concerns. Special Interest Groups may also represent geographic regions, such as the active California SIG.

Contributing to fields within the museum information profession, SIGs provide opportunities for learning new skills, leadership, and growth. Where communication with the MCN Board is indicated, this usually occurs through the Board's SIG Liaison; in some cases, it includes communication with other officers as noted.

Over the years, MCN has formed relationships with various international groups but never formalized these relationships. In 2006, MCN created the mechanism to form separate regional chapters outside North America. In March 2007,

...A ceremony marking the establishment of MCN in Taiwan was held at the National Science Council, attended by MCN President Marla Misunas, Academia Sinica Vice President Liu Tsui-jung, and Academia Sinica academician Ovid J. L. Tzeng. Liu also chairs the state-operated National Digital Archives Program (NDAP) which cooperates with the MCN in the organization of the MCN's branch office in Taiwan.^[7]

Dr. Der-Tsai Lee, Director of the Institute of Information Science, Distinguished Research Fellow, and Director of Research and Development for the Digital Archive Technologies Program in Taipei, Taiwan, is the chapter's first President.

CONFERENCES LOOK TO THE FUTURE—AND THE PAST

Despite the economic downturn of the 2000s, MCN continued to produce strong conferences. Innovative presentations on current topics drew MCN members both experienced and new to its conferences. The conference theme of 2004, "Great Technology for Collections, Confluence, and Community," focused on the intersection of museums, libraries, and archives, which drew delegates from all three disciplines. This intersection too is a recurring theme, as seen when looking back at *Spectra*, Winter 1989, when a member wrote in for help integrating cataloging information for the three different areas within a museum. The topic of integration remains fluid, as museums couple and decouple their electronic resources.

"Digits Fugit," MCN's 2005 conference, focused on digital preservation and partnered with the Northeast Documentation Association, providing an entire week's worth of educational programs in Boston.

The 34th annual conference in 2006, "Access to Assets: Return on Investment," took an entirely practical approach. The conference showed delegates how the sometimes

intangible educational programming for which they are responsible can be shown to be integral to their museum's operation. And whether they bring in funds directly or not, the public expects to have these programs, or will go to other institutions that do.

In 2007, the annual conference celebrated MCN's 40th anniversary, "Building Content, Building Community: 40 Years of Museum Information and Technology." Conference pricing was reduced and conference programming expanded. A full day of plenary sessions focusing on leadership preceded the usual educational sessions and demonstrations, which took place over the remaining 3 days.

COMMUNICATIONS

While publication of *Spectra* ended in 2002, MCN continues to place an emphasis on providing a place for museum technology professionals to communicate. Since 1996, MCN has maintained the MCN-L listserv, which serves as the primary forum for museum professionals to discuss topics from day-to-day operation of a museum's technology infrastructure to the impact of emerging technologies on current practice.

FUTURE DIRECTIONS

Museum Computer Network's strategic plan for the years 2007–2010 is comprised of five major sections: Communication, Finance, Leadership Development, Membership, and Programs and Education. Each section of the plan integrates with the other four to establish and maintain initiatives and goals outlined in the plan. Among the goals are those with which MCN boards of directors have long been concerned: increasing membership, improving the association's financial health, continuing to produce quality programs, and keeping members actively involved in program planning. The methods by which the board and committees of the organization work are changing—for example, the board now actively uses its own wiki—but the core aims of the organization remain helping museum staff use technology effectively and helping museum information professionals advance their careers.

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Museum Informatics

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Abstract

Museum informatics is the study of the sociotechnical interactions that take place at the intersection of people, information, and technology in museums. This entry presents an overview of museum informatics, covering such topics as information representation, information organization and access, information management, information technology, information interactions, and information professionals in museums. It explores the impact of information science and technology on museums, museum professionals, and museum visitors, and argues that museum researchers must take a sociotechnical approach to studying the use of information resources and technologies in museums.

INTRODUCTION

Museum informatics is the study of the sociotechnical interactions that take place at the intersection of people, information, and technology in museums.^[1,2] Over the past few decades, museum researchers and professionals have explored the impact of information science and technology on the people who use museum resources. Museum professionals and museum visitors—including curators, registrars, school children, and scholars—have found their understanding of what museums can and should do dramatically changed by the introduction of new information resources and technologies into museums.^[3]

Museums have traditionally served as repositories of objects for the purposes of research, preservation, and education.^[4] For thousands of years, museums have acquired, stored, and exhibited objects of art, cultural heritage, natural history, science, and technology. Yet museums are not only repositories of objects; they are repositories of knowledge.^[5,6] The modern museum is an information service organization where information about museum collections is just as important as the collections themselves.^[7,8] As knowledge repositories, museums store knowledge; as information service organizations, they make this knowledge accessible and usable for their visitors.

Today's visitors to museums—from elementary school children to academic researchers—expect instant access to extensive information about every object in the museum's collections. To meet these expectations, and to serve their clients as effectively as possible, museum professionals have become more skilled in managing information resources in museums.^[9] They have honed their expertise in information organization and access, become more sophisticated in the application of information technologies designed or adapted for use in museums, and developed skills in such areas as digitization, information

storage and retrieval, collections management systems, and Web-based educational outreach.^[10]

The changing needs and expectations of the users of museum information resources have prompted corresponding changes in the capabilities and services provided by museums. This entry will examine those changes, and explore the impact of new information technologies on museums, museum professionals, and museum visitors.

Taking its cue from the scholarly and practitioner literature published on this topic over the past few decades, this entry will examine museum informatics within the context of the museum profession. It is only recently that the field of museum informatics has begun to develop the critical framing and discourse necessary for the advancement of the field as a theoretical area in its own right. While this entry, therefore, focuses primarily on the professional activities of museum informatics, it concludes with a discussion of the importance of moving from practice to theory, and the future of museum informatics as a research area.

INFORMATION RESOURCES IN MUSEUMS

Many types of information resources are important to museums. The most important information resource that any museum possesses is its collection of artifacts. These objects are valuable documents in their own right, providing information about the world's culture, art, history, science, and nature.

Equally important, however, is the extensive information that museum professionals possess about the objects in their care. When a museum acquires a new collection, information about each object is recorded and organized. Museum professionals must know what they have, when they collected it, why it is of significance, where it came from, what condition it is in, etc. They record specific data

about each object such as nomenclature classifications; physical dimensions; material analyses; geographical, cultural, and temporal designations; artifact histories; scholarly remarks; condition and conservation records; research notes; and so on. They also maintain related information resources such as donor files, accession records, exhibit histories, research studies, temporary loans records, visitor attendance reports, information requests, etc. (Buck and Gilmore^[11] for more information about museum records).

Information Representation

When working with information about their collections, museum professionals rely on principles of information representation to create information surrogates or aggregates that can be manipulated more easily than physical artifacts. Surrogates are created by taking information entities and making them physically or informationally smaller (e.g., catalog card records), while aggregates are single resources that represent groups of information entities based on shared data (e.g., a list of all artifacts accessioned in the same year). Information surrogates and aggregates are usually easier and faster to handle than artifacts themselves, especially when searching, sorting, or manipulating museum resources. In addition, working with object surrogates is safer for artifacts, as museum professionals can research collections, develop exhibits, and work with scholars while artifacts remain safely in storage.

Over the years, museum professionals have used a wide range of tools (such as ledgers, card catalogs, computer databases, and digital collections management systems) to organize and provide access to information representations in museums. While no information representation can duplicate the physical artifact in its entirety, access to a sufficiently detailed information representation can meet the needs of many users, including researchers, scholars, teachers, students, and the general public. For information resources to effectively meet the needs of the museum's users, information must be properly organized and easily accessible.

INFORMATION ORGANIZATION AND ACCESS IN MUSEUMS

Until the 1960s, information resources about museum artifacts were organized into paper records and card files.^[12] There were many drawbacks to this paper-based system, especially in terms of information access: only a limited number of individuals could access the files at any one time; and access was restricted to only a few data points, usually accession number, donor name, and occasionally the object's name or classification.

With such a system, answering questions such as "When did we receive this particular artifact?" or "What has this donor given us?" might be simple enough tasks

(assuming the card files were kept up-to-date). Searching through and sorting records to answer more sophisticated questions could be laborious and time-consuming. Within the limitations of paper-based systems, certain questions prove virtually impossible to answer, including: "How many oil-based paintings do we have that were painted before 1450?" or "Do we have sufficient numbers and types of shoes to create an exhibit illustrating the history of shoemaking over the past 500 years?" When faced with such questions, even the most knowledgeable and skilled museum employees might be unable to provide satisfactory answers.

This situation improved with the introduction of modern, computerized systems for museum cataloging.^[13] Museum professionals were now able to search and sort digital records about their collections using almost any database field. They could store more information about their artifacts, and they could share data more easily with other institutions. Museums had the potential to work together to improve the quality of their information resources and provide better, more useful, and more accurate information to their users; but the realization of this potential did not turn out to be an easy task.

There were few accepted standards for organizing information within museums, and organizational methods were typically institution specific and varied greatly from museum to museum. Given the inherent uniqueness of museum artifacts, it was impossible for one museum to document an object and then share that information with other institutions with the same object. No two institutions would record the same information in their ledgers, or use the same terminology when describing their collections. How, then, could museums develop standards to improve the quality of their records and more easily share data about their collections?

Standards and Metadata

There have been many attempts to create data content, structure, and value standards for documenting and describing museum artifacts.^[14] Cultural heritage institutions, for instance, frequently classify collections of man-made objects using a nomenclature system developed in 1978 by Robert G. Chenhall,^[15] later revised and expanded by James Blackaby et al.^[16] It is difficult to develop a classification system that works equally well across all institutions with widely different kinds of collections. Museum professionals attempting to use Chenhall's nomenclature may encounter many difficult questions, such as: Should an ancient Egyptian document written on a torn piece of papyrus be classified as a material fragment or according to the content of the document? or Should a wine jug from ancient Greece be classified under the generic term "Pitcher, Wine" or the specific term "Red Figure Oinochoe?" Different institutions tend to answer such questions in their own way, thereby

making it very difficult to establish standards that can be upheld by all organizations.

Museum professionals at many different institutions are working to solve these problems. The Getty Research Institute has developed detailed vocabularies and thesauri specifically for the use of museums.^[17] The products of their research include structured vocabularies such as the Art and Architecture Thesaurus (which provides 131,000 terms for describing cultural materials), the Union List of Artist Names (which contains 293,000 names of artists and architects), and the Thesaurus of Geographic Names (which includes 1.1 million terms for geographical and historical locations). The Getty Research Institute has also developed the Categories for the Description of Works of Art, which establishes a data content standard for describing museum objects and images.

International organizations have developed and evaluated metadata standards to see whether they can be used when describing museum artifacts. The International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM) has led the development of the Conceptual Reference Model (CRM), providing perhaps the most complete model for describing concepts and relationships when documenting cultural heritage objects (<http://cidoc.ics.forth.gr/>). During the late 1990s, the Consortium for the Computer Interchange of Museum Information (CIMI) evaluated the effectiveness of the Dublin Core Standard for describing museum artifacts, concluding that Dublin Core elements are useful to cultural heritage institutions in the abstract, but potentially problematic when used for institution-specific needs. More recently, academic researchers have been investigating the use of Extensible Markup Language (XML) for describing museum artifacts, and exploring the potential of the Open Archives Initiative for harvesting museum metadata for collections repositories.^[18]

Museum associations have also been working to develop standards for best practices when managing museum collections information. The Museum Documentation Association (MDA) in the United Kingdom has developed a standard called SPECTRUM that is a guide to good practice for all museums when documenting their collections.^[19] The Visual Resources Association (VRA) has established data content standards for Cataloguing Cultural Objects (CCO), fulfilling much the same purpose as the Anglo-American Cataloguing Rules (AACR2) in library and archives communities.^[20]

Data Sharing Initiatives

Efforts to develop international standards acceptable to a range of institutions have resulted in initiatives to build extensive shared collections databases. From local to national levels, collections of digital information resources organize and allow access to a variety of data from museums of all types. The Canadian Heritage

Information Network (CHIN) connects hundreds of Canadian museums into one national network, providing a searchable database of millions of museum artifacts and an extensive Virtual Museum of Canada. The Collections Australia Network (CAN) provides a portal for information about Australian museums, including a searchable index of hundreds of thousands of Australian artifacts.

When developing these shared collections, museum professionals often have the opportunity to evaluate different standards and recommend best organizational practices. During the 1990s, the Museum Educational Site Licensing Program explored a variety of issues ranging from data standards to intellectual property rights, when six museums worked with seven universities to share information resources about thousands of digital images.^[21] More recently, the Art Museum Image Consortium (AMICO) was able to use the resources of its extensive library of digital images to develop detailed specifications and data dictionaries for institutions scanning and organizing data about images.^[22] These projects frequently relied on the resources of their member institutions to test different methods for providing access to distributed sets of artifact data, and for connecting multiple museum databases while accounting for variations in data types, semantics, and query terms.^[23]

Museum professionals often form consortia to achieve the common goals of the member organizations collaborating on digital projects. Typically, these consortia are able to undertake projects of greater complexity than any one institution would be able to handle alone. Museum collaborations are usually formed to create a collective digital resource to which all participating organizations will contribute. The Museums and the Online Archive of California, for example, brings together 75,000 object records from 11 cultural institutions in California.^[24] The Collaborative (formerly Colorado) Digitization Project brings together cultural heritage materials from institutions across the western United States into one shared resource repository.^[25] The Scottish Cultural Resources Access Network has gathered hundreds of thousands of multimedia and text records about Scotland into one central repository.^[26] These cooperative endeavors testify to the museum community's commitment to finding new ways of organizing and sharing information resources.

INFORMATION TECHNOLOGY IN MUSEUMS

The first attempts to computerize museum collections occurred in the early 1960s, when several institutions began exploring the potential benefits of automating their collections management with computerized systems.^[27,28] These early systems were developed on mainframe systems and used to store descriptive information about museum artifacts. The Smithsonian Institution, for example, developed information systems, such as Smithsonian

Institution Information Retrieval System (SIIRS) and Self Generating Master (SELGEM), which were used at institutions across the country during the 1960s and 1970s. The Museum Computer Network (MCN), founded in 1967, developed and distributed a system called Generalized Retrieval and Information Processing for Humanities Oriented Studies (GRIPHOS) to their member organizations. One of MCN's first projects was to evaluate standards for information organization and access at 12 art museums nationwide, and MCN sponsored the first conference on computers and their potential applications in museums at the Metropolitan Museum of Art in New York in 1967.^[29]

Soon, a number of institutions were using mainframe systems to store data about their collections in electronic format. Museum professionals began to meet at a variety of conferences to discuss organizational standards, best practices, and new uses for information technologies in museums. As computers became cheaper, faster, and easier to use, even professionals working for small, poorly funded museums were able to purchase computer systems and database software for collections management. Vendors started developing and distributing collections management systems for many different types of museums. By the 1980s, new technologies had been developed that supported digital imaging, and museums began to experiment with building digital image databases. As the use of digital networks such as the Internet became more widespread, museum professionals found even more ways to share data about their collections. Today, museum professionals face a rapidly evolving information environment, and conferences such as the international conference of Museums and the Web and the annual meetings of the MCN help keep hundreds of museum professionals up-to-date with the latest techniques and methods of bringing museum information resources online.

Museums and Digitization

When museum professionals discuss “digitizing their collections,” they refer to a process in which two things can occur: 1) they record in electronic format descriptive data about their artifacts; and 2) they produce some type of digital representation or image of each object. These two activities are often easily confused. When museums first began working with computers, digital imaging was not even a possibility, and when museum professionals referred to “computerizing” their collections, they meant taking descriptive, textual data from their ledgers and card files and converting them into electronic format. Today, with the prevalence of digital cameras and scanners, most museum professionals have expanded their definition of “digitization” to include digital imaging, and it is easy to forget that when a collection is digitized, the museum professionals in charge of the project must do more than produce a digital image of each artifact. They must also record descriptive data about the object (such as its

provenance, classification, and composition) in electronic format, and generate new, additional metadata for the electronic object.

Recording data about museum artifacts in digital format offers museum professionals immediate benefits. These benefits include the ability to make a virtually infinite number of perfect copies of digital surrogates, and transmit them over great distances with no loss in quality; to offer new levels of interactivity between objects and users; to take advantage of hypermedia and multimedia to remove objects from the constraints of physical space and present arrangements impossible in physical galleries; to provide remote access to information resources for visitors, scholars, researchers, and students; and to target unique information needs, by broadcasting information resources to wide audiences or narrowcasting information resources to individual users.

The ever present push for digitization has created new problems and exacerbated old ones for museums. These problems include concerns, worries, or fears over such issues as copyright and intellectual property; the potential lessening of the “aura” or authenticity of museum artifacts; the blurring of individual museum identities online; and the potential impact of access to digital surrogates on physical museum visitation. The opportunities and challenges afforded by digitization have prompted new questions and concerns about the rise of the digital museum in the information age.

The Digital Museum

New technologies and online museums mean easier access and wider use of information resources that may previously have been more firmly controlled by the governing institution.^[30] Some museum professionals worry that when they digitize their collections and make digital resources available online, they lose control over the museum's intellectual property and other copyrighted materials. Such concerns have prompted some institutions to protect their intellectual property by restricting access to certain types of data or making it difficult to reproduce the content they control. For example, museum professionals may attempt to prohibit the illegal duplication of digital images by embedding visible or invisible watermarks into digital image files.^[31] These approaches are only stopgap solutions, however, and a true solution to this problem will only come when the museum community reevaluates its approaches to rights administration and content distribution, developing new economic models for digital cultural heritage.^[32]

Another question asked about digital museums concerns whether visitors will stop visiting physical museums as more information about museum collections is available online. This fear has become even more prevalent as the quality of digital artifact representations online has increased; many museums offer extremely high-resolution

images of their artifacts online, and some even offer three-dimensional representations that can be manipulated by virtual visitors and examined from all sides. With such features available online, some museum professionals wonder whether museum visitors will still bother to visit the real thing. Fortunately for museum professionals, recent surveys have provided compelling evidence that online museums actually drive physical museum attendance instead of discouraging physical visits; in the majority of studies, planning a museum visit is consistently cited as the primary reason people visit museum Web sites.^[33,34] Kravchyna and Hastings^[35] found that 57% of museum Web site users visit museum Web sites both before and after they visit physical museums. Similarly, Thomas and Carey^[36] found that 70% of museum visitors specifically looked for online information prior to a museum visit, and that 57% said the information they found online increased their desire to visit the museum in person.

Despite the potential challenges, museum professionals remain eager to digitize their collections, prompted no doubt by the growing number of museum visitors who now expect museums to provide access to their collections in digital formats. As the technologies required to build a digital collection become easier to use and cheaper to acquire, more museums have the opportunity to embark upon digitization programs, and more opportunities arise for museum visitors to interact with digital museum collections.

INFORMATION INTERACTIONS IN MUSEUMS

Museum professionals use new information technologies to develop innovative ways of reaching their visitors, online and in-house.^[37,38] Inside the museum, interactive kiosks encourage visitors to explore topics in greater depth and at their own pace. Online, virtual museums allow visitors to plan gallery tours, research artifact collections, and learn from interactive educational exhibits. New information technologies have changed how museum professionals achieve their missions, and encouraged museum visitors to embrace the new capabilities of the digital museum.

Museums and the Web

When museums started going online in the 1990s, museum professionals discovered that the Web offered them the potential to provide more than information about their museum's location, hours of operation, and brief descriptions of their collections. They began to explore the capabilities of online exhibits, realizing that increased access to digital collections offered new opportunities for interacting with museum collections and information resources.

Online museums and virtual exhibits have the potential to cover topics in ways not possible in physical museums. For example, Douma and Henchman^[39] present an online exhibit that allows visitors to digitally remove layers of a painting (Bellini's *Feast of the Gods*), examining earlier versions using simulated infrared or x-ray lenses. Gillard^[40] explores how the National Museum of American History's HistoryWired project encourages visitors to manipulate a collection of artifacts, uncovering connections between objects along temporal, cultural, and thematic lines. Sayre^[41] describes how the Minneapolis Institute of Arts allowed online visitors to follow the restoration of a painting in real time, drawing them into the process and building stronger relationships between the museum and its visitors.

Many museums offer three-dimensional interactive tours online that mimic the experience of visiting the museum in person, while simultaneously opening an array of new possibilities for interaction.^[42,43] Online museum visitors, for instance, can compare and contrast artifacts that in real life may not be in the same exhibit or even the same museum. Some institutions have experimented with live online exhibits, using webcasting techniques to interact with global audiences in real time. The Exploratorium in San Francisco, for example, broadcasts live coverage of solar eclipses (online and recently in the virtual world of Second Life) and has developed a related online resource guide (<http://www.exploratorium.edu/eclipse/>).

New technologies have also offered museum professionals ways to bring information about their collections directly to their audiences. As museums continue to digitize their collections, it has become more common for museum professionals to make their records available online to the general public. These resources are used by a wide variety of online visitors, from recent visitors interested in learning more about artifacts they saw in person, to academic researchers at distant universities searching for particularly unique specimens. As more museums develop online collections databases, museum professionals have explored the potential benefits of linking these databases directly into their online exhibits, providing online visitors with instant access to the latest collections data.^[44]

Personalization Technologies

Modern museums can personalize the museum-going experience in ways never before possible. It is now common for museums to offer handheld devices—such as audio guides—to their gallery visitors. In essence, visitors to these museums have their own digital docents that can discuss artifacts of personal interest to them, providing a digital twist on traditional museum guided tours.^[45] Using a handheld device, visitors can listen to audio descriptions of works of art, allowing them to explore the gallery's contents in any order and at their own pace.

As handheld computers become less expensive, museum professionals continue to experiment with the capabilities of these devices, offering their visitors detailed text and digital images in addition to audio tracks. Projects that explore the educational potential of mobile computing devices in museums are becoming especially crucial as more museums integrate such systems into their exhibits and learning experiences.^[46] Several projects have demonstrated the value of mobile computers for increasing visitor interactions and improving educational experiences in museums.^[47,48]

As museum professionals explore new methods of making information on collections available online, revolutionary trends in personalization have occurred in the online museum environment.^[49] A growing number of museums, including the Metropolitan Museum of Art, the Virtual Museum of Canada, and the Fine Arts Museums of San Francisco, now allow visitors to create personal digital collections of their favorite artifacts, adding or removing artifacts at will, and returning to view their collections whenever they like. Some museums, such as the Minneapolis Institute of Arts and the Walker Art Center, allow online visitors to group digital artifacts into personal galleries, annotate them with textual descriptions, and share them with other online visitors.

The future of museum personalization can be found in the application of web 2.0 and social computing technologies for online museums; the collaborative social tagging project Steve (<http://steve.museum>) provides an excellent example of how these technologies can be implemented for museums. It will likely soon be common for museum professionals to encourage their online visitors to draw new connections between artifacts, store those connections on the museum's computers, and share them with other museum visitors. In this way, museum visitors will add value to digital collections, contributing their knowledge to the museum's collections by adding new connections and interpretations across user communities.^[50,51]

INFORMATION MANAGEMENT IN MUSEUMS

Information management skills have always been important for museum professionals, who have a lengthy history of working with information resources and technologies.^[52] As museum information resources become more technically complex, and the users of those resources become more information literate, the needs and expectations of visitors have become increasingly sophisticated. Users of museum resources are no longer satisfied with limited access to information about museum collections, and many desire 24 hr access to museum data, no matter where the data are located, or how the data are organized. While the ability to manipulate and manage information resources has long been an important skill for museum

professionals, meeting these changing expectations can be difficult for museum professionals.

Changing ideas about the museum's position as an information service organization can pose difficult challenges for museum professionals, often requiring them to learn new information management skills and integrate new information technologies into their daily work.^[53] Increased access to the digital information resources of libraries, archives, and museums has driven changing expectations from all museum users, including museum visitors and museum professionals, about the information resources museums should provide online and in-house.^[54] Users of all types frequently expect digital museums to act more like digital libraries—a situation that puts immense pressure on museum professionals to live up to the changing needs and expectations of their users.

Information Professionals

Museum professionals have become increasingly concerned with the ability of museums to function in the information society, to meet user needs, and to ensure that the right information resources are available at the right time and place, inside or outside the museum. To accomplish these goals, a new role has emerged for information professionals in museums.^[55] The success of museums in the information age will depend largely on the work of information professionals trained to deal with the problems of museum informatics and the museum's information needs.

Information and communication technologies in museums change so rapidly that museums need individuals on staff who can guide them through the hazards of planning digitization projects, purchasing collections information systems, or joining online data sharing initiatives. Museum administrators know that if a museum is to participate in the information society, someone at the museum needs to be able to set information policy, manage information resources, administer content management systems, implement metadata standards, evaluate information interfaces, etc. While some technical jobs (including Web design) can be outsourced, museums that do not have in-house skills with museum informatics will find it difficult to meet the constantly evolving demands of their increasingly information-savvy audiences.

MUSEUM INFORMATICS: FROM PRACTICE TO THEORY

The future of museum informatics as a unique research area depends on its ability to bridge multiple disciplines, drawing upon disparate theories and methodologies, and connecting the traditional professional world of museum studies with critical theories from the emerging worlds of new media and digital cultural heritage. Recent

publications have been extremely influential in setting an agenda for museum informatics and providing the intellectual framework necessary for the advancement of the field as a research area, a particularly important achievement for an emerging field such as museum informatics.^[56,57]

The principal challenge facing the establishment of museum informatics as a unique research area lies in the fact that museum informatics is an extremely interdisciplinary field of study. Researchers interested in the museum's changing role in the information society have drawn upon theories and techniques from dozens of related fields, including digital libraries, human-computer interaction, social network analysis, cognitive science, museum studies, library and information science, etc. While early work in this area focused primarily on how information technologies should be used in museums, researchers are now emphasizing the need for an underlying body of theory and methods for studying museum informatics as well as related fields such as museums and new media or digital cultural heritage.^[58]

To explore new theoretical perspectives and to develop new methodologies, researchers and professionals from around the world have joined together to form evolving communities of practice, dedicated to providing guidance to museums and other institutions of cultural heritage as they address important issues in museum informatics.^[59] Interest in museum informatics is now widespread, and each year, thousands of people worldwide participate in discussions, projects, and research initiatives related to museum informatics.

Museum professionals and researchers today belong to many different professional organizations and attend a variety of conferences dedicated to exploring museum informatics, including the meetings of such organizations as the MCN, the MDA, the International Council of Museum's International Committee for Documentation, the International Cultural Heritage Informatics Meeting, the International Museums and the Web Conference, and the Institute of Museum and Library Services' WebWise Conference. The published conference proceedings from these meetings, many of which are freely available online, provide important, timely, and often extremely cutting-edge primary resources for individuals interested in studying museum informatics.

The prodigious number of museum informatics-related events (including conferences, training events, symposia, etc.) as well as their regular high attendance are indicative of a continued and widespread professional engagement in this area. In addition, during the last few years, there has been a flourishing of university programs in this area. In the United States and Europe, for example, there are educational programs where students can study exclusively in such areas as museum informatics and digital cultural heritage. These programs are indicative not only of an increase in research activity by academics, but also of the

increase in interest and demand by students for resources and publications in the area of museum informatics. To meet this demand, a growing number of scholarly journals now publish papers about museum informatics. The *Journal of the American Society for Information Science and Technology*, the *Journal of Digital Libraries*, and *Curator*, for example, have all published special issues on museum informatics. More recently, the *Journal of Museum Management and Curatorship* has added a permanent section on Digital Heritage to its quarterly issues.

While the increase in publications related to museum informatics (including books, journals, and conference proceedings) is extremely encouraging, the increasing amount of literature has posed challenges for museum informatics researchers. In particular, the natural interdisciplinarity of museum informatics (covering such topics as technology, communication studies, museology, education, information science, etc.) tends to result in a centrifugal approach to publishing, where key pieces of research can appear in very different domains, speaking to very different peer groups. As interest in museum informatics continues to rise, therefore, researchers and practitioners seeking to establish museum informatics as a research area must collaborate to bring together any and all research related to the intersection of people, information, and technology in museums—including both the practical processes and theoretical discourses that relate to the organization, management, and use of museum information resources.

CONCLUSION

The study of museum informatics requires a sociotechnical approach to information resource management in museums. New information technologies have changed the way museum professionals think about the purpose and capabilities of museums. These sweeping changes have affected the way museums manage their information resources, in-house and online, in almost every aspect. The world of museums is being altered constantly by the introduction of new information technologies, as new technologies reshape the job of the museum professional and the overall function of museums in the information society.

To understand these changes, museums must be examined as complex sociotechnical systems that evolve and adapt to meet new challenges. Museum researchers must study museum informatics within complex and interlocking organizational and social contexts affecting the nature of museums in general and the expectations of museum professionals and visitors in particular. In this way, museum professionals and researchers will be able to embrace the growing role of museum informatics in the twenty-first century museum, and continue to explore the sociotechnical implications of people, information, and technology interacting in museums.

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Museum Management

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Abstract

Museums must address an increasing array of issues to succeed in the dynamic environment of the twenty-first century. In response to this often-daunting process, the role of institutional management has been assigned greater responsibility and often, greater liability. It must define the museum's mission, justify its legitimacy, and reconcile its relationship with changing constituency expectations. In response to this challenge, museum management is exploring the economic landscape to develop creative and sustainable institutions that serve the interests of the public while negotiating the legal pitfalls, and maintaining the ethics and standards of the international museum community. This entry addresses a number of the issues relating to contemporary museum management. It draws from the precepts of the corporate, as well as the not-for-profit communities, to stimulate understanding of the role and responsibility of inclusive management as a practical response to the complexities of the contemporary museum.

INTRODUCTION

Museums as a part of the rapidly expanding not-for-profit sector must be prepared to adjust to the changing demands. The traditional separation between the not-for-profit and the for-profit worlds is an ever-narrowing gap due to the commonly shared need for money, growth, and prominence. However, unlike the commercial sector, the museum must also conform to the ethics and standards of the professional community and a scrutinizing public. Museum management is often at the epicenter of this shifting landscape of successful achievements and unresolved challenges.

The purpose of museums continues to be service to society, the community, the public and its various constituencies, including those persons that are physically or mentally challenged. The collections are for people, whether those people are the public or researchers. Museums must retain these time-honored values and beliefs while considering escalating expenses, public demands, technology, changing demographics, mergers, outsourcing, governmental regulations, tourism, outcome assessments, and maintaining donor confidence to name but a few issues. The challenges increase exponentially for museums pursuing international interests, such as collections and exhibitions. Nevertheless, the successes are frequent enough to keep dedicated individuals engaged in pursuing the elusive quality customarily called excellence.

The Museum community has endorsed different methods for dealing with management issues in the quest for excellence. Some institutions have turned to the business community for leadership, and others have reinforced core values by relying on museum professionals and more formalized management practices to guide the institution. Both approaches demonstrate the critical concern about

museum management in these early years of the twenty-first century.

Often the management of an institution is the least considered aspect of a functional and effective museum. The popular belief is that museums are about unique, often beautiful, and usually significant cultural objects. How those objects are collected, housed, protected, conserved, and exhibited is not and should not be a concern for the average museum visitor. Nevertheless, the "life" of a museum is best represented by the activities that the public never sees, and by the dedication of numerous museum professionals that champion the care and protection of cultural and natural heritage.

This entry will acquaint the reader with a range of museum management issues, processes, and practices. The information will explore the importance of museum management and explain such topics as management structures, personnel management, teamwork and mission, financial management, management planning, and management ethics. Each of the elements is critical to a successful and sustainable museum and its continuing effort to serve the profession and the public.

MUSEUM MANAGEMENT

Museum management is an important but often misunderstood element of the museum profession. Individuals, particularly those entering or preparing to enter the workforce, normally think of museum management as that activity performed by only the director or upper administrators. Many persons associate the idea of management with the "boss." That perspective continues today, although many managers/directors consider themselves leaders instead of individuals who tell others (subordinates) what to do. All

museum personnel are involved with management in fact. Every person in a museum, regardless of title, has a position of responsibility that includes accountability, duty, and trust. Everyone should be working to accomplish organizational goals, that is, contributing to the process used to attain what the museum wants to achieve—its defined mission.

The term “management” is likely to be called “administration” in most English-speaking countries. Whereas in the French, Spanish, or Italian tradition of public service it is referred to as “*gestion*.”^[1] Although this entry will focus on that aspect of museum management (administration), many of the practices described are applicable throughout the institution. Elements such as budgeting, planning, human resource considerations, communication, teamwork, honesty, and accountability have obvious generalized applications. Museum management is an inclusive concept that involves the judicious use of resources to accomplish an objective. It is both an intellectual and a practical concept.

Museums, as public institutions, exist for the public’s benefit, and to be successful, all aspects of their operations should reflect that obligation and commitment. Management is an integral element in maintaining and promoting ethical and legal stability. Collecting, conservation, and research should be executed with a public consciousness, just as the more visible or public-oriented exhibitions and educational programming. These activities are valued elements of museum management. An organization operating in the public interest must manage its affairs properly, but museums as custodians of the cultural, natural, and scientific heritage of a people, region, or nation must function, as nearly as possible, above criticism.

Management and administration are often used to mean the same activity in many locations. The use of “management” in this way applies a collective term describing the “manager” of an organization, for example, a museum. However, management as an act of controlling something successfully can apply throughout the museum, whereas “the administration” is by definition charged with regulating the affairs of the museum. Interestingly, there is no consistent prototype for the general administration (management) of museums. This situation is usually ascribed to the diversity of museum collections and may reflect a lack of understanding of the role of museums in contemporary society. The ambivalence is the result of not knowing whether museums are guardians and interpreters of cultural heritage, repositories for the study of human and natural history, social instruments in community development, or facilities of leisure and recreation.^[2]

Museum management is commonly associated with the level of authority within the organizational structure where institutional decisions are made. The museum manager may have different titles, such as director or chief executive officer (CEO), and it is that person who normally makes decisions about the way the museum is

organized, the services it provides, and the people it serves. The manager/director is usually hired or appointed by the governing authority, and that person is vested with the authority to make day-to-day operational decisions, including the hiring and disciplining of staff. Managers/directors are expected to provide the leadership, vision, and guidance that are a part of good management.^[3]

Organizational management, including the manager/director, represents the essential nature of museum operations. It is that part of the institutional structure that acknowledges and supports the cultural, natural, or scientific experience through carefully prepared and thoughtfully presented exhibitions of collections, quality research, and an insightful plan for preserving objects for future generations.

Effective museum management at any level and in most countries does not occur in a vacuum. All museums operate under some form of governing body—board of directors or trustees, Minister of Culture, or city government. The museum should be established according to the laws of the country or state in which it exists. It should have, as a part of its documentation, a written constitution, statute, or other enabling document that states the museum’s legal and financial status. The documentation should confirm that the museum is not organized to make a profit; rather, that it is intended to serve the public need. The concept of not-for-profit maintains the idea that any income generated by the museum is intended for the support of the institution and not for distribution to individual subscribers. This idea seems simple, but the concept is sophisticated, because it includes the principle of philosophical ownership as opposed to physical ownership as found in for-profit organizations. The stakeholders of the not-for-profit organizations are the public, and the governing authority (board) of the museum that represents them. That authoritative body has fiduciary (i.e., evoking public trust) responsibility for the museum. They can make decisions and determine programs, exhibitions, and collections, but may not receive benefits as individuals beyond knowing they have acted as good stewards and responsible trustees.

(NOTE: The terms nonprofit and not-for-profit continue to cause confusion in the international museum community. Nonprofit is interpreted to mean that the museum cannot make money. Whereas, not-for-profit means that the museum is not a commercial enterprise. It is generally accepted that the latter definition is the more acceptable.)

The concepts of public service and philosophical ownership of museums are closely related. The idea of individual (personal) or board (group) ownership of museums as not-for-profit organizations should not exist. There is no physical ownership in the traditional sense because museums are intended to serve a public purpose. This notion of ownership is a very important aspect of the not-for-profit sector. The governing authority (board) governs on behalf of individuals who are not seated at the board

table. That group (board) may change and the staff may change, but the “public,” although an ill-defined entity, continues to “own” the museum as a holding place for cultural, natural, and scientific heritage.

One of the most important aspects of the organizational documentation is that it reflects the values and beliefs that initiated the need for the museum and that will sustain its continued growth. The museum may be the result of a personal or governmental vision, but that vision must be of appropriate significance to mobilize others into action as supporters and visitors. The beliefs of a museum constitute its value system that differentiates the work of a particular museum from others, or defines critical differences in approach or methods among similar efforts. The management must work to sustain belief in the museum, promote its mission, and advocate its permanence.

The defining institutional attitude that directly connects to management is the museum’s mission and policies and provides the organization, its leadership, and staff with a stable foundation upon which to build. The authority of the manager/director generally depends on the laws and regulations under which the museum is established, as well as the internal documents. The regulatory rules may differ from location to location; nevertheless, a primary role of museum management is assisting the museum in achieving consistent results so the institutional mission can be articulated and fulfilled.

The operation of all types of museums is based on teamwork, and this has important implications for the management structure. Managerial (administrative) duties are commonly assigned to the manager/director, and it is normal for that individual to guide the institution toward the desired goal through planning, organizing, directing, and controlling. These four functions of management are applicable throughout an organization. There may be one manager/director for the museum, but there are other managers at different levels. Diversified museum management is exemplified by the processes associated with accessioning and deaccessioning, inventory of collections, educational programming, exhibitions preparation and installation, preventive conservation, integrated pest management, and a continuing list of other practices common to all professionally oriented institutions. The four functions are included at each level of management, though the emphasis on each function may change. The management role fulfilled by the upper administration of the museum is a relatively small, albeit important, aspect of the overall activities of the institution.

Because museums are labor intensive and require a wide range of skills, the management duties may be assigned on different levels, depending on the size and structure of the particular institution. Larger museums may have a structural layer identified as “upper management.” This element of the museum includes the manager/director and a number of assistants (senior specialists) identified by different titles. The second layer may be

called “middle management” to identify the division heads. These managers have a specialized understanding of certain tasks such as collection management or program development. They are usually responsible for implementing decisions made by upper management as well as supervising employees. Some museums also identify a level of “lower management” that ensures the decisions and plans are executed. These managers have responsibility for tasks of limited duration and include a limited number of support staff.

It is important for all persons with management responsibilities to understand the administrative, legal, and ethical issues applying to their circumstances and the conditions relating to their work. Although these factors also vary from country to country, issues relating to import, export, or transfer of cultural property, endangered species, sacred materials, and human remains have universal implications that must be considered. These issues may significantly influence both museum management and professional practices.^[3]

Building and stabilizing an organizational climate is the crux of the concept of public trust as placed in museums. Although a museum’s management responsibilities and therefore its structure may differ, there are, nevertheless, certain elements that are common to most. These include the following:

- Purpose*—a clear understanding of the purpose of the museum in the public interest
- Program*—maintaining a program consistent with the museum’s stated purpose and its available personnel and financial resources
- Expenses*—supervising programs, management, and related expenses
- Promotion*—ensuring ethical publicity and promotion, excluding exaggerated or misleading claims
- Fund raising*—soliciting contributions without payment of commissions or undue pressure
- Accountability*—producing an annual report that describes program activities and supporting services in relation to expenses and that contains financial statements
- Budget*—developing and implementing an annual budget approved by the governing body in a form consistent with an annual financial statement

Because museum personnel other than the manager/director may be engaged in completing these tasks, management is often thought of as simply having the ability to get something done by other persons. The manager/director should ensure the museum is a professional, systematic, enjoyable, and socially conscious institution regardless of who performs a particular task. The management must understand and apply principles drawn from research and “best practices” in business and public service, as well as the museum field, to meet these various challenges.

Consideration should be given to a wide range of academic disciplines, including economics, law, psychology, sociology, and information technology.^[1] Attention must also be given to management functionality, as the action of measuring a quantity on a regular basis and of adjusting initial plans as actions are taken to reach the intended goal.

The management has a responsibility that embraces all the resources and activities of the museum in fulfilling its various duties. Effective management is the means of ensuring that a museum, regardless of its size or complexity, achieves consistent results so the institutional mission can be fulfilled. It is a necessary element in the development and advancement of a museum. Without proper management, a museum can neither provide appropriate care and use of collections, nor can it maintain and support an effectual exhibition and education program. Public interest and trust can be lost without qualified management, and the museum, as an institution in the service of society,^[4] can be jeopardized.

It may be important to gain greater insight into the way museums operate to better understand the museum management process. Who or what authorizes the museum and to whom does it (the museum) report are questions to consider. There are at least four different types of museums based on their authorizing agencies:

- Governmental—those museums that are authorized and supported by local, regional, or national governmental agencies.
- Private—museums funded and operated by individuals or private organizations. Church museums are included in this group.
- University—museums that are attached to colleges or universities and maintained for educational, that is study, collections.
- Combination—museums that were initiated by governmental agencies or private organizations and transferred to the other for operational purposes. (This type of museum may be the result of governmental change or the reduction of funding. A nongovernmental organization may be formed to provide funding for the museum to continue the museum's operation.)

The authorizing agency is generally responsible for defining the governing authority for the museum. That authority is often referred to as a Board of Trustees because they are entrusted with oversight responsibility for the museum. That board has fiduciary responsibility of the institution. The governing board (trustees) has the duty and responsibility to manage the affairs of the museum, so its property will not be diverted from the public purposes for which it was entrusted. They hire, evaluate, and when necessary fire the manager/director. They approve the budget and promulgate policies, but should leave the management of the organization to the manager/director.

It is the responsibility of the board to

- Clarify the organization's mission
- Interpret the mission statement to the public and enhance the organization's public image
- Approve goals and objectives and set long-range plans
- Establish policies and other guidelines for agency operations
- Be legally responsible for all aspects of the organization's operations
- Ensure the organization's financial stability and solvency
- Hire and support the manager/director and assess his or her performance

There are also boards that give counsel but do not govern. These are advisory boards. They may provide advice to the governing board, the director, or any element of the organization. Advisory boards can be positioned anywhere in the museum structure as long as they are attached to some element. They have only the authority assigned by the governing body. The assigned authority may be extensive or limited, but it must be retractable, that is, someone or some board must have the power to remove the authority granted to the advisory board.

Some museums have a workgroup board. This generally refers to a governing board with minimal or no staff support. Therefore, the board must govern and do the work. Small organizations may have boards with these dual responsibilities. This is not a true board type because it has no assigned location within the organizational structure. It is at the top and everywhere else. Workgroup boards have two different roles and those roles are best served when kept separated.

Governance and management are used to describe the functions or activities by which a board carries out its responsibilities. When a not-for-profit organization has a professional staff, the partnership between the board and staff occurs in fulfilling the management function rather than governance and administration. Boards provide governance and staff does the management and administration functions in theory; however, in practice, the three activities are often intermixed. When this happens, it may be a source of frustration for both the staff and the board. It compounds the issues of "who does what." This complexity is most noticeable when an organization grows and the organizational demands increase. The expansion results in unclear lines of communication, authority, and decision-making, thus causing confusion and organizational dysfunction.

MANAGEMENT STRUCTURE

It may be of value to differentiate between leadership and management before discussing the management structure

of museums. These terms are important to the organizational structure of a museum. They acknowledge different characteristics, but are often used interchangeably.

There are good leaders who are good managers just as there are good managers with excellent leadership qualities. However, the opposite is as likely to be true. A good leader is not necessarily a good manager. Managers, by simple definition, are considered experts of efficient organization planning, direction, and control of the operations of a museum. Leaders, on the other hand, are to provide a more visionary reference point for institution attitudes, beliefs, and responsibilities. Leaders set the standard of achievement anticipated by institution personnel such as trust, honesty, personal integrity, efficiency, competency, equity, and dignity. The successful contemporary museum leader is a composite of experiences, skills, and attitudes.

The abilities of the manager/director often influence the organizational structure of a museum. It is also true that a structure appropriate for a smaller museum may not be satisfactory or acceptable for a larger institution. Museums operated as part of a governmental construct may be required to function and be structured according to the management system of the governing body. There is, however, a need to maintain a proper system of operations according to accepted museological practices. A crucial matter for management is therefore to define the structure under which the museum is authorized, governed, supported, and operated. This basic procedure is valuable for existing as well as newly formed museums. Often the management structure is assumed and based on previous practices but lacks clear documentation. A simple diagram or organizational chart can be used to demonstrate lines of authority and information exchange.

The organizational structure may be viewed in different ways. The exact relationship between members of the staff often depends on the perspective of the participants and the practice of the museum. Nevertheless, an organizational diagram (also called a flow chart) is very beneficial in defining structural relationships.

The governing authority is at the top with the director/manager immediately following in the most common organizational structure. The rest of the staff is arranged below according to their relationship with the primary divisions (or functions) of the museum. This arrangement is known as a *hierarchical structure* (Fig. 2) and is an authoritative or top-down approach to institutional management. A second arrangement, often called a *horizontal (or flat) structure* (Fig. 3), spreads the line of contact with the director/manager to give all staff equal access. A third organizational configuration that can function very successfully is the *matrix structure* (Fig. 4). All elements ultimately converge on the director who is the link between the governing authority and the staff regardless of the structural arrangement. The structure may vary, but it should be clearly defined, and care should be taken to involve staff in a range of decision-making roles. One way

to promote this exchange is to have a management advisory committee (team). This arrangement allows members of the staff to meet regularly with the director/manager and to discuss issues related to operational activities.

Although certain organizational structures are common across the museum community, each institution by its unique nature has a structure that has evolved over time to meet the particular needs of that institution. The structure of many museums gradually flattens to allow greater access to the director/manager. The more centralized the decision-making authority, the more likely the institutional structure will gravitate in that direction.

A variation of the matrix structure is becoming more common as the museum staff becomes more diverse. Fundraising, marketing, and community engagement personnel often require a coordinated focus group (or committee) that must follow a specific agenda. Fund raising, for example, must establish a systematic process for identifying, developing, and soliciting donors. This process is time consuming and requires intensive communication between members of the team. The team may expand or contract depending on the leader's assessment of a particular project and the approval of the manager/director. Other activities within the museum may be equally well served by using a matrix structure. Communication is a primary factor in organizational structures, but with the matrix structure, that importance increases. The seeming autonomy of the team should not result in unilateral decision-making and unauthorized actions.

Most museums have a management structure that includes at least three components—administration, curation, and operations—regardless of the visual representation that structure may take. All elements of the museum may be the responsibility of one person, or they may accommodate many people. The tri-parted structure allows distribution of various tasks. The division of curation and operation activities is generally based on the concept of collecting and noncollecting areas. This relatively simple structure can be expanded to facilitate increased activities while maintaining clear lines of communication and an easily comprehensible reporting procedure.

The structure may be as simple as the diagram in Fig. 1, or it may be complex with a range of primary, secondary, and tertiary positions, as shown in Fig. 2. Education and exhibitions are often under operations as noncollecting elements of the museum. Budget oversight, fund raising, public relations, and marketing are often a part of institutional management reporting directly to the manager/director. The important issue is to have a clearly defined structure. All museum personnel should know where they fit into the organization and their relationship to other staff members. The organizational chart is a map that defines the system and describes the flow of museum work. It demonstrates the organizational attitude of the institution.

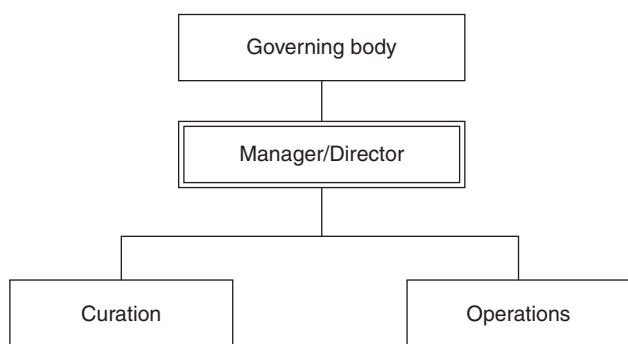


Fig. 1 This diagram shows a simplified *hierarchical* management structure that divides the museum activities between three basic functions. The division is between collecting and noncollecting areas of the museum.

The museum management methods and structures tend to reflect the prevailing practices of national organizations, concepts of business, and levels of development. The management structure of the museum should promote teamwork, communication, and an endorsed sense of purpose regardless of these influences. It is important, in any structure, to have personnel who have adequate experience and training to fulfill the needs of the museum or heritage organization and its stated mission.

The horizontal or flat structure (Fig. 3) is most common in museums where there is a small staff (team) and a shared workload. It has a number of advantages and disadvantages. The staff has greater access to the manager/director, and consequently, this arrangement is popular with the museum personnel. Direct communication with the manager/director has distinct advantages for individuals; however, institutional communication can suffer. Care should always be taken to ensure that there is the circulation of critical information to all parts of the museum.

The third organizational structure found in museums is the *matrix* (Fig. 4). This configuration utilizes many of the

same principles as those used in project management. The matrix structure assigns duties to unit leaders and a team of staff members qualified to address a particular task. The team may be responsible for developing an exhibition, designing a gallery, or formulating a fund raising plan. Membership in the team may extend for the entire project or for a specific part, such as the developmental stage. The matrix organizational structure may have overlapping elements that add to the exchange of information and the utilization of personnel.

LEADERSHIP

Museum management must include the issues of identity and leadership development. Consistent with the process of leadership development, museum personnel in many locations are seeking institutional identity based on preservation and dissemination of the cultural patrimony that characterizes the character of the host community. The process of patrimonial protection is ongoing and constantly evolving in a layering process of institutional awareness. Heritage preservation challenges museum identity because it is a form of social consciousness dedicated to communication and eventual understanding in the sense that it is the foundation for redefining the common wealth of humanity.

The issues of museum identity and leadership are of great immediate concern. There are few challenges that a museum must deal with as critical or as immediate as identity. Visitorship, funding, collections, social and cultural affiliations, conservation, and education are but a few of the most obvious issues to be considered within leadership and identity equation. The question of identity as a management issue is fundamental, and includes concerns about the guiding principles for museums as they address decreased funding and increased social and political expectations.

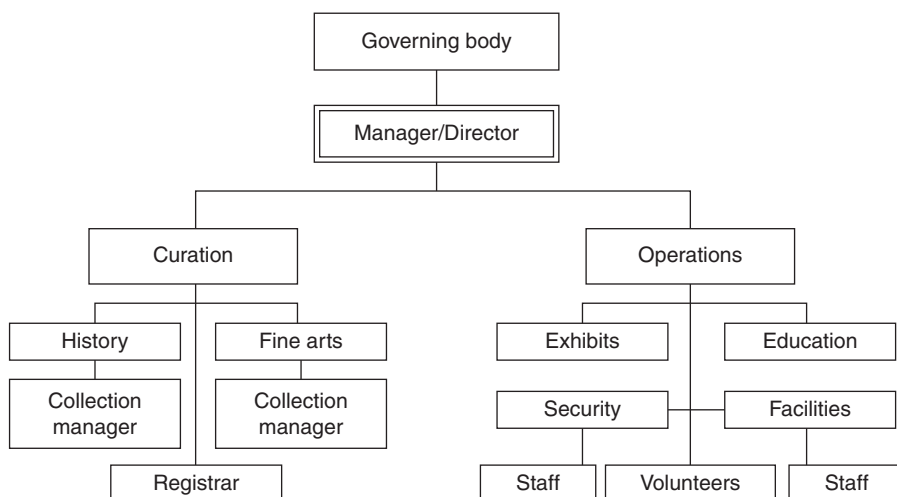


Fig. 2 This is an example of a more complex *hierarchical* structure that includes a second and third layer of museum personnel. The structure can be expanded to include any number of positions.

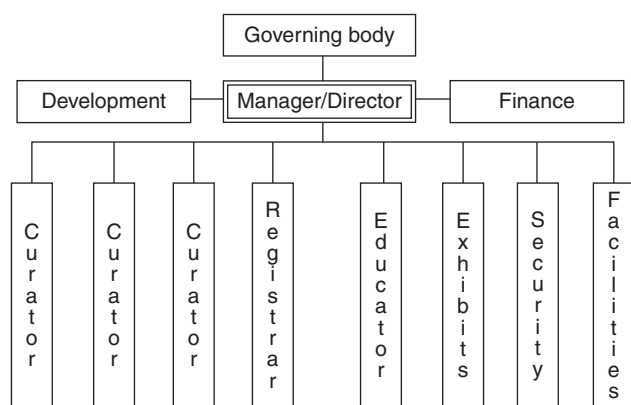


Fig. 3 Example of a horizontal (flat) organizational structure. In this arrangement, all members of the museum staff report directly to the manager/director.

Museum management is directly influenced by the manager/director/leader that often comes from within the ranks of the museum. However, theories about leadership maintain that traditional dependence on paternalistic rule (or materialistic as the case may be) based on status, birth, property, charisma, and power (the so-called “great man” or “great woman” theory of leadership) has been replaced by the less arbitrary measure of knowledge and ability. Although this approach was first advocated many years ago, it appears to remain true during the first years of the twenty-first century. However, this so-called leadership model has evolved at different rates in different part of the world. Privileged leadership continues to be

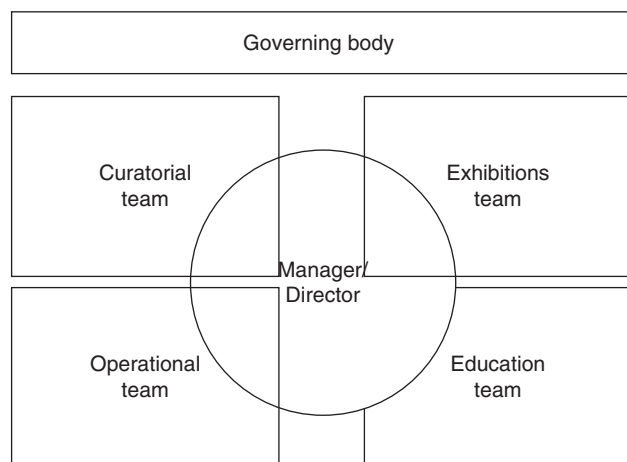


Fig. 4 Matrix organizational structure. Each part of the matrix structure has a level of autonomy, that is, it has a project or activity to accomplish. The team leader or project manager oversees and coordinates planning and resources. The team leader is a facilitator that encourages communication, sees that information and resources are available, calls meetings, and assigns tasks. The team leader reports to the manager/director. The number of teams deployed depends on the needs of the museum and the availability of qualified personnel.

accentuated and implemented by the issues of status and power as epitomized by political appointment. This practice is resident in many locations and is often detrimental to the museum community.

Wise leaders established management teams that balanced the ideas, attitudes, and aspirations of its members to accomplish the stated institutional mission. Early in the knowledge-based leadership process, it was assumed that expertise was the critical factor in effective leadership. However, it was quickly determined that intellect alone was not sufficient to make someone an effective leader. Instead, a participative leadership style that allowed team input in decision-making proved more effective.

PERSONNEL MANAGEMENT

Established values and beliefs drive the museum, good management makes it operate efficiently and effectively, and strong collections give it identity and creditability. Nonetheless, it is the personnel, paid or unpaid, who makes the museum a meaningful and functional place. People generate the activities that other people attend (Fig. 5).

Probably the single most defining characteristic of a nonprofit organization is the people who work within it. The role of the staff is to implement board policy, supervise museum activities, maintain the facilities, manage and recruit volunteers, and handle public relations.^[6] However, national laws and the regulations of the country in which the museum is located usually determine the rules and policies regarding employment and work conditions. The employing ministry or other governing authority may also control employment practices, and these regulations may vary greatly from country to country.^[7]

Though there is no standard approach for successful personnel management, most criteria are based on cultural assumptions about what such practices should entail and how they are to be achieved and implemented. Regardless of the museum’s location, good personnel management requires 1) selecting the right person for the job, 2) determining the work to be done, 3) deciding the way the work is to be accomplished, and 4) managing the relationship between the person doing the work and the other elements

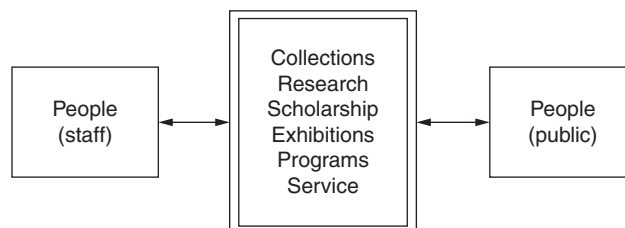


Fig. 5 The inflow and outflow of people involved with the museum.

Source: From Edson.⁵

of the museum. These activities may be accomplished either directly or indirectly, depending on the size and scope of the museum. They are, however, fundamental to the management process.

A primary concern when dealing with personnel issues must be attitude. Attitude is defined as a “way of thinking” that exists in an individual and the workplace. Attitude is a major factor for museums. This attribute is reflected in intangibles such as research and education, as well as the study, care, use, and maintenance of the collections and, perhaps most specifically, in public trust. Personnel that cannot be trusted to invest in the ethics and values of the museum should be trained or redirected. Museums must be value driven. This calls for an attitude of dedication, honesty, and openness. It is a very simple concept. Institutional core values are those qualities that cause people to share their treasures and cause them to support the museum with their participation. Trusted measures are identified with values, and values are identified with trusted museums. Every museum employee and volunteer is a part of that value system.

VOLUNTEERS

Personnel management often includes volunteers used to fill the vacancies in the museum’s workforce. Certain services make effective use of volunteers in areas such as classes for children, sales in the museum shop, or housing of collections. Volunteers may also be lawyers, accountants, contractors, teachers, scholars, entertainers, and a range of other persons with specialized skills who contribute their time and effort to support the museum. Volunteer services are so important for some museums that without them, the museum would have to limit its activities.^[8] The people working in the museum, whether paid or volunteer, are one of the institution’s most valued assets.

The volunteer cadre may also include docents used to guide groups through the museum’s exhibitions and teach visiting school classes. These docents should be thoroughly prepared for their duties by the museum staff or a volunteer coordinator. The docent should receive training in all subject matter in which he or she will have to be informed, as well as the teaching of children within the museum context. Such training requires a commitment on the part of the volunteer, as well as a decision on the part of the museum that docents are an important and valued addition to the staff. A rule to remember in using volunteers is that their training and supervision should not take more professional staff time than will the work that the volunteers perform.^[8]

TEAMWORK, MISSION, AND POLICY

Of all the factors that contribute to sustained success in museums, one of the most important is creating a cohesive

and effective team. Sustaining such a team requires leadership, vision, and a commitment to the value of team effort. The most powerful function of an effective manager/director is that of inspiring others to be part of the team. The transfer of power from one or a few to many involves the delegation of tasks and the sharing of responsibility. The museum with its teams that have “equal value” is a shift in the traditional museum context where authority was vested in a few highly placed individuals.^[9]

In addition to selecting qualified personnel, good museum management builds teamwork, develops the institutional vision, and creates an environment where others can work effectively and efficiently to meet institutional goals. Team building extends beyond the museum’s administration (manager/director/CEO) office. The manager/director keeps all persons involved and feeling appreciated, so they contribute their best efforts for the good of the museum. Every member of the staff should have a meaningful role in making the museum a successful contributor to the constituency it serves.

Beyond being good practice, teamwork encourages open communication and reduces misunderstandings. As a result, individuals work toward and accept new ideas. The potential for change is heightened and institutional renewal is stimulated. An environment of openness and mutual respect is a hallmark of good management. Management fails when the manager/director loses sight of the mission of the museum, and instead becomes obsessed with issues related to the organization as an entity separate from its purpose. The possibility of this myopia is reduced when team attitudes guide institutional thinking.

A basic element of management and team building is trust, and it is more than a notion of legal or ethical action. Trust is the foundation of positive relationships, both inside and outside the museum. It facilitates a sense of intellectual and emotional security based on mutual respect, honesty, and loyalty. Trust promotes open exchange, constructive assessment, and creative achievement. These elements influence the ability of a museum to accomplish its goals. A shared commitment to respecting individual qualities, maintaining open communication, and promoting the institutional mission is essential for a functional, forward thinking, and professionally oriented museum.

MISSION

Every museum needs a mission regardless of its financial and service orientation, that is, a direction to which all its functions are dedicated. The mission is the heart of the museum’s existence. It must be a proactive indication of the organizational intent, and as a ubiquitous statement of mission, it must be endorsed and advocated by the management and staff.

A good mission statement is one that is sufficiently broad to encompass the many possible activities in which the organization may wish to engage and is adequately focused to give proper guidance. This type of broad end statement is philosophical. It results, at least in part, from what the board, staff, and volunteers believe, the world should be, and how the museum complements that perspective. This statement derives from the “idea” of “mission” as a strategy and a commitment. It verifies what the museum is about and what human needs it addresses.

A mission may be a short statement about how a museum wants to be (what it is) and how it wants to be viewed by its audience. Or, it may be the broadest expression that accurately defines the most global ends statement for the organization. It can be brief or broad but accurate and true to ends (outcome) attributes. It should not be a statement of how the organization wants to be or to be seen, but a statement of how the world will be different due to its existence.

It is normally more difficult to identify and articulate the mission of a not-for-profit organization and consequently to develop criteria by which success can be measured.^[10] A mission statement is only valuable if it gives some specific guidance on the direction the organization should take in regard to programs, services, and activities. It should be an announcement of the results to be achieved, and a constant reminder of the museum’s purpose.

A mission statement is a basic document for all museums as a declaration of purpose, and policies provide the means for achieving the goals of the institution. The governing authority guided by management and staff normally formulate policies, and persons inside and outside the museum should have easy access to these documents. Policies that address specific museum issues should be written to accomplish two primary goals. They are 1) to plan a course of action to influence and determine institutional decisions, actions, and other matters, and 2) to define a course of action for the museum that is considered expedient, prudent, or advantageous.

POLICIES

The governing entity (board) must state what is expected of themselves, the manager/director, and the staff in the policy form of management. When the policies are well formulated, the manager/director knows their limits and the staff is free to pursue institutional objectives within the established parameters. The management should formulate three types of policies:

- Philosophical
- Resource development
- Working

The philosophical policies address ethical issues, resource development policies define allocation of major resources, and working policies are concerned with operational matters. In many organizations, the management generates the first and second types of policies, and the third is staff produced. However, in forward-thinking museums, staff input into the policies regarding ethics is essential, and fund allocation without staff support is often nonproductive. If policies are designed to meet specific needs, then the persons most qualified to identify those needs are the individuals with a detailed knowledge of the organization—the staff. Nonetheless, policy recommendations may emanate from any level of the organization.

Policies are essential to good management. They will undoubtedly differ depending on the institutional mission. However, it is important to establish consistent policy documents that reflect the values and beliefs of the museum and the expectations of staff, as well as define collections’ care and use, fiscal matters, physical plant use, and other issues that directly impact upon the ability of the museum to fulfill its mission. Well-defined policies outline the framework in which management and staff can operate and help them make proper decisions. Policies also reassure the public that an institution has given careful consideration to its actions.

FINANCIAL MANAGEMENT

A significant element of all management systems is fiscal accountability. Most museums are subject to a governing authority that determines the financial practices of the institution. The authority may differ and the level of financial oversight may vary, but few museums have complete and unrestricted control over all aspects of their finances. Regardless of the level of flexibility or the source of funding, museums have an obligation to be accountable for the money allocated (given) to them. The process of budget development, fund accountability, and financial planning is generally described as financial management, and while the governing authority may carefully structure the guidelines, the implementation rests with the museum manager/director and subsequently with the staff.

Museums generally use the cash accounting method (instead of the accrual method) for maintaining financial records. Using the cash method income is not counted until the money is received, and expenses are not counted against the budget until they are actually paid. This process differs from accrual accounting in which a transaction is counted (entered into the financial record) when a pledge or commitment is made regardless of when the money or service is received. Likewise, the museum will not record an expense, in cash accounting, until all parts of a project are received, completed, and billed.

Financial management is viewed by many as one of the most difficult aspects of museum management. In reality,

the difficulty usually resides in the usability of the budget document. A budget in the simplest terms is a management tool stated in numbers. It is a planning document. Budgeting is more than balancing expected revenues with expenditures. It indicates the money available, the money needed (by projection), and the difference between the two. It also allows management to determine the most appropriate alternatives for resource allocation. A budget, in most instances, is a statement of intent that is used to guide an institution's activities. It empowers museum management to decide how to use financial resources most effectively.

The relationship between the mission-oriented goals and financial resources is critical, and budget formulation is an integral part of the planning and management process. Actual spending and receipts can be tracked against planned targets as an instrument of managerial control. Variances between expenditures and the projected budget may signal the need to slow spending or increase income, or to shift resources from one category or financial commitment to another. Differences in spending or in revenues that are more than incidental departures from the planned amounts require the management's attention.

FUNDING SOURCES

Most museums receive income from different sources. Primary support in many locations comes from the governing authority, but even in those cases, additional income may come from admission charges, the museum shop, donations, or food service. Museums have several financing opportunities:

- Admission charge
- Museum shop
- Food service
- Marketing
- Tourism
- Gifts
- Voluntary contributions (donations)
- Corporate sponsorships
- Publishing
- Travel tours
- Membership
- Grants

The financial prospects are often dependent on the imagination, commitment, and work of the management in coordination with the governing authority. An analysis of the museum's mission, location, collections, programming, and other assets will give an idea of the funding potential of the particular institution. Not every museum has every financial opportunity, but most museums have several possibilities. Care should be taken to determine

possible restrictions or prohibitions by regional or national rules before initiating nontraditional financial schemes.

The ultimate gauge of good financial management is the quality of the service provided and the relevance of that service to the museum's mission. The budget must therefore relate to the mission and the money should be used to further that mission. In formulating a budget, museum management should consider two distinct principles: 1) use established policy as a guide to planning and projections, and 2) make efficient use of funds by carefully considering how much things cost and how the money is obtained.

It should be acknowledged that budgeting is an ongoing process. It is not something done once a year and ignored the rest of the time. A budget is a working document that should be reviewed monthly by the manager/director, the appropriate staff members, and members of the museum's governing authority. This scrutiny is important because neither income nor expense can be predicted with total accuracy. Regular review is the only way museum management can know its financial standing.

MANAGEMENT PLANNING

Planning is critical to successful museum management. It is vital for all museums as a basis for supervision by the governing authority, sound management by the manager/director and staff, effective fund acquisition and utilization, and meaningful program evaluation in fulfilling the museum's mission. Every museum can be improved, and effective planning is an integral aspect of the improvement process.^[11]

Museum planning should be an inclusive activity that considers the museum's history, mission, collections, staff, facilities, funding, community support, audience, political status, local and regional problems, and other environmental and social potentialities for making decisions that will guide the museum into the future. This planning process allows the museum (management and staff) to assess, redefine, and implement its mission, programming, exhibitions, and the audience served. There is a close connection between the planning process and marketing because the planning must precede the marketing, and the marketing analysis of a museum is a part of the planning process.

Planning may include any or all of the following:

Finance/revenue: These are issues related to the current and future funding needs of the museum and its ability to secure sufficient resources to support activities for the execution of its stated mission.

Community needs and involvement: These issues refer to changing community needs and the museum's ability to develop effective responses appropriate to its mission and priorities.

Human resources: These issues concern the recruitment, training, and retaining of sufficient qualified personnel with adequately diverse backgrounds to fulfill staff and volunteer service needs.

Organizational/structural: These issues evaluate the museum structure to determine the best configuration to meet current and future museum and community needs through the provision of quality, cost-effective services.

Communications/visibility: These issues ask how the museum can make itself more visible and inform the public about its mission and services and consider what resources will be needed to execute the processes of gaining greater visibility.

National agenda: Assuming the museum is part of a national group, the institutional agenda should support increased awareness and advocacy of national issues such as funding, accountability, and standards.

Service effectiveness: These issues relate to evaluation of services, programs, and exhibits and the results to measure museum effectiveness in meeting the needs of targeted populations, and ensuring that marginal services will be enhanced or discontinued.

A museum should undertake planning to reaffirm or to modify its mission—why it exists, what its purpose is, and what it does—and to agree on its vision—what it wants to be and do in the coming years. The ultimate product of the planning process is a guide to govern the activities of the museum. It is not the purpose of the plan to decide what should be done in the future, but to decide what should be done now to make desired things happen in the future.

For museums, planning is essential to success; however, flexibility, adaptability, and creativity are elements of the planning process that must be carefully considered. This does not mean changing the museum's mission in response to social or financial opportunities. The traditional practice of relying on a five-year plan, however, is no longer practical because the cultural, financial, political, and social environment changes rapidly. The successful adaptation to change requires establishing a stable means for the museum to accomplish its mission, despite challenging external or internal conditions.

Elements of the museum that should be considered in the planning process are the following:

- Mission
- Organization
- Decision-making
- Fund raising
- Resource allocation
- Performance evaluation
- Organizational effectiveness

Financial planning is an integral part of the planning process of museums. The allocation of resources is a

significant element in setting organizational goals and fulfilling them. Depending on the needs of the museum, budget planning will assume varying degrees of importance. However, in all cases, considering the financial realities of the organization will play an important part in the development of a strategic plan.

The development of a financial plan may extend far into the future, and in all cases, it is an ongoing activity. Financial planning as a process implies intentional preparation for the future and must promote growth in a rational and achievable way. Budget and financial stability must be a part of all planning. A careful look must be taken at the feasibility of proposed services, programs, and exhibitions, not to mention staff and facility expansion. One of the most difficult elements of financial planning is projecting future income. This is an area where good information and experience cannot be underestimated.

Without planning, the organization's effort will be haphazard, the outcome unpredictable, and the management indecisive. Planning should focus on achieving the most appropriate connection between a museum and the environment in which it operates. The environment means those conditions that exist both inside and outside of the museum that have a say over its operations. Effective planning deals with the issues that develop along the margin between the inner workings of the museum and outer influences. Planning should delineate a strategy for success.

It is the governing authority's responsibility to see that planning takes place. The staff can encourage planning through the director, but ultimately the board (trustees) must start the process because, it is responsible for the welfare and effectiveness of the museum. The board, therefore must not only assure planning takes place and oversee the process, it must actively participate in the process.

SELF-ASSESSMENT

Information is an important part of the management of any organization, and to be of value, the information must be based on evaluation and assessment. Proper decision-making requires dependable information gathered in systematic ways. An assessment can be conducted on the entire institution, as with the accreditation self-study, or it can be used to assess one aspect of the museum such as financial development, public relations, and marketing, or volunteer involvement.

Self-assessment is a part of planning and one way to determine the effectiveness of the museum and the method for deciding the value or purpose of the institutional mission. Planning is a process through which a museum may

Identify needs in society

Define its relation to the mission of the museum

Evaluate its capabilities as a museum
 Assess its external environment
 Set objectives for the museum
 Select strategies for the museum
 Design programs for the museum
 Determine a budget for the museum
 Evaluate performance of the museum

A part of the assessment process is called environmental scanning. Environmental scanning is a means for the museum to systematically examine and compile data on the factors that are significant to the organization today and in the future. Centralizing this information will help the museum to understand the realities that are a part of developing the strategic plan. This process looks at the activities around the museum to determine influencing factors that may alter the future of the organization in a positive or negative way. Most of the time, these influences are monitored in an informal way. It can be very beneficial to the museum to look carefully at factors that have an impact upon the following areas:

Economics
 Legal or regulatory
 Politics
 Technology
 Society
 Demographics
 Competition

PLANNING METHODS

Planning is a necessary element of every museum. The collecting plan defines the objectives of institution collecting. A collection management plan (or policy) addresses a range of issues related to collection care and use, including accessioning, deaccessioning, loaning, cataloging, exhibiting, conserving, and storing objects and specimens. There are also exhibitions, financial, marketing, long-range, human resources, and strategic planning that must be considered.

In preparing any institutional plan, it is essential to be clear about who are the intended recipients of this documentation. It is often the expectations of this audience that will determine the type and structure of plan that is appropriate. For example, the requirement by government, or local authorities (city or nation/state) for museum strategic plans may differ from the information gathered for the internal document. (It is often the case that what government bodies require is something more akin to a business plan.)

A strategic plan, regardless of the format, is the result of careful and extensive research and strategic thinking by the museum. It is a disciplined effort to produce fundamental decisions and actions that will shape and guide

what a museum is, what it does, and why it does what it does.^[12] Strategic planning is important to museums as a basis for strong governance by the board, sound management by the executive and staff, effective fund raising by both the board and the staff, and constructive program evaluation by all participants in fulfilling the museum's mission.

There are various ways to develop a strategic plan. The two most common planning processes are the "goals approach" and the "vision of success approach." Each of these methods has a different anticipated outcome, but either may serve as a starting design for the museum.

The goals approach is a commonly used method for planning. That process requires the museum to establish goals and objectives for itself and to develop strategies to achieve the anticipated outcomes. This approach can be effective if there is general agreement on the established goals and objectives, and if those goals and objectives are adequately detailed to guide the development of strategies. This process is most effective when there is a hierarchical management structure with leadership that can establish goals for the museum.

The vision of success approach is another recognized form of planning. In this approach, the museum develops an "ideal" picture of itself in the future as it successfully fulfills its mission. This approach is most usable when it is difficult to identify strategic issues directly or if no specifically agreed upon goals and objectives exist. The vision approach is also effective when drastic changes are necessary, and the development of future achievement can provide the concepts that enable organizational members to identify necessary changes.

A commonly used method for analyzing the institutional assets is called SWOT.^[13] This technique calls for an examination of the institution's strengths, weaknesses, opportunities, and threats. It is a process and not an end unto itself. It is, however, an effective method for gathering information to be used in the planning process.

In initiating the planning process, it is not necessary to have a consensus. Different ideas, approaches, and unique viewpoints are good as a starting point for museum analysis. This kind of self-assessment should be an ongoing part of the planning and management activities of the museum.

MANAGEMENT ETHICS

No profession can survive without a body of ethics as the dynamic principles developed to reflect a changing environment. Comprised of ideals and values that guide individual and group conduct, ethics can be defined in terms of these two groups. Individual ethics are "value statements," such as rules, positions, and inferences, which incorporate ideas such as good and bad, and right and wrong.^[14] Group ethics include customs and codes that monitor an individual's behavior for the benefit of a group. Ethical

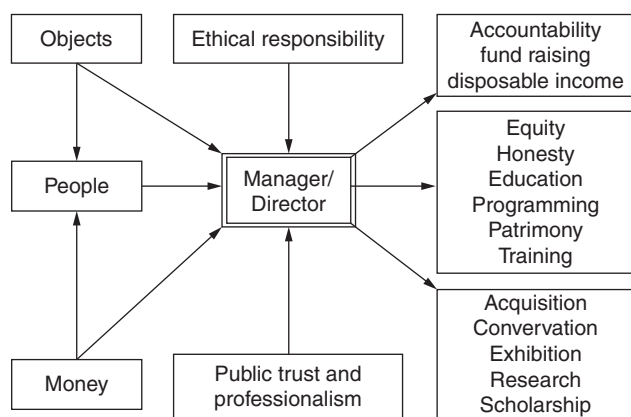


Fig. 6 Ethics is a body of correct actions that reinforces the concept of the museum as a trusted resource and the means for recognizing the highest common good. The worth of an activity is not derived from the purposes it seeks to achieve, but from its being in accordance with a policy that respects a code of ethics. **Source:** From Edson.¹⁶

theory involves how people see reality, why they associate “value” within it, and how they respond to it.^[15]

Ethics seeks to establish principles of right behavior that may serve as action guides for individuals and groups (see Fig. 6). The activities an individual, manager/director, or staff member, performs consciously and willingly and for which that person is responsible (accountable) are within the domain of ethics. Therefore, ethical concerns ought to be common to all areas of the museum. It is naïve to assume that ethics is the responsibility of the management (administration or board of trustees) and not that of the general workforce. Ethical reasoning is a part of every decision, and is fundamental to interaction with other members of the museum profession and the public. Every act or action associated with the museum profession has a related ethical matrix (Fig. 7).

Ethical responsibility is evidenced by interaction inside and outside the organization and the way a museum conducts its activities. An ethical museum is one in which all participants acknowledge professional standards and

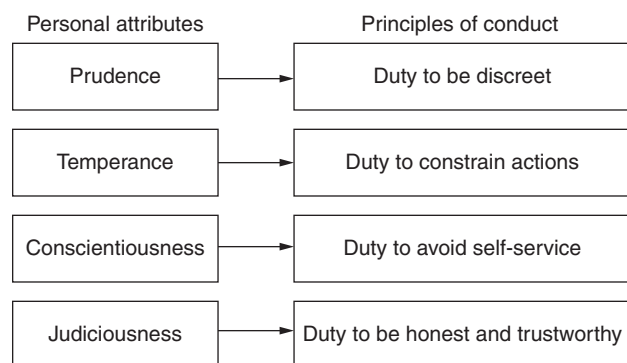


Fig. 7 The relationship of attributes to conduct. **Source:** From Edson.¹⁷

where those principles are exemplified by the museum’s activities. The public perception of a museum’s ethical correctness (trust) revolves around its collections’ stewardship, as well as its dealings with fiscal and institutional accountability. The numbers of ethical issues related to museum management are increasing, and they go well beyond the traditional concerns for use of collections and money. There are also national and international laws that influence an increasing array of museum activities regardless of the museum size or location. Museums should have policies that delineate organizational rules and responsibilities, as well as to guide the manager/director in management duties.

Ethics is more than following the rules. It is a holistic endorsement of doing the right thing. A code of ethics is a part of the process of creating and maintaining an ethical institution and ensuring proper management. However, it is only a part of the equation. An ethical museum is one in which all participants acknowledge the core values such as loyalty, honesty, integrity, respect for others, and pursuit of excellence, and where those values are promulgated in the context of the museum’s mission.

CONCLUDING COMMENTS

Museums, as institutions in the service of society, are a reflection of the high level of social development enjoyed in many areas of the world. They require personnel (management and staff) with varied educational and decision-making backgrounds. The balancing of these efforts result in a properly functioning museum. The modern museum must be an informative, professional, systematic (in its collection care and planning), enjoyable, and socially active institution. To meet this challenge, management must include the application of practices developed by research, economics, law, education, and physical plant management combined with the latest technology. The exact arrangement of these elements in an effective model may change, but the concern for the management process enjoys equivalent importance in most locations.

Working in a museum involves public trust and entails great responsibility, including steadfast personal integrity. Ironically, the role of the manager/director with all its responsibilities and obligations is among the least well-defined positions in the contemporary museum. This impreciseness reflects the wide range of managerial duties that include the technological, political, and social capabilities required to manage and lead a museum in uncertain and demanding times. The manager/director must be a public representative, service advocate, and museum professional capable of securing essential resources for the museum while maintaining the integrity of the institution. The manager/director must have the scholarly and administrative skills to promote the mission of the museum, as well as the ability to explain critical issues that may not be

understood by the public. No job description can completely describe all the variables that might be encountered in museum management.

Because management is accountable for the way the museum conducts itself, it should be inspired by a high standard of public service and ethical conduct. If those ideals are overlooked or ignored, the museum will cease to warrant public trust and support. Conversely, a museum guided by proper management will establish the identity of the institution with reference to the social and cultural environment, and position it for future growth and influence. It is certain that a museum cannot survive without a sense of growth, identity, leadership, and vision. Management is therefore about the future of the museum and the people associated with that institution.

The contemporary museum evokes a feeling of prestige and a sense of pride that inspires and reassures visitors. It grants a measure of certainty in uncertain times. The value of a museum is in direct proportion to the services it gives to the emotional and intellectual life of the people. Proper management by an individual dedicated to serving the interests of the public, protecting cultural and natural heritage, and promoting goodwill and understanding will ensure that trust is not denied.

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Museum Registration and Documentation

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Abstract

Keeping documentation on museum objects is vital to good museum management. Important policies such as the Collection Management Policy that enumerates what and how the museum will collect objects, and the museum's code of ethics that defines acceptable behavior of staff, boards of directors, and volunteers provide the framework for long-term museum management. Records of accession and deaccession procedures contain specific information on the objects, their donors, and the reasons for their inclusion in, or removal from, the museum collection. Documentary files contain sections on appraisals, condition reports, correspondence, deed of gift or purchase information, notes, and shipping records. Records of loans to and from the museum are important historical documents and contain details of condition reports, photography, loan agreements, shipping details, and correspondence between parties. All files should be kept in perpetuity and preserved through the safeguards of backup documentation, protection from hazards, and deterioration and destruction.

INTRODUCTION

Museum collections are comprised of more than objects or specimens, also included are the documents and data pertaining to the objects. Documentation consists of official and legal transactions such as accessions records, loan contracts, field notes, scientific analysis, and deaccession records. Museums must establish recordkeeping procedures as a matter of responsible collections care; without supporting documents museum objects would be worthless. Keeping information relating to the collection (including any objects that may be loaned to the museum or be housed there for any reason) is one of the primary duties of the registrar. Records concerning permanent collection objects are deemed to be a part of the museum's collection and equal in stature to the objects to which they pertain; their importance cannot be overstated.

The goal of this entry is to introduce the topic of museum registration, particularly as it pertains to recordkeeping and to fully describe the collections documents and how to house them in a responsible manner. A brief background of the history of registration assists the reader in understanding the transition from early museums where the function was merely to display objects and was purely curatorial in focus, to the museum of today as educational institutions with vast resources that detail not only the object, but its place in our cultural history.

Important policies and documents under the control of the registrar are discussed such as Collections Management Policies, Codes of Ethics, and creating the documentary files for Accession and Deaccession and Loans. Philosophical and legal reasoning is offered to explain and inform each topic.

HISTORY OF REGISTRATION

The Museum at Alexandria, founded by Ptolemy in the third century B.C. may have been the first institution to use the term museum, meaning "seat of the Muses," but with a group of scholars and a library, it was more of a philosophical, educational organization. The Museum was the name given to a collection of objects owned by Lorenzo de' Medici in fifteenth-century Florence. Even then the term referred to a concept of comprehensiveness more than a building. By the seventeenth century Europeans were using the term to describe collections of curiosities. The Ashmolean Museum, built in 1683, housed the collection of Elias Ashmole and is considered the prototype of museums as we know them today.

Museum personnel in the earliest times were trained in a specific discipline and knew little of the larger concept of the museum as a whole, or its place in society. The apprenticeship nature of early training of museum staff gave little opportunity for the introduction of new ideas or methods, and the growth of museology, or museum studies as we know them.

When the Tammany Society of New York City opened its American Museum in 1791, it promised that all donations would be accepted, and the generous donors' names would be inscribed in a large register, a book kept just for that purpose. The duties of the "Keeper" of the museum included recording presents given to the museum and insuring that no visitor remove or injure any of the articles belonging to the museum. Thus the concept of a staff member dedicated to the care and control of objects was confirmed.

In 1880 Steven C. Brown was named Registrar for the United States National Museum that would become the

Smithsonian Institute. His duties included shipping, storage, accessions, recording of objects, and the distribution of objects and specimens.

Henry Watson Kent addressed the 5-year-old American Association of Museums (AAM) in 1911, and presented a complete procedure for accessioning articles. By 1925 John Cotton Dana had described various staff descriptions as he schooled apprentices at the Newark Museum. The registrar would be responsible for receiving and recording accessions, labeling, creating storage lists, filing and maintaining documents, care of photographs and negatives, inventories of book collections and in particular, the care of objects on exhibition.^[1] Thus began a transition from the arenas of display with vague practices and few rules, to professionalized institutions honoring and preserving the country's cultural heritage. Emphasis on training led to industry-wide standards of care and responsibility. Some formalized instruction through public education furthered professional development. By the second half of the twentieth century, post-World War II Americans looked to museums as a popular leisure activity. In response, widespread training programs for a variety of museum staff positions began in earnest.

In 1977 the Registrars Committee was recognized as an official Standing Professional Committee of AAM.

The mission of the Registrars' Committee (RC-AAM) is to give assistance to the AAM and its regional associations in their objectives of sound professional preparation and promotion of high standards and, specifically, shall endeavor to increase professionalism among museum registrars through educational programs and publications, establish standards of professional practice, and create an atmosphere of understanding and respect, of communication and cooperation among registrars, between registrars and other museum professionals, and between registrars and individuals in related service fields.^[2]

Registration Today

Today the duties of the registrar still resemble the earliest models, but with many additional responsibilities. At the same time they also have new tools to assist them. In particular the computer has enhanced collection management care. It facilitates many tasks such as generation of reports and compilations of collections formerly done by hand. Software programs exist to assist museums of any size and budget and have truly changed the way museums conduct much of their business.

A registrar oversees the operations that affect collections and manages risk, space, information, and people. It is generally recognized that museum collections are comprised of more than objects or specimens, but also of documents and data. Documentation consists of official and legal transactions such as accessioning, the process that makes the object property of the museum,

deaccession records documenting the removal of objects from the collection, loan contracts, donor and artist information, field notes, scientific analyses, business archives, and factual information about the objects. The term "Collections Manager" is often used interchangeably with "Registrar" to describe registration duties, literally the person who manages the collections held by the museum. Our focus, however, is on museum documentation therefore the term registrar, one who records and preserves collection information as a part of collections care, will be used in this entry.

MUSEUM DOCUMENTATION

Several types of documents are common to most museums no matter their size. While each museum may design and create their own documentation specific to the needs of their discipline, much of the content is common to all museums. Museums record their standards and practices in their incorporating documents. Writing policies, some relating to collecting and exhibiting museum objects, and others which inform the ethical behavior of the director, staff, board of directors, and volunteers, are now common practice and required for accreditation by the AAM. Files related to legal ownership of every object in the collection, and exhibition files spanning the history of the museum are important parts of a museum's documentation.

Policies

The best policies are created by a team made up of appropriate staff members so that each department's needs and individual concerns may be discussed prior to policy being set. Ethical considerations as well as the physical mechanism for carrying out these policies should be discussed and understood by the staff. New hires should be given copies of relevant policies so all staff stay current with procedures within the museum. While there are many policies that may govern a museum or a department within a museum, two in particular are considered key by AAM for every collecting institution, the Collection Policy and the museum's Code of Ethics Policy.

Collections management policy

Vital to good museum management is a written Collections Management Policy. A Collections Management Policy defines the direction of collecting that will be undertaken by the museum, spells out the criteria for selecting acceptable objects for its permanent collection and designates authority in selecting additions to the collection. It should also outline the procedures by which the policy is carried out. This policy is the capstone of the museum's documentation, and may be consulted in cases where museum collection procedures are in question. In

legal cases concerning museum objects the Collections Management Policy will serve as proof of a museum's standard practices.

Not all objects that enter a museum are destined to become part of the permanent collection. Unlike the early directive of the Tammany Museum, museums today do not, and should not, accept all objects that they are offered. Storage space and staff time are often limited and it is considered irresponsible to the rest of the collection to accept an object that will never be utilized. Objects that seem far outside the collecting scope of the museum may be rejected as legal donations by the Internal Revenue Service (IRS). For example, the donation of a violin to a museum that collects modern art may be called into question. The museum could be asked to show proof that a violin is an acceptable gift by submitting its Collections Management Policy to the courts. Therefore, careful consideration must be given in formulating the policy. It should be based upon the museum's mission, goals, and past history. It should not be so restrictive that normal collecting is hampered, yet it should not be so broad as to be meaningless. Its purpose is to identify the collecting priorities of the museum and to serve as a guide in the identification of potential purchases and appropriate gifts. The policy should incorporate existing areas of interest, as demonstrated by past collecting efforts, as well as desirable areas of expansion. It must take into consideration the organizational structure of the museum and all laws, guidelines, ethical standards, and appropriate practices. Common Collections Management Policy criteria include quality, relatedness, utility, control, and ethical considerations.

Quality is to be considered relative to the museum's existing collections. While it is ideal to acquire objects of impeccable excellence, the minimum standard for acquiring an object is that it be as good as or better than a similar object already in the collection. After reasonable determination of authenticity—verification of scholars, provenance, testing, etc.—the object will be graded according to esthetic merit and condition. Objects in poor condition should not be accepted unless the museum is reasonably sure funds exist for restoration or repair.

Relatedness is graded according to existing collections; it should fill a need or gap among existing holdings and enhance the overall collections. If it duplicates another object, will the collection be strengthened by having two or more similar objects?

Utility is defined by how well the object enhances the museum's goals and resources, and takes the following into consideration: exhibition potential, does the museum foresee exhibiting the object and with what frequency? Is the object's medium a limitation to its usefulness?

Control must be taken into consideration if there are any encumbrances accompanying an object that will have a negative impact on the museum's ability to manage the collection or are contradictory to ethical standards

embraced by the museum. Donors should be discouraged from placing any restrictions on their gift. Donor stipulations regarding retention and/or exhibition schedule may inhibit the museum's exhibition programming. No promises should be made about how often or how long an object will be exhibited. Often donors do not consider the negative impact of a lengthy exhibition time on their gift. They may not be familiar with environmental concerns such as over exposure from light and heat. Donor restrictions should not prevent the removal of the object through sale or trade from the collection. Any restriction that prevents the museum from its normal activities of exhibition and care should be avoided.

A statement should be included in a letter of acceptance from the director of the museum confirming that all objects must conform to the museum's ethical standards. These include ethical standards regarding collecting as established by the AAM, the Association of Art Museum Directors (AAMD) and United Nations Educational Scientific and Cultural Organizations (UNESCO). Museums will generally not accept human remains, objects that are suspected of being war loot or stolen during international conflicts, endangered species, or objects imported or obtained illegally.

Code of ethics policy

Museums in the United States are grounded in the tradition of preservation of cultural heritage. Nonprofit museums are organized as public trusts, holding their collections and information as a benefit for those they were established to serve. Members of their governing authority, employees, and volunteers are committed to the interests of these beneficiaries. The law provides the basic framework for museum operations. As nonprofit institutions, these museums comply with applicable local, state, and federal laws and international conventions, as well as with the specific legal standards governing trust responsibilities. Legal standards are a minimum. Museums and those responsible for them must do more than avoid legal liability; they must take affirmative steps to maintain their integrity so as to warrant public confidence. They must act not only legally but also ethically.^[3]

Codes of ethics exist for many staff positions within a museum, including Boards of Director, directors, curators, registrars, museum store managers, educators, and volunteers. Since 1999 the AAM has required every museum applying for accreditation to have their own specific Institutional Code of Ethics tailored to their collection and mission statement. They require that it be approved by the museum's governing authority. While not all museums apply for accreditation, most follow the AAM blueprint for the creation of an institutional ethical code, demonstrating to the public how seriously the museum takes its role as steward of the collections it holds in the public trust. Museums must be committed to public

accountability and be transparent as far as their day-to-day operations. Further, having a Code of Ethics cements responsibility to the collection in the minds of all staff. Guidelines and instructions for writing codes can be found on the AAM Web site, as well as in many reference materials. Topics include governance, responsibility to the collection, acquisition procedures, deaccession and disposal methods, public accountability and professional conduct, responsibility to the public, and conflict of interest for staff, volunteers, and members of the governing authority. Among these duties, one of the highest is to maintain truthful, complete, and accurate records of each object within the collection. This duty most often resides with the registrar and the information contained in the registration files.

Registration Files

Two types of files under the control of the registrar are: Documentary Files, those which contain accession and deaccession information about the individual objects in the museum's permanent collection, and Exhibition Files that relate to all exhibitions of the museum's collection as well as loaned objects from other institutions and/or individuals. Files containing research on individual objects, such as their historical or cultural significance, are generally gathered and maintained in the curatorial department, and are not included in the discussions here.

Accession numbers

Once the museum has confirmed that a new acquisition (addition to the collection whether by donation or purchase) is to take place the registrar should assign an accession, or inventory, number to the gift and its objects.

While each museum may choose its method of creating accession numbers, one traditional system uses a tripartite number that begins with the year of the gift, followed by a number designating its place among gifts given that calendar year by all donors, followed by a number designating each individual object's place within that gift. For example, if Mr. Smith donated three paintings, all given on a particular day in 2009, and it is the fifth gift the museum has received from all its donors that year, the number for the gift would be 2009.5. Numbers are assigned within that gift, to each individual object. Painting one will be designated as 2009.5.1, painting two will be 2009.5.2 and painting three will be 2009.5.3. In cases where the object may have several components, such as a tea set or a pair of shoes, a suffix may be added indicating that the objects are part of a larger set. In the example of a tea set, the gift may be 2009.7 while the tea pot is 2009.7a, a saucer may be 2009.7b, and a cup 2009.7c. Generally this system is used when all objects together form one exhibitable object. One saucer without the cup is not likely to be exhibited, nor one shoe without the other.

Documentary files

Every object belonging to the museum should have, at the least, some reference in a registration documentary file. Registration files document both the acquisition process and the care information for the objects in the museum's collection. They are distinct from curatorial files, often maintained outside the registration department. While curatorial matters are not the subject of this commentary, for the sake of clarity the difference is important to understand. Curatorial files contain research information on the individual objects as well as bibliographic references, exhibition histories, and other information of a curatorial nature that is pertinent to the display and use of the objects. Each file pertains to one object in the collection, and those may be arranged alphabetically by object name or type. Curators build these files as research is conducted and the objects are exhibited. Conceivably, not all objects will have a file if no information has been gathered or the object has not yet been displayed. Curatorial files may also exist on objects not in the collection of the museum, but which are similar in nature to those which the museum collects, for reference purposes.

Registration files, often called documentary or accession files, however, are created immediately upon the acquisition of new objects, perhaps even prior to the object's receipt by the museum. They record the acquisition event, whether by donation, purchase, transfer, bequests or other means, as well as subsequent care information. These files include incoming and outgoing receipts, deeds of gift, gift agreements or purchase information, loan agreements, condition reports, copyright licenses, letters of correspondence, packing and shipping documentation, object photographs, appraisals, and insurance records. Registration files in natural history museums may also include collection maps detailing the location of archeological digs, permits, licenses, and import/export documentation.

It is not necessary, or even desirable due to space limitations, to have an individual documentary file for each separate object because much of the content would be duplicated in each. Each file represents one gift, no matter how many objects are in that gift. If one donor, for example, gave the museum ten paintings at one time all of the documentation for the gift would be in one documentary file. The delivery information, the correspondence, the gift agreement and so on relates to one event. It would be redundant to have ten copies of each piece of documentation contained in ten separate files. Purchases, as opposed to gifts, are considered individual events, therefore each purchase is represented by one documentary file.

Creating the accessions file

Although retention schedules for many businesses recommend that files be purged after a certain number of years,

museum records should be retained forever. Provenance (ownership histories) field records, conservation treatments, and the like, cannot be traced without the retention of all records no matter how long ago they were created.

File with manila folders (or other similar types of folders) inside contain and separate the documents by subject. For long-term preservation of the original legal documents, such as the deeds of gift, they should be created using acid-free paper and stored separately in an acid-free folder. A fire-resistant filing cabinet kept in a secure location is an excellent repository for these documents. It is important to understand that any archival or acid-free file that contains documents on non-archival paper will, over time, lose its archival quality. The acids will migrate and contaminate any archival documents. Copies of these documents should be made for inclusion in the documentary file, while the archival master should be handled as little as possible.

Tabs on the exterior of the file folder contain the accession number of the gift, the name of the donor, and a brief description of the gift, for example, 2009.2.1-15, John Smith, 15 Masks. Files should be maintained in accession number order, which will also be a chronological order in which the accessions were made. File cabinets storing this or any other important documentation should not sit directly on the floor, but be raised at least three inches to protect against any water that may accumulate on the floor during a fire or flood emergency. Manila folders within the file will hold a variety of information depending on the museum's discipline. Common folder contents are: APPRAISAL, CONDITION REPORTS, CORRESPONDENCE, DEED OF GIFT, PURCHASE INFORMATION, INCOMING/OUTGOING RECEIPTS, LOANS, PHOTOGRAPHY, PUBLICATIONS, and NOTES. When marking the content of the manila file it is advisable to write directly on the folder's tab rather than applying a gummed label which will fall off the folder as it ages and dries out.

Each section of the file, described below, contains information regarding the legal status, the care and condition, and all other pertinent documentation relating to the objects in the collections. Proper maintenance of these files is one of the highest priorities of the registrar's job.

Appraisals

Donors preparing to make a gift to the museum often do so with the intent that they will take a charitable contribution tax exemption. In cases where the value of the contribution exceeds a certain dollar amount, the Internal Revenue Service requires that a certified appraisal be done on the object no longer than sixty days before the gift is made. Museum ethics prevent the staff from supplying a donor with an appraisal for a donation they expect to receive. Indeed, staff should remain at arm's length concerning any appraisal done for a potential donor. Should a donor

ask for a recommendation or help in finding a qualified appraiser, the museum should supply the donor with a list of area appraisers, preferably three or more names, none with significant ties to the museum. This is done to prevent even a suspicion that the donation hinges on a favorable appraisal in which the value of the object may be overstated. Similarly the museum should not pay for the appraisal nor any services provided by the appraiser including travel, meal, or hotel reimbursement. The IRS now requires that appraisals be done by certified appraisers who are recognized as such by a professional appraisal organization and to follow generally accepted appraisal standards. The law further calls for severe penalties for appraisers who intentionally under/over value property.^[4]

A museum may accommodate an appraiser's visit to the museum to view the object, should it be housed there prior to the donation. The museum staff may also assist the appraiser by providing photographs or other supporting documents, as long as the choice of the appraiser and the funds to pay him/her comes directly from the donor.

Because the appraisal is solicited and paid for by the donor, the museum should not assume that the documentation produced will be shared with the museum at the time of the donation. It is not unreasonable to ask the donor if the museum may have a copy of the appraisal in order to make sure that the insurance value placed on the object by the museum is accurate. Often donors will volunteer a copy of the appraisal, especially when they understand that it insures proper valuation for their gift. Copies of the appraisal are kept confidential, and should be kept in the object's documentary file.

At times the museum may choose to have one or more of its own objects examined and appraised for a variety of reasons usually related to insuring the collection or loan documentations. In cases where the museum already holds title to these objects, there is no conflict of interest and therefore no problems associated with the museum paying for the services of the appraiser. Care should be taken to only hire those appraisers who have been certified by a professional appraiser's organization. Valuations placed on objects by those without these credentials may be questioned or disallowed in the future.

Note that insurance values, often placed on loan agreements, are distinct from appraisals and may be assigned to museum objects by curators or others knowledgeable about the type of object. Insurance values may be higher than appraised values because they reflect not only the object's value, but also compensation for staff time in handling repair or replacement issues, should something be damaged.

Condition reports

Many publications offer detailed descriptions on how to write a condition report, and sample pages are provided

for recording damage to many types of medium. Therefore this section will only deal with general practices regarding condition reporting. Many different condition report formats exist, each one particular to the type of medium of the object. A museum is free to design its own condition report form but care should be taken to use terms common in standard museum practice and those appropriate for the object's medium.

A condition report is an account of an object's physical state at any given time. When an object first enters the museum, whether as a new acquisition or a loan, an examination should be conducted and the report written. Condition reports done at the time of acquisition establish a baseline of the object's physical status. Follow up examinations, done as part of an inventory or in preparation for an exhibition of the object, can be compared to the original report. If discrepancies are noted they may signal a problem with storage conditions that should be remedied. For example, buckling or wavy paper can indicate high humidity levels in storage areas; dry and cracked wooden items may signal that environmental conditions are too dry; these should be adjusted for proper object maintenance.

Condition reports done on objects coming to the museum on loan are done to confirm that both the borrower and lender are in agreement about the condition of the object and that no damage has occurred in transit. Loaned items should be examined immediately upon their unpacking at the borrowing institution. If there is a discrepancy between a condition report written by the lender and the report done by the borrowing registrar, the lender should be notified immediately. Objects with damage should not be displayed and may need to be returned to the lender for restoration or repair. Reports are completed again just prior to the object's return to its museum to insure it is being returned in the same condition as when it arrived. By careful examinations both before and after the exhibition, a museum may avoid accusations of responsibility for damage that did not occur on its premises.

Condition examinations are ideally conducted in a well-lit and clean environment. Common tools that assist with this process are: soft pencils, forms, rulers and or calipers, clean white gloves, flashlight, ultraviolet light, magnifying glass and/or jeweler's loupe, a rolling cart to transport objects and a metal measuring tape (a cloth or plastic tape will stretch over time and become inaccurate and should therefore not be used however care should be taken that a metal tape does not scratch the object).

Several methods exist to describe the location of damage on an object. Because condition reports are often consulted by someone other than the reporter it is vital that the location and the damage are described clearly and definitively. A zone method divides a canvas or other two-dimensional object into top, middle, and bottom sections as well as right, left, and center sections. Damage is noted,

for example, in the top left corner of the object, or bottom center, accurately conveying the location of concern. A second method of determining location is the axis method, in which damage may be described as located, for example, five inches to the left, and three inches up from the bottom. It is also acceptable to describe the location using the subject of the object. "There is a crack just above the man's eyebrow," can be just as clear as either of the previous methods described. The method used is not important as long as the information can be understood by any reader.

Damage is described in terms of length, width, color, shape, or another appropriate physical property. It is not necessary to determine the cause of the damage however, if known, that is helpful information. The extent of damage is referred to as negligible, slight, moderate, marked, and extreme.

Condition reports are to be stored in the object's documentary file and reviewed periodically. New information from subsequent examinations should be written on the original form and dated to indicate that it is not an original comment. Having all information on one sheet insures a much better historical report on the overall condition and is more efficient than locating and consulting several pages of old documentation.

Correspondence

Written correspondence between the museum and the donor can be important in determining the donor's intent to gift an object to the museum. In some cases heirs have disputed the validity of a gift made by a family member when that donor is no longer present to confirm their wishes. Correspondence between the museum and the donor often reveals clear intent to give the object to the museum. Courts will rule according to the donor's intent, often found within correspondence, despite the lack of a deed of gift or other receipt. This circumstance underscores the need for all file documentation, especially correspondence, to be permanently retained in the object's file.

Deeds of gift

Once the object offered for donation has been accepted by the museum the registrar will generate a deed of gift or similar conveyance spelling out the terms of acceptance. The deed should contain the name, address, and telephone number of both the donor and the museum, and a description of the object including as appropriate, title, artist, country of origin, medium, and dimensions. The donor states on the agreement that he has full ownership and authorization to make the gift, that he gives up all rights of ownership (with the possible exception of copyright) that the gift is unrestricted, and was not acquired by illegal means, and that the donor is not receiving any goods or

services in exchange for the gift. The museum should stipulate in writing that it accepts the gift. A letter of thanks from the museum usually suffices for written acceptance.

Two identical deeds are created on acid-free paper. The donor signs and returns both copies to the museum for signature by an authorized member of the staff. It is important, but not a legal requirement, for the museum representative to be the last signatory on the deed in order to prevent the donor from making unexpected additions to the agreement. Once the deeds have both been signed by the museum representative one fully-executed agreement is returned to the donor and the other is filed in an acid-free folder in a fire-resistant file cabinet dedicated only to archival materials. (Note: some file cabinets are referred to as “fireproof” a misnomer; at high temperatures of lengthy duration, metal cabinets can be destroyed by fire.) The deeds of gifts should be handled as little as possible in an effort to conserve them as long as possible. Copies of the deed are placed within the object’s documentary file.

While a deed of gift is a succinct document containing much of the information related to the donation, it is not a necessary component of the legal transfer from the donor to the museum. The law stipulates that for a valid transfer to take place there must be: 1) an offer; 2) an acceptance of the offer; and 3) physical transference of the object to the museum out of the control of the donor. Transfer may occur for example, when a donor writes a letter to the museum offering an object, the museum responds favorably to the offer and the donor delivers the object to the museum. A full and legal gift has not been made if any of these three components has not occurred. Therefore when a donor wishes to take a tax deduction in a particular year it is incumbent on the registrar to insure that the museum has actual physical control of the object by year’s end. Physical control means “under the museum’s care” and includes storage at a facility where the museum has contracted to store the object. As of yet, the IRS does not consider the gift complete if it is removed from the donor but still enroute to the museum.

Bequests

In some cases donors will request, through their wills, that some of their property be donated to a museum upon their death. These are considered gifts but there are special considerations involved. In essence, a bequest is an offer to a museum. The museum may or may not be aware of the plans of the donor; ideally the donor will have discussed their interest in making a gift after their passing, and the museum will have a chance to accept or decline the offer. In many cases the bequest comes as a surprise to the museum. Museums are under no obligation to accept post mortem offers, just as they are under no obligation to accept any other offer. In cases where the museum declines the offer the executor of the will makes other

arrangements for the object. If the bequest is accepted, the executor may sign the deed of gift and handles the transfer in place of the donor. Bequest documentation should be included in the documentary file, however it is not necessary for a copy of the will to be submitted to the museum as it may contain other, sensitive material. It may be permissible to photocopy just the pertinent section of the will for inclusion.

Purchase information

Not all acquisitions are made through donations. Museums often purchase objects for their collections, either from reputable dealers, auction houses, or private sales. In those cases there will be no deed of gift and a sales receipt will suffice as the conveyance of title. Details of the sales are still important and should be retained. If the purchase was done through an auction the catalog may be filed in the documentary file, along with any known provenance or dealer information that may be historically relevant.

Incoming and outgoing receipts

Receipts should be issued for any potential collection object coming into the museum or leaving it, even temporarily. Office furniture and equipment and personal objects are not treated in the same manner as collection objects and are excepted from this discussion. Objects may enter the museum to be reviewed as potential acquisitions at the request of the director or curator; as objects of scholarly study, loans, or, least desirably, as unsolicited objects left as a museum donations. A receipt should be issued that clearly states the owner’s name, address, telephone number, e-mail address, or other contact information. The receipt should state the purpose for which the object is left, and the expected date, if any, that the object will be returned to its owner. The object should be described fully enough to assist in identifying it, should that be necessary. Materials and dimensions are helpful, as is a short narrative recognizable by a lay person. Therefore a description of “a painting” will not suffice should the object become separated from its identifying information. More helpful would be “a framed painting, 16 × 20 in., oil on canvas, subject is a dog wearing a party hat.”

All receipts should bear the name and signature of the person receiving the object, as well as the person depositing the object. Terms under which the object will be held, such as responsibility for insuring the object, should be noted on the receipt. The addition of language describing the duty of the owner to keep the museum apprised of their contact information helps reduce the chance that loaned objects will be forgotten by the lender and become abandoned property in the museum. Although many states now have abandoned property laws specifically to aid museums in the acquisition or disposal of abandoned objects, the process is cumbersome and time consuming, particularly

if the object is not wanted by the museum. Registration staff should strive to return deposited objects promptly for the same reason. No object should remain in the museum without proper documentation.

A receipt should not substitute for a loan agreement; if the object is expected to remain in the custody of the museum for a significant length of time, or the museum has plans to use or exhibit the object, a loan agreement should be written that will spell out the responsibilities of both the lender and borrower, including insuring the object. See Loan Documentation below for further information.

Outgoing receipts are to be issued for any collection object leaving the museum, no matter how short the duration. The receipt should contain the same information as on the incoming receipt. If permanent collection objects leave the museum for conservation, photography, or similar purposes, a copy of the outgoing receipt should be given to the security staff who notes that the object is out of the building. The security staff should likewise be informed when the object returns to the museum. If an object is given back to its owner the receipt should state that the object is not expected to return. Under no circumstances should any object leave the building without a record of its removal. All receipts should be filed in the object's Shipping folder; they may be useful as records of the object's movement.

Loan records

Upon the return of an object that has been lent to another institution, a copy of the loan agreement should be placed in the object's documentary file with the original remaining in the loan file. Records of loans to other institutions are retained as part of the object's provenance. While this information may also be recorded on the museum's collection database, it is important to have the original loan agreement that contains all the information pertaining to the loan. Having the agreement at hand may assist with future grant applications that request the museum's loan history.

Standards of care include the responsibility to limit the number of hours sensitive objects are exposed to light. Light exposure records for individual objects should include times when the object has been on loan, just as they would for objects on exhibition in their home museum. Having a copy of the loan agreement can assist in the calculation of these hours. Incoming and outgoing loans are discussed in a later section. Further information concerning loans is discussed in a later section.

Photography

Documentary photography is an important part of any object's file. When an object first enters the collection a photograph, even one of low quality, is immediately

taken, marked with the object's accession number, and stored in the Photography section of the file. Documentary photographs are to be used only for object identification; their quality is not adequate for publication.

In ideal circumstances all objects would have a series of publication-quality photographs taken as soon as they enter the collection as a part of the accession procedure. Unfortunately staff availability and financial resources often preclude this from occurring right away. If and when a publication-quality photograph does become available it can be stored in this file. If it is stored in another location, such as in a curator's or publicity manager's office, its existence should be noted in the documentary file. Additionally, surrogates of the image should be linked to the object's record in the collection database and in the museum's digital asset management system as appropriate. Publication-quality photography may also be held by the donor, gallery, or auction house from which the object came. These sources are often willing to provide the photos to the museum.

Copyright considerations should be observed when planning to publish any photograph of museum objects. While "fair use" or "educational use" may be defenses, it should not be assumed that any museum use of photographs is allowed. In addition to artist rights, the photographer often holds copyright protection. It is a wise decision to note any copyright information in the object's database.

Registration staff often assume the task of photographing one or more objects in the permanent collection for documentation purposes. For efficiency, a time is set aside when photography of a number of objects can occur at once. Objects to be photographed are grouped according to size to avoid frequent camera adjustments. Very small objects may benefit from having a ruler, a coin, or other measuring device placed in the photo in order to help the viewer determine the object's size accurately.

A neutral background is selected so that visual distractions do not interfere with the photograph. Depending on the size of the object a neutral background can be created by placing a piece of foam board or cloth behind the object. Wide rolls of photography paper (purchased from local photography stores) may be hung on the wall behind larger objects.

Photo flood lights are placed on both sides of the object at approximately the same height as the camera and about six to eight feet from the object. Cool burning lights specifically for studio photography are used. Nonetheless, use of any light is judicious as all light exposure can damage most objects by varying degrees. Lights are not placed in close proximity to objects, nor are they left burning when the object is not actively being shot.

Each object is photographed by itself to avoid any confusion or background interference. Lighting must be adequate and care is taken that shadows do not fall across the object. Should there be important markings on the

object, more than one photograph may be necessary. Markings on the bottom or reverse of the object are also included. The object's accession number may be legibly written on an index card or similar paper tag, and displayed prominently in the photograph without interfering with the subject. This aids in identification of the object absent any writing on the photograph.

The viewfinder area is filled with the object and the focus is as sharp as possible. While some photographic errors can be reduced or corrected with digital manipulation it is better to take a good quality shot the first time.

When possible framed works are unframed prior to being photographed otherwise glare can hamper the quality of the final product. If unframing is not possible the use of polarizing screens and/or filters helps to reduce any reflection. If glare persists lighting should be moved until the glare is reduced or eliminated. When photographing a flat object from above, the camera must be secured by a tripod or strap around the neck of the photographer so that it does not fall onto the object. Use a secure tripod or keep the camera's strap around your neck at all times.

Publications

From time to time the objects in a museum's collection may appear in publications. Whether they are scholarly texts, museum catalogs, newspaper articles, museum receptions, or another form of printed media, copies of the publication are retained, and stored in the object's documentary file. If the publication is a book or other cumbersome format, a reference to the publication and note about where the book is stored in the museum should be placed in the file. Similarly, if the reference is an Internet site a note in the file listing the URL and the date it was first posted is acceptable. Because of the transient nature of the Internet, it is best to print a hard copy of the Web page showing the object and its reference. This does not apply to aggregate Web sites where large groups of objects are published, such as ArtStor or the California Digital Library, for example.

Notes

The notes section of the documentary file is meant to hold all notes, memos, and internal correspondence concerning the object. Memos written to alert staff that an object is entering or leaving the building, requests for preparation work or installation schedules should all be retained and filed in chronological order. Leaving these types of notes intact and available in the file will assist future staff who research an object's movements.

Other sections

Depending on the museum's discipline and governance there may be other types of information that is gathered

and preserved in the documentary file. Natural history museums may have sections for field notes, maps, excavations, among other things; zoos and aquariums may have information on their "living collections' fish and animals" historic homes may have files relating to furniture restoration, and so on. No matter the discipline an accurate history of the museum, its collections, and the objects themselves can only be assured if the information is clearly documented and carefully preserved. The staff must keep in mind that electronic storage devices such as computers and their software programs will become outdated and the information held by them may not be accessible if it has not been kept up-to-date.

Deaccessions

Museums generally accept objects into their collections through the process of accessioning, an act of recording and processing the object and its documentation. Acceptance of any object into a museum's collection is a thoughtful process taking into consideration the benefit the museum and its visitors will enjoy, the ability of the museum to care for the object, its suitability for exhibition, its appropriateness for the collecting mission of the museum, its quality, its freedom from excessive donor restrictions, as well as all laws, guidelines, and ethical considerations. The decision often involves the staff, collection committees, boards of directors, as well as the donors. Laws regulating museums and their collections are promulgated by state and federal laws including those involving the Internal Revenue Service. Every attempt is made to accession wisely. Objects in museums validate our culture and the heritage of peoples around the world. Museum personnel take this fiduciary responsibility very seriously, realizing that public trust is sacred. Donors give objects to the museum with the expectation that the objects will be kept, cared for, and preserved for future generations to come. Museums are loathe to act in a manner that would imply that this trust is misplaced. Making a decision to permanently remove an object from the collection for any reason is therefore done in a thoughtful and well-considered manner. Museums exist to serve its public and to do so they must have the confidence of their community. Deaccessioning is related to the museum's purposes, policies, resources (staff, physical facilities, acquisition, and conservation funds), and long-term goals and is not intended to be a reflection of the particular tastes of the period or individuals involved. A decision to deaccession objects in the permanent collection should be considered not only in light of the law, but with regard to the museum's public trust.

From time to time it may be necessary to remove objects from the collection in the interest of constantly improving the collections and maintaining a high standard of esthetic quality and historical importance. Museums must retain the right to deaccession any item, however

acquired, which does not meet standards which demonstrably enhance existing collections, esthetically fulfill an identifiable instructional purpose, or contribute in significant ways to an academic or research program. Deaccessioning and disposal of museum objects must be conducted in accordance with museum policy and any applicable state and federal laws. Criteria applied to deaccessioning and disposal are as stringent as those applied to the museum's acquisition process, and reflect professional standards of ethics as established by the Association of Art Museum Directors and the American Association of museums.

Regulations cover the circumstances under which an object may be deaccessioned, as well as what may be done with any funds or other proceeds realized by this process. These regulations apply to a wide variety of museum disciplines whose objects may break, wear out, or degrade to such a state as to render them useless for the museum's purposes. Living history museums often use their objects in educational demonstrations which contribute to their deterioration. Zoological collections include living mammals and fish whose remains must be removed from the museum collection at death.

Authority to deaccession

The authority to determine the disposal method lies with the museum director and the board of directors. Criteria, authority, and procedures for deaccessioning should be contained in the museum's Collections Management Policy. Legal consultation will help insure that all existing laws and regulations are satisfied by the procedures adopted by the museum and incorporated in its policy. Depending on the size and discipline of the museum, and the value of the object in question that authority may shift. In a natural history museum, where scientific specimens that have little or no market or scientific value are added and removed from the collection as a matter of course, the decision may rest with the curator or others working with the collection. In a publicly funded art museum where the object is of significant value, or a majority of the museum's collection is being considered for deaccession, the state's attorney general may be consulted to ensure that the terms of the sale are fair and reasonable and that the purpose of the organization is promoted by these actions. The greater the object's value the higher the decision-making authority must be.^[5] A general guideline is that the level of authority to remove an object should be equal to or higher than the level of accessioning it.

Criteria for deaccessioning

Objects meeting certain criteria are deemed acceptable to deaccession. Such criteria include the following: the museum's inability to preserve or care properly for the object; the extent to which an object may, in the context

of the collections, be redundant or a duplicate of equal or inferior quality; an infestation or other condition of an object which cannot be ameliorated that makes it dangerous to other objects in the collections; the object's lack of relationship to the museum's collections; objects below museum quality standards, either intrinsically or relatively, in comparison with objects of the same type in the collections; the existence of an object in the collections in violation of UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property; objects determined to have been missing over five years; specimens that are deceased, or the discovery that an object has been misattributed, falsely documented, and/or is considered to be a forgery (in which case the museum's records must be changed to reflect the object's rightful attribution). In some cases objects may still be useful for study purposes and can be retained; deaccessioning does not demand that an object be removed from the museum.

Verification of records

The museum must confirm clear and unrestricted title to any object being considered for deaccession. The records of donation, if any, must be consulted to ascertain that no contractual contingencies in a gift prevent a deaccession. Legal counsel may need to review the validity of any restrictions that have been placed on collection objects that may interfere with the deaccession process. No collection object that has been acquired by gift or bequest with a restriction as to its retention should be deaccessioned while said restriction remains in effect, unless the retention of the object presents a clear, physical danger to other objects in the collections or unless it is proven that the object is held in violation of the UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property.

Precatory (nonbinding) stipulations which do not impose any accompanying legal obligation are respected to the extent possible, unless modified by the donor, or if the donor is not living, the donor's heirs or legal representatives. If the object is unrestricted the museum may proceed with the deaccession. Unless stipulated in the accession documents, donor notification of deaccession procedures is not necessary. An object given to a museum without restriction becomes the museum's property to be administered as the museum sees fit. Some museums adopt a good-will policy under which the donor or surviving family may be notified of a deaccession but this is done only as a volunteer practice.

The deaccession procedure

All deaccession action must be approved by the governing authority. In areas where, in the opinion of the

director or board of directors, museum staff expertise is not adequate to determine suitability for deaccessioning on the basis of authenticity or quality, outside professional advice is secured. Expert opinions may be sought from outside consultants who are acknowledged specialists in the field.

Once it has been determined that no detriment to the deaccession exists, the museum generates a written justification for the deaccession of the object in accordance with the criteria for deaccession described above. This justification generally includes an estimate of the object's current value, a recommendation for the method of disposal, and the date acquired; value at time of acquisition (if known); the source of acquisition, and stipulations, if any, detailing terms of the gift or bequest, and, if appropriate, an estimate of the amount of money that can be expected from this act. This justification and any report of the proceedings is included in the object's documentary file.

Disposal of deaccessioned objects

Deaccessioned objects may be transferred or donated to other museums or agencies as appropriate, they may be sold, donated, exchanged, or if necessary, may be destroyed.

Any sales should be conducted openly, preferably at auction. An object may be offered for donation or exchange to another museum or suitable institution for the express purpose of keeping that object available to the public. As mentioned above, in some circumstances the museum may elect to retain the object but reduce its status and subsequent level of care, to be used for educational purposes. Of course this would not be a factor where it was determined that the object had been stolen or otherwise illegally obtained, and in the case where the object was a living specimen, if it had died.

Ethical considerations in art museums demand that no employee, representative, or agent of the museum may receive any benefit, including the right to purchase any work of art removed from the collection. A conflict of interest may arise if employees may both suggest that a work of art be removed from the collection and purchase or otherwise receive that work of art once it has been removed.

As stipulated by the AAM and endorsed by the American Association of Art Museum Directors, all proceeds from the sale of works of art may be used only to acquire other works of art for the collection or to fund conservation of its collection. Ideally the museum will use the funds to purchase a similar yet superior work of art to that being removed. This considers the wishes of the donors who gave the original object to the museum. By selecting a similar work of art the

intentions of the donor are presumed to attach to the newly purchased work of art. Works acquired with the proceeds of sales of donated items should, if feasible, be credited as an original gift from the donor of the work that was sold.

A recent debate in the nonprofit museum community has arisen that surrounds proceeds from the sales of collections objects that fund building projects, facilities maintenance, or other institutional operations. The 1992 code of ethics for the American Association of State and Local History offers the following guidance concerning proceeds: Collections shall not be deaccessioned or disposed off in order to provide financial support for institutional operations, facilities maintenance, or any reason other than the preservation or acquisition of collections.^[6] In 1994 the AAM promulgated a revised code of ethics which contained a similar statement:

Disposal of collections through sale, trade or research activities is solely for the advancement of the museum's mission. Proceeds from the sale of nonliving collections are to be used consistent with the established standards of the museum's discipline, but in no event shall they be used for anything other than acquisition or direct care of the collections.^[7]

The definition of direct care has been left to the individual museum.

While the law has been more receptive to a broad interpretation of use of deaccession procedures, common ethical practices support the more strict understanding. A museum's mission invariably centers on the maintenance and use of its collections. When the collections are treated as assets they cannot serve the public trust. Museums facing serious financial difficulties argue that without this source of income they will shut down completely and will not be available to serve the public at all. This debate underscores the reality that laws can be enforced whereas ethical codes uphold the integrity of the profession and may be more demanding than the law.

Records of deaccession procedures

Complete and accurate records, including photographs and documentation of the circumstances of its disposal, are maintained on each object removed from the collections. At a minimum the records should include copies of the original accession documents, the museum's written justification for deaccession, any records of expert opinion, the record of disposal method and use of proceeds, and a photograph of the object. These records are kept in perpetuity but not stored with the documentary files of the current collections. The registrar adjusts the records to reflect the deaccession action.

Loan Documentation

Duty to loan

In July of 2000 the AAM wrote guidelines on exhibiting borrowed objects. An excerpt from the guidelines says this:

Over time human societies have increasingly turned to their museum to provide a special place, a *sacred precinct*, for the display of significant objects and ideas created by human civilization. Since no museum contains or could contain, all objects worthy of admiration and understanding, museums have traditionally exhibited not only objects from their own collections but also objects from other museums and private individuals and organizations. Borrowing objects allows museums to provide more comprehensive exhibits and to make objects accessible that would otherwise be seen only by a few.^[8]

Most museums have within their Collections Management Policy criteria and procedures to both make and receive loans. As educational institutions museums welcome the opportunity to exhibit objects from other areas, and to use those objects to enhance and highlight their own collections. Loan agreement forms are usually generated by the registration department and the documentation that ensues is permanently housed in that department. Like other museum documents, these records are kept in perpetuity.

The registrar's role in loan discussions centers on the objects that will be loaned. The registrar, as manager of the collection, keeps the schedule of the objects that have been selected for its own upcoming exhibitions, as well as those that are scheduled to travel to other institutions. The registrar also oversees conservation schedules and maintains environmental exposure records that indicate the maximum amount of time an object can be responsibly displayed. Decisions to loan or accept a loan are usually made by the director and curator, keeping in mind those important considerations. A registrar's records must be kept up-to-date and accurate in order to contribute to a wise decision.

Loan requests

When an object is requested for loan by another museum the registrar may request that the borrowing museum complete a Facilities Report, a standard but lengthy report that details the building construction, the environmental controls, exhibition and storage areas, the expertise of the staff and the handling, and collection practices followed by the borrower. Careful review of this document may reveal concerns surrounding the loan. Any issue the lender has with the borrowing museum or staff should be addressed and cleared up before the loan process proceeds.

In addition to the institutional practices of the borrowing museum, the lender should be concerned with the reason for the loan request and the circumstances for the

exhibit. It is standard practice not to lend objects to individuals. Museums collections are maintained for the benefit of the public and it is hard to justify their exclusive use for any one individual. When museum objects are on loan they should be afforded the same standard of care and protection as when they are in their own museum environment. Private homes or offices cannot replicate the security nor the controlled atmosphere that a museum can. Additionally, tax regulations require donors to relinquish complete control over the items for which they have received a charitable contribution exemption. If donated property was lent back to the donor, even temporarily, the deduction could be called into question. Staff members of the museum, including the board and volunteers, have a duty not to receive any personal benefit from their positions. Lending museum objects to a staff member is a direct and serious violation of this ethical consideration.

Some institutions have a policy of only lending to a certain type or size of museum. Some may lend only to educational museums, some to museums within their state, some only to institutions their size or larger. Many larger museums will not consider loaning an object to another institution that has not been accredited.

Loan agreements

Once a loan has been accepted by the lending museum the registrar crafts a loan agreement with responsibilities of both lender and borrower clearly designated. Loan agreements may be written by either the borrower or lender. In some cases both institutions write an agreement to insure their particular concerns are met. In this case the registrar should carefully review each document to make sure they do not conflict with each other, nor with state regulations.

Components of the agreement include: a description of the object being lent, dates both of the arrival and return of the object and dates of the public exhibition, name of exhibition, instructions on what to do if an object is damaged, caution against cleaning or altering any work in any way, including reframing; the expected standard of care for the object, the necessity of condition reporting, who may pack and transport the object, who may handle the object at the borrowing museum, cost assignments for transportation, conservation, framing, and insurance, information on how to unpack and repack, and who insures the work in transit and on site. The lender may ask for a diagram of the gallery and layout of the show in order to check the anticipated traffic patterns. A covered vitrine, a raised pedestal, or stanchions may be requested to protect fragile objects in high density areas. Other issues that may be contained in the agreement concern who may get invited to the opening reception, courier or travel costs to be reimbursed, and any sales costs for museum catalogs or other exhibitions support materials.

Once the registrar has completed a written agreement with all the supporting information, two originals are sent and signed, each museum keeping one of the originals. Copies of the agreement may go to the director, the curator, and the business office. The original loan agreement should be kept on file in perpetuity and copies made from which to work.

Creating the loan file

The loan file is the repository of every scrap of information pertaining to the loan, from the first loan request to the object's return. A loan number may be assigned in a similar manner as are accession numbers. A commonly used system uses an alpha-numeric designation such as Outgoing Loan (OL) or Incoming Loan (IL) followed by the year in which the loan will begin plus the number of loans that have been created for that year. For example, the third outgoing loan in 2009 would bear the number OL2009.3. Depending on the database, if any, different configurations of the prefixes may be used to help sort the loan information.

Tabs attached on the exterior of the file folder contain the loan number, the exhibition dates, and the institutional name of the lender/borrower. Files are maintained in a chronological order. File cabinets should not sit directly on the floor, but be raised at least three inches to protect against any water that may accumulate on the floor during a fire or flood emergency.

Manila folders within the file will hold a variety of information depending on the museum's discipline. Common incoming loan folder contents are CONDITION REPORTS/PHOTOGRAPHY, CORRESPONDENCE, INSURANCE, LOAN AGREEMENT, NOTES, PUBLICATIONS, and SHIPPING. Outgoing loan folders may contain the same designations with the addition of FACILITY REPORT. When marking the content of the manila file it is advisable to write on the folder's tab rather than applying a gummed label which may fall off the folder as it ages and dries out.

An additional folder within in the exhibition files should be designated LOANS DENIED. Historical information on loans which have been requested from the museum but for whatever reason did not occur. Correspondence between the borrower and lender concerning the denied loan are kept here.

Condition reports: Incoming

Condition reports insure that both the borrower and lender are in full agreement on the condition of the loaned objects. While a condition report done as a matter of standard operations for collection objects aids in long-term tracking of condition, a condition report done in a loan situation protects each institution from unfounded

claims of damage. Incoming loan objects should arrive at the borrowing museum with an individual condition report for each object. If there are no reports the receiving registrar should prepare them and immediately send copies to the lending museum. While it is an imposition of time and effort, the protection afforded the borrowing museum is priceless. Numerous manuals exist to aid in completing condition reports on a wide variety of materials. Consulting an appropriate form will aid the speed with which one can complete this process.

Condition reporting is best managed by a two-person team. One person reads the existing report (or writes one, if no report exists) while the other examines the object to confirm the report. Should damage to the object be discovered that is not on the report, the lending registrar should be notified. Judgment should be used to determine if the damage is slight and was just overlooked, in which case the registrar may add the observations to the report, sign and date them, or is new damage that has occurred in packing or transit. If damage to an incoming crate or container is obvious the damage should immediately be reported to the shipper, as well as to the lending registrar, preferably while the drivers are still on premises. The packing material in a damaged container should not be discarded; it may hold shards or other material necessary for the repair of the object. It can also indicate how the damaged happened, which may impact the person financially responsible for the damage.

The loan agreement contains instructions on what to do when damage is found. Under no circumstances should the borrowing museum staff attempt to unframe, clean, repair, or alter the object in any way without written permission of the lender. A telephone conversation to the lender should be followed by a fax or e-mail detailing the damage in writing along with photographs of the damage. The lender should reply, in writing, giving instructions on how to proceed. If the lender is not familiar with museum procedure (in the case of a private lender, for example) the options can be outlined to the lender so they may grant written permission, in writing, to have the repair made.

If after the object has been examined and its condition is as stated in the report, the examiner should so indicate by writing "No Change" on the report, sign and date it. It is not necessary to reiterate any damage that is already listed on the report.

When the loan period comes to an end, a second round of condition reports is completed for each object. On the original report it may again be noted "No Change" if the object is in the same condition as when the first review was done, along with the examiner's signature and date. If damage has occurred while on the borrower's premises it should be reported immediately to the lender following any instructions in the loan agreement and noting the damage on the condition report. It is helpful to include any photographs of the damaged area with the report.

Condition report: Outgoing

When sending an object to another museum, the object is carefully examined for condition. Numerous manuals exist to aid in completing condition reports on a wide variety of materials. Consulting an appropriate form will aid the speed with which the process can be completed. A photograph or rough sketch on which indicators pointing to each area of damage has been drawn, makes the report easier to understand. Any observations should be clearly written so that anyone reading the report will understand what is being conveyed. As with all condition reporting, it is easiest to accomplish using a two-person team. One person will examine the object and report verbally, while the other makes accurate notes on the report.

Should the loan be to multiple venues, and/or there are many objects in the loan, a condition report notebook should be compiled in a three-ring binder and sent along with the objects. In addition to condition reports and accompanying photographs the notebook may include any special packing or exhibiting instructions, a crate list indicating which objects are contained in each crate, and contact information for the registrar, curator, and publicity person. Packing instructions may be on paper and in an electronic format. A video of packing or assembling complicated objects can be invaluable.

Correspondence

Prior to a loan being realized there will be correspondence, generally between the borrowing and lending curators, that will contain information such as details of the exhibition, the reason for the exhibition, why certain objects are being requested, other lenders to the exhibition, and stipulations concerning the loan. All of this information is important and may answer future questions or assist in settling any disputes. These notes should be retained in the correspondence folder.

Insurance

Proof of insurance for either party should be retained in this file. Often the borrowing institution will issue a Certificate of Insurance that confirms that the borrowed objects are covered by the borrowing museum's policy. Either the borrower or the lender may choose to insure the objects. This information should be contained within the loan agreement.

Loan agreement

The original signed loan agreement should be preserved in this folder. Because it is a legal document it should remain as pristine as possible. Copies may be made and circulated to those staff members directly involved with the loan

(including the development officer), however the original should remain in the file.

Notes

This section of the loan file should store any internal notes between staff referring to any meetings, schedules, requests for labor, or any similar material.

Publications

Any catalog created for an exhibition which contains references to the museum's objects should be kept as a record of the exhibition. Any exhibition opening invitations, copies of newspaper or magazine articles should also be retained. Pertinent online articles should be printed out and filed with the URL and the date accessed noted.

Shipping

Any shipping invoices, correspondence to shipping companies, bills of lading, or any documentation concerning the movement of objects pertaining to the exhibition should be stored here.

PROTECTION OF RECORDS

In addition to maintaining the information the registrar assumes responsibility for the physical safety of the files. Long-term retention is the goal; ideally the information will be readily available for the life of the museum, no matter how long that may be. Acid-free materials and folders should be used for all legal documents and records that are deemed archival. Acid-free pages should not be stored with acidic pages nor stored in acidic file folders as the acid will migrate and contaminate the acid-free materials. All pages should be free of paper clips, staples, and creases, factors that degrade paper. File labels should be written directly on the folder, not attached by a sticker that will fall off once the glue ages. The file cabinets should be stored in an environment conducive to long-term preservation. High heat and humidity conditions should be avoided. Because much of the material contained within the files may be sensitive, the files should not be accessible to the public, nor to any staff not directly involved with collections care. Storage in a locked cabinet is preferred. Staff should be reminded that the information contained in the files is confidential and should not be shared with others.

The material in the documentary files may be duplicated in part in a museum's computerized data management system. Backup procedures should be done on a regularly scheduled basis to insure that the material is up-to-date, accurate, and safely maintained. Backup records should not be stored in the same building as the computer.

A secure offsite location, known by more than one person is recommended for all backed up computer records. Unless they are on a network server that automatically stores and backs up documentation. Because data management systems constantly evolve, they are not part of the further discussion of records management.

All records must remain secure from hazards such as fire, theft, and water damage. Slower acting agents of destruction also present a hazard to the collection such as light exposure, pests, acid reactions to paper, and mishandling. Safeguards should include restricting food, drink, and smoking from record areas, nearby fire extinguishers (and the training to use them), and a system for locking and monitoring access. Managing collections is a rigorous task. Even museums with few resources can design systems to safeguard both the collections and its pertinent records.

CONCLUSION

A museum's documentary records on its objects are unique and irreplaceable assets of the organization and should be systematically collected and preserved. These records allow personnel to properly care for and access the museum's collections. Records prove ownership, describe the material in the collection, and document loans. They insure that museum collections are physically and intellectually available for collections management, interpretation, exhibition, and research. They demonstrate accountability for the collections. Today, as the public

demands more accountability from those who steward objects of cultural heritage, it is more important than ever to preserve this important documentation. Governing authorities such as the AAM regulate what information a responsible museum should preserve.

Documentary records can be considered secure as long as information is entered in a timely manner, access is restricted to those working directly with the records, errors are corrected as soon as they are discovered, and the museum's standards of practice address the importance of these files and their contents.

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Museum Studies

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Abstract

Defined at its most basic level, “museum studies” sometimes referred to as “museology” or “museum science” is the study of museums. Since its origins in the early 1900s, its development has been tied to ongoing discussions within associations like the American Association of Museums (AAM) and the International Council on Museums (ICOM) about how best to train those who work in professional roles in museums. Beyond its emphasis on practical training, museum studies scholarship also explores museums’ cultural, political, and historical roles within society. Universities and other research institutions, like the Smithsonian and the Getty, offer a range of museum studies courses, graduate degrees, workshops, research, and publications. There is debate about how to approach the study of museums. The entry below offers discussion on these issues from a historical perspective. It largely focuses on the United States, although it should be noted that museum studies programs and scholarship exist around the world. Given the complexity of the museum field and museum studies and the number of individuals who have made contributions to its advancement, the discussion below is by no means exhaustive or complete.

INTRODUCTION

Defined at its most basic level, “museum studies” sometimes referred to as “museology” or “museum science” is the study of museums. This study, according to the Smithsonian Institution Center for Education and Museum Studies, encompasses “the ideas and issues involved in the museum profession—from the practical, day-to-day skills needed to operate a museum to theories on the societal role of museums.”^[1] Museum studies is interdisciplinary and is thus undertaken by individuals from a variety of backgrounds and disciplines, including, but not limited to: 1) university professors and other scholars who incorporate museums as part of their research or apply their academic discipline (e.g., Anthropology) to an understanding of various aspects of museums, 2) university faculty who teach courses to students who are pursuing academic degrees in museum studies, 3) adjunct instructors who are employed by museums or are retired professionals and teach one or two university courses on topics like museum collections management or museum ethics, 4) practitioners in museums or in independent research institutions who research and publish studies about different trends in museum practice (e.g., visitor studies), and 5) individuals who hold academic degrees and/or certificates in museum studies.

Museum studies departments are housed at a select number of universities throughout the United States and around the world, either as sections of traditional academic departments, such as a Department of Anthropology or Art History, or as stand-alone departments in Schools of Education, Liberal Arts, Library Sciences, or

Continuing Education. Other museum studies departments are run by educational and research divisions of large institutions, such as the Smithsonian Institution. Typically museum studies departments offer services like workshops, conferences, publications, and reports related to museum work, research and credit courses that lead to a certificate or master’s degree in museum studies. These courses cover topics such as museum history and theory; administration; marketing; collections management; education; technology; exhibition design, ethics and law; and community outreach.

A variety of organizations, ranging from professional museum associations to academic presses, publish journals and books that disseminate museum studies research. Some publications are theoretical in nature and address different philosophies on the role and meaning of the museum in society. Others take on more practical aspects of museum work such as how to design exhibitions and public programs, preserve a specific kind of fragile artifact, understand museum audiences, or measure economic viability. Still others meld theory and practice. In addition to academic journals and books, museum studies research is disseminated through trade publications and professional committee newsletters.

Despite the growing number of museum studies publications, researchers, college-level courses, and universities that offer a master’s degree or certificate in museum studies, there is little agreement or cohesiveness within the field. Since the institution of the museum encompasses a staggering array of organizations, collections, disciplines, organizational structures, public services, economic models and professional practices, it follows that the field of

museum studies is equally disparate. Many professionals who work in museums are not acquainted with or knowledgeable of the field of museum studies. Likewise, many museum studies scholars, researchers, and professors have limited direct work experience in museums.

Given the varied perspectives, there are lively debates about the nature, stature, and future of museum studies. These debates address issues such as: 1) standardization of curriculum and accreditation of university and other museum studies training programs; 2) the knowledge, skills, and learning outcomes that museum studies curriculum should strive for; 3) appropriate subfields of study, such as visitor studies, curatorial studies, ethics, legal issues and educational learning theory; and, of course, 4) the ever-changing nature of museums themselves. Museum studies scholars have been instrumental in framing key intellectual issues in the field including the repatriation of looted objects, the role of indigenous peoples in creating museum displays of their culture, how the design of galleries shapes the visitor's experience, and the tensions between creating entertaining blockbuster shows and more scholarly interpretations of collections.

EARLY HISTORY OF MUSEUM STUDIES

The history of museum studies is tied to the development of museums as professional workplaces, and the ongoing need for trained employees. It should be noted that although most museum practitioners and academicians agree that a museum is a professional workplace, some do not believe that museum work is a distinct profession, another contention in the debates about museum studies.^[2]

Stemming from their beginnings as royal and priestly cabinets of curiosities and then private collections in Europe during the fifteenth and sixteenth centuries, early museums were eclectic, described by museum historian Edward Alexander as “individualistic and unorthodox,” and subject to decisions by wealthy collectors and benefactors that were “uncertain, haphazard, and wasteful.”^[3] Even as museums became more accessible and thus more accountable to the public during the seventeenth and eighteenth centuries in France and England, and likewise in the nineteenth century in the United States, no attention was given to developing a coherent set of practices, or focused study of, the growing phenomenon of gathering art and natural science collections, studying, and classifying them, arranging them in publicly accessible displays, and managing their care and upkeep.

As museums grew in number, especially in major cities in the United States after the Civil War, great attention was paid to amassing collections and developing an architecture to house them that communicated grandeur. But no internal system existed for training employees to manage or care for them. Most museums were run by their founders, their founders' relatives, or other volunteers who had

personal financial cushions and could forgo a salary. A high number listed their occupation as “amateur archaeologist” or “volunteer.” Some doubled as benefactors, donating their own collections and inheritances to keep their museum afloat. In short, museums remained the purview of wealthy hobbyists.

In 1891, G. Browne Goode, a curator at the Smithsonian Institution, wrote the first American book to lay out ideas for the professional management and organization of museums. In *The Museums of the Future*, he opined that not just anyone could run a museum. Museums needed employees who possessed a “museum sense” meaning that they understood the unique qualities of collections, exhibitions, and public display.^[4]

A collective “museum sense” was slow in coming. Professionals working in other types of scholarly and public organizations had begun to develop a collective sense of profession in the nineteenth century. Several autonomous professional associations—for example, the American Bar Association (1878), the American Historical Association (1880), and the American Library Association (1881)—were born at that time. In 1889, the first association of museum workers—the Great Britain Museums Association—was founded in York, England. It held meetings where various ideas and practices were discussed. In 1902, British museum workers published the field's first professional journal: *Museum Journal*. Those working on the other side of the Atlantic Ocean were intrigued. The Salt Lake City Museum of Utah was the first foreign museum to join the Great Britain Museums Association, and Americans began to sail to England to participate in meetings.

In 1905 at the Smithsonian Institution a group of museum workers who had been attending the meetings in England set forth a charter for an independent American museum association. The next year, in New York City, at the American Museum of Natural History, 71 individuals working in art, natural science, and history museums held the foundational conference of the American Association of Museums (AAM). Within a year, they had recruited 160 founding members (mostly curators). Their idea was straightforward. Museums, whether devoted to art, science, history, or a combination of all three, had common interests and goals. Therefore, people working within them would benefit from a formal network through which to share practices. As the Smithsonian reported: “the importance of this movement so auspiciously inaugurated cannot be overestimated, since the opportunity for interchange of views will surely stimulate the activities of museums everywhere. . .”^[5]

American Association of Museums became a forum for workers (they called themselves “workers” through the 1940s, then used the term “museum people,” and finally, around the late 1950s, the then-disputed term “professional”) to develop their own voice, while remaining obedient to their places of work, and their patrons.^[6] Scarcely

anyone knew how to organize exhibits, deal with artifacts, or run museums. Scarcely any literature existed that described what a museum was and what it should do. In 1907, Frederic A. Lucas, curator of the Museums of the Brooklyn Institute of Arts and Sciences, wrote about the shortage of information and workers in an expanding field. Where could he find trained taxidermists, landscape artists, and preparators to help create exhibitions?^[7] That same year, *The Nation* ran an editorial noting that despite the shortage of workers, wealthy philanthropists continued to found new museums. What was needed, the editorial suggested, was a specialized curriculum devoted to training a cadre of curators to advance the work of museums. This curriculum should include a thorough understanding of classical antiquities, as well as an understanding of how European museums operate. Around the same time, A. R. Crook, curator of the Illinois State Museum of Natural History, surveyed AAM members and synthesized their ideal qualifications needed to run a museum. His recommendations were: “a knowledge of museum history and philosophy; a grasp of exhibit techniques; skill in soliciting materials and money; good health; and the ability to handle a canoe.”^[8] Thus, two courses covering the fundamentals of museum work (minus the canoe) were created, one in Iowa and the other in Pennsylvania. In 1907 in Iowa City, Homer Dill, an anthropologist and taxidermist, set up a “Taxidermy and Plastic Art” teaching lab and course at the University of Iowa Museum of Natural History. His students went on to direct natural science museums in Denver, Ann Arbor, and Minneapolis. A year later in Philadelphia, Sara Yorke Stevenson, curator at the University of Pennsylvania Museum of Archeology and Anthropology and an expert on ancient Egypt, taught a course in museum work at the Pennsylvania Museum and School of Industrial Arts, now The University of the Arts.^[9] Her course emphasized Greek, Roman, and Egyptian antiquities and their classification, as well as techniques for educating the public about these artifacts.

Demand for the fledgling museum training courses was high. “We cannot furnish enough graduates to supply the demand for curators and other workers,” Dill reported to the AAM.^[10] Yet, collectors and other prominent citizens who continued to found museums had little interest in training a workforce. Dill, Stevenson’s, and others’ efforts were discontinued. Throughout the next decades, seasoned museum workers remained in such scarce supply that, in its first code of ethics, AAM warned museums not to steal employees from another institution without the prior consent of the director. “A museum may not properly offer a position to an employee of another museum with which it has regular and intimate relations without having first notified the director of its intentions to do so.”^[11]

In the 1920s, two charitable foundations—the Carnegie Corporation and Rockefeller Family Foundations—advanced the cause of training museum workers. In face of accusations of their undue political influence on

educational institutions like libraries and museums, these foundations realized the value of an autonomous organization of museum workers. In 1923, the Laura Spelman Rockefeller Memorial Foundation gave AAM its first grant which was soon followed by support from the Carnegie Corporation. This support launched five activities that helped to establish a collective “museum sense” of professional practice, laying the groundwork for many of the practices embraced today by museum studies departments. They were: 1) a code of ethics; 2) a monthly journal called *The Museum News*; 3) a partnership with the National Park Service (NPS) to establish trailside museums (nature centers) to teach visitors about flora, fauna, and geology; 4) training programs; and 5) data gathering.

American Association of Museums’ 1925 code of ethics—the field’s first such guidelines—emphasized the public function of museums, noting that “the life of the museum worker, whether he be a humble laborer or a responsible trustee, is essentially one of service.” The code also promoted the virtues of loyalty, sincerity, tactfulness, and courtesy in the workplace, warning that “jealous acts, gossip, inquisitiveness, sarcasm, practical jokes, while often thoughtless, are always uncharitable.”^[12] Despite the ethical code, early issues of *The Museum News*, edited by Harold Madison, director of the Park Museum in Providence, Rhode Island, often printed gossip items. These included betrothals, summer vacations, and other life events of AAM members. However, the journal also provided short articles on new acquisitions and new kinds of educational programs offered at member museums and announcements of the availability of equipment, such as cases, shelves, collecting jars and the like. *The Museum News* offered tips for providing better public service, including the advice to let visitors touch objects when possible, perhaps the first iteration of the interactive education movement that decades later would become a serious subject of study in many museum studies departments.

The NPS trailside museum initiative was an important development because it represented the first coordinated effort between museum workers to develop a cohesive group of museums with similar styles of architecture, display, and educational interpretation. Lessons learned from establishing the first trailside museums inspired the first museum exhibition design manual, written in the late 1930s, by Ned Burns, head of the NPS Museum Division.^[13]

The Carnegie Corporation, headed by Frederick Keppel, a former dean at Columbia University, directly helped to advance efforts to train museum workers. Keppel was a proponent of adult education, in vogue because of the rush of non-English speaking immigrants into American cities. Possibly influenced by the work of John Dewey who was on Columbia’s faculty while Keppel was a dean there, Keppel believed that museums were ideal places to expose America’s adult population to higher cultural

values. Keppel began by training a museum workforce, sponsoring museum workers to travel to Europe to study the museums there. He then steered support to the first sustained museum training course in the country established in 1921 at Harvard University by Paul Joseph Sachs, son of Samuel Sachs, financier and founder of the banking firm Goldman/Sachs.

The Harvard curriculum emphasized materials, chemistry, application techniques, and new restoration technologies like x-ray equipment. Sachs' famous course "Museum Work and Museum Problems" covered not only art restoration, but museum history, philosophy, and management. He stressed that his students needed "educated eyes" in order to observe artwork closely and recognize the telltale flourishes of important artists. Sachs forged alliances between his students, the AAM (he served on its board) and the inner circles of the art world. Sachs "insisted that the museum must remain 'firmly in the control of a trained elite, [which would] maintain standards of quality independent of the contingent values of daily life.'"^[14] His illustrious disciples went on to lead America's best-known art museums, including the Museum of Modern Art, the St. Louis Art Museum, and the Toledo Museum of Art.^[15]

While the Harvard museum course focused on applying the values of connoisseurship to the nation's elite art museums, three contemporaneous training courses in the United States emphasized other areas of the museum field. In 1923, at the Newark Museum, Louise Connolly initiated a program that trained primarily young female apprentices in library work and museum education. Two members of the first graduating class of the Newark program—Dorothy H. Dudley, registrar at the Metropolitan Museum of Art, and Irma Bezold Wilkinson, registrar at the Museum of Modern Art—went on to write the first manual of standard techniques in collections documentation.^[16] From 1926 to 1929, Laura Bragg, director of the Charleston Museum (the nation's oldest museum) worked closely with AAM to pioneer a summer course at Columbia University in New York that included an apprenticeship in Charleston. Its goal was to emphasize the community educational role of museums and, in Bragg's words, "to make clear the ideals of the modern museum and the potential scope of its activities and influence."^[17] Starting in 1929, with funds from the Rockefellers, the Buffalo Museum of Science trained museum workers in the design and construction of natural science dioramas and exhibitions, including those at NPS trailside museums. This program was run by longtime AAM board member Chauncey Hamlin as well as Carlos Cummings who went on to write a classic museum text that compared world's fair displays to museum exhibitions.^[18] Museum training courses were also founded in Europe and South America during this era.

As trained men and women found employment in museums, the field gathered and analyzed data to guide their work. Until the 1920s, the majority of written

materials available to museum workers consisted of reams of technical information on taxidermy techniques. A perusal through AAM's 1928 *Bibliography of Museums and Museum Work* reveals only one article (by John Cotton Dana, director of the Newark Museum) discussing the value of public service. The majority of articles are on the details of taxidermy. Carnegie now began to fund research projects to cover other subjects, including the first studies of museum fatigue. From 1924 to 1928, Yale University psychology professors, Edward Stevens Robinson and Arthur Melton studied how visitors used exhibits, with an eye to creating environments and buildings that would be less tiring and more invigorating.^[19] Their work influenced directors to advocate for less cluttered displays and more comfortable viewing galleries. In 1928, Carnegie underwrote the first intensive cross-comparative study of museums. Paul Marshall Rea, a former director of the Charleston Museum, studied 104 museums and compared attendance and population data for their locales. He produced a dense study with 150 pages of elaborate logarithmic calculations and suggested such innovations as branch museums (urban institutions opening branches in outlying areas) and other cost efficiencies.^[20] Museum training and research programs were largely discontinued during World War II, when museums, like the rest of the nation, focused on the war effort. Yet these foundational efforts framed the importance of professional conferences and networks, publication of data and information, and training courses to advance and improve museums.

MUSEUM STUDIES IN THE SECOND HALF OF THE TWENTIETH CENTURY

After World War II, interest in training museum workers grew significantly. Through the Commission for the Protection and Salvage of Artistic and Historic Monuments (known as the "Roberts Commission" and housed at the National Gallery of Art), American museum specialists traveled to postwar Europe to assess the damage war had levied on the continent's monuments, masterworks, and archives. These specialists included Paul Sachs and many of his former students at Harvard. The Commission was named for Owen Roberts, Justice of the U.S. Supreme Court. With fresh memories of the damage World War II had wreaked on Europe's cultural landscape, museum directors from throughout the world founded international organizations like UNESCO and ICOM (International Council of Museums), dedicated to the protection and advanced public understanding of the world's cultural and education heritage. The need for training museum personnel at all levels was a significant topic of discussion, "enshrined in the basic charter setting out ICOM's role, with particular reference to the objectives of UNESCO."^[21] "If we must have museums at all in the postwar world"

declared Metropolitan Museum of Art director Francis Henry Taylor in 1945, then they “desperately . . . need to be overhauled and reorganized. But this overhauling . . . must be intellectual as well as physical.”^[22]

One urgent necessity was the training of personnel to manage and care for museum collections, a process that was becoming increasingly specialized. Until World War II, recordkeeping had primarily been the responsibility of curators, often referred to as “keepers,” a title still used in Great Britain. As the postwar examinations made abundantly clear, museums around the world had “kept” collections, but had largely neglected to care for them.^[23] Collections documentation systems had existed since the 1910s. But the first coordinated collections management and care training efforts did not begin until the second half of the twentieth century. In 1955, at the New York State Historical Association in Cooperstown, Paul Sachs’ former students, Sheldon Keck and Carolyn Kohn Keck taught the first course in painting conservation. In 1959, Sheldon opened the first training program for art conservators at New York University. Other training labs were founded at the University of Delaware (1951) under the tutelage of historian Charles Montgomery and Oberlin College (1952) by conservator Richard D. Buck. Much of the impetus for delegating this work to a specialist came from the rising value of art and the increased number of traveling exhibitions.

Americans were also traveling in greater numbers, due to the postwar economic boom and greater focus on leisure time activities. Outdoor museums like Colonial Williamsburg and those run by NPS began to develop educational programs for families and produce manuals for workers in how to create these programs.

Freeman Tilden’s classic guide to educational interpretation at historical sites, *Interpreting our Heritage*, was released in 1957 and is still a benchmark in the field.^[24] Other museum trends, especially in exhibition design, were analyzed in the field’s first independent journal, *Curator*, founded in 1958 and published by the American Museum of Natural History. In 1959, Edward Alexander, one of the twentieth century’s most prolific writers on museum history, founded the Seminar for Historical Administration at Colonial Williamsburg. Like museum training programs before it, the purpose of the summer-long seminar was to address the “critical shortage of adequately trained personnel . . . to staff [museums].” Alexander’s curriculum included courses in museum history, educational interpretation techniques, administration, and how to conduct research.^[25]

Increasing university resources and new government agencies led to a boom in new museums on campuses and in cities during the 1960s, and an expanded interest in developing resources for those wishing to work within a growing sector. The Smithsonian Center for Museum Studies was founded in 1965, along with university-based training programs including the University of Wisconsin

in Milwaukee (1963), Cooperstown Graduate Program (New York, 1964), and the Museology program at the University of Leicester (United Kingdom, 1966). In 1969, ICOM’s newly formed International Committee for the Training of Personnel (ICTOP) held a major symposium on the professional training needs of museum workers at the University of Leicester. Among the issues explored were the lack of recognition within universities of museology as a valid academic discipline and the need for an internationally recognized basic syllabus and training standards.^[26] Under the guidance of Smithsonian specialist Nancy Fuller, the initial ICOM Basic Syllabus for graduate-level Professional Museum Training was published in 1971. The components and emphasis of this syllabus has been revised several times in the ensuing decades to assure that it reflects changes in the museum field.

During the 1970s, despite the international calls for a standardized curriculum, in the U.S. universities founded museum studies training programs to meet local and regional needs. Like the early individualistic museums, discussed above, these programs were eclectic and reflected the expertise and strengths of their founders as well as their trends in their locales. John F. Kennedy University (JFKU)’s Department of Museum Studies, founded in the San Francisco Bay Area in 1974 by Deborah Kirschman, drew on the then-unique community focus of the Oakland Museum as well as the experimental educational work of the Exploratorium, Berkeley Art Museum, and San Francisco Museum of Modern Art. The George Washington University (GWU)’s program, founded in Washington, D.C. in 1976 by a committee of professors in the Art History, Anthropology, and American Studies departments, distinguished itself in museum education, curriculum development and law, drawing on its proximity to the Smithsonian Institution. Both JFKU and GWU created professional journals to disseminate current museum research to others in the field. John F. Kennedy University’s Museum Studies Journal was discontinued in 1988. Another early program was founded at New York University in 1977 by Flora Kaplan. New York University’s program emphasized art history, conservation, and exposure to the diverse landscape of museums throughout New York City. University of Delaware’s program (1972) emphasized history and the decorative arts; Bank Street College’s program (1978) was known for embracing progressive educational techniques.

These programs, as well as others forged during the 1970s, benefited from the large increase in philosophical and practical guides to museum work. Texts published during this era addressed a range of subjects, from the expanding role of museums’ education departments, to calls for accountability that were emerging from the growth in government funding, to modern architecture, to the future of museums in uncertain times (a recurring theme in the field of museum studies). They included such

seminal publications as Ellis Burcaw's *Introduction to Museum Work* (1975); Barbara Newsom and Adele Silver's *The Art Museum as Educator* (1978), and Edward Alexander's history text *Museums in Motion* (1979). The growing numbers of disparate museum studies programs led to the founding of AAM's Museum Studies Curriculum Committee in 1973 (now known as the Committee on Museum Professional Training [COMPT]). Like ICTOP, COMPT members have continually argued for standards and rigor within curriculum and scholarship. As Patrick Boylan, chairman of ICTOP, noted in 1987: "There is [still] no unanimous view about the form, content or extent of training for museum staff."^[26]

Museum studies changed radically during the 1990s. The popularity of cultural and postcolonial studies in universities, coupled with high-profile controversies at several museums over the content of exhibitions, led to intensive analysis of the politics, ideology, and values inherent in museums by scholars (for example, Tony Bennett, James Clifford, and Donna Haraway). With museums reeling from the Robert Mapplethorpe and *Enola Gay* scandals on one hand, and the passage of the Native American Graves Protection and Repatriation Act on the other, art historians and anthropologists posed difficult questions. What was the relationship between cultural displays and the cultural assumptions of the people who created those displays? How had the museum acquired their collections and who really owned those collections? Who was the museum really for?

Concurrently, the growth of children's museums and interactive science centers led to intensive attention to the educational theories like multiple intelligences (Howard Gardner), and constructivist learning (George Hein). With interactive displays seemingly blurring the lines between education and entertainment, academicians accused museums of "dumbing down" while educators defended their attempts create to more accessible programs. More debate ensued as government cutbacks and financial retrenchment led to increased calls for accountability, ethical decision-making, and greater attention to the museum-going public. Key texts by scholars like legal expert Stephen E. Weil and educational researchers John Falk and Lynne D. Dierking advanced the thinking in these areas. In his edited book, *The New Museology*, Peter Vergo, an art historian and theorist at England's University of Essex, published a collection of essays that aimed to open the door toward a "radical reexamination of the role of museums within society."^[27] These growing and sometimes bitter debates contributed to new research and ways of thinking about the core issue that concerns museums: the improvement of museums. All of these debates were undertaken in museum studies curriculum and literature. Dissertations on museums grew in number, as did conferences, symposia, and workshops.

Toward the end of the 1990s, the spread of digital technology radically impacted museum studies. In the late 1990s, museum studies departments at JFKU, GWU, and Harvard University offered the first courses in museum studies and technology, taught respectively by Richard Rinehart, Kym Rice, and Katherine Burton Jones. This area of study has grown substantially in the last decade, with attention paid to researching how to create more accessible online databases, caring for digital assets, communicating through online social networks, developing technology in exhibitions, and so on. Another result of online technology has been the spread of distance-learning and online courses in museum studies.

Despite or perhaps because of the growth of museum studies as an area of scholarship and professional training, the debates continue. Is museum studies a subset of larger academic disciplines or is it a field in its own right, meriting a separate Ph.D.? Does museum studies curriculum really train future professionals to successfully lead museums in all of their complexity? Are there too many museum studies programs and initiatives for a relatively small sector of the nonprofit economy, or are there not enough for a creative industry that continues to found new institutions and create new initiatives?^[28] Would museum studies programs benefit from industry accreditation standards, or would these standards confine a curriculum and area of study that thrives on adapting to rapid changes in the marketplace? All of these questions and others point to a robust future for the field of museum studies.

ONLINE MUSEUM STUDIES RESOURCES

- American Association of Museums (AAM)—<http://www.aam-us.org/>
- American Association for State and Local History (AASLH)—<http://www.aaslh.org/>
- Canadian Heritage Information Network—<http://www.chin.gc.ca/English/index.html>
- Committee on Museum Professional Training—<http://www.compt-aam.org>
- Getty Trust—<http://www.getty.edu/>
- International Committee for the Training of Personnel (ICTOP)—<http://icom.museum/international/ictop.html>
- International Council of Museums (ICOM)—<http://icom.museum/>
- National Association for Interpretation—<http://www.interpnet.com/>
- National Park Service Museum Management Program—<http://www.nps.gov/history/museum/>
- Smithsonian Institution Center for Education and Museum Studies—<http://museumstudies.si.edu/>
- Visitor Studies Association—<http://www.visitorstudies.org/>

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Museum Web Sites and Digital Collections

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Abstract

Museums adopted the Web early, building on their experience with videodisc and CD-ROM publications in the 1980s and early 1990s. From the first, they introduced experimental features including visitor feedback, three-dimensional (3D) walk-throughs, and deep coverage targeted at niche audiences. Only with the maturation of the genre did they routinely have basic hours and location information for visitors as part of their sites. Consistently, museum use of the Web has been programmatically driven, emphasizing exhibitions and events, rather than collections databases and privileging browsing over site-searching (though supporting search engines). Over the next years, museums will increase the amount of location-based content delivery and aim content at cell phones, pdas, and similar devices being carried by their potential audiences.

INTRODUCTION

The World Wide Web (the Web) has provided an easy way for museums to reach their many audiences, publishing a range of materials about their institutions and collections, and creating spaces for their varied constituents to engage with each other, and with the content of collections. Following its release in 1993^[1] the Web was rapidly adopted by museums (a development traced in the proceedings of the Museums and the Web conferences (1997–). Today, 15 years after its release, having a Web site is considered a necessity by museums. This rapid adoption of the Web by museums reflects the fit between museum needs for widespread dissemination of multimedia content and the ease with which the functionality embodied in the Web supports programmatic needs.

Museums care for information as much as they care for collections. The Web enabled relatively easy publication of complex documents, richly illustrated in color (something that the economics of print publication was making more and more difficult). The broad reach of the Web enables contact with both local constituencies, and international networks of potential tourist visitors and subject-specialist scholars. Broadcast of basic information about the institution (such as location, hours, and exhibition program) and narrow-cast of in-depth information for particular audiences (such as teacher-packets and interpretive programs for schoolchildren) are enabled by the same technology.

Museums were well positioned to take advantage of the Web through early experiments in multimedia. They remain leaders in the use of social computing technologies, because of the true fit between these tools and the desire to engage communities—based in part on the new museology.^[2]

HISTORY OF MUSEUMS ON THE WEB

Background

Museum adoption of the Web in the mid-1990s built on a decade of museum experiences with hypertext, networking, and multimedia. By 1993, museums were widely exploiting stand-alone interactive image and text on kiosks within the museum, often using videodisc or CD storage.^[3] While these technologies enabled distribution outside the museum on fixed digital media, the reach of these publications was extremely limited when compared to the near ubiquity that the network now provides. Authoring tools were proprietary and often difficult to use, and run-time environments were closely prescribed and often hardware-based.

Museum networking on private, proprietary connections had been available in the 1970s, and national networks (such as the Canadian Heritage Information Network) and regional ones (such as the Museum Computer Network GRIPHOS application), had been built. But prior to the Web, networking databases was expensive, limited to text only, and for institutional rather than public needs; early French experiments with public access to Minitel reached out more broadly. Immediately prior to the advent of the Web, in the late 1980s and early 1990s, open protocols developed for access to (predominantly text) files over the Internet—such as archie [for ftp] and gopher for files—were experimentally employed by some museums. The most radical aspect of the Web was that it enabled true multimedia. While initially only text and image, for a community that had struggled with side-by-side monitors for text and image videodisc display, and hardware-dependent CD-Rom authoring, this was a major breakthrough.

Early Cultural Web Experiments

Most museum technology professionals were probably introduced to the possibility of networked access to cultural heritage information by the Library of Congress' exhibit of *Treasures from the Vatican* which was delivered over the Internet^[4] from January to April 1993, even before European Organization for Nuclear Research (CERN) board decided to make the World Wide Web publicly available, using the alpha release of the first popular Web browser, Mosaic.^[5] A few might even have seen the exhibit of Soviet materials released in the previous year, before any inkling of the Web had spread beyond CERN. Outside of academia, uptake was only slightly slower. The French Ministry of Culture site on the Lascaux caves, which first appeared late in 1994 played an important role in alerting generalists to the benefits of publishing cultural content on the Web.^[6]

Some museums in the academic sphere were introduced to the Web before commercial browsers made their debut in late 1994. Teaching and research collections took the lead by implementing Web access to their existing databases. As early as August 1993, the University of Illinois's Krannert Art Museum launched a hypermedia exhibit on the Web; the University of California at Berkeley, Museum of Paleontology had a site underway by September which by year-end included a walk-through of the Dinosaur halls and an interactive guest book. The University of Virginia Rosetti Archive had launched an experimental Web site with digital collections, exhibits, and educational materials by the spring of 1994. The Perseus Project, a digital library that was under development since the spring of 1987, was quick to try out Web-based access methods.^[7] These early scholarly initiatives pointed out a new audience for museum collections content. In January 1994, the Exploratorium became the first nonacademic museum site on the World Wide Web.

However, the Web was not seen as the only viable solution to networked access to linked image and text for a few years. In late 1994, when the Getty Museum Educational Site Licensing Project launched its competition for University participation in a museum image sharing project, one element in evaluation was whether the participants had the capacity to develop applications to deliver networked multimedia. Several contenders had existing, non-Web, applications that were in experimental use, and were selected in part based on that. However, by the time the first MESL applications appeared a year later, all but one of the Universities employed Web protocols rather than the special solutions each had been expected to have to create to deliver multimedia over the Internet.^[8]

Early Museum Web sites

It is tempting to paint a path from simple to complex museum Web site—from brochure, to exhibit, to shop, to

online collection, to social network, to semantic Web—but the history of museum use of the Web is not linear. Many museums first saw the Web as an experimental space in which they could develop hypermedia and test very demanding digital delivery scenarios. It was only with the broad public popularity of the Web that museums came to realize that their sites ought to include basic “brochure” information.

It is still surprising to many that the first sites built by museums often lacked such fundamental elements as museum hours (and especially location information), and that some of the earliest museum Web sites included collections, exhibitions, educational interactives, and even what we would now think of as social networking features.

The citation given by GNN (The Global Network Navigator) in 1994 to the Paleontology Server at The University of California Museum of Paleontology^[9] read:

The server is an interactive natural history museum available over the Internet. This museum without walls is well organized and makes interesting use of large graphics. You can learn about phylogeny, the “Tree of Life,” or examine photographs of Great White Sharks off the California coast, which proves that paleontologists study living things as well as fossils.

Other early adopters included the Museum of Natural History, London^[10]; the Science Museum, London; and the Canadian Museum of Civilization.

MUSEUM PROGRAMS ONLINE

Web pages of museums have evolved to reflect the range of museum programming. An informational core, which presented the museums' physical reality in cyberspace, soon formed the required “brochure.”^[11] The basic elements of a museum Web site included information about the museum, location, maps and admissions, details of exhibits and current events such as tours, a profile of the collections, possibly with some highlights, perhaps some detail about the institution's history, a welcome from the director, information about museum membership and giving to the museum, facilities rental, and the museum store. Extended features often centered around special exhibitions, and then were “archived.” Education materials, for teachers could be exhibition related, or related to the permanent collection. If this sounds like a reiteration of the physical museum, in many ways it was. Each department found its place on the Web, and early museum sites often reflected the concerns of their internal leads.^[12]

Online Museum Exhibitions

As with the physical site, most museums' preferred way to display their collections online has proven to be as part of

an online exhibition. The fundamental advantage of the Web is that it offers opportunities for additional content and broader audiences. From the first, exhibitions were about more than simply showing museum objects with juxtaposed text; the object was to create an experience in multiple sensory dimensions, not unlike that of entering a real-world exhibit. In early 1994, when “fast” Web access meant someone was using a 14.4 mbps modem, the Smithsonian’s “The White House Collection of American Crafts,” (which opened on the Web on April 25, 1994), included extensive video and audio clips of the curator talking about selected pieces and handling them in ways that would not be possible during the exhibition.^[13] In addition, each artist was asked to answer a series of questions about their work, which was not part of the exhibition itself. An important element of the exhibit, novel at the time, was what we would now think of as a “social networking” feature that allowed visitors to add comments to a comment book.^[14]

In 1995, the Museum of Modern Art, New York (MOMA) was developing online exhibitions to accompany many of its physical shows. Like many museums, it still lacked an infrastructure to support its online activity so sites for “Annette Messenger,” “Video Spaces: Eight Installations,” and “Mutant Materials in Contemporary Design” were hosted for MOMA by the School of Visual Arts.^[15]

Within a short time, museums developed a range of interpretive materials to augment online exhibits. These were often aimed at specific niche audiences, such as games for children, pre- and post-visit guides for families, learning packages for teachers, and extensive scholarly research pathways, and have become a standard way both to market the in-house show and to extend its useful lifetime. Most museums today will have an online surrogate or augmentation of current exhibitions on their sites. In addition, many will provide access to past exhibits, which of course are no longer accessible in the physical world, even if they are not truly serving a guaranteed, permanent archival function.

Substantial research has been undertaken on storytelling and narrative presentation online in support of museum exhibitions. But museums are aware that their efforts are often subverted by the fact that their visitors do not “enter by the front door” and read the linear script as written by curators, but rather reach the museum by search engines taking them deep into the interpretive narration.^[16]

Online Events

Museums have found the low cost of entry to broadcasting over the Internet highly attractive, in part because of their interactive capability (though the facility for narrow-casting provided by Web-based programs is equally important). Using the network to bridge geography is a common

strategy, whether this is the virtual reuniting of a dispersed work, or the creation of a real-time multipoint event. As an example of the latter integrated into a museum’s educational program, from February 11–21, 1997, the Exploratorium site provided live interactions with astronauts servicing the Hubble Space Mission. In two shows daily, they combined live feeds from the orbiting shuttle, science demonstrations, videoconferencing with researchers across the country, and questions from the audience.^[17] Since then, at the Exploratorium and many other science museums worldwide, regular interactions between scientists and school children via Webcasting, have become standard features of museum programming. At the Natural History Museum (London) these Web-based features now occur daily.^[18]

Social Experiences

Museums envision themselves as gathering places designed to encourage thinking, generate dialogue, and occasionally create controversy. So the social potential of the Web was seen as crucial to its museum implementations long before the mainstream invented the rubrics Web 2.0 and social computing. Partnerships with schools were the first territory explored by museums, and this rapidly led to the teachers, and then the students, contributing content back to the museum.^[19] Applications that enabled visitors to provide their views followed swiftly.^[20]

By 1997, museums were inventing mechanisms for user feedback missing from the Web at large. Web designers for the Smithsonian Institution’s *Revealing Things* exhibit envisaged users as both “designers of their personal exhibits” and “contributing objects and stories to the presentation. . . chang(ing) the experience for themselves and others.”^[21]

Early observers recognized that user-generated (or user-contributed) content and the interaction of the Web would challenge the authority of museums. Some celebrated that,^[22,23] while others were concerned. The resulting dialogue clarified the differences between authority and authenticity and helped museums position themselves vis-à-vis their varied publics.^[24]

Some museums, led by the National Museum of the American Indian in Washington and Te Papa in New Zealand—two national institutions that were first opened during the “Web-Age,” began to construct architectures that enabled them systematically to obtain and use the insights of indigenous informants to bring a perspective from within the societies that originally created artifacts to bear on museum documentation.^[25] The Encyclopedia of New Zealand encourages and incorporates user-contributed content.^[26]

Because one of the problems museums face is that of describing the objects in their collections, and providing access to them in ways that visitors find useful, engaging volunteer catalogers over the Internet was explored in the 1990s. In the MESL project, the Fowler Museum’s

experience of obtaining remote assistance in describing part of its African collection from Columbia University was held up as a justification for the effort involve in putting collections online.^[27] The Fine Arts Museum of San Francisco had early success with volunteer keywording of its Thinker database.^[28,29] But action came with the success of social tagging at del.icio.us and flickr in 2004. Organized investigation of the potential for folksonomy in the steve. museum project^[30,31] coincided with implementations of nonresearch taggers, the most extensive of which is at the Powerhouse Museum in Sydney.^[32] Early findings are that many people find it rewarding to tag, and will generously give their time to museums if asked. The resulting tags are mostly relevant and not terms that the museums have in their own documentation.^[33,34]

Museums have also been attracted by the engaging power of serious games, especially as a means of attracting and keeping the attention of younger audiences and people who might be alienated by more traditional methods of teaching. An excellent example, Launchball at the Science Museum of London, winner of several “best of the Web” awards in 2008, including one at the South by Southwest Interactive Festival.^[35] Similarly, the power of providing visitors with sophisticated tools with which to construct their own meanings and publish them to the Web, has been successfully used by museums to engage visitors, as with the film editing widget at the American image exhibit of the Maxwell Museum of Anthropology.^[36]

Museums are also finding that they can meet potential audiences in engaging social spaces created by others, including commercial services. Social computing spaces such as FaceBook, Flickr, and YouTube are attracting museum attention and programming.^[37–39]

Virtual Experiences

Museum exhibitions are three-dimensional (3D) installations designed to offer context to objects so that they may be better understood. It is not surprising, then, that efforts to create 3D environments on the Web attracted museum interest from the first. In 1993, the University of California Berkeley Museum of Paleontology demonstrated the potential of exhibition walk-throughs. By 1997, museums were regularly providing remote visitors with 3D experiences over the Web—both walk-throughs of spaces, and 3D models of artifacts.^[40,41] Quickly, though, the community realized that we didn’t need elevators in Web museums; the logical models of museum information-space were more effective when they didn’t mirror the architecture—and historic organic growth—of physical museum spaces.

Early reports featured natural history educators using 3D modeling to teach morphology, registrars providing information to potential researchers prior to shipping a fragile item, and school teachers exciting students into careful observation. Reconstructions also tested historical hypotheses.^[42] The Science Museum in Milan provided

remote 3D access to “working” models of Leonardo Da Vinci’s inventions, including those never built in the real world, in 1999, and allowed avatars representing individuals logged in from remote locations to “join” each other in an experience^[43,44] similar to that museums are now exploring virtual worlds such as Second Life.^[45]

Museums have also successfully used the Web to offer a window onto otherwise “back-room” museum processes. Projects like those that chronicled the lengthy conservation of works of art at the Minneapolis Institute of Arts^[46] helped museums demystify some of their professional processes.

Some museums (along with universities, governments, and many other institutions) have taken up a virtual presence in these virtual worlds today. Often, they have done so, like the Exploratorium, explicitly in order to provide experiences that are not possible in the physical world, such as experiencing Brownian motion by riding on a dust particle.^[47] Others are content to see virtual worlds as useful because avatars provide an emotional extension of humans into the virtual world and thereby enhance interpersonal communication that might otherwise occur through online chatting or bulletin boards alone.

Evaluators are still trying to determine when these kinds of experiences were necessary, and when they might be simply entertaining, or even distracting. Investigation about how to bridge the physical space of the museum and the virtual space of the Web is ongoing.^[48] Findings have often seemed counterintuitive; for example, after years of experimentation, museums have discovered that bookmarking, per se, is not something that visitors do at museums, though museum professional repeatedly hypothesized that it would be a highly rewarding application.^[49]

Searchable Collections

Although “virtual collections” and “digital museums” are concepts that are often associated with museum use of the Web, they have their roots, and their primary appeal, outside of the museum culture, in broader society and in academia. Many early “virtual museums” such as the Virtual Louvre or the Artchive, were creations of individual enthusiasts rather than institutions.

Online catalogs have not been the primary goal of museums on the Web, in direct contrast to libraries, who have seen the OPAC as the first point of contact with their online public. Some institutions with close academic ties, particularly if their collections were assembled for research or teaching, made their collections catalog searchable on the Web early. For example, the American Museum of Natural History had its Library catalog online in 1996.^[50] The Fine Arts Museums of San Francisco (FAMSF)—an early adopter of digital imaging technology—had over 65,000 works online for viewing at its “Thinker” site in 1996,^[51] and encouraged its Web visitors to “be the curator!”

The FAMSF site included teachers' guides and online tours of temporary exhibitions as well.

Museum collections catalogs are difficult for the nonspecialist to interpret and are often better suited for expert use. These text databases often only include rudimentary data often without any images, or with only one relatively low-resolution image. Because the primary audiences museums wish to reach through the Web are not only "researchers" but potential visitors, additional contextual and interpretive materials have priority.^[52] One approach to making the museum catalog more accessible has been to link it to familiar interfaces. Integrating museum databases with other sources of information, especially to enable graphical displays that are intuitive to end users, was a desire of museums before the Web and suggested as an early objective of Web implementations;^[53] with the advent of Ajax and techniques for Web mashups, integrating museum data with data and tools from other sites, there have been successful implementations in museums. By dragging multiple images from the public sources on the Web, researchers have been able to recreate 3D renderings of historical sites as if they were flying through them.^[54] Many "museum-like" applications, such as the mashup (combination) of ornithology data with map coordinates, have emanated from university laboratories.^[55]

Still in its infancy, but growing quickly, geo-encoding of museum collections enlists the potential of location-aware information delivery based on open APIs (Application Programming Interfaces) to put museum objects where the audience is physically, rather than expecting the audience to come to the museum. By geo-encoding the locations of important events in the life of an object into its digital record, museums use the same Web-based infrastructure that is evolving to tell people in passing cars about local restaurants and other commercial offerings, to inform them about the cultural artifacts that are native to the area in which they find themselves, even if these are in museum collections thousands of miles away. This has potentially revolutionary consequences for how people relate to the spaces in which they live, and for museums it has the capacity to "turn the museum inside out" and show its collections in the contexts in which they were made, used, or collected.^[56]

Collecting and Preserving

Museums, particularly art museums that have contemporary culture as part of their collecting mission, or those that are dedicated to understanding contemporary events, such as science centers, face a special challenge since they not only need to use digital methods to provide the public with access to their collections, but also are challenged to collect and exhibit digital works.

Art museums, self-consciously collecting *avant garde* digital art, were the first to encounter the challenges of

exhibiting and preserving born-digital collections.^[14,57,58] Some early examples, such as "Gallery 9" as of December 1998, can still be seen at the Internet Archive.^[59]

Increasingly science museums and even history museums are being challenged to collect digital artifacts as these artifacts have an impact on everyday life. A community museum, might, for example, have to collect digital artifacts in order to document community involvement in a planning process conducted using environmental impact mapping in a collaborative Web space.^[60] This process, conducted over many months, relied on visualization tools, models, and data that were specific to the community, and logged hundreds of citizens participating in the discussion and illustrating their points by digitally generating representations of different possible futures. Science museums which are experimenting with making science news feeds a part of their on-site exhibition, such as the Minnesota "Science Buzz" project, or which are creating opportunities for visitor feedback by cell phone as at the Liberty Science center, will need to consider just what place an archival record of these interactions has in documenting the museum programs.

Ongoing digitization programs are retrospectively creating digital versions of photographic surrogates kept by museums for identification and documentation purposes. But while in libraries retrospective digitization is sometimes cast in terms of preservation (for the digital copy holds the same informational content as the original), in museums digital surrogates will never take the place of original museum artifacts. Although digitization projects in museums are primarily about access they have spin-off preservation benefits by reducing the impact of repeated handling for reference purposes, and have, unfortunately, also sometimes left us with the only copies of works once in museums but lost through war or natural disaster.

IMPACT ON MUSEUMS

In its brief 15-year history, the World Wide Web has already had significant impact on museums as institutions.

Sectoral Identity: The Museum Domain

At MW97, Cary Karp proposed that museums ought to have a place in the Internet domain name system.^[61] By 2000, he had led ICOM and the J. Paul Getty Trust in an effort to obtain a high level domain for museums in the belief that high level domains would proliferate and that a distinctive one for museums would serve their needs to be recognizable in Web space.^[62,63] Although widely publicized in the museum community, the new top level domains have not had the impact socially that was expected in 2000. Museums, which generally maintained their identities in "dot org" or "dot edu" space, have not

made the switch to “dot museum” in appreciable numbers. At present it seems unlikely that they will because newer top level domains, introduced after the national domains and the three original ones for commerce, civil organizations, and education, have not captured the popular imagination in other sectors either.

Outreach

Though the distinction of museums as high level domains did not enhance their sectoral visibility, Web technologies are being deployed successfully to raise the profile of individual institutions and their programs. Many museums are using RSS (really simple syndication) to narrowcast the contents of their sites to those with specific interests in their topic. By tagging their content with a variety of highly specific descriptors, and using RSS to distribute a feed of news items, they enable aggregation and representation of museum content in diverse contexts. The 24 hr museum, now culture 24, aggregates news about U. K. museum activities, and presents it as an integrated museum-related RSS feed.^[64] RSS has also been used to create content streams that are used to animate museum exhibition environments.^[65,66]

Some museums are encouraging viral marketing^[67] in order to build mini-communities of interest around particular parts of their content. Museums are actively engaged in blogging, podcasting, and even in posting videos to YouTube. And the “fans” of museums on social sites such as Facebook, are being used to promote its activities to their friends.

Like other institutions influenced by academia and libraries, museums were caught off-guard by the overwhelming success of search engines. By 1997, reports already revealed that while museums were expending much energy in authoring visually and intellectually enticing sites, their content was organized narratively and linearly while most of their users were finding specific content in searches and then linking directly into the museum site at the level of that content. Museums have responded to their users “entering by the window rather than the front door” in several different ways. Some museums have taken great care to be fully available to search engines—hiring Search Engine Optimization (SEO) consultants, inviting crawlers, making metadata for the search engines to use, identifying resources with URIs and other digital identifiers, and attending to the requirement for persistent addressing. Others have become engaged with libraries and universities promoting the use of the Open Archive Initiative (OAI) protocols for harvesting museum collections data. The Consortium for Computer Interchange of Museum Information (CIMI) led a well-publicized effort to adopt OAI for museums, but the limitations of the Dublin Core metadata framework essentially defeated this effort, despite funded attempts to overcome them.^[68]

Some museums are watching carefully to see how the Semantic Web evolves and what kinds of discovery can be provided by geo-aware methods. When museums were first introduced to the semantic Web in 2002, the excitement level was high^[69,70] however as these technologies evolved and it became clearer that semantic Web accessibility of collections depended not just on metadata but on quite sophisticated metadata expressed in Resource Description Framework (RDF) with a defined ontology, the enthusiasm gave way, outside academic circles, to watching and waiting.^[71] In 2008, with the launch of some more sophisticated toolsets demonstrating the potential of semantic Web approaches, some cautious renewed interest is being expressed, but as always the barriers to museum making their collections available in this way are that they lack the resources and often the knowledge of their collections, to create the necessary metadata. Meanwhile, geo-aware devices in phones and automobiles, and an array of services that might be built upon these, are attracting significant attention in museums whose collections were gathered from locations around the globe and can often be best interpreted in those contexts, if they could be discovered there by tourists or locals.

Staffing and Resource Allocation

The Web has created new opportunities for museums to reach their audiences and conduct their missions, but it did so at a cost. In effect, each museum has now opened another branch. While early museum Web sites were often projects of one or two dedicated people (or even unauthorized “skunkworks”), increasingly museums have learned that their Web presence requires all the manpower and programming attention of a second venue.^[72]

Maintaining a quality Web site makes both technical and program content demands on the museum. Staff throughout the institution become responsible for updating the public face of their departments and programs as represented on the Web. Data that was created for internal purposes needs to be revisited and repurposed for public access. As information is created digitally for use in-house, on the museum Web site, in virtual exhibits and in syndicated content for “cultural events” sites and ticketing agents, the need to manage digital objects that can be reused for a variety of purposes increases. The technical sophistication demanded by such reuses has led museums to implement Digital Asset Management and Digital Rights Management systems in addition to traditional Collections Management Systems that keep track of the physical collection of the museum.

User expectations based on the evolution of nonmuseum Web experiences impinge on acceptance of the museum product and force the museum to continuously upgrade its capabilities and offerings. And requirements imposed by governments, for example to provide

accessibility to those with physical handicaps, now extend to online visitors.

Museums face the challenge of retaining skilled staff. In a project-driven culture, where much work is often outsourced developing institutional capacity is an issue. Many museums don't have programming staff on site and so are stretched to take full advantage of the potential of the Web.

Even maintenance becomes a great challenge, since the Web imposes a constantly changing technical requirement on the museum. Information technologies within the institution and servers providing access to the outside world must be maintained. Specialist staff must learn about online education, online fundraising, online publication, and other online programming skills. Technical standards that were optional for institutions without interconnections become mandatory. And in-service education becomes necessary. Ongoing venues for professional development include annual conferences such as Museums and the Web, the meetings and listservs of organizations such as the Museum Computer Group (United Kingdom) and the Museum Computer Network (USA), the Association of Science and Technology Centers, The Visitor Studies Association, and to some extent the work of the International Council of Museums' Committees on Documentation (ICOM/CIDOC) and Visual Information (ICOM/AVICOM). Emerging online communities of professionals include ExhibitFiles.org and conference.archimuse.com.

Business Models

In the early days of the Web, museums and other social institutions, wondered if it had income potential, and if so whether they wanted to exploit that source. Quite a few museums were caught up in the early widespread notion that the Web might be a source of significant new income. Museums lived through the dot.com boom and bust; while only a few (notably the Museum of Fine Arts Boston, museum shop^[73]) succeeded in making money from it, none went out of business as a consequence. However, some museums joined high-profile consortia with universities to provide online education, and these did collapse in the bust of 2001. Since then few museums have made online commerce a priority. However, most museum Web sites have e-commerce functionality (often delivered by an outside provider) to support basic store purchases, membership sales, and occasionally online ticketing. Although advertising emerged as a means of making income from the Web in the early twenty-first century, other than a few high-profile sponsorship relationships (such as British Telecom and Tate) museums have not introduced advertising on their sites. For the present, anyway, museums are treating the Web as a service to be provided for free and without commercial advertising, even when they charge for access to the physical museum and actively solicit sponsorship for on-site exhibitions.

Outside the museum community, museums are perceived to be making money from the sale of rights and reproductions; however, far from being a major source of new income, online licensing has become a cost-center for most museums.^[74,75] As well as requiring costly research in order to discover the rights inherent in collections, museums often pay fees to use materials online themselves. Efforts to make the works available under Creative Commons licenses or free to scholars have not proved very attractive to museum administrators, who, unlike their counterparts in libraries, have historically incurred high costs in making images available and recovered some of that cost through fees. Experiments with access for noncommercial uses at the Victoria & Albert Museum and The Metropolitan Museum of Art are, however, ongoing. The Creative Commons was not flexible in offering museums a license that worked for them, until the CC+ license of 2008, which some museums may now be ready to consider.

In 1997 more than 30 high-profile art museums joined to form the Art Museum Image Consortium (AMICO). The purpose of AMICO was not to earn income for the museums, though it developed a successful licensing scheme that ultimately recovered its costs of rights clearance (which are quite high for art of the past century), but to find a way to serve university and school students high-quality digital reproductions by reducing transaction costs.^[75,76] Its success attracted the Mellon Foundation which launched ArtStor, a program with similar objectives which subsequently absorbed AMICO and now licenses a collection of art reproductions (much not sourced from museums) to higher education.

Despite these experiments, museums have generally not followed either the commercialization route or the licensing route. The trend is toward more open access, with mission-related goals of accessibility and education guiding museums to make content available on the Web without restrictions, but within the context of museum programming rather than as discrete objects in searchable databases.

Issues Facing Museums Online

From the first, museums have been concerned that their move of programming to the Web increase opportunities for participation. Early implementations were highly sensitive to average slow access speeds and low resolution monitors, and present implementations avoid proprietary tools. The Digital Divide continues to echo in museum discussions. As public institutions museums don't want their choice of delivery channel to exclude users.

Using the Web in a socially responsible way has led museums to open themselves up to challenges to their ownership of objects in their collections (creating, for example, avenues that can be used by those claiming they

benefited from Nazi war loot), their interpretation of objects in their collections (enabling alternative accounts from aboriginal communities for instance) and ensuring accessibility.

Finally, museums are beginning to alter their measures of success. Instead of counting “visitors” to the museum itself, or to its Web sites, some museums are beginning to find ways to measure their audiences or impact even when the content of the museum is seen or used somewhere other than the museum site.^[77] It is likely that syndication of content on other nonmuseum sites, as the Library of Congress and Powerhouse Museum are now experimentally doing with photographs from its collections in the Flickr Commons,^[78] will become a growing trend. Museums are slowly ceding control of their content in order to reach audiences through as many channels as possible.

CONCLUSIONS

Museums have long used new media technologies, be they murals, dioramas, films, or interactive Web pages, to help explain the complexities of their collections to many diverse audiences. They publish a wide range of materials, from printed ephemera (in-gallery hand-outs) to scholarly tomes (exhibition catalogs), in a wide range of formats. From its outset, the Web has proven a suitable platform for delivering many types of information to many different users, and museums have adopted its many potentials. As the Web interpenetrates real space, with portable, geo-aware devices like the iPhone™, museums will find that it continues to serve their goals: engaging communities with collections and encouraging active learning and participation.

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Museums

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Abstract

Museums are diverse institutions—and grow more so. Few museums have remained untouched by shifting paradigms of research, education, and leisure activities. During the late twentieth century, museums increased their emphasis on their public educational missions. As part of these efforts, museums and related institutions, such as planetaria, botanical gardens, and zoos, are embracing new ways of engaging with audiences, for example through new technologies or during special events that emphasize civic discourse. Despite the opportunities offered by these new approaches, museums continue to wrestle with issues of funding and larger cultural politics.

INTRODUCTION

Museums are slippery institutions in that many of them are reevaluating their missions and redistributing their resources to meet the challenges of an increasingly urbanized culture, digital communications, and national and global environmental and cultural crises. This entry provides an overview of the state of museums in the early twenty-first century.

This entry begins with a definition of museums and a brief bit of museum history, then moves into more detailed descriptions of the contemporary functions of a museum: collections and research, exhibition and education, civic outreach, and leisure destination. There follows a list, with brief descriptions, of a dozen different types of museums. This entry then looks at current opportunities and challenges within the museum field—technology, civic discourse, funding, and politics—before concluding with an overview of professionalization processes. This entry is appended by a list of resources—professional organizations, books, journals, and websites—that allow for further learning about museums and the museum field.

WHAT IS A MUSEUM?

Definition

Museums are sites where objects, ideas, and cultural beliefs are represented and contested. More so today than in the past, they embody the intersection of expert knowledge with more local ways of knowing.

The International Council of Museums defines a museum as a nonprofit organization that conserves, studies, and exhibits “the tangible and intangible heritage of humanity and its environment” for the “education, study, and enjoyment” of the public.^[1] The U.S. federal

government, through the Museum and Library Services Act, defines museums similarly, requiring in addition a professional staff and regular public exhibitions.^[2] The American Alliance of Museums (AAM) Code of Ethics for Museums notes that their common denominator is making a “unique contribution to the public by collecting, preserving, and interpreting the things of this world.” The Code recognizes various types of museums, many of them places that those outside the museum profession might not consider to be museums, for example, botanical gardens, aquaria, zoos, and historic sites.^[3] The Institute of Museum and Library Services tracks 35,000 U.S. museums and related institutions—such as botanical gardens and aquaria—which the AAM estimates employ 400,000 Americans and generate 850 million visits per year.^[4]

HISTORY

The earliest “museums” were religious sites dedicated to the muses (mouseion) of ancient Greece. By 340 B.C.E., Greek philosophers such as Aristotle were founding lyceums to further scholarly study and discourse, and some of these sites were home to collections of plants and other biological specimens. Between about 200 and 60 B.C.E., the Romans became enamored of Greek statuary and art, and many public spaces as well as private homes in Rome featured Greek art. As time passed, Roman homes as well came to contain frescoes and moveable paintings.

By the time of the Renaissance, traders and explorers provided Europeans with biological specimens and cultural artifacts from around the world. The wealthy class began to collect these objects in cabinets, drawers, and even entire rooms dedicated to flora, fauna, and cultural curiosities. These Wunderkammer, or cabinets of curiosity, are often cited as the first “real” museums because

they attempted to organize knowledge, as represented by biological specimens and material culture, within architectural space. In 1682, Elias Ashmole donated his collection to Oxford University to found the Ashmolean Museum; in 1686, he codified the museum's structures in a memo on the museum's income, governance, and operations. This museum was one of the first to be open to the public.^[5]

While European museums came out of a tradition of aristocracy and the practices of elite travelers, collectors, and patrons, American museums arose out of different impulses. From their earliest days, American museums have been more entrepreneurial in that they tend to articulate their usefulness to society in terms of value to individuals and to communities.^[6] Throughout the nineteenth century, American museums were concerned with uplifting the masses and, in particular, assimilating new immigrants through the twin processes of education and enculturation. Free lectures and increased access to works of art, scientific specimens, and displays of new technology were meant to showcase American ingenuity and improve Americans' cultural and scientific literacy.

As the nineteenth century progressed, museums collected not only the best artistic production and most interesting scientific specimens of their own region, but from their nation's colonial territories as well. In the twentieth century, foreign governments and indigenous peoples raised questions about the ethics and legality of the acquisition of this cultural patrimony. In response, museums in the developed world continue to rethink how they represent "others" within their galleries and halls, while many museums in the developing, formerly colonized, world attempt to divorce themselves from the colonial heritage at the core of their museums' missions and collections.

In the twentieth century, many museums increased their focus on public education, particularly on the education of children. Museums targeting young visitors emphasized hands-on activities, role-playing, and kinesthetic exercises that engage the whole body. Families thus became a core constituency of the museum-going public, and museums extended their outreach to families and neighborhood groups, thereby building the institutions' sensitivity to the interests and needs of local and regional inhabitants.

FUNCTIONS

In the edition of the *Encyclopedia of Library and Information Science* published in 1968, James L. Swauger named three basic functions of museums: collection, study, and communication.^[7] Twenty-first century museums have embraced a much broader, and at the same time very granular, spectrum of functions. Collecting remains at the core of many museums' missions, and the study of these collections—whether they may be centuries-old textiles, natural history museum specimens, or oil paintings—by

scholars is still an important function of museums that own art and artifacts. Today, however, museums function just as much as institutions of public education, civic outreach, and leisure or "edutainment."

Collections and Research

Historical museums, art museums, and natural history museums have at their core a collection of objects—artifacts, fine arts or crafts, or scientific specimens. Museums place these objects on permanent or temporary exhibit, but in museums with larger collections, an object may never go on display. For example, the Smithsonian Institution in Washington, D.C., has more than 138 million objects in its possession; even within its 19 museums, 194 affiliate museums, and 9 research centers, it would be impossible to exhibit all of those objects in any human lifetime.^[8]

Museums acquire objects in numerous ways. Scientists and anthropologists collect specimens and artifacts in the field, in the best cases adhering to local and international ethical guidelines regarding the acquisition of objects. Individual collectors give objects to museums during their lifetimes or bequeath them to the institution upon their death. Museums also purchase art, artifacts, and other objects, or trade with other museums to secure these objects for their collections. Zoos, aquaria, and gardens additionally have breeding and cultivation programs that increase their collections.

Museum collections can be contentious. Stakeholders and members of the public have called into question museums' ownership of sacred tribal objects, human remains, and ancient art. In the United States, this critique resulted in the 1990 North American Graves Protection and Repatriation Act (NAGPRA), which requires any institution receiving federal funding to return to the original tribes sacred objects, human remains, funerary artifacts, and related objects.^[9] Internationally, agreements among countries and museums have made institutions more responsible for determining the provenance of objects in the hopes of reducing the traffic, for example, of archaeological artifacts and early art from their countries of origin. Most notable among these agreements may be the 1970 United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention, which regulated the traffic of cultural artifacts, and particularly antiquities, from one country to another.^[10]

Most museums allow researchers access to objects not currently on display. Many collections are open to the public by appointment, but some institutions restrict access to fragile or otherwise sensitive collections to scholars who provide relevant credentials. Curators and archivists at these museums frequently provide finding aids online, as well as guidelines on how to handle and photograph (or not) specimens, artifacts, and ephemera in the collections.

Increasingly, museums with collections are digitizing their texts and placing photos of their artifacts online as well. Many art museums let website visitors create “collections” of their favorite pieces of art. One museum that has made its digital collections particularly accessible is the Powerhouse Museum in Sydney, Australia, which has harnessed visitors’ interest in its collections to expand the museum’s understanding of both its objects and its visitors. The Powerhouse collections’ online interface allows visitors to “tag” objects with vernacular words and phrases, adding to its curatorial taxonomy of the museum’s objects a vernacular “folksonomy.”^[11]

Exhibits and Education

Museums are best known for their exhibitions. Exhibitions largely take two forms. The first type displays artifacts from a museum’s—or several museums’—collections, with the goal of giving visitors a comprehensive overview of, for example, an artist’s work, military aircraft, or animals of the Pleistocene. The second type of exhibit—which has come to dominate larger museums’ exhibition design—is less focused around objects, but is fabricated to provide a particular learning experience. For example, an exhibit on climate change may not lend itself to the exhibition of artifacts; in this case, an exhibition designer would create interactive exhibits that are less dependent on artifacts and more focused on informational panels, multimedia presentations, and hands-on activities designed to facilitate learning about the phenomenon.

As increasing numbers of cultural organizations compete for the same pool of funding, many of the larger museums have turned to “blockbuster” exhibitions. Examples of this type of exhibition include King Tut and the Golden Age of the Pharaohs by National Geographic and the Supreme Council of Antiquities of Egypt, The Vatican Collections—The Papacy and Art and Van Gogh in Arles.^[12] These exhibitions are so popular that visitors must reserve tickets in advance and enter the museum at a specific time. These exhibitions have been criticized for needlessly endangering works of art by shipping them around the world, for shifting the focus of museums from curatorial scholarship to marketing and visitor numbers, and for driving traffic from smaller museums toward those that can afford to mount these expensive exhibitions.^[13] Supporters of blockbuster exhibitions claim they bring new audiences and revenues to museums, as well as make world-famous art and artifacts more accessible to the public.

Not all exhibitions are curated by experts. Community curation, or the selection and interpretation of objects by museum outsiders, takes many forms. In 1991, the Walsall Museum in the United Kingdom invited townspeople to nominate their own collections for display at the museum. This “People’s Show” became so popular that it was repeated in later years at Walsall and elsewhere.^[14]

In 2007, the Tech Museum of Innovation in San Jose, CA, invited inhabitants of the virtual world Second Life to prototype exhibits in the virtual world; several of these prototypes were fabricated and exhibited in the real-world Tech Museum.^[15]

Some curators are skeptical of crowdsourcing, but others see an opportunity for museums to curate the endless digital stream of user-generated content. In the analog world, museums have long filled this role of identifying information and items relevant to their communities and organizing content for visitors.^[16] Thanks to interactive digital displays—multitouch tables are but one example of this technology—museums’ curation of this content need not be limited to their websites; curators and educators can literally place the information at users’ fingertips on the exhibition floor. Some of these exhibitions sit at the nexus of libraries and museums. For example, the Emerging Issues Commons is a physical gallery in the Hunt Library of North Carolina State University’s Centennial Campus in Raleigh. Using multitouch tables and walls, visitors can interact with dynamic, data-driven graphics, watch historical and contemporary videos showcasing how the public has addressed the state’s problems, view relevant social media streams, learn how state government policies come into being, and recommend solutions to current and emerging challenges. The gallery has a companion website where visitors may continue their engagement at home.^[17]

Museums use their websites to expand their audience beyond visitors to their physical sites. News of events, exhibition previews, and even searchable collections all have proven to be of interest to web visitors. Individuals and organizations that lack the resources or interest to host visitors in a physical space are increasingly creating online “museums.” The best resource to date on these online museums is the Museum of Online Museums (MoOM), which includes links not only to revered institutions such as the National Portrait Gallery and the United States Holocaust Memorial Museum, both of which are in Washington, D.C., but also to such virtual exhibits as a locomotive horn sound file collection, the Museum of Soviet Uniform Caps, and the Gallery of Firework Label Art.^[18]

Leisure Destination

Individuals and families turn to museums not just for learning experiences, but as leisure destinations. Over the past several decades, museums have struggled to balance their appeal as leisure destinations with their educational missions, and family groups are at the center of this tension. Although families may come to museums to help their children learn, the visit is as much about forging family and individual identity as it is about the exhibition’s content. In fact, recent visitor studies have analyzed not only what individual visitors perceive in exhibits, but also what they say to one another in family groups.

This research also takes into account the fact that any given museum is but one island in an archipelago of a family's learning resources.^[19] Families are looking for time and space to spend together in an era where family time is less plentiful and childhood is compressed.^[20]

Museums and similar sites are not stand-alone institutions, but part of a leisure landscape. For example, Carole Blair and Neil Michel have demonstrated that the Astronauts Memorial at the Kennedy Space Center Visitor Center in Orlando, FL, is part of the same cultural landscape as Disneyworld.^[21] Similarly, the Smithsonian Institution museums are part of a larger touristic experience in Washington, D.C. Accordingly, a museum's education and marketing teams need to think beyond the walls of their institution when planning for visitors.

Civic Outreach

Traditionally, a museum's functions have been dictated by the type of museum it is (e.g., art museum, children's museum), but in recent years more museums have been crossing over into other areas of inquiry and expanding their public service missions. Museums are motivated to make this shift as they reevaluate their missions in light of changing patterns of public life and civic participation online and offline. Part of this effort has been providing free or inexpensive space for people to interact informally in public.^[22]

These museum programs are diverse and frequently focus on children and youth—but without the feel of a more traditional museum education program. For example, the Boston Children's Museum in Massachusetts has entered into numerous collaborations with other institutions in the city, developing community open spaces within several office complexes near the museum.^[23] The de Young fine arts museum in San Francisco engages high school students as “museum ambassadors” who lead interactive activities at classrooms and community centers and offer tours at the museum.^[24] The National Museum of American Jewish History in Philadelphia, PA, formed a neighborhood action bureau that trained high school students to interview longtime residents about race relations and other neighborhood issues, particularly relations between Jewish Americans and African Americans.^[25]

In Africa, where many museums have sought to divorce themselves from their colonialist roots, museums are focusing on community service, particularly in urban areas that have been stressed by immigration from rural regions. The Musée des Civilisations in Abidjan, Côte d'Ivoire, participated in the project “African Ingenuity: Creative Recovery and Recycling.” The museum produced an exhibit of recycled and repurposed objects and drew attention to living conditions and caste systems within major African cities.^[26] Other museums in Africa, including the National Museum of Nigeria, are moving from a mission of merely collection, preservation, and

exhibition to a more proactive role in fostering healthy urban development, for example by opening up, via exhibitions, conversations about traffic jams, the relative safety of the suburbs over the cities, or mosquito eradication efforts.^[27]

Museums and related institutions around the world have recently invested considerable resources in explaining climate change and encouraging visitors to consider ways to address this global crisis. Sometimes the engagement is very subtle, for example in the British Museum's gigapixel exhibit *Stories in the Rock*, which uses exceptionally large-format photographs of petroglyphs in part to tell an older climate-change story of the desertification of the Arabian Peninsula.^[28] In other cases, institutions tackle climate change head-on. In 2015, The Long Beach Aquarium of the Pacific in Southern California, for example, convened a climate change summit that brought together policymakers; scientists from the government, university, and nonprofit sectors; industry representatives; and members of the public to identify critical areas of research that might provide solutions to Southern California's vulnerability to rising temperatures, drought, and coastal flooding.^[29] Some scholars and museum professionals have recently called for using the accelerating climate change crisis as an opportunity to shift museums' approaches to preservation. Rather than addressing heritage—and particularly historic sites and other significant places in a community—as something that can be preserved perpetually, cultural institutions should, they argue, help visitors and the wider community adapt to new realities and to heritage loss.^[30]

TYPES OF MUSEUMS

Museums come in many forms, including those listed as discussed the following list. Due to budget constraints, new technologies, patron or community interests, and changes in staff, museums are always innovating and partnering with other organizations, forging new kinds of institutions. This list, therefore, is by no means exhaustive.

Art museums: Art museums collect, exhibit, and conserve arts and fine crafts. Unlike natural history museums and science centers, which have wide appeal, especially among families, art museums have long battled with a public perception that they are elitist institutions. Indeed, the spare white, hushed galleries dotted with security guards, coupled with abstract artworks that may feel emotionally or intellectually inaccessible to laypeople—these may decrease enthusiasm for an institution significantly. However, like most other museums, art museums have been undergoing a transformation to make themselves more appealing to families and laypeople. For example, the Louvre in Paris has programs specifically targeting families, as well as workshops for children age 4 and older.^[31] The Museum of Modern Art in New York City

offers “Tours for Fours” and “Tours for Tweens” to satisfy young visitors, as well as family art workshops and films.^[32]

Natural history museums: Traditionally, natural history museums’ exhibitions housed hundreds, if not thousands, of preserved specimens of plants and animals (e.g., taxidermied mounts or skeletons). In the late nineteenth and early twentieth centuries, glass cases of specimens gave way to habitat group dioramas that placed animals in context but in many cases were loaded with cultural messages about nuclear families and patriarchy.^[33] These aging dioramas, which were expensive to install and are not simple to renovate, are gradually being replaced by more interactive, multimedia exhibits and, in some cases, even older approaches to natural history display. For example, the renovated mammal hall that opened in 2003 at the Smithsonian’s National Museum of Natural History features single, magnificent taxidermied mammals—a more “big game” approach to display—in lieu of habitat groups. Through video screens on walls and floor, shifting lights, and targeted sounds, visitors to the exhibition experience changing weather patterns on the veldt and in the forest. Natural history museums are also increasingly targeted at laypeople; instead of having rows of dioramas or specimens labeled with species’ common and scientific names and a bit of explanatory text, exhibits are themed and narrative. The Smithsonian mammal hall, for example, welcomes visitors to a “Mammal Family Reunion.”^[34]

Science centers: Science centers (sometimes called science and technology centers) take a decidedly less object-oriented approach to museum exhibition in that most science centers do not have collections in the sense that other museums do. Science centers are intensively hands-on, informal learning environments that encourage observation, curiosity, role-playing, cooperation, and a sense of discovery.^[35] Like children’s museums, science centers are audience-focused rather than exhibits-centered (and by extension, curator-centered). The Exploratorium, which was founded in San Francisco in 1969 by noted physicist Frank Oppenheimer, is often credited with being the first science center.^[36]

Children’s museums: Children’s museums seek to provide an enriching experience for young visitors, particularly those in their communities. The first children’s museum, the Brooklyn Children’s Museum in New York, was founded in 1899; today there are 300 children’s museums worldwide. Like science centers, children’s museums emphasize hands-on learning, discovery, and play. Also like science centers, they tend not to have large collections, although the Brooklyn Children’s Museum has 29,000 natural history specimens and cultural artifacts.^[37]

Museums of history or anthropology: History museums collect artifacts and ephemera related to the specific region or era reflected in the museum’s mission. Very

large museums, such as the National Museum of American History in Washington, D.C., have the space and staff resources to collect a wide range of artifacts from all eras of American history. Other museums, such as the Computer History Museum in Mountain View, California, focus their collections and exhibitions around more specific objects. These museums’ exhibitions might be celebratory, informative, or commemorative. One particularly interesting approach to history is embodied by the Jim Crow Museum of Racist Memorabilia at Michigan’s Ferris State University, which collects and exhibits objects—contemporary and historical—that draw on racist stereotypes of African Americans. The museum not only documents a history of hate but also serves as a resource for civil rights organizations.^[38]

Living history museums: At these sites, historical reenactors wear the clothes and perform the tasks of people living in an earlier era. At some sites, these reenactors may serve as docents, who explain what they are doing and its significance to visitors, and even give visitors an opportunity to try a task or chore. The Living History Farms in Iowa are an example of such a site. At other living history museums, the reenactors are historian actors who never break from character. Some sites blend these two approaches. For example, at Plimoth Plantation in Massachusetts, Native American staff at the Wampanoag Homesite dress in Native historical garb but serve as interpreters rather than actors in order to better inform visitors about Native American culture today and in the past. Yet in the English Village portion of Plimoth Plantation, interpreters portray the daily life and special events experienced by specific settlers in 1627.^[39]

Historic house museums: Historic house museums concern themselves with the conservation, maintenance, and interpretation of homes—and often their accompanying landscapes—of historic significance. The exhibition and education programs of these museums usually focus on the everyday lives of the former inhabitants of the house.^[40] The notable exceptions to this practice are U.S. plantation house museums, 80% of which, according to one survey, either do not mention the contributions of slaves or trivialize their presence at the site.^[41]

Community-based museums: Community-based museums take many forms, but all insist on representing and serving the people in their communities. “Community” can be defined narrowly, to include a museum’s immediate community, or more broadly, to encompass a regional or ethnic mission. For example, the Smithsonian’s Anacostia Community Museum sits in a largely African-American community in Washington, D.C., but focuses on African-American history and culture as well as its community’s history.^[42] In its exhibitions on art, history, the environment, and people, the Oakland Museum of California aims to be responsive to its immediate community.^[43] Community museums are among those most likely to partner with other cultural

organizations and institutions; take, for example, the Heart of Brooklyn cultural partnership among the Brooklyn Museum, Brooklyn Public Library, Brooklyn Botanic Garden, Prospect Park, Prospect Park Zoo, and the Brooklyn Children's Museum to promote learning and access to collections.^[44]

Indigenous museums: In the United States and elsewhere, European immigrants and others long have been fascinated with the culture of the land's indigenous peoples. Individual and institutional collectors amassed—through means ethical and unethical—vast collections of native art and material culture. Museums used these artifacts—some of them sacred objects that native peoples felt should not be put on display—to represent indigenous cultures in ways that were not always accurate and in many cases were racist. With the rise of native self-determination movements in the 1960s and 1970s, indigenous peoples increasingly sought to represent themselves in museums.^[45] The result has been the establishment of museums that either were established by native peoples or in partnership with them. The largest example of this in the United States is the National Museum of the American Indian in Washington, D.C. In Australia, the Aboriginal Heritage Unit works with native communities to establish cultural centers to represent their cultural heritage and “keeping places” to safely and securely house artifacts.^[46]

Planetaria: A planetarium is a large theater designed for educational and entertaining presentations about objects in the solar system, Milky Way galaxy, and the larger universe. Usually these theaters have a dome-shaped ceiling and walls, as well as seats that recline backward so that audiences can comfortably look upward to see stars projected onto the dome. Planetarium shows may mimic space flight, instilling in viewers a sense of the universe's scale and the relative size and distance of night sky objects. The original planetarium shows used optical “star ball” projectors that simulated the movements of planets and stars relative to Earth. Contemporary planetarium shows tend to use digital projectors that allow for virtual travel into the night sky.^[47]

Botanical gardens and arboreta: Botanical gardens and arboreta showcase plants and trees. These gardens not only serve as respites from urban or suburban landscapes but also conserve local, native, or endangered plants. Increasingly, these gardens target multiple users: runners, teachers and students, families with small children, the elderly, artists, and research scientists. For example, the Huntington Botanical Gardens in San Marino, CA, features a children's garden with hardy plants, low tunnels overgrown with vines, and fountains at toddler height.^[48]

Aquaria and zoos: Aquaria and zoos display and conserve animals that live in freshwater and saltwater and on land. Although long criticized by animal activists and others for keeping animals in restricted spaces and barren environments, many zoos and aquaria have sought to replicate animals' habitats in order to foster breeding and

conservation. Of particular current interest is amphibian conservation because large numbers of frogs and other amphibians are threatened with extinction due to habitat loss and a highly infectious disease. Other high-priority conservation projects include ocean habitats and elephants.^[49]

OPPORTUNITIES

Technology

Museums are increasingly embracing the opportunities of the digital, networked age. Many museums have gone beyond websites that provide information, choosing instead to offer online visitors an interactive virtual experience—and in some cases, let visitors contribute to the site's content. Visitors comment on museums' blogs and Facebook pages, contribute videos of their museum experiences, enter videos they made into museum-sponsored contests, tag items in museum collections in crowdsourced projects, and share photos on Instagram and Flickr.

Many museums have smartphone apps that allow visitors to engage more deeply with exhibition content. In late 2015, the Brooklyn Museum released ASK Brooklyn Museum, an app that lets visitors ask real-time questions of art historians and educators who use Bluetooth-aware sensors to determine next to which works visitors are standing at the moment they use the app.^[50] Monticello, Thomas Jefferson's former estate, developed an app in 2014 that shares haunting details about the slaves who lived and died there.^[51] A coalition of museums in the United Arab Emirates share an app, MuseumsUAE, that provides visitors with information about each museum, including which museums are closest to them. In addition, as visitors check in at each museum, the app awards virtual badges that reveal additional information about each museum.^[52]

A slightly older yet still compelling use of digital technology is the United States Holocaust Memorial Museum's Mapping Initiative, which uses Google Earth to map and interpret sites of historical and 21st-century genocide. Google Earth users can explore burned-out villages in Darfur and view accompanying texts and photographs documenting the destruction and loss of human life. The museum has similarly mapped the Holocaust, providing photographs, texts, and animated maps that demonstrate the scope of Nazi crimes against humanity.^[53]

Civic Discourse

As explained earlier in this entry (see section “Civic Outreach”), museums are already reaching out to their communities in various ways. In an age of reduced funding for public education, large-scale human suffering, and local

and global environmental crises, many museums and similar cultural and scientific institutions are redoubling their outreach efforts. These new activities go beyond bringing objects and lessons to school classrooms or setting up temporary exhibits in public venues. Increasingly, museums see themselves not merely as institutions that perform civic outreach, but as institutions that facilitate civic discourse.^[54]

As part of this effort, some museums have teamed with universities and scientific organizations to promote efforts, such as *Café Scientifique*, where scientists and laypeople gather informally to discuss current issues in science. *Cafés Scientifiques* meet in locations around the world, including—to name just a few—Uganda, Iran, Israel, Bulgaria, Finland, Mexico, Chile, and the Philippines.^[55] These and other efforts at promoting civic discourse—symposia, forums, and more—challenge traditional notions of the museum as a single site where people walk quietly through large halls, gazing at or interacting with objects. Some museum professionals find this shift disconcerting and not entirely within the missions of their museums, but others feel museums must be more proactive in leading and facilitating discussions and conversations lest museums become irrelevant in the larger everyday culture.

CHALLENGES

Politics

Museums the world over feel pressure to modify their exhibition content as a result of broader cultural and political landscapes. One particularly stunning—and oft-cited—example of this pressure resulted in the Smithsonian's National Air and Space Museum cutting back significantly on a 1995 exhibit commemorating the dropping of the atomic bombs on Hiroshima and Nagasaki. Complaints from veterans and conservative political groups convinced the museum to change the exhibition from one that looked at the decision to drop the bomb, the bombing itself, and its aftermath to a much smaller one centered around the restored fuselage of the *Enola Gay*, the plane that dropped the bomb.^[56]

Criticism of this exhibition and others has led the public, politicians, and museum professionals to ask what exactly is the purpose of a museum, and particularly of a history museum. When it comes to interpreting events such as the bombing of Japan, what is the proper role of a museum, especially if it receives state or federal funding? Should the museum commemorate the bombing with displays of artifacts accompanied by simple, factual labels (even though these facts will likely be contentious); celebrate the contributions of the innovators and soldiers who brought about the end of the war in the Pacific; or look more critically at the bombing based on what we have learned, for example, about radiation during the past half

century? Should museums be places where people's beliefs are challenged, where people are asked to think critically about commonly held notions about science and culture? Or should museums be a place where a culture's beliefs and knowledge are showcased uncritically? These are questions that are far from settled within communities and cultures around the globe, but professionals in museum fields tend to see museums as institutions of education that on occasion challenge visitors' understanding of the world and their places in it.

Contemporary transnational politics and events also affect museums in the short- and long-term. In the second decade of the twenty-first century, the rise of the self-styled "Islamic State" (ISIS) operating in Syria and Iraq not only touched off a human rights and refugee crisis of tremendous proportions; it also threatened the ancient cultural patrimony of the region. Jihadist fighters blew up signature historic sites in Palmyra, Syria, and the Islamic State funds its terror in part by selling antiquities on the black market.^[57] Prior to the rise of ISIS, the Taliban and Al Qaeda looted museums, destroyed antiquities, and obliterated historic sites, including the famous 150 ft tall Bamiyan Buddhas carved into a cliff in central Afghanistan.^[58] As a result, in some parts of the world, the physical security of museums and historic sites has taken on new urgency and importance.

Funding

Securing adequate money to maintain their collections and exhibits, as well as fund their education and outreach efforts, has been a perennial problem for many, if not most, museums. Museums typically rely on financial support from a combination of government agencies, foundations, and private fundraising. In the United States, funding for educational institutions shifts depending on which political party is in power in Washington, D.C., and even when funds are available, often those projects that favor the dominant political party's ideology receive funding over those that present alternative views.

To keep their doors open, most museums charge admission fees. It can be difficult to strike a balance between the amount of money a museum needs to collect and what the average visitor—and particularly the average family—is willing to pay. The result is typically a modest admission fee, although some museums charge no admission. For example, the Smithsonian Institution offers free admission to all its museums, and the United Kingdom features more than 50 free national museums.^[59] In January 2009, French President Nicolas Sarkozy announced that French citizens aged 18–26 would gain free admission to public museums and monuments, including the Louvre—which set off its own controversy because non-French residents of France saw this policy as discriminatory.^[60] Other museums raised their admission fees considerably in the 2000s. In 2004 the Museum of Modern Art in New York

City reopened with a new building and a \$20 fee for adult visitors, representing a 60% increase in ticket prices, and in 2008 the California Academy of Sciences in San Francisco also opened a new facility with a \$24.95 admission fee for adults, a significant increase over its previous ticket price of \$10.^[61] By late 2015, the Academy's price had risen to \$34.95 for adults and \$29.95 for youth.^[62]

Coupled with stiff competition for private grants and government funding, museums' modest revenue means museum professionals, like many who work in the non-profit sector, tend to receive salaries far below those of professionals in the corporate sector. While many people enjoy long careers in the museum field, lower paid positions experience a good deal of turnover as younger employees realize they might not be able to balance their personal budgets on such incomes. Those who remain in the field alternately describe it as enriching and frustrating; they have big ideas and ideals, but they may lack funding and public support for their projects.

PROFESSIONALIZATION AND TRAINING

The museum field boasts countless areas of specialization, but among them are curating, education, exhibit development, conservation, historic preservation, organizational management, development (fundraising), evaluation, and marketing and public relations. Depending on the size and status of the museum, some of these career tracks begin with entry-level jobs that require little prior experience or training. Others, such as curation or conservation, typically require advanced degrees in relevant disciplines. Museum professionals have advanced degrees in fields as diverse as museum studies, art history, library science, education, integrated pest management, conservation, and nonprofit management.

Undergraduate programs in museum studies are relatively rare; graduate degree and certificate programs are far more common. The best museum studies programs provide their students with a historical perspective on museums, a solid theoretical grounding in areas of interest to the student (e.g., education, curation, marketing), and access to internships at the best regional and national institutions. The Smithsonian Institution keeps an updated list of museum studies programs internationally.^[63]

CONCLUSION

Museums are dynamic institutions. While conservative curators, researchers, and some patrons might see collections and their exhibition as museums' *raison d'être*, the museum-going public, museum educators, and others continue to make museums more responsive to community needs and thus more relevant to people's everyday lives. "Collaboration," "public outreach," and "civic discourse"

are key terms in this new paradigm—one that undoubtedly will persist in this highly networked, digital age.

ASSOCIATIONS

1. International Council of Museums <http://icom.museum/>.
2. American Alliance of Museums <http://www.aam-us.org>.
3. Institute of Museum and Library Services, <http://www.ims.gov>.
4. Association of Science and Technology Centers, <http://astc.org/>.
5. The Association for Living History, Farm and Agricultural Museums, <http://www.alhfam.org/>.
6. Association of Zoos and Aquariums, <http://aza.org/>.
7. American Public Gardens Association, <http://www.publicgardens.org/>.
8. American Association for State and Local History, <http://www.aaslh.org/>.
9. Visitor Studies Association, <http://www.visitorstudies.org/>.
10. More museum-related organizations listed at <http://museumstudies.si.edu/websites.htm>.

Resources for Further Learning

Books

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Magazines and Journals

1. ASTC Dimensions (Association of Science and Technology Centers). <http://www.astc.org/pubs/dimensions.htm>.
2. Curator: The Museum Journal. John Wiley & Sons, Inc., New York. <http://www.curatorjournal.org/>.
3. Journal of Museum Education. Museum Education Roundtable. Washington, DC. <http://museumeducation.info/jme>.
4. Muse. Canadian Museums Association. Ottawa, Ontario. http://www.museums.ca/site/muse_current.
5. Museum Magazine. American Alliance of Museums. Arlington, Virginia. <http://www.aam-us.org/resources/publications/museum-magazine>.
6. Museums and Social Issues. Taylor & Francis. Abingdon, Oxfordshire. <http://www.maneyonline.com/loi/msi>.
7. Museum History Journal. Taylor & Francis. Abingdon, Oxfordshire. <http://www.maneyonline.com/loi/mhj>.
8. Museum Management and Curatorship. Taylor & Francis. Abingdon, Oxfordshire. <http://www.tandfonline.com/loi/rmmc20>.

Websites

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2. HEREIN System (European heritage policies) <http://www.herein-system.eu/>.
3. Museum 2.0 <http://museumtwo.blogspot.com/>.
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Museums and Community

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Abstract

In spite of Charles Willson Peale's ideal of a democratic museum, most in the early nineteenth century were either eclectic and intimidating, or filled with sham amusements. In the late nineteenth and early twentieth centuries, museums began to consider their educational mission on an equal par with collecting and research. A lack of representation in mainstream museums led to the foundation of many American and international ethnic museums, beginning with African American museums in the 1960s, giving voice to cultures often excluded from the historical narrative. Larger institutions responded to societal demand for inclusion by engaging community advisory boards and first voice perspective through oral history. The most recent museum community to develop has been online, and crosses traditional barriers of race, class, and gender. Innovative museums looking to the future have invited visitors to participate in the narrative process.

INTRODUCTION

The ever-changing relationship between museums and their communities is a topic which reflects the fluid landscapes of culture and technology. The industry which began as a smattering of avid scholars amassing personal collections has grown through the efforts of individuals and organizations to become a global network of public resources. Presentation and accessibility have improved to attract a wider demographic, and in the past 50 years a staggering array of cultures and viewpoints has come into the public eye through the establishment of ethnic and neighborhood museums. The relationship between community and museum has been personalized through the collection of firsthand accounts and the involvement of community advisory groups, while information is becoming ever more accessible through the reaches of the Internet. The predominant trend in the history of the relationship between museums and their communities is a steady increase in the appeal and availability of information to all facets of the population.

BODY OF TEXT

Early American Museums

The founder of the first American museum, Charles Willson Peale, struggled with some of the same issues as museums of the twenty-first century. Namely, how does one endeavor to attract, educate, and entertain the broadest possible audience while maintaining a commitment to research and scholarship? Peale believed that government financial support would make both of these ideals possible. In an address to the state legislature of Pennsylvania,

printed in *Poulson's American Daily Advertiser*, December 18, 1810, Peale said

In Europe, all men of information prize a well regulated museum, as a necessary appendage to government, but in several parts of that quarter of the earth, the means of visiting those repositories, are within the reach of particular classes of society only, or open on such terms or at such portions of time, as effectually to debar the mass of society, from participating in the improvement, and the pleasure resulting from a careful visitation.^[1]

Peale solicited the new American government to provide public monies so that he could operate a museum that would offer "rational amusement" to a wider swath of society; he articulated a more democratic intent than the models in Europe. Believing that natural history could "promote National and Individual happiness,"^[2] he experimented with presentation techniques, using his fine artistic skills to paint backdrops for mounted specimens. At the end of the gallery, he even included a three-dimensional natural setting, with trees, shrubs, and a pond, for a collection of mammals, reptiles, amphibians, and birds. But he could neither gain public funding nor attract enough visitors to pay the 25¢ admission fee to keep the doors open. The Philadelphia Peale Museum closed in 1827 shortly after his death, and the collection was largely sold off to P. T. Barnum and Moses Kimball.

Two of Peale's sons, Rembrandt and Rubens, also tried their hands at museums, opening one in Baltimore, and later one in New York. Rubens had an especial flare for marketing: he installed gas lighting to attract visitors at night, and he hosted (for the substantial fee of \$650) the blockbuster of the day—the first Egyptian mummy brought to America. The effectiveness of such entertainment events is recorded in his detailed accounts. For

example, visitorship spiked during the Mummy's six weeks of display, and generated \$1842 of income.^[3]

Like the Peale family's, many early American museums actively appealed to public interests in an effort to increase visitation. In their endeavors to remain solvent, they struggled with the tension between entertainment and education, often including such elements as wax figures and vaudeville-like performances. P. T. Barnum had no qualms about promoting amusement and hokum before science in his New York Museum, to the extent that when the museum burned in 1870, he abandoned the museum business and devoted his attention to the circus.

On the other hand, early private collectors, more concerned with their own education than that of the public, joined to form societies and share information.

The naturalists who studied and collected natural history objects typically shared a commitment to self-improvement, group collaboration and national advancement. They created local societies to link the layers of individual activity—private conversations, semi-private correspondence, exchange of specimens, and presentation of ideas—into a collaborative project to identify and map all species in the American landscape.^[4]

While the public may have been allowed into the sanctums of these societies, they found no aids to help them understand what they saw. There were few docents or legible labels, and the species were organized for efficient storage, not pleasurable viewing. Indeed, the societies became just one more way to establish the elite standing of well-heeled Americans. Museum theorist Stephen E. Weil put it this way: "Museums were created and maintained by the high for the low, by the couth for the uncouth, by the washed for the unwashed, by those who knew for those who didn't but needed to know and who would come to learn."^[5] Neither the P. T. Barnum types nor the natural history societies democratized the natural sciences as Peale had yearned to do.

Birth of Museum Education

Beginning in the 1870s, Alpheus Hyatt at the Boston Society of Natural History, aided by teacher Lucretia Crocker, worked to attract a more general public. They hired guides, "introduced special evening and Saturday classes, produced guidebooks, and added more descriptive charts and posters to displays. . . ."^[6] After the Civil War, systematic displays (with rows of species organized by their biological relationship to one another) became the norm for "serious museums." But teachers and the general public exerted their influence to produce more attractive and understandable displays. George Brown Goode, the Smithsonian Institution's Associate Director, said in the SI's first circular, that the museum had three roles: museum of record, museum of research and museum of

education. In other words, the Smithsonian established public education on equal footing with collecting and research.

Into this milieu came John Cotton Dana. Primarily a librarian, he first revolutionized that field in Denver, where he headed the Denver Public Library from 1889 to 1898. He believed that libraries', and later museums', prime mission is relevance and usefulness. He was instrumental in changing the library from "a closed temple of 'wisdom undisturbed' to an open workshop of delight and learning"^[7] by introducing open stacks, a special business library, a children's library, community rooms, branch libraries, and foreign language collections to serve immigrant populations. When he relocated to Newark, New Jersey to become head of the Free Public Library in 1902, he also took on the task of developing a museum using the same principles of usefulness to the public. Noting that the citizens of Newark had access to landmark temples of art and natural history across the river in New York City, he concluded that what was needed was a museum of, by and for Newark—a museum that was "supported by, and. . . duty bound, to try to be of direct value and service to a city of industries. . . for the pleasure and advantage of our chiefest patron—the people of Newark. . . ."^[8] Among the innovations there during his lifetime were hiring an educational advisor, making 300 trips to museums to learn what worked or didn't for others, holding public forums to gain insight into public desires, mounting a wide range of exhibitions (such as clay products of New Jersey with "the daily presence of a skilled potter," or immigrant textiles collected through schoolchildren), lending collections to classrooms, establishing one room as a children's museum, and forming a junior museum club.

Dana spread his revolutionary ideas through letters to *The New York Times*, a series of small volumes under the general title "The New Museum," papers at the annual meeting of the American Association of Museums (founded in 1906), and finally by the founding one of the nation's first museum studies programs at the Newark Museum in 1925.^[9] The New Museum continues his legacy through innovations such as the High School Art Program (HSAP), one of the first museum education programs in the country to engage at-risk teenagers in contemporary art, launched in 1980.

Ethnic Museums

The next sea change for museums and community came with the Civil Rights movement. While scholarship on the history of blacks was well developed by the early twentieth century, the dearth of African Americans in museum positions that could influence the interpretive course meant that mainstream museums continued to teach and display a distorted and biased version of America's past.

Consequently, in the 1960s and 1970s, blacks formed their own community-based museums to show that they indeed held an integral place in history: The DuSable Museum of African American History in Chicago, Illinois (1961); The Charles H. Wright Museum of African American History in Detroit, Michigan (1965); the African American Museum and Library at Oakland, California (1965); and the National Afro-American Museum and Cultural Center in Wilberforce, Ohio (1972). Most recently, Congress chartered the newest Smithsonian museum, the National Museum of African American History, in 2003. The NMAAH will allow African American scholars and educators a federally supported institution to preserve, study, and share their unique place in American history.

The establishment of Latino art and culture museums followed on the heels of the movement for African American Museums: El Museo del Barrio in New York City (1969); The Mexican Museum in San Francisco (1975); Chicago's Mexican Fine Arts Center Museum (now the National Museum of Mexican Art, 1982); the Mexic-Arte Museum in Austin, Texas (1983); and many others since then. Their shared first-voice identity "utilizes Latino self-expression as a lens for examining parallel experiences shared by many cultural communities..."^[10] Carlos Tortolero of Chicago's NMMA reiterates that the museum is an expression of the Mexican American community, but that it is a place for everyone. "We want both the local community and the mainstream world to visit. . .so that we can break down some of the barriers. . .If only our own people come here, we will have failed our mission."^[10]

Because The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 coincided with the licensing of many Indian casinos, American Indians had the legal means to reclaim many of their ancestors' remains and sacred artifacts from American museums at the same time that they were gaining the financial ability to house them properly. This convergence of circumstances has contributed to a renaissance on many reservations, and the establishment of approximately 300 tribal museums and cultural centers. The noteworthy Mashantucket Pequot Museum in Connecticut (1998) is a 308,000 square foot complex that cost \$193 million.

Dozens upon dozens of ethnic museums now operate in the United States, some of them arising early in the twentieth century, such as the Jewish Museum in New York in 1904, and Chicago's Polish Museum of America in 1935. The numbers, however, have burgeoned since the 1970s. These new ethnic museums range in size from small storefront operations run by volunteers to large initiatives such as the Japanese American National Museum in Los Angeles, California (1992); the Arab American National Museum in Detroit, Michigan (2005); and the newly expanded Wing Luke Asian Museum in Seattle, Washington (2008). The Chicago Cultural Alliance, formed in 2006, boasts a membership of 25 Chicago-area ethnic museums, historical societies, and cultural centers that

represent Cambodian, Swedish, Scottish, Irish, East African, African American, Mexican, Puerto Rican, Lithuanian, Latvian, Polish, Arab, Korean, Filipino, Japanese, Asian Indian, American Indian, Chinese, and Brazilian communities. Detroit's Cultural Exchange Network is a similar consortium of ethnic arts groups, and other cities have equally rich arrays of cultural assets. Immigrant populations may be Americanized, but they are not—indeed, they resist—becoming homogenized. Dr. Rosa Cabrera, senior urban anthropologist at the Field Museum in Chicago, asserts that these communities and their museums have a reciprocal benefit—that the very process of establishing a museum shapes community identity.^[11]

International Examples

The United States is not alone in the outgrowth of small neighborhood or ethnic museums. El Museo Shan-Dany was founded in 1986, through the cooperation of Mexico's Instituto Nacional de Antropología e Historia (INAH) and the community leaders of Santa Ana del Valle, Oaxaca. The project was inspired by the discovery of several archeological burial sites during plaza and road construction. INAH did not judge the artifacts to be of a high enough caliber for display in the national museum, but they were extremely important to the identity and patrimony of the people of Santa Ana. El Museo Shan-Dany became a model for the formation of 16 other museums in neighboring villages. Together they comprise The Union of Community Museums of Oaxaca, and like the Chicago Cultural Alliance, they do joint planning, fundraising, programming, and marketing.^[12]

The Lower East Side Tenement Museum, opened in 1988, does not focus on a particular ethnicity. Instead, its community is defined by the former residents of 97 Orchard Street, an estimated 7,000 people from more than 20 nations between 1863 and 1935, when landlords chose to evict rather than invest in meeting new building codes. The museum connects its historic stories to the plight of current immigrant communities, many of them toiling in sweatshops just as the residents of Orchard Street 100 years before them. According to founder Ruth Abram, "Behind every door is a family with a different religion, a different language, each special and unique. But in the hallways, stoops, and streets, all those people are together pursuing the American Dream. . ."^[13] Because its mission is to promote tolerance through the historical perspective, the museum's programs ask what policies and attitudes persist as obstacles to immigrant families today.

Like the Tenement Museum, the District Six Museum was formed to preserve a neighborhood consciousness. But District Six did not have a "time capsule" building to resuscitate. In fact, there was no neighborhood at all after the Apartheid government of South Africa declared in 1966 that it would be "white" and the homes and businesses of the multiethnic residents razed. Some 60,000

people were relocated, but they never stopped fighting to regain the right to return. In 1989, the Methodist Church, one of the few structures left standing, became the center for an outpouring of collective memory, inscribed by former residents on a huge floor map. The Museum served as a tool to preserve memory and fight to reclaim the neighborhood for the dispossessed, a battle won in 1998. The Museum continues to work with community memory in the renovated Methodist Church.^[14,15]

Te Papa Tongarewa, the National Museum of New Zealand opened in 1998, does not give voice to its native minority through a special museum. Rather, the government adopted the concept of unified collections and narratives developed via a bicultural partnership. Tangata Whenua (the Maori, those who belong to the land by right of first discovery) and Tangata Tiriti (the Europeans, those who belong to the land by right of the Treaty of Waitangi) worked together to interpret the cultural heritage and environment of New Zealand, drawing equally on Maori and western knowledge systems. Te Papa's marae, or Maori meeting house, symbolizes this collaborative and consensual effort. A marae is a sacred place inhabited by ancestors; indeed the house IS the ancestor. Rigid protocols protect both the marae's power and the well-being of those who enter. The museum created a marae that gives all people the right to enter because of their shared history.^[16,17]

In 1999, the Tenement Museum, together with the District Six Museum (South Africa); the Gulag Museum (Russia); the Liberation War Museum (Bangladesh); Maison des Esclaves (Senegal); National Park Service (U.S.A.); Memoria Abierta (Argentina); Terezin Memorial (Czech Republic); and the Workhouse (United Kingdom) founded the International Coalition of Historic Site Museums of Conscience (now known as the International Coalition of Sites of Conscience) to unite institutions whose mission is to preserve difficult histories in order to enable an educated citizenry to build civil societies. The Coalition Web site states, "By initiating new conversations about contemporary issues through a historical lens, places of memory can become new centers for democracy in action. But the power of historic sites is not inherent; it must be harnessed as a self-conscious tactic in the service of human rights and civic engagement." Since its founding with the above 9 institutions, the Coalition had grown to 17 accredited sites in 2008. Regional Networks led by accredited members in Russia, Asia, Africa, and South America bring together an additional 20–30 organizations for joint projects, workshops, one-on-one consultations, and other activities to build the capacity of emerging initiatives and strengthen the collective memory. An Immigration Network of 1 European and 13 American members formed in 2008 to foster an international dialogue on current immigration issues. An additional 100 affiliate members around the world support the mission.^[18]

ICOM

The International Council of Museums (ICOM) is an older and larger organization founded in Paris in 1946 at the initiative of American Chauncey J. Hamlin, previously president of AAM and then president of the board of the Buffalo Society of Natural Science. The organization immediately established a cooperation agreement with United Nations Educational, Scientific and Cultural Organization (UNESCO), and within the first few years, 53 countries were active members. It has grown to currently boast 26,000 members from 151 countries. ICOM's mission includes professional cooperation and exchange, advancement of professional standards and ethics, and interpretation and preservation of the world's natural and cultural heritage, both tangible and intangible. Since its inception, ICOM has been a valuable ally for local museums to protect and repatriate cultural assets, through such initiatives as standardizing the ethics of acquisition, "One Hundred Missing Objects" publications that fight illicit traffic of cultural property, and the International Committee of the Blue Shield that provides preservation aid in emergency situations. This concrete aid to keeping tangible culture in the hands of the community that created it is accompanied by theoretical assistance in democratizing museums. Conferences, workshops, and publications on such topics as "Local Museums and Cultural Development Outside Large Centres" (1954), "The Most Effective Means of Rendering Museums Accessible to Everyone" (1958), and "Museum as a Cultural Centre in the Development of the Community" (1960) were early innovations. The theme of the 1995 ICOM conference in Stavanger, Norway, was "Museums and Community." ICOM also invests in capacity building for community museums, most notably training staff at the Nubia Museum (1993–2001), and facilitating training in new technologies in museums in Caribbean countries (2001). Recently ICOM has turned its attention to sustainable cultural tourism, recommending that museums promote "participatory democracy by bringing together heritage resources and their neighbouring communities, stimulating community based development through heritage tourism that contributes to poverty alleviation without compromising the integrity of heritage resources."^[19]

AAM's Museums and Communities Initiative

Mainstream museums have become increasingly attuned to diversifying the communities they serve, reaching out through innovative program partnerships, target audience marketing, special exhibitions highlighting local ethnic communities, multilingual labels, accessible design, and other new methods of inclusive interpretation. These cultural accessibility issues were important enough that the American Association of Museums conceived the Museums and Communities Initiative in 1998. AAM

convened a national task force, held six community dialogues around the country through 2001, and passed a Museums and Community Resolution in 2002,^[20] urging all museums to be active and collaborative in their communities. In 2002, AAM published two volumes to assist museums in becoming more community minded: *Mastering Civic Engagement: A Challenge to Museums*, and *A Museums and Community Toolkit*. AAM also hosted seminars on building community connections in Los Angeles and Philadelphia in 2003, and Chicago and New Orleans in 2004. While the grant-funded initiative ended in 2007, AAM continues to encourage the work between museums and community. AAM members can access current information on its Web information center.^[21]

In 2007, AAM took its community focus abroad, converting its International Partnership Among Museums (IPAM) program into the Museums and Community Collaboration Abroad (MCCA). From its inception in 1980 through the end of the program in 2007, the IPAM program made possible over 245 museum exchanges that focused on administration, collections care, education, research, marketing, and design. MCCA programs emphasize exchange projects that go beyond the museums and into the communities. The first granting cycle included a project that partnered the tiny Black Pine Animal Park in Indiana, with only three paid staff, with the struggling Dushanbe Zoo in Tajikistan. The Black Pine Animal Park prospers because of its ability to mobilize volunteers and in-kind donations, and through AAM's MCCA they have embarked on a training program for Dushanbe to adapt the Black Pine model to the Tajik community.^[22]

The National Park Service

In 2001, the Advisory Board of the National Park System, chaired by renowned historian John Hope Franklin, issued a report entitled "Rethinking the National Parks for the 21st Century," in which they called on the agency to use the Parks not just for recreation, but as springboards for intellectual and cultural enrichment. They admonished that the Parks "must ensure that the American story is told faithfully, completely, and accurately. . . . Our nation's history is our civic glue." Said Franklin, "The places that commemorate sad history are not places in which we wallow, . . . but instead places in which we may be moved to a new resolve, to be better citizens. Explaining history from a variety of angles makes it not only more interesting, but also more true."^[23] Northeast Regional Director Marie Rust responded by holding a workshop focused on civic engagement and agency in New York in December 2001. The Civic Engagement Initiative

is the National Park Service's challenge to itself, to find new ways to revitalize its mission of preserving and

interpreting our nation's natural and cultural heritage. Forming meaningful partnerships with the very people most invested in the parks will instill in them a sense of ownership, and ensure the relevance of NPS resources and programs.^[24]

Oral History

Oral history is one way for mainstream museums to record the experiences and inner lives of those "... absent from the historical record—workers, dissenters, recent immigrants, ethnic minorities, and farmers. . . ."^[25] This valuable tool had its beginnings even before the early days of recording devices, when such projects as documenting the narratives of 2,300 former Slaves was conducted by Works Progress Administration journalists. Its use exploded in the 1960s and 1970s, and some believe it has yet to reach its full potential. Richard Rabinowitz, president of the American History Workshop, notes that oral history videos in exhibitions allow the visitor to experience a conversation with the subject, not a lecture from "a masked authority figure with a very remote kind of knowledge."^[26] A milestone for the Smithsonian Institution's National Museum of American History was the 1987 exhibition *A More Perfect Union: Japanese Americans and the U.S. Constitution*. As a lesson on the constitution, the NMAH decided to tell a story of its violation: the saga of 110,000 U.S. citizens of Japanese descent who were held in internment camps during World War II. Selma Thomas, the filmmaker on the project, reflects,

We wanted to create a document that was incontestable. . . . but the oral history also gives it a humanity that is often lacking in other kinds of documents. . . . You're asking a person to relive a painful moment and make it part of the public record. It's very invasive. But unless they do it, some part of the historical record is missing from the public forum.^[27]

Oral history projects have proven even more integral to community museums than to mainstream museums. The Alutiiq Museum in Kodiak, Alaska, makes its collection come alive by showing artifacts to elders and recording their explanations of use and meaning. Recordings are also a means to preserve the Alutiiq language, in danger of dying with so few living native speakers. While the Alutiiq Museum is focusing on oral history as a tool to preserve its culture, the Japanese American National Museum has reached out to multiple cultures to preserve the history of a neighborhood. In its 2002 exhibition, "Boyle Heights: The Power of Place," oral histories of Jewish, Japanese, Mexican, Italian, Armenian, Russian Molokan, and African American families, conducted by a team of scholars, volunteers, and university and high school students, revealed the evolution of the neighborhood, and how these ethnicities interrelated. According to

Associate Curator Sojin Kim, the teenagers actually collected some of the most interesting stories, because the older interviewees were more open to sharing their stories with the young people than with scholars.^[27] The Boyle Heights project achieved a more diverse visitorship for the museum, and fostered a sense of pride in the participants.

Community Advisory Groups

Mainstream museums often invite community advisors to shape their exhibition, collection, and educational programs. The Denver Museum of Nature and Science has enjoyed the benefit of a Native American Resource Group since the mid-1970s. From 2003 to 2005, the Chicago History Museum employed a 15-member Teen Council to develop a Web site, a program series, and an exhibition, and also to create content by collecting 100 oral histories of growing up in the city. The Royal British Columbia Museum in Victoria, B. C., Canada, not only worked with Nuu-cha-nulth tribal members on a 1999 exhibition about their artworks, but the Nuu-cha-nulth also served as paid “hosts” in the galleries. Nuu-cha-nulth youth came to a deeper knowledge of their own culture by explaining it to non-native visitors. In the 1980s, the Field Museum in Chicago established the Center for Cultural Understanding and Change to help the museum connect with and understand its contemporary urban community. It convened a forum entitled “Conversations on Pluralism and Identity in America” and in 1998 launched Cultural Connections, an annual series of six programs, each jointly presented by two Chicago area ethnic museums. One pitfall for museums that convene community advisory groups for special projects is that they often disband them when the project is complete. Relationships must be based on more than just the museum’s agenda. Says Claudine K. Brown of the Nathan Cummings Foundation, “Each partner should be in a better position for having participated in the process.”^[20]

Communities on the Net

New trends in museum communities include those growing through the Internet. As early as 1996, The Fine Arts Museum in San Francisco launched “The Thinker ImageBase” (<http://www.thinker.org>) with 80,000 images from its collection, stating “The collections belong to the people of the City and County of San Francisco” and that the museum’s mission was to be more a resource than a repository. By 2003, it was noted that many museums had more virtual visitors than real visitors.^[28] Online communities can convene people for activities, discussions, games, exhibitions, stories, research, collaboration, and much more. The Carnegie Science Center in Pittsburgh, Pennsylvania created the social networking site, Braincake, in 2006, as part of the Girls, Math and Science Partnership. Girls aged 11–17 years join this upbeat virtual

community, whose tag line is “Smart. Sweet,” to participate in programs, get homework help, find out about scholarship and career opportunities, and blog about science.^[29] In 2008, Tate Modern in London, England, opened the Great Tate Mod Blog, inviting Web visitors to help shape the development of their new wing by posting photographs and ideas of their favorite spaces on a “mood board.”^[30] Museums are also taking advantage of existing social networking and other Web 2.0 sites. For example, the Chicago History Museum joined the MySpace community in 2008, and its profile reads “female; 101 years old; mood: cultured; interests: hearing and telling stories.” At the time of this writing, most of her friends were other museums.^[31] In 2006, San Francisco, California’s Exploratorium mixed real and virtual world experiences by inviting avatars (a virtual representation of oneself) to gather in the museum’s Second Life amphitheater to view a live Webcast of the total solar eclipse in Turkey. Second Life is an enormous, multiuser, three-dimensional online virtual world that people visit through their avatars, and explore virtual environments built by other people’s avatars. The museum also hosts events and tests prototypes on “Exploratorium Island,” their corner of the Second Life world. A staff avatar can make a presentation and take questions from an international avatar audience.^[32]

The information superhighway may connect a museum with visitors from around the world or down the block, but access is not universal. Poverty keeps away both the real and the virtual visitor in what has come to be known as the “digital divide.” Even though the United States is among the most networked nations in the world, the 2000 U.S. Census reported that among children 3–17, 77% of white households and 72% of Asian households had computers with Internet access, while only 43% of African American children and 27% of Latino children had Internet at home.^[33] While the gap is certainly narrowing, pockets of isolation exist in both urban and, perhaps even more so, rural regions of the United States.

Visitor-Generated Content

The Tech Museum of Innovation in San Jose, California, brought the real and virtual worlds even closer when it launched The Tech Virtual Experiment. In early 2008, the museum posted an open call on Second Life for avatars, individually or in virtual collaborations, to develop and design museum exhibits. Of the 50 virtual exhibitions created by hundreds of avatars, seven were converted to the real world and installed in the Virtual Test Zone gallery in June 2008.^[34] This kind of visitor-generated content may be an increasing trend embraced by museum innovators, but many museums still fear dilution of their authority. In 2005, Marymount Manhattan College Art Professor, David Gilbert, turned the museum world on its ear with a guerilla audio tour project called Art Mobs. His students produced unauthorized audio guides to works in

New York's Museum of Modern Art (MoMA), that they offered to the general public via the Internet, at a time when museums were only beginning to ponder the possibilities of downloadable media content. Says Gilbert, "we are democratizing the experience of touring an art museum; we are offering a way for anyone to 'curate' their own little corner of MoMA."^[35] Since then, many museums have begun to realize that they can ride the crest of this wave, and many welcome a far flung audience to the table to participate in the creation of history, culture, and meaning. The Minnesota History Center invited Minnesotans to suggest topics for their October 2008 exhibition celebrating the sesquicentennial of the state. They received over 2,700 entries. Each of the 150 subjects chosen for display includes a photo and testimonial of the person who nominated it. Minnesota Historical Society director Nina Archabal asks, "Who better to tell us about Minnesota than the people who live here?"^[36] In March, 2008, the Brooklyn Museum in New York made an open call to artists to submit a work of photography that represented the theme "The Changing Faces of Brooklyn," along with a 100-word statement. Next they invited the general public to evaluate the submissions using an online evaluation tool. 3,344 evaluators cast 410,089 evaluations for the 389 entries. The photographs were curated by the crowd, and the top 20% were installed in the exhibition gallery at the Museum from June 27 to August 10, 2008.^[37,38] These online initiatives redefine the very nature of community—online visitors choose to join the virtual community based on personal interest, completely independent of their class, gender, ethnic profile, or national origin.

CONCLUSION

While there remain many bastions of curated culture that do not embrace the notion of accessibility and community involvement, the evolutionary arc of museums over the last 200 years tends toward greater inclusion. The introduction of first voice into a mainstream museum can offer new authentic and personal perspectives on a shared past. But just like the difference between memoir and biography, first voice narratives and mainstream historical analysis both hold value. In combination, they produce a synergy of meaning that provides empowerment and self expression at the same time as a sense of context in the overall course of human society. Mainstream museums can offer a stitching together of the patchwork of many first voice stories, but where the lines are drawn can be contentious territory. Museums and communities often struggle over who owns the narrative. These tensions are not limited to mainstream museums, as the politics of inclusion and exclusion play out in ethnic museums as well. Those in the dominant culture often consider minority groups to be homogenous, but a little interaction is enough to reveal the remarkable diversity within each group.

In spite of the challenges of community collaboration, it is one of the key strategies for museums to become and/or remain relevant. In an October 2008, keynote speech, Jonathon Katz posited that society is trending from empathy to agency. He cited the fact that the gaming industry, which operates on agency, has overtaken the gross sales of the film industry, which banks on empathy. He advised museums to embrace this trend toward agency, and to provide means for visitor influence on the content and experience in programs, galleries, and online.^[39] Nina Simon agrees; on her museum 2.0 blog, she says "In a world where visitors want to create, remix, and interpret content messages on their own, museums can assume a new role of authority as 'platforms' for those creations and recombinations."^[40] The museum of the future will prosper if it invites its visitors to enter the narrative process.

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Museums and Their Visitors: Historic Relationship

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Abstract

The makeup of the museum visitor is perhaps one of the most challenging aspects of museum history for historians to uncover. Historians of museums have often noted that before the field of Visitor Studies grew to prominence, museums often envisioned their audiences as nameless, faceless masses. Historians have either painted this public as composed of members of the privileged elite or as those receptive to being shaped by the elite cultural institutions. This entry examines how the museum visitor has been discussed by both museum professionals and historians of museums in the nineteenth and twentieth century United States.

The Victorian museum visitor leaves but ghostly images in photographs and paintings of historic exhibition halls. Natural history museums greet the Victorian audience with objects grouped comparatively by type or geographic location, which form seemingly endless, straight lines within cold, glass cases. Art museums greet the same visitors with top to bottom walls of paintings or paintings along single lines intend to represent the development of art from its “primitive” forms to its highest (read) European incarnations. The Victorian museum visitor would hardly recognize most contemporary museums in either the United States or Europe, save for the seemingly timeless Greco-Roman architectural façade that masks the past century of change protected within the museum’s walls. Museum audiences and visitors, unlike exhibition spaces, collections acquisitions, architectural developments, and institutional changes, leave little documentation of their change over time. Historic visitors to museums have traditionally been treated by scholars in either one of two contradictory terms; they either represented the bourgeoisie elite of a given region or time period, or they have represented the faceless masses subjected to the social control of the elites governing the museums themselves. For more on this contradictory viewpoint related to museum audiences, see Conn.^[1] Other scholars have argued that American museums have, since their origins, been geared more towards educating broader audiences than European museums.^[2] Museums today, unlike their earlier manifestations, make deliberate efforts to empirically understand who their audiences are, how they learn, and what most interests them. This also helped allow modern museums make conscientious efforts to educate wide-ranging audiences, including children and the disadvantaged. Museums also increasingly work to include their visitors in their presentation of knowledge. Computer-based guest books, blogs, touch screen monitors, and other new technology allow visitors to “talk back” to

exhibitions and participate in their development. While most recognize these developments as being, on the whole, overwhelmingly positive, others criticize that museums have gone too far to embrace a brand of “edutainment” and long for a return of a museum “golden age” that, in truth, never really existed. In fact, the use of quantitative analysis by museums in efforts to better understand their audiences and how they learn has made museums both more effective and more enjoyable. This entry will attempt to trace the history of museum audiences and their representation in the historical literature. This entry focuses mainly on the history of museums in the United States from the late nineteenth century to the present. This entry does not focus on the growing body of literature focusing on professionalized Visitor Studies, but rather, it examines the nature of the more casual, yet concerted dialogue about museum audiences in which museum professionals engaged throughout the late nineteenth century to the present.

In his study of the intellectual history of American museums, the historian Steven Conn notes that, “Museum audiences are elusive quarry for the historian,” as “They left little trace of themselves and did not register with and specificity in the official records of most museums.”^[3] Before the 1920s, many museums understood their visitors in terms of one or two basic categories often limited a dichotomy of either adults or school groups. Many museums associated with universities differentiated between school groups and students from the university, sometimes even noting which courses required students to visit the campus museum. Beyond that, however, historians are left with only the museum professionals’ speculation on their patrons. Museums did not typically record the educational background of adults visiting the museum and their understanding of how to cater to their audiences continued to be limited. Generally, most museum archives are devoted primarily to the

maintenance of a record articulating the development of collections, general institutional policy, and exhibition spaces. Archives are perceived as generally silent on the subject of audiences; however, historians can gain clues to their nature upon close readings of the available sources. The contrast in the available documentation related to collections and exhibitions vis-à-vis the available documentation for museum audiences is perhaps telling. It might be argued that museums considered their collections and exhibitions as a greater priority to the health of the institution, leading directly to the ratio of available archival materials.

By the turn of the last century, museums and museum professionals were seriously contemplating the experience of the visitor to their institutions. Franz Boas, the illustrious cultural anthropologist working at the American Museum of Natural History (AMNH) engaged in just the sort of intellectual debate that characterized the discourse surrounding the experiences of the museum visitor during this time period in a 1907 exchange in the journal *Science*. In responding to a review penned by a curator at his former institution, the Field Museum of Natural History (FMNH) in Chicago, Boas chose to broaden the discourse and entitled his response “Some Principles of Museum Administration.” Boas, in comparing two institutions that were well known as significant research institutions vis-à-vis the sleepy American universities at the time, explains, “Museums may serve three objects. They may be institutions designed to furnish healthy entertainment, they may be intended for instruction and they may be intended for the promotion of research.” Boas was perhaps one of the most significant researchers working in the United States at this time and yet he explains in the article that the “value of the museum as a resort for popular entertainment must not be underrated.”^[4] Boas, despite much of what is said in this article, was never fully understood by historians to be a great popularizer. He also adds that, “every attraction that counteracts the influence of the saloon and the racetrack is of great social importance.” Museums, therefore, should be both entertaining and intellectually stimulating. George Dorsey, the curator from FMNH who initially offered his critique of the exhibits at the AMNH, longed for the good old days of museum exhibitions. Dorsey comments, “Such exhibits as those above [at the AMNH] characterized might with some degree of propriety be found in the lower grades of the public school, but they certainly do not seem worthy of an institution with claims to be foremost of American museums.” Dorsey argues that if the AMNH’s leadership truly desires for objects to serve the purpose of educating the general public, they should simply pack them up and send them off to the public schools around the region. He concludes condescendingly, “thus the ideal of this scheme might be more easily and cheaply realized.”^[5]

For many curators at the early part of the past century, however, museum exhibits were intended to be forums for

the presentation of the most recent available research. While the tension between creating cutting-edge research and the desire to popularize major ideas existed throughout the course of the twentieth century, several factors forced museums to begin changing. While a significant number of important exceptions exist, many of the top researchers in fields such as anthropology, biology, and geology began taking academic job posts in universities as opposed to curatorial positions in natural history museums. In fields such as ethnology and archaeology, the rise of new cultural patrimony laws governing the international transport of objects of cultural patrimony resulted in the decrease of certain types of collections arriving in museums. This claim is not without its problems. Certain institutions maintained, on the surface, a steady flow of objects into their collections, though, in the case of anthropological collections in museums, it is important to differentiate between archaeological and ethnographic material. The Hearst Museum of Anthropology at the University of California, Berkeley offers an example of this phenomenon. During the Great Depression and Second World War, when international travel and the purchase of objects from indigenous peoples became increasingly difficult, an increased number of archaeological expeditions allowed the museum to continue to grow at a steady pace in terms of the number of objects accessioned per year.

While the visitor experience was becoming more commonly discussed in various forums utilized by museum professionals, summations of the health of individual museums, or museums as a whole, began not with attendance figures but rather notable collections acquisitions and the development of research programs. Visitors were not left out of documents produced by museums entirely, however, and the visitors experience is hinted at on certain occasions. In a 1908 article summarizing the annual reports of several major institutions, F.A. Lucas notes that the Carnegie Museum’s annual report expressed dissatisfaction with the fact that the museum had been opened to the public before the exhibits were ready to host them.^[6] Lucas further notes the troubles of the Brooklyn Museum, which complained of having too many tasks without the necessary resources to address them. Two items that the Brooklyn Museum’s annual report disparages are a lack of labels for objects and disarranged exhibit cases. It does not take a vast leap of the imagination to begin to understand how a visitor might experience the self-described disarranged and unlabeled, exhibits of the Brooklyn Museum during this time period. Attendance figures, though not included in Lucas’ opening remarks on the health of American museums, are included in his commentary later on, presented alongside the attendance figures for several major institutions. Lucas notes that attendance figures, in his estimation, are commonly misunderstood:

We are accustomed to regard the number of visitors to a museum as a measure of its importance and public

usefulness, but it may more properly be looked upon as an indication of its interest for the public and to some extent the state of the weather. If it is of interest to the public, there is small doubt but what it will prove to be useful.^[7]

Lucas also gives an indication of how museums were beginning to understand their audiences. He notes that visitors to the U.S. National Museum (now the Smithsonian Institution) are largely out-of-town tourists, while many of the other major metropolitan museums, such as the FMNH and AMNH, host primarily local and regional residents. Lucas is also quick to point directly to the construction of a new, elevated train station in New York near the AMNH as the direct cause for a spike in attendance. Lucas writes, "Museum attendance, as shown by the report of the U.S. National Museum, is subject to great fluctuation and, like sun-spots, has its maximum and minimum periods." Lucas utilizes similar experiences from museums in London to conclude his analysis on the topic. Clearly then, museums were coming to a better understanding of their audiences by 1908, and this was starting to coalesce in the national and international discourse.

Art museums in the first half of the twentieth century understood themselves as serving multiple audiences. One of these audiences was the student of art. In 1915, Edith R. Abbot examined the experience of the art student as museum visitor in *The Metropolitan Museum of Art Bulletin*. Abbot notes that, "A sculptor comes to visit the classical collection. For him the antique marbles are all lessons in transcription; it is not enough to connect them with the past, their relation to the types of today is quite as pertinent." While these audiences were certainly welcomed to the museum, Abbot argues that the art student is best served by the museum by taking a guided tour, "with some one whose eye is . . . keen." Abbot also notes, however, "The instructor who is familiar with the resources of the Museum is in requisition in all of these instances as guide rather than as teacher. It is only when individuals or groups of persons arrange in advance for a series of appointments that museum instruction can be called organized in any sense."^[8] While articles like Abbot's lack the quantitative evidence utilized in later forms of visitor studies, it is demonstrative of attempts to examine anecdotal experiences to improve various types of visitor experiences.

By the late 1920s certain museums were attempting to better understand their audiences through quantitative rather than qualitative methods of observation. Instead of providing anecdotal evidence of the background of the audiences, or reporting casual curatorial strolls through exhibitions spaces in attempts to gauge how much audiences were learning, articles from this period, along with museum annual reports begin to demonstrate attempts at quantitative analysis. In the December 1929 issue of the *Pennsylvania Museum Bulletin* (now the Philadelphia Museum of Art), the museum reported the results of a

survey during the first year of its occupation of a new facility. The simple survey was given to one thousand of the first million visitors to the museum. The survey consisted of six basic questions related to the visitor's occupation, place of residency, mode of transportation to the museum, what prompted the visitor to come to the museum, what the visitor liked about the museum, and suggestions for improvement. The occupations of those visiting the museum represent rather basic categories separated into men and women, then subdivided into basic categories such as businessmen, salesmen, lawyers, doctors, and factory workers. Unsurprisingly, students represented the largest number of visitors in the male category. Tellingly, however, male individuals working in manufacturing were well represented in the survey; in short, the museum's audience was more complex than the anonymous hoards of art students assumed to have been visiting museums by previous estimates. The Philadelphia Museum of Art, unlike many of its counterparts including the Metropolitan Museum of Art in New York, was becoming well known as an institution that not only eschewed discouraging the working classes from visiting the museum, in fact, the museum worked to reach out to them. The Philadelphia Museum of Art also ran the School of Industrial Arts. Additionally, the museums advertisements on streetcar lines are indicative of this commitment to the working classes. For more on the development of the Philadelphia Museum, see Conn.^[9] To provide further evidence of this, lawyers, making up an estimated 6000 visitors, barely outpaced farmers, who represented 5000 of the 1,000,000 total. A majority of the art students visiting the museum were women (23,000), yet they were outpaced many times over by housewives (264,000). Housewives, in fact, represented over a quarter of the total number of museum visitors represented in the survey.^[10]

A vast majority of the visitors represented in the survey were from the metropolitan Philadelphia region, though a roughly equal number of visitors arrived from the suburbs of Philadelphia as did those from other regions of Pennsylvania (nearly 11%). A majority of visitors arrived to the museum by private car, though various types of public transportation, when combined, greatly outpaced this number. Over half of the visitors learned about the museum through word of mouth, though over 40% were prompted to go to the museum due to some form of advertisement, many of which were placed on streetcars. Housewives and farmers mostly enjoyed the period rooms, students and artists appreciated the paintings—as did the factory workers—and architects and engineers appreciated the museum building itself as much as they enjoyed the exhibits. The most common suggestion for improvement was a desire for a greater number of lectures, a desire for a café, and better modes of transportation to and from the institution. The museum report concludes that the institution does not simply represent a small portion of the public, but rather a large cross-section of the population. That said, the museum attracted, "a proportionally large

number of people from those groups whose vocations make them most dependent upon a knowledge and study of works of art.”^[10]

In reading the 1929 report on the Pennsylvania Museum’s survey, one is struck by not only the broad cross-section of the population visiting the museum, but also the wide range of reactions to the institution, most of which were positive. The report concludes that it was initiated in an attempt to better the museum’s service to the public. This report complicates the notion that museums in the United States were simply gathering points for the bourgeois elite of a given community. The vast number of farmers and factory workers visiting the museum indicate that it was not simply a form of entertainment for the upper class. Additionally, the roughly proportionate female visitors (54.8%) to male visitors (45.2%) indicate that museums were neither sites of male or female domination.^[10]

Though quantitative forms of analysis were becoming increasingly available, broad assumptions related to museum audiences and visitors remained the currency of academics and museum professionals that attempted to be the authority on the subject. In a 1940 article appearing in *Science*, Marcus S. Goldstein posited a number of questions on museum visitors but then noted, “I am not acquainted with the literature on museum administration, and research based on the above queries may already be available.” Rather than familiarizing himself with this literature, Goldstein believed his assumptions, and the assumptions of those around him, to be interesting enough for publication, “In any case, my own observations (and the response of a number of other individuals with whom the subject has been discussed support these views), point to the following conditions. . . .” While many of Goldstein’s arguments prove to be interesting and valid, (e.g., museum exhibitions should have movement to attract a broader audience) a complete lack of evidence beyond his assumptions prevent the argument from being wholly effective.^[11]

The experience of visiting museums in both the United States and Europe changed swiftly after the close of the Second World War. Museums in the United States began hiring educators who worked directly with visitors, curatorial staff, and perhaps most importantly, the docents who guided tours through museum exhibits. Docents were trained to guide tours aimed toward educating specific types of audiences, rather than repeating the same tour for every group. Art museums, specifically, had taken the lead role in working with young children in the field of museum education following the Second World War.^[12] More specifically, art museums in cities like Indianapolis, rather than the major metropolitan museums of Chicago or New York, assumed the lead role in developing children’s art classes or workshops in museums. In addition to developing new exhibition spaces specifically aimed at childhood education, museums were changing the nature of how school groups visited museums. Whereas previously

museums would encourage school groups to tour the entire museum in a single day, museums such as the Denver Natural History Museum (now the Denver Museum of Nature and Science) began encouraging teachers to tie visits closely with classroom materials. By the late 1950s, museums were discouraging schools from bringing in groups for general visits, and strongly encouraging these types of classroom-related visits. An example of this type of guideline can be found in its annual report.^[13] Attendance in museums in both the United States and in many places in Europe boomed following the Second World War. Long lines awaited newly reopened museums on the coasts or in vulnerable areas including the British Museum in London and the Metropolitan Museum of Art in New York, both of which had been closed or redacted during the course of the war. The Denver Natural History Museum, Art Institute of Chicago, and numerous other American museums broke attendance records as the Second World War came to a close. Americans, as the war waned on, possessed a far greater amount of disposable income than during the latter years of the Great Depression, and one manner in which they spent their new income was at museum turnstiles. Theodora Kroeber, wife of the famed American anthropologist, Alfred Kroeber, describes in her biography of her husband their waiting in line with throngs of Londoners to visit the reopened British Museum of Natural History.^[14] Museum visitors again availed themselves to many of the most prized works of arts possessed by these institutions that were placed in storage or sent inland, to other museums for safekeeping.

By the 1950s, in addition to changing methodologies related to collections, loans and exchanges, the goals of various types of museum exhibitions, were continuing to evolve. In 1957, the *Los Angeles Times* described the development as the museum shifting its gaze from the exhibition cases themselves to those that were supposed to be looking at the cases. The *L.A. Times* reporter argued that when museums did in fact begin to attempt to understand the museum visitor, it noted that they were generally uninterested in many of the ideas presented to them. “Perhaps,” the *L.A. Times* reported, “it was because the presentation was uninspired.”^[15] Generally, museum curators by this time were taking fewer risks in their exhibitions. By 1954, a pair of museum commentators and curators, Donald Collier and Harry Tschopik, Jr. commented in *American Anthropologist*, “Most importantly, the newer exhibits have not, to date, reflected any systematic or integrated plan, and treatment of many problems of current theoretical interest. . . .” Unlike museums of the first half of the twentieth century, exhibits did not address matters of “current theoretical interest.”^[16] Instead, museums presented basic educational materials and served as introductions to broader topics. Museums had become more analogous to introductory textbooks than scholarly journals. Interestingly, the notion of educating the public via exhibitions and the production of top-notch research continued to be

somewhat at odds. This was especially true in university-based museums. In 1953, in discussing the continued desire for a new anthropology building, the anthropology department at the University of California, Berkeley circulated a memorandum that noted museum research and the use of collections for exhibition spaces were somewhat at odds, “The use of the collections for undergraduate teaching exhibits frequently conflicts with their use for research, when materials in an exhibition case are needed for a research project, and the reverse situation also arises.”^[17]

Popular notions surrounding museums, however, were anything but fully changed by the 1960s. In 1963, another *L.A. Times* reporter argued that if the word, “museum” came up in a word association game, his response would be “stuffed Indian.” This word association response, the reporter then argues, would have been inaccurate, “Because museums are moving magically these days.”^[18] The postwar period of American history also meant the development of new museum facilities in many parts of the country. This development, in turn, led to greater pressure for museums to draw larger crowds. Museums began responding to these pressures by hosting a greater number of major, “blockbuster” exhibitions on topics of popular interest, thus changing the visitor experience.

While most museums were essentially developing educational programming without quantitative analysis informing the decision-making process, museum professionals during the 1960s and 1970s worked to better understand their audiences and develop programming specifically attuned to the need of the public. In 1975, an article in the journal *Studies in Art Education*, estimated that 93% of the art museums in the United States sponsored educational programs. Of those programs, no serious, systematic documentation of the programs’ effectiveness or scope had been attempted. In other words, while museums were attempting to educate their audiences utilizing more refined processes, they possessed little understanding of how well they were working.^[19]

By the late 1980s and early 1990s, museums were arriving at a more complex understanding of their audiences. In 1989, a study of several American art museums that corroborated with another study in England demonstrated that those visiting art museums were typically “in the upper educational, occupational and income groups, younger than the population in general (average age is 34) and active in community and leisure-time organizations.”^[20] While natural history and science museums were understood as catering to audiences differently than art museum, the common notion that museums were synonymous with the upper class of western society continued to stick, and arguably with some supporting evidence. One of the authors of the 1989 study, would, 1 year later, argue that the one of the most important factors in turning a nonart museum visitor into a regular patron was not parental encouragement or the entrance into a new tax bracket, but rather, having art lessons as a child. The most important factor however, between visitors and non-

visitors, was simply being offered the opportunity to visit the museum in the first place.^[21]

In 1999, the Smithsonian’s National Museum of American History featured an exhibit on the history of sweatshops in the United States. The exhibit, which covered a subject that was challenging for many visitors to the museum, provided a guest book for visitor comments. Mary Alexander, an educator employed by the Smithsonian, published many of her observations related to the visitors’ reactions and comments to the exhibit, which was entitled, “Between a Rock and Hard Place: A History of American Sweatshops, 1820–Present.” The following year, the results of Alexander’s study were published in the academic journal, *The Public Historian*. The exhibit is representative of attempts by museums to better understand—and subsequently cater to—their visitors. The process of documenting the audience’s reactions to an exhibition, studying these reactions, and then disseminating the results of the study in an academic journal would have been unheard of throughout most of the twentieth century. As Alexander’s study demonstrated, museum audiences were, by-and-large, understanding many of the complex and challenging themes presented in the displays. Alexander reported the comments of the visitors to museums in a fashion that might surprise some, arguing that their comments were “intelligent, articulate, sophisticated, and sometimes vehement.”

Several years before the Smithsonian exhibition on sweatshops in American history, the American Association of Museums developed a report entitled, “Excellence and Equity: Education and the Public Dimension of Museums.” The report examines museums and spaces of public education and offers 10 guidelines for improving and maintaining the role for museums well into the future. For the American Association of Museums, the changes occurring related to the professionalization of museum education represented progress. Analysis of this document can be found in Crew.^[22] The changes occurring in museums during the closing decades of the twentieth century did not go undisputed. In 1991, John Terrell, a Curator of Anthropology at the FMNH compared the contemporary museums to Disneyland, calling for a return of, “The Good Old Days,” when academic departments were responsible for the development of exhibition spaces. The problem with Terrell’s commentary, however, is that “The Good Old Days,” as he envisions them, never really existed. Terrell notes that while museum curators were responsible for exhibitions from the founding of the museum through the 1960s, the museum displayed some of its most popular exhibitions. What Terrell carefully ignores, however, is that some curators were not simply just “mediocre in their exhibit talents”; some curators deliberately misled the public and the press in order to push for greater attendance, including a notable example of Henry Field at Terrell’s own Field Museum in the display of a set of European human remains from the

Magdalenian Period. (Henry Field, upon the occasion of the display of the Field Museum's Magdalenian Girl.) Field called the display of the specimen a "chance to fire the imagination of Chicago."^[22] In connection with the skeleton, Field purchased an ivory harpoon point he claimed to have been found near the remains. Field began referring to the projectile point as the possible cause of death for the woman, and labeled it in the exhibition space as such. No archaeological evidence exists to make this claim, and it is unclear as to whether or not the projectile point even came from the same site at all. Despite the tenuous nature of the evidence, however, Henry Field, the museum, and the popular media, eagerly ran with the story. The museum and the press further speculated on the story of Magdalenian Girl's murder as coming at the hands of a jealous lover. By the time the remains arrived in Chicago, the press had latched firmly onto the story, splashing it on the front pages and further speculating on the circumstances of the prehistoric woman's death, and the public became fascinated. The first Saturday of her display, 22,000 visitors, a record crowd, came to view the skeleton firsthand.^[23] Despite the fact that over a decade had gone by since her first appearance in Chicago, lectures on the subject of Magdalenian Girl were still selling out following the Second World War, as long as they included dramatizations of the circumstances of her demise.^[24] In other words, possessing a doctorate in an academic discipline (like Henry Field) does not prevent an individual from being disingenuous or an effective communicator. On the other hand, educators with specialized knowledge of communicating ideas on a broad level have, on the whole crafted exhibits in museums which are arguably more interesting and entertaining than those developed by previous generations of scholars. My point here, of course, is not that educators are above the human temptation to exaggerate claims or make mistakes, but rather, that academic credentials does not prevent these types of errors. Like Dorsey before him, Terrell misjudged the modes of crafting the visitor experience in his own day-and-age. In the interest of full disclosure, the author is a former employee of the Field Museum.

Terrell and those still pining for a return to an age before the professionalization of education departments within museums would be wise to heed the words of A.E. Parr, the director of the American Museum of Natural History, who wrote upon the conclusion of the Second World War,

"... to see as the goal of reconversion only a reversal to an earlier state of happier memory, and to seek mainly the reestablishment of previous contacts with fellow sufferers rather than attempt to reenter the turbulent main stream which left them on its shores for a while. This is the deepest pitfall across the path of the natural history museums today."^[25]

Museums today understand their visitors and audiences much more effectively than throughout the course of most

of their history. Anecdotal assumptions about what makes a museum effective have been replaced in a successful manner with quantitative analysis. While visitor surveys and the hiring museum professionals with backgrounds in education have proven to be a positive development for these institutions, they cannot fully replace the casual observation of exhibition halls on a day-to-day basis. Curators would be well served to spend more time in their own exhibitions, working directly with visitors and observing docent tours rather than assuming they understand their constitution. Additionally, curators should avoid the assumption that their galleries were either more effective or possessed some a greater form of academic rigor in the "Good Old Days." While museums at the turn of the last century did, in fact, present a more complex exhibition of their subject matter, the over-verbalization and emphasis on theory made many exhibits more pedantic than effective. While the Victorian museum visitor would hardly recognize most of their own cultural institutions, museums, and their audiences, have largely profited from these developments.

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Museums as Place

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Abstract

Theoretical approaches to place have been the domain of geographers, sociologists, psychologists, and, to some extent, museologists and academics with an interest in culture and heritage. This entry positions museums within these theories, in particular exploring how contemporary museum practices deal with place representation. Particularly relevant here are the changing nature of places caused by globalization and migration. Alternative approaches to exploring places enshrined in the philosophical approaches of ecomuseology are also discussed.

INTRODUCTION

Place is a complex concept, and few places are as potentially emotive as the museum environment. Place is inevitably linked to concepts of identity and community; museums attempt to construct the identities and histories of places and their communities, making them institutions with challenging responsibilities. This entry reviews the theoretical approaches to places that have been explored by geographers, sociologists, and psychologists and attempts to position museums within them. Globalization and the changing nature of places are of increasing relevance to museums and are discussed briefly before exploring views about place representation enshrined in the philosophical approaches of ecomuseology. Here geographically defined places and the complexities of their landscape, natural resources, archaeology, history, and contemporary culture offer an alternative museum model for the celebration of the tangible and intangible characteristics of place.

THEORIES OF PLACE AND THEIR RELEVANCE TO MUSEUMS

... Les Salants is dead throughout the summer, panting and parching in the wind and heat. But to me, it's still home. Not the most beautiful place in the world, or even the most welcoming. But it's my place

—Joanne Harris, *Coastliners*

The image that Joanne Harris paints of her fictional village of Les Salants, located on a small island off the coast of Brittany, France, is that of an imperfect place; isolated, desolate, and inward-looking, it is a place rich in family rivalry and feud where the community scrapes a living

from the sea. Nevertheless, despite its frailties and uncertain future, for the central character it remains “my place,” a place—according to the islanders—to which “everything returns.”

All people have their own place, or perhaps several places, where they feel they “belong.” Terms such as “belonging,” “sense of place,” “identity,” and “community” are all related to—or confused with—ideas about place. Perhaps it is unsurprising then that place, and the more elusive “sense of place” have been a research focus in several disciplines, including geography, anthropology, ecology, psychology, sociology, and cultural and heritage studies. A variety of terms seeking to capture the relationship between people and place, including “sense of experience,”^[1] topophilia,^[2] place identity,^[3] place attachment,^[4] and insidedness, local sentiment, or community sentiment^[5,6] have been coined. Discussion has sought and found inspiration from cross-disciplinary evaluation.^[7–9] So, for example, although the physical geographer may examine place as a defined geographical entity, “the sentiments of attachment and detachment that human beings experience, express and contest in relation to specific places”^[8] have been increasingly examined by human geographers as a result of psychoanalytical, social, and environmental approaches. Place lies at the heart of human geography^[9] with Yi-Fu Tuan, Edward Relph, and Anne Buttimer being regarded as pioneers in reflecting on place and “sense of place” from experiential perspectives.^[10,11] These three authors’ understanding of place puts people at the heart of the concept. Tuan^[12] reminds us that a sense of place goes beyond aesthetic appreciation, while Relph^[13] demands that we examine the idea in terms of “authenticity”; Buttimer^[14] argues that place is something that must be experienced rather than described. All emphasize that place provides “a world of meaning.”^[11]

Tuan^[15] sees space and place as mutually defined terms: “what begins as undifferentiated space becomes place as we get to know it better and endow it with value.” Similarly Casey agrees that the place must be experienced: “there is no knowing or sensing a place except by being in that place, and to be in a place is to be in a position to perceive it.”^[16] This has resonance with Escobar’s^[17] view that place is not simply “a constructed reality”—a physical space—but it is also “a category of thought,” a conceptualization of identity. This is an important issue for museums, because they also seek to conceptualize place. Museums also add an additional layer of complexity because they frequently attempt to portray a place not only as it can be experienced today, but also seek to create a vision of a place at an earlier point in history. Museums may attempt to take us back to the mediaeval past when discussing social histories, or deep into the Mesolithic to explain archaeological finds, or into the Mesozoic to explore dinosaur diversity. Dioramas of environments, re-created streets, house interiors, immersion habitats, and digitally created worlds are all utilized by curators and designers to create illusions of places past and present, attempting to provide a “real” and truthful experience.

There is an interesting contrast then between the illusion of places and events that museums create within their walls, and the experience the visitor has at a heritage site. These *in-situ* encounters with place and the past become part of our lived experience and may—arguably—be more meaningful as a result. Smith^[18] regards this “affect” of place as being of particular significance in order to understand the meaning of heritage and heritage sites. She writes:

Heritage as place, or heritage places, may not only be conceived as representational of past human experiences but also of creating an affect on current experiences and perceptions of the world. Thus, a heritage place may represent or stand in for a sense of identity and belonging for particular individuals or groups.

If the word “museum” is substituted into this paragraph for the term “heritage” it makes equally sound reasoning. The idea of place is vital to our understanding of the significance of museums to society, helping us to comprehend—and question—the role museums have in constructing identity.

Place theories make us ask what meanings and values are museum buildings—as place entities themselves—endowed with? With their imposing architecture and sense of power, permanence, and purpose museums are an essential feature of our mental maps of familiar places. They are a reference point in our physical landscape and help us to navigate spaces. So, for example, the museums that grace the waterfront of Stockholm (Sweden) are signifiers and guides to the physical and cultural landscapes

for local people and tourists alike. For the local person with a strong attachment to place and memories of childhood (and later), visits to a local museum building are also significant in placing museums within our cognitive geography. It is accepted that memory and place are strongly connected and Casey suggests that “we might even say that memory is naturally place-oriented or at least place-supported.”^[19] Hummon^[5] also addresses the social dimensions of place and the emotional investment and meanings attached to it. Of especial interest to museums are his views on the personal and social meanings of place, how a “symbolic locale”—such as a museum building—serves as an extension of self and community identity. For many people then, museum buildings are a part of the tangible landscape and consequently important in their own right through providing a beacon for a sense of belonging and a symbol of permanence.

The notion that “place provides a world of meaning”^[11] demands that we question how museums construct and convey meanings and values about a place—its history, its natural environment, its cultural landscape, and its people—and how they represent a range of identities and memories. How do museums help their visitors to position themselves within a community, to find a “place” in the social, cultural, and physical world, to affect them? Museums are a cultural tool that societies, communities, and even nations have used to construct and express a sense of identity and belonging, but what elements of place feature in the collections held by museums, and are there restrictions on what can be exhibited to represent place? How are objects selected from this store of artifacts to construct “truth,” a narrative about a place, peoples, histories, or events that took place there?

Before exploring these ideas further, it is essential to discuss the nature of museums themselves. All museums are not the same, indeed, their diversity is extraordinary. They can be managed and financed centrally by the state, by local authorities, by charitable trusts, and by private individuals. They may exhibit specialist collections or hold a diverse range of artifacts and specimens. They may have high levels of funding and professional staffing or be small volunteer-run institutions. They may identify their audience as being international or national tourists, or only local people; they may appeal to elite audiences or they may regard themselves as being family oriented. They can be located in large cities or in remote rural areas. All these variations influence how individual museums determine their role in society, and consequently how they might wish to interpret their place. What image of “their place” might they attempt to portray in their exhibitions, and who makes those decisions? It is evident that the complexity and diversity of museums make it dangerous to generalize about the relationships between museums and place.

The situation is complicated further by the types of collections that museums have amassed over time.

Collections may be of international scientific and historic interest or be of purely local significance. Collections can have immediate or explicit links to local places (a locally collected herbarium, a collection of local landscape paintings, or ceramics from a local pottery) or may gain an association with a place over time, an inferred link. Thus a stuffed polar bear or a collection of French impressionist paintings held by a museum in an industrial northern city in the United Kingdom might not have explicit links with the immediate locality. Nevertheless, generations of local visitors have “appropriated” them; for local people these items constitute elements in the memories and knowledge of “their” museum in their city, they have become a part of their place.

Where does this leave National Museums and their “universal” collections? Large national museums, such as the Smithsonian, the British Museum, or the Louvre, portray a global view of place. The British Museum, for example, does, of course, hold collections which enable it to interpret aspects of British history but most of its galleries present a global perspective, using artifacts to celebrate ancient civilizations and the diverse cultures of the world. These exhibitions also represent Britain and the British as traders, explorers, and especially, as colonists. Objects exhibited here are not only a testament to humankind’s ingenuity and craftsmanship, but also a record of the acquisition of places and their natural resources, and of the subjugation of people. Perhaps it is unsurprising that the objects themselves, rather than people or place, are the principal focus of interpretation in the British Museum. For this reason much of the following discussion ignores national museums, as they say little about the more familiar places within which we locate ourselves.

What then are the key theoretical components of place that museums have to consider in relation to their audiences and their exhibitions? Relph^[13] places particular emphasis on time, suggesting that the length of time in a locality appears to play an important part in how it is perceived by the individual; other studies^[20] support the view that the longer a person stays in a place, the more strongly he or she is attached to it, and especially so if they were born there. Attachment may therefore differ between long-term residents and more recent immigrants.^[15,6] However, recent research^[21] in Lancashire (United Kingdom) has revealed that incomers have an ability to place themselves “in an imaginary landscape which is central to people’s sense of belonging.” The authors refer to this phenomenon of contemporary attachment to place as “elective belonging,” where “Belonging is not that of an individual to a fixed community rooted in place, but rather, one in which the place becomes valuable to the individual.”^[22] It appears that incomers grasp the opportunities places make available to them, and that they frequently become involved as active players in local social networks. Tuan^[12] suggests that an individual’s perception of place

also varies according to the stage of life he or she has reached, but other variables—for example, gender, education, religion, class, occupation—must also surely come into play. The nature of the person–time–place interaction demands that museums be aware of its complexity and of the range of knowledge about and attitudes to place that occur among its visitors. Long-term residents may have a very different place identity to that of more recent arrivals, but the latter may be more receptive to innovation by, and participation in the museum.

Museums can be confident that even though every individual has their own unique concept of place, strong elements of place are frequently shared with others.^[23] So, for example, in the redesigned (2007) galleries of Sheffield’s Weston Park Museum, two of the elements chosen to represent Sheffield (United Kingdom) as a distinctive place are its past and current involvement in the steel and cutlery industries, and the contemporary natural history of the wooded river valleys that are so characteristic of the city. The link is made between the valleys and their industrial archaeology as it was here that water powered early industrial activity. These attributes have been interpreted by the museum’s professional staff using a range of local objects and specimens from the collections, but also using local voices and experiences—in text and oral/visual presentations—to provide meaning.

The dynamic interaction between people and place—the creation of the cultural landscape—is particularly significant for museums. Lippard^[24] suggests that every individual interacts with place differently, whereas Agnew^[25] proposes that “Common experiences and interests create an emotional attachment and self-definition peculiar to the specific place in which the locales of enduring social relationships are concentrated. This is local identity or sense of place.” It would seem that this author regards a shared local identity as being the same concept as sense of place. However there are dangers for museums in these imagined, shared identities, the ways that communities “remember” the past. Watson^[26] illustrated how the subject matter for the new (2004) Great Yarmouth (United Kingdom) museum became focused on the herring fishing industry, the theme chosen by local people during an extensive consultation process as the most significant historical narrative for the town. Fishing surpassed all other suggested topics despite the fact that it was (short) seasonable work that even in its heyday (1913) employed only a small percentage (5.6%) of Yarmouth people. By 1968, only five boats were active and the demise of herring fishing in 1971 was not publicly mourned. Historical research indicated that other industries—especially tourism, and silk and crepe manufacture—had been far more important in establishing the town’s prosperity. However, in popular imagination, fishing had a deep historical legacy; it was a picturesque tradition where people lived in harmony with the sea and the coastal landscape, something that Great Yarmouth

people could identify with and be proud of. As a consequence, the new museum has proved to be popular and has been significant in restoring local pride. Due to the widespread public consultation, and the strength of collective memory about the fishing industry that this demonstrated, the museum had little choice but to embrace a myth about place and reinforce it.

So can museums ever construct and celebrate an “authentic” or “truthful” sense of place? By carefully selecting artifacts and stories that trigger an emotional response they may have the ability to do so, reminding visitors of significant moments in local history, or—as in Sheffield Museum—introducing the past through engaging media such as oral histories and by introducing the visitor to key elements of the tangible and intangible cultural landscape. However, Watson’s^[26] research reminds us that museums must recognize the complexities of place and history and Lippard^[24] hints that place must be interpreted from multiple perspectives. This is important for museums if seeking to reach a wide audience, and especially so when dealing with “difficult” histories. For example, Crooke’s^[27] discussion of the presentation by museums of the contested histories of conflict in South Africa and Northern Ireland clearly demonstrates the value of presenting multiple, contested viewpoints about places and their histories.

Identity, including place identity, is not only socially constructed but also constantly shifting. Thus although the distinctive characteristics of places can to an extent be quantified at a point in time by identifying key tangible and intangible elements, for example using the “Parish Maps” and “Illuminated Alphabets” promoted by Common Ground,^[28–30] the dynamic nature of “local identity” and “sense of place” is much more elusive, it is a chameleon concept. Shifting identities pose a real challenge for museums and demands that they collect contemporary evidence to represent changes in place. Some disciplines in museums, for example, art or archaeology, find this more challenging than others. However, other museum specialists—social historians, anthropologists, and natural scientists—are continually documenting change not only by collecting objects and specimens but also using digital recording media. So while not all museums will dedicate efforts to this goal contemporary practices in collecting have been reviewed by many individual museums. At Te Papa (New Zealand):

Since the early 1990s, collection development has increasingly aimed to represent the visual culture and history of Pacific peoples in New Zealand. The scope is broad and ranges from contemporary high art and fashion through to new forms of weaving, *tīvaevae*, and *tapa* that migrants have brought with them to New Zealand. Complicating this changing curatorial focus is the fact that many island-based communities have become more transnational in nature as a result of developments in telecommunications, air travel, email, and print media.^[31]

Such strategic approaches to documenting a changing material culture that reflects place are now a feature of most museums’ collecting policies. Museums—as Te Papa does—must also acknowledge that new communication media enable people to be more aware of their place by making comparisons with the homelands of other communities.

The dynamic and emotional dimensions of place enable Cresswell^[9] and Lippard^[24] to propose that place is somewhere to be lived, experienced, and explored from inside. In contrast, an outsider, or visitor, can only observe “landscape” as they lack the longer term, intimate experience of a place. Similarly, Cross,^[6] proposes that sense of place is comprised of two aspects: relationship to place and community attachment. Anyone can build a relationship to place, even temporarily as a visitor, but she emphasizes that communities—insiders—relate and attach themselves to a place in many ways, and that those processes and feelings about place are dynamic. Hummon^[32] also sees sense of place as having two separate features, namely an interpretive perspective on the environment and an emotional reaction to it. While these theorists fail to address how the transition from outsider to insider, or from not belonging to belonging occurs, these views suggest that museums can never really provide a true experience of place for insiders, those communities that belong. Museums can interpret place but cannot convey the emotional dimension that locals have, simply because emotional attachment to place lies in the locality, not inside the museum. This is something of a paradox as most local or regional museums regard local people as their key target audience. So in order to best interpret place in museums, we firstly need to be aware that continual revision of ideas and concepts in exhibitions is necessary to successfully capture its dynamic local nature and secondly, to try to provide an emotional, affective experience. Ultimately museums have to make choices not only about the vision of place and the histories of place that they wish to portray, but also *how* places are interpreted. To really affect visitors they need to employ a full range of media and innovative design techniques, but in truth full representation of place will always be out of reach, an illusion.

If place theory tends to suggest that most museums will deliver an interpretation of place for consumption by “outsiders,” this may help to explain patterns of museum visiting by holiday-makers or tourists to local museums, where people are making an investment of time in order to better understand a place. However, these theoretical approaches fail to totally explain why some museums (such as Glasgow Museums, Scotland, or the Watercolour Museum, Tjörn, Sweden) appear to develop an emotional relationship with their local communities, encouraging ownership and involvement, while many other museums fail to do so. O’Neill^[33] links the success of Glasgow’s museums in terms of community relationships to the organization’s drive to create a more positive identity of the city and its

people, so that it is a place its inhabitants are proud to belong to.

Proshansky et al.^[34] use the term “place identity” to approach this issue of how individuals react to “their place,” linking their ideas to notions of the self, or self-identity. They define place identity as “... cognitions [that] represent memories, ideas, feelings, attitudes, values, preferences, meanings, and conceptions of behavior and experience which relate to the variety and complexity of physical settings that define the day-to-day existence of every human being.”^[35] The authors attribute five functions to place identity, namely recognition; meaning; expressive-requirement; mediating change; and anxiety and defense. Of particular relevance to museums is the recognition function, which affirms a sense of continuity and environmental stability by allowing an individual to recognize their physical world; museum exhibitions can reinforce feelings of historical attachment and permanence of place. The “meaning function” that serves as the source of an individual’s perception of place and their behaviour is also interesting in terms of how visitors react to museum environments or “museum places”; quiet and reflective gallery spaces may play a role in allaying anxiety. The notion of mediating change is interesting for museums, and may help us to understand how Glasgow’s museums (mentioned above) have created an emotional bond with their local communities. The transition from once industrial city to a city of learning and culture has certainly been aided and supported by the museum’s vision of Glasgow as place; here we observe the museum as both mediator of change and advocate for place.

For Proshansky et al., place identity is predominantly cognitive. By contrast, Dixon and Durheim^[36] propose a discursive approach to place identity, relocating its construction from “the vault of the mind” to “the flux of human dialogue.” They suggest that actions such as “blaming, justifying, derogating, excusing, excluding and all of the other things people do with words” construct place. Museums can be identified as an element in this “flux of human dialogue”; they have the potential to act as an inclusive venue for discussion about place identity with their communities. The need to consult with all communities is especially important for museums, where the concept of multiple voices and multiple interpretations of places and their histories is gradually being accepted. Previously “hidden histories” and untold stories have begun to emerge as part of wide-reaching postmodernist changes in practice in museums.^[37,38]

PLACE, COMMUNITIES, AND IDENTITIES IN A GLOBAL WORLD

In the early 1990s, globalization theorists revitalized concerns about the demise of local identities, the loss of place. They argued that due to the movement of peoples, objects,

capital, and information across large distances, life for most people is not restricted to one place, to a defined locality with fixed boundaries. New media of communication played a crucial role here, enabling rapid contact over long distances, leading to the instability and fragmentation of face-to-face community exchanges, which for some writers^[39] was the essence of social life. Other developments—shopping malls, corporate logos, fast food—pointed to the dilution of the unique nature of places and the emergence of “placelessness.”^[13]

However, by the mid-1990s, a different view of globalization began to appear^[40–42] that explored how globalization could encourage the reworking of social relationships and generate new approaches to localization. Central to these arguments are that place, or the local, are not subsumed by the national or international, rather that nation or the region are composed of innumerable places; in Lefebvre’s words “the worldwide does not abolish the local.”^[43] Robertson popularized this view as “glocalisation” where “globalisation has involved the reconstruction of ‘home,’ ‘community,’ and ‘locality.’”^[44]

So how do we think about our place—the local—within a globalized world? Massey’s^[41,45] views on “progressive sense of place” are especially helpful as they demonstrate how individuals move into and out of places; this can happen irregularly or with a regular pattern. Massey regards “coming and going” as crucial to understanding how people develop or perceive their relationship to place. The implication here is that knowing another place, or other places, is essential to understanding your own. Appadurai^[46] takes this argument a stage further by suggesting that localities are socially produced through processes of boundary definition; delineating the boundary of place is achieved by making comparisons—aided by global flow—with adjacent places. Individuals and communities create a shared identity that provides boundaries that lie beyond physical features such as fences, walls, rivers, or mountains. The line drawn between communities, between places, is socially constructed, invisible, and dynamic, and often difficult to define.^[9,39,47] Consequently globalization makes us question firstly the nature of the communities museums are attempting to serve, and secondly how local places should be represented by museums in terms of the different reconstructions of “locality” and “place” influenced by globalization.

One major feature of globalization is the movement of peoples. Hall^[48] refers to the concepts of the “contact zone” and transculturation to explore how culture and identity is constantly changing through these interactions and mutual influences. He argues that intense encounters with different cultures, where one identity negotiates with the “copresence” of another identity or identities and where elements of cultures fuse together, lead to identities with multiple frames. Diaspora discourse has been significant in terms of understanding place; indeed, these views

about shifting cultures are also true for place identities. Consequently museums must try to acknowledge and reflect such dynamism. No single identity is pure and is “always already ‘the product,’ in part, of a long history, of connections with the beyond, with other places.”^[49] A place can also be “hybridized” under multiple influences through the passage of time, and museums need to respond to and document such change. One relevant example here is Sheffield Museum’s (2008) temporary exhibition on Sudanese immigrants to the Yorkshire city, which explored the reasons for their migration, the ways in which they have adapted to new lives and developed new communities, and how they feel now about their homeland. Similarly Tyne and Wear Museum’s temporary exhibition (2008) “Destination Tyne and Wear” uncovered and described the history of the region’s migrant communities and demonstrated how they helped to shape its culture from the nineteenth century onward. Immigrant voices are used to give powerful and emotive recollections of movement and settlement, demonstrating how the import of new ideals, new cultures, has enriched the region, creating a new, vibrant, and changed culture. The exhibition reflects on the ways that the region has become a different place, but one that all its inhabitants can share pride in.

Some observers feel that immigrant individuals and families cannot immediately identify with places (and hence their museums) because they are strangers; this feeling of “not belonging” can be even stronger for refugees and exiles “who did not leave their homes voluntarily.”^[50] However, this conclusion is refuted by researchers who, in relation to their study group in Lancashire, state that

... we agree with proponents of globalization theory. Although in our four locations there continue to be people who live in the vicinity of where they were brought up, these are not necessarily the people who feel they belong there. It is the perceptions and values of incoming migrant groups, which more powerfully establish dominant place identities and attachments ... people’s sense of being at home is related to reflexive processes in which they can satisfactorily account to themselves how they come to live where they do.^[51]

This research is significant for museums, reminding them that incomers rapidly adapt to new places and adopt a sense of belonging to that place. Strategic approaches for museums require inclusive recognition of its multiple communities.

Interestingly, Halls’ “back-to-basics” model of cultural change, invites a different response to globalization, one that turns inward to more “closed” definitions of culture and place with “the revival of an attachment to more ‘local,’ or fixed, or placed aspects of culture.”^[52] This model is reflected in the continuing growth of small museums dedicated to celebrating place at a local scale. The *hembygdsmuseum* movement in Sweden, for example,

a network of some 1400 small social history museums, seeks to capture and even fossilize place and time by conserving vernacular houses, landscapes, and their associated material culture.

Similarly, concerns for the general “loss of place” has led to movements which emphasize local culture and heritage and attempt to defend local distinctiveness. However, Harvey^[39] notes that place is always subjected to influences beyond its immediate boundaries and consequently by the need to adapt. Places compete against each other for capital investment, production, and consumption, yet decry the loss of distinctiveness and authenticity. Similarly, Massey^[47] argues that places cannot be understood without the “consciousness of its links with the rest of the world” and asks that the possibility of developing a progressive, “global” sense of place be considered. This global responsibility is echoed by several new museums, including the Museum of World Culture in Gothenburg, Sweden, which promotes the world as place, and creates exhibitions on subjects such as *Aids* and *Human Trafficking* that reflect connections across the world rather than divisions and difference.

PLACE AS MUSEUM

Interestingly, Tuan regarded museums as poor channels to communicate place because “[t]he museum, after all, consists wholly of displaced objects”^[53] and “[t]he effort to evoke a sense of place and of the past is often deliberate and conscious.”^[54] Tuan rejects the creation of a sense of place using artifacts and artificial situations. Other researchers^[55] have similarly suggested that:

It might be argued that the complexity of place and what it represents to individuals and communities [means] that the traditional museum can never capture its elusive qualities. It is impossible for the curator to acquire place, carefully label it and store it in an acid-free container. Museums can acquire fragments of place, and exhibit them together to re-create their version of place, but that is all. The essence of place lies beyond the museum, in the environment itself, and is defined by the individuals and the communities that live there.

So is a different museum model required to try to capture and celebrate places? Place theory indicates that individuals and communities attach deep significance to their place and particular sites within it. Various mechanisms exist to conserve the sites or objects that possess special significance, at every level from the World Heritage Site to the Tree Preservation Order. So, for example, in England the preservation and interpretation activities of English Heritage, Natural England, and the National Trust have helped to proclaim the significance of heritage sites, adding labels, signposts, or other markers in a process that has witnessed the “musealisation” of place. “Experts” who

attach their own meanings to sites or objects have largely carried out these processes, not the local people or visitors who experience them. There is a paradox here, in that these organizations declare what is important on a national scale, but until recently have only rarely taken local needs or interests into consideration. This can mean that the features of the immediate environment that local people value most may not be protected, and even where they are that the associated histories or stories told are too “academic,” irrelevant or take no heed of local knowledge.

A new museological approach demands two important changes in attitude. The first of these, the realization that the museum has a role in documenting places (sites) beyond the walls of the museum as well as constructing place in its exhibitions, has been largely accepted. The second demand—community empowerment—is beginning to be met in developed, and some developing, countries. One new philosophical approach that recognizes these needs is ecomuseology, which has the potential to provide local people with a process for rescuing fragments of heritage, a building, redundant factory, a habitat, intangible heritage, or a way of life from loss or destruction, and also helps them to express a deep conviction to preserve and deepen their sense of place.

Empowerment became a key feature of ecomuseum philosophy and practice as it emerged in the late 1960s and early 1970s.^[56] Its two main proponents, Hugues de Varine and Georges Henri Rivière (1897–1985) were central to the development of new ideas about place, communities, and heritage. The first experiments with ecomuseology occurred in French Regional Natural Parks and other rural areas in the late 1960s. Later developments focused on postindustrial urban areas, most famously at Le Creusot-Montceau in Burgundy (1974).^[57] The latter established not only political, social, and regeneration ideals but cemented the concept of the “fragmented museum,” which encouraged the visitor to explore the local area by visiting several local heritage sites. This split-site approach has since become the most common feature of ecomuseums worldwide. By this time the ecomuseum had taken the notion of place, expressed as “territoire” (territory), as a cornerstone of its philosophy and industrial heritage had been identified as of particular significance, a situation that was in tune with the growing “industrial museum” movement of the 1970s.

The word “ecomusée” was devised in September 1971 by De Varine to express new museological approaches to community–heritage–place interactions. Rivière’s^[58] definition of the term ecomuseum includes many of the key concepts—local identity, territory, landscape, a sense of history, and continuity—that appear to be important in creating a sense of belonging. Perhaps the most significant features of Rivière’s definition are the repetition of the word “population” (the emphasis on communities) and the idea of the ecomuseum having “limitless diversity,” a suggestion that the ecomuseum can be anything local

people and museum professionals want it to be, and that it is a malleable concept.

One of the most interesting features of Rivière’s definition^[58] is the comment that “it is an interpretation of space—of special places in which to stop and stroll.” Here is the link to place—the ecomuseum is not limited to a building or even a museum site, but it encompasses everything within the region it refers to as its “territoire.” Here, key sites have special meaning and are integrated into the museum. Heritage is not defined, but the assumption is that it is more than just sites and material culture, encompassing memories, folklore, music, and song. At the extreme, the ecomuseum includes everything within its territory. Intangible local skills, behaviour patterns, social structure, and traditions are as much a part of the ecomuseum as the tangible evidence of landscapes, geology, wildlife, buildings and objects, and people and their domestic animals. As Van Mensch^[59] observed “it has become increasingly difficult to discern where the ‘museum’ stops and the ‘real world’ begins.”

There have been many attempts to state succinctly what an ecomuseum is. Rivard^[60] compared the traditional museum (= building + collections + experts + public) to the ecomuseum (= territory + heritage + memory + population). Varine suggested that the label “ecomuseum” was nothing more than an opportunity to run with new ideas, to be imaginative, and to initiate new ways of working.^[61] Despite the problems of definition, the flexibility of the ecomuseum model has meant that some 400 are now found worldwide, on every continent, with the recent growth in Asian countries being especially marked. Here, the processes of creating ecomuseums have been frequently linked to meeting demands for sustainable tourism, encouraging conservation, and interpretive practices of places that will ultimately benefit local people. It is this trend that led Davis^[62] to define the ecomuseum as “a community-driven museum or heritage project that aids sustainable development.” It is this link to economic development through low-level tourism that has encouraged the rapid adoption of ecomuseum practices worldwide. Now fully established in Europe, and especially France, Spain, Portugal, Italy, and Sweden, the concept is now emerging strongly in South America and especially Asia, with significant numbers created in Japan and China.

The one characteristic that appears to be common to all ecomuseums is their pride in the place that they represent. This is true whatever the nature of the ecomuseum, whether it be a rural farming community in mainland China, a scattered group of heritage sites on a Japanese peninsula, an old farm settlement in Brittany, or abandoned terraces in northern Italy. This pride is expressed in a variety of ways. It can be seen in the careful design of an exhibition, in the sheer pleasure people take in performing local music and dance, the pride in demonstrating weaving skills, or delivering bold and imaginative interpretation. Ecomuseums encourage dialogue with

local people as well as inviting visitors to explore their territory, which can only promote a better understanding of sense of place and local identity.

CONCLUSION

Museums have an affinity with places and their peoples. The origins of public museums in the nineteenth century are often associated with “local” or “civic” pride, the museum being perceived as a venue to reflect on the natural and cultural characteristics of a place and the achievements of its people. However, in the twenty-first century the rapidly changing nature of places—in terms, for example, of their spatial characteristics, ethnicities, and cultures—require museums to adapt to new needs and find different techniques—and new models—to engage with and represent changing local communities, and to construct images of place that meet local demands.

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Music Information Retrieval

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Abstract

This entry gives an overview of the area of music information retrieval. More specifically, it focuses on what has been done for retrieving polyphonic musical documents both in symbolic and audio forms. It also describes research efforts to combine symbolic-based and audio-based approaches.

INTRODUCTION

The spread of the Internet and the creation of the World Wide Web have offered exciting real-world problems for existing and novel theories and methods. Among the large amount of digital documents publicly available, there is a large number of musical documents, in various formats, that should be retrievable in musically pertinent and user-friendly ways.

This entry focuses on content-based techniques, as opposed to the text-based methods, developed for retrieving music from large databases of polyphonic music. In a typical setting the query pattern to be searched for is a short musical excerpt that can be given, e.g., by humming or playing an instrument, or by recording a snippet from a sound recording. In this entry, we divide the techniques in two categories depending on whether they are based on symbolic or audio representation. In general, the symbolic methods are appropriate for a *query-by-humming* application, where an occurrence of a query forms only some portion of the whole polyphonic structure of the matching part in the database. The audio methods are used for *query-by-example* applications, where the query constitutes a possibly distorted snippet taken from the underlying database.

The symbolic techniques developed for content-based music retrieval are based either on string or on geometric representation. The “Symbolic Techniques” section gives an overview on techniques and results that are obtained by using these frameworks. In the section “Audio Techniques,” we provide a survey of different content-based problems using audio representations that have been proposed. The survey is structured based on the type of query used, the information extracted and the specificity of the desired results. Finally in the section “Bridging Symbolic and Audio Content-Based Music Retrieval,” we conclude the entry by some ideas on how to bridge the gap between the symbolic and audio techniques.

SYMBOLIC TECHNIQUES

Symbolic music representations, such as the Western Common Music Notation (CMN) or Music Instrument Digital Interface (MIDI), are most often used for storage purposes: they include detailed information for artists or, in the case of MIDI for musical instruments, how to perform the stored music. Although performances differ from each other, the listener still perceives them as the same musical works. This justifies the use of symbolic representations for content-based music retrieval purposes. The advantage of performing retrieval in the syntax level (i.e., using a symbolic representation as opposed to audio) is the possibility to search for occurrences that are embedded in the music structure, such as a melody line in a polyphonic orchestration—the occurrence may even be distributed among several instruments of the orchestration.

Choosing the representation. There are several important, intrinsic features of music and the application that need to be taken into account to have effective retrieval results, the most important being:

1. the inherent polyphony of real-world music,
2. location invariance to allow occurrences to reside anywhere in the database, not just in incipits (the “opening line” of the music; usually the first four bars of the melody),
3. transposition invariance to allow matching music in different keys,
4. time scaling invariance to allow matching music in different tempi, and
5. tolerance to “noise” caused by various sources (the database may contain unexpected musical embellishments, a conversion process may have caused errors, the hummed/played query pattern contains inaccuracies).

Together these five features form a complex problem field and they all have to be considered already when choosing a suitable representation.

Previously, the symbolic representations used for content-based music retrieval have been based either on string^[1–4] or geometric representations.^[5–10] Of the five aforementioned properties, the first one has the strongest impact on choosing an appropriate representation. As opposed to monophonic music, which is relatively naturally representable by using string representation, casting polyphonic music to linear strings^[11–14] is often not effective.^[15] However, string matching has been adopted to some restricted cases, as discussed below. When using the string matching framework, the properties (3) and (4) are dealt with at the representational level, the remaining ones by the methods solving the specific problems.

The geometric representations, on the other hand, accommodate equally and naturally to both monophonic and polyphonic music. This discrimination has led most of the recent studies on symbolic content-based music retrieval to focus on the geometric representations. With the geometric framework the properties (2–5) are typically dealt with the methods solving the problems.

Using String Matching Framework

Problem definition

When using the string matching framework, the polyphonic content-based music retrieval problem is casted to a slightly modified string matching problem. In this case the usual setting is such that the pattern to be searched for is monophonic while the database to be searched is polyphonic. To this end, let us represent both the musical pattern $P = P_1, \dots, P_m$ and the database $T = T_1, \dots, T_n$ as strings of sets of integers. Thus, in a string S (corresponding either to P or T) each S_i models a chord and is formally a subset of an integer alphabet Σ . Let us denote by q the size of the largest chord in S , i.e., $q = \max \{|S_i| \mid 1 \leq i \leq m, n\}$. The polyphonic structure may consist of K parallel monophonic *voices*. In such a case each S_i consists of pairs $\langle k, h \rangle_i \in K \times \Sigma$ in order to be able to track the voicing information. Naturally, if $q = 1$, S is monophonic; otherwise it is polyphonic. Each S_i thus corresponds to a chord of notes, and is comprised of notes having their onsets simultaneously. This representation is also known as *onset-based representation*.^[15]

The content-based music information retrieval (MIR) problem is as follows. Given a long database $T = T_1, \dots, T_n$ and a relatively short music query pattern $P = P_1, \dots, P_m$, the task is to find all locations in T where P occurs. Here an occurrence might mean an exact, transposed, or approximate occurrence.

We define that there is an *exact occurrence* of P at position j , if $P_i \in T_{j+i-1}$ holds for $i = 1, \dots, m$. Furthermore, there is a *transposition invariant occurrence* of P at position j , if there is an integer d such that each $(P_i + d) \in T_{j+i-1}$.

When both P and T are monophonic, an exact and a transposition invariant occurrence means that $P_i = T_{j+i-1}$ and $(P_i + d) = T_{j+i-1}$ for each i , respectively. A k approximate occurrence of P is found if there is a subsequence P' of T , such that P' can be obtained from P by using k or fewer editing operations. An *approximate transposition invariant occurrence* is defined accordingly.

Results

When dealing with the polyphonic content-based music retrieval problem, in some limited cases it may suffice to heuristically reduce the polyphonic music structure in a monophonic one and then apply classical string matching algorithms. See, for instance Blackburn and DeRoure^[16] and Uitdenbogerd and Zobel^[17] for such reduction heuristics. The power of the onset-based representation becomes evident when searching for *distributed occurrences* of the pattern. In such a case the pattern appears in consecutive positions within the database but may jump across the voices (or the voicing information is simply absent).

If transposition invariance is not needed the edit distance framework can be used in a straightforward manner.^[11,12,18] The combinatorial explosion in the transposition invariant case can be avoided by chopping the possibilities in n -grams (strings of length n).^[19] When the degree of polyphony is high, however, this may prove not to be an efficient solution because of the large number of generated n -grams. Another possibility is to split the pattern to bare intervals that are searched individually.^[13] This requires a two-pronged search: the candidates found in the first phase have to be examined in another phase to discard discontinuous patterns (the subsequent interval does not begin in the note where the former ends). When the voicing information is available, one can also look for a transposition invariant occurrence that minimizes the number of jumps across the voices.^[14]

Using Geometric Framework

Problem definition

Let us now introduce the geometric framework and consider the content-based music retrieval problems as point pattern matching ones. The points are real values in a d -dimensional real space $\mathbb{R}^d$; at times the space needs to be discretized to the integer space $\mathbb{Z}^d$ for efficiency purposes.^[5,7] In a typical case, music is represented by using two dimensions: one (horizontal) dimension represents the note *onset time* (i.e., when the associated note is to be invoked), the other (vertical) gives the *pitch* (i.e., the perceived height of the note) information. To consider the note durations, several extensions to this basic point setting have been suggested^[6,9,20] (see below).

In this way, the symbolic content-based music retrieval problems can be seen as special cases of point pattern

matching (an excellent tutorial to point pattern matching can be found in Mäkinen and Ukkonen).^[21] Let us consider this more formally. Given two point sets P and T , where typically $|P| \ll |T|$, both being finite subsets of $\mathbb{R}^d$ ($\mathbb{Z}^d$), the general task is to search for pairs (f, τ) where f is a transformation ($f \in F$) and $\tau \subset T$, such that $f(P)$ matches τ . To take care of the properties (2) and (3) (cf. above), the set of allowed transformations includes *translations*, denoted by F_t , where a constant vector is added to each point in P . Time scaling invariance (property (4)) is obtained by including *scales*, denoted by F_s , in which case distances to a common origin are multiplied by a constant. Depending on the application, a *match* may be exact or approximate; in the latter case an appropriate similarity measure needs to be selected. Please note that by definition, as opposite to the string matching case, an exact match allows “extra intervening” elements in T .

The most typical problems are exact point pattern matching and largest common pointset matching under translations. In *exact point pattern matching under translations* the quest is to find $f \in F_t$ such that $f(P) \subset T$. The straightforward way to include approximation in this is to allow a minimum number of unmatched points of P . To that end, the *largest common pointset matching under translations* looks for the largest $\tau \in T$ where $\tau \subset f(P)$ for some $f \in F_t$. The respective problems including scalings are defined analogously.

Results

In the following we assume that P and T are lexicographically ordered. (Let $(a,b), (a',b') \in \mathbb{R}^2$. In a *lexicographic order* vector $(a,b) \leq (a',b')$ if and only if $a < a'$ or $(a = a' \text{ and } b \leq b')$.) If that is not the case, they can be ordered in $O(|P| \log |P|)$ time and $O(|T| \log |T|)$ time, respectively. Moreover, recall that typically $|P| \ll |T|$.

Matching under translations. The exact point pattern matching problem under translations is solvable in $O(|P||T|)$ time and $O(|P|)$ working space.^[6] However, the solution has an expected running time of $O(|T|)$. For deterministic point pattern matching algorithms quadratic running times seem to be the lower bound.

THEOREM 1. [8] THE LARGEST COMMON POINTSET PROBLEM UNDER TRANSLATIONS IS 3SUM-HARD.

If we assume that $|T| = n$ and $|P| = \Theta(|T|)$, according to Theorem 1 an $o(|P||T|)$ time algorithm for largest common pointset would mean that there is an $o(n^2)$ algorithm for the 3SUM problem, which would be an unexpected theoretic breakthrough. (Given n numbers, the 3SUM problem is to find whether there are three numbers a , b , and c among them for which $a + b + c = 0$ holds.)

A straightforward algorithm solving the largest point pattern matching under translations runs in $O(|P||T| \log |P|$

$|T|)$ time.^[22] The algorithm calculates translation vectors from each point in the pattern P to each point in T . The translations are subsequently sorted in order to find the translation giving the maximal occurrence. With a better sorting routine the running time can be improved to $O(|P||T| \log |P|)$.^[6]

To date, no deterministic algorithm is known to solve the problem in a quadratic time. It may be that the largest point pattern matching under translations is also SORTING $X + Y$ -hard, in which case Ukkonen et al.’s algorithm may already be an optimal solution. (Given two sets X and Y of n numbers, the SORTING $X + Y$ problem is to sort the set $X + Y = \{x + y \mid x \in X, y \in Y\}$.)

By accepting that some of the true occurrences may not be found, faster solutions are obtainable. To this end one can either use subquadratic time approximation algorithms,^[8,9] or a solution based on discretized values and an indexing schema similar to inverted files used for natural language information retrieval.^[5]

Indexing. Exact solutions based on indexing face two major problems; let us assume an index T for T that is built in time $f(n)$. First, Theorem 1 implies that it is 3SUM-hard to create largest common pointset queries using T , working in $g(m)$ time and holding $f(n) + g(m) = o(n^2)$. Second, the number of the possible translation vectors is exponential in the length of T and, therefore, a total index would also require exponential space.

In addition to the inverted file approach, recently two more indexing schemes have been proposed. The first uses a *metric index* working under earth moving distance.^[20] However, it seems difficult with this approach to support translations or partial matching with polyphony. Another method is to use a sparse index and a statistical filtering approach to search for promising areas in T . This approach relies heavily on the power of filtration but seems to be several orders of magnitude faster than the online (nonindexing) algorithms, both in the exact point pattern matching and in the largest common pointset problem.^[10]

Note durations. There are several suggestions on how to equip symbolic representations with note durations. A natural idea is to replace the points (representing the note onsets) with horizontal line segments, where the length of the segment represents the duration of the corresponding note.^[6] Then the task becomes to search for a translation so that the segment patterns, representing P and T , intersect as much as possible. Interestingly enough, this modified problem is solvable in $O(|P||T| \log(|P||T|))$ time, and if reduced to integer space, in $O(|P||T| \log |P|)$ time.^[6] The space reduction also enables the use of a more general distance function considering consonance/dissonance aspects of the music in hand.^[17] Other possibilities include the use of earth moving distance when the durations are represented as the weight of the points^[20] or the use of a third dimension to represent the durational information.^[9]

Matching under translations and scaling. For the moment, it has not been widely studied how to have both translation and scaling invariance at the same time. The problem in combining these two invariances is due to that the former is an additive, while the latter is a multiplicative property. Recall that the translation invariance actually captures two features: transposition and location invariances. The obvious way to achieve scaling invariance would be the use of a logarithmic encoding of the time axis. That way, however, only occurrences starting at the origin chosen for the logarithmic scale would be found thus losing the location invariance.

A naïve solution for solving largest common pointset problem under translations and scaling works in time $O(|P|^3 |T|^3)$. First, the translation vectors are calculated, in a lexicographical order, from each point in the pattern to each point in the database. This gives $|P|$ increasing sequences of vectors (pairs of real values) each of length $|T|$. Then, each possible time scaling value is selected by choosing two vectors from two distinct sequences; there are $O(|P|^2 |T|^2)$ possibilities in this choice. For each time scaling value, the maximum co-occurrence between pattern and database needs to be determined. This can be done by checking whether each of the remaining $|P| - 2$ sequences (each containing $|T|$ vectors) includes a vector that accords with the chosen scaling factor. This is feasible in $O(|P||T|)$ time. These found candidates are to be verified by checking that the associated pitch intervals also match.

In order to avoid the high polynomials in the running time, it has been suggested to consider only those scalings that appear within a window whose width is chosen independently of the size of P and T .^[9]

AUDIO TECHNIQUES

A wide variety of different retrieval scenarios have been explored using audio-based techniques. In many cases they can be formulated as “query-by-example” applications in which the user provides a possibly distorted snippet and looks for similar music pieces in a large collection. Even for the cases where the “query-by-example” view is not a perfect fit it is a reasonable approximation. For example, genre or style classification can be formulated as a retrieval problem where given a piece of music or a genre label the system returns other pieces in the same genre or style. In addition even in the cases of systems with no notion of a query such as audio-based music browsing systems based on exploration many of the underlying techniques and algorithms are the same.

A rough taxonomy of audio-based MIR systems can be created along the following major “dimensions”: query type, extracted information, and specificity. Although for presentation purposes we describe these various stages and types of information separately, successful MIR systems typically utilize multiple of these stages and

representations. The citations provided are mainly representative of existing research and its diversity rather than being an exhaustive list.

Query Type

Probably the most common type of query is a piece of music in audio format (query-by-example). The goal of the MIR system is to retrieve other pieces of music from a large collections that sound “similar” to the example query. This problem is typically formulated as a nearest neighbor problem between audio content representations which are described in more detail below. Other query possibilities are based on metadata such as genre,^[23] style,^[24] mood,^[25] or artist name.^[26] These problems are typically formulated as classification problems and solved using a supervised learning approach. In such an approach the MIR system is “trained” to classify music pieces it has not encountered before by analyzing music pieces that have been labeled by a human. This is done in order to create statistical models that can predict the correct label with high accuracy for data that has not been encountered before. A variety of such “classifiers” have been proposed including Gaussian mixture models, decision trees, artificial neural networks (ANNs), and support vector machines (SVMs). More details can be found in textbook such as Theodoridis and Koutroumbas.^[27]

Although not as explored as the previous two approaches to queries another interesting possibility is for the user to “perform” some aspect of the desired returned results. Examples of such “performed” queries include beat-boxing,^[28] humming,^[29,30] singing,^[30] tempo by tapping, or even matching the retrieved music to the speed of jogging and more generally specific exercise goals.^[31]

Representations and Extracted Information

A variety of different sources of information can be used as the basis for creating audio music retrieval systems. To some extent the traditional musical aspects of melody, harmony, rhythm, and instrumentation have inspired similar types of audio analysis. The most direct modeling is through sequences of feature vectors that statistically represent the time varying timbral characteristics of a music piece. Frequently features proposed for speech recognition such as the Mel-Frequency Cepstral Coefficients (MFCCs)^[32] are utilized. MFCCs summarize spectral information (the energy distribution of different frequencies) by taking into account the characteristics of the human auditory system. Such features depend on the instrumentation of a piece, how the timbral “texture” changes over time as well as how humans perceive this information.

In other cases, for example in cover song identification or automatic chord detection, it is desired to have a representation that is related to the pitch content of the music

rather than the specifics of the instruments and voices that are playing. Although a full music score generated by an automatic transcriptive system could be used, unfortunately current transcription technology is not robust enough to be used reliably. Instead the most common pitch content representation is the Pitch and Pitch Class Profile (other alternative names used in literature are pitch histograms and chroma vectors). The pitch profile measures the occurrence of specific discrete musical pitches in a music segment and the pitch class profile considers all octaves equivalent essentially folding the pitch profile into 12 pitch classes. The pitch profile and pitch class profile are strongly related to the underlying harmony of the music piece. For example, a music segment in C major is expected to have many occurrences of the discrete pitch classes C, E, and G that form the C major chord.

Automatically extracting information related to rhythm is also an important component of audio MIR systems and has been an active area of research for over 20 years. A number of different subproblems within this area have been identified and explored. The most basic approach is finding the average tempo of the entire recording which can be defined as the frequency with which a human would tap their foot while listening to the same piece of music. The more difficult task of beat tracking consists of estimating time-varying tempo (frequency) as well as the locations in time of each beat (phase). Rhythmic information is hierarchical in nature and tempo is only one level of the hierarchy. Other levels frequently used and estimated by audio MIR systems are tatum (defined as the shortest commonly occurring time interval), beat or tactus (the preferred human tapping tempo), and bar or measure. For some MIR applications such as automatic classification it is possible to use a representation that provides a “salience” value for every possible tempo—e.g., the beat histograms described in Lu, Liu, and Zhang.^[23]

Beat analysis approaches can be characterized in different ways. The first and most important distinction is by the type of input: most of the earlier beat tracking algorithms used a symbolic representation while audio signals have been used more recently. Symbolic algorithms can still be utilized with audio signals provided an intermediate transcription step is performed—typically audio onset detection. Another major distinction between the algorithms is the broad approach used which includes rule-based, autocorrelative, oscillating filters, histogramming, multiple agent, and probabilistic. A good overview of these approaches can be found in Chapter 4 of Klapuri and Davy.^[33]

In many modern pop and rock recordings each instrument is recorded separately and the final mix is created by a recording producer/engineer(s) who among other transformations add effects such as reverb or filtering and spatialize individual tracks using stereo panning cues. Information about this production process can be reverse-engineered from the recording and although not strictly

musical in the traditional sense can be used to build more effective MIR systems. For example, the amount of stereo panning and placement of sources remains constant in older recordings that tried to reproduce live performances compared to more recent recordings that would be almost impossible to realize in a live setting. Stereo panning features have recently been used for audio classification.^[34]

Specificity

Given a particular query as well as a representation that captures relevant musical content information the user expects to retrieve a set of results that are “similar” in some way to the original query. A variety of different “similarities” have been explored with varying degrees of specificity. The most specific type of retrieval is audio fingerprinting where the goal is to return other instances of the exact same recording possibly subject to noise, minor edits (such as hand clapping removal), and audio compression.^[35] Audio fingerprinting can be used for discovering copyright violations as well as associating metadata with music pieces. Remixes also correspond to the same underlying recorded performance, however, with the addition of extra musical materials such as drum loops and beats. In cover song identification the goal is to find other recordings of the same song that are performed by different musicians and instrumentation.^[36] Content-based features for cover song identification must capture higher level musical constructs such as chord progressions and not be sensitive to instrumentation changes. Pitch and pitch class profiles are frequently used for this purpose. Artist,^[24] album and genre similarity^[23] although to some extent artificial tasks have the advantage that it is relatively straightforward to obtain ground-truth using existing metadata associated with files and therefore provide qualitative comparisons between different feature sets for describing audio content.

Specificity also relates to the amount of relevant results returned by the system which has implications about the methods used for matching. High-specificity results typically only return few relevant objects and therefore typically require calculating some kind of similarity or matching function between the query and all items in the collection. For low-specificity queries such as, e.g., based on a genre label the number of retrieved objects is typically much larger and therefore amendable to a different type of approach. When there is sufficient label data supervised machine learning techniques can be used to “train” statistical models of the data that can directly “classify” a music piece with a discrete category. Retrieval can then be more efficiently performed by randomly selecting pieces and returning as relevant only the ones that have the correctly assigned label avoiding full comparisons of the query with the entire collection.

Evaluation

Music information retrieval is a new growing research area and one of the major challenges that researchers have to face is evaluation. A lot of the early work in MIR and still a large part of existing work is performed with in-house datasets which makes systematic comparison of different approaches and algorithms impossible. Since 2005 MIREX (the MIR Evaluation eXchange) http://www.music-ir.org/mirex2007/index.php/Main_Page has been an effort to address this problem and provide comparisons and evaluations on common datasets. It is a community-based formal evaluation framework coordinated and managed by the International Music Information Retrieval Systems Evaluation Laboratory (IMIRSEL) at the University of Illinois at Urbana-Champaign (UIUC). Every year based on interest by the community a set of different tasks are proposed and research groups around the world submit their algorithms for comparative evaluation. One of the challenges with MIREX is that the datasets used are not provided to the participants and therefore all submitted algorithms must be executed at UIUC. This to some extent also prevents “overfitting” of submitted systems to the particular data collection. Browsing the results for each task is a great way to see what the current state of the art is and which groups are active in each task. There are multiple metrics that can be used to evaluate different systems even for the same task. In order to provide a rough picture of the current state of the art we provide representative results of the “best” performing systems for some of the MIREX audio-based tasks: genre classification 68.29% (7000 30-sec clips, 10 genres, MIREX2007), audio mood classification 61.50% (600 30-sec clips, 5 moods, MIREX2007), and audio artist identification 48.14% (30-sec clips, x artists, MIREX2007). All these results show percentage of clips correctly classified using a threefold cross-validation scheme where one-third of the data is used for testing and two-thirds for training and the process is repeated three times. Other results include audio music similarity 0.568 (100 random queries from 7000 songs, evaluated by human graders with a fine score between 0 and 10, score is the normalized sum of fine-grained human similarity decisions, MIREX 2007) and audio tempo extraction 94.29% (percentage of at least one tempo correct, MIREX 2006).

User Interfaces

Ultimately any MIR system needs to be used by humans. Music listening is a personal, subjective, enjoyable experience which automation should enhance and support. Therefore, the interaction with the user is a critical and essential component of MIR research that has been gaining importance as the field matures. One of the interesting directions in this area is content- and context-aware user interfaces that rely on automatic audio analysis

techniques to inform the visual presentation of music collections. Such interfaces typically employ content-based audio feature extraction as described previously followed by dimensionality/visualization techniques that map the extracted features into visual attributes or positions of objects. Self-organized maps (SOM) are used in the Islands of Music system to map audio feature vectors to positions in a two-dimensional grid which is colored using a map metaphor.^[37] Musicream utilizes principal component analysis (PCA) to assign colors to disks that represent individual music pieces and to adjust the playlist composition by using a water tap metaphor.^[38]

BRIDGING SYMBOLIC AND AUDIO CONTENT-BASED MUSIC RETRIEVAL

The obvious possibility for bridging symbolic and audio content-based music retrieval is to use an automatic polyphonic music transcription method for extracting a symbolic representation from an audio signal, and then to apply some of the methods described in the section “Symbolic Techniques.” Nevertheless, automatic polyphonic transcription is a hard technical problem for which there is no current general-purpose and reliable solution, although there has been remarkable progress in this direction.^[33]

In some cases it is possible to combine symbolic and audio content-based music retrieval approaches without requiring a full music transcription system. For example, it is possible to use the monophonic reduction (recall from the section “Using String Matching Framework”) in order to use symbolic queries for audio databases^[39] or to retrieve a symbolic score from a score collection by using a polyphonic audio query.^[40] More generally, the polyphonic audio-score alignment can be used to discover the respective parts of an audio signal and a score.^[41,42] An *off-line* application for such an alignment is in the back-end of a query-by-humming system: the back-end is needed in order to playback the part of an audio file that corresponds to the found occurrence, in a symbolic music file, of a hummed query. *Online* audio-score alignment is needed in computer accompaniment.^[43]

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Music Librarianship

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Abstract

This entry explores the major aspects of music librarianship beginning with a review of the core literature, types of music libraries, professional organizations, and music librarianship as a career. The general areas of acquisition, cataloging, classification, reference, and preservation are examined as they relate to the unique needs of music. Future challenges to the profession are summarized.

DEFINITION

Music librarianship is a specialization of librarianship that involves the acquisition, cataloging, and preservation of music materials in audio, visual, print, and digital formats and the provision of instructional and reference services to the users of these materials.

LITERATURE

In 1893, James Duff Brown^[1] wrote the first manual describing the organization of a music library. Books and collections of essays about music librarianship offering an historical perspective include McColvin,^[2] Bryant,^[3] McColvin and Reeves,^[4] Redfern,^[5,6] Jones,^[7] and Turbet^[8] written from the British point of view and Wallace,^[9] Hill,^[10] Bradley,^[11] Mann,^[12] Ochs,^[13] and Cassaro^[14] viewed from the American perspective. Additionally, Bradley^[15] compiled a collection of seminal articles published about music librarianship up until 1973. Timely essays summarizing the state of the profession appeared in *Notes*, the official journal of the Music Library Association, by Watanabe (1981),^[16] by Davidson (1993),^[17] and by contributors in the field in a special millennial issue.^[18] In *American Music Librarianship: a Biographical and Historical Survey*,^[19] Bradley acknowledged the pioneers who built collections, devised classifications, and developed cataloging codes. She later documented the literature of the field in her exhaustive bibliography *American Music Librarianship: a Research and Information Guide*.^[20]

TYPES OF MUSIC LIBRARIES

Academic Libraries

Academic music libraries primarily serve students, faculty, and visiting scholars. Collections are driven by the evolving curriculum of the institution and are important resources supporting its educational mission. Such collections tend to be interdisciplinary in scope and are augmented by musical archives of importance to the institution and the locale. Critical editions, study scores, sound and visual recordings, and monographs and periodicals on music-related topics form the basis of these scholarly collections. Depending on the curriculum, performing editions with parts are often well-represented in the collection.

Academic music libraries employ music librarians, frequently with advanced degrees in music, to administer the collection, develop and catalog it, provide instruction, and answer reference questions. The work of the music librarians is usually supported by library and/or student assistants.

Academic music collections may be incorporated within a general academic library or exist as a separate branch library. Often music collections were initiated in music departments and later incorporated into the administrative structure of the institution's academic library.

Research Libraries

Research libraries are administered by an organization, founder, or foundation. As a result, these collections may be more narrowly focused in accordance with the mission of the supporting body than their counterparts in

academia. Examples of research library collections may be found worldwide in societies, foundations, museums, and church, monastery, or other spiritual organizations, for example, the Moravian Music Foundation (the United States), the International Library of African Music (South Africa), Internationale Stiftung Mozarteum Bibliotheca Mozartiana (Austria), English Folk Dance and Song Society, Vaughan Williams Memorial Library (the United Kingdom), and Biblioteca Apostolica Vaticana (Italy). Staffing of these collections ranges widely. Research music libraries may employ music librarians with advanced degrees or expertise in specific areas of music. However, small collections may be administered by knowledgeable volunteers.

Conservatory Libraries

Conservatory libraries, at institutions such as the Curtis Institute of Music (the United States), Royal College of Music (the United Kingdom), and Sibelius Academy (Finland), serve students, faculty, and visiting artists. Similar to the academic library, their collections are driven by curricula; however, the emphasis is generally on performance and pedagogy. Performing editions with parts, orchestral excerpts, sound and visual recordings, and monographs on performance issues are augmented with the basic resources found in academic libraries. Conservatory libraries may also perform an archival role relating to the institution or to artists of local interest. Conservatory music libraries hire music librarians to administer the collection, develop and catalog it, provide access and bibliographic instruction, and answer reference questions.

Public Libraries

Public library music collections are shaped by the size and resources of the community they serve as well as the significance of local historical music events. They are funded by local government and most contain some music-related monographs and small popular music audio/visual collections. However, large public library collections such as those found in major cities are similar to research collections. While public libraries may maintain archival collections of local music history, the primary aim of the library is to circulate materials and provide access to members of the community. Public libraries with large music collections employ several music librarians. In smaller public libraries, the tasks of collection development, cataloging, and reference may fall to those librarians who have an interest in the subject.

Music Information Centres

Music Information Centres are national organizations that collect, document, and promote the music of the supporting country. Services are provided to anyone

worldwide with an interest in the music of the country. Collections include scores, recordings, and biographical and research materials. In addition to administration, collection development, cataloging, and reference, Music Information Centres are charged with promoting the music of their country through various activities. Since 1939, the American Music Center has served this purpose for the United States.

National Libraries

National libraries are generally responsible for “acquiring, cataloguing, and maintaining copies of the national bibliographic output and preparing the national bibliography.”^[21] These library collections combine characteristics of public and research libraries and Music Information Centres. Like public libraries, national libraries are funded by a government and provide services to its citizens. However, national music libraries are broader in their collection scope than most public libraries and may include scores, sound and visual recordings, and monographs and periodicals on music-related topics. Similar to Music Information Centres, they collect and promote the music of their country. Often they are required by legislation to serve as a repository for copyrighting newly published music and many also set cataloging and other policies for libraries in their country. Music collections in national libraries are staffed by music librarians. Some of the many important national libraries with substantial music collections include: the British Library (the United Kingdom), Bibliothèque Nationale de France (France), Bayerische Staatsbibliothek (Germany), Oesterreichische Nationalbibliothek (Austria), Biblioteka Narodowa (Poland), Rossiyskaya Gosudarstvennaya Biblioteka (Russia), and the National Diet Library (Japan). Though often considered a national library, the Library of Congress (the United States) was created to serve the members of Congress.

Performance Libraries

The purpose of a performance library is to meet the specialized needs of performers and performing organizations. These library collections include few of the music reference and sound and visual recordings found in other types of music libraries. In these libraries, the music librarian is responsible for obtaining the music needed for performance each season through purchase or rental, organizing and maintaining parts acquired by the organization, and marking parts with directions for performance as required by the conductor of the work. Librarians from many of these organizations are served by a professional society, the Major Orchestral Librarians Association (MOLA).

Because of its global lending policy and extensive holdings, the Edwin A. Fleisher Collection of Orchestral

Music, at the Free Library of Philadelphia, is the world's largest lending library of orchestral performance material.

Media and Broadcast Libraries

Significant changes have taken place in the collections of radio and broadcasting station libraries. In the United States, until recently, radio stations maintained large collections of physical recordings. With the rise of Internet radio stations, digitized collections are being amassed for streaming. Many traditional stations are digitizing recordings to offer content via both Internet and terrestrial radio.

In Europe, radio broadcast libraries, such as the British Broadcasting Corporation Music Library, traditionally provided scores for broadcast performances. Over time, some collections changed their focus as has Radio France, Documentation Musicale which originally provided performance scores for its orchestra, Orchestre National. It now acts as a national documentation center promoting contemporary music. In the past, Sveriges Radio Förvaltning, Musikbiblioteket commissioned works for radio and television performance, thus it contains autograph manuscripts of Swedish composers in addition to other performance scores.

PROFESSIONAL ORGANIZATIONS

IAML: International Association of Music Libraries, Archives, and Documentation Centres (<http://www.iaml.info>)

Established in 1951, IAML provides an international forum for music libraries, archives, and documentation centers with an interest in the collection, preservation, access, and dissemination of musical sources. Open to individuals and institutions interested in the goals of the association, this trilingual organization utilizes professional and national branches, subject commissions, committees, and working groups to accomplish its aims. Institutional and individual members number approximately 2200. National branches support IAML at the local (country) level. Communication is facilitated by the IAML-L listserv and the journal of the organization, *Fontes Artis Musicae*, published in English, French, and German. IAML holds a major annual conference, hosted in a different country, to encourage member participation.

IAMIC: International Association of Music Information Centres (<http://www.iamic.net>)

Since 1986, IAMIC has served as an international organization for the 41 Music Information Centres that make up its membership. IAMIC fosters the sharing of resources and collaborative projects to further the aims of the association. Recent projects include the *2009 IAMIC Annual*

List: a "reference for performers seeking to expand their new music repertoire."^[22] Communication is provided via *IAMIC News* on the IAMIC website. Like IAML, IAMIC's annual conferences are held in different countries to allow equitable opportunities for attendance.

MLA: Music Library Association (<http://www.musiclibraryassoc.org>)

Founded in 1931, MLA is a professional organization "devoted to music librarianship and all aspects of music materials in libraries."^[23] MLA's over 2000 members are primarily music librarians from the United States and Canada; however, membership is open to all institutions and individuals, regardless of professional status, who support the work of the association. MLA is composed of committees, roundtables, and interest groups which work to further the goals of the association. Regional chapters support MLA on the local level. Communication is promoted through the listserv MLA-L, an online newsletter, and the organization's quarterly journal, *Notes*. MLA publications facilitate the work of music researchers and librarians and articulate the responsibilities and training of the music librarian. MLA holds a major annual conference, hosted in a different area of North America, for information-sharing among members.

MOLA: Major Orchestral Librarians' Association (<http://www.mola-inc.org>)

Organized in 1983, MOLA is an international association which supports the work of librarians in professional performance organizations by sharing resources and information related to the performance library arena. As of January 2009, MOLA comprised 249 member organizations, representing over 400 individual librarians, and 18 individual honorary members. Members exchange information through the association's online discussion forum and a quarterly newsletter, *Marcato*. MOLA publications facilitate the work of the members and articulate the responsibilities and training of the orchestral librarian. Annual meetings are hosted by MOLA members.

MOUG: Music OCLC Users Group (<http://www.musicoclcusers.org>)

In 1977, MOUG was formed as a task force of the Online Computer Library Center, Inc. (OCLC) to examine issues regarding OCLC's implementation of the MARC (Machine-Readable Cataloging) music format for scores and sound recordings. From its early concentration on cataloging issues, the group expanded its scope to encompass the use of OCLC products in activities such as music acquisition and reference. Communication is facilitated by the *Music OCLC Users Group Newsletter*. Membership is open to individuals and institutions that are interested in

the goals of MOUG and, as of January 2009, totaled 207 personal and 229 institutional members. Because there is much overlap in membership between MLA and MOUG, annual meetings are held together.

ARSC: Association for Recorded Sound Collections (<http://www.arsc-audio.org/index.html>)

ARSC, founded in 1966, is of particular interest to music librarians since music libraries tend to have large collections of sound recordings. ARSC's mission is to share knowledge and education about recording preservation, cataloging, history, and copyright law. The Association comprises 1072 individual and institutional members. It publishes the *ARSC Journal* and a newsletter. Annual conferences are held throughout the United States.

IASA: International Association of Sound and Audio Archives (<http://www.iasa-web.org>)

Established in 1969, IASA promotes international cooperation between libraries, archives, museums, and private collectors that preserve recorded sound and audiovisual materials. As of January 2009, interest in the work of the IASA is reflected in its 215 institutional and 180 individual memberships. Members share expertise in digitization and preserving sound in electronic formats.

The association publishes the *IASA Journal* semi-annually, and also issues an electronic bulletin, and various technical reports. Annual conferences are held in locations around the world.

CONSIDERING A CAREER IN MUSIC LIBRARIANSHIP

The ability to read musical notation coupled with a background in singing or playing a musical instrument and/or participating in a musical ensemble is essential for carrying out the responsibilities of a music librarian. For example, music catalogers must be able to read musical notation to determine the form of a piece and other identifying elements, such as key, used in descriptive cataloging; those who purchase music and provide reference service must possess knowledge of musical notation to be able to select items for a collection and to answer questions that require score identification; and those who are in charge of binding music must understand how scores and parts are used to make appropriate binding choices.

Besides a library master's degree, music librarians need a broad background in music including substantial undergraduate coursework. Often a second master's degree in music is required for those preparing to assist academic scholars. A reading knowledge of foreign languages, especially German, is invaluable in working both with the

music and the secondary literature. Knowledge of current digital resources and applications is expected, and practical experience in the profession is valued. An excellent way to gain experience for entry into the profession is through an internship in a music library as part of a library degree-related graduate program.

The Music Library Association supports mentorship activities and its website^[24] offers information about job requirements, a directory of library school offerings in music librarianship, and up-to-date details about career prospects. In April 2002, the MLA's Library School Liaison Committee drafted a report^[25] outlining the core competencies of music librarians. Published in 2004, *Careers in Music Librarianship II*^[26] offers a realistic picture of the profession through essays by professionals in the field that describe their experiences as music librarians and their assessments of career path options.

While small collections may employ only one music librarian, larger collections are better served with at least one music subject specialist and a specialized music cataloger. Thus, career advancement may only be achieved through moving on to a larger institution or taking on more varied responsibilities in the current job. Some music librarians find that managing a music library provides excellent experience for advancement to library supervisory and administrative positions. On the other hand, large academic and public libraries that employ a number of music librarians may offer opportunities for advancement within their library organizations.

DEVELOPING COLLECTIONS

Typically, music libraries contain books on music, audio and visual recordings, music scores, and specialized reference tools, indexes, and periodicals. The large collections of printed music and sound recordings make music libraries unique. Many music library collections originally focused on Western classical music and have expanded their scope to include popular genres and world music.

Acquiring music materials is challenging because they are published in multiple manifestations and recorded in different versions. In addition, the same work may be published under different titles in different languages, further complicating the issue. Traditional book vendors rarely handle music scores so acquiring these materials requires working with specialized music vendors and publishers. Book vendors may handle recordings; however, obtaining foreign and specialized labels can be challenging and require the services of knowledgeable recording vendors. Fling's *Library Acquisition of Music*^[27] presents a detailed examination of the music acquisition process and its inherent complexities. *A Basic Music Library*,^[28] now in its third edition, was written to identify what

constitutes a music library core collection of scores and recordings.

Scores

Music librarians acquire scores in different manifestations for different purposes. As Krummel observed, “Musical documents are physically distinctive for reasons which are essentially musical” (p. 327).^[29] Scores are published in different formats to meet users’ needs. For example, in the nineteenth century a market developed for scores to be used by concertgoers, who wanted scores to follow while listening. To be portable full scores were published in a reduced size that could easily slip into a pocket. Today, these scores are referred to as miniature, pocket, or study scores and are often used by students in analyzing music.

Likewise, the demand of musicians for scores to study and perform resulted in the publication of piano-vocal scores, also called vocal scores. Piano-vocal scores feature the orchestral music reduced or arranged for piano while maintaining the original vocal parts. These types of scores can be used by vocalists to rehearse their parts without requiring the full instrumental accompaniment.

Those interested in performance practice seek historical/critical editions of scores prepared from an in-depth examination of all known primary sources. These scores present the most authoritative versions of a musical work as scholars in the field have determined. A critical report, detailing the editorial practices, identifying the autograph and/or copyist’s manuscripts consulted, and outlining research issues, often accompanies each volume. Music librarians may spend a good portion of their acquisition budget on standing orders to obtain these scholarly critical editions of music.

Scholars want to consult a composer’s manuscripts, sketches, and the earliest printed editions of music to determine a composer’s intentions. When original materials are unavailable facsimiles are sought. Researchers also seek access to modern scholarly editions that reflect current scholarship.

Performers who use a music library may range in skill from beginners to professionals. For the less-skilled amateurs simplified editions, in which the composition has been reduced to the basic thematic line and an easy accompaniment, are requested. Skilled musicians look for scores reproduced with sensitivity to the intentions of the composer that do not dictate performance practice through editorial accretions. Modern publishers use the term *Urtext*, “original text,” for performing editions that attempt to distinguish editorial markings from those of the composer. Editorial practices used in producing *Urtext* editions vary by publisher. Performing editions may include indications of fingering, bowing, phrasing, tempo, and articulation markings not found in the composer’s manuscript.

Some libraries collect octavo and sheet music. The term “octavo” originates from the size of the paper folded into eights and is the size commonly used in publishing choral music. Sheet music is printed on large unbound sheets of paper and is the format commonly used for popular music. The late nineteenth and early twentieth centuries witnessed the heyday of sheet music publishing. Sheet music is of historical interest for its song texts and illustrative covers that document events and offer insights into the popular culture of the period.

Unique sheet music collections in the public domain, such as the *19th-Century California Sheet Music Project*,^[30] have been digitized to make the collections available for online viewing. Duke University,^[31] the University of California at Los Angeles,^[32] Johns Hopkins University,^[33] and Indiana University^[34] maintain their own sheet music websites and also make their collections accessible through the catalog of the Sheet Music Consortium. The Consortium, hosted by the UCLA Digital Library Program, works to build an open collection of digitized sheet music using the Open Archives Initiative standards.^[35] Their website facilitates searching sheet music collections from many institutions, including the Library of Congress, through a common interface.

Like digital sheet music collections, access to electronic music scores is a recent development. Begun as the Variations Project, Variations2^[36] for scores brought Indiana University to the forefront of digitizing music. The Sibley Music Library at Eastman^[37] and the Eda Kuhn Loeb Music Library at Harvard^[38] are examples of other libraries that have digitized scores in the public domain and offer access through their library websites. Collaborative websites of content-related library holdings, such as *CFEO: Chopin’s First Editions Online*,^[39] are also new developments. In 2007, the Internationale Stiftung Mozarteum, Salzburg, in cooperation with the Packard Humanities Institute, Los Altos, California, completed a groundbreaking project to digitize the *Neue Mozart Ausgabe* (W. A. Mozart’s complete works).^[40]

In the commercial arena, Alexander Street Press has been a pioneer in licensing access to copyrighted music (Boosey & Hawkes Study Scores) through their electronic database *Classical Scores Library. CD Sheet Music*, also available through ebrary, sells access to digitized older editions of scores in the public domain. Individual scores can be purchased and downloaded through a variety of vendors such as *Digital E-Print Delivery* from J. W. Pepper.

Audio and Visual Recordings

When Thomas Edison patented his phonograph in 1877, the way we listen to music changed forever. Before that time we could only hear music in live performance, but after the invention of sound recording, music could be

captured and listened to at any time and in almost any place. This invention made recordings of music a commodity that could be collected. Sound recordings eventually became just as important as scores to music libraries. In practice, music librarians strive to coordinate the audio and score titles collected to facilitate study and performance. Variant performances of the same work, sometimes in different instrumentation, are collected to allow users the opportunity to hear different interpretations.

Edison's phonograph recorded on fragile wax cylinders. The machine was purely mechanical, not needing electricity, and it was quite portable. This made it ideal for use in ethnographic fieldwork. The earliest cylinders of music recorded in this fashion were made by Jesse Walter Fewkes and date from the 1880s. Cylinders had several disadvantages. First, the maximum recording time on each cylinder was around three minutes; therefore, to record even a movement of a work could take multiple cylinders. They were better suited to recording popular songs and ethnographic examples rather than classical music. Second, cylinders were a fragile medium. They were made of wax or similar materials and were prone to breaking, sensitive to high temperatures, and wore down as they were being played. For these reasons, early music libraries generally did not establish large cylinder collections. Today most of these collections are found in ethnographic sound archives, like the American Folklife Center at the Library of Congress, the Archives of Traditional Music at Indiana University, Bloomington, and the Phonogramm-Archiv in Berlin.

In 1887, Emil Berliner invented and patented the gramophone that recorded on discs. These were less bulky and easier to store than cylinders, making sound recording collection more practical for libraries. Although early commercial 78 rpm discs played for about three minutes, the same as a cylinder recording, record players were developed where one could stack discs and play them one after another in sequence. This facilitated listening to lengthy classical works. For these reasons discs triumphed over cylinders in the war of competing formats.

Many technological advances were applied to disc recordings. These included making discs from new materials that were less heavy, bulky and fragile, using electrical microphones for recording and amplifiers for playback (adapted from radio), and an electric lathing process. Eventually discs featured microgrooves. Slowing the speed to 33 1/3 rpm increased the recording time to more than twenty minutes per side. They were called LPs (Long Playing recordings) and they soon featured significantly improved sound quality with high fidelity and stereo. The LP disc became the most widely collected sound recording medium by libraries.

In the 1930s, magnetic sound recording was developed in Germany. Two competing formats emerged: wire and magnetic tape. Early magnetic tape was backed with paper and was a fragile medium which could tear or lose its

magnetic surface. After World War II, magnetic tape continued to be developed in the United States, especially by the 3M Corporation, the makers of Scotch Tape. Their magnetic tape was made of newly invented plastics and offered a more permanent medium. Magnetic tape won over wire in the competing magnetic recording formats. In the early 1960s, the Phillips Corporation of the Netherlands developed the cassette tape which eventually became the most widely used recording medium in the world.^[41,42]

Magnetic tape also made possible the recording of video. Video recorders and players featured a rotating steel head that produced a recording of much higher quality, equivalent to a much faster tape speed. The home recording video market also had two competing formats, Betamax from Sony and VHS from JVC. VHS eventually became the standard format for home video recording, even though it was bulkier and not as technically advanced as Betamax, partially because VHS tapes could record up to six hours of video, compared to only one hour for Betamax. This longer time made possible the recording of feature-length films on a single VHS cassette.

Music libraries did not fully embrace collecting magnetic recordings, except for VHS tapes, and continued to collect LPs, since they offered higher quality audio and a permanent medium that could not be recorded over. Reel-to-reel tapes, which were more cumbersome to use than LPs, were found in professional applications such as studio recording, concert, or ethnographic field recording, and by audiophiles. Cassette tapes, and to a lesser extent 8-track tapes, were collected primarily by public libraries for their circulating audio collections.

In the late 1970s, a century after Edison's first patent, digital recording was commercially developed. The compact disc (CD) was invented jointly by Phillips and Sony. They avoided the major mistake made with the cassette tape in that CDs would be a permanent recorded medium, like LPs. During the final two decades of the twentieth century, the CD replaced the LP as the default pre-recorded music medium. The video equivalent of the CD is the digital video disc (DVD). Like the CD, the DVD was initially a playback only medium, but personal computers eventually made both the CD and DVD into recordable mediums. The February 19, 2008 announcement by Toshiba that it would no longer develop, market, or manufacture high definition DVD players and recorders, marked the triumph of Blu-ray over High Definition DVD in the fierce competition of formats for the next generation of video recordings.

Like audio recordings, commercial vendors are beginning to license access to streaming video content. Alexander Street Press markets the *Opera in Video* and *Dance in Video* databases that feature performances and video clips of interviews with artists.

No one could have anticipated the coming of the Internet revolution. This began with the development of the Personal Computer (PC) in the 1970s, and as millions of

these computers became networked, with ever increasing transmission and computing speeds, the Internet came into its own in the 1990s. The Internet made possible the easy recording and sharing of digital audio files. The Napster website gained notoriety for sharing audio files. Individuals could find literally millions of sound recordings, both legal and illegal under copyright laws, and download them onto their own personal computers. The Recording Industry Association of America (RIAA) sued Napster and won. Now Napster works with the recording industry and charges a modest fee for each digital file.

Recorded sound is progressing to the digital file. One can listen to music on computers and on portable devices, such as the iPod. Libraries have adapted to this revolution by subscribing to digital listening services, such as Napster, Rhapsody, *Classical Music Library* and *Smithsonian Global Sound* from Alexander Street Press, *DRAM* from the Anthology of Recorded Music, Inc., and *Naxos Music Library* from the Naxos Digital Services Ltd. These listening services feature hundreds of thousands of digital tracks of music, far beyond the ability of most music libraries to provide by purchasing physical recordings. Libraries subscribe annually for a fee which allows their patrons access, but not the downloading of files. Most libraries are engaged in determining the appropriate balance between ownership and access for their users and continue to purchase CDs based on the needs of their institution.

Reference Tools

The basic print bibliographies of music reference sources are Duckles,^[43] Marco,^[44] Brockman,^[45] and Foreman.^[46] Beginning in 2001, with *Grove Music Online* (now part of *Oxford Music Online*), publishers started to offer electronic access to some core music reference titles such as the *Harvard Dictionary of Music* and *Baker's Biographical Dictionary of Musicians*.

Thematic catalogs offer unique access to library collections. They authenticate a musical work by identifying it through its opening and/or major musical themes given in musical notation, referred to as *incipits*. Thematic catalogs also distinguish works by key, opus, and thematic catalog number and provide information about the composition's publication history, variant editions, and relevant bibliographic literature.

Other unique music reference tools include repertoire guides and graded lists, discographies, and song indexes. Musicians consult repertoire guides and graded lists in search of new works to perform. These sources include information about the musical characteristics of a composition and its performance difficulties, instrumentation, publisher, and performance timing. Discographies are bibliographies of sound recordings that offer information about a particular musician's recordings or document the recorded evolution of musical forms and genres. Song indexes provide access to large songbook collections

through song title, composer, subject, and the words of the song text.

Important to music research are indexes to the critical editions of composers' complete works and to the historical monuments of music. For many years Charles^[47] Heyer^[48] served as the definitive sources for this information. Subsequently, Hill and Stephens^[49] compiled an updated bibliography of the historical sets and series, collected editions, and monuments of music whose specific content is being entered into an electronic database version and hosted by a number of aggregators.

Music scholars use the *Répertoire International des Sources Musicales*, *The International Inventory of Musical Sources (RISM)*, to locate music manuscripts and early printed music, works on music theory, and libretti held in libraries, archives, monasteries, schools, and private collections. Only portions of *RISM* are available via electronic access, these being *Series A/II: Music Manuscripts After 1600* and the *U. S. Libretto Database*.^[50]

The Internet has become a major resource for music reference information.^[51] Large collections of music-related materials have been digitized and organized by individuals, organizations, and institutions, such as the music collections of the Library of Congress' *Performing Arts Reading Room*.^[52] Websites enable musicians, scholars, organizations, and libraries to promote their works and offer contact information and/or access to their collections.

Indexes and Abstracts

The basic indexes/abstracts to music periodical literature are: *The Music Index Online*, *The International Index to Music Periodicals (IIMP)*, and *Répertoire International de Littérature Musicale (RILM)*. *RILM*, "the first automated abstract journal in the humanities,"^[53] features abstracts in English and, most recently, in the language of publication for articles, *festschriften* (collections of celebratory essays), dissertations, and reviews in 140 languages. Although varying in coverage, journal databases such as *Journal Storage: the Scholarly Journal Archive (JSTOR)* and *Project Muse* provide a form of indexing through searchable full-text access to runs of music journals.

The *Retrospective Index to Music Periodicals, 1800–1950 (RIPM)*, indexes runs of music periodicals published before 1950 from around the world. Index coverage is intended to dovetail with *RILM*.^[54] This index is available in print, CD-ROM, and electronic formats. The *RIPM Online Archive of Music Periodicals* provides full-text access to the journals indexed in *RIPM*.

CATALOGING

Music catalogers follow the same rules *Anglo-American Cataloging Rules* (AACR 2 rev.) and use the same tools, for example Machine Readable Cataloging (MARC)

Records and Library of Congress Subject Headings (LCSH) as other catalogers; however, music has specialized provisions for bibliographic description and access. These specialized provisions and music cataloging guidelines are detailed in books written by Smiraglia^[55] and Weitz.^[56–58] In 2006, Smiraglia published a bibliography of literature relating to music cataloging.^[59]

Music cataloging practices are geared towards collections of Western classical music. This music exists in written form, either printed or in manuscript. It could be a score, showing all the parts of an ensemble displayed vertically, or a part showing the music performed by one member of an ensemble. Music libraries traditionally collect scores and parts up to nine parts. If a work has ten or more parts, such as a band, orchestral, or wind ensemble piece, it is usually housed in a separate performance ensemble library. Girsberger's *Manual for the Performance Library*^[60] provides guidance in how to organize ensemble libraries.

The composer has served as the primary point of access in music cataloging. This assumption dates from the mid-nineteenth century when cataloging rules were first being developed.^[61] Establishing the title of a piece of music has always been problematic because of the various languages used by publishers and composers, and because there are many generic forms in Western classical music, such as sonatas, concertos, and symphonies, with many pieces identified only by these generic titles. Thus, uniform titles become essential in music cataloging as a way to standardize variant titles and titles of generic forms. Also subject headings and in part, music classification systems largely rest on these standard musical forms. With the advent of musical sound recordings, the same cataloging conventions were applied.

Sheet music is “musical notation printed on sheets of paper that remain unattached and unbound at the time of sale” (p. 1).^[62] For years, music catalogers did not catalog sheet music because of its popular and ephemeral nature, and because there were no cataloging guidelines for sheet music. But as large sheet music collections began to be preserved and made available, cataloging became necessary. A working group of the Music Library Association developed cataloging guidelines for sheet music.^[62]

Music Uniform Titles

Uniform titles are more widely used in music cataloging than in any other cataloging context. Uniform titles make it possible to find a composition listed in one place, no matter its language, form, or physical arrangement. Music is published in various languages, so there frequently needs to be a single uniform title that draws together (collocates) the same musical work from various publishers. Also, music is frequently composed in a generic form. Uniform titles are needed to distinguish a particular generic piece from others of the same form by the same composer. Finally, since the very earliest time of music publication, music has been commonly published in

collections and anthologies. These anthologies need generic uniform titles to identify and group together collections, usually under a composer's name. Thus, music cataloging recognizes three types of uniform titles: Distinctive titles, Form titles, and Collective titles. Distinctive titles are unique titles, given by the composer, in the original language, for example Debussy's *Prelude to the Afternoon of a Faun* = [Prélude à l'après-midi d'un faune]. Form titles are used for “generic” works such as sonatas, symphonies, and songs. They follow a specific structure: [Form, instrumentation, number, key], for example Beethoven's *Pastoral Symphony* = [Symphonies, no. 6, op. 68, F major]. Collective titles are used for collections and anthologies of music, for example Bach, Johann Sebastian. *Neue Ausgabe sämtlicher Werke* = [Works].

Library catalogs that display uniform titles alphabetically under the composer's name allow users to see all manifestations of a work listed together. Electronic catalogs that allow linking to an item with the same uniform title are valuable tools to collocate, identify, and locate a specific piece of music. Music library users benefit by being aware of the way uniform titles are used to organize music. For detailed information about music uniform titles consult Koth.^[64]

Music Subject Headings

Library of Congress Subject Headings (LCSH) for music are unique because they fulfill two functions: to retrieve books about music and to retrieve the actual music itself. The headings used to find books about music are true subject headings. Those used to retrieve music could more properly be called form headings. Terms describing musical forms, such as sonatas, concertos, and symphonies, may be used in both types of music headings, those for finding information about a form, as well finding compositions in that form. Generally, if the term is in the plural, it retrieves the music itself. If it is in the singular, it retrieves books about that subject as a musical form. For example, the subject heading “Concertos” will retrieve scores and recordings of concertos, while “Concerto” will retrieve books about the concerto. This works for most musical forms; however, one exception is “Songs.” There is no singular subject heading “Song” for books about this musical form. The heading “Songs—History and criticism” is used.

All the music subject headings from the LCSH (to 1997) have been gathered in a single volume. For further study, this work includes an excellent seventy-five page introduction by Young about the workings of music subject headings.^[65]

The Future of Music Cataloging

Cataloging is at the very beginning of a new age. As international committees attempted to update the AACR2,

they found that the traditional way of cataloging was less functional in the Internet environment. They began creating a new standard for cataloging called the RDA (Resource Description and Access), marking a fundamental change in cataloging practices.

The MARC record has been at the center of cataloging for more than 30 years and may be approaching the end of its life. As cataloging migrates to web-based standards such as Dublin Core and MODS (Metadata Object Description Schema), cataloging elements will retain their semantic value, the meaning of their controlled vocabulary, but they may lose their syntactic value, which comes from the precise order in which these terms are arranged. The many thousands of MARC records created in the twentieth century will still form the core of data for cataloging records into the future, regardless their format. Knowledge of music cataloging practices will continue to help library users find the music they seek.

CLASSIFICATIONS

Today most academic libraries in the United States use the Library of Congress Classification (LCC). The “M Schedule” for music,^[66] was devised by Oscar Sonneck in 1902 to meet the needs of an existing collection, the Library of Congress. Since its inception, LCC has been amended to accommodate popular music, world music, and other new areas of music research. Smiraglia’s *Shelflisting Music*^[67] provides guidance in how to construct LCC call numbers.

Conceived as a way to organize all knowledge, the Dewey Decimal Classification (DDC) was drafted by Melvil Dewey in 1876. Adopted by public, research, and some academic libraries the DDC is the most used classification globally.^[68] Inherent problems in DDC were its inability to adapt to new musical forms and genres and its lack of a provision to separate music scores from music literature. Some libraries addressed this problem by adding a prefix “M” for music scores before the Dewey class number while others elected to reclassify their collections to LCC. The revision of “780 Music” of Dewey (DDC20) attempted to resolve these problems by creating a faceted system allowing scores to be segregated from music literature. It also added classification numbers for folk and popular music and modeled the classification of musical instruments on the wider encompassing Sachs–Hornbostel system which distinguishes instruments by how sound is produced.^[69]

Over the years, a number of music classification systems were formulated as examined by Krummel,^[70] Elliker,^[71] McKnight,^[72] and Bradley.^[73] For example, a classification specifically for music scores was devised by George Sherman Dickinson, Professor of Music, and the first music librarian at Vassar College, Poughkeepsie, NY (USA). In his classification system, *The Classification of Musical Compositions: A Decimal-Symbol System*,^[74]

published in 1938, Dickinson recognized that not one system could serve each library type equally. The result is a system that can be modified to conform to different types of music libraries and the needs of their users. The Dickinson classification system was used by a number of music libraries in the northeastern United States. However, because the Dickinson classification utilizes special music symbols, many libraries have adopted classification that are more compatible with integrated library systems.

For audio collections, libraries may choose not to classify recordings but to organize them in accession order. This arrangement offers the most economical use of space because room is not left to interfile new items. Some music libraries elect to use the record label and label number as a way to organize recordings. Both arrangements have the benefit of avoiding the decision of where to classify a disc when it includes works of different genres by different composers.

If recordings are classified libraries often adapt LCC or DDC. Some music libraries use the *Alpha-Numeric System for Classification of Sound Recordings* (ANSCR)^[75,76] intended to facilitate browsing in public libraries. ANSCR arranges recordings in a hierarchy of subject, composer or subcategory, title, and performer’s name.

PRESERVATION

Music libraries will continue to have LP and CD collections, as well as collections of recorded magnetic tape in various formats. The challenge in keeping these collections valid and useful is twofold: preservation and access. An LP is a great medium for preservation; even discs 60 years old or older will play well if not worn, warped, or scratched. However, challenges remain of maintaining working playback equipment and obtaining replacement parts. Magnetic tape formats are becoming obsolete and finding working playback machines is becoming difficult. For these reasons, many libraries are digitizing their analog collections for purposes of preservation and access.

Preservation needs to be considered even for digital formats. The oldest CDs are now nearly 30 years old. They can be subject to oxidation and damage from wear and tear. Digital media require migration to newer digital formats to keep them useful. Sound recording archivists held a conference at the Library of Congress in 2001, which took into consideration problems of access, preservation, and intellectual property for folk heritage sound recording collections.^[77] Most recently, Indiana University and Harvard University published audio preservation standards^[78] based on their tests of new technology.

For print collections, attention must be taken to process materials for long-term use. Since music is used in performance, it must be bound to lay flat on a music stand. Special binding provisions are needed for parts,

comb bindings, and nonstandard sized items. Carli's *Binding & Care of Printed Music*^[79] presents a detailed examination of the issues of paper conservation and binding and offers how-to information for in-house conservation steps.

ETHNIC AND WORLD MUSIC

Music libraries have traditionally collected materials in Western classical music, but ethnic and world music have become common in collections over the past three decades. In 1994, MLA published a technical report examining world music in libraries.^[80] The term "world music" is a popular current alternative for such terms as primitive, non-Western, ethnic, and folk music. Its broadest definition is simply all types of music from around the world. In this context the definition expands beyond the purely popular idiom to include all styles of music with ethnic or foreign elements.^[81]

With the growth of worldwide systems of communication and commerce, librarians will feel increasing demands for materials characterized as world music. Reference questions pertaining to world music have become more numerous in recent years, as college and public school curricula have emphasized cultural diversity and interest in globalization. Music education majors now look for examples of ethnic music to teach in the classroom. Public librarians face ever greater numbers of patrons seeking music of their ethnic heritage.

The techniques used to handle Western classical music do not always easily apply to world music. Certain basic assumptions are made about Western classical music: that it exists in a written form and can be identified in an historical context from written sources; that the composer serves as the primary point of access; that uniform titles can be created according to what is found in written sources; and that subject access and classification rest on standard forms. World music is less likely to exist in a written form, since it may be passed on by aural tradition. The composer may be unknown, thus the performer, informant, or even the collector may have to serve as primary points of access. Music in aural traditions may vary with each performer and even with each performance. The title of a work may exist in variant forms and may not be found in any written source. Finally, world music frequently exists in forms and genres that cannot be identified in written sources, thus subject access and classification may require special provisions.

Many music reference tools also address world music; however, there are also specialized sources. One of the best is the 10-volume *Garland Encyclopedia of World Music*^[82] which is also available in electronic format. Each volume covers an area of the world. This work is not an encyclopedia in the traditional sense, where one could look up a specific term. Rather, it should be thought

of as a collection of well laid-out and illustrated scholarly articles written by experts. To find specific information, readers need to use the detailed indexes. Other specialized reference works are cited in annotated bibliographies by Schuursma^[83] and Post.^[84]

Subject access to world music presents special problems. LCSH are designed for use primarily with Western classical music. A basic tenet of these headings is that they tend to use genre or form of a composition as the initial entry point. This becomes a problem with world music, because it tends to scatter headings of music from a specific geographic region throughout the catalog. Examples of LCSH for Japanese music include: "Ballads, Japanese," "Buddhist hymns, Japanese," "Folk Songs, Japanese," "Hymns, Japanese," and "Songs, Japanese."

Another tenet of LCSH is that they use only the most specific heading that fits and typically do not add more general headings. For example, Japanese koto music would receive the subject heading "Koto music" and not "Music-Japan." If this music is in a specific form, such as a sonata, it would be cataloged under "Sonatas (Koto)." Patrons need to know details about the music in order to find the specific subject heading.

Libraries with large collections of world music have tended to use the Murdock's *Outline of World Cultures*^[85] to augment subject access to their collections. Additional information about subject access to world music materials may be found in Kaufman^[86] and in Pierce.^[87]

FUTURE CHALLENGES

Music, as a humanities discipline, has been slow to enter the digital environment. While journals were the earliest format to be digitized in other fields, music journals are relatively recent inclusions in *JSTOR* and *Project Muse*; however, other music formats are much further behind. Projects for digitizing musical scores are uneven in coverage and not fully developed. The physical practicalities of using digital scores for performance have yet to be successfully addressed. Currently, some databases of copyrighted music permit access to scores by allowing users to pay per item download. Others allow users to view scores for study purposes but not to perform from the digitized versions. Digital audio content from commercial databases is broadening, but is still representative of only particular recording labels or specialized subject areas. Alarming, lacking are provisions for perpetual access to the content of these digital audio and music resources. In addition to physical hurdles to overcome, in general, non-book materials are plagued with much more complex limitations imposed by copyright law than are books.

Because music materials are not in step with other disciplines, music libraries have been slower to feel the problems and challenges which face general libraries in the first decade of the new millennium, and music

librarians are only beginning to realize these changes in their daily work. In the area of collection development questions of access vs. ownership are further complicated because not as many music-related items are yet available electronically. Music publishers tend to be small businesses and are often reluctant to fund the development of new electronic resources.

Aside from digitization, music-related materials themselves are changing. For example, the field of music study has expanded in new directions. It is increasingly interdisciplinary, focusing on cultural, ethnic, racial, and gender issues, and requiring new reference tools and resources.

The future of sound recording looks very much like the past. The issue of retention of older formats and their playback equipment while acquiring new formats continues to be a challenge. The history of sound recording has been characterized by competing formats, and we still have competing formats today. Digital files can be in a variety of formats such as WMV, RealAudio, MP3 and AAC. There is absolutely no guarantee that today's audio file will play on a computer even 5 years from now, let alone into the foreseeable future. All digital file sound recordings, just like other computer media, will have to be migrated to newer formats as they are developed and become the standard for that time.

In the digital age, academic music institutions are expected to provide course reserve listening assignments in digitized form. This new service requires acquisition and training in the use of software and hardware, beyond the simple scanners needed by their counterparts in other disciplines.

The Indiana University Digital Library Program proposes to create Variations3, a digital music library system, modeled after Indiana's highly successfully electronic Variations music library, which can be deployed at other academic libraries. In support of instruction and learning, the system will enable institutions to digitize and provide online access to recordings and scanned scores for use with annotation and analysis tools.^[88]

Historically, music libraries have been somewhat autonomous from general collections because of their many nontraditional needs. Integrated library systems provide a benefit for increased collaboration with colleagues in other disciplines but also a downside. With integrated library systems the special needs of music materials often take a backseat to the general needs of book materials. Music libraries are finding themselves pressured to standardize procedures and to abandon specialized classifications.

However, new technology can offer new opportunities. It is hoped that new digital resources will offer a wider range of access points tailored to musicians' needs such as song text, date of composition, exact instrumentation, edition, and type of score. Especially useful would be sources that display for recordings liner notes and for scores the first page of music, if not the entire composition, to allow

users to view editorial practices, typography, and page layout.^[89]

While the idea of librarians as teachers is gaining acceptance in all disciplines, students especially benefit from help in evaluating music resources and effectively finding music materials in the largely book-oriented library online catalogs. The expanding interdisciplinary scope of music research brings new patrons who need to familiarize themselves with the different procedures, equipment, and classifications found in music libraries. Blotner observed greater need for instruction to address the growing number of databases.^[90] Users seek help in selecting the appropriate database to consult, in formulating search strategies, and in evaluating search results. Recognizing this need, in 2004 MLA published *Music Library Instruction*.^[91] Physical barriers that are inevitable with separate music library facilities or collections are reduced through electronic access to portions of the collection or to a music librarian by email, chat, blogs, and social networking tools.

Space issues are increasingly a problem for many older libraries and music libraries are no exception. As patrons look to accessing audio music and course reserves from their computers, academic libraries are using space formerly devoted to on-site listening areas to meet other needs. Computer work areas, group study spaces, and classrooms are taking their place.

Digitization of reference tools and primary resources offer an opportunity to improve reference service and foster communication with a broader range of users. The future of music librarianship requires that music librarians, who best know the field of music and its users, advocate for and participate in the design of music reference tools, library systems, and digital resources that advance music scholarship and satisfy the needs of those who study, perform, and enjoy music.

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Name Authority Control

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Abstract

The purpose of name authority control is to facilitate searching and browsing by 1) ensuring retrieval of all the works of a person, personal identity such as a pseudonym, family name, or organization where they may be published under different name versions over time and in different places; 2) enabling other works by the same identity to be retrieved from any one work; 3) by eliminating works of other identities with the same name; and 4) by concise name indexes that ensure efficient browsing. Authority records may include name variants, and these are distinguished from related names of other identities of the same person. Records also contain differentiating information and, most importantly, identifiers that are the key elements facilitating linking. Differentiating information differs for personal and organization names. The creation of authority records is a labor-intensive process, and the trend is toward creating locally and sharing internationally. Consolidated sources are important for facilitating reuse and as key resources in linked data. Input data are accepted from a variety of sources, including biographical sources, encyclopedias, institution records, and crowdsourced systems. Different models and encoding systems are detailed.

INTRODUCTION

There are multiple purposes of name authority control. Firstly, name authority control facilitates searching and browsing by ensuring retrieval of all the works of, or about, a person, personal identity such as a pseudonym, family name, or organization where they may be published under different name versions over time and in different places, and ensuring that they are retrieved with the same form of name that the specific community will understand (e.g., “Confucius” in Anglo-American communities, and “孔子” in CJK [Chinese, Japanese, and Korean] communities). Name versions differ in different languages; in particular, transliteration practices differ by language. There are also differences in name forms among regions sharing the same language such as Belgian Flemish and Dutch name forms. Geographic names are prime examples: Firenze (Italian), Florenz (German), and Florence (French and English). Name authority records also enable other works by the same identity to be retrieved from any one work, at the same time eliminating works of other identities with the same name. Name indexes can be created from authority records instead of bibliographic records so that the indexes are more concise, ensuring faster and more efficient browsing.

In librarianship, name authority control is traditionally the process of collecting together different versions of a name and recording them together in a name authority record along with differentiating information. Names in bibliographic records’ access points are linked to name authority records either via a name form or by an identifier.

In traditional library practice, the authority record indicates a preferred name form that is used in bibliographic records. The most common form of name used in the official language of the community is generally selected as the “preferred form,” and the preferred form can vary from one community and language to another. Where there are different persons or organizations sharing the same name, the usual practice is to extend the preferred form of name in an authority record with additional differentiating information such as dates or profession in the case of persons, and location in the case of organizations. However, identifiers are now replacing the concept of preferred name.

NAME CONTROL OR IDENTITY CONTROL?

As stated earlier, name authority control allows the differentiation of different persons and organizations with the same name. The International Standard Name Identifier (ISNI)^[1] makes a clear distinction between a name, an identity, and a person or an organization. A person may have one or more names, such as a maiden name, married name, change of sex name, and name in a different script, but only one identity. A person may also have one or more identities that he or she uses to present creative works publically. Where a person has multiple name forms, within a MARC (Machine Readable Cataloging) authority record one is marked as preferred and others as name variants. The Virtual International Authority File (VIAF)^[2] and ISNI, being crafted from multiple sources, have moved away from the traditional library concept of a

preferred form of name, allowing preferred names to differ according to source. Preferred name is challenged by some professional communities that do not designate “one preferred form” but identify which forms are used in particular contexts, both geographic and temporal.^[3] For scholars, VIAF and ISNI have not gone far enough, but the notion of a preferred form of name is endemic even outside the library community, for example, in the knowledge organization systems (KOS) such as thesauri, classification schemes, subject heading systems, and taxonomies, and that is reflected in the W3C SKOS standard.^[4]

NAMES AND NAME VARIANTS

Meryl Streep has only one public identity that she uses for her creative works. VIAF includes Streep, Meryl (Mary Louise), as the name form on her birth certificate is Streep, Mary Louise. Her married name Gummer, Mary Louise, is mentioned in Wikipedia and could also be considered as a name variant (Fig. 1). Changes in the preferred forenames and change of name due to marriage are not considered as constituting a change of identity as there is not necessarily a wish by the person to separate his or her creative output corresponding with a name change. Researchers, for example, will mention the ensemble of their publications in their curriculum vitae where they have been published over a lifetime involving name changes.

Alternative name forms that do not usually indicate a change in identity can take variant forms including names in different scripts or transliterated with different schemes, changes due to change of sex, marriage, or legal declaration.

PSEUDONYMS AND MULTIPLE IDENTITIES

Kingsley Amis in Fig. 2 is an example of an author writing under three different identities: writing as himself and writing under two different pseudonyms. His works attributed to each of the three different identities are clearly separated. In this case, the association of pseudonyms with the real person is public but that is not always the case. For example, J.K. Rowling chose to create a pseudonym Robert Galbraith^[5] so that she could write in a different genre and have her works in the new genre judged without any influence of the successful Harry Potter series. When the relationship between a pseudonym and a real person is or becomes public, the works tend to become associated with the real person as well as the pseudonym; for example, they may be republished or released in collected works. One example is John Wyndham, the main pen name of John Wyndham Parkes Lucas Beynon Harris (July 10, 1903, to March 11, 1969). Under an earlier pen name, John Beynon, he wrote *Secret People*, but this is now published under John Wyndham. As a general rule, separate authority records should be made for each identity used as a public identity. This allows the history of works to be accurately traced, enabling catalogs to respond to questions such as “under which identity was the work conceived and first published?” The authority records related to each of the public identities should be linked where the relationship is public. Encyclopedias such as Wikipedia tend to have only one entry for a person, grouping all public identities. This entails the need for one-to-many relationships in linking especially

Streep, Meryl, 1949-....

Streep, Meryl

Streep, Meryl (Mary Louise), 1949-

VIAF ID: 66485464 (Personal)

Permalink: <http://viaf.org/viaf/66485464>

ISNI-test: [0000_0001_2281_1152](http://isni.org/isni/0000_0001_2281_1152)

Preferred Forms

4xx's: Alternate Name Forms (6)

- 400 1 _ \$a Streep, Mary Louis
- 400 1 _ \$a Streep, Mary Louise
- 400 1 _ \$a Streep, Mary Louise.
- 400 1 _ \$a Streep, Mary Louise \$d 1949-
- 400 1 _ \$a Streep, Meryl Louise, \$d 1949-
- 400 _ | \$a Streep \$b Mary Louise \$f 1949-....

Fig. 1 Image of VIAF authority cluster for Meryl Streep.



Kingsley Amis
Writing as himself

Kingsley Amis
Writing as
Lt. Colonel William
(Bill) Tanner,
Fictional character in
the James Bond
Series

Kingsley Amis
Writing as
Robert Markham,
the successor of Ian
Fleming

Many works
including
“Lord Jim”

1 work “the
book of
Bond”

1 work
“Colonel
sun”

Fig. 2 Kingsley Amis and his two pseudonyms.

from library authority records to encyclopedias. For example, VIAF links its clusters to Wikipedia and ISNI includes MusicBrainz links in its records (including links to library authority records).

Figs. 3–5 from VIAF indicate that VIAF and ISNI have three separate records for the three separate public identities of Kingsley Amis. All but one VIAF source considers Robert Markham to be a separate identity, whereas two sources (National Libraries of Poland and Catalonia) have declared the name as a variant name.

When is there a change of identity? Authority records include name variants and related identities. Practices differ among libraries. The same name can be declared to be

Markham, Robert, 1922-1995

Markham, Robert

VIAF ID: 103212356 (Personal)

Permalink: <http://viaf.org/viaf/103212356>

ISNI-test: 0000 0001 0787 3128

5xx's: Related Names (3)

500 1 _ta Amis, Kingsley

500 1 _ta Amis, Kingsley, td 1922-1995

500 1 _ta Amis, Kingsley.

Fig. 4 Image of VIAF cluster for Robert Markham.

Tanner, William

Tanner, William, 1922-1995

VIAF ID: 16755133 (Personal)

Permalink: <http://viaf.org/viaf/16755133>

ISNI-test: 0000 0000 4289 6002

5xx's: Related Names (1)

500 1 _ta Amis, Kingsley

Fig. 5 Image of VIAF cluster for William Tanner.

a name variant by one library and the name of a related identity by another. The VIAF includes many examples of these among its clusters, as in the case of Robert Markham. As the concept of public identity is core to ISNI, and giving separate ISNIs to each separate identity is critical,

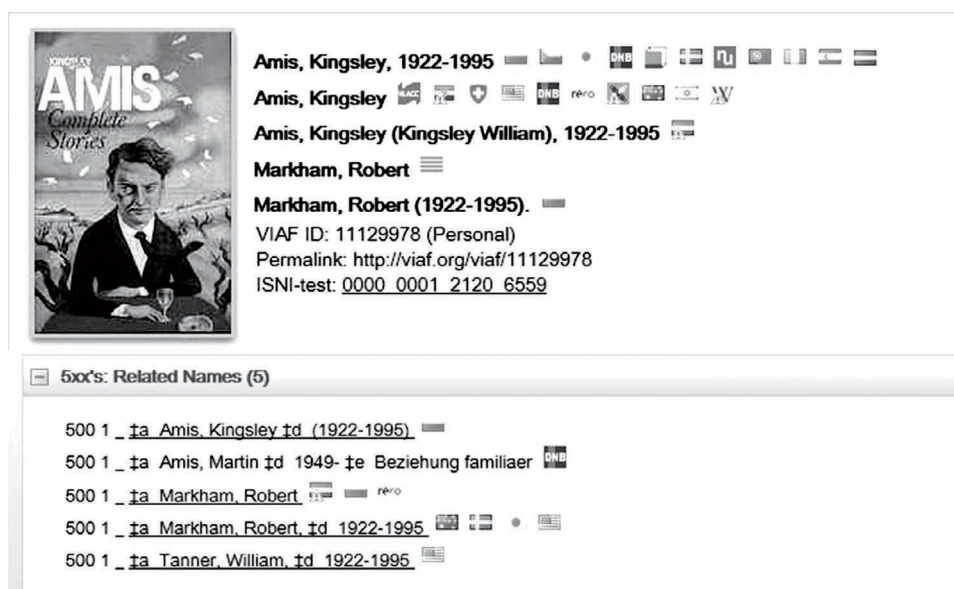


Fig. 3 Image of VIAF cluster for Kingsley Amis.

the ISNI Quality Team has produced a policy document^[6] defining when a name form should be regarded merely as a name variant or as belonging to another identity (both identities being linked in the ISNI database by a “Other identity same Person” link) and is working closely with VIAF to encourage adoption of consistent treatment.

UNDIFFERENTIATED NAMES

Many library systems include a feature that will generate name authority records from the name forms in the name fields in bibliographic records. Links are then made between the generated authority records and the name fields from which they were derived. One such system is Centraal Bibliotheek Systeem (CBS), used by the Deutsche Nationalbibliothek (DNB).^[7,8] The DNB makes a distinction between the records that are generated by program and those that are made by catalogers using biographical information from multiple sources including that published within a work, encyclopedias, and contacts with creators directly or through their publishers. However, it should be noted that not all undifferentiated names are machine-generated. For example, in Library of Congress/Name Authority Cooperative Program (LC/NACO),^[9,10] undifferentiated authority name records have been created by catalogers for the purpose of making catalog access points where there was insufficient information available at the time to create separate authority records. Undifferentiated authority records control a name string and may bring together works by different identities sharing the same name string. They serve a purpose to facilitate search and browse within the file in which they were generated. However, their utility beyond the one file is limited. Undifferentiated data cannot be used confidently in a broad networking environment and become a serious problem when exposed in Linked (Open) Data. For this reason, the Program for Cooperative Cataloging has a new policy as of November 13, 2013, stating that no new undifferentiated authority name records will be created.^[11]

ORGANIZATION NAMES AND HIERARCHIES

Organizations, including institutions, corporate bodies, and less formal groups of individuals, pose their own problems for name authority control. Like individuals, names may change over time without a change of identity, for example, a university library may be given the name of an emeritus person. Organization names are often abbreviated and the sequence of words within a name string may be altered, for example, the University of Sydney and Sydney University. These are examples of name variants for organizations. More often, a change of name reflects a change in scope, purpose, or ownership, constituting a change of identity. For example, a name with the

same words in a different sequence can sometimes be the same organization and sometimes a different organization and many abbreviations and acronyms can be shared among identities.

Organizations raise other issues from their structural perspective. The same name may represent separate identities for the same organization—a legal, a commercial, a branding, and a contracting identity. Some of the organizations, depending on the nature of their activity, insist on the need for separating these identities. Organizations also have hierarchies. Depending on the needs for information processing, representing these hierarchies can be very important.^[12] Within authority records, hierarchies can be represented using related name fields plus relationship type.

DATA ELEMENTS: DIFFERENTIATING CRITERIA AND INFORMATIONAL METADATA

In order to separate different identities with the same name, library authority records include differentiating elements, in particular date of birth and/or death that may be included in the preferred name form. In the preferred name form, distinguishing data may also be included such as occupation, fuller forms of forename, and name qualifiers such as Jr. (Junior). More data can be included in supporting fields such as the new MARC fields introduced for compatibility with the new rules Resource Description and Access (RDA)^[13] that allow for more granularity in data encoding and, therefore, provide new possibilities for exploiting the information. These are special coded dates, associated place, address, field of activity, affiliation, occupation, gender, family information, and associated language.

Other data included in authority records that also play an important differentiating role include titles of works, identifiers of works, associated languages, and occupation. VIAF considers coauthors and performers as well when merging or differentiating, and ISNI has extended the differentiating criteria to include instrument and voice for musicians and performers.^[14]

The important elements for differentiating organizations with the same or similar name strings are geographic location, organization type (e.g., university or hospital), and name use (e.g., legal or brand).^[15] Dates are important for organizations as well. However, they are less frequently included in the authority records than those for persons as they are not widely known. Therefore, the use of dates as a criterion of disambiguation for organizations in automated processing is less reliable. Similarly, works published by organizations tend to have generic titles such as “Annual report” and so are less useful for disambiguation of organizations. Relationships between individuals and organizations are important complementary elements. A person record can include institutional affiliations and links to other persons. Organization records can include

links to related persons and to other organizations. Recording the precise type of relationship is now replacing the more generic “see also” that is implied from the existence of the related field within an authority record.

The International Federation of Library Associations (IFLA)’s mandatory elements for internationally shared resource authority records (MLAR) report recommends mandatory elements required for records to be suitable for international sharing.^[16]

In other domains, the emphasis on differentiating criteria can vary. Encyclopedias such as Wikipedia^[17] and MusicBrainz^[18] tend to use similar criteria to libraries, whereas Rights Management Societies may use passports and other official documents, together with dates, all of which is regarded as confidential data. ORCID^[19] relies on e-mail address as the main differentiating element, and this is usually marked as confidential.

Archival authority records, though built on the library authority control tradition, are in general much richer than library authority records. The identity part of information, that is, the management of names, is much in line with the library practices. The difference is in the descriptive information about the entity. While libraries tend to create detailed records for bibliographic resources and smaller authority records with just enough information to differentiate identities, archival authority records include extensive, supportive, descriptive information such as biographical and genealogical data, called “contextual information.” The detail in archival authority records can be richer than that in the records of associated resources.

Archival authority records, however, need to support a much wider set of requirements than is the case with library authority records. These additional requirements are associated with the importance of documenting information about records creators and the context of records creation in archival description systems. As such, archival authority records go much further and usually will contain much more information than library authority records.^[20]

RELATING BIBLIOGRAPHIC AND AUTHORITY RECORDS

Many libraries exemplified by the contributors to the LC/NACO file link from bibliographic records to authority records principally by name string. The name string of the preferred name form is included in the bibliographic records with optionally a reference to the authority record identifier. The fact that preferred name forms may contain dates and qualifiers that are nonname elements reflects this usage. While it allows the use of authority records without imposing actual links, it has limitations:

- The preferred name form in the authority record needs to be stable, so dates are not consistently added to

headings where known and they are not updated when a person dies, though they can be recorded in other fields in the authority record.

- Differentiating metadata is in both the preferred heading and in supporting fields within the authority record.
- It necessitates the choice of a single preferred name form, whereas many name variants merit equal weight, for example, in a bilingual or multilingual country such as Canada or Switzerland. Name forms in multiple scripts provide another example where multiple preferred forms should be possible.
- It makes global changes of bibliographic records a lengthy practice where each corresponding bibliographic record needs to be updated when the preferred name in an authority record changes, for example, in the case of a typographical correction or a change of name.
- In the case that it is necessary to split an authority record into two or more separate identities, the global change procedure is even more complicated and inadvertent omissions are common.

Many library systems store only an identifier in the bibliographic record, making global change a far less onerous task but as not all do, these problems remain, particularly when records are split and one identifier is retained.

To begin to overcome these problems, it is necessary to systematically use identifiers when linking from bibliographic to authority records. This is a new recommendation of the Program for Cooperative Cataloging.^[21]

IDENTIFIERS

Where multiple preferred forms are allowed within an authority record, identifiers become the essential element and are used for reliable linking. The number of data elements necessary to establish identity and distinguish from other identities with the same name varies depending on the commonness of the name. For example, two persons could have the same name and be born in the same place on the same date. In this case, the name of their parents or other data elements such as profession would differentiate them. Because the number of elements is not finite, identifiers serve to act as shorthand for the ensemble of metadata elements within an authority record. Identifiers are concise, easily sharable elements, and are the key elements in linked data. In 2008, an IFLA Working Group on Functional Requirements and Numbering of Authority Records^[22] concluded that development of a system of international scope to issue and maintain authority identifiers was unlikely to happen. Nevertheless, they recommended the use of the VIAF cluster number as an alternative with a close watch on the development of the ISO working group on the ISNI. Three years later in

November 2011, the ISNI-IA announced the ISNI database with 1 million assigned identifiers. In 2 years of operation, the number of assigned identifiers has grown to 7.5 million with 30 contributors.^[23]

The key identifiers for international use are ISNI, VIAF, and ORCID. ORCID started in 2012 with the aim of providing identifiers for researchers to use in submission of articles for publication and in grant applications. Thus, an ORCID can be assigned and an authority record can be born before the researcher has actually published. Another identifier that is used internationally is the Interested Party Identifier (IPI) of the International Society of Authors and Composers (CISAC).^[24] This identifier is used in the music industry in particular, but access to it is restricted because it links to confidential information. Thus, CISAC became one of the early drivers of ISNI to act as an independent neutral identifier for cross-database and cross-domain linking.

RECORD CREATION AND REUSE

Creating high-quality authority records takes time and research. The training for LC/NACO certification is 5 days.^[25] The British Library, for example, often contacts authors through their publishers to determine whether they have previous publications. Apart from a work in hand that may contain biographical information, there are many sources on the web that can be consulted including encyclopedias such as Wikipedia and MusicBrainz, personal web pages, institutional web pages, biographical dictionaries, and trade information such as Scholar Universe,^[26] Scopus,^[27] Web of Knowledge,^[28] and Amazon.^[29]

Considering the high cost of creating authority records, libraries seek to reuse existing authority records wherever possible. Records made by national libraries are made available to other libraries for reuse.

In the mid-1970s, the Program for Cooperative Cataloging established the LC/NACO program and database that currently includes over 7 million records. As well as the Library of Congress, participants include the British Library, National Library of Medicine, National Agricultural Library, and national libraries of Mexico, New Zealand, Scotland, South Africa, and Wales, and over 200 other participant libraries.^[30] The records are freely available via web search and as linked data. The LC/NACO file contributes to VIAF that started in 2003. In January 2014, VIAF included 33 sources, of which LC/NACO is just one. National libraries and library networks worldwide have contributed to VIAF as well as the Getty Museum and Perseus Digital Library hosted by Tufts University. Wikipedia data are harvested and appear as a source within VIAF, and ISNI started contribution to VIAF in 2013. VIAF clusters data from its sources and makes it available for consultation via a web interface and by an SRU API (Application Program Interface). The data

are also available for harvesting by bulk downloads and for diffusion as linked data. VIAF contains 34 million authority records, of which more than 26.4 million are personal name and 5.1 million are corporate name records. Name/title (1.8 million) and geographic name (400,000) authority records make up the total. It has become a significant international resource for libraries and linked data. This is evidenced by its traffic with close to a million personal visits a year.^[31]

VIAF is a major source within the ISNI database. ISNI is an international database maintained by a not-for-profit consortium, the ISNI-IA. The database scope is different from VIAF; though it includes VIAF, it does not include its name/title records, meeting, or geographic name records and excludes undifferentiated and sparse records. On the other hand, ISNI's scope is larger than VIAF with 28 other contributors from multiple domains: rights management, trade, and education and professional societies. In particular, it includes more researchers, musicians, and publishers. Like VIAF, ISNI's data are clustered, but the records are flagged for confidence and there are strict rules for assignment. ISNI also defines extensive vocabularies, for example, creation roles, relationship types, organization types, name use, and matching types. There is a freely available web interface and SRU enquiry API and RDF (Resource Description Framework) serialization.^[32,33]

Name disambiguation is a common requirement for databases in multiple domains. Rights management societies collect money for reuse of resources and need to track down rights holders. Online stores such as Amazon and iTunes need disambiguated identities in order to provide, for example, "more by this author or performer" searches and biographical information. Search engines are also beginning to provide such information. Examples are Amazon's Author Central program^[34] and Google's knowledge graphs.^[35]

Just as libraries use external sources for creating authority records, their records are being reused in other domains. The major Internet search engines harvest data from VIAF and ISNI such that, for example, the VIAF search API accounts for 98% of external access and averages about 5 million searches a week.^[31] The lack of authority control in institution repositories has been recognized as a major problem for retrievability.^[36] The University of North Texas Libraries^[37] has estimated that less than 35% of researchers can be found in VIAF and LC/NACO sources. Consequently, it has built a name authority system that allows access to VIAF, LC/NACO, Wikipedia, and ORCID and builds links at the same time.

The level of reuse and sharing is necessary to enable libraries, archives, and all organizations involved in the creative domains to concentrate on local identities, especially as the scope of authority control must be broadened to include many more types of publication, both physical and digital. Name authority control of the authors of journal articles was long avoided by libraries but is now being embraced in cooperating systems such as ISNI and

ORCID and in the OCLC Research activity on registering researchers in library authority files.^[38]

CROWDSOURCING

Crowdsourcing is increasingly important for enriching and correcting data. A large number of databases are based on crowdsourcing such as Wikipedia and MusicBrainz, social networking sites, and professional networking sites such as Mendeley,^[39] RePec,^[40] AuthorClaim,^[41] ResearchGate,^[42] and PublicationsList.^[43] ORCID too is based on researchers self-registering.

The major drawbacks of sourcing data from the public at large are risks of incompleteness and inconsistency in detail and quality. Moreover, in the current information environment, quality is more needed than ever. The question is how to benefit from crowdsourcing as a powerful means of enhancing quality and enriching data in authoritative systems and at the same time making sure of the quality of the input. Such a model requires careful monitoring and a solid policy for resolving conflicts. ISNI has setup a monitored crowdsourcing system. The general public is encouraged to enrich and correct data, but the data that are collected trigger an e-mail alert to the Quality Team at the British Library and the Bibliothèque nationale de France. In this way, ISNI strives to achieve a balance between curated data from the library world and other domains and individual knowledge. ORCID too is striving to find a balance between data input by researchers and that input on their behalf by their institutions.

MATCHING AND CLUSTERING

VIAF and ISNI collect data from multiple sources. Both use similar matching algorithms; VIAF then creates clusters and ISNI creates composite records. Where names, dates, and title of a work match from different sources, a match is made. In the absence of a direct match, other metadata elements are considered such as subjects, classification, active time period, nationality, coauthors, institutional affiliations, publishers, instruments, and uncommon title words. In addition, ISNI assigns two confidence scores; one in the data itself and another in the matching. Some records are flagged as possible matches needing manual review or retry against new data or with revised matching algorithms. ISNI also seeks to find sources that are rich in elements that can help cluster sources with different differentiating elements. For example, MusicBrainz encyclopedia was harvested so that it could help match data from the performers' rights management data that contains identity dates and instruments with other sources containing names and works only.

LINKED DATA

In the words of Corine Deliot of the British Library "Linking is not a new concept in librarianship. Within databases, bibliographic records contain links to authority records. Even WorldCat, to which thousands of libraries worldwide contribute, links to only one name authority file, to LC/NACO. The newly coined linked data extend links beyond databases to multiple Internet sources. The Internet was a method of linking computers (useful, but difficult, and not interesting to most people); the Web is a way of linking content (pages) held on computers (interesting and useful to people); linked data are a way of linking information (interesting to people and very useful to machines). This opens up new possibilities for machine to machine processing and new services that depend fundamentally on accurate identification of entities." Linked data add context to links and provide to bibliographic databases the capability of links to a myriad of authority files and resources.

Cross-domain linking is a trend. Wikidata, the pool available to all language versions of Wikipedia, has been populated with VIAF and ISNI identifiers via the "VIAFBot," and so far the German and English versions of Wikipedia include these identifiers.^[44–46] In the Netherlands, the universities' Current Research Information System called National Academic Research and Collaborations Information System uses the national union catalog's authority file to register researchers receiving government funding.^[47]

Links too can be complicated, not necessarily a simple one-to-one relationship as is seen in the case of Wikipedia that generally has just one page per person, grouping all known pseudonyms. One-to-many and many-to-one links are necessary.

Error correction is a major challenge with linked data. The more links there are, the more difficult it is to stamp out an error in the same way that it can be difficult for a person to suppress a former address. ISNI (which has 18 million links) has a notification system that pushes error corrections to all known sources. Acceptance of such notifications is a condition of ISNI membership and data contribution.

ENCODING AND MODELS

Data models, data rules, and encoding are closely related. Rules determine the semantics of data elements and how to construct them, for example, how to abbreviate and how to sequence elements. Examples of rules for library cataloging include *Anglo-American Cataloging Rules*, 2nd ed. (AACR2),^[48] *Personennamendatei* (PND),^[49] and the French rules AFNOR NF-Z44-061.^[50] RDA^[13] has been introduced first to replace AACR2 but is likely to become an international cataloging code replacing all the national and regional rules. In the archival world, there

is ISAAR (CPF).^[51] The early library rules have a common model of a bibliographic record for a publication linked to one or more authority records (names, subjects, places, etc.) where names of authors, editors, illustrators, translators, etc., are linked to authority records. RDA are new rules brought into being for two main purposes; to be international rules that could replace the myriad of national cataloging codes and to reflect a new model, Functional Requirements for Bibliographic Records (FRBR)^[52] and its associated Functional Requirements for Authority Data (FRAD).^[53] In the new model, the production of bibliographic data is not viewed as simply creating bibliographic records but as a process of creating descriptive information about the four FRBR Group 1 entities; the work (original creation), expression (content level), manifestation (publication level), and item (physical level), as well as information for the Group 2 entities (agents) defined by the FRAD model. RDA also articulates the roles of authority records that can be linked to any of the three theoretical FRBR levels. For example, authority records for authors and composers are linked at the work level, whereas translators, illustrators, and performers are generally linked at the expression level and publishers may be linked at the manifestation level.

There are many standards in practice for encoding authority records. Schemas determine the name of record elements and how they are structured. They include MARC in its many variations, in particular, MARC21^[54] and UNIMARC^[55] and MADS,^[56] with various encoding options, including ISO 2709, XML, RDF, Turtle, and JSON. The experimental Bibliographic Framework Transitions Initiative (BIBFRAME)^[57] is being developed as a replacement for MARC21 and a general model for expressing and relating bibliographic data, including name authorities. In addition, the emerging BIBFRAME authority schema^[58] may serve as an enriched alternative to the schema.org^[59] schema that is used by major search engines to harvest metadata from web pages. In the archival world, there is EAC-CPF,^[60] natively expressed in XML with alternative serializations in RDF.

TRENDS

Libraries have traditionally shared their data, and that sharing is increasingly international and cross-domain with the emergence of freely available, consolidated sources such as VIAF and ISNI as databases, enquiry targets, and linked data. The data are being harvested and used in library systems as well as institutional systems and Wikidata and Wikipedia. Maintenance of authority data is federated with an emphasis on local creation and international sharing. With increased sharing, there is a greater need for standard and consistent labeling of such things as

pseudonyms and for usage of common vocabularies such as relationship terms and organization types. It is important to maintain data locally and also within consolidations to ensure correct clustering, data consistency, and quality linked data. Multiple web sources and linked data are facilitating information gathering as library and archive data are coming together with data from multiple domains and crowdsourced resources. Authority data are being extended to link from all types of creative works, physical and digital.

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National Archives

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Abstract

The scope of this entry covers the development of national archives from antiquity to the present day, charting the changes in the understanding of what constitutes a national archive and the differences between countries throughout the world. It looks at the different positions of national archives within governments, at their varying responsibilities, the scope of their holdings, and the activities which they undertake.

INTRODUCTION

National archives are the repositories of the selected records of government, in whatever medium, normally preserved in a government building and made accessible to the public. As in other archives they gain their authenticity from retention in official custody which in this case maintains their value as evidence of decisions and subsequent implementation by government. The reasons for maintaining a national archive are also much the same as for any other archive but often on a larger scale; the official record plays a role in society by ensuring that the rights of the individual and of government are documented and retained over time. Thus a national archive may contain diverse material ranging from treaties or boundary agreements on a national scale to the personal details of births, marriages, and deaths or the financial rights of individuals. The word *archive* covers both the historic records and the organization which looks after them but the context makes it clear which definition is referred to.

The concept of a national archive appears relatively simple at first sight, but on further investigation proves to be a highly diverse subject with many variations. This discussion is necessarily limited, due to the global scope of the subject and the availability of information, but the recent comparative work undertaken by the European Union (EU) demonstrates the value of deeper investigation. It is also clear that the concept changes and develops over time depending on the regime which it documents; these changes will continue, not least as greater global importance is placed on the right of all citizens to official information.

The footnotes indicate the main sources used and it must be emphasized that where examples are given the information is provided by the country cited and it has not been possible to verify it independently. It should also be noted that they are intended to be exemplars only and citing one does not mean that other countries do not follow the same practices. The regions of the world cited are those adopted by UNESCO.^[1]

HISTORICAL CONTEXT

The concept of ensuring the survival of key government documents dates back to antiquity although the recording format has changed over the centuries. The need for administrations to make their promulgations and laws public initially led to inscriptions being made on stone and clay tablets, foreshadowing the more sophisticated use of papyrus, parchment, paper, and ultimately electronic documents in the hands of those in power.

The survival of records in antiquity and their secure buildings is patchy—in some countries, such as Egypt, actual records survive but not the buildings; “Rarely indeed has there been a bureaucracy as record conscious as that of ancient Egypt. It not only used records as tools of management but also contributed toward making record—consciousness integral and important in the life of people”^[2] Elsewhere in the ancient world buildings, such as the Metroon in Athens or the Tabularium in Rome, which used to house the records of administrations, are known to have existed but their contents have not survived. The concept, however, was well developed and understood; for example, the tradition of keeping the royal archives with registers of the documents in Babylon was maintained by Alexander, the Great when he conquered the Persians in 333 B.C. The Greeks also influenced later Ptolemaic and Roman Egypt, bringing enhanced administrative skills which included quite sophisticated record keeping. In the Roman Empire, the Tabularium became the seat of the imperial archives after Caesar before the system was reformed by Diocletian (284 A.D.) and the previously centralized government became a migratory body, taking its documents with it. Many of such archives disappeared between the fifth and seventh centuries during the barbarian invasions in central and western Europe but the tradition of national—or at least regime—record keeping was to some extent maintained by the Arabs. Evidence for this is found in the Fatimid administration of Sicily from the tenth

century where advanced techniques of making, arranging, and preserving the records of the administration were introduced.

Northern Europe lagged behind these traditions, though by the time of Charlemagne (769–814 A.D.) codification of the law and some concept of the importance of keeping central administrative records must have been quite widespread. Evidence such as Domesday Book (1086), compiled for William the Conqueror in England, suggests that at least some of the information gathered for the survey was already available in written form by that time. The Normans instituted considerable administrative changes throughout their territories in Europe, including registers of grants and taxes as well as writs of instruction, most of which, in England were kept by the king in the Curia Regis and subsequently in the Chancery or government secretariat.

Elsewhere in Europe similar developments occurred, though frequently the archives related to powerful independent areas such as the city states in Italy, or the duchies in France. The archives of the kingdom of Aragon (modern Spain) date from 1346 and the first formal amalgamation of archives to form a type of national archive there occurred in 1542 with the foundation of the Archivo de Simancas. Two centuries later, the Hungarian historic archive was founded (1756) and most European administrations already held archival material essential for managing each country or region and its citizens by the end of the eighteenth century. However, the French Revolution is widely regarded as the moment at which the birth of national archives took place. The Archives Nationales, as an organization, was created in 1790 and legally established by law in 1794, centralizing the archives of France, making them available to the public and establishing an archival network throughout the country. The impetus came from the need to legitimize and preserve the archives of the new government, to rearrange those of the Ancient Regime and to take charge of confiscated documents regarded as part of the national heritage.

Similar changes occurred in the Netherlands, Italy, Germany, and Spain following the Napoleonic Wars of the early nineteenth century as the abolition of existing regimes necessitated control by new administrations. This confirmed the concept of a division between an historic national archive—relating to previous regimes—and current national records which in time would be selected for transfer to a place of permanent security.

Elsewhere in the world many of the governments and dynasties which relied on written communications had long established archives. The preeminent example is that of China where the magnificent chests in which the Ming emperors (1368–1644) kept their archives are still maintained in the Forbidden City in Beijing. Slightly later in Russia, Peter the Great initiated reforms when he issued an instruction to regulate transfers to the Russian Imperial

Archive in 1720, an interesting development demonstrating the importance he attached to the official record. Other countries or rulers also maintained their archives privately, for reasons of legitimacy, reference or self aggrandizement in a more or less complete state and transferred them to official national repositories when these were created. For some, this moment came with the expansion of government in the nineteenth century. In South America the Argentinean national archives was founded in 1821, the Mexican in 1823, the Bolivian in 1825, the Venezuelan in 1836, the Brazilian in 1838, and that of Peru in 1861. In Iceland the first national archive was housed in the attic of the Cathedral of Reykjavik in 1882; shortly afterwards, and on the other side of the world a national archive was created in India when the Imperial Record Department was established in Calcutta in 1891. As in some other countries a formal national archives was not established in the United States until the early part of the twentieth century since all government departments held their own records.^[3]

The catastrophic events of the two World Wars in the twentieth century precipitated further changes in the history of the national archives.^[4] Radical alterations to the constitutions and legal systems of Germany, Italy, and the Russian central and eastern European countries changed previous concepts and in 1992 Michel Duchein^[5] categorised three distinct groups as

- Centrally controlled systems in countries such as Bulgaria, Czechoslovakia, Poland, Romania, and the USSR where all archives, except for personal documents, were regarded as part of the state archive fonds following Lenin's decree of June 1, 1918 outlining their status.
- Dispersed control systems in countries such as Switzerland where each canton is separate archivally, with no national archive laws or standards.
- Intermediate systems in countries such as
 - Germany where the federal (Länder) archives are separate but a compliance system is enforced
 - Italy where provincial archives are part of the State Archive and municipal archives are controlled by regional Superintendents appointed by the Director General
 - Spain where the state archives have their own network of repositories but the regional authorities are given most of the archival power by the state
 - England where the national and local archives are not connected other than where public records, subject to the authority of the Lord Chancellor, are deposited locally
 - France where the national and local archives are governed by the same laws but the Archives Nationales is under the Director General of the French Archives and the local archives are under the supervision of the General Inspectors.

Since then the emergence of independent countries formerly part of the USSR, and changes in the Balkan areas of southern Europe have resulted in further developments of national archives. These have included Estonia which established a National Archive in 1998, Lithuania which did the same in 2004, and the Slovak Republic which created the National Archives Service in 2002.

Elsewhere in the world, the second half of the twentieth century saw a proliferation of national archive legislation and a burgeoning of national archive buildings and organizations. Information on these can be accessed from the relevant national archive Web site.

In the Pacific area these included

- The Australian National Archive which was created as a result of the Archives Act of 1983
- The Japanese National Archive which started as a government department in 1971 though it is now an independent agency following an amendment to the Archive Law in 2001
- The Malaysian National Archive created in 1963 although it was actually founded 6 years earlier as the Public Record Office and
- Archives New Zealand which was established in 2005 following new legislation although the archive had existed from much earlier.

In Africa many ex-colonial countries scrambled to establish archives as symbols of independence and legitimacy; these included

- Kenya which established a National Archives and Documentation Service in 1965.
- Mozambique which divided the library and archive to form a national archive in 1976.
- Ethiopia which opened its National Archives in 1979.
- South Africa where the State Archives Service became the National Archives in 1996.

Amongst the Arab countries

- The Lebanon passed legislation establishing the National Archives in 1977.
- Tunisia finally renamed the archive (which had served in various state capacities since 1874) as the National Archive in 1988.

In the Caribbean, national archives were established

- In the Bahamas in 1971.
- In Puerto Rico in 1972.
- in Jamaica in 1982.

The above are all examples, many other countries have established national archives and will continue to do so as administrations change and boundaries alter. However the

progression of national archives through the centuries demonstrates the importance attached to the secure maintenance of official papers and the legitimacy which the possession of such documents confers on a regime.

ISSUES

Reviewing the development of the national archives as described above it is abundantly clear that no two are exactly alike. The European Commission came to the conclusion that "It is impossible to say that there is a 'typical' 'National Archives service, exemplifying a general pattern, which applies to a greater or lesser extent throughout the European Union.'"^[6] If that is so for Europe, how much more true is it for the rest of the world, given the variety of histories, legal, and administrative differences?

Position of National Archives in Government

National archives are established by law in the country to which they relate. The provisions of each piece of legislation will dictate the activities undertaken by the directors and the staff of the archive, but all statutes embrace the three basic principles of selection, preservation, and access.

Different interpretations abound about the scope of these responsibilities, dependant on the financial and professional skill resources available. Selection of material is, in many ways, the most controversial since it is open to accusations of partisanship and bias, political, social, and economic. Even unwittingly archivists can shape the future historical perspective depending on which records are selected for permanent preservation and for national archives this may be a bigger issue than for a smaller, more local organization. This perception, of the official record whether it be national or local, has played a part in the proliferation of community archives, often established in localities or amongst the ex-employees of a business no longer operating, to add an additional, unofficial dimension to history.

The impact of freedom of information legislation has also accelerated the ways in which all public archival organizations have widened access to their holdings. Improved service delivery is a growing trend, with some of the national archives leading the way, not least since for the developed countries it has been possible to employ additional specialists who have skills in audience development, digitization, and education. The growth in interest in genealogy has been behind many of these developments and it has been possible to widen access to the relevant records as well as others following the development of digitization techniques. In consequence, a world wide audience is now a target for many access programs.

The different attitudes between administrations to the correct place for national archives within government are

clearly demonstrated by scrutinizing their location; the report on European archives in 2005 shows that the majority of the 25 national archives surveyed were the responsibility of the relevant Ministry of Culture (14); three others were situated within the Ministry of Education, two within the Ministry of the Interior, two within the Ministry of Justice, three within the Office of the Prime Minister, and one within that of Science policy.^[7] These statistics suggest that although it is widely acknowledged that archives are part of modern public administration, they, and in particular those which are sometimes referred to as historic archives, are more comfortably placed under the aegis of culture. In other parts of the world the same is broadly true, judging by those national archives which offer information of this sort on their Web sites. The Arab world has a tendency to give the oversight of the archives to the presidential or prime ministerial office as do a few Latin American countries but elsewhere the trend is toward culture and heritage. Many of these ministries have additional responsibilities ranging from the Status of Women (Canada) to Heritage and Sport in some African countries and in Australia, contributing to the impression that the organizations within their aegis are something of a ragbag. In just a few places, such as New Zealand, Japan, and the United States the national archive is a department or agency in its own right in government.

The variance in the position of national archives throughout the world is indicative of the problem of explaining their dual role in not only promoting access to the past but also in ensuring good current record keeping in government.

Responsibilities of National Archives

Strictly speaking, the scope of an archive of a government or regime would be limited to managing the records of the transactions of that body and its predecessors. In practice, the work undertaken in different countries is surprisingly variable. The titles have also changed over the years ranging from the very Victorian, and confusing, title of Public Record Office used in England and Malaysia (by now changed in both) to State Archives in Austria, Italy, Poland, and quite a number of other countries. "National" is the preferred term for most but transfer between the two has been quite common, the progression usually being from "state" to "national." South Africa switched from the title State Archives Service to National Archives and Record Services in 1996 with a mission to foster a national identity and the protection of rights. Swaziland is also very clear that these issues are central to the mission of the Swazi National Archives—which "is to empower Swazi citizens to fully participate in their country's social, political, and economic life through the equitable development, preservation, and protection of the Swazi cultural heritage."^[8]

These, and other similar statements elsewhere reflect the difference between the two terms, *state* denoting "a nation or territory considered as an organized political community under one government" and *nation* "a sovereign state of which most of the citizens or subjects are united also by factors which define a nation, such as language or common descent."^[9] Others however have adopted the term state with rather different meanings—in Denmark the State Archives is the collective name for the Danish National Business Archives, the Danish Data Archives, the Danish National Archives, and the four regional archives. In Georgia, the historic archive and the modern record archive are both referred to as state organizations although in practice they both contain much more than just the records of government.^[10] In Latvia, the State Archive consists of the Latvia State Historical Archive, the State Archive of Latvia, Latvia State Archive of Audiovisual Documents, State Archive of Personnel Files and 11 Regional State Archives, as well as the Archival Inspection, the Conservation Laboratory, and the Archival Training Centre with Library.^[11] The scope of the term therefore appears to vary according to the historical development of each archive and although some use the term national for specific reasons it seems likely that others are less concerned about the precise definition but more concerned to ensure that the various elements within the sphere of the archive are well looked after.

The governments of ex-colonial countries in many parts of the world have struggled with the concept of their former rulers that the records of the earlier administration are the property of the colonial power. In many cases, the provision of copies of the records concerned have been provided to ensure that the information about the ex-colony is available in the place of origin, but for some this is inadequate and disputes remain. Many of the arguments hang on the concept of *respect des fonds* and the integrity of the complete archive. Demands for restitution are often argued on the same basis as the return of museum objects to their place of origin. In the Philippine Islands, however, a conscious effort was made to re-create a national identity by handing over the Spanish archives of various agencies to the Americans at the Treaty of Paris in 1898, despite the fact that the records are in archaic Spanish and now rarely understood. "The National Archives, both as an institution of colonial creation and as a collection of records of colonial control, reinforces the *imagined* [my italics] idea of nationhood."^[12]

A few national archives are combined with libraries, either as a result of historic connections or as a rationalization of existing services. In Bolivia, the national library and archive have existed together since an economy measure in 1935; in Eritrea, the Research and Documentation Centre which is in the process of establishing the national archives encompasses the national library as well as other printed documentation and exists to collect all types of materials relating to the country. Much the same argument

was behind the formation of the national Library and Archives Canada where the two were merged as partners in 2004; the vision is that of being the “stewards of a collection that is the keystone of Canada’s national documentary heritage, a collection of national scope and importance.”^[13] In the United Kingdom, the National Archives is moving in somewhat the same direction but more as the centre for government information than as the provider of all official documentary material both manuscript and printed.

Scope of National Archive Holdings

The scope of national archive holdings might seem self-evident but in practice many have gaps in the records which they hold and many also hold material which might appear to be not strictly within a brief definition of their remit. Even the meaning of the phrase “national archive holdings” is not static since increasingly many countries include material amongst their holdings which is not necessarily the result of government activity but that of others in a government related role. This recognizes the value of nongovernmental organizations (NGOs), in particular, those that have been divorced from central government policy departments and operate in a more independent way. In effect, national archive policy must stem from and reflect current government’s means of working and ensure that as complete a picture as possible is maintained for future reference. Government is not limited to strict boundaries in an information rich society.

The narrow definition might also lead to the assumption that a national archive would have the responsibility for the selected material from *all* government departments. A quick look at the available evidence makes it clear that this is far from true. Disregarding secret or classified records the EU report on archives in the enlarged EU^[14] identified some clear trends; 12 of those surveyed took in neither the records of Parliament nor the Department of Defense, eight did not have Foreign Ministry records, four did not have the records of the President or Prime Minister’s Office, two had neither the records of the Department of Finance nor those of the Interior and one did not have material emanating from the Department of Justice. The omission of the records of Parliament are understandable since national archives are usually established for the executive arm of government and special arguments on security grounds may be adduced for the some of the Defense records, but many of the others seem to negate the principles of openness which democratic countries are at pains to proclaim. Only eight out of the 25 EU national archives held the records of all the major departments of government and three were denied custody of as many as five or six departments, seriously limiting their ability to ensure the survival of a full record of activity.

Information about the gaps in the holdings of other countries is hard to find as it is not included on Web sites and no global survey has been undertaken; however, it seems likely that all over the world some governments still restrict the scope of the holdings in their national archives while maintaining a cloak of democratic access.

Issues to do with access to sensitive material have dominated the history of national archives, in particular with changing regimes. Attitudes vary according to stance; those who are successful in overthrowing a government which they regard as illegal are often keen to demonstrate this by reference to archival material. For the same reason, the previous regime may have left much activity undocumented or destroyed material which could prove compromising. The Japanese government, as just one example, destroyed almost all the records of their wartime administration both at home and in occupied territories, but it has happened in many places at different times. Distrust of official custody has also made it difficult to resolve the eventual custody of reports and documentary material held as a result of national legal proceedings such as international criminal tribunals or truth and reconciliation commissions. In South America, Africa, and parts of Europe where the latter have been held, the issues have been very carefully considered to ensure that previous victims are comfortable with the designated repository for the archive. In the case of the reunification of Germany in 1991, the level of concern over free access to the Stasi files of the German Democratic Republic (which held immense amounts of personal detail) were so high that a separate archive was established to manage the records. Many German archivists felt that special arrangements were unnecessary and that this compromised the existing system, but a pragmatic solution had to be found. Other countries have had to resort to similar ways of dealing with highly sensitive material.

The impact of data protection and freedom of information legislation on national archives has been no less dramatic than for other archives—in many ways it has been greater. The resources allocated to ensuring that the right information is available to the right people at the right time have had to be huge; quite apart from the records management issues surrounding the custody of personal information in electronic formats the requirement to provide information freely has necessitated new procedures, additional departments, and dedicated staff. In many countries, the lead has been taken by the national archives but has sparked controversy about the responsibilities which then ensue.

An added change to the role of twenty-first century national archives is that they may now no longer be the obvious place of custody for material which crosses international borders. Globalization and improved communications has led to world wide organizations such as the United Nations and its various branches as well as commercial businesses which know no boundaries. Thus while

international diplomatic activity may be on record in the national archives the decisions to which they relate may well not be part of the official record, bringing a further dimension to the search for archival sources.

Turning to the question of material which is held in many national archives, but which might not be expected, is also interesting. The issue of the custody of private archival material in national archives is one which has generated considerable debate. The theory that national archives exist for purely administrative material is fine on paper and is often adhered to more strictly by national archives which have been established relatively recently such as Cyprus or Sweden. In practice, it is often less easy to distinguish between the official material and that which is frequently generated by individuals in the course of their duty. Additionally, for many countries the national or state archive may be, or have been in the past the only available repository for private papers. In Scotland the National Archives holds a considerable number of family, legal, and estate papers; and records of businesses, societies, and institutions. In Cuba the holdings cover all those papers that relate to a civil society including papers of those who contributed to cultural and political life. In Canada the remit of the Library and Archives is so wide that they solicit every type of material from Canadians on their Web site—"Anyone who feels that they have valuable materials, whether published or unpublished, and regardless of media, is encouraged to offer them to Library and Archives Canada (LAC)."^[15] This sort of statement is powerful in creating a national vision and the new title chosen by the Canadians—"Library and Archives Canada"—indicates the inclusiveness of their collecting policy; *Directions for Change* states that the combined organization "will play a significant role in the government of Canada and within the library, archival, cultural heritage, and learning communities in Canada."^[16] In India too it is recognized that the rich collection of private papers, acquired through donation or gift, and held in the National Archives complements the public records. Elsewhere some limitations are imposed such as in Australia where the private paper holdings are limited to those of prominent people such as governors-general, prime ministers, ministers, secretaries, and High Court judges. Indeed, to clarify the scope of their holdings the Web site of the National Archives of Australia specifies what it does not hold, and presumably will not accept. This includes information on convicts, on colonial migration, on nineteenth century Australian history including exploration or colonial administration, land title or settlements and records of births, deaths, and marriages. In England, although the National Archives has some private papers deposited in earlier periods, the policy is to encourage potential depositors to select another, more appropriate archive.

Legal papers are frequently part of the holdings of national archives although not specifically administrative

documents relating to government. In Portugal, the National Archives has oversight of the district archive services to which the records of civil registration, the courts, and the notaries public must be transmitted. In the Caribbean, legal holdings are part of the material held in the Bahamas and in Latin America, judicial material from the sixteenth century is kept in Ecuador, and the records of tribunals from about a century later in Argentina. In Europe, the National Archives of the Czech Republic holds judicial records as does the National Archives in Hungary which emphasizes the importance of many of the judicial papers of the second half of the twentieth century as an essential part of the history of a turbulent era.^[17] In Scotland, the National Archive holdings include legal records such as registers of deeds and land holdings (seisins), Chancery records, and adoption records leading to considerable use of their legal search room by lawyers. In England, the judicial exhibits produced as evidence in law courts and now held in the National Archive constitute a wonderful rag bag of items, hardly archival but adding much substance to similar legal reports. In Iceland, the records of the Supreme Court are regarded as public records and are transferred accordingly to the National Archives.

Ecclesiastical documents are another category of archive frequently found in national repositories though not within the strict definition of such organizations. In many cases this is due to historical accident, since the national archive may have or have had a wide remit as the only obvious place of safe deposit. This is often the case where the church in earlier periods acted as part of the civil administration, registering baptisms, marriages, and burials and providing the mechanism for proving wills. The necessity for court proceedings associated with the latter resulted in a need to ensure that documents were kept and often copied for safety; in England, the records of the Prerogative Court of Canterbury (testamentary court of the Archbishop of Canterbury) are available at The National Archives and form a valuable source for family historians. In Luxembourg, the archives of the Hospice of St John with genealogical information as well as evidence of the activities of the church from the thirteenth century are maintained in the National Archives. In Portugal, an extensive archive of ecclesiastical material is held in the National Archive of Torre do Tombo including diocesan and monastic papers.

Private papers, legal reports, and ecclesiastical documents all form part of many national archives but the twentieth century brought the advent of material in other formats—photographs, tapes, film, and electronic formats. In some countries these are accepted as any other deposit of selected archival material; the National Archive and Record Administration (NARA) in the United States multimedia collections include nearly 300,000 reels of motion picture film and more than 200,000 sound and video recordings. In Australia, as in some other countries, the

audiovisual holdings comprise not only those produced by government (200,000 film and video items), but also audiovisual material from Australian Broadcasting Corporation (ABC), Film Australia, Australian Film, Television and Radio School (AFTRS), Special Broadcasting Service (SBS), Defense, and many other government agencies. In other national archives such as Malta, Kenya, Costa Rica, and Yemen such collections, though smaller, are an essential part of the history of each country since audiovisual material, especially television footage, may be the only archival material which survives for some twentieth century events. Not all national archives contain audiovisual archives, however, partly due to the specialized nature of the material; in England the British Film Institute acts as an agent for The National Archives and the BBC maintains its own archive. Practical considerations make this a more convenient arrangement, obviating the need to maintain the facilities for viewing such material in the National Archives and ensuring that the collections are looked after by specialists. Elsewhere the broadcasting organizations also often maintain their own archival material, particularly commercial firms. In Thailand, by contrast, the government is planning to establish the Royal Private Film Archive as the place to preserve the King's moving and still pictures. The Coordinating Council of Audio-visual Archive Associations (CCAAA) which was established by UNESCO in 2001, has recommended that "Deposit conditions should apply to publicly funded archives with recognised national responsibilities and should apply to both commercial and noncommercial productions,"^[18] but it is not specified which organization this should be and it will undoubtedly vary according to circumstances.

Scope of National Archive Activity

If the scope of the holdings of national archives is diverse then the scope of the activities undertaken worldwide under this aegis is even more so. The description which each organization gives itself is revealing: some call themselves national archives and leave the interpretation to a vision statement, often backed up by a mission statement—for example the National Archives of Scotland or of Brazil; others include records management in the title to indicate a greater than just historic role, such as the National Archives and Records Administration of the United States of America; others use the term National Archive Services such as the Botswana National Archives and Records Services, or National Archival Services in countries such as Norway where the term encompasses a wider range of archive institutions than simply the designated national institution. The word "services" is used increasingly, documenting a global perception that while the historic archive must be maintained in its own right as a record of events, it is also imperative that every archive, whether national or other, serves the citizens of the country in which it is situated in a number of spheres.

A survey of Web sites on which national archives identify their *raison d'être* makes it clear how diverse these activities can be. In India, their vision is to help in spreading a feeling of national pride in the documentary cultural heritage and ensuring its preservation for posterity. The National Archives is concerned to develop the best means of conserving the records, to foster good relations between archives both at home and abroad, to increase access, and develop greater professionalism amongst creators, custodians and users. In the United States, the aspiration goes further with a vision that "all Americans will understand the vital role records play in a democracy, and their own personal stake in the National Archives."^[19] Although the title of the organization proclaims that they form the records administration arm of government, in the mission statement it is not explicitly stated, support for democracy, and the promotion of civic education being more prominent. In Kenya, the National Archive is clear that it has a vision to excel as an archives service in the view of all Kenyans and to serve as the Memory of the Nation; the Web site cites the overall activities of the service, which are common to many countries in the world, as continuing to

- Advise public offices on proper records management.
- Select valuable records for permanent preservation as archives.
- Store and preserve archives in the repositories.
- Publicize availability of information resources in our custody through computerization of indexes, digitization, World Wide Web; and through use of other communications and information technologies.
- Promote access to public records and archives for reference and research purposes, or just for leisure and enjoyment.^[20]

The Australians manage to encompass some philosophy about their approach to record keeping in their mission statement, referring to best practice in management from the point of creation and their concern to develop, manage, and promote a visible, known, and accessible national collection. This argues a confidence which is also visible in the statements issued by the Malaysian National Archive with a vision of molding a knowledgeable nation that values its national heritage, and a rather simpler mission which repeats the overall purpose of all national archives namely acquisition, conservation, and preservation but also includes popularizing the archives and national heritage and making the National Archives a resource and research centre. This introduces an academic element which is shared among some other national archives, such as Greenland, suggesting links to higher education. Finally, in the Netherlands another issue is explicitly raised, that of wishing to play a leading role in archive policy and to advise the State Secretary effectively, a point followed in the mission statement of The

National Archives in the United Kingdom where that is developed into information management—"The National Archives is at the heart of information policy—setting standards and supporting innovation in information and records management across the United Kingdom, and providing a practical framework of best practice for opening up and encouraging the reuse of public sector information."^[21]

It is clear that national archives fulfill a number of roles many of which are very similar and have been so for some time. Other roles are being developed not least on account of the dual role of preserving the past for the future but also ensuring that current records, increasingly in electronic format, are properly managed. Some, such as the State Archives of China, divide their activities, and their premises and staff, so a clear distinction is made between the two roles; others run a multifaceted operation connecting the past and the present with a view to ensuring the survival of it all for the future. Much depends on the scale of the organization and available funding; in a few countries large sums of private money supplement government support, but for defined purposes. The obvious example is that of the presidential libraries in the United States which are administered by the National Archives and Records Administration but with private endowments. Elsewhere the more modest official sums available require archives to bid for exterior funding to support digitization programs or even basic improvements to buildings and storage areas. In areas of the world where the workforce constitutes the major part of the annual expenditure all effort will be put into reducing that to a bare minimum; elsewhere the limiting factor may not be the size of the workforce but the untrained element.

CONCLUSION

National archives are a defined but diverse group, carrying out both basic and more advanced archival work on behalf of governments. The scope of what they do is limited by resources and by the type of national archive system, as well as the national perception of the role of archives in modern society. The diversity is important as it reflects the differing characteristics of each country, historic, legal, and cultural factors, and, as recognized by the EU, "it

would be inappropriate even to contemplate a 'model' of a National Archives service."^[22] If that is true for the EU, it is equally applicable to other areas of the world, let alone impossible to impose. Much of the value of national archives is contained in what each can offer to its very varied citizens.

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National Biological Information Infrastructure (NBII)

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Abstract

The United States National Biological Information Infrastructure (NBII) is a collaborative program with the mission of improving online access to the country's information about its biological resources. Coordinated by the Biological Informatics Program Office of the U.S. Geological Survey (USGS), the NBII provides a distributed infrastructure for scientific information provided by national, state and local governments, universities, museums, private organizations, and international collaborations. Concentrating on the fields of biodiversity and ecology, the NBII's main audience is considered U.S. land managers, scientists, and policy makers, but specific programs also support educators as well as private citizens. The NBII catalogs and links to data and information resources, provides searches of Web sites, develops tools for the integration and display of data, and synthesizes the latest information on select subjects; it also supports the development and use of standards and technological tools. The NBII is the only organization within the United States with the mandate and experience to organize and deliver the depth and breadth of biological information to the people.

INTRODUCTION

The U.S. NBII (<http://www.nbii.gov>) is a broad, collaborative program to make accessible online the nation's biological data and information, especially in the fields of biodiversity and ecology. The NBII includes over 250 agencies and organizations, with coordination and program management provided by the Biological Informatics Program of the U.S. Geological Survey (USGS). Because biological information comes from numerous public and private partners, and is found in multiple formats (e.g., datasets, maps, documents, and images), pooling these resources is a significant management and organization challenge. Many individuals and organizations, however, have recognized the value in discovering otherwise hidden information, in having rapid access to new data, and in data integration; this recognition has driven the formation and operation of the NBII over the past 15 years.

Calls began in 1993 for a national, digital system "to collect, house, assess, and provide access to the scientific information needed to understand the status of the nation's biological resources, the trends in the changes of that status, and the causes of those changes."^[1] Digital system initiatives already were underway for genomic, medical, and molecular information, and various government agencies, universities, and other organizations felt that an infrastructure was needed for biodiversity and ecological information. These calls led to the creation of the original NBII within the U.S. Department of the Interior (DOI) in 1994. The NBII initially focused on developing standards

and infrastructure to support the linking of specific data and information. Further calls for the expansion of the program, to a "next generation" NBII (p. 30),^[2] yielded a viable, distributed infrastructure for linking and providing a wider breadth of information online.

The current NBII seeks to meet information needs defined by the U.S. government, by NBII partners, and by outside users, which include researchers, resource managers, policy makers, educators, students, and others. Its efforts emphasize credible, scientific information from the government agencies (federal, state, and local), museums, university collections, gene banks, nongovernmental organizations, botanical and zoological gardens, libraries, bibliographic services, as well as other sources. The NBII has four approaches to gather and disseminate information from these disparate sources: 1) improving standards and technology; 2) working with various regions to meet local information needs; 3) supporting data sharing on national or global issues (e.g., invasive species); and 4) creating the network for integrating local to global knowledge. The resulting infrastructure has both centralized and distributed components: the NBII National Program Office at USGS maintains the standards and protocols, a data repository, a search engine, and Web sites; and distributed offices feed in data from various sources and support specific information portals. Both the Program Office and the distributed projects also help develop tools to synthesize, integrate, and apply biological information.

Overall, while the NBII's general mission has remained relatively constant since its inception in 1994, it has grown

with the opportunities afforded by new technology and with new partnerships from local to global levels. The next section addresses the history of the NBII, as well as its mission, goals and strategy, and its organizational structure. The NBII's extensive and complex relationship to other organizations is discussed in sections for Regional Foci, Thematic Foci, National Standards and Technology, and Knowledge Integration.

HISTORY

Throughout American history, many leaders and agencies have recognized the value of information on its biological resources. Shortly after the United States was formed, Thomas Jefferson charged Meriwether Lewis with gathering knowledge about the landscape, soil, plants, and animals of the West during the Lewis and Clark Corps of Discovery trip to the Pacific Ocean.

Your observations are to be taken with great pains & accuracy, to be entered distinctly, & intelligibly for others as well as yourself, to comprehend all the elements necessary...^[3]

Lewis collected extensive field notes and specimens during the 1804–1807 trip. In the two centuries that have followed, hundreds of local, state, and federal agencies and projects, universities, museums, and private citizens have amassed huge amounts of diverse data and information. Unfortunately, there has been no overarching plan to organize and make these disparate collections accessible. The NBII was created to help find and serve information about our nation's biological resources.

The origins of the NBII can be traced, if not to Jefferson, then at least back to a 1993 report by the National Research Council (NRC), titled “A Biological Survey for the Nation.”^[1] In this report, the NRC recognized the value of interoperability and of linking disparate information types from distributed sources via the Internet, thus providing better and quicker access to scientifically reliable information on biological resources. The NRC recommended that the DOI create a “National Biotic Resource Information System” (NBRI) that would develop new methods to collect and distribute data and information about data, as well as promote standards to ensure compatibility among information sources. The NBRI would especially support database development and coordination at local, regional, and national levels. To help address the multiple issues identified in the NRC report, including that of information management, the U.S. Secretary of the Interior Bruce Babbitt created the National Biological Survey (NBS) within the DOI in 1994; the NBS included the NBRI as one of its major components. The NBS was later renamed as the National Biological Service.

The following year, President Clinton signed Executive Order 12906^[4] and created the National Spatial Data Infrastructure (<http://fgdc.gov/nsdi/>) to coordinate acquisition and access to geographic data. In recognition of the parallel objectives of the NSDI and the NBRI, Secretary Babbitt renamed the NBRI to the “NBII.” The NBII began work early on standard vocabularies in order to interlink data and information. An initial focus of the NBII was to assist the NSDI by writing the Biological Data Profile of the Federal Geographic Data Committee (FGDC) Metadata Content Standard. Metadata is information that describes data and datasets, (both geospatial and non-geospatial); this standard carries both metadata and actual data content, such as specimen descriptions. The NBII also joined the partnership for the Integrated Taxonomic Information System (ITIS; <http://www.itis.gov>), an authority for organism names and taxonomy, and supported development of the National Vegetation Classification Standard, part of a collaborative program between the USGS and the National Park Service.

In 1996, the entire NBS was folded into the USGS and was renamed the Biological Resources Division (BRD); the Office of Biological Informatics and Outreach (OBIO, which later would become the Biological Informatics Program) of the BRD then became the official coordinator of the NBII. Work continued on standards, on building partnerships, and on building Web sites to disseminate information. This work resulted in a number of awards, including the 1997 APEX Award, the 1999 Government Technology Leadership Award, Best Feds on the Web (1999); and the 1998 and 1998 Renew America National Awards for Environmental Sustainability.

Over the next few years, more entities and organizations expressed the need to expand the NBII to meet the initial mission as proposed by the NRC. In 1998, the Biodiversity and Ecosystems Panel of the President's Committee of Advisors on Science and Technology (PCAST) provided strong support. The PCAST reiterated the role of the NBII in society in a report to President Clinton titled “Teaming with Life: Investing in Science to Understand and Use America's Living Capital.”^[2] The cover letter by John A. Young's states “The PCAST report provides a roadmap to bringing the vast advances in information technology to the field of biodiversity in order to develop a ‘next generation’ national biological information infrastructure. Such capacities will allow researchers and resource managers worldwide to make full use of information generated on ecosystems and biodiversity.” The PCAST proposed the most suitable configuration for this “next generation NBII” as being a distributed system of data sources, complemented with multiple entry points, or “nodes.”

The PCAST report was the decisive factor, and in 2000, the U.S. Congress appropriated funds for the development of a NBII node-based infrastructure. In 2001, the NBII initiated two thematic and six regional nodes, including the

Fisheries and Aquatic Resources Node (<http://far.nbii.gov>), and the Pacific Northwest Node (<http://pnwin.nbii.gov>). These nodes identify, compile, and disseminate information by working with partners associated with a specific region, issue, or research data need. Today, there are eight regional nodes and four thematic nodes, along with similar, smaller projects, as discussed in more detail below.

The new node structure brought additional local and national partners into the NBII. The thematic work, however, as well as the NBII's continued work with standards, meant that the NBII also needed to develop strong ties with international entities. In 2001, the NBII began a formal collaboration with the Global Biodiversity Information Facility (GBIF; <http://www.gbif.org>), an international effort to meet the framework of the Rio Convention on Biodiversity, which proposed a worldwide information and data exchange, as well as training in informatics for developing countries. One objective of GBIF, with which the NBII has close coordination, is to provide a global, online infrastructure for primary biodiversity data, especially museum specimen information. The NBII helped support the standards and protocols needed for this broad effort, and became the U.S. representative and the U.S. node of GBIF. Beginning in 2002, the NBII also began helping the NATO Information Management Committee of the NATO Research and Technology Agency with the design of the NATO Science, Research, and Technology Network (STARNET), and the International Council for Science (ICSU) recognized the NBII as the U.S. World Data Center for Biodiversity and Terrestrial Ecology. In 2003, the NBII helped launch the Global Invasive Species Information Network (GISIN; <http://www.gisinet.org>). That same year the NBII also became a leading member of the Inter-American Biodiversity Information Network (IABIN; <http://www.iabin.net>), which helps coordinate and network biodiversity information from the Western Hemisphere, and it helped launch the IABIN Invasives Information Network (I3N) search system (http://i3n.iabin.net/search/mercury_search.html). The NBII has continued to join in other international information partnerships, such as the Conservation Commons.^[5]

Today, the NBII partnership includes more than 250 agencies and organizations contributing their expertise, data, equipment, facilities, and labors directly to create and support standards, to strengthen the NBII infrastructure, and to increase the pool of accessible information.

MISSION, GOALS, AND STRATEGIES

The current NBII mission is similar to its original mandate and is defined as *providing the nation with a mechanism for accessing the vast amount of existing biological and natural resources data, information products, and analytical tools that support and enhance science-based decision-making.*^[6]

The NBII mission encompasses all biological and natural resource data and applications for the nation, a very complicated task requiring wide coverage from molecular work and genetics, to species interactions, to biomes, to related resource information such as water and geology. Thus, the NBII Steering Team formulated its Strategic Plan^[6] from the plans of both the DOI and the USGS Biological Informatics Program in which the NBII is housed, and from input from multiple parties, including NBII partners, other stakeholder groups, and Congress. These groups specifically requested ecological information to support a “better understanding of current environmental conditions, develop predictions about the future, and provide options for adopting a course of action or response to these conditions (p. 1).”^[6] The NBII thus focuses on three knowledge domains: 1) species information, including biosystematics and nomenclature, habitat requirements, and population dynamics; 2) landscape level information, including land, vegetation, and water classifications and status; and 3) the environmental drivers behind trends in invasive species, wildlife diseases, climate change, and human impact.

The NBII's methods of information management fall within the science and practice of “biological informatics,” or “bioinformatics,” which creates and utilizes techniques for compiling, linking, organizing, storing, integrating, synthesizing, and delivering biological data and information, as well as tools to help analyze and apply this information. The terms bioinformatics and biological informatics often have been used more narrowly to denote biomolecular information only, but both terms actually address all scales of biological data from the molecular to ecosystem levels.

For each of these knowledge domains, the NBII has four main goals (p. 8).^[6]

- Develop the framework to support knowledge discovery and creation for the nations' biological and ecological resources.
- Create an integrated library by systematically discovering, acquiring, organizing, storing, updating, and making available scientific data and information from diverse sources. Ensure that this library responds to the information needs of land and resource managers and other stakeholders and users.
- Lead the development, selection, and distribution of tools and standards necessary to facilitate system-wide interoperability and allow meaningful interactions with scientific data and information.
- Empower NBII users by creating an awareness of the NBII and its capabilities and providing support to enable users to directly apply NBII products and services within their own areas of concern.

To meet these goals, the NBII coordinates with the many other organizations that have developed similar regional or thematic interests and resources. Consequently, a web of

projects and funding has emerged. Recently, funding for NBII operations has been flat or declining (p 132),^[7] and much increasing in-kind work through partnerships is critical for the NBII to meet its goals. For example, according to a 2005 DOI Investment Overview,^[8] partners provided the equivalent of \$3 for every one the NBII spent in 2002. This funding and leveraging environment influences the projects on which the NBII can focus. Many pressing national concerns, however, are not fully met under the current funding regime. For example, most natural history collections are not digitized and remain inaccessible over the Internet.

Organization

The NBII is managed by the Biological Informatics Program of the USGS, based in Reston, VA, and is led by the NBII Steering Team, consisting of USGS employees (Fig. 1).

The figure shows how multiple groups provide input on information needs, goals, and objectives. One such group is the Biodiversity and Ecosystems Informatics Working Group (BioEco; <http://www.bioeco.gov>), established under the White House's Office of Science and Technology Policy in 1997 to improve the coordination of federal

biodiversity and ecosystem informatics activities. The NBII also receives input directly from the scientific communities through staff who attend scientific meetings and participate in discussions with outside scientific committees and associations. Finally, the hundreds of partners in the NBII federation provide input either directly to the Steering Team or via project managers.

In building the national infrastructure, the NBII has four organizational approaches: national themes, regional foci, network standards and technology, and knowledge integration. Staff within the thematic and regional foci concentrate on discovering, incorporating, and integrating data specific to a region or theme, as well as in creating application tools. The Network Standards and Technology and the Knowledge Integration groups assist in this process, but also provide overarching standards, tools and applications, and technical support for all NBII Web sites and repositories. Many project managers and staff are based at a USGS or partner science centers that specialize in their subject, such as the USGS Center for Biological Informatics (CBI) in Denver, CO, while additional Program staff are based in Reston; project managers within each approach, however, commonly work closely with managers in others, in person or remotely. The main projects within each approach are detailed below.

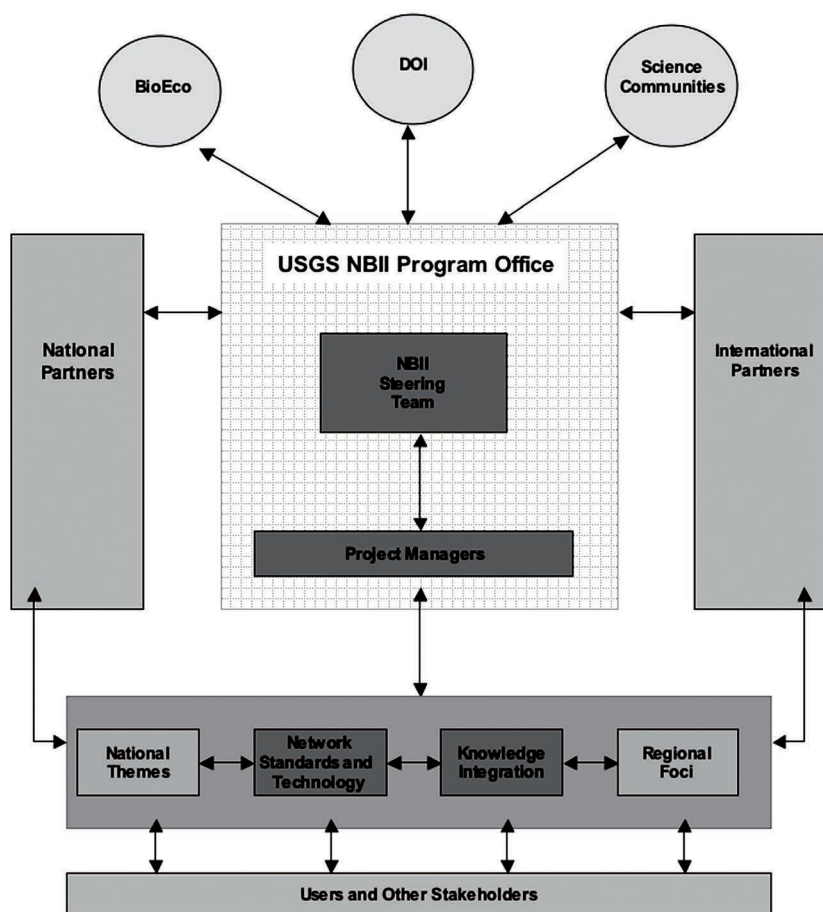


Fig. 1 Organization of the NBII's activities.

Source: Modified from Ruggerio, M.; Marcia McNiff, M.; Olson, A.; Wheeler, B. Strategic Plan for the U.S. Geological Survey Biological Informatics Program: 2005–2009; U.S. Geological Survey, Biological Resources Discipline, 2005; 1–22, http://www.nbii.gov/images/uploaded/8496_1178901646922_BIO5yrPlan.pdf (accessed March 15, 2008).^[9]

Regional Foci

Data issues and collections often have a geographical basis and orientation, thus information users often seek a regional approach to sharing data. A NBII regional focus, or “node,” includes local and regional partners who work with a NBII regional manager to help determine the data priorities for that region, and then to develop, acquire, and manage that content. The resulting Web site within the NBII system provides an entry point to that regional data and information, which also becomes accessible to the general NBII user community through the main NBII Web site and overarching tools. Eight regions currently have projects underway, and the strategic plan calls for the implementation of 12 nodes to effectively blanket the country (Fig. 2; Table 1).

Different regional nodes can have different subject and resource foci, depending on their partners’ needs. The Pacific Northwest Information Node (PNWIN; <http://pnwin.nbii.gov>) makes available information about forests, as well as other subjects. The Southern Appalachian Information Node (SAIN; <http://sain.nbii.gov>) was one of the first nodes to form, and it combines information and resources to improve productivity, resource management, and sustainable development within its region. An example SAIN project includes assisting the Appalachian State University in developing a Southeast Herbaria Network to support the digitization of and improved access to botanical collections. A more recent formation, the Mid-Atlantic Information Node (MAIN; <http://main.nbii.gov>) provides online access to biodiversity information about the Chesapeake Bay area, as well as expanding into other subjects.

National Themes

Many environmental issues are relevant in a majority of regions. To help research and decision-making on these issues, the NBII provides a layer of national-level coordination by constructing several major thematic information nodes: Bird Conservation, Wildlife Diseases, Invasive Species, and Fisheries and Aquatic Resources. It also manages smaller thematic projects, such as collecting information on Amphibians, Botany, and Pollinators.

Table 1 Regional nodes of the NBII.

Regional node	States
<i>Active nodes</i>	
California	California
Central Southwest/ Gulf Coast	Arkansas, Louisiana, Oklahoma, and Texas
Mid-Atlantic	Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, and West Virginia
Mountain Prairie	Kansas, Montana, Nebraska, North Dakota, South Dakota, and Wyoming
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont
Pacific Basin	Hawaii, Guam, and the island nations of the Pacific
Pacific Northwest	Idaho, Oregon, and Washington
Southern Appalachian	Alabama, Kentucky, Mississippi, and Tennessee
<i>Future nodes</i>	
Alaska	Alaska
Great Lakes	Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, and Wisconsin
Southeast	Florida, Georgia, North Carolina, and South Carolina
Southwest	Arizona, Colorado, Nevada, New Mexico, and Utah

Source: Strategic Plan for the U.S. Geological Survey National Biological Information Infrastructure (NBII) July 2005; National Biological Information Infrastructure: Reston, VA, 2005, http://www.nbii.gov/images/uploaded/8496_1165236262413_NBII_Strategic_Plan.pdf (accessed March 15, 2008).^[6]

Examples of the focal work conducted within a node can be seen in the Invasive Species Information Node (ISIN; <http://invasivespecies.nbii.gov>), which integrates invasive species data at a national level and which supports real-time and predictive modeling, species identification, and early warning. For example, the ISIN is working with the National Invasive Species Council and federal agencies to develop a national framework for Invasive Species Early Detection and Rapid Response (EDRR). Like most nodes, the ISIN has major partners; among them in this case are the Nonindigenous Aquatic



Fig. 2 The NBII regional foci, or “nodes.”

Source: Strategic Plan for the U.S. Geological Survey National Biological Information Infrastructure (NBII) July 2005; National Biological Information Infrastructure: Reston, VA, 2005, http://www.nbii.gov/images/uploaded/8496_1165236262413_NBII_Strategic_Plan.pdf (accessed March 15, 2008).^[6]

Species Project of the USGS Florida Integrated Science Center, and the National Institute of Invasive Species Science at the USGS Fort Collins Science Center. Another example of the NBII's thematic work is the Wildlife Disease Information Node (<http://wildlifedisease.nbii.gov>), which helps operate the Chronic Wasting Disease Data Clearinghouse and is helping build the National Highly Pathogenic Avian Influenza Early Detection Data System.

National Standards and Technology

The remaining two NBII organizational approaches, Network Standards and Technology, and Knowledge Integration, help provide the means to link to and serve all the information from various partners.

Interlinking data and information depends in part on a common vocabulary, or standard. Scientists use different techniques for research and thus original data differs in the types and scales of measurements. Supplying metadata provides an opportunity to document the resource (e.g., dataset, information product, tool, etc.) with a common vocabulary. This way, researchers know what they are comparing, and thus can implement conversions if necessary. Metadata also adds value by supplying keywords and information about provenance, quality, timeliness, and authority.

As previously mentioned, one of the first projects of the NBII was to create the FGDC Biological Data Profile (<http://www.fgdc.gov/standards/projects/FGDC-standards-projects/metadata/biometadata/>). Work also continues in support of ITIS and the Vegetation Mapping Classification. Other work in standards includes

- *The Biocomplexity Thesaurus* (<http://thesaurus.nbii.gov/>)—an online thesaurus of scientifically reviewed biological terms and preferences for use. Begun in 2002, the NBII develops and maintains the thesaurus in partnership with CSA (previously known as Cambridge Scientific Abstracts). It includes over 15,000 terms on subjects such as aquatic sciences and fisheries, life sciences, pollution, social sciences, ecotourism, and, now incoming, fire ecology, and management.
- *The Darwin Core* (<http://wiki.tdwg.org/twiki/bin/view/DarwinCore/WebHome>)—a derivative of the Dublin Core standard, the Darwin Core deals specifically with natural history museum specimens and other primary species data. In partnership and with support from the NBII, the Biodiversity Information Standards (until recently known as the Taxonomic Databases Working Group; TDWG; <http://www.tdwg.org>) develops Darwin Core and similar standards.
- *The Geospatial Interoperability Framework* (http://www.nbii.gov/portal/community/Communities/Toolkit/Geospatial_Framework/)—a data strategy to reduce development time for geospatial applications, based on the International Standards Organization (ISO)

standards and the Open Geospatial Consortium (OGC) specifications. It is integrated with other core NBII Framework standards and protocols, such as the Universal Description, Discovery and Integration (UDDI) protocol.

The NBII continues to create or adopt, and then implement new standards, such as for ecological datasets, multimedia resources, and observational records. The NBII also is investing in the development of semantic Web technology for biological data through Spire (<http://spire.umbc.edu/>) and others entities, allowing the linking of common terms and scientific concepts.

In addition to standards, many activities within the NBII require technological support. The CBI, which is also managed by the USGS Biological Informatics Program, provides a significant portion of this technical support. It houses the majority of the servers, supplies the security, provides Web services, researches new bioinformatic techniques, and helps create protocols, tools, and applications. Further, the NBII provides technological support to partner systems, for instance, it houses a mirror of the GBIF's data.

Knowledge Integration

The NBII accesses data and information from a variety of organizations. Its mandate is to compile and, where possible, to facilitate the integration of this data and information in order to support the discovery, comparison, and use by a wide variety of users. The NBII provides information directly to individual users through its Web sites, search engine, and other tools; it also shares information with research institutions and other agencies, with organizations that help compile, integrate, and synthesize information, and with other distributed networks that help feed data from multiple organizations (Table 2; see http://www.nbii.gov/portal/community/Communities/Toolkit/NBII_Partners/ for a complete list). The level of integration depends on the format of the data, customer needs, and the technology on hand.

The objective of NBII knowledge integration activities is to bring together scientifically credible data and information in a manner that not only maintains attribution, provider ownership, and the integrity of the data, but also adds value by applying standards and by providing further, similar data resources. This objective is a challenge in light of the great variability in information and in source organizations. Many suppliers do provide information available in preset, standardized formats, easily served by the NBII through a catalog or other appropriate means. More often, however, information suppliers with different base infrastructures serve the NBII with collections of varying sizes and in different formats, including record-level databases, datasets, maps, images, documents, and

Table 2 Sample NBII data and information partners.

U.S. federal government	U.S. local and state governments	Nonprofits	Universities	Multisector and international
U.S. Fish and Wildlife Service	California Department of Fish and Game	Conservation International	University of California	International Ocean Biographic Information System
U.S. Bureau of Land Management	Colorado Division of Wildlife	Ecological Society of America	City University of New York	FishBase
U.S. Department of Agriculture	Illinois Department of Natural Resources	Natural Science Collections Alliance	Colorado State University	Global Biodiversity Information Facility
USGS Gap Analysis Program	New York City, Borough of Queens	Association of Fish and Wildlife Agencies	Appalachian State University	CBD Clearing-House Mechanism
Smithsonian Institution	Chattanooga-Hamilton County Regional Planning Agency	Bernice Pauahi Bishop Museum	Columbia University, Earth Institute	Eastern Brook Trout Joint Venture
Greater Yellowstone Coordinating Committee	Galveston Bay Estuary Program	Appalachian Trail Conservancy	Boise State University, Raptor Research Center	BirdLife International
U.S. Department of Energy	Wyoming Game and Fish Department	NatureServe	Cornell University	Global Invasive Species Programme

species lists. Thus, the NBII must find and apply multiple, flexible integration methods. Furthermore, the act of integration may reveal gaps in the information, and the NBII may then support initiatives to gather the missing data. Finally, in many cases, the methods to gather or integrate biological information may be difficult to use or nonexistent; thus, the NBII also develops new protocols, data processing programs, and other tools to assist in data integration.

The NBII has multiple knowledge integration activities: the key activities are the cataloging of information sources, data harvesting from multiple servers and indexing them in one location, the hosting of collections, the coordination of experts, and the provision of platforms through which the information can be accessed.

Catalogs and Collections: The identification, prioritization, description, and linking of important data and information sources is the first step in integrating information, and has been a NBII focus for the past several years. The NBII's regional and thematic operations describe and document data resources using the NBII Resource Catalog standard, which aids in searching these resources from any NBII Web site. Other multiagency partnerships contribute to specialized catalogs or data collections that are also served through the NBII's search portal, including

- *The NBII Metadata Clearinghouse* (<http://mercury.ornl.gov/nbii>)—a program of the NBII and the U.S. Department of Energy's Oak Ridge National Laboratory in Tennessee. The Clearinghouse provides detailed descriptions of thousands of biological data sets.
- *The Natural Resource Monitoring Partnership (NRMP)* (<http://nrmp.nbii.gov>)—provides Web-based tools developed by the NBII for the NRMP. These

tools are for sharing natural resource monitoring project locations, and a library of monitoring protocols.

- *The NBII LIFE* (<http://life.nbii.gov/>; recently known as the NBII Digital Image Library; <http://images.nbii.gov>)—a growing, searchable collection of images related to nature and the environment. A variety of NBII partners contribute the images and detailed metadata about those images. This library is also setting up harvesting mechanisms with other image libraries that have similar metadata.

Harvesting Partner Sites: The NBII's partners help provide biological data and information such as abstracts, databases, species pages and lists, and maps. The NBII constructs software programs to “crawl” the partner sites, and the partner provides services that help open hidden or blocked information, or to make the process easier. Examples of the information exchanged include species pages from NatureServe, datasets from the Long-Term Ecological Research (LTER) Program, and reports from the UNESCO Man and the Biosphere programme (MAB). The NBII also links to national and international collections networks such as the Mammal Networked Information System, MaNIS (<http://manisnet.org/>) and HerpNet (<http://www.herpnet.org/>), a global network of herpetological collections data. Finally, the NBII is partnering with other major informatics initiatives, for example, within the fields of hydrology and geology, to share information.

Web Crawling: The NBII also uses software to crawl public Web sites. A NBII staff member first researches a site, such as the U.S. Fish and Wildlife Service (<http://www.fws.gov>), and constructs a software program to crawl the site, called a “spider.” The spider starts at a designated page, copies it, and then crawls the hyperlinks

from that page to the next set of pages, and so on to a depth set by NBII staff. Exception lists are generated for each site to exclude irrelevant information. As the crawler returns Web pages, available metadata is attached, and the pages then are served through the NBII. Crawling has some drawbacks, but the NBII is dedicating staff to refining the process.

Hosting: The NBII provides infrastructure to the data networks of selected partners such as ITIS, the Fire Research and Management Exchange System (<http://frames.nbii.gov>), and the Terrestrial and Aquatic Gap Analysis Program (GAP; <http://gapanalysis.nbii.gov>), a national program that integrates data on land cover, species distributions, and land stewardship to determine gaps in the protection of species. The NBII also hosts Web sites or provides other technological support for partners: it helped develop and maintains the U.S. Web site for IABIN, along with the I3N (<http://i3n.iabin.net>), and the I3N cataloging tool.

Expert Coordination: Within the NBII's regional and thematic activities, as well as within overarching projects, much effort is put into finding and enlisting the experts in a field, one of the best data resources available. The NBII brings together experts in workshops on critical topics and helps maintain expert directories, such as the Taxonomic Resources and Expertise Directory (TRED; <http://tred.nbii.gov>). The NBII also provides gateways to outside expert databases.

Collaborative Platforms: The NBII provides a password-protected virtual collaboration space, (<http://my.nbii.gov>), where one can join communities, find project-related documents have discussions, and share information in a dynamic, secure environment. Specific communities have been set up for projects such as the Appalachian Trail Environmental Monitoring Program and the Multistate Aquatic Resources Information Systems.

EXAMPLE OF THE FOUR APPROACHES

A good example of how the NBII applies the four different approaches to making biological information accessible is with the use of species occurrence data, especially museum collection information and observational records. Species occurrence data can be used by land managers, scientists, and policy makers to predict current, past, and future distribution of species; to identify biodiversity hot spots; to predict the impact of road construction; or to help model the impact of climate change. Museums and research institutions have long held historical records of occurrences, but this data has not been readily available over the Internet. Global Biodiversity Information Facility is now providing an online platform for serving such information. Through its regional and thematic projects, the NBII finds collections and catalogs them; it also helps recruit museums to join GBIF and make their museum

records available. As one necessary component, GBIF and the NBII assisted and helped support financially the development of the standards needed for data integration, including the Darwin Core, the FGDC Biological Data Profile, and species names from ITIS. Once the records at each of the thousands of museums are in a standard format, GBIF uses transport protocols to query and transfer the information over the Internet. The NBII and GBIF helped support development of these transfer protocols, including the Distributed Generic Information Retrieval (DiGIR) protocol currently in use, and now a protocol combining DiGIR and others, called TAPIR (<http://www.tdwg.org/standards>). The NBII sponsors two to three workshops a year on the implementation of DiGIR protocols. Finally, the NBII also assists with the development of geospatial applications, such as the Geospatial Interoperability Framework, in order to help provide a common platform for serving the collected information from thousands of providers.

All of these activities extend past the U.S. borders. Through the NBII-GBIF partnership and other partnerships, the NBII provides global access to U.S. data and collections, representing them to the international community, but it also brings critical data directly back to the United States that is useful for investigating the impact of invasive species, climate change, and other environmental issues.

CONCLUSION

Knowledge about the biological world is critical to our health and prosperity, and best practices to ensure that information is organized and accessible are vital. Prior best practices concerned providing and storing handwritten copies, as Jefferson instructed Lewis:

Your observations are to be taken with great pains & accuracy, to be entered distinctly & intelligibly for others, as well as yourself, to comprehend all the elements necessary, with the aid of the usual tables, to fix the latitude and longitude of the places at which they were taken, and are to be rendered to the war office for the purpose of having the calculations made concurrently by proper persons within the U.S. s[sic]everal copies of these as well as of your other notes should be made at leisure times, & put into the care of the most trust-worthy of your attendants, to guard by multiplying them against the accidental losses to which they will be exposed. A further guard would be that one of these copies be on the paper of the birch, as less liable to injury from damp than common paper.^[3]

Today, information can be also stored digitally and made available over the Internet to a broad range of users, thus helping society make informed decisions about the use of our biological resources. The NBII attempts to discover, organize, and add value to information from the molecular level to the ecosystem level, and then disseminate it. To

accomplish this task it has developed partnerships with local, state, and federal agencies and well as intergovernmental bodies and private organizations. Because of the interconnectedness of the world's biological resources and the people within it, the NBII mission has come to include the coordination of information at a global scale. In so doing, the NBII has shepherded in a new global information network that has been recognized by distinguished scholarly and public panels as both incredibly successful and valuable.^[10–13]

The same government and private study groups, committees, and task forces have also recognized the huge challenges in providing access to our natural resource knowledge base, as well as acknowledging gaps in the knowledge we do have. The information that we now have through the NBII's efforts does not begin to approach the volume and diversity that we need to make informed decisions. The NBII will continue to face daunting challenges in the political, social, and technological spheres. Our demands for food, water, shelter, medicines, and energy require that we develop a much greater understanding of the biological world. Greater understanding can only be built on data and information that have been gathered over the centuries and are still being gathered. We can hope that society has the will and foresight to support the NBII to the degree necessary to accomplish this massive undertaking, since there is no other organization in the United States with the mandate and experience to address the breadth of the issue.

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National Historical Publications and Records Commission (NHPRC)

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Abstract

The National Historical Publications and Records Commission (NHPRC) is the grantmaking arm of the National Archives and Records Administration, supplying financial support for projects that preserve and provide access to historical records of national significance housed in collections across the country. Each year, the NHPRC awards grants, based on its annual appropriations, to state and local government archives, nongovernmental archives, historical documentary editing projects, and other nonprofit organizations. It currently runs 10 grant or subvention programs and one fellow program. Since 1964, the NHPRC has awarded nearly \$175 million to some 4400 projects in all 50 states, the District of Columbia, and other special jurisdictions. As part of the National Archives, the Commission is chaired by the Archivist of the United States and governed by a 15-person advisory board, unique among Federal agencies since it includes appointees and representatives of all three branches of government—the Executive, Legislative, and Judiciary.

DOCUMENTING DEMOCRACY: THE NATIONAL HISTORICAL PUBLICATIONS AND RECORDS COMMISSION

The National Historical Publications and Records Commission (NHPRC) is the grantmaking arm of the National Archives and Records Administration, supplying financial support for projects that preserve and provide access to historical records of national significance housed in collections across the country. Each year, the NHPRC awards grants, based on its annual appropriations, to state and local government archives, nongovernmental archives, historical documentary editing projects, and other nonprofit organizations.

The National Archives serves American democracy by safeguarding and preserving the records of our Federal Government, ensuring that the people can discover, use, and learn from this documentary heritage. Continuing access to the essential documentation of the rights of American citizens and the actions of their government helps support democracy, promote civic education, and facilitate historical understanding of our national experience.

As part of the National Archives, the Commission is chaired by the Archivist of the United States. A 15-person advisory board serves as Commissioners, and they are charged with reviewing all of the applications and recommending projects to the Archivist which projects to fund. Unique among Federal agencies, the Commission is represented by all three branches—the Executive, Legislative, and Judiciary, as its members include two Presidential appointees and representatives from the Department of

State and the Department of Defense; a member from each house of Congress and a representative from the Library of Congress; and a representative appointed by the U.S. Supreme Court. Rounding out the advisory body are representatives from the professional societies of archivists, historians, documentary editors, and records administrators. An Executive Director, appointed by the Archivist, reports to the advisory board and manages a small administrative staff at the NHPRC offices in the National Archives headquarters in Washington, D.C.

Since 1964, the NHPRC has awarded nearly \$175 million to some 4400 projects in all 50 states, the District of Columbia, and other special jurisdictions. From the papers of America's Founding Era to contemporary electronic records, the NHPRC documents democracy, linking the records of the Federal Government with historical materials across the country. It awards grants through the following funding categories:

- *State and National Archival Partnership Grants* to build a national archival network by strengthening archives and historical records programs in each of the states. *Only state government agencies, or their designated fiscal agents, are eligible to apply.*
- *Digitizing Historical Records* to digitize nationally significant historical records collections and make the digital versions freely available on the Internet.
- *Electronic Records Projects* to support efforts that will lead to sustainable electronic records archives that preserve digital records with enduring historical value.

- *Professional Development Grants for Archives and Historical Publishing* to improve the training and education of professionals in the archival and historical publishing communities.
- *Strategies and Tools for Archives and Historical Publishing Projects* to develop new strategies and tools that can improve the preservation, public discovery, or use of historical records.
- *Archives—Basic Projects* to reveal “hidden collections” in archives by processing materials in backlogs.
- *Archives—Detailed Processing Projects* to conduct detailed processing and preservation of collections of national significance.
- *Publishing Historical Records* to publish historical records of national significance.
- *Publishing Historical Records—Founding Era* to publish the records of the Founding Era of the United States. *Open only to the previously funded projects dedicated to publishing the papers of John Adams, Benjamin Franklin, Thomas Jefferson, James Madison, George Washington, and records that document the Ratification of the Constitution and the First Federal Congress.*
- *Publication Subventions* to enable nonprofit presses to publish volumes of historical documentary editions. *Open only to assist publication of NHPRC-sponsored or -endorsed editions.*
- *Historical Editing Fellowships* to allow publications projects to host Historical Documentary Editing Fellowships. *Open only to NHPRC-sponsored or -endorsed publishing projects.*

A Brief History

Imagine a national archive double the size and scope of the National Archives. According to the 2004 National Archives and Records Administration Plan, traditional archival holdings total 2.9 million feet. Extrapolating data from earlier surveys, we estimate that state archives alone hold about 2.7 million feet. The mental jump is easy if you count state archives and records repositories which house the documentary heritage of governments from Alaska to Florida. This American archives increases exponentially when the hundreds of city and local government archives are added to the mass. Imagine the American archives connected to a Web of the many other private institutions, nongovernmental organizations, and community associations, home to billions of documents, images, recordings, and other clusters of information. *Where History Begins*, a 1998 report by the Council of State Archivists, estimated nongovernmental repositories held 4 million cubic feet. This *archives of archives* runs like a great river through our national consciousness: official government records at all levels providing the essential evidence for documenting our

political democracy, and billions of other records and papers complementing our understanding of our diverse history and culture.

En masse, the archives defeat every hope of completion. Archivists cannot save it fast enough; researchers cannot ever reach the bottom. Order is provisional, always. Selecting what to save, what to discard, and how to organize and make public the records embedded in the great American archives is the central challenge to all those engaged in documenting democracy.

The NHPRC is a mechanism within the National Archives and Records Administration for reaching out to and connecting thousands of archives, and records repositories across the country dedicated to preserving and publishing the primary sources of the American story in its many forms. For the past 45 years, the Commission has awarded grants to help strengthen the network of state government and local archives and to make public documentary materials in possession of the Government and those in private hands.

“National archives have a natural history of their own.” So wrote J. Franklin Jameson and the Assistant Committee on the Documentary Historical Publications of the United States Government to the Committee on Department Methods in its 1908 report. Their report laid out the case for a Federal program in conjunction with a National Archives, which would publish the documentary materials, whether issued by the Federal Government or not, that would “meet more fully the needs of the Government, of historians, of the public, and be a source of credit to the nation.” Commonly known as the Keep Commission, after its chairman, Charles H. Keep, the Committee on Department Methods was a panel appointed by President Theodore Roosevelt to review the efficiency of operations of the Federal Government. The Assistant Committee was chaired by historian Worthington C. Ford, and had as its members: Charles Francis Adams, Charles M. Andrews, William A. Dunning, Albert Bushnell Hart, Andrew C. McLaughlin, Alfred T. Mahan, Frederick J. Turner, and its Secretary, J. Franklin Jameson. The Assistant Committee’s full report can be found in *John Franklin Jameson and the Development of Humanistic Scholarship in America*, Vol. 3, The University of Georgia Press: Athens, Georgia (2001), pp. 56–71.

Jameson and his fellow historians had been gently twisting the government’s arm for some time. One of the first tasks undertaken by the American Historical Association after its founding in 1884 focused on the need for a national archival system, and as early as 1891, calls went out for a commission empowered to publish the national record. The natural history of the archives and a national publishing program evolved slowly. Fifty years after the call, the answer finally came with the establishment of the National Archives and the National Historical Publications Commission.

As envisioned by Jameson, the national program would support publishing of two classes of documentary materials:

The one class consists of lists, inventories, indexes, and calendars in the exact or restricted sense of that term, which are intended to serve the officials and the public as finding-lists or guides to the materials kept in the official repository. . . . The other is that of publications which consist of documents printed at full length, such as the Journal of the Continental Congress, the Official Records of the War of the Rebellion, the old American State Papers, or almost any other of the historical publications of the American government. It is submitted that the main question with respect to such a plan is, What collections of material hitherto unprinted are most needed in order that the history of this country may be elucidated to its citizens?

—MEMORANDUM respecting the organization and administration of the proposed National Archives, by J.F. Jameson, Director of the Department of Historical Research in the Carnegie Institute of Washington, November 30, 1927. The full memorandum can be found in *John Franklin Jameson and the Development of Humanistic Scholarship in America*, pp. 257–270.

The old-fashioned elegance of Jameson's question notwithstanding, the sentiment lies beneath the mission of the NHPRC's ongoing work as the grantmaking affiliate of the National Archives and Records Administration.

The National Archives and the National Historical Publications Commission (NHPC) were born on the same day in 1934 after about 50 years of gestation. The idea, put simply, was for the Archives to be the steward of the national record and the Commission to select, publish, and tell the story of eminent and important figures from that national record and, importantly, from the archives and records not under the control of the Federal Government, including local and state government, colleges and universities, other nongovernmental organizations, and individuals. Implicit in the idea of the Commission is that the papers of Thomas Jefferson, to take one example, are part of America's documentary heritage, belonging to all of the people, no matter who owned the particular original documents.

The Commission itself met sporadically during the Great Depression, through the war years, and afterward. In 1950, however, a chance encounter took place in The White House that proved catalytic. Impressed by Volume 1 of *The Papers of Thomas Jefferson* presented to him by Julian Boyd and the Princeton University Press, President Harry Truman proposed a comprehensive program for the publication of the public and private writings of persons who have contributed greatly to the development of the United States. A spirited debate over the proposal ensued among historians, and the Commission worked through 1952 to expand and refine its scope.

Early in 1954, a final report to President Eisenhower, *A National Program for the Publication of Historical*

Documents, recommended 361 individuals as worthy of consideration for a national publications program, and it singled out 112 persons, including the five Founding Fathers, for immediate attention. Together with the Jefferson papers, these series became the core of the NHPC's editions program. The report also recommended selective editions for 107 individuals, and three series called for the Federal Government, rather than a private publisher, to produce the documentary editions on the Constitution and the First Federal Congress.

An additional report to President Kennedy (*Report to the President containing a proposal by the National Historical Publications Commission to meet existing and anticipated needs over the next ten years under a National Program for the collection, preservation, and publication, or dissemination by other means of the documentary sources of American History*, Washington, D.C.: Government Printing Office, 1963) laid the groundwork for approaching Congress for appropriations, and in 1964, the Commission was funded for a national grants program: the Public Law 88–383, signed by President Lyndon Johnson on July 29, 1964. By November of that year, the NHPC awarded its first grants—a total of \$350,000—for historical documentary editions.

Another decade slipped by, and the National Archives changed into the National Archives and Records Service (as part of the U.S. General Services Administration. NARS became the National Archives and Records Administration when the agency gained independent status in April, 1985) and NHPC became the NHPRC, acknowledging its responsibility for preservation of original records as well as publishing through grants and other assistance. With the increased responsibility for "records," NHPRC's budget shot up to \$2.5 million in Fiscal Year 1975, and the Commission recognized that to effectively carry out its preservation mission, it had to involve the states. The Commission mandated and began working with State Historical Records Advisory Boards for planning and grant review, then for implementation of those plans, actual archival strategies, and operations, and finally for regrants to local archives and records centers within the states. The 1998 reauthorization of the NHPRC made explicit the *raison* for the NHPRC, amending the language of the enabling legislation to include the Commission's training and education programs, and its partnership with the states:

Section 4, Duties and Functions (a) The Commission shall make plans, estimates, and recommendations for historical works and collections of sources it considers appropriate for preserving, publishing or otherwise recording at the public expense. The Chairman of the Commission shall transmit to the President and the Congress from time to time, and at last biennially, the plans, estimates, and recommendations developed and approved by the Commission. (b) The Commission shall cooperate with, assist

and encourage appropriate Federal, State, and local agencies and nongovernmental institutions, societies, and individuals in collecting and preserving and, when it considers desirable, in editing and publishing papers of outstanding citizens of the United States, and other documents as may be important for an understanding and appreciation of the history of the United States. (c) The Commission may conduct institutes, training and educational programs, and recommend candidates for fellowships related to the activities of the Commission and may disseminate information about documentary sources through guides, directories, and other technical publications. (d) The Commission may recommend the expenditure of appropriated or donated funds for the collecting, describing, preserving, compiling and publishing (including microfilming and other forms of reproduction) of documentary sources significant to the history of the United States and for the activities described in subsection (c). (e) The Archivist of the United States may, within the limits of available appropriated and donated funds, make grants to State and local agencies and to nonprofit organizations, institutions, and individuals for those activities in subsection (d) after considering the advice and recommendations of the Commission.

The Impact of NHPRC Grants

NHPRC awards have helped identify, preserve, and make public the original papers and documents of the Founding Fathers—George Washington, John Adams and Family, Thomas Jefferson, Alexander Hamilton, James Madison, and Benjamin Franklin. Other multivolume editions trace the history of the first Congress, the first Supreme Court, and Ratification of the Constitution. And two hundred or so other Americans—rebels and mavericks, explorers and fighters for justice and equal rights, Presidents and pioneers—have had their legacy preserved and published through printed volumes that number in the hundreds, reels of microfilm that stretch into thousands of feet, and new Web sites on the Internet. Among the noteworthy figures are Martin Luther King, Jr., the expeditions of Lewis and Clark, Abraham Lincoln, Thomas Edison, and many more. These papers projects provide easy access to our documentary heritage—but these are not endings in and of themselves.

Rather, the publishing function of NHPRC is only the beginning, and the effect of its grants ripple out to new interpretative works—dozens of biographies, histories, textbooks, and reconsiderations. Drawing on the works of the 27-volume edition of *The Papers of Alexander Hamilton*, historian Ron Chernow recently published a new monumental biography that may restore Hamilton's reputation and place in American history. Virtually every new American history or historical biography has tapped into the rich vein of source materials uncovered through NHPRC-supported projects.

Plays based upon the words of slaves and the newly emancipated have emerged from the primary sources

uncovered through NHPRC support, along with documentary films and television programs—from *The Civil War* to *Emma Goldman*. New curricula have been created at history classes in high schools, colleges, and universities, and new editions of textbooks reflect what educators have learned through close examination of these published primary sources. On the Internet, users can read the original documents of Eleanor Roosevelt, listen to Kennedy White House tapes from the Cuban Missile Crisis, or read a “mini-edition” of the *Papers of Frederick Douglass*. And these new stories have the ripple effect of deepening and broadening people's understanding of their own history and the individual's place in the American story.

To grasp the impact of the program, take the example of the Freedom History Project, a highly selective edition of documents pertaining to black American life in the years between the beginning of the Civil War and the advent of Reconstruction. The Freedom History Project has kept a cumulative tabulation of how people are using its publications. For example, the papers have been cited in 23 reference works, 15 documentary editions, 130 monographs, 212 scholarly articles and essays, and 68 college-level textbooks and anthologies. At least 152 college courses have made use of the work, as well as 41 teacher workshops, 8 publications for elementary and middle school teachers, 3 CD-ROMs, 9 books for young readers, 24 books for popular audiences, 9 exhibits, 6 films, 11 television programs—including Ken Burns's Civil War series, 16 radio programs, 80 stage productions, and 176 Web sites. One of the editors of the project, Steven Hahn, also wrote *A Nation Under Our Feet: Black Political Struggles in the Rural South from Slavery to the Great Migration* (The Belknap Press of Harvard University Press) which received the 2004 Pulitzer Prize for History. Virtually every scholar of American history has benefited, at one time or another, from works preserved and published through the NHPRC. And even all of these related “products” produced out of the primary sources are still means to an end: to give citizens a better understanding of our nation.

Understanding of our democracy, history, and culture, however, is not limited to the study of great men and women, nor is the American story complete without broad access to the documentary heritage of our states and territories, our great cities and towns, and the records held in smaller repositories across the nation. The NHPRC began to fund the underlying archival work of identification and preservation of documents and records in 1974 through grants to local archival institutions. Coupled with the direct grants to state archives and historical repositories for records preservation and access, the accumulative impact has been to strengthen and develop a national archival system.

Grants through this program have helped preserve and make accessible documents and records throughout the country—from the records of the Rhode Island towns'

meetings to ratify the U.S. Constitution to the oral histories of the Crow tribe in Montana. NHPRC helped the Boston Schools Desegregation-Era Records Project find and preserve records in danger of being lost in a flooded basement, and the Cook County (IL) Local Records Commission discover Chicago's original record of the city council's vote for incorporation from September 1833, long thought destroyed by the Great Chicago Fire of 1871. Through finding aids and database construction, individual users are now able to go online and search through photographs of Colorado's railroads at photoswest.org, daguerreotypes from Harvard University, the whaling industry at the Nantucket Historical Society, and the University of Pittsburgh's Archives of Industrial Society. Genealogists are able to drill down into the records of pioneers and early settlers to Utah. Environmentalists can dig through the archives of the Sierra Club at the University of California's Bancroft Library. Researchers and historians can visit scores of historical societies, libraries, universities, archives, and state and local governments, and their chances of finding the evidence they seek have been greatly improved through NHPRC grants. A complete list of grants from 1976 onward can be found on the NARA Web site at http://www.archives.gov/grants/funded_endorsed_projects/states_and_territories/.

Just as the documentary editions and records program grants produce results beyond their own intrinsic worth, the NHPRC also has invested in other ways to strengthen the archival infrastructure. Since 1967, the Commission has awarded fellowships in documentary editing, and for the past 38 years has sponsored a two-week summer seminar for editors known informally as "Camp Edit," most recently at the University of Wisconsin. In 2008, the Commission also established its Archives Leadership Institute, also at the University of Wisconsin, to provide leadership training to the next generation of archivists and records managers.

Through grants to national professional associations, such as the Society of American Archivists, the National Association of Government Archives and Records Administrators, the Association for Documentary Editing, and others new archival tools and techniques have developed—from basic handbooks for archivists to greater dissemination of sophisticated electronic descriptive tools and standards, such as MARC and Encoded Archival Description. In the wake of the devastating hurricanes Katrina and Rita, the NHPRC entered into a groundbreaking partnership with the Council of State Archivists (CoSA) to

provide disaster preparedness training for archives and records centers, and through grant support it helped in the recovery efforts in Alabama, Texas, and Louisiana. Out of this partnership and the longstanding partnership with CoSA, new efforts are underway to establish a Partnership for America's Historical Records that would provide bloc grants to the states, and in 2008, the NHPRC began a new program to allow the states—through their historical records advisory boards—to undertake new programmatic initiatives and to plan for a true national archival network.

The NHPRC was the first Federal agency to fund research and development efforts to preserve electronic records—records either "born" digital or digitized—beginning in the late 1980s and continuing through this day at projects such as the San Diego Supercomputer Center's Distributed Custodial Preservation (DCP) Center for electronic records. The DCP Center will develop a cost model for providing preservation services for electronic records by developing the iRODS (integrate Rule-Oriented Data System, <http://www.irods.org>) to meet the needs of state archives and other repositories. More recent efforts in digitization are helping archives digitize entire collections, helping preserve records ranging from the work of natural conservation pioneer Aldo Leopold to an exploratory effort to bring online the works of the Founding Fathers.

Results of all this Federal funding can be measured by finding aids or cubic feet of records been saved, research requests of visitors through the doors or Web sites of thousands of repositories. In the greater sophistication the archival field brings to its task of preserving and publishing. In the sheer number of hidden collections now exposed and neglected records uncovered in a courtroom basement or warehouse attic. But the data say what data everywhere says. These measures are not the end. The real measure is in the connection made between the National Archives and Records Administration, the national archival system, and the millions of American citizens who use and benefit from the record of our democratic experiment.

The NHPRC is a bridge to and from the National Archives and the thousands of repositories where the essential evidence is channeled and stored. NHPRC provides funding and leadership. It is a signal commitment from the Federal Government to the local historian in Peralta, New Mexico, to the graduate student in Knoxville, Tennessee, to the genealogist in Juneau, Alaska, to readers, searchers, and explorers of our democracy, history, and culture wherever they may be.

National Libraries

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Abstract

The entry describes the various attempts that have been made to define the role and functions of national libraries. The historical background is reviewed, beginning with the royal libraries of Europe, and examining the growth in the number of national libraries in nineteenth-century Latin America and in the postcolonial world of the twentieth century, leading to the most recent wave of national library creation following the dissolution of the Soviet Union. The main collaborative organizations of national libraries are described and the prospects for national libraries in the changing circumstances of the digital age are considered.

INTRODUCTION

Any consideration of national libraries should begin with the definition of what a national library is and what it does. Since every national library is distinctive, if not unique, in its historical origins, development, functions and position within a country's library system, it is not surprising that in the past a simple definition has proved elusive. The evolution of these attempts at a definition is traced, from the earliest, mainly under the auspices of UNESCO, to the more recent approaches that tend to focus on roles rather than functions.

A brief historical overview of national libraries and their services is provided, grouping them into the successive waves by which they appeared, from the early royal libraries of Europe to the new national libraries of the post-Soviet world. This is followed by a more detailed look at the complex and varied evolution of a few notable examples. Since the 1960s there has been significant growth in the main cooperative organizations that national libraries have created in order to pursue collaborative projects and these organizations are described, together with the activities that they have made possible.

Finally, the prospects for national libraries in the digital age are considered, including the threats that are posed by the alternative providers of the information previously only accessible in the large collections of national and research libraries, and the opportunities that exist for extending national libraries' reach, for example through Web-based services.

WHAT IS A NATIONAL LIBRARY?

The question of definition is one that has exercised many writers on national libraries. Because these libraries can differ dramatically in size and function, their nature is not

subject to a straightforward, and short, definition. In the well-known comparison suggested by one of the most prolific and respected of thinkers about national libraries, Maurice Line, "national libraries are in fact rather like dogs: dogs also exhibit an enormous variety, but we somehow recognize them all as dogs [. . .] Anything that is said about national libraries (or dogs) is almost certain not to apply to one or another specimen. Just about the only thing they (dogs and national libraries) have in common is that they all have very hearty appetites."^[1]

With the notable exception of the work of Esdaile,^[2] the literature on national libraries before the mid-twentieth century is sparse, authors perhaps assuming that their nature was self-evident. However, stimulated by a series of seminars sponsored by UNESCO in the 1950s and 1960s, the discussion about national libraries, what functions they should have and what role they should play in a country's overall provision of library services, became more intense and systematic. In 1966, K. W. Humphreys summarized the various activities of national libraries and divided them into three categories—essential, desirable, and inessential.^[3] The essential functions included the holding of an outstanding collection of the nation's literature, the receipt of publications by legal deposit, wide coverage of the scholarly literature of other countries, the publication of the national bibliography, operating as the national bibliographical information center, the publication of catalogs, and the creation of exhibitions. The desirable functions were seen as the organization of interlibrary lending, coordination of the nation's manuscript and archive activities, and research on library techniques. Other activities, described as "functions of the national library service which are not necessary functions of the national library" were the international exchange service, the distribution of duplicates, the provision of books for the blind, professional training, and advice and assistance to other libraries on library techniques.

Another approach to the classification of national libraries is exemplified by Burston's analysis by type.^[4] This identifies institutions such as "cultural national libraries"—those libraries providing services to major administrative regions, sometimes formerly independent, of federal states. "Dual-purpose libraries" include "national-academic libraries" and "national-public libraries," which combine their national responsibilities with services aimed at specific groups, as well as "national-parliamentary libraries," such as the Library of Congress in the United States and the National Diet Library of Japan, which not only serve the country's legislature but also operate as de facto national libraries. The growth of national subject libraries was seen as a recognition of the fact that no one library could hope to achieve complete coverage of global publishing output, but this might still be feasible in a particular subject area, especially in scientific and technical fields, for example those covered by the National Library of Medicine and the National Agricultural Library in the United States.

Sylvestre's *Guidelines for National Libraries*,^[5] prepared and published under the auspices of UNESCO's General Information Programme, advanced the definition of a national library by describing the functions "on which there exists a very large measure of agreement." According to these *Guidelines*, the fundamental task of the national library is to acquire, preserve, and make accessible the publications of the country, and legal deposit legislation is seen as the most effective means to make this collection of the nation's literature as comprehensive as possible. The national library should also acquire foreign literature, although Sylvestre recognizes the practical and financial limitations to this aspect of collection building, and suggests that in some instances the national library might be best suited to promoting and monitoring a national acquisitions plan, aimed at the avoidance of duplication of effort by other collecting institutions, rather than seeking to acquire foreign material widely itself. The collection of manuscripts of national significance, other than public records, should also be given high priority. The national library should normally contain a country's national bibliographic agency, responsible for compiling the current and retrospective national bibliographies. The national library's public services should aim to complement, rather than duplicate, those offered by the nation's other libraries, and should be supported by adequate reading rooms, reprographic facilities, current catalogs, professional advice, and permanent and special exhibitions. Sylvestre places more weight than earlier writers about national library functions on the need for programs to ensure the preservation of library collections, including then novel techniques such as digitization, and recognizes the conflict inherent in satisfying the needs of present researchers while safeguarding collections for future generations. The *Guidelines* suggest that national libraries need to seek public support through consultation with their users, and engage in research

related to the improvement of services. They should encourage the development of nationwide library networks, using the best technology currently available, but making sure that their services are accessible to libraries at various levels of technological development. The national library should act as the clearing house for the international exchange of publications and participate in international library programs, regional and worldwide. Sylvestre suggests that national libraries should preferably be separate organizations with a clear mandate to provide nationwide services, but when they are attached to another institution, such as a university, the services to that parent institution should not have a detrimental effect on national services. Whether responsibility for national library services lies with a single institution or is distributed between two or more institutions, the national library should be the lead body for promoting cooperation among the country's libraries.

Line's *National Library and Information Needs*^[6] is described by the author as complementary to Sylvestre's *Guidelines*, in that it considers national libraries from the point of view of national information needs, rather than from national libraries' existing practice. In this analysis, Line identifies the paradox that developed countries are most likely to be able to afford and already have a national library, but their need for a national library is less than that of the developing countries, who may find it more difficult to justify in economic terms. The sequence of documents on national libraries published by UNESCO was continued by Cornish,^[7] who discusses the various functions that a national library might reasonably be expected to exercise and the impact of new information technology on the way a national library should carry out those functions. He acknowledges the difficulty of defining a national library, and concludes that there are only three characteristics that most have in common: they are funded mainly from the public purse, they are open to the public, and they act as the major archive of printed material produced within the country concerned. *Guidelines for Legislation for National Library Services*,^[8] designed to be of particular use to developing countries without a satisfactory legislative basis for the national library, proposes an updated definition that encompasses both the "heritage" and "infrastructure" responsibilities that a modern national library should embrace:

National library: an institution, primarily funded (directly or indirectly) by the state, which is responsible for collecting, bibliographically recording, preserving and making available the documentary heritage (primarily published materials of all types) emanating from or relating to its country; and which furthers the effective and efficient functioning of the country's libraries through the management of nationally significant collections, the provision of infrastructure, the coordination of activities in the country's library and information system, international

liaison, and the exercise of leadership. These responsibilities are formally recognised, usually in law.

Reexamining the position of national libraries in the digital environment of the twenty-first century, Brindley suggests a definition based on roles rather than functions: support for research, preserving the cultural heritage and providing a locus for national cultural identity, support for the knowledge economy, support for education and lifelong learning, support for community development, support for citizens, and leadership for the library system.^[9]

It can be seen from these evolving definitions that many activities can reasonably, but not necessarily, form part of what the national library does. In addition to the commonly encountered tasks of collection building and management, the national library may offer services to a specific target audience, such as the scientific, business, and industrial communities, or develop cultural programs for the wider public—a “Centre for the Book,” musical performance, lectures, exhibitions. It may maintain the agencies assigning International Standard Book Numbers (ISBNs) and International Standard Serial Numbers (ISSNs), promote research and development in areas relevant to library and information services, and manage information and document supply networks.

The legislative position of national libraries exhibits as much variety as the work they perform. Typically they are answerable to a ministry with responsibility either for education or for culture and the arts, although there are many variations to this pattern. A number of national libraries have a direct link to the office of the head of the government, and this arrangement can be of particular benefit to the institution. It is not uncommon for a national library to have a representative, nonexecutive board providing advice and guidance, and in some cases direct managerial control.

HISTORY AND DEVELOPMENT OF NATIONAL LIBRARIES

Europe

The earliest form of national library, that of a library founded on the collections of royal and aristocratic personages, expanding through the acquisition of collections from a variety of sources, taking on the responsibilities of legal deposit and a range of services to a wider public, can be seen in many of the national libraries of Europe. The Austrian National Library, for example, which was established in 1920, can be seen as heir to the library of the Holy Roman Empire and the Hapsburg Imperial Court Library (Fig. 1). Some libraries retain their royal identity, for example Sweden’s Kungliga biblioteket, the Bibliothèque royale de Belgique, Denmark’s Kongelige Bibliotek, and the Koninklijke Bibliotheek of the Netherlands. Others have made their “national” role explicit, for example Spain’s Biblioteca Real, which assumed the title Biblioteca Nacional as early as 1836.

Not all European national libraries have their origin in royal libraries. Learned and patriotic societies are another historical starting point: The National Library of Ireland was founded in 1877 on the basis of the collections of the Royal Dublin Society; The Slovak National Library grew from the national cultural organization Matica slovenská. Hungary’s National Széchényi Library honors in its name the donor of its first collection, Count Ferenc Széchényi (1754–1820), who saw the establishment of a national library as the natural accompaniment to a national academy of sciences, and until 1949 the Library operated within the framework of the National Museum. Other national libraries had affiliations with private organizations and individuals: the National Library of Scotland



Fig. 1 The Austrian National Library, Heldenplatz.
Source: Photograph: Austrian National Library.

was founded, with a substantial private endowment for running costs, on the basis of a gift to the nation of its collections by the Faculty of Advocates, a private legal association. The National Library of Portugal illustrates the link that sometimes existed between early forms of legal deposit and the control and censorship of publications. The Library can date its origin to the creation of the Mesa Censória in 1768, which examined works submitted for publication and received a copy of each work that was approved for publication and printed. Italy has libraries called Biblioteca Nazionale Centrale in both Florence and Rome. The newer institution in Rome, founded in 1876, reflected the desire to furnish the new capital of a united Italy with a symbol of the national culture. National responsibilities continue to be divided between the two libraries, although both collect material of national interest. Florence, for example, houses the national bibliographic agency, while Rome maintains the National Centre for Manuscripts.

In some instances the functions of a university library have been combined with national responsibilities: in the case of the National Library of Finland and the National Library of Norway, for example, it is only in recent years that they have separated organizationally from the universities of Helsinki and Oslo. The National Library of the Czech Republic, housed in the famous complex of buildings known as the Klementinum, was born out of the University Library of Prague, which received a donation of books from the Emperor Charles IV in 1366. In 1769 the library was open to the public and later in the century was named "Public and University Library." In 1935, in the period of the Czechoslovak Republic, it became the National and University Library, and has been known as the National Library since 1990.

In all these cases, however varied, the concept of nationhood is obviously a vital factor in the libraries' creation. The National Library of Bulgaria, for example, is the oldest cultural institution in the country, dating from 1878, shortly after the country gained its independence from the Ottoman Empire. In 1747 the public library which was to be the forerunner of the National Library of Poland was founded in Warsaw by the brothers Józef Załuski, Bishop of Kiev, and Andrzej Załuski, Bishop of Cracow. By the 1780s the library was placed under the control of the Commission for National Education and had received the right of legal deposit. After the partition of Poland in 1795, the library's collections were moved to St. Petersburg. It proved possible to recover some of this material after the Russian Revolution and the end of hostilities between Russia and the independent Polish Republic, but much had been lost and therefore could not be returned to the new National Library of Poland, established in 1928. After the Nazi assault on Poland, many of the National Library's collections were destroyed, either at the time of the invasion or after the Warsaw Uprising of 1944, as part of the attempt to obliterate all manifestations

of Polish culture. Unfortunately such attacks on national cultural identity are not just a matter of history, as the destruction of the National Library in Sarajevo in 1992 sadly demonstrated.

Latin America

The rise of the national library as an explicit statement of national identity is linked, in particular, to the emergence of newly independent states in Latin America at the beginning of the nineteenth century. These new nations naturally wanted to ensure that their history and literature was recorded and retained and also to demonstrate their independent status through the symbols of statehood. In some instances, the new national libraries were created on the basis of existing institutions. The National Library of Colombia, for example, had its origins in the Real Biblioteca Pública del Nuevo Reino de Granada, which opened to the public as early as 1773; the National Library of Ecuador similarly originated in the Biblioteca Pública founded in 1792. The National Library of the Republic of Argentina traces its roots to the creation of the Biblioteca Pública de Buenos Aires after the Revolution of 1810. Others, such as the National Library of Peru, owed their existence to the country's proclamation of its independence—its governor, José de San Martín, issuing the ordinance establishing the national library only a matter of weeks after proclaiming Peru independent in 1821, and also donating his own collection of books to the library. The foundation of the National Library of Chile in 1813 made it one of the first state institutions created after Chile's declaration of independence in 1810, although its core collection was the existing colonial library of the Jesuits. The National Library of Brazil, inaugurated in 1810, the same year as the Biblioteca Pública de Buenos Aires, is unusual in that it owes its foundation collections to events many miles away in Europe. One of the casualties of the Lisbon earthquake of 1755 was the royal library, and following its destruction a new royal library was assembled which included the collections of the bibliographer Diogo Barbosa Machado and books from the Portuguese Jesuit colleges. When the forces of Napoleon entered Portugal, the royal family and the royal library departed for the then colony of Brazil. When João VI returned to Portugal in 1821, the royal library remained, becoming public property after the proclamation of Brazil's independence in 1822. It was not uncommon for the national libraries of Latin America to be associated closely with a university. The National Library of Chile was linked to the Universidad de Chile until 1852; the National Library of Colombia was attached to the National University after 1867. In North America, the National Library of Mexico also has long-standing associations with the National Autonomous University of Mexico. Although the first attempts to establish a national library of Mexico date to the 1830s, it was not until 1856 that a

decree of the President proposed the establishment of the National Library, which came into existence the following year after the suppression of the University of Mexico and the assigning of its building and books to the National Library. The National Library was not immune from the political upheavals experienced by Mexico in the nineteenth and early twentieth centuries, but with the granting of autonomy to the University of Mexico in 1929, control of the National Library passed from a department of government to the University itself, and is now under the administration of the Institute of Bibliographic Investigation. The National Library still forms part of the cultural complex on the university campus, Ciudad Universitaria.

National Libraries in the Postcolonial World

The former British Dominions (self-governing territories of the British Commonwealth) tended to have developed library systems at a relatively early stage in their political and economic development. The National Library of New Zealand (in Māori Te Puna Mātauranga o Aotearoa) was formed by the merger of three institutions: the General Assembly Library created in 1858 to serve Members of Parliament; the Alexander Turnbull Library, a research collection bequeathed to the nation and opened to the public in 1918; and the National Library Service, which brought the Country Library Service and the School Library Service together in 1945. The updated legislation of the National Library of New Zealand Act 2003 placed more emphasis on the responsibilities of the Library toward Māori heritage and knowledge, and extended legal deposit to electronic publications.

Library and Archives Canada/Bibliothèque et Archives Canada (LAC) was created in 2004 with the merger of the National Library of Canada (dating from 1953) and the National Archives of Canada (dating from 1872), thereby establishing one of the few organizations in the world to bring together an existing national library and national archives. The intention was not simply to bring two sets of functions under a single administration, but to create a fully integrated knowledge-based institution. The legislation establishing Library and Archives Canada introduced the term “documentary heritage” to encompass all recorded information about the country, including electronic media, which are now subject to legal deposit. Library and Archives Canada also harvests a representative sample of Canadian Internet sites for preservation purposes.

Before the creation of the National Library of Canada, national library functions fell to the Library of Parliament. Similarly, Australia's Commonwealth Parliamentary Library, inaugurated in 1902 after the model of the Library of Congress, enjoyed the legal deposit privilege from 1912 and formed the basis of the National Library of Australia. The National Library Act 1960 separated the National Library from the Parliamentary Library and a new building

for the Library was opened in Canberra in 1968. The Library has been at the forefront in exploring the preservation of digital information, and is committed to the exploitation of its collections through digital technologies.

In the twentieth century a further wave of national libraries accompanied the emergence of new nations in the postcolonial period. This was seen clearly in Africa, although the term “bibliothèque nationale” was used more frequently in francophone Africa than “national library” in Anglophone countries, where a national library service was often introduced. In Ghana, for example, which gained its independence from Britain in 1957, the Ghana Library Board was established to set up and manage public libraries. However, it is also responsible for the George Padmore Research Library, which acts as a National Library in the absence of a statutory body. The Kenya National Library Service was established by an Act of Parliament in 1965 in order to develop public library services, but it too carries out a range of services within the remit of a national library, such as acquiring comprehensively material published in Kenya and abroad about the country, providing bibliographic and reference services, and publishing the national bibliography. A similar picture is seen in Botswana, where a Division of the Botswana National Library Services administers the acquisition of books by legal deposit and produces the *National Bibliography of Botswana*. Zambia also lacks specific legislation for a national library service, but the Zambia Library Services, a unit in the Ministry of Education, undertakes a range of national functions. The National Library of Nigeria was established by the National Library Act 1964, which was unusual among national library legislation in that it called for the creation of a branch of the National Library in each of the country's States. As a result of the political situation in the country, as well as the familiar financial pressures, the Library still has some way to go in achieving the goal, although branches now exist in some 14 States. Uganda has taken the step of repealing its Public Libraries Act 1964, which established a Public Libraries Board responsible for managing libraries nationally in Uganda, and replacing it with the National Library Act 2003. Responsibility for libraries had already been decentralized in 1997 by new local government legislation, and the 2003 Act established the National Library of Uganda as an advisory body for national library policy and the executive body for managing legal deposit, maintaining the national collection, and publishing the national bibliography. The national libraries of Africa face the most challenging conditions of any national libraries. The economic and political environment in which they operate, and the competing needs of other pressing social and economic concerns, can make the role of the national library seem marginal. Nevertheless, in many countries the impact they make in support of national library services and the importance they have as national symbols are clearly significant.

The most developed national library of sub-Saharan Africa is undoubtedly the National Library of South Africa. Until its creation in 1999, South Africa had two libraries performing national library functions, the South African Library in Cape Town, founded in 1818, and the State Library in Pretoria, founded in 1887. For historical reasons both libraries received South African publications by legal deposit legislation which dated back to the middle of the nineteenth century. The South African Library, formerly the South African Public Library, developed as a national reference library, whereas the State Library operated as both a public and a national library, being a center for national functions such as exchange agreements, bibliographical information, and interlibrary lending. The new National Library, created from the reconstitution of these two libraries as a single entity on two sites, was seen as reflecting the goals of democratic, postapartheid South Africa.

The national libraries of North Africa are distinguished by rich historical collections, particularly of manuscripts, their national status tending to center on the preeminence of their collections rather than their role in a system of national information provision. The National Library and Archives of Egypt, founded in 1870, and the National Library of Tunisia, founded in 1885, for example, both contain collections predating the creation of these libraries by many centuries. Both are now embracing the possibilities provided by new technology to digitize and make available their collections internationally. In Morocco, the *Bibliothèque Générale et Archives*, established in 1926, undertakes the functions of a national library through the legal deposit privilege and the publication of current and retrospective bibliographies, as well as the collection of manuscripts and the production of catalogs of manuscripts. The National Library of Algeria traces its history to 1835 but considers its new library building, fully opened in 1998, essential for its mission of providing access to information for a wide public, including children and young people, who are seldom catered for specifically by national libraries.

The distinction between a national library and a national library service, which is a recurring theme in any account of national libraries, is illustrated by the different development paths taken in Jamaica and in Trinidad and Tobago. The National Library and Information System of Trinidad and Tobago (NALIS) was created by legislation in 1998. This legislation formalized the integration of three public library systems, the Trinidad Public Library, founded as a subscription library in 1851; the Carnegie Library, opened in 1919; and the Central Library of Trinidad and Tobago, established in 1941. The result was a structure that provided traditional public library functions through its administration of a network of branch and mobile libraries, as well as school and special libraries, while meeting the heritage obligations of a national library, including the maintenance of a legal deposit

collection and the creation of the national bibliography. On the other hand, the National Library of Jamaica began its operations in 1979 against a backdrop of an existing public library system and its role in coordinating the national information system depends on its ability to manage various cooperative relationships among autonomous bodies.

The national libraries of Asia generally were founded relatively recently, although they may have much earlier historic roots. The National Library of Thailand, for example, like many European national libraries, was founded on the basis of a number of royal libraries, brought together in 1905. As well as the buildings within the National Library complex in Bangkok, there are now 17 provincial branches of the National Library throughout Thailand. The Library not only has the oldest and largest collection of manuscripts and printed books in the country, but also provides a range of services, such as training courses and document delivery, to other libraries. It is the National Bibliographic Agency of the country, assigning ISBNs and ISSNs and publishing the national bibliography. The forerunner of the National Library of China, the Metropolitan Library, was also created at the beginning of the twentieth century (1909) at a time of expanding Western influence and operated as a legal deposit library from 1916. From 1928 the Library was known as the National Peiping Library, and after the founding of the People's Republic of China as the Beijing Library. Its *de facto* national status was recognized when it was renamed the National Library of China in 1998. It contains the largest collection of Chinese books in the world and the largest collection of foreign books in China. It serves the country's library system by acting as a center for library research and development, as the national bibliographical center, and the center for national information networks. These national functions extend to the responsibilities the Library has for three important national cultural projects: the National Cultural Information Resources Sharing Project, the Chinese Rare Book Facsimile Project, and the Rural Area Book Distribution Project. The implementation of the National Digital Library of China Project and the National Library of China Phase II approved in 2001 illustrates the way that the rapid growth of China as an economic power is permitting substantial investment in the country's information infrastructure.

The emergence of many of the national libraries of the region can be seen as part of the process of national building in the postcolonial period. The National Library of Malaysia began as a unit in the National Archives of Malaysia in 1966, before becoming a separate federal department under the National Library Act 1972. A high priority for the Library is the collection of materials published in and about Malaysia and the Library's Centre for Malay Manuscripts contains the world's largest single institutional collection of Malay manuscripts. The Library's building is itself an unusual physical expression of

national identity, since its design was inspired by the traditional Malay headdress, reflected in the shape of the building's roof and symbolizing Malaysia's achievement and culture. The National Library of Indonesia was established in 1980 as the result of the amalgamation of four existing libraries. In 1989, a further merger with the Centre for Library Development extended the Library's responsibilities. As well as undertaking the common national library functions such as building the national collection and providing bibliographical and reference services, the Library develops national policies in the library sphere. Through the Provincial National Library, a division of the National Library of Indonesia, it maintains a presence throughout the country. In Sri Lanka, the National Library developed to encompass documentation services when in 1990 it became the National Library and Documentation Centre with a clear mandate to provide information resources to the whole population. Its central role has been demonstrated in recent years through the leadership it has brought to the reconstruction of libraries following the devastation caused by the tsunami of December 2004. The National Library of Singapore was established in 1958, although its origins can be traced to the Singapore Institution founded in the 1820s. Since 1995 it has been under the administration of the National Library Board and integrated into a national system including regional, community, and children's libraries, with all publicly funded libraries in the country linked to the totality of the country's information resources. In Singapore the role of libraries has been recognized as crucial for the successful development of a knowledge-based economy, and the *Library 2010 Report* defines its current objective as "to bring the world's knowledge to Singapore to create a positive social and economic impact."

The origins of the National Library of India date to 1836 and the creation of the Calcutta Public Library, a subscription library that from its earliest days made provision for limited use free of charge by indigent scholars and others who were unable to afford the subscription. At the end of the nineteenth century an Imperial Library was formed to serve the needs of the Government, and with an amalgamation of this library with the Calcutta Public Library in 1903, a new Imperial Library, functioning as a general reference and public library, was born. It was intended that it should contain all works written about India in all languages as well as standard reference works. After gaining its independence, the Government of India changed the name of the Library to the National Library of India.

Of the national libraries with a role to serve the legislature, the National Diet Library, Japan, resembles most closely the Library of Congress in its responsibilities. This is not coincidental, as there was significant input to the discussion about the shape of national library services in Japan after the Second World War on the part of an advisory mission of representatives from the Library of

Congress and the American Library Association. New legislation governing the National Diet Library came into effect in 1948. The National Diet Library merged with the old Imperial Library (founded in 1872 and renamed the "National Library" in 1947) to form a single national library providing services to the Diet of Japan and to the general public.

The Post-Soviet World

Following the collapse of the Soviet Union and the subsequent political changes in Central and Eastern Europe, many of the national libraries of the region received a new lease of life. The national libraries of the Soviet Republics began to operate as the cultural representatives of independent states. The redrawing of national borders, in the former Yugoslavia, for example, created sovereign states from previous federations and the national library took its place as a national symbol among other cultural institutions, such as national museums and galleries.

In the case of the Baltic States, their national libraries had been founded after the end of the First World War as the result of an earlier reordering of European nations. The Estonian State Library was founded in 1918, at first primarily for the use of the members of Parliament. It developed as a public library during the Soviet period, but was renamed the National Library of Estonia in 1988. As well as assuming responsibility for building the national collection of works published in and about Estonia, it once more became the library of the national Parliament. The National Libraries of Lithuania and Latvia were established in 1919, both with the title of State Library, emerging from the turbulence of the twentieth century as National Libraries on the restoration of their countries' independence in 1990 and 1991, respectively. The Vernadsky National Library of Ukraine and the National Parliamentary Library of Georgia combine national responsibilities and services to the general public with support for Parliament and government bodies. Some aspects of Soviet library organization survive, as in Armenia, for example, where the National Library of Armenia coexists with the National Book Chamber of Armenia, which remains the center of national bibliographical activity.

In the Russian Federation, the Russian State Library in Moscow (Fig. 2), formerly the Lenin State Library of the USSR, and the National Library of Russia in St. Petersburg, formerly the State Public Saltykov-Shchedrin Library, are the two libraries that both exhibit in one form or another the characteristics of a national library, including the privilege of legal deposit. The Russian State Library has its origins in the collections of printed books and manuscripts bequeathed by Count Nikolai Petrovich Rumiantsev to the nation on his death in 1826. In 1861 the collections were transferred from St. Petersburg to Moscow and, supplemented by other private collections and



Fig. 2 The Russian State Library, Moscow.

Source: Photograph: Russian State Library.

selected art works from the Hermitage, opened to the public as the Moscow Public and Rumiantsev Museum in 1862, in effect the city's first publicly accessible library. After the Revolution of 1917 there was a period of substantial growth as numerous private and institutional collections entered the Museum. In 1925 the museum objects were dispersed to other institutions, including Moscow's Museum of Fine Arts (now known as the Pushkin Museum), and the library collections were retained in what was renamed the Lenin State Library. In the Soviet period the Library grew to be the largest in the country, extending into a new complex of buildings constructed in the 1950s, and it remains one of the largest in the world. After the breakup of the Soviet Union, the remit of the Library was adjusted accordingly, no longer being responsible for coordinating the work of the libraries of what had been the Union Republics, and it received the designation of Russian State Library in 1992. The closer coordination of its activities with those of the National Library of Russia dates from this time.

The National Library of Russia was founded as the Imperial Public Library in St. Petersburg by Catherine the Great in 1795 on the basis of the Załuski collection, removed from Warsaw. It was intended to supplement this collection with others already in government hands, including the libraries of Voltaire and Diderot, although in practice it was many decades before these collections were transferred to the Library. The Library's main purpose would be to maintain a complete collection of books in Russian, wherever published, and books about Russia in all languages. The planned opening of the Library's building on Nevsky Prospect in the center of St. Petersburg was delayed by Napoleon's invasion of Russia in 1812 when the most valuable collections were removed from the city for safekeeping, and the Library was finally opened to the public in 1814. Through the efforts of a series of energetic

directors, including Modest Andreevich Korf, whose influence has been likened to that of Panizzi at the British Museum, the Library grew through the nineteenth century to become one of the most notable in Europe. After the Revolution, the Library was known as the Public Library of Russia and, like its counterpart in Moscow, absorbed many library collections from individuals, public bodies, and religious foundations. In 1932 it was renamed in honor of the famous Russian satirist Mikhail Evgrafovich Saltykov-Shchedrin (1826–1889). In 1941 the Library's most precious items were again evacuated when the invading Nazis threatened the city. With great difficulty the Library remained open during the Siege of Leningrad (1941–1944) when the remaining collections were distributed on the lower floors and in underground shelters. The Library's pressing problems of accommodation, felt throughout the twentieth century, were finally addressed with the construction of a new building in the 1990s. Its designation as the National Library of Russia in 1992 confirmed the national functions that it had undertaken to a greater or lesser extent throughout its history, but allowed it a greater independence of action in carrying them out than it had experienced before.

Some Notable National Libraries

While it is impossible in the space available to consider the historical development and individual characteristics of each of the national libraries of the world, a closer consideration of a small number of notable examples can give an indication of their range and complexity.

Bibliothèque nationale de France

The Bibliothèque nationale de France (Fig. 3) is generally regarded as having the strongest claim to being the first



Fig. 3 Bibliothèque nationale de France.

national library. Tracing its foundation to 1368 as the royal library of Charles V, it was the first to receive the country's publications through a system of legal deposit, introduced in France by the Ordonnance de Montpellier of Francis I in 1537. This decreed that a copy of every book printed in France should be deposited in the royal library at Blois and that every book printed abroad and sold in France should be offered to the library for purchase. The library was also the first to be styled "national" when the title of the royal library was changed in 1789 at the time of the French Revolution. By the first quarter of the eighteenth century, as a result of its continual growth, the library reached the point when it needed to be reorganized in some systematic way in order to be managed efficiently and so five separate departments, including Printed Books, Manuscripts, and Prints, were established. From the 1720s, under the king's long-serving librarian, Abbé Jérôme Bignon, the library also became more accessible to the generality of scholars. After the Revolution the library was greatly enhanced by collections confiscated from suppressed monasteries and French émigrés who had not been successful in removing them from the country. The private libraries of Louis XVI and Marie-Antoinette were among the many that entered the national collections at this time, as the library rapidly doubled in size, helped by the spoils of Napoleon's armies. At this time the library occupied part of a complex of buildings adapted from other uses on and around the rue de Richelieu in Paris. In 1856 more of the complex was given over to the library and the government architect Henri Labrousse combined a restoration of existing buildings with newly built book stacks and the famous *salle de travail* which opened in 1868. In the twentieth century, responding to the pressure, familiar to all national libraries, for more space for continually expanding collections, the library had to find various ingenious solutions for extending accommodation on the rue de Richelieu

site, which allowed no horizontal development and was subject to strict controls over any change in its appearance. This increased storage capacity in central Paris was supplemented by three annexes at Versailles built between 1934 and 1971. A radical new phase in the history of the library was heralded by the announcement by the President of the Republic on July 14, 1988 of the construction of a new library which would provide not only conventional storage (albeit in a controversial series of book-shaped glass towers) but would also exploit the most up-to-date technological solutions for the management of information. The new building opened to the public in December 1996.

The British Library

The history of the British Library illustrates some of the complexities that accompany the development of national libraries and the way in which they often reflect the constitutional arrangements of the states they serve. The British Library is the national library of the United Kingdom, but since the United Kingdom is a federal state of four countries, two of which (Scotland and Wales) have their own national libraries, the British Library has a particular responsibility also to act as the national library of England. The British Library is a relatively new institution, established by The British Library Act of 1972, but brought together individual institutions with a much longer history: the British Museum Library, the National Reference Library of Science and Invention (the Patent Office Library), the National Central Library, and the National Lending Library for Science and Technology (Boston Spa). Further additions were the British National Bibliography and the Office for Scientific and Technical Information in 1974, the India Office Library in 1982 and

the British Institute of Recorded Sound in 1983. The library departments of the British Museum date to the foundation of the Museum itself in 1753. The wealthy physician and collector Sir Hans Sloane directed in his will that his collections of printed books and manuscripts, as well as his collections of botanical, zoological, and mineralogical specimens, should be offered to the nation for £20,000. Thanks to a lottery, this sum was raised, together with sufficient funds to acquire the Harleian Manuscripts collected by Robert and Edward Harley, Earls of Oxford, as well as to provide a home for the collections and an endowment for their upkeep. These collections, which formed the basis of the Museum, were enhanced by the acquisition of others, such as the Old Royal Library, presented by George II in 1757, and by the legal deposit privilege. In 1823, shortly after the death of George III, the Museum was presented with the remarkable "King's Library," with the proviso that it should be retained as a separate entity. The King's Library doubled the size of the Museum's collections of printed books at a stroke, and a special gallery was created for it in the new Museum building designed in the Greek style by Sir Robert Smirke. When the British Library's new St. Pancras building was opened in 1998, the King's Library was housed in a striking six-story glass tower, visible to those entering the building and a vivid reminder of the continuity of collecting from the eighteenth century to the present day.

Before the construction of the St. Pancras building, for many users the British Library meant the round Reading Room, built within the quadrangle of Smirke's Museum building in the 1850s to a concept by Antonio Panizzi, the Museum's inspirational and energetic Principal Librarian. However, the institutions brought together by the British Library Act provided a wealth of other services, not only to individual researchers, but also to the scientific community, commerce, and industry as well as to other libraries worldwide. Many users of the Library's services would be unaware that their information requirements, presented to their local library service, would be satisfied with the help of the British Library. The National Central Library and National Lending Library for Science and Technology merged in 1973 to form the British Library Lending Division, later the Document Supply Centre, coordinating and providing loans and supplying documents internationally. The British National Bibliography, unlike the other constituent parts of the British Library, had operated as a commercial company, publishing weekly listings of all British publications, and in its new home in the British Library became a leader in the production of machine-readable catalog records and their exploitation in computerized library management systems.

Die Deutsche Nationalbibliothek

The history of the German national library reflects the political turmoil of the twentieth century. As a relatively

new unified European state, Germany inherited a rich legacy of State libraries, such as the Preussische Staatsbibliothek in Berlin, and the Bayerische Staatsbibliothek in Munich, but no national library as such. The national library was established as the Deutsche Bibliothek after the reunification of Germany in 1990 through a merger of the Deutsche Bücherei Leipzig and the Deutsche Bibliothek Frankfurt. The Deutsche Bücherei was established in 1912 on the initiative of the book trade, the city of Leipzig, center of publishing in the German Reich, and the Kingdom of Saxony. Its remit was to collect, catalog, and make available free of charge German and foreign-language literature published in Germany and German-language literature published abroad. At the end of the Second World War and the division of Germany into four zones by the occupying Allies, a second depository library, the Deutsche Bibliothek, was set up in Frankfurt am Main in the American zone. With the later emergence of two German states, these two libraries became the national libraries of the German Democratic Republic (Leipzig) and the Federal Republic of Germany (Frankfurt). As the two states became one, the two libraries integrated their activities as the Deutsche Bibliothek, which changed its name in 2006 to the Deutsche Nationalbibliothek.

The Library of Congress

The foremost representative of those national libraries whose primary purpose is to serve the legislature of the country, the Library of Congress was established in 1800 by the Congress of the United States when Congress itself transferred from Philadelphia to Washington, D.C., the new capital city. By moving, Congress lost its access to the existing libraries of New York and Philadelphia and \$5000 was appropriated to establish a reference library for Congress, consisting mainly of immediately relevant works, for example on public law and legislative procedures. By 1814 the library had grown to some 3000 volumes when it was completely destroyed by British troops who set fire to the Capitol Building during the War of 1812. Former President Thomas Jefferson immediately offered his personal library, to be purchased on Congress's own terms, as a replacement. The offer aroused some controversy as the library contained literary, scientific, and philosophical works as well as legal and political material, but the purchase was authorized and the collection of over 6000 works was duly bought in January 1815 for \$23,950. The present Library of Congress still maintains the comprehensive collecting policies that have their origin in Jefferson's belief that all subjects are potentially important to a nation's legislators. In 1816 restrictions on the use of the library were eased, so that in practice access was allowed to scholars in general, but it remained in scale and nature a library for Congress, "national in no sense but ownership."^[10] The tenure of Librarian Ainsworth Rand Spofford, which extended from 1864 to 1897, saw the

library strengthened by improved copyright legislation that required deposit at the Library of Congress as a condition for copyright protection for a wide range of printed material, including music, maps, and photographs. To accommodate the growing collections, in 1886 Congress authorized a new library building, now known as the Jefferson Building, completed in 1897, which made a statement about the wealth, prestige, and values of the nation as well as housing the collections in the then most technologically advanced library building in the world. The collections were seen as a resource for the nation and during Spofford's term as Librarian, the library's opening hours were extended to every weekday and eventually to evenings as well.

Even longer serving than Spofford, Herbert Putnam oversaw in his 40 years in the office of Librarian (1899–1939) a tenfold increase in the size of the collections, staff, and funding. A notable achievement was the creation of a centralized cataloging service, supplying printed catalog cards to the country's libraries, supported by other central services such as the national union catalog and interlibrary loans. Putnam also looked overseas to collect material from other countries, for example the Yudin library of Russian literature and important collections of oriental books, and no fewer than three copies of the Gutenberg Bible were acquired with the Vollbehr collection in 1930. The expansion of collections, staff, accommodation, and services continued through the twentieth century, making the library a world resource for scholarship and research, as well as continuing its role of information provision for Congress. Although the library rejected the suggestion that its name should be changed to National Library, and was careful not to claim any directing role over the rest of the nation's libraries, its leadership in many areas of library and information services could not be doubted. Its policy of large-scale acquisition of foreign publication meant that it was the most successful of the national libraries of the world in maintaining the concept of a comprehensive collection. Its pioneering developments in library automation and the digitization of collections to make them accessible remotely have been emulated by many other national libraries wishing to adapt their traditional role of collecting institutions to the changing circumstances of digital technology and the world of the Internet.

NATIONAL LIBRARY ORGANIZATIONS

The Conference of Directors of National Libraries (CDNL) is described as “an independent association of chief executives of national libraries, established to facilitate discussion and promote understanding and cooperation on matters of common interest to national libraries worldwide.”^[11] The Conference was established in 1974 and meets annually, providing an important framework for

international collaboration. Being open to all the national libraries of the world (the list of national libraries on the Web site of the International Federation of Library Associations now contains over 160 entries^[12]), there are practical difficulties in members attending each meeting and partly for this reason a number of regional organizations has been established focusing on national libraries: La Asociación de Bibliotecas Nacionales de Iberoamérica (ABINIA), the Conference of Directors of National Libraries of Asia and Oceania (CDNLAO), the Standing Conference of National and University Libraries of Eastern, Central and Southern Africa (SCANUL-ECS), and the Conference of European National Librarians (CENL).

La Asociación de Bibliotecas Nacionales de Iberoamérica's aims are to encourage the exchange of knowledge and experience among the national libraries of Latin America, for example through collaborative training and the promotion of new information technologies and conservation techniques. Joint initiatives include digitization projects, of the nineteenth-century Latin American press for example, and the creation of a union catalog of Ibero-American musical records.^[13] La Asociación de Bibliotecas Nacionales de Iberoamérica has a special concern to promote the adoption of appropriate and adequate legislation for national libraries.

The 26 members of CDNLAO similarly promote cooperation and the exchange of information.^[14] The CDNLAO Newsletter^[15] records the activities of the Conference and publishes reports and research from the national libraries of the region. The Libraries of Asia and the Pacific Directory,^[16] an initiative of CDNLAO, supported by the National Library of Australia, aims to provide a single access point for retrieval of information about the functions, services, and collections of libraries in Asia and the Pacific region.

The SCANUL-ECS was founded in 1994 with the following aims: to support and develop national and university library services in the areas covered by Eastern, Central, and Southern Africa; to promote interchange, contact, and cooperation among national and university libraries in the region; to collect, coordinate, and disseminate information on library activities; to encourage increased contact among members and the international library community; to organize and encourage conferences, seminars, workshops, and subject meetings; to initiate and implement regional projects and resource sharing; and to promote the participation of the information sector in the major socioeconomic activities in the region.^[17] In support of these aims SCANUL-ECS organizes meetings, supports case studies, and publishes a newsletter.

The CENL, founded in 1987, states its aim to be “increasing and reinforcing the role of national libraries in Europe, in particular in respect of their responsibilities for maintaining the national cultural heritage and ensuring the accessibility of knowledge in that field,” and explicitly elaborates the rationale for a collaborative

approach: “National libraries need to secure their own position in order to establish the conditions necessary for free and unhindered access to information and documentation. This information must be, as far as possible, complete, clearly organised, prompt, and reliable. More than ever before, it is therefore necessary to develop new models of cooperation, to divide work tasks and share resources. National libraries can act as a focus within a cooperative network.”^[18] Conference of European National Librarians draws its membership from the national librarians of the member states of the Council of Europe and acts through annual meetings as well as through specific projects and initiatives. Its mission^[19] is to support the European national libraries in their role to

- Give everybody fast, comprehensive, multilingual, and long-term access to their collections and information, and wherever appropriate without cost.
- Build the European Digital Library.
- Safeguard European national cultural heritage and knowledge.
- Do research and development to improve user services of national libraries.
- Promote cultural diversity and multilinguality as basic values of the European culture.
- Cooperate with other cultural heritage institutions, universities, publishers, and information providers on a European as well as on a global level.

The Conference expanded from the original 11 national librarians from Western Europe with the growth of links to the national libraries of Eastern Europe through the 1990s. The Conference’s priority areas for activity have remained as defined at the first meeting: harmonization and innovation of national policy concerning libraries; implementation of new information technology in the libraries; standardization of data structure and communication interfaces within a European network; and preservation and conservation of important collections in Europe. The Conference working groups illustrate the concerns that are at the forefront of thinking on national libraries in Europe. For example, the challenge to the concept of legal deposit posed by electronic publishing prompted the creation of a “Statement on the development and establishment of voluntary deposit schemes for electronic publications,”^[20] which reflects the level of cooperation currently enjoyed by national libraries and publishers and draws on the need to share the experience of those countries which already have legislation for electronic deposit or developed voluntary deposit schemes.

The European Library (TEL), the Web service of CENL,^[21] gives access to the resources of 48 national libraries in Europe in 20 languages. These resources are both bibliographic, such as catalogs and collection descriptions, and digital (including some 300 photographs of Europe’s national libraries). The European Library states

that it exists to open up the universe of knowledge, information, and cultures of all Europe’s national libraries, and aims to provide equal access to promote worldwide understanding of the richness and diversity of European learning and culture. Starting in 2006, the European Digital Library project, funded by the European Union and managed by CENL, built on TEL with the aim of integrating the digital content of the main European national libraries into a single multilingual service, Europeana,^[22] launched in prototype at the end of 2008. Europeana encompasses not only libraries, but also museums, archives, and audiovisual collections, and is managed by a team based at the national library of the Netherlands, Koninklijke Bibliotheek. The management team is tasked with recommending a business model that will ensure Europeana’s long-term sustainability as a cross-domain portal that will bring together existing digital content and provide support for further digitization of Europe’s cultural and scientific heritage.

Conference of Directors of National Libraries coordinates its activity with the other main forum for the national libraries of the world, IFLA’s National Libraries Section.^[23] The Section’s *Strategic Plan 2007–2009*^[24] lists its goals as

- To promote the universal availability of information by such activities as encouraging the creation and building of national libraries, the development of national legislation for national libraries—especially legal deposit dispositions and preservation activities—and to promote the convergence of information and heritage institutions.
- To serve as a forum to share and learn from the experience of the practical problems of national libraries, in order to promote benchmarking, best practices, and quality models, and to improve management skills.
- To promote research in fields of interest to national libraries, always considering the opportunities to share experiences with other groups within IFLA and in close cooperation with CDNL, and to promote the development and implementation of standards.

As well as producing its regular *Newsletter*,^[25] the Section organizes sessions and workshops at the annual World Library and Information Congress, collaborates with other Sections of IFLA on the Congress program, and contributes to specific projects in support of its strategic plan.

FUTURE TRENDS: NATIONAL LIBRARIES IN THE INTERNET AGE

In 1998, Line posed the question “What do national libraries do in the age of the Internet?”^[26] One new activity is to attempt to manage the information that the Internet has given birth to. While most national libraries still strive to acquire the nation’s printed output (and some also cover



Fig. 4 Kongelige Bibliotek, Copenhagen.

various types of nonprint media), usually by a form of legal deposit, the scope and nature of electronic and Web-based publishing presents particular challenges. As legislation changes to bring electronic publications within the scope of legal deposit, for example in Denmark,^[27] Norway, and the United Kingdom,^[28] national libraries are faced with a series of new responsibilities. The global nature of the Internet can obscure or confuse the national origin of a digital publication. Once the material is identified, systematic methods of harvesting, sometimes volatile and ephemeral, information must be implemented. Information may be subject to legal or voluntary deposit, but contains embedded links that refer to material that is beyond the scope of these arrangements. Other digital publications may contain technological systems to limit or prevent access or copying and rely on changing hardware and software platforms. National libraries now have to devise structures to manage digital information and build digital repositories that address these issues of acquisition, access, and preservation. With the dramatic increase in the resources available via Internet search engines and as a result of commercially funded mass digitization projects, national libraries are looking beyond their former roles and services to find new ways to exploit their collections, whether they be in digital or traditional forms. As well as developing their own individual Web-based services, they are forging new partnerships and working collaboratively, nationally and internationally, to create gateways such as Libraries Australia^[29] and TEL, or supranational digital libraries such as the projected European Digital Library and the prototype World Digital Library.^[30]

Such initiatives might suggest that the day of the national library as a physical expression of national identity and prestige is now gone. However, with major new national library buildings recently completed or planned in countries as dissimilar and widespread as Denmark

(Fig. 4), Belarus, Peru, Latvia, the United Kingdom, the Czech Republic, France, and Korea (where a major new building is to house the National Digital Library), the evidence is that many nations continue to value the symbolic presence of the national library as the visible expression of their history and culture.

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National Library of Medicine

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Abstract

The National Library of Medicine (NLM) is one of 27 Institutes and Centers of the National Institutes of Health (NIH), located just outside Washington, DC in Bethesda, Maryland, United States. The NLM is responsible to the Department of Health and Human Services (HHS) and to the Congress, which annually reviews its programs and appropriates funds for its operation. The institution was and continues to be a leader in applying computer technology to the handling of large databanks of medical information. This entry provides an introduction to the National Library of Medicine by first discussing some of the library's history and then shifting focus to organizational structure, administration, extramural programs as well as various other aspects of the library.

INTRODUCTION

The National Library of Medicine (NLM) is one of 27 Institutes and Centers of the National Institutes of Health (NIH), located just outside Washington, DC in Bethesda, Maryland, United States. The NLM is responsible to the Department of Health and Human Services (HHS) and to the Congress, which annually reviews its programs and appropriates funds for its operation. The institution was and continues to be a leader in applying computer technology to the handling of large databanks of medical information. Today, it is the largest library of the health sciences in the world. Extensive information about the programs described here is on the NLM's website at www.nlm.nih.gov.

The National Library of Medicine is independent of the other national libraries but works closely with the Library of Congress and the National Agricultural Library in a number of areas to ensure, for example, that acquisitions policies are complementary and cataloging practices are consistent.

Most of the library's programs are housed in three buildings at the southeast corner of the National Institutes of Health campus. Two library divisions, Extramural Programs and Specialized Information Services, as well as some of the staff from Library Operations and the Office of Computer and Communication Systems (OCCS) are housed in leased facilities a couple of miles away. The NLM building, occupied in 1962, contains the collections, technical processing, public services, and administrative offices on five floors (three below ground). The remaining programs are housed in the adjacent Lister Hill National Center for Biomedical Communications Building, a 10-story structure dedicated in 1980, and in the Natcher Conference Center, across the street and north of the other NLM buildings. The permanent full-time staffing level of the library in 2012 was

about 800. The appropriation for the year ending September 30, 2012 was \$337 million.

HISTORY OF THE LIBRARY

The National Library of Medicine had its origin with a collection of books in the office of the U.S. Army Surgeon General, established in 1818. The first request for funds for the library—\$50 for medical books—appeared in the 1836 estimate of expenses for the Surgeon General's Office, and, in 1840, the office issued its first "catalogue of books in the library." The year 1865, when John Shaw Billings assumed charge of the collection, marked a turning point in the development of the library. By 1880 the collection contained 50,000 books and 60,000 pamphlets. Within that decade, books and journals were regularly going out on loan to physicians, and thousands of reference inquiries were being answered annually.

Just as important as the increase in the collection was the publication of reference and bibliographical works inaugurated by Billings. In 1879, there appeared the first issue of *Index-Medicus, a Monthly Classified Record of the Current Medical Literature of the World*. The following year, volume 1 of the *Index-Catalogue of the Library of the Surgeon General's Office* was published. This project was a combined author and subject listing of monographs and periodical literature in the library. Fifteen years later, in 1895, volume 16 appeared, thus concluding the first series of the *Index-Catalogue*. The work contained a total of 176,364 author and 168,557 subject entries for books and pamphlets, as well as subject entries for 511,112 journal articles. William Welch, professor of pathology at the Johns Hopkins Medical School, claimed that the *Index-Catalogue* was America's greatest contributions to nineteenth-century medicine.^[1] The holdings of

the library in 1895—the year Billings retired—included 116,847 books and 191,598 pamphlets.

When Billings assumed charge of the library in 1865, it was housed in the Riggs Bank Building in Washington. In 1866, the collection was transferred to Ford's Theatre. These facilities, however, were also woefully inadequate, and, in 1887, the library and the Army Medical Museum moved into a newly constructed, three-story, red brick building that Billings and architect Adolph Cluss had designed on the Washington Mall. The library remained there until 1962, when it moved to new quarters in Bethesda.

The official name of the library, the Library of the Surgeon General's Office, remained in effect until 1922. In that year, it was changed to the Army Medical Library. Thirty years later, in 1952, the secretary of defense redesignated the library as the Armed Forces Medical Library, thus making it a joint agency of the three military departments. The last change came in 1956, when the institution officially became the National Library of Medicine and was transferred to what is now the Department of Health and Human Services. A source of detailed information about the development of the NLM is *A History of the National Library of Medicine*.^[2]

LEGISLATION

Senators Lister Hill (Alabama) and John F. Kennedy (Massachusetts) introduced the legislation that established the National Library of Medicine and authorized construction of necessary facilities. After wrangling about the location of the library, Congress finally passed the bill, and it was signed into law by President Eisenhower on August 3, 1956. The act established the library, created a board of regents to advise it, and left the question of where the library should be located up to the board. The legislation mandated that the library

- Acquire and preserve books, periodicals, prints, films, recordings, and other library materials pertinent to medicine
- Organize the materials...by appropriate cataloging, indexing, and bibliographical listing
- Publish...catalogs, indexes, and bibliographies
- Make available, through loans, photographic, or other copying procedures...materials in the library
- Provide reference and research assistance
- Engage in such other activities in furtherance of the purposes of this part as (the surgeon general) deems appropriate and the library's resources permit

The NLM Board of Regents advises the HHS secretary on matters of policy affecting the library. Ten regents, drawn from academia, the health sciences, librarianship, public life, and industry, are appointed by the secretary for 4-year terms. In addition to the appointed members, there are

nine ex officio members who are high-ranking federal officials in related fields, including the surgeons general of the Army, Navy, Air Force, and Public Health Service. Pioneering heart surgeon Michael E. DeBakey, whose persuasiveness in the halls of the Congress was instrumental in the passage of the NLM Act, was a member (and chair) of the first NLM Board of Regents. Reacting with dispatch to the act's provision for a new building, that original board, at their second meeting, recommended that a 10-acre tract on the campus of the National Institutes of Health in Bethesda, Maryland, be designated as the site of a new building for the National Library of Medicine. Five years later, in 1962, the library moved from the Washington Mall to its new \$7 million building in Bethesda.

The wording of the original legislation has been amended several times. The six functions listed above have been expanded with a seventh: "publicize the availability from the Library of the above products and services..."; and an eighth: "promote the use of computers and telecommunications..." Other congressional actions have had a profound effect on the library: the Medical Library Assistance Act (MLAA) of 1965, also championed by Dr. DeBakey, which created a program of grants and called for the establishment of a system of regional libraries, the joint resolution establishing the Lister Hill National Center for Biomedical Communications (1968), and the legislation creating the National Center for Biotechnology Information (1988), and the National Information Center on Health Services Research and Health Care Technology (1993).

Administration

The recommendations in a 1944 American Library Association report called *The National Medical Library: Report of a Survey of the Army Medical Library* would lay the foundation for the modern era of library practices. In the succeeding decades the Library would hire a Library Director, Brad Rogers, (1948) and ensure that he received training in library science; implement a collection development policy, with accompanying manual (1951), the first edition of the Army Medical Library Classification, a scheme for arrangement of books on medicine and pre-clinical sciences, designed for use in conjunction with the Library of Congress Classification, also as recommended by the *Report of a Survey* (1944). Rogers, though a physician selected from the Army Medical Corps, was sent to Columbia University to obtain a librarian's degree. In his role as Director of the Army Medical Library, Rogers was asked to modernize the library, provide it with more professional management and better organization and make it relevant to Congress.^[3] He oversaw the transition of the library from the military to the civilian sphere, the construction of a new building, and the tremendous job of moving the collection from Washington to Bethesda. It was Rogers who laid much of the groundwork for the

present-day National Library of Medicine, including the planning and early development of MEDLARS[®] (Medical Literature Analysis and Retrieval System) and the creation of the Medical Subject Headings (MeSH[®]) vocabulary, both of which figure prominently in the library's reputation as a leader in scientific communication.

Succeeding Rogers was Martin M. Cummings, a scientist, educator, and administrator, appointed in 1963. In the two decades under his guidance, the library assumed new responsibilities in a number of areas: a grants program, audiovisual facilities, research and development, specialized toxicology information services, and the introduction of a national online information retrieval services (MEDLINE[®] 1971). Cummings retired in late 1983, and in May 1984, Donald A.B. Lindberg, was named by the secretary of Health and Human Services to succeed him. Dr. Lindberg continues in that post today.

Lindberg, who at the time of his appointment was director of the Information Science Group and professor of pathology at the University of Missouri School of Medicine in Columbia, is an expert in the field of medical informatics—the use of computers and communications technology in medicine. Lindberg's tenure has been marked by a number of major initiatives: an extensive long-range planning process and publication of a detailed long-range plan for the library,^[4] a practical means of end-user searching of the NLM databases, the establishment at NLM of the National Center for Biotechnology Information and the National Information Center on Health Services Research and Health Care Technology, and the transition to the Internet and the Web as the primary distribution method for NLM information and data, the development of health information resources for the general public, and tremendous expansion in the amount of biomedical literature, scientific data, and health information that is freely available on the Web.

Organizational Structure

The NLM's organizational structure consists of an office of the director and six major operating components. The office of the director includes all the centralized management functions: planning, personnel, budget, contracting, purchasing, public communications, and equal employment opportunity. The director is assisted by a deputy director, a deputy director for research and education, an associate director for health information programs development, an assistant director for policy and development, and an associate director for administrative management. There are two assistant directors in the specialized areas of health services research information and high performance computing and communications (HPCC).

The major NLM components include the following:

- *Library Operations* (acquisition, cataloging, indexing, reference services, preservation, interlibrary loan, on-

line database management, health services research information, the National Network of Libraries of Medicine, and history of medicine)

- *Extramural Programs* (grant administration)
- *Specialized Information Services* (toxicology and environmental health information)
- *Lister Hill National Center for Biomedical Communications* (research and development)
- *National Center for Biotechnology Information* (programs in molecular biology information and sequence databases)
- *Office of Computer and Communications Systems*

Mission and Long Range Plans

The laws that shape and animate the National Library of Medicine are further informed by the Library's mission, and Long Range Plans, which add form and function to Library products and services. In the words of its Director, Donald A. B. Lindberg: "The purpose of the National Library of Medicine, flat out, is to acquire, organize and disseminate the biomedical knowledge of the world for the benefit of the public health. I mean, that's clear, and most people here understand that very well. It's one of the reasons we function efficiently."^[5] NLM had no long term plan when Lindberg arrived. "My predecessors were good, made wise decisions and needed no plan, but I needed one."^[6] Though a 1993 law would later require all agencies within the Department of Health and Human Services to have a strategic plan that defined its mission, goals, and the means by which it will measure its progress in addressing specific national problems, needs, or challenges related to its mission over the course of at least 5 years,^[7] NLM's first strategic plan was in place a full 6 years before that law, in 1987, and has followed with successive plans, to include the current Long Range Plan, *Charting the Course for the 21st Century: NLM's Long Range Plan 2006-2016* (<http://www.nlm.nih.gov/pubs/plan/>). NLM's current Long Range Plan has as its core four goals:

- Seamless, uninterrupted access to expanding collections of biomedical data, medical knowledge, and health information
- Trusted information services that promote health literacy, improve health outcomes, and reduce health disparities worldwide
- Integrated biomedical, clinical, and public health information systems that promote scientific discovery and speed the translation of research into practice
- A strong and diverse workforce for biomedical informatics research, systems development, and innovative service delivery

The library's commitment to meeting its legislative mandate, its mission, and its goals is visible in its print and

digital collections, along with a commitment to public access to scholarly publications; its databases, where bibliographic data, full-text, scientific data, and consumer health information are organized and made accessible to scientists, health professionals, and the public; vocabularies that underpin NLM's databases, and are also widely used in external product development; intramural research and development in computational biology, information retrieval, knowledge representation, natural language processing, imaging, and communications; grant funding of external informatics research and training; and through outreach, exhibits and training, where the library connects its products and services with the communities that need them.

COLLECTIONS

Print

In 2013, NLM's print collection held 20,869,244 items, comprising in part 863,182 monographs, 1871–present; 1,451,840 serials; and 17,372,682 manuscripts. The library broadly collects materials in the areas of biomedicine and the related areas of the life sciences, items that document the practice and teaching of medicine broadly defined, demonstrate how health services are organized, delivered, and financed, chronicle the development and implementation of policy that affects research and the delivery of health services, and illustrate the public perception of medical practice and public health. Since the mid-1990s, there have been added emphases and expansions in collecting in the subject areas of fundamental life sciences research; chemistry, physics, engineering; public health issues to include disaster management and bioterrorism; and complementary and alternative medicine.^[3,8] These areas correspond to relatively recent extensions of the Library's responsibilities in health services research, with the Congressionally directed founding of the National Center for Biotechnology Information in 1988, the National Information Center for Health Services Research and Technology in 1993, and the Disaster Information Management Research Center (DIMRC) in 2008. This broadening of scope reflects a goal set for NLM in the Board of Regents' Long Range Plan for 2006–2016. The print collection contains material in virtually every written language and from every country. The Library is guided in its selection process through its current Collection Development Manual (CDM), available online at: <https://www.nlm.nih.gov/tsd/acquisitions/cdm/index.html>, has antecedents in previous manuals dating back to 1951.

Historical

The judicious collecting of important medical works by nineteenth-century library director John Shaw Billings

resulted in the nucleus of the library's rare book and medical history collection. The ongoing accrual of rare books and manuscripts, as well as the acquisition of current monographs and periodicals for over a century, has made the library's holdings in the history of medicine one of the finest research collections in the world. The earliest medical work in the library is an Arabic manuscript of 1094. The earliest dated printed work is Rabanus Maurus, "*De sermonum proprietate*," published in Strasbourg in 1467. Altogether, the library owns over 580 incunabula. There are over 5000 volumes in the library printed in the sixteenth century; and nearly 65,000, including serials and theses, printed in the seventeenth and eighteenth centuries. The library holds not only most of the great landmark works of medicine, but also many less well-known works necessary for historical research, often in several successive editions and translations. Some of the volumes in the collection are the only known copies that survive.

Among the library's historical research collections are the modern manuscript items, dating from 1700. Many of these items were acquired over the past century as part of the general collecting of historical materials. However, to help preserve a record of the present and provide sources for future research in the history of medicine, the library has a "current manuscripts" acquisitions program as well. These new collections are, at times, supplemented by selected oral history interviews. The NLM also has a collection of some 60,000 pictures relating to the history of the health sciences and a significant collection of historical audiovisuals and motion pictures. The library's acquisition of significant manuscript materials, its collecting of rare books and monographs, and its publication of historical bibliographies help to give the scholar access to the history of medicine, just as other NLM functions supply bibliographical assistance for current research and information.

Preservation

The library has a committed focus on preservation of the collection in keeping with its national role as the library of last resort for other libraries, as well as its legislative mandate to preserve the books and other works it has acquired. One of the first steps in that process is collecting and maintaining the print collection. From 1986 to 2007, the Library microfilmed approximately 105,000 volumes of serial and monograph volumes printed on deteriorating paper.^[9] NLM stopped microfilming opting instead to provide digital access to selected collection holdings.

In 2011, the Library instituted a nationwide, cooperative, voluntary program with National Network of Libraries of Medicine (NN/LM) guaranteeing retention of clinically significant titles in print. The program, called MedPrint, identified approximately 250 journals as the primary set of materials to preserve in print. At the end of 2012, NLM had received 15 signed agreements from

institutions representing all eight NN/LM regions. Of the 250 titles identified in the MedPrint program, libraries across the country had made commitments to all but 10 titles. The goal of the program is to get commitments for 12 copies of each MedPrint title, with NLM's copy being the 13th. Thirty-nine of the 250 titles now have 12 or more commitments.^[10]

Collection Access

The library ensures the discoverability to its print collection through its online catalogs, LocatorPlus, and the NLM Catalog. In March 2013, NLM began using RDA: Resource Description and Access for all original cataloging of modern material, replacing the Anglo-American Cataloging Rules, second edition.

The print collection is available to the public onsite through the Library's History of Medicine and Main Reading Rooms. The print collection circulates beyond the Library's doors through the Library's interlibrary loan program, a service begun in 1870, when loan service was first established to make volumes from the Library's collections available to distant libraries and physicians.^[11] Onsite use of the print collection, though, is declining with in-person visits to the Main Reading Room decreasing throughout the late 1990s and 2000s.

In 2013, 1.4 million document requests were filled throughout the network using DOCLINE, the Library's own system for interlibrary loan requests and management. The number of interlibrary loan requests filled via DOCLINE peaked in 2002 at 3,038,934.^[12] In 2013, NLM instituted scan on demand, offering library users throughout the world the option of having a monograph, if copyright-free, fully scanned and a PDF copy sent to the requestor. A scanned copy of the monograph is then placed in NLM's digital repository.^[13] The results of a 2012 national survey of librarians who participate in DOCLINE largely attributed the decline in interlibrary loans to the availability of materials online and though not stated, presumably available online without charge; and the greater availability of online journals through package deals that even smaller libraries could afford, or participate in through consortia. Changes in how users interact with the collection are seen most readily in the inception and growth of the Library's digital collections.^[12]

Public Access to Journal Literature

Launched in February 2000, PubMed Central® (PMC), a free archive of biomedical and life sciences journal literature, was developed and is managed by NLM's National Center for Biotechnology Information (NCBI). In keeping with NLM's legislative mandate to collect and preserve the biomedical literature, PMC serves as a digital counterpart to NLM's extensive print journal collection. In 2012, PubMed Central held 2,540,2952 articles and 1,149

journal titles.^[14] The NIH Public Access Policy ensures that the public has access to the published results of NIH funded research. It requires scientists to submit final peer-reviewed journal manuscripts that arise from NIH funds to the digital archive PubMed Central immediately upon acceptance for publication. To help advance science and improve human health, the Policy requires that these papers are accessible to the public on PubMed Central no later than 12 months after publication.

Digital Collections

NLM also maintains "Digital Collections," a free online archive of nonjournal biomedical resources. All the content in Digital Collections is in the public domain and freely available worldwide. Digital Collections provides preservation of and unique access to NLM's rich, historical resources. In 2012, the Digital Collections Repository held 6979 texts and 70 audiovisuals. The Digital Collections encompass subject areas of Medicine in the Americas, 1620–1920; Cholera Online, 1817–1900; NLM Publications and Productions; Tropical Disease Motion Pictures; The Public Health Film Goes to War; and the NIH Annual Reports.^[15]

In 1998, NLM introduced the web site "Profiles in Science," a web site that makes the archival collections of prominent biomedical scientists available to the public through modern digital technology.^[16] The collections have been donated to the NLM and contain published and unpublished materials, including books, journal volumes, pamphlets, diaries, letters, manuscripts, photographs, and audio tapes and other audiovisual materials. The collection includes famous American scientists and public health figures such as Oswald Avery and C. Everett Koop, plus Nobel laureates Christian Anfinsen, Julius Axelrod, Joshua Lederberg, and Martin Rodbell.^[16]

Born Digital

Started as a pilot in 2009, "Health and Medicine Blogs," is a unique repository of archived health blogs, developed by NLM in collaboration with the Internet Archive. Collected blogs feature the perspectives of physicians, nurses, hospital administrators, and other health professionals. The Library has also collected blogs of patients chronicling their experiences with conditions such as cancer, diabetes, and multiple sclerosis. These blogs illustrate the public perception of medical practice, provide insight into the health care environment, and document medical innovations and medical education in the twenty-first century.^[17]

DATABASES

Ever since the Library's earliest days, it had dual roles, one in which it built and maintained a print collection, and

one in which it indexed the medical literature, making it accessible at the article level for not just on-site users, but to users throughout the world, through the publication of the indexes, the *Index-Catalogue* and the *Index Medicus*. From *Index Medicus* to MEDLINE/PubMed[®], NLM has continued its role in aiding users worldwide in the discovery of information contained in the biomedical literature, while expanding its services to include other kinds of information and data. During the first 25 years of its online services, NLM charged modest fees to recover the cost of online access via commercial telecommunications networks. When Internet access became prevalent in the mid-1990s, NLM was able to make its databases freely available.

MEDLINE/PubMed[®]

Currently, MEDLINE/PubMed is the premier biomedical database in the world, providing free access to MEDLINE, NLM's database of citations and abstracts in the fields of medicine, nursing, dentistry, veterinary medicine, health care systems, and preclinical sciences. PubMed links to full-text articles found in PubMed Central or at publisher web sites, and other related resources.^[18] In 2013, PubMed held 23 million records, 5,669 journals currently indexed for MEDLINE, 61% of the citations linking to full-text, 18% linked to free full-text; and in a typical day 3.5 million Web searches are recorded (730,000 users), 5.5 million record views (1.7 million users), and 75,000 mobile searches (18,000 users).^[19] The Entrez system that delivers PubMed is developed and maintained by the National Center for Biotechnology Information (NCBI). NCBI improves users' search experience following a Discovery Initiative model, using automated methods to draw users' attention to related data that do not necessarily appear as part of the original search. Various "ads" on results pages provide links to related articles and citations, queries, gene names, gene symbols, free full text, protein and nucleotide records, and accession numbers.^[20] In 2013, NCBI debuted PubMed Commons (<http://test.ncbi.nlm.nih.gov/pubmedcommons>), a new system that enables researchers who are PubMed authors to share their opinions about scientific publications indexed in the PubMed database.^[21]

Today NLM has over 295 databases, resources, and application programming interfaces (APIs), on biomedicine, toxicology, hazardous substances, lactation medicine, household products, genes, and consumer health. MedlinePlus Connect, a system for linking electronic health records (EHR) systems to NLM consumer health content, and ClinicalTrials.gov, with detailed information on human subject studies, are two resources that have significant impact on information for patients, and patient care. A list of NLM databases, resources, and APIs can be found on this page: http://wwwcf2.nlm.nih.gov/nlm_eresources/eresources/search_database.cfm

MedlinePlus Connect

MedlinePlus Connect, launched in 2010, is a system to link patient portals, electronic health record (EHR) systems, and health IT systems to consumer health information from MedlinePlus.gov. MedlinePlus Connect meets the meaningful use requirement of the HITECH Act (Health Information Technology for Economic and Clinical Health), part of the American Recovery and Reinvestment Act (ARRA) of 2009, which seeks to improve American health care delivery and patient care through an unprecedented investment in Health IT (HIT). The provisions of the HITECH Act are specifically designed to work together to provide the necessary assistance and technical support to providers, enable coordination and alignment within and among states, establish connectivity to the public health community in case of emergencies, and assure the workforce is properly trained and equipped to be meaningful users of certified Electronic Health Records (EHRs). Meaningful use is a Center for Medicare and Medicaid Services (CMS) payment incentive program for the use of certified EHRs by hospitals and providers in a way that meets specific requirements.^[22]

MedlinePlus

MedlinePlus Connect uses the MedlinePlus web site, a popular portal to consumer health information. The site offers authoritative, up-to-date health information, without advertisements, and is available anytime, anywhere for free.^[23] A Spanish-language version, MedlinePlus en español (<http://medlineplus.gov/spanish>) is also available. MedlinePlus pages contain carefully selected links to Web resources with health information on over 900 topics. MedlinePlus follows a list of guidelines for the inclusion of web sites. The MedlinePlus health topic pages include links to current news on the topic and related information. The public can also find preformulated searches of the MEDLINE/PubMed database, which allow them to find references to latest health professional articles on a topic. The A.D.A.M. medical encyclopedia brings health consumers an extensive library of medical images and videos, as well as over 4000 articles about diseases, tests, symptoms, injuries, and surgeries. Drug and supplement information is available from the American Society of Health-System Pharmacists (ASHP) via AHFS[®] Consumer Medication Information, and Natural Medicines Comprehensive Database Consumer Version.^[24]

ClinicalTrials.gov

ClinicalTrials.gov, launched in February 2000 to implement provisions of the Food and Drug Administration Modernization Act (Public Law 105-115), that required creation of a centralized, consumer-friendly online listing of clinical trials of drugs for serious and life-threatening

conditions. In an effort spearheaded by NLM, the National Institutes of Health (NIH) developed this site in collaboration with all NIH Institutes and the U.S. Food and Drug Administration (FDA). The database now has more than 160,000 clinical trials and observational studies, with studies in locations in all 50 states and 185 countries and includes summary results tables for more than 11,000 trials. It is the only public source of results data for many trials. In 2007, the FDA Amendments Act mandated deposit of registration data for an expanded set of trials of FDA regulated drugs, biologics, and devices and deposit of summary results for trials of approved products. The ClinicalTrials.gov results database was launched in September 2008 to implement the clinical trials provisions of this law. Submission of adverse event information was optional when the results database was released and became mandatory in September 2009. In 2013, ClinicalTrials.gov saw 95 million page views per month, 60,000 visitors per day.

MEDICAL TERMINOLOGIES

NLM is home to a number of medical terminologies that it creates and curates for use in its own products, and for use by others in commercial and free products. A standardized medical terminology is often used within a database in such a way that it enables users to interact with the database using their own words and have their words connect with other words like theirs (synonyms, or ones with the same meaning) using the controlled vocabulary. NLM also licenses SNOMED CT[®], a clinical terminology, designated as a U.S. standard for electronic health information exchange in Interoperability Specifications produced by the Healthcare Information Technology Standards Panel.^[25]

Medical Subject Headings (MeSH)

MeSH is the National Library of Medicine's controlled vocabulary thesaurus. It consists of sets of terms naming descriptors in a hierarchical structure that permits searching at various levels of specificity. The MeSH thesaurus is used by NLM for indexing articles for the MEDLINE/PubMED database and for the NLM-produced database that includes cataloging of books, documents, and audiovisuals acquired by the Library. MeSH, in machine-readable form, is provided at no charge via electronic means. MeSH descriptors are arranged in both an alphabetic and a hierarchical structure.

The MeSH thesaurus is used by NLM for indexing articles from 5600 of the world's leading biomedical journals for the MEDLINE[®]/PubMed database. It is also used for the NLM-produced database that includes cataloging of books, documents, and audiovisuals acquired by the Library. Each bibliographic reference is

associated with a set of MeSH terms that describe the content of the item. Similarly, search queries use MeSH vocabulary to find items on a desired topic.^[26,27]

Unified Medical Language System (UMLS)

The National Library of Medicine (NLM) produces the Unified Medical Language System[®] (UMLS[®]) to facilitate the development of computer systems that behave as if they “understand” the meaning of the language of biomedicine and health. As part of the UMLS, NLM produces and distributes the UMLS Knowledge Sources (databases) and associated software tools (programs) for use by system developers in building or enhancing electronic information systems that create, process, retrieve, integrate, and/or aggregate biomedical and health data and information, as well as in informatics research.

By design, the UMLS Knowledge Sources are not limited to particular applications; they are multipurpose. Developers will find that they can be applied in systems that perform a range of functions involving one or more types of information, e.g., patient records, scientific literature, guidelines, public health data. The associated UMLS software tools assist developers in customizing or using the UMLS Knowledge Sources for particular purposes. The Unified Medical Language System (UMLS) integrates and distributes key terminology, classification and coding standards, and associated resources to promote creation of more effective and interoperable biomedical information systems and services, including electronic health records. All UMLS Knowledge Sources and associated software tools are free of charge to U.S. and international users. There are three UMLS Knowledge Sources: the Metathesaurus[®], the Semantic Network, and the SPECIALIST Lexicon. The Metathesaurus contains over 150 source vocabularies, such as MeSH[®], RxNorm, SNOMED CT[®], ICD-9-CM, ICD-10-CM, CPT[®], and LOINC[®]. Many of the vocabularies are designated as U.S. health standards for electronic health records.^[25]

RxNorm

RxNorm is two things: a normalized naming system for generic and branded drugs; and a tool for supporting semantic interoperation between drug terminologies and pharmacy knowledge base systems. RxNorm is a controlled vocabulary for drugs, providing normalized names and codes for clinical drugs and links its names to many of the drug vocabularies commonly used in pharmacy management and drug interaction software, including those of First Databank, Micromedex, MediSpan, Gold Standard Alchemy, and Multum. By providing links between these vocabularies, RxNorm can mediate messages between systems not using the same software and vocabulary. RxNorm is the U.S. medication standard for health data exchange.^[25,28]

SNOMED CT

SNOMED Clinical Terms (SNOMED CT) is an extensive clinical terminology that was formed by the merger, expansion, and restructuring of SNOMED RT[®] (Reference Terminology) and the United Kingdom National Health Service (NHS) Clinical Terms (also known as the Read Codes). It is the most comprehensive clinical vocabulary available in English (or any language). SNOMED CT is concept-oriented and has an advanced structure that meets most accepted criteria for a well-formed, machine-readable terminology. It has been designated as a U.S. standard for electronic health information exchange in Interoperability Specifications produced by the Healthcare Information Technology Standards Panel and has also been adopted for use by the U.S. Federal Government, through the Consolidated Health Informatics (CHI) Initiative, for several clinical domains.^[29]

Coordination of Clinical Terminologies

NLM is the central coordinating body for clinical terminology standards within the Department of Health and Human Services (HHS). NLM works closely with the Office of the National Coordinator for Health Information Technology (ONC) to ensure NLM's efforts are aligned with the goal of the President and HHS Secretary for the nationwide implementation of an interoperable health information technology infrastructure to improve the quality and efficiency of health care. NLM supports, licenses, or develops key Clinical Vocabularies identified for Meaningful Use and HIPAA transactions: SNOMED CT[®], LOINC[®], and RxNorm. NLM represents the United States on matters related to the structure and content of SNOMED CT, as member of the International Health Terminology Standards Development Organisation (IHTSDO[®]). NLM provides uniform distribution for more than 150 clinical vocabulary standards and HIPAA administrative code sets through the UMLS Metathesaurus.^[30]

Value Set Authority Center

In 2012, in cooperation with the Office of the National Coordinator for Health Information Technology, and the Center for Medicare and Medicaid Services (CMS), NLM launched the Value Set Authority Center (VSAC).^[31] VSAC currently serves as the authority and central repository for the official versions of value sets that support Meaningful Use 2014 Clinical Quality Measures (CQMs). The VSAC provides search, retrieval, and download capabilities through a Web interface and APIs. The VSAC will maintain and update the value sets consistent with the overall process for maintaining and updating the 2014 CQMs themselves. Through the VSAC, NLM draws upon the UMLS Metathesaurus and its responsibility as the central coordinating body for clinical terminology

standards within the Department of Health and Human Services (HHS) to assure the on-going validity and accuracy of the value sets. In the future, the VSAC will provide authoring tools for users to create value sets.^[20]

RESEARCH AND DEVELOPMENT

There are two divisions within NLM that conduct research: the Lister Hill National Center for Biomedical Communication (LHNCBC) and the National Center for Biomedical Information (NCBI). Lister Hill Center conducts and supports research and development in high quality imagery, medical language processing, high-speed access to biomedical information, intelligent database systems development, multimedia visualization, knowledge management, data mining, machine-assisted indexing, and electronic health records to facilitate patient-centric care. NCBI conducts research in basic and applied research in computational, mathematical, and theoretical problems in molecular biology and genetics; and data representation and analysis, including the development of computer-based systems for the storage, management, and retrieval of knowledge relating to molecular biology, genetics, and biochemistry. Both Lister Hill Center and NCBI have Boards of Scientific Counselors (BOSC) who review the work of their intramural researchers; and both offer training opportunities for post-doctoral fellows. NLM's Board of Regents delineated specific research directions for NLM overall and Lister Hill Center and NCBI in particular, in the 2006–2016 Long Range Plan, in Goal 3: Integrated biomedical, clinical, and public health information systems that promote scientific discovery and speed the translation of research into practice.

NCBI

Within the Long Range Plan, NCBI was specifically charged with developing linked databases for discovering relationships between clinical data, genetic information, and environmental factors and that NCBI should

- Lead the development of repositories of information on human variation that will be essential tools for discovering the associations between genes and disease
- Continue to be the computational and database focal point in a trans-NIH program to connect clinical and genotypic data from large, long-term studies
- Assume a leadership role in this effort (make data available, protect privacy, and inform public) and thus contribute to the transformation of clinical, genomic, and environmental information into better evidence-based medicine and improved patient care

NCBI's molecular biology information resources are based on sequence repositories upon which curated and annotated sets of data resources are built. Information ranges from genetic sequence data to entire genomes, protein sequences and structures to chemical structures and assays, as well as clinical data paired with genotypes. The primary source for NCBI sequence data is GenBank, the NIH genetic sequence database. GenBank is an annotated collection of all publicly available DNA sequences.^[3] GenBank is part of the International Nucleotide Sequence Database Collaboration, which comprises the DNA DataBank of Japan (DDBJ), the European Molecular Biology Laboratory (EMBL), and GenBank at NCBI. These three organizations exchange data on a daily basis.^[20] Eleven taxonomy divisions within GenBank contain sequences for over 380,000 species.^[20]

LHNCBC

Within the Long Range Plan, the Lister Hill Center was specifically charged with promoting the development of next-generation electronic health records to facilitate patient-centric care, clinical research and public health. Additionally, the Plan encouraged NLM and Lister Hill to

- Enhance these efforts in response to specific U.S. government priorities and feedback from those attempting to implement standards in current electronic health records and personal health records, regional health information exchanges, clinical research systems, and public health applications
- Build on its long development and policy studies related to electronic health records by promoting work to define and develop the next generation of electronic health records (EHR)
- Promote development and use of advanced electronic representations of biomedical knowledge in conjunction with electronic health records
- Continue to promote research and development on robust and scaleable approaches to synthesizing, representing, updating, and deploying electronic knowledge and decision algorithms for use in conjunction with electronic health records

In 2008, Lister Hill debuted an NLM Personal Health Record (PHR), with an early version aiming to help individuals who are caring for their elderly parent(s) and/or young children. The goal of the NLM Personal Health Record is to help individuals manage health care for themselves and their relatives. The PHR is intended to serve as a test-bed for patient-specific and reminder-based consumer education information, validating and improving NLM clinical vocabularies, studying consumers' use of PHR systems, studying the potential of PHR-based educational reminder systems to improve prevention, and as a potential vehicle for gathering information during clinical

trials. The PHR supports the entry and tracking of key measurements, test results, prescriptions, problems, immunizations, and future health appointments.^[33]

Also in 2008, LHNCBC researchers initiated an effort to develop an open source text de-identification tool. The tool, called Clinical Text De-identification (CTD) system, is software that complies with the privacy rule of the Health Insurance Portability and Accountability Act (HIPAA). The rule requires the removal of 18 individually identifiable health information elements that could be used to identify the individual, the individual's relatives, employers, or household members. In 2011, LHNCBC researchers conducted a study of the CTD tool against four state-of-the-art systems and found that the CTD was superior in the detection of personal names in clinical reports than the methods of the other four systems.^[33]

Extramural Programs

The Extramural Programs Division (EP) administers extramural grant programs for NLM as authorized by the Medical Library Assistance Act (MLAA) and Public Health Service Act. EP's first grant awards were issued in 1965. Funds are expended as grants-in-aid to the extramural community in support of the Library's mission. Review and award procedures conform to NIH policies. EP awards several categories of grants, all of which pertain to biomedical informatics and the management and dissemination of biomedical knowledge. Biomedical informatics research applies computer and information sciences to improve the access, storage, retrieval, management, dissemination, and use of biomedical information. Applications are received through "parent" NIH funding announcements or through special funding opportunity announcements issued by EP. Each year, NLM makes new and/or continuing awards in these five grant categories: Research Projects, Resources, Career Development, Research Career Training, and Small Business Research & Development. NLM's EP FY2012 base budget for grant awards was \$44,281,000, the same amount as in FY2011. One hundred thirty-seven new and continuing awards were made with NLM's appropriated funds. An additional \$3.3 million in co-funding was received for 11 awards from other NIH and Department of Health and Human Services (DHHS) sources. FY2012 funds were awarded to 35 organizations in 32 states.^[33]

OUTREACH, EXHIBITIONS, AND TRAINING

NLM conducts its outreach primarily through the National Network of Libraries of Medicine (NN/LM), its network of over 6000 organizations throughout the country. These include academic medical libraries, hospital, pharmaceutical and other special health sciences libraries, information centers, public libraries, and community-based

organizations with an interest in promoting access to health information. The NN/LM was created through the Medical Library Assistance Act of 1965 (Public Law 89-291), which both authorized NLM's extramural programs of grant assistance to improve the nation's medical library and health communication resources as well as establishing the Regional Medical Library Network (now called the National Network of Libraries of Medicine). The introduction of an extension of the National Library of Medicine to the rest of the country through the NN/LM caused some contention at first among health sciences libraries, but in time the creation of the Network only served to strengthen the ties to health sciences libraries and extend NLM's influence.^[34] Other offices and divisions that conduct outreach are the Office of Health Information Program Development, which sponsors specialized programs in outreach to elementary through high school students in choosing careers in health; a program called VIVA!, peer tutoring for the Latino population in Texas and elsewhere; and Native American outreach through NLM representation at American Indian Pow-Wows through the Mid-Atlantic area. The division of Specialized Information Services (SIS) also conducts outreach, focusing on reaching special populations of minority populations through its United Negro College Funds Special Programs (UNCFSP) HBCU Access Project; debuting an outreach effort in 2012 to Black Greek Letter Organizations to combat health disparities; training in the use of NLM resources through partnerships with minority health professional organizations; and through the development of special population web sites focusing on health information including the American Indian Health Web Portal, Women's Health Resources, Arctic Health Web Site, and the Refugee Health Information Network (RHIN).^[33]

National Network of Libraries of Medicine (NN/LM)

Today, the NN/LM is comprised of eight regions throughout the country, each led by a Regional Medical Library (RML), through a contract awarded every 5 years from the National Library of Medicine. The current Regional Medical Libraries are based at the University of Massachusetts, University of Pittsburgh, University of Maryland, Baltimore, Houston Academy of Medicine/Texas Medical Center, University of Utah, University of California, Los Angeles, University of Illinois at Chicago, and the University of Washington. These Regional Medical Libraries employ staff that vary in size from five to eleven, and extend the National Library of Medicine's reach and assistance to medical libraries through education and training and outreach, and the reduction of health disparities.

With the assistance of other NN/LM members, the RMLs do most of the exhibits and demonstrations of NLM products and services at health professional,

consumer health, and general library association meetings around the country. In FY2012, NLM and NN/LM services were exhibited at 29 national and 281 regional, state, and local conferences across the United States.

RMLs and other network members conduct many special projects to reach underserved health professionals and to improve the public's access to high quality health information. Virtually all of these projects involve partnerships between health sciences libraries and other organizations, including public libraries, public health departments, professional associations, schools, churches, and other community-based groups. In FY2012, the NN/LM initiated 232 outreach projects which target rural and inner city communities and special populations in 37 states, the District of Columbia, U.S. Virgin Islands, Puerto Rico, and Guam.^[33]

DIMRC

A relatively recent addition to NLM's outreach efforts was the creation of a Disaster Information Management Research Center. Recognizing the untapped potential of libraries, librarians, and information services to aid in the nation's disaster management efforts, the Long Range Plan (2006–2016) recommended the creation of a Disaster Information Management Research Center to help with national emergency preparedness, response, and recovery efforts. As part of NLM's SIS division, DIMRC is tasked with the collection, organization and dissemination of health information resources and informatics research related to disasters of natural, accidental, or deliberate origin. NLM has a long history of providing health information to prepare for and respond to all types of disasters, and has developed a number of tools and advanced information services designed for disaster and emergency. NLM provided information for the Bhopal, India gas leak in 1984 and helped create local disaster information centers following Hurricane Mitch in Central America. NLM's Hazardous Substances Data Bank (HSDB[®]), a comprehensive toxicology database, provides the framework for the Wireless Information System for Emergency Responders (WISER[®]), a resource used by emergency responders to assist with the management of chemical, radiological, and biological emergencies. WISER was used in Louisiana after Hurricane Katrina, and in Iraq to help identify potentially toxic substances. More recently, NLM assisted public health officials responding to H1N1 influenza, earthquakes in Haiti and Chile, the Gulf of Mexico oil spill, and the Japanese radiation event, by providing timely, evidence-based information.^[35]

Exhibitions

NLM hosts major exhibitions in its rotunda. Designed to appeal to the interested public as well as the

specialist, these exhibitions highlight the Library's resources and are an important part of NLM's outreach program. The most recent exhibition is *Native Voices: Native Peoples' Concepts of Health and Illness*, exploring the interconnectedness of wellness, illness, and cultural life for Native Americans, Alaska Natives, and Native Hawaiians. Through the extensive use of interviews and media, visitors discover how Native concepts of health and illness are closely tied to the concepts of community, spirit, and the land. NLM sent out 25 copies of 12 exhibition titles, to 156 host venues, most in libraries, in 43 states, and five international locations during 2012. Host venues and their audiences had positive and favorable responses to the traveling exhibition program. All exhibitions also feature an online counterpart as well.^[33]

Training

The fourth goal of the Long Range Plan 2006–2016 is a strong and diverse workforce for biomedical informatics research, systems development, and innovative service delivery. NLM meets this goal in part through its training programs, from its early career fellowship program for recent library science graduates, to mid-career training opportunities in biomedical informatics, funded support for academic training in biomedical informatics, fellowships in medical informatics and senior level career support for health sciences librarians preparing for director-level positions in academic health sciences libraries.^[36] Many health sciences library directors, distinguished informatics researchers, and leaders in health information technology are graduates of these programs.

CONCLUSIONS

As the National Library of Medicine moves more fully into the twenty-first century, it can see the fulfillment of many initiatives begun in the last century: the greater availability of the scholarly literature through online repositories, and through its own web sites of digital collections and the integration of and use of its databases and terminologies into others' work through the creation of apps, and repurposing of terminologies used in other settings. The National Library of Medicine also continues to chart its future, through its research and development branches, the awarding of extramural grants, and through its investment in the future in training a biomedical workforce. The underlying commitment of the National Library of Medicine remains the same: the acquisition, organization, and preservation of the biomedical literature for the public.

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Natural Language Processing for Information Retrieval

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Abstract

Natural language processing (NLP) is the computerized approach to analyzing text that is based on both a set of theories and a set of technologies. Although NLP is a relatively recent area of research and application, compared with other information technology approaches, there have been sufficient successes to date that suggest that NLP-based information access technologies will continue to be a major area of research and development in information systems now and into the future.

INTRODUCTION

Natural language processing (NLP) is the computerized approach to analyzing text that is based on both a set of theories and a set of technologies. And, being a very active area of research and development, there is not a single agreed-upon definition that would satisfy everyone, but there are some aspects, which would be part of any knowledgeable person's definition. I offer the following definition: Natural language processing is a theoretically motivated range of computational techniques for analyzing and representing naturally occurring texts at one or more levels of linguistic analysis for the purpose of achieving human-like language processing for a range of tasks or applications.

Several elements of this definition can be further detailed. First, the imprecise notion of "range of computational techniques" is necessary because there are multiple methods or techniques from which to choose to accomplish a particular type of language analysis.

"Naturally occurring texts" can be of any language, mode, genre, etc. The texts can be oral or written. The only requirement is that they be in a language used by humans to communicate to one another. In addition, the text being analyzed should not be specifically constructed for the purpose of the analysis, but rather that the text be gathered from actual usage.

The notion of "levels of linguistic analysis" (to be further explained in the section titled "Levels of Natural Language Processing") refers to the fact that there are multiple types of language processing known to be at work when humans produce or comprehend language. It is thought that humans normally use all of these levels because each level conveys different types of meaning. But various NLP systems use different levels or combinations of levels of linguistic analysis, and this is seen in the differences among various NLP applications. This also leads to much confusion on the part of nonspecialists as to what NLP really is, because a system that uses any

subset of these levels of analysis can be said to be an NLP-based system. The difference between them, therefore, may actually be whether the system uses "weak" NLP or "strong" NLP.

"Human-like language processing" reveals that NLP is considered a discipline within artificial intelligence (AI). And although the full lineage of NLP does depend on a number of other disciplines, because NLP strives for human-like performance, it is appropriate to consider it an AI discipline.

"For a range of tasks or applications" points out that NLP is not usually considered a goal in and of itself, except perhaps for AI researchers. For others, NLP is the means for accomplishing a particular task. Therefore, you have Information Retrieval (IR) systems that use NLP, as well as machine translation (MT), question-answering, etc.

Goal

The goal of NLP as stated above is "to accomplish human-like language processing." The choice of the word "processing" is very deliberate and should not be replaced with "understanding." For although the field of NLP was originally referred to as natural language understanding (NLU) in the early days of AI, it is well agreed today that although the goal of NLP is true NLU, that goal has not yet been accomplished. A full NLU system would be able to:

1. Paraphrase an input text.
2. Translate the text into another language.
3. Answer questions about the contents of the text.
4. Draw inferences from the text.

Although NLP has made serious inroads into accomplishing goals 1–3, the fact that NLP systems cannot, of themselves, draw inferences from text, NLU still remains the goal of NLP.

There are more practical goals for NLP, many related to the particular application for which it is being used. For example, an NLP-based IR system has the goal of providing more precise, complete information in response to a user's real information need. The goal of the NLP system here is to represent the true meaning and intent of the user's query, which can be expressed as naturally in everyday language as if they were speaking to a reference librarian. In addition, the contents of the documents that are being searched will be represented at all their levels of meaning so that a true match between need and response can be found, no matter how either are expressed in their surface form.

Origins

As most modern disciplines, the lineage of NLP is indeed mixed and still today has strong emphases by different groups whose backgrounds are more influenced by one or another of the disciplines. Key among the contributors to the discipline and practice of NLP are the following: Linguistics focuses on formal, structural models of language and the discovery of language universals—in fact, the field of NLP was originally referred to as computational linguistics; computer science is concerned with developing internal representations of data and efficient processing of these structures; and cognitive psychology looks at language usage as a window into human cognitive processes and has the goal of modeling the use of language in a psychologically plausible way.

Divisions

Although the entire field is referred to as natural language processing, there are in fact two distinct focuses: language processing and language generation. The first of these refers to the analysis of language for the purpose of producing a meaningful representation, whereas the latter refers to the production of language from a representation. The task of NLP is equivalent to the role of reader/listener, whereas the task of natural language generation is that of the writer/speaker. Although much of the theory and technology are shared by these two divisions, natural language generation also requires a planning capability. That is, the generation system requires a plan or model of the goal of the interaction to decide what the system should generate at each point in an interaction. We focus on the task of natural language analysis, because this is most relevant to library and information science studies.

Another distinction is traditionally made between language understanding and speech understanding. Speech understanding starts with, and speech generation ends with, oral language and, therefore, rely on the additional fields of acoustics and phonology. Speech understanding focuses on how the “sounds” of language as picked up by the system in the form of acoustical waves are transcribed

into recognizable morphemes and words. Once in this form, the same levels of processing, which are used on written text are used. All of these levels, including the phonology level, are covered in “Levels of Natural Language Processing”; however, the emphasis throughout is on language in the written form.

BRIEF HISTORY OF NATURAL LANGUAGE PROCESSING

Research in natural language processing has been going on for several decades dating back to the late 1940s. Machine translation (MT) was the first computer-based application related to natural language. Although Weaver and Booth^[1,2] started one of the earliest MT projects in 1946 on computer translation based on expertise in breaking enemy codes during World War II, it was generally agreed that it was Weaver's memorandum of 1949 that brought the idea of MT to general notice and inspired many projects.^[3] He suggested using ideas from cryptography and information theory for language translation. Research began at various research institutions in the United States within a few years.

Early work in MT took the simplistic view that the only differences between languages resided in their vocabularies and the permitted word orders. Systems developed from this perspective simply used dictionary lookup for appropriate words for translation and reordered the words after translation to fit the word-order rules of the target language, without taking into account the lexical ambiguity inherent in natural language. This produced poor results. The apparent failure made researchers realize that the task was a lot harder than anticipated, and they needed a more adequate theory of language. However, it was not until 1957 when Chomsky^[4] published *Syntactic Structures* introducing the idea of generative grammar, did the field gain better insight into whether or how mainstream linguistics could help MT.

During this period, other NLP application areas began to emerge, such as speech recognition. The language-processing community and the speech community then were split into two camps with the language-processing community dominated by the theoretical perspective of generative grammar and hostile to statistical methods, and the speech community dominated by statistical information theory^[5] and hostile to theoretical linguistics.^[6]

Because of the developments of the syntactic theory of language and parsing algorithms, there was such enthusiasm in the 1950s that people believed that fully automatic high-quality translation systems^[2] would be able to produce results indistinguishable from those of human translators, and such systems should be in operation within a few years. It was not only unrealistic, given the then-available linguistic knowledge and computer systems, but also impossible in principle.^[3]

The inadequacies of then-existing systems, and perhaps accompanied by the overenthusiasm, led to the ALPAC (Automatic Language Processing Advisory Committee of the National Academy of Science–National Research Council) report of 1966.^[17] The report concluded that MT was not immediately achievable and recommended it not be funded. This had the effect of halting MT and most work in other applications of NLP at least within the United States.

Although there was a substantial decrease in NLP work during the years after the ALPAC report, there were some significant developments, both in theoretical issues and in construction of prototype systems. Theoretical work in the late 1960s and early 1970s focused on the issue of how to represent meaning and developing computationally tractable solutions that the then-existing theories of grammar were not able to produce. In 1965, Chomsky^[8] introduced the transformational model of linguistic competence. However, the transformational generative grammars were too syntactically oriented to allow for semantic concerns. They also did not lend themselves easily to computational implementation. As a reaction to Chomsky's theories and the work of other transformational generativists, case grammar of Fillmore,^[9] semantic networks of Quillian,^[10] and conceptual dependency theory of Schank^[11] were developed to explain syntactic anomalies and provide semantic representations. Augmented transition networks of Woods^[12] extended the power of phrase-structure grammar by incorporating mechanisms from programming languages such as LISP. Other representation formalisms included Wilks' preference semantics^[13] and Kay's functional grammar.^[14]

Alongside theoretical development, many prototype systems were developed to demonstrate the effectiveness of particular principles. Weizenbaum's ELIZA^[15] was built to replicate the conversation between a psychologist and a patient, simply by permuting or echoing the user input. Winograd's SHRDLU^[16] simulated a robot that manipulated blocks on a tabletop. Despite its limitations, it showed that natural language understanding was indeed possible for the computer.^[17] PARRY^[18] attempted to embody a theory of paranoia in a system. Instead of single keywords, it used groups of keywords and used synonyms if keywords were not found. LUNAR was developed by Woods^[19] as an interface system to a database that consisted of information about lunar rock samples using augmented transition network and procedural semantics.^[20]

In the late 1970s, attention shifted to semantic issues, discourse phenomena, and communicative goals and plans.^[21] Grosz^[22] analyzed task-oriented dialogues and proposed a theory to partition the discourse into units based on her findings about the relation between the structure of a task and the structure of the task-oriented dialogue. Mann and Thompson^[23] developed Rhetorical Structure Theory, attributing hierarchical structure to

discourse. Other researchers have also made significant contributions, including Hobbs and Rosenschein,^[24] Polanyi and Scha,^[25] and Reichman.^[26]

This period also saw considerable work on natural language generation. McKeown's discourse planner TEXT^[27] and McDonald's response generator MUMMBLE^[28] used rhetorical predicates to produce declarative descriptions in the form of short texts, usually paragraphs. TEXT's ability to generate coherent responses on-line was considered a major achievement.

In the early 1980s, motivated by the availability of critical computational resources, the growing awareness within each community of the limitations of isolated solutions to NLP problems,^[21] and a general push toward applications that worked with language in a broad, real-world context,^[6] researchers started reexamining nonsymbolic approaches that had lost popularity in early days. By the end of the 1980s, symbolic approaches had been used to address many significant problems in NLP, and statistical approaches were shown to be complementary in many respects to symbolic approaches.^[21]

In the last 10 years of the millennium, the field was growing rapidly. This can be attributed to the following: 1) increased availability of large amounts of electronic text; 2) availability of computers with increased speed and memory; and 3) the advent of the Internet. Statistical approaches succeeded in dealing with many generic problems in computational linguistics such as part-of-speech identification, word sense disambiguation, etc. and have become standard throughout NLP.^[29] Researchers of NLP are now developing next-generation NLP systems that deal reasonably well with general text and account for a good portion of the variability and ambiguity of language.

LEVELS OF NATURAL LANGUAGE PROCESSING

The most explanatory method for presenting what actually happens within a natural language processing system is by means of the "levels of language" approach. This is also referred to as the synchronic model of language and is distinguished from the earlier sequential model, which hypothesizes that the levels of human language processing follow one another in a strictly sequential manner. Psycholinguistic research suggests that language processing is much more dynamic, because the levels can interact in a variety of orders. Introspection reveals that we frequently use information we gain from what is typically thought of as a higher level of processing to assist in a lower level of analysis. For example, the pragmatic knowledge that the document you are reading is about biology will be used when a particular word that has several possible senses (or meanings) is encountered, and the word will be interpreted as having the biology sense.

Of necessity, the following description of levels is presented sequentially. The key point here is that meaning is conveyed by each and every level of language and that because humans have been shown to use all levels of language to gain understanding, the more capable an NLP system is, the more levels of language it will use (Fig. 1).

Phonology

This level deals with the interpretation of speech sounds within and across words. There are, in fact, three types of rules used in phonological analysis: 1) phonetic rules for sounds within words; 2) phonemic rules for variations of pronunciation when words are spoken together; and 3) prosodic rules for fluctuation in stress and intonation across a sentence. In an NLP system that accepts spoken input, the sound waves are analyzed and encoded into a digitized signal for interpretation by various rules or by comparison to the particular language model being used.

Morphology

This level deals with the componential nature of words, which are composed of morphemes (the smallest units of meaning). For example, the word *preregistration* can be morphologically analyzed into three separate morphemes: the prefix *pre*, the root *registra*, and the suffix *tion*. Because the meaning of each morpheme remains the same across words, humans can break down an unknown word into its constituent morphemes to understand its meaning. Similarly, an NLP system can recognize the meaning conveyed by each morpheme to gain and represent meaning. For example, adding the suffix *-ed* to a verb, conveys that the action of the verb took place in the past. This is a key piece of meaning, and in fact, is frequently only evidenced in a text by the use of the *-ed* morpheme.

Lexical

At this level, humans, as well as NLP systems, interpret the meaning of individual words. Several types of processing contribute to word-level understanding (the

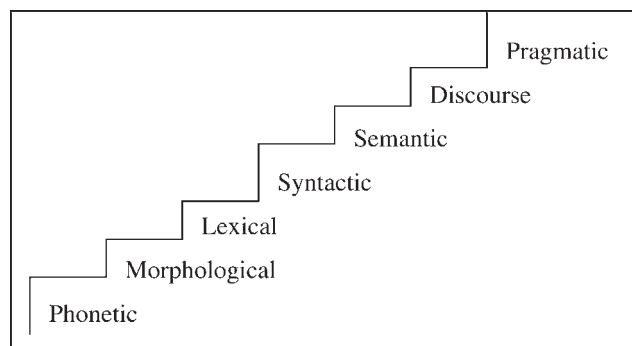


Fig. 1 Model of synchronized language processing.

first of these being assignment of a single part of speech tag to each word). In this processing, words that can function as more than one part of speech are assigned the most probable part of speech tag based on the context in which they occur.

In addition, at the lexical level, those words that have only one possible sense or meaning can be replaced by a semantic representation of that meaning. The nature of the representation varies according to the semantic theory used in the NLP system. The following representation of the meaning of the word *launch* is in the form of logical predicates. As can be observed, a single lexical unit is decomposed into its more basic properties. Given that there is a set of semantic primitives used across all words, these simplified lexical representations make it possible to unify meaning across words and to produce complex interpretations, much the same as humans do.

launch(a large boat used for carrying people on rivers,
lakes harbors, etc.)(((CLASS BOAT PROPERTIES
(LARGE)(PURPOSE(PREDICATION
(CLASS CARRY(OBJECT PEOPLE))))))

The lexical level may require a lexicon, and the particular approach taken by an NLP system will determine whether a lexicon will be used, as well as the nature and extent of information that is encoded in the lexicon. Lexicons may be quite simple, with only the words and their part(s) of speech, or may be increasingly complex and contain information on the semantic class of the word, what arguments it takes, and the semantic limitations on these arguments, definitions of the sense(s) in the semantic representation used in the particular system, and even the semantic field in which each sense of a polysemous word is used.

Syntactic

This level focuses on analyzing the words in a sentence to uncover the grammatical structure of the sentence. This requires both a grammar and a parser. The output of this level of processing is a (possibly delinearized) representation of the sentence that reveals the structural dependency relationships between the words. There are various grammars that can be used and that will, in turn, impact the choice of a parser. Not all NLP applications require a full parse of sentences; therefore, the remaining challenges in parsing of prepositional phrase attachment and conjunction scoping no longer stymie those applications for which phrasal and clausal dependencies are sufficient. Syntax conveys meaning in most languages because order and dependency contribute to meaning. For example, the two sentences “The dog chased the cat.” and “The cat chased the dog.” differ only in terms of syntax, yet they convey quite different meanings.

Semantic

This is the level at which most people think meaning is determined; however, as we can see in the above defining of the levels, it is all the levels that contribute to meaning. Semantic processing determines the possible meanings of a sentence by focusing on the interactions among word-level meanings in the sentence. This level of processing can include the semantic disambiguation of words with multiple senses; in an analogous way to how syntactic disambiguation of words that can function as multiple parts of speech is accomplished at the syntactic level. Semantic disambiguation permits one and only one sense of polysemous words to be selected and included in the semantic representation of the sentence. For example, among other meanings, “file” as a noun can mean either a folder for storing papers, or a tool to shape one’s fingernails, or a line of individuals in a queue. If information from the rest of the sentence were required for the disambiguation, the semantic, not the lexical level, would do the disambiguation. A wide range of methods can be implemented to accomplish the disambiguation, some which require information as to the frequency with which each sense occurs in a particular corpus of interest, or in general usage, some which require consideration of the local context, and others which use pragmatic knowledge of the domain of the document.

Discourse

Although syntax and semantics work with sentence-length units, the discourse level of NLP works with units of text longer than a sentence. That is, it does not interpret multisentence texts as just concatenated sentences, each of which can be interpreted singly. Rather, discourse focuses on the properties of the text as a whole that convey meaning by making connections between component sentences. Several types of discourse processing can occur at this level; two of the most common are anaphora resolution and discourse/text structure recognition. Anaphora resolution is the replacing of words such as pronouns, which are semantically vacant, with the appropriate entity to which they refer.^[30] Discourse/text structure recognition determines the functions of sentences in the text, which, in turn, adds to the meaningful representation of the text. For example, newspaper articles can be deconstructed into discourse components such as lead, main story, previous events, evaluation, attributed quotes, and expectation.^[31]

Pragmatic

This level is concerned with the purposeful use of language in situations and uses context over and above the contents of the text for understanding. The goal is to explain how extra meaning is read into texts without actually being encoded in them. This requires much world

knowledge, including the understanding of intentions, plans, and goals. Some NLP applications may use knowledge bases and inferencing modules. For example, the following two sentences require resolution of the anaphoric term “they,” but this resolution requires pragmatic or world knowledge.

The city councilors refused the demonstrators a permit because they feared violence.

The city councilors refused the demonstrators a permit because they advocated revolution.

Summary of Levels

Current NLP systems tend to implement modules to accomplish mainly the lower levels of processing. This is for several reasons. First, the application may not require interpretation at the higher levels. Second, the lower levels have been more thoroughly researched and implemented. Third, the lower levels deal with smaller units of analysis (e.g., morphemes, words, and sentences), which are rule governed versus the higher levels of language processing, which deal with texts and world knowledge, and which are only regularity governed. As is seen in the following section on approaches, the statistical approaches have, to date, been validated on the lower levels of analysis, whereas the symbolic approaches have dealt with all levels, although there are still few working systems that incorporate the higher levels.

APPROACHES TO NATURAL LANGUAGE PROCESSING

Natural language processing approaches fall roughly into four categories: symbolic, statistical, connectionist, and hybrid. Symbolic and statistical approaches have coexisted since the early days of this field. Connectionist NLP work first appeared in the 1960s. For a long time, symbolic approaches dominated the field. In the 1980s, statistical approaches regained popularity as a result of the availability of critical computational resources and the need to deal with broad, real-world contexts. Connectionist approaches also recovered from earlier criticism by demonstrating the utility of neural networks in NLP. This section examines each of these approaches in their foundations, typical techniques, differences in processing and system aspects, and their robustness, flexibility, and suitability for various tasks.

Symbolic Approach

Symbolic approaches perform deep analysis of linguistic phenomena and are based on explicit representation of

facts about language through well-understood knowledge representation schemes and associated algorithms.^[21] In fact, the description of the levels of language analysis in the preceding section is given from a symbolic perspective. The primary source of evidence in symbolic systems comes from rules and lexicons developed by humans.

A good example of symbolic approaches is seen in logic- or rule-based systems. In logic-based systems, the symbolic structure is usually in the form of logic propositions. Manipulations of such structures are defined by inference procedures that are generally truth preserving. Rule-based systems usually consist of a set of rules, an inference engine, and a work space or working memory. Knowledge is represented as facts or rules in the rule base. The inference engine repeatedly selects a rule whose condition is satisfied and executes the rule.

Another example of symbolic approaches is semantic networks. First proposed by Quillian^[10] to model associative memory in psychology, semantic networks represent knowledge through a set of nodes that represent objects or concepts and the labeled links that represent relations between nodes. The pattern of connectivity reflects semantic organization (i.e., highly associated concepts are directly linked, whereas moderately or weakly related concepts are linked through intervening concepts). Semantic networks are widely used to represent structured knowledge and have the most connectionist flavor of the symbolic models.^[32]

Symbolic approaches have been used for a few decades in a variety of research areas and applications such as information extraction, text categorization, ambiguity resolution, and lexical acquisition. Typical techniques include explanation-based learning, rule-based learning, inductive logic programming, decision trees, conceptual clustering, and K nearest neighbor algorithms.^[6,33]

Statistical Approach

Statistical approaches use various mathematical techniques and often use large text corpora to develop approximate generalized models of linguistic phenomena based on actual examples of these phenomena provided by the text corpora without adding significant linguistic or world knowledge. In contrast to symbolic approaches, statistical approaches use observable data as the primary source of evidence.

A frequently used statistical model is the Hidden Markov Model (HMM) inherited from the speech community. The HMM is a finite state automaton that has a set of states with probabilities attached to transitions between states.^[34] Although outputs are visible, states themselves are not directly observable, thus “hidden” from external observations. Each state produces one of the observable outputs with a certain probability.

Statistical approaches have typically been used in tasks such as speech recognition, lexical acquisition, parsing,

part of speech tagging, collocations, statistical machine translation, statistical grammar learning, etc.

Connectionist Approach

Similar to the statistical approaches, connectionist approaches also develop generalized models from examples of linguistic phenomena. What separates connectionism from other statistical methods is that connectionist models combine statistical learning with various theories of representation; thus, the connectionist representations allow transformation, inference, and manipulation of logic formulas.^[33] In addition, in connectionist systems, linguistic models are harder to observe because connectionist architectures are less constrained than statistical ones.^[21,35]

Generally speaking, a connectionist model is a network of interconnected simple processing units with knowledge stored in the weights of the connections between units.^[32] Local interactions among units can result in dynamic global behavior, which, in turn, leads to computation.

Some connectionist models are called localist models, assuming that each unit represents a particular concept. For example, one unit might represent the concept “mammal,” whereas another unit might represent the concept “whale.” Relations between concepts are encoded by the weights of connections between those concepts. Knowledge in such models is spread across the network, and the connectivity between units reflects their structural relationship. Localist models are quite similar to semantic networks, but the links between units are not usually labeled because they are in semantic nets. They perform well at tasks such as word-sense disambiguation, language generation, and limited inference.^[36]

Other connectionist models are called distributed models. Unlike that in localist models, a concept in distributed models is represented as a function of simultaneous activation of multiple units. An individual unit only participates in a concept representation. These models are well suited for natural language processing tasks such as syntactic parsing, limited domain translation tasks, and associative retrieval.

Comparison Among Approaches

From the above section, we have seen that similarities and differences exist between approaches in their assumptions, philosophical foundations, and source of evidence. In addition to that, the similarities and differences can also be reflected in the processes each approach follows, as well as in system aspects, robustness, flexibility, and suitable tasks.

Process

Research using these different approaches follows a general set of steps, namely, data collection, data analysis/

model building, rule/data construction, and application of rules/data in system. The data collection stage is critical to all three approaches although statistical and connectionist approaches typically require much more data than symbolic approaches. In the data analysis/model building stage, symbolic approaches rely on human analysis of the data to form a theory, whereas statistical approaches manually define a statistical model that is an approximate generalization of the collected data. Connectionist approaches build a connectionist model from the data. In the rule/data construction stage, manual efforts are typical for symbolic approaches, and the theory formed in the previous step may evolve when new cases are encountered. In contrast, statistical and connectionist approaches use the statistical or connectionist model as guidance and build rules or data items automatically, usually in relatively large quantity. After building rules or data items, all approaches then automatically apply them to specific tasks in the system. For instance, connectionist approaches may apply the rules to train the weights of links between units.

System Aspects

By system aspects, we mean source of data, theory, or model formed from data analysis, rules, and basis for evaluation.

Data. As mentioned earlier, symbolic approaches use human introspective data, which are usually not directly observable. Statistical and connectionist approaches are built on the basis of machine-observable facets of data, usually from text corpora.

Theory or Model Based on Data Analysis. As the outcome of data analysis, a theory is formed for symbolic approaches whereas a parametric model is formed for statistical approaches, and a connectionist model is formed for connectionist approaches.

Rules. For symbolic approaches, the rule construction stage usually results in rules with detailed criteria of rule application. For statistical approaches, the criteria of rule application are usually at the surface level or underspecified. For connectionist approaches, individual rules typically cannot be recognized.

Basis for Evaluation. Evaluation of symbolic systems is typically based on intuitive judgments of unaffiliated subjects and may use system-internal measures of growth such as the number of new rules. In contrast, the basis for evaluation of statistical and connectionist systems are usually in the form of scores computed from some evaluation function. However, if all approaches are used for the same task, then the results of the task can be evaluated both quantitatively and qualitatively and compared.

Robustness

Symbolic systems may be fragile when presented with unusual or noisy input. To deal with anomalies, they can anticipate them by making the grammar more general to accommodate them. Compared to symbolic systems, statistical systems may be more robust in the face of unexpected input provided that training data is sufficient, which may be difficult to be assured of. Connectionist systems may also be robust and fault tolerant because knowledge in such systems is stored across the network. When presented with noisy input, they degrade gradually.

Flexibility

Because symbolic models are built by human analysis of well-formulated examples, symbolic systems may lack the flexibility to adapt dynamically to experience. In contrast, statistical systems allow broad coverage and may be better able to deal with unrestricted text^[21] for more effective handling of the task at hand. Connectionist systems exhibit flexibility by dynamically acquiring appropriate behavior based on the given input. For example, the weights of a connectionist network can be adapted in real time to improve performance. However, such systems may have difficulty with the representation of structures needed to handle complex conceptual relationships, thus limiting their abilities to handle high-level NLP.^[36]

Suitable Tasks

Symbolic approaches seem to be suited for phenomena that exhibit identifiable linguistic behavior. They can be used to model phenomena at all the various linguistic levels described in earlier sections. Statistical approaches have proven to be effective in modeling language phenomena based on frequent use of language as reflected in text corpora. Linguistic phenomena that are not well understood or do not exhibit clear regularity are candidates for statistical approaches. Similar to statistical approaches, connectionist approaches can also deal with linguistic phenomena that are not well understood. They are useful for low-level NLP tasks that are usually subtasks in a larger problem.

To summarize, symbolic, statistical, and connectionist approaches have exhibited different characteristics; thus, some problems may be better tackled with one approach and other problems by another. In some cases, for some specific tasks, one approach may prove adequate, whereas in other cases, the tasks can get so complex that it might not be possible to choose a single best approach. In addition, as Klavans and Resnik^[6] pointed out, there is no such thing as a “purely statistical” method. Every use of statistics is based on a symbolic model and statistics alone is not adequate for NLP. Toward this end, statistical approaches are not at odds with symbolic approaches. In fact, they are rather complementary. As a result, researchers have begun developing

hybrid techniques that use the strengths of each approach in an attempt to address NLP problems more effectively and in a more flexible manner.

NATURAL LANGUAGE PROCESSING APPLICATIONS

Natural language processing provides both theory and implementations for a range of applications. In fact, any application that uses text is a candidate for NLP. The most frequent applications using NLP include the following:

- Information retrieval. Given the significant presence of text in this application, it is surprising that so few implementations use NLP. Recently, statistical approaches for accomplishing NLP have seen more use, but few systems other than those by Liddy^[37] and Strzalkowski^[38] have developed significant systems based on NLP.
- Information extraction (IE). A more recent application area, IE focuses on the recognition, tagging, and extraction into a structured representation, certain key elements of information (e.g., persons, companies, locations, and organizations) from large collections of text. These extractions can then be used for a range of applications including question-answering, visualization, and data mining.
- Question-answering. In contrast to Information Retrieval, which provides a list of potentially relevant documents in response to a user's query, question-answering provides the user with either just the text of the answer itself or answer-providing passages.
- Summarization. The higher levels of NLP, particularly the discourse level, can empower an implementation that reduces a larger text into a shorter, yet richly constituted abbreviated narrative representation of the original document.
- Machine translation. Perhaps the oldest of all NLP applications, various levels of NLP have been used in MT systems, ranging from the word-based approach to applications that include higher levels of analysis.
- Dialogue systems. Perhaps the omnipresent application of the future, in the systems envisioned by large providers of end-user applications. Dialogue systems, which usually focus on a narrowly defined application (e.g. your refrigerator or home sound system), currently use the phonetic and lexical levels of language. It is believed that use of all the levels of language processing explained above offer the potential for truly habitable dialogue systems.

CONCLUSION

Although NLP is a relatively recent area of research and application, compared with other information technology

approaches, there have been sufficient successes to date that suggest that NLP-based information access technologies will continue to be a major area of research and development in information systems now and far into the future.

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2. Cogn. Sci.
3. Comm. ACM.
4. Comput. Humanit.
5. Comput. Intell.
6. Comput. Linguist.
7. Comput. Speech Lang.
8. IEEE Trans. Intell. Syst.
9. Inf. Process. Manag.
10. J. Am. Soc. Inf. Sci.
11. J. Artif. Intell. Res.
12. J. Doc.
13. J. Logic, Lang. Inf.
14. J. Nat. Lang. Eng.
15. Lit. Linguist. Comput.
16. Mach. Transl.
17. Mind Lang.
18. Nat. Lang. Linguist. Theory.

Conferences

1. American Association for Artificial Intelligence (AAAI).
2. Applied Natural Language Processing (ANLP).
3. Association for Computational Linguistics (ACL).
4. Empirical Methods in Natural Language Processing (EMNLP).
5. European Association for Computational Linguistics (EACL).
6. Human Language Technology Workshop (HLT).

7. International Conference on Computational Linguistics (COLING).
8. International Joint Conference on Artificial Intelligence (IJCAI).
9. North American Chapter of the Association for Computational Linguistics (NAACL).
10. Special Interest Group in Information Retrieval (SIGIR).
11. Text Retrieval Conference (TREC).

Electronic Resources

1. AI on the Web: <http://www.cs.berkeley.edu/~russell/ai.html>. The site provides pointers to other sites on the Web with information on Artificial Intelligence. It has a section on natural language processing, and it lists homepages of people who are active in the field, companies, research groups, journals, software, etc.
2. Natural Language Processing and Computational Linguistics Links: <http://www-a2k.is.tokushima-u.ac.jp/member/kita/NLP/nlp.html>. Another NLP site that provides links to pagers, technical reports, on-line proceedings, organizations, NLP people, and so on.
3. Statistical Natural Language Processing and Corpus-Based Computational Linguistics: An Annotated List of Resources: <http://www-nlp.stanford.edu/links/statnlp.html>. This web site is maintained by Christopher Manning. It provides links to many useful tools and toolkits such as part-of-speech taggers, language modeling toolkits, etc. It also has pointers to various corpora, lexical/morphological resources, educational resources, and mailing lists.
4. The ACL NLP/CL Universe: <http://www.aclweb.org/u/db/acl/>. The largest index of computational linguistics and natural language processing resources on the Web. It features a search engine that should allow you to find specific NLP-related Web pages.
5. The Association for Computational Linguistics site: <http://www.aclweb.org>. The Association for Computational Linguistics is the major international organization in the field.
6. The Computation and Language E-Print Archive: <http://xxx.lanl.gov/archive/cs/>. The Computation and Language E-Print Archive is a fully automated electronic archive and distribution server for papers on computational linguistics, natural language processing, speech processing, and related fields.
7. The Language Technology Helpdesk: <http://www.ltg.ed.ac.uk/helpdesk/faq/index.html>. Frequently asked questions of the Human Communication Research Center at the University of Edinburgh.
8. The Linguistic Data Consortium: <http://www ldc.upenn.edu/>. An open consortium of universities, companies, and government research laboratories. It creates, collects and distributes speech and text databases, lexicons, and other resources for research and development purposes. The University of Pennsylvania is the LDC's host institution.

Network Management

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Abstract

Network management includes activities related to the design, construction, and operation of communications networks, which are performed by a network management organization. Network management is inherently a distributed activity because a network includes equipment distributed across multiple locations. Network management work is described in terms of the five dimensions of network management as defined by the International Standards Organization: fault, configuration, performance, accounting, and security management. Network management work is further described as a melding of design and real-time supervisory control work, depending upon effective information management and coordination of activities within the network management organization and with external organizations, including customers, peer organizations, and equipment and service providers.

INTRODUCTION

Network management includes activities related to the design, construction, and operation of communications networks, which are one type of distributed infrastructure. Network management activities are performed by a network management organization (NMO). An NMO is one of many types of information technology service organizations and, as discussed here, is responsible for the design, monitoring, and evolution of distributed infrastructure (an assemblage of hardware, software, and services) in its particular organizational context. The network itself is the primary object of the NMO's work and the NMO generally has little influence over how the network is used by other members and affiliates of the organization. An NMO may be a single organization but will typically interact with multiple organizations including customers, peer organizations collaborating to provide network services, and vendors. Network management, in all but the simplest cases such as a home or small single-site local area network (LAN), is inherently a distributed activity: a network usually includes equipment distributed in multiple locations. At the smaller end of the scale, equipment may be located in multiple rooms or on multiple floors of a building (referred to as a LAN). In more complex cases, the equipment may be located in multiple buildings (on a campus or across a metropolitan area, often referred to as a MAN, or metropolitan area network), in multiple cities, or even multiple countries (a WAN, or wide area network). This entry will assume, for purposes of illustration and discussion, a MAN or WAN unless otherwise noted.

This entry begins with a brief description of the types of components that make up a MAN or WAN and are the network components that require management. The five major dimensions of network management, as defined by

the International Standards Organization (ISO) as part of the Open Systems Interconnection model, are used to introduce the range of activities associated with management of complex networks. Next, how design work is approached in NMOs is discussed in terms of the classic "waterfall" software development life cycle. The dynamic and collaborative nature of work within an NMO is described in terms of two interrelated modes of working: design work and real-time supervisory control work. Finally, the critical role of information management is described in the context of a disaster recovery/business continuity test.

WHAT IS MANAGED IN A NETWORK?

Networks, including the Internet, closed or private networks built by organizations, and smaller-scale LANs, are composed of several classes of components. Applications (e.g., Web sites, enterprise databases, digital libraries, e-mail systems) made accessible to remote users, messages carried by the network (i.e., frames, packets), end-user computers (i.e., client computers), server computers (e.g., Web servers, file servers, proxy servers), routers, switches, hubs, equipment racks, link signaling devices (i.e., link encryptors, digital signaling units/digital "modems"), access lines (e.g., the Ethernet cabling from client computers to a local switch, router, or hub), wireless access points, and long-distance telecommunications circuits (e.g., the higher-capacity, leased digital line between network locations usually connecting routers to each other).^[1] All of these network components, except the cables, contain software and configurable parameters and all must be managed in order to provide effective network services that evolve to meet demand and keep pace with technical

innovations. Vendor-provided software for configurable components must be tested and implemented to fix bugs, patch security holes, and to add functionality. The NMO also monitors the network in real-time for failures, errors, traffic bottlenecks, etc., and corrects problems by issuing commands to change component state and by swapping failed components with replacements. The NMO also monitors actual usage patterns and takes requests for new services into account as part of its network design and provisioning work.

The NMO must have the means to organize information about all the elements of the network in order to manage these components. The NMO must also have a set of operating parameters that, in combination with the network components, can enable the NMO to create appropriate standard operating procedures (SOPs) and ancillary support systems such as trouble ticket, configuration management, test scheduling, and reporting systems.

DIMENSIONS OF NETWORK MANAGEMENT

A conceptual framework associated with the ISO's Open Systems Interconnection model for communications systems is used to organize the full range of network management activities.^[2] While originally focused on network management, this framework may be used to characterize the management of distributed computing systems more generally. The OSI framework is broken down into five functional areas: fault management, configuration management, performance management, accounting management, and security management.

Fault management is the detection, diagnosis, and correction of problems, or faults, in a network. Network components asynchronously generate fault data as messages, referred to as alarms, which are categorized as major, minor, and informational depending upon their significance or impact. Major alarms are generated when a network component fails due to hardware failure, software failure, or because the component can no longer be contacted by the network management systems (i.e., it has become isolated from the rest of the network). Minor alarms are generated when less critical events are detected, such as a performance threshold being exceeded, a burst of transmission errors is detected, or a failure of a subcomponent (e.g., a single interface card failure on a large router). Informational messages are generated for a variety of reasons, do not require direct attention by the real-time supervisory control (RTSC) staff, but are logged and available if needed (e.g., an anomalous but automatically recoverable condition, such as a communications protocol error). As alarms are generated, they are propagated to the NMO via both a real-time and an archival path. Alarms are sent to network management workstations that are continuously monitored by RTSC staff and to databases for long-term alarm storage. Propagation of

alarms to the network management workstations supports the real-time work of isolating and correcting faults requiring direct intervention by NMO staff. Examples of faults requiring real-time intervention include failures that do not automatically recover or large-scale failures that trigger the performance of a SOP. Propagation of alarms to databases provides comprehensive historical data for postevent, trend, or long-term fault analysis. Faults are logged in a database using a record format that includes date, time, location, fault codes, and other information of potential use in diagnosis, correction, or to support subsequent, long-term analysis. To support fault diagnosis, NMO staff use diagnostic test tools and component status query commands to retrieve real-time component status, and various component activation/deactivation commands to alter component status or component operating parameters. NMO staff are trained in troubleshooting procedures, and have access to SOPs for monitoring the network, documenting fault conditions in trouble tickets, and problem escalation (i.e., when to contact next-level expertise and/or management if a fault cannot be corrected in a timely manner). Trouble tickets are created for all faults requiring intervention. The trouble ticket is a locus for a textual narrative of the situation as it unfolds, providing capabilities to combine descriptions of evidence, activity, causal hypotheses, as well as a record of interpersonal, intra-, and inter-organizational communications. To correct faults that have been diagnosed, the NMO staff use commands to alter physical configurations (e.g., to replace a failed component with a backup component), manually activate a deactivated component, or to modify the operating parameters of affected components.

Configuration management is the set of capabilities that allow the NMO to set up and modify the network's physical and logical configurations. Following initial implementation the network's physical and logical configurations will change "to alleviate congestion, isolate faults or meet changing user needs."^[2] Configuration changes may be unplanned, caused by network faults, or as a result of NMO staff action in response to a fault or changing, real-time network conditions, or as part of a preplanned configuration change. Faults often cause spontaneous network reconfigurations, such as removal of a long-distance telecommunications link from the network topology. Networks must be fault-tolerant: their internal complexity (the large number of varied and interconnected components) and reliance on long-distance telecommunications links result in frequent (e.g., several per day) single component failures. Therefore, networks must be designed to tolerate all single-component failures in order to be considered minimally reliable. In order to provide availability on the order of 99.9% or higher, the design must tolerate the simultaneous failure of any two components. In some situations, networks are designed to tolerate all dual-component failures as well as a subset of three-component failures. Network components are designed to attempt

automatic recovery following failures, and many failures are corrected automatically. In a significant percentage of cases, NMO diagnosis and correction are required to either effect component recovery (e.g., manually reactivating a component) or to temporarily reconfigure the network so connections and traffic flow around the failure (e.g., moving a LAN's connection from its failed default router to an available connection on an alternate router). Planned network reconfigurations take two forms: predesigned modifications that are intended to be permanent, such as changes made to address new requirements, and predesigned modifications that are intended to be temporary, such as those that are part of disaster recovery/business continuity plans. Adding, modifying, or removing routers, interface cards to a router, or telecommunications circuits between routers are examples of common planned permanent configuration management activities. Network planning and design work is required prior to implementation of either a new network or a significant revision to an existing network. One of the implications of designing a fault-tolerant system is the need to preplan the organization's responses to a range of anticipated fault events including normal, single-component failures (e.g., loss of a long-distance telecommunications link) or high-impact failures (e.g., complete loss of connectivity for a network site, whether it is caused by natural disaster, massive telecommunications link failure, fire, simultaneous failure of both primary and backup routers, etc.). Preplanning work is complex, and results in the creation of SOPs that guides NMO reconfigurations in response to classes of failures (see discussion below in the section on "Perspectives on Network Management Work").

Performance management refers both to the capabilities in the network that support measurement of network use and the expertise within the NMO to analyze data, justify recommendations for change, and plan the configuration changes needed to support emerging or anticipated network uses. NMOs are interested in understanding and documenting past usage patterns, comparing current usage patterns to historical patterns, and using both historical and current data to support the capacity planning process. While performance monitoring occurs in real-time as the RTSC staff continuously monitor utilization of network components like routers and long-distance telecommunications links, the bulk of performance management activities are performed "off-line" by design staff. Network components periodically—every few minutes—log levels of usage by writing data to network management servers for later analysis. Network components may also generate fault messages or alarms when utilization levels exceed certain thresholds to enable real-time supervisory staff to respond with network configuration changes. Networks and their protocols are designed to be tolerant of fluctuations in network traffic or topology, so real-time intervention is not usually required. Performance management is part of the longer-term network design process and involves analysis

of the logged performance data in order to detect changes in usage patterns that lead to modifications in the network's configuration. For example, increasing network traffic between two locations may lead to installation of higher capacity routers, telecommunications links, reconfiguration of the network topology, or a combination of the three.

Accounting management is the set of capabilities that allows the NMO to collect and manage usage and configuration data, track costs, and charge network users according to the tariffs, service level agreements, or contracts that are in place. Several network components may be capable of generating and transmitting usage data that may be fed into an off-line accounting or billing system (e.g., routers and servers running shared applications may generate data that are fed into a billing system). Costs of other components, such as cables, routers, or equipment racks, may have their costs allocated on some other basis (such as employee head count or a count of connections), or may be factored into usage-sensitive charges. NMOs evaluate the costs, benefits, and complexity of collecting and correlating large amounts of data and negotiating customer agreements in order to produce detailed bills against other approaches that don't require detailed usage-based calculations (e.g., simpler, flat-rate or percentage-allocated cost-recovery arrangements). The simpler approaches are particularly useful for networks built to support the internal operations of an organization. NMOs providing services to the public, such as land-line and mobile telecommunications organizations, are more likely to develop usage-sensitive procedures.

Security management is concerned with control of physical access to network components, end-point authentication, user authentication, key management for encryption, end-to-end data encryption, security log management, monitoring emerging security threat vectors and developing organizational responses, and firewall management. Security management has two objects in the network management context: first, the network itself must be secured (e.g., control the access to router management ports which are used to issue reconfiguration commands to the router; ensure that physical access to network equipment at all locations is controlled; manage NMO staff authentication and access); second, the network must support the security requirements of the users and applications transmitting data across the network (e.g., providing encryption of telecommunications circuits; end-to-end encryption of data streams; management of encryption keys). In environments with high security needs, including financial institutions, health care organizations, and commercial organizations in highly competitive markets, security management responsibilities are concentrated in an independent part of the organization, with a management chain distinct from the RTSC and technical staffs. A separate management chain encourages, enforces, and makes a high degree of transparency possible through establishment of arms-length relationships between different parts of the NMO. NMOs with these types of stringent needs

will also employ a comprehensive internal auditing process, augmented by recurring external audits. Security logs, like fault logs, identify date, time, location, and diagnostic information. Security logs should be reviewed regularly in order to identify unusual usage patterns or to correlate successful and unsuccessful access attempts by users and intruders alike. Several of the activities included in security management, including encryption key management and developing responses to emerging security threats, are complex management challenges in a distributed environment (see the entry “Authentication and Authorization,” p. 413).

PERSPECTIVES ON NETWORK MANAGEMENT WORK

Network management depends upon the blending of actions performed by people with a range of skills and expertise, and these actions depend upon information management practices. Design and RTSC work patterns are defined, and the central role of information management in network management is described. These two work patterns are discussed in the context of the five dimensions of network management. The section concludes with a description of a complex yet typical activity, a disaster recovery test (DRT), which illustrates the relationship between information and activity in distributed infrastructure management.

Patterns of Work

Network management combines patterns of both design and RTSC work. Research has shown that design work and RTSC work have different rhythms and patterns that, in network management, are coordinated to perform fault, configuration, performance, accounting, and security management. RTSC work is event driven, dynamic, and involves the interaction of multiple workers with complex systems.^[3] Malfunctions in the operation of these systems can result in serious consequences such as the loss of human life or financial loss. Signs of malfunction must often be recognized and responses formulated within minutes or seconds in order to prevent adverse consequences. By contrast, design work has different patterns and rhythms than RTSC work and is characterized as being self-paced (as opposed to being event-driven), reflective (as opposed to being time-constrained), and creative.^[3–5] The object of design work is usually to iteratively create, study, or revise some artifact like a document, a set of specifications, a product, or a system, such as a data communications network. In network management, there are frequently occasions when workers who usually do design work join the RTSC staff to perform event-driven and time-constrained work, particularly with regard to fault and configuration management. This section will first describe how an NMO for a WAN is organized. How new network implementations are managed is described next, followed

by a description of the role of information management in network management work. Finally, the five dimensions of network management (above) are discussed in terms of design work and RTSC work.

The NMO for a large network, such as a national-scale WAN, includes a staff of technical specialists who provide depth of knowledge in particular technologies, the RTSC staff, budget, accounting, and administrative support staff, and executive management. Categories of technical specialists include network hardware engineers, network software engineers, data security specialists, and circuit/topology experts. Network hardware engineers are specialists in network equipment, signaling equipment, electrical requirements, lower-level network protocols, and troubleshooting. The most skilled network hardware engineers will have degrees in computer or electrical engineering. Network software engineers are more likely to be trained in computer science, and will have expertise in higher level network protocols, software debugging, software development, and software engineering processes (e.g., the waterfall systems development life cycle discussed below). Circuit/topology experts manage the leased long-distance telecommunications circuits and the relationships with the vendor or vendors from whom they are leased, and are responsible for managing the network topology. Security specialists may have backgrounds in either engineering or computer science, but will focus on authentication, authorization, dedicated security hardware (e.g., link encryptors and firewalls) and encryption key management processes. In large NMOs, the security experts will be in a separate group and report to a different manager than do the hardware and software engineers in order to maintain arms-length relationships and help ensure that security procedures and standards are not compromised by expediency (e.g., cost or schedule pressures). In total, these technical experts are referred to here as “members of the technical staff.”

The RTSC staff is organized into three shifts, with shift supervisors who report to the supervisory control manager. The RTSC staff are the people who work most directly and most often with the network itself, monitoring the network’s health and configuration (fault and configuration management). The RTSC staff also act as the human interface between the network and the NMO’s internal and external customers. The RTSC staff work in one or more centralized network control rooms. RTSC staff backgrounds are likely to vary from some who have university degrees in a variety of technical and nontechnical fields, to those who have experience in real-time operations but little or no postsecondary education.

The budget and accounting staff rely upon information generated by and about the network to manage billing, budgeting, and financial planning. The executive managers often have backgrounds that include a degree in a technical field and experience as a member of the technical staff. As managers, they will have a well-developed model of the technology and the ability to perform

cross-community coordination with the various NMO groups (members of the technical staff, RTSC staff, accountants), internal and external customers, and vendors.

Network design and software engineering processes have many parallels, and can be described by well-known life cycle models such as the “waterfall” model of software development (Fig. 1). In both situations, the goal is to create a new object: the network or piece of software. The life cycle begins with the identification and documentation of *requirements*. Given a set of relatively stable requirements, one or more *design* alternatives can be produced to satisfy the requirements. Given agreement on a design, *implementation* of the object can begin. As the object is created, each discrete piece undergoes *testing*, and the object is ultimately tested as a whole. After successful testing, the object is released and goes into *maintenance* (software) or goes into *production operation* (network). The life cycle is repeated as new requirements emerge. Each of these subsequent iterations can be managed using the same life cycle model: new requirements are documented, a network design revision is created, and the changes are implemented, tested, and made operational. The NMO is responsible for managing the entire implementation/revision life cycle for its network, and the cycle can be reiterated many times throughout the useful life of the network. Typical types of new requirements for a network include expanding the network into new locations, increasing capacity, or adding support for new data transmission protocols.

In order to design a new network (or modify an existing network), requirements must be gathered to inform the network design (network locations, traffic patterns and types, security and reliability requirements, service level requirements, cost parameters, etc.). During the network design process, engineers use a combination of formal, algorithmic, and professional heuristic processes. For example, given a certain expected traffic load, algorithmic tools can be used to define the number, arrangement, and sizes of routers and the circuits connecting them. The arrangement of routers and circuits is referred to as the

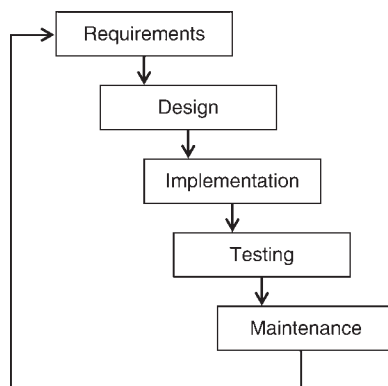


Fig. 1 The “waterfall” systems development life cycle.

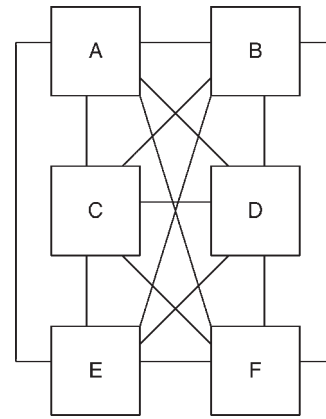


Fig. 2 Full mesh topology, where A, B, C, D, E, and F are network sites.

network topology. WANs are never designed as a completely interconnected mesh (i.e., each site linked directly to each other site, Fig. 2), so the topology must be carefully designed to provide adequate support for the traffic patterns and service-level expectations while minimizing operating costs: long-distance circuits between cities are often leased from a telecommunications provider and have recurring monthly costs (Fig. 3). The set of equipment and services needed can then be acquired, installed, and tested. Any moderately complex network is, when built, an ecosystem comprised of a wide variety of equipment and services, including cables, equipment racks, signaling devices (e.g., encryptors and digital “modems”), routers, and network management servers and workstations. Each type of equipment (e.g., routers) can be thought of as a species within the ecosystem. Engineers plan and manage installation and testing of hardware and services at each site (the routers, link signaling

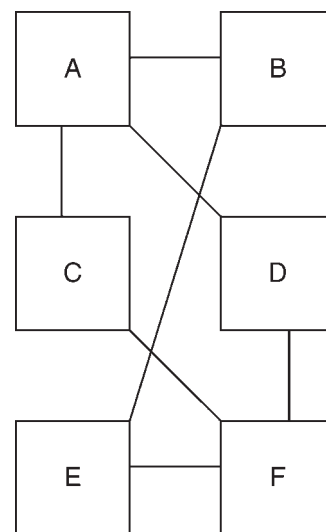


Fig. 3 Optimized network topology, where A, B, C, D, E, and F are network sites.

devices, switches, hubs, racks, long-distance telecommunications circuits, wired and wireless access points, and cables). Software engineers define and test connection parameters and system options within routers, link signaling devices, and any other software-configurable network components. RTSC staff monitor and control the systems as they are installed and tested, perform routine tasks (on both a daily and per-shift basis) and respond to faults. Documentation, policies, and SOPs are developed and refined throughout the planning, implementation, and testing phases. Customer endpoints (LANs, hosts, servers, and applications) are connected to the network, tested, and the new network is in production operation and maintenance mode. Following initial implementation of a network, configuration change tends to be gradual, to replace failed equipment, replace a species (e.g., routers) with an upgraded version, or to make modifications in response to changing user or organization needs. Whether initial installation or incremental upgrade, network reconfigurations include both physical changes (replacing a hardware component), software changes (modifying software parameters related to the component, also known as provisioning), and changes to the documentation.^[6]

Management of distributed infrastructure, including network management, is information-intensive work. Each kind of equipment included in the network is managed by its own workstation-based suite of applications tailored to manage that layer of technology. Each of these systems contains a database (the Management Information Base, or MIB) that provides a representation of the configuration of that layer of the network, providing an accurate, one-to-one correspondence to the physical network configuration. Information in each MIB is, however, isolated and few tools exist to provide effectively merged views of data from all layers of the network. SOPs are created, using an iterative process of proposal, negotiation, and testing, in order to define preplanned and vetted operational sequences for use in routine and nonroutine but anticipated situations. SOPs are organization and context specific, reflecting organizational values and priorities as well as the combinations of technology that make each WAN unique (e.g., kinds of equipment and locations). Some (SOPs) are so commonly used that the RTSC staff has them memorized and the paper documents are only used by newcomers or as referents during discussion. Other procedures, like disaster recovery procedures, are hopefully never actually used. Versions of these types of procedures are often modified into test scripts, which are used once and then discarded.

The NMO staff creates formal databases and other information management tools to serve the specific needs of the NMO, such as trouble ticket, configuration management, and test scheduling systems. Other formal information systems include the vendor provided MIBs and the NMO's own SOPs. Other more situated and less formal information systems included are handwritten notes and

collections of information assembled by individuals, created spontaneously by the NMO staff in order to allow them to do their work more effectively. The informal systems often combine information drawn from one or more formal information sources. The combination of information from multiple sources results in new information compounds^[7] that highlight, through processes of extraction, juxtaposition, and integration of domain semantics, what is salient in a domain rich with information.^[8] People from all parts of the organization spend a great deal of time seeking and gathering bits of formal data, adding the organization-specific stuff of meaning and context, and producing useful, but often difficult to find and manage collections of information. These informal information compounds are often expressed in tabular format in order to represent relationships between physical and logical objects. The relationships of logical objects (like the symbolic or mnemonic name of a network device) to physical objects (like a port on a router or a cable) are enormously important during troubleshooting or in planning for network changes. These information compounds are a means by which the members of the NMO can introduce the organization-specific data about customers, purpose, and meaning into both the real-time supervisory control and design environments. However, maintaining the integrity of these informal representations over time is difficult due to the high rate at which changes are made to the network configuration.

Schematic drawings of relationships between network devices are another common information compound useful in highlighting important relationships between discrete elements in the network. These, too, are prone to problems caused by change and poor document maintenance.

Patterns of Work and Dimensions of Network Management

The degree to which members of the technical staff, who are primarily responsible for network design work, and the RTSC staff, who are responsible for monitoring and controlling the network in real-time, share and coordinate the work associated with the five dimensions of network management varies by dimension, and is influenced by the values, priorities, and other characteristics of the NMO. The work patterns described below are based upon network management work as practiced in a large financial institution,^[9] but are typical of any NMO operating a WAN in a context where high security, reliability, and availability are expected.

In terms of fault management, members of the technical staff will be engaged in the requirements definition and implementation of equipment and software related to fault management. Software engineers may develop or customize systems for managing alarm data in either real-time or for fault diagnosis or post hoc fault analysis. Members of

the technical staff do not participate routinely in fault monitoring activities: this is the responsibility of the RTSC staff. However, under certain conditions, such as during real-time troubleshooting, members of the technical staff merge with the RTSC staff—usually joining together in the network control room—to isolate and resolve a difficult problem as quickly as possible.

Faults requiring intervention occur frequently in large networks, often because of the complex hardware and software configurations located at each network site or because of problems with the telecommunications circuits that connect network locations to each other. An NMO creates procedures (SOPs) that define the canonical responses to typical fault situations. RTSC staff use the SOP as a reference when responding to typical faults, which should result in rapid service recovery performed in a standardized manner. If the standard response does not work, the RTSC staff moves into troubleshooting mode in order to restore service to affected users (by perhaps reconfiguring the network so that redundant or alternate components can be used by the affected users), isolate and characterize the outage, document the outage in a database (by creating a trouble ticket that serves as a collection point for alarms, actions taken, actors involved; a trouble ticket created in response to nonroutine events becomes a narrative of the NMOs collective actions), and escalate the situation (i.e., notify management and next-level technical support, including hardware and software engineers who are responsible for network design and are typically expert in relatively narrow areas such as circuits, routers, or security; or possibly equipment or service providers).

Configuration management is primarily performed by members of the technical staff using a reflective, self-paced, and creative design process, although the RTSC staff are involved for the implementation, testing, and ongoing maintenance. A standard implementation process, such as the waterfall process described above, is typically used to manage preplanned, permanent configuration changes. The RTSC staff may make temporary configuration changes in response to network faults, or as part of the execution of a SOP (e.g., see the description of a DRT, below).

Performance management is almost entirely done by members of the technical staff in a reflective process where data collected by the network is compiled and analyzed. In rare cases, real-time network congestion may bring RTSC and design staff together in the control room for real-time analysis and intervention. These rare real-time situations are likely to cause a network capacity review by members of the technical staff.

Accounting management is also almost entirely a post hoc, off-line activity. RTSC have little to do other than ensure that the accounting data is being collected continuously. Accounting data is usually important to the NMO even in cases where detailed usage tracking is not done; usage information is still likely to be used to demonstrate

NMO and network relevance as well as to help apportion network costs to customer organizations.

Security management involves members of the technical staff most directly and includes managing access control, user accounts and passwords, and encryption key management procedures. The RTSC staff does get involved, particularly in diagnosing suspected link encryption or data encryption problems. In a 24 hour, high-security environment, additional control procedures are required to manage access to “superuser” passwords that may need to be accessed from a secure location, such as a safe, when required for fault resolution.

Information and Activity in Network Management

An example of how an NMO plans and conducts a disaster recovery, or business continuity, test (DRT) is indicative of the ways the design and RTSC staffs interact and of the reliance of the NMO on effective information management. The DRTs in a WAN are complex. The DRT scenario assumes that the entire network site, its servers, and LANs at that the site have all been disabled (e.g., due to a fire, flood, etc.). A private network with high standards for availability would set as a network design requirement the ability to survive the complete loss of any network site by providing connectivity at an alternate, backup site. This requirement directs many other decisions and activities. For example, the need to redirect huge flows of data from a failed site to a backup site has an impact on the initial design of the network and its topology, as well as the way recovery mechanisms within the network are customized. The NMO also commits significant human resources from the technical and RTSC staff to create SOPs that will support this sort of recovery within the target times, which require complete network and server recovery within a few hours of the outage. The SOP likely contains scores of steps that are to be performed in a preplanned sequence, often by multiple organizations working in coordination. Such a complex document must be created and reviewed by both RTSC and technical staffs: the members of the technical staff are subject matter experts with deep knowledge of a narrow technical specialty, while the RTSC staff have broad working knowledge of the range of network technologies, but with less technical depth. The RTSC staff’s “big picture” view of the network and the organizational environment allows them to contribute information about how activities should be sequenced and coordinated, both within and across the participating sites. People from multiple organizations and sites must be familiar with the procedures and rehearse them regularly. Backup data must be transmitted regularly, often on a continuous transaction-by-transaction basis, or by using daily data transfers. In either case, these data transfers become part of the RTSC staff’s ongoing responsibilities.

The planning for a DRT begins a couple of months before the test date. A DRT director, usually a manager, is assigned responsibility for planning and running the test. Draft test scripts are distributed, which are modified versions of the SOP. The modifications reflect the goals and exceptions for the current test. (It is, as a practical matter, nearly impossible to take a major site out of the network for the 18–24 hours it takes to run a disaster simulation and test all of the recovery and fallback procedures. The tests are invariably limited to some degree to accommodate other competing requirements.) Conference calls are held where the site being tested, the NMO, and any other sites involved in recovery of servers “walk through” the script, looking for errors, sequencing problems, negotiating modifications, and inserting proper articulation and control points (e.g., periodic management conferences to review progress and status when the test is executed). Members of the technical staff and RTSC staff are present at all of the planning meetings and participate in the discussions and negotiations. The SOP is designed to serve as a canonical text in that it embodies the actions to be taken in the event that an “ideal” disaster occurs: a complete, total disaster at the site that would render it unusable. As such, the SOP embodies a “best practice” approach to dealing with a disaster, providing guidance on the most reliable way to effect the recovery of each piece of the failed environment at the backup sites. At the start of the test, the disaster itself is simulated, and how the simulation is to be performed is part of the test script. Specific dates and times are included in the test script to provide a rough sense of what it means to be on or behind or ahead of schedule during the test, values which are not included in the canonical SOP.

As the test date nears, it is discussed during the normal change and scheduling meetings to ensure the readiness of the NMO and other direct participants, to allow new information to be integrated into the schedule and plan, and to ensure awareness by a wider range of people and organizations who may be conducting other activities that overlap with the DRT. The day before the test begins, a final meeting is held, attended by representatives from all locations with responsibility for conducting the DRT. This meeting is the last opportunity for cancellations, late modifications to the test script, discussion of resource conflicts, times, etc.

The DRT begins a couple of hours before dawn, and RTSC staff from the NMO are responsible for many of the first steps to reconfigure the network to support movement of servers and other systems from the site under test to various recovery sites at other locations across the network. The third shift NMO staff cannot participate in daytime planning meetings that have occurred during the past week, and so they rely upon the written test schedules and scripts, plus any information passed verbally to them by the previous shift staff. They are also likely to have other network reconfigurations to perform during the

same time period, near the end of their shift. If this part of the day goes well, the NMO will be in good shape for the entire weekend. If not, the political fallout could last for weeks. The site disaster will be simulated by disabling all of the network connections from other network sites to the site under test, in effect isolating that site from the rest of the network. The NMO RTSC staff issue status commands to ensure that the circuits are inactive. Alarms printers and displays record the disables as well as hundreds of other, cascading events. Network elements, represented by icons, change from green to red on many of the workstations. The NMO RTSC staff contact the test director to report that their current task is completed.

Contingencies are bound to arise in any event this complex. One site may get a late start; there may be problems reading a tape when trying to restore a software image at the backup site. The NMO is also likely to be dealing with normal problems, such as circuit problems that are causing high error rates and affecting network performance. In real time, processes move forward at the many participating sites. Some parts of the process get stuck and require intervention; some succeed; others simply fail, and the test script is modified on the fly in a continuous series of phone calls and negotiations. When the reality of the test day proves problematic, people can refer to the plan and make on-the-spot decisions about how to work around the difficulty: steps may be done in the “wrong” order, certain steps skipped, or certain steps repeated. These variations must be noted at the NMO as they occur, both to keep track of the test status in real time and as information to be used to modify the underlying SOP and subsequent similar test scripts.

The duration the DRT and other tests may span shift boundaries, making it necessary for accurate status to be passed from shift to shift. Managers from the NMO need status and may be on site or at home. The technical staff members supporting this and other simultaneous tests need to be aware of the status of the major test and adjust their weekend activities accordingly. The NMO must coordinate its activities through the DRT manager. As the test runs, problems may occur which must be resolved. Some parts of the test may be omitted in response to unexpected problems to avoid compromising the entire test.

The final event associated with a DRT is the postmortem held the following week. The participants in the postmortem are the same as those who participated in the many pretest meetings. The DRT director in effect grades the performance of the participants. The NMO and other organizations are held responsible for problems arising during the test. Responsibility for resolving each problem is publicly assigned. Resolution of problems assigned to the NMO may involve modifying the SOP or making configuration changes to the network. Even though problems occur during the DRTs, they are, due to the careful preplanning and test-day coordination, almost always considered successful.

CONCLUSION

Network management is not exclusively a technical issue of routers, telecommunications links, servers, applications, and the interconnections of LANs via metropolitan or WANs. Effective network management depends upon the blending of design and RTSC work to support all dimensions of network management: fault, configuration, performance, accounting, and security management. Effective organization and control of complex, dynamic information is also important to the NMO, as it enables the recording and communication of large amounts of information in forms that incorporate the values of the NMO and the larger organization within which it is embedded. While the five dimensions of network management form a common basis for organizing network management across a wide variety of organizations, the details of network management practice are situated and influenced by security requirements, available technical expertise, and budget. The concerns of network management apply as well to other situations in which distributed infrastructure must be managed.

Standards published by the Internet Engineering Task Force (IETF) have come to dominate network management practice. The most important of these are the Simple Network Management Protocol Version 3 (SNMPv3), defined in Requests for Comment 2571–2575.^[10–14] Further information about the technical aspects and best practices of network and infrastructure management, including how SNMPv3 is used in practice, can be found in a number of works, including Limoncelli–Muller.^[15–18]

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Network of European Museum Organisations (NEMO)

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Abstract

European professional museum organizations joined together in 1992 in order to establish a political network of museums that would be able to act on a supranational level within the EU.

The Network of European Museum Organisations (NEMO) was founded in 1992, based on a Danish initiative. The intention was to establish a cooperation between the museum organisations within the then EC. Besides Denmark, Great Britain and Holland were the other driving forces in furthering this work.

The Maastricht Treaty made the need for NEMO even more evident and gave the network a clearer political dimension. After Maastricht, museums had to be able to act on a supranational level.

NEMO is an initiative for professional museums organizations, but professionally staffed state institutions and committees are invited to join from other countries, where no nationwide organisations exist. NEMO is set up with minimum bureaucracy. It is informally structured and has led to a flexible and workable organisation.

NEMO's members meet for 2–3 days every year. The meetings are held in rotation in the member countries, and are led by the chairman and the executive committee, who together monitor the work in NEMO and prepare for the annual meeting. The secretariat follows the chairman.

NEMO tries to get the expenses for running the secretariat and network financed by EU programs. The executive committee meets 2–3 times a year. One of these meetings is held at Brussels, and includes meetings with other cultural networks, with the cultural committee

of the Parliament, and with the relevant offices of the Commission.

NEMO has made the presence of museums felt in the EU, and it is the duty of NEMO to bring museums into the current political debate. NEMO does so, by means of its meetings and contacts at Brussels, by taking part in conferences, by cooperating with other networks, by the distribution of information on the work and necessity of museums, by written submissions, and, especially, by contributing to different EU programs. The latest example is the compilation of a standard loan agreement for museums, which will make it easier to procure mobility of collections within Europe.

NEMO has brought about a close cooperation between museum organisations within the EU, and gaining knowledge and understanding each other has been one of the most important results of NEMO's activities. NEMO has also been part of the inspiration behind a new attempt to create a global collaboration among professional museum associations.

NEMO's Web site is a meeting point for museums that are looking for partners for projects. NEMO's Web site is also the forum for dissemination of information from EU that is relevant for museums.

Today, NEMO is considering its role in the future. Will it be obliged to be formal in order to meet the demands of formality from EU authorities? Or can it stay informal and keep the flexibility of an independent network?

Networked Knowledge Organization Systems/Services (NKOS)

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Abstract

The NKOS Community is described in this entry. NKOS (<http://nkos.slis.kent.edu/>) is an informal network of academics and practitioners who are interested in the use of knowledge organization systems (KOS) in networked information environments. The general aim of the community is to enable KOS to act as networked information services (both machine-to-machine and human-computer), and support the description and retrieval of information resources on the Internet. The community is a forum for presentation and discussion of KOS applications, and interchange of ideas, from technical issues to intellectual, semantic, and terminological problems related to the use of KOS. The participants come from a variety of disciplines, and from academia as well as practice, and interact and communicate by a diverse set of means: annual workshops in the United States and Europe, a Web site, a mailing list, and publication of special journal issues and working papers about contemporary issues. The NKOS community represents topical diversity, informality, and multiple perspectives on networked KOS applications. There is an implicit danger that this variety diverts the focus and discussion. However, it appears from the analysis that the constancy in the organization of the activities and the well-established peer review process is adequate to attract participants, maintain satisfactory quality, and keep focus in multiplicity.

INTRODUCTION

Networked Knowledge Organization Systems/Services (NKOS) is an informal network of academics and practitioners from a variety of disciplines who are interested in the use of knowledge organization systems (KOS) in networked information environments. The notion of KOS covers a wide range of systems from authority files, classification systems, thesauri, gazetteers, and ontologies.

The NKOS network interacts and communicates by a diverse set of means. Since 1997, there has been an NKOS workshop each year, at either the Joint Conference on Digital Libraries (JCDL) or the European Conference on Digital Libraries (ECDL). In addition, NKOS Special Sessions have been held occasionally at other conferences or seminars. NKOS-related special issues have appeared in the online Journal of Digital Information (JoDI) in 2001 and 2004 and in the printed journal *New Review of Hypermedia and Multimedia* (NRHM) in 2006. A variety of KOS-related documents have been proposed and emerged from the NKOS community.

The community operates a mailing list, <http://listserv.oclc.org/archives/nkos-l.html>, today hosted at the Online Computer Library Center (OCLC). Diane Vizine-Goetz, OCLC oversees the list. From June 2001 to May 2007 the archive of the NKOS mailing list was hosted by the National Science Foundation (NSF) DLI2.^[1] There is access to information about activities and means of communication at the NKOS Web site (<http://nkos.slis.kent.edu/>), hosted and administered by Marcia Zeng, Kent State University.

This entry is a description of the NKOS community, its interests, and activities. The remainder of the entry is organized as follows. Section “Aims, Participants, and Topical Focus” provides an overview and discussion of the aims, participants, topical focus, and themes that NKOS covers. Section “The NKOS Workshops and Special Sessions” presents the NKOS workshops and other NKOS meetings. Section “Special Journals Issues” discusses the special journal issues and other related documents proposed and developed within the NKOS community. Section “Conclusion” sums up and concludes about the contribution of NKOS.

AIMS, PARTICIPANTS, AND TOPICAL FOCUS

NKOS is devoted to the discussion of the functional and data model for enabling KOS as networked interactive information services to support the description and retrieval of diverse information resources through the Internet.^[1]

From the start the NKOS community and its primary means of communication, the NKOS workshops were planned to be an *informal* meeting place for researchers and developers, a forum for discussions and interchange of ideas and experiences. In calls participants are encouraged strongly to present problems or lessons learned that will benefit from workshop discussion. Substantial, extensive discussions, with “crosscutting discussion points,” is a crucial goal for the NKOS workshops.^[2] At every the

workshop a portion of the meeting time is reserved for informing about research and development projects, current as well as planned, deliberately with the idea of exchanging ideas and identifying collaborative development opportunities.

The workshops invite participants internationally from the industry as well as academia, and looking at the workshop programs participants also embrace a wide range of disciplines and professionals: thesaurus, taxonomy and ontology developers, digital library and information infrastructure developers, library, museum and archive professionals, standard developers, user interface designers, and knowledge managers. The workshops bring together developers of traditional KOS tools such as classification schemes and thesauri and developers of newer semantic tools such as ontologies and topic maps, and as such provide a meeting room where recent KOS development can take advantage of the vast body of knowledge from more traditional systems and where the practices for traditional KOS structures can benefit from the technological advances being developed to improve semantic access to Web content.

The main, overall workshop topics are themes related to KOS applications and networked implementation of KOS, ranging from technical challenges, terminology and standards development, identification of user needs, and understanding of the advantages and the general scenario for searching and navigating networked knowledge organization systems. Over the years the NKOS members have discussed the four essential discussion points that was developed already at the second NKOS workshop in 1998:^[2]

1. The data model: what kind of data model is needed to support the interactive use of thesauri and other terminologies in online information services such as digital libraries? What data elements and/or relations are needed to convey the content of these resources?
2. The functional model: how do users want to use thesauri and other authority files in searching and resource description? What kind of access is important in exploring or “navigating” through the thesaurus?
3. Thesaurus-level metadata and thesaurus registries: what thesaurus-level metadata is needed to represent the scope, structure, size, ownership, access constraints, etc. of a thesaurus so that potential users will know what is available and how to access and use it?
4. The business/intellectual property model: what types of collaborative agreements and partnerships are necessary between thesaurus owners? What kinds of relationships are possible between owners of vocabularies published over a public network and users?

These topics have appeared at almost all workshops, and may be considered the main topical focus. Beyond these basic topics most of the workshops have had a special

theme in the call for proposals, with the purpose to cover proactively up-coming issues and problems relevant to networked KOS. During time the community has picked up emerging issues such as cross walks and vocabulary mapping, interoperability, user-centered approaches to design and development. Consequently, the NKOS community has covered KOS related issues from multiple perspectives. Table 1 provides an overview of all the workshops NKOS in the United States and Europe from 1997 to 2008, with indication of their special issues and themes.

THE NKOS WORKSHOPS AND SPECIAL SESSIONS

The main activity for the NKOS community is the NKOS workshops, with NKOS workshops in the United States since 1997 (US NKOS workshops) and in Europe since 2000 (EU NKOS workshops).

The very first NKOS workshop was held in the United States in June 1997 at the 2nd ACM International conference on Digital Libraries. Also the following workshops in 1998, 1999, 2000, and 2001 were hosted by ACM Digital Libraries Conferences. From 2001 the host was ACM and IEEE Joint Conferences on Digital Libraries (JCDL), continuing until 2005. After a break in 2006 and 2007, the 2008 US NKOS workshop was held as a Joint NKOS/CENDI workshop. CENDI: the Commerce, Energy, NASA, Defense Information Managers Group.

Joseph Busch, Taxonomy Strategies organized the first NKOS workshop. Later workshops were organized by a large group of people, with Linda Hill, University of California, Gail Hodge, Information International Associates, Marcia Lei Zeng, Kent State University, and Diane Vizine-Goetz, OCLC as the regular and primary organizers over the years.

From the start the workshops were international with participants from the United States as well as European countries. As a result, workshops were also held in Europe from 2000, still with broad international participation.^[3–6] The European Conference on Digital Libraries (ECDL) hosts the European workshops. Traugott Koch, Max Planck Digital Library, Douglas Tudhope, University of Glamorgan, and Marianne Lykke Nielsen, Royal School of Library and Information Science have been the principal organizers.

The NKOS workshops are peer-reviewed, with a formal call for proposals and a program committee. The organization group and the program committee are dynamic, and consist typically of a set of earlier organizers and new people, in order to keep simultaneously the primary scope and add new perspective. The program committee is multidisciplinary and international, and represents a wide range of professionals, disciplines, and interests.

Table 1 NKOS workshops, 1997–2008.

Workshop	Location	Workshop theme
US NKOS 1997	ACM Digital Libraries Conferences, United States	Metadata and thesauri
US NKOS 1998	ACM Digital Libraries Conferences, United States	Standards for networked terminology/thesauri/classification/authority systems
US NKOS 1999	ACM Digital Libraries Conferences, United States	Thesauri registry and data models
US NKOS 2000	ACM Digital Libraries Conferences, United States	Networked knowledge organisation systems, with special focus on ontologies and gazetteers
EU NKOS 2000	European Conference on Digital Libraries, Portugal	European initiatives and projects/options for global cooperation
US NKOS 2001	ACM Digital Libraries Conferences, United States	Classification crosswalks and vocabulary mapping
US NKOS 2002	Joint Conferences on Digital Libraries, United States	Digital gazetteers
US NKOS 2003	Joint Conferences on Digital Libraries, United States	Transformation of traditional KOS to new semantic tools
EU NKOS 2003	European Conference on Digital Libraries, Norway	Standards in networked KOS
EU NKOS 2004	European Conference on Digital Libraries, United Kingdom	User-centered approaches
US NKOS 2005	Joint Conferences on Digital Libraries, United States	Interoperability and integration of KOS
EU NKOS 2005	European Conference on Digital Libraries, Austria	User-centered strategies
EU NKOS 2006	European Conference on Digital Libraries, Spain	Semantic Web applications of KOS in Digital Libraries
EU NKOS 2007	European Conference on Digital Libraries, Hungary	KOS in next-generation digital libraries
US NKOS 2008	JOINT NKOS/CENDI, United States	New dimensions, e.g., mapping, collaborative KOS development
EU NKOS 2008	European Conference on Digital Libraries, Denmark	User centered systems and Terminology Registries

Source: <http://nkos.slis.kent.edu/> (accessed January 2009).^[1]

In 2004 the EU NKOS workshop was held in collaboration with Sebastian Ryszard Kruk, National University of Ireland, who comes from the semantic web community. The purpose was to have a special session, highlighting semantic web applications of KOS in Digital Libraries. The session was chaired by Thomas Baker, Goettingen State and University Library and Bernhard Haslhofer, ARC Seibersdorf research, Studio Digital Memory Engineering.

In 2003, 2005, and 2008 NKOS events were held three times yearly: workshops at JCDL in the United States and at ECDL in Europe, and NKOS Special Sessions at the DCxxx International Conference on Dublin Core and Metadata Applications (DCxxx). The first special session was held at DC2003 in Seattle. The session explored the relationship between metadata structures and values, and discussed the traditions and innovations in controlled vocabulary use in the networked environment. The second special session was held at DC2005 in Madrid, and focused on the practical applications of networked KOS. The last DC special session was held in Berlin in 2008. The presentations covered topics such as the combined use of KOS and social tagging, controlled vocabulary in metadata for semantic web usages, and metadata and terminology registries.

In 2008, the conference of the American Society of Information Science and Technology (ASIST) hosted a NKOS meeting, which was a new invention and meeting platform. The meeting was held as a panel discussion that addressed important issues around standards and applications. A registry for controlled vocabularies at the Library of Congress was presented, the architecture of the OCLC

Terminology Services, and a MeSH indexing tool for Health Science Repository System. The panel was a continuing effort of the ASIST Standards Committee in order to promote awareness of standards.

SPECIAL JOURNAL ISSUES

The workshops do not publish workshop proceedings, but publish the Power Point presentations at the workshop Web site.^[1] However, NKOS-related special issues have appeared in the online Journal of Digital Information (JoDI) in 2001 and 2004 and in New Review of Hypermedia and Multimedia (NRHM) in 2006. These special issues have their origin and evolve from the NKOS workshops where the participants are encouraged to submit papers based on their NKOS presentations. However, the calls for papers are open calls within the topical scope of networked KOS.

The first special issue of the JoDI evolved from the EU NKOS 2000 workshop, held in Lisbon.^[7] The focus was European initiatives and projects, and the issue presented five papers on the general workshop themes, on both conceptual aspects and technical implementations of knowledge organization systems. The papers covered the development of a four-language multilingual social thesaurus, exploration of the potential of thesaurus facet structure in query formulation, problems of semantic mapping between thesauri, approaches to the mapping and understanding of equivalence and hierarchical relationships between terms from different subdomains, and the use of the Unified Modeling Language (ULM) for

representing ontologies and mapping from Extensible Markup Language (XML) encodings and UML.

The second special issue was published in JoDI in 2004 with its origin in the two NKOS workshops, held in 2003 in the United States and Europe, respectively.^[8] Three of the five accepted papers represent classical NKOS topics. The first paper reported a reengineering project of a traditional thesaurus structure to an ontology structure for conceptual reasoning and automatic use. The second paper discussed automatic mapping and creation of intervocabulary associations, and the third paper concerned development of protocols for distributed access to thesauri. The fourth paper was a theoretical paper discussing the role of knowledge organization systems and arguing that the effective teaching of scientific concepts may be facilitated by digital library systems, which provide integrated knowledge organization structures. In the paper a system was presented, based on a strongly structured model of scientific concepts that integrates a domain-specific KOS with associated metadata and specialized learning models. The fifth paper reviewed the topical notion of the semantic web, and argued that the semantic web is based on a restricted and static sense of meaning. The last paper was long for a conventional journal paper, but as JoDI is an electronic journal, it was possible to publish the extended historical treatment of the semantic web. This is precisely in the spirit of the NKOS community that focuses on facilitating informal communication of new perspectives and viewpoints.

The third special issue was published in the *New Review of Hypermedia and Multimedia* in 2006. The issue had its origins in the EU NKOS workshops, held in 2004 and 2005, although the majority of contributions resulted from an open call for papers.^[9] The themes were typical for NKOS. One paper reported research evaluating automated subject classification of textual Web pages with categorization rules based on a controlled vocabulary. The second paper continued the automatic indexing theme by reporting on a variety of natural language processing techniques that have been used in combination to improve information retrieval, including query expansion. Semantic interoperability was the topical focus of the third paper that reported results from a major project by the Food and Agriculture Organization (FAO) in mapping two large agricultural thesauri. The fourth paper described a freely faceted classification method that allows the free combination of concepts in complex subject descriptors. A Web demonstrator illustrated its application to a small set of bibliographic records. The last paper reported on initial results from proof of concept projects conducted by the Metropolitan Museum of Art and the steve.museum collaboration.

The NKOS community has proposed and initiated the development of several working papers. Linda Hill and Interconnect Technologies drafted in 1996 document defining and describing a set of thesaurus attributes.^[10] A reference documents for data elements was developed in 1998, and later updated in 2001 and 2008.^[11] Gail Hodge

drafted a taxonomy of knowledge organization systems in 2000.^[12] A document describing a vocabulary mark-up language was published in 2000.^[1]

As a whole, the special issues and working papers represent well the objectives and topical focus of the NKOS community. All three journal issues are a mix of the classical NKOS topics related to the use and development of KOS and up-coming topics such as user-oriented approaches to design and development, social tagging, and KOS as a teaching facility. Similarly, the NKOS-related documents cover classical NKOS topics.

CONCLUSION

The analysis of NKOS community and its activities shows that the NKOS community is an active network which enables presentation and discussion of the use and development of KOS. The community is international and multidisciplinary with participants from a variety of fields such as information science, library science, computer science, semantic web community, and language engineering. Correspondingly, the participants come from academia as well as practice. The network facilitates informal interchange of ideas, viewpoints, and approaches by a diverse set of means, a Web site, mailing list, workshops, journal papers, and working papers.

The overall focus is KOS, but this topic is approached from many different angles, from technical issues to intellectual, semantic, and terminological problems, standardization and registries, from design, development, and use of KOS applications. NKOS is a topical broad forum, and provides room for completed and on-going research, early and mature development projects, and demos of prototypes as well as full applications. The review of the NKOS activities shows clearly that the community covers multiple KOS-related issues from a large set of disciplinary perspectives.

This topical diversity, multiple perspectives, and informality in communication should be considered an advantage in its richness and complexity, but the multiplicity might also be a disadvantage and “Achilles’ Heel,” with an implicit danger of lack of focus and mixed quality. However, it seems from the analysis of the activities and the fact that the community has existed more than 10 years that the more or less constant organizing committees in the United States and Europe, and the well established peer review process is adequate and sufficient to maintain satisfactory quality, attract participants, and keep focus in multiplicity.

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New Zealand Aotearoa: Libraries

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Abstract

This entry provides an overview of libraries and library services in New Zealand Aotearoa. Taking as a starting point British colonization in 1840, the entry follows the development through until the present day. In addition to outlining the four major library sectors of public, academic, school, and special libraries, it also includes detail of the National Library of New Zealand. Education for librarianship in New Zealand is described along with descriptions of professional associations. Finally, some issues and challenges in New Zealand libraries are identified.

INTRODUCTION

Situated at the bottom of the Southern Hemisphere in the Pacific Ocean, New Zealand consists of two major islands (North and South), and smaller surrounding islands. It was originally settled prior to A.D. 1300 by Polynesian people from the eastern Pacific islands. It is believed that they made landfall along the eastern coast of New Zealand^[1] (p. 35). For the ensuing almost 350 years, the indigenous people of Aotearoa lived without European contact or influence and a community with a strong oral history and tradition developed. The *tāngata whenua* (people of the land) Māori lived in independent subtribe groups.

The first European discovery in 1642 was by Dutch explorer Abel Jansen Tasman, who mapped portions of the west coast of both islands. Subsequently, some 120 years later, New Zealand was effectively rediscovered by British Captain James Cook in 1769.

The beginnings of European settlement were in the late 1700s and early 1800s, primarily by whalers and sealers, with the first traders and missionaries following shortly after. New Zealand became annexed to the British Crown in 1840 with the signing of the Treaty of Waitangi, and by this time there were only a few hundred Europeans living in the country.^[2] The Treaty is now considered the founding document of New Zealand Aotearoa as a nation. The British understood that the Treaty granted sovereignty to the British Crown, whereas the Māori chiefs that signed the document understood they were granting governance to the Crown but not sovereignty. The differences between the two versions (one in English and one in Māori) have been a point of tension and debate since 1840.

The wave of settlers that followed the declaration of British sovereignty were predominantly those looking for a better life than they were leaving behind, with an image of a society that was both egalitarian and equal. Literacy levels were relatively high among the settlers and those

who had low levels of reading ability were determined to better both themselves and their society.^[3]

New Zealand today has a population of over 4.8 million people. While it is truly multicultural, with recent high immigration rates from the Pacific, Asia, and the Middle East, the Treaty of Waitangi establishes a formal bicultural framework for Māori and Pakeha (non-Māori) to work within. To this end, New Zealand has three official languages—English, Te Reo Māori, and, since 2006, sign language.

The impacts of British colonization can be clearly seen in the government and the legislative structure. While there was a brief period of provincial government in the nineteenth century, this was short-lived, so unlike Australia and the United States, New Zealand does not have state or provincial government. This has led to more cooperative developments on a national scale.

New Zealand has a state schooling system that is free for all 5–19-year olds and compulsory for all 6–16-year olds.^[4] While achievement rates for New Zealand students in the OECD PISA reports are higher than average (ranked seventh in 2009),^[5] on closer inspection, the education system is not serving all students equally well. There are higher numbers, in particular, of Māori children leaving school before eighteen, and one in four New Zealanders over the age of fifteen does not hold any educational qualifications. Low literacy levels among Māori are an ongoing concern, and various Māori education initiatives have been developed over the years to address these gaps.

The New Zealand economy was traditionally based on primary industries, with a focus on agriculture, forestry, and fishing exports to drive the economy. In recent times, there has been a shift in focus for development with subsequent government investing in manufacturing innovation, the knowledge economy, and tourism. While the primary industries continue to make the most significant contributions to the economy, the newer areas of emphasis

are having an impact and are an attempt to spread the risk in times of recession and slow growth.^[6] New Zealand does suffer in terms of the global economy being geographically isolated from many of its major markets. The increasing financial cost of freight and concern about the environmental footprint of long-distance exporting places the country at a disadvantage when seeking new markets, as well as the barrier of trade protection measures in potential markets. Free trade negotiations are a priority for New Zealand governments, and it is a party to the Trans-Pacific Partnership Agreement negotiations.

While New Zealand is a well-developed first-world nation, in recent times, there has been increasing concern about levels of child poverty and a widening divide between the socioeconomic classes.^[7,8] Improving technology infrastructure is one method that is being proposed to address these gaps. Ultrafast broadband is to be rolled out nationwide by 2020.^[9]

LIBRARY ORIGINS AND LEGISLATION

The first library in New Zealand is thought to have been a Mechanics' Institute and Library that opened in Auckland in 1842,^[10] and in 1854, the first Provincial Council libraries were founded.^[10] The 1874 Census states that there were 161 public libraries and other literary institutes in New Zealand at that time. However, these were not public libraries as we know them now, but private members' collections. In 1879, the Auckland Free Public Library was formed from the previous Mechanics' Institute and was the first of its kind in the country with other centers following suit thereafter. By 1926, there were 435 public libraries listed.^[10] However, the majority of these libraries were still subscription based. In 1934, only the Timaru Public Library was lauded by Munn and Barr (a commissioned report on libraries in New Zealand) as being completely free for its constituents to use.

The General Assembly Library (established to meet the needs of central government representatives) was first established in Auckland in 1856, and subsequently moved to Wellington when the more southern city was established as the capital city in 1864.^[3] The National Library Service was initially formed in 1945 as an amalgamation of a collection of national services, and in 1965 was merged with the General Assembly Library and the Alexander Turnbull Library (a private collection gifted to the country) to become the National Library of New Zealand.

The first academic/tertiary library was established in Dunedin in 1869 at the then University College of Otago, with other centers such as Christchurch (1873), Auckland (1883), and Wellington (1899) following shortly after.^[11]

Much of the development of New Zealand libraries following the pioneer period was as a result of a report commissioned from the Carnegie Corporation by the New

Zealand Library Association (NZLA)—commonly known as the Munn-Barr report and published in 1934. A similar report was researched and written for Australia's libraries and published in 1935 (known as the Munn-Pitt Report). In addition to the recommendations of the Munn-Barr report, which governed the strategic development of libraries for the next 50 years,^[12] New Zealand was the beneficiary of several Carnegie grants to both build libraries and fund development of collections and librarians.

LEGISLATION

The primary piece of legislation governing public libraries in New Zealand has its origins in the original Public Libraries Act of 1869. It provided, in principle, for local authorities to be authorized to charge a rate for library funding, that management of libraries would sit with the local authority, and that admission to libraries should be free. The current legislation covering public libraries is the Local Government Act 2002, and in essence it lists a library as a core service for consideration (although does not obligate any local authority to provide a library), and states that where a library is provided, constituents must be able to join free of charge. While public libraries are in general free to join, there has been a history of some libraries charging for borrowing some items. This could stem from the original intent of the 1869 Act, when it was not envisaged that public libraries would be lending libraries.^[10] Recent lobbying attempts by the Library and Information Association of New Zealand Aotearoa (LIANZA) to ensure core library services are provided free of charge in all local authorities were not successful.

The National Library Act 1965 was enacted when the National Library Service amalgamated with the Alexander Turnbull Library and the General Assembly Library. This Act was repealed in 2003, and replaced with The National Library of New Zealand (Te Puna Mātauranga o Aotearoa) Act 2003.

Other legislations that impact on New Zealand libraries are the Copyright Act 1994 and associated regulations, privacy laws, classification laws, and laws and regulations concerning digital access. The New Zealand Bill of Rights Act 1990 is designed to protect citizens from discrimination and, although not an Act, the Treaty of Waitangi as a founding constitutional document plays a large part in guiding libraries' moves toward biculturalism.

NATIONAL LIBRARY

The National Library of New Zealand officially came into being in 1965, although its seeds were planted much earlier in a variety of national library services. Key among these was the Country Library Service (started in 1938), which sent bulk loans of books to small rural libraries. The

other key national service was the School Library Service that began in 1942. These two services were amalgamated in 1945 to form the National Library Service. Then in 1965, the Alexander Turnbull Library and the Parliamentary library were added and the National Library became an official entity.

The National Library of New Zealand has, as its purpose in The National Library of New Zealand (Te Puna Mātauranga o Aotearoa) Act 2003, to collect and preserve documentary heritage and taonga (treasures), to supplement and further the work of other New Zealand libraries, and to work collaboratively with other institutions having a similar role. The current work of the National Library is focused on providing easy access for all New Zealanders to the information and resources they need to turn knowledge into value.^[13]

In 2011, the National Library along with Archives New Zealand was integrated into the Department of Internal Affairs. In late 2012, the National Library reopened to the public after a three-year refurbishment of the building and service. During the closure, mass digitization projects were undertaken that now provide over 250,000 online images and two million pages of historical newspapers. More than 2000 at-risk audio recordings were also digitized during this period.

In its role of working collaboratively and furthering all New Zealand libraries, the National Library has been the driving force behind several major innovative projects. Highlights include the following:

- Te Puna Services—a partnership with New Zealand libraries that facilitates shared cataloging, inter-library loan, and the maintenance and searching of the National Union Catalogue (<http://natlib.govt.nz/librarians/te-puna>).
- EPIC (Electronic Purchasing in Collaboration), which provides access to a range of online databases to libraries in a collaborative purchasing model (<http://www.epic.org.nz/>).
- DigitalNZ is a collaboration between more than 120 partners to make access and discovery of digital content relevant to New Zealand easier (<http://www.digitalnz.org/>).
- Aotearoa People's Network Kaharoa (APNK) provides free access to broadband internet services via public libraries and marae around New Zealand (<http://www.aotearoapeoplesnetwork.org/>).
- Kōtui is a shared library management system and discovery service that public libraries can join by subscription, thereby reducing cost to individual libraries and increasing shared capability and knowledge (<http://www.kotui.org.nz/>).

The Library is also working with New Zealand publishers and other stakeholders on e-publishing and e-lending models in order to establish a workable solution to the

issue of ebooks in libraries. Through Services to Schools (<http://natlib.govt.nz/schools>), the National Library provides critical literacy and resourcing support to teachers and students throughout the country.

The collections of the National Library are both heritage and general. Under the legal deposit clause in the National Library Act 2003, two copies of all material published in physical format are to be sent to the National Library for the collection. The general collections are primarily held and developed to support the Library's reference services and the Services to Schools collection. Heritage collections include the Alexander Turnbull Library (see below) and other collections of material significant to the history of New Zealand.

The Alexander Turnbull Library

A “library within a library,” the Alexander Turnbull Library began life as the private collection of Alexander Horsburgh Turnbull, born in Wellington in 1868. By the time of his death in 1918, the collection held 55,000 items including books and other print items that he bequeathed to the Crown to “form the nucleus of a New Zealand National collection”^[14] (p. 1). The collection has been added to continually over the years with a strong but not sole focus on information relating to New Zealand and the Pacific. It also includes an outstanding collection regarding John Milton—a particular interest of Turnbull's. Most of the material in this collection is for use in specialized Reading Rooms within the National Library building and it is predominately a closed access collection as befitting its value and worth.

PUBLIC LIBRARIES

New Zealand's public libraries are administered and funded solely from local government. There are 290 local public libraries across 78 local authorities and the range in size, scale, and capability is vast. Auckland Libraries (formed by a local government amalgamation in 2010) is the largest public library system in Australasia with 55 library branches across the system. As outlined in the legislation section, there is no legislative requirement for a local authority to provide a library service, but in reality, most people have access to a public library within their region. Libraries are funded usually from a levy made on property owners, which is gathered by the local authority. This local government funding usually contributes around 80% of the library's annual income. Further income is generated from overdue loan penalties and value-added services such as business research services and digital collections.

With the cessation of the Country Library Service in the late 1980s and mass local government amalgamations in 1989, it became unviable for many small rural libraries

to continue as a local government function. In an echo of the subscription libraries of the pioneer days, some of these libraries have continued to function as community membership libraries.^[15]

LIANZA published Public Library Standards regularly, with the most recent edition in 2004. With the establishment of an independent Association of Public Library Managers (APLM) in 2007, the updating of the Standards has become a priority for this group to undertake, and at the time of writing, these are yet to be published. In 2012, APLM released the refreshed Strategic Framework for Public Libraries 2012–2017, which outlines a bold direction for the sector in coming years. The eight key priorities from the framework for the coming five years are to

- Work with New Zealand authors, publishers, and booksellers to develop a whole-of-country approach to deliver an ebook solution that meets the needs of all parties
- Develop an evidence-based model of measurement that can be used to demonstrate public libraries' value and contribution to outcomes and for benchmarking purposes
- Identify or develop business models that make it easy for collaboration on a regional, national, and cross-sector basis in association with the local government New Zealand
- Explore a nationwide partnership with schools to deliver content and reading support in schools and across the Network for Learning, in association with the Ministry of Education and the National Library of New Zealand
- Collaborate with the National Library of New Zealand to deliver a National Year of Reading program to celebrate the joy of reading and improve literacy levels in New Zealand
- Develop a national approach to workforce planning, skills development and recruitment, and, in association with LIANZA, foster leadership for the new generation of libraries
- Investigate the opportunities for the development of whole-of-country digital solutions to ensure public library content and services are delivered in the mobile environment
- Dramatically increase the range of New Zealand's unique and legacy content available in digital format, in association with the National Library of New Zealand, universities, and other appropriate national and international partners^[16]

Services provided in New Zealand public libraries include lending and reference collections in many formats (e.g., DVDs, CDs, MP3, ebooks, online databases, and research tools). Many provide mobile libraries in order to serve communities that are further away from their physical branch as well as outreach services to community

members with special needs. Through the APNK free internet access is provided at 149 sites around the country, with libraries that are not part of the network also providing internet access, although non-APNK libraries sometimes charge a small fee for access. Children's and young people's services are offered nationwide, and many public libraries work closely with their local schools to provide tailored programs and services at appropriate levels. Provision of ebooks through public libraries is increasing in New Zealand, primarily through a consortial approach to purchasing and local solutions.^[17]

The reinventing of public libraries as community spaces or hubs has been a recent and strong development in New Zealand, with many libraries being either refurbished or moving in to completely new buildings in the last decade or so. The library as place has led to new models of community service being provided from library buildings, such as community meeting rooms, flexible furniture, cafeterias, and multimedia computing suites, and of course the expert help that goes along with them. There have also been some significant developments bringing libraries, museums, and galleries into one space (e.g., Puke Ariki in New Plymouth) as well as some libraries providing services that have traditionally been provided by local authorities (e.g., rates payments, dog registration, cemetery records, etc).

SCHOOL LIBRARIES

While there are more than 2550 school libraries across all age levels of the compulsory sector, it is not a legislative obligation of schooling in New Zealand to provide a library service. As schools have considerable freedom in how they manage their own environments and budgets, the quality of any school library can vary greatly from school to school. School libraries in the main suffer from being both underfunded and undervalued in many schools in the country, with the importance of professional, qualified staff not uniformly recognized or understood.^[11] Of course, there are exceptions of well-funded and supported school libraries, but these are not common, and in the LIANZA Remuneration Survey, school librarians are the lowest paid of all sectors across all roles.^[18]

Both the School Library Association of New Zealand (SLANZA) and the National Library are active proponents in this sector. SLANZA provides advocacy and professional development for those working in school libraries through a range of resources and events. The National Library, through the Services to Schools section, provides a range of support services to schools, librarians, teachers, and learners. These include a curriculum service where resources are sent to schools around the country to assist teachers and school librarians in teaching the curriculum. They also provide advisory services to teachers and school

librarians as well as offering an online chat reference service to students called “Any Questions.”^[19]

The New Zealand curriculum identifies five key competencies: thinking; using language, symbols, and text; managing self; relating to others; and participating and contributing.^[20] While these concepts are very broad, it is possible to place developing information literacy skills and using library resources effectively within them. School librarians face an ongoing advocacy challenge to build strong working relationships with both school management and teachers to embed information and research skills in to day-to-day teaching.

In 2012, the New Zealand Government requested that the Education and Science Select Committee carry out an “Inquiry into 21st century learning environments and digital literacy.”^[21] Following submissions to the Select Committee by SLANZA, LIANZA, and various individual libraries, it is encouraging to note that the important role of both school and public libraries in the twenty-first century learning has been highlighted as an area for further investigation by the government.

ACADEMIC LIBRARIES

New Zealand’s tertiary education system is made up of eight universities that are public institutions; eighteen government-funded Institutes of Technology or Polytechnics (ITPs) that offer tertiary education with a focus on technical, vocational, or professional education, but also encourage research particularly in applied or technological areas; and three Wānanga (Māori teaching and research institutions) with sites throughout the country. While all tertiary institutions receive government funding, most (especially the universities) seek additional revenue through research and development and other commercial initiatives. Government funding is currently allocated according to four broad education performance indicators: qualification completion rate, course completion rate, retention, and progression. In addition, a stand-alone government fund, the Performance Based Research Fund (PBRF), is allocated according to the standard of research output from an institution.

While the Munn-Barr report of 1934 stated that “[t]he college libraries of New Zealand do not even approach accepted overseas standards”^[10] (p. 35), the same cannot really be said today. Development in the university libraries took a turn for the better in the 1960s, with increasing budgets for building collections that were relevant and necessary for the teaching and research activities of their institutions. This was a result primarily of the Parry Report^[22] that urged an immediate injection of funds to libraries. It was not, however, until the advent of electronic access to scholarly databases and later full-text online academic journals that vast improvements were seen. University libraries are still subject to the constant

vagaries of budget allocations from the university and ever-increasing subscription costs. In recent times, the open access movement has offered alternatives for both scholarly publishing and scholarly collections of university libraries.

All the university libraries contribute to the New Zealand interlibrary loan scheme, and there are also reciprocal borrowing arrangements in place between most of them. Consortial purchasing of electronic packages increases the buying power for what is still a small market by working with universities in Australia through the Council of Australian University Librarians Electronic Information Resources Consortium (CEIRC), of which all the New Zealand university libraries are members.

The ITP libraries have also had mixed fortune since their establishment in the 1960s as technical institutes. Woefully underfunded during this stage, the institutes were widely criticized for the state of their libraries. The 1990s saw a loosening of control by the central government over the qualifications and courses that the ITPs could offer, and this era saw them begin to offer undergraduate degree courses. In order to be accepted as meeting New Zealand Qualifications Authority (NZQA) standards significant, investment in their libraries was required, and many ITP libraries experienced phenomenal growth as a result.

As with the university libraries, the ITP libraries continue to struggle against variable funding and increasing vendor costs. As subsequent governments continue to review and alter tertiary education policies, these all have a flow-on effect to the library budget.

Wānanga were established in the early 1980s but were not officially recognized under the Education Act 1989 until the early 1990s. Wānanga were established to provide a tertiary education option for Māori, which was a distinct experience from the mainstream universities and ITPs. The rationale for wānanga can best be stated as “. . . characterized by teaching and research that maintains, advances, and disseminates knowledge and develops intellectual independence, and assists the application of knowledge regarding ahuatanga Māori (Māori tradition) according to tikanga Māori (Māori custom).”^[23]

As tertiary academic institutions, all three types of libraries offer similar services to their patrons, including lending, reference services, information literacy teaching, collection development and management, and ensuring access to large collections of print and electronic resources. Increasingly, the academic library is taking on other roles such as computing and learning services and providing flexible spaces for group research and projects. Several institutions have had major refurbishment to match the new vision of what an academic library is. Discovery services are a relatively new development in terms of providing access to resources for patrons as libraries continue to strive toward a solution that delivers quality results to users in the most painless way possible

and are still a work in progress in many institutions. Other recent developments are focusing on embedding library and research skill development into the online learning environment using teaching and learning pedagogy and tools, developing digital institutional repositories, and starting to work with researchers in the e-research field.

SPECIAL LIBRARIES

Special libraries exist to meet the information needs and requirements of their parent bodies. Included in this group are libraries serving government departments, medical libraries, corporate and law libraries, as well as those from the not-for-profit sector. They can be described as having a narrow scope in both collection and online resources, but greater depth to that collection than is possible in a more general library.

There are approximately 300 libraries in this sector in New Zealand, the earliest of which can be traced back to the establishment of the nation with various court libraries and scientific collections, including those of the Royal Society of New Zealand.^[10]

Special libraries are in general funded directly by their parent body, and some have needed at times to be very inventive to raise additional funding with initiatives like accepting overseas interns for a fee and even teaching English in overseas centers. In an increasingly tight economic climate, special libraries need to work very hard to demonstrate their value to their funders, particularly when there is a common misconception that everything is available on the internet. By developing subject-specific expertise in the required narrow fields of knowledge, special librarians help to preserve their role, but they also need to be vigilant in marketing their specialist skills and services to their clientele. There has also been a broadening of role as evidenced by the increasing variation in position titles from librarian to information manager or knowledge manager. While some corporate libraries have been lost over the last decade, it appears there has been an increase in special library workers in the noncommercial sector.^[24]

Of particular significance in this Sector are the Crown Research Institute (CRI) libraries. There are eight different institutes, each with a specialist research library service to meet the needs of scientists and technicians working in their fields to further research in areas such as environmental, agricultural, and food research.^[25]

The Parliamentary Library that began as the General Assembly Library in 1856 was part of the National Library from 1965 until 1985. It was felt then that separating the Library out again would help to clarify its purpose as the library for parliamentarians,^[3] and in 1986, its name was changed from the General Assembly Library to the Parliamentary Library. While the Library had in the past fulfilled many of the roles of a National Library, since the separation, it has been able to focus much more on

providing an efficient and effective information service to members of parliament, parliamentary staff, and research units from its vast collections of both print and digital material as a special library.

EDUCATION AND THE PROFESSION

Education for Librarianship

As a result of New Zealand's geographical isolation, the education of librarians was a concern as early as 1910, when the first NZLA Conference set one of their aims to be to improve the "status and qualifications"^[26] of New Zealand librarians. Given that there were no library training opportunities within New Zealand, this invariably meant travel to either the United Kingdom or the United States.

By 1942, the NZLA was ready to offer a general certificate course by correspondence, and there were forty-six students in the first intake. It was a requirement for enrolment that students must be currently employed in a library for at least fifteen hours a week and the nature of the course was both practical and theoretical. In 1946, the first postgraduate diploma was offered and was taught from within the National Library Service from the then newly formed New Zealand Library School. The Diploma was considered a professional qualification and would take one academic year of full-time study in Wellington.

This model of library education and training was to remain in place for almost a further 40 years. After several years of discussion and planning, the Certificate course moved to the Wellington Teacher's College and the Diploma to Victoria University of Wellington in 1980.^[27] Since 1980, most qualifications have been renamed as information management courses, the Diploma has been upgraded to a Master's degree, and a Doctor of Philosophy degree has been introduced. In 1996 the undergraduate education was moved to the Open Polytechnic of New Zealand.

The Victoria University of Wellington is the only educational provider offering postgraduate qualifications. Current options are postgraduate certificates and diplomas, in addition to the master of information management degree with a library science endorsement. Victoria also offers the option of PhD study in the School of Information Management, although there have been very few enrolments focusing on topics in librarianship to date. Victoria courses are offered both by distance education and on campus in Wellington.

The Open Polytechnic of New Zealand offers subdegree programs in LIS as well as undergraduate bachelor of arts or applied science degrees in library and information science. The Open Polytechnic is a distance education provider.

Te Wānanga o Raukawa offers a one-year diploma or a three-year undergraduate bachelor degree in information management, with a specific aim to develop bilingual and bicultural managers of Māori information resources in Māori and non-Māori organizations.

Professional Registration

After several years of debate, planning, and consultation around the need to improve the standing of librarianship as a profession, in 2007, LIANZA introduced its Professional Registration scheme. The scheme is an open, voluntary scheme that provides a framework for continuing professional development and accreditation with like organizations outside New Zealand. It is designed to firmly position library and information management as a graduate profession, as registrants must hold a recognized degree in library studies. Similar in structure to CILIP's Chartership scheme, the Professional Registration scheme required registered librarians to revalidate every three years by submitting a reflective journal of development and learning. While still relatively new, the scheme aims to benefit librarians, employers, and the public as a whole by providing both the motivation and means to continually upskill. LIANZA's scheme has reciprocal recognition with CILIP, allowing registered New Zealand librarians to be recognized as equivalent to chartered librarians in the United Kingdom.

The LIANZA Professional Registration scheme has a body of knowledge adapted from the IFLA guidelines, with the significant addition at the time of an eleventh element regarding indigenous knowledge frameworks. Both LIANZA and Te Rōpū Whakahau (an association for Māori library workers) have worked diligently to have this eleventh element internationally accepted as part of the LIS Body of Knowledge with the support of the IFLA SIG on Indigenous Matters, and they are to be congratulated that this amendment to the IFLA guidelines has been made in 2013.

Professional Associations

The NZLA, trading as LIANZA, came into existence in 1910 in Dunedin, following the first conference of library leaders. It was incorporated under its own statute, NZLA Act 1939, and celebrated its centenary with the publication of the Association's history in 2010.^[26] LIANZA is a membership organization with both individual and institutional members and has as its vision to "... be the vibrant, vital professional voice for those engaged in Librarianship and Information management."^[28] LIANZA operates the Professional Registration scheme for librarians and information professionals as well as providing an annual conference, continuing professional development program, regular publications, and high-level advocacy on behalf of members with central and local government.

Te Rōpū Whakahau was formed in 1992 as a SIG of LIANZA and in 1996 was incorporated as an independent organization. It was formed as a specialist support network for Māori staff working in libraries and to build understanding and capacity for all when working with Māori patrons or Māori information. There is a formal partnership between LIANZA and Te Rōpū Whakahau that assures the two associations' work together in the pursuit of bicultural development of librarianship in New Zealand. Notable achievements for Te Rōpū Whakahau have been the development and delivery of CPD courses nationwide to increase bicultural awareness in LIS workers, working with The National Library of New Zealand to develop Māori subject headings for use in library catalogs, and working with Te Wānanga o Raukawa to deliver library education in a Māori environment.

Over the decades, other professional associations have come into being to serve specific needs and sectors. Notable examples are the SLANZA, APLM, and the New Zealand Law Libraries Association (NZLLA). Sector specific groups are also in existence within LIANZA's structure in the form of Special Interest Groups (SIGs) and these include HealthSIG, SLIS (Special Libraries), and the Digital Libraries SIG, to name a few.

Issues and Challenges

Biculturalism

As described earlier, New Zealand is in the unique position of having a founding document in the Treaty of Waitangi that essentially requires two distinct cultures to live as equals in one nation. The reality of colonization is of course quite different to this ideal, and true biculturalism remains a challenge for the country as a whole.

Since a resurgence of Māori culture and language in the late 1980s, there has been considerable movement along the bicultural continuum in libraries and information services. Two key research reports have contributed to these developments "Te Ara Tika: Maori and Libraries" and "Te Ara Tika: Guiding Voices."^[29,30] The project that led to their publication during the 1990s was jointly commissioned by LIANZA and Te Rōpū Whakahau.

Evidence of the development of bicultural library services includes such practical things as bilingual signage, bilingual staff, special and separate collections of Māori material, Māori artwork, and adhering to the Treaty of Waitangi appearing in libraries' strategic plans and goals. With the twenty-first century has come a deeper commitment to understanding of a Māori worldview in many leading institutions. For example, the National Library's "Bicultural Implementation Plan" shows great potential.^[31] Te Rōpū Whakahau continues to work toward helping non-Māori library staff achieve authentic

bicultural understanding and knowledge, but maintaining this momentum will be a challenge for some time to come.

The Waitangi Tribunal is a central government body established to settle claims brought against the Crown by Māori under the Treaty of Waitangi. A recent report (WAI-262) on a claim relating to ownership of intellectual property and cultural treasures or taonga makes it clear that in order to truly meet the needs of Māori, libraries need to consider not just the services offered to Māori clients but also how Māori information and knowledge is cared for and preserved.^[32] Having a deep understanding of the indigenous knowledge frameworks at play is critical to achieving this.

The Digital Revolution

As we enter the twenty-first century, all libraries face the challenge of remaining relevant in the digital world. As the general purpose of libraries has not changed, the challenge in particular is demonstrating relevance and value to stakeholders and decision-makers that fund libraries. These challenges are felt just as strongly in New Zealand as in the rest of the world. A particular vulnerability for New Zealand public libraries is the lack of any legislative obligation for local authorities either to provide public library services or to ensure that those services are provided free of additional charge. As costs continue to increase and local authorities must spread levy income further, libraries can seem an easy way to cut spending, especially when there is a common misunderstanding of the continued importance and relevance of libraries in the digital age. This misconception is common across all library sectors.

The digital divide in New Zealand (due both to the physical lack of high-speed broadband in remote areas, and the comparatively high cost of data traffic) is both an opportunity and challenge for New Zealand libraries. Libraries are well placed to help address the divide (if they are funded to do so), but, at the same time, they will inevitably move to providing more services that are only available online, thereby underserving some parts of the population and further exacerbating the issue. Of course, at the same time libraries support developing their customers' information and digital literacy skills as part of their everyday work, and this will go a long way to bridging the digital divide.

As more and more information is created online and shared on the internet, there will be an increasing need to address the preservation of digital New Zealand knowledge and information for future use and research. With the National Library undertaking a biannual all-of-domain web harvest and maintaining the National Digital Heritage Archive (NDHA), steps are being taken that are both sustainable and forward-looking. Many institutions also maintain digital repositories of local research and theses, as well as a community "kete" or repository movement

gaining momentum to capture local stories, images, and media. Of course, in relation to the discussion on biculturalism, automatic harvesting of digital content can be a fraught process where different ownership or intellectual property paradigms are in place, and this will need to be handled carefully to fall within the WAI-262 settlement guidelines.

CONCLUSIONS

Since the earliest days of pioneer settlement, New Zealand's libraries have struggled in an environment of both geographic and intellectual isolation. The Munn-Barr report of 1934 was very disparaging of the situation then but provided a clear path to improvement that was followed for a further five decades. The National Library of New Zealand, LIANZA, and leading libraries have since also provided insightful, innovative, and at times, groundbreaking leadership in the profession.

New Zealand has at times led the world, for example, in nationally acknowledging the importance of indigenous knowledge frameworks, developing an all-of-country digital preservation strategy, and establishing collaborative library purchase and collection agreements. Indeed at times, the nature of being an isolated, small country has been of benefit, allowing more agile, creative solutions to be formulated and implemented relatively quickly.

New Zealand libraries and librarians face the same challenges of underfunding and misconception that all libraries face in the twenty-first century, and they will need to meet these challenges with strength of purpose and commitment for many years to come, while continuing to innovate and think creatively to remain as Munn and Barr put it in 1934, the "community storehouses of knowledge and culture, not in the sense of compulsory educational institutions but as places where people may obtain help, self instruction, or recreation whenever they require it."^[10]

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Non-governmental Organizations and Information

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Abstract

The advent of global civil society has highlighted the importance of the nongovernmental organization as a factor in the development of the information society. Understanding this phenomenon is essential for those interested in the dissemination of information surrounding various actors in civil society. Here we define the nongovernmental organization, discuss the different types of nongovernmental organizations and the areas in which they are active. The development of these organizations is discussed as well as future scenarios. Most importantly, the place of these organizations in information society, and interaction of the organizations with libraries, archives, and others in the pursuit of free and equitable access is explored.

INTRODUCTION

Nongovernmental organizations or NGOs are sometimes thought to be prominent examples of the effects of globalization. These organizations are ubiquitous in the world of interconnected, interdependent social movements. The mention of any major natural disaster brings to mind the work of the International Federation of the Red Cross and the Red Crescent Societies. Humanitarian relief efforts frequently include the work of Oxfam or Doctors without Borders. Environmental threats often find Greenpeace at the forefront of the fight to publicize and remedy the results. In 1997, the International Campaign to Ban Land Mines received the Nobel Peace Prize as had three other organizations before it. All of these organizations are examples of international NGOs.

What is an NGO? When and why did they develop into major players on the world scene? Why are they important to libraries and information science? How do they interact with individuals, states, and other international organizations? What do they do?

DEFINING THE NONGOVERNMENTAL ORGANIZATION

The problem with defining a term like “nongovernmental organization” is very similar to that of defining other self-referential terms. Although it seems simple at first, the mere definition of the term does not express the wide ranging implications of the concept. Literally, a nongovernmental organization might be assumed to be any group that is not part of a state organization and does not receive direct funding from a state government. This simple definition would include a wide range of organizations from humanitarian relief agencies to criminal syndicates, from religious organizations to multinational

corporations. Further exploration of the term provides us with a little more specificity. Generally, these organizations are privately funded, either directly through philanthropic organizations or individual members. Occasionally, however, government may play a role in their funding, or use the NGO as a funnel for distribution of assistance. In many countries, the state plays a role in the development and certification of NGOs. The missions of NGOs tend to focus on the remediation of some societal problem, or publicize some perceived injustice. They have alternatively been referred to as “the conscience of the world” or the “warning voice.”^[1] Several themes are repeated when attempting a more granular meaning for the NGO. They are not entirely governmentally supported or founded, although government policies might have been a major reason for their genesis. They usually have defined goals and objectives relating to the creation of a civil society. They frequently work at the grassroots level to provide aid, education, and, most importantly for the librarian, information both to the audience they are trying to provide services to, and to a wider audience of policymakers, state organizations, funding agencies, and actors on the international stage. The most useful advocacy tool of any NGO is information. Whether it is in the form of pamphlets distributed to a target population, a report to a funding agency, a public relations campaign, or a policy planning interaction with other organizations, the dissemination of information is key to the work of any NGO.

There are also many variants to the basic concept of the NGO. Related non-state actors include a variety of organizations such as the donor-organized nongovernmental organizations (DONGO), the governmentally organized nongovernmental organization (GONGO), the quasi nongovernmental organization (QUANGO), the grassroots organization (GRO), and the intergovernmental organization (IGO). They can be international in nature, or very local. After the antiglobalization riots during the

WTO economic summit in Seattle in 1999 the term “wild NGOs” came into use to denote NGOs that sought change through less-than-peaceful means of protest. Table 1 lists many of the terms and formats of these organizations including those terms used in several different countries.

The areas in which NGOs are active include a list of societal issues such as human rights, economic, and agricultural development, education, humanitarian relief, environmental degradation, health, international security, and economic development. Several of these areas are explored in depth later in this essay. NGOs might be social movement organizations, grassroots groups, religious organizations, or even the philanthropic organizations that fund other NGOs.

HISTORY OF NGO DEVELOPMENT

It should be noted that at one time, the theory of state sovereignty provided no recognition for organizations outside of other sovereign states as power-holders. The state

Table 1 Typology of organizations.

BINGO—Business NGO
CBO—Community-based Organization
Citizens’ Organizations—Local NGOs (commonly used in Japan)
Civic Advocacy Organization—Frequently used to refer to community-based organizations in the United States
CONGO—Conference of NGOs in Consultative Relationship with the United Nation
CSO—Civil Society Organization
DONGO—Donor-organized nongovernmental organization (can be governmentally organized, United Nations organized, or private)
GONGO—Government organized nongovernmental organization
GRINGO—NGO with a symbiotic relationship with a government
GRO—Grassroots Organization
IGO—International governmental organization (e.g., the United Nations, World Trade Organization, OECD, OAS)
INGO—International nongovernmental organization (e.g., Red Cross/Red Crescent, Oxfam, Amnesty International)
NGDO—Nongovernmental Development Organization
NGO—Nongovernmental Organization
NPO—Non-Profit Organization (used in United States frequently for philanthropic organizations)
PANGO—Party-affiliated Organization (mostly Latin American)
PDO—Private development organization
PSO—Public Service Organization
QUANGO—Any organization that relies on government funding, but is administratively distinct from the state
SMO—Social Movement Organization
VO—Voluntary Organization
“Wild” NGO—Newly developed NGOs interested in the negative effects of globalization

and its leaders interacted with other states in the development and application of policies both within and outside of its borders. This is sometimes referred to as the Westphalian model of sovereignty. In the late nineteenth century, non-state actors began to influence policy-making and intergovernmental relations. These organizations evolved into today’s nongovernmental organizations. One of the ultimate purposes for the NGO is to earn a place at the table when local, national, and international policy-making is taking place. This has truly changed the dynamic of the relationship between the NGO and the state.

The development of NGOs before and after World War I was quite rapid. Whether in spite of, or because of, the devastating “War to End All Wars” and the Great Depression in the United States, the growth in the number of NGOs was quite steady in the first three decades of the twentieth century. The 1940s saw the advent of the NGO as a recognized societal actor. But the true political power of these organizations was yet to be realized. Exponential growth in the number of NGOs occurred at the end of the twentieth century. The Yearbook of International Organizations first listed nongovernmental organizations, in 1949. The three categories of nongovernmental organizations listed there totaled 73 organizations in all.^[2,3] In the 2008–2009 edition of the work, 11,859 organizations were noted as Cluster 1 NGOs.^[4] It is interesting, but not surprising, that the rapid multiplication in the number of NGOs coincided with the expansion of the Internet as a tool for the dissemination of information.

Few publications concerning NGOs existed before the 1950s. The Online Computer Library Center’s (OCLC) WorldCat lists 49 books and 114 serials published for the time period between 1900 and 1950 if one searches for “nongovernmental organizations” as a keyword search. The decade between 1990 and 1999 shows 7553 book records and 209 serial records in the database. A search for the first half of the current decade reveals almost 5437 books and 96 serials records.^[5] Clearly, in recent years, publications by or about these agents of civil society and change have increased almost as exponentially as the organizations themselves.

This growth can also be seen in the relationship between NGOs and the United Nations. When the United Nations was chartered (itself an international governmental organization), 44 NGOs were legitimized through the authority found in Article 71 of the UN Charter. This entry states:

The Economic and Social Council may make suitable arrangements for consultation with non-governmental organizations, which are concerned with matters within its competence. Such arrangements may be made with international organizations and, where appropriate, with national organizations after consultation with the Member of the United Nations concerned.^[6]

In addition to this mention, Resolution 288 B(X) provided consultative status to recognized NGOs in 1950. In 1968, ECOSOC Resolution (XLIV) further defined this relationship and Resolution 1996/31 established three categories of consultative status—general consultative status; special consultative status; and inclusion on the roster. Most recently, the Millennium Declaration provided a new mandate to enhance the partnership of the NGOs and the United Nations.^[7,8]

At the state level, different nations have different reactions to the development of organizations within their boundaries that seek to share power. In more democratized areas, these reactions range from encouragement to benign neglect. In other cases, the development of organizations that give voice to the intrinsic problems of an area is frowned upon and varying controls are in place to prevent any thought of power sharing or governmental influence by these organizations. In still other states, the development of NGOs is fostered and sometimes the goals and influence of the organization are coopted for political ends.

THE PROS AND CONS OF THE NGO

Traditionally NGOs have been held in high regard by many governments and intergovernmental organizations, as well as individuals. There are three empowering aspects of NGOs. First, they are seen as having a good deal of expertise in the area to which they relate. The data produced by NGOs in exploring their target population or issue provides them with a great deal of information concerning the problems, issues, and policies that might be necessary to obviate a perceived need. Second, and related to this expertise, is the credibility they have in the promotion their agendas. They have been seen as free from the pressures that might arise from government funding or close ties to a business or industry. Even when the NGO is employed as a way of pushing government aid out to a population, the organization itself is considered an independent and frequently more efficient avenue for distribution than the state. Examples of this are particularly apparent in the delivery of humanitarian aid after natural and man-made disasters. Finally, many NGOs are perceived as having broad and effective networks to deal with problem issues. Although there are some exceptions, primarily due to cultural conditioning, NGOs are very good at reaching out to other organizations for both moral and financial support. The relationship between mass media and the NGO is usually a strong bond due to the importance of public relations for the organization and the issues it addresses.

In recent years, especially since the events surrounding the WTO-associated riots in various countries, the image of the NGO as an independent, peaceful change agent has been somewhat tarnished. The “wild NGOs” active in

these events frequently represented more radical even anarchist movements. In addition to behavioral problems, some questions have arisen regarding the accountability of many of these organizations. Less-democratic governments have used this as an excuse to shut down or at least severely limit the work of many NGOs. The existence of funding outside of the sphere of the state can be perceived as a threat and many instances exist of government policy interfering with the work of the NGO that receives its funds from an agency beyond its borders. Regulations for reporting are becoming more common in the state-NGO relationship.

NGOS AND INFORMATION

Information Dissemination

Other than increasing the amount of material written about NGOs, what impact do these organizations have on the library, the archive, or the larger information society? These organizations are both producers and consumers of large amounts of sometimes difficult-to-capture information. Ostensibly, grassroots organizations seek to send a flow of information downward to the clients and interested parties affected by the group. Information on weather patterns, water resources, health, and human rights are pushed out to the target populations. In this way, the NGO creates and disseminates information for its client base. This client base is also frequently the source of information the NGO needs to engender awareness of the issues and problems in its area of expertise. Using the client-generated information, NGOs must also push information upward to funding agencies, government agencies, and the international community for the purposes of financial support and influence. Information flows between the funding body and the organization in the form of reports, grant requests, and information bulletins. If the NGO has an affiliated relationship with a larger body such as a coordinating council or other international governmental organization an exchange of ideas, plans, statistics, or other information types is shared. Additionally, information may flow to a larger audience through publications and media outlets. Frequently, the information generated by the local agency will be passed up an information avenue to a coordinating council and ultimately to a supranational agency such as the United Nations for consideration in policy planning. A variety of information flows can be seen in Fig. 1.

Information Types

The production of information comes in many forms and formats. Information outflow from the organizations to funding and state agencies can include physical and financial progress reports, narrative reports, annual reports,

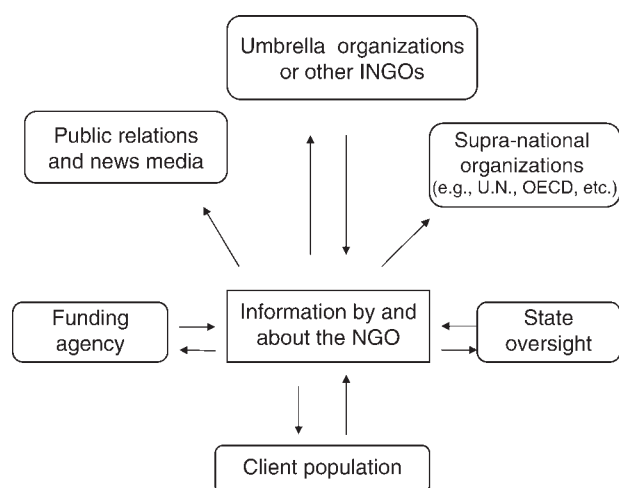


Fig. 1 Information dissemination.

annual budgets and work plans, published studies, internal studies, baseline and impact data, participatory appraisals, process documentation research, internal evaluation exercises, records, diaries, “significant changes,” field notes, dialogue with community members and field observations, and meeting minutes. The funding agencies for the NGOs studies provide project and program proposals, documents describing program strategies and interests, annual budgets and “summary justifications,” news clippings, trends, and networks, workshops and fairs, publicity documents, meeting minutes, field visit reports, evaluations and reviews, consultant reports/expertise, and monitoring missions.^[9]

Some of these documents may be a matter of public record, but most are not. Most of these documents are typical examples of grey literature. They are not widely distributed, and do not easily find their way into the traditional publication cycle. Those that are actually created electronically are rarely archived, and often difficult to find due to the lack of technological know-how on behalf of their creators. A researcher may come across a report during a field interview, and then be unable to obtain a copy when returning home. The temporary nature of these documents is of concern for the scholar and researcher as well as the librarian or archivist.

More easily accessible materials are frequently those that the organization uses to provide public relations and outreach for its clientele or cause. Well-established and financially supported organizations can often afford to maintain some kind of Web presence. In some cases this presence consists of basic information about the program, how to contact staff, and a mission statement. More robust sites include publications such as reports and newsletters, press releases, mailing lists, donor information, and a variety of policy statements. Although the information on these sites is more accessible, it is not always as stable as the print materials an organization might produce, and is subject to becoming inaccessible over time.

Following is a description of information flows of some of the types of NGOs whose information is widely sought or interact regularly with information professionals and librarians.

Human Rights Information

Perhaps the most publicly known NGOs are those that focus on human rights and social justice issues. Some of the most prominent of these include Human Rights Watch, Amnesty International, and the Child Rights Information Network, which operate on an international basis. Human rights NGOs, particularly those that advocated for the abolition of slavery in the nineteenth century, are among the first documented NGOs after the advent of the current nation-state system. Currently, human rights NGOs focus on topics that range from state-initiated abuses of power to the cultural and economic aspects of human rights outlined in the UN Universal Declaration of Human Rights.

Unlike NGOs that focus on development or education, these groups often operate counter to official government policy and action. This complicates the ability of these organizations to collect and disseminate information, secure funding, and receive technical support. Often support to disseminate reports and research comes from international organizations and transnational communities. This unstable relationship between human rights NGOs and their host countries was quite visible in Uzbekistan in recent years when almost all NGOs with international support, including educational and developmental groups, were closed down.

The dangers faced by these NGOs and their workers affects researchers and librarians since the dissemination of documentation emanating from human rights NGOs can be difficult to verify and attribute. Additionally, primary source materials from these NGOs that become widely available have the potential to imperil those who work under repressive regimes and seek to work and cooperate with NGOs anonymously.

Following the flows of human rights information through NGOs provides a view of a vast and interconnected group of organizations that operate on local, national, regional, and international levels with the explicit goal of documenting and disseminating information related to human rights and related issues. In a sense, information flows from these organizations in an inverted pyramid as seen in Fig. 2, with local NGOs, researchers, and advocates pushing information upward in the system toward the larger organizations that in turn publicize, reuse, and consolidate information towards a worldwide audience that ranges from nations and intergovernmental bodies to the general public and researchers of social phenomena.

The data these NGOs rely upon in this stream consists of published and unpublished information. Many NGOs routinely collect published information from traditional



Fig. 2 Information flow—human rights.

print and electronic media, other NGOs, IGOs, and governmental sources to incorporate into reports, press releases, and handbills. Depending on the scope and scale of the NGO, these “collections” maintained by NGOs are on one extreme, collected, cataloged, and distributed electronically to staff throughout the world, such as the system employed by Amnesty International. At the other extreme, collections simply pileup in office corners without systematic processing or organization.

Unpublished information from these NGOs consists of the actual data or primary source material gathered from within a community or region by the NGO’s staff and researchers. This “data” can consist of anything from interviews with prisoners and witnesses of abuses to an accounting of local demographic information. This data is also integrated into research reports and other publications of the NGO. Like published collections within an NGO, this unique data is collected and archived based upon the scope and capacity of the organization. Unlike the published collection, these vast unique repositories of local and regional knowledge are largely inaccessible to outside researchers and organizations, and represent one of the least stable and inaccessible forms of grey literature.

Much of the current information pattern is heavily reliant on the growth of the Internet and availability of cellular- and satellite-based communications technologies. Information can be disseminated quickly and often synchronously to a large audience as violations occur, impacting greatly the potential to inform the public and promote remedial action. In addition, organizations once isolated are now networked to enable direct communications and collaboration. The 1984 Vallerti Agreement formed one of the first of these networks, linking aid and social justice organizations to worker organizations, activists, and effectively facilitating community-based research through the Interdoc network. This in turn led in 1990 to the Association for Progressive Communications’ online network and ultimately to Interdoc.^[10] The advent of the World Wide Web and open source technologies that allow

organizations to create online communities and groups has further provided organizations with access to the Internet, with the capacity to disseminate information and share expertise among social justice and human rights NGOs.

Internet technologies also provide the various publics of an NGO with a venue through which to access information. For example, the organization HURIDOCs maintains a search engine that provides access to documentation and materials from over 3000 Human Rights NGOs, effectively linking these groups and their potential impact to researchers and members of civil society around the world.

Human Rights NGOs also work to educate people about the concept of human rights as formally defined by the United Nations and legally defined within countries. Human Rights Education was catapulted into the mainstream when the UN made 1994–2004 the “Decade for Human Rights Education.” The UN’s focus on Human Rights Education, which continues today, provided NGOs with funding from organizations ranging from governments, UN bodies, and foundations such as Soros to educate and broadly disseminate human rights information to the general public, the legal community, and even military groups. Through these initiatives, many resources ranging from curricular materials to research on outcomes were developed throughout the world. Some of this is available through the Office of the United Nations High Commissioner for Human Rights though most is dispersed throughout the world’s NGO community.

It is evident that the Internet quickly became a tool for protecting and promoting human rights, but has also impacted upon traditional modes of information management within organizations, requiring organizations to allocate more resources towards technology and focus on information organization, metadata, and a notion of an audience broader than a local population or government. In most instances, NGOs have opted to emphasize technical infrastructure and Web-based resource development. Most NGOs, especially those that operate locally or regionally, do not employ information professionals or maintain and archive digital and print materials that are produced. Additionally, a formal library to collect and organize research materials, publications, and archival records is the exception rather than the norm among NGOs.^[11–13] This fact heightens the need for larger international NGOs to actively collect, organize, and archive materials from the local organizations. University libraries, research consortia, and associations can also potentially address these needs through collaborative digitization and archival programs.

Development and International Assistance NGOs

Development and international assistance NGOs work toward economic development within a country. In this context economic development includes activities aimed

at building a society's capacity to provide for the welfare of its people. Activities range from institution building, developing markets, educating farmers, and providing technical assistance and material resources among others.

Unlike many Human Rights NGOs, NGOs that work in development often partner directly and openly with their own and other governments plus international organizations such as the World Bank and the UN's Food and Agricultural Organization (FAO). This often presents to the public and general researcher a confusing network of governmental, nongovernmental, and quasigovernmental organizations that works with similar communities and often in partnership on the same program. For example, the U.S. Agency for International Development and FAO might simultaneously fund an NGO whose aim is to alleviate famine in Liberia.

The number of organizations that may work in a region to address a problem potentially causes much confusion and can inhibit the provision of aid. For example, the lack of information coordination was acutely visible in the aftermath of the South Asian Tsunami when multiple governments and aid organization sent resources and personnel to assist in recovery and redevelopment efforts.

The shape of information flow within the development community is more pyramid shaped, with knowledge and technical expertise moving from larger organizations such as governments, universities, IGOs, and large NGOs. This knowledge moves through a variety of conduits. Often knowledge transfer occurs through direct exchange and training. For example, an NGO that works in the area of water quality and access might receive support from a larger organization that funds university experts to consult with and train a local community in the development and maintenance of an efficient and sustainable water purification system. These experts from the academic community may also receive funding from various government research grants for their field work.

Technology and mobility have also contributed to providing access to knowledge and information. For example, Book Aid, a U.K.-based NGO, works directly with communities to select and disseminate books and other reading materials to set up lending libraries. On the technical side, JSTOR, initially an NGO funded by the Mellon Foundation and whose mission is to archive and provide wide access to prominent scholarly journals, initiated a program through which universities and nonprofit organizations in African countries are eligible for free access to the entire electronic collection.

As in the case of Human Rights NGOs, the Internet and similar technologies have allowed the structure of information flows to begin changing from one in which knowledge flowed mainly one direction to a growing structure through which NGOs increasingly have the capacity to share knowledge and expertise, creating a flow that may resemble more of a churning motion than linear trajectory.

Educational NGOs

Educational NGOs focus on a myriad of topics, ranging from human rights, as noted above, to health education, literacy, and ICT proficiency. These organizations constitute a subgroup in the development category, yet for the information society, many educational NGOs overlap heavily with services offered by libraries and information professionals.

ICT Education

Greater access to technology and the realization of the potential for knowledge and information to empower people and enhance capacity-building programs fuels the need for and expansion of ICT education programs within the NGO community. These programs include skill and technology development for NGOs and community-based projects to provide education on the use of ICTs to support everything from small business and entrepreneurs to virtual student exchanges.

For example, the International Institute for Communication and Development, a Dutch NGO, maintains multiple programs throughout Africa, Latin America, and the Caribbean to promote capacity building in ICT expertise and sharing knowledge among organizations across regions through networked-based technologies. In addition to capacity building, this NGO works closely with iEARN, an NGO that facilitates student exchanges and international friendships with a vast network of affiliated offices in nearly 120 countries. iEARN in turn collaborates and works with NGOs, IGOs, and governments around the globe, constituting another vast and churning network of information exchange and communication maintained by NGOs and facilitated by ICTs.

Literacy Education

Literacy education, including basic, computer, cultural, and economics is a major activity among NGOs in the developed and developing world. Many literacy programs, especially those that promote adult literacy and reading to children partner directly with public and school libraries and work in consultation with librarians and their associations. For example, Baby Talk, a U.S.-based NGO, operates its early reading intervention program within local public libraries and community centers. On an international level, the UN has denoted 2003–2012 as the Literacy Decade. Similar to the impact on human rights education, UN denotation has increased the level of funding for organizations involved in literacy education through both the UN and foundations from Carnegie to Starbucks.

Information Literacy is also an educational component within NGO literacy education. As noted by Jackman and Jones, information literacy is an essential piece in capacity building as individuals and organizations gain greater

access to information through open markets and greater access to technology.^[14] Libraries and information professionals are poised to provide information literacy training to NGOs at a time when these organizations are adopting ICTs and developing new systems to organize and disseminate knowledge. In addition, library-focused associations such as IFLA and the U.S.-based ACRL are dedicating increasing energy to information literacy education and dissemination of materials to assist librarians and other information professionals improve their education programs.

Library Professional Development

Library professional development programs are also widely funded and delivered by NGOs. The MacArthur, Mellon, and Carnegie foundations all fund programs to educate and train library leaders in both developing and more developed countries. The Mortenson Center for International Library Programs, which is housed at the University of Illinois at Urbana-Champaign, offers exchanges and training programs within the United States, Russia, and Africa through a combination of support from these foundations. Beyond foundations, some of the other major funders of library-related NGO programs include UNESCO, and numerous government-sponsored grant and development programs that focus on both national and international capacity building.

ACCESS TO KNOWLEDGE (A2K) MOVEMENT

The global A2K movement focuses simultaneously on human rights, ICTs, and education in an effort to advocate for access to knowledge. The movement is based on the premise that access to knowledge is central to the well-being of societies, communities, and individuals.^[15] A2K organizations work as both policy advocates and providers of direct assistance. NGOs in the A2K community directly support, and in many ways parallel, the work and missions of libraries through their advocacy, access, and educational missions.

A2K policy advocates focus on national and international policy such as copyright, accessibility standards, and technical protocols. One of the major campaigns of the movement is to reform the World Intellectual Property Organization (WIPO) to limit new treaties and standards that impede access to information while shifting WIPO's focus away from intellectual property protection toward an agenda that would promote knowledge creation and developmental assistance. The International Federation of Library Associations (IFLA) works closely with IGOs and NGOs in the A2K community, notably through their work with the UN's World Summit on the Information Society (WSIS).

As noted above, many NGOs provide developmental assistance in the form of access to information and training. These programs parallel and complement the A2K movement by virtue of work they promote and perform.

Electronic Information for Libraries (eIFL.net) works within this A2K community to support and advocate access to electronic resources by working with libraries in developing countries to negotiate affordable subscriptions and build capacity to develop, disseminate, and preserve locally produced knowledge.

Through policy work and development assistance, the A2K NGOs encompass the numerous legal, economic, and technical issues that library professionals in all nations face. These issues include digital copyright, privacy, data security, and advocacy for the profession and its global community of users.

NGO ARCHIVES AND COLLECTIONS

A variety of archives exist for nongovernmental organizations. These include true archives of all organizational papers and more loosely collected works by and about organizations. Some NGOs such as Oxfam recognize the importance of an information archive and have the resources to maintain their own archival materials. Others, with fewer resources or a briefer history, rely upon others to collect and preserve their materials.

For example, the University of Colorado at Boulder maintains archival materials from the American Friends Service and various other pacifist movements. On a more global basis, the Database of Archives of Non-Governmental Organizations (DANGO) is attempting to maintain an information archive of the activities of a large number of organizations in Great Britain that have been in existence since 1945. On the other side of the globe, the Center for the Study of Cooperative Human Relations at Saitama University in Japan houses a large collection of what is referred to as "Citizens Records" going back to the 1970s. This includes the publications of a large number of NGOs and grassroots organizations published both in Japan and elsewhere.^[16-18]

In addition to formal archives, some educational institutions support the dissemination of information to answer the questions that NGOs might have in various areas. A good example of this is the Women's Human Rights Resources Programme at the University of Toronto. The program has developed a database of resources to assist those working in the area of the legal rights of women in Canada and elsewhere that can be queried. This is ultimately what many NGOs strive to do—provide easily accessible information to a client base and beyond.^[19,20]

CONCLUSION—THE FUTURE OF GLOBAL CIVIL SOCIETY

The concept of global civil society as exemplified by the existence of NGOs will continue in importance in the future. The exponential growth of these organizations that

was witnessed in the last part of the twentieth century and the beginning of the twenty-first century will no doubt slow in the future. However, the organizations will always spring up where there is need for joint action, information dissemination, and a seat at the table of policy-makers. These are ultimately the purposes for which these organizations exist. If the organizations are true to their goals, they should hope they will fade from view as the problems and issues they highlight are addressed. In the meantime, it is likely that less-democratic countries will continue to challenge their work, especially those working in the area of human rights. More stable democratic regimes will no doubt attempt to make these organizations more accountable for both their actions and their finances. The library community needs to start now to capture the information production of these groups and assist organizations create and disseminate the information at the heart of all NGOs.

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North American Serials Interest Group

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Abstract

The North American Serials Interest Group (NASIG) was founded in 1985 and hosted their first conference at Bryn Mawr College in 1986. NASIG is an independent organization that promotes dialogue and professional growth among all members of the serials information community. NASIG is a membership-driven organization that holds an annual conference to represent the diverse interests of the serials community.

INTRODUCTION

The North American Serials Interest Group (NASIG) was founded in 1985 after 16 American librarians attended the United Kingdom Serials Group (UKSG) Meeting in 1984 and began to discuss what it would take to create a similar organization in North America. Becky Lenzini, who was a librarian working for the Faxon Company, and John Riddick, a librarian working at Central Michigan University, started a study group to investigate the feasibility of a North American Serials Group. An ad hoc executive council was formed that included John Riddick and Becky Lenzini as cochairs, Tina Feick (Boley) as vice-chair, Susan Davis (SUNY-Buffalo) as treasurer, Marilyn Gonsiewsky (Cal Poly-San Luis Obispo) as secretary, and Lenire Wilkas as the first newsletter editor. Dues were initially set at U.S. \$15. Membership solicitation began and the first conference site, Bryn Mawr College, was selected. In addition, a site selection committee made up of John Riddick, George Lupone (Cleveland State University), and Tina Feick did site visits in Ohio to find the location for the second conference.

The first *NASIG Newsletter* appeared in January 1986. In the meantime, Leigh Chatterton from Boston College and Mary Beth Clack from Harvard were appointed to serve as the first conference program chairs. Denison University in Granville, Ohio, was selected as the site for the second conference. By May 1986, membership had grown to 324 members and draft bylaws for the organization had been distributed. In June 1986, the first conference took place and remains the highest ranking conference in the history of NASIG. The first elections took place in November of 1986 where the bylaws were approved by the membership and NASIG was well on its way.

NASIG's 10th anniversary conference was held at Duke University in 1995 and was a wonderful celebration of the organization's decade of history. Members recollected that while the organization has continued to grow, they maintained an enthusiasm and dedication to the

organization that has been unparalleled. NASIG's 20th anniversary was held in Minneapolis, Minnesota, in 2005. This celebration noted that NASIG continued to work on refining its function as an organization and the ongoing development of their governance. In 2010, NASIG celebrated its 25th anniversary in Palm Springs, California. Financial planning, membership development, and technological planning have become the main issues of the organization during its maturity.

Permanent archives for the organization were established in 2003 at the University of Illinois, and an archivist position was created to archive. Today, NASIG is a financially stable organization that holds a world-recognized annual conference in North America and continues to provide a forum that promotes the communication, understanding, and sharing of ideas among all members of the serials and electronic resource information community.

MEMBERSHIP

NASIG has continued to grow and prosper. Having reached a membership high of close to 1500 members in the early part of the millennium, NASIG now holds a steady membership of around 725 members. The membership dues have grown to keep up with the economic climate and currently are at U.S. \$75 for regular members and U.S. \$25 for retired and student members. In 2010, an organizational membership category was created and instituted. The rate for this membership category is U.S. \$1500. The organizational member rate allows for a dedicated table at the annual conference vendor exposition, recognition of the organization's membership on the NASIG website, and the ability to designate three individuals in the organization as NASIG members.

Personal membership benefits include access to the online membership directory, presenter's handouts from

the annual conference, and access to the *NASIG Proceedings* archive. In addition, members also receive the NISO (National Information Standards Organization) member rate for NISO webinars, reduced rates for the annual conference and webinars, and a discount subscription rate to *The Serials Librarian*. Lastly, members also get biweekly e-mails of *Serials E-News* from UKSG.

NASIG ORGANIZATIONAL STRUCTURE

NASIG has an executive board made up of the following positions: President, Vice-President/President-Elect, Past President, Secretary, Treasurer, six Members-at-Large, and ex officio member in the form of the *NASIG Newsletter* Editor-in-Chief. Each member of the executive committee serves as a direct liaison to NASIG's committees and task forces. The current committees are Awards and Recognition, Bylaws, Conference Planning, Continuing Education, Database and Directory, Electronic Communications, Evaluation and Assessment, Financial Development, Membership Development, Mentoring, Nominations and Elections, Program Planning, Publications and Public Relations, Site Selection, and Student Outreach. There is currently one task force, Core Competencies. In addition, there are individuals appointed to the positions of Archivist, Conference Coordinator, Conference Proceedings Editors, Newsletter Editor-in-Chief, and Registrar.

Each committee has a formal written charge from the Board, which is reviewed and modified as needed by the executive board. Any current NASIG member is eligible to serve on a committee and can indicate their preference for committee appointments by submitting a volunteer form. The vice-president/president-elect is responsible for all committee, task force, and board liaison appointments. In general, committee members are not allowed to serve more than two consecutive terms on any given committee.

AWARDS AND SCHOLARSHIPS

The greatest benefits that NASIG provides to the information community are the numerous awards the organization provides. Currently, there are eight awards sponsored by NASIG each year. The John F. Riddick student grant award is the oldest award offered by NASIG. The grant provides conference expenses and a one-year membership to current library and information science students. The grant was named after one of the cofounders and first elected presidents of NASIG, John F. Riddick. It was his idea to begin to offer student grant awards in 1988, and they have been successfully granted since the inception of the award. Many members of the NASIG student grant awards have gone on to become leaders in the library and information science field in addition to serving in

leadership roles in NASIG as committee chairs and on the executive board. To date, 162 student grants have been awarded and NASIG is recognized as a leading organization in the profession in fostering and mentoring new professionals.

The next oldest award is the Horizon Award, which was created to advance the profession by providing promising new information professionals with the opportunity to accelerate their knowledge and understanding of serials by networking and interacting with all members of the serials information environment from vendors to other librarians. This award is granted to professionals who have three or less years' experience in their serials-related position and have not previously attended the NASIG annual conference. To date, there have been 27 Horizon Award winners and many of those winners have gone on to serve as NASIG committee chairs and executive board members.

In 1998, NASIG awarded the first Fritz Schwartz Serials Education Scholarship. The scholarship is named in honor of Fritz Schwartz, who was a well-known and highly respected authority on Electronic Data Interchange (EDI), the Internet, and library standards. He was a frequent and well-received speaker at NASIG conferences. This award is open to qualified graduate-level students in any NASIG member country (Canada, Greenland, Mexico, or the United States) who demonstrate serials-related work experience and a desire to pursue a professional serials career after earning their degree. To date, 16 Fritz Schwartz Serials Education Scholarships have been granted. The winner is awarded a U.S. \$3000 scholarship as well as a student grant award to attend the NASIG conference for the year in which the scholarship is granted and a one-year free membership to the organization.

In 1999, the Marcia Tuttle International Grant Award was created to provide funding for an individual working in any area of the serials information chain to foster international communication and education through activities involving some aspect of serials. The award provides a U.S. \$3000 grant and a one-year free membership. This award is only given as qualifying applications are received, so there are years where this award is not granted. To date, eight awards have been made for research projects based in or working with China, Europe, Eastern Europe, and the Middle East.

Another premier award developed and offered solely by NASIG is the Mexican Student Grant Award. This award grants assistance to a Mexican student of library/information science to attend the annual conference and to receive a one-year free membership in the organization. This award was first created in 2001 and has been awarded almost every year since then with 11 recipients of the award to date. The Mexican students enjoy the recognition as well as the opportunity to participate in the national library conference event in the United States.

The Champion Award was created in 2005 in conjunction with the 20th anniversary of NASIG. The Champion Award is selectively given to members of NASIG who have a long history of dedicated service to the organization to honor their contributions both to NASIG and to the profession at large. To date, only two Champion Awards have been made, the first to Tina Feick, a founding member of NASIG and active member in the serials information chain. The second recipient, Susan Davis, is also a founding member of NASIG and has also been extremely active in the serials profession throughout her career. Both award winners served as President of NASIG at one point in their careers.

In 2006, NASIG created the Serials Specialist Award in order to provide conference travel funding for a promising paraprofessional working with serials to advance their knowledge and understanding of serials work. Along with the travel stipend, the award winner also gains a year's free membership to NASIG. There have been eight recipients of the serials specialist award to date.

The Rose Robischon Scholarship Award was created in 2009 to honor NASIG member Rose Robischon who had two decades of service to NASIG. She served as a chair on numerous committees and was the NASIG Treasurer from 2005 to 2007. The scholarship provides the recipient with funding to attend the annual conference in the year that it is awarded. The award is open to any NASIG member who currently holds a position where their primary responsibilities cover some form of serials management or enterprise and for whom travel to the conference cannot be covered by their employing institution or organization. Preference is given to applicants who have not been able to previously attend NASIG and who can show a benefit in their application for attending the conference. To date, there have been four award winners for this scholarship.

The most recent award is one that was developed in conjunction with UKSG. The award is named in honor of John Merriman in recognition of the role he played both in UKSG and with the development of NASIG. John was the conference organizer of UKSG and was the person who extended an invitation to 16 American serial librarians in 1984, which led to the creation of NASIG. The John Merriman Joint NASIG/UKSG Award pays for one UKSG member to travel to the NASIG conference each year and for one NASIG member to travel to the UKSG conference. The award is open to any member of each organization and consists of travel expenses up to U.S. \$3000 for the attendance at the other conference but does not cover the expense of attending the local conference. Current board members of either organization are not eligible for the award. The committee vetting the award is made up of members from both organizations. To date, six members of NASIG/UKSG have been able to experience each other's conference and learn how serials are managed in different areas of the world.

CONTINUING EDUCATION

NASIG sees the need for finding ways to better support the ongoing educational needs of its members and the serials community. In addition to the annual conference, NASIG has sponsored local and regional continuing education activities such as the North Carolina Serials Conference and the Ohio Valley Group of Technical Services Librarians annual meeting as well as numerous CONSER and Serials Cataloging Cooperative Training Programs offered by the Library of Congress. In 2012, NASIG began offering a quarterly webinar series including sessions on open-source integrated library systems, library use of publisher metadata, and effective negotiation. NASIG has also partnered with the NISO allowing NASIG members to register for NISO continuing education events at a discounted rate. This has been a well-utilized partnership for NASIG and NISO.

PARTNERSHIPS & OTHER OUTREACH

In addition to UKSG, the Library of Congress, and NISO, NASIG has sought to forge partnerships with other relevant organizations. Most specifically, in 2009, NASIG entered into an information sharing agreement with the Association for Subscription Agents and Intermediaries to help promote events of both organizations. As part of its student outreach efforts, NASIG established the Student Ambassador's Program, which links NASIG members with North American library and information science programs. The presentations that NASIG ambassadors give to LIS students are often the first time that a student has heard of the organization or become aware of that specialization in the profession.

NASIG PUBLICATIONS

NASIG has two primary publications that it produces on a regular basis. The first is the *NASIG Newsletter*, which is produced quarterly each year and covers the business and membership news and information. The newsletter is expanded upon with the use of the *NASIG Blog*, which is updated four to six times a month. Begun in 1986, the newsletter with the inception of the organization has been produced regularly since then. In the early 2000s, the *NASIG Newsletter* moved online and is now produced entirely electronically. Certain segments such as the President's Corner, conference reports, and member updates have been an integral part of the newsletter since its inception. All issues of the *NASIG Newsletter* are freely available here: http://www.nasig.org/publications_newsletter.cfm.

In addition to the *NASIG Newsletter*, the *NASIG Conference Proceedings* have also been produced since the

inception of the organization. The conference proceedings fully encapsulate the scholarship and presentations given each year at the annual conference. The *NASIG Conference Proceedings* appear each year in *The Serials Librarian*, and NASIG and the publishers of *The Serials Librarian* have enjoyed a joint partnership in bringing this area of knowledge and expertise for 27 years. An electronic version of all of the conference proceedings are made available on the NASIG website to NASIG members. The *NASIG Conference Proceedings* are highly cited works, and it is to the organization's credit that this level of scholarship is brought to publication each year.

NASIG has recently developed a statement of *Core Competencies for Electronic Resource Librarians*. As an emerging area of the profession, this document has become a useful publication for students, early career professionals, and employers who wish to describe these specialized positions and the criteria upon which to evaluate the performance of those who hold them.

ANNUAL CONFERENCE

The annual NASIG conference is considered the go-to event for technical services librarians and collection management librarians involved in the selection and management of ongoing subscription services and more recently the management of electronic resources. The conference brings together a mix of librarians, publishers, intermediaries, and service providers in one event for concentrated programs on serials and electronic resource management. Initially, the conference was held on universities with the attendees staying in campus dorm rooms during the intercession periods for the university/college. This dictated the annual conference occurring during May and/or June each year between spring and summer terms. Over the years, as colleges campuses began to charge more and the meeting became more popular, it was found that hotel conference centers were often competitive in both amenities and location. For this reason, NASIG's membership voted in 2013 to move the conference from the university setting to the hotel environment. The conference has remained in the May/June time frame since long-term members and attendees have come to expect the conference being held in this time frame.

The location of the annual conference varies each year to allow for attendance by local members and others within the library and information science community who may otherwise not get to travel to conferences.

The conference typically runs for four days and usually occurs over a weekend. The first day of the conference includes preconferences that are additional cost to the main registration and provide in-depth exploration of various topics. In the evening of the first day is the opening

reception and welcome to the location from the conference planners and local members of the community. The second and third days are full conference days with plenary sessions kicking off the conference each day followed by breakout sessions that attendees can choose from to attend. In addition, there are usually lunch breaks provided that allows plenty of time for networking and joining up with colleagues. There are usually evening opportunities presented as well for attendees, and NASIG has a long tradition of trying to pick locations with either minor or major league baseball games occurring for blocks of members/attendees to attend as well. The last day of the conference is usually a half day to allow for travel arrangements. In addition to programmed events, there are committee meetings, a members' business meeting/town hall event, as well as various networking opportunities that focus on the use of specific management tools or products.

In 2010, NASIG instituted a vendor showcase for vendors and publishers to have an opportunity for a dedicated "sales" time period. This is usually held prior to the opening session on the first day, and attendees/members have an opportunity to interact with their friends and colleagues on a business level prior to the conference beginning. This event was seen as controversial for some NASIG members since the intent of the annual conference was meant as meeting of the minds from all areas of the serials and continuing resources community and not a sales event. However, the past few years have shown that having this minor business opportunity upfront has benefitted both the corporate institutions involved with NASIG as well as providing the librarians to explore products and content they might not otherwise know.

CONCLUSION

NASIG has been and continues to be a vital organization in the library and information profession. It provides opportunities for new librarians and information specialists to become professionally active and participate in an environment that is nurturing and engaged in many activities from publishing, to attendance at the annual conference, to committee work. NASIG offers multiple opportunities for engagement and for forging a sense of community who may otherwise become lost in larger professional organizations such as the American Library Association and its myriad of divisions and committees. NASIG was founded with the ideology that would remain an independent organization that promotes dialogue and professional growth among all members of the serials information community. NASIG has not only succeeded in this vision but continues to prosper upholding the principles its founders developed 27 years ago.

OCLC: A Worldwide Library Cooperative

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Abstract

This entry describes the history, governance, and current activities and plans of OCLC Online Computer Library Center, a nonprofit, membership, computer library service, and research organization dedicated to the public purposes of furthering access to the world's information and reducing library costs. OCLC and its member libraries cooperatively produce and maintain WorldCat—the OCLC Online Union Catalog.

INTRODUCTION

OCLC, Online Computer Library Center is a nonprofit, membership, computer library service, and research organization. Since its founding in 1967 by university presidents in Ohio, OCLC's mission has been to further access to the world's information and reduce library costs. At this writing, more than 69,000 libraries participate in a worldwide cooperative that extends to 112 countries. Libraries use OCLC services to help manage their collections and provide reference services to end-users.

OCLC has approximately 1200 employees, with some 860 on its main campus in Dublin, Ohio. In the United States, OCLC has offices in California, Colorado, Kansas, New Jersey, Pennsylvania, Washington state, and Washington, DC. There are also 16 offices in these countries: Australia, Canada, China, France, Germany, Mexico, the Netherlands, Switzerland, and the United Kingdom (Fig. 1).

HISTORY

Founded in 1967 by librarian Frederick G. Kilgour and the Ohio College Association (a group comprising the presidents of Ohio's private and public colleges and universities), OCLC was originally called the Ohio College Library Center. In 1971, OCLC pioneered the digital revolution in libraries with the introduction of its first service, the Online Union Catalog (today called WorldCat) and Shared Cataloging System. Since then, enormous changes in computer technology and telecommunications have occurred. The original terminals, computers, and telecommunications network have given way to several succeeding generations of technology, each of which has been faster, better, cheaper, and smaller than its predecessor.

The advent of the Internet in the mid-1990s, and then the World Wide Web, caused a sea change for libraries and librarianship. The sheer volume of electronic information, coupled with the emergence of search engines that

appeared to offer viable alternatives to library services, presented libraries with new challenges.

OCLC enters the twenty-first century and its fourth decade with services and strategies that are intended to help libraries not only cope, but thrive, in an environment of continuous change. To that end, OCLC at this writing was pursuing two strategic objectives: 1) to weave libraries into the World Wide Web and the Web into libraries and 2) to extend the cooperative to provide more value to more libraries around the world.

GOVERNANCE

OCLC's governance has always been closely intertwined with the use of OCLC services and the growth of WorldCat, the OCLC Online Union Catalog. Membership is based on the use of OCLC services and contribution to the OCLC cooperative.

From 1967 to 1977, membership in OCLC was limited to institutions in Ohio and governance of OCLC resided in a nine-member board of trustees elected by Ohio member institutions of the Ohio College Library Center. In 1977, the Ohio membership relinquished control of OCLC and established a governance structure that extended membership to libraries and other institutions outside Ohio. The governance structure that was implemented in 1978 consisted of three parts: Members, Users Council, and Board of Trustees. This structure provides libraries with an institutionalized role in governing the cooperative whereby members elected Members Council delegates, who in turn elected six members of the 15-member OCLC Board of Trustees.

In 2002, the governance structure was modified to complement new services, increased international activity, and new forms of contribution. The name of Users Council was changed to Members Council. The Board and Members Council broadened the definition of "contribution," which since 1978 had included current cataloging and holdings information. Contribution was defined as

OCLC's Chartered Objectives

As set forth in OCLC's Articles of Incorporation, the objectives of OCLC are to "establish, maintain and operate a computerized library network and to promote the evolution of library use, of libraries themselves, and of librarianship, and to provide processes and products for the benefit of library users and libraries, including such objectives as increasing availability of library resources to individual library patrons and reducing rate-of-rise of library per-unit costs, all for the fundamental public purpose of furthering ease of access to and use of the ever-expanding body of worldwide scientific, library and educational knowledge and information."

Fig. 1 OCLC charter.

"intellectual resources provided and shared by libraries and other institutions through the products and services of OCLC and its affiliates for the benefit of other members of the cooperative."

There were three levels of membership participation: Governing Members, Members and Participants. Governing members were institutions that contractually agree to contribute metadata to WorldCat, including all current cataloging and holdings as described in the "OCLC WorldCat Principles of Cooperation," and to make the information available for the benefit of all participants in the OCLC cooperative. Governing members received credits from OCLC for their contributions to WorldCat and received a discount on OCLC services. Governing members elected delegates to the OCLC Members Council, which in turn elects six members of the Board of Trustees.

Members, like governing members, embraced the OCLC values of commitment to collaboration by contributing intellectual content and by sharing resources. While they were not contractually bound to contribute all of their current cataloging to WorldCat, they did contract to contribute to cooperative products or services provided by OCLC and its affiliates. They also received a discount on OCLC services. Representatives from member institutions were eligible for election to Members Council and the Board of Trustees.

Participants contracted to use OCLC products and services without any obligation to return any intellectual content to the cooperative. While participants did not have a direct vote in the affairs of the cooperative, they are encouraged to provide input to their networks, service centers, and Members Council delegates.

The second part of the governance structure was the Members Council, which provided a formal institutional means for the governing members to participate in election of trustees and policy decisions. The OCLC Members Council consisted of 66 delegates who met three times a year. Elections were conducted by OCLC-affiliated networks and regional service centers in the United States and around the world.

Members Council delegates had three main responsibilities: 1) to elect six delegate librarians to the OCLC Board of Trustees; 2) to ratify amendments to the OCLC Articles of Incorporation and Code of Regulations; and 3) to provide advice and counsel to

OCLC. The number of delegates each network or service center may elect is based on a formula that takes into account service revenues in cataloging and resource sharing.

A typical Members Council meeting took 2.5 days. The meeting was organized along an annual theme adopted by the delegates. In 2006–2007, the theme was "OCLC Organizational Dissonance: The New Harmony." On February 5–7, 2007, delegates for the first time met outside the United States in Quebec City, Quebec, Canada.

Much of the work (the providing of advice and counsel to OCLC) of the Council was done in small groups that are asked to address specific questions and issues. These groups were organized along service areas, such as cataloging and metadata, digital libraries and research, global librarianship, cooperative reference and preservation/electronic collections, and resource sharing. Additional groups were organized by library type: systems and state libraries; government and special libraries; research libraries; public libraries; private academic libraries; and state academic libraries. These groups produced minutes, which were forwarded to the Members Council Executive Committee. This activity resulted in a written report of significant issues that is sent to OCLC management for comment and possible action and feedback to the Council. This communication, both formal and informal, helped the OCLC cooperative stay in close touch with its member libraries and constituents.

The third part of the governance structure was the Board of Trustees, which was composed of six trustees elected by the Members Council, five trustees elected by the Board itself from fields outside librarianship such as law, finance, government and business, and three board-elected trustees from the general library community. The President of OCLC is an ex-officio trustee. The Board sets strategic goals and policy, approves plans and programs for achieving those goals, hires and evaluates the chief executive officer, approves annual budgets, oversees audits and other reports pertaining to the financial condition of OCLC.

Membership and participation in OCLC continues to become more global. Revenues from international operations in fiscal 2008 were \$56.2 million, which was about 23% of total revenues of \$246.4 million. That compares with 9.3% of revenues in fiscal 2000. In the past 10 years,

the number of libraries participating in OCLC outside the United States has increased from 6000 to almost 14,627 and the number of countries from 75 to 112. In 2007–2008, there were 17 Members Council delegates elected from outside the United States.

In 2007, the OCLC Board of Trustees recognized that as OCLC was becoming an increasingly global cooperative, its governance must be adjusted to ensure representation and participation by members around the world and conducted another periodic review of OCLC's governance. In 2008, the membership adopted a new governance structure for the OCLC cooperative. The new structure is designed to extend participation in the OCLC cooperative to an increasing number of libraries and cultural heritage institutions around the world. It includes regional councils that send delegates to a Global Council, which in turn elects six members of a 15-member Board of Trustees. The transition to the new structure was under way in 2009 and was coordinated by representatives of the 2008/2009 Members Council and the Board of Trustees. In 2009, regional councils were established in the Americas region, the Asia Pacific region, and Europe, the Middle East and Africa, with the first Global Council meeting set for 2010.

FINANCES

Throughout OCLC's history, the organization has funded its operations and paid for research and development with revenues generated by services provided to member libraries. OCLC does not rely on government appropriations, foundation funding, or membership assessments. OCLC's financial philosophy can best be summed up by the introduction to the financial section of the fiscal 2008 annual report reads:

OCLC is a nonprofit, membership, computer library service, and research organization whose public purposes of furthering access to the world's information and reducing library costs dominate its plans and activities. In support of these purposes, OCLC strives to maintain a strong financial base by operating in a business-like manner in order to accommodate growth, upgrade technological platforms, conduct research and development and still subsidize worthwhile projects for the benefit of libraries and their users. OCLC follows a conservative, nonaggressive accounting and operating philosophy in maintaining its financial reporting and internal control systems."^[1] (OCLC 2007/2008 Annual Report, p. 50)

OCLC WORLDCAT

At the heart of the OCLC cooperative is the WorldCat bibliographic database, which member libraries and

OCLC cooperatively produce and maintain. WorldCat is the world's largest Online Union Catalog, and among the most consulted databases in higher education. Each WorldCat record contains a bibliographic description of a single item and a list of institutions that hold the item. Institutions share these records, using them to create local catalogs, arrange interlibrary loans, and conduct reference work. Institutions contribute records for items not found in WorldCat using the OCLC shared cataloging system.

Since 1971, more than 130 million records have been added to WorldCat. These records describe materials that span five millennia of recorded knowledge, from approximately 3400 B.C. to the present. Records are in eight formats: books, continuing resources (serials), sound recordings, musical scores, maps, visual materials, mixed materials, and computer files. A member institution adds a new record to WorldCat every 10 sec.

WorldCat has become a unique library resource that is consulted by librarians and library users around the world. It is the result of the concept of shared cooperative cataloging, advanced by OCLC's founder and first president, Frederick G. Kilgour. Shared cataloging not only increased the productivity of library staffs, it also increased the availability of information for library users.

Using the OCLC cataloging system, a cataloger searched the database for a bibliographic record for the item being cataloged. If a record was found, the cataloger used it for the library's catalog. If no record was found, the cataloger created a new record and input it into WorldCat. Thus, shared cataloging made it possible for only one library to create an original catalog record for an item and then provide a means for other libraries to use that same record for their catalogs.

Today, libraries find records they can use for current cataloging 94.6% of the time. Thus, for every 100 books cataloged, only about six required original cataloging. It is possible to catalog up to 14 titles an hour when records are resident in WorldCat, compared with two to three an hour when an original cataloging record must be created.

The ability to edit records and add information in real time meant that contributors could see cataloging results immediately, and any member library connected to the system could use the new information right away. Economies of scale increased as the number of records in the database and number of users grew.

Through WorldCat, OCLC has provided libraries with over \$1 billion in services based on cooperative cataloging and resource sharing. These services have not only been at low cost, but have saved libraries billions of dollars in potential duplicate costs. Today, libraries use WorldCat to help them select, order, catalog and get materials ready for shelves, and arrange interlibrary loans. WorldCat is now available to people everywhere on the Internet through WorldCat.org (see below). WorldCat is also available to library users as a reference database

OCLC Worldcat statistics by format
June 30, 2007

Type of material	Number of records	Percentage of total	Locations on LC records	Locations on participating	Locations on member-input	Location of items cataloged
Books	72,166,205	83.90%	594,439,084	373,798,972	70,291,465	1,038,529,521
Continuing resources format [Serials]	3,490,048	4.06%	19,380,291	15,369,184	608,641	35,358,116
Visual	2,804,530	3.26%	488,015	22,532,443	19,190	23,039,648
Maps	1,168,069	1.36%	1,635,135	3,410,395	84,561	5,130,091
Mixed materials	787,880	0.92%	17,478	543,194	1,052	561,724
Sound recordings	3,215,057	3.74%	3,497,696	22,518,124	1,858,612	27,874,432
Scores	1,927,684	2.24%	1,624,017	7,514,673	2,117,208	11,255,898
Computer files	451,050	0.52%	69,452	1,428,652	2,415	1,500,519
Totals	86,010,523	100.00%	621,151,168	447,115,637	74,983,144	1,143,249,949

Compiled from cataloging file statistics: Analysis of online bibliographic records

Fig. 2 OCLC WorldCat statistics by format.
Source: OCLC annual report 2006/2007.

through the OCLC FirstSearch service. The continuing evolution of WorldCat is discussed later in this entry (Fig. 2).

WORLDCAT ENRICHMENT AND QUALITY CONTROL

OCLC member libraries and OCLC maintain a proactive and rigorous quality control program that includes cooperative efforts at the national and international levels. To ensure the quality of WorldCat, all participating libraries are required to comply with specified cataloging standards. The quality control program includes both manual correction of records or elimination of duplicates by OCLC staff and selected participating libraries and automated software that corrects headings and other items automatically.

In the Enhance Program, specially authorized users may lock and replace most full-level member-input bibliographic records in WorldCat, including national-level records. Through the Cataloging in Publication (CIP) Upgrade Program, OCLC works with materials vendors to accelerate the upgrading of CIP records in WorldCat and provide libraries with full cataloging records as soon as possible after publication. A number of OCLC member libraries and OCLC participate in the Program for Cooperative Cataloging (PCC), an international cooperative effort coordinated by the Library of Congress and aimed at expanding access to library collections by providing useful, timely and cost-effective cataloging. As part of the PCC, WorldCat is the host database for the CONSER (Cooperative Online Serials) program in which libraries and publishers build and maintain a comprehensive

database of authoritative bibliographic information for serials. OCLC also employs automated techniques in maintaining the quality of WorldCat records.

OCLC member libraries have been able to upgrade minimal-level records and add information, such as call numbers and subject headings, to many of the records in WorldCat. However, major changes to many records have been restricted to participants in the Enhance Program. In response to requests from the cataloging community, in 2009, OCLC started the Expert Community Experiment, in which OCLC libraries with full-level cataloging authorizations were able to improve and upgrade many more WorldCat master bibliographic records. The experiment was expected to result in more corrections and additions to master bibliographic records and more timely actions to correct record problems. The experiment was inspired by long-standing requests from members to be able to do more—and more immediate—upgrading of WorldCat records. The experiment also allowed OCLC to test a “social cataloging” model involving the existing community of cataloging experts who have built WorldCat record-by-record over the past four decades. Interest in such an experiment had grown with the launch of WorldCat Local and with the popularity of other socially cooperative ventures, such as Wikipedia.

In 2008, OCLC began the Next Generation Cataloging and Metadata service pilot, which explored the viability of capturing ONIX metadata upstream from publishers and vendors and enhancing that metadata in WorldCat. A variety of academic and public libraries, publishers, and vendors are participating in the pilot. In 2009, OCLC was preparing to publish case studies and findings from the pilot and to routinely ingest, create, and enhance metadata in WorldCat and output enhanced data in MARC and

ONIX. The start of the pilot last year coincided with the recent release of a "Report on the Future of Bibliographic Control" by the Working Group on the Future of Bibliographic Control, which was formed by the Library of Congress to address changes in how libraries must do their work in the digital information era.

WORLDCAT AND INFORMATION STANDARDS

WorldCat is based on MARC ("Machine-Readable Cataloging"—a format for communication of bibliographic information in machine-readable form developed at the Library of Congress in 1967) and *Anglo American Cataloging Rules* 2nd Edition. MARC21, the current format, represents a harmonization of U.S. and Canadian MARC. There are other MARC formats, such as U.K. MARC and UNIMARC, which is intended to be a global MARC standard.

In the 1990s, the Internet and then the World Wide Web changed the nature of publishing and information seeking. Cataloging information evolved into metadata, and the library community (AACR2/MARC) was not the only group creating and distributing metadata about electronic resources. In 1991, the OCLC Office of Research began studying Internet resources and their potential impact on library operations. In 1995, the National Center for Supercomputing Applications (NSCA) and OCLC held a workshop in Dublin, Ohio to discuss metadata semantics. The result was the Dublin Core, a 15-element metadata set intended to be interoperable and also allowing for author-generated description. In 2001, the American National Standards Institute approved the Dublin Core as NISO Z39.85-2001, and in 2003 it became an ISO standard (ISO 15836). In 1999, WorldCat began supporting Dublin Core as well as MARC21/AACR2.

OCLC was the host for the Dublin Core from its founding in 1995–2005, when it became a public, not-for-profit Company based in Singapore. The founding members of the new legal entity were the National Library Board Singapore and the National Library of Finland.

EVOLUTION OF WORLDCAT

Since 1971, OCLC had built and maintained WorldCat on its own proprietary system that it had developed in-house and continuously modified and updated. From 2001 to 2005, OCLC was engaged in a major project to move WorldCat to a new platform based on hardware and licensed software with widespread industry adoption. This was an important step in OCLC's strategy to evolve WorldCat beyond bibliography into a globally networked, Web-based information resource that would also provide links to digital objects in other knowledge repositories. The switch from a monolithic legacy system to hardware and licensed software with widespread industry adoption

enabled OCLC to develop new component applications based on open architectural models that provide improved interoperability within OCLC services and also with external services.

The new WorldCat platform supports additional standards such as Dublin Core and IFLA (International Federation of Library Associations and Institutions) standards for bibliographic records and Unicode, a character coding system designed to support the worldwide interchange, processing, and display of written texts of the diverse languages of the world. In 2007, WorldCat supported the following scripts for cataloging: Arabic, Bengali, Chinese, Cyrillic, Devanagari, Greek, Hebrew, Japanese, Korean, Latin, Tamil, and Thai. OCLC has also moved beyond bibliography to enrich WorldCat with new types of metadata and content such as book cover images, summaries, authors' notes and reviews.

GROWTH OF WORLDCAT

WorldCat has grown continuously since it began operation on August 26, 1971. In 2002, the number of records in WorldCat reached the 50 million after 31 years of shared cataloging. Libraries added the next 50 million records in just 6 years, with the 100 millionth record attained in 2008. The number of holding symbols in WorldCat reached 1 billion in 2005, and by 2009 had climbed to 1.4 billion. This growth is attributable to improvements in automated, batchloading processes and to the new technological platform with its Unicode capabilities that support 12 language scripts noted above, which makes it practicable for an increasing number of international organizations to merge their national union catalogs or other large files with WorldCat.

OCLC was also working to make it easier for national libraries and others to keep their union catalogs in synch with WorldCat. In 2008, the Dutch Union Catalogue started updating WorldCat in real time using SRU technology. In 2009, WorldCat's second SRU record update implementation began operation with Libraries Australia. Records appearing in the Australian National Bibliographic Utility now show up 5 second later in WorldCat. This machine-to-machine process is definitely introducing system-wide efficiencies that benefit the entire cooperative.

It is interesting to note that the language composition of WorldCat has changed over the past decade, with the percentage of records in languages other than English going from 38% in 1998 to slightly over 50% in 2008 (Fig. 3).

CATALOGING

In 2002, OCLC launched the Connexion cataloging service on a new technological platform. It combined functionality from existing OCLC services such as CORC,

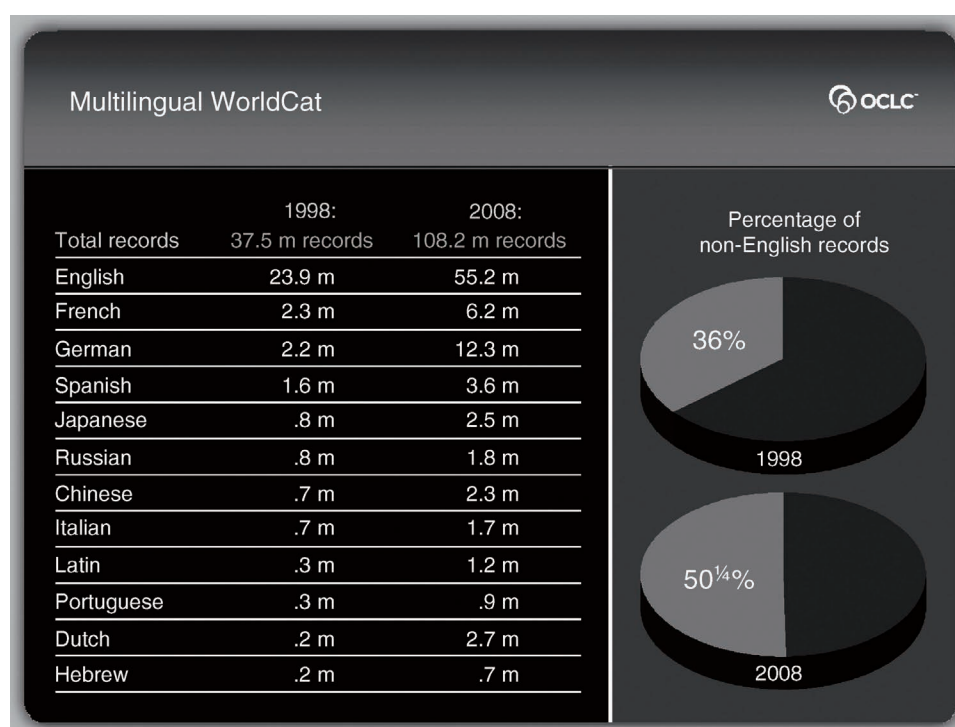


Fig. 3 Languages in WorldCat.

Source: OCLC.

CatExpress, the Cataloging Micro Enhancer, Passport, and WebDewey. Connexion supports cataloging of all materials and formats from a single interface that the library can customize. It provides access to WorldCat, linked authority control, automatic classification, and the ability to build subject guides.

OCLC metadata and cataloging services are designed to help libraries manage their collections and increase the speed at which materials are made available for patron use. In addition to the online shared cataloging service described above, OCLC provides batch processing and Web-based cataloging systems that libraries use to catalog materials and maintain information on their physical and electronic collections.

These services include: automatic delivery of cataloging information with new books received from book vendors; automatic upgrading of cataloging records; workstation software that can be used on the cataloging system to automate certain cataloging tasks; cataloging system for Chinese, Japanese, and Korean (“CJKTM”) library materials; cataloging software for Arabic library materials; a Web-based copy cataloging system for small libraries with low volumes of cataloging (CatExpress); an authority control service; online, batch and microcomputer-based retrospective conversion services to convert older library cataloging records, usually cards, to machine-readable form; contract cataloging and processing service that acquires, catalogs and adds necessary labels to library materials, including

videos, DVDs, and CDs as well as books; and a terminologies service.

The oldest OCLC metadata service is the Dewey Decimal Classification (DDC) system, created by Melvil Dewey and first published in 1876. He established Forest Press in 1911 to edit, publish, and distribute the classification. In 1988, OCLC was asked to assume control of Forest Press. Subsequently, OCLC has published 20th, 21st, and 22nd editions of the DDC, 12th, 13th, and 14th abridged editions, and three electronic versions. The DDC has been translated into 30 languages and is used by over 200,000 libraries in 135 countries. Editing of the DDC is done at the Library of Congress. The DDC is available in both print and electronic versions.

In 2007, OCLC introduced a terminologies service, which provides access to multiple controlled vocabularies to enable creation of consistent metadata for library, museum, or archive collections. The vocabularies include: the Dublin Core; the Art & Architecture Thesaurus of the Getty Vocabulary Program, which describes objects of art as well as the processes and materials from which the objects are made; Newspaper Genre List from the University of Washington, Māori Subject Headings/Ngā Ūpoko Tukutuku from the National Library of New Zealand; and Thesauri for Graphic Materials I and II from the Library of Congress. One goal of the terminologies service is to make it easier for museums and archives to participate in the OCLC cooperative.

WORLDCAT COLLECTION ANALYSIS

Launched in 2005, WorldCat Collection Analysis provides data mining and manipulation capabilities that enable libraries to determine subject coverage in their collections and compare their collections with peer libraries to identify titles held in common and gaps in their collections. The service now includes: peer library comparisons, analysis of library collection and comparison to all holdings in WorldCat, and interlibrary loan analysis, which enables OCLC Resource Sharing users to determine how their collections are being used by others, as well as how they are supplementing their collections via interlibrary loan. Future developments include analysis of circulation usage statistics.

WORLDCAT SELECTION

In December 2006, OCLC introduced the WorldCat Selection service, which is based on ITSO CUL (Integrated Tool for Selection and Ordering at Cornell University Library). The service allows selectors of library materials to view new title data from multiple vendors in a single system. Acquisitions staff export selected records to load into the ILS to complete the ordering process. Staff can share selection decisions with others in their institution. The system streamlines selection, saves time and costs, and requires no software to load. The service now has these library materials vendors as partners—Aux Amateurs de Livres, Blackwell, Casalini libri, China National Publishing Industry Trading Corporation, Coutts, Erasmus, Howard Karno Books, Harrassowitz, Leila Books, Lindsay & Croft, Touzot, and YBP Library Services.

eSERIALS HOLDINGS SERVICE

In 2006, OCLC launched the eSerials Holdings Service, which helps libraries manage their eSerials collections. It automatically sets and updates WorldCat holdings for ISSN-based electronic serials each month. OCLC currently partners with EBSCO, OCLC Openly IGate, Serials Solutions, and TDNet on this service. About 1.8 million holdings have been set automatically in the past year. This service helps lower costs and increase the visibility of a library's eSerials collection to searchers and ILL librarians via FirstSearch, Resource Sharing, and Open WorldCat.

REFERENCE AND RESOURCE SHARING

OCLC's reference and resource sharing services build on and strengthen the tradition of interlibrary cooperation. OCLC introduced its online interlibrary loan service in

1979, and its online end-user reference service, FirstSearch, in 1991. Since then, the two services have become closely connected, based on the notion that searching, retrieval and delivery of information should be merged into a single, integrated service that would provide information to the user when and where needed.

The interlibrary loan service enables libraries to select holdings information electronically from WorldCat and to send requests for materials to other libraries in the OCLC network. For the year ended June 30, 2008, libraries conducted 10 million interlibrary loans online through OCLC.

The direction of resource sharing could be seen in OCLC ILLiad software that integrated borrowing automation, lending automation and electronic document delivery into one Web-based customer interface. Library users could easily send and track requests electronically through the Web while the system automatically processed filled requests and contacted users when requests were completed.

In 2009, OCLC further refined its consortial borrowing service with the introduction of WorldCat Navigator. The service manages returnable and nonreturnable items, and integrates with circulation systems to create a discovery-to-delivery tool.

QUESTIONPOINT

In 2002, with the Library of Congress, OCLC introduced QuestionPoint, a virtual reference desk collaborative service that includes e-mail, phone, walk-up, and fax capabilities. In 2004, OCLC acquired the assets of the 24/7 cooperative reference service project of the Metropolitan Cooperative Library System, Los Angeles, California, which enables library users to ask questions and get answers from qualified reference staff in real time on the Internet. In 2009, more than 1900 libraries were using QuestionPoint in 23 countries, and more than 1500 libraries were participating in the 24/7 reference cooperative, including 13 statewide services, the nationwide enquire service in the United Kingdom, and an additional 15 major regional services. The service handled questions in 26 languages. In 2008, the three-millionth reference question was logged on the service.

QuestionPoint uses the expertise of librarians to provide answers to questions, research guidance, and help navigating the Internet. Libraries may brand their own customized versions of QuestionPoint. For example, the Netherlands Public Library Association has customized QuestionPoint into Al@adin, a Web-based network of librarians in 50 libraries that delivers reference assistance to any library user in the country. Al@adin answers questions locally and nationally and can seamlessly refer them to other QuestionPoint users around the world. QuestionPoint subscribers maintain a Global Knowledge Base, which contains 18,000 records in 10 languages. In

2008, a chat widget was introduced that give libraries the ability to embed a snippet of HTML code throughout their Web pages and in a variety of environments, thereby providing access to the QuestionPoint service.

eCONTENT

Initially, OCLC services were designed for use by librarians to help manage their collections. When the FirstSearch service was launched in 1991, it was the first end-user reference system in the library community. Indeed, FirstSearch was in some respects as revolutionary in its early days, before the advent of the Web and search engines, as online shared cataloging had been 25 years earlier. Before FirstSearch and its user-friendly, menu-driven interface, online database searching was the exclusive preserve of reference librarians who alone knew how to devise search strategies to navigate complex and expensive databases. The library community rapidly adopted FirstSearch.

In use in more than 22,000 libraries, FirstSearch provides library end-users with desktop access to bibliographic, abstract, and full-text information from approximately 84 databases. It also provides document delivery of print and electronic materials and permits library users to request interlibrary loans. In the year ended June 30, 2008, there were 79.7 million searches conducted on FirstSearch.

OCLC FirstSearch Electronic Collections Online (ECO) provides cross-journal searching and access to electronic versions of 5600 journals and over 2.2 million full-text articles from 70 publishers. Accessible as a database on FirstSearch, ECO enables libraries to assemble, circulate, manage, and archive large collections of academic and professional journals on the World Wide Web. ECO provides links to other databases, WorldCat holdings information, and access to the OCLC interlibrary loan service. Libraries could also obtain bibliographic records that matched their journal subscriptions in order to facilitate access to the collection from the library's online public access catalog (OPAC).

In addition to WorldCat, OCLC produces eight databases that are available on FirstSearch:

- OCLC Union Lists of Periodicals includes more than 7 million location listings of local information linked to over 750,000 bibliographic records for periodicals WorldCat.
- OCLC ArticleFirst (15 million records) includes bibliographic citations from over 12,600 serials, covering science, technology, medicine, social science, business, the humanities, and popular culture.
- Electronic books include 675,000 records for online electronic books cataloged by OCLC member libraries.
- OCLC ECO provides cross-journal searching and access to electronic versions of 5600 journals and over 4.2 million full-text articles.

- OCLC PapersFirst (6.9 million records) gives access to individual papers presented at every congress, symposium, exposition, workshop, and meeting added to The British Library Document Supply Centre since October 1993.
- OCLC ProceedingsFirst (192,000 records) provides tables of contents of presented papers from conferences worldwide.
- OCLC WorldCat Dissertations and Theses (8 million records) provides access to the dissertations and theses available in OCLC member libraries.
- CAMIO (Catalog of Art Museum Images Online) provides more than 95,000 high-quality art images from prominent museums around the world.
- ArchiveGrid provides access to nearly 1 million descriptions of archival collections held by thousands of libraries, museums, historical societies, and archives worldwide.
- OAster provides access to 19 million records pointing to open archive collections, contributed by over 1000 organizations worldwide.

In July 2009, OCLC planned to make available all of its eContent resources through a single discovery platform—WorldCat.org. (see below). It will provide libraries with a single and familiar access point to their content and collections available anytime, anywhere. It also adds functionality that has been in high demand from users—social software, citation management, and tagging.

ELECTRONIC BOOKS

In the mid-1980s, the OCLC Office of Research had experimented with electronic books with EIDOS, the Electronic Information Delivery Online System. With the envisioned system, a user could search for a document and browse tables of contents and index pages and, if desired, request the actual text. Staff developed a prototype system, but it did not go into production. In the early 1990s, OCLC, with the American Association for the Advancement of Science, launched the world's first peer-reviewed medical journal, the Online Journal of Current Clinical Trials. OCLC also experimented with different technological approaches to electronic journals until settling on the current ECO model in 1997. Thus, OCLC was no stranger to electronic books and journals when the technology of the World Wide Web made such electronic publications practicable.

In 2002, OCLC acquired the assets of NetLibrary, a provider of electronic books and textbooks. The NetLibrary division provides electronic book content and tools to libraries. NetLibrary's collection contains more than 171,000 titles from 400 publishers, with 90% of new, incoming content published within the last 3 years. The collection includes 7000 eAudiobooks. OCLC MARC

records are included with all NetLibrary eBook and eAudiobook purchases, and holdings are automatically set in WorldCat for member libraries. The multilingual interface is available in Chinese, Dutch, English, French, German, Japanese, Korean, Spanish, and Thai.

DIGITAL COLLECTION SERVICES

In 2003, OCLC began making available CONTENTdm, a software package that facilitates WorldCat access to photos, graphics, and other objects in digitized special collections of libraries and other cultural heritage institutions. In 2006, OCLC acquired DiMeMa (Digital Media Management), the organization that developed and supports CONTENTdm software, which was distributed by OCLC and used by more than 450 institutions to manage their digital collections. In 2008, OCLC added Unicode support to CONTENTdm, thereby extending the software's application in the United States and throughout the world to organizations with primary source materials in many languages. OCLC is now building the OCLC Digital Repository, which will integrate CONTENTdm collections with WorldCat. The metadata for some 100,000 items has already been harvested from 105 organizations and is already in WorldCat.

The DLF/OCLC Registry of Digital Preservation Masters, introduced in 2004, helps libraries build a central, shared registry of digital formats that all participating institutions may one day contribute to and use. By accessing the registry, a library can identify items already digitized and make informed decisions about what items they need to digitize, thereby reducing duplication of effort.

The OCLC Digital Archive provides long-term access and preservation for digital collections. Libraries can share their collections with the world or limit access for their own administrative purposes. Objects can be added one-at-a-time or in batches in a variety of formats. The Digital Archive follows the Reference Model for an Open Archival Information System, which has been adopted as an ISO standard. Dissemination Information Packages from the Digital Archive conform to the Metadata Encoding and Transmission Standard.

Web Harvester, introduced in 2008, allows users of Connexion and CONTENTdm to capture Web-based documents and Web sites from the live Web and manage the collected content as part of their overall digital collection management program.

OCLC also provides high-quality preservation microfilming and digital scanning services for libraries, operates preservation microfilming and digital scanning services for libraries, archives, historical societies, and museums. OCLC has digitized the microfilmed papers of George Washington, Thomas Jefferson, and Abraham Lincoln for the American Memory Project of the Library of Congress. OCLC operates preservation centers in the United

States in Bethlehem, Pennsylvania; Lacey, Washington; and Richmond, Virginia; and in Winnipeg, Manitoba, Canada.

INTEGRATED LIBRARY SYSTEMS

With the merger with Pica BV in the Netherlands in 1999 and the formation of OCLC EMEA, OCLC reentered the local systems business. Pica was a well-established local systems provider, primarily in Europe with its LBS and CBS systems. LBS is an integrated local library management system that supports acquisitions, cataloging, and circulation. The CBS (Central Library System) provides the infrastructure for the creation and management of union catalogs and tools for regional interlibrary loan. There are CBS installations at the Royal Library of the Netherlands, the German National Library, and the National Library of Australia, and at ABES (Agence bibliographique de l'enseignement supérieur) in France, to name a few.

OCLC EMEA also develops and maintains three other library management systems acquired through acquisitions. The OLIB (originally developed by Fretwell Downing Informatics) library management system is installed in about 250 organizations worldwide. In 2008, OCLC EMEA completed a 5-year project to create new public catalog site for the U.S. National Archives and Records Administration based on OLIB. The SunRise library system (originally developed by Sisis) is installed in more than 150 libraries, primarily in Germany, Switzerland, and the Netherlands; the Bavarian State Library is a SunRise user. The Amlib system has some 500 installations in Australia, Africa, and the United States.

OCLC's long-term strategy for the ILS is to create an infrastructure to deliver a large-scale, network-based workflow solution to manage library business processes. The design of the future library management environment will comprise a number of important aspects. It will be an evolutionary process, with new service implemented in a building block process that will eventually become a unified solution. The new services can also be integrated into a library's existing infrastructure and current library management system. The notion is to preserve the functionality of the ILS, but at the same time enhance it by placing it in a network environment, and extending it to manage print, licensed, and digitized material with one solution.

OCLC PROGRAMS AND RESEARCH

On July 1, 2006, OCLC combined operations with RLG, a nonprofit organization of over 150 research libraries, archives, museums, and other cultural memory institutions. By the end of 2007, RLG's services in online cataloging, resource sharing, and digitization/imaging had been integrated with OCLC's. RLG's program initiatives

are being continued as RLG-Programs, a new division of OCLC Research. This unit, based in San Mateo, California, combines RLG's successful tradition of identifying issues and building consensus among research institutions with OCLC's research capacities and robust prototyping capabilities. The combined memberships represent a critical mass of libraries, museums, archives, and other cultural heritage institutions.

OCLC Research staff have developed the following work agenda:

- Supporting new modes of research, teaching, and learning.
- Managing the collective collection of the cooperative.
- Renovating descriptive and organizing practices.
- Modeling new service infrastructures.
- Participating in architecture and standards activities.
- Measuring and assessing end-user behaviors.

The Office of Research, established by OCLC Founder Frederick G. Kilgour in 1978, is one of the world's leading centers devoted exclusively to the challenges facing libraries in a rapidly changing environment. The mission of OCLC Research is to expand knowledge that advances OCLC's public purposes of furthering access to the world's information and reducing library costs. This mission is achieved through the integration of computer, library, and information sciences into research activities including experimentation, prototyping, standardization advancements, studies, and research collaborations. Main areas of research include content management, interoperability, knowledge organization, system and service architecture, and collection and user analysis.

OCLC Research also provides programs that benefit the larger library community. The OCLC/ALISE Library and Information Science Research Grant Program funds research projects by full-time academic faculty in schools of library and information science. The Visiting Scholar program brings experienced professionals to OCLC to work with staff, facilities, and data resources. The Distinguished Seminar Series brings distinguished information professionals to OCLC to discuss their research activities.

OCLC Research develops and provides source code free of charge to the library community for use and further development. OAICat and OAIHarvester are OCLC open-source software programs that implement OAI protocols for data storage and harvesting in support of institutional repositories. DSpace, the open-source repository software created by MIT, uses OAICat to support its OAI (Open Archives Initiative) capability. OCLC Research has also released an algorithm that provides instructions for implementing Functional Requirements for Bibliographic Records on bibliographic databases.

In 2008, OCLC Research staff engaged in variety of projects, including studying the information behaviors of college students. They were also closely involved in

launching the WorldCat API and Developers Network, creating a WorldCat widget for use in Facebook and other social Web sites and developing a service that makes different metadata standards interoperable. They also contributed to the enhancement of OCLC's terminology-based services, the release of a production version of WorldCat Identities, the testing of the Registry of Copyright Evidence and an examination of circulation data from libraries that are members of the OhioLINK consortium. Also in 2008, OCLC Research opened an office at the University of St. Andrews in Scotland to better serve the needs of research libraries and other cultural heritage institutions in Europe.

ADVOCATE FOR LIBRARIES

Libraries have been increasingly urging OCLC to become more active as an advocate for libraries. OCLC pursues this role in a variety of ways. OCLC researchers serve as advocates for libraries in the development of standards. For example, OCLC researchers are active in the Dublin Core Metadata Initiative (see above). OCLC officers and senior managers are involved in national and international professional activities in the library and information community in such groups as the OAI Steering Committee, the Digital Library Federation Steering Committee, the JISC/FAIR (Focus on Access to Institutional Resources—United Kingdom), ALA's Library Business Alliance, NISO's Board of Trustees and Standards Development Committee, and the IFLA Standing Committee on Cataloging.

Another advocacy effort is the Jay Jordan IFLA/OCLC Early Career Development Program, which provides early career development and continuing education for library and information science professionals from countries with developing economies. On an annual basis, up to six individuals, including a theological librarian, are selected for participation in this intensive 5-week Fellowship program. Four weeks are based at OCLC's headquarters in Dublin, Ohio, United States; 1 week is based at OCLC in Leiden, Netherlands. The program gives Fellows opportunities to meet with leading information practitioners, visit libraries, and explore topics including information technologies, library operations and management, and global cooperative librarianship. The Fellows visit selected North American and European libraries, cultural heritage institutions, and library organizations. The Fellows also observe OCLC's governance structure in action, gaining insight into issues affecting the global library cooperative. Fellows give presentations about their home countries and libraries, meet leading information professionals, and discuss real-world solutions to the challenges facing libraries today. The Fellows translate their learning and experiences into specific professional development plans that guide their continued growth as well as their personal contributions to their home institutions and country of

origin. Since the program began in 2001, there have been fellows from Brazil, China, Colombia, Georgia, Ghana, India, Indonesia, Jamaica, Kenya, South Korea, Malawi, Malaysia, Mauritius, Moldova, Morocco, Nepal, Pakistan, Philippines, Rwanda, Serbia, South Africa, Sri Lanka, Trinidad and Tobago, Turkey, Uganda, and Vietnam.

In 2009, OCLC launched the OCLC Minority Librarian Fellowship program designed to provide a unique opportunity for aspiring library professionals from historically under-represented groups. The Fellowship program offers an opportunity to be part of the world's leading library cooperative. The 12-month program offers the selected Fellow two, three-month assignments within specific divisions of OCLC, and one six-month assignment with a specific operating unit within the OCLC organization.

OCLC also develops studies and other information sources that OCLC members can use in their planning and, indeed, in their own advocacy activities. Here is a sample of recent reports.

- "Five-Year Information Format Trends" outlines trends in popular and scholarly materials, digitization projects, and Web resources.
- "Libraries: How They Stack Up" compares library economics and activities to other sectors, professions, and destinations in the worldwide economy.
- "OCLC Library Training and Education Market Needs Assessment Study" produced in conjunction with the Members Council Task Force on OCLC's role in staff development.
- "Libraries and the Enhancement of E-learning" is a white paper issued in 2003 by the OCLC E-Learning Task Force to help frame discussions as to what roles libraries and the OCLC cooperative might play in e-learning.
- "Perceptions of Libraries and Information Resources: A Report to the OCLC Membership" (2005).
- "Sharing, Privacy, and Trust in Our Networked World" (2007).

In 2004, OCLC issued "The 2003 OCLC Environmental Scan: Pattern Recognition." This report to the OCLC membership identified trends that are affecting libraries, museums, and archives in five landscapes: social, economic, technology, research and learning, and library. The *Scan* was based on interviews with 100 information professionals and a review of 300 relevant articles and papers. The report has been well received by OCLC members, some of whom were using it for their own strategic planning efforts. In 2004, the Association of Library Collections and Technical Services, a division of the American Library Association, awarded the authors of the *Scan* a Presidential Citation.

In 2008, OCLC published *From Awareness to Funding: A Study of Library Support in America*. Using a \$1.2 million grant from the Bill & Melinda Gates

Foundation, OCLC partnered with the Leo Burnett marketing agency to conduct research about library funding, and to evaluate the potential of a large-scale library marketing and advocacy campaign to increase awareness of the library's role in the community.

WEBJUNCTION

Started in 2003 with a \$9.2 million grant from the Bill and Melinda Gates Foundation, WebJunction has become a thriving online community of library staff that supports peer-to-peer sharing through online discussions and distributed content publishing. There are over 40,000 registered members and 90,000 unique monthly visitors. There are 15 community partners, most of them state libraries that operate customized versions of WebJunction. The site also hosts 700 online courses for continuing education and 17 custom learning communities for library staff that are sponsored by library service organizations. In 2009, WebJunction launched learning communities for the Research Learning Group, ILLiad (resource sharing) and for library staff outside the United States.

WEAVING LIBRARIES INTO THE WEB: OPEN WORLDCAT

In 2003, OCLC launched the Open WorldCat pilot program to determine the feasibility of providing new services that would integrate the collections of OCLC member libraries into heavily used Web sites. The notion was to make it easy for a person who is looking for information via a search engine to end up finding it in a nearby library. To do this, OCLC would make WorldCat records directly available to the general public for the first time via the Web. Heretofore, WorldCat had been available only through participating libraries.

OCLC began the pilot after extensive consultations with the Board of Trustees, Members Council, regional service providers, and member libraries. The consensus was that it was something the cooperative had to try since numerous studies had indicated that people were turning increasingly to the Web first for their information needs, often ignoring libraries when doing research. The pilot offered the possibility of raising the visibility of libraries on the Web.

In the first phase, users could access links to Open WorldCat through selected Web sites, including Alibris, Abebooks, Antiquarian Booksellers Association of America, BookPage, and HCI Bibliography. In the second phase, 2 million records from WorldCat were made available on search engines, such as Google and Yahoo! Search, with links to the Web-based catalogs of 12,000 academic, public and school libraries participating in OCLC.

In 2005, Open WorldCat became an ongoing program, making bibliographic records of library-owned materials in WorldCat visible and accessible to Web users through popular search engines such as Google, Yahoo! and Ask.com. OCLC has also made it easier to get to member libraries' catalogs by adding always-there access to Open WorldCat from toolbars on FireFox, Google, and Yahoo! Another feature enables users in the United States to buy books online that they find in Open WorldCat; they can then donate a portion of the sale proceeds to the Open WorldCat library of their choice.

WORLDCAT.ORG

On August 8, 2006, OCLC introduced the WorldCat.org Web site. It offers a search box that people can download and use to search all the records and location listings in WorldCat. For the first time, collections in OCLC member libraries became visible on the Internet to people everywhere. This was one of the signal achievements in the history of the OCLC cooperative, testifying not only to the vision of OCLC's founder Frederick G. Kilgour, but to the perseverance and hard work of catalogers and librarians who have built WorldCat record by record since 1971.

By reaching into the working and learning patterns of today's information consumers, Open WorldCat raises the visibility of libraries and other cultural heritage institutions on the Web. It enables information seekers to guide themselves to quality information contained in libraries in an increasingly seamless fashion. It gives users knowledge management tools that enhance their use of the library, both for traditional collections and, increasingly, for digitized special collections.

WORLDCAT LOCAL

In 2008, OCLC introduced WorldCat Local, a compelling user environment that provides a single interface to the collections of a library. It interoperates with locally maintained services such as circulation, resource sharing and resolution to full text to create an integrated experience for library users. WorldCat Local searches the entire WorldCat.org database and presents local and group library holdings at the top of the results list, as well as ownership details for WorldCat libraries outside the local library and consortium.

With the implementation of WorldCat Local, OCLC began providing a local connection to cloud computing. It is a service provided to the library across the Internet that eliminates costs to the library for hosting, operating, and maintaining software. WorldCat Local is "activatable," which means that library staff configure the service from their library using their library's policies. This configuration is done using an online questionnaire that ideally

requires the involvement of staff from both public services and technical services.

WEB SERVICES

Web services enable applications to interconnect over the Web through machine-to-machine interfaces. They cover a wide range of activities that let people tap into computing power on the Web.

In addition to WorldCat.org, WorldCat Local and the WorldCat Identities mentioned above, OCLC has also introduced other Web services in the past 5 years. The xISBN service, developed by OCLC Research, supplies International Standard Book Numbers (ISBNs) associated with an individual intellectual work, based on information in the WorldCat database. It finds all related editions of a book, including paperback, hardback, audiobook, foreign and out-of-print. Easily incorporated into library catalogs, the service is available free to OCLC cataloging members and for a fee to others.

The WorldCat Registry is a Web service, which enables a library to manage its institutional identity more efficiently. On a secure Web platform, a library can create and maintain a single profile that includes information of use to the library's consortium members, technology vendors, eContent providers, funding agencies, and other partners. This access enables the library to automate routine tasks such as activation of a new subscription service or renewal of an existing one. In 2008, the Registry included more than 120,000 institution records for OCLC and non-OCLC members.

In 2008, OCLC established the WorldCat Developer's Network by inviting a small group of developers from OCLC cataloging institutions in North America and Europe to use the WorldCat API (Applications Programming Interface) to build applications that would guide people from the Web to library services. These developers could then link WorldCat information to Internet applications as well as presentations, blogs, and e-mails. This shared development will enhance the creativity and usage of WorldCat.

GOOGLE AND OCLC

In 2008, OCLC and Google agreed to exchange data to will facilitate the discovery of library collections through Google search services. OCLC member libraries participating in the Google Book SearchTM program, which makes the full text of more than 1 million books searchable, may share their WorldCat-derived MARC records with Google to better facilitate discovery of library collections through Google. Google will link from Google Book Search to WorldCat.org, which will drive traffic to library OPACs and other library services. Google will share data and links to digitized books with OCLC, which will make it possible for OCLC to represent the digitized



Fig. 4 The OCLC cooperative: 2008.
Source: OCLC.

collections of OCLC member libraries in WorldCat. OCLC began online operations in 1971 with 54 academic libraries in Ohio. In 2008, more than 69,000 libraries in 112 countries had a unique holding symbol in the WorldCat database and were participating in some way in the OCLC global cooperative (Fig. 4).

U.S. ACTIVITY

For the year ended June 30, 2008, revenues from U.S. operations were \$190.2 million, or 77.2% of total revenues of \$246.4 million. Here are a few highlights of U.S. activities in fiscal 2008.

- University of Washington Libraries enters 100 millionth bibliographic record in WorldCat on April 1, 2008.
- State Library of Ohio begins using WorldCat Local production version.
- Mellon Foundation awards OCLC \$145,000 grant to conduct data exchange study with seven RLG Programs art museum partners.
- Orbis Cascade Alliance and OCLC are working together to migrate the Alliance's Summit union catalog of 38 libraries to a consortial borrowing solution.

ACTIVITY OUTSIDE THE UNITED STATES

Revenues from operations outside the United States in fiscal 2008 were \$56.2 million, or 22.8% of total revenues. Here are some highlights of OCLC activities outside the United States for fiscal 2008 (year ended June 30, 2008).

OCLC ASIA PACIFIC

- OCLC Beijing Representative Office established on July 25, 2007.
- National Library of China to load Chinese records into WorldCat.
- National Central Library, Taiwan to load Chinese records into WorldCat.
- Completed loading of the National Union Catalog of Australia into WorldCat.
- Completed loading of the National Union Catalog of New Zealand into WorldCat.

OCLC CANADA

- University of Manitoba to use OCLC Canada LTS for outsourced cataloging.
- Edmonton Public Library to use OCLC Canada LTS for outsourced cataloging of Chinese language materials.
- Twelve new governing members to catalog on OCLC.
- Six new Canadian publishers to contribute eBooks to the NetLibrary collection.
- Presented the first OCLC Symposium in Canada during Canadian Library Association annual conference on Social Networking and Web 2.0.

OCLC LATIN AMERICAN AND THE CARIBBEAN

- More than 48,000 records from RedALyc (scientific journals from Latin America, Spain, and Portugal)

were loaded into WorldCat with access to article level full text.

- The National Library and Information System Authority of Trinidad and Tobago became the first national library in the Americas offering the QuestionPoint service to provide virtual reference services.
- The Pedro Henriquez Ureña National Library in the Dominican Republic joined OCLC as a cataloging member.
- More than 470,000 records of scientific material related to agriculture and animal research from Embrapa (Brazil) were loaded into WorldCat.
- State of Jalisco Public Library system (Mexico) began using NetLibrary eBooks.

OCLC EUROPE, THE MIDDLE EAST AND AFRICA

- Signed an agreement with the UKB (Association of Dutch University Libraries, the Royal Library, and the Library of the Royal Academy of Sciences) in the Netherlands to continue managing the Dutch national information infrastructure.
- Loaded into WorldCat bibliographic files from the National Library of Sweden, Swiss National Library, Hebils, and Bavarian State Library.

- Migrated LinkUK data to UnityUK creating a single national union catalog in the United Kingdom.
- Introduced the Netlibrary platform for distribution of Dutch eBooks to Dutch public libraries.

FUTURE DIRECTIONS

Since 1971, OCLC has provided libraries with \$3.7 billion in products and services. WorldCat is in the workflows of most parts of the library, including acquisitions, cataloging, reference, resource sharing, and circulation. OCLC products and services have not only been at low cost, but have saved libraries millions of dollars. Clearly, the OCLC cooperative has worked well for 37 years. Going forward, OCLC will provide local, group, and global nodes that work together seamlessly and symbiotically as it continues to pursue its mission of furthering access to the world's information and reducing the rate of rise of library costs.

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Older Adults' Information: Needs and Behavior

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Abstract

The proportion of older adults, usually defined as aged 60 or 65 and over, is expanding rapidly in the populations of many countries of the world, leading to the expectation that they should have growing importance from a research perspective. It is therefore surprising that there have been few substantial studies of the information needs and behaviors of this group, apart from research of which the principal focus is library services. This entry discusses the major studies that have been undertaken on the topic, mentioning library studies only where relevant. Library services are not part of the purview and are dealt with only briefly. The introduction discusses definitions of "older adults," why there is an imperative for studying this large, diverse group and the role played by research with a library focus. The entry then examines what is known about human information behavior (HIB) in the context of everyday life information focusing particularly on information needs, the sources used to meet those needs and the role of residential context (for the very old and frail) where this is relevant. Where possible, the findings are discussed in terms of the three age groups into which older adults are sometimes divided: the young aged (60–74), the old–old (75–84), and the very old (85+). Recently, the concept of the Fourth Age has been introduced into the HIB field. The Fourth Age describes people who have multiple disabilities and are usually in the last stage of their lives. The physical, cognitive, and social losses of the Fourth Age have significant impact on HIB. Since computers and the Internet have now become such important tools in the information-seeking process, the next section of the entry focuses on these topics. The conclusion is that further research is needed, that people in the wide age span from 60 to 65 plus should not be treated as homogeneous in their needs, and that the Internet be included in future research but that it should be examined in the context of other sources of everyday life information.

INTRODUCTION

The goal of this entry is to explore what we know about the information needs and behaviors of older adults. To do this, we need to begin by defining the group at the center of the discussion, involving as it does a very large age span that needs to be further subdivided for meaningful conclusions to be reached.

Defining "Old"

The simplest, most comparable, and widely used definition of "old" is chronological age (p. 9),^[1] also referred to as calendar age. In the United States, because the Social Security Act of 1935 was viewed as "old-age security legislation" intended for people aged 65 and older (p. 184, 200),^[2] this age became, officially and in common parlance, the time when old age was said to begin (p. 258).^[3] The age of 60 plus is the definition of "old age" accepted by most developed countries, though there is no UN standard numerical criterion.^[4] It should be noted that the age at which citizens are eligible for the

old-age pension is set to rise over the next few years to 67 in countries such as United States, the United Kingdom, and Australia, the adjustment considered necessary because of the increased life span now occurring.^[5–7]

Because of the disparate physical and cognitive differences noted among adults aged 60 and older, gerontologists early on divided the aged into three groups commonly designated as the young aged (60–74 years), the old–old (75–84), and the very old or "oldest old" (85+). In the field of library and information science, most researchers have continued to treat older people as one group, aged over 60 or 65. There have been exceptions, which include Turock^[9] and Wooliscroft,^[10] who, in their work about older people and libraries, have found the three subgroups useful. Today, the "very old" group is often referred to as the "oldest old"^[11] the designation that Asla et al.^[12] used in their 2006 article in *Library and Information Research*.

Even the division of the aged into three groups did not solve problems for researchers who found a wide disparity in abilities among members of each of the specific groups. Consequently, gerontologists developed Fourth Ages

theory, with the Fourth Age referring to that time in life described as “the disability zone” (p. 31).^[8] Members of the Fourth Age are identified by specific, measurable physical, cognitive, and social losses, which have significant impact on their lives and also on HIB: vision, hearing, cognition, chronic illnesses, and mobility. Thus researchers who employ the Fourth Age definition “are assured of studying a homogeneous group of individuals approaching the end of life.”^[13] Recently, the concept of the Fourth Age, describing people in the “disability zone” and usually in the last stage of their lives, was introduced into the HIB field by Asla,^[13,14] whose study was undertaken in two retirement communities in the United States.

In this entry, we review literature where “older adults” are regarded as aged at least 60 years, but we also describe what is known about how baby boomers might bring changes in HIB as they reach the age of 60 plus as the oldest ones have already done. Where possible, the sub-age groups, mentioned earlier, will be discussed in relation to key topics of discussion.

The Imperative for Studying Older Age Groups

Of crucial importance in any consideration of the information needs and behavior of older people is the effect of the very large generation labeled as “baby boomers” (persons born between 1946 and 1964). While the youngest baby boomers have yet to turn 60, there is growing interest in the future impact on the public library of the library and HIB needs of this cohort.^[15] A key argument for focusing research attention on older age groups stems from the fact that the proportion of older people is increasing and becoming quite significant. The phenomenon of the burgeoning older population is well known in the developed world. In the United States, the number of people aged 65 and over at the time of the 2010 Census was more than 40 million or 13% of the total population. Between 2000 and 2010, the population 65 years and over increased at a faster rate (15.1%) than the total US population (9.7%).^[16] Between 2010 and 2050, the US population aged 65 and over is projected to grow to 88.5 million, with the baby boomers, who began turning 65 in 2011, being largely responsible for this increase. By 2030, when all of the baby boomers will have turned 65, the percentage of the US population aged 65 and over will be 19% (compared to 13% in 2010) and will rise slightly again by 2050.^[17] In 2030, when the last baby boomer turns 65, the demographic landscape will have changed significantly. One of every five US citizens—about 72 million people—will be an older adult.^[18] The number of people in the oldest age group (85+) is also projected to rise dramatically from 5.8 million in 2010 to 8.7 million in 2030 and 19 million in 2050 (4.3% of the US population, up from 2.3% in 2030), again because of the effect of the baby boomers.^[17]

In Australia, where the lead author of this entry lives and where a major study of the information-seeking behavior of the older population was undertaken, there are comparable statistics. At the time of the 2011 Census, 3.1 million people were aged 65 or over, accounting for about one in seven Australians.^[19] Between 1971 and 2011, the proportion of Australia’s older people increased from 8.3% to 14%. The projected increases are to 22% in 2061 and to 25% in 2101. For those aged 85 years and over (the age group most apt to be in or entering the Fourth Age), numbers had more than tripled, to 420,300 between 1971 and 2011, with proportions increasing from 0.5% to 2% of the population over that period. This group is projected to grow rapidly, to 5% by 2061 and to 6% by 2101.^[20]

Like Australia and the United States, all of the world’s developed nations face the same problem of rapidly aging populations. Given such large increases in numbers and population percentages, it is imperative that there be an increase in research in all fields, including in the “information” arena.

Library-Based Research

Starting with the 1975 White House Conference on Aging, there were a large number of studies and discussions focusing on the provision of library services to older people, some emanating from the American Library Association (ALA). In recent years, the number of such studies has declined dramatically despite the increased aging of the population, as noted by Perry.^[21] The White House Conferences on Aging, held every 10 years, involve events sponsored by the ALA, the latest in 2005 titled “Libraries, Lifelong Learning, Information and Older Adults.”^[22] The ALA has also provided guidelines for library services to older adults.^[23] An important resource, the database AgeLine, produced by the American Association of Retired Persons and available on EBSCO Host, is a very useful resource provided in some public libraries. Decker provides a worthwhile discussion of baby boomers in relation to the US public library system, focusing on facilities, services, technology, and library staff.^[24] Her article draws on several papers presented at a conference in NSW (Australia) in 2009: “Next chapters: public libraries for older adults in Australia and New Zealand” and published in the journal, *Australasian Public Libraries and Information Services*. The papers cover a range of needs, services, and age cohorts, including baby boomers.^[25] Earlier library-based research focused primarily on audits of services, programs, and the allocation of library resources for older patrons, for example, Turock and Ip.^[9,26] A recent study using this approach was undertaken by Perry.^[21] Unfortunately, most of these studies treated older users as a homogeneous group aged about 65 years and older. Since library services are not central to this entry, studies where libraries are the focus are not discussed further unless they shed significant light on needs and behaviors associated with everyday life information.

Everyday Life Information Seeking

What do we know about the needs of older adults for information for everyday life and how these needs are met? There are few projects that have explored this topic in any depth. We know that "health" is an important topic for older people and that there have been a number of studies of older people in relation to health information.^[27–29] Other studies have focused on online access for older people and people with disabilities, with "information" being an obvious concomitant.^[30] Other examples are provided later.

Two of the major studies of information seeking, published during the 1990s, took different approaches to the topic. Chatman^[31,32] studied the information world of 55 women, who lived alone in a retirement community in a southern US city and whose average age was 82 years (age range 68–100). Using what she termed "social network theory" and an ethnographic approach during the 2-year study, she explored the women's information and recreational needs, as well as the sources routinely used in response to those needs. For her, the term "social network" referred to the interpersonal communications that assist people in meeting problems and her focus was on the role of personal networks, for example, family, friends, neighbors, or professionals, in meeting the needs of older women. Williamson^[33,34] used an ecological framework, taking into account the physical and social environments of her participants, to explore the information-seeking behavior of her 202 older adults, aged 60 and over. The sample included 146 persons who were aged 60–74 (the young-aged), 44 persons aged 75–84 (the old-old), and 12 individuals aged 85 and older (the very old). The data were collected by interview (three with each participant) in both city and rural areas.

A further major multidisciplinary study employing the Fourth Age rather than chronological age was recently completed by Asla.^[13,14] Significant findings about the HIB of this specific group emerged from this study, which was undertaken in two retirement communities in the Midwestern US.

Information Needs

Chatman identified six broad areas where older people needed help: 1) *dealing with loss*, including loss of material possessions, friends and family, familiar and known surroundings, health, and control over one's life events; 2) *death and dying*, pertaining not only to one's own death but to the death of loved ones; 3) *the aging process*, the first dimension concerned with maintaining a high level of involvement in social and personal interests, known to be important in successful aging; the second concerned with sexism due to the unequal standards applied to men and women with regard to physical attractiveness as they age; 4) *uncertainty about the future*, focusing on worries such as "being a burden, going to a nursing home, dying, poor

health, or financial concerns"; 5) *fear of crime*, particularly affecting women; and 6) *loneliness*, again particularly acute for women who are four times as likely to be widowed as men. Chatman confirmed these broad areas in her own research but also found that the women had significant needs in such areas "as health, financial problems, and general news about activities in which one could become involved" (p. 78).^[32]

Williamson's approach^[33,34] was to build on earlier projects about information-seeking behavior of the broader community, as well as studies of older people from other fields, for example, Tinker et al.^[35] from gerontology and Nussbaum et al.^[36] from communication. This enabled comparison with these studies. As with other studies of the information needs of older people, health was the number one topic for the sample as a whole. The second topic of concern was income and finance, and recreation was the third. These topics have all emerged as important in other studies. Other topics, in descending order of importance, included government, consumer, housing and accommodation, retirement benefits, crime and safety, environment, pharmaceuticals, holidays, legal, transportation, family and personal, education, employment, services (e.g., meals on wheels), and volunteer opportunities. Voluntary work was found to be an important topic in phase 2 of Wicks' North American study, the phase involving the younger of his two cohorts who were not living in residential communities.^[37] This topic is likely to be a significant interest of baby boomers who are now beginning to be part of the "young aged" group.

Asla's study^[13,14] findings, regarding the daily living information needs of his Fourth Age cohort, were similar to those of Williamson. The first of the two exceptions was "adaptive devices" for which about 80% of participants expressed a need for information, mostly for vision and hearing losses. The second was "safe mental challenges," noncompetitive activities such as matching wits with television game shows like *Wheel of Fortune* (these were encompassed, in a more minor way, in Williamson's "recreation" category).

Research focusing on the likely library needs of baby boomers as they retire from their full-time occupations suggests that some of their information needs, right through the stages of their older age, are likely to be different from the past^[10,38–40] especially given the better health they will experience and their increased life expectancies. The literature indicates that additional important information needs will be connected to issues of successful retirement and the challenges of aging well, estate planning, travel, genealogy, and employment planning that will be different from the past in that baby boomers may wish to continue working, although in a more flexible capacity than in the past, or may have to work to sustain the lifestyles they want. The latter scenario is more likely in the case of the younger boomers who are likely to face more financial hardship than the older cohort.^[41] Projected

worker shortages mean that governments are now encouraging people to work longer.

What do we know about the differences in information needs of the three groups within the broad older cohort? The Williamson study found that the younger aged had a need for more information topics and that the range of information needs diminished as people became part of the "old-old" or the "very old" cohorts. The exceptions were the topics health, income, recreation, and pharmaceuticals, where the needs remained strong as people age. Asla, too, found that information needs declined, although this decline could sometimes be slowed by outside intervention, such as providing people in the Fourth Age with opportunities designed to help them maintain their role identities. For example, in one of the retirement communities, residents were given roles such as "librarian" or "artist."

Information Sources

Given that social networks underpinned Chatman's study, she undertook a deep exploration of the interpersonal relationships and support provided to study participants. The residential setting was crucial here as it meant that there were many "neighbors."

Although Chatman found some use of professionals (e.g., doctors, lawyers) as sources of information, she did not find as strong dependence on professionals as Williamson did among the old-old and very old (but not the young aged). Chatman^[31] found the mass media to be important in mediating access to the larger world for those who were now isolated from it. The most frequently used medium was television, followed by books, newspapers, radio, and magazines. Wicks^[37] and Williamson^[33,34] also found that the media were very important, with newspapers, television, printed information, and radio all being in the top six most used sources in the Williamson study. A recent study has focused on media use by older adults.^[38] Both Chatman and Williamson found that there was considerable use of libraries that, in Chatman's case, occurred through the outreach service offered to the retirement community.

In the Williamson study, the list of six sources that were very frequently used in information seeking or acquisition, regardless of topic, included (along with the media sources) family members at number 1, and friends at number 3. Nevertheless, there was a difference in source use according to age, which to some extent mirrored the "information needs" picture in that the young aged used more sources, particularly media sources, than the "old-old" or the "very old" cohorts. The two oldest groups set particular store by medical professionals and paraprofessionals for meeting key information needs and also were more reliant on family members and, to a lesser extent, on friends. As Chatman found, "friends" from earlier life stages were not a key information source for some of the very old since members of this group were becoming

increasingly isolated due to failing health and the loss of friends through death or other circumstances. Also, they sometimes appeared to be unable to sustain the effort needed to maintain friendships. Asla,^[13,14] whose study like Chatman's was undertaken in the small world of retirement communities, found that key information sources were caregivers, usually one specific family member or an individual who was "like family" (including retirement community staff members). Other key informants were intimate social networks, including other family members and close friends. Other sources included wider social networks; mass media; small world sources such as resident meetings and information grounds; and outside professional and institutional sources. Asla also found proxy information seekers (i.e., people who sought information on behalf of those needing the information) became increasingly important, as also demonstrated by Pálsdóttir's Icelandic study of frail elderly still living in their own homes.^[43]

Information Literacy of the Very Old (the Fourth Age)

This is a topic that has been discussed in the literature, to a limited extent. Williamson and Asla^[44] discussed issues of whether commonly discussed definitions of information literacy are appropriate for people in the Fourth Age and thus whether general definitions of information may be found wanting for this group. The multiple disabilities experienced by people in the Fourth Age are likely to have a major impact on information literacy, which is usually strongly linked to textual information. Williamson and Asla postulated that the first and foremost element needed for sustaining information literacy in this last stage of life is maintaining a healthy relational system, thus facilitating communication. Another component is attempting the "compression of information illiteracy" where the focus is to help people maintain the information literacy skills, which they have developed earlier in their lives. Asla explores these issues in his thesis.^[14]

Residential Communities

The effect of retirement communities on information-seeking behavior was important to the Chatman study,^[31,32] the first phase of the Wicks' study^[45] and to Asla's study of the Fourth Age.^[13,14] The sample for Wicks study consisted of 15 people residing in one of two residences for seniors, the majority of whom were in the "oldest-old" age group (mean age was 83.6). Wicks found that participants relied largely on meetings to find out what was happening in their residential setting. Wicks concluded that "information flow within seniors' accommodation is crucial and becomes even more important as age and functional abilities decline" (p. 23). He discussed the role of staff in this and called for research on information dissemination in residential communities. Asla

confirmed these findings about the importance of information provision within the small world. He also found that the opportunity for his participants to do internal voluntary work related to their personal role identities was important. Especially in one of Asla's two retirement communities, management consciously tailored volunteer opportunities to residents' interests. This challenges the conclusion of Wicks who found that lifelong role identity played no significant part in the information behavior of his retirement community participants.

Computers and the Internet

The Internet is making a major difference to the information-seeking behavior of the "young aged" as is made clear in the study of baby boomers by Williamson et al.^[15,25,46] The study was undertaken with baby boomers in 2005–2007, meaning that some of the participants would now be part of the "young aged." There was mainly a continuity of information needs as revealed in the earlier major studies, with health information needs being particularly important. While participants, as before, wanted access to a wide variety of information in as many formats as possible, they were making considerable use of the Internet for a range of information needs. As one technologically savvy participant commented, "apparently there's quite a growing trend towards self-diagnosis [on the Internet]." Another spoke of relying a lot "on electronic media. . . I access electronic databases like Medline to find out about medical issues."

Although the percentage of older people who go online has risen as the technological revolution has proceeded, there are still big differences between younger and older age groups. While, for the first time ever, more than half of Americans aged 65 or older went online in 2012 (59%), they still lagged behind younger Americans in technology adoption (p. 1).^[46] Moreover, Internet use and broadband adoption in this age group each fell off notably starting at approximately age 75. Some 68% of Americans in their early 70s went online in 2012, and 55% had broadband at home. By contrast, Internet adoption fell to 47% and broadband adoption fell to 34% among 75–79 year olds (p. 2). Physical, cognitive, and sensory losses are major impediments for the very old or people in the Fourth Age.^[47] In Australia, 83% of the population went online in 2012–2013, but age group percentages fluctuated from 97% of people aged 15 to 17, to 46% of those who were 65 or over.^[48]

Dickinson and Gregor^[49] found that "technology is frequently presented as a panacea for the support needs of the ageing population" but that research did not support that conclusion. Research shortcomings included "failure to distinguish between the effects of training/support and computer use; misattributing causality; [and] inappropriately generalizing results from a different population" (p. 744). With technology use declining as people become

increasingly old, electronic information delivery is unlikely to meet their needs. While half of Asla's Fourth Age participants used, or had recently used computers and/or the Internet, by the end of the 2-year study, not one participant had been able to independently master, let alone successfully maintain a new computer or Internet skill. As their physical and cognitive health failed, they needed more and more technical support and services, and had to rely more and more heavily on proxy information seekers.^[13,14] Wales^[50] saw the Internet for frail and vulnerable older people (including those in daycare centers and residential homes) as "a person issue before a technology issue." While some may be able, with assistance, to learn Internet skills for themselves, a personal approach is needed because of the physical limitations of the people involved and the unfamiliarity of the technology and its benefits to many older people (p. 41). Even the younger aged may not be satisfied by electronic information delivery alone. A key finding of Wicks' study of nonresidential older people^[37] was that they strongly preferred obtaining information through interpersonal contact and print sources rather than through electronic delivery despite the increasing preference of governments to delivery of information via the Web (p. 20).

There is a large body of literature about computer use in relation to disabilities, much more likely to affect the very old/oldest old and, to a lesser extent, the old-old. The use of assistive technology, such as large print keyboards and enlarged text on screens, can be greatly beneficial and help to prolong Internet use.^[51,52] There is also no shortage of advice in the literature on interface design issues.^[53,54]

There has been some useful research undertaken regarding e-health literacy and collaborative learning.^[55–57] Xie conducted a series of experiments focused on computer-based training, to encourage participants to play a greater role in their health management. The experiments showed improvements in skills and attitudes. Participants reported that their learning had affected their participation in their own health care and provided positive feedback on the intervention.^[57]

Conclusion

To date, there have been few substantial studies of the information needs and behaviors of older adults that have not been limited to a library context. Given the fact that the proportion of older people is increasing and becoming quite significant, at least in the developed world, there is scope for more research to take place. It is important that future research take account of the very wide age span from aged 60 or 65 upward, and that this group is no longer treated as homogeneous in its needs, behaviors, and environmental contexts. It will also be important to include the use of the Internet for information seeking by the older age groups as this area is under-researched at

present, but it is particularly important that it should be examined in the context of other sources of everyday life information. Studies that span all sources of everyday life information are likely to be most fruitful, given the finding of the extensive Williamson study (pre-Internet), confirmed in other literature, that “no one source is able to provide all the information needed by a very diverse older group” (p. 267).^[58] Williamson, the first author of this entry, added that “it is also imperative to consider the likelihood . . . that older people will be slower than other groups to accept computer-based sources of community information.” This prediction of almost 20 years ago is, at this stage, turning out to be correct. With regard to tomorrow’s Fourth Agers—those who have employed computers and the Internet in the workplace—the second author’s research^[14] suggests that the physical, social, and cognitive losses associated with the Fourth Age will make it increasingly difficult to maintain those skills, let alone master new ones. Research into viable outside intervention and support to offset or delay this HIB challenge is badly needed.

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One-Person Libraries

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Abstract

A one-person librarian (OPL) is a person who works in a one-person library. What does that mean? An OPL is the only librarian (or only professional librarian) in a library or information center. The OPL does everything from acquisitions, cataloging, circulation, and reference, even dusting the shelves and vacuuming the carpet, if necessary. It is a situation in which there are no professional peers with whom to share problems and ideas, or to commiserate with when things get tough. The OPL often does not have to go through layers of administration to get approval for purchases or new programs. OPLs know exactly what is going on their libraries: what is being checked out, what questions are being asked, who is using the library, etc. The OPL is often perceived as the “information guru” in the organization—the one to whom everyone comes for answers. Finally, any and all successes (and, of course, failures) of the library are also those of the OPL. They can make of it whatever is in their vision and power.

Other names for an OPL are solo, sole-charge librarian, or one-man band. The movement, and even the term OPL, can be attributed to Guy St. Clair, the original founder of *The One-Person Library: A Newsletter for Librarians and Management*.

INTRODUCTION

A one-person librarian (OPL) is a person who works in a one-person library. What does that mean? An OPL is the only librarian (or only professional librarian) in a library or information center. The OPL does everything from acquisitions, cataloging, circulation, and reference, even dusting the shelves and vacuuming the carpet, if necessary. It is a situation in which there are no professional peers with whom to share problems and ideas, or to commiserate with when things get tough. The OPL often does not have to go through layers of administration to get approval for purchases or new programs. OPLs know exactly what is going on their libraries: what is being checked out, what questions are being asked, who is using the library, etc. The OPL is often perceived as the “information guru” in the organization—the one to whom everyone comes for answers. Finally, any and all successes (and, of course, failures) of the library are also those of the OPL. They can make of it whatever is in their vision and power.

Other names for an OPL are solo, sole-charge librarian, or one-man band. “Until about twenty-five years ago, one-person librarianship as a recognized branch of specialized librarianship and information services did not exist.”^[1] The movement, and even the term OPL, can be attributed to Guy St. Clair, original publisher of *The One-Person Library: A Newsletter for Librarians and Management*.

Although there are OPLs all over the world, this entry focuses on their history and activities in English-speaking countries, mainly the United States, Canada, the United Kingdom, and Australasia.

BRIEF HISTORY OF THE OPL MOVEMENT

1972: Guy St. Clair was invited to lead a discussion at the 1972 Special Libraries Association (SLA) annual conference in Boston, Massachusetts, on “The One-Man Library.” He said he would do so only if the title was changed to “The One-Person Library.” This is the first instance of the term OPL being used. Hundred of OPLs attended the session, overflowing the room.

1976: St. Clair’s first article on the OPL was published, followed by several workshops and seminars.

1984: St. Clair founded *The One-Person Library* newsletter with Andrew Berner.

Early 1980s: The One-Man Bands group of Association of Special Libraries and Information Bureaux (ASLIB) was formed in the United Kingdom. The group is no longer active.

1986: The first book on OPLs, *Managing the One-Person Library*, was published by St. Clair and Joan Williamson.

1986: The One-Person Library Support Group was established as part of the Toronto, Canada, chapter of the SLA. First chair was Penny Lipman, Rio Algom, Ltd. This is the first OPL group we know of anywhere in the world. It is still very active.

1987: The first 2-day continuing education course on one-person librarianship was taught at the SLA annual conference in Anaheim by Guy St. Clair, who taught similar courses until 1998.

1988: At the SLA annual conference in Denver, Martha Rose (Marty) Rhine led two roundtables on one-person libraries. She circulated a list to obtain participants’ names

and addresses so they could keep in touch. Ninety-nine people signed the list.

1988: Using the list as a base, Marty formed the Solo Librarians Caucus of the SLA, with an initial membership of about 100.

1991: The Solo Librarians Caucus became a full-fledged division of the SLA. Judith Siess was the first chair.

1991: Guy St. Clair was inaugurated as president of the SLA.

1991: *The Best of OPL* was published, consisting of selections from the first 5 years of the newsletter.

1995: One-Person Australian Librarians (OPAL) was formed as a special interest group of the Australian Library and Information Association after the Health, Law and Specials Conference in Sydney. Georgina Dale, Toni Silson (now Kennedy), and Therese Bendeich were its first leaders.

1996: The first German OPL Roundtable was held, organized by Evelin Morgenstern of the Deutsches Bibliotheksinstitut/German Library Institute (DBI), Berlin, Germany.

1997: AspB (the German Special Libraries Working Group), devoted its biennial conference to small special (OPL) libraries.

1997: VdDB (Verein der Diplom-Bibliothekare), an association of professional librarians in Germany, established the OPL Kommission, with Regina Peeters as chair. This special working group offers continuing professional education programs for OPLs at least twice per year.

1997: *Das Robinson-Crusoe Syndrom und was man dagegen tun kann* (The Robinson Crusoe Syndrome and What You Can Do About It) was published, with reports from 24 German OPLs describing their work.

1997: The Solo Librarian's Sourcebook by Judith Siess was published.

1997: The first meeting of Special Librarians (many of them OPLs) in the Midlands (SLIM) was held in Birmingham, England. Chris Crabtree and Margaret Brittin were the founders.

1998: A Most Delicate Monster: The One-Professional Special Library by Jean Dartnall was published in Australia.

1998: Information Bridges International purchased *The One-Person Library* newsletter. Judith Siess was the new editor/publisher.

1999: Special Librarians in London (SLIL) was founded by Bert Washington of Sports Marketing Surveys. This function is now fulfilled by the Industrial and Commercial Libraries Group of CILIP.

1999: The Workplace Libraries discussion list was launched April 1999, by the Library Association (now CILIP, Chartered Institute of Library and Information Professionals; United Kingdom). (Now discontinued.)

1999: An electronic discussion list just for OPLs was established by the Library Association. (Also discontinued.)

1999: The Workplace '99 Initiative was started by the LA to increase awareness of commerce, industry, government, and voluntary institution libraries. Lyndsay Rees-Jones and Mark Field are the LA Professional Advisors for Special Libraries. (Discontinued, but Rees-Jones is still actively assisting solos.)

1999: A Solo Professional network was set up by Steve Witowski of the East Midlands Branch of the LA. (No longer active.)

2000: The first meeting of Special Librarians in Cambridge (SLIC) was held in England. Lis Riley was the founder. (Still active.)

2000: OPAL published its first book, *Evaluating Websites*.

2000: Initiative Fortbildung für wissenschaftliche Spezialbibliotheken und verwandte Einrichtungen (Initiative for Special Libraries and Similar Institutions) was formed in German as DBI was being dissolved.

2004: The OPL Archives were established by Judith Siess at the University of Illinois at Urbana-Champaign (where both she and Guy St. Clair received their library degrees). Material in the archives includes copies of all issues of *The One-Person Library* newsletter; books on OPLs from the United States, the United Kingdom, and Australia; copies of many articles by and about solos and OPLs.

2005. *The Essential OPL, 1998–2004: The Best of Seven Years of The One-Person Library: A Newsletter for Librarians and Management*, was published by Judith Siess, with Jonathan Lori.

2006. *The New OPL Sourcebook* was published by Judith Siess.

How many OPLs are there? Because of their size, there is no accurate count of OPLs, but the following figures are available. The SLA estimates that close to 60% of their more than 11,000 members are OPLs. That is nearly 7000 OPLs in special libraries alone! (The Solo Librarians Division of SLA grew to nearly 1000 members before a decline that paralleled that of SLA as a whole. In 2007 there were nearly 700 members, the fifth largest division in the organization.) A large percentage of U.S. public libraries have no more than one professional librarian. Most school libraries have only one professional (if that many), as do most hospital libraries. Small law firms are unlikely to have more than one professional, and prison and church or synagogue libraries are lucky if they have any degreed staff. There seems to be a consensus that about one-third of the world's libraries are one-person or one-professional operations.

WHERE DO OPLs WORK?

Most OPLs work in special libraries. A special library is one serving a specialized or limited clientele, with specialized or limited materials and services. The emphasis is

often on providing information, rather than on books. The collection is usually small. The OPL nearly always reports to a nonlibrarian, and the library is part of, but not considered critical to, the parent organization's main mission. Most OPLs (about 80%) are solo by chance, with only 20% by choice. However, a lot of OPLs that started by chance now like it so much that they would not go back to a large library.

According to St. Clair and Williamson,^[2] a library with an OPL may be the organization's first library, newly established and unsure of how many staff it needs, destined to grow to include a larger staff. It can also be a downsized library, formerly having several librarians, but due to less demand, less money, or less awareness of need, now be reduced to one professional. Or, it can also be a right-size library, one that needs only one well-trained and efficient professional to serve the organization's information needs. This is probably the most common situation.

Although many OPLs work for corporations, there are other opportunities. Following are just a few of them.

Law Libraries

Librarians serving private practice or small law or bar associations are often OPLs, as are law librarians in government institutions such as courts or agencies, and some public law libraries, but these make up only about 15% of law librarians. Most law librarians in academia and law schools, where a library is required for accreditation, are not OPLs. Only 29% of law librarians have law degrees, but nearly all (80%) have library degrees. Most employers look to their law librarians to save billable hours of the lawyers, to save attorneys' time and billable hours looking for information, and to add to revenues by having the librarian perform billable information searches for clients. Sometimes they are also looking for other capabilities, such as archives, records management, managing dockets, conflicts checking, and supervising paralegals. The future will probably see an expansion of the law librarian into other areas, including skill-based resource management, client current awareness services, research for client and practice development, supporting speaking opportunities (speeches and seminars), research or reference and/or technology training for clients, internal and client newsletters, web page design, content, management, coordinating continuing legal education programs, managing paralegals, and formal legal research training for new staff. (Note: If librarians are asked to perform research for clients, they should be sure it is included in the firm's profitability analysis.) The issues facing legal OPLs are the need for rapid delivery of information, often with price insensitivity; the currency and accuracy of the information; the high degree of confidentiality expected; deciding the fine line between legal research and interpretation; and dealing with summer interns or law clerks. Also, academic

law librarians are becoming increasingly responsible for teaching legal research techniques to students. Other issues not unique to law librarianship are timeliness, currency, accuracy, thoroughness, detail, rising costs, and burnout, and an emphasis on the practical uses of information. Academic law librarians get more involved in research, history, and comparative law. In a summary of several studies of how lawyers find information, researchers found that 50–60% of them do not go to librarians for help, even if they have trouble finding the information themselves. They do not use the librarian to learn how to search, only to provide the documents they identify from their own search.

Prison or Jail Libraries

Most states require the provision of access to legal materials to inmates (although some have decided to close all their prison libraries). Most prison libraries remain one-person positions, despite staffing-level recommendations. Most prison librarians are professionals. Prison librarians have problems motivating their inmate assistants due to turnover and lack of a strong work ethic. They are also concerned with confidentiality, and the dividing line between legal reference and legal advice. Another hot current issue is the computerization of prison libraries. Prisons are reluctant to replace books with computers because of the potential for online crime. Jail libraries are usually smaller and less likely to hire a professional. The emphasis is on access to legal materials and recreational reading as a form of behavior control or self-improvement. Lack of funds, censorship, and low status are major issues. Personality traits needed by prison or jail librarians include an understanding of the political climate of the institution, survival skills, patience, a sense of humor, ability to follow the rules, and a professional demeanor.

Hospital Libraries

Hospitals used to be required to employ professional librarians for accreditation; however, they are now only required to provide access to appropriate materials. However, most hospitals still have libraries and librarians. Except in the large medical schools and hospitals, the librarian is often an OPL. The needs of physicians are similar to those of lawyers—rapid delivery of current and accurate information, price irrelevant, and with a practical application. Many hospital librarians are also involved in patient service, archives, consumer health information, and administration of physician continuing education. Some librarians are even part of the treatment team—this practice is increasing with the advent of higher training levels for librarians and the computerization of medical information. Hospital libraries frequently have a staff of volunteers of varying degrees of training and commitment with which to work. This may or may not help the OPL's

workload. The Medical Libraries Association offers a certification program in medical librarianship. Although certification is not required for all medical librarian positions, it is strongly encouraged.

Museum or Zoo Libraries

Museums, zoos, and libraries acquire, describe, and make accessible to us the records of human experience, covering life sciences, education, business, philosophy, and art. Not all museums or zoos have libraries. The American Zoo Association/Librarian Special Interest Group (AZA/LSIG) consists of zoo and aquarium librarians, as well as individuals in zoos and aquariums that are responsible for their institution's library and operations. Formed in 1978, AZA/LSIG now has more than 90 members from zoos and aquariums spread across three continents. Some zoos use volunteers to staff their libraries, whereas many others combine the job of librarian with another position. These libraries have historically been underfunded, understaffed, and underused. Facilities range from just a collection of books and magazines for staff use to a fully organized and professional-directed information collection. The library is likely to have a relatively large number of volunteers. Nearly all the libraries provide reference service to staff, members, and the general public. Few circulate items beyond the staff, provide online searching, perform document delivery, or have access to the Internet.

Church or Synagogue Libraries

Many churches and synagogues have libraries. Some are staffed by volunteers (often a retired librarian or schoolteacher), but some of the larger ones hire professional librarians. Nearly all these are one-person positions. The church library functions as a centralized place for materials for church programs (a sort of learning and resource center), with the specific aim of promoting the spiritual development of its users. There are no specific educational requirements for the church librarian, but dedication, friendliness, ability to work with details, neatness, patience, and a sense of humor are suggested—the same criteria as for an OPL. Funding is usually minimal, as is pay, but it is a rewarding field for the dedicated.

Public Libraries

Surprisingly, a large number of OPLs work in public libraries. Nearly 80% of public libraries serve populations of fewer than 25,000 and are staffed by no more than one professional.^[3] The library director is the heart of the library, representing the library to the community, the board, and the staff. Public librarians face similar issues as corporate or other types of librarians: a sense of intimacy with their patrons, overwork, doing it all, dealing with nonlibrarians as supervisors (the library board). The

librarian and the board are often at odds about the role each should play. OPLs in public libraries also face some unique issues: building maintenance, bond issue, etc. Another issue unique to public libraries is the relationship to the school system. Some communities may not understand the necessity to support two separate library systems. Pay for directors of small public libraries is often abysmal; there are personnel issues and long hours, but, as with all OPLs, you run the show.

Public or Private School Libraries

School librarians and media specialists are often OPLs. Many of them serve two or more school libraries, with volunteers (often students) staffing the library when the librarian is not there. All professional school librarians must also have a teaching certification. They are seen as an extension of the classroom and often assist teachers with special projects, as well as running the library and teaching library skills to the students. Some even have such varied duties as story hours, teaching reading or English, computer instruction, advisor to student groups, running the bookstore, and lunchroom supervision.

Information Brokers

The work of information brokers falls into two main categories: information retrieval and delivery, and information organization. The latter is often called information consulting. He or she may design and produce databases, perform primary and secondary research, obtain documents, perform abstracting and indexing, evaluate libraries, manage libraries, perform outreach and public relations, perform translations, act as a records manager, train librarians, write or edit books, articles, or newsletters—or almost anything else you can imagine. What does it take to be a successful information broker? Patience, speaking and writing and telephone skills, organizational skills, a sense of humor, ability to integrate disparate concepts, problem-solving ability, perseverance, broad base of knowledge, dedication and hard work, enjoying working alone, ability making decisions, ability to prioritize, energy, intelligence, creativity, computer skills, confidence, optimism, and the ability to sell yourself and your services—in other words, the same skills as a good OPL.

Market Researchers

An increasing number of librarians work in the competitive intelligence (CI) field, usually as OPLs. CI is the gathering of information that will assist a company in maintaining its competitive edge. (It is not, as some think, only gathering information about one's competitors. It also includes information about a company's customers, keeping up with technology and anything else that makes

the company better able to compete.) Librarians are exceptionally well qualified to do CI, being trained to search for, analyze, organize, and disseminate information. They are experienced in working in an interdisciplinary environment. They already have their own networks. Other traditional library competencies that transfer well to CI include online searching, the reference interview, current awareness, knowledge of bibliographic tools, computer skills, written presentation skills, and time management.

Other Opportunities

The nontraditional sector is probably the fastest-growing area of librarianship. A librarian's skills can be applied in many fields. One can be a representative for a library supplier, a writer or publisher, a consultant, work for a market research firm, a not-for-profit organization, a government agency, a document delivery service, an association library, in website development, or for a library consortium or network. Job opportunities are limited only by your imagination, creativity, interest, and persistence.

WHAT DOES AN OPL DO?

The tasks of an OPL fall into the following categories:

Managerial

- Manage any clerical employees or volunteers available, including hiring, discipline, and firing.
- Manage one's own time, including learning to deal with interruptions.
- Create and distribute publicity for the library. This may include a weekly newsletter, articles in the organization's publications, and open houses.
- Organize library files and, because there is no one else to do it, file.
- Write monthly and annual reports to management.
- Prepare, distribute, and evaluate user surveys to determine user desires, attitudes, and satisfaction.
- Keep and analyze a wide variety of statistics.

Technical

- Locate, evaluate, and order books and magazines, often for the entire organization, not just the library.
- Follow up on orders.
- Check books and magazines in and out, and keep statistics on what is and is not being used.
- Answer questions from people within the organization, whether they come in by telephone, mail, e-mail, fax, or in person. These requests for information may use resources in the library or involve ordering articles from another library. Often these are "rush" requests

with a deadline that can be as short as within the hour. Other questions involve extensive research and a written summary.

- Teach users how to find information, in the library and on the Internet.
- OPLs are often in charge of the organization's audio-visual equipment (slide projectors, etc.).
- Evaluate new electronic services and sources; arrange a demonstration or trial period, if possible; and recommend or make the final purchase decision. This may include computer, systems, and software, too.
- Troubleshoot or repair equipment such as computers, photocopiers, printers, and even entire networks.
- OPLs are often asked to create web pages for an organization's Intranet or Extranet, and sometimes serve as the organization's webmaster.
- In addition to the above, OPLs are often in charge of an organization's archives or records. OPLs in hospitals are often given responsibility for tracking physician continuing medical education and/or patient or consumer education materials.

Professional

- Participate in local, regional, national, or even international library organizations and networks. OPLs often serve in leadership positions.
- Keep up with the library and information worlds by reading professional literature and following electronic discussions.
- Arrange for one's own continuing education—attending seminars, professional conferences, and courses.

Financial

- Pay bills.
- Purchase office supplies, catalog cards, copy paper, computer media, etc.
- Prepare the library budget.
- Track library expenses.

Why would anyone want to be an OPL? The three most common reasons are independence, variety, and an enhanced feeling of self-worth. OPLs enjoy the ability to run their show, plan their own schedule, and set their own priorities, with a minimum of supervision (and interference). The life of an OPL also has its drawbacks. The most commonly mentioned problems are professional isolation, lack of clerical support, the need for reporting to a nonlibrarian, and low pay.

Because many OPLs are OPLs by choice, obviously the pros must outweigh (or at least equal) the cons. Perhaps the key is in fitting the right person to the job. Most people agree that an OPL should be flexible and creative, biased toward service, able to share and build coalitions,

idealistic, resourceful, curious, self-confident, and patient. In addition, the OPL should be able to work alone; manage time, think analytically, and see the big picture; have a sense of humor, good organizational skills, good recall, excellent oral and writing skills, and a high tolerance for frustration. Can these skills be taught? They probably cannot, but the specific tools and techniques to make the most of them can be learned, either in library school, on the job, or through continuing education. An OPL must also have confidence in making good decisions, an entrepreneurial attitude, comfort with networking, proficiency in gathering supporters, a lot of flexibility, good time management and balancing of priorities, a love for the profession, ability to cope with lots of bosses and patrons who think they are the only client, a readiness to take risks and learn something new every day, a passion and enthusiasm, and a willingness to dive in to do anything.

HOW DOES AN OPL HELP THEIR ORGANIZATION ACHIEVE ITS GOALS?

All employees must be involved in their organization's goals, but this is especially important for OPLs. They must ensure that the library is seen as a critical part of the organization and that it is involved in mission-critical issues. The library's mission statement must closely mirror the mission of the organization. The library must also be relevant to the lives of its users. The OPL knows more about the organization and its business, the users and their needs, and how to collect, organize, and disseminate information than anyone else in the organization because of its strategic position as the information hub.

Power makes organizations run. An OPL must know the organization's corporate culture—its shared beliefs, values, and assumptions. The OPL also learns how the organization is formally structured and how it actually works, who is in power and who is not; what information the organization needs, who needs it, how it flows within the organization, team dynamics, and communication.

The OPL's customers are management, other professionals, secretaries and other clerical staff, manufacturing workers, the mailroom, and perhaps even the cleaning staff. All these are potential customers of the library. Ideally, all should be treated equally, but it would be foolish not to recognize that one will be much faster to respond to an inquiry from the president or managing director of the organization than from a worker on the assembly line. However, it is the importance of the answer to the continued existence of the organization, not the position of the customer on the organizational chart that matters. Users do not want information, they want answers. They want their problems solved. This answer could be an article, a book, a list of references or websites, or even a summary report with the answer to the question. This is how the library can best add value. Clients also expect the library to help lower

their cost of doing business—by saving them time and, therefore, money. Another way the OPL helps the organization is by making information convenient for them. This can mean anything from taking requests over the Internet to putting databases and research services on their desktops.

OPLs must be proactive and anticipate what customers will need and be sure they can meet the demand. This involves planning, thinking, anticipating, and taking the initiative. The keys are communication with and to customers, and taking responsibility for information (evaluating it for content and quality). OPLs find out what customers need by observing, listening, and reading both the library and industry literature.

The OPL should also be involved in "knowledge management." Knowledge management is the art of making creative, effective and efficient use of all the knowledge and information available to an organization all for the benefit of clients. Its implementation requires a review of the organization's values, culture, infrastructure, and management of intellectual assets. Knowledge management is a new focus on information and knowledge, creating a knowledge-valuing environment, where information is shared, managed, and used. Librarians in general, and OPLs in particular, are perfectly situated to be the knowledge management leaders in an organization. They already understand the organization and its information flows. Their people skills and customer service orientation allow them to work well with all levels of the organization, from the factory floor to the highest levels of management. They can find information, evaluate it, and produce analytical reports of its significance.

THE FUTURE OF ONE-PERSON LIBRARIANSHIP

Librarianship will increasingly depend on technology. However, the computer or the Internet will not be able to answer every question, will not replace the human touch, and cannot greet the user with a smile. Technology must be seen and designed as just another tool to solve problems, not an end in itself, leading us only to find new ways to use new technology. The costs, benefits, and impact on users of any proposed innovation must be weighed before its adoption.

Many people expect that the information user of the future will not have to come to the library at all, relying on Internet, phone, or e-mail access. Libraries may indeed go virtual, but there will always be a need for a physical repository somewhere and someone to decide what to put in it, devise an order for it, and arrange access to it.

More and more librarians, especially OPLs, will be working outside libraries in an organization or on their own. The location of a librarian in a physical library may be unnecessary and, in some cases, undesirable. In the corporate sector, librarians are moving out of the library into the business units, working alongside other professionals to provide the information needed for informed decisions right

at the point of the decision. Partnering or team-building skills will become even more vital in the future in the corporate world. This is also important outside the for-profit arena, as librarians are increasingly required to work as part of research or project teams in organizations, participate in clinical rounds in hospital rounds, and support teams of attorneys working on large, involved cases. In the electronic future, the librarian's world will become wider.

Medical librarians are already moving out of the library and into the future. One example is clinical librarianship, where the medical librarian receives special, accelerated medical training and then becomes a part of the patient team. The librarian accompanies the physicians on rounds. Equipped with a laptop computer, a wireless modem, an Internet connection, and access to medical databases, the librarian can often provide instant answers to clinical questions. When the answer cannot be found immediately, the librarian returns to the library (or their desk or cubicle) and engages in a lengthier search, delivering the answer (not raw data or articles) to the physician within hours.

Instead of OPLs being downsized out of existence as many fear, it is likely more will be created. Some of these will be, unfortunately, from the downsizing of larger libraries, but many more will come from the realization that information is absolutely necessary for an organization's success and that a trained information professional, that is to say a librarian and not a computer person, is the best one to handle this responsibility. To quote St. Clair:

[managers] will find that they get more value for their money by employing one highly skilled and effective librarian/information specialist instead of a team - however small - of generalists who are not as skilled. There is also recognition in the profession that one-person librarianship just might become a standard for library staffing in the future. [Often] one excellent, efficient, and enthusiastic librarian or information specialist is preferable to two or more who do not provide the same level of service for users.^[4]

Although there have been drastic changes in the information climate since he wrote these words, the desire for good library service or good information delivery has not changed. Because of the following, the OPL more than ever is able to serve an organization's information needs with little or no assistance:

- Advances in technology, including networking, electronic information available online or on the Web at little or no cost (in money or time)
- Concentration of librarian resources on mission-critical functions and outsourcing or elimination of nonessential services
- Increasing capability of users to find answers to noncomplex questions, or for law librarians or attorneys using electronic resources to perform their own

legal research, thus allowing librarians to focus on business, medical, or international issues

- Better training and education for librarians in general and OPLs in particular; a heightened sense of professionalism by OPLs, accompanied by more attendance at continuing education events; and increased interpersonal networking and establishing of professional cooperative relationships

There will, of course, continue to be challenges. The idea that "everything is on the Internet and is free" is a serious problem. OPLs must show their clientele that they have only found the tip of the information iceberg and the rest can best be found with the assistance of a librarian. A second major challenge is downsizing. All librarians, but OPLs in particular, need to demonstrate their value to management on a daily basis. They have a responsibility not only to keep the information professional in the organization, but also to demonstrate to future generations of librarians how great it is to be an OPL.

Fundamentally, OPLs around the world are the same; yet, there are some critical differences. The concept of one-person librarianship has not been well known outside the United States, Canada, the United Kingdom, Australasia, and Germany. Although there undoubtedly are many OPLs around the world—in fact, they may predominate—there is no good way of reaching them. They are most likely working in "less-developed" nations in small libraries in small communities or charitable institutions, and are unlikely to be degreed librarians (or to have even had any library training at all). Managers and even library directors are not library professionals. Library work is not valued. Job responsibilities for trained librarians may be limited to technical processing (choosing books, cataloging them, checking them in and out), with no time for helping people with their information needs.

The full potential of technology is unrealized in much of the world. Even e-mail and electronic lists cannot be used because some of the smaller libraries do not have access to a network, but need to dial up to use their e-mail and they only get the chance to do this once or twice per day. Some libraries do not even have a computer. In many countries, library resources and organizations are less plentiful. Problems with currency fluctuations and the resultant high cost of online services and journals can cause major problems for many OPLs. Educational systems outside the United States are structured quite differently. There is not always an emphasis on customer service.

It is almost certain that there will be more OPLs in corporate and other institutional settings, and probably even in public and academic settings. Although some may see this as a bad thing, it can be an opportunity for those who enjoy working alone. Networking is now and will continue to be imperative for survival. Fortunately, this is getting easier every day. There are multitudes of electronic discussion lists. Organizations serving OPLs are

growing and beginning to cooperate. For those in developing countries, networking is even more important. Therefore, it is incumbent on experienced OPLs to establish and maintain mentoring relationships with OPLs elsewhere so that they will no longer feel alone.

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Online Catalog Subject Searching

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Abstract

The Online Public Access Catalog (OPAC) is an information retrieval system characterized by short bibliographic records, mainly of books, journals, and audiovisual materials available in a particular library. This, coupled with a Boolean search interface and a heterogeneous user population with diverse needs, presents special problems for subject searching by end users. To perform effective subject searching in the OPAC system requires a wide range of knowledge and skills. Various approaches to improving the OPAC design for subject searching have been proposed and are reviewed in this entry. The trend toward Web-based OPAC interfaces and the developments in Internet and digital library technologies present fresh opportunities for enhancing the effectiveness of the OPAC system for subject searching.

OVERVIEW

An OPAC database records are usually derived from the MARC (MACHine Readable Cataloging) format. The records are brief bibliographic descriptions enriched with a small number of controlled subject descriptors (often taken from the Library of Congress Subject Headings) and a classification number (usually a Library of Congress or a Dewey decimal class number). The database records, thus, contain minimal information for searching—little more than the author, title, publication year, subject description, and a class number.

The subject descriptors are selected to reflect the subject content of the item as a whole rather than to provide in-depth indexing of the information contained in the item.^[1] For example, if a book contains many articles, subject descriptors are not assigned for each article but only to the overall topic of the book.

For periodical publications, only the periodical as a whole is described. Individual journal articles are usually not recorded in the database. This is in contrast to indexing and abstracting databases that provide keyword searching in the abstract and even the full text of articles, and provide exhaustive indexing of the content of journal articles. However, the distinction between OPACs and other kinds of information retrieval systems is blurring. Increasingly, OPACs are also providing links to full-text document, electronic books, and Internet resources.

Most of the online catalogs in use today are what Hildreth^[2] termed second-generation OPACs. Most

OPACs are Boolean retrieval systems that perform exact matching and require the search query to be specified as a Boolean expression. Typical search features include the choice of keyword searching (i.e., searching for individual words in the title and subject fields) or field searching with automatic truncation (e.g., searching for a whole title or author name), the use of Boolean operators to combine two or more terms, the use of a truncation symbol, and limiting a search to specific fields. *The onus is on the user to translate the user's information need into the subject headings and indexing terms used in the OPAC database and to refine the search based on the initial search result.*

Because most OPAC systems now offer Web access, OPAC interfaces are increasingly Web interfaces in the form of web pages containing HTML forms. Such interfaces are mainly form-filling interfaces. The user selects the type of search and the fields for searching either by entering the query in the appropriate input box or by toggling the appropriate checkbox or radio button. For keyword searching, the search expression can include Boolean operators as well as indications of which field(s) to search.

OPAC users are heterogeneous, varying widely in background, age, subject interests, and computer and information literacy. So the OPAC has to be designed to cater to a wide range of users, ranging from users who have little knowledge of what a catalog contains and have little experience with computer terminals to librarians who are experienced in online database searching and who require the system to have powerful search capabilities.

SUBJECT SEARCHING

OPAC searching is of two types:

- Specific-item searching (or known-item searching), where the user is trying to locate a particular item that the user knows of and has some information about (e.g., the author or fragments of the title)
- Subject searching, where the user wants to retrieve any item(s) on a particular topic.

The distinction between these two types of searching is fuzzy. A search often involves both types of searching. What begins as a specific item search often ends up as a subject search, especially if the specific item search fails to locate the desired item. Both types of searching have their particular problems. This entry focuses on the problems with subject searching.

Slone^[3] distinguished between two types of subject searching: unknown item searching and area searching. In an area search, the OPAC is used to identify the area in the library where materials on a particular topic are located. Online searching is kept to a minimum, and the user relies on shelf browsing to identify specific relevant items. In contrast, unknown item searchers rely on the OPAC to identify the specific relevant items.

Subject searching is an important activity that constitutes a major proportion of OPAC searches. However, estimates of the proportion of subject searches vary, partly because the proportion varies with the type of library and user group, and partly because of the practical difficulty of distinguishing subject searches from other kinds of searches.

In a nationwide survey of U.S. libraries in the early 1980s, Matthews et al.^[4] found that about 59% of online catalog use involved subject searches. Recent studies of OPAC transaction logs obtained percentages of subject searching ranging from 35 to 60%.^[5–10] It is possible that the actual proportion of subject searching is even greater than reported because some of the keyword title searches actually represent subject searching.

A number of studies found subject searching to be the most common type of OPAC searching,^[6,9,11] although other studies found a decline in subject searches and an increase in title searches.^[10,12,13] Two studies of university OPAC use found that undergraduate students tend to do subject searching, whereas graduate students and faculty tend to search by author or title and do subject searching only when working outside their own fields.^[13,14]

KNOWLEDGE NEEDED FOR SUBJECT SEARCHING

To perform effective subject searches requires the following kinds of knowledge:

1. Knowledge of the fields in the bibliographic records that can be used for subject searching and their characteristics.
2. Knowledge of the thesaurus system or subject headings list from which subject descriptors are selected and assigned to each bibliographic record.
3. Knowledge of search strategies and when and how to apply them.
4. Knowledge of the search capabilities provided by the OPAC system and how to use them.
5. Knowledge of the subject area.
6. Knowledge of how to translate an information need into a searchable query.

Borgman^[15] divided the knowledge needed into three types:

1. Conceptual knowledge of the information retrieval process—how to translate an information need into a searchable query.
2. Semantic knowledge of how to implement a query in a given system—how and when to use system features.
3. Technical skills in executing the query—basic computing skills and the skill of formulating search statements in the syntax required.

The main fields in the bibliographic record that contain subject information are the title fields, subject fields, and class number fields. Each subject field contains a subject descriptor or subject heading selected from the Library of Congress Subject Headings (LCSH) or from some thesaurus [e.g., the U.S. National Library of Medicine's MEDical Subject Headings (MESH)]. A subject descriptor comprises a main descriptor and optionally a number of modifiers called subheadings or subdivisions. To know what descriptor and modifiers to use when searching the subject field, the user has to consult the Library of Congress Subject Headings or thesaurus, which may be searchable online or available only in printed form.

Knowledge of the thesaurus structure, how the descriptors are selected to represent the subject content of a work, and how the descriptor–modifier combinations are constructed is important for searching the subject field effectively. Knowledge of the thesaurus structure includes knowing the kinds of relations (broader term, narrower term, related term, etc.) used in the thesaurus and how to make use of these relations.

In selecting terms to search in the subject field, users should be aware of the following two principles used by indexers when selecting descriptors from the thesaurus:

1. Descriptors are selected that summarize the content of the whole item rather than index all the concepts contained in the work. This suggests that when searching the subject field, the user should use a term

or descriptor that is broader than the concept of interest.

2. When selecting a descriptor to represent a concept in a work, the most specific descriptor that matches the concept is used (the rule of specific entry), and usually only one descriptor is used to represent a concept. An item that is assigned the descriptor "Fishes" will usually not be assigned descriptors for specific types of fish (e.g., "Sharks" or "Goldfish"). So, to locate books on all kinds of fishes, the descriptor Fishes and all narrower terms should be used for searching.

An alternative way of doing subject searching is to search for keywords in the title and subject fields. Keyword searching in the title field is particularly appropriate when there is no descriptor that matches exactly the concept that the user is interested in. The disadvantage is that a concept may be expressed by several synonymous words, each having several variant forms, and that all the synonyms and variant forms have to be used in the search to retrieve all the relevant records. In addition, keyword searches may retrieve many nonrelevant records if the keyword has more than one possible meaning.

One field that is often overlooked in subject searching is the class number field. To search this field effectively requires knowledge of the classification system and notation used. The user also needs to consult the appropriate classification schedule to identify the correct class numbers to use. The major advantage of class number searching is that it allows the user to browse neighboring numbers and find related works. This is similar to browsing at the shelves. One problem with the class number search is that only one class number is assigned to an item, even if the item covers more than one topic.

Author fields can also be used for subject searching, inasmuch as publications by the same author tend to be on the same or related topics.

Although most online catalogs have subject, title, class number, and author fields, the catalogs vary in the search capabilities provided, in the search language used for searching these fields, and in the design of the search interfaces. To perform effective subject searches, the user needs to know the search features available and how to use them.

Also needed is the more general skill of translating an information need into a searchable query. This may involve visualizing what information is needed to satisfy the need, the kind of book that is likely to contain the desired information, the content or topic of the book, and the terms that can be used to represent the topic. Some knowledge of the subject area is needed to think up broader terms, narrower terms, and related terms for searching and for looking up appropriate descriptors in the thesaurus.

Slone,^[3] in a study of OPAC use in a public library, found generating search terms was crucial to a successful unknown item search. When term generation was difficult,

unknown item searches failed. She found that users who performed very narrow searches tended not to find what they needed. Users who performed broad searches and then narrowed the search, by selecting terms from the search results to use in a new search, were more successful. However, many users had so little knowledge of what they sought that they were not able to generate related terms to initiate a search.

An appropriate search strategy is thus needed to apply all the above knowledge creatively to perform an effective subject search. Search strategies can be divided into initial strategies and reformulation strategies. Initial search strategies are used in formulating the initial search request. Reformulation strategies are used for formulating subsequent search requests to improve the search result after reviewing the initial search result. Reformulation strategies include broadening strategies for increasing the number of relevant records retrieved and narrowing strategies for decreasing the number of unwanted records retrieved.

PROBLEMS USERS HAVE WITH SUBJECT SEARCHING

Numerous studies using a variety of research methods have found that users have difficulty performing subject searches in online catalogs. Problems experienced by users include the following:^[8,16-18]

- Users have difficulty matching their search terms with those used in the online catalog.
- They have difficulty identifying terms that are broader or narrower than their topic of interest.
- They lack understanding of the thesaurus structure and the Library of Congress Subject Headings.
- They don't know how to broaden the search and increase the search result when too little or nothing is retrieved.
- They don't know how to narrow the search and reduce the search result when too much is retrieved.
- They don't know how to use Boolean operators and truncation and how to limit keyword searches to specific fields. They are generally not aware of the more sophisticated capabilities of the OPAC system.
- They don't know how to translate their information need into a Boolean search statement.
- They have difficulties with spelling.
- They have difficulty formulating a search command using the search language of the system.

Slone^[3] found that 60% of unknown item searchers in a public library OPAC were frustrated and 40% were disappointed. Only 20% were relaxed or content.

To obtain optimal results in subject searches often requires using more than one search strategy. The typical online catalog user does not know the range of strategies

that can be used or the limitations of each strategy. Users lack much of the knowledge described in the section “Knowledge Needed for Subject Searching” above.

A high proportion of OPAC subject searches result in null sets or zero postings.^[6–8,19] Spelling and typographical errors are among the most common errors.^[7,8,10,19] More help is clearly needed to help users recover from spelling and typographical errors and guide them to related terms that may retrieve items with useful information.

Studies of OPAC transaction logs have found that few users make use of Boolean operators in their searches (e.g., Connaway).^[10] Users are also confused about the difference between keyword searching and searching by subject headings. Connaway et al.^[14] found that many users searched the subject field when a keyword search might have been more appropriate. Hildreth^[20] found that most users do not understand how the OPAC system processes their keyword searches.

IMPROVING THE DESIGN OF OPAC SYSTEMS

Numerous writers have suggested how the on-line catalog can be designed to help users perform more effective subject searches. The suggested improvements can be divided into the following categories:

1. Develop more helpful and user-oriented interfaces.
2. Develop graphical and direct manipulation interfaces.
3. Develop interfaces for browsing.
4. Enhance catalog records with more subject and table of contents information.
5. Provide query expansion and query formulation support.
6. Provide non-Boolean best-match search capability.
7. Provide relevance feedback and query refinement capability.
8. Incorporate search heuristics.
9. Incorporate search trees and knowledge-based techniques.

These solutions are briefly reviewed below.

Design More Helpful and User-Oriented Interfaces

Simple changes to the OPAC screen design can help users improve their searching significantly. Such improvements to the OPAC screen can be identified by analyzing the OPAC transaction log. Bleic et al.^[21] analyzed the transaction log of a university OPAC system, identified the main errors made by users, and then made simple changes to the OPAC screen, such as simplifying and clarifying the wording in the introductory screens, using the same book for all search examples, placing the keyword search option as the first option, and making certain help messages more

prominent. An analysis of the transaction log 6 months later found a statistically significant reduction in errors and more effective searches. Ballard^[22] had also found that the amount of keyword searching increased when keyword search was listed as the first option on the OPAC screen. In a follow-up study, Bleic et al.^[23] found that some of the initial improvements did not hold over time, indicating that the same OPAC screen design can affect different user groups differently, especially in a changing computing environment.

Hildreth^[20] found that users seldom read help screens. Nevertheless, they expressed a strong interest in context-sensitive search assistance from the system while conducting their searches. Context-sensitive help messages displayed on the same screen as the search result can guide the user on how to improve the search. When no record or few records are retrieved, the system can suggest shortening the search phrase, substituting synonyms or more general terms, or retrying the search using a different search method. When too many records are retrieved, the system can ask the user to enter additional search words or enter limiting criteria to narrow the search. The messages could tell the user what to do, how to do it, and why it may improve the result.^[24] However, online prompts can provide only a limited amount of help. Some search strategies require an understanding of the bibliographic record, controlled vocabulary, cataloging rules and online searching, and too much information about “what to do, how to do it, and why” will overwhelm the user.

Some researchers have called for OPAC systems to incorporate models of the user and the user’s task and situation. Such an OPAC can provide different search screens, use different search strategies, and guide the user in different ways according to:

- Whether the user is a new OPAC user or an experienced user.
- Whether the user is knowledgeable about the subject area.
- Which stage of a project the user is at.^[25–27]
- Whether the search is a continuation of an earlier search.^[28]
- What the goal of the user is in performing the search.^[27,29,30]

While clearly desirable, it is not yet known how user models can be incorporated into OPAC systems effectively.

Graphical and Direct Manipulation Interfaces

With new developments in interface technology as well as advancements in Internet and Web-related technologies, such as Dynamic HTML, new types of graphical OPAC interfaces are likely to be developed, which incorporate 2-D and 3-D images, animation, virtual reality, and direct

manipulation capabilities that allow users to manipulate objects on the screen. Such techniques can be used to help users visualize relationships between search terms as well as documents and help users to browse the OPAC database. They can also be used to help users understand search strategies and make the manipulation of search results and OPAC records more intuitive. Some ideas for the use of icons, animation, manipulation, and metaphor have been explored in prototype OPACs.

Lee^[31] described an animated, object-based OPAC interface that featured 2-D and 3-D interactive objects such as card catalog drawers, bookshelves, and cassette tapes that could be manipulated. Bovey^[32] described an online catalog for a collection of cartoons. The set of cartoons retrieved in a search was displayed on a time line showing the number of cartoons published on each month and year. The user could use the mouse to point to a place on the time line to select a cartoon published at a certain time. Chung^[33] explored how virtual reality can be incorporated in an OPAC interface.

Pejtersen^[34] described a prototype online catalog of fiction materials called the Book House, which used the metaphor of a house as a search environment, with different rooms in the house representing different user groups (e.g., children and adults) and different kinds of searching. Each room in the house had objects that could be manipulated to represent different aspects of a search. Animations were used to suggest the type of search, and icons were used to represent different dimensions of the classification system e.g., a globe to represent the geographical setting, a clock to represent the time dimension, and theater masks to represent the emotional experience provided by the books. Records retrieved were represented as a bookcase of books, and individual records were displayed as text in an image of an open book.

Develop Interfaces for Browsing

Most OPAC systems require the user to think up appropriate terms for searching. This is difficult if the user is not knowledgeable in the subject area. Moreover, few users know how to identify the appropriate Library of Congress subject heading to use. A browse interface reduces the user's cognitive load by requiring only that the user recognizes relevant concepts. Three main approaches have been proposed for an OPAC browse interface: browsing the classification system or the class numbers assigned to library items, browsing Library of Congress Subject Headings, and browsing a semantic network of associated terms.

Class number browsing makes use of the principle that books on similar topics are assigned the same or neighboring class numbers. Users take advantage of this when they browse the library shelves. Class number browsing on the OPAC provides an online equivalent of shelf browsing—especially if the books' table of contents are available online for scanning. OPAC records can be displayed in

class number order to facilitate such browsing. Beheshti^[35] proposed using object-oriented graphical interfaces with images of books representing bibliographic records on the OPAC screen. Book titles can be superimposed on the spines of the book images, and these can be arranged by class number on the image of a bookshelf. If the classification system uses a hierarchical notation (e.g., the Dewey decimal classification system), the user will be able to broaden or narrow a search by using a shorter or longer class number and to zoom in on the detailed class number for a specific subject. For the Library of Congress classification system, which uses an enumerative notation, Huestis^[36] has formulated an automatic method of identifying ranges of class numbers.

Some writers have proposed making the Library of Congress Subject Headings thesaurus available online for users to browse. Subject headings have broader terms and narrower terms, as well as several levels of subdivisions that can be browsed hierarchically. However, the list of subject headings and subdivisions for some subject areas may be too extensive to browse easily. Allen^[37] and Massicottee^[38] have proposed ways of reducing the length of subject heading displays by replacing many headings with broad conceptual categories and summarizing all headings beginning with the same initial word or phrase with one line containing just that word or phrase followed by an asterisk to indicate that the line can be expanded.

The Library of Congress Subject Headings can be further enhanced with a network of associated terms to form a rich semantic network. Associations between terms can be based on the co-occurrence of two terms in the same bibliographic record. Associations suggested by Bates^[39] include title keywords with the assigned subject headings, two subject headings assigned to the same book, subject headings and the class number label (taken from the classification system), as well as two words in the same title. Such an enhanced thesaurus or semantic net increases the chances of the user's initial terms matching one or more terms in the system and allows the user to explore a rich network of links and associations.^[39]

Lin^[40] reviewed various ways of displaying a semantic network on a browse screen: hierarchical displays, network displays with links and nodes, scatter displays (graphical dotted images produced by mapping high-dimensional data to a 2-D visual space), and map displays which apply the geographical map metaphor to information space.

Web interfaces provide a natural way of navigating and browsing a semantic network using hypertext links (hyperlinks). For example, in most Web OPAC interfaces, bibliographic fields that are displayed in the search result screen can be clicked on by using a mouse device. Clicking on a subject heading displayed in a bibliographic record automatically sends a search request to the OPAC system to search for other records containing the specific subject heading.

Enhance Catalog Records with More Subject and Table of Contents Information

Catalog records can be enhanced with more subject information in a number of ways:^[41–44]

- Include the book's table of contents in the record.
- Include selected terms from the back-of-book index.
- Include in the record terms from the Library of Congress Subject Headings that are related to the assigned subject headings and terms in the classification schedule that correspond to the assigned class number.

Enhancing the catalog records in the above ways will increase the probability of retrieving relevant records and reduce the number of searches that retrieve no records. It will also allow the user to use more specific terms in a search rather than the possibly broader subject descriptors used in the subject fields.

The disadvantage of enhancing catalog records in these ways is that more nonrelevant records will be retrieved and it is much more likely for a search to retrieve too many records for the user to scan.^[45,46] This will place a heavier burden on the user to know how to narrow a search when too many records are retrieved.

Traditionally, fiction books are not assigned subject descriptors in online catalogs. However, fiction books constitute the major proportion of loans in public libraries, and effort is now being made to assign subject headings also to fiction materials.^[47]

Provide Query Expansion and Query Formulation Support

OPAC users need more help with query expansion to identify broader, narrower, and related terms to use in a search, and with query formulation to formulate a Boolean query in the search language of the system. A number of prototype OPAC systems have explored the use of an online Library of Congress Subject Headings or some other thesaurus or semantic network to help users identify alternative search terms and controlled subject descriptors to use.^[48] This has been shown to be useful and effective.

Drabenstott et al.^[49–54] developed a prototype OPAC system that matched the user's query terms with entries in the Library of Congress Subject Headings and displayed the exact and partial matches for the user to select. If the user's terms matched a "see" reference, this was automatically replaced with the authorized subject heading. The user could then browse the thesaurus structure to view broader, narrower, and related subject headings as well as the subdivisions.

Poo and Khoo et al.^[55] in a prototype expert intermediary interface called the E-referencer used a knowledge base of associations between title keywords and subject headings. The keyword-subject heading associations were

derived by analyzing several years of catalog records. For each title keyword, all the subject headings associated with it (i.e., assigned to titles containing the keyword) were identified and assigned a score equal to the number of times the heading was assigned. The raw scores were then normalized by dividing by the highest score (the score obtained by the most frequent subject heading). The normalized scores were used to represent the strength of the association between the title keywords and subject headings. This knowledge base was then used to identify the subject headings that were most highly associated with the users' query terms.

Larson^[56,57] and Micco and Pop^[58] have proposed an indirect way of query expansion by clustering records in the library database by the class numbers assigned to the records. The title keywords and subject headings of all the records in each cluster are then used as index terms to the cluster. A keyword search would retrieve not just the records containing the keyword but all other records belonging to the same cluster as the retrieved records. A list of retrieved clusters, with their class number and some descriptive phrase, can be displayed for the user to select.

The OPAC interface can also incorporate some degree of natural language processing to allow users to express their information need in natural language and have it converted it automatically to a Boolean query. ALEXDOC^[59] was one natural language retrieval front end that performed linguistic analysis to match the user query with terms in the thesaurus and constructed a Boolean search statement using a set of transformation rules. Researchers have developed other automatic methods for constructing Boolean queries from natural language statements (e.g., Salton).^[60]

Provide Non-Boolean Best-Match Search Capability

Information retrieval researchers have advocated a "best-match" retrieval approach with relevancy ranking for the OPAC system. In such a system, records containing some or all of the user's terms are retrieved, and relevancy ranking is performed to display the records in decreasing order of probable relevance—with the records that most closely match the user's query being shown first. A major advantage of best-match systems is that natural language queries can be processed by the system and users need not formulate Boolean queries.

Best-match retrieval approaches include the vector-space model and the probabilistic model^[61] and are commonly used in Web search engines and full-text retrieval systems. The Okapi system^[62–64] is a well-developed experimental OPAC system that used a probabilistic best-match approach. Relevancy ranking is available in the Library of Congress OPAC system (URL <http://catalog.loc.gov/>) but is still generally uncommon in OPAC systems. Extended Boolean retrieval models that combine the

strengths of Boolean retrieval with best-match relevancy ranking have also been proposed.^[65–67]

Best-match retrieval requires different indexing structures and search mechanisms in the back end of the OPAC system than those used for Boolean retrieval. An alternative to using best-match search engines in the OPAC system is to incorporate some relevancy ranking capabilities in the OPAC front end residing on the user's desktop computer or in a middleware or metasearch engine that sits between the OPAC server and the user's computer. This can then behave as an intelligent agent to retrieve a large number of records from multiple OPAC servers and perform relevancy ranking on the records retrieved.^[55,60,66,68–70]

Incorporate Search Heuristics and Relevance Feedback Capability

Hildreth^[24] pointed out that “to optimize retrieval results in subject searching, more than one search approach may have to be employed in the overall search strategy.... Conventional information retrieval systems place the burden on the user to reformulate and re-enter searches until satisfactory results are obtained.” Cherry^[5] analyzed zero-hit subject field searches and found that converting the queries to other search forms such as keyword subject, keyword title or title searches would have obtained useful hits in 71% of the cases. An OPAC system can use automated search algorithms to reformulate the user's search query and refine the search criteria to improve the search results.

Cheng^[71] described a front end to the OPAC system at the University of Illinois, Urbana–Champaign, which executed a sequence of strategies to help the user improve the search results. When an initial search did not find a subject heading, the front end performed a sequence of modifications on the search string, including adding a truncation sign, displaying alphabetically similar headings, separating the words and searching by using the Boolean AND, and finally searching for the words in the title. If the title search retrieved a relevant record, the system extracts the first subject heading from the record and continued the subject search with that heading.

Automated search heuristics can also be used to simulate relevancy ranking. The E-Referencer system^[55,68] first formulated a narrow search to retrieve and display the most relevant records. Broadening strategies were applied gradually to retrieve additional records, which were appended to the end of the display. Because the records retrieved by the broadening strategies were less likely to be relevant than those retrieved by the initial search, the result is a list of records roughly in order of probable relevance.

Search algorithms can also be used to perform relevance feedback: the user can indicate which of the retrieved records are relevant, and an automatic procedure

can attempt to retrieve other relevant records by analyzing the records already retrieved to extract appropriate terms to include in a new search.^[24,72]

The CITE system^[73] performed a frequency analysis of the subject headings that occurred in the records that the user indicated to be relevant. It then displayed a ranked list of the subject headings for the user's selection. Classification numbers from the relevant records were then used together with the selected headings in a best match search.

In the Okapi system,^[63,74] the automatic query expansion facility took the subject headings and classification numbers from records chosen by the user and assigned each a weight based on the number of chosen records in which they appeared. Later versions of Okapi made use of interactive query reformulation where users can select the subject headings to use in a new search. The researchers found that fewer users took up query reformulation than expected and concluded that a better balance between automatic and interactive query reformulation had to be designed.^[75,76]

Incorporate Search Trees and Knowledge-Based Techniques

Although using a fixed sequence of search heuristics and query reformulation procedures have been shown to improve the search effectiveness, more flexible and sophisticated methods for selecting appropriate search strategies in response to different situations might work better than a fixed sequence of heuristics. Expert systems or knowledge-based systems have been proposed for online searching. An expert system that embodies within it the knowledge and skills of a librarian or “search intermediary” for carrying out online bibliographic searches is called an expert intermediary system.

Several researchers have attempted to apply knowledge-based techniques to information retrieval. Gauch^[77] and Ford^[78] surveyed some of the more well-known systems. Most of these have focused on abstracts and full-text databases, rather than library OPACs. They have also focused on the selection of query terms from a thesaurus or semantic net representing the knowledge base. Chen^[79] and Khoo^[80] present designs of expert intermediary systems that focus on search strategies and rules for selecting them.

Chen's system^[81,82] was the most ambitious expert intermediary system developed for OPAC subject searching, with many search strategies and knowledge bases. However, the prototype was applied to a very small database and narrow domain, and it is not clear whether it can be scaled up easily to a real library database.

Drabenstott et al.^[50–53] has developed a prototype OPAC system that uses search trees or decision trees that represent how experienced librarians might select a search strategy and formulate a search statement. The decision tree was represented as a flowchart and was developed on

the basis of an analysis of user queries captured in OPAC transaction logs.

The E-Referencer^[55,68-70] was a prototype expert intermediary system for searching OPACs on the Web. It was implemented as a proxy server that mediated the interaction between the user and Boolean OPAC servers. It processed the user's natural language query, mapped the query words to Library of Congress subject headings, selected a suitable search strategy, and formulated an appropriate search statement to send to the library system. Based on the user's relevance feedback on the search results, it further selected a strategy for refining the search. The knowledge incorporated in the E-Referencer comprised:

- A conceptual knowledge base that mapped free-text keywords to subject headings.
- Search strategies coded in the system.
- Initial search strategies for converting the user's natural language query to a Boolean query.
- Reformulation strategies for refining a search, including broadening strategies, narrowing strategies, and relevance feedback strategies.
- Rules for selecting an appropriate search strategy in the form of a decision tree.

MULTIPLE LIBRARY OPACs SEARCH

With the advent of Internet and the high-speed delivery of information via efficient networking infrastructure, multilibrary OPAC and electronic databases, search has now become a reality and is becoming a necessity in the offering of library services. In Poo,^[83] Poo and Khoo discuss the problems with Information Overload, a phenomenon brought about through the globalization of information via the Internet and demonstrate how various state-of-the-art technologies can be applied to enhance user's experience in multicatalog and electronic database search.

CONCLUSION

Users have many kinds of problems performing subject searches in OPAC systems. Typical users do not have the range of knowledge and skills needed for effective subject searching. This entry has surveyed possible improvements that can be made to OPAC system design.

With developments in Internet and Web browser technologies, many of the proposed improvements can be instituted without major changes to the OPAC back end system. Changes can easily be made in the design of the web pages used as an interface to the OPAC. Dynamic HTML, Javascript, and Java applets can be used in Web OPAC interfaces to provide users with more assistance and to implement more interactive direct manipulation

features. Improvements that require access to a knowledge base or more processing power can be implemented in a middleware program (metasearch engine or intelligent agent) that sits between the user's computer and the OPAC server. The middleware can be implemented as Java servlets that use the Z39.50 Information Retrieval protocol or the internet HTTP protocol to communicate with the OPAC server. Solutions using Java applets and Java servlets have been implemented in a number of systems.^[55,69,83,84]

OPAC interfaces are playing increasingly expanded roles. They now provide access not just to records of books and journals held by a library but also to multiple library systems, to full-text documents and journal articles, and to databases and other resources on the Internet. OPAC interfaces are increasingly becoming digital library interfaces and even Web portals, providing a window to the world of information. This presents new challenges for developing OPAC interfaces for subject searching.

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Online Library Instruction

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Abstract

Online library instruction, or instruction in information skills delivered over the Internet, varies in its content, levels of technical complexity and intended audiences. Public libraries and special libraries, academic libraries and school libraries, graduate schools of library and information studies, library organizations, commercial vendors, and individuals all provide library instruction in an electronic environment. Delivering library instruction through the Internet is a new approach for educating learners and researchers using technology. It comes at a time of an increasing desire for librarians to educate themselves and their users and follows a history of librarians applying technology in education.

INTRODUCTION

A child studying in the Denver Public Library learns how to navigate through the online public access catalog using a specially designed interface for children.^[1–3] A lawyer at the Miami office of a national firm is referred to information about electronic resources on the library website by the law librarian at the firm.^[4] A library school student takes an online distance education class in “Managing Change in Information Environments” through the University of Pittsburgh FastTrack MLIS program using a computer at a cybercafe in Clarksburg, West Virginia.^[5] Library paraprofessionals at Northwestern University Libraries, once trained on the job with a video on handling library materials, now acquire new skills on their own with a self-paced, Web-based tutorial.^[6]

Online library instruction, or instruction in information skills delivered over the Internet, varies in its content, levels of technical complexity and intended audiences. Public libraries and special libraries, academic libraries and school libraries, graduate schools of library and information studies, library organizations, commercial vendors, and individuals all provide library instruction in an electronic environment. Delivering library instruction through the Internet is a new approach for educating learners and researchers using technology. It comes at a time of an increasing desire for librarians to educate themselves and their users and follows a history of librarians applying technology in education.

HISTORY

The Need for the Teaching Librarian

Three major American library associations have recently crafted mission statements identifying ongoing education

and professional development as critical for practicing professional librarians.^[7–11] Embedded in each of these statements is the understanding that librarians who upgrade their skills are better equipped to further the information education of their constituents. Increasingly, librarians are expected to be both learners and teachers. They are expected to understand different learning theories and adapt them to the different learning styles of students.^[12,13] The purpose, according to theorists, is to position librarians to make lifelong learners of information seekers.^[14] Fig. 1 shows an exercise from a Web-training tutorial.

The Emergence of Distance Education

Distance education allows learners to become educated in many disciplines where barriers of time and place may have once prevented them from accessing instruction.^[16,17] Early distance education was often delivered through correspondence courses mailed to students and extension courses taught by faculty who traveled to remote sites.^[18–20] Technology has expanded the options in delivering distance education. Although higher education may have been slow to adapt to the new methodologies,^[21] according to the National Center for Education Statistics, one third of colleges and universities in the United States offered distance learning courses in 1998, and 20% of the schools not offering distance education courses at the time had plans to do so within the following three years.^[22] Furthermore, if Gary Smith is correct that degrees offered for online study are recognized to be of equal value to degrees offered for a traditional course of study,^[23] a major social, political, and economic barrier to students choosing online learning will be removed.

Though the Open University in the United Kingdom is often cited as the model institution offering an entire curriculum remotely since 1970,^[24] colleges in the United

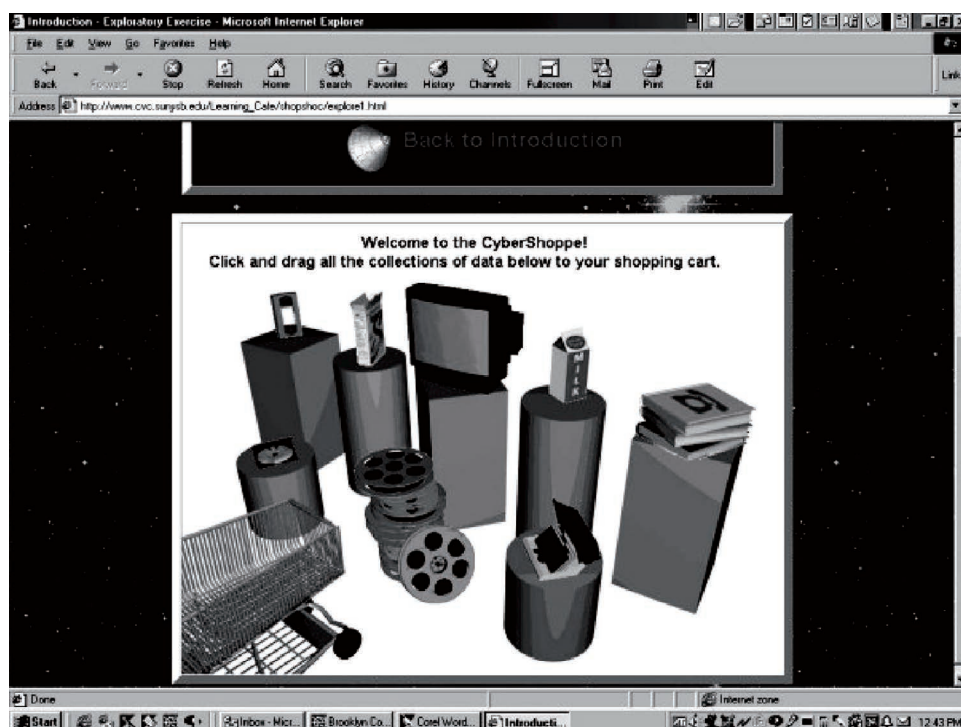


Fig. 1 An exercise from the Learning Café, an online information literacy tutorial. Tutorial exercises that allow for interactivity on a Web site are believed to increase student learning.(From Scarlatos.)^[15]

States have offered technologically facilitated courses since the beginning of the twentieth century. Technologies that have enabled distance learning around the world have included standard radio and television transmission; microwave; cable; open circuit; closed circuit, and satellite transmission; teletext; telephone; audio conferencing; facsimile; videodisc; slow scan video; sideband FM transmission; and Instructional Television Fixed Services. Distance education programs have partnered universities with each other and with broadcasting networks, foundations, and corporations.^[25–28]

Online Education as Distance Education

Linda Harasim makes the point that

[o]nline education is not the same as distance education, although it shares some of the same attributes. Both are any place, any time, and largely text-based. However, the critical differentiating factor is that online education is fundamentally a group communication phenomenon. In this respect, it is far closer to face-to-face seminar-type courses.^[29]

Whether the current examples of online library instruction conform to Harasim's model is a reflection of the evolving thinking about the purpose and method of library

instruction, the varied audiences targeted, the content delivered, and the methods of delivery employed.

SETTING THE STAGE FOR ONLINE LIBRARY INSTRUCTION

Predictors and Predecessors

Looking to the future of libraries and librarians in the last two decades of the twentieth century, a number of writers foretell of the lessening of the importance of the physical library collection, the increasing availability of electronic resources, and the subsequent decreasing need for librarians to work in a dedicated, physical location. F. Wilfrid Lancaster describes libraries as becoming “disembodied,” necessitating that in order “[t]o survive, the librarians must get out of the library.”^[30] Carolyn Dusenbury and Barbara G. Pease consider the lessening importance of having a physically present librarian in a physical library with particular respect to library instruction:

Can we continue to expect users to come to our place at our pre-set time in order to learn what they need to learn? Can we expect all users to be equally motivated or equally ready to learn at the same time? These questions combined with staff and budget shortages are causing careful re-examination of how resources are deployed and how effective current programs are.^[31]

The Library and the Early Days of Distance Education

Librarians have long been sensitive to the desire of students to learn research skills at their own convenience. Reference desks were established in libraries to provide point-of-need research assistance.^[32–34] Similarly, an essential concept in distance learning is timing delivery to connect with the learner at the moment of need. The early efforts of libraries to use technology to reach and assist researchers studying on their own predate the widespread use of the Internet. In the 1980s and early 1990s, libraries saw video and satellite television as ways to instruct without an instructor being present.^[35] Programs such as Elginet in Illinois,^[36] the Library Video Network in Maryland and, nationally,^[37] the Global Library Project at the Library of Congress^[38–41] and the Library and Information Science Distance Education Consortium^[42] developed and delivered staff and pre-professional training videos and information programming to the public. Fig. 2 shows the Library and Information Science Education Consortium website.

Computer Assisted Instruction (CAI) in Libraries Prior to the Internet

The computer-assisted demonstration

Librarians began to use the computer to assist with instruction as personal computers became more ubiquitous

in libraries and on college campuses during the 1980s. At the same time as the growth in the availability of computers in the library, there was an increase in library reliance on online searching of remote subscription databases. Electronic classrooms with multiple computers available for all students were yet to come, but in the 1980s librarian instructors used computers with projection systems for live demonstrations of online resources to catch the attention of students and to give them a realistic sense of an online searching environment.^[43] Moreover, librarians continue to teach with computer-assisted demonstrations using laptops and portable projection systems when the computer classroom in their library may not be available and they work with students in noncomputer equipped classrooms outside the library.^[44]

Live assistance and hand-on, computer-based learning

The computer, as a tool to assist with learning information skills, moved out of the hands of the instructor and into the hands of the students when libraries gained access to or built computer classrooms. Librarians teaching in person instructed students in practical skills, particularly in online searching.^[45] Linda Friend describes the new role academic librarians were able to play as consultants for their patrons who were paying for personal accounts on online systems. These remote users were working without detailed manuals and were likely to need help choosing

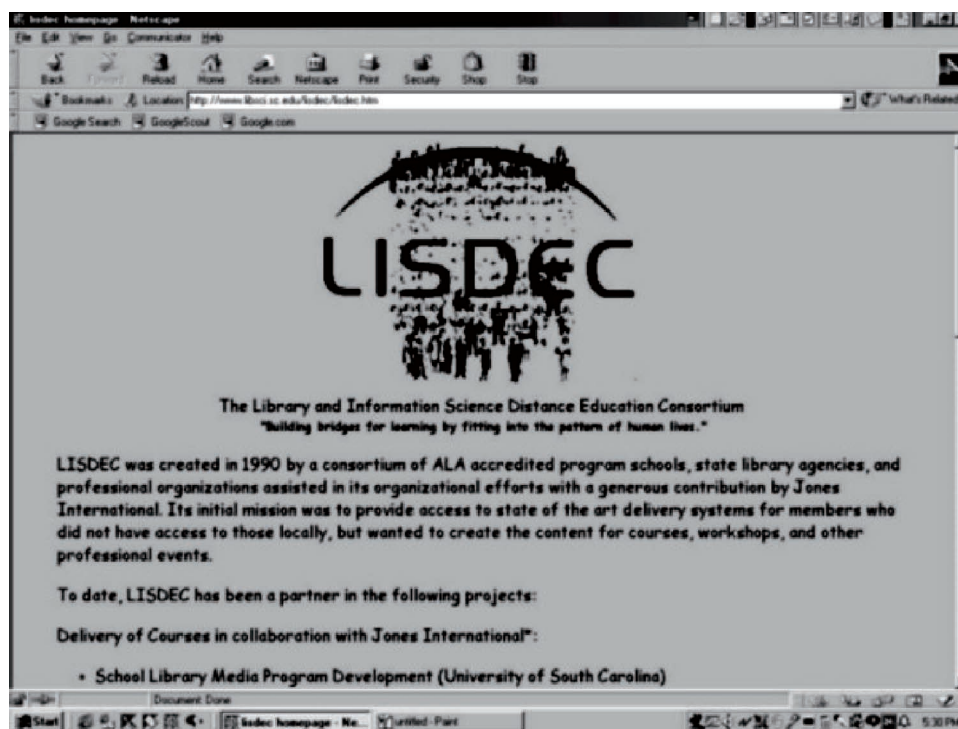


Fig. 2 Web site for the Library and Information Science Distance Education Consortium. Before wide-spread use of the Web, consortia fostered distance learning in librarianship through televised workshops.(From Barron.)^[42]

search terms and constructing a search. Librarians provided initial patron training sessions in person and were then on call to do follow-up troubleshooting for students working at remote locations.^[46] In addition to librarians giving live, hands-on instruction in searching vendor-provided databases, librarians also used the electronic library classrooms to instruct in how to use the online library catalog, or online public access catalogs (OPAC).^[47] The OPAC has typically been a library-created database and not a subscription product available from a vendor. Requiring no per-search or connection-time fees, the OPAC was often the first publically available, end-user electronic resource in a library and an important candidate for classroom exploration.

Tutorials for independent learning

With the increasing presence of the personal computer in academic libraries, librarians began to develop computer-assisted instruction software to meet their local training needs. Instruction continued to focus on online searching as one content area. Nancy Fjällbrant observes the affinity between method and content in discussing CAI tutorials developed to teach online searching: “[o]nline information retrieval is an interaction dialogue between the user and the host computer. It is, therefore, hardly surprising that computer-based learning packages have been developed for online training purposes.”^[48] Tutorials for online searching instruction primarily targeted graduate students and faculty. Nonetheless, in addition to developing CAI for these advanced researchers, academic librarians created CAI applications to provide basic library instruction for large numbers of undergraduate students.

Librarians designing tutorials for stand-alone computers often used Hypercard and Macromedia’s Authorware and Director. Instruction librarians who did not see themselves as technologically sophisticated praised these tools for their simplicity to learn and use.^[49] Modules were developed and saved on CD-ROMs that could be mounted on individual library or campus lab computers,^[50,51] set up in information kiosks,^[52] or offered to students to use at remote sites. Andrew Cox, writing in 1997 with a historical perspective on pre-Internet CAI delivery, points out an advantage of students learning from the nonnetworked CAI modules. When students are working in the Web-environment, they can easily click their way out of their focused task. Students using tutorials in the stand-alone environment, however, are not as easily sidetracked.^[53] Nonetheless, despite the possible drawbacks of delivering instruction through the Internet, as libraries began to go online, Web-delivered instruction began to replace CAI delivered on stand-alone workstations and on local area networks (LANs) restricted to the library or campus.

THE INTERNET, LIBRARIES AND ONLINE LEARNING

The Case for CAI

Arguments in favor of creating computer-based instruction have withstood the migration of delivery from stand-alone computers and LANs to delivery over the Internet. Supporters of CAI reason that student use of the computer-based instruction frees up staff time and offers a consistent set of material.^[50,51] Additionally, when learning with live instruction, students are limited to learning from one individual. A CAI tool usually reflects the talent and ideas of a number of creators, and students gain from the expertise of all. Furthermore, when a librarian is not available to assist them, students may use a computer-learning module at their own convenience and work at their own pace. Working with a computer application provides students with a nonjudgmental environment where they may be more comfortable venturing with answers to questions posed or reviewing material taught early on in the tutorial. In addition, because CAI can be used outside of class, instructors do not need to give up any of their teaching time to allow for library instruction. Lastly, computer-based instruction can also reach upper-level transfer students who may have missed the standard library instruction offered in conjunction with a freshman class.^[54–58] The many benefits of CAI and the increasing availability of Internet access have encouraged librarians to develop instructional tools to work in a number of teaching situations online.

Instructional Opportunities for Online Library Instruction

The advent of World Wide Web browsers has offered libraries new ways to instruct their remote users and the ability to reach more users than they can with stand-alone, CD-ROM tutorials. Online library instruction may be designed to orient users to a physical library or a library website through a virtual tour. The online instruction may focus on a single library tool such as an online public access catalog or on a vendor-provided database. It may provide general information literacy skills, focus on computer skills, teach research skills in the context of a given course, or deliver a full curriculum in library and information studies. The intended audience for online library instruction may be the public served by a single library or library system, K–12 students at a school, undergraduate and graduate students, faculty and staff at a college or university, library school students, working professionals in any field, librarians and library staff, individuals interested in upgrading their technology skills, and Internet surfers who may chance upon the website of a library providing instruction.

The virtual tour

Web-based information delivery has allowed many library services to be offered remotely. Consequently, researchers often may feel no need to visit the physical library. Librarians working with these remote patrons have often been eager to put a face on their virtual presence, or they have wanted to prepare visitors for what to expect before they visit an actual library, or they have created virtual libraries that have no physical equivalent as an access point to electronic information. Library virtual tours have been developed that make use of a range of Web technologies and give the distant user a sense of being in a physical place. The Stephens-Burnett Library at Carson-Newman College in Tennessee includes a virtual library tour module as part of a four-part instruction package. The virtual tour includes still images of each floor of the library and text descriptions.^[54,55] The Texas Agricultural and Mechanical University Evans Library Educational Media Services Department used Spin Panorama to update its original virtual library tour of still photographs and give a more realistic view of the six floors of their library annex.^[59-61] Using Macromedia Flash, librarians at the Baruch College of the City University of New York have created a virtual tour of the Newman Library with music and text available in nine languages.^[62,63] Jeff Bobicki's Libtech, a virtual library in the Active World Librarea, connects to Bobicki's writings on library technology topics and biographic information about authors through links embedded in book and face images.^[64-67] Each method of providing an online library tour orients information seekers so that they are better equipped to find what they need when they visit the physical library or continue to explore the virtual library website.

Focus on a single resource: the popular database and the OPAC

Librarians ponder if one day all library instruction will be built into every database they acquire for researchers. Successful, intuitive systems, it has been suggested, could eliminate the need for teaching librarians and serve as sufficient guides for doing research.^[68,69] Recognizing the limitations of database software design as it currently exists for the end users, both remote and in the library, librarians in many environments have developed online tutorials focused on heavily used, individual electronic resources. Institutions with large numbers of potential users, such as public universities or urban library systems, cannot give extensive live instruction in their online catalog or heavily used aggregated database to thousands of users, but they can reach any one of these patrons with an OPAC or a database tutorial.^[70-72] Database providers often provide help screens and tutorials to accompany the systems they design.^[73,74] But, as Anne Tubbs Prestamo

observes, users of electronic resources often do not use the built-in help links that come with most databases. Librarians who know the learning styles of their own clientele best may be the most appropriate instructors to design online help for these resources.^[72]

Teaching information literacy skills

Arguments against librarians investing time in developing CAI for individual resources include concerns that the interface and search options may change or the library may cancel its subscription to the product. Frequent changes in the appearance and functionality of information resources remain part of the impetus to design an information literacy approach to library education. Furthermore, advocates for teaching information literacy skills suggest that librarians move away from tool-based instruction and adopt a concept-based approach to library instruction instead.^[14] In designing CAI that teaches students how to use the online catalog and individual databases, librarians intended to package tool-based instruction and consequently free more of their time for concept-based instruction in the live classroom. Nonetheless, librarians have also developed online tutorials to deliver basic information literacy, or critical thinking skills. Nancy H. Dewald found, in 1999, that a majority of the online library tutorials noted by the ALA Library Instruction Round Table fell into this category of teaching general, information literacy skills.^[75]

Colleges and universities that traditionally offered in-person classes have begun to supplement their curricula with distance education courses to provide an extensive range of information literacy tutorials. Commercial online education providers, however, such as the e-global library of Jones International, have also offered tutorials in library research skills for those studying through an institution partnered with Jones and for individuals willing to pay for the service.^[76,77] Regardless of the provider, online information literacy skills tutorials are often modular with each module being made available as it is developed.^[78] Though not tied to the academic courses of study that students will choose for their majors, basic online library instruction at academic institutions is often embedded in freshman courses designed to ease the transition from high school to college. Basic library tutorials are included as part of English composition courses generally required of all college students.^[54,58,79,80]

Alternatively, librarians may develop basic library instruction modules without a guaranteed group of users in mind and seek out a small pilot group in one academic department when the online modules are ready to deliver.^[81] Additionally, developers may find that online information literacy modules are adopted and required by faculty in a range of courses soon after the library makes them broadly available. Although the tutorial designers may create instruction modules with a look and feel

designed for freshmen and sophomores, upper classmen are likely to use the tutorials and need to be considered as a potential audience in the design process.^[78] A library may also consider offering its basic library instruction tutorial with multiple interfaces to appeal to its various targeted audiences.^[82] Furthermore, a library may need to develop information literacy modules with varied content reflecting the developmental stages of student learning or a progression of skills.^[83,84]

Discipline-specific online library instruction

An information literacy, or basic library skills, approach to research education, though it seeks to serve the needs of many, may be found to fall short in helping learners with specific, deep, and complex research assignments. Consequently, library instruction, live and online, in the university, is thought to be most effective when tied to the research work required of students registered in discipline-specific classes. Course-related library tutorials have been developed for courses in business,^[85] criminal justice,^[82] engineering,^[86,87] chemistry,^[88] biology,^[89,90] modern languages,^[91] and Latin American studies^[92] as well as other disciplines.

Creating and successfully implementing course-related, Web-based instruction depends on cooperation between the library and college departments. A department may invite the campus library to develop a tool to assist with teaching research specific to a discipline.^[85,92] An advantage of course-related library instruction is that departments are likely to pool resources with the library and jointly seek funding to cover the cost of technologically enhanced learning tools.^[91] When developing course-related tutorials, the librarian typically will discuss their development and use with the classroom instructors who will be teaching the course prior to their delivery. When the classroom instructors are not familiar with the tools the library has created, the students, who are required to use the tools for problem solving in their classes, quickly become frustrated and see both their instructors and the library as falling short of adequately preparing them for their tasks.^[89]

Library instruction tied to courses presents opportunities for collaboration and sharing among students, faculty, and librarians. In the Learning Links Project, jointly run by the Spanish and Portuguese Department and the Scholarly Communications Center of the library at Rutgers University in New Jersey, graduate students in Spanish language and culture courses developed websites and prepared multimedia material that the undergraduates used in their own study.^[91] Students in a library media course at Georgia State University had an opportunity to do collaborative Web development online with a sister library in Toulouse, France.^[93] Additionally, librarians who develop course-related, online resources have something substantive to share with their colleagues in the library. A

librarian with responsibility for collection development in a particular subject area may rework, to suit his or her own instructional needs, a course-related tutorial developed by a colleague working in another discipline.^[82]

Online library instruction as a credit course

Many institutions have designed online library instruction to teach broadly applied information literacy skills or to support specifically focused college courses. Though these modules and tutorials may be connected with individual courses, the library content is adjunct to the course content. Learning the library content may contribute to the students' earning a grade but achieving these skills is not an end in itself. Colleges and universities do offer a number of examples of library instruction comprising the complete content of online, credit-bearing courses. Moreover, the examples of information-skills courses offered for credit at academic institutions often have in common interinstitutional ties or multidisciplinary content. In some situations, in order to make the creation of the tutorial worth the time and resources required, extensive application of the finished tool is required.

The Utah Academic Library Consortium currently supports a credit-bearing, information literacy tutorial Internet Navigator offered in 10 public and private colleges and universities throughout Utah.^[94] Fig. 3 shows the opening screen. Each participating school has independently selected the department that offers the course, has determined the amount of technical support needed, and has set tuition according to its own guidelines.^[95] Mercy College in New York State and Hasharon Distance College in Israel partnered to deliver an eight week, eight module course on research using the Internet. Students at Hasharon take the required course in their first semester, are encouraged to connect their research to what is needed for their other classes, and use the subscription online resources offered by the hosting college in the United States. The instructor of the course notes the special cultural challenges of teaching across national boundaries.^[96]

Interdisciplinary fields such as women's studies and area studies, or topics students develop that cross over discipline boundaries are challenging for both the classroom instructor and the librarian to teach and for students to research successfully. A brief, single session in the library is not adequate to introduce the major research tools from all the included disciplines. Nor is one individual instructor expert in the range of fields that may comprise an interdisciplinary topic. Consequently, interdisciplinary studies are good candidates for any method of library instruction that is not bounded by the constraint of a single session with a single instruction librarian in the library. Patricia J. Herron and Lily G. Griner have had an opportunity to teach a live, one credit research course in Latin American Studies and integrated a Web component, a noninteractive research guide, into

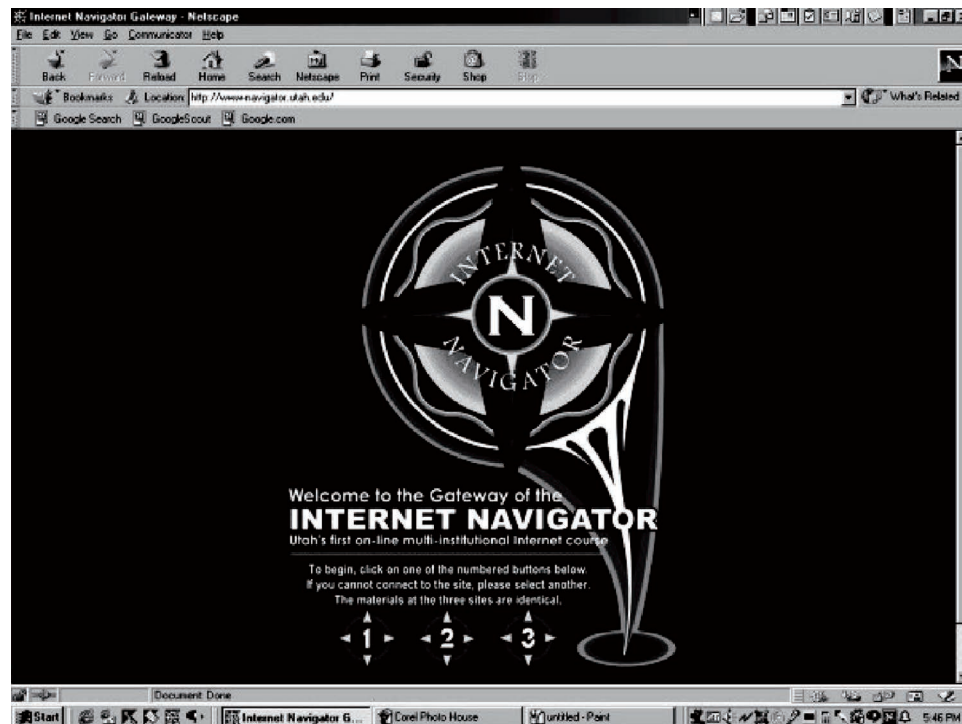


Fig. 3 The opening screen of the Utah Academic Library Consortium's Internet Navigator Tutorial. Library tutorials have been developed for use as credit-bearing courses implemented across a number of institutions.(From Hansen.)^[95]

the course they teach. The guide is extensive, reflecting the many fields upon which an interdisciplinary course draws. It was designed for students to print out and use in support of their other Latin American Studies courses.^[92]

Online library instruction in schools of library and information studies

Graduate programs in library education are increasingly providing opportunities for instructors to develop credit-bearing online courses in information skills. Thirty-six colleges and universities in 25 states in the United States and in Canada offer graduate students in library and information studies distance education opportunities.^[97] In 2001 the United States Institute of Museum and Library Services awarded two of seven grants to universities and colleges with projects designed to recruit and educate students in library and information science through distance education.^[98] Distance education programs in developing nations such as India and Thailand recognized the limited availability of computers and reached out to future librarians and information professionals with numerous study centers to provide online learning.^[99–101] The Open University in the United Kingdom, educating a more affluent population, has encouraged personal computer ownership since the late 1980s and facilitated online learning in all disciplines including library and information studies.^[102] The British Open University Library, once faulted for not opening its doors to part-time students,^[103] began

extending access to electronic resources to all students in the late 1990s.^[104,105] This access is invaluable to distance learners in information studies. Fig. 4 shows the website of the University of Pittsburgh online MLIS program.

Online instruction for librarian professional development

Practicing librarians and library support staff continue to need instruction in understanding, using, and instructing in standard library operations, new resources, and technology systems. Commercial providers may concentrate on marketing one or two library-specific training tools,^[106] offer a diverse listings of online tutorials in Internet research skills,^[107] or provide a full catalog of online training options for both library and specialized technology skills with broad applications within and outside a library setting.^[108,109] Library consortia and organizations also have offered practicing librarians online training.^[110–112] In the fall of 2001, the Illinois State Library launched LibraryU, a clearinghouse of free tutorials aimed primarily at library staff and administrators, but they are also of use to library users.^[113,114] The advantages of libraries turning to outside providers to provide on line training to upgrade the skills of their own professionals and staff are that training can be offered in an extensive range of topics and carefully targeted to the needs of selected individuals. For smaller libraries with limited staff and local talent, turning outside of their own institution is the only option for professional

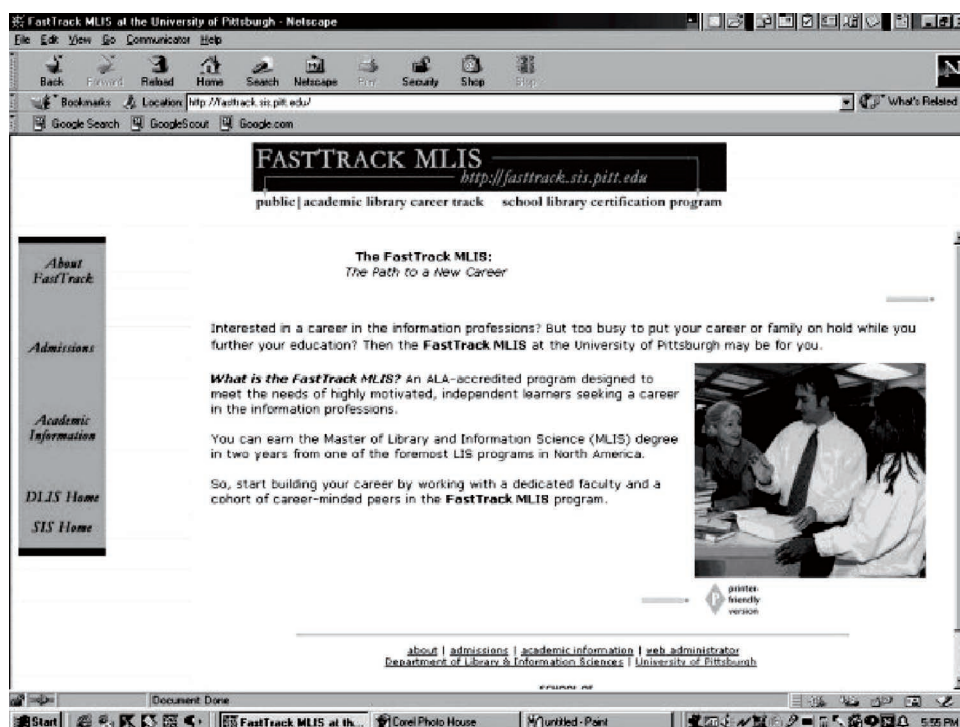


Fig. 4 The Web site for the FastTrack MLIS at the University of Pittsburgh School of Information Science. Graduate programs in library and information science are increasingly enabling future librarians to obtain a degree through distance learning.(Source: University of Pittsburgh.^[5])

development. Fig. 5 shows a Webpage from an online workshop for professional librarians.

Options in Technology for Online Library Instruction

In addition to taking advantage of the many opportunities to offer online library instruction to a wide-ranging audience, libraries have experimented with an array of technologies to deliver online library instruction. Often libraries will mix different forms of technology in order to meet the different levels of students' needs and to work more effectively within the technological limitations of the library. Central Queensland University in Australia, for example, offers tutorial modules through the Web, but gives each participating chemistry graduate student an introductory video on the broad topic of information access and two CD-ROMs on searching the OPAC and on general database search strategies.^[88]

The examples of online library instruction suggest that for online courses to be developed, librarians need to be skilled in their disciplines, adept in pedagogy, and in some situations able to negotiate the politics of passing a curriculum through a campus evaluation process. Furthermore, in order to design and deliver online library instruction in the Internet environment, librarians must be skilled in using a range of sophisticated and rapidly changing Internet-based technologies. Librarians have delivered online

library instruction that has succeeded on different levels of functionality. Static Web pages have evolved into interactive, multifunctional sites. Some faculty have used courseware software to deliver their course content, while others have embellished their sites with streaming video and audio. Students have come to interact online with the course website, their professor, and their classmates. With each technology they choose, librarians have looked to appeal to their learners and to be effective teachers.

Moving beyond the static web page to web site interaction

The earliest and simplest uses of Web technology for teaching have involved construction of websites of information embedded with hyperlinks to related information. Librarians have designed sites as guides to major disciplines or tied directly to individual courses. The sites may reflect a particular instructor's syllabus and library assignments and can double as handouts students may download and study for their courses. Librarians may also offer questions and quizzes on the websites and require students to print out and answer the questions in a traditional manner.^[92,115-117] As technological developments have given librarians the opportunity to reach a virtual community in a number of ways, advocates of using the Internet for instruction have urged librarians to think differently about how they can teach using a website. Bridget Loven and

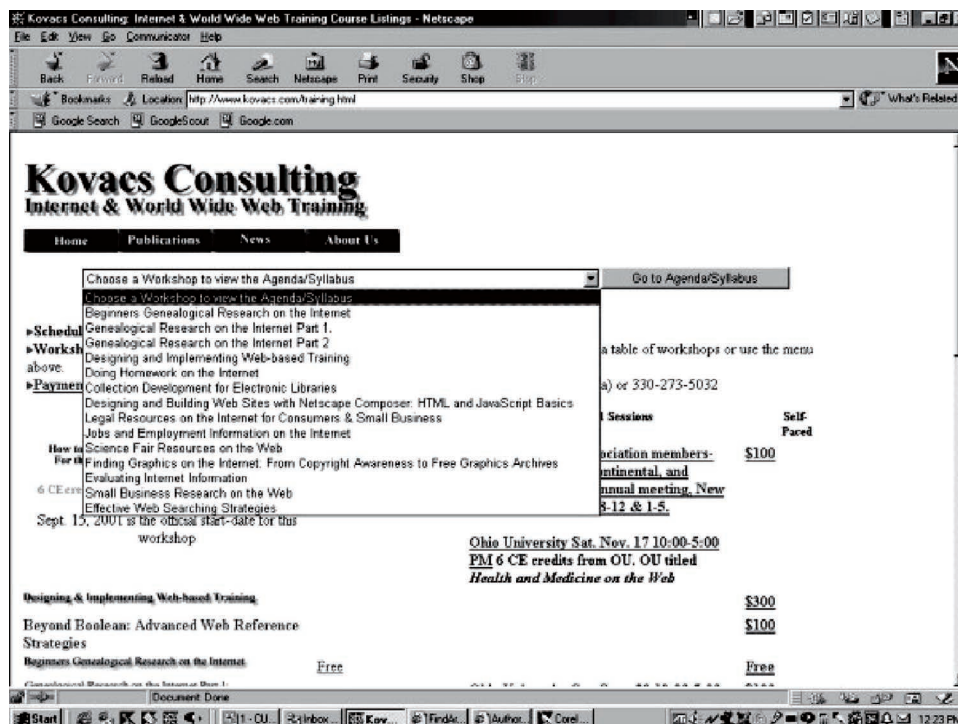


Fig. 5 The Web site for Kovacs Consulting. Independent trainers offering Web-based workshops provide continuing education opportunities for practicing librarians. Source: Kovacs Consulting.^[107]

others stress that librarians “go beyond merely ‘digitizing’ handouts that already exist.”^[118] Websites designed for teaching should take advantage of technology that creates an environment as similar to a live situation as possible.

Although eager to create complex, technologically enhanced library instruction websites, libraries with a limited, in-house knowledge base may find themselves restricted to choosing only development tools that do not require extensive programming knowledge.^[71] Nonetheless, library administrators may also consider the need to create online instruction tools as an opportunity to expand on the skills of the librarians working in their institution,^[119] an occasion to hire nonlibrarians to do the development,^[50] or a chance to find partners with the necessary skills outside of the library. Such varied strategies have enabled libraries to be at the forefront of online instruction with cutting-edge technologies and also to use low-end technologies in new and ingenious ways. The library at the University of Tennessee at Knoxville found that by positioning itself to be the pilot project for streaming video on campus, the Telecommunications and Network Services unit of the college provided network and digitizing support for them to build a virtual library tour.^[120,121] Librarians at Bowling Green State University in Bowling Green, Ohio, conversely, used the simple ability to edit HTML source code from their Web-based catalog results screens, ready-made graphics, text written to appeal to students, and hyperlinks to create a Web-based tutorial for basic library instruction.^[70,122] Because of Internet

design restrictions on the Bowling Green campus, the authors looked for ways to achieve interactivity without the benefit of server-side scripts. Fig. 6 shows the opening screen of a virtual tour of the University of Tennessee Libraries. Fig. 7 shows the Bowling Green State University interactive tutorial FALCON.

Librarians have also used javascript programming and Macromedia Shockwave to enable their Web tutorials for interactive learning. Quizzes, such as those included in the tutorial for the library at the University of Nevada, Las Vegas,^[123] depend on javascript to allow students to answer multiple choice questions online. The information literacy tutorial (TILT) at the University of Texas at Austin^[124,125] and the Data Game at Colorado State University Libraries^[126] instruct in basic library skills with appealing and often humorous Shockwave presentations that move as the viewer clicks and makes choices. Including exercises that require the learner to be more than a passive reader is frequently recommended for good library tutorial design.^[75,127,128] Hyperlinking, scripting, and Shockwave have all given libraries different ways to integrate exercises into tutorial lessons and to include quizzes that require student input.

Reaching out to the online learner through electronic mail

Clicking on radio buttons and making selections from pull-down menus that are included as part of the exercises

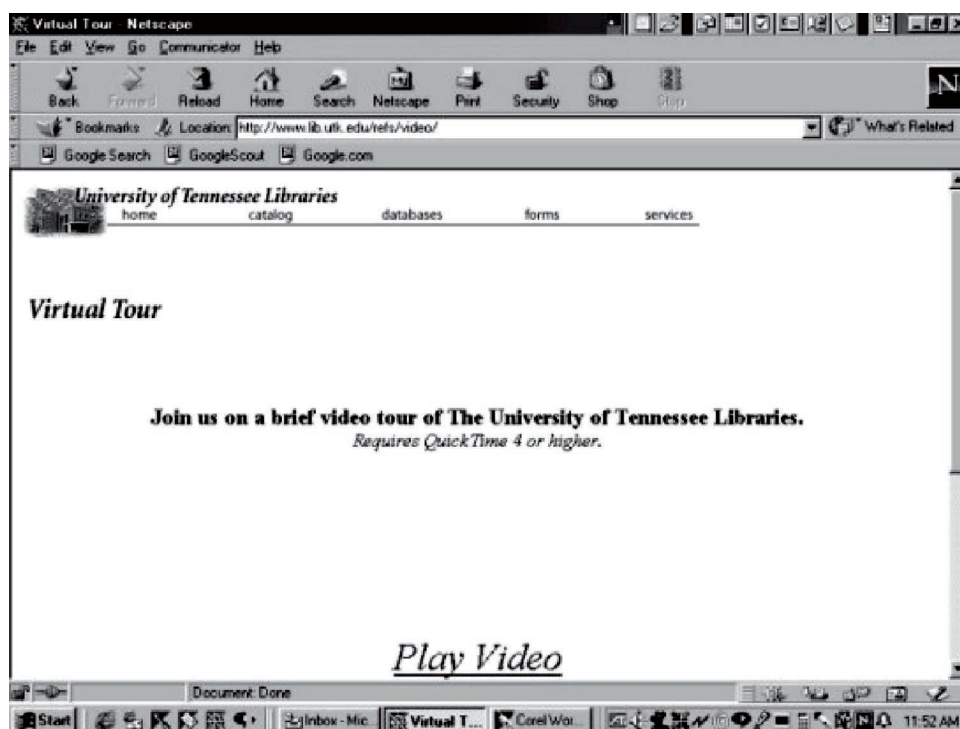


Fig. 6 Virtual Tour of the Hodges Library at the University of Tennessee at Knoxville. A QuickTime movie played on a Web site can substitute for an orientation tour of the library. Source: University of Tennessee Libraries.^[121]

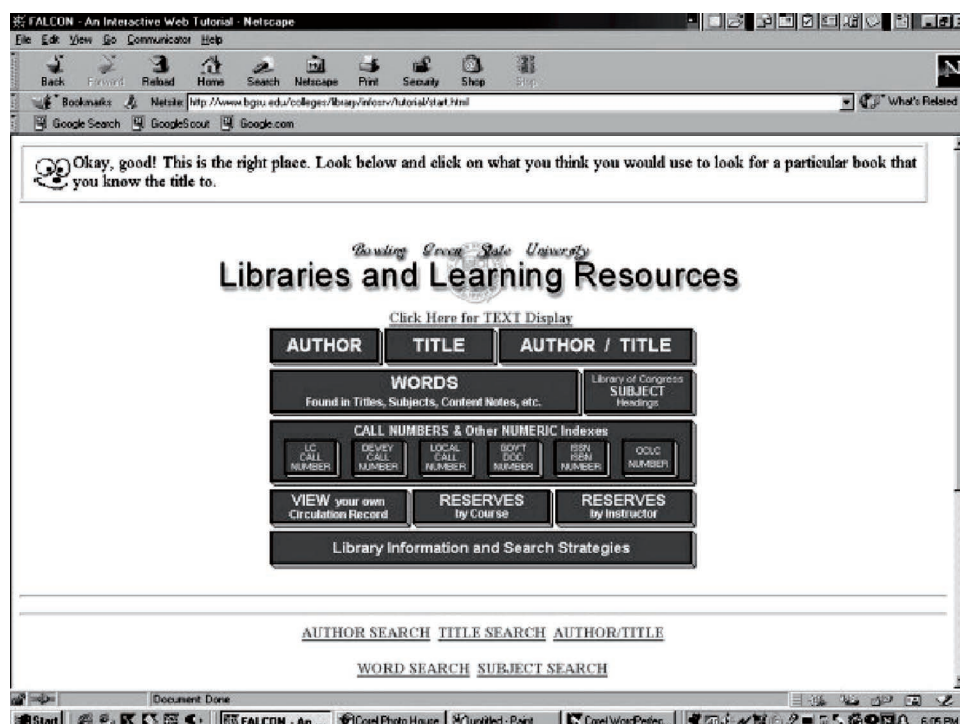


Fig. 7 FALCON, the interactive tutorial created for the libraries at Bowling Green State University in Bowling Green, Ohio. ©2001 Stefanie Hunker (used by permission of the author). Often a library tutorial may focus on a single resource and allow for interactivity without server or client-side scripting. Source: From Hunker.^[122]

or quizzes on an instructional website may give users of library tutorials a sense of active participation in the learning process. However, libraries have aimed to increase the interactive experience of online learning so that the student's interaction can be with the librarian instructor, or with other students, whenever possible, rather than only with a computer program or a website. Prior to the widespread use of graphical Web browsers, librarians reached out directly to potential users by delivering lessons in segments through e-mail. The librarians have instructed faculty, students, and staff, both affiliated and unaffiliated with their institutions. The e-mail instruction opened an opportunity for a direct, online conversation with an individual librarian.^[129-131] Even when libraries are able to offer instruction through the Web, as Sigrid Kelsey points out,

[t]he e-mail messages constitute a form of pro-active outreach; in contrast the web pages [are] a passive method of instruction largely dependent upon the participants' initiative to educate themselves.^[132]

Sending out instruction modules through e-mail may be seen as proactive, but once students have an invitation to e-mail an instruction librarian, the amount of student feedback may vary greatly. One librarian, who had established a mailing list of 109 interested readers for her seven-week sequence of lessons, received three e-mail queries from her students.^[132] Another librarian, however, running an online course with three graduate students in a school media program, sent out over 650 course-related e-mail messages, most dealing with technical issues.^[93] Academicians will often cite the large amount of e-mail that may be associated with running an online course to counter the belief that online education provides an opportunity to teach larger classes with no increase in instructor workload. Instructors have documented that running an online course and reading and answering student e-mail is more time consuming than running a traditional class.^[133] Teaching librarians in all capacities, who make themselves available to their students through e-mail, are as vulnerable to an unknown quantity of contact as instructors in other disciplines. Despite the potential for an overwhelming student response to an e-mail invitation offering support, however, librarians who offer their contact information to students and who also collect student e-mail addresses when they have the opportunity may find they have facilitated communication with individuals who might otherwise have held back from their instructor and remained reluctant to ask questions.

Expanding the connection with conferencing software, courseware, chat, and co-browsing

Telecommunications facilities allow the remote learner to communicate and to learn as part of a social process,

what Søren Nipper calls "the key element in the conceptual development of third generation models of distance learning."^[134] E-mail opened the first door of communication in the virtual classroom. Conferencing software and courseware have added features that enable the online classroom to mirror the physical classroom more fully. Conferencing or threaded discussion software allows for asynchronous discussion among students and instructors. An instructor posts text for consideration or poses a question and students respond. Each student's response is posted on a growing stream of responses to the initial posting. New topics engender new streams of responses.

Students may not be any more responsive as a group when their class includes a threaded discussion than they are when they sit in a live classroom. Consequently, instructors have a responsibility to keep students involved in an online threaded discussion.^[96] Faculty may have to cajole reluctant students to participate and require them to refer to the discussion content in their written assignments.^[24] As with physical classrooms, some students are more willing to participate than others. Conversely, students who may be reluctant to talk in a traditional classroom may be more comfortable and willingly express themselves in a written discussion setting.

Multifunction courseware packages such as TopClass,^[135] eCourse,^[136] WebCT,^[137] and Blackboard^[138] have expanded instruction possibilities for librarians offering course-integrated and credit-bearing instruction. The packages do not require the instructor to know hypertext mark-up language (HTML). They allow teachers to incorporate text documents and multimedia on their course sites, manage multiple courses, give online examinations, and monitor their students' achievement and grades. The software may provide an area for student biographies and images so that student working together virtually can attach faces to names of classmates. One application originally designed for business conferencing, Microsoft's Netmeeting, integrates a camera and audiobridge to allow online library instruction to include audio and visual connections in real time.^[18]

A number of courseware packages allow for chat or synchronous discussion in addition to threaded discussion forums.^[80,91] Chat, or software that allows typed conversation in realtime, is becoming increasingly popular with libraries of all types. Businesses and dot-com information services such as Webhelp^[139] use chat to provide real-time customer service and to answer a range of queries.^[140-142] Chat allows libraries to extend their reference services with point-of-need assistance and may be used to answer reference questions as well as to instruct.^[143-145] Chat can be useful for librarians running online classes. It enables them to set up online office hours and have real-time conversations with their remote learners. Fig. 8 shows a website^[145] where online chat can be used for communication.

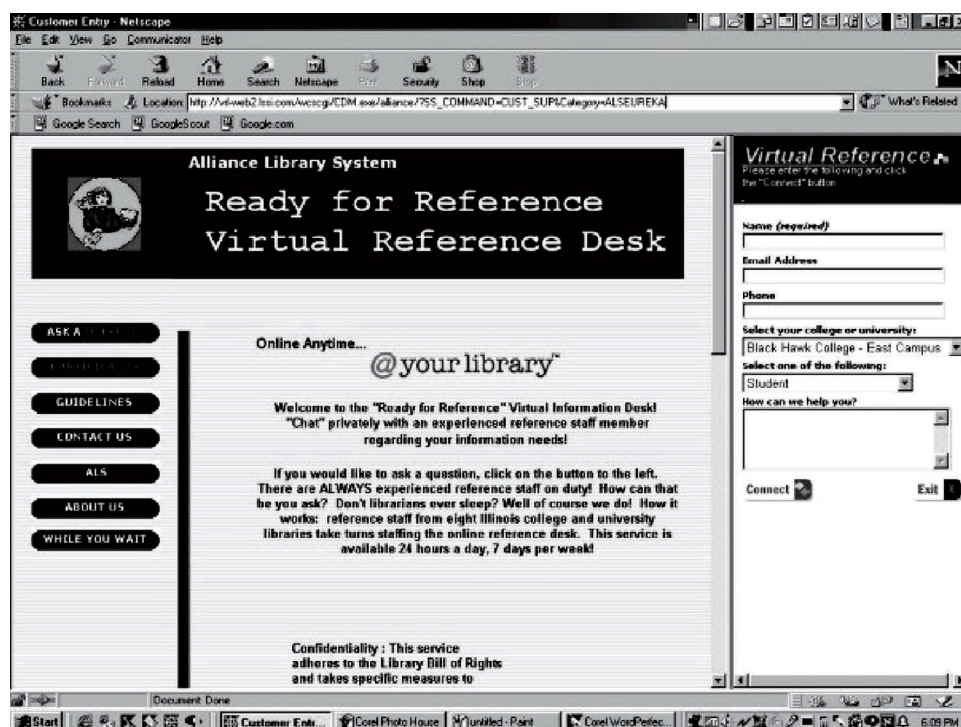


Fig. 8 The Virtual Reference Desk (Library Systems and Services) of the Illinois-based Alliance Library System. Chat software allows librarians to provide round-the-clock reference assistance and help with research. Source: Alliance Library System.^[145]

Chat as a tool for classroom interaction is limited by the typing abilities of those communicating and the tendency of chat conversations to become disjointed. Furthermore, most libraries currently offering chat service do not have the capability to engage more than one user synchronously with a librarian and each other. An emerging Web technology that is likely to replace chat and eliminate the tendency of conversations to become fragmentary is Voice over Internet Protocol (VoIP). Using VoIP, teaching librarians and remote learners can speak to each other using their computers and avoid the typing required in chat.^[146–148] A drawback of VoIP is that it requires users on both ends to upgrade their computers with expensive peripheral hardware. It was not until chat software that did not require the client computer user to download any plug-ins became available that librarians began to set up chat services. Until the cost of having access to VoIP drops and the procedures for installing it are simplified, librarians are not likely to see it as practical for providing remote assistance and instruction.

Some software libraries have used, other than courseware, incorporates a chat function and may also allow for collaborative Web browsing. Collaborative Web browsing is useful for online library instruction when a librarian is working in real time with an individual student doing Internet research. The screen exchange allows the remote student to show the librarian unsuccessful strategies and results and the instructor to show effective alternative search techniques.^[149–151]

Assessment of Online Library Instruction

Usability, learning outcomes, and learner/instructor preferences

Recent studies of alternative teaching methods in libraries have found that students learn equally well with live instruction and with online tutorials.^[90,152,153] Such evidence may encourage libraries with shrinking resources to embark on a program of online instruction. Nonetheless, libraries and all institutions of learning that have a distance learning program in place need to evaluate individually if the way in which they are teaching is effective and should be continued.^[154,155] Teachers and administrators have to consider student feedback on the usefulness and appropriateness of the online instruction methodology in addition to examining evidence of student learning.^[85]

The Emerging Technologies in Instruction Committee of the Instruction Section of the Association of College Libraries provides a number of criteria libraries may use to evaluate their instructional tutorials.^[156] Early on in the process of designing a tutorial, libraries can evaluate how usable their online instruction is by organizing focus groups of testers who mirror their potential users.^[78] Measuring the usability of an online instructional tool, nonetheless, differs from measuring the effectiveness of the instruction carried within the tool. Whereas computer and telecommunications technology makes tracking the use of instructional material possible in ways that could not have

been done before so much information became available electronically,^[157] the use statistics gathered by the technology do not measure how much learning has taken place. In addition, testing students in course content in online learning situations presents unique challenges that would not exist in a live classroom where the student seen attending a course is the student who arrives for a test.^[96,158,159] Moreover, as Denis Madland and Marian A. Smith point out, with specific reference to library instruction, educators would like to know if the skills learned through a library tutorial administered early on in the college career of a student carry over and show up as ability in a student doing research in later semesters.^[160] The question, nonetheless, is a question that may be asked of all library instruction, online and in person.

Libraries may find that using online instruction meets their needs to reassign professional staff to other tasks, but online instruction may not meet all of the needs of the students who are asked to use the CAI as their primary tool of learning. Furthermore, online instruction may not meet all the needs or desired goals of the instructors. Both students and instructors may favor live contact with each other and doubt that electronic correspondence is the most efficient or effective way to communicate with each other. Students encountering all library tools virtually through a CAI module may look for opportunities to use the physical library collection,^[161] value anything they can take away in print from a session with an online tutorial,^[58,90] and give highest ratings to the time spent with a librarian in person when their lessons couple traditional and online learning.^[80] Moreover, in some situations, computer-based instruction may be contraindicated. Students in a freshman program at California State University at San Marcos were not confident in their computer skills. This weakness, coupled with difficult subject matter, inhibited learning.^[79] Additionally, according to one study, students tracked into online library instruction modules as an alternative to live instruction show a high rate of failure to complete the instruction as offered.^[153] In addition, student ownership of a personal computer has been found to impact on the ability of participants in a sequence of online library instruction to do well in the course.^[86] Colleges and universities requiring that students learn through CAI need to consider this imbalance in outcomes as they plan a campus computer infrastructure and, alternatively, debate requiring all incoming students to own or lease a personal computer.

Economic viability

In addition to determining if online instruction is an effective teaching tool, researchers and administrators are interested in assessing the economic value of developing online learning.^[162,163] Librarians may assert that online instruction saves money without giving specific evidence of the facts.^[56,153] V. Lonnie Lawson, however, did a cost

analysis of developing CAI for library tours in comparison to the cost of staffing live library orientation visits. The analysis showed that the high cost of investing in hardware can outweigh the cost-savings in staff time.^[164] Polley Ann McClure argues, additionally, that the use of technology in education is still in the research and development stage where the costs of development are a long way from being recovered.^[165] The desire of academic administrators to reuse, and, consequently, prorate the cost of packaged CAI, has led faculty to debate their institutions over ownership of online courses and has challenged visions of how much money could be made by colleges and universities offering instruction online.^[166] Moreover, designing and keeping current multiple versions of an instruction tool in order to reach learners who may be using older versions of browsers, have slow connections to the Internet, or have limited vision is an added expense of online instruction.^[78,84,120]

CONCLUSION

Individual institutions of education, including libraries, will find themselves reviewing programs of online education at other institutions as well as in their own settings to decide if such programs should be implemented, need to be redesigned, or are doing well to serve their purpose. Beyond the programmatic level, nonetheless, these same institutions and academicians everywhere are considering the place of online education in the greater philosophical framework of what is the fairest and best way for an individual to learn.^[167] Concurrent with the discussion about the overall value of online education, moreover, librarians have been engaged in an ongoing dialog to define themselves clearly as educators, rather than guardians or deliverers of information. Electronic resources and telecommunications connectivity have removed the content of libraries from the physical structures of these institutions. Traditional library users have gone into cyberspace seeking out information and taking it where they find it. Librarians who see that their users are turning to this new online setting, look for ways to continue to play a role in the information-seeking experience for these online adventurers, even as they continue to serve a physical public.^[168] Just as providing the information alone may never have been enough of a role to play to satisfy librarians who recognize that knowledge is more than information, developing ways to make information more understandable remains an important goal for librarians in an online environment. Whether they play this role in the design of the systems that deliver information, or stand aside from the information systems as partner-explorers with the information seekers, librarians continue to recognize the importance of researchers having successful experiences in their search for and assimilation of information. Remembering that the information seeker is the reason

that information is gathered has encouraged librarians to migrate with their users into the online environment. Providing online library instruction has enabled librarians to meet their users where they are working and make the connection from one physical space to another across the digital information sphere.

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Online Public Access Catalogs (OPACs) [ELIS Classic]

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Abstract

In one form or another, from a mental list in the mind of the librarian, to book catalogs, card indexes, and online information retrieval systems, some type of meta access has existed to guide library users through library collections. Over the last 40 years, these constructs of paper and wood evolved into Online Public Access Catalogs (OPACs). When the catalog shifted out of drawers and off of three by five cards to become a networked, universally accessible entity, its role in the library shifted as well. The OPAC competes with the World Wide Web, metadata registries, search engines, and more sophisticated database structures for attention. Amongst this assortment of access mechanisms, the purpose of the OPAC has become muddled. The OPAC has now become one information source among many and one of a number of portals for accessing library collections and beyond.

INTRODUCTION

As long as there have been libraries there have been catalogs. In one form or another, from a mental list in the mind of the librarian, to book catalogs, card indexes, and online information retrieval systems, some type of meta access has existed to guide library users through collections. Over the last 40 years, these constructs of paper and wood evolved into Online Public Access Catalogs (OPACs). When the catalog shifted out of drawers and off of three by five cards to become a networked, universally accessible entity, its role in the library shifted as well. The OPAC competes with the World Wide Web, metadata registries, search engines, and more sophisticated database structures for attention. Amongst this assortment of access mechanisms, the purpose of the OPAC has become muddled. The OPAC has now become one information source among many and one of a number of portals for accessing library collections and beyond.

HISTORICAL DEVELOPMENT

The OPAC is understood to be the technological device that replaced the card catalog. The card catalog had in turn replaced the book catalog form that preceded it. The widespread acceptance of the card catalog at the beginning of the twentieth century reflected a trend towards standardization. The format used by these card catalogs lasted well into the 1990s and represented the influence of mass production in libraries. Catalog cards were first written by hand in library script, then typed, and ultimately ordered from vendors or the Library of Congress. Later they were produced via bibliographic utilities such as OCLC using MARC records. Each change in turn marked a move

toward a more efficient means of record creation and maintenance.

The widespread acceptance of the online catalog in the early 1980s marked a trend toward experimentation in library catalog design.^[1] However, the card catalog still has a strong influence on how current OPACs have been developed. Current systems and usage patterns are historical artifacts of the library card catalog. The OPAC interfaces and usage patterns embody a history of assumptions made during the card era.^[2] At the time online catalogs were developed, the library catalog had reached a remarkable degree of standardization and stasis as a device. The standardization arose from the mass production of cards and from the cultural acceptance of the card catalog as an access device. Online catalogs upset that stasis, and it appears that the standardization enjoyed during the era of the card catalog will not return for some time.^[2]

Online catalogs did not develop during a crisis situation. There was no pressing need to find an alternative to the card catalog. The technological capability was there, so the attempt was made to apply the new technologies to the existing systems and routines. Thus OPACs were not brought about by a revolution, but by an evolution of need. A large catalyst in this development was the creation and widespread acceptance of MARC. Use of MARC led to lower cataloging production costs and a greater standardization of description. The first attempts at library automation revolved around card production, acquisitions, and serial control. As the data formerly typed by hand or printed onto three by five cards was encapsulated and transmitted via the MARC formats, libraries and bibliographic utilities began to amass archives of bibliographic records. A natural next step for these libraries was to experiment with making access to these archives available to librarians, libraries, and the public by adapting or

creating search interfaces and emerging computer and database technologies. Early library automation centered on using these records to computerize circulation functions. This tendency to apply new technology to existing systems and routines is a common response to technological advance. There seemed to be no overwhelming burden under which librarians and users toiled that motivated them to push for the development and implementation of online catalogs. Consequently, the OPAC was not expected to be a great improvement over previous catalog formats. It was simply seen as a better, faster way to realize desirable system and cost efficiencies.^[2]

The cost and capabilities of computer and communications technologies shaped the ability of libraries to realize these efficiencies, as well as drove the dominant trends in library automation over the last three decades.^[3] In the specific case of OPACs, four factors can be seen as necessary for their development and acceptance:^[2]

1. The technology had to be available.
2. It had to be available at a price that was perceived as cost efficient by potential purchasers.
3. The systems had to be acceptable to users with their specific needs.
4. Online catalogs had to mesh with the goals of the libraries that developed or purchased the system.

The requisite technology for the birth of online catalogs (other than the MARC record structure perhaps) developed outside the library profession. This parallels the current trend in digital library development. Digital libraries initially arose out of the engineering and computer science disciplines before catching on in libraries. In the early days of OPAC development, library collections still revolved around monographs and serials, in various physical formats. Automated library access to monographic holdings developed after automated access to journal literature in most fields was well established.^[4] Many of the design features of the prototype online catalog systems, however, did not mimic the automated systems for access to journal articles.

The card catalog remains as the most influential parent of online catalogs and reinforces the evolutionary nature of their development. Online databases of journal articles, for example, did not emulate printed abstracts and indexing tools to the extent that early online catalogs emulated the printed card catalogs.^[2] This may have been an outgrowth of the fact that the same MARC record used to produce a catalog card was being used to create an on-screen display. Libraries did not switch en masse from card catalogs to OPACs. Large bibliographic utilities such as OCLC were still producing cards for libraries during this transition period. As a result, there was no immediate or revolutionary change in the basic record structure. It still had to play a dual role.

The development of Integrated Library Systems (ILS) and OPACs has been a response to needs for efficient

production and maintenance workflows within libraries. Needs for efficient authority control, inventory tracking of serials, circulation, and acquisitions were among the initial reasons for their development. Most systems developed out of MARC-based cataloging systems or commercial online circulation systems. In both of these instances, automation of library staff functions came first. Efficient production and maintenance routines were the chief attraction of online catalogs, not enhanced access. To the extent that access was discussed, an increased number of access points to bibliographic records were stressed, rather than enhanced user access possibilities.^[2] Much of this can be traced to the relative lack of search engine and interface design development at the time, but it also demonstrates the continued influence of the card catalog paradigm.

Although several academic libraries offered enhanced keyword searching early in OPAC development, it was not until the advent of the World Wide Web that we see real pressure from users to develop more sophisticated search and display mechanisms for OPACs. As the field of interface design began to thrive and better, faster more efficient search mechanisms became standard on the Internet and within commercial databases, the pressure to develop more effective services to users of OPACs grew. The World Wide Web and the perceived universal access to content it provides have raised expectations for OPAC interface design.

The imagined production efficiencies hoped for from ILS and OPACs were within the library as an institution, not efficiencies to be realized by the users of information systems. Initially, online catalogs were much more attractive to libraries and librarians than they were to users.^[2] In terms of automating arduous tasks and maintaining tighter bibliographic control, the systems were a boon to libraries. Unfortunately interface design at the time was not as sophisticated an area as today. This resulted in often-difficult interactions with the catalog as users attempted to grasp the new technology.

Online catalog development initially was supported by underfunded institutions (e.g., libraries) and the systems needed to be designed for a broad, untrained user population. Database and user interface design were not, then, traditionally part of the librarians experience. This was definitely the case during these early days. These two facts may explain why online catalogs were not on the leading edge of bibliographic storage and retrieval development and reflect the evolutionary, rather than a revolutionary, nature of their development.^[2] These systems were designed not to replace, but to enhance and continue preexisting practice.

There were three major types of OPAC systems developing during these early years: in-house, consortium, and package or turnkey systems.^[5] Of the pioneering in-house systems, the Library Control System (LCS) of the Ohio State University Libraries is perhaps the best known. Developed by IBM for the university in the late 1960s, it

developed from a circulation system to an online catalog. The LCS planners did not envision patrons conducting their own searches at public terminals nor did they plan on replacing the card catalog with LCS. Nevertheless, both of these things came to pass.

Notable milestones introduced by LCS in 1978 included the ability to store and display full bibliographic records, the provision of subject access to records, and the ability to browse through subject heading lists.^[5] Other pioneering in-house systems were Northwestern University's Northwestern Online Total Integrated System (NOTIS) and the Virginia Tech Library System (VTLS).

Libraries and library consortia that have designed and developed online catalogs locally to provide access to their databases of MARC records represent another type of online catalog development. What sets these online catalogs apart from those such as LCS and NOTIS is their radical departure from the card catalog as the model for online searching. The database structure and search methods of these catalogs were modeled largely after commercial information retrieval systems such as DIA-LOG and BRS. The challenge for these online catalogs was not merely to apply the models used by these information retrieval systems but to also preserve the traditional functions of the catalog and to produce a retrieval system that could be used by novices without assistance.^[5] Dartmouth College Library developed an end-user, self-explanatory, user interface to the BRS retrieval system as their online catalog in the early 1980s by creating a database using Dartmouth's OCLC transaction tapes. These MARC records were converted to BRS's internal record format. The project was innovative in its interface design goals and it uses of a record structure other than MARC.

One of the more significant consortial endeavors was begun in 1977 by the University of California system. Dubbed MELVYL, the purpose of the catalog was to make it possible to use the separate collections of the university's libraries as a single collection or to allow a user at any campus to access the collection at any other campus. Since some of the UC libraries used OCLC and others used RLIN, MELVYL became the first catalog to successfully merge OCLC and RLIN records into a single database. The prototype version went operational in 1981. As a public-access retrieval system, MELVYL was innovative in that it had a file structure that supported keyword access and Boolean queries, a patron interface that included two user-selectable dialog modes (menu-guided and command language) and an extensive "help" facility.^[5]

During the 1970s commercial vendors began to replace large university libraries as the principal developers of computer-based library systems.^[3] Among the reasons were libraries' lack of funding and research and development staffing. Commercial vendors were able to fund development more consistently; however, they did not always understand the access needs of patrons. These were

more inventory control systems with a searchable front end for the public than true information retrieval systems. Early online systems evolved according to the hardware and software systems of the era. Those that ran on proprietary operating systems and hardware fell away replaced by those that ran on operating systems thought of as industry standards.^[6] These turnkey systems were implemented in libraries often with mixed results.

The economic and technical realities of the 1980s favored increased autonomy and local library responsibility.^[3] A reaction to the economies of scale of the online technologies developed. In the 1980s administrators tried to regain much of the control over their own operations and decision making that they gave up to the networks in the 1970s.^[3] Many institutions of higher education were getting out of the systems design, development, and support business.^[2] Libraries began either purchasing entire systems from vendors or assembling ILS modules from several different vendors to create systems that fit their needs.

During the 1990s, integrated systems design became the exclusive domain of vendors. However, libraries and universities began exploring a tangential subject, that of digital library development. With the explosion of the World Wide Web in the mid-1990s, many information retrieval systems and search engines were developed to locate, organize, and retrieve information on the Web. The OPACs, as information retrieval systems, were, in many cases, left behind. They are now beginning to find a role in this new information landscape. The interfaces for these early OPACs tended to be less user friendly than their paper-based predecessors. The strongest pressure for the adoption of online catalogs came not from users, but from library management. Again, a need to find better, faster ways to realize production and management efficiencies was a driving force. However, the more online catalogs are expected to perform the functions of inventory control, acquisitions, cataloging, and public access to the collection, the less likely it is that public users will have a system well designed for public use.^[7]

WHAT DO OPACs Do?

The OPAC serves as a public face on a library's ILS. The ILS controls the following functions:

- Circulation (keeping track of items checked out and by whom)
- Cataloging (keeping and offering access to materials)
- Acquisitions (acquiring new items and tracking payments for them)
- Serials (tracking periodicals, claiming missing, or nonreceived items and binding)
- The OPAC
- Interlibrary loan (cooperative sharing of library materials)

At the core of the majority of ILS is the MARC record. Although there are innovative systems using BRS/Dataware, SGML/XML, or SQL to reformat data, typically a MARC/AACR2r-based bibliographic record serves as the focal point for all functions. Order, serial check-in, item, and circulation records “hang” off of it. The bibliographic record acts as a surrogate for the item describing its provenance, content, and container. The ancillary records document financial transactions related to acquisition, continued maintenance, and usage by the public. The OPAC interface translates MARC tags within the records to display labels read more easily by the public (i.e., 100 becomes author, 650 becomes subject).

A great deal of effort must be put into translating tags into labels that make sense to nonlibrarians. Also, given the large number of tags in the typical MARC record, the OPAC displays can run quite long. This has given rise to the traditional brief record display in today’s OPAC. Typically one MARC tag generates one labeled field unless the system is instructed to collapse fields together. The library can, depending upon the ILS involved, control what gets displayed and in what order.

The OPACs will search MARC records by author, keyword, corporate name, class number, title, series author/title acronym, ISBN/ISSN/LCCN, subject heading keyword, and subject heading browse. In addition, most OPACs offer phrase and keyword searching. Keyword searching within OPACs has become problematic. Web search engines lead users to believe that OPACs provide deeper access to content than they actually do. The OPAC keyword search is dependent upon the keywords being used within the MARC record. A Web search engine keyword query may mine the full text of an item in an effort to locate the terms used. Since an OPAC consists of item surrogates rather than complete text, the results are not the same.

A review of OPAC search logs may reveal that users attempt to use the OPAC as if it were a Web search engine without knowledge of the classification and subject heading structures inherent in it. Content enhancement of the basic OPAC record would allow the user to take full advantage of the abilities of the basic OPAC, let alone the future incarnations. Addition of abstracts, table of contents, back of the book indexes, etc. would greatly enhance the search experience.

Advanced OPACs allow users to sort and save search results for export in specific data formats. Results can be imported into programs for creating bibliographies or databases. Increased access is also available to patrons for reviewing their circulation records or, in the case of academic libraries, print and retrieve reserve materials for classes.

The OPACs began as stand-alone systems unique to each library, much the same as card catalogs. If a user wished to search the online catalogs of multiple institutions, they would need to locate the catalogs for each and run their search repeatedly. As networking and the

Internet came to the fore, more and more OPACs became linked via academic, regional, and statewide consortia. Consortia allow for simultaneous searching across member catalogs or group specific types of libraries together in clusters depending upon the subjects they represent (law, theology, etc.) or their status (academic, public, etc.). Consortial catalogs allow users to search the catalogs of multiple institutions at once, collate the results, and request materials needed through cooperative borrowing arrangements. This allows users access to the combined catalogs of many public and academic libraries with enhanced borrowing functions. It facilitates cooperative collection development among the institutions involved, as they will now be able to see where collections overlap. This has become more prevalent as libraries shift from the paradigm of collecting materials “just in case they are needed” to providing access to materials “just in time.”

In addition, bibliographic utilities placed public search interfaces on their union catalogs. OCLC’s WorldCat and FirstSearch allow users to search across OCLC’s database and retrieve records for items throughout the world. The OCLC’s InterCat and CORC projects have extended the scope of the catalog beyond traditional media. Increasingly, recent journal holdings are being made available to libraries through aggregator databases. In a number of cases, vendors will hook the holdings of a particular journal title in their databases to the MARC record in the library’s OPAC, allowing users to find the print version of the text should the full text not be available in the vendor’s database.

These recent enhancements to OPACs have allowed them to serve as gateways or proxy servers to licensed databases. The ILS patron database can be used to verify that an individual has authorization to access the databases and ensure that the library functions within licensing agreements. Also, additional enhancements have allowed title-level access to aggregator databases, and hooks to holdings that allow reverse access as well. Methods have become available that allow users to jump directly from an OPACs bibliographic record to a Web site or electronic file, text, or journal. Use of the 856 MARC field as a linking technology or bridge between the catalog record and the item described has made this commonplace. It alters, significantly, definitions of the catalog. Now the catalog not only describes what the library owns, but also what the library potentially has access to. These developments illustrate a growing convergence of portal development and OPAC design. Through this portal-OPAC, the user gains access to resources and people far beyond what earlier, more traditional definitions of a catalog would allow.

HOW EFFECTIVE ARE OPACS?

Users come to the OPAC with a particular need for information. However, they tend to search the OPAC as if it

were a Web search engine. While various metadata schemes exist to provide more structure to Web-based information, they are not in widespread use. As successive generations of users, savvier at searching, come to expect natural language oriented, full text searching and retrieval, the OPACs interface and search capabilities begin to look dated in structure and potential. The surrogate record structure does not lend itself easily to that type of query. Most users are unaware of the catalog's structure and are unable to use it effectively.

OPACs depend on user expertise for reasonably successful operation. Given their increased use of search engines on the Web, it is hard for users to understand that they cannot find everything in the catalog by using their own vocabulary, as they would doing a Web search, but must use a precoordinated subject heading system that does not necessarily match their language usage or topical vocabulary. The OPACs are very bad at subject searching often due to poor authority control and subject heading assignment and the fact that increasingly students and the public attempt to search the OPAC as they would search with an Internet search engine. These two insufficiencies combine to provide poor search results. With international access to OPACs on the Web, automation in multilingual and multiscript environments becomes important. Some vendors support this, but not all.

There appears to be a need to break the public pieces of the ILS away from the administrative functions related to the collection and other licensed databases. One system cannot do all of this effectively while still clinging to the vestiges of a card catalog. Not all of this is the fault of the OPAC. Descriptive cataloging has not yet mastered bibliographic control of electronic or digital items with the same degree of expertise as it has the medium of print. Innovative OCLC-led projects such as InterCat and Cooperative Online Resource Catalog (CORA) experimented with the ability of OPACs and the MARC format to access and describe electronic objects. Much progress has been made, specifically in describing and providing access to e-journals, but, despite great strides forward, library systems still lag behind many of their Web search engine counterparts. More work is needed to create descriptive metadata that focuses on content, not containers, and public displays that distill for users the information they require to find and retrieve items while, at the same time, balancing the needs of libraries for full, robust, standardized record keeping. An OPAC can only display and interpret the information it contains. It cannot make up for inefficiencies in the catalog record.

CONCLUSION

It is becoming more and more clear that in the future library catalogs will no longer retain their exclusive role

as the sole portal to the collection. More and more items are being cataloged in separate registries or via links and portal systems. The catalog becomes, then, one of many access tools. What is not clear is what will be the connecting force between all of these registries and the catalog.

MARC was created as a method of communicating bibliographic information. It is not necessarily the best method for organizing information within a database. New, more object-oriented methods have developed since MARC came on the scene. Mark-up languages such as XML as well as developments in descriptive metadata will improve functionality of the OPAC and allow for a more flexible container or packet structure for the data. Leveraging these technologies would make OPAC function more flexible and allow for the integration of other data structures. All of these technologies also play into the OPACs function as a user interface for the catalog. Compared to other search engines prevalent on the Internet, the OPACs interface seems very dated.

Library automation vendors vie with each other to deliver a system that can stand as a true client/server, multitiered, graphical, Web-enabled, Unicode-enhanced, object-oriented integrated library system built on an industry-standard relational database management system.^[6] And so the standard is set for the current generation of library automation systems. The OPAC's general characteristics will include a client/server architecture; support for multiple character sets, preferably through Unicode; a windows-based graphical user interface for library staff; a Web interface for library users; use of a standard relational database system; a Z39.50-compliant server; import and export of MARC records; and Electronic Data Interchange (EDI).^[6]

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Ontologies and Their Definition

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Abstract

This entry introduces ontologies as a potential “silver bullet” for knowledge management, enterprise application integration, and e-commerce. Ontologies enable knowledge sharing and knowledge reuse. The degree to which an ontology is machine-understandable, its formality, is determined by the language used for the specification of the ontology. There exists a trade-off between the expressiveness of an ontology language and the modeling support it provides for the ontology developer. This entry also describes how different knowledge representation formalisms, together with the Web languages XML and RDF, have influenced the development of the Web ontology language OWL.

INTRODUCTION

The current Web and current enterprise application integration (EAI) systems lack standards and formal descriptions that impede information sharing and reuse, and cooperation between individuals and organizations. This problem is illustrated in the Web while performing a search. A search query typically returns many unrelated results, and information from such search results needs to be manually extracted from the source and manually combined with different sources. Inside organizations this problem is illustrated by the overlap in the data maintained by many applications. This overlap is often hard to detect. Even when such an overlap is identified, it is hard to deal with because the relation between data in different applications is often difficult to precisely characterize.

Ontologies can potentially solve these problems by facilitating knowledge sharing and reuse through formal and real-world semantics.^[1] Ontologies, through formal semantics, are machine understandable. A computer can process data annotated with references to ontologies and through the knowledge encapsulated in the ontology deduce facts from the original data. Ontologies make knowledge explicit, thus making it easier to see what kind of data are maintained by an application and to understand the meaning of the data. Therefore, ontologies facilitate the discovery of overlaps, and thus enable interoperability between heterogeneous systems. Furthermore, ontologies are intended to be shared models of a certain domain facilitating cooperation between different applications and even between different partners within that domain.

ONTOLOGIES AND THE SEMANTIC WEB

The term “ontology” originally comes from philosophy, where it stands for the universal theory of existence. The term ontology has been adopted by several Artificial Intelligence (AI) research communities; these were originally the knowledge engineering, natural-language processing, and knowledge representation communities. In the late 1990s, the notion of ontologies also became widespread in fields such as intelligent information integration, information retrieval on the Internet, and knowledge management.^[2]

In AI, the term ontology refers to a description of a part of the world in a program. Ontologies were developed to facilitate knowledge sharing and reuse. A common definition of the term ontology, used by many researchers in the field of ontologies, is given in Gruber:^[3] “An ontology is a formal explicit specification of a shared conceptualization.” A conceptualization is an abstract simplified view of the world that we wish to represent for some purpose. The ontology is a specification because it presents the conceptualization in a concrete form. It is explicit because all relevant concepts and constraints of the domain are explicitly defined. It is formal, which means that the ontology should be machine processable. It is shared—the ontology captures consensual knowledge.^[2]

According to Fensel,^[1] ontologies, through formal, real-world semantics, and consensual terminologies, interweave human and machine understanding. The real-world semantics are not captured by Gruber’s definition, but we feel that this is a very important property of ontologies. It is the real-world semantics that allow sharing and reuse of ontologies by both humans and machines.

A reason for the increasing interest in ontologies nowadays comes from the development of the Semantic Web.^[4] The Semantic Web can be understood as knowledge management on a global scale. Tim Berners-Lee, inventor of the current World Wide Web and director of the World Wide Web Consortium (W3C), envisions the Semantic Web as the next generation of the current web, where the information will be machine readable and the services will be automated. According to Fensel^[1] “The explicit representation of the semantics underlying data, programs, pages, and other web resources will enable a knowledge-based web that provides a qualitatively new level of service.” Ontologies provide such an explicit representation of semantics. The combination of ontologies with the web enables overcoming of many of the problems in knowledge sharing and reuse and information integration.

Ontologies interweave human and computer understanding of symbols. These symbols, also called terms (We mean here by “term” the word which is used to specify a certain concept.) and relations, can be interpreted by both humans and machines.

The meaning for the human is presented by the term itself, which is usually a word in natural language, and by relationships between terms that are understandable to humans. An example of such a human-understandable relationship is the superconcept–subconcept relationship (often denoted by the term *is-a*). This relationship denotes the fact that one concept (the superconcept) is more general than another (the subconcept). An example would be the superconcept person, which is more general than the subconcept student. Fig. 1 shows an example concept hierarchy (taxonomy), where the more general concepts are located above the more specialized concepts.

Concepts describe a set of objects in the real world. For example, the concept PhD-Student aims to capture all existing Ph.D. students. One such Ph.D student is Peter, modeled in Fig. 1 as a box. Peter has an instance-of relationship to the concept PhD-Student. This instance-of relationship means that the actual object is captured by the concept PhD-Student. Because of the formal relationships between the concepts PhD-Student, Student, Researcher, and Person, Peter must also be an instance of the concepts Student, Researcher, and Person.

These relationships are fairly easy to understand for the human reader. As the meaning of the relationships is formally defined a machine is able to reason with them and draw the same conclusions as the human reader. That which is implicitly known to humans (a human knows that every student is a person), is formally and explicitly encoded into these relationships, so that they can then be understood by a machine. In a sense, rather than the machine gaining real “understanding,” it is able to process “understandings of humans” and draw conclusions through logical reasoning.

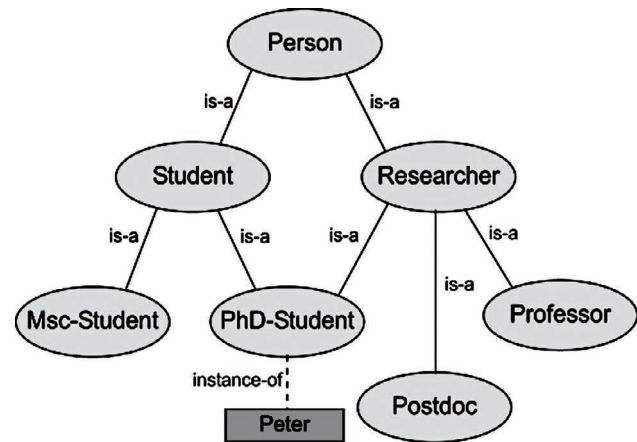


Fig. 1 Example *is-a* hierarchy (taxonomy).

Types of Ontologies

There exist many different ontologies built for many different types of applications, which vary in the detail they express and the generality of their uses.

WordNet, for example, aims to cover all of the English language by providing a natural-language description for each English term and then specifying simple relationships, such as synonym (equivalent terms) and hyper-/hyponym (more/less general terms), between terms.^[5] The scope of WordNet is very broad (all of the English language), the level of detail is relatively low, and the relationships are quite simple. The term descriptions are limited to natural language and are thereby not machine understandable.

Cyc is another example of an ontology with a very broad scope attempting to capture all commonsense knowledge (e.g., space and time), but with a high level of detail.^[6] There are many very strict formal relationships between different terms. These formal relationships are machine-understandable.

We will refer to the scope of the ontology as the generality of the ontology; the level of detail is the expressiveness of the ontology. We provide a more detailed description of the generality and expressiveness of ontologies below and use these as dimensions to classify existing ontologies.

Generality of Ontologies

Because ontology is a specification of a shared conceptualization within a particular community, domain experts, users, and designers need to agree on the concepts and relations that are specified in the ontology. Such an agreement can be difficult to achieve. By layering the necessary knowledge in different ontologies based on generality, all parties need not agree to all ontologies. Agreement on the concepts and relations in the ontology is only required for

the utilized top-level ontologies and for the specific domain and application ontologies.^[7]

In the literature, we generally find three common layers of knowledge, corresponding to three different types of ontologies, based on their levels of generality, namely:^[1,2,8,9]

- *Generic (or top-level) ontologies*: Capture general, domain-independent knowledge (e.g., space, time, etc). Examples are WordNet and Cyc. Generic ontologies are shared by a large number of people across different domains.^[5,6]
- *Domain ontologies*: Capture the knowledge in a specific domain. An example is UNSPSC, which is a product classification scheme for vendors.^[10] Domain ontologies are shared by the stakeholder in a domain.
- *Application ontologies*: Capture the knowledge necessary for a specific application. An example could be an ontology representing the structure of a particular web site.

The separation between these three levels of generality is not always strict. For example, WordNet contains some domain-specific relations and Cyc contains domain-specific microtheories (modules of the ontology).

Although sometimes other types of ontologies (such as representational ontologies or task ontologies) are distinguished, the above three types of ontologies are commonly referred to in the literature and serve as the most useful separation of ontology types according to generality.

Expressiveness in Ontologies

Orthogonal to the generality of ontologies is their expressiveness. The expressiveness of ontology is typically, but not necessarily, determined by the ontology language; the expressiveness of the ontology language is the upper

bound for the expressiveness of the ontologies that are specified using this language. We distinguish several levels of expressiveness partly based on the ontology spectrum introduced in McGuinness^[11] (see also Fig. 2). These are:

Controlled vocabulary: A list of terms. An example is Dublin Core.^[12]

Thesaurus: Relations between terms, such as synonyms, are additionally provided. An example is WordNet.^[5]

Informal taxonomy: There is an explicit hierarchy (generalization and specialization are supported), but there is no strict inheritance; an instance of a subclass is not necessarily also an instance of the superclass. An example is the Yahoo! Dictionary.^[13]

Formal taxonomy: There is strict inheritance; each instance of a subclass is also an instance of a superclass. An example is UNSPSC.^[10]

Frames: A frame (or class) contains a number of properties and these properties are inherited by subclasses and instances. Ontologies expressed in resource description framework schema [RDF(S)] fall in this category.^[14]

Value restrictions: Values of properties are restricted (e.g., by a data type). Ontologies expressed in OWL Lite (see the section on “Ontology Language” below) fall in this category.

General logic constraints: Values may be constraint by logical or mathematical formulas using values from other properties. Ontologies expressed in OWL DL (see the section on “Ontology Language” below) fall in this category.

General logic constraints: Very expressive ontology languages, such as those seen in Ontolingua or CycL, allow first-order or even higher-order logic constraints between terms and more detailed relationships, such as disjoint classes, disjoint coverings, inverse relationships, part-whole relationships, etc.^[6,15] Note that some of these detailed relationships, such as disjointness of classes,

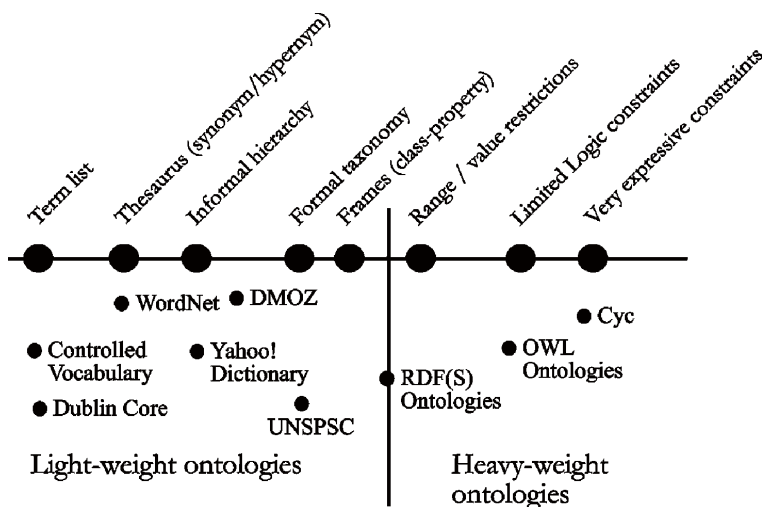


Fig. 2 An ontology expressiveness spectrum.

are also supported by OWL DL (and even OWL Lite), which indicates that the borders between the levels of expressiveness remain fuzzy.

Besides the distinction between different levels of expressiveness, Fig. 2 also shows the distinction between lightweight and heavyweight ontologies, as introduced in Corcho,^[16] as well as several examples of ontologies according to their location in the ontology expressiveness spectrum. Lightweight ontologies include concepts, properties that describe concepts, relationships between concepts, and concept taxonomies. Heavyweight ontologies also (perhaps instead of “also” you could write “extend lightweight ontologies to”) include axioms and constraints, such as value and cardinality restrictions.

ONTOLOGY LANGUAGES

In the areas of knowledge engineering and knowledge representation, interest in ontologies really started taking off in the 1980s with Knowledge Representation systems, such as KL-ONE and CLASSIC.^[17,18]

An important system for the development, management, and exchange of ontologies in the beginning of the 1990s was Ontolingua, which uses an internal KIF (Knowledge Interchange Format) representation, but is able to interoperate with many other Knowledge Representation (ontology) languages, such as KL-ONE, LOOM, and CLASSIC.^[15,19]

The languages used for ontologies were determined by the tool used to create the ontologies. Systems like KL-ONE, CLASSIC, and LOOM each used their own ontology language. The Ontolingua system was capable of translating ontologies between different languages using the KIF language as an interchange language. The languages and tools can be understood as interdependent, but also somewhat orthogonal, where we have the language on one axis and the tool on the other. For example, KL-ONE, CLASSIC, and LOOM all have their basis in Description Logics, while KIF has its basis in first-order logic.^[20]

In the early 1990s, KIF could be seen as a standard for ontology modeling. The language was used in prominent tools, such as Ontolingua, and in important ontology engineering projects, such as TOVE (Toronto Virtual Enterprise) and The Enterprise Ontology.^[21,22]

Later on in the 1990s, ontologies began to be applied to the World Wide Web. SHOE, for example, used ontologies to annotate web pages using formal ontologies embedded in HTML documents.^[9] Ontobroker and its successor On2broker, developed in the late 1990s, uses ontologies not only to annotate web pages, but also to formulate queries and derive answers.^[23] Ontobroker (and On2broker) provides an annotation language, which is used to annotate HTML documents with references to ontologies. The ontology (the terminology used by the annotation language) is specified using the representation

language based on F-Logic.^[24] Finally, Ontobroker uses a query language for the retrieval of documents based on their annotations. This query language is a subset of the representation language.

These ontology languages have all influenced the ontology languages for the Semantic Web. Below, we describe the different languages on the Semantic Web. We describe the history and development of the ontology languages in the context of the Semantic Web, starting with RDF(S) and moving to OWL.

Toward an Ontology Language for the Semantic Web

In this section, we describe the languages that are used to enable the Semantic Web and provide a basis for the development of ontology languages for the Semantic Web. The goal of such development is to establish one Web ontology language, developed by the W3C, as well as other web-enabled ontology languages, which will collectively form a basis for the W3C OWL language.

In the late 1990s the idea of a Semantic Web boosted the interest in the development of ontologies even further.^[4] The general conviction, held by the W3C, is that for the Semantic Web an ontology language needs to be developed that is both compatible with current Web standards and layered on top of them. The language needs to be expressed in XML and preferably layered on top of RDF(S) (see the subsections below for an overview of these languages). We will present the Web ontology language OWL, which has been developed as an ontology language for the Semantic Web.

An (perhaps too) often used depiction of the vision of Semantic Web languages, originally presented at XML2000 (<http://www.w3.org/2000/Talks/1206-xml2k-tbl/slide10-0.html>) by Tim Berners-Lee, is shown in Fig. 3. This so-called Semantic Web language Layer Cake depicts the different kinds of languages envisioned to be used on the Semantic Web. The layering of languages on the Semantic Web is both a syntactic and a semantic layering of languages.

The two bottom layers in the Layer Cake, Unicode-URI and XML (Schema), consist of existing standards and provide a syntactical basis for the Semantic Web languages. Unicode provides an elementary character-encoding scheme, which is used by XML. The Uniform Resource Identifier (URI) standard provides a means to uniquely identify and address documents and, more generally, resources, on, but also outside, the Web. All concepts used in the languages located higher in the Layer Cake can be specified using Unicode and are uniquely identified by URIs.

We will describe the XML, RDF(S), and ontology layers below. We will not cover the Logic, Proof, and Trust layers here. The Logic layer on top of the ontology language layer in the Semantic Web tower seems a little strange because current ontology languages have a good

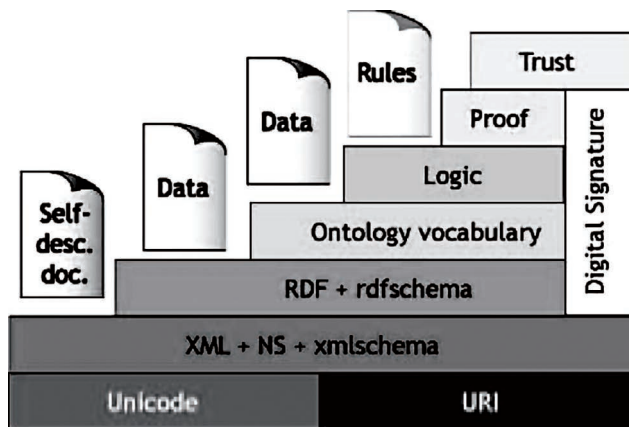


Fig. 3 The Semantic Web Language Layer Cake.

Source: <http://www.w3.org/2000/Talks/1206-xml2k-tbl/slide10-0.html>.

grounding in logic. There is some debate on this logic language layer; some say a more expressive logic language should be layered on top of the ontology language.^[25] It could also be argued that this is not an appropriate layering; that the ontology language should be the top language and that applications should use it directly. However, there is a general conjecture that a more expressive rule language is required. There is currently a proposal for a Semantic Web Rule language, which is layered on top of OWL.^[26] The Proof and Trust layers are not well understood, but most likely refer to the application and not to some specific language (the application could prove some statement by using deductive reasoning and a statement could be trusted if it is proven and digitally signed by some trusted third party). The user would very likely play an important role in the Trust layer because it is the user that should decide whether or not some information source should be trusted.

Extensible Markup Language

Extensible Markup Language (XML) is a language for describing data in a structured or semistructured manner.^[27] Data are described using a number of tags with arbitrary names that can contain other tags or arbitrary data. A tag may contain attribute-value pairs. Furthermore, tags can be nested yielding a tree-based data structure. The names of the tags can be chosen arbitrarily by the creator of the XML document. This means that an XML document can be understood by a human reader if the name of the tags and the structure are chosen with care by the author and the reader understands the language used by the author. But even then problems can arise, because different people have different associations with terms. For example, some people would argue that the concept “Animal” includes humans, whereas others might

feel uncomfortable being classified as an animal, and thus do not consider the term to include humans.

Because an XML document is formally structured using tags, it is possible to process the document using a machine if there is an agreement about the structure of the document [using a document type definition (DTD) or XML Schema, discussed below]. However, a machine cannot understand the meaning of an XML document, as the tags are arbitrarily chosen by the author. The data in an XML document can only be processed in a prescribed way by organizing tags in a specific syntactical structure. The major benefit of using XML as the foundational layer of other languages is the fact that it presents a standardized way of representing data structures. Structures in higher-level languages can be mapped to structures in XML. Furthermore, XML makes use of the URI concept and provides namespace support. Also, XML enables the use of Unicode for character encoding and provides a standardized way of identifying the character encoding of a document.

An example XML document is shown in Fig. 4. The root element is “student,” denoted by the <student> start and the </student> end tags. All data are enclosed in elements nested within this root element.

If the XML document from Fig. 4 is sent from one machine to the other, the other machine can only process the document if it knows the schema of the document (i.e., the exact syntactical structure) and if it knows how to process the data enclosed in the document.

We illustrate this requirement of being aware of the exact schema and the way of processing each element with the XML document in Fig. 5. One can see that both XML documents aim at representing exactly the same information. The data in both documents have the same meaning (i.e., the same semantics), but the way it is represented (the syntax or structure) is different. For example, where the document in Fig. 5 uses the element PhD-Student to denote a Master’s student, the document in Fig. 4 uses the Student element, together with a Type element containing the data PhD, to denote a Ph.D. student. A human looking at the documents can see that they both represent the same student. A machine processing the document, however, does not see the similarity between the two documents because it has no means of relating different names and different structures.

```
<student>
  <name>Jos de Bruijn</name>
  <type>PhD</type>
  <birthdate>1979-06-23</birthdate>
  <email>jos.debruijn@deri.org</email>
</student>
```

Fig. 4 XML document “Student.”

```

<phdstudent>
  <name>Jos de Bruijn</name>
  <dateofbirth>23-6-1979</dateofbirth>
  <contact>jos.debruijn@deri.org</contact>
</phdstudent>

```

Fig. 5 Sample XML document “PhD-Student.”

XML can be used as a format for data exchange between machines, in which case all parties taking part in the exchange need to agree on a common structure for the XML document, a common DTD or XML Schema. Furthermore, all parties need to agree on how to process these structures, i.e., they need to agree on the semantics of the XML tags, even though XML does not provide support for this. Another possible use of XML, as it is done in the Semantic Web, is to use it as the serialization language for other languages. This has the additional advantage of the possibility of reuse of many XML parsers, validators, and other XML-related tools.

Document type definitions

The structure of an XML document can be described using a DTD. A specific DTD describes the constraints on the structure of an XML document for it to be valid with respect to that DTD. A DTD describes the structure of a class of XML documents. Agreement on a DTD between different parties allows exchange of XML documents that conform to the DTD. However, note that only agreeing on a specific DTD is not enough for understanding all valid XML documents, as only the structure (the allowed tags) is described and not the meaning of these tags. A simple DTD describing the class of XML documents to which the document of Fig. 4 belongs is shown in Fig. 6.

XML Schema

Just like DTD, XML Schema is used as a language to describe classes of XML documents. As with DTD, the structure of XML documents is prescribed by the schema.^[28] A major difference between DTD and XML Schema is the fact that the latter has a broad range of (simple) data types (e.g., string and integer) and the

```

<!ELEMENT student (name, type, birthdate, email)>
<!ELEMENT name (#PCDATA)>
<!ELEMENT type (#PCDATA)>
<!ELEMENT birthdate (#PCDATA)>
<!ELEMENT email (#PCDATA)>

```

Fig. 6 Document type definition for “student” example.

possibility to form (arbitrarily) complex data types. An example of XML Schema for the class of XML documents to which the document in Fig. 4 belongs is shown in Fig. 7.

Because XML Schema also allows for the specification of many types of constraints, it would be a more suitable candidate for an ontology language than DTD. The main problem with an XML Schema is that it describes the physical structure (syntax) of an XML document but not the meaning (semantics) of the data. The relationship between ontology and XML Schema can be seen as analogous to the relationship between a conceptual database schema (e.g., an EER diagram) and a physical database schema (e.g., a relation database schema).^[29]

Klein et al. examined the relation between a specific ontology language, namely, OIL, which is a predecessor of OWL (see below), and XML Schema.^[29,30] One of the results of the comparison was that OIL has more expressive power when it comes to expressing knowledge and XML Schema has more expressive power when it comes to the structure of the data (e.g., there is no such thing as ordering in OIL) and data types (there are no data types other than string in OIL and to completely axiomatize different data types would be complex; OWL adopts XML Schema data types). Here again, it is stressed that ontology provides a domain theory and not the structure of a data container (like an XML Schema does), which explains most of the differences between the two.

Resource Description Framework Schema

The RDF is the first language developed especially for the Semantic Web. It was developed as a language for adding machine-readable metadata to the existing data on the web. It uses XML for its serialization to realize the layering as depicted in the Semantic Web Language Layer Cake (Fig. 3). Resource description framework schema extends RDF with some basic (frame based) ontological modeling primitives.^[14] There are such primitives as classes, properties, and instances. Also, the instance-of, subclass-of, and

```

<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema">
  <xs:element name="student">
    <xs:complexType>
      <xs:sequence>
        <xs:element name="name" type="xs:string"/>
        <xs:element name="type" type="xs:string"/>
        <xs:element name="birthdate" type="xs:date"/>
        <xs:element name="email" type="xs:string"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
</xs:schema>

```

Fig. 7 XML Schema for “student” example.

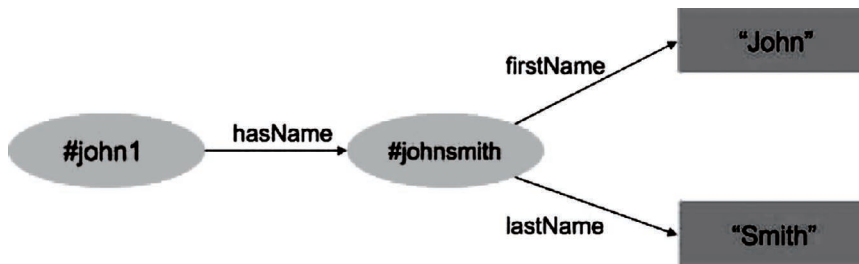


Fig. 8 Sample RDF graph.

subproperty-of relationships have been introduced enabling creation of class and property hierarchies.

The RDF(S) (referring to the combination of RDF and RDF Schema) is not very expressive compared to many other ontology languages, as it just allows the representation of concepts, concept taxonomies, and binary relations. In the ontology expressiveness spectrum of Fig. 2, RDF(S) has the expressiveness of formal taxonomies combined with frame-based representation.

Resource description framework has the subject–predicate–object triple, commonly written as P(S,O), as the basic data model. An object of a triple can in turn function as the subject of another triple, yielding a directed labeled graph, where resources (subjects and objects) correspond to nodes and predicates correspond to edges. Furthermore, RDF allows a form of reification (a statement about a statement), which means that any RDF statement can be used as a subject in a triple; however, reification is not reflected in the formal semantics of RDF, and thus no additional conclusions can be drawn from the use of reification. A sample RDF graph is shown in Fig. 8. The corresponding triples notation is shown in Fig. 9; the RDF/XML serialization is shown in Fig. 10.

An XML Schema prescribes the order and combinations of the tags (the structure) in an XML document. In contrast, RDF Schema only provides information about the interpretation of the statements given in an RDF data model, but does not say anything about the syntactical appearance of the RDF description. Resource description frameworks can, in fact, be seen as an extension to RDF. Resource description frameworks provide for a means to define classes, class hierarchies, properties (binary relations), and property hierarchies. The classes and properties of RDF(S) can be instantiated in RDF (Fig. 11).

We have described the foundational Semantic Web languages XML and RDF(S). These languages are used as the lower layers in the Semantic Web Language Layer Cake, on top of which more expressive languages can be layered.

```

(hasName, #john1, #johnsmith)
(firstName, #johnsmith, "John")
(lastName, #johnsmith, "Smith")
  
```

Fig. 9 RDF triples.

OWL

Using the DAML+OIL language^[32] as the basis, the W3C Web Ontology working group has created a new ontology language for the Semantic Web; one that implements true layering on top of RDF(S) and incorporates the wishes of many stakeholders, both academic and industrial. The Web Ontology Language OWL consists of a set of three strictly layered dialects, namely OWL Lite, OWL DL, and OWL Full.^[33] This means that OWL Lite is a subset of OWL DL and OWL DL is a subset of OWL Full.

OWL is an extension of RDF(S). There are, however, some problems when layering OWL on top of RDF(S).

In Fig. 12 we see a very simple example of OWL, corresponding to the “student” example introduced earlier (see Fig. 4). Because of the very verbose RDF/XML syntax, this example is very hard to read. Fig. 13 presents the abstract syntax form of this simple OWL ontology. Note that the abstract syntax can only be used for the OWL Lite and OWL DL sublanguages. Note also that even the abstract syntax is quite complex for such a simple definition (just one class with four properties). This complexity originates from the Description Logic origins of OWL. The properties are defined separately from the classes instead of as a part of the classes.

It is possible to define the local property restrictions in OWL, thereby regaining some of the frame-based modeling possibilities originally introduced in OIL.^[32]

```

<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:s="http://description.org/schema/">
  <rdf:Description about="#john1">
    <s:hasName>
      <rdf:Description about="#johnsmith">
        <s:firstName>John</s:firstName>
        <s:lastName>Smith</s:lastName>
      </rdf:Description>
    </s:hasName>
  </rdf:Description>
</rdf:RDF>
  
```

Fig. 10 RDF/XML serialization.


```

<rdf:RDF>
  <rdfs:Class rdf:about="#student">
  </rdfs:Class>
  <rdf:Property rdf:about="#birthdate">
    <rdfs:domain rdf:resource="#student"/>
  </rdf:Property>
  <rdf:Property rdf:about="#email">
    <rdfs:domain rdf:resource="#student"/>
  </rdf:Property>
  <rdf:Property rdf:about="#name">
    <rdfs:domain rdf:resource="#student"/>
  </rdf:Property>
  <rdf:Property rdf:about="#type">
    <rdfs:domain rdf:resource="#student"/>
  </rdf:Property>
</rdf:RDF>

```

Fig. 11 Example of RDF(S) ontology.

Problems with OWL and Language Layering on the Semantic Web

In the language layering on the Semantic Web, we can distinguish syntactic layering (RDF uses a subset of XML, so every RDF document is valid XML) and semantic layering (every valid RDF statement must be a valid OWL Full statement). There is syntactic layering between Unicode, XML, and RDF and semantic layering between RDF and RDF schema [i.e., the RDF(S) meaning of constructs incorporates the RDF meaning of constructs] and now also between RDF(S) and OWL Full.^[25]

The following are the problems we have found with the current OWL language and the layering on top of RDF(S).^[1,25,34]

- It is not possible to fully layer a Description Logic-style language on top of RDF(S). The first problem is the fact that in RDF(S) keywords in the language are allowed to occur in RDFS ontologies. For example, one can create subclasses of `rdf: type`. Using the language constructs in the language itself is not possible in a first-order framework, because first-order logic does not allow for redefinition of the language. The second problem is the mixing of identifiers for classes, properties, and individuals. In RDF(S), the same individual can be a class and an individual at the same time. This cannot be captured in a first-order framework, because predicates are not allowed to occur in the place of terms.
- OWL Lite is the least expressive of the species of OWL. However, it still requires a fully fledged Description Logics reasoner and is therefore not as “Lite” as it seems. It turns out that features such as disjunction and negation can be expressed in OWL Lite, even though these constructs are not explicitly

```

<rdf:RDF>
  <owl:DatatypeProperty rdf:about="#birthdate">
    <rdfs:domain>
      <owl:Class rdf:about="#student"/>
    </rdfs:domain>
    <rdfs:range rdf:resource="&xsd:date"/>
  </owl:DatatypeProperty>
  <owl:DatatypeProperty rdf:about="#name">
    <rdfs:domain>
      <owl:Class rdf:about="#student"/>
    </rdfs:domain>
    <rdfs:range rdf:resource="&xsd:string"/>
  </owl:DatatypeProperty>
  <owl:DatatypeProperty rdf:about="#type">
    <rdfs:domain>
      <owl:Class rdf:about="#student"/>
    </rdfs:domain>
    <rdfs:range rdf:resource="&xsd:string"/>
  </owl:DatatypeProperty>
</rdf:RDF>

```

Fig. 12 Example of OWL ontology.

represented in the syntax. Horrocks^[35] shows how several features of OWL DL can be expressed using the constructs of OWL Lite. In fact, the only features in OWL DL that cannot be expressed in OWL Lite are

```

Class(a:student)

  DataProperty(a:birthdate
    domain(a:student)
    range(xsd:date))
  DataProperty(a:email
    domain(a:student)
    range(xsd:string))
  DataProperty(a:name
    domain(a:student)
    range(xsd:string))
  DataProperty(a:type
    domain(a:student)
    range(xsd:string))
)

```

Fig. 13 OWL example using abstract syntax.

arbitrary number restrictions and nominals (individuals in class descriptions).

- OWL DL is a language created by a standards committee, and is thus necessarily a compromise between the wishes of different stakeholders. The most important design goal was to create a sublanguage for which the satisfiability problem is decidable. OWL DL is equivalent to the SHOIN(D) Description Logic.^[36] It is known that this language is decidable, but there are currently no reasoners for this language, nor is there a known algorithm for deciding satisfiability of OWL DL ontologies. The major problem is dealing with nominals (individuals in class definitions). Arguably, it would have been better to restrict the language to SHIQ(D), which underlies the OIL language, a predecessor of OWL. Several optimized algorithms and implementations have been developed for reasoning with SHIQ, such as Racer and FaCT++.
- OWL Full is completely semantically layered on top of RDF(S). In this respect, it accommodates all wishes for a Web ontology language. However, the semantics for OWL Full are very hard to understand and entailment in OWL Full is not computationally decidable.^[37] Furthermore, ontologies provide a vocabulary for more expressive language in the Language Layer Cake (see Fig. 3), such as rule languages, and as a result this undecidability is propagated to the higher layers.
- Current proposals are for rule languages on top of the OWL layer on top of the OWL DL species, because of the nonstandard semantics of OWL Full and the nondecidability of the language. The most prominent proposal for a Semantic Web rule language is SWRL, which layers on top of OWL DL.^[26] Because SWRL combines the full expressive power of an expressive Description Logic with the full expressive power of (function free) Horn Logic, the language is in general undecidable.^[26]

We think OWL Full will probably not be used very much on the Semantic Web because the semantics is very hard to understand and it is very hard to deal with in an automated way. Even now, most research involving OWL focuses on OWL DL. Most practical applications will most likely use a subset of OWL DL, which is efficiently computable. However, wide-scale application of OWL on the Semantic Web will have to show what requirements arise when the language is actually put to use. It can, however, be argued that entailment (proving that one ontology is the logical consequence of the other; this is the problem that is undecidable in OWL Full) will not be the most common reasoning task, in which case OWL Full can be very useful.

For a more elaborate critique of the different species of OWL and language layering on the Semantic Web, we refer the reader to de Bruijn.^[38]

CONCLUSIONS

We have introduced ontologies as a potential “silver-bullet” (cf. Fensel^[1]) for knowledge management, EAI, and E-commerce (which is in fact EAI on an interorganizational level) for the following practical reasons:

- Ontologies are shared by a group of stakeholders in the domain.
- Ontologies interweave formal semantics with real-world meaning.
- Ontologies relate a human-understandable domain description with a machine-understandable description.

Because of these attractive properties, ontologies enable knowledge sharing and knowledge reuse. However, it turns out that we are not done with the introduction of the concept of ontologies. The degree to which an ontology is machine-understandable, its formality, is determined by the language used for the specification of the ontology. This also applies to the expressiveness of the ontologies (i.e., the degree of detail to which the domain can be described in the ontology), which is limited by the expressivity of the ontology language.

Actually, what an ontology looks like and what can be expressed by an ontology are entirely determined by the ontology language used. We have also seen that there exists a trade-off between the expressiveness of an ontology language and the modeling support it provides for the ontology developer. The use of Description Logics^[20] in current ontology languages, such as OWL,^[33] limits the understanding of developed ontologies, because of the decoupling of classes and properties. Fully fledged inferencing is necessary to determine the properties for certain classes.

We have described how different knowledge representation formalisms, such as first-order logic, frames, and Description Logics, together with the Web languages XML and RDF, have influenced the development of the current Web ontology language OWL.

The existence of version 1.0 of OWL does not mean the development of ontology languages will stop. Horrocks et al. identify several possible future extensions and improvements of OWL, which include support for modularization, closed world reasoning, and the unique names assumption.^[35] Furthermore, there is a current proposal for a Semantic Web rule language, which has been submitted to the W3C.^[26]

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Open Access Scholarship and Publishing

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Abstract

Open access publishing helps scholars to be more productive and to reach larger audiences. The challenge for entrepreneurs and universities is to design systems for publishing that take advantage of the digital technologies, offer substantial intellectual value, and are cost effective. Authors, publishers, libraries, and readers are changing their roles as the methods of financing publication shifts in part from readers to authors.

INTRODUCTION

At the beginning of the twenty-first century, the growth of the Internet changed the economics of scholarly publishing. The dramatic and sustained increases in prices of paper-based materials had narrowed access to scholarship.^[1] In contrast, the publication of digital materials on the Internet expanded and accelerated access and lowered costs. Indeed, substantial quantities of high-quality material became available to readers worldwide without charge. Such open access scholarship changed the relationship between authors and readers with fundamental shifts in the roles of publishers and libraries. Open access publication supports collaboration, a wider range of publishing opportunities, and access to wider audiences. There is a concern, however, that its openness may foster disorder that may make it less valuable than it could be.

FROM CONVENTIONAL TO DIGITAL PUBLISHING

The conventional print books and periodicals of the twentieth century involved both the up-front cost of editing and typesetting along with the substantial variable cost of paper, printing, and mail for each copy shipped. Publishers earned revenue from selling subscriptions to their readers and libraries sufficient to cover both the up-front and variable costs. The publishers typically charged higher rates to libraries than to individuals, particularly for journals. For many scholarly books and journals, revenues to publishers from libraries were predominant, effectively paying for most of the publisher's up-front costs and more. For many journals, prices to libraries grew beyond plausible association with production and distribution costs.^[2] Moreover, the libraries incurred significant additional costs in managing their purchases, registering each item in a database to sustain control and

access, and providing space to store the materials.^[3] Under such pressure, library budgets did not expand enough to sustain their collecting programs. The number of publications and growth in the number of pages expanded faster than the purchasing power of library collection budgets and the libraries bought a smaller share of all that was available. In addition, print had considerable delays from the time an author submitted her work until it was in the hands of readers.^[4]

The digital revolution changed many of these costs while accelerating the process. Digital materials are often stored once on the Internet, or a few times for security, rather than on each campus. Materials offered by subscription may be licensed as whole databases rather than by individual title, reducing each library's processing costs. Open access materials particularly, but often all digital materials, are fully searchable by individual words with freely available search services that not only point to items by content but reveal the importance of the item in wider streams of scholarly work. The digital documents whether through open access or by database subscriptions are delivered directly to reader's workstations within a few seconds. Many digital publications put works in the hands of readers within a few months, sometimes within weeks. As the quantity of material available digitally exceeded the content of most conventional academic libraries, as the power of digital searching exceeded conventional indexing, and as a host of quality materials became instantaneously available at any workstation, the digital document took center stage from the published paper document as the standard medium of scholarly communication.

In 2007, *Ulrich's Periodicals Directory* listed more than 23,550 active, peer-reviewed, academic periodicals worldwide; 15,205 of them were available online.^[5] In August 2007 Ulrich's listed 1673 current, refereed academic journals as open access, 7% of the total. *The Directory of Open Access Journals* listed 2821 open, quality controlled academic journals, including many titles not

captured by Ulrich's.^[6] Of course, journals differ in intellectual reputation. One hallmark of quality is evaluation by ISI's *Journal Citation Reports* (JCR), as discussed more fully below. Ulrich's listed 6875 current, refereed, academic journals as being evaluated by the JCR, 29% of the total. Of the journals evaluated by JCR, 94% are available digitally and 4% (265 titles) are available in the open, a significant start.

FROM DIGITAL TO OPEN PUBLISHING

Whether a digital document will be supported by subscription or made available by open access depends on the extent of its up-front costs, the acceptance of fees paid by authors and funds from third parties, and the possibility of Internet advertising. Indeed, publishing strategies range from an author posting her work as-is on a personal Web site, freely available to all without review, editing, or promotion, to formal periodicals with creative editors who winnow large numbers of submissions, commission works by leading authors, rewrite author's drafts to improve style, include extensive graphics to enhance readability, and develop reputations for sustained intellectual influence. Up-front editorial costs will range, then, from zero to many thousands of dollars per essay. Open access, that is publication without charge to readers and libraries, dominates when editing costs are low. In contrast, significant revenue streams must support the intensity of editorial effort seen, for example, in *The New England Journal of Medicine* (Nature uses only a full-time editorial staff, located in nine offices around the world, <http://www.nature.com/nature/about/contact/editorial.html>. The editorial staff at NEJM appears at <http://content.nejm.org/misc/edboard.shtml>). A central issue in the development of open access publications is how much editorial service can be sustained with revenue streams from sources other than subscriptions?

A second issue for open access is the role of copyright. Lawrence Lessig, professor at Stanford Law School, launched the Creative Commons in 2001 to reduce the restrictions imposed by copyrights.^[7] Authors can retain the copyright to their own materials and grant limited rights of use to others instead of assigning all rights to a publisher. Many open access publications only require a nonexclusive right to publish materials. Authors may allow reuse, for example, by others for noncommercial purposes. The ready opportunity to reuse materials may promote more rapid intellectual advance much as Open Software makes significant progress by expansive collaboration.

E-PRINT SERVICES

Understanding the financial underpinning of open archives provides a basis for understanding the possibilities for open journals discussed below. Paul Ginsparg developed a

database of e-prints, that is, works-in-progress as well as published works, in high-energy physics beginning in 1991 at Los Alamos Labs that has become the dominant vehicle for physicists to share their work worldwide.^[8] ArXiv, now owned by the Cornell University Library, expanded to encompass most topics in physics, mathematics, quantitative biology, and statistics. The database includes about 500,000 essays, received nearly 5,000 new submissions in some months in 2007, and has upward of 500,000 connections per day (a measure of usage) at peak periods at the Cornell site with additional usage at several mirror sites around the world. Research Papers in Economics (RePEc) is a similar service that depends entirely on volunteer effort in 57 countries (The RePEc: Research Papers in Economics, repec.org) holds 470,000 items with 12,700 users and 10,250 participating institutions in 2007).

ArXiv provides a minimal screen of its submission, far short of editing. Authors register with the site and submit their work in a prescribed format. They may subsequently publish posted work in edited journals and works published in edited journals may be posted when consistent with the journal's copyright policies. Most of the processing of work into arXiv is automated. Readers search the database and download materials without charge. Cornell with some grant funds sustains the cost of the hardware, software, and modest staff for the arXiv service at a cost of under \$300,000 per year.

ArXiv, then, is an open access self-publishing service (i.e., the author posts the work in the open for anyone on the Internet to read). It is widely used and operates at modest cost per unit of service. Scholars in the relevant disciplines use arXiv to search for the latest work in their area. The processing provided by arXiv, primarily a cursory decentralized review, is designed to assure that submitted essays are within the subject scope of the service. The author's work appears as the author submits it, however authors may replace or withdraw their essays.

A similar service in economics and related fields is self-financed. Michael Jenson, an economist at the Harvard Business School founded the Social Science Research Network (SSRN) in 1994.^[9] It is privately organized and self-financed through sale of abstracting journals and other ancillaries, however, access to all author-uploaded papers in the SSRN database is free. Its annual budget is in excess of \$800,000, supporting a database of 50,000 essays with over 300,000 downloads per month.

SELF-ARCHIVING

The success of arXiv, SSRN, and similar open e-print publishing services along with the growth of the Internet led scholars in other disciplines to consider services that allow authors to post their drafts in the open and that also invite authors to post the articles they have published in

edited journals in the open. The up-front costs across all disciplines might be shared among many universities. One method of sharing the mostly fixed cost of universal, open access e-print services is to have each campus archive the work of its scholars in formats that could be readily indexed across all campuses and disciplines. To this end, the Open Society Institute launched the Budapest Open Access Initiative in 2001.^[10,11] Stevan Harnad, a research professor of Cognitive Science at Université du Québec à Montréal, is one of the leaders of the open access movement.^[12,13] Posting published, peer-reviewed work in open archives other than through a published journal is called green open access.^[14]

The Open Archive Initiative (OAI) propounded standards for metatags, that is, a method for labeling the author's name, the essay's title, subject, and date.^[15] When materials that are tagged in compliance with the OAI standard are posted to a compliant digital archive, the tagged information can be harvested by indexing software that spans all of the participating archives. Documents with tagged fields support more precise searching. A reader can then search the universe of open archives of all of the participating institutions, also called institutional repositories, as though they were all under one roof and identify and retrieve a document wherever it is stored. In 2007, there were 687 registered archives in 60 countries participating in the OAI with a total of over 6 million documents.^[16] DSpace, developed by MIT and Hewlett-Packard and released in 2002, is open source, OAI compliant software for managing digital archives.^[17] Institutional repositories are typically not specific to discipline and do not generate the attention of the discipline specific arXiv and SSRN.

Self-archiving under the OAI makes significant quantities of published material available to readers without charge. Libraries encourage open archiving as an antidote to expensive journal subscriptions.^[18] If all published material were available in this format, how would publishers generate revenue streams to support the editorial processes for their journals? The European Commission, the U.S. Congress, and the national legislatures of several other countries are considering laws to require that research that is funded by their governments be made available in open archives shortly after publication.^[19] Such legislation is typically supported by libraries but opposed by many scholarly publishers. Former Congresswoman Patricia Scott Schroeder, President and Chief Executive Officer of the Association of American Publishers, leads publishers on the issue.

WIKIPEDIA

Open publications using many volunteers with modest philanthropic support can create substantial digital publications. Wikipedia, a collaborative online encyclopedia

published in the open, gives a sense of the power and limits of open publication. Founded in 2001 by Jimmy Wales and Larry Singer, Wikipedia supported close to 2 million articles in the United States in 2007 with an annual budget of just over \$1 million in philanthropic funds.^[20] Requests for Wikipedia pages approach 30,000 pages per second at peak times. Although Wikipedia articles appear without authors' names, submissions go through a review process and conform to style guidelines that require entries be neutral in tone and based on peer-reviewed publications. Occasionally, articles appear that are biased, erroneous, or fraudulent (Virgil Griffith, a graduate student at CalTech, developed Wikipedia Scanner to identify the IP addresses of people editing Wikipedia entries. He found, for example, that negative information about WalMart and Diebold had been deleted by people located at these companies).^[21,22] The "discussion" section on each article provides reader comments. Problems flagged by readers may be changed in time through new submissions.^[23] In a sense, however, Wikipedia is permanently a work in progress. Some professors ban the citation of Wikipedia articles by their students, citing errors and biases, the lack of author attribution, and to give preference to primary sources.^[24] Wikipedia continues to evolve. In 2005 it began requiring contributors to register and it has introduced a more thorough review for "featured articles." Wikipedia also continues to invest in developing improved search software.

Wikipedia is the dominant encyclopedia on the Internet. Even though entries are often anonymous, scholars contribute and edit Wikipedia articles. Proponents of open access scholarly publishing, and indeed more generally of collaborative, network-based ways of doing intellectual work, have in mind technological and financial relationships that are similar to Wikipedia.^[25] Voluntary editorial effort, supported by modest levels of philanthropic or institutional funds, can sustain large-scale publications, freely available to all. The building blocks of such an environment in academia are open journals that require a formal review mechanism and post only attributed works.

OPEN JOURNALS

Open archives and Wikipedia provide limited mechanisms for supporting an editorial process. Careful review that assures relevance, quality, originality, and acknowledgment of related work is a hallmark of academic publication. If scholarship consisted only of archives of material that wasn't reliably reviewed, readers would be challenged to sort through large quantities of poorly differentiated materials in order to identify the most important ideas and to evaluate the quality of the content. Often even very creative scholars present their work poorly and important new ideas may be ignored until ratified by a distinguished editor. Effective editors provide the

valuable service of identifying the most important ideas, verifying accuracy, and polishing presentations to make them accessible to the intended audience.

Academic publication typically means that an editor has evaluated an author's work, often with the counsel of other scholars knowledgeable in the specific subject matter of the work. Such peer review helps keep new work focused on a specific audience, makes it more likely that the work both relates well to established ideas and adds something new, and that the style of presentation conforms to academic norms. Quality assurance allows an academic to concentrate on reading works that are sophisticated, original, relevant, and well written. In fact, editors of many higher quality journals select for publication from among many well-crafted and original submissions. In 2006, the 64 academic journals in biology that were evaluated by the ISI JCR published 5783 articles.^[26] A working biologist will choose carefully what to read among the torrent of new materials.

Fortunately, there are several ways beyond subscriptions to finance the editorial process that turns the authors' raw materials into journals of sufficient quality to be attractive to readers. One method involves institutional support for the hardware, software, and managing editor supplemented by a significant amount of volunteer effort by reviewers, that is, an arrangement much like Wikipedia. Historically, universities supported their presses to produce books and journals that help advance their campuses' intellectual reputations. Supporting an open journal can be less expensive.

Readily available software lowers the cost of managing the editorial process. The Public Knowledge Project, launched in 1998 at the University of British Columbia by John Wilinsky, Pacific Press Professor of Literacy Technology, created the Open Journal Systems software and makes it available for use on any campus without charge. It and similar software support a database environment that manages the flow of submissions to a journal, the process of review and editing, and the presentation of the digital journal online with full-text searching.^[27] With such software installed locally, a university can support scholars in launching and sustaining a digital journal at modest cost. As of 2007, the Open Journal Systems software supported the back-office functions of more than 900 journals worldwide, some supported by subscriptions and some in the open (A list of the journals is at <http://pkp.sfu.ca/ojs-journals>. Cornell University has developed alternative software. E-Journal, <http://drupal.org/project/ejournal>).

Theoretical Economics is an example of an open journal, launched in 2006 and managed with public domain software at the University of Toronto with a distinguished international editorial board.^[28,29] Authors pay a \$75 submission fee but may avoid a per page publication charge by putting their essays in a specific format for publication. The editors reach a decision on 90% of submissions within

90 days, a relatively short time for an academic peer-review process. The journal is available without charge via the Internet and sells its annual volume in print. Publishing in formally reviewed open journals is called gold open access publishing.

AUTHOR-FUNDED JOURNALS

A second strategy for open publication relies on publication charges to authors to finance the up-front and distribution costs. With the cost of distribution to another reader near zero, a zero price provides access to everyone on the Internet. If usage grows dramatically with the drop in price to the reader to zero, then the author-pays strategy may yield more generally useful publications than the reader-pays system. The likelihood of greater exposure for an author may make author-based finance more desirable than a reader-based financial strategy.

The shift from reader-pays to an author-pays regime is somewhat like the change in the charge for postage made in the 1850s. In the old policy, the recipient paid the postage in order to receive the mail, much as in a reader-pays regime for publications. After the 1850s, the U.S. Post Office introduced postage stamps and imposed the charge for delivery of mail on the sender.^[30] The post office has much lower costs in selling stamps than in collecting from each recipient for each separate piece of mail. The post office avoided the expense of attempting delivery of mail only to have it rejected. The shift to a sender-pays system allowed advertisers to use the mails to push unsolicited materials to customers, a change not necessarily welcomed by all recipients.

The *Public Library of Science* (PLOS) offers high-quality author-paid journals. It produces open journals with a high level of editing. PLoS launched its journal-publishing venture in 2003, a venture led by Harold Varmus, Nobel Laureate in Medicine, former head of the National Institutes of Health, and President of the Memorial Sloan-Kettering Cancer Center. BioMed Central, a comparable venture, began publishing open journals in the United Kingdom in 1999.^[31] Because the content of these journals is in the open, their articles are archived as part of the OAI and readily available to many Internet search engines. In 2007, the author fees were \$2750 for the top journals at PLoS (\$2410 at BioMed Central) per published article. Because dissemination of research results is an important part of grant supported research, the funding agencies often allow payment of author fees from grant funds. Because publications advance a scholar's reputation, salaries often increase with more publication. It is then in an author's interest to support payment when an article is published in a more widely cited journal. Universities gain intellectual reputation as their faculty publish, and it is then in the interest of universities to support author fees.

A university provost might compare the university's cost of a subscription journal plus the cost of tracking and processing the subscription through the library to the likely outlay of author publication fees of the university's faculty. If the expenditure on editing is the same per article, on average the net gain with the open journal with author fees arises from the smaller number of transactions with authors rather than with readers and the expanded readership with a zero price to readers. A university with a large number of faculty who publish in the journal might incur more cost with author fees, net of grant support for the author fees, than with subscriptions, net of the partial indirect cost recovery from grants based on library expenditures. Prestigious universities with highly productive faculty may, however, place a premium on the greater exposure their authors receive in open journals.

INFLUENCE OF OPEN JOURNALS

On their face, open journals look a little like vanity publishing, much as a hobbyist might publish a memoir for his family at his own expense. Many readers are less likely to read self-published works than those that have been reviewed and edited. On the other hand, open journals can be scrupulously edited and have more value by being more accessible.

One way of gauging the intellectual impact of a publication, that is, its value to readers, is to observe the frequency with which other writers cite it. A commonly used measure of a journal's intellectual value is the ISI Impact Factor as posted in the JCR.^[32] The Impact Factor is the ratio of the number of times the articles are cited in academic journals in the first 2 years after publication as the numerator to the number of articles published in a journal in a given year as the denominator. The median Impact Factor for 103 journals in medicine evaluated by ISI was 1.21 in 2006. Twenty-eight of BioMed Central journals were evaluated by ISI (among 100 it publishes) with a median Impact Factor of 2.74. BioMed Central's journals have impact. PLoS has five journals scored of seven it offers in medicine and biology with a median Impact of 7.67, far above the norm. PLoS Biology at 14.01 has the highest impact of 64 rated journals in biology and PLoS Medicine at 13.75 is the fifth highest among 103 rated journals in medicine. PLoS had the advantage of significant philanthropic support for its launch that enabled it to achieve extraordinary impact quickly and to build a reputation that should allow it to be self-sustaining with author fees. The high level of impact of PLoS and BioMed Central's journals clearly establishes that open journals can achieve high levels of intellectual quality. Articles in open journals are more likely to be cited and thereby enhance their authors' reputations more than subscription journals, other things equal.

Some publishers offer hybrid journals, with articles in the open with a substantial author publication fee combined with other articles available only by subscription without an author fee. For example, Springer, a publisher of over 1900 academic journals, offers Open Choice, its program that charges a \$3000 publication fee from authors to allow their article to be published in the open. Springer promises to adjust journal prices in light of the number of open choice articles published in the preceding year.^[33] Springer's journal, *Economic Theory*, for example, had a library price of \$1398 per year in 2007. It published about 120 articles per year with an Impact Factor of 0.50, compared to a median of 0.66 among 175 rated journals in economics.^[32] Two of the most recent 17 issues are available in the open, but no other individual articles are in the open in the 2006 volume.^[34]

A publisher is likely to prefer selling subscriptions to libraries instead of selling publication to authors. Journal quality, after all, depends on the quality of its authors and author fees could discourage them. Libraries show limited response to price increases; they tend to sustain their subscriptions. In contrast, authors are more likely to be influenced by author publication fees in selecting a journal. When demand is more responsive to price, suppliers find that setting price closer to marginal cost maximizes profit. A journal based on author fees is then likely to be less profitable than one based on subscription fees to libraries, other things equal. Self-financing publishers, whether for-profit or not-for-profit, may be more reluctant to move to author fees. They may then set author fees in hybrid journals well above the fees that might prevail when fully open journals are ready alternatives in a discipline. From the point of view of readers, a likely advantage of the growth of open publications is a reduction in the price of subscriptions for other journals. Authors must be persuaded of the higher probability of citation in open journals.

Another way to compare the intellectual impact of subscription with open journals is to consider the number of citations to articles published in the open to other articles in the same journal that are not in the open, while controlling statistically for the number of authors and the author's prior publication record and other attributes. One study compares citations to 212 openly published articles in the *PNAS: Proceedings of the National Academy of Sciences* to 1280 articles in same journal that are only available by subscription.^[35] Articles published in the open had more than twice as many citations 4–10 months after publication and nearly three times as many 10–16 months after publication, other things equal. Open publication is more valuable, given the reputation of the journal.

SUBSCRIPTIONS

Subscriptions continue to provide the dominant revenue stream for the support of the publication of academic

journals. The *American Economic Review* (AER), for example, goes to members of the American Economic Association. For \$90, the 18,000 members each get three journals and about 4000 libraries subscribe to the three-journal bundle at \$345 per year in 2007. The Association devotes about \$1.5 million to producing the AER with about 185 articles per year including those in a proceedings issue, that's about \$8000 per article.^[36] This figure is about three times that of the PLoS author fee. The *New England Journal of Medicine* has 200,000 subscriptions at \$149 for print and online, \$99 for online only, \$599 for libraries. It is generating about \$50 million per year in revenue associated with the *Journal*, offering 300 or so articles per year in its weekly publication (Massachusetts Medical Society: Waltham, MA, "2005990-RET Returns" reports \$106 million of total revenue for the year with expenditure of \$63 million on publishing. It lists eight publications on its website, <http://www.massmed.org>, of which the *New England Journal of Medicine* is the most important. Although the society does not provide detailed information about its expenditures, it seems reasonable to assume that \$50 million is spent publishing the journal). It is probably spending more than \$150,000 per article, although how much of the revenue is spent specifically on the publication is unclear.^[37] Although distribution costs for a weekly are significant, the cost of selecting about 300 articles from among 5000 submissions per year, two-thirds of which are from abroad, and editing those selected into more readable essays is substantial. Publishers, particularly of journals with a high level of editorial effort and a high volume of circulation, are likely to continue to depend on subscription revenue. Readers value quality editing and are willing to pay for it. Editors are readers' agents just as they are also author's agents.

High circulation publications can sustain relatively low-cost subscription rates because they spread their front-end costs among many readers. The gain to readers from offering the same content with a zero subscription fee may be less than for a publication with a high subscription rate. Subscriptions to some high circulation scholarly publications are likely to continue even as more open publications appear that are financed with author fees, philanthropy, and advertising. The boundary for scholarly publications is likely to continue to shift as technologies and reader tastes change just as the boundary may shift for popular newspapers and magazines. Some publications like the *New York Times* offered some digital content free with premium digital content available by subscription. In 2007, the *Times* shifted to an all-open format, viewing the gain in advertising revenue from general Internet access as more than sufficient to offset the loss in subscription revenue.^[38] Typically academic publications eschew advertising to focus reader attention on scholarship.

The timing of availability is an important dimension for academic publishing. Newspapers and magazines

obsolesce quickly. Academic journals have enduring value. ISI publishes a cited half-life for journals, an estimate of the number of years in which half of all citations that will ever occur have occurred. The median half-life for articles in 103 medical journals is more than 6 years; for history, it is over 10 years.^[32] A subscription publisher may then choose to offer online access to its content with a delay. The publisher imposes an embargo on online access to the full text of its content by online services in order to avoid cannibalizing subscription revenue. In effect, subscription buys immediate access while less restrictive or open access to full text online comes with a delay. Embargoes of 12 months are common for access to journals, as discussed below.

SEARCH AND INDEXES

In addition to attracting strong authors and providing effective editing, the intellectual success of publications depends on appearing in indexes and finding aids. Although readers find items by browsing, many also look for materials on specific topics when an interest arises. Finding aids migrated from print to digital ahead of the publications themselves because digital searching is more convenient than searching a printed index.

Printed indexes typically covered journals and books within a discipline. Professional indexers scanned each item as it was published, noted author and title and assigned a subject category. The index then showed citations to articles listed under subject categories with an index to authors, aggregated by year or less frequently.

The leading professional society in each discipline typically published an index for its discipline. For example, *Chemical Abstracts* began publication in 1907 and became part of the American Chemical Society in 1956. It first offered an online service in 1980. Its database contained more than 27 million bibliographic records in 2007.^[39]

A milestone in the launch of a new journal is when the appropriate indexing service includes the content of the new journal. For example, *Theoretical Economics*, an open journal launched in 2006, was indexed in *EconLit* from its first issue while the *International Journal of Economic Theory*, a subscription journal addressing a similar audience, was not indexed in *EconLit* even in its second year of publication.

With the digital revolution, the conventional indexes moved to digital media with search engines to provide faster, more comprehensive searching than can be achieved with print. Digital searching can identify materials by words in titles and abstracts and allow Boolean operators to control searches. With the success of the digital tools, the print version of indexes began to shrink and disappear. For example, the American Economic Association stopped publishing its *Index to Economic Articles* in 1996.

Other indexes have broader scope. The Institute for Scientific Information, for example, published the *Science Citation Index* beginning in 1961 to report the citations to prior works and now covers the content of more than 6400 journals in science and technology. Tracking references to other published literature allows building a bibliography that traces how ideas develop. It also provides a way to identify the importance of particular publications. The ISI Impact Factor, mentioned above, is a by-product of the *Citation Index*. The *Social Sciences Citation Index* indexes 1700 journals in the social sciences and the *Arts and Humanities Citation Index* tracks the contents of over 1000 journals.

The digital revolution made radical changes in indexing, epitomized by the founding of Google by Larry Page and Sergey Brin in 1998 while they were graduate students at Stanford University. Google, the largest search service on the Web, provides nearly 100 million searches daily.^[40] It gained dominance because of the quality of its method for ranking Web pages in response to a search. By counting and evaluating the linkages from other pages to a given page, a process called dynamic indexing, Google identifies pages that are more likely to be sought and presents them first. Dynamic indexing is superior to static indexing, that is, searching based only on the words in the article, even when the word search encompasses the full text of a document. Google generates substantial revenue from the advertising it sells that appears as part of typical result-screens on basic Web searches.

In 2004, Google launched *Scholar*, its free service for searching a large part of the scholarly literature in a single database. *Scholar* encompasses many journals, books, working papers, and government reports. It applies Google's powerful dynamic indexing search engine to retrieve results. It reports a count of materials that cite the item at hand and will provide a list of them. When copy-right allows, *Scholar* provides a link to the full-page images of the item, sometimes by linking through a local library's digital subscription. *Scholar* plays a key role in open access publishing by providing an open access index.

Critics of *Scholar* lament that *Scholar* uses a machine-created database that does not use systematic tagging of authors, titles, dates, and subjects.^[41] (The American Economic Association attempted to replicate assignment of its subject codes to articles using software and achieved only a 50% success rate. Private communication from the Secretary of the Association.) As a consequence, the result of a *Scholar* search often includes more extraneous items than a search of a carefully structured data file. Critics also note that Google does not describe what materials are included in the *Scholar* database. Users cannot be sure what literature they have missed with a *Scholar* search. Because databases differ, a *Scholar* search typically complements other searches. Because *Scholar* is free and simple, it is often the starting point for searches. Another generation of open indexes may invite readers to set tags to indicate their assessment of quality that then influence the importance of an item in a search result.^[42]

DATABASE INTEGRATORS

Another player in scholarly publishing is the database integrator, a firm that provides access to multiple databases with a common interface. A firm with suitable search software may license the use of databases from their publishers, for example the index databases of a number of scholarly societies, and, in turn, license an aggregation of the databases to libraries, using the integrator's common search software. Since the 1990s, a number of integrators began offering linkages to full text.

Ingenta, founded in 1998, launched a service called IngentaConnect in 2004 that provides access to the content of more than 31,000 publications with the full text of 8000 of them via the Internet, either by subscription through libraries or by direct pay-per-use. Ingenta reached agreement in 2004 to allow Google to index Ingenta's digital collection. Users can search Scholar for free and retrieve full text from Ingenta for a fee. In 2007, IngentaConnect processed 31 million sessions per month.

Also in 2004, Elsevier, publisher of 1900 academic journals, launched its latest search service, SCOPUS, as a digital service offered by subscription through libraries.^[43] In 2007, SCOPUS indexed 15,000 academic journals with abstracts, including 1000 open journals, 30 million abstracts, and 21 million patents with links to the content of many journals in full text. It also alerts readers to new items appearing in the database that match the reader's standing search query. Elsevier developed a Web search engine, Scirus, to identify and index only science-oriented pages on the Web. Access to a Scirus search is open.^[44] The SCOPUS subscription service includes the Scirus index of 275 million scientific Web pages.

Another major integrator is EBSCO. EBSCO markets its integration service to libraries, offering specific services by individual discipline. In 2007, its service for economics uses the American Economics Association *EconLit* index database to 1233 publications and provides links to the full text of 400 of them.^[45] Of these, 11 had embargoes of 6 months and 227 had embargoes of 12 months.

The National Library of Medicine (NLM) plays a number of roles, including being an integrator of a number of databases relevant to medicine and medical research. It began publishing *Index Medicus*, an index to the medical literature in 1876.^[46] It began creating a digital search and retrieval system in 1964 and put it online 1976. It made the MEDLINE service available in the open on the Internet in 1997. In 1996, it began offering links from the citations in MEDLINE to the full text of articles in PubMedCentral. These articles are then available in the open. MEDLINE abstracted about 5000 current journals in 2007 and contains more than 17 million citations. PubMed supports 3 million searches per day.^[47] The NLM has given significant support to the growth of open scholarly publication.

Academic libraries themselves also act as database integrators. They provide links from varied search services that allow a campus searcher to click to the library's full-text service for the item. Open access services both compete with and complement subscription services (For example, the Exlibris Group, <http://www.exlibrisgroup.com/index.htm>, offers to libraries software that integrates searches across disparate sources).

ADVERTISING

Although academic journals generally include few ads, database integrators have an opportunity to offer access to full-text academic journals in the open supported by advertising. In 2007, Elsevier launched OncologySTAT.com, an Internet portal with immediate open access to the current content of 100 of its own medical journals.^[48] Elsevier expects to earn more from advertising than it loses in dropped subscriptions. OncologySTAT.com will include synopses of articles published outside Elsevier and will include the full text of such articles once their embargoes expire. Elsevier's initiative suggests that advertising may support significant quantities of open scholarly publications in some disciplines. Elsevier's move to open publication supported by advertising is a part of a widespread movement including the *New York Times* and other mass publications.^[49]

BOOKS

Scholarly monographs have played a principal role in some disciplines, for example, history and the humanities, but the digital revolution is reshaping the place of books. The digital revolution for books began in 1971 in the early days of computing when Michael Hart invented e-Books and launched Project Gutenberg at the University of Illinois with the goal of making the full text of books freely available in digital format.^[50] Gutenberg had mounted 20,000 items in 2007. The World Public Library, founded in 1996, offered 75,000 titles without charge in 2007 and more than 500,000 total for a modest annual membership fee.^[51] The titles are generally old titles in the public domain rather than current publications. Producing digital books and making them available on the Internet either in the open or by subscription is technically no more difficult than offering digital journal articles. However, few people choose to read whole books online. Although several firms have marketed appliances for reading digital books that are nearly as portable as a conventional book, none to date have enjoyed wide appeal. For example, the Sony Reader System launched in January 2006.^[52] Sony offers several thousand titles for its reader through <http://ebooks.connect.com/>. Making digital books in page turners, *Business Week*, September 3, 2007.^[53]

Digital books appear to be successful in two other ways. First, digital access to the full text of a book allows the work to be readily searched, making the content

discoverable by general Web searches. Led by its Director, Scott Lubeck, the National Academy of Sciences Press offered access to all its books in the open online in 1994 and sales of print increases.^[54] In this case, the digital book was a complement to print.^[55] In 2004, Google reached agreement with several large academic libraries to digitize large blocks of each library's holdings.^[56] Materials out of copyright are made fully available in the open. For materials under copyright, Google's Book Search points to the work with links to libraries. Book Search is a very large and powerful book catalog available in the open.^[57] The site includes both links to publishers and booksellers as well as advertising.

Second, digital books offer ways of presenting color, graphics, and even extend to animation, video, and sound. Rice University announced the reopening of its press in 2007 as a publisher of digital materials exclusively, particularly books.^[58] Among other things, it intends to offer medical diagnostic books with rich color photographs and illustrations. Readers may read the works online in the open or buy print-on-demand copies.^[59] Print-on-demand vendors use the digital file from the publisher and print books in a variety of formats, paper, color, and bindings. Authors who publish with the Rice University Press will submit works under the Creative Commons copyright policy, offering nonexclusive rights to the press to publish the work while allowing others to reuse the material under terms the authors specify.^[60] Scholarly monographs can be published in the open with normal editorial review at less expense as digital products with print-on-demand available. In this manner, digital books may allow book-oriented disciplines to communicate more effectively with larger audiences than in paper-only formats.

LONG-TERM STORAGE AND RETRIEVAL

Scholarly publishing includes a commitment to long-term storage and retrieval so that the work of today's authors can influence the work of future generations. Works printed on acid-free paper, kept in climate-controlled conditions, and not subjected to vandalism can be used for hundreds of years. Libraries owned the physical artifacts and could maintain storage and access as long as the library maintained its facility. Digital products, in contrast, are often inherently volatile and rely on machines for use that quickly obsolesce. In addition, libraries sometimes license access to digital products. Under some contracts, the library loses all access when it stops paying the license fees and long-term access depends on the viability of the vendor rather than on the library.

The advantage of digital storage is that remote access is as convenient as local and therefore the cost of fixed long-term storage can be widely shared. William G. Bowen, President of the Andrew W. Mellon foundation, led the launch of JSTOR in 1995 to capitalize on this opportunity. Now a freestanding, not-for-profit, JSTOR seeks

permission from publishers to digitize page images and create full-text files of the complete historic runs of journals. It then licenses access to libraries to its digital collection, with an embargo on recent years as stipulated by each publisher. Libraries pay an initial capital fee and a continuing annual license for access to more than 900 journals from 450 publishers in 2007 with more expected.^[61] In 2007, 1900 libraries in the United States and its possessions and a similar number in 122 other countries subscribed to JSTOR, including academic, school, and other types of libraries. EBSCO and similar database integrators provide similar de facto shared digital storage services for their collections. JSTOR and similar organizations store their files at multiple sites, maintain off-site copies, and use formats that can more easily migrate to future technologies.

Long-term archiving of open access materials is another step. JSTOR is essentially a subscription service for storing and retrieving materials also originally published and paid for by subscription by libraries. One of JSTOR's criteria for deciding to include a journal in its collection is the number of institutional subscribers to a journal. Libraries justify participation in JSTOR, in part, on the ability to substitute a license to a remote digital archive for building more space to store old print journals. Open access journals do not involve library subscriptions and require no storage space. Will libraries pay for long-term archival storage of materials that are readily available without charge today on the Internet? Libraries have often purchased reprints and microform collections of historic materials. Library subscriptions to back files of open access journals seem well within the scope of traditional library collections just as JSTOR licenses sustain back files. Intellectually valuable open access publications are then likely to endure as part of library collections based on library license fees just as digital archives of subscription journals will. The Portico, spun off by JSTOR in 2005, archived 1.8 million articles by 2007 with funding from publishers and libraries.^[62]

FRONTIERS

For scholarly journals, there are several frontiers at play between subscription and open publication. One frontier is the launch of new journals. A group of scholars or a publisher who intends to launch a new journal will decide whether to sell it by subscription or to offer it in the open. If in the open, the scholars might decide to depend on the good offices of a university and philanthropy to sustain the venture, relying primarily on volunteers as editors or they might rely on author fees to generate revenue flows to compensate editors. In 2007, Blackwell Publishing, a for-profit publisher, launched its first fully open access journal, *Archives of Drug Information* with author publication fees of \$2600.^[63] The fee is \$2600 for up to 10 pages plus \$250 for each page over 10. This new publication points to

an expanding role for open journals through the launch of new journals. In contrast, the American Economic Association will launch four new journals in 2009 that will be offered by inexpensive subscriptions (Journal closings also influence the number of journals of each type. *Ulrich's Periodical Directory* lists 1679 referred academic journals as ceased; 535 of these had been available online but only 19 had been evaluated in JCR. Only 17 of the ceased journals were open access).

A second frontier arises in the selection of editors. For small-scale journals intended for specialists, an editor might serve as a volunteer, depending primarily on the good offices of his home campus. For large-scale journals that aim for wider intellectual impact that therefore must manage a larger flow of submissions, voluntary editors may not suffice. Among the distinguished scholars with the temperament and organizational skill needed to be successful editors, substantial financial inducements may be necessary to draw people into the role. Annual payment in excess of \$100,000 plus support staff may be necessary to fill demanding editorships. Substantial author fees will be necessary to support editing of such journals when they are to be open. Subscription fees may be necessary for journals with high circulation to sustain the necessary level of editorial expertise. The ability to recruit appropriate editors is an important frontier for open journals.

A third frontier, the requirement of green archiving, involves the policy of research funding agencies in requiring results to be posted in the open. As mentioned above, governments might require open publication of publicly funded research. The policy might include an embargo, might limit open publication to prepublication versions, and limit posting to institutional repositories rather than in discipline-specific databases. Leading subscription-based journal publishers, particularly those with hybrid journals, can negotiate lower author payments with longer embargoes or limit the versions and location of postings. This frontier is one of political action and contract negotiation.

A fourth frontier is the critical one of authors choosing where to publish. Authors who focus on achieving substantial reputations can choose open publications with higher expected citation rates with their highest quality works appearing in journals with significant author fees. The support of funding agencies and universities for author fees will advance this frontier. Authors may also choose subscription journals with wide circulation.^[64] For authors who publish works for narrower audiences, open journals with volunteer editors and modest or no author fees may dominate other choices.

A fifth and critical frontier is that of libraries who make decisions about support for relevant open publications and purchase of subscriptions. With modest effort, libraries can include reference to intellectually important open journals and other publications in their catalogs and other finding tools. Libraries can use their role as database integrators to include indexes that point to open materials, enhancing the frequency of use and value of open materials.

The libraries make decisions about subscriptions to databases. Some databases will be more valuable for some libraries than others in the way that a large set of medical journals is more valuable to a medical library. The better the fit of the database to a library, the more a vendor is likely to charge with database prices varying by type and size of library. The vendor will increase profit (or publisher's net in the case of not-for-profits) with prices high enough to nearly induce some libraries not to subscribe. For large databases taken to be very significant for a given category of library, the subscription rates can be quite large. The greater the extent and quality of open access alternatives, the more easily some libraries may choose not to subscribe. For smaller libraries and those for which a given database is less relevant, the vendor will offer lower prices in part because the library is more likely to find a given set of open materials to be sufficient. The vendors, in turn, seek to bundle materials into larger databases and to offer unique features to make their offerings more compelling. Open posting in institutional repositories with short embargoes narrow differences in service available in the open compared to the subscriptions.

A sixth frontier is that of readers in choosing to use open publications more often than subscription publications. Even on well-supported campuses, however, readers may turn first to open indexes and link more readily to digital full-text materials published in the open. As readers, for whatever reason, give precedence to open materials, authors, editors, publishers, and libraries will move toward open journals. Readers' willingness to tolerate advertising will also have influence. In 2007, conventional subscription journals hold sway.^[65] Scholars invest in building their reputations by publishing in highly regarded journals. Most take the traditional system of subscription journals as given in deciding where to publish and this behavior gives existing patterns inertia.

The speed of development of open publication will vary across disciplines because these frontiers will differ. Disciplines with high levels of research funding, those where more new journals are being launched, where volunteer editors are more common, where authors accept publication fees more readily, and where library support is not as deep, are likely to move to open publication faster. Where high levels of editing produce polished publications that reach wide audiences subscriptions are more likely.

THE KNOWLEDGE BASE

The intellectual success and economic viability of open access archives, journals, and indexes creates the possibility of a universal, open access knowledge database, an intellectual commons.^[66] The knowledge base could be universal in the sense of encompassing all disciplines, in being accessible to everyone on the Internet, and expanding with media beyond black text on white pages.

As a large and increasing proportion of the workforce are college graduates, universal access to the knowledge base will make it more valuable. As countries around the world make larger commitments to higher education, scholarship will play a larger role in economic growth everywhere. Scholarship, when it is available in the open, will have more value than in the past.

The tragedy of the commons, the loss of value from congestion—making it more difficult to identify the most important ideas, exploitation—pressing volunteers to undertake unreasonable efforts, and pollution—an overflow of extraneous materials, points to limitations of overreliance on sharing. The market place for ideas where intellectual property has dollar value can be an antidote to the excesses of the commons. Market forces focus effort on more important ideas, reward leading scholars who invest in becoming editors who promote the work of others, and encourage scholars to develop teaching materials and to put scholarship in forms useful beyond academia. Scholarship has value in training a more capable workforce and a better-informed citizenry. Subscription services may have particular value with high levels of editorial service, more structured and precise searching, and long-term archiving. Financial incentives tied to intellectual property from reputation, copyrights, and patents channel scholarly effort to more valuable roles in ways that may be difficult to achieve simply by sharing.

On the other hand, markets are seldom perfect. They can be frozen by monopoly. They can be overheated by pointless arms races. Dollars can give misleading signals of value. A report in 2007 by Ithaka, a not-for-profit committed to promoting innovation in higher education, urges an active role for universities and not-for-profits in developing digital publishing services.^[67] It calls for new publishing models to offer immediate access, dynamically updated materials, and collaborative environments with a broad range of digital materials. New investments will be needed to support more sophisticated publishing operations. The extent to which universities and philanthropy will decide to support such ventures will influence whether such developments will be under not-for-profit and university control. Finally, by the nature of their investments, the universities will determine the extent of open access scholarly publishing.

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Open Archival Information System (OAIS) Reference Model

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Abstract

The Reference Model for an Open Archival Information System (OAIS) describes components and services required to develop and maintain archives, in order to support long-term access to and understanding of the information in those archives. This entry discusses the context in which the OAIS was initiated and provides a chronology of the OAIS development process, including its transformation from a space data standard into a document of much wider scope. The author explains the nature of reference models as a particular type of standard, and then describes the major components and concepts of the OAIS Reference Model. The primary mechanisms that the Reference Model uses to convey the aspects of an OAIS are its functional model and information model. The entry also summarizes numerous (completed, ongoing, and emerging) initiatives that have adopted and expanded on the OAIS. Finally, the author discusses major implications of the OAIS.

INTRODUCTION

The Reference Model for an Open Archival Information System (OAIS) describes components and services required to develop and maintain archives, in order to support long-term access to and understanding of the information in those archives.^[1] The development of the OAIS took place within a standards development organization called the Consultative Committee for Space Data Systems (CCSDS), whose formal purview is the work of space agencies, but the effort reached far beyond the traditional CCSDS interests and stakeholders.^[2] It has become a fundamental component of digital archive research and development in a variety of disciplines and sectors.

This entry discusses the context in which the OAIS was initiated and provides a chronology of the OAIS development process, including its transformation from a space data standard into a document of much wider scope. It then describes the major components and concepts of the OAIS Reference Model. The entry also summarizes numerous initiatives that have adopted and expanded on the OAIS. Finally, the author discusses major implications of the OAIS.

HISTORICAL CONTEXT

Digital preservation has long been an area of concern for those responsible for repositories of digital objects. Data mismanagement, technological dependency, media degradation, and technological obsolescence have all threatened the long-term accessibility of resources stored in digital formats. In the 1950s, 1960s, and 1970s, organizations

began increasingly to rely on collections of computer-dependent data. Several streams of activity gradually emerged to address parts of the digital preservation problem (e.g., care and physical properties of physical storage media; hardware and software interoperability; management and provision of access to digital library collections), but there was often little communication or coordination across the streams. The streams of activity often developed their own distinct forums (journals, conferences, consortia) and sets of funding mechanisms (government budget areas, research agendas, foundation support).

Two trends that began in the 1960s and 1970s, but became much more prominent during the 1980s and early 1990s, were: 1) actors with long traditions of preserving physical artifacts (e.g., archivists, librarians, museum curators) increasingly recognizing that information which fell within the scope of their responsibility was now digital; and 2) actors with long traditions of managing computer-dependent data sets (e.g., scientific data center personnel, corporate information technology managers) increasingly recognizing that information which fell within the scope of their responsibility had long-term preservation value. The effort to develop the OAIS came at a time when the separate streams of activity were making important progress but they were only beginning to identify points of intersection between the streams. During the years immediately preceding and throughout the OAIS development effort, participants in digital preservation work increasingly recognized that they were addressing similar issues.

The 1990s were characterized by a broadening societal awareness of both the importance of standards in supporting the infrastructure that underlies various activities and the challenges of long-term digital preservation. Two

closely connected factors were the development of widely distributed computer networks and an industry trend toward commercial off-the-shelf (COTS) equipment. Rather than depending on the compatibility of an entire suite of hardware and software from a single vendor, producers and consumers of computer equipment came to rely on conventions for interchange of data between a heterogeneous set of components. Both the International Organization for Standardization (ISO) and Internet Engineering Task Force (IETF) developed layered architectures to which hardware and software producers could conform in order to ensure that their products could interchange data with other products on the Internet. In the early 1990s, the adoption of the World Wide Web reflected and contributed to a dramatic growth in the base of consumers who had a stake in the interchange of data over computer networks. The Year 2000 (Y2K) conversion effort was one widely recognized example of dependence on a widespread assortment of hardware and software components that usually interoperated in ways invisible to most people, but could cause significant problems when they failed to interoperate. In 1994, the Commission on Preservation and Access (CPA) and Research Libraries Group (RLG) created a Task Force on Digital Archiving. The Task Force issued a report in 1996 called *Preserving Digital Information*, which was frequently cited by subsequent literature on digital preservation.^[3] Two works that brought digital preservation to popular attention were a 1995 article by Jeff Rothenberg in *Scientific American* called “Ensuring the longevity of digital documents”^[4] and a movie called *Into the Future*,^[5] which was released in 1997 and shown on Public Broadcasting Service (PBS) across the United States in 1998.

Prior to the development of the OAIS, there had been numerous calls in professional literature for both development and adoption of open standards in support of long-term digital preservation. The most active standardization and consensus was associated with physical storage media and storage conditions. In other areas of digital preservation, most of the existing standards had served primarily to advance work within specific streams of activities, rather than spanning multiple professions.

OAIS DEVELOPMENT PROCESS

The historical context discussed in the previous section is essential to understanding the character and impact of the OAIS. The Reference Model was both a product of and an influential factor in the evolution of digital preservation activities in the mid- to late-1990s—reflecting preexisting notions and helping to define new notions. A major factor in the success of the OAIS was the timing of its development. Actors within several streams of activity related to digital preservation perceived the need for a high-level model but had not themselves developed one. At the same

time, several actors now felt they had knowledge from their own recent digital archiving efforts, which could inform the development of the OAIS. Despite this growing body of practical experience and understanding of the functions associated with digital archiving, one essential element that was missing was a common vocabulary. Problems had often stemmed from terms—such as archives/archiving or metadata—that were used so widely and for so many different purposes that it was difficult to determine if they were being used in the same way by different actors. The combination of pressing need, available expertise, and inconsistent language meant the time was ripe for developing a reference model that could codify and support greater consistency in discussions of digital archives.

The development of the OAIS took place within the CCSDS, whose formal purview was specifically support for study of the terrestrial and space environments. However, the OAIS development effort took on a much wider scope than one may have reasonably predicted, given its CCSDS origins. The OAIS development process ultimately involved and gained visibility among a much broader set of stakeholders than simply members of the CCSDS. The word “Open” in the acronym OAIS—meant to indicate that the standard was “developed in open forums”—was a defining feature of its evolution. The leader of the OAIS development process was Don Sawyer, Computer Scientist and head of the U.S. National Aeronautics and Space Administration (NASA) Office of Standards and Technology (NOST) at the Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. Sawyer indicated early and continued to reiterate that the process should be open and inclusive, in order to get sufficient input and buy-in. The core development team actively recruited commentary on the drafts of the document and gave dozens of public presentations about the Reference Model to a diverse range of professional groups.

The formal process began on April 5, 1994, when Gael Squibb of the Jet Propulsion Laboratory (JPL) proposed a New Work Item (NWI) related to “archiving space data” to ISO Technical Committee 20 (Aircraft and Space Vehicles), Subcommittee 14 (Space Systems and Operations). This proposal ultimately found a home in another subcommittee of ISO TC 20: Subcommittee 13 (Space Data and Information Transfer Systems). The formal Secretariat for TC 20/SC 13 is the American National Standards Institute (ANSI), and it is administered by NASA. The CCSDS is a liaison organization to TC 20/SC 13 (see Fig. 1). Sawyer made the case for this effort to NASA management. As the NASA representative, Sawyer also submitted a document to Panel 2 (Information Interchange Processes) of the CCSDS on April 25, 1995, proposing a new “work package.” In May, Panel 2 created “WP [Work Package] 700 Archiving” with Sawyer as the leader and the initial subtask being “WP 710 Archiving Reference Model.” Sawyer and Lou Reich, who worked under contract for

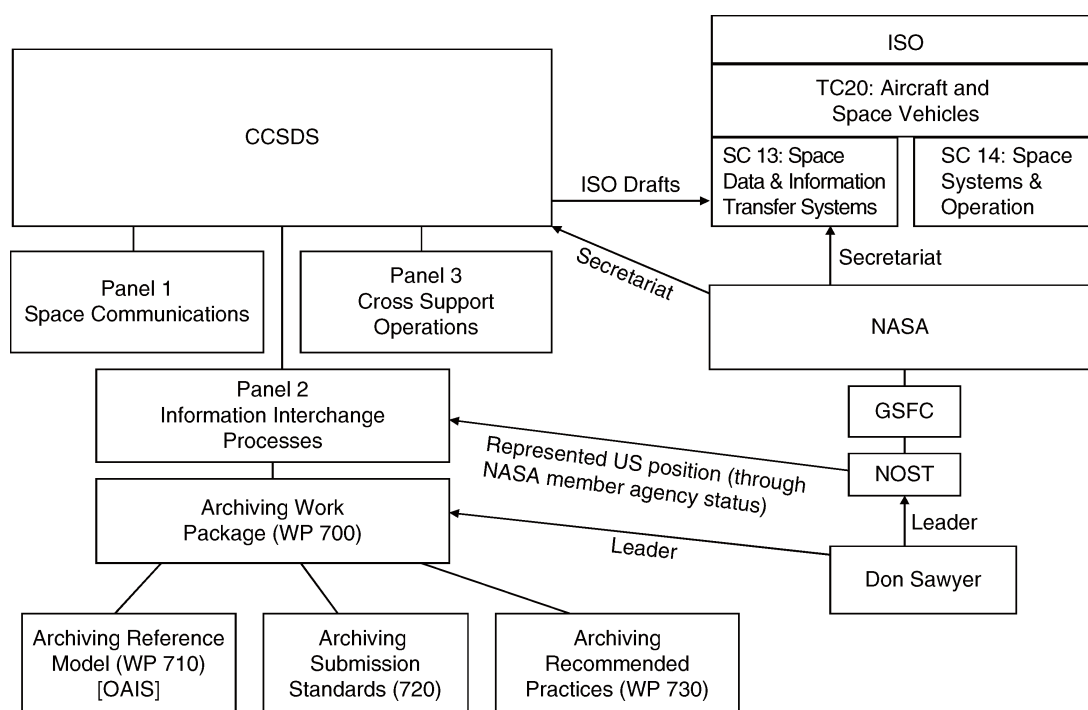


Fig. 1 Organizational context of OAIS development.

Source: Adapted from C. Lee, *Defining Digital Preservation Work: A Case Study of the Development of the Reference model for an Open Archival Information System*. Doctoral Dissertation, University of Michigan: Michigan, 2005.^[2] CCSDS, Consultative Committee for Space Data Systems; GSFC, Goddard Space Flight Center; ISO, International Organization for Standardization; NASA, U.S. National Aeronautics and Space Administration; NOST, NASA Office of Standards and Technology.

the GSFC as Senior Consulting Engineer for the Computer Sciences Corporation, coauthored a preliminary discussion draft of a reference model document. Sawyer and Reich remained the primary authors and editors of later versions, but the process also increasingly drew from contributions (both text and figures) from other participants. John Garrett, who was a contractor for the NSSDC as Senior Analyst at Hughes STX (ST Systems Corporation), helped to set up the initial meeting, and he served as a significant source of administrative support and documentation throughout the OAIS development process.

Development of the OAIS was markedly different from the previous standards development efforts of the CCSDS by being both broader in scope and inclusive of a more diverse set of actors. In order to support this unusually inclusive effort, the leaders set up a unique meeting and decision-making structure. In addition to the well-established semiannual CCSDS meetings, the OAIS development effort also involved a set of 18 U.S. Workshops, devoted primarily to document development, and a set of more open meetings (one in France, two in the United Kingdom, and two in the United States), designed to gather input and review from a wider set of actors. Most of the U.S. Workshops took place at the Archives II facility of the U.S. National Archives and Records Administration (NARA); Bruce Ambacher, Archives Specialist at NARA, was one of the most active participants in the

OAIS development process. The creation of the Reference Model involved a relatively small and stable set of core actors, but it also involved a much larger set of actors who had more limited Workshop participation. The latter played an extremely important role in the development, review, and visibility of the Reference Model. There were 306 individuals who participated in one or more of the Workshops.

Development of the OAIS involved negotiation over issues such as the scope of the Reference Model, its intended purpose, and the definition of basic terms. The development process also involved considerable borrowing and adaptation of ideas and documents already in existence. Over time, common notions about the content of the Reference Model became more established, and the number and extent of revisions to drafts of the Reference Model decreased.

After being requested to do so by CCSDS Panel 2, ISO SC 13 voted on May 22, 2000 to allow circulation of Red Book 1^[6] as a Draft International Standard (DIS) to all ISO national member bodies. By releasing the Reference Model as a Red Book, the CCSDS was indicating that the document was “technically mature and ready for extensive and formal review by appropriate technical organizations within each Member Agency.” Comments received in response to Red Book 1 implied substantive changes to the document. SC 13 sent a request to the ISO in January

2001 to “reprocess” the DIS, meaning a revised document would be resubmitted to ISO member bodies for another vote. Red Book 1.1 (April 20, 2001), Red Book 1.2 (June 2001), and Red Book 2 (July 2001) were the result of efforts to address the comments received in response to Red Book 1. On October 23, 2001, SC 13 approved the submission of Red Book 2 for ISO vote. There were then a few minor editorial changes to the document before it was circulated (as the Blue Book)^[6] to ISO member bodies for balloting. A Blue Book is a CCSDS Recommendation, which “reflects resolution of official comments from Member Agencies during formal reviews, and, as such, represents the consensus of appropriate implementing organizations within each Member Agency. Member Agency approval of a Blue Book implies an intent to reflect its provisions in future data systems standards developed through internal mechanisms.” The ISO balloting process, which involved ISO national member bodies, ran from January 24 to April 5, 2002. There were eight affirmative votes, no negative votes, and two abstentions. The chair of SC 13 formally reported the results of voting on the Reference Model to ISO on August 20, 2002. On February 24, 2003, the Reference Model was finally published by ISO as an International Standard (ISO 14721:2003).^[7] The Blue Book version, which is freely available from the CCSDS Web site, is identical in content to the International Standard, except that the current Blue Book version reflects a September 2007 “editorial correction,” involving slight alterations to several figures to correct “display anomalies” (problems with encoding of line breaks had resulted in extraneous square blocks appearing next to some text elements) and a “typographical error” in one of the figures.

Many important activities in the development of the OAIS took place outside the context of formal ISO Archiving meetings and review processes. Teleconferencing, e-mail, and the Web greatly facilitated work on the OAIS and allowed review and use of the Reference Model drafts by those who were not necessarily able to attend the Workshops. Core members of the OAIS development effort gave dozens of presentations related to the Reference Model at conferences and other professional events. Several of the actors in the ISO Archiving Workshops also took part in mass storage systems and technologies (MSST) conferences, which served as forums for both the dissemination of information about the development of the Reference Model and recruitment of actors into the process. Individuals and organizations involved in initiatives that attempted to apply and test the Reference Model—e.g., CEDARS (CURL [Consortium of Research Libraries] Exemplars in Digital Archives) in the United Kingdom, NEDLIB (Networked European Deposit Library), British Library, and PANDORA (Preserving and Accessing Networked Documentary Resources of Australia)—played an essential role in the process. The archives certification work that built off of the Reference

Model also provided important input into the development of the OAIS and demonstrated the Reference Model’s potential value to a variety of stakeholders.

Development of the Reference Model drew from many other sources. These included concepts, terminology, models, and strings of text and images from guidelines, reports, and standards. In some cases—such as the “Z39.50 profile for access to digital collections” (PDC),^[8] *Preserving Digital Information, Planetary Data System Data Preparation Workbook*,^[9] and *IEEE Guide to the POSIX Open System Environment (OSE)*^[10]—it is possible to identify specific terms or concepts that were incorporated into the Reference Model. Other sources were discussed during Workshops and provided varying degrees of conceptual background for the work on the Reference Model.

OAIS AS A REFERENCE MODEL

The OAIS is a reference model, which is a very particular type of standard. Carl Cargill provides a framework for describing standards, which distinguishes providers of information technology products and services from the users of those products and services. According to Cargill, these two groups have very different motivations and needs in the standardization process.

On the provider side is the global model that describes all of the potentials that the IT industry will need to satisfy all users over a long time in nearly all situations, and that serves as a reference for all providers. This reference model, if it is correctly constructed, includes some present and future technologies, a road map function, and some of the methodologies of the thought processes that occurred when it was constructed. The time span covered is up to ten years, and the model is applicable to all technical disciplines that deal in this area. On the IT user side is a description of a solution implementation that is immediate and particular to that user’s application problems (p. 1-11).^[11]

As explained by Cargill above, reference models operate at a higher level of abstraction than other types of standards and are purposely designed to be “implementation-independent.” The OAIS itself provides the following definition of reference model:

A framework for understanding significant relationships among the entities of some environment, and for the development of consistent standards or specifications supporting that environment. A reference model is based on a small number of unifying concepts and may be used as a basis for education and explaining standards to a nonspecialist.^[11]

Cargill explains that bridging the gap between reference models and application implementations requires a chain

of standards at increasing levels of specificity (p. 1-12).^[1] Within the arena of digital archives, this means that one would expect more specific standards to emerge, which indicate how to apply the concepts of the OAIS in more specific contexts. As explained later in the section on “OAIS Adoption, Extension, and Future Directions,” such follow-on standardization has been taking place.

CONTENT OF THE OAIS

The OAIS is a 148-page document, composed of six sections and six annexes. Section 1 frames the content to follow, by providing discussions of purpose, scope, applicability, definitions, rationale, and conformance requirements. It also situates the document in a larger context by including a “road map for development of related standards.” Section 2 lays out several core concepts that are then modeled in more detail in Section 4. These include archive; information (as distinct from data); interfaces between an archive, Producers, Consumers, and Management; and Information Package and its subtypes: Submission Information Package (SIP), Archival Information Package (AIP), and Dissemination Information Package (DIP). Section 3 discusses the responsibilities of an Open Archival Information System and “some examples of mechanisms to discharge these responsibilities.” Section 4 presents a “more detailed model view” of the concepts previously laid out in the document. The section includes a functional model (including a high-level view and then unpacking of each entity and data flows between the entities) and an information model, which provides a hierarchical set of views and explanations for what logical elements should be stored and managed in association with a data object. Section 4 also provides an account of the “transformations, both logical and physical, of the Information Package and its associated objects as they follow a lifecycle from the Producer to the OAIS, and from the OAIS to the Consumer.” Section 5 provides some discussion—intended to be implementation agnostic—of technical issues and strategies that an archive can potentially use to address changes in underlying hardware, software, formats, and access services. Section 6 discusses potential arrangements between multiple archives. The annexes that follow Section 6 are not considered part of the Reference Model’s normative content but are instead “provided for the convenience of the reader.” The annexes include a set of five “scenarios” that use OAIS terminology and concepts to describe specific existing archives; explanations of how the Reference Model relates to other standards and projects; a brief Unified Modeling Language (UML) tutorial; list of references; a layered model of how software could be used to support Representation Information; and a “composite diagram” that presents in one place the detailed interfaces between each of the entities in the functional model.

Fundamental Terms and Concepts

The Reference Model defines an OAIS as “an archive, consisting of an organization of people and systems, that has accepted the responsibility to preserve information and make it available for a Designated Community.” Many of the requirements for an OAIS are based on the needs of its Designated Community, which is the set of one or more “user communities” that the OAIS is serving. An OAIS is responsible for digital information over the “long term,” which is “long enough to be concerned with the impacts of changing technologies, including support for new media and data formats, or with a changing user community” (p. 1-11).^[1] One of the fundamental challenges of an OAIS is to ensure that the digital information in its care is “independently understandable” to the Designated Community, which means that the Designated Community can understand it “without having to resort to special resources not widely available, including named individuals” (p. 1-10).^[1] The Designated Community has a certain “knowledge base,” which can change over time.

One of the most important insights embedded in the Reference Model is that the “Content Information” to be preserved by an archive is composed not only of a “set of bit sequences” (the “data object”) but also associated sufficient “Representation Information” to allow the bits to be rendered, used, and understood.

Since a key purpose of an OAIS is to preserve information for a Designated Community, the OAIS must understand the Knowledge Base of its Designated Community to understand the minimum Representation Information that must be maintained. The OAIS should then make a decision between maintaining the minimum Representation Information needed for its Designated Community, or maintaining a larger amount of Representation Information that may allow understanding by a larger Consumer community with a less specialized Knowledge Base. Over time, evolution of the Designated Community’s Knowledge Base may require updates to the Representation Information to ensure continued understanding (p. 2-4).^[1]

The three main roles played by the external entities with which an OAIS interacts are Producer, Consumer, and Management. Producers are “persons, or client systems, who provide the information to be preserved.” Consumers are “persons, or client systems, who interact with OAIS services to find preserved information of interest and to access that information in detail.” Management is “the role played by those who set overall OAIS policy as one component in a broader policy domain (p. 1-11).”^[1]

A diversity of workflow and collaborative arrangements can be mapped to the Reference Model by representing “other OAISs” and “internal OAIS persons or systems” as Producers and Consumers (pp. 1-8, 1-12).^[1] The Reference Model describes “four categories of archive association” based on “successively higher degrees of interaction”:

- Independent—“no management or technical interaction.”
- Cooperating—“potential common producers, common submission standards, and common dissemination standards, but no common finding aids.”
- Federated—serve “both a Local Community (i.e., the original Designated Community served by the archive) and a Global community (i.e., an extended Designated Community) which has interests in the holdings of several OAIS archives and has influenced those archives to provide access to their holdings via one or more common finding aids.”
- Shared resources—have agreed to share resources between the archives, which “requires various standards internal to the archive (such as ingest-storage and access-storage interface standards), but does not alter the user community’s view of the archive” (p. 6–2).^[1]

The primary mechanisms that the Reference Model uses to convey the aspects of an OAIS are its functional model and information model. Roughly speaking, the former indicates what an OAIS must do, and the latter indicates what the OAIS must have in its collections.

Functional Model

The functional model is composed of seven main functional entities and the interfaces between them: Access, Administration, Archival storage, Common Services, Data Management, Ingest, and Preservation Planning. The single figure from the Reference Model that has received the most attention in the digital preservation literature is a representation of six of the functional entities (see Fig. 2). Not directly represented in Fig. 2 are Common Services,

which are the “supporting services” that must be in place for computer systems to operate and perform properly, including interprocess communication, name services, temporary storage allocation, exception handling, backup, directory services, as well as other aspects of operating system, network, and security services. Although Common Services are necessary for an OAIS, they are not a major focus of the Reference Model, because they are “assumed to be available” (p. 4–2).^[1] As illustrated in Fig. 2, the OAIS functional model also identifies between Administration and management, but it does not elaborate any function within management itself.

Many aspects of the functional model rest on the distinction between SIPs, AIPs, and DIPs. SIPs are what the OAIS receives from Producers. AIPs are what the OAIS manages and preserves. DIPs are “derived from one or more AIPs, [and are] received by the Consumer in response to a request to the OAIS” (p. 1–10).^[1]

Ingest is the entity that receives SIPs, performs quality assurance on the SIPs, generates AIPs, extracts Descriptive Information from AIPs, and coordinates updates to Archival Storage and Data Management. Archival Storage is responsible for “receiving AIPs from Ingest and adding them to permanent storage, managing the storage hierarchy, refreshing the media on which archive holdings are stored, performing routine and special error checking, providing disaster recovery capabilities, and providing AIPs to access to fulfill orders” (pp. 4–1, 4–2).^[1] Data Management supports the populating, maintenance and accessing of both Descriptive Information and administrative data associated with the OAIS holdings; this includes database administration, database updates, performing queries on the data, and producing reports that result from the queries. Administration is responsible for “the overall

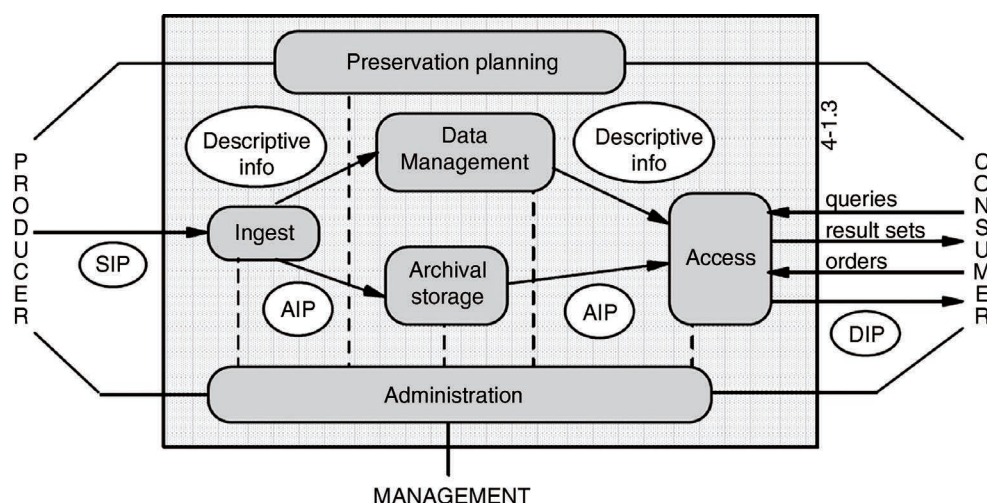


Fig. 2 OAIS Functional Entities.

Source: Reference model for an Open Archival Information System (OAIS); Consultative Committee for Space Data System: Washington, D.C., 2002; 4:1. [SIP = Submission Information Package; AIP = Archival Information Package; DIP = Dissemination Information Package].

operation of the archive system,” which includes soliciting and negotiating submission agreements, auditing submissions, configuration management, system engineering, activating stored requests, and the establishment and maintenance of standards and policies (p. 4–2).^[1] Preservation Planning monitors the environment for important changes in technology or the needs of the Designated Community; evaluates the implications of those changes to the archive’s holdings; designs Information Package templates; “provides design assistance and review to specialize these templates into SIPs and AIPs for specific submissions”; “develops detailed Migration plans, software prototypes and test plans,” and provides periodic recommendations for “archival information updates,” standards and policies (p. 4–2).^[1] Access both provides and appropriately restricts Consumers’ ability to discover, request, and receive information from the archive, including DIPs, “result sets” and reports (p. 4–2).^[1]

Information Model

The information model defines and describes “the types of information that are exchanged and managed within the OAIS” (p. 4–18).^[1] It is based on the recognition that

long-term preservation of digital information requires an archive to “store significantly more than the contents of the object it is expected to preserve” (p. 4–19).^[1] The Reference Model uses the term “Information Package” to refer to the logical unit that includes both a digital object and the other types of information that should be associated with the digital object in order to preserve and provide meaningful access to it over time. AIPs are the information packages that are managed internally by the OAIS. An AIP can be either an Archival Information Collection (AIC), “whose Content Information is an aggregation of other Archival Information Packages” (p. 1–7),^[1] or Archival Information Unit (AIU) “whose Content Information is not further broken down into other Content Information components.”^[24] Fig. 3 presents the main types of information that constitute and are associated with an AIP. The Package Description is information about an Information Package, which is used by Access Aids. An Access Aid is “a software program or document that allow[s] Consumers to locate, analyze, and order Archival Information Packages of interest” (p. 1–7).^[1] Packaging Information, in contrast, is not intended for direct use by Consumer but is instead “used to bind and identify the components of an Information Package”

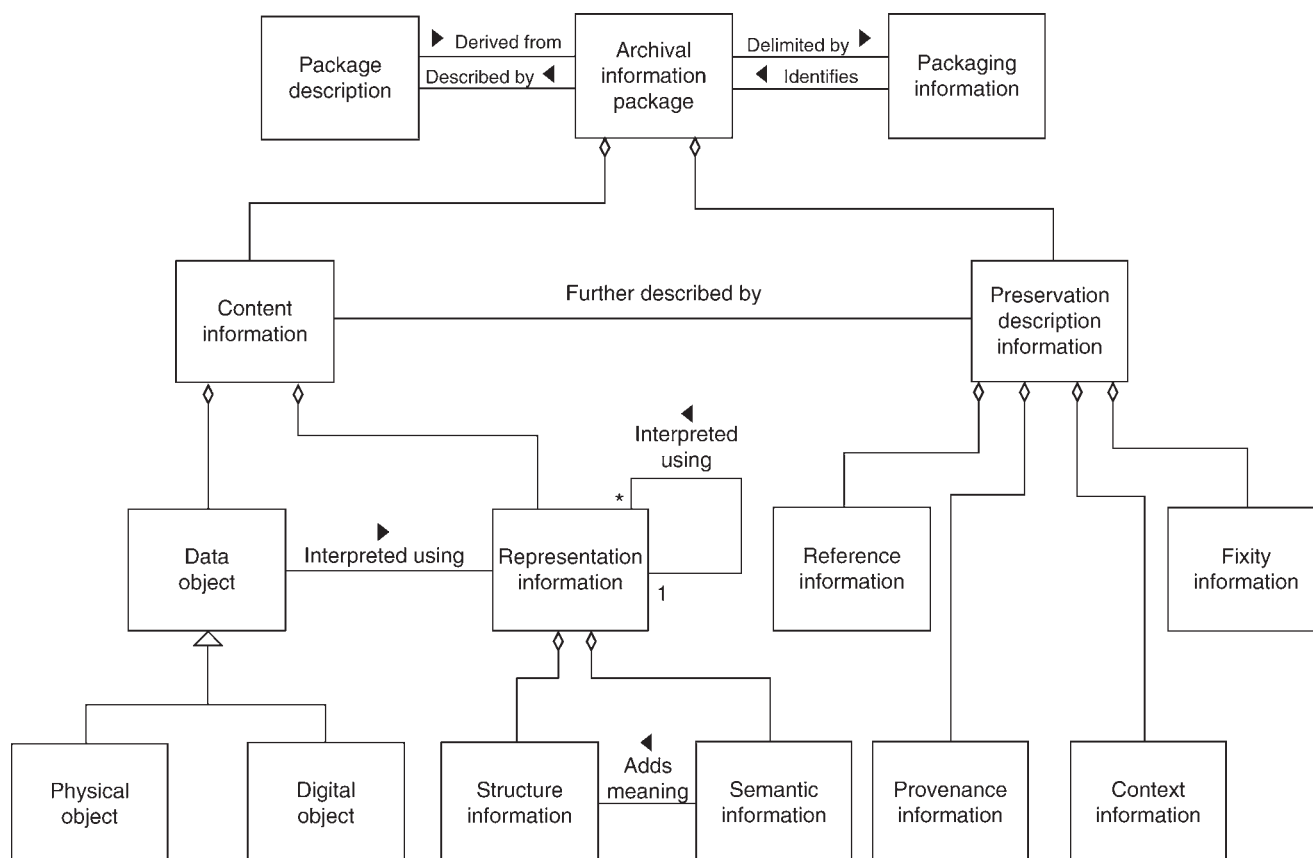


Fig. 3 Archival Information Package (Detailed view).

Source: Reference Model for an Open Archival Information System (OAIS); Consultative Committee for Space Data Systems: Washington, D.C., 2002-4-37.

(e.g., volumes and directory information for the components) (p. 1–12).^[11]

The Content Information is the “the original target of preservation” (p. 1–8).^[11] As described earlier, Content Information is composed of both the Data Object (for digital information, one or more sequences of bits) and Representation Information, which “allows for the full interpretation of the data into meaningful information” (p. 4–19).^[11] Representation Information can be either Structure Information, which “imparts meaning about how other information is organized,” such as mapping “bit streams to common computer types such as characters, numbers, and pixels and aggregations of those types such as character strings and arrays” (p. 1–13),^[11] or Semantic Information, which indicates the meaning of language used in either the Structure Information or other parts of the Content Information.

Representation Information is often conveyed using Digital Objects, which then require their own Representation Information, resulting in what is called a Representation Network. For example, a string of bits (Digital Object) could represent an array of pixels, but a Consumer would also need information about the file format (Representation Information), in order to render and use that Digital Object as an image. If the image were encoded using Scalable Vector Graphics (SVG), which is based on Extensible Markup Language (XML), then rendering and using the image would require not only the SVG specification but also the specification for XML, as well as other specifications for character encoding and Uniform Resource Identifiers (URIs) upon which XML itself depends.

As illustrated in Fig. 3, Content Information is “further described by” Preservation Description Information (PDI), which “is necessary for adequate preservation of the Content Information.” PDI is composed of:

- Reference Information—“identifies, and if necessary describes, one or more mechanisms used to provide assigned identifiers for the Content Information” and “provides identifiers that allow outside systems to refer, unambiguously, to a particular Content Information.”^[13]
- Provenance Information—“origin or source of the Content Information, any changes that may have taken place since it was originated, and who has had custody of it since it was originated” (p. 1–12).^[11]
- Context Information—“documents the relationships of the Content Information to its environment” including “why the Content Information was created and how it relates to other Content Information objects” (p. 1–8).^[11]
- Fixity Information—“documents the authentication mechanisms and provides authentication keys to ensure that the Content Information object has not been altered in an undocumented manner” (p. 1–10).^[11]

PDI is an extension and elaboration of what *Preserving Digital Information* called the “features that determine

information integrity and deserve attention for archival purposes”: “content, fixity, reference, provenance, and context.”^[12]

OAIS ADOPTION, EXTENSIONS, AND FUTURE DIRECTIONS

Several years before it had reached formally approved status within the CCSDS or ISO, the OAIS was already receiving considerable attention from those engaged in digital preservation research and development. An extensive survey of the English-language literature up to April 2005 identified 335 sources that cite or discuss the OAIS, beginning in 1997 and increasing every year thereafter.^[13] Over the past several years, the OAIS has come to be a widely assumed basis for research and development on digital archives, with conference papers, articles, and reports very often presenting their findings within the context of the OAIS.

The OAIS has become “the reference model of choice of those involved in digital preservation worldwide,”^[14] serving as a “galvanizing force”^[15] and a “major factor in the advancement of digital archiving efforts.”^[16] It has contributed “a common language and concepts for different professional groups involved in digital preservation and developing archiving systems.”^[17] “The reference model represented common ground upon which to consolidate understanding of the needs and requirements of digital preservation: an opportunity to gather the strands of isolated digital preservation activities, merging them into a shared (albeit highly conceptual) characterization of the problem’s boundaries.”^[18]

A large number of research and development projects have either based their work directly on or claimed that their final products conform to the OAIS, many of which are listed in Table 1.

Professional development has also been strongly influenced by the OAIS. One of the earliest activities of the Digital Preservation Coalition (DPC) in the United Kingdom after its formation in 2001 was to develop, along with the British National Space Centre (BNSC), a seminar to discuss and “raise the profile of” the OAIS. The Cornell University Library offered a highly acclaimed workshop series from 2003 to 2006, and disseminated an associated tutorial, both called Digital Preservation Management: Implementing Short-Term Strategies for Long-Term Problems, which used the OAIS as a foundation.^[19] In 2008, Inter-University Consortium for Political and Social Research (ICPSR) became the host of the Digital Preservation Management workshop and tutorial, which continue to be based heavily on the OAIS.

From its initial conception, the OAIS was intended to serve as the basis for further development of more specific digital archives standards, and the OAIS has indeed played that role. It has served as the basis for several very prominent digital preservation metadata initiatives, including

Table 1 Examples of research and development activities with stated OAIS influence or requirements.

Major institutions, organizations, and repositories	British Library Digital Curation Centre in the United Kingdom European Union French Archive Institute French National Archiving Center for University and Scientific Publications (CINES) Inter-University Consortium for Political and Social Research (ICPSR) JSTOR (Journal Storage) National Library of Australia National Library of France (BnF) National Library of New Zealand National Library of the Netherlands (KB) Online Computer Library Center (OCLC) Portico Project Euclid—Cornell University Library and Duke University Press U.S. Government Printing Office U.S. Library of Congress, National Library of China U.S. National Archives and Records Administration U.S. National Library of Medicine U.S. National Oceanic and Atmospheric Administration United Nations Educational, Scientific and Cultural Organization (UNESCO) Numerous university libraries and space agencies
Funding bodies emphasizing OAIS in solicitations and research agendas	U.S. National Science Foundation Joint Information Systems Committee (JISC)—United Kingdom
Digital collection management systems and preservation platforms	aDORé Archive—Los Alamos National Laboratory CONTENTdm—OCLC DSpace—Massachusetts Institute of Technology Flexible Extensible Digital Object and Repository Architecture (Fedora) Digital Information Archiving System (DIAS)—IBM LOCKSS (Lots of Copies Keep Stuff Safe)—Stanford University Libraries Integrated Rule-Oriented Data System (iRODS)—Data Intensive Cyber Environments (DICE) Group Preservation and Long-term Access through Networked Services (PLANETS) Testbed Securing a Hybrid Environment for Research Preservation and Access (SHERPA) Digital Preservation (DP) Service—Arts and Humanities Data Service (AHDS)

CEDARS, NEDLIB, and two joint Research Libraries Group (RLG)/Online Computer Library Center (OCLC) efforts—the Working Group on Preservation Metadata and then the Preservation Metadata Implementation Strategies (PREMIS) Working Group. The CCSDS also has been coordinating the development of follow-on standards based on the OAIS, which provide more detailed guidance related to parts of the OAIS functional and information models. The *Producer–Archive Interface Methodology Abstract Standard* (PAIMAS) “defines the methodology for the structure of actions that are required from the initial time of contact between the producer and the archive until the objects of information are received and validated by the archive.”^[20] PAIMAS was issued as a CCSDS Blue Book in May 2004 and was published as an ISO standard (ISO 20652) in 2006.^[21] The *Producer–Archive Interface Specification* (PAIS) focuses on an even finer level of granulating, by presenting “a standard method to formally define the digital information objects to be transferred by an information Producer to an Archive and for effectively transferring these objects in the form of Submission Information Packages (SIPs).” As of the writing of this entry, the PAIS

was in a tenth White Book version (April 2009), undergoing consideration for Red Book status. A White Book is “a preliminary draft of a planned CCSDS Recommendation or Report” that is “under development” and “not necessarily endorsed by any CCSDS Member or Observer Agency or given any CCSDS external distribution.”^[22]

RLG and NARA formed a Digital Repository Certification Task Force, whose efforts were explicitly tied to the OAIS. An initiative by the Center for Research Libraries (CRL) is extending the RLG/NARA certification work, with funding from the Andrew W. Mellon Foundation. A Birds of a Feather group is also attempting to develop an ISO standard for digital repository audit and certification, through the same channels as the OAIS, viz. ISO TC 20, SC 13, and the CCSDS.

The OAIS is currently undergoing a 5-years review within the CCSDS and then within the ISO. During the comment period, which ended in October 2006, the CCSDS received 11 separate documents containing comments. At a meeting on October 4, 2007, the Digital Archive Ingest (DAI) Working Group began reviewing the OAIS review comments, and identified several action

items related to specific parts of the text. In 2003, the CCSDS underwent a major reorganization. The digital archives standardization activities that were previously part of Panel 2, including the OAIS, were moved into a new area called Mission Operations and Information Management Services (MOIMS). The DAI working group, is part of MOIMS. The DAI Working Group determined an initial set of responses to the comments, shared the potential responses with those who submitted the original comments, and then revised the OAIS document based on the comments and follow-on interchanges. On May 5, 2009, John Garrett (Chair) and David Giaretta (Deputy Chair) of the DAI Working Group disseminated a proposed draft of the revised OAIS Reference Model through several electronic mailing lists, “seeking primarily to identify errors” in preparation for submitting the revised Reference Model for ISO review and balloting.

CONCLUSION

The OAIS has been a focal point and foundation for discussion of digital preservation and digital curation across many professional boundaries. It is thus valuable for information professionals not only to understand the content of the document but also to learn lessons about how the Reference Model was developed and promulgated. A reference model is a very high-level, conceptual standard. Rather than providing detailed specifications of mandatory data elements or file formats, the OAIS has introduced a set of interrelated terms and concepts. Its development occurred during a period when many professional communities had a need for such a high-level standard but had not yet developed one themselves. There are various ways in which the Reference Model is able to provide detailed concepts, while still remaining relatively “implementation-independent”: presentation of the functional model and information model in terms of high-level entities; extensive use of figures; and elaboration of implementation details in nonnormative appendices to the document, including several organization-specific “scenarios.”

Much of the value of the Reference Model comes from its coherence, clarity, and synthesis of ideas. The Reference Model does define many new terms and introduces many original concepts, but its development has also been characterized by significant adaptation and reuse of preexisting sources.

Finally, the word “Open” in the acronym OAIS—meant to indicate that the standard was “developed in open forums”—was a defining feature of its evolution. The leaders of the effort presented draft products to many professional forums and actively recruited contributions and commentary. In addition to the traditional set of CCSDS stakeholders (space agencies and their contractors), many other organizations and individuals also contributed to the OAIS development process.

The OAIS is playing a major role in many current standardization, research, and development initiatives. Its impact on professional conversations surrounding digital preservation and digital curation continues to grow, 7 years after the Reference Model was approved as an International Standard.

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Open Source Software

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Abstract

Open Source software is distinguished not by programming language, operating environment, nor application domain, but rather by the license(s) that governs the use, distribution, and, most importantly, the rights to access and modify the software's source code. Together, software source code and open source licensing have dramatically changed many conventional assumptions about software and the software industry itself.

Open Source software is an important^[1,2] and growing^[3] class of software. Open Source software is distinguished not by programming language, operating environment, nor application domain, but rather by the license(s) that governs the use, distribution, and, most importantly, the rights to access and modify the software's source code. Together, software source code and open source licensing have dramatically changed many conventional assumptions about software and the software industry itself.

As of early 2009 there are roughly 70^[4] licenses that are officially recognized as Open Source Licenses. These licenses govern software that spans the software gamut from operating systems (like Linux) and compilers (like GCC and G++) to Web servers and clients (like Apache and Firefox) to leading applications and technologies in bioinformatics, statistical display and analysis, 2-D and 3-D paint, illustration and animation software, databases, content management, customer relationship management, accounting, and geographic information systems. And even these categories encompass but a few of the 10,000 + open source software packages that are freely available for major Linux distributions such as Fedora,^[5] Ubuntu,^[6] and Red Hat Enterprise Linux.^[7] In 2004 it was estimated that the Linux kernel, if it were to be developed using proprietary methods and private investment, would have cost more than \$600M to create, and that the roughly 1000 packages typical in Linux distributions of the time would have cost more than \$1B.^[8] In 2005 an analysis of the Debian project estimated that its 230 million lines of source code (230M SLOC) would have required 60,000 person-years of development at a cost of more than \$3B USD.^[9] But these estimates speak to the possible cost, not the real cost of developing open source (which was far lower, most likely less than 1/20 the cost of developing proprietary software, for reasons discussed later in this entry). Nor does it consider the true value of open source, which has the potential to remedy as much as \$1T USD per year in dead-loss write-offs of failed proprietary software implementations. (The \$1T per year figure is extrapolated from the statistics that worldwide ICT is expected to top \$3.4T USD in 2008^[10]

and because 18–30% of all ICT investments, predominantly based on proprietary software because that is the dominant model of the industry today, are dead-loss write-offs).^[11,12] Open source software is thus an important topic because the financial implications to the global economy are potentially large.

Before explaining what is an open source license, and thus what is open source software, we will first give a brief history of the origins of open source principles and the success of the open source software model.

The two most important precursors to the idea of open source software as a movement unto itself were the Berkeley Systems Distribution of Unix (also known as BSD Unix) and Richard Stallman's Project GNU (GNU is a recursive acronym for "GNU's Not Unix!"). Both of these projects became known to the academic and entrepreneurial communities in the early 1980s. BSD was licensed under terms that permitted users to read, modify, and redistribute the software for research or commercial purposes, but without a requirement that the source code be made freely available to all who used any product that incorporated the operating system. Sun Microsystems successfully commercialized BSD as the basis of their SunOS operating system, and Sun chose to make their version of BSD—including access to the source code—proprietary to Sun, as permitted by the BSD license. The GNU project was covered by the General Public License (GPL), which permitted users the freedom to read, modify, and share (redistribute) the software, subject to the restriction that users who distribute modified or unmodified versions of the software must also distribute the source code from which those versions were created. These two licenses, one which made source available and sharing optional, one which made source availability and sharing both mandatory as a condition of redistribution, began a long and far-reaching experiment: what licensing model is best for what type of software project, in what contexts, and for whom?

The Free Software movement, founded by Richard Stallman and defined by his *GNU Manifesto*^[13] argued

that software freedom was an ethical issue of the highest importance, and that software hoarding was an unethical activity. Some programmers were swayed by this argument and joined the Free Software Foundation or made common cause with Stallman, but many more simply enjoyed the freedoms granted by the GPL to use what they considered to be better software than any proprietary alternative. And as more software developers used GNU software, more developers also naturally contributed to it (as they were free to do). Before long, despite the fact that many did not agree with Stallman's politics, they found his software to be unimpeachable and they found that contributing their changes to the GNU project was more economical than trying to maintain those changes themselves.

At the same time, the University of California at Berkeley provided a great institutional environment for software developers to learn, contribute, make a reputation, and then join the ranks of Silicon Valley startups to make millions. By the late 1980s, Sun Microsystems was one of the most powerful and respected companies in Silicon Valley. Their key technology asset, SunOS, was based on source code that Bill Joy wrote while a graduate student at Berkeley. But the fact that Sun did not share their code freely with the community began to irk many, and there were signs that for all its power, Sun's competitive position was vulnerable to the many projects that freely shared source code could produce, including versions of BSD that others chose to work on and commercialize.

Cygnus Support was the first company to make a business providing commercial support exclusively to software whose source code was freely available. The tagline of the company was "We make free software affordable," a joke about the fact that just because something is freely available doesn't make it cheap to use or manage. Although Cygnus Support was a successful company, growing fast enough to be profiled in *FORTUNE*^[14] and earn a spot^[15,16] on the Software 500 list of the world's largest software companies before its 10th anniversary, the mainstream business press focused so much on the paradox of making money on "free" software that it never could take seriously the multimillion dollar revenue streams that Cygnus generated year after year.

Moreover, the politics of "free software" was off-putting to many would-be entrepreneurs who wanted to focus their efforts on technology and business, not freedom *per se*. Thus, while GNU software was seriously challenging the core assumptions of proprietary software advantage (that somehow secret knowledge is superior to knowledge that is widely known and shared), and while GNU software was demonstrating just as clear and positive a return on investment as companies investing in proprietary software,^[17] there was a distinct lack of critical mass around the idea of commercializing free software.

In 1997, Eric Raymond published a seminal essay, *The Cathedral and The Bazaar*.^[18] This paper attempted to

unravel how it was that a group of amateurs (doing software for the love of it), many of whom had not even met each other, could coordinate their activities and out-produce the best funded, most highly recruited programmers of Silicon Valley and the Pacific Northwest. Among the many insights in this paper, one of the most powerful (dubbed Linus's law) was the idea that the more widely available the source code is for public testing, scrutiny, and experimentation, the more rapidly all forms of bugs will be discovered. This was a remarkable repudiation of Brook's Law (discussed below), which argued that adding more developers to a late project only makes it later.^[19] In the world of software, this insight was like finding a way to travel faster than the speed of light, and the only requirement, it seemed, was to abandon the model of proprietary software development.

In 1998, a group of individuals that included both Eric Raymond and the author advocated that the term "free software" be replaced by open source software (abbreviated OSS) as an expression which is less ambiguous and more comfortable for the corporate world.^[18] In addition to creating the term "open source," the group attempted to codify the features and benefits they saw that derived from granting liberal rights with respect to software source code and software distribution. The group created the Open Source Definition (OSD)^[19] which codifies how licenses must be written to provide these rights and thus deliver the benefits. The term "open source" became immediately popular, and the Open Source movement was born (Fig. 1)

The Open Source Initiative (OSI) was founded in 1998 as a California 501(c)3 nonprofit education and advocacy group for open source software. The OSI acts as the steward of the OSD and it judges whether licenses submitted to it do or do not meet the criteria set forth in the OSD. The GNU GPL and the BSD licenses were among the first to be approved as "open source licenses," but now there are dozens and dozens that have been approved. The license approval process developed from the time-honored tradition of scientific peer review. Namely, when a new theory (or in this case, license) makes a claim (or in this case, a license asserts that it is open source), it is up to the community to study the claim and attest to its validity or point out its flaws, and it is up to some formal authority to review the community's findings and make a judgment as to whether the claim is accepted into the canon of knowledge (or in this case the list of approved licenses). This consensus-based approach has been sufficiently transparent and fair that an increasing number of national governments are adopting the OSD and the OSI's rulings as a legitimate basis for determining whether software is open source for national policy purposes.^[20]

We shall now turn our attention to the subject of software development, specifically to compare and contrast open source software development with some prominent

1. Free Redistribution

The license shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several different sources. The license shall not require a royalty or other fee for such sale.

2. Source Code

The program must include source code, and must allow distribution in source code as well as compiled form. Where some form of a product is not distributed with source code, there must be a well-publicized means of obtaining the source code for no more than a reasonable reproduction cost preferably, downloading via the Internet without charge. The source code must be the preferred form in which a programmer would modify the program. Deliberately obfuscated source code is not allowed. Intermediate forms such as the output of a preprocessor or translator are not allowed.

3. Derived Works

The license must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.

4. Integrity of The Author's Source Code

The license may restrict source-code from being distributed in modified form *only* if the license allows the distribution of "patch files" with the source code for the purpose of modifying the program at build time. The license must explicitly permit distribution of software built from modified source code. The license may require derived works to carry a different name or version number from the original software.

5. No Discrimination Against Persons or Groups

The license must not discriminate against any person or group of persons.

6. No Discrimination Against Fields of Endeavor

The license must not restrict anyone from making use of the program in a specific field of endeavor. For example, it may not restrict the program from being used in a business, or from being used for genetic research.

7. Distribution of License

The rights attached to the program must apply to all to whom the program is redistributed without the need for execution of an additional license by those parties.

8. License Must Not Be Specific to a Product

The rights attached to the program must not depend on the program's being part of a particular software distribution. If the program is extracted from that distribution and used or distributed within the terms of the program's license, all parties to whom the program is redistributed should have the same rights as those that are granted in conjunction with the original software distribution.

9. License Must Not Restrict Other Software

The license must not place restrictions on other software that is distributed along with the licensed software. For example, the license must not insist that all other programs distributed on the same medium must be open-source software.

10. License Must Be Technology-Neutral

No provision of the license may be predicated on any individual technology or style of interface.

Fig. 1 Text of the OSD.

examples of proprietary software projects and development models.

The documented failure of the industrial model of software development is almost as old as the software industry itself. IBM's OS 360 project, begun in 1961, was perhaps the most ambitious attempt to industrialize the development of software.^[17] Fred Brooks, the IBM executive responsible for the project,^[21] hired the best coders, managers, analysts—whatever it took. And IBM ended up spending more money to produce that operating system than the U.S. Government spent on the Manhattan Project to develop the first atomic weapon, a fact that greatly troubled IBM's CEO at the time, Thomas Watson Jr. The product shipped—barely—in 1965, and though the product was a great commercial success, IBM's CEO really wanted to understand how it was possible that the software part of the project was so much more difficult and costly

than the hardware part. He put the question to Brooks, but Brooks himself did not have a ready answer. Ten years later Brooks answered the question in the form of a book titled *The Mythical Man Month*. The title comes from his insight that "it takes a woman nine months to have a child, no matter how many women are assigned the task." This was the first clue that the process of industrialization—breaking down tasks into simpler steps, optimizing the steps, and then managing the steps through production—had very significant limits when applied to software. Today, this book is often the first reference given to explain why multibillion dollar software projects like Microsoft's Vista slipped and slipped and slipped again, running wildly over budget and why, when it finally did ship, it did so without the very features that justified the project in the first place. Thus, more than 30 years later, we have the Gartner Group (who famously predicted the

success of the Personal Computer in enterprise computing) making the only logical prediction that can be inferred from *The Mythical Man Month* and Microsoft's own experience.^[22]

Vista will be the last major release of Windows in its current form. The current, integrated architecture of Microsoft Windows is unsustainable—for enterprises and for Microsoft. Each new version integrates more functionality and features, adding to the scale and complexity of the operating system.

While IBM and others struggled to industrialize software, the mainstream industrial model itself was beginning to show weakness across the board. In the 1940s, Dr. W. Edward Deming properly identified serious problems with the model that focused on optimization in terms of measurable (but arbitrary) inputs and outputs as related to costs and production. Deming had no luck convincing American companies to focus on quality as defined by the customer, nor to recognize the value of people working in teams on a larger and transforming goal, nor to consider whether work gave people joy. However, Deming did find a receptive audience in Japan, and the transformation that resulted from his approach has set the standard for modern industry, lowering costs, accelerating innovation, reducing environmental impact, improving safety, and inspiring pride in workmanship.^[23]

By the 1980s, Deming's work had reached even those still trying to industrialize software, in the context of the Software Engineering Institute (SEI) and their Capability Maturity Model (CMM) in a 1987 SEI Technical Report.^[24] First adopted not in the United States, but offshore, in Chennai, India,^[25] it was credited with dropping software defect density 98% while doubling profits. Though these first attempts have now been retired,^[26] the urgent question remains: why is software quality so low?^[27]

In 2005, Bill Gates gave a keynote speech at the RSA Security conference where he said "We spend over US\$6 billion a year on research and development. I'd say that over a third of that is directly security-focused, and the other two-thirds all tie in and relate to that security work, all the new code being reviewed and going through the threat model, a pretty dramatic thing there."^[28] Why is it that companies like Microsoft spend fully a third of their R&D budget correcting remedial security problems that should never have existed in the first place? As President of the OSI and Vice President of Open Source Affairs for Red Hat, I believe software quality is low because companies place a higher value on control than on innovation or quality or transparency or user participation. It is a failure to understand both the negative lessons that Brooks have taught, as well as the positive lessons that Deming taught. And perhaps it is because those who have achieved great status, wealth, and power are rarely willing to trade all

three for a new system that requires accepting new, disruptive assumptions.

The most significant transformation in ICT has been the emergence of Free and Open Source Software (FOSS).

Consider the popular Internet as embodied by the World Wide Web. This vision was first published by Vannevar Bush in 1945,^[29] and prior to 1990 there had been dozens of attempts to create such systems, the most popular being the French MiniTel system.^[30] But none of these systems became truly ubiquitous until the underlying software was free as in freedom. The freedom to read, modify, and share Web server and client code led to an explosion of innovation, and to date the most popular product of that explosion, the Apache Web server, remains dominant in spite of considerable efforts by some powerful companies to take over that space.^[31]

This came as no surprise to Tim Berners-Lee, creator of the World Wide Web, who explained his decision to make the original Web software free and open:^[32]

[H]ad the technology been proprietary, and in my total control, it would probably not have taken off. The decision to make the Web an open system was necessary for it to be universal. You can't propose that something be a universal space and at the same time keep control of it.

The popular Internet has created a dramatic new factor in the software industry equation, which is that developers and users represent a creative continuum, not distinct castes. Developers can be any people interested in a problem, not merely people employed to work on a specific problem. Free and Open Source software turns on its head the practice of optimizing software production by limiting the number of people working on a problem. Instead, those employed (producers), those annoyed (customers), and those who merely enjoy working on a problem (hackers)^[33] can work together in a problem-specific, rather than organization-specific or property-specific way. In his book *Democratizing Innovation*, Eric Von Hippel presents several studies which, together, show that 85% of all quantum innovation (as opposed to incremental innovation) is user-driven.^[34] The proprietary software model therefore limits innovation to one-sixth of its theoretical potential.

The democratization of innovation has also demonstrated a remarkable solution to the problem of *The Mythical Man Month*, thereby transcending the limits of conventional industrialization. For example, *sourceforge.net* is an open source development resource that hosts over 180,000 projects and has more than 1.9M registered users as of December 2008.^[35] Extrapolating from the extensive Free, Libre, and Open Source Software (FLOSS) survey of 2002^[36] (and updated in 2005)^[37] there were over 490,000 *sourceforge.net* developers in 2006 (when the thesis of this section was first developed—Tiemann) who spend more than 10 hr a week or more tending their open source

projects^[38]—an aggregate effort of some 5 million person-hours per week. The three top reasons they list for their involvement is:

1. Because it's fun.
2. Because it improves their skills.
3. Because it is good for society.

Note that this does not include Linux developers (who use *kernel.org*, not *sourceforge.net*), nor Apache, nor the GNU project, nor many of the other larger and more heavily commercialized open source projects. To put these 5 million joy-filled person-hours per week into perspective (again, this does not include Linux, Apache, GNU, or many of the other “large” projects), let's look at the productivity potential of the most successful proprietary software company, Microsoft, in two ways (using numbers that were contemporaneous with the FLOSS survey data, October 2006):

1. If all 61,000 employees^[39] wrote code, they would have to work over 80 hours per week.
2. If Microsoft's \$6.6B per year R&D budget^[40] were spent on programmers averaging just \$25 per hour, they could pay for about 5 million person-hours of work per week.

Thus, the *sourceforge.net* Web site has equaled or exceeded Microsoft's productive potential using a social, not an industrial model. When we consider all the open source developers not included in the *sourceforge.net* numbers (numbers that are increasing exponentially), we see the clear emergence of a new software production capacity entirely outside the conventional limits of the industrial model. Moreover, we find precisely the kind of improvements that Deming would have predicted by taking a transformative approach: according to findings published by Coverity (references below), typical proprietary software has a defect density of 20–30 defects per 1000 lines of code (KLOC), a number relatively unchanged since the 1960s. When they measured the quality of the Linux kernel (and later, other open source software) they found the following results:

- 2004: 985 defects in 5.7 MLOC of Linux kernel source code, or 99.3% lower defect density than average (compared to 114,000–171,000 defects in the same amount of code).^[41]
- 2005: While the Linux kernel grew 4.7% in overall code size, defect density decreased by 2.2%. Moreover, 100% of all “serious” defects identified were fixed within 6 months.^[42]
- 2006: The survey was expanded to entire LAMP stack and an additional 32 OSS programs. No correlation found between size and defect density, implying OSS

development methodology is not limited by scale (nor restricted to just Linux developers).^[43]

What the top industrialists could not achieve with proprietary software and financial capital, free software has demonstrated with community development and intellectual capital.

But free and open source has done more than revolutionize the production or the quality of software. The open source model has opened innovation. Open source helped crack grand challenge science problems such as sequencing the human genome.^[44] The world's largest public search engine, google.com, is built on open source.^[45–47] Open source has become a fixture in tech-heavy disciplines such as financial services,^[48] military intelligence,^[49] online retailing,^[50] and next-generation cellular telephones and base stations^[51] and handsets, including the recently announced Google Android project/product.^[52] And open source is helping to bridge the digital divide for millions of children who are literally off the grid.^[53] The model has even informed the strategy of the Bill & Melinda Gates Foundation to better combat infectious diseases:^[54]

[On July 20, 2006] the Bill & Melinda Gates Foundation announced that it would require that any researcher who accepts its grant monies for HIV/AIDS research will have to agree to share their scientific findings. The Gates Foundation was apparently frustrated that two decades of secrecy and competition among AIDS researchers have impeded efforts to come up with an AIDS vaccine.

Clearly there is a bright future for those who embrace the open source model, whether as users, developers, or entrepreneurs. The best way to learn more about open source is to become involved in a project, first as a user, then as a person who reports bugs or tests releases, and then follow where interests or expertise leads. Different projects have different personalities and protocols, but almost all viable projects have a history of being inviting at some level, and almost all provide concrete rewards for participants of all kinds. And with open source software doubling in size and scope every 12.5 months,^[3] there are more than enough examples to demonstrate why open source has become an increasingly preferred method of software development, procurement, and deployment, as the above references make clear.

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Oral History in Libraries and Archives

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Abstract

This entry reviews the development of oral history in the United States, covering its theory and method, major professional associations, and influential programs. It also describes how oral history collections are processed, cataloged, and made available for public use and concludes with a discussion of the international oral history movement.

INTRODUCTION

Oral history is an historical/archival method of recording the memories of individuals involved in a specific historical event or era. The term oral history encompasses both the creation of the interview as documentation in historical study and the processing and preservation of the recording in a library or archives. These historical/archival activities can occur together as a holistic project. In other instances, the interview is conducted solely for research purposes and afterwards it is deposited in an historical repository. Regardless of the interviews' origin or purpose, oral histories exhibit key characteristics which distinguish them from other forms of oral documentation such as folklore and oral tradition.

This entry will survey the origin and progress of the oral history movement, its theory and method, and the major functions of its professional infrastructure. It will also note the major oral history programs in the United States and trace how oral history collections and their administration have evolved since the 1950s. The entry covers recent theoretical trends and concludes with the emergence of an international oral history movement.

ORAL HISTORY DEFINED

Defining oral history begins with what it is not. Although humankind has preserved its cultural memory for centuries, oral history differs from oral tradition in several ways. Oral tradition is passed down from generation to generation and does not require that the narrator be a participant in or witness to the event being told. Oral tradition also requires a narrator to memorize and perform the story as opposed to critically describing observed events. Neither is oral history an oral memoir, although an oral history interview includes elements of a life review. The difference here is that a memoir is an uninterrupted, unproblematic personal narrative. Oral history, in contrast, requires the

intervention of an interviewer, whose questions guide the narrator's reminiscences and probes for further reflection.

Oral history, then, is a structured conversation between a researcher and an individual who has witnessed or participated in a historic event. Its goal is to gather information that supplements and expands traditional primary source material such as personal papers and archival records. For some topics, oral history creates historical documentation where none other exists. Oral history is an audio form of historical evidence, though many oral history programs create verbatim transcripts for researchers' use.

HISTORY OF ORAL HISTORY

Although the present-day oral history movement originated following World War II, historians have made use of eye-witness accounts since ancient times. As early as the fifth century B.C.E. Herodotus used firsthand testimonies in his writing on the Persian Wars. There is evidence that personal narratives were recorded by scribes in China (1122–256 B.C.E.) and early modern Europe as well. Priests in colonial Latin America similarly preserved the stories of indigenous people, in this case to create a record of their declining civilizations.^[1]

In the United States, the term "oral history" reportedly was first used in 1863 when Joe Gould recorded overheard conversations in New York City for a book he never actually wrote called "An Oral History of Our Time."^[2] About this same time, historians and antiquarians began preserving pioneer reminiscences in more a systematic manner. A prolific collector was Lyman Copeland Draper. When he died in 1891, his interviews and papers collected from Revolutionary War veterans and other prominent individuals filled 486 volumes and were donated to the Wisconsin Historical Society.^[3] On the West Coast, historian/publisher Hubert H. Bancroft also recorded pioneer reminiscences, which he called "Dictations." The resulting 125

interviews with the state's leading Californios (i.e., pre-1848 inhabitants of Alta California) are now part of the University of California, Berkeley's Western Americana Collection.

Oral history fell into disfavor at the turn of the century as historians pursued what they believed to be a more objective means of understanding the past. Following the dictates of German historian, Leopold von Ranke, these so-called "scientific" historians preferred to ground their research in official written records and dismissed personal narratives as hearsay. However, as official and personal records gained ascendancy in historical writing, new forms of long-distance communication and modes of travel were causing them to disappear. The reel-to-reel tape recorder, invented in Germany in the 1930s, offered a solution by making it possible to permanently capture people's conversations.

The modern oral history movement began in the late 1940s, when Columbia University professor Allan Nevins employed several graduate students to interview important figures in New York politics and government. Nevins first raised concerns about the loss of primary sources in his 1938 book, *The Gateway to History*, proposing that historians make a "systematic attempt" to record the firsthand accounts of individuals important in contemporary society.^[4] In 1948, Nevins secured an endowment from the university's Bancroft Fund and the Columbia Oral History Research Office was born.

Columbia's oral history program set the agenda for oral history projects during the movement's formative period. The program was largely funded through grants and contracts, which reinforced its initial focus on prominent individuals in government and industry. (Among Columbia's early projects were oral histories of prominent government officials as well as executives of major corporations like the Carnegie Corporation, Ford Motor Company, Weyerhaeuser Timber Company, and McDonnell Douglas Aircraft.) Columbia's interviews were recorded in long-hand until the portable tape recorder became available in the early 1950s. Even after the interviews were recorded, they were still transcribed and the original tape destroyed or reused. Theoretically, early oral historians felt that the printed transcript—which included editorial corrections by the researcher and narrator—was the primary source of record, the tape being simply a conduit. Reusing tapes was also an economic measure, since the oral history method was expensive and funding scarce.

In 1958 Allan Nevins retired and turned over the administration of Columbia's program to his associate director, Louis Starr. Starr hired Elizabeth "Betty" Mason as his assistant, and together the two regularized and systematized the management of their growing oral history collection. They developed formal guidelines for conducting and processing interviews and arranged for formal deposit of the completed transcripts in the Special Collections Department at Columbia's Butler Library.

They also established policies regarding access to and use of the transcripts, which set in place various protections governing the interests and rights of narrators. In 1964, the Columbia Oral History Research Office published its first catalog containing descriptions of the program's 1345 interviews.

During the 1950s and 1960s, Columbia's Oral History Research Office continued to function as an independent, self-funded entity on campus. When it decided to offer a class in oral history, it did so not through the university's history department but instead in its library science program. According to Betty Mason, these original oral history classes attracted 16–20 faculty and students from various disciplines across campus. "We saw oral history as something which could be used in lots of different ways," she recalled. "Louis [Starr], in his speeches, used to talk about it being more than a tool and less than a discipline."^[5,6]

While Columbia University was developing oral history in the East, other programs were starting up in universities and government agencies throughout the country. In 1965, 89 different oral history centers were in operation; by 1971, 230 programs had begun with 90 more planned.^[7] Oral history programs were in colleges and universities, historical societies, private foundations, museums, and government agencies. Their collections ranged from interviews with Jewish labor activists to the lives of American composers.

Driven by technological advance and popular culture, oral history expanded rapidly in the 1970s. The inexpensive portable cassette player (invented in 1963) made oral history activity feasible outside government and the academy. Best-selling oral history-based books published by Studs Terkel and Alex Haley popularized the oral history method among the general public, and the oral history work of Eliot Wigginton's high school students with Appalachian old-timers attracted nationwide praise. By the time Haley's "Roots" aired as a wildly popular TV miniseries in 1977 oral history had come of age.^[8–10]

Key to oral history's development in the 1970s was a major theoretical shift from preserving the memories of prominent individuals to collecting the stories of everyday life. This new theoretical thrust was a by-product of changing lines of historical inquiry, most notably the emergence of the new social history. Often described as "history from below," social history documented the lives of nonelites—workers, women, and ethnic minorities—whose personal papers rarely found their way into the government archives or university library. It was an energizing time for oral historians, as Linda Shopes recalled. "I was excited by what I sensed to be oral history's potential for transforming that body of received wisdom called history, transforming it from the codifications of a few learned men to the experiences, attitudes, and perceptions of ordinary men and women."^[11] The major projects inaugurated at this time reflected oral history's widening

historiographical lens: Howard University's Civil Rights Documentation Project (now the Ralph J. Bunche Collection); Long Beach State University's Feminist Oral History Project; Radcliffe College's Black Women Oral History Project; Wayne State University's Autoworkers Oral History Project; and the Doris Duke American Indian Oral History Program to which many university's contributed interviews.^[12]

By the end of the 1970s, oral history had become an established historical methodology with a growing body of practical and theoretical literature. Much of the early writing on oral history appeared in library science and archival journals. In fact, between 1968 and 1978, more than 110 articles were published. Most reported on new oral history projects and collections. Some, however, raised concerns regarding the value of oral history as historical documentation and the role archivists should play in its creation and administration.^[13]

The 1970s saw the expansion of oral history books as well. Written by oral history pioneers, initially these texts focused on oral history methods. In 1969, Willa Baum, head of the University of California, Berkeley's Regional Oral History Office (ROHO), published one of the earliest manuals, *Oral History for the Local Historical Society*. A flurry of how-to guides appeared thereafter, including *A Guide for Oral History Programs* (1973), *Transcribing without Tears* (1976) and another text by ROHO's Baum, *Transcribing and Editing Oral History* (1977).^[14–17]

Coincident with the publication of these practical guides, oral history writing moved in a more theoretical direction. The turning point came in 1975 when Ronald Grele put together a small volume of essays titled *Envelopes of Sound*. With contributions from historians, anthropologists, and popular writers, *Envelopes of Sound* asked some challenging questions regarding oral history method and use. In the introduction, historian Alice Kessler Harris compared oral history to more traditional archival sources created as a natural by-product of daily activity. "Unlike diaries, letters, and personal papers that were themselves responses to the event or period being studied," Kessler Harris observed, "interviews are created after the fact and reflect the participants' self-conscious attempts to preserve what they remember for the future."^[18] In his essay "Movement without Aim," editor Grele also considered the authenticity of oral history as evidence, given the role played by the historian in its own creation. "The recorded conversations of oral history," Grele maintained, were "joint activities, organized and informed by the historical perspectives of both participants [narrator and interviewer]." They are not really autobiographies, he continued, but "conversational narratives." Their content must be understood within this unique framework.^[19]

Subsequent writings on oral history continued this introspection concerning the meaning and value of oral history as primary source material, especially in light of

criticisms coming from traditional documentary historians regarding the interviewees' faulty memories. David Henige, in *Oral Historiography* (1982), devoted several chapters to interpreting oral history evidence, stressing how the context of the interview's creation impacted the resulting content.^[20] Other publications confronted the issue of historical accuracy of interviews, suggesting ways in which information should be authenticated. There was also a growing interest in how other disciplines might use oral histories in their research. Publications such as Daniel Bertaux's *Biography and Society: The Life History Approach in the Social Sciences* (1981), David Dunaway and Willa Baum's *Oral History: An Interdisciplinary Anthology* (1984), and David Stricklin and Rebecca Sharpless's *The Past Meets the Present: Essays on Oral History* (1988), considered how interviews can serve as documentation for not just historical study, but also for sociology, cultural anthropology, literary studies, linguistics, and more.^[21]

This theoretical dialogue regarding oral history's creation and use came to full flower with Michael Frisch's 1990 book, *A Shared Authority: Essays on the Craft and Meaning of Oral and Public History*. A collection of his own ruminations of oral history theory and practice, Frisch explored how the interviewer, narrator, historian, and audience all play a part in constructing and interpreting the past. Frisch stressed that oral history is a socially constructed activity which not only reflects personal experience but also cultural forms and the context from which it emerges. An oral history interview, argued Frisch, is a mix of experience, memory, and cultural perspective. As such, it allows the researcher to "stand somewhat outside of cultural forms in order to observe their workings."^[22]

Questions about memory and oral history did not diminish its value as a primary source, but became its strength, allowing scholars to not only learn about what happened in the past, but also to see how memory can be influenced by culture and time. Moreover, the increasingly international exchange among oral historians (see below) has deepened practitioners' appreciation of the field's sociocultural implications and its multiplicity of uses. As British oral historian Alistair Thomson explains, the interview provides "clues not only about the meanings of historical experience, but also about the relationships between past and present, between memory and personal identity, and between individual and collective memory."^[23] Oral history has thus evolved from historians' desire to preserve the memories of powerful individuals into an important interdisciplinary tool for the study of society and culture.

ORAL HISTORY METHODS

Michael Frisch's concept of shared authority (that is, the redistribution of power between the historical actor and

the historian) has particular resonance for understanding the theoretical underpinnings of oral history practice.^[24] Typically oral history is not a single interview but a series of interviews to gain multiple perspectives on a given topic. The project director selects narrators based on their knowledge and representativeness of the community their story embodies. The interview itself is a dialogue between the interviewer, who has researched the topic extensively, and the narrator, who responds to a series of questions posed by the interviewer. While the interviewer prepares an outline of topics to cover, the narrator is encouraged to tell his or her story without interruption or contradiction. Oral historians typically ask open-ended, neutral questions. They listen patiently as the narrator reminisces at length or stops and pauses to consider his or her answer. Once the narrator fully responds to a given question, the interviewer probes for further details and reflection. The interviewer is expected to be sensitive to the narrator's perspective and personal background, allowing the interviewee to determine what will be discussed and how it will be expressed. This give-and-take between the interviewer and interviewee, and attentiveness to the narrator's feelings and values, allows for an oral historian to discover not only what happened but, in the narrator's view, why it happened and what it meant.

Once an interview has been recorded, a verbatim transcript is prepared and returned to the narrator. The narrator has the opportunity to review what was said in the interview and correct or clarify material not accurately expressed. The narrator can delete passages that, upon reflection, he or she would prefer to be kept off the record. When controversial material has historical significance, the interview might be sealed for a number of years or until vulnerable parties are deceased. The power of the narrator to review and approve the transcript before depositing it in a library or archives is a core component in this collaborative process and serves as the backbone of ethical oral history practice.

For both ethical and legal reasons, oral history transcripts are carefully vetted to prevent unintended harm to those mentioned in or connected to the interview. As the Oral History Association Evaluation Guidelines warn: "Interviewers should guard against possible exploitation of interviewees and be sensitive to the ways in which their interviews might be used."^[25] An oral history project will often employ editors to go through the transcript and identify material potentially injurious to the narrator, innocent parties, and the oral history program itself. Oral history programs can be held accountable for libelous or slanderous material contained in interviews subsequently published and distributed.^[26]

Because oral history methodology emphasizes the narrator's right to voice and control his or her own story, other protections are part of standard practice. In addition to reviewing and approving the transcript, the narrator signs a legal agreement form that deeds the interview to a

specific repository and outlines copyrights pertaining to its publication and future use. Before signing this release, the narrator is fully informed of his or her rights and told how the interview will be used. Because an oral history is a "coauthored" document, the interviewer signs a similar agreement form transferring his or her interest in the tape and transcript to the repository as well. Typically, a repository asks the narrator and the interviewer to transfer copyright to the institution so that the archives can control the interview's access and use. Without these signed release forms, an oral history collection cannot be made available to researchers and the public.

Although oral history methodology focuses on the recorded interview, the ultimate archival record includes collateral material in addition to the tape and transcript. In some programs, the interviewer prepares field notes about the interview experience that become part of the archival record. Oral history projects might accumulate other documentation, such as a narrator biographical form (to record personal and contact data about the interviewee), photographs, research files, and personal papers. Thus each interview in an oral history project generates a large body of documentary material in multiple formats. Once the project is completed, these materials are cataloged and shelved according to a system designed by the oral history program. Many oral history programs transfer completed projects to their institution's library or archives for curating.

CURATING ORAL HISTORY

Oral history curating refers to the administrative and archival activities surrounding the processing and management of oral history tapes and transcripts. It includes the paper trail that provides important context for researchers to understand the project's provenance and authenticity as a primary source. Curating also involves the management of legal rights as stipulated in the signed agreement forms. Finally, oral history curating requires the creation of various finding aids and access tools to promote oral history collection awareness and use.

For many years oral history curating was done by oral historians (as opposed to librarians and archivists) who focused on processing the interview. This included transcribing, editing, and indexing the recording. The standard text on oral history processing devoted a mere two paragraphs to the actual "curating" of a collection:

With the deposit of the interview(s) and related materials in an appropriate depository, the processing phase of oral history is completed. But the work is not done. If the interviews are to serve their intended purpose, they must be properly preserved, serviced, publicized, and used.

This passes over into the area of curatorship and involves such considerations as storage conditions for tapes, cataloging, publicity, dissemination of information about

holdings to appropriate regional and national information networks, and encouraging users. But that is a subject of another book.^[27]

As more and more historians conducted interviews in the course of their research, librarians and archivists had to consider oral history's place in an archives or manuscript repository. Some information professionals believed that oral histories were not true records, according to traditional definitions. Others pressed that archivists and curators collected documents created as a natural by-product of daily activity; to generate records themselves was both inauthentic and a conflict of interest. On a more pragmatic level, oral history collections—with their numerous interviews, legal forms, and multiple formats—did not fit into standard cataloging or other descriptive practices. Preserving reel-to-reel and cassette tapes, not to mention various generations of tape recorders to play them, presented problems as well.

On the other hand, historiographical developments in the 1970s and 1980s demanded that library and archival collections keep pace. Social history, in particular, called for new documentation strategies that would capture the histories of previously ignored groups and topics. Oral history provided an ideal opportunity for libraries and archives to expand their collecting areas and provide historical materials for an increasingly diverse clientele. In the 1980s, numerous articles appeared in the *Journal of Library History*, *American Archivist*, and other professional journals promoting the value of oral history collections. In 1983, the Society of American Archivists established its Oral History Section to coordinate and sustain the profession's growing interest in oral history materials.

A major obstacle in curating oral history collections was the dearth of cataloging models and standards. "In an age in which even artifact curators are moving toward a standardized format for information exchange," complained Bruce Bruemmer, archivist at the Charles Babbage Institute, "oral history remains steadfast in its reliance on the published guide."^[28] Indeed, since Columbia published its first oral history catalog in 1964, many programs printed their own collection guides. Other oral history centers created in-house databases of their interview holdings. Some simply kept an on-going list of narrators and topics. When librarians and archivists did catalog oral histories, they treated the transcript as if it were a book. This item-level approach to cataloging oral history was expensive and time consuming and discouraged many libraries from fully processing their recorded and transcribed interviews. As a result of these cataloging problems, curators and librarians frequently resorted to what might be called the shoe-box method: they put their oral history tapes in a shoe box and stowed them away on a remote shelf.

In the early 1990s, several prominent archivists, including Bruce Bruemmer, Lila Goff, James Fogerty, Stephen

Hearn, and Michael Fox, secured a grant from the National Historical Publications and Records Commission (NHPRC) to adapt standard cataloging rules for oral history collections. At the outset, they had to confront the uniqueness of the materials' origin and content:

The oral history interview has developed as a distinct intellectual form, sharing some characteristics of deliberately created works, such as monographs, and some characteristics of unself-conscious accumulations, such as archival records. Oral histories are sometimes both produced and managed by separate oral history program units within larger repositories (usually libraries or archives). Small repositories often acquire oral histories created by individuals, schools, or community projects which don't have the resources to undertake long-term preservation and management of their products.^[29]

The challenge, then, was to adapt descriptive cataloging rules and the MARC format to accommodate the full range of materials comprising an oral history collection.

The grant project was overseen by Marion Matters, who had previously worked on the Society of American Archivists' cataloging manual *Archives, Personal Papers, and Manuscripts* (1989). The resulting *Oral History Cataloging Manual*, published by the Society of American Archivists in 1995, was an important step in "mainstreaming" oral histories so that they could be included in online catalogs and bibliographic databases. Key was the decision to describe oral history as a collection or project. That is, oral history cataloging would take an archival rather than library materials approach so as to depict oral history as a group of materials related by provenance.

Another important step in oral history curating was the 1985 publication, *Oral History and the Law*. Written by history professor and municipal judge John Neuenschwander, this text provided authoritative discussion of laws, court cases, and legal precedents relating to the creation and use of oral histories. It provided sample legal forms and policy documents (i.e., release forms, deeds of gift, contracts, etc.) to guide curators in developing policies and procedures that met legal requirements. Successive editions have continued to keep oral historians informed of changing case law and how it affects oral history administration. (This guide is now in its third edition. See work by Neuenschwander).^[30]

A third element in curating oral histories involves tricky preservation issues relating to the sound recording. For many years, audiotapes were not preserved, despite pleas from several prominent archivists and librarians.^[31] (See, for example, speech by Louis Shores, Dean of Florida State University's School of Library and Information Science.) Ultimately changing oral history theory convinced oral historians of the recording's research value, so even when the tape is transcribed, it is now preserved as the primary source. As a consequence,

librarians and archivists must contend with the vulnerability of audiotape, its gradual degradation over time, the loss of quality when copied, and the obsolescence of machines needed for playback. Oral historians initially debated the merits of reel-to-reel vs. cassette tapes as the best format for archival preservation. The debate then shifted to the feasibility and potential impact of videotaped interviews. When digital recording became commonplace in the 1980s, oral historians argued over the positive and negative aspects of replacing more stable analog tapes with compact disks. As with earlier debates over preserving audio recordings, the analog vs. digital controversy has been decided by the marketplace. Now that reel-to-reel and cassette recorders have all but disappeared, oral history curators are engaged in large-scale digitization projects to preserve their analog collections on CD and in other digital formats.

Responding to growing concern about the long-term viability of sound recordings, the U.S. Congress passed the National Recording Preservation Act in 2000. This legislation authorized the Library of Congress to establish the National Recording Preservation Board (NRPB) to develop a comprehensive program to preserve America's recorded heritage. Comprised of sound experts from the music, library, and archival fields, the NRPB commissioned a series of publications on audio preservation and digitization. Of particular importance was the 2006 report, *Capturing Analog Sound for Digital Preservation*, which established best practices for transferring analog recordings to digital format.^[32]

Despite this progress in digitizing oral history collections, the transitory nature of digital technology makes long-term preservation increasingly elusive. As Kevin Bradley, curator of oral history and folklore at the National Library of Australia, observed in 2007, "The goal of a permanent media has been wrecked on the rocks of relentless progress. Even if any media could be claimed and trusted, as permanent, the quandary is that within a short period of time the storage system would be technically superseded by storage media exhibiting superior performance specifications, and manufacturers would no longer support the old technology."^[33] Currently sound preservationists speak of "digital sustainability" rather than archival permanence and argue that the storage, access, and migration of sound recordings must become part of a broader and continuing digital assets management program.^[34]

While posing troubling preservation issues, digitization has revolutionized how libraries and archives are making their oral history collections available to researchers and the general public. Initially, oral history programs prepared published directories containing brief annotations of the interviews in their collections. Once cataloging rules were developed, oral histories were added to large bibliographic utilities like OCLC and RLN as well as to more specialized primary source databases like Alexander Street Press's *Oral History Online*. Individual oral history

programs are now placing transcribed and recorded interviews on their institutional Web sites, expanding access to their collections in ways unimaginable when many of the interviews were originally conducted.

More recently, libraries and archives have begun developing new indexing systems to enhance access to digitized audio files. For example, the Shoah Foundation's Visual History Archives enables online searching of its 52,000 testimonies of Holocaust victims by indexing the interview in 1-minute time segments and linking the index terms to the original recording. The Virtual Oral/Aural History Archive at California State University, Long Beach, provides online access to 1000 hours of its interviews by connecting segments of the voice recording to written synopses of the interview's content. At the University of North Carolina, the Southern Oral History Program partnered with the University Library to develop an ambitious oral history database which contains both the transcript and the audio file so users can move back and forth between the text and spoken word. Perhaps most promising is the software currently under development by Randforce Associates that will embed indexing terms and cross references directly into the audio file, making the interview itself fully searchable.^[35]

These innovations in digital storage and access have profound implications for oral history methodology and practice. Digitization reemphasizes the aurality of oral documentation, allowing researchers to by-pass mediation imposed by transcribers, editors, and catalogers.^[35] At the same time, putting unprocessed, digitized oral histories on the World Wide Web raises new theoretical, ethical, and legal concerns which the oral history profession assuredly will address in the near future.

ORAL HISTORY ASSOCIATIONS

The diverse oral history community is tied together by a network of national and regional professional associations. Through conferences, workshops, discussion lists, and publications, these organizations foster standards and ethics in oral history practice and help disseminate information regarding new programs and projects.

The Oral History Association (OHA) had its genesis in the First National Colloquium on Oral History held in September 1966 in Lake Arrowhead, California. Spearheaded by University of California, Los Angeles, special collections librarian James Mink, the conference attracted over 70 participants, including the movement's founder, Allan Nevins. The historians, archivists, librarians, folklorists, psychiatrists, and medical doctors in attendance debated how to define oral history and what constituted good interviewing technique. They also considered ethical issues involving funding arrangements and interview use. Conference organizer Jim Mink recalled that the "hottest and heaviest" topics were "keeping the tapes" and the editing the transcripts.^[36]

It was not at this meeting, but at the second national oral history colloquium that the Oral History Association was officially established. Held in New York City in November 1967, the 145 oral historians present chose Columbia's Louis Starr as OHA's first president and crafted the organization's constitution. One of OHA's earliest priorities was to establish connections with library and archival groups to promote oral history as a documentary source. Oral History Association representatives spoke at American Library Association, Society of American Archivists, and other professional conferences and contributed articles about oral history to their publications.^[37]

The OHA continued to host annual fall conferences, attracting a multidisciplinary audience interested in the conduct and use of oral history. From 1966 through 1972, the association recorded and transcribed conference proceedings and distributed them among its members. As the field matured, the OHA sought to expand its publication's coverage, and in 1973 began its journal, the *Oral History Review*. Under the founding editorship of Samuel Hand, the *Review* came out once a year. It continued to publish selected conference presentations and OHA board meeting minutes, but featured articles by leading oral history theorists and practitioners, and, after 1976, added book reviews. The publication of meeting minutes was dropped in 1981, making the journal a purely refereed periodical. The *Oral History Review* is now published twice a year, affiliated with a prominent university press, and continues as major source of professional and theoretical discourse for the field.

In addition to hosting conferences and publishing the *Oral History Review*, the OHA sponsors a helpful pamphlet series and other publications to codify and promote professional practice. The quarterly *Oral History Association Newsletter*, edited for many years by Baylor University historian Thomas Charlton, provides a window on current oral history issues and events. The pamphlet series addresses topics of general concern, such as "Using Oral History in Community Oral History Projects" and "Oral History Projects in Your Classroom."

The OHA also maintains an influential and highly regarded policy document called "Oral History Evaluation Guidelines." Available on the OHA Web site and reprinted in every oral history text, these guidelines were developed at the 1979 "Wingspread Conference" to define and describe ideals of oral history practice. (The Wingspread Conference was named after the conference center in Racine, Wisconsin, where the meeting was held.) Revised in 1989 and again in 2000, the current version sets forth oral historians' ethical and professional responsibilities to the interviewees, the public, the profession, and the sponsoring institution. In addition to establishing standards for oral history conduct, the Evaluation Guidelines also include best practices for oral history project design and implementation. Taken together, these guidelines and standards serve as a benchmark against which oral history work can be assessed.^[38]

The oral history movement is also supported and sustained by a network of regional associations. These local groups are quite active, holding annual conferences, organizing workshops, and publishing newsletters. They also raise money for scholarships and give awards for significant oral history work in their regions. Presently there are seven active groups: Michigan Oral History Association, New England Association for Oral History, Northwest Oral History Association, OHMAR—Oral History Mid-Atlantic Region, Southwest Oral History Association, and Texas Oral History Association.

MAJOR ORAL HISTORY PROGRAMS

"Let us begin by disposing of the myth that I had anything to do with the founding of oral history," protested Allan Nevins at the first national meeting of oral historians in 1966. "It founded itself," he asserted, and "would have sprung into life in a dozen places, under any circumstances."^[39] Although Columbia's Oral History Research Office is credited with launching the modern oral history movement in the United States, Nevins rightly recognized that other historians were beginning to record interviews about the same time.

Several government-funded projects predate Columbia's pioneering work. The Federal Writers' Project, a New Deal program sponsored by the Works Progress Administration between 1935 and 1943, employed over 6600 interviewers to collect the stories of Americans representing all walks of life. (These interviews are now available online through the Library of Congress's American Memory Historical Collections.) During World War II, the United States Army hired historians to accompany troops into battle and record their experiences as they were happening. The Army continued its oral history program after the war, and today over 1200 interviews with military men and women are available at the U.S. Army Center of Military History.

The U.S. Army is not the only government department to employ oral history. Since the 1960s all branches of the armed forces have sponsored oral history projects to supplement their documentary record.^[40] One of the largest collections is housed at the Marine Corps Historical Center and includes interviews with nearly 6500 soldiers who served in Vietnam. The U.S. Senate Office also has an important oral history program dating back to 1976. Under the direction of Senate historian Donald Ritchie, hundreds of interviews have been conducted with senators and people associated with the Senate spanning half a century.

American presidential libraries were another significant player in the American oral history movement. The Roosevelt Presidential Library was the first to collect oral histories, contracting with the Columbia Oral History Office to interview individuals associated with Roosevelt's administration. The Truman, Hoover, Eisenhower, Kennedy, and Johnson presidential libraries also sponsored major oral

history projects in the 1960s and 1970s, often hiring full-time oral historians to oversee the work. The Johnson Presidential Library, which interviewed people while Johnson was still in office, boasts the largest oral history collection, with over 1500 interviews in its archives. Presidential libraries established since the Carter Administration have not undertaken such large-scale oral history projects, but instead preserve exit interviews done with White House staff members leaving office.^[41,42]

Other federal agencies and institutions have also used oral history to document their programs and activities. The National Institutes of Health, National Library of Medicine, Social Security Administration, NASA, and the National Parks Service have all conducted interviews since the late 1960s. Today the Smithsonian Institution has an ambitious oral history program dealing with the history of aeronautics, science, and technology. The Smithsonian also sponsors important oral history projects for the Archives of American Art and on the history of American jazz.

The most impressive government-funded oral history work is happening at the Library of Congress. Its American Memory Web site contains thousands of interviews recorded by federal employees or donated by the general public. The Library of Congress also sponsors the Veterans History Project which asks former military personnel to donate oral histories and documents relating to their wartime experiences. At this writing, the Veterans History Project contains more than 45,000 personal testimonies, making it one of the largest oral history collections in the world.

Much of the oral history activity in the United States takes place in colleges and universities. As more and more faculty used oral history in their research and teaching, they needed an institutional base to manage the expanding body of documentary materials, leading to the establishment of oral history programs on campus. California's universities provide a good case in point. In the early 1950s, James Hart and George Stewart, English professors at the University of California, Berkeley, were inspired by Bancroft's "Dictations" to hire graduate students to interview additional California pioneers. In 1954, the university established the Regional Oral History Office to coordinate this oral history effort. The University of California, Los Angeles, began its oral history program in 1959, the brainchild of British historian John S. Galbraith and University Librarian Lawrence Clark Powell. The University of California, Los Angeles (UCLA) oral history program was initially managed by faculty member Doyce Nunis and librarian Elizabeth Dixon, until Special Collections Librarian James Mink, who as a graduate student had earlier worked on the Berkeley oral histories, assumed responsibility in 1967. Claremont College's Oral History Program was founded in 1962 by history faculty members Douglass Adair and W. John Niven. Niven had been a student of Allan Nevins at Columbia University,

and Nevins served as a consultant to Claremont's program in its founding years. Forty miles away, California State University, Fullerton, history faculty were also conducting interviews for their research and assigning oral history projects in their classes. The Cal State Fullerton oral history program was founded in 1968 by Gary Shumway and administered jointly by the history department and the university library.^[43-45]

California has been a hotbed of oral history activity for over 40 years, which explains why the first national oral history meeting was held in that state. However, many other regional colleges and universities are equally productive and influential in the field. It is not possible to list every major academic program, but any count would have to include: the Oral History Institute at Baylor University; the Southern Oral History Program at the University of North Carolina, Chapel Hill; the Maine Folklife Center at the University of Maine, Orono; the Center for the Study of History and Memory at Indiana University; the Center for Oral History at the University of Connecticut, Storrs; the Oral History Program at the University of Alaska, Fairbanks; the University of Kentucky Oral History Program; and the University of Nevada, Reno Oral History Program. These programs are significant not only for their collections, but also for the leading role they take in conducting oral history institutes, publishing oral history manuals and texts, and making available other oral history products and services.

Although government and university-based projects dominate the American oral history movement, public libraries, historical societies, and museums have also successfully used oral history to enhance their historical projects, exhibits, and collections. The New York Public Library (NYPL), for instance, began its Oral History Project and Archive in 1974 to document the history of dance. A significant project within NYPL's dance archive are interviews with dancers afflicted with AIDS. Smaller libraries have also relied on oral history to document their distinctive communities. A good example is the "Front Porch Oral History Series" sponsored by the Way Public Library, in Perrysburg, Ohio, which videotapes and preserves conversations with longtime residents born before 1930.^[46,47]

Oral history is also an important tool for preserving institutional memory, in both the for-profit and nonprofit sectors. The Forest History Society was, perhaps, the first organization to use oral history to document changes in its field of interest—forestry management and conservation—beginning its oral history collecting in the late 1940s. Many other organizations have followed suit and developed important oral history projects to document the experiences of individuals in their organizations and communities. Among the most ambitious is the Shoah Visual History Foundation, founded by film director Steven Spielberg in 1994 to videotape the stories of holocaust survivors and witnesses. Nearly 52,000 interviews

have been collected as a result of this project. They are now part of the Shoah Foundation Institute, established at the University of Southern California in 2006.^[48]

INTERNATIONAL ORAL HISTORY MOVEMENT

Although oral historians have been active outside of the United States for 60 years, the oral history movement has been self-consciously international since the 1980s. The first International Conference on Oral History was held in England in 1979; the *International Review of Oral History* began publication the following year. Renamed the *International Annual of Oral History* in 1990, it merged with the European oral history journal *Life Stories* in 1992 to become the *International Yearbook of Oral History and Life Stories*. Interdisciplinary as well as international, each *Yearbook* addressed a different theme, such as memory and totalitarianism, cultural transmission between generations, and migration and identity. The *Yearbook* ceased publication in 1996 when the International Oral History Association was established. In addition to sponsoring biennial conferences, the association publishes the bilingual, *Words and Silences/Palabras y Silencias*, continuing the *Yearbook's* mission to promote dialog among oral historians throughout the world.

Oral history's internationalism has challenged accepted oral history methodologies and fostered new theoretical understanding and applications. For example, oral historians' experiences interviewing people in different cultures have better illuminated the extent to which memory, culture, and the telling of history are interconnected and grounded in social context. Interviewing techniques promulgated in one region or culture may be entirely inappropriate and counterproductive in another.

The international movement in oral history also shows that the motives behind and uses of oral history vary in different parts of the world. While in the United States oral history originally sought to document the experiences of political leaders, the oral history movement in England, led by sociology professor Paul Thompson, has focused more on nonelites as a means of empowering the lower classes. Oral history in Latin America has an openly political agenda and is tied to important social movements of the region. Oral historians in postapartheid South Africa have found in oral history a means to cultivate a new national identity that, to quote its Oral History Association, "encompasses all people, irrespective of race, culture, genders, sexual orientation and social status."^[49] In New Zealand and Australia, capturing the history of aboriginal peoples has been among those regions' major oral history goals.

Finally, some of the most significant theoretical developments in oral history originated within this international setting, particularly in the work of Luisa Passerini and Alessandro Portelli. Passerini, in her studies of Italian

women and the working class, uses sociological, psychological, and feminist theory to better understand the multiple "subjectivities" of oral history interviewees and the fluidity of their personal narratives depending on the interview's context and goals. [See, for example, *Fascism in Popular Memory: The Cultural Experience of the Turin Working Class* (1987) and *Memory and Utopia: The Primacy of Inter-Subjectivity* (2007).] Portelli, arguably the most influential contemporary oral history theoretician, writes about how communities create and popularize their own historical narratives, sometimes in opposition to what actually transpired. As Portelli explains in *What Makes Oral History Different?* oral history "tells us less about events than about their meaning." [As cited in work edited by Perks and Thomson.^[50] Portelli's books include *The Order Has Been Carried Out: History, Memory, and Meaning of a Nazi Massacre in Rome* (2003); *The Battle of Valle Giulia: Oral History and the Art of Dialogue* (1997); and *The Death of Luigi Trastulli and Other Stories: Form and Meaning in Oral History* (1991).]

CONCLUSION

In this encyclopedia's original essay, Louis Starr defined oral history as "primary source material obtained by recording the spoken words—generally by means of planned, tape-recorded interviews—of persons deemed to harbor hitherto unavailable information worth preserving." These interviews, Starr elaborated, were not solely conducted for researchers' personal use, "but for libraries or other repositories to hold for the benefit of scholars of this and succeeding generations." Reflecting the status of oral history in 1977, Starr's entry focused on the strengths and weaknesses of oral history as historical documentation and chronicled the growing list of publications based on oral history interviews. Starr could already see social history's impact on oral history, noting that this historical methodology had the potential to "reflect the myriad interests of a pluralistic society." Starr was also enthusiastic about emerging technologies, most notably microforms, and their promise to extend oral history's reach beyond the originating institutions. Despite oral history's success and future prospects, Starr still bemoaned the fact that many historians continued to reject oral history as primary source material. He also criticized archival and educational institutions for not providing the financial support oral history programs sorely needed.^[51] (See also work by Fogerty^[52] for a similar comparison between Starr's early writings and contemporary oral history.)

While the spirit and substance of Starr's oral history remains much the same, there are important changes as well. Whereas Starr claimed that the vast majority of oral history producers and users preferred the typed transcript, today's interdisciplinary and theoretically attuned

researchers rely as much on the audio as the printed document to do their work. Starr was impressed with the many books using oral histories in the 1970s. Today's important publications are as much about oral history as based upon its interviews. And while Starr complimented oral historians on their printed catalogs and openness to new technologies, contemporary curators look to digitization to make oral histories available to researchers and the public. The opportunities of the World Wide Web, unimagined in Starr's time, have raised new issues concerning narrator rights. So while Starr barely mentioned legal and ethical practice in 1977, today they are central to oral history curating.

Starr concluded his essay rather plaintively, stating that until more universities and research libraries "perceive the work as central to their purpose" the full impact of oral history would not be felt.^[53] Today oral history enjoys wide acceptance, its value as both historical and cultural documentation is fully appreciated. Librarians and archivists are integrating oral history holdings into online catalogs and databases and developing exciting new ways of disseminating digitized tapes and transcripts on the World Wide Web. It appears that the days of shoe-box cataloging are coming to an end as oral history finds its rightful place in library and archival collections.

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ORCID

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Abstract

ORCID is a nonprofit organization dedicated to providing an open registry of unique person identifiers for researchers, and to working collaboratively with the research community to embed these identifiers in research workflows to connect researchers and research. Together, the registry and embedding of identifiers supports discoverability and ensures that researchers get credit for their work. This entry describes the ORCID mission and organizational structure, describes relationships with other identifier systems, and provides details on the use of technical tools to support adoption and embedding of ORCID identifiers in research systems.

ORCID (<https://orcid.org>) was founded in 2010, a product of conversations among commercial and association publishers, research funders, universities, repositories, researchers, and data providers, who together determined that to solve the name ambiguity problem in scholarly and research communication required an organization that represented the entire research community without proprietary interest. ORCID spans sectors, disciplines, organizations, and nations. It is a community-driven effort to implement a standard and persistent representation of an individual contributor's name, and to link that standard to others, such as document and dataset identifiers, research sample identifiers, grant identifiers, association membership, other person identifiers, and other research activities as determined by the community. Together these linkages support the unique identification of an individual connected with their research contributions.

WHAT IS AN ORCID ID?

The ORCID identifier is a 16-digit number, expressed as a URI, that is unique to an individual. The format of the ORCID iD is consistent with the ISNI ISO 277729 standard, and ISNI has set aside a block of numbers from its range for assignment through the ORCID registry. An example of an ORCID iD is <https://0000-0001-5109-3700>. Display guidelines are posted online at <http://orcid.org/trademark-and-id-display-guidelines>.

WHAT DISTINGUISHES ORCID FROM OTHER IDENTIFIERS FOR RESEARCHERS?

ORCID is different in three ways. First, ORCID is an open effort. ORCID code and APIs are available as open-source code (see <https://orcid.org/blog/2013/02/21/orcid->

<https://orcid.org/blog/2013/04/22/orcid-and-isni-issue-joint-statement-interoperation-april-2013>). Second, ORCID links to other identifiers, making it possible for researchers to connect their work between existing systems, whether they are disciplinary or organizational, without devaluing those systems. The ORCID registry supports identifier linkages and metadata exchange with many identifier systems including Scopus Author ID, Researcher ID, and ISNI. ORCID and ISNI are committed to interoperation (see <https://orcid.org/blog/2013/04/22/orcid-and-isni-issue-joint-statement-interoperation-april-2013>). Third, ORCID is a community-wide effort. It does not stop at providing a registry, but also works to ensure the identifier becomes part of the metadata on works and research activities at the time the work enters the public domain. This removes author ambiguity for new works and makes it possible to use metadata to link back with an individual's ORCID record and automate the update process. Together, ORCID makes a researcher's work more easily discoverable, regardless of the system used to search. In short, the goal of ORCID is interoperability through community collaboration.

THE ORCID REGISTRY

The ORCID registry is a hub for linking information between systems and sources. As such, to the extent possible, ORCID uses persistent identifiers, such as DOIs for publications and datasets, to establish a persistent connection between the ORCID record and the object. We capture metadata in addition to the object identifier but do not capture or store objects themselves.

The registry is researcher-driven. Located at <https://orcid.org>, an individual may register and obtain an identifier without fee or membership requirement, nor are there requirements to qualify as a researcher. To register,

an individual must provide their name, e-mail address, create a password, and accept the ORCID privacy policy and terms of use. ORCID does not collect date of birth, financial, or government identification information. A user may augment their ORCID identifier by adding additional information such as other names they have published under (e.g., their married name or name expressed in different character sets), research area keywords, website URL, other e-mail addresses, and country in which they are currently employed. A user may also add information on their organizational affiliations, and search external databases through the ORCID registry to link their record to their existing research works, such as publications and datasets, and in some cases, push their ORCID identifier into these databases.

The ORCID iD is always public and may never be deleted. Individual users control the privacy of all other information in their record. A user may set each data field to either public, limited access, or private. Public data are searchable and viewable by anyone and are provided by ORCID to the public in an annual data snapshot under a CC0 waiver. This waiver means that ORCID makes no copyright, related, or neighboring rights claims to the aggregated data. Limited access data are only available for search or view by ORCID members that the user has specifically approved. Private data is only viewable by the user or their designated proxy.

Through adoption and embedding, ORCID is becoming a part of the metadata for publications and other works, making it possible to automatically update ORCID records with new research works metadata. ORCID iDs are being embedded in publisher workflows, grant application and reporting systems, university research information and personnel systems, repository submission systems, dataset management systems, and professional society member and meeting management systems. Each of these workflows supports a validated linkage between a researcher and their works.

COMMUNITY INVOLVEMENT AND GOVERNANCE

ORCID is governed by an elected board of directors, majority nonprofit, comprised of 11–15 members of the global scholarly research community <https://orcid.org/about/team>. Membership in the board of directors is drawn from and representative of ORCID member organizations. The board is responsible for establishing general policies for the governance of ORCID based on a set of core principles, among them openness and transparency. In addition to the board of directors, ORCID has several steering and working groups, open to the research community.

The ORCID community includes individual researchers, universities, national laboratories, commercial research organizations, research funders, publishers,

national science agencies, data repositories, and international professional societies, all of whom have been critically affected by the lack of a central registry for researchers. Prior to the launch of ORCID, over 300 organizations had registered their support for ORCID, and 50 of these provided start-up financial support. Since launch, a number and variety of organizations are integrating ORCID identifiers into their research workflows, using the application programming interfaces (APIs) ORCID has made available. A list of ORCID members, sponsors, and partners is available on our community page, at <https://orcid.org/about/community>.

ORCID has established groups to guide and support the evolution and ongoing development of the ORCID system. These are structured to facilitate broad and open participation of interested community members, provide opportunities to participate with different levels of time commitment according to interest and expertise, and provide ORCID guidance on priorities and execution of specific plans. ORCID encourages and welcomes community involvement in our business, outreach, and technical activities, ad hoc working groups, and community groups.

Our principles of openness and transparency extend into how the registry is managed. Development is carried out with new features and bug fixes tracked in an open manner. In addition, ORCID has implemented tools for community technical input, both through an open code repository and a support forum, where users are encouraged to submit ideas for new features, and view and vote on existing submissions. Input from both channels feeds into the prioritization of development work.

ORCID staff include the executive director, technical and outreach directors, and internal and contract technical staff. ORCID maintains a distributed office, with a primary location in Bethesda, MD. ORCID Inc. maintains a governance relationship with its ORCID EU affiliate but is distinct from a financial and legal perspective.

DATA PRIVACY AND SECURITY

Confidence and trust are important to ORCID. We have put in place controls, policies, and practices (see <https://orcid.org/about/trust>) so that connections are controlled by researchers, and that the source of each connection is openly articulated.

Researcher privacy is important to ORCID. Following research community-sanctioned privacy practices is essential to the success of ORCID and the registry it operates. ORCID is committed to providing users with meaningful choices about privacy and the ability to control how information is used. The ORCID privacy policy is available online at <http://about.orcid.org/privacy-policy>.

A core ORCID principle is that users control the privacy settings of their own ORCID record data through

various opt-in features. To that end, ORCID allows users the right to control how their information is published on and shared via the ORCID registry. Data marked as *public* is available to the public for viewing and use, including commercial use. Data marked as *limited access* may be viewed through the registry by the user, their designated proxy (if any), or the user may elect to share a field or specific data within a field with trusted parties. Data marked as *private* are viewable only by the user or their designated proxy.

To ensure the transparency of the registry, ORCID maintains an audit trail of when and by whom registry information has been deposited or changed and any changes to privacy settings. ORCID uses this information to assist users in addressing concerns about the provenance of data in the registry and questions about identity ambiguity or theft. ORCID reviews concerns about data in accordance our dispute resolution procedure (see <http://about.orcid.org/content/orcid-dispute-procedures>), which includes the provision to remove or hide from the registry and its servers any record data that violates the privacy, publicity, or other rights of any person.

ORCID is committed to protecting the registry and users from unauthorized access to or authorized alteration, disclosure, or destruction of personal information in the ORCID registry or which we otherwise hold. ORCID stores information in a data center with restricted access and uses a variety of technical security measures to secure data. We also use secure socket layer (SSL technology) and intrusion detection and virus protection software. Data are stored on servers that are not accessible directly via the Internet. We periodically review our information collection, storage, and processing practices, including physical security measures. We restrict access to information marked as private or limited access or which is otherwise not public. And, all passwords are hashed and are not visible to ORCID, its contractors, or agents.

ORCID may store and process personal information on servers or on a cloud located outside of the country where a user originally deposited the data. Regardless of where data are stored, ORCID takes steps to protect information, consistent with the principles set forth in the ORCID privacy policy, intended to comply with the Safe Harbor and Privacy Shield Principles issued by the U.S. Department of Commerce for data transfers from the European Union and Switzerland to the United States. As a not-for-profit organization, ORCID is not subject to the jurisdiction of the U.S. Federal Trade Commission, which oversees the implementation of Safe Harbor and Privacy Shield Principles. However, we adhere to the Principles in recognition of their importance in ensuring the protection of user information. We undergo an annual enterprise privacy certification review by an independent third party to verify our compliance with user data privacy management practices.

HOW IS ORCID SUPPORTED?

ORCID has many generous participants who have supported the start-up phase of ORCID: hundreds of volunteer hours from dozens of participants and board members, sponsorships and loans received from publishers; grants received from The Andrew W. Mellon Foundation, National Science Foundation, the European Commission, and the Alfred P. Sloan Foundation; the Leona M. and Harry B. Helmsley Charitable Trust, and a perpetual no-fee license of the Researcher ID code from Thomson Reuters.

Over the longer term, ORCID revenues are entirely derived from membership and subscriber fees from organizations that license the member API (see <https://orcid.org/about/membership>). In addition to a standard member and subscriber agreement, ORCID supports consortial membership and national membership. To support broad community adoption and use, ORCID provides fee-free access to a public API, including authentication and exchange of an ORCID identifier. Discounts are provided to nonprofit organizations, and to groups. Member policies are reevaluated regularly by the ORCID Board to ensure inclusiveness. Members and subscribers are listed on the ORCID website, at <https://orcid.org/about/community/members>.

EMBEDDING ORCID IDENTIFIERS

ORCID APIs

ORCID integration is entirely through APIs. There is no system to implement. As such, the technical work to embed ORCID identifiers into local systems involves mapping to the ORCID API. Maintenance involves monitoring the API documentation for updates and ensuring continued connectivity. ORCID APIs, software code, and documentation are posted in an open-source repository, and the community may obtain information on updates by registering for a mailing list.

ORCID provides two APIs. The public API, open for anyone to use, supports search of the public data in the registry. The member API is available only to those organizations that have accepted the terms of the ORCID member agreement. It supports authentication, search, read, write, and update. ORCID members may also serve as trusted parties, with the ability to read limited access data when approved by the user.

To support integration, ORCID provides a sandbox server for testing. Use of this server is free but requires registration and provision of a test token. It is the goal of ORCID, through provision of these tools and community resources to support not only integration of identifiers, but also the creation of tools and applications to interact with

the registry itself. Third-party tools already created include sites that use the APIs to consume ORCID works data and generate publication usage statistics.

Other APIs and Data Exchange Standards

Fields to capture ORCID identifiers are being added to other data exchange standards. The widely used CERIF standard for data exchange with research information systems (CRIS) includes a field to capture the ORCID identifier, as does the VIVO ontology, another CRIS system used in the United States, Australia, and Europe. The National Library of Medicine (NLM) article and journal DTDs both provide a field to capture ORCID identifiers as do several publisher production systems that submit article metadata to NLM and CrossRef. CrossRef captures ORCID identifiers during the journal article deposition process, and DataCite is doing the same for datasets. This information can be used to trigger a process to update the ORCID registry.

ORCID identifiers are included in the Journal Publishing Tag Library NISO JATS Version 1.0 XML specification. ORCID identifiers are captured in the `%contrib-id-type` attribute on `<contrib-id>` as the full URI. For more on the standard, see <https://orcid.org/blog/2013/03/22/orcid-how-more-specifying-orcid-ids-document-metadata>.

`<contrib-id>` Contributor Identifier

One identifier for a person such as a contributor or principal investigator. This element will hold an ORCID, a trusted publisher's identifier, a JST (Japanese Science and Technology Agency) identifier, or an NII (National Individual Identifier).

Attributes

content-type Type of Content

contrib-id-type Contributor Identifier Type

specific-use Specific Use

Content Model

`<!ELEMENT contrib-id %contrib-id-model; >`

Expanded Content Model

`(#PCDATA)`

Description

Text, numbers, or special characters

This element may be contained in

`<contrib>`, `<principal-award-recipient>`,
`<principal-investigator>`

Example

```
<contrib-group>
<contrib>
<contrib-id contrib-id-type="orcid">http://orcid.org/
0000-0002-1825-0097</contrib-id>
<name><surname>Carberry</surname>
<given-names>Josiah</given-names>
</name>
<degrees>BA, MA</degrees>
</contrib>
</contrib-group>
```

Use Cases

There are four basic steps for implementing ORCID identifiers, all of which require authentication as a core component. (1) **Collecting** validated ORCID iDs for individuals to ensure they're correctly associated with their affiliations and contributions. (2) **Displaying** iDs to signal to researchers that an information system is plumbed to support their use of ORCID. (3) **Connecting** information about affiliations and contributions to ORCID records, creating trusted assertions and enabling researchers to easily provide validated information to systems and profiles they use. And, (4) **Synchronizing** between research information systems to improve reporting speed and accuracy and reduce data entry burden for researchers and administrators alike (see <https://members.orcid.org>). Using these integration points, ORCID identifiers have been embedded in a number of different systems. Researchers are being asked to include their ORCID identifier when they submit a manuscript, dataset, or grant. Publication metadata repositories are ingesting ORCID identifiers and adding fields to search by ORCID identifier. Universities are providing faculty tools to link their local CRIS data with their ORCID record and the opportunity to synchronize data between the systems. Students are being asked to register for an ORCID identifier at the time of thesis submission. Data repositories have amended their metadata standards to include an ORCID identifier for dataset creators and contributors and are supporting linkages with ORCID records. Repositories are using ORCID identifiers as a means to maintain and update their holdings. External identifier systems are supporting cross-platform linkages between identifiers, supporting opportunities to review and validate algorithmically created name-based information clusters, and pass metadata between platforms. Altmetrics providers and research funders are leveraging ORCID registry data to support assessment of research impact. More detailed information on use cases is available at <https://members.orcid.org>.

CONCLUSION

The core issue underlying the ORCID initiative is the effective and appropriate identification of individuals who participate in the research community, and linking them with their research works, funding, and affiliations. Prior to the formation of ORCID, there were fragmented proprietary and discipline-based systems for uniquely identifying researchers, many of which are still operational today. In addition to providing a common identifier that can link existing researcher identifier systems, ORCID works with the community to ensure that the common identifier is embedded in research workflows and becomes part of the metadata associated with research

works, funding, and affiliations. It is the combination of these two ORCID mission activities—common open identifier and linking—that gives the community cause to believe that ORCID is a key component of solving the name ambiguity problem in research and scholarly communications. Solving this problem makes individuals more discoverable, assisting researchers in finding resources and collaborators to support their work. Linking the common researcher identifier with works, funding, and affiliations extends interoperability and supports reporting. At the individual level, this means improved discoverability and less time entering data on forms such as grant applications and postaward reporting, and at the

institutional level this means less time and more accuracy in identifying researchers and their works for workforce and outcomes evaluation reporting. Overall, the system interoperability supported by ORCID can lead to broader acknowledgment of research activities and the potential for expanding existing incentives.

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Organization Theories

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Abstract

The dominant paradigm of organization theory based on bureaucracy, open systems, and contingency theory is described with concepts traced to their historical roots. Parallel developments in public administration are also presented. This entry concludes with a consideration of network theories that have emerged in the latter half of the twentieth century as researchers consider groups of organizations rather than individual units.

For many years, organization theory has had a dominant paradigm based on bureaucracy, structural analysis, systems and contingency theory. This theoretical paradigm, usually called functional or rational, despite criticism from interpretative theory and critical social theory^[1] continues to be supported in schools and journals and to guide manager's decisions. Changes in the environment that reward speed and innovation have brought new networked organizational forms to the fore. These changes have affected both public and private sector organizations.

In this entry, I will take a more or less historical approach beginning as most organization texts do (Daft-Tsoukas^[2-9] (among others)) with a description of classical organization theory and then contrasting newer networked organizations to the classical model.

I have attempted to include theoretical writings from public administration that sometimes parallel and sometimes diverge from writings about corporations in the for-profit sector. Another article could be written about applications of these theories to the library and information world. Certainly libraries as large bureaucratic organizations are often involved in competition for resources and even existence. They confront issues of power and control, and have concerns about how to choose an appropriate structure (physical and social), how to integrate technology, how to socialize workers (professionals and nonprofessionals, full-time and part-time, career and contract workers), and how, when, and whether to enter into strategic alliances and joint ventures beyond their organizational boundaries. Libraries and other information agencies are good laboratories to study the interplay of forces described and predicted in organizational theory. However, the exigencies of time and space leave this task to others.

One fairly inclusive and often quoted definition of an organization by Hall^[10] is as follows: "An organization is a collectivity with a relatively identifiable boundary, a normative order, ranks of authority, communication

systems, and member coordinating systems; this collectivity exists on a relatively continuous basis in an environment and engages in actions that are usually related to a goal or set of goals" (pp. 22–23). Some of the qualities that define organizations often referred to in the literature include that a pattern of interaction has developed that is enduring and resists change, that there is a dominant and definable culture, that there is a hierarchical power structure that ensures conformity and provides control such that certain behavior regularities are more likely to occur than others.^[9] Over time, organization theory has come to embrace a fairly large domain. Lawrence and Lorsch^[11] argue that the heart of organization theory is the task of integrating and coordinating the components and domains of an organization including its environment, its strategy and decision-making processing, its goals and values, its culture, its structure, its authority and power relationships, its tasks, its communication processes, its people—leaders, teams, groups, and their individual motivations, work attitudes and behaviors.

Since Adam Smith^[12] first described the positive effects of work specialization and division of labor, organization theorists have wrestled with two primary opposing forces—differentiation and coordination. The more an organization divides labor into specialized tasks and separates departments, the greater the strain on communication and the greater the need for coordination or integrating mechanisms. As specialization increases and the complexity of the organization, so techniques of coordination must also increase. Even today with the potential of coordinating through electronic networks, the hierarchy continues as the dominant coordinating mechanism although there are signs that this is beginning to change.

Formal investigations of the organization qua organization began with Max Weber, who was born in 1864 and died in 1920. He wrote at a time when industrialization was affecting all facets of society and traditional authority structures were being challenged. Weber, a sociologist

defined and described the bureaucracy and called it the “ideal model” for an organization.^[13] He identified division of labor and the centralization of authority through hierarchy as two of its primary characteristics.

In fact, in one of the earliest of a continuing stream of criticism of Weberian bureaucracy, Merton in 1940^[14] observed that specialization (division of labor) and an emphasis on adhering to rules can lead to *trained incapacity*, in which employees find difficulty in dealing with situations that do not fit the rules or changes in rules and routines. *Displacement of goals* can occur in which people focus so much on following rules or on pursuing the goals of a simple department that the larger organizational goals as a whole are ignored. Victor Thompson,^[15] a public administration scholar in his book tellingly titled *Without Sympathy or Enthusiasm; the Problem of Administrative Compassion*, argued that Weberian bureaucracy can cause “bureaupathology” in its members who can become overly concerned with protecting the authority of their offices and too impersonal in their dealings with clients and other members of the organization.

Early writers on organizations built on Weber’s definition of bureaucracy and focused on technical rationality as the principal objective of an organization. This early period of organization theorizing is often referred to as classical organization theory. For example, Henri Fayol,^[16] a mining engineer, studied the problem of state public services and developed a theory appropriate to a wide range of organizations. He defined management as comprising five core functional elements: planning, organization, command, coordination, and control. He then outlined 14 fundamental principles of organization design, many of which are still considered valid today, are described below as tenets of classical organization theory. In 1937 Luther Gulick,^[17] a public administration theorist used Fayol’s theory and advocated dividing government work up into small specialized segments, allocating the work to those most skilled and coordinating it through supervision, clear task definition, instruction, and direction. Like Fayol, Gulick proposed a set of functions for the executive that form the acronym POSDCORB that, for some reason, has proved memorable to generations of management students. POSDCORB stands for planning, organizing, staffing, directing, coordinating, reporting, and budgeting.

By contrast, Mary Parker Follett,^[18] a consultant to government and business organizations, suggested that the same principles that create strong social communities could be applied to creating successful organizations of all kinds. In a startlingly modern formulation, she proposed a cooperative participatory process for giving orders in which supervisors and subordinates develop a shared understanding of the situation and what is required. This “law of the situation” foreshadowed ideas of workplace democracy and nonhierarchical networks of self-governing groups.

At the turn of the twentieth century, professionalization and the scientific method emerged. Efficiency became the

chief goal of both government and industry. Engineer and efficiency expert, Frederick W. Taylor^[19] urged a “scientific management” approach in order to learn the “one best way” to perform each task in the organization. The primary goal of the organization, according to Taylor and other proponents of the “organization as machine” model, was efficiency gained through research and task analysis. Taylor’s ideas met with bitter resistance on the grounds that work controls alienate workers and displace master craftsmen. Despite the furor, Henry Ford adopted Taylor’s principles for the assembly of automobiles. Later developments of total quality management (TQM) and business process reengineering (BPR) are considered direct descendants of Taylor’s ideas or Fordism, as it came to be known.

These ideas about organizations covered both public and private enterprises. Classic organization theory emphasizes rationality and efficiency, the importance of specialization and coordination, and asserts that the principles of classical organization theory are universal, “irrespective of the purpose of the enterprise, the personnel comprising it, or any constitutional, political or social theory underlying its creation” (p. 49).^[20] Writers in the 1920s and 1930s found attractive the idea of a strong chief executive vested with power and authority operating through an organization structure characterized by unity of command, hierarchical authority, and a strict division of labor. Dwight Waldo, a well-known public administration theorist, wrote “Democracy, if it were to survive, could not afford to ignore the lessons of centralization, hierarchy and discipline” (p. 200).^[21]

Woodrow Wilson, then a college professor, suggested in an often quoted paper^[22] that public administration should follow the model of business and that a government should establish executive authority, a controlling hierarchical organization, and have as its goal the achievement of the most reliable and efficient operations possible. The notion of the business model for government and nonprofit agencies, including libraries, with the primary goal of efficiency and an assumption of rationality continues today as a dominant theme in the study of organizations.

Classical theory of organization deals almost exclusively with the structure and design of the formal organization. The principles of classical theory are prescriptive for the rational structuring of organizations. Drawing upon early ideas from Fayol, the *functional* principle asserts that labor must be divided as the organization grows and that the division should follow clear areas of specialization. This leads to *departmentation* and the grouping of like activities into departments. The *scalar* principle deals with vertical growth in the chain of command through the dynamics of delegation of authority and responsibility. *Unity of command* ensures that a subordinate is accountable to one supervisor only. No gaps or overlaps in authority jurisdictions among the positions in the chain of

command should exist. The resulting shape of the organization structure becomes the familiar pyramid.

The *line-staff* principle addresses the proper relationship between specialists employed for their technical expertise and the people with central decision-making authority (“the line”). The distinction between line and staff comes from military organizations and dates back to antiquity. The potential of conflicting authority between line and staff is recognized in classical organization theory and resolved by stipulating that the staff may advise and facilitate line work but may never command the line; only those with formal legal authority may do so. We see this principle in public administration theory as well. The line-staff division is most clearly seen in the emphasis by Wilson on the distinction between politics and politicians (here equivalent to the line of command) and public administration and administrators (equivalent to staff support in an advisory capacity).^[23]

Span of control refers to the number of subordinates a manager can effectively manage. When people are added to an organization the result can either be a wide span of control and a relatively flat structure or a short span of control and a tall structure. Classical theory favored close supervision and recommended that a supervisor have responsibility for no more than four to six direct reports. The more various the work, the fewer people are to be supervised and conversely, the more similar the work of those supervised, the more people a supervisor can oversee.

Today, the structural approach to organizations is still the aspect to which most space in organization texts is dedicated. Probably the most well-known and thorough description of the structure of an organization comes from Mintzberg^[24] who provides a comprehensive review summarizing the structural alternatives that managers can choose among. Galbraith^[25] also described strategic choices in organization design. Mintzberg’s scheme for describing organizational structure identifies five major components: *the operating core* where members perform the basic work of the organization, *the strategic apex* where the top positions reside, *the middle line* for those managers who link the apex to the core through supervision and implementation (hence the term “middle managers”) and two types of staff units: *the technostructure*, where analysts work to standardize work, output, and skills, and *the support staff* who provide support to the organization outside the work flow of the operating core, for example the mail room, food service, public relations, the library, legal services, and the like. Often these latter units are considered the first candidates for outsourcing as they are not essential to the work of the organization.

According to Mintzberg, organizations establish structures to divide and then coordinate work within and among these five components through the use of four different structural design tools:

1. *Positions* through the use of job specializations, behavior formalization, training, and indoctrination.
2. *Superstructure* or departmentation through unit groupings based on knowledge and skill, function, time, output, clients, or place. Grouping choices can follow workflow among departments or join people working on common processes or one can group by scale (large units need their own functional categories); groupings can even be created to facilitate social relations, morale, and cohesiveness.
3. *Lateral linkages* through performance-control systems, action-planning systems, and liaison devices.
4. *Decision-making systems* through decentralization either vertically by pushing decision-making authority down or horizontally by spreading decision-making authority out to staff analysts, experts, and other individuals involved in the work of the organization.

Mintzberg also proposed a typology of five kinds of organization structures based on their choice of these design elements. The five structures begin with *simple structures* for new and small entrepreneurial organizations with vertical and horizontal centralization and coordination by direct supervision at the apex. Mintzberg identified two types of machine *bureaucracies* that are elaborations of simple structures that have evolved through growth, age and/or external control. These organizations employ a standardizing technostructure for work processes, experts, and staff specialists. *Public machine bureaucracies* are required to standardize their operations for political reasons. *Professional machine bureaucracies* are those organizations where professionals dominate the operating core, decentralization is general, and coordination is via standardization of skills. These machine bureaucracies may further evolve to divisionalized forms with product-oriented subunits each with its own manufacturing and marketing units. The final kind, Mintzberg calls the *ad-hocracy*. It is organic, innovation oriented, greatly emphasizes fluid communication and flexibility and is decentralized into design teams. The ad-hocracy may be seen as a forerunner of some of the newer networked and virtual organizational forms to be described in the last section of the paper.

To return to the historical thread, in the 1930s a reaction to the dominant classical organization theory was provoked by some experiments performed at the Hawthorne plant of the Western Electric Company that demonstrated the importance of human motivation on the expenditure of effort in an organization and shifted the attention of theorists away from the structure and design of the organization to a focus on the employees within and relationships among them. Workers were more than “hands” but had “hearts” (feelings and attitudes that affected productivity). Norms or implicit rules of work groups affected productivity.

Charles Barnard,^[26] an American industrialist and telecommunications executive, developed a theory of

management and organization that he called a cooperative system. He observed that human physical, psychological, and social limitations forced people to enter a “cooperative contract” in order to achieve goals that they could not accomplish alone. Having agreed to cooperate, the range of individual freedom to act autonomously was reduced and the domain of joint action was enlarged. Independence was sacrificed (or traded off) for greater material and social satisfactions from the cooperative effort. Barnard saw the problem of maintaining the cooperative spirit once the cooperative contract was formalized as the primary task of the manager. His ideas echo those of Mary Parker Follett.^[17]

Barnard asserted that the manager needs to develop a deeper understanding of the organization and its employees by drawing upon the behavioral sciences. Organizational rationality, he argued, results from the manager’s conscious effort to create a cooperative system by continually maintaining an equilibrium between organizational goals and individual employee goals. Barnard’s one book, *The Functions of the Executive*,^[26] remains an influential work calling the manager’s attention to the importance of social and psychological factors in motivating workers. Motivation and the culture of the organizations continue to be major topics within organizational theory.

Some examples of often cited early theorists who write about motivation include Maslow,^[27] Herzberg,^[28,29] McGregor,^[30] and McClelland.^[31] Maslow’s theory of human needs and motives first advanced in the mid-1950s may be the best known motivation theory. People continue to find the theory appealing even though research validation is lacking. Maslow held that needs and motives fall into a hierarchy ranging from lower order to higher order needs. *Physiological needs* (food, shelter) are lower order, followed in ascending steps by *safety and security*, *love and belonging*, *status and self-esteem* and at the highest level, *self-actualization*. The needs at each level, according to Maslow, dominate until satisfied and then the individual can focus on the next level of need.

Herzberg’s two-factor theory of motivation,^[28] distinguishes between what he terms *hygiene factors* that are extrinsic and cause dissatisfaction, like working conditions and rewards, and *motivating factors* that are intrinsic and relate to interest and enjoyment of the work itself accompanied by a sense of growth and achievement. Other researchers argued that the methods used to develop Herzberg’s theory (self-report of events leading to satisfaction or dissatisfaction) may have skewed the findings because of a social desirability effect in which the participants may have provided what they felt were the most socially acceptable responses.

McGregor^[30] divided managers into two types: Theory X and Theory Y. The theory X manager sees workers as passive requiring management and motivation and direction; theory Y managers take advantage of higher order needs and build on the worker’s capacity for self-motivation and

self-direction. Many current writers on motivation theory focus on theory Y concerns and advocate for a human investment philosophy.

One of the most enduring and well-supported theories on motivation is David McClelland’s^[31] grouping of people into three categories depending on what is the primary motivating factor: the need for *achievement* (to master one’s environment and to successfully accomplish tasks based on one’s own abilities), the need for *power* and control over oneself and others, and the need for *affiliation* (the desire for friendly relations with others). McClelland concludes that the most effective managers develop a high motivation for power but with an altruistic orientation and a concern for group goals. He adds that too strong a need for friendship (affiliation) can hinder a manager.

Current emphasis on work motivation emphasizes process more than content. Expectancy theory, for example, asserts that an individual performs a mental calculation summing up the desirability to him/her of all the outcomes that might result from an action with each outcome weighted by the probability of its actually happening. The rational individual will do what he/she perceives will most likely result in the most good and the least bad.^[32] Social learning theory blends behavioral ideas from operant conditioning (positive and negative reinforcements provided on some schedule either fixed or variable) with cognitive processes like goal-setting and a sense of “self-efficacy” or personal effectiveness.^[33,34]

The approach to organizations that focuses on motivation and uses social psychology is often called the human relations approach. Effectiveness is measured by the commitment, cohesion, and good morale of the employees. A strong focus is placed on participation, conflict resolution, and consensus building. Teams are emphasized and there is a belief that involvement leads to commitment.^[35]

Leadership and group processes in organization have also received substantial theoretic attention in the study of organizations. Studies on the traits of effective leaders at Ohio State in the 1950s led to the observation that leadership behavior was more important than any particular trait. Two dimensions of leadership behavior have been singled out: *consideration* or a concern for people and *initiating structure* or a concern for production. Blake and Mouton^[36] developed a managerial grid based on these two dimensions as an approach to improving management practice. They urged managers to strive for high levels on both factors.

In reaction to too great an emphasis on the qualitative aspects of the work in organizations, Herbert Simon^[37] attacked these principles as too vague and contradictory. Simon followed up with a book, *Administrative Behavior*^[38] focused on decision-making. Simon observes that managers are less rational than theorists assume. Decisions are limited by the number of variables our brains can handle, the time available, and our reasoning powers so that decisions are made under conditions of bounded rationality. Simon

invented the term “satisficing” to describe administrative decision-making behavior in selecting the best available alternative after a limited search using simple heuristics or rules of thumb. Simon’s work on bounded rationality and satisficing challenged the assumptions of the rational man economic theory and won him the Nobel Prize in economics in 1978. Cyert and March^[39] provided evidence in support of Simon’s observations in a study of business firms reported in *A Behavioral Theory of the Firm*. March and Simon’s 1958 *Organizations*^[40] book provided a more elaborate conceptual framework with hypotheses about behavior in organizations, especially about an individual’s decision to join an organization and to participate actively within it.

Using this conceptual framework, the Tavistock Institute in Great Britain began conducting research on “socio-technical systems” emphasizing the close relationship between technical and social factors in the workplace.^[41] This ushered in a new model of the organization as an open system. It drew heavily on general systems theory as described by biologist Ludwig von Bertalanffy.^[42] He envisioned an overarching theory that would govern all living phenomena from molecules and cells up to individuals, groups, and society. To generalize across all these elements he referred to each phenomenon as a system with mutually interrelated parts that affect each other and depend upon the whole. Kenneth Boulding,^[43] an economist, outlined a hierarchy of systems from the simplest that he called *frameworks* (e.g., lists, indexes, anatomies) through nine levels to the *transcendental* (metaphors and esthetics). His level 4 included living things which he called “open systems.” These were characterized by input of energy, throughput of materials, reproduction, and self-maintenance.

Open systems theory became popular in part due to the rapidly changing environment of the mid-1960s. Two aspects were key. First, each different part of the organization was seen as interdependent on the other parts, and second, the external environment affects the way an organization performs.^[44] The open systems perspective for organization theory was most fully developed by Katz and Kahn^[45] who used general systems theory as a broad framework for conceptualizing the organization as an open system with inputs, throughputs, and outputs. They stated that the organization has *equifinality*, that is, the same outcome can be achieved by different means. *Negative feedback* enables the organization to adapt and innovate in order to continue to acquire needed external resources. The internal regulatory mechanisms within an organization must be at least as diverse and complex as the environment in which it operates (“the law of requisite variety” appropriated from cybernetics).^[46] In analyzing the processes in the throughput, Katz and Kahn distinguish three major subsystems—maintenance, adaptive, and managerial. The vision of the organization as an open

system adapting to a variety of influences and imperatives suggests that the “fit” between the organization and its environment and between the organization structure and its dominant technology is central.

Burns and Stalker^[47] argue that effective open systems organizations must adapt their structure to contingencies. They propose that successful organizations are either *organic* or *mechanistic*, depending on the environment in which they function. Successful mechanistic organizations operate under stable conditions with a high need for consistency and specificity and are bureaucratic. Organic institutions are more fluid and able to adapt to rapidly changing environmental or technological conditions. In the organic organization, greater emphasis is placed on networking and lateral communication rather than on hierarchy; superiors act as facilitators.

Formulating a contingency theory of organization structure, Lawrence and Lorsch^[11] studied U.S. firms in three different industries where they confronted varying degrees of uncertainty, complexity, and change. More uncertainty and turbulence in the surrounding environment meant more differentiated internal structures (different goals, time frames, and work cultures). The more differentiated firms, as one might expect, also had more elaborate structures for integrating diverse units. Organizations in more stable environments showed less differentiation and integration.

James Thompson^[48] further developed the contingency perspective drawing on Herbert Simon’s ideas about bounded rationality and consistency. Thompson presented his work as a series of propositions about how the rational organization will use hierarchy, structure, and buffering units to isolate the technical core in order to provide stable conditions for the work of the organization. He suggested that the organization will group subunits based on its need for information exchange during the work process. When organizations confront a shifting unstable environment, Thompson hypothesized they will adopt a more decentralized structure with fewer rules and procedures. A decade later, Mintzberg^[49] echoed this proposition with his assertion that the more complex the structure, the more decentralized the structure, all things being equal.

One school of thought with the central thesis that organizations are limited in their power to adapt to their environments is called “population ecology.”^[50] Here the emphasis is on groups of organizations that are “selected” for survival on the basis of adaptation and “fit” between their structure and the environmental characteristics. In this theoretical framework, the environment is the determinant of effectiveness which explains why organizations in similar environments have similar structures. As the environment changes, different structural variants become more fitting and previously selected characters are selected out. The organizational environment has a saturation point beyond which it cannot support more organizations, so claim Hannan and Freeman.^[51]

Robert Quinn^[52] attempted to combine four of the main streams of organization theory into what he called a “competing values” framework. The four streams he selected were scientific management from Taylor in the late 1800s, administrative theory from the 1920s with Fayol and Weber’s ideal bureaucracy. The third stream was the human relations school from the Hawthorne studies of the late 1920s and 1930s and Barnard’s writings. The fourth stream was the decision-making school described by March and Simon in the late 1950s. In the Quinn framework there is no “one best way” to manage in all situations but effective leadership varies according to the particular situation. The two key dimensions that predict the appropriate managerial style are first, the continuum between flexibility (innovation) and control (prediction, order, stability) and second, the continuum between emphasis on the organization (concern for productivity, systems) and emphasis on people (concern for people).

Another primary concept of organization theory is the organization life cycle. Every organization seems to pass through the same stages on the way to maturity. Haire^[53] suggested that a biological metaphor could be used, (see above for biological metaphors for open systems and for sets of organizations selected for survival). The life-cycle approach has some key assumptions. There are distinct stages through which an organization progresses; the stages follow a consistent pattern and the transitions from stage to stage are predictable. Based on age, size of the organization, and growth rate for the industry, Greiner^[54] proposed five phases, each stage having a specific management, style, and a dominant problem whose solution initiates the next stage. Phase one is marked by *creativity*. The organization is young and has an energetically committed leadership and resourceful employees, all dedicated to the mission. Communication is frequent and face-to-face. A leadership crisis emerges because the owner-founder’s competence is often technical rather than managerial. Phase two is marked by *direction* under the leadership of a capable business manager who creates a functional structure and reporting requirements, puts a hierarchy in place, and hires specialists. As things become more formal and systematized, a crisis of autonomy emerges. Lower level employees feel encrusted in red tape and want more initiative. This leads to *decentralization and delegation* allowing the organization to expand in many directions; this, in turn leads to a crisis of control and the need for coordination. The fourth coordination phase uses *formal systems* to promote integration often through databases and formal planning procedures. A proliferation of systems leads to a crisis of red tape solved by a fifth *collaborative* phase in which project teams are initiated, problem-solving task forces are created, and more collaboration is encouraged. Social control, personal responsibility, and self-managed teams tend to replace formal control systems. Greiner suggests the crisis at this stage may be “psychological saturation” or burnout and

provides a few strategies to deal with it. The main message is that no solution is permanent as the characteristics of the solution often breed new problems.

Other life-cycle models are similar suggesting that an organization is formed, grows, matures, and then declines or possibly undergoes radical change and renews itself. Organizational learning is one way for the organization to move away from inevitable decline. Argyris and Schön^[55] define learning as the ability to detect and correct errors, which they define as a mismatch between intention and outcomes. They identify two kinds: single-loop learning (improving strategies to reach a goal) and double-loop learning (questioning the fundamental assumptions and values of the organization). They define organization learning as a preference for double-loop learning and the will to implement it.

W. Richard Scott^[56] in summing up the changes in the field or organization studies asserts that the introduction of open system models provided the impetus for a search out into the environment to identify the determinants of organizational structure. Contingency theory predicts that the variation in the complexity and uncertainty of an organization’s environment leads to “best fit” organization structures. Resource dependence theory also focuses on adapting organizational structure to the environment. It emphasizes political as well as economic dependencies based on the fact that an organization must exchange resources in order to survive and that, in the exchanges, power differences arise. Thus, managers must not only adapt their organizational structure to the environment but must try to act on the environment reducing dependencies in order to see advantages in power relationships.^[57]

Network theory has also emerged as a powerful explanatory tool and methodology to measure the relationships of organizations within a network.^[58] The location of an organization within a network and the structure of the network affect behavior and decisions within an organization.^[59] Hannan and Freeman^[60] argue that researchers should shift attention from the individual organization to a set, or population, of organizations of the same type, because, according to these theorists, fundamental change affects all organizations of the same type in an approximately equal way. Just as the life cycle approach to organizations (described above) follows the birth, growth, maturity, and decline (or renewal in a new form) of a single organization, so in the population ecology approach groups of organizations of the same type are examined over long periods of time in a similar way from birth, growth, maturity, and decline (or renewal as a new type of organization).^[61]

Research in organizations today focuses on a set of similar organizations and their resource exchange partners as the appropriate unit of analysis. This allows concentration on resource dependence relations and organizational strategy by looking at exchange partners, funding sources, competition, and regulations.^[62]

The shift to open systems and the emphasis on looking at populations of organization within their exchange environment reveals that the boundaries of organizations have become less stable and fixed. Organizations now employ more temporary, part-time, and contract employees so that the concept of membership in an organization is less meaningful. Individual firms merge or split off components; they enter into alliances and partnerships creating new, often temporary organizations.

In the past organizations tended to absorb environmental challenges through adding workers, technologies, and technical expertise as well as incorporating sources of inputs and marketing and distribution systems, thus growing in size and scope over time.^[63] Today organizations have moved in the opposite direction shedding personnel and units and contracting out functions that were formerly performed in-house.^[64]

Miles and Snow^[65] describe the dynamic network—a group of organizations, partnerships, and/or individuals who subcontract their services to a “broker” core that provides coordination, supervision, and control of a given project. The networked organization keeps human relations and overhead low while increasing responsiveness to customers. They describe the network organization as “delayed, highly flexible, and controlled by market mechanisms rather than administrative procedures” (p. 4).

Galbraith^[66,67] contends that all organizations today need to develop lateral capability, that is, ways of coordinating different functions with other functions that need to communicate with throughout the organization. He describes three types of lateral linkages: across functions, across business units in a diversified corporation, and across countries and regions for global firms. Horizontal structures are sometimes called *process structures* while network structures are *organic* and increase lateral capability.

Horizontal organizations are flat structures with minimal layers of management and self-managed, multidisciplinary teams organized around a core process. The primary goal is customer satisfaction, which is attained by reducing the boundaries with suppliers and customers and by empowering employees. Teams are the central organizational building block and they manage themselves. Members are rewarded for skill acquisition and team performance. The benefits include lower management costs, more widely shared communication and decision-making and greater employee involvement. Decision-making is more rapid. The disadvantage is figuring out how to define the numerous processes in most organizations. The design is most appropriate in companies with short product life and development cycles where customer satisfaction is the goal and the environment is uncertain.

Four major design features of the new organizational forms are: 1) *vertical disaggregation*—major functions like finance, product design, and manufacturing are performed by independent organizations and tied together

in a network; 2) *brokers*, who facilitate linking, locate potential partners, and coordinate the separate aspects; 3) *market mechanisms*—work is by contract and payments are based on performance; (4) *full-disclosure information systems*, which become important in mutually and instantaneously verifying individual contributions.

Walter Powell^[68] asserts that today’s economy resembles a Web and not a hierarchy and “to force technologies that enhance ‘networking’ into a pyramidal form serves only to constrain their effectiveness” (p. 502).^[69] He argues that the impact of the rapid growth of new information and communication technologies is changing the way work is constituted and the way organizations are structured. One big change is the shift in conceptualizing work from *jobs* to *projects*. Jobs have been the standard way to package work for the last two centuries and are suitable for situations where the same tasks are done repeatedly. The emerging form of work organization is a team or work group charged with responsibility for a project. The activities of the team are coordinated by iterated goal-setting as the group members learn through monitoring the partial results of their work.^[70] The project form of work organization integrates design and production and rewards productivity rather than seniority. Thus, according to Powell, the conception of work has changed from a focus on specific tasks carried out by individuals and constrained by rules and standard operating procedures to a collective effort conducted by teams with diverse skills and considerable discretion who are judged by results.

The change in the organization of work causes the rise of the networked organization where the firm is “an intricate latticework of collaborations with outsiders” (p. 507).^[71] thus blurring the boundaries of individual organizations. Harrison^[72] states that the new networked firms have four key components: 1) a core-ring structure in which there is a group of highly paid, highly skilled employees and everyone else is relegated to a lower cost periphery; 2) new information technology is used to coordinate widely scattered activities for just-in-time production; 3) extensive use is made of subcontracting, especially across national boundaries for lowest cost work; and 4) the firm uses various measures to attempt to gain greater commitment from the most expensive-to-replace employees. Powell et al.^[73] examined the biotechnology and pharmaceutical industries and concluded that centrality is key and that a firm grows by becoming a player and not vice versa. Speed is also important. Brown and Duguid^[74] point out that the core task of organizations today is to access knowledge rapidly and turn it into tangible products.

The not-for-profit organizational side has also been affected by these deep structural changes although perhaps less so. Public and private organizations remain different in goals and operation, so the movement in the direction of post-bureaucracy is more limited. Traditional bureaucracies

continue to exist in government and not-for-profit agencies, but we also see an array of public-private partnerships with many services that are contracted out.

The new public management movement has encouraged a shift toward government by network and government by market.^[75,76] Fiscal authority measures and efforts to improve public productivity led to experimenting with alternative service delivery mechanisms in the public sector, including contracting out and privatization. These ideas were captured in Osborne and Gaebler's 1992 book, *Reinventing Government*.^[77] These writers provided 10 principles for what they called "public entrepreneurs" to bring about massive governmental reform. These principles are at the core of what is called the "New Public Management," and include introducing competition among public, private, and nongovernmental service providers, injecting the concept of profit into the public realm through charges and fees for public services, using information technology and improved communications systems to decentralize government and shaping the environment to create a market.

Reinvented government praises competition, flexibility, employer empowerment, and customer service. Central control mechanisms are reformed and performance measures introduced. An ethos of innovation, experimentation, and cross-agency work replaces the ethos, according to one proponent of reinventing government.^[78] Critics of the government by network call it a "hollow state,"^[79] in which a government agency relies on others (firms, nonprofits, or other government agencies) to deliver public services jointly and no one knows how to manage these networks.

In government by market, the government uses state power to create a market that fulfills the public purpose. For example, in order to control pollution, one might require polluters to pay for their right to pollute. As in the private sector, we see decentralization and empowerment of individual government agencies (now called "business units") to create own objectives. Through the use of information and communication technology, the staff is controlled less by regulation and more by market and customer measures. Hierarchy and rule-based controls are replaced by such market-type mechanisms as benchmarking for best practice, setting targets, and using service-level agreements.

Critics of the network and market governance models^[80] predict that these newer organizational forms that are intended to make government more flexible and responsive and less hierarchical may have unintended dysfunctional consequences. Growth in centralized monitoring can lead to a decline in trust and collegiality. Bureaucracies represent some positive values, such as impartial conduct, due process, separation between public and private, between the role and the person. Some of the restructuring of work described above can lead to problems on the human relations front. As boundaries become more permeable, roles

more flexible, there will be fewer career paths and rewards for loyalty and conformity to standardized organizational obligations. The "portfolio" worker becomes reliant on his/her own human capital and knowledge and exists outside the corporate hierarchies. Post-bureaucratic theorists need to consider alternative ways of holding organizations together. Presumably cultural and other indirect means of cooperation replace rapidly disappearing middle management. Even within the organization, units are compelled to serve as customers in simulation of market disciplines.

Denhardt and Denhardt^[81] have proposed an alternative to the new public management which they call the new public service. This alternative draws on more humanistic traditions, such as interpretive theory (phenomenology), critical social theory, and postmodernism. In this view, the individual is not seen as a customer but rather as a citizen who looks beyond self-interest to the larger public interest. Even as the rhetoric speaks to new networked organizations with responsibility devolving to self-managed teams, there is a counter trend that appears equally strong. In the fast food and retail industries and in call centers operations incorporate classic organizational processes. The service encounter is standardized and employees must learn scripted language and behavior. They work in continued high surveillance via technology and customer monitoring. Even in organizations embracing knowledge management, networks, and communities of practice, there is parallel work in codification, storing, and distributing the commodified knowledge and many rules for using these databases.

What does the future hold for theories of organization? The purely rational approach has been softened and added to by an understanding that decisions are made on the basis of human emotions and intuitions.

It is best to see the forms assumed by contemporary organizations as a series of hybrids often with hierarchy concealed behind more complex forms of coordination and control.

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Organizational Culture

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Abstract

The literature covering organizational culture is broad and there are many angles and perspectives, different fields of study, schools of thoughts, and theories covering the subject. In this entry, organizational culture is first described through the historical influences with some general definitions and categorizations. Furthermore, organizational culture is described from an information and knowledge perspective, giving information resources a cultural dimension. Finally organizational culture is presented in the library context and some reflections on the assessment of organizational culture are given.

INTRODUCTION

Organizations may be described from many different points of view, depending on what one chooses to emphasize. Organizations can be viewed from environmental, cultural, or social perspectives. The physical structures and the technology of an organization can be focused and there are different metaphors to use as a starting point. In his 1986 book, Gareth Morgan introduced a set of metaphors to describe different perspectives of organizations (e.g., as machines, organisms, political systems, and cultures).^[1] These images have been valuable tools when talking about complex phenomena within organizations. The image of organizations as cultures can be used as an umbrella concept when approaching organizations from cultural and symbolic points of view. Organizational culture is a way of understanding an organization in all its richness and variation (p. 2)^[2] but is at the same time very complex and includes subcultures, information cultures, etc.^[3] Organizations consist first of all of individuals shaping together a unique context. This means that every organization has its own unique organizational culture. The culture of an organization is a mix of values, thoughts, and traditions of the people in the organization (p. 5)^[3] and the organizational culture sets the framework for what is expected and how things are normally done, and supports the organizational goals and aims.^[4] Organizational cultures carry systems of meanings shared to various degrees that help the members of the organization to collaborate without having to define or contextualize their action constantly (p. 2).^[2] Using the organizational culture metaphor brings forward useful information on intangible assets and explains informal behavior and activities of an organization. On the other hand, this metaphor generates a fairly general picture, covering many aspects, and might become vague in its meaning.

The literature covering organizational culture is broad and there are many angles and perspectives, different

fields of study, schools of thoughts, and theories covering the subject. While there are a wide range on meanings and perspectives, this entry starts by briefly looking at the historical influences on the organizational culture perspective and thereafter describe the information and knowledge perspectives within the organizational culture context, and how organizational culture perspectives are used within Library and Information Science.

INFLUENCES ON ORGANIZATION CULTURE

The development of studying organizational culture has its origin in many different perspectives and fields of study. In the 1980s, a shift from the more static and system-oriented perspectives toward the perspective of organization's as cultures^[2,5] began to emerge from success stories of Japanese companies as well as big companies in the United States.^[2] The main themes of this cultural perspective are based on anthropological studies and symbolic aspects,^[6] the sociological perspective, and aspects of social construction of reality,^[7] and the management perspective looking at the social psychology of organizing.^[8]

Through the anthropological perspective, studies on organizational culture have been inspired to look at language, rituals, and social structures.^[9] The symbolic cultural theory identifies culture as a system of common meaning and symbols. For example, a company culture consists of values, norms, and symbols shared by the employees in the company. These are shaped within the company's process of surviving external challenges and demands while striving to keep its internal stability. These values and norms are actively shared by the members of the company, shaping the culture that creates continuity and behavioral structures.^[10]

The influence of organizational sociology is very broad and direct. According to the sociocultural perspective,

culture is a component in the social system and relational and structural perspectives are highlighted. Organizational life has been studied through numerous sociological studies with the organizational culture as the basis.^[9] Many researchers have described the organization as a micro-society where the structures and systems are the same as those existing in the society.^[11] The sociological perspective has also been combined with social psychology, which is connected to cognitive viewpoints and organizational climate. Representatives of the cognitive viewpoint are, e.g., Witkin and Goodenough (p. 57)^[12] and according to this theory, culture is a result of common processes of thoughts. Studying events, behaviors, and feelings of the organizational culture may be pictured and it gives a possibility to reveal whether everyone has the same way of thinking or if different subcultures can be identified. The difference between the social and cognitive perspective to organizational culture lies in the question whether culture is something an organization has, or what an organization is.^[5,13] If organizational culture is a possession or a definition of the organization has also managerial implications. While culture has long been a strategic tool in business organizations it is important to clarify which perspective is more important for the particular organization.

Apart from the many existing theories concerning cultural influence, there are also several dimensions and layers of the culture to take into account. Culture is not an isolated variable affecting the organization. On the contrary, it is always integrated into many other areas of organizational understanding.^[10] A way of mapping the understanding of organizational culture is to use schemes and dimensions. Quite a useful model and definition is the one by Schein^[14] who says that culture is “a pattern of basic assumptions—invented, discovered, or developed by a given group as it learns to cope with its problems of external adaptation and internal integration—that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems” (p. 9).^[14] He then distinguishes three levels of culture. The first and most visible level is artifacts and creations including the written and spoken language and the behavioral patterns of the members of a group or organization. The second level is described through values reflecting the sense of how to deal with problems and unpredicted action. Most values are conscious and serve as the normative function, guiding members in how to deal with situations. The third level, basic underlying assumptions, is reached when a solution to a problem has worked several times and it becomes the pattern of how to deal with it. When something becomes this taken for granted there is little variation within the cultural unit (p. 14–18).^[14] According to Schein’s definition the underlying assumptions are at the core of organizational culture and communicated through values and artifacts. This definition is

further developed by Hatch^[15] who integrates dynamics of symbols and processes into organizational culture. This is done in order to obtain a more holistic picture of how culture is formed by assumptions, values, artifacts, symbols, and the processes that link them.

Another important way of categorizing organizational culture is through the dimensions introduced by Hofstede (p. 188).^[16] Through a large research project across 20 organizational units in Denmark and the Netherlands in the 1980s, Hofstede identified six independent dimensions of practices which play a role in determining the organization’s culture:

- Process-oriented versus result-oriented;
- Job-oriented versus employee-oriented;
- Professional versus parochial;
- Open systems versus closed systems;
- Tightly versus loosely controlled; and
- Pragmatic versus normative.

Identifying where an organization stands in these dimensions makes it easier to manage the organizational culture.

A third example of defining different kinds of organization cultures is Wallach’s^[17] identification of bureaucratic, innovative, and supportive cultures. The bureaucratic culture is based on systematic thinking, clear division of responsibility and power, with business activities based on long traditions. The innovative culture is alert to changes and flexibility, whereas the supportive company culture strives to create a safe environment for the personnel where there is no need to be afraid of changes.

These kinds of categorizations, dimensions, and layers of organizational culture are important managerial tools. Identifying and understanding the organization’s culture makes it easier to adjust the organizational activities to change and respond to challenges, or other kinds of activities to fit the particular organization and its members.

DEFINING INFORMATION CULTURE AS A PART OF THE ORGANIZATIONAL CULTURE

During the 1990s there was a shift in the literature on organizational culture toward dynamic perspectives that underlined the individuals in a social context^[18–20] targeting aspects of learning and knowledge creation,^[18,20,21] with a further focus on innovation^[4] and performance. Managing information and knowledge as important assets became important perspectives especially in information science research (p. 88).^[3] In the following section, the role of organizational culture is discussed from an information management (IM) and knowledge management (KM) perspective.

When the concept information culture is discussed in the literature, we are often reminded of the fact that every company has its unique information culture. There are

several factors affecting the information culture and several layers of information behavior to take into account. Wilson^[22] shows that individual information behavior is affected by psychological, social, and environmental variables, and consequently the organizational information behavior is a result of constant interaction between individuals in a social and cultural context. Knowledge is created through human interaction which means it is a cultural product. In organizations, one finds networks of people interacting which are not visible on the organizational chart. It is therefore important to recognize these networks in order to manage knowledge effectively.^[23]

The function of information culture is about having access to information as a resource for reaching organizational aims. Information culture is responsible for unwritten and tacit behavior and fills the gap between what has officially happened and what really happened (p. 24).^[24] Its function is also to maintain the balance in the social system and create meaning and contents. The information culture focuses more specifically on cooperation, communication, and information behavior in general in the organization. Information culture can be defined in many ways. On a general level information culture could be defined as "... a context in which needed information is communicated so that the company has the greatest possible use of internal and external information. This culture consists of individuals, traditions, systems, and values. The aim is to show how these factors together create the context in which the information is regarded as an information resource for fulfilling corporate goals" (p. 32).^[25] Information culture is often also defined from a more specific information technology perspective: "a culture in which the value and utility of information in achieving operational and strategic success is recognized, where information forms the basis of organizational decision making and Information Technology is readily exploited as an enabler for effective Information Systems" (p. 94).^[26]

Different kinds of information cultures provide different solutions for handling quick changes and challenges in the information intensive society. In a study of the information culture in Finnish insurance businesses it was shown that information, as a resource in an organization, should be supported by an open and active information culture. While there are different kinds of information cultures among the insurance businesses and they adapt differently, it is important to know what kind of culture exists in the company in order to adjust the information work and planning accordingly. Open, changeable companies, where integration of processes and functions are working well, can more easily shape an active information culture. That means that the planning of processes like production and marketing is strongly integrated and a company is able to create overall solutions for the whole company. Because of the integration of the processes, a more active communication between the units is created^[25] with effective knowledge-sharing as a goal.^[27]

Actual information use in the workplace is shaped by the organizational culture^[25,27-29] through its influence on the organizational values. Knowledge about existing information culture and information infrastructure enables a more effective implementation of IM strategies and makes KM an important part of cultural management.^[30,31]

As mentioned earlier the categorization of organizational cultures is a usable managerial tool. This has also been shown in the context of integrating KM practices into the organization. Among others Leidner, Alavi, and Kayworth^[32] have examined how different kinds of cultures influence the KM practices. For example, a bureaucratic culture^[17] favors an initial process approach to KM. An innovative culture^[17] enables groups in organizations to develop KM practices useful to their group. Cooperative cultures^[33] enable more process-oriented and practice-oriented KM activities as well as creation of different communities of practice around KM, while individualistic cultures^[33] inhibit sharing, ownership, and reuse of knowledge.

An important premise of the knowledge-based view of the firm is that organizations exist to create, transfer, and transform knowledge into competitive advantage.^[34] When a KM culture is the goal it is important to make knowledge sharing a norm in the organization. In reaching a KM culture it is important to encourage people to work together effectively and collaborate.^[3,6] When people collaborate they try to clarify each other's knowledge, which means that they interpret codified information and vague perceptions of implicit knowledge, which eventually will correspond to one's expectations (p. 222).^[35,36] This means collaboration is not always a very straightforward process and when aiming at effective knowledge sharing it is important to create a culture of trust, respect, recognition, reward, and interactivity (90-92).^[3] Cultural enablers and barriers to knowledge sharing are however often invisible and difficult to grasp. The visible dimensions of culture such as values and missions, structures and stories, should then be balanced with the invisible dimensions of culture such as unspoken sets of core values. This means that the awareness of cultural dimensions and widely held core values helps to link knowledge sharing efforts with the common interest. Visible connections between knowledge sharing and practical goals are then possible to make and the holistic view of persons working closely, techniques, and technology is important.^[28,37,38] In the end, overcoming the cultural barriers to sharing information and knowledge has more to do with how one designs and implements one's management efforts into the culture than with changing the culture.^[28]

ASSESSMENT OF ORGANIZATIONAL CULTURE

Cultural analysis includes a variety of possible perspectives in a multidimensional context. Alvesson (p. 189-190)^[2]

suggests some principles for the productive use of the culture concept.

- The cultural concept should be related to specific events, situations, actions, and processes.
- Culture should be treated as a network of meaning guiding feeling, thinking, and acting rather than an external force. Meanings should be viewed as processual and situated, not as a fixed essence.
- Cultural interpretation should be sensitive to variation and contradiction.
- It is also important to relate the understanding of culture to power and how power operates in social relations.

These principles can be realized both theoretically and empirically. Theoretical studies of organizational culture include both macro- and micro-perspectives. When looking at organizational culture from a macro-perspective, culture is usually interpreted as a consequence of the needs of the firm. Rites and ceremonies are studied and different types of cultures and subcultures are identified (e.g., productive, bureaucratic, professional, closed, open). The micro-perspective is more concerned with the psychological point of view, attitudes, and behavior. Usually the studies look beyond the surface, and culture may be assessed from a psychoanalytical perspective going deeper into meaning and structures.^[9]

Empirical studies of organizational culture can mainly be divided into three categories: holistic studies (ethnographic, observations), semiotic or language studies (focusing on language and symbolism), and quantitative studies. Often organizational studies involve a combination of both qualitative and quantitative techniques mentioned above.^[9] Several methods are often needed when the aim is to study company values, practices, artifacts, and core tasks, finding underlying assumptions existing in the company.^[39]

ORGANIZATIONAL CULTURE IN THE LIBRARY CONTEXT

Organizational culture has also become important when studying libraries and how they can meet challenges and changes in today's society. Challenges in libraries are anchored in the demands that the information society shapes where especially the technical development has been of critical importance.^[40] The main goal for a library is to bring clarity into the information chaos and help the information users to find and use relevant information at the right time and place. Apart from the traditional information resources management issues there are aspects of user orientation which have also become important for libraries to manage. Collaborative and information sharing skills are highlighted. For example, sharing knowledge is important where librarians share desk duty and consistent

service is required.^[41] There is a growing trend of using libraries both locally and virtually giving them great potential for collecting new forms of user-produced information. The libraries need to reconstruct their role from being a physical location of information and knowledge, where the information professionals have all the keys to knowledge organization, to an organization where the users actively can take part in shaping the library and their information provision. The development of new electronic services, digital libraries, and new learning environments affect the structures and organizational culture within the library, and put great demands on their management.^[42-46]

Cultural studies in library organizations are challenging. As public organizations the libraries are different from, e.g., private as far as their external environment and expectations are concerned. Public organizations are often more structured and rule-oriented. This often means that public organizations are not often accustomed to change management or aware of the role of organizational culture in practice.^[47] The role of organizational culture in the context of change management has been underlined in some empirical library studies.^[42,48] Cultural studies in the library context have also discussed different organizational challenges for different kinds of libraries, e.g., the importance of a cross-cultural approach in the leadership of university libraries which are situated in large organizations with a variety of subcultures.^[49] Promoting cultural change and cultural awareness through training and leading by example has been showed to be effective when it comes to public organizations^[47] and is probably true in library context as well.

CONCLUSIONS

It has been stated that organizational culture is a multi-dimensional concept with many meanings and definitions. We have seen that culture is significant for how the organization functions, what is valued, what it is aiming for, how the aims are reached, and how capable the organization is to change. How people's knowledge is created, interacted with, and used is crucial in this process (p. 2).^[2] The company culture plays an important role in the company's ability to handle changes (e.g., new information technology), but also on a broader perspective, i.e., in the handling of information as a resource.^[50,51] Although the whole company culture is difficult to picture, it provides an easier way to analyze the information culture in order to focus on the role of information as a resource. Studying information culture is concluded to be a useful where aspects of organizational culture and IM are combined. In these studies the understanding of networks, motives for sharing, and learning aspects are important.^[52] IM and KM is about structure and management of information in organizations in order to shape better circumstances for organizational activities (p. ix).^[53] Today, most organizations are a mix of

traditional, digital, local, and global arenas making the information activities a great challenge. Naturally, these circumstances are shaped by environmental and cultural factors and IM should be adjusted to both internal and external specialties.

Studies into organizational culture today emphasize the individuals in a social context focusing on aspects of learning and knowledge creation. This is important while organizations in general and libraries in particular, face challenges in their organizational structures because of the technical development as well as the virtual and digital development, resulting in new tasks and services. The organization is not solely a physical entity which gives new perspectives on cultural issues in the organization. It is important to address these kinds of studies in the future.

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Organizational Learning

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Abstract

Organizational learning (OL) is a growing field that studies the processes through which new knowledge is learned and used in an organization. OL involves the leveraging of organizational knowledge assets and the continued development of an organization's knowledge base. While OL has been studied since the mid-1960s, there are many aspects of the field for which researchers have yet to reach a consensus. Most notable is the lack of commonly accepted definition of OL. Additional aspects that remain unresolved include the appropriate theoretical perspective from which to view OL and the identification of the most appropriate agent of learning. This entry begins with a discussion of the various definitions of OL followed by a brief history that highlights key OL researchers and key OL journals. The following section reviews cognitive, behavioral, and social constructivist perspectives of OL; the individual, group, and organizational levels as agents of learning; the commonly accepted components of the OL process; and the types of learning that occur in organizations. This entry concludes with a discussion of the value of OL and a map of the conceptual landscape of OL research.

INTRODUCTION

Organizational learning (OL) is an evolving field that studies the processes through which new knowledge is learned and used in an organization. OL involves the leveraging of organizational knowledge assets and the continued development of an organization's knowledge base.^[1–3] Knowledge assets can be viewed as the inputs, outputs, and moderating factors that are involved in the knowledge creating process, the sum of which forms the organization's knowledge base. While OL has been studied since the mid-1960s, there are many aspects of the field for which researchers have yet to reach a consensus.^[4] Most notable is the lack of a commonly accepted definition of OL. Additional aspects that remain unresolved include an appropriate theoretical perspective from which to view OL as well as which elements of the organization are the learning agents.

This entry begins with a discussion of the various definitions of OL. This section is followed by a brief history that overviews some key individuals in the field and the leading journals that publish OL research. The following section reviews cognitive, behavioral, and social constructivist perspectives of OL; the individual, group, and organizational levels as agents of learning; the commonly accepted components of the OL process; and the types of learning that occur in organizations. This entry concludes with a discussion of the value of OL and a map of the conceptual landscape of OL research.

DEFINING OL

While the field of OL has already received numerous and extensive reviews, there remains multiple conceptualizations and inconsistencies in the terminologies used to define OL.^[5] Distinguishing OL from other processes such as knowledge sharing, knowledge transfer, change management, and the learning organization, which are each sometimes confused with OL, is an appropriate first step in defining it.

The scope of OL extends beyond the processes of knowledge sharing and knowledge transfer to include processes through which new knowledge is understood, remembered, and embedded in the organizational level in a way that it can be easily reused in the future.^[6] In addition, OL is a continuous ongoing dynamic process, as opposed to a specific episode of organizational change, that focuses on managing ongoing collective learning processes. While on the surface the cognitive and/or behavioral changes that result from OL may appear to be punctuated or disjointed episodes of change, they are actually the result of fluid and continuous underlying OL processes.^[7] In this way, OL differs from traditional change management initiatives, which are generally conceived of as a process of various stages of freezing, changing, and refreezing.^[8]

Last, the two terms OL and the “learning organization” (a concept that was popularized by Peter Senge's 1990 book *The Fifth Discipline*) are often used interchangeably.^[9,10] However, the two domains focus on different research goals. Research on the *learning organization*

focuses on prescriptive and practice-oriented theory building that deals with specific applications of best practices that an organization *should* follow in order to become an organization that learns. In essence, the *learning organization* domain tries to identify *what* characterizes organizations that learn effectively and productively. This differs from the descriptive theories of OL which focus on describing the processes through which learning occurs in an organization.^[11,12]

When looking at explicit definitions of OL, one sees that the field is still saturated with an array of partially overlapping and sometimes contrasting definitions. Below are a few sample definitions:

...the ability of the institution as a whole to discover errors and correct them, and to change the organization's knowledge base and values so as to generate new problem-solving skills and new capacity for action. Organizational learning refers specifically to a change in organizational knowledge and values.^[13]

process in the organization through which members of the dominant coalition develop, over time, the ability to discover when organizational changes are required and what changes can be undertaken which they believe will succeed.^[14]

the process of improving action through better knowledge and understanding.^[15]

the acquiring, sustaining, or changing of subjective meanings through the artifactual vehicles of their expression and transmission and the collective actions of the group.^[16]

a dynamic process, occurring over time and across levels, that involves a tension between new and existing learning.^[7]

organizational learning as the process of change in thought and action—both individual and shared—embedded in and affected by the institutions of the organization.^[5]

A thorough review of these and other definitions of OL reveals a number of common themes:

Organizational learning is

- a cyclical process;
- a response to changes in an organization's environment;
- based on experience and observation;

that involves

- knowledge acquisition and distribution;
- collective interpretation and sensemaking;

and results in

- cognitive and/or behavioural changes;
- increased understanding of action–outcome relationships; and
- the embedding of new routines and/or practices.^[7,13,14,17–19]

Based on these common themes, an overarching definition of OL can be provided as follows:

Organizational learning is a process through which knowledge is developed and shared, changes in cognition and/or behaviour occur, and new routines and practices are embedded in the organization.

HISTORY

Early research on OL was initiated in the late 1950s and early 1960s by March and Simon, and Cyert and March respectively.^[19,20] Together with researchers such as Argyris and Schön,^[21] Levitt and March,^[22] Simon^[23] and Huber,^[24] these early OL researchers focused specifically on either the cognitive or behavioral aspects of OL. Until the 1990s much of the literature used the metaphor of knowledge acquisition to understand the process of OL.^[21–24] This metaphor suggested that learning in an organization was a process of employees acquiring new knowledge (cognition) and then acting upon it (behavioral).^[25] Research that has followed the knowledge acquisition metaphor has typically focused on the individual, who is separate from the organization, as the agent of learning.^[26]

Beginning in the 1990s, authors such as Brown and Duguid,^[27] Lave and Wenger,^[28] Cook and Yanow^[16] and Gherardi and Nicolini,^[29] began exploring a more participatory perspective in which learning was viewed as a social process.^[16,25,27–29] Within this social perspective, authors began to integrate individual learning with learning processes on the group, organizational, and interorganizational levels of analysis.^[26]

The literature on OL has grown considerably since the 1990s with notable increases in the new millennium. The growth of interest in OL has been attributed to the emergence of the knowledge economy in which knowledge, knowledge management, and OL are cited as key factors in creating and sustaining competitive advantage.^[4,30] Academically, journals such as *Management Learning* and *The Learning Organization* focus specifically on OL and the learning organization (with crossover between the two). Other popular journals for OL research include *Academy of Management Journal*, *Academy of Management Review*, *Administrative Science Quarterly*, *Human Relations*, *Management Science*, *Organization Science*, *Organization Studies*, *Sloan Management Review*, and *Strategic Management Journal*.^[31]

THEORETICAL FOUNDATIONS

Organizational learning has been explored from a number of theoretical foundations including the cognitive, behavioral, and social constructivist perspectives.

Cognitive

Cognitive perspectives of OL focus on changes in the mental states of the individual within the organization. These sorts of cognitive changes can manifest themselves as modifications to the individual's knowledge base, conceptual frameworks, mental models, beliefs, or interpretations and do not require any sort of behavioral change to qualify as learning.^[15,32] The organizational cognitive perspective incorporates the individual cognitive perspective, which emphasizes the ability of the individual to absorb and organize knowledge for later reuse, and extends this process in order to apply it at the level of the organization as a whole. The focus of inquiry in this approach is centered on individuals and the changes in their understanding of organizational knowledge.

Behavioral

Behavioral perspectives on OL view changes in an individual's observable behavior as a consequence of a stimulus-response occurrence. From this perspective, the internal cognitive processes of the individual are largely ignored, and it is the observable changes in behavior that are equated with learning. Behavioral theories of OL are based on three fundamental observations: 1) Organizational behaviors are based on routines where action reflects a sense of legitimacy rather than an understanding of action outcomes; 2) Routines are based on past experience more than on anticipation of the future environment. These routines include rules, procedures, strategies, belief, frameworks, culture etc. . . ; and 3) Organizations are target-oriented and behavior is based on success or failure in attaining specific targets.^[15] The focus of inquiry in this approach is thus centered on changes in routines which manifest as behavioral changes.

Social Constructivist

Finally, the social constructivist perspective examines the individual within the context of a social system and purports that people build their understanding of the world through constant sense making within their social systems.^[33] Consequently social constructivism moves away from strictly cognitive notions of information acquisition, storage, and retrieval as well as behavioral conceptions of change that are viewed as the simple consequence of stimuli and response. Instead, OL is viewed as a social process with multiple actors interacting within an organizational

environment. As individuals interact and converse, new knowledge is created and a shared social understanding of the world emerges. As people develop a common language and a shared knowledge base, organizational members begin to learn from their interactions with one another.^[34] Organizational theorists who favor this view emphasize the importance of relationships in creating and sustaining successful organizational practices.^[35] Consequently, the focus of inquiry shifts to studying learning in the context of organization-based social practices.^[36]

LEARNING AGENTS

One of the more controversial elements of OL is determining whether individuals, groups, or organizations are the agents of learning. Some of the literature suggests that only individuals are capable of learning and not the organizations as a whole. At the individual level of analysis, individual learning is said to lead to changes in beliefs, schemas, and behaviors in the organization. Others propose that learning occurs at the group level where the focus is on integrating knowledge from different parts of the organization. It is suggested that group learning leads to shared beliefs and concerted actions. A third group proposes that OL at occurs the organizational level, where learning is a process of institutionalizing knowledge and routines that have been learned.^[7]

Individuals

Individuals may be studied as the main agent of OL from both the cognitive and behavioral perspectives. Within the cognitive perspective, there are two main schools of thought about individuals as the agents of learning. The first views OL as a particular kind of individual learning that is simply occurring in an organizational context. The second suggest that it is possible to use individual learning theories to understand OL based on the similar capacities and capabilities that exist between individuals and organizations.^[4] In contrast, the behavioral perspective views changes in individual behavior as the mechanism that permits the organization to learn.

Numerous authors however, have found weaknesses with viewing the individual as the main agent of OL.^[4,16] Their arguments suggest that OL can not be studied by looking exclusively at individual learning because there is no evidence to suggest that an organization can learn through the same cognitive processes as individuals do. Others argue that focusing on individual behavioral responses fails to sufficiently take into account the social aspects of learning that are so critical to OL. Argyris and Schön argued that individual learning is a necessary but insufficient condition for OL.^[21] While individuals are undoubtedly agents of learning in organizations, OL is not just the cumulative result of individual learning events

repeated or captured on a larger scale. Many authors^[6,13,17,37] argue that individuals' learning processes and behaviors cannot be used as an appropriate metaphor for the processes that permit OL^[6,13,17,37] because the storage of and access to knowledge in the individual and the organization differ in dramatic ways. Individuals have access to personal knowledge that is rarely, if ever, accessible to organizations, while organizations can retain knowledge that has been forgotten or lost to individuals.^[13,38] Similarly, OL is not simply the sum of individual learning because behaviour at the collective and organizational levels is often significantly different from those of the individuals in an organization.^[13,23,37,38] Mob mentality or "group think" are examples of how collectives and groups of individuals can act in a manner that differs radically from how individuals might act on their own.

As these reviewed shortcomings emerged in the research field, many theorists began to look for a more appropriate agent of OL.

Groups

Social constructivism focuses on groups as the agent of learning in organizations. From a group level perspective, it is suggested that group learning leads to the development of shared beliefs and concerted actions which then results in OL.^[6,7] Organizational groups which may consist of such groups as formal teams, departmental divisions, or informal gatherings of colleagues who share similar professional interests, are viewed as the agent of OL from the social constructivist perspective. This latter type of group is generally referred to as "communities of practice" and are often perceived as the bridge between individual and OL.^[28,34] From a group level perspective, it is suggested that group learning leads to the development of shared beliefs and concerted actions which then results in OL.^[6,7] The emphasis in this perspective shifts from individual knowing, to collectively made decisions and agreements. The sensemaking processes that are critical to learning are no longer attributed solely to the individual but are recognized as fundamentally social in nature.^[34] The researchers who focus on groups as the agents of learning in OL view OL as a social process that constructs and situates knowledge within work practices.

For some authors though, even the group level perspective is insufficient for understanding how learning occurs in the organization.

Organizational

More recently there appears to be an evolution in OL research towards viewing OL as a process that occurs on all three levels of an organization (individual, group, and organizational).^[31] This view argues that learning at the organizational level is a process that can only occur once knowledge at the individual and group levels have been

collectively recognized, accepted, and used as organizational knowledge. Learning is thought to begin with individuals' cognitive and behavioral changes, followed by socially constructed interpretations of these changes and ultimately maintained by organizational adoption.^[39] At the organizational level, learning is embedded in the organization's systems, structures, procedures, and strategies which are then available to all employees on an ongoing basis,^[40,41] through a process that is referred to as "institutionalization" by Crossan, Lane, and White.^[7]

ORGANIZATIONAL LEARNING PROCESSES

A tension exists between learning by exploring new possibilities and learning by exploiting known certainties. Exploration involves searching for new information, experimenting, playing, taking chances, discovering, and innovating. It is a process that helps overcome organizational inertia and institutional rituals but that can be confronted with internal political resistance.^[42] Exploitation, on the other hand, involves refining existing knowledge, improving upon practices and procedures, and increasing efficiency. Exploration feeds new knowledge into the organization's knowledge base and exploitation feeds existing knowledge from the organization's core back to the individuals and groups who make daily use of it.^[43] OL cycles are affected by a trade-off between exploration and exploitation as the organization attempts to address both short- and long-term goals.^[44,45] There are a number of models that map out the various processes of OL which suggests that, while there is no single definitive model of OL processes, an underlying understanding of the processes is emerging.^[7,35,46,47] The following section provides an integration of these various models by adopting the terminology developed by Crossan, Lane, and White^[7] to describe four main OL processes: intuition, interpretation, integration, and institutionalization.

Intuition

Organizational learning is triggered by intuition. Intuition occurs when individuals identify and acquire knowledge that has potential use in their current work environment through pattern recognition (exploitation), or through making novel connections and identifying new possibilities (exploration) in the way they do their job. In many ways, intuition is seen as a preconscious process, in that the knowledge is hard to describe in concrete terms and often occurs as a result of observation, participation, or socialization.^[7,46]

Interpretation

Interpretation is the process through which individuals verbalize or put into action their own intuitions. It is also

the phase in which individuals develop personal cognitive maps of their knowledge. Metaphors, which describe a relatively unknown or unfamiliar domain in more familiar terms, are often used to help individuals interpret and share their insights and ideas with others. Finding the right words to describe intuitions is a critical part of the interpretation process. Interpretation involves individuals interacting with other organizational members in an effort to make sense of their own intuitions. Viewed in this way, interpretation can be seen as a social process that involves sensemaking activities between organizational members. At this stage, however, the process is still focused on making sense of the individual's ideas. Other authors have also used the terms exchange, distribution, or externalization to describe this process.^[7,24,35,46,47]

Integration

As the understanding and value of the knowledge extends beyond the individual and is shared among group members, the process is said to be one of integration. Integration involves the collective development of a shared understanding of new ideas and of how to put them into action. This process occurs and has impacts on the group level in the organization. Through continued conversations, group members engage in mutually adjusting each other's understanding of new knowledge and through this, an agreed upon way of making use of the knowledge emerges. This new knowledge can impact how the group works in ways that are often different than those prescribed in the organization's standard operating procedures, rules, or guidelines.

This process has also been called combination, which is a process in which new knowledge is combined with existing knowledge; and objectification, which is the process in which knowledge becomes common property and is accepted as being reliable, valuable, and useful by the organization's members.^[7,35,46,47]

Institutionalization

Institutionalization involves a deliberate effort to embed knowledge at the organizational level so that it may persist and be available for future use. This new knowledge then becomes a norm or custom of the organization and can at that point, be viewed as having been added to the organizational knowledge base. It is through institutionalization that individual and group learning is leveraged and capitalized on in an organization.^[7] In essence,

institutionalization is the process through which knowledge that has been intuited by individuals, and interpreted and integrated on a group level, is finally internalized into the organization's systems, routines, structures, and culture and consequently, can be seen as evidence of OL. Transfield and Smith explained that "this embedding, or institutionalizing of new ways of working, is complete when old tacit routines are removed and replaced with new taken-for-granted ways of working".^[48] Institutionalization is the process that distinguishes OL from individual and group learning as it is through institutionalization that ideas are transformed into institutions of the organization, which are then available to all employees on an ongoing basis.^[40,47] Fig. 1 shows how these four processes of OL occur at the individual, group, and organizational levels.

These processes are affected by internal politics and the organization's culture. In order to take into account the political nature of organizations, some authors^[40,42] have explored the influence that power has on OL processes. It has been argued that new ideas only have the opportunity to become institutionalized when they are championed by key players in the organization and when coalitions are formed to support the interpretation and continued development of the ideas. These can be seen as political activities in that champions will only support particular ideas at particular moments in time and coalitions will be instrumental in gaining resource allocation.^[42] These champions and coalitions are also instrumental in the institutionalization of new knowledge by using their power to get senior management and the rest of the organization in line with the new knowledge. Power may be used to influence people to accept a chosen interpretation, to drive particular ideas to the top of the organizational agenda, to restrict alternate options, and to socialize and train organizational members into the new way of thinking or behaving.^[40]

While these processes and the role of politics give the impression that OL is a particularly structured process, it is also appropriate to see it as a fluid and dynamic process that is greatly influenced by the organization's culture, identity, and ability to be self-reflective. An organization's culture, which includes its beliefs, values, and philosophies along with the artifacts and means through which they are transmitted across the organization, influences the way knowledge is interpreted, who will champion it, and when it can be integrated and institutionalized in the organization.^[16,49] Organizations with rigid cultures struggle in the exploration phase of learning because they cannot see beyond their existing organizational configuration, or

	Individual	Group	Organizational	
Individual	Intuiting	Interpreting		
Group			Integrating	
Organizational				Institutionalizing

Fig. 1 4I framework of organizational learning.
Source: Adapted from Crossan et al.^[7]

organizational identity, to envision ways to integrate new knowledge.^[50] To overcome such challenges, organizations need to be more actively reflexive and engage in improvisational learning and working. Improvisation has been used as a technique to support OL as it teaches the organization to quickly and dynamically interpret and process vague and incomplete information and to recombine past knowledge and experiences to create new solutions and directions for action.^[49,51] Schön^[52] refers to the activity of reflecting on past knowledge while acting as “reflection-in-action”. As organizations embrace these learning behaviors, their capacity to identify new potential strategic directions, to engage in transformative learning, and to adapt their organizational culture and identity increases.^[50]

TYPES OF OL

The processes of OL can be further characterized by three types of learning; single loop, double loop, and deutero-learning.^[21]

Single-Loop Learning

Single-loop learning involves the detection and correction of errors in routine actions. When single-loop learning occurs, the actions and rules of the organization may change, but the values and norms behind the actions are not questioned.^[53] In this type of OL, the focus is on improving specific techniques, routines, or work processes. New ways of carrying out routines can reach the organizational level (become institutionalized) without requiring any changes in organizational strategies, culture, or identity.

Double-Loop Learning

Double-loop learning occurs when the underlying causes of errors or poor performance are analyzed and altered.^[54] The focus in this type of learning is on the adjustment of cultural values, norms, and strategies rather than specific activities and behaviors. Resulting changes in routines are thus based on new organizational goals and perspectives.^[53] The results of double-loop learning may include the development of new organizational skills, cognitive frameworks, interpretive schemes and the unlearning of earlier, ineffective behaviors.^[15]

Deutero-Learning

Deutero-learning is a “meta” process in which the learner reflects on his own learning (either single- or double-loop learning). From an organizational standpoint this involves reflecting on the way the organization thinks about and approaches learning opportunities. This type of learning

can have an influence on the learning processes and culture that is already in place in an organization. Deutero-learning is actually less knowledge and skill dependent than double-loop learning as it can be a simple reflection on single-loop issues.^[53]

VALUE OF OL

Organizational learning is an essential activity for organizations in a knowledge-based economy. The strategic management of OL and knowledge assets is most successful when these activities are linked to the organization’s strategies, goals, and practices.^[55,56] When organizations focus their learning on strategic issues, these issues will influence the firm’s perception and interpretation of knowledge and this knowledge will in turn influence, and often renew, the organization’s strategies, goals, and practices.^[5] When learning is effectuated on the organizational level, the basic assumptions underlying organizational knowledge are reframed and can lead to changes in the strategic orientation of the organization.^[57] Linking OL with strategic goals helps build the organization’s ability to both discover new knowledge (exploration) and make the most out of the knowledge that it already has (exploitation).^[5,56]

Organizational learning is also at the heart of an organization’s ability to adapt and respond to a changing environment and can ultimately lead to improved business performance. Research has found that OL can enhance the survival and effectiveness of acquisitions, increase innovation, and facilitate the implementation of new information systems and business process reengineering.^[31] OL has also been shown to reduce costs and to contribute to organizational success by reducing the number of repeated tasks and preventing individuals from repeating the mistakes of others.^[58–60]

Organizational learning also contributes to sustainable competitive advantage by enabling organizations to learn faster and to deploy their knowledge assets more quickly than their competitors.^[2] Furthermore, an organization’s core competencies are typically the result of its collective and continuous learning and the ability to manage the knowledge assets that result from this learning.^[2,61] Managing these processes and assets allow organizations to achieve greater flexibility and adaptability, and through that, increased competitive advantage.^[17]

CONCLUSION

Organizational learning is a complex process that involves multiple learning agents, subprocesses, and types of learning and can be viewed from a variety of theoretical perspectives. The growing tendency in OL research is to integrate as many of these components as possible into a

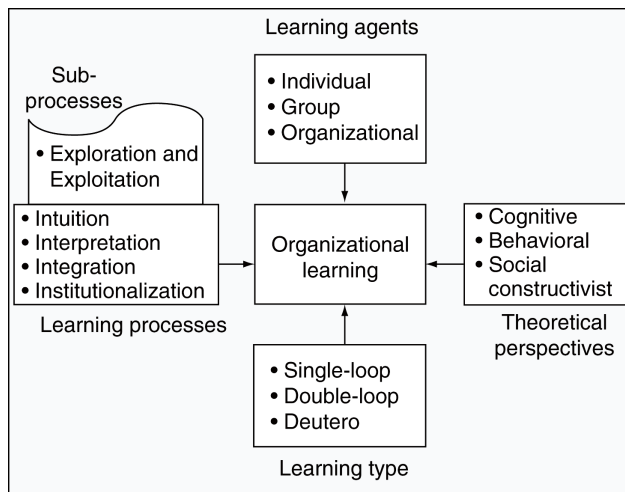


Fig. 2 A conceptual landscape of organizational learning.

Source: Reproduced by permission of Oxford University Press. From figure 3.2 in “A Conceptual Framework for the Management of Organizational Learning” from Chapter by Pawlowsky et al.^[47]

single framework. This implies integrating cognitive, behavioral, and social perspectives on learning to develop comprehensive models that explore the OL process as a cycle that affects, and functions differently, on all levels of the organizations. The following diagram (Fig. 2) represents a mapping of this conceptual OL landscape, highlights components that are critical for a more in-depth understanding of OL and can serve as a foundation for further research and exploration in this area.

An improved understanding of these key aspects of OL is crucial for more effective strategic management of learning at the organizational level.

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Organizational Memory

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Abstract

Organizational memory (OM) has to do with an organization's ability to access and use the knowledge, expertise, and experience gained by its staff for the purpose of meeting its ongoing business needs. Across the literature, there is consensus that the primary repository of OM is the staff that carries out the work of that organization. This is increasingly important given the large wave of retirements expected across the private and public sectors in the near future as well as a change in employment tenure as workers increasingly change jobs every 3–5 year. This entry provides a high-level review of OM.

How can an organization remember? what does that mean? and why should we care? Organizational memory (OM) is about the accrual and preservation of knowledge held and shared by its employees paired with the organization's history and culture. Together, these contribute to its uniqueness, all of which leads to competitiveness and improved decision-making. Evidence of it may also be found in the organization's documents, systems, and processes. OM may be lost through resignations, retirements, and reorganizations, as well as through deliberate or unconscious suppression. Memory loss can be expensive as without the benefit of prior knowledge and experience, organizations may duplicate work and have to relearn lessons.^[1] This entry provides a high-level review of OM. References at the end of this entry can be consulted by the reader wanting more detail or to further explore specific issues raised in the text.

As long ago as 1959, Penrose, in *The Theory of the Growth of the Firm*, recognized that an organization functions as a knowledge repository (as cited in Bontis).^[2] What goes into the repository is the tacit (unwritten and uncaptured) knowledge of its employees. Tacit knowledge influences the attitudes of individuals and is a knowing that informs the individual about how to best accomplish a task; it is produced by the individual and changed by experience.^[3,4] The knowledge is dynamic and can change frequently and take on new meaning as a result of new experiences.^[5] It is impacted by the individual's personal way of interpreting it so the knowledge may be held and explained differently person to person. Memory is the application of this knowledge, impacted by further experience, and the sum of all employees' knowledge becomes the institution's OM.

This knowledge must be passed on to each generation to establish continuity and to allow each generation to contribute to and build upon the previous knowledge base so that it becomes an organizational asset.^[6] Knowledge is further expanded and shared by the

relationships in which employees participate (their networks), by use of explicit knowledge such as databases and paper files, and through organizational processes and procedures that have been refined through lessons learned.^[7] Employees contribute to the dissemination of personal and organizational tacit knowledge; this is important because it ensures that the various interpretations can be heard, understood, and combined with the individual interpretations to build expertise. "From very early times, wise people have secured sustained succession by transferring in-depth knowledge to the next generation."^[8]

Kransdorff and Williams break OM down into three time frames, short term (less than 5 year), medium term (up to 10 year), and long term (over 10 year).^[1] It is the short- and medium-term memory that is most relevant to an organization's daily or core operations, while long-term memory impacts its strategy. Since OM is critical to an organization's ability to perform effectively (do the right thing) and efficiently (do things well) and much of this critical knowledge is held by individuals within the organization in tacit form, it is particularly at risk for loss in countries or sectors expecting a large number of long-term employees to retire. It is also increasingly impacted by the new trend of employees' tenure lasting five or less years and by outsourcing.

ORGANIZATIONAL MEMORY: DEFINITION AND OVERVIEW

In 2000, Olivera defined OM as the means of storing knowledge for future use by discussing OM as it relates to the complex environment of an organization that exists as multiple units and including networks of individuals, sophisticated computer-based technologies, and formal knowledge management initiatives. He discusses OM in

this environment as dispersed among people and documents and integrated through mechanisms such as social networks and computer-based technologies.^[9]

As important as individuals may be in creating the knowledge base, OM is more than just the addition of what individuals know or store in databases. The existence of an OM is what makes it possible for an organization to have a memory that is sustained even as individuals leave.^[10] It is through sharing by individuals, according to Walsh and Ungson, that “organizational interpretation is made possible” and “through this process of sharing, the organizational interpretation system in part transcends the individual level. This is why an organization may preserve knowledge of the past even when key organizational members leave.”^[11] Walsh and Ungson identify five storage bins for OM: individuals, culture, transformations, structures, and ecology, and one external bin—external archives.^[12]

Beazley, Beazley, and Harden identify seven types of operational knowledge:^[6]

- *Cognitive knowledge*: Content knowledge that includes job-specific data and information and their sources.
- *Skills knowledge*: The skills and training necessary to perform well in the position.
- *Systems knowledge*: An understanding of the interplay of cause-and-effect relationships that is essential for sound decision-making.
- *Social network knowledge*: An understanding of the crucial social relationships that make it possible to get things done in the organization, including who can grease the wheels, provide inside information, clarify options, or offer reliable advice and counsel. When employees face an unfamiliar situation with which they feel unprepared to deal, they do not rely on databases or procedure manuals. They turn to their network of trusted colleagues for information, knowledge, and advice.
- *Process and procedural knowledge*: Knowledge of formal and informal organizational processes and procedures, which are often more effective for getting things done in an organization.
- *Heuristic knowledge*: Knowledge of shortcuts for accomplishing tasks, rules of thumb for decision-making, and quick fixes that have come to constitute best practices for the position. Heuristic knowledge includes procedures that modify or circumvent obsolete, ineffective, or cumbersome official procedures.
- *Cultural knowledge*: Knowledge of organizational norms, values, roles, and standards of conduct that govern interaction with colleagues and other stakeholders.

The importance of OM to an organization lies in its role in problem-solving, decision-making, strategic planning, and developing tactical approaches. In 2006, Feldman and

Feldman note that “despite continued efforts to dismantle the concept’s mystery, it has not lost its essentially baffling quality.” They suggest that this baffling quality may be due to an approach that is too “narrow to capture the complex character . . . of organizational remembering.” They suggest a shift from the term “‘organizational memory’ (an object) to ‘organizational remembering’ (a practice)” and discuss organizational remembering as “a collective, culture and time specific process and practice, hinged on the concept of tradition as the cradling framework of meaning.”^[13]

ORGANIZATIONAL MEMORY AND CULTURE

“Culture embodies past experience that can be useful for dealing with the future. It is, therefore, one of organizational memory’s retention facilities. . . . Because this information is transmitted over and over again, some of the detail and context of the various decisions are likely to be dropped or even altered to suit the telling.”^[14]

According to Adler, Goldoftas, and Levine, management’s task is to create an environment that promotes interaction between the individual and the organization to share knowledge.^[15] “Managers must accept the inevitability of employee turnover, and through an understanding of social networks, make structural changes to their organization which promotes the diffusion of knowledge before crucial information is lost.”^[16] Brief and Motowidlo state that leadership style and organizational climate affect prosocial organizational behavior.^[17] Prosocial behavior supports knowledge sharing through encouraging interactions between employees. Leaders determine what activities are rewarded by role modeling and supporting wanted behavior such as networking. “Leaders have direct control over what activities are rewarded, what behaviors are encouraged, and how work will be valued in the organization. These factors all influence workers’ motivation and ability to develop new knowledge.”^[18]

A knowledge sharing culture is one in which employees are encouraged to share and to ask questions, where experience and knowledge from other sources are included, and where mentoring is supported.^[19] Awareness of and support for knowledge sharing networks and the individuals within is a critical function of leadership and management as the networks are used daily in the completion of work. “The traditional organization chart may show who reports to whom, but often who talks to whom is more important in getting work done and generating new ideas.”^[20]

Fahey and Prusak note that when management recognizes that knowledge is part of a process rather than an object, it will be recognized that it is affected by the organization’s structure and systems.^[21] Often knowledge sharing is confined to small groups of employees who

have developed a trusting relationship over the years. “A great deal of knowledge in an organization is undocumented and therefore isn’t easily available to everyone. It may be shared among a few individuals or within local groups, but rarely migrates outside those circles.”^[22] Organizational leaders and managers must create a culture that encourages sharing to these groups and beyond.

According to Choi and Lee, organizational knowledge management programs with a human orientation focus on the sharing of tacit knowledge. The human orientation is important in industries with high uncertainty or complexity because employees rely on the experience and knowledge within networking relationships.^[23] It is also valuable within more stable environments to ensure that organizations continue to grow and innovate. The human orientation can be complemented by a technical orientation that captures the supporting explicit knowledge and makes it available through a knowledge repository such as a searchable database or a corporate intranet.

TOOLS AND APPROACHES TO PRESERVE ORGANIZATIONAL MEMORY

“Devising strategies to properly manage knowledge is imperative for many organizations due to its significance for attaining organizational outcomes.”^[24] In addition to being stored in people’s memory or in databases, OM is embedded in processes, systems, services, and cultural norms. It is encoded in routines, in established policies and procedures, in products, in the way a business is organized, in the beliefs and routines in which employees are trained, and the cultural norms that guide how staff interact and share knowledge. And these things can, in turn, be impacted by “changing incentives, evaluation processes, or planning and budgeting processes.”^[25]

Knowledge sharing by individuals is fundamental to creating an organizational knowledge base—the foundation of OM. Walsh and Ungson note the important role of the individual in acquiring and sharing information. “This focus on individual cognitive activities as the central element in the organization’s acquisition of information reflects an active construction of memory.”^[11] It is in the give and take among individuals combining their understanding and experience of how to accomplish work (tacit knowledge) with known information (explicit knowledge) in a specific context that new knowledge is created.^[9,26–28] This creativity, in turn, allows an organization to more effectively exploit what it already knows if that new knowledge is transformed into organizational knowledge.^[29–31] This suggests that the process of learning by individuals and sharing of information by them is an important step in creating an organizational knowledge base.^[32,33] Networks among staff, in turn, are frequently identified as an important means of accumulating, accessing, and sharing knowledge.^[34]

As long-tenured staffs begin to leave, they take with them their knowledge, skills, and other valuable job-related information—components of the organization’s memory that may become inaccessible to the organization. Additionally, this loss may disrupt OM systems as these components are part of organizational knowledge that may be dispersed across actors, systems, and interactions in organizations.^[35]

Knowledge repositories—databases or document collections—are an important tool in storing and making accessible organizational knowledge, but they play a limited role. In practice, “people are about five times more likely to turn to friends or colleagues for answers than to other sources.”^[36] The U.S. Department of Defense identifies knowledge sharing as being 90% culture and 10% technology in its Knowledge Management Primer.^[37] Aside from usage tendencies, there are issues related to inputting information in such a way that it is accessible to users. A report by the U.S. Federal Highway Administration on a 12-state survey of Quality Assurance databases ended up concluding that “Data Rich and Information Poor” best describes the current status of today’s databases. The focus of many agencies is on entering data, not retrieving or analyzing the data.^[38] “Briefly, individuals store their organization’s memory in their own capacity to remember and articulate experience and in the cognitive orientations they employ to facilitate information processing. Moreover, individuals and organizations keep records and files as a memory aid.”^[39] Therefore, encouraging employees to share their knowledge and to capture elements that explain the “why” of actions and strategies in databases may act as a catalyst for remembering.

OM may be shared between members of a group for a specific purpose or it may be passed down through mentoring or apprenticeships.^[26] Tacit knowledge originates with the individual and it is necessary for that knowledge to transfer from person to person to be useful to the organization. One way of transferring is described by Nonaka and Takeuchi as socialization, the sharing of experience to create shared mental models as through apprenticeships.^[29] It might also be codified within organizational routines through rules and guidelines:^[2]

The organization, however, cannot dictate the rules of coordination and knowledge sharing. Since only a part of tacit knowledge is internalized by the organization, the other part is internalized by employees. Therefore, it becomes critical for management to find some kind of commonality between individual and organizational knowledge and provide necessary incentives to employees to share their knowledge and enhance the contents of the organizational knowledge base.^[40]

Sharing is dependent on the levels of solidarity and employee buy-in to organizational goals.^[41] Leadership is

critical to garnering this buy-in and willingness to share. Management is critical to establishing the means to share both explicit and tacit knowledge.

“Blue-collar skills are predicated on available explicit knowledge; white-collar skills are predicated mainly on the less-than-visible tacit experience. Explicit knowledge can be taught while tacit knowledge is best learned. . . . Teaching is instruction *received*. Learning is instruction *acquired* out of an abstracted process of critical reflection, reasoned deduction, and applied action, the evidential base for which is OM.”^[42] “Learning as an integral part of working occurs when individuals adapt new tools to solve current problems, share success and failure stories, etc. Unlike individuals who are ‘automatic’ learners, OL (Organizational Learning) is a conscious activity in the organizational context and can be enhanced by an effective knowledge-management system.”^[43] Individuals develop knowledge based on personal experience, their personal values and beliefs, and the addition of new knowledge, thus determining what it is they remember.^[13] Providing training and education will ensure the sharing of explicit knowledge. Creating networks, such as through communities of practice, will support sharing of tacit knowledge and provide access to those with expertise and experience.

Access to experts within the organization is important to problem-solving, building the knowledge base of employees and innovation in product construction or delivery. “The role of experts is important as they are ultimately the source of the innovations or knowledge that is being diffused. Consequently, they form local peaks in the knowledge distribution, and agents directly connected to them benefit, becoming second-order experts.”^[44] By sharing knowledge with others, the demand on the time of experts is lessened freeing the expert to focus on high-value projects. It also supports the redundancy of knowledge within the organization ensuring that knowledge does not walk out the door. Lesser and Prusak state that

The research and experience at the Institute for Knowledge Management has shown that social networks play a critical role in helping people identify, share and work with corporate knowledge. Through such networks, individuals identify experts, provide referrals for those seeking answers and facilitate knowledge transfer among groups. Downsizing disrupts the structures and causes ‘potholes’ that impede and often block the flow of knowledge.^[45]

The presence and support of networks within the organization supports knowledge sharing by creating opportunities for employees to exchange information and insight informally as well as formally. Access to different knowledge through interactions with others allows employees to update their knowledge banks.^[42] The transfer requires that members of the network share a common framework to effectively share knowledge.^[46] This can be accomplished through organizationally supported

communities of practice to share lessons learned and after-action reviews. According to Swan et al., “knowledge has to be continuously negotiated through interactive social networking processes.”^[47] It is the organization’s responsibility to establish a culture or environment that supports the forming of these networks, both loose and tight, to encourage the sharing of knowledge.^[26,47]

Networking with external experts is also critical. Many of these networks are based on personal relationships. Creating an expert database to share these relationships can be helpful to other employees. “External memories are accessed through directories held in the mind of individual team members that identify existence, location, and mechanisms for retrieval of knowledge held by other team members or in various storage devices.”^[48] These connections may be direct or indirect.

In the 1960s, an American psychologist named Stanley Milgram tried to form a picture of the web of interpersonal connections that link people into a community. To do so, he sent letters to a random selection of people living in Nebraska and Kansas, asking each of them to forward the letter to a stockbroker friend of his living in Boston, but he did not give them the address. To forward the letter, he asked them to send it only to someone they knew personally and who they thought might be socially ‘closer’ to the stockbroker. Most of the letters eventually made it to his friend in Boston. Far more startling, however, was how quickly they did so—not in hundreds of mailings but typically in just six or so. . . . Milgram’s findings became famous and passed into popular folklore in the phrase ‘six degrees of separation.’^[49]

Often, the size of the organization influences how easily and readily employees share information. The smaller the organization, the more likely employees will share as they know and trust each other.^[50,51] Sharing may also be affected by employee age and where they are in their career.^[50] Sveiby and Simons found that senior people are more experienced in sharing knowledge than junior people due to larger networks and that investing time in assisting less experienced employees to build these networks in the first 3–5 year of employment is a profitable investment by the organization.^[52] While this may not be practical now given the increasingly short tenure of employees, developing a mechanism to quickly acquaint them with expert networks will benefit the organization.

ORGANIZATIONAL FORGETTING

If organizations remember they also forget, either deliberately or through a lack of awareness of knowledge at risk because it has not been shared.

Organizations that have been deeply concerned about organizational ‘learning’ have been oddly negligent about

its opposite: corporate 'forgetting,' which occurs with every departing knowledge worker. What kind of organizational learning can take place if the knowledge base on which it relies is subject to continual degradation or if the organization itself cannot remember enough to pass on its knowledge and its secrets to the newcomer expected to carry the torch?^[53]

However, strategic forgetting is also important. According to Bontis, much of the literature fails to acknowledge that while tacit knowledge can contribute to the competitiveness of an organization it can also limit its competitiveness if that knowledge does not fit the context of the desired industry.^[2] At the same time, too much forgetting may impact employee ability to identify with the organization. Organizational forgetting may be by mistake or on purpose and it may be helpful or hurtful to the organization and therefore, organizations need to also pay attention to what and how they forget in a strategic way. Strategic forgetting may be employed to help employees learn and adapt to new circumstances. Non-purposeful forgetting may hurt the organization when it loses the value of lessons learned that might be helpful to future events. Official and personal historical memories can omit or neutralize events and perspectives that contradict the approved history. This may be purposeful or unintentional. The emphasis on remembering and on forgetting impacts the actual history.^[54]

It is necessary to strategically capture knowledge that the organization wishes to retain and embed it in procedures and the culture.^[55] If the organization forgets critical knowledge, it must be relearned or created anew at great expense and can affect the competitiveness of an organization.^[53] It can also be harmful as seen in the Challenger and Columbia disasters at the U.S. National Aeronautics and Space Administration where the focus was on the

Quantitative measure 'experience base.' (In 1986 the Space Shuttle Challenger broke apart 73 sec into its flight. In 2003, the Space Shuttle Columbia broke apart on reentry over Texas). This measure abbreviates memory to a dangerously low level because it not only excludes qualitative data, but also arrests and reifies memory by excluding historical analysis of quantitative data relevant to safety and other organizational goals. In other words, a lack of memory was not only responsible for misunderstanding the level of risk on Columbia's last flight, but engineers also did not notice the accumulation of risk in the flight history preceding Challenger.^[56]

Unfortunately, the organization may not be aware of its knowledge if it lacks awareness of employees' personal knowledge.

Managers do not know the value of their own intellectual capital. They do not know if they have the people, resources, or business processes in place to make a success of a new strategy. They do not understand what

know-how, management potential or creativity they have access to with their employees. Because they are devoid of such information, they are rightsizing, downsizing, and reengineering in a vacuum.^[57]

As employees leave, they take the organizational knowledge with them, employee networks are disrupted, and documentation is lost or hidden.^[58] According to Lesser and Prusak, when organizations downsize, it is often the most knowledgeable employees who leave first, resulting in a damaged critical social network and an increase in time needed for knowledge transfers.^[45] This often occurs when organizations offer buyouts and early retirement incentives without considering the knowledge held by those designated as eligible. These knowledgeable employees have built and maintained extensive networks used to share knowledge. Trends such as rightsizing and reorganizations along with the pending retirements of long-term employees and the mobility of the new workforce destroyed or compromised tacit knowledge networks. The informal contract between the company and an employee moved from employment for life to employment for as long as there is mutual benefit.^[59] As noted earlier, trust is a determining factor for knowledge sharing, and when organizations have a history of downsizing, trust is compromised and requires focused attention to reestablish.^[60,61]

CONCLUSIONS AND RECOMMENDATIONS

OM is the accumulation of employees' knowledge and experience. It is the means through which an organization ensures that its historical knowledge, experience, and expertise are retained to support its future. While snippets of it may be captured for future use in databases, processes, and procedures, the richness of the knowledge is only realized in ensuring employees are provided with opportunities to share and discuss their personal knowledge. Focusing just on structure, like databases and processes, means we miss the activity happening between people. Leadership is required to ensure focus on its importance to the organization and to create a culture that values knowledge sharing. Management is required to ensure opportunities for sharing and learning are supported. Careful consideration is required to determine what should be remembered and retained for consistency and competitiveness versus what should be strategically forgotten to allow room for innovation and adaptability. Failure to consider this strategically may result in inaccurate remembering or loss of cultural knowledge when employees leave.

By building up knowledge sharing networks among staff, organizations are not just able to share information, but it becomes second nature when there is a need. This conclusion is supported by a 2006 study by Scalzo looking at mid-sized financial services organizations with

approximately 2500 employees and that underwent radical change (a significant shift in values, behavior, and how the organization performs the work required to meet organizational need). Scalzo found that an organization can successfully manage the process in order to retain the wealth of information and knowledge that exists in the OM. The findings showed that the subject organization of this research study followed three key management practices throughout the entire change process (ongoing communications, senior management commitment, and planning) that enabled it to access, share, and retain its OM while undergoing radical change.^[62]

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Pacific Islands Association of Libraries and Archives (PIALA)

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Abstract

The Pacific Islands Association of Libraries and Archives (PIALA) is a voluntary association established within the islands of Micronesia in the Western Pacific Ocean. Officially created in 1991, it has grown to be a stable association of librarians and archivists, holding annual conferences on different islands, supporting training opportunities, encouraging awareness and fostering resource sharing among libraries, archives, museums, and related institutions in the Pacific Islands.

INTRODUCTION

The Pacific Islands Association of Libraries and Archives (PIALA) is a regional association established in 1991 within the islands of Micronesia in the Western Pacific Ocean. The islands include the United States (US) Territory of Guam, and the former U.S. Trust Territory entities of the Commonwealth of the Northern Mariana Islands (CNMI); the Federated States of Micronesia (FSM) comprising the states of Chuuk, Kosrae, Pohnpei and Yap; the Republic of the Marshall Islands; and the Republic of Palau. The goals of PIALA are to promote knowledge of the functions, resources, services, and needs of regional collections of information resources; to develop and promote programs for the extension and improvement of information literacy and services in the region; and to provide an ongoing forum for people working in libraries, as well as archives and museums.

Regional Context

Micronesia, meaning “tiny islands,” is composed of some 2200 volcanic and coral islands spread throughout 4,500,000 mi² of the vast Pacific Ocean (see Fig. 1).

Lying north of Australia, south of Japan, east of the Philippines, and west of Hawaii, these tropical islands cover an expanse of water almost as large as the mainland United States, yet the total landmass is less than 1200 mi², with a total population estimated at no more than 300,000 inhabitants.

The region has a history of foreign involvement dating back to 1521 when Fernando Magellan, sailing for Spain, landed on the island of Guam. Throughout the next several hundreds of years, the Micronesian islands have been at various times under Spanish, German, Japanese, Australian, British, New Zealand, and United States rule. After World War II, with the exceptions of Guam, Kiribati, and Nauru, all the islands were designated by the United Nations as a Trust Territory to be administered by the

United States with the eventual goal of each achieving some type of self-government. Over the past 50 years, these U.S. affiliated islands have grouped together into five separate political entities (with one entity, the FSM, comprising four separate states). These political entities are reflected in the composition of PIALA. Although Kiribati and Nauru are geographically considered part of Micronesia, they were not included when establishing PIALA. Recently, representatives from the *Kiribati Library and Information Network (KLIN)*, the local Kiribati library association, have participated in PIALA conferences.

HISTORICAL BACKGROUND

The seeds for regional cooperation that grew into a regional association go back to the early days of the Trust Territory of the Pacific Islands administration and the work of Daniel Peacock, Director for Library Services for the Trust Territory. Through his efforts, Peacock established the foundation from which PIALA could emerge. In his insightful article, “Micronesian Library Services,” Nicholas Goetzfridt^[1] provides a context for understanding Micronesian library development and the significant role Peacock played in fostering this development.

In 1967, when the Trust Territory became eligible for the *Library Services and Construction Act (LSCA)* funds, Peacock wrote both the 1967, and later the 1972 state plans, providing funding for library projects in the region. Very early on, Peacock saw the need for regional networking and “The 1972 state plan called for increased bibliographic cooperation between the Trust Territory and ‘the libraries of the neighboring Pacific area.’”^[2] This is further discussed under the section “Resource Sharing” in this entry.

The 1978 *Commonwealth of the Northern Mariana Islands Pre-White House Governor’s Conference on Library and Information Services*, held on Saipan, was a first attempt to bring regional librarians together, although

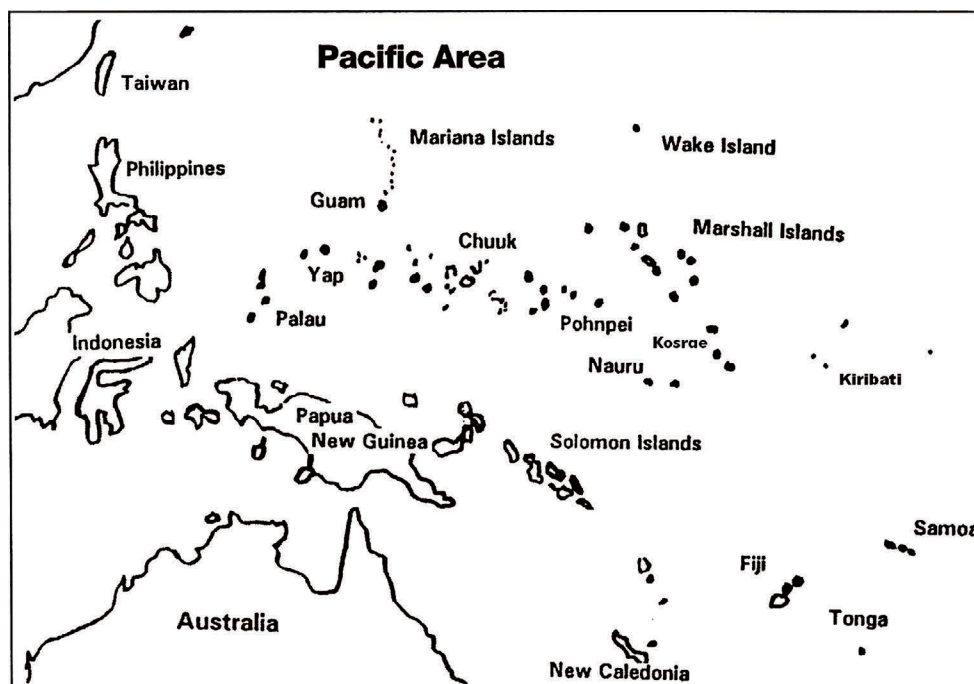


Fig. 1 Map of the Pacific Area. Created by Joanne T. Crotts.

Source: From *Developing library and information services in Micronesia*, by A. Cohen, J.T. Crotts, I. Lovas, In *Libraries: Global Reach/Local Touch*, de la Pena Cook, K., Ford, B.J., Lippincott, K., Eds., American Library Association, Chicago, IL. 1998, 58. Revised for this entry by the author (Arlene Cohen) with permission of the creator.

no formal organization emerged from this gathering. Twelve years later, the 1990 *Commonwealth of the Northern Mariana Islands Pre-White House Governor's Conference on Library and Information Services*, held again in Saipan in October of that year, finally provided the impetus for the establishment of a regional association. Several participants and observers from outside CNMI were invited to attend and during the conference, an informal meeting was held to discuss establishing a regional library association. Minutes of the meeting were taken and the group called themselves the *Western Pacific Library and Archives Association*.

The 1990 *Guam Pre-White House Governor's Conference on Library and Information Services* was held the following month and the group met again informally in Guam. During this meeting, funding from the U.S. government was identified to hold an organizational meeting at the University of Guam in February 1991. With funding secured, two participants each from the Federated States of Micronesia, the Republic of Palau, the Republic of the Marshall Islands, the Commonwealth of the Northern Marianas Islands, and the Territory of Guam were invited to the organization meeting. At that meeting, a set of *By-Laws* was adopted, the Executive Board was elected and Palau was selected as the site of the first conference, planned for November 1991.

Soon after the organizational meeting, Margo Vitarelli, a prominent artist and educator in Micronesia designed the

letterhead of PIALA using Micronesian art motifs. Her design is still being used today, incorporated into the *PIALA Newsletter*, announcements, brochures, and other publications.

Thus, PIALA was born. From the onset, people working in museums have been an integral part of PIALA. In 1991, at the first PIALA general meeting in Palau, there was an attempt to change the name of the association to the *Pacific Islands Association of Libraries, Archives and Museums* (PIALAM); however, the attempt failed and the name has remained PIALA.

Throughout the years, several publications about PIALA have appeared, many of which are listed at the end of this entry. One article worth noting came about during Barbara J. Ford's term as President (1997–1998) of the American Library Association (ALA). Under her leadership, *Libraries: Global Reach/Local Touch* was published, and includes a detailed description of the development of PIALA in the chapter on library services in Micronesia.^[3]

In 1996, PIALA began submitting information to the Belgium-based *Union of International Organizations* (<http://www.uia.be/>), with updates submitted yearly.

As PIALA evolved, so did the materials documenting the association. Serving as a model for the importance of preserving historical materials, the permanent collection of PIALA archives was established and are housed in the Pacific Collection of the College of Micronesia—FSM

National Campus Learning Resources Center in Palikir, Pohnpei, Federated States of Micronesia.

GOVERNANCE

The *Pacific Islands Association of Libraries and Archives By-Laws* were adopted on February 28, 1991. Interestingly, the *PIALA Constitution* was not drafted until 1993, reflecting what was already in the *By-Laws*.

The original *By-Laws* included the purpose, duties of officers, composition of the Executive Board, voting, the committee structure, and dues. The group also decided that the venue of the annual meeting (including the annual conference) would rotate among all locations represented. By having the meetings on different islands, local librarians and archivists with little possibility to travel would have the opportunity to plan and attend a professional conference. Moreover, hosting a conference would also provide an excellent advocacy opportunity, focusing attention on the island's libraries, archives, and museums.

Purpose

The purpose of PIALA, as established in the *By-Laws* in Article II, Section A is

- a. to foster awareness and encourage cooperation and resource sharing among the libraries, archives, museums, and related institutions of the Pacific Islands;
- b. to promote knowledge of the functions, resources, services, and needs of regional collections;
- c. to develop and promote programs for the extension and improvement of library, archival, museum, and related services in the region;
- d. to improve a forum for discussing issues of interest to libraries, archives, museums and related institutions;
- e. to provide a vehicle for the exchange of ideas and information to librarians, archivists, museum curators and related personnel; and
- f. to offer continuing education experiences for library, archival, museum, and related personnel.^[4]

By-Law changes

Although the purpose of PIALA has not changed over the years; other parts of the *By-Laws* have changed to reflect the development and changing needs of PIALA.

When PIALA was established, the *By-Laws* stated that "The Executive Board shall consist of the officers, shall represent all locations, and have no fewer than five members. Locations not represented by officers shall elect a representative."^[5] Over time, the island states of Chuuk, Kosrae, Pohnpei, and Yap were considered locations in their own right and subsequently the *By-Laws* were changed to expand the Executive Board to no fewer than

nine members. Other important changes included dropping the office of Executive Secretary; allowing all members to vote, including institutional members, instead of just individual members; voting at the annual meeting instead of by mail; and accepting proxy votes. Attesting to the stability of PIALA's governance structure, the last time the *By-Laws* were changed was November 1996.

PIALA Board Meetings

Soon after PIALA was established, the Executive Board attempted, with varying degrees of success, to hold monthly meetings and this effort continues. The PEACESAT (Pan-Pacific Education and Communication Experiments by Satellite) federally funded satellite network has been used since the beginning and remains the most economical means of voice communication. PEACESAT stations are on the major Micronesian islands; however, the system has limited channels, tight schedules, and frequent breakdowns, with few spare parts available locally and limited local expertise to carry out the repairs.

In 2007, an attempt to conduct PIALA Board meetings using an online collaboration and conferencing system was tested. After several unsuccessful attempts to bring the group online, it was abandoned. It became clear that any new communication system, no matter how extensive the documentation is, must be accompanied by hands-on, onsite training for most users.

Happily, in the past few years with e-mail becoming more widely available and less costly, much of the work of the PIALA Executive Board is handled this way, with monthly scheduled PEACESAT meetings held whenever possible.

FINANCIAL ORGANIZATION

When PIALA was established, a bank account was set up in the Commonwealth of the Northern Mariana Islands. A few years later, this became the PIALA Publications account and another account was set up for general income and expenses. There is usually an account also set up on the island where the conference will be held, sometimes in conjunction with the establishment of the local library association. These arrangements have worked well throughout the years. However, with the retirement of the author from the University of Guam, the PIALA Publications account has been closed.

Although not part of the *By-Laws*, to facilitate the planning of the annual conference, PIALA provides \$500 as seed money to the island entity hosting the conference. Conference registration fees become part of the PIALA treasury, although any pre- or postconference fees remain with the hosting island.

MEMBERSHIP

PIALA members are divided into two categories: individual and institutional or corporate members. The membership fee was established with the founding of PIALA and to date, has never been increased. The fee for an individual member is \$20 per year, and institutional or corporate membership is \$50 per year.

Membership is not restricted to PIALA's geographical boundaries. In December 2007, PIALA had 63 currently paid members representing Micronesia, several other Pacific Islands and Hawaii. In the past, people have joined PIALA from Australia, New Zealand, the Philippines, Japan, Canada, Finland, Sweden, the United Kingdom, and the continental United States; however, it is difficult to collect membership fees on an ongoing basis. They are usually paid at the annual meeting. Many people from outside of Micronesia who have attended a PIALA Conference usually join at that time, but do not keep up their membership in succeeding years.

COMMUNICATIONS LINKS AND PUBLIC RELATIONS

Given the vast geographic area covered by PIALA, coupled with the reality of costly and unreliable telecommunication systems, one of the biggest challenges is maintaining membership and communication links within the PIALA and promoting the association throughout the world. PIALA uses several methods to communicate, as described below.

PIALA Newsletter

The *PIALA Newsletter* was born soon after PIALA was established, with the first issue published in June 1991. When first launched, it was hoped that the newsletter would be published quarterly. Although the publication has continued throughout the years, being a volunteer effort has made for an irregular publication pattern. All issues ever published appear on the PIALA WWW site (<http://piala.org.googlepages.com/newsletter>) (accessed September 2008).

As many parts of the world still have inadequate, costly, slow, and unreliable Internet access, paper copies of the *PIALA Newsletter* are mailed to all individuals and institutions that are or have been members in the recent past, or have participated in an annual conference. PIALA maintains a distribution list used for mailing the *PIALA Newsletter* throughout the region and the world. This has been an important way to keep people involved in the association, even if they may not have recently paid dues. As of October 2007, we had 393 addresses on our list. Although the last issue of the PIALA Newsletter was published in 2005, it is hoped future issues will appear.

PIALA Web page

The first PIALA Web page appeared in 1995 and was the result of the collaborative efforts of the author and Tom C. Gerhardt, an information scientist with an interest in the Pacific at Saarland University and State Library in Saarbrücken, Germany. The site was hosted on a server at Saarland University and remained there for several years. In 1998, the University of Guam offered to host the www page and it continued to reside on their server until early in 2008, when it was moved to (<http://piala.org.googlepages.com/>) (accessed September 2008).

PIALA Listserv

In 2000, an electronic mailing list for PIALA was established on the University of Guam Robert F. Kennedy Library server. A few years later, the list was moved to a server at the Secretariat of the Pacific Community in Noumea, New Caledonia, where it currently resides. This is an open list and anyone with an interest in PIALA or Pacific Island libraries, archives or museums may subscribe to it. As of the beginning of 2008, there were 132 subscribers and the number of messages posted varies between 15 and 50 per month. [Anyone with an interest in PIALA or the Pacific Islands can subscribe to the PIALA list at http://lists.spc.int/mailman/listinfo/piala_lists.spc.int (accessed September 2008). The PIALA list archives beginning from 2001 are available for public access at <http://lyris.spc.int/read/?forum=piala> (accessed September 2008). Archives beginning in August 2006 are also available at http://lists.spc.int/pipermail/piala_lists.spc.int/ (accessed September 2008).]

PIALA Proceedings

Beginning with the PIALA 1993 Conference held in Saipan, Commonwealth of the Northern Mariana Islands, the proceedings of most conferences have been published, with some exceptions. The PIALA 1999 Conference proceedings were never published, the PIALA 2001 Conference was cancelled, and the PIALA 2002 and PIALA 2003 Conference proceeding were not published as well. The PIALA 2004 and PIALA 2005 Conference proceedings were published as one volume, and the proceedings for the PIALA 2006 and PIALA 2007 Conferences are still in process.

Once published, the volume is submitted to ERIC (Educational Resources Information Center) in the United States and is available online in full text from the ERIC www site (<http://www.eric.ed.gov/>) (accessed September 2008), as well as the PIALA www page (<http://piala.org.googlepages.com/proceedings>) (accessed September 2008). They are also deposited with the United States Library of Congress and have ISBN numbers assigned.

One complimentary copy of each edition of the proceedings is deposited in every public and academic library throughout Micronesia. A complimentary copy is also given to each contributor included in the publication. They are also sold worldwide and the money received from the sale has been used to publish succeeding volumes. In the future, it appears that all new editions will be available only electronically, at no cost.

PIALA CONFERENCES

The traditional *bai* (a traditional Palauan men's hut or council house) on the grounds of the Belau National Museum was the venue of PIALA's first conference held in November 1991, with the theme *Preserving Knowledge for Tomorrow*. Over 40 participants from throughout Micronesia, Fiji, Hawaii, and the mainland United States gathered in the *bai* to hear presentations on resource sharing, preservation techniques for the tropics, serials and government documents, continuing education, and electronic telecommunications (see Fig. 2).

With each year, this eagerly awaited conference moves to another island with a new theme, and a continually growing number of local librarians and archivists participating and appearing on the conference program. Although the same general areas from the first gathering still are discussed, each year new topics are added to reflect the changing landscape of the field and new areas of interest.

A keynote speaker is selected for each conference. One memorable keynote speech was given by Norma Amenu-Kpodo, the Executive Secretary of the *Commonwealth Library Association*, coming all the way from the island of Jamaica for the PIALA 2000 Conference in Guam. She presented *Library Associations in Developing Countries: the Caribbean Islands as a Point of Comparison with*

Micronesia,^[6] conveying in her paper that no matter where in the world your library association resides, we all face an array of the same problems. At the PIALA 1995 Conference in Yap, Dr. Marcia Bates from the University of California at Los Angeles presented another important keynote speech, "*Learning About Your Users' Information Needs: A Key to Effective Service*."^[7]

In 1996, at the Marshall Islands PIALA Conference in Majuro, the first PIALA resolution was passed,^[8] addressing the need for cost-effective high performance Internet access to libraries and archives. In passing this resolution, the association took on an important advocacy role in fostering library development and information access in the region.

In addition to providing an opportunity to experience a professional conference for many who do not have the opportunity to travel, the PIALA conferences have served to promote libraries and library services to the host island communities. Local government officials are always invited to the opening session in hopes that they show their support for local libraries, and are encouraged to speak on behalf of their government, with their remarks being included in the *PIALA Proceedings*. Local newspapers usually report the event, along with local radio and television coverage. Usually banners announcing the conference appear at the airport to welcome participants and decorate the conference venue.

PIALA conferences are also used to exchange local resources. Local telephone books and college catalogs are among the most popular materials exchanged. There is also a time set aside for each island group to report on their activities during the year, providing for the exchange of new ideas between participants. Tours of local libraries, archives, and museums are always a part of the conference, providing local hosts the opportunity to proudly spotlight their facilities and for participants to become familiar with the islands' resources.



Fig. 2 Participants sitting in the Belau National Museum's traditional *bai* during a session at the first PIALA conference. Photograph by Arlene Cohen (the author).

Depending on the venue, the conference draws between 50 and 75 people, with about 40–50% of the participants representing the local island hosting the conference. Conference registration fees are usually determined by the local organizers, as well as pre- and postconference workshop fees. To promote the conference and raise local funds, PIALA T-shirts are usually sold during the conference.

Because conferences are planned by people on the hosting island, PIALA conferences have at times spurred the establishment or reawakening of local library associations. After PIALA met on Palau in 1991, the local librarians established the *Palau Library Association*. Soon after the 1992 conference, the Marshall Islands also established their own local library association. A library association was formed in Yap prior to the 1995 annual conference held there. Although Pohnpei has hosted PIALA Conferences from the beginning, it was in 2006 that the *Libraries, Archives, and Museums of Pohnpei (LAMP) Library Association* began to meet informally. The *By-Laws* and a charter are currently in draft form, almost ready to be formalized by the membership. Chuuk and Kosrae began working to revitalizing their library associations soon after the *Library Advocacy Workshop* held at the PIALA 2006 Conference in Palau. The *Guam Library Association* had been active for several years before PIALA was established and took an active part in the PIALA 1994 and PIALA 2000 Conferences held in Guam.

A *Chronology of PIALA Conferences* was published in the 2004/2005 *Proceedings*, including the conference theme, date, and conference venue.^[9]

ADVOCACY

As in many parts of the world, Pacific Islands government officials, educators, and the public generally do not appreciate the role and value of libraries in our society. Given this reality, library associations must take an active role in influencing government decisions in such areas as basic funding for libraries, new emerging areas of information literacy, copyright, indigenous knowledge, training, and telecommunications technology. However, to have any impact, library association leaders must understand the role of library associations as pressure groups for political action and policy decisions, and must have the requisite skills in policy development and implementation, building effective advocacy campaigns and public relations.

To address this advocacy training need, at the PIALA 1997 Conference in Pohnpei, a postconference workshop on library advocacy was presented by Tuula Haavisto, then the Finnish Library Association Director General. The workshop was funded by the *International Federation of Library Associations and Federations (IFLA) Advancement of Librarianship in the Third World Programme* and brought local librarians from throughout Micronesia to Pohnpei. At the PIALA 1998 Conference in Kosrae the

following year, several participants reported on their advocacy projects.

Several years later in 2005, another library advocacy workshop was proposed and funding was again obtained from the *IFLA Advancement of Librarianship in the Third World Programme*, as well as the *IFLA Management of Library Associations Section (MLAS)* and the ALA. At the PIALA 2006 Conference in Palau, the library advocacy workshop was held as a preconference and was presented by Keith Michael Fiels, the ALA Executive Director and Michael Dowling, the ALA International Relations Office Director.^[10] This workshop also brought library association leaders from throughout Micronesia, as well as Papua New Guinea and Kiribati.

At the Palau advocacy workshop, the participants prioritized issues ripe for advocacy, which reflect the pressing needs in the region. Those areas were

“Increased government funding for library materials and technology
Funding and resources for school libraries and librarians
Need for national libraries and archives
Extension of services for un-served regions and islands and
Increase public awareness of value and benefit of libraries.”^[11]

Participants created action plans for their islands and the following year, presented reports of their work at the PIALA 2007 Conference in Tinian. Most recently, stemming from the Palau advocacy workshop and the subsequent Tinian reports, Atarino Helieisar presented a paper on library advocacy in Micronesia at the 74th IFLA Conference in Quebec, Canada. <http://www.ifla.org/IV/ifla74/papers/093-Helieisar-en.pdf> (accessed September 2008).

Moreover, as a result of the advocacy training, several islands were able to obtain funding for projects, and local library associations in Chuuk, Yap, and Kosrae were refreshed.

Thanks to PIALA, librarians throughout the region are aware of each other's needs, issues, and challenges, and help to advocate for each other. Recently, a librarian from Guam worked to establish a school library in Kapingamarangi, an isolated atoll in the Federated States of Micronesia. In another instance, a terrible typhoon in 2004 completely devastated the Yap State Public Library and the Yap State Hospital Medical Library in the Federated States of Micronesia. The author of this entry, working with another Guam librarian wrote successful grants to help reestablish these libraries.

TRAINING INITIATIVES

The region faces a serious lack of professionally trained librarians, archivists, and museum curators. In a plea made

by Jean Thoulag, Vice-President for Institutional Affairs at the College of Micronesia—FSM at the PIALA 2005 Conference in Kosrae, she said, “Please let us in PIALA and those of you from these [Pacific] institutions work together to find practical and affordable solutions to address the critical need for staff development training in the region.”^[12]

Currently, there is only one active library skills training program in Micronesia at Palau Community College. The only one certificate/diploma program in the rest of the Pacific Islands is provided through the University of the South Pacific. In the recent past, there was an undergraduate School Librarianship program at the University of Guam, however, due to lack of university support, it is now defunct. The closest campus offering a Master in Library Science is the University of Hawaii.

Beginning in 1994, PIALA began to actively address this critical problem by providing the first preconference 2 day workshop on collection development for small libraries, given by Dr. Harry Uyehara, a noted librarian in Guam. In 1995, another pre-conference workshop was presented by two noted archivists, Karin Brennan from the University of New South Wales in Sydney, Australia and John C. Wright from Honolulu, Hawaii. The 2 day workshop dealt with the practical care of books, preservation, and disaster preparedness and recovery. At the following year’s conference, both pre- and postconference workshops were presented and now are an integral part of all PIALA conferences, covering a wide range of topics.

Although these PIALA pre- and postconference workshops attempt to fill a gap, there still remains the serious lack of opportunities for education and training leading up to a credential or professional degree.

RESOURCE SHARING

One of the purposes stated in PIALA’s *By-Laws* is “To foster awareness and encourage cooperation and resource sharing.”^[4] In a 1998 paper, the authors observed that “perhaps the most important impact of PIALA has been the increase of networking and resource sharing among the members.”^[13] However, before one can do resource sharing, one must know who is out there and what they have. Given the geographical vastness and lack of easy communications, when PIALA was established, very few in the Pacific Islands knew who was out there and what resources were where.

To address this critical need, one of the first projects PIALA undertook was compiling a list of regional libraries and in 1993, the *Directory of Libraries, Archives, and Museums in Micronesia*^[14] was published. This was the first comprehensive regional directory ever done. Subsequently, in 2003, the content became part of a bigger online project undertaken by the National Library of Australia, *Libraries of Asia and the Pacific Directory*<http://www.nla.gov.au/lap> (accessed September 2008). The online resource allows libraries to update and amend their own entries whenever needed. However, since many Pacific Islands do not have reliable, or in some cases, any Internet access, a print edition^[15] was published, funded by IFLA from a grant submitted by PIALA, in cooperation with the National Library of Australia and the Secretariat of the Pacific Community.

The first attempt to compile a regional union catalog came about with the help of Daniel Peacock’s LSCA funds when a bibliography of reports, surveys, and studies dealing with the Trust Territory was compiled and published.^[16] Throughout the ensuing years, there were scattered lists of serial holdings throughout the region. The first attempt to draw these serials holdings together was in 1997 with the publication of the *Union List of Serials in Libraries in Guam and Micronesia*.^[17] The collection of content for this publication was done with the support of PIALA members realizing the value of a union list for resource sharing. The latest edition published in 2002 and titled the *Union List of Serials in Pacific Islands Libraries*^[18] was expanded and now contains the holdings of both the University of the South Pacific Library in Suva, Fiji, and the Secretariat of the Pacific Community Library.

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LIBRARY ASSOCIATION LINKAGES OUTSIDE OF MICRONESIA

As Goetzfridt wrote when referring to meeting the needs of the public, “the Pacific Islands Association of Libraries and Archives (PIALA) established an organizational paradigm of unity for Micronesia.”^[19] As PIALA has matured that unity has expanded to include other library associations both inside and outside the Pacific Islands working toward meeting those needs, as discussed below.

International Federation of Library Associations and Institutions

In 1996, PIALA was first represented at the IFLA Conference in Beijing, China^[20] and the following year, the author of this entry was elected as the PIALA representative to sit on the *IFLA Roundtable for the Management of Library Associations* (RTMLA), which later became MLAS. In 1998, the author became the RTMLA (then MLAS) Secretary and continued in that position until 2005.

In 2004, PIALA nominated Mark Perkins from New Caledonia to stand for election to the *Regional Standing Committee for Asia and Oceania*. He was elected with his term beginning in 2005. Then, in 2006, PIALA nominated three members to stand for election to IFLA Standing Committees and all were elected. Tamina Noddy from Papua New Guinea became a member of the *Management of Library Associations Standing Committee*; Libby Cass from Fiji was elected to the *Regional Standing Committee*

for Asia and Oceania; and Mark Perkins was elected to the *Free Access to Information and Freedom of Expression Committee*, each with terms beginning in August 2007.

Throughout the years, PIALA has applied for and received several grants from IFLA for publications, workshops and attendance at both PIALA and IFLA conferences.

Swedish Library Association

For several years, PIALA's IFLA membership was supported by the *Swedish Library Association*, under the visionary leadership of their Secretary General Christina Stenberg. She hoped this would serve as a model within IFLA for library associations in developed countries to encourage library associations in developing areas to engage with IFLA. This arrangement allowed PIALA members to see the benefits of IFLA membership before the major financial decision to join IFLA was made by PIALA. In 2001, PIALA voted to become a self-supporting member of IFLA and has maintained their membership since.

Moreover, without the additional financial support of the *Swedish Library Association*, PIALA's participation in the *RTMLA* and later the *MLAS* meetings between 2000 and 2004 would not have been possible. This too was part of the *Swedish Library Association's* effort to model library associations in developed countries supporting the participation of officers on IFLA Sections from developing areas.

Hawaii Library Association

Throughout the years, participants from Hawaii have attended and participated in PIALA conferences, conducting workshops, presenting papers, and providing support.

In 1998, inspired by the *America Library Association* President Barbara Ford's theme *Global Reach, Local Touch*, the *Hawaii Library Association (HLA)* and the *Pacific Islands Association of Libraries and Archives* formed an international partnership. This relationship was formalized in a resolution passed on November 2, 1998 by the *HLA* Executive Board, followed by another resolution passed by the PIALA Executive Board on November 19, 1998. The ALA Chapter Relations Office was informed of the partnership and the resolutions appear on the PIALA www page <http://piala.org.googlepages.com/history> (accessed September 2008).

American Library Association

Although individual PIALA members were involved with ALA throughout the years, it was not until 2005 that ALA became actively involved with PIALA. At that time, ALA took on a leadership role in the *IFLA Management of Library Associations Section* and funded the author's

participation as Secretary of the section at the 2005 meetings, much as was previously done by the *Swedish Library Association*.

Soon after, thanks to funding from IFLA and ALA, the *2006 Library Advocacy Workshop*, described elsewhere in this entry, was a pivotal event in bringing ALA to the Pacific Islands. Stemming from that involvement, in 2007, when judging was over for ALA's *Outstanding Reference Books* competition, ALA donated many of the reference books to the Palau Community College Library. Hopefully, this relationship will continue to the benefit of both associations.

Fiji Library Association

Several *Fiji Library Association* members have participated and presented papers at PIALA Conferences throughout the years. Recently, PIALA and the *Fiji Library Association* worked together to request the *Australian Library and Information Association* to develop a sponsorship program for Pacific Island librarians to attend the 2010 IFLA Conference in Brisbane, Australia.

OTHER LINKAGES

To foster greater unity between library associations, PIALA representatives have participated in many library conferences throughout the world. In addition to the many IFLA, HLA and ALA conferences where PIALA has participated as early as 1994, PIALA participated in the 1994 joint *New Zealand Library and Information Association and the Australia Library and Information Association Conference* in Wellington, New Zealand. PIALA also participated in both the *8th Interlending & Document Supply Conference* in 2003 in Canberra, Australia and the *10th Interlending and Document Supply Conference* in 2007 in Singapore.

Most recently, PIALA was invited to participate in the *11th Aboriginal and Torres Strait Islander Library Information and Resource Network (ATSILIRN) Conference* in Darwin Northern Territory, Australia in 2008. These events each broaden the network and increase awareness of PIALA and the issues faced in Micronesian libraries.

Pacific Resources for Education and Learning

Pacific Resources for Educational and Learning (PREL), an independent, nonprofit agency based in Honolulu and serving the educational communities in Micronesia, has been supportive of PIALA for many years. In 2000, PREL funded a librarian from the Solomon Islands to present a paper about the Forum Fisheries Agency Library at the PIALA 2000 Conference in Guam.^[21] Throughout the years, PREL representatives have attended PIALA conferences and presented papers and workshops.

In the past several years, PREL has funded several training initiatives for librarians in the region. Most recently, a successful 3 day workshop on disaster preparedness, response and recovery was held in conjunction with the PIALA 2007 Conference in Tinian, Commonwealth of the Northern Mariana Islands. This workshop was the first to be presented with funding from a 3 year United States Institute of Museums and Library Services grant entitled *Leaders for Pacific Libraries*. The grant included three, 3 day subject-specific workshops held in conjunction with PIALA annual conferences, providing the opportunity for workshop participants to attend the PIALA Conference, as well.

OTHER NOTABLE EVENTS

The PIALA Lifetime Achievement Award

The PIALA Lifetime Achievement Award was created by a resolution passed by the PIALA Executive Board 1997 at the annual meeting in Pohnpei. This award was designed to “honor librarians and lay persons who have made a substantial and integral contribution to libraries and librarianship in the Western Pacific.”^[22]

In 1998, the award was first bestowed on Daniel J. Peacock, former Director of Library Services for the Trust Territory of the Pacific Islands. In 2006, Dr. Karen Peacock, the University of Hawaii Library Head of Special Collections and Pacific Collection Curator was the second recipient of the award. Most recently in 2007, the author, who was then the University of Guam Robert F. Kennedy Memorial Library Circulation and Interlibrary Loan Librarian, was presented the award.

Florence Nalezny Warpeha Memorial Books to Micronesian Libraries

The PIALA 1997 Conference in Pohnpei saw the beginning of the *Florence Nalezny Warpeha Memorial Books to Micronesian Libraries*. Every year, Rita Warpeha, formerly a librarian at the Pohnpei Public Library, would donate a selection of Micronesian and Pacific Island-related natural science children's books in memory of her mother. The donations continued until 2003 and the books found homes in local libraries on the island hosting the annual conference.

Dakio Syne Memorial

Dakio Syne, the Director of the College of Micronesia—FSM Learning Resources tragically passed away in 2002. He was a founding member of PIALA and PIALA's first President, as well as the first Micronesian to earn a master's degree in library science in 1976 from New York University. In his honor, the *Dakio Syne Memorial Fund*

was set up to help fund a Micronesian librarian's first attendance to PIALA. Also, PIALA supported the publication of a book memorializing him and his work.^[23]

CONCLUSION

The Pacific Islands Association of Libraries and Archives was established 17 years ago as a voluntary association of dedicated people sharing many hopes and challenges. Yvan Souares, a Pacific Islands epidemiologist summed up well the challenges when he wrote,

“These islands are scattered over 30 million square kilometers of the Pacific, an area almost four times that of Australia. Ninety-eight percent of that area is water, leaving a total land area only half that of the Northern Territory of Australia. For seven million Pacific people, the development of human networks in these conditions is both a challenge and a prerequisite to socio-economic development.”^[24]

Although he was writing about health care workers throughout the entire Pacific, these human networks are just as profoundly important to people working in libraries, archives, museums within Micronesia. With the establishment and growth of PIALA, in the face of the major economic, communication, and training challenges, the human networks are alive and thriving, expanding borders to throughout the Pacific Islands. As these networks continue to grow, we all benefit in access to the information and resources needed for socioeconomic development and personal well-being.

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Papyrology

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Abstract

Papyrology is the science of preserving, reading, and interpreting ancient texts written on papyrus. It includes texts written on other materials using ink. The majority of preserved papyri come from the first millennium B.C. and the first millennium A.D.; most are in Greek, but many texts in Egyptian and other languages also survive. They contribute to our knowledge of ancient literature and books, as well as practically every aspect of ancient history, including especially social, economic, and cultural history.

INTRODUCTION

Papyrology is the science of preserving, reading, and interpreting ancient texts written on papyrus. The field historically dealt particularly with those papyri written in Greek or Latin; those in other languages were often considered part of the domains of Egyptology and Semitic studies, but papyrology has increasingly included a wider range of languages and materials; studies of papyri in Demotic Egyptian, Coptic, and Arabic are now active parts of the discipline. This entry explains what papyrus is, how it was used in ancient times and is treated today, how the discipline of papyrology works with papyri and other ancient textual supports, where papyri are published, and what contributions the work of papyrologists has made to the study of literature, history, and language.

THE PLANT AND THE PAPER

The writing material is made from the fibers of the reed *Cyperus papyrus*; strips are cut from the stalks, laid side by side, first in one direction and then on top of these at a right angle. They are pressed together so that the natural juices of the plant flow, acting as a binding agent. After drying, the resultant pieces provide a smooth, flexible, light-colored, and durable writing surface. Typically, a number of such pieces would be glued end to end (with small overlaps) to make a roll, which was the standard form of papyrus for commerce and book production. For documents of smaller than roll size, pieces would then be cut from the roll to the desired dimensions.

Paper from papyrus was manufactured by the Egyptians as early as the fourth millennium B.C.; for various reasons (partly the circumstances of preservation), the papyri that have survived to modern times come largely from the first millennium B.C. and the first millennium of the present era, although there are some notable earlier literary, documentary, and funerary texts in Egyptian.

Papyrus came to be used less and less after the Byzantine period, for reasons that are not fully understood (see “Contributions of Papyri: Literature,” subsection “History of the Book”). Whether as cause or effect, the papyrus swamps in Egypt, which were the source of the raw material of the paper industry, gradually silted up and disappeared from Egypt so that the plant is now found growing wild only in an area 500 miles up the Nile in Ethiopia. It has been reintroduced in Egypt and elsewhere in modern times.

Papyrologists also deal with texts written on certain other materials: potsherds (*ostraka*), wood, waxed tablets, leather rolls, and parchment. Writing on stone and metal, on the other hand, is considered to belong to the province of epigraphy. The division between the two disciplines is sometimes indistinct.

THE REDISCOVERY OF PAPYRI

Although a certain number of papyri continued to be preserved in archives in Europe through the Medieval Period, the Western world lost awareness of papyri during this period, and not until the eighteenth century did papyri come back to the attention of Europe. In Herculaneum, in 1752, a villa was found in which numerous carbonized rolls of papyrus from a private philosophical library were preserved. When to the difficulty of unrolling the brittle texts was added the disappointment of the literary world at the failure of the rolls to contain famous lost works of literature, the papyri of Herculaneum receded from the public view. (The study of these papyri, mainly works of the Epicurean philosopher Philodemus, has had a notable resurgence in the last 30 years.) No less disappointing to scholars of the time was a papyrus roll brought back from Egypt in 1778 that turned out to be an account of laborers on irrigation works rather than a lost play of Sophocles or some such.

It was not until the middle of the next century that a few sizable collections of papyri in Europe were formed

and published, notably those of London, Leiden, Paris, and Turin. Then in the last quarter of the nineteenth century, numerous finds were made and a vast expansion of papyrus collections in Egypt, Europe, and North America was underway. Over the next 60 years, hundreds of thousands of texts, often fragmentary, were found, both literary and documentary, from organized or clandestine excavations. The largest number of papyri comes from Middle Egypt, particularly Oxyrhynchus (modern Bahnasa) and the Fayûm, a low-lying area to the southwest of Cairo, but other finds have ranged from the Nubian frontier in the northern Sudan to the Delta. Few papyri, however, have been excavated in the Delta and other regularly irrigated areas, because of the destructive effects of water on papyrus; desert areas (especially tombs) and once-cultivated but now dry regions have been the most productive. From Alexandria, the capital, we have only a small number of texts found in other areas (sometimes sent there as waste paper for wrapping mummies—cartonnage, as it is called).

Outside Egypt, significant finds of papyri have been made at Dura-Europos and elsewhere in the Euphrates valley in Syria (mostly from the third century of our era), from Nessana in the Negev (late Byzantine period), in the area of the Dead Sea, at Petra (Jordan, also Byzantine), and in Italy the carbonized papyri of Herculaneum already mentioned. A very early carbonized roll (fourth century B.C.) was found in a tomb at Derveni in Macedonia. Unsuitable climatic conditions have caused papyri to be destroyed in most areas, but more finds may yet be made in countries with desert regions similar to Egypt. Ostraka are found more widely, from North Africa to Iran, and parchment documents have been found from late antique Bactria and other parts of the Near East and Central Asia. Wooden tablets with ink texts have been excavated in England, at the Roman military camp at Vindolanda, where anaerobic conditions preserved them.

COLLECTIONS OF PAPYRI

There is no full census of collections and their contents available, for papyri are usually made known only when published in full, and the process of publication is slow. The largest collection is probably the Oxyrhynchus papyri (in the Sackler Library, Oxford, from Grenfell and Hunt's excavations a century ago), not yet fully inventoried, the next that in the National Library in Vienna, formed by the Archduke Rainer by purchases 75 to 100 years ago; its total number of objects, in many languages, is around 180,000. There are many collections in Germany, with the largest in Berlin, and others in Heidelberg, Cologne, Munich, Freiburg, Jena, Leipzig, and Trier. The principal French collections are those in Paris, Strasbourg, and Lille; in Italy in Milan, Florence, and the Vatican; in England in London, Oxford, and Manchester; and in

Scandinavia at Oslo and Copenhagen. Egypt itself possesses one of the largest collections in the Egyptian Museum in Cairo and smaller ones in the Coptic Museum (Cairo) and Graeco-Roman Museum in Alexandria. In North America, the largest collection is at the University of Michigan, and smaller but important ones exist at Berkeley, Yale, Columbia, Duke, and Princeton. Still smaller but significant collections are at New York University, Washington University, Toronto, Pennsylvania, and others. Many American colleges have small groups of papyri distributed by the Egypt Exploration Fund in the early part of the century. There are also private collections in many countries, mostly small but occasionally (as with Martin Schøyen in Norway) quite large.

TREATMENT OF PAPYRI

Papyri are commonly in bad condition when found—torn, full of holes, wadded together, dirty, folded, and even charred. Relatively simple problems can be solved by humidifying the papyri and manipulating them in this condition, allowing them to dry only when clean and straightened. For cartonnage, a technique has been developed whereby a dilute solution of an enzyme is used to dissolve the adhesive between sheets within a few minutes. Papyri of any size are normally best preserved between thin sheets of glass, held together with clips or tape, although folded acid-free paper or blotting paper may be an acceptable short-term substitute for little-handled materials. Like other old paper materials, they benefit from storage out of the light and in controlled temperature and humidity conditions.

Various aids can be used in reading texts that are not clear to the naked eye: first, simple magnifiers, then if needed, more powerful microscopes. Photography by infrared or ultraviolet is sometimes helpful, and even conventional photography can on occasion, by long exposure time, make faint ink traces appear more clearly. Digital photography has largely displaced film; multispectral imaging allows more precise targeting of the wavelength of ink and sometimes the recovery of effaced or hidden ink.

RESEARCH AND RESEARCH FACILITIES

The beginning of the study of a treated papyrus is reading it. This is an easy or difficult task depending on the physical condition of the papyrus, the difficulty of the handwriting, the clarity or obscurity—and sometimes, the vulgarity—of the writer's language, the nature of the contents, and the skills of the reader. The papyrologist's task is not so much to read individual letters and words as to grasp the thought of the writer; once that is understood, the words can be read more easily. In a banal standardized document (e.g., a lease) this can often be very easy, while

a very individual, private letter may resist all attempts at understanding. The reading of a text is thus inseparable from the work of translation and commentary, which sets forth the editor's understanding of the text. In the commentary to a papyrus one finds an explanation of its general import and contribution to our knowledge, as well as a detailed examination of problems in the language or contents.

The publication of the annotated and translated text is only the start, however. Because of the many difficulties of reading and understanding papyri, few texts are so perfect when published as not to need correction. And a published text may give rise to extensive studies of its literary, historical, juristic, economic, or social implications: studies that often finish by correcting the texts.

To carry on the various stages of this work, the papyrologist needs good light, a magnifying glass, and sometimes a microscope, but above all, a complete collection of the already-published papyri of other collections. These volumes (see section on "Publication"), together with the special lexica, grammars, prosopographies, indices, and monographs in the field, form the indispensable working library of the papyrologist. In the course of a few hours work, one may consult dozens of volumes to check references to possible parallels to a phrase or an institution, and only the assembly of the requisite books in one place for easy consultation can make serious papyrological research possible; such studies have flourished only where special working libraries could be created. Particularly good collections in North America of this sort exist at Michigan, Columbia, Duke, Toronto, and Yale—not surprisingly, the places where actively worked collections are found. The Greek documentary texts on papyrus have been digitized in the Duke Databank of Documentary Papyri, allowing scholars to find words and names relatively easily, and the Heidelberger Gesamtverzeichnis der griechischen Papyrusurkunden Ägyptens provides a typological catalog useful in finding parallel texts. Similar tools for other languages are at various stages of development and completeness. Many papyri are available on the Web in digital images. But the full editions, with commentary, are still available almost entirely in book form. That limitation may be expected to be removed in time, making it far easier to conduct research in places far removed from major libraries.

PUBLICATION

All modern editions of papyri follow, in essentials, the form outlined above: introduction, text, translation, and line-by-line commentary. These texts are published primarily in volumes uniting many papyri from one collection, provenance, or archive. Publications by the place of finding include notably the *Oxyrhynchus Papyri* (now 70 volumes with over 4800 texts) and the *Tebtunis Papyri*

(5 volumes with over 1100 texts); specific archives are numerous, the largest being that of Zenon, an estate manager of the third century B.C., which is scattered in several collections and numbers around 2000. Other large collections published are the Michigan papyri, the collection of Florence, the Berlin papyri, and several series of volumes of Cairo papyri. Papyrologists have a standard set of abbreviations for these volumes (e.g., *P.Oxy.* = *The Oxyrhynchus Papyri*).

Many other texts are published for the first time in journals. These are periodically reprinted in the *Sammelbuch*, started by Fr. Preisigke, which indexes them as well. More than 20,000 texts (inscriptions as well as papyri) are printed and indexed in the 26 volumes that have appeared so far. Preisigke also started another publication that records, in more or less systematic fashion, conjectures and corrections to papyri and *ostraka*, scattered through the literature. More details on this and the other essential reference works of the subject are given in the bibliography.

CONTRIBUTIONS OF PAPYRI: LITERATURE

History of the Book

Papyri provide virtually all of our firsthand evidence about the form and character of ancient books. The usual form of the book was a roll of papyrus on which a succession of columns of writing was placed, so that the reader would start with the outer edge of the inside face, unrolling the papyrus as he went, rolling up again from the other side. (In Egyptian the texts on these rolls generally run from right to left, in Greek from left to right.) Practical considerations limited the amount that could be written on one roll, and the cumbersomeness of referring to a location inside a roll encouraged the habitual practice of giving references to other authors only by the "book" (i.e., roll), with no further precision.

About A.D. 100, we get the first examples of the codex, the forerunner of the modern book with pages created from folded sheets and opening from a common spine. The codex appears to have originated in Rome in imitation of notebooks of tablets. It was popular in the Christian community in the early centuries A.D. and was used for scriptural texts almost to the exclusion of the roll. Later, and gradually, it came into much wider use for all kinds of books and for some types of documentary records, perhaps under Roman influence. Increasingly, parchment was also used for making codices, perhaps because it resisted wear and tear along edges better than papyrus. But because parchment was more expensive than papyrus, parchment books remained luxury items.

Many examples of both types of books have been found, whether largely complete or (more commonly) badly damaged, among the papyri. They show us not only

the form of the book but its characteristics, notably the handwriting (book-hands are normally neat, carefully written scripts) and the critical marks (full or partial accentuation of Greek appears for the first time in a few papyri, above all in educational contexts). From these, we are able to form a more accurate idea of the type of manuscript that lies behind the medieval ones through which most ancient literature is preserved.

Greek Authors

The range of literature in circulation in Hellenistic and Roman Egypt was much larger than what survives to our day in medieval manuscripts, and numerous discoveries, occasionally of complete or nearly complete works—but more often of scraps—have considerably enriched our store of Greek literature over the last 100 years. Among authors or works found in significant amounts are lyric poets, especially Bacchylides, Sappho, Archilochus, and Alcaeus; the Athenian orator Hyperides; the comic dramatist Menander (of whom previously only fragments had survived); the “Constitution of Athens” by Aristotle; Callimachus; the *Hellenica* from Oxyrhynchus by a historian of the fourth century B.C.; the Epicurean writings by Philodemus found at Herculaneum; Herodas; a satyr play by Sophocles; and the epigrams of Poseidippos. Some of the paraphernalia of ancient learning have also appeared to increase our knowledge, such as lists of initial lines of plays; lists of Homeric vocabulary, which was obscure already in ancient times; summaries of works; and the like. Through these we get valuable information about lost works and come to understand how the ancient reader approached texts.

The majority of the literary papyri discovered and identified give us texts from works already known; besides informing us on the character of ancient books, these give us an idea of the reading habits of the literate public in Hellenistic and Roman Egypt. The *Iliad* of Homer was by far the most popular work, with the *Odyssey* next. After Homer come Demosthenes, Euripides, Callimachus, Hesiod, Isocrates, Plato, Thucydides, Aeschylus, and Xenophon. Many more authors have more than one papyrus each, and another large group just one apiece. Well over 100 authors—to count only those identified—were read even in provincial Egypt. The literate Greeks of the period thus had available to them a considerably larger selection than survived the Middle Ages. At the same time, we see that very few works were *commonly* read that have not survived in medieval manuscripts.

Almost half of all literary fragments have not been assigned with certainty to a known author and work. Sometimes this results from our knowing too little about the works of authors whose books have not otherwise survived; the *Hellenica Oxyrhynchia*, of which we have a sizable amount but whose authorship is disputed, is an example. Most often, the fragment is very small and, in

the absence of its discovery in a known work, the preserved material is so small as to make an attribution to an author (about whom little may be known) very difficult, even impossible. Many fragments have, however, been assigned to known authors in the past two decades since the corpus of classical Greek literature became available in digital form (the *Thesaurus Linguae Graecae*) and thus easily searchable even for brief sequences of letters.

Religious Literature

Numerous papyri have preserved parts of the texts of the Old and New Testaments, contributing considerably to the study of the earliest form of these texts. Many other Greek and Coptic papyri of theological or liturgical significance have been found, including many witnesses to the diversity of the early Christian tradition, in particular the *Sayings of Jesus* from Oxyrhynchus, and the Gospel of Thomas from the important find of Coptic Gnostic texts at Nag Hammadi and the Gospel of Judas from a separate discovery in Middle Egypt. Other apocryphal gospels have also been found. The history of the New Testament is further illuminated by early manuscripts of the gospels and by a fragment of Tatian’s *Diatessaron*, giving an attempted harmonization of the four gospels (with some apocryphal material), found at Dura-Europos.

The early centuries of Christianity in Egypt are also illuminated by some outstanding discoveries, notably two major works of Origen and a large number of commentaries on the Old Testament by Didymus the Blind, found in the Tura quarries near Cairo.

Many aspects of other religions also gain from the papyri; those from Egypt provide much information on the life of Jews in Egypt, and the finds from the Dead Sea region in Palestine make a more direct contribution to the study of Judaism in the first two centuries. Major finds of Manichaean texts have transformed our knowledge of that religion. In pagan religion, there is a wealth of information varying from hymns to priestly practices to organizations of cultic associations. Magic and astrology are well represented in the papyri, with horoscopes and spells well known.

CONTRIBUTIONS OF PAPYRI: HISTORY

Political History

Most of the thousands of documents found concern affairs internal to Egypt and usually local in character. The history that they yield is largely the story of the otherwise unknown landowners, small farmers, businessmen, soldiers, and other ordinary people, a story entirely ignored by the “historical” writings that we have from antiquity. There are exceptions, cases in which the papyri provide us with important facts about the main course of politics,

war, and diplomacy. It is, for example, from papyri that most of our information about the chronology of the Ptolemaic kings comes. From the archives of Zenon (see section on “Publication”), we hear of court intrigues, diplomacy with the Seleucids, and the government of the Ptolemaic empire. A report by Ptolemy III gives a narrative of part of the Syrian War of 246–241.

The several native revolts and civil wars of Ptolemaic Egypt are documented in the papyri, especially by repeated royal amnesty decrees such as the well-preserved edicts of 118 B.C. and by some correspondence from troubled periods. Typically, we get, from the papyri, not an overview but rather the effects that historical events had on some individuals.

From the Roman period, with its larger number of papyri, we derive correspondingly more abundant information. We learn the names and dates of the Roman governors of Egypt, and we have considerable information on the composition and activities of the garrisons they commanded. The political vicissitudes of Egypt in the turmoil of the later empire are reflected in the dating formulas used, giving us a degree of precision about shifts of allegiance difficult to come by in other provinces.

It is, however, more in the areas of institutions, social and economic aspects, and culture that the masses of papyri create for us, with a wealth of detail (but not always any generalizations!), a minutely detailed panorama of life. Particularly valuable are the surviving archives, groups of interrelated papyri, which taken together give us much greater insight than the individual documents could if isolated. Several examples are cited below.

Law and Institutions

We learn of the governing of Hellenistic and Roman Egypt, both in theory and in practice, from a considerable number of documents. Nearly a hundred Ptolemaic laws of various sorts are preserved in full or in extracts: city laws of Alexandria; royal decrees about subjects such as military service, slavery, taxes, police work, and judicial procedure; detailed regulations for the operation of the monopolized oil industry; and royal laws applicable to areas outside Egypt such as Syria and Phoenicia.

Under the Romans, we are no less richly benefited by legal texts on papyrus. The famous *Gnomon of the Idios Logos* (a collection of excerpts of imperial rulings and laws) gives the gist of the detailed and repressive code under which Roman administrators confiscated property, prohibited marriage between many groups, and enforced numerous aspects of Roman social policy. Imperial and prefectural edicts and responses to petitions set forth principles of law and their application, broad or narrow; some of the most famous are two edicts of Germanicus Caesar and some responses of Septimius Severus.

The detailed application of the law and the machinery through which it operated are revealed in numerous

records of court proceedings and in a host of related documents. One of the most famous is the dossier recording the feud between a Greek soldier and some Egyptian priests of the dead about a house in Thebes in Upper Egypt. The extensive knowledge of judicial procedure gained from these texts has led to scores of monographs and many works of synthesis. It is fair to say that the study of Greek and Roman law has been profoundly influenced in the last century by the papyri.

The other aspects of royal and imperial administration—finances especially—are shown in great detail by surviving official correspondence, petitions, accounts, memoranda, and other records. One of the most interesting archives is that of Menches, a village scribe in a Fayûm hamlet in the late second century B.C., struggling to maintain royal revenues in a time of declining agricultural production—and, above all, to protect his own position. His counterpart 300 years later, Petaus, is barely able to sign his own name, but his scribe-written files give us much information on such problems as compulsory public service in his period.

Society and Economy

The papyri offer no economic laws and few obvious generalizations, but they do give us thousands of transactions—leasing land, renting a house, selling crops, buying a slave, apprenticing one’s son or oneself, paying taxes, and much more. We see the major processes of the economy of Egypt from both the government’s side and that of the individual. In the so-called Revenue Laws papyrus, we find the detailed instructions for the maintenance of the crown monopoly on the production and sale of edible oils; elsewhere, we hear about smuggled oil and violation of other regulations. We find Ptolemaic soldiers selling plots of land that belong to the king rather than to them; we also have the royal edicts prohibiting this practice.

The economy of Egypt rested predominantly on the grain crop, and so it is the grain crop about which we hear most—its sowing, cultivation, harvest, taxation, and ultimately its sale or dispatch abroad for Ptolemaic foreign trade or the Roman grain dole. But we learn also of other industries like papyrus, of trade in rarer items like spices, of the trade through the Red Sea ports to India. In many cases, the evidence allows the distillation of statistics, though their reliability is not always secure.

The society of Egypt that we see in the papyri was a mixture of Greek and Egyptian, but only to a limited extent a blend of them. We find Greeks living in groups in towns, Egyptians mostly farming the land. The Greeks preserved their culture by various institutions (see section on “Culture”). Some Egyptians sought self-advancement through learning Greek and rising in the bureaucracy (or the Roman army), and some Greeks married native women and were essentially absorbed by Egyptian society. In general, the vast mass of Egyptians was only

slowly affected by any direct influence of Hellenism, but over time even such fundamental Egyptian habits as drinking beer gave way to the Greek preference for wine.

The Greek papyri, naturally, come predominantly from the part of society that could speak Greek, a group that included many Egyptians as time went on. The early Ptolemaic papyri reveal to us a still very Hellenic society, made up of immigrants and their children, but the more ambitious natives were added to it as time went on, and the Greek openness to the gods of their new country led to a growing adoption of personal names based on Egyptian deities. The longer the separation from the world of the Greek *polis* (city-state), the greater the tendency was to develop what we may call a Greco-Egyptian society, rather less centered on a privileged citizen body than the classical pattern and accepting many native customs. If more of our surviving documentation concerned the Greek cities, our view might be different, but it is the provincial towns and villages that are, above all, represented in the surviving texts.

Culture

The extent of literacy and reading among the Greeks in Egypt has already been discussed briefly. The Greeks sought to preserve a corporate and cultural identity by means of their educational institutions—schools, and especially the gymnasium, in which the young men of Greek families received the athletic training and other education to fit them for a place in Hellenic society. The gymnasium remained a center of community life for these men as adults, providing the focus for the athletic contests, which were such a prominent part of social activity. Fewer women received an education, but some were literate thanks to schooling whether at home or in a more formal school. Many papyri, ostraka, and tablets preserve examples of both teacher's models and student exercises from the schools of Egypt, allowing a detailed reconstruction of the process by which students learned to write and read, probably in that order.

A host of smaller private clubs existed among both Greeks and Egyptians to promote a congenial social atmosphere and to celebrate the cults of various gods. We find some evidence of Greek forms of entertainment in the papyri, such as flute players and comic actors, often hired for private parties.

Language

Fifty thousand Greek papyri and ostraka, together with thousands of texts in other languages, provide one of our major resources for understanding several ancient languages. The material is richest for the transformation of the language known in the classical Greek authors into that of modern Greece. There is still much to be done in the systematic study of this evidence, but already the

trends that are visible have been described in sufficient detail for it to be clear that the *koine* Greek of the New Testament was not a special language concocted for it alone, nor yet a heavily "semitized" Greek from Palestine, but rather a type of Greek abundantly illustrated by documents and letters, very characteristic of the actual language of its time. Similar insight has been gained into the language used by many literary figures of postclassical Greek antiquity.

The tendencies of the period are heavily in the direction of simplification, in part no doubt because of the absorption of many non-Greek peoples into the body of Greek speakers. The perfect tenses and the optative mood become rarer, and many irregular forms give way to newly formed regular ones. The vocabulary too changes; many Homeric words were sufficiently unknown in Roman times that readers of Homer would have special glossaries at hand to help. The nature of papyrus texts has led to a knowledge of many classes of words connected to everyday life that literary sources do not use, thus broadening our knowledge of the language. Conversely, the papyri shun much of the elaborate vocabulary of classical Greek, especially of poetry.

The other languages found in the papyri were in some cases written mainly by trained professionals (as in the case of Demotic Egyptian) according to rules that changed far more slowly than did the spoken language. The last written form of Egyptian, Coptic, is recorded in many documents of everyday life that give a vivid sense of something closer to the spoken vernacular of the time, which had absorbed many Greek words. And early Arabic papyri show how the language was written at a time when the written form familiar today was not yet fully fixed.

CONCLUSION

Papyri are an important part of our written heritage and document several major steps in the development of human communication. Papyrus was a crucial element in the organization of one of the earliest complex societies, the first reasonably portable means for recording man's memory, the most convenient way of transporting information across distances, and the vehicle by which large portions of the ancient world came to have more than perfunctory literacy. In the papyri, we find, more than in any other source, the material for a direct understanding of the daily life of ordinary people in antiquity. Although papyrus gave way to parchment and paper after four millennia of use, the shape of books in paper remained the codex, one of those for which papyrus was employed, and only the invention of movable type changed significantly the style of communication that papyrus represents in the history of the Western world.

ACKNOWLEDGMENTS

The principal international organization in the field is the Association Internationale de Papyrologues, with headquarters in Brussels (<http://www.ulb.ac.be/assoc/aip/>). Its American affiliate is the American Society of Papyrologists (Department of Classics, University of Cincinnati, Cincinnati, OH 45221; <http://classics.uc.edu/asp/>). The International Association of Coptic Studies (<http://rmcisadu.let.uniroma1.it/%7Eiacs/>) and the International Society for Arabic Papyrology (<http://www.ori.unizh.ch/isap.html>) deal with specific parts of the field.

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Patents and Patent Searching

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Abstract

Patents are limited monopoly rights granted by governments that allow inventors to prevent others from making, using, or selling their inventions for up to 20 years. In exchange, inventors must disclose details about their inventions. Patent documents are a valuable open source of scientific and technical information, some of which does not appear in other types of publications. For more than 200 years patent offices have disseminated patent information to the public in order to promote awareness of patent rights and to further technological development. During that time patent documents have evolved from handwritten manuscripts to printed documents to electronic text. Print-based search tools such as indexes and patent classification manuals have given way to online databases and hyperlinked documents. Today, patent searchers can search and retrieve millions of patent documents from numerous free Web-based databases hosted by patent offices and independent organizations.

PATENT INFORMATION

Patent literature is one of the oldest and most interesting forms of technical literature in the universe of sci-tech information. Patents first appeared in Europe in the fifteenth century as a special privilege granted by monarchs. The World Intellectual Property Organization (WIPO) predicts that in 2008 more than 2 million patent applications will be filed and 750,000 patents granted worldwide. China, Japan, and the United States are the countries with the highest growth.^[1]

Simply stated, a patent is a monopoly right granted by a government to an inventor for a limited time, generally 20 years, that allows the inventor to exclude others from making, using, or selling his or her invention. Modern patent law is based in part on the concept of novelty. That is to say, in order to obtain a patent, an inventor must prove that his or her invention has never before been published, used, or sold in public. This requirement is not limited by geography or time. The inventor must also fully disclose the nature of the invention he wishes to protect. This exchange of information for monopoly rights is at the heart of the patent system.

Of course, patent information is most useful to patent owners and inventors wishing to apply for patent protection. It is always a good idea to conduct a patentability search before applying for a patent. Patents are also a valuable source of business information and competitive intelligence.^[2,3]

Patents are an important source of historical information about technological development, geographic regions, culture, and social trends.^[4-6] Patent documents can be used for genealogical research or to identify the date of an antique. Patents can be used to teach students at all levels

about science, engineering, inventiveness, and problem solving.^[7,8] Patents are an important source of technical information that is not published in scientific journals.^[9,10] Increasingly, patent information is a window into industrial and academic research conducted in developing countries.

In order to understand patent information and patent searching, it is necessary to understand how patent information and search tools and techniques have evolved over the last 200 years.

HISTORY OF PATENT INFORMATION

1790–1870: Early Beginnings

Prior to the 1870s, patent information was difficult, costly, and at times impossible for the average citizen to obtain. Printing was expensive, communications were slow and public access to government documents limited. In many countries, patent laws were administered in a haphazard and decentralized fashion. For example, in the United Kingdom prior to 1852, patents were registered by three separate offices located in England, Scotland, and Ireland. In North America, colonial assemblies granted their own patents, a practice that was continued by U.S. state legislatures after the American Revolution. In Canada, the patent office moved no fewer than six times from 1824 to 1857 as the colonial capital moved to Kingston, Montreal, Toronto and, finally, Ottawa.

In the United States, the Patent Act of 1790, the first federal patent statute, provided no means for printing patent documents or publishing information about granted patents.^[11] It did, however, authorize the secretary of state, who was responsible for administering patent

records, to provide copies of specifications upon request for a small fee. In 1791, Secretary of State Thomas Jefferson proposed patent reform legislation that would require inventors to publish information about their patents in federal district court gazettes. Furthermore, Jefferson proposed that copies of patents, printed at the government's expense, be made available to the public upon the expiration of the 14 year patent term.^[12] However, no such provisions were included in the Patent Act of 1793, although it did allow the public to request copies of patents at the rate of 20¢ per 100 words and \$2 for drawings.^[13] Patent applications were confidential and, therefore, not permitted to be copied.

The Patent Act of 1793 was in force until 1836. During most of this time the patent system was administered by one man, Dr. William Thornton, who served as the superintendent of patents from 1802 until his death in March 1828. Thornton understood and appreciated the value of patents as records of scientific progress and human ingenuity. When the British captured Washington, D.C. during the War of 1812, Thornton's appeals to the officer in charge of burning government buildings saved the Patent Office from being put to the torch.^[14]

Having saved patents for posterity, Thornton, however, was less enthusiastic about providing copies of patents to his fellow citizens. He frequently rejected such requests on the grounds that he did not have the authority or resources to do so. The latter was certainly true. Burdened with an increasing workload and lacking sufficient staff, Thornton often enlisted his wife to help write out patents.^[15] Thornton also wanted to protect the patent rights of inventors, believing that easy access to patents would only encourage piracy. In 1825, the Franklin Institute of Philadelphia sued Thornton after he refused to provide copies of patents which it wanted to abstract in its journal. After a lengthy court battle, the matter eventually was put before Secretary of State Henry Clay (Thornton's boss), who decided that patents were indeed public documents.^[15]

The Patent Act of 1836 clarified and affirmed the public's right to access patent documents.^[16] It also reduced the fee for copying patents to 10¢ per 100 words. In order to meet the demand for patent copies, the Patent Office hired temporary employees, most of them women working in their own homes, to transcribe documents on a piecework basis. In the 1850s the Patent Office was the first government office to hire women as full-time clerks. Clara Barton, founder of the American Red Cross, worked as a patent copyist and clerk from 1855 to 1857 and 1860 to 1865.^[17] When printed patents reduced the need for copyists, women were employed in the production of patent documents and the *Official Gazette*.

On December 15, 1836, fire destroyed the Patent Office and all its records and models. After the smoke cleared, Congress quickly appropriated funds to restore the files.^[18] But of the approximately 10,000 patents issued

from 1790 through 1836, only about 2,700 were recovered. Of these, 70% issued after 1830, 23% issued from 1810 through 1830 and 7% prior to 1810. Only six of the 67 patents issued under the Act of 1793 exist today. Occasionally, persistent patent researchers discover copies of missing pre-1836 patents in libraries, archives, and courthouses.^[19]

The Patent Office Fire of 1836 was a huge disaster for patent information, but not everything was lost. Lists of patentees and patented inventions had been published from time to time by the Patent Office and private companies. For example, S. Alfred Elliott, a Washington, D.C. printer of directories and guidebooks, published a list of granted patents from 1790 forward, updated annually, throughout the 1820s. Other publishers soon took notice of the public's increasing interest in patent information. The *Scientific American*, a weekly periodical established in 1845 to chronicle developments in American science and technology, also published claims of newly issued patents. Prior to the establishment of the *Official Gazette of the Patent Office* in 1872, it was the only reliable and timely source of information on new patents. The Patent Office even purchased extra copies of each issue for the use of patent examiners and in the preparation of its annual reports.^[20]

Lists of granted patents were included in the superintendent of patent's annual report to Congress from 1810 forward; however, it was published regularly only after 1836. During the 1840s the annual report was expanded to include alphabetical and classified lists of expired patents, a classified list of issued patents, alphabetical list of patentees and the claims of issued patents, miscellaneous reports and statistics, and other information related to agriculture. The latter was discontinued in 1862 upon the creation of the Department of Agriculture. Latter years included patent drawings. During this period the annual report was printed in huge quantities; for example, 135,000 copies of the 1847 report were produced, the bulk of which was delivered to members of Congress.^[21] Two especially useful guides to early U.S. patent documents include *A List of Patents for Inventions and Designs, Issued by the United States from 1790 to 1847*^[22] and the three-volume *Subject Matter Index of Patents for Inventions Issued by the United States Patent Office from 1790 to 1873, Inclusive*.^[23]

1870–1970: The First Golden Age of Patent Information

Three developments in the early 1870s ushered in a golden age of patent information: the printing of patent specifications and drawings, the establishment of a weekly *Official Gazette* containing abstracts of issued patents, and the distribution of patents to public libraries. Advances in printing technology in the mid-1800s greatly reduced the cost of printing, making it feasible for the first time to produce

large quantities of patent documents quickly and relatively inexpensively. The invention of photolithographic printing in the 1850s revolutionized the reproduction of technical drawings. Previously, patent drawings had to be hand-drawn by a skilled draftsman or engraved on metal plates at great expense. Photolithography also allowed drawings to be reproduced in different scales without the loss of details. The adoption of wood pulp papermaking techniques in the 1870s and the invention of the linotype automatic printing press in the 1880s further decreased the cost of printed patents.

In 1861, Congress first authorized the printing of patent specifications and drawings, but very little progress was made toward this goal during the Civil War. In 1871, a new Patent Commissioner, General Mortimer D. Leggett, was appointed and Congress again directed that copies of patents be printed for sale to the public and free distribution to libraries. Commissioner Leggett undertook this task with energy and initiative. He ordered that copies of all patents, including patents recovered after the fire of 1836, be transcribed and printed. The weekly publication and distribution of new patents would continue for over a century. By the 1960s, the Patent Office had amassed an archive of 100 million printed patents stored in vaults beneath the Department of Commerce Building on Pennsylvania Avenue.^[24]

In 1870 the Patent Office began publishing a weekly pamphlet containing claims of issued patents. This publication evolved into the *Official Gazette of the United States Patent Office*, which officially debuted on January 3, 1872. The *Official Gazette*, or OG as it became known, contained one or more patent claims with a representative drawing for each patent, in addition to summaries of the Decisions of the Commissioner of Patents, Patent Office statistics, and official notices. The OG greatly expanded the distribution of patent information. The \$6 yearly subscription fee was affordable to most individuals and organizations. Numerous patent attorneys, inventors, libraries, and foreign patent offices subscribed. A week's worth of patents occupied a thin volume; an entire year could fit easily on a bookshelf. The publishers of the *Scientific American* enthusiastically proclaimed that the OG would end the need for costly patent examination and litigation, as every applicant could consult the OG prior to filing their application.^[25] The success of the OG inspired other countries to follow suite with their own patent journals. The *Canadian Patent Office Record* was first published in 1873. The British Patent Office established its *Official Journal (Patents)* in 1884.

The third development in the 1870s that greatly enhanced the public's access to patent information was the decision by Congress and the Commissioner of Patents to distribute copies of patents to libraries. The Patent Act of 1836 required the Patent Commissioner to grant the public access to the patent models and records stored in the Patent Office. About 20 libraries, mostly located in the

industrial cities of the northeast and midwest, were initially selected to receive copies of patents. This network of patent depository libraries would remain relatively stable until the mid-1970s when the U.S. Patent and Trademark Office (USPTO) launched a program to recruit more libraries into the program. There are currently 83 designated Patent and Trademark Depository Libraries (PTDL).^[26] Of course, many non-PTDL libraries can and do provide patent information to the public.^[27]

Patent information dissemination became international. The 1870s and 1880s was a time of increasing international trade and capital investment and closer cooperation among countries on matters related to intellectual property protection. In 1883, 10 countries, including France and the United Kingdom, signed the Paris Convention for the Protection of Industrial Property, the first international intellectual property agreement. Article 12 of the Convention requires member states to establish a central office for disseminating patents to the public and to publish an official periodical journal containing information on granted patents and registered trademarks. Although countries had exchanged patent documents as early as the 1850s, the Paris Convention set the first international standard for disseminating patent information.

The dissemination of patent information remained unchanged for 100 years. The Patent Office continued to print and distribute copies of patents for a small fee to individuals and designated patent depository libraries. Those who did not want or could not afford to purchase patent copies, could subscribe instead to the *Official Gazette*.

1970–2008: Patents Go Digital

The arrival of digital computers in the 1950s promised to revolutionize how patent information was produced, stored, searched, and disseminated. As early as 1950, the Patent Office had conducted pilot projects using IBM punch card machines to store and retrieve patent information.^[28] In 1955 the U.S. Patent Office established the Office of Research and Development (ORD) to study the possibility of developing mechanical and, later, hybrid mechanical–digital patent search systems.^[29] In 1962, the Patent Office joined with other national and regional patent offices in the International Committee for Information Retrieval among Examining Offices (ICIREPAT) to study the possibility of an international patent search system. During the 1960s, ORD tested a number of experimental patent search systems based on index cards, inverted files, and microforms.

Little progress was made in digital search systems until 1970 when the Patent Office awarded its first contract for transcribing the full text of allowed patent applications onto magnetic tape. The tapes were used on a Linotron machine at the Government Printing Office to compose patents for printing; the first patents printed from electronic text issued on August 4, 1970.^[30] Afterward, the

Patent Office retained the tapes to create a full-text patent database. In the meantime, the Patent Office continued to test and deploy computer-operated microfilm search and retrieval systems. In 1980 the USPTO started distributing to libraries copies of patents on microfilm, thus ending more than a century of paper distribution.

In September 1981, the Patent and Trademark Office awarded a contract to a private firm to develop and deploy to patent depository libraries a Classification and Search Support Information System (CASSIS). Using CASSIS, users could, among other things, search words in U.S. Patent Classification (USPC) class and subclass titles and display all patent numbers assigned to a specific subclass. CASSIS was the first online patent search system available to the public. In 1987, the USPTO established a pilot project to evaluate the potential for a CD-ROM-based patent search tool as a replacement for CASSIS. The project was a success and in 1989 the first CASSIS/CD-ROM discs were released to patent depository libraries. The CASSIS series expanded in the early 1990s to include CD-ROMs containing searchable patent bibliographic, classification and assignment data, and full-text patent manuals.^[31] In the mid-1990s, a second CD-ROM product called *USAPat* was released. *USAPat* contained the facsimile images of patent documents and by the end of the decade replaced patents on microfilm.

In the early 1980s, Congress ordered the USPTO to develop an in-house patent search system for patent examiners. The Automated Patent System (APS) was operational by the end of the decade. APS was a full-text database with powerful search functions. Beginning in 1991, APS was offered at select patent depository libraries. APS was replaced by the WEST and EAST search tools in 1999, which were extended to all patent depository libraries in 2003.

The development of the World Wide Web in the early 1990s ushered in a new age in the dissemination of patent information.^[32] In 1994, the USPTO in cooperation with the Center for Networked Information Discovery and Retrieval (CNIDR) mounted its first patent database on the Web, the International AIDS Patent Database, a full-text collection of European, Japanese, and U.S. patents related to AIDS/HIV. In November 1995, the USPTO released a database of bibliographic data from patents granted from January 1976 forward. By October 1, 2000, the USPTO patent database contained full-text patents from 1976 forward and images from 1790 forward. In March 2001, the USPTO launched a second database for published applications.

Other patent offices quickly followed suit with their own Internet patent databases. In addition, a number of free unofficial patent databases appeared in the late 1990s. First were the EDS Shadow Patent Office, which offered free browsing of the current 52 weeks of U.S. patent titles and numbers, and IBM Patent Search, a free database of U.S. patents from 1971 forward. EDS and IBM are no longer operational, but in their place have appeared Google Patents, Patent Lens, FreePatentsOnline, and others.

The rise of powerful computer technology and universal Internet access radically changed patent dissemination in a very short time. Most patent offices discontinued print gazettes. The print version of the USPTO OG was discontinued in 2002 in favor of Web-based and CD-ROM versions. In 2003, paper patent search files were removed from examiner work areas and the Public Search Facility. Also in 2003, the USPTO launched Public PAIR, an online repository for case files for published applications and issued patents.

Of course, these rapid changes also presented challenges. The patent information industry, which earned large sums from patent search tools and document delivery services, was angered by what it saw as unfair competition from the patent offices. Its representatives argued that patent offices were exceeding their mandates in providing free Internet access to patent data.^[33,34] At times the relationship between patent offices, which supply patent data, and patent information companies has become tense and confrontational.^[35] Although there has been some consolidation in the patent information industry since 2000, free patent databases have also inspired new products and services.

Librarians at patent depository libraries were also concerned that Internet patent databases might put them out of the patent information business.^[36,37] To date this has not happened. There are currently 83 patent depositories in the United States, four more than in 1995. And in Europe, the PATLIB network of patent information centers has expanded four more than 320 sites in 83 nations. Librarians at non-depository libraries, especially librarians at universities, may be working with patent information more in response to increasing interest among instructors and students.^[38]

PATENT DOCUMENTS

Historically speaking, patent offices have published patent documents in a variety of formats that reflect their own national customs, patent laws, and publication requirements. During the last few decades, however, the patent offices of the world, under the auspices of WIPO and various intergovernmental working groups, have established a number of standards governing the format of patent information in order to facilitate the exchange, storage, and use of electronic patent data. The international movement toward harmonization and increasing cooperation between patent offices has also led to greater standardization in patent documents.

Patent documents consist of three parts: the *front page*, *drawing*, and *specification*. The term *Letters Patent* refers to the grant, drawing, and specification. The *grant* is the certificate issued to the inventor. The *front page* contains bibliographic information describing the patent document and may also include an abstract, the name of a patent

attorney/agent, list of references, and/or representative drawing. Common bibliographic data include patent number, date of issue, publication number, date of publication, application number, date of application, name of inventor, name of applicant or assignee, patent classification, and title of invention.

The *drawing* consists of one or more pages of numbered figures that illustrate the invention. It may appear after the front page or at the end of the patent document. Patent offices have specific requirements on what constitutes an acceptable drawing. In general, drawings must be rendered in black and white and show enough detail to enable the reader to understand the invention. Color drawings and photographs are generally not acceptable, except for U.S. plant patents, and black and white photographs are only permitted in limited circumstances where black and white drawings would not adequately illustrate the invention. Drawings are not required in patent documents that describe a process or method of doing something, such as a method of synthesizing a new chemical compound.

The *specification*, which is also known as the description, contains a description of the invention. At the end of the specification are the claims. The specification may start with a description of the background of the invention and a discussion of the prior art related to it. The claims describe, in legal terms, the scope of the invention.

A patent document may be of any length ranging from a few to several hundred pages depending on the complexity of the claimed invention. A few exceptionally long patent documents have page counts in the thousands.

INID Codes

INID is an acronym that stands for “Internationally Agreed Numbers for the Identification of (bibliographic) Data.” INID codes, which are described in WIPO Standard ST.9, identify bibliographic data printed on the front page of a patent document. See the table below for selected INID codes. (see Table 1) INID codes are printed in circles or parentheses.^[39]

Table 1 Selected INID codes

10	Patent number
12	Type of document
21	Application number
22	Filing date
43	Issue date
45	Publication date
51	International Patent Classification
54	Title
57	Abstract
71	Applicant
72	Inventor
73	Assignee

Document Kind Codes

Document kind codes distinguish between types of published patent documents as defined under WIPO Standard ST.16.^[40] While most major patent offices began including kind codes on their patent documents in the 1970s and 1980s, the USPTO began doing so only recently on January 2, 2001. (see Table 2) Kind codes are usually printed near the patent or published application number on the front page of a patent document and may be enclosed in a circle or parentheses. In general, kind codes A, B, and C are used on documents related to patent applications; P for plant patents (US); S for design patents (US); T for translations; and U, Y, and Z for utility models.

Utility Patents

Utility patents protect new and useful processes, machines, products, and compositions of matter or improvements of any of the above. The type of subject matter eligible for patent protection may differ from country to country. For example, patent protection for some applications of computer software, medical therapies, and genetically modified living organisms is allowed in the United States but not in many other countries. Some countries severely restrict patents for pharmaceuticals and medical treatments. Inventions deemed harmful to public safety and national security may be denied patent protection. For example, inventions that facilitate criminal or immoral activity, e.g., a letter bomb, cannot be patented in most countries. In the United States, the Atomic Energy Act of 1954 specifically prohibits the patenting of inventions related to nuclear weapons.

In most countries, utility patent applications are published 18 months after filing. The United States adopted 18 month publication only in 2001. The term of a utility patent is 20 years from the date of application and

Table 2 Kind codes applied to U.S. patent documents as of January 2, 2001

Code	Document type
A1	Utility application, first publication
A2	Utility application, second or subsequent publication
A9	Utility application, correction
B1	Utility patent, no pregrant publication
B2	Utility patent, with pregrant publication
C	Reexamination certificate (C1, C2, C3, etc.)
E	Reissue patent
H	Statutory invention registration
P1	Plant patent application, first publication
P2	Plant patent, no pregrant publication
P3	Plant patent, with pregrant publication
P4	Plant patent application, second or subsequent publication
P9	Plant patent application, correction
S	Design patent

most countries require the payment of maintenance fees during the life of a patent. About 7.5 million patents have been granted in the United States since 1790; 1.9 million utility and plant patent applications have been published since 2001.

Since 1995, applicants have been able to file in the United States a provisional application for a plant or utility patent. Provisional applications are not examined and applicants have one year from the date of filing to file a regular, or non-provisional, application based on their provisional. The requirements for a provisional application include a written description and drawing, if necessary to understand the invention. Provisional applications are not published but are included in the file wrapper of any subsequently filed non-provisional application.

Utility Models

Utility models are a weaker form of protection for innovations that do not meet the criteria for a patent. They are granted in a few countries, including Australia, China, Germany, Japan, and Mexico. Application fees are less expensive and the examination process is much less rigorous than for patents. The term of a utility model is much shorter than a patent, generally 5–10 years. Utility model applications may be assigned International Patent Classification (IPC) codes.

Design Patents

Design patents, or industrial designs as they are known in some countries, protect new, original, and ornamental designs applied to a product. For example, the ornamental design of a lamp or the shape of a food storage container may qualify for design patent protection. In the U.S. design patents have a term of 14 years from the date of issue. In Canada, the term for industrial designs is 10 years. Design patents were first granted in 1842 in the U.S. and in 1849 in Canada. The specification of a design patent is short, generally limited to a brief description and one claim. As of July 2008, approximately 560,000 design patents have been granted in the U.S. The WIPO-administered Hague System for the International Registration of Industrial Designs provides for the international registration of designs. The U.S. and Canada are not members of the Hague System. The Locarno Classification system provides for the classification of designs; approximately 49 countries, including the U.S. but not Canada, apply Locarno classifications to their industrial designs.

Plant Patents

Plant patents are unique to the U.S. They were established in 1930 for the protection of distinct and new varieties of asexually propagated plants, which includes plants that are reproduced by means other than seeds. Like utility patent

applications, plant patent applications are published 18 months after filing. The first plant patent was granted in 1931. The term of a plant patent is 20 years from the date of filing and maintenance fees must be paid as for utility patents. Plant patent specifications must provide a complete description of the plant but only one claim is allowed. Where color is a distinctive feature of a plant, color drawings or photographs must be provided. Plant patents are classified in the USPC in Class PLT. As of July 2008, approximately 18,000 plant patents have been granted.

Reissue Patents

An inventor who has claimed less than he or she is entitled to in a patent may apply for a reissue patent. Reissue patent applications are examined like regular patents. The term of a reissue patent does not extend beyond the term of the original issued patent. The first reissue patent was granted in 1838 and about 39,000 reissue patents have been granted since.

Additional Improvement (AI) Patents

The Patent Act of 1836 permitted inventors to apply for AIs to their patented inventions within 2 years of issue. From 1837 through 1861 the Patent Office granted approximately 300 AIs.^[41] AI patents were assigned a unique serial number for identification purposes but were considered integral to the original patent specification. The Patent Act of 1861 abolished AI patents and instead required inventors to obtain separate patents for subsequent improvements. AI patents are included in the USPTO database and may be retrieved by number, date of issue, and current classification.

Defensive Publications and Statutory Invention Registrations (SIRs)

In 1968 the USPTO enacted a new rule permitting applicants to request publication of unexamined patent applications. The intent of the rule, which was known as defensive publication, was to give applicants a means of protecting their inventions when obtaining a patent was not practicable. Defensive publication documents include only bibliographic information and an abstract. The entire application may be obtained by requesting the appropriate file from the USPTO. Defensive publications are identified by a unique number consisting of the prefix T (for technical disclosure) followed by the *Official Gazette* volume number and a serial number ranging from 1 to 999. Approximately 5,000 defensive publications were published from May 1, 1968 through July 5, 1988.

In 1985 defensive publications were replaced by statutory invention registrations (SIRs). SIRs never exceeded 200 in any given year and have steadily decreased in

number since 2001 when the USPTO began publishing utility and plant patent applications.

Reexamination Certificates

Reexamination certificates are issued upon completion of a reexamination proceeding. Reexamination proceedings were introduced in 1980 as a means of allowing third parties to challenge the validity of claims in a granted patent based on new prior art. Approximately 9,300 reexamination certificates have been issued since 1981. Reexamination certificates are attached to the original patent and can only be retrieved in the USPTO's Web-based patent databases by searching the appropriate document number.

Certificates of Correction, Disclaimers, and Dedications

The USPTO does not republish patents that contain minor typographical errors. Instead, the USPTO may at the request of the patent owner issue a certificate of correction that contains the corrected material. A copy of the certificate is then attached to the original patent. Certificates of correction have been issued since the late 1800s. (See patent no. 200,709.) Lists of patent numbers that have been issued certificates of correction are published weekly in the *Official Gazette*. In recent years, it is not uncommon for the USPTO to issue several hundred certificates of correction in any given week. The USPTO publishes data on the number of issued certificates of correction in its annual report. Since 2003, the USPTO has issued approximately 137,000 certificates of correction.

A disclaimer is formal statement made by the applicant or owner of a patent that disavows one or more claims in an issued patent or allowed application that have been found to be invalid. A patent owner may also file a terminal disclaimer that dedicates to the public the entire term or any part of the term of a patent or allowed application.

The Certificate of Correction Branch in the Office of Patent Publication is responsible for issuing certificates of corrections and disclaimers. Electronic copies of certificates of correction and disclaimers may be accessed in the USPTO's Patent Application Information Retrieval (PAIR) system and PatFT patent database (but they are not searchable) several weeks prior to their publication in the *Official Gazette*.

Trial Voluntary Protest Program (TVPP) Publications

In the mid-1970s, the PTO conducted two trial voluntary protest programs (TVPP) to assess the effectiveness of allowing the public to comment on pending patent applications. The intent was to elicit from the public prior art

information not cited by the examiner which could impact the patentability of the claims. About 650 applications were partially published (abstract, drawing, and cited references). These documents were designated with a B prefix before the application serial number. The PTO concluded that TVPP was not effective and plans for a permanent program were abandoned.^[42]

Alien Property Custodian (APC) Documents

During World War II the U.S. government seized approximately 4,700 patent applications assigned to nationals of enemy and enemy-occupied countries. The Office of the Alien Property Custodian, the agency responsible for managing seized property, published the applications in order to promote their use by American industry.^[43,44] These documents became known as APC documents; they are identified by the prefix "APC" followed by the application serial number and date of publication. APC documents are not included in the USPTO patent database.

PATENT CLASSIFICATION SYSTEMS

Patent offices created patent classification systems to organize patent documents and, in some cases, non-patent literature (NPL) into searchable collections based on related subject matter. The two principal patent classification systems in use today are the USPC, which is used by the USPTO, and the IPC, which is used by more than 100 countries worldwide. Many countries that once maintained their own national patent classification systems have in recent years switched to the IPC. For example, the Canadian Intellectual Property Office phased out the Canadian Patent Classification (CPC) in the early 1990s and the U.K. Patent Classification, which was established in 1888, was discontinued in July 2007. The IPC has inspired two regional versions, the European Classification (ECLA) system used by the European Patent Office (EPO) and the File Index (FI) system used by the Japan Patent Office (JPO). These will be discussed in the context of the IPC.

USPC

The USPC was officially established in 1898, although its origins can be traced back to the 1870s.^[29] Originally consisting of some 200 classes, the USPC today consists of approximately 450 classes and 150,000 subclasses.^[45] The range of subject matter classified in the USPC is immense, ranging from apparel in Class 2 to genetically engineered animals in Class 800. It also includes one class for plant patents (PLT) and 33 classes for design patents (D1-D30, D32, D34, and D99). In this respect, the USPC is unique: no other patent classification system in use today encompasses inventions, designs, and plants.

The USPC also includes seven cross-reference art collection classes for subject matter that falls into multiple classes.

USPC classes are organized under one of four principals: 1) Industry or Use; 2) Proximate Function; 3) Effect or Product; and 4) Structure. An excellent starting point for learning about the USPC is *The Examiner's Handbook to the U.S. Patent Classification System*.^[46]

The USPTO assigns patent classifications to utility, design, plant and reissue patents, published utility and plant applications, SIRs, and defensive publications. Between 1979 and 1995, the USPTO classified foreign patents in the USPC.

The base unit of the USPC is the class/subclass, which is often referred to as a classification code, classification symbol or, simply, a classification. Each class/subclass pair is a unique identifier. For example, the classification "482/140" represents "Class 482, Exercise Devices," and "subclass 140, Sit Up Device." The USPC is a flat taxonomy. That is to say, classes are arranged in numerical order and not by subject matter. In a few cases one class has been expanded to multiple classes in order to accommodate an exceptionally large amount of subject matter. For example, classes 600, 601, 602, 604, 606, and 607 are considered to be integral to Class 128, Surgery.

The principal document of the USPC is the *Manual of Classification*, which includes class schedules for all 450 classes. A class schedule is a listing of all subclasses arranged as a hierarchy. The *Manual of Classification* is supported by *Index to the U.S. Patent Classification System*, an alphabetical listing of common terms and trademarks corresponding to individual classifications. Users can consult the *Index to the USPC* in order to determine their initial classification. Definitions are provided for all utility and plant subclasses and most design subclasses.

Revisions to the USPC are handled by reclassification projects, the end product being a classification order. Classification orders contain information on abolished and established classes and subclasses, indent changes, position changes, title changes, and changes to the definitions and USPC-IPC concordance. Orders are issued on the first Tuesday of every month. Since 1947 there have been approximately 1886 classification orders. Classification orders issued since November 2003 are available in PDF format on the USPTO Web site. In addition, a *Classification Orders Index*, which is updated quarterly on the USPTO Web site, contains all changes to the USPC from 1976 forward.

IPC

The IPC is administered by the WIPO in consultation with a Committee of Experts representing members of the Strasbourg Agreement. More than 100 countries apply

Table 3 IPC hierarchy

Section	A	Human necessities
Class	A62	Life saving, fire-fighting
Subclass	A62C	Fire-fighting
Group	A62C 11/00	Portable extinguishers with manually operated pumps

IPC codes to their patent documents. It is estimated that almost 95% of the 2 million patent documents published annually are assigned IPC codes. The United States began using the IPC in 1969 and Canada in 1978. The IPC is a hierarchical system that is divided into four subdivisions: sections, classes, subclasses, and groups. (see Table 3) There are 70,000 groups, of which 10% are main groups and the rest subgroups. Each subdivision is identified by a unique code and title. The eight top-level sections are identified by letter codes ranging from A, Human Necessities, through H, Electricity.

In January 2006, a new reformed version, the 8th edition, of the IPC was implemented. Prior to 2006, the IPC was revised and updated every 5 years. The 7th edition was in force from January 1, 2001 to January 1, 2005. The 8th edition is divided into two levels, the core and the advanced. The core level contains 18,000 classifications and is intended for use by smaller patent offices that issue fewer patents. Revisions to the core level occur every three years. The advanced level contains the full 70,000 classifications. Changes to the advanced level are made quarterly.

The EPO maintains the European Classification (ECLA), an extension of the IPC that includes, about 134,000 groups. ECLA's structure is very similar to IPC. In fact, many of the classifications are identical to corresponding IPC codes. For example, A01M 23/10 is the code for animal traps with rotating turnstiles or cylinders in both IPC and ECLA. The EPO classifies documents that are published in English, French, and German, German utility models, and documents published by Belgium, the Netherlands, and Luxembourg. About 30 million documents in esp@cenet have ECLA codes. ECLA is updated on an ongoing basis.

The JPO also maintains a version of the IPC called FI. Like ECLA, the FI is more detailed than the IPC.

PUBLIC PATENT DATABASES ON THE INTERNET

An in-depth discussion of all the public patent databases and search tools available on the Internet is beyond the scope of this entry. Therefore, only the most important resources will be discussed. The proliferation of Web-based public patent databases in the last decade has been both a boon and a challenge for public access to patent information. The public now enjoys better access to

patents than at any other time in history. Anyone with a laptop computer and a connection to the Internet can search dozens of free or semifree patent databases (from both patent offices and independent organizations) containing millions of patent documents. However, this wealth of information may also confuse and mislead novice searchers. When considering which patent database to use, the patent searcher must balance functionality and ease-of-use with currency and comprehensiveness.

CIPO

The CIPO launched its Canadian Patents Database (CPD) in October 1998. Today, the database includes patent bibliographic data from 1869 to the present and full-text data for abstracts and claims from August 15, 1978 forward. Images of patent documents in PDF and GIF formats are available for patents issued from January 1, 1920 to the present and laid-open applications published from October 1, 1989 to the present. As of July 2008, the database contains approximately 1.9 million records. It is updated weekly. As Canada has two official languages, English and French, patent applications may be written in either.

Since its launch, the CPD has undergone numerous improvements and enhancements. In August 2003 administrative status data became available for withdrawn applications and patents that have been reissued, reexamined, or expired. Maintenance fee payments and status data was added in April 2004. In May 2006 bibliographic data for patents issued from 1869 to 1920 was added. Searchable fields include title, abstract, claims, inventor, owner, applicant, Patent Cooperation Treaty (PCT) filing number, international publication number, and IPC and Canadian Patent Classification (CPC) codes. The CPC was discontinued in the early 1990s and is not included on patent documents published after this time.

USPTO

The USPTO Web site hosts four significant patent information systems: two patent document databases, a patent assignment database, and a patent application file search system. Additional patent status information is also published in the front sections of the *Official Gazette* which is available on the USPTO Web site from 1995 to the present.

USPTO Patent Databases

The Patent Full-Text and Image Database (PatFT) is one of the largest and oldest public patent databases on the Internet. It can trace its history back to November 1995 when the USPTO launched PatBib, its first comprehensive Internet-based patent database containing bibliographic data for patents issued from 1986 through 1995. The USPTO maintained a small database of AIDS-related patents from December 1994 through April 1999. PatBib was expanded

a few months later to include bibliographic data from January 1976 forward. Full-text data was added in November 1998, followed in March 1999 by images of patent documents in TIFF format. In October 2000, the USPTO again expanded PatFT by adding number and current classification data and TIFF images for patents back to 1790. Also in 2000, the USPTO added an integrated patent classification search tool that allowed searchers to retrieve patents in any given subclass. In April 2006, the date of issue for all patents from 1790 through 1975 was added.

PatFT currently contains data and images for approximately 8 million issued patents and related documents. It is updated every Tuesday when new patents are issued. Patent classification data for all patents is updated approximately bimonthly. In addition to searching full-text, users may also search separate fields including title, abstract, name of inventor, name of assignee, date of issue, patent number, date of application, application number, current classification, etc. Patents issued from 1790 through 1975 may only be retrieved by number, date of issue, and current classification. Certificates of correction, disclaimers, and dedications are not searchable, but are attached to the end of the patent document image.

In early 2001, the USPTO launched a second database called AppFT containing full-text data and images of published utility and plant patent applications, which are also known as pregrant publications. Since November 1999, all utility and plant patent applications have been eligible for publication 18 months after their effective filing date. The first pregrant publication was published on March 15, 2001. Searchable fields include many found in PatFT and Kind Code, etc. AppFT is updated on Thursdays when new applications are published. AppFT currently contains full-text data and images for approximately two million pregrant publications.

USPTO Assignment Database

Assignments on the Web, launched in December 2003, consists of two databases, one for patent assignments and one for trademark assignments. The Patent Assignment database contains all recorded assignment information for patents and published applications from August 1980 to the present; data is updated daily. Assignment records are searchable by patent number, publication number, assignor name, assignee name, and microfilm reel/frame number. Assignment records display the title of the patent, inventors' (assignor) names, assignee name, application number, date of application, date of execution, and date of recordation. Assignment records are linked to the PAIR system.

PAIR

The USPTO launched the PAIR system in mid-2003 using software acquired from the EPO. The system is divided

into two components: Private PAIR and Public PAIR. Private PAIR provides secure access to current patent application status. Only registered patent attorneys/agents, independent inventors, and persons granted limited recognition who have a valid USPTO customer number and digital public key infrastructure (PKI) certificate may access Private PAIR.

Public PAIR, which may be accessed by anyone, contains application bibliographic data for patents and published applications from about 1989 to the present. The system has very limited search capabilities. PAIR records may be retrieved by application number, patent number, publication number, PCT, application number, and control number (for *ex parte* and *inter partes* reexamination proceedings). In addition to application data, PAIR contains transaction history, patent term extension history, maintenance fee payments, applicant address, patent attorney/agent, parent/child application data and supplemental content, such as computer program listings and nucleotide/amino acid sequences.

PAIR also provides access to application file wrapper documents in PDF format for applications pending on or filed after June 30, 2003. File wrapper contents include all correspondence between the USPTO and applicant, application worksheets, copies of cited foreign patent documents, examiner search strategies, information disclosure statements, related provisional patent applications, etc. Copies of cited NPL, such as journal articles, are not available due to copyright restrictions.

The USPTO does not disclose the current number of file wrappers available in Public PAIR, but 1.5 million is a plausible estimate. In the first year after the launch of PAIR the USPTO digitized more than half a million pending applications. Since July 2003, the USPTO has published approximately 1.2 million applications and issued some 762,000 patents.

EPO

The EPO's public patent database is esp@cenet. Launched in 1998, esp@cenet contains more than 60 million patent documents, including utility models, from approximately 70 countries and 1 million references to NPL.^[47] The data is current for most patent offices. Patent documents are stored in PDF format and may be printed one page at a time. Documents with fewer than 100 pages may be downloaded and printed. Up to 100 documents may be stored in the My Patents list. Machine translation is available for several languages including German, Spanish, and French.

Documents may be retrieved by application, publication, or priority number, or NPL reference number. The Advanced Search allows users to search terms in the title, title and abstract, inventor and applicant, publication date, European Classification, and IPC. No date range search is available, but up to 4 years may be entered into the

publication date field in order to limit a search. Searches may also be limited by country by entering up to four country codes in the publication number field, e.g., CA, US, WO. Search results are displayed in accession order and may not be re-sorted.

Individual patent records are linked to INPADOC legal status and patent family data, and citing references. Cited references are provided for WO and EP documents.

Register Plus is the EPO's equivalent of the USPTO's PAIR system. It contains bibliographic and procedural data for published EP applications and international applications in which the EPO or one or more of its member states are designated. Legal status is available only for published EP applications. Patent family information is also available. One of the most useful features of Register Plus is that it provides access to all documents in an EP application case history, also known as a file wrapper. Users may retrieve documents by application or publication numbers, date of filing, date of publication, priority number, priority date, inventor, applicant, representative, opponent, and IPC classification. Users may register with the WebRegMT e-mail alert service to monitor changes in the status of EP applications; up to 1000 applications may be monitored per e-mail address.

The EPO's third free patent database is ESPACE EP, which was launched in May 2008. Unlike esp@cent and Register Plus, users must register with the EPO in order to access the system. ESPACE EP runs on MIMOSA, a powerful full-text search engine. Users may search the most recent 4 weeks of EP published applications and patents. Users may also customize display, printing, and download options.

JPO

The JPO's Intellectual Property Digital Library (IPDL) contains Japanese patent and utility model data and images from 1922 to the present. IPDL offers several access points. Users may retrieve documents from the Patent and Utility Model Gazette Database by kind code and document number. Prior to January 2000, Japanese patent and utility model documents numbers were prefixed by the imperial year. For example, H12-123456, is the number of a document that was published in the 12th year (2000) of the reign of Emperor Akihito (1989-), also known as the Heisei period. After January 2000, the JPO adopted western years, e.g., 2000-123456, as prefixes.

Users may search the *Patent Abstracts of Japan* (PAJ) by document number, word in the title, applicant or abstract fields, date of publication, and IPC code. PAJ contains data from 1976 forward and is updated monthly. Utility models are not included in PAJ. Recent documents are automatically machine translated into English. PAJ contains legal status data from January 1990 forward; it is

updated biweekly. Users may also conduct an FI/F-term classification search or browse the FI/F-term system using the Patent Map Guidance. An FI/F-term search will retrieve patents and utilities models back to 1885. Users may limit an FI/F-term search by publication date range and document type.

WIPO

WIPO's PatentScope Web portal, which was launched in mid-2005, provides access to bibliographic and full-text data and document images for 1.3 million PCT international patent applications published from 1978 to the present. The database is updated weekly (usually on Thursdays) when new international applications are published. PatentScope is the successor to the WIPO's electronic *PCT Gazette*, which went online in October 1998. The print and digital versions of the *PCT Gazette* was discontinued in April 2006.

PatentScope supports more than 25 searchable fields, including title and abstract in English or French, applicant and inventor name, address and country of residence, publication, application and priority number, IPC code, etc. The language of filing and publication may be searched by the full name or abbreviation of the language, e.g., "German" or "DE." Approximately 650,000 PCT applications are available in English, German 139,000, and Japanese 130,000.

PatentScope supports a number of advanced features not found in other patent office databases. Users may register for a free account where they can store search queries in between sessions. Search results may be sorted by date or relevance and search result displays customized. In late 2006, WIPO added RSS feeds for updated searches and graphical views of search results. Users may generate graphs displaying search results by year of publication, country of publication, applicant name, and IPC code.

The WIPO Web site also hosts the Hague Express Database of internationally registered industrial designs. Records are searchable by registration number, owner, international registration date, Locarno classification, indication of products, priority date, publication date, and contracting parties. No information is provided on coverage and update frequency.

FreePatentsOnline

FreePatentsOnline is a free patent database supported in part by paid advertising. Since its launch in 2004 it has become one of the more popular independent patent databases on the Internet. It contains searchable full-text patent documents from the United States (1976–), Europe (1978–), WIPO/PCT (1978–), and Japanese abstracts from 1976 forward. PDF images of U.S. patent documents are available from 1790 forward. Data and images for U.S.

withdrawn patents are available back to the mid-1980s. Certificates of correction and reexamination certificates are attached to the original patent.

There are 26 searchable fields, many of which are identical to the search fields found in the USPTO patent database. The Advanced Search mode allows complicated search queries using field codes, Boolean operators, proximity operators, term weighing and wildcards. Users who register for a free account may store up to 10,000 records in 20 folders. Saved references (up to 250 at a time) may be downloaded in spreadsheet format. Citations may be exported in BibTex and EndNote formats. Other tools include a Google Toolbar plugin and RSS feeds for new patents and published applications organized by category or USPC class.

FreePatentsOnline recently introduced a chemical structure search based on SureChem's normalized database of chemical names and structures. It is the first free patent database to offer chemical structure searching. Chemical structure, substructure, and similarity searches may be searched using SMILES (a chemical notation system that allows two-dimensional chemical structures to be represented by a linear string of characters) or a graphically drawn structure. Structure data is updated about week after new patents are published.

Google Patents

Google Patents was launched in June 2006. It contains OCR'd full text of U.S. patents and published applications from 1790 forward. It is not clear how frequently the data is updated, but the online FAQ indicates that coverage includes patents issued in the past few months. Documents are stored in PDF format and may be easily printed or downloaded. Certificates of correction and reexamination certificates are attached to the original patent.

The Advanced Search option allows users to search by patent number (but not by published application number), words in title, inventor name, assignee name, USPC code, and IPC code. Searches may be limited by document status (issued patent or published application), type of patent (utility, design, plant, etc.), issue date, and filing date. Search results are automatically ranked by relevancy and may be sorted by date. Records are linked to records in the USPTO patent database.

Google Patent's principal weaknesses are its lack of current USPC classification data and erratic classification search results. Its reliance on optical character recognition (OCR) full text also produces unreliable and erratic search results.

Patent Lens

Patent Lens, launched in early 2006, is the brainchild of a group of life science researchers in Australia who want to

make the patent system more transparent and patent searching easier for nonprofessionals. It contains almost 9 million full-text patent documents from Australia (1998–), the United States (1976–), Europe (1980–), and WIPO/PCT (1978–). Data is current for US, EP, and WIPO/PCT documents. AU documents may be several weeks behind.

Search modes include Quick, Structured, and Expert. Searchable fields include full-text, frontpage, title, abstract, inventor, assignee/applicant, agent, references, claims, and description. Expert search allows complicated search queries using field codes, Boolean operators, and wildcards. Searches may be limited by publication or filing date, and U.S. patent predicted expiry date and lapsed date. Patent documents may be saved and previous searches reused. Patent family and status data is provided where available. Patent families may be displayed as graphical trees in PDF format. RSS search alerts may be created.

Patent Lens is the only free patent database that supports gene sequence searching. It uses the National Center for Biotechnology Information's BLAST software to find DNA and protein sequences that are listed in U.S. patents and published applications.

The greatest disadvantage of the system is the inability to search current USPCs or IPCs. This is not an oversight. The designers of Patent Lens believe that patent classification is too complicated for their intended users. It is possible to do a crude approximation of a classification search by searching USPC or IPC codes in the frontpage. However, search results should be treated with caution.

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5. Japan Patent Office—<http://www.jpo.go.jp>
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People with Disabilities

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Abstract

This entry discusses people with disabilities in relation to libraries and other information institutions. It briefly summarizes the social category of disability, the disability rights movement, relevant laws, and the history of disability in the literature and practice of information studies. It focuses largely on libraries, with some discussion of archives, museums, and for-profit information professions. The United States is the primary geographical focus, although other countries and international bodies are discussed. In addition to addressing accessibility of physical spaces, print resources, and electronic resources, the entry discusses disability as subject matter, library staff members with disabilities, and outreach. The entry emphasizes the importance of involving people with disabilities, both in scholarly research that concerns them and in accessibility evaluation and planning.

INTRODUCTION

Disability is a part of the human experience. Approximately 15% of people around the world have physical or cognitive impairments that limit their ability to perform one or more important functions.^[1] The interaction between these impairments and barriers in the environment is defined as disability.^[2] Disability is a category that anyone can enter as life circumstances change; some activists highlight this fact by referring to people without disabilities as “temporarily able-bodied.”^[3] People with disabilities are almost certainly present in any community served by libraries or other information institutions.

In recent decades, people with disabilities have made important gains in asserting their right to live, work, and play alongside others in their communities. Laws in many countries have affirmed the idea that social institutions and public spaces should be accessible to all. However, people with disabilities are still socially and economically marginalized. They face barriers to full participation in education, public life, and the workforce. Libraries, museums, websites, and other sources of organized information can be empowering resources for this underserved group; they also have the potential to contain barriers to access, reinforcing marginalization and isolation. Most information institutions contain a combination of enabling and disabling features. Information professionals need not wait until our institutions are perfect before cultivating relationships with the disability community.

Information professionals believe strongly in equity of access. The notion that resources should be available to everyone in a community is a core ethical principle of information professions. In practice, however, institutions often fall short of the accessibility ideal for a variety of reasons: finances, competing priorities for time and attention, attitudinal barriers, and lack of awareness. Many

dedicated information professionals have worked for decades to promote empowering and fair services for people with disabilities. In becoming allies with people with disabilities, information professionals enter a mutually beneficial relationship with a large, diverse sector of the community.

DISABILITY AS A SOCIAL CATEGORY

The meaning and scope of the category of disability varies among cultures and countries. A given set of physical or cognitive characteristics might be considered a disability in one context, but thought of as simple human variation in another context. Although the context-dependent nature of the term disability makes it difficult to quantify, the World Health Organization estimates that 15% of people worldwide have a disability.^[1]

The contemporary understanding of disability is that it is a social phenomenon. The social model of disability represents a shift from the previous conception of disability as an individual problem. Historically, the responsibility for disabled individuals' quality of life lay with the individuals and their families. Institutions that made accommodations for people with disabilities did so out of charity. In the second half of the twentieth century, due largely to activism and organizing by people with disabilities, a social model of disability emerged. The social model contests the idea that individuals and families should bear the burden of conforming to a nondisabled world. Under the social model, society is responsible for building its institutions in ways that include all citizens. The social model calls attention to the way that disability results from the interaction between a person's impairment and their environment.

There are many different kinds of disability. Some broad categories of disability are

- Mobility disabilities
- Sensory disabilities
- Cognitive disabilities
- Learning disabilities
- Mental illness

Many disabilities change in severity and expression over time. Some people experience multiple disabilities. Many disabilities are “invisible”; arthritis, epilepsy, learning disabilities, and many more are not apparent to an outside observer. In most cases, information professionals do not need to know the details of our users’ medical diagnoses; the important thing to understand what they need to effectively use information resources. In many cases, the best way to learn about what people need is to ask. A great deal of the current literature on accessibility of information institutions emphasizes the importance of consulting with people with disabilities.

The disability rights movement, which began after the end of WWII and continues today,^[3] focuses on the rights of disabled people to make their homes outside of institutions and to participate in all aspects of society. Some histories of the disability rights movement are Shapiro’s *No Pity: People with Disabilities Forging a New Civil Rights Movement*^[4] and Fleischer and Zames’s *The Disability Rights Movement: From Charity to Confrontation*.^[5] The academic field of disability studies, which is closely aligned with the disability rights movement, developed in the 1980s.^[6] The *Disability Studies Reader*, a good introduction to the field, is periodically updated with new editions.^[7] The major professional organization in the field is the Society for Disability Studies, which publishes the journal *Disability Studies Quarterly*.

Print Disabilities

The category of print disabilities is convenient when discussing disability in relation to libraries and information. Print disabilities are any disabilities that affect a person’s ability to read standard print and can include blindness, low vision, some learning disabilities, and some cognitive disabilities. The category includes people who have difficulty holding a book or turning pages. The term “print disabled” was coined by George Kerscher in the late 1980s.^[8] Ways for print-disabled people to access books and articles include magnification, change in font, text-to-speech technologies, audiobooks, and Braille.

Language

Among people with disabilities, as among many historically marginalized groups, language and labels are taken

seriously. Words are understood as vehicles for social power that can either enforce or subvert oppressive structures. Historically, people with disabilities have been given many labels, many of which strike the modern reader as dehumanizing: invalids, cripples, freaks, and the insane. In the 1980s, the people-first language movement grew out of a concern about the dehumanizing nature of much of the language used to describe people with disabilities.^[9] Advocates of people-first language promoted the use of words and phrases that emphasize the person rather than the disability. The American Psychology Association’s “Guidelines for Non-Handicapping Language in APA Journals”^[10] explains key principles of people-first language. Examples of preferred language include “blind people” rather than “the blind”; “people who have epilepsy” rather than “epileptics”; and “people with disabilities” rather than “disabled people.” Terms with superfluous negative overtones, like “a victim of...,” “afflicted by...,” or “confined to a wheelchair,” are discouraged.

Person-first language is not universally embraced; there is ongoing debate about it within the disability community. Especially in the United Kingdom, writers and activists tend to use “disabled people” rather than “people with disabilities.” Many in the autistic and blind communities also embrace identity-first language. Those who use identity-first language often view it as less linguistically cumbersome and as a way to assert their social and political identity (Schur et al.,^[11] p. 7). Both people-first and identify-first language are used in this encyclopedia entry.

In another example of the significance of language, many Deaf people capitalize the term to denote Deafness as a culture, while the term deafness with a lowercase “d” describes the physical condition. Hard-of-hearing is often used to describe the condition of partial hearing loss.^[12]

Some writers reject the term “hearing impaired”: Harlan Lane writes, “The label has embedded within it the infirmity model that legitimates that establishment; and it exists only in opposition to hearing; in this it is like ‘non-men’ as a label for women, ‘non-white’ as a label for people of color, or ‘sexually impaired’ as a label for gays” (Lane,^[13] p. 89). Others, in contrast, find “impairment” a useful term. Lennard Davis writes, “An impairment involves a loss or diminution of sight, hearing, mobility, mental ability, and so on. But an impairment only becomes a disability when the ambient society creates environments with barriers—affective, sensory, cognitive, or architectural” (Davis,^[14] p. 41).

As cataloging and metadata librarians are well aware, language norms are culturally relative and change over time. The most important policy for information professionals is to speak respectfully, be willing to ask people about their preferred language, and be open to changing language after receiving new information.

LEGISLATION

In 1990, the United States passed the Americans with Disabilities Act (ADA), a major piece of legislation addressing the civil rights of people with disabilities. Among other provisions, the ADA requires that employers make reasonable accommodations for workers with disabilities and that public buildings offer ramps, accessible parking, and accessible bathrooms. Several other countries also passed major civil rights legislation in the 1990s, including Australia (Disability Discrimination Act of 1992) and the United Kingdom (Disability Discrimination Act of 1995).

Another relevant law in the United States is the Rehabilitation Act, which prohibits discrimination on the basis of disability by the federal government. Section 508 of the Rehabilitation Act requires that websites and other information technologies used by the government be accessible to people with disabilities.

The United Nations Convention on the Rights of Persons with Disabilities, an international treaty obliging countries to protect the human rights of people with disabilities, was adopted by the UN General Assembly in 2006. As of this writing, 158 countries had signed the convention and 149 had ratified it. The United States is not among the countries that have ratified the convention.

NONLIBRARY INFORMATION INSTITUTIONS

While this entry focuses primarily on libraries, information needs and perspectives of people with disabilities are highly relevant to all information-focused institutions. Many of the entry's statements about libraries hold true for other types of institutions.

For-Profit Sector

Many information professionals are employed by for-profit companies, working in fields such as usability, information architecture, and database management. Accessibility of electronic resources is an important aspect of these fields. A 2007 special issue of the *Information Society* provides a multidisciplinary analysis of disability in information technology, addressing questions about how to align accessibility with the profitability goals of corporations.^[15]

Museums

In museum studies, there are ongoing conversations about ways to design exhibits with accessibility in mind. Strategies for enhancing the museum experience for disabled people include tactile exhibits, touch-tours, audio description of visual works, and closed captioning of audio

works. A 2013 special issue of *Disability Studies Quarterly* focuses on museum experience and blindness, featuring best practices, curators' perspectives, and personal accounts of museum experiences.^[16] Designing for accessibility can be a creative endeavor: Cachia, an art curator and chair of the Dwarf Artist Coalition of the Little People of America, calls on museums to "think about how access can move beyond a mere practical conundrum, often added as an afterthought once an exhibition has been installed, to use as a dynamic, critical and creative tool in art-making and curating" (Cachia,^[17] p. 259).

A few museums focus on disability as subject matter. The June 2014 issue of the *Journal of American History* features exhibition reviews of several brick-and-mortar museums: the Museum of disABILITY History in Buffalo, New York; the Oregon State Hospital Museum of Mental Health; and the Museum of the American Printing House for the Blind.^[18] Several online museums and exhibits document disability history. The Smithsonian's National Museum of American History hosts *EveryBody: An Artifact History of Disability in America*, which launched in 2013, as well as an ongoing web version of their 2000–2001 exhibit the Disability Rights Movement. The University of Leeds maintains the online Disability Archive UK. Another major online museum is the Disability History Museum maintained by Straight Ahead Pictures. Laurie Block, founder of the Disability History Museum, discussed the challenges of collecting and describing artifacts for the online museum in a 2007 article.^[19]

Representing disability in museums is complicated by historical traditions of exploitative, dehumanizing presentations of disabled bodies. Sandell, Delin, Dodd, and Gay discuss this topic in their article "In the Shadow of the Freakshow."^[20]

Archives

The archival record of disability experience, like the archival record for many historically disenfranchised groups, is fragmented. Some archives, such as the University of Toledo Archives, have proactively sought to find and preserve historical materials by partnering with community organizations.^[21] The Bancroft Library at the University of California, Berkeley, has a substantial collection of records from the disability rights and independent living movements. Articles in the archives literature have addressed finding aid accessibility^[22] and people with disabilities as archives employees.^[23]

HISTORY

Libraries began addressing the needs of people with disabilities long before the passage of the ADA. Throughout the 1960s, 1970s, and 1980s, a variety of books and

articles discussed library services for disabled patrons, particularly those with visual and mobility disabilities.

In the United States, the Boston Public Library established the first collection of embossed books for blind people in 1868, followed closely by the Library of Congress Reading Room for the Blind.^[24] In 1931, Congress passed the Pratt-Smoot Act (Act to Provide Books for the Blind), establishing what is now the National Library Service for the Blind and Physically Handicapped (NLS). The NLS produces Braille materials and audiobooks—also known as talking books—and distributes them by post-age-free mail to borrowers' homes. They recently began offering online access to talking books and Braille books (digital Braille books can be downloaded and printed using embossing hardware). The NLS operates through a national network of libraries in each state.

Before the independent living movement of the mid-twentieth century, many people with disabilities lived in institutions. A few authors have explored the histories of libraries patients' libraries in hospitals and mental institutions.^[25,26]

After the ADA was passed in 1990, many libraries made changes to come into compliance with its requirements for physical spaces. In a 1991 *American Libraries* article, Gunde describes efforts by the library profession to respond to the ADA. He describes brochures and conference programs sponsored by Association of Special and Cooperative Library Agencies (ASCLA). In colorful language, he calls on libraries to do more to make their programs and services inclusive: "Many citizens with disabilities will come to question the sincerity of our commitment to the professional principles that we so eloquently proclaim at our overcrowded conferences and in our bombastic Association resolutions" (Gunde,^[27] p. 809).

In 1994, Scheimann studied ADA compliance among Ohio public libraries.^[28] Although the study's scope is limited, it provides a useful glimpse into a point in time shortly after the passage of the ADA. Libraries reported relatively high levels of physical accessibility and provision of alternative formats—87% had accessible parking, 71% had appropriate aisle width, and 95% provided large print, for example. Most libraries had not solicited significant patron input—only 7% had done so, with some including patrons with disabilities on an ADA evaluation committee, some distributing evaluation forms, and one inviting members of the local Handicapped Society to tour the building and offer suggestions. Many libraries had neglected to perform the self-evaluation that public entities were legally mandated to perform in 1993. Survey respondents expressed concerns about the cost of modifications, and several stated a perception that their service community did not include people with disabilities.

Perry's 2014 study of information services for older adults showed that many, but not all, libraries were in compliance with ADA guidelines.^[29] Perry surveyed libraries in suburban counties, receiving 91 responses. Over 90%

of responding libraries provided large print and audiobooks, 87.9% of buildings met ADA guidelines, and 81.3% of library websites were ADA compliant. In a variety of other categories, including assistive technologies, large-print brochures, and visible and high-contrast signage, between 35% and 45% of libraries provided accommodations.

The ASCLA, a division of the American Library Association, has done substantial work promoting improved library services to people with disabilities. The ASCLA maintains a series of library accessibility tip sheets that provide brief, readable introductions to topics such as assistive technology, service animals, and various categories of disability.^[30] In 2001, the ASCLA was instrumental in adding a section on Library Services for People with Disabilities to the policy manual of the American Library Association.^[31]

The International Federation of Library Associations and Institutions (IFLA) is another long-time player in the field. What is now IFLA's section on Library Services to People with Special Needs was founded in 1931 as the Sub-Committee on Hospital Libraries. From 1981 to 2008, it was called the Section for Libraries Serving Disadvantaged Persons.^[32] During the section's long history, it has facilitated international cooperation among libraries serving people with disabilities and has published many sets of standards, guidelines, bibliographies, and resource lists. In 2005, it published the Access to Libraries for Persons with Disabilities Checklist, which is used internationally to evaluate and improve services.

In a content analysis of disability and accessibility in the library and information science literature from 2000 to 2010, Hill found a strong emphasis on accessibility of electronic resources and on visual disabilities.^[33] A comparatively small amount of research has focused on information behavior or on attitudinal and social barriers to access. Thirty-six percent of the research articles Hill examined involved participation by people with disabilities, and she states that increasing this proportion would benefit the field.

In the United Kingdom, the now-defunct Museums, Libraries, and Archives Council produced several tools and documents related to people with disabilities, including a database launched in 2005 of disability trainers and consultants with an interest in working with heritage organizations.^[34] The Museums, Libraries, and Archives Council was closed in May 2012 as part of government restructuring. Some of the Council's responsibilities were taken over by Arts Council England and the National Archives, but the Disability Experts database appears to no longer be maintained.

PHYSICAL RESOURCE ACCESSIBILITY

Space

Accessibility of physical spaces is an essential aspect of library services to people with disabilities. People who use

wheelchairs, walkers, or scooters need wide enough pathways to navigate library buildings. Some physical space considerations, such as signage, also affect people with visual and cognitive disabilities. The ADA mandates that any new construction or renovation of a public space follow accessibility standards. Institutions that do not follow these standards are open to lawsuits. The ADA Standards for Accessible Design were updated in 2010, replacing the 1991 Standards.

The practice of designing spaces to be inherently accessible to all, including elderly and disabled people, can be called universal design, accessible design, barrier-free design, or inclusive design. Universal design from the beginning of a project is easier than retrofitting non-accessible spaces, and it is more inclusive than making only certain areas accessible. William Sannwald's *Checklist of Library Building Design Considerations* includes a chapter on ADA considerations and is periodically updated to keep pace with current standards and technologies.^[35] Several libraries have successfully obtained grant or government funding for ADA compliance construction projects (Vincent,^[36] p. 51).

There are many ways for libraries to improve their physical accessibility without undergoing new construction or renovation. They can provide plenty of seating, good lighting, and large and high-contrast signs. They can make sure that aisles, workstations, and handrails are kept clear. Tables can be raised or purchased at an appropriate height for wheelchairs. Vincent's *Making the Library Accessible for All* has a clear and concise chapter on architectural and environmental accessibility.^[36]

Physical Books and Media

Physical books present inherent accessibility challenges to many people with visual disabilities, learning disabilities, and mobility disabilities. Libraries have a long history of collecting large-print books, which facilitate access by people with low vision. Another way to increase accessibility of physical books is to offer assistive technology that magnifies printed text, such as closed-circuit televisions. Many libraries arrange accommodations such as extended borrowing periods, proxy borrowers, renewal by phone, or extended reference help to facilitate access by disabled patrons. Communicating directly with patrons is the most effective way to learn what accommodations might help them use the library's books.

Under the 1996 Chafee Amendment, the NLS has permission to convert print materials to accessible formats, such as audio and Braille, without being subject to copyright law. Materials converted under the Chafee Amendment can only be distributed to eligible borrowers with a documented disability. These materials represent only a small fraction of the books published in any given year.

Standard type can often be made accessible through scanning. Scans can be run through optical character

recognition programs to produce text that can be converted to audio, Braille, more readable font, or large print. In 2013, the University of California, Berkeley, library announced that it will scan materials on demand for students with disabilities as part of an out-of-court settlement following structured negotiations with four students.^[37]

Deaf and hard-of-hearing patrons can access a much larger proportion of a library's holdings than visually disabled patrons, but videos may present an accessibility challenge. Many DVDs and Blu-Rays include captioning. Some libraries lend audio-described videos, which provide narration of the film's action for blind viewers.^[36]

Services and Programming

Libraries offer a wide range of programs, classes, book clubs, and other events. One way to avoid excluding people with disabilities from events is to publicize the fact that sign language interpretation or other accommodations are available if the library is notified a certain number of days in advance. Providing reasonable accommodations so that people with disabilities can participate in library programs is not only ethical, but likely falls under the ADA's provision that no individual should "be denied the benefits of the services, programs, or activities of a public entity."^[38]

Staff delivering presentations can increase accessibility by making sure slides and visual aids are clear and readable, with large text. White text on a dark background is easier to read by people with low vision.^[36]

Libraries increasingly produce video tutorials. An article by Oud offers guidance for creating accessible screencasts.^[39] She recommends Captivate or Camtasia for creating accessible videos. Best practices for accessibility include captioning, keyboard alternatives to mouse clicks, avoiding videos that start automatically, and including either alt text or spoken narration that describes what is happening onscreen. She writes that closed captioning (hidden by default) is preferred over open captioning (visible by default) because open captioning has been shown to be distracting to nondisabled users.

Many libraries provide programs specifically geared for people with disabilities. The Seattle Public Library, for example, hosts a book club conducted in American Sign Language. Several books and websites offer suggestions for programming for children and youth on the autism spectrum.^[40,41]

There is a long tradition of programs that deliver library materials directly to people's homes, historically called "homebound" or "housebound" services. These programs serve people who have difficulty getting to the library for a variety of reasons, including age, illness, and disability. In a 2004 study of home library service in the United Kingdom, Ryder found that libraries provide home library service to over 120,000 people and that

volunteers—often in combination with paid staff—support programs in over half of responding libraries. Only 62% of responding libraries publicize their home library service, partly due to fear of not being able to cope with demand, which may make them legally vulnerable under the UK's Disability Discrimination Act.^[42]

ELECTRONIC RESOURCE ACCESSIBILITY

Born-digital electronic resources have the potential to be more inherently accessible than print since assistive technology can modify text in a variety of ways to make it possible for people with disabilities to access. Assistive technology can change font size, style, or color; convert print to spoken word; or convert print to Braille. Other types of assistive technology allow users to use speech for text input or to navigate resources using a keyboard, mouth stick, or head wand. Unfortunately, many websites and electronic resources contain features that make them difficult or impossible to navigate using assistive technology.

Nina McHale provides a concise overview of web accessibility guidelines.^[43] Accessible web design is defined by two major sets of guidelines: the Web Content Accessibility Guidelines (WCAG), which are produced by the World Wide Web Consortium (W3C) and followed voluntarily, and the guidelines of Section 508 of the Rehabilitation Act, which are mandatory for federal agencies.

Many web accessibility guidelines are related to website performance on assistive technologies such as screen readers, while some, such as the recommendation to provide text transcripts of videos, address accessibility needs that are not related to screen readers.

Tatomir and Durrance developed a 10-point checklist, the Tatomir Accessibility Checklist, which provides a quick overview of some key components of accessibility. The checklist was inspired by a combination of the WCAG guidelines, Section 508 guidelines, and personal experience.^[44] The 10 elements of the Tatomir Accessibility Checklist are

1. Accessible versions of PDF web pages and documents
2. Skip navigation and jump-to links
3. Clearly labeled page elements
4. Text captions for tables, images, graphics, graphs, and charts
5. Limited use of incompatible programming languages and scripts
6. The absence of identically named page elements
7. Text transcripts of videos, animations, and podcasts
8. Logical and consistent page organization
9. Absence of timed responses
10. Digital forms and functionalities accessible and usable with adaptive technologies^[44]

Accessibility often goes hand in hand with usability. Accessible websites tend to be well-structured, quick to load on slow connections, compliant with web authoring standards, optimized for search engines (due to semantic markup), and easy to view on mobile devices.^[36]

Accessibility of electronic resources is relatively well covered in the library literature, although gaps still exist in many areas, such as usability testing by people with disabilities.^[33] Schmetzke edited special accessibility issues of *Library Hi Tech* in 2002^[45,46] and 2007.^[47] In 2012, Booth edited a special accessibility issue of *Library Technology Reports*.^[48]

Vendor Databases

One of the more troubling findings in the literature on electronic accessibility is that many vendor-supplied databases, to which large portions of library budgets are dedicated every year, do not meet accessibility standards. Tatomir and Durrance studied 32 vendor databases and found only 9 to be moderately accessible; most were either marginally accessible or inaccessible.^[44] Tatomir and Durrance gave relatively high marks to government websites, Google Scholar and Google Books, JSTOR, ProQuest, and OCLC World Cat. They noted that as of 2010 important accessibility elements were missing from databases produced by Gale, Lexis-Nexis, and Elsevier Science Direct. EBSCO databases were marginally accessible. Through a questionnaire directed at database vendors, Dermody and Majekodunmi found that most vendors did not work with people with disabilities to conduct usability tests.^[49]

The ASCLA maintains an online toolkit entitled *Think Accessible Before You Buy*, which provides checklists and questions to ask when evaluating electronic resources for accessibility.^[50] Libraries can require that potential vendors submit a Voluntary Product Accessibility Template (VPAT), a standardized document for reporting a product's compliance with accessibility standards. Many federally funded projects require a VPAT.^[51]

The Universal Accessibility Interest Group of the Association of College and Research Libraries maintains an online guide to resources on web accessibility, which as of this writing included information on vendor databases and LibGuides in addition to websites.^[52] Mulliken compiled a list of statements from vendors on their products' accessibility or lack thereof, which is no longer being maintained but remains informative.^[53]

Library Websites

Website accessibility may be a new field for many managers of "homegrown" library websites, and even for some professional web designers. Several websites and books outline small changes that can make a big difference for accessibility.^[36,54,55]

Comeaux and Schmetzke have collected longitudinal data on accessibility of North American academic library websites since 2002. In both 2010 and 2012, approximately 60% of websites were approved by Bobby 3.1.1, an automated checking tool.^[56] Maatta Smith used another checking tool, the WebAIM Accessibility Evaluator, for a 2014 study of 127 urban public libraries in the United States. She found that all websites contained some errors, with the most common being contrast errors (low contrast between text and background), missing alt text (no text alternative to images or video), and missing form labels (no navigational aids to help users identify and fill out forms).^[57]

Circulating Equipment

Increasingly, libraries circulate electronic equipment such as e-readers. Some e-readers are accessible to people with print disabilities, and some are not. The Free Library of Philadelphia and the Sacramento Public Library have both been sued for loaning inaccessible e-readers.^[58] The Department of Justice and Department of Education issued a Dear Colleague letter in 2010 stating any e-readers used by colleges and universities should offer text-to-speech functionality.^[59]

Assistive Technology

Many libraries provide assistive technology, also known as adaptive technology, for patrons' use. Vincent's book *Implementing Cost-Effective Assistive Computer Technology* provides an overview of options and considerations.^[60] Decisions about what technology to offer should be based on assessment of local needs.

STAFF TRAINING

One of the most important accessibility resources a library can offer is quality public service. All public services staff should know the library's accommodation procedures and the basics of using assistive technology within the library, including what is available through operating systems, browsers, and Microsoft Office. Accessibility information can be compiled in a staff manual easily accessible from service points. Training can be provided in-house, with outside trainers, through webinars, or through attendance at conferences.^[36]

In a qualitative study of library access, Clayton Copeland quotes from interviews with several people with disabilities. One of the participants, Nate, offers his impression of library staff attitudes:

...librarians are among the people who are most interested in helping people...their whole job is to help you find the book that you want and maybe even the book that

you didn't even know you wanted. And I think that tends to carry over into how they treat people with disabilities. Now in a modern situation where all jobs are getting more and more duties put on top of them, and cutting back on how many staff there are...If anybody comes along and needs a little extra work [deep sigh], that can be a problem. And certainly, you know, I think they catch their breath before they take on a whole new area. But I don't find a lot of resistance (Copeland,^[61] p. 235).

As Nate observes, the vast majority of library staff are friendly and willing to help, but many are unsure and hesitant when it comes to disability issues. Clear policies and staff training on effective communication with people with disabilities can increase the quality of service and decrease staff uncertainty and anxiety.

The tipsheets provided by the ASCLA present a good overview of best practices and etiquette. For example

Staff should ask, "What's the best way I can help you?" when a patron requests assistance. Let the person guide you.

After offering assistance, wait for acceptance; don't be afraid to ask questions if you aren't sure about something.

Respect the patron's privacy. Do not ask questions about his or her disability or its cause.

Understand that the adaptive equipment of a person with a disability is an extension of his or her body—this is true for adults and children. Ask for the person's permission before touching or moving the equipment.

Always speak directly to a person with a disability—not the person's companion, aide, or sign-language interpreter.^[62]

Use normal language. "See you later" will not offend visually impaired persons.^[63]

Written library policies can include statements that affirm the institution's commitment to the ADA and to providing access to all patrons. Policies and procedures can also outline the steps a library will take if it receives a complaint or request. Some libraries might write transition plans for changes that are not yet financially or logistically feasible.^[64]

Library Staff with Disabilities

People with disabilities are underrepresented in librarianship and library work. As the library profession works to increase diversity in its ranks, disability is one of the areas targeted. The ALA Century Scholarship is provided annually to support a library school student with disabilities. Few empirical studies of librarians with disabilities have been conducted. A study of academic library managers in the Republic of Ireland found that they were aware of the

need to accommodate disabilities, but that one-third of their libraries did not have procedures in place to address requests for reasonable accommodation.^[65]

In the title of a 1995 opinion piece in *American Libraries*, Barlow exhorted, “Don’t Just Serve People with Disabilities—Hire Them.” She recounts the struggles and successes of several library employees with disabilities, gathered from a listserv query. Marilyn McLean, then head of science reference at Boston Public library, who has spina bifida, stated, “I frequently have had students writing paper or other people call about disabilities or birth defects, and I can often lend a personal touch to the reference encounter” (Barlow,^[66] p. 722).

Fran Ziglar, a wheelchair user, wrote about her 31-year career at the Nashville Public Library in a 2006 *Tennessee Libraries* article. She writes, “There have been a few issues about accessibility: what to do when the elevator broke; early accessible bathroom stalls with curtains rather than doors, etc. Overall, I think that a sense of humor, concerned supervisors, and supportive co-workers have made the way successful and meaningful.”^[67]

OUTREACH

Community members with disabilities might not know that the library has resources for them. Especially if they have had negative experiences with libraries in the past, the prospect of going to a library without knowing whether they will be able to carry out simple tasks could be daunting. Outreach is an important part of an accessibility strategy. Used here, outreach refers to communication with community members who may not be library users and includes both informing people about what the library offers and asking them about what they need. Outreach might be conducted through partnerships with disability organizations, schools, or senior centers. Outreach could include co-hosted events or inclusion of library information in outside organizations’ marketing materials.

In *Making the Library Accessible for All*, Vincent recommends that every library recruit a group of “accessibility resource people.” This advisory group would provide ongoing feedback on local needs and accessibility issues. Accessibility resource people could provide information either through in-person meetings or electronic communication; she recommends SurveyMonkey as the most accessible of the free online survey tools. Vincent’s book includes a sample list of questions for initial information-gathering. She quotes Alan Bern of the Berkeley Public Library: “There is, perhaps, nothing more important than a focus group—or, better, an ongoing Advisory Group—to discuss accessibility issues at your library. You WILL get requests you cannot meet—and even off-base questions and requests—but the number of spot-on questions and requests AND unexpected, fantastic ideas far outweighs any negative outcomes” (Vincent,^[36] p. 3).

Once people with disabilities feel welcome in the library, they are often enthusiastic and active patrons. Vincent quotes computer accessibility expert Marc Sutton: “There are many books and magazines available through online library databases that would otherwise not be accessible to print-impaired persons. Often, a patron just needs a little help finding these items and then a whole new world of knowledge opens up” (Vincent,^[36] p. xii).

DISABILITY AS SUBJECT MATTER

Discussions of disability and libraries often focus solely on the accessibility of resources and services. Another important aspect of disability, however, is disability as subject matter. Materials related to disability culture, art, and politics, as well as materials created by people with disabilities, are of interest to library users with and without disabilities. Strong collections will include materials that reflect the intersections of disability with other aspects of diversity, including class, race, gender, and sexual orientation.

Collection development in the disability field may involve turning to some specialized reference sources or small publishers. Many mainstream depictions of disability, especially in film, continue to rely on stereotypes, portraying people with disabilities either as villains or as one-dimensionally inspirational or tragic figures.^[68] The Schneider Family Book Awards, administered by the ALA, are given yearly to children’s and young adult books about the disability experience. A bibliographic essay by Cole, focusing on disability studies, also contains useful references to materials on disability history, culture, and memoir.^[69] An annotated bibliography by Klauber, although out of date, lists categories of books providing practical information about aspects of living with a disability: College and Careers; Easier Living; House and Garden; Recreation and Travel; and Love, Marriage, Baby Carriage.^[70]

Cataloging and Indexing

Because the terminology used to describe disability has historically reflected discriminatory cultural attitudes, library catalogs can contain archaic or insensitive words. The word “handicapped,” for example, is commonly found in indexes despite not being in general use. Emmett and Catherine Davis discussed subject access to disability materials in the 1980s *Mainstreaming Library Service for Disabled People*, where they critiqued then-current Library of Congress headings such as *Idiocy* and *Castration of Criminals and Defectives*.^[71] In a 2013 study of award-winning books about disability for youth, Kaney found that catalog terms failed to adequately represent many important disability issues.^[72] In a 2014 article, Koford interviewed nine disability studies scholars about

their impressions of subject headings, finding that they often encounter and use nonpreferred language when searching.^[73]

Catalogers and indexers continuously change standards to reflect changes in society and language. Drabinski argues that problematic subject access terms can be used as pedagogical tools, helping library users better understand historical and social aspects of information.^[74] In the *Disability Studies Reader*, disability studies scholar Lennard Davis recounts a meeting between the Committee on Academics with Disabilities and a bibliographer from the MLA Bibliography. He writes, “an article on ‘crippled saints’ could not be searched by computer because the word ‘crippled’ was disallowed by MLA regulations as constituting discriminatory language. The bibliographer therefore filed the article under ‘saints’ thus rendering it unretrievable by anyone with an interest in disability” (Davis,^[7] p. xvii). This story illustrates the idea that access structures cannot be fixed by replacing terminology; rather, structures serve as evidence of history, struggle, and change. In practical terms, the variety of words historically used to describe disability means that searching for disability information is challenging and might require extra time and creativity.

CONCLUSIONS

Access to information, both about disability and about other topics, is essential for people with disabilities. Many disabled people have had positive experiences finding information through websites, databases, museums, archives, and libraries; at the same time, many have encountered barriers that prevented them from accessing the full range of information available to nondisabled people. Awareness of some disability issues, such as the importance of large-print books, is high within the library profession, while awareness of other issues, such as the poor accessibility record of many vendor-supplied databases, is low. There are many gaps in the library and information science literature on disability, and more studies that include disabled people as participants are needed. Some key principles that emerge in the literature are

- People with disabilities should be involved in the accessibility evaluation and planning process.
- Universal design, when it is possible, is more efficient and equitable than retrofitting nonaccessible structures or building alternate versions. This principle applies both to physical spaces and to electronic resources.
- Designing for accessibility often leads to usability. For example, large and clear signs benefit not only people with low vision or cognitive disabilities, but also nondisabled library users. Websites designed for accessibility tend to perform well not only on screen readers, but also on slow connections and mobile devices.

Providing equitable access to information for all people, including those with disabilities, is an ongoing process. Asking questions and opening lines of communication is essential to improving library services to people with disabilities.

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Personal Information Management

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Abstract

Personal information management (PIM) refers to the practice and the study of the activities a person performs in order to acquire or create, store, organize, maintain, retrieve, use, and distribute information in each of its many forms (paper and digital, in e-mails, files, web pages, text messages, tweets, posts, etc.) as needed to meet life's many goals (everyday and long term, work related and not) and to fulfill life's many roles and responsibilities (as parent, spouse, friend, employee, member of community, etc.). PIM activities are an effort to establish, use, and maintain a mapping between information and need. Activities of finding (and refinding) move from a current need toward information, while activities of keeping move from encountered information toward anticipated need. Meta-level activities such as maintaining, organizing, and managing the flow of information focus on the mapping itself. Tools and techniques of PIM can promote information integration with benefits for each kind of PIM activity and across the life cycle of personal information. Understanding how best to accomplish this integration without inadvertently creating problems along the way is a key challenge of PIM.

INTRODUCTION

Personal information management (PIM) refers to the practice and the study of the activities a person performs in order to acquire or create, store, organize, maintain, retrieve, use, and distribute information in each of its many forms (paper and digital, in e-mails, files, web pages, text messages, tweets, posts, etc.) as needed to meet life's many goals (everyday and long term, work related and not) and to fulfill life's many roles and responsibilities (as parent, spouse, friend, employee, member of community, etc.) or, to paraphrase, PIM is the art of getting things done in our individual lives through information.^[1] PIM places special emphasis on the organization and maintenance of personal information collections (PICs) in which information items, such as paper documents, electronic documents, e-mail messages, digital photographs, web page references, and handwritten notes, are stored for later use and repeated reuse.^[2]

PIM provides a productive meeting ground for several disciplines including cognitive psychology and cognitive

science; human-computer interaction, information science, and human-information behavior; and the fields of data, information, and knowledge management. In a world increasingly defined by the information we receive, send, and share, the ability to manage this information is one of life's essential skills.

One ideal of PIM is to always have the right information in the right place, in the right form, and of sufficient completeness and quality to meet the current need. This ideal is far from reality for most people. In practice, people do not always find the right information in time to meet their needs. It may be that the necessary information is not found or may arrive too late to be useful. Or information may arrive too soon and then be misplaced or forgotten entirely before opportunities for its application arrive. People forget to use information even when (or sometimes because) they have taken pains to keep it stored somewhere for future use.

To better “keep found things found,”^[3] people may store their information in multiple locations and in multiple applications, using organizational schemes that are roughly comparable but still inconsistent (often in

important ways). The result is *information fragmentation*^[4]—the information people need is scattered widely, making activities of PIM more difficult:

- *Maintaining and organizing* personal information is more difficult when so many separate stores of information must be considered. Are organizations the same or at least consistent? Which version of a document is current? Is information getting backed up?
- *Managing for privacy, security, and the overall flow of information* (incoming and outgoing) is more difficult when a person's information is so widely scattered. What have people shared and with whom?^[5] Is there an "Achilles heel" in a person's data protection efforts?
- Information fragmentation makes more difficult even the basic, every-minute activities of *keeping* and *finding*. Where/how to keep an important file, reference, or reminder when there are so many alternatives to choose from? And where among these alternatives should people later look for this information?

Information fragmentation is manifest in the many sources of information a person must consult to make even simple decisions. The decision to accept a dinner invitation, for example, may depend upon the information to be found in digital calendars, paper calendars (e.g., a shared household calendar), web pages, and e-mail exchanges. PIM activities in general take longer and are more prone to error when information is scattered.

While new applications, tools, and devices often increase information fragmentation, this does not have to be the case. Some tools and techniques of PIM promote information integration, which can simplify PIM activities and have benefits across the life cycle of personal information. Tools can also simplify the sharing and exchange of information across devices and people, and can help users to see unified views of their information spaces.

In the following sections, we provide

- A brief history of PIM
- An analysis of PIM including the several senses in which information can be "personal" and major kinds of PIM activity
- A selective review of PIM research especially as this relates to major kinds of PIM activity
- Concluding notes on some of the significant challenges and opportunities for the PIM field of study in the years ahead

A BRIEF HISTORY OF PIM

PIM is a new field with ancient roots. When the oral rather than the written word dominated, human memory was the primary means for information preservation.^[6] As information was increasingly rendered in paper form, tools

were developed over time to meet the growing challenges of management. For example, the vertical filing cabinet, now a standard feature of home and workplace offices, was first commercially available in 1893.^[7]

The modern dialog on PIM is often traced to the publication of "As We May Think" by Vannevar Bush at the close of World War II.^[8] Bush expressed a hope that technology might be used to extend our collective ability to handle information and to break down barriers impeding the productive exchange of information.

The 1940s also saw the development of Shannon's theory of communication that laid the groundwork for a quantitative assessment of information.^[9] Key to this theory is the notion that the information content of a message can be measured for its capacity to reduce uncertainty.

To understand information exclusively as the reduction of uncertainty can be seen as overly restrictive.^[10] As Buckland notes, "sometimes information increases uncertainty,"^[11] p. 351. Nevertheless, even as we search for complementary, qualitative characterizations of information (e.g., Dinneen and Brauner^[12]), a larger point in Shannon's work endures: The value of information is not absolute, but relative to a context that includes the intentions of the sender, method of delivery, and the current state of a recipient's knowledge. This holds true even when the sender and the recipient are the same person albeit separated in time, for example, when people place "appointments" in their calendars a week from today as a reminder to do something (e.g., "book plane tickets").

With the increasing availability of computers in the 1950s came an interest in the computer as a source of metaphors and a test bed for efforts to understand the human ability to process information and to solve problems. Newell and Simon pioneered the computer's use as a tool to model human thought.^[13,14] They produced "The Logic Theorist," generally thought to be the first running artificial intelligence program. The computer of the 1950s was also an inspiration for the development of an *information processing approach* to human behavior and performance.^[15]

After research in the 1950s showed that the computer, as a symbol processor, could "think" (to varying degrees of fidelity) like people do, the 1960s saw an increasing interest in the use of the computer to help people to think better and to process information more effectively. Working with Andries van Dam and others, Ted Nelson, who coined the word "hypertext,"^[16] developed one of the first hypertext systems, the Hypertext Editing System, in 1968.^[17] That same year, Douglas Engelbart also completed work on a hypertext system called NLS (on-Line System).^[18] Engelbart advanced the notion that the computer could be used to augment the human intellect.^[19,20] As heralded by the publication of Ulric Neisser's book *Cognitive Psychology*,^[21] the 1960s also saw the emergence of cognitive psychology as a discipline that focused primarily on a better understanding of the human ability to think, learn, and remember.

The computer as an aide to the individual, rather than a remote number cruncher in a refrigerated room, gained further validity from work in the late 1970s and through the 1980s to produce personal computers of increasing power and portability (for more on the history of the personal computer, see Refs.^[22–24]). These trends continue. Computational power roughly equivalent to that of a desktop computer of a decade ago can now be found in devices that fit into the palm of a hand (see Jones,^[25] Chapter 4, for discussion on the present and future of information “always at hand” via devices).

The phrase “personal information management” was itself apparently first used in the 1980s^[26] in the midst of general excitement over the potential of the personal computer to greatly enhance the human ability to process and manage information. The 1980s also saw the advent of so-called “PIM tools” that provided limited support for the management of such things as appointments and scheduling, to-do lists, phone numbers, and addresses. And a community dedicated to the study and improvement of human–computer interaction also emerged in the 1980s.^[27,28]

As befits the “information” focus of PIM, PIM-relevant research of the 1980s and 1990s extended beyond the study of a particular device or application toward larger ecosystems of information management to include the organization of the physical office^[29] and the management of paperwork.^[30] Malone^[31] characterized personal organization strategies as “neat” or “messy” and described “filing” and “piling” approaches to the organization of information. Other studies showed that people vary their methods for keeping information according to anticipated uses of that information in the future.^[32] Studies explored the practical implications that human memory research might carry in the design of, for example, personal filing systems^[33–35] or information retrieval systems.^[36] Studies demonstrated a preference for navigation (browsing, “location-based finding”) in the return to personal files,^[37] a preference that endures today notwithstanding significant improvements in search support^[38–41] and an increasing use of search as the preferred method of return to e-mails.^[42]

PIM, as a contemporary field of inquiry with a self-identified community of researchers, traces its origins to a special interest group session on PIM at the CHI 2004 conference^[43] and to a special National Science Foundation–sponsored workshop held in Seattle in 2005.^[44] (Since 2005, PIM workshops have been held roughly every 18–24 months, see: <http://pimworkshop.org/>.)

AN ANALYSIS OF PIM

A deeper understanding of what PIM *is* begins with definitions of associated concepts and the description of a

conceptual framework in which to interrelate key kinds of PIM activity.

The Information Item and Its Form

Information sent and received takes many *information forms* in accordance with a growing list of communication modes, supporting tools, and people’s customs, habits, and expectations. People still send paper-based letters, birthday cards, and thank you notes. But ever more so, people communicate using digital forms of information including e-mails, documents shared (as attachments or via a service such as Dropbox), and “tweets,” text messages, blog posts, Facebook updates, and personal web pages.

Across forms, it is useful to speak of an *information item* as a packaging of information. An item encapsulates information in a persistent form that can be managed. An information item can be created, stored, moved, given a name and other properties, copied, distributed, and deleted.

The concepts of information item and information form are helpful abstractions for considering aspects of PIM. For example, an e-mail message, as an item, packages together information such as a sender, receiver, subject, body text, and date sent. All e-mails, as befits their form, share common characteristics such as the expectation of a timely delivery (i.e., in seconds not days) and a timely response (i.e., within a day or two, not a month later). An e-mail message can be *transformed*, i.e., it can be copied to create a new information item of a different form. For example, a user may print the e-mail and view it in a paper form. Each form is associated with a distinct set of tools, techniques, habits, and expectations for interacting with and managing the information.

Personal Information

There are several senses in which information can be personal. Each represents a different relationship between the information and the person: Information can be owned by, about, directed toward, sent by, experienced by, or relevant to “me.” (See Table 1.) This definition and the several relationships captured in Table 1 form an inclusive definition of personal information. Prior work in PIM has at times limited the definition of PIM by not including some of these relationships.

Clearly, the senses in which information can be personal are not mutually exclusive. In many cases, the same information may be personal in several senses. For example, a folder of photos taken last Thanksgiving is information about the friends and family at the dinner—and about “me” (P2). The photos are owned by “me” (P1), and these represent events experienced by “me” (P5). The owner can also elect to share the photos with others via a service like Dropbox (P4).

Table 1 Information can be personal in any of several relationships to a person

	Relation to “me”	Examples	Issues
P1	Controlled by/owned by me	E-mail messages in our e-mail accounts; paper documents in a home office; computer files on a hard drive or in a web cloud service.	Security against break-ins, virus protection, backups to prevent data loss, etc. What to share and with whom? These questions apply both for paper filing cabinets and for folders in a service like Dropbox.
P2	About me	Credit history, medical records, web search history, records of library books checked out.	Who sees what, when, and under what circumstances? How is information corrected or updated? Does it ever go away?
P3	Directed toward me	E-mails, phone calls, drop-ins, TV ads, web ads, pop-ups. Also, invitations to join a share of a cloud service. Facebook posts. Tweets “@” you.	How to stay focused long enough to complete a task? “When I’m not interrupted by others, I interrupt myself! I worked nonstop today, but what did I accomplish?”
P4	Sent/posted/ shared by me	Sent e-mail, personal websites, published reports and articles, folders shared via a cloud service like Dropbox.	Who sees what when? Did the message get through? Am I making the “right” impression? Am I sharing the right information for our teamwork?
P5	For things experienced by me	Web history, photos (taken by others as well as by me), handwritten notes, full-motion videos from head-mounted cameras. ^[45]	How to get back to information again later? How to pick up where I left off (i.e., with a task, a book or episodes of a drama on Netflix)? How much history do I really need?
P6	Potentially relevant/ useful to me	Somewhere “out there” is the perfect vacation, house, job, lifelong mate. If only I could find the right information!	If only I knew (had some idea of) what I don’t know. But also... how to filter out information we don’t wish to see? (How to do likewise for our children?)

A Personal Space of Information

Each person has a single unique personal space of information (PSI) defined by the union of personal information

in each of its six senses as depicted in Table 1. A PSI affects the way its owner views and interacts with the rest of the world. A PSI also affects the way its owner is seen, categorized, and treated by others.

At its center, a person’s PSI includes all the information items that are, at least nominally, under that person’s control. At its periphery, the PSI includes information that the person might like to know about and control, but that is under the control of others. Included is information about the person that others keep. Also included is information in public spaces, such as a local library or the web, which might be relevant to the person.

Personal Information Collections

Personal information collections, referred to as PICs or simply collections, are personally managed subsets of a PSI. PICs are “islands” in a PSI where people have made some conscious effort to control both the information that goes in and how this information is organized. PICs can vary greatly with respect to the number, form, and content coherence of their items. Examples of a PIC include

- The papers in an office and their organization, including the layout of piles on a desktop and the folders inside filing cabinets
- A collection of projects each represented by a folder stored in a cloud storage service and accessed from different devices
- A collection of information items related to a specific project that are initially “dumped” into a folder on a person’s notebook computer and then organized over time as the project takes shape
- A reference collection of articles in digital format, organized for repeated use across projects
- Digital songs managed through a laptop computer or smartphone
- A collection of media (TV shows, movies, music) stored in a streaming service under a personal account, organized by some preference and including information such as ratings, watched/unwatched, and other notes

A PIC includes not only a set of information items but also their organizing representations, including spatial layout, containing folders, properties, and tags.

Activities of PIM

PIM activities are an effort to establish, use, and maintain a mapping between information and need, whether actual, perceived, or anticipated. Fig. 1 depicts a mapping between information and need as well as the activities of PIM that work with this mapping.

Information can arrive as aural comments from a friend, a billboard seen on the way to work, letters in

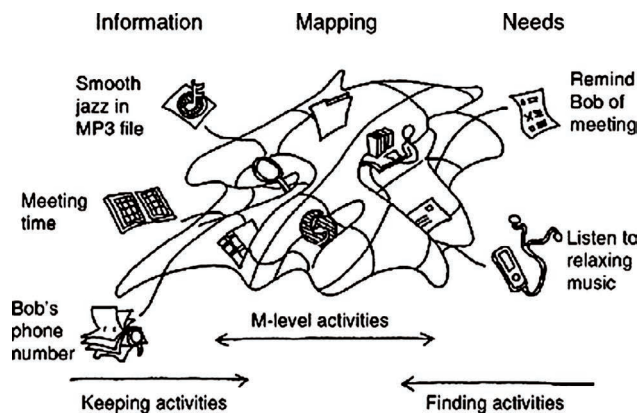


Fig. 1 PIM activities viewed as an effort to establish, use, and maintain a mapping between needs and information. Keeping and finding activities are interrupt driven (as prompted by incoming information or a need). M-level (meta-level) activities are broader in focus and more strategic in nature.

surface mail, or any number of digital items including e-documents, e-mail messages, Web pages, text messages, and tweets.

Needs can arise from internal or external sources. A person may recall, for example, that she needs to make plane reservations for an upcoming trip. The need may arise from the question posed by a colleague in the hallway or a manager's request during a meeting. External needs can also be evoked by an information item, such as an e-mail message or a web-based form.

Connecting between need and information is a mapping. Only small portions of the mapping have an observable external representation. Much of the mapping has only a hypothesized existence in the memories of an individual. Large portions of the mapping are potential and not realized in any form, external or internal. A sort function or a search facility, for example, has the potential to guide from a need to the desired information.

However, parts of the mapping can be observed and manipulated. The folders of a filing system (whether for paper or digital information), the layout of a desktop (physical or virtual), and the choice of names, keywords, and other properties for information items all form parts of an observable fabric helping to knit need to information.

Activities of PIM can be grouped and interrelated with reference to Fig. 1 as follows:

- **Keeping activities** map from encountered information to need (immediate or anticipated). This grouping includes decisions concerning whether to attend to information in the first place and, then, whether to make any effort to keep the information. Some information—the time on a clock or a sports score, for example—is “consumed” immediately with no need to keep the information for later access. Much of the information people encounter is simply ignored. For

the subset of encountered information to be kept for later use, questions arise regarding how the information should be kept. Should information items be piled (where?), filed (which folder?), tagged (with which tags?), or committed to memory?

- **Finding/refinding activities** map from need to information. This grouping includes explicit search queries as posted to a web-based search service or to a computer desktop-based search facility. The grouping also includes various activities of sorting, navigation, and “nosing around” that people use to get back to information for reuse.
- **Meta-level activities** focus on the mapping itself as a way of connecting together information and need. Meta-level activities include efforts to maintain (through backups, periodic cleanups, updates, and corrections) and organize (via schemes of piling, filing, or tagging) information; manage privacy, security, and the flow of information (e.g., through subscriptions, friendships, policies of disclosure, firewalls, virus protection); measure and evaluate (how are supporting tools and strategies working?); and make sense of and use of personal information (“What is the information telling me? What should I do?”).

PIM RESEARCH

PIM research can be organized according to PIM activity as follows:

Finding/Refinding: From Need to Information

The focus of a finding/refinding activity can be on information in a public space such as a physical library or the web, or focus can be on the information a person owns in a private space such as an office filing cabinet, the hard drive of a personal computer, or a cloud storage service.

A large body of information seeking and information retrieval research applies especially to finding public information.^[46–50] There is a strong personal component even in efforts to find new information, never before experienced, from a public store such as the web. For example, efforts to find information may be directed by a personally created outline or a to-do list. In addition, information inside a person's PSI can be used to support a more targeted, personalized search of the web.^[51]

The search for information is often a sequence of interactions rather than a single transaction. Bates^[52] describes a “berry picking” model of searching in which needed information is gathered in bits and pieces through a series of interactions, and during this time, the user's expression of need, as reflected in the current query, evolves. Teevan et al.^[53] note that users often favor a stepwise approach even in cases where the user might have sufficient

knowledge to access the information more quickly and more directly via a well-formed query. The stepwise approach may preserve a greater sense of control and context over the search process and may also reduce the cognitive burden associated with query formulation. For frequent information needs, users may well-trod paths of access, whereas for less common needs, search may be more likely to play a role.^[54]

People may find (rather than refind) information even when this information is ostensibly under their control. For example, items may be “pushed” into the PSI (e.g., via the inbox, automated downloads, web cookies, the installation of new software, etc.), and a person may have no memory or awareness of these items. If these items are ever retrieved, it is through an act of finding, not refinding. Memories of a previous encounter with an information item may also fade so that its retrieval is more properly regarded as an act of finding rather than refinding.^[55] While searching for information, one might come across information that, though not relevant to the current search, is relevant to another project. Or one may find information that is incorrectly filed or is in a “download” folder awaiting more proper organization (e.g., as part of “spring cleaning”).

Lansdale^[26] characterized the retrieval of information as a two-step process involving interplay between recall and recognition. The steps of recall and recognition can iterate to progressively narrow the search for the desired information—for example, when people move through a folder hierarchy to a desired file or e-mail message or navigate through a website to a desired page.

But a successful outcome in a refinding effort depends upon the completion of another step preceding recall: A person must remember to look. A person may know exactly where an item is and still forget to look for the item. It is also useful to consider a final “repeat?” step. Failure to collect a complete set of information (e.g., all potential conflicting commitments before accepting a proposed meeting time) can mean failure for the entire finding episode.

Refinding, then, is a four-step process with a possibility to fail at each step:

Step 1. Remember (to look). Many opportunities to refind and reuse information are missed for the simple reason that people forget to look. This failure occurs across information forms. In a study by Whittaker and Sidner,^[56] for example, participants reported that they forgot to look in “to do” folders containing actionable e-mail messages. Because of mistrust in their ability to remember to look, people then elected to leave actionable e-mail messages in an already overloaded inbox.

Web information is also forgotten. In one study of web use, participants complained that they encountered web bookmarks; in the course of a “spring cleaning,” for example, that would have been very useful for a project whose time had now passed.^[57] In a study where participants were cued to return to a web page for which they had a web bookmark, the bookmark was used on less than 50%

of the trials.^[58] Marshall and Bly^[59] report a similar failure to look for paper information (newspaper clippings).

Remembering to look depends, in part, upon the effective use of *attentional spaces*^[3], such as the surface of a physical desktop, a computer desktop, or the visible region of an inbox’s display.

Steps 2 and 3. Recall and recognize. Recall and recognition can be considered together as two sides of a dialog between people and their PSIs. A person types a search word (recall) and then scans through a list of results (recognition). A person’s recall is often partial. For example, a person may have some sense that the e-mail message was sent by a person whose name starts with an “S” (“Sally?”). As prompted by this partial recall, she might then sort e-mail messages by sender and then scan through the “s” section of this sorted list.

Though any act of retrieval involves a combination of recall and recognition, their relative importance can vary with method. Recall is typically more important in a search, i.e., a person initially recalls the keywords to be used in a search query (though, of course, the person might have recognized these words from a web page previously viewed and simply copied them into the query). Recognition is typically more important in what is alternately referred to as location-based finding, orienteering, browsing, or, simply, *navigation*.^[37,53,60]

Many PIM studies have determined that users prefer to return to information, most notably the information kept in personal digital files, by navigating rather than searching.^[37–39,41,53,60–62] This may be surprising; the use of navigation often depends on remembering or recognizing a specific path to the folder in which the item was stored, while a search is more flexible insofar as users can specify in their query any attribute they happen to remember about the information item. Fertig et al. argued back in 1996^[63] that an observed preference for navigation over search was due to the limitations in the search technologies at the time and that improvement in search would inevitably lead to a shift from navigation to search as the preferred method of return. Commercial PIM search engines have indeed improved dramatically. However, the combined results of a large-scale study and a longitudinal study^[39] indicated that the availability of new and improved search facilities (such as Mac Spotlight) did not result in more search than was observed for older and slower search facilities (such as Sherlock). Search was apparently used only as last resort on those occasions when participants could not remember the location of the files they sought. This finding gains further support from a recent log study indicating that participants used search in only 4.2% of their retrievals.^[64]

One explanation for a preference for navigation over search in the return to personal information derives from a persistent, general finding in cognitive psychology literature that people are better able to recognize than to recall information previously encountered (see Neisser^[21]). As noted previously, in the interplay between recognition and

recall, recognition is more dominant in navigation and recall is more dominant in search.

“Navigation” to digital files and other information is, of course, done in a computing environment that is much less rich in sensory experience than the physical environments people navigate through on a daily basis. But perhaps digital and physical navigation engage, at some level, some of the same processes. In support of this intuition is a recent, innovative fMRI study^[65] demonstrating that, when people use navigation as a means to retrieve their own personal files, they are using some of the same brain structures as when navigating in the physical world (i.e., the posterior limbic regions). In contrast, search activates Broca’s area, commonly observed in linguistic processing.

Another recent study asked people either to navigate to or search for a target file. As people did so, a list of words was read to them in the background. People were later better able to remember these words, presumably a linguistic task, when navigating rather than searching.^[66]

The argument for the observed preference for navigation to search in the retrieval of personal information would then appear to be very strong indeed. Navigation places higher reliance on recognition, which people are usually better at than recall. Navigation to digital information engages some of the same neural structures as are engaged in physical navigation, which is a highly practiced skill in people. Furthermore, navigation places fewer demands than search on linguistic processing and the regions of the brain involved in linguistic processing, thus freeing this capacity for use elsewhere in a person’s computing interactions.

But the discussion continues. Just as navigation vs. search and the use of supporting tools appear to engage different facilities and different areas of the human brain, there is reason to suppose that other activities, too, as done through the computer and computer-based tools, will vary qualitatively in the nature of processing demands placed upon the user. Studies done in the 1980s, for example, suggested a significant shift in processing demands with the advent of support for full-screen, WYSIWYG text editing.^[67–69]

A more recent study suggests that the now-standard support for fast, indexed “desktop” search may be having some impact, not on the preferred method for return to personal digital files, which remains navigation, but on another form of personal information: e-mail.^[42] Consistent with this is the finding that people are less inclined to invest in the organization of e-mails into folders electing instead, for example, to leave information in a single larger folder or even the inbox.^[70]

How, then, to account for this apparent disparity—that even as preference may be shifting toward search as a primary method for return to e-mails (i.e., those that aren’t readily available in the current inbox display)—people persist in navigating to digital files? And why is this despite the fact that essentially the same fast, indexed search support can be applied to both e-mails and files?

We consider one last explanation that relates to the well-established *primacy* effect of psychology

research:^[21] Under a *first-impressions* hypothesis,^[42] people’s first choice of return aligns with their initial experience with the encountered information. Given adequate search support, people might naturally prefer to retrieve an e-mail via a search on the sender or subject since this information is often an initial focus of attention (and is used as a basis for deciding whether to attend to the e-mail). Likewise, since people must initially place a file into a folder (unless they accept a “My Documents” default), navigation to the folder is a first choice of return to the file. Given better, more universal support for tagging, for example, people might be more likely to prefer search (on tags) as a preferred method of return to documents and other files. (But see the section on keeping for its discussion of folders vs. tags). Conversely, were people first to create and exchange e-mails “in place,” in the context of a project (folder) they are working on, they might prefer navigation as a method of return (see, e.g., work on the Project Planner/Planz representing one attempt to situate e-mail by project.^[71,72])

Habits change slowly and desktop search support continues to improve. Desktop search is increasingly integrative and ever closer to an ideal where anything that can be remembered about an information item or the circumstances surrounding encounters with it (e.g., time of last use or nearby events) can be used to help find this item.^[35,73,74]

Search vs. navigation? Since many circumstances of real-world information retrieval are likely to involve a little of both,^[53] a challenge in our tool-building efforts toward better PIM is to support artful ways of combining and seamlessly switching between these two general methods of information retrieval. Toward this goal is recent work that explores ways to integrate search and navigation by highlighting certain navigational pathways based upon the results of a background search.^[75]

Step 4. Repeat? In many instances, information need is not for a single information item but, rather, for a set of items whose members may be scattered in different forms within different organizations. If the likelihood of successful retrieval of each item is strictly independent from the others, then the chances of successful retrieval of all relevant items go down as their number increases. So even if the likelihood of success for each of four items is high, the retrieval of all four items is presumably much lower.

However, in situations of *output interference*, items retrieved first interfere with the retrieval of later items so that chances of successful retrieval of the whole set are worse than predicted by a strict independence of individual retrievals.^[76] The effect can be explained with reference to interference paradigms of human memory retrieval such as the basic *spreading activation model*.^[77] As a useful simplification, think of items in a simple set as primarily indexed and accessed through a single node such as “People in my book club.” In this case, during a retrieval attempt, each item in the set competes with other items for a limited amount of activation. Moreover, the successful retrieval of

initial items strengthens their connections to the access node at the expense of later items not yet retrieved, e.g., as “Susan” is retrieved, the corresponding link to “People in my book club” is strengthened at the expense of, say, the link to “Jonathan” (not yet retrieved).

The chances of successfully retrieving all members of a set can also be much better than predicted by independence. Certainly, retrieval is better if all items are in the same larger unit—a folder or a pile, for example. Retrieval may also be better if items of a set have an internal organization or are interconnected to one another so that the retrieval of one item actually facilitates the retrieval of other items.^[78] By one explanation, activation sent to one item can be “shared” with other items through these interconnections.^[79]

Keeping: From Information to Need

Many events of daily life are roughly the converse of finding events: People encounter information and try to determine what, if anything, they should do with this information, i.e., people must match the information to current or anticipated needs. Decisions and actions relating to encountered information are collectively referred to as *keeping* activities.

The ability to effectively handle information that is encountered by happenstance may be essential to a person’s ability to discover new material and make new connections.^[80] People also keep information that they have actively sought but do not have time to process currently. A search on the web, for example, often produces much more information than can be consumed in the current session. Both the decision to keep this information for later use and the steps to do so are keeping activities.^[57]

Keeping activities are also triggered when people are interrupted in the midst of a current task and look for ways of preserving the current state so that work can be quickly resumed later.^[81] For example, people keep appointments by entering reminders into a calendar and keep good ideas or “things to pick up at the grocery store” by writing down a few cryptic lines on a loose piece of paper.

People *keep* not only to ensure they have some particular information later, but also to build in a reminder to look for and use that information. Failure to remember to use information later is one kind of prospective memory failure.^[82–84] People may, for example, self-e-mail a web page reference in addition to or instead of making a bookmark because the e-mail message with the reference appears in the inbox where it is more likely to be noticed and used.^[57]

Research relating to keeping points to several conclusions: 1) keeping is difficult and error-prone; 2) keeping “right” has gotten harder as the diversity of information forms and supporting tools has increased; and 3) some costs of keeping “wrong” in the digital realm have gone away due to advanced search capabilities, but challenges remain.

Keeping is difficult and error-prone. The keeping decision is multifaceted. Is the information useful? If so,

do special steps need to be taken to keep it for later use? How should the information be kept? Where? On what device? In what form should the information be kept? The keeping decision can be characterized as a signal detection task subject to errors of two kinds: 1) an incorrect rejection (“miss”) when information is ignored that, as time tells, should have been kept (e.g., those paper receipts that are needed now that the tax return is being audited) and 2) a false positive when information kept as useful (“signal”) turns out not never to be used later. The physical and digital clutter in our lives is often evidence for false positive decisions.

Filing information items—whether paper documents, e-documents, or e-mail messages—correctly is a cognitively difficult and error-prone activity.^[26,31,56] Difficulty arises in part because the definition or purpose of a folder or tag is often unclear from its label (e.g., “stuff”) and then may change in significant ways over time.^[56,85] Filing and tagging difficulties increase if people do not recall the folders or tags they have created previously and then create new folders or tags rather than reusing those already created.^[56]

But placing (or leaving) information items in piles, as an alternative to filing, has its own problems. In Malone’s study,^[31] participants indicated that they had increasing difficulty keeping track of the contents of different piles as the number of piles increased. Experiments by Jones and Dumais^[86] suggest that the ability to track information by location alone is quite limited. Moreover, the extent to which piles are supported for different forms of information is variable, limited, and poorly understood.^[87]

Kwasnik^[32] identified a large number of dimensions that might potentially influence the placement and organization of paper-based mail and documents in an office. Overall, a document’s classification was heavily influenced by the document’s intended (anticipated) use—a finding subsequently reproduced by Barreau.^[88] Similarly, Jones et al.^[57] observed that the choice of method for keeping web information for later use was influenced by a range of considerations or functions. Marshall and Bly^[59] also note that the reasons for keeping information vary and are not necessarily task related or even consciously purposeful.

Keeping “right” is harder when information is more fragmented. An act of keeping might be likened to throwing a ball into the air toward a point where we expect to be at some future point in time and space. The ongoing proliferation of information forms and supporting tools and gadgets makes keeping activities even harder. The information people need may be at home when they are at work or vice versa. It may be on the wrong device. Information may be “here” but locked away in an application or in the wrong format so that the hassles associated with its extraction outweigh the benefits of its use. Users employ a variety of methods to ensure that information is in the “right” place when it is needed and methods may require additional, manual work to transfer and synchronize

information across devices and locations. Personally imposed and employer-imposed information boundaries may further fragment the information owned by or under the control of the user (P1—see Table 1) with significant impact on activities to maintain and organize and also to manage the flow of information.^[89] Considerations for these and other *meta-level activities* are further described later in this section.

People must contend with the organization of e-documents, e-mail messages, web pages (or references to these), and possibly also a number of additional forms of digital information including phone messages, digitized photographs, music, and videos—each with its own special-purpose tool support.^[90] The number of keeping considerations further increases if a person has different e-mail accounts, uses separate computers for home and work, or uses any of a number of special-purpose PIM tools.

Keep less, keep nothing, keep more, keep everything, or keep “smarter”? With respect to some forms of information, people may elect to adopt a “keep less” (or even a “keep nothing”) approach. For example, people can rely on “do nothing” methods of return to web pages—such as searching, auto-completion, inspection of browsing history, or navigating from another website—that require no explicit keeping activity.^[58]

On the other hand, experiencing difficulty in refinding can motivate people toward a “keep more” approach. After a failure to refind a useful website, for example, teachers were reported to have shifted toward a more aggressive strategy of bookmarking “anything” that looked at all useful.^[91] But conscious keeping is costly in time, distraction, and the potential clutter of new items, especially when these end up to be “false positives,” i.e., information judged to be useful but never in fact used.^[4]

Digital memory research (e.g., Tan et al.^[92]) explores an automated “keep everything” or “total capture” approach manifest in one extreme by a full-motion, line-of-sight video recording of daily experiences, second by second.^[45] But the utility of such an approach can be questioned on grounds both practical (e.g., how to selectively access just a portion of the continuous stream?) and psychological (the recording alone does not compare to human memory, and its ability to evoke a person’s actual memory for events may decline with time).^[93] Chapter 6.^[94] Automated keeping also points to a dilemma identified by Lansdale:^[26] without some engagement in the keeping process, people may be much more likely to forget about the information later. Alternatives to “keep everything,” “keep nothing,” and “keep automatically” approaches are ones that help people to “keep smarter,” i.e., to make better decisions concerning future uses of current information.^[4] If people have prepared a clear plan, for example, they are often more effective at keeping relevant information (including a recognition of its relevance) even when the plan and its goal are not the current focus of attention.^[95]

Folders or Tags?

The demise of folders and the file system is a recurrent theme in discussions on the future of information management (e.g., Economist,^[96] Seltzer and Murphy;^[97] see also Jones,^[98] Chapters 6 and 7). There are good reasons for such predictions. A strict folder hierarchy does not readily allow for the flexible classification of information even though, in a person’s mind, an information item might fit in several different categories.^[99] For example, pictures from a conference in Copenhagen can be stored under “Pictures,” “Trips,” “Conferences,” or “Copenhagen.” Why not then, instead of placement in a single folder, allow people to tag these items, i.e., with a tag for each of the categories?

Tagging models of information storage would seem to align more closely with the way people think and might wish to represent their information. Toward the exploration of this possibility, a number of tag-related prototypes for PIM have been developed over the years (e.g., Refs.^[100–103]). A tagging approach has also been embraced in commercial systems, most notably Gmail (as “labels”).

The verdict? The success of tags so far is at best mixed. In one study, Bergman et al.^[104] found that users, when provided with (and informed of) both options to use folders and tags, preferred folders to tags (for both their files and e-mails), and even when using tags, they typically refrained from adding more than a single tag per information item (also a finding in^[105]). Even Gmail, though fundamentally architected to support tagging, has added support for “folders,” <http://googlesystem.blogspot.com/2009/02/gmail-adds-folders-by-improving-label.html>.

Why isn’t the case for tagging more compelling (so far)? Support for the tagging (annotating, labeling) of information items remains basic and fragmented. Many design questions remain. One study, for example, found that users performing tagging had more persistent memories about their information, but that nuanced interaction design was necessary to alleviate the cognitive demand entailed by creating and recalling tags.^[106]

But more fundamental limitations may also apply. Civan et al.^[105] through an engagement of participants in critical, comparative observation of both tagging and the use of folders (through the use of Gmail and Hotmail for the organization of e-mails), were able to elicit some limitations of tagging not previously discussed openly in comparisons between tagging and the use of folders. For example, once a user decides to use multiple tags, it becomes important to continue doing so. A tag such as “Copenhagen,” when not consistently used, becomes much less useful later as a retrieval cue. Conversely, critical discussion can reveal advantages in the use of folders that are not always apparent, for example, that a folder structure can serve as an informal task decomposition and a simple kind of reminder for task completion.^[107]

Just as the answer for the finding (retrieval) of information may be neither navigation nor search but tools that

support an artful combination of both, so to the answer toward better keeping may be neither purely tagging nor use of folders but a tool that artfully combines the best of both.

The Meta-Level: Mapping between Need and Information

Meta-level activity operates broadly upon collections of information (PICs) within the PSI, on the configuration and effective use of supporting information tools, and on the mapping that connects need to information. The daily actions of keeping and finding are largely reactive (i.e., faced with a need, find the information to meet this need; faced with information, identify if and what need it might meet). In contrast, meta-level activity is more proactive. Thus, meta-level activity focuses not on the need or information immediately at hand but on a larger consideration of information collections, supporting tools, and the overall mapping. Alternatively, meta-level activity can be seen to move to a more strategic level in a person efforts to manage their information.

One factorization of meta-level activity makes the simplification that the PSI is one big store to be maintained and organized, and for which, input and output should be managed. People might also benefit from an ability to take measurements in support of various evaluations of the store (e.g., does it have the right information in the right forms, sufficiently current and complete?). This approach leads to the following overlapping kinds of meta-level activities: *maintain and organize*; *manage privacy, security, and the flow of information* (incoming and outgoing); and *measure and evaluate*. Implicit in each of these activity types is an effort to *make sense of and use* the available information. This section takes a close look at each of these meta-level activity types.

But first, note the following:

- Actual PIM behavior we would wish to observe and analyze is likely a combination of meta-level activity, keeping, and finding. The sharing and synchronization of information in a cloud service, such as Dropbox, has elements of *maintenance and organization* (i.e., information is automatically backed up) and *managing for privacy, security, and information flow* (can people trust that their information is secure and safe from snooping? With whom should people share what?). The meta-activity types we consider here might be thought of as vectors—*independent but not necessarily orthogonal from one another—forming a basis for the description of a “point” of actual PIM behavior* (in a large space of possibilities).
- A consideration of meta-level activity makes clear the point that information is not an end in itself but rather a means to an end. Going back to the definition of PIM at this article’s outset, PIM is about managing

information to realize life’s goals and roles. Further, information provides people with a way of managing their limited resources. Here we can consider “META” as an acronym for money, energy, time, and attention. Each of these resources must be managed if people are to be effective in the realization of their goals and the fulfillment of their roles and responsibilities. But people don’t “touch” (manage) these resources directly. People manage via their information. Financial statements tell people whether their expenses are under control and whether they are on track for retirement. Their calendars help them to manage their time. The use of open windows and the tabs of a web browser can be considered as a way of managing attention.

- Further and especially as people’s information is increasingly in digital form, people don’t “touch” (manage) their information directly either but rather via their information tools. Even for information in paper form, people use tools, of course, including staplers, filing cabinets, and their own hands. An investment to select, configure, and learn to use information tools is a critical component of each kind of PIM activity. This holds especially for meta-level activity.
- Finally, as another sense of “meta,” meta-level activity is the “after” activity. Actions at this level such as “spring cleaning” or “cleanup,” notwithstanding their overall importance, are seldom urgent and so easily postponed and avoided.

Patterns of postponement and avoidance are in evidence as we further explore meta-level activity in the remainder of this section.

Maintaining and organizing

Differences between people are especially apparent in their approaches to the maintenance and organization of information. Malone^[31] distinguished between “neat” and “messy” organizations of paper documents. “Messy” people had more piles in their offices and appeared to invest less effort than “neat” people in filing information. Comparable differences have been observed in the ways people approach e-mail,^[56,108–110] e-documents,^[58,62] and web bookmarks.^[62,111]

Across information forms, differences in approaches to organization correlate with differences in keeping strategy. For example, people who have a more elaborate folder organization—whether for paper documents, e-documents, e-mail messages, or web bookmarks—tend to file sooner and more often.^[62] However, people are often selective in their maintenance of different organizations. Boardman and Sasse,^[62] for example, classified 14 of 31 participants in their study as “pro-organizing” with respect to e-mail and e-documents but not with respect to bookmarks; 7 of 31 participants only took the trouble to organize their e-documents.

Diekema and Olsen^[91] found that spring cleaning of information by teachers mostly pertained to physical information rather than digital information. Organization behaviors may also vary based on context. In a study by Capra et al.^[112] university employees reported having more folders for their work e-mail accounts than for their personal accounts.

Several studies have now looked at how the same person manages across different forms of information.^[62,107,113] The following composite emerges:

- People do not generally take time out of a busy day to assess their organizations or their PIM practice in general.
- People complain about the need to maintain so many separate organizations of information and people complain about the fragmentation of information that results. People struggle to organize their information so that they can keep their focus of attention and avoid “getting lost.”^[114–116]
- Even within the same PIC, competing organizational schemes may suffer an uneasy coexistence with each other. People may apply one scheme on one day and another scheme the day after.
- Several participants in one study reported making a special effort to consolidate information in their PICs,^[57] for example, by saving web page references and e-mail messages into a file folder organization or by sending e-documents and web page references in e-mail messages.
- People don’t, in general, have reliable, sustainable (i.e., automatic) plans for backing up their information.^[117,118]

Even if digital forms of information can be integrated, people must still contend with paper forms of information. Paper documents and books remain an important part of the average person’s PSI.^[85] The integration of paper and digital forms of information can be troublesome. In a study of elementary and secondary teachers, for example, Diekema and Olsen^[91] found that the teachers’ dualistic system of digital and physical information was especially challenging; while some teachers tried to standardize their organization schemes across material type, some teachers resorted to digitizing all materials. Others printed out their digital materials so they could be filed with the rest of the paper files.

Managing privacy, security, and the flow of information

We continue with the useful simplification that a person’s PSI is one large store. If maintenance and organization activities are concerned with the store itself and its contents, the activities to manage privacy, security, and, more generally, the flow of information are concerned with the input and output to the store. What do people let in? What do people let out?

Letting the wrong things (information, data) into a PSI or letting the wrong tools access or modify a PSI can, at minimum, be a major hassle (e.g., a need for “disinfection”). At worst, the computer may be hijacked to nefarious ends, and all its data corrupted. Indeed, problems of malware (“viruses,” “Trojans,” “worms”) are endemic. By some estimates, 30% or more of the computers in the United States are infected.^[119] Letting the wrong information out to the wrong people can also be a costly source of trouble—e.g., if credit cards are compromised or worse a person’s identity is stolen.

And yet, the exchange of information, incoming and outgoing, and increasingly in digital forms, is an essential part of living in the modern world. To order goods and services online, people must be prepared to “let out” their credit card information. To try out a potentially useful, new information tool, people may need to “let in” a download that could potentially make unwelcome changes to the web browser or the desktop. Providing for adequate control over the information, coming into and out of a PSI, is a major challenge. Even more challenging is the user interface to make clear the implications for various choices in privacy control and in clicking the “Accept” button for use of services such as Facebook.^[120–128]

Also of relevance are the daily challenges associated with sharing information with others in various social situations ranging from the home, to school, to work, to play, and “at large” (e.g., via open-ended discussion boards on the web). These challenges are further discussed in the section “GIM and the Social Fabric of PIM.”

Measuring and evaluating

Choices are made in support of all the activities described so far. Schemes of organization are selected; strategies, policies, and procedures are adopted; and supporting tools are put in place. People then need to ask, at least occasionally, “Is it (the resulting mapping between information and need) working? Is it helping me to make the best use of my limited resources (money, energy, time, attention) toward meeting my goals and fulfilling my roles and responsibilities? Can it work even better? If so, what should change?”

These questions depend both upon the measurements that can be made and also on the evaluations people must make in cases where measurements (and the underlying objectives they reflect) are in competition with one another.

Actions of measuring and evaluating are often high level and qualitative. For example, as people are driving home from work much later than they’d planned for and with no time nor energy to exercise at the gym, they may reflect on a day of nonstop meetings and interruptions as they ask themselves “What did I *really* accomplish?”

But increasingly evaluations can be based upon numerical data. Questions such as “where does the money go?” or “where did the time go today?” needn’t be only rhetorical.

Increasingly detailed, consolidated data is becoming available to answer these and other questions concerning not only how people manage their resources but also how effectively they're living the lives they wish to live. Detailed financial data can tell people "where" the money is going. Calendars consolidated with activity logs can tell people "where" the time went and much more besides. On which devices? Which applications? Relating to which people or which projects? Involving physical activity as well? Or, conversely, the intake of calories (e.g., a business lunch)? How did physical measures of heart rate, blood pressure, blood sugar levels, etc., vary during these activities?

People's every actions can be tracked, and a digital trace formed. The nearly constant use of computational devices (even as people sleep) creates opportunities to capture additional data about people and their environment for purposes of correlation and, potentially, deeper understanding. Associated issues of privacy are enormous and beyond the scope of this article to address (but see Refs.^[129–131]).

On a more positive side, how can measurements be used to a person's advantage?

The increasing capture (by intention or incidentally) and availability of data in digital form to measure everything from heart beats to gaze duration to affective response give rise to notions of the *quantified self* and *personal informatics*.^[132–137] Definitions of personal informatics (PI) vary. Some would tightly connect PI to enabling devices and applications for tracking (e.g., Li et al.^[138]). But self-efforts to track personal activity—the better to understand and make adaptive changes in behavior—are not new (see, e.g., the description of Benjamin Franklin's efforts at self-observation in Jones,^[139]). Rapp and Cena provide a more flexible definition: "**Personal Informatics** (PI), also known as Quantified Self (QS), is a school of thought which aims to use technology for acquiring and collecting data on different aspects of the daily lives of people,"^[140] p. 613.

PI applications are often affiliated with health information and many times have a dedicated hardware device, such as the FitBit, <http://www.fitbit.com/>. But some examples also include systems that collect personal information over time from a variety of sources to provide upon request more integrative summaries of the many scattered events happening that relate to a person in one way or another. A popular example of this second variety is Mint.com, which collects information from all of one's financial accounts (checking, saving, credit cards, etc.) and summarizes this data into an integrated dashboard.

Personal informatics is properly regarded as a subset of PIM where special focus is given to activities of measuring and evaluating and also to making sense of and using the data collected. For example, Li et al.^[141] decompose a personal informatics system into five stages: 1) preparation; 2) collection; 3) integration; 4) reflection; and 5)

action. The first three stages fit well under the more general activity of measuring and evaluating while the last two stages fit well under the more general activity of making sense of and using information. Not surprisingly, users of PI systems also face challenges to manage for privacy and information flow and to maintain and organize the large amounts of data collected. According to Li et al.,^[142] users face information fragmentation problems comparable to those already discussed in the introduction to this article. More recent work in personal informatics seems to acknowledge a need to think more broadly and to place efforts at "self-tracking" in the larger context of an overall PIM practice.^[134,143,144]

Making sense of and using information

Making sense of information represents another set of meta-level activities operating on personal information and the mapping between information and need. People must often assemble and analyze a larger collection of information in order to decide what to do next. For example, among the choices available in new automobiles (new laptops, new employees, etc.), which will best meet a person's needs? Which treatments to select in the aftermath to surgery for cancer? Does radiation therapy "make sense"? Making sense of and using information means more than just retrieval and comprehension of the information "at hand." A person may look up a budget number and understand that it reads "42" but may conclude that the number doesn't "make sense" (and is possibly a pop culture reference, [https://en.wikipedia.org/wiki/42_\(number\)](https://en.wikipedia.org/wiki/42_(number))) if all other budget numbers are 9-digit numbers beginning with "11-."

Making sense of information is "meta" not only for its broader perspective but also because it permeates most PIM activity even when the primary purpose may be ostensibly something else. For example, people organize information in folders ostensibly to insure its subsequent retrieval but then also as a way of categorizing and so making sense of the information. In the Jones et al. study,^[107] folder hierarchies developed for a project often resembled a project plan or partial problem decomposition in which subfolders stood for project-related goals and also for the tasks and subprojects associated with the achievement of these goals. Similarly, some teachers organize their files by utilizing the structure as established in their curriculum standards.^[91]

Barsalou^[145,146] has long argued that many of a person's internal categories arise to accomplish goals. His research demonstrates an ability of people to group together seemingly dissimilar items according to their applicability to a common goal. For example, weight-watchers might form a category "foods to eat on a diet." Rice cakes, carrot sticks, and sugar-free soda are all members of the category, even though they differ considerably in other ways.

Folders and tags (and piles, properties/value combinations, views, etc.) can form an important part of external

representations, which, in turn, can complement and combine with internal representations (“in our heads”) to form an integrated cognitive system.^[147,148] Finding the right external representation can help in *sense-making*,^[149,150] i.e., in efforts to understand the information. For example, the right diagram can allow one to make inferences more quickly.^[151] The way information is externally represented can produce huge differences in a person’s ability to use this information in short-duration, problem-solving exercises.^[152] Different kinds of representations, like matrices and hierarchies, are useful in different types of problems.^[153–155]

But the effects of an external representation on longer-term efforts to plan and complete a multiweek or multimonth project are less well understood. Mumford et al.^[156] note that, more generally, the study of planning has proceeded in “fits and starts” over the past 50 years and remains underdeveloped. Of special relevance to the study of PIM is the possibility that better support of planning might also, as a by-product, lead to better organizations of the information needed to complete a project.

GIM and the Social Fabric of PIM

Group information management (GIM) as a natural extension to PIM has been written about elsewhere.^[157,158] The study of GIM, in turn, has clear relevance to the study of Computer Supported Collaborative Work (CSCW).^[159]

In legal contexts, it may be useful to treat a corporation as an entity—a “person”—in its own right. A corporation or other organization may have policies, procedures, habits, history, and routines that further give it a collective identity as an entity in its own right.

But in many situations, there really is no group entity operating on its own behalf to manage information toward realization of goals and fulfillment of roles. Rather, there is a collection of individuals. Members of a group may hold in common (more or less) certain goals (whether implicit or explicitly expressed in a charter or mission statement). Members may apportion group roles (e.g., treasurer, secretary, president, etc.), but each member operates as an individual and according to personal interest. In keeping with this article’s topic, therefore, focus is more appropriately on what might be called the *social fabric of PIM*,^[160] Chapter 10. The needs of the individual must be met in any group situation, for example, when engineers need their own private space for working drafts, they are not yet ready to share with a larger team.^[161] On the other hand, group and social considerations frequently enter into a person’s PIM strategy, for example, when one member of a household “keeps” medical test results by passing these on another member of the household who has agreed to maintain and organize medical information for all household members. (And perhaps there is a reciprocal arrangement for financial information.)

Although a collaborative “divide and conquer” approach, where responsibilities are apportioned among the members of a group, can reduce the burdens of PIM, the opposite is frequently the case when people seek to share information collections. People may vary greatly in their approaches, especially to keeping and maintaining and organizing information.^[162] Working together through these issues often entails a delicate negotiation process,^[89,163] as categorization affects each member of the shared space, and the tools used to perform such activities provide no preexisting conventions for tasks like organizing a project’s files and folders.^[164] Some users may customize shared information spaces to meet their own needs, but at the cost of decreasing the intelligibility of that space for others.^[165] These challenges later affect refinding information in shared spaces, where attempts to retrieve information from a shared collection are more likely to fail than when retrieving from a PIC that is not shared.^[166]

As further studies aim to better understand the challenges of sharing and managing information in group contexts, improved software may help to alleviate some of these challenges and facilitate the relevant activities.^[5] Prototypes of such software have attempted to support GIM, for example, by analyzing group activities,^[167] a “silver bullet” solution has yet to be found, however. When faced with the limitations of current software, users often prefer more traditional, ad hoc methods of sharing information, such as the use of e-mail attachments,^[168] to more sophisticated methods supported by tools more explicitly designed to support collaborative work such as the use of web services that support shared folders.^[166,169] In some cases, people will circumvent group-centered approaches even when they are institutionalized.^[170] Therefore, the need for understanding and improving collaborative information tasks is clearly great, and work remains to be done.

The Interplay between PIM Activities

We noted in the previous section that the senses in which information can be personal (i.e., owned by, about, directed toward, sent/shared by, experienced by, or relevant to “me”) don’t provide for groupings of information that are cleanly separated from one another. Rather, these are better seen as different perspectives on one large PSI.

Likewise, activities of PIM can be seen as different vectors of approach, we might say, to a person’s PSI and to the creation, use, and maintenance of a mapping (between need and information) for this space. Any actual action of PIM is likely to be a mixture of each. The interplay between activities of finding and keeping was noted in the previous section. An act of keeping, for example, often engenders acts of finding (e.g., the effort to find a folder where the encountered information should be kept). Likewise, an act of finding frequently engenders ancillary acts of keeping. In the effort to retrieve a file from a personal store, for example,

the person may move (“re-keep”) other files after noticing these are in the wrong folder. And certainly, newly found information beyond simple look-ups (e.g., the weather report or a sports score) must often be kept pending the proper time and place for more careful study.

Interplay is in further evidence as the meta-level of PIM activity is considered. Any actual activity of PIM observed or reported is likely to resist clean categorization as solely one or another kind of activity. People may elect to place project-related files, web references, and even e-mails into a single folder named for the project^[71,171,172] and may elect to keep this folder under a larger folder synced with a service such as Dropbox. The folder may then be shared with others also involved in the completion of the project. Keeping activity? Maintaining and organizing? Making sense of and using information? Managing for the flow of information (and privacy/security)? Yes: all four. And since a cloud service such as Dropbox maintains a log of activity in the folder, we can add measurement and evaluation.

CONCLUSION: CHALLENGES AND OPPORTUNITIES

To summarize, the practice of PIM involves finding, keeping, and several kinds of meta-level activities in an effort to establish, maintain, and use a mapping between information and need. Challenges arise with respect to each kind of activity:

Finding is a multistep process. First, people must *remember* to look. An item is retrieved through variations and combinations of searching and navigation. Navigation and searching each involve an iterative interplay between basic actions of *recall* and *recognition*. Finally, in many situations of information need, people must *repeat* the finding activity several times in order to “re-collect” a complete set of information items in order then to make sense of and use the information at hand.

Keeping is multifaceted. Certainly keeping, like finding, can involve several steps. But the essential challenge of keeping stems from the multifaceted nature of the decisions about information needs. Is the information useful? Do special actions need to be taken to keep it for later use? Where? When? In what form? On what device? With no crystal ball to see into the future, answering these questions is difficult and error prone. Caution is warranted with regard to tool support to “keep everything” or “keep automatically.” The approach can lead to the collection and storage of information that overwhelms even as it falls far short of providing a true “external memory.”

Meta-level activities are important but easily overlooked. Meta-level activities are critical to a successful PIM practice, but rarely urgent. There are few events in a typical day that direct a person’s attention to meta-level activity involving considerations of maintenance and organization, managing privacy, security and the flow of

information, measuring and evaluating, or making sense of and using information in a larger collection. As a result, meta-level activities can easily become afterthoughts.

Researchers also face several challenges in their efforts to develop PIM as a field of study:

Integration to counter fragmentation. In their daily practices of PIM, people must overcome problems of both information overload and information fragmentation. Problems of information fragmentation are often introduced by the very computer-based tools that are meant to help with PIM. The study of PIM itself is often fragmented in similar ways. Many excellent studies focus, for example, on e-mail, other studies on the web, or the management of special forms of digital information (such as digitally encoded songs or photographs). There is a need for integrative approaches both in the study of PIM and in the design and evaluation of supporting tools. The “I” in “PIM” should be for information in all its many forms, paper based and digital, and for a larger perspective that considers the life cycle and impact of information as it is communicated from one person to the next.

Toward more practical methodologies with more practical implications. PIM requires the study of people, with a diversity of backgrounds and needs, over time as they work in many different situations, with different forms of information and different tools of information management. This scope of PIM inquiry brings a need for practical, cost-effective methodologies that can scale. Furthermore, there is a need not only for *descriptive* studies aimed at better understanding how people currently practice PIM (e.g.,^[173]) but also for *prescriptive* studies aimed both at evaluation^[174] and also toward the recommendation of proposed solutions in the form of new, improved tools, techniques, and strategies of PIM.

A kind of “checkbox” methodology—call it “*six by six* (6×6)”—can be devised from the framework described in this article (first described in Jones^[139] and subsequently updated^[11]) with its provision for six senses in which information can be personal 1) controlled by/owned by, 2) about, 3) directed toward, 4) sent/posted/shared by, 5) for things experienced by, and 6) potentially relevant/useful to “me”) and its six-part factorization of PIM activity 1) keeping; 2) finding; 3) maintaining and organizing; 4) managing privacy, security, and the flow of information; 5) measuring and evaluating; 6) making sense of and using information).

For any tool, technique, or larger strategy of PIM, real or proposed, it is important to consider the likely impact on personal information in each of its senses. For example, a “cool new tool” (desktop or web based) that promises to deliver information potentially “relevant to me” (P6, the “6th sense” in which information is personal) may do so only at the cost of a distracting increase in the information “directed to me” (P3) and by keeping too much personal information “about me” (P2) in a place not under the

person's control. Similarly, a tool, technique, or strategy of PIM can be considered for its impact on PIM activity. Tools of personal informatics and digital tracking, for example, may do a great deal to improve "measuring," but if such improvements are accompanied by extra hassles in maintaining and organizing or in managing privacy, security, and the flow information, then the trade-offs may not be worth it.

This 6×6 methodology is not the only approach toward a more thoughtful, systematic design of PIM tools. Bergman, for example, reports good success in the application of a *user-subjective approach* in PIM system design.^[175] The user-subjective approach advances three design principles. In brief, the design should allow the following: 1) all project-related items no matter their form (or format) are to be organized together (the *subjective project classification principle*); 2) the importance of information (to the user) should determine its visual salience and accessibility (the *subjective importance principle*); and 3) information should be retrieved and used by the user in the same context as it was previously used in (the *subjective context principle*). The approach may suggest design principles that serve not only in evaluating and improving existing systems but also in creating new implementations. For example, according to the *demotion principle*, information items of lower subjective importance should be demoted (i.e., by making them less visible) so as not to distract the user but be kept within their original context just in case they are needed. The principle has been applied in the creation of several interesting prototypes.^[176-178]

In a similar vein is the research by E. Jones^[179] identifying five factors that determine whether a promising new system (tool, technique, and strategy) of PIM will be successfully adopted:

1. *Visibility*—More generally, do users notice the system and remember to use it?
2. *Integration*—Does the system connect and work well with what the user already has in place?
3. *Co-adoption*—Is it necessary for others to use the system as well? (Lack of co-adoption is a major source for failure in CSCW applications.^[180])
4. *Scalability*—Will the system still work over time and especially as the amount of information continues to increase?
5. *Return on investment (ROI)*—After the hopeful enthusiasm with which a system is initially embraced has waned, the system has to prove its value and that the costs of its use are more than compensated for by benefits.

The trouble with the adoption of PIM systems is twofold: 1) some may be discarded prematurely before the daily habit of their use has been established (e.g., for lack of visibility or integration); and 2) the problems with other

systems (e.g., lack of scalability or ROI) are apparent only much later after a system has been deeply embedded in a person's overall practice of PIM, making its removal a costly hassle. Consider, for example, a "perfect" folder organization that turns out to be too much trouble to maintain but can't be undone without many hours of reorganization.

More recently, the notion has been advanced that tools, techniques, and strategies of PIM might be assessed for their ability to increase or reduce the "clerical tax" people pay as they manage their information.^[93] What is the impact on the time spent in clerical, mechanical actions of PIM (think filing paper documents in a vertical filing cabinet), and how much time remains for the more fun, creative aspects of working with information? The utility of such an approach will depend upon the development of more detailed methods for reliably, effectively "assessing" the clerical tax.

Finally, are efforts to engage the user in active discussions (possibly mediated by the web) directed toward the evaluation and even the design of PIM systems? The use of participant observation is well established in fields such as sociology and anthropology (see, e.g., Jorgensen^[181]). But here we might talk instead about the *observant participation*, i.e., explicitly tasking a participant to reflect upon a PIM system, the good and the bad, either in a single session or over an extended period of time. The use of diary methods of data gathering is well established (e.g., Czerwinski et al.^[81]), though motivating people to consistently record their thoughts can prove challenging and reminders can prove intrusive or, worse, impact the data gathered.^[182]

Two recent efforts of *observant participation* are worthy of further mention. Civan et al.^[105] engaged users in a within-subjects comparison of tagging (labeling) vs. the use of folders as a means of organizing e-mails. Participants experienced each condition (via actual web-based versions of Hotmail and Gmail as these were offered in 2007/2008) in an ordering counterbalanced across participants. After each condition (each lasting for 5 days), participants were interviewed using an open-ended set of questions to assess their experiences of and reflections on the condition just experienced (i.e., use of folders vs. tags for organization of information). The study provided a very useful set of considerations and some unexpected drawbacks in the use of tags (e.g., with the freedom to tag items in several ways comes the potential tedium of then consistently using multiple tags for *_every_new_* item). A second method—following a Delphi approach^[183]—shows great promise for better understanding various current practices of PIM and assessing which to "recommend" and "advise against."^[184]

Observant participation relates to but is distinct from approaches in *participatory design*^[185,186] wherein that attempt to "actively involve all stakeholders (e.g., employees, partners, customers, citizens, end users) in the design process to help ensure the result meets their needs

and is usable,” http://en.wikipedia.org/wiki/Participatory_design. Methods of observant participation such as those described previously are best seen as exploratory heuristics to gather pros and cons and considerations in the use of one tool, technique, system, or strategy of PIM vs. another. The participant observer approach to PIM can be traced at least back to Malone’s^[31] work (with only 10 participants). In his “methodological note,” Malone writes, “Sometimes . . . carefully controlled studies or more extensive naturalistic observations are suggested by the insights obtained from exploratory observation, and these are certainly worth performing. In other cases, the needs for designing systems (or time and budget constraints) do not justify other studies” (p. 101).

How to protect the privacy and security of personal information? The more complete the digital records of personal information, the more completely a person’s identity can be stolen. New PIM tools—especially those aimed at information capture—must be accompanied by new levels of information security and privacy.^[127]

Other questions arise for PIM-related tools and technologies:

How to keep e-mail from being spoiled by its own success? E-mail messages are easy and free to send—good for us; good for spammers too. E-mail is used for tracking tasks, storing documents, and saving contact information. It was designed for none of these. People may feel like they are “living” in their inbox.^[187] But are they doing the things they really want to be doing? Why should all incoming correspondence go into one undifferentiated inbox? E-mail filters to sort have their own problems (e.g., that people forget to look in the sorting folders later). Research efforts have explored ways to better situate e-mails and other correspondence in larger contexts involving tasks, projects, and “places” of collaboration (e.g., Refs.^[188–190]). People are also making ad hoc use of alternatives to e-mail such as Facebook groups.^[191]

How can search get more personal? Search has application to PIM both as an interaction and as an underlying technology. Search as an interaction supports finding and refinding and also other PIM activities such as keeping, maintaining, and organizing. Search as technology, including the analysis and indexing of information, can be seen more broadly as a way of “mining” a PSI toward a wide range of personalized support.^[51,98,192,193]

How can information convergence bring information integration? Information tools increasingly let people work with their information anytime and anywhere. This has increased the amount and diversity of information collected. Thoughts of laptops, smartphones, or tablets as a point of convergence for information and practices of PIM are inspired by the ongoing rapid pace of technical developments in hardware capacity, miniaturization, and integration.

Thoughts of the web as a point of convergence are also inspired by hardware advances supporting, for example,

increases in bandwidth (especially along the “last mile” to private homes) and storage capacity. But equally, the web is a point of convergence for its basic ability to connect, nearly instantaneously, person to person and person to information, no matter where these are in the real world, no matter what the physical distances. But convergence does not equal integration. Web-based and portable computing are still in their infancy, and new opportunities for convergence and integration are still being created (e.g., watches, wearables). The field of PIM has a special opportunity to guide development in these new areas.

As researchers study and strive to improve PIM, it is important never to lose sight of the “personal” in PIM. People manage information neither for its own sake nor for the joy of managing. PIM is a means to an end. A person manages information in many forms, ranging from appointments of a digital calendar to paper checks of a check book, in order to manage life’s resources—money, energy, attention, and, especially, time. A person manages information as a means toward the fulfillment of a life’s important goals and precious roles.

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Peru: Libraries and Library Science

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Abstract

Libraries in Peru have been the subject of tremendous evolution. The Spanish influence brought the concept of libraries and the printing press, but it was not until the twentieth century when librarianship in Peru was established as a discipline and profession. Library education has grown rapidly and the post-Internet times have produced a very dynamic information society that still requires more consistent library services.

INTRODUCTION

Located on the western rim of South America, Peru is bordered on the north by Colombia and Ecuador, on the east by Brazil, on the southeast by Bolivia, on the south by Chile, and on the west by the Pacific Ocean. Its geography varies from the arid plains on coast to the spectacular Andes Mountains and the lush tropical forests of the Amazon Basin. Estimated at 29,180,900 (July 2008), the population of Peru is multiethnic: Amerindian 45%; mestizo (mixed Amerindian and white) 37%; white 15%, black, Japanese, Chinese, and other 3%. The government is a representative democratic republic divided into 25 regions (Fig. 1).

HISTORICAL BACKGROUND

Libraries in Perú have a long history that started with the Spanish conquest and the introduction of the printing press in the sixteenth century. During the Spanish domination there was a strong impetus to create private and monastic collections, intended mostly to indoctrinate the indigenous populations. The Inca and Pre-Inca cultures did not have an alphabet, but that did not preclude them from achieving extraordinary development. Based on oral traditions and quipus as a way of translating words, they built up one of the most important cultures in the southern hemisphere. The Inca Empire also gave birth to the most important and wealthiest Spanish possession in the Americas—Peru. During the period when Peru was a colony of Spain (from 1535 to 1824) monastic and private collections were developed to instruct the Indians with Christian doctrine. The Franciscan Monastery of our Lady of Ocopa was a good example of a large monastic collection of around 20,000 volumes.

Some of the Spanish conquerors carried personal libraries with them, and during the expansion of the Spanish viceroyalty reading spread among clergyman, lawyers, and a growing student population. The book trade also developed, but

most works were imported from Europe. However, the sixteenth century was critical for the development of a book culture and printing thanks to Antonio Ricardo and his printing Press in Lima. The Jesuits gave a space to Antonio Ricardo at the Colegio de San Pablo to install his printing press which was set up as early as 1584. Ricardo's first book was the *Doctrina Christiana* and it was published in three languages: Spanish, Quechua, and Aymara.

The Inquisition also played an important role in its censorship role of heretic literature. The Holy Office of the Inquisition in Spain controlled the importation and publishing of books. Efforts to counteract that control were sometimes made by individuals who collected private libraries that then emerged as a sort of "counter culture" space because they held materials that were listed as banned in the *Index Librorum Prohibitorum*. However, the owners of these private libraries that contained banned materials risked being prosecuted. The French Enlightenment and the Bourbon dynasty of 1701 brought new impetus to those private collections.

Special mention needs to be made here about the important role that universities played in the creation of library collections, encouraging reading and developing the culture of the viceroyalty of Peru. The Universidad Nacional Mayor de San Marcos (UNMSM) was founded in 1551. When the Jesuits were driven out of Peru in 1768 their major collections at the Colegio de San Pablo were given to UNMSM. Around this time we find the first attempts to promote some sort of public librarianship. Around 1778 UNMSM suggested that rooms at the Colegio de San Pablo be offered to the public for public reading.

It was mainly during the independence period of 1821–1824 that the concept of public libraries emerged in the new republic. The National Library was created by Don José de San Martín on September 17 of 1822. At the time of its inauguration, the library held around 112,256 volumes. Most of its holdings came from citizens' donations, from the University of San Marcos, and even the private collection of Don José de San Martín. During the Pacific



Fig. 1 Map of Peru.

Source: CIA World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/pe.html>

War in 1881 the National Library was invaded and decimated by the Chilean army and its collections ransacked. Of the 56,000 volumes only 738 remained after the Chileans left. Ricardo Palma, a writer and scholar, who was later famous for his *Tradiciones Peruanas*, rebuilt the National Library from the ruins. Palma's task was monumental and symbolizes perhaps one of the most challenging reconstruction tasks of a library in world history. When assigned to the job by President Iglesias, he asked the president if he was going to be a "mendicant librarian," the President's answer was yes. He then got the nickname *the mendicant librarian* (el bibliotecario mendigo). International donations were essential, and many donations were received through Palma's contacts in the South American region. Palma even asked the President of Chile for the restitution of some collections. Contrary to what we might think, his wishes were acknowledged. The National Library reopened on July 28, 1884.

RECENT HISTORY: THE POST-WAR YEARS

Library education and professionalism in Peru were given an impetus by the events that happened around 1943. The library profession itself took its first major step with the appointment of Jorge Basadre (1905–1980) to rebuild the Biblioteca Nacional (National Library) devastated by a fire in 1943, and the foundation on June 23 of the same year of the Escuela Nacional de Bibliotecarios (National School

of Librarians). Basadre had been exposed to international librarianship and had a strong interest in building and strengthening the library profession. For example, he participated in professional exchanges with North American advising committees such as the American mission of 1943, which included Dr. Keyes D. Metcalf, Director of Harvard libraries and President of ALA; Lewis Hanke, Director of the Spanish Foundation of the Library of Congress; and Wilmarth S. Lewis, Director of Yale University Libraries. Basadre's push brought a new wave of library publications. Important library publications of those years were the *Boletín de la Biblioteca Nacional*, *Fénix*, and the publication of the *Anuario Bibliográfico Peruano* in 1945. Basadre's influence was also noticeable in the new conceptualization of public libraries and their role in society. He was responsible for the promotion of the popular libraries and the decree of May 25, 1947, Law 10847 that supported taxation for public libraries.

Basadre's interest in public librarianship later stimulated the development of some important public libraries like the Ricardo Palma in the district of Miraflores and the ones in Surco and San Isidro. The post-World War II era saw an increasing concern in society about the need to strengthen and solidify municipal and public libraries, two institutions that targeted similar kind of patrons. Municipal libraries are administered by the municipal government, and by 2004 there were 1080 municipal libraries in Peru. Even though such libraries are numerous, their work is very much limited by the lack of an adequate funding, and their overall development has been hindered

by the lack of a coherent vision concerning their role in society. One of the oldest municipal library is the *Callao Municipal Pilot Library* founded in 1936. The first bookmobile in Perú was inaugurated in 1957.

School libraries are present in most private schools, but their quality varies depending on their funding and administration, which is based on tuition and the school policies. The earliest academic libraries in Peru date from the sixteenth century around the time of the founding of the oldest University in the Americas, the *Universidad Nacional Mayor de San Marcos* on May 12 of 1551 by decree of Charles V. Numerous new academic institutions have proliferated since then. Among the oldest public academic institutions are the *Universidad San Antonio Abad* (1692, Cuzco), and the *Universidad Nacional de Trujillo* (1827), and the *Universidad de San Agustín* (1827, Arequipa). There are around 98 public and private universities in Peru, and most of them have academic collections. The quality of their collections however is very uneven. Some recent efforts toward more digital collections have been made and academic libraries were among the first institutions that developed digital resources and supported widespread use of the Internet. One of the leaders in this area was the *Universidad Peruana de Ciencias Aplicadas*, which began to develop digital resources in the mid-1990s. In terms of collections (print and online), among the most important are the collections from the UNMSM (public) and the Peruvian Pontifical Catholic University (private), Cayetano Heredia, and the Pacific University (private).

Other important libraries that are not necessarily public in terms of access but contain important collections are those of foreign institutes such as the Alliance Francaise, the Instituto Británico and the Instituto Cultural Peruano Norteamericano (ICPNA). The library of the Lima Art Museum, the *Manuel Solari Swayne Library*, holds around 10,000 volumes, and was created in 1986. The Getty foundation has supported its acquisitions program.

LIBRARY EDUCATION AND PROFESSIONAL ASSOCIATIONS

The *Escuela Nacional de Bibliotecarios* was transferred to the UNMSM as a university program, and its name changed to *Escuela Académico Profesional de Bibliotecología y Ciencias de la Información*. This national school and the Library School at the Peruvian Pontifical Catholic University (PUCP), established under the sponsorship of the British Council in 1990, are the only library schools in Peru.

In recent years research in library and information science has developed, as is evident in the production of professional journals such as *Alexandría*, *Bibliodocencia*, *Biblios*, *Bibliotecólogos*, and *Infobib*. Some of these journals are peer reviewed and reflect the interest of an increasing professional and research community to

improve professional knowledge. The existence of associations is also another sign of the interest of professional librarians in expanding their knowledge and professional expertise. Among the most important associations are the *Colegio de Bibliotecólogos del Perú* that followed the *Asociación Peruana de Bibliotecarios* created in 1945.

THE NATIONAL LIBRARY

On March 27, 2006, the Peruvian National Library inaugurated a new building, which also houses the *Centro Bibliográfico Nacional*, which is in charge of national bibliographic control through legal deposit (the current Legal Deposit Law 26905 was passed in 1997). The national bibliographic center also carries out other tasks such as the registration of all bibliographic materials at the national library, implementation of technical processing of Peruvian materials, and the creation of bibliographies of important Peruvian authors. The National Library is a member of the *Asociación de Bibliotecas Nacionales de Iberoamérica*. In many ways, the move to a new building has also enhanced the visibility of the National Library in Peruvian society, but much more work around public librarianship needs to be done.

MODERN CHALLENGES

The modern challenges are related to building a stronger municipal/public library system with adequate funding, the improvement of the public library system that still is administered by the National Library, and the provision of Internet access in broadband to the academic and special library sector. In addition, environmental concerns and the importance of the indigenous population in Peru have prompted discussions about librarianship that are centered around enhancing the development of library services for underserved populations and on the implementation of projects that target their information needs. Some projects revolved around The *Centro de Documentación e Información del Instituto de Investigación de la Amazonía Peruana* (IIAP) and the “*Red de bibliotecas fluviales del Alto Marañón*.” Rural librarianship and its growth is also another area that librarianship needs to integrate more consistently into the progress and development of the indigenous information needs.

Academic libraries in Peru are now facing important changes and challenges with regard to database access, use of open access software, design of OPACS, and the integration of their services. Most academic libraries utilize closed stacks and that affects the circulation and the characteristics of the services they provide.

Special libraries, such as the ESAN (Escuela Superior de Administración de Negocios) or Inrena (Instituto Nacional de Recursos naturales), are important examples of the diversity of information resources available now. Peru has a tremendous diversity of natural resources and

land, and given the current interest on environmental issues, has paid attention to creating information networks and virtual libraries concerning natural and agricultural resources. For example, Rebiapi is a portal of agricultural information. The *Biblioteca Agrícola Nacional* is located at the *Universidad Agraria* in la Molina, a district of Lima. Public health has also been an important focus for the development of information services in Peru. With regard to public health, special mention needs to be made of REPEBIS, *Red Peruana de Bibliotecas en Salud*, which also produces the *Biblioteca Virtual en Salud*.

Librarians in Peru began to participate in the trend toward the development and promotion of Internet use for education, scientific information, and libraries when Red Científica Peruana (RCP, the Peruvian Scientific Network) was created in 1991 as a nonprofit organization. RCP developed an innovative way of offering Internet access to citizens using public computer terminals. RCP was innovative in many other ways as well, implementing the first satellite connection to the Internet, the first use of listservs, the first Web site, and the first electronic newspaper, all without government subsidies. In many ways the RCP introduced the value of the Internet as an educational tool to Peruvian society.

CONCLUSION

In summary, librarians in Peru are currently working

- To improve the access and quality of their collections, particularly in academic areas.
- To design and implement innovative efforts to build up information resources for indigenous populations.
- To expand special libraries.
- To strengthen rural librarianship.
- To provide better access services through broadband.

Libraries will not be able to evolve without dependable electronic access services and discounted access rates that need to be discussed in the context of wider information policies. For that reason, advocacy on the part of the library world is necessary as is awareness and education about ways to advocate for library funding and tools. Another challenge comes from the lack of a coherent and supportive policy on the part of the government regarding the book trade and publishing, since this is still the main source supplying materials in library collections. High costs and widespread piracy are factors that make the production of books in Peru difficult.

Libraries are still working hard to find a permanent space in the every day life of the Peruvian citizen. Funding and professional expertise remain a challenge for most of the small public/municipal and academic libraries that survive on donations and small budgets. The last 10 years of post-Internet development have stressed the importance of the library, but the improvement of the quality and promotion of the services is a major task yet to be done.

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Philosophy and the Information Sciences

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Abstract

Philosophy and the information sciences intersect in various ways. Philosophical approaches to the study of information and information-related phenomena focus on metaphysical, epistemological, and ethical questions; philosophical approaches to the study of the information sciences focus on methodological issues. Metaphilosophical questions may also be asked about philosophy of information and about philosophy of the information sciences.

INTRODUCTION

There are several scholarly activities or practices that coalesce at the intersection of, on the one hand, philosophy, and on the other, the information sciences. The aim of this entry is to distinguish among some of these practices, and to assess their significance, both for philosophy and for the information sciences. In particular, a distinction is drawn between philosophical questions asked *in* the information sciences and philosophical questions asked *about* the information sciences, and the goals and subject matter of *philosophy of information* and *philosophy of the information sciences* are described. This distinction is made in the spirit of conceptual clarity, rather than to reflect a division that is rigorously respected in actual scholarly practice: people interested in philosophy are likely to be interested in questions of all of these kinds.

To some who work in the information sciences, the questions that are posed in philosophy may seem like “meta-questions,” in the vague sense that they are after, later, beside, beyond, or above other questions to which answers are required more immediately, directly, or pressingly. Since categories of meta-questions are commonly identified as forming core components of the contents of fields at the intersection of philosophy and the information sciences, it is worth taking some care to clarify several different conceptions of the qualities that distinguish meta-questions from their non-meta counterparts.

Philosophy of Information as a Meta-Field

Encountering the information sciences for the first time, we might wonder what they are all about. We might want to ask, for example, What is this thing they call “information”? In what way does it exist? What kind of thing is it? Of what fundamental category of things is it an instance? What is its essence? What are its properties? What are the necessary and the sufficient conditions some thing must

satisfy for it to be counted as information? Questions about the mode of existence and the basic nature of different kinds of things are questions that are asked in the branch of philosophy known as *metaphysics*, i.e., philosophy of being. They might be treated as meta-questions simply because they are foundational questions about the fundamental nature of the things in which we are interested. The simple form of questions of this sort belies the difficulty of providing answers that survive all challenges.

The questions just listed are questions about a phenomenon—information—that is a core component of the subject matter of the information sciences, and they are questions that are commonly addressed both in introductory texts^[1] and in more advanced treatises^[2] in the information sciences. Their philosophical nature (of which more will be said below) and their focus on the phenomenon of information are individually necessary and jointly sufficient conditions of their also being considered part of a branch of philosophy known as philosophy of information, and they are questions that are commonly addressed both in introductory texts^[3] and in more advanced treatises^[4] in that field, too. Philosophy of information is discussed in a separate section below (headed “Philosophy of Information”).

Meta-Questions about the Information Sciences

We may distinguish questions that are raised *by* or *in* a discipline or field of inquiry, or in a group of fields like the information sciences, from questions that are *about* that field or group of fields. Questions of the second kind might include questions about the subject matter of the field, its scope, its purposes and/or goals, its methods, its relationships to other fields and to other activities, and its usefulness, worth, or value. These are meta-questions about the field *as a field*, i.e., questions that are raised by studies *of* the field, rather than by studies *in* the field.

Sometimes it is considered that it is worth keeping the second-order questions that relate to a given field separate

from their first-order cousins, and treating the second-order questions collectively as a discrete “meta-field.” Sometimes such meta-questions are identified as being philosophical questions simply in virtue of their second-order status, and the aggregate of such questions is what is construed as the philosophy of field x —even though it might be unclear as to what is strictly *philosophical* about any given meta-question. More commonly, however, the history, sociology, and politics of any given field x are identified as meta-fields that are distinguishable from the philosophy of field x . Meta-questions about the who, what, where, when, and why of the information sciences are the kinds of questions that are asked by sociologists, historians, and political theorists: What is the subject matter of the information sciences as they have been practiced at different points in history, and in different social contexts? What are the characteristics of the social groups whose members work on the information sciences? What motivations have people had for devoting time and other resources to the study of information and related phenomena? Why ought people to be interested in information?

Philosophy of the information sciences may then be distinguished from the history, sociology, and politics of the information sciences as the meta-field in which distinctively philosophical questions are posed (and philosophical answers attempted) about the information sciences. We might ask, for example, What is the nature of the information sciences? In what essential respects do they differ from other areas of inquiry? Questions of this kind are different from questions of the kind asked in Philosophy of Information (as defined above), in the sense that they do not arise *in* the information sciences and are not answerable by doing information science. Indeed, philosophy of the information sciences—like, for instance, philosophy of the biological sciences—may readily be construed as a branch of philosophy of science. Philosophy of the information sciences is discussed in a separate section below (headed “Philosophy of the Information Sciences”).

Philosophy of Philosophy as a Meta-Field

There is another, narrower sense in which a field of inquiry may be identified as a meta-field. This is the sense in which philosophy of philosophy (also known as *metaphilosophy*) is considered a meta-field. One important characteristic of metaphilosophy is its reflexivity. A *reflexive* meta-field is one that comprises the x -like study of x —for example, the philosophical study of philosophy;^[5] or the information-scientific study of the information sciences.^[6] Indeed, it is possible to ask philosophical questions about philosophy of information and about philosophy of the information sciences: about, for instance, how they ought to be done. Again, questions of this kind are different from questions of the kind mentioned in the previous paragraph, in the sense that they

are questions *about* philosophy of those particular kinds, rather than questions that arise *in* philosophy of those kinds or that are answerable by doing philosophy of those kinds. The possibility of a productive metaphilosophy of information and of the information sciences is briefly revisited in the section below on “Meta-Questions about Philosophy.”

The Information Sciences as Meta-Fields

Sometimes the information sciences themselves are taken to form a group of fields of inquiry that are each, in a unique and significant way, concerned to answer meta-questions about other fields.^[7] In one important sense, much of the subject matter of library and information science, for instance, consists of other fields of inquiry: the objects of inquiry are those other fields. Studies of the structural relationships among and within different fields (for example, studies of the frequency with which, and the ways in which, authors in field x cite authors in field y), of the information needs and uses of people working in and between different fields, of the processes by which information is produced, organized, retrieved, communicated, and applied in different fields—these can all be considered as exemplifying a meta-field, in the sense that the subject matter of that field is made up of other fields. Other fields of inquiry that are regularly identified on this basis as meta-fields are education and, indeed, philosophy of science. Introductory characterizations of the information sciences and of philosophy are respectively provided in sections below on “The Information Sciences” and “Philosophy.”

Information Meta-Studies as a Meta-Field

Sometimes it is enough that a particular study involves or requires comparative evaluations of alternative theories, models, or conceptual frameworks, or simply that it consists of an overview or summary of multiple sets of previously published data, findings, or conclusions, for it to be categorized as a meta-study. Examples certainly exist of named meta-fields that are devoted to classifying and assessing theoretical frameworks: recently emerging subfields of philosophy include meta-ethics, metaontology, and metametaphysics. By analogy, we might imagine a field called “information meta-studies” that comprises comparative evaluations of alternative theories in the information sciences. Such work is not considered further in this entry.

Personal/Professional Philosophies of Information Work

Similarly, one sense of “philosophy” that will not be covered further in this entry is the one that people mean when they talk about their (or their institution’s) personal or

professional “philosophy” of information work, scholarship, or research. It is in this sense that people sometimes talk about *having* a philosophy, which is different from the sense in which philosophers *do* philosophy. Talk about the philosophy that one has, in this sense, is typically equivalent to a statement of one’s long-term or fundamental goals or mission, or a statement of one’s basic or most strongly held values. Having a knowledge of professional ethics is not a necessary prerequisite for making statements of goals or values. Nevertheless, study of professional ethics can provide suggestions of values to hold that are in line with others’, and can provide knowledge of ethical principles that can aid choice among values. Information ethics is commonly construed as a branch of philosophy of information, but mere statements of values (which may or may not result from the study of information ethics) are not usually conceived as contributions to philosophy—at least, not in the strict sense of “philosophy” used by most philosophers.

THE INFORMATION SCIENCES

Before embarking on any further examination of the intersections between them, it would be useful to be able to draw on characterizations both of philosophy and of the information sciences—ideally by considering suggestions of the necessary and sufficient conditions which must be satisfied before identifying any given work as a contribution to either philosophy or the information sciences. Some would say that to define either field would itself be to engage in philosophy; so maybe if we briefly indulge in an attempt to define the information sciences, it will become partially clear, through example, what philosophy of the information sciences is.

The goals of people engaged in any field of inquiry typically include not just fame, fortune, and happiness, but also the production of knowledge about (or, perhaps, the shedding of light on, or the making of sense of) a particular part or aspect of the world, through the construction of theories and explanations and the interpretation of meanings and understandings, and the application of that knowledge in a way that changes the world for the better in some respect. What is the particular part or aspect of the world with which the information sciences, especially, are concerned? In other words, what is the subject matter of the information sciences? What are they *about*?

The simplest answer, of course, would be that the information sciences are about information. Perhaps this answer could be extended relatively uncontroversially to include, as the subject matter of the information sciences, certain phenomena that are thought to be closely related to information, and the ways in which people interact with information and with information-related phenomena. Even taking this short step, however, would likely dismay some who would prefer to treat an emphasis on people’s interactions with

information as merely one example of a range of approaches that may possibly be taken to the study of information, each of which is associated with a number of pre-suppositions about the nature of information and its role in the world. In any case, such a barely extended answer would require augmentation in several respects before it could provide real insight into the nature of the information sciences. Helpful additions would include: a definition of information; enumeration and description of information-related phenomena, and indication of the respects in which and strengths with which they are related; and enumeration and description of ways in which people interact with information and with information-related phenomena.

Definitions of Information

Different conceptions of information have attracted consensus to different degrees in different communities. The multiplicity of current conceptions partly reflects the lack of agreement among communities on a prioritization of the desiderata that a conception should satisfy. In particular, the outlook for those who would hold out for a “one size fits all,” transdisciplinary definition of information is not promising. It is possible, nevertheless, to identify a number of general categories or families of conceptions of information that have proven useful in relatively broad ranges of contexts.

1. A *semiotic* family. In conceptions in this group, distinctions are typically made on the one hand between: 1) real-world states, facts, or situations; 2) mental representations of those situations; and 3) linguistic expressions of those representations, and on the other between tokens and types, of situations, representations, and expressions—forming a model (of the relationships between reality, thought, and language) of the kind roughly depicted in Fig. 1.^[8] Each distinct conception of information in this family equates information with the content of a different cell in the model. For many, the crucial decision will be to choose between a conception of information-as-signal (Buckland’s “information-as-thing”), and one of information-as-message (Buckland’s “information-as-knowledge”), but conceptions of information as the stuff of which real-world states are actually composed are not rare.^[9–11] *Objectivist* versions of the popular view of information-as-message assert that information resources (texts, sentences, words, characters, bits) “contain” information, that information resources “have” meanings, that “the” meaning of an information resource is discoverable by all, and that whether a given information resource has a given meaning is an objective matter. *Subjectivist* versions recognize, in contrast, that information resources do not “have” meanings, but that different meanings are assigned to the same resource by different people at different

	Real-world situations: Information as reality	Mental representations: Information as message, meaning, knowledge, image	Linguistic expressions: Information as signal, vehicle, data, document, thing
Tokens / Particulars	States of affairs	Thoughts	Utterances
Types / Universals		Propositions	Sentences

Fig. 1 A semiotic model of the relationships between reality, thought, and language.

times, and that “the” conventional meaning of a given resource is a matter of intersubjective consensus.^[12]

2. A *sociocognitive* family. In conceptions in this group, the emphasis is on action and process, and especially on processes by which people become informed or inform others. Information is conceived either as the act that causes a change in a person’s mental state or internal “knowledge structure,” or as the event in which such change takes place.^[13,14] Different theorists have different views about the respective strengths of different kinds of influence on the effects of the informing act. Adherents to a *physical*, systems-oriented paradigm that is based on a literal reading of Shannon’s mathematical theory of communication^[15] ascribe no role to the intentions of the individual person, whereas proponents of the *cognitive*, user-oriented viewpoint allow that the nature of the change wrought on an individual’s mental model or image of the world by a given informative act depends at least partly on the prior state of that individual model. The main theme of the *sociological*, community-oriented paradigm is that individuals’ images of the world are shaped at least partly by those individuals’ understandings of others’ views, while the *cultural*, discourse-oriented paradigm derives from a recognition that the world itself is socially constructed in a strong sense, i.e. as a direct result of people talking about it.^[16]
3. An *epistemic* family. Conceptions of information in this group are developed with the aim of providing an account of the properties that an information resource must have if the beliefs that are generated upon interpreting the content of that resource may be said to be justified. These are conceptions of information-as-evidence.^[17] On the relatively few occasions on which information is taken seriously in the philosophical literature as a category to be distinguished carefully from knowledge, it is typical for “information” to be equated roughly with “evidence,” and for the primary question about information to be understood as the question about what the evidence must be like to justify a given belief-that-*p*, and thus to qualify that belief (if it is one that is true) as knowledge. Theories of *semantic information* (also known as informational semantics) have

been developed that propose probabilistic methods of evaluating the informativeness of evidence as the degree to which it provides warrant or grounds for believing-that-*p*. Such methods typically involve calculating the unexpectedness of the observed evidence given the probabilities of occurrence of all the possible alternatives. In this sense, they derive from Shannon’s “information theory” (i.e., the mathematical theory of communication), and form the core of the branch of philosophy of knowledge known as *information-theoretic epistemology*.^[15,18] The project that Floridi calls “Philosophy of Information” (PI) is a major contribution to this subfield.^[19]

Information-Related Phenomena

Different kinds of phenomena may be considered to be “related” to information (howsoever information is defined) in different ways. Some phenomena may be seen to be related in virtue of their being the same kinds of things as information. Conceptions of information-as-message, for example, tend to be held at the same time as conceptions of knowledge-as-message, in which case knowledge and information are said to be related in the sense of their being identical. On the other hand, in such conceptions, information is distinguishable from data on the basis that information is the content or meaning of data: here, information and data are related, not in virtue of a conceptual identity, but in virtue of one (information) being a kind of property of the other (data). Similarly, authors, indexers, and searchers are related to information in respect of their being agents that are involved in the creation, representation, and seeking of information resources; libraries, archives, and museums are related to information in respect of their being institutions that are involved in the preservation and provision of access to collections of information resources; aboutness and relevance are related to information in respect of their being relations that structure networks of information resources; and so on.

Kinds of Human–Information Interaction

Lists of information-related phenomena are necessarily endless, and of limited utility: what is potentially more

interesting from a philosophical perspective is the structure of fundamental categories of phenomena (e.g., objects, properties, relations, agents) developed by the listmaker. Similarly, no list of the kinds of things that we might imagine people wanting to do to, with, or through information could be exhaustive, no matter what definition of information is accepted. But taxonomists of information-related actions or events commonly adopt a framework that is loosely based on the notion of an information life cycle, whereby information resources (if not the meanings attributed to those resources) are assumed to have a concrete existence in space–time, and to be subject to change and to processes of cause and effect. Within such a framework, distinctions are often made between the following categories of actions or events: production, creation, and generation; reproduction; preservation and storage; representation, description, cataloging, registration, and documentation; organization, arrangement, and classification; transfer, communication, retrieval, and provision of access; search, discovery, and seeking; evaluation and appraisal; use and application; and destruction.

The Scope of the Information Sciences

The aggregate scope of the fields collectively labeled “the information sciences” or “information studies” is very broad. Any precise delineation of that scope will depend partly on the sense in which “information” is understood. Different authors, working with different conceptions of information, continue to define the scope of the information sciences in very different ways. There nonetheless appears to be a reasonably stable consensus about the identity of those areas of concern that collectively form a central core, in contrast to other areas that are typically recognized as more peripheral. One formulation of the goals of projects associated with this core might run as follows:

1. Understanding the nature of information, of information-related phenomena, and of human–information interaction.
2. Understanding the identities, purposes, motivations, intentions, needs, desires, and actions of people engaged in interaction with information.
3. Designing and building systems, services, and structures that help people to meet their goals when interacting with information.
4. Developing and administering policies and institutions that enable and/or constrain people’s interactions with information.

Within this framework, it is possible also to distinguish between a conception of the information sciences (or of some of its components) as essentially descriptive,

devoted to the construction of theories that explain how information-related events actually do occur in the real world and why real people actually do act and think in the ways that they do, and a conception of the field as essentially prescriptive or normative, devoted to the specification of the ways in which things should happen and the ways in which people should act.

In pursuing projects of these kinds, information scientists draw on theories and practices developed in many overlapping fields of inquiry, not least of which is philosophy and its various branches. Understandings of the nature of information and of information-related phenomena are constructed in the light of developments in metaphysics, epistemology, ethics, and logic, as well as in the humanistic fields of art theory, literary theory, semiotics, linguistics, and history. Understandings of the activities of information users build on the behavioral and cognitive models developed in the life sciences: biology, psychology, cognitive science. Information systems design is informed by work done in engineering, technology, and design fields, including computer science; while information policy development and institutional management rely on insights generated by the social sciences and related applied fields: sociology, anthropology, political science, economics, public policy, business administration, and law. Notwithstanding one’s readiness to accept the particular formulation of the core of the information sciences presented above, the extent to which the content of the information sciences overlaps with that of “other” fields should be clear.

PHILOSOPHY

The question “What is philosophy?” is a meta-question about philosophy. It is one that arises in philosophy of philosophy (a.k.a. metaphilosophy). Answers of many different kinds have been proposed since the original identification of philosophy as a discrete field in the ancient era. These proposals may be categorized on the basis of the kinds of criteria on which each proposal distinguishes philosophy from other fields. For example, one proposal might be to distinguish philosophy from other fields by pointing to differences between the kinds of *phenomena* that form the subject matter of philosophy and those of other fields; another might point to differences in the kinds of *questions* that are asked in philosophy and in the other fields; another might point to differences in the kinds of *methods* that are used to answer the questions that arise in philosophy and in the other fields; while yet another might point to differences in the kinds of *goals* or purposes that motivate people to engage in philosophy and in the other fields.

Different kinds of proposals have attracted varying levels of consensus at different times and in different places. It is important, yet difficult, to avoid misleading

overgeneralization when characterizing the state of philosophy, even when the scope of the exercise is deliberately restricted to whatever is called “philosophy” by those who claim to practice it in a particular culture, such as the academy in the “western” world of the early twenty-first century. A simple caricature of the nature of philosophy at this point in its history might emphasize its concern with the most basic, fundamental, or foundational of phenomena (such as action, beauty, belief, being, causation, consciousness, evidence, existence, experience, goodness, identity, intentionality, justice, knowledge, meaning, necessity, rationality, reality, representation, responsibility, rightness, thought, time, truth, value, and virtue); its concern to ask the most basic of questions (such as “What is x ?” “How do we know that p ?” and “Why ought we do a ?”); its promotion of, and reliance upon, the most basic of methods in answering such questions (such as analysis of the very concepts that are used in expressing the questions, analysis of the logical form of arguments, and analysis of the mental processes by which we interpret our worlds); and its pursuit of the most basic of goals (such as truth, happiness, justice, peace, authenticity, power, and an understanding of the meaning of life). Such a caricature would fail to represent several significant respects in which metaphilosophy inspires ongoing debate:

1. The ways in which contemporary “western” philosophy is similar to and different from philosophy as practiced in “other” contemporary cultures, and from philosophy as practiced in earlier eras.
2. The ways in which philosophy as traditionally practiced is infected with systemic biases deriving from its domination by old, white, middle-class, heterosexual males.
3. The ways in which twentieth-century “analytic” philosophy (also known, somewhat misleadingly, as Anglophone or Anglo-American philosophy) is similar to and different from twentieth-century “continental” philosophy (also known, again somewhat misleadingly, as European philosophy).
4. The ways in which several historically specific “turns” or transdisciplinary shifts in emphasis (such as “the cognitive turn,” “the linguistic turn,” and “the cultural turn”) have affected different groups’ understanding of the nature of inquiry in general and the proper purpose of philosophy in particular.
5. The extent to which philosophy is conceived as having: 1) a normative or prescriptive rather than merely descriptive purpose, on account of which conclusions are drawn about how the world *ought* to be, as well as or instead of about how the world *is*; and 2) an “applied” as well as a “pure” function, in which real-world decision-making is informed by insights derived from philosophical analysis.
6. The ways in which different communities of philosophical practice emphasize different criteria for

evaluating the results of philosophical analysis: e.g., truth, correspondence with external reality, internal coherence, power, utility for producing testable theory, utility for controlling future events, richness of coverage, simplicity, and elegance.

7. The ways in which the methods and goals of philosophy are similar to and different from those of the empirical or natural sciences, and the ways in which, historically, the pendulum of dominant opinion has swung between rationalism (very roughly, the view that a priori knowledge is possible) and empiricism (which denies the possibility of any kind of justification for knowledge other than experience).
8. The ways in which philosophy may be divided into discrete branches or subfields.

At the most general level, it has become conventional to distinguish between, on the one hand, a small number of long-standing subfields such as metaphysics (which focuses on questions to do with being and existence), epistemology (knowledge and belief), ethics (goodness), aesthetics (beauty), phenomenology (experience), and philosophical logic (truth), and on the other, a much larger number of subfields with (in most cases) shorter histories, whose names typically take the form “philosophy of x .” There are branches of philosophy that are concerned with the fundamental ways in which human beings relate to their selves, to one another, and to their environments: philosophy of mind, philosophy of language, and philosophy of action. And there are branches of philosophy that are concerned with particular intellectual, creative, spiritual, social, and physical pursuits: philosophy of education, philosophy of art, philosophy of technology, philosophy of religion, political philosophy, and philosophy of sport. There are branches of philosophy that are concerned with particular disciplines, fields, professions, and practices: philosophy of science (including philosophy of physics, of mathematics, of psychology, of the social sciences, of the information sciences, etc.), philosophy of history, and philosophy of law. And there are branches of philosophy concerned with particular phenomena: philosophy of time, philosophy of race, and philosophy of information.

These branches of philosophy are themselves social constructs. Their boundaries are entirely arbitrary and far from definite. Insights derived from any one are regularly applied in (or, just as regularly, contradicted by) work done in another. Both philosophy of information and philosophy of the information sciences, for instance, are informed by many findings, claims, and proposals originating in other of the branches of philosophy listed above. That the findings, claims, and proposals that originate in philosophy of information and philosophy of the information sciences likewise inform the work done in those other branches is a claim that warrants further investigation (see “Conclusion,” below).

PHILOSOPHY OF INFORMATION

Some of the questions asked *in* the information sciences are philosophical questions and it is in this sense that philosophy and the information sciences overlap.

Metaphysics

Some of these philosophical questions are *metaphysical* questions, in that they are motivated by a desire to understand the essential nature of information-related phenomena, and the roles or positions of those phenomena within the totality of phenomena. For instance, we may ask: What is information? What are documents, data, records, meta-data? What are works, texts, editions, versions, copies? What are representations, reproductions, images? What are information sources, information structures? What is relevance, aboutness, authorship? What are subjects? What are authors, indexers, searchers? What is information production, reproduction, representation, preservation, storage, organization, access, seeking, transfer, retrieval, evaluation, use, destruction? The basic motivation for attending to questions of these kinds is the prediction that our answers—developed by carrying out careful analysis of the concepts or categories that we construct and use to think about real-world substances and properties—will help us to clarify our thoughts, strengthen our arguments, and improve the quality of the decisions and actions taken on the basis of the conclusions of those arguments.

Some of these metaphysical questions can be construed as *ontological* questions. Ontology is the branch of metaphysics that is concerned to identify and understand the fundamental categories or kinds of things that exist in the world. For any of the phenomena listed above, we may ask, What kind of thing is it? An abstract thing or a concrete thing? A universal or a particular? A substance or a property? An object or an event? A set or an element? One of the tasks of ontology is to identify and characterize these different categories.^[20] It may sometimes be helpful to distinguish between “pure” ontology in that sense and the “applied” ontology that is being done when information-related phenomena are being fitted into any predefined categorical structure.^[21] (Another sense of applied ontology is that which is used to encompass work on modeling the kinds of entities and relationships about which information is to be stored in databases.^[22]) In virtue of its focus on human-created artifacts that are the objects of human interpretation, ontology of information is closely related both to ontology of art (including ontology of literature) and to projects with metaphysical ramifications in philosophy of language and representation and in semiotics.^[23,24]

Epistemology

Some of the philosophical questions that are asked in the information sciences are *epistemological* questions, in that

they are motivated by a desire to understand the ways in which information and other information-related phenomena are involved in the processes by which belief can become knowledge.

In the information sciences, just as there is no standard conception of information, there is no standard conception of knowledge. The two main rival views are those of knowledge as true information (or information about the facts, i.e., information about the way the world really is), and knowledge as internalized information (i.e., the content of individuals’ mental images or representations of the world). These both differ from the theory of knowledge that is traditionally provided by epistemology, which is that knowledge is justified true belief. In other words, for any one of our beliefs to count as knowledge, it must be both 1) one that is true, and 2) one for which justification can be provided. Different forms of the traditional theory give different accounts of what it means for a belief to be evaluated as true, how the truth-value of a belief may be determined, how justifications of different kinds may be supplied, what degree of certainty is required of a justification, and so on.

For the information scientist, there is a dual motivation for studying and contributing to epistemology. In the first place, we may learn about potentially productive methods of generating information-scientific knowledge (see the section below on “Philosophy of the Information Sciences”). In the second place, if we accept the idea that there is some sort of conceptual relationship between information and knowledge, we are only a short step away from accepting that what we say about the nature of knowledge and about how it is acquired will influence what we say both about the nature of information and about how we collect, organize, and provide access to the content of information sources (i.e., recorded knowledge). An understanding of epistemology thus helps us to determine what our information structures, systems, services, policies, and institutions ought to be like, and what they ought to do, if the processes by which we interact with information are to result in the satisfaction of our “epistemic objectives”—e.g., the rapid, cheap, and easy acquisition of all and only those beliefs that are justified, true, and relevant.^[25]

Historically, there have been two main points of intersection between epistemology and the information sciences. Firstly, and as already mentioned above in the section on “Definitions of Information”, some accounts of justification rely on a particular conception of *information-as-evidence*. Secondly, library scientists were among the first to express and address the idea that the processes by which knowledge is acquired are significantly *social* in several respects. Margaret Egan and Jesse Shera were the first authors to use the term “social epistemology” in print, and focused on demonstrating how an understanding of the ways in which social groups (as well as individuals)

acquire knowledge can be applied in the design of information services to those groups.^[26–28] More recently, epistemologists such as Alvin Goldman have been concerned to give an account of the conditions under which social processes such as the provision and receipt of testimony can result in the acquisition of knowledge, and a number of philosophical analyses have been undertaken of trust, reputation, authority, reliability, and other criteria for evaluating the likelihood that information sources of various kinds will be productive of epistemically valuable beliefs.^[29–31]

Ethics

Several branches of philosophy deal with questions of value or goodness, and with claims about the kinds of things that ought to be done in given situations. Social and political philosophy, for example, are concerned with the evaluation of public policy, and governmental activity, and group interaction, and with the analysis of socially valuable states such as justice and freedom. Aesthetics is concerned to establish criteria upon which works of art may be evaluated. Ethics is concerned with the rightness of actions in general. Within ethics, some fairly fuzzy boundaries may be drawn between ethical theory, meta-ethics, and applied ethics. Ethical theories propose criteria for distinguishing between right and wrong actions; meta-ethics categorizes ethical theories and analyzes the concepts and assumptions on which they are based; and projects in applied ethics demonstrate the consequences of applying particular ethical theories as guides to action in particular situations.

As we approach the end of the first decade of the twenty-first century, information ethics is the most visible of subfields of philosophy of information. This is a field which already has its own international association, its own journals, and its own handbooks.^[32] “Information ethics” is typically understood to include “computer ethics,” and to emphasize questions about the ethical implementation and use of information technologies, but rarely to the exclusion of more general questions about the ethical provision and use of information services (online or off-line; computerized or not). For the information policymaker, systems developer, or service provider, the fundamental ethical question is: Who should have what level of access to what information? The issues that tend to arise in the evaluation of rival answers to this question include equity of access to information; intellectual freedom; information privacy and confidentiality; and intellectual property.^[33] The literature on each of these issues is large and straddles the boundaries between ethical theory, meta-ethics, and applied ethics. Further research on meta-ethical categories and concepts can only raise the profile of information ethics within mainstream philosophy circles even higher.

Other Branches

Other branches of philosophy upon which work in the information sciences has touched more than momentarily include philosophies of action, art, communication, education, history, language, law, logic, mathematics, mind, representation, science, and technology, as well as critical theory, hermeneutics, and phenomenology. A comprehensive review would require more space than allotted here. In an attempt to succinctly demonstrate the diversity of philosophical approaches that may potentially be taken in the information sciences, in this section a particular object of information-scientific study is selected, and a number of specific issues highlighted as ones that could be productively addressed from various, overlapping, philosophically informed perspectives. The selected object of study is the design of a service for the effective provision of access to relevant information resources or documents (i.e., a document retrieval or resource discovery system).

- What are documents? What kinds of things are they?—Metaphysics.
- What is the nature of the relationship between a document and the work that it instantiates? What is the nature of the relationships between a document and the classes of similar documents of which it is a member?—Philosophy of art; Philosophy of logic; Philosophy of mathematics.
- What do documents do? How do they “mean”? How do they inform?—Philosophy of representation; Philosophy of language; Philosophy of mind; Epistemology.
- How do documents serve as evidence? How does the informational value of a document relate to its evidential value?—Epistemology; Philosophy of science; Philosophy of history; Philosophy of law.
- What is the nature of people’s conscious experience of interacting with documents, with information, with information services?—Phenomenology; Hermeneutics; Philosophy of mind.
- What is information? What is the difference between information, education, and entertainment? What kinds of motivation do people have for choosing to engage with information, education, and entertainment services? How do we evaluate these interactions?—Metaphysics; Philosophy of action; Philosophy of education; Philosophy of communication; Philosophy of language; Philosophy of value.
- What is effectiveness? How do we determine how effective information services are?—Philosophy of value; Philosophy of technology; Epistemology.
- What is relevance? How does relevance relate to other epistemic values? How do we determine how relevant a document is?—Philosophy of logic; Philosophy of value; Philosophy of mind; Epistemology.

- What is access? How does access relate to other socially important objectives, such as preservation? In what ways are information services socially valuable? How should access to information resources be distributed among members of a given social group? How should resources be represented and organized so that access is optimized?—Social and political philosophy; Ethics; Critical theory.

PHILOSOPHY OF THE INFORMATION SCIENCES

Some of the questions asked *about* the information sciences are philosophical questions. The aggregate of these questions forms the field of *philosophy of the information sciences*. On a strict view, philosophy and the information sciences do not literally overlap in this sense, since philosophy of the information sciences is a branch only of philosophy (specifically, of philosophy of science), not of the information sciences.

The goals of philosophy of the information sciences may be stated as follows:

- To locate and illuminate the position of the information sciences as a group of fields in the universe of inquiry, i.e., to understand their role in interpreting and changing the world, their internal structure, and their relationships with other fields.
- To provide justifications for any decision to engage in information-scientific research.
- To provide orientations toward and directions for information-scientific practice by identifying the kinds of problems that are most significant, the kinds of questions that are most relevant, the kinds of methodologies that are most reliable, and the kinds of answers that are most acceptable.

There are two general approaches to philosophy of the information sciences. One is more descriptive, passive, and sociohistorical: the emphasis is on giving an explanatory account of what information scientists actually do, and what they have actually done, to locate themselves in the academic universe, justify their decisions, and orient their practices. Another flavor of philosophy of the information sciences is more prescriptive, active, normative, and (it might be argued) genuinely philosophical: the assumption is that philosophy of the information sciences should determine what the information sciences should be about, now and in the future.

Some of the questions asked in philosophy of the information sciences are *metaphysical* questions. For example: Do the information sciences share a distinctive ontology, or a distinctive view of the kinds of things that exist in the world? The short answer here appears to be “No.” Any acceptance, explicit or implicit, of a proposition that a given category of things exists is an ontological commitment.

Different theories in the information sciences, constructed by scholars working in different subfields, have different ontological commitments. Often, however, the precise nature of a theory’s ontological commitments will not be made clear at the time of the theory’s presentation, even though it may well be recognized that any evaluation of the theory will depend partly on an evaluation of those commitments.

Many of the philosophical questions that are asked about the information sciences are *epistemological* questions, in that they are motivated by a concern to understand the various kinds of knowledge that are produced, and the various processes by which knowledge is producible, in the information sciences. Even more specifically, such questions are normative, methodological questions about the ways in which research in the information sciences ought to be carried out—about the ways in which hypotheses should be tested, results interpreted, and theories constructed. Again, we might ask: Do the information sciences share a distinctive methodology, or a distinctive view of how knowledge claims might be generated and defended? And again the answer appears to be “No.”

One common way of distinguishing among fields of inquiry or communities of inquirers is to locate the fields or communities somewhere between two opposite poles according to their methodological assumptions. Kuhn,^[34] for instance, distinguishes between those academic communities whose members generally find themselves in agreement about the kinds of question that they ought to be asking (and about the kinds of method that they ought to be using to arrive at answers), and those “preparadigmatic” communities that presently lack such consensus (but that continue to strive toward it). Becher^[35] develops a two-dimensional model that distinguishes between the “hard pure” (natural sciences and mathematics), “hard applied” (science-based professions, such as engineering), “soft applied” (social professions, such as education and law), and “soft pure” (social sciences and humanities). In Becher’s model and others like it, the hard–soft dimension roughly corresponds to a scientific–humanistic distinction. “Hard” fields are restricted in scope, studying a clearly delineated range of physical phenomena with a limited range of tried-and-tested methods, with the positivist goal of establishing general, deterministic laws of cause and effect that can each be used to explain the occurrence of large numbers of discrete events. Members of “hard” communities tend to make objectivist assumptions about the nature of reality, of truth, and of knowledge: scientists typically proceed, for example, on the basis that it is possible to acquire knowledge of “the” truth about “the” real world. “Soft” fields, in contrast, are more open to the study of complex, messy, lumpy problems, using a wide range of exploratory methods to come to interpretative understandings, both of the unique constellations of factors that produce particular events, and of the meanings those events

have for individuals and for groups. Members of “soft” communities typically allow that our knowledge of the world (if not the world itself) is both socially constructed, in the sense that our beliefs are shaped not only by the ways in which we interpret others’ beliefs about the world, and perspectival or relative, in the sense that the “truth” (or goodness) of our beliefs may be evaluated differently depending on the evaluator’s present point of view.

Several communities of inquirers who have self-identified with a focus on information and information-related phenomena have a long tradition of soul-searching when it comes to locating themselves among the four quadrants of the Becherian model. Many commentators have drawn attention, in more or less exasperated tones, to the positivist nature of much of the research in the information sciences,^[36,37] and such observations have usually been accompanied by impassioned calls for a “softening” (in the Becherian sense) of information research. These days, we are more likely to read about information studies’ hospitality to a plurality of approaches, the implication being that each of its different subfields can be comfortably located in different quadrants, or even that each of its topics or problem sets can be explored using multiple methods originating in different quadrants. Bates,^[11] for instance, distinguishes nomothetic (hard, scientific, universal) from idiographic (soft, humanistic, particular) approaches, and describes 13 separate approaches to library and information science that can be located along the nomothetic–idiographic spectrum.

Humanistically oriented scholars are more likely to emphasize questions about the relations between information and the following (among other phenomena): conscious experience and the human condition; interpretation and sensemaking; meaning, language, and discourse; ideology, race, class, and gender; identity and diversity; preservation and cultural heritage; remembering and forgetting; narratives and stories; and aesthetic and moral value. Several attempts have been made to develop complete epistemological frameworks for such research, based variously on phenomenology, hermeneutics, critical theory, and discourse analysis. An understanding of philosophy of representation, itself a diffuse area, would appear to be a quality shared by proponents of the emergent view that the information sciences are properly about the relation between people and (not technology, nor even information, but) *reality*.^[38]

Comparative evaluation of the propriety of rival approaches to the information sciences is a difficult task. We could choose to ignore that the issue exists, or at least to deny that it is important (other than perhaps from a sociohistorical perspective), given that the bundling up of questions and methods to form more or less distinct fields is essentially arbitrary and varies historically and culturally according to how phenomena are perceived rather than according to how the phenomena change in themselves. A more productive approach might be to focus on establishing the criteria (truth, power, utility, etc.) upon

which different approaches may be evaluated, and the methods by which an approach’s “performance” against such criteria may be measured.

META-QUESTIONS ABOUT PHILOSOPHY

Just as there are meta-questions (philosophical, historical, sociological, and political) to be asked about the information sciences, there are meta-questions that may be asked both about Philosophy of Information and about philosophy of the information sciences. These include questions about when, where, and how philosophy of these kinds has been done, who it has been done by, and what motivations people have had for doing it. Such questions are asked by historians and sociologists of philosophy.

It is relatively easy to trace the histories of a few well-defined branches of philosophy of information: information ethics, information-theoretic epistemology, and social epistemology come to mind. But, taken as wholes, both philosophy of information and philosophy of the information sciences are diffuse, unbounded fields that lack scholarly associations, journals, textbooks, and reputations. The high-quality work that exists remains scattered, infrequently cited, and (one sometimes suspects) unread. The appearance in the early 2000s of several special issues of journals devoted to topics in philosophy of information demonstrates that the field is gradually attaining some degree of respectability within the information sciences (if not within philosophy); but, given the field’s lack of a clearly expressed identity, it is probably too early to expect any significant contributions to an understanding of its historical development. When that history is written, it will assuredly be of great interest to scholars wishing to see how the kinds of philosophical questions asked in the information sciences, and the kinds of answers offered, have changed over the years, which long-standing assumptions and beliefs (if any) have been challenged by the various paradigm shifts that have been identified in the broader academy, and how social factors have played a role in those developments.

Some of the meta-questions about philosophy of information and philosophy of the information sciences are themselves philosophical questions. For instance, we may ask what kinds of questions ought to form the content of each field, and how each kind of philosophy ought to be done. Contributions to the general field of metaphilosophy, which examine the nature of philosophy and the nature of motivations to engage in philosophical thinking, may serve as provocative resources in this regard.

CONCLUSION

The intent of this entry has been to examine the influence of philosophy on the information sciences. As part of any

general quest to understand the interdisciplinary nature of information studies,^[39] we may well wish to look in the opposite direction and ask, To what extent do the information sciences contribute to “mainstream” philosophy? The short answer here is... well, “Hardly at all.” The “trade deficit” produced by the imbalance between intellectual imports (from philosophy to information studies) and exports (to philosophy from information studies) could doubtless be demonstrated bibliometrically (see, e.g., Cronin and Meho^[40] for a description of the kinds of method that might be used). Certainly, the frequency with which contributions to the literature of the information sciences are cited in the literature of philosophy is vanishingly low. Moreover, the respective statuses within the general philosophical community of philosophy of information (in the broader, pre-Floridian sense) and philosophy of the information sciences sometimes seem to be roughly on a par with that of the philosophy of pasta. Things may change in the future as increasing numbers of philosophers first find inspiration in information-related phenomena and subsequently become aware of the existence of an entire field that, for one reason and another, has often struggled to attract the academic respect for which it has yearned. The most philosophically interesting of contributions to the information sciences—those with the highest potential value for philosophy, if only they were to be disseminated appropriately—include the following:

- Marcia Bates’s definitions of fundamental forms of information.^[2]
- David Blair’s analysis of the implications of contemporary philosophy of language for our understanding of information retrieval as a linguistic process.^[41,42]
- Brien Brothman’s deconstruction of conceptions of record and evidence in archival discourse.^[43]
- John Budd’s evaluation of the prospects for a phenomenological approach to information studies.^[44]
- Rafael Capurro’s assessment of the significance of intercultural information ethics.^[45]
- Ron Day’s critical-theoretic analysis of the discourse and rhetoric of the information society.^[46]
- Don Fallis’s development of epistemic value theory as an approach to the evaluation of information services.^[25]
- Luciano Floridi’s and Kay Mathiesen’s analyses of the moral value of information.^[47,48]
- Bernd Frohmann’s discourse-analytic reformulation of traditional epistemological frameworks for the study of scholars’ information behavior.^[49]
- Kenneth Einar Himma’s meta-analysis of justifications for the legal protection of intellectual property rights.^[50]
- Birger Hjørland’s examination of the epistemological assumptions underlying the practice of library and information science.^[51]

- Allen Renear’s examination of the metaphysical assumptions underlying the design of data models for library and museum catalogs.^[52]
- Keith van Rijsbergen’s (and colleagues’) demonstration of the utility of mathematical logic (including nonclassical systems of logic) for modeling the process of information retrieval.^[53]
- Patrick Wilson’s and Elaine Svenonius’s incomparable explications of the philosophical foundations of bibliographic description and organization.^[54,55]

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In the information sciences, the standard encyclopedic source is, of course, the one you are reading. The cumulative volumes of the *Annual Review of Information Science and Technology* (ARIST; Information Today: Medford, NJ, 1966–) are equally indispensable. There are several bibliographic databases that cover different portions of the field: one with good international coverage is *Library and Information Science Abstracts* (LISA; ProQuest: San Diego, CA, 1969–). The environment for scholarly publishing in the information sciences is very diverse, and different subfields are represented well by different publishers (e.g., information retrieval by Cambridge University Press; digital libraries by MIT Press; museum studies by Routledge). There is no single text that provides a comprehensive overview of philosophical concerns in the information sciences, but monographs by Blair,^[42] Budd,^[56] Cornelius, Day,^[46] Frohmann,^[49] Hjørland,^[61] Svenonius,^[55] and Wilson^[54] serve as philosophically sophisticated introductions to their respective areas, as do chapters in ARIST by Blair,^[41] Capurro and Hjørland,^[57] Cornelius,^[59] Day,^[60] and Fallis^[25] (all listed in "References," above) Journals in the information sciences that carry philosophically informed articles on more than a very occasional basis include *Archival Science*, *Archivaria*, *Journal of the American Society for Information Science and Technology*, *Journal of Documentation*, *Library Quarterly*, and *Library Trends*. The Special Interest Group on the History and Foundations of Information Science (SIG/HFIS) of the American Society for Information Science and Technology (ASIS&T) regularly sponsors sessions of philosophical interest at annual meetings of ASIS&T, and the Conceptions of Library and Information Science (CoLIS) conference series is similarly receptive to philosophically themed papers.

Philosophy of Science [ELIS Classic]

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Abstract

The author notes: "...although a scientist may understand a science to the extent that he or she *does* science, a second level of understanding, that of understanding his or her understanding, may be absent." Philosophy of science is about that second level of understanding. That philosophy forms the basis of how and why a scientist conducts research, and conditions the judgments a scientist forms about the value and validity of the results of that research. Peters also addresses implications for library and information science.

—*ELIS Classic*, from 1977

INTRODUCTION

The philosophy of science is of fairly recent vintage as far as philosophical specializations go. Harré^[1] calls our attention to this fact by noting that the idea that the systematic sciences presuppose styles of inquiry different from those of the ordinary commerce of the mind did not really take root until the early nineteenth century. Before this time, what we have by way of a literature are the records of the methodological deliberations of scientists and the technical developments of epistemologists (philosophers of knowledge). It seems quite natural that at some point efforts would have been made to marry these two, in many ways different, literatures.

The courtship preceding the marriage began in the nineteenth century, but the wedding has not been an easy one to arrange. Representatives of the two families involved, that is, philosophy and science, have sometimes traded harsh words. It is not difficult to find scientists who resent the "intrusion" of philosophers who never have had to face the demands of empirical research. Philosophers can be found, moreover, who retort that scientists can be likened to clumsy bears wandering about in a woods with no concept of, or even a desire for a concept of, the geography of the forest. Ackermann^[2] illustrates this familial rivalry by calling attention to the awkwardness of the situation in which a philosopher is placed when queried by a scientist (particularly a physicist): Tell me something you've learned recently about science. The situation can be balanced by the philosopher reversing the initiative and questioning: Tell me something you've learned recently about philosophy. Socially, however, scientists seem to win the day, because, on the whole, it is philosophers who have declared an interest in science and not scientists in philosophy.

Such rebuffs and retorts may seem to be so much dirt in the laundry of the philosophy of science. In fact,

however, they are diagnostic of a most stubborn impasse in the foundation of a philosophy of science. This impasse, as phrased by Danto,^[3] is the attitudinal predisposition of philosophers and scientists alike that competent works in the philosophy of science are philosophic, for the former, or scientific, for the latter. It is the case, nevertheless, that since the nineteenth century, we can find not only individuals who are known for their philosophy but produced scientific works, such as René Descartes, or who are known for their science but produced philosophic works, such as Francis Bacon, but also individuals who refer to their works as the philosophy of science.

Some of these individuals, moreover, have produced "introductory" treatments and, consequently, have provided a resource from which we can derive a general appreciation for the scope of philosophies of science:

1. Hanson—exploration of the internal structure of scientific thinking.^[4]
2. Churchman and Ackoff—explication of the systemic presuppositions of inquiry.^[5]
3. Ackermann—explication of general, problem-independent principles of scientific practice.^[2]
4. Frank—systematic approach to the understanding of the tactics and strategies of science.^[6]
5. Harré—exposition of the principles operative in science that enable the acquisition of knowledge about the world and the things in it.^[1]
6. Lambert and Brittan—analysis of conceptual and methodological issues in science and exploration of how science, as an experience, relates to human activity in general.^[7]

An attempt to synthesize these six statements (among others) concerning the scope of philosophies of science results in a statement to the effect that a philosophy of

science constitutes a critical understanding of science. The word “critical” in this statement is important in that it implies that the ways in which science is understood are themselves subjects for examination and understanding. Consequently, although a scientist may understand a science to the extent that he or she *does* science, a second level of understanding, that of understanding his or her understanding, may be absent. The degree to which this second level (and an infinite number of other levels defined similarly) is missing in the thinking of science (or a science) is the degree to which science’s (or that science’s philosophy) is undeveloped.

In discussing the critical understanding of science attempted by the philosophy of science, it is important for us to keep in mind that its understanding is just one such of a number possible. Others have come, recently, to be subsumed under the umbrella descriptor of “sciences of science.” The closest of these to the philosophy of science is probably that of the history of science. Whereas, however, history of science inquiries usually result in descriptive expositions (as is characteristic of history), those of the philosophy of science result in prescriptive developments (as is characteristic of philosophy). These sciences of science will occupy our attention again in the final section of this article.

ORGANIZATION

Our objectives for this article are two: *a*) we want to conduct a survey of some of the thinking that has been done in the name of the philosophy of science and *b*) we want to open discussion of how this thinking can be said to apply to the work of library and information scientists. The “applications” aspect of this article is included more for crystallizing the material around familiar seeds than for any other reason. It is hoped that each reader will be able to think through her or his own applications, given the material of the survey.

It is evident that a survey can take any of a number of forms. Some surveys are organized around people, others around eras, and still others around issues. The organization of the present survey is that of “-isms.” Other authors who have employed this style are Churchman and Ackoff,^[5] Churchman,^[8] Pepper,^[9] and Turner.^[10] (What we understand by “-ism,” others have called “school.”) It is possible to overwork the notion of an “-ism.” Consequently, before we identify those we will cover, we do well to take steps to clarify our intentions. (Our development in this area is related to Ackermann’s discussion of scientific theories.)

When discussing the genetic constitution of an organism, it is convenient to make a distinction between “genotypical” and “phenotypical” characteristics. Genotypical characteristics are those said to be encoded in the organism’s genetic makeup, while phenotypical characteristics are the result

of the interaction between this makeup and a specific environment. Insofar as an organism is always in an environment, we can observe only phenotypical characteristics and, by examination of a number of “similar” organisms, infer genotypical characteristics. Since genotypical characteristics are inferred, they stand as idealizations and, as a result, no one expects to be able to observe them directly.

As we discuss the characteristics of philosophy of science “-isms,” we will be dealing with the genotypical. This is to say that when we outline an “-ism” in terms of the way in which an “-ist” views the world, the “-ist” does not actually exist. Nevertheless, we will name historical personages and label them as an “-ist” of one type or another. It should be understood from here forward, however, that when we do this, we mean to say that the person involved is more of this type of “-ist” (has more of the characteristics of this “-ism”) than he or she is of any other.

With these cautionary comments in mind, we can turn to identifying the “-isms” of our survey. This identification has been accomplished by grouping orientations assumed by philosophers of science as they have considered the following two questions:

How should scientists conduct their inquiry?

What should be our attitude toward the products of scientific inquiry?

These questions are not the only ones asked by philosophers of science. Nevertheless, they can be said to account for much of that which philosophers of science have debated among themselves. We shall refer to the first of these questions as the “how” question and the second as the “what” question.

Given these two questions of interest, we note that it is possible to find philosophers of science who agree in their orientations toward one and disagree on the other. Consequently, we have at our disposal a two-dimensional classification of philosophy of science thought. This classification is represented by the matrix shown in Fig. 1. Therein the “-isms” associated with orientations toward the how questions are displayed as rows, while those associated with orientations toward the what question are given as columns. Some “-isms,” moreover, are presented in parentheses. These are “-isms” that we will develop as “modern” variants of traditional approaches.

The matrix in Fig. 1 expresses exactly the way in which we will organize our survey. Our first concern will be that of orientations toward the how question. This discussion will be followed by one centering around orientations toward the what question. As mentioned at the start of this section, the material of these survey sections will be focused through a perusal of what the philosophy of science might be said to have to do with the work of library and information scientists. After that, the article will

How question	What question	
	Conventionalism	Realism
Rationalism (speculativism)		
Empiricism (positivism)		
Criticism (pragmatism)		

Fig. 1 Two-dimensional classification of philosophy of science thought.

conclude with an articulation of some of the present and future issues in the philosophy of science.

ORIENTATIONS TOWARD THE HOW QUESTION

All vital questions raised by philosophers seem to attract a great deal of attention directed at stating them precisely and clearly. Authors can be observed to begin discussions so directed with the query: What is it that we are really asking? Answers to such second-order questions usually lead directly to answers for the original question.

The two questions that we have chosen are philosophically vital in the above sense. For this reason, we can say that it is according to the way in which an author formulates the how or the what question that we will class him or her as an “-ist” of one type or another. Authors can be said to subscribe to the same “-ism” by virtue of the similarity of their statement of questions.

Applying this reasoning to the how question leads to three main “-isms”: rationalism, empiricism, and criticism. Each of these had reached a high degree of sophistication prior to the nineteenth century. Consequently, each has had an opportunity to undergo growth sufficient to allow identification of “modern” variants. These contemporary counterparts are known as speculativism, positivism, and pragmatism, respectively.

In this section, our primary concerns will be those of the traditional “-isms.” This is the case for two reasons: *a*) due to their place in history, the traditional “-isms” appear more “stable” than their modern versions and *b*) we have provided for a section dealing with “current and future issues” in this article and can focus upon the modern there

rather than here. Consequently, our immediate plan is one of laying out the traditional and discussing the modern only insofar as they can be said to carry on certain lines of thought.

We can convey a quick notion of who the people involved were, how they formulated the question under discussion, and what answers they provided. Some of the principal proponents of each “-ism” were:

Rationalism—Leibniz (1646–1716),^[11] Descartes (1596–1650),^[12] and Spinoza (1632–1677)^[13]
Empiricism—Locke (1632–1704),^[14] Berkeley (1685–1753),^[15] and Hume (1711–1776)^[16]
Criticism—Kant (1724–1804)^[17,18]

These people can be said to have formulated our how question as follows:

Rationalism—What are the simplest ideas which: *a*) can be had by a scientist and *b*) are sufficiently “powerful” as to make their correctness unquestionable?
Empiricism—What are the simplest sensations which: *a*) can be had by the scientist and *b*) are sufficiently “clear” as to make their existence unquestionable?
Criticism—What capabilities must a scientist have prior to an inquiry in order to make judgments about the experience represented by that inquiry?

These formulations, in turn, lead to the following answers:

Rationalism—Scientists should conduct their inquiry so that it is guided by theory.

Empiricism—Scientists should conduct their inquiry so that it is guided by data.

Criticism—Scientists should conduct their inquiry so that it is guided by both theory and data.

Rationalism and empiricism were, and are, diametrically opposed positions that became synthesized with the advent of criticism. Such a synthesis was required because both rationalism and empiricism, taken separately or together, were, in one degree or another, inadequate for the explanation of certain notions judged basic to science. The explication of the areas of adequacy and inadequacy of both rationalism and empiricism will be our first concern.

For both rationalists and empiricists, the component of science requiring the most explanation is the ability of its practitioners to make any “sense” out of the flows of perceptions that arise from interactions between the human sensorium and the energies of the universe. Characteristically, a rationalist looks to the world of sensory experience and finds no permanence, no order, no intelligence; in short, he or she finds a world of appearance. Rationalistic reasoning led to the conclusion that the fact that there is any stability in human perception is due to the existence of certain simple concepts. These concepts were said to be used by the scientific *mind* to recognize the things contained in the chaos of sensation. Scientists come to make sense of the world, rationalists proposed, when they come to see instances of concepts.

Let us illustrate the rationalist program to the extent that we have presented it. In the world of everyday experience there are familiar objects that we call “chairs.” None of us would claim that we have seen or will see all chairs. We know that chairs are manufactured according to different designs and are fabricated from different materials. Yet none of us feel particularly stressed when applying the term “chair” to an object we have never seen, manufactured by a design we have never seen, and fabricated from materials we have never seen. Rationalists concluded that this state of affairs is possible only because there exists a concept of “chair” that is common to all human reasoning and that can be employed by each of us to recognize, without hesitation, that each of a number of sensually dissimilar things is, in fact, an instance of this concept.

Rationalism received its justification from the “force” of the double-edged proposition that God exists and is good. From this basis, rationalists proceeded to conclude that a good God would not construct an unintelligible universe. Consequently, as we have said in the above, it was asserted that the flux of reality was deceptive. The problems of science were proposed to be: *a)* the discovery of the simplest of ideas and *b)* the combination of these ideas to develop other ideas. The methods appropriate to science were claimed to be intuition, for discovery, and deduction, for combination. The correctness of the products of intuition was debated according to the “principle of contradiction,” which required that for an idea to be

judged correct, it must be impossible for the universe to be otherwise. The products of deduction, moreover, had their correctness assessed according to the demands of logic wherein the principle of contradiction also played a role in that a combination of ideas would be judged to be incorrect if it could be shown that it asserted the opposite of other ideas that were already accepted as correct.

The twentieth-century mind, in general, has not been sympathetic to the rationalist program. It somehow seems incredible that philosophers and scientists would have proposed that intuition was the primary method of discovery appropriate to science. Although we will soon have much more to say on this, it seems important to itemize, at this point, some of the contributions to science made by scientists who ascribed to rationalism. First of all, Leibniz was a rationalist, and he, with Newton, added integral calculus to the armamentum of science. Descartes, to whom we owe gratitude for the Cartesian coordinate system, was also a rationalist. Finally, almost all of mathematics, in particular, and logic, in general, can be said to be motivated by rationalistic considerations.

It is much, therefore, that science can be said to have gained as a result of the efforts of individuals who believed deeply in a rationalistic philosophy. The fact remains, however, that the rationalist program was, in a sense, lopsided. Rationalism could always talk with more confidence and precision about deduction than it could intuition. The question of discovery of simple ideas and the associated validity of the entire rationalistic program loomed large. This was particularly the case because empiricism submitted that the notion of “simple ideas” was confused altogether.

It is difficult to imagine how two systems of belief could be more fundamentally opposed than those of rationalism and empiricism. Whereas, as we have discussed, rationalists viewed the products of sensation as intelligible only when based in thought, empiricists viewed the products of thought as intelligible only when based in sensation. Empiricists located the responsibility for the flux and chaos of experience in the mind. The world as we see it, the empiricists submitted, is simple and clear. It is the influence of undisciplined operations of the mind that introduces confusion. Whereas the existence and goodness of God is a matter of mere opinion, the clear and distinct sense impressions of a crisp, juicy, sweet, and red apple are undeniable facts. It was the proposition of the empiricists that scientists come to make sense of the world when they begin to notice the similarity of certain simple sensations among a number of objects.

Empiricists have always been quick to call attention to the superfluity of rationalistic beliefs when compared to theirs. As an example of this, consider the experience of pain. For an empiricist, pain is understood to be simply and distinctly forceful in its influence of the mind of man. There is no need to assume, with the rationalists, that a concept of pain is needed for the experience of pain. As

children, each painful experience we encounter is unique. With time, we come to associate the similarity of all painful experiences and to develop a general notion of pain together with a system of types (such as dull, sharp, shooting, and the like). It is the sensation of pain that enables the recognition of a concept of pain. If it were otherwise, then children would have to be assumed to partake of the same experience as adults. For an empiricist, this implication of rationalism was decidedly absurd.

The justification of the empiricistic attitude was one of common sense (almost taken literally). Empiricists challenged scientists to admit that colors and shapes of things are trustworthy, while their naming of things was error prone. From this framework, the problems of science that empiricists recommended were observation and induction. The products of observation, that is, the simplest sensations, were verified by the agreement (consensus) of scientists performing the observation (either together or separately over time). The ideas admitted by induction, moreover, were said to be judged according to the “sufficiency of evidence” invoked in the induction.

Previously, we commented that the twentieth-century mind has not been, in general, sympathetic to rationalistic science. This is, in part, demonstrated by the fact that for most of us, our basic image of science is one of controlled observation of the world through experimentation, an image of empiricistic origin. All “good” scientific investigations must be replicable. All “good” scientific theories must fit the “facts.” It is easy to recognize the empiricistic program as it enters our daily lives through social values and customs. Logical thinking is also a scientific value, and we still turn to rationalists to give us assistance in this area. Yet we refer to them as “logicians” instead of “scientists.”

Rationalism was challenged by empiricists to explicate the origins of simple ideas. Such an explication, the argument was made, was the whole point of science. The program of empiricism proposed an explication, as we have discussed, involving a notion of simple sensations and induction in contrast to the simple ideas and deduction of rationalism. It is important to note, however, that the observations of simple sensations are “guaranteed,” so to speak, by the trustworthiness of consensual agreement. The execution of induction, furthermore, is guaranteed by a belief in the principle of sufficiency of evidence. Rationalists challenged empiricists to explicate exactly how the principle of sufficiency of evidence could *itself* be verified. Using this approach, rationalists argued that empiricism was at fault due to circularity of reasoning.

As might be expected, adherents to rationalistic and empiricistic orientations toward our how question did not find much ground for thoughtful communication. There was one rationalist, however, who, late in his life, heeded the arguments of an empiricist and proceeded to define a new orientation. The rationalist was Immanuel Kant. The

empiricist was David Hume. The emergent philosophy of science “-ism” was criticism.

The message that Hume^[16] sent from England to Germany (which, incidentally, was the direction of most empiricistic critiques of rationalism) was contained in a revolutionary account of the scientific use of the notion of “causality.” Hume had believed in the empiricistic proposition that we come to awareness of the cause of something, say B, by observing that it is always preceded by another thing, say A. It is said that while playing billiards one evening, Hume, by observing the interaction of the balls on the table, recognized that all one could correctly say is that “B succeeds A.” He concluded that the notion of causality made no sense or was, at least, superfluous when viewed strictly from an empiricistic vantage point. The situation was no better, he discovered, in the rationalistic camp. In order for a rationalist to state that “A causes B” it would have to be assumed that the concepts of A and B “provided” for their causal relationship. Otherwise, the concept of A causing B could not be deduced from their individual concepts. But this would require our concepts of everything to include provisions for their relationship to everything else. This, Hume concluded, would result in our concepts being “unworkably” broad. Hume thus argued that the notion of causality was not scientific and that it should be abandoned.

Kant^[17] accepted Hume’s devastating thesis, announced that the notion of causality had to be “saved,” and set about the task. Evidently, the only way that this salvation could have been accomplished was by formulating a new orientation. This is what Kant attempted and his approach was one of synthesis of rationalism and empiricism. As mentioned in the above, the synthesis he devised came to be known as “criticism.”

The fundamental premise of the criticistic orientation was that the products of scientific inquiry originate neither *exclusively* in the world nor the mind. Rather, these products are the result of a process of cooperation between thinking and sensing. For a criticist, simple sensations or simple ideas simply do not exist. Instead, there are actions of judgment that are made possible when the mind structures reality as presented through the senses. A criticist would regard our how question as directed to the problem of a scientist deciding exactly how to conduct her or his observation. When asked how a scientist should conduct inquiry, criticists think of the structure of the world that must be assumed in order for observation to be possible.

The criticistic program called for the senses to provide the contents of our scientific judgments while the mind provided their form. As examples of what criticists meant by “form,” we cite space, time, and a number of “categories of the understanding.” One of these categories Kant defined “as to Relation” and it included, among substance and community, cause. Herein Kant’s proposed solution of the Humean problem can be found. Whereas the senses

inform us as to what needs to be related, the mind performs the relation. One such category of performance results in the judgment that A causes B. We find causality neither in the world nor in our concepts, suggested Kant, not because there is no causality but because it is contained in the *operation* of the mind.

Over time, the details of Kant's philosophy have been shown to be in error by developments in science itself. For instance, Kant accepted the Newtonian treatments of space and time as basic to the operation of the mind. Einstein and his followers have taught us that it is logically possible to think otherwise and that it is empirically mandated in certain situations to do so. Nevertheless, the criticistic orientation toward our how question deserves a place alongside of its parents, rationalism and empiricism. Rationalistically oriented scientists have given us logic, empiricistically oriented scientists have given us experimentation, and criticistically oriented scientists have given us motivation to temper our logics with experiments and our experiments with logics.

With the articulation of criticism, the divisions between orientations toward our how question have become progressively less distinguishable. It would be admitted now by almost all scientists and philosophers of science that scientific theories do not occur in the minds of people without some provocation, brought to bear by data from experimentation, as to what it is that needs to be theorized. Observation in the name of science, moreover, is generally accepted to require some theoretical deliberation if only to define the extremes that can be measured by the instruments to be used. The issues of debate among interested parties in the twentieth century seem to have become those of "degree" (the degree to which intuition is important and the degree to which observation is important), with speculation emphasizing intuition and positivism, observation.

As we have mentioned in one way or another a number of times in this section, it is speculation, the modern version of rationalism, that is on the defensive in contemporary discourse. The speculative program claims that certain sciences, particularly those dealing with life and society, are intrinsically intuitionally based. This is to say that important components of the conceptual frameworks associated with these sciences will never be able to be expressed in terms that enable observation. Consequently, speculatists reason, there will always be a central place in science for intuition. Realizing this, a number of speculatists, Husserl,^[19] for example, have devoted attention to the development of well-circumscribed intuition methods.

Positivists, on the other hand, have responded to speculativistic arguments by acknowledging that unobservable concepts may be required by science, but the extent to which they are required is the extent to which the body of knowledge involved is prescientific. The demand of positivists is that scientific knowledge be "positive" in the sense

that it make assertions about things that are observable. The meaning of *scientific* terms, argue the positivists, is nothing more and nothing less than the operations required to observe the terms' referents. Terms for which such operations cannot be specified are said to be nonscientific. The fact that there are other types of meanings than those scientific should not influence the scientist. As well, positivists regard the analysis of the language(s) of science as one of the most important tasks to be performed by philosophers of science.

Two individuals who have done the most with the positivistic orientation as we have discussed it are Carnap^[20,21] and Bridgman.^[22] Other individuals involved in the speculation-positivism debates are:

Speculation—Whitehead (1861–1948)^[23] and Bergson (1859–1941)^[24]

Positivism—Mach (1838–1916),^[25] Wittgenstein (1889–1951),^[26] and Ayer (1910–)^[27]

It seems important to note that the positions of both speculation and positivism can be said to be reasonable. Scientific knowledge, as we have come to understand it, must be based on publicly available information. Positivists have concluded that this requires that scientific knowledge be based on observation even though at some point some of the components of that knowledge may have been little more than very private, and very tentative, intuitions of some scientists. Speculatists complain that the labeling of the products of intuition as nonscientific or prescientific is an arbitrary and dangerous limitation of the scope of science. To them, it seems warranted that whatever influences, the development of scientific knowledge be considered to be part of science.

Speculation and positivism can be said to have arrived at the same sort of communication impasse as their forebears, rationalism and empiricism. Criticism, we have seen, attempted to break this barrier by demonstrating how the scientific mind could be both rationalistic and empiricistic at the same time. Although criticistic arguments seem to have succeeded in this demonstration, the resurgence of rationalism and empiricism can be interpreted as an indication that the criticistic thrust did not cut deep enough. Pragmatism can be viewed as the modern version of criticism in that it attempts to demonstrate how a philosophy of science can harmonize speculation and positivism.

The basic component of the pragmatic orientation as we shall discuss it is that a *science* can be both speculativistic and positivistic at the same time. Pragmatists bring to the surface of contemporary debates the fact that at any given time a science involves a number of different individuals at different stages of understanding of different (types of) problems (phenomena). Some of these individuals may be speculativistic in their outlooks, while others may be positivistic. Pragmatists regard as unnecessary the classification

of concepts as nonscientific simply because they are speculativistically based. The classification of fields of inquiry as nonscientific simply because their practitioners are predominantly speculativistic is similarly viewed.

For pragmatists, science as an activity is not as separable from other forms of human activity as other philosophers of science seem to view it. The relations among sciences, that is, physics, biology, etc., moreover, are not as cut-and-dried as many would have it. The question of what psychology has to say to physics, or what art has to say to physics for that matter, is meaningless to a pragmatist unless a problem has been defined. Once a problem has been specified, the importance of a solution to the problem assessed, and an inventory of available knowledge accomplished, a pragmatist will accept anything as scientific that contributes to the attainment of a state of knowledge that is appropriate to the importance of the problem.

Pragmatism, then, attempts its synthesis of speculation, positivism, and the other orientations we have covered in this section by focusing upon the inquiry of science rather than of individual scientists. Some of the people who have enunciated a pragmatic philosophy of science are James (1842–1910),^[28] Dewey (1859–1952),^[29] and Singer (1873–1954).^[30] It should be noted, as we complete this discussion of pragmatism, that pragmatic thinking has not received the same recognition from speculation and positivism as did criticism from rationalism and empiricism. Some additional remarks will be made on this point when we turn to the current and future issues in a later section.

It has been our goal in this section to expose some of the main currents in the thoughts that philosophers of science have given to the question of how scientists should conduct inquiry. This we have done by discussing the tenets of orientations to the question that we obtained by grouping the efforts of individuals who can be said to have formulated the question similarly. Although this survey has focused on the “-isms” so defined, it is important to recognize the issues involved to be basically those of the relative contributions to be made to science by intuition versus observation and deduction versus induction.

ORIENTATION TOWARD THE WHAT QUESTION

The second question that we selected for the survey of this and the preceding section was: What should be our attitude toward the products of scientific inquiry? In comparison to our first question, the meaning of this second query is less obvious. Its history, moreover, is considerably less extensive in that it has only been an active area for debate since the middle of the nineteenth century. Nevertheless, deliberations in its name have become increasingly commonplace in recent times.

Before proceeding much further, we had best be clear about our understanding of the question. First of all, we acknowledge that the products of scientific inquiry are manyfold. The specific class of products that we are addressing with the question, however, is that of “theories.” Generally, we want to avoid the question of what the structure of a theory might be said to be [see Campbell^[31] or Braithwaite^[32] for expositions of widely accepted views]. The question that we do want to raise is that of the *function* of scientific theories. The debate that we want to survey has been concerned with the correctness of supposing that we can do certain things with theories.

To illustrate the form of this debate, we appeal, for the moment, to what is probably the most prevalent opinion on the subject. For many of us, scientific knowledge in the form of theories constitutes the “safest” and most “useful” knowledge that we humans can achieve. It is “safe” in the sense that it is dependably error-free. It is “useful” in the sense that it is tailored to provide solutions to problems of survival. No matter how strongly we might argue that the cost of scientific knowledge is excessive or that the methods by which it is obtained are inhumane, scientific theories have the advantage that they “work.” They have provided direction for handsome material development, they have enabled us to reach for the stars, and they have justified utopian visions of disease-free societies. In sum, scientific theories enable us to predict, explain, and control the events of our world with precision.

The view of scientific knowledge that we have just articulated can be analyzed to expose an orientation toward our what question. For instance, we note that the viewpoint assumes: a) that a world of physical objects and processes exists independent of the scientific mind; b) that the nature of these objects and processes are (in principle) knowable; and c) that scientific theories are the most precise form of such knowledge attainable. Debates on the merits of the third part of this characterization usually occur between scientists and nonscientists, and even though they are fascinating, we have omitted any record of them from this article. There has been debate in philosophers’ circles, moreover, on the appropriateness of the assumption that a world exists independent of the mind, but we will also leave that discussion to another place and another time. What we will take up for discussion are the thoughts of those scientists and philosophers of science who have found themselves more in agreement than not when comparing attitudes toward questions about the existence of a physical world and the precision of scientific knowledge relative to other forms of human knowledge but, all the same, disagree radically on the issue of the knowability of the physical world.

The orientation that holds that scientific knowledge does constitute an understanding of the nature of things in the physical world has come to be called realism. Two of

the individuals who have thought through realistic positions are Moore^[33] and Ryle.^[34,35] Most of the rationalists and empiricists whom we cited in the previous section can be said to have been realists to one degree or another. In addition, a number of psychologists have attempted to develop theories of sense perception that are overtly realistic ["Gestalt" theorists, such as Köhler,^[36] for instance, postulate that the contents of reality and those of the mind are "isomorphic," i.e., are in a one-to-one correspondence]. Turner^[37] can be cited as a contemporary, philosophically minded psychologist who openly discusses his commitment to realism.

Realists are opposed by a number of points of view that agree to the extent that they all emphasize the strongly *conventional* rather than *real* character of scientific knowledge. Individuals of this orientation frequently refer to certain events in the history of science in order to convey an appreciation for why they have brought the realistic thesis under examination. Inventories of these events always include the "revolutions" of Copernicus and Einstein whereby complete systems of scientific knowledge, those of Ptolemy and Newton, respectively, were summarily replaced.^[38–40] Mention is also made of developments in modern physics (in the form of quantum mechanics) that have led to the conclusion that there are limits to the ability of the human mind to know in real terms.^[41] Even the world of mathematics, the contents of which lie beyond the perceptive powers of most of us, has been the scene of similar developments.^[42–44] It is noted, moreover, that astrologers and alchemists once laid an unchallenged claim to being scientists; and ether, phlogiston, and humors once laid a similar claim to being scientific, realistic concepts. In no small way, the history of science can be said to be littered with the decaying parts of discarded theories and concepts.

It is not the case that realists ignore the dramatic events itemized in the previous paragraph. Rather, they don't accept the conclusions that "conventionalists," as we will call them, can be said to draw from the study of the history of science. Realists claim that it is to be expected that science's movement toward *real* theories should exhibit progress whereby concepts and theories are refined. Events such as the replacement of Ptolemy by Copernicus and Newton by Einstein should be viewed as nothing more than "growing pains." The assertion that scientific theories are realistic *in principle* cannot be rejected simply because we haven't yet achieved perfect science.

Conventionalistic response to realistic arguments can be said to have appeared in two major forms. First of all, there are those who have held that science doesn't need to assume a realistic attitude. This tactic has been most forcefully adopted by psychologists of a behavioristic bent^[45,46] and has come to be known popularly as the "stimulus-response," "black-box," or "input-output" view of things. It has also influenced philosophic treatments of

cybernetics [that of Craik,^[47] for example]. Essentially, this strain of conventionalism, which has also been called "instrumentalism," holds that science need only record the correlations of actions performed by scientists and results observed. Introduction of any additional material into scientific theories is said to be unnecessary.

A second conventionalistically motivated response to realism can be found in the writings of Mach,^[25] Poincaré,^[48] and Duhem.^[49] The suggestion of these authors, among others, is that the realistic attitude is inappropriate. It is their assertion that the reality of a theory cannot be assessed on *scientific* grounds. How could such an assessment be performed, they ask, without a comparison of the contents of the theory with those of reality itself. Obviously, such a comparison is impossible because it presupposes knowledge of that which is unknown. These conventionalists acknowledge that one theory can be said to be unrealistic in comparison to another in the sense that it does not account for observations as adequately. But, they are quick to remind us, science has experienced in its history the "unfortunate" co-occurrence of theories that account for the same observations to the same degree of accuracy. To say that one such theory became ascendant because it was more *real*, they conclude, is to postulate an impossible decision-making capability.

In the place of a realistic orientation, conventionalists of the form we are discussing would substitute an orientation that views scientific theories as "languages" by which scientists can communicate results of observation unambiguously and economically. It is not to be denied that the contents of these languages are provoked by reality as observed, but it is to be contested that they tell us about that reality as it is unobserved. If Duhem's program is followed,^[49] it is held that the relationships among the contents of a theory, on the one hand, and the relationships among the contents of reality, on the other, move toward a coherence over time, but beyond this "natural classification," little more of the realistic attitude toward scientific theories can be interjected.

The survey of conventionalistic critiques of realism that we've conducted to this point hopefully engenders an appreciation for why the assumption of "in-principle knowability of reality" has come under examination. Without introducing considerable additional detail, it would be difficult to take the discussion much further. It has been our intention in going this far to demonstrate how quickly the deceptively simple question "What should be our attitude toward the products of scientific inquiry?" becomes complicated when investigated critically. As with the previous section, it is important to keep in mind the issues that have structured debate about the question. For our what question, these issues can be said to be those of the (in)appropriateness, (un)necessity, and (im)possibility of the attitude toward scientific theories as constituting real versus conventional knowledge of the world.

APPLICATION TO LIBRARY AND INFORMATION SCIENCES

At the start of this article, the promise was made that our survey of philosophy of science thinking would be applied to the problems of the library and information sciences. To produce such an application in the full form possible would be to develop a philosophy of library and information sciences. This we cannot do within the scope of a single article, but we hope to sketch out the components and promise of such a philosophy.

If we recall, for a moment, the definition of “philosophy of science” that we introduced for our discussion, we will be able to develop precisely what function a philosophy of library and information science might have. This definition stated that a philosophy of science constitutes a critical understanding of science where the word “critical” implies that the means by which the science is understood are themselves subjects for examination and understanding. People who dedicate thought to the philosophy of science, or to the philosophy of a science, therefore function, through the results of their work, to enable scientists to be more selective, more conscious about what they do and the ways they do it than they might be otherwise. This is the case, that is, if there exist open lines of communication between the two groups of scholars (those concentrating on the science, on the one hand, and those concentrating on the philosophy, on the other).

Stated in familiar terms, those who work upon a philosophy of a science assist those who work in that science in conceptualizing design options and interpreting situations. The options available to an individual approaching a system or an experimental design task can be categorized, given sufficient work, along the lines we followed in discussing our how question in previous sections. This is to say that a design task essentially raises questions about how something should be done and, philosophers of science assert, answers to such questions, upon examination, can be said to contain rationalistic, empiricistic, and criticistic orientations. It follows that a scientist who is able to recognize and analyze the strengths and weaknesses of these orientations is better equipped to formulate and evaluate design alternatives than one who is not.

Library and information scientists, for instance, face daily the problem of representing the contents of documents. Whether the mode of representation is that of classifying, abstracting, or indexing, to cite three, the problem remains to be one of developing a “substitute (surrogate)” for a document that enables that document to be related to other documents for purposes of storage and retrieval. We solve this problem by using classification and indexing systems. The designs of these systems have evolved over time and can be viewed to demonstrate the philosophy of science orientations we have discussed. The approach to classification adopted by Dewey, for example, relied heavily upon a conceptualization of the universe of

knowledge, while that of the Library of Congress is based more upon the actual contents of documents themselves. In this respect, the Dewey decimal classification, oriented toward the ideational, can be said to be predominantly rationalistic while the Library of Congress classification can be said to be predominantly empiricistic because it is oriented toward the observable. S.R. Ranganathan, moreover, with his colon classification, can be recognized to have assumed a criticistic orientation. This is by virtue of his use of the process-matter-energy-space-time formula in the context that *every* document contains something about each of these facets (an ideational assertion), but what is contained has to be determined by continual surveillance of published literature (an observational assertion).

The point of discussing how library and information scientists have gone about designing systems for representing the contents of documents, however, is not to claim that the designers involved used philosophy of science thought to guide their work. Rather, this brief exposition stands as evidence for the proposition that philosophers of science do serve to help the practicing scientist understand more fully the ways things have been done in the past and the ways they could be done in the future. Faced with a problem of design and equipped with a comprehension of philosophy of science, scientists could explore, at the outset of work on the problem, the rationalistic, empiricistic, and criticistic viewpoints to the problem. Such an exploration would result in a preliminary inventory of subproblems, subtasks, associated with the theory that has to be invoked relevant to the problem (rationalistic), the data that has to be collected relevant to the problem (empiricistic), and the means by which the theory and the data can be matched to evaluate the effectiveness of the design (criticistic). This inventory, in turn, can function to clarify what the design could do and, after consideration of the practical, what it can do. It is in this latter category, that of what is practical for a design, that the inventory is again very useful because it enables an understanding of what the design is not doing. Thus, the task of explaining design failures, after a system is implemented or an experiment is conducted, becomes more systematic and less ad hoc than it is otherwise.

In some ways the above may be read as an articulation of the “systems approach” or the procedure of “systems analysis.” This is not by accident. A number of contemporary philosophers of science have also contributed to the “systems” literature. A partial list of authors in this category includes Ackoff,^[50,51] Churchman,^[5,8,54,55] Helmer,^[56] and Rescher.^[57,58] The work of Mitroff^[59] is particularly interesting in this respect, especially his effort with Williams and Rathswohl,^[60] because it is frequently applied to information science topics.

Beyond the functioning of philosophy of science thought as an aid for the conceptualization of design issues and options, which is a function it has for all science, there

are a number of possibilities for the direct application of philosophy of science developments to the problem spaces of library and information sciences. The concept of “user,” for instance, is one that library and information scientists have discovered needs increasing precision. Library and information workers are frequently encouraged to actively consider and involve the “user” in the design of services first and in the delivery of services over time. Indeed, the attention that the concept of “user” has attracted in recent years can be said to account for the metamorphosis of the library and information sciences into the behavioral and social realms. To date, however, the language that the library and information profession has developed for discussing this concept is predominantly anecdotal in tone and descriptive in approach.

The concept of “user” can probably be said to have begun its ascendancy as people who work with information endeavored to make scientific sense of the associated concept of “relevance.” On both intuitional and evidential grounds, it is clear that the relevance of an item of information is a judgment made by a recipient of that item. The proposition is offered, then, that relevant items of information transform a passive recipient of information into an active user. A design objective that is consistent with this reasoning is that information delivery systems should strive for making *users* out of the *recipients* of their services. The manner in which these systems might do this, to come full circle, is to deliver highly relevant items of information.

In an article summarizing conclusions made from experimentation with relevance, Saracevic^[61] notes that comparisons of relevance judgments have been made among users, nonusers, experts, and nonexperts. The remark we want to make at this point is that such comparisons are quite obviously based upon a typology of recipients of information. This is to say that considering the degree of subject specialization of a recipient or the conditions of reception, an individual is typed, for purposes of analysis, as a user, nonuser, expert, or nonexpert. Referring back to our previous comment about the language that library and information scientists have for discussing the concept of user, we can now see exactly what that language is.

The hint of an alternative language, that is, an alternative typology, for discussing recipients and users of information can be recognized to reside in the philosophy of science thought we have surveyed. Assuming that library and information work will be concerned with scientific and technical communication for years to come, which is certainly true in part, the ways in which philosophers of science have come to discuss orientations assumed by scientists toward their work could be explored as a base for similar discussions among library and information scientists. This is to say that we would come to state information requirements and judgmental criteria of groups of recipients of information in terms of the degrees to which

they could be said to be rationalistic, empiricistic, and criticistic in their orientations. Although statements of this type are premature given current levels of development, we can suggest for purposes of illustration that the differential relevance of items of information could be systematically approached by assessing the rationalistic, empiricistic, and criticistic influence at work in the author and recipient.

Insofar as philosophies of science provide theories of science and of scientists, then, they allow two major areas of application to the library and information sciences to be pursued. Both of these have been discussed in the above. First of all, in summary, philosophies of science as theories of science help to make library and information scientists more aware of the constellation of approaches available for the execution of any given inquiry. Second, as theories of scientists, they contain characterizations of recipients and users of information to the extent that the information involved is that of scientific and technical communication. It is not to be concluded, however, that the philosophy of science is completely ready to be applied in these ways. There remains much work to be done by both philosophers and scientists.

SOME PRESENT AND FUTURE ISSUES

That which one regards as an “issue” in a field is that which is regarded as the problematic. It is the case, moreover, that the perception of the problematic is something that varies greatly from individual to individual. Everything we have said in this article pays tribute to this fact: what a rationalist takes for granted, an empiricist questions and vice versa. It has to be understood, therefore, that as we state some current and future issues in the following, these statements have to be interpreted, more than those of any other section of this article, in the light of the author’s point of view. Obviously, this point of view is not that of a philosopher of science per se; rather, it is that of an information scientist who has found material in the literature of the philosophy of science that provokes thought about and adds perspective to his work. In addition, the point of view of the author tends to be criticistic, that is, he favors the examination of the interaction of concepts and observations over the examination of concepts or observations by themselves.

Within this framework, it can be stated, preliminarily, that the major present and future issues of the philosophy of science are at the “fringes” of the field instead of at its core. In truth, it has to be acknowledged that this entire article has been on the fringes. Such “core issues” as laws versus empirical generalizations, the (a)symmetry of explanation and prediction, the structure of theories, and the explication of terms have occupied little space in the preceding. These core topics can be said to be focused on the *products* of science. Our focus can be said to have

been that of the *processes* attendant with the science. This consideration of processes attendant with science, moreover, is still a fringe concern for philosophers of science.

It is not fringe, however, for a number of other groups of scholars that we reference through the descriptor of the “sciences of science.” Such scholars have come to understand that a full treatment of the processes of science will require *at least* a politics, sociology, and psychology of science and scientists. Seminal works in this respect are those of Price^[62] and Maslow.^[63] Crane^[64] published a related effort, as has Mitroff.^[65] The monumental study by Freidson^[66] is also of interest, as are those of Hanson.^[4,38]

It is the case that many philosophers of science in modern times have systematically excluded the psychological from their sphere of inquiry. As he begins his milestone treatise on probability as inductive logic, Rudolf Carnap^[67] remarks at length on how it is inappropriate for a logician to attempt to speak to the point of the ways in which scientists actually do or even should reason. Logic and, so it seems, philosophy of science in this widespread conception should be neutral as to the actual practice of science. The core issues raised in this context are associated with the development of objective knowledge and the formulation of universal hypotheses and laws from time-bound experimentation. As is the situation with mathematics, the results of such research are presented as declarations of possibilities rather than imperatives for action.

In a certain sense, this attempt to define the core of the philosophy of science is similar to what some authors have tried to do with the issue of relevance in library and information science. Cooper,^[68] referencing Wilson,^[69] for instance, states clearly that his concern is that of *logical* relevance (topic-relatedness) rather than utility. King^[70] has also seen value in separating the psychological aspects of relevance from other aspects that could be considered. The main group of philosophers of science have placed such logical matters at the center of their specialization, as many library and information scientists can be said to have done with relevance.

The formal or “logico-mathematico” vein of philosophy of science has spawned a richly substantial literature. Recently, moreover, it has developed along lines that bring it into proximity with the library and information sciences. Some of the work in this class has been done by Kemeny,^[71] Watanabe,^[72] Hintikka and Suppes,^[73,74] and Suppes and Atkinson.^[75] The common ground involved here is bounded by inductive inference and information theory wherein information theory provides a “calculus” for certain measurement of language tasks associated with the procedures of inductive logic.

The neutrality of this style of philosophy of science can be said to be responsible for both its strength and its weakness. It has been strong because scholars devoted to it and working within it have been able to push forward without being constrained at every step by speaking to the

actualities of science and scientists. Note that this state of affairs, wherein philosophers of science have excluded behavioral and social inquiry from their approach, is symptomatic of a rationalistic frame of mind. This is the case even when the philosophers involved have been extolling the virtues of empiricism. But it is important to recognize that philosophers of science *do* philosophy and not science and, consequently, it is not inconsistent for them to use rationalistic arguments in philosophy for empiricistic conclusions in science.

There are those who are not convinced by this reasoning, and it is these that we have referred to as the fringe of the philosophy of science. We are at a point now from which we can understand clearly their position and the present author’s conception of the future. The fringe of the philosophy of science is constituted by those individuals who have adopted empirical methods for developing their philosophies. Evidently, they believe such philosophies are possible even though it can be expected that philosophy, psychology, and sociology may be radically transformed in the process. This is the area, the “empiricizing” of philosophy, in which interesting future issues will develop. It is the area in which interesting present issues have crystallized. The projected result is that the core of philosophy of science will itself transform to something that is more directly approachable and appropriate to scientists than that which is currently the case. Whether or not this transformation will also result in a philosophy that is too “vulgar” to attract the attention of competent philosophers is something that is difficult to decide.

Possibly the first and foremost group on this fringe of which we have made so much is that of the pragmatists. The reasons for this are not hard to guess. Philosophies can be characterized, as we have in the preceding to a limited extent, by their “unit of analysis.” Rationalism, for instance, analyzes things in terms of ideas, while empiricism uses sensations. Criticism’s interest is in the act of judgment and thus its emphasis is on the relation of idea and sense. The unit of analysis of pragmatism, which we have presented as the modern variant of criticism, is that of human action in general [see Mead,^[76] for instance] For pragmatists more than any other philosophers of science, therefore, the demand has been for an action-directed philosophy of science.

In addition to the push pragmatists have provided from the fringe, certain developments in the study of “objectivity” have set off some minor eruptions in the core itself. Primarily, it would seem, most of the problems are associated with the social sciences. Therein the appropriateness or even possibility of an objective comprehension of human and social behavior has been strongly questioned. Basically, the issue has come to be known as that of the “value-(non-) freedom” of the social sciences. Krimmerman’s anthology^[77] contains an excellent sampling of opinions on this subject. The biases that a social

scientist can introduce into an experiment have been the subject of study by Rosenthal,^[78–80] among others. To make the situation complicated many times again, moreover, it has been determined that the objectivity of social science research is in question due to biases introduced by *subjects* themselves. The classic case in point in this regard is that of the “Hawthorne Program” [which provided the material for a book by Roethlisberger and Dickson^[81,82]], wherein it was concluded that an improvement in industrial worker productivity and satisfaction could be traced to the workers’ participation in an announced experiment rather than to any alteration of the working environment.

No doubt to some, the problem of objectivity in the social sciences represents no less than a diagnosis of their inadequacy as sciences. Things, however, are not that simple. Astronomy, for instance, is certainly an “acceptable” science and yet astronomers have struggled for years (indeed, centuries) with the problem of consistency in observation. Such consistency would be, in principle, possible if objectivity of observation and reporting were operative. Physics, as viewed by Heisenberg,^[41] has evolved to a state of uncertainty in this respect as well. In an almost poetic chapter,^[41] Heisenberg outlines the dilemma of the physicist historically an expert in the realms of the obviously real (levers, inclined planes, pendula, etc.), approaching the atom and the awareness that with things atomic there is a world of “potentialities or possibilities rather than one of things or facts.” When the language of the physical sciences moves toward a potential or possible or probable calculus, it begins to sound similar to the dispositional or expectational or probable one of the social sciences.

So we find that the concept of objectivity, at the center of logico-mathematico strains of philosophy of science, is in a position of change of outlook. Modern physical science and modern social science have furnished evidence to the effect that objectivity is in the process of being replaced by intersubjectivity. Intersubjectivity, moreover, seems radically less a logical matter than one empirical insofar as the “inter-” of the concept requires attention be given to at least two things acting together rather than the solitary “ego” that can be found in so much of what we understand as logic. This is the major issue, though, that we have identified with the present and future of the philosophy of science. For purposes of summary, we again state that this issue, and all attendant issues, are those associated with the development of empirical techniques of philosophy in general and philosophy of science in particular.

CONCLUSION

The bibliographical sources for this article are extensive, and, thus, it may be of use to cite some works for purposes

of general reference. The author’s personal favorites, which is to say the ones that he consults most often, are those of Hanson,^[4,38] Turner,^[10] Churchman,^[8] Duhem,^[49] Kuhn,^[39,40] and Pepper.^[9] These are listed according to some measure of increasing difficulty. In the area of collections, the author favors those of Krimmerman^[77] and Brody.^[83] It can be noted that all of those references are from the twentieth century; it is the author’s opinion that it is best to start with these rather than the original, classic sources from which they draw.

Individuals who have not received citation in the preceding discussion but who have played influential roles in the development of contemporary philosophy of science thought are: Broad,^[84] Crombie,^[85] Eddington,^[86] Feigl,^[87] Feyerabend,^[88,89] Kaplan,^[90] Merleau-Ponty,^[91] Merton,^[92] Mill,^[93] Neurath,^[94] Pascal,^[95] Pearson,^[96] Popper,^[97,98] Quine,^[99] Reichenbach,^[100] Russell,^[101–103] Schlick,^[104] and Scriven.^[105] This list, however, should not be regarded as being exhaustive, for it reflects the scope of study of its author. The references given throughout this article also need not in every case be the most representative of an author although the attempt has been consciously made to meet such a condition for the majority.

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Encyclopedia of Library and Information Sciences, Fourth Edition

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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable.

Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

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Physical-Primary

Print-Qualitative

Rare-Reference

Regional-School

Science-Semantic

Semiotics-Slovakia

Smithsonian-Society

Sociology-Special



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Physical Sciences and Mathematics Literatures and Their Users

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Abstract

The literatures of the physical sciences and mathematics are as diverse as the information wants and needs of their users while serving the common purpose of disseminating their research findings. The peer-reviewed journal is the hallmark of scholarly communication for physicists, astronomers, chemists, and mathematicians yet each discipline has its own unique information sharing practices. This entry discusses the information behavior of physical and mathematical scientists and the ways in which their literatures mesh with their distinctive research activities. Although physicists and astronomers were among the earliest adopters of electronic modes of scholarly communication, chemists and mathematicians have been slower to embrace digital information sharing. This entry therefore also considers the influence of electronic distribution of physical science and mathematical information on the ways in which their intended audiences access and manage the plethora of digital resources. Recent initiatives designed to facilitate access to the literatures of physics, astronomy, chemistry, and mathematics are also surveyed.

INTRODUCTION

Physical scientists study nonliving matter and energy through the lenses of the disciplines of physics, astronomy, and chemistry. Employing the scientific method, physical scientists develop concepts and theories to explain the physical world. Mathematicians are interested in numbers, quantities, and magnitudes and their relationships as well as the properties of space. Using methods involving logical reasoning and symbolic notation mathematicians investigate applied and theoretical problems in algebra, analysis, arithmetic, calculus, geometry, and trigonometry. The peer-reviewed journal is the hallmark of scholarly communication among both physical scientists and mathematicians; however, there are variations in the ways in which physicists, astronomers, chemists, and mathematicians access the information they want and need to support their research and creative activities. These differences in information behavior are reflected in the ways in which the different literatures of astronomy, physics, chemistry, and mathematics are organized, disseminated, accessed, and archived.

Beginning with a discussion of the traditional model of scientific communication, this entry describes the information behaviors of three groups of physical scientists: astronomers, physicists, and chemists, as well as the information behavior of mathematicians. Also considered are the ways in which the physical sciences and mathematics literatures mesh with their intended audience's information access and delivery preferences. Attention is given to the ways in which physical scientists and mathematicians handle the burgeoning body of information generated via high-output, cutting-edge scientific techniques plus their usage and acceptance of scholarly information that has not

only recently become accessible electronically but also that which is born digitally. This entry provides librarians and information scientists with an overview of the current understanding of the ways in which physical scientists and mathematicians access and use information to support their scholarly work. This understanding will enable the design and creation of products and services that facilitate, enhance, and improve the management, organization, and provision of information resources that not only meet, but also match, the specific information requirements and behaviors of physical scientists and mathematicians.

MODELS OF SCIENTIFIC COMMUNICATION

William Garvey and Belver Griffith discovered in the early 1970s through the observation of psychologists that scientists' information behavior is intimately tied to the ways in which they conduct their scientific work.^[1] Garvey and Griffith's model of scientific communication delineates the path scientific results travel from the laboratory to citations in the peer-reviewed journal literature. Along the way scientific results are disseminated locally at seminars and colloquia, followed by presentations at regional, national, and perhaps even international, scientific meetings. After vetting the results in these venues, the results may be deemed worthy for submission to a peer-reviewed scientific journal for publication consideration. Once a report of scientific findings has successfully traversed the gauntlet of peer review and become published, indexing and abstracting services catalog the article's bibliographic information to provide the scientific community with an entree to the results. Subsequent researchers whose projects are informed by the published reports then

cite the article in their scholarly publications thereby furthering the accessibility to the scientific results through reference linking. Running in tandem with Garvey and Griffith's model of scientific communication is an informal form of discourse described over 40 years ago by Price and Beaver as the "invisible college."^[2] Similar to the prototypical office water cooler, informal, yet highly valuable, communication among scientists takes place in the hallways of academia, at social gatherings during professional conferences, as well as over the telephone and through written correspondence. In contrast to formal scientific communication, which can be traced through the journal literature and via indexing and abstracting tools, informal scientific communication is difficult to track as it is not codified and archived even though its impact on scientific information behavior can be significant.

Moving forward in time to the beginning of the twenty-first century, Garvey and Griffith's model still holds true with the peer-reviewed journal remaining the coin of the realm for dissemination of scientific research findings. However, the advent of the Internet and the World Wide Web has impacted the ways in which physical scientists and mathematicians not only access, but also create and share, the results of their research endeavors. The creation of public and private online repositories of scientific data allows scientists and mathematicians to exchange information with a wide array of collaborators, as it is being generated, without having to first pass through the peer-review gauntlet. Electronic preprint servers and online journals deliver up to date scientific information to scientists' desktops around the clock. Online forums and electronic mail allow physical scientists to discuss issues of scientific importance with their colleagues without constraints of

borders, time zones, and languages. The model of electronic scientific communication proposed by Lancaster^[3] and revised by Hurd^[4] as presented in Fig. 1 incorporates these modes of electronic communication suggesting that the flow of scientific information will soon circumvent printed journals, indexes, and abstracting tools and will eventually be entirely digitized. Even though electronic communication facilitates information sharing and dissemination among physical scientists and mathematicians, the forecasted completely digital model of information flow has received varying degrees of acceptance by physicists, astronomers, chemists, and mathematicians.

THE LITERATURES AND THEIR USERS

A major task for all physical scientists and mathematicians is discovering, collecting, and reading articles about their area of research. Tenopir and colleagues found that time spent in reading by physicists, astronomers, and chemists, ranges from 144 to 198 hours per year.^[5] To access their literatures, physical scientists and mathematicians have at their disposal a myriad of indexing and abstracting services which employ an array of organizational schemes and offer a variety of access points. Providers include the American Association for Mathematics, a nonprofit professional society, as well as the scientific publishing powerhouse, Elsevier. Physical scientists and mathematicians have the option to access their literatures using not only sophisticated citation searching techniques through the Institute for Scientific Information's (ISI) *Science Citation Index* but also via simple, yet powerful, keyword searches

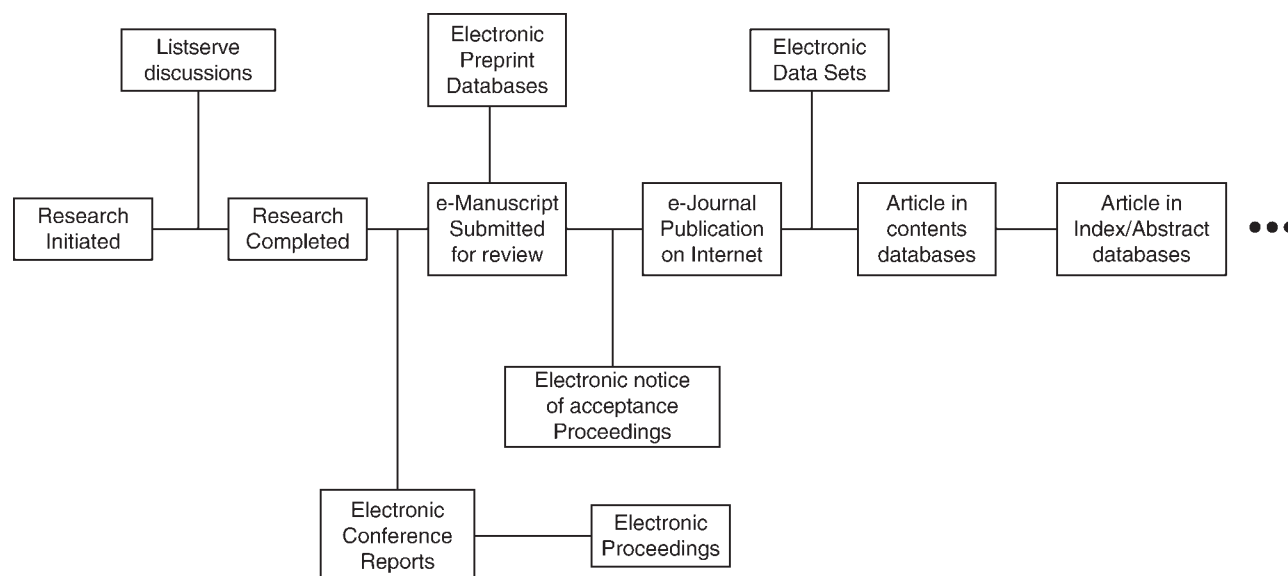


Fig. 1 Hurd's revised Garvey/Griffith model.

Source: From Hurd,^[4] on p. 22.

using Chemical Abstracts Service's *SciFinder*. The information yielded ranges from bibliographic data for monographs and journal articles to full-text page views and research related data. The wide variety of bibliographic services available gives physical scientists and mathematicians great latitude in finding tools that meet their information seeking preferences and needs. Of note in the scholarly communication cycle of physical scientists and mathematicians are the prestigious journals, *Science* and *Nature*, published by the American Association for the Advancement of Science and the Nature Publishing Group, respectively. Also worthy of mention is the *Proceedings of the National Academy of Sciences*, published by the National Academy of Sciences of the United States, a scientific and engineering honor society dedicated to furthering science and technology for the benefit of the general public. These interdisciplinary publications are highly sought after venues for publication of research findings for all physical scientists, as well as mathematicians, and are the cornerstone of any science information collection. Even though the ultimate goal is the publication of research results in a peer-reviewed journal; physicists, astronomers, chemists, and mathematicians exhibit different information behaviors that are tightly aligned with their field of study and also the characteristics of their literatures.

Physics

Physics is considered to be the most basic of the physical sciences as physicists ask fundamental questions about energy and the structure of matter and their interactions in the universe. Physicists study physical phenomena within systems as large as the Milky Way galaxy or as small as the subatomic quark. Approximately 20% of physics research involves collaboration between several scientists around the world using large equipment with substantial support from private and federal agencies. Often referred to as "Big Science," this is particularly the case for research in high-energy physics where it is not unusual for over 50 scientists from several universities and research institutions to author a single journal article. Notable for a high volume of research and publications are the Stanford Linear Accelerator Center and the Fermi National Accelerator Laboratory, which employ thousands of scientists and engage in worldwide collaboration with many more. The majority of physicists, however, work individually or within smaller groups in one of several physics subfields including chemical, condensed matter, and molecular physics where funding remains critical but the research is less equipment intensive. Regardless of the size of the project or group, or the topic of investigation, physicists strive to disseminate their results via peer-reviewed journals.

Two scientific societies, the American Institute of Physics (AIP) and the Britain-based Institute of

Physics (IOP), are responsible for publishing, indexing, abstracting, and archiving a significant fraction of the physics literature. The freely available *Scitation* from the AIP provides references to 1 million documents in scholarly journals, magazines, and conference proceedings from a range of scientific societies and technical publishers. Coverage is not limited to physics or the AIP and full-text is available to subscribers. Also accessible by subscribers from AIP is *Searchable Physics Information Notices (SPIN)*, which hosts more than 1.5 million article abstracts including publications indexed in *Scitation*. The AIP makes it possible for subscribers to search both *Scitation* and *SPIN* simultaneously for a comprehensive search of the physics literature. Additionally, the American Physical Society, a member of the AIP, has a free searchable Web interface for mining the contents of its suite of journals. The IOP similarly allows users to search their journals without charge plus users may freely download all papers published by the IOP for 30 days from the date of online publication. Physicists interested in issues related to engineering and technology make use of the Institution of Engineering and Technology's (IET) *Inspec* database. A new institution formed in 2006 by the joining together of the Institution of Electrical Engineers and the Institution of Incorporated Engineers, IET indexes and abstracts more than 3500 scientific and technical journals and 2000 conference proceedings, plus books, reports, and dissertations. The suite of IET journals is freely searchable via the *IET Digital Library*. Large, profit-generating publishing houses such as Springer, Elsevier, Taylor & Francis, and John Wiley & Sons also publish the research findings of physics and make the bibliographic information freely searchable via sophisticated Web interfaces; however, users must engage in licensing agreements to access full-text publications.

The commitment of physics scientific societies and publishers to make experimental results accessible online is reflected by the discipline's early adoption of electronic information dissemination. Physicists were among the first physical scientists to embrace electronic publication of their research findings with the IOP and AIP creating digital journal archives with searchable interfaces in the early 1990s. Perhaps the most significant indicator of acceptance of digital distribution of research findings by physicists is the extensive use of the online preprint server, *arXiv.org*. A preprint is the precursor to an article that is in the process of being submitted or has been submitted for publication consideration in a peer-reviewed journal. Physicists, particularly high-energy physicists, have been disseminating their research results via preprints for over four decades to facilitate large international collaborations, to avoid duplication of effort, and to bypass lengthy journal publication schedules.^[6] Before the widespread adoption of the Internet, the paper preprint was used to share physics research information; however, the electronic preprint, or eprint, has replaced this classic mode

of information exchange. The transition to eprints was a natural one for computer literate physicists who value the immediacy, efficiency, and simplicity of electronic communication. Developed by physicist Paul Ginsparg in 1991 for use by a group of 200 physicists at Los Alamos National Laboratory, *arXiv.org* has grown to be a repository of approximately 430,000 eprints and is connected to by approximately 450,000 visitors around the globe per day. Encompassing eight subfields of physics in addition to four areas of high-energy physics, *arXiv.org* also archives eprints in the areas of mathematics, computer science, quantitative biology, and statistics. Other eprint servers available for the high-energy physics community include *Stanford Public Information Retrieval System (SPIRES)* and the Central European Research Network's (CERN) document server. Physicists' acceptance of eprints in their scholarly communication cycle is indicated by the similar citation rate of eprints from *arXiv.org* and *SPIRES* to that of peer-reviewed journal articles.^[7]

Originally a purely physical science, physics has become interdisciplinary in nature with overlap in many areas including astronomy, computer science, mathematics, medicine, chemistry, biology, and engineering. As a result, physics research has both theoretical and practical arms with the research results being dispersed across the literature of several scientific disciplines. For example, physicists who partner with medical colleagues to develop new techniques for cancer detection using noninvasive scanners employing magnetic resonance imaging (MRI) techniques may find a medical journal to be the best outlet for their results. Although there are journals that concentrate on interdisciplinary issues in physics such as the IoP's *Physics in Medicine and Biology* and the AIP's *Journal of Chemical Physics*, physicists engaged in interdisciplinary research are nonetheless required to be cognizant of the need to search beyond the physics literature to inform their research activities. Helpful in this endeavor is the National Library of Medicine's (NLM) index to the biomedical journal literature, *Medline*, which is also known as *PubMed*. The terminology used to assign topic headings to the articles within *Medline* is available in NLM's *Medical Subject Headings (MeSH)* database. A MeSH search for the three main physics terms: physics, health physics, and nuclear physics also locates several subheadings such as radiation protection, biophysics, and rheology and retrieves over 150,000 articles. Databases available from ISI also facilitate interdisciplinary work in physics. Of specific utility is *Science Citation Index* which was conceived by Eugene Garfield in 1955 as a tool for searching forward in time from a known article to articles citing that article. A cited reference search in the online version, *Web of Knowledge*, for Albert Einstein's 1906 *Annalen Der Physik* publication about the theory of Brownian motion yields a list of more than 500 publications that cite the seminal work thereby highlighting not only the paper's importance to the field of physics but also

denoting other works that further inform the reader about the random movement of particles.

Astronomy

Perhaps the oldest of the physical sciences, the study of astronomy has classically involved the structure, relative positions, and motions of the bodies in the universe including the earth. More recently, astronomers have turned their attention to the physical properties of astronomical objects to gain an understanding of the development, composition, and evolution of galaxies and planetary systems. Similar to high-energy physicists, astronomers collect data using very large-scale equipment such as the earth bound Mauna Kea Telescope in Hawaii or the orbiting Hubble Space Telescope. Before 1957, astronomy was a small field, where both amateur and professional astronomers studied and recorded observations of the sky. The launch of Sputnik by the Soviet Union stimulated the United States to establish the National Aeronautics and Space Administration (NASA) in 1958 thus beginning the era of "Big Science" in astronomy.^[8]

Research in astronomy is highly data driven and technology dependent. Several scientists collaborate together on expensive, equipment-intensive projects like NASA's Mars Exploration Rover Mission while smaller groups and individuals purchase research time from observatories to collect information about the formation of black holes, the death of stars, and the rate of the universe's expansion. Whether the project involves several scientists or a single professor and their students, astronomers collect large volumes of data, often over prolonged time periods, which require extensive computing capability to house, organize, and maintain. The information amassed ranges from images and spectrographs to astrometric and photometric data all of which retain their value indefinitely thereby causing data preservation to be critical for the life of the project and beyond. Astronomers require access to not only research findings published in peer-reviewed journals but also to the original raw data. This access has classically been provided through astronomical catalogs that present data compiled from completed projects in a static print or CD-ROM format. Examples include Francis Wollaston's *A Specimen of a General Astronomical Catalogue* published in 1789 and the more recent *Second US Naval Observatory CCD [Charged Coupled Device] Astrogaph Catalog* published for the American Astronomical Society (AAS) by the AIP in 2003, the final volume of which is expected in 2009. The Internet now affords access to dynamic sets of data via several online repositories that rapidly provide highly specific information to support astronomers' research activities using sophisticated search interfaces. The spectrum of repositories is constantly changing and growing with foremost projects including *NASA/IPAC Infrared Processing and Analysis Extragalactic Database (NED)*, operated by the

California Institute of Technology's Jet Propulsion Laboratory, and *Set of Identifications, Measurements, and Bibliography for Astronomical Data* (SIMBAD), overseen by the Strasbourg Astronomical Data Center. Recently updated in March of 2007, *NED* provides spectral and photometry data for over 80,000 objects plus links to over 1 million journal and thesis abstracts. Equally impressive are *SIMBAD*'s current collection of over 3.5 million objects, 200,000 bibliographic references, and 5.5 million citations to objects in journal articles.

Recognizing the challenges of staying abreast with the highly dynamic nature, as well as the increasing magnitude, of online astronomy data repositories, nine astronomers at seven institutions across the globe merged their personal lists of online resources in 1994 to create *AstroWeb*. In addition to listing data resources, *AstroWeb* also links astronomers to astro-phy, the astrophysics archive of *arXiv.org*, and *ADS*, the Smithsonian/NASA Astrophysics Data System, which acts as a freely searchable portal to the astronomy and physics literature. Although subscriptions are needed to access most of the peer-reviewed content, when possible *ADS* provides a direct link to the *arXiv.org* eprint. Similar to physicists, astronomers appreciate the immediacy, ease of use, and free availability of eprints and are loyal users of and contributors to *arXiv.org* with 18.5% of submissions to the eprint server being to the astrophysical subject section. In addition to accessing the astronomy literature via *ADS* and *arXiv.org*, astronomers can also search the *Astronomisches Rechen-Institut Bibliographical Database (ARIBIB)*. A freely available online database, *ARIBIB* is based on the printed bibliography, *Astronomy and Astrophysics Abstracts*, however much of content in *ARIBIB* is also indexed in IET's *Inspec* database. The AIP's *Scitation* and ISI's *Web of Knowledge* are additional valuable resources for tapping the astronomy literature.

The limited number of astronomy-specific bibliographic databases is reflected in the narrow range of astronomy journals with the Royal Astronomical Society of Britain's *Monthly Notices of the Royal Astronomical Society* and the AAS's three publications: *Astronomical Journal*, *Astrophysical Journal*, and *Astrophysical Journal Letters*, being among the most highly read in the field. This small corpus of astronomy journals helped contribute to the ease with which the astronomy community adopted electronic publication of their scholarly works. The AAS, like their physics counterparts IOP and AIP, was a leader in electronic scholarly publication by offering their *Astrophysical Journal* online in the mid-1990s, with the online dissemination of their other publications following shortly thereafter. The small body of astronomy literature is enriched by its interweaving with that of physics. The tight relationship between the astronomy and physics communities is exemplified by AIP's publication of the journals *Astronomy Letters* and *Astronomy Reports* as well as EDP Science's, *Astronomy and Astrophysics*. Also

extending the astronomy literature is that of cosmology, the study of the universe as a whole, as illustrated by the research reports published in IOP's highly rated, *Journal of Cosmology and Astroparticle Physics*. In addition to physics and cosmology, astronomers are embracing additional disciplines such as paleontology, biology, and chemistry as they strive to understand the origins of life in the universe. The journal *Astrobiology*, launched in 2001 by Mary Ann Liebert Inc., exemplifies this trend by publishing articles about astropaleontology, bioastronomy, and cosmochemistry.

Chemistry

Chemistry is the physical science concerned with the properties, composition, and structure of matter and how it can be transformed from one substance to another. The subfields of chemistry include organic, inorganic, physical, analytical, and biological. Biochemistry, the chemistry of living things, has its own distinct, vast literature and biochemists possess unique information needs and information behaviors that differ from the other branches of chemistry. This entry emphasizes the information behavior and literatures of chemists who are considered to be physical scientists rather than that of biochemists. In all fields of chemistry, the literature is expanding at a swift pace with the American Chemical Society (ACS) currently publishing approximately 30,000 articles per year. As a result chemists download, view, and read far more journals than any other physical scientists.^[9,10] Chemists, who primarily work individually or in small groups with equipment needs ranging from basic balances and pipettes to more expensive ultracentrifuges and mass spectrophotometers, universally require immediate and thorough access to up-to-date research findings that are primarily presented in short articles containing explicit methodologies and graphical data displays.

Similar to the fields of physics and astronomy, the ACS began making their journal content available on their website to subscribers in the mid-1990s beginning with the *Journal of Physical Chemistry*. In the fall of 1997 all of the ACS journals became available from 1996 forward. Ultimately in 2002, the ACS Journal Archives made the entire suite of 35 journals containing over 750,000 articles available online from the first published issue and volume beginning in 1879. The ACS journals are among those most highly cited in the field of chemistry, particularly the multidisciplinary *Chemical Reviews*, *Accounts of Chemical Research*, and the *Journal of the American Chemical Society*. The ACS also publishes several journals in each subfield of chemistry including the important titles *Analytic Chemistry*, *Organic Letters*, *Chemistry of Materials*, and *Inorganic Chemistry*. The Royal Society of Chemistry (RSC), ACS's older European counterpart, publishes over 20 prestigious titles in a variety of areas of chemistry. The RSC online gateway allows subscribers to reach the

full-text of more than 240,000 articles published from 1841 to present. Titles range from the multidisciplinary *Chemical Society Reviews* and *Chemical Communications* to the discipline-specific *Journal of Materials Chemistry* and *Natural Product Reports*. Both societies offer a free Web-based search interface to gain bibliographic access to their journals; however, the primary database for comprehensive searching of the chemistry literature is *Chemical Abstracts*. Produced by Chemical Abstract Service (CAS), a division of the ACS, *Chemical Abstracts*, in addition to several other ACS databases, is searchable online via CAS's online portal, *SciFinder*. Even though *SciFinder* is expensive and access is complicated by firewalls and convoluted downloading procedures, *SciFinder* is nonetheless the premier search interface for accessing the chemical literature. Bibliographic information is not restricted to the publications of the ACS but rather strives to include all publishers of chemistry information from John Wiley & Sons and the Nature Publishing Group to the Indian Institute of Chemical Engineers and the Polish Academy of Science. Full-text is available to titles to which the user's institution subscribes. For individuals and institutions whose budget cannot afford the yearly subscription fee and/or who only need occasional access, the CAS databases are available for a per-search fee via ACS's online search service *STN* and ProQuest's *Dialog*.

A discussion of the products available from the 100-year-old CAS is critical in understanding the information behavior of chemists. Housed in Columbus, Ohio, CAS's 2000 employees index and abstract the extensive literature of chemistry. Access is provided to 9500 journals and patents from 1840 to the present in a manner that aligns with the way chemists work. The *SciFinder* interface offers access to more than 13 million chemical reactions through *CASREACT* as well as information about suppliers of commercially available chemicals via *CHEMCATS*. The information in *SciFinder* is accessible not only by simple keyword and author queries but also by chemical structure and molecular formula, the fundamental language of chemistry. Information can also be located using a CAS Registry number from the *CAS REGISTRY* database, which provides a unique numeric identifier for more than 31 million organic and inorganic substances. Originally a unique feature from CAS, the powerful ability to look for information using the standard CAS Registry number has recently met with competition from the National Institute of Health's (NIH) *PubChem*, a free online repository for storing records of small organic molecules. Although created for accessing biomedical resources, *PubChem* is remarkably similar to *CAS REGISTRY* in that it is based on a system of unique Chemical Identification Numbers (CIDs), which are housed in NIH's *ChemID* database. Information is available for over 380,000 chemical records, including 260,000 chemical structures, and is searchable using a wide range of options including CAS Registry number, molecular formula, and chemical

structure. The NIH considers the free *PubChem* to be directed toward a different audience than, and therefore is complementary to the subscription only *CAS REGISTRY*. Nonetheless, the ACS is concerned about the impact NIH's free service will have on their organization's endeavors. While NIH and CAS debate the issue, *CAS REGISTRY* and *PubChem* continue to thrive and provide chemists with a controlled vocabulary with which to identify chemical compounds and their properties thereby facilitating access to their literature.

To standardize and support worldwide chemical communication the scientific, nongovernmental International Union of Pure and Applied Chemistry (IUPAC) was formed in 1919 to create a common chemical language. The IUPAC is considered the world's authority on chemical nomenclature and terminology plus the standardized methodologies for collecting measurements, atomic weights, and several other forms of data. The IUPAC core series of four publications, commonly referred to as the Red, Blue, Green, and Gold Books, provide rules for the nomenclature of organic and inorganic compounds, lists of quantities, units and symbols in physical chemistry, and definitions of technical terms used in chemistry. Updated information is provided in the quarterly *Journal of Physical and Chemical Reference Data* which is published by the AIP for the National Institute of Standards and Technology (NIST). Although the journal is not a typical peer-reviewed publication of original experimental results, it is a critical reference source for chemists as well as physicists. Two additional indispensable tools for chemists are the *Beilstein Handbook of Organic Chemistry* and its inorganic counterpart, *Gmelin*. First published as monographic series, the two resources are now available together in the online product, *Crossfire*, through which chemists can search structures, properties, and literature references for organic, inorganic, and organometallic compounds using Elsevier's MDL Crossfire Commander client software. Similarly, Springer's *Landolt-Börnstein* series of data handbooks provides chemists with mechanical, electrical, and thermodynamic property data for inorganic and organic substances. A freely searchable online interface allows chemists to use molecular and elemental formulae, CAS Registry numbers, or chemical names to find the volume within the *Landolt-Börnstein* series in which the desired information can be found.

In addition to requiring access to data about chemical compounds and to the journal literature, chemists also need the ability to search national and international patent repositories. This is especially critical for chemists working in the pharmaceutical, petrochemical, and agricultural industries, as well those in academia, who must be knowledgeable of current developments to retain a competitive edge. The United States Patent and Trademark Office's free online database indexes patents issued in the United States since 1790. A comprehensive and global patent search is available through CAS's *SciFinder* which allows

chemists to simultaneously look for patents from 50 international patent-issuing authorities while also exploring the journal literature. Additional access to the patent literature is available through Thomson Scientific's *Derwent World Patents Index* (DWPI) which provides value-added expert analysis including a "Novelty" paragraph outlining the less than obvious technology improvements over previous patents as well as a "Technology Focus" abstract highlighting technological perspectives of the invention. Access to DWPI is available on a per-use or subscription basis via several platforms including ProQuest's Dialog and *Westlaw*, and CAS's *STN*. It is also possible to search and discover patents issued around the world using ISI's *Web of Knowledge* in tandem with a search for journal articles.

In contrast to physicists and astronomers, chemists do not wholeheartedly embrace eprints as part of their scholarly communication. The *Chemistry Preprint Server* (CPS) produced by Elsevier was active from only 2000 to 2004 even though chemists believed the eprints posted to be of high quality and appreciated the forum provided by the CPS for open discussion of current chemical research.^[11] Despite the positive reception of the CPS, chemists' concern about the lack of peer review and the uncertain permanence of eprint storage, coupled with the refusal of editors of the top chemistry journals to subsequently publish papers previously posted on the server, the CPS was destined to fail. The chemistry related holdings in *arXiv.org* are limited to a small microcosm of eprints in the field of chemical physics. Even though chemists are reluctant to capitalize on free eprint distribution of their work, the ACS has a long tradition of making research-related data available to its readers, first as microfilm and now as free electronic files in the ACS *Electronic Supporting Information* archive. Similarly, the RSC's *Electronic Supporting Information* (ESI) service allows authors to deposit repetitive experimental details and large data sets including color diagrams, three-dimensional molecular models, and movies in this free repository. This practice of making research-related data openly accessible enhances chemists' scholarly communication by giving readers free access to potentially useful information while saving valuable journal page space.

Mathematics

Mathematicians study magnitude, quantity, and numbers and their relationships, as well as the properties of space, using logical reasoning methods and symbolic notation. Branches of mathematics include geometry, algebra, analysis, and applied mathematics. It is contended that mathematics is a philosophy rather than a science as mathematics involves the rational investigation of questions about existence and knowledge rather than being a process for evaluating empirical knowledge. In practice, though, mathematics is a combination of philosophy and science

depending on the nature of the problem being studied. Problems in mathematics can be purely theoretical in nature where patterns or relationships are studied for the knowledge yielded or they can be highly practical wherein the patterns and relationships are used to develop solutions for traffic flow issues or to create a data categorization scheme. Similar to astronomy information, information in the mathematical sciences retains its relevance for many decades as classical techniques and theories are frequently utilized for finding solutions to modern day problems. As a result the information needs of mathematicians range from historical theorems to cutting-edge computer modeling techniques, which they acquire by browsing information published in both journals and monographs. A very unique aspect of mathematics is that it is a support discipline for virtually all other sciences including the social sciences wherein phenomena can be described, or problems solved, using mathematical formulae or theories.

Mathematics research is similar to that in chemistry as mathematicians tend to work individually or in small groups. However, despite their solitary work style, mathematicians highly value attendance at conferences and personal discussions with colleagues to develop and augment their research ideas and processes.^[12] This is supported by the range of mathematical societies that hold conferences, fund research in mathematics, and publish mathematics journals. The American Mathematical Society (AMS), the premier mathematics society in the United States, lists 110 national and international mathematics societies, associations, and groups on their Web site. The list includes the Estonian and Hellenic Mathematical Societies as well as the Clay Mathematics Institute in Cambridge, Massachusetts and the International Society of Dynamic Games in Finland. This breadth and diversity of mathematics-related organizations are evidences of the great importance of social networking in the daily work of mathematicians.

As is the case of the physical scientists discussed above, the peer-reviewed journal is the hallmark of dissemination of research information among mathematicians. The AMS publishes their suite of journals in a combination of print and electronic formats and includes the highly rated *Journal of the American Mathematical Society*, an outlet for articles about both pure and applied mathematics. Princeton University's top ranked *Annals of Mathematics* publishes reports of pure mathematical research while a wide array of field-specific titles such as *Geometry & Topology*, the *Journal of Differential Equations*, and the *Journal of Functional Analysis* provide researchers studying highly specific problems a venue to share their findings. Applied mathematics researchers find a prime outlet in the titles published by the Society for Industrial and Applied Mathematics (SIAM) including the very specific *SIAM Journal on Matrix Analysis and Application* and the more general *SIAM Review*. Most mathematics journals are available in both print and electronic

formats with some exceptions such as the AMS's *Conformal Geometry and Dynamics* and *Representation Theory*, which are both published purely electronically. In an effort to make global research more accessible to its members, the AMS has a long-standing practice of translating mathematics journals into English from other languages especially Russian and Japanese. Currently four translation journals are fully searchable on the AMS online search interface: *St. Petersburg Mathematics Journal*, *Sugaku Expositions*, *Theory of Probability and Mathematical Statistics*, and the *Transactions of the Moscow Mathematical Society*.

A unique aspect of mathematics scholarly communication is the key role played by monographs and monographic series. For example, Springer's *Graduate Texts in Mathematics* series is comprised of over 240 titles providing advanced-level introductions to research in a wide variety of topics including group theory, complex analysis, and Lie groups. The Oxford University Press publishes a similar series titled *Oxford Graduate Texts in Mathematics*, albeit on a smaller scale. Also of note is Springer's *Lecture Notes in Mathematics* series, published since 1964, which presents lectures about new fields of mathematics as well as fresh perspectives on classical mathematics. The expository presentation style of the *Graduate Texts* and *Lecture Notes* is echoed in the AMS's *Bulletin* and *Notices* journals. The *Bulletin* publishes peer-reviewed articles about current research topics written for the nonexpert while the *Notices* serves as a current awareness vehicle for mathematicians while including explanatory articles about current developments in mathematics research. Additionally, the AMS publishes 17 monographic series ranging from a sequence of research volumes generated from the Fields Institute for Research in Mathematical Sciences to *What's Happening in the Mathematical Sciences*, a series devoted to describing cutting-edge research in modern pure and applied mathematics at a level accessible to those with a high school mathematics education. Furthering the worldwide scholarly exchange in mathematics are the AMS's series of research and expository monographs that have been translated from Japanese, French, and Russian into English. One example is the series of *SMF/AMS Texts and Monographs* which is copublished with the Société Mathématique de France (SMF) and includes translations of the well-regarded series, *Astérisque*.

Mathematicians use two very distinctive tools to gain access to their literature: *Zentralblatt MATH (Zbl)* and *Mathematical Reviews (MR)*, which not only index and abstract, but also review, the literature of mathematics. The reviewing feature is further illustrative of the high value mathematicians place on discourse with their colleagues around the world. Although the reviews are not fully equivalent to face-to-face, real-time interaction, they do provide a forum for assessing and discussing a work, a feature that sets these apart from traditional bibliographic

tools. Originally titled *Zentralblatt für Mathematik (Zbl)*, became available in 1931 and is edited by the European Mathematical Society, the Heidelberger Academy of Sciences, and Fachinformationszentrum or Specialized Information Center (FIZ) Karlsruhe. Published by Springer-Verlag, *Zbl*'s coverage extends from 1868 to the present with some full-text availability. The reviews in *Zbl* are primarily in English, with some French and Russian content, by approximately 5000 scientists who analyze over 2000 journals, conference proceedings, and monographs per year. Similarly, AMS's *MR* provides mathematicians with bibliographic and selected full-text access to the mathematical sciences literature that is augmented by more than 60,000 new expert reviews each year. Reaching back to 1864, the online equivalent of *MR*, *MathSciNet*, holds 2 million items with direct links to over 700,000 articles. Since 1991, the citations in both *Zbl* and *MR* have been organized according to the *Mathematics Subject Classification (MSC)* which was updated in 2000 in a collaborative effort between the editors of *Zbl* and *MR*. The classification scheme was devised to facilitate access to the mathematics literature and employs two-, three-, and five-digit classification codes that correspond to a discipline of mathematics. For example, the *MSC* code for partial differential equations is 35 while the code 35B can be used to find information about qualitative properties of solutions. Even greater specificity can be gained by using the code 35B40 to locate information about the asymptotic behavior of solutions. The search interfaces of both *Zbl* and *MathSciNet* allow users to search for information using the code that corresponds to their area of interest. Also organized according to the *MSC* is AMS's *Current Mathematical Publications (CPS)*, which serves as an index of forthcoming mathematics publications. Published in print every 3 weeks and updated daily in *MR*, *CPS* is compiled by the editors of *MR*, and is searchable online via *MathSciNet*.

Although mathematicians are beginning to embrace electronic access to their literature, they continue to appreciate the browsing capability they believe to be distinctively afforded by printed information.^[13] The browsing behavior of mathematicians is similar to humanities scholars in that both groups look for connections between wide ranging information sources that they can apply to the problems they are currently studying. Another complaint voiced by mathematicians about purely electronic access is the maintenance of the archive in perpetuity.^[12] To help resolve this issue, as well as that of the ever-increasing issue of inadequate library shelf space, the non-profit organization, *JSTOR*, is committed to creating and maintaining a stable archive of full-text scholarly journals, including 54 mathematics titles. The page images in *JSTOR* have been scanned to retain their original format and have been found to be a reasonable alternative to print journals for some mathematicians.^[13] Titles available via *JSTOR* include publications from both AMS and SIAM as

well as Springer and the National Council of Teachers of Mathematics. Although mathematicians find an electronic-only environment hampers their ability to browse the literature, they are the fastest growing group of authors submitting their research reports to *arXiv.org*'s mathematics archive. More than 1000 new submissions were posted to *arXiv.org*'s mathematics archive per month in 2008, surpassing the rate of 750 per month submitted to the high-energy physics archive, traditionally the most active archive of *arXiv.org*. The mathematics archive of *arXiv.org* contains eprints from 1991 to the present that are organized into 32 categories including logics, spectral theory, and combinatorics. The growing submission rate to the mathematics eprint archive, plus the availability of several other mathematics eprint repositories from institutes and universities worldwide, including the Mathematics Sciences Research Institute in Berkeley, California, Florida State University, and Hokkaido University, indicates an increasing acceptance of eprints by mathematicians. To date, however, the role of eprints in the scholarly communication of mathematics remains to be fully investigated.

OPENLY ACCESSIBLE PHYSICAL SCIENCES AND MATHEMATICS LITERATURES

The information behavior of physicists, astronomers, chemists, and mathematicians is deeply rooted in the way in which they conduct their scholarly work. Although the peer-reviewed journal model is the highly sought after end product, new formats and modes of information flow in the physical sciences and mathematics are quickly emerging in response to the desire for electronically delivered information. The ability to freely access scholarly information online allows scientists to expand and enrich their traditional modes of scholarly communication while helping to combat the ever rising cost of acquiring scholarly scientific journals. For example, to temper the high cost of scientific journals, the Association of Research Libraries formed the Scholarly Publishing and Academic Resources Coalition (SPARC), in 1998. Fuelled by the belief that inordinately high-scientific journal costs restrict the scientific community's ability to access, share, and use scholarly information, SPARC has forged partnerships with over 220 academic and research libraries to support promotion of and access to quality journals free of charge or for a nominal cost. In their commitment to reducing subscription prices SPARC publishes titles such as the affordably priced, yet peer-reviewed *Geometry & Topology* and the all-electronic, freely available *New Journal of Physics*, as alternatives to similar, yet much higher priced, titles distributed by the for-profit sector. Further reducing price barriers to physical science and mathematics scholarly information is the *Directory of Open Access Journals* (DOAJ). Supported in part by SPARC and the Open

Society Institute, the DOAJ is additionally funded and maintained by Lund University Libraries and provides access to peer-reviewed or editorially controlled journals. Currently 15 astronomy, 52 physics, 87 chemistry, and 132 mathematics titles are available at no cost through the DOAJ portal. HighWire Press, a division of Stanford University Libraries, is another leader in providing unfettered access to the scientific literature. Beginning with the *Journal of Biological Chemistry* in 1995, HighWire Press works with scholarly societies, university presses, and publishers to create a fully searchable, online collection of the research literature. Although the focus is on the life sciences, physical scientists and mathematicians will find access to the full-text of several prestigious titles including *Science* and the *Proceedings of the National Academy of Sciences*, and the *Proceedings of the London Mathematical Society* via HighWire Press's easy to use search interface.

Although the efforts of SPARC, DOAJ, and HighWire Press are making great strides in ensuring continued access to critical research information in the face of rising subscription costs and shrinking library budgets, physical scientists and mathematicians still require access to information beyond the reach of these progressive services. Consequently, several institutions, including the University of Wisconsin at Madison and Trinity University, are experimenting with a pay-per-view model where scientists request the articles they wish to read on a per-article basis rather than acquiring a subscription to the complete journal. The direct desktop delivery of articles as PDFs (Portable Document Formats) complete with legible diagrams, clear scientific notations, and color images provided by the pay-per-view model aligns well with physical scientists' and mathematicians' information needs and desires. Of concern with this mode of delivery is the maintenance and storage of the downloaded article, as these functions now become the burden of the user rather than the library or information center. Additional complications include the user's rights to share the article with their colleagues and to archive the article for an extended time. The pay-per-view option is available through several providers including HighWire Press, Elsevier, and Ingenta.

To simplify sharing of science information, Science Commons, a branch of the nonprofit Creative Commons, began establishing standardized licenses in early 2004 through which scientists can enter into agreements to share their research results. Two large open access publishers, the Public Library of Science (PLOS) and BioMed Central have adopted the "some rights reserved" licensing advocated by Science Commons. In the spirit of Science Commons, college and universities throughout the world are establishing their own online repositories of research related materials produced by their faculty and researchers. An excellent example is *Purdue e-Scholar*, a digital repository of e-books, papers, reports, dissertations, journal articles, research data sets, and data files by Purdue

authors and researchers. Also of note is OhioLINK'S *Digital Resource Commons* which is committed to managing and preserving educational and research materials such as preprints, working papers, and dissertations from OhioLINK members and other Ohio institutions. On a national scale is the National Science Foundation's (NSF) National Science Digital Library (NSDL) which was created in 2000 to act as a dynamic repository of high-quality resources to support teaching and learning at all levels of science, technology, engineering, and mathematics education. Access to the free, well-organized resources are intended primarily to support science education; however, the research articles and data sets available from the NSDL are also of relevance to physical scientists and mathematicians. Furthering capitalizing on the Internet to facilitate and enhance the dissemination of scientific information is *SciVee*, an online multimedia repository where scientists can augment the content of their published works with narration, slides, and videos. Although still in its infancy, *SciVee*, the result of a partnership between the PLoS, the NSF, and the San Diego Supercomputer Center (SDSC), is contributing to the shift in scientific information dissemination from a one-dimensional article model to a multifaceted, interactive platform.

The rich and powerful online tools and services developed over the past decade are a boon to the scholarly communication of physical scientists and mathematicians, however, as their magnitudes and numbers intensify, the task of information seeking becomes highly complex. In 2000, several leading publishers of scholarly information including AIP, the Nature Publishing Group, Wiley, and Elsevier jointly formed the nonprofit, independent organization, Publishers International Linking Association, Inc. to promote the development and cooperative use of new and innovative technologies that speed and facilitate scholarly research. The result of the union is *CrossRef*, a collaborative reference linking service that helps users find additional articles of interest. Facilitated by Digital Object Identifiers (DOI), which are assigned to an article by participating publishers, *CrossRef* acts as a digital citation-linking network where, by clicking on a reference in an article, researchers are instantly directed to the cited article. Although *CrossRef* does not provide full-text access, it provides bibliographic information for millions of articles in journals of interest to physical scientists and mathematicians ranging from RSC's *PhysChemComm* to Elsevier's *Topology and its Applications* and IOP's *Chinese Journal of Astronomy and Astrophysics*. Elsevier is further working to facilitate the task of online searching across disparate scholarly resources with their science specific search engine, *Scirus*. The freely available service allows users to search over 415 million science-specific Web sites for scientific data, technical reports, peer-reviewed articles, patents, and eprints from providers like IoP, SIAM, and NASA. Perhaps the most promising and exciting new technology for managing digitalized

scientific resources is the *Google Scholar* library links program. The program, currently a beta service from the extremely popular search engine *Google*, allows libraries to link their holdings to *Google Scholar* thereby making it possible for scientists to mine the resources their institution has licensed using a single entryway. Scientists at universities including Northwestern, MIT, and Emory are able to use the familiar and straightforward *Google* interface to search their libraries' holdings and directly connect to full-text articles to which their institution subscribes, regardless of provider.

Although the reception and use of these forward thinking services by physicists, astronomers, chemists, and mathematicians remains to be fully elucidated, innovative programs like *SciVee*, *CrossRef*, and *Google Scholar* library links have great potential to facilitate the task of information seeking as digital access becomes the norm for scientific discourse. Regardless of format, delivery of scientific information in a mode physical scientists and mathematicians will utilize is critical to promoting and supporting innovation and progress in the physical sciences and mathematics. Physicists, astronomers, chemists, and mathematicians depend upon library and information centers to provide fast, comprehensive, and persistent access to information to support their research and creative activities. This has traditionally been the role of librarians and information scientists since the first libraries emerged 5000 years ago and remains the cornerstone of service in the emerging digital era. Continued awareness of the information behaviors and preferences of physical scientists and mathematicians is key to enabling the efficient and effective access to information products and services that scientists can rely on for the foreseeable future.

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INTERNET RESOURCES

The following is a list of the URLs for the resources referred to in this entry organized according to the field of study plus those mentioned in the “Openly Accessible Literatures” section.

Physics

1. American Institute of Physics' Scitation & SPIN (Searchable Physics Information Notices): <http://www.scitation.aip.org>.
2. American Institute of Physics: <http://www.aip.org>.
3. CERN (Central European Research Network): <http://www.public.web.cern.ch/Public/Welcome.html>.
4. Elsevier-Science Direct: <http://www.sciencedirect.com>.
5. IET Digital Library: <http://www.ietdl.org>.
6. Inspec: <http://www2.theiet.org/inspec/index.cfm>.
7. Institute of Engineering & Technology: <http://www.theiet.org>.
8. Institute of Physics: <http://www.iop.org>.
9. John Wiley & Sons Interscience: <http://www.interscience.wiley.com>.
10. MeSH (Medical Subject Headings): <http://www.nih.nlm.gov/mesh/>.
11. NLM (National Library of Medicine): <http://www.nih.nlm.gov>.
12. SPIRES (Stanford Public Information Retrieval System): <http://www.slac.Stanford.edu/spires/index.shtml/spires>.
13. Springer Verlag: <http://www.springer.com>.
14. Taylor & Francis: <http://www.taylorandfrancisgroup.com>.
15. ISI web of Knowledge: <http://www.iswebofknowledge.com>.

Astronomy

1. AAS (American Astronomical Society): <http://www.aas.org>.
2. ADS (Smithsonian/NASA Astrophysics Data System): <http://www.adsabs.harvard.edu>.
3. ARIBIB (Astronomisches Rechen-Institut Bibliographical Database): <http://www.ari.uni-heidelberg.de/aribib>.
4. AstroWeb: <http://www.cv.nrao.edu/fits/www/astronomy.html>.
5. NASA (National Aeronautics and Space Administration): <http://www.nasa.gov>.
6. NED (NASA/IPAC Extragalactic Database): <http://nedwww.ipac.caltech.edu>.
7. Royal Astronomical Society of Britain: <http://www.ras.org.uk/>.
8. SIMBAD (Set of Identifications, Measurements, and Bibliography for Astronomical Data).

Chemistry

1. ACS (American Chemical Society): <http://www.chemistry.org>.
2. ACS Electronic Supporting Information: <http://pubs.acs.org/supmat/supdoc.html>.
3. CAS (Chemical Abstracts Service): <http://www.cas.org4>.
4. CPS (Chemistry Preprint Server): <http://www.sciencedirect.com/preprintarchive>.
5. IUPAC (International Union of Pure and Applied Chemistry): <http://www.iupac.org>.
6. Landolt-Boernstein: <http://lb.chemie.uni-hamburg.de/>.
7. NIST (National Institute of Standards and Technology): <http://www.nist.org>.
8. PubChem: <http://pubchem.ncbi.nlm.nih.gov/>.
9. RSC (Royal Society of Chemistry): <http://www.rsc.org>.

10. SciFinder: <http://www.cas.org/products/scifoindr/index.html>.
11. STN: <http://www.cas.org/products/stnfamily/index.html>.
12. ProQuest Dialog: <http://www.dialog.com>.
13. USPTO (United States Patent and Trademark Office): <http://www.uspto.gov>.

Mathematics

1. AMS (American Mathematical Society): <http://www.ams.org>.
2. JSTOR: <http://www.jstor.org>.
3. MR (Mathematical Reviews): <http://www.ams.org/mathscinet>.
4. MSC (Mathematics Subject Classification): <http://www.ams.org/msc>.
5. SIAM (Society for Industrial and Applied Mathematics): <http://www.siam.org>.
6. Zbl (ZentralblattMATH): <http://www.zblmath.fiz-karlsruhe.de/MATH/home>.

Openly Accessible Literatures

1. BioMed Central: <http://www.biomedcentral.com>.
2. Creative Commons: <http://creativecommons.org>.
3. CrossRef: <http://www.crossref.org>.
4. DOAJ (Directory of Open Access Journals): <http://www.doaj.org>.
5. Google Scholar Library Links: <http://scholar.google.com/intl/en/scholar/librarylinks.html>.
6. HighWirePress: <http://highwire.stanford.edu>.
7. MIT Open Courseware: <http://web.mit.edu/ocw>.
8. National Science Digital Library: <http://nsdl.org>.
9. OhioLINK's Digital Resource Commons: <http://info.drc.ohiolink.edu/projects/>.
10. PLoS (Public Library of Science): <http://www.plos.org>.
11. Purdue eScholar: <http://e-scholar.lib.purdue.edu>.
12. Science Commons: <http://sciencecommons.org>.
13. Scirus: <http://www.scirus.com>.
14. SciVee: <http://www.scivee.tv/>.
15. SPARC (Scholarly Publishing and Academic Resources Coalition): <http://www.arl.org/sparc/>.

Piracy in Digital Media

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Abstract

Piracy of digital media refers to the unauthorized copying, usage, and sale or distribution of copyrighted materials in digital form, excluding materials which have been created or are distributed either specifically as fully “open access” materials, or those which have been licensed under some form of “open access” license (such as, for example, that offered by Creative Commons—see <http://creativecommons.org/>). These materials may include software, audio files, music, video files, movies or TV shows (in their entirety or in part), or electronic versions of books, journal articles, or databases. The term “piracy” itself remains somewhat controversial, as it carries a pejorative connotation, and not all copying for which authorization is not specifically obtained constitutes any form of theft; many forms of copying are legal, including copying of fully open access materials or materials licensed under Creative Commons or similar organizations. Also, there are ongoing and long-standing debates on what constitutes “fair use”; however, these issues are complex and are, in many cases, still before the courts and the legislators. However, for simplicity’s sake, we will use the term “piracy,” as described above, with the noted exceptions, throughout this entry.

Piracy can be accomplished through a variety of means, including copying materials from one medium to another, e-mailing zipped copies of files, downloading materials from servers, and many more elaborate schemes. Piracy is a global phenomenon, which costs software producers, recording artists, movie and TV production companies, publishers, and others considerable revenue; the exact amounts are near impossible to determine and frequently under dispute. Legislation governing copyright and technology has tended to lag behind the pace of technological developments, and much newer legislation is controversial. There have been numerous lawsuits against companies and individuals purportedly engaged in piracy; individual companies and artists have launched such lawsuits, as have the Recording Industry Association of America (RIAA), the Motion Picture Association of America (MPAA), and various other organizations. However, many of these cases are in process or pending, and the legal issues remain unclear. The situation is similar in many other countries as well, and there are great variances in copyright law, laws governing Internet Service Providers (ISPs), filtering, and other issues that affect piracy matters. Technological solutions designed to halt or limit piracy have proven generally unworkable, and legislative issues are thorny and remain unclear in many ways.

INTRODUCTION

Piracy, when used in discussions of digital media, refers to the unauthorized copying, usage, and often sale or distribution of copyrighted materials (or materials for which some party has other intellectual property rights) in digital

form, excluding materials which have been created or are distributed either specifically as fully “open access” materials, or those which have been licensed under some form of “open access” license (such as, for example, that offered by Creative Commons—see <http://creativecommons.org/>). Also excluded are materials or portions of materials deemed to have been utilized under “fair use” provisions of copyright law (though “fair use” is, in the digital world, sometimes a disputed concept). A full discussion of “fair use” is beyond the scope of this entry; the interested reader is referred to Section 107 of the U.S. Copyright Act (title 17, U.S. code, online at <http://www.copyright.gov/title17/92chap1.html#107>), or to a discussion of fair use on the Web site of the U.S. Copyright Office, at <http://www.copyright.gov/fls/fl102.html>, and the topic has been discussed at length in legal, technical, and library literature.

Any discussion of piracy in digital media must necessarily encompass several major categories of digital media. There are common issues in discussing piracy across various types of digital media, but there are also specific considerations for various categories of media. Media and issues are outlined briefly here, but will be discussed in greater detail in the following section. Major types of digital media for which piracy is an issue include software (including various business applications), audio files/music, and video-based materials, including movies and television shows. Publishers who have ventured into e-books also have concerns about piracy. Indeed, digital intellectual property of any kind, from e-books to online lectures and classes to full-length creative works such as music albums or movies, is vulnerable to piracy. Piracy can be accomplished through a variety of means, from

simple copying of material to a portable media device such as a “flash” drive or CD to much more elaborate schemes. Piracy is a global phenomenon; where there are computers, Internet access, and digital materials, there is piracy at some level, though its prevalence varies greatly from one country to another. There are a number of factors that have been identified or posited as contributing to the likelihood of piracy being widespread, including economic factors, cultural factors, and more, along with factors which inhibit widespread piracy. Piracy of digital media can cause economic harm to producers and inhibit development of new software or artistic creations. However, digital hosting, sharing, or transmission of files can also provide a means by which lesser known or previously unknown content creators can gain exposure for their work, and potentially attract future sales. Some well-known musicians (including highly popular bands such as Radiohead, Oasis, and Nine Inch Nails, to mention just a few) have also utilized digital sharing of files or offered portions of their work at low or reduced prices or even at no cost, or have offered to allow users to pay what they wish. There are strong arguments that such sharing increases music fan bases and in some cases frees musicians from restrictive contract agreements.^[1] However, as has also been extensively reported in the media, major associations for the software, music, movie, and publishing industries have been taking aggressive (and frequently controversial) legal action to fight back against piracy.

PIRACY OVERVIEW: MEANS, PREVALENCE, AND COSTS

Software

Software can be quite vulnerable to piracy. Common business productivity software, especially, is often purchased by a single person, who then shares his one legal copy with friends, family, or colleagues.^[2] There are also numerous sites where unlicensed or illegally copied software is available for free or greatly reduced costs, either by downloading or by placing an order for a copy which is then delivered or sent to the user upon receipt of payment. In some countries, the rates of software piracy exceed 90%—meaning that for every 100 copies of software, only 10 (or fewer) have been legally purchased and installed (see below). The rest are illegal copies, sometimes known as warez.^[3] This affects software publishers’ revenues, and many publishers claim this leaves a lower level of funds available for investment and research in new or updated software applications. As long ago as the year 2000, Ram D. Gopal and G. Lawrence Sanders (who have written extensively on piracy-related issues) provided some specific and surprising details on the widespread and dramatic problems associated with software piracy.

They reported that as early as 1997, the Software Publishers Association estimated that losses due to piracy for business application software in the United States alone reached \$2.8 billion, and that worldwide, the revenue losses were estimated at \$11.4 billion, and in some countries, including Kuwait, Pakistan, Indonesia, Bulgaria, China, Turkey, Egypt, Bolivia, and El Salvador, the rate of piracy was estimated to approach or exceed 90%.^[2] Furthermore, because of a number of unique characteristics, software and other digital goods are particularly vulnerable to piracy: it is expensive to produce the first copy, but inexpensive to reproduce and distribute additional copies, and it is easy to share without impacting the value of the original product. “These idiosyncratic traits of software and related digital products,” they write,

have facilitated their illegal distribution worldwide. Several countries in the world are referred to as “one-legitimate-copy” countries, where one legal copy of a software package is sufficient to meet the demands of an entire nation. The advent of the Internet has amplified the problem. There are numerous warez (colloquial reference to pirated and cracked software) Web sites that permit customers to select from a menu of pirated software up to the 650 MB capacity of a CD. For around \$30–\$60, payable via credit card, the warez vendor will burn the CD and deliver it to the customer’s doorstep.^[3]

In the intervening years, there have been some changes in copyright law and there have been efforts by the U.S. government and by professional and business organizations to persuade other countries to take measures to lessen piracy rates, but they have met with mixed success, and in some cases with none. (It should also be noted that the Software Publishers Association merged with the Information Industry Association to become the SIIA—the Software and Information Industry Association.) “Many countries, particularly those without a viable local software industry, find it counterproductive to thwart piracy,” Gopal and Sanders argue.

While the threats of trade sanctions have arm-twisted many countries to enact copyright laws, they are rarely enforced. ... China, for example, has recently cranked up raids against CD factories that manufacture bootlegged copies of software and confiscated the CD presses (each worth as much as \$1 million). The suspicion, however, is these presses are put back into service in government-owned factories to manufacture CDs containing pirated software.^[4]

Meanwhile, the costs of piracy continue to rise. In 2006, the Business Software Alliance (BSA) estimated total costs of software piracy worldwide at \$40 billion, and reported that piracy rates have discouraged investment by software producers in some countries, such as the Philippines, where the BSA reports a piracy rate of 71% since

2004.^[5] However, in the same article, representatives of such major software publishers as Symantec, Alcatel-Lucent, and Adobe Systems are quoted as providing statements to the effect that piracy is a concern, but does not determine strategic direction and is not the primary concern, and that they have made various adaptations to fight piracy and continue to do so.^[5] Doubtless, piracy has an effect on revenue and on product distribution and development strategies; how much of an effect seems difficult to determine, and dependent on sources and methods.

Audio Files/Music

Piracy of audio files (especially music) is probably the best known area of digital piracy, due to heavy publicity surrounding court cases and activities by the RIAA and various music companies directed at stopping piracy, and due to statements by many artists on both sides of the file-sharing issues. The issues of pirated music, the services and tools which facilitate music file sharing and downloading, and the industry and legislative responses to such activities, have been widely reported in newspapers, magazines, and professional journals. Certainly not all shared music is pirated music; as aforementioned, many musicians support file-sharing or make portions of their music available for free or at reduced costs via various methods. As well, many users remember the days in the 1970s when the music industry claimed vociferously that home taping was killing music, and tried to discourage people from taping songs from the radio or sharing a homemade mixed cassette tape with a friend. It didn't work, and in reality, music sales grew. "Before the advent of home taping," writes Peter Martin, Economics Editor of the *Canberra Times*,

Americans bought around 2.5 long-playing records a year. After two decades of home taping, they were buying 4.5 recorded cassettes and LPs a year. Stan Liebowitz, a Professor of Economics at the University of Texas, argues forcefully that the explosion in recorded music sales wasn't accidental. It was caused by the introduction of the cassette. Before then, music listening was limited to one room in each house—the one with the record player. The advent of the cassette made it possible to listen in the car, while jogging, in the garden, practically anywhere.^[6]

Today, one commonly hears stories about the decline of the recorded music industry.

In a 2007 *Washington Post* article, Frank Ahrens reported that

The music industry experienced the greatest one-year loss in sales of compact discs last year, and rising revenue from songs and albums bought on the Internet failed to offset the consumer flight from CDs. Revenue from CD sales was down 13 percent last year compared with 2005, the

Recording Industry Association of America reported yesterday. The drop-off exceeds that of any year during the Napster era of 2001 to 2004, when the file-sharing service and its descendants—such as Kazaa and Grokster—allowed users to download music for free. Meanwhile, online sales of singles from services such as Apple's iTunes were up 60 percent last year. However, because online sales remain a small percentage of all music sales, the industry's total revenue—for tangible and online products—was down 6.2 percent compared with 2005, the RIAA reported. . . . The music industry has blamed piracy for the dive in CD sales and began suing downloaders and the file-sharing services in retaliation in 2003.^[7]

A lengthier discussion of legislative responses is included later in this entry; however, it is worth noting at this point that on December 22, 2008, an Associated Press report confirmed that the RIAA

. . . has abandoned its policy of suing people for sharing songs protected by copyright and will work with Internet Service Providers (ISPs) to cut abusers' access if they ignore repeated warnings. The move ends a controversial program that saw the RIAA sue about 35,000 people since 2003 for swapping songs online. Because of high legal costs for defenders, virtually all of those hit with lawsuits settled, on average for around \$3,500. The RIAA's legal costs, in the meantime, exceeded the settlement money it brought in.

This applies to individuals only; there is no current indication that organizations will no longer be sued.^[8]

Yet even in claims that music sales are being "destroyed" by illegal downloading, there appears to be conflicting information. Again in the *Canberra Times*, in response to a request by the Australian Recording Industry Association to have the Minister of Communications enact a "three strikes and you're out" law which would ultimately allow users to be cut off from Internet access if they were caught three times illegally downloading material, Peter Martin reported that according to the Australian Recording Industry Association's own sales figures, in 1982, sales of recorded music were at the level of 29 million units, and have risen steadily; now, ". . . after the most recent five years of sustained CD-burning, intensive file swapping, the introduction of the iPod, wringing by the industry, we bought 99 million—easily an all-time record and an impressive jump of 23 per cent on the year before."^[6] This includes not only 44 million units of physical CDs sold in that year, but also sales of new formats for music, including ring tones, digital albums, single tracks, music videos, and more. "The industry," Martin argues,

will argue that it would be selling even more if it wasn't for illegal downloading. It's hard to prove. Certainly it would be selling less if it turned back the clock to before

illegal downloads began. And it is highly likely that illegal downloads stimulate sales. That used to be the function of CD-singles—loss-making samplers that would introduce consumers to new music and new bands. CD singles are all-but extinct. At the start of the decade the industry sold 12 million. It now sells just 2.5 million, having ceded the promotional business to the file sharing sites it claims to hate. Without those sites we would be exposed to a lot less new music and we might buy less. . . . In the face of zero evidence that illegal downloads are hurting music sales or drying up the supply of music, the industry wants the Minister for Communications to empower our ISPs cut us off from the web if it finds we have been downloading something it does not want us to.^[6]

Again, we find conflicting reports from various sources on the effects which downloading (whether illegal or not) is having on the music industry, and thus on the effects of piracy on digital music.

However—to return to basics, including procedures and methods, and a brief history of music downloading—how precisely are music files shared? Music files are widely shared in many ways, including peer-to-peer networks which allow users to permit access a portion of their computer; networks and services which host files and allow for storage on their site; file-sharing services which allow users to post a file and notify a friend that the file is there for them to retrieve; or simple e-mailing of compressed files.

In some peer-to-peer networks, one must apply for “membership” to the network. One example of a way to apply for membership might be to offer to share rare or desirable files; this was the model followed by a service known as Hotline. If your application is approved by the site organizers, then you can access other files available through the network. But you must upload the promised files, or permit network members to access a secured portion of a server where these files are located. Many files shared via such services were not illegally obtained or even copyright protected, and often materials were not uploaded to servers owned by the company, but naturally, copyrighted and pirated materials were sometimes available. However, the idea was that responsibility for copyright clearance would fall upon the users, as would liability for infringements. There were many such networks and services that facilitated file sharing, and many persist. Such services, however, never obtained the notoriety or popularity of later incarnations such as Napster.

Napster was started by Shawn Fanning, a young programmer and student at Northeastern University in Boston, MA, and ultimately released by Fanning and two friends, Jordan Ritter and Sean Parker. It was the first well-known (and wildly popular) peer-to-peer file-sharing service. The service was unveiled broadly in 1998. The difference between Napster and many earlier peer-to-peer sites was that users could upload music files to,

and download music files from, Napster itself, and the files were hosted on Napster servers. Users liked the cost (free), the ease of use, and the ability to download only songs they liked and create their own compilation CDs. Musicians could also post their own songs on Napster, and many did so in hopes of stimulating growth in their audience; it was a means of marketing their material and hopefully stimulating radio play and future sales. However, music industry players soon launched multiple lawsuits against Napster, claiming that Napster’s actions and services were illegal and facilitated theft; certainly, some of the material that users posted on Napster was copyrighted, non-open access material, for which permission to post had not been sought. The RIAA launched a lawsuit against Napster in December 1999. The band Metallica was infuriated that some of their work was circulating on Napster, and shortly thereafter being played on radio stations, even before it was even released for commercial sale. Dr. Dre, Madonna, and other artists soon followed suit. In 2000, A & M Records sued Napster under the Digital Millennium Copyright Act (DMCA). The plaintiff’s lawyers contended that Napster’s users were directly infringing copyright, that Napster was liable for contributory copyright infringement, and that Napster was liable for vicarious copyright infringement.^[9]

Napster argued that it was not liable for users’ breaches of copyright, and that it could be used for many noninfringing purposes as well. Many users also contended that file sharing would help sales by allowing users to hear music and decide if they liked it before purchasing. However, the court found Napster guilty on all counts. Napster appealed to the Court of Appeals for the 9th Circuit but lost, though the appeals court recognized that Napster could be used for many purposes which did not constitute or facilitate copyright infringement. Napster was ordered to block access to infringing materials, but found this technologically and practically unfeasible; they shut down in July 2001 and eventually filed for bankruptcy. The service was restarted some time later under new ownership as Napster 2.0, a service offering legal copies of music files for sale, but it has never regained the popularity it had enjoyed as a free service.

Today, there are numerous services which offer legal copies of music. One popular example is the iTunes music store, which sells songs to be played on its popular iPod music players. Microsoft offers a similar service, as do many other companies. There are also still many copyright-infringing sites and services, both better and lesser known; some will be briefly discussed later in this entry. Lawsuits continue as each one is discovered by the music industry, and the music industry and other industries continue to lobby government for changes to legislation and harsher penalties for copyright infringement and theft of intellectual property. But it is difficult to keep up with the

sheer volume of such sites, and some are better than others at hiding their activities from unwanted eyes.

Currently, BitTorrent is one popular technology used for downloading files. There are near-innumerable sites which make use of BitTorrent technology, for legal purposes or otherwise. While some such sites (such as the now-defunct Oink) have been shut down, others proliferate. It is impossible, in any practical way, to keep up with the sheer volume of sites which offer material (both legal and in violation of copyright) for downloading. In BitTorrent sites, the site acts as an organizer and indexer, and does not provide files for downloading. Rather, BitTorrent sites offer metadata giving the location of files being offered for downloading, and checksums which can be used to verify the integrity of the file once a download is completed. Pirate Bay, one popular BitTorrent tracker (as systems offering BitTorrent technology, file metadata and locations, and checksums are called), offers indexes to sites where one can download music, movies, games, and software. Pirate Bay has been the subject of repeated legal actions, but the founders assert that they are not participating in copyright violation. Peter Sunde Kolmisoppi, speaking on behalf of Pirate Bay to *Wired* magazine, compared Pirate Bay to Google, saying “We’re just a general purpose search engine and torrent-tracking system. You can put whatever you want on the Pirate Bay. We don’t participate in how the people communicate with each other. We only participate in bringing the possibility to communicate and share files.”^[10] Lawyers for various plaintiffs disagree.

As well, some sites are located in other countries, and therefore not bound by U.S. law; many countries (notably Russia) refuse to recognize many international copyright agreements or restrictions. Other sites have relocated to, or are located in, countries where they feel they are less likely to be prosecuted for copyright infringement. Pirate Bay moved to a double-blind distributed server model; the founders provided servers to other people without telling them the content included Pirate Bay, and those people rented space for the material without telling the founders where the servers were.^[10]

Another way in which music files (and many other types of files) can be shared is through file-sharing services which allow users to post a file and notify a friend that the file is there for them to retrieve. These function in a manner somewhat analogous to a post office. One person uploads a file to the site, specifying a single person or a group of addressees to whom notification should be sent. One such service is known as YouSendIt. The recipient receives a notice via e-mail, much like the slip that the post office puts in your mailbox to tell you that a large parcel has been delivered to your local post office and is awaiting pickup. The addressee then clicks on the link in the e-mail or goes to the appropriate URL and enters specific information, and then retrieves the file. YouSendIt and similar services are popular as a means of avoiding the

file size restrictions on attachments which are common to many e-mail systems. This avoids any issue of posting a file to a server and making it widely available, and there is nothing illegal about offering services such as YouSendIt provides, but there are still no guarantees that the file being sent is legally obtained or copied or perhaps is open access.

A similar type of service allows you to upload a file to a server and leave it there, and then tell other people, by e-mail or by posting a notice on a blog or wiki, or in any number of other ways, to go to a certain link and download the file. Many music blogs provide links to uploaded files, and a wide array of search tools is available for use in locating such blogs. Finally, users can simply compress or zip files and send them directly to friends and colleagues as well. Such services are a highly convenient means of sharing information, and certainly not inherently illegal in any way; the question of illegality would arise only when considering the contents of a file attachment and whether permission to copy or share any materials for which such permission was even required had been granted.

One more way in which material is made widely available is through the creation and sale of pirated, illegal copies of CDs. This is an issue for software and for music alike, and for movies, there are pirated copies of videos, DVDs, or Blu-ray discs. This is an international concern, deeply disturbing to the associated industries—music companies, software producers, film companies, and others. In many countries, one can easily find the latest CDs from popular recording artists selling for a fraction of the price that would be charged in the United States, often before the official release dates. Pirated music or movies are not necessarily of the same quality as those that are legitimately produced: quality can vary widely, depending on a number of factors. Some copies are created from original tapes or files or other original materials that have been leaked to counterfeiters; some movies are copied simply by a person who sits through a viewing of a legitimate copy of a movie in a theater, with an illegal handheld video device, and then sells copies of the resulting movie. Similarly, copies of downloaded audio files may vary. RealAudio files purportedly were of poorer quality than purchased, legitimate CDs; however, with the advent of the MP3 standard, there have been considerable improvements in quality. Many people claim the quality of MP3 audio files remains inferior to legitimate CDs, but the popularity of downloading (whether legal or illegal) attests to the fact that many users consider it adequate. Pirated copies of music and movies are also not limited to foreign countries: one need only walk down the streets of New York (to use just one example) to find street vendors selling CDs and DVDs for far less than one would expect. Some may be legal, but police have frequently cracked down on pirated and counterfeit copies being sold.

Video: Movies, TV Shows, and More

Video sharing sites are among the most popular destinations on the Web. YouTube, Yahoo! Video, and many others offer users the opportunity to upload videos to their servers, and make them publicly available. Many people upload perfectly legal materials—home videos or other materials for which they own the copyright or for which they have obtained permission, or open access materials. Libraries have posted training and orientation videos, promotional videos, and much more on YouTube, sometimes as a way to avoid the bandwidth restrictions in place at their institutions, or simply as a way to ensure widespread distribution of their materials. One simple example of a YouTube video explaining how to use the library catalog of Brooklyn College is located at <http://www.youtube.com/watch?v=zLq1BzASsGU>; many libraries have posted extensive orientation and training videos. Companies post materials: to provide just one example, ARTStor, an art image database, has posted a video showing people how to register with and use their service at <http://www.youtube.com/watch?v=oAIQsiINlAA>. Political campaigns and political action groups post videos highlighting the achievements and purported virtues of some candidates, or pointing out the alleged deficiencies of others; the 2008 U.S. Presidential Election saw an explosion of material from individual voters and advocates, action groups, and even the campaigns of the candidates themselves; there were even “YouTube” debates, where during a number of the official debates, candidates took questions from voters who had posted their questions via their own YouTube videos. But there are also many instances of copyrighted materials being posted without permission having been obtained, in violation of the policies of the host site. These can be subject to takedown, but by the time the offending material is removed it may have been further copied or distributed.

YouTube has received a number of takedown notices under the DMCA. Several entertainment companies claimed that the site contained full-length versions or long clips from a number of popular TV programs, and that these had been posted by users who had not obtained permission from rights holders.^[11] YouTube was also sued by private individuals such as Robert Tur, who captured on tape the beating of trucker Reginald Denny during the 1992 riots in Los Angeles, and noted that this footage appeared on YouTube without his permission. Interestingly, “Tur did not claim that the site violated the DMCA. Instead, he invoked the 2005 Supreme Court decision in *MGM v. Grokster* and accused YouTube of building a network through the promotion of copyright infringement—i.e., piracy.”^[11]

However, YouTube had one advantage which had previously been unavailable to Napster. Congress has since added a provision to the DMCA, known as the Online Service Provider Safe Harbors provision (Section 512(c)).

Under this provision, YouTube is not liable for the actions of its users if it has posted a clear notice and takedown provision, which indicates that if copyright-infringing material is found and YouTube is notified that material on its site infringes copyright, it will remove the material. YouTube has such a posting, and removes infringing material when it is notified. This has not entirely stopped lawsuits: in July 2008, a lawsuit in the amount of \$779 million (USD) was filed against YouTube (owned by Google since 2006) by the Italian broadcaster Mediaset.^[12] In 2007, a \$1 billion copyright infringement lawsuit was filed against Google itself; the plaintiff was Viacom, which owns MTV networks and Paramount Pictures.^[12]

There are also a number of smaller sites that offer content which potentially infringes on copyright (presuming permission to post/distribute has not been sought). In 2007, Michael Arrington, coeditor of the popular Techcrunch weblog, wrote that:

Full length copies of well known TV shows and/or movies are readily available on a number of YouTube competitors. Watch, for example, *The Office* on DailyMotion, *Scrubs* on GoFish, or *South Park* on Veoh (update: GoFish and Veoh have apparently removed the shows ...). And if searching for the shows on these sites is just too much work, there are other sites that aggregate and organize this content, and embed it on their own sites. Watch any episode from any of the 11 seasons of *South Park* on Allsp.com. And new site VideoHybrid is in a class of its own, with dozens of full length movies and virtually every popular TV show. VideoHybrid even gives statistics showing exactly how many times copyrights have been violated.^[13]

The MPAA and various entertainment companies and television producers have been watching YouTube, Yahoo! Video, and many other sites, but not all well-known sites have yet been targeted. “It’s not clear if the MPAA and networks just aren’t focusing on these smaller video sharing sites yet,” Arrington also states, “or if DMCA notices are simply being ignored. These sites aren’t hiding out and trying to evade the law—they’re funded by well known venture capitalists and, in Veoh’s case, copyright holders. And GoFish is actually a public company.”^[13]

As noted, the sale of pirated counterfeit DVDs and Blu-ray discs of movies, whether internationally or locally, is of great concern to the motion picture industry. Companies get no revenue from pirated movies, and many claim that the sometimes poor quality of the counterfeit materials could damage the movie producers’ reputations and standards. But again, it appears to be nearly impossible to determine or even estimate with any degree of certitude how much piracy is taking place. The entertainment industry claims that “piracy costs the United States between \$200 and \$250 billion annually in lost sales, and 750,000 jobs.”^[14] However, there does not appear to be independent verification of these figures.

Published Works

Creators and distributors of other published works, such as book publishers and authors, are also concerned about issues of piracy. If the published works are normally in electronic form, the potential piracy issues and opportunities are similar to those for other digital materials. If the published works are in print, digitized copies of the original print works are at issue. (Of course, book “piracy” can also be accomplished by making additional print copies of print volumes, via such means as obtaining books and creating copies or additional print runs for sale. However, since this entry focuses on piracy in digital media, this will be excluded from discussion.)

One example of controversy surrounding digitized copies of print works is the Google Print Library Project. When Google announced in late 2004 that it would be working with the University of Michigan, Harvard University, Stanford University, the New York Public Library, and Oxford University to scan all of or portions of their collections (Harvard, for example, provided only a portion of their vast collections, and included no books which were in copyright), the reaction was swift. The Authors Guild, which is the largest society of published writers in the United States, termed this project a “brazen violation of copyright law”^[15] and promptly sued Google. The Association of American Publishers (AAP) and their president, former Democratic congresswoman Patricia Schroeder, agreed, arguing that Google’s business model for this project was to “take everything you create, for free, and sell advertising around it.”^[16] Five major publishers (McGraw-Hill Cos., Pearson Education Inc., Penguin Group (United States) Inc., Simon & Shuster Inc., and John Wiley & Sons Inc.) filed suit as well, and the French Publishers Association (representing over 400 French publishers) and La Martiniere Group also filed suit. Google argues that only material which is out of copyright will be freely available to all users; that books which are indexed in this project and which are still under copyright will be held to a limited display of “snippets” of text; and that creation of an index such as they avow the Google Print Library Project to be constitutes fair use under copyright law. As well, they state that any publishers who do not wish their books included can request removal of individual titles by contacting Google. Some authors support the lawsuits, but others have opposed it, arguing that it can only help them if potential readers find it easier to discover their books, even in “snippet” form. Several additional university libraries later joined the Google Print Library Project. The entire project, including other stakeholders in addition to libraries, became known as the Google Book Search project.

On October 28, 2008, Google announced that it had reached a settlement with U.S. publishers and authors, for \$125 million.^[17] The settlement agreement runs to approximately 300 pages, not all questions have been

resolved, and reactions have been decidedly mixed. Harvard University Librarian Robert Darnton asserted that potential limitations on access to and use of materials could make it impossible for Harvard to continue to participate; Paul Courant of the University of Michigan wrote that the agreement changed Google from a “universal digital library” to a “universal digital bookstore” because of fees which would be charged to access more than small portions of books in copyright.^[18] Other reactions, positive and negative abound. A discussion of the settlement could be fodder for an entire book in itself, and is beyond the scope of this entry, but it is worth noting that issues of fair use were not resolved for one and all. Writing a legal analysis for the Electronic Frontier Foundation (EFF), Fred von Lohmann asserts that

... this outcome is plainly second-best from the point of view of those who believe that Google would have won the fair use question at the heart of the case. A legal ruling that scanning books to provide indexing and search is a fair use would have benefited the public by setting a precedent on which everyone could rely, thus limiting publishers’ control over the activities of future book scanners. Instead, only Google gets to rely on this settlement, and the agreement that makes many concessions that a fair user shouldn’t have to make.^[19]

By contrast, the Open Content Alliance, a book scanning project sponsored by Microsoft and Yahoo and working with a number of other academic libraries, including libraries from Columbia University and the University of Toronto among others, deals only with books currently in the public domain. Google News Search was also entangled in a lawsuit in Belgium, where Copiepresse, an organization managing a number of Belgian newspapers, was objecting to its use of content, including headlines, in Google News Belgium. The decision in that case went against Google, and Google was ordered to remove Copiepresse articles. Other legal action is still pending.

Another example of a controversy surrounding books and journals is the lawsuit against Georgia State University (GSU), launched in 2008 by the American Association of University Publishers (AAUP). GSU made available, through electronic reserves and its password-protected course management system, digital copies of articles in journals to which they subscribed. The AAUP claims as well that professors linked directly to some of the resources through open Web pages; however, at the time of this writing, it is unclear whether or not specific examples of this latter practice were available. The lawsuit alleges widespread copyright infringement; GSU counters that these practices are permissible under fair use. The case remains before the courts. Many universities and colleges have made deals with publishers to permit e-reserves, either in response to threatened lawsuits or in efforts to avoid them;

Cornell University, in particular, was an early player, and developed a set of comprehensive electronic course content guidelines, available online at http://www.copyright.cornell.edu/policy/Copyright_Guidelines.pdf.^[20]

LEGISLATIVE FRAMEWORK

Before 1964, laws relating to piracy of intellectual property covered only printed works; in 1964, the U.S. Copyright Office began including software for registration. In 1974, the National Commission on New Technological Uses (CONTU) began to try to determine whether new technology growth was out-pacing existing copyright law, and what protection should be extended; in 1980, the Copyright Act was amended to explicitly include computer programs. In 1990, Congress approved the Software Rental Amendments Act, which “prohibits the commercial rental, leasing or lending of software without the express written permission of the copyright holder. An amendment to Title 18, of the United States Code, was passed by congress in 1992. This amendment, known as Public Law 102-561, made software piracy a federal offence and instituted criminal penalties for copyright infringement of software.”^[21]

In 1998, the DMCA became law. The reasoning behind this law was that copyright holders needed better laws to protect their rights and combat piracy.

DMCA provided those tools – and also created a whole new class of crime that causes unfortunate side effects. The Electronic Frontier Foundation (<http://www.eff.org>) posted *Unintended Consequences: Three Years Under the DMCA* in May. The executive summary argues that DMCA’s anti-circumvention provisions (Section 1201) have not been used as Congress envisioned. Congress was after pirates and wanted to ban black boxes, but the provision has been used to stifle legitimate activities. According to EFF’s report, Section 1201 chills free expression and scientific research, jeopardizes fair use, and impedes competition and innovation. The summary provides examples of otherwise-legitimate activities made impossible by Section 1201 (e.g. fast-forwarding through commercials before a DVD movie), real-world examples of the harm done by DMCA, including self-censorship for fear of violating the act, scientists unwilling to come to the U.S., the assault on fair use represented by copy-protected pseudo-CDs, and more.^[22]

As one media education professor complains, “The DMCA trades the broad fair use doctrine for a series of narrowly defined exemptions”^[23] and there is no exemption for media education; theoretically, for every usage of media work for educational purposes, a media education professor would need to research the rights holders and obtain written, explicit permission—a tiresome and lengthy process. Also in 1998, shortly after the passage of

the DMCA, the *Sonny Bono Copyright Term Extension Act* was passed into law. This law extended copyright terms by 20 years, causing many materials to take much longer to become available in the public domain.

In May, 2008, the U.S. District Court in Seattle ruled in favor of a man named Timothy S. Vernor who had posted a copy of Autodesk software on the Internet auction site eBay for resale. Autodesk had requested summary judgment against Vernor for contributory copyright infringement, but the Court ruled in his favor, and stated that the first sale doctrine of copyright law applied. The Court found that first sale applied.^[24] This is the same principle as that by which used book stores operate: the publisher of a book gets nothing when a reader resells his copy of a novel to a used book store, as the publisher has already benefited from revenues received from the first sale. The case may be appealed, though, and there is much remaining confusion as to what constitutes legal or illegal practice regarding resale of technology. It is confusing, because contributory copyright infringement is essentially that with which Pirate Bay was charged. Pirate Bay charges nothing (and various materials loaded on its servers may not be under copyright, or may be open access), and Mr. Vernor was reselling a piece of software. Yet each was charged similarly, in very different environments. The legislative framework for copyrighted, non-open access software is often still unclear—as is indeed the case for other copyrighted materials. Additionally, the legislative structure in which intellectual property exists and operates varies widely depending on the country in which the property is created or utilized. Laws can be quite different from one country to the next, and international law is not accepted everywhere.

Pirate Bay is currently facing charges that it is “promoting other people’s infringement of copyright laws”^[10] and there is a movement by Swedish Culture & Justice ministers to give Swedish courts the power to force ISPs to reveal the Internet Providers (IPs) of their subscribers, in order to charge the subscribers themselves for copyright infringement.^[25] Pirate Bay continues to face charges in Swedish courts, and people and organizations continue to appeal to the Swedish government to address the issues raised by Pirate Bay, even though they have ostensibly moved all of their servers out of Sweden.

According to some reports, in China, “bootleggers selling 75 cent DVDs dominate 95 per cent of the market”^[26] and in an effort to combat this trend (which the studios claim cost them up to \$3.8 billion a year), some companies have begun slashing the prices of legitimate DVDs. For example, “Time Warner is reducing the price further, to \$1.50 or less, and releasing movies in as little as 15 days after theater runs.”^[26]

The Software Industry Association of America (SIAA) monitors auction sites, and insists that pirated materials be removed, “either the DMCA’s notice-and-takedown process or eBay’s VeRO (Verified Rights Owner) program.”^[27] Microsoft has launched several lawsuits against vendors

using auctions sites to sell pirated software; “suits were brought in the U.S., Germany, the Netherlands, France, and Britain, as well as Argentina, Australia, Belgium, Korea, Mexico, and Poland.”^[28] FileMaker, Symantec, and other companies have also launched similar suits.

In the European Union (EU), however, the top court (the European Court of Justice) recently ruled, in a dispute between the Spanish music rights holders association Promuscaé and Spain’s top telecom operator Telefonica, that EU countries were permitted to refuse to disclose names of file sharers on the Internet in civil cases. Telefonica argued that it was only required to disclose subscriber information in criminal cases, and the court said that “Community law does not require the member states, in order to ensure the effective protection of copyright, to lay down an obligation to disclose personal data in the context of civil proceedings.”^[29] In Belgium, Copiepresse won its lawsuit against Google news; in Italy, the lawsuit against YouTube proceeds. Requirements of service providers to reveal information about customers vary widely, and legal decisions regarding fair use and copyright continue to vary as well from country to country.

In the United States, various commercial ISPs have been accused of BitTorrent throttling—refusing to allow access to known BitTorrent sites, regardless of whether material being accessed is legal or copyright-free, or of choking access to such an extent as to reduce download speed to a crawl, in hopes of limiting or discouraging user access. ISPs generally deny this practice is occurring, but some are currently under investigation for the practice. Notably, Comcast has been cited for BitTorrent throttling, and the Federal Communications Commission (FCC) asserts that this practice violates Net Neutrality rules. However, it is unclear whether the FCC has authority to actually do anything about BitTorrent throttling, or take any action against Comcast.^[30] ISPs have also sometimes been asked to turn over subscriber information, especially when there are allegations of piracy or other illegal practices, and some have complied, while others have refused and taken the issue to court, with varying results. In some countries, notably China, the Internet is filtered, and many sites cannot be accessed; Pirate Bay is apparently among those blocked by the Chinese government.

Universities and colleges have in many cases become perplexed not just about what they can legally provide in terms of electronic course reserves, but also about what professors may do in terms of excerpting materials for their classes. How large a clip from a film can they show to their class, for example, without having to obtain public performance rights? Will they risk being accused of piracy, or potentially charged, if the clip is too large? With so much still before the courts and the government, and many laws and regulations still unclear, many potential users of materials are afraid of risking a lawsuit, and claims of a “chilling effect” are common. In an attempt to alleviate this, the Center for Social Media of the School of Communication

of American University has created a set of guidelines for copyright and fair use in documentary film, available online at http://www.centerforsocialmedia.org/resources/fair_use.^[31] However, especially in the digital world, the exact parameters of fair use remain difficult to ascertain. A number of organizations which dispute the strong actions of many copyright holders or organizations representing copyright holders claim that not only does strict enforcement infringe upon fair use and cause a chilling effect, it also infringes upon free speech, as writers and artists and filmmakers may be unwilling to risk being sued.^[32]

The legislative structure in which music, TV, and motion picture companies attempt to protect their material from unauthorized distribution or piracy is also somewhat unclear. The DMCA seems to lean heavily toward support for rights holders (some claim to the detriment of other stakeholders) but the Online Provider Safe Harbor clause does protect sites and their owners from unauthorized behavior by their users, if they have a clear “notice and takedown” policy. And yet, video and music sharing sites proliferate, and many offer free and easy access to copyrighted material. Is the MPAA not focusing on smaller sites? Or are the sites getting takedown notices, and ignoring them? Why, as aforementioned, are some of the sites public companies, or “funded by well known venture capitalists and, in Veoh’s case, copyright holders”^[13] if there is fear of legal reprisals? As well, the RIAA in particular has focused strong efforts on targeting universities and colleges, asserting that students are heavy users of pirated music. On May 3, *Wired* magazine noted “universities in the US are experiencing a ‘20-fold increase’ in the number of takedown notices from the RIAA in the last ten days. Indiana University reports 80 notices a day, but they say their traffic hasn’t increased significantly over the same time period.”^[32] There have been mixed responses from the universities and colleges that have been thus targeted; various responses and recent changes to RIAA actions will be discussed in the next section.

Finally, there is also a lack of clarity surrounding access to and distribution of electronic copies of journals, journal articles, and books. Back in the days when all books and journals were published in print form, libraries had long-established and clear policies and procedures. They might vary from library to library—but you knew what to do, whether you were a publisher, a librarian, or a researcher. Books and journals were published and sold in print form. Libraries purchased the materials (whether outright or via a standing order or subscription), and processed them according to whatever procedures they had established. Materials were made accessible to library patrons—again, according to whatever policies the library had established. Some institutions had “open stacks” and patrons could browse; others had closed stacks and library staff would retrieve requested materials. When photocopyers came into existence and became commonly used in libraries, researchers might copy articles or chapters

they needed. Hopefully they would follow fair use principles as to the amount of material that could be copied, but whether they did or not, the principles and legal issues were generally fairly clear, and libraries frequently posted signs informing patrons of any restrictions. Interlibrary loan departments receiving article requests knew how much they could copy and send.

In a digital world, the legislative issues are again somewhat murky, and many questions have arisen. Articles in electronic form are much more easily transferred, copied, and shared. This is perfectly legal in many circumstances, but often there are disputes. For example, some licenses for electronic journals and databases refuse to permit libraries to use articles within these databases for interlibrary loan purposes, or they may place a variety of restrictions on the usage of the articles. Some will permit a library to print a copy of an article from an e-journal and use the printed copy to fill the request, but will not permit an electronic copy to be e-mailed. There are many possible permutations of restrictions that can be imposed. Some publishers wish to restrict access to their e-journals and databases by imposing such restrictions as limiting access to a single terminal or a set number of terminals within a library; some publishers refuse to permit remote access. As well, some publishers require institutions, including libraries, to sign agreements which require them to keep the terms of particular licenses confidential—so theoretically, you cannot even compare the deal your library has signed with that signed by another library.

As for e-books, procedures and restrictions vary by publisher here as well. Many publishers place restrictions on how much of a book can be saved, downloaded, and/or printed by a particular user or from a particular computer IP address. Some put restrictions on the number of simultaneous users for each item. Some object to e-books being used by entire classes unless multiple copies or user licenses are purchased. Some attempt to restrict access to e-books or e-journals in course management systems or online course systems such as Blackboard.

Again, one need only look to the aforementioned lawsuit against GSU for one example of a dispute between publishers and an academic institution as to how electronic materials may be used for online courses; many institutions (such as Cornell University and its libraries, for example) have worked out detailed agreements. Publishers are concerned about potential lost sales if their product is copied or shared—and this is much easier to accomplish when the material in question is in electronic format.

The recent settlement in the Google Book Search seems to impose a number of restrictions on access to and usage of works in their database, and reactions have been mixed. Many people have praised the increased overall access to digital copies of books. However, in an editorial

written for the online *Library Journal*, Editor in Chief Francine Fialkoff criticizes restrictions that will affect libraries and their patrons:

One public access terminal per public library building. Institutional database subscriptions for academic and public libraries that secure once freely available material in a contractual lockbox, which librarians already know too well from costly e-journal and e-reference database deals. No remote access for public libraries without approval from the publisher/author Book Rights Registry, set up to administer the program. And no copying or pasting from that institutional database, though you can print pages for a fee. Of course, you can always purchase the book, too.

Those are just a few of the choice tidbits from the 200-page settlement in the Association of American Publishers (AAP) and Authors Guild three-year-old suit against Google, drawn from Jonathan Band's "Guide for the Perplexed: Libraries and the Google Library Project Settlement."^[33]

Fialkoff emphasizes that the settlement document does include provisions and specifications that outline what libraries are and are not permitted to do, and that in many instances, access to materials should become more widespread. However, she continues by stating that

ultimately, it is the restrictions that scream out at us from the miasma of details. Even the libraries that were initial partners (or those that become partners) in the Google scan plan don't fare well. They get a single digital copy of each book from their collection—mind you, they've paid for these books already—and can print a replacement copy only if a new copy isn't available at a "fair price." They can allow faculty and students to "read, print, download, or otherwise use five pages of any book in its LDC" (library digital copy set) for books "not commercially available," but they can't use the LDC for interlibrary loan or e-reserves. There are all kinds of potentially costly, nightmarish administrative minutiae, including a security plan and annual audits of usage and security.^[33]

Intellectual property and the rights of creators, publishers, vendors, and users are all tied in closely with issues of piracy and other (sometimes arguably) unauthorized or illegal access to and usage of digital materials of all types.

A related controversy is the issue of whether research which is accomplished and published partially or wholly with the assistance of public funding, such as grants, should be free of charge, either immediately or after a period of time. One interesting, and ongoing, case in point is the controversy surrounding the National Institutes of Health (NIH) Public Access Policy. In December 2007, the United States Congress and President George W. Bush authorized the NIH to require that any articles which were a result of research that had received public funding (such as an NIH grant, for example) be deposited, after a period

of one year, in the PubMed Central archive. Articles need not be deposited immediately; a lag period of one year from time of publication was granted. This allowed publishers of the scientific journals which had accepted and printed the articles to continue to have sales of their journals, but researchers who were willing to wait a year would ultimately be able to obtain free access to the specific articles containing research results which had been supported by public funding. The American Association of Publishers fiercely opposed the NIH Public Access Policy. Subsequently, on September 9, 2009, Representative John Conyers (then Chairman of the House Judiciary Committee) introduced a bill (H.R. 6845, the Fair Copyright in Research Works Act) “designed to strike down the NIH Public Access Policy and prevent other federal agencies from implementing similar policies. According to the text of the bill, ‘No Federal agency may, in connection with a funding agreement, impose or cause the imposition of any term or condition that requires the transfer or license to or for a Federal agency of any right provided under’ copyright law.”^[34] Of course, if the Public Access Policy is struck down, then articles resulting from publicly funded research would be treated as any other articles, and “piracy” of such materials (or any other unauthorized action) would be subject to the same laws and penalties.

In December 2007, the Prioritizing Resources and Organization for Intellectual Property Act (variously shortened and referred to as PROIPA or PRO IP Act or PRO-IP Act) was introduced. In May 2008, it passed the House Judiciary Committee; this is the first step, though, and if the bill fails to pass both the House and the Senate before the end of the year, it would need to be brought forward anew in 2009. The bill is cosponsored by many legislators, including the Chair of the House Judiciary Committee, Representative John Conyers, Jr. and the Chair of the Subcommittee on Courts, the Internet, and Intellectual Property, Representative Howard Berman. Some of the provisions of PROIPA include massive reforms to copyright and patent enforcement. Statutory damages would be raised, and there would be a lower threshold for prison terms for copyright offenses.

In its initial form, the bill included a controversial rule which allowed litigants to stop treating compilations of copyrighted works as a single work. Thus, a music label could seek many times the normal statutory damages if they sued someone for copyright violation involving copying an album: every song would be treated separately. Similarly, for magazines or newspapers, every article would be treated separately. This rule, Section 104, was removed by Representative Berman before the bill went to the full Committee, after hearings during which proponents of the section argued that allowing works to be treated as compilations devalued individual articles or songs or other portions of a compilation. Opponents of the provision argued that statutory provisions for damages

were already high, and that there was no proof any rights holder had ever been injured by insufficient compensation due to the existence of the compilations rule. Accordingly, the provision was removed.^[35] The bill also provides for the establishment of an Intellectual Property Enforcement Division in the U.S. Justice Department.

Issues of copyright, intellectual property, piracy, and related issues (such as the issue of whether open access to publicly funded research shall be mandated or optional) continue to be issues of hot debate and ongoing interest to a wide variety of stakeholders.

RESPONSES

Library associations, intellectual property scholars, technology associations, and many others are unified in opposition to the PROIPA legislation and to various provisions of the DMCA. The Library Copyright Alliance, the Computer & Communications Industry Association, and the EFF, among others, have all written to Congress to express this opposition and dispute various claims made (such as claims about how widespread piracy is, and how great its costs are). In an essay on the difficulties created by raising the bar on getting permissions for usages that were clearly previously considered fair use, Peter Decherney argues that “If you are a documentary filmmaker, insurance companies and distributors have raised the permission bar to an impossibly high level. Documentary filmmakers are frequently expected to clear every use of copyrighted and trademarked material even when those uses are plainly allowed by the law.”^[23] He also goes on to describe the difficulties now inherent when professors wish to show clips of movies for classes; in many cases, they risk being in violation of copyright, though usage of portions of work for nonprofit, educational purposes had generally been considered to fall within the range of fair use in predigital times. As previously mentioned, GSU is battling the AAUP, which claims that copyright was infringed by the way in which GSU made electronic course reserve materials available.

Some ISPs are also unhappy—and not just those who have been accused of BitTorrent throttling. In the United States, to date, ISPs have generally not been held responsible when copyrighted materials are illegally made available via their servers. They must comply with takedown notices, but are not held responsible for the behavior of their users in posting the infringing materials in the first place. But this is not the case everywhere. In February 2008, *Business Week* reported that proposed legislation in Britain could turn ISPs into a different kind of ISP—Internet Service Policemen. ISPs would be held responsible for the behavior of their customers, ISPs who failed to halt illegal downloads would be sanctioned, and ISPs could be compelled to turn over information about customers who

infringed intellectual property rights.^[36] These proposals are still in their early stages. However,

the tough ISP stance has already set off alarms. Industry analysts and legal experts warn the proposals could hurt legitimate downloading of Internet content and saddle ISPs already suffering from thinning margins with much higher costs. Equally important, the proposal raises privacy and free-speech issues. Under long-standing common carrier principles, communication companies aren't legally responsible for the content of the traffic they carry over their wires and wavelengths even if it's a conversation between robbers planning a crime or somebody downloading child porn. Britain's ISP plan could upend this bedrock principle by turning carriers into cops.^[36]

At present, it is not technologically possible to distinguish between legal and illegal content being carried across the ISPs; imposing such restrictions could lead to extensive content monitoring by ISPs, jeopardizing user privacy. And even if the content of every file was monitored, who is to say that a user transmitting a file containing a research article, a scanned chapter of a book, a song, a video, or any other digital material, has not obtained permission to do so?

Universities and colleges are themselves ISPs, to their large communities of faculty, staff, and students. The RIAA has targeted postsecondary educational institutions, claiming that music piracy is rampant among students. Tactics espoused by the RIAA have included sending letters to university administrators demanding that the university reveal the identities of students using computers with various IP addresses; demanding that universities filter their Internet access to exclude peer-to-peer sites; and sending notices to universities asking them to pass along to individual students prelitigation letters demanding that they pay up to \$3000 or face prosecution in court. Since February 2007, the RIAA "has provided some 4,000 such letters to more than 150 colleges and universities. The letters offer the students what they call bargain settlements if they act fast, by punching in a credit card number at <http://www.p2plawsuits.com>."^[32] The RIAA is also "backing legislation in states such as Illinois and Tennessee that would require schools that get a certain number of notices to begin installing deep packet monitoring equipment on their internet and intranets."^[32] As well, the RIAA had hired a company called MediaSentry to gather information about students and other potential music copyright infringers. MediaSentry would "troll the Internet in search of people who upload large amounts of music. The information that MediaSentry collected became an integral part of the RIAA's aggressive litigation strategy."^[37]

However, MediaSentry was the cause of considerable controversy, including allegations by lawyers acting (for students and for some academic institutions opposing the RIAA in court) of invasion of privacy. In a report in the *Wall Street Journal*, Ray Beckerman, a lawyer who

"maintains the Recording Industry vs. the People blog and who has represented more than a dozen clients fighting the RIAA"^[37] was quoted as citing "MediaSentry's practice of looking for available songs in people's file-sharing folders, downloading them, and using those downloads in court as evidence of copyright violations. He says MediaSentry couldn't prove defendants had shared their files with anyone other than MediaSentry investigators."^[37] Other tactics MediaSentry allegedly employed included "scan[ning] for anyone downloading files through LimeWire and Ares."^[38] In 2008, the RIAA ended its agreement with MediaSentry, without disclosing its reasons, switching instead to Danish firm DtecNet Software ApS. Officially, the RIAA stood by the methods MediaSentry used, "citing University of Washington research released last year that concluded the company's methodology incorporates 'best practices.'"^[37]

Responses (to RIAA actions) from colleges and universities have varied widely. In some cases, the university in question has simply immediately turned over all student information. Of course, this is easier if the student is always using the same computer, i.e., in a dorm room. Even in these cases, though, if there are two students sharing a dorm room, the RIAA has been known to sue both students, though only one may be guilty of infringement. This was the case when, in 2004, the RIAA sued two students attending Portland State University. The University responded to the subpoena from the RIAA by providing personal identifying information about two roommates. It could not determine which student was using the computer in the room, so it provided information on both students. One student, Delaney Conway, was not the person using the computer at all, yet the record company lawyers insisted that she pay \$4500. She refused, and determined to fight the case. The case against Ms. Conway was finally dropped, and her roommate paid a settlement fee. Other universities have refused to provide any identifying information, citing either student privacy issues or, in some cases, the impossibility of telling which student was using which computer. The latter is particularly difficult to determine when the computers are public, or available to many people, as is the case in a computer lab or library.

Some universities have fought back on behalf of their own students, or, in one case, on behalf of non-students accused of piracy. The University of Maine's Cumberland Legal Aid Clinic has fought back against the RIAA on behalf of its students. In Oregon, the University of Oregon, with support from the State Attorney General, filed a motion to quash the RIAA's subpoena demanding student identities, explaining that

it is impossible to identify the alleged infringers from the information the RIAA has presented: 'Five of the seventeen John Does accessed the content in question from double occupancy dorm rooms at the University. With

regard to these Does, the University is able to identify only the room where the content was accessed and whether or not the computer used was a Macintosh or a PC . . . The University cannot determine whether the content in question was accessed by one occupant as opposed to another, or whether it was accessed instead by a visitor.'

The AG's motion further argues that "Plaintiffs' subpoena is unduly burdensome and overbroad. It seeks information that the University does not readily possess."^[39] The University of San Francisco School of Law has taken action against the RIAA even further, and attorneys-in-training from its Intellectual Property Law Clinic, under the supervision of law professors, are helping clients outside of their own community, pro bono. "They reached out 3000 miles to get involved in *Elektra v. Torres* and *Maverick v. Chowdhury*, two cases going on in Brooklyn, NY, against non-college defendants."^[40] Some additional complications include the fact that the Family Education Rights Protection Act (FERPA) makes it illegal to reveal most private information about students; that IP addresses of individual computers may be dynamically allocated, rather than static, and thus it can be impossible to identify with any certainty who used what computer at what time, and for what purpose; and that IP addresses can be falsified by clever people wishing to hide their identities and actions.

Results to such cases have been mixed. In some cases, various privacy arguments have not held; in others, judges have strenuously objected to some RIAA tactics and actions, even to the extent where some judges have threatened to fine RIAA lawyers. There have been allegations in court that MediaSentry violated privacy and engaged in unlicensed data mining to gather information about defendants or those suspected of engaging in illegal downloading. A defendant named Tanya Anderson filed an amended complaint against the RIAA, seeking to stop them from "continuing to engage in criminal investigation of private American citizens."^[41] Again, this case is ongoing; it had begun as a the countersuit to the lawsuit where "RIAA lawyers tried to grill a 10-year-old girl, only later to drop their case for lack of evidence and have the mother sue them for malicious prosecution."^[41] In a case involving four Boston University students, the EFF filed a brief in support of the students, who were represented by other lawyers. In that case, the *Boston Globe* reported on April 4, 2008 that

US District Judge Nancy Gertner ruled this week that the university cannot turn over the names of students to several major record companies that sued for the information until she can do a more in-depth review. The ruling, for the moment, quashes the companies' efforts to hold the students liable for copyright infringement, which could have resulted in thousands of dollars in fines. Lawyers who supported the students said the decision would make

it harder for record companies to win some 20,000 similar cases they have brought nationwide.^[38]

Judge Gertner's ruling forbade Boston University from "turning over names until it shows her its Internet service agreement with students so that she can review what privacy protections, if any, it affords."^[38] One recent development in the RIAA strategies is especially interesting. In December 2008, the RIAA decided to cease filing lawsuits against individuals engaging in downloading, though it plans to continue with cases currently filed; instead, it will continue its discussions with ISPs to attempt to reach agreements on file monitoring.

FUTURE DIRECTIONS AND CONCLUSIONS

Illegal downloading of music, software, visual images, videos, films, electronic books, electronic journal articles, or any digital material is theft. But what constitutes "illegal" downloading? This is, in many instances, unclear. "Fair use" has long been part of copyright law, and some allegations of piracy are met with a defense that the copying or usage or sharing falls within fair use. What, in a digital environment, constitutes fair use? There are many complications to various cases, and many debates about the appropriateness of various responses and actions. Arguments have become quite heated on all sides, in the courts and in the popular press. There are many details to be worked out by the courts, and it is likely that these battles will continue for some time.

Many technological solutions have been attempted, including copy protection added to DVDs and CDs; thus far, all solutions seem to have been vulnerable to hacking, and none appears to have succeeded. It may indeed be illegal to circumvent such protective technology; that does not mean it is not possible, and once a means to circumvent the protection is devised, one can be fairly well assured that it will be posted all over the Internet within hours.

Solutions have been proposed that would see ISPs held legally responsible for the content of what is posted on their services; arguments made against this include considerations such as privacy rights or freedom of speech. There have been suggestions that persons caught illegally downloading music or films should lose access to their Internet service; some schools have instituted such policies, and there are proposals being floated to have commercial ISPs follow suit. Alternatively, there have been proposals to have ISPs levy monthly fees on broadband customers and turn these fees over to the RIAA, the MPAA, the SIIA, the BSA, and/or other groups. Fees have been proposed on blank media, such as recordable CDs, as well. In some cases, reducing the prices of software, music, and movies is being attempted; the success of this strategy has not been fully documented to date. The only

certainty appears to be that digital piracy (and even the definition of what constitutes digital piracy) will remain a controversial subject for many years to come.

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Plagiarism of Print and Electronic Resources

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Abstract

This entry discusses plagiarism of printed and electronic resources, explores definitions of plagiarism, and provides a literature review. The entry then discusses the following issues: how prevalent plagiarism is, faculty's attitudes toward plagiarism in general, cyber-plagiarism in particular, predictors that correlate with plagiarism, and how to cope with plagiarism. The entry offers suggestions for future research on the topic of plagiarism.

INTRODUCTION

This entry concerns itself with plagiarism of printed and electronic media. It starts off by reviewing literature on definitions of plagiarism, and answering questions as to how prevalent plagiarism is, faculty's attitudes toward academic dishonesty in general, and plagiarism in particular. Predictors that associate with acts of plagiarism are discussed under the headings of social factors and individual differences. To answer the question, what is done to cope with increase of plagiarism incidents, this author summarizes theories of ethical reasoning as well as various approaches, such as instructional techniques and software detection programs. The entry concludes with an agenda to be considered for future research.

DEFINITIONS OF PLAGIARISM

Merriam-Webster's Collegiate Dictionary^[1] defines plagiarism as the act of stealing and passing off (other creators' ideas as expressed in words, pictures, music) as one's own; use (another's production) without crediting the source; to commit literary theft: present as new and original an idea or product derived from an existing source. The *Oxford English Dictionary*^[2] defines plagiarism as the "wrongful appropriation or purloining, and publication as one's own, of the ideas, or the expression of the ideas (literary, artistic, musical, mechanical, etc.)." The OED cites numerous sources that mention plagiarism in different historical contexts starting with a citation from 1621.

Many articles that write about the concept of plagiarism also talk about related, but very distinct topics such as fabrication, academic integrity in the context of ethics and moral development; vocabulary also pertains to fair use, copyright and intellectual property, various cheating behaviors, and honor code violations by different user populations in different countries. While the acts of stealing, corruption, lying, piracy, and forgery are normally

punished by law, stealing intellectual or artistic content (e.g., textual, musical, visual, software code) from another person and passing them off as one's own, sometimes remains undetected and unpunished. Dames in his 2007 article "Understanding plagiarism and how it differs from copyright infringement," states that "plagiarism allegations can be much more damaging [than copyright infringement that can result in financial damages or even jail] to a person's professional reputation than allegations of copyright infringement" (p. 26)^[3].

Numerous other writers have attempted to define the concept of plagiarism. In an excellent bibliography on plagiarism that reviews nearly 700 books and scholarly articles written in English between 1900 and 1995, Anderson discusses different definitions in the historical, cultural, and disciplinary contexts.^[4] The annotated bibliography is organized chronologically, following an extensive Introductory section, and discussed under four sections: 1) trends in definition; 2) follow the money; 3) detection, proof, and punishment; and 4) protecting one's property.

Angélil-Carter, in her work *Stolen Language? Plagiarism in Writing* (2000), discusses the historical development of the notion of plagiarism, along with copyright.^[5] From the British perspective, she tries to convey that plagiarism is an elusive concept and has been treated differently in different contexts. As Angélil-Carter writes in her Introduction, she wanted to "understand plagiarism differently," and to communicate that understanding to teachers and writers of academic discourse (p. 3).

Two college English professors, Rebecca Moore Howard and Margaret Price also address the concept of plagiarism from multiple perspectives. Howard discusses plagiarism from the perspectives of authorship, pedagogy, and scholarship; in closing, she proposes policy on plagiarism, as well as advice for students and teachers.^[6] Howard characterizes plagiarism as "patchwriting" if students are "copying from a source text and then deleting some words, altering grammatical structures, or plugging in one synonym for another." (p. xvii)^[7]. Price considers

plagiarism in a given time, academic community, workplace, defined in a specific discipline, rather than as an absolute concept across different cultures and communities.^[8]

Not All plagiarism Is Perceived Equally

Burke distinguishes among the four forms of cheating: *Cheating*, according to Burke, is “intentionally using or attempting to use unauthorized materials, information, or study aids in any academic exercise.” *Fabrication*, Burke writes, is “intentional and unauthorized falsification or invention of any information or citation in an academic exercise.” *Facilitating academic dishonesty* is defined as “intentionally or knowingly helping or attempting to help another to commit an act of academic dishonesty,” and *plagiarism* is defined as “intentionally or knowingly representing the word of another as one’s own in any academic exercise.”^[9]

The Council of Writing Program Administrators, CWSA, thinks of plagiarism as a deliberate use of “someone else’s language, ideas, or other original (not common-knowledge) material without acknowledging its source.” This definition is extended to printed and digital materials, manuscripts, and other works.^[10] The Council’s statement on Best Practices suggests a five prong strategy: to explain plagiarism and develop clear policies; to improve the design and sequence of assignments; to attend to sources and the use of reading; to work on plagiarism responsibility; and to take appropriate disciplinary action.

The following studies investigated various forms of plagiarism pertaining to college students. For example, Klausman makes three distinctions between direct plagiarism, paraphrase plagiarism, and patchwork plagiarism.^[11] Lasarenko offers exercises to help students understand the differences between summarizing and paraphrasing practices, and how both can result in plagiarism if the original sources are not cited.^[12] Birnbaum and Gosciolo^[13] (cited in Kaltenbaugh^[14]) distinguish direct copying, rearranged copying, selective omission, copying selective words or phrases, paraphrasing, not citing a secondary source within a primary work, and making attribution unclear. In two separate studies with college students at St. John’s University, New York, Roig asked students to determine which of 10 rewritten versions were plagiarized.^[15] He found that 40–50% of the students did not identify plagiarized versions. Roig suggested that students in his tests were unclear as to what plagiarism meant.

The idea of “inadvertent plagiarism” or unconscious plagiarism has been examined in young and older adults.^[16] From the perspectives of memory as well as psychology and aging, experiments have established that older adults were more likely to plagiarize inadvertently than did younger adults. McCabe, Smith, and Parks conclude that the primary cause of the age differences in plagiarism is the nature of the retrieval processes involved

in monitoring for plagiarism errors, including age-related declines in recall of studied exemplars and/or to age-related declines in working memory.

WHAT DOES THE LITERATURE ON PLAGIARISM TELL US?

Literature on the topic of plagiarism is scattered, mostly descriptive, anecdotal, and has not as yet received a unique and deserving place in the scholarly literature it warrants. The reviewed literature asks important questions but the methodology used to study many of the questions is wanting in validity and applicability.

Plagiarism is a moral issue which is at the heart of the educational enterprise. It cuts across multiple disciplines, all sectors of the society, and hinges upon learning, teaching, levels of moral development, and applying ethical behavior in our everyday lives. This problem is reflected in the nature of literature that reports on plagiarism; it is spread out across library and information science, education, technology, social sciences, sciences, and ethics. How many English teachers read history or library-related literature? How many college instructors read literature especially targeted to secondary school teachers, technology coordinators, administrators, or to engineers and scientists? We have not made wide strides across disciplinary lines or between higher and secondary school education on plagiarism prevention. While the problems are basically the same, we see fragmentation along professions and educational status; professional conferences are designed around these lines, and literature follows the same structure. We need to learn much from one another, to share research results, evaluate models, and apply them in practice.

When this author searched ProQuest Platinum (thereafter ProQuest) database on the topic of plagiarism in peer-reviewed full-text articles, she retrieved the following distribution of results summarized in Table 1. It suggests a trend toward a significant increase in published articles on plagiarism since Internet has become widely available in various educational institutions. The numbers show rise of published literature at more than sevenfold in ProQuest Platinum database since the Web has become an ubiquitous and widely affordable information resource at all levels.

Plausible explanations are that: 1) plagiarism has started to receive the attention it deserves in the literature; 2) there are more cases of plagiarism detected, and with the advent of cyber-media in schools, colleges, and work places, more allegation cases are reported in the literature; and 3) it is easier to detect plagiarism as more electronic submissions are requested by publishing houses, and therefore it has become easier to compare texts on similarity strings and detect plagiarized contents.

Besides ProQuest and JSTOR, this author searched *Library and Information Science Abstracts*, Online

Table 1 Search results from ProQuest Platinum on plagiarism

Results on "plagiarism"—	<i>Proquest Platinum</i> (2300+
before and after the Internet	periodical titles in all
era. The cutoff date was set for	disciplines with about 43% full-
January 1, 1993	text coverage)
Pre-Internet era	49
Internet era	377

Computer Library Center (OCLC)'s *FirstSearch* databases, such as *ArticleFirst*, *PapersFirst*, *Library Literature*, and *Dissertation Abstracts Online*. The retrieved items are published in journals, newspapers, reports, dissertations, and conferences. In addition to the information obtained from database searches just described, this author reviewed published bibliographies. The Center for Teaching and Learning maintains compilation of articles from a variety of sources on plagiarism-related issues. Other bibliographies are in books, such as in Harris^[17] and in Marsh.^[18] For example, a brief content analysis of 154 entry bibliography on plagiarism demonstrates that the topic is largely fragmented and domain-centered with little or no attention given to the domains outside the scope of authors' own. Bill Marsh, an English language instructor, in his book titled *Plagiarism: Alchemy and Remedy in Higher Education*, covers literature from 1874 to 2004 with about 70% pieces published since 1992 from the perspectives of electronic media composition techniques, education, rhetoric, print history, and communication.

Previous editions of *Encyclopedia of Library and Information Science* (ELIS)^[19,20] contain articles under headings of copyright-related issues such as fair use and piracy. In volume 2, Jay Daily defines the word "piracy" as an "unauthorized publication of works," and taken to mean differently from plagiarism in that the "original author may be given credit for the intellectual content" p. 263.^[19] In the 1988 Supplement to ELIS (volume 43), W. Z. Nazri's article titled "Federal actions against plagiarism in research," reviews "policies and specific cases involving plagiarism in federally funded research" including such agencies as the Office of Research Integrity of the U.S. Public Health Service and the Office of Inspector General of the National Science Foundation.^[20] The article gives definitions of plagiarism as adopted by the research agencies, frequency of plagiarism allegations, process, findings, and actions taken against plagiarists.

The literature reviewed for this entry is primarily focused on plagiarism issues among secondary school students and college students.^[9,11,15,21,22] A subset of that literature is concerned with issues among professional school students.^[23–28] Articles cover scenarios of single case plagiarism-related issues in individual educational institutions, ranging from secondary schools, higher education institutions, research labs, professional schools such as nursing, business, engineering, and science. Though interesting, these reports cannot be generalized to populations outside a single case study or a

single school described in any given report. Other articles in newspapers, magazines, and search engine alerts continue to report sensational cases that involve paper mills, software companies, stories about prominent figures in journalism, writing composition, research, and academe.

The author examined literatures for effective pedagogical approaches that instructors can use to design specific academic integrity programs that would be appropriate for secondary schools and colleges. Since students at different levels of their cognitive development reason differently when presented with specific moral dilemmas,^[29] educators need to customize academic integrity programs to make them sensitive to and compatible with students' levels of moral reasoning.

HOW PREVALENT IS PLAGIARISM?

Under the "Extent of the Problem," Kibler reviews literature that demonstrates that various forms of academic dishonesty have been with us since ancient civilizations, and that academic dishonesty, for a variety of reasons, has increased.^[21] More recently, literature has shifted its attention from the student behavior toward a more robust approach to academic integrity taking into consideration a broader environment of teaching and learning.^[30]

In terms of K-12th grade educational level, the *Center for Academic Integrity* consortium of more than 300 institutions at Clemson University, South Carolina, publishes valuable reports such as "Smart & Good High Schools: Integrating Excellence and Ethics for Success in Schools, Work, and Beyond."^[31] Josephson Institute's "2008 Report Card on the Ethics of American Youth," reveals that young people are almost anonymous in saying that ethics and character are important on both a personal level and in business but they express very cynical attitudes about whether a person can be ethical and succeed.^[32] Based on a survey of 29,760 students in public and private high schools across the United States, the *Report* found that 64% cheated on a test within the past 12 months, up from 60% in 2006. There were no gender differences on the issue of cheating on exams. However, students attending independent schools reported the lowest rate (47%) compared to those attending religious schools (63%). The lowest cheating rate was reported in the Midwest (59%) compared to the Southeast (70%). Thirty-six percent of the surveyed students copied an Internet document to a classroom assignment within the past 12 months compared to 32.9% in 2006.

Working with a smaller set of secondary school children, an exploratory study examined students' understanding, their attitudes, and general practices toward cyberplagiarism.^[33] The article, based on a sample of availability, surveyed 37 high school juniors and framed questions in the context of information literacy standards and

respective performance indicators. The study used a self-reported paper-and-pencil questionnaire to obtain data on content knowledge (what students say they know), students' attitudes toward cyber-plagiarism-related issues (what students feel), and students' practices (what students are telling us they actually do). Among the interesting findings was the extent of difficulties students had with regard to giving credit to creators of nonbook resources. Examples included photographers, choreographers, and cartoon artists. Equally confused were the students with respect to attributing to computer code, information obtained through e-mail transcripts, and personal communication. To gauge the question, "Is the Google generation information literate?," a case study looked at information-seeking behaviors of 105 middle school students.^[34] The surveyed students are fluent with digital cameras, iPhones, Blackberries, Facebook, MySpace, YouTube, and Amazon's Kindle interfaces; their first best sources, regardless of the nature of inquiry, included search engines, (wiki)cyclopedias, books, and primary (digital) sources. Their perception was that 80% or more of everything that has been published is available on the Web. Other findings include problems with attribution, especially of digital resources, understanding what primary sources are, how to critically separate good sources from inappropriate or unreliable ones, and how to find those golden nuggets from the deluge of data. The surveyed students have both conceptual and mechanical problems in deciding when to give credit and how to do it properly; many come from elementary schools confused as to the differences between quoting and paraphrasing. More than 8 out of 10 surveyed students would give credit in order to "avoid plagiarism-related issues" (82%). Clearly, there is a gap between the surveyed students' understanding of the concepts of the ethical use of information and the belief that provided the basis for the newly created information literacy *Standards for the 21st-Century Learner*—that ethical behavior in communicating information is crucial.^[35]

There have been a number of studies of college students in the context of plagiarism-related questions. Roberts, Anderson, and Yanish found that in the self-reported 1997 surveys of 422 college students at a midsized 4 year public university, 91.7% reported that had engaged in at least one type of academic misconduct during the surveyed year.^[36] Virginia Polytechnic Institute reported that various forms of academic cheating have more than tripled, from 80 in 1995/1996 to 280 in 1997/1998. Virginia Tech is one among numerous campuses that has seen a rise of plagiarized information stolen from the Internet, e-mail, and other digital communication services. Ten years later, however, Virginia Tech has developed their Undergraduate Honor Code System which functions are to communicate the meaning and importance of intellectual honesty to all students of the University; to articulate and support the interest of the community in maintaining the highest standards of conduct in academic affairs; and to

identify, sanction, and educate those who fail to live up to the stated expectations of the university community with regard to these standards.^[37]

Authors from Harvard University and University of Illinois at Urbana-Champaign found that in their introductory political science course in the spring of 2000, about one out of eight papers seemed problematic.^[38] In the spring of 1999, a University Honor Council survey found that 54% of Penn students "considered copying homework to be cheating," and 61% of the students indicated that they would not "report a case of cheating to the Office of Student Conduct."^[39]

In the scientific world, several recent incidents reported that stellar scholars at two highly regarded research institutions (Bell Labs, and separately at the Lawrence Berkeley National Lab), faked data. In his article, "Peer trouble: How failsafe is our current system at ensuring the quality and integrity of research? Not very," says Crace.^[40] The author reports on a recent study by the University of Minnesota of 4000 researchers "that one in three scientists plagiarized, 22% handled data "carelessly" and 15% occasionally withheld unfavorable data." Most recently, Ben Martin, in his editorial article, details a case of a serial plagiarist, Hans Werner Gottinger (management/economy) who had been caught numerous times; each time he confronted the problem by moving to different research labs and academic institutions in the United States and Europe, and by apologizing, retracting his papers, and repeating all over again at his next affiliations.^[26] In an anonymous article, "Policing Integrity," scientific misconduct, especially plagiarism, has been discussed.^[41] Oversight organizations of the Office of Research Integrity at the Health Department, and by the Nation Science Foundation (NSF) in the United States are contrasted with those in Britain, France, Italy, and Germany. Sandler, an attorney at law, marshals examples of statutes from 14 states about sales of term papers; he gives detailed accounts of plagiarism by students, professors, and cases against commercial agencies that sell papers.^[42]

ATTITUDES OF FACULTY TOWARD ACADEMIC DISHONESTY

As we have seen above, the literature suggests some disturbing facts on the state of academic dishonesty in the United States, especially the growing prevalence of plagiarism. Other related research offers insight into the attitudes of faculty toward plagiarism. In his 1997 dissertation, Burke studied factors that influence faculty response to academic dishonesty at a multicampus, 2 year college. His "research investigated faculty: 1) perceptions of the extent of academic honesty; 2) perceptions of, and attitudes toward Academic Dishonesty Policy and policy implementation; 3) responses to academic dishonesty; 4) attitudes concerning values education; and 5) attitudes about responsibility for reducing academic dishonesty"

(p. 3).^[9] The study delineated perceptions, responses, and attitudes among faculty grouped by employment status, campus, seniority, and discipline. Seven hundred and forty two faculty members completed a 25-question survey. The results indicated that faculty do not perceive academic dishonesty to be a serious problem. Faculty believed themselves to be familiar with current policy and procedure, and are not concerned with policy implementation. The surveyed faculty members believe that they have a primary role in values education. Of the faculty surveyed, 86% have suspected, and 65% have been certain of, academic dishonesty in their classrooms. The majority of the surveyed members do not regularly follow institutional policy; most handle incidents of cheating and plagiarism on the individual basis. They believe that the responsibility for reducing academic dishonesty lies primarily with students and individual faculty. The fact that 86% of the studied faculty have suspected academic dishonesty in their classrooms, and did not perceive this to be a major problem, should be investigated further.

Marcoux's doctoral work studied college faculty's awareness level of the Kansas State University's honor code and cheating policies.^[43] The faculty's responses varied and indicated that they had not received training in how to handle cases of academic cheating.

Freedman^[44] reports his experience with preservice elementary school science teachers; some plagiarists were apologetic, others were offensive. He proposes prevention rather than detection as a new paradigm to combat plagiarism. For example, Freedman asks his student teachers to find an existing lesson plan, and creatively adapt for his or her students, language, and programs; another technique requires students to reflect on the relevancy of selected lessons with regard to diversity, assessments, and inquiry-based teaching. While we have no data on evaluation of the proposed program, it seems reasonable to assume that teachers will benefit in many ways to access information, critically evaluate source lesson plans, acknowledge the sources, and adapt to suit their needs.

Johnston's article reflects on a moral dilemma she dealt with relating to cheating that occurred during one of her unproctored exams in her Moral Development and Education course by some upper division students at Colgate University in New York.^[45] She decided to use that incident as a teaching challenge and "role-taking" technique. When Johnston confronted her class, she was alarmed with the range of students' responses. Some were surprised if no one cheated, some did not know how to deal with cheating if it occurred, many students rated cheating on a continuum, some viewed cheating as "refreshing the memory," others were bothered that students majoring in education in that particular class cheated. Students were equally divided about moral decision making as a group. Johnston's analysis of cheating takes her to search for causes of cheating behaviors beyond pressure and individual integrity. She writes, "it occurs because students do it if they won't 'get

caught' and being caught by their peers is not problematic" (p. 290). Ethical behavior is often assumed among professionals, such as teachers, managers, scientists, and other scholars. However, as Hall and Berardino point out, this set of skills unless taught cannot be taken for granted.^[25] Teaching professional behaviors (e.g., punctuality, honesty, cell phone usage, and appropriate appearance) is an important, complex, and underestimated area in general educational systems. It seems that there is a lack of alignment between offences and punishment, and lack of communication between administrators, faculty, parents, and students. Other problems are related to students' state of readiness to understand issues involved in academic dishonesty and plagiarism, and in relationships with peers, teachers, and as part of their educational climate as a whole.

CAN WE PREDICT ACADEMIC DISHONESTY?

The reviewed literature identified specific variables of learners in ethical uses of information.

Social Factors as Predictors of Academic Dishonesty

In a broader context, we sought to find societal indicators that strongly and positively correlate to academic dishonesty. Again, we turned to *The State of Americans: This Generation and the Next* to find possible answers to this question.^[46] There is evidence to support that nuclear family correlates positively and strongly with students' academic performance (GPA scores), cheating behavior, drug use, and teenagers' trust in others.

In competitive classrooms across the board, under parents' pressure to produce high grades, many students, including those from professional schools, have been found guilty of academic misconduct and plagiarism. Kibler divides his literature review into *Personal Characteristics of Cheaters* and *Situational Factors Involved in a Student's Decision Whether to Cheat*.^[21] Among the situational factors, important ones include unproctored tests, penalty systems, teaching styles (authoritarian style incites cheating, overly difficult tests, hopelessness, soft teachers), climate of the school, and "likely to get caught" (pp. 257–259). Schab writes that high school graduates cheat due to "fear of failure," because "parents demand and expect good grades" in order for their children to be admitted to top universities; other reasons given were that everyone cheats, and that teachers were "too soft on these issues" (p. 840).^[47]

Individual Differences as Predictors of Academic Dishonesty

In the study mentioned earlier, Roberts, Anderson, and Yanish examined the relationship between demographic

variables and academic dishonesty among undergraduates.^[36] A total of 422 students from 22 classes completed a 27-item self-reported survey that was designed to measure their involvement in 17 types of academic misconduct. The survey also obtained data on class standing, age, gender, GPA, and college major. Results revealed that being male and/or younger than 24 years of age were characteristics associated with greater involvement in academic misconduct. The authors did not find significant difference in self-reported academic misconduct between students and respective GPA scores.

In an earlier study, the authors used a questionnaire to obtain data on self-reported frequency of 21 cheating behaviors ($n = 943$) sophomores and juniors from 19 disciplines).^[48] This “first large-scale study of cheating carried out in the United Kingdom” (p. 238) calculated the frequency with which each reason was given for both cheating and for not cheating. Reasons given for cheating include time pressure, to get a higher grade, because everybody does it, to help a friend, and laziness. Students gave reasons for not cheating “because it is immoral,” “situation did not arise,” “it was unnecessary,” and “personal pride” (p. 233). The study found that men cheated more, that cheating declines with age, and that it occurs more frequently among science and technology majors than among other disciplines.

Pennycook writes about some of the complexities of text, ownership, memorization, and plagiarism.^[49] The author suggests that plagiarism needs to be understood in terms of relationships between text, memory, learning, literacy, and cultural differences.

Six hundred and ninety-eight college students from nine universities completed a survey on Internet plagiarism. A substantial minority of the surveyed students reported they used the Internet to copy and paste text into their own papers without giving credit to sources they used in their writings. Buranen in her piece, “But I wasn’t cheating: Plagiarism and cross-cultural mythology,” presents experiences with ESL (English as a Second Language) students and their writing problems and practices.^[50] In many cases, students lack a combination of vocabulary skills, factual knowledge, and bibliographic conventions. According to Buranen, cultural differences may also influence students’ attitudes toward “borrowing” and “ownership” of ideas or of text” (p. 66). Cultural perspective has been further explored by Dryden in the context of Japanese education (pp. 75–85).^[51]

Angélil-Carter writes about developing writing skills in general and not limited to non-English language students.^[52] She writes, “This is what is so difficult for the novice writer of academic discourse (or for any writer)—it is the control of the voices so that the authorial voice speaks through them. . .” (p. 35). Nearly 70 years earlier, Edwards wrote about “good and bad borrowing,” differences between imaginative and unimaginative borrowing, and those between a derivative artist and a thief.^[53]

COPING WITH PLAGIARISM

In his chapter on “The Moral Atmosphere of the School,” Kohlberg summarizes important findings by educational sociologists, such as Emile Durkheim, Philip Jackson, Robert Dreeben, and Edgar Friedenberg.^[53] Kohlberg introduces us to a concept of “hidden curriculum” in which characteristics of the crowds, the praise, and the authority are of major influences on the development of children. “After the family the school is the first social institution an individual must deal with, the place in which he learns to handle himself with strangers” (Friedenberg, *Coming of Age in America*, 1963, p. 149).^[53] Kohlberg’s research builds on that tradition and on the notions of Dewey and Piaget, and finds that the development of moral reasoning is sequential progression through distinct stages. Kohlberg believes that the role of the teacher is to translate moral ideology into a working social atmosphere in which students understand the meaning of the “hidden curriculum” based on the universal principle of justice underlining respect of all people. In this context, teachers have considerable flexibility to implement “hidden curriculum” within respective school cultures. Theories of ethical reasoning are in line of combating plagiarism through teaching, information literacy units on ethical use of information, and campus-wide honor code policies. Another line of coping with plagiarism has been through detection tools and adjudication of student plagiarism. These two perspectives are described next.

Ethical Reasoning

Granitz and Loewy studied theories of ethical reasoning that students invoke when they defend their plagiarism behavior.^[54] The researchers used a content analysis of written records of students formally charged with plagiarism. The authors classified case studies based on six types of reasoning students gave as justification for their academic misconduct. These were deontology, utilitarianism, rational self-interest, Machiavellianism, cultural relativism, or situational ethics. The authors found that students predominantly invoke deontology (41.8%), followed by situational ethics (19.9%) and Machiavellianism (18.4%). Under *deontology*, students typically justify their dishonest behavior by saying that they didn’t know what plagiarism was or that it was wrong. The *Machiavellianism* reasoning considers the act successful if they can get away with it without being caught. The *situational* plagiarism blames a given situation for dishonest activity (e.g., being late, being poor, inequity, stress). For each of the six reasoning theories underpinning plagiarism, Granitz and Loewy recommend prevention techniques: have honor code, teach proper citation techniques, act as a role model, and avoid standardized assignments. Based on responses obtained from 2200 students on 21 college campuses,

McCabe and Trevino concluded that schools with honor codes had fewer repeat offenders.^[55] This finding has policy implications, and honor codes have been widely practiced in numerous campuses.

Online Instruction

Among plagiarism prevention Web-based tutorials within information literacy units, Jackson assessed data from 2829 student quiz scores on their understanding of plagiarism.^[56] The study found that students have difficulties with paraphrasing, don't understand the concept of plagiarism, and mechanics of citing sources. The article concludes that online tutorials should be considered a part of a broader educational framework in the area of intellectual property and academic integrity.

Plagiarism Prevention Techniques

An approach taken in Harris's *Handbook*^[17] against plagiarism is to teach students about plagiarism-related issues rather than to assume that they know what plagiarism is. He uses anecdotes, cartoons, and plain language to demonstrate differences between plagiarism and copyright issues, good citing practices and careless note-taking techniques, differences between paraphrasing, summarizing, and copying sentences and paragraphs. An important section is directed toward explaining reasons why plagiarism is unethical, and the benefits of citing sources. McKenzie suggests specific ways in order to "prevent highway robbery in an electronic age:" distinguish between levels and types of research, give instruction to educators to go beyond "just factual" scavenger hunts and challenge students to use facts to explain, solve problems, and make decisions; go beyond "conventional thinking;" encourage students to "emphasize essential questions;" learn how to paraphrase, summarize, and cite the sources of ideas or information; use of color-coded text to differentiate between the ideas of others (black ink) and students' fresh ideas, reactions, or insights (green ink).^[57] Niels reports that the entire academic program at the Central Park East Secondary School (CPESS) in New York City is organized around the five main questions: Whose viewpoint is being described? What evidence is there? How is this connected to other things? What are the alternatives? How is this relevant? Niels develops an argument that in order to deal with various forms of cheating behavior, we need to look at contextual factors that influence cheating, which is moral education.^[58]

Brown and Howell, both with the University of St. Andrews, Scotland, studied the effectiveness of policy statements of plagiarism on students' behaviors.^[59] The study concluded that there was a positive influence between students who read carefully worded statements of plagiarism and respective academic behaviors.

Software Detection Programs

In their two 90-student sections in Introduction to Political Science course at the University of Illinois at Urbana-Champaign, Braumoeller and Gaines used assignment sheets with: 1) explicit written and verbal warnings not to plagiarize in one section; and 2) plagiarism detection software in another section.^[37] The investigators found that while verbal and written warnings not to plagiarize had a negligible effect on rates of plagiarism, plagiarism detection software proved to be successful in discouraging students to plagiarize. Policing plagiarism in any of the environments seems to be of mixed success.^[60] This author has long been in line with those who strongly feel that software tools such as turnitin and eve are at the end of plagiarism pipeline, and therefore limited. As Evans states, trust and student honesty remain central to a successful academic scholarship.^[59]

CONCLUSIONS

Plagiarism has always been known, although not adequately understood and reported, to teachers, administrators, behavioral psychologists, and sociologists. Literature has reported cases of plagiarism, under various names, including research misconduct, lack of academic integrity, academic dishonesty, misappropriation of intellectual property, and fabrication. This is not only a serious issue among students in secondary schools and colleges. It is rampant and on the increase among researchers, professors, and other professionals regardless of their age, discipline, seniority status, culture, and geographical region. Many have attributed its rise of epidemic proportions to a growing number of paper mills on the Web, "cut and paste" techniques, and educational culture as a whole; this has manifested itself through various ways in schools, such as instructors' inconsistent treatment and overall attitudes toward cheating, lack of plagiarism prevention strategies, uncertainty to interpret and apply honor codes, detect instances of plagiarism in print and electronic media, and customize teaching units on ethical use of information to meet students' uneven moral developmental capacities. In the higher education, plagiarism audits have been dealt with inconsistently and reported through peer review process, doctoral committee members, by individual readers, publishers, editors, and funding agencies. Much progress has been made about understanding of plagiarism and how to deal with at various levels of educational ladder. We need more effective pedagogical tools to engage students in real-life dilemmas at their levels of moral reasoning. We have illustrated paradigm shifts that have taken place between pre-Web and the Web era in Table 2.

Research is needed to study predictors that might suggest students' behavioral patterns at different phases of their reasoning development. Attention is also needed in

Table 2 Paradigm shifts in dealing with plagiarism

Paradigm shifts in plagiarism	Pre-Web era	The Web era
Medium and format	Piracy of mainly <i>printed texts</i>	Piracy of <i>multimedia</i>
Method of copying	<i>By hand</i> , purchase papers	" <i>Cut and paste</i> ," paper mills
Domain: discipline and level of educational institutions	<i>English</i> teachers mainly at <i>college</i> level	<i>Multiple disciplines</i> (e.g., library literature, science, and professional schools) at different levels including secondary schools
Combating plagiarism in educational domains	<i>Mechanical</i> techniques: template-based bibliographic citations; detect and punish; however, some authors write about plagiarism preventions in pre-Web era (e.g., Daniels ^[65] , Saalbach ^[66] , and Carroll ^[67])	<i>Conceptual</i> techniques: Focus on the <i>reasons</i> to give credit to sources; scenario-based discussion prior to mechanics (how to apply templates to specific cases)
Pedagogical approach as represented in Information Literacy Standards	Legalistic approach, need for educational approach (see, for example, Drum ^[68])	Intellectual property and digital rights management → Learning Standards. ^[35]

the areas of mapping research results to pedagogical experiences and specific subject (and interdisciplinary) authentic scenarios and lesson plans, diagnostic and assessment tools that instructors can customize for individual curricular needs.

FUTURE RESEARCH

Doctoral level work in the context of moral reasoning and development starting with seminal works by, for example, John Dewey,^[61] Jean Piaget,^[62] and Lawrence Kohlberg^[29] can advance our understanding and give us a conceptual framework around which to design research with specific questions in mind. Reporting beyond anecdotal stories would be useful in order to study trends of various segments in our society, reasons "plagiarism is on the rise," factors affecting these behaviors, as well as prevention strategies that might be considered and put in practice. In summary, plagiarism is not an isolated problem to any particular discipline.^[26,63,64] It is systemic issue of epidemic proportions requiring the entire educational community to mobilize, to study the problem from different angles, communicate findings, propose models, verify, and translate into best practices across the educational ladder.

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Poland: Libraries and Archives

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Abstract

This entry discusses the role and status of Polish libraries and other information institutions during the two decades following the collapse of Communist rule in 1989. Although the focus is contemporary issues, a short historical overview is included. Special attention is paid to the National Library, its collections, activities (including the compiling of the national bibliography), and the Polona National Digital Library project. Other Polish digital libraries are also briefly described, as well as the first fully computerized union catalog called NUKAT. Major topics discussed include library legislation, public, school and research libraries, library networks, and professional education. There is also a brief section concerning archives and a briefer discussion of museums.

INTRODUCTION

Poland is a republic in Central Europe bordered by Germany to the west, Belarus and Ukraine to the east, the Czech Republic and Slovakia to the south, and Lithuania, Russia, and the Baltic Sea to the north. It has a population of 38,500,696 (July 2008 estimate) making it the sixth most populous country in the European Union, which it joined in 2004 (Fig. 1).

Historical Background

The history of Polish libraries began with the Christianization of the country in 966 and the adoption of Latin culture. Cracow's (Polish: Kraków) capitulary library inventories of 1101 and 1110 are the earliest book lists in Slavic Europe. In 1364 King Casimir the Great founded a university in Cracow, which was first called Cracow Academy. This institution was the second university to be established in Central Europe, after Prague (1348). From 1400 onward the library collections of individual colleges started to accumulate quickly. The most prestigious among the colleges was Collegium Maius, which had an important book collection by the sixteenth century, and therefore started to be acknowledged as the main university library. During its entire history, the university in Cracow played an important role in the history of book culture in Poland. The most important function of Polish libraries in the first period of their existence was book collecting, and sometimes book production (copying, illuminating, binding, etc.) Yet the social impact of the collections established at royal or ducal courts, or in religious institutions, was limited to a narrow elite.

The sixteenth century—a time of the Renaissance and the Reformation—has often been called the golden age of

Polish culture. This cultural flowering was stimulated by the spread of printing, and this in turn initiated a new phase of library development. Outstanding humanists, lay and church dignitaries, created their own private libraries; even wealthier burghers started to collect books. The library of King Sigismundus Augustus (d. 1572), which included over 4000 volumes, holds a prominent place among the Polish book repositories of the time. Later on, this extremely valuable collection was dispersed.

During the sixteenth century, Western influence stimulated a new type of library development in Poland: municipal libraries established by city councils. The Renaissance also fostered a deeper understanding and love of books, and elitist bibliophily flourished. Nonetheless the dominant trend was a pragmatic one. Most books purchased were primarily of utilitarian character, in the broadest meaning of the term: professional, intellectual, and ideological. School libraries also appeared during the sixteenth century after the arrival of the Jesuits in Poland in 1565.

The beginning of the seventeenth century is a distinct turning point in the history of Polish printing and librarianship. The Polish–Swedish wars (1601–1639 and 1655–1660) drastically diminished the holdings of Polish libraries. The wars not only brought about an end to some of the private collection (for example, that of the royal Vasa family) they also brought losses and instability to institutional libraries belonging to churches, monasteries, and schools.

The university library in Cracow also was changing during the seventeenth and eighteenth centuries. Even though the Collegium Maius Library was acknowledged as the main university library, separate collections of individual colleges still existed. However, during the eighteenth century, Hugo Kołłątaj (writer, politician, philosopher, and school reformer) initiated the process of



Fig. 1 Map of Poland.

Source: CIA World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/pl.html>.

bringing them together, which resulted in the present day Jagiellonian Library.

The eighteenth century brought chaos and the military defeats of the Saxon period (1697–1763) led to the partitioning of Poland among the neighboring powers of Russia, Prussia, and Austria (1772, 1793, 1795). These events ultimately led to the total annihilation of the Polish–Lithuanian Commonwealth. At the same time, the eighteenth century brought about the flourishing of Enlightenment and the reforms of the country during the reign of King Stanislas Augustus Poniatowski (notably the Constitution of May 3, 1791). The Enlightenment was the time when all types of libraries developed. Eighteenth-century ideology, science and teaching subjected all earlier concepts and ideas to criticism and revision by reason. Book repositories were an essential element in this process. The end of the eighteenth century saw a national uprising orchestrated by Tadeusz Kościuszko (1794), that led to the foundation of modern Polish society, interested in new forms and ideas in culture. School librarianship underwent substantial changes too. This intellectual ferment prevailed in spite of partitions during the subsequent period of national captivity.

Libraries and books played an important part of all those turbulent changes. The institution which impressed its mark on the history and character of Polish librarianship the most, was the Library of the Polish–Lithuanian Commonwealth, commonly referred to as the Załuski Library (in commemoration of the brothers Andrzej Stanisław and Józef Załuski, who founded it). That library

was also a school of professional librarianship. Its holdings brought together a large collection of unique value, abundant in rare prints and exceptional bibliophile specimens. On the basis of that collection, Józef Andrzej Załuski compiled, the nearly complete, multivolume national bibliography: *Bibliotheca Polona Magna Universalis*, the first national bibliography in Polish history. *Bibliotheca Polona Magna Universalis*, which remained in manuscript form, was annihilated alongside the other works of Załuski and the manuscript catalogs of the library in 1944, after the Warsaw Uprising. Only the partial, printed catalogs and bibliographies prepared by Jan Daniel Janocki, librarian, are still in existence.

The Załuski Library formed the foundations of the Polish National Bibliography and of the Polish National Library. The Załuski Library ceased to exist in 1795 when as a measure of repression, after the Kościuszko Uprising it was confiscated and transported to St. Petersburg, where it became part of the Imperial Public Library and several other Russian libraries. Some of its holdings were returned to Poland after the Riga Peace Treaty of 1921, only to be destroyed during World War II. Today, only individual books are in existence.

The most modern of Polish school libraries was the one of the Warsaw Collegium Nobilium (1765–1794). Throughout the country, truly novel solutions, even by international standards, as to managing school libraries were introduced by the National Commission of Education (1773–1794). It created a network of school libraries after the dissolution of the Jesuits' monasteries in 1773, reorganized two university libraries [in Cracow and in Wilno (currently, the capital city of Lithuania)], and set up district and province elementary school libraries. Hence, it can be summarized that the eighteenth century in Poland brought about important developments in librarianship, chief among which were the appearance of public libraries, organization of a network of school libraries, secularization, creation of the Library of the Collegium Nobilium, modernization of collections, cataloging and access, establishment of librarianship as a profession and recognition of its legal status, beginnings of library law, national bibliography, proliferation of bibliophiles, and collecting attitudes.

During the whole of the nineteenth century Poland was partitioned between its three neighbouring countries—Russia, Prussia, and Austria. This had a lasting negative impact on library development. But there were also a positive impact on book culture and libraries. For example, one can observe the development of collecting attitudes among the educated classes, chiefly in the form of bringing together all types of publications concerning Poland, with the intention of preserving Polish culture. The nineteenth century was also the time that works such as the *Bibliograficznych ksiąg dwoje* (1823–1826; Bibliographical Book Duo) by Joachim Lelewel were produced. This outstanding work includes the foundations of the

theory and methodology of the bibliography and its importance cannot be overestimated. Unfortunately it has never been translated into foreign languages.

In the part of Poland occupied by Austria, an impressive public library was opened in Lwów (1827) under the name of the Zakład Narodowy im. Ossolińskich—bibliotheca patria (Ossoliński National Institution—bibliotheca patria). In Prussian Poland, Count Edward Raczyński donated his family collection, chiefly from his Rogalin residence, to the nation. From 1868 Karol Estreicher Sr., author of the monumental national retrospective bibliography (*The Polish Bibliography*) and the reformer of Polish librarianship to the German model, worked on shaping the Jagiellonian Library in Cracow into a modern, European library.

Immediately after World War I, when Poland regained its independence, new libraries were established. The most important was the opening in Warsaw of the National Library (1928), under the direction of Stefan Demby (d. 1939). Some of the specialized libraries, which still exist, were organized in that time: the Library of the Central Statistical Office (1918), the Central Military Library (1919); the Library of Parliament (1919), and The Library of the Silesian Parliament in Katowice (1924). The number of libraries affiliated with higher education institutions rose during the interwar period from 10 to 32. In 1917 the Association of Polish Librarians came into being. Two important journals devoted to library issues started publication: *Przegląd Biblioteczny* (*Library Review*; since 1927) and *Bibliotekarz* (*The Librarian*; since 1919 primarily under the title: *Biuletyn Biblioteki Publicznej m. st. Warszawy*—*Bulletin of the Warsaw Public Library*). Designated libraries started receiving legal deposit copies from publishers.

World War II and the German occupation inflicted grave losses upon Polish cultural heritage in general and Polish libraries and books in particular. The losses are estimated at approximately 75% of all Polish library collections. Many librarians and professionals linked with books and literature were killed. As had happened in the past, during difficult times the activities of the Polish émigrés supplemented the book culture in Poland and were of great assistance.

Polish librarianship made considerable progress again after World War II. New libraries of all types were opened and functioned for the benefit of society. The establishment of the Polish Academy of Sciences in 1950 began a new period in Polish library history. It created new types of libraries that required a different kind of information services. The Library Act of April 9, 1968 provided the legal foundations for modern librarianship in Poland, including the specialization of libraries, interlibrary cooperation, and regulations concerning the licensing of librarians. The current binding act is The Library Act of June 27, 1997. Work is in progress to replace it due to its many shortcomings.

The Communist regime, in accord with its principles, took control over all book collections. During the whole postwar period, until 1989, preventive censorship was enforced by the Main Bureau for the Control of the Press, Publications and Performances in Warsaw, and by its delegations in individual provinces. Repressive censorship also existed. Nevertheless, from 1976 until 1990 (the official end of censorship in Poland) books were often issued outside the official system.

An unquestionable achievement during this period was the creation and upkeep of a network of numerous stable public libraries. Despite the fact that the administrative system changes in Poland did not always have a beneficial effect on the network, the country has provided the means (however modest they were) for the development of public libraries.

Research libraries were also developing due to industrialization and progress in research. This development however was hampered by the political isolation of Poland, problems with access to publications from outside of the Socialist Block and lack of access to technology.

Computerization of library and information processes began in the 1970s but progress was slow. In 1971 the appearance of further legislation, paved the way for the implementation of the National System of Scientific, Technical and Organizational Information SINTO. In practice, however, the system generally remained a concept, not a reality. Work on computerization of libraries was substantially accelerated two decades later. At present, the vast majority of Polish libraries, of all types, are computerized and their catalogs can be searched via the internet. Digital libraries and digitalization have become common practice and all services are directed for benefit of the public they serve. In the 1990s several major library buildings were constructed, among them the new facilities of the University Library in Warsaw (Fig. 2), which have already become an integral part of the largest Polish university and its capital city. In general Polish libraries have made significant progress and simultaneously have developed to better serve a new, democratic society (Fig. 3).

LIBRARIES

Library Legislation

The goals and areas of responsibility of different types of libraries are stipulated in the Library Act of June 27, 1997. The act introduces the concept of a national library network. In 2007 the network encompassed all public libraries (their participation is obligatory) and approximately 20 others, mainly those belonging to higher education institutions. One of the obstacles to the process of extending the network is the obligation imposed by Polish library law, which requires that a library willing to enter the network must apply through their founding bodies, (e.g., ministries,



Fig. 2 The University Library in Warsaw—outdoor sight.
Source: Courtesy of the University Library in Warsaw.

universities, local governments, and The Polish Academy of Science). Only the future will tell whether the national library network will be revived and what shape it will take.

During the transition from the communist system in Poland, which began in 1989, there have been many changes in the spheres of science, education, and culture

and in the field of law, with respect to libraries. The following acts were passed:

- An Act concerning organization and conduct of cultural activities (October 25, 1991; amended in 1994, 1996, and 1998).
- An Act concerning libraries (June 27, 1997).
- An Act concerning the changes of some acts defining the competences of the agencies of public administration with respect to changes in the administrative division of the country (July 24, 1998).
- Amendment of library law (July 27, 2001) which introduced the prohibition of combining libraries with other institutions.

With regards to these matters, the role of the Krajowa Rada Biblioteczna (National Library Council), an advisory body to the Ministry of Culture and National Heritage has been the key. It provides a meeting place for those in authority to learn more about public opinion.

Public Libraries

Public libraries in Poland are open to the general public and their resources are accessible free of charge. Should the need arise to charge the user for any kind of services, such as photocopying or scanning, the payment cannot exceed the costs of the service. Public libraries are simultaneously cultural institutions and information centers. They are organized in such a way as to facilitate easy access to library materials and information for the inhabitants of a given region. Public libraries in Poland are closely connected with and dependent on governmental and/or local administrations. Their activities are financed by the state or by local councils; in most cases they draw upon both sources simultaneously.



Fig. 3 The University Library in Warsaw—interior.
Source: Courtesy of the University Library in Warsaw.

As a result of such close ties with the administration, each change in the administrative structure of the country requires respective changes in the public library network. The last reform of the administrative division of Poland in 1999 introduced a three level system. The number of provinces (Polish: *województwo*) were reduced from 49 to 16, which were then broken down into districts (Polish: *powiat*; previously nonexistent as an administrative unit), and then each district was divided into councils (Polish: *gmina*—the smallest territorial unit). The current network of public libraries therefore consists of three levels reflecting the territorial division of the country. The lowest level is the level of council or local libraries. Each council is required to organize and support at least one public library with an appropriate number of branches and library outlets. The district is also required to organize and provide for at least one district public library, while the self-governing authorities of a province are obliged to organize and support at least one provincial public library. Professional guidance for all public libraries is the responsibility of the National Library.

In 1989 there were 10,313 public libraries, 3342 of which were located urban areas, and 6971 in rural areas. In 2007 there were 8489 libraries (2871 urban and 5618 rural). The decline in total numbers equals about 17%. On occasion small libraries are closed and their responsibilities are taken over by larger libraries. In some cases the reasons for dissolution of a library are cost savings. There are eighteen provincial libraries (two of the provinces have two provincial public libraries each). In 2008 due to the importance of their holdings, their activities and the qualifications of their staff, 12 provincial public libraries were awarded the status of public research libraries.

The number of registered readers is slowly but steadily rising. In 2007 about 6.7 million readers (commonly known as borrowers) were registered, most of them in urban areas. (For context, the total number of the Polish citizens is about 38.5 million). Looking at the statistics of the age of users of public libraries, we find that the largest group consists of those aged 19 or younger and these school age users make up almost half of the total. Persons 60 years of age or older represent the smallest group of library users. A review of readers' professions demonstrated that farmers are the least interested in public libraries (0.9% of the total).

A section for children and young adults (below 15 years old), can be found within public libraries; sometimes there are also separate collections for children. In urban areas there are some branch libraries especially for children and young adults. Some public libraries function as a part of another institution, such as a school (as joint public/school library) or a cultural center. These libraries do not have independent legal status because they are an integral part of the parent institution. In 2006, there were 2002 public libraries functioning within the structures of other institutions, including 250 joint public/school libraries.

From the point of view of the average person, public libraries are the most important type of libraries in Poland because they are legally mandated to be open to everybody without regard to his/her nationality, place of residence, educational status, or social background. Public libraries respond to the needs of the largest groups of users, thus forming an image of "the library" in most minds.

One can follow the most recent developments thanks to the bulletin *Public Libraries in Figures*, an invaluable publication to be found on the Internet (http://www.bn.org.pl/doc/bpwl_2006_pl.pdf), although the latest issue shows the data from 2006. National statistics that include libraries, museums, archives, etc. are available on the Internet on the Web page of the Central Statistical Office: http://www.stat.gov.pl/gus/45_737_PLK_HTML.htm The current list of libraries in Poland is available on the Internet <http://www.ebib.info/biblioteki>.

School Libraries

The activities of public libraries are complemented by school libraries. School libraries are the most numerous type of library; they are administered by the Ministry of Education. Every school in Poland is obligated to have a library, often called a media center. Their holdings consist of 156 million volumes; 151.8 million of these volumes are in schools for children and young adults, i.e., 20 million volumes more than in the public libraries network. This gives an average of 22 books for every student (in schools for children and young adults: 24) and for every school an average of 3907 volumes (in schools for children and young adults: 4577). Through their efforts in promoting reading and the use of other media, and through offering training in information literacy skills, school libraries play a key role in the preparation of future readers, media users and information seekers. School librarians in Poland enjoy the status of teachers and the title of "teacher-librarian." Other teachers are assisted by the librarians in their daily teaching work, in continual training, development and upgrading of their own skills and knowledge, and in introducing new forms and methods of teaching. School libraries also cooperate with parents, school staff, and other libraries.

RESEARCH LIBRARIES

Research libraries hold an important place in the Polish library system. Among these we distinguish the National Library, the libraries of the Polish Academy of Sciences, libraries of research and development units, and other libraries which support research and conduct research activities themselves, like those of higher education institutions. A library receives research library status on the basis of the character of its holdings, types of users served,

its activities, and the qualifications of its staff. In 1999 there were 1209 research libraries; this figure includes: the National Library; 981 libraries in higher education institutions; 98 libraries in research units of the Polish Academy of Sciences; 92 branch research and development units, and 9 public libraries.

In 2005 there were 1219 research libraries, which included 1 National Library, 1005 higher education institutions, 82 research units of the Polish Academy of Sciences, 89 branch research and development units, and 42 others, including 12 public research libraries.

One of the largest and most famous research libraries in Poland is the *Jagiellonian Library* (Polish: *Biblioteka Jagiellońska*, commonly known as *Jagiellonka*). Already in 1364 the Jagiellonian Library was considered the main library for the entire university. During the partition of Poland, the library continued to grow thanks to the efforts of such people as Jerzy Samuel Bandtkie, and Karol Estreicher Sr. Its collections were made public in 1812. In 1932, the Library was granted legal deposit status and obtained the right to receive a copy of every book printed in Poland by a Polish publisher. It has a large collection of medieval manuscripts, among them is the famous *De Revolutionibus orbium coelestium* by Copernicus. In 2007 the Library holdings were about 6.3 million volumes and on average 650,000 people visit the Library each year.

The Jagiellonian Library together with the Medical College Library and the departmental and chair libraries make up the library-information system of the Jagiellonian University. Thanks to its importance, its extensive collection of Polish publications and staff qualifications, the Jagiellonian Library is known as another national library. Currently, the Library collects and archives all Polish publications printed in Poland and abroad. The Library also collects foreign scholarly literature in fields related to the University's areas of research and coursework. Priorities include cultural studies, linguistics, literary studies, art, and religious studies. In the 1990s several priceless books (including Galileo, Johannes Kepler, Basilius Bessarion) were stolen from the library, presumably in order to be sold outside Poland. Some of them were recovered from an auction in one of the German auction houses.

The largest group among research libraries consists of the libraries of higher education institutions. These are organized in the form of an academic library network, which includes: the main library, libraries of individual faculties, institutes, chairs, centres, etc. The holdings of the main library cover all the fields of knowledge studied at the institution as opposed to the other libraries of the school's network, which are specialized.

There are also research libraries in nongovernmental institutions of higher education. In 2007 there were slightly more than 300 such institutions, but only one-third of them had a library.

Many of the research libraries cooperate to create a union catalog called NUKAT (Polish: *Narodowy Uniwersalny*

Katalog Centralny—National Universal Union Catalog; <http://www.nukat.edu.pl>). NUKAT is managed by the NUKAT Centrum which is an organizational unit of the University Library in Warsaw. The objectives of NUKAT are

1. Furnishing information concerning documents and their location.
2. Allowing for copying by local catalogs of bibliographic and authority records.
3. Acceleration of the cataloging efforts in individual libraries.

NUKAT is a catalog with a single, extensive central database of bibliographic and authority records. In mid-February 2009 the NUKAT database contained 1,231,492 bib records (almost 52,000 of which were for periodicals) and nearly 2,555,873 authority records (both name and subject headings). Over 900 librarians, employed in 60 libraries (chiefly in institutions of higher education), cooperate in the ongoing creation of NUKAT. Since 2005 this body had also included the National Library. However as of August 1, 2007 the National Library withdrew from the project. NUKAT primarily contains bibliographic records of recently acquired materials (since July 2002) of the cooperating libraries; in addition there are a certain, still growing, number of records which are the effect of retroconversion. Since 2006 NUKAT cooperates with OCLC. However, if one is looking for a document issued prior to 2002, it is better to use the search engine *KaRo* (<http://www.karo.umk.pl>).

Since 1992 some of the research libraries also cooperated on creating the subject headings system KABA, which is a universal system, with a relatively large vocabulary. Initially it was supposed to be compatible with the three subject headings systems used internationally: the American Library of Congress Subject Headings, the French RAMEAU, and the Canadian RVM. From 2006 the requirement of compatibility started to be treated less seriously. There are 22 libraries creating the KABA system, which was being implemented by a 30 additional libraries. In mid-February 2009, the KABA authority files (<http://www.nukat.edu.pl/nukat/pl/kaba.phtml?sm=5&poz=3&id=73>), which have never had a hard copy version, contained about 265,000 records for topical headings and about 1,126,000 records for heading-subdivision combinations.

The National Library

The National Library – Polish: *Biblioteka Narodowa* (<http://www.bn.org.pl>). At present, the National Library (Figs. 4 and 5) is under the authority of the Ministry of Culture and National Heritage. It is regulated by The Act concerning libraries, and by the Statute of the National Library, issued by ordinance No. 4 of the Minister of Culture and National



Fig. 4 The National Library in Warsaw—outdoor sight.

Source: Courtesy of the National Library in Warsaw.

Heritage (July 6, 2000). The above-mentioned legislation stipulates that the National Library is the central book repository of the country and one of the main cultural institutions of the nation. The National Library is responsible for conducting library, bibliographical, research, informational, conservational, advisory, editorial, and service activities. In particular, it is responsible for

1. Collecting, cataloging, informing, and preserving library materials, produced in Poland, and those published outside the country, if they are related to Poland.
2. Preparation and publishing of the national bibliography.
3. Conducting research in the field of librarianship, book, and related sciences.



Fig. 5 The National Library in Warsaw—interior.

Source: Courtesy of the National Library in Warsaw.

4. Improving the functioning of libraries in Poland and Polish libraries outside of Poland.
5. Administering the centers responsible for assigning ISBN, ISSN, and ISMN.

The National Library collects manuscripts, old prints released by Polish publishers, contemporary publications, graphical, audiovisual, and electronic documents, as well as Polish publications issued outside of Poland, and foreign publications concerning Poland.

The initial basis for the creation of a complete archive of national publications is the law promulgated in 1927, by which the National Library received a legal deposit copy of all documents issued in Poland. Under current law The National Library receives two copies of every book, periodical, newspaper, musical notation, atlas, Brail publication, musical recording, audiovisual document, and electronic materials, leaflets, and gray literature. Currently work is in progress to take over the collections of the National Film Repository in Warsaw. As a consequence of this, the National Library will also receive a copy of every cinema and television production. Each year the National Library receives between 140,000 and 170,000 documents of various types, 75% of which belong to the category of legal deposit copies. The remainder are purchased, received as a bequest, or obtained through exchange programs. Through purchasing old works pertaining to national heritage, which appear on the antiquarian market, the library is rebuilding its former collections that were destroyed during times of war. All the Polish publications and valuable foreign items constitute a National Library Archive, and are therefore under additional protection. All Polish printed work and those which are related to Poland are gathered in at least two copies, one of which, listed as "A"-type copy, is accessible to the reader only in exceptional cases and exclusively in the reading rooms. The "A"-type objects form the archival, specially protected, holdings of the National Library.

The National Library is in possession of the oldest specimens of writing in the Polish language: the *Świętokrzyskie Sermons* (mid-fourteenth century), *St.-Florian Psalter* (Fig. 6) (late-fourteenth century), and the *Przemyskie Meditations* (fifteenth century). Among the more valuable manuscripts that represent the European literary heritage are

- The *Braniewo New Testament* (late-eighth to the early ninth centuries).
- The *Evangelary of Anastasia* with a silver, binding adorned with gold plate (twelfth century).
- The *Wilanów Psalter* (ca. mid-thirteenth century).
- The *Roman de la Rose*, fourteenth century.
- The *Calendarium Parisiense*, fourteenth century.
- The *Revelationes sanctae Brigittae* fourteenth century.
- The *Legenda aurea* (ca. 1480).
- The *Cosmographia* (1467)—an early copy of Ptolemy's Geography.

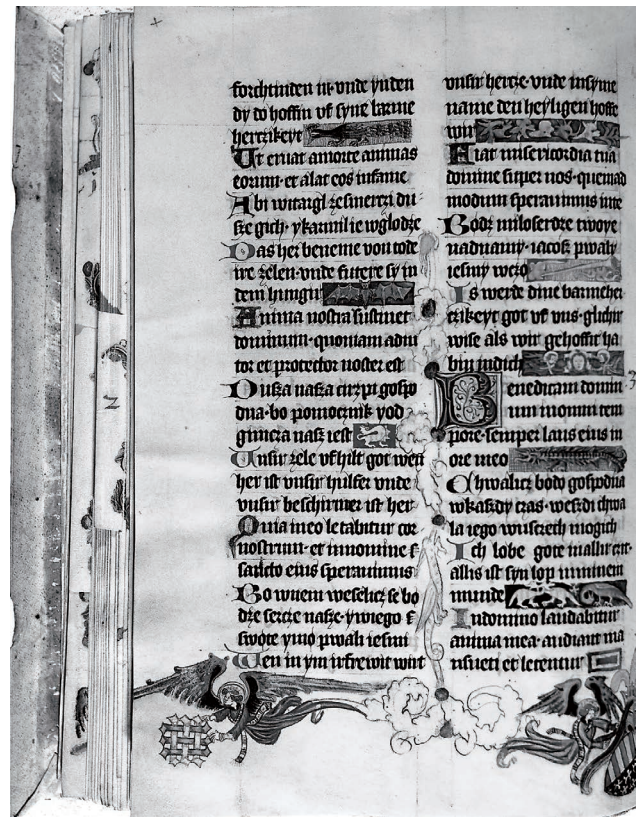


Fig. 6 Florian Psalter.

Source: Courtesy of the National Library in Warsaw.

(cf. *More Precious than Gold*—http://www.bn.org.pl/doc/nzd_eng.pdf).

The materials in the National Library are of special interest to the historians of the Napoleonic era and of the history of the November Uprising (1830–1831), for art historians and for those working on the history of the Polish peasantry at the turn of the nineteenth and twentieth centuries, as well as for those interested in the history of the Polish socialists. The collection of over 10,000 volumes that belonged to the Schaffgotsch family of Cieplice, has substantially supplemented the Silesian materials. The library of the freemason lodge B'nei Brith, which was dissolved prior to World War II contributed numerous (2600) volumes of freemason publications. Philologists and historians of literature are particularly interested in those books, which came from collections belonging to Polish writers and bibliophiles. The collection of Polish scientific and technical literature, in particular with respect to older works, is less comprehensive than in other fields.

There are numerous periodicals from the early nineteenth century. The same applies to the January Uprising (1863–1865), with the caveat that this collection is supplemented by an extremely valuable set of periodicals, circulated illegally during the years 1861–1864 and a collection of émigré periodicals of the nineteenth century in general. There are also rare complete sets of nineteenth

century socialist publications, as well as agricultural periodicals of the same period and a formidable collection of calendars, taken over from the former Krasieński Family Library.

In spite of the gaps—the results of war losses—there is a fairly complete set of Polish periodicals from the interwar period, in particular those issued during the years 1927–1939. The collection of World War II conspiratorial periodicals ranks among the most extensive in the country. In addition, the National Library is in possession of the largest collection of microforms in Poland, which at the end of 2005 numbered nearly 242,000 units. Within this collection are 2500 units of unified sets of Polish periodicals that are of special value, encompassing materials beginning with seventeenth century special issues through to twentieth century journals. Single existing copies of these periodical issues were found in various collections and microfilmed, thus providing a full run and enabling wider access and scholarly use. Among the collections of ephemera, one can find leaflets dating back from 1801 to 1930 (e.g., parliamentary speeches, military orders, tsarist proclamations); from the November Uprising of 1830–1831; the Cracow Revolution of 1846; the Spring of Nations (1848); the January Uprising of 1863–1865 (proclamations, circulars, and manifestos of the National Government), and from World War I. There is an abundance of materials from World War II: the September Campaign in Poland (1939) and the German occupation. Finally, there are numerous valuable and rare posters.

By the end of 2007, the National Library contained more than 7 million items;

5,795,710 belonging to the main collection

- 2,496,480 volumes of books issued after 1801.
- 869,200 volumes of periodicals issued after 1801.
- 2,202,259 items such leaflets, grey literature, etc.
- 215,157 items of bibliological (book studies) special collections.
- 12,614 electronic documents.

1,385,934 items from special collections

- 26,810 manuscripts.
- 161,879 volumes of old prints.
- 119,257 units of printed musical notations.
- 106,935 units of musical and audiovisual units.
- 482,769 units of iconographical documents.
- 119,058 cartographical units.
- 266,993 microforms.

In 2002, with preservation in mind, as well as to create wider access and in accord with global trends, the National Library started to digitize its collections. In January 2003 a special agreement was signed with the University Library in Warsaw, aimed at creating a Digital Collection of Polish Periodicals. This collection of nineteenth century Polish periodicals is being created on the

basis of the microfilms made in the University Library. On October 11, 2006, with both library and Internet users in mind, the National Library launched the Polonal National Digital Library project (Polish: *cyfrowa Biblioteka Narodowa Polona*, cBN Polona; <http://www.polona.pl/dlibra>). The admission of Poland to the European Union in 2004 opened new areas of research and information activity. The National Library, as one of the ten national libraries of the new member states, participates in the TEL-ME-MOR project, aimed at unifying the access to the electronic holdings of the European national libraries and library services. As a result it became a partner of The European Library (TEL), and the holdings of the Polish National Library can be researched through the TEL portal.

NATIONAL BIBLIOGRAPHY

The current Polish national bibliography registers all documents published in Poland, notwithstanding their language or the nationality of the authors. It also registers documents published outside Poland, but related to her by subject matter, language, or the origins of the author. The aim is to provide as much as possible, a complete picture of the publishing production of the nation and the country. The current Polish national bibliography consists of four parts, all of which are prepared by the staff of the Bibliographical Institute of the National Library:

1. *Przewodnik Bibliograficzny* (Bibliographical Guide).
2. *Bibliografia Wydawnictw Ciągłych* (Bibliography of Periodicals).
3. *Bibliografia Zawartości Czasopism* (Bibliography of the Contents of Periodicals).
4. *Polonica Zagraniczne. Bibliografia* (Polonica Published Outside Poland: A Bibliography).

Przewodnik Bibliograficzny is a continuation of the interwar *Urzędowy Wykaz Druków wydawanych w Rzeczypospolitej Polskiej* (Official List of Printed Matter Published in the Republic of Poland), which was revived in 1946. At first it appeared irregularly, but since 1948 it has been published weekly. It is based primarily on the legal, signal copies sent to the National Library by the publishers. According to internationally acknowledged guidelines a national bibliography is to register books and the first issues of periodicals. *Przewodnik Bibliograficzny* registers also cartographical documents (maps and atlases, but not contour maps), musical prints (scores, songbooks, musical notations), graphics (but without single page prints), conference materials notwithstanding the number of copies issued, nor the physical form (e.g., bound folder), scholarly theses, notwithstanding their editorial form and destination, as well as bibliographical lists and Braille editions. It is not a complete bibliography. Iconographical documents are not included, neither are

sound recordings (since 1990 they are registered in the database called The bibliography of sound recordings), nor gray literature, while electronic documents have only been registered since 2001 (Bibliography of Electronic Documents; a supplement to the *Przewodnik Bibliograficzny*). Each year, approximately 25,000 bibliographic entries are registered. It is estimated that about 15% of the books and other materials issued in Poland are not registered in the bibliography due to the fact that the publishers fail to send in the legal deposit copies to the National Library. Starting in 1986, *Przewodnik Bibliograficzny*, has also been available in an electronic form, through the home page of the National Library. *Przewodnik Bibliograficzny* has a bimonthly supplement, which has appeared since 1976, registers new and suspended periodicals as well as title changes. During recent years it has registered about 1300 titles of periodicals.

Bibliografia Wydawnictw Ciągłych until 1981 appeared under the title: *Bibliografia Czasopism i Wydawnictw Zbiorowych* (Bibliography of Periodicals and Collective Editions); It is currently an annual publication that registers periodicals appearing in Poland. This bibliography registers approximately 5000 titles every year and has appeared regularly since 1996. Retrospective materials, which did not appear in print as current yearly volumes, are accumulated and prepared for publication as single volumes covering 5 years.

Bibliografia Zawartości Czasopism is a monthly publication that has appeared since 1947. It registers approximately 55,000 bibliographic units, mainly articles, each year deriving from over 1300 periodicals (chiefly scholarly). It covers all subject matter, although some of the topics (e.g., medicine, agriculture, military) are very sparsely represented, due to the existence of appropriate specialized bibliographies. Since 1996 this bibliography has also been available on CD ROM, and since 2005 it has been published exclusively in an online version.

Polonica Zagraniczne. Bibliografia is published annually and has appeared independently since 1956. Initially foreign polonica was registered together with the current bibliography of books. At present this bibliography registers about 2400 bibliographic descriptions every year, half of which are taken from 30 foreign national bibliographies and databases. It encompasses books, musical notations, maps, individual literary pieces published in collective publications and larger fragments of book publications in the Polish language, by Poles, or related to Poland by subject matter.

Apart from those mentioned above, a number of specialized bibliographies appear regularly:

- *Bibliografia Filozofii Polskiej* (Bibliography of the Polish Philosophy).
- *Polska Bibliografia Lekarska* (Polish Medical Bibliography).

- *Polska Bibliografia Literacka* (Polish Literary Bibliography).
- *Polska Bibliografia Wojskowa* (Polish Military Bibliography).
- *Polska Bibliografia Prawnicza* (Polish Legal Bibliography).
- *Polska Bibliografia Ekonomiczna* (Polish Economical Bibliography).
- *Polska Bibliografia Bibliologiczna* (Polish Bibliography of Library Science).

There are also numerous retrospective bibliographies, like the *Bibliografia polska* (The Polish Bibliography) initiated in 1870 by Karol Estreicher, Sr. and continued by his son Stanisław, and then by his grandson Karol Jr.; *Bibliografia historii polskiej* (Bibliography of Polish History) by Ludwik Finkel; *Literatura polska od początków do powstania styczniowego* (Polish Literature from the Beginnings to the January Uprising) by Gabriel Korbut (the second edition brought it chronologically until World War I); *Bibliografia literatury polskiej: "Nowy Korbut"* (Bibliography of Polish Literature: "The New Korbut").

All these bibliographies, despite the extensive expertise and precision of their compilers, usually still have one common weakness—they have no online version.

Digital Libraries

The first digital library in Poland, the Polska Biblioteka Internetowa (<http://www.pbi.edu.pl>), was unsophisticated from a technological standpoint, usually employing simple html Web sites with links to individual publications. As the digital libraries grew in size, they were supplied with search engines and metadata systems. They are orientated toward scanning and making available the generally recognized canon of culture (literary classics, historical heritage) no longer protected by copyright law. A major breakthrough came with the advent of the dLibra software (original Polish product). Its first implementation was the Wielkopolska Biblioteka Cyfrowa (2002). In mid-February 2009 the number of dLibra libraries exceeded 30.

There is no doubt that the most important implementation of dLibra is Polona by the National Library. The objective of the project is providing free of charge broad, general access to digital holdings. The unique character of the collections of the National Library was the chief factor considered in working through the guidelines for Polona. The highest priorities for digitization were the most valuable holdings, such as rare manuscripts, old prints, first editions of great works of Polish literature, and the conspiratorial World War II documents—all of which are seldom displayed in public. Such documents are no longer protected by copyright law. These publications are described using the Dublin Core Metadata Set. It was decided that the documents digitized and published in

Polona will not receive an independent bibliographic and library registration, therefore they will not be treated as separate entries in the catalog of the National Library. Exceptions to this rule will be made for documents enhanced in some way with respect to the original, e.g., created from selected fragments of the original, or compiled of several original documents. In such cases they will be considered as new publications. Full-time work on the creation of Polona commenced in July 2006. By the end of January 2009 the library numbered almost 16,000 units.

Over the last few years global tendencies in digital libraries have pointed to the centralization of smaller projects and the creation of great national or even international virtual libraries. Europe has the European Library (TEL) and the European Digital Library (EDL). Do we see the same tendencies in Poland? The network of digital libraries, which operates in Poland now, demonstrates that the collections available on the Internet are strongly regionalized. Should this process be assisted and preserved? It is hard to answer.

In the context of digitalization it is worthy of mention that in Poland there is only one periodical devoted to library issues published exclusively in electronic form: the *Biuletyn EBIB*, appearing in monthly intervals since April 1999. Each issue has a thematic character dealing with current matters and a different editor. This journal is an element of a wider Internet service for librarians—the electronic platform of the Association of Polish Librarians (<http://ebib.oss.wroc.pl>).

Professional Education and Training of Librarians

In contemporary Polish, the term “librarian” means a qualified employee of a library. The qualifications in question encompass either a diploma in library and information science from a higher education institution or higher education in another field and a postgraduate course in library and information science. In Poland, one still finds library personnel with professional training at the secondary level, but this group is constantly diminishing in numbers. There is also another category of library staff, librarians of higher professional status (commissioned librarians and commissioned specialists in documentation and information science), who are research workers. To achieve commissioned status one is required to have a degree, have an appropriate length of employment in libraries or information centers, publish scholarly works, attend conferences, have certified knowledge of at least one foreign language, and pass an exam before a state commission authorized by the Minister of Science and Higher Education.

The first chair in library science, to train librarians, was established at the Humanities Faculty of the University of Łódź in 1946; it was headed by Jan Muszkowski. Next came the Chair of Library Science opened by Aleksander Birkenmajer within the Philological Faculty of the

University of Warsaw (1951) and a similar institution supervised by Karol Głombiowski at the Philological Faculty of the University of Wrocław (1956). In 2008 there were 13 units in Poland, which offer programs in library and information science (University of Warsaw, University of Wrocław, Jagiellonian University in Cracow, Silesian University in Katowice, Marie Curie-Skłodowska University in Lublin, Białystok University, Szczecin University, Adam Mickiewicz University in Poznań, Nicholas Copernicus University in Toruń, University of Warmia and Mazury in Olsztyn, Gdańsk University, University of Łódź, King Casimir the Great University in Bydgoszcz, Pedagogical University in Cracow, and Świętokrzyska Academy in Kielce). Training is offered in the form of standard MLIS studies, consisting of two levels (a 3-year BLIS and a 2-year MLIS), both regular and part-time (extramural) studies. Post-master courses for university graduates in other fields wishing to pursue a library career are also available. Some of the aforementioned university centers, e.g., Institute of Information and Book Studies of the University of Warsaw, also offer post-master PhD studies. The quality of training is overseen by an independent interuniversity commission and a state commission (Państwowa Komisja Akredytacyjna—State Commission for Accreditation) authorized by the Ministry of Science and Higher Education.

The largest Polish library school is the Institute of Information and Book Studies of the University of Warsaw. In 1999 the 5-year masters program was divided into two independent cycles: 3-year BLIS and 2-year MLIS studies. Moreover, the Institute runs four post-master professional programs and doctoral studies. In 2007, approximately 1500 students, including approximately 350 full-time, 850 extramural, and 300 students in postgraduate studies attended the Institute. The Institute employs 38 full-time and 3 part-time research and didactic staff, including 16 full professors. (Fig. 7)

Organizations Supporting the Activities of Libraries and Librarians

There are several organizations that support librarians and libraries, including

- Stowarzyszenie Bibliotekarzy Polskich (Association of Polish Librarians).
- Polskie Towarzystwo Informacji Naukowej (Polish Society of Scientific Information).
- Polskie Towarzystwo Bibliologiczne (Polish Bibliological Society).
- Konferencja Dyrektorów Bibliotek Szkół Wyższych (Conference of the Directors of Higher Education Libraries).
- Towarzystwo Nauczycieli Bibliotekarzy Szkół Polskich (Polish Schoolteachers–Librarians Society).



Fig. 7 The Institute of Information and Book Studies of the University of Warsaw—logo.

Source: Courtesy of the Institute of Information and Book Studies of the University of Warsaw.

The Association of Polish Librarians is the largest and the most important among these organizations and was established in 1917. It brings together over 9000 members representing various types of libraries, although most members are from public libraries. Members of the Association can join task teams which are dedicated to particular issues of library theory and practice. Among the most important of these 16 task teams are the following: the Subject Cataloging and Classification Commission, the Automation Commission, the Private Higher School Libraries Section, the Regional Bibliography Team. The Association publishes five journals devoted to library and information science of national character. These are: *Bibliotekarz* (*The Librarian*, a monthly published since 1919 in cooperation with The Warsaw Public Library); *Przegląd Biblioteczny* (*Library Review*, a quarterly published since 1927); *Poradnik Bibliotekarza* (*Librarians' Guide*, a monthly published since 1949); *Zagadnienia Informacji Naukowej* (*Journal of Information Science*, published twice a year since 1963 in cooperation with the Institute of Information and Book Studies, University of Warsaw), *Biuletyn Zarządu Głównego Stowarzyszenia Bibliotekarzy Polskich* (a quarterly published since 1993). In all, about 40 library and information science periodicals of scholarly, popular, and professional character appear in Poland. The Association of Polish Librarians also has a publishing office, which is especially known for the series *Science-Didactics-Practice*.

In Poland libraries themselves are members of a group of cultural institutions. Of special interest are: the Book

Institute (<http://www.instytutksiazki.pl>), National Film Library (<http://www.fn.org.pl>), and the Polish Audiovisual Publishers (<http://www.pwa.gov.pl>).

MUSEUMS

The first museum in Poland was established by Duchess Izabela Czartoryska in 1801. At the end of 2007 there were 720 museums and nearly 300 art galleries in Poland, and among one can find the Museum of Children's Literature, a branch of The Warsaw Public Library (The Central Library of Mazovian Province) which was opened in 1938. Its collections encompassed 42,000 volumes of books and periodicals: Polish fiction for children and young adults, works of popular science (excluding school textbooks), periodicals for children, works on the theory of children's literature, biographies, bibliographies, and dictionaries. Literary classics and books bestowed by acknowledged international institutions are among the foreign literature found there. The foreign language section forms approximately 30% of the holdings. In accord with its name the Museum collects books of antiquarian value. It possesses numerous rare volumes published prior to 1900. The Museum is also conducting publishing activities, by issuing a new volume of the *Bibliografia z zakresu historii i krytyki literatury dla dzieci, bibliotekarstwa i czytelnictwa dziecięcego* (*Bibliography of history and critics of children literature, librarianship, and readership*) every year.

ARCHIVES

State archives in Poland are supervised by the General Director of State Archives, who in turn is answerable to the Minister of Culture and National Heritage. The General Director controls the state archives through his Head Office of State Archives (Polish: Naczelna Dyrekcja Archiwów Państwowych; <http://www.archiwa.gov.pl>). The main responsibilities of this office are the supervision and protection of the state archival holdings. In 2007, the archival network in Poland included: 30 state archives, 48 regional branches and 4 affiliated units of state archives, 3 central archives (Central Archives of Historical Records, Central Archives of New Records, National Digital Archives) and the State Archives of Personal and Payment Documentation. These repositories gather materials produced by local and central state institutions, law courts, self-governing administrations (including acts of town authorities), commercial and manufacturing organizations, family archives, landed estates, private persons, and regional institutions. Most of the materials kept in archives come from the nineteenth and twentieth centuries; however, in some cases charters can date as far

back as the Middle Ages. It is perhaps worth mentioning, that during the communist regime, there were no archives for local governmental institutions in Poland (or at least that is what was said). Archives for local government institutions, officially came into existence only after 1989.

In addition to those mentioned above, there are also other types of archives:

1. Specialized archives (11), which are responsible to respective ministries (e.g., the Archives of the Ministry of Foreign Affairs; Central Military Archives; Archives of the Parliament) and collect documents produced by those ministries and their organizational units.
2. Archives with deposited collections (for limited and unlimited periods of time).
3. Archives of individual state administrative units (offices, institutions, industrial organizations), which gather materials produced by their mother institutions (including records destined for perpetual keeping);
4. Archives of political parties, trade unions, public organizations and associations, churches, and religious organizations. Archival materials are also to be found in numerous libraries (mainly research libraries) and museums run by the state and by local governments.

Three of the central archives are located in Warsaw:

1. Archiwum Główne Akt Dawnych (Central Archives of Historical Records; <http://www.agad.archiwa.gov.pl>).

The Central Archives of Historical Records were established during the Napoleonic period in 1808, as the General Archives of the Country. At present it stores the records of central and regional authorities produced prior to 1918, archives of the more important Polish families, and cartographic collections (seventeenth to twentieth centuries). As a result of the losses inflicted during World War II, this archive consists of only 7 km. of acts. It also includes a library consisting of over 22,000 volumes of books and periodicals, and about 600 titles of old prints.

2. Archiwum Akt Nowych (Central Archives of New Records; <http://www.aan.gov.pl>);

The Central Archive of New Records, was established in 1919 as a Military Archive. This archive has been known under its current name since 1930. It currently holds records of central government institutions, produced after 1918, and all national institutions and associations, as well as important individuals in political and public life.

3. Narodowe Archiwum Cyfrowe (National Digital Archives; <http://www.nac.gov.pl>).

On March 8, 2008, the Archives of Audio-Visual Records, founded 1955, have been transformed into the National Digital Archives (NDA). The aim of NDA is to provide digital files as a response to the development of recording, storing, and access technologies. NDA is obliged to

- Archive digital materials, including digital documents.
- Archive photographs, films, and sound recordings.
- Create digital files of hard copy materials.
- Share information about archives and make the collection accessible online.

In addition to the digital collection, the NDA also manages traditional archive materials. The NDA's collection contains almost 14 million photographs (including the oldest tintypes and daguerreotypes), 30,000 sound recordings, and 2500 films.

Until the late 1980s, Polish archives did not have any computers at their disposition. As time progressed this situation gradually started to change. The computerization of the state archives is supported by the Centralny Ośrodek Informacji Archiwalnej (Centre for Archival Information), a section of the Head Office of State Archives. In 2003 the Head Office of State Archives conceptualized the idea of an Integrated Digital System of the National Archival Holdings. The goals of the system were stated as follows: enhancement of the effective management of the national archival holdings; design of an effective and user-friendly system of archival information; facilitation of access to digital archives; attaining compatibility of the archives with the needs of online governmental administrations; and creation of an archival research network, which would integrate archival information holdings, with the holdings of library and research networks.

The archives have at their disposal a certain number of databases that enhance, to a certain extent, the exchange of archival information and provide better management of archival holdings. The databases in question are as follows: SEZAM (system of organising of archival holdings), PRADZIAD ("grandfather "birth, marriage, and death records register), SCRINIUM (register of documents dated prior to 1800), IZA (register of inventories of archival fond), KITA (technological computer information), ELA (people registering in archives), SUMA (system of archival material accessing), NADZÓR, RAP (register of archival research).

As of 2007, approximately half of the state archives had their own Web sites. The Central Archive of Historical Records is an exemplary case, with numerous inventories in the Encoded Archival Description (EAD) format accessible through the Internet or the Crown Metrica

search engine, which enables researching preparation act registers, of the Polish central government (<http://www.agad.archiwa.gov.pl/metodyka/metodyka.html>). This archive is currently developing an online order form for accessing archival records.

Computerization confronted the Polish archives with new challenges. Information systems require precision and therefore standardization becomes a necessity. Works on the Polish standard FOPAR were started in 1987. In practice, the archives did not choose the FOPAR standard, but adhered to the ISADAG (International Standard Description—General). Decision No. 4 of the General Director of the State Archives issued on February 1, 2005 concerning the structure and contents of the computer databases created and managed by the state archives, obliged the archives to use the ISADAG standard (http://archiwa.gov.pl/repository/decyzje/dec_4_2005.pdf).

The ISAD(G) standard has its Polish version. Six elements of the original have been considered as important for the international exchange of information and have been made compulsory: country code, archive, fond, shelf mark, title, date, level of description, size, and creator. The other elements of the description of the archival object are optional. The information on the object is inscribed into the EAD standard, which is managed by the American Library of Congress. ISAD (G) and EAD enable the description of archival objects at the level of the fond, series, subseries, inventory unit, and even individual document. Such a description can be supplemented by a digital object.

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Politics of Representation in Museums

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Abstract

This entry begins by examining key words, “politics,” “power,” and “representation,” as they relate to the museum. It then moves on to explore how the politics of representation have been manifested in displays. A range of exhibitions is examined, particularly in national, art, and ethnographic museums. The entry posits the case that museums are not simply neutral containers of objects, but are ideologically loaded spaces, and it demonstrates how museum displays have, over the past decades, become politically charged battlegrounds between differing communities.

INTRODUCTION

The political implications of representation in museums have come under mounting scrutiny over the past 20 or so years. The authority of the museum has been disputed, with the exhibitions becoming increasingly the subject of debate. This entry begins by reviewing theories of power and representation in the museum. It examines how these institutions have traditionally reflected the values of societal élites. It will be argued that museums are not neutral frames through which objects are viewed, but places where ideologies are manifested through the positioning and interpretation of objects on display.

The focus moves to the documentation of key exhibitions where the politics of display has come to the forefront of debate. Sections are organized around different museum types—national museums, art museums, science museums and finally, and perhaps most controversially, ethnographic museums.

MUSEUMS, POWER, POLITICS

Displays of power have always been what museums do.^[1]

If we consider the premise that, at its most general level, politics is associated with the workings of power,^[2] then museums have always been “political.” Since their inception these institutions have been embedded within, and represented, power structures in society. Many cabinets of curiosities of the sixteenth to seventeenth centuries (which were the precursors of the modern museum) began as elitist institutions designed to limit access to privileged classes.^[3] Such early collections often operated as status symbols for the aristocracy and royalty in Europe.^[4]

The modern museum emerged in the late eighteenth to early nineteenth centuries in an era of global politics and colonial domination, and when the vast collections of

Royal families in Europe were transferred to public ownership. The most renowned instance of the transformation of a formerly private collection to a politically charged symbol of a new regime is the Musée du Louvre, which opened in Paris in 1793. By the end of the nineteenth century, every Western nation had at least one major public museum. As collections shifted from private to public, so museums consolidated their social status, becoming bastions of European society. For authors such as Tony Bennett, “. . . their central message was to materialize the power of the ruling class. . . in the interest of promoting a general acceptance of ruling-class cultural authority.”^[5]

While museums historically formed part of systems of prestige, they continue to be associated with status and power today. Just as in the nineteenth century in Europe and North America when museums were established to consolidate wealth, so in places such as China, new building projects—in Beijing, Nanjing, and Shanghai—are being harnessed to assert China’s growing influence in the twenty-first century. There will be 1000 new museums built in China in the next decade and Shanghai alone is planning to open 150 by 2010.^[6] Macdonald characterizes such contemporary museums as “global symbols” through which “status” and “community” are expressed.^[7]

A number of influential authors have analyzed the operations of power in the museum. For example, Tony Bennett argues that in the nineteenth century museums became an important component of cultural governance, involved in processes of regulating the moral, mental, and behavioral characteristics of the population.^[8] Bennett notes that the spatial configuration of the nineteenth century museum—the balconies and courtyards, and display cases arranged along evolutionary ideas of progress—enabled them to function as a means for knowledge-control and the observation and control of behavior. Bennett characterizes museums as “agents for establishing and policing norms of public conduct.”^[9] By indoctrinating visitors with the current political ideology, they were able

to regulate the population: “Going to a museum, then as now is not merely a matter of looking and learning: it is also...an exercise in civics.”^[10] Bennett’s work draws on that of Michel Foucault in examining cultural technologies for exercising “disciplinary” or “governmental” power. According to a Foucaultian perspective, museums would be considered part of a system reinforcing the state’s hegemony.

Pierre Bourdieu too sees the art museum as closely tied to power structures.^[11] Working in the 1960s, he conceptualized the art museum as the exclusive domain of the cultivated classes, arguing that it was only those equipped by education who have a mastery of the codes and who are able to decipher the works on display. For Bourdieu, the art museum is a place through which the middle-classes and élites in society reinforce their sense of cultural distinction, perpetuating the notion of high art as exclusionary.^[12] Culture, power, and class are related here, legitimating social differences and reproducing relations of power. As an important cultural site for the definition of distinction and taste, museums in this view become instruments of class hegemony.^[13] Carol Duncan also conceptualizes the art museum as a “social, political and ideological instrument.”^[14] For her, like Bennett, they are “performative” environments. In particular, her writing focuses on their role as ceremonial sites that use display arrangements to promote national pride.^[15] The visitors to an art museum perform a “ritual,” which constructs them as ideal bourgeois citizens.^[16]

Museums, of course, may be read in ways other than as articulations of social and political power. Witcomb argues for a position in which museums are not always considered to be concerned with power relations and puts forward alternative readings of the museum.^[17] The notion of museum as an organ of the state may be clearly manifested in national museums but not particularly

evident in small, local sites—in community run or private museums. While acknowledging that many different types of museum exist, and that there is a range of funding regimes and sizes, here the focus is on exhibitions in larger museums, which are more clearly tied to systems of power and have been more consistently the subject of political debate.

Large civic or national museums have “status-conferring” roles: they are expected to present “authorized or established pictures of a nation’s history and culture.”^[18] Such museums are perceived to represent socially approved definitions of reality. As Riegel notes: “People look to museums as the arbiters of ‘high class’ taste, a source to be relied upon when it comes to matters of culture.”^[19] The social power of museums derives from this belief that their views are sanctioned by the state. Displays that represent a culture, a people, a religion, even a nation, as we see in a later section, assume considerable social authority.

One of the most obvious ways in which museums emanate power is through architecture and position. Often collections are housed in imposing buildings which have been likened to ceremonial monuments that emulate classical temples, medieval cathedrals, or Renaissance palaces.^[20] In the nineteenth century many were built in the style of Greek temples with columns, porticos, and steps (Fig. 1). Such architecture was intended to stand out in the cityscape, marking these as sites of cultural significance. Riegel notes how the Royal Ontario Museum (ROM) in Canada, “exudes authority: the architecture is monumental, the technical aspects of exhibits are superbly executed.”^[19] This observation applies equally to such edifices as the British Museum, the Louvre, the Metropolitan Museum, New York, and indeed many of the large national institutions, or what have been termed “universal museums.”



Fig. 1 National Archaeological Museum, Athens.
Source: Photograph taken by the author, 2008.

The location of museums is also important. In the nineteenth century, many were built in the centre of towns or cities, near other places of civic authority, such as the town hall and library. Giebelhausen refers to this as the “symbolic geography of power.”^[21] The siting of major museums in visually prominent positions continues today—one thinks immediately of Bilbao’s Guggenheim, Te Papa Tongarewa in New Zealand, the National Museum of Australia, or London’s Tate Modern.

It is not only external architecture but the inner codes and conventions that are indicative of the authority that museums wield. Bennett refers to these as the “regulation of conduct”^[22]—the silence imposed, the hushed conversations, the prohibition of daily activity, the slow and careful movements, the sense of reverence. Behavior inside is marked by a particular type of receptivity and contemplation that Carol Duncan likens to a ritual^[23]—and most of us conform to this. As well as the modification of behavior, the messages imparted through display exert powerful effects. Exhibitions are generally not authored or dated, and seem intended to be read as the anonymous “voice” of the institution. The workings of the museum—the decisions made about how to display objects, who decides on themes, and why—are usually left opaque. Lavine and Karp argue that it is precisely the “neutrality” of museums that enables them to become instruments of power.^[24] People think that what they are looking at in a large public museum is the undisputed “truth.”

REPRESENTATION IN THE MUSEUM

Let us now examine the relationship between museums and representation. Stuart Hall defines representation as the “production of meaning through language,”^[25] and museum displays, he argues, can be seen as “systems” or “practices of representation,” in which objects stand for verbal concepts.^[26] Rather than “words or images,” then, the elements of this system of signification are things—their arrangement and display within a physical space.^[26]

It is through objects and exhibitions that museums construct their most powerful representations. Hooper-Greenhill argues that displays are “visual public statements” of an institution.^[27] The selection of certain objects and the exclusion of others, their arrangement on display, the type of language chosen for text panels, the use of photographs, lighting, display devices (cases, plinths, etc.) and interactives all function to construct certain images: “Every choice—to show this rather than that, to show this in relation to that, to say this about that—is a choice about how to represent.”^[26] For Hall, museum representations can never be objective, neutral, or value-free: they will always articulate particular perspectives. Bennett,^[23] Duncan,^[23] and others argue also that the museum is a place that manifests dominant ideologies: they do not passively display objects but actively construct

the spaces in which things can be viewed. Being able to order the representation of the world carries with it a certain authority—“the power to name, define, classify and re-present.”^[28]

Hall maintains that politics has to do with the *effects* and *consequences* of representation.^[29] It is the way the objects, the texts, and the spaces are read by visitors that enables them to become political. For some, the entire structure of display is permeated with power relations. Riegel argues that the practices of representing culture through imagery is:

...an inherently political act which separates those who view the exhibit from those who are on display. The act of viewing is related to the acts of ordering, defining and representing according to categories of the ‘viewing’ culture.^[30]

Lavine and Karp too believe that the very nature of exhibiting makes it a contested terrain: “Decisions are made to emphasize one element and downplay others, to assert some truths and to ignore others.”^[31] While museums promote particular perspectives, they also, inevitably, conceal others. Museums have the power to include and exclude, to interpret objects, peoples, and cultures in specific ways. In the nineteenth century, many ethnographic museums, for example, placed the material culture of non-Western peoples in evolutionary sequences in order to promote the idea of a hierarchy of progress from “primitive” to “civilized.” Such a system of representation, now politically unacceptable, was a product of the ideology of the time.

Over the past 20 or so years, the museological literature has been increasingly concerned with the processes of representation and its political effects.^[32–39] Since the 1980s, in particular, the authority of the museum has been challenged and groups have questioned the right of institutions to control how their cultures are displayed.^[31] Communities and individuals have raised questions relating to power, authority, and representation. Who decides on what should be selected for exhibition and why? Who authors displays? Who should represent and speak about cultures? Whose voices are heard? Whose voices are excluded? What are the languages of representation? Who is empowered and who is disempowered by particular methods of display?^[40] (Fig. 2).

The above discussion has outlined a framework for considering the museum as a site of power and a place of representation. Next let us examine some examples.

NATIONAL MUSEUMS: POWER, IDENTITY, AND THE NATION

More than any other, a national museum may be considered part of a state’s political apparatus of representation.



Fig. 2 Mahayana Buddhism case, World Cultures gallery.

Source: Photograph taken by National Museums Liverpool, 2008.

Large “nationals” play important roles in expressing established values and sanctioning the images a nation wishes to convey of itself. Some national museums are utilized overtly for political purposes, as tools of the state or instruments of propaganda. For example, the Museum of the Chinese Revolution, which opened in Tiananmen Square in Beijing in 1960, is a political institution, serving the interests of the Chinese Communist Party.

But what exactly is meant by the idea of the nation and how can this be manifested in a museum? Benedict Anderson famously argued that the concept of “nation” is imagined because “members of even the smallest nation will never know most of their fellow-members, meet them, or even hear of them. . . .”^[41] The “nation,” for him, is created by people to serve specific purposes. It is abstract and anonymous and needs symbols as a way to manifest itself—flags, coins, monuments, uniforms, and, of course, museums, give the idea of the nation a physical presence. In this sense, national museums function to create bonds between individuals and the abstract political concept of the state. Exhibitions—or representations—within these buildings assume a particular social significance.

We saw earlier how there was a trend in the eighteenth and nineteenth centuries for the private collections of the aristocracy and royalty in Europe to be transformed into national museums. This was also a key period in the formation of modern nation-states in Europe, and museums were often established, then harnessed, as manifestations of national pride.^[42,43] In other parts of the world, national museums have been created in response to radical political change or independence. Throughout the nineteenth and twentieth centuries a host of countries, in throwing off the yoke of colonial rule, used museums as a way to articulate a new sense of national identity. Greece is a good example. The year the Greek state was legally established, in 1834, the first National Archaeological Museum was constructed in Athens.^[44] The new Greek nation was characterized by its fascination with the classical past, and

museums in particular were mobilized as political symbols of a new independent identity. In Mexico too, museums and archaeological objects became entangled in the processes of nation-building after the Revolution. Four years after independence from Spain, in 1825, a decree was issued for the establishment of a National Museum (though it would not be until 40 years later that the museum was built, in the city centre, near the presidential palace).^[45] By the early twentieth century, the state had begun to take more direct control of the representation of the country, as the president, Porfirio Díaz (r. 1876–1880 and 1884–1911) patrolled the national museum, approving or disapproving the content of exhibition halls.^[46]

This pattern between political independence and the establishment of national museums continued into the twentieth century. The National Museum of India in Delhi, for example, was created the same year as independence in 1947. The National Museum of Pakistan in Karachi was set up shortly after, in 1950. The first National Museum of Nigeria was opened in 1952. (Nigeria became independent in 1960). Though these links must not be overstated—for countries gain independence and do not construct national museums—these institutions nevertheless are clearly considered a means to articulate new nationhood. Patrick Boylan has even suggested that building a national museum is one of the top four priorities for newly independent governments. The four are: 1) a national defence force; 2) a national broad casting service; 3) a national museum; 4) a national university.^[47]

The National Museum of Scotland is worthy of consideration here—this too is an institution that emerged at a key moment in Scottish political history. It opened in Edinburgh in 1998, seven months before the British Queen opened the first session of the Scottish Parliament in July 1999. Donald Dewar, the First Minister of Scotland, in fact drew a parallel between the museum and the new Scottish Parliament, describing both as “symbols for a cultural renaissance in Scotland.”^[48] As the plans

progressed all “non-Scottish” elements were deleted. The museum became more rigorously thematic, documenting the story of the nation. It starts with *Beginnings*, (geological foundations and early wildlife), moving on to *Early Peoples*; *The Kingdom of the Scots*; *Scotland Transformed* (eighteenth century); *Industry and Empire* (nineteenth century); *Victorian and Edwardian Life* and, finally, *The Twentieth Century*. The choices and the arrangement of the galleries and their associated interpretation are deliberately configured to promote narratives of Scottishness (Fig. 3).

Since the mid-1980s, a number of new national museums have emerged offering different political representations of a country’s history, culture, and identity. What seems to distinguish the national museums of the late twentieth to early twenty-first centuries is that they consciously celebrate diversity and equality. The idea of the nation tends to be defined as a blend of voices and groups marginalized through dominant white narratives of history are prominently addressed. Former colonial powers, in particular, have come under pressure to reappraise their representations of the past, especially those related to imperialism. The National Museum of Australia, in Canberra, which opened in 2001, is a good example, a place that consciously celebrates the Aboriginal peoples and their contribution to, and place within, the nation. This is also evident at the National Museum of New Zealand—Te Papa Tongarewa—which opened in 1998. Te Papa is a “bicultural” institution, with a Maori name, and it celebrates the Maori presence in New Zealand as never before. The museum calls itself a “gateway, or an encounter with the essence of New Zealand’s land and people,” its key task being to preserve and present the *taonga* (treasures) of New Zealand’s indigenous people.^[49]

Such national museums operate on a political level, as symbols of newly configured nationhood. It is evident that objects and collections here may be manipulated for ideological purposes. We now turn to examine how politics has been reflected in other museum types—firstly those devoted to art.

INSTITUTIONAL CRITIQUE AND “SENSATION”: THE POLITICS OF REPRESENTATION IN ART MUSEUMS

It is in the art museum, with its predominant focus on the singularity of the object, that the codes of behavior seem most pronounced, the rituals of visiting heightened and the reverence of things most evident.^[23] When this hallowed world and contemporary issues clash, the politics of representation is intense.

From the 1960s, artists started to explicitly engage with the idea that the gallery environment is socially, politically, and institutionally conditioned. Marcel Broodthaers, Daniel Buren, and Hans Haacke were associated with what came to be known as “Institutional Critique,” a fundamental questioning of the practices of the art museum. In their various ways, they drew attention to the power of the museum apparatus in promoting taste and value, and used visual means to expose the ideological underpinnings of this institution.^[50] More recently, in the 1990s, Fred Wilson’s work has exposed the racial and political implications of display in installations such as “Mining the Museum” at the Maryland Historical Society.^[51]

Hans Haacke’s documentation of high art’s corporate affiliations is perhaps the most overtly political. In 1970 he created an installation at the Museum of Modern Art (MoMA) in New York which asked “Would the fact that

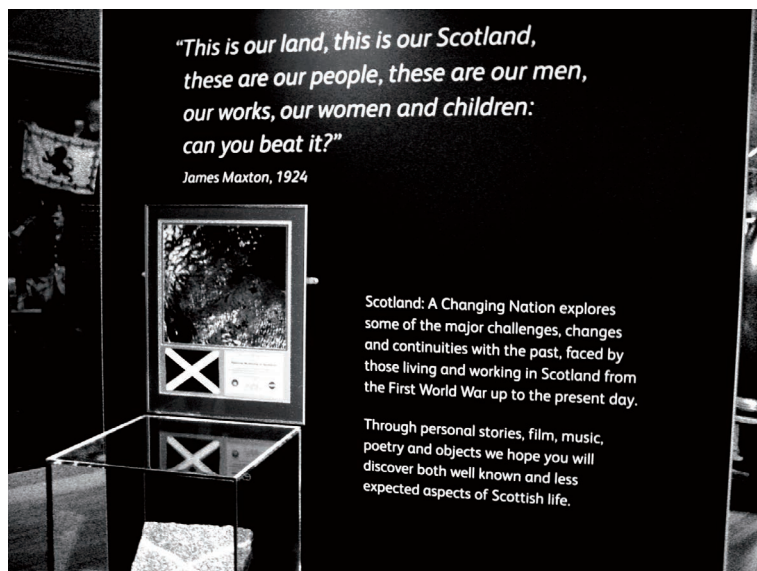


Fig. 3 Display at the National Museum of Scotland. Source: Photograph taken by Kostas Arvanitis, 2008.

Governor Rockefeller has not denounced President Nixon's Indochina Policy be a reason for you not voting for him in November?" with two ballot boxes: there were twice as many "Yes" as "No" ballots. The installation also criticized a board trustee, and MoMA itself. The following year, Haacke planned a show at the Guggenheim Museum to expose the questionable transactions of a real-estate businessman, Harry Shapolsky, and his links with the museum's trustees, but this was cancelled by the Director. In another exhibition at the Museum of Modern Art in Oxford in 1978, Haacke's "A Breed Apart" criticized British Leyland for exporting vehicles for military use in apartheid South Africa.

Not only have artists deliberately drawn attention to political injustices—Mark Wallinger's installation "State Britain" at Tate Britain in early 2007 is a good example, a 40 m long replica of the minipeace camp run by Brian Haw opposite the Houses of Parliament—but art exhibitions themselves have become (sometimes unwittingly) entangled in wider political debates. "Sensation: Young British artists from the Saatchi Collection" is a notable case. In 1997 the display created a stir at the Royal Academy, London, because it included the painting, "Myra," an image of the child murderer, Myra Hindley, by Marcus Harvey, made up of hundreds of copies of a child's handprint. Winnie Johnson, the mother of one of Hindley's victims, asked for the portrait to be excluded. Along with supporters she picketed the show during its first day. Despite the protests, the painting remained on exhibition. Windows at the Royal Academy were smashed and demonstrators threw ink and eggs at the picture. It was taken off display for conservation and upon return, was placed behind glass and guarded by security officers.

"Sensation" traveled to the Brooklyn Museum of Art in New York City (October 2, 1999 to January 9, 2000) and here too it was met with political protest, this time focusing on a different image and issue. A public battle erupted around a painting, "The Holy Virgin Mary," by Chris Ofili. The press incited controversy by reporting that the work had been smeared with elephant dung. New York Mayor, Rudolph Giuliani, declared the show to be "insulting to Catholics." Protesters outside the museum handed out vomit bags and threw manure in protest. As a precautionary measure, the museum placed "The Holy Virgin Mary" behind protective glass. Even so, on December 16, 1999, a 72-year-old man was arrested for "criminal mischief" after smearing it with white paint. The Catholic League for Religious and Civil Rights issued press statements asking for a boycott of the museum and asking citizens to write to New York City Council demanding that the museum have its grant withdrawn. Two days before the opening, New York City Hall indeed severed its funding and threatened to evict the exhibition from the building. A court ruled against this on the grounds of freedom of expression.

"ENOLA GAY": HISTORY, WAR, AND POLITICS

Science museums too have become sites for the struggle over representation—the most renowned example being the display of "Enola Gay" at the Smithsonian's National Air and Space Museum (NASM) in Washington, D.C. in 1995, which aroused levels of controversy comparable to "Sensation."

The fuselage of "Enola Gay," the B-29 bomber that dropped the atomic bomb on Hiroshima, went on exhibition to commemorate the end of World War II, and the aeroplane's role in securing Japanese surrender. An earlier planned exhibition "The Crossroads: the End of World War II, the Atomic Bomb and the Origins of the Cold War" had been cancelled and after much discussion, the fuselage alone was allowed a public airing.^[52] Yet this created huge controversy, particularly amongst veterans and the Air Force Association (AFA), who attacked the Smithsonian's interpretation for being "pro-Japanese" and "anti-American."

Dubin notes how the display was significant in coinciding with a period when Japan was a major U.S. trading partner, and sensitivities had to be handled carefully.^[53] The exhibition texts were monitored and went through many amendments—some of which were requested by the AFA.^[54] Both veterans and the AFA in fact accused the curators of only wanting to show the devastation the bomb had caused, and exaggerating Japanese suffering. They complained that the Japanese were being turned into tragic victims, or, worse still, heroes, and that the Allies by contrast were demonized as ruthlessly aggressive. The loan of material from Hiroshima and Nagasaki and planned videotape testimonies about the bomb's legacy came under particular attack.^[55] It would not be possible, they argued, to display a balanced perspective if only the "last act" was shown.^[56] The curators were accused of political bias. The House Speaker, Newt Gingrich argued: "Political correctness may be okay in some faculty lounge, but...the Smithsonian is a treasure house that belongs to the American people, and it should not become a plaything for left-wing ideologies."^[57] Veterans wanted to counteract curatorial "bias" by including information on the Japanese war camps, the numbers of Allies lost in the Pacific, images of disabled veterans, and the numbers of lives saved because the bomb brought the war to an end.^[58] Fundamentally, of course, their concern was to legitimize the bombing and pay tribute to the bravery of their comrades. Eight conservative members of the House of Representatives were outraged by the low figures suggested by curators for American casualties had the bomb not been dropped, and called for the Director, Martin Harwitz to resign. Harwitz indeed left in the wake of controversy.^[59–61]

Peace campaigners were also enraged. On the opening day, 21 people were arrested during a demonstration, some bearing signs urging "Never Again" or "No More

Hiroshimas.” Four days later, the museum closed for 90 min after three protestors poured human blood and two bags of ashes on the fuselage. The protestors were charged with, and found guilty of, felony destruction of government property.^[62]

During the development of the exhibition, some had wanted the plane to be displayed without comment, so that it “could speak for itself”^[63]. “Critics came to prefer a display of the aircraft in minimalist interpretative dress—precisely because they did not want to impose any particular reading on museum visitors.”^[64] One pilot, for example, said it should be displayed alone.^[64] Yet, as we saw earlier, objects can never be interpreted neutrally. The apparatus of the museum will always influence the angle from which an exhibition is understood. The choice of words on texts and the other associated documentation—the information that is included *and* excluded—work to produce certain readings.

This particular exhibition demonstrates the difficulty of representing opposing points of view in the public space of the museum, particularly in such a culturally authoritative institution as the Smithsonian.^[65] These controversies revolved around the perspective from which the war should be recounted. Critics were concerned about the authorship of the texts and whether they were biased. They wanted to know who was being celebrated—the Americans or the Japanese? Who was being blamed? Whose voices were being heard?

It is significant that the display was mounted at the Smithsonian, one of America’s most powerful national museums. As an American Legion Spokesman noted, “this is. . . a public institution, where the impression is that anything it says is official history.”^[66] The authority of this museum functioned to underline the idea that the “truth” was being presented—and this is the reason why exact interpretations were so carefully monitored. In the next section we examine other groups whose historic injustices have created impassioned debate within a very different type of museum, and we see how controversial racial imagery was taken to be the officially sanctioned view due largely to its display in one of North America’s most authoritative institutions.

REPRESENTING “OTHER” CULTURES: POLITICS IN THE ETHNOGRAPHIC MUSEUM

While museums in general have come under increasing attack in recent decades, it is in the sphere of ethnographic exhibitions that the political dimensions of display have come under the sharpest scrutiny. Ethnographic museums, above all others, have become targets of controversy. Hooper-Greenhill writes that, “the negotiation and contestation of museum authority has been at its most evident in relation to colonial collections”^[67] (Fig. 4).

Why should this be? In many ways it is due to the historical formation of collections. Many ethnographic collections were created in the nineteenth to early twentieth centuries as a direct result of colonialism—and under such regimes, it is well documented that a great number of objects and collections were taken by force. The display strategies of ethnographic museums in the nineteenth century were also clearly linked to colonial ideology. Early ethnological galleries promoted dominant beliefs in the superiority of Western cultures. In particular, evolutionary displays visualized unequal power relations between peoples and implied the need for progress from “primitive” to “civilized.” By the end of the nineteenth century, evolutionism had come to dominate the arrangement of non-Western objects in ethnographic museums.^[68]

While evolutionary displays were largely abandoned in the twentieth century, ethnographic museums continued to be the keepers of other people’s material and the interpreters of their histories. Museums continued to assume the undisputed power to speak for and represent other people. Here indigenous groups never had a voice: they were discussed, exhibited, and interpreted, but were never able to “talk back.” As a result, for some, they became symbols of white power and domination, perceived “. . . to serve a cultural élite, staffed primarily by whites, reflecting white values, and excluding from the interpretative process the very peoples whose cultures were represented in the collections.”^[69]

In the 1980s, alongside wider social and political changes, indigenous peoples started to challenge the authority of museums to represent their cultures. Communities began to demand a greater voice in how they were being displayed. A series of exhibitions at this time resulted in the politics of representation being foregrounded as never before—such exhibitions became implicated in politics because of tensions between who was doing the exhibiting and who was being exhibited.^[70]

This section documents three exhibitions in the 1980s that illustrate well the climate of the times.

The earliest was “Te Maori” (literally “the Maori”) which toured the United States between 1984 and 1986, before returning to New Zealand in 1986 and 1987.^[71] This is considered a turning point in museum presentations of Maori culture and more widely in the relationship between Maori and museums.^[72,73] For the first time, Maori people were consulted about their tribal *taonga* or treasures.^[74] Not only did the exhibition combine Maori objects from museum collections all over the world, it also created links between collections and contemporary Maori people. It also brought to the surface issues over who should control the representation of their heritage. Elders and scholars, who were actively involved in setting up the exhibition, made recommendations to museum professionals in the light of the show—one of which was that the Maori should determine how their *taonga* is to be interpreted.^[75] As a result of the exhibition, a conference was held in 1990 in



Fig. 4 Entrance to the World Cultures Gallery, World Museum Liverpool.

Source: Photograph taken by the author, 2005.

Wellington, where plans were launched for the creation of a museum of New Zealand, Te Papa Tongarewa, which, as we saw in an earlier section, opened in 1998.

Another exhibition in which politics came to the fore was the “Spirit Sings: Artistic Traditions of Canada’s First Peoples” at the Glenbow Museum, Calgary, Canada in 1988. This was organized in association with the Calgary Winter Olympics and was designed to highlight the rich artistic and cultural traditions of Canada’s native peoples. However, the exhibition became caught in the cross fire of a political campaign to support land claims by the Lubicon Lake Cree of northern Alberta. The Lubicon were demanding a boycott of the Winter Olympics in order to draw attention to their 50-year dispute with the Canadian government. At the same time they called for a boycott of the exhibition. The group was particularly incensed by the sponsorship of Shell Canada Ltd., who were actively involved in harmful drilling activities on land the Lubicon claimed as their own.^[76] The exhibition created a great deal of publicity and, perhaps for the first time, made people realize that museums cannot simply ignore contemporary issues such as land claims when presenting an exhibition of the cultures of indigenous peoples. As a direct result of the show a First Peoples–Canadian Museums Association Task Force was established jointly sponsored by the Assembly of First Nations (the preferred term for indigenous peoples in Canada) and the Canadian Museums Association.^[77] After several meetings, it produced recommendations on how to improve relations between First Nations and museums. Since this date there has been a dramatic change in power relationships—a shift from Canadian museums telling First Nations about their cultures, to dialogue, and inclusion.

A year later, in Canada, an exhibition at the ROM turned out to be the most politically controversial in its history (November 1989–August 1990). It was curated by a cultural

anthropologist, Jeanne Cannizzo, who set out to show the origins of the ROM’s African collection within the context of Canadian imperialist history. However local Afro-Caribbean communities were highly offended by it, labeling it racist. They formed an ad hoc group, the Coalition for Truth about Africa, and held protests every Saturday afternoon outside the museum. They also petitioned the ROM for the exhibition text to be changed or the exhibition to be closed, but the museum did neither. The main problem was that the displays represented the voices of “white” people—Canadian soldiers and missionaries—without incorporating African voices. There was ambiguity in messages in texts and the catalog, and an impression that the exhibition was celebrating rather than critiquing the role of missionaries and colonists in Africa.^[78] The use of irony in text panels, in particular, was misunderstood. Although Cannizzo italicized terms such as “barbarous” and “savage customs” with the intent of questioning them, the placement of such problematic language in italics next to visual images was not taken as a critique, but rather as an affirmation of this problematic imagery.^[79] This museum—one of Canada’s most prestigious and powerful—was simply thought to be condoning contentious colonial and racist perspectives.^[80]

The lack of consultation with African communities at a time when they were demanding a voice only inflamed anger.^[81] Communities contested the ROM’s right to ownership of its African collection, as well as the museum’s ability to present an exhibition of Africa. They questioned the authority and ability of Cannizzo—a white cultural anthropologist—to “represent” Africa.

MUSEUMS AS “CONTACT ZONES”

As a result of these exhibitions and the wider critiques that emerged in the 1980s, museums became, in James

Clifford's words, "contact zones."^[82] The historic aloofness and neutrality of the museum seemed to have been broken open by communities who had previously been ignored. Questions of power and authority came to the fore, as did questions about who has the right to speak for and represent whom. Ethnographic museums started to realize that they had to redefine their practices and strategies of display. In becoming sensitized to the political implications of their role, some began to acknowledge the unequal power relations that their collections and historic representations had been predicated upon.

The changes taking place within ethnographic museums have had a significant impact on the work of curators. Over the past decade or more, a new type of museum professional has emerged, who see themselves as "facilitators" or "stewards" of collections on behalf of communities. New forms of curatorship are increasingly sensitive to multiple voices and diverse audiences (Fig. 5). In ethnographic museums today, it is often the case that curators are not the sole voices of authority in interpreting and displaying objects, but acknowledge an obligation to involve source communities in the care and representation of collections.^[83] Emphasis is placed on the active involvement of indigenous curators, consultants, or advisors, especially in North America, New Zealand, and Australia.

One of the most significant developments here is the National Museum of the American Indian in Washington, D.C. Opening in 2004, it represents an unprecedented collaboration between the Smithsonian and Native Americans. The museum was authorized by Congress in 1989, and from its inception was a political creation. It has three facilities: The George Heye Center, Manhattan opened in 1994; the Museum building itself in Washington, D.C. and a Cultural Resources Centre in Maryland.^[85] Native peoples had the authoritative role in approving the architecture, design, and displays. The interpretation and

presentation of the collection was planned in consultation with tribal groups, and special regard was given to the exhibition of sacred or sensitive material. Material culture and sacred traditions are presented by native people in ways that reflect *their* values and viewpoints.^[84]

What we are seeing in the twenty-first century is a transformation in the power relations in ethnographic museums. Clifford describes this as "... a shift from a 'colonial' to a 'cooperative' museology."^[85] Museums and indigenous peoples have started to work together to redress the imbalances of cultural representation, using collections for promoting cross-cultural awareness. Yet such changes have been uneven, with museums in the United States, Canada, Australia, and New Zealand being much more active than those in Europe. In certain places, however, museums have indeed become institutions through which indigenous peoples now finally have a "voice."^[86]

CONCLUSION

In this entry we have seen how museums have been intimately related to power and politics, traditionally reflecting the interests of those dominant in society. We have looked at how the authority of the museum emanates from a range of structures—architecture, location, the historical formation and ownership of collections, the themes and arrangements of exhibitions, the selection of objects, the authorship of displays, and the inclusions and exclusions in textual interpretation. We have also seen how the power of the museum is evident in its operation as a social space that modifies public behavior and how museums "represent" through the display of objects.

The museum as an institution has come increasingly under attack in the past 20 or more years, with previously marginalized groups questioning its traditional authority.



Fig. 5 Visitors to the Weston Discovery Centre, World Museum Liverpool.

Source: Photograph taken by the author, 2005.

Increasingly exhibitions have become the subjects of criticism and, at times, impassioned debate. Some shows, as we have seen, have unleashed dramatically opposing views. Controversy can erupt over the display of an aeroplane, a painting or the representation of “Africa”—particularly when touching upon topics such as war, religion, and race. In the ethnographic museum—and in other places too—the power issues often lie in the discrepancy between those who control access to, and those who want to have access to, collections. As exhibitions become more concerned to address contemporary concerns, it seems inevitable that they will become more controversial.^[87] Increasingly, in the twenty-first century, museums are politically charged spaces, not neutral sites of display.

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Popular Literature Genres

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Abstract

This entry defines the concept of “genre” in relation to popular reading. It then briefly reviews the eight traditional genre categories, discussing their forms, structures, history, major subgenres, and trends. The increasing interest in narrative nonfiction and its relation to genre is explored. Three emerging genres are then discussed as examples of new developments in the field. The topic of reading interests versus genre is examined, and cross-genre writing and genre separation are discussed.

INTRODUCTION

The idea of genre provides readers and librarians a convenient mechanism for categorizing and providing access to fiction writing. As Ursula K. Le Guin notes, “The concept of genre is a valid one. We need a method for sorting out and defining varieties of narrative fiction, and genre gives us a tool to begin the job.”^[1] Understanding genre fiction allows librarians to analyze

the stylistic elements that authors use that will appeal to readers—of fantasy, Westerns, romances, mysteries, etc. The concept of genre is useful here because it defines a set of precepts that describe a certain style of writing. This knowledge allows librarians to connect readers to books that they will enjoy. In fact, it is an understanding of what the appeals of a particular genre are that will allow librarians to make connections between books and authors that may be separated by genre classification.^[2]

A readers’ advisor who grasps the broad concepts of genre appeal will be able to make reading suggestions both within genres and across genres, expanding the range of possible titles to offer readers. Here, genre becomes a useful tool for offering suggestions to readers. It is a concept that most readers understand. Librarians frequently hear from their users, “I like mysteries,” “I love to read Regency romances.” As an increasing number of authors (Michael Chabon, Audrey Niffenegger, Mary Doria Russell, and Cormac McCarthy to name only a few) write novels that blend genres, an understanding of the appeals of the various genres becomes even more essential to the provision of readers’ advisory services to the reading public.

In the library world, genre has also been an important mechanism in collection arrangement. As in bookstores, many libraries separate some parts of the fiction collection by genre. Most commonly, libraries offer sections of mysteries, romances, science fiction, and so on. Breaking out large fiction collections into smaller, more browsable units may offer readers an easier time in locating desired

materials. Sharon Baker’s book *The Responsive Public Library: How to Develop and Market a Winning Collection* does a good job of summarizing the research done on genre separation and shelving.^[3] Baker notes that in addition to increasing reader satisfaction, separating genre fiction collections generally results in higher circulation of library materials.

As in all areas of fiction, genre writing generally has a set of characteristics that can be defined and described. These patterns offer a sense of familiarity to the reader, and make a substantial contribution to the continuing popularity of genre fiction among readers. Like the structures of formal poetry, the structures of genre fiction create a frame within which authors can develop stories that will appeal to a wide range of readers. Crime fiction, most commonly centers around the concept of bringing order and justice to a chaotic world. Within that frame, mysteries stories can vary from the cozy to the graphic, and from the lyrical to the terse. Similarly, fantasy and science fiction writing allows the reader to ponder on the structure of the world. In these speculative genres, the author asks the reader to consider the question of whether society has to be as it is now.

In their landmark work on readers’ advisory services, Joyce Saricks and Nancy Brown developed the concept of using appeal characteristics to more logically connect readers to the stories that they are seeking.^[4] When looking at genre fiction, two of Saricks and Brown’s appeal factors are of particular importance to readers of genre fiction. The appeal of character is clearly a major draw for readers of genre fiction. Readers come to identify with the character, whether that is the detective in a mystery, the sword-wielding hero of a quest fantasy, or the love-struck protagonist of a romance. Furthermore, the importance of character to genre readers is seen in the affection that many readers of genre fiction have for series characters. The pleasure of following a particular character from book to book is clearly one that genre readers enjoy. The second important appeal factor to consider in

looking at genre fiction is the setting, both geographic and chronological. Many readers of genre fiction look to be transported to other places and times. This factor can be a manifestation of an interest in learning something new about a historical period or a particular place, or simply a desire to travel vicariously to a different locale that the reader enjoys. The other appeals discussed by Saricks and Brown also all apply to the enjoyment of genre fiction. Mood, tone, language, and story are as important to genre readers as they are to readers of other fiction.

Most discussions of popular genre fiction separate the field into eight areas: Adventure, Crime Fiction, Fantasy, Historical Fiction, Horror, Romance, Science Fiction, and Westerns. The next section will examine each of these traditional genres, looking at their basic structures, their foundations, their major subgenres, and their primary appeals to readers.

ADVENTURE

Novels that fall in the adventure genre are invariably fast-paced, plot-driven stories. These are stories that appeal to readers who enjoy breath-taking escapes, hair-raising exploits, and resourceful heroes. Though enjoyed by both male and female readers, the protagonists of adventures tend to be male, usually blending the intelligence of a Sherlock Holmes with the athleticism of an Olympic star. Readers come to these stories looking for action and suspense. At their most elemental, adventure stories present a main character, frequently on his own, with little assistance, who finds himself in danger and spends the rest of the story extricating himself from the problem. In the course of finding safety, the hero generally also saves some portion of society from the machinations of the evil-doers. Often these heroes exhibit powers of physical strength, intellectual acumen, and recuperation that are beyond the norm. Readers surrender disbelief here in order to enjoy the thrilling narrative. In many stories in the adventure genre, a secondary appeal is in the intricate details the author uses to construct the story. The minutiae of weaponry and equipment are frequently important to readers, and they look for authenticity as well as for action. In other adventure novels the particulars of legal or medical proceedings draw the reader into the tale. Adventure novels can be grouped into several subgenres, each of which has its readers. Military adventures can be either contemporary (Tom Clancy) or historic (Patrick O'Brian). The espionage subgenre has survived the end of the Cold War, and flourishes again with the rise of global terrorism. Legal and medical thrillers, such as those written by John Grisham or Robin Cook examine corrupt practices and frightening pandemics. Inspirational thrillers blend Christian themes with action-packed adventure (see Frank Peretti or Tim Lahaye). In all cases though readers are looking for an adrenaline jolt that will keep them glued to the pages.

CRIME FICTION

Crime fiction is one of the most pattern driven of the genres. Readers are drawn to these stories for the sense of resolution that they bring. The seeking out of justice is at the heart of the crime novel. The typical storyline features the commission of a crime (usually, but not exclusively, a murder), the arrival of the detective (amateur or professional), the investigation of the suspects, the solution of the crime, and the bringing of the criminal to justice. As in all genre fiction though, the way the author chooses to follow this pattern varies widely. The subgenres of crime writing are numerous, though they all reflect the basic structure outlined above. The early days of crime fiction (in the early twentieth century) were predominated by the puzzle mystery (Agatha Christie's Hercule Poirot and Miss Marple mysteries being typical examples), where the author sprinkled clues to the crime throughout the story, and the reader could solve the crime along with the detective. These cozy mysteries often featured an English setting and an amateur detective. Following the First World War, a new, harder-edged mystery story came to prominence, and readers began to enjoy the exploits of the hard-boiled detective, who solved crimes with his fists as much as his intellect. Here, the puzzle was less important and the reader began to follow the exploits of the detective rather than solving the crime in tandem with the detective. Writers such as Raymond Chandler and Dashiell Hammett led the way here. In the last quarter of the twentieth century, crime writing expanded its scope even further. Women and minorities started appearing as detectives, and a host of subgenres grew in popularity, including the heist caper (usually told through the eyes of the criminal, see Donald Westlake's *Dortmunder* series), historical mysteries (taking detection as far back as the days of the pharaohs, Ellis Peters's *Brother Cadfael* books did much to promote this subgenre), forensic thrillers (featuring the often grisly details of pathologists as central to the story, Patricia Cornwell and Kathy Reichs both are key authors here), police procedurals (for readers who enjoyed the details of policing, P.D. James, in England, and Ed McBain, in the United States provide benchmarks for police crime fiction), paranormal mysteries (blending elements of fantasy and science fiction with crime stories, see Kim Harrison, Jim Butcher, or Eric Garcia), and the new cozies (with a range of amateur detectives solving crimes while running B&Bs, herb shops, quilt stores, etc. among the leading authors here are Susan Wittig Albert, Earlene Fowler, and Carolyn Hart). As the twentieth century ended, there were several new developing trends in crime writing in addition to the expansion of the subgenres. Authors began to take a much more realistic approach to crime, resulting in darker, more violent, stories (George Pelecanos, Dennis Lehane, and Ken Bruen among others). Societal concerns began to be reflected in the crime fiction of such writers as Sara Paretsky and Marcia Muller. The

rise of the serial killer novel paralleled the reporting of this sort of crime in the media. In the early twenty-first century, terrorism at home and abroad has become a central theme in much crime fiction. In addition to darker themes, crime fiction also has seen an increasing interest in the lives of the detectives. Crime writing now is often as much about the development of a series character as about the solution of the crime. The lives of the detectives are of great interest to readers, and family relationships and other personal details are sought out. Investigators are frequently dealing with problems in their own lives as well as with the misdeeds of others. Along with this trend toward darker detectives, contemporary crime novels frequently have a more ambiguous sense of justice. The criminal may never be brought to trial or serve time. Sometimes it is a corrupt state that allows criminals to get off, but it is not uncommon for extra-judicial justice to be meted out by the detective or by the victim's family or friends. It is this sense of order restored that is at the heart of the crime novel.

FANTASY

The story of a struggle between good and evil unites much of the writing in the fantasy genre. From the earliest times, people have told tales of the conflict between the dark and the light in order to reassure themselves that there is some chance to bring order out of the chaotic world. Fantasy novels continue to offer this hope to readers. In most fantasy fiction new worlds are created, or the existing world is reshaped, in order to provide the backdrop for the story. Fantasy invites its readers to suspend their understanding of the natural world and enter into a new place where the unexpected becomes real, and where magic replaces science as a source of power. The level of magic in the story may be quite variable. Earlier fantasy stories were often centered around the use and misuse of magic (Tolkein's Ring series for instance). In later fantasy fiction, magic often has a more ambiguous and less central role, with the exercise of power taking a toll on those who choose to use it. Although myths and tales of magic have been in circulation as long as people have been telling stories, beginning in the late nineteenth century a style of writing, typified in the works of George MacDonald and Lord Dunsany, emerges that would be recognizable to today's fantasy reader. The popularity of these early titles encouraged the growth of the genre, and by the end of the twentieth century, fantasy writing was flourishing among readers. In the early twenty-first century, much fantasy writing is looking at darker themes, and it is frequently more challenging to distinguish between good and evil than it was in the early days of fantasy writing. Much of the appeal of the fantasy genre comes from the intricate worlds created by the authors. Writers such as Robert Jordan and Lois McMaster Bujold create sprawling,

multi-title series featuring recurring characters who move from novel to novel. Readers come back again and again to these stories to discover what is going to happen to the characters. Character is complex in fantasy, with a multiplicity of fantastic creatures in addition to the human characters. Fantasy is also frequently concerned with things—rings, swords, helmets, jewels, etc. These sorts of potent icons give power to those who wield them, and feature prominently in much of fantasy writing. Fantasy fiction has a variety of subgenres of interest to readers. Much early fantasy was of the “swords and sorcery” variety, featuring swashbuckling heroes and powerful wizards. The quest, popularized by J.R.R. Tolkein's *Lord of the Rings*, continues to be a common theme in fantasy writing. An increasingly popular subgenre is the political fantasy, where the struggles for power within an invented world predominate, and magic has a secondary role (George R.R. Martin). Alternate histories continue to thrive as writers and readers explore the “what if” of various real times. The urban fantasies of writers such as China Miéville and Tannith Lee have grown increasingly popular, featuring dark and gritty city settings and equally ambiguous characters. At the opposite end of the fantasy spectrum, high fantasy invites the reader into a world of elevated speech, rhetorical flourishes, and courtly practices. Here, readers still enjoy classic authors such as E.R. Eddison as well as newer practitioners such as Guy Gavriel Kay or Patricia Wrede. Whatever the subgenre, fantasy allows the reader to visit a new world where things are rarely as they seem, and where characters are fighting the good fight.

HISTORICAL FICTION

In the historical fiction genre, readers are usually seeking stories with a strong sense of time and place. The key appeals here are those aspects of the novel that take the reader back in time to a specific period and/or to a specific geographic location. In order to do this successfully, the authors of historical fiction often provide intricately detailed stories that are the result of extensive research. The quality of this research is important, as many readers of historical fiction are also readers of historical nonfiction. These readers will be the first to note any details that are inappropriate to the period under discussion. Many readers will dismiss an historical novel out of hand if they discover anachronisms. This attention to detail also is important in considering the author's use of language. Historical fiction readers will be put off by language that sounds to them more modern than the setting of the book. An eighteenth century maid who talks like a Valley Girl will lead many readers to close the book. One reason that these sorts of period details are so essential to the success of historical fiction is that many readers come to these stories to learn something about a particular time or place.

This educational experience is diminished if the reader is not confident about the accuracy of the story. The accrual of details in historical fiction often means that these are long works that readers can sink themselves into. Though not as common as in fantasy and crime fiction, series titles also make their appearance in the historical genre, especially in the form of family sagas (e.g., John Jakes's *North and South* series or Jean Auel's *Earth's Children* titles). Historical fiction must, by definition, be set in the past. But there is no strong consensus about how far back the tale must take place. For some readers it may relate to their own age. For a reader born in the 1980s, a novel set in the 1960s might be considered historical. The same novel read by someone born in the 1930s may not have as strong an historical feel. In most cases, it is accepted that the story needs to be set in a time prior to the period of its writing. So Tolstoy's novels are not historical fiction, but are simply older examples of contemporary fiction. It is generally accepted that the earliest examples of historical fiction are the works of Sir Walter Scott. In novels such as *Waverly*, Scott used period details and an eighteenth century setting to frame his story of love and politics during the Jacobite rebellions. Since that time, historical fiction has seen a steady readership, with specific time periods or subgenres waxing and waning to the rhythm of cultural interests. There are several popular subgenres of historical fiction, including military stories (e.g., Bernard Cornwell or C.S. Forester), with their focus on details of battles and campaigns. Historical mysteries became increasingly popular in the last quarter of the twentieth century, as readers enjoyed the period details of historical fiction blended with the elements of a crime novel (Ellis Peters, Bruce Alexander, and Anne Perry are all benchmark authors here). The early twenty-first century has seen a number of popular titles that blended history with fantastic elements, especially Diana Gabaldon's *Outlander* titles. Although not really subgenres, historical mysteries can also be subdivided by geographic location, time period, and the focus on real or fiction characters. Regardless of the specific period of interest, historical fiction readers continue to seek out the genre for its blend of detail and story.

HORROR

The horror genre is at heart about fear. Readers come to horror fiction looking for a visceral reaction to the story. While these reactions can range from a cold chill up the back of the neck to a sweat-drenched panic, to be successful, horror must induce a sense of dread in the reader. Horror fiction arises out of the Gothic novels of the late eighteenth century, in particular, the dark and fear-shrouded *Castle of Otranto* by Horace Walpole. The macabre tales of Poe and other nineteenth century novelists continued the trend. Bolstered by the popularity of horror titles in the pulp publications of the 1930s and

1940s, horror continued to build a dedicated, though perhaps limited, following. Unlike fantasy fiction, which can at times be frightening, horror fiction sustains a sense of dread throughout the entire story. The reader also has a feeling that these things could really be happening. As Joyce Saricks notes in *The Readers' Advisory Guide to Genre Fiction*, there are two paths that horror fiction generally uses to create an atmosphere of dread.^[5] The first is the psychological thriller, what Saricks calls "Storyteller Horror." Here, the terror is a reflection of a dark and menacing atmosphere that becomes increasingly oppressing as the story progresses. The characters, and the readers, are drawn into an evermore frightening situation as they move through the novel. There may or may not be physical violence involved in the resolution, but it is the overwhelming and progressive sense of fear that draws readers to these tales. The ghost stories of Peter Straub or the classic tales of H.P. Lovecraft exemplify this subgenre. The other path chosen by horror writers is the graphic and gory tale which appeals to the reader's fears of physical violence (Saricks's "Visceral Horror"). Here, the fear comes more from the actual events than from the anticipation of those events. The works of writers such as Clive Barker and John Connolly are benchmarks here. In much of horror writing, the fear of "the other" dominates. Monsters are common in horror fiction, and whether they are imagined or real, they create the chaotic events that mark the story. Unlike most other genre fiction that closes with a clear resolution to the story, horror novels often have an open ended feel. As horror has developed, some subgenres can be identified. While less popular than in earlier days (M.R. James is a classic here), the ghost story continues to have its readers (see Joe Hill, Stephen King's son). The late twentieth and early twenty-first centuries saw an increasing number of horror stories focusing on the undead, particularly vampires, though zombies and werewolves also have their followers (Ann Rice and Laurell K. Hamilton stand out here). Splatterpunk, which arose as a horror subgenre in the 1980s, is known for its extremely graphic violence, its realistic urban settings, and its grim tone (see David Schow, Jack Ketchum). The late twentieth century also saw an increasing level of eroticism in horror fiction, exemplified by some of the stories of Poppy Z. Brite or Tannith Lee, that continues to exist alongside more traditional tales of terror. Though horror readers do not make up as large a percentage of the genre audience as crime or romance readers, the demand for fear-inducing fiction is still a driving force.

ROMANCE

In 2007, statistics from the Romance Writers of America indicate that romance fiction made up about 12.9% of book sales.^[6] Like horror fiction, romance novels also arose out of the Gothic literature traditions. Here though,

the path led not toward the macabre and horrific, but to the dark castles inhabited by brooding dukes who fell hopelessly in love with young women of dubious backgrounds. These Gothic tales eventually led to historical romances by writers such as Georgette Heyer that dominated the romance market in the first half of the twentieth century and that eventually led to the contemporary romance novel. At the core, romances are the most optimistic of genre fiction. They tell the story of two people falling in love. Like crime fiction, romances follow a pattern that is consistent throughout the genre. In a typical romance, the male and female protagonists are introduced at the start of the book. In most cases, there is some source of conflict between these characters. This conflict may be personal, the result of social constraints, or have its roots elsewhere in the characters' lives. The story then deals with the overcoming of these obstacles, allowing the couple to find a measure of happiness together. In the traditional romance story, this resolution is marriage, though more contemporary romances sometimes settle for some form of committed relationship. Many readers find the commitment to traditional values of family and marriage an appealing piece of the romance genre. The happy ending is essential to the success of the story for the reader. While the positive outcome of the relationship is a primary appeal to romance readers, other appeals also draw readers to these stories. Romances generally feature strong female characters who take responsibility for their own lives and fates. This is particularly true in the work of writers such as Linda Howard and Sandra Brown, who write in the increasingly popular romantic suspense subgenre. As romances developed in the last part of the twentieth century, authors such as Nora Roberts, Karen Kingsbury and Susan Wiggs began exploring difficult societal issues, including abortion, spousal abuse, alcoholism, single parenting, and other challenging topics. These elements add another layer to the traditional romance story. Romances can vary widely across time periods and geographic settings, and readers are often drawn to particular writers for these details. Romances also vary on the amount and the graphicness of sexual content, moving from the chaste to the erotic. As societal norms have loosened, romance fiction has become more open to graphic depictions of sexuality by writers such as Bertrice Small and Rochelle Alers. In addition to these looser categories of romance fiction, there are some well-defined subgenres that attract readers. Historical romances have been an important area for many years, and continue to have a strong following. In particular, stories set in England during the Regency period are much sought after. The previously mentioned romantic suspense novels continue to command a wide audience. Lori Wick and Karen Kingsbury among others have crafted inspirational romances that feature evangelical Christian themes and stories and have a large readership, especially among readers looking for more chaste stories. The fantasy or paranormal romance also is increasingly popular in the early twenty-first century as is seen in the

interest in stories by writers such as Diana Gabaldon and Debbie Macomber. As the sales of romance novels reflect, these tales of requited love continue to inspire readers.

SCIENCE FICTION

Readers who are interested in questions of where society is going and what the future has to offer have always found much to enjoy in the science fiction genre. Throughout its history, science fiction has explored the possibilities and challenges of technology, and in particular what changes technological innovation brings to human society. Like other genre fiction writing, science fiction is shaped by cultural trends and changes. The earliest science fiction writers in the late nineteenth century, among them Jules Verne, H.G. Wells, looked at the technological advances of the industrial revolution and posited where those advances would lead. Throughout the first half of the twentieth century, science fiction writing explored the themes of space travel, exploration, and colonization, particularly in the pulp magazine of the period. As the world entered the Atomic Age, science fiction took a darker turn, and many writers produced dystopian novels of the end of human culture. The rise of computers in the last quarter of the twentieth century saw an equivalent rise in science fiction writing that looked at issues of technology and personal identity. In all cases though, science fiction uses the theme of technological advancement to explore the world. Much of science fiction writing is concerned with ideas, examining the nature of society, and the role of technology in society. There is also a strong component of science fiction writing that delves into the intricate details of science. As a result the character appeal, so common in much of genre fiction, is often less central to traditional science fiction writing. Over the years, the trend in science fiction writing has been a move from the adventure-based novels of exploration and conquest of space to philosophical stories that examine the consequences of actions in a more nuanced fashion. Some critics have speculated whether science fiction will be able to thrive as real science continues to uncover the secrets of the universe. As the elements of hard science become less important, and the more philosophic approach becomes common, character has become more central to science fiction writing, and the early twenty-first century has seen a rise in the publication of science fiction titles that concern themselves with the impact of the future not only on civilizations but also on individuals. Like the other genres, science fiction has a number of subgenres that attract readers. The space operas of Lois McMaster Bujold or Larry Niven bring together a large cast of characters and usually features themes of exploration and conquest. Space travel is also an essential part of the colonization subgenre, where alien worlds come into contact (see the novels and short fiction of Ursula K. Leguin). Post-apocalyptic tales of dark futures have already been

mentioned as has computer-centered science fiction. The cyberpunk subgenre, exemplified in the work of Bruce Sterling and William Gibson, is an offshoot of these computer-based stories, and blends dystopian views and information technology. Military science fiction such as that of David Drake or Robert Heinlein appeals to readers looking for tactics and strategy on a galactic scale. Some readers place alternative histories, for example, Harry Turtledove's *American Empire* series in the science fiction genre, particularly those that include the introduction of modern technologies into earlier days. Although real scientific work has taken much of the mystery out of the world, science fiction readers are still captivated by the genre's exploration of the possibilities and the challenges of technology.

WESTERNS

In both the traditional and the contemporary Western novel the setting is the main appeal for most readers. The open spaces and the wide views across the prairies and deserts of the American West in the work of classic Western writers such as Louis L'Amour and Zane Grey continue to attract readers. The history of the western is rooted in the dime novel tales of outlaws, mountain men, cowboys, and other denizens of the early days of the westward expansion. These stories featured tough men who often found themselves in dangerous situations, and used their skills to extricate themselves from danger. In addition to the action/adventure themes though, many westerns have an elegiac feel as well. The stories tell of the incursion of the modern world into a seemingly idyllic life on the range. The coming of the railroads, fences, and towns all become challenges to the heroes of western novels. This concept of "hero" is essential to the western. The popular western novels of the twentieth century generally featured a lone hero who finds himself fighting against evil and corruption. Often battered, but rarely broken, this hero cleans up the problem and then moves on to the next task. A strong influence from western films can be seen in many of the novels of the West. The visual nature of the films, with sweeping views becomes part of the visual scene painting of the western writers. Contemporary westerns, such as those written by Elmer Kelton and Larry McMurtry, have seen a move toward expanding the role of the hero beyond cowboys. The perspectives of Native Americans and women characters are occasionally seen, and some writers have explored social and environmental issues in their stories. In addition to the traditional western, readers can find western romances, inspirational westerns, and mysteries with strong western settings and characters, as well as novels of the contemporary west. Many librarians note a decline in the popularity of the western since its apogee in the 1960s. In the future, Westerns may come to be considered a subgenre of historical fiction. Although the circulation of westerns has declined,

there is still a dedicated body of readers looking for these tales of western adventure.

NARRATIVE NONFICTION

Although readers' advisory work has generally focused on fiction reading, the early twenty-first century saw a shift toward working with readers of narrative nonfiction as well. Narrative nonfiction blends the narrative style of fiction writing with facts, capturing characters, and telling stories with intricate plots and detailed settings. These are books that tell a story, and that are read for pleasure by a wide assortment of readers. Writers such as John McPhee, Sebastian Junger, Sue Hubbell, and Tracy Kidder are among the many prominent practitioners of this style. Like its fictional counterparts, narrative nonfiction is centered around the idea of story. All of the appeal factors that can be derived from fiction writing are applicable to narrative nonfiction. Readers in this area respond to variations in character, story, setting, language, and mood in the same way fiction readers do. The development of the structure of narrative nonfiction as a genre is still fluid at the end of the first decade of the twenty-first century. Several attempts have been made to organize the broader world of narrative nonfiction writing into more accessible, genre-like, areas. Some of these areas mirror or share characteristics with fiction genres—True Adventure, True Crime, History, Science. Other areas are not reflected in fiction writing—Food, Travel, Microhistories, Sports. Ongoing work with nonfiction readers will shape the future direction of narrative nonfiction as a genre, but given the wide readership and the interest of the publishing industry in works in this area, narrative nonfiction will continue to grow in importance in the popular reading world.

EMERGING GENRES

The late twentieth century witnessed not only an explosion in the popularity of traditional genre fiction, but also the emergence of some new directions in genre. Whether these emerging genres will stand the test of time or prove to be short-lived remains to be seen.

Chick Lit

The mid-1990s saw the development of a new type of fiction, dubbed "chick lit," that has gained acceptance as a popular genre over the past decade. Helen Fielding's *Bridget Jones's Diary* was among the first chick lit stories to attain popular success, and she has had many imitators in the years since. Although it is sometimes classed as a subgenre of romance, chick lit's themes set it apart from the romance genre. Chick lit tells the stories of the lives and loves of young, urban women who are trying to find a place for themselves in the professional world. The stories

are filled with pop culture references to hip clothing, fashion accessories, and drinks. While romantic relationships may form a part of the story, the successful resolution of relationships that is crucial to romances is not necessarily a part of a chick lit tale. Success here may as likely be dumping a boyfriend as marrying him. The story here is not about romantic accomplishment, but about a young woman learning to stand on her own. Friends play an important role in these stories as supports for the main character. A variety of urban settings spreads the appeal of chick lit across ethnic and geographic boundaries.

Slipstream

The last decade of the twentieth century produced a number of writers whose works bridged the gap between literary fiction and speculative fiction. These novels are imbued with a sense of the surreal. The settings are mainly contemporary and based in reality, but these stories manage to twist reality in ways that “simply makes you feel very strange,”^[7] as writer Bruce Sterling who coined the term “slipstream” notes. There may be occasional elements of science fiction or fantasy in these works, but these novels do not follow the usual patterns of those genres, and may not be as satisfying to a dedicated science fiction or fantasy fan. The idea of the surreal intruding on everyday life finds its roots in the magical realism of Latin American fiction and even in earlier works that created a feeling of unease in the reader. Sterling’s essay goes on to question whether slipstream will succeed as a genre, but thus far it continues to gain readership. In addition to Sterling, other notable slipstream authors include, Jonathan Lethem, Paul Auster, Aimee Bender, and Cory Doctorow.

Street Lit/Urban Fiction

The burgeoning street lit genre tells hard-edged stories of African American life in bleak urban settings. Street lit arises out of the 1970s autobiographical fiction of drug dealing and prison life by authors such as Donald Goines and Iceberg Slim as well as the tradition of African American romance and erotica. Contemporary street lit features all the elements of “gangsta” culture—flashy jewelry, big cars, drugs, prostitution, and guns. Like the emerging chick lit genre, the stories feature a lot of name-checking of expensive or hip brands and pop culture trends. The stories tend to be graphic in language, violence, and sexuality. Street lit is notable for featuring strong protagonists, both male and female. There has been some controversy over the genre, with some condemning the romanticization of criminal culture and others noting the moral lessons that can be drawn from the stories. Street lit seems to be diverging into two main streams. The first are the gangsta novels that center around drugs, money, and guns. The second are the more relationship-centered stories, still set in the violent street world, but focusing more on romantic issues. Benchmark authors here include Chunichi, K’wan, and Nikki Turner.

GENRE OR READING INTEREST

In addition to looking at genre as a way to define popular reading tastes and areas, it can also be useful to consider divisions that are more logically termed “reading interests” (the phrase used for these areas in Libraries Unlimited’s Genreflecting series). Reading interest is a broader term, and identifies a theme-related group of books or authors whose writings can be found in many genres. Three major reading interests to examine are Inspirational, African American, and Multicultural. In each of these areas, readers and librarians will find authors who write stories in most if not all of the traditional and emerging genres. What ties these disparate authors and their books together in the mind of readers, librarians, and publishers is an overarching theme. In the case of inspirational fiction it is the evangelical Christian outlook that is at the heart of the story, regardless if it is a mystery, romance, or legal thriller. With African American fiction, the unifying theme is the story of the lives of an ethnic minority in the broader American culture. Multicultural fiction details of the lives and concerns of a broad range of ethnic groups across the world, either in their own countries or as immigrants to a new society. In all these cases, the application of a genre label would be difficult since each of these reading interests encompasses the entire world of genre fiction.

CROSS-GENRE PHENOMENON

There has always been a certain amount of cross pollination between genres. Historical mysteries may appeal to both readers interested in crime fiction as well as readers with an interest in history. Similarly, many readers of Regency romances enjoy the period details as much as the satisfaction of a good love story. However, the trend toward cross-genre writing has exploded in the early twenty-first century. The popular success of titles such as Mary Doria Russell’s *The Sparrow* (which uses a very literary style to explore space travel and the issues of alien encounters and colonization) or Diana Gabaldon’s *Outlander* series (which blends time travel, romance, and history) have exposed many readers to styles of writing they would not necessarily have tried otherwise. Blending of paranormal elements usually found in horror fiction with crime fiction, romances, and chick lit tales has become common. For librarians, the cross genre publishing phenomenon has raised certain challenges. One difficulty that arises is how to categorize a particular book for a specific reader. Is a mystery that features a vampire detective more appealing to a crime fiction reader or a horror or fantasy reader? Another concern is the tendency of some readers to use genre not as a system of classification but as a method to reject titles that they do not wish to read. Assigning *The Sparrow* to the science fiction genre may deter some readers who aver that they never read science

fiction. Ursula Le Guin notes that it is when genre begins to be used to make value judgments about a particular work that the system leads to “arbitrary hierarchies” that promote “ignorance and arrogance.”^[1] The cross genre trend has led to renewed discussion in the library profession about the value of separating out genres in the fiction collection (see p. 33–38).^[2] Decisions on what genres to separate out from the main fiction collection and how to assign cross genre titles to a particular area will continue to be debated as the trend toward blending genres grows.

CONCLUSION

An understanding of fiction genres and their characteristics enables librarians to organize and locate materials that will meet the needs of their users. Awareness of emerging genres and trends in popular reading tastes will continue to be important for collectors, readers’ advisors, and other library staff working with popular fiction collections.

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Precision and Recall [ELIS Classic]

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Abstract

F.W. Lancaster's work has been immensely influential in library and information science. He has written on indexing and information system evaluation, and has been looked to as a pioneer in many areas. Here he describes precision and recall, the two most fundamental and widespread measures of information retrieval effectiveness.

—*ELIS Classic*, from 1978

INTRODUCTION

The terms “precision” and “recall” refer to measures that are commonly used to evaluate the performance of a literature search, especially a search conducted in some type of information retrieval system. These measures are probably best explained in the context of the well-known 2×2 table of search results, as illustrated in Table 1. When a search is conducted in most information retrieval systems, the system divides up the document collection into two parts. The documents that match the search strategy used to interrogate the system are *retrieved* ($a + b$), and all the documents that fail to match this strategy are *not retrieved* ($c + d$). This dichotomous partitioning of the document collection may be regarded as a form of system relevance prediction. The system, in a sense, predicts that certain documents are likely to be relevant and others are likely not to be relevant. It retrieves the former and holds back the latter.

OVERVIEW

In almost all situations, the number of documents retrieved by a search will be quite small in relation to the total collection size. Put differently, in almost all searches, $a + b$ will be quite small but $c + d$, the number of items not retrieved, will be very large. A search might, for example, retrieve 80 document references from a total file of 500,000 references. In this case, $a + b = 80$, while $c + d = 499,920$.

The other dimension of the 2×2 table relates to the relevance decisions of the system user (i.e., the person for whom the search is conducted). A perfect search would retrieve all the documents in the database that the user judges to be relevant ($a + c$) and would not retrieve any that he judges not to be relevant ($b + d$). In this case, there is perfect coincidence between the user relevance assessments and the system relevance predictions. That is, $b = 0$ and $c = 0$. We would say that this search has achieved 100% recall and 100% precision.

Recall relates to the ability of the system to retrieve relevant documents and *precision* relates to its ability not to retrieve irrelevant documents. The degree of recall achieved in a search, and the degree of precision achieved in a search, may both be expressed as ratios. The *recall ratio* is defined as

$$\frac{\text{Number of relevant documents retrieved}}{\text{Total number of relevant documents in the collection}} \times 100$$

In terms of Table 1, the recall ratio is

$$\frac{a}{a + c}$$

The *precision ratio* is defined as

$$\frac{\text{Number of relevant documents retrieved}}{\text{Total number of documents retrieved}} \times 100$$

In terms of Table 1, the precision ratio is

$$\frac{a}{a + b}$$

The precision ratio and the recall ratio, used jointly, express the filtering capacity of the system: its ability to let through what we want and hold back what we don't want. Neither one on its own gives a complete picture of the success of a search because, clearly, it would always be possible to get 100% recall if we retrieved enough of the total collection; if we retrieved the entire collection ($a + b + c + d$), we would certainly achieve 100% recall. Unfortunately, however, precision would be extremely low in this situation because, for any typical request, the great majority of the items in the collection will not be relevant.

The precision ratio may be viewed as a type of cost factor. It is a cost factor in user time—the time required to

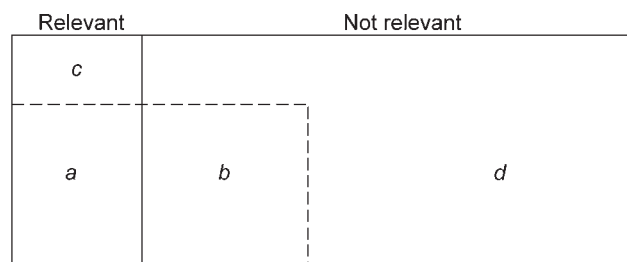
Table 1 2×2 Table of results of a literature search

System relevance prediction	User relevance decisions		
	Relevant	Not relevant	Total
Retrieved	a	b	$a + b$
Not retrieved	c	d	$c + d$
Total	$a + c$	$b + d$	$a + b + c + d$

separate the relevant citations from the irrelevant ones in the output of a search. Consider, as an illustration, a search request for which there are 20 relevant documents in a particular database. Suppose that one uses three different search strategies to interrogate the system and that each strategy retrieves 15 of the 20 relevant items (i.e., recall is 75%). In the first search, the total number of items retrieved is 30; in the second, it is 60; and in the third, it is 150. The precision ratio in these three searches is 50%, 25%, and 10%, respectively. In the first search, the user has to examine only 30 citations to find the 15 of relevance; in the second he must examine 60; and in the third, 150. All other things being equal, it will take him longer to separate the relevant from the irrelevant in the second search and considerably longer in the third. It is in this sense that we can regard the precision ratio as a measure of user effort or cost. A search that achieves 75% recall at 50% precision is more efficient than one that achieves 75% recall at 25% precision, and this is more efficient than one that achieves 75% recall at 10% precision.

As stated earlier, these ratios measure the degree of coincidence between the user relevance assessments and the system relevance predictions. In a perfect search, these will exactly coincide. Unfortunately, such perfect searches are relatively rare. We are more likely to get a situation in which there is partial coincidence between the set $a + c$ and the set $a + b$, as shown in Fig. 1. In this diagram, the total collection is represented by the solid rectangle and the set of items retrieved by the dotted rectangle. The hypothetical, but very typical, search has retrieved most, but not all, of the relevant documents and has avoided retrieval of most, but not all, of the irrelevant documents.

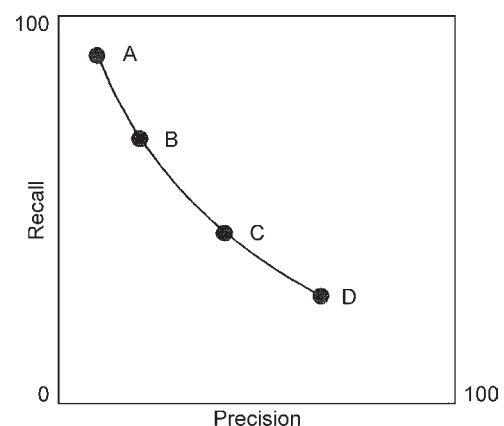
Recall and precision tend to be related inversely. By this we mean that when we broaden a search, to achieve better recall, precision will tend to go down. Conversely, when we narrow the scope of a search, in order to improve

**Fig. 1** Results of a typical search in a retrieval system.

its precision, recall will tend to deteriorate. For a particular group of, say, 50 requests, we could conduct each search at a number of different levels, from an extremely broad search designed to get very high recall, to an extremely narrow one, designed to get high precision. If we derived recall and precision ratios for each of these search approaches, we could reduce the results to a plot of recall versus precision. The resulting plot would look something like that of Fig. 2. It represents the average of the recall and precision ratios for all 50 searches, with each search being conducted at four different “levels.” It can be seen that when the searches are conducted very generally (point A), a very high recall of around 90% is achieved; the precision, however, is very low. When, on the other hand, the searches are made very specific, a high-precision, low-recall result (point D) is achieved. The points B and C represent compromise strategies between these two extremes.

The curve of Fig. 2 represents the *average* of the results for 50 searches when each search is deliberately conducted at four different levels. But, in this situation, as in others, averages may be quite misleading. The performance figures for the individual searches are unlikely to fall on this curve. In fact, they are likely to be widely scattered, as shown in Fig. 3. Here we can see some very good results (top right-hand corner of the plot), some very poor results (bottom left-hand corner), some high recall–low precision results, some high precision–low recall results, and some completely middle-of-the-road results. When we average out all of these, we arrive at average performance figures and an average performance curve, A–D.

Recall and precision ratios are two important measures that can be used in the evaluation of an information retrieval system. Their major value lies in the fact that they can be used to determine under what conditions the system seems to operate best. Consider Fig. 3 again. What we really want to know is why some searches have produced very good results and some very poor results. In

**Fig. 2** Typical plot of recall versus precision.

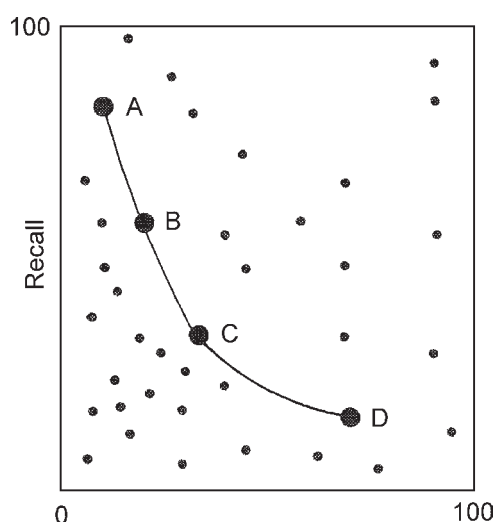


Fig. 3 Scatter diagram of search results.

other words, “what makes a good search good” and “what makes a bad search bad”? One way of approaching an answer to this question is to divide up all the searches according to various characteristics and to produce a family of curves for the various sets of searches thus created. In Fig. 4, we see the average performance curves for three groups of searches. Clearly, Group 1 has produced the best results and Group 3, the worst. The curves shown in Fig. 4 may represent searches conducted in different subject fields, searches conducted by different processing centers, searches conducted for different types of users, searches conducted for requests arriving in various ways (by mail, by telephone, by personal visit), and so on.

An analysis of this type might indicate weaknesses in the system and ways in which the performance might be improved. For example, if the Group 3 curve represents searches in a particular subject area, these poor results might indicate inadequacies in the vocabulary of the

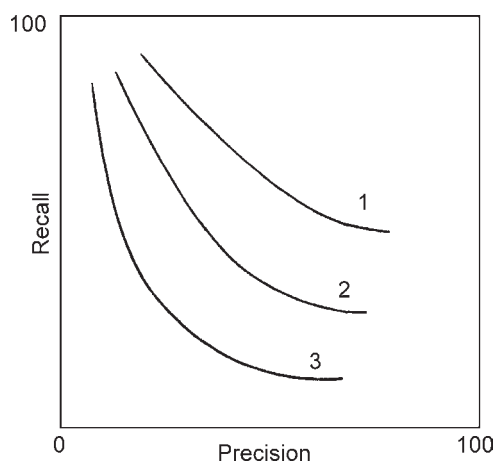


Fig. 4 Family of curves representing results for groups of searches of different “types.”

system in this subject field. The evaluation has pinpointed this weakness and thus allows us to take appropriate corrective action. It should be pointed out, however, that we are likely to need a fairly large number of searches (many more than 50) to conduct, with any level of statistical confidence, the type of comparison exemplified by Fig. 4.

Recall and precision ratios have another important use. Each ratio is likely to indicate a certain number of failures and this permits us to conduct an analysis to determine why these failures occurred. To take a simple example, suppose that a particular search has performed as follows:

1. $7/10 = 70\%$ recall
2. $7/28 = 25\%$ precision

These results indicate 3 recall failures (instances in which a relevant item was not retrieved by the search) and 21 precision failures (instances in which irrelevant items were retrieved by the search), and these failures must be analyzed to determine why they occurred. Failure analysis of this type is the diagnostic element in an evaluation program. It is the most important part of the entire evaluation activity. Failure analysis requires an examination of the document involved, how it was indexed, the request statement, the search strategy, and the vocabulary of the system. The objective is to determine why the failure occurred and to attribute the failure to the appropriate component of the total retrieval system (the indexing, the search strategy, the vocabulary, or the user-system interface).

So far in this article, we have assumed that it is relatively simple to obtain recall and precision ratios for a search in a retrieval system. It is relatively easy to obtain a precision ratio for a search, but, it is not at all easy to measure recall. Consider another 2×2 table, Table 2, this time with some hypothetical results entered. Some of the results in this table are directly observable, others can be obtained through the cooperation of the requester, and some can only be estimated.

The database represented in this table contains 500,000 items, and this hypothetical search has retrieved 50 items and has not retrieved 499,950. This is a typical result. For any search in a retrieval system, the great majority of the items in the collection are not retrieved. To obtain a precision ratio for the search, we need to discover how many of the 50 items retrieved are “relevant.” We can obtain this

Table 2 Results of a hypothetical search in an information retrieval system

System relevance prediction	User relevance decisions		
	Relevant	Not relevant	Total
Retrieved	10	40	50
Not retrieved	5	499,945	499,950
Total	15	499,985	500,000

figure by submitting these items to the person requesting the search and asking him to assess their relevance to the information need that prompted the request to the system. In this hypothetical case, he judges only 10 to be relevant. The precision ratio is thus 10/50, or 20%. We have assumed here that it is the requester who should make these relevance assessments. Not everyone accepts this assumption, however, and some would have relevance assessments made by an independent observer or possibly a jury of such observers.

We are still left with the problem of estimating recall, and this is not particularly easy. To establish recall, we need to determine how many of the documents not retrieved by the search are, in fact, relevant to the search request. There is only one way of determining absolute recall for a search and that would involve the examination of each and every item not retrieved. This is an impossible task in any but a very small, experimental situation. In the case of the search represented in Table 2, 499,950 documents would need to be examined. Random sampling does not improve the situation very much. In the case of this hypothetical search, we would need to examine a sample of $499,950/5$ items, almost 100,000, in order to have any chance of finding even one relevant item purely at random.

Since it is virtually impossible to determine absolute recall, we must usually be satisfied with an estimate of recall. The most satisfactory of these is to base the recall estimate on some subset of documents known to exist in the database and known to be relevant. The situation is represented in Fig. 5. For any request R , the collection I contains a set of documents A that the initiator of the request would judge relevant if he saw them. That is, they are the set $a + c$ of Table 1. Unfortunately, we do not know the identity of the documents in this set. For a very large collection, we will never know it. We can, however, estimate recall on the basis of a subset $A1$ of the set A . The subset $A1$ consists of a group of documents that we know to be relevant and we know to exist in the database. This subset could consist of relevant documents known by the requester before the search is conducted, it could consist of items found by a parallel search in one or more other indexes (e.g., printed indexes) and judged relevant by the requester, or it could be derived from a combination of these two sources. However we arrive at it, the recall ratio

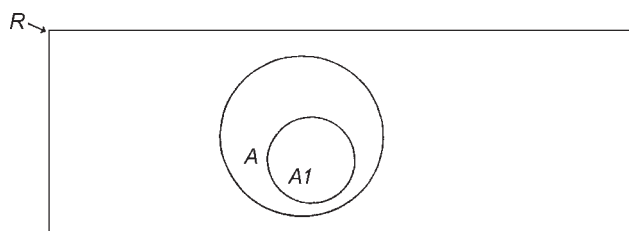


Fig. 5 Method of estimating recall by subset of relevant documents known to exist in the database.

of the search is estimated on the basis of the number of this subset $A1$ that are retrieved. To take a very simple example, suppose that the subset $A1$ consists of 3 documents known to be relevant and known to be in the collection. The search retrieves 2 of the 3 and our recall estimate is, therefore, 66%. In the case of the hypothetical search of Table 2, we know that 10 relevant documents have been retrieved. Our recall estimate indicates that 10 is approximately 66% of the total of relevant documents in the database. Our estimate of the number of relevant documents missed, then, is 5.

The subset $A1$ is the *recall base* by which we estimate the recall ratio for a search. It is obvious that with very small recall bases we can have little statistical confidence in the recall estimate for a single search. But when we apply this technique to a large number of searches, we can create quite a large composite recall base and, as shown by Shumway,^[1] we can achieve quite a high degree of confidence in the results for the entire set of searches or for large groups of these searches. This technique was used by Lancaster in the largest evaluation so far conducted.^[2] This study was an evaluation of MEDLARS, the computer-based system of the National Library of Medicine. Some 300 searches were used in this study, and the combined recall base for these searches consisted of almost 2,000 known relevant documents.

DIFFERING REQUIREMENTS FOR RECALL AND PRECISION

Not everyone needs high recall all of the time. Different users will have different requirements for recall and precision, and a particular individual will have different requirements at different times. The precision tolerance of the user is likely to be directly related to his recall requirements. At one end of the spectrum, we have the individual who is writing a book, preparing a review article, or beginning a long-term research project. He is likely to want a comprehensive (high recall) search, and he may tolerate a fairly low precision in order to assure himself that he has not missed anything of importance. At the other end, we have the typical user of, say, an industrial information service who needs a few recent articles on a subject and needs them right away. This individual does not need high recall, but he will expect high precision in the search results. Other individuals may prefer a compromise; they would like a "reasonable" level of recall at an "acceptable" level of precision.

It seems rather pointless to use the recall ratio as a measure of the success of a search in which high recall is unimportant. This has led some writers to suggest the use of some measure of proportional recall (or relative recall) in which the success of the search is expressed in terms of the number of relevant documents retrieved over the number of relevant documents wanted by the requester. For example,

the requester specifies that he needs five relevant documents but the search retrieves only three. The proportional recall ratio is, therefore, three-fifths or 60%. This measure, while attractive on the surface, is rather artificial in that very few requesters will be able to specify in advance just how many documents they want from the system.

Another limitation of the recall ratio is that it assumes, more or less, that all relevant documents have approximately equal value. This is not always true. A search may retrieve 5 relevant documents and miss 10 (recall ratio = 33%) but the 5 retrieved may be much better than the 10 missed. They could, for example, be more up to date and might in fact make the other 10 items completely redundant. The recall ratio, while important, must therefore be used with some caution in the evaluation of information services.

ALTERNATIVE PERFORMANCE MEASURES

The 2×2 table (Table 1) contains all the data that we really need to know about a search in a retrieval system for evaluation purposes. One way of expressing the results of this table is by the recall ratio and the precision ratio, used jointly. But there are several other measures of performance that can be derived from this table, and there are various ways in which these results can be presented. Before we mention some alternative measures, it may be desirable to give some names to the various cells of Table 1. The set a we can refer to as the *hits*, the set c as the *misses*, the set b as the *noise* (in the communications sense), and d as the set *correctly rejected*.

From Table 1, all of the following measures can be derived:

- $a/(a + c)$ The *recall ratio*, also known as the *hit rate*. The measure was apparently first suggested by Perry, who referred to it as the *recall factor*.^[3] Swets calls it the *conditional probability of a hit*.^[4] Goffman and Newill have called it *sensitivity*.^[5]
- $c/(a + c)$ This is the complement of recall. Fairthorne has called it a *snobbery ratio*.^[6] Swets terms it *conditional probability of a miss*.
- $a/(a + b)$ This is the *precision ratio*, sometimes referred to as the *relevance ratio*. Again, Perry seems to have introduced the measure.^[3] Perry called it the *pertinency factor*. Others have referred to it as an *acceptance rate*.
- $b/(a + b)$ This is the complement of the precision ratio, called, by Perry, the *noise factor*.
- $b/(b + d)$ This measure seems to have been first suggested by Swets, who referred to it as the *conditional probability of a false drop*.^[4] Cleverdon et al. have since named it the *fallout ratio*.^[7] It has also been referred to as *discard*.
- $d/(b + d)$ The complement of *fallout*. Goffman and Newill have called it *specificity*.^[5] Swets names it the *conditional probability of a correct rejection*.

Each one of these measures can be referred to as a *single measure* of merit for a search. When two measures are used together (as in a plot of recall versus precision or recall versus fallout), this has been referred to as a *twin variable measure*. When an attempt is made to combine two of these separate measures into a single measure (e.g., one reflecting both recall and precision), the result is known as a *composite measure* or, possibly, a *single figure of merit*.

These measures are appropriate for use with a retrieval system that merely divides a collection into two parts, those items retrieved and those not retrieved by a particular search. But certain systems will do more than this. They will generate a "ranked output" of documents in order of probable relevance to a request. Ranking systems should be evaluated in a somewhat different way because here we need an indication of the success of the ranking procedure. Various measures that have been applied to ranking systems include *rank recall*, *log precision*, *normalized recall*, and *normalized precision*. These measures, introduced by Salton, essentially compare the actual ranking achieved by the system with an ideal ranking.^[8] That is, the measures reflect the degree to which the ranking matches the ideal situation.

CONCLUSION

Rather complete discussions of evaluation measures, methods of averaging results, and methods of presenting results of retrieval tests have been provided by Keen^[9,10] and by Robertson.^[11,12] Recall ratios and precision ratios have been the measures most used in evaluations of information retrieval systems. These measures were popularized by Cleverdon in the ASLIB Cranfield Project.^[13] Many other writers, however, have presented reasons why other measures may be regarded as more accurate or more informative. Robertson's paper provides a useful analysis of the pros and cons of the various measures that have been proposed or used.

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Presidential Libraries

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Abstract

The National Archives and Records Administration (NARA) administers a nationwide network of Presidential libraries beginning with the 31st President of the United States, Herbert Hoover. These are not traditional libraries, but rather repositories for preserving and making accessible the papers, records, and other historical materials of U.S. Presidents. When a President leaves office, NARA establishes a Presidential project until a new Presidential library is built and transferred to the Government. Presidential libraries and museums are great treasures of our nation's history. They are important sources for historians and other researchers studying our presidents and our history. In addition to archiving and preserving presidential papers and objects, presidential libraries and museums bring history to millions of visitors from around the world.

BRIEF HISTORY OF THE PRESIDENTIAL LIBRARY SYSTEM

Sixty years ago, Franklin D. Roosevelt proposed creating a Presidential Library that would be part of an institution whose growth he had shepherded—the National Archives. Roosevelt suggested a creative approach—he would donate the land, build the library with private funding, and then give the library and his papers to the National Archives. On June 30, 1941, as the war in Europe threatened democracy, Roosevelt dedicated his library at Hyde Park. His words of dedication express as well today as then the importance of records in the nation's history and the nation's future.

To bring together the records of the past and to house them in buildings where they will be preserved for the use of men and women in the future, a Nation must believe in three things.

It must believe in the past.

It must believe in the future.

It must, above all, believe in the capacity of its own people so to learn from the past that they can gain judgment in creating their own future.^[1]

The Roosevelt Library is the only Presidential Library built, dedicated, and used while the president was still in office. It became the model for the Presidential Library system. Privately constructed and donated to the government, Presidential Libraries provide extensive services for their researchers, an expansive collection of presidential materials, and incorporate a museum experience for hundreds of thousands of visitors each year. Geographically

dispersed around the country, Presidential Libraries allow more students and the public to learn about the election process; how government works; leadership, decision making, and the role of the presidency; and historical events that have taken place in much of the twentieth century.

In 1952, President Truman, deploring the scattering of presidential papers in the past, stated “[the President's papers] ought to be accessible in one place...where the scholars and archivists can get to them without difficulty. I hope we will have that in the future.” He went on to say that he wanted the “state papers of President Roosevelt and myself properly cared for.”^[2] Originally, Truman considered depositing his papers at the National Archives, in Washington, DC, but by 1950, he decided on a Presidential Library in his hometown of Independence, Missouri. Truman strongly believed that Presidential Libraries were not to be monuments to a president but centers for the study of the presidency. The Truman Institute, established to build and support the library, has a long history of sponsoring intellectual exchanges through conferences and the Truman Grants program for the study of the presidency.

Dwight D. Eisenhower's clear support of the development of a library at the site of the already established Eisenhower Museum in Abilene, Kansas, prompted Congress to pass The Presidential Libraries Act of 1955 (44 U.S.C. § 2108). The legislation had full bipartisan support, and was hailed by scholars and educators. This act provided continuing legal authority for the government to accept the gift of a Presidential Library without seeking legislative authority for each new library.

President Hoover had originally given his papers to Stanford University, but responded favorably to a request of a citizens committee from his hometown for the

development of a library in West Branch, Iowa. His library became the third added to the system in 1962. The Eisenhower Library was also opened in 1962, and a pattern, which has remained unbroken, was established.

Over time, however, the venue for a Presidential Library shifted from the president's hometown, to larger metropolitan areas or a university campus. The Lyndon B. Johnson Presidential Library and Museum became the first Presidential Library located on a university campus. President Johnson sought to place his library in a university environment convenient for students and faculty where materials housed in the library could be used to promote the study of history, economics, political science, public affairs, and numerous other academic pursuits. Along with building the library, the Lyndon Baines Johnson Foundation established to provide additional support for the library also supports the LBJ School of Public Affairs located next door to the library.

This has meant that this remarkable public-private partnership that builds and supports the libraries has often expanded into three- and even four-way partnerships, as the library foundation, the university, and the local community come together to build a presidential center that can be turned over to the government. The Presidential Libraries Act of 1955 presciently enabled this by authorizing the government to enter into agreements with any state or political subdivision, universities and institutions of higher learning, and institute or foundation for the purposes of using land, buildings, and equipment for a Presidential Archival Depository. The John F. Kennedy Library is adjacent to the University of Massachusetts; the Lyndon B. Johnson Library and Museum is on the campus of the University of Texas at Austin; the Gerald Ford Library is at the University of Michigan; the Jimmy Carter Library is near the campus of Emory University; the George Bush Library is part of Texas A&M University; and the William Clinton Library will be affiliated with the University of Arkansas at Little Rock.

Overseeing these institutions for the National Archives and Records Administration (NARA) is the Office of Presidential Libraries established as a permanent part of NARA in 1964. Until then, the functions of supervision, coordination, and administration of Presidential Libraries had been handled directly out of the office of the Archivist of the United States. Herman Kahn, who had been the director of the Roosevelt Library, became the first Assistant Archivist for Presidential Libraries. His job was to establish and coordinate policies with regard to Presidential Libraries, including programs for acquisition, preservation, and use of historical materials appropriate for deposit in the Presidential Libraries, and to maintain liaison with the incumbent administration and with officials of former administrations with regard to organization, storage, and reference service on presidential papers and other historical materials. The current Assistant Archivist for Presidential Libraries, appointed in November 2001, is

Richard Claypoole who now oversees a system of 10 Presidential Libraries, the Clinton Presidential Project, the Nixon Presidential Materials Staff, and the Presidential Materials Staff.

In 1986, Congress passed various amendments to the 1955 Presidential Libraries Act to reduce the costs of operating Presidential Libraries. 44 U.S.C. § 2112 requires that an endowment equal to 20% of the cost of the building be transferred to the government at the time the library is turned over to the government. Libraries larger than 70,000 square feet are to be accompanied by an endowment that increases geometrically in accordance with the size of the building. The George H.W. Bush Library is the first library required to have an endowment. On the day the Bush Library was dedicated, the Bush Foundation presented a check for \$4 million to the National Archives Trust Fund. Interest on the endowment is now used to offset part of the cost of operating the library. The act also required the Archivist to promulgate architectural and design standards for the preservation of materials and the inclusion of adequate research facilities. Architectural and design standards for Presidential Libraries address program and siting requirements and standards for structures, security, fire and life safety, lighting, electrical, and HVAC design.

The 1986 act did not change the requirement that the Archivist submit a written report to Congress prior to accepting a library, but it did set forth the specific information required in the report. The Archivist may not accept the library until the expiration of a period of 60 days of continuous session of Congress beginning on the day the Archivist transmits the report. The report must include:

- A description of the proposed gift
- A statement specifying the total cost and the amount to be deposited in an endowment
- A general description of any papers, documents, or historical materials proposed to be deposited in the library
- An estimate of the increase in the total annual cost to the United States of maintaining, operating, and protecting the depository
- A certification that the depository and the equipment therein will comply with the standards promulgated by the Archivist

PRESIDENTIAL MATERIALS

Throughout the eighteenth, nineteenth, and well into the twentieth century, no one questioned the private ownership of presidential papers by the president. Former presidents could donate them to a library or archives, or not, as they saw fit. Fortunately, many presidential papers were donated and are available for historical research

today. However, many were accidentally or purposely destroyed. Biographers of George Washington snipped out pages of Washington's diaries. Chester Arthur burned his papers. Former presidents and their families exercised considerable discretion in what they donated resulting in selective donation and selective destruction. One very powerful reason the National Archives wanted libraries built and given to the National Archives was that the donation of a library meant the National Archives would also receive the president's papers. In its time, this system of donation worked very well. Although there was nothing mandatory in the legislation for Presidential Libraries requiring that presidents systematically preserve their presidential papers, the legislation assured a president who donated his materials to the National Archives that the integrity of his papers would be preserved. The papers would be cared for by a professional archival staff and made available to all as historical records.

The handling of presidential materials began to change again with President Nixon's resignation in 1974. Congress enacted the Presidential Recordings and Materials Preservation Act (PRMPA; 44 U.S.C. § 2111) to ensure that no evidence in President Nixon's papers, tapes, or other historical material relating to Watergate would be destroyed. The PRMPA seized the Nixon presidential materials and gave the National Archives and Records Service, now the NARA, legal custody and control over them.

Historians, journalists, and Congress now raised serious questions about the ownership of presidential materials, suggesting instead they be treated as government records. PRMPA had established the National Study Commission on Records and Documents of Federal Officials to explore topics of ownership, control, disposition, and preservation of historic materials. The report of the commission, completed in March 1977, made two basic recommendations:

1. All documentary materials received or made by federal officials in discharge of their official duties should be considered the property of the United States.
2. Federal officials should be given the prerogative to control access to their materials up to 15 years after the end of their federal service.

In 1978, Congress acted on the report and passed the Presidential Records Act (44 U.S.C. § 2201-2207). This act created and defined a new category of records—presidential records—and established the terms of access to these records. The act clearly established that these records are owned by the United States. After conclusion of a president's tenure, the custody of presidential records is transferred to the Archivist of the United States. The former president retains the right to impose specific restrictions outlined in the Presidential Records Act statute

on the records until 12 years after he has left office. Executive Order 13233 signed by President George W. Bush outlines a process for notification and review for executive privilege of presidential records proposed for opening.

Government archivists and curators preserve, process, and provide access to the presidential materials in their care. The process for providing access to donated historical materials and the process for providing access to presidential records vary somewhat in implementation because of the statutory and regulatory requirements. However, the mission of the government staff in each library is the same—to preserve and process the materials, and to provide access as fully and promptly as the law or deed and resources permit.

The 10 Presidential Libraries, the Nixon Presidential Materials Staff, and the Clinton Presidential Materials Project maintain more than 400 million pages of textual materials; more than 24 million photographs; 14.5 million feet of motion picture film; 103,000 hours of disc, audio-tape, and videotape recordings; nearly 500,000 museum objects; and 40 million e-mail messages. In addition, the Clinton Presidential Materials Project has available on its website (<http://www.clinton.archives.gov>), four snapshots of the Clinton White House website.

The most important materials in each library are those the president and his staff create in the course of their official duties. In recently established Presidential Libraries, these documents can also be in electronic form. Researchers find that each library contains a rich audiovisual and photographic record of a president at work. Taken together, these historical materials form the substantive record of public policy in each administration. Libraries also house numerous museum objects including family heirlooms, items collected by the president or his family, campaign memorabilia, awards, and the many gifts given to the president by American citizens and foreign dignitaries. The latter include Head of State gifts under The Foreign Gifts and Decorations Act (22 U.S.C. § 264), and gifts received by the president from private citizens and accepted by him for eventual deposit in his presidential library (44 U.S.C. § 2111-2112). These gifts range in type from homemade items to valuable works of art. Curators in Presidential Libraries and in other museums throughout the country draw upon these collections for historical exhibits.

Other significant holdings include the personal papers and historical materials donated by individuals associated with the president. These individuals may include cabinet officials, envoys to foreign governments, political party associates, and the president's family and personal friends. Several libraries have undertaken oral history programs that have produced significant tape-recorded memoirs. A third body of materials comprises the papers accumulated by the president prior to, and following, his presidency. Such collections include documents relating to Franklin Roosevelt's tenure as Governor of New York and Dwight Eisenhower's long military career.

Each of the libraries has available on its website detailed information about their holdings. Many also provide copies of significant documents, photographs, and oral histories from their collections online. To access library websites, visit <http://www.archives.gov> and click on “Presidential Libraries” for links to each website.

Many historians, educators, and other users have offered their testimonials on the value of Presidential Libraries and the dedicated staff that preserve, process, and assist them in using the materials. Countless forwards to well-known historical works over the past 50 years refer to the importance of these materials for exploring and understanding historical themes and issues of our time. In a recent *Washington Times* article (2/28/00), the reporter noted that “As far as scholars, educators and the U.S. government are concerned, the libraries are among the most important research sites in the United States.” In the same article, Page Miller, former director of the National Coordinating Committee for the Promotion of History, is quoted saying, “All you have to do is check the footnotes of major prize-winning books and monographs dealing with presidents and you’ll see they all reference presidential libraries.” Anna Nelson, a long-time user of archives, has found that “in all these presidential libraries the archivists are splendid,” a view widely shared by other professionals who use the libraries.

The materials in Presidential Libraries are among this nation’s most important documents. Presidential records are often open for research long before the records of other departments and agencies of government are even transferred to the National Archives. Political scientists study the different approaches and processes used by presidents to govern, and then make recommendations to new presidents on what works and does not work. Economists study the impact of presidential decisions on economic indicators and project what will happen in the future. The media searches for examples from our past to inform the public about current events. Hundreds of thousands of children visit libraries each year to learn about how presidents make decisions, how laws are passed, how wars were fought, how our civil rights have been ensured, and how their ancestors lived. More than 1 million visitors each year view the human drama of the presidency through the power of objects and documents displayed in the libraries.

PUBLIC AND EDUCATIONAL PROGRAMS

Each library offers various public and educational programs designed to give visitors a better understanding of the president, the institution of the presidency, and the American political system as a whole. Exhibits, conferences, and lectures funded by privately endowed library foundations are among the special events that help to define a library, and enhance its role as a

repository and cultural institution. Museum exhibits use library holdings to depict the stages of a president’s life, the important policy decisions of his administration, and the various world and national events that occurred during his term.

Libraries work with educators to encourage the use of primary source materials by students, and sponsor public lectures, film series, and other events of historical or current interest. Conferences are another way in which the libraries serve the public and examine various topics ranging from public affairs and domestic policy to foreign affairs and world wars.

In 1973, James B. Rhoads, then Archivist of the United States, told an education symposium at the Lyndon Baines Johnson Library, “Presidential Libraries would be fulfilling their purpose if they did nothing more than preserve and provide access to the papers they contain. . .but their charters are broad and their possibilities for service are unlimited.” However broad their charters may be, the libraries face limitations imposed by financial reality. Taxpayers are under no obligation to fund a temporary exhibit on the Civil War, a conference on civil rights, or educational efforts aimed at high school students, admirable and useful as these undeniably are to the public. These efforts are funded by the libraries’ support organizations, which constitute much of the financial support received by the Presidential Libraries. Congressionally appropriated funds cover many of the personnel costs; program costs, such as collections maintenance, preservation, and access to records; building operations and maintenance; and repair and restoration. In 2001, actual obligations from appropriated funds totaled nearly \$40 million for the Presidential Library system.

LIST OF PRESIDENTIAL LIBRARIES

- Dwight D. Eisenhower Library
200 SE 4th Street
Abilene, KS 67410-2900
- Franklin D. Roosevelt
4079 Albany Post Road
Hyde Park, NY 12538-1999
- George Bush Library
1000 George Bush Drive, West
College Station, TX 77845
- Gerald R. Ford Library
1000 Beal Street
Ann Arbor, MI 48109-2114
- Gerald R. Ford Museum
303 Pearl Street, NW
Grand Rapids, MI 49504-5353
- Herbert Hoover Library
210 Parkside Drive
P.O. Box 488
West Branch, IA 52358-0488

Harry S. Truman Library
500 West U.S. Highway 24
Independence, MO 64050-1798
John Fitzgerald Kennedy Library
Columbia Point
Boston, MA 02125-3398
Jimmy Carter Library
441 Freedom Parkway
Atlanta, GA 30307-1498
Lyndon Baines Johnson Library
2313 Red River Street
Austin, TX 78705-5702
Nixon Presidential Materials Staff
8601 Adelphi Road, Room 1320
College Park, MD 20740-6001
Presidential Materials Staff
700 Pennsylvania Avenue, NW
Washington, DC 20408-0001

Ronald Reagan Library
40 Presidential Drive
Simi Valley, CA 93065-0699
William J. Clinton Presidential Materials Project
1000 LaHarpe Boulevard
Little Rock, AK 72201

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Primary Records: Future Prospects [*ELIS Classic*]

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Abstract

G.T. Tanselle probes deeply into the nature of primary records. He addresses many contextual questions about their future prospects in the light of current trends to microfilm and digitize documents and destroy pre-existing versions of them.

—*ELIS Classic*, from 2003

INTRODUCTION

When one speaks of “the future of primary records,” there are at least four questions implicit in the phrase. One is, “Will people in the future have any interest in primary records?” An assumption that records of some kind will be needed leads to a second question, “What will be the form of the primary records that are created in the future?” A third question, looking backward to earlier records, is, “Will the primary records created in the past have a future usefulness as objects from the past?” This question asks, in other words, whether the perceived content of earlier records will be transferred to new forms employing the same technology as the newer records; and, if so, whether there is a reason to continue using the original physical objects as well. A fourth question, independent of the third but closely related to it, is, “Will the presently surviving physical objects that transmitted texts in the past continue to be available?” Do they—that is to say—have a future in the most basic sense: will they survive? And if they do survive, can they be found in accessible locations?

All of these questions are obviously interconnected. An object cannot be used unless it exists; and though it may exist without being used, its chances of survival are greater if it is perceived to serve a function. As technology changes, the function of earlier objects is brought into question, because there is a convenience in having all materials in compatible forms, and because the newer forms are likely to be regarded, by a great many people, as superior to the older ones. But if no one sees any function for records from the past, and if, therefore, no one has any interest in them, then their survival is not a matter of concern in any case. Although the questions continually impinge on each other, taking them up separately can be an aid to clear thinking. The late twentieth century has seen a great deal of discussion of the whole subject, but much of the commentary has been vitiated by a failure to think through, in a methodical way, the complexity of issues necessarily involved. The following responses to the four questions posed here constitute an attempt to provide a logical framework for further discussion.

INTEREST IN PRIMARY RECORDS

Any concern for the future of primary records presupposes a future interest in them; and such an interest does not seem self-evident to everyone. A necessary foundation, then, for discussing this topic is an understanding of the inevitability—almost by definition, one might say—of an interest in primary records. It is essential, therefore, to know what definition of the term “primary record” leads to that conclusion; and the process of defining it reveals many of the issues that make the subject complex.

The word “record” is ambiguous in the same way that “book” is: sometimes it refers to a physical object, sometimes it denotes what is regarded as the content of a physical object, and sometimes its meaning shifts from one to the other within a single discussion, producing a confused argument. If a literary critic first employs “book” to mean “literary work” (as we all do when we speak of a “good book”) and then quotes from or discusses “the text of the book,” referring to the particular text physically present in the copy being read, the result is fundamentally flawed by its unexamined assumption that a verbal work is identical to any given text of it.^[1] The two are theoretically distinct, because a verbal work, made of language, is intangible and cannot reside in physical form. Each tangible object that carries a verbal text, such as a printed book, is one effort to transmit an intangible work, to make it transportable across time. But, each may be deficient, in one way or another, according to any of various possible standards for judging what ought to be there. The distinction between these senses of “work” and “book” is a necessary one, whatever terms one chooses to use. In coherent discussion, therefore, “book” must be used in only one way, and it seems sensible to employ the word to refer to a physical object, not to the intangible work that the object aims to transmit.

“Record” is simply a more encompassing term that includes “book” as one of its subcategories. Archivists are likely to think of “record” as denoting unprinted or unpublished material (especially when created as a by-product of the activities of an institution or individual).

But the extension of this archival term, and “archive,” to include printed artifacts has been common, as in phrases like “the print record” or “the national printed archive.” Archivists are no less guilty than literary critics of blurring the distinction between physical text and intangible work: they may think of a “record” initially in physical terms, but when they include microfilming as a procedure for “record management,” they have obviously switched to a concept of a “record” as a disembodied text. (The same switch applied to the word “materials” occurs in this sentence from a library newsletter: “Most brittle materials can be returned to usable condition by reformatting—transferring the information to another medium.”^[2]) If, to avoid this problem, we restrict “record,” like “book,” to the physical, it denotes a wider range of objects than books, from all kinds of handwritten and printed ephemera to business ledgers and card files. What links all of these objects is that they are the vehicles by which compositions in intangible media are transported. To make the compositions tangible, they are converted to notations that can be presented visually on physical surfaces—such notations as musical scores, choreographic diagrams, mathematical formulas, or alphabetical and numerical characters arranged to represent words and calculations.

A “record,” then, for present purposes, can be defined as an artifact carrying a text that represents in physical form an intangible work. (The word “document” can be used synonymously with it.) Such objects are aptly called “records,” because they do not contain the works themselves but only “records” of those works. There are other artifacts, of course, that convey works made up of physical media. They are not usually called “records,” because the works actually exist in them or are identical to them. Paintings, sculptures, and buildings, which use physical media, exist as physical objects. One might, for certain purposes, wish to think of them as “records” of human activity rather than as works of art, but in either case, one would be examining the same objects. Reproductions of paintings, sculptures, or buildings could also be thought of as “records”; but, as long as the works survive, the reproductions do not provide the sole means for approaching them, because the works can be apprehended directly. Tangible records of intangible works, on the other hand, are essential for reconstructing and experiencing those works, because there is nowhere else to turn (except, in some cases, to oral tradition, which poses analogous problems).^[3]

One might think, then, that the future of such records would be considered in the same terms as that of works in physical media, but by and large, it is not. Art historians and museum curators would scarcely condone the destruction of the artifacts they study, and their discussions of the future of those artifacts focus on preservation. But persons who deal with intangible works—from readers of literature to economic historians studying company archives—frequently believe that the content of what they are

concerned with can be separated from the physical objects in which it has appeared. To these persons, preservation is less likely to mean saving physical records than maintaining their “content” in some form. Discussions of records, as defined above, therefore, involve explaining the value of physical details in a way that would usually seem superfluous when talking about other kinds of artifacts.

This is where the concept of “primary” evidence comes in, though adding the word “primary” to “record” presents further complications. “Primary” means simply “first-hand”—that is, not derived or reported. Whether it also refers to physical evidence depends on the context. The term “primary record,” when used by those persons who equate records with intangible works, would not signify any physical details; it would mean a direct quotation from the figure being discussed or from an eyewitness account of an event, rather than a restatement made by someone farther removed from the subject of the discussion. From this point of view, an original manuscript and a microfilm of it would equally be primary records. If, however, one takes “record” to refer to an artifact, as we are doing here, then a “primary record” is a specific object containing a particular text of a work—the object being one directly connected with the historical moment that is the focus of one’s attention. Under this definition, if an author’s manuscript or a business ledger were considered a primary record, no copy of the texts in them—whether produced by handwriting, typewriting, photography, xerography, electronic scanning, or any other means—would be primary, because all such copies would constitute different physical objects.

One must remember, however, that an object regarded as primary for one purpose is not necessarily primary for another. Although an author’s manuscript (the manuscript itself, that is, not a photocopy of it) is a primary record for the study of the author’s method of working, it is not primary for an examination of the public influence of the work represented by the text in that manuscript. For that purpose, the primary record is made up of copies of the published edition. Similarly, to understand a particular critic’s response, one must have access to the edition, and preferably the specific copy of it, used by the critic. F.O. Matthiessen’s famous mistake in discussing Melville’s *White-Jacket* illustrates the point. He wrote about the phrase “soiled fish of the sea” rather than “coiled fish of the sea,”^[4] because he was using the Constable edition of 1922 rather than the original English and American editions of 1850.^[5] The Constable edition in its original 1922 printing—not in the 1963 Russell & Russell reprint, which did not exist when Matthiessen wrote—is therefore a primary record for the purpose of studying Matthiessen’s work, though it is not primary for understanding Melville’s intention. Because the latter is what Matthiessen was interested in, it is fair to say that his failure to look behind the Constable edition was a mistake.

If his purpose had instead been to investigate the reception of Melville's work in the 1920s, not only the Constable edition but also the other Melville editions available in the 1920s would have been primary records for him. But later reprintings or photocopies of those editions would not have offered primary evidence of what readers in the 1920s had in front of them, because all reproductions are new documents with their own distinctive characteristics. Although the features of any document are subject to alteration over the years, a document surviving from the moment one is concerned with nevertheless provides evidence unobtainable elsewhere for understanding that moment. Therefore, every textual artifact, however it may be classed in terms of "originals" or "reproductions," is potentially worthy of future study as a primary record. Even a private xerographic copy can be a primary record if a person who used it becomes a subject of historical inquiry—or, of course, if one's topic is the history of reproductions.

The definition of "primary record" adopted here is obviously not the only one possible. But, because the distinction between intangible works and physical texts is logically essential, limiting "record" to only one of them is conducive to rigorous discussion. If we agree to use "primary record" to mean *a physical object produced or used at the past moment that is the subject of one's inquiry*, we can further say that there must always be an interest in primary records, simply because no derived record can automatically be assumed to be trustworthy as a guide to what the original contains. Financial records, for example, will continue to be produced, in some form, as a by-product of a company's activity. Settling disputes over billing will require, in the future as in the past, recourse to those original documents, regardless of their form. In the same way, a questioned word or note in a verbal or musical text necessitates research into the most authoritative document available, because anything short of that (whether newly keyboarded or photographically reproduced) may be misleading, through human error or mechanical flaw. Obviously, primary documents may be untrustworthy as a record of what was intended, but they are the final authority for the texts that are actually present in them.

Of course, not everyone is, or needs to be, interested in historical accuracy. If one wishes to approach a text as a given arrangement of elements existing in the present, not as a link with a past time, one need not be concerned with distinguishing originals from reproductions (despite the fact that, paradoxically, the acceptance of the text of any document links one with the past moment when that document was produced). There is no need, however, to claim that everyone has or will have (or should have) an interest in primary records to make the point that such an interest must always exist, for some people will always have to turn to primary records, either because their temperament leads them to the study of the past or because their business requires them to locate the best evidence for a past

occurrence. There are other reasons, to be taken up below, for the importance of primary records. But the fact that they are "primary"—direct witnesses to the past and, thus, the ultimate sources against which the accuracy of any reproductions must be assessed—is enough reason for the permanent usefulness of all the records already produced and all those yet to be created.

FUTURE FORMS OF PRIMARY RECORDS

Speculations about the future, in any field, may be knowledgeable and shrewd, or ignorant and foolish, but they remain speculations nonetheless. Sometimes people engage in them through a desire to influence what happens and sometimes through disinterested intellectual curiosity. On the subject of records, the discussions in recent years have focused on an electronic future, with some discussions being eagerly receptive and others fearful or wary. Debates about whether printed books will, or should, continue to be produced have aroused strong feelings, on one side or the other, among large segments of the general public. This sort of controversy is natural enough at a time of significant change, and there is no doubt that the last part of the twentieth century and the early part of the twenty-first constitute such a time, with a proliferation of technological developments in the electronic manipulation and storage of texts. But these debates really have no relevance to the present topic.

Primary records, as defined here, will continue to be produced in some form and will continue to be important, regardless of their form. A concern with the future of primary records is not tied to any particular form but to whatever forms primary records take—the forms they have taken in the past and the forms they will take in the future. They have always taken multiple forms, and presumably they always will take a multiplicity of forms, though the dominant forms shift over time. Electronic forms are at the beginning of their ascendancy now, just as letterpress forms were (at least for some purposes) five centuries ago. Some people seem to believe that anyone arguing for the preservation of physical records from the past must be opposed to computers; and while of course some arguments may be motivated by a fear of change, the serious arguments for the retention of primary records imply no attitude, one way or the other, about the relative desirability of electronic forms. The electronic handling of texts offers so many advantages that it is hard to see why anyone would not welcome it. Be that as it may, one's welcoming it or not welcoming it has nothing to do with recognizing the importance of all primary records and understanding that the preservation of individual surviving electronic forms of texts will be just as imperative in the future as the preservation of handwritten and printed forms is at present.

Not only is the future form of new texts a matter of current discussion, so is the question of whether old texts should be repackaged in new forms. An awareness of the significance of primary records is not incompatible with a desire to see old texts converted to forms that make them amenable to the advantages of electronic access and searching. What it means, however, is a recognition that any converted form can never stand as a full substitute for the original record from which it derives. There is no reason not to use such a secondary record for convenience, so long as one understands its limitations as a source of documentary evidence; but to think, as some people do, that a converted form can replace the original is to disregard the role of primary evidence in pursuing the past. This issue is not new, for it has existed as long as people have been copying visible texts from one surface to another; but the electronic revolution is so pervasive at present that it sometimes seems to have produced the issue.

A useful illustration is the current conversion of many library card catalogs to electronic form, followed by the disposal of the cards. Some of the questions raised by these activities were brought to a large audience by the novelist Nicholson Baker's long, well-written, forceful article in *The New Yorker* of 4 April 1994.^[6] Baker's defense of the card catalog was occasionally sentimental, but it enumerated some legitimate reasons for dissatisfaction with the conversions that have been taking place, notably the errors that result in even the best conversions and the fact that budgeting constraints have caused some library administrators, even in major research libraries, to ask for something less than the most sophisticated conversions available. It is hard to imagine, however, that these questions would have been the focus of a major article in a mass-circulation magazine if the computer had not been involved—if, that is, the problem had not been symbolic of the computer's many intrusions into familiar ways of doing things. (That the article touched a nerve is shown by the amount of discussion it engendered (e.g., see Barker,^[7] Carpenter,^[8] Douglas,^[9] and Max^[10].) Yet, the real subject was not computerization but rather the relation of primary and secondary records. Although Baker chose not to say so, computerization was only the immediate occasion for taking up an old issue—old even in relation to library catalogs.

Retrospective conversions of card catalogs were, after all, undertaken in precomputer days as well. The National Union Catalog, for example, was once a card catalog in the Library of Congress, made up of copies of cards contributed by libraries throughout the United States and Canada. The process of turning it photographically into a book-form catalog, published as *National Union Catalog: Pre-1956 Imprints* between 1968 and 1981, involved hundreds of thousands of editorial judgments, such as deciding which cards could be eliminated (as duplicative) and replaced by library symbols added to other cards.^[11,12]

Inevitably, errors were made, but there is now no way to check entries in the published catalog against the cards. One may not normally think of a union card catalog as a primary record, because the cards are not the books themselves, and even the cards are derived from the cards in other catalogs. But as a reference tool, as a particular grouping of references, the cards once housed in the Library of Congress were a primary record, for they constituted the original form of this tool. Any edited version of it is a derivative form, which despite its advantages still rests on the original for its authority. No computers were involved, but this conversion raised the same questions that Baker's article implicitly (if not explicitly) raised.

Another large card catalog, that of the New York Public Library, and the card catalogs of many special collections or specialized libraries have been similarly converted by photography into book-form catalogs. In these instances, the original catalogs have not uniformly been discarded, but the common tendency to think of the published catalogs as fully adequate replacements ignores the potentiality for defects in any reproduction. Publishing card catalogs in book form serves to reinforce the fact that the texts of such catalogs constitute reference works and that their reproduction, by whatever means, is analogous to the reproduction of other reference books, or other books of any kind. The conversion of card catalogs (whether by photography or by rekeyboarding) deserves no more, and no less, publicity than all other conversions of recorded texts. There is no reason to object to the conversions, if they are responsibly carried out at the highest level that current technology can offer. Indeed, it would be foolish not to take advantage of the benefits of new technology. But one can legitimately complain if the converted or reproduced form is thought to supplant the original and if the original is therefore not retained. (The fact that many libraries have an "official" and a shelf-list card catalog as well as a public one does not affect this point, for each of those catalogs is a separate record, and whichever one is used as the basis for a reproduction is the primary record for that purpose.) The future forms of primary records will be whatever they turn out to be; but, even though we may find an interim usefulness in converting many old texts to the new forms, those forms have no bearing on primary records of the past, the forms of which are historical facts.

USES OF PRIMARY RECORDS FROM THE PAST

There are many reasons for the retention of primary records as defined here, despite the usefulness that derived forms undeniably have for some purposes. It would not matter, however, whether there were any reasons other than the one already given: that primary records—the original physical objects—constitute the authority for judging every kind of copy. Occasions for questioning

reproductions (in whatever form) occur continually. If the primary records from which the reproductions derive do not exist, those questions can only be speculated about, and any conclusions then drawn from the reproductions do not rest on as firm a foundation as if they had been based on the original artifacts. Whenever one settles for something other than the original (or has no choice but to do so), one is deprived, quite simply, of the best evidence.^[13]

There are other reasons to use the originals, for they always contain unreproducible evidence. Every means of reproduction has its own characteristics, its own advantages and disadvantages; but whatever they are, they always leave some details unaccounted for and add new characteristics of their own. Electronic texts that have been freshly keyboarded, for example, have the advantage of being easily searchable for any given word or phrase; but they do not allow one—as photographed texts do—to see the typography (or handwriting) and lineation of the original. For this reason, electronic renderings of texts from the past, if they are to serve their readers well, should always be made up of a combination of keyboarded texts and scanned (“bitmap”) images. But, even if texts reproduced in these ways were accurate as far as they can be (such accuracy to be determined, of course, by reference to the originals), there would still be important evidence that remains inaccessible, because reproductions do not give readers access, for instance, to the original paper, ink, and binding. “Accuracy” is clearly a relative matter, dependent on the details one is focusing on in a given instance. The common misconception that verbal texts can easily be extracted from their physical embodiments leads frequently to calling a reproduction “accurate” if the words and marks of punctuation are accurate. In addition, when the original typography or handwriting is reproduced, many people do not understand how the original is being misrepresented. Yet the fact that physical texts are our primary way of getting at intangible works means that the shape, feel, and structure of the objects conveying those texts—all the characteristics of the objects, in other words—constitute relevant evidence for assessing the texts and reconstructing the works (or, put more simply, for reading).

The physical evidence in books (or any other artifacts, for that matter) can be studied for two kinds of information: the light it sheds on how the objects were conceived and produced, and the insight it offers on how the objects have been responded to and treated since the time they left their producers’ hands. Those who concentrate on the first of these in respect to printed books are often called analytical bibliographers.^[14,15] Although the field of analytical bibliography was developed in connection with the study of fifteenth-, sixteenth-, and seventeenth-century books, especially the textual investigation of the plays of Shakespeare and his contemporaries, this kind of work has by now uncovered significant details about the manufacture of books of all periods. It has been particularly

associated with literary study, for analytical bibliographers have repeatedly demonstrated the way in which a detailed knowledge of the production history of a book is crucial for establishing the evolution and authority of the text printed in it.^[16–20]

The amount of such analysis that can be undertaken with rekeyboardings or reproductions is extremely limited. One might at first think, for example, that the analysis of variant spelling and punctuation, which is useful in the attempt to distinguish portions of a text set by different typesetters, could be pursued with rekeyboarded texts (assuming their accuracy). But knowledge of the lineation of the original is essential for this purpose, because the spacing within a line and the position of the spelling or punctuation at issue are relevant to the interpretation of a typesetter’s behavior. Photographic, xerographic, or electronic images of the originals are therefore necessary; but they, in turn, are insufficient for other kinds of typographical analysis. The identification of broken types, for instance, is a standard technique for working out the order in which pages were set and printed.^[21] But such identification requires that one distinguish (often with the help of magnification) the traces of the typeface impression within the total ink smear, which can be affected by many factors; and reproductions never preserve this evidence. As Adrian Weiss, who has studied this matter intensively, said, “the nature of the typographical evidence present in reproductions renders them highly untrustworthy for absolute identifications, even in regard to those damaged types which seem obvious in a reproduction.”^[22]

If the failure of reproductions in this respect is surprising to some people, no one is startled by the fact that reproductions are useless for the analysis of paper, or of the way the type bites into the paper, or of the structure of the folded sheets in a book. Yet, such analysis reveals information important for printing history, literary history, and textual study. Identification of paper (through the study of its watermarks and chainlines or, if those features are lacking, as they are in many papers of the last two centuries, its texture, weight, and color) can be of assistance in dating a book, as in the celebrated instance of the *Missale speciale*.^[23] It also helps one to detect cancel leaves or, more likely in later books, whole cancel gatherings (that is, leaves or gatherings inserted to replace others that had been removed). The indentations made in paper by the bite of the type can reveal the order in which the two sides of a sheet were printed, because the one printed second will be smoother.^[21,24] And, the way in which the sheets were folded and sewn together can be established only by examining the paper and sewing, for the printed signatures that mark the early leaves of gatherings (in most books before 1900 and many afterward)—and that can thus be expected to show up in reproductions—cannot be relied on for this purpose. Signatures may accurately indicate the number of leaves in gatherings (as they usually do in the hand-press period), but they do not show

whether the gatherings consist of folded single sheets, multiple sheets, or half sheets. It is not uncommon in nineteenth-century books for signatures to be unrelated to the actual gatherings.^[25,26] These pieces of information, and others like them, retrievable through bibliographical analysis, are obviously relevant to printing history and, through their contribution to the story of how particular texts were made publicly available, to literary history. Their broader relevance to the concerns of readers comes through their role in textual criticism and scholarly editing. Knowing how a text was handled by the persons who printed and published it helps one to assess the relative responsibility of author, publisher's editor, typesetter, proofreader, and so on, for specific words or features of the text.

Furthermore, reproductions normally represent single copies; but there is no limit to the number of copies that are useful for textual collation and physical analysis. Differences among copies of the same editions exist in books of all periods, as a result of stop-press alterations, damage to type or plates during printing, changes or handling between printings, duplicate settings, cancellations and replacements of leaves or gatherings, and—in the era of edition binding—variations in the design and wording on bindings. Thus, no matter how many copies one has looked at, there is always the possibility that the examination of additional copies will disclose further variants. Although Charlton Hinman inspected in detail about two-thirds of the Folger Library's 80 copies of the Shakespeare First Folio,^[17] new variants are still being found in other copies.^[27] David L. Vander Meulen has learned new facts about the text of Pope's *Dunciad* in an ongoing investigation that by 1988 had encompassed some 800 copies of the early editions.^[28] No period or kind of publication is exempt: there are significant differences, for example, among the so-called "editions" of nineteenth- and twentieth-century newspapers. And, the bibliographers of the famous Tauchnitz series of paperbacks (1841–1955), after examining a total of 56,000 copies and discovering thousands of previously undetected impressions and issues, can still say that, as additional copies are looked at, one in 60 is likely to be an unrecorded impression and one in 20 an unrecorded issue.^[29] The ease with which electronic texts can be altered (both intentionally and inadvertently) is already a matter of concern to some readers seeking the primary records of writings that were originally transmitted in digital form. It is misleading, however, to contrast this instability with what one writer on the subject calls "the fixity of text in the print world,"^[30] for variations exist in printed editions of all periods. There is no means of textual transmission that is exempt from the possibility of alteration, and printing technologies have been a sophisticated step in the progressive development of easier ways to produce textual changes.

All of these uses of physical evidence for learning about the production history of printed books seem

obvious enough, once they are pointed out, but most readers are not likely to be familiar with them. These approaches have been primarily employed by textual scholars, after all, and their impact on readers occurs through the effect they ultimately have on the texts of new editions. In contrast, the other large category of information dependent on physical evidence, the postproduction history of books, requires less explanation, for all readers are aware, from personal experience, that the reading of books is affected by their design, by the contexts into which verbal texts are placed. Although typographical arrangement can be seen in reproductions, its scale and placement on the page are not always evident, and the quality of the paper, the relation of ink and paper color, and the characteristics of the binding, endpapers, and jacket are of course not accessible in reproductions. Some authors have taken considerable pains with such matters, as Congreve did when preparing the three-volume octavo edition of his *Works* in 1710.^[31] Whether the author or the publisher was responsible for format and layout, and whether or not one wishes to regard those features as part of the verbal work, they were often deliberately chosen to produce certain responses in readers, and they always produce responses, even if not necessarily the intended ones. The totality of a book's design constitutes a cultural message and is part of what the book offers for reading. D.F. McKenzie effectively demonstrated this point at the beginning of his centenary lecture to the Bibliographical Society, when he explored the meanings conveyed by the paper, format, and bulk of a blank book:^[32] "every book," he observed, "tells a story quite apart from that recounted by its text." Historians are now charting, more intently than ever before, the role of book design in various times and places. The history of reading has become one of the most studied aspects of the history of books.^[20] Scholars are not the only people who need access to artifactual evidence. Because the look and feel of books affect reading, all who wish to experience texts with as much historical understanding as possible require the objects that survive from particular past times.

These points are clearly valid for all varieties of printed matter, not just those with texts that can be classified as belles lettres; and they are applicable as well to all manuscript material. Scrutiny of the inks and papers in a manuscript is essential for drawing inferences about its production history—for working out stages of revision, for example, or simply determining which ink marks show through from the other side of the paper. And, whether the text consists of prose or of the entries in a business account, its physical setting plays just as important a role in understanding it as physical evidence does in the case of printed matter. The experience of reading an electronic text is also inevitably affected by its physical presentation.^[33,34] The information conveyed by the physical object as a whole is what Ruth Perry called "embodied knowledge." In her eloquent statement at the Houghton

Library 50th anniversary symposium,^[35] she said, “the object itself is part of the material culture of its own time, and carries with it something of the social context that produced it.” For those interested in the past, there will always be uses for primary records, because their “content,” their “meaning,” can never be fully transferred to any other objects.

SURVIVAL AND ACCESSIBILITY OF PRIMARY RECORDS

Whether the primary records that now exist will survive and be available to serve these purposes in the future depends in part on the materials out of which they are made, in part on the unalterable vicissitudes they encounter, and in part (the largest part, in fact) on the attitudes people hold about them. Some of the destructive events that befall artifacts, whether caused by natural forces or human actions, are of course unpredictable or, in practical terms, unavoidable, but not all are inevitable, for human attitudes can often prevent them or alleviate their effects. Pre-nineteenth-century items are likely to be relatively safe, because the paper used in them is high in rag content and because they are widely perceived to be valuable in monetary terms. The voluminous stock of nineteenth- and twentieth-century materials, on the other hand, is certainly at risk, because many contain highly acidic wood-pulp paper that becomes brittle and because the vast majority are regarded as having insignificant market value. When these facts are combined with a belief that verbal content and physical form are distinct, the items considered important enough to be microfilmed or otherwise (as in electronic form) reproduced are in danger of being discarded afterward. And what is considered important or unimportant at one moment, it should be added, may not be so regarded at another.^[36–38]

Considerable attention has fortunately been paid to the problem of books with brittle paper, and the pages of a great many books have been microfilmed as part of individual library programs or of the massive cooperative effort overseen by the Commission on Preservation and Access. As a general rule, there has been no concern with what happens to the artifacts after microfilming. In practice, most libraries have not kept them, regardless of the state of their deterioration or their mutilation by the microfilming process, and they have regularly been destroyed. Sometimes the point is made that items of “artifactual value” will be kept, as if it were logically possible for artifactual value (the value inherent in an artifact) not to be present in some artifacts.^[39] Although no known treatment can return brittle paper to its original condition, there are deacidification processes (likely to become less expensive in the future) that can retard or stop the deterioration,^[40] and whatever can be salvaged will be useful to future readers. Commonly, however, the

existence of a microfilm or electronic copy of the text in a deteriorating book causes many people to believe that the artifact from which the copy was made is disposable. Although some pieces may be doomed to eventual destruction in any case, this notion serves to hasten their disappearance.

The question of the stability of the objects carrying texts has most frequently been discussed in relation to books containing acidic paper, but one must remember that other vehicles for textual transmission have limited life spans as well. As the *Scientific American* noted,^[41] electronic documents are “far more fragile than paper.” “The contents of most digital media,” as stated in the article, “evaporate long before words written on high-quality paper.” The text on a magnetic disk, for instance, can be completely erased by oxidation or stray magnetic fields. As more and more writings are initially produced in electronic form, the future problem of preserving primary records will be even more acute than the present one. (This problem is in addition to the difficulty of access resulting from the obsolescence of software and hardware).

Of course, the urge to make reproductions is not limited to instances in which physical deterioration of originals has been recognized. Texts of all periods are often reproduced, to save wear on the originals and to make the texts more accessible, even if the objects carrying them are not in danger of disintegrating or becoming otherwise unusable. When the reproductions take up less space than the originals, librarians sometimes prefer the reproductions and deaccession the originals. This practice may well increase, as the inventory of texts available in electronic form becomes ever larger. Certainly some library administrators have already predicted that book stack space can be diminished in the future. Although the books thus removed from stacks are not necessarily destroyed, they may wind up in less accessible locations. The accessibility of artifacts, not simply their survival, is of vital importance for the study of the past. When one understands the inseparability of texts and their transmitters, one sees that the phrase “preservation and access,” often stated as the dual aim of textual reproduction, applies equally as the goal of a concern for textual artifacts. The uses of physical evidence, described above, imply, as far as printed books are concerned, the significance of multiple copies. A multiplicity of copies makes possible, even likely, a widespread distribution of copies. Whether one is looking at physical details as evidence of printing and textual history (in which case, every copy is a potential source of new information) or as an indication of a book’s cultural milieu, access to copies is essential for the fullest kind of reading, where a physical text and its physical setting are read together. If the existence of electronic reproductions of old texts causes books to be moved from community and academic library stacks to less accessible (and perhaps noninstitutional) locations, the opportunities for this kind

of reading are lessened. The idea that reproduced texts are replacements for the originals can thus affect not only the survival of artifacts but also the availability of those that survive.

Some of these points are well illustrated by recent events at the Kansas City Public Library, where the decision was made to dispose of the Rare Book Collection. This is not the place to debate whether the action was appropriate but only to note the reasoning that was considered adequate to justify it. The director of the library said that “it is the preservation of the ideas and information contained in the book, rather than the book itself, which the library preserves and makes available to the community.”^[42] This statement shows no awareness of the connections between text and artifact, or of the consequent usefulness of physical evidence to all readers, whether scholars or not. Indeed, the notion that so-called “rare books” are assembled only for scholars provides another of the arguments given for the deaccessioning: the director states that the “role of the public library is educational but not academic” and that its function is not the support of scholarly research. It is no doubt the case that most readers have not thought about the importance of artifacts in the reading process, but one can argue that a community library might appropriately undertake to educate them in this regard. Public libraries play an important role in bringing historical embodiments of texts, and the sense of the past they impart, to a wide readership. Still another argument for the decision is that the library has no climate-controlled storage space, as if “rare books” and books in the general stacks were somehow different in kind (if not in their physical makeup) and that the necessity for properly housing “rare books” does not extend to other books (any of which may be considered “rare” from a different viewpoint). If the flexibility of the line between “rare” and “nonrare” had been recognized, the additional argument that the Kansas City rare book collection had no focus might well have seemed irrelevant, because its “focus” would not then have been judged separately from that of the whole collection of the library. (It can be argued, as I have, that a library’s entire book stack should be regarded as a “special collection” and treated as such.^[35,43]) The director of the Kansas City Public Library should not be singled out here for special comment: his remarks could have been made by many other librarians. But for that reason, the remarks usefully point out a common misconception.

Its ubiquity is revealed by its presence in a great deal of the writing and speaking on the future of libraries. There has been no shortage of conferences, reports, and special issues of periodicals exploring the impact of digital technology on humanistic scholarship. In all of this commentary, there is scarcely any recognition of the role of artifactual evidence in reading, while many statements imply the replaceability of originals. For example, at the April 1990 meeting of the American Council of Learned

Societies, which addressed the topic “Scholars and Research Libraries in the 21st Century,” considerable emphasis was given to the idea that “access” will replace “ownership” as a goal of libraries—electronic access to texts, that is, in contrast to ownership of the objects that originally transmitted them. One speaker,^[44] welcoming the new ways to “repackage” verbal works, saw the old system in terms of inefficient duplication (“multimillion volume collections. . . housed in massive buildings duplicated across the country at enormous expense”), overlooking the importance of multiple collections of artifacts for providing widespread access to physical evidence and to the historical insights that such evidence allows.

Two and a half years later, the Mellon Foundation’s report, *University Libraries and Scholarly Communication*,^[45] also made much of the opposition between ownership and access. It stated, in its third paragraph, that we have lived “with a world in which the technology of publication meant that access *required* ownership,” but new technologies, it was stated, “allow the possibility of uncoupling ownership from access, the material object from its intellectual content.” These comments led the authors to the question, “What is the viability of the traditional model of the library as a single-site comprehensive collection of printed materials?” Neither this question nor the more detailed discussion later in the report adequately recognizes that the concept of primary evidence is an essential ingredient of any useful response to the question. Indeed, the idea of “uncoupling. . . the material object from its intellectual content” logically involves rejection of the distinction between primary and derived documents. Even when the report turns to a future in which “the primary artifact is itself electronic,” it does not pursue the implications introduced by the word “primary.” It alludes, for instance, to changes that such artifacts will produce “in the relationship between interpretive works and the underlying data or primary texts on which they are based,” as if that relationship could ever be different, regardless of the original form of the “primary texts.”

The point is also made that “print products” will still have an “important role” to play in a world of electronic publishing. No note is taken of the fact that such products, when they are printouts of electronic texts, will be derived documents. What is ultimately missing from the discussion is an awareness of the immutable gap between intangible works and the tangible means of their transmission. The phrase “dematerialization of information” is used as a description of what the new technology is achieving. Actually, it describes what the process of reading has always accomplished, as readers extract works, or “information,” from the physical details before them. Electronic documents offer a new set of physical details, but physical, nevertheless, and readers will still be in the position they have always been in. What is most basic for them, if they are historically minded, is not what the physical form

happens to be but whether a given document is primary or derived.

The same misconceptions reappear continually in other reports. In the summary of the proceedings of the 1992 Irvine conference on “Technology, Scholarship, and the Humanities,”^[46] for example, there are repeated references to an envisioned “national electronic library” or “digital library” of millions of volumes as a national priority, without any suggestion that having those volumes in this form (though unquestionably helpful) would not eliminate the need for reading them in their original forms. Indeed, the frequent linking of this project with “preservation” might seem to imply the opposite. The published report of the 1993 Bellagio conference on “Preserving the Intellectual Heritage,” sponsored by the Commission on Preservation and Access,^[47] also failed to address the question of primary evidence, even suggesting that the reason for scholars’ resistance to microfilm is the “incredible force of custom and tradition.” This report briefly noted that “some scholars make strong arguments for the conservation of the actual publication, the object itself.” In response, it only suggests conserving samples or the “one best remaining copy” of “particularly important” works—an idea that shows no awareness of the nature of bibliographical evidence or of the need for broad access to it. (In the formal resolution that emerged from the conference, access to reproductions is not distinguished from access to originals for instance, the phrase “to promote more effective means of storage, conservation and preservation, to insure access in the future,” in a context in which “preservation” refers to transferring texts to new physical objects).

Similarly, the Spring 1993 number of *Representations*, devoted to the subject “Future Libraries,”^[48] contained no discussion of the future use of old books as primary evidence. Even Geoffrey Nunberg’s thoughtful article on “The Places of Books in the Age of Electronic Reproduction” ignored this topic, though it includes a good description of the role of physical details in reading and briefly recognizes the distinction between texts that originally appeared in printed form and those that were initially disseminated in electronic form. Roger Chartier’s contribution, “Libraries without Walls,” asserted that, in the electronic age, “texts are no longer prisoners of their original physical material existence.” But there was no indication of why such liberated texts are inappropriate for many purposes, despite Chartier’s clear understanding, expressed in the next paragraph (and in many of his other distinguished writings), that a text “is no longer truly the same” when it is moved from codex to monitor screen, because the new “mechanisms” of transmission “modify the conditions of its reception and its comprehension.” In the 1994 Cornell symposium on “Digital Imaging Technology for Preservation,” sponsored by the Research Libraries Group, M. Stuart Lynn neglected artifactual evidence in his vision of the future in which “we convert back

and forth between the use of digital technologies for storage and transmission and analog technologies for human presentation and interaction.”^[49] What he called “paper facsimiles,” produced from digital images of printed pages, can be, in his view, “reshelved for traditional forms of access,” though the essence of the traditional process is not using paper but locating primary evidence.

Whatever else these various publications, and others like them, have accomplished (they contain much thoughtful comment), they do not build their arguments on a firm understanding (or at least an explicit acknowledgment) of the way historical study employs artifacts. Unfortunately, the level of sophistication in thinking about the physical book is frequently no higher among participants in conferences on the electronic future (many of whom think of themselves as “information specialists”) than it is among the general public, or advertisers. The publisher Chadwyck-Healey’s advertising brochure for its CD-ROM entitled *The English Poetry Full-Text Database* (1994) stated that “the texts are more accessible than any printed source and yet take up no shelf-space. There are no problems of conservation and security of rare volumes and no significant cataloging costs.” There is obviously a built-in contradiction here. Why should “rare volumes” require “conservation and security” if the texts that are now made “more accessible” are the equals of the texts in those volumes? Despite the illogic of the statement, it will be persuasive to many people and thus reflects the popular perception of the situation.

One cannot entirely blame the public for this view, however, when the statements of prominent library administrators are similarly deficient. On 13 October 1994, the Librarian of Congress, James H. Billington, held a press conference to announce three donations, totaling \$13 million, for the first phase of the creation of a National Digital Library. In his remarks, he spoke of making, through this project, a “mother lode” of “original” materials “accessible to people across America.” He also predicted that the “user-friendly book will not disappear.” By neglecting to say anything about the differences between originals and reproductions and by implying that the choice among presentations of texts is only a matter of personal preference, he was missing a significant opportunity for educating the public in the concept of primary evidence.^[50,51] An earlier occasion on which Library of Congress officials spoke on this topic was the 10 March 1989 meeting of the Library’s Council of Scholars. Although at that gathering Stephen R. Ostrow argued for a “collection-based institution” and made the distinction between primary and derivative documents, he was paired on the program with Robert Zich, who saw the interest in books as simply the “worship of original formats,” which he designated as “idolatry” and “fanaticism.”^[52]

Zich is not alone in his view. For example, Michael Lesk took essentially the same position in his 1997 book *Practical Digital Libraries*.^[53] As an administrator of the

Digital Library Initiative, he believed that libraries should, in general, replace books made of printed paper with electronic versions of the texts in them. The motivation for reproducing large quantities of texts is no longer simply to salvage them from objects thought to be disintegrating. Now, as Lesk and others see it, even the texts of books that are not deteriorating should be converted, because their electronic forms are searchable and take up (if on CD-ROMs) only a fraction of the space occupied by bound volumes or (if on the Internet) no space at all. This thinking lies behind several large projects, such as the Mellon Foundation's JSTOR, an Internet database of scholarly journals.^[54] The searchable database that underlies the images unquestionably makes access to journal articles easier. But the idea that it also saves space (accepted by many of the subscribing libraries) ignores the fact that it cannot possibly render the originals unnecessary.

Just as Stanley Katz could observe at the 1992 Irvine conference^[46] that adequate funding for the humanities and the arts will not come until "the public understands that it is in its interest to invest much more heavily" in them, so one can say that effective support for the retention of textual artifacts, and not just the texts, depends on a broad-based awareness of the fundamental role that such artifacts play in reading. The number of voices thus far raised to make this point is small compared to those championing reproductions. There is no reason, of course, for these two opinions to be thought of as opposed, or for those expressing them to think that both cannot be simultaneously embraced. An appreciation of the benefits conferred by reproductions—enormous benefits in the case of electronic texts—is not incompatible with an understanding of their limitations and of the irreplaceability of the originals.

Those who have spoken in defense of artifacts have usually expressed this comprehensive view. For some examples, one could turn to the published remarks of several speakers (Barker, Gundersheimer, McKitterick, Mason, Perry, and Tanselle) at the September 1992 Houghton Library symposium, a rare instance of a conference that repeatedly recognized the value of artifactual evidence.^[35] (An earlier Harvard Library publication that recognized the importance of originals was the special issue of the *Harvard Library Bulletin* on "Preserving Harvard's Retrospective Collections."^[55]) Another public occasion that included a particularly trenchant statement of the same kind was the October 1993 annual meeting of the Association for Documentary Editing, where Elizabeth Hall Witherell devoted her presidential address to this topic.^[56] "I see," she said, "that the raw material that I need and that future editors and historians will need is in jeopardy"; the "threat is that, having been microfilmed, or digitized, or microfilmed and then digitized, the originals will be discarded with some relief by those making very hard decisions about allocating money and space."

Her main point is concisely and effectively phrased: "We cannot rely exclusively on copies, though we may begin our work with them, because they do not tell the whole story that we need to know."

One of the most powerfully expressed statements on the place of artifacts in reading was offered by D.F. McKenzie at the conclusion of a conference on "Scholarship and Technology in the Humanities" at Elvetham Hall, Hampshire, in May 1990.^[57] Because books "encode the history of their production," he said, "It follows that to abstract a conceptual or verbal information content from them by representing them in another medium is to contradict the very assumption that the artefact is the product of a distinctive complex of materials, labour and mentality." To reproduce texts is "an impoverishment, a theft of evidence, a denial of more exact and immediate visual and tactile ways of knowing, a destruction of their quiddity as collaborative products under the varying historical conditions of their successive realizations." It is ironic, but not unexpected (given the usual approach to such matters), that the official "Resolutions" adopted by the conference (and printed only 10 pages after these sentences of McKenzie's) include the following: "Encouragement should be given to the conversion of printed texts to machine-readable formats and to the improved electronic transmission of such texts." (The only reference to conservation in the "Resolutions" failed to distinguish the use of originals from the use of reproductions: "In view of the rapid deterioration of printed materials, there should be national and international efforts towards their conservation and their reproduction in alternative forms.")

In recent years, there has been a growing interest in the artifactual evidence in printed books on the part of literary and cultural historians and those in the flourishing field of *histoire du livre*.^[20] This interest has been reflected in the activities of the Modern Language Association of America (MLA). In June 1992, the executive director of that association, Phyllis Franklin, speaking at the American Library Association convention, reported on a survey she had taken of the views of scholars in the humanities.^[58] Although, she said, they "respect the access photocopies and microfilms of the written and print records allow" and "welcome electronic databases of all kinds," looking forward to "the creation of electronic texts of publications that appeared originally in print," the majority also "argue that our society should maintain as complete a record of print as possible because such a record will continue to be essential to scholars who wish to study the print era." They felt that "saving a few copies of a book" is not sufficient. The following February, the MLA Council established an Ad Hoc Committee on the Future of the Print Record, consisting of eight scholars and librarians (Shelley Fisher Fishkin, Everette E. Larson, Philip Lewis, J. Hillis Miller, Ruth Perry, Alice Schreyer, Philip Stewart, and G. Thomas Tanselle, chair). Despite its name, the committee's purview was understood as textual artifacts

of all kinds, not just printed ones. Its charge was to prepare an official MLA statement on the subject, to assist in disseminating it, and to engage in any related activities that would help to create public awareness of the issues. At the MLA's December 1994 convention in San Diego, the committee held three sessions, where, in addition to general discussion, 16 scholars and teachers reported instances in which primary records were crucial to their work.^[59] The committee's statement explained the importance of retaining artifacts after the texts in them have been reproduced and also urged the establishment of standards for the creation and identification of reproductions.^[60] Unfortunately, the effect of this statement was somewhat blunted by the appearance, four years later, of another MLA-endorsed statement, *Preserving Research Collections* by Jutta Reed-Scott,^[61] which takes a step backward. It focuses on access through reproduction and does not recognize the value of physical details, except for items "that have scholarly value as artifacts," apparently unaware of the logical absurdity of that often-used phrase.

Another organization that was preparing a draft statement at the same time as the MLA is the American Institute for Conservation of Historic and Artistic Works (AIC). Its Library Collections Conservation Discussion Group (chaired by Maria Grandinette and Randy Silverman) wished to make more widely known the research value of publishers' bindings and the consequent importance of preserving them, using simple protective procedures or nondamaging conservation techniques.^[62] (A survey of attitudes toward rebinding books, including those from the period before publishers' bindings, was offered in the spring of 1995 by Michèle Valerie Cloonan. She noted, "The current approach to conservation is to save as much of the original as possible in a rebind."^[63]) Support for the preservation of artifacts has also come from a surprising source, BookLab, Inc., a firm that produces paper replacement copies of deteriorated books. In a series of pamphlets, this firm has promoted the idea that the originals should be regarded as "leaf masters" and retained as the sources for future reproductions.^[64,65] Although the importance of access to physical evidence in reading is not sufficiently appreciated here, there is, nevertheless, a recognition that reproductions can be misleading and impermanent and that "a continuing role for originals"^[64] exists, along with a corresponding need for facilities in which to house them. This concern with housing reminds one of a somewhat similar proposal, from the world of scholarly bibliography, for depositories in which books can be placed after microfilming or digitization.^[66] The motivation of bibliographers is not the same as BookLab's, but both approaches share a disapproval of the widespread practice of discarding originals after reproduction.

Still another encouraging sign was the establishment in June 2000 of a Center for the Cultural Record at the Graduate School of Library and Information Science at

the University of Texas at Austin. Its aim is to bring together, for mutual reinforcement, instruction in the fields of archives and records management, preservation and conservation, and museum studies. In the words of one of its initial statements, the center reflects a "growing convergence of interests" among these fields, which have "common foci" in that they are concerned with "managing the source original in a digital environment."^[67] The act of treating verbal documents and museum objects under the same rubric is significant for its recognition of the essential role of artifacts in all approaches to the human cultural heritage, and one hopes that this action and its implications will be widely noticed.

Thus there have been some events to be applauded, but the primary credit for acquainting a broad public with the importance, and endangered position, of verbal artifacts belongs to Nicholson Baker. Following his card catalog article, he wrote, for *The New Yorker*, an exposé of the extensive book-discarding activity of the San Francisco Public Library, about which he had already raised public concern in San Francisco.^[68] Then, in the summer of 2000, he published in *The New Yorker* an eloquent essay about the British Library's decision to dispose of a large part of its great collection of non-British newspapers.^[69] Because most of the large American collections of American newspapers had already been decimated (on the grounds that space is scarce and that microfilms are an adequate substitute), many of the British Library runs of major American papers were the best surviving ones (and in some cases, probably unique). Baker's thoroughly informed piece made clear the tragedy of the British Library's action. And Baker announced that, in order to save at least some of the papers, he was using his own savings and raising additional money to establish a non-profit American Newspaper Repository. His essay aroused a great deal of attention,^[70,71] both favorable—such as H. R. Woudhuysen's article in the *London Times Literary Supplement*^[72]—and unfavorable—such as an attempted defense of the British Library's action by its chief executive, Lynne Brindley.^[73] Baker had already been working on a book dealing more broadly with the movement by libraries to replace printed matter on paper with space-saving reproductions. In the spring of 2001, he published *Double Fold: Libraries and the Assault on Paper*,^[74] a remarkably researched account of the history and unfortunate consequences of library administrators' many schemes based on the misconception that reproduced texts are the equivalent of the originals. It is to be hoped that Baker's powerful and widely reviewed book will inaugurate a new period in the understanding of the nature of verbal artifacts.

Baker has, of course, focused on paper artifacts. Another task for the future is to confront the problems of identifying and preserving the originals of records that were first produced in electronic form. Fortunately, some people have made a start in thinking about this question.

There have, for example, been projects dealing with the subject at the University of Pittsburgh^[75] and the University of British Columbia,^[76] and the Council of Library and Information Resources established a Task Force on Archiving of Digital Information, which published a report in 1996^[77] and held a conference on "Authenticity in a Digital Environment" on 24 January 2000.^[78] Several of the speakers at this conference thoughtfully grappled, in a preliminary way, with the thorny issues of how to define a primary digital record and what role design features play in such documents. One tendency that must be recognized and counteracted, however, is to conflate the disparate concepts of authenticity, textual accuracy, and correctness of content. The mere fact that a text has been copied "accurately" (in terms of words and punctuation) from an original source does not make the new document (the text in a setting) authentic. Furthermore it does not signify that the wording and punctuation, and therefore the meaning, are what the author intended, to say nothing of being factually accurate. Clear thinking about digital texts, as about those on paper, demands vigilance in maintaining the distinctness of these concepts.

If other organizations and individuals endorse these positive activities and help to circulate the publications resulting from them, or undertake in their own ways to educate the public, the result will be a gradual increase in general awareness of the reasons for taking pains to protect verbal artifacts and to keep them in libraries of all kinds, community as well as academic. There will be a greater recognition that the choice between printed and electronic texts is not a question of personal preference but of primary evidence, and that the real issue is determining *which* printed text or *which* electronic text is the appropriate one for a given purpose. Obviously, some verbal artifacts, like some artifacts of every category, will be lost to the vagaries of time, chance, and human energy, and no one can realistically expect them all to survive. The realization that every one of them, however, has its role to play in the study of human culture provides a necessary grounding for thoughtful library decision making. Although the fallacious notion that texts are easily extractable from their physical embodiments is unlikely to be fully eradicated, there is the possibility of a considerably better informed public than has previously existed. Broad public understanding is a prerequisite for the demand, and in turn the funding, necessary to make preservation a goal fully compatible with conversion. Given sufficient public sensitivity to the issues, the two will be seen as complementary necessities, not competing alternatives.

The power exerted by the physical presentation of verbal texts is shown in many ways, such as the ease with which we remember page layouts as we recall certain passages of text, or the figurative use we make of specific book forms as embodiments of knowledge. Melville (in Chapter 32 of *Moby Dick*) used book formats to classify the varieties of whales, discussing the most imposing as

"chapters" of the "Folio Whale" and then moving down to octavos and duodecimos (skipping quarto, because it "does not preserve the shape of the Folio volume" and hence would not be metaphorically appropriate). He later (Chapter 104) spoke of a fossilized Leviathan leaving "traces in the stereotype plates of nature," and thereby reinforced the idea of the world as a book. His frequent puncturing of pedantic commentary further suggests that there is no substitute for reading the book of nature in the original. Reading and writing are a part of life, however, and the objects that contain texts from the past are elements of our physical surroundings. At those times when it is our wish to examine the responses of other people to the world and to the writings they encountered, we must take care in locating the objects most appropriate to our purpose, for reading encompasses all aspects of the objects we choose. We learn something from the folio format (and something else from the quarto), and we learn from all the clues embedded in each set of stereotype plates (be they literal or metaphorical). Caught in a material world, we have no choice but to recognize that the most reliable evidence from the past comes to us in physical objects. The concept of primary sources cannot be separated from this fact. And the search for those sources, in whatever forms they happen to take, is a fundamental activity not only in the work of scholars, lawyers, and scientists, but also in the lives of all other thinking persons.

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Print on Demand

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Abstract

Advances in digital printing have enabled print on demand to support major changes in book publishing and distribution. The ability to print small numbers of titles only when needed by consumers has allowed a huge increase in content to be made easily available in the marketplace. Print on demand has also impacted other areas especially art and artist book publishing as well as music publishing.

Advances in digital printing have enabled print-on-demand (POD) systems to support new channels of book publishing and distribution. The ability to print small numbers of titles only when needed by consumers has allowed a huge increase in content to be made easily available in the marketplace. POD has also impacted other areas of publishing, especially art and artist book publishing as well as music publishing.

POD is the process of creating print products using digital printing technology at the point when needed by customers. The POD process is based on the use of a digital image to directly feed a digital printer that can reproduce the image on the desired media. A single copy can be printed or large print runs can be produced all depending on the customer's need. The digital image can be a wide variety of objects including books, journals, art/photo reproductions, maps, sheet music, etc. Digital printing is also used in the commercial marketplace to produce packaging, brochures, and manuals at the point of need with the flexibility to make minor changes in the materials without reproducing a complete print run.

Based upon the technology first used in copying machines and then prevalent in desktop laser printers, digital printers have progressed far from their humble beginnings and now produce very-high-quality results across a broad spectrum of applications. Digital printing spans a huge variety of systems, from desktop printers for photos to large commercial presses used by companies like Ingrams' Lightning Source. The major differences between digital and other forms of printing are the lack of setup and cleanup required for the digital, enabling the process to produce works as needed. Digital printing has higher fixed costs per copy produced, so there are price points where digital printing is cheaper than offset, but if enough copies are printed, then the setup and clean-up costs are distributed across enough copies to make offset printing cheaper. Digital printing is not yet able to provide the very-high-quality results produced by letterpress

printing, but the high expense of letterpress makes it attractive only to very specialized needs. For larger print runs, offset printing at this time remains the most economical approach, but for small print jobs digital printing has found its niche. It is precisely this ability to produce low-cost small printing jobs that makes POD an agent of change in the publishing industry.

POD impacts publishing in several ways. Foremost, POD enables publishers or authors to print books as needed, which means that books do not have to be printed in large batches and semipermanently warehoused, yet orders can still be fulfilled in a very short period of time. POD also cuts down on transactional overhead that adds costs to book distribution. Prior to POD, books moved through several intermediaries on their journey from the printer to the consumer. Books were shipped from the printer to publishers who then repacked and shipped the books to wholesalers or other intermediaries who then unpack and then repack the books for distribution to retailers, libraries, or consumers. At the retail level, books that do not sell are repacked and shipped back to the wholesaler and eventually publishers. POD removes most of these added transactional costs as only the required items are printed and shipped. Another important consideration, POD is a green technology. It only consumes paper and energy when a book is needed. It has a much lower carbon footprint as the book is shipped once, and by only printing what is needed it avoids pulping unused volumes, again an environmental plus. The digital file is sent from the creator/publisher to the POD supplier and the POD supplier can ship directly to the end customer. Larger POD suppliers can print orders and ship directly to customers within 24 hours of the order's receipt. Customers are provided with the item they want and are not frustrated by messages like, out of stock, back order only, title is out of print, etc. Without costs for added print runs and storage, books no longer have to go out of print. Backlists can produce sales without the added expense of

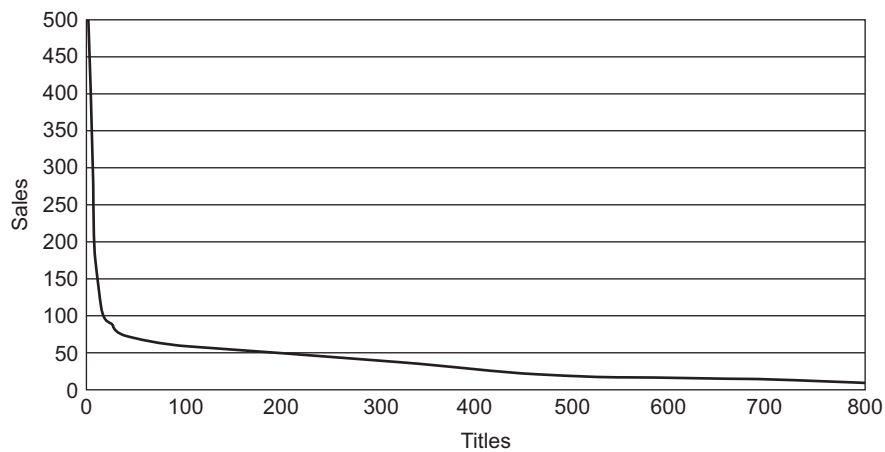


Fig. 1 Example of a long tail chart.

large prints runs and the need to warehouse the content. POD reduces the cost of book distribution and brings the long tail of publishing into the marketplace.

What is the long tail in publishing? Long tail is derived from the graphical representation of statistical data in which a small number of high-value data points dominates the left side of the graph while a high number of low-value data points dominate the right side of the graph. The chart in Fig. 1 is an example of what a long tail looks like as a graph. For publishing, this translates to a small number of titles produces very high sales while a huge number of titles sell but only at low volumes.

How long tail sales impact publishing has not been verified with quantifiable research, but there are some observable effects. Online retailers like Amazon have probably seen the most benefit from long tail sales. Although the exact sales breakdown between standard commercial titles and long tail sales are not available from Amazon, long tail sales make up a large portion of their commerce. Amazon, and similar online retailers, take metadata about books available for purchase from book data suppliers like Bowker and Nielsen, as well as metadata from wholesalers like Baker and Taylor, and Ingram and populate their online catalogs exposing huge amounts of content to customers. Changes in the industry like the development of POD and electronic books make it possible for retailers like Amazon to list huge amounts of content for sale as it can be easily delivered when ordered. Traditional book distribution systems could not support such a huge catalog as the transactional and storage costs would make it economically impossible to support based on the low volume of sales for the majority of titles in the catalog. POD changes that equation and makes it economically possible to sell huge numbers of titles in low-volume sales.

In addition to carrying other publishers' titles, Amazon provides a self-publishing service, CreateSpace, that assists authors with bringing their work to the marketplace without the need for a publisher. Self-published titles make up a large part of the long tail, and the area has seen

huge growth over the past few years. CreateSpace provides a variety of services from simply printing a set of books, to assistance with the design, editing, marketing, and distribution of both print and electronic books. The service is not limited to book publishing but also provides similar services for music and video producers. Amazon not only profits from the sale of the self-published items, but also produces revenues on the front end by helping authors self-publish their works. CreateSpace is only one of many POD suppliers that can provide authors with a complete suite of services from printing to distribution.

How large is the long tail? In the summer of 2014, Bowker® released a report that describes the size of the U.S. book publishing industry and recent changes in output. The data are based on ISBNs registered. Bowker is the agency responsible for assigning and registering ISBNs. Ebooks are not included nor does the data pick up self-published books that do not register for an ISBN.

The data released for 2013 indicated that the number of titles reported for nontraditional publishing (e.g., self-published, the long tail) was nearly four times greater than the number of titles published by traditional publishers, 1,108,183 titles compared to 304,912. Bowker defines nontraditional publishing as reprint houses specializing in public domain works and presses catering to self-publishers and "micro-niche" publications with these producers marketing their titles almost exclusively on the web and printed on demand. Changes in web commerce and improvement in POD helped the long tail see explosive growth over the past decade. Traditional publishing grew by 27%, from 240,009 titles to 304,912, while nontraditional publishing grew by 4126% from 26,224 titles to 1,108,183. See the full report from Bowker.^[1]

POD has led to some fundamental changes in the book industry. It is now far easier for authors to bypass traditional publishing, both commercial and vanity, and have their works produced and distributed at fairly low costs. Self-publishing has always been an option for authors. There are many great examples of authors who after being rejected multiple times by commercial publishers have

taken the risk of printing a fairly large number of books and selling the titles themselves. The *Huffington Post* covered many of these success stories in a blog by Ronald Balson^[2]. Amazon has a list of top-selling self-published books, and many of these titles were first self-published and then picked up by commercial publishers,^[3] but POD lowers the required investment by huge factors and makes this an option for many authors as the risks are quite manageable.

Traditional publishers benefit from POD as they are able to make their mid and back lists easily available to consumers without having to maintain inventories. POD also reduces their transactional costs as items can be printed and shipped directly to consumers or bookshops without added handling. Traditional publishers can also risk underestimating initial print runs as POD could act as a stop gap, meeting immediate demand after the print run sells out while the publisher considers the need for another offset print run.

The growth in POD has also fueled growth in suppliers. Starting from a handful of suppliers just a few years ago, there are now hundreds of potential suppliers, far too numerous to discuss in a short article. There are websites that provide listings of POD suppliers, one being on the Bookmarket site.^[4] Another site, *An Incomplete Guide to POD Publishers*, compared several of the major POD suppliers' costs and services.^[5] Neither of these sites are complete by any means but they are good places to begin a review of suppliers. There are also many other websites that do comparisons of POD providers. Any good search tool can lead to a wealth of useful information. It is safe to say that practically any large-scale printing house will now offer some form of digital printing services to meet the needs of POD.

Although there are hundreds of POD suppliers and applications, there are some large players in the POD environment that should be discussed. One of the early adopters and one of largest POD suppliers is Lightning Source. Lightning Source, one part of the Ingram Content Group, provides POD services to the largest publishers as well as individual authors. According to the official website,^[6] Lightning Source has more than six million titles in their inventory, processes 27,000 orders per day and prints 50,000 books per day. Lightning Source is an international operation with facilities in Australia, France, Germany, Italy, Spain, and the United Kingdom as well as the United States. As part of the Ingram Content Group, Lightning Source taps into the Ingram distribution chain and can distribute POD content to 38,000 booksellers and libraries including all of the major retailers like Amazon, and Barnes and Noble. Lightning Source is an industry leader and has demonstrated the viability of the POD process as a positive development in book distribution.

Another major player in the POD supply chain is on-demand books (ODB), distributor of the Espresso Book

Machine (EBM). ODB does not market their services as a POD solution. They define themselves as digital to print sales channel that eliminates sales losses due to items being out of stock. Although their business model differentiates them from other POD suppliers, the basic service is still printing a digital object at the point in time needed by a customer. ODBs support a decentralized approach to supplying POD services. Their core business is the sale of the EBM to bookstores and libraries. The EBM is essentially a small stand-alone digital printing and binding installation. The technology is patented by ODB but the printers are actually supplied by Xerox. On demand at the point of sale, the EBM can print, bind, and trim a perfect bound library quality paperback book with four-color cover in a matter of minutes. The EBM cannot supply a full suite of print options, but it does bring POD directly to the end of the supply chain through a bookstore or library. ODBs maintain a catalog of over seven million titles that are available to be printed. ODB also provides software tool set to support self-publishing, and ODB makes it easy for authors to add their works to the online title list making an author's works available to all customers at EBM sites in a matter of minutes. ODB has a complex business model that distributes the proceeds from a book sale to the author, publisher, and EBM owner depending on who is involved with the transaction. Lightning Source does distribute many titles to ODB and also works with ODB self-publishing program to distribute that content through Ingram's digital network.^[7]

Lightning Source and ODB are only two examples of the many POD suppliers that are active in the industry. This is not an endorsement of either company but merely a discussion of what a POD supplier looks like. Lightning Source was selected since they are probably the largest POD supplier. ODB was selected as they bring a unique model to the industry. There are many other quality providers available and information is abundant on the web.

Much of the discussion around POD has focused on book publishing but POD has had an impact in other types of publishing as well. As mentioned earlier, digital printing uses any digital image to directly feed a digital printer that then reproduces the image on the desired media at the point of need. The digital image can be practically any digital object. This could include maps, photographs, sheet music including scores, documents, art reproductions, posters, etc.

Art reproductions and artist books are areas that have seen changes due to the availability of POD. Very-high-end digital printers are capable of making excellent reproductions of artworks, photographs, and posters. In addition, the print jobs can be done in small batches and delivered in short periods of time. POD enables museums and galleries to tailor their printing needs to existing demand as opposed to having to pay to print 5,000 copies of an exhibition catalog and only needing 4,000. The same logic applies to other types of retail items that could be

sold in connection with an exhibition, or any other need, including art reproductions, calendars, greeting cards, etc. These retail items can be ordered based on need, and consequently once demand dwindles, there is no over stock to deal with. POD enables museum and galleries to offer far more works to their customers since they avoid the costs of large print runs and storage of the items awaiting sales. Web commerce can expose the digital catalog to consumers, and at the point of sale, the item can be printed and sent to the buyer.

Artist books have been similarly impacted by the development of POD. In the late 1960s and early 1970s, artists were experimenting with creating books as works of art. Many of the artist's books were completely unique one-of-a-kind creations, and those are outside this discussion. However, many other artists' books were a fusion of text and graphics and these were printed and distributed. With traditional book distribution channels, creativity was hampered by the need to print fairly large amounts of books that had a very limited audience. With POD, artists, designers, architects, and photographers are now able to produce work at the scale needed, and in some areas like photography, new areas of creative work opened up. Nearly all weddings, or similar major social events, are now documented in books that accompany the photos of the event. The creation of senior portraits is seeing similar developments. The digital images are used to produce photos, books, and graduation announcements, all of these products enabled by POD. Traditional printing methods would be far too expensive to allow for a whole suite of customized products at a personal level. If anyone you know has recently been married, baptized, graduated from school, or you just happen to know a photo enthusiast, you probably have one of these books somewhere in your house—brought to you by POD.

Music publishing, like other areas, has seen new opportunities due to the availability of POD. Digital distribution of sheet music and scores has not become the standard distribution channel. It may be that trying to balance laptops or tablets on sheet music stands in the orchestral pit is not yet workable, and the killer app for sheet music has not come to market like the e-reader for ebooks. Music publishing like traditional book publishing has similar issues surrounding the warehousing and distribution of printed works. Works have been traditionally printed in fairly large runs and then distributed through channels to various retail outlets. Once a score goes out of print, the high cost of another print run frequently precludes a new printing and the score then becomes very hard to locate and acquire. A parallel exists between music and book publishing. Using POD and avoiding the costs for added print runs and storage, scores no longer have to go out of print. Music publishers' backlists can produce sales without the added expense of large prints runs and the need to warehouse the content. POD reduces the cost of music distribution and enables consumers to obtain sheet music and scores that were previously not available.

POD has created many opportunities for authors. There are now many entrance points to the marketplace and a variety of ways to have your work published without going through a commercial or vanity publisher. There is a huge spectrum of POD suppliers. Many will provide a minimal service and print whatever number of items you request. It may be 5 copies, it may be 500. Others suppliers will provide the author with a complete suite of services including editorial, design, and layout assistance, as well registration of the book to obtain the ISBN and provide marketing and distribution assistance. These added services all come with a price, but for many authors the price is worth getting their work to market. The major consideration for most self-publishing authors, there is no rejection notice from the POD provider. POD has opened up self-publishing, and consequently, there is now a huge number of books available for consumers to choose from.

Authors now have much to think about as they decide how to put their work forward. Do they go the route of a commercial press or publish on their own. If they got the route of the commercial press, they have to consider what rights they will sign away. Since their work may not go out of print, authors need to consider the impact of the terms of the agreement concerning the life of the work since for some titles, especially textbooks, authors may be asked to agree to not publish competing works. Similarly, authors have to be careful what they agree to as they sign self-publishing agreements. With the advances made in POD, authors and publishers now have many more choices about their product and the product's distribution than were available with traditional publishing and distribution systems.

POD is no longer a trendy new upstart. Many of the major businesses involved with book distribution have brought their version of POD services to market. The two major book retailers have POD services, Amazon supports CreateSpace and Barnes and Noble supports the Nook Press Program. Ingram launched Lightning Source and Baker and Taylor has textstream, which is a POD service delivered through a partnership with Bookmasters. Large printing houses like R.R. Donnelly have also launched POD/digital print services. In addition to these industry leaders' investment in POD, there are a huge numbers of smaller suppliers who offer competitive services to potential authors and small publishers. The nature of authorship is also changing. It is now common for significant social events to be recorded and "published" in books. The wedding album is fast becoming the wedding book. Even for those with no special skills, it is possible to take a series of digital photos, drop them into a template, add a few lines of description, and they have a book they can print and send to their friends and family. As long as consumers are interested in physical objects, there will be a market for printed objects. POD lowers the costs and entrance barriers to that market. The development of the on-demand supply chain goes together with the development of the long tail in retailing. They make each other possible.

POD opens up new market space for creators but who prospers in that market space remains to be seen.

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Private Presses and Fine Printing [ELIS Classic]

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Abstract

Cave, an expert on private presses, surveys several types of private presses, and includes a discussion of printing as a fine art.

—*ELIS Classic*, from 1978

INTRODUCTION

The term “private press” has been used by historians of printing from the mid-seventeenth century onward to describe a variety of printing or publishing establishments outside the normal run of printers active in the period or in the society in question.^a In a totalitarian society, for example, any press not directly under state control might be regarded as a private press; but, this press, its *raison d’être*, and its publications will all be very different from those that are often (in the English-speaking world) regarded as the only private presses: those of the kind that regard the making of books as an art form.

One can trace the development of presses that are outside the normal pattern of printing and book production right back to the invention of printing from movable types in fifteenth-century Europe or even beyond: The manuscripts produced in the scriptorium of the Florentine scribe Vespasiano da Bisticci, for example, can, in more senses than one, be regarded as the ancestors of the modern “fine books” in the production of which the private press movement has played so large a part.

ORIGINS

After the invention of printing at Mainz, printers spread rapidly to the main mercantile and academic centers of Western European life. In the large centers, where the local demand was sufficient, printers could maintain themselves by their trade without outside assistance. But in smaller towns with a lesser local market, or in less settled parts of the world, there was insufficient work to keep a printer employed or to attract him there in the first place. In such circumstances, many presses that one must regard

as private grew up. In Chartres, for instance, a canon of the cathedral, named Pierre Plumé, in 1482 invited the Paris printer Jean du Pré to come to Chartres to produce a missal for the cathedral’s use, and he installed du Pré and his equipment in the canon house while it was being printed. A Chartres Breviary was produced in the same way in the following year.^b

THE QUASI-OFFICIAL PRESS

A distinct category of private press is to be found in those establishments financed and controlled by rulers and other wealthy patrons to produce work at their behest. Almost the first ruler to recognize the propaganda value of the printed book was the Holy Roman emperor Maximilian I. By appointing Johann Schönsperger the elder as court printer and by ordering the production of the emperor’s prayerbook (1512–1513) and the *Theuerdank* (1517)—which glorified the exploits of the House of Habsburg in general and of Maximilian in particular—the emperor was controlling a press that was undoubtedly private. But it was also the forerunner for many prestige items produced by government printing houses, such as the Imprimerie Royale’s *Médailles sur les principaux événements du règne du Louis le grand* (1702).

Rather similar in character were the presses that were established in less settled parts of the world. The introduction of printing into Iceland, for instance, followed the Chartres pattern closely when, in 1530, the last Catholic bishop of Hoolum organized the establishment of a press that produced a *Breviarium Nidarosiense* in the following year. That the press was not regarded as an undesirable eccentricity is shown by the fact that the bishop’s Lutheran successor continued to give employment to his printer, Jon Matthiesen. Without such patronage, it is most unlikely that any printer would have set up in Iceland at

^aThe earliest writer to distinguish private presses was Bernard Mallinckrodt, in his *De ortu ac progressu artis typographicae dissertatio historica* (Cologne, 1639). The earliest extensive treatment of private presses was given by Adam Heinrich Lackman in *Annalium typographicorum* (Hamburg, 1740), of which a modern English version remains a desideratum in private press literature.

^bThe references for this and the later examples given in this article are to be found in Cave.^[1]

this early date. In many respects, the mission presses in Asia, Africa, and the South Seas—often as amateur in their operation as they were uncommercial in their aims—were the successors of this early variety of private press.

THE SCHOLARLY PRESS

A type of amateur press that has recurred time and time again is one that is established with the prime purpose of printing works of scholarship. This was, of course, sometimes undertaken by presses of the quasi-official or patron's kind—The production of the great *Complutensian Polyglot Bible* at Alcalá in Spain is the best instance of this type of work, and it cost Cardinal Ximenes some 50,000 gold ducats (a sum roughly equivalent to \$3–4 million dollars in today's terms).

Some of these scholarly presses were clearly filling the role that would later be taken by the typewriter and the mimeograph. Such was the production of a private edition of Archbishop Parker's *De antiquitate Britannicae ecclesiae*, which the Elizabethan printer John Day printed for him in Lambeth Palace so that the archbishop might always have a copy by him to amend the text as need arose. Cardinal du Perron is similarly credited with a press at his chateau de Bagnolet in France, which was used to print preliminary drafts of the cardinal's works. After these had been circulated (for comments and criticism) to a select group, the text would then be revised for general publication.

Most scholarly presses were not set up as aids to composition in this way, but rather to supply needs that the ordinary commercial printers could not handle. In the publication of astronomical work, for instance, where absolute accuracy is essential, it was not uncommon for the astronomer to have his work printed in his own house under his direct personal supervision: Regiomontanus, Hevelius, and (in particular) Tycho Brahe adopted this method for their books.

Tycho Brahe's press is particularly interesting. In 1576, he had been granted the island of Hveen by the king of Denmark and had built an impressive observatory there. Finding that Copenhagen printers could not meet his exacting requirements and that he was too remote from the better craftsmen in Germany to have his work produced there, he imported presses, type and other equipment, and a printer, and set up a printing office as an adjunct to his observatory. Subsequently, when paper supplies proved inadequate, he added a paper mill to his operations. With this equipment, some of the most significant work in the history of science was produced.

Another area of scholarship in which the normal commercial printer was often inadequate was in language studies. Many of the special typefaces needed for printing in exotic languages had their origin in private commissions.

The Anglo-Saxon type used for Elizabeth Elstob's *Anglo-Saxon Grammar* in 1715, and the type cut by Charles Wilkins for his *Grammar of the Sanskrita Language* (1808) are examples of such private typefounding, although in both cases the books were printed commercially. Another "linguistic" press was that operated in London by Prince Louis-Lucien Bonaparte in the 1850s. This printed texts from St. Matthew in a variety of Basque dialects, a specialized area of work in which the old advantages of having a printer under the scholar's direct control are obvious. But by that time, much of the need for a private scholarly printing house had disappeared: With the growth of academic publishing and of printing houses specializing in particular languages, it was perfectly possible for a scholar to have work printed, in Cambodian, Cree, Catalan, or what you will, without setting up a press of his own. Yet the private scholarly press is not dead, as will be seen below.

THE EDUCATIONAL PRESS

The advantages of a small printing establishment as an aid to education were widely recognized in ruling houses in Europe by the eighteenth century. Such did not call for a permanent establishment, of course a visit by the young Louis XIV to the newly established Imprimerie Royale in 1648, during which he "helped" with the production of an edition of the *Mémoires* of Phillippe de Commynes, or the occasion on which, in 1731, the London printer Samuel Palmer set up a press in St. James's Palace so that the royal children could try setting up type—these are instances of the many occasions on which children of the ruling classes were exposed to the "black art." In a few cases, however, special permanent printing rooms were set up: Both Louis XV and Louis XVI as children had small presses on which they (with assistance) printed a few small books and no doubt more easily learned the texts they were setting up.

THE ARISTOCRATIC PLAYTHING

In the eighteenth century, printing also developed as a hobby among the wealthier and more leisured classes. Such had been advocated in England by the newspaper *The Craftsman* in reporting Palmer's work in St. James's Palace in 1731: "We could wish that our *Nobility* and *Gentry* would follow this Royal Example, and set up a *Printing Press* in their Houses; which. . . would be a much more polite as well as a more instructive Amusement for Themselves and their Heirs, than the modern fashionable Diversions of *Billiard Tables* and *Foxhunting*." Few of the English aristocracy took *The Craftsman's* advice, though it was certainly known to Horace Walpole, owner of the Strawberry Hill Press (q.v.). During its 32 years of life, from 1757, the Strawberry Hill Press produced several

books of real importance, as well as a good deal of ephemera (complimentary verses in honor of visitors, guides to the contents of the house, and the like). Walpole's comment that the Strawberry Hill books "have all the beautiful negligence of a gentleman" typifies the spirit of these presses.

On the continent, many such playthings existed. The duchesse de Bourbon-Condé had a press in the Palais de Bourbon in 1730; at Versailles, the duc de Bourgogne, Madame de Pompadour, and others were all printing in the 1760s and 1770s; while many of the aristocracy—the marquis de Lussay, the duc de Choseil, Président Saron, and others—had presses in their own châteaux from which they issued volumes of memoirs, family histories, and the like. Most of this work was of little general interest, but two exceptions must be noted. The press of Caperonnier de Gauffecourt in 1763 printed the first manual on book-binding ever to be published separately, while, in the 1780s, Léorier de Lisle printed two books on papers made from nettles, mallow, and other fibers new to the papermaker's craft.

Far more substantial and serious in intent than most of these was the press "au donjon du château," which Frederick the Great of Prussia operated from 1748 until such things were brought to a halt by the outbreak of the Seven Years' War. As well as producing Frederick's own *OEuvres du Philosophe de Sans Souci* (1750), it printed Frederick's history of the House of Brandenburg, for which Voltaire acted as reader, and—unusual for such hobby-presses—a manual on military tactics for distribution to the Prussian general staff.

The French Revolution and the Napoleonic wars tended to dislocate, if not to stop, the activities of all private presses of this kind on the continent. In Britain, however, they gained a new lease on life from the fashion for book collecting, which went through a boom period in the early nineteenth century. Several collectors started presses with a more scholarly purpose than the playthings of the preceding century: to put into print manuscripts never before printed and to reprint very scarce works. Such presses as the Hafod Press of Colonel Thomas Johnes, or Sir Egerton Brydges's Lee Priory Press, or Sir Thomas Phillipps's Middle Hill Press served as forerunners to the publishing societies such as the Roxburghe Club and Hakluyt Society, whose work was to be important later in the century.

THE MIDDLE-CLASS HOBBY

Although the educational advantages of printing and the pleasure to be derived from it as a spare-time occupation were already clear in the eighteenth century, only persons with considerable means could afford the very heavy outlay involved in setting up a full-scale printing office. Until iron presses were developed at the beginning of the

nineteenth century, there was no really practicable way of miniaturizing printing equipment. Nearly all the private presses mentioned above were operated with the assistance of full-time paid personnel: Few indeed of the French aristocrats undertook the heavy work of operating their presses themselves. But in England, where the introduction of iron presses had been pioneered by Lord Stanhope in 1800, miniature printing outfits were being marketed from the 1830s onward for "the amusement and education of youth." In the United States, where the first press to cater specifically for the amateur market was introduced in 1857, the movement took a radically different form. The first advertisement of William A. Kelsey (whose firm at Meriden, Connecticut, still produces presses for the amateur market) emphasized its commercial advantages: "Business Men save expense and increase business by doing, their own printing and advertising. For boys, delightful *moneymaking* amusement."

Between Victorian high-mindedness and Yankee entrepreneurship, there was a very wide gulf, but between them was created a real craze for printing as a hobby. From Rudyard Kipling to Thomas Edison, from Robert Louis Stevenson to "Little Lord Fauntleroy" himself, one finds instances of people playing with printing. Most of these amateurs produced little of interest to other than their own immediate circle of friends (an exception being the Daniel Press, q.v.). By the end of the nineteenth century, the craze for printing had largely been superseded by other hobbies such as photography, and only those "back bedroom" amateurs who were following Kelsey's advertising and irritating the printing trade with their production of letterheads and other jobbing work at cut rates continued work.

THE AUTHOR AS PUBLISHER

This group fits uneasily into the categories of private presses already listed above. The man who buys a printing press in order to print his own work may do this (rather than employing commercial printers) because it is more rewarding financially: In Britain, a lawyer, Charles Viner, and a physician, John Hunter, both ran presses that were very profitable in the eighteenth century. More commonly, authors set up as their own publishers because they cannot sell their work to commercial publishers and cannot afford the rates charged by vanity presses. The supreme instance is of William Davy, a Devon clergyman who, between 1795 and 1807, printed his *A System of Divinity* in 26 thick octavo volumes. In its production, the only assistance he had was from his housemaid, whom he taught to set type.

In most cases, to get an author's texts into print was all that was required of such printing, no matter how badly it might be executed. But there were and are private presses operated by authors who choose this method for deliberate aesthetic reasons: where an author has felt that only by his

personal design and decoration of the book that was to be the vehicle for his texts could the full intention of his work be realized. The exemplar for such work is to be found in the “illuminated” books printed by the artist/poet William Blake. Blake towers so far above most others who have attempted work of this kind that it is all too easy to forget that he *was* operating a private press—an extremely influential one. Among the enormous number of those inspired by his work and who have attempted work in the same tradition are a few that deserve mention, such as the Iona Press in the 1880s, or the work of Ralph Chubb from the 1930s to the 1950s, or today, Morris Cox’s important Gogmagog Press in London.

CLANDESTINE PRESSES

Private printing establishments have, of course, flourished in secret ever since man discovered the power of the printed word, whenever there has been political, religious, or moral oppression. In Elizabethan England, for example, one finds instances of clandestine presses at both ends of the religious spectrum: in the work printed by the Catholic martyr Edmund Campion on the one hand, and in the Puritan “Martin Marprelate” tracts on the other. Or—to take another instance from a country with a long tradition of freedom of the press—the seizure of the private press operated by the English politician John Wilkes in London in 1763 (a seizure ostensibly on moral, but, in fact, on political grounds) is a classic case in British constitutional history.

Sometimes called “underground presses,” such clandestine operations have occasionally been literally that, like that of the Abbé François Xavier de Feller at the end of the eighteenth century, which produced anti-Austrian propaganda from the bottom of a coal mine near Liège, while the police of the Austrian Netherlands vainly sought it. But normally “underground” refers only to the presses’ clandestine status (and this has, in any case, been devalued as a descriptive phrase by its misapplication to presses espousing minority causes and an alternative society, which are not in danger of suppression at all). These clandestine presses flourished in Ireland during “the Troubles” and in prerevolutionary Russia (and since: the *samizdat* editions, which figure in contemporary Russia, are the direct descendents of earlier endeavors against censorship); and they were by no means the least important aspects of the resistance to Nazi occupation in Europe in World War II. In both France and the Netherlands—and only to a lesser extent in Poland, Denmark, and other occupied countries—there were extensive illicit printing enterprises carried on by amateurs in the 1940s.^c Some of the work produced was of very high literary and typographic quality, but with the twentieth-century development of easy photocopying and office duplicating methods, such illicit work is nowadays more often carried out by such simpler methods rather than by letterpress printing.

There are other private presses that are clandestine in their work for less high-minded reasons than those that inspire the operators of the presses named above. In the stricter moral climate of the past, the printing of erotica such as *Fanny Hill* was attended by such penalties that it tended to be produced by clandestine printers, as today hard-core pornography is still so produced. And for those who interpret the Kelsey Company’s advertising slogan “Print—make money” too literally and turn to counterfeiting, the role of the clandestine printing plant is vital.

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PRINTING AS A FINE ART

The twentieth-century private press movement and its association with the production of “fine books” is to be traced back to the establishment of William Morris’s Kelmscott Press (q.v.), which was in turn inspired by a lecture given by Emery Walker (q.v.) to the Arts and Crafts Exhibition Society in 1888.

The work of such presses is discussed in the previously published, print version, of this encyclopedia (*see* Ashendene Press, Vol. 1, pp. 662–665; T.J. Cobden-Sanderson, Vol. 5, pp. 224–231; Daniel Press, Vol. 6, pp. 425–428; Doves Press, Eragny Press, Vol. 8, pp. 161–164; and Kelmscott Press, Vol. 13, pp. 407–415). Their function, so far as they understood it, was to reestablish sound principles of book *design*, which, during the nineteenth-century mechanization of the printing trade, had not kept pace with the technical advances of the period. These presses attempted it usually by returning to first principles: to the standards in design and execution to be found in the finest fifteenth-century Italian printing as a rule, although in some instances other models were adopted, for example, the Daniel Press’s revival of seventeenth-century types.

With hindsight, it is possible to discern many mistaken routes taken in their quest for the “ideal book”: the gothicising element in Kelmscott work, the frigid classicism of Cobden-Sanderson. By tying their work to the ideals of hand craftsmanship and “truth to materials,” which were so important to those in the Arts and Crafts Movement, they did not form good examples for commercial book production. Those trade books that were produced early in the twentieth century under direct private press influence were not seldom ugly and ineffectual vehicles for an author’s words. Nevertheless, the fact that work of Kelmscott, Doves, and other private presses was successful in redirecting attention toward book design—in making it a subject about which the ordinary educated

^ccf. Dirk de Jong, *Het vrije boek in onvrije tijd* (Leiden, 1953); and “Vercors,” in *Voices of Silence* (London, 1968).

man could be expected to be aware—was a major step forward.

During the years between the two world wars, the lesson of the private presses was successfully applied to trade book production. The work of professional typographers like Bruce Rogers, W.A. Dwiggins, and Stanley Morison (allied to the revivals of good type designs of the past by manufacturers of composing machines) was of particular importance in this respect. No less important were the publishing imprints, the Nonesuch Press and the Limited Editions Club, which showed that it was possible to produce books of excellent design and fully up to the standards of workmanship of the old private presses, while using the mechanized equipment of modern commercial printing houses. There was also the growth of small commercial printing houses that worked in the tradition and to the standards of the private presses. Such printers were to be found in many locations (a famous example being Will Carter's Rampant Lions Press in Cambridge, England); but these were to become a particular feature in California, where the work of such printers as the Grabhorn Press, the Plantin Press, and Ward Ritchie is justly of high reputation.

At the same time, many private presses much closer to the Kelmscott tradition continued to produce fine work, particularly in Germany, the United States, and in Britain. One may, for example, cite the Shakespeare Head Press, or the Golden Cockerel Press (q.v.), which was particularly important for the part it played in the revival of wood-engraved book illustration. In France, the influence of the arts and crafts movement had never been strong, and the French *livres d'artiste* were produced with different ideals in view from the private press credo, though similar in some respects to good private press work.

THE CONTEMPORARY PRIVATE PRESS SCENE

Although several of the important private presses continued operations in the 1940s (particularly, of the course, in the United States), World War II and the years of austerity that followed it in Europe almost destroyed the market for expensive books of the traditional "fine printing" kind. The era of the deluxe book seemed to be at an end, and obituary notices for the private press were commonplace in the early 1950s. However, just as the past quarter-century has seen the steady decline of commercial letterpress printing before the advances in offset lithography, so the same period has witnessed a recrudescence of private presses (most of which are devoted to letterpress work), so that today there are more amateur printers active than ever before.

The spirit that imbues the contemporary private printer is very different from that of the parlor printers of the nineteenth century. Today's amateurs are bibliographically well informed, being brought up on the typographic

literature of D.B. Updike, Stanley Morison, and others, and, in consequence, they are able to practice their spare-time avocation with a taste and skill seldom possessed by their nineteenth-century predecessors.^d

There are many private presses whose proprietors devote themselves mainly to amateur journalism, producing (sometimes as a collective venture) many hundreds of little magazines. Occasionally, these will print material of literary importance, but more usually their work is produced with a deliberately lighthearted ephemeral content, which renders it of limited interest outside their own immediate circle.

In contrast, one can, among today's private presses, distinguish many that work directly in the traditions of earlier varieties of the private press and that publish matter of much more weight and general interest. Their work, of which a substantial proportion is listed in the Private Libraries Association's annual bibliography *Private Press Books* (1959–), falls into several different (though not mutually exclusive) groups:

1. *The typographic presses*, which exist primarily to produce experiments in design, layout, and so forth. John Ryder's Miniature Press, or the Cuckoo Hill Press of David Chambers, or the Tuinwijkpers of Sem Hartz are good instances of such private presses. To an increasing extent, some of these are allied to a new hobby, that of the amateur typefounder. Such private printers as Paul Hayden Duensing at Kalamazoo, Michigan, have not only produced new castings of typefaces that have disappeared from the repertoires of commercial founders but have also originated some very effective new designs, some of which have been pirated for the commercial market in exactly the way that the Kelmscott Press's types were commercially imitated.
2. *The scholarly presses*, which print important texts of limited appeal, for which the normal commercial or academic publisher may not be well suited. In England, Geoffrey Wakeman's Plough Press—with its portfolio on *Nineteenth Century Illustration Processes* (1971), which was illustrated with leaves from nineteenth-century books that had used the processes described—is one example of the genre. In the United States, there are: Henry Morris's distinguished series of books on papermaking from his Bird and Bull Press; or from the Press of John Cumming in Mount Pleasant, Michigan, several substantial volumes of Michigan history; or from Charles Ingerman's Quixott Press in Doylestown, Pennsylvania, some studies on local Quaker history—these are representative of the valuable work published by contemporary amateurs.

^dWith the aid of such excellent manuals as Dobell^[2] and Haas.^[3]

3. *Fine art presses*: these are normally working directly in the tradition of William Morris and the private press movement in attempting to build books of typographic excellence as vehicles for worthy texts (though some, like the Allen Press in Kentfield, California, span the gap between the private presses and the French *livres d'artiste*). These range from Alan Tarling's modest "Poet and Printer" in Essex, England (which is content with unassuming texts for sale at a low price), through the severely classical and exquisitely produced work of the Nuns of Stanbrook Abbey Press (Worcester, England) and that of Kim Merker at the Stone Wall Press in Iowa City, through the less classical but equally splendid Janus Press books produced by Claire Van Vliet in Vermont, to the extraordinary work of Walter Hamady at the Perishable Press in Wisconsin. Perishable Press books, often printed on paper made at the press, have, at times, broken every typographic rule there is and are, at times, unsusceptible to adequate bibliographical description—yet they remain some of the liveliest and most exciting volumes of contemporary poetry.

Some presses transcend these categories, of course. In England, one of the most interesting private presses is that of Trevor Hickman, the Brewhouse Press in Leicestershire. Some of its books have been serious contributions to scholarly knowledge, whether typographic (*Typographia Naturalis*, a history of nature printing) or local history (*The Oakham Canal*); others are exercises in fine illustration (*The Pickworth Fragment*); yet other productions will be lighthearted ephemera or typographic experiments. This press is by no means unique in its range and styles of work; though producing more and often better work in the various fields in which it operates, it typifies much that is best in the private press of today.

The presses range as widely in equipment and scale of operations as in the types of work they issue. Some of them are virtually working museums, keeping in use presses built a century and more ago, and preserving techniques of craftsmanship that would otherwise be lost. Some, though still devoted to the use of the best materials, prefer to employ more modern presses in order to be able to produce long runs of high quality with less labor. Yet others will be very small indeed; a small flatbed press that can be stored under a bed, plus enough type to print a page at a time, will be the sum total of their equipment.

BIBLIOGRAPHICAL PRESSES

An interesting and significant development from the private presses has been the appearance of *bibliographical presses*.^[4] Schools of art that teach courses in graphic design have, of course, for long had printing equipment

on which student work was produced. Porter Garnett's famous Laboratory Press in Pittsburgh (1923–1935), and the Lion and Unicorn Press of the Royal College of Art in London are among the best known of these, and they have produced a considerable volume of important work prized by discerning collectors. The bibliographical presses, on the other hand, are working laboratories set up to assist the bibliographical student to an understanding of book production methods, through personal experience in setting, presswork, and so forth. Presses of this kind are to be found sometimes in university libraries (as at Bodley, McGill, or Sydney), sometimes in English departments, and often in schools of librarianship. In the nature of things, their productions tend to be slighter and more ephemeral, but they have also produced a generation of literary scholars and librarians whose understanding of the niceties of printing is much greater than a generation or two ago.

"LITTLE" PRESSES

The "little" presses may be regarded perhaps as an offshoot of, perhaps as a rival to the private press movement. These undertakings—the publishing industry of an alternative society—are not in general very much interested in typographical excellence: They exist in order to put into print works that their owners feel passionately *should* be published and that, for one reason or another, are unsuitable for the commercial publisher. Particularly active in the production of literary magazines, experimental poetry, and work of a kindred nature, they span the gap between the amateur and the full-scale publishing operation. At one end of the scale (because of their concern with the text rather than its presentation), they may produce their pamphlets by office duplicating processes; at the other, they may be semi-commercial publishing imprints having all their printing done for them by others. Advances in small offset litho printing have meant that many of these little presses will employ such techniques for their work rather than the letterpress printing favored by most other private printers. With a successful public response to their literary programs, they may become almost indistinguishable from the ordinary commercial publisher, with the important proviso that they remain more interested in producing what they think is good work than in maximizing profits (which is true of the better commercial publishers also, of course). The Unicorn Press in California and the Gaberbocchus Press of London are good examples of the species.

THE FUTURE OF THE PRIVATE PRESS

It is a commonplace that changes in the structure of the publishing industry, and in printing technology, have

produced a situation in which the book that is of limited appeal or is a slow seller is much less likely to achieve publication than was formerly the case. In consequence, a book of merit, one that will appeal only to a minority group, will not in the future be published unless subsidized by a learned society or other body or if the amateur publisher takes an active role. To be sure, some unprofitable publishing areas will be catered for through the programs of scientific journals, publishing societies, and the like. But in the fields of imaginative literature and local history (in its widest sense), there is a distinct gap that can be filled only by the concerned group or individual enterprise.

The little presses can cater for some of society's needs in this way. Similarly, the traditional private press will continue to produce work for those who feel that the book can and should be more than just a vehicle for the texts they contain (or that on occasion the vehicle should be a Rolls-Royce rather than a Detroit production-line job). At present, there is too wide a gap between these two kinds of private press: though it may be unrealistic today to expect that private press ideals of craftsmanship can be carried over into normal commercial book production, many of these ideals could advantageously be applied by the little presses. In the same way, the little presses' concern for the texts they print would render more permanently valuable the work of those private printers who demonstrate great taste and skill in printing rather negligible texts.

CONCLUSION

There is no doubt that the increase in the number of amateurs producing books and literary magazines presents many problems for the librarian. A good deal of the work they print may technically not be published (in the legal sense) at all and so escape record in those national bibliographies that are based upon legal deposit. Being produced outside normal book trade channels, their work may not be listed in the standard trade bibliographies and will seldom be carried in the stocks of booksellers and library suppliers. In consequence, the librarian concerned with selection of stock will have difficulties in finding out about these publications. In addition to this barrier (which requires perseverance on the librarian's part to overcome), there is also, at times, a consumer resistance, on the librarian's part, to the purchase of material that may occasionally be very awkward to process, store, and make available to readers (how *does* one shelve a book that opens concertinawise? or one triangular in shape?). The puritan ethos that imbued many earlier librarians also made them reluctant to buy some of the rather luxurious (and expensive) private press work of the past. For these various reasons, one often finds that private presses' work

is less widely distributed in public libraries than one might expect.

Some libraries deliberately cultivate good relations with those amateur printers/publishers active in the area they serve and build up an archive of the press's work (ephemera as well as books), which—although difficult to handle—has important long-term cultural significance. In addition, some research libraries built up substantial collections of private press material: the Eric Gill collections at University of California at Los Angeles, the Will Ransom collection in the Newberry Library, Chicago, and the Bodleian Library's collections are of particular importance in this way. But in general, professional librarianship's attitude to private press work has been one of lip service and little more: with the purchase of a few representative Kelmscott, Golden Cockerel, or Grabhorn books to grace the library's display cases, the librarian has assumed that he has performed his function adequately. But, given the increasing importance of much published by these amateur printers and publishers, unless librarians succeed in improving their coverage of private press work, posterity will judge their professional competence harshly.

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Provenance of Archival Materials

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Abstract

Historically, the principle of provenance was defined to mean that archivists must not mix the archival records of one person or organization with that of another. Sometimes this principle included respect for original order, which meant that records must be kept in the same order as maintained by the creator. In order to assign provenance, however, archivists needed to define the provenancial unit or the volume and level of records that would be described by provenance. This would be used as the basis for appraisal, acquisition, arrangement and description, retrieval, and reference. This definition was, and continues to be, problematic. Originally, the principle of provenance applied to both the physical and theoretical handling of records in an archives, but more recently archivists have suggested that provenance is a theoretical construct and that description based on provenance must capture all the myriad aspects of the origins of the records from the context of their use in the active record-keeping system to their transfer and handling in the archives. Since the inception of the principle of provenance, archivists have debated every aspect of it. The principle only gets more complex with time and the question becomes: how can these complex notions be applied in the real world?

INTRODUCTION

Provenance is considered to be a foundational principle of archival science, particularly in the Western world. It is the basis for acquiring, appraising, arranging, describing, and accessing archival records, or in other words, deciding what to acquire, how much to retain, whether to organize the records or leave them in their original order, how to describe the records, and how to find useful records. Provenance is also the means for establishing the authenticity of records and often can be used to date them. There is, however, disagreement among archivists and in the archival literature about what exactly constitutes provenance, how it can be attached to records, and how to apply provenance to various archival functions. Given this principle's importance to the practice of archival science and the complexity of its application, it is likely that the concept will continue to be further defined and refined in the future.

This entry covers the established definition of provenance, the origins and history of the development of the concept, the meaning of provenance, and the modern-day expansion of the principle. Readers will come to understand why, as French theorist Michel Duchein said, provenance "is easier to state than to define and easier to define than to put into practice."^[1]

THE DEFINITION OF PROVENANCE

According to the International Council on Archives (ICA) *Multilingual Archival Terminology*, the word provenance is defined as being "the organization or individual that created, accumulated, and/or maintained and used

RECORDS in the conduct of business prior to their transfer to a RECORDS CENTRE or ARCHIVES." The ICA Committee on Descriptive Standard's "Glossary of Terms Associated with General Rules" adds that it is also the relationship between records and the organizations or individuals that created, accumulated and/or maintained, and used them in the conduct of personal or corporate activity.^[2] The principle of provenance means that "records/archives of the same provenance must not be intermingled with those of any other provenance."^[3] There is an equivalent term for provenance: *respect des fonds*. The term *fonds* refers to the records created and accumulated by an individual, family, or organization in the conduct of their personal or corporate activity. So *respect des fonds* then means to respect these records by not intermingling them.

There is also the concomitant principle of original order, or *l'ordre primitif*, which according to the *Multilingual Archival Terminology* states that "archives of a single provenance should retain the arrangement (including the reference numbers) established by the creator in order to preserve existing relationships and evidential significance and the usefulness of finding aids of the creator."^[4]

THE ORIGINS AND DEVELOPMENT OF THE CONCEPT

The Inclusion of Original Order and the Definition of the Provenancial Unit

The earliest documented origin of provenance was traced by Spanish archivist Rosana de Andres Diaz to the *Instruccion para el gobierno del Archivo de Simancas*

published by Philip II in 1588, which applied the principle of provenance to the arrangement of title deeds.^[5] E. Lodolini has traced the practice, if not the principle, back to the archives of Republican Rome.^[6] American archivist Maynard Brichford brought to light the provenancial nature of the work of French Maurist scholar and Benedictine Dom Jean Mabillon. Mabillon's publication, *De re diplomatica libri sex*, published in 1681, established the science of diplomatics and paleography. His treatise on textual criticism and the authentication of documents directed attention to the source of records by employing detailed studies and comparisons of documents issued by the same chancellery.^[7]

Mabillon's pioneering work was followed, Brichford noted, by diplomatic manuals employed by history professor Johann Gatterer at the historical institute that he founded in Göttingen, Germany, in 1764. These manuals similarly linked documents to the administrations that created them. According to Spanish archivist Antonia Hereñia Herrera, archives were following the principle of *respect des fonds* in such diverse places as Halle (Saxony) in 1777, Denmark in 1791, and Naples in 1812.^[8] Others have noted that the principle was legislated in the Grand Duchy of Tuscany in 1822 and the Papal State in 1839.^[9]

These early forays into the theory and practice of provenance were supplanted in the nineteenth century by a new enthusiasm for subject arrangement. The practice of reorganizing records from different creators to fit subject classification schemes evolved into the principle of pertinence. There are many possible explanations for this interest in subject classification. Some of those employed in archives, such as Gottlieb Friedlaender, an archivist who worked in the Prussian State Archives from 1853 to 1873, were influenced by their library experience.^[7] A number of authors have pointed out that during the European Enlightenment many scientists employed classification schemes to validate their pursuits and that this possibly provided a basis for the employment of such classification schemes in archives.^[10]

But perhaps the most significant events that altered practices in archives were those where records associated with previous régimes were relegated to archives to fulfill scholarly interests rather than the interests of the state administration. This occurred in the Netherlands in 1795 and in France after the French Revolution in 1799. Instead of being working documents, these records became historical curiosities, and archivists began to cater to historians rather than to government officials. Subject classification only worked, however, if one could assign a classification to every document. As long as archivists did not have to manage any records of the current administration, they were able to assign such classification. While it was possible for them to classify each and every document when the amounts were very small, however, as time went on inevitably more current records began to enter the archives and as the volume of records grew it was no longer

possible to treat records at the item level. The additional volumes began to affect the maintenance of a consistent classification scheme.

In addition to these reasons for abandoning subject classification for archival records, there was a growing realization that subject classification failed users in a number of important ways. For instance, subject classification physically assigned records to a single class. Further subject classification required a cross-reference system to be set up that linked the documents to other subjects, something that was extremely time-consuming for the significant amounts of individual documents that entered an archives. Yet records rarely provided information on only one or two topics, requiring a selection to be made as to which subjects were the most important. Organizing records classed by creator, however, gave unlimited points of entry, based on the activities and functions of that creator that could be captured globally for large numbers of documents tied together by their common provenance. Furthermore, there was a growing understanding that multiple relationships often existed between the records produced by one creator and that it was important to preserve these relationships. Later archival theorists would refer to this as the "organic" nature of records creation, reflecting the natural growth of records within a record-keeping system.

The French claim that they were responsible for reintroducing the notion of provenance when archivist, diplomatist, and historian Natalis de Wailly defined *respect des fonds* in a circular issued by the Minister of the Interior on April 24, 1841. In it, de Wailly stated that "all documents which come from a body, an establishment, a family, or individual form a *fonds*, and must be kept together." There is some debate about whether any consideration was given to original order. French archival theorist Michel Duchein maintained that *l'ordre primitif*, or original order, emerged shortly after de Wailly's original circular in France.^[10] Canadian archival studies student Alain Giroux argued strongly that de Wailly's circular implied that *respect des fonds* was only to supplement pertinence, or the organization of records by subject, not to replace it and that original order emerged in Germany. Giroux noted that Johannes Papritz's "Verwaltungsstrukturprinzip" was used to classify records below the *fonds* level, employing administrative units of an organization in order to classify its records.^[11]

In England, at about the same time de Wailly produced his circular in France, Sir Francis Palgrave, the first deputy keeper of public records, wrote in 1840 that archival records were to be placed in groups according to their provenance. Palgrave permitted a parallel "literary or theoretical classification" of records into subject groups to be registered on paper. This worthy attempt to establish the supremacy of *respect des fonds* was later supplanted by the physical rearrangement of records into different subjects or classes. In time however, Hilary Jenkinson,

archivist and later deputy keeper of the British Public Records Office from 1906 to 1954, returned to the notion of provenance. The first step the archivist would make, Jenkinson declared, would be to determine which creators created and accumulated the different records in the archives. This practice would have reflected Jenkinson's own experience where records were disassociated from their creators. Only the records of an administration "complete in itself, capable of dealing independently, without any added or external authority, with every side of any business which could normally be presented to it" would warrant being kept together and these would be called an "archive group."^[12] Once the creator was established, then the archivist was to study the history and organization of the administrations that produced the records, and to establish, or to reestablish as necessary, the original arrangement of the documents of the organization. However, as time went on and the volume of records increased, archivists abandoned Jenkinson's archive group and began to focus on the series or class level, a level that groups files or other physical units of related records together.^[13]

Although we do not know how the notions of *respect des fonds* and original order spread, a number of countries developed these ideas shortly after de Wailly's circular. In Belgium, an Order in Council issued by Louis Prosper Gachard dated December 17, 1851, regulated the State archives in the provinces with instructions similar to de Wailly's.^[14] In Italy, Francesco Bonaini developed the *metodo storico* in 1867, which included both *respect des fonds* and original order. This principle became state policy and was applied to all government records in Italy in 1875.^[15] In Germany, the director of the Privy State Archives, Heinrich von Sybel, issued regulations employing provenance or *Provenienzprinzip* written by Max Lehmann on July 1, 1881. This principle was augmented by the registry principle or original order.^[16] This principle made eminent sense in the context of the Prussian government because it was based on the central registry system used by the government bureaucracy. This system assigned designations to each document and then the designations were recorded in a central registry. It would have been exceedingly difficult for any archivist to try to tamper with such a rigid system once it was in place.

These developments, however, were eclipsed when the seminal *Handleiding voor het ordenen en beschrijven van archieven* or *Manual for the Arrangement and Description of Archives* by Dutch archivists Samuel Muller, Johan Feith, and Robert Fruin was published in the Netherlands in 1898.^[17] It is pretty certain that this manual, which championed provenance or *herkomstbeginsel*, was influenced by developments in Germany and France. All three writers referred in their text to German and French manuals on diplomatics and to various French and German writers. In addition, Muller attended several lectures at the Écoles des Chartes, the archival studies school in

France, in 1873. It is also quite clear from studies made of the private papers left by the three authors that provenance included both *respect des fonds* and original order.^[18] What made this development different from all the others across Europe was the influence the manual had on spreading and reinforcing these principles in other countries. The manual was published in German, Italian, French, and American editions in 1905, 1908, 1910, and 1940, respectively.

In their manual, Muller, Feith, and Fruin described the *fonds* or "archival collection" as "the whole of the written documents, drawings and printed matter, officially received or produced by an administrative body or one of its officials." Once the documents were placed in a repository, these collections were to be kept separate and in the same order that the organization that produced the records kept them in. The three authors felt that this order would correspond in the main to the organization of the administrative body.^[17]

In 1910, the Conference of Librarians and Archivists held in Brussels gave international recognition to the principle of provenance when conference attendees formally endorsed the principle. Interestingly, although the conference actually used the word provenance, none of the early archival theorists or archivists, including the French, used that word, but most often referred to some variation of *respect des fonds*. The word provenance does not come into common use in English-speaking countries until much later in the twentieth century. British archivist Hilary Jenkinson wrote *A Manual of Archive Administration Including the Problems of War Archives and Archives Making* in 1922 and Italian archivist Eugenio Casanova published *Archivistica* in 1928.^[19,20] These two manuals also helped publicize the ideas of *respect des fonds* and original order.

Waldo Gifford Leland, American historian and archivist, and New York State Archivist Arnold Johan Ferdinand Van Laer both attended the Congress in Brussels in 1910. Van Laer reported on the Brussels conference at a conference of archivists in Indianapolis in December of 1910, paving the way for the introduction of the principle of provenance to the United States. In a report to the Illinois State Education Building Commission in 1913, Leland outlined his understanding of the concept of provenance. He emphasized that the first activity of an archivist was to create a guide that outlined the various public offices and their functions. He felt that the records would clearly reflect the organization and functions that created them. These ideas were spread by annual meetings of the Public Archives Commission around the country. By the time the U.S. National Archives and Records Administration was founded in 1934, a number of state archivists were practicing the principle of provenance in their institutions.^[21]

The employment of the principle took a sudden turn in 1941 when the committee set up to study the adequacy of

finding aids at the National Archives introduced a variation of *respect des fonds*, which did not include original order and which established the “record group” as the unit of description. The record group was defined as “a major archival unit established somewhat arbitrarily with due regard for provenance and to the desirability of making the unit of convenient size and character for the work of arrangement and description and for the publication of inventories.”^[22] These record groups were themselves to be grouped into broad subject fields, such as defense or industry, or form, such as cartography or films, which it was hoped would aid in control. These groupings, however, were based in some cases on tenuous relationships, although the records continued to be identified by their creators. Commissions, for example, were all placed together even if they originated from different pieces of legislation to carry out completely different functions.

The reasons for the establishment of the record group were myriad. There were practical considerations to be made at the National Archives; archivists there had received 800,000 ft^[3] of records *in a single decade* and were looking at even faster and larger accumulations in the years to come. According to American archivist Frank B. Evans, the lack of a strong tradition in methodical record-keeping, the absence of a fully developed registry system, the fluidity of administrative organization, the relatively late establishment of a national archival agency, the institutional autonomy and procedural diversity encouraged by a federal system of government, the strong influences exerted by the allied professions of the librarian and the manuscript curator, and the lack of a stable terminology all contributed to the development of this unique definition.^[23] Whether the National Archives affected practices in other American archival repositories, or whether as American theorist Theodore Schellenberg supposed, the Library of Congress Manuscripts Division was responsible, Schellenberg discovered in 1942 that two-thirds of American repositories were arranging items chronologically and one-third were arranging material by subject, or using a combination of the two. In other words, almost no archives in the United States were employing the principle of provenance to arrange and describe their records.

Gradually, however, the ideas of *respect des fonds* and original order filtered down through the American archival community were strongly influenced by Schellenberg’s seminal text *Modern Archives: Principles and Techniques* published in 1956 and reinforced by his second work *The Management of Archives*, which followed in 1965.^[24,25] The archival community was also influenced by the writings of Schellenberg’s compatriot Margaret Cross Norton who, often quoting Jenkinson, maintained that provenance was made up of both *respect des fonds* and original order.

In Canada, archivists were introduced to European archival theory in the 1950s through their colleagues in the United States. The then Public Archives of Canada

followed the example of what became the National Archives and Records Administration by implementing a similar variation of provenance. In 1966, W. K. Lamb wrote in the journal *American Archivist* that the Public Archives of Canada used the word manuscripts to describe private papers and that this term enabled the archives to “organize the vast mass of miscellaneous papers into manuscript groups, each of which brings together collections that are alike in kind or in period or, occasionally, in subject matter.”^[26] The first Canadian essay on the principle of provenance was written by Robert Garon in Québec in 1969. However, it was not until 1977 that the attention of Québec archivists was drawn to the concept of *respect des fonds* by an article by French archivist Michel Duchéin.^[27,28] By the mid-1970s, Anglo-Canadian archivist Carl Vincent began to speak of using provenance theoretically on paper to define the record group, divorcing it from physical arrangement.^[29]

The Consultative Group on Canadian Archives’ report, published in 1980, established that archivists should employ the principle of provenance in order to provide the context of records. The group added what it called an extension of the principle that would become the first in a series of extensions of the concept. This extension was the principle of territoriality, which maintained that the locale or milieu of the records was part of their context. Allied to the principle of provenance was the principle of unbroken custody that stated that there needed to be a chain of continuous custody of the records in order to ensure their integrity. Thus, the group felt that archival materials “should be kept together, passed through as few hands as possible (at every stage with proper authority and continuity), and remain as close to their source as possible.”^[30] This report would be the foundation of the Bureau of Canadian Archivists’ Planning Committee on Archival Descriptive Standards that chose the *fonds* as the basis of archival description in 1992. Finally, the translation of Michel Duchéin’s article into English in 1983 helped galvanize English-speaking archivists in Canada to apply the principle of provenance in their institutions.^[1]

Australian archives employed provenance but in 1964 abandoned the record group in favor of the series. Peter J. Scott, an archivist at the National Archives of Australia, published an article in *The American Archivist* in 1966 that suggested that the record group was not capable of reflecting the variety of relationships that existed between records and government agencies. The lower level of the series was the only level that would allow records to be properly linked to all the various agencies that might have had responsibility for producing the records. As departments changed, as the names of departments changed, as their functions changed, as responsibilities for functions were split between departments, the records that arose from the same functions would be linked together. Peter Scott was the first to seriously challenge the level at which description would occur. After he fired the opening salvo

in the battle over the level of the provenancial unit, there was a brief flurry of articles either supporting him and/or championing the status quo. Since Scott's application of provenance at the series level did not fit the records of private individuals very well, where series were ill defined and inconsistent, his system did not spread very far outside government archives in Australia. Several writers, including Australian Chris Hurley and Canadian Terry Cook, later noted that the real advancement that Scott made was not just linking records to multiple creators but more importantly breaking archival description away from the physical nature of the records. Scott in effect separated the description of the creator from the description of the records.^[31]

HISTORIC DEVELOPMENTS IN THE MEANING OF PROVENANCE

While the definition of provenance, or what it was, changed over time, the meaning of the principle of provenance, or what it meant for archival practice, also changed. In Hilary Jenkinson's manual, for instance, he stated that papers that did not have the context provided by provenance would lack the qualities of *authenticity* and *impartiality*. Authenticity meant that the records were free from the suspicion of tampering; they were an authentic record of the person or organization that created them. Impartiality referred to the fact that records, by being drawn up in the course of daily activity, were an impartial testimony to the actions they represented. This was a very important point for Jenkinson. Archival records were not drawn up in the interests of posterity.

In the United States, Margaret Cross Norton felt that records were evidence and needed to be proven as authentic in order to be employed in a court of law and provenance was the tool to accomplish this. Theodore Schellenberg also saw records as evidence but, like Jenkinson, felt that they were evidence of actions. A birth certificate, for example, was the evidence of a government recognizing and documenting a birth; a diary was the evidence of persons recording their thoughts. This was the records' *evidential* value. But beyond the evidential value of records, Schellenberg felt that the contents of the records also held value and this was the records' *informational* value.

Based on the qualities of evidential and informational value, Schellenberg identified two uses for records. The *primary* use of a record was its usefulness to its creator. The *secondary* use of a record was its use to persons other than the creator. Schellenberg felt that records needed to be preserved for reasons beyond the creator's benefit in order to be considered archives, although the records might well be used by both the creator and others. Schellenberg felt that certain records would be preserved for their informational value only and not for their evidential value, and so records kept for that purpose could be

reorganized in an order that would best serve the needs of both scholars and government officials. Thus in that case, archivists would maintain the records by their creator but would not maintain original order.

French theorist Michel Duchein stressed the context of provenance, or the who, what, when, where, and why of records creation. He also talked about how to determine exactly what a *fonds* was, particularly the level of records creation. His *maximalist* level assigned the *fonds* at the highest level. Duchein pointed to Russia which treated the entire Russian country as forming a single *fonds*. Duchein's *minimalist* level would treat a department of a government as a *fonds*. When determining a *fonds*, the archivist would need to consider many qualities of the creator, such as a body having legal status, a structured, known organization regulated by an organizational chart, and so on. The *fonds* would be the basis for description.

Adolf Brenneke, the Director of the Prussian Privy Archives in Berlin, introduced in his lectures in the 1920s and 1930s the notion that provenance should reveal the functions of a business or government. It was the duty of the archivist to organize records to reflect how they were created. Researchers, he said, needed to know the structure of an organization, the organization's tasks and functions, and the structure of the records.^[32] Brenneke was farsighted; many modern archivists have returned to this need for functional analysis of an organization either to produce a description of the record-keeping system or to appraise the value of records arising from these functions.

Thus, from the early archival theorists we can understand that keeping records by creator ensures that one can judge the authenticity of the record by answering such questions as who created these records for what purpose? In other words, are these documents what they purport to be? The context of the creation, under what conditions these records were created, is also critical to determining the value and reliability of the contents of the document. This becomes essential when one is caring for documents that ensure the rights of citizens for example. The legal values of records must be maintained in such cases. To use a modern-day example, knowing that a governmental office of vital statistics has recorded a death ensures that a will can be probated and heirs can inherit. By keeping records in their original order, where there is one, the archivist ensures that the functioning of the individual or organization is captured.

MODERN THINKING ABOUT PROVENANCE

In the early 1980s, there came a sea change in the understanding of provenance, propelled in part by both the urgent demand of electronic records and the possibilities offered by computer retrieval systems. In the United States, Richard Lytle reported on an experiment he conducted in comparing the results when archivists used

provenance to retrieve archival materials versus when a computer system used content indexing methods of subject retrieval. He found that both methods had fairly similar retrieval results, but that provenance had its own strengths and could be improved.^[33] In Canada, Gordon Dodds, addressing members of the Association of Canadian Archivists at their annual conference in 1982, entreated delegates to study provenance as a tool to tackle modern archival problems. His call to action was answered shortly after in an article by Terry Cook, who stated that archivists needed to shift from providing information from records to providing a contextual understanding of the provenance of the records.^[34,35]

In the Winter 1985–1986 issue of *Archivaria*, Americans David Bearman and Richard Lytle wrote a prescient article that both consolidated thinking presented by earlier thinkers such as Scott and foreshadowed many later developments surrounding provenance. The two authors stated that archivists could make a unique contribution to information management by providing provenancial information about how organizations create, use, and discard information; provenance information about organizations (or creators) should be separate from descriptive data about the records themselves; archivists needed to capture organizational relationships in their provenance information; many-to-many relationships between creators and records also needed to be described; archivists should focus on the functions of organizations and the forms of their records to enhance the provenancial record; the authority record should include information about the history, structures, relationships, processes, and activities of records creating organizations; and such a record could show changes in particular functions or activities over time. Bearman and Lytle saw all of this enhanced provenancial information as providing a solid foundation for improved archival retrieval systems.^[36] These first articles, combined with critical writings by Canadian Hugh Taylor a few years later, were the beginnings of a flowering of the notion of provenance.^[37,38]

One of the new questions being asked was would provenance apply equally to both the physical and theoretical aspects of records? Although most assured the principle of provenance was meant to apply to the physical arrangement of archives in the repositories of the late eighteenth and nineteenth centuries, that slowly changed over time once more recent records began to enter archives. The volumes of these recently created archives increased exponentially, and many of the accumulated records remained open for further accruals. Archivists were no longer able to physically group together the total archival records of defunct administrations. Records typically began to be received and processed by archives in varying amounts referred to as accessions. Although there were still attempts at some sort of physical organization of records as late as the 1970s, eventually records were placed on shelves as they were received in whatever way made most

efficient use of space or eased retrieval and were assigned control numbers. There was no attempt to keep the records of a single department or person physically together. Archivists acknowledged that these accessions had to be maintained in order to preserve good physical and administrative control over the records. The accession would tell when the records were acquired, from whom and under what conditions. Archivists no longer used provenance in order to organize records physically in the archives but theoretically on paper.

With the advent of electronic records, the question was would provenance apply to such records, which often remained in situ, where they were created? The answer to the question of the application of provenance was fairly straightforward. As Terry Cook stated, “a world of relational databases, of complex software linkages, of electronic office systems, of hypermedia documents, of multilayered geographical information systems, is, when all the high-technology rhetoric is put aside, still a world of information relationships, of interconnections, of context, of evidence, of provenance.”^[39] Whether the records remained with the creator or were transferred into the archives, it would still be critical to know who was responsible for the creation of the records and the context of that creation and thus provenance would still be critically important to capture. Canadian Luciana Duranti emphasized that among other aspects, “an authentic electronic record is one the identity and integrity of which can be verified, that is, a record whose provenance and authorship are known at every time.”^[40]

At about the same time as Bearman and Lytle were writing of provenance in *Archivaria*, American Max Evans proposed the creation of authority control, or officially separating creator histories and linking them with all records associated with that body, which created a new relationship between provenance and original order.^[41] Canadian Debra Barr expanded on Evans’ idea, noting that inventories should demonstrate connections of records to as many creators *and other records* as was appropriate.^[42,43] Chris Hurley added to this notion by suggesting that the context of records creation should expose multiple relationships based on formal functions.^[44] Since then there has been major work on descriptive standards that would allow this separation of provenancial information from the descriptions of records, including the creation of the International Standard Archival Authority Record (Corporate Bodies, Persons, Families) or ISAAR (CPF). Australian Adrian Cunningham noted that the second iteration of ISAAR (CPF) added a new element to provenancial description: the relationships between creators and records. Michelle Light emphasized the importance of including all names or terms representing an entity as it changed over time.^[45,46] David Bearman’s desire to have functions recognized in provenancial descriptions came about with the development in 2007 of the ICA’s International Standard For

Describing Functions, which provided guidance for describing the functions of corporate bodies associated with the creation and maintenance of archives, although the standard separates the description of functions from the description of provenance.^[47]

Beyond these new considerations and developments, there has been a virtual explosion of writing on the subject, including proposals to radically expand the very notion of what constitutes provenance. Many of the authors have built on aspects of each other's work, adding new concepts and ideas. In analyzing provenance from a postmodern perspective, Terry Cook proposed a societal provenance that would acknowledge that records are authored and interpreted in a social context. This notion was seconded by Tom Nesmith who said this expanded view of provenance would contextualize the records more fully by providing information about the social circumstances that surrounded their creation. In this way, the provenance can never be fully known but is constantly emerging and evolving.^[48,49] American Jeannette Bastian felt that creators of records and their acts of creation were tied to the actual spaces in which they engaged. This "provenance as place" suggested that there were multiple levels of provenance.^[50] Lori Podolsky Nordland encouraged archivists to go beyond the surface interpretation of records to do the research and deconstruction of the records if necessary to add a "secondary provenance" to their description. She also noted that as records underwent what Hugh Taylor referred to as a "transmedia shift," the provenance of the record shifted or acquired new layers of meaning.^[51] Joel Wurl proposed ethnicity as a form of archival provenance. This understanding of provenance would lead archivists to overcome a tendency toward excessive veneration in documenting ethnic groups, avoid oversimplified notions of cultural diversity, and would lead to the stewardship, instead of custodianship, of the records of ethnic communities. Chris Hurley stated that the provenancial context beyond that of the immediate creator should also be captured.^[52,53] Emily Monks-Leeson also extended the coverage of provenance to new contexts created by new uses. "...As records take on new meetings and new contexts, understandings of provenance can shift to encompass not only the original contexts of creation (which should be preserved), but also those new contexts in which records come to belong."^[54]

Other authors such as Canadian Laura Millar noted that while provenance was originally based on the concept of the *fonds*, the archival notion of the *fonds* was simply a theoretical construct. What came to the archives could never be the whole of the records created and accumulated by the creator, and what was preserved by the archives became an even smaller subset of the whole.^[55] In Britain, Geoffrey Yeo agreed that the term *fonds* rarely describes the whole of the records of a single creator and furthermore, when those records are spread across a number of institutions, for each of those institutions to designate their

part of a larger aggregation as a *fonds* is "misleading, if not erroneous."^[56]

In applying provenance to personal records, Geoffrey Yeo said that conventional approaches to archival description used in capturing provenance did not do justice to the often complex histories of personal archives. Chris Hurley in Australia noted that all organizational records have both corporate and personal provenance.^[56,57]

Laura Millar in recent years has suggested that provenance needs to capture three separate components: the creator context, the record-keeping context, and the custodial context. She based her definition of *creator context* on the definition by Terry Cook, stating that archivists should capture the functions and activities of the creator that produced the records. The *records-keeping context* would record the physical management and movement of the records over time and answer such questions as how the records were created and used, where the records moved to and why, and whether any records were lost, destroyed, enhanced, or altered and why, among others. The *custodial context* would document how the records came to be in the archives and how the archives managed the records over time.^[55]

In terms of applying the principle of provenance to various archival functions, for Terry Cook, provenance was a tool for the appraisal of records, particularly the vast amounts of case files and records generated by government. Many other authors have agreed.^[58] As for the role of the archivist in the principle of provenance, Emily Monks-Leeson in 2011 wrote that archivists and archival institutions contributed to the provenance of the records "through their acts of interpretation and inscription," and thus this also needed to be part of the description. Tom Nesmith noted "in their daily work archivists... make decisions about the origins of a record. For whatever reason, they focus on certain aspects of it which seem meaningful to them and omit much else which may or may not be knowable." He suggested that archivists may want to highlight different aspects of provenance depending on the records.^[54,59] And finally, according to Jennifer Meehan in the United States, archivists should include information about their own maintenance, transmittal, and use of the records by all custodians, themselves included.^[60]

Finally, regarding original order, in the Netherlands, Peter Horsman proposed in 2002 the principle of (virtual) provenance that would be a visualization through archival narratives that would describe "functional structures, both internal and external." Tom Nesmith stated that archivists should speak of the order the records are in when they arrive at an archives instead of original order.^[61,62] As other postmodern archival scholars recognized, Canadian Heather MacNeil noted that the original order of a *fonds* is constructed, not found, by the archivist. She stated that "the arrangement of a body of records is not fixed at a single point in time. The survival and ongoing preservation of the records mean that they are in a continuous state of becoming as their physical and intellectual orders are shaped and

reshaped, contextualized and recontextualized, initially by their creators and subsequently by their custodians.” Archivists did not restore original order so much as construct and reconstruct it in accordance with their own biases and understandings. And finally, while archivists might understand the functions that created the records, they were also reminded that those records no longer carry out those functions. MacNeil called this “archivalterity.”^[63] When applying original order to personal records, Jennifer Meehan maintained that archivists could not use approaches that worked with organizational records but needed to focus attention on the relationships between records and activities whether there was a discernible order or not. Archivists should concentrate on the relationships between records and the activities that gave rise to them.^[60]

CONCLUSION

The original conception of provenance was that it was the origin of archival records, and the notion that records of one creator must not be intermingled with those of another was the foundation of the principle of provenance. The corollary of this principle was the concept of original order that not only must records be identified by the person or organization that created or accumulated the records, but also the records should remain in the order in which they were originally kept. These two principles were born of necessity as European archivists struggled to gain physical control over records that had been passed from administration to administration. Depending on the unique situations of each country, different adaptations and interpretations of the concepts developed as they spread from Europe to other parts of the world. It is difficult to say whether countries outside the western tradition independently arrived at a similar principle (as only a small amount of archival literature from Asia, South America, the Middle East, etc., has been translated into English); this warrants further investigation.

Closely tied to this however has been the major struggle to identify the provenancial unit of control that formed the basis for arrangement, description, reference service, and so on. One could not identify the provenance of records unless one were able to determine the unit to which the identification would be attached. The advent of computers and the development of descriptive standards to take advantage of computer power only exacerbated the problem. Archivists began to take a renewed interest in provenance and original order and question the identification of the unit, the *fonds*, the archive group, the record group, or the series. It was only a matter of time before they began to reconsider every aspect of provenance and original order and their meaning for both archivists and researchers. Today the idea that provenance is simply the origin of archival records has been transformed into the idea that provenance captures the entire context of

the creation of records, everything from the identity of the person, persons, or organizations that created them, the system that supported them, and the conditions under which the records were created, to their movement from originator to archives, and the archivist or archivists who appraised chose and described them.

The principle of original order likewise changed to accommodate the postmodern realities that original order does not exist independent of the person who is describing it, and that it should reflect the relationships that exist between creators and records.

No doubt the future will bring further developments in thinking about the principles of provenance and original order. The changes these theoretical proposals have made to actual practice have been slow however, tempered by the awful reality of enormous twentieth-century backlogs of unprocessed records awaiting arrangement and description and the looming volume of physical records created from the Second World War on beginning to show up on archives' doors. A breakthrough that brings theory and practice together will require new thinking that concentrates on application.

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Provenance of Museum Objects

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Abstract

Museum professionals, museum supporters, and observers understand provenance to be the history and circumstances of an object's ownership and possession. Knowing the story of an object's ownership and possession may contribute to understanding the relative meanings and significances of that object to individuals, nations, groups, and locations and may improve understandings of legal rights, titles, and interests in objects. Museum professionals understand that ascertaining and sharing provenance information can further public trust and public service and build historical records for objects. However, the ability of museums of any type to ascertain provenance for objects is greatly dependent on the motivations and practices of past owners or possessors, and other interested parties, to document and share knowledge about ownership and possession. Discussions and actions within the last several years related to the history and practices surrounding twentieth- and twenty-first-century acquisitions of certain objects by museums have focused acute attention on the importance of studying, documenting, and revealing provenance.

INTRODUCTION

The meaning of provenance in a museum context is unambiguous. Museum professionals, museum supporters, and observers understand provenance to be the history and circumstances of an object's ownership or possession. While the definition of provenance may be commonly understood, the ability of museums of any type to ascertain provenance for objects is greatly dependent on the motivations and practices of past owners or possessors, and other interested parties, to document and share knowledge about ownership and possession.

Expressed stewardship mandates of museums commonly imply aspects of collecting, preserving, interpreting, and exhibiting objects. In museum parlance, *object* is used to describe very generically the fullest range of items conceivably collected, preserved, interpreted, and exhibited by museums, recognizing the flattening effect of using one term to denote items of potentially vastly different types and meanings, ranging, for instance, from works of fine art such as paintings and sculptures, and artifacts such as flags and masks to natural world specimens such as plants and shells. Distinctions might be drawn between definitions of *object* used here as a generic, equalizing term to describe products of humankind and nature, and *cultural property* used elsewhere to identify products of humankind and nature deemed by some to have special significance to the cultural heritage of a nation or group, or special significance to a location. This entry intends to review, under one umbrella, the meanings, roles, and practices around provenance information within the context of diverse types of museums, such as public, private, and governmental museums of art, cultural history, history, anthropology, natural history, and science.

The following provides an overview of topical issues facing museum professionals when studying, documenting, and sharing information about provenance, beginning with a general discussion of ownership and possession, and the relevance of such to museum policies, particularly reflecting on recent interest in the history and practices surrounding twentieth- and twenty-first-century acquisitions by museums of certain types of objects. The entry then considers sources for provenance information and explores the challenges of finding partial, conflicting, or otherwise not wholly complete and accurate information for an object, and the part museums may play in perpetuating the availability of only partial information.

While provenance research, documentation, and dissemination competes with other demands for museum resources, museum professionals understand that work around ascertaining and sharing provenance information can further public trust and public service and build historical records for objects. Within at least the last 40 years, motivations from within museums, and influences from without, have kept discussions of provenance related to museum objects active and passionate.

CUSTODIAL PATHS

The ownership and possession of an object is marked chiefly by place (location), time (duration), and purpose (circumstance). To determine and, ideally, ultimately, to share an object's provenance, museums must first map the path of ownership or possession, from the place and time of an object's origin through a maker, patron, or culture or from the time of an object's discovery at a findspot, through any subsequent points of rest and transactions,

reaching the place and time of that same object's current or last known owner or possessor. The term *provenience* is used by archeologists to mean the original context of an object or, more precisely, to mean documentation of an object's original findspot, including description of its placement and interpretation of its situation relative to other objects found in the same place. This entry considers the findspot for an archeological object to be the starting point of its custodial path.

Custodial paths—marking points of rest and transactions—can vary in duration, purpose, and traceability, with some objects changing hands more frequently and more transparently than others. Objects might change hands through transfers of title, such as by gift, bequest, purchase, sale, or exchange. Ownership and possession might otherwise be defined by agreements for commissions, shared ownership, restitution, or repatriation. In theory (although unlikely in practice), an object might be transferred from the original owner, or location, through a hybrid and abbreviated combination of private, unknown, corporate, governmental, and museum collections, with the majority of transfers in ownership occurring at the private collection level (p. 269).^[1] With familiar or longer-established media—such as paintings, decorative arts, coins—in layman's terms, owning an object is equated with having physical control of the object as property. Some contemporary artists are pressing understandings of what it means to own an object in that, in some cases, the original work of art may not have a primary, staid physicality. Observations about works created by the artist Tino Sehgal (born 1976, London; active Berlin) provide just one example:

Art can be defined, provocatively, as an intangible quantity that transforms an ordinary object—a urinal, a soup can, an unmade bed—into something worth many times more than its material value. Tino Sehgal seeks to isolate precisely that intangible quantity. His art is completely immaterial; it can be bought and sold without involving any objects whatsoever.^[2]

In such cases, an owner may acquire from the artist a right to make new instances of the artist's original concept based on parameters agreed upon by the artist and the owner. Exercising a right to make new instances may or may not yield a physical object, and the outcome may vary, instance to instance, prompting questions about the object per se and what is actually being collected.

In other cases, simply possessing a physical object may not constitute legal or valid right, title, or interest in that object, as when, for example, a current owner consigns an object to an auction house in order for the auction house to promote the object, its maker, or past owner (e.g., someone of renown) when brokering the sale of that object to a new owner, or when authorities in a country at war give temporary custody of at-risk objects to a public museum located elsewhere for safekeeping until the objects can be returned to the country of origin. Provenance

information for an object should distinguish between those who have owned an object and those who have held the object transitionally.

Tracing the custodial path for an object is also intertwined with verifying that the information at hand about an object, its path, and caretakers is connected with the actual object under review. The concerns here include receipt of completely fabricated provenances or innocently inaccurate mix-ups that connect otherwise reliable details about provenance to the wrong object. Demonstrating verisimilitude between provenance information and an actual, or the original, object through place and time, however, might be predictably and acceptably variable. As noted, with some contemporary works of art, for example, a collector may acquire a right to use the artist's original concept, and any "object" resulting from exercising that right may or may not be the same as any previous instance. This kind of predictable, intended variability is distinguished from circumstances where caretakers take it upon themselves to change an object in ways unexpected and unintended by the artist/maker or culture, as when, for example, a medieval altarpiece has been radically restructured by division into parts for dispersal to different locations.

Rightful, Clear, or Good Title

Knowing the story of an object's custodial path may contribute to understanding the relative meanings and significances of that object to individuals, nations, groups, and locations, and the object's function within any intended and subsequent contexts. From legal and ethical perspectives, knowledge of provenance may improve understandings of rights, titles, and interests in objects. Ownership may be described as rightful, legitimate, legal, valid, clear, clean, good, and proper as in, having rightful, clear, or good title in objects. The means and requirements for acquiring rightful, clear, or good title in an object may differ under different nations' laws and may vary by type of object (e.g., requirements for acquiring a well-documented modern sculpture directly from the artist may be different from the level of diligence expected when acquiring a fragment of an ancient urn long removed from an archeological site).^[3–5]

Depending on the types of objects and scopes of collections involved, the museum professional researching provenance will be aware that countries such as China, Egypt, Greece, Peru, and Turkey have modern patrimony laws that give the national government primary ownership rights and interests in some objects created or newly discovered in that nation's territories. Patrimony laws imply support for cultural nationalism, or a national cultural heritage view, which recognizes that certain objects have special significances to originating nations, groups, or locations, and privileges a nation's rights to possess and provide access to those objects over other ownership

interests, in some cases, regardless of the perceived legitimacy of subsequent transfers in title or possession.^[6] This position has been criticized as being retentionist and politically based.

The museum professional researching provenance will also be aware that some nations—including Australia, Canada, and the United States—have laws covering the possession and control of human remains and certain cultural materials. For example, the U.S. Native American Graves Protection and Repatriation Act of 1990 (<http://www.nps.gov/nagpra>) recognizes that descendants have primary rights to possess, control, and guide outcomes of ancestral remains, funerary and sacred objects, and cultural patrimony notwithstanding current possessions by nondescendants.^[7,8]

Some museum professionals, museum supporters, and observers advocate cultural internationalism, or a world cultural heritage view, emphasizing the value of more open access to objects in furthering understandings of cultural heritage. Cultural internationalism holds that objects are common patrimony, belonging to all peoples, and assumes museums—depending on type, mission, and scope—need objects to move from location to location in order for museums to collect, preserve, interpret, and exhibit objects. This view foregrounds a belief in the contemporary museum as an impartial caretaker in providing objects, regardless of origin, with a good home, good care (such as curatorial, documentation, and conservation services), and good visibility through public display and discourse, an assertion reproached by others as elitist and encouraging destruction of original context.^[9–11]

The “Elgin Marbles” (or the Parthenon sculptures) at the British Museum in London are a frequently cited example of a dispute over ownership, possession, and location.^[6,12,13] In brief, the “Elgin Marbles” comprise a group of sculptures removed from the Parthenon on the Acropolis in Athens between 1801 and 1805 under the direction of Lord Elgin (an early-nineteenth-century British ambassador to the Ottoman Empire), with the assent of Ottoman Empire officials (then in control of Greece). Elgin transported the sculptures out of Greece to Britain; and in 1816 the sculptures were acquired by the UK Parliament from Elgin, and placed subsequently in the British Museum (https://www.britishmuseum.org/about_us/news_and_press/statements/parthenon_sculptures.aspx).

Some have argued that the “Elgin Marbles” in the British Museum should be returned to Greece because the sculptures are intrinsically Greek, therefore of utmost significance to Greece and the identity of the Greek people; this perhaps in addition to believing that the removal of the sculptures by Elgin was legally and ethically problematic. Taking this view, the sculptures should be returned and installed in the Acropolis Museum in Athens, opened in 2009 and located very near the Parthenon, providing an obvious place and time to reunite the sculptures removed

under Elgin’s direction with those objects from the Parthenon still remaining in Athens. Counterarguments for keeping the sculptures at the British Museum consist of the perceived legitimacy of the transactions (to Elgin from Ottoman officials; to Britain by Elgin), as well as the bond the British people now have with the sculptures, and beliefs that the British Museum will continue to provide the sculptures with a good home, good care, and good visibility.

When questions about ownership or possession arise, an object’s documented provenance may provide examiners and owners with key information. A previous owner may seek to recover an object when the modes of transfer surrounding later possessions are deemed problematic, a determination perhaps made partly after considering information (or lack thereof) about an object’s path of ownership, possession, and location.^[14] In some cases, the provenance secured by a current owner may be considered irrelevant when weighed alongside assertions that, for example, a nation holds primary rights to an object. Here, calls to right wrongful possessions may point to the special cultural, historical, archeological, religious, or spiritual significance of the physical object to a nation, group, or location (an argument put forth by both parties in the case of the “Elgin Marbles”).

Interest in Provenance

Within at least the last 40 years [loosely marked by the 1970 United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention described in the following text], governments, journalists, merchants (such as dealers and auction houses), and communities of museums, researchers, and descendants of object makers have focused acute attention on the importance of studying and revealing provenance. Much attention has been given to revealing information about aspects of ownership or possession that might suggest questionable transfers or, conversely, might provide evidence or convincing arguments to quash such suggestions. Discussions and actions are particularly heated around identifying and possibly returning to previous or rightful owners objects looted, seized, and/or illegally exported in the twentieth and twenty-first centuries such as antiquities, archaeological objects, and ethnographic materials taken clandestinely by individuals from historical structures and archeological sites located around the world and works of art and Judaica abandoned unwillingly by owners or taken forcefully in Europe during the Nazi era. DeAngelis poses the question, “. . .when can we ignore misdeeds of the past?” (p. 253);^[15] see also Merryman^[9] and Yeide et al.^[16] for descriptions of pre-twentieth-century plundered objects finding their way into museum collections.

Museum organizations and international bodies such as the American Alliance of Museums (AAM, formerly the American Association of Museums), the Museums

Association in the United Kingdom, and UNESCO have campaigned to encourage museums to document and share, as widely as possible, images and descriptive information about objects in permanent collections, including information about known and incompletely known provenance. Calls for information sharing and transparency related to collecting activities often point to the public service and education goals of museums as reasons enough to make information about objects available through, for example, online collections catalogs, print publications, and on-site exhibitions.

MUSEUM POLICIES

Each type of museum may face, and certain objects may pose, distinct challenges relating to provenance. All museums, however, may consider a set of fundamental questions relating to ownership and possession when, for example, publishing descriptions of objects in collection or exhibition catalogs and borrowing objects from other collections for inclusion in temporary exhibitions. Questions about ownership and possession specifically comprise part of the diligence and care exercised by museums today when accepting or buying newly proposed objects for permanent collections.^[17,18] Fundamental questions are considered concerning where an object has been, with whom, when, and under what circumstances. Contemporary museum policies for acquiring, preserving, interpreting, and exhibiting objects may acknowledge the importance of ascertaining as complete and accurate provenance information as possible in furtherance of good stewardship of objects (acquired for permanent collections or borrowed for temporary exhibitions), building historical records for objects, and sustaining public trust by demonstrating ethical practices.

It is not unusual, however, for museums to know imperfectly, at present, the full story of an object's ownership and possession, from place and time of origin to the current or last known owner or possessor. Museums will need and want to continue operating in the time between having partial, more than partial, and perhaps complete knowledge of provenance. In support of collecting activities in particular, a museum may establish parameters for accepting, buying, or rejecting proposed objects when provenance is, at the time of offer, known incompletely. For instance, a museum's acquisition policy might place the responsibility of judging and advocating the acquisition of objects with limitedly known, but not suspicious, provenances squarely in the hands of museum curators. See, for example, the British Museum's *Policy on Acquisitions*.^[19]

Some believe, and museum acquisition policies may imply, that museums should be in positions to provide objects with good homes, good care, and good visibility. In other words, assuming objects are acquired properly and through open channels (e.g., reputable commercial

markets), and absent evidence of problematic transfers, museums are in better positions than some to be repositories and advocates for objects with incompletely known provenances.^[20] While a currently incompletely known provenance does not automatically or necessarily mean that something about an object's history of possession is problematic, others argue that by continuing to acquire objects (particularly those originating from historical structures and archeological sites) with incompletely known provenances, even good-faith donees or purchasers (who have conducted some form of due diligence and acquired objects properly), might inadvertently intensify the market for objects with problematic histories of possession and, further, encourage contemporary clandestine stripping of objects from historical structures and archeological sites, without regard to documentation or interpretation, resulting in loss of knowledge about contexts and meanings relative to a place, time, and people.^[21]

The international agreement, the 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property (<http://www.unesco.org>), intends to protect objects from illicit removals and changes in possession, and protect nations from undue loss of cultural heritage. Many museum professionals, museum supporters, and observers have generally interpreted the principles and directives articulated in the Convention to mean that, to be acquired soundly and ethically today, certain types of objects must have been in proper circulation outside an originating nation before 1970 (using the date of the Convention as a marker), or have been legally exported from that nation and in proper circulation after 1970. Contemporary museum policies may refer to the Convention as one benchmark to apply when assessing the soundness of acquiring certain types of objects.^[22,23] The literature includes passionate discussions about the implications of contemporary exporting and importing of objects, such as antiquities and ethnographic materials, with currently incompletely known ownership histories. It is generally agreed, however, that preventing illicit removals of objects from structures and sites should be a priority for the cultural heritage community.

MUSEUM PRACTICES

Beginning in the 1990s, many museums began making mostly modest portions of collections information available on institutional websites, including, to greater and lesser extents, some provenance information about objects. Ongoing moves by museums to share more collections information on websites, other digital platforms, and through linked open-data initiatives are in line with expectations of museum professionals, museum supporters, and observers that museums should share what

they know or believe about artists/makers, the objects themselves, and the values, meanings, or functions associated with objects, and encourage discourse with museum audiences about objects and these contexts.

In this respect, provenance is one among several areas of interest in museums competing for research, documentation, and dissemination resources. Museums may need to prioritize which objects in a collection and which types of information will be the focus of research, documentation, and dissemination at a given time. Retrospective provenance research may be higher or lower in priority depending on the museum and its influences, such as the expressed interests of museum supporters (including museum audiences) and museum observers (including museum professional organizations and government agencies), as well as by work underway for contemporaneous museum activities (e.g., inventorying collections, making new acquisitions, exhibitions, publications, and conserving objects). Permanent professional positions focused solely on provenance research are uncommon in museums, excepting perhaps specialized positions created by some larger museums to speed sharing of provenance information. Provenance research is more likely part of a defined project, or folded into the routine information activities of staff with curatorial, registrarial, or documentation responsibilities.

Efforts to address issues related to some twentieth- and twenty-first-century acquisitions of antiquities, archeological objects, and ethnographic materials and looting of objects by the Nazis provide examples of expressed interests influencing museum prioritizations for research, documentation, and sharing of provenance. As a case in point, in 2000 the AAM, Association of Art Museum Directors, and the Presidential Advisory Commission on Holocaust Assets announced an agreement recognizing the commitment of U.S. museums to disclosing provenances for objects in permanent collections that might have changed hands in Europe during the Nazi Era (1933–1945).^[24] In 2006 the Conference on Jewish Material Claims Against Germany sharply criticized U.S. museums for their slowness in making available provenance information for objects in accordance with the 2000 trilateral agreement. Today, the responsiveness and actions of U.S. and European museums in addressing matters of provenance for objects within this scope continue to garner international attention and concern.^[25,26]

Museum Standards

Museums demonstrate differing practices for and commitments to sharing provenance information for all types of objects. Some museums may make available only the known and verified provenance for an object, which might include vague references to past owners (e.g., gift of an anonymous donor) and might exclude information for all but the most immediate past owner (i.e., excluding owners prior to the anonymous donor), and/or skim over known

gaps in the history of ownership or possession. Other museums may communicate, bluntly, in widely available online records that there are known gaps in the custodial path for a particular object. See, for example, efforts of U.K. museums to share information about objects with gaps in provenances covering the Nazi era: <http://www.collectionstrust.org.uk/collections-link/cultural-property-advice/spoliation>. For a chair made in France in 1925, for example, a museum might note that before acquisition by the museum in 2007, the chair was in the private collection of Jane and John Doe from 1940 to 2007, but the location of the chair from 1925–1939 is unknown. Putting consistently described provenance information in a shared online environment may increase access to that information, and help bring together distributed, related content, but its usefulness—to museum professionals, museum supporters and observers, previous owners, and descendants of object makers—will depend in some measure on the completeness, accuracy, and understandability of the information. For instance, the museum data standard Categories for the Description of Works of Art notes, “It should be possible, for example, to locate all the works in a particular collection, or to answer questions such as ‘What works, now in American collections, were owned by the eighteenth-century Venetian collector Padre Resta?’”^[27]

Museums keep provenance information, particularly about objects in permanent collections, in a combination of internal systems typically comprising a collections management system and documents (paper or digital) authored or collected by staff with curatorial, registrarial, or documentation responsibilities. Standards for museum object information reflect practices and certain expectations around provenance documentation and dissemination. A museum might refer to standards such as the Categories for the Description of Works of Art (CDWA) (http://www.getty.edu/research/publications/electronic_publications/cdwa/index.html), CIDOC Conceptual Resource Model (CIDOC CRM) (<http://www.cidoc-crm.org/Version/version-6.2>), and Spectrum (<http://www.collectionstrust.org.uk/spectrum>) when planning or vetting current systems for documentation. Each of these standards refers to ownership and possession, and each might offer museum professionals’ part, or most, of what is needed to organize provenance information in, for example, a collections management system.

For example, the CDWA includes several data elements related to provenance:

- Ownership/collecting history—provenance description (e.g., prose description of the custodial path)
- Ownership/collecting history—owner/agent (e.g., Doe, Jane)
- Ownership/collecting history—transfer mode (e.g., gift, purchase)
- Ownership/collecting history—owner’s credit line (e.g., Gift of Jane and John Doe)

- Current location—repository/geographic location—(e.g., City Art Museum, My Town)

The CDWA identifies just one provenance-related data element as a core category comprising a core record for an object: Current Location—Repository/Geographic Location. This category is intended to identify only the current or last known owner, a limitation that may well reflect practical experience in art museums in particular: namely, that it is not unusual for museums to know imperfectly the full story of an object's past ownerships and possessions; therefore, recording anything beyond current or last known owner may be highly recommended, but is optional.

The CIDOC CRM identifies two specific classes (or, loosely, elements) that are primed for data reflecting museum understandings of ownership and possession. The classes Acquisition and Transfer of Custody can be used to tease apart the state of having legal and valid right, title, and interest in an object (Acquisition) from that of having transitional custody (Transfer of Custody); both states, as noted earlier, are important for provenance research, documentation, and sharing.

Spectrum identifies units of information (or, loosely, elements) for recording an "owner's personal experience" with an object (such as personal meanings or relevancies) and an "owner's personal response" to an object (such as personal feelings about the object), in addition to identifying expected elements related to ownership history such as the Ownership Exchange Method (gift, purchase), Owner (City Art Museum), and Ownership Dates (1951–2007).

In terms of cataloging practices, several resources—including CDWA, the AAM Guide to Provenance Research,^[16] and Cataloging Cultural Objects (CCO) (http://cco.vrafoundation.org/index.php/toolkit/cco_pdf_version/)—suggest basic principles and expectations for recording and communicating information about provenance: for example, be clear, specific, accurate, attempt to fully account for the history of ownership (to the extent possible), and cite information sources. Getting to the point where it is possible to record and communicate as complete and accurate provenance as possible can take time, diligence, and care. Museum professionals work—over periods of time and through changes in staffing—to reduce incompleteness or imperfections in provenance information to the extent possible, given that the information known and available to a museum at a particular time may be partial, conflicting, inaccurate, or otherwise not entirely satisfactory.

TIME, DILIGENCE, AND CARE

A museum's ability to secure provenance information will depend partly on the priority and standard for documentation and dissemination followed by each previous owner

or possessor, and/or by those with professional or academic interests in objects, such as independent researchers. Each known collecting entity or interested party may have idiosyncratic motivations and practices for documenting and sharing knowledge about previous and current ownerships, possessions, and locations. Museums, for instance, may be motivated to share information in furtherance of public trust, public service, and building historical records for objects. (As noted, museums may have idiosyncratic practices and motivations for sharing provenance, and therefore may have a hand in perpetuating uncertainties.) Other owners may not feel bound or influenced by the same levels of accountability related to collecting activities and documentation expected of and by museums today.

Ascertaining provenance may be a simple exercise if the custodial path is well documented, trusted, and unbroken; as when a living artist sells one of her drawings directly to the first and remaining collector, and sufficient details about the transfer are known. As time passes, and objects change hands and information is exchanged (or not), ascertaining provenance can become complicated. Credible information may be readily available for some periods of ownership (e.g., ample knowledge of the immediate past owner), but the museum professional researching provenance may be challenged by a complete lack of information for other periods of ownership for the same object, and/or by the provision of partial, innocently inaccurate, or possibly manufactured information about still other periods, depending perhaps on the motivations of previous owners to share or withhold information. Museum professionals may need to identify and deal with any red herrings (no matter the source), such as fabricated provenances intended to mislead, or the perpetuation of informed best guesses about certain periods of ownership, or any innocently inaccurate bits of information that have cascaded through oral or written histories of ownership.

Finding Favored Sources

Ascertaining provenance requires familiarity with objects, collections, collectors, and documentation at all levels allowing the researcher to detect what information may be missing in sources and to parse good information from bad. Each successive owner must determine the levels of credibility, completeness, and accuracy of provenance information provided by sources, including information sought or inherited from previous owners. Sought sources for provenance will provide as specific, accurate, and complete information as is known or shareable by the source's author at a given time. A favored source will provide a cluster of credible information describing where, when, and from whom the object originated, and the circumstances surrounding any subsequent changes in ownership and possession.

Some of what is assumed or known about ownership comes from evidence left by previous owners or possessors. Art collectors, for example, use various methods to mark and communicate their ownership of works of art. Collectors might apply unique stamps, inscriptions, inventory or property numbers, or labels directly onto objects in their collections, or might signal ownership by lending objects (along with the owners' names) to exhibitions or by supporting references to objects in publications (e.g., exhibition catalogs and catalogues raisonné).

Some advise museums to get signed statements from sellers regarding provenance (when provenance is known),^[5,17] an action that, if taken, serves museum goals for object documentation and furthering public trust (by helping to show good-faith purchases). Others caution that concerns for liability (as well as damaged reputations) may limit the extent to which sophisticated sellers (such as dealers and auction houses) will commit to statements about provenance, since what is known or understood at a given time about provenance may subsequently be proved inaccurate, if more pertinent information surfaces. Darraby notes, "Those who create a document entitling it 'provenance,' at least within the context of a mercantile transaction, do so at their own peril" (p. 86).^[18]

Museum professionals researching provenance may encounter familiar research challenges related to information availability and accessibility; challenges such as chasing down and getting access to known materials distributed geographically, linguistically, and disciplinarily or discovering along the way that some materials have been lost or destroyed (as may be the case with records of dealers long gone out of business). Custodians of potentially useful materials may do nothing to document and publicize the existence of the materials in order to restrict access, or custodians may simply be unaware of the materials' potential value to anyone else. Not every object carries inscriptions or labels (trusted or not), has been studied, exhibited, or referenced in published or unpublished materials.

When researching provenance for proposed or acquired objects, for instance, museum professionals consult internal records (such as bills of sale, loan receipts, import and export documents, deeds of gift, and curatorial defenses) and may consult external records (personal and corporate papers, inventory lists, photographs, excavation field notes, and oral histories of previous collectors), as well as an array of generally available published materials, such as monographs, catalogues raisonné, journal and newspaper articles, catalogs and announcements related to exhibitions and auctions. The provenances for objects held in other collections sharing some ownership or possession-related context with an object under review by a museum might provide comparable information or clues about provenance, as when, for instance, some stretch of the custodial paths for a group of pendants, earrings, and lockets once held centrally in a private collection, and

now dispersed among several collections, can be traced (backward and forward) through ancestors or descendants of the private collector.

Recent attention on the history and practices around twentieth- and twenty-first-century acquisition of antiquities, archeological objects, and ethnographic materials, and investigations into the custodial paths of objects possibly looted during the Nazi era, has in part fueled interest in maintaining centralized databases or other resources for information about sought objects and sought information, at least through specialized bibliographies, finding aids, and collection catalogs. See, for example, the subscription-based Art Loss Register for stolen objects (<http://www.artloss.com/>), the Object Registry (<https://aamd.org/object-registry>) where museums describe antiquities acquired with incomplete ownership histories, and two examples of freely available databases related to Nazi era looting: the Nazi-era Provenance Internet Portal (<http://www.nepip.org/>) and the earlier referenced database related to museums in the U.K. reporting gaps in provenances (<http://www.collectionstrust.org.uk/collections-link/cultural-property-advice/spoliation>). The AAM Guide to Provenance Research is an example of an existing print publication providing museum professionals with recommendations as well as extensive, annotated lists of resources for investigating changes in ownership or possessions specifically occurring during the Nazi era.

Centralized access to information, if described consistently and made freely available, might provide anyone with an interest in objects—including museum professionals, previous owners, descendants, researchers, lawyers, law enforcement agents—with starting points for investigation; starting points because sources may be in different states of completion and usefulness, with some offering extensive item-level access to needed documents, and others providing limited descriptions, leaving the option of travel to an archive, library, museum, or private collection for direct access to materials, unless restricted or restrictive.

TEMPERED SHARING

Even when information about ownership or possession is readily available, however, that information might be limited to only the most recent transactions or movements, depending on the venue for dissemination. Museum exhibitions and publications commonly identify the current owner of an object through credit lines accompanying object descriptions. A credit line for a drawing by an American artist might read, for instance, Collection Jane and John Doe. Credit lines for museum-owned objects are used, at the very least, to identify the current and immediate prior owner of an object and the means of transfer: for example, Collection City Art Museum, Gift of Jane and

John Doe. This does not tell the full story of an object's custodial path.

Museums, private collectors, dealers, auction houses, and independent researchers may create or perpetuate uncertainties about provenance by highlighting or, alternately, downplaying or suppressing some periods of ownership or possession over others. In the first of two extreme examples, a current owner may greatly value, and therefore want to emphasize, a perceived possession-related connection with a high-profile previous owner, perhaps because the position or reputation of that previous owner is intriguing (e.g., it may be fascinating and beneficial to know and promote the fact that an early-seventeenth-century painting once given to King Charles I of England is now in the collection of an American museum). By contrast, some owners or possessors may be less inclined to share details about previous owners or possessors who have earned notoriety through association with questionable modes of transfer (e.g., the Nazi art dealer Karl Haberstock).^[16] Questionable possessions are equally important to document and share, as knowing each period of ownership or possession may contribute to collective awareness about an object, its custodial path, and caretakers.

Decisions to withhold some provenance information in some venues (e.g., exhibition wall labels or online collection catalogs) may be influenced by motivations to protect commercial interests (if in the business of trading objects) or commitments to respecting requests for confidentiality. Museums and auction houses, for example, are unlikely to freely disclose names of donors or consignors when anonymity is desired, and when no one has yet requested that information. Redacting known provenance information in some cases may be a response to past and continuing assumptions about what people want to know about objects; where it has been assumed that people are very interested in the "back story" for an object: for example, learning about the artist/maker or originating culture, the object itself, and the cultural, historical, archeological, religious, or spiritual significance of the object. Knowing about past owners and possessors may contribute to understanding these significances (and *Spectrum* includes elements for recording an "owner's personal experience" with an object and an "owner's personal response" to an object); however, many museums, previous owners, and other interested parties have demonstrated (and many still demonstrate) a lesser preoccupation with sharing known information about every past and intermediate owner and possessor of an object, at least in public venues like collection, exhibition, or auction catalogs.^[14,15] A sinister assumption is that museums and other owners have in the past not asked about ownership, and not shared what they know, in order to skirt confronting dubious histories of ownership or possession.

One compounding effect of tempered sharing of known provenance—let alone not disclosing known gaps in provenance—is inheritance of light and possibly vague

documentation by subsequent owners and other interested parties and diminished abilities to fully know the story of an object's provenance; a state of awareness that may remain status quo for a long time or may change when information must be revealed, perhaps to comply with information disclosure requirements. More likely, as museums and other interested parties commit resources to researching provenance over time, partial or uncertain information provided by sources or inherited from previous owners might be fleshed out or corrected. Activities surrounding inventorying collections, making new acquisitions, exhibitions, publications, and conserving objects can present museums with ready opportunities and reasons to dig further into what is known about past ownerships and possessions, and to then share that information.

CONCLUSION

Recent calls for museums to share information about provenance more robustly have given profile to ascertaining as complete and accurate provenance as possible, even over time, as part of the diligence and care exercised when acquiring and managing objects. In a good scenario, a complete and accurate picture of the custodial path for an object will have credible, sourced information describing who has held the object in the past, when, where, and under what circumstances. Provenance information alone may not reveal the underlying motivations of an owner to give or accept, to sell, buy or to decline any proposed object. However, knowledge of provenance may improve (or help prove) understandings of rights, titles, and interests in objects from private property to national patrimony; understandings that serve museum goals for object documentation, education, and furthering public trust.

Further still, knowing the full story of an object's history of ownership and possession may contribute to understanding the relative meanings and significances of that object to individuals, nations, groups, and locations, and the object's function within any intended and subsequent contexts. The latter in particular jibes with the assumed interests of museum audiences to know the "back story" for an object, a natural complement to what is happening in museum research, documentation, and dissemination. The message sent in recent years to museums by supporters and observers is for museums to share more of what they know or believe about objects and contexts (including provenance), more widely and more quickly.

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Provenance of Rare Books

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Abstract

Just as people have lives, so do books. Like identical twins who end their lives looking quite different, even the seemingly indistinguishable copies of twentieth-century trade books accumulate their own histories and physical characteristics over time from readers' habits and storage conditions. With regard to rare volumes, research on provenance seeks to describe not only books' origins but also their subsequent bibliojourneys as they are read, borrowed, sold, collected, and held by institutions. Unlike studies concerned with the subject matter or content of rare books, provenance investigates the specific histories of individual copies, either by themselves or in the context of larger collections.

A rare book's provenance is the history of its ownership, often elaborating its associations with libraries, private owners, or collections. A significant aspect of book collecting and the history of the printed record of cultural heritage, provenance concerns not only the initial origins of a book but also the ongoing connections to collectors and collections. Research and documentation of provenance deal with two categories of evidence that reveal the histories of individual books. Internal evidence, including marks, inscriptions, bookplates, and bindings, focuses on the physical components of volumes. External evidence, such as catalogs issued by publishers and booksellers and those compiled by libraries, dealers, and auction houses, documents the places and conditions of manufacture, subsequent sales, owners, and collections that held the volumes. Provenance research concerns primarily the authenticity and integrity of rare books; however, in recent decades its data can also be used to develop and write innovative histories of books' circulation, collecting, uses, and reading.

DEFINITION

In the English language, "provenance" refers to the origins of an object, particularly a work of art or an antique. The English and French words are spelled the same and have similar meanings. Both words derive from the Latin verb "provenire," to come forth. However, the root word reverses the direction of contemporary provenance studies that return or seek to go back as far as possible to the object's origins in order to discover proof or, in the best cases, documentation of past owners and locations from the time of an object's conception or production. In French, provenance has been used in commercial and legal contexts, as well as by art connoisseurs, bibliophiles, and book collectors, in the sense discussed in this entry. Provenience is a related term, often used in the same sense of provenance. Archaeologists use it to refer to the precise location or to find the spot of an excavated object.

A rare book's provenance is the history of its ownership, often elaborating its associations with libraries, private owners, or collections. As a significant aspect of book collecting and the history of the printed record of cultural heritage, provenance concerns not only the initial origins of a book but also the ongoing connections to collectors and collections. In the past, research on provenance was seen as an arcane area of interest limited to people who recorded and studied the history of books and collecting.

Those who researched and kept track of provenance were principally librarians and bookdealers, as well as collectors. Like aristocratic family backgrounds and high society connections, distinguished provenances pointing back to a famous collection or library have long been prized by collectors. This aspect of provenance is engagingly described in Frederick Adams' [1969] lecture with occasionally amusing vignettes of collectors among his tales from the world of books. As Adams points out, such "good" provenance affirms the present owners' and collectors' own taste and erudition. Booksellers recorded noteworthy provenances in their catalogs to enhance the interest or value of significant books and to encourage sales. Moving beyond marketing and commercial interests, today, the history of particular copies of books is central to research that seeks to reconstruct a collector's interests, scholarship, and collecting strategies. Provenance can help to define the importance of certain titles or the relationship among books and to create the social histories of reading and collecting.

In its broad contemporary sense, provenance concerns the original owners and all subsequent persons and institutions that acquired books by purchase, gift, inheritance, or legacy up to the present. Borrowed books were occasionally never returned to their owners and libraries. More dramatically, rare volumes were transported from collections in less savory or deliberately illegal ways including

episodes of outright theft. Among other cultural artifacts, books were often taken as spoils; they have been looted during wars and civil unrest up to the present day. Extraordinary dispersals of books and destructions of entire libraries took place during the Reformation with the closure of monastic libraries, as well as during the French Revolution and World War II. Hence, much provenance information has been lost. Amid the disasters of wars, due to the prevalence of plunder and resulting devastation, it has always been the case that cultural conflicts and depredations wreak havoc with the clear views researchers seek to construct of books' and libraries' history.

Early Printed Books

From the invention of Western printing in the mid-fifteenth century to the present, books were printed in various editions or issues, sometimes on different papers. They were often sold in parts or fascicles, held in paper covers or boards. Books' owners frequently had volumes bound according to their own tastes; they and others wrote personal inscriptions denoting ownership (called an *ex libris*) on the inside front cover or on the first pages. Collectors pasted in their specially printed bookplates. Readers and scholars annotated the texts. Wealthy bibliophiles shelved their books in elegantly designed and decorated private libraries, binding the books in specially designed leather covers embellished with coats of arms and other collection-specific ornamentation. Other readers and librarians in religious or educational organizations housed books in less impressive ways. Books from these libraries and institutional collections also frequently bear ownership inscriptions, and they have characteristic (though more modest) bindings and shelf marks on the bindings or edges of pages. Some owners were less careful with their books, using them for professional purposes and/or scholarship. They may have kept books in places where dust, mold, and vermin had their own deleterious effects on the unstable and perishable materials from which books were made. However, such details of condition can sometimes be helpful in identifying books' past history.

As described in the section "Internal Evidence: Physical and Material Qualities," both the materials and physical condition of books can provide primary evidence about past history. Unfortunately for the present interest in provenance, it was not always deemed important for collectors and libraries to preserve the physical integrity of books. As Roger Stoddard writes in the preface to his 1984 catalog *Marks in Books*, up to modern times, binders reassembled books in the course of binding or refurbishing covers. Only rarely did they make a special effort to preserve historical evidence, especially when dealing with books in poor condition. Covers and endpapers were considered to be of little value and they were discarded, taking with them any past library indications and shelf marks,

ownership inscriptions, booksellers' notes and collations, and other annotations. According to Stoddard, "Typically, the only evidence of provenance is on covers and endpapers, so the whole history of the copy may be sacrificed," if indeed books have been restored or rebound.

Modern Editions

Provenance concerns not only early books but also twentieth-century trade books. Although they were published in editions of hundreds or sometimes thousands, these volumes sometimes contain original graphics and specially designed jackets or covers. Their present condition and the marks of provenance that they bear associate them with libraries and collectors in different locales. Signed copies of literary works, variants of book jackets, inserted pages or photos, special bindings, library stamps, collectors' signatures, and booksellers' notations all assist in establishing the history of ownership and location of specific copies. Recently, there is particular interest among collectors in books linked to authors and artists who were associated with twentieth-century avant-garde groups and circles. In turn, the libraries of well-known authors and historical figures can be tracked by their characteristic marks as well as by external documents such as library lists and sale catalogs.

THE STUDY OF PROVENANCE

Provenance research and documentation deal with two kinds of evidence that reveal the histories of individual books. Internal evidence concerns the physical components of volumes. External evidence documents the places and conditions of manufacture, subsequent sales, owners, and collections where the volumes were held.

Internal Evidence: Physical and Material Qualities

Specifics on places of production and means of manufacture provide essential clues that establish the authenticity of books and initiate the chain of provenance history and ownership. Early printed books have associations not only with printers but also with artists, illuminators, patrons, and other participants who played a role in accomplishing the finished volume. When books were offered for sale, printers' and booksellers' lists, in manuscript or printed versions, can provide information about where the books were marketed and where potential buyers lived and worked.

Types of paper and printing ink, page formats, and seemingly pedestrian elements such as folds and sewing styles can all reveal historical information about the place of production. Physical features and formats can indicate whether a book was initially valued highly, collected, and thus bound in an elaborate binding or rather printed for

purposes of public information and record keeping, using less expensive materials and smaller formats. Other books, perhaps those used for educational purposes, were never bound but read and reread as indicated by tattered or heavily annotated copies. In rare but fortunate instances, heavily marked up and seemingly unattractive copies can be traced to historical figures or perhaps editors, sometimes indicating that the copy in hand was a proof copy and a witness of the publication process. Richard Rouse's detailed article on copy-specific features provides examples of marks, marginalia, and other kinds of evidence that he discovered in early books. These held clues that pointed back to early owners, libraries, and related works, which were either bound together as collected works or separated in the process of binding or by greedy dealers who made several books (and sales) from an early collected volume. Similarly, the very rare surviving copies of artists' model books depicting schematic figures and multipurpose decorations and ornaments for use by artists are frequently found with missing pages, cutouts, or pricks that indicate how artists made copies of the designs. In addition, such model books often have spots of paints or inkblots. These could seem to mar the beauty of the original book, yet collectors prize such marks as verifications of books' use by early artists.

All and any indications of ownership are central elements of provenance information that tell about the history of circulation and collection of books. Conveniently for the study of provenance, past owners frequently wrote their names in books, and they made reading notes and personal annotations as well. Collectors and libraries pasted a bookplate inside the front covers to identify their holdings. For locational purposes in their libraries, they affixed a spine label or wrote a shelf mark outside of the volume. These brief alphanumeric notations are found on books' spines or on the page edges if books are shelved on their sides.

Inscriptions: The most obvious evidence of ownership, highly useful to contemporary collectors, are inscriptions. These handwritten notations with full names or initials of owners, dedicatory or presentation phrases, or another mark (occasionally a cipher) most frequently appear on the book's initial pages, particularly the title page. In the simplest form, the owner writes her or his name, occasionally supplying the date when the book was acquired and its price. Several centuries later, such paleographic details can be difficult to read, and considerable research or expertise is needed to decipher them. In early printed books, owners' names were frequently written in their Latin form, with degrees, affiliations with educational institutions, and dedications to others in cases when the books were gifts. Some inscriptions, ciphers, and monograms combine initial letters in decorative calligraphic presentations. In addition, some book collectors inscribed favorite mottos that were related to their family heraldry, or of religious or emblematic significance. Although

inscriptions were frequently effaced as books passed through collections, twentieth-century science (e.g., black light) affords a way to read inscriptions no longer visible to the naked eye.

Bookplates: Owners' names, initials, and mottos may also be found on printed bookplates and labels, again most frequently on the book's initial leaves. The decorative designs of the bookplates comprise heraldic devices, emblemata, images drawn from family history, and, in recent centuries, vignettes that allude to libraries, books, and the practice of reading. Like inscriptions, in many instances, names or initials on bookplates are not immediately comprehensible but must be deciphered with the aid of reference works on bookplates, armorial designs, or initials—of which, fortunately, there are many published compilations. Pasted into the front cover or endpapers, bookplates are usually etched or engraved or printed in relief with woodblocks; occasionally, similar information has been applied with a stamp. Bookplates can be a study in themselves with a substantial literature and specific research strategies that overlap with the historical and art historical areas of genealogy, heraldry, emblems, and ciphers. These highly specialized works on paper (just a few collectors, such as the California bibliophile Estelle Doheny, have had leather bookplates) have been collected as a specific book-related genre for centuries.

Library marks and stamps: Institutional ownership of books was first recorded on the volumes themselves by way of handwritten inscriptions. These often accompanied shelf marks on the outside of each volume (occasionally, shelf marks are seen on the front pages of volumes also). Usually far simpler in their designs than private owners' marks, library marks gave the name of the institution and place. More recent kinds of library marks include embossed names as well as perforations. Although library stamps or deaccession marks of former owners and defunct collections could seem to be irrelevant and were sometimes erased or cut out to eradicate the past historical associations, this practice works against historical research, particularly provenance studies. In fact, marks of past institutional ownership serve to provide highly useful information for tracking provenance.

Heraldry: Marks of heraldry, such as coats of arms, special insignia, and devices associated with court collections and holdings of eminent families, can appear in many places on books but are most frequently found on covers and initial pages. As an important aspect of tracking collectibles, this is an essential element for provenance. Heraldry is an arcane field requiring special expertise because of the necessity for recognizing and deciphering the symbols used in the marks and understanding the protocols for their application.

Bindings: In addition to marks found on pages, book covers are bearers of considerable provenance-related evidence. Paper covers may carry the same types of inscriptions and stamps as the inner pages. Early books with

leather bindings that had notable owners frequently have armorial ornaments or superlibros (ownership stamps on bindings), emblems, or initials applied with binding tools. Embellished by gold tooling with the words “IO. GROLIERII ET AMICORUM” (meaning that a volume belonged to Jean Grolier and his friends), the bindings on sixteenth-century French humanist’s books are among the best known examples of collectors’ bindings. On a grander scale, royal libraries such as those of the French court had characteristic styles of leather bindings marked with identifiable decorations that connected volumes with rulers and family members.

Conservation science: Recent advances in conservation techniques and material sciences not only serve to preserve books but also assist in the analysis of books’ origins. In addition to aiding the identification of printers and publishers when these do not appear on the book itself, specifics on paper stock used for the text block, endpapers, and covers help to locate probable sites or regions of book production and binding. Analysis of paper and coloring also provides solid evidence that the copies of rare books are not recently constituted or newly colored. Further analysis of paper, pastes, bindings, and examination of past treatments assists in ascertaining the integrity of copies, insuring that no pages are inserts or facsimiles. The latter are made easily by means of digital photography and photocopy technology using blank sheets of old paper. Dealers, scholars, and collectors almost always desire complete copies of rare books with all pages intact. However, when books are fabricated from various incomplete volumes, considerations of provenance and bibliography are confounded. Indeed, these “restorations” obliterate books’ history, since they are essentially new assemblages crafted from the spare parts of old or incomplete books.

External Evidence: Inventories and Library Catalogs, Auction Sales Catalogs, and Dealers’ Catalogs

Manuscript inventories and printed lists can document conditions of manufacture, subsequent sales, owners, and collections holding rare books. Valuable accessory information concerning the persons who played roles in making the books (such as papermakers, typefounders and page designers, printers, publishers, and binders) are additional clues that provide historical verification relating to books’ identification and biblio-history. Subscription lists enumerating future owners were printed for prospectuses and later insertions into the completed publications. In addition to collectors, businesses such as dealers and auction houses were central to books’ circulation and, ultimately, to their survival. However, other institutions and social organizations, such as monasteries and missionary societies, were also crucial to the collection and transmission of books. As described in the following text, owners, dealers, and libraries all generate various kinds of lists and

catalogs that provide specific information about individual copies of rare books, serving the study of provenance.

Inventories and library catalogs: Upon the owner’s death, estate and house inventories were prepared that included art and furniture among other collectibles. Following this age-old practice, lists of book collections were first produced in manuscript versions. Early inventories are frequently organized in the order of rooms, according to the shelves and cabinets where books were kept. Arrangements of books in libraries were important elements in the process of creating a collection, and locations were subsequently recorded in catalogs. Sometimes lists and catalogs were organized by physical sizes, possibly relating to their storage or shelving orders, and booklists bear headings for octavos, folios, and portfolios. Within subject categorizations (such as history, religion, travel, festivals), early catalogs describe books briefly by authors and catch titles. Inconveniently for current researchers, the full form of a bibliographical citation (e.g., author, title, place, publisher, and date) by which books are identified according to current practice was almost never used in the early modern period. Therefore, it is often very difficult to identify specific copies or editions without further historical context or knowledge of the physical features of volumes, such as authors’ signatures, bookplates, or bindings. Collocating the collector’s printed works on paper, book catalogs often included prints and maps. Rather than single sheets, both maps and prints were frequently bound into albums for purposes of carriage and storage. Indeed, in the context of early modern collections, portfolios or albums of prints looked like books, although they lacked bibliographical features such as title pages. Given the brief mentions in early inventories and catalogs, it is often difficult to identify items exactly without the aid of further information from biographical, bibliographical, or historical sources.

According to their date of purchase, handwritten library catalogs were entered in ledger books in accession order. Fortunately, some meticulous bibliophiles did include details of their acquisitions, noting where, from whom, and how much the book costs. Parallel to the utility of booksellers’ and dealers’ catalogs that advertised books, when discovered, such documentary archives of collecting activity are mines of information that detail provenance, illuminating the history of book production and circulation. When a private library reached critical mass, collectors occasionally prepared owner’s catalogs of their collections and had them privately printed. These were not intended for sale but rather for bibliophilic purposes, recognizing the collector’s efforts, disseminating information about the collection, and publishing the collector’s own scholarship and comments. Elaborating on the early lists and publications of private rare book collections and early museums, in later centuries, more comprehensive catalogs of libraries and collections of books on specialized subjects were produced. Beyond the utility of their

bibliographic content, these described assemblages of books owned by a collector or held by an institution, and thus they are sometimes useful for determinations of provenance.

Auction sale catalogs and dealers' catalogs: Since the sixteenth century, auctions and dealers' sales have mediated the transfer of books among other collectibles, such as art and antiques, from former owners and estates to new ones. Using inventories or catalogs of collections as their basis, auction sale and dealers' catalogs provide valuable documentation on the contents of libraries and private collections, and specifics on individual books. For provenance, it is especially desirable to find dealers' and collectors' copies of catalogs interleaved with extra paper sheets inserted with notes giving the names of buyers and sale prices. Dealers and collectors routinely marked up their auction catalogs with information about the condition or physical characteristics of the book offered. All types of book inventories and catalogs can be studied not merely as lists but also as authentications of books' presence. They can indicate rarity or the availability of copies for readers. More generally, catalogs can provide an overarching view of the book business, the market for past publications, and genres of collecting.

THE USES AND VALUE OF PROVENANCE

Authentication: Most importantly, precise documentation of a rare book's history helps to establish that it is an authentic object, not a spurious work or facsimile. Careful examination of the material and collation of elements provides evidence of the work's integrity. Occasionally, incidents of war and theft, coupled with greed, conspire to obliterate books' provenance. This blurring of history opens doors for forgeries and fakes whose appearance is accompanied by a fictitious provenance. New owners do not realize the true identities of the works until they embark on research, seek to sell the book, and consult experts such as librarians, curators, or dealers. Ironically, in such cases, although the subject and content of a rare book are quite clear, its loss of provenance can amount to a decontextualized state of biblio-amnesia, like a person found wandering who has forgotten his name and address. On the positive side, books have long lives and can easily traverse national borders and cultural boundaries, passing from readers on to collectors through the centuries. For scholarship, however, the significance of a rare book is enhanced considerably by comprehension of its social meanings and contexts.

Association: For some collectors of art and books, the ability to link a particular work to its author, to a well-known patron, to an eminent collector, or to a prominent historic institution is a primary interest that has made certain books valuable and highly collectible. Book dealers and auction houses reliably stress "good

provenance," indicating that the rare book comes from a famous collection, such as those seen in current citations that track the diaspora of books emanating from the numerous sales of Sir Thomas Phillipps's collections in the nineteenth century. In other association copies, the volume was signed or annotated by a celebrity or a scholar. Noteworthy associations can become the reasons for present-day collectors' pursuits. Occasionally, association becomes the basis upon which a collection or a scholarly project is developed. Collectors like the Los Angeles doctor Elmer Belt sought to reconstruct the components of Leonardo da Vinci's library for the collection now held by UCLA, although it was not possible to do so with the specific volumes. In his scholarly quest of Horace Walpole's bibliographical milieu, Professor Wilmarth Sheldon Lewis at Yale University re-collected the collector's books and manuscripts, seeking volumes and related materials for the Lewis Walpole Library at Yale University, formerly owned by the eighteenth-century author and collector Walpole at Strawberry Hill in England. Conveying the aura of past collecting and taste, so-called association copies convey the pedigree of the collector along with the physical presentation of their rare books. Thus, present owners and libraries also associate themselves with a distinguished lineage of ownership and history of taste.

Book history: Past provenance research has focused on the history of a particular volume for purposes of ascertaining integrity and authentication. Viewed broadly, provenance research can also inform the history of collecting by identifying copies associated with specific readers, scholars, libraries, religious orders, and educational institutions. Inventories and catalogs can assist in identifying single copies and the contents of libraries. Similarly, information gathered in the course of provenance research itself provides data for constructing the history of scholarship and research techniques. It provides responses to specific questions such as "To what books and editions did historic figures have access?" and furnishing facts for histories of reading, research techniques and writing, and literary taste.

CATALOGING PROVENANCE INFORMATION

Until recently, information on previous owners of rare books was infrequently and somewhat erratically included in both dealers' catalogs and sales catalogs, as well as library catalog records. More often it was found in dealers' archives and in libraries' local files, recording physical characteristics of books such as heraldry, bindings, monograms, or embellishments such as fore-edge painting. The 1980s was a watershed for interest in provenance of rare books. Roger Stoddard introduced the topic visually in the innovative 1984 Houghton Library exhibition at Harvard University, *Marks in Books, Illustrated and Explained*. Published in 1985, the large format catalog was "devoted

to those mysterious traces left in books by printer, binders, booksellers, librarians, and collectors.” Stoddard’s explanations are a useful guide to interpreting the often cryptic marks for purposes of identification of owners and readers of books.

In the last three decades, more detailed descriptions of specific copies and editions of rare books in bibliographic databases and in online book trade resources have made substantial contributions to the information now widely available on provenance. The advent of machine-readable cataloging and the proliferation and population of online catalogs not only afforded immediate access to bibliographic data but also provided a convenient venue for tracking ownership in specific volumes. Librarians and scholars realized that searches for provenance information, if data were entered in specific fields and in standard formats, could yield promising amounts of information on individual copies, rarity, past owners, and others who had documented relationships with particular books. Along with two other thesauri on rare publications and historical evidence (Printing and Publishing Evidence, 1986, and Binding Evidence, 1988), the ALA/ACRL Rare Books and Manuscripts Section Standards Committee published Provenance Evidence in 1988 (and it is now available online). These thesauri are intended to be used dynamically by catalogers for terms relating to evidence of provenance, and they contain a useful list of possibilities where provenance in rare books can be discovered.

Most helpfully, the term is “interpreted in its broadest sense to refer not only to former owners in the legal sense, but also to any who may have had temporary custody of the material (such as auction houses or library borrowers) and have left their mark in some way on it.”

In 1997, the Bibliographical Society of America sponsored “Marks in Books,” a conference for European and American researchers at Yale University that considered a range of perspectives on the uses of provenance information and the recording and organization of relevant information. Contributions to the conference were published the same year in the society’s papers. Among these diverse reports on research projects, Paul Needham’s article “Index Possessorum Incunabulorum” presents two simple rules gleaned from his records of provenance. The first and main principle is that “Unindexed provenance is lost provenance.” The second is “Identification of ownerships should be based on definable and classifiable evidence.” Present-day research and cataloging of provenance follow these two general but highly useful guidelines.

Reflecting recent developments in twenty-first-century book history, the Consortium of European Research Libraries (CERL) has put considerable effort into developing the Heritage of the Printed Book Database. Its records of rare books frequently include provenance information, and the CERL home page has a helpful link to its own resources on provenance. The CERL Thesaurus includes provenance records from a number of old and

important German institutions as well as other European libraries. The CERL website also has a Provenance Information section, and some database records now include a digitized image of the ownership marks.

Recently, researchers from the Kislak Center for Special Collections, Rare Books, and Manuscripts at the University of Pennsylvania initiated the Provenance Online Project (POP). Digital images of provenance evidence contained in books, such as inscriptions, labels, bookplates, bindings, and other physical attributes indicating ownership, are available together with bibliographic and descriptive metadata about the books. POP is intended to create a collaborative international workspace and communication space to which librarians, researchers, and collectors can contribute information about the provenance images contained in POP. The goal is to capture and construct identifications of persons who can be associated with specific provenance marks, thus connecting individual copies of books and past owners. POP will ultimately create a network of provenance evidence and bibliographic information. Sparked by an initial group of 1200 images, the project’s unique approach makes visual data easily accessible and enables an open community of users to contribute and exchange information. Although the database initially focused on works from the early modern period, the project is increasingly open to documenting books from any period. In addition, POP is currently expanding beyond Penn’s collections to include images from other libraries’ collections. POP is an innovative resource that demonstrates the growing significance of provenance evidence for research, which takes in book history and material culture, informing the study of past libraries, the uses of texts, and the cultural and geographic groups whose recorded history resides in books.

LEGAL IMPLICATIONS OF PROVENANCE

Insofar as provenance information provides documentation on books’ past owners, their countries of residence, and the time span during which they owned the books, there are overlaps and intersections with national and international laws concerned with export and import. Accurate provenance information can be helpful for the determination of rightful ownership in instances of contention. According to the 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property, rare books are included under the category of cultural property. Presently, the European Union defines a rare book as one that is more than 100 years old and valued at more than €50,000 (cf. Consolidated Text produced by the CONSLEG system of the Office for Official Publications of the European communities 1993L0007–July 30, 2001). If a rare book of this age and above this value not presently owned in the United States is acquired by a U.S.

collector or library, it must have an export license when it leaves the European country where it was sold. In addition, the U.S. Customs Service views rare books as cultural property [cf. "Rare manuscripts and incunabula, old books, documents and publications of special interest (historic, artistic, scientific, literary, etc.) singly or in collections" in Works of Art, Collector's Pieces, Antiques, and Other Cultural Property: An Informed Compliance Publication (February 2001); see also <http://www.unesco.org/culture> and <http://www.unidroit.org> for the 1995 UNIDROIT Convention on stolen or illegally exported cultural objects (not yet signed by the United States)]. Therefore, rare books entering the United States from abroad must have import documentation describing the item with the date of publication, price paid, and the country from which it was exported. Because of legal requirements for accuracy, all such information is of great use for identifying specific copies, owners, and institutional holders. In addition, security is enhanced by the detailed identifications of books in private and public collections. In cases of very rare books known in only a few copies, this can assist in establishing the authenticity of the volume. Similarly, although no documentation is usually required for books that have been in the United States for more than 5 years, it is very useful to extend the documentation of ownership back as far as possible in case there are questions concerning ownership similar to those asked about titles to any type of property. Throughout history, in times of war and oppression, looting and theft were widespread. Books frequently became booty or were seized by victors; thus, the entire contents of libraries and private collections were displaced. Likewise in times of peace, along with artworks, books are frequently pawns on political game boards and in legal debates concerning patrimony, cultural restoration, and ongoing attempts to preserve cultural artifacts from wanton destruction.

CONCLUSION: PROVENANCE AND BOOK HISTORY

Traditional rare book collecting has focused on a canon of important books or types (such as herbals and atlases) that chronicles the Western intellectual tradition, well described by bibliographies such as *Printing and the Mind of Man*. Volumes such as Shakespeare's *First Folio*, the *Nuremberg Chronicle*, Vesalius's *Anatomy*, and Newton's *Principia* have been highly collectible for centuries. This focus on a book's subject, particularly a book seen as a seminal work or turning point, provided secure avenues for collecting. More recently, historians and social and literary scholars have turned to studies of individual books as physical objects or artifacts. In this vein, provenance research can be used to identify a sequence of owners and readers who owned and used the books and their social contexts. These clusters of data provide substantial

evidence for rewritings of history that spotlight minor but revealing figures and shed light on less well-known contexts of book use (e.g., Carlo Ginzburg's tale of the sixteenth-century peasant's reading referenced in *The Cheese and the Worms*). Founded in history, the study of books' provenance itself creates innovative perspectives that define new genres hitherto seen as unimportant, describing environments of texts' availability, their communities of reading, and reasons for retention, often outlining less elevated versions of book collecting than were seen in country houses or royal libraries. Studies of particular libraries and collectors not only tell about the sources on which further research and book production is based but also supply a portrait of the world of knowledge in certain times and places. To date, provenance studies have not given much attention to non-American or non-European books and collectors. The increasingly global focus of advanced research in history, literature, and bibliography points toward a new avenue for scholarship that will shed light on cultural practices and cross-cultural exchanges in book history.

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Public Librarianship [ELIS Classic]

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Abstract

Public librarians are the community's cultural support as providers of lifelong learning, reading, information provision, and a vibrant public sphere for people of all ages. Public librarians provide access to books and all varieties of media to meet the needs of people for education, information, and personal development. This entry focuses on public librarianship as it is practiced in the United States with a brief history of the field's development in two parts: beginnings to 1966 when the field used a national service model and 1966 to the present with a community-based focus. The education, certification, and working conditions of public librarians are reviewed. The philosophical and ethical worldview of practice with a human rights ethos is described. Finally, current (2009) issues in public librarianship are stated.

INTRODUCTION

The *Public Library Manifesto* as set forth by the International Federation of Library Associations and Institutions (IFLA) defines the public library as the local gateway to knowledge, which provides a basic condition for lifelong learning, independent decision-making, and cultural development of the individual and social groups.^[1] Public librarianship as practiced in the twenty-first century is the occupation that provides access to books and all varieties of media to meet the needs of people for education, information, and personal development. This entry will focus on public librarianship as practiced in the United States, but the reader should be aware of the many varieties of public library practice due to the different level of public library development worldwide. At the time of this writing the Public Libraries Section, Standing Committee 2007–2009 of the International Federation of Library Associations and Institutions was comprised of representatives from 20 nations: Canada, Chile, China, Colombia, the Czech Republic, Denmark, Estonia, Finland, Germany, France, Iceland, Malaysia, Nigeria, Norway, the Russian Federation, South Africa, Spain, Sweden, the United Kingdom, the United States, and Uruguay.^[2] The composition of this global committee demonstrates the great variety of nations that support public libraries today. We show here the development of the public library profession in the United States.

THE DEVELOPMENT OF U.S. PUBLIC LIBRARIANSHIP TO 1966

Tax-supported public libraries were established in the United States in mid-nineteenth century New England.^[3] The documentation that provided the foundation for the Boston Public Library in 1852 demonstrates the earliest summary of the intended practice of public librarianship with a focus on developing the collection; support of learning beyond formal schooling; and the intellectual advancement of the whole community.^[4]

Looking back on a century of library development, library historians Ditzion (1947)^[5] and Shera (1949)^[6] attributed the founding of public libraries to idealism and a societal commitment to education, while later historians such as Harris (1973),^[7] Garrison (1979),^[8] and Wiegand (1989),^[9] took into consideration the element of societal control as crafted by the male gentry elite. As is true with much history, public librarianship was initially narrated through the biographies of men. Biographies of founders of the profession such as Justin Winsor (Boston Public Library, 1867–1877) or William Frederick Poole (Cincinnati Public Library, 1869–1873, Chicago Public Library, 1873–1887) were the backdrop to understanding the field of public librarianship during the first century of service.

But from the vantage point of the twenty-first century, the growth of public librarianship following the establishment of the American Library Association in 1876 is now

more broadly understood in the context of a more progressive and humanitarian service style that owes much to the participation of women. Women comprise the majority of workers in public libraries—about 80% of public library workers are women. The historical evolution of the role of women in the field must be viewed as a reflection of the role of women in the larger society. It was not until the work of Weibel,^[10] Maack,^[11] and Hildenbrand^[12] that the historical library past vis-à-vis women's central role began to be reclaimed. And it is only in the recent decades that the history of public librarianship has come to be understood against the backdrop of race, gender, and class as so cogently analyzed by Pawley.^[13]

Many factors combined to increase the number of libraries established in the United States from 1876 to 1966. Prominent were 1) philanthropy including that of Andrew Carnegie; 2) the creation of new libraries often at the urging of women's clubs; 3) the establishment of state library commissions; 4) laws enabling tax-supported public libraries; and 5) national level legislation such as the Library Services Act (LSA, 1956). The LSA was designed to support rural library services. Successor legislation, the Library Services and Construction Act (LSCA, 1966), included support for all public libraries, and funded construction as well as services.^[3,14–16]

As libraries began to be established in communities across the United States the scope of public librarianship as an occupation expanded. In addition to the administration, development and organization of collections specializations emerged. Three specializations that developed between 1876 and 1966 were adult education and services, service to youth, and service to special groups.

Adult education and service: The American Library Association was linked closely with the adult education movement in the first decades of the twentieth century. During the 1920s Learned's report to the Carnegie Corporation, *The American Public Library and the Diffusion of Knowledge*, and the ALA Commission on the Library and Adult Education report, *Libraries and Adult Education* provided philosophical rationales for the public library as an extension of public education.^[3,17–20] In 1934 John Chancellor was appointed to the ALA headquarters staff to initiate a 10-year assessment of adult education and public libraries. Public librarians developed skills and techniques to accomplish adult education through readers' advisory, services to organizations, and establishment of discussion groups. With funding from the Ford Foundation, the ALA set up an Office for Adult Education from 1951 to 1961 for political education and Great Books discussion.^[3,21,22] The role of public librarians as adult educators laid the basis for the ongoing support of public libraries as major contributors to lifelong learning and the preservation of cultural heritage. By the 1960s these ideas were challenged as librarians moved to community-based service provision.

Serving Youth: Public librarians serving youth have played an essential role in library development. While men dominated the administration of public libraries because of the public library's initial association with scholarship—a male sphere—a dedicated group of female librarians worked to develop books, magazines, and libraries for young people. Vandergrift has written the history of the first women who fought to establish and to expand service to young people in libraries, while developing a national and international presence for their philosophy and practices. Those interested in children's work in libraries came together in the Children's Librarians Club of ALA in 1900, which then became the Section for Library Work with Children. It was not until 1951 when the American Association of School Librarians (AASL) separated from what was then the Division of Libraries for Children and Young People that the missions of the two types of institutions became distinctly different.^[23] Minerva Sanders, Lutie E. Stearns, Caroline Hewins, Anne Carroll Moore, and Effie Louise Power were pioneers of youth services in public libraries and their biographies provide insight into the development of services to children and young adults in the twentieth century.

Serving Immigrants and Minorities: Public librarians have also worked diligently to assist immigrants and minorities as a central part of their mission and librarians have developed expertise in working with underserved groups. In 1918 the American Library Association established the Committee on Work with the Foreign Born to address the needs of immigrants for library services, but also to assist with "Americanization."^[24] This assimilation movement gradually became less of a rationale as librarians expanded their focus to work with people within the context of the adult education movement.^[25]

Because the U.S. southern states did not permit African-Americans to use public libraries segregated facilities were established in some cities such as Charlotte, North Carolina; Houston, Texas; and Memphis, Tennessee. But very few libraries surveyed in 1922 employed African Americans or made special effort to serve this community. Although there were some notable exceptions such as the Harlem branch of the New York Public Library, few African-Americans had library services until the New Deal initiatives of the 1930s under President Franklin Roosevelt. By 1941 only four states had integrated library services for all.^[26–29]

The Public Library Inquiry: "The Public Library Inquiry," a research and report initiative, shaped the way public librarianship was viewed as a profession following the Second World War. The publication of the series of volumes that comprised the "Public Library Inquiry" took place from 1947 to 1952 and are viewed by Raber as a professional legitimizing project and an exercise in identity creation that relied on public librarians viewing themselves as sustainers of democracy.^[30]

The emphasis on the need to serve opinion leaders based on the assumption they constituted the library's "natural" and most likely audience—an assumption not entirely wrong—because they were educated and more likely to be readers as reported by the "Public Library Inquiry" authors became part of the long conversation throughout the 1950s that caused librarians to reconsider their practice and expand their methods of providing service to all people.^[31]

COMMUNITY-BASED PUBLIC LIBRARIANSHIP—1966 TO THE TWENTY-FIRST CENTURY

In the 1960s widespread recognition grew that U.S. society was split into a nation of rich and poor—that there was, indeed a "Other America." The "War on Poverty" declared by Lyndon B. Johnson in his State of the Union speech on January 8, 1964 affected the future of public library service and caused members of the American Library Association to launch a series of initiatives that responded to the reality of poverty and marginalization. The Social Responsibilities Round Table was begun within the ALA and a Coordinating Committee on Library Service to the Disadvantaged established. These new units within the national association provided context for public librarians' growing realization that the 1966 *Standards for Public Library Systems* did not clearly address the needs of all people.^[32] The 1966 *Standards* were unacceptable to the field for many different reasons; including their perceived irrelevancy to emerging "modern" and evidenced-based management methods, i.e., output-driven effectiveness measures related to local conditions and goals. The 1966 *Standards* and the three prior sets of standards that had been issued by U.S. public librarians in 1933, 1943, and 1956 had defined public library services and staffing from a national perspective. After 1966 the Public Library Association launched a review of goals that resulted in a paradigmatic shift in the practice of public librarianship in the United States.^[3]

Instead of top-down national standards public librarianship shifted to a planning model that sought input from library users. After 1966 public librarians no longer based service development on external guidelines, but worked collaboratively with their communities to analyze, set objectives, make decisions, and evaluate achievements. Pungitore has studied this innovation which resulted in community-based public librarianship based on the needs of the people rather than the standards formed by experts.^[33] The core documents that were the foundation for the planning model of public library services were issued in two phases: 1) "Planning and Role Setting for Public Libraries" (1980–1995) based on *A Strategy for Public Library Change*,^[34] and 2) the "New Planning for Results" approach (1995–present) based on the premise that resource allocation

decisions must be subordinate to and driven by the library's service priorities.^[35] This signaled a major change of public librarianship's and the public librarian's identity; from humanitarian/scholarly to bureaucratic/manager practitioner. For lack of a better word, this represented a "paradigm" shift, although clearly the two identities still exist as opposing points of tension within librarianship's identity.

The practice of public librarianship in the twenty-first century United States as conceived by those involved in the development of the Public Library Association's "New Planning for Results" model is about managing change. The 2008 guide, *Strategic Planning for Results*, identified 18 service responses that were selected by public librarians through several years of meetings and interactive discussion. These 18 service responses will guide the practice of public librarianship in the United States for the next decade.^[36,37] Each response defines a different specialization for public librarianship such as youth services, adult services, information technology, programming, community service, literacy educator, information services, collection development, and career guidance and planning.

The service responses set forth in *Strategic Planning for Results* are

1. "Be an Informed Citizen: Local, National and World Affairs."
2. "Build Successful Enterprises: Business and Non-profit Support."
3. "Celebrate Diversity: Cultural Awareness."
4. "Connect to the Online World: Public Internet Access."
5. "Create Young Readers: Early Literacy."
6. "Discover Your Roots: Genealogy and Local History."
7. "Express Creativity: Create and Share Content."
8. "Get Facts Fast: Ready Reference."
9. "Know Your Community: Community Resources and Services."
10. "Learn to Read and Write: Adults, Teens and Family Literature."
11. "Make Career Choices: Job and Career Development."
12. "Make Informed Decisions: Health, Wealth and Other Life Choices."
13. "Satisfy Curiosity: Lifelong Learning."
14. "Stimulate Imagination: Reading, Viewing and Listening for Pleasure."
15. "Succeed in School: Homework Help."
16. "Understand How to Find, Evaluate, and Use Information: Information Fluency."
17. "Visit a Comfortable Place: Physical and Virtual Spaces."
18. "Welcome to the United States: Services for New Immigrants."

In addition to this strategic planning model based on responses as promoted and developed at the national level, over 20 individual states have defined library services through state association standards.^[38] Some states such as Wisconsin and Florida tie staffing to the state administrative code or statutes. An understanding of the working conditions of public librarianship requires reference to specific state standards and/or local level ordinances and civil service regulations as well as the national approach as outlined in the Public Library Association's *Strategic Planning for Results*.^[37]

EDUCATION, CERTIFICATION, AND WORKING CONDITIONS OF PUBLIC LIBRARY WORKERS

The "librarian" designation generally refers to individuals who hold the master's degree in library and information science from a program accredited by the American Library Association. Public libraries in the United States employed 140,000 paid full-time-equivalent (FTE) staff and "librarians" (staff with the credential from an accredited program) accounted for 33% of that total in the most recent government report (2008). Other library workers include library technicians, library assistants, clerks, and shelvees. These individuals worked at 9,208 public libraries (administrative entities) in the 50 states and the District of Columbia with 16,592 service stationary points (central libraries, branches) and 819 bookmobiles. They managed multiple materials in different formats as public libraries hold 807.2 million print materials, 42.6 million audio materials, and 43.9 million video materials, in their collections. They served people of all ages during 1.4 billion library visits—4.8 per capita. Serving youth was a special focus as circulation of material to children was 728.1 million items and 57.6 million children attended programs at public libraries. Provision of access to technology was a key service as 334 million uses were made at 196,000 Internet terminals available in public libraries nationwide.^[39]

In 2005 the American Library Association-Allied Professional Association (ALA-APA) launched the Certified Public Library Administrator (CPLA) program, a voluntary post-MLS certification program for public librarians with 3 years or more of supervisory experience. The CPLA certification is intended to further professional education and development so that public librarians can move to a higher level of practical professional experience; improve career opportunities; demonstrate that the certified person has acquired a nationally and professionally recognized body of knowledge and expertise in public library administration; and improve the quality of library service through the provision of practical knowledge and skills essential to successful library management.^[40]

The salaries of U.S. public librarians can be reviewed on the "Library Salary Database" maintained by the ALA-

APA. The 2007 median salaries for public librarians in 2007 were: Directors: \$77,200; Associate Directors: \$74,942; Department Heads: \$60,327; Librarians who do not supervise: \$47,772, and beginning public librarians: \$41,334.^[41]

There is no national union for public librarians. Instead local public libraries affiliate with unions like AFSCME (Boston Public Library, Brooklyn Public Library, Milwaukee Public Library, Los Angeles Public Library), SEIU (San Francisco Public Library, Orange County Florida), and various other unions such as the Civil Service Employee Association, United Public Employees of California, and the National Association of Government Employees.^[42] Collective bargaining may be the library alone or in collaboration with a larger employee union. Union librarians earned an average of over 29% more than nonunion librarians in 2006.^[43]

General advancement of the welfare of public librarians is addressed by national association such as the Public Library Association, and the ALA-APA as well as by local chapters/state associations that have annual workshops and programs for librarian development. The Public Library Association 2008 conference, for example, included the program, "How to Work Positively and Constructively in a Unionized Environment."

HUMAN RIGHTS: THE ETHICAL AND PHILOSOPHICAL WORLDVIEW OF PUBLIC LIBRARIANS IN THE TWENTY-FIRST CENTURY

Public librarians have developed philosophical and ethical statements and documents that guide daily practice. While there is little documentation as to underlying philosophies in these various guidelines and statements, we know that the profession has drawn from a variety of traditions of justice as ancient as the Code of Hammurabi (1780 B.C.) right on up to the *Universal Declaration of Human Rights* (1948) and subsequent treaties.

Many of librarianship's key statements and guidelines such as the *Code of Ethics of the American Library Association* and *Library Bill of Rights (LBR)* are shared by all librarians. The *LBR* was adopted in its current form by the Council of the American Library Association on June 18th, 1948 and is Policy 53.1 of the *ALA Policy Manual*.^[44] In 1961 the *LBR* was amended to include civil rights to ensure library rights are not denied because of race, religion, national origin, or political views. In 1980 and again in 1996, ALA reaffirmed these rights to persons of all ages. The final section on access in the *LBR* states: "A person's right to use a library should not be denied or abridged because of origin, age, background, or views."

In 1971 the American Library Association Office of Intellectual Freedom collected Interpretations of the *Library Bill of Rights*. Political, social and technological

history is reflected in these statements and a review demonstrates the convergence of technology and defense of freedom to read. For example, the 1951 statement against labeling arose during the McCarthy era to discourage labeling materials as subversive. It was revised in 1990 to address concerns regarding audiovisual rating guides (53.1.7). Contemporary pressures to limit intellectual freedom and human rights are reflected in statements about infringement of access through electronic filtering (53.1.16), invasion of privacy, which requires a distinction from confidentiality, and recognition of economic barriers (53.1.14).^[45]

In 1991 the American Library Association endorsed the *Universal Right to Freedom of Expression* as set forth in the *Universal Declaration of Human Rights*, adopted by the United Nations General Assembly: "Everyone has the right to freedom of opinion and expression; this right includes freedom to hold opinions without interference and to seek, receive and impart information and ideas through any media and regardless of frontiers."

The Preamble to the *Universal Declaration* states that "...recognition of the inherent dignity and of the equal and inalienable rights of all members of the human family is the foundation of freedom, justice, and peace in the world...and...the advent of a world in which human beings shall enjoy freedom of speech and belief and freedom from fear and want has been proclaimed as the highest aspiration of the common people."

In 1997 the American Library Association passed the "Resolution on IFLA, Human Rights and Freedom of Expression" which committed the association to support of human rights and freedom of expression. Human rights values permeate library policies. As public librarians carry on their work it is inspirational to keep in mind the history of human rights advocacy, and note the work of librarians as essential to the commitment to foster an open society, a public space in the library where democracy lives.^[46-48]

In the philosophical and ethical assessment of the field, *Librarianship and Human Rights: A Twenty-first Century Guide*, Samek has challenged librarians to act on human rights resolutions as a foundation for practice.^[49] In keeping with this 21st mandate for public librarianship we provide three examples that illustrate the way public librarians serve human rights.^[50] Increasingly the challenges and ethical situations public librarians face are given guidance by a human rights orientation for service.

Privacy

(UDHR, Article 12: No one shall be subjected to arbitrary interference with his privacy, family, home or correspondence, nor to attacks upon his honour and reputation. Everyone has the right to the protection of the law against such interference or attacks.)

Connecticut public librarians Peter Chase, George Christian, Janet Nocek, and Barbara Bailey in the *Doe v. Gonzales* case challenged the constitutionality of the nondisclosure provisions of the National Security Letters issued by the government under the USA Patriot Act in terrorist or other investigations. They won.^[51]

People with Disabilities

(UDHR. Article 21: Everyone has the right of equal access to public service in his country.)

The Americans with Disabilities Act Assembly, a representational group administered by the Association of Specialized and Cooperative Library Agencies (ASCLA), a division of the American Library Association, developed the ALA Policy on "Library Services for People with Disabilities" that notes, "Libraries play a catalytic role in the lives of people with disabilities by facilitating their full participation in society. Libraries should use strategies based upon the principles of universal design to ensure that library policy, resources, and services meet the needs of all people."^[52] Recognition that all people have a right to equal access to public service is underscored by public librarianship's commitment to universal libraries. Additionally, services such as the National Library Service for the Blind and Physically Handicapped require collaboration with librarians in community public libraries to activate service.^[53]

Immigrants, People of Color

(UDHR. Article 2: Everyone is entitled to all the rights and freedoms set forth in this Declaration, without distinction of any kind, such as race, colour, sex, language, religion, political or other opinion, national or social origin, property, birth or other status.)

Public librarians have made great effort to work creatively with people of all backgrounds to deliver fair and equitable service. Library workers reflected on their role in the twenty-first century at the Joint Conference of Librarians of Color (JCLC) in October 2006. This transformative event connected librarians to over-arching societal issues and concerns such as war, economic injustice, environmental challenges, poverty, and racism. The event was a collaboration of the American Indian Library Association, the Asian/Pacific American Librarians Association, the Black Caucus of the American Library Association, the Chinese-American Librarians Association, and REFORMA (National Association to Promote Library Services to the Spanish Speaking). The participants shared experiences, best practices, research, and theory. They made new connections, and built and strengthened coalitions.^[54]

In 2008 the report, *Serving Non-English Speakers in U.S. Public Libraries*, the first national study to consider the range of library services and programs developed for

non-English speakers, including effectiveness of services, barriers to library use, most frequently used services and most successful library programs by language served was released. Researchers found that the most frequently used services by non-English speakers were special language collections (68.9%) and special programming (39.6%), including language-specific story hours and cultural programming.^[55]

THE FUTURE OF PUBLIC LIBRARIANSHIP

As we wrote this entry we discussed the ideas in the air for public librarians in this winter 2009. Because public librarianship is ever changing in reflection of the nature of the communities served and because of the evolution of new technologies there is no static representation that we can use to describe the future. After attending the Public Library Association conference^[56] in spring 2008 the topics that demonstrate the range of concerns that public librarians address today include community as in "One Book, One City";^[57] adult and youth summer reading programs; cultural programming for libraries;^[58] roving reference; serving homeless people;^[59] electronic collections replacing paper; funding in times of fiscal austerity; political advocacy for library support; virtual reference;^[60] fostering civic engagement; LEED certification for green libraries;^[61] the economic impact of public libraries;^[62] and the impact of new technologies; family places and early literacy environments in library space; home library services; and community services Web sites.

Public librarianship ranges from service in small communities where the library worker might take on multiple tasks from budgeting to story-telling to more focused service in large systems and highly specialized practice in local history, genealogy, service to different language users, or web development. The range of a public librarian's possible practice is as diverse as the communities where people live. Some public librarians will practice in sparsely populated rural counties, others in cities; in suburban communities; and still others on bookmobiles that take books and materials to people where they live. Regardless of the site of service public librarians act as the community's cultural support as advocates and providers of resources for lifelong learning, reading, information and the full-range of human capabilities.

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Public Libraries *[ELIS Classic]*

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Abstract

This entry provides an introduction to public libraries throughout the world including an overview of the mission, roles, services, governance, legal and financial framework, collections, human resources, facilities, marketing and performance measurement. The trends, challenges, issues, and future of public libraries are also discussed. The entry is written from the perspective of informing a new library school student, legislators and decision makers, and/or someone looking to find basic information about the purpose and role of public libraries worldwide.

INTRODUCTION

The institution known universally as the public library is defined by the IFLA/UNESCO Public Library Manifesto as a local gateway to knowledge. It is an institution which provides a basic condition for lifelong learning, independent decision-making and cultural development of the individual and social groups.^[1] It does this primarily through the provision of organized collections of books, documents, audio visual and other electronic and digital media, and related programs and services. Public libraries are a worldwide phenomenon and have existed in various forms for centuries. They occur in a variety of societies, in differing cultures and at different stages of development. Though no one body or institution is responsible for keeping global public library statistics it is estimated that there are over 251,324 public library locations worldwide including main libraries and branches. The United States and Canada respectively have 16,543^[2] and 3100 public library buildings. Although the varied contexts in which public libraries operate inevitably result in differences in the services they provide and the way those services are delivered, public libraries the world over have many characteristics in common and all work toward making a contribution to the improvement of the lives of the citizens they serve and the societies in which they operate.

Since its inception the modern public library has been designed and aspired to be the local center of and access to information and ultimately knowledge. This initially was largely through the medium of print but libraries have always provided access to media in its multiple formats and that now includes digital content. Since their early days public libraries have also played multiple social roles (although book purveying has been a primary role). Public library services are usually provided free (or for a small charge) on the basis of supporting equality of access for all, regardless of age, race, sex or sexual preference, religion, nationality, language or social status or mental or physical

ability. They are funded primarily by local government, but often with assistance from regional/provincial, federal government authorities and established and increasingly supported by mandatory or permissive legislation.^[3]

PURPOSE OF THE PUBLIC LIBRARY

The primary purposes of the public library are to provide facilities, resources, and services in a variety of media (print, audio, visual, electronic/digital) to meet the needs of individuals and groups for both formal and informal education, as well as for information and personal development which includes recreation and leisure. Public libraries have an important role in the development and maintenance of an open and democratic society by giving the individual access to a wide and varied range of knowledge, ideas, and opinions.^[4] Public libraries are considered by many (but not all) citizens and parent governing bodies as essential or core public services which support civic engagement and economic development and which enhance the quality of life in a community.^[5]

The IFLA/UNESCO Public Library Manifesto and Guidelines which were designed and redeveloped over the last 60 years to apply to public libraries worldwide, provide a succinct list of key missions or roles for the modern public library (Table 1). These roles relate to information, literacy, education, culture, and leisure. Of course cultural and political differences between states have significant implications for libraries and the actual meaning of these roles do vary. These key mission statements include creating and strengthening reading habits in children from an early age; supporting both individual and self-conducted education as well as formal education; providing opportunities for personal creative development; stimulating the imagination and creativity of children and young people, promoting awareness of cultural heritage, appreciation of the arts, scientific achievements and

Table 1 Mission and global ends Statements of Markham Public Library, Canada

The Markham Public Library (Markham, Ontario, Canada) is an example of a library that has developed a Mission, Vision and supporting Global ends policies

Vision: *Markham Public Library-the Place where Markham's communities come together to imagine, learn and grow.*

Mission: *We enrich the lives and empower people by providing a spectrum of resources and services that delight our diverse community. You will feel empowered at your library.*

Source: <http://www.markhampubliclibrary.ca/about/mission.asp>

Global Ends Policy: *The Markham Public Library exists to that people who live, work or study in Markham have lifelong, universal and equitable access to the information, and resources that support and contribute to an enriched community.*

- *The community is informed*
- *The community is inspired*
- *The community is empowered*
- *The community is linked*

Source: http://www.markhampubliclibrary.ca/docs/policies/board_policies.pdf

innovation; fostering inter-cultural dialogue and favoring cultural diversity; supporting the oral tradition; ensuring access for citizens to all sorts of community information, providing adequate information services to local enterprises, associations and interest groups; facilitating the development of information and computer literacy skills; and supporting and participating in literacy activities and programs for all age groups, and initiating such activities if necessary.^[1]

Public libraries around the world have interpreted the IFLA Manifesto and Guidelines in different ways:

- In Singapore the stated mission of the National Library Board is to be “an inspiring beacon of lifelong learning, bringing knowledge alive, sparking imagination, and creating possibility for a vibrant and creative Singapore.”^[6]
- In South Africa, where many people particularly in rural areas have inadequate living space and no electricity to enable them to study, public libraries give a high priority to providing the basic facilities, light, tables, and chairs for their users to read and study^[4] (Fig. 1).
- In the Barcelona province in Spain, some library services give support to distance learning students from the Open University in Catalonia.^[4]
- In the state of Queensland, Australia, public libraries provide homework resources and support to upper primary and secondary school children through organized homework clubs in libraries. Electronic homework support is also available.^[7]

In many respects the mandate and role of public libraries has remained timeless and universal throughout the years. However, in the last 30 years, public libraries as public institutions whether in developed countries or developing countries have experienced more change in terms of technology, format, approaches to customer service and democratization than in the previous 200 years. These changes are continuing into the twenty-first century at an accelerated and intensified pace as information and media goes increasingly digital and the way people use public libraries and their perceptions of public libraries continue to evolve.^[8,9] These changing expectations have been



Fig. 1 Mpumalanga Township Library, Kwa-zulu Natal Province, South Africa.

Source: From Barbara Clubb (author).

documented in a number of studies about the perception and use of public libraries. In the OCLC study, *The Perceptions of Libraries and Information Resources*, researchers found that while libraries continue to be trusted information providers, users were not aware of the e-resources of the library, that the library brand (i.e., books) is dated, that users want more self-service and seamless access, and that libraries appear to be losing mindshare of the information-seeking public.^[10] The study *Long Overdue* reported that public libraries get high marks from citizens for service, that computers and Internet access are priority service elements, that there is clear demand for more convenient hours and more service for teens, and that while there is strong community support for libraries, the public is generally unaware of how financially vulnerable libraries are becoming and finally that library representatives need to speak up and reach out if public libraries are to survive and thrive.^[11]

New Roles for Public Libraries

In 2007 the Public Library Association, a division of the American Library Association completed a study to look at the unique roles of American public libraries and their core services today and into the future. The result has been the articulation of 18 new service responses for American public libraries services focusing on citizen outcomes:

- Be informed citizens: local, national, and world affairs.
- Build successful enterprises: business and non-profit support.
- Celebrate diversity: cultural awareness.
- Connect to the online world: public Internet access.
- Create young readers: early literacy.
- Discover your roots: genealogy and local history.
- Express creativity: create and share content.
- Get facts fast: ready reference.
- Know your community: community resources and services.
- Learn to read and write: adult, teen, and family literacy.
- Make career choices: job and career development.
- Make informed decisions: health, wealth, and other life choices.
- Satisfy curiosity: lifelong learning.
- Stimulate the imagination: reading viewing and listening for pleasure.
- Succeed in school: homework help.
- Understand how to find, evaluate, and use information: information fluency.
- Visit a comfortable place: physical and virtual spaces.
- Welcome to newcomers: services for new immigrants.

While these responses echo the IFLA/UNESCO Manifesto and Guidelines, they provide a more precise

definition of service as well as a more clearly stated relationship between the library and its customer within its political and civic environments. They also reflect the new environment in which many public libraries operate particularly with regard to rapidly changing technology and fiscal realities. For instance there is clear emphasis on the library's role to provide public Internet access and to help patrons use information technology and become fluent with new information. In this way, the Public Library Association (PLA) has performed a valuable service and provided a new tool for public libraries worldwide.^[9]

LEGAL AND FINANCIAL FRAMEWORK OF PUBLIC LIBRARIES

To support the level of service proposed by the IFLA/UNESCO Manifesto and the concepts in the new PLA Public Library Responses, strong legislation and sustained funding is essential. Around the world there are a vast array of models which delineate the relationship between the public library and their governing and funding authorities. Depending on the country, the provinces, regions, states, or municipalities are either in whole or in part responsible for service. Usually it is the local municipal unit but often (e.g., some provinces in Canada) two or more levels of government provide a combination of sustained and special purpose funding. In some countries (e.g., Argentina) libraries are required to seek sustained funding from nongovernmental organizations, agencies and/or individuals. Even in developed countries, public libraries are becoming increasingly aggressive and sophisticated in their non-tax fund-raising activities largely from necessity as tax bases are stressed and service demands increase. In North America most public libraries are governed by appointed or elected boards. This is not common in the rest of the world.

The most important instrument for public library development is legislation at either the national and/or state/provincial level combined with provincial and/or national information policies, standards and guidelines. Public library legislation and related regulations vary greatly from country to country and within countries from state to state and region to region. Legislation can be simple or complex, mandatory or permissive, dictatorial or encouraging. Some examples of this variation include:

- Mexico and Venezuela have specific public library legislation whereas in Colombia and Brazil, legislation only includes references to public libraries.
- The Finnish Library Act of 1998, largely regarded as a model piece of legislation, stipulates that the public library should be provided by the municipality, either independently or in cooperation with other public libraries, that public libraries should cooperate with

other types of libraries and that the library should evaluate the library and information services that it provides.

- In Armenia, local authorities have responsibility for the financing and maintenance of public libraries. The Law on Local Self-Government, 1966, defines their obligations for maintaining and developing public libraries.

In addition to specific library legislation, the modern public library must respond increasingly to and/or be compliant with other legislation related to such issues as copyright, financial management, data protection, services for persons with disabilities, pay equity, health and safety, global trade negotiations, intellectual freedom, environmental protection and increasing requirements to develop environmentally supportive or “green” policies, practices and facilities.^[4]

ELEMENTS OF THE PUBLIC LIBRARY

The IFLA/UNESCO Manifesto and the related Guidelines for Development provide a clear framework for understanding and defining public library service no matter what the local context. This entry has already touched upon role and purpose as well as the legal and financial framework. Within this organizational framework major elements of public library service include: meeting the needs of the users; collection development and access; the development of the library’s human resources; the marketing of public libraries and their services and the physical facility—or library as place.

Meeting User Needs

Those responsible for public libraries have always recognized that they must know the size and characteristics of the current and potential user base, understand what these groups want from their public library, anticipate emerging needs, and make services and collections as accessible as possible. Needs assessments done by almost every public library finds that people want more books and resources, better hours, more and faster computers, and more parking (where public transportation is not available). More specific areas of need identified refer to serving people at all ages and stages of life as well as individuals and groups with special needs and institutions within the wider community network.^[4] Because resources are always scarce, libraries have to carefully collect and analyze data that clearly identifies the needs and assists the library in putting them in a priority order that makes best sense in that particular community. Sometimes needs are deliberately underserved or not served at all because of resource

constraints or because another community agency has been able or has the mandate to address the needs. For example in a new community with many children, pre-school programs and materials might be the library’s highest priority, where a high seniors population would dictate different priorities in another community. In some locales assessing needs can be a simple enquiry to the community. In other instances, public libraries are using a wide range of research and information-seeking strategies to develop both qualitative and quantitative approaches to studying and planning for their community needs. This approach moves libraries away from strictly quantitative standards which may be inappropriate for an individual community. Quantitative standards may not be relevant to services or evaluation of their effectiveness yet still be politically important in the effort to raise or maintain revenue.

Once users needs have been identified, public libraries then have to plan to provide services to satisfy those needs often while eliminating or narrowing other areas of activity. In general the services include: loans of books and other media, provision of materials for use in the library, reference and information services, access to the public Internet and related technology, readers advisory services, information about the community, user education—in particular literacy including computer literacy, outreach services to those unable to physically access the library facilities, and a selection of materials, programs, and events for various age and ability groups.

Materials and Services for Children

Materials and services for children are a mainstay of the modern public library in all parts of the world. Libraries have embraced the role of helping children discover and experience the joy of reading and adapting to other media. They also work intensively with parents and caregivers as co-conspirators in the development of a literate youth population. Responding to these trends in 2008, the Danish Library Authority issued a report which recommended radical changes in the approach to library services for children. It is an encapsulation of how children’s library services are responding to the complex digital world in which so many of our children live. The recommendations (translated from the Danish) take the form of 10 commandments and include: 1) New competencies create new activities in the library; 2) The library space must create surprise and inspiration; 3) Libraries must develop their net services (libraries create new frameworks and facilities by exploiting social technologies and using staff as hosts and resources in virtual networks for children); 4) Children play in the library; 5) The library gives children reading experiences and reading skills; 6) Create assets in new forms of cooperation between the school library and the public library; 7) The library creates community feeling—also for those

outside (meaning children with special needs, handicapped, socially vulnerable and children with ethnic backgrounds other than Danish); 8) The library supports learning and cultural development; 9) The library must reach out to children; and 10) The library's management focuses on children.^[12]

The range of programming for children in public libraries is rich with examples which illustrate the new Danish thinking. In Bucharest, Rumania, the city library offers summer programs, run by volunteers, aimed at children from 11 to 14 whose parents are at work. In Singapore, more than 40 children's libraries for children under 10 have been established in cooperation with grass roots organizations. These have over the years made way for larger public libraries complete with library services for children. During the war in Croatia, a step-by-step reading program was organized in Zagreb public library to aid the psycho-social recovery of children and adolescents through reading and literacy.^[4] In Ottawa, Canada, the public library provides back-packs of high quality and popular children's materials for busy parents to grab on their way out the door of the library. In Fujian, China, the Xiamen Public Children's Library has established the Apple Tree Library aiming to promote English language competency. One of the newest service concepts is seen in the Library of 100 Talents in Heerhugowaard, the Netherlands. "In this library, the children are the librarians. The organization of the library reflects the way that children use information, create new contexts, and share this with other children. More than 250 children participated in the library's design; the multimedia collection is presented in a number of 'islands' of things to do: nature, the living room, me and the world and dreams." The Library is a successful attempt to move the library to be both linguistic and nonlinguistic in the discovery and learning experiences it offers its young clients.^[13] Increasingly public

libraries are creating early childhood learning and literacy centers in their children's departments. For instance these are being developed by the Toronto Public Library as substantial areas, as branches are renovated and have been trademarked as KidsStop™ (Fig. 2). This approach is built on research that proves that the higher the literacy rates in children and the earlier children are exposed to a positive reading and learning environment, the better chances they have for positive life-outcomes in such key areas as health, employment, and participation in the justice system.^[14,15]

Materials and Services for Teens

Materials and services for teens have always been an important part of public library offerings. However, now many public libraries, such as the Jacksonville Public Library in Florida, United States, are placing increasing focus on the creation of separate physical teen spaces or teen zones (Fig. 3), specialized materials both print and digital, teen programming, and in particular the introduction of video/computer gaming as a form of both teaching, learning and building literacy and new social skills in young people.

In Hamburg, Germany, young adults help to select and buy media stock for the young adults' library in a project called EXIT. They select media reflecting their own cultural background and have organized and gained sponsorship for their own Internet café. In Singapore, a library aimed at people years 18–35 was established in the heart of the shopping area. Focus groups helped to define the profile of the collection and design the "library@orchard" which has been immensely popular and received 1.4 million visits per year. (It is currently closed for relocation in 2010.) In Queensland, Australia, public library staff



Fig. 2 Toronto Public Library, new KidsStop™ area in S. Walter Stewart Branch, Toronto, Ontario, Canada.

Source: From Ben Rahn/A-Frame, permission received.



Fig. 3 Jacksonville Public Library, Main Library Teen room, Jacksonville, Florida, United States.

Source: From Jacksonville Public Library, permission received.

receive specialist training in working with young adults. The training covers customer service, programming ideas, and how to run teenage advisory groups and homework clubs.

Services and Materials for Adults

Services and materials for adults in public libraries support lifelong learning, literacy, employment, health, recreation and reading, small business, literature and culture, settlement services, citizenship, civic engagement, and the strengthening of democracy. Again it is critical that the local library carefully analyze its community to determine the best place to invest limited resources and identify where networking with other institutions can leverage more service offerings for their clients.

Many public libraries support lifelong learning working with schools and other educational institutions to help students in both formal and informal educational settings. This often takes the form of support for literacy by supplying resources and facilities for students and trainers or actually being the primary provider of literacy programs themselves. In other libraries it means supporting distance education programs or providing invigilation services. For instance, the South Dublin County Library Service, Ireland provides self-learning facilities for adults, including computer-based learning and audio- and video-based language-learning materials.^[4] The new central library in Salt Lake City welcomes all comers providing classes in English as a second language, meditation and Braille. Organizations such as Weight Watchers, to the Royal Court of the Golden Spike Empire, to No More Homeless Pets, have used the building for their meetings. Other groups such as Single Moms, the Utah Socialists and a group that reads to their dogs are also users of the library.^[16]

Services for New-Comers, Immigrants, the Socially Excluded and Diverse Populations

Service for newcomers is not a new offering for many public libraries but increasing globalization and movement among countries has made this a new or higher service imperative for many public libraries particularly in countries that are experiencing high levels of immigration such as the United States, Canada, Australia, Great Britain, the Scandinavian and Benelux countries, and Germany. In the United States, the immigrant population has grown to 33.5 million or 12% of the population.^[17] In Canada, according to the 2006 Census, one in five (19.8%) residents were born outside of Canada. Most newcomers settle in large urban centers. For example the Canadian metropolitan area of greater Toronto has a population of more than 5 million of which 45% were born in another country.^[18]

Services for immigrants particularly in North America go back to library philanthropist Andrew Carnegie's desire to fund libraries as a place for immigrant self-education. For example, in 1910 the Minneapolis (United States) Public Library created a reading room for the unemployed most of whom were immigrants and in 1915 the Hibbing, Minnesota (United States) Public Library operated a library bus that served a clientele which included populations of Finnish, Irish, and Serbian immigrants.^[19] Currently services range from collections in multiple languages, bilingual or multilingual staff, multilingual and newcomer sections of library Web sites (with both text and video) as well as library publications, computer services and training for newcomers often in a variety of languages, language and literacy training programs, multilingual conversation programs and book clubs, foreign language and bilingual workshops including book groups and literacy tutoring, heritage day celebrations,

specialized outreach and program partnerships with a wide range of ethno-cultural organizations. Some examples include:

- In Nuremberg, Germany, there is a significant Russian immigrant population. The library provides print and audio visual material in Russian, language courses and books about Germany, specialized materials about career training and re-qualification. It also employs Russian speaking public service and technical services staff.^[20]
- In Ottawa, Canada, the library Web site features a welcome to the library video in 17 different languages to supplement library settlement services in 9 of the 33 branch locations.^[21]
- Public libraries also develop programs to foster inter-cultural harmony and understanding. In the public library in Malmo, Sweden and in some libraries in the United Kingdom and Canada, patrons can use the “living library” to borrow a living person for a 30 min chat. Two of the most popular individuals “borrowed” are immigrants such as a veiled Muslim woman and an imam.
- In Denmark, the growing number of immigrants and refugees is a relatively new experience for public libraries.^[22] A major public library response published by the Danish Library Centre for Integration has been the creation, maintenance, and updating of FINFO a Web portal that gives local, national, and global information in the 11 most frequently used languages in Denmark.^[23] The purpose of FINFO is to support integration of the minorities into Danish society.^[24]
- In Queens, New York (United States), the public library has partnered with the Mayor’s Office for Immigrant Affairs to provide computers and assistance for customers who wish to fill out the application for the Diversity (Green Card) Visa Lottery.

Susan Burke’s research on public library resources used by immigrant households^[25] found that newcomers were “less likely to use non-English language materials, attend library programs, for help finding a job or to search for information than the literature suggests. They were most likely to borrow books, tapes, and CDs, not specifically those in languages other than English, to pursue hobbies and entertainment, and use the library for educational pursuits.” This suggests that the public library needs to carefully evaluate their newcomer services to ensure that they are reaching and meeting the needs of that specific target group.

In 2008, The Intergovernmental Council for UNESCO’s “Information for All Programme,” endorsed the IFLA/UNESCO Multicultural Library Manifesto.^[26] This is a useful tool for public libraries to work with multicultural issues on the local, national, and international level. The three major pillars of the Manifesto states

that: libraries can play an important role in our globalized and multicultural world; respect for the diversity of cultures, tolerance, dialogue, and cooperation are among the best guarantees for international peace and security; and libraries promote and preserve cultural and linguistic heritage. This new Manifesto complements the IFLA/UNESCO Public Library Manifesto, the IFLA/UNESCO School Library Manifesto and the IFLA Internet Manifesto. It is also supported by the Guidelines for Libraries Serving Multicultural Populations.^[27]

Services to diverse populations also take the form of many types of outreach programs including services to prisons, homeless and battered spouse shelters and residences, low-income communities, hospitals and persons confined to their homes for reasons of age or infirmity or both.^[28] Libraries also provide on-site shelter and support for homeless and indigent populations and are often partners with social service agencies. This is particularly the case in large urban central libraries and branches in inner-city areas. Other libraries have developed specialties at specific branches which could include African-American history, genealogy and Aboriginal author, and oral history programs. Four major public libraries in Canada have recently concluded a multiyear project and produced a tool-kit called “Working Together” to assist libraries in reaching out to marginalized populations. More sophisticated market segmentation of communities is also revealing that the upwardly mobile middle and upper middle classes are also often underserved.^[29]

Resource Collections

Collections are at the heart of all public libraries. They are never big enough or good enough. In 2008, there are several key external and internal issues and trends that are affecting collection management and the ability to provide client-focused service. The first of these is population including growth, continuing shifts from rural to urban centers and changing demographics. Demographic shifts, combined with limited budget increases, the relentless emergence of new formats and the increasing use of library collections mean that there could be fewer library materials for future users. In many developed countries like Germany and Sweden, an aging population, falling birth rates and new patterns of immigration are increasingly placing new and different demands on public library collections.

News media and many forms of entertainment continue to influence sales and demand for particular titles in a wide range of formats. Curiously, some libraries report that while there is an insatiable demand for new titles there is also sustaining customer interest in older publications at a time when publishers trend toward maintaining limited backlists. This can be attributed to the “long tail” effect where increased aggregation of titles and speedy access to the databases leads the library user away from best sellers

and to the rest of what is available further afield.^[30] It could also reflect the desire to find more, older works by authors (particularly novels) whose new or current works they have just discovered.

Social networks such as Facebook, Myspace, and Flickr are also having an influence on collections and services. Library customers of all ages, but particularly the young, use the Internet to stay tuned and connected. The February 19, 2007 issue of *Publishers Weekly* noted that,

With kids now spending more time on the computer than they do in front of the TV or the printed page, publishers are trying to reach them where they live through online marketing campaigns, utilizing blogs, podcasts, instant messaging, video-sharing and social networking sites like MySpace which is a regular destination for 55% of teens according to a recent PEW survey.^[31]

The history of public libraries shows that libraries have always, since their early days provided media in all its multiple formats. (p. 1)^[32] Today, there is increasingly rapid change in all audio and visual formats. Library budgets must allocate larger percentages to film, television, and other performances available on an increasing variety of media formats, and the selection is becoming broader. In addition, DVD collections are increasingly reflecting libraries' expansion to world languages to better service newcomers to the community. The DVD has replaced the video as the format of choice for library users. Many library leaders and collection specialists believe that the DVD will soon give way to a faster, more compressed digital format.

Libraries are also registering usage declines in certain other and earlier formats. Many libraries have completely withdrawn their video-cassette collections and book tape collections are no longer being developed. For now CDs have become the format of choice for audio visual resources within the marketplace and within the library. This includes book CDs, downloadable audio books playable on computers, MP3 devices, and IPODs. In public libraries this is being expanded to music and video products. Digital rights management is coming more to the fore as producers work through the challenges of downloading and file sharing. Specialized resources for the print disabled are increasingly provided to libraries and clients using the Digital Accessible Information System (DAISY) format.

The growing range of resources in digital form is increasingly extending the Library's reach into the community providing registered customers with more convenient access to information and recreational materials. The majority of library catalogs have long been available via remote access on an almost 24/7 basis. Many libraries anticipate that electronic media will eventually become the norm for the delivery of spoken word and video

resources to customers and that these e-resources will replace books on tape, books CDs, MPS3 audio books, videos and DVDs. Electronic media is predicted to be the format of choice for language learning, test preparation, and career planning. E-book devices are becoming cheaper and easier to use. E-learning will increase. Best of all, unlike physical items, Web-based electronic products require no physical shelf space.

Public libraries are increasingly treating their collections of e-resources as another branch. Many public libraries subscribe to dozens if not hundreds of electronic databases. These are often provided through consortia or national, state, regional, or provincial licensing schemes. Library Web sites are being redesigned to draw the user in and keep them there. This is evident in the Vaughan Public Library's teen zone,^[33] the Ottawa Public Library's Kids Site^[21] and the Cleveland Public Library's island in Second Life virtual reality.^[34] Other e-initiatives include online book clubs, online training, offerings such as NewspaperDirect PressDisplay which provides same day access to more than 230 newspapers from around the world with the text in the language of origin. As more vendors respond to new public needs, such digital resources as Home Repair Reference Centre, Small Engine Repair are becoming increasingly available in digital form.

The continuing migration from print to digital, especially in the area of reference tools, means that public libraries' print reference collections are now declining significantly particularly. In many library branches the print reference collection takes up no more than a few shelves.

However there is still the pull of print as Mattern states in *The New Downtown Library: Designing with Communities*:

There is a materiality to particular media and artifacts and experiences that cannot be reproduced in a digital environment. There must be a place for this material knowledge—a place where people can feel the heft of a book, smell the ink of a newly printed magazine, turn gingerly the brittle pages of a worn manuscript, or dig through collections of yellowed historical photographs. (p. ix)^[32]

And of course there must be a place where someone can go to get a book and settle in to read if she so desires.

Human Resources

The four pillars of public library services are books, buildings, bytes and bodies or in common parlance, materials, buildings, technology and staff, and other elements of human capital. The human resource element of the budget is usually the largest (between 60% and 80%+). Staff are required to lead, direct, manage, and plan for the future of the service, advocate for funding and resources, collect

and organize the services and programs, provide direct services such as circulation and information services, function as the intermediary between the users and the resources and technology available, reach out to the unserved, develop service partnerships, work with professional colleagues of other systems and associations to plan for, leverage and advocate for service and funding improvements over larger units of service and governments. This is largely driven by the desire to provide as equitable a service to as many citizens as possible.

Categories of staff found in public libraries normally include directors and managers, qualified librarians, library assistants, technical staff and/or paraprofessionals, specialist staff, and a wide variety of support staff. Employees are either full time or part time in a variety of permanent, term, temporary, or casual status categories. Most public library workers are not unionized but most workers in large and/or urban library systems are either unionized or part of a staff association.

The public library workforce is currently under severe pressure. As public library service has become more complex so have the requirements for the skills and qualities of those working in them. Library service now requires confident, outgoing individuals at all levels of the organization who can communicate effectively with patrons, community groups, politicians, and fellow workers; understand and interpret their needs; and work effectively within a climate of cultural, ethnic and intergenerational diversity. Increasingly library staff are required to be innovative, flexible, entrepreneurial, imaginative and visionary, work as part of a team, and be able to respond to rapid change in both methods of service and professional practice. They are asked to be knowledgeable about building and maintaining facilities, computers, printers, photocopiers, scanners, digital environments, and social software while simultaneously developing and applying skills that some might see more appropriately assigned to a psychologist or social worker. And they work in institutions where only a few years ago the primary (but not only) reward system was too often driven by following the rules and getting the books back on the shelves. All public libraries are being asked to do more with less and to exploit technology to become more efficient and effective.

Libraries, like most public service institutions are now being charged with developing their workforce to reflect the community it services in terms of ethno-cultural and linguistic diversity. This is happening at a time when the library workforce is aging, there are insufficient recruits to fill all the vacancies, wages are not always competitive, there is increasing difficulty in attracting professional librarians into the managerial ranks and an often blurred distinction between professionals and paraprofessionals.

One of the major challenges of the public library director is to provide an environment where staff have continuing opportunities for growth and development particularly in the areas of technology, networking, supervision,

management and leadership skills development, budgeting and opportunities for special projects that provide an appropriate level of professional engagement. The IFLA Guidelines suggests that between 0.5% and 1.0% of the total library budget should be designated for training.^[4]

Marketing the Service

Almost every public library needs assessments including the recent OCLC report on perceptions of libraries reveal that regardless of what new and innovative offerings libraries provide, the vast majority of users and potential users think of their public library as a place to get books and that they are unaware of the vast resources and connections available to them.^[10] At the same time the *Long Overdue* study on public and leadership attitudes toward libraries reported that in America at least, people believe that their libraries are an important part of a healthy community; that libraries spend money well; that libraries need to provide information free of charge; that they expect a good supply of current books, reference materials, convenient hours, knowledgeable staff, and spaces for children and teenagers. Libraries are supported and given high marks for services by users but most users are unaware of the needs and pressures that libraries face in maintaining these services.^[11] This was reinforced by the OCLC study *From Funding to Awareness* which reported that for many public libraries the need to grow awareness and mindshare is intensifying^[35] as annual operating budgets fail to keep pace with the services and resources needed to meet the library's mission. The study reinforced that this lack of awareness is leading to reduced budgets staff, hours, and services in spite of increased circulation, library visits, and Internet use. The findings suggested that there is sufficient but latent support for increased library funding but that a large-scale library support campaign using brand segmentation and marketing is urgently needed. A further finding identified that the majority of elected officials while appreciative of the values and services of the public library and librarians are reluctant to support a tax increase for local services, including the public library.^[35]

The IFLA Guidelines for public libraries state that libraries must continually promote their offerings to the public.^[4] This requires a strategic vision plus communications, marketing and promotion policy, plans and strategies to tell the library story and engage both the user and potential user. Libraries worldwide have used an array of strategies including Web sites, print, electronic, and commercial media; displays and exhibits; friends of libraries and library foundations; celebrations of events, individuals and milestones; public speaking events; targeted activities to engage elected officials at the local, state and national levels; special campaigns such as one-city/one-book, library sign-ups and the use of well-known persons

such as actors, astronauts, and authors to help link the library to the community.

Often staff, trustees (where they exist) and library friends and advocates receive special communications and media training to help them deliver the library message in a convincing and professional way to councils, groups, individuals, and potential funders. This activity is intensified at budget time but the most successful libraries employ these strategies on an ongoing basis. However, all studies indicate that these efforts are still not sufficient to get the message across or sustain the support needed.

Library as Place

Notwithstanding the above, public libraries continue to be regarded by many as relevant, vital public institutions (whether or not survey respondents use them). Now new forces are requiring and shaping library design and drawing users back. These forces include the proliferation of new media, the integration of non-media activities, new hours, the introduction of commercial elements such as coffee houses and other retail outlets, and the new view of libraries as economic generators as well as hubs of urban revitalization.

The library building is as much a part of public library service as the resources and the staff within. Increasingly, in many parts of the world the public library is becoming a third community place—apart from home and school or home and church—a community gathering place where there is no pressure to buy, consume, or perform as well as a place that provides encouragement for exploration, discovery, connection, and civility. Library space is becoming more and more important when so many other activities and services are increasingly offered in virtual form. From China, to Columbia to Australia to Slovenia to South Africa, new and beautifully designed libraries are becoming facilities of service, community congregation and human engagement, and a focus of civic pride.

When planning a library facility, the library staff, governing and funding bodies consider provisions for the range of functions of the library, the size of the library, designated spaces or zones, accessibility, way finding, ambience, information and computer technology, food services, meeting room space, heritage, genealogy, and archival functions.^[4] Increasingly attention has to be paid to environmental sustainability and adhering to LEED (Leadership in Energy and Environmental Design) or equivalent standards, proximity or integration with public transportation hubs, group project and study space, catering facilities, prayer, meditation or quiet rooms, archival and heritage functional space, special and/or flexible spaces for groups such as newcomers, teens, children and seniors, and services for the alternately abled. In addition, the general public is increasingly being invited to participate in the planning and funding of these important

civic spaces which they pay for through their tax dollars or their participation in fund-raising and advocacy efforts.

At the same time, the ever adaptable public library still brings service to the people in many other forms. And so the concept of library as place also includes, bookmobiles, donkey libraries in Zimbabwe, camel library services in Kenya, subway and garden market library kiosks in Chile and floating libraries or library book boats in such diverse countries as Thailand and Norway. And making a debut are DIY (do-it-yourself) electronic kiosks libraries such as those in Roanoke, Virginia (United States), which are being located in community centers, transit stations, and commercial shopping malls as a way of extending service and keeping costs down in tight economic times. In these types of facilities, library staff are sometimes available through remote electronic access and the kiosks are restocked by non-public staff. But, everything that comes around, goes around. Allen Lane, founder of Penguin paperbacks, first established a “Penguincubator” in the mid-1930s in London, England—a slot machine that dispensed his paperbacks for a small fee of six pence—the price of a packet of cigarettes.^[36]

In *The Library as Place*, Buschman and Leckie provide a collection of 14 original articles documenting the library as a place of immense cultural, symbolic, and intellectual meaning for users whether they are seeking pleasure, scholarship, or both.^[37]

New Central Libraries

In the last 20 years, the building of significant new iconic central and/or national libraries has surged across the globe reinforcing the concept of third place beyond home, school, and work. The result has been such striking facilities as the Seattle Public Library by Rem Koolhaas (Fig. 4), the new Singapore National Library (Fig. 5), the Grande Bibliothèque du Québec in Montreal by John Patkau (Fig. 6) as well as his renovation of the Winnipeg Public Library (Fig. 7), the Mitterand Library in Paris, the Amsterdam Public Library by Jo Coenen (Fig. 8), the Jacksonville Central Library in northern Florida, the Vancouver (Fig. 9) and Salt Lake City (Fig. 10) public libraries by Moshe Safdie and the Shanghai Library (Fig. 11) which with 83,000 m² is one of the 10 largest libraries in the world. In many situations including Seattle, Vancouver, Singapore, Jacksonville, and the Harold Washington Library Center in Chicago, the building of the central library has been part of a major redevelopment of existing branch libraries as well as the introduction of new service points throughout the city.

In building these massive facilities, library planners are having to balance the need for access while ensuring security, the provision of both public and commercial space, providing universal access within budget constraints, and an economical and efficient building.



Fig. 4 Seattle Public Library, new central library, “living room” area, Seattle, Washington, United States.

Source: From Paul Hussar, permission received.



Fig. 5 New Singapore National Library, Singapore.

Source: From Singapore National Library Board, 2009, permission received, All Rights Reserved.

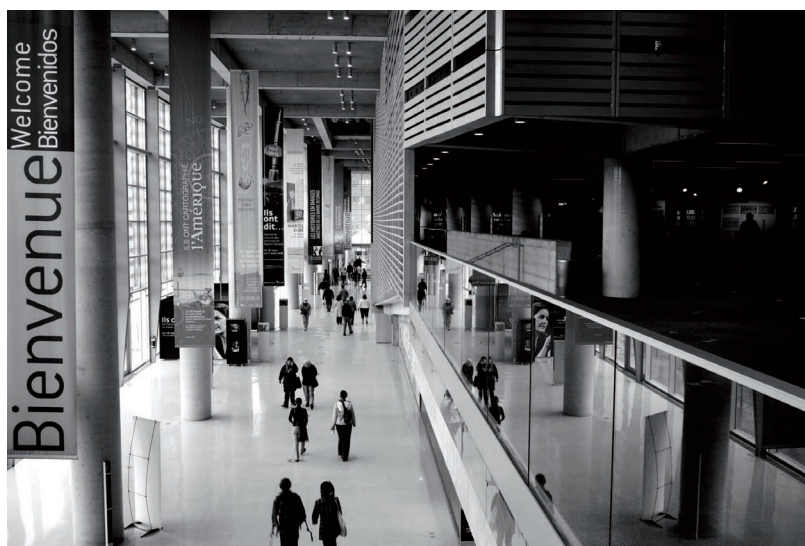


Fig. 6 Bibliothèque et Archives du Québec (Canada).

Source: BanQ, Bernard Fougères, permission received.



Fig. 7 Winnipeg Public Library, grand staircase, Winnipeg, Manitoba, Canada.

Source: From Winnipeg Public Library, permission received.

Notwithstanding the many significant central facilities that have been erected, the approval and funding process is often very difficult, challenging and always political. Many citizens, whether they are users or not, fear the

reduction or elimination of beloved branch facilities in favor of a large downtown library. Sometimes the library capital scheme is bundled with other less attractive public sector projects. Some citizens and elected officials have concerns about the relevance of a large, expensive downtown facility in an increasingly digitized, decentralized, and privatized culture.^[32] And a new downtown facility, indeed the whole library system always has to compete with other public service priorities such as police, schools, fire, and public housing. In many American cities, a major library project has to be put to a public vote. Once political and public approval is obtained most cities use an architectural competition to select its design team however the use of public-private partnerships is increasing and this sometimes affects the selection of architectural and design professionals. New central libraries must always be integrated into the life of the community whether there is a vibrant downtown to be nourished or the facility is part of a broader effort to revive life downtown.

MEASUREMENT AND EVALUATION OF PUBLIC LIBRARIES

Performance Measurement

Performance measurement has been used in libraries for many years. Originally libraries, library organizations and legislative bodies developed state, national, and international standards. In 1973 and 1977 IFLA issued *Standards for Public Libraries* which contained a range of quantitative standards including the recommended size of collection, size of administrative unit, opening hours, staffing levels and building standards. But beginning in 1986, IFLA took a different approach recognizing that worldwide resources and needs differed so significantly that there could be no common standards for service. Still



Fig. 8 New Amsterdam Public Library, Amsterdam, the Netherlands.

Source: From Ian Macredie, permission received.



Fig. 9 Vancouver Public Library, British Columbia, Canada.

Source: From Vancouver Public Library, permission received.



Fig. 10 Salt Lake City new central library (library pond), Salt Lake City, Utah, United States.

Source: From Dana Sohm, permission received.



Fig. 11 Shanghai Library, Shanghai, China.

Source: From Shanghai Library, permission received.

libraries, especially those in developing countries repeatedly asked for some type of levels or standards to assist them in their planning and development and in particular supporting the concepts of that public library services are provided without charge and without censorship. Therefore in developing the latest Guidelines for Development the planners decided to produce a set of guidelines with some standards that could be relevant at various points in a library's development, and to leave the development of specialist areas to the special sections of IFLA.^[4]

Measuring the performance of libraries is increasingly a combination of quantitative and qualitative approaches. Measurement normally begins with identifying performance indicators to measure the resource input, as well as outputs or what is achieved as a result of the activity or service being carried out. For example, a lending service requires books and other resources, staff, space, delivery services, computers, and other equipment that can all be assigned a numeric and financial value. The output of this service could be described as the total number of books circulated, the cost per capita expended on resources, the number of first time check-outs and the number of renewals, the number of card-holders or users per capita, etc. Inputs and outputs are usually compared within an institution to determine changes over time and how effective the service is. They can also be benchmarked with results from other libraries of similar size and characteristics. These statistics are often required as a condition of funding from a parent body. They are often used to illustrate the role of the library in the community or to make a case for increased funding and support. State and national agencies and organizations usually provide statistical gathering support to individual libraries.

Increasingly libraries are being called on to provide detailed reports and statistics that present more and more qualitative assessment of library performance and to measure the outcomes or impact that a library has in addition to inputs and outputs. Some of the major qualitative indicators used by public libraries include results of user satisfaction surveys. For instance, many Canadian public libraries hire independent firms and/or use computerized survey instruments to obtain occasional or ongoing customer satisfaction ratings. On a municipal level, the city government often includes libraries in surveys of citizen satisfaction with a variety of municipal services. On a national level in Canada the "Citizens First" survey conducted every 4 years, measures a wide range of federal, provincial, and municipal services in both the private and public sectors.^[38] The goal is to track improvement overtime. Repeatedly, public libraries have topped the list in service satisfaction usually exceeded only by the fire departments. Other quantitative measures have included prizes, honors, and awards won by the library and its staff and board; results of the library in citywide assessments of city departments making effective use of technology; the role of the library in scoring a city as a learning or smart

city. So important is the concept of consumer-centric service that one library administrator has even gone so far as to propose counting customer smiles per hour (on an occasional basis) as a proxy measure for customer satisfaction.

A new planning, measurement and political tool called *A Library's Contribution to Your Community* published by the Southern Ontario Library Services in Canada helps library boards and administrators measure their library's social and economic contributions to their community and society. It guides users through the development of a contribution strategy including selecting relevant library outcomes from among six contributions and 20 benefits through collecting and interpreting data and constructing the argument. The benefits include elements such as life-long learning, support for individuals in the education system, reading and numeracy skills, English as a second language, cultural awareness, information services to local business, tourism, career development, and search for employment. The contributions identified include: education and learning, literacy, culture and recreation, business and the economy, personal support and community development.^[39] Rubin's publication *Demonstrating Results: Using Outcome Measurement in Your Library* (2006) is the sixth in a series of "results" publications that provide an integrated approach to planning, resource allocation outcome measurement and excellence that is defined locally rather than through a series of universal or national or state standards.^[40]

The Value of Public Libraries

Identifying the economic role that public libraries play in communities is becoming more and more crucial to the funding, support and existence of libraries. Library authorities are now using tools from economics and political science to demonstrate, both qualitatively and quantitatively, the value of the public library to the community it serves.^[41] While many of the studies are American, contributions also come from Canada, Hungary, and Great Britain. One of the most well-known economic impact studies is *The Seattle Public Library Central Library: Economic Benefits Assessment 2007*. The study included surveys and interviews with users, visitors, business owners, tourism operators and confirmed that the new central library which opened in 2004, was functioning as a highly effective gateway to public space and tourist destination and that it was a significant contributor to Seattle's economy, a catalyst for downtown revitalization and development and a new icon for the city. In particular, the study found that the new central library was associated with \$16 million in net new spending outside of the library in its first year of operations.^[42]

Increasingly citizens and political leaders are seeing that not only can new central libraries, like those in Vancouver, Denver, Vienna, Turin, Amsterdam, and Shanghai, demonstrate civic commitment to information, ideas, knowledge, and growth, but they can also be drivers of

economic vitality, contribute to community character and liveability, and enhance the image and identity of the whole city area.

The seminal study by Griffith, King, and Harrington, *Taxpayer Return on Investment in Florida Public Libraries*, used a variety of approaches to assess taxpayer return on investment (ROI) in the state of Florida. The study showed substantial returns exceeding taxpayer investment and that over all public libraries return U.S. \$6.75 for every U.S. \$1.00 invested from all sources (federal, state, local, and other) and that the total impact of Florida's public libraries on the state economy was \$6 billion/year. This impact included non-library job creation, increased gross regional product and income or wage increases.^[43] Similarly, one of the earliest ROI studies of the St. Louis Public Library concluded that the users received \$4.38 in benefits for every tax dollar spent.^[44] A variety of other studies indicate that an overall ROI figure of between 3 and 6 is likely to result although there can be significant variation depending on the key factors relating to community needs, the actual services provided by the library and the evaluation methods used.

TRENDS AND CHALLENGES IN PUBLIC LIBRARY SERVICE

In 2008, in spite of dire predictions by some about the demise of the public library and the stiff competition offered by digitization in particular Google and the Internet, students and others are continuing to use public libraries in greater and greater numbers both physically and virtually. And with the near collapse of the global economic framework in the fall of 2008, it is likely, based on past experience in economic downturns, that public libraries will be busier than ever for the next few years.

Virtual Use

More and more frequently, patrons are accessing public-library services from remote locations. In a recent survey, more than half of American adults said they had visited a local public library in the past 12 months. And a survey conducted in 2006 by KRC Research and Consulting reported that 12% of the 1000 people interviewed "visited" their local library by phone and 12% visited by computer. Among those who visited by phone or computer 41% did so to renew a borrowed item, 48% to consult a librarian for help, 45% to check the library's online catalog and 42% to use other resources on the library's Web page.^[45]

Gaming in Public Libraries

A new phenomenon in many public libraries is the introduction of computer or video gaming. This type of youth programming featuring such games as Guitar Hero and

Dance, Dance Revolution, was first initiated to attract teen-aged clients born in the age of the Internet and quite comfortable with conducting much of their lives in the virtual world. While this type of activity in libraries is not without its detractors, computer or video gaming is now used increasingly in intergenerational programming in libraries and other institutions such as seniors centers and long-term care facilities. In June 2008, the Verizon Foundation, the philanthropic arm of Verizon Communications, announced a \$1 million grant to the American Library Association to study how gaming can be used to improve problem-solving and literacy skills.^[46] Nicholson's study of the role of gaming states that 77% of libraries contacted have formal gaming programs ranging from video games to board games and other more traditional games like puzzles. Gaming he suggests, is a form of story telling and an activity that captures the imagination and creates a comfortable and inviting environment to encourage participants of all ages to enjoy spending time in the library.^[47]

Technology and Access in the Public Library

Nothing has impacted on the role of the public library in the community more significantly in the last 20 years than the introduction of free public Internet access. This new service has changed staff roles and training, allocation of funding, design of facilities, and debates about intellectual freedom and censorship. Since 2006 the American Library Association has issued two major studies on public library funding and technology. Findings can apply to public libraries across the globe. The key highlights conclude that libraries play a strategic role in providing free access to networked information and related telecommunications services and that demand is increasing particularly for access to e-government, lifelong learning, and employment seeking. But the studies also document that funding for public technology access is volatile especially for small libraries; staffing levels to support access is not keeping pace with patron demand; the need for increased bandwidth is becoming critical given the types of information patrons are seeking; library online services (e.g., homework resources, e-books, audio and video, gaming) are growing dramatically but have corresponding impact on the library's public services and technology infrastructure. And finally, the reports' findings include that many library buildings, already inadequate in terms of space and infrastructure cannot support additional public access computers and technology infrastructure.^[48]

This situation is in the context of the major report findings including: funding remains flat for many public libraries; staffing is at a standstill (inadequate staffing topped the list of library concerns); staff training needs outpace supply; ICT (information and communications technology) support is lagging whether supplied internally by the library or externally by another level of government; and connection speed is increasingly insufficient.

Internet services show double digit growth in the availability of a range of resources in five key online areas: audio content, video content, homework help, e-book availability, and digitized special collections. Buildings and infrastructure are being further stretched given that the majority of library buildings are 25–50 years old and 40% of library buildings are estimated to be in only fair to poor condition. While online services are growing everywhere and libraries are facing a growing strain to keep up with user demand for public access computing.

In keeping with the need to actively involve the user in public library service, more and more libraries are looking at and experimenting with using social software such as blogs, RRS feeds (really simple syndication), wikis, photo-sharing applications, chat reference, and electronic discussion forums. This is an example of Library 2.0, a term that is used to characterize the strategies that libraries should use to position themselves as relevant in a digital future.^[49]

Bibliocommons is a new social discovery tool being developed for libraries by a Toronto (Canada) based company with support from two Canadian provinces and with strong potential to replace all user-facing functionality of the library online catalog and allowing for faceted searching, easier user commenting and tagging. It is being created to respond to the new inter-active world and to provide a platform for richer connections between users, content, and community. This is one development trend to watch closely.^[50]

Public Library Funding

From a sample of 29 countries, the OCLC 2003 Environmental Scan estimated that library spending worldwide is approximately \$31 billion/annum. This figure is approximate and likely understated as many countries such as China and Brazil do not regularly collect or report library expenditures.^[16] While usage rates both physical and electronic continue to rise in public libraries, in general, financial support lags.^[43] In most countries the majority of funding for public library services comes from the local level of government. Depending on the legal framework for library services, senior levels of government provide sustaining funding often to support resource development and sharing, and well as special grant funding often to stimulate and strengthen specific service responses e.g., literacy, service to business, public Internet access.

Without suitable and consistent levels of funding over the long-term, it is not possible to develop policies for service provision and make the most effective use of available resources.^[4] Inadequate funding can result in a new library building without adequate funds to maintain it; collections with insufficient funds for new materials; computer systems and equipment not being replaced or upgraded. Most public libraries rely primarily on taxation at the local level. Additional sources of income include

donations from private funding bodies or individuals; commercial activities e.g., book-sales; user fees; special related services e.g., photocopying and computer printing; sponsorships from and partnerships with other organizations e.g., Citizenship and Health departments; and lottery funds. Increasingly libraries are establishing their own separate charitable foundations to professionalize their fund-raising efforts and establishing formal friends of the library groups to both raise money and advocate for better funding from the parent body. Finally, to stretch the available funds most public libraries belong to one or more consortia or resource sharing schemes.

One of librarianship's oldest beliefs is that access to information should be free as a basic right of citizenship. The *IFLA/UNESCO Guidelines* state: "the public library shall in principle be free of charge."^[4] Library membership in most countries is free with some special and supplementary services having associated fees. However in some countries small membership fees are permitted, e.g., Singapore; the province of Alberta, Canada. Many libraries, while not charging for membership, have found creative ways of increasing revenue with a variety of charges to users for such services as faster access to best sellers, printing and photocopying, replacement of lost membership fees, some types of business information services. A number of researchers such as Butterworth have demonstrated that many of these types of fees, but not all, can have a negative impact on borrowing and overall usage of the library, especially if they are combined with a real or perceived decline in service.^[51] However, there is also evidence to indicate that it may not be the amount of money that libraries can raise with fees for service but the fact that they are trying to contribute to the operation of the library and easing the load on the primary tax base that is important.

Usually and especially in times of fiscal recession and constraint which is the situation in many parts of the world at the time of this writing, libraries are viewed as soft services and as targets for budget reductions particularly as replace funders and legislators may believe that the public library could be replaced by Google.

The 2008 OCLC report (*From Awareness to Funding*) studied funding to public libraries in the United States. It documented that while local taxpayers in the United States provided over U.S. \$9 billion in 2004 to support the operations of their public libraries, in general library annual operating funds are not keeping pace with services and operations to meet their mission and that in 2005 over one-third of U.S. public libraries were operating with budgets that are declining and that many more were operating with budgets that are slightly ahead of inflation but significantly behind the current inflation rates for employee benefits, energy and materials. The result is that many libraries are being forced to reduce staff, cut hours, and reduce community services. The study demonstrated that it was possible to apply the latest marketing and advocacy

techniques so successfully used in other venues to create funding awareness, drive action and ultimately increase funding for public libraries; that it was possible to position libraries along other critical hard services like fire and police; and that a national campaign could make a difference in funding. The study's findings strongly suggest that there is sufficient, but latent support for increased funding among the voting public in America. The study further suggested that the funding situation will not self-correct unless there is a major campaign to communicate the value of the public library to the public to funding sources to ensure they are considered for funding. This includes building market segmentation; identifying the drivers of library funding; understanding attitudes toward libraries and library funding among the most likely supporters and creating messaging to motivate the most likely supporters to action. The idea is that this would result in the creation of a brand which would make the library relevant for the twenty-first century; instill a sense of urgency and activate a community conversation about how the library is a vital part of the community's infrastructure and future. One of the most important findings was that positive perceptions of the librarian are highly related to support and that passionate librarians who are involved in the community make a major difference to a voter's willingness to fund the public library.^[33]

In 2007, the American Library Association and the Bill and Melinda Gates Foundation joined forces to study public library funding and with particular emphasis on access to technology. The study revealed that public library infrastructure (staffing, space, and bandwidth) are stretched to capacity. Almost 73% of libraries reported that are the only source of free access to computers and the Internet in their communities; the funding sources to support this access is volatile; staffing levels are not keeping pace with patron demand and, while many libraries reported increased connection speeds to support use, the vast majority reported their wireless and desktop computers share the same network thus diminishing the effective speed of access to the Internet at the workstation. The study also reported that public access Internet services (including homework resources, e-books, audio and video) grew dramatically in the year since the previous study on the same topic and that many library buildings, inadequate in terms of space and infrastructure cannot support addition public access computers and technology infrastructure. Looking at funding over a 9-year period from 1996 to 2005 revealed that the average increase in operating funds was 4% but that there are decreases in both library expenditures and a shift of expenditures away from print collections and staff to other expenditures such as technology, utilities, and building maintenance. A trend to supporting staff salaries from soft funding such as fees, finds and special grants grew. For smaller libraries the shift of local revenue away from funding telecommunications, together with a growing reliance on soft funding

sources and state and federal support for these expenditures was also documented in the survey.^[46]

CONCLUSION

The second decade of the twenty-first century will be very challenging for public libraries. The pressures will continue to come from the relentless march of technology, the competition and the opportunity of the Internet, the googlization of the world and the impact of social networking, the effects of the global recession on government and library budgets, the competition for well-trained, talented and representative staff, the demand of staff to have a balanced lifestyle, new copyright legislation, growing low literacy rates, the need to replace and redevelop aging infrastructure, the drive for libraries to become increasingly entrepreneurial while at the same time maintain a presence as an open, supportive public knowledge institution. Earlier encyclopedia articles on public libraries have all articulated the same concerns. However, public libraries have continually faced challenges of similar magnitudes and they have always come through with vitality, resiliency, and innovation. With history behind them and the support of their associations and advocates beside them they will continue do so. We are people of the book.

BIOGRAPHICAL NOTE

Barbara Clubb is the City Librarian and CEO of the Ottawa Public Library in the city of Ottawa, Ontario, Canada. Ottawa is the capital of Canada and has a population of more than 900,000.

Ms Clubb is a past president of the Canadian Library Association, past Chair of the IFLA Public Libraries Section and a current member of the IFLA Metropolitan Libraries Section Standing Committee. She is the 2009 winner of the ALA/PLA Allie Beth Martin Award for demonstrating a range and depth of knowledge about books and other materials and a distinguished ability to share that knowledge. She is also the recipient of the 2009 Outstanding Service to Librarianship awarded by the Canadian Library Association.

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Public Library Association (PLA)

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Abstract

From its beginning in 1944 with only 1295 members, the Public Library Association (PLA), a division of the American Library Association (ALA), has grown to nearly 12,000 members today with the stated purpose “to strengthen public libraries and their contribution to the communities they serve.” This mission positions PLA to: focus its efforts on serving the needs of its members; advocate for public libraries; and commit to quality public library services that benefit the general public. Based in Chicago and housed within ALA headquarters, PLA is a member-driven organization that exists to provide a diverse program of communication, publication, advocacy, continuing education, and programming for its members and others interested in the advancement of public library service.

INTRODUCTION

From its beginning in 1944 with only 1295 members, the Public Library Association (PLA), a division of the American Library Association (ALA), has grown to nearly 12,000 members today with the stated purpose “to strengthen public libraries and their contribution to the communities they serve.” This mission positions PLA to: focus its efforts on serving the needs of its members; advocate for public libraries; and commit to quality public library services that benefit the general public. Based in Chicago and housed within ALA headquarters, PLA is a member-driven organization that exists to provide a diverse program of communication, publication, advocacy, continuing education, and programming for its members and others interested in the advancement of public library service.

OVERVIEW

The formation of the Division of Public Libraries of the ALA was approved by votes of the ALA Council in March and October 1944, following organizational meetings, filings of petitions by nearly 1200 members, and the adoption of a temporary constitution. It was decided that the purpose of the division would be to “advance public library interests and to cooperate in the promotion of library service in general.” The dues were established as 20% of the dues paid to ALA, not to exceed \$2.00. At that time the bylaws provided that “Any member of the American Library Association interested in public libraries may become a member of the Division of Public Libraries by

indicating the division and section when paying ALA dues.” (from ALA Handbook December 1, 1944).

The first PLA president was Amy Winslow, Cuyahoga County (Ohio) Library. The first executive director was Julia Wright Merrill, an ALA staff member (from the ALA Handbook, December 1, 1945, and from Festschrift prepared by PLA staff for PLA’s Fiftieth Anniversary).

At the time of its formation, PLA was composed of these eight special-interest sections:

- Adult Education
- Branch Librarians
- Business and Technology
- Lending
- Librarians of Large Public Libraries
- Order and Book Selection
- Service Librarians
- Small Libraries

Eventually, these sections evolved into the following six sections, which were in place until 1998:

- Adult Lifelong Learning Section
- Community Information Section
- Marketing of Public Library Services Section
- Metropolitan Libraries Section
- Public Library Systems Section
- Small and Medium-Sized Libraries Section

In the 1970s, public libraries were primarily planning and serving the traditional library users—educated, middle income, more women and children than men. PLA established three age-group task forces to examine goals, missions, and standards for public library services. The

focus of these task forces was on what the public needed (not what was currently offered), and on moving from quantitative to qualitative measures for effective public library services. This led to the development of the first Planning Process for Public Libraries, published by ALA in 1980. There was still a difference in needs of public libraries serving small versus large communities, but marketing of public library services and outreach services had moved into new places of interest for all PLA members.

In the mid-1980s, articles reported that only 5% of America's public libraries were using computers for circulation. Debate was underway on whether mainframes or minicomputers would be the most effective method for automating libraries, and many libraries were experiencing difficulty convincing local officials that computers were needed. By the early 1990s, the impact of computers and the Internet had begun to forge changes in public library services. The PLA officers and members debated the pros and cons of the role of public libraries on the then-new "information superhighway." Few realized that, in less than 10 years, the Internet would become an essential and "natural" aspect of everyday life as well as public library services.

By 1996, the membership of the PLA, by a vote of 1477 (yes) to 539 (no), approved proposed bylaw changes in a special election. The bylaw changes, which replaced PLA's sections with special interest "clusters," took effect with the close of the 1998 ALA Annual Conference. The new clusters organized the work of the association into three key areas:

Library services cluster: Committees within this group focus on how public libraries and librarians can improve their services for library users, including service to children, the business community, literacy services, rural community, and homeschoolers.

Library development: Committees within this group focus on the working activities in which public librarians participate in their careers, such as those involving bibliography, continuing education, library collections, technology, and similar activities.

Issues and concerns: Committees within this group focus on activities that serve the library profession as a whole, such as those reviewing legislation, intellectual freedom, and research.

PLA's Priority Concerns identified in 1991 were given as:

- Adequate funding for public libraries.
- Improved management of public libraries.
- Recognition of the importance of all library staff in providing quality public service.
- Recruitment, education, training, and compensation of public librarians.
- Effective use of technology.
- Intellectual freedom.

- Improved access to library resources.
- Effective communication with the nonlibrary world.

In 2005, PLA approved a new strategic plan that outlined four organizational goals to help further strengthen public libraries and their contribution to the communities they serve:

Advocacy and recognition: Public libraries will be recognized as the destination for a wide variety of valuable services and their funding will be a community priority.

Literate nation: PLA will be a valued partner of public library initiatives to create a nation of readers.

Staffing and recruitment: Public libraries will be recognized as exciting places to work and will be staffed by skilled professionals who are recognized as the information experts, are competitively paid, and reflect the demographics of their communities.

Training and knowledge: PLA will be nationally recognized as the leading source for continuing education opportunities for public library staff and trustees.

In 2008, PLA's membership again voted 2731 to 163 to change the organization's bylaws, effectively reshaping the structure of the organization.

PLA members were given the opportunity to discuss and debate the proposed changes at the ALA 2008 Midwinter Meeting in Philadelphia, and again at member forums held during the 2008 PLA National Conference in Minneapolis, Minnesota. Major components of the bylaws changes include a reduction in the size of the PLA board, the disbandment of the PLA executive committee, and the transition from PLA committees to Communities of Practice. Communities of Practice are virtual groups that are interest-focused and member-driven. Members can create groups, as well as morph and/or disband them at their discretion. This will allow members, many of whom are unable to travel to in-person committee meetings, to get involved with the organization and the public library issues they care about most.

ORGANIZATION

The original officers of the PLA were the chairpersons of the original eight sections, president, first vice-president, second vice-president, treasurer, and executive secretary.

Through June 2008, the officers of this association are the immediate past-president; the president; the vice-president, who serves as president-elect; and the executive director. The executive director is chosen by the executive director of the ALA with the approval of the Board of Directors of the PLA.

With the bylaws change vote of 2008, the PLA Board of Directors changes. With the exception of the officer

positions (president elect, president, past-president); and the ALA division councilor; and ALTA representative, PLA Board members are now all members-at-large. Board service is no longer tied to representing a specific Cluster of member committee. The Executive Committee has been eliminated. Through attrition, the Board will eventually be reduced in size from 24 to 12.

The new bylaws also changes board service requirements. The full Board of Directors will now meet four times a year instead of twice a year. The new meeting schedule consists of a fall board meeting held in conjunction with the ALA Executive Board meeting; a meeting held at the ALA Midwinter Meeting; a spring board meeting; and a meeting held at the ALA Annual Conference.

ACTIVITIES: PUBLICATIONS, CONFERENCES, AND SERVICES

Public Libraries Magazine

Public Libraries, as the official journal of the Public Library Division, commenced publication in January 1947. The editor at that time was Muriel E. Perry, Decatur Public Library, Decatur, Illinois (From the inaugural issue, *Public Libraries*, Vol. 1, Number 1, January, 1947). *Public Libraries* has since become an increasingly important benefit for members of PLA. In the fall of 1988, an editor was hired and paid a stipend, a change from the prior practice of only reimbursing the editor's expenses. This change was made because the board decided to increase the frequency of the magazine from quarterly to bimonthly. Upon the recommendation of the *Public Libraries* Advisory Board and the PLA Board of Directors, in 1990 the editorial responsibilities were divided with a PLA staff member assuming responsibilities as managing editor working with an outside feature editor. In 2006, the position of Editor became a full time PLA staff member position.

Notable PLA Publications

The PLA has developed several important publications in the management of public libraries. These titles focus on planning and measuring effective service to the community, including technology issues and services to children and young adults (see Table 1).

Preconferences and Workshops

PLA holds workshops as preconferences at the ALA Annual Conference, the PLA National Conferences, and the Spring Symposium, a group of five to six concurrent workshops held every other year. In addition, regional or special purpose events are developed in response to member needs.

Table 1 Key publications from PLA in chronological order

<i>Public Library Data Service Statistical Report</i> (PLA, published annually 1988–present).
<i>Output Measures for Public Library Service to Children—A Manual of Standardized Procedures</i> (ALA, PLA, Association for Library Service to Children, 1992).
<i>PLA Handbook for Writers of Public Library Policies</i> (PLA, 1993).
<i>Bare Bones Young Adult Services: Tips for Public Library Generalists</i> (ALA, 2000).
<i>Latchkey Children in the Public Library</i> (PLA, Association for Library Service to Children, 1988).
<i>Unattended Children in the Public Library: A Resource Guide</i> (PLA, Association for Library Service to Children, 2000).
<i>Planning for Results—A Public Library Transformation Process</i> (ALA, 1998).
<i>Wired for the Future—Developing Your Library Technology Plan</i> (ALA, 1999).
<i>Managing for Results—Effective Resource Allocation for Public Libraries</i> (ALA, 2000).
<i>The New Planning for Results: A Streamlined Approach</i> (ALA, 2001).
<i>Libraries Prosper with Passion, Purpose and Persuasion: A PLA Toolkit for Success</i> (PLA, 2007).
<i>Field Guide to Emergency Response: A Vital Tool for Cultural Institutions</i> (Heritage Preservation, 2006).
<i>Public Library Service Responses 2007</i> (PLA, 2007).
<i>Nursery Rhymes, Songs and Fingerplays: Rhyming Words Will Lead to Teaching Children How to Read!</i> (PLA, 2007).
<i>Defending Access with Confidence: A Practical Workshop on Intellectual Freedom</i> (ALA, 2005).
<i>Managing Facilities for Results: Optimizing Space for Services</i> (ALA, 2007).
<i>Creating Policies for Results from Chaos to Clarity</i> (ALA, 2003).
<i>Staffing for Results: A Guide to Working Smarter</i> (ALA, 2002).
<i>Strategic Planning for Results</i> (ALA, 2008).

Public Library Data Service

The Public Library Data Service is a program of the division that consists of the collection of a set of statistics from a group of approximately 800 public libraries which participate voluntarily. These statistics are published in an annual publication, *The Public Library Data Service Statistical Report*. Don Napoli, Director of the St. Joseph County (Indiana) Public Library, originally collected and reported the statistics as a volunteer. In 1991, data collection was contracted out to the School of Library and Information Services at the University of Wisconsin, Madison; and in 1996 it was contracted out to the Library Research Center at the University of Illinois, Urbana-Champaign. In 2007, an interactive Public Library Data Service Statistical Report subscription database was made available for purchase, in addition to the print publication.

PLA National Conferences

The first PLA National Conference was held in Baltimore, Maryland, in 1983, and attracted 1706 paid registrants. For public librarians, friends of libraries, international visitors, educators, and politicians active in supporting libraries, the Baltimore conference provided opportunities to share ideas on current issues and trends in public librarianship and to hear colleagues and other experts in the field present a variety of educational programs. The format established at this first conference has been used for all subsequent PLA National Conferences. Subsequent PLA National Conferences were held in 1983, 1986, 1988, 1991, 1994, 1996, 1998, and 2000, 2002, 2004, 2006, 2008. These are events of great importance to PLA members and to librarians, trustees, friends, and others concerned with the development of public library services. Since the beginning, these conferences have grown steadily in all areas—attendance, exhibits, number of programs, and revenue. National conferences are currently held every two years, with the next conference scheduled for Portland, Oregon, in 2010 and Philadelphia, Pennsylvania, in 2012.

Certified Public Library Administrator (CPLA) Program

A joint committee with representatives from PLA, LLAMA (Library Leadership and Management Association), and ASCLA (Association of Specialized and Cooperative Library Agencies) was established to respond to the expressed need for education beyond the masters program that would lead to a recognized designation of achievement in public library administration. Begun in 2006, the CPLA program provides post-MLS/post-MIS participants, who complete an established curriculum of courses and demonstrate significant library experience and proof of related activities, the CPLA designation. PLA staff members are responsible for administering course offerings, contracts with presenters and organizers, promotion, registration, and financial management. These courses launched in conjunction with the ALA Allied Professional Association (APA) in summer 2007. The CPLA program is managed by the ALA-APA.

RECENT MAJOR PLA GRANT PROJECTS

The PLA has participated in grant projects related to association priorities. In 2007, the Bill & Melinda Gates Foundation awarded PLA a \$7.7 million grant to develop and provide a national advocacy training program for public librarians from 2007 to 2009. PLA's training program provides librarians with the skills and resources necessary to seek increased funding, create community partnerships, and build alliances with local and regional decision

makers. The training will support libraries that are eligible to receive Bill & Melinda Gates Foundation Opportunity Online hardware grants, which require grantees to match foundation funds with local dollars. It will also be available to non-grantees on a limited basis. Grantees will be encouraged to send teams of up to three people to the locally customized training where they will learn about and create advocacy plans grounded in the reality of their local, political, and economic environment. Each participant will also receive the *PLA publication Libraries Prosper with Passion, Purpose and Persuasion: A PLA Toolkit for Success*, which will provide them with step-by-step instructions for implementing their advocacy plan.

In addition, PLA has participated in grant projects related to association priorities. In 1995–1998, PLA was a partner in the Microsoft/Libraries Online project. Through Libraries Online, the Microsoft Corporation, the ALA/PLA, and the Technology Resource Institute joined forces to ensure that everyone has the chance to succeed in the information age. Libraries Online contributed computers, with the latest software and connections to the Internet, for public use and libraries and provided training for public library staff and patrons. Microsoft committed more than \$15 million in grants and software to this project, in order to help build computer access at over 200 public libraries across the country. Key findings from this project included:

1. Libraries Online provided computers, training, and access to information for people in communities in need.
2. Participating libraries found innovative ways to support and maintain new technologies, even when additional staffing was not provided.
3. Once people were exposed to computing power, they became strong advocates—saying they would always want to have access through their libraries.

CONCLUSION

As the PLA continues to support the development of effective public library services, the focus of the organization will reflect changing conditions in our communities and our culture. Current trends in electronic information affect the development and delivery of information services; current research in early childhood development affects the content and presentation of public library programs for preschool children; growing diversity in our communities affects the development of particular services to meet language and cultural needs; changing lifestyles affect the time and location of the delivery of library services. The officers, members, and staff of the PLA will work together for the advancement of public library service.

APPENDIX: PUBLIC LIBRARY ASSOCIATION PRESIDENTS

PLA Presidents—Present back to 1970

Sari Feldman	(2009–2010)
Carol Sheffer	(2008–2009)
Jan Sanders	(2007–2008)
Susan Hildreth	(2006–2007)
Daniel L. Walters	(2005–2006)
Clara Nalli Bohrer	(2004–2005)
Luis Herrera	(2003–2004)
Jo Ann Pinder	(2002–2003)
Toni Garvey	(2001–2002)
Kay K. Runge	(2000–2001)
Harriet Henderson	(1999–2000)
Christine L. Hage	(1998–1999)
Ginnie Cooper	(1997–1998)
Linda Meilke	(1996–1997)
LaDonna Kienitz	(1995–1996)
Judy Drescher	(1994–1995)
Pat A. Woodrum	(1993–1994)
Elliot Shelkrot	(1992–1993)
June Garcia	(1991–1992)
Charles M. Brown	(1990–1991)
Sarah Ann Long	(1989–1990)
Melissa Buckingham	(1988–1989)
Susan S. Kent	(1987–1988)
Kathleen M. Balcom	(1986–1987)
Patrick O'Brien	(1985–1986)
Charles W. Robinson	(1984–1985)
Nancy M. Bolt	(1983–1984)
Donald J. Sager	(1982–1983)
Agnes M. Griffen	(1981–1982)
Robert Rohlf	(1980–1981)
Ronald A. Dubberly	(1978–1980)
Genevieve M. Casey	(1976–1978)
Dorothy M. Sinclair	(1974–1976)
Lewis C. Naylor	(1973–1974)
David Henington	(1972–1973)
Effie Lee Morris	(1971–1972)
Andrew Geddes	(1970–1971)

Qualitative Research Methods in Library and Information Science [ELIS Classic]

Brett Sutton

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Print-Qualitative

Abstract

Sutton's essay is a masterpiece of concise, clear, and measured exposition on this difficult area of methodological theory and practice. As Sutton notes at the beginning: "What we call qualitative research out of convenience is actually a diverse collection of philosophies, historical traditions, discipline-specific concepts, and useful practices. One goal of this article is to articulate this diversity. Another is to demonstrate that the dualistic character that the methodological debate has sometimes taken, pitting qualitative against quantitative approaches, is unproductive, not to say unrealistic."

—*ELIS Classic*, from 1998

INTRODUCTION

Social scientists have practiced what is loosely called qualitative research in many forms for the better part of a century. The results have been both numerous and diverse, although some disciplines have found it better suited to their needs than others. Library and information science (LIS), after establishing a strong preference for quantitative approaches to research grounded in the epistemology of the natural sciences, has begun to develop a body of literature that explores nonquantitative methods of knowledge creation. This article seeks to contribute to this development by summarizing the principal features of qualitative research, reviewing its status in information studies, and exploring its potential for generating new research in the field. These tasks, not easy on their own terms, are made more difficult by the lack of precision of the term qualitative research and the absence of a clearly defined body of theory or practice conforming to such a concept. What we call qualitative research out of convenience is actually a diverse collection of philosophies, historical traditions, discipline-specific concepts, and useful practices. One goal of this article is to articulate this diversity. Another is to demonstrate that the dualistic character that the methodological debate has sometimes taken, pitting qualitative against quantitative approaches, is unproductive, not to say unrealistic. This article does not begin with a definition of the term qualitative research because definitions tend to conceal the very ambiguities and complexities that it hopes to capture. It is possible, however, to sketch the outlines of qualitative research by taking note of some of its identifying characteristics. Based on the published record, one might fairly say that qualitative research tends to emphasize interpretation rather than explanation, in-depth case studies rather than controlled multiple-case analyses, analytic description

rather than formal hypothesis testing, narrative reporting of results rather than the presentation of statistical analysis, acceptance of the investigator's subjective involvement rather than the cultivation of a neutral or objective attitude, attention to the uniqueness of the context in which research data are collected, and tolerance for diversity in claims to knowledge. This is not a complete list, however, and none of these factors can be said to be essential to the qualitative approach. Moreover, many real-world studies in the social sciences are hybrid in character, the product of both quantitative and qualitative techniques, so that attempting to isolate purely qualitative studies is something of an artificial exercise.

This article takes the term research rather broadly and nonrestrictively. It is not the goal here to prescribe a programmatic approach to qualitative analysis, but rather to suggest the variety of ways in which such an approach can be integrated into information studies, taking note of the risks as well as the benefits, suggesting the range of tools that are available, and linking these ideas at key points to the LIS literature. Although a number of studies are cited here by way of example, this is not a comprehensive account of the literature of qualitative methods, nor is it intended to serve as a tutorial in even the rudimentary sense. There are two reasons for this. First, the literature on the subject is too vast to summarize in the limited space available. Second and more important, it is not the particular techniques of qualitative research that play the greatest role in characterizing this research tradition, but the principles and theories that support them.

A central premise of this article is that LIS is a social science to which the entire range of research methods used in the social sciences is applicable. Another is that no single approach, however powerful and productive, can successfully solve all the problems in a field as diverse as LIS. There are several dimensions to this problem.

A significant proportion of the research issues in LIS falls into the category of what are sometimes called the “human” sciences, in which researchers are, in an important sense, interpreting themselves rather than explaining an objective natural world. As Neill notes, “the dilemma in the area of research methods in information science is that information creation and use is complex, imprecise, and subjective”.^[1] The concept of information is so deeply part of the social and cultural experience of being human that the study of information cannot be easily detached from the very phenomena it seeks to investigate. This means that the research problems of LIS cannot be entirely captured by tools optimized for the natural sciences. An additional factor is that as an applied science LIS lends itself to a pragmatic handling of research methods. It is frequently the case that investigations in the field are not pursued merely in the interests of basic research but are also employed as tools for accomplishing practical goals, such as improved services to a user community, a better understanding of the research practices of a scholarly field, the design of new information technologies, or the development of public policy regarding access to information. A final complication is that LIS has in recent years allied itself in productive ways with fields ranging from literary criticism to cognitive science, and has taken up the research tools associated with those fields. All of these conditions lead to the necessity of a pluralistic methodology for LIS.

Before undertaking a discussion of the principles of qualitative methods, it is necessary to make two additional terminological clarifications, one involving the term qualitative and the other involving the term method. In the case of the former, the problem is that a false opposition between the terms quantitative and qualitative—implying, among other things, association with descriptions of phenomena that are numerical on the one hand and verbal on the other—threatens to undermine the more interesting and important aspects of the methodological questions under consideration here. Even a cursory examination of successful research illustrates that there are no social phenomena that are intrinsically unquantifiable, nor are there assertions based on quantification that can be articulately conveyed and interpreted without a verbal component. In Kaplan’s words, “The point is that both quality and quantity are misconceived when they are taken to be antithetical or even alternative. Quantities are *of* qualities, and a measured quality *has* just the magnitude expressed in its measure. In a less metaphysical idiom, we could say that whether something is identified as a quality or as a quantity depends on how we choose to represent it in our symbolism” (p. 207).^[2] We seem to be stuck with the terms, but it is wise to allow them to stand not as terms for types of data but as loose descriptors for a collection of concepts and reasoning procedures, and that is how they will be used here.

The other problematic term is method. The trouble here is that by focusing exclusively on method (in the sense of the means or procedures for accomplishing a task), we beg the question of theory and risk, missing some of the more important issues that any discussion of research should raise. It is possible, in fact, to identify at least three different levels of analysis of the research process: philosophy and theory, methods and techniques, and data. Debate over the relative advantages of various approaches to research has taken place within each of these domains. Philosophical questions address the epistemological foundations of scientific research and articulate hidden assumptions about the consequences of various forms of observation and inference. Theory, a natural extension of philosophy, encompasses investigator’s goals in pursuing a particular line of research and their expectations about what that research is likely to yield. Although it is not necessary, nor even advisable, for investigators to begin every research report with a summary of the philosophical justifications behind their theoretical positions, it is nevertheless useful, some would say essential, for them to be able to articulate those principles. Methods, strictly speaking, are the systematic procedures that researchers use to collect and process data in order to put their theories to the test, which in turn leads to the development of new theories. Aspects of method in this sense include research design, the selection and use of research tools and techniques, and the application of certain inferential procedures. Data and the reports that convey them are presented as the formal, tangible results of research and are a direct product of the theories and methods favored by the researchers. In this article the focus is primarily on theory, with some excursions into the area of methods as they relate to these theoretical principles.

QUALITATIVE RESEARCH AND THE LITERATURE OF LIBRARY AND INFORMATION SCIENCE

The literature on qualitative research is vast, ranging from essays on philosophical foundations to practical tutorials. Some of these works are general in nature, while others address the needs of particular disciplines. The methodological writing on research methods in LIS is small by comparison, and concentrates on quantitative approaches, but it is nevertheless worth reviewing, since it reflects the intellectual environment of the field and sheds light on the evolution toward qualitative approaches to research.

An appropriate starting point for this review is Charles C. Williamson’s report to the Carnegie Commission on the state of library education in the 1920s. A central theme in Williamson’s evaluation was not the quality of research in the field or the methods employed, but the virtual absence of research. He criticized librarians for their tendency to gain professional knowledge through trial and

error, an attitude he criticized as “empirical.” Williamson’s review of library education noted its prejudice against science: “I fear most teaching in library schools promotes rather than diminishes the empirical tendency. Quantitative studies are its greatest enemy, but probably not one librarian in a hundred has ever had training in quantitative methods”.^[3] Williamson’s preference for quantitative research sounded a theme that was repeated by numerous later writers. For example, Pierce Butler, in a 1933 essay entitled “The Nature of Science,” stated that “librarianship, in particular, will become scientific only as it conforms in essential to the habitual methods of thought in the modern temper,” which for Butler included the scrutinization of “objective phenomena” with the “rigor of scientific observation,” wherein “every possible device will be utilized for the isolation of activities and their quantitative measurements”.^[4] This positivistic formulation of library science research is important for its rejection of two concepts central to qualitative research: that human action must be understood not in isolation but in its sociocultural context, and that the forms of observation that do not rely on quantification are also useful.

In 1957 *Library Trends* published an issue devoted to research in librarianship. This collection of essays, however, concerned itself with the subject matter of LIS research and did not take up the issue of method. Only one article could be considered methodological, an essay by Leon Carnovsky supporting the pluralistic principle that the nature of an inquiry will properly determine the methods employed, and citing several approaches widely used by qualitatively oriented researchers—case study and historical analysis.^[5] Carnovsky gives highest priority, however, to methods that yield statements on causality and discourages the use of narrative descriptions, which, although they can be difficult to work with, are important to qualitative researchers.

Seven years later, *Library Trends* returned again to the question of research, this time taking up more directly the question of research methods, with articles on many of the approaches currently in use at that time in the LIS community, including surveys, historical research, bibliographical research, and experimental research. Although there is no direct reference in this collection to qualitative methods as such, the collection does include an essay by Jesse Shera in which the author inscribes an inclusive circle of research in the field, avoiding the scientific language of some of his predecessors. He noted, for example, in his review of approaches to research, the value of two fields closely linked to the development of qualitative methods, cultural anthropology, and philosophy.^[6] Shera’s characterization of research as a critical examination of relevant and reliable evidence and its use in producing valid and generalizable findings is broad enough to encompass qualitative as well as quantitative approaches.

Another volume of articles on research methods in LIS appeared in 1970, consisting largely of essays by noted experts in research outside the field.^[7] Although once again qualitative research as an alternative to quantitative research was not explicitly addressed, the volume did contain articles on two methods widely used by qualitative researchers: participant observation and in-depth interviewing. Galvin’s article the same year describes the use of case studies, but passes quickly over their application in research to concentrate on their utility as instructional tools.^[8] In general, methodologists in LIS during this period continued to apply a quantitatively oriented model of research to information studies. In 1969 Herbert Goldhor, an influential theorist, researcher, and educator, wrote an introductory work whose purpose was to teach “how to do research in librarianship” (p. 2).^[9] Although Goldhor’s accounts of the general requirements of research—a well-formed hypothesis, accurate observation, attention to the validity of data collected—do not in themselves rule out qualitative approaches, his strong preference for the natural science approach is clear throughout. For example, he advocates the gathering of “evidence” (defined as accurately recorded data suitable for use with the scientific model of research), distinguishing it from “testimony” (subjective, unverifiable statements gathered under uncontrolled conditions; p. 18).^[9] a form of observation that he considers unsuitable for scientific work. The problem with this distinction is the extent to which it dismisses the sort of subjective, ill-formed data that are of great value in qualitative research.

The search for rigor in library research continued in the 1970s with a strongly worded essay by Busha and Purcell that echoed Williamson’s theme forty years earlier criticizing library researchers for engaging in too much description and bibliographical work with too little attention to generalization or theory construction.^[10] The authors propose in this article a program for library science instruction that includes a minor role for qualitative research, but focuses almost entirely on techniques that have little or no relevance to qualitative work, including formal hypothesis testing and mathematical modeling. The article also makes a very strong case for impartiality and detachment, conditions that are at least problematic from the perspective of qualitative theory. Although the authors suggest that the ideal methods textbook for information studies should present both qualitative and quantitative approaches, they recommend that “heavy emphasis” be placed on the latter (p. 12).^[10]

Several encyclopedia articles on methodology in LIS were published around this time. Busha’s 1978 essay is devoted to quantitative methods and the natural science model, particularly statistics, and contains no references to the qualitative approach.^[11] Similarly, Kaske and Rush focus almost entirely on mathematical, analytical, experimental, and statistical approaches, mentioning, of the

more qualitative approaches, only historical research. Sounding a familiar theme, the authors note that “sound research is based chiefly upon the scientific method, which provides a framework within which hypothesis testing and inferential thought may be carried out in a disciplined manner,” and suggest that because much LIS research has been unscientific, there is doubt about what has been learned.^[12] A collection of essays published in 1981 addresses many aspects of research, but, outside the recurring exception of historical work, either ignores or criticizes approaches that are favored by qualitative researchers.^[13] In his essay on error, for example, Katzer notes: “The weakest type of case is one based on the researcher’s words rather than on the researcher’s (or other researchers’) deeds. The concerns for factual accuracy and generality still need to be considered, but their justification is limited to verbal arguments of what seems to be likely or plausible.”^[14] This statement, which is accurate for research in the natural science tradition, is incompatible with and in some critical ways undermines the value of interpretive approaches to research, which depend heavily on verbal arguments.

In 1984 *Library Trends* published another collection of essays on research in information studies. Although consistent with earlier compendiums, many of the articles in this collection were not directed toward methodological issues, and when methods were addressed, the highest priority continued to be placed on the model of the natural sciences. In the introductory essay to this volume, Lynch develops a distinction between “scientific” research, which seeks to create new knowledge, and “scholarly” research, in which the data are collected from books rather than nature” (p. 369).^[15] The author goes on to suggest that the preference among humanists for the scholarly type of research in conjunction with the affinity of humanists for librarianship accounts for the field’s prejudice against scientific research in library education (p. 371).^[15] Although this argument does place what are now frequently called qualitative methods in a rather unfavorable light, the analysis is nevertheless accurate in its characterization of such methods, which have in fact frequently been inspired—and are often practiced—by humanities scholars. The approach taken in this and most previous essays on the subject—that natural science is the ideal to which research in LIS should aim—was reiterated by a number of other works published in the 1980s.^[16–19]

The preference for quantitative research models in information studies has not gone unchallenged in information studies. There are, among the methodological writings of the field, occasional statements expressing reservations about the mainstream position on research, such as Shiflett’s comment in the 1984 *Library Trends* collection that historians did not usually have the opportunity to perform statistical tests and sought to convince their readers “not by elaborate numerology” but by facts and persuasive argument,^[20] the latter phrase being of

some significance for its recognition of the role of language in scientific research. Occasionally, however, these arguments took the form of sharply worded theoretical statements that can be viewed as part of the larger debate over the identity (and even the name) of the field. Among these are Curtis Wright’s philosophically oriented discussions of library research, key to which is his explicit separation of librarianship from natural science, the exact opposite of the position taken by the mainstream methodologists of LIS, and his skepticism about the appropriateness and utility of the scientific model in the field. Characterizing librarianship as metaphysics rather than physics, and invoking the literature discrediting the positivistic philosophy (unrecognized or unacknowledged by the earlier authors) on which the scientific model is based, Wright notes that “librarians do indeed invert the world of science, because librarianship is the mirror obverse of science as a knowledge system; it is a technology of knowing based on philosophy, not a scientific technology of action.”^[21] Similarly, Michael Harris, in a review of the 1984 methods issue of *Library Trends*, criticized the identification of librarianship with natural science and expressed concern about “the extent to which this profession has systematically isolated itself from contact with significant empirical and theoretical developments in the social sciences.”^[22] Harris was explicit in his criticism of the field for its commitment to varieties of positivism that were in the process of being abandoned in other social sciences, and directed the debate toward the larger question of whether there can be a library “science” at all.^[23] Relevant in this context is Radford’s epistemological critique of the field, which does not explicitly take up the matter of research, but argues, along with Wright and Harris, that the modern conception of the library has been grounded in a positivistic commitment to neutrality and objectivity, values that have figured significantly in the methodological writing in LIS.^[24]

A small number of writers have invoked the social science literature to defend qualitative approaches to knowledge. Several have voiced the need for a broader range of methods in information studies and for research designs that do not in principle reject particular approaches but rather attempt to fit the tool to the task.^[25–27] Others have argued for the use of interpretive methods based on principles derived from hermeneutics and the “human sciences.”^[28,29] In recent years, rising interest in the qualitative approach has produced extended works examining the application of these methods in LIS.^[30–32]

Taken as a whole, this corpus of methodological literature, with some notable and mostly recent exceptions, clearly takes the model of quantitative techniques and the natural sciences to be the best (and in some cases the only) method for use in information studies. It is important to acknowledge the significance and historical purpose of this work, which has not only helped to improve the rigor and the generalizability of LIS research, but has served the

function of encouraging a field rooted in practice to take up a more research-oriented, theoretically driven professional posture, a movement that has helped to increase its credibility among scholars in other fields. This literature reveals very little awareness of qualitative methods, however, and the articulation of a research program that draws on qualitative, interpretive, and naturalistic approaches to research has yet to occur. This is of some interest, since these methods have been practiced for decades in other social sciences, in which lively and productive debates over methodology are commonplace. The remainder of this article briefly surveys some of the principles on which qualitative research is based and discusses the associated techniques that have proved useful in information studies.

THE PRINCIPLES OF QUALITATIVE RESEARCH

Although it is possible to generate data by applying the techniques of social science research without reference to the philosophical principles on which those techniques are based, it is difficult for researchers to build useful theory out of those data without some understanding of those principles. Research is not so much a matter of gathering up data that already exist, but a process of making successive observations and inferences during which data are not merely gathered but in some sense created according to the theoretical assumptions that drive the researcher's approach. As the authors of a recent methodological essay have pointed out, "The various happenings, objects and people of the world are not data until made relevant within a framework which constitutes them as evidential materials for some purpose."^[33] This in turn suggests that to gain an effective command of a research method is more than just mastering certain skills and tools, but also entails cultivating an understanding of the epistemological implications that drive them. There is no canonical list of the theoretical propositions on which qualitative research is based, but the paragraphs that follow summarize some of the more significant ones evident in the qualitative research of the social sciences.

Most methodologists, whatever their orientation, would agree that *empiricism*, the principle that knowledge is based on observations of the world rather than the imagination, is fundamental to any kind of scientific research. Although Williamson, as noted above, accused librarians of harboring an "empirical tendency" that was an impediment to doing useful research, it is clear that there can be no research in the usual sense of the term without the use of the senses. Quantitative and qualitative researchers differ, however, on the role of the observer. The former tend to argue that scientific observations of the world must be achieved with minimal personal involvement, and lean toward the positivistic position that the most secure form of knowledge is produced by observations that can be

verified by any observer. From this perspective, the researcher is a data-gathering instrument. Qualitatively oriented researchers, on the other hand, without sacrificing their scientific goals, find it not only difficult but a source of error to overlook the interpretive role of the observer. This view is a result of the recognition by qualitative researchers of the role of the knowing subject, a concept that can be traced in the philosophical literature to Kant's break with Cartesian dualism, particularly as articulated in the work of philosophers such as Wilhelm Dilthey and Alfred Schütz. Qualitative researchers, nevertheless, do not believe that their recognition of the role of the observer undermines the claims of qualitative research to being empirical or even scientific, and include in their methods a commitment to basic principles such as validity, reliability, falsifiability, and the proper use of inductive thinking. The key difference is that the researcher is taken to be an interpretive rather than merely a recording instrument. At the risk of oversimplification, one might even say that quantitative research tends to seek to repress the subjective, while qualitative research accepts and even exploits it.

Qualitative research is often associated with *naturalism*, which in this context refers to the avoidance of abstract or reductionist forms of data collecting and analysis and the construction of any explanatory apparatus that is at odds with the subjects' own experience of the phenomena under study.^[34,35] Naturalistic researchers thus tend to focus on the ongoing multidimensional character of the social world, an approach that tends to increase the proximity of researchers to their subjects, and to report their understandings of this world in ways that respect its irreducibility. Practitioners of the naturalistic approach are generally more interesting in discovery and insight than in establishing laws through formal hypothesis testing (although what is discovered may later be confirmed using quantitative procedures), and tend to seek understanding of phenomena in a way that reflects their interrelatedness and complexity. Thus, observation in naturalistic research sometimes takes the form of complex, detailed descriptions rather than the isolation of discrete variables. One particularly interesting feature of naturalistic research is its tolerance of ambiguity and incompleteness. Quantitative approaches are frequently designed to reduce ambiguity by focusing exclusively on those observations that can be objectively confirmed. Qualitative research recognizes complications that call confirmability into question, including politics (people involved in competition over power don't always say everything that they know) and the subconscious (people don't always say everything that is true, whatever they may happen to believe), and looks for ways to operate within these constraints.

Many forms of qualitative research are based on the principles of *constructivism*, a term that refers to the social processes by which humans create a meaningful world. A

central assumption of this approach is that meaning (such as the utility of an information source for a user, the relevance of a fact to a need, or the cultural role of a library) is not an inherent attribute or phenomenon, but is continuously created and recreated by the human participants in that world. Qualitative, interpretive methods provide the tools for understanding and explaining this process. A landmark account of this way of examining the social world is Berger and Luckman's *The Social Construction of Reality*,^[36] a work that has had a major influence on social science research in many disciplines. Constructivism places a great deal of emphasis on the observer and on the process of interpretation. From the perspective of information studies, constructivism is concerned with the processes by which knowledge is made and how it is identified as knowledge. Social studies of science, which examine the details of the settings in which scientific knowledge is created, fall into this category.^[37] Recent applications of constructionist theory in educational evaluation, a subdiscipline that is of particular relevance to LIS, have been explored by Guba and Lincoln.^[38]

One form of constructivist research is *symbolic interactionism*, a term that is applicable both to a theoretical approach as well as to a collection of research techniques. Chief among its philosophical founders is George Herbert Mead.^[39] According to Herbert Blumer, a sociologist who has given Mead's theory methodological form, the three principles of symbolic interactionism are first, that humans act toward the things of the world on the basis of the meanings those things have for them; second, that meaning is derived from social interaction; and third, that meanings are managed through an ongoing interpretive process.^[40] Understanding social reality from the perspective of symbolic interactionism thus requires not just the gathering of objective data, but the negotiation of a complex network of the processes through which meaning is constructed.^[41]

Central to both constructivism and interactionism is the principle of the interconnectedness of social phenomena. One of the concerns that qualitative researchers tend to have about formal data-gathering instruments such as surveys forms, particularly when used alone, is that they are too effective in filtering out the surrounding social environment. Qualitative research is often designed more to explore the relationships between the phenomenon under investigation and its entire environment than to decompose a research question into parts, an approach sometimes referred to as *holism*. Diesing describes the concept as follows: "The holist standpoint includes the belief that human systems tend to develop a characteristic wholeness or integrity. They are not simply a loose collection of traits or wants or reflexes or variables of any sort: they have a unity that manifests itself in nearly every part" (p. 137).^[42] Moreover, the concepts used to capture this holistic quality must be relatively concrete and particularized, close to the

real system being described, rather than abstract mathematical concepts developed in some other science and imposed on the subject matter a priori or concepts that grow out of a testing instrument and get their meaning from the instrument. As many of the concepts as possible should be derived from the subject matter itself, from the thinking of the people being studied; and the other concepts should at least not be foreign to their way of thinking (p. 139).^[42]

Qualitative researchers, whatever their particular research goals or techniques, are usually interested in the meaning of natural human contexts in this holistic sense, which requires attention to more than just the object under examination. This has important methodological ramifications for the qualitative researcher, favoring an "immersion" approach in which the observer is present in the research setting for extended periods of time, a labor-intensive but data-rich way to discover the multiple dimensions of the subject under study that would drop out of many more formalistic, quantitative approaches.

Another way to characterize qualitative research is to say that it emphasizes *discovery* over explanation. This approach to research problems has yet to be broadly practiced in information studies, which historically have tended to focus on the problems of causality, prediction, and control. Pierce Butler, for example, in a discussion of scientific research, noted that "so far as they are possible, explanations will be formulated in chains of immediate causes."^[4] Qualitative methods do not lend themselves easily to these sorts of research goals, but are grounded in the recognition that for symbol-making human beings, "causes" often take the form of articulations of meaning rather than objective accounts of sequences of events (pp. 140–142).^[34] It is not immediate causes that interest qualitative researchers, but frameworks of significance.

The recognition of the significance of subjectivity and contextuality in the human sciences leads to the twin issues of *relativism* and *pluralism*. Relativism refers to the principle that the standards of what passes for truth are not the same in every human community and therefore that each community must be understood in its own terms, while pluralism in the corresponding recognition that the social world cannot be reduced to a single paradigm or system of explanations. These principles have implications not only for the understanding of how people view their own environments and experiences, but also how researchers view those people as subjects of research. Most important, they suggest that the scientific observer's role, particularly in the human sciences, is never purely objective, but is conditioned by values and expectations. The unity of knowledge as a total, well-integrated system that is posited by natural science is not feasible according to this view. It follows that if knowledge has pluralistic aspects then the methods use to produce it must be equally diverse.

In this vein, some theorists have taken as a subject of analysis science itself and identified the possibility of multiple forms of scientific knowledge, distinguishing, for

example, traditional science from a “feminist” science.^[43,44] A pluralistic view of knowledge necessarily admits natural science, but does not necessarily accord it a privileged position.

The key to accommodation among paradigms is rejection of the “queen science” viewpoint that philosophical first principles must determine methodology. Once one begins to look at what researchers do, the walls between paradigms start to break down. In practice, researchers use a variety of imperfect approaches to enhance the credibility of their arguments that require complex trade-offs among precision, generalization, and existential reality.^[45]

This assertion, that there are no clear standards against which to measure knowledge, is possibly one of the most disturbing and challenging aspects of the interpretivist approach to research, but it has the advantage of accommodating a wide range of research practices, a situation of considerable benefit to a multidisciplinary field such as library and information studies.

Another problematic aspect of qualitative research is its accommodation of *subjectivity*, a concept with two linked aspects: the subjectivity of the targets of research and the subjectivity of the researcher. The first refers to the recognition that those persons whose behavior social science attempts to understand and explain possess a subjectively constructed view of the world that may not only be concealed from the scientific observer but also may not be easily articulated even by those who possess it. Human behavior is a complexity that is highly resistant to being untangled by outsiders in a way that accurately reflects its meaning for insiders. While this may not be a serious problem when the subjects of the investigation are members of the researchers’ own culture (often the case in information studies), it can lead to invalid results if the researcher and subject do not share common assumptions and the researcher’s methods are poorly chosen. Some of the most interesting methodological solutions to this problem have been devised by anthropologists, who more than any other social scientists face the challenge of comprehending world views radically different from their own and who have developed ethnographic tools to achieve this goal. But it is clear that similar difficulties are present even when the subjects of research are not members of other cultures. For example, concerns about possible disjunctions between the assumptions of information professionals and their users is a significant issue in information studies, and the application of qualitative approaches to observation and analysis opens the way for new strategies for developing more responsive and effective information systems. Well known among the research addressing this problem is Dervin’s approach to the problem of user needs, which takes into account the users’ own environment and their subjective adaptation to it.^[46–48]

The second key aspect of the subjectivity question focuses on the subjective role of the observer, which can be managed in qualitative research but in principle never

neutralized. The principles of constructivism and relativism mean that no human observer can be wholly detached from the research setting, and many qualitative approaches to social research recognize this condition. Research performed under the constraints of subjectivism can be viewed as an attempt to link the perceptions of the observer and the observed by achieving some degree of common understanding, not always an easy task. Norman Denzin has noted that “being a scientist reflects a continual attempt to lift one’s own idiosyncratic experiences to the level of the consensual and the shared meaning. It is in this context that the research method becomes the major means of acting on the symbolic environment and making those actions consensual in the broader community of sociologists” (p. 12).^[49] The use of participant observation, for example, provides an opportunity for researchers to experience firsthand the phenomena under investigation from a perspective similar to the other actors, an approach that forces recognition of the observer’s own role in the research setting. A notable example is Janice Radaway’s ethnographic study of women who read romance novels, a work that concentrates not on the texts themselves but on the meaning they have for their readers. As the author notes, the construction of meaning in this project involved the observer as well as the observed: “It is essential to point out here that in formulating a hypothesis about the significance of romance reading as an act, that hypothesis inevitably will be a critic’s construction of the reader’s construction of the import of her reading behavior.”^[50]

This characterization of social behavior contrasts with quantitative approaches that make an attempt to isolate certain unwanted forms of meaning, which are sometimes described as bias, from other forms that are described as fact. Qualitative theory does not accept so quickly the characterization of bias as “noise” that must be eliminated; rather, it recognizes that all observations are biased in the sense that they reflect the observer’s intentions and ways of knowing and are inevitably accompanied by unstated assumptions. The task is not to eliminate bias, but to examine it and determine the degree to which it can be controlled. Linked to the issue of the researcher’s subjectivity are questions regarding the truth value of published research results. Qualitative research reports are sometimes essentially first-person descriptive reports of these experiences, a situation that has led to considerable debate over the role of the researcher’s own narrative voice in social science reporting.^[51,52] Acknowledging one’s limitations as an observer, of course, has its risks. It would be a mistake to equate the limitations on the role of the observer with a complete lack of objectivity, and successful qualitative research still requires that the observer maintain a certain balance between detached analysis on the one hand and sympathetic participation on the other, so as to avoid, for example, the dangers of interpreting events as more patterned than they actually are or “going

native” by becoming completely absorbed by the setting and losing the analytic perspective of the researcher.

An interesting and important result of the acknowledgment of observer subjectivity in qualitative research is a heightened sensitivity to issues of *values* and *ethics*. To recognize that the researcher is also an actor is the research setting may raise serious moral and political issues.^[53,54] Qualitative researchers, because of the involving nature of their work, frequently find themselves handling privileged information, falling into moral dilemmas, gaining knowledge of immoral or even illegal acts, becoming entangled in power conflicts, and in other ways being forced out of their roles as neutral observers. Qualitative researchers also face ethical questions when they presume to speak for silent or powerless individuals, particularly when those expressions have the power to influence others’ lives positively or negatively. It is but a short step from a researcher’s acknowledgment that social research cannot be value-free (as natural science has sometimes claimed to be), to the adoption of an activist approach to research whose goal is not merely knowledge, but social change. The perspectives of the “critical theorists,” inspired by the work of writers such as Theodore Adorno, Herbert Marcuse, and Michel Foucault, have drawn the attention of qualitative researchers to these issues.^[55] Recognition of the role of libraries as agents for social change has a lengthy history in LIS, and although this aspect of the field has not inspired a large number of research efforts, there have been attempts to develop these ideas in the LIS literature. Examples include Berman’s revealing juxtaposition of Library of Congress subject headings with facts and commentaries from a variety of other sources, exposing the value-laden nature of the former.^[56] Buschman and Carbone’s application of new theories of education to LIS,^[57] and Frohmann’s critique of the limitations of the “cognitive viewpoint” in LIS.^[58]

METHODS AND TOOLS

As noted above, although a primary purpose of research is to gather data, it is clear that research is more than “fact finding.” No observation, whether recorded as words, numbers, images, or something else, is inherently “factual,” nor do data occur naturally, but rather are the product of observations, which are themselves conditioned by theory. In this sense constructionist principles apply not only to the objects of research, but to the research process as well. Neither theory without data nor data without theory can lay a claim to being research. The process of moving from theory to data is a difficult one, and it is in this relationship that the essence of qualitative research lies. Quantitative researchers use the term *operationalize* to describe the process by which a hypothesis or research question is embodied by some form of data, and

qualitative researchers must pass through a similar stage. This section contains descriptions of some of the higher-level methodological approaches that are used to realize the theoretical goals of qualitative research. Details on the numerous tools and techniques that are appropriate to each of these approaches are described in the handbooks listed in the bibliography at the end of this article.

The *historical* approach to the analysis of human society and culture is sometimes overlooked as a member of the family of qualitative approaches to research, but it is one that embodies many of the attributes described above, and has the added distinction of being used continuously in information studies longer than any other qualitative approach.^[59] Although not every form of historical writing can be considered qualitative, or even research in the social scientific sense, the data-gathering and analytical processes used by historians share a number of important features with other forms of qualitative work, with the close examination of documentary evidence taking the place of direct observation of the social world.^[60] One might argue that some forms of historical writing are examples of ethnographic analysis practiced in remote time frames. Included in this category are biographical works that seek an understanding of the history of libraries and information systems by examining the life and work of individuals who have played pivotal roles in their development, the historical equivalent of the life history method that is widely used in anthropology.

The task of historians is to overcome the analytical limitations of examining phenomena through indirect means. Most forms of qualitative work, however, are designed to avoid having to resort to indirect measurements of human behavior and instead place the researcher as close as possible to the events under examination. These practices are often referred to collectively as *ethnographic* methods. Many entail some form of *participant observation*, in which the researcher, rather than taking up the position of a detached observer, makes an effort to take part in the phenomena under investigation, and in doing so is in a position to perceive complexities of the setting that might otherwise escape attention. “Participation” might be as simple as a series of informal discussions with a subject or as complex as an extended period of full-time residence in the community under examination. Being able to interact with the research subjects in a continuous way, to observe directly the complexities and uniqueness of individual behavior, and to follow the patterns of changing events, are all benefits of this approach. Perhaps most important, participant observation makes it possible to gather data on the subtle and unpredictable events of normal human environment. To give a simple example, the author of this article was sitting in a meeting of librarians, listening to a serious discussion of proposed changes to the library’s mission statement, when one of the staff members passed over a scrap of paper on which were written the words “You’ll note a certain ‘Alice in

Wonderland' character to these discussions." This impromptu act, small as it was, revealed aspects of the organization's culture that staff had not up to that point articulated in more formal interview settings. In a similar way, Forsythe used participant observation to study the work of knowledge engineers, achieving an understanding of their perception of human knowledge and how this perception dramatized the contrast between belief and practice that might have otherwise remain concealed.^[61]

Engaging in ethnographic work and participant observation does entail certain trade-offs. Although these methods are capable of producing richly detailed, highly accurate depictions of social phenomena, they possess certain disadvantages. One is that they tend to generate massive amounts of data, which may include extensive field notes, charts and tables, photographs, transcribed recordings, documents, artifacts, and even quantitative data sets. The higher the volume of data, the more complex the analysis and the greater the time and effort required to move from the planning stages of a research project to the finished report. Qualitative researchers have found their work more difficult than the tasks typically associated with quantitative research to the extent that they have not had the same efficient tools for data processing that are available to quantitative researchers (although the availability of new computer tools for organizing and analyzing qualitative data is changing that). A second class of disadvantages is a consequence of the highly contextualized level at which qualitative research tends to occur. The findings of ethnographic field studies, for example, do not lead as easily to predictive models of behavior, and are not as easily generalized beyond the setting in which they were produced. Moreover, ethnographic approaches can place greater personal stress on the researcher, resulting from difficulties in entering into and maintaining relationships in an unfamiliar social environment.

Compared to the work produced in sociology, anthropology, and education, LIS has not produced large numbers of ethnographic studies. One effort worthy of mention is the High John project, an ambitious experiment in which library students from the University of Maryland collaboratively developed and staffed a public library in an economically disadvantaged minority community.^[62] Although this project had more to do with library development and education than research, it possessed many of the attributes of ethnographic field work (extended participatory involvement in an unfamiliar community, close attention to process, a case-study concentration on a single setting), and serves as an indicator of the kinds of opportunities that exist for field-oriented studies in LIS. Examples of the use of ethnographic research methods in information studies are Chatman's study of the information needs and practices of elderly women^[63] and Tanner's account of the role of ministers as information providers.^[64] Another ethnographic study relevant to the concerns of LIS is Heath's field-based comparative

analysis of speech, reading, and writing in socioeconomically contrasting communities.^[65] Heath's work is just one example of an expanding body of work that examines the sociocultural aspects of reading.^[66] Zuboff's study of the role of information technology in a changing workplace is another useful implementation of ethnographic methods.^[67] The rapidly developing area of the sociology of science has also produced ethnographic studies that provide insights into the ways that scientists produce knowledge and the social dynamics of the writing and publishing process.^[68,37]

Field-based ethnographic research is the classic form of qualitative research, but it is not as much of a "method" as it is a setting in which a wide variety of particular methods might be employed. One of the most common ethnographic tools is *interviewing*, a technique based in large part on conversation, arguably the most natural of all forms of human communication. The subject of interviewing, which is addressed in nearly every handbook of qualitative methods, has long been recognized in sociology for its ability to generate the kind of data that are useful to qualitative analysis.^[69] For researchers unable to actually live or work as participant observers in the community under study, interviewing is one of the most effective ways of collecting qualitative data. Interviewing takes many forms; it may be more or less structured, brief or extended, individual or group-oriented. Researchers may confine their attention to a single cooperative informant, or they may employ sampling procedures to interview a large number of people. Within an interview, the researcher may engage in a variety of tasks: establish rapport in the community, collect life-history accounts, administer open-ended surveys, probe for explanations to questions raised by other aspects of the research process, or conduct psychological tests. Interviewing may be employed, in fact, as a high-yield method for collecting closed-response survey data, and used as such is not really a qualitative method at all. Often in interviewing it is important to gather the subject's responses verbatim, which requires either very careful note taking or recording. This not only facilitates later analysis, but it protects researchers from their tendency to project meaning unintended by the speaker when recording the events in the form of field notes. A disadvantage of interviewing is that it is not entirely a natural setting, and the subjects' awareness of the interviewer's role and purposes may lead them to modify what they say, but this problem can be compensated for by interviewing a large number of subjects, or the same subject a large number of times.

Much qualitative research is based on the *case-study* model, the basis of which is an in-depth understanding of a single event or setting. Typically, in case-study analysis, "the emphasis is on the individuality or uniqueness of the system, its wholeness or boundedness, and the ways it maintains its individuality" (p. 5).^[42] Detailed case studies have limited use in quantitative approaches in which the

goal is the identification of regularities over multiple cases, but they are ideally suited to the goals of qualitative work, in which the recording of contextual detail is a high priority and the researcher can focus on what Denzin calls the “situated aspects” of human conduct (p. 10).^[49] Case studies are often narrative in their final form, but they may be constructed using a variety of data types, a strategy that increases the richness and also the validity of the study. Cases may be reported individually, but gain value when they are juxtaposed with additional similar cases, yielding a comparative case study capable of highlighting not only what is unique about each case, but what they have in common.^[70] In LIS the case method has been used productively in the longitudinal analysis of attitudes and behaviors of information system users, incorporating participant journals and logs, interviews, observational analysis, relevance judgments, and citation analysis, and combining all the elements in a detailed contextual account of the user’s experience.^[71,72]

Qualitative approaches to research tend to be less regularized and structured than quantitative approaches. It would be difficult in fact to demonstrate that qualitative research constituted a particular “system” or set of linked procedures, a characteristic that makes qualitative methods difficult to master. Methodologists, however have succeeded in developing qualitative research approaches that have a certain systematic character. One that has been widely studied and applied is the *grounded theory* approach, as articulated by Glazer and Strauss.^[73,74] The principal purpose of this method is the inductive generation of theory from data through a disciplined application of observation and interpretation. The developers of this approach note that theory is said to be properly grounded when it fits the data used to generate it, is understandable to both the researcher and the subjects of the research, remains abstract enough that it can be usefully applied in other settings, and offers the researcher sufficient tools to exercise some control over its application in subsequent situations (pp. 237–249).^[73] Grounded theory is more than an interesting intellectual construct; it is a practical tool for building useful knowledge about social settings. Its focus on utility and application makes it well suited to a professional field such as LIS, where it has seen some use in recent years.^[75,76]

Another systematic qualitative approach is *ethnomethodology*, which can be briefly described as the study of commonplace behaviors in natural contexts, with particular emphasis on how individuals organize and make sense of their environments.^[77,78] Ethnomethodology is inspired by phenomenological philosophy, which takes up the question of the semantic organization of the social world and is also closely linked to the principles of constructivism. Of particular interest to ethnomethodologists is the use of language, especially the forms of speech that ethnomethodologists call “indexical expressions,” utterances whose meaning cannot be determined apart from the

context of their use. Paying attention to what people normally take for granted, asking how it is that those commonplace perceptions are created, and investigating the procedures by which these meanings are conveyed is the work of ethnomethodology. This approach seeks not only to account for humans’ understanding of their social environments, but also social processes by which that understanding is negotiated and maintained. Ethnomethodological approaches have been applied to several problems in information studies. Relevant to the field of user studies, for example, is Whalen and Zimmerman’s analysis of telephone requests to dispatchers of emergency assistance, a study that elucidates how callers use their knowledge of the conversational situation and how they make their purposes evident.^[79] An influential study with ethnomethodological components is Suchman’s exploration of the complex ways that humans react to machines. A principal theme of this work is to demonstrate that insofar as actions are always situated in particular social and physical circumstances the situation is crucial to the actor’s interpretation.”^[80] This understanding has important theoretical implications for sociologists, but it also has practical consequences for the designers of information systems, who must learn to anticipate the complex and not always predictable ways that users respond to the tools that they use.

As some of these examples have already suggested, there is no form of data more important in qualitative research than language, and the methods used in qualitative work are often designed to elicit, organize, process, and analyze both written and spoken language. Working with words poses certain problems not encountered with numbers, however. Their meaning is in part a consequence of the context in which they appear and changes over time. They are difficult to record and process, and they possess an interpretive openness that complicates analysis. As noted above, quantitative methodologists have on occasion looked for ways to avoid the entanglements of interpretive language altogether, considering it a contaminating force in scientific research, but for qualitative theorists, the role of language in structuring human experience is an essential feature of the research setting, which neither the subjects of research nor the researchers themselves can avoid. Clearly this raises many problems in analyzing linguistic data collected from informants, but those problems also extend to the researcher’s own use of words in reporting the results of research. This is a pattern that holds true, qualitative theorists are eager to point out, even for positivistically oriented researchers. For example, in a critique of the quantitative orthodoxy of economics, Donald McCloskey defends the role of words: “If science is to cohere it must use the art of argument; and if it is to be agreed upon by free people it must be argued persuasively. In English the words ‘science’ and ‘rhetoric’ quarrel childishly.”^[81] An interesting body of literature on the rhetorical character of science that is of particular

relevance to LIS are sociological studies of the verbal strategies employed by scientists in reporting their work.^[82]

One class of useful qualitative research techniques that draw on the centrality of language view human settings as “texts” that observers may examine in order to extract their meaning and come to an understanding of the processes that drive them. Semiotics, for example, the study of signs and their significance, is a branch of linguistics that has been widely applied as a research tool in many disciplines, including communications, anthropology, and literary criticism. Warner has suggested incorporating semiotics into LIS as a way to extend the dimensions of the latter field beyond its customary alignment with the physical sciences and technology.^[83] Other examples of the use of literary studies in LIS are those that draw on the characteristically human tendency to organize experience as narrative or story. One example is Urquhart and Crane’s use of narrative vignettes drawn from the professional literature as a way to elicit in a realistic way data about the information skills of nurses.^[84] A similar strategy is the use of protocol analysis by the builders of expert systems as a method of capturing the elusive knowledge of human experts. This technique involves asking subjects to perform a task while simultaneously producing a narrative account of that task, which can then be used to derive formalized accounts of that knowledge.^[85,86] Another study in which language plays a key role is Myer’s contextual analysis of scientists’ progressive revisions of patent applications, examining the social conditions that affect the articulation of new knowledge.^[87] Also attracting some interest in information studies is “reader-response criticism,” a type of literary analysis based on the proposition that the meaning of a text resides not in the words, but in the reader’s reaction to those words.^[88] Radaway’s study of romance readers is one notable contribution to this literature.^[50] Such studies, when used to determine the effect of literature on various communities of readers, are tools that can be used by libraries to help solve the always difficult task of understanding what their communities want, and has practical consequences for collection development.

CONCLUSION

This article, although brief has traversed a rather wide range of territory. Even as a special topic within the social sciences, qualitative methods lacks distinct boundaries, and any discussion that attempts to summarize this approach runs the risk of granting to the topic a false degree of concreteness. In that regard it is useful to conclude with two related points of a cautionary nature. The first is to clarify that it is not the purpose of this article to impose an authoritarian or prescriptive character to the subject of qualitative methods, but to present a

representative range of issues and techniques. This is in keeping with the spirit of the qualitative approach, which is useful in complex or rapidly changing settings precisely because of its open-ended and adaptable nature. It is unlikely, in fact, that any abstract analysis can really do justice to the topic. Although for reasons already stated this article has taken a somewhat theoretical approach, neither this nor any other similar treatment of the subject is more effective in conveying the essence of the qualitative approach to students of method than a patient examination of the published research literature, and readers interested in learning to use these tools are encouraged to seek out the best examples of qualitative research, not just in LIS but in related fields as well. By extension, just as reading about the principles of research cannot replace reading actual research reports, reading published reports cannot take the place of firsthand field experience. To apply the tools of qualitative research to real research questions and to struggle with the problems of data collecting and analysis using qualitative paradigms is one of the most effective ways of coming to terms with their utility and significance.

The second (and related) point is that any set of research tools must ultimately be measured by the effectiveness of those tools in producing the kinds of understanding that significantly advance the field of study in which they are used. Reflective methodologists are familiar with the danger that a particular set of research tools, once widely used, may become entrenched, and rather than serving the cause of creating new knowledge, may come to dominate it by limiting the kinds of questions that are asked and the kinds of answers that are judged acceptable. According to Abraham Kaplan, who named this condition “the law of the instrument,” what is objectionable about this situation “is not that some techniques are pushed to the utmost, but that others, in consequence, are denied the name of science” (p. 29).^[2] One of the main contributions of qualitative research methods to information studies is their role in increasing the variety of the contents of the researcher’s toolkit, and consequently in expanding the range of what can be learned. This is of particular significance in a field as diverse and rapidly changing as LIS.

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Rare Book Collections

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Abstract

This entry presents a history and definition of rare book collections, as well as a description of how they are formed and maintained. There are two major responsibilities that rare book librarians face in their role as stewards of these collections: collections must be made available for use, and at the same time, care must be taken to ensure that delicate, and often unique, materials are preserved to ensure their availability in the future as well.

INTRODUCTION

The identification of rare books as such and their segregation as distinct parts of general library collections are relatively recent phenomena. The origins of modern rare book collections are largely to be found in the eighteenth and nineteenth centuries, a time when book collecting came into its own as a private endeavor and when the antiquarian book trade developed to meet the needs of those private collectors and to create new demand for rare books. This led to an increased awareness of rare books as a separate entity within the general world of books and manuscripts, although certain book rarities had long been considered worthy of collecting. Incunabula—books printed in the period from the appearance of movable metal type (ca. 1455) until the end of the year 1500—were highly sought by collectors, as were other books and manuscripts whose age and other factors made them significant. Although the existence of collections of books had been in place for centuries in institutional settings, these were not rare book collections per se.

The earliest interest in establishing collections of rare books (i.e., books collected for their rarity) came primarily from individuals and particularly those individuals whose wealth and/or social standing made it possible for them to devote time and funds to such an activity and to relish the intellectual cachet that a fine collection provided. At the same time that the overall awareness of rare books was increasing, the identification of significant volumes, worthy of being collected, was made easier by the rise of modern scholarship and the modern system of academic training. These worked to create a body of knowledge of what constituted the key works in most fields of study, many of which fell into the category of rare books. In addition, research, which had long been recognized as a part of scientific work, came to be accepted as a necessary component of study in other fields as well. To support this

research, viable collections of source materials needed to exist, and again it was rare books and manuscripts that offered some of the best resources.

On the institutional level, the movement to segregate rare books and manuscripts into distinct collections, or even into separate libraries, developed most strongly in the United States, coming somewhat later to Europe and other areas. Perhaps this was because the age of the libraries involved was a major factor in the ease with which the segregation of these materials could take place. In Europe, for example, where many libraries had been developing their collections for hundreds of years, older volumes and volumes that were considered “significant,” tended to have long been incorporated into general collections. Identifying them, locating them, and physically moving them was no easy task. In the United States, with so many collections being started and so many libraries being organized—particularly in the nineteenth century—it was easier to identify and segregate the rare materials where they were present or to work with the newly active antiquarian book trade to purchase works specifically to establish or expand a rare book collection; this was true particularly in academic settings, where such collections came to be seen as an important adjunct to the educational mission of the parent institution.

It was also in the United States that the term “special collections” first came into use to describe a particular type of institutional collection. This term has always suffered from an imprecision of meaning, a problem that is compounded by the fact that its definition has evolved over the years. Originally, a special collection was simply one that had a specific subject focus and was, thereby, “specialized.” This topical focus remained important, although additional factors came into play over the years, such as the depth of the collection and the extent to which it included what might be considered the primary source materials within its given topic. Rare books would often

be part of such collections, but the collections included much else as well. Additional formats might include, for example, photographs, ephemera, manuscripts, prints, drawings, and various forms of realia. To add to the confusion, the term “special collection” is, at times, used synonymously with the term “rare book collection,” or they are used jointly, as in “rare books and special collections.” Generally speaking, all rare book collections are special collections, but the converse is not true. That is, not all special collections are rare book collections. In all cases, the two—rare book collections and other special collections—form a complementary whole as a resource for scholarship and as a section of the library’s collections that, compared with general library collections, is treated in a special manner for such standard library practices as acquisition, cataloging, processing, storage, security, conservation/preservation, and use.

WHAT CONSTITUTES A RARE BOOK?

In its purest sense, the word “rare” means existing in limited numbers, and this is certainly true of rare books as well. But although the number of copies of a particular book may be one factor in determining if it qualifies as rare, it is certainly not the only factor, and, indeed, it is probably not the most important one. The determination of whether a book qualifies as rare (i.e., whether it merits placement in a collection of rare books) is, in some ways, one of the purest applications of the law of supply and demand. Not only should there be a relatively small number of copies of a work, but it should be in high demand as well. As noted bibliographer A.W. Pollard wrote in his entry on “book-collecting” in the famed 11th edition of *The Encyclopædia Britannica*, “. . .the rarity of a book devoid of interest is a matter of no concern.”^[1] The demand for a particular book, then, is determined by the level of interest or desirability it engenders, and that, in turn, is determined by numerous factors.

Laypeople often think that age alone makes a book desirable, and therefore rare, but this is not the case. Many fine press books of the twentieth century are considerably more desirable than are certain books of earlier centuries. Whatever their age, early editions of important works are generally considered desirable, as are works that brought to the world new discoveries and new ways of looking at things, whether geographic, philosophic, economic, scientific, or artistic. Illustrations can often affect the desirability of a book, particularly if they are early examples of a specific technique, if they are especially fine in quality, or if they were done by a noted artist. Controversial works tend to be desirable and are often to be found in small numbers if they were the subject of censorship when they were first issued. Even the place of publication of a particular work can affect its desirability. Early examples of imprints from a particular location tend to be sought,

although if the location is of relative unimportance, the desirability of its early imprints is likely to be only local. There are times when factors other than those intrinsic in the book itself have a great effect on its desirability. Provenance, for example, is a major factor. Books that were owned by famous people or were demonstrably parts of famous private collections have an increased cachet. Related to provenance are books containing notes or marginalia by famous people, particularly if they are commenting on a controversial or significant work. Presentation copies (i.e., books that have been presented to someone by the author and bear the author’s signature) are desirable, the more so if the author is particularly famous, if the book is noteworthy, or if the person to whom it was presented is prominent. Many other factors go into determining desirability as well, including special bindings, limited editions or special printings, and, of course, the condition of the book. Clearly, there is more to determining if a book is rare than simply the number of copies that exist.

Because the determination of rarity involves the application of the law of supply and demand, it is not surprising that the monetary value of a book also plays a part in the decision whether to segregate it in a rare book collection. Here, however, we must tread carefully. Value is less a factor in determining a book’s desirability than it is the product of that desirability coupled with the number of copies available. Still, because the value of a book is generally influenced directly by the aforementioned factors, value is often used as one of the primary guidelines in determining what books will be segregated. This can lead to difficulties as prices for mainstream books continue to rise. Although particularly expensive mainstream books may need to be segregated in some way to make them more secure, they are not necessarily rare and do not necessarily merit inclusion in a rare book collection. In addition, it is not unusual for all books of a certain age (e.g., eighteenth century or earlier) to be segregated into rare book collections, whether they have a monetary value commensurate with other materials deemed rare. Because there are no hard-and-fast rules about what should or should not be segregated and because “local” considerations often come into play, what is deemed to constitute a rare book in one collection may not be deemed so in another.

Whatever factors are used to determine whether a book should be segregated into a rare book collection, the fact remains that this determination is not a one-time event; it must be an ongoing process. Changing tastes and changing demand lead to a constant shift in what is considered rare. Occasionally, works previously considered rare are no longer thought to be so, having, perhaps, been discredited in some way or having been added to the rare book collection in error. Far more common, however, is for works previously considered mainstream to be shifted into the category of rare books. New subjects become popular for

collectors, making previously unsought volumes more desirable, thereby increasing their value and making it more likely that they should be segregated. Because much of the decision making on segregating rare volumes is done on the basis of hindsight (i.e., identifying volumes that have already been deemed rare) the greatest challenge comes in recognizing what will constitute the next generation of rare books. This is a difficult—some would say impossible—task.

WHERE ARE RARE BOOK COLLECTIONS FOUND?

Generally speaking, rare book collections exist either as private collections owned by individuals or as institutional collections (or departments within institutional collections) in a variety of settings. Within these settings, collections of rare books can be of almost any extent, depending on the size and scope of the parent institution, the means through which the rare books were originally acquired (i.e., through purchase or as the result of the donation of a large discrete collection), and whether there is in place a program for the ongoing expansion of the rare book collection. Among the institutions in which significant rare book collections are likely to be found are national libraries, university libraries, public libraries, museum libraries, the libraries of learned societies, occasional special libraries, and independent research libraries.

National libraries invariably will have some form of rare book collection, as well as other special collections, generally quite large and with a depth that makes them of great importance as research collections. Not infrequently, significant parts of these rare book collections originated in the donation of important private collections. The British Library (<http://www.bl.uk>), for example, has been the recipient of numerous fine collections, including those of both King George II and King George III. The National Széchényi Library of Hungary (<http://www.oszk.hu/eng>), takes its name from the fact that it was founded with the collections of Count Ferenc Széchényi, and in the United States, the Library of Congress (<http://www.loc.gov>), was reformed after its destruction in the War of 1812, with the personal collection of Thomas Jefferson. Many more examples exist.

Colleges and universities have traditionally been the sites of a broad variety of special collections, including rare book collections, in part because they exist to promote scholarship and learning but also because they are the natural beneficiaries of the largesse of alumni collectors. Major rare book collections are to be found in most great universities, although occasionally these are actually independent research libraries that are affiliated with the university. Some of the most important rare book collections in the United States (and elsewhere) are to be found in university settings, including the Beinecke Rare Book

and Manuscript Library at Yale University (<http://www.library.yale.edu/beinecke>), the Houghton Library at Harvard University (<http://hcl.harvard.edu/houghton>), the John Carter Brown Library at Brown University (http://www.brown.edu/Facilities/John_Carter_Brown_Library), the Lilly Library at Indiana University (<http://www.indiana.edu/~liblilly>), and the Bancroft Library at the University of California, Berkeley (<http://www.lib.berkeley.edu/BANC>), to name a few.

Significant rare book collections are also to be found in many large public libraries where, again, they have often originated as private collections and are maintained and expanded as a means of serving the scholarly community. At times, public libraries have benefited from the involuntary transfer of collections as well. In France, for example, many public municipal libraries throughout the country boast fine rare book collections, the result of the confiscation of private collections and the collections of religious institutions during the French Revolution and the redistribution of those collections to public libraries where they could be made available to all. In Russia, Eastern Europe, and many other areas, similar redistributions of collections from private to public hands have taken place, although the decline of Communism in some areas has led to the return of some collections to their original owners or their descendants.

Independent rare book libraries are generally based on the collection of a particular individual, who creates a foundation or similar apparatus for the purpose of continuing and maintaining the collection for the future. Many years ago, Randolph G. Adams referred to this as “the wistful desire of the collector, great or small, to want his collecting work preserved,” and further noted, “If a collector wants his scholarly work of collecting, as well as his books, conserved, he must look around and find, or erect, an institution in which that can be done.”^[2] In this way, private collections built over the course of a lifetime can be retained unaltered or even expanded. A few examples of such independent rare book and research libraries include the Pierpont Morgan Library in New York City (<http://www.morganlibrary.org>), the Folger Shakespeare Library in Washington, D.C. (<http://www.folger.edu>), the Huntington Library in San Marino, California (http://www.huntington.org/LibraryDiv/Library_Home.html), and the Bibliotheca Bodmeriana, near Geneva, Switzerland (http://www.ville.ge.ch/geneve/culture/offre_culturelle/musees/musees_ca/bodmer/bodmer.html).

Although the above represents some of the types of institutions in which large and significant rare book collections are likely to be found, the fact is that small collections of rare books may be found in almost any institution with a library. Individual volumes or small collections of value and significance may be donated to smaller libraries, sometimes because donors believe that these “lesser” donations would simply be lost in a major library setting. Such donations can be problematic for an

institution not prepared to deal with them adequately, and some small libraries will choose to sell rare book gifts rather than face the issue of properly securing, housing, and preserving them while making them available for use. Such a decision is problematic at best, because it ensures that the library will not be considered for donations—small or large—in the future.

A DELICATE BALANCE

Although the owners of personal collections of rare books may or may not make their collections available to the public as they see fit, those who work with public or quasi-public collections face an odd dilemma. There are two major responsibilities that rare book librarians face in their role as stewards of these collections, and, unfortunately, these responsibilities can sometimes be in direct conflict. Collections must be made available for use, and at the same time, care must be taken to ensure that delicate, and often unique, materials are preserved to ensure their availability in the future as well. The difficulty of this dichotomy may best be understood if we try to imagine a museum in which visitors are permitted to handle the exhibitions while curators are charged with ensuring that the objects remain intact for future use. To be sure, rare books are not simply museum objects; they are important for their content as well, yet they have much to tell of a nontextual nature (through paper, bindings, ink, endpapers, etc.), and this involves their being preserved in as close to their original state as possible. No matter how open one may wish to make access to rare books (and this desire differs greatly from country to country and from institution to institution), the fact remains that use and preservation are conflicting goals, and therein lies the quandary that stands at the core of rare book collections.

The variety of settings in which rare book collections are found makes it difficult to generalize about how such collections are handled, but it can be said that in virtually all rare book collections some restrictions on use are in place. Primary among these restrictions is that the materials consulted do not circulate. Also virtually universal are restrictions such as identification of readers, use only in a restricted and observable area, note taking only in pencil or using a laptop computer or personal digital assistant, and restricted photocopying. In some libraries, restrictions go well beyond these, and potential readers may be required to demonstrate a clear need to see the materials in question and to explain the purpose of their use—questions that would be anathema to most general collection users and librarians in countries that have a history of promoting open access to books and information in public or quasi-public hands.

The range of opinion on the efficacy of various restrictions on use is broad to say the least. At one end of the spectrum, we have those who say that serious restrictions

are necessary to ensure that materials will be available in the future and who posit that librarians who are not vigilant in applying such restrictions on the use of rare books are performing a disservice to their profession. At the opposite end, are some mavericks who claim that such restrictions are outdated and call for the open use of all library materials on more or less the same basis as general materials, particularly in academic settings. Librarians who do not allow such access—who squirrel away collections to preserve them for the future while restricting use by current readers—are, they say, marginalizing the importance of such collections and are making it more difficult to justify the ongoing expense of maintaining and expanding those collections. In other words, they too are charged with performing a disservice to their profession. As with most such issues, the best path seems to lie between the two extremes, with policies reviewed to ensure that restrictions are not more severe than necessary but with some restrictions remaining in place to ensure the preservation of materials for future use. The “delicate balance” between access and preservation must be maintained, but it must be truly in balance, swinging too far in neither direction.

GROWTH OF COLLECTIONS: PURCHASE

The growth of a personal collection of rare books relies solely on the desire of the owner. Where expansion takes place, it is almost always the result of a direct purchase of materials from antiquarian book dealers and/or auction houses. The relationship between collector and dealer has long been a strong one and a special one, and this is true whether the collector is an individual or an institution, for institutions also use purchase as one of the primary ways in which rare book collections are expanded. It is not unusual for individuals or institutions to establish close working relationships with one or more dealers, who are made familiar with collecting needs and who use their web of contacts and connections to meet those needs.

In recent years, another web—the Internet—has altered the way in which some individuals and institutions make purchases for their collections. In part, this involves the relative immediacy and ease of e-mail contact with dealers and the ability to peruse the web sites of individual dealers, on which they have listed some, if not all, of their holdings. Of greater significance, however, are the multidealer sites in which one can peruse the stock of an international array of hundreds or thousands of antiquarian and second-hand book dealers with a single query. In theory, such sites make it possible for a potential purchaser to see, together, numerous listings for the same title (assuming that it is available from more than one dealer) and to compare prices. Unfortunately, with little standardization in entries, comparisons are not always easy, because the amount and quality of information provided

differs from dealer to dealer. Nonetheless, with the Internet, determining the availability of an item—a process that could take days, weeks, or months in the past—and purchasing that item become issues that can be settled within seconds by just a few keystrokes.

The quantity of material listed is vast, but we must not assume that these listings will suddenly make it possible to find any item that one might desire for a collection. True rarities (i.e., items that exist in only a small number of copies, most of which already reside in institutional collections) will continue to be elusive. As Eric Holzenberg has written, “Although the Internet has certainly brought masses of hitherto obscure and unregarded material to light, and to some extent fostered a market for such material, traditionally scarce and desirable materials have not become more common: the Internet has not brought to light unrecorded copies of the Bay Psalm Book.”^[3]

Relationships with dealers will continue to be significant in the purchase of materials for rare book collections. The Internet—however, sophisticated it may become, and however successful may be attempts to impose standards on descriptions and condition statements to make them more useful—is still just a tool. Rare books cannot be purchased from the Internet. They are purchased from dealers who use the Internet as a means of reaching potential buyers in a more efficient way than through catalogs or storefronts alone. The number of dealers with whom a purchaser can interact is increased vastly through the Internet, and its use has already had a great effect on the ability to gather information on rare books and to make purchases. But for many purchasers, the establishment of a special relationship with a relatively small number of dealers will remain as another method for securing works to be purchased for rare book collections.

GROWTH OF COLLECTIONS: GIFTS

Purchase is not the only means by which rare book collections grow. Gifts are another major source of materials for collection development; indeed, in some cases, they may be the primary source of such materials. Gifts may be of money or they be in kind (i.e., gifts of individual rare books or rare book collections). Monetary gifts may—depending on the wishes of the donor—be used to expand a collection through purchase, as described above. Gifts in kind provide a more direct means of expanding collections, but there are issues involved in accepting such gifts.

Ideally, only unrestricted gifts (gifts that the library can accept and then is free to use or dispose of as it wishes) would be offered and accepted. The fact is, however, that potential gifts often come with at least some connected restrictions. Indeed, even when restrictions are not explicitly stated, it should be assumed that they exist. Most potential donors have at least a tacit understanding that

their donation will be added to the collection and preserved for the future. If this is not to be the case, it is important that the donor be so informed before the gift is accepted. Donors may agree to allow the sale of items that are not suitable for the collection to allow for the purchase of more fitting items. Nonetheless, they should be aware that such a sale, or the transfer of their gift to another institution, is a possibility (if, indeed, it is) before the gift is accepted.

When collections are offered, it is not unusual for there to be at least some explicitly stated restrictions. This is particularly true if the donor is the person who has amassed the collection. Such restrictions may be nothing more than desiring a plaque in the library, or having a collection shelved separately from other materials, or naming the collection for the donor. Sometimes, however, more onerous restrictions are included. In all cases, a determination must be made about whether the importance of the collection is such that restrictions will be accepted or if the donation should be refused. The latter is not an easy course to follow. It requires a great deal of tact and diplomacy, but under no circumstances should a gift be accepted with restrictions if there is no intention of adhering to them.

One useful tool in the gift process is a written gift policy. The gift policies of many libraries and special collections can be found on the Web. These can provide good examples and a framework for creating such a policy, though each institution's policy will need to reflect the specific needs of that collection. This should address such issues as the criteria that the library applies to the acceptance of gifts, the particular strengths of the collection, the areas in which the library is most seeking to expand the collection, the nature of unrestricted gifts and how they might be disposed of, and contact information for potential donors. Under no circumstances should the librarian, or anyone directly connected with the institution, which is to receive the gift, act as an appraiser. This must be done by the donor and at the expense of the donor to avoid the possibility of a conflict of interest.^[4] This also should be clearly stated in a gift policy.

With a clearly defined policy, gifts need not become the minefield that they sometimes do but, rather, can be a major means of allowing for the expansion of rare book collections. For most collections, purchase and gifts will be the two primary avenues of growth, but for collections that are part of a larger library, there is a third means through which this takes place, and that is through the transfer of materials, which previously have been part of the general collection.

GROWTH OF COLLECTIONS: TRANSFERS

Although the first two methods for expanding a collection involve the purchase or acceptance of books known to be

rare, this last involves the identification of materials that were not considered rare at the time they were acquired. The evolution of rarity is an ongoing process. Various factors cause the desirability of a certain work to grow, or this may happen as the result of the passage of time, the development of new scholarship, or the emergence of new fields. Accordingly, review of the general collection is called for on an ongoing basis. Unfortunately, this is a task that is extraordinarily labor intensive and ideally requires a level of expertise in the subject field involved as well as some expertise in rare books management. This alone makes it difficult or impossible for many libraries to undertake a comprehensive review and forces them to adopt alternative approaches.

For example, limited reviews can be undertaken for subject areas in which it is known that materials have greatly increased in value (i.e., desirability). It is also possible for records that are in machine-readable form to be scanned to locate those that meet a particular criterion or set of criteria. This is particularly useful in cases where books printed before a particular date are being sought, because such specific information is readily identified and isolated.

Alternatively, attempts can be made to educate general library staff about the types of materials that are likely to be candidates for transfer, in the hope that they will identify such materials in the course of the day-to-day operations of the general library. This also can be a daunting task, because there are numerous library operations during which such materials might come to light. These include circulation, cataloging, copy services, conservation, inter-library loan, exhibitions, shelf-reading, retrospective conversion, and weeding. In large libraries, the number of staff who would have to be trained could prove a stumbling block. Nonetheless, where it is possible for “consciousness raising” to be undertaken with general library staff, such staff can be an invaluable resource in identifying materials for possible transfer to the rare book collection or other special collections. In any event, no matter what method is undertaken, in a rare book collection, which is part of, or affiliated with, a larger general collection, it must be understood that there may well be important works worthy of transfer that are to be found in the general stacks.^[5]

DEACCESSIONING

The growth of collections, whether through purchase, gift, or transfer, is a vital factor in keeping such collections viable and active. There are times, however, when these ends can also be accomplished, in part, by the removal of certain materials from the collections. The deaccessioning of rare books is perfectly legitimate under certain circumstances. Most collections, no matter how focused they may be, end up with at least some materials that are

beyond the scope of the collection. In fact, the more focused the collection, the easier it is to identify such materials. In other cases, materials not previously out-of-scope may be deemed to be so if the institution has redefined its mission or focus to better serve users. To retain such materials would be a disservice, because they would no doubt receive the lowest priority in issues such as conservation or housing.

It is perfectly acceptable to deaccession materials under such circumstances, once it has been determined that to do so would not violate any prior agreements or restrictions that have been placed on such an activity by donors. If such restrictions are in place, legal action may be required before deaccessioning can take place, or it may simply be deemed unwise to pursue the issue. In any case, it should be kept in mind that the deaccessioning of materials—and especially rare materials—by a library is a process fraught with dangers and potential public relations disasters, and these should all be considered before a decision is made.

Efforts should always be made to ensure that those involved (and in public institutions that includes the public) are kept informed and are aware of the reasons for the deaccessioning, and the legitimacy of undertaking it as a means of strengthening the collection by eliminating materials marginal to the core mission of the library. Unfortunately, there may be times when institutions decide to sell all or part of their rare book collections to raise money for other purposes or to meet financial obligations in difficult economic times. This is a far less defensible undertaking and one that ensures only that the said institution will never again be considered to be the recipient of future largesse in this area. Nonetheless, it is a scenario that unfolds at times, particularly with institutions that have small rare book collections that have come largely as a result of gifts, rather than having been built through purchase. Having said that, when deaccessioning is done for the correct reasons and when it is handled properly, it can be a part of maintaining, and even strengthening, a viable rare book collection.

PROVIDING ACCESS POINTS

In any library, books are not simply acquired and placed on the shelves. In addition to the physical processing of the materials, they are analyzed or cataloged to provide access points that will enable potential readers to identify them when the need arises. Rare book collections are best served by specialized analysis and cataloging, which establishes standard access points describing content and publication while also offering detailed descriptive analysis of the books themselves. This recognizes that rare books are often studied as objects as well as for their content and that their physical attributes may be deemed significant to a scholar. Thus, the analysis of a rare book will often include access points for things such as

bindings, typography, illustration technique, paper, provenance, significant associations, inscriptions, marginalia, and any number of additional copy-specific identifiers, depending on the knowledge and skill of the cataloger and on the importance, which the institution places on such in-depth analysis.

Remote access to resources and records worldwide is becoming greatly enhanced by the conversion of library catalogs to on-line systems, digitization projects, and the power of the Internet and World Wide Web to assist in finding and sharing such information. Standards being developed, such as the Dublin Core set of machine-readable descriptors (<http://dublincore.org>) and Encoded Archival Description (EAD) Document Type Definition (DTD) (<http://lcweb.loc.gov/eadd>) address the uniform coding of metadata to facilitate Internet/WWW searching of information resources. Although these were not created with rare book collections in mind, metadata schemes such as Dublin Core and EAD have the potential, through standardization and rich description standards, to vastly increase the accessibility of information about materials in rare book collections.

ENVIRONMENTAL ISSUES

Although it is to be hoped that all library collections—general or rare—are housed in suitable environments, it would be naïve to assume that this is the case. Heat, light, and moisture are the primary enemies of books, and the control of these three elements is essential to the preservation of collections. Virtually all serious rare book collections address these and other environmental issues in determining proper housing for those collections. Smaller collections do what they can to provide a suitable environment, but all collections—personal and institutional regardless of size—should strive to meet certain basic criteria.

We have become aware, in recent years, of the problems inherent in the papers used in books printed after the mid-nineteenth century; papers made with wood pulp and chemicals react with moisture in the air and become brittle. The existence of this problem, undeniable though it may be, has become so all-consuming that it has led some to think that there are no problems with earlier books. This is decidedly not the case. All natural materials deteriorate, and books are made up of natural materials: paper, leather, cloth, vellum, parchment, ink, wood, sewing thread, glue; all of these elements of books are made (or have been made) of organic materials, which deteriorate over time.

Generally speaking, the lower the temperature the slower the deterioration, but it must also be kept in mind that rapid fluctuations of temperature are most damaging. It is usually accepted that temperatures of 68–72°F are best for books that are being kept in areas where people are also present, with temperatures as low as 60°F favored

for books that are kept in storage. Fluctuations of no more than 5° are considered acceptable.

Humidity, too, is a major factor in the deterioration of books, because fluctuations in moisture content cause natural materials to shrink and expand, thereby weakening their structure. For rare books, a relative humidity within the range of 40–55% is generally considered acceptable, although with both humidity and temperature, photographic materials have different requirements and should be dealt with separately from other rare books.

Everyone has seen the faded spines of books that have been on shelves where they are exposed to the sun. This is a clear demonstration of the destructive nature of ultraviolet light, and this same destructive nature is found in light that originates in sources other than the sun, such as fluorescent bulbs. If rooms with windows are used to house rare books, draperies or blinds should be used to eliminate direct sunlight, and ultraviolet filtered glass should also be considered. If rare books are in storage rooms, from which they are retrieved, lighting in these rooms should be activated on an “as-needed” basis and should not be kept on unnecessarily. Where fluorescent bulbs are used, steps should be taken to minimize ultraviolet exposure.

Other factors affect the deterioration of rare books and should be taken into account when deciding on storage and shelving options for such works. Glass or metal shelves that are properly treated to avoid harmful gases are generally preferable to wooden shelves. Air filters help to reduce the amount of dust and airborne particulates, which work their way into books and cause abrasion and other damage. Food, of course, should always be kept away from rare books, not only because of the direct damage that it might cause but because of the pests and vermin that it might attract. Mice, roaches, silverfish, and the like can cause major damage to rare books. We cannot eliminate all of the forces of decay, but we can minimize them, and if we cannot provide true immortality to our rare books, we should at least ensure that they last as long as possible.

SECURITY

Although not every rare book collection will be housed in a perfect environment, it is likely that virtually all rare book collections—where books that are recognized as rare have been segregated from the remainder of a larger collection or where rare books constitute the full collection—have been secured in some way. This may be anything from a small locked cabinet near the librarian’s desk to elaborate vaults in which the treasures of major rare book collections are protected. Both personal collections and institutional collections face problems with security. Because personal collections are not necessarily heavily used by other than the owner, some form of physical security for the collection as a whole may suffice (depending on the size and

value of the collection, more extensive measures may be required). In an institutional setting, however, there is always more to security than simply placing collections under lock and key.

Some of the previously mentioned restrictions that rare book libraries place on use are for security purposes. For example, identification of users and the use of rare materials only in specific areas and under observation by library staff are significant deterrents to theft. To assume, however, that any measure is completely reliable in preventing the theft of rare books from libraries would be foolish. Accordingly, any viable security program must address both the issue of prevention and the issue of recovery in the event of a theft.

If a theft occurs, the library must have means by which the stolen item or items can be identified. It has already been noted that the extensive analysis of a book is helpful to users in locating the specific work they need. Such detailed descriptive cataloging can also be useful in identifying stolen items. The inclusion in catalog records of unique, copy-specific identifiers can be most helpful. These would include such things as inscriptions, marginalia, extra illustrations, special bindings, or the presence of additional or tipped-in materials. The existence of such a detailed record can be a powerful tool in proving ownership should the need arise.

Copy-specific cataloging alone, however, is not sufficient, and other means are also used to establish ownership of specific materials. Generally, this includes one or more means of placing ownership markings on the book itself. Although curatorial practice frowns on any form of permanent marking, it is often seen as an acceptable compromise, given the difficulty of proving ownership of unmarked books. Bookplates alone are usually not considered sufficient, because they are readily removed. Markings should be permanent but should use archival materials. Special inks are available for this purpose, both commercially and—for U.S. libraries, archives, and museums—through the Library of Congress (<http://lcweb.loc.gov/preserv/inks.html>). Two types of markings are best used, one which is obvious and readily observable and another which is more difficult to detect. To maximize effectiveness, markings should be on a part of the book, the removal of which would significantly reduce the value of the book. This, again, is an issue that must be discussed with curatorial staff.

As with so many aspects of administering a rare book collection, it is best to have a written policy laying out guidelines for security and stating specific actions to be taken in the event of a theft. Security, though, involves more than protection from theft, it involves protection from damage as well. As with theft, preventive measures against damage are important, but it is equally important to be prepared in the event that damage threatens or actually occurs. To this end, a written disaster plan is essential.

Such a plan needs to address a broad range of issues relating both to disaster preparedness and to disaster response. Potential disasters may include fire, water damage (resulting from flood, leaks, or fire-fighting activities), earthquake, tornado, hurricane, physical collapse, and more. Because disasters, by their nature, require swift response, it is imperative that the plan be in place to ensure that decisions are not made under the pressure of the moment. The same is true of a good security plan. Hopefully, the reaction part of each will never have to be put into effect, but having these plans, being familiar with them, and ensuring that staff is also familiar with them and with the roles they are expected to play will go a long way toward guaranteeing the overall safety of the rare book collection, and ensuring that response—when needed—will be swift and proper. The website of the Rare Books and Manuscripts Section of the Association of College and Research Libraries (<http://www.rbms.nd.edu>) contains standards and guidelines relating to security and theft, as well as a variety of additional issues important to rare book collections. It also includes numerous links to relevant Internet sites of use to rare books librarians, scholars, and archivists. Among the topics covered are preservation issues, security, associations and organization, book dealers, digitization, newsletters and E-journals. Many of these, in turn, will lead to further links.

OUTREACH

As with most aspects of life, institutional support for the maintenance and expansion of rare book collections is cyclical in nature. In flush economic times, such support is more readily available than during an economic downturn. In addition, there are times when the intellectual pursuits supported by such collections are more highly valued than at other times. In periods in which support is difficult to come by, the administrators of rare book collections may be called on to justify the expense of these collections. It is unfortunate that concrete measurements, such as return on investment, are often considered inadequate to justify rare book collections, particularly when using the statistics most often quoted by libraries. There is no doubt that by normal standards of library use, rare book collections are expensive. The materials usually cost more to acquire than general library materials, they require specially trained staff and more exacting care and protection, and they are used less frequently than general collections. Research in the humanities and the social sciences—the type of research often supported by rare book collections—does not generally bring the kind of “break-through” or lifesaving results that scientific or medical research can yield and is, thereby, more likely to be questioned in terms of expense.

To counteract the difficulty that sometimes exists in presenting statistical justifications for rare book collections,

the administrators of such collections should not be shy about taking advantage of what one might call the “mystique of rare books.” There is a long history of rare book collections being seen as enhancing the prestige of the individual or institution to whom they belong. Particularly in academic settings, a rare book collection large enough and of sufficient depth to support research in a variety of subjects has often been thought to credentialize the institution and to demonstrate that the institution is able to provide the intellectual framework necessary for serious academic study and learning.

Another means of exploiting this mystique comes through various forms of outreach—methods for bringing rare books to the attention of the institution’s users and potential users and subtly educating them about the importance of these collections. This is most often accomplished through a schedule of some type of exhibitions, although other forms of outreach exist, including educational programs, publications, special events, and anything else that demonstrates to the collection’s “public” the significance of the materials to be found in that collection.

In recent years, another form of outreach has become possible. Through the technology of digitization, the content of some rare books can be made available to a vast audience via the World Wide Web. For many—particularly scholars and bibliographers—such images can never replace the actual object, nor are they meant to. But for those for whom the content of the rare book is more important than its artifactual presence, digitization offers a means of making the text available without causing additional wear to the original object each time it is examined. Although there are numerous issues involved in the issue of digitization, there seems little doubt that it adds one more potential tool to the outreach arsenal that rare book librarians will need to put into use to demonstrate the significance of their collections, in an effort to ensure the continued survival of those collections.

THE FUTURE OF RARE BOOK COLLECTIONS

Personal collections of rare books will exist as long as there are bibliophiles with sufficient disposable income to allow them to engage their passion for such collections. As the rarest materials find their way into institutional collections—and particularly large, wealthy institutional collections where they are likely to remain indefinitely—collectors may have to turn to “new” subjects on which to focus their collections. Incunabula in the traditional sense may no longer be a viable focus for one starting a collection on a limited budget, but the incunabula (i.e., the earliest books) of specific subjects may prove more attainable. Early writings on computers, television, the Internet, perhaps even the earliest e-books,

are likely someday to be the “stuff” of which rare book collections are made.

Although in the future, the actual hardware and software of our current technology may be the focus of collections of their own, at this point, they are tools—and increasingly important tools—in the maintenance and administration of rare book collections. Electronic and digital media allow for easy access to records; the Internet provides an additional source of acquisitions and also provides for the ready exchange of information on all aspects of rare books and collections; digitization offers a means of making rare materials available to a broader audience; technological advances even make it easier to control environmental issues. All of these technologies are going to continue to evolve, as will the effect that they will have on rare book collections, and new technologies are likely to emerge that will also have such an effect. Change is inevitable, not only with regard to technology but in relation to the overall concept of the rare book collection.

As that change occurs, specific rare book collections may not remain intact, and specific institutions or individuals may choose to divest themselves of these collections for a variety of reasons. In the case of institutions, those reasons are most frequently economic. Some smaller institutions may decide to divest themselves of collections that seem burdensome to maintain, with the materials dispersed through sale to larger institutions or to individuals. The collections of private individuals will continue to be offered for sale on a regular basis until such time as bibliophiles find a way to ensure that their heirs share their passion for rare books. The books from these collections—both personal and institutional—will not simply disappear. They will find their way, by purchase or as gifts, into other collections, again both personal and institutional.

Rare book collections in general are likely to exist for as long as there are those who understand the importance of preserving—both as objects and for content—materials that help to tell us about who we are, what we do, what we think, and why we think it. If those involved with rare book collections—whether as administrators, librarians, scholars, bibliophiles, or in any other capacity—help to spread such understanding, there is every reason to believe that these monuments to the endeavors of humanity throughout the centuries, these active and vital sources of knowledge, these essential aids to research, which are our rare book collections, will continue, effectively, forever.

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Reading and Reading Acquisition

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Abstract

The role of written language and therefore of reading in society and in the individual is examined. This is in part achieved by an examination of the historical emergence of writing systems, which in turn is used to suggest parallels with the acquisition of literacy by the child. The hypothesized parallels are tested against empirical evidence on the normal trajectory of reading acquisition. Failures of acquisition (developmental dyslexia) are also discussed. Turning attention to skilled reading, some abiding issues, such as speed reading, eye movements, and the role of “inner speech,” are canvassed. Modern computer-based models of reading are also introduced, models that are bringing the study of reading to new levels of scientific rigor and promise.

INTRODUCTION

Written language as an information source, with “reading” the name of the way we extract the information, is an integral part of the modern world. Instruments of social order (laws), agreements among individuals and groups (contracts), accumulated knowledge of the physical and social worlds (scholarship), and novels (creative works) are examples of the information and ideas stored and broadcast in written form. Thus writing and reading run deeply and broadly through modern social life. In this entry, I consider the status of written language in society and in the individual human mind. I trace how humans moved from oracy to literacy, considering as I do so the various solutions that have been adopted for how to record speech. I then draw some lessons from the history of writing for the processes that a child must go through in learning to read, and go on to summarize recent research on learning to read and on how this acquisition process might go awry. I then consider some of the salient features of skilled reading and the computer models being developed to account for those features. Among other goals, these models are being used to help illuminate why some children and adults remain so unskilled that their educational and economic opportunities are hampered.

THE LITERATE MIND

As pointed out earlier, the operation of many societies is now heavily dependent on print and reading—that much is beyond doubt. But we can also ask how profoundly written language influences the mind of the individual. How different would our processes of thought be without having a graphic form to capture spoken language?

One thing that we can assert with confidence is that mental operations that are close to the interface of written and spoken language are jointly shaped by both forms. The “interface” is where graphic symbols map onto the sound system of language (to be described in more detail later). We have clear evidence of tight integration of print and speech. For example, even though speech is the primary form of language for humans, both in evolutionary and ontogenetic terms, it can be shown that when literate people think about spoken words, they automatically (and often unconsciously) invoke the printed forms. Likewise, when literate people think about printed words, they invoke their spoken counterparts. Ask someone to tell you if there are more sounds in “pitch” than “rich” and chances are they will say “yes,” an erroneous response that shows that spelling, the addition of “t” in pitch, influences conceptions of pronunciation. This influence is evident early in children’s development as readers.^[1] In other classic findings, adults are slower to acknowledge rhyme in spoken pairs with different spelling patterns, like “make” and “ache,” than in pairs like “make” and “cake.”^[2] Adults are also slower to notice that words with similar spellings, like *paid* and *said*, do not rhyme than they are for words with different spellings, like *paid* and *head*.^[3] They are also slower to agree that *rough* and *cough* share a spelling pattern than they are for *rough* and *tough*, showing the influence of phonology (pronunciation) on judgments of orthography (spelling patterns). There is even (anecdotal) evidence that orthography can override phonology and the consequent link to meaning. A regional airline that serves my town is called Rex (a contraction of Regional Express). It is indeed fortunate for the airline’s proprietors that passengers do not “hear” another rendering of Rex, as “wrecks.” Finally, and at a more scientific level, compelling evidence for the obligatory invocation of orthography

in the mental machinery of literate people comes from the famous Stroop effect, whereby people asked to name the color of the ink in which a word is printed are massively disrupted if the word in question is itself the name of a color, such as when the word *green* is printed in red ink and the correct response is “red.” This automatic triggering of the reading response appears in children as young as first graders.^[1] All the evidence, then, points to a tight mental bond between speech and print, and to the easy facilitation of the act of reading even when it is not required, or worse, when it is actually disruptive.

So becoming literate alters mental operations. But how broad in scope are the effects of literacy in the mind? To get an answer to this question, we need to compare groups of people who are literate with those who are not but are in other ways similar, no easy assignment in the modern world with widespread literacy. But there are two well-known sets of studies that have achieved this goal, and the broad picture they paint is that being able to read and write does not have extensive effects on mental processes beyond the print–speech interface. A Belgian group has compared Portuguese-speaking adults who became literate later in life with some who have not had the advantage of reading and writing lessons, with both groups denied early literacy instruction for much the same reasons.^[4] The data are too extensive to do justice to here, but the overall picture is that becoming literate stimulates an awareness of the phonological structure of language, such as becoming aware of how many individual sounds make up a spoken word, and has positive effects on lexical (vocabulary) skills, probably through the very act of reading. But there is little direct effect on other linguistic capacities, or indeed on cognitive processing more generally.

The second study is the classic volume of Scribner and Cole.^[5] They studied the Vai people of Liberia, some of whom were unschooled, others literate in the Vai script, a syllabic one, and some in Arabic, an alphabet. The book is valuable on many levels, including its survey of the range of ideas concerning how, or whether, literacy “changes minds,” on methodological issues such as disentangling the effects of schooling from the effects of literacy per se, and its empirical results. Abbreviated summaries of such works never do justice to their contributions, but here are some of their own words: “Reading and writing the [Vai] script was associated with specific skills in synthesizing spoken Vai..., in using graphic symbols to represent language..., in using language as a means of instruction..., and in talking about correct Vai speech...” (p. 244). But “our results are in direct conflict with persistent claims that ‘deep psychological differences’ divide literate and nonliterate populations... On no task—logic, abstraction, memory, communication—did we find all illiterates performing at lower levels than all literates. Even on tasks closely related to script activities, such as reading or writing with pictures, some nonliterates did as well as those with school or literacy experiences” (p. 251).

Thus, the available evidence points to clear effects of becoming literate on mental processes relatively close to script, such as conceptualizing the sound structure of the language, and perhaps to some mental activities a little further removed from script, such as vocabulary enrichment through reading and the mechanics of teaching. But profound changes in human cognition do not seem to attend learning to read and write, despite the liberating consequences of having a substitute for oral memory in maintaining a society’s sense of itself and gaining the facility to communicate across space and time.

A final comment in this section: Presumably, the bonds between written and spoken language exhibited by skilled readers are built on what neuroscientists refer to as the massive interconnectivity of the human brain, with approximately 60 trillion synaptic connections in the cortex. But the fact that tight bonds between speech and print do form, and do so with only a year or two’s exposure to written language, does not mean that the two forms of language are cut from the same cloth. Indeed, all the evidence points to the primacy of speech over writing, and it is to this idea that we turn as we trace the development of literacy, within society and within the individual mind.

SPEECH AND WRITING

The human species is characteristically singled out not only for its intellectual powers but also for its language, the most complex and precise of all animal signaling systems. Note, however, that in evolutionary terms speech preceded writing by a vast margin, perhaps by as much as 100,000 years. Given the value of written language in modern societies, we can ask how humans got on so long and so well without it and why it took so long to emerge. We can also ask whether there are lessons to be learned from the historical emergence of writing and reading for the individual development of literacy in the child.

Preliterate Society

A society without literacy must, by definition, depend on oracy for the maintenance and transmission of laws, contracts, the accumulated knowledge of the physical and social world, and linguistic creations. At the core, feats of memorization needed to stand in place of written records, and they did. History sometimes affords opportunities to capture the changeover from oracy to literacy in mid-flight, as it were, and with thoughtful reconstruction, Ancient Greece presents us with one such opportunity. In his entertaining and scholarly treatise on the origins of the alphabet, Man^[6] summarizes a case for the first alphabetic works, Homer’s *Iliad* and *Odyssey*, being written versions of pre-existing recited epics. Man suggests that “they were more than after-dinner entertainment. They were works of

genius, designed to tell listeners where their roots lay and what made them what they were. To do this, they included vast amounts of information, so much that Eric Havelock called them ‘tribal encyclopaedias’” (p. 215). The tradition of “oral literature,” a term that could be applied to pre-Homeric recitations and to any number of modern equivalents such as the Balkan bards of the 1930s observed by Milman Parry,^[7] encompasses not only astounding acts of memory but degrees of improvisation set in an agreed metrical form. But once these performances were turned into writing, as began to happen as the alphabet took hold of Greek society, they became fixed. As Man puts it: “A living thing had been captured, and one world sacrificed to create another” (p. 228). The new world included what is now commonplace, the transmission of culture beyond the bounds of person-to-person contact.

Not everyone greeted this transformation with enthusiasm or even equanimity. Socrates famously objected to the emergence of writing on the grounds that it more or less froze language, drained the life out of words, and therefore doomed the dialog that was at the heart of the “examined life.”^[8] He also regretted what he saw as the destruction of memory, which in turn, by the discipline needed to build it, contributed to the examination of knowledge. And perhaps bizarrely to our conceptions of social opportunity, he saw writing as making knowledge available to people who were ill-prepared to use it appropriately. Maryanne Wolf’s entertaining account of the history (and science) of written language^[8] tells us that other scholars around the world had worries similar to Socrates, but that the advantages of the written word overcame these objections to see it spread worldwide.

The facility with which culture could be taught and preserved through face-to-face means, attested to in Greek and many other cultures, may itself have been a reason for the late emergence of script. The U.S. Census Bureau^[9] provides estimates of the world’s population at various points of time, and at 8000 BC, before anything recognizable as writing existed, estimates put the number of people on earth at 5 million. Scattered across Africa, Europe, Asia and the Americas, this allows for groupings of modest size, within the limit suggested by Aristotle as the ideal maximum of about 5,000 citizens (or 25,000 people) that could be “addressed by a single herald.”^[6] Population growth remained slow over the next 4000 years, reaching perhaps 7 million in 4000 BC, but increased to 14 million just a 1000 years later and 50 million by 1000 BC. These latter years were periods of high activity in the development of writing systems, perhaps no coincidence as pressure built for other means of preserving social identity with larger numbers aggregating in single locations.

Another reason for the long period of human history in which people spoke but did not write may have been human psychology in the sense of what comes naturally to human consciousness and what does not. We will return

to this theme in more detail when we consider theories of reading acquisition, but a sense of what is meant emerges already in the historical development of writing systems, to which we now briefly turn.

The Emergence of Writing

There are several classic and more recent sources on the history and comparative natures of writing systems, and readers are referred to two under Bibliography. Here, we consider aspects of the developmental progression that might illuminate the act of reading, and in particular its acquisition.

Sampson^[10] provides the classification of writing systems of Fig. 1. The division between semasiographic and glottographic captures the difference between the direct versus language-mediated representation of ideas. Universal symbols valuable for the tourist trade, such as signs for male and female toilets, passport control, bus stations, taxi ranks, and the like, can be understood by people unfamiliar with the language of the country. They are not always entirely transparent in meaning, as a veridical painting would be, because their interpretations do depend on a degree of enculturation—a picture of a stylized woman could in principle signal many affordances other than toilet facilities, and when it comes to a red bar across an object depicted in a red circle, such as a cigarette, the social learning involved is considerable. But systems that were basically semasiographic did exist, and, as the aforementioned examples demonstrate, still do as elements of communication.

The distinction between direct and language-mediated representation of ideas is a broad-brush one in the context of more-or-less pictorial signs versus ones that stand for speech. But it is a distinction that appears in finer form within glottographic systems for they too vary in how directly the graphic elements map onto units of meaning.

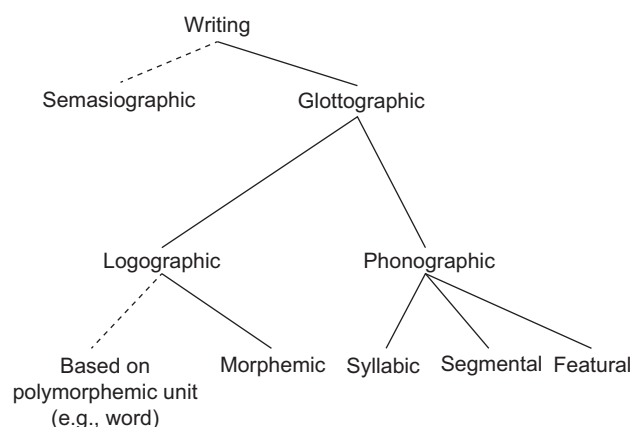


Fig. 1 Sampson’s analysis of writing forms. Dashed lines represent forms whose inclusion as writing is open to doubt.

Source: From Byrne,^[11] Figure 2.1, p. 28.

In a logographic system, should one exist in pure form, the graphic elements stand in for the words of the language, with no lower-level correspondences. To illustrate, consider logographic elements of English such as &, \$, =, and the numbers, 3, 14, 26 (versus three, fourteen, twenty-six). These symbols appear in running text, but only as elements that do not decompose into a more basic currency of representation—thus, while *and* represents the three phonemes of the word “and,” & does not. Nor do we typically think of them as standing for “sounds.” If we did, as Sampson points out, we might be happy to accept *&rew* and *l&* for “Andrew” and “land.” So such symbols are close to meaning in the sense that they represent the words of a language and not its sounds.

Phonographic systems do stand in for sound, and the phonology of language offers several possible sites for mapping graphic symbols onto phonological constituents. Fig. 1 shows syllables (basically a vowel surrounded optionally by one or more consonants), segments (or more commonly, phonemes, the individual vowels and consonants), and features (the building blocks of phonemes, such as the place in the vocal tract where an occlusion occurs in producing a consonant, the height and position of the tongue in producing a vowel). (We will not consider feature-based systems further except to note that features form part of the basis of the Pittman shorthand, and that the Japanese syllabaries represent the voicing feature with diacritics; other manifestations are very rare.) The election to use syllables or phonemes is probably not an arbitrary one available for languages on a whim. Some languages, like English, have a high number of syllables because they permit complex syllables, ones with several consonants on either margin of the vowel, like “strand.” Others, like Japanese, are more or less restricted to single consonant-vowel sequences, like “ma,” with consequently a modest number of total syllables possible. Hence, assuming each syllable gets its own grapheme, one would need thousands for English but less than 200 for Japanese.

As units of sound, syllables are no closer to meaning than are phonemes. But there appears to be a psychological difference in their accessibility to consciousness. There is a substantial research tradition demonstrating that young children can detect rhyme, a syllabic property of words, well before they can detect shared phonemes across words. Thus a child can tell you that “hot” and “pot” rhyme well before they can tell you that “hot” and “cat” end with the same phoneme, or even that “hot” and “hip” start the same.^[11]

It appears therefore that humans possess a hierarchy of self-awareness about language. It proceeds from meaning to words to sound, and within sound, from the large-scale units of syllables to the small-scale ones of phonemes. This hierarchy matches the historic development of writing systems. The earliest graphic systems, those of the Sumerians and Egyptians which were flourishing around 4000 BC, were close to meaning in that they initially

employed pictorial representations. With time, and with the demands of transcription by stylus into wet clay, the symbols became stylized, the pictorial origins obscured. At the same time, and with the aid of insights from the rebus principle, the new logographic signs came to represent first the words (rather than their meanings) and then fragments of the words’ sounds, typically syllables. Syllabic writing gave way to phonemic in the supportive linguistic context of the Semitic language of the Phoenicians, where vowels were fairly predictable from the consonantal frames and the contextual support of meaning, so that symbols needed to stand for consonants only. The Greeks, perhaps around 800 BC, adopted the Phoenician consonantal alphabet. They also adapted it to a language where vowels were not conditioned by the words’ meanings-in-context, and so where vowels needed their own symbols. A mismatch in phonology between the languages also meant that there were “spare” signs, such as the first Phoenician letter, alep, which stood for the glottal stop, absent in Greek. It became the letter for the vowel “a.” Thus was born the complete alphabet, wrought to represent the full range of phonemes, a device that spread from that beginning to become the modal writing system around the globe.

Gleitman and Rozin^[12] neatly capture the psychological progression that this history embodies:

The history of writing... involves the use of successively more analytic units of language to correspond to the squiggles on the page (or rock). Change has always been in this direction: from the representation of ideas or meanings, to the representation of words and morphemes, thence to syllables, and then to the smaller alphabetic units of vowels and consonants... popularly called phonemes. No revisionists are recorded in history. Nostalgia for bygone scripts and more global units has been absent from the history of writing... (p. 21).

Not that all modern systems are alphabetic. Chinese, for instance, uses characters that basically stand in for the morphemes of the language, though semantics and phonetics figure in the design of the characters through radical-phonetic compounds (see Fig. 2 for examples). Japanese employs characters, originating with Chinese, along with two forms of syllabary.

Finally, within alphabets, different languages vary in how consistently they represent the phonology of the language. English is notorious for its unruly nature, with such historical relics as *debt* and *knight*, and traces of the dominance of meaning over sound with such features as the use of “s” to represent the plurals of both *cats* and *dogs*, even though the last sound in “dogs” is “z” and we have a perfectly good letter for that sound. Finnish is an example of a highly regular script, largely with one letter for one sound, and French is an intermediate case. These comparative properties also have implications for the course of reading acquisition, as described later.

Character based on a pictograph:

羊 pronounced *yáng*, means sheep

Some characters that share the same phonetic:

蚱 insect radical 虫 with *yang* phonetic 羊: pronounced *yáng*, means “a kind of Weevil found in rice, etc”

養 eating radical 食 with *yang* phonetic 羊: pronounced *yǎng*, means raise (livestock, children, flowers etc)

洋 water radical 氵 with *yang* phonetic 羊: pronounced *yáng*, means ocean

氧 gas radical 气 with *yang* phonetic 羊: pronounced *yǎng*, means oxygen

痒 sickness radical 疒 with *yang* phonetic 羊: pronounced *yǎng*, means to itch

Some characters that share the same radical:

洋 water radical 氵 with *yang* phonetic 羊: pronounced *yáng*, means ocean

汗 water radical 氵 with *gan* phonetic 干: pronounced *hàn*, means sweat

淌 water radical 氵 with *shang* phonetic 尚: pronounced *tǎng*, means drip or shed tears

油 water radical 氵 with *you* phonetic 由: pronounced *yóu*, means oil

海 water radical 氵 with *měi* as phonetic: pronounced *hǎi*, means sea

湖 water radical 氵 with *hu* phonetic 胡: pronounced *hú*, means lake

河 water radical 氵 with *ke* phonetic 可: pronounced *hé*, means river

Notes:

1. Not all Chinese characters are of the “radical + phonetic compound” character type. There are also ideographs, simple and compound pictographs, borrowings, etc.

2. Both the radical and the phonetic component are guides only; sometimes the connection between the radical and the character’s meaning is obscure; and sometimes geographical and historical variation mean that the phonetic component is quite far removed from the pronunciation of a character in present-day Mandarin.

Fig. 2 Examples showing components of Chinese radical-phonetic compound character types.

LEARNING TO READ

Lessons from the History of Writing

Following is a series of observations from the history of writing accompanied by implications for the child’s emergence as a reader, with supporting research where appropriate.

Observation 1: The long period of human existence prior to the emergence of written versions of language shows that humans by nature talk and listen but do not write and read. In contrast to speech, written language is an invention, not an inheritance. Thus, a child will not know, by nature, that written language is possible. This needs to be taught. Parents who encourage their children to understand that print tracks speech are doing the

children a service, laying a foundation for the growth of literacy.

Observation 2: Humans have invented several ways to write. Thus, when children do come to understand that language can be written, it cannot be assumed that they know how their language is written. This, too, needs to be taught, as evidence under Observations 3, 4, and 5 indicates.

Observation 3: Writing progressed, historically, from direct representation of meaning, pictorially based symbols, to indirect representation, language-based symbols. This progression may re-occur within the individual. The celebrated Mexican educationist, Emilia Ferreiro,^[13] observed children who think that when one reads, one “reads” the pictures. A child’s early attempts to write are often replete with pictographic elements, such as choosing to use a lot of letters to represent a large object like an elephant, and few to represent a small object like an ant, even when the words’ lengths are the opposite (in Hebrew elephant is *pil* and ant is *nemala*^[14]).

Observation 4: Glottographic systems first developed as representing the meaning units of words and morphemes. Once children accept that writing is language-based, they may assume that symbols stand in for elements of meaning, not sound. The present author^[15] conducted experiments in which preliterate children, aged four and five, were taught to discriminate printed word pairs like *small* and *smaller* and associate them with the spoken forms. The young “readers” could correctly select which said “cold” and which said “colder” when challenged with a new pair (cold and colder) that preserved the morphemic relation of an adjective with its comparative. But with pairs in which the “er” represented a sound, not a morpheme, like *corn* and *corner*, they failed. That is, in learning that the letter group “er” discriminated the two training words, the children’s focus was on its morphemic, not phonological, value.

The failure to understand the phonographic nature of writing can undermine reading growth, as self-reports from adults suffering from marked reading disability attest.^[16]

I had learned symbols. . . 1 and 2 and 3. . . so I wanted that for five-letter words. . . I had this idea that. . . I was going to know just by looking. . . But there’s no way you could possibly take all the words in the dictionary and just learn them by sight (p. 157).

This man believed that written words were related to their speech counterparts just as numerals are related to theirs, as unanalyzed wholes. His hypothesis obviously remained entrenched long enough for him to abandon that way of learning, but for one reason or another, he could not replace it with the more systematic alphabetic method.

Observation 5: The alphabet was the last writing system to appear, and has only been invented once, following

a long period in which syllables were the speech unit of choice. We might conclude from this that syllables are more prominent linguistic objects and that the insight into the organization of the speech stream necessary for the alphabet’s invention does not come readily to the human mind.

Two kinds of evidence support the idea that these aspects of history duplicate themselves in reading and writing development in the child. The first is that children’s initial guesses about phonographic script appear to be syllabic. Once children abandon the idea that a single letter can stand for an entire word, their next strategy is to use as many letters as there are syllables in a word.^[13]

The second kind of evidence is the voluminous research on what has come to be termed phonemic awareness. Starting with work cited earlier,^[11] which showed that children are sensitive to the large-scale phonological unit of the syllable before the small-scale one of the phoneme, an overwhelming case has been made for the importance of the child’s grasp of how speech is composed of segments, like the three in “and” or the four in “mist.” This understanding is tested in a variety of ways, such as asking children to affirm that “mist” and “man” begin the same, or to say “fall” without saying “f.” Preliterate children are generally incapable of succeeding with such assignments. Phonemic awareness as a variable measured on the cusp of learning to read predicts later reading growth, and measured during childhood and even adulthood correlates substantially with reading skill^[11]).

A theoretical basis for the difficulty in becoming aware of the phonemic structure of the speech stream has been offered by speech scientists at the Haskins Speech Laboratories in New Haven. Starting with the observation that individual phonemes are integrated into words by a process known as coarticulation, such that the identity of each “sound” is smeared across the word rather than appearing as a discrete block of acoustic energy (see Fig. 3 for an example), Liberman and Liberman draw out the consequences for perception as follows:^[17]

Coarticulation. . . folds into a single segment of sound information about several successive phonemes. . . This produces a very complex relation between the sounds and the phonological structure it conveys, but this considerable complication causes the listener no trouble; he or she has only to listen, for the phonological specialisation parses the signal automatically recovering the several coarticulated gestures that produced it. . . Given the automaticity of that specialization, the constituent phonemes do not ordinarily rise to the level of consciousness (p. 351).

This account, built on the motor theory of speech perception, so named because under it the true units of speech perception are the motoric gestures that produce speech, is advanced as explaining how we can be expert talkers and listeners without needing to be consciously aware of the

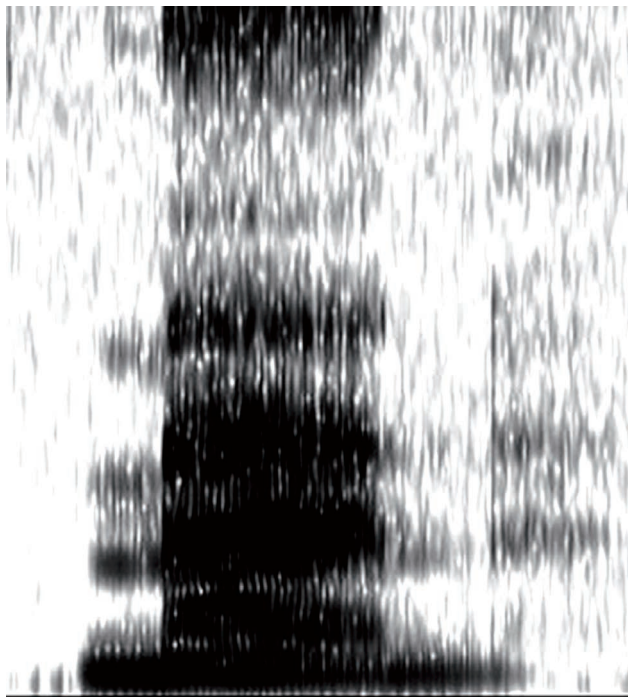


Fig. 3 Spectrogram of the word “man.” Time is on the horizontal axis, frequency is on the vertical axis. The dark horizontal bars show concentrations of energy at particular frequencies.

phonemes that, linguistically, are the units from which words are constructed. Thus the child needs to have the existence of these units brought to conscious attention if they are to make sense of an orthography that exploits them, namely an alphabet.

Two other lines of evidence support the phonemic awareness hypothesis: One is that adults who have grown up without having been taught to read an alphabet are normally unable to perform tasks that reveal phonemic awareness such as deleting a phoneme from a word.^[4] The second is that instruction designed to foster phonemic awareness in preliterate children has been shown in turn to foster early reading development, and indeed to leave traces of a reading advantage well into middle school.^[18]

BEYOND THE ALPHABETIC PRINCIPLE

There is more to becoming a skilled reader in an alphabetical language than understanding the alphabetic principle and learning letter-sound mappings. That allows one to compute the pronunciation of printed words by blending the individual phonemes represented by the letters into whole words, as in “f” + “i” + “g” = “fig.” But if that were all there was to it, reading would be a very tedious business. Further, users of highly consistent languages, such as Finnish, would all be perfectly adequate readers, yet they are not. (As an aside, there is evidence that during the formative stages of reading development, linguistic

consistency is a variable that affects progress. For example, one estimate has it that English-speaking children need nearly twice as many years of learning to establish basic decoding functions as do readers of other European languages.^[19] What is needed beyond basic decoding, for all readers, is a high degree of automaticity in the ability to recognize the words on a page such that reading speed can rise to a level where the reader can understand the text without diverting their energies into laborious decoding. At this level of skill, for example, a person should be able to read number words like *three* and *forty* as rapidly as 3 and 40. This facility comes with increasing exposure to written words, although some children require more exposure to reach an appropriate level than do others, and it now appears that this difference among learners has a partial genetic basis.^[20] We return to the genetics of reading acquisition later.

Much of the available research on the growth of “sight word reading,” as this kind of automatized reading is often called, is summarized by Ehri,^[1] who distills the evidence into a coherent and appealing theory of the phases children go through in achieving mature levels. They are, in brief: the pre-alphabetic phase, in which a child will form connections between print and words that are arbitrary, often based on some prominent feature of the print sequence, such as the large M in McDonalds; the partial alphabetic phase, in which a child can use some alphabetic knowledge to link print and speech, such as the names of letters to create spellings like LFN for “elephant”; the full alphabetic phase, in which the child can exploit letter knowledge to fully decode new words; the consolidated alphabetic phase, corresponding to what was described earlier as skilled reading, where words are recognized more or less as wholes, or if too long for that, on the basis of familiar sequences such as ing, str, and est.

Failures of the basic insight into the nature of alphabetic script, leading to low levels of accuracy in decoding letter sequences, and failures to achieve automaticity, leading to accurate but slow word identification, are presented as two causes of reading disability in the double-deficit model.^[21] Wolf and colleagues identified verbal fluency, the speed at which a child or adult can reel off the names of a sequence of repeated items such as pictures of familiar objects, as a marker of the ability underlying the development of automaticity, and one separate from decoding skill. If decoding accuracy and automaticity are indeed governed by partially independent processes, we can see how there could be marked reading disability in highly consistent languages like Finnish, where accuracy is barely an issue, even in young children.

It should be emphasized that the issue of reading growth and reading disability across different languages is more complex than suggested so far. For one thing, it appears that there is a common core of cognitive deficiencies present to some degree in children suffering dyslexia

whatever their language; deficits in phonological awareness, verbal short-term memory, and verbal fluency.^[22] Despite this, there may be differences, such that, for example, children taught to read Chinese by rote may depend more on visual abilities than children learning alphabetic languages. But, as Caravolas says, “the study of dyslexia in languages other than English is relatively recent, and many questions remain.”^[22]

INDIVIDUAL DIFFERENCES

The Role of Genes

In discussing dyslexia, the focus has shifted from factors that are at work in learners of literacy in general, which I have argued are mirrored in the historical emergence of writing systems, to factors that generate differences among learners in how well and/or how quickly they master the skill of reading. Here the elephant in the room is genetics. Whether one contemplates cases of severe reading difficulties or variation among readers in speed and/or accuracy of reading within what could be called the “normal range,” genetic differences play a major role. We know this largely from the study of twins, who are informative when it comes to distinguishing between environmental and genetic factors in determining variation in human traits. In the case of reading, this distinction is necessary because reading difficulties “run in families,” and families share both environments and genes. Insofar as genes are the major determining factor, identical twins, who share the same genetic code, will be more alike than fraternal twins, who share, on average, half their segregating genes (genes that make people different). Statistical estimates of the role of genes from twin studies suggest that they contribute around 50–80% of the variability in reading skill, including the propensity for severe reading problems, with family-based and individual experiences contributing the rest of the variability. There are accessible and economic summaries of this research.^[23,24]

Some of the genes that affect literacy growth have been tentatively identified, and a recent summary is available.^[25] But relatively little is known about the paths from DNA to variability in reading, making the search for these paths a vital one for the future.

The Role of the Environment

The facts that learners bring their own genetic endowment to the task of learning to read and that these endowments are important do not mean that teaching practices are unimportant. If some new and revolutionary method of instruction were found that lifted the average reading performance by 50% but still left differences among readers, then genes would probably determine most of those remaining differences. Apart from this matter of principle,

evidence indicates that early and intensive intervention to prevent and/or overcome reading problems can be effective for many if not all children.^[18] This intervention often includes explicit training to foster phonemic awareness and the alphabetic principle. But evidence is accumulating that an early boost does not routinely translate into effective long-term improvement, and researchers are beginning to highlight the need for longer-term support designed to encourage children to keep engaging in reading.^[26]

Differences among children in learning to read can thus be attributed to teaching practices to a degree, though apparently less convincingly than to genetic variability. They can also be attributed to some extent to the home and/or aspects of the school environment, which in twin research forms part of what is called “shared environment” because twins share the home and, for the most part, the school. In one such study, estimates of shared environment on tests of literacy skills in Grade 2 ranged from just 0.03 to 0.07, meaning that between 3% and 7% of the variability among children could be attributed to variability in factors that come under the heading of shared environment, such as home literacy and school attended.^[27] Other research has put these estimates higher, especially where literacy instruction is quite varied within an educational jurisdiction; to put it the opposite way, genetic variation matters more when environmental variation is restricted through more uniform teaching practices.^[28] Some of the effective aspects of the (modest) home environment influences are understood, such as the practice of engaging the child while reading to him or her, but so far these factors have not been fully elucidated.

Differences in Comprehension: Reading and “Higher” Language Processes

The goal of reading is not to pronounce the words on the page but to understand the meaning of the text. If a child fails to understand something he or she is reading, the problem may lie not in printed word identification but in the language itself. That is, failure might also attend just listening to the same words—there may be deficiencies in vocabulary, in parsing the words syntactically, in concentrating long enough to extract the gist, and so on. The interplay of printed word identification (call it D for decoding) and more general language processes (call it L for listening comprehension) is neatly captured in the Simple View of Reading,^[29] which has at its heart the formula $R(\text{reading comprehension}) = D \times L$. This multiplicative relationship between the more mechanistic aspects of reading and the “higher-level” linguistic aspects has proven to be robust in the face of substantial research.

Differences in semantic and syntactic processes are beyond the scope of this essay. However, reading researchers are alive to the need to integrate the investigation of the factors contributing to decoding with those

contributing to higher levels of language in order to build up a complete picture of the psychology of reading.

SKILLED READING

Some Perennial Questions

Eye movements

I took a speed-reading course and read *War and Peace* in twenty minutes. It involves Russia.

—Woody Allen

This celebrated quotation successfully lampoons extreme claims about speed reading. There are, however, people who class themselves as speed readers, and who may read at a rate of around 600–700 words per minute, about twice as high as “normal” skilled readers. When they are studied in detail, it appears that these readers are capable of extracting the gist of text but rather poor at answering questions of detail, particularly in regions of text that they had not fixated. Normal readers asked to “skim” text exhibit eye movements and comprehension patterns similar to speed readers, so there appears to be no great mystery about, and no great feats involved in, speed reading.^[30]

Eye movements in reading have been studied extensively. In reading English, skilled adults tend to fixate on a place in the text for about a quarter of a second, to fixate on most words (94 fixations per 100 words), and to regress (move their eyes back) around 14% of total eye movements. In a single fixation readers can process around 3–4 letters to the left of the fixation point and up to 15 to the right, although in Hebrew, which is read right to left, the asymmetry is reversed. In Chinese, where each character contains more information than each letter in an alphabet, the span is around 1 and 3 characters from fixation. Foveal vision, where acuity is high, subtends about 2° of visual angle, the parafovea extending out about 5° on either side of fixation point. Some information is gained from the letters included in the parafoveal range, though the further out in the periphery the less information—mostly just word length.

Between fixations, eye movements, known as saccades, suppress visual information. They tend to occur across 7–8 letter spaces on average (though with a large range of 1 to around 25 letters), and take between 20 and 40 ms (thousandths of a second). When words are skipped, they are mostly function words (articles, prepositions, and the like) rather than content words (nouns, verbs, adjectives), because function words tend to be shorter and more predictable.

During literacy development, fixation duration, number of fixations per 100 words, and proportion of regressions all drop with increasing age and therefore reading skill, as

would be expected. Abnormal patterns of eye movements can be observed in dyslexia (longer and more frequent fixations, shorter saccades, and more regressions), but these appear to be more a consequence than a cause of reading disability as the dyslexic person struggles with word identification and text comprehension. For a recent, extended summary of much of this eye movement research, see Rayner et al.^[31]

Phonology and reading

Another abiding issue is whether during reading the progression is from print to inner speech to meaning, or if meaning can be accessed directly from print. For 100 years imaginative experimental techniques have been created and harnessed to support either the mediated or direct accounts of word recognition from print, with no compelling conclusion. Most recently, the question has been finessed to some extent by the proposal that in skilled readers orthography, phonology, and semantics (word meanings) are integrated into a fully interactive system, with automatic feedback among them once one is activated (e.g., orthography by the act of reading, or phonology by the act of listening). The massive interconnectivity of the human brain, mentioned previously, allows for such a system to develop. If this is an accurate description of how things work, then it is not a matter of a causal chain in one direction (e.g., orthography to phonology to meaning) but an almost simultaneous activation of all three systems. Empirical evidence indicates that this can happen very quickly, with the phonological code for a word coming into play within about 20 ms of seeing its printed form. Recall also the evidence presented earlier for the influence of spelling on conceptions of the sound of words (e.g., that there are more sounds in “pitch” than “rich”), evidence that is consistent with this multiple activation model. On the other side of the coin, there is evidence that reading aloud a word with multiple pronunciations, such as *tear*, is slower than reading one with a single pronunciation, such as *bear*, indicating that the existence of competing pronunciations interferes with reading the word aloud.^[32]

COMPUTER MODELS OF SKILLED READING

In much of modern psychology computers are being used to model human behavior, and reading is no exception. The goal of this endeavor is not to replace human with computer reading (though text-to-speech programs do have that facility), but to understand the act of reading better. There are several widely agreed virtues of trying to model reading with a computer program.^[33] First, a theory of how reading proceeds must be very explicit if it is to be successfully turned into a program—and trying to do so will expose any parts of the theory that are not sufficiently precise. Second, once such a program has been

written, its performance can be compared with that of humans, and adjusted to make it conform better if the match is poor. Third, as often happens, more than one simulation can be written that successfully mimics the behavior. This in turn should stimulate more refined descriptions of the behavior so that the models can be adjudicated.

Another advantage is that variation in reading skill can be modeled to test ideas about the origins of reading disability, including developmental dyslexia, encountered during reading acquisition, and acquired dyslexia, reading and spelling difficulties consequent upon brain injury or disease. Typically, this is accomplished by “damaging” one or more of the components of the models in ways that capture deficiencies hypothesized to underlie the acquired dyslexia in question and examining the new output for how faithfully it reproduces the reading profile of the dyslexic. For example, the models might be underpowered by reducing the number of “units” in the learning algorithm, or random noise might be added to mimic phonological imprecision.^[34]

In this short essay there is not the space to summarize and evaluate current models. Suffice it to say that models with different computational architectures have been developed and tested. Some are connectionist. In these, connections are physically real objects created in an attempt to be “biologically plausible” and in which neural-net learning algorithms are typically employed—see examples for English^[33] and French.^[35] Others are nonconnectionist. They use programming codes with symbolic rules but similarly attempt to achieve biological plausibility by, for example, having excitatory and inhibitory connections between elements, just as the nervous system does.^[33]

CONCLUSIONS

We began in prehistory and ended in the computer age. The uniting theme was literacy in human society and mind. Humans listened and talked before they read and wrote, and so do modern children. There are interesting parallels between the emergence of literate, historical societies and of literate, modern children such that the latter recapitulates the former. At the very least, the temporal primacy of spoken over written language at the social and personal levels should alert us to the fact that children are not born into literacy in the same way as they are born into speech, and that instruction needs to acknowledge this in practical ways.

Once literate, however, the structure of the human brain appears to guarantee a tight bond between written and spoken language, a bond which manifests itself primarily as mutual arousal of the two codes even in activities where only one is required. In normal reading, this bond serves the reader well, if for no other reason than that

mutual activation is fast, allowing reading to proceed with the efficiency and accuracy of speech. Modern models of reading exploit this bond, and are taking the study of reading to new levels, characterized by precision, testability, and clinical significance. Given the value of the skill of reading, and the personal and social burden of lacking it, continued scientific interest in the underlying biological and cognitive machinery can only be applauded.

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Reading Disorders

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Abstract

This entry summarizes current research on reading disorders. Historical trends along with the most recent perspectives on the definitions, subgroup classifications, and causes of the problems related to reading are reviewed. This entry also provides an analysis of interventions to improve reading skills and types of interventions resulting in successful outcomes. This entry concludes by examining the main issues in the field of reading disabilities.

INTRODUCTION

The goal of this entry is to review literature on reading disorders and problems associated with poor reading skills. First, the variety of terminology and definitions are examined and the current definitions of the disorder and the classifications are provided.

Next, a more detailed description of the processes involved in good reading and possible causes of problems in reading are explored. Among these potential causes are impairments associated with basic processes related to word recognition, language processes, naming speed, and memory. The neurological basis of reading problems and some possible genetic factors to account for reading deficits are also discussed. Then we proceed to examining various scientifically based interventions and factors that are related to successful intervention outcomes. Finally, the chapter concludes by reviewing controversial and problematic issues in the field of reading disabilities.

The term reading disorders has been used interchangeably in literature with the term dyslexia, learning-disabled readers, specific reading disabilities, learning disabilities in reading, learning disorders in reading, or reading disabilities. For simplicity, we will use the term reading disabilities. Children or adults with reading disabilities have an unexpected failure in reading, but otherwise possess average intelligence and motivation in schooling considered necessary for accurate fluent reading. Reading disabilities are among the most common neurological-based disorders affecting children with prevalence rates of 5%–10% in clinics and about 17% in unselected population-based samples.^[1] These incidence figures and the review of research reflected in this entry are primarily based on children who are having difficulty learning to read alphabetic language. There has been little consensus on the incidence of reading disabilities in nonalphabetic languages. Reading disabilities is a persistent chronic condition that does not represent a transient developmental

lag. Depending on the definition, the incidence of children with reading disabilities in special education classes is conservatively estimated to reflect 2%–5% of the public school population. It is also the largest category of children served within the context of the label learning disabilities, and children with learning disabilities are the largest diagnostic group of children served in special education.

By definition, children and adults classified as having reading disabilities are those individuals with normal intelligence, but who suffer mental information processing difficulties. Children or adults with reading disabilities are a subgroup of a larger diagnostic category known as learning disabilities. The terms are used interchangeably because approximately 80% of the intervention research on learning disabilities focuses on reading.^[2] Several definitions refer to reading disabilities as reflecting a heterogeneous group of individuals with “intrinsic” disorders that are manifested by specific difficulties in the acquisition and use of listening, speaking, reading, and writing. Most definitions of reading disabilities assume that the difficulties of such individuals are

1. *Not* due to inadequate opportunity to learn, to general intelligence, or to significant physical or emotional disorders, but to *basic* disorders in specific psychological processes (such as remembering the association between sounds and letters).
2. *Not* due to poor instruction, but to specific psychological processing problems. These problems have a neurological, constitutional, and/or biological base.
3. *Not* manifested in all aspects of learning. Such individuals’ psychological processing deficits depress only a limited aspect of academic behavior. For example, such individuals suffer problems in reading, but not necessarily arithmetic.

Before discussing the causes and issues related to reading disabilities, a brief historical review is necessary.

HISTORICAL TRENDS

In 1877, Kussmaul called attention to a disorder he referred to as word blindness, which was characterized as an inability to read, although vision, intellect, and speech were normal. Following Kussmaul's contribution, several cases of reading difficulties acquired by adults due to cerebral lesions, mostly involving the angular gyri of the left hemisphere, were reported (see Hinshelwood^[3] for a review). In one important case study, published by Morgan,^[4] a 14-year-old boy of normal intelligence had difficulty recalling letters of the alphabet. He also had difficulty recalling written words, which seemed to convey "no impression to this mind." That case study was important because word blindness did not appear to occur as a result of a cerebral lesion. After Morgan's description of this condition, designated as a specific reading disability, research was expanded to include children of normal intelligence who exhibited difficulties in reading. Hinshelwood's^[3] classic monograph presents a number of case studies describing reading disabilities in children of normal intelligence. On the basis of those observations, Hinshelwood inferred that reading problems of those children were related to a "pathological condition of the visual memory center" (p. 21).

Researchers from the 1900s to the 1940s generally viewed reading difficulties as being associated with structural damage to portions of the brain that supported visual memory (e.g., see Geschwind^[5] for a review; also see Monroe^[6]). A contrasting position was provided by Orton,^[7,8] who suggested that reading disabilities were reflective of a neurological maturational lag resulting from a delayed lateral cerebral dominance for language. Orton described the phenomenon of a selective loss or diminished capacity to remember words as strephosymbolia (twisted symbols). Orton^[8] noted that "although these children show many more errors of a wide variety of kinds it is clear that their difficulty is not in hearing and not in speech mechanism, but in recalling words previously heard again or used in speech, and that one of the outstanding obstacles to such recall is remembering all of the sounds in their proper order" (p. 147).

Orton stated that such children with reading disabilities had major difficulties in "recalling the printed word in terms of its spatial sequence of proper order in space" (p. 148). Thus, for Orton, reading difficulties in children with reading disabilities were seen as reflecting spatial sequences in visual memory or temporal sequences in auditory memory. However, it is important to note the conceptual foundation for much of Orton's research was challenged in the 1970s (see Vellutino).^[9] Today reading difficulties are viewed primarily as language problems and memory difficulties (e.g., see Stanovich and Siegel).^[10] Memory difficulties are popularly conceptualized in terms of difficulties in language processes.

SUBGROUPS OF READING DISABILITIES

The heterogeneity of performance of individuals with reading problems has led to some confusion in the field and has prompted researchers to theorize the existence of distinct subtypes of reading disabilities.^[11–13] In their recent examination of the current state and perspectives on learning disabilities, Fletcher et al.^[11] proposed the existence of three types of reading disability. The first type is associated with problems in word recognition and spelling. The second form refers to difficulties in reading comprehension. Finally, the third type includes individuals who experience difficulty in reading fluency and poor automaticity of word reading.

The largest number of students with reading disabilities demonstrates problems on word level recognition. It is the most common and best understood form of reading disability and is associated with deficits in phonological awareness (the ability to hear and manipulate sounds in words and understand the sound structure of language), automatized rapid naming, and verbal working memory. However, a subset of students with reading disabilities who have intact word recognition skills show deficits in reading comprehension. This type of disability is related to problems in oral language and working memory. (Working memory is the capacity to integrate new information with old information when high demands are made on attention.) Finally, a group of students with average word decoding skills differ in reading fluency. These individuals have average word recognition accuracy but a slow reading rate.

A prominent study by Morris and colleagues^[12] explored the variability of reading disability subtypes in a large group of 7–9-year-old children with reading problems. Based on the results of their study, several reading subtypes emerged: two subtypes without reading disability, five subtypes with specific reading disability, and two as "globally deficient," in the sense that performance across all measures was very low. Five specific reading disability subgroups varied with regard to phonological (working) memory and rapid naming. Six of the reading disability groups exhibited deficits in phonological awareness skills. The authors concluded that children with reading disabilities could be differentiated from the "garden variety" poor readers on the basis of their vocabulary level, which was in the average range for children with specific reading disabilities.

Overall, Morris and colleagues' work on subtyping reading disabilities is consistent with the phonological processing hypothesis, which postulates that problems in the phonological domain account for reading difficulties. These phonological problems either occur in isolation or co-occur with problems in other cognitive domains.

Other subtype studies tested whether good and poor readers could be differentiated on their performance on memory-related measures. For instance, Swanson^[13]

examined individual differences in several forms of memory of students with and without reading disabilities. Although several subgroups with different profiles emerged, the results indicated that children with reading disabilities had low performance on memory tasks not because of reading, but rather due to inefficient working memory. Swanson concluded that “connections between reading and WM operate on a continuum of independence to dependence as reading becomes more skilled” (p.327).

ADULTS WITH READING DISABILITIES

Reading disability persists through the life span, and children with reading disabilities grow up and become adults with reading disabilities. As these young adults transition to a new stage of their lives, they encounter new problems and challenges at home, at work, and in the community. In adulthood, the implications of having a reading problem are different and not that obvious. Unfortunately, the general population today is still unaware of the specifics of reading disability, and because it is “invisible,” the behavior of these individuals is often misinterpreted and not understood by people with whom they interact in the beyond-school world. Less research has been conducted with adults with reading disabilities than with school-age children and adolescents. The majority of research on adults with reading disabilities has focused largely on examining their social and emotional development, vocational training, transition to postsecondary education, and issues related to employment.

The Individuals with Disabilities Education Act of 2004 (IDEA 2004), the Americans with Disabilities Act (ADA), and Section 504 of the Rehabilitation Act define the rights of people with learning problems, including reading disability. Individuals with learning disabilities in reading are legally entitled to receive special services and appropriate instruction to help them cope with and overcome their learning problems and to adapt to the new environment. Such services may include workplace accommodations, extended time on tests and exams, or use and provision of assistive technology.

READING DISABILITIES AS A SUBCATEGORY OF LEARNING DISABILITIES

As mentioned earlier, a great deal of research on reading disabilities has been linked to a larger diagnostic category known as learning disabilities. The term learning disabilities was first coined in a speech by Samuel Kirk delivered in 1963 at the Chicago Conference on Children with Perceptual Handicaps. Clinical studies prior to 1963 showed that a group of children who suffered perceptual, memory, and attention difficulties related to their poor academic (i.e., reading) performance, but who were not intellectually

retarded, were not being adequately served in the educational context. Wiederholt,^[14] in reviewing the history of the learning disabilities field, said that its unique focus was on identifying and remediating specific psychological processing difficulties. Popular intervention approaches during the 1960s and 1970s focused on visual-motor, auditory sequencing, or visual perception training exercises. Several criticisms were directed at these particular interventions on methodological and theoretical grounds.

By the late 1970s, dissatisfaction with a processing orientation to remediation of learning disabilities, as well as the influence of federal regulations in the United States (Public Law 94-142), remediation programs focused primarily on teaching the basic skills of reading, such as phonics and sight word identification. The focus on basic skills rather than psychological processes was referred to as direct instruction. The mid-1980s witnessed a shift from the more remedial academic approach of teaching to instruction that included both basic skills in reading and cognitive strategies (ways to better learn new information and efficiently access information from long-term memory). Children with learning disabilities, primarily in the area of reading, were viewed as experiencing difficulty in “regulating” their learning performance, especially on reading comprehension tasks. An instructional emphasis was placed on teaching students to check, plan, monitor, test, revise, and evaluate their learning during their attempts to learn or solve problems.

The early 1990s witnessed a resurgence of direct instruction intervention studies, primarily influenced by reading research, which suggested that a primary focus of intervention should be directed to phonological skills. The rationale was that because a large majority of children with learning disabilities suffer problems in reading, some of these children’s reading problems are exacerbated due to a lack of systematic instruction in processes related to phonological awareness. This view gave rise to several interventions, which focused heavily on phonics instruction and intense individual one-to-one tutoring to improve children’s phonological awareness of word structures and sequences.

From the turn of the twenty-first century to the present, assessments of reading disabilities have been linked to intervention. A method of identifying school-aged students with reading disabilities known as response to intervention (RTI) first establishes low academic performance and then determines if a disability is present. The RTI model is partially based on intervention programs that have distinguished children experiencing academic difficulty due to instructional deficits from those with disability-related deficits.^[15] Federal regulations in the United States regarding the Individuals with Disabilities Education Act of 2004 have influenced the use of RTI by supporting a child’s response to scientific, research-based intervention as a process for learning disabilities identification. In general, the RTI model identifies whether a

student's current skill level is substantially lower than the instructional level (based on predetermined criteria: e.g., below the 25th percentile). Low academic performance is established using standardized, norm-referenced and/or curriculum-based measurements. After establishing low performance, empirically based interventions are implemented to determine if a disability is present. Student progress is monitored during the intervention. When a student does not respond to high quality intervention, the student may have a reading disability.

CAUSES OF READING DISABILITIES

Before discussing the possible causes of reading disabilities, it is necessary to highlight what good reading entails and some of the processes (when not operating properly) that may underlie or contribute to reading disabilities. Written words are symbolized representations of the spoken word. The ability to read depends on the acquisition of a variety of different types of knowledge and skills. Good reading ability assumes adequate language comprehension and fluent word identification. Most models of reading suggest that information is stored in our mind (referred to as coding) and can be transformed into units of spoken/written language. This stored information allows us to acquire information related to the spoken and written language. The storing and retrieving of language information is referred to as linguistic coding. Some aspects of linguistic coding involve speech codes or our ability to represent information in the form of words and word parts. This is referred to as phonological coding. There are other types of coding processes that are related to reading. Some of these codes relate to semantic coding that relates to our ability to store information about the meaning of concepts represented by words and word parts (e.g., -ing, -ed) and syntactic coding that is the ability to store word rules that set constraints on how words are organized in sentences. There is also pragmatic coding that is the ability to store information about conventions governing the use of language and how we communicate (in terms of changes in volume, pitch, intensity of spoken language). Linguistic and visual processes together also facilitate the establishment of associations of printed words. Visual coding refers to sensory or high level visualization processes that facilitate storage or representations of written words or graphic symbols.

Proficiency in reading would require the child to actively engage in all of the aforementioned coding processes. There is an "awareness" feature to the coding process, for example, *phonological awareness*, which refers to a child's ability to conceptually understand and have an explicit awareness of spoken words that consist of individual speech sounds (phonemes) and that are combinations of speech sounds (syllables). Such knowledge is viewed as very important in learning letters and converting the alphabet symbols to sounds. There is also *orthographic*

awareness, which refers to the child's sensitivity to how letters or words are organized.

Given all these particular coding process, several models of reading disabilities have emerged. Vellutino et al.^[16] provide an overview of research on specific reading disabilities across four decades. They conclude that adequate facility in word identification, due to basic deficits in phonological coding (converting written letters and words into sounds, skills of segmenting and blending sounds associated with letters—what is generally referred to as phonics knowledge), underlie reading disabilities. These deficits in phonological coding are defined as an inability to use speech codes to represent information in the form of words and parts of words. In short, these individuals have an inability to represent sound units in one's mind. Based on the review by Vellutino et al.,^[16] most cases of reading disabilities are due to phonological coding deficiencies rather than more basic deficits such as visual, semantic, and syntactic processing of information. There are some studies that have suggested that there may be some general language deficits in this population. Some of these general problems have been related to difficulties in attention, making association between sounds and visual shapes, processing verbal to auditory information or transfer, and working memory. We will briefly review some of the research programs that seek to determine the causes of reading disabilities.

Basic Processes Related to Word Recognition

Linda Siegel and her colleagues at the University of British Columbia have conducted several studies on basic processes related to reading disabilities (see Siegel and Mazabel,^[17] Siegel^[18] for a review). Her studies define reading disabilities in terms of word recognition skills that "all" children with reading problems have. A significant contribution of Siegel's program is her definition of reading disabilities. She suggests that the focus of definition should be at the reading recognition level and suggests that a cutoff below the 25th percentile or 20th percentile should contribute to the operationalization of reading disabilities. This work is based on the assumption that there is no reliable evidence to indicate that IQ plays a cognitive role in the development of reading skills. Reading-disabled children at all IQ levels have equal difficulty in phonological processing tasks, such as recognizing the visual forms of pseudo words, and pseudo word spelling. Work by Siegel indicates there are five possible processes that underlie the development of reading skills in the English language. These processes involve phonology, syntax, working memory, semantics, and orthography. Most of this research shows that difficulties in phonological processing are fundamental problems for children with reading disabilities, and these problems continue to adulthood. Three processes are critical in the analysis of reading disabilities: those related to phonological processing, syntax, and working memory.

Language Processes

Virginia Mann at the University of California at Irvine has focused on language processes and their relationship to reading disabilities (e.g., see Mann).^[19] Her studies on language processing skills and reading problems indicate that poor readers have problems with phonemic awareness, with morpheme awareness, and with three aspects of language skill: 1) speech perception under difficult listening conditions; 2) vocabulary, especially in terms of naming ability; and 3) use of the phonetic representation in linguistic short-term memory. Several of these process share a common core related to phonological coding, which concerns the sound pattern of language. Based on comparative studies (e.g., American and German instruction), her research suggests that awareness of phonemes is enhanced by methods of instruction that direct a child's attention to phonetic structures of words. Instructional experiences alone are not the only factors that account for failure to achieve phoneme awareness. Some other factors are related to speech perception (i.e., the awareness of rhyme), working memory, and problems with morphology.

Naming Speed

Several studies by Maryanne Wolf^[20,21] have found a connection between rapid naming of letters, numbers, and objects and reading disabilities. Slow naming speed marks a core deficit associated with reading disabilities. Her work has found strong relationships between rapid naming of letters and sound deletion (phonological awareness task). Rapid naming is associated not only with initial reading fluency but also whether there are any fluency gains after practice. Some research has investigated the role of rapid naming and reading achievement in languages other than English. The research suggests that slow naming speed is somewhat distinct from phonological awareness. Some of Wolf's work has focused on subtyping by strengths and weaknesses in rapid naming as well as phonological awareness. That research suggests a double deficit hypothesis, in which children can vary in terms of difficulty on phonological skills, rapid naming skills, or both of those skills. Georgiou and Parrila's^[22] comprehensive review of the research on rapid automatized naming (RAN) and reading suggests that the factors that underlie the connection are unclear. Some researchers have attributed RAN to the coordination of attention, perception, memory, and lexical processes, whereas others have viewed it as accessing phonological information in long-term memory.

Memory

Lee Swanson and his colleagues^[23] have researched reading disabilities by primarily focusing on short-term

memory, working memory, and their distinction. Deficits in reading comprehension and problem solving experienced by children with reading disabilities are related to memory problems in a speech-based storage system and/or memory problems related to specific aspects of a general executive system of working memory. The executive system focuses on the monitoring of information, focusing and switching attention, and activating representations from long-term memory. Problems in the executive system of children with reading disabilities are related to the inefficient mental allocation of attention and the poor inhibition of irrelevant information. Problems in executive processing are described in terms of limitations in attentional capacity rather than processing strategies. Because short-term memory has minimal application to complex academic tasks, the majority of his research on reading disabilities focuses on the relationship between working memory and complex cognition (reading comprehension, word problems).

Neurological Basis

Evidence from this neurological data suggests the disruption of the neurological system for language in individuals with reading disabilities.^[1] Brain-based research in reading disabilities has focused on the planum temporale, gyrus morphology of the perisylvian region, corpus callosum, and cortical abnormalities of the temporo-parietal region. Although at this point in time it is difficult to summarize this research, the neural biological codes believed to underlie cognitive deficits in the reading-disabled seemed to be centered on the left temporo-parietal region. Differences in the asymmetry of the planum temporale have consistently been found in association with reading disabilities. Specifically, asymmetry of the planum temporale is due to a larger right planum. A reversal of normal pattern of left greater than right asymmetry has been found in individuals with developmental dyslexia.

Recent studies by Sally Shaywitz and Bennett Shaywitz^[1] at Yale University have found differences in the temporo-parieto-occipital brain regions between reading-disabled and non-impaired readers. The converging evidence using functional brain imaging in adult reading-disabled readers shows a failure in the left hemisphere posterior brain system to function properly during reading. Some brain imaging studies show differences in brain activation in frontal regions in reading-disabled compared to non-impaired readers. The majority of this research has focused on the brain regions where previous research has implicated reading and language. The research shows clear activation patterns related to phonological analysis. For example, on non-word-rhyming tasks, reading-disabled readers experience a disruption of the posterior system that involves activation of the posterior superior temporal gyrus (also known as Wernicke's area, the

angular gyrus, and the striate cortex). The research demonstrates a persistent nature of a functional disruption in the left hemispheric neural systems and indicates that this disorder is lifelong.

Genetic Factors

Several studies have addressed genetic influences on reading disabilities. This research suggests that phonological coding abilities have a genetic etiology. The Colorado twin studies support the existence of major gene effects on reading disabilities, although the precise information about the mode of inheritance is less clear. Some of the literature (see Svensson et al.^[24] for a review) has found the localization of dyslexic gene sites (some of the gene sites have been attributed to chromosome 1, 2, 6, 15, and 18). Some research suggests that genes that contributed to nonword repetition also account for the genetic basis of memory span score. Petrill^[25] reviews recent research showing that both genetic and environmental influences are important in understanding reading disabilities. The presence of significant genetic factors among is viewed as a starting point for addressing some of the important theoretical questions concerning the genetic and environmental contributions to reading disabilities. Petrill discusses a fundamental issue referred to as the “missing heritability paradox.” He suggests that a considerable proportion of the genetic variants that influence learning disabilities (reading and math) may be genes that are infrequent within the particular population. Petrill’s research team suggests that there are multiple genetic pathways and routes through which abilities and disabilities emerge.

SCIENTIFICALLY BASED INTERVENTIONS

In the field of reading disabilities, the term treatment or intervention is defined as the direct manipulation (usually assigned at will by the experimenter) of variables (e.g., instruction) for the purposes of assessing learning: 1) efficiency; 2) accuracy; and 3) understanding. Swanson et al.^[2] have provided the most comprehensive analysis of the experimental intervention literature on learning disabilities, and specifically reading disabilities to date. Interventions were analyzed at three levels: general models of instruction, tactics used to convey information, and components that were most important to the instructional success.

In terms of general models, their synthesis of methodologically sound studies (those studies with well-defined control groups and clearly identified samples) found that positive outcomes in remediation reading were directly related to a combination of direct and strategic instructional models. These models included a graduated sequence of steps with multiple opportunities for learning over the content and skills, cumulative

review routines, mass practice, and teaching of all component skills to a level that showed mastery. The interventions involved: 1) teaching a few concepts and strategies in depth rather than superficially; 2) teaching students to monitor their performance; 3) teaching students when and where to use the strategy in order to enhance generalization; 4) teaching strategies as an integrated part of an existing curriculum, and 5) providing teaching that included a great deal of supervised student feedback and practice.

In terms of tactics, Swanson^[26] divided studies into eight models based on key instruction tactics: direct instruction (a focus on sequencing and segmentation of skills), explicit strategy training, monitoring (teaching children strategies), individualized and remedial tutoring, small interactive group instruction, teacher-indirect instruction (teacher makes use of homework and peers’ help for instruction), verbal questioning/attribution instruction (asking children key questions during the learning phase and whether they thought what they were learning would transfer), and technology (using computers to present concepts). The results indicated that explicit strategy instruction (explicit practice, elaboration, strategy cuing) and small group interactive settings best improved the magnitude of intervention outcomes. Explicit strategy instruction included two key components. One component included strategy cues. These studies included instructional components related to reminders to use strategies or multisteps, the teacher verbalizing steps or procedures to solve problems, and use of “think aloud” models. The other component of strategy instruction was elaboration. These studies included instructional components related to providing additional information or explanations about concepts and/or providing redundant text or repetition within text.

What makes an intervention effective regardless of its theoretical orientation or approach? Swanson^[26] analyzed interventions at the component level to address this question. He and his colleagues^[26] found that effective instructional models follow a *sequence of events*:

1. State the learning objectives and orient the students to what they will be learning and what performance will be expected of them.
2. Review the skills necessary to understand the concept.
3. Present the information, give examples, and demonstrate the concepts/materials.
4. Pose questions (probes) to students and assess their level of understanding and correct misconceptions.
5. Provide group instruction and independent practice. Give students an opportunity to demonstrate new skills and learn the new information on their own.
6. Assess performance and provide feedback. Review the independent work and give a quiz. Give feedback for correct answers and reteach skills if answers are incorrect.
7. Provide distributed practice and review.

They also found that some instructional components were far more important than others. For reading comprehension, those key instructional components that contributed in significantly improving the magnitude of outcomes were as follows:

1. *Directed response/questioning*: Interventions related to dialectic or Socratic teaching, the teacher directing students to ask questions, the teacher and a student or students engaging in reciprocal dialog.
2. *Control difficulty or processing demands of a task*: Interventions that included short activities, level of difficulty controlled, teacher providing necessary assistance, teacher providing simplified demonstration, tasks sequenced from easy to difficult, and/or task analysis.
3. *Elaboration*: Interventions that included additional information or explanation provided about concepts, procedures or steps, and/or redundant text or repetition within text.
4. *Modeling by the teacher of steps*: Interventions that included modeling by the teacher in terms of demonstration of processes and/or steps the students are to follow to solve the problem.
5. *Small group instruction*: Interventions that included descriptions about instruction in a small group and/or verbal interaction occurring in a small group with students and/or teacher.
6. *Strategy cues*: Interventions that included reminders to use strategies or multisteps, use of “think aloud models,” and/or teacher presenting the benefits of strategy use or procedures.

In contrast, the important instructional components that increased the effect sizes for word recognition were the following:

1. *Sequencing*: Interventions included a focus on breaking down the task, fading of prompts or cues, sequencing short activities, and/or using step-by-step prompts.
2. *Segmentation*: Interventions included a focus on breaking down the targeted skill into smaller units, breaking into component parts, segmenting and/or synthesizing component parts.
3. *Advanced organizers*: Interventions included a focus on directing children to look over material prior to instruction, directing children to focus on particular information, providing prior information about a task, and/or the teacher stating objectives of instruction prior to commencing.

The importance of these findings is that only a few components from a broad array of activities were found to enhance intervention outcomes.

Two very important instructional components emerged in Swanson’s analysis of interventions for children with

reading disabilities. One component was explicit practice that included activities related to distributed review and practice, repeated practice, sequenced reviews, daily feedback, and/or weekly reviews. The other component was advanced organizers that included: 1) directing children to focus on a specific material or information prior to instruction; 2) directing children about task concepts or events before beginning; and/or 3) the teacher stating the objectives of the instruction.

Issues in the Field of Reading Disabilities

Fundamental problems of definition have severely affected the field of reading disabilities within the public school context. This is because considerable latitude exists among psychologists in defining reading disabilities. This latitude is influenced by social/political trends as well as nonoperational definitions of reading problems. The field of study is further exacerbated because the number of individuals classified with reading disabilities has increased dramatically over the last twenty years. Unfortunately, without reliable and valid definitions of reading disabilities, very little progress in terms of theory development will emerge.

A related impediment to advances in the field is whether students with reading disabilities perform any different than low achievers. Traditionally, studies that have studied children with reading disabilities have relied primarily on uncovering a significant discrepancy between achievement in a particular academic domain and general intellectual ability. The implicit assumption for using discrepancy scores is that individuals who experience reading problems, unaccompanied by a low IQ, are distinct in cognitive processing from slow or low achievers. This assumption is equivocal. A plethora of studies have compared children with discrepancies between IQ and reading with children who are nondiscrepantly defined poor achievers (i.e., children whose IQ scores are in the same low range as their reading scores). These studies found that the two groups were more similar in processing difficulties than different.^[27,28] As a result, some researchers state that current procedures to identify children with reading disabilities are invalid.^[29] They have suggested dropping the requirement of average intelligence, in favor of a view where children with reading problems are best conceptualized as existing at the extreme end of a continuum from poor to good readers. In addition, some researchers have argued that IQ is irrelevant to the definition of reading disabilities and that poor readers share similar cognitive deficits, irrespective of general cognitive abilities.

In contrast to the argument that children with reading disabilities look no different than other poor readers in cognitive functioning or intervention outcome, Hoskyn and Swanson^[27] found in a synthesis of the literature that although children with reading disabilities and poor readers share some deficits in phonological processing and

automaticity (naming speed), performance by children with reading disabilities was superior to poor readers on measures of syntactic knowledge, lexical knowledge, and spatial ability. Another important finding was that cognitive differences between the two ability groups were more obvious in the earlier grades. Perhaps more important, Swanson and Hoskyn^[30] found that students with reading disabilities and low achievers differed in the magnitude of their responsiveness to intervention. After reviewing several intervention studies, the results showed that students who had low reading scores (25th percentile) but average IQ scores were less responsive to interventions than children whose reading and IQ scores were in the same low range (25th percentile) (also see Swanson and Hoskyn,^[31] pp. 300–301).

One of the practical difficulties within the field is that students who are identified by a political notion of reading disabilities have very little resemblance to the description offered within the scientific discipline. Thus, in contrast to the arguments presented related to the validity of reading disabilities as a field, most researchers who study the processing difficulties of children with reading disabilities do not use the discrepancy criteria. The majority of researchers rely on cutoff scores on standardized measures that are above a certain criterion of general intelligence measures (e.g., standard score > 85) and cutoff scores below a certain criterion (standard score < 85) on primary academic domains (e.g., reading or mathematics). Researchers distinguish individuals with reading disabilities from other general handicapping conditions, such as mental retardation and visual and hearing impairments. Further specification is made that socioeconomic status, being bilingual, and conventional instructional opportunity do not account for depressed achievement scores. Such specification allows the scientists to infer that the learning problems are intrinsic to the individual.

CONCLUSION

Children and adults with reading disabilities have normal intelligence but have difficulties in phonological processing, syntax, and working memory. These problems manifest themselves by poor performance on word recognition and reading comprehension tasks. Poor performance is defined as reading scores below at least the 25th percentile on a norm-referenced reading test. There is a biological basis to reading disabilities that causes lifelong difficulties in reading. Effective intervention programs focus on the explicit teaching of word recognition and comprehension skills.

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Reading Interests

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Abstract

“Reading interests” refers variously to the following: an individual’s interest in doing reading itself, as demonstrated by the amount of actual reading done; what a reader wants to read “about” as expressed by a list of topics or subject areas or genres that the reader reads by preference; or the elements in a text, sometimes referred to as appeal factors, that engage a particular reader with a text. Apart from examining bestseller lists and circulation records, two of the most direct ways to find out about reading interests are to ask the readers themselves and to ask the writers who have demonstrated their ability to interest readers by writing popular, bestselling books. Research on reading interests foregrounds the individual reader, whose interests, choices, tastes, reading behaviors, reading competencies, opportunities, frustrations, and pleasures in reading are given a starring role.

INTRODUCTION

Like the related terms “reading habits” and “reading motivation,” the term “reading interests” has the appearance of a stable trait—reading interests shows up in the titles of numerous research studies and has achieved the status of subject descriptor in indexes. Depending on who is asking the question, reading interests refers variously to the following: an individual’s interest in doing reading itself, as measured by the amount of reading actually done; what a reader wants to read “about” as expressed by a list of topics or subject areas or genres that the reader reads by preference; or the elements within a text, sometimes referred to as “appeal factors,” that engage a particular reader with a text. Reading comprehension, though a different concept, is nevertheless related to reading interests. Whatever else it may mean, reading interest entails a necessary element of engagement, as the reader makes meaning from the black marks on the page.

Apart from examining bestseller lists and circulation records, two of the most direct ways to find out about reading interests are to ask the readers themselves and to ask the writers who have demonstrated their ability to interest readers by writing popular, bestselling books. Wilkie Collins, friend of Charles Dickens and popular nineteenth century novelist, said that the secret was to “Make ‘em cry, make ‘em laugh, make ‘em wait.” By the early 1970s, there was already a substantial body of scholarship on reading interests summarized in Alan Purves and Richard Beach’s *Literature and the Reader*. Purves and Beach^[1] sort research on reading interests into three categories: 1) the reading interests themselves, which are broken down to include “interests in content, interests in form, amount of reading and interests, book difficulty and interests, and literary quality and interests; 2) personal

determinants of interests which are taken to be “age, sex, intelligence, reading ability, attitude, and psychological needs”; and 3) institutional determination of interests which are taken to be “availability of books, socioeconomic and ethnic determinants, peer, parent, and teacher influences, and television and movies as determinants.”

On examination, concepts such as reading interests/habits/attitudes/motivation/choices/preferences are hard to pin down and hard to distinguish. One thing we can say is that research on reading interests and cognate areas foregrounds the individual reader, whose interests, choices, tastes, reading behaviors, reading competencies, opportunities, frustrations, and pleasures in reading are given a starring role. In a nutshell, this field of research is reader-centered, in contrast with text-centered approaches that focus on the literary work or with structural approaches that focus on the social milieu in which the text is produced, distributed, taken up, and used. It puts the spotlight on reading itself within the broader communication circuit that includes the text, the author, the publisher, bookstores, and libraries, as well as social and technological factors such as copyright regimes, censorship, educational institutions, and technologies of printing and distribution.^[2] It privileges the cognitive and emotional responses of readers themselves and pays special attention to voluntary reading rather than to required or assigned reading. It is interested in the “why” and “how” of reading as well as in the “who” and “what.”

Why be concerned about reading interests? One answer lies in the link between reading interests, literacy acquisition and the demands for enhanced literacy in citizens of knowledge-based economies and societies. From studies of literacy acquisition, we know that readers learn to read by doing a lot of reading.^[3] And what keeps beginning readers reading through the thousands and thousands of

hours it takes to become a practiced reader? It's the pleasure of the experience itself—what some researchers call “intrinsic motivation.” So in the field of education and literacy studies as well as in the field of librarianship, there is the desire to know what factors motivate people to want to read, help them acquire the reading habit, and keep them reading across the lifespan. The term reading interests points to a key question: what kinds of reading materials/types of stories/kinds of experiences give people sufficient pleasure that they choose to continue reading rather than put the reading material down in favor of some competing activity?

But almost from the beginning reading interests turned out to be a surprisingly complex phenomenon to tease out from other factors and pin down. In the first heyday of library-based, scientific studies of reading, centered at the Graduate Library School at the University of Chicago in the 1930s under the leadership of Douglas Waples, reading interests tended to be thought of as something that preexisted—a causal factor that preceded reading. Researchers asked people to indicate their interests from a set of topics such as history, biology, economics, politics, government, personal hygiene, etc. that could be satisfied by reading nonfiction books on the topic^[4] and that therefore predicted (or ought to predict) reading choices. In more recent reading research, especially in the field of Library and Information Science, reading interest is more apt to be seen as the positive engagement that occurs during a reading transaction when there is an appropriate match between reader and text. This appropriate match often involves a number of intersecting considerations, including the amount of background knowledge needed by the reader to comprehend the text. It turns out that for some readers, the topic is key—there are readers who will read almost anything written about flying or about cooking or about sailing. But for many others, topic turns out to be one factor among many, some others being the feel of the book (upbeat and life-affirming or ironic and critical), pacing (a quick read or a dense, detailed text), setting (similar to the reader's everyday experience or very different), and the demands on the reader made by the language and literary conventions used.^[5]

While studies of reading interests foreground the active role of the reader in making choices and acting on preferences, it has also been recognized for a long time that there is an interplay between the interests and choices of individual readers and the availability of reading material that reaches readers through the various gatekeeping channels provided by intermediaries—e.g., publishers' choices of what to publish and later to advertise as well as the decisions of bookstores and libraries of what to stock and make available. As early as the 1930s, landmark studies by Douglas Waples and Leon A. Carnovsky explored the relationship between expressed reading interests and actual reading as part of a larger research agenda on reading and libraries summarized helpfully by

Stephen Karetzky.^[6] Carnovsky's *Library Quarterly* article, “A Study of the Relationship Between Reading Interest and Actual Reading,”^[7] for example, reports that book readers tend to read most in areas in which they have previously reported most interest, but only when such books are as accessible, as well-advertised, and as readable as other books. In other words, availability and accessibility can trump interest.

RESEARCH APPROACHES TO STUDYING READING INTERESTS

A problem for researchers of course is that reading interests cannot be observed directly. They can, however, be inferred from what people *say* about reading in letters, diaries, and Web-postings and in response to surveys, questionnaires, and interviews as well as from what they *do* through their book-buying, book-borrowing, and participation in book clubs and reading groups. Each of these research approaches is partial and has its own limitations. Bestseller lists and circulation statistics tell us what is sold or borrowed, not what is read or how it is read. Autobiographies, diaries, letters, and to some extent even marginalia are composed with an audience in mind of future readers by whom the writer hopes to be viewed in a favorable light. Small case studies based on interviews or ethnographic observation of individual readers may be idiosyncratic and not representative of general patterns. Large scale questionnaires using national samples are generalizable but tell us only about averages and not about any actual reader. Nevertheless, taken together, a growing body of research using different research methods from different disciplines, including education, sociology, history, psychology, literary history, and library and information science has achieved considerable understanding of the reading interests of readers of the past and present.

Historians and literary scholars have taken the lead in studying readers from periods before the twentieth century. Literary historians have paid most attention to the reading interests of elite readers, in particular of canonical authors. They examine these authors' texts for evidence of literary borrowings and verbal echoes and they track down the books held in authors' personal libraries in the hope of finding underlinings of significant passages and marginalia indicating reader response. Bibliophile Nicholas A. Basbanes^[8] has written entertainingly on studies that examine the “silent witnesses” to reading provided by library collections such as Leon Edel and Adeline R. Tintner's *The Library of Henry James*^[9] or that focus on marginalia, such as the six volumes of Coleridge's marginalia published as part of a Princeton University Press project to publish all of Coleridge's writings.

The burgeoning field of history of the book, or “*histoire du livre*,” has expanded our understanding of the reading interests and experiences of ordinary readers from various

historical periods and geographical areas. In her introduction to a theme issue in *Library Quarterly* on retrieving the reading experiences of ordinary readers by means of library records, Christine Pawley^[10] observed, "Still, some readers are more difficult to recover than others. Especially hard to access are the reading choices and practices of millions of 'common readers,' those with relatively anonymous lives and whom archival collections tend to ignore." Using census records, library catalogs and circulation records, subscription lists, estate inventories, advertisements, printing and transportation records, autobiographies, diaries, letters and other traces, book historians have tried to recreate a detailed picture of the what and how of reading of people in various different times and places. A notable example is William Gilmore's *Reading Becomes a Necessity of Life*,^[11] which examines transformations in reading in rural New England from 1780 to 1835, as reading materials in the home grew from a Bible and Farmers' Almanac to an expanded mix of newspapers, periodicals and books, including fiction. Readers' letters to authors and to publishers have also proved a fruitful source of evidence of reading experience and reception. For example, Robert Darnton^[12] reconstructed the Rousseauistic reading of Jean Ranson, an eighteenth century provincial French merchant, by examining his letters to the Société Typographique de Neufchâtel, a Swiss publisher of French books. Similarly, James Smith Allen's study^[13] of fiction reading in France was based in part on voluminous archives of letters sent by a privileged readership of acquaintances to 10 French authors.

Marginalia has proved an unexpectedly rich resource for investigating ordinary reading. Cathy Davidson's account of nineteenth century American novel readers was based, among other sources, on the marginalia inscribed in copies of early American novels. About well-used books, she notes, "Broken boards, turned-down pages, and abounding marginalia . . . reveal patterns of reading, patterns of use, the surviving traces of an interpretive community long-since gone" through which "some of the early readers remain surprisingly vivid even after nearly two centuries."^[14] English Professor Heather Jackson, in particular, has been a seeker-out of marginalia of all kinds, by exceptional celebrated readers and by common anonymous readers alike. An editor of the Coleridge project, she confesses, "Coleridge's marginalia converted me to writing in books."^[15] In *Marginalia*, she examined some 3000 books annotated in English by various readers from 1700 to 2000 and made the claim that marginalia can contribute to the history of reading by revealing codes of reading of the period as well as by recovering the experiences of individual readers.

As we move to the twentieth century, an expanded array of research methods has become available to investigate contemporary reading interests. Using tools developed for surveys and polling, a large body of work focuses on the *what* of reading interests, often with the help of checklists,

reading inventories, or questionnaires. Survey research uncovers broad patterns by correlating various aspects of reading (amount of reading in various formats, preferred genres, reasons for reading, and source of reading materials) with demographic variables of sex, age, educational level, or occupational group. In contrast, ethnographic research based on in-depth interviews or case studies of individual readers provide a fine-grained picture of reading interests in the context of the reader's life. A notable example is Janice Radway's *Reading the Romance*, which used a combination of individual and group interviews and questionnaires to understand the reading experiences of romance readers. Although the term reading interests is nowhere to be found in the index, the entire book in fact explores the special satisfaction that romance reading provides to romance fans. Radway says, "This theme of romance reading as a special gift a woman gives herself dominated most of the interviews."^[16] Also using interviews with readers, in *Children Talk About Books*,^[17] Donald Fry presents vivid case studies of six child readers as the grounded starting point for discussing familiar themes relating to reading interests: why readers choose to repeat the experience through many rereadings of a favorite book; the role of strong topical interest in motivating a reader to stretch beyond his usual comfort level; the attraction of series books such as those by Enid Blyton; the enjoyment of story; the popularity of genre fiction such as horror stories; and the move from children's fiction into adult books.

Talking to actual readers, rather than generalizing from one's own experience, is especially important in the case of children and young adults. As Holly Virginia Blackford notes in *Out of this World*:^[18] "How children themselves produce meaning is a particularly crucial area of study because child readers are, by definition, colonial subjects of a genre that is controlled by layers of adults and adult institutions (writers, publishers, marketers, critics, bookstores, libraries, educators, parents, and producers and marketers of commercial products and multimedia adaptations)." Blackford herself interviewed 33 girls, ages 8–16, from California and New Jersey, expecting to find that young female readers do identity work by reading fictional representations of characters like themselves and identifying with the protagonists. To her surprise, she found that despite "differences in race, class, age, family circumstances, reading preferences, and reading abilities, the girls' reading practices reveal a consistent pattern. They read for a good story, and a good story means one that they are *not* living—that actually looks *nothing* like the life they know."^[18]

From an accumulating body of research, certain generalizations have been robust. Almost everyone in westernized countries *can* read—95% or more of young adults are proficient at basic reading tasks;^[19] the problem is that too few readers are proficient at the more demanding reading tasks that are increasingly required in a knowledge-based society. Despite widespread belief that literacy skills are

falling from some earlier golden age of reading, performance on literacy tests tell a different story. For example, the Canadian *Reading the Future*^[20] found that there is an enormous improvement in literacy for those educated after World War II in comparison with those who completed their education before the war. Studies conducted over the last 50 years have been remarkably consistent in showing that the vast majority of the population reads something, about half the population reads books, and about 10–15% are avid readers. Occupation group and educational level are more important than age when it comes to predicting whether or not a person is a book reader. Younger people tend to read more than those over age 50; college-educated people and people with higher annual incomes tend to read more than those without a college education or with lower incomes; whites read more than nonwhites.^[21]

Gender makes a difference at all ages: girls and women have reading histories different from those of boys and men. Researchers report that from as young as 2 years old boys and girls display different preferences, with boys preferring scary fairytales and girls preferring romantic ones—preferences that extended into adulthood where men read more westerns, adventure, and science fiction and women read more romance. Boys enjoy information books, humor, action stories, and science fiction, with Harry Potter books enjoying phenomenal success, even among those who normally don't enjoy reading.^[22] Summarizing research on gender and literacy, Smith and Wilhelm^[23] note, among other things, that girls understand narrative texts and most expository texts significantly better than boys do; that boys value reading as an activity less than do girls; and significantly more boys than girls call themselves nonreaders. To build guy-friendly school library collections, Patrick Jones and his colleagues^[24] recommend spending a little less on novels and investing in magazines, graphic novels, comics, joke books, newspapers, books with colored illustrations, and nonfiction in areas of high interest such as sports, vehicles, etc. On average, girls learn to read sooner than boys and with more facility; they read more and they are more apt than boys to report that they enjoy reading for pleasure. As school age readers get older, there is a steady decline in the percentages of both boys and girls who say they enjoy reading and do it voluntarily for fun, with an accelerated drop-off around age 12 or 13. Among adult readers, women read more than men, particularly more fiction. Women are much more likely than men to belong to reading groups or book clubs: Jenny Hartley found that about 65% of reading groups are women, 28% mixed, and 6% men only.^[25] Elizabeth Long's booklength study of white women's reading groups in Houston, Texas^[26] suggests that, for these women, reading is fundamentally a social activity and book club participation a way of reflecting on the meaning of their lives in relation to others.

Reading preferences are idiosyncratic and individualistic, emerging from what Ruth Strang^[27] has called “a central core or radix” that determines any individual's

pattern of reading. Popular fiction, particularly detective fiction/mystery, science fiction/fantasy, and romance, accounts for a large proportion of what people say they like reading as well as what they actually do buy and borrow. An interest in reading materials is positioned within a larger network of media consumption and for many readers is stimulated or reinforced by tie-ins with comics, music, movies, television, or videogames.^[28] Readers develop an awareness of popular literary genres by paying attention to the craft of storytelling across media, learning how, say, fantasy works by experiencing instances of the fantasy genre in books, films, television shows, and videogames.^[29] Although we may think of reading as a solitary activity, social elements are powerful influences. Relationships with family, teachers, and friends are important factors in fostering reading and in influencing what materials are read.^[30] Studies of reading interests of students of all ages repeatedly have found a disconnect between reader interests and the traditional canon entrenched in the high school literature curriculum in U.S. schools^[31,32] where *To Kill a Mockingbird*, *Huckleberry Finn* and *The Scarlet Letter* remain common choices. Not surprisingly, readers are more likely to find books which they have chosen themselves more interesting than they find assigned reading; furthermore high interest increases ease of comprehension.^[33]

Because so much of the research on reading interests has depended on a questionnaire or checklist, it is worth taking a look in more detail at the types of instruments used. Typically researchers elicit basic demographic information (including grade level for school age subjects), ask for the title of the last book read in whole or in part, and ask respondents to complete a checklist or reading interest inventory. “When given the opportunity to read any kind of book you choose, what kind of books do you read. Chose one” (or sometimes two or three):

1. science fiction;
2. fantasy;
3. horror;
4. mystery/thrillers;
5. adventure;
6. western;
7. romance/love stories;
8. biography/autobiography;
9. literary fiction;
10. sports;
11. true life;
12. historical;
13. humor;
14. other (please explain).

Such research based on self-reports is subject to all the usual problems of inexact memory and a lack of shared understanding of the meaning of terms. Is “true life” on this checklist intended as a synonym for nonfiction or does

it mean a realistic novel, set in a familiar setting and focused on real life problems? Does “historical” include historical fiction such as regency romances or war stories or does it refer only to nonfictional historical accounts? As noted by Purves and Beach,^[33] “Adventure as a category may have a number of interpretations (action, suspense, violence, faraway places, and manliness), and the researcher’s conception of adventure may be far from the respondents’ and one respondent’s from another.” These typical problems of survey research are exacerbated in the case of reading by biases introduced by the value society places on certain kinds of sanctioned reading and denies to other kinds of reading which are denigrated if not out and out forbidden. Often the only format asked about is books. Reading magazines, newspapers, fanzines, comics, manga, or Web sites does not count as real reading in most of these studies, although we know that, especially for adolescent boys, these formats are preferred sources of reading pleasure.^[34,35] Research that compiles lists of favorite books or recently read books is likely, especially in the case of students, to reflect the composition of readily available sources of books, such as school-sponsored book clubs and accessible school library or classroom collections.

READING ENGAGEMENT, BOREDOM, AND COMPREHENSION

The flip side of reading interest is reading boredom. In *On Being Literate*, Margaret Meek^[36] says that we need to pay more attention to what beginning readers think they are doing when they read: “Here, again, their boredom is a clue because it manifests itself in their disinclination to continue. When they are bored they shut the book.” Boredom, argues Meek,^[36] is frequently the result of a misalignment between the reader and the text or the learner and the task; boring texts are usually either too difficult or too easy for the reader. Texts can be too hard when they require preliminary knowledge that the reader doesn’t have—either knowledge of the way stories work or of the way the world works—because making meaning out of texts involves fitting what is read into the pattern of what is already known. In any case, what is missing when readers describe books as boring is the element of engagement.

Victor Nell^[37] used the experimental methods of cognitive psychology to investigate the conditions of reader engagement, using terms like “arousal,” “reading involvement,” and “entrancement” to describe the experience of the engaged reader. Experimental subjects who read for pleasure (ludic readers) were asked to read in a laboratory setting an enjoyable book that they chose themselves. Meanwhile subjects were attached to electrodes that recorded heart rate, muscle activity, skin response, and breathing—the variables measured as indicators of

arousal. Among other findings, Nell discovered that levels of arousal were higher during ludic reading than during work reading, despite the fact that the readers themselves experienced the pleasure reading as effortless. The paradox of ludic reading is that deep engagement and high physiological arousal go hand-in-hand with the reader’s sense of effortlessness, where the words on the page drops from consciousness as the reader is absorbed into the world of the book.

The interesting–boring continuum turns out to be a key theme in understanding frustrated readers who have trouble “getting into” a book. When Anne Reeves set out to understand resistant student readers who did not share her own sense of reading as a joyful activity, she conducted in-depth interviews with 25 adolescent readers in grades 9–12 and developed fine-grained case studies of five of these readers. Asked what comes to mind when they hear “reading,” most said the literature studied in English class. These resistant readers all insisted that 1) they could read and 2) that they did read when they were interested in the text. Since most school reading did not interest them, they had developed more or less successful strategies to avoid it, including watching the film, asking someone to tell them what happened in a novel on the English curriculum, or using Cliff notes. The most common advice from her 25 interviewees to teachers was “Choose interesting stuff. Don’t try to make us read boring stuff.”^[38] As Reeves notes, these students view interest as a stable commodity that resides in a text, something that the author can choose either to include or to leave out. They thought of interest-iness as something “outside over there,” not as a product of their own relationship with the text and dependent on their own activity.

Reeves found that readers call a book boring when it requires them to take risks, when the readers’ sense of competence is called into question by a reading task that is too challenging, when the world represented in the book is threatening or painful, or when readers don’t have the necessary background knowledge to make sense of the text. Similarly, in their study of 49 adolescent boys, Smith and Wilhelm^[34] emphasize the crucial importance for readers to have a sense of competence and control in reading; when the boys in their study felt “overmatched” by the reading task, they stopped reading. “Boring” turns out to be a catchall term to describe a negative reading experience, however produced. For example, in Reeves’s study, Duke, a 17-year-old high school senior, described as “boring” the YA book *Go Ask Alice* (1971), which was assigned in one of his English classes. Duke explained: “I don’t like readin’ depressin’ stuff. Her life just started gettin’ worse and worse. . . . It’s bringing me down.”^[39] In the same study, Joel, a 15-year-old student in grade 10, chose to read Stephen King’s *Cujo* (1994) for an English class assignment. He picked *Cujo* because he had heard that King is interesting and because the book itself is “not too long.” However, *Cujo* did not live up to its promise:

Joel found himself at sea because of King's strategy of introducing multiple sets of characters in small introductory scenes, switching rapidly to new scenes and new sets of characters who are apparently unrelated to previously presented ones: "It's just he goes on from one thing, you start reading, and it's like switch to a different thing, and I just kinda got lost about what was going on."^[39] Joel had not read enough complex fiction to have learned that when it's not clear how scenes, characters, or events fit together, you don't start over again at the beginning and read more slowly; you press on because you know the pattern of significance will eventually be revealed. Successful reading of prose fiction depends on knowing what Peter Rabinowitz has called the "rules of reading": these rules "serve as a kind of assumed contract between author and reader—they specify the grounds on which the intended reading should take place."^[40] And how do readers learn these rules of engagement with texts? Most often through reading texts themselves, starting with highly patterned fictions such as fairy tales, series books, and genre books that make the design clear.

READING INTERESTS: HIGH AND LOW

Some scholars have been disheartened by one seemingly intractable fact about reading interests: a majority of readers, when given the chance to choose, prefers a good story told in an accessible style to a literary classic. There are more readers for Harlequin romances than for *Middlemarch* and more readers for thrillers than for serious poetry. When transformations in the technology of printing and distribution, the power-driven cylinder press, new paper-making machinery, cheap postal rates, and a new railway system dramatically lowered costs and made reading materials affordable to a mass audience in the second-half of the nineteenth century in North America, people turned out to want to read cheap popular fiction, a fact that worried some observers. In *The Intellectual Life of the British Working Classes*, Jonathan Rose^[41] notes, "In the late nineteenth and early twentieth centuries, the penny dreadful (cheap crime and horror literature for boys) created something approaching panic among middle-class observers, who were certain that it encouraged juvenile delinquency." A great deal was written at the time and following on the theme of cheap books, trash, rubbish, penny dreadfuls, and sensation novels, some commentators saying that such materials are harmful because they instill "false views of life" and displace better reading while others said that they are beneficial because they introduce readers to the love of reading.

The field of librarianship itself has provided a terrain for a more than century-long contest between two opposed views on what to do about people's reading interests. Should libraries cater to these interests or try to change them by improving reading tastes and inculcating a desire

for something better? Advocates of libraries as a place to serve leisure and recreational readers have recommended finding out more about readers' interests in order to provide reading materials that satisfy these interests. From this perspective, understanding reader interests provides a foundation for building collections of popular materials and for effective readers' advisory service. Advocates of the purely educational function of libraries have criticized this catering to readers' interests as a "Give 'em what they want" approach that undermines the library's educational mandate and produce impoverished "drug store" collections.

Esther Jane Carrier's book *Fiction in Public Libraries 1876–1900*^[42] provides a well-documented account of how these opposing arguments played out during the formative years of public librarianship in North America. With generous quotes from her nineteenth-century sources, Carrier examines what eminent librarians said at the time on such topics as "What is trash?," "High Quality," and "Reading Improvement." During the nineteenth century, there was a strongly held sense of a natural hierarchy of quality in books in themselves. At the bottom were materials whose very names signaled trashiness: penny dreadfuls, dime books, series books, sensational fiction, and popular romances. Further up were solid works of literary fiction as well as nonfiction works that tell a story such as history, biography, or travel books. At the top were serious, nonnarrative forms such as philosophy and theology.

The goal for librarians was to push the reader up the reading ladder from recreational reading to educational reading.^[43] William M. Stevenson,^[44] librarian of the Carnegie Free Library of Allegheny, Pennsylvania, stirred up controversy when he removed from the library books he deemed too low on the reading ladder: books by Horatio Alger, Bertha M. Clay, May Agnes Fleming, Martha Finley (the Elsie Books), E.P. Roe, Mrs. E.D.E.N. Southworth and other popular fiction catering to a taste for "recreation and entertainment only." In his 1896 and 1897 annual reports, he acknowledged that, since "devotees of this class of literature will read nothing else," it was inevitable that overall library circulation figures would drop, but he justified his decision by stating that it is the unswerving duty of libraries to supply "nothing but good books" and set a "high standard for reading in a community." In Stevenson's view, "As a rule the people who care for reading nothing but the latest sensational novel cannot be reached beneficially by the public library. It is a waste of time and money to try." (Quoted in Carrier^[45]). More than a century later, a strong endorsement of the public library's educational function can be found elaborated in Dilevko and Magowan's *Readers' Advisory Service in North American Public Libraries, 1870–2005*. The authors lament the erosion of an earlier age's commitment to a central mission of "meaningful education through serious and purposeful learning."^[46] Regrettably, in their

view, public libraries have become increasingly infiltrated by “a mindset in which the reading of books, no matter their intrinsic quality, is construed as good and where discretionary reading becomes commodified and disposable entertainment, as manifested principally in genre fiction and genre nonfiction (genre titles), bestsellers, celebrity-authored books, and prize-winning titles.”^[46]

READING THE GENRES

Opponents of this hierarchical view of books and reading deny that it is useful to open up too wide a gulf between “high” texts and “low,” between high art and “mass” literature. They point to historical instabilities in the evaluation of genres, one century’s bestselling popular authors such as Dickens and Wilkie Collins becoming canonical works in the next. They argue instead that valuable texts are to be found in all media and in many different genres. Successful reading begins with situating the text: asking what kind of text this is and what qualities and effects do we normally expect to find in texts of this type. The publication of Betty Rosenberg’s *Genreflecting: A Guide to Reading Interests in Genre Fiction*^[47,48] can be seen as a watershed event within the library and information science (LIS) field that legitimized a nonhierarchical way of looking at texts. Rosenberg’s First Law of Reading, “Never apologize for your reading tastes,” included in all six editions of *Genreflecting*, shifts the emphasis to the tastes and reading interests of the reader.

In a simple breakthrough, *Genreflecting* solved for librarians the intractable problem of trying to find a single ladder of quality on which all books can be arranged. Instead *Genreflecting* takes the approach of helping readers situate a given text within its own literary genre, so that comparisons of quality are made *within* a genre not between types of literature that aim at quite different effects. The western is about facing death in an environment stripped down to its bare essentials; the horror story is about scaring the reader; the speculative science fiction story is about “What if?”; the romance is about the developing love relationship of two central characters and the guaranteed happy ending; the mystery story is about uncovering a secret. Since each genre attempts to provide different satisfactions, comparisons are more useful within a genre than across genres. The helpful questions to ask about a particular work become: what are the qualities, effects, and literary conventions that distinguish this particular genre? who are the outstanding exemplars of the craft of writing in this genre? what is it about these exemplars that appeal so strongly to readers who enjoy this genre? how well does this particular work compare with the best examples of the genre in delivering these satisfactions?

An approach to understanding reading interests by studying popular genres has gathered momentum. Robert Scholes defines a literary genre as “a sort of template, used

by both writers and readers, to allow for relatively rapid composition and comprehension. That is, a writer composing a text in a recognized genre begins with a template, a preexisting form, that leaves certain blanks to be filled in.”^[49] This template includes a set of formal qualities that we recognize as typical of the genre and that together work to provide the reader with a predictable experience of pleasure. These formal qualities are like the elements of what Wittgenstein called “family resemblance”—features such as a high-bridged nose or wide-set eyes or red hair that show up in generations of family portraits even though one does not need to find that nose or any other particular feature to identify a portrait as belong to the family. In the case of the Western, for example, the set of stock features, as described by John Cawelti^[50] and Jane Tompkins,^[51] are as formalized as those of the *commedia del arte* or the Petrarchan sonnet. These features include the frontier setting in big sky country of desert, prairie, or mountain; characters such as good and bad gunmen, the solitary outsider who rides into town, the schoolmarm, plucky widow, and saloon girl, the saloon owner, broken-down doctor, cowboy, cattle baron, cavalry officer, scout, Indian, and of course the horse; and plot devices such as betrayal, revenge, retaliatory violence, Indian captivity, the chase, lynching, train robbery, range war, and the show-down or shoot-out.

Blackford^[52] reports that the girls in her study are so familiar with generic conventions “that they identify those conventions as ‘rules’: ‘Now, there’s . . . certain rules that you have to have in horror stories, like whenever you turn around there’s always somebody there, it always has to be nighttime in a thunderstorm, and something scary happens.’ ” The genre book, when it is successful, embodies the familiar elements but in a new way, providing the reader with a satisfying mix of the familiar and the unexpected. Joyce G. Saricks’s *The Readers’ Advisory Guide to Genre Fiction*^[53] provides a very helpful overview of 15 different genres and their characteristic appeal, including for each genre five exemplary authors and titles that are good starting points for exploring the genre. Libraries Unlimited have followed up their wildly successful *Genreflecting* with a series of guides to reading interests, edited by Diana Tixier Herald, that focus specifically on particular genres such as fantasy, mystery, horror, adventure/suspense, historical fiction, romance, or mainstream fiction. Another useful form of introduction to rules governing popular literary genres come from bestselling writers themselves who provide an insider’s view of the genre and its appeal to readers, for example, Sue Grafton’s edited collection of essays on writing mysteries,^[54] Jayne Ann Krentz’s edited collection *Dangerous Men and Adventurous Women: Romance Writers on the Appeal of Romance*,^[55] and Orson Scott Card’s guide to writing science fiction and fantasy.^[56]

As Scholes points out, the genre template serves the needs of writers by providing a ready-made structure and

serves the needs of readers by helping them find their bearings in a book, once reading has begun. Readers use their familiarity with the rules of genre fiction to predict what could possibly happen in a new book they pick up—whether it will scare them or reassure them or amaze them or present them with a mystery to be solved. And of course publishers, who know that readers use genre as a filter in choosing books to read, package books in covers that provide strong generic cues including color-coded covers in green for fantasy, sandy gold for westerns, shades of pink for romance, and black for horror.

Some cultural theorists argue that genre readers are dupes of corporate publishing interests, which provide only the appearance of choice while selling a standardized, mass-produced, cheap commodity that relies on spurious gratifications and emotional appeals. The test case has been the romance, which is the most denigrated of all the genres. Romance accounts for a huge percentage of book sales—one-quarter of all books sold and 40% of mass paperback sales, according to the Romance Writers of America Web site.^[57] The Romance Writers of America website notes that in 2006 there were approximately 6400 romance titles released, generating 1.37 billion in estimated revenue. In her introduction to *Dangerous Men and Adventurous Women*, Krentz describes romance as a fantasy of female empowerment in which the woman always wins: “In romance the success of an individual author is . . . [based] on how compellingly she can create her fantasy and on how many readers discover they can step into it with her for a couple of hours.” Krentz argues that readers have no difficulty distinguishing the inevitably happy endings of the fantasy from the reality of their everyday experience. They *choose* to enter the romance world for a couple of hours to experience a reaffirmation of hope and the importance of loving human relationships.

READERS’ ADVISORY AND APPEAL FACTORS

Understanding reading interests has been considered foundational for readers’ advisory work as it has been practiced in public libraries since the early 1980s. Melanie Kimball’s chapter on the history of readers’ advisory in the sixth edition of *Genreflecting*^[58] describes what she calls a “complete overhaul” of readers’ advisory service. She identifies several significant milestones in the formation of the new breed of readers’ advisor as someone who understands reading interests and can “recommend fiction reading, particularly genre fiction.” Among these milestones were the already-mentioned first edition of *Genreflecting*, Joyce Saricks and Nancy Brown’s *Readers’ Advisory Service in the Public Library*,^[59] Ted Balcom’s *Book Discussion Guide for Adults: A Leader’s Guide*,^[60] and the formation of the Adult Reading Round Table in

Chicago in 1984, a group of librarians who met to foster the study of reading interests and popular genres of fiction. Because fiction accounts for such a large share of popular reading, readers’ advisory work focused initially on popular genres of fiction and their appeal factors. By the 1990s, however, the scope of readers’ advisory service was expanding to include popular nonfiction which can be read for pleasure, specifically those nonfiction works with a strong sense of story, such as travel, biography, history, true accounts of crime, adventure, or sports. Robert Burgin’s *Nonfiction Readers’ Advisory*^[61] is an edited collection of articles that argue that the concepts of genre and appeal factors used for fiction can also be used effectively to serve nonfiction reading interests.

Appeal factor is a concept introduced by Saricks and Brown in the first edition and elaborated in Saricks’s third edition of *Readers’ Advisory Service in the Public Library*. Thinking about a book’s appeal factors takes us beyond subject headings or a bare plot summary. It is a way of helping readers’ advisors identify textual elements in a book that satisfy a reader’s desire for a particular reading experience. On the basis of many years of front-line work with public library users, Saricks^[62] reported, “We have found that most [leisure] readers are not looking for a book on a certain subject. They want a book with a particular ‘feel.’ . . . Appeal elements describe more accurately [than subject headings alone] the ‘feel’ of a book.” Readers provide clues about the appeal factors they prefer when they talk about a book read recently and enjoyed. Does the reader use terms like “compelling” and “fast-paced” or does the reader praise the book’s leisurely unfolding? Is the reader looking for something that is heartwarming and comforting or challenging and edgy? Following deep listening to what readers say they look for in a good book, readers’ advisors try to match a reader’s interests with a book’s appeal factors, namely pacing, characterization, storyline, and frame (i.e., the book’s particular atmosphere or tone).

IN CONCLUSION

As fine-grained case studies of individual readers accumulate, they have confirmed Ruth Strang’s 1942 finding that reading interests and preferences, in all their individuality, emerge from a central core or radix that determines any individual’s pattern of reading. Correlations of demographic factors to reading choices—e.g., men read nonfiction; women read novels; men prefer science fiction and action adventure; women prefer fantasy and romance—these generalizations can be useful in predicting trends in sales and borrowing but don’t help much in understanding any particular reader, whose reading preferences are as individual as a fingerprint. For some librarians and readers’ advisors, the next step in understanding readers is writing a reader profile, starting with themselves. As

Joyce Saricks notes about the process of reflecting on our own reading interests, "When we see the variety of books we enjoy, we begin to understand that other readers feel the same way."^[63]

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Recommender Systems and Expert Locators

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Abstract

This entry describes two important classes of systems that facilitate the sharing of recommendations and expertise. Recommender systems suggest items of potential interest to individuals who do not have personal experience with the items. Expert locator systems, an important subset of recommender systems, help find people with the appropriate skills, knowledge, or expertise to meet a particular need. Research related to each of these systems is relatively new and extremely active. The use of these systems is likely to continue increasing as more and more activity is implicitly captured online, making it possible to automatically identify experts, and capture preferences that can be used to recommend items.

INTRODUCTION

Despite the abundance of recorded information, many information seekers turn to other humans for advice and recommendations. Humans, after all, can be quite adept at identifying and solving problems, summarizing relevant content, generating new ideas, and personalizing information. In addition, for some, interacting with other humans is far more socially enjoyable than interacting with static content. Thus, it is no surprise that the Internet is as much a platform for social interaction as it is a document repository.

System designers have taken advantage of the fact that so much social action is captured online by creating systems that extend traditional word-of-mouth exchanges. This entry discusses two such systems: *recommender systems* that provide personalized recommendations (e.g., movie suggestions) for items of potential interest, and *expert locator systems* that automatically identify experts on a particular topic of interest making it possible to obtain personalized advice from knowledgeable individuals outside of one's immediate social network. Expert locator systems can be thought of as a subset of recommender systems where experts are the "items" being recommended. We treat them separately in this entry because in practice there are often important distinctions between recommending items and people. The remainder of the entry defines these two types of systems, outlines their key characteristics, provides some historical and current examples, and identifies the key research questions related to them. It concludes with a discussion about the importance and potential of these

techniques given the increased amount of activity that can be digitally captured.

RECOMMENDER SYSTEMS

People are often confronted with situations where they need to assess the potential value of something that they have never experienced before. We need to find a new book to read, choose a doctor, and know which business is credible. When confronted with these situations, we often turn to experts or peers for recommendations. Increasingly, people receive recommendations from automated tools called recommender systems. For example, people browsing a book at Amazon are presented with a list of related books of potential interest. The related books (listed under the "People who bought this book also bought" header) are identified by a recommender system that relies upon the historical purchasing patterns of Amazon customers. More generally, recommender systems suggest items of potential interest to individuals who do not have personal experience with the items.

Though recommender systems have gained visibility with the spread of the Internet, they are not confined to the Web. Better Business Bureaus, Zagat's restaurant reviews, and The Times Book Review are some examples of recommender systems that predate the Web. Two things make Web-based recommender systems fundamentally different. First, they are able to provide personalized recommendations tailored to individuals. In contrast to The Times Book Review that provides the same recommendations to every reader, recommender systems can recommend a book based

on the other books you personally enjoy, while not recommending it to others with different tastes. Second, recommender systems are able to base recommendations on the data from the masses, not just a handful of reviewers and editors. The online environment has also made it easier to efficiently capture people's preferences and easily distribute recommendations.

Broadly speaking, recommender systems can be classified into two types: collaborative and content-based. Collaborative recommender systems make recommendations based on the prior experience of other users, while content-based systems make recommendations based on features or descriptions of the items themselves. There are also hybrid recommender systems that mix these two approaches. For simplicity, we present them independently in the following sections.

Collaborative Systems

Collaborative recommender systems draw on the historical experience, or preferences of some users to make recommendations to other users. These systems are also called "Collaborative Filters" or "Social Filters" and have been used in a variety of settings to recommend news-group articles (e.g., GroupLens), books (e.g., Amazon's "People who bought this also bought" feature), movies (e.g., MovieLens), music (e.g., Last.fm), and even people (e.g., eBay's feedback system and other expert locators systems discussed in the following section).

Last.fm is a good example of a collaborative recommender system that offers many different recommendations. The site is a music portal that allows users to listen to music, find new music they are likely to enjoy, and find people with similar music tastes. When a user logs into the site, he can enter in his favorite songs and bands and add them to his "playlist," one of the components of his user profile. The system then compares the user's profile with the profiles of other Last.fm users. This comparison makes it possible to identify users who have similar tastes (e.g., people who like and dislike the same music). These individuals are shown as "neighbors" and a user is presented with opportunities to view their music lists. In this way, the system recommends people based on the similarity of user profiles. The system also provides a user with the option of hearing songs that his neighbors as a collective enjoy. Furthermore, when visiting an artist's home page a user can have songs by "similar" artists recommended, where similarity is based on the collective preferences of people who listen to that artist.

To make recommendations like those at Last.fm, a collaborative recommender system must perform the following tasks:

1. Elicit Preferences: Learn about the users' preferences and store them in user profiles.

2. Compute Predictions: Predict how well a user would like an unfamiliar item based on the data from the user profiles.
3. Make Recommendations: Use the predictions to make recommendations.

Fig. 1 provides a schematic representation of a recommender system, showing how these tasks relate to one another. Different recommender systems use different approaches to perform each of these tasks. We now discuss each of the tasks in turn.

Elicit preferences

Recommender system can learn about the users' preferences by explicitly asking them to rate certain items; or by using implicit measures such as purchase history, search history, or time spent browsing an article. Most recommender systems that use the explicit method ask users to rate items in the database that they have experienced in the past. The systems use these ratings to form and periodically update a model of the user's preferences. Some recommender systems employ an alternative approach where they ask all users to rate items from the same "gauge" data set and model their preferences based on these ratings.^[1]

Recommender systems can vary in the amount of detail that is captured with the ratings and the scale used to capture them (i.e., the dimensionality and granularity of ratings). A recommender system could obtain detailed ratings along multiple dimensions (e.g., quality and timeliness) or it could ask for a one-dimensional rating (e.g., overall satisfaction). Ratings could be on an all positive scale, all negative scale, or a positive and negative scale. The ratings can also vary on granularity. They may use a 1

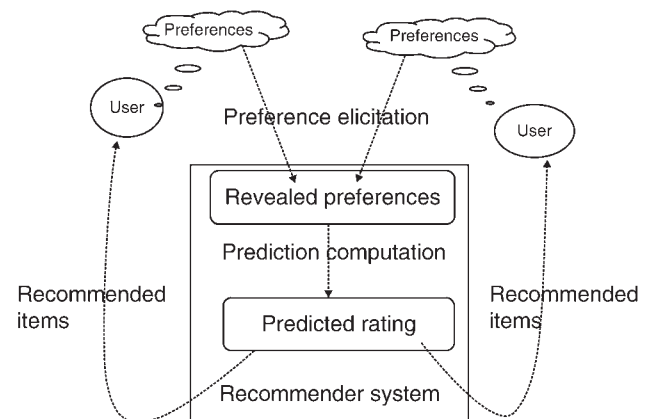


Fig. 1 Schematic representation of a collaborative recommender system.

to 5 scale like Amazon.com or a “thumbs up” and “thumbs down” scale like Digg. Each of these design choices has different implications for the accuracy of recommendations and also a user’s privacy and the ease of entering ratings. They will also influence which prediction algorithms are possible to use.

Compute predictions

Several alternative algorithms are used to make predictions and thus recommendations. Improving the accuracy of predictions is an area of active research, which has received additional impetus through Netflix’s announcement in late 2006 of a \$1 million prize for the first team that improves the predictions of Netflix’s recommender algorithm by 10%.

Recommender algorithms can be classified into two types: (1) memory-based and (2) model-based.^[2] Memory-based algorithms use data from all users to make predictions directly, while model-based algorithms use data from all users to formulate a single model of user preferences, and then use this model to make predictions. Recommender algorithms can also be classified based on whether they use correlations between users or between items.

In the user-user approach, correlation between two users is computed based on the scores of items that are rated (or used if the recommender system uses implicit measures) by both the users. The recommender system computes correlations between all such user pairs, which can be used in a variety of ways. One of the popular approaches is to use these correlations as weights when making predictions by taking a weighted average over the opinions of other users who have rated an item. Another approach is to use the user-user correlations to divide the user population into clusters of users, where users in the same cluster are considered to have similar preferences. Predictions for a user’s hitherto unrated item are made by averaging the opinions of the other users in her cluster. Other approaches use statistical techniques such as Principal Component Analysis or Singular Value Decomposition and seek to identify latent factors in the data and make predictions based on those.

In systems that use the item-item approach (e.g., Amazon.com’s “Users who bought this book also bought” feature), correlations between item pairs are computed instead of correlations between user pairs. Correlation between two items is computed using ratings of all the users who have rated both items. The system recommends items that are highly correlated with the items that are highly rated (or used) by the user.

When computing predictions, recommender algorithms usually perform some sort of normalization in order to account for systematic differences in the way people choose ratings. For example, if a person’s average rating is 4.5 out of 5 and they give something a 3, the 3 rating is

pretty bad. On the other hand, if a person has an average rating of 2.5 out of 5, a 3 rating is pretty good.

Make recommendations

The objective of a recommender system is to present each user with items she is most likely to enjoy. To this effect, a recommender system can use the predictions in a variety of ways. As illustrated in the Last.fm example, the user can choose to have recommended songs play based on similar artists, neighbors, or her entire history.

System designers need to make several important design decisions in this phase. Besides the obvious design decisions about the interface, the system designer needs to determine what is the maximum permissible error. The error could be an error of commission (incorrectly recommending an item) or an error of omission (not recommending an item that should be recommended). The margin of permissible error for either type depends on the benefit of a correct recommendation and the cost of an incorrect recommendation. Consider a hypothetical Web site where medical treatment is discussed and recommended. Here a good recommendation not made or an incorrectly made recommendation could affect the health of a user. For video sharing, Web sites like YouTube, a recommendation is unlikely to have such important ramifications for the user, but it is still an important decision for the service provider. The service provider has an incentive to provide more recommendations if it leads to increased usage (or sale). At the same time the reduced usability due to poor recommendations may result in the user opting out of the system altogether, so there is still a need for an appropriate threshold.

The system designer needs to consider these issues when deciding the metrics for evaluating the predictions and the magnitude of permissible error. A good recommender system should continually seek feedback from the user and evaluate the accuracy of its predictions. Root Mean Square Error (RMSE) and Mean Absolute Error are some of the evaluation metrics commonly used in recommender systems. The Netflix prize requires a 10% RMSE improvement in the predictions of Netflix’s algorithm.

Content-Based Systems

Content-based systems recommend items based on features of the items themselves. Unlike collaborative systems, there is no need for data from other individuals. For a content-based system to work, a representation of each item must be generated. This can be done automatically, as when all of the words in a book or article are indexed. Or, it can be done manually as when a human cataloger associates a particular genre (i.e., romance) or subject heading to a book. An example of a very simple content-based system would be a news aggregation Web site that

displays “related” articles that are textually “similar” to the one that a user is currently reading.

Many content-based systems provide personalized recommendations. In addition to having a representation of each item, this requires that individuals have a user profile that includes data about a user’s likes and dislikes. As with collaborative systems, data for a content-based user profile can be explicitly entered or implicitly captured based on behavior (e.g., purchasing patterns).

This user profile is then compared with the representations of potential items and those that match closely are recommended. A variety of different techniques (i.e., algorithms) are used to compare user profiles and item representations in order to predict which items a user will like. These differ from those used in collaborative systems because the comparison is not between different ratings; it is between a user’s profile and the representations of items. Common techniques are the use of information retrieval and machine learning algorithms (Hinshelwood^[3] for a more complete list with examples).

Pandora is an example of a content-based system that recommends music. In contrast to Last.fm, it does not rely on any other user recommendations. Instead, it is based on a representation of each song, called a Music Genome, which is created automatically by a special software tool. A song’s Music Genome consists of hundreds of musical attributes that describe qualities of melody, harmony, rhythm, form, composition, and lyrics. When a user enters a favorite song, Pandora recommends other songs with a similar Music Genome. Over time, users are presented with new songs which they rate. A user profile is automatically created that keeps track of the user’s likes and dislikes. Additional songs are recommended taking into consideration the entire user profile.

Challenges of Recommender Systems

Designers and managers of recommender systems face several challenges. Some of these are dependent on the type of recommender system.

Content-based systems face two primary challenges:

1. Creating representations of certain items can be costly and time intensive. Although full-text, digital documents lend themselves well to automatic indexing, other items such as physical objects, small textual items such as quotes, and movies are difficult to automatically index in a satisfactory way.
2. Even when representations of items are available, they may not represent the characteristics that are most important to the user’s enjoyment of the item. Jokes are a good example of this. While one could index the words used in a joke, the user’s enjoyment of the joke has far less to do with the words than it does with the humor. In other words, knowing that a

joke is about a chicken doesn’t help a user know if she would enjoy the joke. One potential strategy for overcome this problem would be to add meta-data to items. However, for items like jokes or poems the meta-data would be so subjective that it would not likely produce accurate predictions for any particular user.^[3]

Since collaborative systems are not based on the representation of an item, they can work for items that are costly or difficult to accurately represent, such as physical objects or jokes. However, they have their own set of challenges:

1. Eliciting enough user ratings to generate accurate predictions for all items is a constant source of concern for the designers and managers of recommender systems. Users need to be provided with sufficient incentives to participate.
2. New users and new items both suffer from the “cold-start” problem. New users do not get good recommendations until they have rated a sufficient number of items; and new items rarely get recommended until a sufficient number of users have rated (or used) them.
3. There may be entities that have an interest in manipulating the recommender system in order to promote certain items. An example of such a manipulation scheme called “sybil attack” or “shilling attack” involves creating a number of spurious users and providing ratings such that certain items get recommended more often. Preventing such manipulations or limiting the damage they cause, is an important consideration for recommender system designers and an active area of research.

To overcome some of these challenges, recommender systems may use a combined approach (both content-based and collaborative) or provide tools that allow people to use preexisting data (e.g., upload iTunes playlists all at once).

Recommender System Research

Online recommender systems have been developed and studied since the mid-1990s. Two related systems were simultaneously developed in the mid-1990s and were instrumental in showing the value of collaborative recommender systems:

1. GroupLens—a net news collaborative recommender system created by Resnick et al.^[4] Resnick continued to study recommender systems as an editor for a special issue of *Communications of the Association for Computing Machinery (ACM)* on the topic in 1997^[5] and as a contributor to numerous articles on the subject. Reidl has also remained highly active in recommender system research with his colleagues at the

GroupLens research lab at the University of Minnesota. They have performed a number of studies of MovieLens, a recommender system for movies. Their Web site^[6] is a good starting point for potential researchers with its list of publications and downloadable datasets.

2. Ringo—a music collaborative recommender system developed at MIT by Shardanand and Maes.^[7] It was later made into a commercial product called Firefly, which was eventually bought out by Microsoft. Music recommender systems are now common and among the most advanced and popular (e.g., Last.fm, Pandora).

Research on recommender systems has continued to grow and doesn't show any signs of slowing down. Several special issues of well-respected journals have focused on recommender systems including the *Communications of the ACM*,^[5] *ACM Transactions on Information Systems*,^[8] *ACM Transactions on Computer-Human Interaction*,^[9] and *IEEE Intelligent Systems*.^[10] Research can also be found in conferences like ACM Special Interest Group on Information Retrieval, ACM Computer-Human Interaction, and ACM Electronic Commerce. Numerous workshops have been held over the years, and in 2007, the first annual ACM Recommender Systems^[11] conference was held. Current research focuses on nearly every aspect of recommender systems from the recommendation algorithms, to interfaces design, to security, and privacy issues.

Summary

Recommender Systems are a powerful tool for recommending new items to individuals either based on content (content-based systems) or other users' experiences (collaborative systems). It is a highly active area of research that epitomizes the current social computing trends. While there are challenges with recommender systems (e.g., needing sufficient numbers of people and items rated before it works), they have already become widely used by corporations such as Amazon, NetFlix, Pandora, TiVo, Google, and others.

EXPERT LOCATOR SYSTEMS

Turning to experts for help is nothing new. We are all familiar with the ability of experts to diagnose a complex problem, clarify an issue, identify hidden structure, point us to a hard-to-locate resource, and perform a task that requires significant skill. Although some expert knowledge can be made explicit in the form of books, videos, diagrams, and knowledge-base entries, other knowledge is implicit and difficult to codify. Thus, it is often preferable to gain access to the source of the knowledge, the expert,

in order to obtain the full benefit of the expertise. Unfortunately, it is not always easy to identify experts, especially within large organizations or distributed communities. Recently, systems have been developed to help locate individuals with needed expertise. These expert locator systems go by many names including expertise finders, expertise location engines, expert locators, and enterprise expertise management systems.

An expert locator system is a collection of technologies and social practices designed to help an individual find someone with the appropriate skills, knowledge, or expertise to meet a particular need. Some are stand-alone systems, but most are integrated into a more comprehensive knowledge management solution. While a basic organizational chart or an informal friendship-based network may be considered an expert locator system in the broadest sense, the term typically refers to more advanced systems that use implicitly or explicitly provided data to identify experts.

Researchers and practitioners have developed and examined expert locator systems since the early 1990s. Most empirical studies have taken place within large corporate settings, although more recent work has looked at expertise location among peer groups and virtual help-based communities. The most active research communities currently examining expert locator systems are the Computer Supported Cooperative Work (CSCW) and Knowledge Management communities. As a result, research on the topic is often published in conference proceedings in these areas (e.g., ACM-CSCW, ACM Conference on Information and Knowledge Management, ACM International Conference on Knowledge Discovery and Data Mining, ACM Recommender Systems) and information systems journals such as CSCW and KES (Knowledge-Based and Intelligent Engineering Systems). However, a considerable amount of research is scattered throughout publications on topics such as artificial intelligence, algorithms, Web personalization, and information systems more generally.

The following sections describe different subtypes of expert locator systems. The area is new enough that the vocabulary around them has not yet solidified. We group the systems into the following categories: *expert databases*, *automatic expertise finders*, *expertise recommenders*, and *expert referral systems*.

Expert Databases

Early expert locator systems were usually called expertise databases, knowledge directories, yellow pages, or knowledge maps. These systems consist of a searchable database of individuals along with data about their prior experience, expertise, organizational role, and contact information. Typical systems include Microsoft SPUD, HP CONNEX, and the NASA expertseeker. These systems are usually

designed for identifying experts to help solve technical problems or to match employee competencies with company positions.

Inputting accurate and detailed enough data into these databases can be a significant challenge. Some organizations rely upon assessment interviews, skill inventories, and extensive surveys of employees, but such methods can be costly and labor intensive. In other cases, individual employees are expected to enter information about themselves. Although individuals are the most qualified to describe their own expertise, they often lack motivation to add content—an activity that has few immediate rewards. Furthermore, they may not recognize the potential value of some of their less obvious skills and fail to report them. No matter who contributes the data, expert database entries can suffer from being over-simplified, one-dimensional assessments of expertise that are not informative enough to help direct the fine-grained, context specific questions that lead people to seek out experts. Finally, some systems rely on taxonomies to describe and catalog people's knowledge and skills. While this may encourage consistency and point out areas that may not have been considered, developing, and implementing taxonomies requires considerable effort and are likely to be misapplied if individuals are entering their own data.

Another related challenge is maintaining content over time. People leave, new skills are developed, positions change. For those who rarely use expert locator systems, keeping their data current is not on their top list of priorities. As a result, some expert databases quickly become obsolete. Additionally, organizations may not initially recognize the full investment required to maintain these systems once they are created.

Automatic Expertise Finders

As more and more activity occurs in the digital environment, it has become possible to profile individuals' expertise based on their conversations (e.g., in discussion forums and e-mail exchanges) and the documents associated with them (e.g., publications). An *automatic expertise finder* is a type of expert locator system that takes advantage of the implicit data left behind in the form of digital traces and documents. Such systems typically build expertise profiles from the implicit data by using information retrieval techniques (e.g., indexing). A person's expertise is usually described as a term vector and is used later for matching expertise queries using standard IR techniques. This allows people to search for a relevant expert in much the same way that they might search for a relevant document.

Well-known systems in this category include Who-Knows,^[12] ContactFinder,^[13] and MITRE MII Expert Finder.^[14] Who-Knows identifies experts across an organization by using Latent Semantic Indexing techniques on the project documents people produce. ContactFinder

identifies experts based on their participation patterns and message content. Expert Finder identifies experts based on documents people produce, as well as some experience-related information including basic employment information (e.g., positions held) and projects in which they participated.

These systems solve many of the challenges of expert databases since there is no need to manually contribute and maintain expertise information, and the automatically generated profiles are considerably more developed than the simple keyword-based profiles. However, these systems also have limitations. First, some individuals have expertise that is not yet represented in their digital traces. This is particularly true of new employees, as well as individuals who rely primarily on telephone and face-to-face meetings. Second, from the technical perspective, we still need to improve ways of selecting and integrating different sources and types of data to better reflect people's expertise. We also need to improve the ways of matching information seekers' fine-grained information needs with the large and amorphous expertise profiles. These are active areas of research, and we can expect improvements in the techniques that are used.

Finally, and perhaps most importantly, these systems largely do not consider the social perspectives of expertise sharing. For instance, their results are usually ranked purely based on the computed information similarity between the query and profiles. However, there are many other criteria that people use to select experts in real life and many other social factors that contribute to individual's willingness to share information and have meaningful interactions. The following section discusses systems that were designed with these social considerations in mind.

Expertise Recommenders

Rooted in the field of CSCW, Ackerman and other researchers developed a series of systems that address both social and technical issues related to expertise location and sharing. In contrast to systems that only identify experts based on content overlap, these systems attempt to create a social and technical environment that encourages information sharing and recognizes the importance of social context.

Answer Garden (AG) is a system designed to help in situations like technical support, where there is a continuing stream of questions, many of which occur repeatedly, but some of which have never been seen before.^[15] It has a branching network of diagnostic questions that helps users find answers. If there is no available answer, it automatically routes the question to the appropriate expert who can answer the user and record the answer into the branching network for future users. The design of AG addresses two important social issues in expertise finding. First, askers are anonymous to the experts. This decreases the asker's social

costs related to status implications and the need for reciprocity, although it also loses some of the potentially helpful contextual information. Second, by continually adding questions and answers into the corpus, it decreases the expert's workload in answering the same questions repeatedly and grows the organizational memory incrementally.

Field studies of AG showed mixed results. Questioners appreciated the anonymity, but many of the answers they received were not at the appropriate level (e.g., an answer was too technical and lengthy). This finding suggests that expertise locator systems should route organizational members to individuals with the right level of expertise, not just to experts with the highest level of expertise. A future field study of an AG-like system highlighted some of the limitations of the system including frustration due to incomplete data and continually changing classification schemes.^[16] The study also found that the AG approach is subject to the impact of the given division of labor and organizational micro-politics.

A new version of AG, AG2 was developed to overcome some of the original limitations.^[17] Unlike AG, where the expert location occurred manually, an expertise location engine was developed for AG2. Various computer-mediated communication mechanisms are also added. One important social innovation was the fact that the AG2 expert locator algorithm prefers to "stay local" when selecting expertise to allow contextualization, a concept that was found useful in later systems as well. If a local expert is unavailable, the system supports an escalation process whereby the query is sent on to others until an answer is provided. Thus, the system helps gracefully overcome failures with initial expert recommendations. Another interesting change to AG2 is that the system tends to blur the dichotomy between experts and seekers, recognizing that individuals may be novices in some areas and experts in other areas.

Expertise Recommender (ER) is another system developed by McDonald and Ackerman in order to address issues identified from a field study of AG2.^[18] The major contribution of this system is that it can select experts based on a range of social factors such as organizational closeness and workload, not just level of expertise. As more data about our actions and relationships become available online, many new possibilities for identifying an *appropriate* expert become viable.

It is important to recognize that the systems discussed in this section are research prototype systems that are not as widely used as those previously discussed. Although a framework for including additional factors into the expert identification algorithms has been developed, few modules have been implemented. Future research examining the social factors that should be considered (e.g., privacy considerations and motivational issues) when recommending experts seems promising. It short, this research shows that finding an expert is not enough. One must also understand the other social factors related to

their willingness to participate and have enough contextual knowledge to help.

Expert Referral Systems

Another approach to identifying experts is to use a referral process, where an individual has his colleagues and friends introduce, or refer, an expert. This referral method has been used throughout time. However, as more information about our social relationships is made available in digital form, systems have been developed to augment our ability to get high quality referrals from our peers. We call these *expert referral systems*.

ReferralWeb was the first well-known system that utilized social network information to help individuals find and be introduced to experts on a particular topic.^[19] In ReferralWeb, people's expertise are indexed based on individuals' publications. Social network information is extracted from the coauthorships or co-appearances in their Web pages. Experts are identified via traditional information retrieval techniques (as described in the *automatic expertise finders* section). Once identified, the information seeker is presented with visualizations of the network structure, and a list of referral chains that can be taken to get from your known peers to the desired expert. For example, it might show that my friend John knows Lucy who knows the expert Jack; likewise it would show other paths to Jack through different friends who know him.

Although not designed specifically for the purpose of finding experts, Yenta^[20] helps individuals find others with similar interests—individuals who may be in the best position to provide expert advice. Yenta acts like a personal agent. It creates people's personal interest profiles by mining documents in their local machines. The profile is stored locally and uses inter-agent communication to find people who have information similar to the query, all the while protecting the actual content from being shared with others. Yenta also clusters people based on their shared interests to built social coalitions and provides tools to communicate with others in the same cluster. Thus, Yenta can be thought of as a recommender system as described earlier in this article. Other related systems include MARS^[21] and SWIM.^[22] Recently, with the advancement of social network theory research, there are increasing number of peer-to-peer applications designed to share knowledge and resources (e.g., files and contacts) through social networks, as well as commercial social network systems (e.g., spoke and visiblepath) that are designed to help people share contact information. As social networking sites such as Facebook and LinkedIn become ubiquitous, expert referral systems will be a natural fit.

These expert referral systems have several advantages and disadvantages. They support the age-old practice of finding information through social contacts that is familiar to all of us and socially acceptable. They provide added

motivation for individuals to help those who seek them out; after all, an expert is more likely to provide help if they have been introduced by a mutual friend or perhaps even an automatic agent that has identified some hidden similarity. These systems are relatively easy to implement using basic peer-to-peer and information retrieval techniques. They also can provide contextual information about individuals based on their social network relationships, helping expert seekers make more educated decisions about whether or not it is worth contacting a particular expert. Unfortunately, systems like ReferralWeb increase the amount of time required to contact an expert; not only the information seeker's time but also the friends that are part of the referral chain. They may also decrease the pool of experts who are reachable in practice, since referral chains that are too long (or nonexistent) discourage contact with the expert. There is a need for more empirical studies of these systems to help reveal additional advantages and disadvantages.

Summary

In this section we have outlined a variety of different expert locator systems including expert databases, automatic expertise finders, ERs, and expert referral systems. Additional systems are described in Ackerman et al.^[23] Because research on expert locator systems is still in its infancy, the specific terminology and categorization we provide is tentative and likely to change as new techniques are developed and integrated with other knowledge management and social software programs. However, many of the key principles, trends, and design considerations discussed above are enduring. In this summary, we address two of the most prominent.

One common trend is the use of implicit data rather than explicitly entered data in expert locator systems. This trend is likely to continue as more and more of our activities are recorded in a digital environment and can potentially be used to identify our expertise domains, our social network ties, and other factors of interest (e.g., availability). For instance, Zhang et al.^[24] explored ways of using people's asking-answering histories in online forums to infer expertise levels. Further developing tools to integrate these various data sources will be vital to improving expert locator systems. These issues are also important for designing recommender systems more generally.

Another common theme is the need to consider the social implications of expert locator systems. The *expertise recommenders* and the *expert referral systems* emphasize that locating the most knowledgeable individual on a topic is not enough. After all, the most knowledgeable individual may not be able to present information at the right level for the information seeker or may be too far removed from the local context to be of benefit. Furthermore, the most knowledgeable individuals may not have sufficient incentives to participate, especially if they are

bombarded with questions from strangers. Systems that take into consideration these social factors and align the incentives of the various parties are far more likely to succeed in the long run. In this sense, expert locator systems may be better labeled expertise sharing systems.

CONCLUSION

In this entry we have discussed two types of systems that facilitate learning from other people in a highly personal way. Recommender systems provide personalized recommendations for individuals about items that they have not yet experienced for themselves. Expert locators help identify people who are knowledgeable on a topic, so they can personally engage with those who seek their expertise. These systems provide nice alternatives and complements to traditional information retrieval techniques. When finding a relevant document is not enough, expert locators provide access to individuals with expertise and recommender systems provide additional pointers to resources that may not have been considered in the original search query. Research on these topics is growing rapidly and the methods for performing them are improving as a result. In addition, as more and more activity is implicitly captured online, it is increasingly possible to improve these tools and apply them in new domains.

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Records Compliance and Risk Management

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Abstract

This entry considers *records compliance* and *risk management* in the context of archives and records administration. It provides a definition of these terms as separate concepts and examines them in combination.

INTRODUCTION

The concepts of *compliance* and *risk management* have been applied to various methods and strategies of business operations in a wide variety of industries over the past several decades.^[1] This entry identifies banking, investment firms, and insurance companies as being particularly sensitive to managing risk and maintaining compliance to ensure sound business management. Minimizing risk and meeting various levels of statutory obligations are consistently perceived as necessary for stability, growth, and longevity. This is particularly relevant in the *archives and records administration* field, where securing the human record depends on evolving legal requirements, professional norms, and institutional standards. This entry will examine the place of compliance and risk management within the context of archives and records administration. It will provide separate definitions of each concept and evaluate these as related and complementary aspects of the creation, capture, and use of records.

Perhaps first it would be useful to provide a comprehensive definition for records management, simply because the principles it encompasses are generally applicable to a wide array of records and information activities. Records management is,

a professional discipline that is primarily concerned with the management of document-based information systems. The application of systematic and scientific controls to recorded information required in the operation of an organization's business. The systematic control of all organizational records during the various stages of their life cycle, from their creation or receipt, through their processing, distribution, maintenance, and use, to their ultimate disposition.^[2]

The purpose of records management is, "to promote economies and efficiencies in recordkeeping, to assure that useless records are systematically destroyed while

valuable information is protected and maintained in a manner that facilitates its access and use."^[2]

Records management is also concerned with the analysis of any and all recorded information created, received, maintained, or used by an organization in accordance with its mission, operations, and activities.^[3] Furthermore, records management deals with records regardless of age, type, or format, and is often an enterprise-wide undertaking that relies on cooperation at all levels of an organization.^[4] Present-day records management is an outgrowth of traditional archival practice, but typically deals with contemporary recorded information and documents.^[4] In the mid-twentieth century, a distinction was made between "historical" and "modern" documents, mostly because of the deluge of records flowing into traditional archives following World War II.^[4] However, this distinction is no longer prevalent, and records management principles are applied to records produced by corporations, businesses, and governmental units (organizations using and retaining documents in the course of regular business), as well as those kept by historical societies, manuscript libraries, and other cultural institutions (organizations who hold collections for reasons of scholarship or posterity). In nearly all instances, the concepts of compliance and risk management factor significantly into the modern practice of archives and records administration.

RECORDS COMPLIANCE

It is somewhat difficult to comprehensively define compliance in the context of archives and records administration, simply because compliance measures are constantly in flux. In most instances, recordkeeping and reporting are part and parcel of other core compliance areas within organizations. These might include promoting fair and ethical business conduct, requiring proper environmental, health, and safety policies, or ensuring consumer protection,^[5] and may or may not have a records component.

In general, records compliance requirements derive from legislation, regulatory standards, codes of best practices, or community expectations (p.10).^[4] These requirements exist at all social, political, and organizational levels, might be explicit or implied, and incorporate any number or combination of requirements (pp. 38–39).^[4] For example, explicit legal requirements for the creation and management of records in a particular industry could mandate the extended retention of certain types of records created in particular operational contexts. It might also dictate the form in which these records should be maintained, the rights of individuals or corporate bodies to have access to those records, and the protection of the intellectual property that the records contain (p. 38).^[4]

Compliance requirements affect records at all stages throughout their life cycle and can be subject to multiple legal jurisdictions. A significant amount of legal research is often necessary for organizations to determine the legal requirements for retention, destruction, discovery, and disclosure. The first step is to verify which authoritative entities the organization falls under. The degree of regulation varies by the type of industry and while the majority of businesses and organizations are not subject to any recordkeeping guidelines, those that are (e.g., financial services and pharmaceuticals) tend to be heavily regulated by multiple entities.^[6] In particular, those responsible for an organization's legal and regulatory records compliance in the United States should be familiar with the Uniform Rules of Evidence (which apply to state courts), the Federal Rules of Evidence (which apply to federal courts), the National Conference of Commissioners on Uniform State Laws (which helps interpret and standardize laws across jurisdictions), the Uniform Commercial Code, the Uniform Electronic Transactions Act, the Photographic Copies as Evidence Act, the Federal Paperwork Reduction Act, the Code of Federal Regulations, and the statutes of the National Archives and Records Administration.^[6]

The notion of accountability factors heavily into an organization's need to maintain compliance with strictures set forth by internal and external forces. In order to support accountability the records management department or representative must initiate a multilateral assessment of business needs, evidentiary requirements, legal obligations, and recognized best practices (pp. 155, 158).^[4] This will enable ready response to legal challenges, grievances, and complaints from within and outside of the organization. Typically, compliance is checked—and accountability is fostered—through any number of internal and external inspections and audits, which often consist of a close physical examination of an organization's recordkeeping system measured against whatever compliance issues are at hand (p. 159).^[4] The most effective audit procedures are ones established at the founding of the vital records management program and that remain

sensitive to changing compliance regulations (pp. 75–76).^[3] Audits best support accountability through regular scheduling that matches other organizational troubleshooting efforts and through designating proper authority to carry out inspections, make assessments, and implement recommendations. Though records retention audits typically only consist of a sampling of an organization's records series, this is usually sufficient to determine that organization's appropriate level of need for records security, storage, duplication, and destruction (pp. 75–76).^[3]

RISK MANAGEMENT

According to the Association of Records Managers and Administrators, or ARMA International, risk management is a process that ensures an organization does not assume an unacceptable level of risk and includes both risk analysis and risk assessment procedures as key components.^[7] The level of risk is determined by the importance of the record. All records have relative value, but vital records—ones that are unique and irreplaceable—tend to take precedence over those that can be recreated or those that are not essential to normal business operations (p. 73).^[2] Risk analysis involves the evaluation of exposure of vital records to specific risks and provides a basis for protection planning by identifying threats and vulnerabilities (p. 133).^[3] There are several broad categories of threats, which include destruction, loss, corruption, and improper disclosure of records and information (p. 133).^[3]

In any organization it is imperative to discern acceptable levels of risk and typically this is accomplished through qualitative or quantitative risk assessment. The qualitative approach is most useful at identifying and categorizing physical security problems and other vulnerabilities such as malicious destruction, warfare, terrorist attacks, civil insurrections, purposeful sabotage, vandalism, and theft, as well as natural disasters or man-made accidents, errors, negligence, and incompetence (pp. 133, 136).^[3] Quantitative risk assessment is based on methodologies developed for product safety analysis and computer security applications (p. 136).^[3] It initially relies on qualitative measures such as site visits, and focuses on group discussions, but also uses numeric calculations to determine the annualized loss expectancy of a given institution (p. 136).^[3] This dollar amount is estimated by figuring the probability of a particular event (or events) occurring over a given time span (p. 137).^[3] Ultimately, it factors in the cost of record or information restoration, the loss of business as a result of not being able to perform specific business functions, and the costs of any litigation that might ensue (p. 137).^[3] Upon completion of the analysis and assessment, risk can be managed through a series of controls, protections, and preventative measures that include strategic location (or relocation) of facilities,

limiting access to vital records storage areas, stringent personnel screening and training, effective physical and electronic security, maintenance of multiple copies of vital records and information, initiating disaster recovery and business continuity plans, and developing a system of internal audits to ensure structural integrity (pp. 138–141).^[3]

Though risk management largely addresses the prospect of lost business or capital, it would be insufficient to consider records risk management strictly in financial terms. One of the main tools of managing risk is the development of records retention policies and schedules. A records retention plan helps prioritize value by determining the risks involved in not keeping or destroying a set of records against the costs of maintaining them (p. 161).^[4] However, this often represents a convergence of competing interests between internal and external factors, which are not always financial. For example, cultural institutions such as archives repositories or special research libraries might feel justified spending an inordinate amount of resources to keep a certain records collection because of its social or historical importance, or because of the prestige it confers on the institution. Likewise, organizations that do not use records expressly for their scholarly or cultural value still might justify the expense of maintaining an historical archive because of its potential to provide materials for advertising, marketing, public relations, and in support of corporate memory (pp. 158–159).^[4] The length and quality of any retention program can be radically contingent among the various types of organizations that use records and the functions that those records fulfill.^[8] This entry identifies the traditional retention schedules as following along departmental and functional lines, which can cause a tremendous amount of overlap and duplication. It recommends a process-based retention schedule that documents the work flow and follows legal retention requirements and business needs. This duration is based on the operational needs of the institution and the multiple levels of risk that accompanies those needs.

Though risk management procedures are partially based on what *might* happen—the worst-case scenario, the probability of disaster—it also involves active management of records and information assets from the earliest stages of production. Increasingly this means following a legally viable records retention policy, after taking steps to ensure authenticity in the production of records and information to meet all legal and regulatory requirements (p. 103).^[4] The possibility of litigation has emerged as a primary concern in the creation and capture of records, particularly in the digital age when most documents are not necessarily created, stored, and disseminated in static formats.^[9] The types of records that withstand legal challenges are those created as part of a transaction (as opposed to those created *ad hoc* or retroactively) during the regular course of business and that comply with legal

guidelines for content, medium, or layout (pp. 103–104).^[4] Indeed, the landscape of records management, and thus the tools and procedures for managing risk, currently operate under a hyper-regulated atmosphere of compliance.

RECORDS COMPLIANCE AND RISK MANAGEMENT IN COMBINATION

According to a recent article in a financial services publication,

In recent years... risk management and compliance have begun to converge in a new paradigm. In what amounts to a subtle but important shift in mindset, compliance requirements are now considered a major source of risk... Such thinking leads to a natural prioritization of compliance initiatives: Those risks that pose the greatest threat... are highest on the list. Strategies to eliminate and/or manage such risks become the primary focus of the compliance function. Since compliance requirements that relate to protecting client interests pose some of the greatest risks... taking a risk-oriented approach to compliance naturally aligns the firm's interests with client interests.^[10]

The relationship of records compliance and risk management in archives and records administration is often one of reciprocity. The identification and management of risk is usually dictated by compliance measures that exist within and outside of an organization. Compliance measures—through legislation, best-practices initiatives, or organizational rules—are sensitive to business needs and generally reflect standards determined by industry-wide risk assessment. This reciprocal relationship is perhaps most fully embodied in the Australian National Archives, which adopted the Australian Standards for Records Management (AS-4390) in 1996.^[11] AS-4390 approaches government records from a risk management perspective and seeks to ensure impartiality and accountability among the creators and keepers of state records.^[11] AS-4390 also provides for a system of compliance audits and continual monitoring of documentary integrity (pp. 171–172).^[4] In this sense, AS-4390 demonstrates how, when applied to an organization, the principles of risk management and compliance are interrelated and complementary. In 2001, it was adapted by the International Organization for Standardization (ISO 15489-1:2001) as the preferred model for electronic records produced and maintained by governmental bodies (pp. 27, 249).^[4] The authors note that ISO 15489-1:2001 standard for sustainable records management is based on AS-4390, and these provide the “benchmark against which records management programmes and systems can be measured.”

In some instances the confluence of risk management and compliance complicates the rubric under which an

organization operate's. Risk often accompanies reward and sometimes the benefit of partial or noncompliance is perceived as outweighing the cost. For example, a multinational company may have branches in several jurisdictions that all require different retention periods for vital records. To keep all vital records in every jurisdiction for the longest possible period to cover all bases may be cost prohibitive. To irregularly schedule and follow several retention plans may be logistically impossible. In this instance, the organization will likely turn to whatever cost/benefit analysis its risk and compliance cohorts have formulated. They would consider which records were most abundant and valuable, where these records were located, and exactly what compliance requirements it was absolutely necessary to fulfill. In the event that the compliance measures did not specifically address records, the organization would factor in limitations on legal recourse against any action they might carry out (p. 159).^[4] From there, it could be decided that the risk of less than full compliance of certain records (of relatively low value) in certain jurisdictions (with less punitive measures and enforcement) is acceptable. The likelihood of getting caught and receiving a fine, or of losing business and prestige, might be considered less than the cost of full compliance.

Though this may not present an ideal scenario, realistically the level of compliance becomes a matter of how an institution chooses to allocate its resources, particularly in a regulation-heavy climate.^[12] This entry asserts that despite the billions of dollars spent to accommodate laws like Sarbanes-Oxley and HIPPA, one hundred percent compliance is "fundamentally impossible." However, compliance and risk management are increasingly no longer viewed as necessary evils or impediments to profitable business operations. More and more records are considered assets, whether they are used in everyday business transactions or for academic and cultural reasons. As a result, risk management and compliance are increasingly perceived as core operational functions, integral to the solvency and growth of an organization. In the wake of far-reaching banking, investment, and corporate accounting scandals of this decade, risk management and compliance in records administration should further gain cachet as necessary systemic enhancements. They should no longer merely serve as corrective measures only used after an organization gets caught doing something illegal or unethical.

CONCLUSION

This entry has attempted to identify the key elements of risk management and compliance in archives and records administration, both as individual concepts and as complementary components of recordkeeping. It should be reiterated that the management of risk requires an enterprise-wide assessment of threats and vulnerabilities increasingly

aimed at securing dynamic documentary formats. As a result of greater reliance on digital mediums, the move toward more stringent regulation and standardization has found both support and controversy in the archives and records management world. It could safely be assumed that as governments, businesses, cultural institutions, and other organizations become more fully digitized, risk management and compliance will become even more closely connected.

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Records Continuum Model

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Abstract

The entry begins with general statements on records continuum concepts. It then briefly outlines the evolution of records continuum thinking and practice in Australia because that Australian background helps explain the records continuum model and its points of entry into international discourse. It explores key continuum concepts and provides a detailed exposition of the records continuum model. The use of the model in teaching and research, and its application to professional practice are discussed. The entry also explains how the records continuum model connects to the broader discourses of postmodernism, philosophy and sociology. The entry concludes with a brief discussion of possible future uses and applications of the model.

INTRODUCTION

The records continuum concept of records encompasses records of continuing value (archives) and records in any form. Continuum ideas therefore challenge understandings which differentiate “archives” from “records” on the basis of selection for permanent preservation in archival custody, and definitions of records as physical artifacts in terms of their format or media. Adopting a pluralist view of recorded information, continuum thinking characterizes records as logical objects, belonging to a special genre of recorded information made up of the documentary traces of social and organizational activity. They are accumulated and managed by recordkeeping and archiving processes as record, archive and archives.

All transactions can leave archival traces. They become records when they are stored and managed by recordkeeping and archiving processes. Beyond the immediate business and social contexts which surround records they are transformed into a corporate or personal archive by recordkeeping and archiving processes that “place” records into frameworks for the social and business activities and functions of an organization, group or individual, and manage them in ways that enable them to function as individual, group, or corporate memory. And beyond the boundaries of organizations and individuals, recordkeeping and archiving processes transform the individual or corporate archive by “placing” it into a larger archival framework that enables it to function as accessible collective memory.

Recordkeeping is “a” form of witnessing and memory making, a particular way of evidencing and memorializing

individual and collective lives. Records have multiple purposes in terms of their continuing relevance to an individual, organization, or society. They are vehicles of communication and interaction, facilitators of decision-making, enablers of continuity, consistency and effectiveness in human action, memory stores, identity shapers, repositories of experience, evidence of rights and obligations. On a darker note, they can also be instruments of repression and abuse of power. Whatever function they are performing, their usefulness as evidence is bound up with how they have been created, how they have been captured in recorded form, how they have been organized for distribution and recall, and how widely accessible they are on a continuing basis beyond the confines of the systems managed by records creating agents and their successors. Can records be trusted as accurate, complete, reliable, and authentic sources of information? Can they be recalled and disseminated when needed and do they have integrity? Can users of records be assured that they have not been altered or tampered with? Is information available about related documents, the acts and events which they document, and does it provide links in some way to the wider context of social and organizational activity, and the people and organizations involved?

In records continuum professional discourse and practice, the differences between records on the one hand, and other forms of recorded information on the other, rest on their evidential qualities, purposes, and functionality. From this perspective, the recordkeeping profession and archival institutions in our society are charged with the mission of building and managing frameworks and systems which assure the preservation and accessibility of

accurate, complete, reliable, and authentic records “in” and “through” time and space. The accountability of the recordkeeping profession and archival institutions is therefore a critical issue in democratic societies.

Records continuum thinking takes a multidimensional view of the creation of documents as part of our activities (proto record-as-trace), their capture into records systems (record-as-evidence), their organization within the framework of a personal or organizational archive (record-as-personal/corporate memory), and their pluralization as collective archives (record-as-collective memory). This view is captured in the records continuum model developed by Frank Upward in the mid-1990s. Before discussing that model, the following section trace the evolution of continuum thinking and practice in Australia.

THE EVOLUTION OF CONTINUUM THINKING IN AUSTRALIA

A records continuum approach shares many things with other archival approaches where connections are made between current and historical recordkeeping processes, although sometimes its vocabulary is deliberately provocative in an attempt to disturb preconceptions. For example, a book published in Australia in 1993 used the term “archival documents” in its title as a term to cover both current and historical records, a standard enough usage in some countries perhaps, but relatively rare in Australia. In the opening paragraphs of the book (p. 1), it was noted that:

The effective creation and management of archival documents are critical to their use and the role they play in governing relationships in society over time and space. Their effective creation and management are also preconditions of an information-rich society and underpin the public accountability of government and non-government organisations, freedom of information and privacy legislation, protection of people’s rights and entitlements, and the quality of the archival heritage, made up of documents of continuing value. The concept of the archival document can provide a framework for a greater shared understanding of the nature of recorded information, and of the importance of transactional records to the continuing functioning of a society.^[1]

The book explored a unifying concept of records which is inclusive of archives and encompasses records in any form. It also addressed a key concern of the recordkeeping and archiving communities in the twentieth century in many countries, the recordkeeping-accountability nexus, linked to an emphasis on records as evidence of social and organizational activity. While concerns relating to recordkeeping and accountability are shared by professional recordkeeping communities, the book argued that the divisions in the communities militated against developing recordkeeping professional practice that could meet

society’s accountability needs. The unifying concept of archival documents was intended to be provocative, to challenge the archival and records management divide.

The use of the term recordkeeping by continuum archivists is also provocative. The term is widely used in North America in relation to electronic communications, but is interpreted narrowly in relation to paper based systems and is not inclusive of archiving processes. As used in continuum writings, recordkeeping is broad and inclusive, a form of witnessing, remembering, and forgetting. It encompasses a range of intertwined recordkeeping and archiving processes and activities carried out by records managers and archivists for current, regulatory, and historical recordkeeping purposes. These purposes include the roles that recordkeeping plays in and through space and time in governance and accountability, remembering and forgetting, shaping identity and providing value-added sources of information. In classificatory terms “recordkeeping” in this usage subsumes records management and archival administration. It also encompasses the personal and corporate recordkeeping activities undertaken by individuals in their everyday lives, in families, work or community groups, and in organizations of all kinds. In classificatory terms, recordkeeping runs through records management and archival administration in recurring and equally present fashion. It cannot simply be subsumed as a subordinate activity within either area of activity. The continuum approach tries to avoid the threat posed to recordkeeping and archiving processes if the professional drive of archivists and records managers to separate their disciplines is allowed to override the recordkeeping and archiving needs of particular systems and situations.

Gene Pool

The first clear examples of continuum-based practice in Australia were in the Commonwealth Archives Office in the 1960s. Ian Maclean, the Chief Archivist, noted retrospectively that a hallmark of the Office’s operation was its drive to seek a “continuum of (public) records administration” from administrative efficiency through recordkeeping to the safe keeping of a “cultural end-product.”^[2] MacLean’s reference to the continuum is far from the *Shorter Oxford English Dictionary* definition:

A continuing thing, quantity, or substance; a continuous series of elements passing into each other.

However his approach had genuine continuum-based components. He provided Australian archivists with a topology, a continuing logic for the study of the formation of archives in any place, in any time, and in whatever form, emphasizing three key elements—the characteristics of recorded information, classification processes and recordkeeping systems. The characteristics of recorded information of most interest to archivists are authenticity

and reliability as the basis for evidence-based decision making and public accountability. Classification is the basis for records construction as well as retrieval, and is based on knowledge of organizational functions, activities and processes. Maclean's recordkeeping system emphasis was grounded in the registry tradition and also reflected the organizational and methods approaches of the time.

Maclean's proto-continuum implementation model challenged emerging professional differences between archivists and records managers. He argued that the archival profession has three branches. One branch, registrars, worked in government departments designing recordkeeping systems and maintaining survey data about where records were being created and kept. Members of this branch in his mind were the "true archivists" because they were the ones most directly involved in the archival formation process. Another branch, described as historical recordkeepers, worked in archival institutions. A third branch liaised between the current managers of recordkeeping processes and the historical recordkeepers. The three branches brought recordkeeping and archiving processes together into a style of records continuum management.^[3] One of Maclean's colleagues, Peter Scott, provided the final element in continuum management in the CRS (Commonwealth Record Series) or series system, an archival system of registration that could control recordkeeping objects at any point in time from creation in agencies through to custody in government archives.

In the 1970s this system was at its peak. A strong evidence-based recordkeeping culture had emerged in the Commonwealth Archives Office. Staff engaged in the evolution and implementation of Scott's CRS system developed rich understandings of the web of multiple social, functional, provenancial, and documentary relationships established during the ongoing creation, management and use of records. For a number of reasons including changing technologies, and changes in management emphasis within the Commonwealth Archives Office (known as Australian Archives from 1984), the approach began to wane in the 1980s. New managerial approaches moved away from reliance on registry systems which tightly controlled and integrated business and recordkeeping processes, and downplayed the ethical responsibility of public servants to document their actions.

The Second Generation

In the 1990s when archivists in Australia were challenged by electronic recordkeeping issues, there was a renewed interest in the proto-continuum implementation models of Maclean and Scott. As was being discovered simultaneously by both Australian and North American archivists, in electronic recordkeeping environments, authenticity and reliability issues could not be addressed at the desktop—they needed to be dealt with through systems design and implementation tactics.

Authenticity and reliability issues were also a particular concern in Australia in the early 1990s. At that time the findings of a number of Royal Commissions and major inquiries into a series of accountability crises in government and the corporate sector in the 1980s were released. They focused attention on the role of recordkeeping in supporting democratic and corporate accountability. Complementary questions included: what constitutes accountable recordkeeping, what types of organizational and societal risks are associated with failures in recordkeeping, how can recordkeeping professionals demonstrate the causal links between poor or negligent recordkeeping, and failures in accountability, how can recordkeeping professionals play a part in addressing the need for evidence based decision-making in all spheres of life, and how can the role of public archival authorities as accountability players in democratic societies be safeguarded?

Emerging continuum-based frameworks for the management of electronic records and understandings stemming from preoccupation with the recordkeeping-accountability nexus drove the development of standards for accountable corporate recordkeeping regimes within the Australian community during the mid-1990s, in particular AS 4390, the *Australian Standard: Records Management*.^[4] They also fed into reviews of archival law and the dual role of public archival authorities at national and state level in managing accountable public recordkeeping and the archival heritage. The University of Pittsburgh's "Functional Requirements for Evidence in Recordkeeping Project," in particular Bearman's formulation of a mix of policy, standards, system design, and implementation tactics to satisfy them,^[5] also significantly influenced the Australian standard. AS 4390, elements of which were later picked up in an International Standard (ISO 15849), continued the Australian practice of being transactionally focused, emphasizing the links between activities and functions and related records, but did so in a media independent fashion. The Australian recordkeeping profession is still taking a lead role in developing recordkeeping standards, including standards that link recordkeeping to business processes as part of the formation of archives, e. g. standards relating to work process analysis, functional analysis, and organizational analysis. There was a particular synergy between the work of Bearman,^[6] understandings of recordkeeping systems derived from the registry tradition in Australia, and Maclean's legacy. In continuum practice, recordkeeping system requirements are specified in terms of capturing the content of documents, representing their structure, and linking related documents together. The information content and structure of records at their point of creation needs to be retained in reconstructible relationships. A cumulating history of events documenting the subsequent, management, access and use of records is essential. As more archival traces are incorporated into the record, more documentary and contextual links and relationships need to be captured and

documented. Recordkeeping systems thereby enable records to be retrieved at a later date in a form that represents their original content and structure, exposes their documentary relationships, and reflects their multiple contexts of creation, ongoing management and use, thus preserving their evidentiary nature.

By the early 1990s the use of the term records continuum was becoming ubiquitous in Australia. This usage followed the publication of Atherton's groundbreaking article that showed how the life cycle stages that records supposedly underwent were in fact a series of recurring and reverberating activities within both archives and records management.^[17] At the same time records continuum literature^[8–12] began to expand and engage in discourse across archival boundaries, both geographical in terms of the archival profession, and professional in terms of cognate disciplines. In particular, continuum writers engaged with the writings of Duranti on European archival theory and diplomatics,^[13] and of Hedstrom,^[14] McDonald,^[15] and Hofman^[16] relating to the early implementation of electronic recordkeeping policies and strategic approaches in New York State, Canada, and the Netherlands respectively. Cook's writings on postcustodialism and appraisal, grounded in Canadian re-conceptualizations of provenance, also provided a touchstone for Australian records continuum thinkers.^[17,18] As did Ketelaar's writing in relation to societal and cultural frameworks.^[19]

Records continuum approaches to building holistic, multidimensional frameworks for integrated recordkeeping and archiving processes were informed by the synergies between these discourses. Australian understandings of the nature of records as evidence, and the integrated recordkeeping and workflow processes associated with registry systems were also significant inputs. As were the

concepts of multiple provenance and the rich and dynamic views of records present in the CRS system, as further developed and refined in the work of Chris Hurley.^[20]

THE MODEL

The records continuum is most commonly represented in the seminal model form (Fig. 1) developed by Frank Upward with input from colleagues Sue McKemmish and Livia Iacovino and first published in 1996. As indicated in the preceding sections, the model is representative of a more complex body of thought which came before it and has continued to develop since its publication.

Of key importance in understanding the model, and the continuum approach embedded within it, is the notion of transactionality. In continuum thinking it is defined in terms of the many forms of human interaction and relationships that are documented in records at all levels of aggregation. It encompasses individual acts of communication, and social and business transactions of all kinds, the social and business activities or processes of which they are a part, the social and business functions they fulfill, and the social purposes they serve.

The archival document [record] can be conceptualised as recorded information arising from transactions. It is created as a by-product of social and organisational activity in the course of transacting business of any kind, whether by governments, businesses, community organisations or private individuals. ... The documentation of transactions may be in any storage media and is increasingly an electronic process. In Australia and North America, the use of the terms "records" and "archives", to refer to current

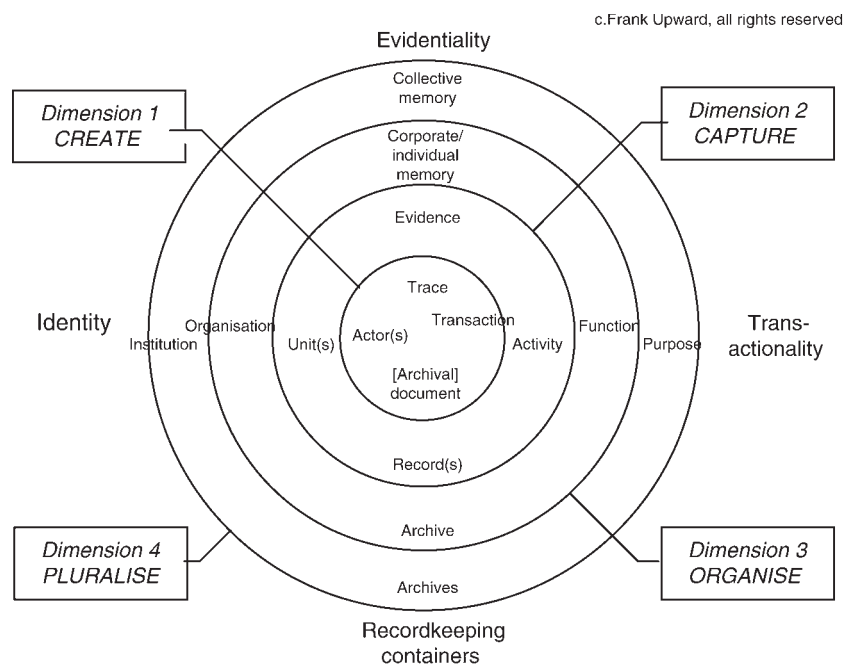


Fig. 1 The records continuum model.

Source: Structuring the records continuum, Part One: Post custodial principles and properties, by F. Upward. In *Arch. Manuscripts* 1996, 24(2), 268–285.

archival documents and archival documents selected for preservation respectively, has created a distracting division within the recordkeeping profession between records managers and archivists. The unifying concept of the archival document encompasses both records and archives. It directs attention to the continuum of processes involved in managing the record of a transaction so that it retains its evidentiary quality... (p. 1).^[1]

The model is explained below using a dimensional (circles) then an axial (lines and points) view. The explanation works from the first dimension outwards to the fourth dimension, but it could equally be written from the fourth to the first dimension. The records continuum is not linear, although for the purposes of explanation it might sometimes seem to be.

The Dimensions of the Records Continuum

This explanation draws substantially from an article by Reed.^[21] Table 1 summarizes the dimensions of the records continuum.

The first “create” dimension of the records continuum model represents the locus of all action, including representations of actions in documents. This dimension provides a perspective on things that are in the process of formation, may exist in versions or as partial expressions. The document has the potential to move beyond the locus of creation, but as yet this potential is nascent—all the elements required for robustness are present but not explicit. Until the connections are explicit, the document cannot be managed as a record.

The beginnings of that journey to robustness occur with transition into the second “capture” dimension when the document is communicated or connected through relationships with other documents, with sequences of action. With characteristics from the second dimension, records, now attest to action and are able to be distributed, accessed and understood by others involved in business activities. The transition to the second dimension may be formal or informal, may involve a deliberate act of registration in organizational systems, or may be an intention represented by placement or grouping. Here contextualizing metadata elements are added and the record is able to be referenced or drawn upon by others. The first and second dimensions of the model can be thought of as the immediate zones of interaction and the recording of that action.

The third dimension, the “organize” dimension, represents an aggregation above individual instances of sequences of actions, investing the record with explicit elements needed to ensure that it is available over time and beyond the immediate environments of action. Here, a record joins multiple other records deriving from multiple sequences of actions undertaken for multiple purposes. This is the dimension of the “archive” or

the “fonds,” the whole, extant or potential, of all of the records of an organization or individual cumulating to form organizational or personal memory. At an implementation level, this is the dimension of policy or rule establishment which will affect the “create” and “capture” dimensions.

The fourth or “pluralize” dimension represents societal perspectives on recordkeeping—the cultural, legal, and regulatory environment of recordkeeping, which is different for every society and in every period. Recordkeeping does not occur in a social, cultural or political void. The environment of recordkeeping external to a specific locus of records action, and the memory and evidence paradigms of a particular time and place, critically determine the nature of the record. The fourth dimension also represents the capacity of a record to exist beyond the boundaries of creating entities, to meet the needs of those not involved with the actions precipitating records creation, capture, and organization. Pluralization processes enable records to be reviewed, accessed and analyzed beyond an organization or individual life, for multiple external accountability and memory purposes in and through time and space.

The Points in the Records Continuum

The words in the model should be thought of as points around which many other words and definitions can cluster, revealing an increasingly complex array of issues of critical concern to recordkeeping, rather than as prescriptive signifiers. The points can be connected in a multiplicity of ways to represent the dynamic relationships between records and their rich, complex and multilayered social, functional, provenancial, and documentary contexts of creation, management, and use in and through space and time. In the records continuum model these concepts find expression in a range of continua described in Table 2. In the original representation of the model, the points were plotted along four axes, but later versions represent only the points, not the lines.

A records continuum approach acknowledges the need to discuss and describe recordkeeping objects in conventional ways, but tries to put that discussion and description into relational contact with other concepts and with the functioning of systems that create, capture, organize, and pluralize the objects. Records can be described with the assistance of different points in the continuum, including memory as it is contained in records, the way they are managed and classified in accordance with the identities of those involved in activities, and their connections with transactions that are the subject of recordkeeping processes.

The evidential continuum opens up many questions for records managers, archivists and others. Does a recordkeeping object provide a trace of action, can it testify to the events it documents (in many different places, not just courtrooms), and what does it witness? Even more

Table 1 The dimensions of the records continuum model.

Dimensions	Concerns addressed in the dimension
Dimension 1: Create [archival] documents-as-trace <i>The first dimension encompasses the actors who carry out the act (decisions, communications, acts), the acts themselves, the documents which record the acts, and the trace, the representation of the acts.</i>	In the first dimension, acts, communications and decisions are documented. Document creation and control processes are implemented which: • capture structure (documentary form) • order and place documents in their immediate context of action and facilitate their retrieval • store documents and provide for their security.
Dimension 2: Capture records-as-evidence <i>The second dimension encompasses the personal and corporate recordkeeping systems which capture records (documents in their contexts of action) in ways which support their capacity to act as evidence of the social and business activities of the units responsible for the activities.</i>	In the second dimension, recordkeeping processes and systems are implemented in accordance with the design requirements, standards and best practice models set up in the third and fourth dimensions. Implemented processes and systems: • capture records at specified points in business processes (when predetermined “boundaries” are crossed) • capture and maintain the metadata required to assure their quality as records of business and social activity (i.e. metadata that places them in relation to other records and links them to their context of activity), and to manage their usability (completeness, accuracy, and reliability) and accessibility through time • deliver records for use through time according to relevant access permissions, and user views • store and secure records through time.
Dimension 3: Organize records-as-corporate memory <i>The third dimension encompasses the organization of recordkeeping processes. It is concerned with the manner in which a corporate body, organization or individual defines it/her/his recordkeeping regime and in so doing constitutes/forms the archive as memory of its/her/his business or social functions.</i>	In the third dimension, recordkeeping concerns involve: • identifying personal and corporate requirements for essential evidence to function as personal/corporate memory • establishing recordkeeping regimes in the personal or corporate domain • developing organizational knowledge bases and classification schemes that represent the personal and corporate contexts of recordkeeping • putting in place storage and migration strategies that carry records through the life of an organization or a person • developing access strategies that manage access according to the rules of a particular personal or corporate domain.
Dimension 4: Pluralize records-as-collective memory <i>The fourth dimension concerns the manner in which the archives are brought into an encompassing (ambient) framework in order to provide a collective social, historical, and cultural memory of the institutionalized social purposes and roles of individuals and corporate bodies</i>	In the fourth dimension, recordkeeping concerns involve: • identifying social and cultural mandates for essential evidence to function as collective memory • establishing recordkeeping regimes that can carry records beyond the life of an organization or person • developing knowledge bases and classification schemes that represent the broadest structural and functional contexts of record keeping • putting in place storage and migration strategies that carry records beyond the life of an organization or a person • developing access strategies that manage access across jurisdictions.

The words in italics in the first column are cited from an article by Upward^[22] and those in the second column from an article by McKemmish.^[23]

tantalizingly difficult to ascertain, how heavily is it memorialized—inscribed into individual psyches, used by groups and organizations? And most dynamic of all, is it fighting with or fitting into other forms of individual, corporate or collectively accessible memory?

The continuum of transactionality raises many professional recordkeeping issues, with the points providing

different levels of analysis for such matters as appraisal, metadata, and classification schemes.

The continuum of identity raises general questions about how we see ourselves and how we relate to the groups, organizations and wider societies to which we belong. Significant issues relating to privacy and openness are brought into play. In a more pragmatic sense, for

Table 2 The points in the records continuum model.

Points	Explanation
<i>Continuum of recordkeeping objects:</i> [archival] documents, records, the corporate and individual archive, and the collective archives	Represents recordkeeping objects—the [archival] document, i.e., the documentary form in which it is created, the records system in which it is captured, the individual or corporate archive and the “plural” (collective) archives.
<i>Evidential continuum:</i> trace, evidence, corporate, and individual [whole of person] memory, collective memory	Represents the quality of recordness, the role that the record plays as trace, evidence, organizational/individual memory, and encompassing collective memory—in informing, witnessing and memorializing.
<i>Continuum of transactionality:</i> act, activity, function, purpose	Here the act (decision, communication, act) forms part of a business or social activity or process, which in turn is part of a business or social function which is an aspect of a higher-level social purpose or ambient function.
<i>Continuum of identity:</i> actor, work group/unit, organization/corporate body, and institution	Represents the actor, the unit (person or group with the corporate or socially assigned authority or power to undertake an activity or play a role in relationship to other units), the organization (a corporate body established to perform certain functions or an individual acting as a legal entity) and the institution (the broad social domain, jurisdiction or competence with reference to which the authority may be exercised or the role played).

The words in the second column are drawn from an article by Upward.^[22]

archivists, identity is significant for purposes of representation, recall and dissemination. Does the data kept about recorded information include and utilize information about the actor, the unit, the organization and the institution? How effectively is that data garnered and used by recordkeeping systems?

The Model in the Broader Intellectual Discourse

The construction of the records continuum model had some grounding in the broader philosophical and sociological discourses of the time. For example four French academics—Jacques Lacan, Michel Foucault, Jacques Derrida, and Jean-François Lyotard—were in vogue in academies in English speaking countries and the model has a genetic connection to all of them.

To Lacan^[24] the model owes its determination to find an accurate and useful topology, a logical structure for the stretching of information and data into different recordkeeping objects. The circles in the model represent the changing shapes of the documentary objects in information stores, a very Lacanian depiction of through-time stretching processes that he sees as part of personality formation, but in the continuum relate to archives formation. Lacan’s famous metaphor for this process in psychoanalysis is the doughnut and the needle, the shapes of the female and the male. At conception we all have the shape of the female, and the needle in fact retains that shape but in apparently different form.

The circles of the model can also be read as thresholds that might or might not be crossed in the manner of Foucault’s thresholds for the process of knowledge formation.^[25] He writes of the irregular manner by which discursive formations build across the thresholds of “positivity” (positive statements about something),

“epistemologization” (arrangement within dominant groupings of statements), “scientificity” (the making of laws for the construction and testing of statements), and “formalization” (when the laws become axiomatic, existing as starting points for statements and shutting out other statements). This view helps explain why Gilles Deleuze at the time this book was published called Foucault the “new archivist.” He placed considerable importance on the way a discursive archive builds up control over discussion by the manner in which participants in it file documents as monuments in a multidimensional, controlled, and controlling manner.

The model’s development also involved a technique for deconstruction which can be called post-Derridan in that the intention is to derail the ingrained habit so common in modern thinking of defining words in terms of the pairing of imagined opposites.^[26] Whenever you have a discourse settling in to dualisms such as archives and records, interpolate a third point into the discussion and relate the other terms to it. Using that technique many pairs of words that are defined in opposition to each other suddenly reveal a wealth of similarities and differences. The interpolation of third points can also be called continuum mathematics, and in the model this grew into interpolating other points, establishing a multiplicity of relationships. The model as a tool can also be linked more directly to Derridan thinking by pausing on words, their use in different places and times, and the spaces that surround them (Derrida’s work, *Archive Fever: A Freudian Impression*^[27] was being drafted in the same time frame as the model itself and therefore had no impact on the development of the model).

Groundings of this type were part of the play of ideas involved in the model’s construction, and no tight academic connections are being claimed. When the model was first presented in print, however, attention was drawn

to Lyotard's^[28] recommendation to use the following approaches to challenging settled discourses:

- Think problems through from every possible direction using conventional analytical techniques (analysis)
- Accept new shapes for our thinking (anamorphosis)
- Sometimes accept solutions because they feel right (anagogy – for Lyotard, for example, it was beyond debate that society's memory banks should serve justice even if we will never achieve consensus about what justice means)
- Be willing to accept that some forgetting needs to be part of the process (anamnesis).

While one can develop transcendental readings of the model relating to aspirations for future professional practice, the model will always provide a critical way of assessing what is actually being done. This capacity for different readings is what makes the model an open one. Continuum philosophies are monistic, offering single explanations, but paradoxically their monadic nature deliberately encompasses diversity. They provide a single metanarrative, but never exclude other metanarratives. This postmodern position, a form of relativism first put by the philosopher Samuel Alexander in 1920 in his epic treatise, *Space, Time and Deity*, has been subject to inconclusive debate in philosophy ever since. Indeed the perpetually postmodern aspect of continuum theory means that debate on it will always be inconclusive.

Attempts to address the metaphysics of the spacetime continuum are taking place across many disciplines, but one of particular relevance to archivists given the close connection between the formation of archives and the modes of operation and survival of social groups, is sociology. One of the most widely read sociologists of the last quarter century, Anthony Giddens, explores spacetime issues at great length and depth.^[29] Giddens' structuration theory deals with the ongoing relationship between our actions and the structures in which they take place. It is a time space theory dealing with the transmutation of structures, the reproduction of social systems, and, most significantly for archivists, the role of recorded information in these processes. In particular, Giddens' ideas suggest that recordkeeping and archiving professionals should be concerned with both the fixity and the mutability of records, and with the persistent and the contingent nature of record-keeping. The records continuum will always be with us but to the professionally functioning archivist, it does not present itself in the same way in different times and places. At present it is not being managed well. Evidence based decision-making systems are collapsing and many people are suffering as a result. To appreciate this, consider those retirees whose superannuation depended upon the shares of the failed company Enron, or the citizens of Iraq invaded, it was said, because of the existence of weapons of mass destruction. In these examples the expanding complexity

of the spacetime continuum have led to complex changes to corporate operations and the conduct of foreign affairs and war, and these changes have outstripped our capacity to manage the records continuum in matching complex ways.

USES OF THE MODEL

Rather than allowing us to think in convenient pairs or binaries, the model encourages consideration of the multiple potential points of recordkeeping intervention and actions. It brings much more complex layers of implicit and explicit meanings to the fore, and importantly enables exploration of the space revealed between the points, opening out a range of possibilities. The model allows what is actually occurring in different environments to be brought in to the discussion. All its spaces and silences make it a very democratic and global instrument inviting anyone to relate to the points in the continuum from any perspective and to enter into a discussion irrespective of their cultural background or professional experiences. Alternatively, and equally, those with sophisticated understandings can convey their developed ideas easily and quickly:

The critical importance of the continuum rests on five factors: 1) its conceptual interaction of the sixteen levels and axes too often viewed in archival circles as separate and static; 2) its insight that these complex relationships are fluid, multiple, and simultaneous across time and space, not sequential and fixed; 3) its reconciliation (with some adjustments as suggested) of evidence and memory; 4) its potential for imaginatively incorporating private-sector manuscripts with institutional archives; and 5) its assertion through pluralization that societal and thus cultural values will influence appraisal and, indeed, all aspects of record-keeping.^[30]

The model is at its most useful when it is made to dance as the Australian archivist, Chris Hurley, once observed. Those who cannot or do not want to make it dance see only circles and words with spaces in between them. But choreographing its dimensions and points reveals complex relationships which are "fluid, multiple, and simultaneous across time and space,"^[30] not sequential and fixed. Relationships between evidence and memory between the private and the corporate, between the archive as an instrument of restriction and the archives as a liberating force can be discussed within its framework in both practical and speculative fashion.

CURRENT USE OF THE MODEL

The records continuum model can serve as metaphor, as a topological model to repattern archival knowledge and reshape professional practice, and as a topographical or implementation model.

As metaphor, for example, it turns the recursivity of action represented in Atherton's continuum insight into a constant return to the moment in time when action occurs. The notion of recursiveness unlocks many different perspectives on recordkeeping processes through spacetime. Examples of the model's use as a topological model are provided below, including its application as a teaching and training tool, and research instrument, and its role in reshaping professional practice in Australia. The proto-continuum implementation models of Maclean and Scott are discussed in the first part of this entry. Their legacy and the use of the Upward model as a topographical model are exemplified in Australia in the development of recordkeeping standards, metadata entity-relationship models and schemas, and best practice guidelines for the design of recordkeeping systems and appraisal programs.

Teaching Tool

The model has been successful as a teaching tool, spreading into educational and training programs worldwide. As a pedagogical tool it provides a framework for interpreting records and archives thinking and practice. For example, the international and national records management standards, developed to serve plural frameworks (the fourth dimension of the model), establish compliance requirements and community expectations for accountable corporate recordkeeping and archiving regimes which need to be implemented in ways that take into account the creating, capturing, and organizing recordkeeping processes (the other three dimensions of the model).

Scott's CRS of series system provides a fourth dimension framework for processes implemented throughout all the dimensions for carrying records beyond the life of an individual or organization. It does so by enabling the representation of the broader structural, functional, and documentary contexts of records' creation, management, and use. The Canadian Total Archives Concept and function-based macro appraisal strategies provide a fourth dimension framework for the incorporation of personal and corporate archive(s) from all sectors of society into the collective archives, enabling them to function as the collective memory of the whole nation.

The records continuum model is also widely used as a training tool opening up discussion about positioning the participants' practice and potential action strategies. Many continuum-based case studies have been developed to explore records continuum practice, the ubiquity of recordkeeping in society and community expectations for recordkeeping.

Research Instrument

Particularly noteworthy is the model's use as a conceptual model and an analytical research tool by researchers around the globe in archival and records management

studies. For example it has been used as a conceptual framework and analytical tool in the development of the Australian Recordkeeping Metadata Schema (ARKMS) as part of a collaborative research project involving Monash University, the National Archives of Australia and State Records NSW.^[31] The records continuum model played a similar role in the development of the US Inter PARES metadata schema and archival descriptive standards registry, MADRAS,^[32] and the Australian Clever Recordkeeping Metadata Project.^[33] Iacovino used the model to analyze the recordkeeping-law nexus^[34] and to explore complex cross-organizational electronic transaction systems.^[35] Oliver employed it, and its sibling the information continuum model, as a research instrument to analyze and present her findings on the influence of national culture on information management in Australia, Germany, and Hong Kong.^[36] Outside Australasia Dunbar has proposed using it as part of opening up Critical Race Theory issues^[37] and it is being used in a number of Northern European informatics research projects.

Reshaping Professional Practice

The model is a Rorschach test, allowing practitioners to understand, think about, and implement recordkeeping and archiving actions. It provides a concise way to express concerns in a shared framework, opening up further thinking and action. It challenges recordkeeping professionals to rethink recordkeeping and archiving processes as recursive actions imparting the characteristics of recordness on any object, in any format, which needs to function as a record-as-evidence or record-as-memory.

Appraisal ceases to be about evaluating the value of a record for evidential and informational purposes from an archival perspective. Rather it becomes a multifaceted, recursive process which begins with defining what should be created (first dimension), what should be captured and managed as record (second dimension), what should be managed as a part of individual or organizational memory (third dimension) and what should be pluralized beyond organizational or individual memory (fourth dimension). Appreciating that records are constructs rather than physical realities, we can begin to see that records can have many manifestations, equally valid over time, in multiple different sequences of action, each of which creates individual records out of potentially the same record object. This understanding of appraisal has been incorporated into Australian practice through implementation of the national and international records management standards, AS4390 and AS/ISO15489,^[38] the development of the DIRKS (Design and Implementation of Recordkeeping Systems) methodology, and the appraisal programs of the National Archives and state archival institutions. The DIRKS methodology was developed by the State Records Office of NSW for use in that State, and is now also

mandated for use in Commonwealth government agencies by the National Archives of Australia.

Description is no longer a post hoc archival process applied within the walls of an archival repository, but one which is continuously building connectors between business transactions, activities and functions as the record is formalized for sharing in wider spaces and across longer periods of time. This process commences as a record is first created (first dimension), becoming more formalized at the first point of capture of a record (second dimension), continuing to occur as records are shared beyond the initial process that created them, within the organization (third dimension) and beyond the organization (fourth dimension). It is undertaken by multiple applications of recordkeeping metadata to maintain the connections to the creating business actions the records evidence and memorialize. This continuum view of description informs the development of national and international metadata standards and schema. The model Australian Recordkeeping Metadata Schema was implemented in standards developed by State Records NSW^[39] and the South Australian Archives,^[40] and more recently in work undertaken by Standards Australia which was adopted as Part 2 of the new International Standard for recordkeeping metadata, ISO 23081.^[41] The ARKMS continuum-based metadata model was also used as a conceptual framework in Part 1 of ISO 23081.^[42]

Preservation cannot be left until records are within a protective custodial space. Archives are increasingly virtual, perhaps never existing as a physical place. Records must be built to withstand the pressures that sustaining them will bring. In electronic systems this implies attention to formats, documenting links with other records, people and processes in ways that will be sustainable over time, and enabling the management of objects independently from the software that created them. Preservation becomes multiple recurring actions designed to provide flexibility for different ways of maintaining records and their authenticity in a world where no ultimate archiving solution does, or ever will, exist. This continuum view of preservation can be seen in increasing attention to migration processes and standard formats for storage in records management functional specifications emerging in Australasian jurisdictions. It is also reflected in organizational concern over continuing support for older proprietary software formats. Records continuum thinking is particularly relevant to the digital preservation community as it increasingly turns its attention to managing digital objects from their point of creation. New digital technologies can enable captured records to be stored simultaneously in multiple physical domains—and thus in both business and archival contexts. Projects such as VERS (the Victorian Electronic Records initiative) extend models of custodial preservation into an active collaborative approach consistent with records continuum practice.

Socially the concept of access to records has undergone the most significant restructuring of all our recordkeeping

processes. It has evolved from being a tightly controlled and monitored archival process of permission to use records to being a process continually negotiated and renegotiated depending on what, why, and when access to records is sought. On the one hand, notions of transparency and accountability have shifted the locus of access and security to different implementation points in the continuum. On the other, social and community interests still protect and define rights associated with use which are highly dependent on circumstances—think of the response to accessing government information post 9/11 or increasing individual rights over access to and use of our personal information. Emerging records continuum approaches to access can be seen in increasing attention to modeling access and security permissions in current records systems, an increasingly complex process in the face of decontextualized digital identities. The beginnings of more formalized articulation of access permissions as a component of recordkeeping in all contexts can be seen in the ISO 15489-2 recommendations for creating formalized instruments for such purposes. Tagging of records as available for public access from the time of their creation is now a reasonably commonplace workplace reality.

CONCLUSION

In discussing the nature and uses of the model we have indirectly indicated that as a way of analyzing recordkeeping systems the model can be given a forensic focus (looking over the past to find records, relationships and meaning), a clinical focus (for example, assessing whether appropriate records are being created and maintained) or a speculative focus to identify imminent changes or transcendental views of the future (for example thinking about recordkeeping in emerging technological environments). In other words it can claim to be a genuine continuum model in that it can be used to address the past, the present, and the future. It can also be used to analyze the relationship between particular issues and archiving and recordkeeping processes, as the research examples above indicated. Each style of analysis has its place in knowledge formation and in working out what skills are required for particular tasks. These uses will continue into the future, but two areas of use are likely to have particularly strong future relevance. Those relate to archival informatics, and to paradigms for forming knowledge about archiving processes.

The records continuum model was designed to open up thinking about the formation of archives and the way documents are shaped, stretched, and re-created into different archival forms within different technologies. Thus it copes comfortably with an increasing emphasis upon informatics, an emerging science dealing with the application of technologies across our activities. In any era and place this will always include the technologies used in

creating documents, capturing them and other information objects as records, organizing them into individual bodies of records (the archive), and bringing the archives together in plural holdings. These “stretching” processes have been occurring in some way or another ever since people began to dance, sing, paint, and carve in ways that recorded transactions and passed on ways of doing things through generations. The record within the continuum is “always in a process of becoming,” and also of dissolving.^[43] In a twentieth century filing system, for example, they might be stretched into new shapes and structures during the filing and aggregating processes that form them. In emerging service oriented approaches, recordkeeping is being disaggregated into component functionality, operating on logical objects at multiple points and in recursive ways, stretching them into new configurations constructed through multiple relationships. Disposal and new administrative patterns can alter their physicality and the control and attention that they receive, and disposition is never final. Records no longer extant or moved elsewhere can still be observed in the place they once occupied through data about their life history or their connection with events. They have multiple lives in spacetime as their use and control alter and open up new threads of action, reshaping and renewing their creation and disposition.

The model can provide a take-off point for visualizing different multidimensional and interconnected topographies. The four interconnected processing dimensions, creation, capture, organization, and pluralization, are always going to be present in any worthwhile informatics project, albeit within a transdisciplinary framework involving many more points to pause upon than the records continuum model itself provides. The difference between archival informatics and archival science is that, whereas the latter concentrates on archival functions as understood by archivists over the ages, archival informatics is still something of a clean slate. From a continuum perspective it involves the application of technology to recordkeeping and archiving processes in and from any era and will lead to a large-scale reconstruction of archival activities.

In modern systems, depending upon the requirements and analysis of the specific technologies involved, the functionality of system selection and deployment can be directed at achieving multiple recordkeeping ends. Building regimes for managing records in such environments involves consideration of every dimension of the records continuum model, and often a rethinking of our professional recordkeeping processes. Ways and means will differ but the aim is still to create appropriate documents in the first place (first dimension), store them as reliable and accessible records in ways that link to the fluidity and ongoing nature of our activities (second dimension), store them as an archive at organizational or personal archive levels (third dimension) and enable cross organizational and personal connections and workings, as well as allowing for multiple patterns of access (fourth

dimension). We happen to be on the threshold of archives formation within the multidimensional places of inscription and consignment provided by Internet and web-browser technologies. We need to seize the opportunities present in our emerging technologies to form archives in continuum fashion.

As a paradigm the continuum provides a way of thinking based on the ongoing and expansionary states of being (more strictly speaking of becoming). The records continuum model is meant to be paradigmatic in this largest of ways, moving from notions of the archives as an end product to an emphasis upon the never-ending process of archiving, with particular emphasis upon recordkeeping and the maintenance of records about our actions. If archivists are to play a real-world role in the construction of the archives in the future, they need to repattern their professional practice with reference to the ways organizations and individuals build their stores of knowledge (their archive), the processes of recordkeeping and archiving, and the role recordkeeping professionals play in these processes. The battles between fixity and fluidity, between traditional views of the record and modern views of free floating information are no longer meaningful. Our technologies can manage both fixity and fluidity and give both characteristics to our recorded information in many locales, including electronic reading rooms and desktops. A focus on “becoming” reveals ways of managing an end product that more of us can now see was never actually an end product anyway.

The need for transmission of recorded information about our actions into different times and spaces is a survival issue for our species, not just a faddish endeavor. To support survival—and that is what is at stake in the formation of archives—information professionals involved in recordkeeping and archiving processes need to be diverse in their approaches, capable of undertaking different styles of analysis, and work within robust and inclusive paradigms for knowledge formation. They need to operate using the technologies of their times and places allied to an understanding of the technology of the eras they happen to specialize in, including present eras and places. As indicated above, the records continuum model opens up perspectives on all these things. Like many schematic drawings, however, it is a tool that is only of value when it is being used.

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Records Organization and Access

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Abstract

Records, as documents which provide evidence of business transactions that have taken place, are collected and preserved for as long as they are useful to the organization, or as is demanded by law. In order to be useful, however, they must be organized in such a way that they can easily be identified, located, accessed, and used, for whatever purpose. First, the records must be described by identifying the most useful salient characteristics; then, they are categorized in various ways, according to their age, function, level of confidentiality, privacy and security, and access to them controlled according to these categories. Records may be arranged by one of several ordinal systems, usually involving letters and numbers, but also color: these symbolically represent the characteristics that are considered as important descriptors. Thus, records can be accessed (or protected from access) by their category; they can be located by correspondence between terms (which may be words or numbers) used to describe characteristics and terms used in searching for particular records or records series. These principles apply to both physical and virtual records.

INTRODUCTION AND BACKGROUND

The work of records management comprises capturing the records produced by an organization by distinguishing them from documents, and describing them; ensuring that they are disseminated to those who require them for action; providing access to them while at the same time keeping them private and secure as necessary; discarding them when they are no longer required, or passing those with historical value to the archives for long-term preservation once their value has been appraised. Records are usually organized by some element of description; access takes place both through the organizational systems as well as constraints, and processes suggested by law or administrative purpose.

The International Organization for Standardization (ISO), in their standard ISO 15489: 2001, defines a record as “information created, received, and maintained as evidence and information by an organization or person, in pursuance of legal obligations, or in the transaction of business.” Typically, this information is contained in a document of some kind, of whatever medium or format. The important characteristic of a record that differentiates it from other documents is that it provides evidence of a business transaction. This is usually interpreted by records managers as the ability of a record to provide evidence by the mere fact of its existence. However, besides providing evidence, records are also the documents used (primarily for the information they contain) in order to conduct the business of an enterprise, thus, records are closely associated with general document management strategies with an organization, as well as workflow processes, as they

facilitate the work of the organization. There is increasing interest, however, in the informational qualities of records from the strategic information management point of view. Records are valuable, therefore, for three reasons:

1. Their existence provides evidence of transactions undertaken (or not);
2. They facilitate the work—processes, procedures, and communication—of an organization (both internally and externally);
3. They contain valuable information which can be used to increase competitive advantage.

When records are no longer actively used in any of these fundamental ways, most of them are discarded and destroyed. However, there will certainly be a group of records which are considered to have an historical value, and these will, in due course, be managed in an archives.

It is worth noting that there are different records management traditions internationally. In the United States, for example, there is a clear distinction between records managers and archivists and their work, while in Australia there has been considerable movement towards uniting the two professions, largely through the enunciation of continuum theory.^[1,2] In Europe, there is a focus on archival work and preservation, with not much attention being paid to current records, although there is increasing interest in such issues. Work is still required to reconcile the various approaches, in spite of the existence of an international standard, and some of these differences are articulated in various organization and access arrangements. However, archival organization, arrangement, and access (such as

fonds, original order, and provenance) are excluded here. Also excluded is discussion of metadata for records, except insofar as it is related to organization, arrangement, and access.

RECORDS ORGANIZATION

One of the major functions of records management is to describe and organize records. Good organization of records is vital: ISO 15489 recommends, “The higher the level of accountability and/or public scrutiny, the greater the need for accuracy, and speed in locating individual records.” [This applies to all three of the essential functions of records: as evidence, as information, and as tools to facilitate the work of the organization. In particular, good organization is required if records are to be acceptable as evidence in a court of law: the system must be consistently implemented, for example, and each record must be complete, identifiable, coherent, accessible, and available (amongst other criteria)].

It is possible to organize records in many ways. One way which seems obvious is to arrange records by the structure of the organization or by the subject with which the record deals. However, both of these methods are subject to a number of problems, particularly because the organizational structure or nomenclature might change. Overall, a functional approach is most commonly adopted. This method of categorization is predicated upon the processes that are identified as critical to the mission and tasks of an enterprise, incorporating the tasks required to perform them. The categories therefore reflect the functions of the organization, which may be, for example, the following:

- General administration.
- Establishing policy.
- Accounting.
- Budgeting.
- Managing contracts and agreements.
- Information and communication technology support.
- Human resources management.
- Manufacturing.
- Goods and services procurement and supply.
- Arranging travel.

In this way, records can be grouped by activity and will relate to the work undertaken by each department. There are several advantages to this approach.

1. Analysis of individual documents (or document series) is avoided, as the principle of division becomes the functions and workflows of the organization;
2. The business context of the record is more-or-less self-evident, often clarifying issues of privacy and security;

3. There is a logical coherence to this style of organization which assists in eliminating duplication;
4. Within each function, file series can be more easily identified and, once these have been approached, disposal of such files is more easily managed as a whole file can be discarded at once, avoiding the need to examine each document within a file.

RECORDS SERIES

The notion of functional classification or organization of records is associated with the concept of “records series.” A records series is a group of related records (such as the minutes of a particular committee) which can be filed as a unit. The records in a series are usually uniform in both form and function, and often cover a particular unit of time (e.g., a financial year or a decade). They can also be appraised as a unit and scheduled for disposition—which makes such tasks simpler. So, there is a logical and useful connection between the categorization, filing, accessing, evaluating, and scheduling activities of the records manager. Functional organization, based on records series, is used in both analog and digital environments.

Classification and Indexing

Records classification occurs after business functions and activities have been identified and categorised, according to the standard structures, procedures, and processes of the organization. The thesaurus provides common administrative support terms, rather than terms that describe core business functions in organizations. This means that the record is classified according to why it exists and where it was created, rather than its information content, which may only be suggested by organizational functions and processes. This differentiates records from other documents, such as monographs or journal articles, which are primarily categorised and indexed according to the subject of their content.

As previously suggested, a classification scheme, based on organizational functions, assists in the other records management activities of appraisal, disposition, security, privacy, and so forth. At the same time, the classification scheme will indicate the location of specific documents, and connect physical and electronic documents that are functionally linked. The process is otherwise similar to the classification and indexing processes undertaken in libraries and other document management centers.

There remains the problem, however, of how to deal with files and folders (and indeed, individual records) at finer levels of granularity and specificity. For these purposes, classification schemes are developed, which can use either alphabetical or numerical notations (and often

both—for different purposes). A classification scheme suggests that similar things can be grouped together in categories, and any relationships between categories are indicated, such as in a hierarchy. Before the classification scheme can be finalised, however, a taxonomy must be created, which articulates the topics and subject categories, as well as their structure. After this, each category can be briefly described through use of notation—which could be words, letters of the alphabet, or numbers. These elements in turn can be used as a basis for the filing arrangement.

Deciding on the appropriate word or code to assign a particular record, or series is guided by the vocabulary selections made in a thesaurus, which controls how the records are classified or indexed. The thesaurus must first, of course, be constructed: this can be a time-consuming process. It involves an analysis of business hierarchies and functions, interviews in order to determine terminology, selecting and developing the terminology, and ensuring its consistency. It is essential that the thesaurus reflects the requirements of the organization and its staff. Once the terminology has been selected and approved, this controlled indexing language is recorded in the thesaurus, ensuring that terms are used consistently, and in the same manner.

A records management thesaurus pays little attention to the information content of a record, however; as noted, it is more important for these purposes to classify the record according to its context and why it was created, rather than what it is about, even though the information content of records can be valuable for strategic purposes. There is nonetheless increasing interest into systems that reveal the subject of such documents as well as meeting the more traditional requirements of records management, so that organizations can compete more successfully.

In Australia, the State Records Authority of New South Wales developed a Keyword AAA Thesaurus intended for use by all agencies of government, as it contains terminology common to the business functions and activities of most enterprises. In this way, records that are common across the state, but found in a range of agencies, will all be described in the same way. Indeed, it has been found to have such general applicability that it has been used, either in its entirety or as a basis for other thesauri, throughout Australia and internationally. It is intended to be used with a functional thesaurus that specifically deals with the functions, activities, and procedures of a particular office or agency—thus, extending its flexibility of use.

All business classification schemes, as recorded in a thesaurus, must include all the functions of the particular enterprise, but not be related to various departments; the terminology should be widely used and familiar to all staff; ideally should be hierarchical (proceeding from broad categories to specific items); and should be constantly maintained. It can then be used by all staff to index the records they create and receive.

Indexing

Using the thesaurus as a guide, the record can be described, identifying the document as well as providing the mechanism for arrangement, retrieval, and disposition. Increasingly, electronic records management systems allow for the storage, retention, and searching of the complete, full-text document, which to some extent assists in access but is not helpful for retention and disposal purposes. That records are managed primarily for their evidential properties must never be forgotten.

Filing and Arrangement

The arrangement of records or files—whatever their medium—should be kept as simple as possible, so that all can understand it. This helps at all stages of locating and returning records. Deciding on a filing system, first of all requires determining what descriptor will constitute the filing element: will it be the indexing term, a sequential numbering system, the name of the department from which the record originates, or the surname of the action officer? What must also be borne in mind is how the filing system will identify linked files if they occur in a variety of media and formats, and so are not all found together in the same place.

A most useful work which explains filing in great detail is Suzanne Gill's *File Management for Information Retrieval Systems: A Manual for Managers and Technicians* (1993).^[3] This comprehensive work, now in its third edition, includes how and why various filing systems might be chosen and used. She includes alphabetical filing (and the differences that various filing rules can make, either letter-by-letter or word-by-word); numerical filing—including serial, middle digit, and terminal number; chronological (subject and alphabetical); alphabetical subject and hierarchical subject; phonetic filing, geographical filing, and color-coded filing.

Records Access

Records must, of course, be made accessible to the employees of an enterprise to enable them to do their work. In a physical, or paper-based environment, the record will be sent to an action officer who can perform the work required by the document; the action officer might also need to access records which have already been dealt with—perhaps only partially—and will recover these either from the records center or by the records management system. The records manager keeps a close account of where all records are at any particular time—as well as who the record might be passed on to prior to returning to the file. This process is known as tracking, and this can be either manual (like a circulation system) or automated (often through the use of bar codes).

Generally speaking, the question of access is associated with controlling the distribution or circulation of physical records within an organization. Access management systems are usually designed to work with records series rather than individual documents. It is, however, necessary to ensure that rights of access to records and to functions are granted to authorized individuals and groups and withheld from unauthorized individuals and groups. Access management aims to strengthen privacy and security while facilitating information sharing.

Access to records can, however, be differentiated in a number of ways. For example, there are different issues and procedures related to access to physical records, as opposed to digital or electronic records. There are also different ways to manage access to active, semiactive, or inactive records. Other dimensions of access include the ease with which an individual can understand the descriptions of records, and how they have been arranged, so that the correct record can be identified and located without the constant intervention of the records manager. In addition, there is the issue of controlling access, so that records remain uncorrupted by unauthorized amendments or deletions.

The information that records contain, which, as previously noted, has largely been ignored by records managers for the most part, is clearly a concern here, as it is the information (rather than the physical artifact) that must be protected from violations of privacy and security. These issues are covered by a number of international laws and regulations (so much so that some records managers feel that their more appropriate title should be “compliance officer”!). On the other hand, there are also laws that specifically permit access to records about people (such as Freedom of information legislation) and governments, after certain periods of time have expired. Yet, another issue that controls access to records is that of intellectual property, as many companies would not wish to have their information (as intellectual capital) made widely available. There are additionally specific issues of records access management and control related to particular industry sectors, such as health, nuclear power, the military, and chemical industries.

Access, security, and privacy

Many systems that provide access to information permit only selected persons to exercise access. It is frequently the case that some records may never be allowed to leave the organization; some may only be seen by certain individuals or certain categories of staff, for a range of reasons, such as privacy, organizational or national security, industrial espionage, and so forth. These restrictions may be put in place either manually or electronically. Records contain evidence of business transactions and many activities that must remain confidential, and may also possess personal, commercial, or other sensitive information. It will be necessary to manage access to these records to

ensure compliance with the regulatory environment and corporate policy, and in accordance with the organization’s security policy. With reference to access, the main areas to be considered are freedom of information, privacy, security, and intellectual property (which includes copyright, trademarks, and patents).

Freedom of information legislation has to do with providing citizens access to information (particularly about themselves) which is held by government bodies. Each country has its own suite of legislation which controls these aspects. In the United Kingdom, for example, there are Public Records Acts and a Code of Practice on Records Management for Freedom of Information; in the United States there is the 1966 Freedom of Information Act, and the 1996 Electronic Freedom of Information Act Amendments.

Privacy laws seek to control potential misuse of personal information. The European Community, in 1995, issued the European Directive on Protection of Personal Data, and in the United States there is the Code of Fair Information Practice issued by the Office of Technology Assessment. Privacy in the United States is also controlled by the Health Insurance Portability and Accountability Act (1996), the Fair Credit Reporting Act, and the Electronic Communication Privacy Act. Security of information continues to be an issue, as instances of identity theft rise, as well as the possibility that trade or other secrets might be stolen and used inappropriately. Authentication (by either security framework or by some kind of electronic signature) is increasingly required, and the transaction—the request for access to a particular record or record series—can be recorded.

Access to physical records

Active records (in other words, records that are still being used by action officers on a regular basis) can be controlled through a tracking system, as the location of a file or document must be known at any time (One of the great disadvantages of the physical artifact is that it can only be at one place at a time, and this has led, rather dangerously sometimes, to many duplicate copies being made, which may fall into the wrong hands as they are difficult to control). Tracking systems can be manual or automated. Some examples of manual systems are:

1. File movement book registers, which are hopelessly inefficient and have mostly been replaced.
2. Separate file movement card for each file, held in one sequence. These are a little better, but they are held outside the file which means users must make an effort to sign them.
3. File movement markers—placed into the file storage area in place of a file when that file is taken by a user. This is widely used.

However, all of these systems rely on the users providing the necessary information. Automate tracking systems

offer much better control over materials and are easier to use (especially by the action officers). They work in the following way.

- Each user is allocated a borrower's code.
- The electronic recording of file movements may be centrally controlled or may be done at remote workstations by departmental users.
- Remote recording of file movements can eliminate the need for other usually inefficient methods of informing records staff that a document or file has been handed on to someone else.
- Many systems incorporate bar code tracking of documents and/or files. This works like the library's circulation system. A portable bar code reader can also be used to carry out a file census. The records staff member enters each office, passes the reader over the user's bar code, and then over each file in the office.

Resubmit systems allow files to be returned to users (action officers) on a predetermined date for follow-up action. This is necessary when, for example, annual reminders need to be sent out. Users can book a file to be sent (or submitted) to them by a particular date.

Once records become semiactive or inactive, they are usually moved to a "records center," which is a central storage area where inactive records are kept. This could be on-site, which is common for small or medium size companies, but more commonly such records are moved off-site, which may be managed by the company itself or by a commercial records management center. The choice can be determined by, inter alia, costs of leasing or purchase, insurance, power and other overheads, staffing retrieval times, protection against the elements and disasters, security, growth rate, and general convenience.

Access to electronic records

More and more work is done in digital format only, in both public and private enterprises. Part of the notion of an "information society" is that of "e-government" or "e-democracy," in which governments at all levels—local, state, and federal—are encouraged and obliged to make their documents easily available to the public at large. Electronic records can be easily transmitted using information and communication technologies, and this makes them more vulnerable to modification and destruction. There also remain a number of uncertainties with regard to the long-term preservation of digital documents.

CONCLUSIONS

As long as paper is used, questions of physical organization, arrangement, and filing will be important. How to

identify and locate individual records or records series is an important issue in records management. A great deal of work is currently being undertaken to protect and preserve electronic documents and records, and this will continue, as will increased interest in using the information contained by records for competitive advantage.

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Records Retention Schedules

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Abstract

Records retention is managed within an organization by developing and implementing a records retention schedule. A records retention schedule is a list of records maintained by an organization and the length of time that the records must be retained. It is a policy document that states the organization's intent to maintain its records for defined time periods and to disposition them systematically once the time period is reached. Thus the retention schedule supports compliance activities within the organization, promotes transparency and good "corporate" governance.

The purpose of the retention schedule is to manage each records series throughout its "life cycle"—the creation or receipt of the record through its disposition. Proper management of each records series ensures that the growth of records is controlled; that is, records are available as long as they are required to support the business need or to comply with a statutory or regulatory requirement and they are dispositioned when they have met these two requirements. Thus, records do not accumulate unnecessarily, and the organization does not incur the costs of maintaining obsolete records. Additionally, removing obsolete records routinely and systematically helps the organization to avoid the appearance of willful destruction, obstruction of justice (in the event of a pending legal action) and thus serves to limit the organization's legal liability.

INTRODUCTION

Records retention is a key element of a comprehensive records management program. It consists of determining how long to retain a record (the retention period), maintaining that record so that it is retrievable and useable over the defined time period, and when the retention period has been met, destroying the record or—if it has historical value—transferring it to an archive. The process of records destruction or transfer to an archive is called "dispositioning."

Records retention is managed within an organization by developing and implementing a records retention schedule. A records retention schedule is a list of records maintained by an organization and the length of time that the records must be retained. It is a policy document that states the organization's intent to maintain its records for defined time periods (or, in some cases, until an event occurs) and to disposition them systematically once the time period is reached or the event occurs. Thus the retention schedule supports compliance activities within the organization and promotes transparency and good "corporate" governance.

The records retention schedule is the basic tool used in performing records retention activities and an appropriate records management tool for all organizations: private enterprise, government agencies, cultural institutions, or non-profit groups.

The schedule is typically organized by "records series," a group of related records that are maintained or used as a

unit and that can be evaluated as a unit for retention purposes.^[1] The time period for maintaining each records series is called the "retention period."

A comprehensive retention schedule includes all records in all stored formats, including, for example, paper-based, electronic, and photographic records, as well as physical objects (e.g., soil or water samples, scale models, etc.) that are determined to be records.

Records retention schedules must be customized specifically for an organization. There are no "generic" records retention schedules that can be used "as is."^[2] Although organizations may produce many similar type records, especially for those functions such as accounting or human resources management that are common to most organizations, the differences in industry regulations, geographic locations, legal jurisdictions, and especially the "corporate culture" are all factors in determining how long an organization is prepared to maintain records, or conversely, at what point in time the organization is comfortable destroying records deemed obsolete.

PURPOSE

The purpose of the retention schedule is to manage each records series throughout its "life cycle"—the creation or receipt of the record through its disposition. Proper management of each records series ensures that the growth of records is controlled; that is, records are available as long as they are required to support the business need or to

comply with a statutory or regulatory requirement and they are dispositioned when they have met these two requirements. Thus, records do not accumulate unnecessarily, and the organization does not incur the costs of maintaining obsolete records.

Additionally, removing obsolete records routinely and systematically helps the organization to avoid the appearance of willful destruction or obstruction of justice (in the event of a pending legal action) and thus serves to limit the organization's legal liability.

RETENTION SCHEDULE TYPES

There are two basic retention schedule models based on the method for organizing the records series—the “departmental” model and the “functional” model. Other types of retention schedules, such as “process-based” or “large aggregation” schedules are a variation on the functional model. There are advantages and disadvantages to the development and maintenance of each model.

A records series is a group of files or documents kept together (either physically or intellectually) because they relate to a particular subject or function, result from the same activity, document a specific type of transaction, take a particular physical form, or have some other relationship arising out of their creation, receipt, maintenance, or use.^[3]

Departmental Retention Schedules

Traditionally, records retention schedules have been organized by the business unit (department) where the records were identified during the records inventory process. Therefore, the “departmental” retention schedule organizes the record series alphabetically by the business unit (department, division, or section) in which the records are maintained and to which responsibility for maintenance is assigned. This type of retention schedule is also called the “detailed retention schedule” because it generally has a greater number of records series (more “detail”) than a functional schedule. Departmental retention schedules are still in wide use because they are relatively easy to develop. The business unit uses its own terminology for the records series name, sets an operating retention period to meet the business unit's needs, and there is no need to classify the records series.

A disadvantage in using departmental retention schedules is that they require maintaining not only multiple schedules per organization (one for each business unit) but also significantly more records series, as the same records series is often maintained by many business units in an organization. For example, contracts, expense reports, and some personnel records may be maintained in many different business units and thus must appear on many schedules. It is not unusual for an organization

maintaining multiple departmental retention schedules to identify and maintain hundreds or perhaps thousands of records series. Different business units may assign conflicting retention periods to the same records series, which can be a liability when trying to defend retention practices. An additional requirement is that the departmental retention schedules must be revised each time there is a re-organization.

Functional Retention Schedules

The “functional” retention schedule classifies each records series by the “function,” or purpose, that the records series serves. Schellenberg^[4] defines functions as “the responsibilities assigned to an agency to accomplish the broad purposes for which it was established.” Within each function the records series are listed alphabetically.

The functional retention schedule approach eliminates tracking of duplicate records series, as each series is listed only once, associated with the appropriate function. Thus the functional schedule generally contains significantly fewer records series. Skupsky^[5] states, “The typical functional retention schedule for even a large organization will contain under 100 different retention categories. . . .”

In addition, the functional retention schedule does not have to be significantly revised each time there is a re-organization; only the ownership information, or “office of record,” may require revising. However, developing a functional retention schedule requires collaboration from each business unit to agree on the naming conventions for the records series, on the retention period, and on the “owner” or “office of record”—the unit that is responsible for maintaining and dispositioning the records series. An additional step is required in developing a functional retention schedule as the records series must also be classified into the appropriate function. As with any classification initiative, functional retention schedule development is part art and part science.

Large Aggregation Retention Schedules

A more recent development in records retention schedule theory is the so-called “big bucket” or large aggregation approach to developing records retention schedules. This approach is based on the theory that maintaining fewer records series promotes more efficient and more accurate classification of records into the proper records series and thus promotes compliance. The U.S. National Archives and Records Administration (NARA), which provides records management expertise to federal agencies, has embraced this approach to ease the perceived burden of using and maintaining the traditional retention schedule.^[3] This approach is somewhat controversial and has not been widely adopted.^[6]

Records management software application vendors are strong proponents of this approach. To support successful

implementation of an electronic document management system, an enterprise content management system, or other automated recordkeeping system, vendors urge their customers to simplify retention requirements.^[7] The users of that system must select the appropriate category (records series) to classify records, in order that the system can automatically impose retention times and systematically disposition the electronic records.

As the volume of records created and maintained steadily increases (due to the ease of creating and distributing electronic records) and as the burden for classifying records by records series is increasingly placed on individual employees, the manual application of the retention periods becomes extremely labor-intensive and time-consuming. If there are too many records series “choices,” the user has difficulty accurately and consistently classifying the record. Thus there is pressure to reduce the number of “places” where users can classify their documents.

In developing a large aggregation retention schedule what defines a records series changes. Instead of being “a group of related records that are maintained or used as a unit and that can be evaluated as a unit for retention purposes,” large aggregation retention schedules are organized by very broad functional categories containing many records series or, in some instances, by the retention period.

For example, multiple records series classified into the “Accounting” function on a typical functional retention schedule (e.g., accounts payable, accounts receivable, and general ledger records), are combined into one big bucket, “Accounting” records series. The longest retention period of the various accounting records series that have been classified into the new larger “bucket” is assigned to the entire group. The disadvantage to this approach is the risk that many records will be maintained much longer than is strictly necessary. Another strategy is to establish the organizing principle for the “bucket” as the retention period. A few retention periods are selected (e.g., one-year, five-year, ten-year, and “permanent” time frames), and all records are classified into the “buckets” by time period rather than by record subject matter or function.^[6]

A disadvantage to this strategy, in addition to maintaining many records beyond the time they are useful is that it does not accommodate the application of events in considering how long to keep the records. Rather this strategy relies on a fixed time frame for calculating retention which may not adequately span the time until the event occurs.

Report format

There are also different retention schedule report formats. For example, schedules can be presented as simple alphabetical lists of record names, in a descriptive paragraph format, or in a table format.

Traditionally the records retention schedule has been maintained as a “stand-alone” document published and distributed by the records management group within an organization. More recently, database technology has been used to maintain retention schedule data and to publish the retention schedule report as a hardcopy report or as a file posted on an organization’s intranet site.

Report content

In addition to the records series name and retention period, schedules may also include descriptive information about the records series. For example, schedules can contain:

- The office of record—the group within the organization that is assigned responsibility for maintaining the records series.
- The basis for the assigned retention period—an administrative or operating requirement, a legal statute, or agency regulation.
- Separate time periods for retaining the records series “onsite,” for transferring records “offsite,” for destroying records, and for duplicate copies.
- Records storage formats (e.g., paper, microfilm, digital).
- Records destruction requirements (e.g., shredding).
- Access, preservation, or security requirements (e.g., records are “confidential”—access must be restricted; or “historical”—records have research or social importance beyond the business and legal need; or “vital”—records must be available to respond to an emergency or disaster).
- Notes or comments.

RETENTION PERIODS

A retention period is the length of time, usually stated in terms of the number of years, that records must be maintained to meet operating, legal or fiscal requirements of the organization.^[1] Many records series must be maintained until a certain event has transpired. In some instances retention periods are a combination of the event plus a set number of years.

A retention period based on a finite time period (such as a certain number of years) is used when it is known that the records will not be needed past that time frame. A retention period that is based on an event is used when the retention time that the record is required is based on the occurrence of an event or on a circumstance whose date cannot be predicted. For example, for the records series, “Personnel Files,” the retention period would be governed by the event that was the end of employment, or “termination” (the event). The termination date of employment cannot be accurately predicted. Therefore Personnel Files would have a retention period

of “Termination,” or a number of years after that event (e.g., “Termination plus 5 years”).

The retention period is sometimes further delineated into the time period to retain the records in the working environment (e.g., office, workstation, online), a time period for retaining records in a lower-cost storage area (e.g., a warehouse for paper-based records, a climate-controlled vault for photographs or microfilm, or off-line storage on tape for digital records), and a total retention time.

DEVELOPMENT

In order to manage its records, the organization needs to understand what records are maintained and how they are used. The information needed to have this understanding is collected during the development of the retention schedule in a process known as the “records inventory.”

The first step in creating the retention schedule is to prepare a plan that describes the strategy for the retention schedule. This strategy should include determining:

- The scope of the retention schedule—which parts of the organization will be inventoried (e.g., all operations, domestic operations only, headquarters office only), what storage formats are used for records (e.g., hardcopy only, electronic, photographic)
- The type of retention schedule to be developed—departmental or functional
- The type of information to be collected
- The records inventory method to be used—detailed physical inventory, high-level survey approach, or questionnaire
- The resources needed to develop the retention schedule—in-house staff, outside consultants, or a combination
- A project schedule for development
- The type of approval—the level of internal management, external counsel, or board of directors approval required
- The method of implementing the retention schedule—for example, one business unit at a time or one location at a time

Records retention schedules can be developed using one of several methods: a detailed physical inventory, a questionnaire, a high-level overview or “survey,” analysis of business processes, questionnaires, or a combination of these methods. Regardless of the type of retention schedule and the exact method of schedule development, the basic need is to understand what records exist and how long they must be retained.

The inventory process collects information about the records that can be determined by a visual inspection (e.g., the volume of records stored, and their physical condition) and by interviewing knowledgeable individuals

in each business unit (e.g., concerning records usage, electronic records creation or maintenance, government reporting requirements, if any, and litigation history). The type of data collected varies depending on decisions made during the development of the records retention schedule strategy. It can include, for example:

- Names of the files and documents
- Storage location
- Storage equipment
- Volume of records
- Date range
- Condition of the records
- Storage format (paper, microfilm, electronic, photographic)

The interview process collects information about the use of records, frequency of reference, computer applications that create or store electronic records, problems encountered with finding or storing records, government regulatory requirements for preparing, reporting, or maintaining records, and the records required to respond to legal actions.

The inventory and interview data are analyzed to develop records series, the building blocks of the retention schedule. Once the draft version of the retention schedule is complete, the following activities complete the schedule development process.

Legal Research

It is necessary to establish the legal jurisdictions that apply to the organization in order to understand which recordkeeping statutes and agency regulations must be followed. The records management function of the organization can research these requirements as well as consult with legal counsel to establish what the legal recordkeeping requirements are, if any. Not all records are governed by statutes or regulations. The retention period for the majority of records series is determined by the business need to refer to the record (sometimes referred to as the “operating” need). The legal requirements are considered with the business need and the longer of the two time periods is selected.

Review and Approval

Once the first draft of the retention schedule is completed, it is issued to the business units and to legal counsel for review and comment. The retention schedule is then revised based on the comments received and then issued to the appropriate group within the organization for approval (executive office, legal department, or governing board).

Implementation

Once approved, the records management function within the organization applies it to the organization's records, matching the record series to the physical or electronic records maintained and culling obsolete records from their stored locations. This begins the systematic process of destroying obsolete records (those records whose retention period has been met).

Maintenance

Periodically the records management function of the organization completes the retention schedule review and update process to incorporate new record series and new legal requirements, to add in changes that have occurred in the organizational structure affecting the responsible department (office of record), and to delete record series which are no longer maintained. The frequency of update will vary from one organization to another depending on the frequency of change to governing statutes and regulations and to the internal business practices.

CONCLUSION

Records retention has been called “. . .the defining responsibility of records management as a business discipline.”^[8] The primary tool used in records retention activities is the records retention schedule. Developing and implementing the retention schedule are fundamental activities of a records management program.

The retention schedule is the official policy that allows an organization to effectively manage its records and it is the primary building block upon which other program components are constructed.

The retention schedule categorizes and describes the organization's records and how long they must be kept. Maintaining a comprehensive retention schedule is key to managing records to ensure that they are available for use as long as they are needed, and are destroyed (or transferred to an archives, if historical) when no longer needed, thereby avoiding costs associated with uncontrolled records growth, limiting legal liabilities, and promoting operational efficiencies.

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Reference and Informational Genres

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Abstract

In order to reduce the problems of information overload, librarians and indexers have created systems of categorization that allow large numbers of individual books or articles to be perceived initially through smaller numbers of categories of literature. These categories can be either subject or format groupings. Format designations are particularly useful in segregating reference works from larger collections or retrievals. The distinctive nature, and the purposes and uses of reference works (“tertiary literature” composed of 60% or more of files or lists, as opposed to “primary” or “secondary” literature) are discussed. The mechanisms for finding such works via *Library of Congress Subject Headings*, or via the peculiarities of their shelving in either the Library of Congress Classification or the Dewey Decimal Classification, are explained. “Publication types” and “document type” searches within databases covering formats other than books are also treated.

The phrase “reference and informational genres” refers to types of literature that are distinctively formatted in such a way as to expedite the discovery of particular kinds of information. Such genres include almanacs, atlases, chronologies, dictionaries, encyclopedias, and so on, that usually present informational content in brief, segmented displays, rather than in connected narratives or continuous expositions.

The need for such genres arises from the fact that efficient research cannot be done in large, unsorted collections of resources, whether printed or electronic. Some kind of categorization of the material is necessary to prevent information overload. While the mind cannot grasp huge numbers of individual items in relationship to each other, it can more easily discern relationships among broader—and fewer—*categories* into which the items may be sorted or assigned.

In book literature, for example, one can get a better sense of what is or is not contained within the category of works on “Afghanistan—history” if one can readily see that subdividing categories other than “history” per se have been created for country’s “antiquities,” “boundaries,” “civilization,” “economic conditions,” “foreign relations,” “geography,” “intellectual life,” “politics and government,” “social life and customs,” and so on. That is, one can more readily discern what may be contained within a “history” of Afghanistan category by being able to note, quickly, the relationship of this category itself to an array of all the other subject-aspects that impinge on “history” without being included by it. (These particular categorizations are all formal terms within the *Library of Congress Subject Headings* system.)

The segregation of large collections of resources into smaller and more manageable “chunks,” however, is not solely accomplished by the creation of *subject* groupings;

it is also brought about by *format* and *genre* categorizations. In the same example, a researcher interested in “Afghanistan—history” may, in a large research library, still be overwhelmed by too much material within that subject itself; but further subdivisions of the topic into types of literature such as “Afghanistan—history—bibliography,” “—chronology,” “—dictionaries,” “—encyclopedias,” can provide the additional options needed to make the various aspects of the “Afghanistan—history” group more perceptible and manageable.

Format and genre groupings thus allow very useful discriminations to be made on a basis other than subject content: on the one hand, they enable immediate focus to be directed toward some particular types of relevant resources “within” a subject; on the other, they enable whole groups of irrelevant sources to be immediately excluded, which would otherwise remain as cluttering elements if only subject (rather than format/genre) categories were available to choose from. In this same example, still other format designations (“personal narratives,” “pictorial works,” “registers of dead,” “songs and music,” and so on) may appear as subdivisions of “Afghanistan” directly—e.g., “Afghanistan—pictorial works” rather than “Afghanistan—history—pictorial works,” thus allowing other relevant *genre* categories to be recognized in the same roster in which *subject* subdivisions appear.

The major types of format and genre categorizations used in the library field were initially developed as mechanisms to sort and characterize literature contained in books; but similar or analogous types of category designations have been created to prevent, in comparable ways, the retrieval of “too much” information within other kinds of knowledge records. (For example, within journal literature it is possible to focus on, or filter out, letters-to-the editor, book reviews, editorials, etc. from conventional

“articles”—points that will be discussed below.) The present entry therefore starts with a consideration of mechanisms for sorting book collections, and then moves on to consider nonbook resources.

Several key formats and genres within book literature are traditionally distinguished:

Almanacs. These contain miscellaneous data and information for quick look-up purposes. They are good sources for information concerned with statistics, awards, historical dates and anniversaries, geography (i.e., basic data on countries, states, large cities, and natural features such as mountains, rivers, volcanoes), sports records, flags, lists of governmental agencies and officials, directory information for consumers, information on national or world figures, brief chronologies or overviews of world historical events, astronomical data and calendars, postal information, basic world maps, and so on. Almanacs are particularly useful for answering questions having to do with *who, what, when, and where* when only brief, objective information is required.

Atlases. These are usually compendiums of maps that display information graphically and spatially. Maps can show not just national or political relationships but also data on atmosphere and weather, temperature and rainfall, climate variations, crop production, vegetation, soil conditions, biodiversity, ecological changes, mineral concentrations or distributions, geologic processes, fishing patterns, military power balances, wars and conflicts, status of women, literacy levels, technological levels, population trends, occupational distributions, trade patterns, spread of diseases, health levels, standards of living, area histories, and the like. Many atlases also include representations of astronomical information on stars and constellations, the solar system, planets, moons, comets, and so on. (The term *atlases* is also sometimes used in an older sense, referring to compilations of statistical tables rather than maps.)

Bibliographies. These are compilations of citations to books, journal articles, conference papers, dissertations, reports, and so on. They may be *enumerative* (listing works from a country or other locale, from an author, or from a printer), *descriptive* (providing details of the physical characteristics of published works), or *subject* compilations. The latter are usually assembled by experts who have specialized knowledge of the topic, and so the listings in subject bibliographies are often annotated with descriptive summaries or evaluative notes on the intellectual content of the works cited. A particularly valuable feature is that these bibliographies may include many sources that lie beyond the range of database indexing. They serve to provide overviews, often comprehensive, of the extent of literature on a topic; and, being compiled by human scholars rather than machine algorithms, they often provide readers with a better survey of research options than computer printouts can supply. They usually have some arrangement or categorization of entries

reflecting something of the internal structure or chronological development of the topic itself, an overall mapping of parts or aspects of the subject that cannot be captured or conveyed by automated term-weighting. Frequently subject bibliographies have detailed indexes revealing additional connections among the citations that are not apparent from the structured order of the listings within the body of the bibliography. Bibliographies compiled by experts, in short, are often much better than databases in providing starting points for research, or initial overview listings of resources. They are especially important in historical and literary research.

Catalogs. Catalogs provide listings of objects rather than bibliographic citations; the objects may be merchandise, art objects, equipment, machine parts, professional or art/craft supplies, and so forth, that are located at particular places or that are available for sale. Catalogs, like bibliographies, may also list publications; but catalog listings are usually for publications as physical objects residing in a particular place. Catalogs often provide descriptive details, technical specifications, and prices of the listed objects.

Chronologies. These present historical facts arranged by the time sequence of their occurrence. Some chronologies present parallel listings that display the developments within different areas of interest (e.g., politics, arts, technology, and religion) simultaneously, so that a reader may correlate the events of one area with contemporaneous, earlier, or later developments in other subject areas.

Concordances. These are alphabetical lists of individual words derived from particular texts (usually literary or philosophical classics) that enable researchers to determine exactly where any particular word or words appear within the text.

Dictionaries. These provide an alphabetically arranged list of words with their definitions, pronunciations, etymology, scope of usage, variant forms or spellings, and so on. Often they contain biographical and geographical names. Their scope may vary from coverage of an entire language to a focus on only the technical terms or jargon of a particular subject area. The term “dictionary” is often synonymous with “encyclopedia,” referring simply to an alphabetical (rather than a systematic) arrangement of entries, regardless of whether the entries are brief and factual or lengthy and expository.

Directories. Directories are sources for identifying and locating individual people, organizations, or institutions; they list persons or corporate bodies that are situated in certain geographical areas, or that are related by thematic, professional, commercial, or subject concerns. Nowadays they usually list names, addresses, telephone and fax numbers, e-mail addresses, Web home pages, or other contact data; and they may provide basic information about an individual’s qualifications and background, or an institution’s purposes, history, and internal structure. Directories may

be arranged alphabetically, geographically, or numerically (e.g., by telephone numbers or street addresses).

Encyclopedias. Encyclopedias are usually compilations of information in expository form in articles arranged alphabetically. The articles are generally intended to provide concise (rather than exhaustive) overview-summaries of the basic facts on a subject, written for an audience of nonspecialists who do not start with any prior knowledge of the subject or its technical jargon. Encyclopedia articles, too, usually provide brief bibliographies of basic works rather than exhaustive lists of all relevant sources. The aim of an encyclopedia, as a whole, is to summarize established or objective knowledge at a level comprehensible by lay people, and to provide a starting point for more extensive or in-depth research. The scope of individual encyclopedias may vary from attempting to survey all knowledge in all fields to focusing on particular subject areas or academic disciplines. (Note that encyclopedias specialized in a particular *subject area* still tend to be written with a nonspecialist *audience* in mind.) Subject encyclopedias, as a form, may be contrasted to treatises, which also attempt to survey entire subjects, but which do so exhaustively (rather than concisely) in both their texts and bibliographies, in a systematic (rather than alphabetical) order of presentation, and at a level of detail appropriate to specialists. Encyclopedias often include cross-references among articles, and frequently have detailed indexes that reveal specific data and interrelationships not discoverable by the alphabetical arrangement of the articles themselves.

Gazetteers. These are alphabetical dictionaries of geographic place-names; entries often include brief descriptions of the history, population, economic characteristics, and natural resources of the places listed. Gazetteers are also useful for identifying the larger geopolitical units in which a smaller locale is included (e.g., an entry on a town name will also designate the county, state, or other larger district of which it is part).

Handbooks and manuals. These are a type of information source intended to be easily transportable for actual use “in the field” rather than just in libraries. They are related to encyclopedias and treatises in that they try to provide the principles and important facts of a subject area, and in that they can be arranged either alphabetically or systematically. Their major distinction from these other forms is their emphasis on practice, procedures, and other “how to” directions for producing actual results or specific identifications of natural objects (plants, birds, botanical specimens, etc.), rather than just broad intellectual understanding. Also, they tend to be much more concisely written, as well as formatted in smaller-sized volumes, so as to be more easily carried about in field situations.

Newsletters. These are sources for current information in fields that develop or change rapidly. In print form, they appear daily, weekly, or monthly.

Sourcebooks. These are compilations of primary sources relevant to a particular topic or subject area. They conveniently assemble in one place original documents important to an understanding of the history or development of the subject, often with introductions that provide context and point out relationships not apparent from the texts themselves.

Union lists. These are location devices; they enable researchers who have already identified specific sources to determine which libraries (or other repositories) actually own a copy of the desired works. They are like catalogs in that they list physical objects; but the items recorded in union lists are drawn from multiple institutions in different locales.

Yearbooks. This type of literature seeks to provide a record of the year’s developments in a particular field, often with evaluative commentary on what has transpired. Such annuals are often cumulations of the updating information contained in newsletters, but with more structured arrangement, additional introductory material, and better indexing; they are also usually produced as hardbound volumes to serve as permanent replacements for the ephemeral newsletter formats they may cumulate or supersede.

Many other formats and genres have also been customarily distinguished within book-format literatures. The *Library of Congress Subject Headings* roster provides numerous standardized form categories; note that in each instance in the following list, as with the above roster, the particular *subject* of the work to which these designations can be given is not relevant. (One obvious qualification is in order, however, some format and genre designations do have defined subject *scope ranges*—i.e., a form designation such as “description and travel” may have wide applicability within works on geographical topics, but not be appropriate at all for works in biology or physics.) Among the many traditional form and genre subdivisions, in addition to the above list, are

- Abstracts
- Archival resources
- Bio-bibliography
- Case studies
- Charts, diagrams, etc.
- Correspondence
- Criticism and interpretation
- Cross-cultural studies
- Description and travel
- Diaries
- Discography
- Fiction
- Film catalogs
- Guidebooks
- History
- Indexes
- Interviews
- Inventories

Manuscripts—catalogs
 Microform catalogs
 Patents
 Periodicals—bibliography
 Personal narratives
 Photograph collections
 Pictorial works
 Portraits
 Quotations
 Registers
 Problems, exercises
 Sermons
 Statistics
 Tables
 Textbooks

A practical problem for librarians arises in distinguishing *reference* genres within the larger roster of all form and genre designations. That is, within the entirety of a library's book collection, librarians need to create subcollections of *reference books* segregated from the general collections, and located in close proximity to the reference staff whose job is to provide quick information on some topics, and overall guidance into the larger collections not immediately at hand.

Although every book may be said to contain information, not every one qualifies as a *reference book* on its topic. Format and genre considerations come into play here, although not *all* format and genre considerations. "diaries" and "correspondence," for example, are labels indicating formats (rather than subjects), but not formats that would be considered appropriate for assignment to a reference collection. The "history" label is less clear cut. In one sense, "history" is a subject in itself (as distinguished from, say, "anthropology" or "religion"). In another, however, "history" is indeed a format designation, indicating a presentation of information in connected narrative sequence, as opposed to other presentation possibilities ("encyclopedias," "quotations," and "pictorial works"). Even if "history" is regarded as a form, however, all histories cannot possibly be shelved in working reference collections, which have particular space limitations.

How then can librarians make practical distinctions of reference genres from other informational genres? Two considerations are generally useful. The first is the distinction among *levels* of literature: primary, secondary, and tertiary. *Primary literature* is generated by participants in a particular activity or event, recording their original impressions, experiences, observations, experiments, or creative expressions. *Secondary literature* is generally comprised of either popularizations or scholarly analyses of the primary literature; it is based on surveys of, or research into, primary sources. *Tertiary literature* consists of works that identify, point out, summarize, abstract, compile, or repackage the information provided by the

other two levels. As Ranganathan^[1] has pointed out, they are works intended to be consulted for one or more of their parts, rather than read through consecutively and completely. Reference works, such as almanacs, dictionaries, chronologies, and encyclopedias, are usually at this third level.

A second distinction between reference genres and others is provided by a particularly insightful analysis by Bates.^[2] "Reference books," she writes, "have traditionally been defined administratively (e.g., as books that are noncirculating) or functionally (e.g., as books used for reference), rather than descriptively (i.e., in terms of the essential characteristics that distinguish reference books from other books)." She then provides a very useful definition of reference books based on their organizational structure: they are

books that contain a substantial percentage of their length—operationally defined... as 60 percent or more in pages—in files and/or lists. Files are sets of records ordered according to a readily recognizable ordering principle [e.g., alphabetical order, chronological date, geographic continent/country relation, biological phylum/species relationship, etc.], and lists are sets of records ordered in the same manner as [an] author's idiosyncratic ordering of the contents of a book.

The best example of an author's "idiosyncratic ordering" of material would be, exactly, the *table of contents* of his or her book, which is likely to show an arrangement or conceptual structure other than that of an alphabetical, ordinal, geographic, or other immediately-recognizable sequence (as in a "file"). If the actual book itself, however—i.e., the *content* of the book that follows the *table of contents*—is primarily composed of discrete informational units or entries that "can stand alone" (i.e., rather than being integrated in continuous expository or narrative text), and if these discrete units could have been "arranged in different orders with respect to each other without harming their meaning or use," then such an idiosyncratic order is designated a "list" rather than a "file." "Reference books," again, are defined as those having 60% or more of their pages made up of files or lists. Thus not all genre or form designations (e.g., "case studies," correspondence, "diaries," "personal narratives") are *reference* genres.

Bates's theoretical distinctions were backed by an empirical study of the characteristics of actual books in the reference collections of three libraries, in comparison to the "stacks" books of the same libraries. Nearly 90% of the volumes designated "reference" books did indeed have "60% or more of their pages made up of files or lists." One notable exception was discovered: "canonical texts" are frequently included in reference collections although they are not made up primarily of files or lists. Such texts are things like standard treatises on particular

subjects; compilations of laws and regulations; collections of standards and specifications; or literary, religious, and other authoritative texts (e.g., the *Bible*, the *Qu'ran*, or an indexed set of *Great Books*).

The primary virtue of having form and genre designations, in addition to subject groupings of material, to work with is that these categorizations greatly facilitate research for certain kinds of information *within* any subject area. The fact that the reference literature of any topic can be expected to fall into bibliographies, chronologies, dictionaries, directories, encyclopedias, and so on, provides a predictability factor to research that enables immediate attention to be directed toward some sources rather than others. Without the existence of predictable *formats* of literature being available, much time would be wasted—i.e., some questions are immediately answerable by directories, whereas regular monographs or dictionaries or chronologies within the same subject area would be irrelevant; others are best answered by encyclopedias, where monographic or atlas-format sources would only get in the way if they showed up in the same retrievals.

If one has a foreknowledge of the existence, as well as of the range and functions of the different reference formats available within *any* subject area, one can immediately think in terms of those categories, and thereby channel one's search efforts right from the start to only those resources whose format characteristics are appropriate to the question, while bypassing the others. For example, if one wishes to get brief overview knowledge of the Muslim historian Ibn Khaldun—his dates, his most important writings, his key ideas, and so forth—without having to read through hundreds of full-length books on him, one's search time and effort will be greatly reduced if one knows enough to anticipate the likely existence of an “encyclopedia” format reference source within the field of Islamic studies. In this case, the *Encyclopedia of Islam* (E.J. Brill, 1960–2002) provides a seven-page article that provides just the overview desired. Similarly, a researcher looking for an overview of the extensive literature on the British essayists Addison and Steele would be well served by first looking for a “bibliography” on the topic, such as Charles A. Knight's *Joseph Addison and Richard Steele: A Reference Guide, 1730–1991* (Prentice Hall, 1994), a 561-page annotated listing of 2006 directly relevant books, editions, articles, and doctoral dissertations—*none* of which have “the right keywords in the wrong contexts,” the bane of Internet type searches. The important point here is that searchers who can frame their questions in terms of predictably existing *reference formats* may, even without having any prior *subject* knowledge of the field in question, be much more efficient in finding desired information about a topic, without any wasted effort, than even full professors who have subject expertise but who lack an understanding of the predictability of various formats.

The same predictability of genre formats facilitates not just research itself but also the teaching of how to do it. Many courses in library research methodology use texts that are themselves structured by formats or types of literature. Such texts may seek to provide the means of searching, via reference formats, within all subjects across the board^[3]; or they may confine themselves to research within a specific discipline. An example of the latter is C. D. Hurt's *Information Sources in Science and Technology*^[4]; the first three sections of its contents are structured as follows:

MULTIDISCIPLINARY SOURCES OF INFORMATIONS

1. Multidisciplinary sources of information
 - Guides to the literature
 - Bibliographies
 - Abstracts and indexes
 - Encyclopedias
 - Dictionaries
 - Handbooks
 - Serials
 - Directories
 - Biographical directories
 - Theses and dissertations
 - Meetings
 - Translations
 - Copyrights and patents
 - Government documents and technical reports
 - Internet guides
 - Web sites

THE BIOLOGICAL SCIENCES

2. Biology
 - History
 - Guides to the literature
 - Abstracts and indexes
 - Encyclopedias
 - Dictionaries
 - Handbooks
 - Treatises
 - Directories
 - Web sites
3. Botany
 - Guides to the literature
 - Bibliographies
 - Abstracts and indexes
 - Encyclopedias
 - Dictionaries
 - Handbooks
 - Directories
 - Web sites

Essentially, the same few format breakdowns are used in 21 different subject areas (zoology, astronomy, chemistry, environmental sciences, general engineering, civil engineering, health sciences, etc.) It is, again, *predictable* that such reference genres can be found within *any* subject. While no one can remember the 1542 individual sources described in Hurt's book, anyone with a bit of training can remember the much smaller number of *types* of literature that can be expected to exist, no matter what subject is being researched. The predictability of this format structure within any topic area, once more, allows many inquiries to be much more immediately focused, with fewer wasted steps, and accomplished without the searcher having to wade through massive retrievals of term-weighted irrelevancies. (The phrase "relevance ranking"—*term weighting* is more accurate—is misleading in more ways than one. Not only does such algorithmic weighting fail to bring about the conceptual categorization of relevant sources, no matter what keywords [or languages] the sources themselves use; it also fails to bring about format categorizations that allow immediate focus to one's search efforts.)

One drawback in reliance on reference-format materials to pursue inquiries should be noted: a foreknowledge of the various types of literature enables a researcher to zero in quickly on reference sources relevant to a topic—i.e., those made up essentially of 60% or more of files or lists—but it does not enable the searcher to see "regular" books that are written in connected narrative or expository form. In terms of the distinction made earlier, not all primary literature or secondary literature is adequately covered by the tertiary literature of reference works. Direct access to the former levels, unconstrained and unchanneled by access through listings in reference sources, is still imperative. To gain this direct access (at least in research libraries in the English-speaking world) one must also know how to use the *Library of Congress Subject Headings (LCSH)* system within the library's general catalog; and one must also be aware of the trade-offs between searching via standardized conceptual and format categories (determined by *LCSH* terms) versus searching by keywords, no matter how the words are term-weighted by computer algorithms. Research instruction classes, in other words, need to cover more ground than a survey of reference-types of literature alone; they must also cover additional methods of searching (e.g., via controlled vocabularies [such as *LCSH*], via keywords, via citation links [showing which articles cite a known source], via related record links [showing which articles have footnotes in common with a known source], via bookstacks-browsing [exploiting LC or Dewey classification shelving arrangements], etc.). The predictable availability of this larger array of search methods (for gaining access to primary and secondary literature) is just as useful in focusing some searches as is the predictable availability of certain

reference formats (for gaining access to tertiary literature) in focusing other inquiries.^[5]

Form and genre designations are primarily useful within library catalogs or subject bibliographies, as mechanisms for *subdividing* larger categories of items that are themselves created on the basis of subject similarities. (Again, the subject "Afghanistan" is subdivided by the formats "bibliography," "encyclopedias," "gazetteers," etc.). To a lesser extent, format considerations also play a role in library classification schemes, in determining how physical book volumes may be shelved in relation to each other. The Library of Congress Classification (LCC) scheme, for example, is primarily structured according to subject categorizations (e.g., Class E books for American History, Class L for education, R for medicine, etc.). These groupings are further subdivided primarily by other subject considerations—but also, in some cases, by considerations of literature formats. A structured order of these subgroupings was largely standardized by Charles Martel, one of the architects of the LCC system in the early years of the twentieth century. As Immroth^[6] has noted, "The order of entries or foci within a class or subclass or individual subject is another unifying feature of LC classification. This order is called the General Principle of Arrangement within the Classes or 'Martel's Seven Points' as Martel is said to have instructed the subject specialists to follow this order as appropriate in the development of any section of the classification." That order is as follows:

1. General form divisions
 - Periodicals
 - Societies
 - Collections
 - Dictionaries
 - Encyclopedias
 - Congresses
 - Exhibitions
 - Museums
 - Yearbooks
 - Documents
 - Directories
2. Theory, philosophy
3. History
4. Treatises, general works
5. Law, regulation, state relations
6. Study and teaching
7. Special subjects and subdivisions

As Immroth further notes, "Usually the general form divisions that are applied [within any subject class] precede any other divisions. There is no absolute internal order for the general form divisions."

An example of the form subdivisions within Martel's structure may be found within the N (Visual Arts) class in the current LCC schedule:

N	(Visual arts)
N1–N8.Z	Periodicals
N9.A1–N9.9.Z	Yearbooks
N10–N17.Z	Societies
N21	Congresses
N25–N27	Collected writings (serial)
N31	Encyclopedias
N33	Dictionaries
N34	Terminology
N40–N44.Z	Biography
N45	Artists's marks and monograms
N50–N55.Z	Directories

The clustering of distinctive formats at the beginning of a class arrangement may be found in the Dewey Decimal Classification (DDC) system as well as in LCC. In Dewey, several form subdivisions are indicated by standard numerical designations that subdivide many different subject-classes at the same numerical position within each. Thus the 100s group in DDC (i.e., classes 100 through 199), representing the subjects “philosophy, parapsychology and occultism, psychology,” has several form clusters at its start:

103	Dictionaries, encyclopedias, concordances of philosophy
105	Serial publications of philosophy
106	Organizations and management of philosophy (roughly corresponding to “societies” in Martel’s Seven Points within LCC)

The designations -03 for dictionaries, -05 for serial publications, and -06 for organizations show up in the same positions within other topical classes, for example, 403 for dictionaries, 405 for serial publications, and 406 for organizations within the overall 400s (language) class.

The clustering of forms—particularly reference forms—at the beginning of any new class area, in either LCC or DDC, facilitates reference work for those who know what to look for. To begin with, the appearance of long runs of volumes of the same height, and having uniform bindings, immediately signals the presence of serial publications within a library’s book stacks. Since “periodicals” (LCC) or “serial publications” (DDC) always appear at the beginning of any new subject-class area, such visual markers indicate transitions on the bookshelves from one major subject-category to the next. But then, because of Martel’s Seven Points, a stacks-browser in an LCC library who notices a clustering of uniform serial volumes will also be able to predict that reference formats such as yearbooks, encyclopedias, dictionaries, and directories will follow the bound journals in reasonably close proximity. In a DDC library, the browser who spots the serial runs will similarly be able to predict that dictionaries, encyclopedias, and

concordances will immediately precede the cluster of journal volumes. The classes in both systems were designed by practicing librarians who, more than a century ago, did not have the array of databases and full text electronic sources that we take for granted today; for them, the arrangement of the books themselves, in the stacks, was structured to enable reasonably efficient access even in the absence of a card (or other) catalog of the collection. Even today, the structure of that arrangement retains a practical utility for reference work that cannot be matched by any system of mere “mark it and park it” inventory control shelving, in which neither subject nor format relationships of volumes determine the order of their arrangement.

Format considerations also show up the LCC in other significant ways, beyond Martel’s use of them as structuring elements within individual classes. Specifically, large parts of two entire classes (A and Z) are mainly composed of nothing but reference format material. Class A (General Works), right at the start of the entire LCC sequence, brings about some very useful groupings of reference genres. “General,” here, means “not discipline-specific”; for example, the *Encyclopaedia Britannica* seeks to cover all areas of knowledge; and a standard index to journals, *Readers’ Guide to Periodical Literature*, similarly covers articles in all subject areas. The various subdivisions of Class A deliberately bring together such “initial overview” sources:

AE	Encyclopedias For example: <i>Encyclopaedia Britannica</i> [AE5], <i>La Grande Encyclopedie</i> [AE25], <i>Brockhaus Enzyklopadie</i> [AE27], <i>Enciclopedia Universal Ilustrada</i> [AE61]
AG	Dictionaries and other general reference works For example: <i>The Columbia Encyclopedia</i> [AG5], <i>Famous First Facts</i> [AG5], <i>The New York Public Library Desk Reference</i> [AG6], <i>Guinness World Records</i> [AG243]
AI	Indexes For example: <i>Readers’ Guide to Periodical Literature</i> [AI3], <i>Essay and General Literature Index</i> [AI3], <i>Poole’s Index to Periodical Literature</i> [AI3], <i>New York Times Index</i> [AI21]
AP	Periodicals (general or multi-topical, not discipline-specific)
AS	Academies and learned societies For example: <i>Gale Directory of Learning Worldwide</i> [AS2], <i>The Europa World of Learning</i> [AS2], <i>Encyclopedia of Associations</i> [AS22], <i>The Foundation Directory</i> [AS911]
AY	Yearbooks, almanacs, directories For example: <i>World Almanac</i> [AY67], <i>Whitacker’s Almanack</i> [AY754]

One of the overall purposes of Class A as a whole is thus to serve as a kind of “table of contents” to all of the other classes (B through Z1199). Works shelved here tend to provide introductory-level information—wide in scope

but not very deep in coverage, providing a kind of overview mapping of the terrain that will be covered in greater depth, in its various parts, within each of the following classes. Thus the general encyclopedias in Class AE provide articles that are very brief (compared to full books) in all subject areas; and their articles also usually have concise bibliographies of the most important “starting place” sources for further reading (rather than exhaustive listings of all relevant sources). In a similar way, the periodical indexes in Class AI provide access to general magazines and newspapers; the articles contained therein may be on any topic, but they do not match the depth of subject penetration provided by whole books and specialized journals, which will be shelved in the subsequent classes starting with B. Class A, then, is a mixture of categorizations created by both “general” subject and reference-format characteristics, but it is especially laden with the latter.

The DDC has somewhat analogous clusters of general encyclopedia-format material near its beginning, in Class 000 (computer science, information, general works): Class 030 consists of “general encyclopedic works.” Bringing all of the general encyclopedias to the front of the entire scheme here, too, provides a kind of introductory overview mapping of subjects that are covered in much greater detail within the whole books and specialized journals shelved in the subject categorizations to follow (100 through 999).

Whereas Class A in the LCC system serves as the “table of contents” to the classes which follow, Class Z at the very end serves much like the “index volume” at the end of a large encyclopedia. The Z (bibliography and library science) grouping has two major parts: Z4 through the Z1100s are classes mainly composed of monographs and serials about books, publishing, and library science as subjects in themselves; the Z1200s and above are clusters of actual reference-format bibliographies covering *all* subject areas (i.e., not limited to bibliographies about books, publishing, and libraries).

The noteworthy point is that these subject bibliographies (covering particular subjects or geographic regions *as* subjects, in depth) are not shelved with the regular books on their corresponding topics. For example, regular monographs on Indians of North America tend to be classed in E51–E59 (pre-Columbian America and Indians of North America), but bibliographies on the same subject are classed in Z1209–Z1210. Similarly, monographs on President Millard Fillmore tend to be classed in E426–E430 (United States—Revolution to the Civil War); but bibliographies on him are in Z8295.9.

As mentioned earlier, in most instances in either the *LCSH* system (in the library catalog) or the LCC system (in the bookstacks), format considerations are used to subdivide subject groupings, rather than vice versa. The subdivisions of the “index volume” bibliographies at the end of Class Z, however, are an exception. The material

in this range is all of a particular reference format—bibliographies—to begin with; the arrangement of the bibliographies’ sequence is then subdivided by topical considerations, in three large clusters:

Z1201–Z4890 Geographically localized subject bibliographies (by continent, country, state, county, etc.) arranged in the order of North America, South America, Europe, Asia, Africa, Australia, and Oceania, with narrower localized subdivisions within each continent.

For example:

North America	Z1201–
The United States	Z1201–1363
Alaska	Z1255–1256
Arizona	Z1257–1258
Canada	Z1365–1401
Mexico	Z1411–1431
Central America	Z1437–
Belize	Z1441–1449
Costa Rica	Z1451–1459
South America	Z1601–

Z5000–Z7999 Subject bibliographies (usually lacking geographical limitations or focus, arranged alphabetically by subject).

For example:

Agriculture	Z5071–5076
Anthropology	Z5111–5119
Astronomy	Z5151–5156
Bees and bee culture	Z5256
Biology	Z5319–5323

Z8000–Z8999 Personal bibliographies (on individual people, usually literary authors or historical figures), arranged alphabetically by the surname of the subject.

For example:

Adams, Henry	Z8015.3
Austen, Jane	Z8048
Burton, Sir R.F.	Z8136.2
Chesterton, G.K.	Z8166.5

The use of simple and easily remembered ordering mechanisms (continent/country, alphabet) for these unusually important reference-format materials once again enables stacks-browsers to recognize where they are in relation to the whole scheme, even in the absence of a separate catalog of the collection. The class scheme thus increases the predictability of finding bibliographies on any topic—i.e., even if one does not know in advance that a bibliography actually exists on a particular subject, the arrangement of the Z classes gives an informed searcher a foreknowledge of which niches within the overall system are likely to contain such works, since the existence of the geographical and alphabetical niches is itself predictable, even if their specific contents are not.

The clustering together of all subject bibliographies, on all topics, at the very end of the LCC scheme also enables them to be browsed in relation to each other, as reference sources, without the cluttering presence of millions of non-reference works on the same subjects. This gives the bibliographies a cumulative utility that would be dissipated if each one were shelved with the monographs on its topic, in the regular B through Z1100s subject classes. (For example, the ability to see whole shelves of hundreds of subject bibliographies on women's studies, in Z7961 through Z7965, gives searchers in this subject area the capability of seeing relationships, and paths of access into the relevant literature, that could not otherwise be noticed.) The aggregation of reference sources at the end of the LCC scheme, again, enables them to serve as a kind of "index" to material to be found in all of the other classes. Whereas Class A provides relatively superficial "overview" access to all subjects, Class Z provides corresponding in-depth access to each of them. These functions are brought about primarily by the respective clustering of different *reference formats*, in strategic beginning and ending positions in the overall LCC sequence, which placements serve the different purposes.

The DDC system has a class analogous to LCC's Z1200–Z8999 for grouping together all subject bibliographies; but Dewey puts its "index volume" class at the beginning of its sequence, in Class 016 (Bibliographies and catalogs of works on specific subjects or in specific disciplines) within the 000s, rather than at the end, in the 900s.

Libraries must collect or provide access not just to conventional monographic books, but to other kinds of knowledge records as well. Journals, periodicals, and magazines have always been sought for research collections; but, as a rule, their individual articles are not indexed within a library's own catalog. Further, although journals do receive classification numbers in both LCC and DDC systems, the shelving of all volumes of the same journal in one location does little to indicate to a shelf-browser the particular subject content of any particular article(s) contained within the extensive runs of issues. Thus, neither the designations of reference formats in

the library's catalog through form subdivisions of LCSH headings (e.g., Philosophy—encyclopedias, France—history—chronology), nor the classification schemes' various clusterings of reference formats (i.e., via Martel's arrangements within classes, or via the A and Z groupings) reveal the content of individual journal articles in the way that the catalog and the class scheme reveal *books'* content. The various printed indexes themselves are indeed clustered intelligibly within the A and Z classes in LCC (or 016 in DDC); but this placement also separates the indexes from physical (and browsable) proximity to the hundreds of journals, shelved throughout the entire classification scheme, whose contents they index.

Although libraries catalog and classify the indexes that provide access to individual journal articles, they do not usually create such indexes to begin with; with the exception of some few special libraries' catalogs that do cover articles,^[7] this matter has largely been left to commercial publishers. Of course computerized versions of such indexes are the norm today; and many databases now provide full text access to journals, too; but these databases as well are generally created by commercial services rather than by libraries themselves. (Research libraries, all with chronic budget limitations, have always found it less expensive to subscribe to the indexing work done by private industry than to duplicate such costly labor on their own.)

But here, too, format and genre designations come into play, in ways analogous to their functions in the realm of book collections—i.e., journal articles, like books, may often be indexed not just according to their subjects, but also according to their various formats. And some of these journal formats are unusually important as reference genres. For example, the commercially-produced database *RILM Abstracts of Music Literature*, from the National Information Service Corporation, is not simply a subject index to thousands of journals (also books, conference papers, dissertations, etc.); it also enables users to search or limit by formats and genres. Specifically, it provides a search box allowing access by "publication type," including all of the following:

All

- Article in a collection of essays
- Article in a dictionary of a related discipline
- Article in a newspaper
- Article in a periodical or yearbook
- Article in a symposium proceedings or Congress report
- Article in a volume of essays printed as a Festschrift
- Article in translation
- Book division or chapter
- Book in facsimile or reprint form
- Book in translation
- Book of collected essays, letters, or documents
- Book of essays printed as a Festschrift

Book of symposium proceedings or a Congress report
 Book, monograph, or pamphlet
 Book: periodical as a whole
 Commentary accompanying a recording
 Commentary printed in the program of a concert or opera
 Commentary printed within an edition of music
 Commentary, printed separately, on an edition of music
 Dissertation, doctoral
 Dissertation, master's or other non-doctoral thesis
 Electronic resource
 Motion picture
 Music recording, sound recording
 Review of a book, monograph, or pamphlet
 Review of a dissertation
 Review of a facsimile or reprint edition
 Review of a new edition or music other than scholarly
 Review of a periodical or yearbook
 Review of a recording or film
 Review of a scholarly edition of music
 Review of a symposium proceedings or Congress report
 Review of a translation
 Review of a volume of collected essays
 Review of a volume of essays printed as a *Festschrift*
 Review of an article
 Review of an opera or concert
 Review of electronic resource
 Review of motion picture (video)
 Technical drawing of a musical instrument

Similarly, the *ISI Web of Science* database, from the Institute for Scientific Information (a subsidiary of The Thomson Corporation) is an index to 9000 scholarly journals in all subject fields (including social sciences and humanities, not just sciences); and it allows searches to be limited to a variety of "document types":

All document types
 Article
 Abstract of published item
 Art exhibit review
 Bibliography
 Biographical item
 Book review
 Chronology
 Correction
 Correction, addition
 Dance performance review
 Database review
 Discussion
 Editorial material
 Excerpt
 Fiction, creative prose
 Film review
 Hardware review
 Item about an individual
 Letter

Meeting abstract
 Meeting summary
 Music performance review
 Music score
 Music score review
 News item
 Note
 Poetry
 Record review
 Reprint
 Review (i.e., literature survey articles)
 Script
 Software review
 TV review, radio review, video
 Theater review

Many other commercial databases offer such "publication type" or "document types" search features. Several of these literature types—especially "reviews" of various sorts—are unusually important for reference work. Reviews are not easy to find within books; but such format-search capabilities in journal databases make them quite easy to zero in on, without burying them within much larger keyword retrievals—and it is within journals that most reviews appear in any event. As with the reference formats distinguished within book collections, such types of literature here, too, are not dependent on particular *subjects* (although there are sometimes *scope ranges* involved, as with the various formats connected to music—i.e., document types such as "dance performance review" or "music score review" will obviously not be found within journals devoted to subjects such as linguistics or nursing). The fact that most of these nonbook reference formats will predictably appear within multiple journals, usually regardless of the overall subject area of the journals, similarly enables many searches to be done much more efficiently, quickly, and precisely, than they could be if only subject (or keyword) searching were possible.

The predictability of reference formats, and their use in narrowing and focusing searches that would otherwise result in information overload, is, on the whole, still lacking in Internet search environments. Although it is now possible to limit Net searches to some large format-segments of sites—e.g., blogs, images, games, maps, news stories, patents, videos—the range of such types of sites is noticeably limited compared to the wider variety and greater specificity of format options available within library catalogs and commercially produced index databases. A major reason for the difference lies in most search engines' reliance primarily on automated computer algorithms to bring about the sorting of retrieved results; and term-weighting of keywords, designed mainly to cut down the clutter of sites irrelevant by subject, is not adequate either to make important distinctions among, or to clearly segregate, formats of records. Cataloging or indexing according to document types, especially the subset

of types that are reference formats, has up to now been successfully accomplished only by human beings. Whether it can be accomplished in the future by machine algorithms is a question not yet answered.

In any event, whether human-created or machine-generated, reference form and genre designations play an increasingly important role in research today: the greater the size of any subject retrieval, the more necessary are filtering mechanisms that sort, categorize, and subdivide the results in ways that prevent information overload and allow searches to be efficiently focused on only the most appropriate sources. In addressing this need, form categorizations are equally as important as subject groupings.

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Reference and User Services Association (RUSA)

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Abstract

The Reference and User Services Association (RUSA), a division of the American Library Association (ALA), has the following mission: RUSA is responsible for stimulating and supporting in every type of library the delivery of reference/information services to all groups, regardless of age, and of general library services and materials to adults.

INTRODUCTION

The Reference and User Services Association (RUSA), a division of the American Library Association (ALA), has the following mission: RUSA is responsible for stimulating and supporting in every type of library the delivery of reference/information services to all groups, regardless of age, and of general library services and materials to adults. At the 2000 ALA midwinter meeting, the RUSA Board of Directors adopted the following vision statement: The RUSA is the foremost organization of reference and information professionals who make the connections between people and the information sources and services they need.

Also at the 2000 ALA midwinter meeting, the RUSA Board of Directors adopted the following statement of values:

- We believe in universal access to information in a wide variety of formats.
- We value collections and information sources of the highest possible quality.
- We believe in reading as fundamental to quality of life and value all activities that promote it.
- We value the provision of innovative services and programs that meet the changing information needs of diverse populations.
- We value continuous evaluation and improvement in the management and delivery of collections and services to users.
- We value the professional growth and development of reference and user services staff.
- We value the role of reference and user services staff as educators in creating lifelong learners and critical thinkers.
- We value the unique contributions that human beings bring to the process of connecting users with the information they need.

MEMBERSHIP

The RUSA has a membership of over 5000, including both personal and organizational members. Personal members of RUSA work in all types of libraries and the publishing and information industry. Past studies of the membership have shown that about one-half of the membership works in academic libraries, one-fourth in public libraries, and the remainder in school libraries, networks, library education, and publishing. Members of RUSA are reference librarians, bibliographers, administrators, adult services librarians, collection development specialists, readers' advisers, public service librarians, and individuals working in the publishing and information industry.

NAME CHANGE

The RUSA was previously named the Reference and Adult Services Division (RASD). The RASD was formed in 1972 when two ALA divisions, which had been created in 1957, merged—the Reference Services Division (RSD) and the Adult Services Division (ASD). In 1995, the RASD Board of Directors considered changing the name of the organization. During their deliberations, they indicated their interest in including the word “association” in the name to clearly indicate that the organization was an association in its own right in addition to being one of the component parts of the ALA. By this time all of the other ALA divisions had already changed the word “division” in their names to “association.” The Board of Directors was also concerned that the name “Reference and Adult Services Division” did not adequately reflect the mission of the organization, since the name did not mention reference services to children. Lastly, the board also wanted a name with a pronounceable acronym. After it was approved by the membership in the spring of 1996, the change from RASD to RUSA took effect in September 1996.

ORGANIZATION

The RUSA is organized into six membership sections: Business Reference and Services Section (BRASS), Collection Development and Evaluation Section (CODES), History Section (HS), Machine-Assisted Reference Section (MARS), Reference Services Section (RSS), and Sharing and Transforming Access to Resources (STARS). Each section offers members committee and discussion group opportunities. The BRASS has committees on business reference in academic and public libraries, as well as a committee that reviews business reference sources. The CODES sponsors the Notable Books Council, a group that selects the best fiction, poetry and nonfiction for adults, as well as committees on readers' advisory, collection development and evaluation, and a committee that selects the year's best reference sources. In 2007, CODES created a genre fiction booklist award, the Reading List. The Reading List Council highlights outstanding genre fiction in eight categories including: Adrenaline titles (suspense, thrillers, and action adventure); Fantasy; Historical Fiction; Horror; Mystery; Romance; Science Fiction and Women's Fiction. The History Section sponsors groups that focus on genealogical research, historical events and historical bibliographies. The MARS has committees on management of electronic services, local systems and services, and user access to services. The RSS represents all aspects of reference and information services including delivery, management, and evaluation, with committees focusing on services to specific populations such as the aging, Spanish-speaking, and adults, as well as those concerned with research, marketing and information literacy. The STARS focuses on interlibrary loan, document delivery, remote circulation, access services, cooperative reference, cooperative collection development, remote storage, and other shared library services.

PUBLICATIONS

The RUSA publishes *Reference and User Services Quarterly (RUSQ)*, a scholarly journal with referred articles, regular columns and reviews of reference sources, professional materials, and electronic resources. Previously named *RQ*, the journal's name change took effect with Volume 37, Number 1 in 1997. The association also publishes *RUSA Update*, a quarterly electronic newsletter containing news of division activities. In addition to these periodical publications, the association publishes monographs and an occasional paper series. Recent titles include *Key Business Sources of the U.S. Government*; *Adult Programming: A Manual for Libraries*; *Towards a New Vision of Reference: Kaleidoscopic Collections and Real Librarians*; and *Collection Evaluation Techniques: A Short, Selective, Practical, Current Annotated Bibliography*.

AWARDS

The RUSA has an active award program to recognize outstanding achievement by members of the library profession. The division sponsors the following awards:

- Isadore Gilbert Mudge—Gale Cengage Learning Award (established 1958): \$5000 and a citation to an individual who has made a distinguished contribution to reference librarianship.
- Dartmouth Medal (established 1974): A medal and honorable mention certificate that honors the creation of reference works of outstanding quality and significance.
- John Sessions Memorial Award (established 1980): A plaque given to a library or library system to honor significant work with the labor community and to recognize the history and contributions of the labor movement toward the development of this country.
- Margaret E. Monroe Library Adult Services Award (established 1985): A citation to honor a librarian who has made significant contributions to library adult services.
- Reference Service Press Award (established 1985): \$2500 and a plaque presented to recognize the most outstanding article published in *RUSQ* during the preceding two-volume year.
- Gale Cengage Learning Award for Excellence in Business Librarianship (established 1989): \$3000 and a citation to an individual who has made a significant contribution to business librarianship.
- Gale Cengage Learning Award For Excellence in Reference and Adult Library Services (established 1990): \$3000 and a citation to a library or library system for development of an imaginative and unique resource to meet patron's reference needs.
- Louis Shores—Greenwood Publishing Group Award (established 1990): \$3000 and a citation to an individual reviewer, group, editor, review medium or organization to recognize excellence in book reviewing and other media for libraries.
- BRASS/Gale Cengage Learning Student Travel Award (established 1992): \$1000 award given to a student enrolled in an ALA accredited master's degree program to attend the ALA Annual Conference.
- Genealogical Publishing Company Award (established 1992): \$1500 and a citation awarded to a librarian, library, or publisher to encourage professional achievement in historical reference and research librarianship.
- Virginia Boucher—OCLC Distinguished ILL Librarian Award (established 1999): \$2000 and a citation recognizing a librarian for outstanding professional achievement, leadership, and contributions to interlibrary loan and document delivery.

- Dun & Bradstreet Public Librarian Support Award (established 1999): A citation and \$1000 to support the attendance at the annual conference for a public librarian who has performed outstanding business reference service and who requires financial assistance to attend the ALA annual conference.
- Dun & Bradstreet Award for Outstanding Service to Minority Business Communities (established 1999): \$2000 and a citation that recognizes one librarian who, or library that has created an innovative service for a minority business community, or has been recognized by that community as an outstanding service provider.
- ABC-CLIO Online History Award (established 2005): Every other year beginning in 2005, \$3000 and a citation recognizing a person or a group of people producing a freely available online historical collection, or an online tool tailored for the purpose of finding historical materials, or an online teaching aid stimulating creative historical scholarship.
- Emerald Research Grant Award (established 2006): \$5000 and a citation to individuals seeking support to conduct research in business librarianship.
- STARS-Atlas Systems Mentoring Award (established 2006): \$1000 to a library practitioner who is new to the field of interlibrary loan/document delivery or electronic reserves, for travel, registration, and membership at ALA Annual Conference.

CONTINUING EDUCATION OPPORTUNITIES

The RUSA offers its members many continuing education opportunities. At each ALA annual conference, the division sponsors programs on a broad range of topics such as readers' advisory services, best practices in reference and user services, collection development, the use of electronic journals, and the dynamics of print vs. online reference sources. Before the ALA annual conferences, the division also offers full-day workshops on topics such as business reference, emerging electronic reference sources, genealogical research, and resource sharing. RUSA also offers a variety of online electronic courses on topics including the reference interview, reader's advisory and genealogy.

GUIDELINES

The association establishes guidelines to serve as authoritative documents offering suggested levels of performance for the profession. Guidelines in the following categories have been established:

Electronic Services

- Guidelines for Implementing and Maintain Virtual Reference Services, 2004.
- Guidelines for the Introduction of Electronic Information Resources to Users, 2006.

Genealogy, History

- Guidelines for Developing Beginning Genealogical Collections and Services, 1999.
- Guidelines for a Unit or Course of Instruction in Genealogical Research at Schools of Library and Information Science, 1996.
- Guidelines for Establishing Local History Collections (2006).

Interlibrary Loan

- Interlibrary Loan Code, for the United States and Explanatory Supplement, 2001.

Reference/Information Services

- Guidelines for Behavioral Performance of Reference and Information Service Providers, 2004.
- Guidelines for Cooperative Reference Services, 2006.
- Guidelines for Implementing and Maintaining Virtual Reference Services, 2004.
- Guidelines for Information Services, 2000.
- Guidelines for Liaison Work in Managing Collections and Services, 2001.
- Guidelines for Medical, Legal and Business Responses at General Reference Desks, 2001.
- Professional Competencies for Reference and User Services Librarians, 2003.
- Definition of a Reference Transaction, 2008.

User Populations

- Guidelines for the Development and Promotion of Multilingual Collections and Services, 2007.
- Guidelines for Library Services to Older Adults, 1999.
- Guidelines for Library Services to Spanish-Speaking Library Users, 2007.

PROBLEMS AND ISSUES

Concerns of RUSA members mirror those of many of the ALA's other divisions: recruitment, professional development, and library school education. But RUSA members are also concerned about issues focused on reference librarianship, particularly the development of reference services in a digital age, and the diminishing value that

information seekers place on more traditional library reference services.

To respond to these concerns, RUSA's strategic focus is on the future of reference and users services, with a goal to recast the provision of reference service to meet the needs of twenty-first century users. In particular this means positioning reference librarians to serve as consultants to help patrons evaluate and select quality information amid a rising sea of information presented in ever increasing formats and technologies and encouraging reference librarians to more than ever serve as resources and teachers of new technologies, information and research skills to increasingly diverse populations with a wide range of needs and skill levels.

Another challenge facing RUSA membership is that while demand for electronic resources and collections continues to grow, concerns persist about costs, coverage, availability, and access. Reference librarians constantly strive to provide accurate and current information to their users, but are often stymied when database coverage changes or license changes curtail access. Future access to database information could also be in jeopardy as database companies change ownership or discontinue a product.

Although many libraries have reported a decline in the number of reference transactions, the length of the

reference encounter seems to be on the rise. The decline has been attributed to more people using the Internet to find the information they need. The reason for the longer encounter time is also the Internet. Reference librarians are increasing the amount of time they are taking to teach patrons how to design effective search strategies and then evaluate the search results. Although some have predicted that Internet search engines will put reference librarians out of business in 10 years, reference librarians know this is unlikely. In fact, they believe that reference and user services will become the library's core service. The key to this, however, is how well we can reinvent our services to match the changing needs of our clients. The RUSA will be there to help reference librarians in this endeavor.

NOTES

More information on the RUSA, including the full-text of guidelines, *RUSQ*, *RUSA Update*, lists of best reference websites, bibliographies, and information on the organization is available on the RUSA Web site at <http://rusa.ala.org>.

Reference Services

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Abstract

This entry provides an overview of reference services and the impact of technology on reference sources and services. Following a brief overview of the history of reference services, the types and scope of reference services are explained. Features of the reference interview and factors contributing to its success are considered, followed by a discussion of the various types of reference sources and the development of reference collections. An outline of the impact of technology on new forms of service delivery includes an explanation of both asynchronous and synchronous approaches. The ways in which reference ethics and reference policies guide services are reviewed, and the role of evaluation in assessing effectiveness of reference services is explored. This entry concludes with indications of future trends in reference services.

INTRODUCTION

To mediate between a library user's information needs and the information resources accessible to that user through the library, libraries offer reference services. The provision of reference services in libraries dates from the late 1800s. As noted by Margaret Hutchins in 1944, "Reference work includes the direct, personal aid within a library to persons in search of information for whatever purpose, and also various library activities especially aimed at making information as easily available as possible."^[1] Reference services continue to exist in libraries because the many means of access to and use of information resources are not intuitively self-evident. Reference services may range from a minimal level of aid to users in locating their own information to the actual delivery of information to users. Librarians may also offer assistance to users in deciding which materials to read for pleasure or study.

Prior to initiating a search in response to a question, the reference librarian conducts a reference interview to develop a more complete understanding of the user's information need. Successful reference interactions require a variety of skills in addition to effective questioning. Librarians should have a genuine interest in users' information needs, an ability to establish trust and confidence, flexibility in developing search strategies, and knowledge of reference sources. Reference sources can be divided into two main classes: compilations that furnish information directly and compilations that refer to other sources by indicating places in which the information sought may be found. The work of reference librarians includes selection of an adequate and suitable collection of reference sources and arrangement and maintenance of the collection so that it can be used easily and conveniently.

Developments in telecommunications and computer technology have impacted both reference work and reference sources. Users need no longer come to the library to ask questions; instead they may use the telephone, e-mail, web forms, or instant messaging. Physical reference collections housed in reference rooms in libraries are now supplemented by licensed databases and freely available authoritative web resources.

In their work reference librarians are guided by ethical principles as expressed in professional codes of ethics and by their own library's reference policies. The continuing improvement of reference services depends on regular evaluation of service effectiveness.

HISTORY OF REFERENCE SERVICES

The generally recognized starting point for the history of reference services is the 1876 paper by Samuel Swett Green of the Worcester Public Library on *Personal Relations between Librarians and Readers*.^[2] Green identified four components of reference services: (1) instruct the reader on how to use the library and its resources; (2) answer readers' questions; (3) aid the reader in the selection of good works; and (4) promote the library within the community. The concept of reference services emerged in the United States in first public and then academic libraries as the result of a number of factors—increasing urbanization, growing immigrant populations, the rise of public education, and changing modes of instruction in American colleges and universities.^[3] In a growing number of libraries, this led to the designation of one or more library staff members to fill the reference function, the creation of reference rooms, and the establishment of distinct reference collections. Beginning in the early 1900s, the special

library movement in business, industry, government, and research settings placed an emphasis on more in-depth information services to the clientele of those organizations. To better prepare library staff for this emerging role, courses in reference work were introduced in library schools, and the first text, Alice Bertha Kroeger's *Guide to the Study and Use of Reference Books*,^[4] was published in 1902. Over the next century, reference services continued to develop as library collections grew and library organizations became more departmentalized. In larger libraries, specialization could occur by subject (e.g., business), clientele served (e.g., children), form of material (e.g., government documents), or function (e.g., interlibrary loan). Throughout the same period, developments in technology, from the telephone to the Internet, had a significant influence on the emergence of new approaches to reference services. The maturing of reference services as an area of specialization is also reflected in the establishment of the Reference Services Division within the American Library Association (ALA) in 1957. This became the Reference and Adult Services Division in 1972, renamed the Reference and User Services Association (RUSA) in 1996.^[5] An important function of RUSA is the development of guidelines for various aspects of professional practice.

Beginning in the 1970s, reference services transitioned from a period of certainty regarding roles, resources, and methods to a period of change and challenge,^[6] driven in large part by developments in computer and communications technology. In his 1984 article "What's wrong with reference," William Miller called for a reexamination and reorganization of reference services.^[7] This led to a period of "rethinking reference" that included exploring alternative staffing models, experimentation with newer technologies, and a focus on patron-centered service. Nevertheless, most libraries kept their reference desks as the focal point of reference services. The emergence of the World Wide Web and search engines resulted in a dramatic shift beginning in the 1990s. The proliferation of high-speed campus networks, broadband access from homes, and wireless access in public spaces highlighted the inadequacy of a building-centered model for delivery of reference services.

CHANGING CONTEXT FOR REFERENCE SERVICES

Trends in technology impact the extent to which the reference librarian is needed as an intermediary between the user and resources in digital form. Digital databases were initially accessible through telecommunications networks beginning in the 1970s. Reference librarians searched these resources on behalf of users because of the expertise required to search effectively and the cost associated with access. When databases on CD-ROM later became

available on computer workstations housed in the library, the era of "end-user searching" began.

With the emergence of the World Wide Web, it has become much easier for users to find information on their own. Mobile communication devices have led to the diffusion of access into a wide range of work, school, and leisure activities. In this information-rich world, information can be sought anytime, anywhere. Now users have alternatives that are more convenient than coming to a physical library at set hours to consult with a reference librarian. As a result, reference librarians have to find ways to respond to contemporary users' values and expectations of immediacy, interactivity, personalization, and mobility. If reference services are to be used, attention must be given to minimizing the time, the effort, and the difficulty of use.

While the intermediary role of the librarian may now sometimes involve doing some searching on behalf of the user, it is more likely to emphasize guidance in choosing among and using available resources, both print and digital. Reference librarians need to raise user awareness that the resources freely available through Internet search engines are only a portion of what could be helpful in meeting their information needs. Library print collections still contain centuries of accumulated knowledge not yet in digital form (although mass-digitization projects by organizations such as Google and the Open Content Alliance are shifting that balance) and libraries subscribe to databases because they provide information not available elsewhere. Because users can answer simple questions themselves, the types of question handled by reference librarians have become more complex.

Another trend to which reference librarians have to respond is the increasing diversity in populations served. Users of libraries in the United States today come from all over the world and speak many different languages. Library users can also vary in such dimensions as age (e.g., children, teens, adults, senior citizens) or disability (e.g., physical, mental). Success in providing reference service depends on flexibility, cultural competence, openness, and empathy toward the many diverse users.

SCOPE OF REFERENCE SERVICES

Definitions

The contemporary role of the reference librarian is reflected in two definitions approved in 2008 by RUSA:^[8]

Reference transactions are information consultations in which library staff recommend, interpret, evaluate, and/or use information resources to help others to meet particular information needs. Reference transactions do not include formal instruction or

exchanges that provide assistance with locations, schedules, equipment, supplies, or policy statements. *Reference work* includes reference transactions and other activities that involve the creation, management, and assessment of information or research resources, tools, and services.

In the second definition, creation and management of information resources includes the development and maintenance of resources that can be used independently, either in-house or remotely, to satisfy information needs. Assessment activities include the measurement and evaluation of reference resources and services. These definitions emphasize the informational dimension of reference work. In many libraries, reference services also include responsibilities for both instruction (formal or informal) and guidance (the readers' advisory role). The relative emphasis among information, instruction, and guidance depends on the library's mission and users' needs. While the definition of reference transaction excludes "exchanges that provide assistance with locations, schedules, equipment, supplies, or policy statements," users do need assistance in such activities as getting oriented to the library building, working with computers and printers, and understanding circulation policies. Either reference librarians also answer these questions or some type of tiered service is implemented, with reference assistants answering basic questions and referring more complex questions to the reference librarians.

Types of Reference Service

Some common types of reference service include readers' advisory, ready reference, research consulting, bibliographic verification and interlibrary loan, and instruction. Some reference librarians may be involved in all of these activities, while others may specialize in areas such as readers' advisory services or instruction. Marketing is needed so that users are made aware of the range of services available from the library.

Readers' advisory is the process of recommending sources to library users. A successful readers' advisory service is one in which knowledgeable staff help fiction and nonfiction readers with their leisure-reading needs. Readers' advisors see themselves as links between readers and books, just as reference librarians are the connections between users and informational materials.^[9]

Ready reference is the provision of short, factual answers to highly specific questions. A wide array of reference sources, such as directories, dictionaries, and encyclopedias, are useful in answering ready reference questions. In the past, reference librarians did more ready reference simply because the sources required to answer such questions were in library collections and not available to users. With the increasing volume of authoritative

content made accessible through a library's website or search engines such as Google, many users now have the tools to find this type of information on their own. As a result, there is less need to consult a librarian for ready reference. With the decline in ready reference has come an increase in emphasis on research consulting. In this case, the librarian may suggest sources, search terms, and strategies that will lead to material related to the user's information need.

Given the increasing volume and complexity of information sources in both print and digital form, reference librarians are often called on for bibliographic verification, determining full and accurate bibliographic information for a sought document and its location. If the document is not available as part of the library's collection or freely available on the web, then the librarian can assist the user in securing a copy through interlibrary loan.

Instruction can take two forms: direct and indirect. Direct instruction is characterized by the librarian communicating directly with the user. This may occur one-on-one with the librarian teaching the user as they work together to locate information or it may be done in a group environment in workshops or classes. Indirect instruction is provided in anticipation of user needs and involves development of instructional tools. These may include guides that describe how to use the catalog, a database, or a specific reference source. Other guides may focus on a specific discipline, highlighting relevant and authoritative print and digital sources.

While some users will discover the range of available reference services unaided, many will need to have the services promoted to them before they will be aware of what modern reference services have to offer. Marketing is the activity through which librarians develop the needed services, decide how to deliver the services, determine how best to communicate their value, and then promote the services relevant to each group of users. Reference librarians are often central to a library's marketing efforts.

Approaches to Reference Service

In the late nineteenth century, the reference desk was established as the central point of library services and patron interaction. For over a century, it remained largely unchallenged, but the reference desk is now just one of many avenues by which users can receive assistance. Any location in the library can be served by a roving reference librarian. The roving method is distinguished by the fact that the librarian is the one who initiates the reference transaction by approaching the potential user. Tiered service enables staff with varying levels of expertise to answer questions at different levels of difficulty. Paraprofessionals or student assistants staff an information desk and answer directional questions and basic ready reference or library holdings questions, freeing up reference librarians to answer more challenging research-level questions.

In contrast to these models that require that the user be physically in the library building in order to receive assistance, there is now increasing emphasis on serving users at a distance. This may involve “embedded” librarians, spending time where the users are, such as in a student union or academic department on a college campus. Alternatively virtual (also called digital or electronic) reference uses available technologies such as e-mail, instant messaging, or web-based forms to enable users at a distance to submit questions and receive responses from reference librarians. Technologies on the horizon for enhanced interactivity include Skype and videoconferencing.

The impact of technology on reference is best seen as a continuum rather than as primarily a phenomenon of the recent past. For several decades, many libraries have provided some question answering over the telephone. Increasingly, the attitude among reference librarians in all types of libraries is to support whatever means possible for responding to users’ information needs, within staffing and budgetary constraints. This can mean having a virtual presence where users are, whether in online courseware, social networking sites such as Facebook, or virtual worlds such as Second Life. E-mail, text chat or instant messaging, and web-based forms have come into wide use as a way for reference librarians and users to communicate.

REFERENCE INTERVIEW

Purpose of the Interview

A reference transaction is initiated by a reference interview. The user’s initial question often has to be clarified. The purpose of the interview is to elicit from the user sufficient information about the user’s information need to enable the librarian to understand it enough to begin searching. Some reference questions are straightforward and do not require a high degree of interaction between the reference librarian and the user to be successful. Others require a great deal of negotiation. Questioning during the reference interview may elicit information about what the user wants to know; how the user plans to use the information; what level of detail would be useful; what format of information is preferred; and any other restrictions, such as whether there are time limits or deadlines. After determining a more complete understanding of the information need, the librarian must match that need with the information sources available, whether in print or digital form.

Communication Techniques

The reference interview has been the subject of much research and analysis, demonstrating that the quality of the interaction that the user has with the librarian is

important to a successful outcome of the transaction. As a result, guidelines have been developed with the goal of enhancing communication effectiveness.^[10] These guidelines outline in a linear way the elements of best practice in reference interviewing, including visibility/approachability, interest, listening/inquiring, searching, and follow-up. These guidelines have been updated to encompass both face-to-face and remote encounters by telephone, e-mail, chat, and so on, where traditional visual and nonverbal cues do not exist. However, since the reference interview is a process, with steps repeated and returned to as necessary, the guidelines alone do not give a complete picture.

The questioning process seeks to: (1) elicit the user’s question in his or her own words; (2) make information available that the librarian needs to enable effective searching and accurate provision of information; and (3) verify that the librarian and user share the same understanding of the information need. There are several communication strategies that can be used during question negotiation, including the judicious use of open and closed questions. Open questions encourage users to talk about the information need using their own terms (e.g., We have a number of books/articles about [TOPIC]. Was there something in particular you were looking for?). Closed questions ask for a “yes” or “no” response or present the user with options from which to choose (e.g., Do you want advanced material or something basic?).

It is important not to start searching too early in the interview process. Once the search process has been started, the librarian can continue to ask questions, refining the search strategy accordingly. When providing information, it is important to cite the source and verify that the answer matches the scope of the user’s question and that the level or amount of information given is what was desired. The end of the reference interview should leave open the opportunity for the user to request further assistance if needed.

Increasingly, reference interviews are taking place virtually rather than face-to-face. The two basic modes of virtual service, asynchronous and synchronous, differ substantially in their immediacy and interactivity. Asynchronous services based on e-mail and web-based forms offer the advantage of a medium familiar to nearly all users of the Internet. Though it is possible to engage in a reference interview through a series of e-mail exchanges and clarifications, e-mail is best suited for straightforward questions. Some libraries attempt to overcome the limitations of unstructured and potentially incomplete e-mail questions by utilizing a web-based form in an effort to elicit enough information and context to provide a useful response. In contrast to the asynchronous communication mode of e-mail, synchronous reference service using the telephone and now chat or instant messaging has the potential to enhance communication effectiveness through real-time collaboration between the user and the librarian.

Librarians are justifiably concerned with the quality of the user's virtual experience when compared with face-to-face transactions. RUSA Guidelines for Implementing and Maintaining Virtual Reference Services provide librarians with things to consider as they prepare for and provide such services.^[11] Libraries are extending their participation in resource sharing to include sharing reference expertise as an extension of virtual reference services. For example, the QuestionPoint service of OCLC Online Computer Library Center (OCLC) provides libraries with access to a growing collaborative network of reference librarians in the United States and around the world.

REFERENCE SOURCES AND REFERENCE COLLECTIONS

Reference Sources

Reference librarians must be able to respond to a wide variety of questions, depending on the needs expressed by library users. Increasingly, the concept of a reference collection made up of reference books is an inadequate characterization of the resources most frequently used by reference librarians. Although print materials continue to be used, they are supplemented by authoritative digital resources. With the availability of a growing number of freely available resources on the web, it is limiting to think of the reference collection as only those materials that are purchased or licensed by the library. As more and more information has become available in digital form, libraries are finding that the use of print reference collections has decreased substantially.

It is possible to divide reference sources into two main classes: compilations that furnish information directly and compilations that refer to other sources containing information. In practice, this distinction becomes blurred because sources of the first type often refer to others for fuller information, and those of the second type are adequate for answering some questions. Sources of the first type include encyclopedias, dictionaries, almanacs, handbooks, yearbooks, biographical sources, directories, atlases, and gazetteers; sources of the second type include catalogs, bibliographies, and indexes.

While some indexes and abstracts have been available in digital form for nearly 50 years, the digital availability of other categories of reference sources, such as specialized subject encyclopedias and handbooks, is much more recent. The last decade has seen a rapid increase in the availability of reference titles in digital form, the aggregation of multiple titles into virtual reference collections, and the emergence of new forms of collection that go beyond a simple aggregation of the contents of individual print titles. An example of a resource that aggregates content from multiple publishers is Credo Reference. As of

2016, this web-based collection included hundreds of titles from more than 100 publishers.

This proliferation of digital products has allowed librarians to access content they may not have been able to collect in print, but there are potential drawbacks. Rather than having the flexibility to select individual reference volumes from many different publishers, librarians increasingly have to select one aggregated package over another. This can have the effect of increasing the range and depth of a reference collection while also decreasing the flexibility to customize the collection to reflect the interests of the library's specific user community. An additional concern is that digital content is often licensed rather than purchased, meaning that such titles are not permanently added to the collection.

Reference Collection Development and Maintenance

The work of reference librarians includes selection of an adequate and suitable collection of reference sources and arrangement and maintenance of the collection so that it can be used easily and conveniently. Increased costs of reference sources and proliferation of formats and titles have focused attention on the importance of a systematic approach to reference collection development. Decisions in collection development include whether to buy newly published titles, buy new editions of titles already in the collection, cancel a title that is now freely accessible on the web, continue serials such as indexes, or license access to a newly published web-based resource. A written collection development policy can provide guidance in making these decisions and will help in establishing and maintaining an effective reference collection.

Just as different libraries have somewhat different sets of titles making up their reference collections, there are different possible arrangements of titles. One possibility is to maintain a classified arrangement regardless of type. An alternative is to group types of sources together, creating sections for encyclopedias, biographical sources, directories, indexes, and so forth. Most collections designate a portion of the titles as ready reference, kept at or near the reference desk. With the increasing availability of resources in digital form, reference librarians are often involved in projects to design the interface or gateway to orient library users to available digital resources and aid in their selection. There must be a systematic basis for weeding and for adding new titles to the collection. A growing number of libraries are weeding and reducing the size of their print reference collections, reflecting the decreasing use of print resources as more materials become available in digital form.

In building the reference collection, the librarian must evaluate the quality of individual sources and their suitability for inclusion in the library's reference collection. Selection criteria can include format, content, authority,

and cost. Added considerations of digital resources include such factors as the user interface and possibilities for customization. The Internet has facilitated new forms of collaborative authorship that make it more difficult to judge the authority and accuracy of the resulting product. For example, Wikipedia is written and edited by numerous volunteers, who can continuously change and add articles.^[12] Reference librarians need to exercise the same type of selectivity that they do in building physical reference collections when developing virtual collections. The Library of Congress Virtual Reference Shelf^[13] is an example of a virtual reference collection. As the emphasis on building digital collections grows, guidelines are being developed to inform their design.^[14]

REFERENCE ETHICS AND EVALUATION OF SERVICES

Reference Ethics

Reference services are guided by both reference policies at the institutional level and the Code of Ethics of the American Library Association.^[15] The Code consists of eight principles. Those with particular relevance to reference services include Items I, II, III, IV, VII, and VIII.

Principle I expresses the responsibility for providing courteous, accurate, unbiased, and equitable service (drawing on a strong collection of resources): “We provide the highest level of service to all library users through appropriate and usefully organized resources; equitable service policies; equitable access; and accurate, unbiased, and courteous responses to all requests.” Principle VIII addresses the need for the reference librarian to stay up-to-date with the field and continually expand one’s knowledge: “We strive for excellence in the profession by maintaining and enhancing our own knowledge and skills. . . .”

Principle III speaks to the need to respect user privacy and confidentiality in the context of reference transactions: “We protect each library user’s right to privacy and confidentiality with respect to information sought or received and resources consulted, borrowed, acquired or transmitted.” Principles II and VII emphasize the need to uphold intellectual freedom in building strong, balanced reference collections and providing users the information they seek: “We uphold the principles of intellectual freedom and resist all efforts to censor library resources” and “We distinguish between our personal convictions and professional duties and do not allow our personal beliefs to interfere with . . . the provision of access to . . . information resources.” Finally, the provision of reference services needs to conform to authors’ and publishers’ intellectual property rights as outlined in Principle IV: “We respect intellectual property rights and advocate

balance between the interests of information users and rights holders.”

Expectations for reference librarians are further elaborated in the RUSA Professional Competencies for Reference and User Services Librarians that describe the activities of a reference librarian performing ethically.^[16] Reference librarians also need to be aware of necessary limits on question answering, especially as they relate to medical, legal, and business questions where librarians must be careful to be of assistance without offering advice.^[17]

Ethical issues such as confidentiality and privacy are also relevant in the digital environment, where it is possible to track a record of an individual’s questions. Such records should be treated with the same respect for confidentiality and privacy as library circulation records. There is also the ethical issue of availability of and access to digital reference services. If librarians devote more and more of their resources and time to digital reference, then service to those who do not have Internet access could be negatively affected.

Evaluation of Services

Principle I of the ALA Code of Ethics indicates that librarians should provide “the highest level of service to all library users.” In order to gauge the effectiveness of reference services, evaluations must be undertaken. At the individual level, evaluation can be continual self-assessment of the effectiveness of the reference interview and the quality of answers given. A more formal evaluation of reference services in a library can focus primarily on inputs to the reference process, such as assessing the quality of the reference collections, whether physical or virtual. Or evaluation can emphasize the process of the interaction between the librarian and the user. In a virtual reference transaction, this can include reviewing the text of e-mail exchanges or chat session transcripts. Finally, evaluation may focus primarily on the outputs or outcomes of the transaction—was the user satisfied with the process and/or the information received. Evaluation data can be gathered through surveys and questionnaires, observation, or focus groups and interviews. As libraries face increasing pressures to demonstrate value to their parent organizations, methods to determine return on investment in reference services need to be developed.^[18]

CONCLUSION

Reference services have changed considerably since Green first proposed the core concept. As Robert Kieft observes, “The service edifice built by reference librarians beginning in the late nineteenth century does not so much threaten to collapse as to be reborn in ways that we are still groping to discern.”^[19] Reference librarians are now

providing “personal assistance to readers” both within the library and far beyond library walls and embracing new technologies as they retain traditional values. Rapid changes in technology will likely continue and those changes will affect the ways in which users seek and manage information. Those changes in user behavior will, in turn, continue to challenge the ways that reference librarians offer their services. As the popular perception that “everything is on the web” grows, reference librarians must find ways to show which types of information resources answer which questions best. As reference librarians develop and work with hybrid collections of purchased, licensed, and freely available web resources, a better understanding of the questions most easily answered by each will emerge. The volume and diversity of information available on the web opens new possibilities to both reference librarians and users, but both must continue to keep in mind that at present it can be hard to find the information sought; once found, such information may later disappear (or at least move); and the accuracy of information found may be difficult to assess. Recalling the definition of “reference work” cited earlier as “reference transactions and other activities that involve the creation, management, and assessment of information or research resources, tools, and services,” it seems likely that more attention will be given to those other activities in order to enable users to serve themselves. To fully realize the promise of reference service in the digital environment, Michael Buckland argues that the objective should be to empower the user, developing organization and access mechanisms using digital technology and attentive to user needs and preferred modes of use.^[20]

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Regional Library Networks: United States

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Abstract

The U.S. Regional Library Networks (RLNs) are a loosely federated system of 15 membership organizations of libraries and related cultural organizations, established in the 20th century to facilitate access to information through resource sharing and cooperation among members. Created by librarians, the RLNs support their members through an array of services (predominately technology based) and provide a formal structure by which their members can work cooperatively to create programs members could not create individually. From as early as the 1930s, the RLNs have served as change agents and facilitators for the introduction and implementation of innovations into their members' operations, including the integration of large-scale technological systems such as Online Computer Library Center (OCLC). In the example of the RLNs' collaboration with OCLC, the result is a highly organized, now international, network of the world's bibliographic information, constituting a cooperative database development model that is unparalleled.

DEFINITION OF "REGIONAL LIBRARY NETWORK"

Because the term "network" is used to describe a variety of infrastructures and activities in the library and information industry, its use in describing a library service organization can be confusing. The formal definition of "network" implies a technical connection or system with numerous users. Within the library field, the term has been "a catch-all for a broad range of cooperative activities."^[1] The American Library Association (ALA) Glossary defines library network as "a specialized type of library cooperation for centralized development of cooperative programs and services, including the use of computers and telecommunications, and requiring the establishment of a central office and a staff to accomplish network programs rather than merely coordinate them." In contrast, library consortium is "a formal association of libraries, usually restricted to a geographic area, number of libraries, type of library, or subject interest, which is established to develop and implement resource sharing among the members and thereby improve the library services and resources available to their respective target groups."^[2]

Cooperation among libraries, librarians, and researchers has been a major force defining the nature and structure of library service programs for much of the 20th century. The benefits of working cooperatively and sharing resources toward collective achievements greater than the sum of individual achievements have been successfully demonstrated repeatedly. That success has resulted in one of the most organized models of cooperation within any industry in the United States.

An important, if not the most important, aspect of the RLNs is their social networking role, which is inherent in

the term "consortium." Librarians created the RLNs to support each member's library programs symbiotically through information and resource sharing, continuing professional development and support, research and development, and collaboration. The distinction between RLNs and consortia has become less clear in recent years, as their organizational structures and the services they offer are very similar. In fact, several long-standing RLNs have begun to refer to themselves as consortia or cooperatives.

HISTORY

The beginning of the individual RLNs in the United States is quite varied. The oldest RLNs are the Bibliographical Center for Research (BCR) and PALINET. These Networks were created as resource centers to facilitate interlibrary lending. Both received grant support from private foundations and the federal Works Progress Administration (WPA) to create union catalogs of library holdings to aid researchers in locating materials.

As a specific example, PALINET started in 1933 as the Union Library Catalog of the Philadelphia Metropolitan Area. A small group of Philadelphia historians, tired of the difficulties they encountered locating books in the numerous and scattered area libraries, issued a prospectus for the proposed union catalog. Ultimately housed at the University of Pennsylvania, the massive union card catalog was created, serving as the centralized resource for locating materials. Over time, this catalog became the tool that enabled interlibrary loan activities to commence among the participating libraries. Other related services naturally followed, such as the Duplicate Book Exchange, where

not needed duplicates were made available to other libraries.

Library networking drew much interest and attention in the 1970s. The ALA and the U.S. Office of Education cosponsored the landmark National Conference on Interlibrary Communications and Information Networks in 1970 to explore the library network concept and recommend a plan of action. This conference grew out of discussions acknowledging the enormous value of the nation's library resources and the need to develop interinstitutional networks among libraries for effective, affordable access to these resources. Recommendations from the conference included a call for the newly established National Commission on Library and Information Science to ensure financial support for developing network programs and to provide a broad base of public and legislative understanding of the need for a national network of libraries and information centers.^[3]

Much federal funding and standards development since that conference have supported the growth of library networks, library systems, and consortia to the point that now over 425 such organizations are listed in the American Library Directory.^[4]

One of the most important developments in library cooperation was OCLC. Founded by the visionary presidents and librarians of the Ohio College Association, OCLC's mission was to reduce libraries' costs by sharing cataloging records through a centralized database.^[5] This enabled libraries to use cataloging records already entered

by other libraries and to add original records that did not yet exist in the database.

In many cases, the first computers in libraries were OCLC terminals. Often they were also the first computers used within the libraries' parent organizations, e.g., campuses, school districts, municipalities. Libraries were positioned as technology leaders for computing within their institutions.

A leader in U.S. network development, Barbara Markuson, formerly Executive Director of INCOLSA, noted, "Library networks developed primarily as a mechanism to allow rapid technology transfer in the U.S. library system."^[1] "Networking provides unparalleled opportunities for a dramatic restructuring of the library as an operational unit and for an astounding array of new information services better designed to meet the needs of an increasingly complex user community."^[1]

REGIONAL LIBRARY NETWORKS TODAY

There are 15 independent library service organizations in the United States known collectively as the RLNs (see Table 1). They are a diverse group of organizations providing many unique programs and services, with OCLC the key service offered by all these organizations. Even though the RLNs are not exactly alike, commitment to cooperation, exceptional customer service, and innovative programs are common among them. Each RLN is a

Table 1 U.S. regional library networks.

Official name	Founding date	Primary service area
Amigos Library Services, Inc. (Amigos)	1978	Arizona, Arkansas, New Mexico, Oklahoma, Texas
Bibliographical Center for Research (BCR)	1935	Colorado, Iowa, Kansas, Nevada, Utah, Wyoming
Federal Library and Information Network (FEDLINK) ^a	1976	U.S. federal agencies in any state or country
ILLINET/OCLC Services (ILLINET) ^b	1977	Illinois
Indiana Cooperative Library Services Authority (INCOLSA) ^b	1974	Indiana
MINITEX Library Information Network (MINITEX) ^b	1968	Minnesota, North Dakota, South Dakota
Michigan Library Consortium (MLC)	1974	Michigan
Missouri Library Network Corporation (MLNC)	1981	Missouri
Nebraska Library Commission (NEBASE) ^b	1976	Nebraska
NELINET, Inc. (NELINET)	1978	Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont
Nylink ^b	1973	New York
OHIONET	1977	Ohio
PALINET & the Union Library Catalogue of Pennsylvania, Inc. (PALINET)	1936	Delaware, Maryland, New Jersey, Pennsylvania, and West Virginia
Southeastern Library Network, Inc. (SOLINET)	1973	Alabama, Louisiana, Mississippi, Kentucky, Tennessee, Virginia, North Carolina, South Carolina, Georgia, Florida, Puerto Rico, and U.S. Virgin Islands
Wisconsin Library Service (WiLS)	1972	Wisconsin

Networks are independent 501(c)3 organizations except as noted:

^aFederal agency.

^bState agency or state-affiliated.

Source: Networks and Service Centers: An OCLC Members Council Directory, 85–86.

separate entity with its own unique mission and characteristics. Some RLNs are federal or state agencies, e.g., FEDLINK and NEBASE; most are independent 501(c) 3 not-for-profit organizations, e.g., Amigos and SOLINET. Many Networks serve libraries in a single state, e.g., MLC (Michigan) and WiLS (Wisconsin); others serve members in a multistate region, e.g., NELINET and BCR.^[6]

Governance

The staff at the member organizations of RLNs are active participants in the governance of their respective Network. The RLNs are governed by Boards of Trustees/Directors or similar advisory groups, elected from and representing the membership. Some Networks' Board positions are designated to represent certain segments of the membership, e.g., type of library or state. Some have public, at-large Board members, people outside the membership and from the community at large with an interest in libraries and the Network. Two Networks, MLC and PALINET, now facilitate their Board elections electronically.

The Networks host annual membership meetings and conferences, some over multiple days. They facilitate the work of numerous advisory committees and user groups within the Network, including the work of their OCLC Members Council delegates.

Support

The RLNs employ nearly 500 staff to support their programs. In 2003, nearly 17,000 libraries are served by the RLNs. Communication with members is facilitated through numerous means: newsletters, technical bulletins, training catalogs, electronic lists, e-mail, and web sites. Most communications and publications are now distributed electronically.

Many Networks have "support" or "help desks" through which they provide member support. They are beginning to use chat and instant messaging as additional ways to communicate with members.

The web sites of the RLNs offer extensive information about their unique governance and membership structures, as well as detailed descriptions of their programs and services (see Table 2).

Alliance of Library Service Networks

In the 1980s, the RLNs founded the Alliance of Library Service Networks. Originally, an informal forum for RLNs to discuss issues of mutual concern, the Alliance has become an effective means by which the RLNs implement cooperative ventures. Of note are the recent national negotiations with LexisNexis[®] led by SOLINET and with the Oxford University Press led by NELINET and Nylink. These programs dramatically reduced the cost of database access to these electronic resources for member libraries,

Table 2 Web sites of the U.S. regional library networks.

Network	Web site
Amigos	http://www.amigos.org/
BCR	http://www.bcr.org/
FEDLINK	http://lcweb.loc.gov/flicc/
ILLINET	http://www.cyberdriveillinois.com/departments/library/who_we_are/OCLC/home.html
INCOLSA	http://www.incolsa.net/
MINITEX	http://www.minitex.umn.edu/
MLC	http://www.mlcnet.org/
MLNC	http://www.mlnc.org/
NEBASE	http://www.nlc.state.ne.us/netserv/nebase/nebserv.html
NELINET	http://www.nelinet.net/
Nylink	http://nylink.suny.edu/
OHIONET	http://www.ohionet.org/
PALINET	http://www.palinet.org/
SOLINET	http://www.solinet.net/
WiLS	http://www.wils.wisc.edu/

Source: Networks and Service Centers: An OCLC Members Council Directory, 85–86.

many of which could never have financially afforded access to these resources. Thus, the Alliance has become a means by which the RLNs can reduce costs through collaborative partnerships with each other and with vendor partners to serve the entire U.S. library community: a model "network of the networks," as envisioned in the 1970s.

RELATIONSHIP WITH OCLC

A primary service provided by all RLN's is access to and support of OCLC, the international membership organization (<http://www.oclc.org/>) that originally developed and currently manages a shared cataloging and interlibrary loan system, which has become the de facto U.S. national bibliographic database. The ability of OCLC to operate outside of Ohio is due largely to the work of the RLNs nationwide in promoting the benefits of OCLC in their respective regions and providing OCLC-related technical support and training for their members.

The RLNs' relationship with OCLC started in 1970 with the Pittsburgh Regional Library Center (now part of PALINET), a year before the on-line shared cataloging system was introduced. Some Networks existed prior to the founding of OCLC, e.g., BCR and PALINET, as previously described. Others came into existence to provide OCLC support for libraries in their region, e.g., SOLINET and Amigos. In some cases, state libraries established service programs to support OCLC services in their state, e.g., ILLINET and NEBASE.

Initially, in determining how shared cataloging functionality would be provided for libraries outside of Ohio, some regional Networks proceeded to replicate the OCLC database for their regions, e.g., NELINET, Amigos, and

SOLINET, reflecting a distributed national catalog model. After study and testing, it was quickly determined that the more favorable means by which to provide this service was through the centralized OCLC system accessible via propriety telecommunications lines. OCLC telecommunications hubs were housed and managed by several of the RLNs.

Of the U.S. libraries participating with OCLC 99.9% do so through an independent RLN- or OCLC-owned Service Center. Reciprocally, libraries have a direct role in the governance of OCLC through their RLN or OCLC Service Center. The RLNs and OCLC Service Centers comprise the membership of OCLC's Members Council, a 66-person advisory group responsible for providing advice to OCLC on service development and for the election of 6 of its 15 Board members. Networks also facilitate the work and communication of their OCLC Members Council delegation. For more information on the OCLC Members Council, see <http://oclc.org/memberscouncil/default.htm/>.

As of September 2003, nearly 17,000 libraries were members of the RLN's. This represents 90% of the U.S. libraries participating in OCLC. The remaining 10% of U.S. libraries receive support and training from two OCLC-owned and operated Service Centers: the OCLC CAPCON and the OCLC Western Service Centers.

To participate in OCLC, libraries typically join the RLN or OCLC Service Center serving their geographic area, but may choose to join any RLN or OCLC Service Center of their choice. A map illustrating the geographic service areas for the RLN's and OCLC Service Centers is located at <http://oclc.org/contacts/regional/default.htm>.

In-depth information on the RLN's and OCLC Service Centers is available in *Networks and Service Centers: An OCLC Members Council Directory* at <http://oclc.org/memberscouncil/documents/directory.pdf>.

GROWTH OF REGIONAL LIBRARY NETWORK SERVICES

The array of services provided by RLNs has grown dramatically over the years and continues a rapid evolution as the needs of their members evolve and innovative technological solutions become available. Services include, but are by no means limited to, training and continuing education, access to electronic databases (full-text, and abstracting and indexing services), consulting, technical support, preservation, digitization, retrospective conversion, union listing, web site development and hosting, courier/delivery services, remote storage facilities, and electronic publishing.

In the 1980s, RLNs were among the first suppliers of e-mail and then internet access to their members. This is another example of how Networks facilitate the broad

adoption of new technologies by libraries through their extensive technical support and training infrastructure.

The RLNs have a long-standing role in advocacy on behalf of their members through national and international groups. Several RLNs are active participants in policy and standards organizations like the National Information Standards Organization, the Coalition for Networked Information, and the International Consortium of Library Consortia. Networks also work with regional and local groups to promote the role and needs of libraries.

Educational Programs

RLNs are well known and highly regarded for their training and continuing education programs. Thousands of library staff receive training in hundreds of classes offered by Networks annually.

Traditionally, training has consisted of instructor-led, in-person workshops held at the Network offices and at sites throughout each Network's specific region. In the past, self-paced courses were available in the form of workbooks, audio courses, and computer-based training. Recently, RLNs have made significant advances in the application of distance learning technologies to their training programs, bringing educational opportunities to broader audiences: those unable to travel and those who prefer a self-paced approach. The distance learning technologies implemented include videoconferencing, Web-based interactive workshops, and Web-based self-paced courses. Some Networks are beginning to include streaming video technology in their distance learning workshops.

Several RLNs have entered into cooperative training agreements with their Network colleagues. Still in the developmental stages, these programs now permit libraries to attend the training programs of other Networks at reduced cost. These alliances have the potential to expand greatly libraries' access to training.

As a natural extension of training, several RLNs offer custom consulting services. Consulting projects include, but are not limited to, workflow analysis of library operations and process reengineering, technology needs assessment, automation system selection, human resources development, web site design, facilities and buildings, database negotiation, collection development, and management of regional consortia.

Electronic Resources

Another primary service offered by most RLNs is access to electronic information resources. From the early years, the RLNs have provided access to traditional abstracting and indexing services such as Dialog and BRS. Electronic services have evolved dramatically to include full-text and image databases. The RLNs have effectively negotiated significant group discounts with hundreds of database providers, resulting in substantial cost savings to their

members. Each RLN will typically negotiate with each database vendor separately. There have been, however, examples of some excellent national discounts for databases, facilitated through the Alliance of Library Service Networks, e.g., LexisNexis® and the Oxford University Press electronic resources.

Amigos and Nylink have embarked on promising new electronic publishing ventures, supporting the electronic publication of intellectual property held in educational institutions and learned societies. Amigos is the American (United States and Canada) distributor for BioOne®, a collaborative project founded by the American Institute of Biological Sciences, the Scholarly Publishing & Academic Resources (SPARC), The University of Kansas, the Greater Western Library Alliance, and Allen Press, to provide electronic access to biological resources. Nylink has a similar alliance with Cornell University for Project Euclid, a nonprofit venture developed by Cornell University. These models have been instrumental in making journals from independent publishers and learned societies available electronically while preserving the publishers' intellectual and economic identities. These and related electronic publishing ventures bear continued examination as a means of keeping electronic resources affordable and the control of the intellectual property within the academy.

Unique Programs

The list of services provided by the RLNs is extensive. The following are a few examples of unique projects developed and managed by Networks:

- SOLINET and Amigos, with the support of the National Endowment for the Humanities, manage regional preservation education and support programs. As participants in a national network of regional preservation programs, they offer training in preservation treatment, needs assessment and disaster recovery, and preparedness.
- Several RLNs facilitate the development of digital resource collections. One example is Virtually Missouri, managed by MLNC and a collaborative project with the Missouri State Library.
- Amigos, Nylink, and MINITEX manage interlibrary delivery services for their members, enabling the rapid shipment of materials between libraries at reduced cost. These services are typically supported in part by the state libraries and like groups within individual RLN service areas.
- NELINET operates the New England Regional Depository, a remote storage facility. Members with limited space for collections may choose to store low-use materials at this facility and retrieve the materials as needed via delivery service.

CONCLUSIONS

Regional Library Networks in the Future

The RLNs have a long and successful history of assisting libraries with the integration of technology into their operations. The cost savings for libraries have been astounding, and the task of supporting and training so many libraries has been monumental.

As services mature and become mainstream, those services are often replicated by other consortia. With the recent increase in the number of consortia, many offering services competing with those offered by the RLNs, library administrators are faced with the dilemma of choosing between organizations with which to be affiliated. Those affiliations require staff resources to manage, and at some point, the duplicative relationships are no longer cost-effective. This has led to a waning in libraries' long-standing loyalty to their regional Network to the point that their choice to participate in any group is based solely on which has the lowest price for a specific service.

Therefore, the RLNs continue to be challenged to find the next set of innovative services to offer their members. To address this challenge, some RLNs have established research and development units within their organizations to identify the next areas in which they can provide value for their members. These units, coupled with the widespread assessment of member needs and satisfaction, position RLNs for the successful continuation of their role as leader organizations for libraries.

Susan Martin stated recently in "The Transformation of Library Networks," "Library networks are changing in character and concept in order to address changing technological, economic, and social needs of libraries and their patrons. Any idea that the network has gone away as a force in our environment is inaccurate. Rather, librarians need to recognize the strength the cooperative alliances have in shaping their future, and align their organization to deal effectively with these critically important partnerships."^[7]

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Relevance in Theory

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Abstract

Relevance is the central concept in information science because of its salience in designing and evaluating literature-based answering systems. It is salient when users seek information through human intermediaries, such as reference librarians, but becomes even more so when systems are automated and users must navigate them on their own. Designers of classic precomputer systems of the nineteenth and twentieth centuries appear to have been no less concerned with relevance than the information scientists of today. The concept has, however, proved difficult to define and operationalize. A common belief is that it is a relation between a user's request for information and the documents the system retrieves in response. Documents might be considered retrieval-worthy because they: 1) constitute evidence for or against a claim; 2) answer a question; or 3) simply match the request in topic. In practice, literature-based answering makes use of term-matching technology, and most evaluation of relevance has involved topical match as the primary criterion for acceptability. The standard table for evaluating the relation of retrieved documents to a request has only the values "relevant" and "not relevant," yet many analysts hold that relevance admits of degrees. Moreover, many analysts hold that users decide relevance on more dimensions than topical match. Who then can validly judge relevance? Is it only the person who put the request and who can evaluate a document on multiple dimensions? Or can surrogate judges perform this function on the basis of topicality? Such questions arise in a longstanding debate on whether relevance is objective or subjective. One proposal has been to reframe the debate in terms of relevance theory (imported from linguistic pragmatics), which makes relevance increase with a document's valuable cognitive effects and decrease with the effort needed to process it. This notion allows degree of topical match to contribute to relevance but allows other considerations to contribute as well. Since both cognitive effects and processing effort will differ across users, they can be taken as subjective, but users' decisions can also be objectively evaluated if the logic behind them is made explicit. Relevance seems problematical because the considerations that lead people to accept documents in literature searches, or to use them later in contexts such as citation, are seldom fully revealed. Once they are revealed, relevance may be seen as not only multidimensional and dynamic, but also understandable.

DEFINING RELEVANCE

Relevance is widely held to be the central concept in information science (IS). Discussions of it abound in the discipline, but there are so many conflicting accounts that some reviewers believe the term cannot be defined. Among the majority who believe otherwise, Rebecca Green's formulation of 1995^[1] captures something like the standard view: "Relevance is the property of a text's being potentially helpful to a user in the resolution of a need." Patrick Wilson in 1978^[2] was more succinct. Applied to a document retrieved by a query, "relevant" means "retrieval-worthy." What Wilson calls "the chief evaluative term in information retrieval" is simply the discipline's specialized form of the word *acceptable* or *good*. But where information retrieval (IR) systems are concerned, the acceptability or goodness of retrieved documents is a prediction, not a guarantee.

When IR systems are formally evaluated, judges decide the goodness of fit between documents and the sense of

the query that elicited them. In everyday life we constantly do the same thing less formally when we search the Web. Relevance is thus a variable; in judgments of documents it can take at least two values, "Relevant" and "Not Relevant," and many IR system evaluators have used scales that allow values in between.

Goodness of fit is most commonly based on the degree to which a document matches the *topic* implied by the query. However, for many years critics in IS have protested that relevance is not solely a matter of topical match, because a document need not be on a pre-expressed topic to be useful or helpful. For example, a passage in a document could count as evidence for or against a claim without matching the claim in topic. In like fashion, authors often cite documents that are topically unlike what they are writing about; a mathematical textbook, for example, could be relevant to articles in vastly different areas, from measuring the size of the Internet to estimating global warming. Conversely, a document that perfectly matched the topic

of a query could still be judged irrelevant because the potential user had already read it or had other grounds for rejecting it.

Despite these complexities, topical match remains the most important component of relevance as it is understood in IS. That is because topical match is something that IR system designers can design for, whereas other considerations, such as the novelty of the document to the user, are beyond their control.

This chapter explores these and other notions of relevance in IS theory and practice, including the long-running debate on whether it is subjective or objective or both. While relevance in IR is the main focus, there is some discussion of the concept as it motivates citers to link their documents to other documents. The chapter ends by suggesting that relevance, despite its complex and contested nature, is now reasonably well understood.

LITERATURE-BASED SYSTEMS

Although we may put our questions more readily to other people, we also want the powers that answers from literatures can give. When IS is defined as *the study of literature-based answering*, much else falls into place, including the oft-repeated claim that relevance is the central concern of IS.

“Literature-based answering” grounds *IR*, a traditional IS concern, in bodies of related writings such as are studied in *bibliometrics*. The phrase thus suggests the two main subfields of IS. “Answering” implies human questioners, since literatures cannot query themselves. And since they cannot respond by themselves either, it also implies that literatures must communicate through a system or systems of some kind. A questioning person and an answering system (and not pairs of persons) are the main dyad in IS. The strategically ambiguous term “information” in IS connotes both the answers that questioners want and the literatures (aka documents, writings, Web pages, material texts) that provide them. In Michael Buckland’s formulation,^[3] answers can be construed as messages expected to produce cognitive change on the human side (his “information as process”), and literatures can be construed as sources of that change on the system side (his “information as thing”).

While the questioner–answerer pairing implies a dialog, the pairing in this case is unusual in that one of the participants is human and the other, artificial. But dialogs between persons remain the point of reference, especially where implicit expectations are concerned, because that is humanity’s default setting. Answers from literatures, that is, will be held to much the same standards as answers from persons. For example, just as we rarely want persons to lie to us or be mistaken in what they say, we do not, as a rule, want to be presented with lies or errors from literatures. We want *truthful* answers,

which Patrick Wilson^[2] defines as information in the strong sense, as opposed to misinformation or disinformation. At the same time, we want *relevant* answers—answers appropriate to *what we meant* by our questions as put. In practice, this usually includes their being on topic or relatable to the topic by inference. Wilson characterizes literature-based answers that are topically appropriate but of uncertain truth value as information in the weak sense or “content.” Information in his strong sense is *what is known* about a matter; in his weak sense, *what has been said* about it.

Notoriously, systems can also deliver answers that miss the intended topic altogether. This is annoying, especially if such answers are numerous. The more dangerous possibility, however, is the system-supplied answer that is highly relevant but *false*. Imagine that your happiness depends on your catching a certain train, but the timetable you trusted—surely a relevant text—is outdated and the train no longer runs. Or imagine entrusting your eternal fate to scriptures that, although applicable to your case, happen to be wrong. If “information” is taken in Wilson’s strong sense, these are examples of literature-based answering but not of IR. Indeed, much of what is called IR is content retrieval at best. IR that *consistently* informs in any domain is still science fiction.

In their standard textbook,^[4] Ricardo Baeza-Yates and Berthier Rebeiro-Neto distinguish IR from *data* retrieval. In the latter, likely questions and appropriate answers are foreseeable, and systems can meet strict standards of relevance. Such systems are often databases that accept regimented language in limited domains—for example, telephone directories, personnel files, flight monitors in airports, dictionaries, topographical maps, stock price listings, and theater pages. Relevance is not a major issue in judging the performance of these nonbibliographic systems (and IS has had little to say about them), because the ability to match query statements with answer statements in them is seldom problematic. (Flight monitors, a boarding pass, and signs at the gate all answer the airline passenger’s predictable question, “Where’s my plane?”) In contrast, the literature-based systems of IR are portals to relatively unstructured full-text writings that may or may not speak to inquirers’ real questions, and relevance *is* problematic in judging their outputs.

When systems deliver multiple possible answers, we apparently screen first for relevance and only then for truthfulness; the truth value of what we filter out remains a matter of indifference. But we make other judgments as well. In our dialogs with systems no less than people, an invisible meter is running, and we want answers that are both timely and of acceptable length. Qualitatively, they should convey neither more nor less than we want to know, and they should not merely repeat what we know already. These latter requirements may be seen as components of relevance along with topical appropriateness.

INTERMEDIARIES AND DISINTERMEDIATION

A major way of obtaining true and relevant answers from systems has been to rely on human intermediaries who can connect questioners with the right parts of literatures because they understand both explicit and implicit criteria for what is wanted. (By giving answers from writings rather than from their own heads, they act as mouthpieces for systems rather than as communicators in their own right.) While the obvious example is reference librarians, anyone with sufficient expertise can play this role. With writings, however, neither sentences nor passages nor entire texts are marked as to truth value, which means that intermediaries will frequently be unable to guarantee the truthfulness of the answers they supply. At best they can retrieve one or more texts that have passed through society's (and perhaps their own) mechanisms for establishing veracity—crude editorial filters that may nevertheless screen out the blatantly false. As for relevance, intermediaries may be able to guarantee topically appropriate content because, given sufficient conversation, they can pick their way through the homonyms, synonyms, pronouns, and other complexities of natural language to understand what questioners mean. They can disambiguate what they hear and respond in a way that, in the dictionary definition of relevance, “bears on the matter at hand.”

Even so, the problem that has always most interested information scientists, including those of precomputer times, is how to make writings respond to questioners in these ways *without benefit of human intermediaries*. IS explores disintermediation in the sense of replacing workers in libraries and bibliographic publishing houses with devices and machines. (“Library automation” is a historical synonym of IS.) Unlike people, bundles of selected texts can be made universally and perpetually available. But can they be induced to perform like a helpful human agent? Can they be made as easy to query as a person? Can they be turned into something that forestalls the need for endless exploratory reading by responding truthfully and to the point and in real time?

The only reply at present is, *sometimes*. We still lack, and are not likely to have soon, systems that understand language like a human conversationalist. What we have instead, and have always had, are systems that match the words in people's questions with words in texts that may yield good answers or at least cater to interests. The premise in many of these systems is that users' words will be mapped onto text-words through intervening vocabularies—that is, through indexing. But, as noted earlier, the truthfulness of textual statements is not explicitly marked—not indexed—and so no metadata exist for word-matching technologies to operate on. The problems of supplying information in the strong sense must be addressed through publishers' quality-control measures, such as peer review of scientific articles or

periodic updating of reference works, that IS has always more or less taken for granted. That leaves word-matching systems to address the other major requirement in dialogs—that answers be relevant to questions. Human beings have a natural gift for relevance in verbal exchanges, but our best attempts to duplicate this gift artificially are as yet far from wholly successful. All that can be said is that, through schemes developed over centuries, we have some chance of matching people's question-texts with appropriate answer-texts from literatures. It is relevance in this sense that preoccupies information scientists, who have long foregrounded the problems involved. A concern with relevance is central to the study of human communication in general, but it becomes acute in IS, where systems can respond only through artificial substitutes for human capacities, such as computer programs and indexed stores of writings.

What IS really deals with, then, are system-supplied answers that may or may not be truthful and that may or may not be relevant to users' real questions. Exactly the same may be said of answers from people, of course, but we want our information systems to avoid or minimize human imperfections. Ironically, the study of user-system dialogs in IS has shown that limitations of users for which systems cannot compensate are in no small part the source of failures of performance. On their side of the dialog, users do not know (and are often too impatient to learn) how to put queries so as to get the answers they want. On the opposite side, designers still cannot cope with all the complexities of natural language (let alone people's unspoken expectations) and so routinely turn out systems that either overwhelm users with irrelevant answers or produce no answers at all. This is not to say that successes are not also frequent; merely that attempts to communicate with literatures meet with barriers not easily removed.

SOME HISTORICAL PRECEDENTS

It is worth noting that systems for delivering relevant answers from literatures without human mediation appeared long before the computer. For example, Melvil Dewey's widely used decimal classification system, which dates from 1876, underpins an attempt to build an answering device out of library books themselves. The word-bearing bookspines are shelved in standardized subject classes to curb the unconstrained vocabularies of authors and to respond relevantly to inquirers facing them. One might even see in these massed books an incipient artificial intelligence possessing some of the characteristics of a person. In any case, the system anticipates how we will ask for items of interest to us and suggests, through proximity, other items of potential interest. It is, in today's lingo, a “recommender system.”

Complementing it, Dewey's “Relativ Index” (thus spelled) alphabetizes thousands of terms both in and not

in the classification schedules and maps them onto the decimal classes. Thus people can look up noun phrases in their questions alphabetically and find the corresponding Dewey classes (often more than one) without knowing the nonintuitive decimal order. This easing of the mapping process may be seen as Dewey's move to make his scheme more responsive—more relevant—to users.

The full-scale alphabetical index that was added to Peter Mark Roget's *Thesaurus* in 1879 is a close analog. The *Thesaurus* was first published in 1852 as a list of words in classified order. According to David Crystal (p. 158),^[5] "Roget assumed that his readers would be able to find their way through the *Thesaurus* by working intuitively down through his classifications. He added a short alphabetical index, but it was left to his son, John Lewis Roget, to develop this in the 1879 edition into a major feature of the book." Again we see an attempt to make a less-than-intuitive system respond more relevantly in user-system dialogs. As confirmation in this case, the son's index contributed to increased sales and became almost everyone's doorway into the *Thesaurus*.

Another nineteenth-century example of designing for relevance is the subject cataloging system devised by Charles A. Cutter. Francis Miksa^[6] relates that Cutter, in his *Rules for a Dictionary Catalogue* (first edition 1875; fourth edition 1904), advocated entering books under *the most specific* subject heading that matched their entire scope (e.g., he would put a book on cats under "Cats" not "Domestic Animals"). In making headings for complex topics without established subject names, he preferred *concrete individual nouns* to *concrete general nouns*, and the latter to *abstract general nouns* (e.g., he would put a book on the ornithology of Massachusetts under "Massachusetts" with a cross-reference from "Ornithology"). These principles derive from Cutter's faith in the psychology of mental faculties advanced by eighteenth-century Scottish philosophers such as Thomas Reid. That faith was probably misplaced, but there can be no doubt that Cutter was trying to increase the relevance of subject cataloging—and hence library collections—to users by designing headings that conformed to what he took to be laws of human thought. In this, he was acting much like Peter Roget before him and the designers of search engines today.

Cutter's work anticipates twentieth-century thesauri that predate the computer—for instance, the Library of Congress Subject Headings (LCSH) for books and the Medical Subject Headings (MeSH) of the National Library of Medicine for journal articles. Such tools contain controlled vocabularies for building verbal bridges between writings and users. A look at what "control" means in them sheds additional light on how relevance is sought in literature-based answering.

The vocabularies make explicit certain abilities of an answering person, who, though absent, serves both indexers and literature searchers. The ability to understand that

different expressions have a common underlying meaning is imitated by establishing a preferred expression and linking synonyms to it with *See* or *Use* references—for example, "Attorneys, *See* Lawyers." The ability to connect an expression with its nonsynonymous conceptual neighbors is imitated by *See Also* or *Related Term* references—for example, "Lawyers, *See Also* Judges." For hierarchical neighbors, *Broader Term* or *Narrower Term* references are added—for example, in the "Guns" hierarchy, "Weapons" is *Broader* and "Pistols" is *Narrower*. The ability to discriminate among homonyms is imitated by attaching indicators of sense—for example, "Interest (Monetary)" versus "Interest (Psychological)." Finer shadings of word-knowledge can be imitated by full-sentence scope notes, as when "Bibliometrics" is differentiated from "Scientometrics" or "Informetrics."

While all of these aspects of vocabulary control may seem old hat, they in fact serve as ways of inducing relevance that Google and several other search engines now lack. These engines process not indexers' controlled vocabulary but authors' and users' natural language to provide near-instantaneous answers from a very wide range of writings. The answers returned, sometimes numbering in the thousands, are algorithmically ranked high to low by predicted relevance to the query. Identification of the *best* answer, if it exists, is left to users. But the lack of vocabulary control as a screening device guarantees the frequent appearance of answers that are largely or entirely irrelevant. At the same time, other potentially relevant answers are not returned because they do not match users' input terms.

RELEVANCE IN SYSTEMS EVALUATION

The example just given implicitly pits natural-language retrieval against controlled-vocabulary retrieval, or perhaps Google against a search engine built with different algorithms. Which is better? The answer leads us back to why the concept of relevance is central to IS. A major historical reason is that, from the 1950s onward, it has been central to the most challenging practical enterprise in IS—the design and evaluation of IR systems. The intent is always to discover explicit operations on explicit bodies of texts that designers can use to improve system performance. Toward that end, researchers have recruited people to judge the goodness of retrievals in experimental trials because they thought this would eventually show the most effective techniques for retrieving relevant answers and blocking irrelevant answers.

The thinking goes something like this. Given a large collection of documents containing wide-ranging discourse, the goal of an IR system is to retrieve documents that satisfy unforeseen requests: those that adequately answer a question or that speak appropriately to an interest. At the same time, the IR system should screen out

documents that fail to do these things. For any query put to the system, there is a set of documents that *should* be retrieved because they meet the specifications of the request—in the words of IR evaluators, are relevant to it. Assuming that these documents can be retrieved in comparable ways, such as by natural language or by controlled vocabulary, one can set up retrieval trials to see how many of these documents are in fact retrieved by each competing mode, and how many are missed. One can also see how many documents each mode retrieves that in fact *should not* have been: they are somehow unsuitable, even though their indexing matches the language of the input request. Finally, one can relate these counts to the size of the entire collection from which retrievals are made.

There is a persistent technical problem in determining the total number of documents in a collection that are relevant to a request. Either the entire collection must be examined to find them, or, if that is impracticable, the total must be estimated. Examining collections for relevant documents query by query is highly laborious, but it can be done: some documents are prejudged as relevant, and then various competing means are used to retrieve them. The alternative is to take each query, perform a retrieval, have a judge identify relevant and irrelevant items, and then try to estimate through additional searches or sampling techniques the relevant documents that the first search missed.

In the pioneering days of IR experiments, relatively small test-bed collections of documents were used to compare the effects of different forms and levels of indexing and different search strategies. Since the 1970s, larger operational collections have been similarly evaluated. Regardless of size, the standard summary measures for individual tests are computed from data partitioned as in Table 1. The cells are filled in as follows: *a*, a count of documents that should have been retrieved and were—the hits; *b*, a count of documents that should not have been retrieved but were—the junk (also called noise, false alarms, false positives); *c*, a count of documents that should have been retrieved but were not—the misses (also called false negatives); and *d*, a count of the remaining collection correctly dodged in the retrieval.

Once these numbers are known, common summary measures for evaluation—precision, recall, and fallout—can be computed. Precision is the proportion of retrieved

documents that are relevant: $a/(a + b)$, the higher the better. (In systems that rank documents by relevance, the upper ranks should have higher precision than the lower.) Recall is the proportion of all relevant documents that are retrieved: $a/(a + c)$, also the higher the better (except when reading is to be minimized, or the *absence* of hits is desired, as in some patent searches). Fallout is the proportion of all irrelevant documents that are retrieved: $b/(b + d)$, the lower the better. (With large collections, one wants a relatively tiny fraction broken out.)

Further interpretations and refinements of these summary measures need not detain us here. The key point is that the measures depend crucially on what documents have been declared relevant. “[I]n using recall and precision ratios,” writes Cyril Cleverdon (p. 171),^[7] leader of the classic IR evaluation studies at the Cranfield Institute of Technology in England, “it is not relevance which is being measured, but the decisions regarding relevance that have already been made.” If those decisions are often faulty across retrieval trials, then comparative evaluations of IR systems are neither reliable nor valid. For half a century there has been a battle in IS over whether relevance can be objectively determined, as it must be if tables like Table 1 are to be believed. Naysayers hold either that relevance is altogether subjective or that it has both objective and subjective sides, and that the latter is more important.^[8–10]

In the culture of Cranfield-style IR evaluation, relevance is presumed to be objective. It is like a “beep” that only certain documents emit (perhaps in varying strengths) when matched against the user’s input terms. Table 1 is in fact historically related to tables in the field called signal detection theory (SDT). Indeed, one of the creators of SDT, John A. Swets, applied it to the results from three large-scale IR evaluation studies of the 1960s.^[11] But, as noted, critical information scientists have long argued that the “borrowed toolbox” from SDT is not right for evaluating IR systems. These critics doubt that *relevance to a request* is a good criterion for judging documents and filling in the cells of Table 1, because the concept has not been well operationalized. It has not resulted in quick, reliable agreements on what is at issue, and some would say it cannot.

As input, SDT uses data on people’s ability to discriminate between signal (noteworthy items) and noise (unnoteworthy items) under conditions of uncertainty. However, in typical SDT studies the phenomena from which signal and noise emerge are well defined and could be readily agreed on by judges. For example, if enemy planes are the signal and friendly planes are the noise, military spotters might misjudge some enemy planes as friends, or some friendly planes as enemies, but they would not be in doubt as to what they were monitoring. An analogous case involves faces. In an STD study described on the Web, people were asked to memorize faces from a pictured set. They were then shown pictures

Table 1 Table for computing standard IR evaluation measures.

	Relevant	Not relevant	
Retrieved	<i>a</i>	<i>b</i>	<i>a + b</i>
	Hits	Junk	Hits + Junk
Not	<i>c</i>	<i>d</i>	<i>c + d</i>
retrieved	Misses	Dodged	Misses + Dodged
	<i>a + c</i>	<i>b + d</i>	<i>a + b + c + d</i>
	Hits + Misses	Junk + Dodged	Total collection

of individual faces and asked whether each was one they had seen earlier. Their correct and erroneous responses can be captured in four cells just like those for relevance judgments in Table 1. But, unlike the abstract and protean relation called relevance, it is easy enough to say what they were judging. Swets himself noted that relevance is a thorny problem in IR and sidestepped defining it himself, although he based his large-scale statistical analysis on data involving relevance judgments that others might consider suspect.

OBJECTIVE RELEVANCE

Of the various grounds for deciding a document is relevant to a request, three seem most likely to be considered objective. The first is that a document constitutes evidence for or against an inquirer's claim. The second is that a document acceptably answers an inquirer's question. The third is that a document is on (or about) the inquirer's stated topic of interest. To comment briefly on these possibilities in turn:

Evidentiary relevance. That something counts as evidence for or against a claim is the *definition* of relevance, according to many dictionaries. The objective quality of such evidence can be tested when claims are made public in, for example, science, scholarship, or courts of law. But bringing evidence to bear is a creative act. Just as documents are not indexed by their truth value, so they are not indexed by their evidentiary value in strengthening or weakening an assumption or a case. If they are not already known, they cannot be retrieved simply by entering a claim (or topical noun phrases from a claim) in an IR system. (Citation indexes might sometimes lead to them, but only if they have already been used and cited by another author.) As a result, IR evaluation tests do not involve judgments on the value of documents as evidence for claims.

Question relevance. Questions and proper answers are logically related. Don R. Swanson writes (p. 392):^[12] "The idea of objective relevance is perhaps clearest in the case of requests that leave little room for subjective interpretation—for example, requests that entail questions about the physical world. A document that gives the vapor pressure of mercury at ten different temperatures is objectively relevant to the question, How does the vapor pressure of mercury depend on temperature?" William Cooper shows that, in pairings of this type, objective logic guarantees the relevance of certain answers to questions.^[13] Similarly, objective logic makes proofs relevant to theorems in mathematics (even if relatively few persons can follow them). "In such cases," Patrick Wilson writes (p. 458),^[14] "we presume the existence of a relationship that holds whether or not it is noticed, one about whose presence or absence we can be mistaken, and one that can be investigated by other than purely psychological

means." Swanson and Wilson view objective relevance as arguable in principle; it can be intersubjectively determined if it meets standards of criticism (such as the possibility of being proven wrong).

Topical relevance. IR studies involving topics are more common than studies involving questions. Questions are sentences, whose syntax clarifies their meaning. By contrast, statements of topics are usually only noun phrases, not all of whose possible meanings were intended by the person submitting them. Moreover, even when disambiguated, topics lack sharp cognitive boundaries. While judgments on them are far from wholly subjective, the notion of a document's being on (or about) a topic depends on judges' interpretations, which vary. (Different indexers are likewise known to vary in how they index the same document.) Sometimes most or even all judges agree that a document matches the sense of a given topical request. Other times, they do not. For example, Swanson recalls a well-known clash between judges from two organizations in 1953 (p. 390):^[12] "After each team had reviewed all of the retrieved documents, they jointly agreed that 1390 documents were relevant to the ninety-eight requests, but there were an additional 1577 documents that were considered relevant by one team but irrelevant by the other, a rather large arena of disagreement." Studies rarely if ever make the reasons for such disagreements explicit (a point to be further considered below).

DEGREES OF RELEVANCE

Like goodness, relevance for most information scientists admits of degrees. Some researchers have asked judges to measure it on nine- or seven-point scales or by marking an unmarked line representing a continuum (no relevance at left, complete relevance at right). Other researchers have called for simple binary judgments. Table 2, which reproduces instructions to judges on using a five-point, a three-point, and a binary scale, shows how researchers have operationalized the measurement of relevance in three major studies from the past 40 years.^[15–17] They treat it as if judges can assess the retrieval-worthiness of documents without a great deal of explanation.

Also admitting of degrees is the *focus* of an inquiry, which ranges from a specific question with a definite answer to a broad and nebulous interest that any number of documents might satisfy. The study by Saracevic and others^[16] used five-point scales to capture the range of specificity, as well as clarity and complexity, in questions. The 1966 Cranfield study (pp. 185–200)^[15] illustrates something of this range in the questions that were used in retrieval tests in aeronautics. Very specific: "How do interference-free longitudinal stability measurements (made using free-flight models) compare with similar measurements made in a low-blockage wind tunnel?"

Table 2 Scales and instructions for judging relevance in three studies.

<i>Instructions to Relevance Judges, Aslib Cranford Research Project</i>	
Mark as (1)	References which are a complete answer to the question. Presumably this would only apply to supplementary questions. . .since if they applied to the main question, there would have been no necessity for the research to be done. ^a
Mark as (2)	References of a high degree of relevance, the lack of which either would have made the research impracticable or would have resulted in a considerable amount of extra work.
Mark as (3)	References which were useful, either as general background to the work or as suggesting methods of tackling certain aspects of the work.
Mark as (4)	References of minimum interest, for example, those that have been included from a historical viewpoint.
Mark as (5)	References of no interest.

Source: Cleverdon, C.; Mills, J.; Keen, M. *Factors Determining the Performance of Indexing Systems. Volume 1. Design. Part 2. Appendices*; College of Aeronautics: Cranfield, England, 1966. (p. 129).^[15]

^aThe judges were aeronautical engineers who were scoring the relevance of (a) papers they cited in their own works to (b) questions they themselves created for the study. Those are the “supplementary questions” referred to; the “main question” was the one their own works answered—HDW.

<i>Instructions to Relevance Judges, A Study of Information Seeking and Retrieving</i>	
The following definitions have been provided to users for judging the answers (i.e., abstracts):	
“Each abstract should be evaluated according to its degree of relevance to the question you submitted for searching. The degree of relevance should be determined using the following three-point scale:	
Relevant—Any document which on the basis of the information it conveys is considered to be related to your question, even if the information is outdated or already familiar to you.	
Partially Relevant—Any document which on the basis of the information it conveys is considered only somewhat or in some part related to your question or to any part of your question.	
Nonrelevant—Any document which on the basis of the information it conveys is not at all related to your question.”	

Source: A study of information seeking and retrieving. I. Background and methodology by T. Saracevic, P. Kantor, A.Y. Chamis, D. Trivison, *J. Am. Soc. Inform. Sci.* 1988, 39 (3), 161–176. (p. 169).^[16]

<i>Instructions to Relevance Judges, Text Retrieval Conference (TREC)</i>	
Relevance judgments, or the “right answers,” are a vital part of a test collection. TREC uses the following working definition of relevance: If you were writing a report on the subject of the topic and would use the information contained in the document in the report, then the document is relevant. Only binary judgments (“relevant” or “not relevant”) are made, and a document is judged relevant if any piece of it is relevant (regardless of how small the piece is in relation to the rest of the document).	

Source: National Institute of Standards and Technology. Data—English retrieval judgments, 2000. http://trec.nist.gov/data/reljudge_eng.html.^[17]

Quite general: “[I want] papers on pressure and force distributions on wings.”

Reflecting similar differences in scope decades later, the Text REtrieval Conference sponsors “tracks” in which researchers compete not only in retrieving entire documents but in algorithmic answering of specific questions from TREC test collections. The question–answering track,^[18] whose test collections are drawn from large corpora of news articles, is “designed to take a step closer to IR rather than document retrieval.” For example, an actual TREC question is:^[19] “What is the relationship between poverty and disease?” TREC’s gloss on acceptable answers (supplied for all questions) states: “Documents that do not link poverty to diseases directly but mention a link between poverty and health care are relevant. Documents that simply mention poverty and disease but do not draw a connection are not relevant.”

In daily life, questions are put constantly, and everyone routinely judges the degree to which answers are relevant. (To “Where’s our flight?” the answer “Gate B9” is both relevant and *more* relevant than “Somewhere in Terminal B.”) While the questions in the TREC question–answering trials are the special kind asked at reference desks, the cognitive skills required to judge the

answers for relevance (if not truth-value) are the same ones people use successfully every day. It therefore should be easy enough to score answers, especially with the glosses TREC provides. For example, millions of people could judge answers to the request for articles on the relationship between poverty and disease. Many of them could at least *recognize* apparent answers to the technical Cranfield question about longitudinal stability measurements in aircraft, even if they were unfamiliar with the aeronautical vocabulary. Moreover, people would probably agree on what documents contained answers, as opposed to those that did not, even if they did not always agree on the *best* answer.

However, these are examples of inquiries at the specific-question end of the scale. When the focus is broadened from specific questions to interests expressed as topics, people tend to agree less on what literature-based answers are relevant. They read different things into noun phrases expressing topicality (such as the request in the Cranfield study for “papers on pressure and force distributions on wings”) and produce inconsistent results.

As noted above, such inconsistencies have prompted the claim that relevance on the user side is subjective or that relevance has an objective component (documents

that match the stated topical request) and a subjective component (documents that for any other reason are retrieval-worthy). Swanson writes (p. 397),^[12] “For the most part, bibliographic retrieval systems are topic oriented, and topics are presumed to be objectively defined and applied. However, the question of whether a document is or is not about some topic can depend on the observer’s point of view, and so a subjective element may intrude into a topic-oriented relevance judgment.” In *Information Retrieval*, an influential textbook in the Cranfield tradition, C. J. van Rijsbergen states flatly that relevance is subjective (p. 146).^[20] However, he seems to have in mind something like Swanson’s mixture, since he, like other Cranfield-style researchers, thinks there is enough agreement among judges for IR evaluation tests to be successfully conducted.

Contributing to the supposedly subjective component are factors such as the user’s expertise, situation, work task, cognitive style, and stage of searching; the amount of information provided about the document; and the conditions under which judgments are made. Linda Schamber extracted from IS studies some 80 variables that supposedly affect relevance judgments (p. 11),^[21] and her unprioritized list is not exhaustive.

WHOSE SUBJECTIVITY COUNTS?

Surrogates, such as students, librarians, or subject experts, have replaced end users as judges in many retrieval evaluation tests. In the limited time periods of the tests, what can they reasonably be expected to do? Can they judge whether short, specific answers adequately respond to a set of short, specific questions? Yes. Can they compare a set of retrieved citations plus abstracts with a request and decide whether each has the same sense as the request? Yes again. Crucially, however, such judges lack a stake in the information they are given because they lack real needs generated by real projects. The only criterion by which they can reasonably be asked to evaluate retrievals is whether a retrieved document answers a question or matches a topic. Since this tells us little about the relevance of the document (or passage or phrase or image) to the person who asked for it, they cannot judge documents validly, and—so goes the critique—it is fatuous to base system evaluations on their opinions.

By this light, the only judge of relevance worth considering is the person who requested the information. Consider again Green’s definition: “Relevance is the property of a text’s being potentially helpful to a user in the resolution of a need.” Her wording allows surrogate judges to judge relevance by topicality, because any document they deem to be on topic—even mistakenly—is at least *potentially* helpful. But for evaluations to be convincing—again, according to the critique—relevance should depend on whether a text *actually* helped an end user resolve a need.

Only end users can decide whether they benefited cognitively from seeing a particular system-supplied document. Only they can connect documents with ideas material to their projects. Only they can know how well documents capture the *intended sense* of their search terms, despite literally matching them.

Consider further that systems can respond to user needs only as they are expressed in language the systems can accept. That means that the needs must be couched in words that explicitly match either controlled vocabulary or authors’ natural language. However, neither type of indexing permits easy matches on pieces of unknown text that users might find *extremely* relevant: evidence for their new claims, original appearances of a concept, good examples of some phenomenon, ways of putting a complex matter in a nutshell, critiques not labeled as such, interesting analogies, lucid popularizations, fruitful metaphors, anecdotes appropriate to a context, linkages between hitherto unlinked ideas, better methodologies than those already used, arguments paralleling one’s own, discussions of terms as terms, and so on.

While another person could help find these desiderata, more often they can be found only by creative reading over time. They are not quickly retrievable through an IR system because they cannot be adequately expressed in any language known to IR. They depend on interactions with full texts, not indexing. Given enough time, readers do find them, but they are not generally available as criteria to judges in IR evaluation tests.

So, if one cannot ask for the inexpressible, what *can* be expressed to IR systems? Other than bibliographic data such as titles, authors, and journals, what can be entered as search terms? Practically speaking, the answer turns out to be: phrases representing topics and phrases representing questions. This would seem to put users and surrogate judges back in the same boat as they decide on the goodness of document retrievals. According to many information scientists, however, it does not. For them, “objective system relevance” as achieved by term-matching goes out the window, to be replaced by something like Buckland’s “information as process.”

The judges in Cranfield-style evaluations must regard requests to the system as indicators of a fixed user need, to which the documents retrieved by the request are a fixed response, complete in itself. Even if searches are revised to take user feedback into account, it is assumed that the underlying need does not change. In sharp contrast, the needs of real-world users and the requests they lead to are constantly changing, sometimes over long periods. Such users draw on IR systems progressively, taking in new information to reach new conclusions or revise old ones. This fact prompted Stephen Harter to argue that “user need” should not be equated with the *initial* state of consciousness that led to a request but with the dynamic *current* state (p. 606).^[22] It prompted Marcia Bates to advocate a “berrypicking” model of literature

retrieval over the classic Cranfield model. In her words (p. 421):^[23] 1) typical search queries are not static but rather evolve; 2) searchers commonly gather information in bits and pieces [like berries] instead of in one grand best retrieved set; 3) searchers use a wide variety of search techniques which extend beyond those commonly associated with bibliographic databases; and 4) searchers use a wide variety of sources other than bibliographic databases.

RELEVANCE THEORY APPLIED

Opposition to static topicality as the sole basis for relevance judgments is now commonplace among information scientists. In making his case against it, Harter^[22] adapted Dan Sperber and Deirdre Wilson's relevance theory (RT) from linguistic pragmatics. He was attracted to their ideas because, although their book^[24] deals mainly with talk between persons, they treat relevance at a level of psychological complexity appropriate to serious users of literatures (e.g., writers who cite for many reasons) and not merely as a verdict on topical matches.

In briefest summary, RT says that the relevance of any communication varies directly with its cognitive effects in a context and inversely with the effort it takes to process—that is, $\text{Relevance} = \text{Cognitive effects} / \text{Processing effort}$. (The more pronounced the effects and the smaller the effort, the greater is the relevance.) Human beings experience communications by means of this ratio automatically. Cognitive effects are the new inferences drawn when a new message interacts with a person's existing assumptions in a context. In general, the new inferences add to, cancel, or strengthen or weaken the existing assumptions. Such effects can be ordered by degree although they cannot be precisely measured. Processing effort serves as a brake on the potentially endless multiplication of cognitive effects; whatever inferences are *easiest* to draw are the ones we stop at. Possible effects that are harder to process are eliminated.

Extrapolating from RT, Harter argues that if a document produces little or no cognitive effect after it has been read, the fact that it is on topic does not matter; it is not relevant. Conversely, if, upon reading, the document does have a cognitive impact, it *is* relevant, even if it misses one's expressed topic of interest. The issue becomes, did a document, for whatever reason, prove informative? Did exposure to it yield valuable new inferences? The document's novelty and whether its appearance is well-timed (given one's current cognitive state) may also contribute to its impact. Other components of relevance mentioned earlier, such as whether a document is acceptable in length and neither under- nor over-informative, can now be seen as related to processing effort.

The addition of processing effort to the concept of relevance improves IS theory. Following RT, we may

infer that the harder a communication is to process, the more likely it will be rejected or ignored; it literally becomes *less relevant*. This goes for entire IR systems as well as individual messages. (Recall that Dewey, J. L. Roget, and Cutter all acted to reduce the effort of using their systems, so as to increase their perceived relevance to users.) Reviews by Herbert Poole^[25] and Thomas Mann^[26] show that, when people interact with information systems, they tend to attain relevance not by seeking high cognitive effects but by minimizing processing effort. (George Zipf's phrase, the "principle of least effort," is often adduced in this regard,^[27] and Herbert Simon's notion of "satisficing"^[28] is also related.) Yet, over the years, the least-effort studies and the copious writings on relevance in IS have generally been separate streams of analysis. The RT formula for relevance has rich implications for uniting the two streams, as Howard White argues.^[29]^[30] The numerous variables seen in the IS literature on relevance (such as many of those tabulated in Schamber's review) become more meaningful and less miscellaneous if they are organized as either cognitive effects or as determiners of processing effort.

This line of reasoning from RT further allows that a document's being on topic may indeed contribute to its cognitive effect and hence its relevance. Harter dwells more on the point that people *create* relevance by seeing connections across topics, a point Swanson also makes.^[12] But while topical relevance is far from being the only kind, it remains a very important kind, as Kelly Maglaughlin and Diane Sonnenwald found.^[31] (We want neither our conversational partners nor our IR systems to be constantly changing the subject.) Relevance theory's inclusion of processing effort in the relevance formula leads to insight here: topical match is an important component of relevance because it depends on explicit language and is *relatively easy to see*. Harter calls it "weak relevance" (i.e., subject to quick negation), which resembles Green's calling a document "potentially helpful." Thus, we can better understand why surrogate judges are used in IR evaluation tests: it is because they can recognize weak relevance (as potential helpfulness) in documents. They can stand in for end users because they share this ability with them (and are often more convenient to work with). Judgments on topical match, in other words, have high, although far from perfect, intersubjectivity.

It nevertheless remains true that judges cannot accurately take into account all the other factors that affect the relevance judgments of actual users—implicit factors that only the latter perceive. What is hard or impossible for judges to evaluate may be easy for users with project-driven needs.

Harter's criterion for a relevant document^[22] is whether it produced in him a desirable cognitive effect, regardless of where, how, why, or when the document was obtained. This cognitive effect ("psychological relevance" for him; "subjective relevance" for Swanson) exists only for the

end user who *wants to create new knowledge*. The experience of surrogate judges in IR tests is not comparable, and to assign relevance judgments to them is considered a serious error by Swanson. Swanson (p. 139)^[32] says, “We therefore infer that a consensus as to whether a particular document is relevant to some request is meaningless, for this notion of relevance has meaning only in the mind of the one person whose information need gave rise to the request.” If consensus with other judges is nevertheless sought and reached, it can only be on the relatively trivial grounds of topic match. The Harter-Swanson critique vitiates Cranfield-style tests of particular IR systems, and in fact Harter writes (p. 612):^[22] “I no longer believe that there is a valid interpretation of the meaning and results of such tests.”

A key consideration for Harter is *whether the document is read*. All the valuable “finds” mentioned earlier, such as evidence for claims, interesting analogies, good examples, and arguments paralleling one’s own, are discoverable only by someone interested enough to read documents at length. Surrogate judges cannot be presumed to have interests this strong, and they are generally asked to read only brief forms of documents, such as a citation plus abstract.

Users, too, of course, need not read a document to form some opinion of it, and a glance will tell them more than its subject matter. According to a study by Carol Barry,^[33] they go also by their impressions of authors, the quality of a journal or publisher, the apparent specificity or generality of what is discussed, the apparent difficulty of the exposition, and about 20 other implicit criteria. Even so, lists such as Barry’s merely complement topical relevance; they do not invalidate it. Judy Bateman (p. 30)^[34] shows that students rate topic-match highest among the criteria in their literature searches. Moreover, if one looks at the documents that professionals cite, one finds that their choices tend to conform to their own main topics. For example, writers on relevance such as Barry, Harter, Schamber, Swanson, and the present author frequently cite other writings on relevance.

This account bears as well on surrogate judges’ *disagreements* about topical relevance. Judges, like users, may be swayed by implicit criteria that go beyond topicality in the strict sense. Even with only a citation plus abstract, a judge might declare a document relevant to a request because, for instance, she makes a connection not readily apparent to others or lets the name of an author or journal tip the scales in the document’s favor. The judge here is acting creatively, like an end user (although not necessarily as a real user would), and disagrees with judges who are more literal-minded. When the inferences behind such creativity are hidden, judgments seem bewilderingly subjective. In the language of RT, undercommunicated chains of reasoning increase others’ processing effort, which makes claims of relevance based on them problematical.

Courts of law have a procedure for standoffs like this: a lawyer who, in arguing a case, is charged with irrelevance by opposing counsel (“Objection, Your Honor!”) must clarify his or her reasoning to the satisfaction of the court. IR evaluation trials being less grave, differences are seldom ironed out so that relevance judgments reach a higher level of intersubjective agreement. If judges in retrieval tests could be induced to reveal the logic by which they reached controversial conclusions on relevance, their assumptions—including possible mistakes—*could* be objectively evaluated, and this would dispel the mystery of disagreements. (This resembles getting coders in content analysis to resolve their differences so as to improve intercoder reliability.) But time and energy are too short for such additional labor to be likely.

OBJECTIFYING SUBJECTIVITY

The RT formula permits a new approach to the vexed question of whether there are two kinds of relevance, objective and subjective, in IS. Following RT, we may want to dispense with the objective/subjective split altogether and simply conclude that people differ in the assumptions they bring to documents, which affects their processing effort, which affects the cognitive effects the documents have.

To say that something is RT-relevant implies that its cognitive effects were not zero. Communications that produce no effect—no change in one’s assumptions—are irrelevant even though the effort to process them may be very low (e.g., weather reports from most places on earth). Communications may also produce no effect and hence be irrelevant because the effort required to process them is too high (e.g., for many persons, mathematical models of weather patterns).

In both cases, a person’s mind is always the context in which communications are evaluated and effects occur. People differ widely in the cognitive contexts they embody (e.g., for some, mathematical models of weather patterns are child’s play). But they do not differ on *kinds* of relevance, objective versus subjective, they perceive within these contexts. As their powers of inference operate, they simply experience a communication’s greater or lesser cognitive effects. In that sense, perceived relevance is unitary. It does not require switches between, say, one capability that knows a question has been answered, a second that realizes a line in a play is funny, a third that takes “I want a divorce” more seriously than “I want a snack,” and a fourth that sees a hitherto unseen connection between two documents or between a document and a request.

What does seem to vary across people, given the cognitive context each sets, is processing effort. Some communications are relatively easy for many people to process. They produce cognitive effects with little need for explanations

or new thought. Many communications called “objectively relevant” in IS would seem to be of this sort. It is not that they are necessarily popular in content, like sitcom dialog. It is that most people can follow their underlying logic by using the same inferential abilities they bring to content of all kinds. By this line of reasoning, “subjective” relevance in IS may mean no more than “as yet obscure, as yet hard to follow.”

The notion of subjective relevance has two main uses in IS, both having to do with topical relevance. First, it is invoked in IR tests when surrogate judges *disagree* on whether a document matches a topical request. (Their agreements are taken as signs of objective relevance.) Second, it is invoked when actual end users (the persons who put the requests) use criteria *in addition to* topical relevance in judging documents, because no topical statement can capture the full, dynamic complexity of their information needs. Such end users might *agree* that a document matches the topic of their requests, yet still reject it on other grounds often called subjective.

Swanson and other information scientists treat subjective relevance as if it results from a flash of insight during an IR experiment—a moment of creativity that then remains mysterious. It is true that judges in IR tests usually score documents without explanation, so that, if they go beyond topic matching, their reasons are hidden from others. But such tests are too artificial to be a suitable base for a general psychology of information needs and uses. In life, a person who wants credit for linking topics across documents cannot leave the linkage unexplained. What started as subjective creativity—unique cognitive effects—must be communicated so that others can understand it. It must be recontextualized from private to public—more plainly, explained by writing and citing. As a result, it moves toward objective relevance, or at least much higher intersubjectivity.

This is not to say that claims of relevance will always be convincing. When explained under standards of criticism, they may turn out to be feeble or wrong. Rather, it is to say that the “subjectivity” of relevance judgments has roots in the way IR tests are administered: researchers want to avoid saddling judges with processing effort beyond filling out simple forms. The whole subjective-objective muddle in IS results from attempts to derive user psychology from the narrow world of Cranfield-style evaluation, where relevance judgments typically have little explanatory context.

If, moreover, end users are the only ones whose judgments should count, why not ask them what they *did* with the citations plus abstracts in some period after a search? For example, was an item obtained in full-text? Was it filed but never looked at? Was it read? Assigned to students? Cited in the preparation of a new work? Surveys of this sort would replace users’ subjective judgments with reasonably objective behavioral measures. (Their original hit-lists might be quite altered in the process.)

Judy Bateman^[34] and Peiling Wang^[35] have initiated research along these lines that would seem to offer a more valid account of the retrieval-worthiness of documents than the snap judgments of IR tests. But longitudinal studies go contrary to the ethos of the Cranfield tradition, where, to this day, the emphasis is on getting quick counts for the various evaluation ratios.

While purists may want to reserve the term “objective relevance” for relations of logical entailment,^[13] that seems overfastidious in the messy world of IS. There are relations other than entailment that are admissible as instances of relevance—for example, the relations of analogy or illustration or historical continuity. In any case, what Swanson and others in IS call “subjective relevance” can be taken as a set of effects that are temporarily hard for others to process because their justification has not yet been shared. For example, since one of Swanson’s favorite philosophers, Karl Popper, never wrote specifically on IR, the bare assertion that he is relevant to IR would puzzle the uninitiated. Yet readers can easily see Popper’s relevance once they read Swanson’s bridging accounts (p. 138).^[32] Popper has also been adapted and cited by other information scientists, which heightens the sense of intersubjectivity with Swanson.

RELEVANCE AND CITATION

As we have seen, Swanson and Harter are leading underminers of topical relevance as the sole basis for evaluating IR systems. Swanson’s claim that end users create relevance across topics is elaborated at length by Harter,^[22] who shows how nine IS papers not strictly on his stated interest (which is “empirical research on how people do online searches”) can in fact be brought to bear on it through theoretical conjectures. “Thus,” Harter writes (p. 612),^[22] “we come to the perhaps surprising conclusion that, in IR, *references on the topic may be less important than relevant references not on the topic*—references that allow the making of new intellectual connections or cause other cognitive change” (italics his).

We come also to a practical question: how does one search for relevant references not on the topic? How, for instance, did Harter find his nine stimulating papers? Using the standard noun-phrases of topical retrieval, neither he nor anyone else can frame the idea, *items not on the topic but relevant to it*. Granted, if he had already guessed that online search behavior might be related to another topic, he could search on the latter. But that strategy is likely to produce few hits (or far too many). The most probable assumption is that Harter did not assemble the nine papers through deliberate search; they had simply found their way into his personal collection from various sources over the years, and now he was able to exploit them. In other words, he was putting the fruits of long-term berrypicking to new use.

Could Cranfield-style tests be replaced by the berry-picking model as a means of evaluating IR systems? The latter is certainly a more realistic model of human–literature interactions. On reflection, however, they could not. Berry-picking includes, but is more complex than, literature searches by topic and so is incommensurable with them.

Harter discusses another possibility (p. 614).^[22] That is for information scientists to link theorizing on relevance to citation analysis. Citations are to relevance judgments what fossils are to paleontology—objective evidence of what has gone before—and the prose around them feeds interpretations of their functions and of citer motives. Several studies reveal that writings tied to a document through citation have little overlap with writings tied to the same document through subject indexing. These studies confirm, with data from end users rather than surrogate judges, that relevance relations go beyond topicality. Citation indexes in fact answer the question asked above: how does one search for relevant references not on the topic? Google Scholar, Scopus, and the Web of Science allow this by enabling a searcher to retrieve later documents that cite an earlier one for *any* reason, whether they match it in topic or not. According to White’s nonexhaustive list of reasons (p. 595),^[30] a citer might cite an earlier document to recognize topical similarity, but also to point out an analogy, establish a causal connection, acknowledge use of a research method, provide evidence or examples, borrow rhetoric, or discuss terminology.

So, why not base evaluation of IR systems on some form of citation data rather than judges’ opinions? Actually, Cleverdon, Mills, and Keen in England and Gerard Salton in America did experiment with citation links, as opposed to subject headings, in their project (pp. 106–112).^[36] But they used straight citation matches (e.g., bibliographic coupling) without embellishment. To go further requires additional processing effort. Citations do not come tagged with the metadata needed for more refined IR evaluations. For instance, they lack labels such as “provided an analogy” “provided historical background,” or “provided a method.” This deficiency was noted by (among others) Swanson (p. 145):^[32] “[W]hat is lacking in present systems is any convenient and rapid method for discovering the *nature* of the relevance link which the citing author has established. This can be discerned only by studying the citing article” (*italics his*).

Interestingly, the five-point Cranfield scale shown in Table 2 was a bit of early citation analysis, though not billed as such. It called for citers to rank the relevance of their own citations to particular research questions—in Swanson’s phrase, “to show the *nature* of the relevance link.” Quotes from those citers indicate they thought the task difficult (pp. 29–31).^[36] The Cranfield project took place more than 40 years ago, yet little has changed today. It is utopian to think that citers will ever enrich their citations with metadata, as proposed by Swanson (pp.

145–146),^[32] among others. Several bibliometricians have added metadata to others’ citations by hand, in the style of old-fashioned content analysis, but that is very slow. The best hope lies in *automated* enrichment of citations with explicit pieces of language around them, such as tagging citations in a scientific paper with the headings of sections in which they occur. For example, one would expect citations from *Methodology* sections to refer to methods papers, but citations from *Introduction* sections to refer to earlier substantive findings or theory. As data increased over time, citations would come to be typified by their tags, and this information depending on the nature of the relevance links could be exploited to increase the precision of retrievals in citation databases. Experimental analysis of full-texts along these lines is ongoing.^[37]

CONCLUSION

Writers on relevance in IS often observe that the concept is not well understood and call for further research to clarify and ultimately measure it. The conclusions here are that, on the contrary, we understand relevance quite well (thanks in part to explications such as those cited here), and that it will always be measured only crudely (ordinally at best, according to Sperber and Wilson). What is relevance in IS? In an RT-flavored sentence, it is the ability of a document to produce in the mind of a user *valuable cognitive effects without undue processing effort*. This way of putting it can be made compatible with the definitions of Rebecca Green and Patrick Wilson in the first paragraph and with those of many other information scientists. The debates of the past seem increasingly passé.

The Cranfield tradition of evaluation lives on—for example, in the TREC competitions—but it is hard to believe such tests will dramatically improve IR systems, at least during the shelf-life of this *Encyclopedia*. The early researchers in IR assumed that systems could and should be designed to serve demanding people with fixed information needs, expressed through well-chosen noun phrases. Hence the idea of the IR system as a fine-tuned robot—one that applied the best algorithms to the best indexing so as to deliver all relevant documents in a collection and only those. That idea died long ago. In its place, we have systems that simply recommend more or less plausible items and facilitate exploration by trial and error. They work because people are so adept at creating relevance as they go, especially by intuitive manipulations of their own processing effort.

Undeniably, current systems such as Google need improvement, but it is not likely to come about through tests of recall and precision. One evident need is for better disambiguation of search terms. Systems in which natural language has replaced controlled vocabulary produce countless “false drops”—false not in nuance but in major differences of sense. For example, Google at present

cannot tell whether the phrase “shoulder of mutton” means a cut of meat or an English pub. (Human beings can almost always tell from the context.) A few search engines do cluster their retrievals by sense (on the basis of words that frequently co-occur with the search term). They can separate, for example, recipes for meat dishes from ads for pubs, so that requesters can choose the cluster they meant rather than having to scroll through a long mixture of items. But Google and Yahoo, to name only the giants as of 2008, lack that ability. To say they need better precision ratios is a roundabout way of stating the obvious. They need the ability to detect various search-term senses and group documents accordingly. Less effort means greater relevance for users.

As a provocation, however, suppose that the future brings *no* improvements in IR systems—that we simply cope with what we have today. There is no reason to think human communication would suffer much. People have always had ways of compensating for the defects in their literature-based answering systems. For example, designers of computerized IR systems have probably never relied on their own systems to find most of what they themselves read and cite. They berrypick. Their friends and assistants hand them things. Rumor has it that Stephen Harter came across Sperber and Wilson’s *Relevance* while browsing in an airport bookstore. Even if that is biographically false, it is true as a parable. No one can complain that, because systems do not find all relevant documents, or only relevant documents, too little of value is written.

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Relevance Judgments and Measurements

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Abstract

Users intuitively know which documents are relevant when they see them. Formal relevance assessment, however, is a complex issue. In this entry relevance assessment are described both from a human perspective and a systems perspective. Humans *judge* relevance in terms of the relation between the documents retrieved and the way in which these documents are understood and used. This is a subjective and personal judgment and is called *user relevance*. Systems compute a function between the query and the document features that the systems builders believe will cause documents to be ranked by the likelihood that a user will find the documents relevant. This is an objective *measurement* of relevance in terms of relations between the query and the documents retrieved—this is called *system relevance* (or sometimes similarity).

INTRODUCTION

One of the main objectives of information science as a discipline is to retrieve relevant information, and as such the concept of relevance is regarded as a central notion in the field. The concept of relevance has changed substantially over the years and it is now realized that relevance implies a relation, has many dimensions, various manifestations, can either be judged in absolute or relative terms, is dynamic, and is very difficult to define.

The idea of quantifying relevance is a very complex issue, and one that has been studied for many years with varying degrees of success. A user very often intuitively knows whether a retrieved document is relevant or not and relevance is mostly understood in the fuzzy sense of “I will know it if I see it.” On the other hand, an information retrieval system (IRS) may confidently rate a document as 100% relevant to the query used to retrieve it, while the user does not judge it as relevant at all.

It is already clear that there are at various interpretations of the term “relevance.” In systems approaches to information retrieval (IR), relevance is considered to be a property of the relation between the content of the document and the system’s search criteria. In user-oriented and cognitive approaches to IR, relevance has to do with the cognitive processes of the users and their changing knowledge and needs regarding information, within or stimulated by the context.^[1] Context hence implies the socio-organizational environment as well as the systems and information objects involved and surrounding the actual user.

It is widely accepted that IR comprises three elements or role players—systems, users, and the environment.

- The system involves documents or information objects (represented in various ways), which are then

organized in some way and, through a given algorithm, prepared for matching a query via an interface mechanism.

- The user typically has a problem to solve, a work task to perform, or an interest to satisfy, and a derived information need which has to be apparent to a certain degree to the user. For example, it might be verbalized before it can be transformed into a query that is acceptable to the system algorithm.
- The socio-organizational environment provides the context or situational framework influencing the activities of the user. This can include anything from the definition of the work task, to the choice of retrieval system, the type of information available, etc.

The process of information seeking and retrieval clearly consists of many aspects that may influence the role players, the steps followed to find and use information and the iterations of the processes as various circumstances change over time (e.g., the manner in which the user understands the problem, the work task, the situation). Perhaps the easiest way to understand the complexity of the process is by means of the following example: A chef works at an embassy and receives notice that he/she has to prepare a dish for a dinner meeting where an important trade agreement might be signed. The chef identifies keywords and selects an appropriate database to look for a suitable recipe. In this scenario, the following role players may be identified:

- The chef is the *human user*.
- The preparation of the dish is the *work task*.
- The meeting is the *situation* for which the information retrieved will be utilized.
- The embassy and the guests at the meeting are the user’s *socio-organizational environment*.

- The database and search engine is the *IRS*.
- The keywords combined by logical operators is the *query* that is input into the IRS.
- The recipe is the *document* that will be retrieved.

Once the user realizes that his/her state of knowledge is incomplete and decides that an IRS has to be used to find documents that will satisfy the information need, the process of information seeking and retrieval starts and typically consists of the following stages:

- A question (in natural language) has to be reformulated as a query to be input into the IRS.
- Documents are retrieved, measured, and ranked according to relevance by the IRS.
- The relevance of the documents are then judged by the human user in terms of his/her own cognition, in terms of the work task that has to be executed, in terms of this situation for which the information is to be utilized, and also within the socio-organizational environment in which the information is presented (in the latter case not necessarily by the user himself/herself).
- Depending on a variety of factors, the documents that were retrieved are then either rejected or used.
- The entire process of seeking and retrieval is iterative—any of the stages may be repeated if the outcome is not satisfactory.

The example illustrates that there are many factors involved when we deal with the issue of relevance. In each of the stages from the definition of the work task to the outcome of the meeting, relevance was measured or judged.

Whether relevance is measured objectively by an IRS or subjectively judged by a human user, ultimately it is a *relation* that has to be evaluated. Mizzaro^[2,3] stated that relevance may be viewed in terms of a relation between two groups of entities:

- The first group of entities deals with the information and information objects as such—documents, document surrogates, or the information which the user perceives when reading the document or surrogate.
- The second group of entities deals with the work task (the problem that has to be solved, the task that has to be fulfilled, or the interest that has to be satisfied), the information need resulting from the work task (this is a representation of the problem in the mind of a user), the request that is formulated on the basis of the information need (a representation of the information need in human language), and the query (a representation of the information need in a format that can be processed by an IRS).

Relevance can be viewed as a relation between any of two entities, one from each group. Each of these entities may

be divided further into three components: *topic* (subject area), *task* (activity that will be executed when documents are retrieved), and *context* (other factors, excluding topic and task that will influence the information behavior).

In addition to these components within the relationships, there is yet another dimension, namely that of time. The information-seeking situation takes place over time and the user's cognition of his/her work task changes over time. An overview document that was highly relevant at the beginning of a research project (perhaps because the user did not understand the problem) may no longer be relevant at the end of the project, because the user then knows the background, and that same document is then viewed as too elementary. The same argument goes for a user whose problem has changed over a period of time.

Mizzaro^[2] also discusses the issue of “who judges what?” and this can happen in any of the following five dimensions: the kind of relevance judged; the kind of judge (user or nonuser); the physical entity the judge can use (document, surrogate, information) for making his/her relevance judgment; what the judge can use (query, request, information need, or problem) for expressing his/her information need; and the time at which the judgment is expressed.

For the purpose of this entry we will make a distinction between *relevance judgments* and *relevance measurements* (these should not be read as formal definitions of the terms):

- *Relevance judgments* can be seen as a subjective process where the human user decides on the relevance of retrieved documents in relation to the work task that he/she has to fulfill. Humans judge the relevance of information objects in terms of a variety of factors, some of which are very subjective and individualized. Furthermore, it is acknowledged that as a user's cognition changes over time, his/her judgment of relevance (even of the same documents) also changes. This is called *user relevance*.
- *Relevance measurement* is an objective method where the process of retrieval can be quantified in terms of its outcome. The term measurement implies objective criteria, physical entities, and quantification. When a query is entered into an IRS, the user is presented with a ranked or sorted list of documents. These documents are those that have been assessed as relevant based on the degree of similarity between the query and the documents. This is an objective measurement of relevance and is called *system relevance*, sometimes also called *similarity*.

RELEVANCE JUDGMENTS

The judgment of the relevance of a document is the evaluation of a relation. These relations are always between

the document (or information object) on the one hand and some aspect of the seeking process on the other—for example the request, the information need, the underlying situation. Furthermore, these relations change over time.

User Relevance Criteria

Longitudinal studies show that users have a wide variety of factors that can affect judgments of the relevance of an information object. Two of the major longitudinal studies where responses were elicited from the users themselves are those by Barry and Schamber^[4] and Vakkari and Hakala.^[5]

Barry and Schamber^[4] combined the results of two separate studies on relevance criteria in order to establish whether there is a “finite array” of user relevance criteria. The result of the study indicated that this array does indeed exist and is also finite, and that it is applied consistently across types of information users, problem situations, and source environments. The list below shows the criteria by which users judge the relevance of information objects:

- Depth/Scope/Specificity: Focused, specific to user’s needs, sufficient detail or depth, interpretation, etc.
- Accuracy/Validity: Accuracy, correctness, and validity of information.
- Clarity: Presentation of information in a clear or well-organized manner.
- Currency: Current, recent, up-to-date, timely.
- Tangibility: Extent to which information relates to real, tangible issues, proven information, hard data, actual numbers.
- Quality of sources: General standards of quality, reliability.
- Accessibility: Effort and costs.
- Availability: Availability of information/sources of information.
- Verification: Consistent with or supported by other information in the field. Agreement with the user’s point of view.
- Affectiveness: Affective or emotional response to information (e.g., pleasure, enjoyment, or entertainment).
- Effectiveness: The extent to which a procedure that is presented is effective or successful.
- Consensus within the field: Consensus or agreement in the field relating to the information being evaluated.
- Time constraints: Whether time constraints or deadlines are a factor in deciding to pursue information.
- Relationship with author: User’s personal or professional relationship with author.
- Background/experience and ability to understand: User’s background and experience helps to judge quality, reliability, or understanding of the issues.

- Novelty: Document novelty, source novelty, and content novelty.
- Geographic proximity: Geographic location covered in document may not be relevant to user’s situation.
- Dynamism: Presentation of information: live or dynamic. Can user manipulate the presentation of information.
- Presentation quality (excluding entertainment value): Format or style of presentation.

The aim of the Vakkari and Hakala^[5] study was to analyze how changes in relevance criteria are related to changes in the problem stages during task performance processes and it was concluded that the user’s relevance criteria are (partially) dependent on the stage of the task performance process. The list below shows the relevance criteria users identified, and the subcategories of each criterion:

- Information content: topicality, point of view, recency, discipline, geographical area, references, examples, clarity, research approach.
- Sources of documents: person’s relation to sources, source type, author.
- Document as physical entity: availability, length.
- User’s situation: time constraints, stage of the process.
- User’s experience and preferences: ability to understand, language, interest, novelty, saturation.
- Information types: general information, specific information, theories, methods, empirical results.

From the two studies above it is clear that users judge the relevance of an information object on much more than simply the relationship between the query and the documents—the manner in which systems measure relevance. It would seem that in some cases, users do not even take the content of the document into account when they judge the relevance of these—there are many other factors that play a role.

Subjective Relevance Types

In 1996 Saracevic (and expanded in 2007)^[6–8] produced a stratified model that deals specifically and comprehensively with interactive communicative aspects of interactive IR. The model described five increasingly subjective types of relevance:

- Algorithmic relevance is objectively measured through an algorithm and results in a sorted or ranked list of documents. These objective measurements will be described in the next section.
- Topicality or topical relevance is the assessment of the aboutness of the query as compared to the aboutness of a document.

- Cognitive relevance or pertinence is the judgment of the content of the information object and the information need as perceived by the user at a given point in time.
- Situational relevance is the judgment of the document in terms of the work task situation as perceived by the user.
- Motivational or affective relevance is an emotional or intentional type of judgment that is highly individualized.

It was argued by Cosijn and Ingwersen^[9] that this emotional/intentional type of relevance is included in all the subjective relevance types. They also argue that another type of relevance should be defined, namely:

- Socio-cognitive relevance that refers to domain, context, and collective situational preferences.

Each of the subjective relevance types will be discussed in more detail below, with specific reference to what relations are evaluated and how the measurement or judgment is made. The example used in the introductory section will also be used to illustrate the complexity of the subjective relevance judgments.

Topical relevance judgments

When a user has a work task to fulfill and realizes that he/she has to use an IRS to find information, he/she first has to find the focus of the problem. The information need is typically verbalized, but this “question” has to be reformulated as a query in order to be processed by an IRS. If we return to the example of the chef in the introduction, the information need is the need for a recipe that fulfils the requirements of the situation. In order to find a recipe, the chef has to identify appropriate search terms, combine them with logical operators, input this query into an IRS, and retrieve a set of information objects.

Topical relevance may be defined as the relation between the *topic* of the query and the *topic* of the retrieved information objects, and is assessed in terms of the aboutness of the information objects. If the chef used the query “lobster AND fish,” he/she might retrieve several documents: some are recipes having lobster and fish as ingredients; others are recipes having lobster and fish only as terms in the description of the recipe (e.g., a novelty birthday cake in the shape of an aquarium). In this case, only the first group of recipes will be relevant in terms of the topic of the query (being ingredients in a recipe) and the topic on the retrieved information objects.

The assumption is that both query and the objects may be assessed by a cognitive agent as being about the same or a similar topic. This assumption implies a degree of subjectivity on the user side. The subjectivity is

compounded if the information objects are represented by human-indexed terms.

Pertinence or Cognitive Relevance Judgments

Pertinence is measured in terms of the relation between the state of knowledge, or cognitive information need of the user, and the information objects as interpreted by that user. The criteria by which pertinence are inferred are cognitive correspondence, informativeness, authorship, information preferences, currency, and adequacy of form. For instance, a paper may be topically relevant but repeating what the user already knows. In the example of the chef now having retrieved several recipes with “lobster” and “fish” as ingredients, and having judged this subset of documents relevant on a topical level, it may be that he/she already has knowledge of some of these recipes, but for some reason did not deem these as relevant to the task at hand. Other recipes are new to him/her, and these are judged as pertinent (or cognitively relevant).

In the case of an intrinsically ill-defined information need at a given point in time, the user may not be able to assess pertinence.^[10] One may say that if the user has insufficient knowledge and does not have a good grasp of the structure of the task, he/she will not have the necessary cognition to understand the problem. Cognitive relevance can therefore be described as the ability to connect a task to prior knowledge.^[5]

This type of relevance is also extensively described by Barry^[11] during an empirical study to define the criteria mentioned in users’ evaluations of the information within documents as it is related to their need situations. The study showed that users included tangible features as well as subjective qualities, together with affective and situational factors.

Situational relevance judgments

Situational relevance^[12,13] describes the relationship between the perceived situation, work task, or problem at hand and the usefulness of the information objects as perceived by the user. The criteria by which situational relevance is inferred are usefulness in decision-making, appropriateness of information in problem solving, and the reduction of uncertainty. In the example of the chef, he/she now has a subset of recipes which are topically as well as cognitively relevant. From this subset of documents the chef has to assess each in terms of suitability within the situation (a very important dinner where a trade agreement is dependent on the outcome). Unusual recipes, both looking and tasting good, may be judged as situationally relevant.

The judgment of situational relevance is deemed not only the evaluation by a user of whether a given information object is capable of satisfying the information need. It offers the additional potential of creating new knowledge

which may motivate change in the decision maker's cognitive structures. In turn, this change may lead to a modification of the perception of the situation and the succeeding relevance judgment, and in an update of the information need.^[14]

Socio-cognitive relevance judgments

Socio-cognitive relevance describes the relationship between the situation, the work task or problem at hand in a given socio-cultural context on the one hand, and the information objects on the other, as perceived by one or more cognitive agents. The social or organizational domain, or cultural context in which the individual finds himself is defined by a paradigm or tradition, which dictates what problem explanations may be found to be acceptable.

The relevance judgments within a particular context are not necessarily made by the user of the information objects. Returning to the example of the chef, we can summarize the process of finding and using relevant information as follows: the user has an information need derived from a particular context. The user perceives the work task in a certain way, states his/her information need, formulates a suitable request, translates the request into a query, inputs the query into an IRS, and retrieves a set of information objects which are measured as relevant by the system (algorithmic or system relevance measurement). The user judges the set of retrieved documents firstly on a topical level (topical relevance judgment) and then within his/her own knowledge of the topic (pertinence or cognitive relevance judgment). The user then decides whether the use of these documents will be suitable within a particular situation (situational relevance judgment). However, the result of this process will ultimately be judged, not by the chef, but by the dinner guests and the outcome of the dinner. If the trade agreement was signed, the documents were relevant, but if the chef was not aware that some of the key guests were vegetarians (thereby adversely affecting the attitude of these guests by serving fish) and the agreement was thus not signed, then the documents were not relevant within the context (socio-cognitive relevance judgment).

Affective relevance

Affective relevance is described in terms of the relation between the goals, intents, and motivations of the user and the information objects. Affective relevance should not be seen as the ultimate subjective relevance in a scale of relevances, but rather as another dimension of relevance judgments that may be associated with the other subjective types of relevance. A user may, for example, decline to use a document that is judged as topically, cognitively, as well as situationally relevant because it goes against his/her moral principles.

Based on the discussion above, it is clear that when a user judges the relevance of a document (or other information object) there are many factors at play. Some of these factors can be relatively objective (e.g., whether the document is dealing with the right topic or not), and some are very subjective, personal, or even emotional.

Algorithmic relevance

Algorithmic relevance as defined by Saracevic^[6] is another synonym for system relevance or similarity. This type of relevance is objectively measured through an algorithm and results in a sorted or ranked list of documents. The following example once again illustrates the difference between system relevance and user relevance. When two users use a particular IRS and input identical queries, they will retrieve identical sets of documents. This is because system relevance is a computed similarity function and as such is an objective measurement as opposed to the subjective judgments, i.e., user relevance. Once these two users have retrieved a set of (systemically) relevant documents from an IRS, they can peruse the documents and know whether a particular document is relevant or not in terms of their own information needs. These two different users may have exactly the same work task (e.g., a class assignment) to fulfill and yet one may judge a particular document relevant while the other may not (perhaps because she already knows the content of that particular document). The complexities of the process of user relevance judgments of information objects have been discussed above. The next section will deal with various aspects of system relevance measurements.

RELEVANCE MEASUREMENTS

System or algorithmic relevance is measured in terms of the comparative effectiveness of logical or statistical similarity of features inferring relevance.^[6] This is system-oriented to a very large extent, as it depends on the degree of similarity between the features of the *query* and the features of the *document*. It is not influenced by the user, nor is it related to any subjective information need the user may have.

Historically, research into the evaluation and improvement of system relevance relied largely on the so-called laboratory model of information retrieval. In the laboratory model there is a test collection (a database of documents), a well-defined set of topical queries and a set of relevance assessments to identify the documents that are topically relevant to the query. The assessments are often (but not always) binary in nature. The results of the assessments are then usually expressed in terms of precision and average recall (see discussion below).

Recently, however, the laboratory model has been challenged by developments in research on relevance and

information seeking. One of the main thrusts in this line of research is the importance of user interaction and involvement during the retrieval process and assessment of the retrieved documents in terms of subjective information needs. For a comprehensive discussion of these issues see Ingwersen and Järvelin.^[12] This section deals mainly with assessment of system relevance within the laboratory model, but ends with a recommendation that the laboratory model be reviewed and extended to also include users and their context.

The laboratory model has its origins in the so-called Cranfield experiments (1957–1968) by Cyril Cleverdon et al.^[15] These experiments entailed comparing several alternative indexing languages. The results of the performance of the different indexing languages were quantified in terms of precision and recall—evaluation measures that calculate the proportion of retrieved documents that are relevant (precision) and the proportion of relevant documents that are retrieved (recall).

In a closed system such as this, we can then use a matrix to evaluate the retrieval of documents in relation to a query:

	Retrieved	Not retrieved	
Relevant	a	b	$n_1 = a + b$
Not relevant	c	d	$n_2 = a + c$
	$N = a + b + c + d$		

documents that are relevant:

$$P = \frac{a}{(a + c)} = \frac{a}{n_2}$$

Precision can alternatively be defined as

$$P = \frac{|\{\text{relevant documents}\} \cap \{\text{document srtreived}\}|}{|\{\text{document srtreived}\}|}$$

Recall (R) is defined as the proportion of relevant documents that are retrieved:

$$R = \frac{a}{(a + b)} = \frac{a}{n_1}$$

Recall can alternatively be defined as

$$R = \frac{|\{\text{relevant documents}\} \cap \{\text{document srtreived}\}|}{|\{\text{relevant documents}\}|}$$

Both precision and recall have a maximum value of 1 and a minimum value of 0.

For each query that is submitted to an IRS, a precision-recall value can be calculated. Each precision-recall value is denoted by an ordered pair (P_n, R_n) where P denotes

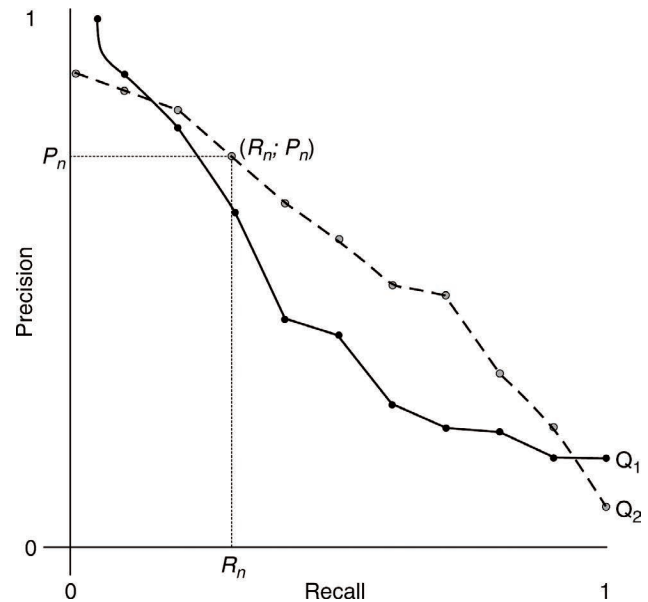


Fig. 1 The precision-recall graphs for two separate queries.

precision; R denotes recall and n a parameter (e.g., rank position). A graph can be plotted (see Fig.1) utilizing the set of ordered pairs for a particular query. In practice and on average, the relationship between precision and recall tends to be inversely proportional—as recall increases, precision will tend to decrease, and vice versa.

Other measures related to precision and recall are fall-out and generality:

Fallout (F) measures how well an IRS filters out nonrelevant documents during the retrieval process and is defined as the proportion of nonrelevant documents that are retrieved:

$$F = \frac{c}{c + d} = \frac{c}{N - n_1}$$

Generality (G) is the proportion of relevant documents within the entire collection:

$$G = \frac{a + b}{(a + b + c + d)} = \frac{n_1}{N}$$

The relative performance of an IRS may be expressed in terms of the measures above:

$$\frac{R}{F} = \frac{P/(1 - P)}{G/(1 - G)}$$

It should be noted that fallout and generality are not used anymore as measures of retrieval system effectiveness in the context of test collections. Fallout is not used because it is generally uninformative. In a collection of any reasonable size the vast majority of the document collection

is not relevant to a particular query and thus almost none of the nonrelevant documents are retrieved (even by systems that are grossly ineffective). Generality is not used because test collections can only be used to compare systems' performance on that given collection, and generality is a constant across systems for a particular collection.

There are many problems related to using recall and precision as a measure of retrieval effectiveness (for a more detailed discussion, see Korfhage^[16] and Baeza-Yates and Ribeiro-Neto^[17]:

- In a closed test collection, both recall and precision can be calculated with some accuracy. In a real-world situation, however, recall cannot be determined, since this would require knowledge of all the documents in the collection.
- Although precision and recall are related to each other, each in isolation does not give a good indication of retrieval effectiveness.

An alternative measure combining precision and recall into a single measure is the Harmonic Mean.^[17]

The *Harmonic Mean* (F) of recall and precision is calculated as

$$F = \frac{2 \times (\text{Recall} \times \text{Precision})}{\text{Recall} + \text{Precision}}$$

This is also called the F_1 measure, since recall and precision are evenly weighted. The generalized F-measure is defined as

$$F_\beta = \frac{(1 + \beta^2) \times (\text{Precision} \times \text{Recall})}{(\beta^2 \times \text{Precision}) + \text{Recall}}$$

where F_β “measures the effectiveness of retrieval with respect to a user who attaches β times as much importance to recall as precision.”^[18] The F_2 measure thus weights recall twice as much as precision, while the $F_{0.5}$ measure weights precision twice as much as recall.

Precision and recall are based on the entire set of documents retrieved by the system related to a query. The *Mean Average Precision* (MAP) (also referred to as the mean non-interpolated average precision) is a mean calculated over a set of queries. The average precision is calculated after every retrieved relevant document (zero is used as the precision for not-retrieved relevant documents). The average precision is then calculated over the total number of relevant documents retrieved for a query:^[19]

$$\text{AveP} = \frac{\sum_{r=1}^N (P(r) \times \text{rel}(r))}{\text{Number of relevant documents}}$$

where r is the rank, N the number of documents retrieved, $\text{rel}()$ a binary function on the relevance of a given rank, and $P()$ precision at a given cut-off rank.

In an ordered list of retrieved documents, the *bpref measure* (binary preference) measures the number of faulty orderings (e.g., where a nonrelevant document is ranked before a relevant document):^[19]

$$\text{bpref} = \frac{1}{\text{ard}} \sum_{r=1}^{\text{ard}} \left(1 - \frac{\text{nn}_r}{\text{nn}}\right)$$

where nn_r is the number of nonrelevant documents in the results list up to the position of the r th relevant document, nn is the number of nonrelevant documents in the results list, and ard is the number of relevant documents in the results list.

Laboratory experiments related to relevance measurements have also started to change from predominantly using binary relevance assessments to using graded relevance assessments by means of N -ary measures (e.g., a three-point scale: not relevant, partially relevant, relevant or a four point scale: not relevant, marginally relevant, fairly relevant, highly relevant). A higher value for N will increase expressiveness of assessment, but will decrease the consistency of assessments.

Normalized Discounted Cumulative Gain (NDCG) is a relatively new measure that utilizes multipoint scales (as opposed to binary). This means that a particular document “gains” according to the level of relevance. The overall utility of N documents are measured by the sum of the gain of each relevant document (“cumulative”). The gain of a low-ranked document is “discounted” so that a highly ranked document will count more toward the gain. “Normalized” means that an ideal ranking is used to calculate an upper limit and the actual gain value is then normalized against this limit.^[20]

In the measurements described in the section above, relevance is a function of the system—the absolute relationship between the query and the document is measured. The assumptions are that relevance depends on static topical similarity and that relevance is a binary (or at least based on discrete values) assessment. It does not take into account that different users may have different cognitive interpretations and information needs.

The process of user relevance judgment starts when the user is confronted with a set of documents for use in the work task. This set of documents (or other information objects) might be a set retrieved through an IRS and was defined as (systemically) relevant, it might be a set of documents gathered through manual effort, or it might even be a set of documents supplied by an intermediary. At this stage, it is dependent on the user to judge the relevance of these documents in terms of his/her own information needs. If the documents were retrieved through an IRS, the relevance of the retrieved set has been

measured objectively as a relationship between the query and the documents retrieved. Once the user starts perusing the documents, their relevance is judged in different terms. User relevance is subjective and individualized, based on a variety of factors.

This multidimensionality of relevance would suggest that the computing of system relevance is but one aspect of the process of Information Seeking and Retrieval. Ingwersen and Järvelin^[12] argue that the laboratory model of IR evaluation has been challenged due to its lack of realism and proposes two alternative approaches to traditional laboratory model—one is to extend IR research to take the user and his/her context into account, and the other is to extend Information Seeking research toward the context of the task as well as toward the technology.

CONCLUSION

Users know intuitively if a document is relevant or not. The formal assessment of relevance and the associated theory, however, is a much more complex issue. Relevance can be assessed in one of two ways. Relevance can be measured through an algorithm in terms of the relation between the query and the information objects retrieved by the query. When a query is entered into an IRS, the user is presented with a ranked or sorted list of documents. These documents are those that have been assessed as relevant based on the degree of similarity between the query and the documents. This is an objective measurement of relevance, and is not necessarily in agreement with what the user perceives to be relevant.

Humans judge the relevance of information objects in terms of a variety of factors, some of which are very subjective and individualized. Users judge documents in terms of their own perception of the problem or work task, in terms of the complexity of their own situation, in terms of the context that they operate in, as well as other subjective and affective factors which are not always clearly verbalized. Furthermore, it is acknowledged that as the user's cognition changes over time, the judgment of relevance (even of the same documents) also changes.

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Renaissance Libraries [ELIS Classic]

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Abstract

The author surveys the history of libraries during the Renaissance and the Reformation in several European countries.

—*ELIS Classic*, from 1983

INTRODUCTION

To define the Renaissance in broadly acceptable terms or to set limits for its beginning and end and its geographical scope is all but impossible.^[1,2] One aspect, perhaps the central one, is beyond any dispute: The book—its collecting, preservation, reproduction, and exploitation for new ideas—was the key to the break with medieval tradition. While there are early and late manifestations of the spirit of the Renaissance, the role of books and libraries in the revival of learning begins, roughly, in the mid-fourteenth century and may be said to continue into the latter sixteenth century when classical scholarship began to take full advantage of the revival of ancient learning and its application to contemporary culture. The library of the seventeenth century is in a direct continuum from those of the previous two centuries; and, as far as modern libraries are concerned, the institutions we know today took shape in the seventeenth and eighteenth centuries.

The humanists found in the book something permanent, over and above its specific service in perpetuating the traditions of classical antiquity.^[3] Thus, they viewed libraries, the basic tool for preserving books, as the most important servants of scholarship. When Cardinal Bessarion gave 746 manuscripts to the Venetian Republic in 1468, the origin of the Marciana, it was “ad communem hominum utilitatem.”^[4] Time and again, we have expressions of confidence in libraries as the one indispensable tool of scholarship.^[5,6] A legend was created that endures today, sometimes to the detriment of scholarship in the reverence for the printed book, much as the respect for the manuscript affected the acceptance of the printed book in the fifteenth century.

ITALY

Francesco Petrarca (Petrarch; 1304–1374) stands at the head of the roll of Italian humanists.^a He must have been an

impassioned bibliophile at an early age. In 1337, he prepared a list of “libri mei,” and he was well on his way to developing the first great humanistic library. He copied Cicero’s letters, discovered in the Verona Cathedral library in 1345; and after he found a manuscript of Vergil, now in the Ambrosian Library in Milan, he always took it on his extensive travels despite its size. In 1362, Petrarch left Milan on account of an epidemic; he went to Padua and then to Venice, where he made an arrangement to deposit his books in Saint Mark’s. He was in Venice for five years, must have left some books there (a sorry remainder was discovered two and a half centuries later), and then went to Arquà (near Padua), with whose master, Francesco da Carrara, he was acquainted. Petrarch’s will of 1370 does not mention his library, and it has been assumed that most went to Carrara. The latter’s library was seized by the Visconti of Pavia in 1388, and, in 1500, it was taken by Louis XII with other bibliographical booty and shipped to Blois, then removed in 1544 to Fontainebleau. Twenty-six manuscripts from Petrarch’s library are in the Bibliothèque Nationale today, a few others in other places. While Petrarch’s library did not survive intact, it was the prototype of the Renaissance book collection, in the method of acquisition, in content, and in its intended use. His notion about a library in Venice for scholars was an enduring one among later humanists.

If Petrarch or his friend Giovanni Boccaccio had never contributed a line to creative literature, they would still be major personalities of the Italian Renaissance on account of their dedication to collecting books for the revival of learning.^[6,14–16] Boccaccio, unlike Petrarch, had limited means and copied most of the manuscripts he found. His most famous discovery was the Tacitus (*Annales*, XI–XVI, and *Historiae*, I–V) at Monte Cassino, whose library he described in some detail for the neglect it had suffered—possibly an excuse to justify removal of the manuscript.^b The Tacitus manuscript fell into the hands of Niccolò dei Niccoli (1363–1437; *infra*), who allowed

^aOf the extensive Petrarch bibliography, only the following may be noted here. See Ullman.^[7] de Nolhac.^[13]

^bNow Laurentianus 68, II. It also contained the *Agricola*, perhaps more, when the monk Petrus Diaconus used it for his life of Saint Severus about 1135. See Bloch^[17] and Pralle.^[18]

Poggio Bracciolini ("Florentinus," 1380–1459; *infra*) to copy it; and it ended in the Marciana after Niccoli's death. In 1374, Boccaccio wrote a will bequeathing his collection of over 200 volumes to his confessor, the Augustinian Martino da Signa, after whose death it went to the monastery of San Spirito in Florence with the understanding that it be generally available. Niccoli heard about the neglected books and had a cabinet made for them, but after the remodeling of the monastery in 1560, most were lost. Fortunately, we do know titles from an inventory of 107 items preserved in Ashburnham 1897 of the Laurentian Library.^[19] Of these, 10 have been found in the Laurentian and the Riccardiana in Florence, of which 2 were copied in whole or in part by Boccaccio. A third has notes in his hand.

Coluccio Salutati (1331–1406) did not attain the literary renown of Petrarch and Boccaccio, but his services as a manuscript collector are no less significant.^[20–22] He held high civil office in Florence, and his position enabled him to identify and acquire many valuable manuscripts, notably Cicero's *Epistolae ad familiares* (now in the Laurentian) and Cato's *De agricultura*. He had a copy made of the Catullus manuscript in Verona (Petrarch had done it earlier), and he also possessed a Tibullus manuscript (Ambros. R 26 sup.). Salutati did not plan to found a library, but the purchase of his books by Giovanni de' Medici had the same effect.

Petrarch, Boccaccio, Niccoli, and Salutati placed much heavier emphasis on Latin than on Greek literature; but when Antonio Corbinelli (ca. 1370 to 1375–1425) left his collection to the Abbey of Santa Maria in Florence, it included 194 Latin and 79 Greek manuscripts, with 105 Latin and 65 Greek authors.^[23] Many of the latter were not known by the humanists of the time, and there were basic things such as an eleventh-century Thucydides, a manuscript of Sophocles and Euripides (now Cod. Laur. C.S.71), and an *Odyssey* (Cod. Laur. C.S.52).

The most famous of all manuscript collectors of the Renaissance was Poggio, prototype of the book hunter down to the age of Lyman Copeland Draper and Herbert Hoover.^[24] Salutati took Poggio into his service when the latter was barely 20 years old and introduced him to his circle, which included Niccoli. In 1403, Salutati arranged for Poggio to secure a position in the Roman Curia, where he was able to intensify his work in copying manuscripts. His great opportunity came when he went to the Council of Constance as a secretary (1414–1418), even though he lost his job when the first John XXIII lost his. He probably spent much of his time poking around monasteries looking for manuscripts, and he was as shocked by the condition of their collections as Boccaccio was by the situation at Monte Cassino. His most significant discovery was the first known complete text of Quintilian's *Institutio oratoria*. Subsequently, he found other texts, lost up to that time, in monastic libraries of Switzerland, Germany,

and France: notably three and a half books on Valerius Flaccus's *Argonautica*, Asconius Pedanius's commentary of five speeches of Cicero, Lucretius, Silius Italicus, Ammianus Marcellinus, Tacitus, Plautus, Columella, Tertullian, and others. Poggio collected more for others than for himself, since only 95 manuscripts appeared in the inventory taken after his death. His sons and nephew inherited them, but today there are only 5 in the Laurentian, 1 in the Vatican, and 1 in the Riccardiana. But Poggio's service to scholarship in locating, copying, and preserving classical manuscripts will be remembered long after schoolboys stop snickering over his amusing but naughty *Facetiae*.

The concentration of early humanists in Florence and presence of the wealthy and influential family of Medici^[25–30] were decisive elements in making Florence a major cultural center with incomparable art collections and libraries. Cosimo the Elder (1389–1464) established a firm position and a fortune for his family after he became the acknowledged head of the Florentine state in 1434. He established a Platonic academy headed by Marsilio Ficino,^[31] but directly pertinent here is that Niccolò dei Niccoli was his adviser in matters relating to books.^[32] Niccoli collected some 800 volumes, which he wanted to be available to scholars in the Camaldolese monastery of Santa Maria degli Angioli in Florence; but, on account of his debts, he changed this decision shortly before his death and left the disposition of his collection to a committee of 16 fellow humanists. Happily, Cosimo assumed responsibility for these liabilities and acquired 200 manuscripts for his personal collection (*la Medicea privata*); he also placed some 400 in the Dominican monastery of San Marco in 1441 in the handsome hall designed by Michelozzo and still basically intact, the first public library in Italy (*la Medicea pubblica*). The librarian, Giuliano Lapaccini, was allowed to draw on the Medici bank for new acquisitions.

Cosimo also rehabilitated the library of the Abbey of Fiesole (the Badia) and provided it with a corps of copyists under the supervision of Vespasiano da Bisticci (1421–1498), who produced some 200 manuscripts in less than 2 years. Along with the collection placed in San Marco, it is the oldest part of the modern Medicea-Laurenziana. The *Medicea privata* was housed in San Lorenzo and was rather modest until Cosimo's grandson, Lorenzo il Magnifico (1449–1492)^[29,33,34] assumed leadership of the family and of Florence in 1469. Especially constructive was his concern for the acquisition of Greek manuscripts and the effective support of his agent, Andreas Janos Laskaris (ca. 1445–1535), in the Levant.^[35] The library was used by such humanists as Politian, Pico della Mirandola, and Marsilio Ficino. From the expulsion of the Medici in 1494, the library was subject to many vicissitudes (and losses), taken to Rome by Lorenzo's youngest son (Leo X after 1513), and finally returned to Florence by Clement VII (Giulio de' Medici) in 1532.

Clement had commissioned Michelangelo in 1525 to design and construct a library building in the upper cloisters of the basilica of San Lorenzo, but it was not opened until 1571, seven years after Michelangelo's death. The magnificent structure is recognized generally as the finest of all Renaissance library buildings.^c The collection in San Marco (the Marciana) was combined with the Laurenziana in 1808 when monastic property was secularized. The Medicea-Laurenziana has survived wars and political changes, but of its subsequent history, we may note only the acquisition of 1,903 Ashburnham manuscripts in 1885.

When Petrarch left Milan on account of the plague in 1362, he went to Venice, where he gave part of his collection to San Marco in return for personal housing in the Palazzo di Due Torri; but, as we have noted, it did not develop into the public library for scholars that Petrarch probably envisioned. It remained for Basilios Bessarion (1395–1472) of Trebizond—bishop of Nicea and later a Roman cardinal (1439) in the movement for reconciliation—to establish a scholarly library in Venice.^[4] In Italy, with the authority of a cardinal, he collected and copied zealously, and, after the fall of Constantinople (1453), he made a special effort to protect remnants of Greek culture by acquiring manuscripts. His young associate, Niccolò Perotti, who traveled as far as Trebizond, was particularly successful.^[37] Further, his connections with Giovanni Aurispa and Francesco Filelfo, two prominent humanists who had been in Constantinople and acquired manuscripts there, must have been productive.^[38–40] In 1423, Aurispa brought back 238 volumes of Greek classics, including the basic collective volume with the plays of Aeschylus and Sophocles and the *Argonautica* of Apollonius Rhodius.

On May 31, 1468, Bessarion presented his library of 482 Greek and 264 Latin manuscripts of the Republic of Venice.^[4,41] In the humanistic tradition, he expressed, in the document of transmission, his concept of books as the best companions of the scholar. The collection was originally destined for the Benedictine monastery of San Giorgio Maggiore, but San Marco was substituted on May 14, 1468. The library was not adequately housed, and, consequently it was not used to full advantage in the beginning. Finally, in the period 1536–1553, Jacopo Sansovino constructed the magnificent quarters for the library long admired as one of the great architectural achievements of Renaissance Italy.^[42,43] Over the last five centuries, the library has had various homes and made important acquisitions,^[44] but most significant are the tradition of Bessarion and his contributions to the preservation of ancient Greek culture.

Outside of Florence and Venice, there were other col-

lections in princely residences. The Visconti and the Sforza had an impressive library in Pavia, in which 988 manuscripts were recorded in 1426,^[45,46] when the Medici and Niccoli had no comparable collections. But, unlike the Medici, the Visconti and the Sforza and their courtiers had no passion for learning comparable to that of the Medici. Florence and, somewhat later, Venice had stature and influence in Renaissance Italy that grew from men who knew how to use books as well as how to collect them.

In Ferrara, the house of Este owned a library that had origins at least in the fourteenth century.^[47–49] A catalog of 1436 recorded 279 manuscripts, mostly Latin but with some Italian and French, and, in 1495, there was a record of 512 manuscripts, with only 2 Greek titles. After Clement VIII claimed Ferrara as a papal fief in 1597, Duke Caesar took the library to Modena in 1598, where it survives today in association with the university (founded 1772). There are remarkable illuminations, bindings,^[50] and vernacular works (Dante, Tasso, Provençal, among others), in all some 9,000 manuscripts in addition to important printed works acquired during the librarianships of Muratori, Tiraboschi, and other competent bookmen.

The Aragonese kings of Naples were diligent bibliophiles and patrons of scholarship, in particular Alfonso V, who assumed power in 1435. He was not only deeply concerned for the development of his library but also entertained such brilliant personalities as Lorenzo Valla.^[51–54] His son, Ferdinand, had less personal interest but continued to add to the collection, particularly with confiscated collections, until his death in 1494. A decade later Naples became a viceroyalty of the Spanish crown, and the noble library was broken up, part going to France and another part to Valladolid. Much of both portions survives.

Perhaps most famous of all the libraries in the smaller residences was that of Federigo da Montefeltro (1410 or 1411–1482), duke of Urbino. Primarily a politician and an effective condottieri chieftan, Federigo nevertheless made strong and successful efforts to furnish his seat with books and works of art. He was not well informed about literature, but he was wise enough to entrust Vespasiano da Bisticci with his buying. He kept a corps of some 30–40 copyists busy in Urbino. An inventory taken after Federigo's death recorded 1,120 volumes.^[55–58] In 1658, Alexander VII bought the collection and turned over the manuscripts (1,767 Latin and Italian, 165 Greek, and 128 Oriental) to the Vatican Library, but he gave the printed books to the library he had recently established for the University of Rome (henceforth called the "Biblioteca Alessandrina").

The Gonzaga family assumed power in Mantua in 1328. During the next century, Gianfranco and Lodovico III were personally concerned about the development of their book collections. In 1407, there were some 300 volumes, including some important Greek manuscripts.^[59]

^cThe libraries and library rooms of the Renaissance in Venice (the Marciana), Siena (in the cathedral), Urbino (in the castle), and elsewhere are noteworthy more for their architectural significance than for any advances in coordinating physical facilities with readers' needs. See von Stegmann.^[36]

THE VATICAN LIBRARY

The Vatican Library was destined to be the most important of all Renaissance libraries and to hold a leading position through the centuries.^[60] From very early periods there had been archives in the Holy See, and there were major collections in the fourteenth century at Avignon, now partially surviving in the Bibliothèque Nationale in Paris and in the Borghese Collection, which finally came into the possession of the Holy See in 1902. The real founder of the modern Vatican Library was Tommaso Parentucelli (1397–1455), who held the pontificate as Nicholas V for the last eight years of his life.^[61] As a young man, he established a respected position for himself among the Florentine humanists and was an eager collector. Bisticci recorded him as a bibliophile whose appetite for books excelled his means.^[62] When Cosimo was developing the library of San Marco, he entrusted Parentucelli with the chore of drawing up a list of desiderata.^[63]

The modest collection of some 350 manuscripts that Nicholas inherited from his predecessor, Eugene IV, was increased by every possible means through agents in Constantinople and book centers in Italy. He accepted only the best copies in fine bindings. His librarian, Giovanni Tortelli, a competent humanist in his own right, did much to promote Nicholas's objective to make the papal library the world's greatest scholarly collection. In 1455, there were some 1,200 important manuscripts, of which about 800 were in Latin. At Nicholas's death it was the largest library of its time.

Calixtus III (1455–1458) was not a bibliophile and scholar of the same stamp, and it was only in the papacy of Sixtus IV (1471–1484), of the della Rovere family, that the library began to thrive again. In 1481, there is a record of 3,499 volumes. Sixtus's first librarian was Giovanni Andrea dei Bussi,^[64,65] succeeded at his death in 1475 by another distinguished humanist, Bartolomeo Platina. In the same year, a budget was provided for the library, and it was increased in 1477. Adequate housing was provided in handsomely decorated quarters, executed by Domenico, David Ghirlandaio, and Melozzo da Forlì. The standards of service in the Vatican Library were superior for the age.

Two Medici popes whom we have already encountered, Leo X and Clement VII, were active patrons of the library. Under Paul III, a new catalog of manuscripts was prepared by Cardinals Marcello Cervini and Jacopo Sadoletto. During the sack of Rome by imperial forces in 1527, the library, now with over 4,000 manuscripts, was probably saved because Philibert of Orange had headquarters in the papal palace, a situation that probably made it immune to looting. It cannot be overlooked that the Vatican itself was the beneficiary of two of the greatest loots of libraries of all time; first, when Tilly

captured Heidelberg in 1622 and Duke Maximilian of Bavaria gave the great collection of the Palatina to Gregory XV; and second, when the apostate queen of Sweden, Christina, took to Rome the handsome collection made up largely of the spoils from her father's campaigns in Poland and the Germanies. The latter was bought by Alexander VII in 1690. The subsequent history of the Vatican Library and some of its great acquisitions belongs to the world history of scholarship, but the policies of Nicholas V have had an abiding influence.

FRANCE

It is ironical that France benefited enormously from the productive activities of Italian collectors and scholars, and yet there were few counterparts of the Italian Renaissance bibliophiles. The remnants of some of the great princely collections such as those in Pavia and Naples found a home in Paris, and rulers of the land promoted the Bibliothèque du Roi. While France produced a collector of the stature of Jean Grolier de Servin (1479–1565), private book collecting in France did not reach the proportions it had attained in Italy in the quattrocento until the age of Richelieu.

There had been a royal library in the Louvre, but as the Hundred Years' War waned, about 1430, a new collection began to take shape in Blois.^d Here the collections brought from Naples by Charles VIII and from Pavia by Louis XII found a home. The first French monarch to perform bibliologically in the style of the Medici was Francis I (1494–1547). He founded a library in Fontainebleau,^[70–73] which included the family collection of his own house (Angoulême), and, in 1544, he combined the Bibliothèque du Roi in Blois with it. After Laskaris acquired important Greek manuscripts for Lorenzo il Magnifico, he rendered the same service to Francis. Francis invested Guillaume Budé (1467–1540) with the office of *maître de librairie*, and this great humanist was lifelong adviser to the king.^[74] Although Francis preferred the manuscript to the printed book, he initiated legal deposit when, in 1536, he gave the librarian at Blois, Mellin de Saint-Gelais, the right to claim a copy of every book printed in France.^[75] Henri II (1547–1559) was an aficionado of fine bindings (as was Francis), and his monograms were an *H* combined with a *D* (his mistress, Diane de Poitiers; 1499–1566) or a *C* (his wife, Catherine de Médicis; 1519–1589).

Catherine was completely imbued with the bibliophilic tradition of her family.^[76] She had a library of some 4,000–5,000 ancient and modern texts in the

^dOf the extensive literature on the origins and history of the Bibliothèque Nationale, see Vallée^[66]–Serrurier.^[69]

Château of Saint Maur, supervised by her confessor, Benciveni, abbé de Bellebranche. It was the collection of a great *femme bibliophile* as well as of an avid reader. Her most noteworthy acquisition was the collection of some 800 manuscripts held by Marshal Pietro Strozzi after he fell at Thionville in 1558. She claimed it as Medici property. After her death, her creditors claimed the Strozzi collection, but it was saved by J.-A. de Thou for only 5,400 écus put up by Henri IV, and most of the collection is in the Bibliothèque Nationale today. The beautiful Diane's collection remained in the Château d'Anet until it was auctioned in 1724 after the death of Anna of Bavaria, who had inherited the castle in 1718.^[6] J.B. Guyon de Sardière bought most of the books, and they ultimately went with his collection to the Duc de La Vallière.^c

EASTERN EUROPE, ENGLAND, AND SPAIN

In the Germanies, the late arrival of humanism was to coincide with the early proliferation of printing and, later, with the Reformation, and to lend a peculiarly national character to the development of libraries and of private and princely collections. Elsewhere, the Renaissance collector appeared sporadically although occasionally in brilliant instances. Most famous was the great collection of King Matthias Corvinus (Hunyadi; 1458–1490) of Hungary.^[78–82] His chancellor, John Vitéz, had studied in Italy, knew the humanists of his day, and was a zealous collector of manuscripts; and his nephew, John Pannonius, followed in his steps. The Hunyadi had had relations with the Visconti and the Sforza, and, in 1476, Matthias married Beatrice of Aragon, daughter of King Ferdinand of Naples. With the help of Bisticci and others, he put together a library in Buda that any Italian prince might have envied. His preference was for handsomely decorated manuscripts from Italian artists, and he was not greatly concerned with the importance of texts. The fame of the Corviniana created exaggerated rumors about its quantity, but there may well have been up to 3,000 titles. His early death, Beatrice's return to Italy, and the indifference of Matthias's successors hastened the dispersion of the collection. After the crushing defeat of the Hungarians at Mohács in 1526, the Turks took what had survived (finally restored in part to the University of Budapest by the Osmanli sultan in 1877). There are other remnants all over the Western Hemisphere.^[83]

Hungary's northern neighbor, Poland, had a major intellectual center in Cracow, where the university had been founded in 1364 and was to acquire distinction, particularly in mathematics and astronomy, culminating in the work of Italian-trained Copernicus a century and a half

later. Gregory Sanok, a *magister* at Cracow, was a zealous humanist and book collector, and the Jagiellonian University owes much to him.^[84]

Humanism found its way to England by the end of the fifteenth century with scholars of the stature of William Grocyn and Thomas Linacre, but neither they nor others were collectors in the tradition of the Italians. Thomas Wotton (1521–1587), a sort of an English Grolier who inscribed his Italianate bindings “Thomas Wottoni et amicorum,” was the closest to a Renaissance collector that England had.^[85] Sir William Pickering (1516–1575) had similar tastes. His daughter married Sir Edward Wotton, Thomas's son. The combined library came to the Stanhope (Chesterfield) family, and the collection survived until 1920 when it was sold at Sotheby's.

Spain had a distinguished collector in the son of the admiral, Don Fernando Colón (1488–1539), who assembled an important library of some 12,000 volumes and deposited it in the Dominican monastery of San Pablo in Seville, but it was neglected and plundered.^[86] The library of San Lorenzo del Escorial was a commitment by Philip II after the battle of Saint Quentin in 1557, established formally in 1565.^[87] Both contained rich collections on Renaissance culture from the beginning, but neither were collected or administered in the same spirit, or for the same purpose as were the libraries of the Medici or of the Holy See of Nicholas V.

THE GERMANIES

Humanism first touched German-speaking territories when Cola di Rienzi, friend and confidant of Petrarch, pleaded with Charles IV in Prague for regeneration of the church. Petrarch himself corresponded with the imperial court. But humanism came north slowly. In 1417 and 1418, Poggio was actively engaged in his constructive carpetbagging in German-speaking areas. Poggio rescued many a basic manuscript; but another brilliant contemporary, Enea Silvio Piccolomini (1405–1464), Pius II after 1458, was the most effective representative of humanism north of the Alps when he served as secretary in the chancellery of Friedrich III.^[88] Thus, in the University of Vienna, and later in other institutions, interest in classical studies began to expand slowly. There is only slight evidence of the acquisition of classical manuscripts by the existing collections in universities, city halls, and monasteries. Most important were private collectors whose inventories reflected the penetration of the new learning. Nikolaus von Cues, Albrecht von Eyb, Hartmann Schedel, and the Fuggers were among the prominent early collectors inspired by Italian humanism.

Nikolaus von Cues (1401–1464), latinized as Cusa or Cusanus, cardinal after 1448, had become a doctor of both laws in Padua and was influenced not only by

^cFor the subsequent history of the La Vallière and other important collections, mentioned here see Bogeng, Bogeng^[6] and Thompson.^[77]

German mysticism but also by Neoplatonism and humanism.^[18,89–91] He recognized significant classical manuscripts in Fulda and probably took a basic Plautus manuscript (now Vat. Lat. 3870) from there to Rome. He also discovered Tacitus manuscripts and may have been the first German in modern times to know the *Germania*. He read Greek and had the opportunity to collect in Constantinople. A significant fact is that, in 1459, his long-time friend Enea Silvio appointed him papal vicar-general. Cues willed his property, including philosophical apparatus and books, to a hospital in his home town of Bernkastel-Kues on the Mosel, and 314 manuscripts (270 from his own collection) are still there, although much has been removed over the centuries (e.g., more than 30 are now in the British Library).

Albrecht von Eyb (1420–1475), Franconian baron, spent 13 years in the south and was a zealous collector.^[92,93] He translated Plautus, and two of his manuscripts of this author are in Augsburg today. His library, including printed books, went to the Eichstätt Cathedral, but it was dispersed without any accurate record. About 20 pieces have been identified in modern German libraries.

Hermann Schedel (1410–1485) and his cousin Hartmann Schedel (1440–1514) both studied medicine in Padua and brought humanism to their native Nuremberg.^[94,95] Hermann's library was inherited by Hartmann, famous for his *Weltchronik*. The latter had studied Greek, as well as medicine, in Padua. While he owned important manuscripts, he also collected printed books. The catalog shows 632 titles. The collection was sold in 1552 to Hans Jakob Fugger, and it contained some 400 collective manuscript volumes and 700 printed books. It was acquired in 1571 by Duke Albrecht V of Bavaria, the founder of the Munich Hofbibliothek (now Bayerische Staatsbibliothek). About 360 manuscripts belonging to Hartmann Schedel have been identified in the modern collections.

Johann von Dalberg (1455–1503) spent most of his productive life in Heidelberg, where he was chancellor of the university from 1480 to 1497.^[96] He was closely associated with humanists of the stature of Rudolf Agricola, Johannes Reuchlin, and Dietrich von Pleningen, and he also collected a significant library. He bought manuscripts in Italy and, back home, commissioned the Strassburg printer and bookseller Adolf Rusch to buy classical texts at the Frankfurt Fair. His librarian, Johannes Vigilius, professor of law, also bought for him at the fair. After Dalberg fell out with the Palatine elector in 1497, he retired to Worms where he was bishop. Presumably, his collection remained in the episcopal see but was gravely neglected. Fewer than 20 titles from this once great collection can be identified today, mainly in various German libraries.

Maximilian I, emperor from 1493 to 1519, had a library as archduke and acquired a vastly greater treasure of books in the dowry of Marie of Burgundy.^[97,98] He was a romantic (“the last knight”) but may well have listened to

Enea Silvio in Vienna. Certainly, his confidence in Konrad Celtis (1459–1508) indicated his inclination to humanism.^[6] Celtis was entrusted with the custody of part of Maximilian's collection, inherited from his father, Friedrich III, and left in the residence of Wiener Neustadt (the more valuable part was moved to Castle Ambros near Innsbruck). In 1497, Celtis was appointed by Maximilian to the chair of poetry and eloquence at the University of Vienna, and it became an important center of humanistic activity with men such as Celtis, the versatile Joachim von Watt (Vadianus; *infra*), and the historian Johannes Cuspinianus. The latter built a handsome collection that was acquired in 1530 by the Vienna bishop Johannes Faber (died 1541), whose collection of 2,162 items passed to the University Library. The collections in Innsbruck were not always given the best care, but ultimately most of these (with subsequent additions) and the material in Wiener Neustadt found a home in the Austrian National Library.

One of the most spectacular events in Celtis's career was the discovery of a map of Roman military roads, 34 centimeters by 7 meters in length, in Worms. It was to have been edited by Konrad Peutinger (1455–1547), but it disappeared until 1714 when Prince Eugene of Savoy discovered it and later willed it to the Hofbibliothek in Vienna. The *Tabula Peutingeriana* is famous enough,^[99] but the role of Peutinger, an Augsburg patrician, in German humanism is even more important.^[100] Today his collection of over 2,000 works, a good proportion reflecting Peutinger's humanistic interests, has been scattered, with less than 100 items identified (happily, 36 went to the Augsburg Stadtbibliothek in 1810). Peutinger did compile two catalogs, a rich source for our knowledge of humanistic book collecting in Germany.

In Nuremberg, the patrician Willibald Pirckheimer (1470–1550) was the central figure in the humanistic movement.^[6,101,102] After study in Pavia and Padua, he assumed a respected position in his native city. He was a friend not only of Celtis but also of Reuchlin and Erasmus. An indefatigable collector, he boasted, in 1504, in a letter to Celtis, that he owned every Greek book printed in Italy. Pirckheimer's library remained in the family for over a century after his death and was sold to Thomas Howard, earl of Arundel, in 1636. It was donated by Henry Howard to the Royal Society in 1667, and, in 1831, the manuscripts (except the Oriental ones) were sold to the British Museum.

Schlettstadt in Alsatia produced two major humanists, Jakob Wimpheling (1450–1528)^[103,104] and Beatus Rhenanus (1485–1547).^[105] We know almost nothing about Wimpheling's library, although he gave books regularly to the church library there. Today the rich old Stadtbibliothek of Schlettstadt has two manuscripts and three printed books that once belonged to Wimpheling. His literary production is well known, but his interest in

book collecting is equally meaningful. In 1496, he and Johannes Vigilius (supra) visited Johannes Trithemius (or Trithem; 1462–1516), abbot of the Benedictine monastery in Sponheim.^[106–108] Trithemius's collection of over 2,000 works included many Greek works and others of obvious humanistic interest. It was a victim of secularization in 1564, and only about 30 pieces are identifiable in various repositories today. Rhenanus, a competent historian, critic, and philologist, was associated with the great Basel printers Amerbach and Froben (Erasmus's intimate) and had a collection of over 900 volumes, which he willed to his native city. Neglected for centuries, it finally was given a suitable home in 1889.

Ulrich von Hutten (1488–1523), famous for his participation in the second part of the *Epistolae obscurorum vivorum* (1515–1517) in defense of Reuchlin's cause, led too turbulent and itinerant a life to have gathered a substantial library.^[109,110] Yet he did have a collection probably useful at least for reference. It was with his friend Franz von Sickingen on the Ebernburg when the latter fell at the end of the Knight's War in 1523 and was captured and sold in Heidelberg by the imperial forces. Most curious about Hutten's bibliological interests is the rather strong evidence that he stole books from Fulda.^[111,112]

In Münster, the canon Rudolf von Langen (ca. 1438–1519) had traveled in Italy in 1466 and most probably acquired books.^[113] The cathedral library received them as a legacy, but virtually all were destroyed in the Anabaptist disturbances of 1534. More important was a protégé of Langen and a friend of Hutten and Reuchlin, Hermann von dem Busche, or Pasiphilus (1468–1534), best known for his *Vallum humanitatis* (1518). Langen urged him to travel in Italy, and he was later at various German universities, always defending Lutheran principles. He collected a small but choice library, which he willed to the Münster Cathedral; but a friend, Rotger Schmising, himself the master of a library, took the books to protect them from the violence of the Anabaptists. The latter carried out his friend's wishes and willed them to the cathedral upon his death in 1547. Most passed, about 1589, to the Jesuits, whose library became the basis of the University of Münster Library. Some 20 books, mostly Venetian editions of Greek and Roman authors, have been identified as Busche's original property.

The greatest of the German humanists, Johannes Reuchlin (1455–1522), was also one of the most zealous book collectors of his age.^[114–119] He began to collect books as a student in Paris under his famous master, Johannes Heynlin vom Stein,^f and he constantly acquired books during his Italian trips of 1482, 1490, and 1498. He knew Aldus Manutius and corresponded with him about book acquisitions. Latin, Greek, and Hebrew books fell

within the scope of his interest. Active in a troubled era and the central figure of all sorts of political issues and controversies about church policy, Reuchlin left an enduring legacy to subsequent ages in his dedication to seeking historical accuracy through sound texts. When the converted Jew Johann Pfefferkorn proposed the destruction of all books in Hebrew, Reuchlin replied that only books that were antagonistic to Christendom should be removed from the shelves, and that the Jews should be compelled to furnish books for the universities and set up chairs of Hebrew in all of them. Reuchlin was vigorously supported by the humanists, above all in the *Epistolae obscurorum vivorum* (supra; first part most probably largely by Crotus Rubianus and the second most probably largely by Ulrich von Hutten), a satire in purposely bad Latin reinforcing the *Epistolae clarorum vivorum* (1514) issued by Reuchlin's friends. Toward the end of his life, he encountered grave problems about the disposition of his books. The larger part of his collection went first to the church in Pforzheim and ultimately to the Landesbibliothek in Karlsruhe, but there are also a few in other major libraries of western Europe.^[5,121,122]

Desiderius Erasmus (1466 or 1469–1536) was the most influential of the humanists, north or south; and it was inevitable that his prestige, his intimacy with Aldus Manutius, his position as an authoritative consultant of Johannes Froben, and his stature in the world of learning resulted in a major private collection.^g In the years 1524–1526, a young Polish nobleman, Johannes Laski, lived with Erasmus in Basel. The latter, feeling the need of funds to live in the style he desired, sold his books to Laski on the condition that he keep them and have the use of them in his lifetime. At the time of Erasmus's death, there was a sketchy checklist of 413 titles. The new owner, who had held a high position in the church in his native Poland, forsook his old faith in 1538 and dedicated himself to promotion of Protestantism in North Germany, Denmark, the Low Countries, and England. He sold the books piecemeal, and today only 15 can be identified, scattered from England to Cracow.

REFORMATION LIBRARIES

A major emphasis of the Reformation leaders—above all, of Luther himself and of Philipp Melanchthon (1497–1560), the “Preceptor Germaniae” and great-nephew of Reuchlin—was on the utility of books and libraries for the new faith and for popular culture in general.^[5,129,130] An immediate result was the incorporation of policies for church libraries in the organizational documents of individual congregations. The oldest (1528) and one of the most important policy statements is that of Johannes

^fHeynlin died in the Carthusian monastery in Basel and left his collection to this institution. The books have been in the University of Basel Library since the Reformation. See Heusler.^[120]

^gOf the voluminous Erasmus literature, one might start with Bömer^[5] and Smith^[123]—ter Horst.^[128]

Bugenhagen for the church of Saint Andreas in Braunschweig, but the collection of 336 volumes willed to the church in 1495 by Gerwin von Hameln was reported in 1587 to have been sadly neglected.^[131,132] Bugenhagen drew up similar policy statements for churches in Hamburg, Lübeck, and his native Pommerania, where he visited all libraries and archives in the province on the order of Duke Bogislaus X. We know something about at least nine newly founded church libraries at Melancthon's death in 1560.

The libraries depended on gifts and secularization of Roman establishments for their growth. Just as in England, they would have been vastly richer had not biblioclasm accompanied the dissolution of monasteries. A ducal order in Pommerania in 1552 directed that unsuitable (i.e., "popish") books from monasteries be sold for scrap. More serious was the violence in the Peasants' War of 1524–1526.^[133] In Thuringia alone, 70 monasteries and their contents were destroyed, and reports from other places are staggering. Libraries of secular nobility and high church officials also suffered.

Luther's insistence on the development of education resulted in a number of new schools with libraries. Some 40 such institutions, which had libraries, survived into the twentieth century, and one might guess that in the sixteenth century, there were probably as many more for which we have no firm evidence of the presence of libraries. Even more significant was the effect of the Reformation on the universities, both the older ones and those founded at this time (Marburg, Königsberg, and Jena).

In Leipzig, there was no general university library, only faculty collections, until 1543.^[134] Thanks to the secularization of three monasteries in Leipzig and seven others in Saxony, the university library was enriched by about 1,500 manuscripts and 4,000 printed books. The real founder of the library, Kaspar Börner, left his collection to it upon his death in 1547. Melancthon's friend Joachim Camerarius was librarian until his death in 1574. After 1550, the library was open for two hours every week.

In Basel, the puny university library received a major impulse forward in 1535 when the rector, Bonifatius Amerbach, persuaded all shops in this major center of printing to deliver one copy of each book to the university.^[120] In 1559, the university acquired the holdings of the Dominican monastery and of the cathedral. The catalog of Heinrich Pantaleon, the librarian, shows a *bibliotheca antiqua* (to 1583: 150 manuscripts and 243 printed books) and *bibliotheca nova* (810 volumes, excluding 190 works donated by Professor Martin Borrhus in 1564).

In Tübingen, there was provision for a library, in 1477, when the university was founded.^[135,136] There were faculty libraries and also a Bibliotheca Publica as early as 1501, but the latter was most likely destroyed with the burning of the *Sapienzhaus*. It was just about the same

time that the Reformation reached Tübingen, and a new general library was put together and housed in a recently constructed university building, where it remained until 1819.

Elector Frederick ("the Wise"; 1486–1525) founded the University of Wittenberg in 1502, where humanism was welcomed from the beginning; and, in less than two decades, the Reformation was to find there an intellectual stronghold.^[137–139] The first sure evidence of the founding of a library at Wittenberg is from December 1512 when the elector wrote to Aldus Manutius asking him for a list of available titles, most probably on the advice of his secretary, the humanist and reformer Georg Spalatin (born Burckhardt; 1484–1545). A catalog of Spalatin's personal library in the Gotha Landesbibliothek also contains invoices for other books purchased on behalf of the elector. Under Elector John Frederick ("the Magnanimous"; 1532–1547), Spalatin again became librarian and had an annual appropriation of 100 guilders after 1534. We know a good deal about Spalatin's administration of the Electoral Library,^[140] and we know that the library served the faculty and that Luther and Melancthon used it.^[141] Some pieces from Luther's personal library can be identified,^[142] but of Melancthon's collection, we know only a volume in the Halle University Library and perhaps one in the Vatican.^[143]

Margrave Phillip I ("the Generous"; 1509–1567) of Hesse founded the University of Marburg in 1527, and its library was established on the basis of secularized monasteries.^[144] About 1532, the library was moved from the castle to the Discalced monastery, but it grew slowly despite a regular appropriation. We know a good deal about the administration of the library. Medieval traditions (e.g., chaining of books in the 1564 regulations) persisted. The professor of logic, Heidericus Theophilus Leonicerus, supervised the library from 1564 to 1581, and he prepared a catalog (not preserved) in 1578. The collections were increased substantially in 1605 with about 650 volumes from the collection of Count Christoph Ernest zu Diez, but the library did not thrive for two centuries, what with the division of holdings with Giessen in 1650. A major impulse forward came in 1748 when Marburg acquired the collection of the lawyer Johann Georg Estor.

Elector John Frederick I of Saxony ("the Magnanimous") was finally defeated in the Schmalkaldic War at Mühlberg in 1547, and the gymnasium founded at Jena in 1548 received his library, the "Electoralis." A decade later, the school became the University of Jena.^[145–147] The "Electoralis" was extraordinarily rich in manuscripts and printed books, altogether about 3,100 pieces, relating to the Reformation, and it remains today one of the major resources for the study of the origin and early development of Lutheranism.

There was a library in the University of Heidelberg soon after its founding in 1386,^[148] but it was the

incomparable Palatina that served the university for three-quarters of a century until it was sent to Rome by Duke Maximilian of Bavaria (supra).^[149-151] It was actually founded by Elector Philipp ("the Honest"; 1476–1508), patron of Chancellor Johann von Dalberg (supra), but it was developed by Ottheinrich (1502–1559; elector 1556–1559). He not only promoted the Reformation vigorously but also had the laudable ambition to develop a library comparable to those of the Italian Renaissance princes. He purchased books from all over Europe, incorporated into his collection that of the famous old monastery at Lorsch, and conveniently forgot to return manuscripts borrowed from the Mainz Cathedral. The library from his seat at Neuburg and the Electoral Library were housed with a collection in the Church of the Holy Spirit, and it is clear from various sources that Ottheinrich meant for the collection to be used by the members of the university along with other books that had been at their disposal. One of the most noteworthy additions came to the library in 1584 upon the death of Ulrich Fugger, the only Protestant in this distinguished Augsburg patrician family. He left his collection to the Palatina in gratitude for the hospitality of Elector Frederick III (1553–1576). As we have noted in connection with the Vatican Library, the catastrophe came in 1622 when Tilly directed the greatest bibliographical loot in history. Except for the partial restoration of 1816, the modern University of Heidelberg Library dates from 1706.

The situation was somewhat similar in Königsberg, where there was a court library (Schlossbibliothek) available to the university and also a university library.^[152,153] The last grand master of the Teutonic Order, Albrecht von Brandenburg, became a Protestant in 1525 and made the old lands of the order a hereditary duchy of Prussia. He soon began to acquire books with Lukas Cranach and his own secretary, Crotus Rubianus (supra), as his agents. After Crotus left Königsberg, a Dutchman, the ex-Carthusian Felix König, became Albrecht's librarian and conducted his office vigorously,^[154] as did Heinrich Zell, librarian from 1557 to 1564. Over the years, the library was reasonably well cataloged and available to scholars. When Albrecht founded the university in 1544 he provided it with its own library, and ultimately, in 1827, the Schlossbibliothek and the University Library were combined as the Königliche (Staats-) und Universitätsbibliothek, a great library, which disappeared in 1945. Albrecht had his private collection, famous for the 20 volumes of his "Silver Library" books bound in finely wrought silver covers, most executed in Königsberg, as were the more conventional bindings.^[155,156]

There were princely libraries elsewhere in Germany (notably in Dresden, Wolfenbüttel, Dessau, and Kassel) that were significant into our own times, but these generally pushed beyond the immediate objectives of Renaissance and Reformation. In Switzerland, the university libraries in Bern, Lausanne, and Geneva (originally based in part on Calvin's collection) have roots in the

Reformation. A particularly noteworthy monument of the period is the collection of Joachim von Watt, or Vadianus (1483 or 1484–1551; supra), humanist and reformer of Saint Gall, now in the local municipal library (Stadtbibliothek).^[157-159]

CONCLUSION

Perhaps with the founding of the University of Leiden in 1575, Renaissance, humanism, and Reformation had run their destined courses, and libraries began to serve scholars in a gradually evolving tradition of analytical scholarship with meticulous attention to detail. The resources had been provided by the great collectors of the previous two centuries; the methods and standards, by scholars with the insight and discipline of Erasmus and Reuchlin.

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Resource Description Framework (RDF)

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Abstract

The Resource Description Framework (RDF) is the standard knowledge representation language for the Semantic Web, an evolution of the World Wide Web that aims to provide a well-founded infrastructure for publishing, sharing and querying structured data. This entry provides an introduction to RDF and its related vocabulary definition language RDF Schema, and explains its relationship with the OWL Web Ontology Language. Finally, it provides an overview of the historical development of RDF and related languages for Web metadata.

INTRODUCTION

The Resource Description Framework,^[1] or RDF, is a knowledge representation language for the Semantic Web,^[2,3] and is used to express knowledge about things both on and off the Web; RDF can be used to write metadata about web pages and to describe real-world objects with equal facility. RDF is a key language in the technical architecture of the Semantic Web, being both a format for describing instance data, and the foundation for the vocabulary definition languages RDF Schema^[4] and OWL.^[5]

The Semantic Web is a development of the World Wide Web that aims to provide an infrastructure for machine-understandable information on the Web. By expressing information in a form that makes the meaning, or semantics, accessible to machines, the goal of the Semantic Web is to create a next-generation Web in which information can be mediated by software agents on behalf of and without intervention from their users. At present, information on the World Wide Web is predominantly textual and requires human understanding to interpret it; the meaning of such natural language information must be made explicit if a machine is to be able to make sense of it. In artificial intelligence, the long-standing discipline of knowledge representation has developed a variety of approaches for expressing information to facilitate reasoning; these knowledge representation languages are of varying degrees of complexity and expressivity, but they share the common feature that they encode information as structures that can be formally interpreted to give some sense of their meaning.

By itself, RDF provides a domain-neutral framework for information interchange that must be augmented with terms to meet the requirements of a specific application domain. For example, a bibliographic application needs to be able to talk about works and authors, while an

e-commerce application needs to be able to talk about orders and prices. This orientation to a particular application domain or domains is accomplished by means of one or more domain vocabularies, or *ontologies*.^[6] In Computer Science, an ontology is a formal description of a domain of knowledge. Gruber^[7] defines an ontology as “a specification of a conceptualization”; in other words, a formal account of an abstract model of some application domain which includes, but is not limited to, the classes of entity that exist within the domain, and the relations that link those entities.

RDF has two accompanying ontology languages, RDF Schema^[4] and the Web Ontology Language OWL.^[5] RDF Schema is the simpler of the two, and provides a small set of modeling constructs for defining classes, properties and certain global constraints on those properties. OWL is more expressive (and correspondingly more complex to reason with), and provides a larger set of modeling constructs that allows an ontology designer to more richly specify classes in terms of the necessary and sufficient conditions for membership of those classes. An in-depth treatment of OWL is beyond the scope of this entry; we refer the reader to^[8,9] for further information.

In addition to these languages for defining RDF vocabularies, the World Wide Web Consortium (W3C) has also published an SQL-like query language for interrogating RDF graphs, known as the SPARQL Protocol and RDF Query Language^[10,11] (or more simply as SPARQL).

THE TRIPLE MODEL

The information presented on the Semantic Web can be viewed as a directed, labeled graph in which the nodes stand for things and values, and the edges (with their labels) are the properties that relate nodes to one other.

The fundamental unit of knowledge representation is the triple, a directed edge that represents a binary relationship between two nodes. Customarily, the components of this triple are referred to as the subject, the predicate and the object: the subject is the node that the directed edge leaves, the object is the node that it enters, and the predicate is the type of the edge. Alternatively, a triple could be considered to be a statement that a particular entity (the subject) has a property (the predicate) with a particular value (the object); this corresponds closely to object-oriented^[12] or frame-based^[13] models of knowledge representation.

The nodes in an RDF graph denote resources, which are things in the domain of discourse. Nodes may be Uniform Resource Identifiers (URIs),^[14] literals, or blank nodes. URIs are used to denote things with identity, such as web pages, organizations, people, or books. Literals are values such as character strings, numbers or dates, which do not have identity; a (plain) literal is considered to denote itself, so two literals with the same value are treated as if they were the same literal. Finally, blank nodes are used to indicate the existence of a thing, without saying anything about the name of that thing.

With the careful use of URIs, RDF allows machines to unambiguously identify entities and vocabulary terms; each URI identifies a single thing, even though it is expected that there may be multiple URIs that identify the same thing (effectively synonyms for the thing). Adapting an example from the RDF Primer,^[15] we can represent the statement (that a particular web page was created by John Smith) as a triple with:

- a subject, <http://www.example.org/index.html>
- a predicate, <http://purl.org/dc/terms/creator>
- and an object, <http://www.example.org/staffid/85740>

In this example, we refer to the web page using its URI: <http://www.example.org/index.html>. We also use URIs to refer to John Smith (<http://www.example.org/staffid/85740>), and to the creator relation (<http://purl.org/dc/terms/creator>), taken from the Dublin Core vocabulary.^[16] Presented graphically, this statement forms a graph containing two nodes with a single directed edge between them, as shown in Fig. 1.

This triple can also be written as:

```
<http://www.example.org/index.html> <http://purl.org/dc/terms/creator> <http://www.example.org/staffid/85740>
```

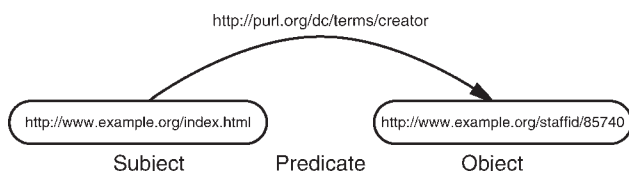


Fig. 1 An RDF graph containing a single triple.

This example uses a syntax based on the Notation 3 syntax for RDF^[17] (discussed in more depth below), in which terms in angle brackets denote resources identified by URIs. In the order written, the three terms are the subject, predicate and object of the triple, and the completed triple is followed by a period.

COMPARING XML AND RDF

The relationship between RDF and the eXtensible Markup Language (XML)^[18] warrants further explanation. Both are used to represent structured information on the Web, and XML is used as the standard syntax for RDF, but the two languages are distinct and have different characteristics.

The most fundamental difference between XML and RDF is in the way in which they structure information. As described above, RDF structures information as a labeled, directed graph, whereas XML is limited to tree structures, which has consequences in the way that data from different sources can be merged. Merging two RDF files can be accomplished by taking the union of the underlying graphs; this operation does not require any knowledge of the vocabularies (schemas) that are used in these graphs. In contrast, merging two XML files that use different schemas is a more difficult operation, because the resulting file will not validate using either schema, but rather a new schema that combines the two original schemas must be used instead.

An XML document can be parsed to give an unambiguous structure, but this structure has no innate meaning; the meanings of XML schemas must be agreed between the relevant parties on a case-by-case basis. RDF differs from XML in that the triples that are created when an RDF file is parsed have a well-defined semantics, which facilitates further information exchange by providing a basic set of rules for manipulating the information while preserving its knowledge content. Together with the ease of merging RDF files, these formal semantics mean that RDF has considerable advantages for information interchange over XML, and can be used to facilitate interoperability between heterogeneous systems.

Finally, RDF uses URIs to refer to objects in the domain of discourse. This has been used to promote what is known as the linked data model of publishing.^[19,20] Given that the resources in an RDF graph may be represented by URIs, the aim of the linked data model is that it should be possible to dereference those URIs and by doing so retrieve a description of the resources that they represent. In effect, linked data results from the hypertextual foundations of the World Wide Web (and so of the Semantic Web); users of the Web follow links to obtain human-readable information in the form of web pages, so Semantic Web agents should be able to do likewise. Linked data may be implemented using several different

Web technologies; a general overview of the more common approaches is given in Sauermann,^[21] and a summary of the best practices for publishing ontologies as linked data is given in Berrueta.^[22]

FEATURE SUMMARY

RDF defines the triple model of data and a standard syntax for expressing those triples (RDF/XML), but does not constrain the vocabulary used in those triples: the URIs denoting categories and relations that we might wish to use in our descriptions. RDF Schema defines a basic vocabulary for use with RDF that lets users represent and define vocabularies that are specific to their problem domains. This basic vocabulary supports the following primitive modeling constructs:

- Named classes and explicit hierarchies of classes
- Named properties and explicit hierarchies of properties
- Global ranges and domains of properties
- A reification vocabulary for using triples to describe other triples
- Containers and collections, two methods for representing information about groups of resources
- A set of ancillary properties for providing human-readable documentation and links to further information

All of the vocabulary terms defined in RDF Schema are assigned URIs from one of two namespaces, `rdf` and `rdfs` (for largely historical reasons that originate with the first version of RDF, the terms defined in RDF Schema are divided across two different namespaces). For clarity, we will write `rdf:XXX` as a shorthand for `http://www.w3.org/1999/02/22-rdf-syntax-ns#XXX`, and `rdfs:YYY` as a shorthand for `http://www.w3.org/2000/01/rdf-schema#YYY`. This abbreviation style, whereby a lengthy URI is reduced to a short string consisting of a namespace abbreviation (representing a URI prefix), a separating colon, and a name defined in that namespace (which is to be appended to the URI prefix), is known as a Qualified Name or QName.^[23,24]

Classes

RDF Schema defines the property `rdf:type` that allows a user to indicate that a resource is an instance of a particular class. For example, if we wished to indicate that John Smith (denoted by the URI `http://www.example.org/staffid/85740`) was an instance of the `Person` class defined in the FOAF (Friend of a Friend) ontology,^[25] we would write the triple:

```
<http://www.example.org/staffid/85740>    rdf:type
<http://xmlns.com/foaf/0.1/Person>.
```

In this example, `rdf:type` is a QName which represents the “type” from the `rdf` namespace; the QName is expanded

to the URI `http://www.w3.org/1999/02/22-rdf-syntax-ns#type` as described above. We can define a resource to be a class by declaring it to have an `rdf:type` of `rdfs:Class`. For example, to define a class of documents (represented by the URI `http://example.org/ontology#Document`), we would write:

```
<http://example.org/ontology#Document> rdf:type rdfs:
Class.
```

These classes may be arranged into an explicit hierarchy by stating that a class is a subclass of another class, using the `rdfs:subClassOf` property:

```
<http://example.org/ontology#Newspaper>  rdfs:sub-
ClassOf <http://example.org/ontology#Document>.
```

In this example, we have stated that the class `Newspaper` is a subclass of the class `Document`, which is equivalent to saying that every newspaper is also a document (or to put it a third way, that the set of newspapers is a subset of the set of documents).

Properties

In the same way that classes are defined in RDF Schema, properties may be defined by declaring a resource to be of `rdf:type`, `rdf:Property`. Properties may be arranged into hierarchies to represent the specialization and generalization of relationships. For example, an “employed by” property might be considered to be a specialization of an “affiliated with” property. A property can be declared to be a specialization of another property by stating that it is `rdfs:subPropertyOf` the other.

```
<http://example.org/ontology#employedBy>  rdfs:sub-
PropertyOf <http://example.org/ontology#affiliatedWith>.
```

Properties can be further described by defining their domain and range using the `rdfs:domain` and `rdfs:range` properties. The domain of a property is the class of objects that it runs from. For example, the “employed by” property might run from a class `Person` (being the class of people). The range of a property is the class of objects that it runs to; the range of “employed by” might be the class of organizations. These constraints on properties permit a reasoner to make inferences about the types of objects that are involved in a relationship.

```
<http://example.org/ontology#employedBy>  rdfs:
domain <http://example.org/ontology#Person>.
```

```
<http://example.org/ontology#employedBy>  rdfs:
range <http://example.org/ontology#Organisation>.
```

Containers and Collections

RDF Schema provides two different mechanisms for defining groups of objects, each with separate properties. The first of these, RDF containers, represents a group of objects with a resource which may be typed to informally indicate the intended semantics of the group; a group of type `rdf:Bag` is unordered, one of type `rdf:Seq` is an ordered sequence, and one of type `rdf:Alt` is a set of

alternatives from which a single member should be selected (in practice, `rdf:Alt` is rarely used). The vocabulary pertaining to containers includes a countably infinite set of special properties (the ordinal container membership properties `rdf:_1`, `rdf:_2` and so on), which indicate both the membership of a resource in the group, and for the ordered `rdf:Seq`, the position of a member within the group.

A sequence of three resources (for example, three email addresses) would be represented as follows:

```
<http://example.org/data#seq1> rdf:type rdf:Seq.
<http://example.org/data#seq1> rdf:_1 <mailto:groucho@example.org>.
<http://example.org/data#seq1> rdf:_2 <mailto:chico@example.org>.
<http://example.org/data#seq1> rdf:_3 <mailto:harpo@example.org>.
```

The container vocabulary has the disadvantage that it produces groups that are open and mutable. There is no way to state that a group is closed, that is that the stated members of a group are the only members; a third party could assert that the above sequence has an extra member by adding the following triple:

```
<http://example.org/data#seq1> rdf:_4 <mailto:karl@example.org>.
```

The collection vocabulary addresses this by supporting the definition of closed groups that can have no further members. A collection is a recursive data structure that defines a group as a resource of type `rdf:List`, which consists of the first object in the group (indicated using the `rdf:first` property), and another `rdf:List` which contains the remainder of the group (indicated using the `rdf:rest` property). This second `rdf:List` contains the second element of the collection, and another `rdf:List` with the remainder of the collection, and so on. This recursion is terminated by the term `rdf:nil`, which represents an empty list. The example above could be represented in the container vocabulary as follows:

```
<http://example.org/data#list1> rdf:type rdf:List.
<http://example.org/data#list1> rdf:first <mailto:groucho@example.org>.
<http://example.org/data#list1> rdf:rest <http://example.org/data#list2>.
<http://example.org/data#list2> rdf:type rdf:List.
<http://example.org/data#list2> rdf:first <mailto:chico@example.org>.
<http://example.org/data#list2> rdf:rest <http://example.org/data#list3>.
<http://example.org/data#list3> rdf:type rdf:List.
<http://example.org/data#list3> rdf:first <mailto:harpo@example.org>.
<http://example.org/data#list3> rdf:rest rdf:nil.
```

As can be seen, an RDF collection requires more triples to represent the same group of objects than does a container, but it has the property that an attempt to tamper with the collection by adding extra members will result in

an ill-formed data structure in which one of the component `rdf:Lists` has more than one `rdf:first` or `rdf:rest` property.

Reification

Reification is a mechanism for treating triples as first-class objects about which other assertions can be made (that is, as resources which can be referred to as the subjects or objects of other triples). The reification vocabulary in RDF Schema introduces the class `rdf:Statement`, which represents triples, and the properties `rdf:subject`, `rdf:predicate` and `rdf:object`, which represent the three components of a triple.

If we were to reify our original example (that a web page was written by John Smith), we would construct a small RDF graph containing four triples: one to represent the type of the reified statement, and one for each of the three components.

```
<http://example.org/data#stmt1> rdf:type rdf:Statement.
<http://example.org/data#stmt1> rdf:subject <http://www.example.org/index.html>.
<http://example.org/data#stmt1> rdf:predicate <http://purl.org/dc/terms/creator>.
<http://example.org/data#stmt1> rdf:object <http://www.example.org/staffid/85740>.
```

In this example, the statement itself is represented by the URI `http://example.org/data#stmt1`; this may be used in other triples to express information about the statement. For example, if John Smith wanted to assert that he was the author of the statement, he could write:

```
<http://example.org/data#stmt1> <http://purl.org/dc/terms/creator> <http://www.example.org/staffid/85740>.
```

The reification vocabulary provides a simple framework that supports the expression of fine-grained (triple level) provenance information about Semantic Web data. However, RDF reification is rarely used in practice, with many RDF practitioners preferring to use named graphs (a set of triples that is identified by a URI) to achieve the same ends, that of making assertions about other assertions.

Ancillary Properties

Finally, RDF Schema contains a number of properties that are not used to define ontology concepts, but to provide human-readable documentation, or to link to related information. The `rdfs:label` property is used to attach a human-readable label to a resource (necessary, given that URIs may be verbose), while `rdfs:comment` is used to add a comment (a natural language definition or rationale, perhaps). The `rdfs:seeAlso` property is used to indicate another resource which contains further information about a given resource; this is specialized by the `rdfs:isDefinedBy` property, which can be used to indicate the Web resource that defines a particular resource (for example, an ontology).

SYNTAX

The standard (normative) syntax for serializing RDF graphs for storage or transmission is RDF/XML.^[24] This syntax is defined by a set of rules for transforming an XML document into an RDF graph;^[18] element names, element contents, attribute names and attribute values are turned into resources, predicates and literals. While this syntax builds on the availability of high-quality XML tools, it tends to verbose serializations; in situations where RDF is to be read (and written) by people rather than machines, other non-XML syntaxes are preferred by many practitioners.

The best known of these alternative syntaxes is Notation 3 (N3),^[17] a non-XML format that produces easy-to-understand serializations that can be quickly written by hand (or reproduced compactly in printed materials). Although it is well-known, N3 is a work in progress and subject to change, and has ambitious design goals; the expressivity of N3 goes beyond that of both RDF and OWL, so an arbitrary document written in N3 might contain constructs that cannot be translated into RDF/XML. For this reason, a number of N3 variants have evolved. N-Triples^[26] is the simplest of these, and represents triples with no abbreviations such as QNames. Turtle^[27] includes the QName-based namespace and abbreviation mechanism used by N3, but restricts the expressivity of the language to match that of RDF/XML.

Finally, there are two different approaches to serializing RDF graphs by embedding them within XHTML documents; the intent with both is to expose the structured data in ordinary web pages in such a way that Semantic Web agents can recognize and extract that data for their own use. The first of these, RDFa^[28] defines a convention for expressing triples using the attributes on the elements in an XHTML document. A SW agent, on receiving a document containing RDFa markup, would first parse it as XML to obtain an intermediate representation, such as that provided by the Document Object Model (DOM), then parse this intermediate representation to obtain the encoded triples. GRDDL,^[29] the second technique, provides a method for attaching a transformation to an XML document; this transformation, typically written in the eXtensible Stylesheet Language (XSLT),^[30] can be used to extract selected information from the XML document and turn it into an RDF/XML document which can then be parsed to yield the RDF triples.

All of these RDF syntaxes have the feature that they do not define a canonical way in which an RDF graph can be written to a flat file for storage (a process known as serialization). Because a graph has no beginning or end, and no order to the edges, two implementations of the same serialization algorithm may process the triples in the graph in different orders, producing two different sequences of characters in the flat file. This complicates the process of

comparing RDF data; comparison must be performed on the graphs themselves, rather than on their serializations.

SEMANTICS

RDF has a formal semantics^[31] that defines the meaning of RDF statements by means of a model theory, an abstract, mathematical account based on the truth or falsity of statements. The goal of a model theory is that it enables the determination of the soundness and completeness of an inference process.^[32]

The RDF semantics permit certain new triples to be inferred from those in an RDF graph. The following list of inferences is not comprehensive, but rather an indicative list of the sorts of inference that RDF permits:

- Transitivity of the `rdfs:subClassOf` relation
 - (if A is a subclass of B, and B is a subclass of C, then A is a subclass of C)
- Transitivity of the `rdfs:subPropertyOf` relation
 - (if A is a subproperty of B, and B is a subproperty of C, then A is a subproperty of C)
- Inferring general properties from more specific properties
 - (if two resources are related by a property, and there is a generalization of that property, then the resources are related by the superproperty)
- Inferring membership of general classes from membership of more specific classes
 - (if a resource is an instance of a class A, and A is a subclass of B, then the resource must also be an instance of class B)
- Inferring membership of classes from domain and range constraints.
 - (if a resource has a property whose domain is B, then the resource must be an instance of B)

Comparison of RDF Schema and OWL

RDF Schema and OWL both fulfill similar roles within the architecture of the Semantic Web, in that they both support the definition of formal vocabularies for classifying entities and specifying the natures of their interrelations. The key difference between the two approaches is one of expressiveness; RDF Schema provides a concise set of primitives that are familiar to users of object-oriented modeling methodologies, but these primitives are limited to expressing explicit subclass and superclass relationships between classes and properties.

The OWL language extends the modeling capabilities of RDF Schema using a family of formal logic known as description logics^[33] in order to produce a more expressive ontology language that allows the user to specify the nature of a class in terms of the necessary and sufficient

conditions that must be met by members of that class. Necessary conditions are those which must be satisfied by all resources that are members of a class, while sufficient conditions allow an OWL reasoner to infer that a resource that satisfies them must be a member of a the class. For example, “is an animal with four legs” is a necessary condition for the class Horse (if an entity is a horse, we can infer that it is an animal and that it has four legs), but not a sufficient condition (if an entity is an animal and has four legs, we cannot be certain that it is a horse, because things other than horses will satisfy those conditions).

If classes are defined in terms of their necessary and sufficient conditions for membership, it is possible to identify the implicit subclass hierarchies that must naturally follow from these definitions. For example, if the class Quadruped is defined with the sufficient condition that it is an animal with four legs (that is, if we have a four-legged animal, then we can infer that it is a quadruped), then we could infer that Horse is a subclass of Quadruped (every Horse is a Quadruped), even though this relationship has not been explicitly stated in our ontology.

HISTORY

RDF and RDF Schema have a strong lineage which draws on the knowledge representation formalisms developed over the past 40 years. The graph-oriented triple model resembles the approaches made by network knowledge representation techniques (principally semantic networks^[34] and conceptual graphs).^[35] Although the simple class and property model of RDF Schema owes much to object-oriented approaches to software engineering, which in turn were derived in part from Minsky’s frames,^[36] RDF Schema is a purely declarative representation (unlike object-oriented models with member functions on objects, or frames with demons attached to slots). There is a further difference between the approach taken by RDF, and that taken by traditional object-oriented languages such as C++ or Java. The former is a property-centric approach, in that classes are associated with properties by defining the global range and domain constraints on the properties, while the latter is more class-centric, and defines classes in terms of the properties that may appear on objects of that category. This is largely a difference of emphasis rather than of the fundamental underlying logic, however. It should be noted that OWL takes an approach closer to that of the frame-based systems, in that classes are defined in terms of the necessary and sufficient properties that their instances must have.

The lineage of RDF in the context of Web-based knowledge representation and metadata languages dates back to the mid-1990s, with the publication of the Meta Content Framework (MCF) and the Platform for Internet Content Selection (PICS). The two languages prepared the way for RDF, by introducing a key use case (web page

description) and the notion of a triple. The first version of RDF was published as a W3C Recommendation in 1999, and this version was deprecated by a revision in 2004 which sought to provide a formal foundation for the more expressive ontology language OWL; the description of RDF in this entry is based on the 2004 standard.

PICS

PICS^[37,38] is a W3C Recommendation that was designed as a means for attaching machine-readable ratings to web pages in order to inform filtering software of the nature of the content of the web pages, with the intent that such filtering software would better be able to control the content displayed to users.

The technology emerged in part as a response to the U. S. Communications Decency Act of 1996 (Sec. 502), which effectively sought to place censorship restrictions on material distributed via the Internet. Rather than place the onus for removing unacceptable material on the publisher, PICS proposed a model whereby a potential consumer of such material could obtain an accurate description of the material that would enable them to decide whether or not they wished to view the material. The descriptions, known as content labels, consisted of values taken from some rating system, where a rating system comprised a set of independent dimensions on which an Internet resource could be evaluated. Such rating systems can be considered to be more complex versions of those used for film classification (for example, the film ratings G, PG, PG-13, R and NC-17 specified by the Motion Picture Association of America); the commonly used ICRA system^[39] specified by the Family Online Safety Institute classifies works on seven different scales: nudity, sexual material, violence, language, potentially harmful activities, user-generated content, and context.

PICS originally used a non-XML (Lisp-like) syntax for expressing content labels, with specific ratings represented by numeric values; a rating system might specify a rating category (dimension) for language, with ratings for “slang” given the value 0, “mild expletives” the value 1, “expletives” the value 2, “obscene gestures” the value 3, and so on. A content label also included information about the party that had generated the metadata, and could be digitally signed to support the verification of the identity of the rating party.

Although the practice of attaching PICS metadata to web pages was never widespread, several Web browsers implemented the standard, including Internet Explorer (from version 3.0 onwards). The principle of a standard syntax for Web metadata was a key step towards the advent of the Semantic Web, even if PICS was too tightly coupled to its application domain to serve well as a general-purpose metadata language. In 2000, W3C published a proposal for the use of RDF as the underlying

syntax for content labels, which specified an RDF Schema vocabulary for expressing both content labels and rating systems.^[40]

MCF

MCF^[41] originated at Apple Computer Inc. in 1995 as a metadata format for representing the content and structure of Web sites, and was used by the HotSauce web navigation system (a browser that allowed a user to fly through a 3D map of a Web site). The author of MCF, Ramanathan V. Guha, moved from Apple to the Netscape Communications Corporation in 1997, and reimplemented MCF as an application of the emerging XML dialect of SGML. This XML syntax for MCF has been an important influence on the development of RDF, and introduced a number of features that persist in the most recent version of RDF and its XML syntax.

The underlying model of an MCF description is a directed labeled graph much like that of RDF. The nodes in the graph can represent both literal values and objects with identity (which could be either web objects or real-world objects), and are linked by typed binary relations. Unlike RDF, it assumes that only Web-addressable objects have URLs; real-world objects are identified by non-URI strings.

RDF (1999 Version)

The original 1999 specifications of RDF^[42] and RDF Schema^[43] differ from the versions described above in three main ways. First, they do not contain a formal account of the semantics of the languages that would be suitable for reasoning. The 1999 RDF specification contains a definition of a triple and an explanation of the entailed triples produced by reification, and the RDF Schema specification informally defines `rdfs:subClassOf` and `rdfs:subPropertyOf` as transitive properties, but there is no model-theoretic account of the sort that would be needed to verify the soundness and completeness of a reasoning engine.

Secondly, they contain a number of features that were deprecated in the 2004 specification because they could not be given an unambiguous meaning. Chief amongst these features is the ability to express statements about the members of a container. Given an `rdf:Bag` containing a number of resources, it was possible to write a single triple which applied to each member of the Bag by using the `rdf:aboutEach` attribute instead of the `rdf:about` attribute to indicate the subject of the triple. While this could be seen as a convenient shorthand for expressing repetitive information, there is an unfortunate interaction with the non-closed nature of RDF containers. In the absence of a framework for provenance, it is possible for a third party to state that a container has extra members; it thus becomes possible to make the original claim about the

members of the container apply to more resources than were intended. A similar construct, `rdf:aboutEachPrefix`, allowed an author to express statements that would hold for all resources whose URIs began with a particular string. The set of triples entailed by this could not be determined without detailed knowledge of all the URIs with a particular prefix, and so the construct would therefore have unpredictable consequences as web pages were created and deleted over time. These two constructs, `rdf:aboutEach` and `rdf:aboutEachPrefix`, were included in the 1999 specification in order to support certain functionality provided by PICS, and in doing so to facilitate the transition from PICS to RDF. The 2004 specification also clarified the formal basis for reification; while the reification vocabulary remains part of the language, a triple does not entail its reification, nor vice versa.

Finally, the 2004 specifications contain a number of new constructs that were intended to bolster those constructs of RDF-1999 that were felt to have awkward consequences, but which were too widely used to be deprecated; the RDF container vocabulary was considered to be such, and was supplemented with the collection construct which enforced a well-formedness criterion on closed lists.

The RDF revision in 2004 aimed to make a number of corrections and improvements following feedback from implementers, and to complete the work on RDF Schema, which had previously only reached the state of W3C Candidate Recommendation. This new version of RDF was developed contemporaneously with the OWL Web Ontology Language, and so there was a close dialogue between the relevant W3C working groups in order to ensure that the revised form of RDF would form a suitable foundation for OWL; the earlier language DAML+OIL,^[44] from which OWL was derived, used RDF/XML as a serialization syntax but disregarded its semantics (or lack thereof) and adopted a conventional description logic semantics.^[33] An aim of the collaboration between these working groups was therefore to develop a semantics for RDF and RDF Schema that would be compatible with the semantics of OWL.

CONCLUSION

The RDF is a versatile knowledge representation language that can be used to express information about both Web resources and real-world objects. In conjunction with the vocabulary description languages RDF Schema and OWL, both of which are built on RDF, it can be used to create complex descriptions of application domains that a computer may use to infer new knowledge. The role played by RDF in the development of the Semantic Web is crucial; it integrates with the existing Web architecture to provide a common infrastructure for the creation and publication of structured data.

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Saudi Arabia: Libraries, Archives, and Museums

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Abstract

This entry surveys the history of libraries and librarianship in Saudi Arabia. It traces the development of librarianship from a branch under the Ministry of Education into an independent field that has become closely tied with the Information Industry. It also briefly touches on museums, archival institutions, and library professional associations in Saudi Arabia.

INTRODUCTION

Ever since the time of Prophet Muhammad (d. 632), the region which had been known as the Arabian Peninsula acquired a lasting symbolic significance not only for its residents but also for Muslims all over the world. For the purpose of simplification, the Arabic diacritics were not used for the letters *hamzah*, *<ayn* as well as the long vowels *ā*, *ī*, or *ū*. It not only comprises the holiest sites of Islam and the places that witnessed the early formative period of the Islamic past, but its importance is reinforced continuously into the present as Muslims face the direction of the Kabah in the city of Makkah during their prayers at least five times a day. The two cities of Makkah, where the Prophet was born, and Madinah, where he died and where he established his religious and political authority, are particularly important due to their connection with the two holy shrines. In recognition of their spiritual significance, King Fahd Ibn Abd al-Aziz (d. 2005) acquired the primary title of Custodian of the two Holy Shrines.

The two shrines have always been recognized as major seats of Islamic learning. Apart from being destinations for the annual pilgrimage of all Muslims, they served as major centers of Islamic education. It was a common practice for any scholar of repute to spend some time in their vicinity to communicate with the leading authorities in the different branches of Islamic knowledge. These constant and vibrant scholarly activities have always facilitated the contact of Arabia with the outside world and also the circulation of the most important educational and cultural commodity: the book. While the political history of the region witnessed many discontinuities, disruptions and dramatic turning points, the two shrines continued to enjoy their prestige due to their strong association with the two major institutions of pilgrimage and Islamic learning.

COUNTRY PROFILE

Saudi Arabia occupies the larger part of the Arabian Peninsula, about four-fifths, in south-western Asia with a total

area of about 1.24 million mi² (2 million km²). It is situated between the Red sea and the Arabian Gulf and it is bordered by Jordan, Iraq, and Kuwait to the north, by Yemen to the South and East, and by Qatar and the United Arab Emirates to the north east. The country's longer western coastline on the Red Sea faces Egypt, Sudan and Eritrea and shorter eastern coastline on the Arabian Gulf between Kuwait and Qatar faces Iran. The larger part of the Kingdom of Saudi Arabia is arid desert. The average summer temperature in coastal areas ranges from 38°C to 49°C with high humidity. The average annual rainfall is between 100 mm and 200 mm. Arabic is the official language which is spoken by almost all the population which according to the estimates for 2007 was 24.3 million. Islam is the official religion and almost all the inhabitants are Muslims where about 85% of the population are Sunni and the remaining 15% are Shia, largely in the eastern part of the country. The capital is Riyadh.^[1] The gross national income per capita is \$22,300. The adult literacy rate for both sexes is 84% (male 88.6% and female 78.4%). Saudi Arabia is an absolute monarchy which was established by the family of Al-Saud and the current king is Abd Allah Ibn Abd al-Aziz Al-Saud. The legal system is based on Shariah-inspired Islamic law (Fig. 1).

HISTORICAL BACKGROUND

The history of the current Kingdom of Saudi Arabia goes back to 1932 when King Abd al-Aziz Al-Saud succeeded in subjugating the competing tribal rulers of the different regions and thereby bringing the entire Arabia under his rule after 30 years of constant struggle between 1902 and 1932.^[3] The claim of Al-Saud family to the rule of the region goes back to their leading ancestor Muhammad Ibn Saud (d. 1765) who consolidated his political influence by adopting the reformative teachings of Muhammad Ibn Abd al-Wahhab (d. 1792) and consequently established the first Saudi state in the Diriyah province of the central region of Najd (1744–1818). The appeal of the Wahhabi



Fig. 1 Map of Saudi Arabia.

Source: From CIA The World Factbook.^[2]

teachings was largely due to its emphasis on purifying the Islamic creed from the later accretions that crept into its basic monotheistic message. The Saudi forces were able to subdue most of the regions of Arabia and they also repeatedly attacked the border regions of Iraq and Syria. The steady advances of the Saudi forces eventually incurred the anger of the Ottoman sultan who instructed the Egyptian ruler Muhammad Ali to send his troops to subdue the Saudi-Wahhabi movement. Under the leadership of Ibrahim Pasha (Muhammad Ali's son), a strong army marched towards the Saudi strongholds and managed to defeat the Saudi forces and destroy the Diriyah. This event signaled the end of the first Saudi state. As the Egyptian forces retreated, the Saudi leaders attempted to restore their rule and eventually succeeded in establishing the second Saudi state under the leadership of Faysal (d. 1865) son of Turki (d. 1834). The second Saudi state, however, did not fare well due to the internal strife among the family of Al-Saud which led to their defeat by Al-Rashid forces. It was not until 1902 when Abd al-Aziz returned from his exile in Kuwait and defeated the al-Rashid forces, an event which marked the beginning of the third and current Saudi State. King Abd al-Aziz

(d. 1953) was succeeded by his sons Saud (abdicated 1964 and died 1969), Faysal (d. 1975), Khalid (d. 1982), Fahd (d. 2005), and Abd Allah (current King).

The political stability achieved by the unification of the region under the rule of King Abd al-Aziz facilitated the task of modern nation building. The discovery of oil during the 1930s brought the wealth that made this task possible. The oil revenues rose from \$13.5 million in 1946 to around \$212 million in 1952.^[3] During the reign of King Faysal the oil revenues reached the all time high of 92.2 billion Saudi Riyals in 1975.^[3]

LIBRARIES AND BOOKS IN THE ARABIC AND ISLAMIC CULTURE

Written manuscripts have always enjoyed outstanding prestige within the Islamic culture. Muslims were inspired by the teachings of the Quran and the instructions of their Prophet to gain knowledge which in itself was considered an act of devotion and a means of drawing near to God. Throughout Islamic history, the transmission of knowledge relied first and foremost on the communities of

learned authorities and certification was given after direct personal training under these authorities. Classical bibliographical works describe in detail the high level of sophistication that this culture of learning reached. For the larger part of the Islamic history, the various educational activities took place either inside a mosque or in a school that was attached to one. Big mosques, therefore, often consisted of compounds that comprised various educational institutions. These compounds traditionally included schools for children, schools for the general public as well as specialized centers especially for the advanced study of Islamic law and theology. Libraries or Book Houses as they were called, also started as one of these institutions that were attached to mosques. Grand mosques such as the two shrines in Makkah and Madinah, al-Azhar in Cairo, Umawi mosque in Damascus as well as other famous mosques across major Islamic cities have always comprised large libraries with rich collections. In addition to mosque libraries, schools often had large libraries that served the needs of its faculty and students.^[4]

Moreover, many Muslim rulers developed great interest in books and some of them built famous libraries that commemorated their legacy for centuries after their death. Many of these libraries started as private libraries and later turned into either public libraries or major research centers. Three institutions in particular were quite reputable: *Bayt al-Hikmah* (House of Wisdom) of Baghdad, *Dar al-Ilm* (House of Knowledge) of Cairo and the Library of Qurtubah.^[5]

Bayt al-Hikmah was founded by caliph Harun al-Rashid (d. 786). It is considered by far the first public library and academy in the Muslim World. During the reign of al-Rashid's son al-Mamun, it became the most important educational institution in the world. It was particularly famous for being the center for the translation movement sponsored and led by the Abbasid caliphs. It was geared towards translating the major works of the classical Greek, Roman, Persian and Indian thought. *Dar al-Ilm* was founded by the Fatimid caliph al-Hakim in 1004 as a rival to the *Bayt al-Hikmah* of Baghdad. The holdings of this major institution was estimated around 2,200,000 volumes which was unmatched by any other library in the world at that time. Following the example of the major libraries and learning institutions in the eastern part of the Muslim world, the caliph al-Mustansir (d. 976) founded the Library of Qurtubah in Muslim Spain which was famous for its rich and rare collection and whose index consisted of 44 big volumes.

PLANNING/LEGISLATION IN MODERN SAUDI ARABIA

With the establishment of the Central Planning Organization (1965), later Ministry of Planning (1975), the kingdom started its five-year development plans, the first of

which was during the period of 1970–1975. The early development plans focused on the development of the basic infrastructure such as the construction of roads, airports, ports, electrical and telecommunication projects. Expenditure on public education rose steadily as the allocations to the Ministry of Education (established 1953) and Ministry of Higher Education (established 1975) increased incrementally.^[6] For example the total number of students in all general and higher education stages increased from about 547,000 in 1969 to about 4.9 million in 2001. In addition to the libraries within the educational institutions (both general education and higher education), the development plans provided allocations for public libraries as well.^[7] For example, the first development plan (1970) emphasized the role of library and museum systems for the enhancement of the various educational and cultural services:

In providing for the cultural development of the Kingdom, the public library system is to be expanded and improved with priority given to enlarging the book collections and periodical sections, and providing libraries with the necessary furniture and equipment. In view of the cultural importance of archeological finds and the educational value of museums, the plan proposes to expand the activities of the Ministry of Education in this area. An annual program of archeological missions is planned for field surveys, site investigations, and site registrations. An acquisition and maintenance program has been designed to assure that buildings and landmarks of historical significance are not lost.^[8]

The plan for the Ministry of Education also provided some provisions on the public library system and archeology.

The ten general public libraries are to be expanded and improved, with priority given to enlarging the book collections and periodical sections and to providing the necessary additional furniture and equipment. A photographic department is to be established at the Riyadh Library to record documents and publications. Five of the libraries that now occupy rented facilities are to be provided with appropriate buildings through a phased construction program, and a new library is to be established in Tayf In view of the cultural importance of archeological finds and the educational value of museums, the plan includes provisions for the establishment of an archeological museum and library.

The second development plan (1975–1980) provided more specific details about the projects that pertain to the sector of libraries and museums which included the establishment of a national museum system and the development of the facilities and activities of the King Abd al-Aziz Research and Cultural institute as a major library, research, publishing, and cultural center. It also provided for the establishment of: biography center, 10 new general libraries (increasing the number of public libraries from

22 to 32 by the end of the plan), six regional museums, two Islamic museums and four specialized museums.^[8]

The third development plan (1980–^[5]) continued with the expansion of the national library and museum systems.^[8] It also provided for carrying out a preinvestment study for a National Central Library.^[8] The increased economic surplus from the oil revenues facilitated the execution of the consecutive development plans. Eventually, the transformation of life styles created more demand for cultural and recreational activities which meant among other things increased need for a robust library and museum systems as clearly manifested in the fourth development.^[8] The subsequent development plans continued to emphasize the important role that both libraries and museums play in the enhancement of the national educational system and culture in general. They also continued to highlight the need to facilitate the integration of the modern technological applications within the national library system in the light of the increasing connection between library and information sectors.^[8]

MAJOR INSTITUTIONS

King Fahd National Library

Planning for the establishment of a central national library for the Kingdom of Saudi Arabia started many years before the project finally materialized. Several proposals were made based on both theoretical and field research.^[9] Eventually, the Council of Ministers issued the resolution no. 80 on December 19, 1990 approving the statute of the King Fahd National Library and its administrative structure. The resolution was ratified by the Royal Decree no. M/9 on December 26, 1990.^[10] The articles of the Statute explained the objectives and the functions of the library. The first article provides that:

- King Fahd Library shall become the national Library of the Kingdom of Saudi Arabia and its name shall become King Fahd National Library.
- The library shall exist as an independent body.
- The library shall be linked administratively to the Presidency of the Council of Ministers.
- The headquarters of the library shall be in Riyadh.
- The library may establish branches in the Kingdom.

The second article explains the main functions of the library to be: collecting, organizing, documenting, and publicizing the intellectual and cultural output of the country. This includes, for example, collecting materials published in or about Saudi Arabia, materials published by Saudi nationals outside the Kingdom, materials of interest from outside the Kingdom, materials from outside the Kingdom that will facilitate research, study and understanding of the human culture in all its facets, and also

collecting old and rare books, manuscripts, documents, and illustrated materials, especially those that are related to Arabic and Islamic civilization. The library also carries out a wide array of activities such as:

- Processing the acquired/deposited materials according to professional standards.
- Publishing national bibliographies, union catalogs, and other documentations.
- Conducting reference studies for the Government departments and commissions.
- Providing reference and borrowing services to individuals, government departments, and the private sector.
- Organizing and hosting conferences, symposia, and book fairs.
- Representing the Kingdom in international meetings and conferences related to the objectives and functions of the library.
- Exchanging books and information with other libraries and cooperating with international organizations and associations.
- Providing leadership for the development of library services and information centers by active participation in:
 1. Preparing a national plan for the development of library and information services in cooperation with the concerned bodies.
 2. Developing national bibliographical standards and specifications in cooperation with the relevant bodies.
 3. Encouraging libraries and information centers to adopt and implement those standards.
 4. Encouraging and developing programs for investment of resources in the field of information including the establishment of an information network of libraries and information centers.
 5. Participating in the preparation and publishing of research studies, guides, directories in the field of library and information services and other areas.^[10]

In addition to its large collection of printed books and modern information resources, the National Library devotes special attention to rare items, historical documents, manuscripts, and numismatics.^[10] According to the Library's Web site, the total number of its holding until 2006 is 1,205,482. The library also contains around 30 special collections and private libraries of prominent scholars and famous personalities that include, in addition to rare books, a diverse collection of unpublished manuscripts. Some examples of these private library collections are:

- The Library of Ihsan Abbas with a collection of 8390 books.
- The library of Sheikh Muhammad Ibn Abd al-Aziz al-Mani with a collection of 5480 books.

- The library of Sheikh Abd Allah Ibn Muhammad Ibn Khamis with a collection of 7740 books.
- The library of Sheikh Uthman Ibn Hamad Al-Haqil with a collection of 17,400 books.
- The library of Sheikh Muhammad Husayn Zaydan with a collection of 4420 books.
- The library of Fawzan Ibn Abd al-Aziz al-Fawzan with a collection of 4470 books.
- The library of Dr. Yusuf Ibrahim al-Sallum with a collection of 4890 books.
- The library of the late painter Muhammad Musa al-Salim.
- The library of Sheikh Muhammad Mansur al-Shaqha with a collection of 8960 books.
- The library of Sheikh Abd Allah Abd al-Aziz al-Anqari.
- The library of Sheikh Abd Allah Ibn Umar Al-Sheikh.
- The library of Sheikh Abd Allah Ibn Muhammad al-Nasban.
- The library of Sheikh Husayn Ibn Abd Allah al-Jarisi with a collection of 4400 books.

King Abd al-Aziz Public Library in Riyadh

In addition to King Fahd National Library, there is also a number of independent educational and cultural institutions that promote libraries and librarianship. One of the most important institutions in this regard is King Abd al-Aziz Public Library in Riyadh. It was established in 1987 by the current King Abd Allah Ibn Abd al-Aziz.^[11] Its holdings include a total number of 150,000 information resources. The library functions as a major cultural center that provides a variety of services and promotes a number of educational and cultural activities especially in the areas of publishing and translation.^[11]

ACADEMIC AND RESEARCH LIBRARIES

The Saudi Ministry of Higher Education was established in 1975 to regulate and oversee university system of the Kingdom.^[6] The system comprises seven universities:

- King Saud University in Riyadh, established in 1957.
- The Islamic University in Madinah, established in 1967.
- King Abd al-Aziz University in Jeddah, established in 1967.
- The Islamic University of Imam Muhammad Ibn Saud in Riyadh, established in 1974.
- King Fahd University for Petroleum and Minerals in Zahran, established in 1965.
- King Faysal University in Dammam, established in 1975.
- University of Umm al-Qura in Makkah, established in 1987.

The organizational structure of the Saudi Universities Administration includes four main sectors: the teaching sector, the educational support and services sector, the graduate studies and research sector, and the administrative and financial affairs sector.^[6] Academic librarianship is regulated by the educational support and services sector. Each of the universities houses a central library, the largest of which is the one at King Saud University which consists of a central library and nine branches.^[9] Each university has a dean of library affairs who oversees the affairs of the university library system. Each library is run by a library director to whom department librarians report and who in turn reports to the dean of library affairs.^[9] Only the libraries of King Faysal University and King Fahd University for Petroleum and Minerals use the classification of the Library of Congress while the rest of the universities use the Dewey Decimal Classification (DDC) system.

According to a survey conducted in the late 1990s, the total number of volumes in the collections of the seven universities was 2,684,837, out of which 913,312 were in Arabic and 1,771,525 were in English. The non-Arabic collection included books in French, German, Spanish, Urdu and Hindi. Some of the problems that were found to obstruct collection development included: lack of collection building plans, managerial problems, insufficient financial support, and absence of interlibrary loan and online searching facilities.^[12] Ongoing efforts are being made to enhance the services and utilize the different Information Technology applications in the day-to-day operations of the academic libraries.^[13]

In addition to the university library system under the Ministry of Higher Education, there is also a number of higher education institutions that are affiliated with other government sectors such as:

- The Presidency for Girls' Education
- Ministry of Education
- Ministry of Health
- General Institution for Technical Education and Vocational Training^[6]

PUBLIC LIBRARIES

Libraries, archives and museums play an important role in preserving a nation's cultural heritage as well as shaping its collective memory and consciousness. This is the reason why governments often give special attention to these institutions. Modern librarianship, as an integral part of the modern educational systems, started with the foundation of modern nation states in most of the Muslim world during the first half of the twentieth century. In the case of Saudi Arabia it started with the formal foundation of the Kingdom of Saudi Arabia by King Abd al-Aziz (Ibn Saud) in 1932. Al-Nahari dates the beginning of modern libraries

back to 1945, with the establishment of the library of the college of Islamic Law in Makkah.^[6] This library was annexed to the library of the College of Education which became the central library of the King Abd al-Aziz University in Makkah, later acquired the name of the University of Umm al-Qura in 1980.

The first public library was founded in Riyadh in 1950 as the Saudi Library in Riyadh and the first modern library was established as a part of King Saud University (Riyadh) which was the largest library in the country with a collection of 398,551 multilingual volumes, 3896 serials subscription, and a large collection of rare books and manuscripts. Gradually with the tangible development of the educational system, the need for a modern system of public libraries was felt and consequently King Faysal signed a Ministerial Decree to establish the Directorate General of Public Libraries within the Ministry of Education in 1959 with the objective of fostering the development of public libraries in the country.^[6] The Directorate consisted of several departments for administration, public libraries, library services, binding, storage, photocopying and microfilming.^[14]

Researchers who trace the history of libraries in Saudi Arabia often refer to the libraries that were established by notable individuals either before or after the foundation of the Kingdom. Most of these libraries were attached to major mosques especially the two Holy Shrines in Makkah and Madinah.^[9,14] Examples of these libraries include the libraries of Sheikh Abd al-Rahman al-Sadi (1940) and Prince Musaid ibn Abd al-Rahman (1944). They also include the libraries that were established by collective communal efforts such as the libraries of al-Riyadh (1951), Shaqra (1952), al-Hariq (1953) and Hawtat Bani Tamim (1956).

The Ministry of Education's Directorate General of Public Libraries is one of the main five supervisory bodies that regulate and oversee the activities of public libraries in the Kingdom. It supervises 68 public libraries throughout the country with an average of one library in each city with the exception of Riyadh which has three public libraries. The Directorate is the major supervisory agency.

It oversees 80% of the public libraries in the Kingdom and provides the technical services for all of them including acquisition and cataloging. The collections in these libraries are classified according to the 17th edition of the DDC after its modification to suit Arabic libraries. The total holdings of these libraries exceed one million volumes (Table 1).^[14]

The second major supervisory body is the Ministry of Islamic Affairs, Endowments, Religious Preaching, and Mentoring. Some of the main libraries under its supervision are:

One of the most important libraries that are currently under the supervision of the Ministry of Islamic Affairs, Endowments, Religious Preaching, and Mentoring is the Library of Holy City of Makkah (*Maktabat Makkah al-Mukarramah*). Administratively it was under the supervision of the Ministry of Information, and then the Ministry of Pilgrimage before it finally came under the supervision of the Ministry of Islamic Affairs, Endowments, Religious Preaching, and Mentoring in 1993.^[4] This library enjoys a particular historical and symbolic significance because it was established on the birthplace of the Prophet after King Abd al-Aziz issued a royal decree for this purpose in 1951.^[15]

The third major supervisory body is the Presidency of Religious Research and Legal Responses. It supervises the Saudi Library of Riyadh which was established in (1944). Its holdings include 45,000 volumes. The fourth supervisory body is the Presidency of the Affairs of the Two Holy Shrines. It supervises the two libraries in the two Holy Shrines. The fifth supervisory body is the Darah (house) of King Abd al-Aziz. It is an independent governmental organization established by the Royal Decree no. M/45 in Riyadh in 1972. Its holdings include 29,734 volumes in Arabic and 3316 in other languages which are all classified according to a modified DDC system.

Given their symbolic importance for Muslims all over the world, the two Holy Shrines mosques in Makkah and Madinah have always received special attention from the different Muslim rulers and dignitaries across history. Because these two mosques were considered major centers of Islamic education, they have always comprised rich

Table 1 Public libraries in Saudi Arabia.

Name of library	Founder	Year	Place	Holdings
Arif	Sheikh Arif Hikmat al-Husayni	1852	Madinah	7045 printed volumes, 4373 manuscripts, and 630 miscellaneous
Mahmudiyah	Sultan Mahmud II	1855	King A. Aziz Library, Madinah	4391 printed volumes and 3314 manuscripts
Abd Allah B. Al-Abbas Mosque	Ottoman ruler of Hijaz	1874	Taif	10,000 volumes and 450 manuscripts
King Abd al-Aziz	Rushdi al-Sharwani	1983	Madinah	45,000 volumes
Public Library in Madinah	N/A	1962	Madinah	4200 volumes and 178 manuscripts
Salihyah	Muhammad ibn Uthman al-Qadi	1919, annexed to the Ministry in 1977	Unayzah	N/A

Source: From Al-Dubayan, *Itlah Tarikhiyah*, 28.^[14]

collections of books and manuscripts. Historians often speak of the different collections that were donated, bequeathed or offered to these two mosques. The Library of the Holy Shrine in Makkah was first established in 1095. Some of these collections that once existed include the collection of the Sharabiya Madrasah (founded 1233), the collection of Qaytbay Madrasah (founded 1477), the Sharawani Library (late nineteenth century), the Faydiya Library. The most famous library to be established in the Holy Shrine of Makkah was the Sulaymaniyah which was founded by the Ottoman sultan Abd al-Majid (1823–1861). Following the damage that was caused by the violent floods of 1861, the salvaged books were housed in what came to be known as the Shrine Library (*Maktabat al-Haram*). From that moment on the collection of the Shrine Library continued to grow with the continuous donations it received.^[16] The current holdings are estimated to be about 65,535 volumes and 6500 manuscripts.^[16]

Similarly, the Holy Shrine mosque in Madinah received many book collections throughout history. Some of them include the Persian collection (1184), the Ashrafiyah collection, the Mahmudiyah Library, the Hamidiyah Library, and Bashir Agha collection. Most of these collections were included in the central library that was established in 1933 and became known as the Prophetic Shrine Library (*Maktabat al-Haram al-Nabawi*). Its current holdings are estimated to be about 18,000 volumes and 2000 manuscripts.

Apart from the major governmental supervisory bodies, there are also several nongovernmental organizations that provide similar services and whose organizational structure resemble, to some extent, that of King Abd al-Aziz Library. These include:

- Dar al-Jawf established by Sheikh Abd al-Rahman Ahmad al-Sudayri in 1984. It comprises two libraries, one for men and one for women. The total number of their combined holdings is 47,063 and 103 serials.
- King Faysal Center for Research and Islamic Studies in Riyadh. It comprises two libraries. The adults' library was established in 1983 and its holdings include 37,765 volumes and 280 serials. The children library was established in 1987. Its holdings include 16,384 volumes.
- The Salihiyah Philanthropic Organization in Unayzah. It was established in 1987 and its holdings include 7145 volumes organized according to the modified DDC system.
- Library of the Cultural Center of Salih ibn Salih (for women). It was established in 1959 and its holdings include 13,685 volumes.

SCHOOL LIBRARIES

School libraries started as a division under the General Administration for Research, Curricula, and Instructional

Resources in the Ministry of Education in 1970.^[16] Prior to the creation of this administrative body, school libraries were affiliated to their regional public libraries. The bylaws of the administration states that it aims to:

- Provide the books, reference materials, audiovisual aides that serve the educational curricula as well as all aspects of educational and cultural activities.
- Encourage students to pursue the free reading and research which is appropriate for their age and aptitude.
- Train students to acquire the necessary library skills that enable them to benefit from the library resources.
- Help achieve the goals of school curricula.
- Develop literary and artistic appreciation and encourage useful entertainment.
- Serve the environment by extending the service hours to meet the needs of the students and their families.^[9]

The Administration serves as a central supervisory and executive body for all the schools under the supervision and control of the Ministry of Education. The management of the school libraries follows the local and regional administrative hierarchy of the Ministry of Education. Each library is run by the school librarian who reports to the school principal. Regional Education Districts include a body of library supervisors who oversee the activities of the libraries under their mandate and who report to the superintendent and to the Ministry. They are also responsible for conducting regular assessment and evaluation of the activities and performance of the library personnel. The books are organized according to a modified DDC System. Collection development is carried out by the central administration which undertakes the purchase and acquisition of materials and examines them before dispatching them to the regional districts. Although some of the public libraries are administratively under the Ministry of Education, the two systems (school libraries and public libraries) remain entirely independent from each other.^[9]

Special Libraries

According to a study that was undertaken in 1984,^[17] there were about 9 special libraries with collections of more than 5000 volumes. There were the libraries of ARAMCO in Dhahran, Institute of Public Administration in Riyadh, Saudi Arabia Consulting House in Riyadh, Educational Data Center in Riyadh, Industrial Studies and Development Center in Riyadh, Ministry of Planning in Riyadh, Saudi Arabia Airlines in Jeddah, King Abd al-Aziz Research Center in Riyadh and Information Center at the Ministry of Finance in Riyadh. In addition to these libraries, there were other small government and corporate libraries such as: The Department of Investigation and Public Security, 738 books and 8 serials; Saudi

Arabia Industries Corporation, 700 books and 80 serials; General Organization for Social Insurance, 598 books and 5 serials; Chamber of Commerce and Industry, 586 books and 26 serials; Ministry of Public Works and Housing, 520 books and 195 serials. All these libraries are in Riyadh. The three libraries of Jeddah Broadcasting, Ministry of Petroleum and Minerals in Riyadh, as well as Saudi Arabia Standards Organization use the Universal Decimal Classification system. The other libraries use the DDC system.

LIBRARY EDUCATION AND TRAINING

Library Education in Saudi Arabia started its first program in the academic year of 1973–1974 in the department of Library and Information Science in the Faculty of Arts—King Abd al-Aziz University.^[17] This program offers bachelor, master, and Ph.D. degrees. It started as a regular department but later adopted the credit hours (semester) system.^[18] Undergraduate students need to successfully complete 134 credit hours in order to receive their degree in four years of full-time enrollment divided as follows:

- University compulsory requirements (14 hr)
- College compulsory requirements (11 hr)
- College selective requirements (15 hr)
- Department compulsory requirements (38 hr)
- Department selective requirements (40 hr)
- Other departments compulsory requirements (10 hr)
- Other departments selective requirements (6 hr)

After finishing the bachelor's degree, students can enroll in the masters program after taking an entrance exam. Students with B.A. in library science are required to finish 36 credit hours and students from other fields are required to finish 46 credit hours. Out of the total credit hours, 6 hr are designated for the master's thesis. Upon successful completion of the M.A. degree, students are eligible for admission into the Ph.D. program which requires a total of 47 credit hours out of which 20 are designated for the Ph.D. dissertation.^[17]

The second program started in the academic year 1974–1975 with the establishment of Library and Information Sciences Department at Imam Muhammad Ibn Saud University. In addition to its focus on general library education, the program offers special training in manuscripts and other heritage-related literature. The program offers a bachelor degree of arts in library science for which students have to complete 174 credit hours divided as follows:

- Library science courses (118 hr)
- Religion, language, education and other courses (56 hr)

The department offers also a postgraduate diploma in library and information science for which students have to complete 20 credit hours and recently started also M.A. and Ph.D. programs.^[18]

The third academic program started in 1986–1987 with the establishment of the Library and Information Science in the College of Arts at King Saud University. The program offers two main specializations upon the completion of the program's core courses: library science and information science. The department's bachelor of arts degree requires the completion of 120 credit hours divided as follows:

- University compulsory requirements (15 hr)
- College compulsory requirements (13 hr)
- Elective compulsory requirements (6 hr)
- Departments compulsory requirements (27 hr)
- Specialization compulsory requirements (47 hr)
- Minor field compulsory requirements (12 hr)

The fourth academic program started in 1987–1988 with the establishment of the Library and Information Science Department in the College of Social Studies at Umm al-Qura University. For the bachelor degree, students have to complete 130 credit hours divided as follows:

- University compulsory requirements (18 hr)
- College compulsory requirements (12 hr)
- Elective compulsory requirements (12 hr)
- Departments compulsory requirements (40 hr)
- Specialization compulsory requirements (30 hr)
- Minor field compulsory requirements (18 hr)^[17]

The fifth academic program is in the department of Library and Information Studies at the Girls College of Arts. The bachelor degree requires 190 credit hours divided as follows:

- Library science courses (107 hr)
- Religion, language, education and other courses (83 hr)

In addition to these five academic programs, there are other institutions that offer training programs in librarianship. The most important program is offered by the Institute of Public Administration. The program consists of two-year training leading to a diploma in library. Similar long-term and short-term programs are offered at the College of Education of King Saud University as well as the Central Library in Riyadh.

Although these programs produce hundreds of graduates every year, recent surveys indicated that the overall quality of the programs is not up to the desired level. These programs were found lacking in many critical areas mainly because they were not updated for many years. They do not offer ongoing training or training in modern

trends in the field due to shortage of adequate resources and facilities.^[19] Many institutions started offering continuing education in the form of courses, workshops, short courses, seminars, conferences and online support in order to help library professionals keep up with users' needs, demands and expectations in a rapidly changing information landscape.

Despite the numerous constraints that the library and information science training faces in Saudi Arabia^[9,17] efforts are being made to modernize the system and cope with the fast-paced changes in the field. For more information about the Arabic Union Catalog, see the Web site of King Abd al-Aziz Public Library in Riyadh.^[20] Special attention is devoted to create a robust education system which is indispensable for producing a well-trained and highly qualified manpower for the country. Most early Saudi library professionals and faculty received training abroad, especially in the United States, Britain and Egypt respectively. See the deliberations and the minutes of the establishing meeting of the Federation that took place in Qayrawan, Tunisia, January 19, 1986.^[21]

ASSOCIATIONS AND JOINT PROJECTS

Arabic Union Catalog

The project of Arabic Union Catalog was launched by King Abd al-Aziz Library in November 2006. It aims to create a unified cataloging system that serves as a platform for all the Arabic-speaking countries in the areas of cataloging and bibliographical standards. The Union seeks to perform the functions of projects such as OCLC or WorldCat but on a regional level. The project aims to:

- Include all the Arabic information resources in a single standardized database.
- Unify the efforts in the area of Arabic cataloging and share a single catalog by all the professionals.
- Reduce the cost of cataloging and bibliographical duplications.
- Promote cooperation and collective initiatives in publishing and circulating Arabic information resources both regionally and internationally.
- Support the Arab researchers.
- Encourage and Facilitate scientific research.
- Facilitate the process of collection development in the Arabic libraries.

Currently, the project includes more than four million bibliographic records that has been prepared according to the most up-to-date standards and that can be easily shared or downloaded by the any of the participating institutions. The project has more than 40 participating institutions most of them are located in Saudi Arabia. The project also includes other participating institutions that are based in

United Arab Emirates, Kuwait, Oman, Qatar, Lebanon, Jordan, Algeria, Morocco, and France. Most of these institutions are University libraries but there are also a number of public libraries as well as research organizations.^[21]

The Arab Federation for Libraries and Information

The Arab Federation for Libraries and Information (AFLI) was founded in 1986 and has members from 20 Arab countries.^[22] Among other things, the association aims at strengthening the ties between the national libraries organizations and preserving the written, oral and visual heritage of the Arab world. The Federation publishes a newsletter, *Sada al-Ittihad* (the echo of the federation), in Tunisia which started its first issue in June 1995. The Federation also started a new scholarly journal which is published in collaboration with King Abd al-Aziz Public Library *Ialam* whose first issue was published in October 2007.^[8]

Arabian Gulf Chapter of the Special Library Association

It was established with the goal of providing an opportunity for Library and Information professionals in the Gulf area to interact and share professional knowledge and experience. More than 150 professionals participated in the inaugural conference that was held in January 1994.

ARCHIVES AND ARCHIVAL INSTITUTIONS

One of the most prominent themes that have been emphasized in the different national development plans is the "desire to maintain a national Saudi identity rooted in Arab and Islamic civilization."^[23] The plans also seek to take advantage of the modern advances in science and technology in all fields. These two goals capture the tension that the Saudi government, like other Arab and Islamic governments, has to contend with. It seeks to preserve its cultural heritage without falling behind the rest of the world. The fifth development plan speaks about heritage as "the authenticity deriving from the security of firmly established cultural roots, which in the case of Saudi context, are founded on Arab and Islamic civilization giving our contemporary culture its own unique identity and endowing it with an ability to withstand attack or undesirable influences."^[24]

One of the important ways to maintain this heritage and to preserve this cultural and historical identity is through museums and archives. Although the plans do not provide specific details on these institutions or their activities, they include however general statements that reflect the government's support for these activities. They also speak about the importance of cooperation between the government and the private sector in this area. For example, the

Fifth Development Plan recognizes the efforts of organizations such as King Faisal Center for Islamic Research and Studies as well as King Fahd Library and museums.

The National Center for Documents and Archives is the formal archival institution in Saudi Arabia. It was founded by the Royal Decree no. (M/55) in 1989. Administratively, it is affiliated to the Council of Ministers and is supervised by its chairman.^[24] The center aims to collect, classify, and store documents and to facilitate their retrieval. The center drafts the policies that regulate the preservation and the circulation of all types of government documents. It coordinates the preservation activities among the different government agencies inside the country and cooperates with similar institutions on the international level.

One of the most important archival institutions in Saudi Arabia is King Abd al-Aziz Foundation for Research and Archives. It aims to preserve and document the history, geography, as well as the literary and cultural heritage of the Kingdom of Saudi Arabia and other Arab and Islamic countries. The foundation was established by the Royal Decree no. (M/45) in 1972. For more information, see the Web site of the Foundation.^[25] Other than the library, it includes many different departments for renovation and preservation of historical items, public affairs, research and publication, journal of the foundation, archive for photographs and documentaries, geographical information systems, manuscripts, documentation of the history of the Saudi Royal family, historical Documents and oral History.

Its documentation center is one of the most important historical and archival institutions in the country. It collects and preserves all types of documents that relate to the history of Saudi Arabia. It holds a rare collection of original as well as copies of important historical documents that include correspondences, deeds, contracts, formal letters, decrees, statements, and reports. The collection includes more than 1,400,000 national and regional documents. It also includes other important documents from foreign archives that deal with the history of Saudi Arabia such as the Ottoman, American, British, French, Dutch, German, Indian, Russian, and Italian archives. The center collaborates with major international organizations in the area of renovation and preservation of rare historical documents such as the Library of Congress, the International Council on Archives, the International Federation of Library Associations, and the UNESCO.

MUSEUMS

According to the directory issued by the Undersecretariat of Archaeology and Museums in the Saudi Ministry of Education, there are more than 50 museums in different regions of the Kingdom (Table 2).^[26] For the museums in Jeddah see the directory posted on the municipality's Web site.^[27] These museums can be classified into five main

categories: archaeological and historical museums, educational and academic museums, scientific museums, popular and cultural museums and private museums. They range from large state-of-the-art museums to small-scale local and private museums. Some of the important museums listed in this directory are:

The most important museum in Saudi Arabia is of course the Saudi National Museum in Riyadh which was inaugurated in 1999. It is located at the eastern side of King Abd al-Aziz historical compound. It is built on an area of 17,000 m² and the total area of its two story structure is 28,000 m². In addition to places for exhibits and shows, the museum includes 8 main halls which display various objects and artifacts that represent the different historical stages of Saudi Arabia. The general themes for these halls are: man and the universe, ancient Arabian kingdoms, Pre-Islamic phase, early Islamic phase, Islam and Arabian Peninsula, 1st and 2nd Saudi states, Unification of Saudi Arabia, Pilgrimage and the two Holy Shrines.^[26]

Another important museum which is also located in the city of Riyadh is the citadel of al-Masmak which was turned into a museum in 1995. It has special historical significance for its connection with the events that influenced the rise of the Saudi state. The capture of the citadel by the young emir Abd al-Aziz Ibn Abd al-Rahman in January 1902 marked the reestablishment of the supremacy of the Al-Saud family over the city of Riyadh. It includes several exhibit halls that depict the different stages of the Saudi family history and recounts the story of the unification of the Kingdom under King Abd al-Aziz.^[28]

The Museum of the Two Holy Shrines in Makkah illustrates the history of the two holy sites. It includes seven main halls with each focusing on one general theme as follows: The Hall of the Entrance, The Hall of Holy Mosque of Makkah, The Hall of Kabah, the Hall of Photographic Pictures, The Hall of Manuscripts, The Hall of Zamzam Well and The Hall of the Holy Mosque of Madinah. It includes numerous collections of old and recent large-scale photos as well as maquettes of the Two Holy Shrines. It also includes many items and artifacts from these sites across the different historical eras.^[28]

CONCLUSION

The successive Development Plans continued to both reflect and drive the steady advances in the different sectors of the Saudi economy. The growing economic surplus from the oil revenues has facilitated the implementation of these successive Development Plans. Librarianship aided by the modern applications of the Information Technology has made great strides. The demand for libraries and other cultural institutions such as museums and archives is increasingly on the rise because of the remarkable

Table 2 Museums in Saudi Arabia.

Name	Type	Region
National Museum	Historical	Riyadh
Masmak Museum	Historical	Riyadh
King Fahd Library Museum	National	Riyadh
Numismatics Museum	Historical	Riyadh
Postal Museum	National/historical	Riyadh
Zoology Museum	Scientific/academic	King Saud University
Archeology Museum	Historical/academic	King Saud University
Folklore Museum	Historical/academic	King Saud University
Pharmacology Museum	Scientific/academic	King Saud University
Anatomy Museum	Scientific/academic	King Saud University
Geological Museum	Scientific/academic	King Saud University
King Fahd Security College Museum	Academic	Riyadh
King Abd al-Aziz Military Museum	Military	Riyadh
Sheikh Muhammad Abd al-Rahman al-Duwayhi Museum	Historical	Riyadh
Sheikh Sad Ibn Abd Allah Al-Muhaymid Museum	Historical	Shaqra
The Two Shrines Museum	Religious/historical	Makkah
Jiddah Regional Folklore Museum	Historical	Jeddah
Ta'if Regional Folklore Museum	Historical	Ta'if
Ocean Museum	Scientific/academic	King A. al-Aziz University
Earth Sciences Museum	Scientific/academic	King A. al-Aziz University
Jiddah Museum	Historical	Jeddah
A. Ra'uf H. Khalil Museum	Historical/private	Jeddah
Al-Khujah Museum	Historical	Makkah
Waqdani Museum	Historical/private	Makkah
Ukaz Museum	Historical/private	Makkah
Al-Madinah Museum	Historical	Madinah
Al-Ula Archeological Museum	Historical	Al-Ula
Royal Association Museum	Historical	Madinah
Buraydah Museum	Historical	Al-Qasim
Al-Dammam Regional Museum	Historical	Al-Sharqiyah
Al-Ahsa Regional Museum	Historical	Al-Sharqiyah

Source: From *Dalil al-Matahif fi al-mamlakah al-Arabiyyah al-Saudiyyah*, Wakalat al-Athar wa al-Matahif, Riyadh, 2000.^[26]

demographic changes that the country has witnessed in the past few decades. For example, the number of schools and colleges has increased from 3283 in 1969–1970 to 22,770 in 1999–2000. Consequently, the total number of teachers increased from 231,000 to 3,548,000 and the total number of enrolled students in the different educational institutions increased from 547,000 to 4.8 million during the same period. Also, the number of students who completed their university degrees both at home and abroad rose from 808 to 42,950 during the same period.

Like many other Muslim countries, Saudi Arabia is striving to preserve its historical heritage but also to catch up with modern education and technology. In the modern period and with the initiation of national development plans, librarianship has initially been attached to the Ministry of Education but gradually it has been developing its independent identity. Many national organizations such as King Fahd National Library and King Abd al-Aziz Foundation for Research and Archives are actively engaged in the process of shaping this identity. Through national, regional, and international programs they are striving to further enhance the field. The early Saudi Information professionals received their education and training abroad

but with the establishment of academic programs in national universities much of the undergraduate and even graduate education is currently being provided at home. As many researchers already observed, the field still faces many challenges that often accompany the localization of technology and standardization procedures.

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Scholarly and Trade Publishing [*ELIS Classic*]

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Abstract

Richard Abel developed vast experience in the publishing and library communities, and brings great perspicuity to his discussion of the publishing industry. In 2008 he received the Jack D. Rittenhouse Award from the Publishers Association of the West. An announcement of the award states: “Richard worked in a bookstore, became a bookstore owner, started a private press for limited edition books, founded a company that grew into an international library distributor, founded a book marketing and distribution company, started a trade publishing company that has grown into a well respected mid-sized publisher, and is the author of numerous articles and a forthcoming book.” [<http://www.against-the-grain.com/d/taxonomy/term/26>]

—*ELIS Classic*, from 2005

INTRODUCTION

This entry is intended to focus on the place of the “trade” in the transmission and dissemination of knowledge, literature, and information in the society. The term the “trade” has long been the shorthand referent to book and journal publishers, book wholesalers, journal agents, retail bookstores, specialist booksellers to libraries, and out-of-print (OP) dealers. Various elements of the trade are integral partners with libraries as the originators and/or suppliers of books, periodicals, and related services. Book and journal publishers are the key players in the trade as they first produce the books and journals, which come to rest on the shelves or in the computers of libraries. As the originators of the knowledge/literature/information packages stored and circulated by libraries publishers stand at the beginning of the process, which results in the dissemination of the material embodiments of ideas, bodies of knowledge, and research findings. (Some may argue, and in substantial measure correctly, that authors stand at the beginning of this creative process, but such commentators fail to understand the role that publishers play in not simply providing the means for authors to make their work available in the marketplace of ideas but in seeking out, stimulating, encouraging, assisting in the writing, and editing their work to get it to and make it most useful to readers.) By virtue of this role of origination in the intellectual and creative process of knowledge and information formation, the present standing and condition of publishing is of substantial interest to librarians and information specialists. This entry does not have as its burden an explanation of the processes and practices of the publishing trade. Rather, its intention is to inform readers of the present trends and problems faced by publishers internationally and how the present state of publishing may affect libraries.

Any effort to provide a statistical portrait of the trade is so marred by inaccuracies as to make such a representation virtually meaningless. The wide differences in the numbers provided by various agencies for a specific year in a specific country not only befuddle veterans of the trade but also simply confuse outside observers. It is a matter of some irony that a trade dedicated to the origination and dissemination of knowledge and information possesses so little information about itself. Probably the most reliable source of statistical information about the U.S. book trade is the Book Industry Study Group. They estimate the total dollar sales of books in the United States is \$26,000,000,000. The reader will quickly note that the individual sales of any number of large corporations exceed the total of sales of all classes of books published by all publishers in the United States. To use a boxing metaphor: “The trade punches above its weight” in terms of setting the cultural agenda of the United States.

THE MAJOR PRESENT TRENDS MARKING PUBLISHING

Several worldwide trends mark, and have marked, the book and journal publishing trade in recent decades. The first is the continuing increase in the number of new titles issued. This trend is really only a continuation of the trend, which began with the invention of printing and has continued ever since, save for the occasional short periods of leveling off attributable to major wars. However, since World War II the rate of increase virtually the globe around has accelerated to an incrementally higher annual rate. In earlier centuries, this secular growth in new book titles could be attributed to the roughly parallel increases in literacy—first in Europe and North America and

subsequently in the other major regions of the world. Indeed, increases in literacy quite closely track increased economic well-being across entire countries and regions. Economic well-being, in turn, generally correlates with not only increased personal income beyond sheer creature needs and increased leisure but job markets depending upon ever larger percentages of more highly skilled jobs. All these consequences, of course, contribute to the desire and need to allocate increased percentages of wealth to reading for increased comprehension, augmenting skills, and filling leisure time in a satisfying way.

Inextricably linked to this growth in book readership is the second observable major trend. That is the globalization of reading interests. This is to say that some titles come to enjoy a near-global readership. This concentrating of readers' taste is served not only through the sale by the original publisher of coeditions to publishers in other countries employing the same language or through the sale of translation rights, but also by the globalization of publishing firms. Although the sale of coeditions and translation rights is a universal practice, and the numbers of titles involved is rapidly growing, the largest fraction of such transactions involve titles published by English-language publishers.

In parallel with this widespread interest in writings originating in English-language countries, the English language has become the principal language of scientific, technical, and medical (STM) writing/publishing, as well as the language of much other scholarly writing/publishing, throughout the world. STM publishing represents about 10% of total book sales in the advanced countries but markedly less in developing countries.

Globalization of reading taste and subject interest based in significant measure on English language writings coupled with the near-universal use of the English language in STM publications and, to a lesser degree, in other scholarly writing/publishing, has led to the third major trend in international publishing. That is the economic concentration of the publishing trade, particularly in the advanced countries. The need to be able to successfully market a substantial fraction of any publisher's list to copublishers, translation partners, and in the case of STM and scholarly books to readers/users worldwide virtually dictates that publishers establish a presence in those countries that constitute their major markets, usually by means of acquiring existing publishers in those countries. The firms involved must possess the financial resources necessary to maintain staffs of a size consistent with the nature of such markets; the management skills to operate such geographically dispersed organizations successfully; and the financial integrity to assure partners of their capacity to fulfill the various agreements into which they enter—almost exclusively on trust, for international contracts and agreements are but at best scarcely enforceable in any way other than moral integrity. Furthermore, such firms typically seek a presence in the countries that

represent their major markets, not only in terms of the sale of the bulk of their titles but in terms of the editorial content and list-building by the acquisition of titles from writers in the countries in which they are domiciled.

The almost inevitable outcome of this concentration produces the fourth major trend, again most marked in the advanced countries where the consequences of increased economic complexity are most clearly being played out. That is the almost exponential growth of small publishers publishing exclusively in narrowly defined subject matter fields and serving fairly readily defined reader audiences. In the United States alone over 50,000 small publishing firms have been formed as documented by R.R. Bowker and *Publishers Weekly*. Such publishers are often styled “niche publishers” reflecting the quite definite outlines of subject matter and audience that they have rigorously focused on. The large, economically concentrated publishers, compelled to support a large and highly specialized staff, must necessarily seek out “big-name” authors, whether writers of fiction or writers of dense scholarly syntheses and every kind of book between these extremes. The large publishers are no longer in a position to gamble heavily on unknown authors or run many of the risks incident to the new, and often novel, hypotheses and syntheses continually being advanced in the various realms of scholarship by young scholars. Therefore, the niche publishers, often founded by editors exiting the world of the large concentrated houses, have identified a multitude of subject matter/audience interests/markets in which they can make genuine cultural contributions as well as reasonable livelihoods. Audiences are typically reached by specialized marketing programs designed to apprise niche audiences of the availability of books devoted to their subject-matter interests. To reach beyond their domestic market for their titles, they typically develop a network of other niche or small publishers in the other major markets for books suited to the specialized subject matter involved. Much trading of coeditions and translation rights is ultimately conducted within these networks. By carefully developing and employing these networks, the niche publisher can reach virtually the entire universe of authors and readers concerned with the subject matter or writings defining such niche networks.

It should be clearly articulated here that the titles classified as “trade” books and marketed by and large through the “trade” channels of retail bookstores constitute not only the most highly visible aspect of the book trade but roughly one-fourth of total book sales. The book-reviewing media and the associated publicity and “smart” talk in literary circles fundamentally turn on trade books. The world of trade books is almost entirely dominated by a handful of large, publishing conglomerates, which are usually international in scale. The same observation can be made of the small contingent of STM book and journal publishers, save only that STM books are not marketed through retail bookstores in any significant numbers. STM

marketing more closely resembles that pursued by niche publishers. It bears repeating that the trade book world, which is what the general public construes as the entire world of books, constitutes but roughly 25% of the total sales of books in most countries. (Of this 25% about one quarter are children's books.) The remaining 75% will be dealt with below.

The fifth major trend is still largely confined to the publishing trades of the advanced countries. That is the leveling off of the sale of units of books. This is to say that the total number of books purchased in the advanced countries has become virtually flat, in year-on-year comparisons, since the last few years of the last century. Given that the total number of titles continues to increase while the number of book units purchased has largely flattened out, the obvious consequence is that the sales of most titles has been declining over the past decade. The book trade economist, Fritz Machlup, first identified this trend in the late 1978.^[1] In a major review of book publishing *The Economist* noted, "... the overall amount of money that the public spends on books is no longer rising."^[2] As this trend continues, the consequences thereof, in terms of book prices, publisher economic viability, etc. have only been ameliorated by the appearance of short-run printing and print-on-demand technologies. The most likely explanation for this phenomenon is, first, that the increasing affluence of the citizens of the advanced countries has led to the formation and articulation of a markedly increased number of more narrowly and selective personal interests.

Second, as Curtis Benjamin pointed out some years ago, virtually all scholarly fields have in recent decades demonstrated what he styled a "twigging effect." This is to say that what were in the early 20th century fairly coherent bodies of knowledge, the content of which most of the scholars in those fields were presumed to have mastered and about which they were in a position to teach both the general public and new recruits to the field, have divided and redivided into increasingly narrow subfields. As the apparent pace of discovery quickened, such generalists became fewer while the numbers of "specialists" who were on the cutting edges of the newly defined subfields increased. In short, these specialties "twigged" off the trunk of the general field. These specialists spent much of their professional lives increasingly narrowly focused on narrow and specialized subfields. As they did so, entirely new subdisciplines arose bringing in their stead specialized books and journals. These specialists, in turn, concentrated most of their attention on these specialized publications to the exclusion of those in other specialties. Thus, while the number of new titles published in the general field increased the specialists mostly purchased titles in their field, thereby increasing the number of titles associated with each general field. The outcome, of course, was fewer copies of most titles sold despite the increase in the numbers of titles published.

A third factor also contributed to this outcome. Libraries have long formed a dependable and major market for books—the public libraries for "trade" books, the school libraries for supplementary "textbooks", and the university and research libraries for scholarly books. But demands on library budgets to offer an ever wider array of materials/services, most notably periodical literature; electronic products, and Internet access have increased very rapidly. The costs of traditional purchases plus this increased demand for other products/services have outstripped available funding. The inevitable outcome, of course, is that library book purchases have been held steady or reduced and so contributed to the reduction in numbers of copies sold of a larger number of titles being published.

Substantial increases in the purchasing of books remain to be realized in second and, more notably, in third world countries. Realization of these increases will depend on both economic development and the retreat of governmental command-and-control authorities from the publishing trade—just as had to occur earlier in the development of the advanced countries to free the public square for open debate occasioned by the increasing complexity of advancing societies.

The sixth major and worldwide trend affecting publishing is the explosion of electronic products and the extension of the Internet to public access, not simply in the United States but worldwide. Much has been made in recent decades of the repeatedly prophesized demise of the printed codex and the replacement of the book by first one and then another electronic product whether as stand-alone devices or some kind of Internet download. A steady stream of fiascoes and exploded hopes and the loss of quite substantial sums of money have failed to diminish widespread enthusiasm for such notions; several celebrity figures in the world of publishing have kept up the drum-beat for such alternatives.

Outcomes such as those associated with the attempted mechanization of the codex have not attended all efforts to provide electronic access to formerly printed material. A brief glance at these successful ventures and the character thereof will, in all likelihood, identify the nature of the kinds of intellectual material that can satisfactorily transit to electronic means of transmission. The most obvious and successful kind of electronic presentation of formerly printed material has proved to be the "encyclopedia" and similar "reference" materials. In short, the electronic transmission and presentation of information (think discrete bits and pieces of data) seems to work quite well for a number of users and uses. Related thereto is the still emerging electronic transmission of more complex forms of information in the shape of research reports and journal articles communicating new discoveries of discrete data. (Many libraries now prefer to receive journal subscriptions in electronic form.) What has become thoroughly evident in the last three to four decades is that information/data transits relatively readily to electronic forms.

Electronic technology has proved, on the other hand, a major boon to book publishers in the “backroom” functions of the publishing cycle. The typical journey of a writing from author to a printed book is now conducted almost entirely electronically. Writing, editing, peer-reviewing, designing, preparing electronic input for the printer, and control of the presses in the printers shop is now largely done on computers. Additionally, all warehousing billing, shipping, accounting, etc. within the publishing house is computer controlled.

Thus, book publishers are well acquainted with electronic procedures and practices. However, their repeated efforts to replace, or offer an electronic alternative to, the printed book have proved fruitless. A brief look at the nature of the book provides the obvious answer to these repeated fizzles. The difference between the miscellany of any assemblage of information/data (think encyclopedias, dictionaries, law reports, an issue of a journal, etc.) and the coherent body of knowledge or the sustained discourse of a fiction writing is a matter of human epistemology and the quite different purposes mental processes served by each. A book of knowledge or a fiction depend for their meaning and use on an extended discourse or narrative—readers must be presented with an often extensive body of evidence or the development of a story, all configured in a logical and coherent way to acquire, in at least some measure, the sense the author intended. Information gathering, by way of contrast, commonly involves simply finding a datum to serve a particular purpose defined by the immediate needs of a mental process engaged by the seeker (think a telephone number or a dictionary word or a brief chronology of the development of the computer or a library catalog entry, etc.). The discursive discourses demanded by the exposition of a knowledge concept, an ethical precept or the telling of a story are not well handled in terms of human epistemological requirements by digital devices. An entirely different epistemological process is involved in the acquisition of a datum or a body of data than is called for in the following of the line(s) of thinking involved in the transfer of knowledge concepts and precepts or the development of a story line inherent to the construction of fiction.

To cast this profound intellectual difference in an entirely other way: a base of knowledge is an absolute prerequisite not only for intelligently seeking information but is equally necessary to the rational understanding of whatever data bits are located. By way of example: imagine an intelligent person who is utterly unacquainted with financial markets. Seat this person before three networked computer screens displaying real-time financial data. The ignorant subject of this thought experiment placed in this situation will prove utterly unable to make any sense of these masses of data, despite the fact that financial data is probably the most complete and accurate body of information/data presently in existence. Only a broad and deep knowledge of financial markets and the economics

underlying them will permit a viewer to decipher this information and put it into understandable and usable form. The same thought experiment could be employed with any body of data resulting in precisely the same outcome of incomprehensibility for the unknowledgeable. In short, the epistemological realities of the human mind must needs deal with knowledge and information in quite different ways. Therefore, the successful migration of information books to electronic forms is perfectly consistent with the functioning of the human mind. The operation of the human mind equally well explains the repeated failures to adapt books of knowledge and fiction to electronic forms.

An exception to this general formulation may occur when a reader requires but a limited portion—a chapter or several pages—of a longer discursive writing. In such cases, electronic access may prove as useful as access to the printed form of the text.

The seventh major trend in publishing again relates to another player in the wider world of books, in this case booksellers. Again this trend has been most clearly played out in the advanced countries enjoying maximum retailing freedom. This retailing trend is being played out in two forms. Both forms take as their base operational objective the immediate supply of the widest possible range of titles. This trend first became evident in the form of the “super bookstore” chains. The huge bookstore stocking 150,000 to 250,000 discrete titles has been the occasional feature of a limited number of major cities for some years. However, such stores were not readily accessible to a large fraction of the population of any country. (This fact also explains the dramatic growth of direct-mail book clubs of all descriptions in the 1930s to the 1940s—they offered most of the citizenry both some information on current publishing output and the opportunity to easily purchase titles of interest.) The radical change in bookselling, which the chain superstores inaugurated, was to place well-stocked stores (75,000 to 200,000 individual titles) in all manner of market locations—even some in which small-scale, “mom and pop” bookstores had failed. The opportunities offered the reader to personally examine hands-on a broad range of books for suitability and immediately acquire any of interest were almost overnight geometrically increased. The advent of the chain superstores has provided a much larger number of readers with a service well beyond that previously available. And not surprisingly, the committed independent booksellers undertook to match the competition created by the chain superstores in virtually every aspect, from increasing the number of titles immediately in stock to providing seating and other amenities for browsers—which has, in turn, benefited readers.

The emergence of the bookstore chains has led to some quite unsustainable conclusions about their impact on publishing. Probable the most common is that the chains have furthered the purported homogenization of taste and

interest among readers and, thereby, narrowed the range of subject matters open to authors and publishers and/or lowered the levels of sophistication to which books have to be tailored. Either one or both of two lines of argument are advanced to support this cluster of related conclusions. The first, and most egregious, is that the buyers/management of the large chains exercise greater or lesser control over the publishing programs of the trade publishers. The fact of the matter is that the opinion of chain bookstore staff is occasionally solicited, e.g., when a publisher harbors some concerns with respect to the size of print run to order or again, as approximations of the quantity of a title that might be purchased when advertising and promotion budgets are being formulated. However, such inquiries are light-years apart from editorial control.

The other common causative factor advanced in support of the notion of the progressive homogenization of public taste and interest attributable to the chain bookstores is that the centralized buying employed fails to offer the full range of subject matters and writings that are available. The obvious assumption is that the chain booksellers are appealing to only the lowest common denominator and thereby lowering and narrowing the literary and cultural horizons of the reading public. The general taste and interest of the reading interests of the vast numbers of readers as documented over the centuries apparently is insufficient evidence of the fact that the chain booksellers, in step with the stocking practices of the independent booksellers, is to stock books that seem to have the potential for enjoying a reasonable sale. In short, the chain buyers are simply doing what they insist they are doing—stocking those titles that in their opinion will find a reasonable audience, even one numbering but one or two copies in most of the chain's stores.

In every age litterateurs, authors, and some publishers have found fault with the taste and interests of the general book-buying public. Thus, it is hardly surprising that the same players are leveling identical complaints but falsely attributing them to the emergence of a class of retail bookseller they instinctively dislike.

This new means of providing rapid access to a stupendous range of books in large numbers of physical locations created by the chain superstores and their independent competitors was then translated to Internet bookselling. So, it is now possible for the readers to learn of and then order books of interest from the precincts of their own home and expect, in most cases, to have the books delivered to the front door three or four days later. The databases of book titles now maintained by the largest of the Internet booksellers are, for all practical purposes, identical to the books in print of one or several countries. These large Internet booksellers have now gone a step beyond the provision of in-print titles to conducting out-of-print searches in cooperation with hundreds of out-of-print book dealers. So, the acquisition of an out-of-print title has now become nearly as routine as the acquisition of an

in-print title. Additionally, universities and other vendors have digitized a large number of out-of-print titles, most of which can be downloaded and printed out. The world of hard-to-find titles has been radically reduced.

The eighth major trend, which has emerged only in the last few years, is the extensive reprinting of titles using print-on-demand technology (POD). The POD grew out of the joining of the photocopying and computer technologies. Like all such new technologies, POD migrated through about a 20-year period of rapid, successive marginal improvements paralleled by a widening body of buyers thereby progressively reducing costs. The technology is now so effective and cheap that it can successfully compete with conventional presswork for editions of up to about 500 copies. However, perhaps more importantly, it can be economically employed for editions of 10 or so copies, assuming the original text exists in a suitable digital format. As the POD technology has been progressively improved, it has become virtually impossible to distinguish a POD volume from a printed volume. The obvious consequence is that publishers are now in a position to keep much larger and increasing fractions of their backlist in print and within the bounds of an acceptable list price. Some of the more farsighted publishers—largely niche and STM firms—are now producing a significant number of their new titles employing POD. By so doing they cannot only print quantities from digitized manuscripts more closely approximating estimated short-term forward sales but reprint in very small quantities, from the same digital format, as demand dictates.

The second largest single class of books in terms of sales is that of textbooks—typically representing 25% of total book sales in advanced countries and larger percentages in developing countries. Textbooks have a history almost as long as that of the book, whether in scroll or codex form. Indeed, Albert Kapr, presently regarded as the leading authority on Gutenberg, opines that the first book printed from movable type was the standard Latin grammar and dictionary textbook used throughout the Middle Ages and early Renaissance for instruction in the universal language of that period, the 27-line Aelius Donatus *Ars Minor* printed in Strasbourg.^[3] Since that day textbooks became an increasingly important and profitable element in almost every publisher's list. Neither the growth of literacy or learning is comprehensible save in the context of an appreciation of the central role the textbook has played in the evolution and present prominence of the culture of the West. The textbook and related supplementary readings continue today to be the principal educational tools in the shaping of the minds of the young and their induction into the mainstream of their culture, now throughout the world.

The textbook, despite its critical role in education, has for much of its history been the lightning rod of cultural conflict, thanks to this very criticality of its role—both within the West and between the West and the balance of

the world. As a consequence, the publishing of textbooks is far from the static, seemingly benign activity it is commonly thought to be. The textbook has always been the target of all manner of special interest groups seeking to impose their various agendas on education—and thereby, on the shaping of the minds of the oncoming generations. While these conflicts over the contents of textbooks erupt on occasion into the view of the larger society—one thinks, e.g., of the contests over the control of schools and textbooks, in the centuries following the Reformation—they are usually confined to the immediate and, in many ways, inbred circle of the educationists. Textbook publishers have long since seen themselves and been considered by other segments of the educational establishment as members in good standing thereof. The textbook publishers, therefore, have chosen, by and large, to accommodate these differences by steering a middle course between contending special interest groups, which often results in a quite bland editorial substance, which in turn proves of questionable educative value.

Textbook publishers, particularly those publishing college and university-level textbooks have turned to alternative forms of publishing over the past two or three decades. The first radical departure from the standard textbook was the “course pack.” The course pack is a collection of chapters from two or more textbooks all focused on a usually narrower subset of the topics typically treated in a textbook, but also commonly derived from the fashion in which professors wish to structure their instructional approach. In the most recent and radical departures from the traditional print textbook, entire textbooks and course packs are now being offered for sale in digital form as CD-ROMs or for downloading from publishers’ Internet sites.

Whatever the periodic lapses by some textbook publishers from contemporaneous best standards of knowledge content, the textbook and its publishers are so central to the passing along and maintenance of the received cultural heritage that they will continue to represent a significant and critical element in the world of publishing.

The next largest class of publishers is the STM publishers. As the name implies their editorial foci are oriented to related worlds of pure and applied science. The STM publishers range in size from international conglomerates publishing widely across the spectrum of the sciences and their applied practices to highly specialized niche publishers. Many also devote a considerable amount of capital and editorial effort to the publishing of journals in some or all of the specialties in which they publish.

Related to STM publishing, and often conducted by STM publishers, is the publishing of professional literature. As the name implies, this publishing sector serves the needs of the growing army of professionals—lawyers, accountants, and the like—and the even faster growing battalions of “experts” of all kinds, both private and public. The political, economic, and social structures and

practices of modern society, and particularly that of the advanced countries, have become so complex that all manner of specialized knowledge is now required to negotiate the tortuous corridors often imposed on the citizen by this complexity. Of necessity, the citizenry has been compelled to turn such experts for help whenever compelled to navigate these uncertain waters. So, the professional publishing sector has arisen and expanded in parallel with this growth of experts. One of the most obvious of these specialized fields is that of management to which a multitude of books are now oriented every year. At a somewhat lower and more common level are the numerous books aimed at serving those seeking entrée to and subsequently maintaining currency in one or another of the numerous skilled vocations that have accompanied the increased complexity incident to the modernization project.

The last major class of books published is that serving a religious orientation. These range from the texts of the sacred texts of the world’s religions to devotional tracts. This class represents about 10% of total book sales in the developed countries and probably larger percentages in some regions of strong religious belief elsewhere in the world. Religious publishing, while remarkably difficult to track and quantify, seems from several accounts to be enjoying a significant upsurge in numbers of publications and in terms of sales at the present writing.

In addition to the major categories of books dealt with above, there is a large and generally unquantified body of publishing conducted across the globe every year. This transient body of publishing is commonly referred to as “ephemeral literature.” The publishing of ephemera serves a multitude of purposes usually confined to the narrow, self-contained objectives of a vast array of small, special interest groups. These groups appear to be endemic to every region of the world, save the poorest and/or most remote portions thereof, and are particularly committed to the use of publication to articulate, advance, and sustain their particular interests.

PRESENT PROBLEMS

Although a shallow backwater in financial terms the publishing trade exerts political, economic, social, scientific, and, more broadly, a cultural impact of the first rank—an influence greatly in excess of its fiscal stature. This disproportionate importance in cultural consequence imposes on the trade in general, and publishers and editors in particular, an enormous professional cultural responsibility. Shabby publishing inevitably and invariably leads to shabby long-term cultural outcomes, as has been agonizingly evident and with alarming frequency in past centuries. It is all too easy for publishers and editors to seek short-term financial relief or wealth by trolling for the lowest common denominator. At least as culpable is the knowing publication of books that advance untrue

or ethically impoverished propositions. Such resorts to the dissemination of populist or dubious goods are not simply contemptible in terms of the critical role that the finest publishing tradition fulfills but culturally corrosive.

Perhaps the gravest problem presented by present publishing trends, second to the continuing extent of shabby publishing, is a fundamental cultural epistemological problem. It arises out of the growing imbalance between the increasing volumes of raw data/information published in journal or electronic form and the comparatively slighter fraction thereof being synthesized/reduced to knowledge concepts published in coherent book form. Random bits and pieces of data/information are of no intrinsic intellectual value save as they can be integrated/synthesized by savants into knowledge concepts. Individual bits of data are absolutely essential and of the utmost importance to the prepared mind, but they possess no meaning and, hence, value to a mind not well stocked with knowledge concepts or working hypotheses into which they can be fitted to support or refute a knowledge hypothesis. There are in a number of subject-matter fields of genuine importance imbalances between the numbers of research people digging out/discovering new data/information and the numbers of people involved in synthesizing these data into hypotheses, thereby weaving some form of coherent knowledge concept out of these data and integrating these concepts/hypotheses into existing bodies of knowledge. Authentic book publishers can play an enormously useful cultural role, as they have in the past, by closely and continually monitoring these imbalances and then identifying and seeking out potential synthesizers and to then encourage them to imbed their works of synthesis into a book for broad circulation—and possible falsification.

In all likelihood, the next most serious problem faced by book publishers is the continuing attrition of library budgets. Two significant deleterious consequences arise from these budgetary constraints. First, libraries are able to acquire a constantly declining percentage of the print output resulting from the still increasing output flowing from research and synthesis. These progressively diminishing budgets are additionally being expected to acquire a far wider range of materials, most notably but not confined to electronic forms. The outcome is that libraries are acquiring a diminishing fraction of an increasing intellectual output—both print and electronic. Consequently, publishers are being increasingly constrained in the performance of their cultural function. Second, libraries have traditionally been not only an indispensable support of serious publishing but a necessary and useful partner in the larger cultural “peer-review process.” In the latter role, they have long been looked to endeavor to not only weed out the culturally mediocre but to promote the dissemination of the culturally sound. Both the preservation of the good and weeding out of the mediocre are at the very best very difficult and subject to real abuse.

Obviously, the acquisition of a declining proportion of the books and journals published in both print and electronic form limits to a greater or lesser degree the effective discharge of both of these two vital cultural functions. Possibly as great a harmful consequence of the throttling of library material budgets and the resulting reduced capacity to bring books into library holdings is either increased book prices for all buyers or, in the more acute cases, the choking off of book manuscripts in publishers’ offices induced by uncertainties about viable markets.

A continuing publishing problem remains that of copyright protection—intellectual property protection. This problem is most acute in the case of STM books and textbooks. While the problem is worldwide, it is especially acute in the underdeveloped regions of the world. The books involved are most commonly those published in the English language. Although Western publishers have over the years made all manner of concessionary exceptions for the underdeveloped countries, the problem continues to evade solution. However, this problem is not confined to underdeveloped countries; the unauthorized use of the intellectual and literary efforts of others is widespread in developed countries. Since the widespread acceptance of the Internet, an increasing volume of piracy in the form of downloading intellectual property has developed in this channel as well. The consequence of these alternative methods of acquiring intellectual property yields the unintended consequences of higher prices for all books and journals for the ethical users as well as a proportional reduction in the property owner’s income.

Another of the seemingly intractable international publishing problems is the matter of publishing in languages of limited usage. The common remedy invoked to solve the publishers’ problem is to look for government subsidies to publishers. This, as any reader of John Milton’s *Areopagitica* knows, is a dangerous game at best. The continuing history of governmental intervention in the publishers’ workshop since Milton’s time simply confirms the wisdom codified by him and provides a continuing sorry account of the unintended consequences resulting from this rent-seeking solution of government subventions. A far better solution to not only this problem but opening a far larger perspective to the citizenry of such minor-language countries as well would seem to be intensive and sustained instruction in one of the world’s major languages. The economic benefits resulting from such an educational investment would likely recover the costs involved many times over.

THE FUTURE

Turning from the disconcerting matter of the problems confronting the publishing trade to the equally dangerous enterprise of trying to make some sense of the present trends in the world of culture, knowledge maintenance

and formation, and authentic publishing some of the following observations may be useful in orienting the planning exercises of librarians and information specialists.

In all likelihood the most important trend that will greatly impact the future of publishing is the continuing increase in the financial support of research, both private and public. One of the major conclusions that can be drawn from the history of the scholarship of the last half century is that the extent of our ignorance not just of our world and our natures but of the history that landed us on the shores we presently occupy is dauntingly large. While the totality of our knowledge is impressive indeed, it still falls short of that level of understanding with which all can feel intellectually and ethically relatively comfortable. This realization has driven the continued increases in support and the inevitable increased publication, as it has in the past. It seems almost certain, therefore, that the number of new book titles being published can only increase. This increase is the inescapable consequence of not simply the synthesizing of new knowledge concepts and the integration of these new concepts into the bodies of existing knowledge. It will also follow from the necessary and continuing falsifying of older, unsupportable knowledge hypotheses in light of the new knowledge hypotheses that emerge or the contradictions that appear as these new hypotheses find their place in existing bodies of knowledge. Book publishers and editors will play a crucial role in this knowledge-building process.

Preceding the falsifying of unsustainable hypotheses and the synthesizing of new hypotheses in books containing coherent bodies of knowledge is the discovery/uncovering of data/information resulting from this continued vigorous support of research. The third likely future outcome is quite how these research results will likely enter into the larger public square of discourse and debate. On present trends, this process of dissemination seems a highly uncertain matter. Traditionally, research results have been made public in the form of journal articles and research reports. The rapidly emerging technology of electronic transmission has radically altered the likely future channels of dissemination.

To come to grips with this seeming conundrum some of the leading characteristics of the uses of the journal and of the nature of the thing in itself at the opening of the new century must be noted. First, as is well understood the cutting edge of research in virtually every subject-area field is dominated by a tiny handful of key players. These key players seldom look to the journal literature for cognitive purposes for they know most of the other members of their respective invisible college as well as the avenues of research/discovery/hypothesis formation being pursued or advanced by their peers. This elite rather employs the journal for several other purposes. First, journals are used to establish priorities of discovery in the highly competitive environment of work at research frontiers. Second, the elite uses journal papers to signal to others in the invisible

college the marking off of future research avenues in an effort to foreclose competition. And lastly, of course, these movers and shakers still intend to communicate their results to the vast bulk of others in the subject field who use these results to maintain currency for the discharge of their pedagogical responsibilities.

These latter preponderant pedagogical members use the journal for quite other purposes. As noted above they use journals to maintain subject currency for instructional purposes. They are, however, also faced with the “publish or perish” employment mandate. Consequently, they tend to publish that 75% to 80% of the papers that make no contribution to the information base of their particular subject area field or are essentially meaningless. This is also the group that uses the journal literature maintaining currency in the intellectual content of their field and for verification purposes.

Turning to the journal itself the principal observation to be made is that it is, and always has been, a miscellaneous gathering of papers. As such any specific issue possesses no substantial coherence for any particular reader. Thus, the vast percentage of papers contained therein is remote from the intellectual interests of most readers. (Notable exceptions are such high-status, general-purpose journals, such as *Science* and *Nature*.)

The second, major characteristic of the journal is that it remains, in essence, a print product and as such is conceived in terms of an issue and for commercial purposes as a subscription for all the issues published within a defined period, usually a year—this for historic reason that the first journals were published as a member benefit by learned societies and so, tied to yearly dues. Thus, the present thinking remains tied to yearly subscriptions to a specific journal title. (Historically, reports are spin-offs, for they did and do not fit the journal format well.) However, the retention of this association with a yearly subscription cycle is becoming increasingly dysfunctional for the publication of research results and that of related forms of information/data as the volume of the latter continues its recent increase.

It seems probable, in light of the recent development of massive computer capacity and the escalating sophistication of management software for enormous databases, that information/data will increasingly be made available by highly defined systems, akin to the approval plan system for books and tailored to the specific needs of individual users. The ongoing operational costs of such a system will prove sufficiently small that such individual profiles can be maintained and serviced directly to subscribers' desktop computers at a very reasonable cost to the individual subscribers.

If this trend is realized an entirely new journal/report infrastructure must be created. Subscribers to such a system will probably be served by newly formed organizations serving as middlemen between publishers and users. Libraries will continue to have a role in information/data

dissemination as the middleman between publishers and occasional users, i.e., those users whose information/data needs do not warrant signing up for a sustained service.

It also seems likely that libraries, operating as stakeholders in some kind of consortium arrangement, will be responsible for warehousing/archiving these vast bodies of raw information/data until various chunks of it are reduced to knowledge concepts by library scholars. The latter are scholars devoted not to uncovering new information/data working in a research setting, but scholars working in libraries on the already discovered information/data literature to reduce it to some kind of comprehensible form—knowledge concepts and ethical precepts—which can be incorporated into existing bodies of knowledge.

The latter role of knowledge concept and ethical precept formulation/synthesis will become increasingly important as the society more fully recognizes the unsustainable disparity between information/data discovery and knowledge formation/synthesis. Consequently, librarians will be called on to play an increasingly critical role as partners in marshalling of information/data for the utilization of the library scholars who will be virtual habitués of libraries.

All of this intellectual work of synthesizing new knowledge concepts and integrating them into existing bodies of knowledge will, of course, be disseminated to the broader public in the form of sustained discourses. Manifestly, so doing will result in a marked increase in the number of books published.

All of which brings us back to library as the cultural warehouse of the culture or the memory of the species—all those seemingly old-fashioned and presently disdained descriptions of the cultural place and function of the library. It brings us back, as well, to where this entry began. The number of book titles published yearly will continue to grow as humankind seeks to better come to grips with the true and the good.

CONCLUSION

Substantial clouds of uncertainty surround publishing at this writing. The principal cloud is economic resulting from the flattening of sales and the other problems noted above. All of this uncertainty is further complicated by the yet unknown consequences of the digital revolution. Publishers have, however, had to perform their cultural role through all manner of difficulties and uncertainties. So, at the end of the day they will continue to originate books and journals as the cultural need for knowledge, literature, and information is not likely to disappear.

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School Librarianship

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Abstract

Professional school librarians have served schools in the United States for just over 100 years. They are certified or licensed to teach in schools as a part of the education rules and regulations established state by state. Their role is to provide access to information for students and teachers, to help teachers teach and students learn. They collaborate with teachers to build curriculum and they expand the use of technology in their schools to help others navigate through the mass of information on the Internet. Studies have shown a strong relationship between the presence of a professional school librarian and a school library, which are factors in the achievement of students.

INTRODUCTION

Over the past century, the role of school librarians evolved from keepers of a book collection to providing multimedia resources, teaching information literacy in all its formats, providing electronic access to the world's information, and offering professional development to colleagues in the use of technologies and the implementation of the Common Core State Standards. Collaborating with teachers, school librarians share the responsibility of educating their students from preschool through high school, ages 4–18. Through computer access and other electronic devices, they offer training in the finding and use of information for administrators, teachers, students, and sometimes parents and the community. While school librarians continue to encourage reading and help students find books for recreational reading, they now collaborate with teachers to improve teaching and learning, helping to plan the teaching of curricular units and to evaluate student responses to the assignments. They collect data to show how school libraries are used to help improve student academic achievement. Their history is short, and many challenges remain to be overcome.

HISTORY OF SCHOOL LIBRARIANSHIP

The first trained school librarian, Mary Kingsbury,^[1] began work at Erasmus Hall in 1900. In 1903, Mary E. Hall was named to the Girl's High School in Brooklyn, and she described her library

...to realize what we mean by a "modern school library" one must see it in action... To have as your visitors each

day, from 500 to 700 boys and girls of all nationalities and all stations in life, to see them come eagerly crowding in, 100 or more every 40 minutes, and to realize that for four of the most important years of their lives, it is the opportunity of the library to have a real and lasting influence upon each individual boy and girl, gives the librarian a feeling that her calling is one of high privilege and great responsibility.^[2]

Providing school libraries and librarians had slow growth over the years until regional accrediting agencies began requiring a trained school librarian in each school. Since few districts accredited their elementary schools, it was not until the mid-1960s and the passage of The Great Society Funding with ESEA Title II dedicated to the creation and improvement of school libraries, that elementary schools created libraries and added professional staff. During this time of expansion, multimedia formats were added to the book collection.

To better describe the role, the American Association of School Librarians (AASL) through its publication of new standards changed the name to school library media specialist, but it reversed this decision in the new century. Today, some states are beginning to adopt a term used in Australia and Canada, *teacher librarian*, to emphasize the teaching role of school librarians.

The numbers of school libraries under the direction of a certified school librarian continue to grow and lessen depending upon the nation's economy. At the beginning of the second decade of the new century, the numbers are declining with some libraries closed and others run by technicians or parents. As parents and school staff become aware of the need for someone to help students become lifelong learners able to access and use information that is accurate and useful, the pendulum should swing again.

PREPARATION OF SCHOOL LIBRARIANS

In 2013, the National Council on the Accreditation of Teacher Education (NCATE) merged with the Teacher Education Council (TEAC) to become the Council for the Accreditation of Educator Preparation (CAEP). Programs in schools of library and information science accredited by the American Library Association's (ALA) Committee on Accreditation, also accepted by the CAEP. School librarians differ from their colleagues preparing for positions in other types of libraries and information agencies because of the focus on teaching and working to improve learning. The degree from an ALA program is the license for public and academic librarians throughout the United States. The school library certificate is unique to each of the 50 states because the education of children is the responsibility of each state's board of education.

Requirements for the school library certificate or credential vary; in many states, school librarians are considered to be "teachers," and they must meet the established requirements or competencies for certification to be eligible to teach in a classroom as well as meet library certification. This means they hold a teaching credential for either multi-subjects in an elementary or high school-specific subject areas. Competencies vary according to the level of student being taught so that elementary teachers may meet one set, while secondary teachers follow a different course.

In other states, a person may be certified only as a school librarian who is not required to be certified as teacher for elementary school or a subject area in a secondary school. In this case, teachers are considered to be "special" teachers—teachers of art, music, and physical education; librarians; and guidance counselors, and they are usually certified for K-12. Persons holding this specialty may not be able to remain when the specialty is no longer considered a necessity.

Moving from one state to another can require a school librarian to take additional courses. Many states allow the first credential to be given at the undergraduate level, whereas other states may require a master's degree. Further, some education agencies insist that all teachers complete a course on that state's history, whereas others may ask the person to complete requirements to teach in elementary or high school if they only hold a school library credential.

The actual certification process for most states employs one of the following three methods: passing a test, certification through the state education agency, or designated teacher training institutions. In the first method, interested applicants sit for a test designed to confirm their eligibility for the credential, and when they pass the test, they are granted the credential. If the state department is responsible, the applicant submits the required documentation directly to the appropriate state department office. Either personnel in that office or their designated evaluators match this information to the state requirements and grant the certificate or point out the deficiencies. In the last method,

a process of program approval is granted to institutions of higher education within the state. The state education agency establishes standards, guidelines, and competencies required by those who will be teaching, and each training program supplies a plan to confirm the competencies are covered in the curriculum. State agencies then send teams of evaluators to the program to confirm that they are, indeed, able to graduate school librarians who have those skills. Continued periodic evaluation ensures that the quality of education programs within the state is maintained.

Most certification programs for school librarians require courses or demonstrated competencies in reference, management, cataloging, and technology. Students must complete courses introducing them to literature for children and young adults, both fiction and nonfiction. A curriculum integration course may be required or this may be interwoven into all courses. If a student has had no classroom teaching experience, this may be required, and most programs require a school library practicum experience, working in a school library with an exceptionally good school librarian for a designated period of time. In many states, a teacher may begin work as a school librarian on a emergency certificate while finishing the requirements for the credential. Also in some states, all teachers, including school librarians, must take additional courses to keep their credentials current with regular, confirmed professional development in college courses or other experiences.

In 2001, the U.S. National Board for Professional Teaching Standards completed Library Media Standards (for teachers of students ages 3–18+). Performance-based assessment procedures have been developed, including a portfolio of practice during a school year and summer "assessment center activities." School librarians who meet the competencies determined by these procedures will become National Board Certified and as such may not only receive recognition for their accomplishments, but their salary also increases. In some states, funding is allocated to teachers to encourage their participation.

The Working Environment

The role of the school librarian may be affected by the educational requirements of the school. No Child Left Behind (NCLB) Public Law 107–110 was first proposed during the Bush administration and put in place by President Obama. It was a part of the reauthorization Title I of the Elementary and Secondary Education Act. Each state was required to develop assessments of basic skills if they were going to continue to receive federal funding. These assessments were conducted yearly at select grade levels to determine the students' annual progress in academic programs. This new emphasis on testing with some of the results tied to teacher salaries has turned education in the second decade of the new century into a test environment, leaving little time for anything but testing. Teachers are reluctant to have their students spend any time on any

activity that does not apply directly to the tests they will be taking. This has further isolated the school librarian and other teachers from offering experiences for students.

In most schools, the school librarian works alone or with an aide. In only the largest schools will a second or third professional be in place. For this reason, they are often solely responsible for the activities going on in the school library, and unless they are able to have classes come to the library under a flexible schedule, collaborating with teachers for curriculum integration is very difficult. Flexible scheduling allows the teachers and the school librarian to determine when classes, students in small groups, or even individual students may visit the library. In other cases, and particularly at the elementary level, classes are scheduled into the library to provide the requisite preparation period for the teacher.

With the downturn in the economy, some school librarians are assigned to multiple schools. An aide may be in the school when the librarian is off-campus, or the library may be closed.

School librarians may have a great deal of autonomy partially because a few in the school or district understand the role of the school librarian. In larger districts, a supervisor of the school library program may work in a central office to oversee programs. However, authority and responsibility for all teachers including the school librarian belong to the school principal. School librarians often spend a great deal of their time educating both principals and teachers on the role of school librarians.

When school librarians are technology leaders in their school, they become responsible for professional development to assure teachers are making the best use of all available technologies. The use of social media by students has made this format a challenge to teachers who can, if prepared, turn these devices into a learning environment rather than a nuisance. School librarians can help teachers prepare for this new educational opportunity.

The Librarian's Responsibility for Teaching and Helping Teachers Teach

While school librarians have been, for many years, teaching students how to locate information in the school library, the 1998 publication of *Information Power* described the new role of the school librarian to include information literacy.

Information literacy—the ability to find and use information—is the keystone of lifelong learning. Creating a foundation for lifelong learning is at the heart of the school library media program. Just as the school library media center has moved far beyond a room with books to become an active, technology-rich learning environment with an array of information resources, the school library media specialist today focuses on the process of learning rather than dissemination of learning.^[3]

This role moves beyond information literacy to the myriad of other literacies that have surfaced including business, computer, health, media, technology, and visual among others.^[4] An even more recent addition is digital literacy. All of these are a part of much that is being taught in classrooms and collaboration between teacher and librarian effectively increases the ability for students to become literate in each.

The role of the school librarian has expanded with the ever-changing technologies in the school, and with the changes in curriculum that have come into schools with programs such as the Common Core State Standards. These were developed in 2009 by David Coleman who was employed by the National Governor's Association to write curriculum standards for literacy, now English language arts, and mathematics. While these standards have not been adopted by every state, where they are in effect, teachers need some assistance in meeting the requirements. This provides school librarians with an excellent means to help teachers teach.

The Librarian's Responsibility for Teaching and Helping Students Learn

School librarians teach students how to find resources to help them learn to become information literate. When school librarians collaborate with teachers, this becomes inquiry learning and provides the student with the skills to become lifelong learners. This responsibility includes making sure those resources are available for their students and that all students have the ability and the freedom to access these resources. The ability specifies their access to technologies needed to search online; and the freedom means the librarian supports and protects the students' intellectual freedom rights. One of those restrictions, filtering, is discussed later in this entry. However, here, the selection of materials and the protection of those choices from censorship by members of the community mean the librarian has a selection policy in place and the process to follow when someone questions any item in the collection.

School Library Standards and Guidelines

Standards for school libraries were published in 1919, 1920, and 1948. It was not until 1960 that the AASL published its own *Standards for School Library Programs*. These standards and those published in 1969 and 1975 were based on quantitative numbers such as professional librarians hired for so many students and so many books per student.

In 1988, *Information Power*^[3] changed the focus from quantitative guidelines to the role of school librarians. School librarians were expected to be leaders and links between students, teachers, administrators, parents, and community, as well as providing information resources.

School librarians were assigned the responsibility for collaborating with teachers to improve teaching and learning.

The newest, *Standards for the 21st Century Learner*, continues the traditional role stating “Reading is a window to the world” as one of the nine common beliefs. The rest focuses on how learners will use skills, resources, and tools. The school librarian functions as someone who will make sure students have the key abilities needed for understanding (skills), ongoing beliefs and attitudes that guide thinking (dispositions in action), common behaviors used by independent learners in researching (responsibilities), and self-analysis strategies.^[5]

FUNCTIONS AND SKILLS OF SCHOOL LIBRARIANS

A key document to describe school librarians is found in the ALA/AASL Standards for Initial Preparation of School Librarians (2010). This document is available at http://www.ala.org/aasl/sites/ala.org.aasl/files/content/aasl_education/schoollibrary/2010_standards_with_rubrics_and_statements_1-31-11.pdf.

Because school librarians usually work alone, they are responsible for all activities, programs, and services including management, cataloging, acquisition, reference, and readers’ advisory. As mentioned earlier, school librarians are the managers of their libraries. While most of their books may come to them from the vendor with the electronic records needed for the online public access catalog, not everything comes from a vendor, so some knowledge of cataloging is required.

Teachers, students, and even parents may make suggestions for purchases for the library; but the final purchase orders are generated by the school librarian. Also, while school librarians strive to help teachers and students learn how to use online references and keep them current as new online resources arrive, this is a skill requiring constant practice and school librarians have the opportunity to use their skills regularly, making them effective reference librarians.

Another skill is that of helping their students choose books that will interest them so that they become lifelong readers. Readers’ advisory takes many approaches including book talking books for students, developing reading lists for teachers, and simply suggesting an interesting title to a student who seems to be having trouble finding something to read. To be truly successful, the school librarian must be an effective communicator, keeping current on new technologies, and being able to make sure their students have open access to information, a truly great challenge, and they must also be ready to change, learn, and grow so that their program and activities respond to the best resources for teachers to teach and students to learn. Once that program is in place, it is imperative that what is

offered and what is being consumed be reported to the people who are important in the continued support of school libraries.

Effective Communication

The first major audience for communication is the student. This may be translated into maintaining good discipline in the library to allow students to learn what they have available for them and a place to exercise their critical thinking skills. It is also being able to talk to students about their lives. In this way, they can learn of problems they may be having with their school work and how information in the library may help them overcome these problems. Because teachers have students in a classroom within a specific time frame, little opportunity may be available for students with problems to share them with their teachers. The relative freedom of the library environment often makes it possible for the school librarians to find out what is troubling students and to help them find the persons or information for the solution of that problem. The next, and perhaps in many instances, teachers must learn what services are offered and how the librarian can collaborate in making sure students learn effective critical thinking skills, becoming literate, and setting them on the path to being lifelong learners. When two professionals are working together to provide curriculum, it doubles the number of persons working with students for a single period of time. They must learn how the librarian is able to help them enhance their teaching and evaluate what students are accomplishing.

Effective communication with the principal means regular reports of interesting activities going on in the library. This can be done with written reports, but even more effective are demonstrations by students. Showing what students are achieving in their use of the library draws the school board and the community into continuing support for school libraries and school librarians. Another important service for both administrators and teachers is keeping them informed about trends in teaching and learning, the results of research reports of methods that could be implemented in their schools, and other ideas to make teaching and learning more effective. Culling the education literature to provide the best will take time, but will also point out most effectively the role of the school librarian in providing information for all.

All of these, administrators, teachers, and students can become effective advocates for the program. Showing members of local social clubs and other community groups what is going on in school libraries allows them to see the value of the school library in the lives of students. Students, teachers, and parents who visit local, state, and national government officials can explain what happens in school libraries and how their school librarian is essential in the learning environment.

Use of Technology

School librarians have been on the cutting edge of the implementation of technology in their schools. In 1915, Mary Hall reported having lantern slides, and “for the English work and indeed for German and French, a Victrola with records which make it possible for students to hear the English.”^[2] Funding in the 1960s found new media and the equipment to play and project these on the library shelves. School librarians began adding computers to the services offered in the early 1980s. The first use was for word processing and management of the collection, cataloging and circulation, closely followed by reference materials on CD-ROMs. These became quickly obsolete with access to online resources from vendors. Computers moved into the library, sometimes in a separate room, in the reference area, and where the card catalog used to stand. Students used computers in the library to write and print their papers.

Student use of computers has become so essential that some schools are providing for laptops and electronic notebooks either for a year or semester assignment or at least checkout for a time from the library. This means that no students are handicapped because their families cannot provide them with computer technology.

School librarians have been responsible for interconnecting classrooms to libraries and providing the electronic resources in the library to be shared beyond classrooms to the student’s home. When school and public librarians have a cooperative relationship, this interconnectivity may be between the public library, school, and homes. This means school librarians have become computer savvy and able to select, install, and use new technologies.

School librarians recognize the constant need to upgrade computers. With every change in software, hardware must have additional storage and a faster response time. As the hardware expands beyond the computer itself to printers, scanners, and copy and fax machines, these also must be upgraded. It is not a situation that will become easier. Also, with the expansion of the Internet, school librarians had an additional challenge of how to keep information one would not choose to have in the library, out of the library.

The Challenge of the Internet: Filtering the Internet

The opening of the Internet has provided a myriad of opportunities to search for information on the World Wide Web (WWW). With this, access to online resources expanded beyond the ability of the school librarian to monitor what information came into the school library. It was possible for students to locate pornography, hate messages, and other information that a school librarian would not select for users. Information on the Internet may be somewhat more difficult to spot than a student with an

issue of an “adult” magazine tucked into a notebook which could be permanently removed by confiscating the magazine. Websites on the Internet are much more difficult to monitor and stop their being used on a school library computer. One solution to the challenge is a filtering system for library computers.

Filters that review information being received via the Internet are available. They have several problems, one of which is that filters often keep important information from coming through; another is that a clever student can easily circumvent them. Other solutions seem to work as well or better. One is to have students and parents or caregivers sign a contract concerning the use of the Internet in the library. Not abiding by this contract can mean the student cannot use the library’s computers or access the library’s other resources. Another solution is to establish links to acceptable websites that will provide students with information that is relevant to their needs.

Even greater challenges are present with the Internet and access to the WWW: misinformation, students who find too many sources and choose irrelevant information, and those students who simply copy information. If students are looking at a screen filled with pornography, it is instantly recognizable for what it is, but the greater problem is the misinformation that can be found on the Web. Unless the librarian is seated with the student and reading what they are reading, the misinformation may go undetected until it is being corrected by a teacher.

Helping students to learn how to find the relevant, accurate, useful information from the overwhelming quantities available on the Web is another responsibility. So much information is available that it is difficult to help students sort through it all to select what they need for their research. School librarians can help students by doing some of the first searching and providing links to relevant information. This does not stop the student from simply copying what is found.

It is also far too easy to download information and reposition it within a report without thinking through the information and adding to it or taking away from it or analyzing it to create new information. At no time has the ability to plagiarize been greater. It takes strong collaboration with teachers to make sure students use their critical thinking skills to determine appropriate information and to use that information to analyze a situation and propose a solution by repackaging the information.

Perhaps the greatest challenge of all is how to help teachers learn how to physically use new electronic resources and how to integrate them into their courses. The constantly changing hardware and software, as well as the constantly changing access to new databases, can be confusing to the school librarian who works with them daily. It is even more distressing to the classroom teacher who is not so close to the situation. This means that the school librarian serves as teacher of teachers to make sure that they also keep up to date.

Ability to Change, Learn, and Grow

Changes in educational theory and methodology for teaching dictate much of what happens in schools. School librarians take responsibility for learning about new trends and methodologies and share these with their principals and their teachers. They constantly demonstrate their ability to change, learn, and grow, and this is most evident in their awareness of the constant upgrading of technologies and their willingness to teach their colleagues how to use each new technology as it becomes available. The advent of the new social media creates a challenge to teachers who do not wish to have their students use cell phones and text during class. While confiscating all cell phones may provide a temporary fix, making an educational application for these technologies so dear to all students can be a more effective solution.

Collaboration with Teachers

The school librarian has moved from the support role of providing resources for teachers and students to one of collaborating with teachers to increase student learning. School librarians plan with teachers, actively helping with the development of curriculum units. As an expert in information resources, learning styles and patterns for students, and teaching styles of all the teachers, the school librarian suggests the best methods for implementing curriculum. Expanding the classroom into the wider world of information, the librarian integrates research skills into the students' everyday questioning, helping students to learn how to judge which materials to use in their research reports, helping students with inquiry skills and increasing their critical thinking skills.

Helping teachers make the best use of the opportunities provided by the new technologies their students have readily adopted is essential. From e-mail and cell phones to texting, Tumblr, Instagram, and blogging are the ways students communicate. These will not go away because teachers ignore them or, worse still, try to forbid their use. Rather, the school librarian helps them make effective uses of these technologies.

The collaboration role does not end with helping match resources to the curriculum, the school librarian helps assess student learning. An active participant in the building of units of instruction, the collaboration continues through the evaluation process and design for the next group of students. This role is not automatic nor is it an easy one. Whenever education moves into a paper and pencil test to ascertain if children are learning, teachers move back to teaching to the test and are reluctant to take time for students to learn in ways other than rote memorization. This makes it very difficult for collaboration until the pendulum swings back and students can learn through a collaborative process which makes their learning based in the real world.

Assessment and Evaluation

School librarians have learned of the need to measure the effectiveness of their services. Many studies^[6-9] have been completed in several states showing the relationship between academic achievement and the presence of a school librarian and an adequate collection of materials.

Workshops at conferences or in the online environment suggest to school librarians that they should conduct their own research to show the value of their libraries in the educational lives of students. Articles in school library periodicals offer many ideas for how to carry out such projects. It is never easy with the demands of the school year; nevertheless, some school librarians do small studies and report the results to their school and even to the district administrators and the members of the school board.

Advocacy

School librarians remain relevant in the school when they are able to "sell" their program and resources. This begins with the development of a website for the library where new arrivals in the library or new activities may be listed. Teachers post assignments and homework with links to the library's resources as well as safe websites and databases available to complete the assignment.

It is both an education and a survival process. In the education mode, school librarians encourage teachers and students to make use of the collection to further their research and learning. New materials and new technologies available in the library itself or virtually through the library increase its importance. School librarians make presentations of new products in the library at meetings of department staff or in teachers' meetings. They provide effective bulletin boards in the library to encourage students to "buy" the products offered. They send lists of new materials to classrooms.

In the survival mode, the use of the school library must be shared with the broad community. School librarians send monthly reports of the activities in the library to their principals. They write columns in both the school newspaper, and whenever possible to the local news media. They plan and implement programs such as inviting a book author, a local politician, or a state or national legislator to the school to bring attention to the library. School librarians singly may ask their principals to invite district administrators and school board members to the school to observe an effective program outcome, or, as a group, they make yearly presentations to their school boards and provide programs about school library initiatives to their communities through their service organizations. All of this serves to help present the role of the school librarian to audiences, most of whom are truly unaware of what they should expect from their school librarian.

The Leadership Role of School Librarians

The traditional role of the person who shares books with students encouraging them to read both for information and enjoyment remains and provides resources for teachers on special subjects being taught continues to be important, but a wider role has opened.

Responsibility for audio-visual materials purchased for the library meant school librarians began to take a leadership role in integrating these new items into the curriculum. Their role expanded from helping find appropriate resources to showing teachers how to use the equipment needed to play or project those materials and even how to create new teaching aids. When computer technology became available to schools, online information became a large part of the library collection, and school librarians accepted the responsibility for teaching both teachers and students how to find information available on a variety of databases.

Today, school librarians continue to lead by presenting new uses of the Internet. They build websites where information about the school library is posted. Working with teachers, homework assignments are available for students and their parents, and the accompanying resources are linked there through bookmarked websites. Keeping up with the trends and suggesting educational uses of each new technology leads teachers into turning what might be considered a distraction into a learning tool.

As the single teacher in any school who works with all of the students, all of the teachers, and all of the curriculum all of the time, school librarians are in a unique position to help build an atmosphere of sharing across the school. When the focus is on something other than testing to determine if students are learning, teachers in all areas of the curriculum are able to work as a team to offer learning experiences which are more closely related to real life than the total separation of school tasks from the student's daily experiences. At that point, school librarians lead teachers in blending all areas of the curriculum, social studies, literature, science, math, art, music, and the others.

Compensation and Unionization

In public educational systems within the United States, school librarians are considered teachers, and as such, are on a salary scale comparable to teachers. These salaries are usually based upon years of service, coursework taken, and degrees completed. Additional stipends are paid for additional work such as staying for one or more weeks at the end of the school year to close the library and coming early to open it in the fall. A school librarian who played soccer in college may be asked to coach the girls' soccer team and receive a stipend for that.

In the second half of the twentieth century, the National Education Association (NEA) began to be challenged by

the American Federation of Teachers to represent teachers in labor relations; and the era of teacher negotiation began. One central issue was preparation time for teachers. At the elementary level, this translated into special teachers providing release time for the classroom teacher. Thus, classroom teachers walked with their students to the door of the music room, the art room, the gymnasium, and the school library, and departed. Some administrators solved this dilemma by having teachers assigned their preparation period either before the school day begins or after it ends. If no such remedy is available, school librarians can suggest a different approach.

One possibility to open the library has been using flexible scheduling, where teachers and the school librarian determine the needs of the students in use of the library and time in the library, or time for the school librarian to come to the classroom. When the school librarian has the opportunity to collaborate with teachers and the time in the library has been carefully designed, children are more interested in finding and sharing information, increasing their critical thinking skills, and setting the stage to become lifelong learners. When the release time for classroom teachers is a union requirement, alternatives must be found.

Another solution might be to have two classes in the library at the same time for book exchange and recreational reading, thereby freeing the same amount of time for planned curriculum integration. This, as with flexible scheduling, means that librarians are no longer required to provide library lessons with no relationship to what is being taught in the classroom.

For school librarians to be considered within the union contract negotiations, the most effective way to do this is to have a school librarian a member of the union negotiating team. Someone must become political enough to win an election to the union board. This will add to an already busy life, but it will be a great benefit to all school librarians in a district.

Performance Evaluation

Many states have created forms for the evaluation of teachers within that state. These have been approved by the teacher's union. They are often difficult to apply in the situation of the school librarian who is not just responsible for teaching but also responsible for managing the inventory of books and equipment found in the school library.

Tenure

As teachers, school librarians fall under the same rules as teachers. In some states, tenure cannot be granted until a teacher has a certain level of education. In others, it is a matter of being certified in a teaching area and a certain number of years of successful teaching, often as few as three.

The yearly evaluation process of teaching is a part of this tenure process. In most cases, the evaluation is done by the building principal, although a teacher or the school librarian might be visited by someone from the central district office with expertise in a particular area. Finally, tenure is granted by the governing Board of Education for the district.

Professional Development

For most school librarians as with most teachers, professional development is offered at the district level through staff development programs offered by the school district. These are effective when they are planned to meet established needs for those who will be in the audience. School librarians, with their knowledge of trends and issues in the world of education can be helpful to the principal or anyone else planning these events. Their research skills can locate experts in the field and determine the cost of the speaker. Often these district-wide sessions are directly related to curriculum content and are less related to librarianship. While many school librarians would like to attend other types of learning sessions, most have a difficult time being released to go to programs during the school day. They are seldom compensated for travel, housing, or daily expenses, and therefore do not feel they can participate. School librarians are well aware and make use of many online opportunities for them to engage in staff development without leaving their homes.

Professional Associations

School librarians have their choices of several professional associations in both the education community and librarianship and at local, state, national, and international areas. In the education world, many school librarians, as teachers, must join either the NEA or the American Federation of Teachers (AFT) through their local and state organizations. One of these will serve as the bargaining unit for the school district or the schools in the state.

Other organizations include the Association for Supervision and Curriculum Development (ASCD) and the International Society for Technology in Education (ISTE). ASCD allows school librarians to attend conferences and meet superintendents, principals, and other administrators and advocate for school libraries. ISTE offers leadership to improve teaching and learning through effective use of technology. Both ASCD and ISTE have members worldwide.

The American Educational Research Association (AERA) has a Special Interest Group (SIG), "Research, Education, Information and School Libraries." The SIG welcomes the posting of research conducted in and about school libraries.

In the library world, divisions of the American Library Association that would be of interest are the AASL, the Association for Library Service to Children (ALSC), and Young Adult Service Association (YALSA). AASL aims to provide a national audience for school librarians, and it holds a national conference every other year. Both ALSC and YALSA serve librarians working in public libraries, but many school librarians are also members of these two. Because these are national associations, travel to conferences is a greater challenge than travel to a state conference.

School librarians choose to join their state associations which are affiliates of AASL, although in some states, New Mexico, New York, and Texas, the library associations include all types of libraries. Conferences are held within the state making travel to the meeting and perhaps the registration a little less costly; yet hotels and meals will be about the same. School librarians need to join professional library associations and attend conferences whenever possible so they have these more applicable staff development opportunities.

Local groups of information professionals may have loosely organized meetings. If public or special librarians meet, school librarians should try to join them to gain support for information services for all. School librarians in a regional area who meet at least twice a year can be better able to see the challenges from one district to another. Because administrators meet regularly and learn of cost-cutting trends that may affect school librarians, the regular meeting of all school librarians in an area can serve as a warning of what may be facing them and allow for the development of ways to counteract negative actions.

SCHOOL LIBRARIANS IN THE GLOBAL COMMUNITY

Because our students are living in a global community, school librarians can help them meet their peers in other parts of the world. Students can ask their fellow students to share cultural events such as celebration of holidays, types of food, recreational activities, and their environment as a beginning. It is very easy to establish these relationships when the school librarian is a member of an international professional association.

Two international professional library associations have school librarians as members from across the globe. The International Federation of Library Associations and Institutions (IFLA) represents information professionals from all types of library associations as well as libraries and institutions. The American Library Association is an association member of IFLA while institutional membership is held by national, city, and governmental libraries, and schools of library and information science. Very few individuals join as personal members because they have

no voting privileges. Rather, they choose to be considered a member of IFLA because they are a member of one of the library associations or work in a member library. The School Library Section of IFLA is directly related to school librarians. IFLA holds its yearly meetings in different countries each year.

The International Association of School Librarians (IASL) is a smaller organization, but programming and publications are directly related to school librarians. Their activities are open to school children and how to become a part is available on the IASL website. This organization also meets yearly in countries across the globe.

School libraries with personnel, facilities, and collections are more likely to exist in the global community in those countries with the designation, “developed,” and less likely to be more than a small collection of books in a locked cupboard in the developing nations. A series of vignettes of a day in the life of a school librarian were published in the publication of the International School Librarians Association, *School Libraries Worldwide*.^[10] Longer articles provide glimpses of the duties of school librarians in Israel, Canada, South Africa, United Kingdom, Namibia, Botswana, and Australia. A series of shorter explanations are found under “International School Library Day.”

Joining an international association provides a global picture for the school librarian who can, in turn, share activities and other suggestions with teachers and students. The cost is small unless one wishes to become more active and attend conferences, but opportunities to travel to another country may just become a vacation opportunity as well as a professional development experience.

Closing

School librarians must be leaders in their schools so that when curriculum or teaching methods change and new technologies become available, they can help their colleagues make the changes needed. The role of school librarians continues to evolve. They continue to monitor the provision of information available from resources around the world and teach both their teachers and their students how to find the best possible materials to meet their needs. School librarians navigate the Internet and research databases as well as use print resources to provide access to information. School librarians will continue

to learn and grow to make sure they provide the best information available for the teachers and students and that these users know how to use the resources. School librarians are critical members of the school’s teachers if all students are going to have access to information, to have higher achievement scores, and if they are going to become lifelong users of information. Beginning more than 100 hundred years ago, school librarians provide “the opportunity of the library to have a real and lasting influence upon each individual boy and girl,”^[12] because this role is “one of high privilege and great responsibility.”^[12]

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School Libraries

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Abstract

School libraries have a comparatively short history, but their importance in the achievement of elementary, middle, and high school students and their role in providing access to the ever-increasing information available worldwide makes them an essential component on the education scene. School libraries are essential because students need free access to information, but not all students have access to the technologies away from school and this makes information unavailable to them online. Standards and guidelines that help define the school library are presented, the effect of changes in the school environment is discussed, and an introduction is given to the research pointing out the importance of the role of the school library in student achievement. Finally, the relationship between the school library and the public library is given. While most of the focus for this entry is the United States, brief mention is made of the international perspective of school libraries in other parts of the world.

HISTORICAL CONTEXT

From the earliest published reports, school libraries were poorly funded with “... any funding allocated for school libraries was limited and sporadic and given without providing for State aid, or supervision of the selections of books.”^[1] Usually disinterested in a second assignment beyond their classrooms, teachers were placed in charge of any collection of books located in schools, allowing the so-called libraries “to sink into neglect and contempt through failure to provide regular supplies of fresh reading.”^[1]

Although book collections, perhaps identified as a school library, existed prior to 1900, it was not until then that Mary E. Kingsbury, the first professionally prepared school librarian, was appointed to Erasmus Hall in Brooklyn, New York, and professional services began.^[2] The number of school libraries grew slowly until accreditation of schools began. “Regional accrediting agencies specified a high school librarian with a trained librarian as a requirement for all schools seeking to be accredited by their association.”^[5] Certainly, two world wars and the Great Depression affected the development of school libraries until the mid-twentieth century.

The launching of *Spudnik* in the 1950s confirmed the superiority of the space program in the USSR and made the United States focus on what were considered to be serious national problems with foreign language, science, and math. Congress passed the National Defense Education Act (NDEA) that provided matching funds to school districts to purchase materials to improve these areas of the curriculum. Later, these funds could be spent for almost any materials in the school library as well as all types of multimedia and the equipment to play or project these. When schools had a library and a professional

school librarian, many of these materials became part of the library collection and the library moved beyond a collection of books.

In the 1960s, a concerted effort was made to point out the lack of facilities, collections, and personnel in school libraries. Mary Helen Mahar’s 1964 national report on the status of school libraries pointed out that “46.3 percent of the public schools of the survey had centralized libraries in 1960–1961. Of the school grade levels, elementary schools had the lowest percentage with centralized libraries—31.2%.”^[3]

With the concentrated efforts of school librarians nationwide, Congress provided one part of the Great Society Funding for ESEA, Title II. With this dedicated funding for the purchase of library materials for school libraries, school districts began to hire professional staff to manage libraries, to remodel or expand existing facilities, and to select new resources such as multimedia. Children at all levels now had access to information in their schools, and school librarians could work to meet standards and guidelines.

The expansion of school libraries continued until the 1980s when the downturn in the economy saw much of the steady growth come to an end, and, in some cases, losses in funds for collection building as well as losses of staff and professional positions. The development of micro-computer technology while increasing access to information and providing new management tools placed an additional burden on the school librarian who saw the limited funding previously allocated for library materials being diverted into the purchase of this new technology.

At the end of the twentieth century, the introduction of affordable computing for library management saw the creation of networks and consortia, especially in the creation of online access catalogs. These databases expanded the sharing of resources through interlibrary loan.

The use of a variety of technologies affordable to schools, including scanners, fax machines, and the Internet allows the transmission of information electronically and seamlessly making the school library an essential part of each student's school life and is critical for those students who do not have access to these technologies away from school. School districts may provide notebooks or laptop computers for each student to take home or in other schools, students must depend upon finding these in their school libraries.

STANDARDS AND GUIDELINES

School library standards and guidelines provide models for developing programs, services, and facilities. The first guidelines^[4] for school library services were developed in 1919 by a committee of the National Education Association. They outlined staffing, collection, and facilities for high schools. The companion standards for elementary school were published in 1925.^[5] Both differentiated between the services offered in a public library and the role of the school library within a school.

The 1945 standards,^[6] the first published by the American Library Association (ALA), were not given much attention as school districts faced the challenge of providing classrooms and teachers to accommodate the large number of children entering schools. However, they did help to create the foundations for those new guidelines that followed.

In 1951, the members of the Children's Services Division of the ALA who worked in schools began the American Association of School Librarians (AASL) as a separate organization. This newer division within the ALA, published their first *Standards for School Library Programs*^[7] in 1960, helping to launch a decade of development made possible with the increased funding.

During the unprecedented growth period of the 1960s, the AASL published their second *Standards for School Media Programs*,^[8] in 1969. The next guidelines, *Media Programs: District and School*,^[9] were published in 1975. All three documents used quantitative requirements for all aspects of the library. By 1975, the new standards were given little attention because redirection of federal funds and the reduction of local funding for schools found school library positions and collections in jeopardy.

Members of the AASL had hoped to produce new standards every 5 years. However, it took them almost 15 years to produce the next edition. In 1988, *Information Power*^[10] changed the focus from quantitative guidelines to a statement of the role of the school library from the standpoint of the building level program. Rather than using what appeared to be an arbitrary establishment of quantities to what constituted an adequate number of staff, collection, facilities, and equipment, a survey of actual school libraries allowed the standards committee to use

information gathered from exemplary elementary, middle/junior high schools, and high schools. School personnel could now match their programs to real-life situations and see how closely their programs met or exceeded those reported in the high-service programs using the results as an indication of their own level of achieving excellence.

The 1998 publication of *Information Power*^[11] came after a decade of change in both educational systems and the school library program. Students began to look for information beyond what they could learn in the classroom, and the school library was able to provide access to the constantly increasing wealth of knowledge. "*Information Power* approached this twofold growth by advocating the creation of a community of lifelong learners. Information literacy - understanding how to access and use information - is at the core of lifelong learning."^[11] These standards included nine information literacy standards defining the student who is information literate, the student who is an independent learner, how the student who is an independent learner is information literate, and how the student who contributes positively to the learning community and to society is information literate.

In 2008, new standards were developed for school libraries and the focus is entirely on the student and what the student can learn. *Standards for the 21st Century Learner* will ask school librarians to help "learners use skills, resources, & tools to:

- Inquire, think critically, and gain knowledge.
- Draw conclusions, make informed decisions, apply knowledge to new situations, and create new knowledge.
- Share knowledge and participate ethically and productively as members of our democratic society.
- Pursue personal and aesthetic growth."^[12]

The final document described the learner's skills, dispositions in action, responsibilities, and self-assessment strategies. They are based upon nine common beliefs:

- Reading is a window to the world.
- Inquiry provides a framework for learning.
- Ethical behavior in the use of information must be taught.
- Technology skills are crucial for future employment needs.
- Equitable access is a key component for education.
- The definition of information literacy has become more complex as resources and technologies have changed.
- The continuing expansion of information demands that all individuals acquire the thinking skills that will enable them to learn on their own.
- Learning has a social context.
- School libraries are essential to the development of learning skills.

When standards and guidelines such as these are developed by professional organizations rather than government agencies, their implementation remains voluntary. It remains the responsibility of school librarians and supporters in the school and community to gather support for them. The new AASL standards explain a philosophy and place the responsibility for implementation on the school librarian working with teachers and are written to have an increasing impact on the education of students.

Government agencies in individual states may publish official standards and they are, in effect, laws. Because of this, these agencies are aware that they will be asked to provide adequate funds if such regulations are expected to be met. Therefore, those standards usually have such low numbers so that most schools can meet them.

Government agencies may also state the number of school librarians per school or per number of students. Again, these often place responsibility upon school districts that have inadequate sources of funds to hire the number or personnel. Most regulations have clauses that allow school districts to use a different route to providing overseeing of school library programs.

CHANGES IN EDUCATION THEORY AND PRACTICE: EFFECT ON SCHOOL LIBRARIES

Constant efforts to improve the education of students result in continual restructuring of schools, rearranging the school day, week, and even year, all under definition of educational improvements sometimes within the curriculum offerings. Changes are implemented, often without adequate research or testing. Prophets gather disciples who accept the pedagogy espoused and put it into practice, sometimes reporting that this change is successful with little or no concrete evidence. The process is similar to a small flame in dry grass; a little wind moves the fire through the land with incredible speed, often leaving behind an utter wasteland. One example of this was the new math movement in the last century. In-service sessions were provided and school teachers were required to attend. At the elementary level, teachers who were weak in math often did not understand the concepts. Parents could no longer help their students with homework, and it slowly faded away. Some of these have more direct effect upon the school librarian. The rearrangement of the school day, week, and semester reflects some of these attempts to improve learning.

With block scheduling of classes, teachers and students move from the pattern of 45-minute daily classes into longer periods of time each day for single subjects and a different pattern of subjects throughout the week. When teachers have a longer time with a single group, it provides the opportunity to work with the librarian to schedule and monitor the research process. Furthermore, students who want to conduct research have a longer time to work in the library without interruption.

Year-round schooling is another innovation, and this varies in choosing how to schedule the year. Sometimes, teachers and students attend on a rotation with different students and teachers occupying the same classrooms depending on the schedule. In others, the school remains closed when students and teachers are not in class. Another model has been to schedule the number of weeks in attendance throughout the year with longer breaks between each school term. In the first case, rotation of teachers and students means the need for additional staffing in the school library.

Changes in practice may come from organizations related to education, and this sometimes has government support supplying further initiatives and implications. Efforts by educators to implement the national program, No Child Left Behind, have turned teaching into total focus on test results. Because salary increases for teachers and funding for schools may be unduly influenced by test scores, teachers now teach students only things that will help them achieve high test scores. It has made a serious impact on the relationship between teachers and the school library and upon the use of the school library as a learning environment. When teachers revert to teaching only what they understand will be on the test, they are not willing to spend any time on research in a school library.

Another innovation has been the Common Core State Standards (CCSS). In 2009, David Coleman was employed by the National Governor's Association to write curriculum standards for literacy, now English-language arts, and mathematics. These have not been accepted by all states, and some states have only adopted some of the standards. The stated purpose of this initiative "is to provide a consistent, clear understanding of what students are expected to learn, so teachers and parents know what they need to do to help them."^[13]

The CCSS Initiative is a state-led effort coordinated by National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO). The standards were developed in collaboration with teachers, school administrators, and experts, to provide a clear and consistent framework to prepare our children for college and the workforce.^[13]

The CCSS initiative has provided an opportunity for school librarians and the library to offer support to teachers who do not understand the concept or who seem unable to move into the requirements. School librarians can be very helpful in conducting professional development to help understand the program and to work with teachers to build the school curriculum.

NEW TRENDS: LEARNING COMMONS AND MAKERSPACES

One of the newest trends has been the remodeling of the library space into a more open area. As reliance on digital

information increases, the need for book shelving has decreased allowing for repurposing use. In some cases, it became a newly created space. Most often through the efforts of one or two school librarians, a new concept is being integrated in many school districts: the recreation of the school library into a learning commons. In this setting, the school library becomes the true center of the school with new and expanded virtual services. When this is implemented fully, a central location in the school is designed to provide the space for teachers who teach other than in a formal classroom. Art, music, guidance counselors, and even school nurses are housed in this central location encouraging collaboration among all the teachers in planning experiences for students and providing the space to carry out this planning.

Another area being created within the school library is a place where students can gather to think, build, create, and produce their ideas and solutions to problems, a makerspace. Designed to promote creativity in students, it has all sorts of tools and equipment and such new technologies as the 3-D printer. If the library is heavily used for other purposes, the components of makerspaces can be placed on a book truck and moved from the library to classroom. The truly creative school librarian can offer much with little output and can engage the community to get them to volunteer to mentor students with their projects.

TECHNOLOGY AND THE SCHOOL LIBRARY

While some technologies were found in libraries before the mid-twentieth century, it was the influx of funding with NDEA and ESEA that provided for audiovisual resources and the accompanying hardware. Libraries were expanded to provide space for listening and viewing, as well as for housing and use of these multimedia resources. They were added to the library card catalog and systems were designed for check out and return. Perhaps two greater challenges came with the need for sufficient electrical outlets and a way to darken the library when the materials were being used.

This new media required a new approach to working with students and teachers, as well as many new skills beyond storage and retrieval. Demonstrating both the effective integration of audiovisual materials into the curriculum and the actual use of the equipment followed the new approaches to acquisition and organization of these, and a new role for the librarian who was suddenly thrust into the role of a teacher-trainer. This continues with available microcomputer technology and all the new formats of social media.

At the present time, librarians continue to demonstrate the appropriate use of the databases available and select appropriate websites and other information from the ever-increasing amount found on the Internet. They help teachers understand the best uses of social media for their

assignments and keep everyone apprised of new technologies.

The school library is the center for learning about the resources found on the Internet and how to use the available databases for teachers and students. Learning how to use new software whether for word processing or other applications happens in the school library. The librarian now trains both teachers and students in finding and using information, making the library the professional development center for the school.

ADVOCACY AND THE SCHOOL LIBRARIAN

The perception of many educators that the school library is no longer a needed part of a school and the consequence of loss of positions for school librarians is a constant threat to student access to information. The support of students, teachers, and members of the community who recognize the value of the information found in and through the library is essential. Readers of Levitov's book, *Activism and the School Librarian*, will "learn the theoretical foundation for activism, how to move from advocacy to activism, how to create a culture of advocacy in terms of working with parents, community groups, and local businesses."^[14]

This advocacy must move beyond the local community and reach legislators at the state and national levels. Kaaland and Kachel suggest that "school library *legislation* advocacy begins with the development of a relationship between school library advocates—librarians and beyond—and legislative decision makers."^[15] School librarians need to convince their students, teachers, and parents to help lobby for school libraries if these programs are to survive.

RELATIONSHIP WITH PUBLIC LIBRARIES

From the beginning, the relationship between schools and public libraries is one of constant change. In the early days of the United States, children did not attend school for long and libraries were only for the wealthy. As the country grew and as it became apparent that it would take informed citizenry to protect the new democracy, state governments began to fund public schools. As the townspeople built their public libraries, they looked at the school funding and wished that they had a similar mechanism for building an adequate budget. This resulted in some public libraries being a part of the school district funding, a model that exists at the present time in some cities.

Although early in education in the U.S. state legislatures were funding school districts, school libraries were not necessarily a part of this plan. Public librarians, looking at the dismal state of libraries at the elementary

level, began sending classroom collections to the schools so that children would have literature to read. The public library also provided the collection and often a librarian in the high school.

In the mid-twentieth century when this began to change particularly when elementary school libraries began to be developed and expanded, school librarians were hired. They could meet with their public library counterparts and true cooperation began. Some of the traditional ways that school and public librarians cooperate include the following:

- Public librarians come to schools to give book talks.
- School librarians collect any book left for students to read and return them after students have finished reading them.
- School librarians share homework assignments with the local public library using fax and e-mail to facilitate the process.
- School librarians invite the public librarian to come to school to explain the summer reading program and to encourage students to participate.
- Librarians invite each other to their staff meetings.
- Public librarians invite teachers to bring their students to the public library. School librarians promote these visits and even accompany teachers and students during the visit.
- Librarians can share the costs of author visits to their libraries, sure that they will attract students.

Cooperation is made easier when public and school librarians are active members of local librarians' groups. Again, newer technologies allow the establishment of e-mail lists to communicate. When cooperation is alive and well between school and public librarians, joint proposals can be written for funding.

With great regularity, as budgets for both schools and public libraries shrink, library and school administrators continue to seek ways to control funding for library services. Although the research shows that combining these two agencies does not result in budget savings,^[16-19] joint facilities continue to be viewed as a measure to cut costs. Little recent research has been conducted, but the factors in place for the earlier research have not changed enough to change those results. None were shown that actually saved money without cutting services.

Successful cooperative efforts that have been cost cutting have been the statewide efforts to provide digital collections, crossing all types of libraries and bringing information equity to everyone within a community. Joining networks that encourage the sharing of resources is a win-win situation. Opening electronic access to information opens access to children at school and to the community, not only when the public or school library is open, but also every day since homes with Internet access will have constant access to online resources. While public

libraries offer access to the Internet, getting to the public library may be difficult for children and for those who live in homes without Internet access, the school library may be their only access to the digital world.

MEASURING THE EFFECTIVENESS OF SCHOOL LIBRARIES

With the funding for the development of school libraries in the twentieth century, the need for professional school librarians increased. Academic programs needed full-time faculty to teach, and a greater number of persons joined doctoral programs to prepare for open positions. The increase in dissertation research added to the body of research. As these new faculty members worked for tenure, they had to continue their research output.

School librarians and faculty teaching school library courses in library and information science programs were eligible for competitive research from the Institute for Museums and Library Services and the Association for Library and Information Science Educators. Smaller grants were available through professional associations, and some vendors offered small grants. Moreover, professional journals featuring research results began providing a venue to share findings.

Research studies served to point out student success when schools had libraries, librarians, and resources. Gaver's landmark study showed the effect of centralized library services in elementary schools.^[20]

In 1989, David Loertscher, then Chair of the AASL Research Committee, and Phil Turner organized the first Treasure Mountain Research Retreat. The school library field was asked "What research questions should be answered by the time the next guidelines are written?" Seventeen research questions emerged, and research reviewers were asked to respond to the following:

- Analyze and synthesize the major research studies dealing with the topic.
- Describe the implications of these studies for practitioners.
- Identify research needs in the topic area for the next decade.
- Discuss the best approaches to use in designing and carrying out this research.
- Describe the infrastructure that must be present.^[21]

Fifty participants discussed the entries developed for this retreat. Subsequently, regular Treasure Mountain retreats have been held usually before the biannual AASL meetings. The results are published and available to help both practitioners and researchers understand what is needed in this field, how to go about collecting the data, and of even more importance, the reporting of this data to a wide audience.

At one Treasure Mountain session, school librarians met Stephen Krashen and discussed reading research, Krashen's *Power of Reading*^[22] (a second edition is available). In spite of the deluge of technology, reading was and is an integral part of the school librarians' assignment. Both Krashen and McQuillan^[23] continue to point out the role of the school library in providing opportunities for students to learn to read. Krashen suggests that few people in the United States are illiterate, it is just that they do not read or write very well. His solution is free voluntary reading, access to quantities of books and other materials that students will want to read, and time allocated so they can read. McQuillan suggests:

Many students attend schools where the level of print access is abysmal, creating a true crisis in reading performance. . . . I do *not* wish to argue that simply providing books is all that is needed for schools to succeed. . . . Teaching is much more than physical resources, and no progress can be made without qualified and sensitive teachers. But just as we would not ask a doctor to heal without medicine, so we should not ask teachers and schools to teach without the materials to do so. Reading material is basic to all education, and providing a rich supply of reading matter to children of all ages, as well as a place and time to read, is the first step to bridging the gap between poor and good readers. This means that school libraries must be stocked with interesting and appealing materials and appropriately staffed; students need to be given time to read silently books of their own choosing.^[23]

By the mid-1990s, the leader in the movement to show that well-stocked and well-staffed school libraries were keys to academic achievement, Keith Curry Lance, completed the first study of school libraries in Colorado.^[24] He patterned his federally funded study after one done by School Match, an independent company.^[25,26] This group had been hired to help real estate agents point out the best school systems for persons moving into the area. In his first study and three among many that followed, Pennsylvania, Alaska, and the second Colorado study, the same results prevailed. What the results of all these studies show is that to increase student achievement, a school community should do two things:

First, they create a quality information-rich and technology-rich environment easily accessible by students and teachers. That is, the school library now extends beyond its walls delivering quality information into the classrooms and into the homes of every learner 24 hours a day, 7 days a week. Learners flourish when quality information is close at home.

Second, they employ a staff of both professional and support personnel in the library center who provide leadership and tireless partnering with the teachers to deliver quality learning experiences. Achievement is affected by the two teaching partners using the best information technology and learning strategies.^[27-30]

School library research continues with individuals in more and more states conducting studies that use or modify the Lance methodology. All these studies report the effects of the library program on the education of children in schools today. The research confirms the importance of such a facility for preparing students to become lifelong learners.

THE VIRTUAL SCHOOL LIBRARY

Much has been written about the school without a library. The argument is that everything anyone needs is available electronically, which means that a school librarian in a book-filled library is no longer required. Certainly, the use of a reference book collection in a school has become obsolete because that type of reference is readily available online, and the speed to find answers is a plus. As evidence of this, watch what happens when someone poses a question about an actor as they are going into a movie. Cell phones appear and fingers click away until someone finds the answer.

As speedy and efficient as this seems, students and teachers need to know where to find accurate information. Students need to be able to use critical thinking skills to determine what information they need to find, to develop questions to guide their research, to evaluate what they find, and to report it in a variety of formats. Students also still need to be taught to read and to be discriminating readers, to sort out what is fact versus what someone would like to be perceived as a fact. As more and more becomes available electronically, it becomes even more important to have the information professional, the school librarian, select the best from these resources for students to use and to teach them how to use them. This is essential if they are going to learn to separate fact from misinformation. In some cases, it is essential that relevant resources be made available through selection by the librarian and links made so students do not drown in the wealth available to them. As the library moves from shelves and shelves of books to access through electronic devices, the school librarian is there to make sure all students have the devices and access to information no matter the economic status of their parents.

The school library remains the bastion to free access to information. Further, students must be encouraged to become lifelong learners if they are to accept their responsibility as citizens in a democracy.

AN INTERNATIONAL PERSPECTIVE

School libraries worldwide are better developed in the countries in the category of "developed" nations and

found less often in those countries considered “developing.” In the poorest nations, books of any kind are limited from textbooks to reference books and recreational reading. In some countries, the librarian is totally responsible for the collection and must pay for any books lost. This does not encourage free exchange of materials even if there are books available.

Cell phone technology is becoming available to students throughout the globe. It is only a matter of time until these students will be able to access information. With the speed with which translating software is being developed, this information will be available to them in their native language.

Two international organizations foster school library development. The International Association of School Librarianship (IASL) has almost 800 members in more than 60 countries. The group holds a meeting each year in a host country, publishes a quarterly online and print newsletter, and offers their excellent research journal, *School Libraries Worldwide* online. Furthermore, IASL maintains a website for its members and an electronic list for communication.

The School Library section of the International Federation of Library Associations and Institutions (IFLA) also focuses on the development of school libraries internationally. The IFLA also meets in a different country each year. The difference between this association and the IASL is that one joins the IASL directly, whereas one is a member of the IFLA through its member associations. That is, all IASL members may attend the IFLA as a member of the IFLA because the IASL is an association member. The IASL and IFLA’s School Library section have been able to work together on projects that will further development of school libraries worldwide, the latest being the development of international school library standards. More information about both these organizations may be found on their websites:

IASL: www.iasl-online.mlanet.org/

IFLA: www.ifla.org/

CONCLUSION

The future of school library services in schools has a challenge at the current time. The explosion of information that seemed overwhelming before the advent of the computers with their great storage capacities, coupled with the advent of the Internet and the introduction of the world’s knowledge in a teacher’s or student’s home, has increased the need for a location and an information expert who can help to sort through the myriad of resources available. It is up to school librarians to convince administrators, teachers, and the community to make sure students in today’s schools have open access to information.

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Science and Engineering Librarianship

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Abstract

Science and engineering librarianship is an integral part of a broad range of theoretical and applied scientific fields; it provides access to current and cutting-edge research and preserves access to the historic scientific record. Science and engineering librarians work in organizations of all sizes ranging from solo operations and small libraries, to corporate research centers and research libraries of large universities. To interact successfully with their clientele, librarians must understand the scientific method, the structure of the scientific literature, and the communication patterns of scientists and engineers.

INTRODUCTION

Science and engineering librarianship has its roots in the specialized subject collections early scientific societies assembled for their members. Connections between scientific research and industrial progress fueled the need for science and engineering libraries and for establishing collections of scientific literature in university, public, and governmental libraries. The number of scientific societies and industrial organizations with libraries grew rapidly in the late 1800s and early 1900s, especially in Great Britain and the United States.^[1] Ranganathan attributes the rise of such specialized libraries, in part, to a change in focus from the macroscopic, or book level, to the microscopic, or article level.^[2] Scientists and engineers in research and industry recognized their need for collections of periodical literature and for librarians to organize those collections. Science and engineering librarianship provided documentation of the growing universe of scientific periodical literature through selection, acquisition, cataloging, indexing and abstracting, and tracking translations of the international science literature. Some of the major indexes of engineering and scientific information began in the late nineteenth century (e.g., *Index Medicus* and *Engineering Index*) or early twentieth century (e.g., *Chemical Abstracts* and *Biological Abstracts*).

Much of the literature on science and engineering librarianship from the 1920s to the 1970s focuses on the physical layout and management of the ideal library, training of staff, delivery of services, and the collection and organization of scientific literature. Scientific research and funding boomed in the period after World War II until the late 1970s, particularly in the United States, and there was a corresponding growth in libraries. The role of the librarian was to optimize the selection, acquisition, organization, and delivery of scientific information for the use of scientists, engineers, faculty, researchers, students, legislators, and the public.

Improvements in information technology led to new formats for library collections and new roles for librarians. Science and engineering libraries subscribed to online systems, purchased CD-ROM counterparts to print indexes, and offered mediated search services for early online systems and full-text databases. As the World Wide Web became predominant in the late 1990s, librarians no longer needed to mediate online database searches; library users could do those searches themselves. Librarians took on new roles to address issues related to electronic resources, such as licensing, managing subscriptions, devising new funding models, cataloging, user instruction, outreach, and promotion. In addition, librarians and researchers continued to conduct research on the information-seeking behaviors of scientists and engineers to learn how libraries could best facilitate information retrieval.^[3,4] Librarians began to offer value-added services such as literature searching, market research, patent searching, and materials properties searching.

Roles for science and engineering librarians shift and change as the information technology environment grows and changes. As access to scientific information and data becomes more ubiquitous, librarians can focus more on fundamental of the profession such as ensuring equitable access to information, providing safe spaces for learning and inquiry, and connecting learners to the skills and information they need to create knowledge. Rather than merely serving as custodians of scientific literature, twenty-first-century science and engineering librarians participate in the scientific process, help educate future researchers, and advocate for fair and equitable access to the scientific record.

SCIENCE AND ENGINEERING LIBRARY SETTINGS

Science and engineering libraries range in size from solo operations and branches of public libraries to settings in

very large corporations and universities. Public libraries, college and university libraries, corporate research centers, hospitals and medical libraries, and other special and technical libraries employ science and engineering librarians. Science and engineering librarians may also work as self-employed information researchers, in information brokerages, in government agencies, in museums, zoos, and aquariums, or for scientific, technical, and medical (STM) publishers and database providers.

Academic

Many science and engineering librarians work in college or university libraries. Depending on the type of academic institution, their duties can include core library functions such as reference, instruction, collection development, outreach, and, for tenure-track positions, research and writing. Some universities have separate libraries for various science disciplines. For example, the University of Wisconsin has science libraries covering agriculture and veterinary medicine, astronomy, biology, chemistry, engineering, health sciences, geology and geophysics, plant sciences, and physics.^[5] Other academic libraries provide science and engineering materials from a single science library, still others from a unified central library.

Public

Larger public libraries often have significant science and engineering collections, although they may not be housed in a separate library, as they are in the Science, Industry and Business Library of the New York Public Library^[6] or in the Los Angeles Public Library's Science, Technology & Patents Department.^[7] Investors, inventors, students, and entrepreneurs can access specialized collections of books, databases, and patent literature, and receive expert research help from highly trained librarians. Another example of a large public library dedicated to science and technology is the Linda Hall Library, an independent public library of science, engineering, and technology in Kansas City, Missouri.^[8] Linda Hall Library has an extensive collection of materials and librarians offer a suite of fee-based research and document delivery services to companies, academic institutions, and individuals throughout the world.

Corporate

Access to scientific and technical information is essential to scientists and engineers developing and designing industrial products. Special libraries in industrial or corporate settings employ science and engineering librarians to facilitate the research needed to bring new products to market. Some information centers or technical libraries can be centralized and large, while others serve smaller segments of corporate organizations. Sometimes,

technical libraries are in the research and development arm of the company. In response to the availability of online resources and materials, many corporate libraries have reduced the physical footprint of the library and moved to a virtual model of desktop delivery of information critical to the daily work of their clientele. Some corporations have closed their research centers in favor of the virtual library. Examples of corporations where science and engineering librarians work are Ford Motor Company, Intel, and Nike.

Government

U.S. federal government agencies run special or technical libraries such as those in the Environmental Protection Agency,^[9] the United States Forest Service,^[10] and NASA.^[11] Science and engineering librarians may work in major federal government libraries such as the Science Technology and Business Division of the Library of Congress,^[12] the National Library of Medicine,^[13] National Institutes of Health Library,^[14] and the National Agricultural Library.^[15] Some science librarians work directly with legislators, for example, at the national level in the Resources Science and Industry Division of the Congressional Research Service,^[16] or within state libraries. They also work on digital libraries and information initiatives such as the National Center for Biotechnology Information,^[17] and the databases Medline and Agricola.

Other examples of governmental technical libraries are those in the National Laboratories including Los Alamos National Laboratory^[18] and the Oak Ridge National Laboratory where librarians "help researchers compete for and carry out research of national importance."^[19] Public users may not be able to visit these technical libraries because of the sensitive nature of the work in the national laboratories and the locations of the libraries within them. An exception is the Hanford Technical Library, run by the Pacific Northwest National Laboratories, which is open to the public and shares a building with a Washington State University branch campus library and a United States Department of Energy Reading Room.^[20] Whether or not the physical libraries of national labs are open to the public, an increasing number of technical reports and unclassified documents from those libraries are available online. An example of such an online collection is SciTech Connect, administered by the Office of Science and Technology Information where thousands of United States Department of Energy documents can be searched and downloaded for free.^[21]

National Science Libraries

Many of the national libraries worldwide have collections or separate libraries dedicated to science and technology. Examples include the British Library's Science Technology and Medicine Collections,^[22] the *Bibliothèque Nationale*

de France Département Sciences et Techniques,^[23] the Russian Academy of Sciences,^[24] the German National Library of Science and Technology,^[25] the Japan Advanced Institute of Science and Technology Library,^[26] and the United States Library of Congress Science Reference Services.^[27]

Medical

Hospitals, government agencies, pharmaceutical companies, and other medical-related corporations are the settings for many medical libraries. There are also health sciences or medical libraries within teaching institutions offering programs in medicine, nursing, veterinary medicine, pharmacy, or allied health. The National Library of Medicine supports the dissemination of biomedical information in the United States, through the National Network of Libraries of Medicine (NN/LM®). Eight Regional Medical Libraries of the NN/LM® work to “improve the supporting infrastructure for health sciences librarians.”^[28] Another resource for medical librarians is the Medical Library Association.

Solo

Sometimes, there is only one science or engineering librarian in a company or institution. Solo librarians are “most likely found in a small library without extensive holdings or resources. Solos are expected to do it all—ordering, cataloging, reference, bibliographic instruction, online searching, filing, budgeting—everything.”^[29] Solo librarians can be found in marine science centers, or observatories.^[30] Professional organizations such as the Solo Librarian Division of the Special Libraries Association connect solo librarians to share resources, expertise, and provide continuing education opportunities.^[31]

Other Settings

Museums, aquariums, and zoos may have science libraries to support staff as they conduct research, build exhibits, and manage those institutions. Outside researchers and the public also use these libraries.^[32]

Other employment options for science and engineering librarians are to work as information brokers, to subcontract with governmental or corporate science and technical libraries, or to work for publishers. Information brokers are information professionals who provide as-needed or contract-based services to clients. Some information brokers are librarians with scientific backgrounds specializing in information collection and analysis. They may have skills in patent searching, engineering, chemistry, or computer programming and software design, for example. Information brokers may be self-employed or work in an information brokerage. They may be subcontractors

working with government or corporate clients, other research firms, or for individuals.^[33]

STM publishers and database producers employ librarians with science and engineering backgrounds to construct controlled vocabularies, perform indexing and abstracting services, and to interact with science and technology libraries and other clients for sales and training.

JOB REQUIREMENTS

Education

A master's degree in library and information studies from an accredited program^[34] is required for most science and engineering librarian positions in public, academic, special, and federal government libraries.^[35] Some positions require qualified candidates to have an undergraduate science or engineering background or to hold a second master's in a scientific field. There are distinct advantages to having a degree in the sciences, including enhanced subject knowledge, understanding the culture of the field, and increased credibility with clientele.^[36] Librarians with science degrees may also be better equipped to work in such specialized subfields as health, bioinformatics, chemistry, data services, or geographic information systems (GIS). To fill these specialized roles, some libraries hire candidates with advanced degrees in relevant scientific fields rather than degree holders in library and information sciences.

Skills

Science and engineering librarians need the same core skills that all librarians require—grounding in the philosophy and techniques of library service, knowledge of library materials and resources, and facility with computers, the Internet and commercially available library software.^[37] A study of job descriptions for science and engineering positions showed that the most frequently required qualifications were not specific to science or technology.^[38] Communication skills, computer and technology literacy, reference experience, teaching experience, and a team orientation were the most commonly required qualifications.

There are some science-related preferred qualifications for prospective science and engineering librarians. Employers may prefer candidates with a science and technology background, which can be coursework in science, a bachelor's degree in science, a library science course in science librarianship, an internship or practicum, or experience in a science library. Additional preferred qualifications are familiarity with the organization and structure of science and technology literature and knowledge of the scientific method as a process of discovery and invention. Some positions require specialized software skills, such as

the ability to work with and teach GIS software. Other jobs require expertise in searching chemical or molecular structures. The Medical Library Association has defined competencies for lifelong learning and professional success that include understanding of the health-care environment, the ability to manage health information resources in a broad range of formats, and understanding of scientific research methods.^[39]

Libraries are changing, and candidates who thrive in changing environments have an edge. Many of the preferred qualifications found in position advertisements are attitudinal. Candidates should exhibit innovation, creativity, curiosity, vision, optimism, integrity, and the ability to work well with a team.^[40] Another aspect of change in libraries is the focus on computer technology—technological skills and aptitude, web design skills, understanding of database structure and design, and searching expertise are examples of preferred qualifications for science librarians.

RECRUITMENT AND CONTINUING EDUCATION

Recruitment continues to be an issue in science and engineering librarianship. Administrators use a number of approaches to recruit librarians, one of which is to relax the requirement for a second degree in a science discipline. Many science librarians with social science or humanities backgrounds have learned science or engineering librarianship on the job. A 2000 survey of science and engineering librarians found that over half of the respondents came into their positions without a science background.^[41] One approach is to recruit promising students from science and engineering majors into library and information science degree programs. Many science or engineering students are unaware of the career opportunities in librarianship. Another approach is for libraries to fill specialty roles by hiring candidates without the library degree who have advanced science degrees and experience in areas like GIS, bioinformatics, statistics, or data collection and analysis.

Continuing education is important as many people come into science and engineering librarianship without a science background (or are assigned to areas outside of their science background), and because new roles are emerging. In some settings (e.g., medical libraries), continuing education credits are required. Professional organizations, library and information science programs, and conferences are venues for updating skills and learning about new areas. Training may be face-to-face, online, or a hybrid and may take place over a few days or a few months. An example of a successful face-to-face continuing education event is the Science Boot Camp for Librarians, which was developed in 2009 by science librarians in New England to help librarians learn about topic areas in science.^[42] This annual regional event has been duplicated

in regions across the United States and Canada. Another example is the Data Carpentry Workshop, which provides data skills training especially useful to librarians who provide research data services (RDS).^[43] Additional examples of selected professional development, conference, and continuing education resources have been compiled by the Science and Technology Section of the Association of College and Research Libraries Division of the American Library Association.^[44]

PROFESSIONAL RESPONSIBILITIES

Science and engineering librarianship includes reference, instruction, cataloging, collection development, and outreach or liaison. Beyond these traditional professional responsibilities, as previously noted, new roles are emerging in response to an ever-changing information environment. The importance of ensuring access to scientific literature spurred librarians to develop expertise in scholarly communication issues, including open access advocacy. Health sciences librarians may provide support for systematic reviews or serve as an embedded librarian in a research term, or as an informationist in a clinical or public health setting.^[45] RDS are increasingly offered to help students, faculty, and staff meet funding agency mandates and, more importantly, to encourage researchers in planning for the whole research lifecycle.

Reference and Consultation

Writing in 1994, C.D. Hurt asserted that “good reference service is predicated on three elements: 1) knowledge of the user, 2) knowledge of the literature, and 3) knowledge of the sources.”^[46] Librarians still need these three elements, but there are now many more channels for interaction with library users. Library clientele may now contact reference librarians 24 hours a day. To cover more hours of virtual reference service, librarians collaborate within their institutions and through networks of colleagues across time zones. Librarians interact with clients by using software tools for virtual reference, instant messaging, video-conferencing or video chat, and even in online game environments. Transactions can take place in real time or asynchronously. Librarians in special libraries provide value-added services along with reference consultations. They may synthesize the research on a particular problem or question, mine the literature for solutions to a problem, and write summaries for clients.

Many science and engineering librarians are skilled in searching highly specialized online databases, as well as standard print reference sources. Chemistry librarians track down chemical information using tools like *SciFinder Scholar* (*Chemical Abstracts*), *Beilstein*, and patent literature search engines. Genetics and molecular structure databases such as *GenBank*^[47] and *BLAST*^[48] are

important tools for biology and bioinformatics librarians.^[17] Geosciences and map librarians can develop reference and instruction services around GIS software. Engineering librarians can be part of courses where students are learning engineering design principles and need to gather information for their projects throughout the term.^[49]

Health sciences librarians integrate reference services into their clients' workflow in a number of ways. One way is to deliver content to mobile devices. Students in evidence-based medicine classes work with librarians to identify best evidence for treatment plans. In the Vanderbilt University Medical Center, the Research Informatics Consult Service (RICS) offers "... training, grant assistance, access to electronic resources, database searching and information filtering."^[50] Librarians make rounds, or house calls to deliver reference services directly to researchers and practitioners in the hospital.^[51]

Instruction

Science and engineering librarians teach people to create productive search strategies, as well as how to use subject-related periodical databases. Librarians train clientele to use powerful search tools for retrieving scientific information, such as those used in bioinformatics.^[52] Science and engineering librarians instruct users one-on-one, in workshops or classes, in stand-alone college courses, as well as through online tutorials. Academic librarians teach students information literacy skills and promote information literacy and science literacy concepts with faculty. They advise instructors constructing research assignments. Ideally, they are building relationships in which they can convey the tenets of information literacy to those who teach in the disciplines, as well as to students. Scientists and engineers need information literacy skills to succeed in their coursework, but also to develop lifelong information skills to help them succeed in their careers. Librarians have developed information literacy standards for science and engineering^[53] based on the Association of College and Research Libraries (ACRL) Information Literacy Competency Standards for Higher Education.^[54]

Science and engineering librarians use technology to deliver instruction to distance learning courses or distributed teams. Librarians increasingly depend on web page design, interface and tool design, online tutorials, blogs and wikis to deliver library content and services to users.

Collections

To work effectively with the scientists and public they serve, science and engineering librarians must understand the structure of scientific communication and develop a strong background in the specialized literature of their particular fields. This includes digital content. Librarians

manage access to digital resources such as online bibliographic, full-text, or fact-based databases. Online access issues, pricing, and license negotiations can be part of the collection development role for science and engineering librarians, especially those in smaller institutions. One of the challenges for libraries is that with online reference sources come yearly subscription or maintenance fees. Another aspect of the collection development role is collection analysis and evaluation in a hybrid print and electronic environment.

Science and engineering librarians select the same formats of materials most librarians select, for example, books, periodicals, reference materials, and multimedia. For many disciplines, the journal is the most important vehicle for scientific communication and it represents the historical scientific record.^[55] Online access to the periodical literature is critical to scientists and engineers, and librarians dedicate a lot of energy to the process of providing it. Many libraries have canceled print journals in favor of electronic journals and purchase online back files as a way to preserve access. Other types of periodicals that can be useful for science and engineering are product and trade catalogs and trade journals.

To further support and enhance access to the scientific record, librarians build institutional repositories and develop and manage digital libraries comprising born-digital and digitized information. There are nearly 2000 institutional repositories tracked by the Webometrics organization.^[56] Science librarians identify unique information sources for digitization and submission to institutional repositories. One example of this is the Technical Report Archive and Image Library, a collaborative project of the Greater Western Library Alliance and the Center for Research Libraries.^[57] On a broader scale, the National Science Digital Library "provides high quality online educational resources for teaching and learning, with current emphasis on the sciences, technology, engineering, and mathematics (STEM) disciplines—both formal and informal, institutional and individual, in local, state, national, and international educational settings."^[58]

Librarians require a working knowledge of formats that are particularly important in science and engineering librarianship: patents, standards and specifications, technical reports, conference papers, preprints and e-prints, maps, and data. Any of these formats can be "gray literature." Gray literature is "produced on all levels of government, academics, business and industry in print and electronic format, not controlled by commercial publishers."^[59] It is especially important in applied fields such as forestry and engineering.

The following is a superficial overview of some of the types of information sources particular to science or engineering. To gain understanding of the structure of science and engineering literatures, new or prospective librarians should consult the many secondary guides that are available.^[60]

Patents

The patent literature is a rich source of scientific and engineering information. While there are free online sources for patent searching (United States Patent Office Database, Google Patents, eSpace.net), librarians should be aware of more powerful subscription patent search engines and to understand when to refer library clientele to expert patent searchers.

Standards and specifications

Standards and specifications guide the design, production, and testing of goods and services. Each industry has many standards-developing organizations. Some of the major standards organizations are the National Institute of Standards and Technology, the International Standards Organization, and the American National Standards Institute. Librarians continually track the best ways for accessing standards and specifications. While some libraries still have print collections of standards, many libraries have moved to online subscription packages that provide access to standards when needed. Library users sometimes need historic standards for academic or legal research.

Technical reports

Technical reports are important in rapidly changing fields such as computer science and engineering where it is important to keep up with the latest techniques and innovations. Technical reports can result from grants, or contracts, and as such, are not subject to the same type of prepublication peer review as journal articles. Scientists and engineers can quickly disseminate their methodology, data, and results for others to review.^[61] Science and engineering librarians support the digitization of technical reports that increases discoverability and access.

Conference proceedings

Because conference proceedings introduce new ideas in a timely manner, the conference paper is the most important type of literature for much of computer science and engineering. Researchers in rapidly changing fields such as computer science and electrical engineering keep up with changes by tracking conference papers. Proceedings from very small or international conferences are sometimes difficult for librarians to collect. Some sponsoring organizations publish proceedings erratically.

Preprints and e-Prints

Preprint means prepublication print. Preprints gained widespread use in the field of high-energy physics after World War II.^[62] Physicists were also early adopters of

online dissemination of preprints, known as electronic preprints or e-prints. The High Energy Physics e-print archive, known as arXiv, was developed by Paul Ginsparg at Los Alamos National Laboratories and went online in August 1991.^[63] The arXiv, now at Cornell, contains over half a million documents covering physics, mathematics, nonlinear science, computer science, and quantitative biology. E-prints continue to thrive in physics and other scientific fields such as computer science and astronomy.

Handbooks and data sources

Handbook information is critical for science and engineering research and practice. Handbooks can contain information on anything from materials properties to spectral data, to biological and genetic data. Handbooks, data sources, and other types of reference sources are increasingly available in digital format. Online access to handbooks and data sources is advantageous to users in laboratories and off-campus.

Maps

Maps are core resources in astronomy, geomorphology, physical geology, and other geosciences, and are widely used in other disciplines such as the agricultural and biological sciences.^[64] Identifying, acquiring, cataloging, storing, and preserving maps is a complex group of tasks. Digital maps and their preservation add another level of complexity to map librarianship.

Data sets

Data Sets are used in geosciences, environmental sciences, health sciences, astronomy, and many other disciplines. Librarians assist investigators to discover and locate appropriate data sets for research and to identify data sets that can be curated for future use. The Registry of Research Data Repositories is a useful starting place.^[65] RDS in libraries range from simple reference (finding and citing data sets) to consulting with students, faculty, or staff on data management plans or metadata standards, to providing technical support and preparing data for repositories.^[66]

Translations

Scientific research is increasingly global. In addition, while English is currently the primary language for scientific publishing, this has not always been the case. Science librarians should be aware of translation services and of sources for translated scientific and technical literature.

Management, Marketing, and Promotion

Science and technical library managers establish strategic goals to align with the institution. They recruit, interview,

hire, manage, and evaluate and support the career development of library staff. Managers may also determine appropriate funding sources and financial management practices, and assess and communicate the value of the library to the broader organization.

Marketing and promotion are especially important in corporate libraries, where librarians must regularly demonstrate the value of the information center to the parent organization. Special libraries have developed means to measure the value of librarians and library services and to communicate the value to clients. Studying the needs of their potential internal customers, librarians focus services on the most critical needs of the organization or clients. The Special Libraries Association conducts research and collects information on the value of the information center.^[67] Marketing, promotion, and measuring the value of library services are increasingly important in academic and public libraries, as well. There have been a number of studies of return on investment for academic libraries.^[68]

Research and Writing

Writing is a vital part of science and engineering librarianship, whether it is composing content for web pages and pathfinders, analyzing and summarizing background information for an engineering client, crafting a press release, or compiling a grant proposal. Tenure-track academic librarians conduct research about all aspects of libraries and services, and communicate those results to the profession. All librarians need excellent research and communication skills and to keep up with new research and best practices in librarianship by reading journals such as *Issues in Science and Technology Libraries* and *Science and Technology Libraries*, by reading magazines such as *Information Outlook*, by following discussion lists and blogs, and by attending conferences and giving presentations.

Web Technologies

Web technologies continue to shape science and engineering librarianship. Science and engineering librarians use the capabilities of the participatory Web to deliver library content and services via blogs, wikis, RSS feeds, podcasts, streaming video, and instant messaging. They teach users to organize, manage, track, and share research using online tools such as EndNote, Zotero, or Mendeley. Librarians have an online presence on social networking websites and online communities. As stated in the revised *Competencies for Information Professionals of the 21st Century*, the successful science and engineering librarian “maintains current awareness of emerging technologies that may not be currently relevant but may become relevant tools of future information resources, services or applications.”^[69]

Scholarly Communication

Science and engineering librarianship has had a close relationship with the universe of scientific periodical literature from the beginning. *The World List of Scientific Periodicals published in the years 1900–1921*^[70] contained in two volumes the titles of 24,028 periodicals. Some estimates suggest that the number of scientific periodical titles doubles every 9 years.^[71] The journal literature is pivotal for scientists and engineers, and librarians have been actively tackling the complex issues surrounding scholarly communication for some time. These issues include publishing and subscription costs, copyright, and maintaining equitable access to scientific information in the digital environment. Journal subscription rates have escalated for many years, greatly outpacing the rate of inflation. Science and technology journals generally have the highest subscription rates as well as the highest annual price increases, which raises serious concerns about the sustainability of the current system of scientific communication.^[72] The scientific process builds on prior and related research, much of which is reported in peer-reviewed articles; decreased access to journals puts scientific researchers at a disadvantage.

Science and engineering librarians disseminate information about the crisis, and advocate for publishers and vendors to adopt more sustainable business models. Productive and close relationships with publishers and vendors give librarians a venue to communicate library issues. One example is the *Punch List of Best Practices for Electronic Resources*.^[73] This list, compiled by the Scholarly Communication Committee of the Engineering Libraries Division of the American Society for Engineering Educators, offers librarians and vendors a starting point for conversations. Librarians are active in SPARC®, the Scholarly Publishing and Academic Resources Coalition (SPARC), “an international alliance of academic and research libraries working to correct imbalances in the scholarly publishing system.”^[74]

Science and engineering librarians support a number of practices that improve access to scientific articles, including alternative publishing and pricing models, open access journals, and the development of institutional repositories. One early example of an alternative publishing model is how the SPARC collaborated with small societies and noncommercial publishers to build *BioOne*, a cost-effective online journal collection supporting biological, ecological, and environmental sciences.^[75] Another example of science librarians taking the lead is SHERPA, a UK consortium of research universities and industry partners that runs a number of projects supporting the development of open access repositories and researching scholarly communication issues.^[76]

Open Access

Science and engineering librarians have long championed open access as a means to address the serials crisis and to

ensure access to the scientific literature. One way to do this is to support open access publishing. The *Directory of Open Access Journals* includes journals in scientific and scholarly subject areas published in any language.^[77] *BioMedCentral* is an open access publisher with over 270 peer-reviewed journals.^[78] *PubMed Central (PMC)* is the U.S. National Institutes of Health (NIH) free digital archive of biomedical and life sciences journal literature.^[79] The Public Library of Science (PLOS) is a nonprofit publisher of a number of free, high-impact, open access journals supported by pay-to-publish fees, including the largest journal in current publication, *PLOS ONE*.^[80]

Global access to scientific information is an issue of great importance in science and engineering librarianship. Researchers, doctors, and scientists in developing countries are at a disadvantage because they lack access to scientific literature. Partnerships between major publishers of scientific information and three United Nations organizations are making medical, agricultural, and environmental sciences journals available for free or very low cost to local not-for-profit institutions in the developing world.^[81] The World Health Organization and six major publishers^[82] introduced the Health InterNetwork Access to Research Initiative in 2002. In 2003, the Food and Agriculture Organization and publisher partners initiated Access to Global Online Research in Agriculture.^[83] Online Access to Research in the Environment was launched in 2006 by a partnership of the United Nations Environment Programme, Yale University, and major publishers of environmental science information.^[84] These three programs will likely continue until 2015 as part of the United Nations' Millennial Plan.

E-Science

An enormous amount of scientific data is generated from satellites, telescopes, lasers, sensors, experiments, and simulations, giving scientists unprecedented access to large sets of networked scientific data. Computational power in conjunction with large data sets is driving a new research methodology called e-Science.^[85] E-Science, or cyber infrastructure, as it has been known in the United States, is a set of technologies that enable people to collaborate: to share computing, data, and the use of remote instruments. In other words, e-Science encompasses the technologies that allow networked, distributed, collaborative, multidisciplinary science. As libraries continue to define roles in collecting, preserving, and disseminating research derived from these large data sets, new areas of focus have emerged for science librarians, including data curation and digital preservation.

Data Management Plans and Research Data Services

A related role for librarians is to offer RDS to researchers and students. One of those services is to consult with and

guide scientific investigators proposing grants to the NIH and the National Science Foundation (NSF). In 2009, the NIH Public Access Policy required investigators funded by the NIH to submit an electronic version of their final peer-reviewed manuscripts within 12 months after publication.^[86] Beginning in January 2011, proposals submitted to the NSF were required to include a Data Management Plan (DMP), a document of two pages describing how research data will be stored and shared.^[87] Public access policies for government-funded scientific research are continuing to be instituted in agencies across Europe, the United Kingdom, Canada, and the United States.^[74] Librarians are in a good position to track these requirements and to offer assistance with open access publishing and data management plans to facilitate compliance. Communities and organizations have formed around supporting various aspects of data management. DataOne has developed the Data Management Planning Tool to give investigators templates for writing their own plans.^[88] DataCite is an organization that supports the standards for identifying and citing data.^[89]

Citizen Science

Citizen science is a term used to describe “public participation and collaboration in scientific research to increase scientific knowledge.”^[90] While scientists have partnered with amateurs to conduct research for years, the Internet, digital media, and mobile devices equipped with geographic positioning units have increased the opportunities for public involvement in the scientific process. Librarians can support citizen science in many ways; by connecting library users with science researchers and by providing services for citizen science, such as data curation and technology training, and by capturing and preserving the formal and informal outputs of citizen science.^[91]

Makerspaces

Makerspaces are places where people meet to share resources like knowledge, skills, tools, and technologies in order to work on their own projects and creations. The focus is on community and sharing—values libraries share. For this reason, many public and academic libraries have developed spaces and programs that support “do-it-yourself” or “do-it-with others activities.” Public libraries large and small employ technology loving librarians and volunteers to run spaces like the TechCentral in the Cleveland Public Library and TekVenture in Indiana's Allen County Public Library.^[92] Librarians at the DeLaMare Engineering Science and Engineering Library at the University of Nevada, Reno offer a makerspace with 3D printers, 3D scanners, and laser cutters.^[93] They also circulate equipment such as electronics and robotics kits that students can use in their own projects.

PROFESSIONAL ORGANIZATIONS

Engineering Librarianship. Science and engineering librarians can be active in a variety of national and international professional organizations, depending upon subject specialty, library setting, and personal interests. The following are some key organizations of particular interest.

American Library Association (ALA) Science and Technology Section (STS)

http://www.ala.org/ala/acrl/aboutacrl/acrlsections/science_tech/sts.cfm

The Science and Technology Section (STS) is in the ACRL Division of the American Library Association. Established in 1961, as the Agricultural and Biological Sciences Subsection of ACRL, the organization later changed its name to reflect the subject specialties of its members. STS offers its over 1700 members conference programming and continuing education opportunities. Publications of the section include the STS-L discussion list, the STS-Signal newsletter, and a peer-reviewed online journal, *Issues in Science and Technology Librarianship*.

American Society for Engineering Education, Engineering Libraries Division (ASEE/ELD)

<http://eld.lib.ucdavis.edu/>

Engineering Library Division members are librarians and information professionals interested in promoting the role of the library as an integral part of engineering education. ELDNET-L is the open electronic discussion list for the division.

Special Libraries Association (SLA)

<http://www.sla.org/>

The Special Libraries Association began in 1909 “to promote the collection, organization and dissemination of information in specialized fields and to improve the usefulness of special libraries and information services.”^[94] Several Special Libraries Association Divisions are related to science and engineering. They are the Science and Technology Division, the Physics, Astronomy and Mathematics Division, the Chemistry Division, the Engineering Division, the Biomedical and Life Sciences Division, the Environment and Resource Management Division, and the Food, Agriculture and Nutrition Division.

Medical Library Association (MLA)

<http://www.mlanet.org/>

The Medical Library Association was founded in 1898 and has members worldwide.^[95] The MLA focuses on the unique issues faced by health sciences information professionals as they deliver critical medical information to physicians, health practitioners, and patients. Several types of publications meet MLA members’ needs: the peer-reviewed *Journal of the Medical Library Association*; newsletters MLA-Focus and MLA News; books; standards; reports; and other documents. MLA offers continuing education courses and delivers medical information training around the world through the Librarians without BordersSM program.

International Federation of Library Associations and Institutions (IFLA)

<http://www.ifla.org/index.htm>

IFLA’s Science and Technology Libraries Section (Special Libraries Division) was formed in 1978. The section supports science and engineering librarianship worldwide, through programming at the IFLA Annual Conference, by conducting research projects on topics of global interest, and by collaborating with other library associations to address issues pertaining to the access and dissemination of scientific literature. Members share information through the section newsletter and the STL-SC discussion list.

International Association of Aquatic and Marine Science Libraries and Information Centers (IAMSLIC)

<http://www.iamslc.org/>

IAMSLIC directs the Aquatic Commons, an open access repository for literature on natural marine, estuarine/brackish, and freshwater environments. Its purpose “is to promote such cooperation and sharing of resources among libraries and information centers which specialize in any aspect of aquatic science—freshwater, brackish and marine.”^[96]

There are also smaller organizations that focus particular fields of librarianship. In addition, many science and engineering librarians join organizations related to their subject domain. These are a few examples:

Association of Independent Information Professionals (AIIP): <http://www.aiip.org/index.html>

American Association of Physics Teacher (AAPT): <http://www.aapt.org/>

The American Chemical Society (ACS) Division of Chemical Information: <http://www.acscinf.org/>

American Society for Information Science and Technology (ASIST) Scientific and Technical Information Science (STI) Interest Group: <http://www.asis.org/SIG/SIGSTI/sti.html>

Geoscience Information Society: <http://www.geoinfo.org/>
 International Association of Agricultural Librarians and Documentalists (IAALD): <http://www.iaald.org/>
 International Association of Technological University Libraries (IATUL): <http://www.iatul.org/>
 United States Agricultural Information Network (USAIN): <http://usain.org/>

CONCLUSION

For over a century, science and engineering librarianship has been instrumental in the advance of modern theoretical and applied science and technology. To remain relevant, future science and engineering librarians will need a keen understanding of the interplay between the information needs of scientists and engineers, and the technologies, economics, and politics that influence access to critical data and information. Librarians alone will not be able to solve the information challenges that a new era of science will bring; a greater degree of collaboration with other professionals will be essential. As Web technologies mature, librarians will require the knowledge and skills to employ them to improve information retrieval and to facilitate research that will be increasingly global, collaborative, and interdisciplinary. Science and engineering librarianship has clearly evolved in the twentieth century in response to changes in information technology and shifts in scientific research, and the pace of change is unlikely to slow. The future of science and engineering librarianship is not in responding to change, but in facing change by participating fully in it.

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Science and Technology Studies

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Abstract

This entry introduces theories of technology developed within the interdisciplinary field of science and technology studies (STS). Theories of technology within STS are conventionally divided into the social shaping of technology (SST) perspective, the social construction of technology (SCOT) perspective, actor-network theory (ANT), and gender and technology studies. The practice theory is emerging as a distinct line of thought and analysis.

INTRODUCTION: THEORIES OF TECHNOLOGY AND INFORMATION SCIENCE

This entry introduces theories of technology developed within the interdisciplinary field of science and technology studies (STS). Theories of technology within STS are conventionally divided into the social shaping of technology (SST) perspective, the social construction of technology (SCOT) perspective, actor-network theory (ANT), and gender and technology studies. The practice theory is emerging as a distinct line of thought and analysis.

Theories of technology developed within STS are important from the viewpoint of information science. Theories and assumptions of what technologies are, how they emerge, and how humans and technologies interact, are important for many research areas in information science. In fact, regardless of whether researchers explicitly define and expose their viewpoint on technology, such views are always present and influence research aims and questions in information science, a field that is concerned with the interaction between information/documents, technologies, and users.

Within information science, STS theories are applied in research fields such as knowledge organization, scholarly communication, citation studies, scientometrics, social informatics, digital libraries, and knowledge management. Some scholars have argued, however, that STS and information science should not be seen as separate fields of study. According to this view, theories developed within STS are the core theories that empirical research programs in information science should draw on. In fact, three different views exist on the relationship between the interdisciplinary fields of STS and information science. Some scholars see these fields as overlapping, that is, as having shared theoretical foundations and research interests. Some scholars see that there is partial overlap between STS and information science in theoretical constructs and research interests. According to a third view, STS and

information science are separate research fields—there is only little or no overlap in research topics and interests. Research areas in information science where STS theories have traditionally been less cited and applied are, for example, everyday life information seeking research and information literacy research.

Regardless of whether STS and information science are seen as unified in their interests and theories, to some extent overlapping, or as separate domains, information science and STS are cognate research fields. Their research interests increasingly cross since information, media, and technology are in current digital environments more and more intertwined. Examples of such integrated information, media, and technology environments are, for example, social media applications such as wikis, blogs, social networking, and social bookmarking services.

This entry proceeds by first briefly introducing STS. After presenting some antecedents to theories of technology in STS, this entry introduces the theoretical perspectives of SST, ANT, SCOT, gender and technology studies, and practice theory of technology. This entry ends by briefly discussing the relationships between STS theories, and the relationship between information science theories and theories of technology.

THE ROOTS OF SCIENCE AND TECHNOLOGY STUDIES

Science and technology studies has roots in the sociology of scientific knowledge and in the social constructivist movement in the study of scientific knowledge production, the “empirical programme of relativism.”^[1] This movement consisted of historical and sociological analyses of the processes which lead to the acceptance of new scientific knowledge. Empirical “laboratory studies” of the mundane everyday practices of scientific work conducted in the late 1970s and 1980s sought to show

how scientific facts are socially constituted and negotiated.^[2-4] A central insight was the indecisiveness of experimental data taken by themselves. Results from scientific experiments are rarely self-evidencing, and initially allow for a degree of interpretative flexibility, that is, alternative interpretations of the empirical evidence. Such ambivalences and potential controversies must for practical reasons at some stage be closed down, since the results must be presented in a clear and non-ambivalent manner in the form of reports and journal articles. The detailed empirical analyses of the contingencies involved in the construction of scientific facts showed how like any work practice, scientific knowledge production involves not only purely cognitive factors but a complex configuration of technological tools, work organization, professional norms and skills as well as formal and informal communication practices. The empirical programme of relativism was influential for the development of the STS research field.^[5] It brought about the understanding that it is fruitful to view technology and technological practices as built through processes of social construction and negotiation in the same way as scientific knowledge.

Science and technology studies were also preceded by sociotechnical studies of computerization in organizations conducted in the 1970s (for a review, see Kling^[6]). These studies stressed that technologies are tightly interwoven with the overall organization of work, the nature of work tasks, social relations at the workplace, and the very conditions and experience of work. This insight led to a more general understanding that a work task mediated by a new technology does not remain the same. New technologies require new intellectual and bodily moves and skills. As a consequence, new needs, meanings, practices, and purposes arise in the work. The concepts of “reskilling” and “deskilling” were used in early studies of computerization and social and organizational change to describe these changes. Later, these concepts were replaced by a more general understanding that any work task involves a combination of physical objects, knowledge and skills, social interactions, and routinized ways of doing things.

Theories of technology in the STS field also developed as contests to technological determinism. Technological determinism is an influential way of thinking about the relationship between individuals, technology, and society—or, more explicitly, the “information society.” It is based on the implicit assumption that technologies are developed through series of innovations undertaken in attempts to overcome the weaknesses and shortcomings of earlier technologies, and that new technologies straightforwardly represent progress and outdate earlier technologies. This perspective constructs technologies as tools with fixed meanings whose uses are known (i.e., immediately identifiable and clear), and defined by the original aims of their designers.

Technological determinism has also been called the technology independence assumption.^[7] According to this

assumption, technology and social relationships each are constituted and evolve independent of one another. Within STS, technologies are not understood solely as tools used for practical purposes. The assumption is that technologies are more pervasive in nature: social and power relations are encoded into technologies, and technologies also embody social relations and aspirations in concrete and powerful ways.

Another central idea in STS is that technologies are the products of “heterogeneous engineering”^[8] which refers to how they are emergent rather than stable phenomena. Whatever may have been the system designers’ original plan, what actually gets produced and reproduced does not fully follow a single fixed plan or strategy. What happens depends on the strategies of a whole range of actors. The “technical features” of technologies are not fully controlled and regulated by any single group of actors. Neither are the consequences, opportunities, and constraints of technologies stable across contexts.

SOCIAL SHAPING OF TECHNOLOGY

The SST perspective emphasizes the mutually shaping relationship between the technical and the social.^[9] The relationship between technology and society is described as “a seamless web”^[10] meaning that technological, social, and cultural worlds and practices are interrelated and inextricably linked.

Social shaping of technology posits that the formation of technologies cannot be explained through a single rationality or imperative: economic (market demands), political (social power relations), technological or material conditions for innovations, or the social interests and desires of particular groups. It seeks to open up the “black box” of technology production by a detailed analysis of how the social, organizational, cultural, and political environment in which a technology originally was created fundamentally shaped the technical characteristics of the artifact.^[11] In its interest of going back in history to study how technologies developed, SST is closely related to historical studies of technology.

Central concepts in SST are “interpretative flexibility,” “relevant social groups,” and “closure.” These concepts contest the notion that technology develops autonomously and according to an inner logic. The concept of interpretative flexibility refers to a core assumption in SST that every stage in the generation and implementation of new technologies involves a set of choices between different options. The initial openness means that choices could always have been different. Each technology could have been constructed based on a different set of premises and decisions. The choices eventually made are not dictated solely by technological considerations. A range of social and contextual factors affect which options are eventually selected.

“Closure” means that the openness to alternative solutions and interpretations present at earlier stages must at some point become regarded as closed, and potential disagreements related to design decisions and their consequences resolved. Such decisions are seen to be guided by alliances between “relevant social groups” and the coming together of their interests. For instance, when a technology moves from planning stages to selling and marketing stages, the representations concerning its content, functions, meanings, and uses become relatively stable.

Ruth Schwartz Cowan’s “How the refrigerator got its hum”^[12] is one influential study in the SST perspective. The study showed that technical qualities, in terms of energy-saving and silent machinery, did not explain the type of refrigerator technology that came to dominate the market—a better technology lost the competition. Analyzing the processes of innovation, patenting, production, and marketing, she came to the conclusion that many interrelated factors explained the outcome of the process and the type of technology that gained market dominance.

Studies conducted from the SST perspective seek to track down all possible proposed solutions by relevant players that were available in the design context in the formative time period, regardless of whether the solutions later turned out to be successes or costly mistakes.^[13] Such historical investigations shed light on why some artifacts succeed and others fail. Both historical and organizational case studies have led to a deeper understanding of typical causes for failure and conditions that must be filled for a technology to succeed.

The assumption in SST is that a technology is eventually stabilized through getting rooted in stable organizational arrangements. But whatever the system designers may have had in mind and wished to do is not the only factor explaining the outcome. What actually takes form depends on the actions, interests, and strategies of a range of other actors as well. There is a network of varying interests and strategies at play, and technological closure means that these reach some kind of accommodation. Closure in technology does not mean, however, that both designers and users would eventually agree on the content, purposes, and uses of the technology. The notion of interpretative flexibility also means that differences continue to exist between different social groups in how they come to see and experience a particular technical artifact. Not only is there a great deal of flexibility in how an artifact is designed, the process of redesign continues throughout its marketing, implementation, and use.

ACTOR-NETWORK THEORY

The ANT was developed by Michel Callon,^[14] Bruno Latour,^[15] and John Law^[8] as an attempt to more fully incorporate technical artifacts as actors in accounts of human action. Latour^[15] termed nonhumans as the

“missing masses” in sociological accounts. He argued that the orderliness of everyday life to a great extent relies on a distribution of tasks between human and nonhumans. Tasks performed by humans can be delegated to nonhumans, as when a policeman guiding traffic is replaced by traffic lights. The function of traffic lights is to guarantee orderly behavior. Even more generally, argues Latour,^[16] when nonhumans are delegated human tasks, nonhumans shape human action in that they “prescribe” certain kinds of action. Prescription is what a device anticipates, allows, or forbids a human actor to do. There is morality in such prescriptions, termed by Akrich^[17] as the “affordances” of a technology. Traffic lights aim at permitting some actions and inhibiting others. This does not mean that a real human actor would necessarily follow the action guidelines of the prescribed, inbuilt user. Latour’s^[15,16] main point is that nonhumans deserve full consideration as social actors. As prescriptions are encoded in machines or devices, they are delegated not only duties but also values and ethics that greatly add to the overall orderliness of societies.

In a similar vein, Law^[18] argued that “the social is not purely social at all,” since the social world would not hang together if the natural, the corporeal, the technological, and the textual were taken away. What we usually call technical is partly social, since in practice nothing is purely technical. And what appears to be the social is partly technical; scraping the social surface we will find that it is composed of networks of heterogeneous materials (p. 10).^[18]

The first version of ANT had much in common with the SST approach. It was developed to avoid explanations of single influences, interests, or background factors—social, economic, or technical—guiding the development of technical artifacts.^[19] ANT posits that the background “interests” formative in technology development are in themselves achievements which depend on a coming together of many conditions: creative, material, financial, legal, markets, and so on.

Within information science, ANT has been applied, for example, by Rob Kling and his colleagues. Kling, McKim, and King analyzed Electronic Scholarly Communication Forums (e-SCFs) such as e-journals, digital libraries, and collaboratories, as sociotechnical interaction networks (STINs).^[20] Kling and colleagues (p. 48)^[20] defined an e-SCF as a network that includes people/organizations, equipment, data, diverse resources (such as money, skills, status), documents and messages, legal arrangements, enforcement mechanisms, and resource flows. There are social, economic, and political factors that enable the interactions that sustain such a network. Attempts to analyze the success or failure of an e-SCF also must take into account the interactions between different technical systems, both large-scale global technological systems and local technologies-in-use.

ANT studies focus on exploring how actor-networks get formed, hold themselves together, or fall apart.^[21]

Kling and his colleagues^[20] conducted insightful analyses of why a technology that on the surface is essentially the same technology—a pure e-journal—can gain momentum in one context and fail in another. Kling and colleagues^[20] showed that if a single network element differs across contexts, the innovation simply no longer is the same. Their empirical studies on the successes and failures of pure e-journal and preprint archive initiatives in some disciplines explained under what kinds of circumstances some components of the STIN will offer resistance (termed by Latour as “antiprograms”).^[16]

ANT case studies have been criticized by Latour, Callon, and Law^[22] themselves as being merely descriptive. Others have criticized ANT studies for the preference for historical analyses of the formation of actor-networks rather than tackling contemporary technologically mediated social life-forms. Kling and colleagues^[20] argued, however, that STIN modeling could be conducted before implementation, which would help in predicting the success of e-SCF design initiatives.

Latour,^[15] in turn, preferred to describe ANT as purely sociological analysis, the “sociology of translation.” In his view, the purpose of ANT research is to “follow the actors” that constitute a sociotechnical actor-network. The study of the constitution of an actor-network is not to study a process of straightforward acceptance or rejection of an innovation, it means following the process of its transformation. “Translation” implies that one technology may stand for another thing in a different context. Actor-network theory analyses show how keeping an innovation functional and achieving its intended effects is a constant struggle with no guaranteed outcomes. Actor-network theory also assumes that social groups encountering a new technology can in fact be deeply transformed by the innovation. Actors and technologies hence coproduce each other, and the interest in ANT is in how these coevolve.

One of the best known studies based on ANT’s concept of translation is by Star and Griesemer^[23] who examined the early development of a natural history research museum (a museum not open to general public), the Museum of Vertebrate Zoology at the University of California, Berkeley. Star and Griesemer focused on how scientific work, conducted as the cooperation between diverse groups (humans, nonhumans, scientists, and non-scientists), inhabiting and participating in different social worlds, was achieved and managed. Objects such as species and subspecies of mammals and birds carried different meanings in these different worlds. Actors wishing to cooperate faced the task of developing tools for reconciling these meanings and for maintaining effective collecting and information-keeping practices. Star and Griesemer^[23] found that developing methods for standardization and the creation and management of “boundary objects” were the main means for disciplining the joint activities.

The analytical concept boundary object, having its roots in ANT, has become widely used both in STS and

many other research domains, including knowledge organization research. Star and Griesemer likened boundary objects to “road maps” whereby concrete objects such as field notes are turned into abstract objects for the purposes of standardizing work practices. Boundary objects thus guide and inform the translation work required for successful collaboration between diverse groups. Boundary objects reconcile differences in interests between groups, differences in degrees of abstraction in the description of objects, and differences in units of analyses. A standard indexing scheme is one example of a boundary object. It does not accurately describe the details of any one object or thing. It is, however, able to serve as a means of communication across diverse lifeworlds. It conveys standard information and reconciles multiple viewpoints. It satisfies the minimum informational demands of all concerned parties in describing and capturing properties of objects (e.g., data or documents) that fall within the minimally acceptable consensus range.^[24]

Geoffrey Bowker and Susan Leigh Star’s^[24] well-known work on classification systems also draws from ANT. Bowker and Star showed how in many types of work, classification systems and recordkeeping technologies form the infrastructure that allows the ongoing reproduction of relevant practices and historically constituted order of things. They showed how classification and recordkeeping technologies are a fundamental aspect of the practical management of everyday activity. The interest in document work and recordkeeping practices has continued to occupy a central position in practice-oriented studies of work and technology. Many practice-oriented studies focus on organizational practices of documentation and recordkeeping and analyze them in a detailed manner. The assumption is that organizational records are central for the ongoing accomplishment of mutually intelligible concerted action and function as ordering devices for organizational accountability.^[25,26]

From the viewpoint of information science, ANT has been particularly influential in two ways. First, it teases apart the common notion that it is meaningful to make a division between “people-centered research” and “system-centered research.” Actor-network theory takes the analytical stance that it is not tenable to start from the notion that people are special, and divide people and technologies into two separate heaps.^[21] From the ANT lens, a copy machine, for instance, is a network of interacting technical materials but also entails roles played by human actors such as operators and repair-persons. Human actors are also generated in networks of heterogeneous social relations and technical materials. This is because human actors assume specific roles and have special attributes in diverse STINs. The concept of affordance, central in ANT, posits that there exists no sharp division people and technology and thus mandates research designs bridging existing divides between people-centered studies and system-centered studies.

SOCIAL CONSTRUCTION OF TECHNOLOGY

The SCOT perspective is embedded in the linguistic turn in the human and social sciences. Social constructionism emphasizes the role of language in the construction of social reality. The basic assumption in social constructionism is that language is not merely a tool for expressing ideas, rather, language sets the boundaries for expressing emotions, knowledge, and views. Studies in the SCOT perspective focus on “representations” of technology and users. Keith Grint and Steve Woolgar (p. 32)^[27] defined the object of research in SCOT as “the regimes of truth which surround, uphold, impale, and represent technology.” The SCOT perspective defines technologies as texts that are written and read. Although technologies are, naturally, also concrete and material, for the purposes of analysis, it is fruitful to adopt a counterintuitive way of thinking about technologies as texts. This makes it possible to see that technologies do not exist independently of human interpretation. Capabilities are attributed to technologies by humans.

The emphasis on the textuality of technology is based on the insight that any attempt to study the “impacts” of new technologies inevitably represents a specific discourse. Descriptions of the large-scale effects of technological change or impacts of new technologies tend to get trapped in either positive (utopian) or negative (dystopian) discourses.^[28] Grint and Woolgar^[27] argued that impact studies are implicitly based on the assumption that there are some inherent static properties in technologies which account for their impacts on work and everyday lives. In SCOT, technologies are unstable and indeterminate artifacts whose significance is negotiated and interpreted but never settled. According to the SCOT theory, since we have no access to reality other than through our social constructions of it, we always have to hold a question mark over what the significant constraints or enablers of a technology are.

According to Foucauldian, thinking concerning the relationship between power and knowledge, not every representation of the nature of a new technology carries equal authority. Some interpretations appear as more credible and objective than others. According to Grint and Woolgar,^[27] in analyzing accounts and representations of technology, the important question to ask is “why do we believe some people’s accounts but not others?” and “What is the work that discourses of technology perform in different communities and contexts?”

Talja^[29] applied the SCOT approach to analyze the implications of discourses concerning information technology users and IT skills. She emphasized that neither standardized tests of skills nor self-assessments of computer skills represent the truth about IT competencies. The variables tested such as computer attitudes, computer self-efficacy, or computer anxiety, are in themselves parts of large-scale discursive formations. They are based on

specific lenses on what are the “core” properties of information and communication technologies and what constitutes competent IT use. In addition, people’s self-assessments of their own computing skills are context-dependent communicative constructs. They are dialogic, situational, perspective-dependent, variable, and multilayered entities. When IT and IT skills are described and approached from different angles, different aspects and truths concerning computing come into view. However, the discourses generally used in society to describe IT competencies shape users’ interpretations of their own IT expertise. General notions of IT expertise and of the groups that possess IT expertise may leave ordinary technology users with a conception of their competencies as limited or elementary.^[29] In dominant discourses, computing expertise is not described as something that is always situated, work task and domain-related.

In advocating the SCOT perspective, Grint and Woolgar^[27] contested both ANT and SST case studies. Such case studies in their view typically bring out only one version of “what happened in reality,” and posit their stories as objective facts. They also criticized the innovation-centeredness of SST, the focus of studies on early stages of technology development at the expense of analyzing prevailing technology discourses that have a profound influence on IT policies and initiatives and IT training.

GENDER AND TECHNOLOGY STUDIES

Gender and technology studies foreground the ways in which technology, expertise, and gender are intertwined and mutually shaped. Feminist scholars such as Cynthia Cockburn^[30] and Judy Wajcman^[31,32] emphasized that the way technologies are designed and implemented contain specific ideas of what is the logical and desired way of performing work tasks. In gender and technology studies the notion of “interpretive flexibility” loses some of its credibility. Whenever an artifact is designed, theories of about users and their behavior, assumptions concerning their activities and their social contexts, notions of what is simple, pleasurable or aesthetically satisfying, specific ideas about knowledge and rationality, come into play. Women and also men, having their own practices and experiences, may in fact experience technologies as highly inflexible.^[33]

As technologies and technological languages highlight certain expectations of use and qualities of users, they also implicitly tell people what sort of people they are. A central interest in gender and technology studies is how information technology intertwines with our thinking, acting, and identities. Donna Haraway’s^[34] famous cyborg concept conveys an idea that the boundaries between humans and machines, natural and artifactual are leaky; all people are hybrids of machines and living organisms. The cyborg

image presents technology as an aspect of our embodiment: it is inbuilt in us. Gender and technology studies mandate that technology needs to be subjected to discerning and critical examination both from the viewpoint of subjects' bodily and historical experiences and from the viewpoint of larger (macro)social and discursive orders.

The emphasis on the situated nature of knowledge is the major difference between SCOT and gender and technology studies. The SCOT perspective has often been criticized of extreme relativism. Some critics view especially the argument posed by Woolgar that every sociological explanation ends up positing a final truth when the final truth cannot by any means be captured, as "deconstruction gone mad." Gender and technology studies start from the assumption that knowledge is site-specific and relative to human agents in specific settings. Knowledge is also embodied, that is, deeply rooted in specific practices and experiences.^[34] This notion does not mean that "agency" would be limited to human actors, only that technologies cannot be understood or studied independently of everyday experiences and practices which constitute people as specific kinds of people. Gender and technology studies are interested in how the intertwining of the self and technology takes place in concrete everyday life settings.^[35]

Empirical studies within the gender and technology studies tradition do not claim to be nonpolitical, neutral, or objective. Gender and technology studies adopt an analytic stance called strong objectivity. This stance is based on the standpoint epistemology developed by Sandra Harding,^[36] Donna Haraway's^[34] concept of situated knowledge, and Karen Barad's^[37] theory of agential realism. All these theorists stress that knowledge is always positioned; it is produced from a particular standpoint and can only represent a partial perspective. Acknowledging this, the important question is from whose viewpoint is the social world examined and described. Haraway's^[34] concept of situated knowledge embraces a view that a degree of partial objectivity can be reached if the analyst explains her position as clearly as possible. Haraway^[34] argues for the replacement of various forms of unlocatable, and hence irresponsible, knowledge claims with a practice of objectivity that privileges especially marginalized and excluded voices, in the hope for transformations in technological systems, systems of knowledge, and ways of seeing. Gender and technology studies mandate accepting responsibility for the kinds of representations produced and attentiveness to the way that scientific accounts take action in the ongoing reproduction of phenomena.

Gender and technology studies contest the notion of technological systems and environments as gender-neutral. Historically, technology and especially information technology, has been developed mainly by men. Information technology has carried and invisibly still carries strong connotations and images of male expertise.^[32]

Studies of technologies in home environments have shown that girls' and boys' computing activities tend to

be perceived differently.^[38] Studies have for instance shown that girls' computing activities such as chatting and online shopping are more often constructed as forms of entertainment, casual leisure, or consumption. Boys' activities such as gaming and downloading free software are more often perceived as expertise-building and expertise-requiring activities. In a study of IT in Finnish homes and families, Nieminen-Sundell^[38] discovered that computers in families were often placed in boys' own rooms and surrounded by objects related to the boys' interests in computing. There is a strong connotation between computing and male expertise. The families in Nieminen-Sundell's study regarded boys' interest and engagement in computing as more than natural and something to be encouraged. In the Finnish families studied by Nieminen-Sundell,^[38] the mothers often had extensive work-related experience of computing. Yet, in family interviews, mothers' computing skills were often downplayed or even joked about. Even the mothers themselves often described themselves as incompetent and as needing their sons' help and advice in matters related to computers. Regardless of the real breadth and depth of the computing expertise of mothers or their sons, the cultural expectation is that young boys perform well with computers. Computing can also have deep symbolic and ritual meanings. Young girls may avoid getting too much involved in computing whereas as regards boys, mastery of computing may culturally be unconsciously perceived as part of the growth into manhood.^[38]

Ethnographic studies of the domestication of new technologies have reached interesting findings concerning the status of diverse technologies at homes. This is not reflected only in the physical placement of technological artifacts at the home and or the domestic patterns of their use.

Nieminen-Sundell^[39] asked married couples to name the technologies they have in their homes. Alarm systems, computers, and digital cameras were typically named and classified as representing technology. Hair dryers, vacuum cleaners, and cooking stoves, in turn, were not typically mentioned or counted as technology. What represented technology was related to the relative novelty of the technology and to whether they were used mainly by men or women.^[39] What represents "smart" technology or even technology thus changes with both the domestication of technologies and gendered patterns of their use.

PRACTICE THEORY OF TECHNOLOGY

Anthropological studies of technology conducted since the 1970s at the Xerox Palo Alto Research Campus (PARC) (e.g., Wynn-Whalen^[40–42]) directed attention to technologies as they are used in everyday work tasks. Xerox researchers conducted detailed studies on the use and role of technologies in the practical accomplishment of work

activities. Through studying workers' activities and interactions, they described how the workers themselves in practice produce the functionality of tools and technologies.^[43] Studies of the fine details of situated work practices proved to be productive for gaining guidelines for technology development. In addition to naturalistic workplace studies, Lucy Suchman's book *Plans and Situated Actions*^[44] had a major influence in the emergence of the practice theory.

Suchman^[44] argued that the formal plan-based models of work task performance which guided studies in artificial intelligence (AI) and cognitive science had failed to consider the immediate context of work activities. Plans, cognitive schemas, scripts, and rules are not static but dependent on the situations in which they are invoked. These do not determine conduct but provide a resource through which people orient in diverse situations and interpret their action and the conduct of others. Suchman argued that formal models of work tasks disregard the contingencies which inevitably arise in real-life problem-solving and ignore the improvisational, interactive, and situational character of individuals' reasoning. This is nevertheless what accounts for the successful execution of work tasks.^[44]

The fundamental assumption in practice theory is that practices are always social. Even when people seemingly work alone and do not belong to any specific group, they rely on a complex body of socially shared skills and understandings.^[43] Views of what constitutes competent practice develop among a community of practitioners.^[45] Practices are therefore always organized in relation to significant others, who may be coworkers, coproducers, recipients, or customers. In this view, all work is collaborative, and the accomplishment of work requires some form of collaborative interaction.^[43]

The term practice refers to recurrent mundane activities through which individuals in situ become skilled workers or learners. Practice theorists define practices as embodied, materially mediated arrays of human activity centrally organized around a shared practical understanding.^[45] The practice approach is not oriented solely toward linguistic representations, since knowledge and expertise are taken to be both implicit, embodied in ways of performing work tasks, and explicit, formed in and through documents and face-to-face interactions. Practice theorists argue that conventional approaches to technical design have tended to underestimate the importance of the socially organized competencies and reasoning on which workers rely in using technologies as part of their daily work. Consequently, system designers miss important aspects of how the work is done that are critical for fitting and integrating technology into work processes.^[46,47]

Practice-based studies focus on the "work practice—artifacts/technology/material objects—human interactions" triangle. Assumption is that it only makes sense to study these in concert, that these are not isolatable. The practice theory of technology is first and foremost a theory

of technology-in-action. Studies adopting a practice approach are oriented toward gaining a detailed understanding of how groups organize their work practices through interacting with texts, coworkers, technologies, and other material objects. Consequently, the practical accomplishment of work activities is usually analyzed in its moment-by-moment emergence.

As observed earlier, many studies in this tradition focus on practices of producing, preserving, using, coding, categorizing, and filing documents for the purposes of work and in the course of work. Studies have placed equal importance on affordances of paper documents and affordances of electronic documents.^[48,49] The attention paid to the role of documentation and documents in the organization of work is exemplified by studies focusing on the production of medical records^[26,49] and practices of indexing of documents in a law office.^[25]

CONCLUSION

The ANT, SST, SCOT perspective, gender and technology studies and practice theories focus on different aspects of sociotechnical practices and processes. While the SST and early studies within the ANT focused more on historical studies and the early stages technology development, the SCOT perspective, gender and technology studies, and practice-oriented studies focus more on current practices.

Each STS theory has opened up new insights into the interplay between technologies and social practices. STS theories have introduced concepts that have enabled the taking of distance to everyday "natural" assumptions regarding technology. Concepts such as "heterogeneous engineering" typically function as labels designed to enable the effective transport of complicated ideas. However, STS theories and studies have often been criticized of heavy use of jargon and of having adopted a complicated style of writing. According to critics, this is an obstacle for a more widespread application of STS theories.

Compared to many theories of human information behavior within information science, STS theories contain a distinctly different view of what is problematic and what is not. The formulation of problems requiring study can be likened to the choice of languages and vocabularies for talking. Most of the time, we do not consciously choose the language or vocabulary we use but just do what comes naturally, use the language of our community. Information science languages and communities are many, however. As observed in the beginning of this entry, some information science topics are also STS topics and commonly approached and studied using the vocabularies that also STS communities deploy. Examples of such topics are classification, documentation, and recordkeeping practices. In some areas information science and STS concerns and research programs overlap, whereas in some research areas, languages and problem definitions do not overlap.

Within information documents, theories have been developed around the concept of information. Technology, in turn, has not been viewed as an equally important concept and object for theoretical work. STS theories extend the scope of theory building to the nature and affordances of technical artifacts. At the heart of STS is the idea that the social and the technical interact and mutually shape one another, leading to the notion that human–information interaction cannot be meaningfully studied as disconnected from technological systems. Another core idea in STS is that technological systems must be conceived very broadly as consisting of technologies-in-use, working practices, social relationships, and larger social/textual and technoscientific orders and processes.

Studies in STS have shown how technologies take shape through conflicts, negotiations, and alternative interpretations. STS theories allow seeing technologies as less closed, fixed, and stable. Looking at technologies as more indeterminate and open to reinterpretation encourages an active critical involvement in interpretative work and the recreation of understandings of how technologies could or should be redeveloped.

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Search Engine Optimization

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Abstract

Search engine optimization (SEO) is the craft of elevating Web sites or individual Web site pages to higher rankings on search engines through programming, marketing, or content acumen. This section covers the origins of SEO, strategies and tactics, history and trends, and the evolution of user behavior in online searching.

INTRODUCTION

Search engine optimization (SEO) is the craft of elevating Web sites or individual Web site pages to higher rankings on World Wide Web (WWW) search engines through programming, marketing, or content acumen. The definition often includes specifications for increased traffic to a given Web site, improved quality of traffic, increased profits, or brand awareness.

In a typical online search on a topic, anywhere from hundreds to millions of articles may be extracted and ranked by probability of relevance on a search engine results page (SERP). From the earliest appearance of Web search engines, creators of Web sites realized that ranking high was vital for visits to their Web sites, since users seldom look on even second or third screens of rankings, let alone the hundredth screen. The numbers of Web sites on the Web increased so rapidly from the beginning that the competition for the most desirable top positions developed rapidly.

In this entry, we move through several key aspects of SEO. First, we define “rankings,” and review the origins and history of SEO. Then we discuss what is known as “Black Hat” and “White Hat” SEO, as the competition for rankings can lead to distortions and misleading rankings, depending on what techniques are used.

The heart of the entry concerns SEO methods. We review keyword selection and then attend to various aspects of the content of the Web pages, such as keyword density, placement, and consistency. We then go on to the technical aspects and review techniques such as keyword stuffing, meta tags, and cloaking, as well as strategies for boosting page rank through links from and to other Web sites, with brief discussion of combined strategies and the analytic methods applied to track results.

The entry expands into more general issues such as broad vs. narrow targeting, page longevity and rank, geographic targeting, and increasing competition. Trends in SEO practices are described from early to present time, as are external trends affecting SEO.

We conclude with a description of SEO regulation, mostly in the form of search engines policing their listings, and an overview of typical behavior patterns of search engine users.

All the methods described have been or continue to be effective SEO to some degree. Changes in search engine indexing protocols as well as their methods for displaying search results mean that no strict description of the best method or methods can remain entirely accurate indefinitely. This entry does not cover pay-per-click, other forms of online advertising, or the resale of Web site traffic or links.

Because the discipline originated in the mid-1990s, terminology is still in flux. General references at the end of this entry point to the more authoritative Web sites and definitions.

DEFINITION OF HIGHER RANKINGS

“Higher rankings” in the popular press or lay discussion generally equates with the goal of having a Web page appear in the first 10 or 20 search records for a particular search term, as it is broadly established by tracking that few search engine users will click through to any link beyond the 20th record. SEO professionals usually discuss rankings in terms of SERP position (Fig. 1).

Before search engines accepted paid advertisements, SEO was considered a unique form of promotion, radically different from all traditional forms of advertising. It is now more often considered a subset of search engine marketing (SEM), and is sometimes referred to as “organic search” or “natural SEM,” as opposed to paid advertisements placed on the pages of search engines or their affiliates.

Online commerce was the originating force behind search engine promotion and remains the primary driving force behind SEO. Nonprofits and government bodies apply some SEO methods but tend to rely on their unique identity to assure them a prominent SERP position,

[Advanced](#)
[Options](#)

Web results 1-10 of 89,800,000

Chocolate, Chocolate Gifts, Gourmet Chocolate, Chocolate Truffles ...
Buy **Chocolate** HERE! Gifts, Truffles, and Boxes of **Chocolate** - Handmade and Artisan Specialties ... Nautical Collection 10 Piece Gift Assortment The Perfect Gift for Every Occasion!
www.chocolate.com · [Cached page](#)

Chocolate - Wikipedia, the free encyclopedia
Chocolate (pronounced /ˈtʃəklɪt/ (help · info), British English: /ˈtʃɒklət/; it originates from a Nahuatl word meaning "bitter water") comprises a number of raw and ...
en.wikipedia.org/wiki/Chocolate · [Cached page](#)

Chocolate - All About Chocolate - History of Chocolate
The tasty secret of the cacao (kah KOW) tree was discovered 2,000 years ago in the tropical rainforests of the Americas. The pods of this tree contain seeds that can be processed ...
www.fieldmuseum.org/Chocolate/history.html · [Cached page](#)

Chocolate - All About Chocolate
Candy bars, milk shakes, cookies, flavored coffee—even cereal and medicine!
Chocolate is a key ingredient in many foods. In fact, it ranks as the favorite flavor of most ...
www.fieldmuseum.org/chocolate/about.html · [Cached page](#)
[Show more results from www.fieldmuseum.org](#)

Fig. 1 Typical SERP in search for chocolate, showing the first four results.

e.g., the Red Cross, Amnesty International, the Vatican, the New York Department of Motor Vehicles, or the Peoria Public Library.

ORIGINS AND HISTORY OF SEO

The term “search engine optimization” came into popular use in 1997–1998 and is frequently attributed to Danny Sullivan,^[1] then operating “Search Engine Watch,” though Sullivan states he is uncertain who coined it. Previous terms included “search engine placement,” “search engine ranking,” “search engine positioning,” and “search engine promotion,” the latter attributed to Jim Rhodes,^[2] author of “The Art of Search Engine Promotion.” Predecessors such as Heath^[3] in his 1995 article “Pointers on how to create business Web sites that work” did not have a formal name for SEO.

The period from the mid-1990s to about 2000 was characterized by broad experimentation on the part of both search engines seeking a business model and Web site creators intent on promoting themselves. Search engines were relatively under-powered and minimally staffed; their primary focus was on keeping pace with the growth in new Web sites. SEO quickly became part of the American “wild, wild Web” metaphor, with more active Web site owners engaging in a huge variety of methods to gain higher rankings, as described in “SEO Methods.” In a period when many multinational organizations did not have Web sites at all, smaller and more nimble organizations and individuals aggressively practiced SEO to establish a beachhead on the WWW.

The early days of search engines were in some ways a struggle against pornography. Visitors who started using search engines after 2000 have little conception of how pervasive the online sex industry was at one time, with their records appearing among search results for cooking, art, quilting, travel, and other innocuous subjects.

As search engines have grown and become more sophisticated, and the number of Web sites has increased more than tenfold, aggressive maneuvering to rank well in the SERPs has to some extent given way to a focus on ranking well in particular niches, and executing well on fundamentals rather than exercising brilliance in manipulating search engines.^[4]

PRACTITIONERS AND SOFTWARE

Early Search Engine Promoters and Reporters

Early SEO innovation was an individualistic endeavor, primarily developed by small-to-midsize businesses ranging from small hotels to makers of custom sports equipment. Several such niche and popular products were financially successful, demonstrating that SEO was a path to profit.

Web sites with forums for exchange of SEO strategies began to appear by 1996, including still-existing Web sites such as <http://virtualpromote.com>, <http://www.searchengineforums.com>, and the archived <http://www.deadlock.com/promote>.

Web sites reporting on search engines and optimization began about the same time, including <http://www>.

wilsonweb.com, <http://www.searchenginewatch.com>, and <http://www.webmasterworld.com>. More recent additions include <http://www.seobook.com/blog>, <http://www.searchengineland.com>, and <http://www.toprankblog.com/search-marketing-blogs>.

The Current SEO Industry

Whether offered as a subset of SEM services or sold alone as organic search, SEO has become a niche industry with its own sales forces and conventions. The service may be sold as a one-time audit or on an ongoing basis with monthly billing and performance reporting.

Pure SEO consulting firms now number in the thousands, primarily concentrated in North America and the United Kingdom. Tens of thousands more Web designers and developers offer the service as ancillary to building Web sites, and an unknown number of Webmasters and Web site owners apply SEO methods to their own Web sites.

Gross expenditures on SEO in 2006 were estimated at over USD one billion, with steady annual growth anticipated. This figure describes organic search and does not include paid advertising or most in-house work in smaller companies.^[5]

SEO Software (Automating the Process)

Automated Web page submission tools came into being in the mid-1990s soon after search engines began indexing the WWW. For some years, they were a vital part of SEO strategy for large Web sites, as manually entering thousands of URLs into the submission pages of a dozen search engines was extremely time-consuming. Submission tools fell into disuse as search engines became more adept at “deep crawling” (following links into the lower levels of Web sites’ file hierarchies). The ones currently in use typically offer additional features such as help in choosing keywords and automated reporting on SERP positions.

Web analytics tools move beyond automated reporting to features such as tracking visitors’ paths through Web sites, and integrating the data with financials.^[6]

Most content management systems, originally focused on intranets, now include management features for Web sites, and many are programmed to allow a significant modification of variables important to SEO.^[7] Likewise most blogging software includes features that encourage users to add keywords to the title tags, the Web page body, and the filename of a given Web page.

SEO Worldwide

While search engines are now used worldwide, most SEO reporting is about the United States, Canada, and the United Kingdom. Activity in other countries must be inferred. Australia, Ireland, and Russia in particular have

significant indications of entrepreneurial SEO, including blogs on the subject.^[8]

BLACK HAT VS. WHITE HAT SEO

“White Hat” SEO typically refers to strategies and tactics that are in concordance with the policies of online search engines, in a loose tacit agreement to provide Web surfers with “relevant content.” “Black Hat” SEO describes tactics that ignore generally accepted conventions of ethical WWW behavior to advance an agenda or commercial interest. The focus on search engine policies before other interests flows from the pervasive position of search engines, at the mid-point in the process of aggregating Web page data and delivering it to users. The tilted point of view is buttressed by the oligopoly of major search engines, with a small number of them processing the vast majority of searches, while millions of Web sites vie for high rankings.

Technically sophisticated tactics are often equated with Black Hat SEO, and a focus on high-quality content with White Hat SEO. However, there is substantial overlap; few if any tactics can be inherently classified as good or evil. From the perspective of a user, the main criteria of legitimate SEO is whether a given search return is relevant to their interests, regardless of how it achieved its ranking. Most experienced SEO practitioners consider intent to be the defining factor.

Typically, methods considered Black Hat SEO develop high page rankings faster, while those known as White Hat SEO tend to create longer-lasting rankings. A preference for one approach or the other is not entirely a matter of the SEO practitioner’s personal preferences; it also depends on the business model. Web sites or pages promoting products and services with short life cycles are suited to Black Hat methods, as they do not suffer from being “burned,” meaning they have drawn the attention of search engine administrators and been banned from that search engine’s index entirely. (This has also happened to sites of long-view organizations such as auto manufacturers when SEO subcontractors acted with an excess of zeal.)

White Hat SEO is better suited to Web sites that offer products with long life cycles. It is also suited to academic or government Web sites, where there is likely to be a consistent focus over decades—such Web sites often gain high and enduring SERP rankings simply by publishing high-quality content about a particular subject.

SEO METHODS

In describing SEO it is necessary to distinguish between automated search engines and manually created directories such as Yahoo! Directory (<http://dir.yahoo.com>) or the Open Directory Project (ODP) (<http://www.dmoz.org>),

where listings are added by human editors rather than automated protocols.

SEO describes strategies and tactics for influencing page rank on search engines that use “robots” (<http://www.robotstxt.org/wc/faq.html>) or “spiders” to “crawl” Web pages, traveling from page to page through hyperlinks, and indexing those pages by algorithms and protocols. While directories such as the original Yahoo! Directory can be searched from within Yahoo!, and the ODP pages can frequently be found in SERPs, it is the manner of creating the index that differentiates search engines and directories.

Elements of a Web Page to Be Optimized

The following example of HTML (Hypertext Markup Language) is referred to throughout this entry. The markup language and page structure used are explained in Table 1 below the example. (Web page structure can be

viewed in almost all Web browsers by selecting the “View > Source” or “View > Page Source” option.)^[9]

```
<html>
<head>
<title>ELIS—Encyclopedia of Library and Information
Sciences 2008–2009</title>
<meta name=“description” content=“The definitive
reference to library and information sciences.”>
<meta name=“keywords” content=“encyclopedia,
marcia, bates, mary, nils, maack, mack, optimise”>
</head>
<body>
<h1>ELIS—Encyclopedia of Library and Information
Sciences</h1>
<img src=“images/ELIS-cover.gif” alt=“ELIS encyclope-
dia cover” />
```

<p>Body content written for SEO is rich in keywords and also readable. Proper nouns such as “encyclopedia” are used instead of pronouns. Initializations such as “SEO”

Table 1 Tags and text in a simple Web page

Tags and text in a simple Web page, as seen through an HTML editing tool	Explanation of HTML tags and structure
<html>	Flag to user’s browser: Begin parsing for HyperText Markup Language
<head>	Begin the head content (which is not visible in a browser)
<title>ELIS: Encyclopedia of Library and Information Sciences</title>	The page title is the single most important part of Web page text for search engine ranking. While not shown in the body text in a Web browser, it can be seen in the title bar at the top, and is shown as the title of the Web page in almost all search engine listings
<meta name=“description” content=“The definitive reference to library and information sciences.”>	Most search engines will use the meta description as the default description in SERPs. SEO practitioners consider this tag a minor influence on SERP position, and usually orient the text towards readers rather than search engines
<meta name=“keywords” content=“encyclopedia, marcia, bates, mary, nils, maack, mack, optimise”>	The meta keywords tag, originally intended as a field for general metadata, was widely abused by SEO practitioners and is now a minor or irrelevant element of SEO
</head>	End of the Head section
<body>	Begin the text visible in a browser
ELIS: Encyclopedia of Library and Information Sciences	Headings tags, from H1 down to H6, are the equivalent of chapter and section headings in books, and are usually considered influential in SEO
	IMG tags define what image to display as part of a Web page. The “alt” attribute is used to store a brief description, typically keywords
Body content written for SEO is rich in keywords. . . [etc.]	The paragraph tag is the fundamental “container” for body content
Resources	The second-level heading tag may have influence on SERP position, as well as significance for metadata and document readability
See the encyclopedia description for further information on ELIS.	An outbound link where the “anchor text” contains the relevant keyword “encyclopedia”
Keywords: encyclopaedia, taylor, francis, marcia, bates, mary, nils, maack, mack, optimise	This is an unsightly but often necessary addition to the body content, displaying related keywords in the body text, where the search engines will read and index them. This practice evolved when search engines stopped indexing meta keywords
</body>	End of the body element
</html>	Flag to user’s browser: end of HTML file

Further information on HTML is available at <http://www.w3.org/MarkUp/Guide/>.

are spelled out as “search engine optimization,” both to include alternate search terms and to increase keyword density in the Web page. To target both sophisticated and lay searchers, common terms such as “acronym” are used in addition to precise terms such as “initialization.” Concepts are described by all likely variants, such as “SERP,” “search engine position,” or “ranking.”</p>
</div>

<h2>Further Encyclopedia Resources</h2>

<p>See the encyclopedia description for further information on ELIS.</p>

<p>Keywords: encyclopaedia, taylor, francis, marcia, bates, mary, niles, maack, mack, optimise</p>

</body>

</html>

Choosing Keywords to Target—The Core of SEO

Regardless of preferred methods, White Hat or Black Hat, content or technical, the most critical part of effective SEO is deciding which keywords to target for high rankings. While search engines continually work to improve their ranking algorithms, they are not clairvoyant; targeting the right keywords is still the foundation of reaching the right audience.^[10]

A self-centric viewpoint will usually lead an organization to aim at high rankings for its own name, services, agendas, or products. For example, the Raffles Hotel or the band U2 might focus on targeting searches for their own name, in a reasonable belief that most potential customers are specifically seeking them, rather than hotels in Singapore or rock music in general.

While this may be a successful strategy for broadly known organizations or people, it is considered poor-quality SEO when an unknown product, service, or agenda is being advanced. Products and agendas without name recognition are better served by targeting a generic search term such as “stainless steel ball bearings” than a term like “Smith Ball Bearing Company.” A multinational company such as General Electric or Hitachi—that manufactures a huge variety of products—might likewise target searches for the products rather than its own company name.

Regardless of whether the focus is on the organization or the products, SEO can fail when names are chosen without forethought to online search, particularly when they compete with long-established names. Two examples:

- Any product named “Guardian” must compete in the SERPs with dozens of well-established newspapers throughout the English-speaking world.
- Organizations using initializations that might be unique in a local telephone directory frequently face obscurity when competing for recognition in a global medium—“ABC” is not only an initialization for the

American Broadcasting Company, but hundreds or thousands of other organizations throughout nations that use the Roman alphabet.

This leads to a fundamental truth about the limits of SEO as a promotional avenue: it can only succeed if people are searching for relevant keywords. If an idea or product is beyond the public’s conception, it cannot be promoted through search engines—in contrast to promotion through traditional untargeted media such as radio, TV, or print. This usually makes SEO a poor method for promoting radically new ideas. For example, “anti-gravity belts” is a search only used by 10-year-old boys.

When possible, experienced SEO practitioners perform keyword analysis before a Web site is built, expanded, or redesigned, using paid or free online tools such as <http://www.keyworddiscovery.com>, <http://www.wordtracker.com>, <http://inventory.overture.com/d/searchinventory/suggestion/> or <https://adwords.google.com/select/KeywordToolExternal> to view aggregated searches conducted on search engines.

Content

At its simplest, the content-focused approach to SEO is to tell the story thoroughly and precisely, in hopes that the words (content) will find a fit with search engine indexing algorithms, and rise in the rankings for particular search terms. The presumption in this strategy is that the writer’s words will also find harmony with the terms used by searchers, and if the writer does have the same interests—and frame of reference—as the target audience, this by itself can result in highly successful SEO. (Conversely, Web pages written in ignorance of either subject matter or audience may achieve high SERP positions, but not necessarily for the keywords that draw the desired audience.)^[11]

A highly content-oriented strategy is often seen in Web sites that were conceived and designed by an individual or small group. Content-oriented Web sites or sub-sites may also come into being in an organization with no SEO strategy at all, such as a department of a university, where the authors are discussing the same or related subjects.

Density

Keyword density receives attention because it is easy to understand and simple to calculate through online density-checkers such as <http://www.keyworddensity.com>. (Such tools are easily found through search engines with the term “keyword density analyzer.”)

Though the effectiveness of intentionally repeating keywords throughout a Web page is debated by SEO practitioners, a search for highly promoted products such as “loans,” “chocolate,” or “discount shoes” will return numerous high-ranking Web pages with the core keyword repeated dozens of times, and keyword densities reaching up to 7% or higher of the page’s content. (However, exceptionally high-density pages can suddenly plummet in the

Science–Semantic

SERPs or be dropped from the index entirely if search engines classify them as examples of “keyword spamming,” described in the Technical strategies section below.)

Conversely, using a set of keywords only once in a Web page usually results in SERP obscurity, even if the set is extremely precise. For example, even “dodo bird nesting” returns tens of thousands of Web pages, and of the first few dozen search engine records, almost all will have the three keywords used several times.

Many SEO practitioners and analysts favor well-written content over keyword density, as search engines become better at differentiating between conventional prose and deliberately enhanced Web pages. This school of thought says that content should be primarily aimed at humans, not search engines, and that good writing not only entices users to read and act, but is better search engine bait in the first place. The belief is often expressed as “Content is king.”

Placement

The placement of keywords in a Web page is a significant factor in SEO, since search engine algorithms accord more weight to certain positions, whether visible or within tags (see Table 1). Notable areas for placement include:

Visible in Web page

Inside heading tags <h1, h2, h3. . . >

Placed at the beginning (top) of a Web page.

Within outbound links, i.e., “anchor text” (example in Table 1).

Placed NEAR other keywords (generally within 10 words).

Visible in SERPs and browser title bar

Inside the HTML <title> tag.

As part of the URL

Competition over search terms and SERP positions has expanded the use of keywords to the point that they are now routinely made part of file names (e.g., <http://www.mysite.com/used-software-for-sale.html>), or may even form the domain name itself, e.g., <http://www.usedsoftwareforsale.com>.

The title tag is almost universally agreed to be highly important by SEO practitioners. Most other placements are debated. The <meta=“keywords”> tag is largely considered of no importance. The “alt” content in image tags is considered significant in image SERPs, less so in the overall ranking of a Web page.^[12]

Inclusion of related keywords

Due to the unpredictability of user search behavior, many SEO practitioners include synonyms, cognates, tangential terms, and misspellings in Web pages. In the mid-1990s, SEO practitioners placed such related keywords in the meta keywords field (see Table 1), but massive abuse and misuse

of that field led virtually all search engines to stop indexing meta keywords. As a result, SEO practitioners reluctantly turned to placing them as a visible footer on the Web page, though this compromises the esthetics of page design. Some examples of keyword (or “tags”) line listings:

Synonyms, cognates, and closely related terms for a medical page about trigeminal neuralgia, formerly called tic douloureux:

“Keywords: tic douloureux, neuropathy, facial pain, face pain.”

Tangential terms (statistical outliers) for a site on vegetarian diet:

“Keywords: low sodium, low fat, organic.”

Variants on the author’s name for a Web page written by Jon Smythe:

“Keywords: John, Smith, Smyth.”

Common misspellings for a travel Web site about Colombia:

“Keywords: accommodation, Columbia.”

(However, when a keyword tag is used to repeat words already in the body content, it simply becomes “keyword stuffing”—see “Keyword Loading” below.)

Consistency

Building a Web site with a consistent pattern of clearly related keywords is commonly known as creating a “theme.”^[13] A Web site with a clear theme stays on a single topic or closely related topics throughout its pages (barring such standard pages as “Contact Us”). This strategy builds the overall ranking of the Web site and, as a consequence, the SERP positions of the individual Web pages.

The concept “clearly related” restricts thematic rank-building to keyword relationships that search engines are capable of recognizing. Where “ship” and “marina” might begin to build a theme relating to recreational sailing, search engines would be less likely to recognize a theme in a Web page with the separate keywords “ship” and “space.” Once combined into the more specific keyword “spaceship,” the page becomes identifiable as related to science fiction or space exploration, and if the Web site also contains the words “galaxy” and “parsec,” a theme begins to build.

The interest in themes peaked around 2004, alarmists suggesting that Web sites without a keyword theme would plummet in the SERPs.^[14] However, there are exceptions to the rule: newspapers, encyclopedias, and many news blogs will never have a clear theme, yet they still can reach high SERP positions for a variety of keywords, based on meeting search engine criteria other than consistency of subject matter.

Technical

A technically oriented SEO strategy emphasizes programming skill or ingenuity over command of language, familiarity with the target audience, or interweaving related content. Tactics vary from the simple, which can be

executed by anyone familiar with HTML, to the sophisticated, which require knowledge of programming, Web site servers, or WWW and Internet protocols.

Keyword loading, stuffing, and spamming

Keyword density can be taken to an extreme. Efforts to increase keyword density or variety that involve excessive or awkward repetition are known as “keyword loading.” An example would be replacing every instance of “it” in a page with the noun in question.

When this repetition reaches the level of incoherence, with the same word or words used dozens of times in the body, title, or tags of a Web page, it is usually called “keyword stuffing” (a.k.a. “cramming”), “spamming the index” (“index” referring to the search engines’ databases of Web pages), or “spamdexing.” One of the earliest SEO tactics, it began with simply repeating keywords hundreds of times, generally at the bottom of the page, and frequently with the font color the same as the background color, thus rendering the text invisible to humans. As search engine algorithms began to discount this tactic, keyword spamming evolved into a more precise metering of keyword density. This obsolete technique periodically sees a resurgence as search engine administrators let down their guard.

The meta keywords tag

Located in the head section of a Web page’s HTML (see Table 1) and invisible to users viewing a Web page in a browser, the meta keywords tag was created purely for metadata.

In the mid to late 1990s meta keywords were highly popular as a quick path to higher rankings, and indeed stuffing the meta keywords field showed some success when only a few million pages were being indexed. By the time the tactic became broadly known—with “keyword-jacking” lawsuits over copyright and trademark infringement—search engines were on their way to down-ranking the meta keywords tag contents, and usually not indexing the keywords in the field at all.

Entry pages

“Entry page” is the broadest descriptor for the strategy of creating particular pages to rank well with search engines, sometimes finely tuned to rank well with a particular search engine. “Doorway page” and “gateway page” imply that a page contains some relevant content that has been tuned for high SERP position. “Bridge page” or “jump page” imply that a page may be little more than an uninformative landing page that either urges the visitor to click through to the rest of the Web site, automatically redirects them to the rest of the Web site, or redirects them

to an entirely different Web site.^[15] Most media coverage of such pages classifies them as Black Hat SEO. However, there is no clear agreement on the definition of these pages or their relative level of deception. Many SEO practitioners observe that while bridge and jump pages may be technical and possibly Black Hat as well, all pages visible to search engines are in a real sense entry pages.

Cloaking

“Cloaking” is used to describe a broad range of tactics. The common element is that the human visitor and the search engine spiders “see” different content when visiting a Web page. In the simplest form, the SEO practitioner creates a page tuned for high SERP position, and replaces it with a human-readable page after the page has been indexed by search engines (of course the artificially high ranking only lasts until search engine spiders visit the page again).

Two of the more technical methods, which attempt to deceive search engines on a continuing basis:

- *User-agent-specific page delivery*, in which the Web page server “sniffs” the incoming page request, extracts the data that identifies what browser the visitor is running (e.g., “googlebot” or “msnbot”), and delivers a special Web page tuned to gain higher SERP on that SE.
- *IP-specific page delivery*, in which the Web page server delivers a special Web page based on the visitor’s Internet Protocol address (e.g., “127.0.0.1”).

Cloaking is broadly considered one of the most aggressive and sophisticated forms of Black Hat SEO, but search engine analysts point out that even cloaking has legitimate purposes, as when a Web site is migrating to a new domain name; the owners may want to keep the old Web site available to the public until the new one becomes established in SERPs.^[16]

Linking

Links have become such an important determinant of SERP position that under some circumstances they may override all other elements of ranking, and catapult a Web page of little or no relevance to a top SERP position.

Link-weighting fundamentals

Since the mid-1990s, search engines have routinely tracked the links from (and to) Web sites, often assigning a relative value based on the links’ source or destination. Links pointing to a Web site are generally called “inbound links,” and links pointing to other Web sites “outbound links.” (Inbound links are frequently called “backlinks,”

though the term has other technical meanings in computing.)^[17]

“Link-weighting” is frequently described as “link popularity” or even “popularity” measurements by popular media. More accurately, search engine link analysis algorithms attempt to infer the value of a Web page or entire Web site based on four factors:

1. The number of inbound links.
2. The “quality” of the inbound links, based on the quality of the originating Web site. Assessing the quality of Web sites is where link-weighting moves into more sophisticated and sometimes arcane mathematics.^[18,19] In simple terms, an inbound link from a major university has more value than a link from an obscure small business, and has a greater beneficial effect on SERP position.
3. The “relevance” of the inbound link. A Web site about a baseball team benefits more by inbound links from other baseball-oriented Web sites than by links from the personal pages of fans.
4. The keywords contained within inbound links (the linked text visible in a browser), known as “anchor text.” The most famous example was the 2003 link manipulation of Google SERPs (known as “Google bombing”) in which hundreds or more Web site owners inserted the link `<a href="http://www.whitehouse.gov/president/gwbbio.html">Miserable Failure</a>` into their pages, causing the U.S. White House biography of George W. Bush to rise to the top ranking for the term “miserable failure.”^[20] (The gwbbio.html page rose to #1 ranking on Google for that term even though it did not contain either of the keywords in question.)

The cumulative importance of these factors in SERP position has led to naming the collective effect of inbound links “link juice” (American “slang definition of” “juice”: influence, clout, <http://www.m-w.com>.)

Web sites with many relevant or high-quality links pointing to them (inbound links) are known as “authority” Web sites; those with many links pointing to other relevant Web sites (outbound links) as “expert” or “hub” Web sites. The presumption built into the search engine algorithms is that a Web site with many inbound links from high-quality Web pages is an authoritative source, and that pages with many outbound links to authority Web sites serve as a WWW resource. (The mathematics can become circular and even self-reinforcing, as when <http://www.wikipedia.org> Web pages briefly started to dominate #1 SERPs positions for thousands of subjects.)

Strategies for leveraging links

Link-weighting was implemented to in effect create a weighted voting scheme and take some of the control of

rankings away from a Web site’s designer. Since weighting means that not all inbound links are of equal value to SERP position, the methodology also opened the door to SEO opportunities of bewildering complexity, in which Web sites buy, sell, and trade links to and from their Web sites in order to improve their SERP positions.

Always a factor in SEO, “link building” is now broadly considered a core element of strategy, and in some schools of thought the most important element.^[21] Increasing media attention brought linking as a SERP ranking factor to the attention of Web site owners and the quickly growing number of SEO practitioners, and today organizations spend substantial time and effort on link building aimed at high rankings.

Non-reciprocal links (a.k.a. “generosity links”) were the first evolution, in the mid-1990s. At that time Web site creators linked to almost any remotely related Web site, including their competitors. By the late 1990s “reciprocal links” had become the standard, though the exchange was offered with a view to a direct increase in traffic rather than SERP position.

Soliciting inbound links, at first done casually, now often means assigning employees or subcontractors to solicit links from high-ranking Web sites. The return on investment is questionable—high-ranking Web sites have little to gain by giving an outbound link, and the site owners may be concerned that linking to a low-quality Web site will harm their own rankings. (Soliciting links should not be equated with link building, a broader term that covers all strategies for gaining inbound links.)^[22]

The practice of posting links in discussion groups also originated with the goal of direct traffic rather than influencing SERP positions. “FFAs” (Free For All Web sites), “link farms,” and “link rings” were crude early link-exchange schemes, most variants indiscriminately exchanging thousands of links without regard to relevance. While such sites are still active, their value in SEO has largely been eliminated by increasing sophistication of search engine ranking protocols. Most SEO practitioners today consider participating in them to be useless at best, and at worst, possibly injurious to a Web site’s SERP positions.

“Paid links”—inbound links that have been purchased, sometimes masking as editorial recommendations—existed before the WWW on Internet bulletin boards, always with the intent of publicity or direct financial gain. With the broadening awareness of SEO, using paid links to influence SERP position has become both a business strategy and a source of contention between Web site owners and search engines.

Good content, the oldest link-building strategy of all, is a somewhat indirect way to build links. Coupled with even a modest amount of self-promotion beyond good SEO—or occasionally just with good content that perfectly targets a popular search—competent writing on a particular subject can generate hundreds or thousands of inbound links to a given Web page, often without any

communication at all with the Web sites that are giving the links. Because content-inspired linking may produce results slowly (in months or years), and is often difficult to quantify, few organizations devote serious effort to the method.

Web Site and Web Page Structure

The directory (folder) structure of an SE-friendly Web site looks similar to a clearly and logically organized hard drive on a personal computer, with the additional proviso that every document is directly or indirectly linked from the home page or some other prominent Web page. Ideally the structure is “shallow” (three or fewer sub-directory levels), to make it easier for search engines to spider, though that has become less important as all major search engines now perform deep crawling.

Actual page structure of HTML pages is in theory dictated by an adherence to W3C standards. In practice, Web sites use almost any markup code that can be rendered by a Web browser and leave the difficulties of indexing to the search engines.

There are drawbacks to unorthodoxy where search engine rankings are concerned. Use of highly irregular Web site structure, page structure, or file naming conventions can seriously harm SERP position. In extreme cases, search engines simply do not add a Web site to their indexes; poor Web site structure can be as destructive to Web site rankings as the most extreme Black Hat tactics, and “site maps” generated specifically to aid search engines in indexing a Web site are not a substitute for logical Web site structure.^[23]

Despite a broad disregard for standards among Web site owners, most SEO practitioners consider disciplined site and page structure fundamental good practice, though these are seen as a foundation for SEO rather than an SEO strategy in themselves.

Web Analytics

The most thorough SEO practitioners use “Web analytics” to analyze Web site traffic for patterns that can lead to enhanced SEO. While the term embraces areas more concerned with usability and user behavior while on a Web site, analytics sweeps in SEO functions such as keyword analysis and SERP position monitoring.

Data can be collected by “tagging” individual Web pages with Javascript and other programming, or by placing cookies on visitors’ browsers.

“Keyword analysis” is often initiated at the server level through “log analysis.” Because WWW communications protocols usually pass the full URL of the previously visited page to the destination Web site, the headers can be processed for search terms, and those terms then organized and further analyzed.

In either case, data is then analyzed manually, or with in-house programming, or with one of the many commercial Web analytics programs.

The data below is a sample of some of the information that can be extracted from Web site server logs: visitor’s ISP, visitor’s IP address, number of pages visited, time and date, visitor’s browser and operating system, the Web site the visitor came from, the search terms they used, and the landing page.

A visitor from “dynamic.dsl.com” (88.104.65.226) was logged twice, starting at 12:46:36 on Sunday, October 14, 2007.

The initial browser was Firefox/2.0.0.7 (Windows XP; en).

This visitor first arrived from <http://www.google.co.uk> while searching “ecommerce business models 1–10” and visited “digitalenterprise.org/models/models.html.”

There has been a general shift in Web analytics from log analysis to page tagging, in part due to the limits of log information compared with information gained by tagging, and in part driven by vendors of analytics software.

Combining Content, Technical, and Linking SEO

Strategies that combine all three forms of SEO may be the most effective in gaining high SERP positions. Combined strategies are uncommon because Web sites are normally designed without regard to SEO (although the most effective SEO is begun at the conceptual level), and because Web site owners and managers rarely allow significant changes to the structure or content of their Web sites after they are built and online.

An alternate way of viewing SEO is “on page” or “off page” SEO, the former being methods applied directly to Web sites and pages, the latter focusing on methods external to a Web site, such as link strategies.^[24]

BROAD ISSUES IN SEO

A number of strategic issues that may affect a Web site go beyond fundamental SEO tactics or current “best practices.”

Building Downwards vs. Outwards

Large or growing organizations face the question of whether to house all their Web pages under a single WWW domain, or to establish separate Web sites for different services, product lines, or agendas. An established organization with a strong brand will usually lean keyword targeting towards its own brand name in SERP positions, and thus benefit from housing all its Web pages under a single domain, whereas a newer organization with separate divisions would be more likely to establish separate Web sites for each product line or goal.

This is not strictly a business issue; a university establishing a new campus in a different city would probably create a new Web site for that campus, just as a business that sells to both architects and game designers might choose to divide its product lines into two separate Web sites. The university would certainly link its two Web sites for the link-weighting benefits; the company selling unrelated products might not link its Web sites at all.

Broad vs. Narrow Targeting and Long-Tail Terms

The potential benefits in targeting highly specific searches were known to SEO practitioners by 1995–1996. Bed and breakfasts were one of the earliest and most evident examples, showing how highly specific keywords (e.g., “bed breakfast Ireland Kilkenny”) could reach precisely the right audience.

Since the Web was still sparsely populated, the more skilled practitioners were able to gain high SERP rankings for broad searches at the same time as they targeted narrow niches. For example, in 1997, it was possible for an Irish bed and breakfast’s Web site to gain a high SERP position for both its own locale and Irish B&Bs in general. That grew more difficult with increasing competition, and today a search for “bed breakfast Ireland” will generally return a SERP dominated by bed and breakfast directories and associations.

The changing situation became somewhat better understood in 2003, when Zipfian distributions were mentioned in an article by Clay Shirky about “power laws” as applied to blogs.^[25] Power laws were later popularized as “The Long Tail” by an article in *Wired* magazine.^[26] With use of the term growing, many clients and SEO practitioners now refer to any three- to four-word term as a “long-tail

term”; others use the description more correctly to describe an uncommon search term.

There are now indications that the pendulum of interest has swung too far towards uncommon terms, and that organizations are targeting long-tail terms without a clear view towards long-term benefits such as memberships or profits.^[27]

Balancing Targeting and Serendipity

While some organizations have only one easily described product or agenda, for most organizations SEO can be too successful when it targets particular search terms so tightly that their Web pages can be found by little else. When virtually all traffic to a Web site comes from a small number of terms, analyzing incoming search terms becomes an exercise in analyzing what one already knows. Ideally, improvements in SEO create an increase in targeted traffic along with an increase in unanticipated search terms. While this can be analyzed in terms of Zipfian distributions, in proactive marketing it is better represented by the APUPA (Alien–Penumbral–Umbral–Penumbral–Alien) bell curve (Fig. 2).

SEO can also be too successful when a Web page captures a high SERP position on a major search engine for an extremely broad term like “health.” Where this might be satisfactory to a large organization like the U.S. National Institutes of Health, an organization focusing on a particular niche of health could be swamped with masses of unwanted Web site visitors and e-mail.^[28] Web sites deluged by unwanted traffic sometimes convert a liability to an asset by “reselling” the traffic or the entire Web site.

Lead Time and Longevity

Search engines rarely assign top rankings to newly indexed Web pages. A Web site can take months or even

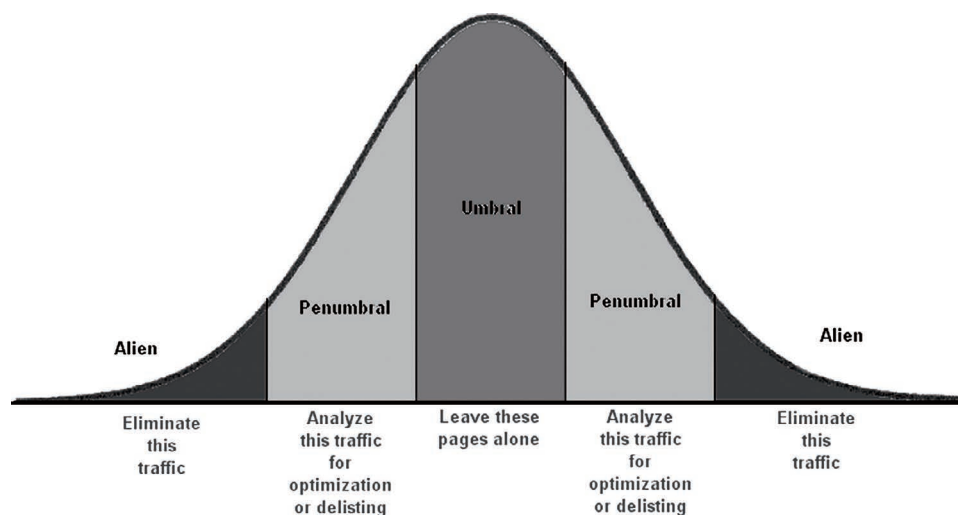


Fig. 2 APUPA chart expressed in SEO terms.

Source: © Hastings Research, 2005.

years to reach its “natural” position in SERPs. This is sometimes called the “sandbox,” referring to the period a new Web site may wait for a good SERP position or even to be listed at all by a search engine.

Equally, search engines assign value to longevity, and older well-ranked Web sites dating from the 1990s can be notoriously difficult to dislodge from their SERP positions by new competitors.

Geographic Targeting

Geographic targeting through SEO had limited success through the mid-00s. Few early Web site designers made a diligent attempt to anticipate all the geographic keywords searchers might use, and those who did target searches with geographic keywords often used so many keywords (e.g., “London,” “Pimlico,” “Knightsbridge,” “Belgravia,” “Dulwich,” “Stratford,” “Paddington,” “Fleet Street”—and every other village and neighboring town) that the pages were treated as index spam by search engines, and down-ranked to obscurity. Other designers created dozens or even thousands of “mirror pages” (pages with substantially similar content), each targeting a particular locale, with the result that the pages were down-ranked for “duplicate content.”

In a cause-and-effect loop, users learned that searching by locale was nearly useless, and abandoned the effort (with the exception of specific travel destinations), leading most SEO practitioners to abandon their efforts at geographic targeting.

With the now-growing success of geographic targeting efforts by search engines—typically displaying maps showing physical locations—users have again started searching geographically, and most SEO practitioners advise making some effort to target searches containing geographic keywords, even though geographic searches may be defined by commercial databases rather than SEO efforts.

SEO Source Tracking

The wealth of data that accompanied visitors to Web sites led many ecommerce pioneers to think the perfection of marketing analysis had arrived. While this sometimes bordered on true for new businesses that were entirely WWW-based, the opposite turned out to be the case for large, established organizations already being marketed through advertising, mail, public relations, and retail outlets; the WWW added another layer of complexity to their market tracking. Due to its 24-hr availability, the WWW also creates a “smoothing” effect on response to promotional efforts, which can hinder analysis of event-driven spikes in visitor traffic.

Refinements in Web analytics have not entirely compensated for these factors, and in many ways Web site

traffic source analysis remains less precise than that of traditional promotion and advertising.

Increased Competition

The continuing growth in the number of Web sites and Web pages means newly created Web sites have increasing difficulty gaining rankings for common keywords, so their approach is often to use a fanciful domain name and drive Web traffic via social networking or publicity instead of SEO.

Aside from the natural growth in Web sites, huge numbers of “made for ads” (MFA) Web sites have been created for no purpose other than to make money by hosting online advertisements—they have no products, services, or agendas of their own. Because advertising revenue indirectly comes from organizations that pay for online ads, MFA Web sites often specifically target keywords used by existing organizations. Nonprofit informational Web sites such as Wikipedia (<http://www.wikipedia.org/>) also compete directly for many search terms, often gaining very high search rankings.

Search Engines Only Index Words

While search engines are often technically capable of distilling words when they are represented in images, and in theory from audio tracks, in practice they index words from readable text documents, file names, or metadata attached to other forms of electronic files. There is a persistent failure to understand this aspect of SEO, with many Web site owners believing that if the human eye can read the words or grasp the meaning, the search engines will correctly index the files.

Further restricting SEO, search engines by choice index only certain types of text documents or metadata. At one time that meant pure text or HTML only. Most search engines are now willing to crawl and index file formats such as PDF (Portable Document Format), Microsoft Word and Excel, and in some cases Flash.

TRENDS

Fading Trends

“Meta keyword tags” were the first major chimera in SEO (“The meta keywords tag” earlier). They have been followed by other imaginary fast-tracks to high SERP position, all beginning with a grain of truth then blown out of proportion.

“Google PageRank” has been one of the most persistent areas of focus in SEO. Because of media attention and the easy access to the publicly visible PageRank via the Google Toolbar, the scale has commanded a great deal of interest from Web site owners, many of whom consider the published PageRank a practical scale for performance-

based SEO contracts. Most SEO professionals now consider public PageRank in itself a minor factor in a Web site's actual SERP positions, more an effect than a cause. The latter opinion is to some extent corroborated by Google, Inc.^[29] Over the course of 2007, countless Web sites saw their Google public PageRank drop significantly, which may further diminish interest in the measurement. ("PageRank" in popular usage should not be confused with "pagerank," an internal Google term.)

Web site "traffic"—whether measured in "hits" (requests for individual files, whether pages or images), "page views," "unique visitors," or the dot-com measure of "more eyeballs"—is slowly losing its popular connection to rankings, as organizations focus on conversion rate of users' visits to desired actions. (In extreme cases, traffic volume will have greater influence on SERP positions than relevance; however, this is uncommon and often results from a situation such as a major news event, where the boost in rankings may be due to a proliferation of inbound links, rather than traffic volume itself.)

Current Trends

Link building previously described in "Link-weighting fundamentals"

Pursuing "long-tail" searches (previously described in "Broad vs. Narrow Targeting and Long-Tail Terms")

Bringing SEO in-house: Major companies in North America and Europe are increasingly bringing SEO in-house as their online sales grow to (USD) millions or hundreds of millions. Companies are hiring in consultants, training current employees, or both.^[30]

Using best practices: Clients and employers are now commonly asking that practitioners follow "best practices." For SEO, the term describes such basic practices as prioritizing meta titles and heading tags, including keywords, and avoiding discredited (Black Hat) tactics.^[31]

Tuning metadata for search engine interfaces: Increasingly, practitioners structure Web pages so that titles, descriptions, and filenames are presented appealingly on SERPs. Eye-tracking studies, where eye motion is represented by printed "heat maps," are currently the basis for most decisions in tuning metadata.^[32]

Tagging Web pages: adding keywords or allowing visitors to add keywords to the visible text—is common on many social networking Web sites and some ecommerce and media Web sites, but has shown mixed results in improving SERP positions, possibly due to the indiscriminately chosen keywords selected by lay users, Web site owners, and bloggers. Tagging may benefit SERP position most for Web sites that encourage commentators to use "controlled vocabularies."^[33] It may also boost SERP positions for "long-tail" search terms.

Web 2.0 designs: Web 2.0 methods have been criticized as being detrimental to SEO. This criticism has arisen with

each evolution in Web site development, from "dynamic page delivery" (assembling Web pages from databases "on the fly") through Cascading Style Sheets and PDF files. In most previous instances, organizations' design preferences have won out over SEO considerations, and eventually the major search engines have adapted their protocols to classify new Web page structures and document formats.

Since search engines do not immediately retool for new forms of Web page markup and structure, Web sites that employ Web 2.0 methods such as AJAX (Asynchronous Javascript and XML) or that stream together content from different sources ("mashups") may drop in SERP positions until search engines decide how to interpret these new document structures.

Trends Affecting SEO

New search engine presentation methods

Clusters of search records such as those displayed by <http://www.clusty.com> or <http://www.ask.com> are likely to continue improving in relevance; if they increase in popularity, each cluster link will constitute a second-tier SERP, and SEO may begin targeting particular clusters.

Drop-down *contextual search suggestions* are now offered at <http://www.ask.com> and <http://www.yahoo.com>. Because users see contextual suggestions as they type, even before seeing the first SERP, "contextual position" may become a sought-after goal of SEO. Since contextual suggestions are all displayed on the first screen of a search engine's Web site, without the need for scrolling down, position is not likely to be as critical as SERP position, and "contextual inclusion" may prove to be the desired goal. (Contextual search flows from a given search engine's database of "most likely" requests; it should not be confused with the URL suggestions that Web browsers make by accessing a user's own search history.) (Fig. 3)

With exceptions, such as the European search engine Kartoo (<http://www.kartoo.com>), interfaces such as topic maps and link maps show little sign of entering the mainstream of WWW search, and thus do not affect SEO.

Blended search—the blending into the primary WWW SERPs of news, images, maps, videos, and other types of records once considered niche searches—have now been instituted by major search engines.^[34] This presents

Web Images Video Local Shopping more	
Nicholas Carr	Search
nicholas carrigan	
nicholas carr it doesn't matter	
dr nicholas carr	
nicholas carroll	
nicholas carr information technology	

Fig. 3 Example of drop-down contextual search suggestions.

opportunities to the more aggressive SEO practitioners, some of whom are attempting to dominate blended SERPs with a mix of varied data formats. (Blended search has also been called “universal search.”)

Specialized searches

Specialized searches have been offered for decades through pre-Web online information providers. They are often called “vertical searches” (i.e., niche search). Specialized search could disrupt current SEO strategies, whether it is offered by major search engines or niche suppliers. First, if niche searches or tools proliferate in the GYM group (Google, Yahoo, Microsoft)—each with its own classification protocols—they may dilute the value of SEO methods that address the GYM standard algorithms. Second, niche search engines such as <http://www.vivisimo.com> have entered the search race, and others such as <http://www.northernlight.com> (founded 1996) are reentering public search; these specialized search engines are usually less susceptible to technical methods, as they tend to use proportionately more human editing than broad reach search engines. Either trend could diminish the importance of technical- or link-based SEO.

“Personal search” has been a holy grail of the Internet industry since the mid-1990s. Early attempts at personal search included Yahoo! personalization features and numerous failures in “push technology” (Push technology: A means of automatically delivering information via the Internet to subscribers based on their choices for customized news, etc. *Webster's New Millennium Dictionary of English*, 2007. Described by H.P. Luhn as “SDI” (Selective Dissemination System), <http://www.ischool.utexas.edu/~ssoy/organizing/l391d2c.htm>, accessed February 2009). The current trend is towards analyzing individual users' search requests in the context of their previous searches (remembered by the server) and delivering customized results. Taken to an extreme, this could theoretically filter out a majority of available Web pages regardless of the SEO efforts invested, as search engines “learn” to focus on individual users' core interests.

“Local search” (geographic search) has become a serious goal for search engines. However other than travel destinations, few small retail businesses have Web sites, so search engines cannot easily find data for them by crawling the WWW. The primary solution to date has been to buy or barter for data such as traditional telephone book databases. Other new local search companies are aggregating local data for search engines, often crawling online local directories for source data search engines themselves are encouraging data entry from local organizations. Some trades with guilds such as law or medicine have niche Web sites with search functions; as yet few are comprehensive. Trades without guild organizations such as auto repair or beauty services may depend entirely on the success of aggregation if they are to be located through broad search. In few of these cases do current SEO

methods provide a clear path into SERPs, and paid listings may vie with SEO in creating online exposure for local businesses.^[35]

Alternate search channels

Alternate search channels could have an even more dramatic effect on SEO practices than blended or niche search services:

SEO for mobile communications devices: Analysis of users' WWW search behaviors on mobile devices has shown an emphasis on local retail search followed by entertainment. Coupling mobile search with GPS navigation feedback opens the prospect of delivering content or ads raises the prospect of directing mobile users to the nearest restaurant or a movie showing, thus both of these searches are potentially lucrative advertising venues—search engines are pursuing them, and SEO will follow. It is not yet certain whether search engines will convert conventional Web pages to mobile-friendly formats, or whether organizations will have to create new pages specifically targeting mobile devices.^[36,37]

SMO (Social Media Optimization): It is arguable how much SMO involves “search” in the sense of users searching by keywords, because the spread of information on social networking Web sites is largely viral (self-promotion coupled with word-of-mouth). SMO is currently practiced by creating profiles on popular social media sharing and news Web sites, building a large base of “friends” and contributing unique promotional content with the option for other community members to vote in favor or against. Popular content that goes “hot” is placed on the high traffic home pages of the social media sharing and news sites, sometimes generating tremendous amounts of exposure, direct traffic, and secondary effect inbound links from bloggers that post about the content. SMO also involves using software to make posts automatically, this latter method being simply spamming. There may be a growing synergy between SEO and SMO, and SMO may become a parallel profession lumped under the umbrella of SEM.^[38,39]

STANDARDS AND REGULATION IN SEO

The practice of SEO is marked by the absence of standards, other than those imposed by the willingness of major search engines to index Web pages, their level of effort in returning the most relevant Web pages, and punitive actions (down-ranking or de-listing) taken against what search engine administrators consider unacceptable manipulation of SERP positions.

HTML

Standard Web pages (HTML) are in theory defined by W3C standards—which are largely ignored by both Web

developers and amateurs. Other formats now being indexed by search engines—including PDF, Microsoft Word and Excel, and still images and videos—follow even fewer standards.

Certification

Certification is in beginning stages. Some businesses have begun offering SEO credentials, and accredited colleges are now beginning to offer courses in SEO.

SEO Industry

The SEO industry may be loosely divided into SEO professionals of varying ability; Web designers and programmers who know the rudiments; and a much more visible group of low-cost SEO companies that operate through advertising and e-mail marketing.^[40]

While there are no formal standards or regulation, informal standards are slowly evolving through consensus of trade associations and Web sites reporting on SEO. (See “Bibliography” at the end of this entry.)

Search Engines

Because it is difficult to mathematically determine whether a given Web page’s content accurately reflects the page’s relevance to visitors (much less the creator’s true agenda), search engines have faced and continue to face an impossible task in down-ranking deceptive pages without penalizing legitimate ones. (In the classic if now simplistic example, a medical Web site can unwittingly trigger an algorithm aimed at filtering out pornography pages.)

Attempts to “game” (manipulate) search engine rankings have been so relentless, from the first significant appearance of online search engines, that many experts consider search engine administration to be equally a process of excluding Black Hat pages and elevating relevant pages.^[41] While penalizing irrelevant content faces the same problem as returning relevant content—a struggle to develop artificial intelligence—most search engines strongly downgrade Web sites that are found to be using the more technically complex SEO tactics such as IP-specific page delivery (see “Cloaking” earlier).

This issue of controlling Black Hat SEO without penalizing White Hat SEO is a continued source of tension between search engine administrators and SEO practitioners. Search engines selling advertising space on their own SERPs has exacerbated the tension by raising the issue that pursues traditional media, of whether there is a true division between editorial and advertising departments (or search relevance and advertising, in the case of search engines).

Like the evolution of military tactics, regulation is a game of innovation and counter-measure. The counter-measures may make a given tactic so ineffective that it is

completely forgotten by both attackers and defenders, at which point it may be reintroduced by the attackers. (A medical analogy would be the mutation of microorganisms in reaction to new antibiotics, accompanied by the resurgence of forgotten diseases when society no longer guards against them.)

Government Regulation

At present there is no hint of SEO regulation. As subcontractors, SEO consultancies are in a position similar to advertising agencies—with no actual control over organizations or distribution channels—so any government regulation is likely to flow indirectly from regulation of Web sites themselves (trade practices) or of search engines (particularly in the United States, where antitrust law may affect conglomeration of major search engines with software, hardware, or media companies).

USER BEHAVIORS IN SEARCH

User behavior while searching online shows more consistency than change in the period from 1995 to 2008. This section will briefly address the consistent behaviors and available research on the course of changes.

Users’ search behavior has a strong effect on SEO, since many users click the first listing in a SERP. On the other hand, gaining a #1 SERP position for a particular search term does not guarantee that a user will click that link; they might click the #2 link or the #10 link if those page titles, descriptions, or URLs are more compelling.

In the same vein, there is no clear evidence that users who click the first record will take further action; many SEO practitioners believe the more motivated users will scan an entire SERP before deciding which link to click. Regardless, user behavior while visiting SERPs affects SEO decisions as well as the search engines’ goal of relevance.

Research into specific behaviors has revealed a great deal about what users do in the specific environment of a search engine interface when tested in a laboratory setting. It leaves unanswered many questions about why users search the way they do—in part because most research has focused on what users do when looking at a SERP, without inquiring how or why they arrived at that particular SERP, or what actions they take after clicking a particular link. More research is required to develop consistent conclusions. Substantial research from information science has yet to be incorporated in SEO; when it is, it may transform strategies and tactics.

Variables that affect user search behavior:

- Users’ level of subject knowledge.
- Improvements in results returned by search engines.
- Users’ confidence in the quality of search results.

- Degree of users' sophistication in search.
- Presentation style of individual search results (title, description, URL, etc.).
- Motivation/curiosity/laziness.
- Habituation among users (hardening behaviors).
- Search engine interface design.
- Number of search engines available.

Basic Behaviors

Few users methodically click search results in sequential order, from the first result to the bottom of the page. Typically they skip over unappealing titles or URLs, and may bounce back and forth between organic search listings and paid listings. (Depending on SERP design, users may not always know the difference between paid and organic listings.) If a relevant Web page is not found quickly, users may change search engines, change their search term, or migrate to a general information Web site such as a dictionary, encyclopedia, or user-fed Q&A Web site.

Searching Popular Subjects

Patterns of search seen on Wordtracker, Yahoo! search tool, or KeywordDiscovery continue to show a preponderance of searches for celebrities and popular news, as described since 1999 in the weekly "Lycos 50" listing of the most popular topical searches (<http://50.lycos.com/archives.asp>) with written analysis and opinion. Google Trends (<http://www.google.com/trends>), which shows the number of searches for chosen terms in chart format, is well-suited to display spikes in interest, relative interest in different subjects, or seasonal patterns in popular searches; like the Lycos 50, it demonstrates that a huge proportion of Web searches are for popular subjects rather than niche information.

Use of Boolean Syntax

In the 1990s, WWW search engines typically limited the use of search syntax to Boolean AND, OR, and NOT, with OR as the default. (With AND or NOT typically applied by +/- symbols.) Initially these options were only available by typing them into the search term entry box. HotBot search engine was one of the earliest to offer Boolean logic to untrained users, with the addition of a drop-down box offering AND as well as "exact phrase" options, but the options were rarely used.

In the late 1990s, search engines moved towards a default (or forced) Boolean AND; by early 2003, it was the default on all major search engines search engines.^[42] Although this change narrowed search results, it also hugely increased the relevance of results, and, at the same time, reduced the average user's motivation to learn

Boolean syntax. Some data samples suggest that Boolean search skills are known to a smaller percentage of users today than in 1997, though it is uncertain whether the decrease is due to a loss of interest in search syntax or an influx of less sophisticated users.^[43]

Search Engine Loyalty

Available statistics strongly indicate that users are now more likely to refine or expand their search term than switch to another search engine.^[44] The disinclination to switch is often called "loyalty" in a broad sense; motivating factors could be the generally improved quality of search returns over the last few years, or users' increased recognition of the value of using precise search terms. In terms of user behavior, this could be described as a slight shift from "berrypicking" (wandering about and collecting bits of information) to more linear search behaviors.^[45]

Hardened User Behaviors

Users' search behavior search engines may have become "hardened," or fixed, by their expectations, in particular in the United States and Canada, because the majority of popular search engines have presented returns as linear lists since the mid-1990s. Current SEO is predicated on the idea that users type keywords into a box, click a "Search" button, and scan a list from top to bottom.^[46] Because they represent a large conceptual shift, interfaces that present information in clusters, topic maps, or relationship maps face an entry barrier.

User Behavior Worldwide

Patterns of user behavior outside the United States and Canada do not show identical evolution. While less analysis has been done, in regions as disparate as England and China users are apparently more willing to examine entire SERP pages, as well as second and third pages, and less likely to click on the first or first few SERP positions.

CONCLUSION

Beginning in the mid-1990s, SEO evolved from placing random keywords in all possible parts of Web pages, to more focused doorway page strategies targeting particular keywords. By 2000, improvements in search engines were rendering most of such tactics obsolete, and SEO practitioners moved on to the integration of overall Web site structure, and then on to establishing a Web site's relationship with the WWW as a whole through linking.^[47] For most, the reluctant and secondary focus of SEO was on users or quality of content. For others, a focus on user experience as well as SEO provided long term, sustainable results throughout the evolution.

SEO now faces broad changes in search and user behavior. The growth of online information is outpacing the indexing rates of all search engines. Search engines are struggling to deal with that overload, and in the process changing their strategies about what information to present and how to present it. Hardware—notably mobile communications devices—is redefining the technical limits of information presentation and also creating niches in user search behaviors.

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Search Engines

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Abstract

This entry provides an overview of Web search engines, looking at the definition, components, leading engines, searching capabilities, and types of engines. It examines the components that make up a search engine and briefly discusses the process involved in identifying content for the engines' databases and the indexing of that content. Typical search options are reviewed and the major Web search engines are identified and described. Also identified and described are various specialty search engines, such as those for special content such as video and images, and engines that take significantly different approaches to the search problem, such as visualization engines and metasearch engines.

INTRODUCTION

Web search engines, for the public at large, have come to be perhaps the most frequently used computer services for locating information. To some degree, the same is true for many researchers, information professionals, and others. To most effectively and efficiently utilize these services, some understanding of the structure, makeup, content, features, and variety and breadth of these services is essential. This entry addresses those various aspects including just what is meant by "search engines," the components of a search engine, and typical search features, and it provides a profile of the major general Web search engines and a look at specialty search engines, visualization engines, and metasearch engines.

is a result and artifact of the history of search engines, but recognition of the ambiguity is necessary for an understanding of the current nature of such services.

Search engines vary in a number of ways and most could be considered to fall into one of four categories: general Web search engines (which have the purpose of searching a large portion of all pages that exist on the Web), specialty search engines (which focus on searching a specific kind of document, file type, or sources from a particular subject or geographic region), visualization search engines (which furnish diagrams, images, or other "visuals" to show relationships among the items in a particular set of retrieved items), and metasearch engines (which gather together the search results on a specific topic from multiple search engines).

WHAT IS MEANT BY "SEARCH ENGINES"?

The term "search engines" can have a variety of meanings, in the broadest sense referring to any computer program that facilitates the searching of a database. In the context of library and information science, however, the term has come to primarily refer to "Web search engines," that is, those services on the Web that allow searching of a large database of Web pages and other Web content by word, phrase, and other criteria. (For this discussion, hereafter, "search engines" will be taken to refer to "Web search engines.") A certain level of ambiguity becomes apparent, however, when it is realized that what is often referred to as a "search engine" is often a reference to the overall service that is provided, beyond just a search of websites. ("Google" is thought of not as just the searching part of the Google enterprise, but the many added features and content as well.) It is often impossible and unproductive to discuss the narrower "searching" part without discussing the broader range of services. That ambiguity in terminology

COMPONENTS OF A SEARCH ENGINE

General Web search engines and specialty search engines can be considered to have four major components that correspond to the steps required to create the service: 1) the identification and gathering of the material (Web pages, etc.) to be included in the engine's database; 2) an indexing program and the corresponding generated indexes; 3) the searching and ranking algorithms; and 4) the user interface. In understanding the history and the capabilities of search engines, it is important to note the rapidly increasing role played by artificial intelligence and related areas such as natural language processing (NLP) in the development of these components.

Identifying Material to Be Included

Search engines identify those Web pages (and other items) to be included in the service's database by two means: "crawling" and submissions of pages. The first,

“crawling” consists of having programs (“crawlers” or “spiders”) that on an ongoing basis scan the Internet to identify new sites or sites that have changed, gather information from those sites, and feed that information to the search engine’s indexing mechanism. The crawlers start by examining pages that the service already knows about and looking there for “new” links (links that the service does not already know about). When such links are identified, the pages to which the links led are likewise examined for “new” links, and so on. More popular websites (such as those that have lots of links to them) may be crawled more thoroughly and more frequently than less popular sites.

The second way search engines identify new items to be added to the database is by having website owners (or others) “submit” sites or pages. Most engines provide a form by which this can be done. Search services maintain their own policies as to whether submitted (or for that matter, pages identified by crawling) will indeed be added to the database, particularly looking to exclude unacceptable content (spam, sexually explicit material, etc.)

Search Engine’s Index and Indexing Program

After a new or changed page is identified by the search engine’s crawler, the page will typically be indexed under virtually every word on the page (up to some usually undisclosed limit). In addition to text words, other parts or characteristics of the page may also be indexed, including the URL (uniform resource locator, the “Web address”), parts of the URL, links, metadata found in the “head” of the document, the URLs of links on the page, image filenames, and words in linked text. By identifying and indexing these pieces of data (pieces or characteristics of the Web page or other type of indexed document, such as an Excel file), they become searchable “fields,” thereby allowing users to use those fields to increase the quality of their search. The search system may also “derive” additional fields, such as language, by analysis of the document. Analysis of the document utilizing NLP techniques also allows the indexing of the document under other terms not necessarily found in the document (but implied by the text) and also allows more precise indexing by identifying specific “entities” (people, places, companies, etc.)

The Search Engine’s Retrieval and Ranking Algorithms

By narrow definition, the actual search “engine” is the search service’s retrieval program, that is, the program that identifies (retrieves) those pages in the database that match the criteria indicated by a user’s query. That identification function is necessarily supplemented by another important and more challenging program that is used to determine the order in which the retrieved records should

be displayed, based on measures that try to identify which retrieved records (pages, etc.) are likely to have the highest relevance in respect to the user’s query.

This “relevance-ranking” algorithm usually takes many factors into account.

Exactly what factors go into the relevance-ranking process varies, but they include the use of keywords in titles, text, headings, etc., popularity of the sites (how many and which sites link to the site), words used in anchors (clickable text), internal links (how many and what kind of links within the larger site point to the page). Google led the field (and to a significant degree gained its reputation for high relevance) by putting high emphasis on “links”, particularly on the “popularity” of a page based on how many pages linked to the site and the popularity of the sites that were linking to the page. Increasingly, the use of artificial intelligence has become a major factor in determining ranking. Ranking of results is determined to some degree (often a very high degree) by “who” is searching—the user’s location, search history, etc.

The success or the failure of the relevance-ranking algorithm is critical to the user’s perception of the search engine, the user’s continued use of that system, and the commercial success of the engine.

The Interface Presented to the User for Gathering Queries

This interface the user typically sees includes the home page of the search service and other pages (such as an advanced search page) that present search options to the users and accept the users’ search queries, as well as the search results page. The search service can choose to have their page focus almost exclusively on “search” (as with Google) or be a more general, wide-reaching “portal” page, providing much more than just searching capabilities. (The “portal” dilemma for search services will be discussed in more detail later.)

Regardless of what other services and information are provided on the service’s home page (or mobile app), the “searching” part usually consists of a single search box plus links to other searchable databases that are made available by the service (images, video, news, etc.). Usually, there are also links to “help” screens, etc. While the simplicity of a single search box appeals to the less experienced user, the search box also usually provides substantial, but not obvious, capabilities for extensive searching sophistication, such as the potential for using Boolean logic and “prefixes” (e.g., “title:”) to perform field searching and other functions. An advanced search page may also be provided, which can much more explicitly lay out the possibilities to the user, providing a menu-based approach to utilization of features.

While the most basic element of the search engine interface (a search box into which users enter their queries) remained very much the same for most of search

engine history, that has also changed with the proliferation of “mobile” devices (smartphones, tablets, and wearable computers). Voice input has become not only possible, but the *preferred* interface for an increasing number of users.

The Portal Dilemma

From the early days of search engines, search engine providers have wrestled with the decision as to whether to make their home page one that focuses almost exclusively on “search” or one that provides a variety of added services, such as news and weather; the latter approach often referred to as a “portal.” From its beginning, before it was even a “search engine” and was just a directory, Yahoo! preferred the portal approach. AltaVista, a leading search engine in the 1990s, went back and forth between the two extremes, a situation that may have contributed to its demise. Google was, from the beginning, almost purely a “search engine,” and the simplicity of its interface was undoubtedly one factor in its rapid rise in popularity. Search services may “cover their bets,” however, by providing alternatives. For example, Yahoo! has provided a Google-like option at search.yahoo.com and Google at one point provided a “portal” version interface (iGoogle).

Searching Options Typically Provided

Search engines may provide a range of user accessible options that permit the user to modify their search queries in ways that can improve both the precision and the recall of their search results. Which specific options are provided varies from engine to engine. The most notable options include Boolean operations, phrase searching, language specification, and specifying that only those pages are retrieved for which the search term appears in a particular part (field) of the record such as the title or URL. Since engines usually cover other document types beyond just pages written in hypertext markup language (HTML), with some engines, users can also narrow their search to a specific file format (Web pages, Adobe Acrobat files, Excel files, etc.). Engines also provide an option to filter “adult content” material.

Up until the early 2010s, most search engines provided two ways for a user to take advantage of these options, syntax applied to search terms or an advanced search page. “Syntax” includes such things as explicitly including Boolean operators, such as “OR” in a search query and inserting a prefix in front of a search term. An example of the latter would be entering *intitle:malaria* in a search statement to specify that only items where the word *malaria* appears in the title should be retrieved.

Boolean logic

In the context of Web searching, “Boolean logic” refers to the process of identifying those items found in the

database that contain a particular combination of search terms. It is used to indicate that a particular group of terms must all be present (the Boolean “AND”), that any of a particular group of terms is acceptable (the Boolean “OR”), or that if a particular term is present, the item is rejected (the Boolean “NOT”). (See the entry, Boolean Algebras [*ELIS Classic*], p. xxx.)

Engines may provide two different ways to qualify a query with Boolean operations:^[1] the option of applying a syntax directly to what is entered in the search box and^[2] menu options on an advanced search page. Using the menus can be thought of as “simplified Boolean” and, depending upon the structure of the advanced search page, may or may not provide the precision achievable by the use of syntax in the main search box. (For example, the ability to apply “OR”s to more than one of the concepts included in the query may be done in the main search box but may not be allowed for on the advanced search page.)

The exact syntax used varies with the search engine. All major engines currently automatically apply an “AND” between your terms, so when the following is entered, *prague economics tourism*, what will be retrieved is what more traditionally would have been expressed as *prague AND economics AND tourism*.

Very precise search requirements can be expressed using combinations of the operators along with parentheses to indicate the order of operations. For example, (grain OR corn OR wheat) (*production OR harvest*) *oklahoma 1997*.

At various times, search engines have allowed the use of symbols (+, &, −, etc.) instead of words (AND, OR, NOT), and indeed, for the “NOT,” search engines typically suggest the use of a minus sign in front of the term. Some search engines require the use of parentheses around “nested” (OR’ed) terms, and some do not.

For details on Boolean syntax for any search engine, the help pages for that engine should be consulted. There are also websites that summarize the syntax (and other features) for all major engines.

The alternative to using syntax to apply Boolean is the use of menus on an advanced search page. There, for example, you may find a pull-down menu, where, if you choose the “all the words” option, you are requesting the Boolean AND. If you choose the “any of the words” option from such a menu, you are specifying an OR. There is usually also a box for excluding terms (“NOT”).

Phrase searching

Phrase searching is an option that is available in virtually every search engine, and almost always uses the same syntax, the use of quotation marks around the phrase. For example, searching on “*Red River*” (with the quotation marks) will assure that you get only those pages that contain the word “red” immediately in front of the word “river.” Of all search engine techniques, this is widely

regarded as one of the most useful and easiest for achieving higher precision in a Web search. It is also useful for such things as identifying quotations and identifying plagiarism.

Title searching

Title searching, that is, limiting your retrieval to only those items (pages) that have a particular term or combination of terms in their title, is one example of “field searching,” as referred to earlier. It is also another example of a technique that can yield very high precision in a search. Some search engines use the “intitle:” prefix and/or the “allintitle:” prefix for the syntax for title searching. (“allintitle:” allows specifying that more than one term be included in the title, not necessarily in any particular order.)

URL, site, and domain searching

A search engine may index Web pages (and other document types) by both the overall URL and the segments of the URL. This facilitates the finding of any document that comes from a particular domain or part of a domain (also a specific site or part of a site). Doing a search in which results are limited to a specific site allows one, in effect, to perform a search of that site. Even for sites that have a “site search” box on their home page, more complete results can often be found by using this technique than by using the site’s own search feature. “inurl:,” “allinurl:,” and “site:” are the prefixes commonly used.

The term “domain searching” is sometimes used to refer to the process mentioned earlier, and the use of the term “domain” points out that this approach can be used to limit retrieval to sites having a particular top-level domain, such as gov, edu, uk, ca, or fr. This could be used, for example, to identify only Canadian sites that mention tariffs or to only get educational sites that mention biodiversity.

Language searching

A search engine may allow limiting retrieval to pages written in a given language with perhaps the 40 or so most common languages specifiable. Though some engines have provided a prefix option for searching for languages, more typically one would go to the engine’s advanced search page to narrow to a language.

Date searching

Searching by the date of Web pages is an obviously desirable option, and most major engines provide such an option. Unfortunately, because of the lack of clear or reliable information on a page regarding when the page itself was initially created, the date on which the content of the

page was created, or even when the content on the page was significantly modified, it is often impossible for a search engine to assign a truly “reliable” date to a Web page. As a “work-around,” engines may take the date when the page was last modified or may assign a date based on when the page was last crawled by the engine. For searching Web pages, users should be aware of this approximation and its effect on precision when using the date searching option that is offered by most search engines (usually on their advanced search page). (On the other hand, for some of the other databases an engine may provide, such as news, the date searching may be very precise.)

Searching by file type

For most of the 1990s, most search engines only indexed and allowed searching of regular HTML pages. In the crawling process (or for submitted pages) when the engine’s indexing program encountered a link that led to another type of document, such as an Adobe Acrobat (pdf), or Excel (xls) file, the link was ignored. Starting with Adobe Acrobat files, other file types were fairly rapidly added to the corpus of “indexable” pages. This not only increased the breadth of resources available to the searcher but also provided the capability for the searcher to limit retrieval by type of file. Limiting to Adobe Acrobat files provides documents more suited to printing. Narrowing to PowerPoint files can provide convenient summaries of a topic. Limiting to Excel files can often enable a greater focus on statistics.

Natural language queries

In the early days of search engines, users could (and often did) enter “natural language” queries, such as *What is the capital of Bulgaria?* Engines would typically ignore the smaller, more common words and simply apply the Boolean “AND” to the remaining words. This often did provide users with an acceptable answer. At present, search services are extensively applying Natural Language Processing (NLP) both to the interpretation of the user’s query and to the analysis of the documents being searched, consequently making natural language queries much more effective and efficient. This became particularly important in light of the greatly increased availability and accessibility of search engines as “apps” on smartphones and tablets, NLP is also central to the utility and effectiveness of the voice input technologies for these devices, for example for Apple’s Siri, Google’s “Google Now,” and Microsoft’s Cortana. The importance of search engines’ NLP and voice input technologies likewise applies to smart home devices such as Amazon’s Alexa and Google’s Google Home.

Search Results Pages

As well as providing enhanced searching capabilities, search engines also enhance the content of results pages, beyond presenting just a listing of the Web page results that match the user's query. At the same time, they search their Web database, they may automatically search the other databases they have, such as news, images, and video, and on search pages may automatically provide links to the matching items from those additional databases. Some search engines may search additional "reference" resources, such as dictionaries, encyclopedias, and maps, and likewise display matching content from those sources and may also provide, "on the fly", a consolidated collection of facts on certain search topics such as places, people, companies, etc.

As well as displaying such supplemental content on results pages, search engines may also provide suggestions for ways in which the user might further qualify search criteria. This is done by suggesting related, narrower, or broader topics. Some engines also provide links to narrow the search by file type, language, or other criteria.

Specific options may also be offered on results pages for each individual retrieved item. Some engines keep a copy of each page they have indexed and provide a link to that "cached" page. This is particularly useful if, in the time since the page was indexed, the page was removed, is not available because of a server problem, or has changed in a way such that the term the user searched for is no longer on the page.

With records for pages that are not in the language of the search engine interface, there may be an option to translate the record (e.g., if the user is using an English language version of Google and a page is in French or if the user is using the French version and the page is in English). Click on the "translate" link to receive a machine translation of the page. As with other machine translations, what you get may not be a "good" translation, but it may be an "adequate" translation, adequate in that it will give you a good idea of what the page is talking about.

One feature offered on search results pages by all of the major engines is a spell-checker. If you misspelled a word, or the search engine thinks you might have, it graciously asks something like "Did you mean?" and gives you a likely alternative. If it was indeed a mistake, just click on the suggested alternative to correct the problem.

In many searches, search results pages will display links labeled as "ads," "Sponsor Results," "Sponsored Links," etc.—these are ads for websites and are there because a company or other organization has paid to have the ad appear on the search engine's results pages. Searchers should remain aware that it is the presence of these ads that makes the existence of search engines possible.

The Search Engine Leaders in the Second Decade of the Twenty-First Century

Popularity of various search engines can change fairly quickly. In the early and mid-1990s, a list of the most popular engines included, among others, AltaVista, HotBot, Excite, InfoSeek, and Lycos (Yahoo! was still primarily a directory, and though it had a search engine function, for that function it made use of, at various times, AltaVista's and Google's databases).

By the late-2010s, for the U.S. search marketplace, the search engine leaders were Google, Bing, and Yahoo! (in that order). Those three search engines represented 96% of all U.S. (desktop) searches.^[2] (Brief profiles of the engines just mentioned are given in the following text.) Outside the United States, in terms of market size and reputation, the leaders are Baidu (China) and Yandex (Russia).

Google

Google, which emerged as a company in 1998, grew very rapidly; its growth attributed largely to the simplicity of its interface, the lack of advertisements on the home page, and the quality of its relevance ranking (that fact significantly affected by Google's patented PageRank program).^[3] Google rather quickly went beyond "search" and began providing additional features and content, some of the enhancements emerging from within the Google organization and some (such as its e-mail service, Gmail) being patterned after such services already offered by its competitors. By the late 2000s, Google claimed more of the search market than all of its competitors combined and was offering a broad range of search services and a number of services not directly related to search.

For its Web search offerings, Google provides all of the typical search options (Boolean, field searching, etc.) plus some unique searching features, the latter including numeric range searching (e.g., *china history 1850..1890*). As well as the searching of Web pages, Google also offers searches of databases of images, maps, news, shopping, books (Google Books), journal articles (Google Scholar), etc. Some of these search offerings are very similar to corresponding services offered by Google's competitors, and some, such as "Google Books," were original and regarded by many as "groundbreaking." (Google Books is a major book digitalization project, in cooperation with major publishers and libraries.) The search features provided with each of these databases are typically tailored to the specific nature of that kind of content.

Many of Google's Web search features are features that were already found on other search engines, but for which Google provided significant enhancements. One example is Google Translate. Many search engines have provided a translation option that allows retrieved items from a number of non-English languages to be translated, using programs such as SYSTRAN's Babelfish. In 2007, Google

enhanced its own translation feature by allowing the user not just to translate a specific result, but to input a search in the user's own language, then have Google automatically translate the search terms, perform the search, and then deliver results in both languages. Translations are done using Google's own statistical translation technology. Google Translate also epitomizes another Google characteristic, rapid changeability. By 2015, Google Translate features had been pared down and though still regarded by many as the best translation tool on the Web, the direct integration of search with translation had been greatly diminished.

As it grew, Google rather rapidly redefined itself to be much more than a "search engine," adding services that went beyond "search" and even beyond usual website content. Some services had a direct relationship to "search," such as Google News Alerts, Google's financial portal ("Google Finance"), and Google's own Web browser ("Chrome"). Some of the services Google began to offer included types of things that already existed as "portal" features in other search services. These offerings included Gmail (a Web-based e-mail service), Google Earth (imagery and related geospatial content for the entire Earth, as well as the Moon and the sky), and Google Calendar. Google Drive (formerly Google Docs) offers a collaborative spreadsheet, word processor, presentations, form generator, drawing programs and "cloud" storage.

Bing

Microsoft has made several attempts since the mid-1990s to produce a Web search engine that is competitive with Google and Yahoo!. The attempts have gone by a variety of names, including Microsoft Search, MSN Search, Windows Live, Live Search, and, most recently, Bing. Search features have varied considerably and have at times been less robust than those of its competitors. Live Search presented some innovative features such as a design that allowed continuous scrolling through search results, but it, like some other features in the MSN Search products, was short lived. The 2008 version provided the typical Boolean and field searching options, plus some additional options such as "prefer:" by which the user could adjust the ranking weight for search terms and "feed:" and "hasfeed:" that identify websites that contain RSS links on the user's chosen topic.

In 2009, MSN further enhanced its engine and renamed it as "Bing." Bing has a different look and feel than the older versions, with a main page that has the now-usual minimalist search engine interface but with a large, attractive photographic background image. Bing enhances its search results with useful "facts," gathered from selected websites. Regarding search features, Bing search features are also somewhat minimalist, with no advanced search

page and very few filters. However, Bing does maintain a large number of prefix search options.

In addition to the search for Web pages, Bing also offers searches for images, video, news, and maps.

Yahoo!

Yahoo! was among the earliest websites that had the purpose of leading users to a specific content on the Web. In the beginning, Yahoo! was exclusively a "Web directory," a categorized list of selected websites. By 2000, however, it had begun a transformation to a portal site, having, in addition to the directory, over three dozen links to news, services, and other resources provided by Yahoo! and its affiliates, including pages for shopping, auctions, phone numbers, and a calendar. From its earliest days, the Yahoo! home page contained a search box, but results for that search came from a search of the directory, and later a search of Web databases from other search providers.

Yahoo!'s directory function became less and less central, and in 2004 Yahoo! created its own database of Web pages. Though emphasis on "search" continued to increase and the emphasis on the directory declined significantly, Yahoo!'s main image continued to be that of a portal, with the emphasis on the wide range of other services provided by Yahoo! and its partners, including Yahoo!'s highly popular e-mail service and its sections on autos, finance, games, groups, health, job listings, maps, real estate, travel, and over 20 other extensive content areas.

As of mid-2010, Yahoo! no longer provides a Web search technology or a Web database of its own. Yahoo!'s Web, image, and video searches were subsequently "powered by" at first by Bing. More recently, Yahoo's search technology, databases, and ads have been powered by combinations of Google, Bing, and Yahoo!'s own resources.

In addition to Web search, Yahoo! offers searching of the following databases: news, video, maps, businesses, shopping, sports, and more.

Non-U.S. general search engines

At various points, a number of other search engines have appeared in various countries. Two in particular have become successful in terms of international attention, extensive usage, and longevity: Baidu and Yandex. Baidu, from the People's Republic of China, was incorporated in 2000 and is used almost exclusively within China. It provides Web, images, and video searches. It may actually be best known because throughout its history, it has been the subject of widespread and extensive reports of government censorship. Yandex, from the Russian Federation, also first appeared in 2000. It provides searches for Web pages, images, video, and maps and also offers e-mail and

translation services. Interfaces are available in Russian, English, and Indonesian.

Specialty Search Engines

Over the years, a variety of search engines have appeared that could be classified as “specialty” search engines. Among these, there have been attempts to create search engines that focus on a particular topic or geographic location. In most cases, an examination of these showed that what was provided was more of a “directory” of selected sites than a broad ranging crawler-based search of Web pages for the specific topic or locality. On the other hand, there have been many successful attempts to produce search engines that provide searching for a particular format or type of document, such as images, video, blogs, and forums.

News

Searching of news databases is available from all of the general Web search engines. There are numerous other websites that specialize in searching news content. Each of these has varying degrees of searchability, and from the research perspective, it is important to note that the coverage can vary significantly, especially in regard to the number of news sources included, the time span for the content of the database, and the languages covered. Among the better-known news search engines are NewsNow, Silobreaker, and News Explorer.

Images

The most commonly encountered image search engines are those that are included within the general Web search engines, including Google, Yahoo!, and Bing. As well as subject searching, most of these engines allow for Boolean, and narrowing by size, coloration, site, and adult-content filtering. On Google’s advanced image search page, you can also narrow to photos that appear to contain faces. Flickr (flickr.com), an image-sharing website, has also gained extensive popularity as an image search engine. The extensive tagging of photos by Flickr users makes millions of images searchable. Picsearch provides an extensive collection of images from the Web and, in addition to the search criteria mentioned, also allows narrowing to animated images. There are also image search engines such as Corbis, Fotosearch, and Stock. XCHNG which enable users (for a fee) to use photos from commercial photographers and photo archives.

Image searching technology has made major advances since 2010. Earlier, images were indexed for searching almost entirely based on text found near the image (captions, other text near the image, file names, etc.) Since then, the major search engines and other organizations and researchers have utilized technologies such as NLP,

entity identification, and machine learning to be able to identify specific people, places, things, and a very wide range of other characteristics of an image. Once these “entities” and other characteristics are identified, all of them can be used as search terms or selectable categories, allowing image search engines to accomplish far more precise and complete results than in earlier years.

Video

As with image searching, searching for video is available from major search engines, including Google, Yahoo!, and Bing. Extensive searching of videos produced by individuals, as well as commercial video, is available from YouTube, the leading video-sharing site. Depending upon the search engine, options are provided for searching by Boolean, language, duration, domain/site/source, format, popularity, aspect ratio, and resolution, plus filtering for adult-content. Some video search engines specialize in video from TV, including news programs and interviews. These include TV News Archive (from Internet Archive, archive.org) and TVEyes (fee based).

Forums

Content found in forums (discussion groups, groups, newsgroups, etc.) can be utilized for a number of applications, ranging from hobbies to tracking terrorist activities, and there are search engines that specialize in finding this category of document. Though at one point there were multiple engines specifically for searching forums, by 2017 the only remaining one that was well-known was BoardReader. (There are a number of other places where groups can be searched, such as Google, Yahoo!, and Delphi Forums, but those sites focus on searching only the content that is hosted on their own websites.)

Other specialty search engines

There are still other categories of specialty search engines, including those for searching podcasts (e.g., podcastdirectory.com), and for searching for information on people (e.g., pipl, Infobel, Intelius, PeopleFinders).

Visualization Engines

Visualization search engines are websites (or programs) that provide a very different “look” (literally) at search results. Instead of the traditional linear, textual list of retrieved items, results are shown on a map that spatially shows conceptual connections. Most visualization engines have not utilized a database of their own but have borrowed one from other engines (Google, Yahoo!) or other sites such as Amazon.com. Visualization has been, and continues to be, an area of extensive research, and there have been several sites for demonstrating various

visualization approaches. The type of conceptual and visual mapping done by these sites can be especially useful for quickly exploring the concept possibilities, directions, and terminology for a particular search. It presents a “connect the dots” approach, enabling understanding relationships among the concepts found in various search results. Some such engines have appeared but are now gone, particularly Kartoo and Grokker. Still extant are TouchGraph and Quintura, the latter as a downloadable program. Visualization technologies are used within a number of websites, including news search engines such as SiloBreaker and EMM NewsExplorer.

Metasearch Engines

The term “metasearch engine” (or “metasearch site”) usually refers to websites that search multiple search engines in a single search. The degree of overlap (or lack thereof) between search engine results is something that professional searchers frequently consider and allow for as they search, and searching more than one engine is a widely encouraged technique. Metasearch engines have been available since the 1990s and include sites such as Dogpile, and Clusty. Each of these may provide additional benefits beyond just a compilation of results from more than one engine, for example, the “clustering” (categorization) of retrieved results, a feature that may not be provided by the target engines themselves. However, users should be aware of several shortcomings that may be encountered with these tools: 1) most of the current metasearch engines have not included results the largest major engines, particularly Google and Yahoo!, which tend to block queries from metasearch engines; 2) metasearch engines typically only return the first 10–20 results from any of the “target” engines; 3) metasearch engine results

often discard useful and search-relevant information found on the actual search engine’s results pages; 4) metasearch sites, even if they do cover the largest engines, may be required by those engines to show paid listings first; and 5) metasearch engines typically do not allow application of many of the search features available in the target engines themselves.

CONCLUSION

Web search engines have evolved extensively since they were first introduced in the early 1990s. The basic concept has remained the same, but the quality of results, the size of their databases, and the types of material that they have included increased dramatically. The total number of general Web search engines “in the race” has decreased and at present is dominated by one service, Google. What has evolved even more dramatically is the “mission” of search services, which, particularly in the case of Google, has gone far beyond “search.” With advancing technologies, increasing interactiveness of the Web, and a more and more Internet-centered society, users can expect continued, fast-paced innovation.

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Self-Publishing Online

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Abstract

Over the past 10 years, self-publishing on the Internet has taken off and presents problems and opportunities for both authors and libraries. Tasks involved in self-publishing are reviewed, and current issues and future trends are discussed.

INTRODUCTION

Until the advent of the Internet, self-publishing (also known as vanity or subsidy publishing) had very little impact on the library world. Without mechanisms for marketing, reviews, and library distribution, vanity press publications were invisible to librarians and library users. Since vanity publishers required up-front payment by authors, their publications carried a stigma, and the widespread belief was that if an author could not persuade a reputable publisher to buy a book, it was not up to library standards.

In the 1980s, however, the development of desktop publishing made it possible for authors to print their works without necessarily having to go through a publisher. These efforts were often amateurish, and the available printer speeds kept production down. There were still few ways to publicize and market such a book, and the products were unattractive. Authors were beginning, though, to realize the power of self-publishing.

Since the mid-1990s, the Internet, and especially the World Wide Web, has become the medium of choice for self-publishers. Some self-publishing is informal in the extreme; according to many, if a person mounts a web page of any kind, they have self-published on the Internet.^[1] Many web users post in message boards or newsgroups, contribute articles to e-newsletters, write fan fiction based on literary or television characters, or maintain “blogs” (weblogs of interesting sites), which may also be considered online self-publishing. For the purposes of this entry, however, self-publishing online will be defined somewhat more formally.

DEFINITION OF SELF-PUBLISHING ONLINE

The *Oxford Companion to the Book* defines an e-book as an electronic book (variously: e-book, eBook, e-Book, ebook, digital book, or even e-edition) is a book-length publication in digital form, consisting of text, images, or both, readable on computers or other electronic devices.^[2]

Electronic publishing usually takes one of three forms: commercial, subsidy (vanity), or self-publishing.^[3] Subsidy e-publishers operate as the traditional vanity press, publishing an author’s work for a fee. When self-publishing, the author is responsible for all aspects of the book. Rather than a clear delineation between vanity publishing and self-publishing, there is now a continuum, from a flat fee for all services, as in traditional vanity publishing, through the author investing very little out of pocket and doing all work himself or herself. In between are myriad systems whereby authors can decide which publishing tasks to do and which to outsource to publishing services.

For the purpose of this entry, then “Self-Publishing Online” will be defined as “Electronic content that is transmitted and/or displayed on a device or system to be read by the viewer similar in experience to reading a book, with technical publication tasks performed or contracted out by the author.”

TECHNOLOGIES FOR E-PUBLISHING

While online publishing can be as simple as a HTML web page, that is not the ideal format for many publications. There are a number of e-book formats vying for attention, and it is too early to tell which will become a standard. Many people believed that e-books would not become popular until they could pass the “Four B” test: ability to be carried comfortably to the beach, the bathroom, the bus, and the bedroom.^[4] To this end, several portable formats are in use, many for the cell phones and tablets people already use. Some devices use unique display software, so that an e-book cannot be published in all formats simultaneously. There are also dedicated e-book readers that are often called e-books themselves; although with the rise of smartphones and tablets, they are already becoming rarer.^[5] They do nothing but read e-books (rather than including web-surfing capabilities or printing) and include the Amazon Kindle (original version).

Industry organizations are at work trying to frame standards that will allow interoperability among the devices

and their software. The International Digital Publishing Forum (formerly The Open eBook Forum) released version 3.0.1 of the EPUB® specification, “a distribution and interchange format standard for digital publications and documents,” in October 2011.^[6] It and Adobe Acrobat are the most widely used open standards for electronic publishing. EPUB can be read on many platforms, including the Sony Reader and the Barnes & Noble Nook, but in order to be used on a Kindle, files must still be converted to their proprietary format.^[7] Another popular e-book platform, iBooks (for use on iPad and related readers), also has its own format.^[8]

Still, eventually standards may enable a manufacturer to produce a device that will read a number of formats. There is historical precedent for this: In 1947, an industry-wide agreement allowed manufacturers of phonographs to include both 33 and 45 rpm speeds on their turntables, making possible the huge popularity of phonograph records in the 1950s and 1960s.^[9]

A variation on electronic publishing is print on demand (POD), which allows books to be stored electronically but printed in book form when a reader wants one. This service is offered by many electronic publishers and favored by some authors. Like pure electronic publication, POD does not require large sales volume in order to be profitable. There is also interest in using it to bring back out-of-print titles for which rights have reverted to the author.^[10] POD can be offered as a choice along with electronic means of publication for e-books.^[11]

TECHNICAL PUBLICATION TASKS

There is a wide variety of tasks that have been traditionally performed by publishers but are now being done by authors who self-publish. Some of these tasks are the same as they have always been (e.g., editing and design of cover art), while some are peculiar to e-publishing (such as converting files to e-book formats and setting up a website for the publication). The more of these tasks that the author elects to perform, the more control the author will have, but the more labor-intensive the project will be. Many authors find that a hybrid approach, contracting out some tasks and performing others, works well. Tasks that must be performed, either by the author or by a publisher or publishing service, include^[12]

- *Editing:* Most authors have trouble changing their work, so this task is often outsourced to a professional editor.
- *Layout and design:* For most text-only books, this can be done using a computer, by either the author or a professional design service. If the book is very visual, however (e.g., an art book), this may be done largely by the author.

- *File conversion:* It is necessary to convert the file format to forms that are readable by the various e-book devices discussed earlier.
- *Web presence:* In order for something to be published online, it must have an online presence; in most cases, a web page. A web host must be found and contracted for, a URL must be decided on and purchased, a website must be designed, and then the site must be maintained to make sure it does not go out of date. Even if the book is published in a portable e-book reader format, there must still be a web page from which purchasers can download it.
- *Cover illustration:* Many authors new to online publishing do not realize that a cover is still important, even for an electronic publication. The web is a visual medium, and customers are likely to pay more attention to a well-designed cover than to a plain title listing.^[13]
- *International Standard Book Number (ISBN):* If the author wishes to list the e-book in *Books in Print*, *Forthcoming Books*, and other such directories, or to distribute it through online bookstores, an ISBN is necessary. ISBNs can be bought individually, or in blocks of ten or 100. A different ISBN is needed for each format, so if the author expects to create several different versions of the book (for instance, more than one electronic format), purchasing ten or more would be most economical.^[14]
- *Publicity, marketing, and listing with online bookstores:* A book must be promoted to its prospective audience, or there will be no customers. Websites that attract the people who would be interested in the book must be contacted with offers of a free review copy or an entry for the site.^[15] Reviews, interviews, radio or television appearances, and other publicity events must be planned. If the author wishes to distribute the work through online bookstores, listing must be arranged with the bookstores.

A new method of publicity and marketing is being pioneered by author Seth Godin, among others. Instead of writing the book and then marketing it, Godin builds what he calls “tribes” via his website and blog, then funds it with a Kickstarter campaign.^[16] This has the advantage of investing his readers in the book before publication, so that they already know what they’re going to get when they buy it, and are eager to read it. This requires intensive effort on the part of the author, though, to build the emotional connection with readers that will make them want to be a part of the enterprise.

- *Sales and order processing:* There are a number of models for pricing and collecting payment. If payment is to be received via credit cards, a merchant account must be set up, either directly through a bank or indirectly through merchant account providers.^[17] Once

payment is arranged, one method of delivering e-books is to load a few entries onto the web for customers to read for free, then charge for the rest. The balance of the book can also be on the web, but under password protection; the file can be transferred to the buyer's computer/reader; or it can be downloaded to disk or printed.^[18] Some sites that host self-published works will also keep track of the number of times an item is downloaded and pay the author a certain amount of money per download. Another part of the transaction can be the collection of information from customers so that future e-books can be marketed to them. An e-mail address is particularly important for reaching customers with news.^[19]

- *Copyright:* It is no secret that copyright of materials on the Internet is a thorny problem. Technically, anything published, whether in print or on the Internet, is considered copyrighted as of publication.^[20] However, enforcing a copyright is often more difficult and is the province of digital rights management (DRM). Usually, people speak of "A" copyright, but it is legally "generally considered to be a bundle of legal rights that accompany the physical creative product... [and] which can be assigned or retained in whole or in part."^[21] Rights under copyright include film rights, serial rights, foreign publishing rights, and more.
- *Security and DRM:* Since it is extremely easy for anyone to download an item from the Internet, and to plagiarize it or quote it out of context,^[22] DRM is an important consideration for electronic publications. DRM has been defined as "effective rights management and protection of digital content across the entire value chain - from creators [and] distributors to customers."^[23] Its purpose is to enforce copyright while maintaining as much interoperability as possible among different e-publishing systems. Opinions differ as to how much of a problem e-book piracy is. On the one hand, there are websites that deal in pirated e-books^[24] and may be losing publishers and authors' untold amounts of money. On the other hand, DRM may not actually be preventing piracy, instead causing a loss of goodwill on the part of the customers.^[25] Publisher's Weekly discovered that it is actually a sales-killer, harming sales "at any price point."^[26] Whether or not to use it is one of the decisions which an author must make.
- *Print on Demand fulfillment, if desired:* The author may not wish to provide access to the e-book via POD, but if it is desired, a method for high-speed printing, as well as shipping the physical item, must be considered.
- *Metadata, if desired:* In early 2000, Guidelines for ONline Information eXchange (ONIX) were published by the Association of American Publishers establishing a set of over 200 elements that will describe every aspect of a book in detail. (The current edition of these

guidelines is ONIX 3.0, published in April 2009)^[27] These elements, tagged for the Internet using eXtensible Markup Language (XML), are searchable online, providing more ways of discovering or finding e-books. Many of the elements are the kinds of information often found on the book jacket of a printed book, such as an author biography or an excerpt, as well as "kernel" data such as author, title, and ISBN. This can increase sales of an e-book as much as eight times those of an e-book without this metadata.^[28]

SELF-PUBLISHING USING A PUBLISHER OR E-PUBLISHING SERVICE

Electronic self-publishing can be done in a way that is close to the old vanity press model. The author can negotiate a contract, pay a fee, and submit a manuscript for publication. However, instead of clear delineation between self-publishing and vanity publishing, it can be seen that there is a continuum from total self-publishing, through contracting some or all of the services above, to actual vanity or subsidy publishing. E-publishing services can do any or all of the tasks listed above for set fees.^[29] The Internet has made the demarcation between publishers and publishing services, like many others, more vague. Publishers may even, in the words of Barnes and Noble's Steve Riggio, "become ... unnecessary [middlemen] in the distribution of electronic content..."^[30] An alternative to this is that publishers may "change from being producers of commodities (books) to being creators of a suite of content-based services"^[31]—in other words, publishing services.

A new profession has arisen to help with any or all of the tasks mentioned earlier but in a more personal way than a traditional publisher might. It goes by a variety of titles, including book shepherd, book coach, publishing strategist,^[32] book consultant, book coach, book doctor, book midwife, book birther, and more.^[33] A book shepherd can help with everything from determining the potential audience and creating platforms, through connecting the author with printers, agents, and other team members, to making sure everything works smoothly throughout the project.^[34] Like the role of the author itself, the role of the book shepherd is fluid, depending on what the author needs and what kind of budget is available.

PROS AND CONS OF SELF-PUBLISHING ONLINE

There are many advantages to self-publishing online, as opposed to more traditional publishing methods.

One of the most obvious reasons is to make more money per copy. Rather than the 6%–10% of the sale price in royalties that traditional printed books bring in, self-

published books can pay 35%,^[35] and with far less overhead for print costs and the like, electronically self-published books could pay even more. The profit margin on electronic publishing is much higher than on traditional publishing; low costs for manufacturing and distribution mean that it may take only a few hundred books to make a profit.^[36] The advantages of speed and full author control are also appealing.^[37]

Noncommercial works, such as “novella”-length fiction, can be published electronically with more success than by traditional means. One of the earliest self-e-publishing projects, Stephen King’s “The Plant,” was of this length. Publication of that story was halted before it was finished because the honor-system pay arrangement did not work, with fewer than half of the downloads paid for.^[38] Newer funding processes are being worked out now, many using social media or crowdfunding sites such as Kickstarter. Seth Godin may be one of the best-known self-publishers and has used the Kickstarter model, in which the author builds interest and gathers seed money before publishing the work.^[39]

“Niche” publications, which appeal to a sufficiently narrow audience that sales are not expected to be large, can also benefit from this model, as can crossover books which span more than one genre (e.g., such as a science-fiction mystery).^[40]

Authors whose works have previously been published traditionally but have gone out of print are using online self-publishing to bring back out-of-print books. When a traditional book goes out of print, rights revert to the author, and authors whose books have become popular several years after publication (because of a movie, for instance) find that they can make new profit by publishing them on their own, on the Internet.^[41,42] Some authors may prefer to self-publish online so that they never lose their copyright at all.^[43] Authors may also be able to serialize long works, as was frequently done through magazines in the nineteenth and twentieth centuries.^[44]

Electronic publishing also offers quick, easy updating of information that changes frequently, as well as interactivity and the convenience of hyperlinks to other parts of the same publication or others on the web.^[45]

There are, however, many disadvantages to this publishing model as well. One is the lack of standards; now that anyone can publish, there will inevitably be many substandard publications. Walt Crawford, of the Research Libraries Group, quotes Sturgeon’s Law: “90 percent of everything is crap.” It is possible that, without standards or gatekeepers, the bad books will crowd out the good ones.^[46] Also, good publications may have no credibility because they have not been subjected to the editorial and critical review that has been the norm.^[47]

Production values are often amateurish, since authors are not accustomed to performing the technical tasks of publishing an e-book. Similar problems arise with promotion, marketing, and distribution.^[48] In fact,

MightyWords.com, a company that worked with authors to publish books electronically, discontinued many of their self-publishing efforts because “As a company, we can’t do a perfect job promoting self-published titles. . . the authors didn’t do enough to participate in the process of marketing and promoting their titles themselves.”^[49] (In 2001, MightyWords closed down, citing insufficient demand for virtual content.^[50]) Unless a book is publicized and marketed, it can hardly be considered to have been published at all.

Copyright, as noted earlier, also presents unique challenges to electronic publications. DRM is becoming big business; according to the Dutch firm GfK, “only 10% of all eBooks on devices were actually paid for, with most of the digital books being pirated.”^[51] Since there is a widespread perception that anything on the Internet is free for the taking, anyone can change and/or repost electronically published material, and finding, proving, and prosecuting such misuse is, so far, very difficult.^[52] The lack of standards and interoperability of e-book devices, mentioned earlier, also contributes to the difficulty of reading and publishing electronically. Archiving of electronic content, with the related problem of the ability of the actual owner of the work (not the person or institution leasing it) to change content in e-books previously “bought,” presents very serious ethical considerations for both individuals and libraries.^[53]

IMPACT OF SELF-PUBLISHING ONLINE ON LIBRARIES AND LIBRARIANS

The impact of electronic publishing in general has been felt in libraries for some years now. Librarians are already dealing with problems of cataloging and bibliographic control, contracts for multiple users, and devices and formats. Adding virtual publications to library collections, monitoring use by library patrons, and deciding on which readers and software to invest in will occupy librarians for years to come. Electronic publishers can help librarians in this by making sure the metadata on their publications conforms to a standard such as ONIX, described earlier, or the Dublin Core (a separate metadata system being developed by librarians).^[54]

Libraries are now “buying” (actually, leasing) more and more e-books, as patrons with reading devices demand them.^[55] The problems of dealing with publisher limits on a number of loans and ridiculously high costs for libraries’ (as opposed to individuals’) downloads of e-books are well known in the library field.^[56] There are a number of distributors, such as OverDrive and Freading, but they can cause new problems, with different requirements for libraries and readers making the borrowing experience more complicated than it is with paper books.^[57] These are problems whether the e-books are self-published or not. Offering self-published books can bring additional concerns.

One of the big problems with offering self-published books, whether electronic or not, has been the difficulty of finding reviews, but with new sources of reviews available, this may not have as much influence as previously.^[58–60] Even such heavyweights as Kirkus Reviews and Publishers Weekly, through their programs Kirkus Discoveries and PW Select, have begun reviewing self-published works.^[61] Another problem has been that the large distributors (such as Overdrive) have not handled self-published books, but that is also starting to change. In May, 2014, Overdrive and Smashwords, one of the largest self-publishing platforms, made a deal to offer Smashwords books to libraries via Overdrive.^[62] Some of the walls are beginning to come down, and libraries will almost certainly be able to offer more and more self-published e-books in the future.

But checking self-published e-books out to patrons is not the only way libraries are interacting with them. Libraries may become centers for authors who wish to publish electronically. Mark Coker, owner of e-publishing platform Smashwords, has developed a series of seminars for libraries to use to help their own users become self-publishing authors,^[63] and has worked with libraries to organize contests for electronic authors,^[64] offering the prize of Smashwords' help in publishing their books. An exciting opportunity for librarians in online self-publishing is the ability for libraries to publish their own resources on the web. Many librarians already count web publishing as part of their jobs, as libraries publish their own unique bibliographies and other home-grown resources to the world via the web.^[65] Thus, items that have been relatively inaccessible to anyone outside the immediate library community can become accessible to a broad audience.

FUTURE TRENDS

As electronic self-publishers become more successful, traditional publishers are moving into this new area in order to preserve their leadership. For instance, Penguin Books purchased a self-publishing platform called Author Solutions in 2012,^[66] German publishing group Verlagsgruppe Georg von Holtzbrinck now owns self-publishing platform epubli,^[67] and Simon & Schuster has its own self-publishing platform, Archway Publishing.^[68] However, some data suggests that this may not be working for them: major publishers charge more per book than self-publishers, but tend to get lower reader reviews. They are also losing ground quickly, with major publishers selling almost the same number of units as self-publishers (based on Amazon sales of “top five” publishers' e-books).^[69] There are several areas in which electronically published books (whether self-published or put out by more traditional publishers) are expected to grow quickly. Quoting a Bowker report, Francine Fialkoff says that most self-

publishers polled “plan to bring fiction to market, followed by inspirational or spiritual works, books for children, and biographies.”^[70]

New technologies are also expected to have an effect on online publishing. Electronic ink is a new digital paper substitute. Display screens are already 30% lighter and thinner than LCDs, and the goal is to make them thin enough to be rolled or folded like paper.^[71] But even with current readers, a person can carry one book, the text of which can be changed or updated at will wirelessly.^[72] The ethical considerations alone of such an innovation are dizzying.

CONCLUSION

After a decade or so of very little growth, self-publishing on the web has exploded since the introduction of convenient readers and tablets like Kindle and Nook,^[73] which pass the “Four Bs”: ability to be carried comfortably to the beach, the bathroom, the bus, and the bedroom. People are reading more e-books, and a surprising number of them are self-published. This field is even more volatile than the Internet upon which it depends, and changes will be happening dynamically for the foreseeable future.

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Semantic Interoperability

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Abstract

This entry discusses the importance of semantic interoperability in the networked environment, introduces various approaches contributing to semantic interoperability, and summarizes different methodologies used in current projects that are focused on achieving semantic interoperability. It is intended to inform readers about the fundamentals and mechanisms that have been experimented with, or implemented, that strive to ensure and achieve semantic interoperability in the current networked environment.

INTRODUCTION

Semantic interoperability, which is defined as the ability of different agents, services, and applications to communicate (in the form of transfer, exchange, transformation, mediation, migration, integration, etc.) data, information, and knowledge—while ensuring accuracy and preserving the meaning of that same data, information, and knowledge—is central to the effective management, sharing, and retrieval of information in an open environment. Within the spectrum of different perspectives on interoperability, semantic interoperability lies at the heart of all matters. It deals with the language and vocabulary used in communication (human and machine) and facilitates information retrieval and resource sharing by users through whatever language or vocabulary they choose to use (often across language and cultural barriers). This entry is intended to inform readers about the fundamentals and mechanisms that have been experimented upon, or implemented, that strive to ensure and achieve semantic interoperability in the current networked environment.

Related standards such as the Resource Description Framework (RDF),^[1] RDF Schema,^[2] Web Ontology Language (OWL),^[3] and Simple Knowledge Organization Systems (SKOS),^[4] developed under the auspices of the World Wide Web Consortium (W3C), and the theoretical basis of semantics, are not discussed in detail here; these topics are covered in separate entries elsewhere.

SEMANTIC CONFLICTS AND AGREEMENTS

The ability to exchange services and data with and among components of large-scale distributed systems is contingent on agreements between requesters and providers. Those agreements may be based on e.g., message-passing protocols, procedure names, error codes, and argument

types. This means that these exchanges must make sense—that the requester and the provider have a common understanding of the meanings of the requested services and data.^[5] When multiple pieces of information are being exchanged, however, correct interpretation of some or all fractions of that information may be considered either partially or perfectly interoperable semantically.

We shall consider the example of the sequence “071210,” which can be literally transferred from one system to another; however, its meaning may be interpreted in any number of different ways. We might ask:

1. Is it a string or an integer?
2. If it is a string, does it represent a date, a phone number, an area code, or a hexadecimal number representing a color?
3. If it specifies a date, what date is it: a person’s birth date, a publication’s issuing date, or an archaeological site’s discovery date?
4. If it represents a date associated with a historical monument, what date is it indicating: the creation date, the restoration date, or the alteration date?
5. If “071210” represents a date in the twentieth century, which format does it represent: yy-mm-dd (i.e., 1907, December 10), mm-dd-yy (i.e., July 12, 1910), mm-yy-dd (i.e., July 1912, 10), or dd-mm-yy (i.e., 07 December, 1910)?
6. If information about *start-time* and *duration* is provided in a system, will the values be equal to the *earliest-date* and *latest-date* (derived by adding duration to the start-time) that are modeled on another system?
7. If “1912” is the value of a year in a system, how could this be mapped to the terms representing the same time period but from different perspectives? For example, in a Dublin Core (DC) record, this value associated with *dc.coverage* could be “Republic of

China 1st Year (民国元年),”^[6] or in a MACHine-Readable Cataloging (MARC) record, in field 260, it could appear as “min kuo 1 [1912].”

8. If the value of the year “1912” from one system is to be mapped to a value defined by another system, how should the non-one-to-one correlation be reconciled? For example, when applying the Library of Congress Subject Headings (LCSH) in subject-related fields in many metadata records, the closest match to “1912” might be a longer time period (e.g., “Nineteen Tens”), especially in the context of historical events, e.g., “Qing dynasty, 1644–1912” or “United States—History—1865–1921.”
9. If a system was designed to generate a second value from a value, e.g., “date < 1920,” which should result in the corresponding value “class = unclassified” (in terms of document release status), will another system be able to interpret the aggregated value?

Indeed, the number could represent almost any of millions of types of quantitative measure, and the strings could be mapped to constructed expressions in many different systems. Questions such as those above illustrate just some of the many possible *semantic conflicts*.

Interpretation of the meanings carried by the string depends strictly on the circumstances of transmission according to the *agreements* among systems. One study^[7] states that the goal of interoperability is to build coherent services for users from components that are technically different and managed by different organizations. This requires cooperative agreements at three levels:

- Technical agreements cover, among other things: formats, protocols, and security systems so that messages can be exchanged.
- Content agreements cover data and metadata and include semantic agreements on the interpretation of information.
- Organizational agreements cover group rules for access, preservation of collections and services, payment, authentication, and so on.

Semantic agreements require the involvement of people (users, designers, and developers) who associate semantics with data structure, data content, and data values. The impact could be at any of the implementation levels such as procedure names, type definitions and type hierarchies, screen layouts, and report formats (e.g., titles, column and row headings, dates, units of measures, sort order, or footnotes). These and many other types of semantic information might be *implicit* in application codes, in diagrams, and in the local “oral tradition.”^[5]

Experience has shown that interoperability through comprehensive standardization is hard to achieve.^[7] There is a need to maximize the amount of semantics that can be utilized and to make it increasingly *explicit*.^[8] Making

semantics explicit in metadata would allow people to detect mismatched assumptions and to create the required mappings to overcome them, despite the still extraordinary difficulties.^[5]

DIMENSIONS OF INTEROPERABILITY

There have been many attempts at defining the concept of *interoperability*. Stressing a result-oriented definition, *Understanding Metadata* states that “[i]nteroperability is the ability of multiple systems with different hardware and software platforms, data structures, and interfaces to exchange data with minimal loss of content and functionality.”^[9] Other groups emphasize a process-oriented definition: “Interoperability is the ability of two or more systems or components to exchange information and use the exchanged information without special effort on either system.”^[10] “Interoperability: The compatibility of two or more systems such that they can exchange information and data and can use the exchanged information and data without any special manipulation.”^[11]

It should be apparent that merely having the ability of two or more systems or components to exchange data does not ensure correct interpretation of an integer or string. Interoperability issues must be addressed not only at the syntactic and functional levels, but also at the semantic level.^[12] Without *syntactic interoperability*, data and information cannot be handled properly with regard to formats, encodings, properties, values, and data types; and therefore, they can neither be merged nor exchanged. Without *semantic interoperability*, the meaning of the language, terminology, and metadata values used cannot be negotiated or correctly understood.^[13] Varying degrees of semantic expressivity can be matched with different levels of interoperability: low at syntactic interoperability, medium at structural interoperability, and high/very high at semantic interoperability.^[14]

Ouksel and Sheth^[15] identify four types of heterogeneity which correspond to four types of potential interoperability issues:

- System: incompatibilities between hardware and operating systems.
- Syntactic: differences in encodings and representation.
- Structural: variances in data models, data structures, and schemas.
- Semantic: inconsistencies in terminology and meanings.

Obrst,^[14,16] on the other hand, intertwines six levels (object, component, application, system, enterprise, and community) of interoperability with three kinds of integration (syntactic, structural, and semantic). According to

Obrst, semantics is fundamentally interpretation within a particular context and from a particular point of view. Semantic interoperability/integration is fundamentally driven by the communication of coherent purpose.

Pollock and Hodgson^[17] consider data to be the foundation of all information sharing programs and believe that next-generation systems rest upon an expanded view of the dialectic of data—information. This view is illustrated in a pyramid in which the interface-level integration, method-level integration, and process-level integration all have developed on top of a foundation of data. With semantic interoperability, the expanded notion of data includes *semantics* and *context*, which thereby transforms data into information. This transition both broadens and deepens the foundation for all other integration approaches, blending semantic interoperability within various levels of interoperability:

1. Semantic interoperability of *data* enables data to maintain original meaning across multiple business contexts, data structures, and schema types.
2. Semantic interoperability of *process* enables specific business processes to be expressed in terms of another by: 1) inferring meaning from the process models and contextual metadata; and 2) applying it in a different process model elsewhere or outside the organization.
3. Semantic interoperability of *services/interface* enables a service to look up, bind, and meaningfully communicate with a new service.
4. Semantic interoperability of *applications* enables platform-independent interactions between heterogeneous software applications.
5. Semantic interoperability of *taxonomy* enables correct expression of all categories (including the definitions and relations with other categories) between different taxonomy systems.
6. Semantic interoperability of *policies and rules* enables businesses to protect valuable resources.
7. Semantic interoperability of *social networks* enables people in different communities of interest to network, make inferences, and discover meaningful connections.^[17]

In general, interoperability, no matter at what level, is concerned with the capability of different information systems to communicate with one another. This communication may take various forms such as the transfer, exchange, transformation, mediation, migration, or integration of information. Therefore, as stated at the outset, we may define semantic interoperability as the capacity for different agents, services, and applications to communicate data, information, and knowledge while ensuring accuracy and preserving the meaning of that data, information, and knowledge.

PERSPECTIVES ON THE CONSTITUENTS OF SEMANTIC INTEROPERABILITY

Semantic interoperability has been a topic discussed in information processing and exchange communities since long before the World Wide Web emerged. However, the issue has never been so critical or of such great concern among so many communities as today. Although the Web is an information resource with virtually unlimited potential, this potential is relatively untapped because it is difficult for machines to process and integrate this information meaningfully.^[18] Components that contribute to achieving semantic interoperability have been proposed by researchers from a number of diverse perspectives.

Semantic Interoperability in Different Processes

In a report entitled *Semantic Interoperability in Digital Library Systems* prepared by Patel, Koch, Doerr, and Tsinaraki at UKOLN, a research organization that is based at the University of Bath, U.K.,^[19] semantic interoperability is characterized by the capability of different information systems to communicate information consistent with the intended meaning of the encoded information (as it is intended by the creators or maintainers of the information system). It involves: 1) the processing of the shared information so that it is consistent with the intended meaning; and 2) the encoding of queries and presentation of information so that it conforms to the intended meaning regardless of the source of information.

Seligman and Rosenthal^[20] categorize information interoperability according to two principal types of processes. For information exchange, a provider responds to a request, and the information is transformed to suit the requester's needs. For information integration, in addition to being transformed, information from multiple sources is also correlated and fused. Integration requires that four levels be addressed: Level 1—Overcome geographic distribution and infrastructure heterogeneity; Level 2—Match semantically compatible attributes; Level 3—Mediate between diverse representations; Level 4—Merge instances from multiple sources. Information interoperability is required both in the information exchange and information transfer processes.

Obrst^[14] has suggested that semantic interoperability could be enabled through: 1) establishing base semantic representation via ontologies (class level) and their knowledge bases (instance level); 2) defining semantic mappings and transformations among ontologies; and 3) defining algorithms that can determine semantic similarity by employing their output in a semantic mapping facility that uses ontologies.

In many cases, mapping and integration are conducted on top of existing systems that might have been created without considering integration with other systems. Addressing semantic interoperability in different processes helps

to identify related problems and methodologies and then resolve those (and other) issues.

Semantic Interoperability at Different Levels

The UKOLN report on *Semantic Interoperability in Digital Library Systems* distinguishes three levels of information that are treated in a distinct manner to address semantic interoperability^[19]: 1) *data structures*, be they metadata, content data, collection management data, or service description data; 2) *categorical data*—data that refer to universals, such as classification, typologies, and general subjects; and 3) *factual data*—data that refer to particulars, such as people, items, or places. It might be expected that the treatment of data structures and factual data would achieve a high level of semantic agreements; however, this correlation is not guaranteed when dealing with categorical data. Whereas the local degree of standardization of categorical data may be very high, the global one may be poor.

Slightly different from the perspectives above is a differentiation based on *data structure*, *data content*, *data values*, and *data communication* in metadata practices. The most notable practice is in the cultural heritage community, which has developed a set of comprehensive standards and guidelines for describing cultural objects. The conceptual reference model (CRM) produced by the International Committee for Documentation (CIDOC) of the International Council of Museums (ICOM) provides definitions and a formal structure for describing the implicit and explicit concepts and relationships used in cultural heritage documentation. Semantic interoperability is defined as the capability of different information systems to communicate information that is consistent with intended meaning (see also the “Semantic Interoperability in Different Processes” section). More precisely, the intended meaning encompasses: 1) the data structure elements involved; 2) the terminology appearing as data; and 3) the identifiers used in the data for factual items such as places, people, objects, etc.^[21] In the museum and visual resources community, agreements have been reached on these constructs to ensure the creation of sharable and high-quality metadata. Categories for the Description of Works of Art (CDWA)^[22] defines a *data structure* which “enumerates a set of categories or metadata elements that can be used to create a structure for a fielded format in a database.”^[23] Cataloging Cultural Objects (CCO)^[23] is a *data content* standard that guides the choice of terms and defines the order, syntax, and form in which data values may be entered into a data structure. Examples of standards for *data values* in the form of controlled vocabularies include the Art and Architecture Thesaurus (AAT),^[24] the Thesaurus for Graphic Materials (TGM),^[25] the Union List of Artist Names (ULAN),^[26] and the Getty Thesaurus of Geographic Names (TGN).^[27] Data content and data

value standards must be used in conjunction with an agreed-upon data structure.

Chung and Moen’s two-dimensional approach for investigating issues of semantic interoperability in digital libraries^[28] is related to the two perspectives above. The *data-attribute* area defines the names, labels, semantics, and granularity of metadata elements and database fields. The *data-value* area addresses the data or information provided in an element or database field. In this approach, the deduction that the data-attribute dimension’s components are *semantics* and *content* was based on another discussion about metadata interoperability by the authors of this entry.^[29] In that paper, the *semantics* aspect is understood to constrain the attributes (metadata elements and their refinements and relationships) according to agreed-upon meanings. The *content* aspect is defined as the declarations or instructions of what and how data values should be assigned to the metadata element.

Addressing semantic interoperability at different levels leads to improved standardization in related communities and the correct implementation of standards at each level. Following all agreements, metadata produced are intended to be shareable from day one.

Conceptualizing Underlying Models

As early as 1923, Ogden and Richard published their famous *triangle of meaning* which illustrates the relationship between language, thought content, and referent.^[30] The graph implies that the referent of an expression (a word or another sign or symbol) is relative to different language users. The model was also adopted by researchers in library and information science as the basis for building knowledge organization systems (KOS).^[31] A working group of the International Federation of Library Associations and Institutions (IFLA) Functional Requirements for Subject Authority Records (FRSAR)^[32] has recently proposed a conceptual model that contains *thema* and *nomen* entities related to the *aboutness* of works in the bibliographic universe.^[33] In this instance *thema* means anything that can be the subject of a work. *Nomen* is any alphanumeric, aural, and visual (etc.) symbol or combination of symbols by which a *thema* is known, referred to, or addressed. The importance of this model for the subject authority data is to separate and distinguish the concepts (or topics and subjects) from how they are designated or represented. In different efforts to achieve global sharing and use of subject authority data, some have focused on *nomen* (e.g., a translated metadata vocabulary, a symmetrical multilingual thesaurus, or a multi-access index to a vocabulary). However, the majority of projects have concentrated on the *thema* level, e.g., mapping the concepts between two thesauri or between a thesaurus and a taxonomy. These concept-centric efforts usually encounter far greater challenges because they are concerned not only

with the concepts as such, but the relationships among them as well.

This thema–nomen conceptual model matches well with encoding languages such as SKOS, OWL, and more general encoding that uses RDF with Uniform Resource Identifiers (URIs) as the basis of a mechanism for identifying subjects, predicates, and objects in statements. SKOS defines classes and properties sufficient to represent the common features found in a standard thesaurus and is an example of the concept-centric view of vocabulary where primitive objects are not terms but abstract concepts represented by terms/labels. Each SKOS concept is defined as an RDF resource, and each concept can have RDF properties attached, which include: one or more preferred terms (at most one in each natural language); alternative terms or synonyms; and, definitions and notes with specification of their language.^[34] Established semantic relationships are expressed in SKOS and intended to emphasize concepts rather than terms/labels.

When the DCMI Abstract Model^[35] became a DCMI Recommendation in 2007, its one-to-one principle (i.e., each DC metadata description describes one, and only one, resource) was recognized or followed by more metadata standards (e.g., the newly released VRA Core 4.0).^[36] Under the one-to-one principle, a record can contain more than one *description set*. A description set contains *descriptions* composed of *statements* which use property–value pairs. The results are data which can then be processed, exchanged, referred to, and linked to at the statement level. At implementation, when a record contains descriptions of the resource, the individual descriptions also can be linked to the authority data that manages the *values* associated with those properties (e.g., the subject authority data, the property name authority data, and the geographic authority data). Such an information model is independent of any particular encoding syntax and facilitates the development of better mappings and cross-syntax translations.^[35] The conceptual model proposed by the FRSAR group corresponds to this abstract model because it allows any thema to be independent of any nomen, including any syntax that a nomen may use. This results in facilitating the sharing and reuse of subject authority data among not only the subject vocabularies themselves, but also among metadata resources.

SEMANTIC INTEROPERABILITY ACTIVITIES

The researchers at UKOLN (see the section “Semantic Interoperability in Different Processes”)^[19] proposed a list of the information life cycle activities in which the creators/authors, publishers, information systems managers, service providers, and end users are all involved. These activities include: 1) creation and modification; 2) publication; 3) acquisition, selection, storage, system and collection building; 4) cataloging (metadata, identification/

naming, registration), indexing, knowledge organization, knowledge representation, and modeling; 5) integration, brokering, linking, syntactic and semantic interoperability engineering; 6) mediation (e.g., user interfaces, personalization, reference, recommendation, and transfer); 7) access, search, and discovery; 8) use, shared application/collaboration, scholarly communication, annotation, evaluation, reuse, and work environments; 9) maintenance; and 10) archiving and preservation. While semantic interoperability issues seem to be relevant in each part of the information life cycle, they are paramount in activities 4 (cataloging), 5 (integration), and 6 (access).

In this section, we will narrow our focus to the activities concerned with metadata and KOS because they are the two areas of most interoperability efforts. In reports on data exchange and integration, data values in metadata records appear to lead to increased scrutiny with regard to the semantics of semantic interoperability. This is because most of the concerns are related to terms or codes controlled by some form of KOS. It is our observation, however, that in addition to providing controlled terms, names, and codes for metadata value spaces, KOS have a more important function: to model the underlying semantic structure of a domain and to provide semantics, navigation, translation through labels, definitions, typing, relationships, and properties for concepts.^[37,38]

KOS Interoperability

Knowledge organization systems have been recognized as the prerequisites to enhanced semantic interoperability.^[19] The term KOS is intended to encompass all types of schemes for organizing information and promoting knowledge management, including classification schemes, gazetteers, lexical databases, taxonomies, thesauri, and ontologies.^[39] Embodied as Web services, they facilitate resource discovery and retrieval by acting as semantic road maps, thereby making a common orientation possible for indexers and future users, either human or machine.^[38] Thus the term KOS refers to controlled vocabularies as well as to systems/tools/services developed to organize knowledge and to present the organized interpretation of knowledge structures.

Establishing and improving semantic interoperability in the whole information life cycle always requires the use of KOS.^[40] Sometimes new vocabularies need to be created (or extracted) first; in other cases, existing vocabularies need to be transformed, mapped, or merged.^[19] This is especially important—and challenging—if existing KOS are different with regard to structure, domain, language, or granularity. In a project conducted by the authors,^[41] over 40 KOS were found to have been involved in interoperability projects between 1980 and 2004. The sizes of differing KOS ranged from less than 100 to nearly one-quarter million terms depending on individual system requirements. Several of the projects

comprise different vocabularies, ranging from a dozen, e.g., the Renardus project^[42] and H.W. Wilson's combined heading list,^[43] to over one hundred, e.g., the Unified Medical Language System (UMLS),^[44] and many are multilingual. During the transforming, mapping, and merging of concept equivalencies, specific term representations formed with definite syntax are sought. Different types of equivalencies have been defined by various standards organizations. The complex requirements and processes for matching terms, which are often imprecise, may have a significant impact on the following aspects of vocabulary mapping: browsing structure, display, depth, nontopical classes, and the balance between consistency, accuracy, and usability. Various levels of mapping/linking can coexist in the same project, such as those identified by the Multilingual Access to Subjects (MACS) project:^[45] terminological level (subject heading), semantic level (authority record), and syntactic level (application).^[46]

Special challenges and controversial opinions have always overshadowed the projects that have attempted to map multilingual vocabularies. For example, equivalence correlation must be dealt with not only within each original language (intra-language equivalence), but also among the different languages (inter-language equivalence) involved. Intra-language homonymy and inter-language homonymy are also problematic semantic issues.^[47]

Taking a different view, Gilreath^[48] suggests that there are four basic requirements that must be harmonized in terminology work: concepts, concept systems, definitions, and terms. Further complications arise when perspectives of different cultures need to be integrated. With the assumption that all languages are equal in a crosswalk table, the central question is whether the unique qualities of a particular culture expressed through a controlled vocabulary—or classification—can be appropriately transferred during the mapping process.

In addition to language and cultural variants, KOS have different microstructures and macrostructures: they represent different subject domains or have different scope and coverage; they have semantic differences caused by variations in conceptual structuring; their degrees of specificity and use of terminology vary; and, the syntactic features (such as word order of terms and the use of inverted headings) are also different.

Metadata Interoperability

Metadata is also an extensively discussed topic within the domain of information exchange and integration activities. Metadata are structured, encoded data that describe characteristics of information-bearing entities (e.g., individual objects, collections, or systems) to aid in the identification, discovery, assessment, management, and preservation of the described entities. Metadata is often simply defined as “data about data” or “information about information.”^[9] In the literature, the words

“schema” and “element set” have been used interchangeably to refer to metadata standards. In practice, metadata element sets are standards for data structures and semantics. An element set is a group of elements useful for describing resources of a particular type, or for a particular purpose. Examples are the 15-element DC Metadata Element Set (DCMES)^[49] and DC Metadata Terms (an extended element set which complements the DCMES).^[50] The word “schema” usually refers to an entity that includes the semantic and content components of the element set(s) as well as the encoding of the elements with a markup language such as Extensible Markup Language (XML). Examples include the XML schemas for simple and qualified DC. In this discussion, when the term “schema” is used, it refers to a metadata standard, although the major focus is often on the semantics and content of the schema rather than the encoding.

The rapid growth of Internet resources and digital collections has been accompanied by a concurrent proliferation of metadata standards, each of which was designed to be based on the requirements of particular user communities, intended users, types of materials, subject domains, project needs, and much more. Problems arise in the creation of large digital libraries or repositories when metadata records are prepared according to so many diverse standards.

In recent years numerous projects have been undertaken by the many players and stakeholders in the information community toward achieving interoperability among different metadata standards and their applications. Ideally, a uniform standard approach would ensure maximum interoperability among resource collections. If all participants of a consortium or repository were required to use the same data structure standards, such as the MARC21 format^[51] or DCMES, a high level of consistency would be created and therefore maintained. This, of course, has been the approach in the library community for over a century and is the optimal solution to the interoperability problem. The uniform standardization method is only viable in the early stages of building a digital library or repository, before different schemas have been adopted by the participants. Although conceptually a simple solution, it is not always feasible. This is especially true in heterogeneous environments serving different user communities where components or collections contain different types of resources already described by particular, specialized schemas. Therefore, other mechanisms of achieving interoperability must be adopted. Implementing interoperability may be considered at different methodological levels:

1. Structure and semantics level—Efforts are focused on the structure and semantics of metadata elements, independent of any applications. Outcomes include derived element sets or encoded schemas, crosswalks, application profiles, and element registries.

2. Record level—Efforts are intended to integrate metadata records through the mapping of elements according to semantic meanings of the elements. Common results include converted records and new records resulting from combining values of existing records.
3. Repository level—With harvested records from varying sources, efforts at this level focus on mapping value strings associated with particular elements (e.g., terms associated with “subject” or “format” elements). The result enables cross-collection searching.^[52]

Common Methodologies

Knowledge organization systems and metadata interoperability efforts have implemented similar methodologies. In the following analysis, we use *vocabulary* to refer to both KOS vocabulary and metadata vocabulary (metadata element set). The projects mentioned in this section are examples only (see also longer discussions).^{[29][41][52]}

Derivation

A new vocabulary may be derived from an existing vocabulary which is seen as a “source” or “model” vocabulary. This ensures a similar basic structure and contents, while allowing different components to vary in both depth and detail for the individual vocabularies. Specific derivation methods include adaptation, modification, expansion, partial adaptation, and translation. In each case, the new vocabulary is dependent upon the source vocabulary (see Fig. 1). A current example is the Faceted Application of Subject Terminology (FAST)^[53] vocabulary which derives subject terms from the LCSH and modifies the syntax to enable a post-coordinate mechanism.^[54] Among the metadata standards, a significant number of lighter element sets (e.g., Text Encoding Initiative (TEI) Lite,^[55] MARC Lite,^[56] CDWA Lite)^[57] and various formats or different encoded schemas have been derived from comprehensive ones. Derivation can also occur in the encoding format (e.g., MARCXML,^[58] CDWA Lite), but the basic original content elements are retained. Many

derivations can be regarded as occurring inside a family, as with the MARC family which includes MARC21, MARCXML, Metadata Object Description Schema (MODS),^[59] and MARC Lite. A derived vocabulary could also become the source of a new vocabulary (as in the case of some translated vocabularies). Another variation might include the adaptation of an existing vocabulary, with slight modifications to accommodate local or specific needs. The degree of modification is relatively low in contrast to specially localized vocabularies such as application profiles (Fig. 1).

Localization and expansion

Even within a particular information community, there are different user requirements and distinctive local needs. The details provided in a particular vocabulary may not meet the needs of all user groups.

Based on the premise that metadata standards are necessarily localized and optimized for specific contents, the emergent concept of *application profiles* is typical for considering individual needs.^[60] While existing element sets are used as the basis for description in a unique digital library or repository, individual needs are met through a set of specific application guidelines or policies established for interest or user groups. Application profiles generally consist of metadata elements drawn from one or more metadata element sets that are combined into a single compound structure and encoded in a schema by implementers, and then optimized for a specialized local application.^[61,62] It should be noted that the DCMI community has recently developed a framework application profiles^[63] based on the DCMI Abstract Model,^[35] that emphasizes the *machine-processable* application profiles which encode metadata elements in machine-processable schemas employing markup languages.

An application profile may also be based on a single element set and then tailored to different user communities. For example, the DC-Library Application Profile (DC-Lib) elucidates the use of the DC metadata element sets in libraries and library-related specific applications and projects.^[64] In practice, the development of an application profile often involves the following steps: 1) selecting a “base” metadata namespace; 2) selecting elements from other metadata namespaces; 3) defining local metadata elements and declaring new elements’ namespaces; and 4) enforcing application of the elements (including cardinality enforcement, value space restriction, and relationship and dependency specification)^[62,65] (Fig. 2).

In thesaurus and classification development, a method known as *leaf nodes* has been used in which extended schemes for subtopics are presented as the nodes of a tree structure in an upper vocabulary. When a leaf node in one thesaurus is linked to a high level (e.g., “wetlands”), and more specific subtopics of that concept exist in a specialized vocabulary or classification system (e.g., “wetlands

Derivation of new vocabularies from a source vocabulary

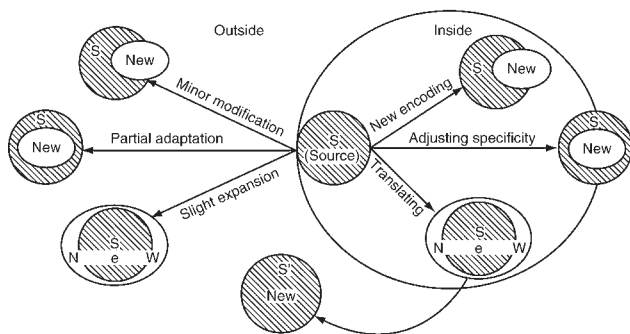


Fig. 1 Derivation of new vocabularies from a source vocabulary.

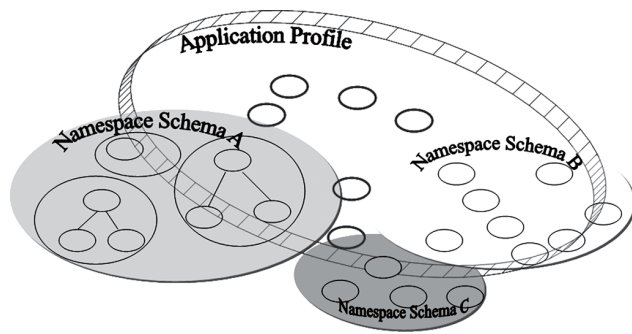


Fig. 2 An application profile consisting of elements drawn from one or more metadata element sets.

classification scheme”), then the leaf node can refer to that specialized scheme.^[41] As with the application profile approach, a new vocabulary can be built on the basis of more than one existing vocabulary. A major task of the developers is to not be unnecessarily redundant. Rather, their primary role is to extend from nodes and grow localized vocabulary leaves (see Fig. 3).

With careful collaboration and management, *satellite vocabularies* can be developed around a superstructure in order to meet the needs of managing specialized materials or areas. The superstructure can exist physically (e.g., LCSH) or virtually (e.g., Getty’s Vocabulary Database).^[66] LCSH-based thesauri include the Legislative Indexing Vocabulary (LIV),^[67] the Thesaurus for Graphic Materials (TGM),^[25] and the Global Legal Information Network (GLIN).^[68] The English Heritage Project’s National Monuments Thesauri^[69] are composed of several separate online thesauri for monument types: archaeological objects, building materials, defense, evidence, maritime cargo, craft type, place name, and so on. These thesauri are displayed in an integrated space through a frame-based Web site. Terms are grouped by classes rather than by broadest terms (Top Term) and are cross-linked (Fig. 3).

Satellites under a superstructure are usually developed deliberately as an integrated unit and require top-

down collaboration for management. An alternative approach, though apparently similar in terms of processes, is to plug-in different pieces to an existing *open umbrella structure*. The reason is that, in the example of ontology development, the upper level of an ontology (i.e., the more general concepts) is more fundamental for information integration. Automatic methods may be used for the semantic organization of lower-level terminology.^[70] The responsibility of ensuring interoperability is that of the developers who will create the plug-ins to coordinate under the umbrella. Patel et al.^[19] identify a three-tier structure of upper-core-domain ontologies: 1) *upper ontologies* define basic, domain-independent concepts as well as relationships among them (e.g., CYC Ontology^[71] and WordNet);^[72] 2) *core (or intermediate) ontologies* are essentially the upper ontologies for broad application domains (e.g., the audiovisual domain); and 3) *domain ontologies* in which concepts and relationships used in specific application domains are defined (e.g., a “goal” in the soccer video domain). The core ontologies comprise concepts and relationships that are classified as basic in the broad application domain context, e.g., an event in the audiovisual domain. The concepts defined in domain ontologies correspond to the concepts and relationships established in both upper and core ontologies, which may be extended with the addition of domain knowledge (Fig. 4).

The *Digital Curation Center’s Digital Curation Manual: Installment on “Ontologies”*^[70] recommends that the editors of KOS first agree on a common upper-level ontology across disciplines in order to guarantee interoperability at the fundamental and functional levels. On the other hand, it is important to fully grasp the conditions and cost-benefit ratio of connecting an upper ontology and domain KOS: 1) the intended purpose—indexing and retrieval vs. automatic inferencing; 2) the alignment of the ontology and domain KOS; 3) the number of different KOS intended to be modeled; and 4) the use cases to be supported.^[73]

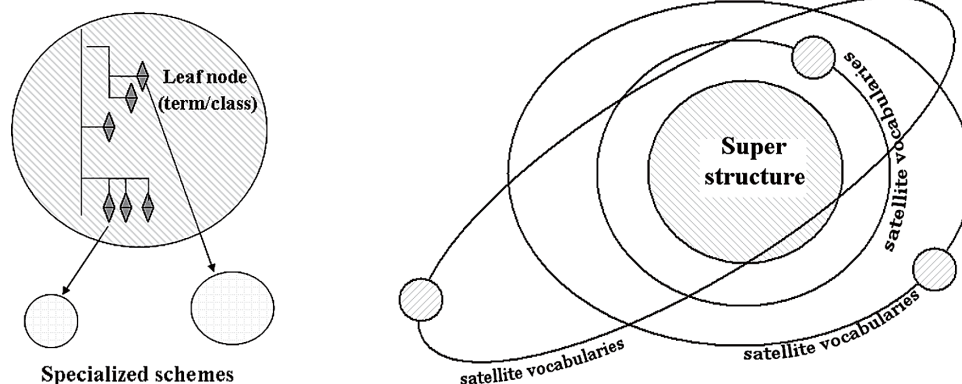


Fig. 3 Leaf node linking and satellites.

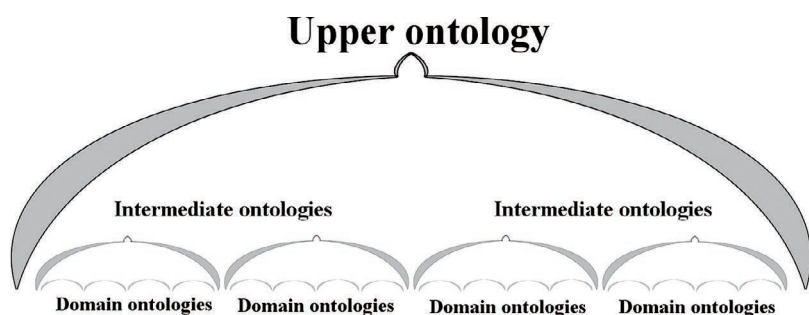


Fig. 4 Intermediate and domain vocabularies plugged-in under an open umbrella structure.

Mapping, crosswalking, and data conversion

The process of mapping essentially consists of establishing equivalencies between terms in different controlled vocabularies and between metadata element sets. In both cases the vocabulary may be presented in verbal terms and/or notation numbers in a scheme. Depending on the number of schemes involved in the process, two different models may be considered.

In *direct mapping*, one-to-one mapping is usually applied when two (or a limited few) schemes are involved. Almost all metadata standards have mapped their elements to the DC 15 elements defined by ISO 15836-2003.^[74] The MACS project mapped subject headings in three monolingual lists: Schlagwortnormdatei/Regeln für den Schlagwortkatalog (SWD/RSWK), Répertoire d'autorité-matière encyclopédique et alphabétique unifié (Rameau), and LCSH.^[46] Nevertheless, when using the direct mapping model, four schemes would require twelve (or six pairs of) mapping processes. This not only is extremely tedious and labor intensive, but also requires enormous intellectual exertion.

Cross-switching is another kind of model usually applied to reconcile multiple schemes. In this model, one of the schemes is used as the switching mechanism between the multiple schemes. Instead of mapping between every pair in the group, each scheme is mapped to the switching scheme only. Such a switching system can be a new system (e.g., the UMLS' Metathesaurus)^[75] or an existing system (e.g., the Dewey Decimal Classification (DDC)). Another example is Getty's crosswalk which allows multiple metadata schemas to all crosswalk to CDWA.^[76] For KOS and subject directories, this is the approach adopted by Renardus and a number of other projects. The Renardus project maps local class schemes to a common scheme: the DDC. Each DDC class that Renardus presents links to "related collections" which enables the user to then jump to the mapped classes in the participating local gateways while continuing to browse in the local classification structure. In addition, a virtual browsing feature allows the merging of all local related records from all mapped classes into one common Renardus result set^[77] (Fig. 5).

In the metadata community, the word *crosswalk* is established and commonly used among practitioners. Previously this format was also referred to as a *concordance* when subject headings were mapped and stored. A metadata crosswalk is "a mapping of the elements, semantics, and syntax from one metadata scheme to those of another."^[9] The mechanism used in crosswalks is usually a chart or table that represents the semantic mapping of data elements in one data standard (source) to those in another standard (target) based on similarity of function or meaning of the elements.^[78] According to the NISO document, *Issues in Crosswalking Content Metadata Standards*, common properties may include a semantic definition of each metadata element and other issues including:

- Whether a metadata element is mandatory or optional based on certain conditions.
- Whether a metadata element may occur once or multiple times within the same record.
- Constraints as to the organization of metadata elements relative to each other, (e.g., hierarchical parent-child relationships).
- Constraints imposed on the value of an element (e.g., free text, numeric range, date, or a controlled vocabulary).
- Optional support for locally defined metadata elements.^[79]

Major efforts in metadata mapping have produced a substantial number of crosswalks. Almost all schemas have created crosswalks to widely applied schemas such as DC, MARC, or Learning Object Metadata (LOM).^[80] Metadata specifications may also include crosswalks to a previous version of a schema as well as to other metadata schemas, e.g., the VRA Core 3.0^[81] and 4.0.^[36]

Two approaches have emerged in crosswalking practice. The *absolute crosswalking* approach requires exact mapping between involved elements (e.g., vra.title → dc.title) of a source schema (e.g., VRA Core) and a target schema (e.g., DC). Where there is no exact equivalence, there is no crosswalking (e.g., vra.technique → [empty space]). Absolute crosswalking ensures the equivalency (or closely equivalent

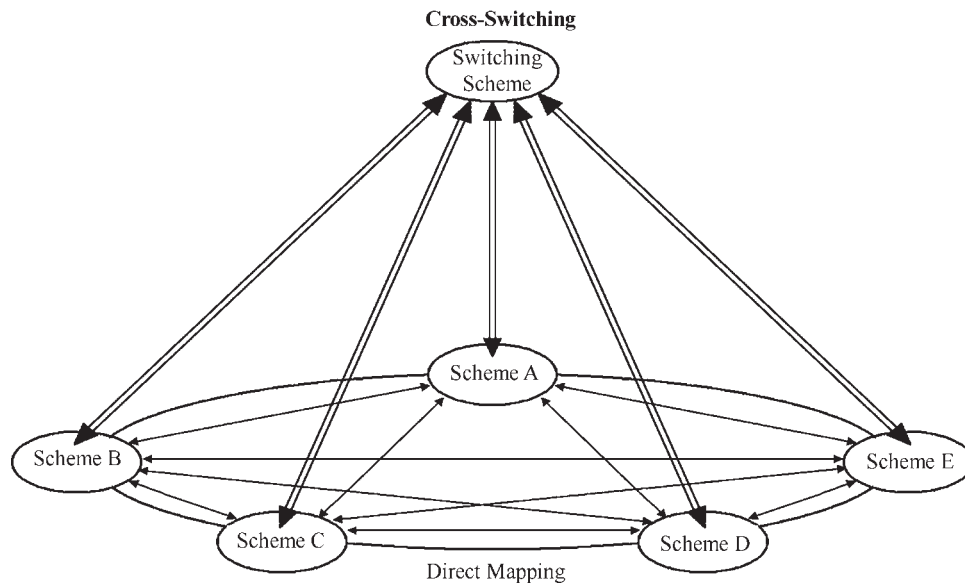


Fig. 5 Direct mapping and cross-switching.

matches) of elements, but does not work well for data conversion. The problem is the data values that cannot possibly be mapped, particularly when a source schema has a richer structure than that of the target schema. To overcome this problem, an alternative approach, *relative crosswalking*, is used to map all elements in a source schema to at least one element of a target schema, regardless of whether the two elements are semantically equivalent or not (e.g., *vra. technique* → *dc.format*). The relative crosswalking approach appears to work better when mapping from a complex to a simple (or basic) schema (e.g., MARC to DC), than the reverse.

Functionally, crosswalks should allow systems to effectively convert data and enable heterogeneous collections to be searched simultaneously with a single query as if within a single database. The reality is that crosswalks constructed from real data conversion may be very different from those based on metadata specifications. The major challenge in *converting records* prepared according to a particular metadata schema into records based on another schema is how to minimize loss, or distortion, of data. In studies by Zeng and colleagues,^[82,83] it was found that when data values were involved, converting may become imprecise and conversion tasks become more complicated. When the target schema is more inclusive and has defined elements and sub-elements with greater detail than the source schema, the values in a source metadata record may need to be broken down into smaller units (e.g., from DC elements to MARC records subfields). As mentioned above, the risk is that data values may be lost when converting from a complex to a simple structure in absolute crosswalking. Equally, granularity may be lost when

converting from a complex to a simple structure in relative crosswalking. Other vexing problems include converting value strings associated with certain elements that have rules for required, mandatory, or optional usage (in addition to the decisions about which controlled vocabularies are selected). Detailed explanations should be provided for as many contingencies that can be foreseen. Regrettably, most crosswalks focus only on element mappings that are based on *metadata specifications*, and not on *real data conversion results*. A recent study on metadata quality provides strong evidence for the impact of crosswalks on quality when converting large amounts of data.^[83] The most serious difficulties include misrepresented data values, important data values lost, incorrectly mapped elements and data values, and, missing elements. It is understood that collaborative approaches are needed in order to solve these problems. Zeng and Shreve recommend a set of approaches to correct many of the errors found in a metadata repository regarding data conversion:

1. Recreating and improving crosswalks.
2. Reharvesting records if quality reviews indicate the need.
3. Sponsoring and enforcing comprehensive standards and best practice guidelines for all elements.
4. Enriching data—both pre- and post-harvest—by automatic processes.
5. Supplying consistent mapping tables to past, present, and future data providers when harvesting is to be conducted.
6. Encouraging and ensuring active collaboration and open communication between repositories and local collection groups.

Co-occurrence mapping is similar to what was done in the MACS project where values in the subject fields of a record from different vocabularies are treated as equivalents. When a metadata record includes terms from multiple controlled vocabularies, co-occurrence of subject terms allows for an automatic, loose mapping between vocabularies. As a group, these loosely mapped terms can answer a particular search query or a group of questions. Existing metadata standards and best practice guides have provided the opportunity to maximize the co-occurrence mapping method. A good example is the VRA Core Categories versions 3.0 and 4.0, which recommend the use of AAT, LCSH, Thesaurus of Graphic Materials (TGM), ICONCLASS,^[84] and the Sears List of Subject Headings^[85] for culture and subject elements. Also, a Feature Class field of the gazetteer of the Alexandria Digital Library^[86] includes terms from two controlled vocabularies (ADL Feature Thesaurus and GNS Feature Classes) in one record.^[87] Additionally, metadata records often include both controlled terms and uncontrolled keywords. Mapped subject terms can be used as access points that lead to full metadata records. These *fielded-in* value strings associated with multiple sources may be integrated to enrich metadata records through automatic processes. As more co-occurrence types of mapping are widely applied, loosely mapped values will become very useful in productive searching with highly relevant results.

Crosswalking services mark a further stage of crosswalk development toward meeting the challenge of ensuring consistency in large databases that are built on records from multiple sources. Efforts to establish a crosswalking service at OCLC have indicated the need for robust systems that can handle validation, enhancement, multiple character encodings, and allow human guidance of the translation process.^[88] The OCLC researchers developed a model that associates three pieces of information: 1) crosswalk; 2) source metadata standard; and 3) target metadata standard. Researchers at the National Science Digital Library (NSDL)^[89] have also included a crosswalking service in their sequence of metadata enhancement services. These crosswalking services are a type of metadata augmentation operation that generates new fielded metadata values that are based on crosswalking from a source (schema or vocabulary) to a target (schema or vocabulary). The operation can be performed on either controlled or uncontrolled vocabulary value strings associated with specific elements.^[90] Both element-based and value-based crosswalking services assist in achieving semantic interoperability and improve the reusability of metadata in a variety of knowledge domains.

Registries, repositories, and web services

Registries and repositories for metadata and KOS vocabularies, powered by semantic technologies such as RDF,

SKOS, and OWL, have emerged in recent years. Their primary functions include registering, publishing, managing diverse vocabularies and schemas, as well as ensuring they are crosslinked, crosswalked, and searchable. Their presence promotes the wider adoption, standardization, and overall interoperability of metadata by facilitating its discovery, reuse, harmonization, and synergy across diverse disciplines and communities of practice.^[91]

The purpose of *metadata registries* is fairly straightforward: to collect data related to metadata schemas. Since the reuse of existing metadata terms is essential to achieving interoperability among metadata element sets, the identification of existing terms becomes a precondition of any new metadata schema development process. Metadata registries are expected to provide the means to identify and refer to established schemas and application profiles, as well as the means to crosswalk and map among different schemas.^[62] The importance of the management and disclosure roles of registries will increase as more metadata and application profile schemas are developed.

The basic components of a metadata registry include identification of data models, elements, element sets, encoding schemes, application profiles, element usage information, and element crosswalks. In addition to these common components, each registry usually has a specific scope and range. Registries can be categorized as:

- Cross-domain and cross-schema registries, e.g., UKOLN's SCHEMAS Registry.^[92]
- Domain-specific, cross-schema registries, e.g., UKOLN's MEG (Metadata for Education Group) Registry.^[93]
- Project-specific registries, e.g., The European Library (TEL) metadata registry^[94] whose purpose is recording all metadata activities associated with TEL.
- Standard-specific registries, e.g., DCMI Metadata Registry.^[91]

Metadata standards often specify vocabulary encoding schemes (such as controlled term lists, subject heading lists, name authority files, and thesauri) for use in value spaces associated with certain metadata elements or fields. Consequently, metadata registries may also contain, or link to, terms and codes from these schemes (e.g., DCMI Registry also includes the DCMI Type Vocabulary). Thus the term "metadata registry" could also refer to an integrated structure housing both metadata and terminologies.

At a minimal level, *terminology registries* hold *scheme information*, and list, describe, identify, and point to sets of KOS and other types of vocabularies (e.g., dictionaries) available for use in information systems and services. At a higher level, a terminology registry can comprise the *member* terms, classes, concepts, and relationships contained in a vocabulary (either monolingual or multilingual). Related to the terminology registries are *services*, which may also be listed in a terminology registry or

separately hosted in a *service registry*. These services, based on terminology, are used for automatic classification, term expansion, disambiguation, translation, and semantic reasoning.^[95] When registering member terms and classes, the scale of the vocabularies becomes significant, often containing hundreds and thousands of entries, along with the complicated relationships among them.

Efforts to register KOS begin with the set of common attributes that describe them. In 1998, researchers belonging to an informal interest group Networked Knowledge Organization Systems/Services (NKOS)^[96] began developing a set of elements for a registry for thesauri and other subject vocabularies. A taxonomy of KOS was developed so as to better differentiate the types and functions of subject vocabularies.^[97] In 2001, the registry reference document was extended to cover more types of KOS in the second version renamed the NKOS Registry.^[98] It includes two blocks of elements. The first block of elements, *KOS Title* through *Rights*, closely corresponds to the Dublin Core Element Set and is intended for creating metadata descriptions that will facilitate the discovery of KOS resources. The second block of elements is intended for the recording of specific characteristics of a KOS resource which will facilitate evaluation of the resource for a particular application or use. Another work, Vocabulary Markup Language: Metacode strawman DTD, was also proposed in 2001^[99] and has been an area of ongoing research by NKOS members.

The National Science Digital Library (NSDL) Registry project, funded by the National Science Foundation in 2005, was commissioned to develop and deploy an NSDL Registry to complement the existing NSDL Central Metadata Repository. The Registry is designed to conform to the DCMI Registry application, and so enables multiple diverse collection providers as well as other NSDL projects to identify, declare, and publish their metadata schemas (element/property sets) and encoding schemes (controlled vocabularies). Further, the project intends to provide support for registration of vocabulary encoding schemes and metadata schemas for use by human and machine agents, as well as to support machine mapping of relationships among terms and concepts in those schemes (semantic mappings) and schemas (crosswalks).

It is one of the production deployments of SKOS.^[100] The functions of the registry serve across metadata, terminology, and services.

Over the past several years, an eXtended MetaData Registry project has been jointly sponsored by several major government agencies^[101] and is currently hosted by the Lawrence Berkeley National Laboratory at the University of California. This project was initiated with the intent of developing improved standards and technology for storing and retrieving semantics of data elements, terminologies, and concept structures in registries. It plans to propose extensions of the ISO/IEC 11179 Metadata Registry (MDR)^[102] standards, create a prototype extended metadata registry, and load selected KOS into the prototype. The diverse types of complex semantic metadata (i.e., concepts), are registered in more formal, systematic ways (e.g., description logic) to facilitate machine processing of semantics in order to: 1) link together data elements and terms across multiple systems; 2) discover relationships among data elements, terms, and concepts; 3) create and manage names, definitions, terms, etc.; and 4) support software inference, aggregation, and agent services.^[103] This last function leads to what we will discuss next: *terminology services* (Fig. 6).

Terminology services are usually related to or include a registry, but are not limited to registering vocabularies. A terminology service can be defined as a group of *services* that present and apply vocabularies, member concepts, terms, classes, relationships, and detailed explanations of terms which facilitate semantic interoperability. The goals are ambitious: to enable searching, browsing, discovery, translation, mapping, semantic reasoning, automatic classification and indexing, harvesting, and alerting. Terminology services can be machine-to-machine or interactive; user-interfacing services can also be applied at all stages of the search process. For example, in supporting the needs of searching for concepts and the terms representing the concepts, the services can assist in resolving search terms, disambiguation, browsing access, and mapping between vocabularies. As a search support for queries, the services facilitate query expansion, query reformulation, and combined browsing and search. These can be applied as immediate elements of the end user

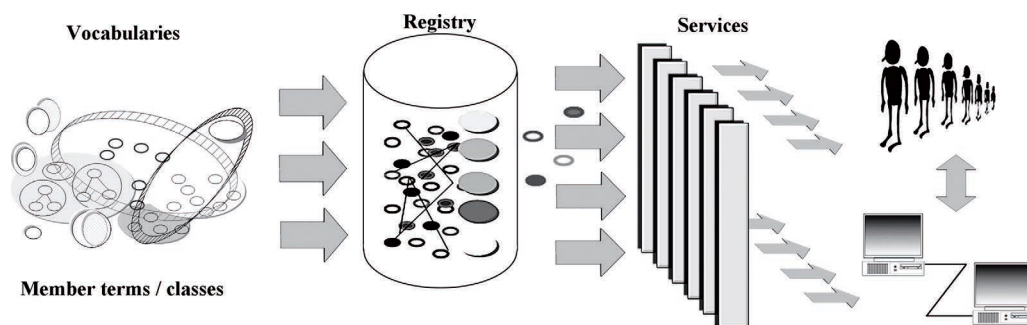


Fig. 6 Terms from metadata and KOS vocabularies registered and used/reused through Web services.

interface, or they can act in underpinning services behind the scenes, depending upon the context.^[104] Technologically, they use Web services to interact with controlled vocabularies, and this represents an entirely new dimension in KOS research and development.

A relevant example is OCLC's Terminology Services project.^[105] As of June 2008, mappings had been made for eight knowledge organization resources through direct mapping (associations between equivalent terms) and co-occurrence mapping (associations based on the co-occurrence of terms from different schemes in the same metadata or catalog record). Co-occurrence mappings are considered to be mapped more loosely than direct mappings, and usually have an intellectual review component.^[106] These services have made records accessible to users through a browser and to machines via the OAI-PMH Web services mechanisms.^[107] OCLC immediately began in 2007 to offer its Terminologies Service™ (more than 10 controlled vocabularies served through a single interface thus far) to its thousands of member institutions throughout the world. In addition to the ability of searching descriptions of controlled vocabularies and their member terms/headings, finding single terms/headings by their identifiers, and viewing term relationships, users can retrieve terms/headings in multiple representations such as HTML, MARC XML, SKOS, and Zthes specifications for thesaurus representation, access, and navigation.^[108]

The High Level Thesaurus (HILT) projects^[109]—a series of research projects funded by the U.K. Joint Information Systems Committee (JISC)—demonstrate a different approach. HILT is concerned with facilitating subject-based access across the broad spectrum of JISC collections that is combined with the automated discovery of relevant collections. HILT has investigated pilot terminology services in collaboration with OCLC Research and Wordmap. DDC was chosen as the central spine for mapping among major vocabularies such as DDC, LCSH, UNESCO Thesaurus,^[110] Medical Subject Headings (MeSH),^[111] and AAT. HILT Phase 3 focuses on developing a machine-to-machine demonstrator based on Web services, the Search/Retrieve Web Service (SRW) protocol,^[112] SKOS Core, and SKOS-type concept URIs. It is being designed so that end users will not access HILT directly; rather, they will be routed through Web-based user services.^[19,113]

Other current operational and experimental terminology services have been reviewed in detail in a report entitled *Terminology Services and Technology* prepared for JISC by Tudhope, Koch, and Heery in 2006.^[104] Since then, more projects have been initiated. The Semantic Technologies for Archaeological Resources (STAR) project, funded by the British Arts & Humanities Research Council (AHRC), is based at the University of Glamorgan. It aims to develop new methods for linking digital archive databases, vocabularies (and associated gray literature), and to exploit the potential of a high-level, core ontology, and natural language processing techniques.^[114] In collaboration with

English Heritage,^[115] a set of extensions to the CIDOC CRM^[21] core ontology have been produced as RDF files. Thesaurus data received from the English Heritage National Monuments Record Centre was converted into the standard SKOS RDF format for use in the project.^[116] The project has developed an initial set of Web services that are based on SKOS representations. The designed function calls can be integrated into a textual- or metadata-based search system. In addition to search and browse concepts in a thesaurus, the service supports semantic expansion of concepts for purposes of query expansion. By an automatic traversal of SKOS relationships, it yields a ranked list of semantically close concepts.^[73]

Another new UKOLN project, Terminology Registries and Services (TRSS), is examining how a registry might support the development of terminology and other services within the context of a service-oriented environment. In particular, it is analyzing issues related to the potential delivery of a Terminology Registry as a shared infrastructure service within the JISC Information Environment.^[95]

Although there is no official recognition or definition regarding the relationships between KOS and ontologies (particularly formal ontologies), there are *ontology repositories* that host formal ontologies, thesauri, and taxonomies together. Practically speaking, artifacts on the ontology spectrum are considered to have not only the OWL ontologies and axiomatized logical theories, but also include traditional and new structures/schemes, from controlled vocabularies, taxonomies, and thesauri to folksonomies, and from KOS schemes to data schema and data models.^[117]

An ontology repository is a facility where ontologies and related information artifacts can be stored, retrieved, and managed. One example is BioPortal,^[118] an open-source repository of ontologies, terminologies, and thesauri that is relevant to biomedicine, developed by the U. S. National Center for Biomedical Ontology. As of June 2008, users may access the BioPortal content (over 100 ontologies) interactively via Web browsers or programmatically via Web services. Downloading, searching, and visualizing are three basic functions of these OWL or Protégé ontologies. Users can search for content within a specific ontology, a group of ontologies, or across all ontologies in the library by: Class/Type Name, Class ID, and other attributes such as definitions and synonyms.

An Open Ontology Repository (OOR)^[119] initiative planning meeting was conducted in January 2008 by ONTOLOG,^[120] an open, international, virtual community of practice. OOR discussions have progressed through a series of mini-conferences that have culminated in the Ontology Summit. With the word “open” added, the ontology repository aims at implementation via open access and compliance with open standards: open technology (with open source), open knowledge (open content), open collaboration (with transparent community process), and

open integration with “non-open” repositories through an open interface.^[121] The project mission and charter of OOR are to

1. establish a hosted registry-repository.
2. enable and facilitate open, federated, collaborative ontology repositories.
3. establish best practices for expressing interoperable ontology and taxonomy work in registry-repositories.^[119,122]

Some current ontology registries/repositories do not provide concept-based mapping. Consequently, most results are based on terms representing concepts, for example, a search for “aging” in an ontology repository may find classes such as “biological imaging methods,” “imaging device,” and so forth that are not relevant to the query. The development of concept-based mapping will be a major and much-needed service, and it will also bring in its wake new challenges for ontology repositories.

CONCLUSION

Semantic interoperability plays a central role in information communication; it has a direct impact on a whole range of interoperability issues. This entry has discussed the importance of semantic interoperability in the networked environment, introduced various approaches contributing to semantic interoperability, and summarized different methodologies used in current projects that are focused on achieving semantic interoperability. The proliferation of repositories, interfaces, metadata models, and semantic technologies accentuates the need for semantic interoperability. The open, networked environment encompasses multiple user communities that employ a plethora of standards for describing and providing access to digital resources. To enable federated searches and to facilitate metadata sharing and management, many efforts have been initiated to address interoperability issues, to overcome numerous obstacles, and to address problems encountered along the way. Nevertheless, new and unforeseen interoperability difficulties continue to emerge. The complexity of interoperability does not stop at the international or industry standards level. Guidelines, rules, measurements, and certification are indispensable at the implementation level to ensure that available standards and technologies are optimized. The foundation of all of these requirements is global collaboration. It should be obvious that in order to build the true Semantic Web, not only must existing issues be addressed, but semantic problems of the future also need to be anticipated where possible.

Interoperability requires commonly agreed-upon standards and protocols at different levels for different levels of interoperability. The prospect is emerging for a broad set of standards across different aspects of terminology

services: persistent identifiers, representation of vocabularies, protocols for programmatic access, and vocabulary-level metadata in repositories.^[19] XML, RDF, RDFS, OWL, and SKOS are the high-level standards that will enable the achievement of semantic interoperability in the networked environment.

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Semantic Web

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Abstract

The “semantic web (SW)” is a vision of a web of linked data, allowing querying, integration, and sharing of data from distributed sources in heterogeneous formats, using ontologies to provide an associated and explicit semantic interpretation. This entry describes the series of layered formalisms and standards that underlie this vision, and chronicles their historical and ongoing development. A number of applications, scientific and otherwise, academic and commercial, are reviewed. The SW has often been a controversial enterprise, and some of the controversies are reviewed, and misconceptions defused.

INTRODUCTION

The semantic web (SW) is an extension, in progress, to the World Wide Web (WWW), designed to allow software processes, in particular artificial agents, as well as human readers, to acquire, share, and reason about information. Whereas the WWW consists largely of documents, which are generally created for human consumption, the SW will be a web of data, making them more amenable for computers to process.^[1] The data will be processed by computer via semantic theories for interpreting the symbols (hence: *semantic* web). In any particular application, the semantic theory will connect terms within a distributed document set logically, and thereby aid interoperability.

For instance, people use a lot of data in daily interactions, viewing bank statements, or digital photographs, or using diaries or calendars. But this does not constitute a web of data, because the data are neither exported from the applications in which they are stored or were created, nor linked to other relevant data. In a genuine web of data, such data could be used seamlessly in a number of applications. For example, one could view one's photographs (which will contain a time stamp) in one's calendar, which would then act as a prompt to suggest what one was doing when they were taken. The data which one uses would be to some extent freed from the constraints of particular applications, and instead could be interlinked and reused creatively.

As another example, Web services can currently be accessed and executed via the Web, but because the Web does not provide much information-processing support, services must be specified using semiformal languages and as with information retrieval humans need to be kept in the loop. Web services described using SW techniques should provide support for autonomous agents and automatic systems.^[2]

The world of linked information is a very unstructured, “scruffy” environment. The amounts of information that

systems need to deal with are very large indeed. Furthermore, systems must pull together information from distributed sources, where representation schemes can be expected to be highly heterogeneous, information quality variable, and trust in information's provenance hard to establish. SW technology needs to be based on standards that can operate in this heterogeneous information world.

The SW therefore requires two types of information standard to operate. First, it requires common formats for integrating information from these diverse sources. And second, it needs a language to express the mapping between the data and objects in the real world, in order to allow a seamless understanding of a distributed set of databases. Hence, for instance, we could signal that a database containing a column *zip code* and another database with a column labeled *ZC*, were actually both referring to the same concept with their different labels, and by creating such a semantic link, we could then start to reason over both databases in an integrated fashion. Such semantic links are often obvious to humans, but not to computers. A key formalism here is the *ontology*, which defines the concepts and relationships that we use in particular applications. Ontologies are central to the SW vision, as providing the chief means by which the terms used in data are understood in the wider context.^[1,3]

THE AIM OF THE SEMANTIC WEB

The aim of the SW is to shift the emphasis of reasoning from documents to data, for three reasons. First, it will facilitate data reuse, often in new and unexpected contexts. Second, it will help reduce the amount of relatively expensive human information processing. Third, it will release the large quantity of information, not currently accessible, that is stored in relational databases (RDBs) by making it directly machine-processable.^[4]

This implies that RDB objects must be exported to the Web as first-class objects, which in practice entails mapping them onto a consistent system of resource identifiers—called Universal Resource Identifiers (URIs—see below). The SW itself is a suite of languages and formalisms designed to enable the interrogation and manipulation of representations which make use of URIs.^[1]

It is hoped that the SW will exhibit the same *network effects* that promoted the growth of the WWW. Network effects are positive feedback effects connected with *Metcalfe's Law* that the value of a network is proportional to the square of the number of users/members. The more people share data that can be mapped onto URIs, the more valuable that data is. As value increases, more agents join the network to get the benefits, and include information that they own in the network which further increases its value. This, like the WWW model, is radically different from other models of the value of information, wherein value is dictated by *scarcity* (copyright, intellectual property restrictions, etc). In decentralized networks like the Web the value of information is dictated by *abundance*, so it can be placed in new contexts, and reused in unanticipated ways.

This is the dynamic that enabled the WWW to spread, when the value of Web documents was seen to be greater in information-rich contexts. One initiative to support the development of the SW is the creation of a discipline of *web science*, which is intended to exploit study of both technical and social issues to predict such matters with more accuracy.^[5,6]

If the SW is to grow in an analogous way, more data has to be exposed to the Web that can be mapped onto URIs. In practice, this means that the data must be exposed in the resource description framework (RDF), an agreed international standard whose role in the SW is described below^[7]; in particular, it can be used not only to assert a link between two resources, but also to name (and therefore make explicit) the relationship that links them. RDF is the language of choice for reuse, because it is a relatively inexpressive language compared to other formalisms used in the SW (see Fig. 1 for a pictorial representation of the layers of formalisms required for the SW vision—expressivity increases as we ascend the diagram). The importance of RDF in this model is dictated by the so-called principle of least power, which states that the less expressive the representation language, the more reusable the data.^[8]

The importance of growth is such that a stage can be reached when reuse of data—one's own or that of other people—is facilitated. There would ideally be so much information exposed in RDF that the contexts into which one's own data can be placed would be rich enough and numerous enough to increase its value significantly. RDF (as described below) represents information as a subject–predicate–object triple each of whose component parts is a URI. If the objects, resources, or representations referred

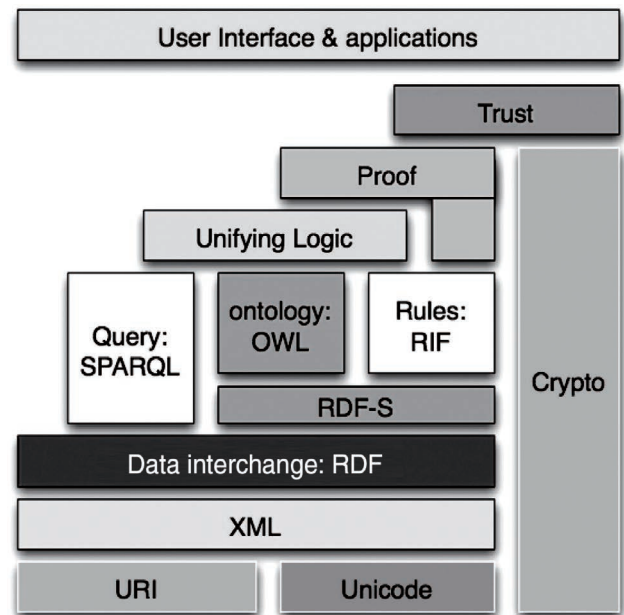


Fig. 1 The layered view of the semantic web.

Source: From A framework for Web Science, by T. Berners-Lee, W. Hall, J.A.; Hendler, K; O'Hara, N.; Shadbolt, D.J. Weitzner, Found. Trends Web Sci. 2006, 1 (1), 1–134.^[6]

to by the URIs are defined in ontologies, then this enables the interoperability at which the SW aims.

Hence another vital component in the SW is the development and maintenance of ontologies. These must be endorsed by the communities that use them, whether they are large-scale, expensive ontologies developed as a result of a major research effort, or relatively ad hoc creations intended to support small-scale collaboration.

Ontologies can also play an important role in bringing (representatives of) two or more communities together for a common purpose, by expressing a common vocabulary for their collaboration, onto which the terms of each discipline can be mapped. Such collaborative efforts are extremely important for reuse of content.^[3]

This is not to say that search and retrieval on the current Web is not of high quality; the methods pioneered by Google and others work very well. Nevertheless, keyword-based search techniques are vulnerable to a number of well-known flaws. Individual words can be ambiguous. A document can refer to a topic of interest without using the keyword. Keywords are language-dependent. Information distributed across several documents cannot be amalgamated by keyword search. And even though PageRank and related algorithms for search produce impressive results, the user still needs to read manually through the ordered list of retrieved pages, and inspect their content to determine relevance to his/her inquiry. This involvement of the user is a hindrance to scalability.

The SW should make more accurate querying possible, using ontologies to help with problems of ambiguity and

unused keywords, and data linking to query across distributed datasets. Furthermore, it should be able to go beyond current search with respect to the three issues of reuse, automation, and exploitation of RDBs. And as well as search and retrieval, the addition of information processing support to the Web will help promote other functions such as Web services and knowledge management.

COMPONENTS OF THE SEMANTIC WEB

At one level, the SW is a complex of formalisms and languages each doing a different job in the representation of information, as shown in Fig. 1. Each formalism is an internationally agreed standard (see below), and the composition of the functions these formalisms serve supports semantically enabled reasoning on data.

At the bottom of this diagram stands the URIs which identify the resources about which the SW provides reasoning capabilities.^[9] The universality of URIs is extremely important—i.e., it is vital that whatever naming convention is used for URIs is adopted globally, so as to create the network effects that allow the SW to add value. Interpretation of URIs must also be consistent across contexts. In other words, when we *dereference* URIs (i.e., when we locate the resource to which the URI refers), we should always get the same object. If these conditions about URI naming schemes are met, then making an association between a URI and a resource means that different people can refer or link to it consistently in their conversations. The other basic formalism, Unicode, is an industry standard that allows computers to represent text in different writing systems.

The next layer up, eXtensible Markup Language (XML), is a language to mark up documents, and a uniform data exchange format between applications.^[10] It allows the insertion of user-defined tags into documents that provide information about the role that the content plays. So, for instance, XML allows one to write a document describing a book, and also to *annotate* the document with machine-readable *metadata* to indicate e.g., who the authors of the book are.

RDF^[7] is a very minimal knowledge representation framework for the Web, which uses a basic subject–predicate–object structure, with the twist that it assigns specific URIs to its individual fields—including in the predicate position, thereby identifying a relationship between the entities identified by the connected nodes. This use of URIs allows us to reason not only about objects but also about the relationships between them. XML is a metalanguage that provides a uniform framework for markup, but it does not provide any way of getting at the *semantics* of data; RDF is the first step toward semantics.

The resource description framework schema (RDFS, sometimes known as RDF(S)^[11]) gives greater scope for sharing information about individual domains; whereas

RDF is a data interchange language that lets users describe resources using their own vocabularies, and makes no assumptions about the domains in question, RDFS provides a basic set of tools for producing structured vocabularies that allow different users to agree on particular uses of terms. An extension of RDF, it adds a few modeling primitives with a fixed meaning (such as class, subclass and property relations, and domain and range restriction).

A key component for SW applications is the *ontology*. Ontologies^[3] are shared conceptualizations of a domain which are intended to facilitate knowledge and information sharing by coordinating vocabulary and allowing basic inference of inheritance and attributes of objects. Several initiatives are developing ontologies, particularly in a number of sciences, which means that the scientists are likely to be among the important early adopters of SW technology (see below). RDFS is an important step toward the SW vision, as the addition of modeling primitives makes it a basic ontology representation language.

However, greater expressivity is likely to be required in the development of more complex ontologies, and the World Wide Web Consortium (W3C) has issued a Web Ontology Language (OWL^[12]) in multiple versions that allows ontologies to be not only represented but also checked for logical properties such as consistency. The three species of OWL are: 1) OWL Full, containing all the OWL primitives, allowing arbitrary combination of those primitives with RDF and RDFS (allowing changes in meaning even of predefined OWL or RDF primitives), but also providing so much expressive power as to make the language undecidable (i.e., it cannot be guaranteed that a computation using the full expressive power of OWL Full will be completed in a finite time); 2) OWL DL, which restricts application of OWL's constructors to each other, and corresponds to a decidable *description logic*, but which is not fully compatible with RDF; and 3) OWL Lite, which sacrifices even more expressive power to facilitate implementation and reasoning.^[12] This set of relations affects the downward compatibility of the SW layer diagram—the only version of OWL that is downward compatible with RDF and RDFS (i.e., so that any processor for that version of OWL will also provide correct interpretations of RDFS) is OWL Full, which is undecidable (pp.113–115).^[13,14]

All varieties of OWL use RDF for their syntax, and use the linking capabilities of RDF to allow ontologies to be distributed—ontologies can refer to terms in other ontologies. Such distributivity is a key property for an ontology language designed for the SW.^[15]

OWL supports some kinds of inference, such as subsumption and classification, but a greater variety of rules and inference is needed. Hence, work is currently ongoing on the Rule Interchange Format (RIF), which is intended to allow a variety of rule-based formalisms, including Horn-clause logics, higher order logics, and production systems, to be used.^[16] Various insights from Artificial

Intelligence (AI) have also been adapted for use for the SW, including temporal (time-based) logic, causal logic, and probabilistic logics.^[1]

Having represented data using RDF and ontologies, and provided for inference, it is also important to provide reliable, standardized access to data held in RDF. To that end, a special query language SPARQL (pronounced “sparkle”), which became a W3C recommendation in January 2008, has been designed.^[17] Logic and proof systems are envisaged to sit on top of these formalisms, to manipulate the information in deployed systems.^[1]

A very important layer is that of *trust*.^[18] If information is being gathered from heterogeneous sources and inferred over, then it is important that users are able to trust such sources. The extent of trust will of course depend on the criticality of the inferences—trust entails risk, and a risk-averse user will naturally trust fewer sources.^[19,20] Measuring trust, however, is a complex issue.^[21] A key parameter is that of provenance, a statement of: 1) the conditions under which; 2) the methods with which; and 3) the organization by which, data were produced. Methods are appearing to enable provenance to be established, but relatively little is known about how information spreads across the Web.^[22]

Related issues include respect for intellectual property, and the privacy of data subjects. In each case the reasoning abilities of the SW can be of value, and initiatives are currently under way to try to exploit them.^[23] Creative commons^[24] is a way of representing copyright policies and preferences based on RDF to promote reuse where possible (current standard copyright assumptions are more restrictive with respect to reuse). And research into the policy aware web is attempting to develop protocols to allow users to express their own privacy policies, and to enable those who wish to use information to reason about those policies.^[25] Cryptography protocols to protect information will also play an important role, as shown in Fig. 1.

ADDITIONAL FACTORS IN SEMANTIC WEB DEVELOPMENT

Infrastructure

Another important part of SW development is the infrastructure that supports it. In particular, if data is to be routinely published to the Web in RDF format, there must be information repositories that can store RDF and RDFS. These *triple stores* (so-called because they store the RDF triples) must provide reasoning capabilities as well as retrieval mechanisms, but importantly must be *scalable*. Examples of triple stores include JENA,^[26] 3store,^[27,28] and Oracle 11g.^[29] OWLIM is a repository which works as a storage and inference layer for the Sesame RDF database, providing reasoning support for some of the more

expressive languages of the SW, RDFS, and a limited version of OWL Lite.^[30,31]

Reasoners

As representation in the SW is more complex than in previous technologies, so is reasoning. The area of SW reasoning has been the focus of much research, in order to infer the consequences of a set of assertions interpreted via an ontology. In such a context, inference rules need clear semantics, and need to be able to cope with the diverse and distributed nature of the SW.

There are a number of important issues of relevance in this area: 1) Under what conditions is negation monotonic (i.e., the addition of new facts does not change the derivation of not-p), or nonmonotonic (including negation as failure, deriving not-p from the failure to prove p)?; 2) How should we handle conflicts when merging rule-sets?; 3) “Truth” on the Web is often dependent on context—how should a reasoner represent that dependence?; 4) How should scalability be balanced against expressivity?; 5) Logic often assumes a static world of given “facts,” but how should it be adapted to the SW, a much more dynamic space where propositions are asserted and withdrawn all the time?; and 6) The heterogeneous nature of the SW means that data in the SW is of varying trustworthiness; how should a reasoner deal with variable reliability? None of these questions has a “correct” answer, but any SW reasoning system needs to address them.

There has been a lot of research on SW reasoning, but an important desideratum is that a reasoner should support the W3C recommended formalisms, in particular supporting OWL entailment at as high a level as possible, and SPARQL querying. Examples include: Jena, an open source SW framework for Java, with a rule-based inference engine;^[32] Pellet, a sound and complete OWL-DL reasoner;^[33] and KAON2, an infrastructure for managing ontologies written in OWL-DL and other SW rule languages.^[34] For a short review of the problems and prospects for SW reasoning, see Fensel.^[35]

Bootstrapping

Bootstrapping content for the SW is one more important issue. Sufficient content is required for the hoped-for network effects to appear. There are initiatives to generate data in RDF and to expose it on the Web as a vital first step. The DBpedia^[36] is based on the Web 2.0 community-created encyclopedia Wikipedia, and is intended to extract structured information from Wikipedia allowing much more sophisticated querying. Sample queries given on the DPpedia Web site include a list of people influenced by Friedrich Nietzsche, and the set of images of American guitarists. DBpedia uses RDF, and is also interlinked with other data sources on the Web. When accessed in late 2007, the DBpedia dataset consisted of

103 million RDF triples. Other examples of linked data applications include the DBLP bibliography of scientific papers,^[37] and the GeoNames database which gives descriptions of millions of geographical features in RDF.^[38]

Even if RDF began to be published routinely, there is still a great deal of legacy content on the Web, and to make this accessible to SW technology some automation of the translation process is required. Gleaning Resource Descriptions from Dialects of Languages (GRDDL) allows the extraction of RDF from XML documents using transformations expressed in Extensible Stylesheet Language Transformations (XSLT) an extensible stylesheet language based on XML. It is hoped that such extraction could allow bootstrapping of some of the hoped-for SW network effects.^[39]

Annotating documents and data with metadata about content, provenance, and other useful dimensions (even including relevant emotional reactions to content^[40]) is also important for the effort to bring more content into the range of SW technologies.^[41] Multimedia documents, such as images, particularly benefit from such annotation.^[42] Again, given the quantities of both legacy data, and new data being created, methods of automating annotation have been investigated by a number of research teams in order to increase the quantity of annotated data available without excessive expenditure of resources.^[41,43,44]

The Social Context: Web Science

The SW vision has been delineated with some care by the W3C, and as has been seen involves an intricate set of connections between a number of formalisms, each of which is designed to do a certain job. As we will describe in the next section, that vision has altered and gained complexity over time.

In general, there are severe complications in the mapping between the microlevel engineering of Web protocols, and the macrolevel social effects that result from large-scale use of the Web. The combination of scales, effects, and phenomena involved is too large to be easily covered by a single discipline, even computer science. The social interactions enabled by the Web place demands on the Web applications underlying them, which in turn put requirements on the Web's infrastructure. However, these multiple requirements are not currently well-understood.^[45] Social studies tend to regard the Web as a given, whereas the Web is rather a world changeable by alterations to the protocols underlying it. Furthermore, the Web changes at a rate that is at least equal and may be faster than our ability to observe and analyze it.

The SW is a development bringing the Web vision to a new level of abstraction, yet the current state of our knowledge of the Web and its relation to off-line society leaves a number of questions unanswered about how it will impact at a large scale. In particular, it is unknown what social consequences there might be of the greater public exposure

and sharing of information that is currently locked in databases. Understanding these consequences is important partly because the developers of the SW want to build a technology that is not harmful to society thanks to emergent social effects, and partly because it is important that the SW goes with the grain of society, in order that it be effective in real-world situations.^[5]

To this end, in 2006 the Web Science Research Initiative (WSRI) was set up as a joint venture by the Massachusetts Institute of Technology and the University of Southampton to foster the interdisciplinary study of the Web in its social and technical context. WSRI's role includes crafting a curriculum for study across the various relevant disciplines; Berners-Lee.^[6] is a detailed review of the wide range of scientific and social-scientific research that is likely to be relevant, including graph and network theory, computer science, economics, complexity theory, psychology, law, etc.

HISTORY AND INTELLECTUAL BACKGROUND

The vision of a web of data was always implicit in the ideas underlying the development of the WWW, and was articulated by Sir Tim Berners-Lee at the first WWW conference in 1994. Berners-Lee is well known as the inventor of the WWW in 1989–1991, and has been a leading figure in the development of the SW. As well as holding chairs at the Massachusetts Institute of Technology, United States, and the University of Southampton, United Kingdom, Berners-Lee is the director of the W3C, which he founded in 1994.

A key moment in the development, and public perception, of the SW was an entry written for *Scientific American* by Berners-Lee, James A. Hendler, and Ora Lassila in 2001.^[46] This entry postulated the next stage of the WWW explicitly as one where data and information, as well as documents, are processed automatically, and envisaged a world where intelligent agents were able to access information (e.g., from calendars, gazetteers, and business organizations) in order to undertake tasks and planning for their owners.

This vision of automation of a series of routine information processing tasks has not emerged at the time of writing (2008). The article's agent-oriented vision distracted attention from the main point of the SW, the potential of a web of linked *data* (as opposed to documents) with shared semantics. Hence, in 2006, Berners-Lee, together with Nigel Shadbolt and Wendy Hall, published another article in the IEEE journal *Intelligent Systems*, which made that point explicitly, and argued that the agent-based vision would only flourish with well-established data standards.^[1]

The *Scientific American* article painted a very enticing picture, but its key message was less to do with the agents and more to do with the semantic information infrastructure that Berners-Lee et al. were advocating. Indeed, the

infrastructure will be used for many knowledge management purposes, not only in allowing agents to communicate. The agent-focused rhetoric of the article has prompted some to argue that the SW is a restatement of the program of AI in the 1960s and 1970s, and will share its perceived failures. We address this question below, in the section entitled “Controversies.”

In 2001 (and before), the conceptualization of the various formal layers of the SW was as shown in Fig. 2, with a fairly straightforward cascade up from URIs to XML and namespaces, to RDF and RDFS, through ontologies to rules, logic, proof and trust (the diagram has been widely distributed, but see e.g., Berners-Lee).^[47] Comparison with Fig. 1 shows how the details of the SW layers have had to be amended over time as implementation has continued. The requirements for expression of ontology-related information has led to an extra complexity from that envisaged in 2001, while the criticism of the SW vision based on the *Scientific American* article has led to a realization that not only the expressive formalisms need to be in place, but also tools and methods need to be created to allow use of SW technologies to integrate smoothly into organizations’ standard information workflows (e.g., Shadbolt, Vargas-Vera, Golbeck and Alani^[1,44,48,49]). This led to a top layer, User Interface, being added to the Fig. 2 structure at a later date.

Where intelligent agency has appeared—and there are currently several applications, including shopbots and auction bots—it has tended to be handcrafted and unable to interact with heterogeneous information types. This is largely because of a lack of well-established scalable standards for information sharing; however, progress is being made toward that goal, especially via the painstaking committee-based standards development processes instituted by the W3C. These standards are crucial for the SW to “take off,” and for the hoped-for network effects of a large number of users to emerge.^[1]

The SW vision has been implemented by standard bodies, such as the Internet Engineering Task Force (IETF) as

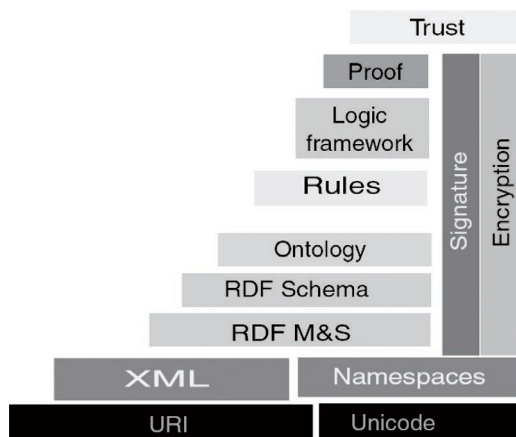


Fig. 2 The early layered view of the Semantic Web.

well as the W3C (the W3C is responsible for standards specific to the WWW), which have orchestrated efforts together with the user community to develop the languages at various levels to share meaning. Once standards are set by the W3C, they are called *recommendations*, acknowledging the reality that with the decentralization of the Web, and a lack of a central authority, standards cannot be enforced. The first RDF standard was specified in 1997 and became a W3C recommendation in 1999, thereby providing a minimal knowledge representation language for the Web with the clear backing of the nascent SW community.

Fixed standards for expressing ontologies appeared later in the process, with RDFS and OWL becoming recommendations in 2004. OWL evolved from other ontology language efforts, including Ontology Inference Layer (OIL)^[50] and DARPA Agent Markup Language (DAML)^[51] whose merged product, DAML+OIL, was the most important predecessor to OWL.^[52] In January 2008, the query language SPARQL became a W3C recommendation, while the RIF was under development in mid-2008.

Fig. 3, created in 2003, illustrates Berners-Lee’s vision of the pattern of SW development using the visual metaphor of a tide flowing onto a beach (this diagram is widely available, but see Connolly).^[53] From top to bottom in the diagram are the various layers of the SW diagram, from trust and proof down to data exchange and markup. From left to right come the various stages in a rough lifecycle from research to deployment: the first stage is a blue-sky research project; the second is the production of a stable system or formalism that is not a standard; the best aspects of these systems are then used as the bases for W3C standards, and the final stage is one of wide deployment. Hence, for instance, early ontology efforts like Cyc and description logics led to efforts such as DAML and OIL, which in turn helped create OWL. Wide deployment of OWL then results in a so-called web of meaning.

The “sea” of research and deployment approaches from the bottom left of Fig. 3 to the top right, as the “tide” comes in. Hence in 1998, various formalisms were in place for all the various levels of representation of the SW, but only XML was a Web standard and beginning to be used widely. By 2003, OWL and RDFS were close to their final forms, and RDF was beginning to be used widely for cross-application interoperability. At the time of writing, the “tide” has advanced further to the right, so work is ongoing on rule language RIF, and query language SPARQL became an official W3C recommendation in 2008. Meanwhile OWL is being used more frequently by ontology builders.

The SW’s history to date is largely one of standard-setting. However, it has also been argued that, analogous to other systems which have spread quickly and grown exponentially, what is needed is a “killer app” (i.e., an application that will meet a felt need and create a perception of the technology as “essential”). Less ambitiously, the SW’s spread depends not only on having an impressive set of formalisms, but also software tools to use

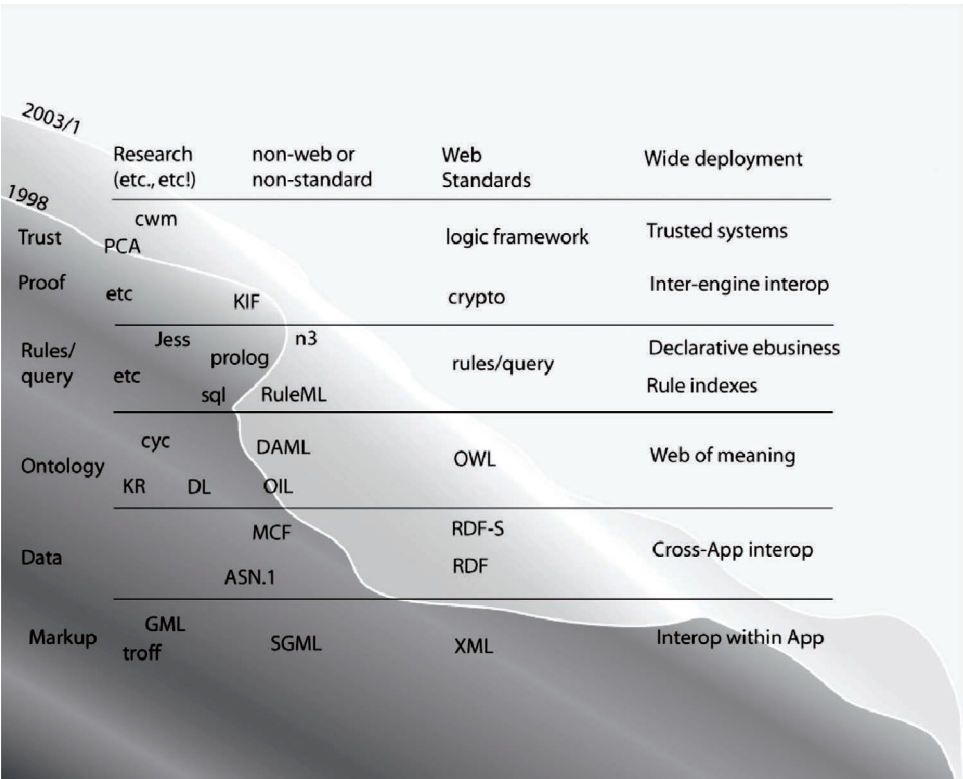


Fig. 3 A representation of the progress of semantic web development.

information represented in those formalisms.^[49] The SW is clearly not, at the time of writing, an information resource in routine use. Nevertheless, there are some applications where SW technologies are serving valuable purposes, and we review some of these in the next section.

real-world systems, before finally looking at some of the more successful academic efforts as judged by the SW development community itself.

Application Areas

There are areas where the SW is already an important tool, often in small focused communities with pressing information-processing requirements and various more or less common goals. Such communities can function as early adopters of the technology, exactly as the high energy physics discipline played a vital role in the development of the WWW. A series of case studies and use cases is maintained in w3.org’s Web site.^[54]

The most important application for SW technology is *e-science*, the data-driven, computationally intensive pursuit of science in highly distributed computational environments.^[55] Very large quantities of data are created by analyses and experiments in disciplines such as particle physics, meteorology, and the life sciences. Furthermore, in many contexts, different communities of scientists will be working in an interdisciplinary manner, which means that data from various fields (e.g., genomics, clinical drug trials, and epidemiology) need to be integrated. Many accounts of distinct and complex systems (e.g., the human body, the environment) consist of data brought from disciplines varying not only in vocabulary, but also in the scale of description; understanding such systems, and the

APPLICATIONS AND SYSTEMS

Properties of Systems

In general, SW projects tend to exhibit a few constant features. They generate new ontologies for the application domain (for example, art, or computer science), and use them to interrogate large stores of data, which could be legacy data or freshly harvested. Hence a body of evidence is building up that ontologies have an important role in mediating the integration of data from heterogeneous sources.

Furthermore, the results of SW projects are generally presented using custom-built interfaces. This hints at a very important research area, which is the development of scalable visualizers capable of navigating the graph of connected information expressed in RDF. As can be seen, the importance of applications and user interfaces was made clear in the latest version of the layered SW diagram (Fig. 1).

In this section we will look at active SW successes, focusing on application areas and types, then commercial/

way in which events at the microscale affect the macroscale and *vice versa*, is clearly an important imperative. Many scientific disciplines have devoted resources to the creation of large-scale and robust ontologies for this and other purposes. The most well-known of these is the *gene ontology*, a controlled vocabulary to describe gene and gene product attributes in organisms, and related vocabularies developed by open biomedical ontologies.^[56] Others include the protein ontology, the cell cycle ontology, Medical Subject Headings (MeSH, used to index life science publications), systematized nomenclature of medicine (SNOMED), and AGROVOC (agriculture, forestry, fisheries, and food).

E-government is another potentially important application area, where information is deployed widely, and yet is highly heterogeneous. Government information varies in provenance, confidentiality, and “shelf life” (some information will be good for decades or even centuries, while other information can be out-of-date within hours), while it can also have been created by various levels of government (national/federal, regional, state, city, and parish). Integrating that information in a timely way is clearly an important challenge (see for instance a pilot study for the United Kingdom’s Office of Public Sector Information, exploring the use of SW technologies for disseminating, sharing, and reusing data held in the public sector.^[57])

Commercial Activity

There is an increasing number of applications that allow a deeper querying of linked data. We have already discussed DBpedia,^[36] DBLP,^[37] and GeoNames.^[38] Commercial applications are also beginning to appear. Garlik^[58] is a company seeking to exploit SW-style technologies to provide individual consumers with more power over their digital data. It reviews what is held about people, harvesting data from the open Web, and represents this in a people-centric structure. Natural Language Processing is used to find occurrences of people’s names, sensitive information, and relations to other individuals and organizations. Declaration of interest: Wendy Hall is chair of the Garlik Advisory Board. Twine^[59] is intended to enable people to share knowledge and information, and to organize that information using various SW technologies (also, like Garlik, using Natural Language Processing). Twine’s developer Nova Spivack has coined the term “knowledge networking” to describe the process, analogous to the Web 2.0 idea of ‘social networking.’

The increasing maturity of SW technology is being shown by the growing number of successful vendors of SW technology. We have already seen OWLIM,^[31] which was developed by Ontotext, a semantic technology lab focused on technologies to support the SW and SW services based in Sofia, Bulgaria, and Montreal, Canada; Ontotext has been and is a partner in a number of major SW research projects.^[60] Ontoprise, based in Karlsruhe,

Germany, is a software vendor for implementing SW infrastructure in large, distributed enterprises; its products include OntoBroker, which provides ontology support using the W3C recommended languages OWL, RDFS and SPARQL, and Semantic MediaWiki+, a collaborative knowledge management tool.^[61] Asemanics, with offices in Italy, Holland, and the United Kingdom, uses a combination of Web 2.0 paradigms with SW technologies such as XML and RDF. The SW technologies are powerful representational tools but are often perceived as hard to use and search, so Asemanics attempts to exploit the perceived usability of Web 2.0 to present data in more widely accepted formats.^[62]

Academic Work: The Semantic Web Challenge

Much of the major work in the SW has been carried out in the academic sphere, and in funded research projects between academic and commercial partners, and is reported in journals and conferences (see end of entry for a list of the more importance conferences). Any review of academic work in this field will inevitably be selective; for the purposes of this entry we will focus on a particular effort to nurture applications, the *Semantic Web Challenge*.

The SW Challenge was created in 2003, and associated with the International Semantic Web Conference (ISWC) of that year. Since then it has become an annual competition to create an application that shows SW technology in its best aspects, and which can act as a “benchmark” application. Hence the SW Challenge gives us a series of illustrative applications thought by researchers’ peers to constitute best SW practice.^[63]

To meet the criteria for the Challenge, a tool or system needs to meet a number of requirements,^[64] which provide a useful characterization of the expectations governing an SW system, and are suggestive of the expected properties of SW applications. For instance, it should use information from sources that are distributed and heterogeneous, of real-world complexity and with diverse ownership. It should assume an open world, and that the information is never complete, and it should use some formal description of the meaning of the data. Optional criteria include a use of data in some way other than the creators intended, use of multimedia, and use of devices other than a PC. Applications need not be restricted to information retrieval, and ideally the system would be scalable in terms of the amount of data used and the number of distributed components cooperating. All these criteria indicate areas where SW systems would be expected to have an advantage.

The winners of the SW Challenge to date are as follows.

2003: CS AKTive Space (University of Southampton), an integrated application which provides a way to explore

the U.K. Computer Science Research domain across multiple dimensions for multiple stakeholders, from funding agencies to individual researchers, using information harvested from the Web, and mediated through an ontology.^[65]

2004: Flink (Vrije Universiteit Amsterdam), a “Who’s Who” of the SW which allows the interrogation of information gathered automatically from Web-accessible resources about researchers who have participated in ISWC conferences.^[66]

2005: CONFOTO (appmosphere Web applications, Germany), a browsing and annotation service for conference photographs.^[67]

2006: MultimediaN E-Culture Demonstrator (Vrije Universiteit Amsterdam, Centre for Mathematics and Computer Science, Universiteit van Amsterdam, Digital Heritage Netherlands and Technical University of Eindhoven), an application to search, navigate, and annotate annotated media collections interactively, using collections from several museums and art repositories.^[68]

2007: Revyu.com (Open University), a reviewing and rating site specifically designed for the SW, allowing reviews to be integrated and interlinked with data from other sources (in particular, other reviews).^[69]

CONTROVERSIES

The SW vision has always generated controversy, with a number of commentators being highly skeptical of its prospects. Let us briefly review some of the disputed issues.

The Semantic Web as “Good Old-Fashioned Artificial Intelligence”

One view holds that the SW is basically a throwback to the project to program machine intelligence which was jokingly christened by John Haugeland “GOFAI” (good old-fashioned AI). This proved impossible: so much of human intelligence is implicit and situated that it was too hard a problem to write down everything a computer needed to know to produce an output that exhibited human-like intelligence. For instance, if a human is told about a room, further explanations that a room generally has a floor, at least three walls, usually four, and a ceiling, and some method of ingress that is generally but not always a door, are not required. But a computer needs to be told these mundane facts explicitly—and similarly every time it is introduced to a new concept.^[70]

One attempt to work around this problem is the Cyc project, set up in 1984, which aims to produce a gigantic ontology that will encode all commonsense knowledge of the type about the room given above, in order to support human-like reasoning by machines.^[71] The project has always aroused controversy, but it is fair to say that over

two decades later, GOFAI is no nearer. The implicit nature of commonsense knowledge arguably makes it impossible to write it all down.

Many commentators have argued that the SW is basically a re-creation of the (misconceived) GOFAI idea, that the aim is to create machine intelligence over the Web, to allow machines to reason about Web content in such a way as to exhibit intelligence.^[72,73] This, however, is a misconception, possibly abetted by the strong focus in the 2001 *Scientific American* article on an agent-based vision of the SW.^[46] Like many GOFAI projects, the scenarios in that article have prominent planning components. There is also continuity between the AI tradition of work on formal knowledge representation and the SW project of developing ontologies (see below).

The SW has less to do with GOFAI as with context-based machine reasoning over content (and the provision of machine-readable data on the Web). The aim is not to bring a single ontology, such as Cyc, to bear on all problems (and therefore implicitly to define or anticipate all problems and points of view in the ontology definition), but rather to allow data to be interrogated in ways that were not anticipated by their creators. Different ontologies will be appropriate for different purposes; composite ontologies can be assembled from distributed parts (thanks to the design of OWL); and it is frequently very basic ontologies (defining simple terms such as “customer,” “account number,” or “account balance”) that deliver large amounts of content. It is, after all, a matter of fact that people from different communities and disciplines can and do interact without making any kind of common *global* ontological commitment.^[1,6,74]

Indeed, we can perhaps learn from the experience of hype and reaction that accompanied the development of AI. There has been a great deal of criticism of AI, but much has been learned from AI research and some AI methods and systems are now routinely exploited in a number of applications. The same may be expected of the SW. We should not expect to wake up one morning with the SW implemented and ready for use. Rather, a likelier model is that SW technologies will be incorporated into more systems “behind the scenes” wherever methods are needed to deal with signature SW problems (large quantities of distributed heterogeneous data).

Arguments for and against Ontologies

The importance of ontologies for the SW has been another point of friction with those who believe the program unrealistic. Ontologies are seen as expensive to develop and hard to maintain. Classification of objects is usually done relative to some task, and as the nature of the task changes, ontologies can become outdated. Classifications are also made relative to some background assumptions, and impose those assumptions onto the resulting ontology. To that extent, the expensive development of ontologies

reflects the world view of the ontology builders, not necessarily the users. They are top-down and authoritarian, and therefore opposed to the Web ethos of decentralization and open conversation. They are fixed in advance, and so they don't work very well to represent knowledge in dynamic, situated contexts.^[75–77]

Furthermore, say the critics, the whole point of the Web as a decentralized, linked information structure is that it reflects the needs of its large, heterogeneous user base which includes very many people who are naïve in their interactions. The infrastructure has to be usable by such people, which argues for simplicity. The rich linking structure of the current Web, combined with statistically based search engines such as Google, is much more responsive to the needs of unsophisticated users. The SW, in contrast, demands new information markup practices, and corporations and information owners need to invest in new technologies. Not only that, but current statistical methods will scale up as the number of users and interactions grows, whereas logic-based methods such as those advocated by the SW, on the other hand, scale less well (cf., e.g., Zambonini).^[78]

Folksonomies

One development as part of the so-called Web 2.0 paradigm (of systems, communities, and services which facilitate collaboration and information-sharing among users) that has drawn attention in this context is that of the “folksonomy.” Folksonomies have arisen out of the recent move to allow users to “tag” content on Web 2.0 sites such as the image-sharing site Flickr, and the video-sharing site YouTube. Having seen content, users are allowed to tag it with key words, which, when the number of users has become large enough, results in a structure of connections and classifications emerging without central control. Their promoters argue that folksonomies “really” express the needs of their users (since all the structure has arisen out of their user-based classifications), whereas ontologies “really” express the needs of authorities who can “impose” their views from the top-down.^[76]

However, folksonomies are much less expressive than ontologies; they are basically variants on keyword searches. A tag “SF” may refer to a piece of science fiction, or to San Francisco, or something else from the user's private idiolect. Indeed, that ambiguity arises even if we make the unrealistic assumption of a monoglot English user community. Once we realize speakers of other languages will use a system, then there are further possible ambiguities—for instance, in German “SF” might refer to the Swiss television station Schweizer Fernsehen.

Resolving This Controversy

When a community is large enough and the benefits clear, then a large-scale ontology building and maintenance

program is justified. In a recent note, Berners-Lee argues that such conditions will be perhaps more frequently encountered than skeptics believe. On the very broad assumptions that the size of an ontology-building team increases as the order of the log of the size of the ontology's user community, and that the resources needed to build an ontology increase as the order of the square of community size, the cost per individual of ontology building will diminish rapidly as user community size increases. Of course these assumptions are not intended to be deeply realistic, so much as indicative of how the resource implications diminish as the community increases in size. Berners-Lee's moral: “Do your bit. Others will do theirs.”^[74]

Even so, not all ontologies need to be of great size and expressive depth. Certainly the claim that has been made that the SW requires a single ontology of all discourse on the model of Cyc, but this is not backed up by the SW community. Such an ontology, even if possible, would not scale, and in a decentralized structure like the Web its use could not be enforced. We should rather expect a lot of use of small-scale, *shallow* ontologies defining just a few terms that nevertheless are widely applicable.^[74] Experience in building real-world SW systems often shows that expectations about the cost and complexity of the ontologies required are overblown, and the ontology-building process can be relatively straightforward and cheap.^[79]

For example, the machine-readable friend-of-a-friend (FOAF) ontology is intended to describe people, their activities, and their relations to other people. It is not massively complex, and indeed publishing a FOAF account of oneself is a fairly simple matter of form-filling (using the FOAF-a-matic tool).^[80] But the resulting network of people (showing their connections to other people) has become very large indeed. A survey performed in 2004 discovered over 1.5 million documents using the FOAF ontology.^[81]

With respect to Folksonomies, it is important to note that ontologies and folksonomies serve different purposes. Folksonomies are based on word tags, whereas the basis for ontology reference is via a URI. One of the main aims of ontology definition is to *remove* ambiguity—not globally, for this may well be impossible, but rather within the particular context envisaged by the developer (see the section on “Symbol Grounding” below). Folksonomies will necessarily inherit the ambiguity of the natural language upon which they are based. And while folksonomies emerge from data-sharing practices, it is not necessarily the case the ontologies are authoritarian; rather, the latter should ideally be *rationalizations* of current sharing practice. This does entail departure from current practice, but not necessarily of great magnitude. Indeed, a strong possibility is to use cheaply gathered folksonomies as starting points for ontology development, gradually morphing the Web 2.0 structures into something with greater precision and less ambiguity.^[82]

Symbol Grounding

An important aspect of the SW is that URIs must be interpreted consistently. However, terms and symbols are highly variable in their definitions and use through time and space. The SW project ideally needs processes whereby URIs are given to objects, such that the management of these processes is by communities and individuals, endorsed by the user community, who ensure consistency. This URI “ownership” is critical to the smooth functioning of the SW.^[1]

But the process of *symbol grounding* (i.e., ensuring a fixed and known link between a symbol and its referent) is at best hard, and at worst (as argued by Wittgenstein, for instance) impossible.^[83,84] Meanings do not stay fixed, but alter, often imperceptibly. They are delineated not only by traditional methods such as the provision of necessary and sufficient conditions, but also by procedures, technologies and instrumentation, and alter subtly as practice alters.

Any attempt to fix the reference of URIs is a special case of symbol grounding, and is consequently hard to do globally. It is certainly the case that attempting to resist the alteration in community practices and norms, and reformulation of meanings of terms, would be doomed.

Yorick Wilks has argued that since much knowledge is held in unstructured form, in plain text, automatic Natural Language Processing techniques, statistically based, can be used to “ground” meanings of terms for the SW.^[73] Berners-Lee, on the other hand, maintains that the SW is necessarily based on logic and firm definitions (even if those definitions were imperfect, or highly situated and task-relative), not words, use patterns and statistics. Wilks’ point is that the aim of defining terms in logic is too idealistic, and anyway depends on false assumptions about ordinary word meaning. Berners-Lee’s counterargument is, in effect, that though meanings are not stable, they can be stable *enough* relative to individual applications and in particular contexts to allow the SW approach to work.

CONCLUSION

The SW has been somewhat misunderstood in some commentaries. Its aim is not to force users to accept large ontologies remote from data-sharing practice imposed by shadowy authorities. Neither is it intended to produce a theory of all discourse, or to reproduce GOFAL. Rather, it is intended to shift the emphasis of the Web from being a web of documents to a web of linked *data*. It is the development of formalisms and technologies facilitating the creation, sharing, and querying of linked data using sharable ontologies to establish common interpretations. For this reason, an alternative name for the SW is the *web of linked data*.

The SW is a work in progress. As it stands, the “buy in” to the SW has not yet produced the desirable network effects, although several disciplines are enthusiastic early adopters of the technology (e.g., the e-science community). And there are still several important research issues outstanding. It is not yet known how best to: 1) query large numbers of heterogeneous information stores at many different scales; 2) translate between, merge, prune, or evaluate ontologies; 3) visualize the SW; and 4) establish trust and provenance of the content.

As complex technologies and information infrastructures are developed, there is a dynamic feedback between requirements, analysis, engineering solutions, and hard-to-predict global behavior of human, machine, and hybrid systems. Understanding how basic engineering protocols governing how computers talk to each other can result in social movements at a very different level of abstraction is very hard, yet essential to realizing the SW vision. Indeed, such understanding, the defining purpose of the discipline of *Web Science*, is essential to ensuring that *any* Web-based information structure is beneficial.^[5]

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9. There are several important annual conferences for the SW community, including: the World Wide Web Conference (WWW); the International Semantic Web Conference (ISWC—pronounced Iss-wick); the European Semantic Web Conference. These conferences preserve their proceedings online.
10. The World Wide Web Consortium's Semantic Web activity page is at <http://www.w3.org/2001/sw/>, and contains references to interviews, manifestos and statements by key SW developers. It also maintains a useful site of case studies and use cases at <http://www.w3.org/2001/sw/sweo/public/UseCases/>. For Web Science, see <http://webscience.org/>.

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Semiotics

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Abstract

This entry deals with the main goals, theories, concepts, and practices of semiotics, as a science of meaning. Based on the fundamental notion of *sign*—anything that has the capacity to stand for something else (real or imagined)—semiotics has a long history behind it that overlaps with those of philosophy and language study. The main notions that undergird the practice of semiotics are examined closely here. These include denotation, connotation, opposition, text, code, and structure. Denotation is the intensional meaning assigned to a sign, while connotation refers to the extensional meanings it gains through usage. Opposition is the technique of sifting out minimal differences in meaning among signs so as to extrapolate an overall meaning structure from them. A text is a form constructed with signs in a structured fashion in order to convey some message; it includes verbal forms (such as books, conversations, etc.) and nonverbal forms (such as body language, paintings, etc.). Codes are the systems that organize the meanings that signs bear in social contexts (language, music, etc.), and structure is the notion that signs bear a patterned relation with each other and that it is through this very relation that they bear meaning.

INTRODUCTION

Semiotics is the discipline that aims to study signs and their functions. A *sign* is any physical form that stands for something other than itself to a specific individual or group in some specific context. A cross figure is such a form. It consists of two lines crossing at right angles. But most people who come across this form in our culture would hardly interpret it as a random (meaningless) shape consisting of two intersecting lines. Rather, they would tend to interpret it as standing for the arithmetical plus sign or for the religion of Christianity, among other things. It all depends on who uses it and in what context it is used. As a form occurring in a math book it would probably stand for the plus sign; as a figure made from two pieces of wood located on a church roof, it would stand instead for Christianity.

Today, semiotics is used mainly as methodological tool to study such sign-based phenomena as body language, art forms, discourses, visual communication, media, advertising, narratives, language, clothing, cuisine, rituals—in a phrase, anything that constitutes meaning-based social activity or behavior. For this reason, it is often referred to as the “science of meaning.” One of its modern-day founders, the Swiss philologist Ferdinand de Saussure (1857–1913), defined it as the science concerned with “the role of signs as part of social life” and “the laws governing them.”^[1]

HISTORICAL SKETCH

The term *semiotics*—from Greek *sēmeiotikos* “observant of signs”—was coined by Hippocrates (ca. 460–370 B.C.E.),

the founder of Western medicine, to designate the study of the symptoms produced by the human body. Hippocrates argued that the particular physical form that a symptom takes—a *semeion* (“mark”)—constitutes a vital clue for finding its etiological source. The form stands not for itself, but for “something invisible”—a disease, malady, or ailment. The concept of *semeion* as a bodily or natural sign was expanded a little later to include human-made forms (such as words) that stood conventionally for ideas or cognitive states. Among the first to tackle the role of conventional signs in cognition was the Greek philosopher Plato (ca. 427–347 B.C.E.), who saw them as forms referring not to specific referents, but to all referents that resemble each other in some identifiable way. For example, the *circle* form does not refer to a singular thing (although it can if need be), but to anything that has the property “circularity.” No matter what “size” the circle form has it is always interpreted as a “circle.” For this reason, Plato argued that signs are not simple replacements for things—a particular drawing of a circle can be altered in size, but it will still be perceived as a circle because it possesses the property of circularity. Plato’s pupil Aristotle (384–322 B.C.E.) argued instead that signs start out as practical devices that do indeed allow us to name singular (specific) things, rather than generic properties (circularity, roundness, etc.). We discover that things have such properties as we go along naming them. It is at such points of discovery that we create more abstract referential domains—words, symbols, etc.—indicating “categories” (plants, animals, objects, etc.).

Eventually, the question arose as to whether or not there was any connection between natural and conventional signs. The Stoics were among the first to deal with this question around 300 B.C.E., arguing that conventional

signs are “evaluative structures,” so to speak, that simply preserve for a specific group what people in that group assess to be useful or important; whereas symptoms (natural signs) are “response structures” produced by biology. The same question was taken up by St. Augustine (354–430 C.E.) in his *De Doctrina Christiana*, in which he describes natural signs (*signa naturalia*) as forms lacking intentionality and conventional ones (*signa data*) as products of human intentions. The former include not only bodily symptoms, but also the colors of plants, the signals that animals emit, and so on; the latter include not only words, but also gestures and the symbols that humans invent to serve their psychological, social, and communicative needs (pp. 24–56).^[2]

For some reason, interest in signs waned shortly after St. Augustine’s writings. It was rekindled in the eleventh century by the Scholastics. Using Augustine’s philosophical ideas and Aristotelian logic as their frames of reference, they asserted that signs captured truths, not simply evaluated them (as the Stoics had claimed). So, a word such as *tree* captured the existence of something real and true—a specific and recognizable type of arboreal plant. But within Scholasticism there were some scholars—called *nominalists*—who argued that “truth” was a matter of subjective opinion and that signs captured, at best, only illusory and highly variable human versions of it. John Duns Scotus (ca. 1266–1308) and William of Ockham (ca. 1285–1349), for instance, stressed that signs, once invented, ended up referring to other signs producing a kind of existential circularity—a perspective that is strikingly akin to some modern theories of the sign. So, for the nominalists, the word *tree* is meaningful because users of the word believe that a particular plant requires identification. The same plant could easily have been subsumed under some other botanically named category (as a subspecies of that category). In effect, there is no truth, just our interpretation (or evaluation) of it. The renowned theologian St. Thomas Aquinas (ca. 1225–1274) countered, however, that one cannot deny that signs such as *tree* refer to real things. The names for these things may vary, but not the “truth” that they exist as such. At about the same time, the English philosopher and scientist Roger Bacon (ca. 1214–1292) developed one of the first comprehensive typologies of signs, claiming that, without a firm understanding of the role of signs in the construction of knowledge, discussing what truth is or is not would end up being a trivial matter of subjective opinion. The first step in understanding how information (raw facts) becomes knowledge is in understanding how signs are used to organize it. Plants constitute an information system, so to speak. They become part of organized knowledge (botany) the instant they are named. Naming the world of objects, events, things, plants, flowers, animals, beings, ideas, etc. allows people to organize the world conceptually, that is, to remember it through the words themselves. Without names the world would not have parts to it, at

least in human cognition. Naming practices bring out what parts are useful or necessary to specific cultures and their knowledge schemes.

It was British philosopher John Locke (1632–1704) who first put forward the proposal of incorporating sign study, which he termed *semeiotics* (recalling Hippocrates’s term), into philosophy in his *Essay Concerning Human Understanding* (1690).^[3] For Locke, semeiotics was useful as an investigative instrument for philosophers, not as a distinct discipline. He thus defined it as the “doctrine” of signs, with *doctrine* meaning “system of principles.” The idea of fashioning an autonomous discipline of sign study did not emerge until the late nineteenth century, when the Swiss philologist Ferdinand de Saussure (mentioned above) put such an idea forward in his *Cours de linguistique générale* (1916), a textbook compiled after his death. Saussure used the term *sémiologie* (English *semiology*) to designate the new discipline. He suggested that the main goal of semiology was to understand the social functions of signs—that is, to study how signs allow people to refer to things in their social environments in specific ways and how these permit people to interact meaningfully.

Today, Locke’s term (*semeiotics*), spelled *semiotics*, is the preferred one. It was reintroduced by another modern-day founder of the discipline, the American pragmatist philosopher Charles S. Peirce (1839–1914), becoming the term adopted by the International Association of Semiotic Studies in the year of its establishment, 1969. The term *significs*, coined by Victoria Lady Welby (1837–1912) in her correspondence with Peirce, is also used occasionally in the technical literature, but with a specific sense—the study of the relation of signs to the senses and the emotions. Although his writing style is rather dense, Peirce’s ideas have come to constitute the theoretical platform upon which the study of signs is now elaborated.^[4] Perhaps Peirce’s greatest insight is that signs are “informed hunches” as to what something means in human terms. In other words, we sense a necessary psychological relation between the sign-forms we create and use and the things they stand for.

Following on the coattails of Saussure and Peirce, a number of key scholars developed semiotics into the sophisticated discipline that it has become today. Only a few can be mentioned here. The philosopher Ludwig Wittgenstein (1889–1951) suggested that signs were pictures of reality.^[5] Each time we utter or hear a word such as *tree*, a generic image of the plant comes inevitably to mind. When we combine it with *apple*, that image is rendered more precise (in contrast to, say, a *fig tree*). Wittgenstein’s view of the sign continues to inform a large part of semiotic theory and practice. The American semiotician Charles Morris (1901–1979) divided semiotic method into: 1) the study of sign assemblages, which he called *syntactics*; 2) the study of the relations between signs and their referents, which he called *semantics*; and 3) the study of the relation between signs and their social uses, which he called *pragmatics*.^[6,7] The Russian-born

American semiotician Roman Jakobson (1896–1982) studied various facets of sign construction, but is probably best known for his semiotic model of communication, which suggests that sign exchanges in communication are hardly ever neutral but involve subjectivity and goal-attainment of some kind—that is, when we speak we intend to get something out of it, and the nature of the signs used bears this out.^[8] The French semiotician Roland Barthes (1915–1980) illustrated the power of using semiotics for unmasking the hidden meanings in popular spectacles such as wrestling matches and Hollywood blockbuster movies (1957). French semiotician Algirdas J. Greimas (1917–1992) developed the branch of semiotics known as *narratology*, which studies the underlying structure of narratives.^[9] The late American semiotician Thomas A. Sebeok (1920–2001) expanded the semiotic paradigm to include animal signaling systems, which he termed *zoosemiotics*, and sign use among all species (including plants), which has come to be called *biosemiotics*.^[10] The interweaving and blending of ideas, findings, and scientific discourses from different disciplinary domains was, Sebeok claimed, the distinguishing feature of semiotics. Finally, Italian semiotician Umberto Eco (b. 1936) has contributed significantly to our understanding of how we interpret sign assemblages such as texts.^[11] For example, a *closed* text, such as a traditional detective novel, revolves around clues that lead inescapably to the identity of the perpetrator of a crime. This is the goal of that type of text, unless it is constructed to accomplish something more (such as the mystery stories of Alfred Hitchcock). On the other hand, an *open* text, such as a novel by James Joyce or Virginia Woolf, leaves the interpretive domain open, since it does not lead to an inescapable conclusion (as does a detective novel).

MEANING

The underlying object of semiotic inquiry is, as mentioned, what *meaning* is and how it unfolds in human activities. What is meaning? A little reflection will reveal that *meaning* is a confusing term. As the psychologists Charles Ogden and I. A. Richards showed in their classic 1923 work, *The Meaning of Meaning*, there are at least 23 meanings of this word in English.^[12]

He <i>means</i> to study jurisprudence. =	“intends”
A red light <i>means</i> stop. =	“indicates”
True love <i>means</i> everything. =	“has Importance”
The way she stared was full of <i>meaning</i> . =	“special import”
Does life have a <i>meaning</i> ? =	“purpose”
What does that word <i>mean</i> to you? =	“convey”
And so on.	

To avoid ambiguity, the terms *semiosis* and *signification* are used instead by semioticians. The former refers to the psychological process itself of producing and recognizing specific forms as signs (p. 32, 41).^[13] The latter is the

mental image that crops up in the brain the instant a sign is used. Signification involves two main meaning-making processes—reference and sense. Reference is the process itself of identifying something in the sign-form; sense is what that form elicits psychologically, historically, and socially. Signs (such as words) may refer to the same (or similar) things, known as *referents*, but they have different senses. For example, the “long-eared, short-tailed, burrowing mammal of the family Leporidae” can be called *rabbit* or *hare* in English. Both words refer essentially to the same kind of mammal. But there is a difference of sense between the two words—*hare* is the more appropriate term for describing the mammal if it is larger, has longer ears and legs, and does not burrow. Another difference is that a *rabbit* is often perceived to be a “pet,” while a *hare* is unlikely to be perceived as such. The German philosopher Gottlob Frege (1848–1925) was among the first to point out the difference between sense and reference,^[14] which he called *Sinn* and *Bedeutung* respectively. This same dichotomy was exemplified practically by philosopher Willard O. Quine (1908–2000). Think of a linguist who overhears the word *Gavagai* from the mouth of a native informant when a rabbit is sighted scurrying through the bushes, Quine (pp. 102–129)^[15] suggests. The linguist cannot determine what the word refers to—“rabbit,” “undetached rabbit parts,” or “rabbit stage”—because all of these are senses associated with that word. The sense, therefore, will remain indeterminate unless it can be inferred from the context in which *Gavagai* occurs.

There is also another aspect of signification that merits mention here—definition. Definition is an analytical technique; it is a statement made about what something means consisting of words and other signs (for example, pictures). As useful as it is, definition leads inevitably to circularity. Take the dictionary definition of *cat* as “a small carnivorous mammal domesticated since early times as a catcher of rats and mice and as a pet and existing in several distinctive breeds and varieties.” The problem with this statement is its use of *mammal* to define *cat*. In effect, it has replaced the latter with the former. So, what is the meaning of *mammal*? A *mammal*, it states elsewhere, is “any of various warm-blooded vertebrate animals of the class Mammalia.” But this definition is hardly a viable solution. What is an *animal*? The dictionary defines *animal* as an *organism*, which it defines, in turn, as an individual form of *life*, which it then defines as the property that distinguishes living *organisms*. At that point the dictionary has gone into a referential loop, since it has employed an already-used concept, *organism*, to define *life*. This circular pattern surfaces in all domains of signification. It suggests that signs can never be understood in the absolute, only in relation to other signs.

In contemporary semiotics, the terms *denotation* and *connotation* are preferred to reference and sense. Consider, again, the word *cat*. The word elicits an image of a “creature with four legs, whiskers, retractile claws,” etc. This is its *denotative* meaning. It allows users of the sign to determine if something real or imaginary under

consideration is an exemplar of a “cat” or not. Denotative meaning thus divides the world or reference into yes-no domains—something is either a cat or it is not. The word *denotation*, incidentally, is derived from the compound Latin verb *de-noto* “to mark out, point out, specify, indicate.” The noun *nota* (“mark, sign, note”) itself derives from the verb *nosco* (“to come to know,” “to become acquainted with” and “to recognize”). All other meanings of the word *cat* are *connotative*—as can be seen in “He’s a real cool cat;” “She let the cat out of the bag;” and so on. These meanings are products of the historical associations forged between cats and socially significant concepts or processes. Connotation also encompasses emotional cues. Consider the word *yes*. In addition to being a sign of affirmation (denotative meaning), it can have various emotional senses (connotative meanings), depending on the tone of voice with which it is uttered. If one says it with a raised tone, as in a question, “Yes?” then it would convey doubt or incredulity. If articulated emphatically, “Yes!” then it would connote triumph, achievement, or victory.

Connotation is not an option, as some traditional philosophical and linguistic theories of meaning continue to sustain to this day; it is something we are inclined to extract at a *prima facie* level from a sign. The numbers 7 and 13 have specific denotative meanings—each digit stands for a specific quantity of things. But in our culture both invariably reverberate at the same time with connotative meanings such as “fortune,” “destiny,” “bad luck,” and so on. Abstract concepts, such as *motherhood*, *masculinity*, *friendship*, and *justice*, are particularly high in connotative content. In 1957, the psychologists Charles Osgood, G. J. Suci, and P. H. Tannenbaum^[16] showed this empirically by using a technique that they called the *semantic differential*, a technique consisting in asking a series of questions to subjects about a particular concept—*Is X good or bad? Should Y be weak or strong?* etc.—which they rate on seven-point scales. The ratings are collected and analyzed statistically in order to sift out any general pattern they might bear. Suppose that subjects are asked to rate the concept “ideal American president” in terms of the following scales: *Should the president be:* 1) *young or old?* 2) *practical or idealistic?* 3) *modern or traditional?* 4) *male or female?* and so on. A subject who feels that the president should be more “youngish” than “oldish” would place a mark toward the *young* end of the first scale; one who feels that a president should be “bland,” would place a mark toward the *bland* end of the *attractive-bland* scale; and so on. If a statistically significant sample of subjects rated the president in this way, we would get a “connotative profile” of the American presidency in terms of the culture-based variations in sense that it evokes. Research using the semantic differential has shown, for example, that connotation is invariably culture-specific—a concept such as *noise* turns out to be a highly emotional one for the Japanese, who rate it consistently at the ends of the scales presented to them; whereas it is a fairly neutral concept for Americans, who tend to

rate it on average in the mid-ranges of the same scales. Connotation is not, therefore, open-ended; it is constrained by a series of culture-specific factors. Without such constraints, our signification systems would be virtually unusable.

Although it has a long history behind it in philosophy, the distinction between denotation and connotation, as we understand it today, was used for the first time by the American linguist Leonard Bloomfield in his seminal 1933 book called *Language*. This distinction was elaborated upon a little later by Danish linguist Louis Hjelmslev^[17] and French semiotician in various works.

Semiotics also makes an important distinction between the terms *image* and *concept*. The former is the mental picture of a referent that is evoked when a sign is used; the latter is the culture-specific interpretation that is assigned to that picture. There are two types of concepts—concrete and abstract. The former is the concept that is formed when a sign refers to something that can be seen, heard, smelled, touched, tasted—that is, observed in some direct sensory way. The latter is the concept formed when the sign is to something that cannot be perceived in such a direct sensory fashion. A “cat” constitutes a concrete concept because the existence of a real cat in the physical world can be perceived and thus easily pictured in the mind. On the other hand, “love” is an abstract concept because, although it can be experienced emotionally, it cannot be observed directly—that is, the emotion itself cannot be separated from the behaviors, states of mind it produces. The mental image that it evokes is, thus, abstract (imaginary).

The distinction between concrete and abstract concepts is only a general one. In actual fact, there are degrees and layers of concreteness and abstraction. At the highest level, called the *superordinate* level by psychologists, concepts are considered to have a highly general classificatory (abstract) function. So, for example, in the dictionary definition of *cat* (above), the related concept of *mammal* would be viewed as a superordinate concept, because it refers to the general category of animals to which a cat is perceived as belonging. Then, there is the *basic* or *prototypical* level, which is where the word *cat* itself would fit in. This is the level where basic types of mammals are classified—cats, dogs, goats, hogs, horses, etc. The third level, called the *subordinate* level, is where more detailed ways of referring to something occur. There are, in fact, many types (breeds) of cat—*Siamese*, *Persian*, *Abyssinian*, *Korat*, etc.—which allow us to refer to culturally meaningful differences in detail. However, such notions as levels and hierarchies in concept-formation are problematic, as Umberto Eco pointed out in his 1984 book *Semiotics and the Philosophy of Language*. The main difficulty, he suggested, is that decisions as to where a concept belongs in a hierarchy invariably end up being a matter of subjective choice.

Ultimately, the meanings that signs capture allow people to recognize certain patterns in the world over and over

again. Signs are thus closely tied to social needs and aspirations, creating an ongoing dialogue between people that would otherwise never come into being—a fact emphasized by many semioticians, especially the Russian theorist Mikhail Bakhtin (1895–1975). Bakhtin went so far as to claim that signs gain meaning only as they are exchanged by people in actual social dialogue or discourse.^[18] In effect, he maintained that all human meaning is constructed dialogically (socially).

SIGNS

Semiotic inquiry is guided by two fundamental models of the sign—known as Saussurean and Peircean. Saussure saw the sign as a binary form—a structure with two components, namely a physical part, such as the sounds that make up the word *cat*, called the *signifier*, and the concept that the sign elicits, called the *signified* (p. 101).^[1] Saussure claimed, moreover, that there is no necessary psychological motivation or reason for creating the word *cat* other than the social need to do so. Any other signifier would have done the job just as effectively. This is why his model of the sign is also called “arbitrary.” Peirce put forward a “triadic” model of the sign—a structure consisting of the actual physical sign-form, called the *representamen*, the thing to which it refers, termed the *object*, and the meanings that it elicits in real-world situations, called the *interpretant* (Peirce 1931–1958: Volume 2, 247–248, 307). The interpretant constitutes itself a “derived” sign, because it entails the further production of meanings (senses) arising from the context in which a sign is used. In our culture, a *cat* is considered to be a domestic companion, among other things; in others it is viewed primarily as a sacred animal; and in others still it is considered to be a source of food. Thus, while the sign refers to virtually the same mammal in different cultural contexts (no matter what name is used), its interpretant varies considerably.

Peirce also developed a comprehensive typology of signs, identifying 66 types in total. Newcomers to semiotics often react with perplexity to his typology, which consists of seemingly obscure and unfathomable notions such as *qualisigns*, *sinsigns*, and *legisigns*. But his terminological style is actually quite straightforward. As its name implies, a *qualisign* is a sign that draws attention to some *quality* of its referent (the object it represents). In language, an adjective is a *qualisign* since it draws attention to the qualities (color, shape, size, etc.) of things. In other sign systems, *qualisigns* include colors (painting), harmonies and tones (music), etc. A *sinsign* is a *representamen* that *singles out* a particular object—a pointing finger and the words *here* and *there* are examples of *sinsigns*. A *legisign* is a form that designates something by convention (literally “by law”). *Legisigns* include various kinds of symbols and emblems such as those used on flags and

logos. Unlike Saussure, Peirce viewed sign-creation as originating in the perception of some property in an object. For this reason, he called the initial act of sign-construction a “firstness” event. Firstness is, more technically, a tendency to forge signs as simulations of objects (or other sign-forms for that matter). The outcome is a sign that resembles what it stands for in some way. Peirce called such a sign an *icon*. Portraits are icons of human faces (and what they mean); onomatopoeic words are icons of sounds made by certain objects or actions (*drip*, *bang*, etc.); and so on. The referents of icons can be figured out even by those who are not a part of the culture, if they are told how icons simulate, resemble, or substitute them. A “secondness” tendency in sign-creation consists in relating objects in some way. He called signs that result from this tendency *indexes*. The pointing finger is a basic example of an index. When we point to something, we are in fact relating it to our location as pointers. If it is close by we refer to it as *near* or *here*. If not, we refer to it as *far* or *there*. Finally, a “thirdness” tendency consists in creating signs in historically based or conventional ways. Peirce called signs that result from this tendency *symbols*. The cross figure used to stand for Christianity is a perfect example of a symbol. Although it represents the figure of a cross on which Christ was crucified iconically, it is interpreted historically and conventionally as a sign standing for the religion that was founded after Christ’s death.

Despite the obvious richness and breadth of Peircean sign theory, the Saussurean model continues to enjoy wide use among semioticians because it is a much more expedient one to apply, especially in the initial phases of analysis. Signifiers can easily be separated from contexts of occurrence and studied abstractly in relation to signifieds, albeit somewhat artificially. Peirce’s model, however, has proven to be a more insightful and all-encompassing one in the development of a comprehensive theory of meaning.

STRUCTURE, TEXT, AND CODE

In order to extract meaning from a form, one must be able to recognize it as a sign in the first place. This means that it must have *structure*. Specifically, a form is a sign if: 1) it is physically distinctive; and 2) it is constructed in a predictable or recurring way. The former is called, more specifically, *paradigmatic* and the latter *syntagmatic* aspects of sign-structure. What keeps the words *cat* and *rat* recognizably distinct? It is, of course, the initial sound. The phonic difference between *c* (= /k/) and *r* (= /r/) is, in fact, what allows us to recognize the two words as different signs. Paradigmatic structure is a feature of all types of signs, not just words. In music, a major and minor chord of the same key are perceivable as distinct on account of a half tone difference in the middle note of the chord; the left and right shoes of a pair are identifiable as different in

terms of the orientation of each shoe; raising the index and middle fingers in a vertical orientation can mean “victory,” “peace” (among other meanings), but aiming the same two fingers in a horizontal way at someone would be interpreted instead as a threat; and so on.

The words *cat* and *rat* are legitimate signs, not only because they are recognizable as different in a specific way, but also because the combination of sounds with which they are constructed is consistent with English syllable structure. On the other hand, *pfat* would not be recognized as a legitimate word in English because it violates an aspect of such structure—English words cannot start with the cluster *pf*. Syllable structure is an example of *syntagmatic* structure. Syntagmatic structure too is found in the composition of all kinds of signs. In music, for instance, a melody is recognizable as such only if the notes follow each other in a certain way (e.g., according to the rules of harmony); two shoes are considered to form a pair if they are of the same size, style, and color; and so on.

The sign can take any form, or “size,” we desire to give it—it can be something “small,” such as a word or two fingers raised in a vertical way; or it can be something much “larger,” such as a mathematical equation or a narrative. If we ask a mathematician what $c^2 = a^2 + b^2$ means, he or she would instantly recognize it as an equation (the signifier) standing for the Pythagorean theorem (the signified). If we ask someone who has just read a novel (the signifier), what he or she got out of it, we would receive an answer that reveals a perception of the novel as a form containing a hidden message or purpose (the signified).

In contemporary semiotic theory, such “larger signs” are called *texts*, rather than simply signs; and the meanings they encode are called *messages*. The term text embraces such things as conversations, letters, speeches, poems, myths, novels, television programs, paintings, scientific theories, musical compositions, and so on. Texts are composite structures (signs made up of smaller signs), but they are still signs, that is, they are not interpreted in terms of their constituent parts, but holistically as single meaning-bearing structures. This is why when we ask someone what a novel means, he or she couches the answer in terms of the message he or she extracts from it, not in terms of the words it contains.

Texts are used primarily to carry out *representation*—defined as the use of signs (words, pictures, sounds, etc.) to relate, depict, portray, or reproduce something perceived, sensed, imagined, or felt in some textual form. As an example, consider the concept of *sex*. This is something that exists in the world as a biological and emotional phenomenon. Perceiving it as something meaningful, humans across cultures have represented sex in various textual forms throughout their history. For example, in our culture, common textual representations of *sex* include: 1) a photograph of two people engaged in kissing

romantically; 2) a poem describing the various emotional aspects of sex; or 3) an erotic movie depicting the more physical aspects of sex. Each of these constitutes a specific kind of textual form. The meanings (messages) that each captures are built into it not only by its maker, but also by certain preexisting notions relative to the culture in which it was made. Representations of sex in, say, Paris are thus going to be different from representations of it Bombay or San Francisco. Moreover, the type of text or medium used to portray the object of sex also shapes its interpretation. Photographs can show fairly limited views of sexual activities, whereas movies can provide much more graphic detail. Finally, the ways in which people living in Paris, Bombay, or San Francisco will derive meaning from the representations of sex will vary widely. This is because they have become accustomed in their specific cultures to different perceptions of what sex is.

Text-making implies knowledge of how signs cohere into systems—words, figures, digits, sounds, etc. To enter into a conversation, for example, one would need to know the language system involved. This provides the signs (words, tones, etc.) and specifies the relations that these bear to each other for the purpose of making verbal messages. The term used in semiotics to refer to such a system is *code*. Language, dress, music, and gesture are examples of codes. These can be defined, more formally, as systems of signs that have specific paradigmatic and syntagmatic properties and, thus, can be used over and over to encode and decode texts. There are many kinds of codes. For example, *intellectual codes* contain signs in them (numbers, words, symbols, etc.) that allow for representational activities of a logical, mathematical, scientific, or philosophical nature; *social codes* (dress, gender, food, space, etc.) contain sign-structures for making messages in socially appropriate ways and for regulating interpersonal activities. Food codes, for example, underlie how people interpret certain foods as signifiers of various rituals, meanings, etc. This is the reason why many Christians say grace before starting a meal together or Jews say special prayers before partaking of wine and bread.

Codes may also have a *contextual* function. Consider a discarded and damaged beer can. If one were to come across this item on a sidewalk on a city street, one would no doubt view it as a piece of garbage or rubbish. But if one saw the very same object on a pedestal, displayed in an art gallery, and given a title such as “Waste,” then one would be inclined to interpret it in a vastly different way. One would, in fact, interpret it as an artistic text, decrying a throw-away or materialistic society. Clearly, the can’s physical context of occurrence and social frame of reference—its location on a sidewalk versus its display in an art gallery—will determine how we will interpret it. The art gallery is, in effect, a social code. This is why we interpret anything that is put on display within it as “art,” rather than as something else (pp. 34–39).^[19]

OPPOSITION

To identify forms as meaning-bearing structures, the so-called technique of *opposition* was used by Saussure in the *Cours*, where he called it *différence*. As we saw above, by opposing the word *cat* to the word *rat* we will be able to establish that the consonants /k/ and /r/ are meaning-signaling phonic cues in English. As a technique, opposition was further elaborated by a number of linguists who congregated in Prague in the early 1920s. The linguist Trubetzkoy,^[20,21] for example, called word pairs such as *cat-versus-rat* that differed by only one sound in the same position *minimal pairs*. Opposition was also used by the same linguists to examine higher-level semantic *différences* such as synonymy (*big-large*), antonymy (*big-little*), taxonomy (*rose-flower*), part-whole relations (*handle-cup*), and so on. As C. K. Ogden (p. 18),^[22] an early promoter of opposition theory claimed, “the theory of opposition offers a new method of approach not only in the case of all those words which can best be defined in terms of their opposites, or of the oppositional scale on which they appear, but also to *any* word.” In the 1930s and 1940s, semioticians started noticing that oppositional structure was not confined to language. It cropped up in the analysis of nonverbal systems and codes as well. For example, in the integer system of numbers, oppositions include *positive-versus-negative*, *odd-versus-even*, and *prime-versus-composite*; in music, basic oppositions include *major-versus-minor* and *consonant-versus-dissonant*; and so on.

The Prague School linguists also argued that there were levels or orders of oppositions. In arithmetic, for example, the *addition-versus-subtraction* opposition is the basic one while the *multiplication-versus-division* opposition is a derived one—since multiplication is repeated addition and division repeated subtraction. The *addition-versus-subtraction* opposition is thus a first-order opposition and the derived *multiplication-versus-division* opposition a second-order opposition. In an analogous vein, French semiotician Algirdas J. Greimas later introduced the notion of the “semiotic square” to connect sets of oppositions.^[9] Given a sign (for example, *rich*), Greimas claimed that we determine its overall meaning by opposing it to its contradictory (*not rich*), its contrary (*poor*), and its contradictory (*not poor*) in tandem. Also, as work with the semantic differential showed in the 1950s (mentioned above), there are also gradations within the binary oppositions themselves, which are due to culture-specific connotative processes. Anthropologist Claude Lévi-Strauss also entered the debate on opposition theory in the same decade by showing that pairs of oppositions often cohere into sets forming recognizable units. In analyzing kinship systems, Lévi-Strauss^[23] found that the elementary unit of kinship was made up of a set of four oppositions: *brother* vs. *sister*, *husband* vs. *wife*, *father* vs. *son*, and *mother’s brother* vs. *sister’s son*. Lévi-Strauss suspected that

similar sets characterized units in other cultural systems and, thus, that their study would provide fundamental insights into the overall nature of human social organization.

Although the idea goes right back to Aristotle, the cognitive importance of opposition was noticed by the psychologists Wilhelm Wundt (1832–1920) and Edward B. Titchener (1867–1927), who were the ones to term it *opposition*. Its use in semiotics and linguistics is due, as mentioned, to Saussure and the Prague School linguists.^[24–26] Since its introduction, the theory has often been criticized as being artificial and not really consistent with human psychology. However, already in the 1940s Jakobson^[27] argued that the notion could, actually, be used to explain the psychology of language development. He noted that sound oppositions that occur frequently are among the first ones learned by children. Nasal consonants—/n/ and /m/—exist in all languages; and they are also among the earliest sounds acquired by children. On the other hand, consonants pronounced near the back of the throat are relatively rare and, seemingly, are among the last sounds to be acquired by children. In other words, the theory of opposition predicts the sequence of phonemic acquisition in children.

Research on metaphor since the latter part of the 1970s^[28–31] has also serendipitously discovered that opposition theory has psychological validity. American linguist George Lakoff and philosopher Mark Johnson started the ball rolling by claiming that a simple linguistic metaphor such as “John is a gorilla” is really a token of something more general, namely, a conceptual metaphor that has the cognitive structure *people are animals*.^[29] This is why we can also say that *John* or *Mary* or whoever we want is a *gorilla*, *snake*, *pig*, *puppy*, and so on. Each specific linguistic metaphor (“John is a gorilla,” “Mary is a snake,” etc.) is not an isolated example of poetic fancy. It is an instantiation of a more general conceptual metaphor—*people are animals*. The question becomes: How are such concepts formed? They are formed through *image schemata*.^[32,33] The source for the *people are animals* conceptual metaphor seems to be an unconscious perception that human personalities and animal behaviors are linked in some way. In other words, it is the consequence of an ontological opposition: *humans-versus-animals*. This is yet another type of opposition—one in which the two poles are not contrasted (*night-versus-day*), but equated. This suggests that oppositional structure operates in a noncontrastive way at the level of figurative meaning.

POSTSTRUCTURALISM

The most severe critiques of opposition theory started in the 1950s, revolving around the relative notion of *markedness*.^[34–37] In minimal pairs such as *night-versus-day*, the question becomes: Which of the two poles is the more

basic one (culturally or psychologically)? The more basic (or default) one is called the *unmarked* pole and the other the *marked* pole. In pairs such as *night-versus-day* it is easy to identify *day* as the unmarked form and *night* as its marked counterpart. This fact comes out in many signifying forms and representations. For example, we ask “How many days are left before your birthday?” not “How many nights are left before your birthday?” Now, consider the *male-versus-female* opposition. In this case, the choice of one or the other as the unmarked pole is problematic and culture-specific. In patrilineal societies the unmarked form is *male*; but in matrilineal ones, as the Iroquois one,^[38] it is *female*. This difference in markedness has social consequences. In English, gendered terms like *chairman*, *spokesman*, etc. were often cited in the not-too-distant past as examples of how the English language predisposed its users to view certain social roles in strict gender terms, with the masculine gender being considered the unmarked one. Feminist critics maintained (correctly) that English grammar and vocabulary were organized from the perspective of those at the center of the society—the men.

Some scholars, especially Michel Foucault (1926–1984) and Jacques Derrida (1930–2004), started to see opposition theory itself as flawed and the unwitting source of social inequalities.^[39,40] Their refutations of this central structuralist technique led to the movement known as *poststructuralism*. To Derrida, the oppositions identified by linguists and semioticians were the result of an endemic logocentrism in western culture, not the result of some tendency present in the human brain. Saussure had emphasized that every sign is understandable in terms of its difference from other signs. In contrast to Saussure’s idea of *différence*, Derrida invented the word *différance* (spelled with an “a,” but pronounced in the same way), to intentionally radicalize Saussurean theory. With this term Derrida aimed to show that Saussure’s so-called discoveries were unwitting biased ones, given the atmosphere of scientific logocentrism in which he operated, and which veiled from him the logic of *différance*—namely that a science of language cannot succeed because it must unfold through language and thus partake of the slippage (as he called it) it discovers.

Derrida argued that all sign systems are self-referential—signs refer to other signs, which refer to still other signs, and so on ad infinitum. Thus, what appears to be stable and logical to the language scientist turns out to be illogical and paradoxical. Many semioticians and linguists have severely criticized post structuralism. It has nevertheless had a profound impact on many fields of knowledge, not just semiotics and linguistics. So what do post structuralists analyze and how does post structuralism differ from traditional structuralist practice? From many points of view, post structuralism is really nothing more than structuralism expanded to include a few radical ideas. One of these is clearly logocentrism—the view that all human knowledge is constructed by linguistic categories.

Because written language is the fundamental condition of knowledge-producing enterprises, such as science and philosophy, these end up reflecting nothing more than the writing practices used to articulate them. In hindsight, there was nothing particularly radical in this poststructuralist position. Already in the 1920s, Jakobson and Trubetzkoy started probing the “relativity” of language oppositions in the light of their social and psychological functions. Basing their ideas in part on the work of German psychologist Karl Bühler (1879–1963), the Prague School linguists posited that language categories mirrored social ones. The goal of a true semiotic science, they claimed, was to investigate the isomorphism that manifested itself between sign and social systems.

In the end, the poststructuralist movement was, arguably, nothing more than a reaction to Saussureanism in its most radical forms. It was (and continues to be) of little or no interest to semioticians who work primarily within the framework of Peircean sign theory, which emphasizes the interpretive component in sign study.

SEMIOTICS AND INFORMATION

Above all else, semiotics is useful as an interdisciplinary tool. It has also been applied fruitfully to the information sciences see, for instance Brier^[41] who gives an in-depth analysis of the “semiotics of information,” as it may be called. Information can be defined simply as data that can be received by humans, animals, or machines. In various scientific theoretical frameworks, it is considered as something mathematically probabilistic—a ringing alarm signal, for instance, is said to carry more information than one that is silent, because the silent state is the “expected state” of the alarm system, while the former is its “alerting state” and thus carries maximum information about the referential domain the system is designed to encode. As is well known, the individual who developed the mathematical theory of information was the American telecommunications engineer Claude Shannon (1916–2001), who showed, essentially, that the information contained in a signal is inversely proportional to its probability—that is to say, the more probable a signal, the less information “load” it carries with it; the less likely, the more.

Shannon’s model essentially depicts information transfer as a one-way process dependent on probability factors, that is, on the degree to which a message is to be expected or not in a given situation. It is appropriately called the “bull’s-eye model” because a sender of information is defined as someone or something aiming a message at a receiver of the information as if in a bull’s-eye target range. Shannon also introduced several key terms into the general study of information and communication: channel, noise, redundancy, and feedback. His model has, over the years, been useful in providing a terminology for describing aspects of communication and information systems,

but it tells us nothing about how messages and meanings shape and ultimately determine the nature of human communication and knowledge-making events. The semiotician would ask: how does information become knowledge? The answer is that it is encoded in the form of signs and codes. Each code thus presents information according to its own particular kind of structure. This allows humans to interpret the world of objects and events in a specific way and, subsequently, to respond to it in specific ways. The innate semiotic modeling system of a species routinely converts the external world of information (sensory, affective, etc.) into internal states of knowing and remembering that are unique to the species. Access to those states without possessing the same mental modeling system is never going to be complete. To study modeling systems, a branch of semiotics, known as *biosemiotics*, has become dominant within the entire field.^[42,43] Essentially, biosemiotics attempts to determine how each species converts information into self-serving knowledge through its innate system of semiosis—the ability to produce and use signs.

In the human world, however, information is assigned meaning, since it is meaningless in itself. This is accomplished by connecting it to some code or system of interpretation (language, science, mathematics, music, etc.), so that it can be utilized for some purpose. Information is useless without a semiotic key for interpreting and using it. It is, as its etymology suggests—from Latin *information* “a sketch, an outline”—nothing more than encoded *form*. Deriving *content* from this form requires knowledge of how it has been represented and how it has been used. Not only, but the relation between the representation of information and the information itself is so intrinsic that it is often impossible to differentiate between the two.

CONCLUDING REMARKS

Semiotics is, in a fundamental way, a study of how humans shape raw information into knowledge categories through sign-creation. We create signs in order to select from the raw flux of information that bombards our senses what we wish to remember from it. Although we create new signs to help us gain new knowledge and modify previous knowledge—that is what artists, scientists, writers, for instance, are always doing—by and large, we literally let our culture “do the understanding” for us. We are born into an already-fixed system of sign-use, called the *semiosphere* by the late Estonian semiotician Juri Lotman (1922–1993)—that will largely determine how we come to view the world around us.^[44] Moreover, the semiosphere, like the biosphere, regulates human behavior and shapes evolution. But although they can do little about the biosphere, humans have the ability to reshape the semiosphere any time they want. This is why cultures are both restrictive and liberating. They are restrictive in that they impose upon individuals reared in them an already-fixed system

of signification. But cultures are also liberating because paradoxically they provide the textual resources by which individuals can seek new meanings on their own. The artistic, religious, scientific, and philosophical texts to which individuals are exposed in social contexts, moreover, open up the mind, stimulate creativity, and engender freedom of thought. As a result, human beings tend to become restless for new meanings, new messages.

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Senegal: Libraries, Archives, and Museums

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Abstract

The authors provide a historical overview of Senegalese libraries, archives, and museums, outlining patterns and trends from the French colonial period to the present. Topics covered include: national, public, academic, special, and school libraries as well as the National Archives of Senegal, regional archives, and major museums. The legal framework for these institutions is detailed. However, although comprehensive and well thought out library legislation was enacted in the 1970s, realization of the plans for a national library, and for a network of public libraries has been stalled due to the lack of funding. The authors also discuss the role of professional associations and the development and professional education in these three fields.

INTRODUCTION

Senegal is the westernmost country on the African continent and is located in the Sahel Region. It is bordered by the Atlantic Ocean to the West, Mauritania to the North, Mali to the East, and Guinea and Guinea Bissau to the South. Senegal almost completely surrounds the Gambia, which forms a virtual enclave within its borders. During the nineteenth century Senegal was a bridge-head for France's conquest of its African colonial empire and the coastal cities of Senegal were the first French colonial outposts in west Africa. In 1902, Dakar became the capital colonial French West Africa (Afrique Occidentale Française, or the AOF) which consisted of several additional colonies and territories. Citizens of Senegal were the first Africans to gain French citizenship rights. The French expansionism and the spread of Islam occurred simultaneously during the late eighteenth and nineteenth centuries have shaped modern Senegal (Fig. 1).^[1]

The official language of government is French, but the country is characterized by cultural and linguistic diversity, with Wolof, Pulaar, Jola, Mandinka, and Serer also common languages. Senegal is a predominantly Muslim country with many Koranic schools, so Arabic is also an important language for reading and writing. The country's area is around 195,190 sq. km. and the Senegalese population was estimated at around 12,853,259 (in July 2008). The country's total literacy rate was about 39.3% (51.1% for males and 29.2% for females).^[2]

LIBRARY AND INFORMATION PROFESSIONS

Systems and Services

A brief overview of legislation

In the early 1970s, the government of Senegal drew up a comprehensive legal framework for the promotion of reading and libraries and this legislation established the infrastructures for several important policy initiatives. By Act No. 71-58 and Act No. 71-53, the exemption of taxes on importation of books was adopted in 1971. By Decree No. 72-1316, a Conseil Supérieur du Livre (High Book Council) was established. And 1 year later many institutions were created in order to promote literacy and a reading culture; these included:

- « Les Nouvelles Editions Africaines (NEA) » (New African Editions),
- The « Société de Presse, d'Édition et de Publicité (SONAPRESS) » (Society of Press, Publishing, and Publicity),
- « Les Nouvelles Imprimeries du Sénégal (NIS) » (New Printing Presses of Senegal),
- a the « Bureau Sénégalais du Droit d'auteur (BSDA) » (Senegalese Bureau of Author's Rights).

Act No. 73-52, dated December 4, 1973 was passed to protect literary and artistic rights. Then in 1980, two legal acts aiming to help the book sector were passed: Act No.



Fig. 1 Map of Senegal.

Source: CIA world factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/sg.html>

80-37 and Act No. 80-79 dated August 25, 1980. These acts instituted a value added tax exemption for periodicals and newspapers, and for the importation and purchasing of local raw materials used in the manufacturing of books and newspapers in Senegal.

This legal framework for the promotion of literacy and a reading culture was completed in 1976, by the legislation on libraries. During this period, important statements of principle were formulated by the government for the best applications of laws favoring open access to information for all.

The library profession in Senegal was given a legal existence in 1969 by Decree No. 69-257, dated March 17, 1969 concerning the status of civil servants who work in libraries and archives. Between 1975 and 1977 much of the Senegalese legislation concerning library and documentation services were signed into law by the first Senegalese president, the poet and French academician Leopold Sédar Senghor (1906–2001).^[3] The years 1976–1977 represented an important turning point when seven major legal documents were promulgated:

- Act No. 76-24, dated April 9, 1976 organizing the national library network,
- Act No. 76-30, dated April 9, 1976 establishing legal deposit,
- Decree No. 76-493 dated May 5, 1976 creating and organizing the National Library,
- Decree No. 76-494 dated May 5, 1976 creating a public lending library,

- Decree No. 76-1021 dated October 14, 1976 establishing the Directorate of Public Libraries (Direction des Bibliothèques publiques) within the Ministry of Culture (Ministère de la Culture).
- April 6th, 1977, a National Center of Scientific and Technical Documentation [Centre National de Documentation Scientifique et Technique (CNDST)] was created by Decree No. 77-272, and
- Decree No. 69-257 was abrogated and replaced by the Decree No. 77-890, dated October 12, 1977 concerning in particular the status of civil servants in Archives and libraries.

All this legal texts were the results of the work of a committee established in 1973.^[4]

Around the same time, the Directorate of Public Libraries (Direction des Bibliothèques publiques) was merged with the Directorate of Arts and Letters (Direction des Arts et des Lettres) to become the Directorate of Arts, Letters, and Libraries (Direction des Arts des Lettres et des Bibliothèques). Raphael A. Ndiaye was appointed to implement these new policies. Unfortunately from the late 1970s to the present, Senegalese libraries have suffered from a lack of funding due to economic structural adjustment. Most of the librarians employed in the public library network left for other positions, leaving these small libraries to be run by nonlibrarians. This situation still persists.

The legal framework remained stable until 2000 when, by Decree 2000-947, a Directorate of Books and Reading (Direction du livre et de la lecture) was created within the Senegalese Ministry of Culture and, at the same time, a professional librarian was appointed to manage the Directorate. Two years later, on April 3rd, 2002, Act No. 2002-17, restoring the National Library was passed and another act on the promotion of books and reading is under preparation.

NATIONAL LIBRARY AND INFORMATION SERVICES

The National Library of Senegal exists only as a legal entity. The Senegalese National Library was created by Decree No. 76-493, dated May 5, 1976, but without facilities, budget, and staff. Three years later, the National Library was made part of the National Archives of Senegal (by Letter No. 7820/PM/SGG/CI, dated October 5, 1979). The autonomy of this institution has been restored legally by Act No. 2002-17, dated April 3, 2002.

Previously, in 1996, then President Abdou Diouf decided to include a project to build a National Library among the priorities of his government. A national task force was named to work on the project, and a professional librarian was appointed to manage it. The National Library project was chaired by the head of the Directorate of Books and Reading in the Ministry of Culture. Three

librarians, an assistant-librarian, a documentalist, and a computer scientist were also recruited for the project and funds were allocated for the constitution of the initial collection of the institution. The construction of the building of the National Library was begun in 1999, but the work was stopped by Abdoulaye Wade, the President of Senegal who was elected in 2000. The latter has decided to develop a new project and move it on another site.

To complete its information policy, the Senegalese Government, following the recommendations of the Conference of Ministers responsible for Application of Science and Technology to the Socioeconomic Establishment of Africa (CASTAFRICA meeting held in Dakar in 1974) decided to create a National Scientific and Documentation Center (CNDST). The decision was taken by the Council of Ministers on April 14th, 1975. The United Nations Development Programme and UNESCO were to help Senegal create this institution, and the CNDST was established by Decree No. 77-272, dated April 6, 1997. The objectives of this institution are to coordinate all the research activities of information and documentation services that constitute the links of the National Scientific and Technical Information Network [Réseau National de l'Information Scientifique et Technique—RNIST]), and to promote all actions of common interest that that could serve to strengthen the scientific and technical information services. In recent years, the CNDST has not really been visible in the information and documentation environment. The Scientific and Research Department even attempted to suppress the CNDST in 2005.

Academic and Research Libraries

Higher education in the former French West Africa was gradually put into place during the colonial period. The first stage of the process began in 1916 with the creation of the Jules Carde African School of Medicine and Pharmacy in Dakar (l'Ecole Africaine de Médecine et de Pharmacie Jules Carde de Dakar). Two decades later, in 1938 by the government of French West Africa created the French Institute for Black Africa [l'Institut Français d'Afrique Noire (IFAN)], which specialized in African research. The first director of IFAN was versatile young scientist named Théodore Monod (1902–2000). Monod laid the foundations for scientific research in French West Africa and saw to the establishment of the first research library in the region. During his 26 years as director of IFAN, Monod made it a priority to develop a good library collection, and by 1949 the size of the original collection had tripled.

Following World War II plans were made to extend higher education to Francophone countries, and Dakar was selected as the site for an inter-African program. In 1949, an undergraduate education program in chemistry/biology was opened. Finally, the Dakar Institute of Higher Education was created, which officially became the

University of Dakar on February 24, 1957, then Cheikh Anta Diop University in Dakar [l'Université Cheikh Anta Diop de Dakar (UCAD)] on March 30, 1987. The Gaston Berger University in Saint-Louis (L'Université Gaston Berger de Saint-Louis du Sénégal), whose cornerstone was laid in 1974 by President Senghor, did not open its doors until 1990. The number of universities in Senegal was recently enlarged by the creation of the University of Thiès (l'Université de Thiès) in 2005, and Regional University Centers in Bambey and Ziguinchor in 2007.

The first collections of the current central library of the University Cheikh Anta Diop date from the creation of the African School of Medicine and Pharmacy. Therefore, the library of Cheikh Anta Diop University is the oldest and the most important university library in Francophone African countries south of the Sahara.

The central university library in Dakar is at the hub of a system of Cheikh Anta Diop University libraries. This network (officially established by Decree No. 95-197 of February 21, 1995) brings together all the libraries falling under the authority of the university; this includes a central library, 15 libraries of the Faculties (Schools), institutes or departments, and a photography collection. The central library of Cheikh Anta Diop University offers study spaces, modern technology and services (OPAC, Internet connection, WI-FI, etc.), and an encyclopedic collection of about 500,000 documents in all media. It also offers online access to digital collections.

The second largest university library system is found at the Gaston Berger University in Saint-Louis. This system offers a collection of about 70,000 items in the central library and 40,000 in the libraries of the training and research units (unités de formation et de recherche).

The recently created Universities of Ziguinchor and of Bambey have already set up university libraries and recruited librarians to manage them. Likewise, the Senegalese campus of Suffolk University offers information services. One can classify in this same category the library of the African Center for Post-Graduate Management Studies (Centre Africain d'Études Supérieures en Gestion — CESAG), a specialized management school.

All of these higher education libraries have joined together in the Consortium of Higher Education Libraries [Consortium des Bibliothèques de l'Enseignement Supérieur (COBES)]. University libraries constitute the most dynamic part of the library sector in Senegal. The university libraries in Dakar and in Saint-Louis, have at their disposal buildings and equipment that conform to international standards and they have integrated information technology into the service that they offer. Furthermore, they are managed by professionally qualified personnel.

Public Libraries

In 1976, the Senegalese government decided to create and organize a national public library network (by Decree No.

76-29, dated April 9, 1976). This legal framework was complemented by a second decree (Decree No. 76-1021, dated October 14, 1976) that created an administrative department, the Office for Public Libraries and by Act 76-30, dated April 9 establishing the Legal Deposit. The national public library network was a very ambitious project that included plans to create a public central library in the capital city Dakar, public regional libraries, public departmental libraries, district libraries, and rural libraries. But, this ambitious network remains to be built. In fact, the national library network, as it was initially conceived, was confined to 10 regional libraries integrated into Regional Cultural Centers and about 10 other municipal libraries integrated into the Departmental Centers of Physical Education and Sports (Centres Départementaux Education Physiques et Sportives). None of these libraries have equipment, separate facilities or professional staff and as a result they are unable to offer adequate library services. The collections are constituted by donations. The International Agency for Francophonie (Agence Internationale de la Francophonie) has established 16 Centers for Reading and Cultural Events [Centres de Lecture et d'Animation Culturelle (CLAC)] in two Senegalese regions. The first network installed in Thies region included seven of these centers; the second one in Kolda had nine centers. The Islamic Education, Scientific and Cultural Organization (ISESCO) has also established another network of 10 ISESCO CLAC for Arabic readers.

Beginning in 1990, eight libraries were created by the municipal authorities in Dakar and the city has plans to establish a network of 18 libraries. The total size of the collections of each of these small libraries is around 2000 books; 80% of the materials in these collections were donated by Canada. The remainder comes from a donation by the Franco-Senegal Alliance (Alliance Franco-Sénégalaise) and acquisitions made by the municipality.^[5] Many other libraries have been set up by private associations. The Alliance Franco-Sénégalaise has established a network of five libraries in Dakar, Saint-Louis, Tambacounda, Ziguinchor, and Kaolack. In addition, libraries have been set up other agencies and organizations headquartered overseas (for example Service de Coopération et d'Action Culturel de l'Ambassade de France, CAURIS, AFVP, Aide & Action, etc.). Local groups such as NGOs sports and cultural organizations, etc. have contributed to creating other libraries around the country.^[5] In addition there are several libraries established by foreign cultural centers (Goethe Institute, British Institute, etc.).

As in the past, most of the public libraries services are located in the capital city Dakar, which is also the major commercial and cultural center of the country. Of the 83 public libraries listed by the Senegalese Library Association, Association Sénégalaise des Bibliothécaires, Archivistes et Documentalistes (ASBAD), about 43 (52%) are

in Dakar. The list of all public library services is published on the Web site of the Minister of Culture (Ministère de la culture). http://www.culture.gouv.sn/article.php3?id_article=324/

School Libraries

Although they are an indispensable tool of education, school libraries still remain one of the weak links in the national network of reading resources. The absence of a legal framework clearly organizing school libraries seems to be recognized as a major obstacle to the development of school libraries in Senegal. Initiatives aimed at addressing this sector have been taken within the framework of two programs which are the Partnership Program for Effectiveness of Senegalese Schools (le Programme de Partenariat pour l'Efficacité de l'Ecole Sénégalaise) that concerns elementary schools and the Quality Education for All Program (le Programme Education de Qualité pour Tous) financed by the World Bank.^[6]

Despite the efforts agreed to by aid associations for the development of education, such as Libraries, Reading, and Development (Bibliothèque, Lecture et Développement (BLD)), the situation on the ground still remains difficult. A 1991 study about libraries of public establishments in the Dakar Region found that facilities housing libraries were often reduced to one cramped room (7 × 5 m) serving both as the office of the librarian, the reading room, and the book stacks. As for the collections, these are often made up solely of textbooks or assigned novels that the students borrow at the beginning and return at the end of the school year.^[6]

Special Libraries

Special libraries are more numerous but also more difficult to study. They are set up by specialized organizations and are not always accessible to the public. The specialized institutions and affiliated organizations of the United Nations (UNICEF, BIT, UNESCO-BREDA, World Bank, CINU) located in Dakar often have a library or a library and information service that one can research. Also, national, regional, or international research centers located in Senegal often set up a library. One can cite many examples of such research centers:

- The Senegalese Institute of Agricultural Research [l'Institut Sénégalais de Recherche Agricole (ISRA)],
- the Oceanographic Research and Documentation Center of Thiaroye [Centre de recherche et de Documentation Océanographique de Thiaroye (CRDOT)],
- the Institute of Food Technology [l'Institut de Technologie Alimentaire (ITA)],
- the Ecological Monitoring Center (le Centre de Suivi Ecologique), and

- the administrative, legal and historical library of the Directorate of the National Archives.
- The library of the Center for Research and Documentation in Saint-Louis (Centre de Recherche et de Documentation de Saint-Louis) comprises about 32,000 volumes;^[7]
- The Council for Social Science Research in Africa (le Conseil pour la Recherche en Sciences Sociales en Afrique (CODESRIA)) offers a library and documentation center specializing in social sciences; and
- The Institute for Development Research [l'Institut de Recherche pour le Développement (IRD)] offers quality information services.

Finally, one could mention among special libraries and information services the libraries and information services of public administration. The Office of the President of the Republic, certain ministries, the Court of Cassation (highest civil court), and the la Cour des Comptes (a quasi-governmental organization that audits government accounts, assesses management of public agencies and advises the government), each have a library and an information service. Some of these services are managed by professional librarians.

Digital Library Collections and Services

A certain number of the projects offered by digital libraries have been developed in higher education and at the level of research centers. Academic and research librarians work more and more on projects such as Cyberdocs and SIST (Système d'Information Scientifique et Technique = Scientific and Technical Information System). Cyberdocs-UCAD is a platform developed by the central library of Cheikh Anta Diop University on the Cyberthèses (Digital Theses) platform. Cyberdocs-UCAD allows for the electronic processing and diffusion of theses and dissertations produced in the faculties (schools) and institutes attached to the university, whose authors have voluntarily deposited an electronic copy. It also permits placing online documents other than theses and dissertations. Its objective is to increase the value of the work of students and researchers, maximize the visibility of the contents, facilitate access to this information, and freely share the results of the research products of UCAD. A cooperative project of the French Foreign Ministry, SIST is aimed at making African research more easily available and thus promoting African expertise and putting the science in the service of development. It offers to researchers and to information professionals in 12 countries a platform for information, communication, and collaborative work. Since 2006 databases, Web sites, Senegalese bibliographic catalogs can be consulted through SIST Sénégal.

EDUCATION FOR LIBRARY AND INFORMATION SCIENCE

The Ecole des Bibliothécaires, Archivistes et Documentalistes (EBAD), http://www.ebad.ucad.sn/acces_dedies/etudiants/info_generales/historique.htm/ or the Senegalese School of Library, Archival and Information Studies is one of the oldest LIS education programs in Francophone Africa. It was created on March 28, 1962 as a French-speaking Regional Center for Library Training and inaugurated on December 4, 1963.^[8,9] The first course began one month before its inauguration, on November 4, 1963 with 20 students: six from Senegal, two from Cameroon, one from Congo Brazzaville, two from Côte d'Ivoire (Ivory Coast), one from Dahomey (currently Benin), one from Guinea, one from Haute-Volta (Upper Volta, currently Burkina Faso), two from Madagascar, one from Mali, one from Chad, and two from Togo. The school still kept this regional orientation when it became the EBAD by Decree No. 67-1235 dated November 15, 1967 and became an Institute incorporated at Cheikh Anta Diop University. Initially, the training was focused on library science, but in 1971, a program on Archival studies was started and later a program on information science was established in 1975. Initially, EBAD awarded a diploma of proficiency in Librarianship, Archival studies, or Information science after a 2 year training period to holders of the Baccalaureate or an equivalent diploma. In 1982, another academic cycle (Final Honors) was created.

In 2007, Cheikh Anta Diop University decided to adopt the European curricular reform. To accomplish this, EBAD is transforming its degree programs into two cycles (Bachelor's and Masters). One of the objectives of this reform is to make its programs of study more compatible with programs in other countries; therefore with the help of The International Federation of Library Associations and Institutions (IFLA), Action for Development through Libraries Programme (ALP). EBAD, is working with newly established library schools of the Francophone countries to harmonize library curricula. Since 2000, EBAD has also been experimenting with distance learning and Internet courses through the project FORMation Continue en Information Informatisée en Réseau funded by the French agency for cooperation.

PROFESSIONAL ASSOCIATIONS

The existence of library associations in Senegal began when the International Association for the Development of Libraries in Africa was founded on September 13, 1957 in Saint-Louis, Senegal by E. K. Dadzie, and a small group of librarians working with other persons interested in promoting reading.^[10] In Dakar, on March 18, 1975 another group of professional librarians founded, a second professional association named Association Nationale des

Bibliothécaires, Archivistes et Documentalistes Sénégalais. These two associations merged on July 9, 1988 to constitute the ASBAD. The aims of ASBAD are to advance the development of libraries, archives, and documentation centers in Senegal and to study concerns common to information professionals in the country.

ARCHIVES AND ARCHIVAL SCIENCE

A Brief Overview of Legislation

Just 2 years after independence, the government of Senegal established a legal framework that regulates the management and accessibility of archives. In 1962, the government ordered that all judicial archives more than 50 years old, be deposited in the National Archives (Decree No. 62-0215 of May 28, 1962). That same year, the President of the Council, Mamadou Dia, ordered the deposit of official archives and publications (in Circular No. 52 of August 16, 1962). A few years later, in 1968, a decree was issued regulating the deposit in the National Archives of notarized deeds (titles) more than 50 years old (Decree No. 68-342 of March 29, 1968). The elaboration of legal texts organizing deposits in the archives also continued. Thus, on March 16, 1976 a Circular of the Prime Minister was issued to regulate the deposit of official archives and publications, (Circular No. 00025) and 2 years later on April 28, 1978, another Circular established procedures for pre-archival records management in ministries and public services. Since 1977, the Archives of Senegal been transformed by statute, attaining the status of a Directorate attached to the Secretary General of the Government in the Bureau of the Prime Minister. Several other official texts organizing the archives were put into place after that date.

National Archives and Services

The Archives of Senegal were created as a subunit (Service) of the Archives of French West African (l'Afrique Occidentale Française/A.O.F.), which were established by Governor General William Ponty on July 1, 1913. Claude Faure, the first professional archivist to work in the French African colonies was hired that year. Over the next five decades this collection was maintained by a professional archivist who also provided training to the first African archivists.^[9] Following the independence movement, these were the only archives in the French African colonies which were not taken back to France time of independence.

In 1958 when the government of Senegal, decided to transfer the capital from Saint-Louis to Dakar, the Archives of Senegal were transferred to the new capital where they were housed with the A.O.F. Archives.^[11] Jean François Maurel, Conservator of the A.O.F. Archives,

remained in Senegal and assumed management of both archives. In 1970, the Archives of Senegal were attached to the Secretary General of the Government, which was a part of the Bureau of the Prime Minister.

By the 1970s, the need to provide the Archives of Senegal with an appropriate building became more and more evident and in 1973 a decree was issued that authorized the construction of a "House of Archives" (Maison des Archives) (by Decree No. 73-080 of January 27, 1973). This decree was never carried out but was extended by Decree No. 75-461 of April 26, 1975. Unfortunately, the construction of this "House of Archives," like that of the building destined to house the National Library, has remained until now an unfinished project due to the decision by President Abdoulaye Wade to halt construction. There are plans that both the National Library and the National Archives should eventually be integrated into a project for a larger cultural complex.

After the departure of Jean-François Maurel, Saliou Mbaye, archivist paleographer, educated at the l'Ecole des Chartes in Paris was named director of the archives. The Archival Service of Senegal (Le Service des Archives du Sénégal) became the Directorate of Archives of Senegal (la Direction des Archives du Sénégal) by Decree No. 77-615 of July 21, 1977. Raising the status of the Archival Service of Senegal to that of a Directorate marks an important step in the history of the Senegales Archives (Law No. 81-02 relative to archives was passed on February 2, 1981). It was followed the same year by General Decree No. 81-430 of April 15, 1981, setting the conditions of organization and functioning of the Archives of Senegal and 2 years later by Decree No. 83-341 of April 1, 1983 devoted to access to documents in archives. This Law No. 81-02 of February 2, 1981 would not be repealed and replaced until 2006 by Law No. 2006-19 of June 30, 2006 relative to archives and administrative documents.

The Archives of Senegal occupy 12 km of shelf space separated into four principal sections according to the four principal collections (*fonds*):

- The Colonial Senegal collection (1816–1958);
- The A.O.F. collection (1895–1959);
- The collection of the Federation of Mali (1959–1960);
- The archives of independent Senegal (since 1958).

Article 7 of Law No. 81-02 of February 2, 1981 stipulates that "the Directorate of the Archives of Senegal is an organism of the State responsible for addressing all archival questions. It administers the national archives and the regional archives. It controls the archives of local collectivities." It is this disposition that established the Senegal collection to be subdivided into two parts: 1) central and regional archives, managed by the Directorate of the Archives and 2) archives of local collectivities placed under their control.

In principle, each Region should have at its disposal its own regional archival service. At the moment, five Regions are equipped with an archival service. These services are established within the services of the Regional Governors.

Since 1979, the Library of the Archives of Senegal houses the National Library Agency (l'Agence bibliothèque nationale) and receives the legal deposits instituted by Law No. 76-30 of April 9, 1976. The collection of the Library of the Archives is estimated at 27,300 works (books, reference works, microforms, and audiovisual documents and printed documents); this collection also includes 1515 titles of periodicals (both current and those which have ceased publication).

MUSEUMS AND MUSEOLOGY

Museums seem to have considerable difficulty in becoming integrated into Senegalese culture. According to an article published on June 8, 2006: "The Senegalese don't know the utility of museums or, in any case, only rarely visit them. In their place, it is rather tourists who flood into the museums after arriving by airplane."^[12]

The museum sector in Senegal experiences a certain number of difficulties of which the most important seem to be: the absence of a legal framework, the timid politics of the government, the absence of a professional training school specialized in this domain, inadequate funding and the lack of public interest.

The most important museums of the country are concentrated in three cities: Dakar, Goree and Saint-Louis, Senegal.

The IFAN Museum is indisputably the most important museum because of its age, its building, and the size and diversity of its collection. It is located in Dakar at Soweto Place, opposite the National Assembly of Senegal. The building which it occupies was allotted to the offices of IFAN by Governor General Jules Brévié (by Decision No. 1958 of August 20, 1936). Currently, the IFAN Museum offers a permanent exhibition on the theme of the arts and cultural traditions of West Africa, temporary and thematic exhibits using the collections of the Museum, and collections conserved in the storerooms.

Dakar also contains two museums that focus on the military and on customs officials. The more important of these is the Armed Forces Museum (le Musée des Forces Armées), created in July 1996, whose mission is to collect, conserve, and spread the national historic and cultural patrimony in the military domain. It also possesses a library of 1200 volumes destined to serve as the basis for the creation of a future Center for the study and military history of West Africa (Centre d'études et d'histoire militaire de l'Afrique de l'Ouest).

With four establishments, the island of Goree occupies a choice place in the museum sector. The most celebrated

is the House of Slaves of Goree (la Maison des esclaves de Gorée), which perpetuates the memory of one of the greatest human tragedies—slavery. The other museums of Goree are either the responsibility of IFAN or are private museums. The two museums administered by IFAN are the Historical Museum (le Musée Historique) that occupies the old Goree Fort and the Museum of the Sea (le Musée de la Mer). The Historical Museum of IFAN is devoted to the general history of Senegal from its origins to our days, illustrated by notable figures, whereas the Museum of the Sea concentrates on the sea, fishermen, and fishing tools.

Last but not least, there is the Henriette Bathily Museum (le Musée Henriette Bathily) devoted to women. The idea of creating a museum celebrating women dates from 1987, following a proposal by film maker Ousmane William Mbaye; however, the actual creation of the Henriette Bathily Museum did not occur until June 1994. Its establishment was justified, according to the words of its Director Annette Mbaye D'Erneville, by the fact that "(...) Women are the center of all communal life, for through their destiny is translated the destiny of an entire people, that her history (Herstory) sums up that of the whole society." This institution assigned itself the objective of making known the place and the role of Senegalese women in rituals and popular arts.^[12] In addition to an Art Gallery, where permanent, temporary, and thematic exhibits are displayed, the Henriette Bathily Museum offers high quality artisanal products made by the women of the museum, and a workshop that introduces women to painting, batik, weaving, and traditional embroidery techniques. The museum employs 12 people and has a garden café as well as a shop. However, the proximity to the House of Slaves, which was perceived to be an advantage has proven to be a real challenge for the Museum of Women. In effect, the latter has a great deal of difficulty in becoming visible.

Finally, in Saint-Louis there is the Museum of the Center for Research and Documentation of Senegal (le Musée du Centre de Recherche et de Documentation du Sénégal). This Museum, the former IFAN Center inaugurated in 1956, is now a part of the Ministry of National Education. It covers three themes: ecology, history, and ethnology.

CONCLUSION

During the first decades following independence, Senegal established and developed EBAD, a well-respected professional school with a regional mission to train librarians, archivists, and documentalists who serve in institutions throughout Francophone Africa. In addition, the Senegalese government enacted a well thought out legal framework for establishing a national library and extending library services throughout the country. Unfortunately, neither the library network nor the national library have

been realized due to difficult economic circumstances combined with the lack of strong political support.

Much work remains to be done in order for Senegal to be endowed with a library, archives, and museum network capable of collecting, processing, conserving, and making available the cultural and international patrimony of the country. Only university and research libraries have experienced a normal development, with collections and services that follow international standards and practices. And it is only the largest academic libraries and a few specialized research libraries (especially those in scientific fields) that have had enough financial support to employ modern information technology. Libraries of administrative services have often been treated as poor relatives while public libraries, school libraries, and all the other types of libraries have been sadly neglected and continue to suffer from a lack of adequate funding.

Given that political support is essential to the realization of these cultural institutions, it is of great concern that President Wade has halted work on the National Library and the House of Archives, declaring that neither of these were his projects. Faced with the situation of libraries, archives, and museums of Senegal, the words of the former President sound like a premonition when he noted in 1977 that:

(...) the most difficult, you know, is not to decide, by decree and even by law, the creation of libraries and their complements, which are archives and museums; the most difficult, in any case the most important, is to create them effectively and, especially, to make them function effectively.^[13]

Those professionals who are providing leadership for Senegalese libraries, archives, and museums have much advocacy work to do in order to persuade the government to support the development of a well-coordinated, effective system of information institutions. It must be noted that information technologies exercise a certain fascination and the discourse about the death of the book and libraries has reached Senegal where there continues to be debates about the need for printed materials at a time when access to the Internet is becoming somewhat more widespread. Even Senegalese political decision makers are becoming swayed by this technophile discourse, which is synonymous with modernity. The lure of technology has led the political leaders to place greater emphasis on the acquisition of equipment rather than supporting efforts to set up viable information institutions. Digitization of documents is also becoming a growing trend in Senegal. Professionals in the libraries and information services must bring thoughtful reflection to the digitization projects and also consider other strategies for making information available to all.

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Sense-Making

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Abstract

This entry focuses on how research approaches labeled as sense-making or sensemaking are used to address user-oriented research relevant to the study of human information behaviors. This entry starts with a focus on the turn to sense-making in user studies and then reviews the historical and methodological roots and application contexts of the five most visible approaches that have addressed sense-making (or sensemaking) systematically in four fields: Human-Computer Interaction (HCI) (Russell's sensemaking); Cognitive Systems Engineering (Klein's sensemaking); Organizational Communication (Weick's sensemaking; Snowden's sense-making); and Library and Information Science (LIS) (Dervin's sense-making).

INTRODUCTION

This entry focuses on how research approaches labeled as sense-making or sensemaking are used to address user-oriented research relevant to the study of human information behaviors. This entry starts with a focus on the turn to sense-making in user studies and then reviews the historical and methodological roots and application contexts of the five most visible approaches that have addressed sense-making (or sensemaking) systematically in four fields: Human-Computer Interaction (HCI) (Russell's sensemaking); Cognitive Systems Engineering (Klein's sensemaking); Organizational Communication (Weick's sensemaking; Snowden's sense-making); and Library and Information Science (LIS) (Dervin's sense-making).

THE TURN TOWARD SENSE-MAKING IN USER STUDIES

Various terms referring to humans making something called "sense" are widely used in most human communities. We talk routinely of things that "make sense" and "do not make sense" and we ask others to "make sense."

Dictionary treatments of the term "sense" start with foundational emphases on basic human faculties of sensation and perception—sight, hearing, touch, taste, smell. These emphases focus on human faculties as transmitting tools that perceive in some way patterns of matter-energy, both inside the skins that enclose human bodies and outside in external environments.

Yet, dictionary definitions clearly branch out from here far beyond anchorings in human perceptual capacities to

such definitions as: intelligibility, intuitive knowledge, capacity for mental feeling, natural understanding, practical soundness, wisdom, consciousness, impressions, emotional sensibility, meaning, signification, and reasonableness. Likewise, attention to the term "sense" as a verb shows wide range. To "sense" is defined foundationally as to perceive and more broadly to: feel, experience, be aware of, comprehend, grasp, ascribe meaning to, understand, interpret.

In the last two decades, theories and studies focusing on users and user interfaces with information, media, and technology systems have increasingly referred to the neologisms "sense-making" or "sensemaking." In doing so, they all point in some way to their interests in how users make "sense" of the information resources systems actually or might provide. Different authors use one or the other of the two grammatical forms, most often deliberately. For sake of readability, sense-making will be used in this entry except in discussions of specific approaches when the forms preferred by specific authors will be used.

In understanding the differences in how the term sense-making is being used it is important to note how the full range of common parlance definitions have invaded scholarly treatments although very often in undefined ways. At one extreme, there is abundant attention to transmission theories of information processing asking whether humans are "sensing" what experts think they ought to. In transmission approaches to understanding users, focus starts with expert judgments of what is accurate, right, and proper in terms of information seeking, retrieving, and using. Experts draw these judgments out of normatively accepted knowledge-based domains. Usually, underlying these transmission assumptions is acceptance of a host of modernist assumptions about the nature of reality, information, and users that rest on often unstated agreements

that the job of information-oriented systems is to encourage and facilitate human access to information assumed to map the orderliness that is “out there” in reality but may elude individual human senses because of lack of access, skill, tools, and expertise. This has meant that the patterned matter-energy that we humans call information, the packages into which we humans put that information (e.g., books, television, journals, blogs), and the systems we create to store, retrieve, and disseminate that information (e.g., libraries, databases, knowledge management systems, media institutions) have been assumed to be edifices against which humans can be measured in terms of standards such as accuracy, breadth, depth, and skill of information processing. This tension between essentialist approaches to understanding human beings and interpretative approaches is in many ways at the center of the many versions of the so-called paradigm wars in the social sciences and humanities that marked the 1980s. While such discussions no longer take center stage, traces are very much still in evidence.^[1–15]

At the other extreme, there is growing attention to what can be called communicative theories of information processing asking how humans are understanding, interpreting, finding insight, and making meaning. Here attention is redirected, again with myriad vocabularies to meaning-making—to the insights, interpretations, significations, and utilities humans construct from the contents and packages of the patterned matter-energy normatively called information.

In both kinds of theories of sense-making—transmission and communicative—emphasis is placed on both outcomes (the sense made) and processes (the hows of sense-making). The ways in which attentions to outcomes and processes have been defined, however, likewise reflect that same movement from sense as measured in terms of its deviation from expertise versus sense as understood as resulting from processes that must be studied as least in part communicatively rather than simply as resulting from transmission.

The purpose of this entry is to give an overview of how phenomena that are labeled with the term sense-making are being defined, studied, and applied in user studies focusing on information seeking and use. The difficulty in choosing what approaches to sense-making to focus on is that there has been over the past decade an explosion of interests in something authors call sense-making, now being applied to a whole host of information-related behaviors (e.g., processing, retrieving, searching, gathering, foraging, using, Web-browsing, rejecting, collaborating, risk-facing, and so on) and a host of potential applications (e.g., the design of libraries, media, software, Web sites, information packages, information-focused pedagogies, knowledge management tools, organizational environments, and collaboration interfaces). For brevity's sake, the abbreviation HIBs (Human Information Behaviors) will be used to stand in for the diverse sets of

behaviors both internal (e.g., cognitive, emotional, spiritual) and external (e.g., seeking, finding, foraging, retrieving) that are the focus of user studies.

The call for attending to sense-making in studying HIBs is most visibly present not only in the LIS field but also in the fields of Cognitive Systems Engineering, HCI, and Organizational Communication studies. At the same time, collaborations and mergings between institutions, scholars, and practitioners representing all these fields are making it increasingly difficult to fix a particular approach to sense-making as belonging only to a particular discourse. These convergences have been impacting LIS particularly as manifested in what has become known as the “information school movement” in which formerly homogenous LIS units have incorporated interdisciplinary expertise from a variety of social science, humanities, and engineering disciplines.

The difficulty in fixing a stable picture of what might be called a “sense-making” approach to studying HIBs is further muddled by the increasing frequency of comparisons executed without anchorings in historical and discourse community roots. Too often issues regarding differences between approaches are reduced simply to matters of the use of different methods or arriving at more encompassing and thus more valid overarching theories. Rarely is there acknowledgment that the various approaches are not defining or addressing sense-making as phenomenon in the same ways.

The intent of this entry is to differentiate between the most visible approaches that are attending to something called sense-making. This entry intentionally focuses deeply on historical roots and methodological differences and does not limit itself to the sense-making approach that 10 years ago all but dominated references to user studies in the LIS field—that is, Dervin's Sense-Making Methodology. Purpose is to attempt to make “sense” of the treatments of sense-making that focus in their different ways on studies relevant to LIS because they address user HIBs, albeit using a variety of labels in very different contexts to focus on very different kinds of HIBs.

DIFFERENT APPROACHES TO SENSE-MAKING

One recent avalanche in literatures relevant to study of users has begun to refer to sense-making as a key concept with no definitional explications at all. The term has simply been co-opted into popular applied social science mainstreams. There have been, however, relatively isolated discourse communities in different fields where the term has received systematic attentions. These efforts do not have the status of field-wide acceptance but rather occupy significant enclaves within four different fields. As named above, the most visible fields where sense-making attentions reside include: HCI, Cognitive Systems

Engineering, Organizational Communication Studies, and LIS.

In general, it must be said that authors in these different fields study what they call sense-making in very disciplinary-centric ways. Work has proceeded in relatively bounded discourse communities with specialized vocabularies, assumptions, and research contexts.^[16–18] Authors may appear to address the same phenomena because they are using the same words (e.g., sense-making, information processing, users, retrieval, relevance) when in fact they mean very different and sometimes incommensurate things. This is additionally exasperated by recent practices of citing across these different approaches as if the differences do not make a difference.

Despite this background of interspersive confusion that is now a common feature of scholarly, research, and professional communities, in general, it is fair to say that all of those who have imported the term “sense-making” share common pulses. They have found accepted disciplinary vocabularies emphasizing cognition, attitude, opinion, information processing, and so on too confining. They have imbued into their projects at least in small measure a communicative sensibility—an interest in going beyond transmission assumptions regarding the interfaces between users and information systems. They share at least in small part a common attention to the idea that one reason research must move from transmission-based theories to communicative approaches is that our understandings of the ways in which information is useful to human life-facing have advanced beyond views drawn only from simplistic notions of modernity where already established and codified knowledge is seen as bridging all gaps. Instead, there is general acceptance of how complexity, uncertainty, and chaos theoretic approaches are needed—approaches that accept assumptions of the challenges human face as they move across time-space to changing environments and situations where knowledge as it is currently codified can rarely be complete enough to bridge all gaps.

Sense-Making in HCI

Human-Computer Interaction is a field, according to the Association for Computing Machinery (ACM)^[19] “...concerned with the design, evaluation, and implementation of interactive computing systems for human use...” Those identified with HCI usually conduct research in academic, corporate, and governmental settings for application to practice, in particular to design of interactive computing systems including hardware and software interfaces.

The terms sense-making and sensemaking have no presence as of this writing in the Wikipedia entry on HCI.^[20] However, there has been regular attention paid to sensemaking (using this grammatical form) by HCI researchers since at least 1993. The HCI sensemaking

community traces its emphasis back to what seems to be the first use of the term presented in a paper at CHI1993 by Dan Russell, Mark Stefik, Peter Pirolli and Stuart Card.^[21] Computer-Human Interaction (CHI) is an ACM special interest group.

In 1993, these authors were at PARC, the Palo Alto Research Center, Inc., a research and development company focusing in large part on human-computer interfaces. Much diffusion of a sensemaking emphasis has since ensued witnessed, for example, by PARC’s listing of sensemaking as one of its 2008 research foci.^[22]

Daniel Russell’s (et al.) sensemaking

The Russell group’s 1993 paper^[21]—“The Cost Structure of Sensemaking”—defined sensemaking as:

Making sense of a body of data is a common activity in any kind of analysis. Sensemaking is the process of searching for a representation and encoding data in that representation to answer task-specific questions. Different operations during sensemaking require different cognitive and external resources. Representations are chosen and change to reduce the cost of operations in an information processing task. The power of these representational shifts is generally underappreciated as is the relation between sensemaking and information retrieval.

With this paper and in their work since, the authors have most commonly examined the discrete cognitive steps, stages, and strategies with which users navigate databases seeking increasingly effective representations to support task-facings. The authors have been interested in understanding user sensemaking in specific information retrieval situations and then explaining and predicting user behavior so as to inform technology design choices. Typically, the research approach has involved qualitative and/or quantitative analysis of the online use histories of user engagements with particular database or software systems, sometimes coupled with in-depth interviewing and field observations.

All four authors have continued to pursue this research trajectory and have actively promoted understanding of sensemaking within the HCI community. Pirolli and Card, still working at PARC, have explored respectively sensemaking in relation to information foraging^[23] and sensemaking as it relates to information visualization.^[24] Other researchers from the HCI community such as George Furnas (University of Michigan) and Yan Qu (now at University of Maryland) have continued research programs focusing on much the same approach in varied contexts.^[25–27]

In general, this approach to sensemaking focuses on what users do to make sense during specific task-related HCI that involve information retrieval in some form. Sometimes, user behavior is examined as it naturally

occurs; sometimes it is examined in the context of specific design tools. The researchers have generally accepted that users do not navigate systems in orderly ways as prescribed by external experts. Russell and colleagues went to the essence of this community's focus in the call for papers for the CHI2008 Workshop on Sensemaking:^[28]

Making sense of the world is a ubiquitous activity, taking place around the margins of what we know. . . . It arises when we change our place in the world or when the world changes around us. It arises when new problems, opportunities, or tasks present themselves, or when old ones resurface. It involves finding the important structure in a seemingly unstructured situation. It is an activity with cognitive and social dimensions, and has informational, communicational, and computational aspects.

Sense-Making in Cognitive Systems Engineering

The second field having a visible systematic literature invoking the term sensemaking (using this grammatical form) is Cognitive Systems Engineering. On the surface, the approach seems almost identical with the HCI approach because both have focused on improving technology design solutions to better serve human needs. The differences between the approaches are important, however, because they reflect differing disciplinary and historical origins.

The Cognitive Systems Engineering Consortium defines its focus as: "...a design discipline that uses analyses of work (practice, structure, purposes, and constraints) to inform the design of process and technology for Human-System Integration." It examines cognitive work, traditionally viewed as "the thinking associated with knowing, understanding, planning, deciding, and problem solving." It sees cognitive work as involving the interplay between perception, cognition, and action and "...the way the interplay establishes meaning."^[29] Those focusing on sensemaking in this field generally work for industry, government (primarily military and defense), and academia and have backgrounds in psychology. They apply their expertise to designing more effective intersections between human cognitive competences, technologies, and work environments, particularly to computer and system designs.

Gary Klein's sensemaking

Gary Klein, a cognitive psychologist and leading figure in Cognitive Systems Engineering, has been the major proponent of this community's emerging focus on sensemaking. World-renowned for his pioneering work on decision making in natural settings, he was among those who concluded that laboratory models were not useful for understanding decision making in uncertainty

conditions.^[30,31] He founded Klein Associates Inc., where he spearheaded a focus on naturalistic decision making.^[32] In 2005, Klein Associates was acquired by engineering solutions development firm Applied Research Associates where Klein now serves as Chief Scientist.^[33] In addition to much cited books, Klein's primary publication venue has been *IEEE Intelligent Systems*, top-cited journal in electronic and electrical engineering. IEEE considers itself the leading association for the advancement of technology. Originally IEEE referred to the Institute of Electrical and Electronics Engineers Inc., but now the organization is known simply by its acronym.^[34]

The primary emphasis in Klein's work focuses on individual and team decision making. In a set of two 2006 coauthored papers, he described sensemaking as having "become an umbrella term for efforts at building intelligent systems."^[35,36] Klein et al., were careful to explain that a broad definition of sensemaking as "how people make sense out of their experience in the world" could easily encompass or be confused with concepts often studied in psychology such as creativity, curiosity, comprehension, mental modeling, and situation awareness. Instead, the authors anchored themselves in this definition: "sensemaking is a motivated, continuous effort to understand connections (which can be among people, places, and events) in order to anticipate their trajectories and act effectively."

Klein's primary empirical method is what he calls Cognitive Task Analysis^[37] (CTA) described in these terms: "In order to understand how people act upon the world around them, it is necessary to understand what goes on inside their heads. . . .to find out how they think and what they know, how they organize and structure information, and what they seek to understand better." Cognitive Task Analysis focuses on eliciting understandings from decision-makers of the cognitive events, structures or models they use in situation assessment, sensemaking, decision making, and planning activities. With empirical evidence from a large corpus of studies, Klein and colleagues extracted a list of refutations of stereotypes about how domain practitioners make complex decisions in dynamic environments.^[38] It is not so, they said, that: 1) data fusion and automated hypothesis generation aid sensemaking; 2) sensemaking is simply connecting the dots; 3) more information leads to better sensemaking; 4) it is important to keep an open mind; 5) biases are inescapable and prevent reliable sensemaking; and 6) sensemaking follows the waterfall model of how data leads to understanding.

Klein has emphasized that he studies sensemaking at macrocognitive not microcognitive levels. The macrocognitive positions people's problem solving behavior in terms of their views of complex sociotechnical systems while the microcognitive seeks to understand sequences of mental events. In a later paper, Klein and coauthors extrapolate their understanding of how sense making occurs in what they call a Data-Frame Model of

Sensemaking.^[39] They emphasized, as Klein has continually done, that experts make decisions primarily through an “...understanding of the current situation, how it got there, and where it is going.” However, the situational awareness here focuses not only on how the current situation invokes a working memory of the past but rather how experts make sense amid “...the growing suspicion” in the face of “...unexpected changes and surprises” that the “...current understanding is incorrect.”

Using performance observations, interviews, and incident accounts, this research studies sensemaking as the process by which individuals and teams come to understand gaps between their initial accounts and new incoming data. The research focuses on how sensemakers get fixated on current explanations, investigate inadequacies, and then reframe accounts. The ultimate goal is what Klein and coauthors call Decision-Centered Design, in which sensemaking is one of a number of macrocognitive functions that are supported in design solutions.^[40]

Sense-Making in Organizational Communication

There are two highly visible proponents of a focus on sense-making in organizational communication: Karl Weick and David Snowden. Weick deliberately uses the term sensemaking in order to convey the idea that the term is so all encompassing that it needs to be distinguished as a new concept.^[16] Snowden uses both terms—sense-making and sensemaking—interchangeably to refer to a whole set of processes specifically addressed in his organizational interventions. While Weick and Snowden both focus on organizational communication and share many assumptions in common they come from different backgrounds and pursue their projects in distinctive ways.^[41]

Karl Weick's sensemaking

Karl Weick is a social psychologist whose career has been mostly academic. He currently serves as professor of organizational behavior and psychology in the University of Michigan Ross School of Business. Drawing from his social psychologist's background, he emphasizes tensions inherent in organizational life such a threat versus rigidity, commitment versus decommitment, doubt versus self-fulfilling prophecy, and dissonance versus assurance. He brings this rich emphasis to bear on his central focus: “the conditions that precipitate the collapse of sensemaking in organizations.”^[42] In doing so, he attends with a broad and interdisciplinary reach to the intersections of literatures from social psychology, organizational studies, and communication. He generally works from theory to research practice but then turns his research results into recommendations for specific organizations and uses them as well to amplify his theoretic ideas.

He often cited 1996 book, *Sensemaking in Organizations*,^[16] describes sensemaking as a process involving

comprehending, constructing meaning, searching for patterns and frameworks, redressing surprise, and interacting with others in the pursuit of common understandings. Sensemaking, he emphasizes, should not be used as a synonym for interpretation which emphasizes a one-way relationship between interpreter and text. Sensemaking is also about authoring. It is not outcome but process—ongoing, social, retrospective, driven by plausibility rather than accuracy, and grounded in identity construction. It is about the enlargement of small cues. It is a search for contexts within which small details fit together and make sense. It is people interacting to flesh out hunches. It is a continuous cycling between particulars and explanations, with each turn giving added form and substance to the other. Sensemaking is concerned with how people “construct what they construct, why, and with what effects.”^[16]

Weick has generally applied his attention to sensemaking to those organizations that require acute mindfulness to avoid small errors, that is, High Reliability Organizations. He conceptualizes organizations as “...social structures that combine the generic subjectivity of interlocking routines, the intersubjectivity of mutually reinforcing interpretations, and the movement back and forth between these two forms by means of continuous communication.”^[16]

The emphasis on eliciting narratives which is a hallmark of Weick's approach is rooted in the central idea that storytelling is democratic: anyone can tell a story and anyone can criticize and analyze a story. “When people tell a story they are invoking a personal philosophy of reason, value, and action.”^[43] A narrative approach interrupts the privileged edifices of expert interpretation frozen in the past and requiring special technical skills for comprehension.

Weick's research approach is enacted through field studies involving both observation and interviews with primary emphasis on attending to narratives. Among the organizations he has researched have been jazz orchestras, firefighters, aircraft carriers, and power plants.^[44] The research typically involves intensive and overtime observation and/or interviewing reconstructions of organizational events from different vantage points and different observers.^[45,46] These are sometimes interspersed with workshop discussions with organizational representatives. Systematic analyses involve the use of triangulation of selected “interpretations” (usually those of multiple researchers) coupled with grounded theorizing approaches as espoused by Glaser and Straus.^[47] Various paper and pencil data collection tools are sometimes used.

Research usually concludes with recommendations to specific organizations as well as mandates for organizational life. An example of the latter is the Weick, Sutcliffe, and Obstfeld emphasis on how organizations must focus not only on successes (which potentially lead to hubris) but on failures, doing so as a means of regular iterative review without fear of punishment.^[48] Another example is

a call for fostering individually distinctive interpretations on what is going on and accepting diverse inputs in order to counteract oversimplification.

Weick's work in organizational sensemaking is highly diffused and cited. According to the ISI Web of Knowledge database (as of August 28, 2008), there are some 4600-plus journal articles that have cited his writings giving Weick a status within ISI as a "highly cited author."

David Snowden's sense-making

David Snowden's approach to sense-making shares much in common with that of Weick. Both have focused largely on organizational decision making, strategy development, and dealing with complexity. Both emphasize the value of narrative as a procedural response to complexity. Both pinpoint a need for organizations to move away from emphasizing top-down hierarchies to fluid structures responsive to changing and often elusive conditions.^[41] Both use direct involvements via workshops and other interventions as an inherent core of their research-application processes.

In contrast with Weick, Snowden implements his approach not from within academia but from organizational settings. He has been identified as a major figure in the movement toward integration of humanistic approaches to knowledge management. He defines his project as naturalizing science-based approaches to decision theory and sense-making, bringing together both academic and practitioner perspectives. A native of Wales, he has a background in philosophy and business administration. He also makes frequent references to literacy and science fiction sources in his work.^[41]

Formerly Director of the IBM Institute of Knowledge Management, Snowden is currently Founder and Chief Scientific Officer of United Kingdom-based Cognitive Edge, an international network of organizational consultants that focuses on rejuvenating management practices to better equip organizations to address intractable problems and uncertain and complex situations. Cognitive Edge's approach to research is based on action research principles.^[49] The approach typically involves interacting with representatives in organizations using participatory and discovery methods so that issues and problems can be explored in a coevolutionary process.

In this context, sense-making is defined as "how we make sense of the world so we can act in it." Snowden and colleagues focus on developing and implementing tools and practices for analyzing narrative complexity in real organizational settings. One example is a branded software named "SenseMaker Suite" that provides tools for applying the themes of narrative, complexity, and networks directly into organizational analysis and practice. Snowden explicitly focuses on the development of specific alternative forms of organizational dialogue with labels

such as "Story Circles" and "Knowledge Discourse Points."^[49]

The glue that holds much of this in place as described in Snowden's writings is an emphasis on "Cynefin"—a Welsh term referring as noun to habitat and as adjective to being familiar.^[50,51] Cynefin is one of Snowden's organizing concepts, pointing to the idea that responding to complexity requires a sense of place that enables one to advance diverse views (i.e., different storytellings) and imagine narratives of what happened, what could have happened, and how to act differently in the future.^[41,52-54]

From this anchoring in situated narratives, Snowden engages his organizational participants in differentiating between different kinds of sense-making gaps. One set of five distinctions involves differentiating between the simple, complicated, chaotic, complex, and disorderly. This framework might be used to gain insights into contentious issues, plan interventions to move situations from one domain to another, consider how to approach or manage different communities of practitioners, or develop strategies for knowledge retention.

In conjunction with the use of his various frameworks, Snowden employs action research methods such as contextualizations, narrative databases, convergences, and alternative histories. In his research, Snowden moves from a set of highly abstract philosophic premises to the dialogic practices and inventions he uses in his organizational interventions. From these he has developed tools for analyzing complexity in organizations that in turn gives feedback to his research emphases.

LIS

While LIS is the one field that most exhibits convergences between the various approaches to understanding sense-making, these convergences are of recent origin. Historically, the one approach to sense-making that has most marked LIS since 1986 is Dervin's. The germinal reference is the Dervin and Nilan review in the 1986 *Annual Review of Information Science and Technology* that called for a turn away from "traditional" approaches to studying users in which information is defined as objective, humans are seen as input-output processors, and the aim is to arrive at *trans*-situational propositions regarding information seeking and use.^[4] The authors called instead for a turn to "alternative" approaches where information is defined as outcome of human constructing processes and humans are seen as making "sense" in response to changing and sometimes elusive conditions.

Since 1986, there has been an explosion of interests in user-oriented studies in LIS. This has led to the establishment of a special interest group in the American Society of Information Science and Technology focusing on information seeking and use (SIGUSE); and the founding of the European-based Information Seeking in Context

(ISIC) consortium that holds biannual conferences. Dervin has been frequently identified as instrumental in these developments and one of the key instigators of the shift from system-centered to user-centered research in information science.^[55–59]

Brenda Dervin's sense-making

Dervin's disciplinary background is the field of communication.^[60] Prior to her graduate studies she served as communication practitioner focusing on communicating with the urban poor. After graduate school she brought this specialty to the then Syracuse University School of Library Science, now incorporated in Information Studies. Since that time she has been located at the University of Washington (1972–1986) and Ohio State University Schools of Communication. Her emphasis has expanded from the poor to any communication efforts where experts attempt to communicate with nonexperts via their messages, procedures, or system designs. Dervin is often quoted as stating that in some context, we are all information poor.^[61] For her, the biggest gap between users is not their differences as defined by outsiders but the yawning gap between nonexperts and expertise frozen in historical pasts and locked in specialized discourses.^[62,63]

Dervin focuses broadly on phenomena she terms sense-making and sense-unmaking. Her mandate is to understand how individuals engage internally (intrapersonally) and externally (interpersonally and via mediated communication) with the patterned matter energies that humans call by varied names—for example, observations, information, expertise, knowledge, wisdom. Since the 1970s, Dervin's writings have pivoted around a central theme—a call to focus on communication as communication rather than as transmission and to bridge gaps between research and practice with user-oriented research. Dervin's emphasis is applied to users and potential users by any other name, for example, patrons, audiences, patients, employees, citizens, leaders, constituents, customers, and so on. In addition to users of her work in LIS, Dervin's approach has been applied in numerous research communities, for example, pedagogy, media studies, public communication campaigns, citizen participation, development communication, and health communication.^[63]

While her work has gone through developmental transitions since first being labeled as focusing on sense-making,^[4,64] in its current form it consists of a comprehensive theory of how dialogue must be conceptualized to work communicatively.^[17,18,62] Dervin sees user research as an instance of dialogue. She aims to theorize human sense-making in the realm of what she calls “verbings” that rise above the specific noun-based idiosyncrasies of formalized information domains to the universals of

how humans navigate the human condition where discontinuities are ever-present constants even in the most orderly of conditions.

She shares with all those who focus on sense-making a reach for attention to human beings in ways more holistic than traditional emphases have allowed. She also shares the common emphasis on humans making sense amid uncertainty, complexity, and chaos. She shares especially with Weick and Snowden their emphases on facilitating diverse voices to speak and be heard, their use of various philosophic inputs, and their emphases on narrative and storytelling. With Snowden, she shares an interest in inventing alternative systematic forms of communicative intervention.

What differs in Dervin's Sense-Making Methodology is that of all the approaches it is the only one that moves from a generalized set of philosophic premises to a fully explicated methodology and practice for studying and engaging sense-making. In addition, Dervin's approach is not anchored in specific research contexts but has been designed to be useful in any context that involves communicating intrapersonally, interpersonally, or via mediated means.

For Dervin, research is itself treated as sense-making and is not privileged as a special stance outside the phenomena it studies. What Dervin proposes is that understanding the sense-makings of others cannot be simply a matter of using open-ended queries and inviting alternative voices to the table. Rather, it requires a designed reframing of communicative processes, a reframing that explicitly attends to philosophic assumptions implemented in visibly aligned methods.

The most well-known example of the application of Dervin's Sense-Making is to the methodology's interviewing approaches.^[62,65] These are all organized around a central Sense-Making Metaphor that draws together the approach's philosophic premises mandating that user studies attend systematically to: context, time, space, movement, gap, horizon, energy, power, history, experience, constraint, change (flexibility, caprice, chaos), and constancy (habit, inflexibility, rigidity). Briefly stated, these mandates require that users be studied as navigating situations while traversing two constant discontinuities of the human condition. The first is gappiness between times, spaces, and human as well as nonhuman entities that can never be bridged entirely with a priori information or instruction. The second is the struggle to sense-make one's own agency and to simultaneously sense-make one's engagements with external structures (e.g., communities, collectivities, organizations).

In its briefest form the metaphor is called the Sense-Making Triangle^[62–64] linking situationally-based step-takings out of specific histories to the building of bridges (e.g., cognitive, emotional, spiritual, physical) across ever-present gaps and sensing outcomes (e.g., consequences, impacts, effects that help and/or hinder) that then in

themselves become grounds for the next step-takings. This metaphor is not intended to suggest all human sense-making involves problem-solving or decision-making although these are conceptualized as among the possibilities.

Briefly, these philosophic assumptions mandate that sense-makers be seen as: changing as they move through time-space; navigating both certainty and uncertainty and the gaps between; sometimes confused, sometimes in doubt, and sometimes sure; struggling with how to be the same as others and yet be different; struggling, at least sometimes, with imposed structures and power constraints, albeit sometimes silently, sometimes unconsciously; sometimes acting as agents of structures, and sometimes acted on and resisting them.

In interviewing practice, these assumptions are applied in a series of different interviewing approaches conceptualized as implementing a fully developed theory of the interview.^[62] Each of the approaches involves eliciting from informants situated narratives anchored in descriptions of internal and external movements through time-space. The various interviewing approaches, labeled with such names as the Micro-Moment Time-Line, Life-Line, Micro-Element Interview, and Help Chaining, all involve bracketing time-space in different ways. They serve different purposes depending on research, application, or dialogic context.

At the core of every interview is repeated uses of Sense-Making Triangulation where informants are anchored in specific time-space moments and asked a roster of questions—adapted with vocabularies suitable to informants and context—based on these core elements: What happened? How did it connect with your life/past/work? What questions, confusions did you struggle with? What ideas/conclusions/insights did you arrive at? What emotions or feelings did you have? How were you helped and/or hindered? How did you hope to be helped? How did this connect to constraints and power dynamics as you experienced them? The intent of the questioning is to insofar as possible keep researcher and expert nouns and understandings from being imposed during the interviewing process.

Over the years, rosters of central Sense-Making categories have emerged that are used for systematic analyses. The categories focus on “universals” of sense-making drawn from 30 years of projects across myriad contexts and applications. One example category set addresses how users see their micromoments of situated sense-making stopped at junctures requiring new or revised sense and/or abandoning old sense. The categories use such names as: decision, barrier, spin-out, wipe-out, tightrope, time passing, waiting, being chased by time, observing, moving. The category labels illustrate how the methodology attends to context-free universals even while mandating that user narratives be elicited in context and situationally anchored ways.

The various Sense-Making categories form a basis for Sense-Making's approach to Situational Contingency Analysis.^[62,65] The primary gain from using this analytic approach to date has been to show repeatedly that users when seen through the lenses of their views of their situated movements in time-space are rarely well understood or predicted in traditional terms by measures that freeze individual users to attributes such as demography, personality, or cognitive style that transcend time-space. Likewise, users are rarely predicted well by attributes that freeze situations, tasks, domains, or contexts with expert driven framings that assume users see these as the same as they move through time-space.

The execution of Sense-Making informed studies have taken on many forms. All have interviewing as foundation, but administered in numerous ways—in person, by phone, online, text messaging, self-administered; executed in formalized surveys, laboratory settings, and in the field via participant observation and ethnographic approaches. The interviewing core has always involved the methodology's mandated structure of open-ended questions. Close-ended queries are sometimes added in ways consonant with the methodology's metatheoretic premises. Analyses involve both quantitative approaches including systematic content analyses and statistical displays, and qualitative approaches informed primarily by grounded theory^[44] and use of Sense-Making's Situational Contingency Analysis. Some applications have involved field or laboratory experimentation focused on dialogic invention and intervention. In these cases, Sense-Making Methodology informs both the design of the communication inventions and the researching of their impacts.

While cited, according to the ISI Web of Knowledge, in more than 1000 journal articles, most references to Dervin's work uses it to document a generalized call for more user-oriented approaches. About 120 authors have gone beyond this general usage to systematically applying Dervin's approach in small or large part to research that has been applied to message, information, procedure, and system design; and to the design of communicative interventions for dialogue. Among the notable full-scale applications are a series of studies spearheaded by Dervin and funded by governmental agencies at the state and federal levels. Examples include Dervin's early studies of the everyday information needs of residents in Seattle in 1976^[66] and California in 1984.^[67] The most recent application is an Institute of Museum and Library Services (IMLS) funded study of college and university users in central Ohio.^[68,69] Dervin has also supervised a large roster of doctoral dissertations that have applied the methodology to myriad kinds of users in varied contexts.

Some LIS anchored researchers who have given sustained attention to Dervin's approach include Savolainen^[70,71] at the University of Tampere, Finland, particularly with his attentions to improving user studies of HIBs; Fisher and colleagues at the University of

Washington^{[72],[73]} in their studies of the information grounds from which users move. In addition, the projects of a number of LIS researchers who have developed their own versions of a variety of user-oriented approaches to studying HIBs have drawn on Dervin particularly in the early stages of their projects. Examples include: Chatman;^[74] Durrance;^[75] Kuhlthau;^[76] Nilan;^[77] Ross;^[78] and Solomon.^[79–81] The most well-known application to design in LIS is Sense-Making Questioning originally presented as Neutral Questioning.^[62,82] This approach to the procedures of the library reference interview is still being taught in many LIS schools and used actively in some library systems.^[83]

SENSE-MAKING APPROACHES AS CLARION CALL

The approaches to sense-making described above have all been used in different contexts to focus on understanding HIBs, albeit using discourse-distinctive vocabularies. All have extracted recommendations for system designs and practices that will help humans better meet changing and often elusive situational conditions. All veer to the humanistic and veer away from the mechanistic. All move out of formerly accepted models of information exchange as transmission toward more interpretive, narrative, and phenomenological approaches.

At the same time, the approaches differ, sometimes subtly and sometimes distinctly. The fact that the approaches use common vocabularies belies how they proceed in quite different ways for quite different purposes. Some of the differences are easier to penetrate for they involve more readily identifiable differences in research intent and focus—who the research is conducted for; how it is used; what kind of HIBs it focuses on; in what kinds of contexts, situations or tasks; within the brackets of what time horizons; and, pointing to what kinds of outcome.

Other differences are far more subtle. Despite surface appearances of similarities, penetrating to the meanings deeply anchored within each of the different sense-making discourse communities takes time-consuming study. Deeply held assumptions are often unstated, understandably most often in approaches anchored in fields that privilege research applications to practice. Some approaches emphasize epistemology, focusing primarily on interpretive differences between sense-makers. Others emphasize ontology, focusing more on the different sense-making requirements of elusive and changing situations. Some focus at the micro level, some macro, and some both. All do a little bit of all these although sometimes only implicitly. The differences are a matter of emphasis in both articulation as well as procedure. More often than not, the tools that would allow the unraveling of these deeply rooted differences are themselves hidden beneath

surfaces. Most efforts to compare and contrast assume essentialist meanings and, thus, execute approaches to dialogue based on transmission rather than communicative theories of communication.^[17,18]

Clearly, while not all those who have turned to studying sense-making share an entirely common roster of assumptions, all have attempted to change traditional and accepted transmission oriented approaches in their research. They all reach as well to look at HIBs in ways that attend to complexity, chaos, and uncertainty. This a fundamental change and enlargement in the “paradigm” accepted for studying the human condition. Given the magnitude of this change and the challenges of the intellectual grounds that are being traversed, it is not surprising that there are inconsistencies, even contradictions, between the various approaches.

The move toward focusing on sense-making can be seen as having two major trajectories. One is a general trajectory in which the term sense-making serves as a clarion call, a marker of the growing energies directed at studying human beings and HIBs in more humanistic ways. The second trajectory is the way the term, in its various grammatical forms—sense-making and sensemaking—is being implemented to meet this clarion call in specific research and application contexts. The difficulty, for the reader attempting to grasp what sense-making is, is understanding that sense-making is not any one phenomena seen in any one way. The very difficulty of its defining and the inability to hold it still is itself a trace of the very sea-change in the understanding of HIBs toward which it may be said the sense-making movement directs research and design attention.

CONCLUSION

This entry has focused on how research approaches labeled as sense-making or sensemaking are used to address user-oriented research relevant to the study of human information behaviors. Starting with a focus on the turn to sense-making in user studies, this entry reviews the historical and methodological roots and context applications of the five visible approaches that have addressed sense-making systematically in four fields: HCI (Russell’s sensemaking); Cognitive Systems Engineering (Klein’s sensemaking); Organizational Communication (Weick’s sensemaking; Snowden’s sense-making/sensemaking); and LIS (Dervin’s sense-making).

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Serbia: Libraries, Archives, and Museums

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Abstract

This entry provides a brief historical overview of the emergence of libraries, archives, and museums in Serbia. It describes the current environment of these cultural and information institutions, including their legislation, organization, staffing, collections, automation, and services. Representative institutional profiles are also given. The entry also discusses professional education in library science, library associations, and interinstitutional cooperation.

INTRODUCTION

The Republic of Serbia is a country in Central- and South-eastern Europe. It is bordered by Hungary to the north, Romania and Bulgaria to the east, Former Yugoslav Republic of Macedonia and Albania to the south and Montenegro, Bosnia and Herzegovina, and Croatia to the west (Fig. 1). Serbia is divided into 24 districts plus the City of Belgrade. The districts and the City of Belgrade are further divided into 161 municipalities.^[1] Serbia has two provinces: Kosovo (full official name Kosovo and Metohija) and Vojvodina. The part of Serbia that is neither Kosovo nor Vojvodina is called Central Serbia. Unlike the two provinces, Central Serbia is not an administrative division. Since the armed conflict and NATO intervention in 1999, Kosovo has been governed by the United Nations Interim Administration Mission. According to the 2002 census, Serbia (without Kosovo) had a population of 7,498,001.^[2] Serbia is populated mostly by Serbs (82.9%). Significant minorities include: Hungarians (3.9%), Bosniaks (1.8%), Roma (1.5%), Croats (1%), and Slovaks (1%). The census was not conducted in Kosovo. According to the *CIA World Factbook*, Kosovo had an estimated population of 2,126,708 (Albanians 88%, Serbs 7%, and other 5%) in 2007. With 71,111 refugees from Croatia, 27,414 from Bosnia and Herzegovina, and 206,000 Serbs and Roma internally displaced from Kosovo, Serbia has the largest refugee population in Europe. The official language is Serbian, a Slavic language.

Serbia is on one of the major thoroughfares from Western Europe to Turkey and the Middle East. It is also intersected by several major navigable rivers that connect Serbia with Northern and Western Europe. Belgrade and Novi Sad are major regional Danubian harbors. Serbian terrain is extremely varied: to the north lies the rich fertile Pannonian Plain. To the east, limestone ranges and basins, and to the southeast mountains and hills. Over a quarter of Serbia's landmass is covered by forests.

Although it had a favorable economic outlook at the beginning of the process of economic transition in 1989, years of mismanagement of economy, U.N. economic sanctions (1992–1995), and the damage to the infrastructure and industry during the NATO airstrikes (1999) took their toll. In 2000, Serbia's economy was only half the size it was in 1990. And although its economy, with the GDP for 2008 estimated at \$80.717 billion and \$10,985 per capita PPP, is considered an upper-middle income economy by the World Bank, it still faces many problems, the most prominent of which are high unemployment, high export/import trade deficit, and considerable national debt. Serbian economy is based mostly on various services, industry, and agriculture.

Serbia is still developing its telecommunication infrastructure. In 2007 89% of households had fixed telephone lines, and 74.5% of households had a cell phone.^[3]

In 2008, 40.8% of households had a computer. One-third of all households had the Internet connection, of which 51.1% had a dial-up connection, 24.4% had Asymmetric digital subscriber line (ADSL), and 23.2% had cable Internet.^[4]

HISTORICAL OVERVIEW

The Serbs, a Slavic people, settled the Balkans in the seventh century. Timeline of major historical events is provided in Appendix 1. They adopted Christianity in the second half of the ninth century. From the eighth to the twelfth century they inhabited the lands under the Bulgarian and the Byzantine rule. In the twelfth century, under the Nemanjić dynasty, Serbia became a kingdom with an autonomous Orthodox Christian church. Saint Sava, son of Stefan Nemanja, the founder of Nemanjić dynasty, is accredited with writing the first Serbian prose, dealing with the life of his father. He is also acknowledged for laying the foundations of the national, religious, and



Fig. 1 Map of Serbia.

cultural identity of Serbia. The most important libraries in the medieval Serbia were those in the monasteries of Studenica (twelfth century), Žiža (thirteenth century), Gračanica (fourteenth century), Dečani (fourteenth century), and Manasija (fifteenth century). The most outstanding library was the collection of the monastery Hilandar (1199), which was founded by Serbian rulers on Mount Athos in Greece.

With the end of the Nemanjić dynasty in the fourteenth century the Serbian lands became fragmented among the competing nobility. The fragmentation made it harder to resist the advancement of the Ottomans who won two major battles against Serbs in 1371 and 1389. The country finally succumbed to the Ottoman Empire rule in the fifteenth century.

Under the Ottoman Empire rule the majority of Serbian population lived in the countryside, in small villages organized on traditional bases. The Orthodox church played a particularly important role by preserving the national identity and keeping the memory of the medieval Serbian kingdom. The center of the church was the Patriarchate of Peć (Province of Kosovo).

In the seventeenth century, Serbs helped Habsburg troops gain significant territory from the Ottomans. As the Habsburg forces were pushed back, Patriarch Arsenije III and over 30,000 families who feared massacre migrated with the retreating army to settle in the Habsburg lands. At the time of great migration in 1690 Serbs were promised freedom of religion and an autonomous church administration by the Habsburg ruler, Holy Roman Emperor Leopold I. Thus, Serbs had a relatively favorable status in the Habsburg

Empire. As in the Ottoman Empire, the church dignitaries were in practice the leaders of “shadow” Serbian secular government, with a Serbian metropolitan, established at Sremski Karlovci, at its head. Sremski Karlovci (Province of Vojvodina) became the foremost Serbian religious, cultural, and educational center. The first Serbian schools of higher education were established there.

The Orthodox church served as a major vehicle in the transmission and preservation of past traditions. It provided the only available education. Another method of the transmission of culture and history among illiterate peasants was by storytelling and oral epic and popular poetry. This oral literature had both historical and religious themes. The literary language at the time was the so-called Serbian-Slavonic, an artificial creation close to Church Slavic, but not to the speech of the common people. Vuk Stefanović Karadžić (1787–1864), the most important linguistic reformer and the great leader of the Serbian intellectual and literary renaissance, created both the modern Serbian literary language and the modern Serbian literature. He simplified Serbian orthography and introduced the “living” people’s language into literature.

After the first (1804–1813) and the second (1815) uprising against the Ottomans, the social-political and economic development in Serbia was dynamic. First secular schools were being opened right after the first uprising, replacing monastery schools. By the end of the uprising, there were around 50 schools funded by local municipalities or by parents. The first higher education institution (Velika škola) was founded in Belgrade in 1808 to educate first civil servants.

After Serbia gained the autonomy within the Ottoman Empire in 1830 the conditions became favorable for the systematic development of education and the establishment of cultural and scientific institutions. During the first decades of the autonomy, the chief intellectual influence came from the Serbs living in the Habsburg Monarchy who became an important element in the new bureaucracy. One of the first institutions to be established by the newly formed Serbian government was the Printing press in 1831. It was followed by the foundation of the National Library in 1832; the first Serbian theater and its library in 1841; The Serbian Learned Society and its library in 1842; the Library of the Serbian Lyceum in 1844, and a number of reading rooms in Belgrade and larger towns in Serbia from 1846 onward. The appearance of reading rooms (*čitališta*) in Serbia during the 1840s was important for the history of books and libraries. The reading rooms were based on the models from Western Europe. They became the public cultural institutions established by the emerging middle class to serve their cultural, national, and political development.^[5] There are records on 79 reading rooms that were active between 1846 and 1900. These reading rooms had the function of public libraries, although they were never funded by the state. The development of all types of libraries in Serbia was not the result of an

organized state policy, but came out of the need for books by different types of users. The first official librarian, Filip Nikolić, was the first person to professionally organize the National Library in the period from 1853 to 1856. He set the foundations of cataloging for the library following the Austro-Hungarian regulations, and formulated the library's first set of procedures.

The country finally gained independence with the Treaty of Berlin in 1878. As a parliamentary monarchy Serbia went through a period of economic and cultural prosperity. The 1901 Law on National Library was very important for librarianship in Serbia. This law was based on best practices in librarianship from abroad (mainly Western Europe). It also defined the role of the National Library as well as public libraries. The libraries were considered educational institutions with the aim of supporting science and educating the population. The regulation regarding the state exam for National Library personnel from 1928 is the first regulation on the obligatory education for the librarians in Serbia. However, no formal or informal library training was provided until after the end of World War II.

Serbia joined union of states (soon to be named Yugoslavia) in 1918. Its capital, Belgrade, also served as the capital of the joint state. After World War II the monarchy in Yugoslavia was abolished and the Communist Party took power and established a socialist state. Serbia was one of six federal units ("the republics") of the state. Under the leadership of Josip Broz Tito (1892–1980) and his successors Yugoslavia pursued a policy of neutrality during the Cold War, managing to steer its path between the Warsaw Pact nations and the West. It became one of the founding members of the Non-Aligned Movement along with countries like India, Egypt, and Indonesia. Besides the close ties with developing countries, Yugoslavia maintained cordial relations with the United States and the Western European countries. It was the first communist country to open its borders to all foreign visitors, and to abolish visa requirements in 1967. After the breakaway from the Soviet sphere in 1948, Yugoslavia came up with its own form of communism that allowed for some degree of free market called "market socialism." People enjoyed far greater liberties than in the Soviet Union and Warsaw Pact states. The federal state dissolved in the early 1990s, with only Serbia and Montenegro remaining in the union. The following decade brought civil war in the region and economic destruction of the country which culminated in NATO bombing campaign in 1999. In 2000 democratic changes swept the country, and Serbia entered transitional phase with aspirations of joining the European Union. In 2006 both Serbia and Montenegro became independent states.

LIBRARIES

Libraries in Serbia today are organized in a system of central libraries performing coordinating functions. The

system was set in place by 1960 Republic of Serbia Library Law. It is currently regulated by the 1994 Library Law. Central libraries manage library registers, create library catalogs, offer professional assistance, monitor professional activities, provide continuing education for library staff, analyze current conditions, and suggest improvements. The National Library of Serbia is the central library for all libraries in the country. Matica Srpska Library is the central library for all libraries in the province of Vojvodina, and University Library "Svetozar Marković" is the central library for all university, college, and research libraries in Central Serbia. This organization is regulated by the 1994 Resolution on Libraries performing coordinating functions. According to this Resolution, each county has a central library, a major public library, which oversees the functions of smaller public libraries. All coordinating activities are funded by the government. All central libraries contribute to and maintain "Serbian libraries network," a database containing statistics on all member libraries. At the end of year 2006 there were 2389 libraries in this network.

As a part of the coordinating activities, the National Library of Serbia and Matica Srpska Library conduct state professional examination of some 200 librarians twice a year. The central public libraries organize 10–20 seminars and 3–5 conferences for library staff under their jurisdiction. The National Library of Serbia, the Matica Srpska Library and the University Library "Svetozar Marković" are also the main leaders who implemented the project "Virtual Library of Serbia." The Virtual Library of Serbia^[6] has: the union catalog with over 1.9 million bibliographic records; the online library catalogs of participating institutions; a database of libraries participating in the collaborative cataloging; bibliographies; and portals to electronic journals and online databases.

In 2005 central libraries formed the Association of Central Libraries of Serbia,^[7] the role of which is enhancing coordinating functions. In 2007 the Association started the "Biblionet" project, an annual conference promoting both scholarly and professional contributions, proceedings of which are published by the Association.

The activity of libraries in Serbia is bounded by a set of laws regarding libraries, press, cultural property, and copyright. The major laws are: The Library Law from 1994; Cultural Property Law from 1994; Press Law and its amendments from 1991, 1993, and 1994; Civil Service Law from 1991; and Copyright Law from 2002. A number of new laws are in the process of being written: Culture Law, Library and Information Law, Cultural Property Law, and Legal Deposit Law.

The major library association in the country is Library Association of Serbia,^[8] founded in 1947. The aim of the society is to promote the professional interests of librarians. The Association has been an International Federation of Library (IFLA) member since 1950. It has been publishing professional journal *Bibliotekar* since 1949. The

Association has also established several awards, the most important being “Stojan Novaković” for the best book on library and information science, and the “Best librarian” award. In the last 5 years, the Association has been organizing annual international conferences.

A new type of association, the Consortium of the libraries in Serbia for Cooperative Acquisition (KOBSON),^[9] was formed in 2001. The idea for the creation of the consortium came from the directors of major academic and research libraries and the representatives from the Serbian Academic Library Association. The National Library’s Center for scientific information took a leading role in founding and managing KOBSON. The primary aim of this consortium is cooperative acquisition of scientific journals in both print and electronic format. In 2003, through the funding from the Ministry of Science, Technology, and Development, the consortium purchased 800 printed works and obtained access to 9000 electronic titles. In 2002 the consortium became an active member of the Electronic Information for Libraries (eIFL) project, the aim of which is to enable access to full text databases to countries in transition. The first publisher to participate in the project was EBSCO, providing access to eight databases with approximately 5000 journals, primarily in social sciences and medicine. Today, the project is fully funded by the Ministry of Science, Technology, and Development and offers access to full text of 35,000 journals to 387 participating libraries of all types. It also provides access to electronic books through ebrary (offering access to 30,000 scientific books) and Oxford Scholarship Online (offering access to 1300 books).

National Library of Serbia

The National Library of Serbia^[10] was founded in Belgrade in 1832 while parts of Serbia were still under the Ottoman rule. The library was first established as a town library, then served as the library of the State Printing Press (1833–1838), and as the library of Ministry of Education (1838–1870). However, from the very beginning it was receiving depository copies, thus acquiring the character of a national library. One of its missions from the outset has been to collect and preserve each Serbian book in order to document the national heritage. World War I brought losses to the library. Part of the collection was destroyed in Austrian bombing. In 1928 the library started producing the current national bibliography. In 1940 it started publishing *Glasnik Narodne biblioteke*, a refereed journal on library and information science, which is still being published.

However, World War II brought even harder blow to the library. The library was completely destroyed in German air raids on April 6, 1941. The reconstruction of the destroyed library began almost immediately, during the war at which time the library absorbed several collections (those of the Parliament, Senate, the Court, and the Saint

Sava Society), as well as personal libraries of some of the literary figures and university professors.

In 1947 the library made its collection of 133,574 items again available to the public. The library was appointed the central library of the Republic of Serbia. In 1953 the Library Center, later to become the Department for the Promotion of Library Services was founded. In 1960 the library also added the Bibliographic Department, charged with compiling the Serbian retrospective bibliography; the Palaeographical Department, whose function was to describe and register South Slav Cyrillic manuscripts; and the Conservation Laboratory for the conservation and preservation of library materials. The library started the construction of the new building in the 1960s, which was inaugurated in 1972. In the following years the National Library started using various international standards, such as International Standard Bibliographic Description (ISBD) and Universal Decimal Classification (UDC). In 1987 the library started Cataloging-in-Publication service for monographs. In 1989 it established an online catalog for all new acquisitions, and the cataloging cards stopped being produced for new acquisitions in 1991. In 1996 the library got its local computer network and Internet access, as well as its first Web site.

The National Library is the central copyright depository of the country. It also serves as a research library. The library has the collection of 5 million volumes. Its collections relate to all fields of knowledge. In particular, it collects and catalogs materials published in and pertaining to Serbia. The main emphasis of the collection is preservation of the past and promotion of the cultural heritage. The library is also a central point for the deposit of international documents (of the World Health Organization, UNESCO, European Council, Organization for Security, and Cooperation in Europe). The library prepares both retrospective and current national bibliographies. It also maintains the union catalog.

After the democratic changes in 2000, the library tried to enhance its international activities, and the Center for International Cooperation gained a more prominent role. The National Library is cooperating with other national libraries. It is a member of International Federation of Library Associations, Conference of Directors of National Libraries, Conference of European National Libraries, European Bureau of Library, Information and Documentation Associations, Consortium of European Research Libraries, and Ligue des Bibliothèques Européennes de Recherche (LIBER).

Although, the library’s main goal is to preserve accomplishments of the nation, its new and very important role is to help in building new democratic society by educating and informing the people of Serbia. Since this new mission includes building and promoting democracy and helping economic, social, and cultural revival of the country, a few new projects have been initiated to fulfill this goal. One of them has already been mentioned, the

KOBSON network for cooperative acquisition of print and electronic scientific journals. The library also took a leading role in reintroducing the cooperative cataloging efforts, which were halted in the 1990s. In 2003 it initiated project Virtual Library of Serbia,^[11] the aim of which is to connect all online catalogs of libraries in Serbia. At the moment 91 libraries participate in this project.

In addition to the other functions, the library is a thriving cultural institution, offering film screenings, concerts, book readings, and exhibitions. It is also the center for professional library training. In its regulative role it gives accreditation to librarians and decides on rank and title given at promotion. It oversees public libraries in the country. It takes an active part in drafting and proposing laws pertaining not only to libraries, but to broader issues such as the book trade. By taking a visible role in the society, the library also promotes the profession of librarianship.

The library is active in the library community. It hosts information on the professional association on its Web site. It also provides information on accreditation, exams, continuing education classes, workshops, seminars, and talks. The library presents a number of awards annually to libraries, librarians, and authors. It publishes two journals and books on library and information science.

The Digital National Library of Serbia^[12] has since 2003 grown to over half a million of digital documents organized into 70 collections. Ten collections are available through the European library portal,^[13] while four collections are Open Archives Initiative compatible. One of the earliest projects was the Serbian Children's Digital Library,^[14] which contains digital copies of 127 most notable Serbian children's books. The publishers granted copyright to post full-text in the form of scanned books.

Public Libraries

After World War II, public libraries were established in increased numbers as the result of government initiatives. Public libraries in Serbia serve four main functions: they provide for education-information needs of the people and they provide for their cultural and recreational needs. Another important activity performed by public libraries is the creation, development and, more recently, the digitization of local history collections. As of the end of 2005 there were 160 registered public libraries, 25 of which were central.^[15] The legal status of public libraries is regulated by the Civil Service Act of 1991 and the Library Law of 1994. The public library is defined as an independent cultural institution established and funded by local municipalities. In 2007 public libraries had the professional staff of 1507. In 2006 they had 457,182 members, which is 6.10% of the entire population.^[16] In order to help update library collections, in 2006 the Ministry of Culture purchased and distributed 62,082 books to all public libraries.

Public libraries have a lively programming activity. The most popular programs are exhibits, promotions of books, lectures, and round tables with wide range of topics.^[17] A good example is a series of talks, lectures, and round tables of interest to a local community and a society in transition under the name "Tea on Thursdays at 6 P.M.," held in Jagodina Public Library in 2002 and 2003. This project was supported by the Fund for an Open Society as an example of a project that affirms libraries as centers of local communities. Public libraries also publish 14 titles of professional journals and magazines.^[18]

Belgrade City Library^[19] is the largest public library in Serbia. It was founded in 1929 and opened to public in 1931. In 1961 it became the central library for municipal libraries in Belgrade. It was the first public library in the country to implement an automated library system in 1987. Today, it has 14 different departments and divisions and coordinates a network of 13 municipal libraries and their branches covering 77 locations throughout the city. According to the 2007 Belgrade City Library network annual report, the staff of 300 served the population of close to 1,300,000 by managing the collection of close to 1,800,000 items. As the central public library in Belgrade, it serves in an advisory capacity, arranges exhibits of domestic and foreign books, arranges meetings with writers, and promotes lectures and discussions about new books.

Academic Libraries

The first institution of higher education in Serbia was the Serbian Lyceum founded in 1844. In 1863, the Lyceum transformed into a college, "Velika škola," and in 1905 into the University of Belgrade, absorbing the faculties of Philosophy, Law, and Technology. The Medical School, Faculty of Theology and Faculty of Agriculture were founded in 1919 and the Veterinary School in 1936. In 2008 the University of Belgrade had 2800 faculty and 90,000 students in its 31 faculties (separate legal entities within the university) and eight institutes and centers. Other major universities are University of Fine Arts, University of Novi Sad, University of Niš, and University of Kragujevac. Higher education in Serbia is undergoing major reforms in order to comply with the Bologna Declaration, the aim of which is to create the common European higher education system by making academic degree standards and quality assurance compatible throughout Europe.

Academic libraries differ from other libraries in that they belong to two systems: that of higher education (overseen by the Ministry of Education) and that of national library network (overseen by the Ministry of Culture). Academic libraries help universities fulfill their research and education functions. There are two models of academic libraries within the university, which is made up of separate legal entities, faculties, such as Faculty of

Law, Faculty of Philology, etc. Some faculties have central libraries, while the others have a large number of department libraries. Departmental libraries are created to better meet the specific needs of their users through the development of specialized collections and the types of services they provide. Department libraries are staffed with librarians with the appropriate subject background, usually holding the degrees from the departments they serve. In 2005, academic libraries had the professional staff of 509. Since most academic libraries are department or faculty libraries it is not surprising that 46% of academic libraries were one-person libraries, 29% of the libraries had staff of two, 18% had the staff of three or four, and only 8% had the staff of five or more.^[20]

The legal status of academic libraries is governed by The Library Law, the University Law, and the Law on Scientific Research, as well as the statutes of their parent institutions. Libraries are also subject to the Cultural Property Law, Press Law, and Civil Service Law. According to the Library Law, minimum requirement for an academic library are a collection of at least 3000 volumes and one librarian. The newly founded academic libraries need to be funded by not less than 7% of their institution's budget for the first 5 years of their existence and 5% afterwards. All academic libraries receive depository copies of doctoral dissertations and master theses from their parent institutions.

The University Library "Svetozar Marković" in Belgrade^[21] is the largest university library in the country and the central library of the University of Belgrade and Art University of Belgrade as well as the central library for all libraries in institutions of higher education and special libraries in research institutes in Central Serbia.^[22] The network includes three central University libraries, 119 libraries at faculties and colleges and 98 libraries in

research institutes. As of 2007 the University Library had the staff of 96 and a collection of over 1.5 million volumes. The forerunner of The University Library "Svetozar Marković" in Belgrade was the library of the Serbian Lyceum. However, with the foundation of the University in 1905 the library was disassembled and the collection divided among a number of university institutes and the National Library. The library was reestablished in 1921, as the University Library. In 1926, through Carnegie funds, the new library building was constructed and the library regained its stature. It was the first purpose built library building in Serbia. The building is still being used (Fig. 2). After World War II the library introduced contemporary international methods and standards in the organization of the collection. Together with the National Library of Serbia it created Rules for cataloging which signified the beginning of collaborative cataloging efforts in Serbia. In 1977 the University Library became the central library for all libraries in institutions of higher education in Central Serbia. In 1987 the University Library became the center of the university information system. The library automation started in 1988, and its Web site came online in 1996.

Unlike specialized departmental and institute libraries which collect in their specialized areas, the University Library collects general works from all areas of science with an emphasis on social science and humanities. It is the depository library for all the doctoral dissertations granted in Serbia. The library also has a special museum-gallery with folk literature department, an archival collection of personal correspondence of prominent individuals from the seventeenth till the twentieth century, and a collection of old geographic maps and atlases.

There are two other central academic libraries: the Matica Srpska Library in Novi Sad for the libraries on the territory of the province of Vojvodina and the University



Fig. 2 The University Library Svetozar Marković in Belgrade.

of Priština library for the libraries on the territory of the province of Kosovo. The Matica Srpska Library is the first Serbian public and scientific library. With the establishment of the University of Novi Sad, the Matica Srpska Library^[23] became the university library in 1960 and the central library for all academic libraries in province of Vojvodina. The Matica Srpska and its library were founded in 1826 in Budapest (Hungary), but the library was not opened to the public until 1838, when a wealthy citizen, Sava Tekelija, donated his collection of 4000 volumes; at that time it was known as Tekelianum. The library's holdings were further enriched through gifts, exchanges, and purchases. The first Serbian current bibliography was begun in the library in 1842. Throughout this period the library was located in Budapest except during the 1860s when it was transferred to Novi Sad where it remained till 1875. The library was finally moved to Novi Sad after World War II. The library automation started in 1989. In 2008 the library had the staff of 150 and a collection of over 3 million volumes. It has the largest collection of Serbian books from the fifteenth to the eighteenth century and the richest collection of the Serbian periodicals from the eighteenth and the first half of the nineteenth century. The University of Novi Sad had 1610 faculty and 43,259 students in 2007. In 2003 the University founded the Central Library of the University of Novi Sad.

The University of Niš was founded in 1965. Today, it is organized into 12 faculties with over 1400 faculty and 27,000 students.^[24] The network of academic libraries in Niš consists of the University library "Nikola Tesla," founded in 1967, and 19 academic libraries. The University library Nikola Tesla has the collection of 80,000 books and 1200 titles of periodicals in print.

The University of Kragujevac Svetozar Marković was founded in 1976. Today, it is organized into 11 faculties and three centers with 600 faculty and 12,000 students. The network of academic libraries at the University of Kragujevac has the University library, founded in 1977, and 14 academic libraries. The University library has over 100,000 books and over 500 periodical titles in print.

In 1976 University of Belgrade Libraries Association was founded to help coordination among all the libraries of the university, however, it ceased to exist in the 1980s. In 1992, a new effort for better coordination resulted in the foundation of the Serbian Academic Library Association.^[25] Its members are libraries from all six public universities, as well as the libraries of major research institutes. The association publishes two journals *Visokoškolske biblioteke* and *Infoteka: Časopis za informatiku i bibliotekarstvo*.

Special Libraries

According to the current Library Law special libraries are organizational units serving library functions within other organizations. In 2003 there were 228 registered special

libraries. However, it can be claimed with certainty that the actual number is larger than that. In 2003 special libraries had close to 2.5 million volumes. The average special library collection is fairly small, around 10,000 volumes. The libraries had professional staff of 257.^[26]

One of the largest special libraries is the Library of the Serbian Academy of Science and Arts.^[27] The Serbian Academy of Science and Arts grew out of the Serbian Learned Society (1841) and the Serbian Royal Academy (1886). The library's collection started as a gift from Dimitrije Tirol, one of the first members of the society. Until 1952 the library was closed to the public, and only the members of the academy had access to it. Today the library is open to all researchers. With the collection of around 1.3 million volumes it is the fourth largest library in the country. It has a valuable collection of old and rare books with over 3000 titles. It also has a collection of 10,000 photographs of individuals active in the scientific and cultural life of the country in the nineteenth and twentieth centuries.^[28]

In 2002 with cooperation with The Council of Europe, The Organization for Security, and Cooperation in Europe and Fund for an Open Society, the National Library of Serbia opened the Center for Law Information. The center is organized as a special collection within the National Library. It is an open stacks collection of official documents with the aim of making it available to wide audience. At the same time it serves the information needs of the legal professionals, members of the parliament, and law scholars by providing comprehensive legislative information pertaining to Serbia, Europe and the international law. A similar center was opened at the University library "Nikola Tesla" in Niš.

School Libraries

School librarianship emerged and developed professionally since 1945. In 1974 Law on the Elementary School stipulated that every school must have a library with the collection consisting of at least 2500 books. Under the current laws each elementary and high school is to have a library. School libraries today are subject to both laws on education and laws on libraries, where laws on education have primacy. There are 1342 school libraries in Serbia: 980 elementary school and 362 high school libraries.^[29]

Larger school libraries developed into efficient media instructional centers. In 2006 the average elementary school library in Serbia had the collection of close to 9000 volumes. Library collections in elementary schools are divided into two separate collections: for students and for teachers. High school libraries have one collection for both students and teachers.

Among the major problems of school libraries are the lack of funds for the adequate development of the collections and the lack of permanent professionally trained staff. Prior to 2005 school library staff did not have to pass

the state professional library exam if they passed the state professional teaching exam. Now school library staff needs to pass an exam for school librarians organized by the Ministry of Education.

LIBRARY EDUCATION

The first legal act to regulate library appointments was issued in 1928, requiring a civil service examination for the employment in the National Library. The requirements of this law were extended in 1929 to positions in the University Library in Belgrade.

Professional status for most library positions is attained primarily through a system of state professional examinations. These exams also serve as a form of continuing education. There are exams for librarians, senior library assistants, and library assistants. The exam is taken after at least 9 months at a position (for high school diploma holders) and a year at a position (for the associate and college degree holders). The exam must be taken during the first 3 years of employment. The exam consists of seven parts: 1) the constitution, library legislation, and legislation regarding preservation of old and rare books; 2) introductory knowledge of library science; 3) alphabetical catalog; 4) subject catalog; 5) introduction to information science; 6) introduction to bibliography; and 7) history of book, script, and libraries. Seminars for the preparation of the exam are organized by the National Library. Exams are held twice a year in the National Library in Belgrade and Matica Srpska Library in Novi Sad, the examiners are a committee appointed by the Ministry of Culture.

In 1948 the country's first library school, Secondary Library Science School, was founded in Belgrade marking the beginnings of regular library education. The school trained students for library assistant positions until it closed in 1979.

In 1962 at the Faculty of Philology (University of Belgrade), the department of library science was established offering an undergraduate degree. However, the department was closed after only two cohorts graduated.

The next attempt of bringing library education to universities was the establishment of interdisciplinary four-semester program for juniors and seniors from all the departments of the Faculty of Philology (University of Belgrade) in 1980. The courses included an introduction to library science; the organization of libraries; cataloging; bibliography; and the history of books and libraries. The program ceased to exist in 1990, when the Faculty of Philology University of Belgrade established the Department of Library and Information Science. The department offers undergraduate and graduate degrees. The department also offers the post-undergraduate certificate for school and special librarians. After the adoption of the

Bologna Convention, the department introduced new classes on research methods, archives, and museology.^[30]

The main institution of the continuing education for libraries is the National Library. The Educational center of the National Library offers Co-operative Online Bibliographic System and Services education, state exam preparation and different seminars and courses. University of Belgrade Library "Svetozar Marković" also organizes different lectures, seminars, courses, and workshops. Other institutions offering continuing education opportunities are the Department of Library and Information Science at the University of Belgrade, Matica Srpska Library, Serbian Library Association, and Serbian Academic Library Association.

ARCHIVES

Archival collections in Serbia began to develop throughout the country after 1918 and expanded after 1945. The Archives of Serbia was the only institution of this kind to exist in Serbia prior to 1918. Preservation of archival material in Serbia is regulated by the Cultural Property Law adopted in 1994. The Decree on the division of archival jurisdiction determines a geographical division of 34 archives within Serbia (20 in Central Serbia, five in Kosovo, and nine in Vojvodina). In addition to archives organized on the geographical jurisdiction, there are specialized archives (military, film, corporate, etc.) as well as in-house archival departments.

The contemporary Serbian archives network is comprised of the Archives of Serbia as a central archives, two provincial, 30 intermunicipal, and four city archives. The Archives of Serbia^[31] was founded in 1900. It holds records from 512 institutions in Serbia, from Serbian government, from social and political organizations, and also from the University of Belgrade. It also holds records from companies, societies, associations as well as notable individuals. Today, it is responsible for archiving records produced by over 70 institutions. The archives signed an agreement with the Serbian Orthodox Church and The Ministry of Culture to preserve the clerical documents from 1830 onward.

The Archives collects records from the nineteenth century onward. There is only one older collection and some individual documents. The oldest record is *Dečanska povelja* from 1330. The archives has 937 major collections and 48 smaller collections.

The Archives is responsible for education of archivists by offering various courses. There is an exam at the end of each course, which has the character of the professional state exam. Since 1957 archive courses covering a variety of topics have been taken by 700 archivists. In 2008 the Archives started summer archives school. The Archives publishes the professional journal *Arhivski pregled*.

The Archives of the Serbian Academy of Science and Arts^[32] began its work in 1841, but became an independent institution in 1952. The main mission of the archives is to collect records relevant to the history of the Academy and the history of Serbian people. The archives contains administrative documents of the Serbian Learned Society (1864–1892), Serbian Royal Academy (1887–1944), and two defunct institutes (Institute for the study of literature (1947–1954) and The institute for the study of villages (1948–1954). It also has minutes from the Serbian Academy of Science and Arts meetings as well as the meetings of its various bodies. The archives has four collections of documents: rare book and manuscript collection (collection of Serbian manuscript books and old print books from the thirteenth to the nineteenth century); historical collection (the largest collection with 15,071 signatures covering the medieval to modern period); ethnographic collection (collection of folk literature and ethnographic material from all parts of Serbia from the nineteenth and the twentieth centuries); and the oriental collection (collection of manuscript and print books in Turkish and Arabic from the fifteenth to twentieth centuries).

Besides the main archives in Belgrade, the Serbian Academy of Science and Arts also has archives in Sremski Karlovci. This archive has over 3 million records arranged in 44 fonds and 10 smaller collections covering the period from the mid-sixteenth century to the 1970s. This archive also contains documents important for the understanding of the political, cultural, and economic history of Serbs in the Habsburg Monarchy, with particular emphasis on churches and religious life, schools, education, literature, and arts. The first inventory for this archive was created in 1719.

Yugoslav Film Archives^[33] is the national film archives founded in 1949. The archives today includes a museum and a library. In 1951 it became one of the founders and permanent members of The International Federation of Film Archives. The archive collects and preserves films and accompanying film material, photographs, posters, advertising material, documentation, props, and old equipment. The archives can be used by researchers of film and film theory. It takes an active part in educating general public and promoting film culture by organizing film screenings, lectures, round tables, and exhibits. The film collection has over 85,000 film copies, 80% of which are international. It also has a collection of documentary films pertaining to former Yugoslavia from the oldest film, *The 1904 Coronation of King Peter I*, up through the breakup of the country in 1992. It also has a valuable collection of Yugoslav movies, containing 90% of the entire production of former Yugoslavia since World War II. The library has over 21,000 books. Of special importance is the collection of scripts, scenarios, and dialog lists. The museum has a special theater that regularly shows films from its collection. In 2006 a small 18-seat theater was opened for digital media projections.

Historical Archives of Belgrade^[34] was founded in 1945. Together with the Mathematical Institute of the Serbian Academy of Science and Arts, the archives is developing an archives description program based on application of the International Standard for Archival Description (General) [ISAD(g)] and the Document Type Description for the Encoded Archival Description. The Historical Archives also translated and made available archival metadata standards ISAD(g) and the International Standard Archival Authority Record for Corporate Bodies, Persons, and Families. The archives also translated and made available all resolutions of the International Council on Archives (1994–2007).

MUSEUMS

Churches and monasteries have large collections of valuable art objects. The oldest of these is the collection at the Serbian monastery Hilandar on Mount Athos in Greece from the beginning of the twelfth century. The first museums were founded as the result of initiatives taken by prominent Serbs. In the period between 1900 and 1945 numerous specialized museums (such as ethnographic, education, and military) as well as art galleries were opened. Altogether some 70 museums were founded. Unfortunately, many museum collections were partially or completely destroyed during World War II. The oldest gallery in Serbia is Matica Srpska Gallery in Novi Sad, founded in 1847 and opened to public in 1933.

Today, museums function within the legal framework of the Cultural Property Law.

The major professional association is Serbian Museum Association,^[35] established in 2001. It continues the tradition of the previous association founded in 1962. The association has both individual and institutional members interested in the advancement of museology and museums. The association installs an annual award to the best museum and the best curator.

The National Museum

The National Museum Belgrade,^[36] founded in 1844, is the oldest and most important museum in Serbia (Fig. 3). It initiated the first archeological excavations in Serbia in 1865 and started collecting world art in 1891. Today, the museum is the central institution in the museum network of Serbia. It is also a central museum for archeological, numismatic, and art collections dating before 1900. It is the central institution for the preservation of cultural property.

The museum has 34 archeological, numismatic, art, and historic collections. Its goal is to preserve, interpret and promote cultural heritage of Serbia and its neighbors. Apart from the archeological collection, the museum also has 1700 Serbian paintings from the eighteenth and



Fig. 3 The National Museum in Belgrade.

nineteenth centuries; 3000 Yugoslav paintings from 1889 to 1999; and international collection of 1100 mainly European paintings and sculptures from fourteenth to twentieth century. The museum holds Miroslav Gospel, the first preserved Serbian Cyrillic manuscript dating from around 1180 with miniatures of outstanding beauty. It has been registered in UNESCO's Memory of the World program in 2005.

In 1957 the museum opened new conservation lab. In 1997 it founded the school for conservation "Dijana." The school is now department for preservation and conservation.^[37]

The museum has extensive educational activities. It organizes museum workshops for group visits by kindergarten and elementary school children. It also has guided tours and lectures for high school and college students.

In 1933 the museum started publishing the journal *Numizmatičar* and in 1937 the journal *Umetnički pregled*. Today, it publishes five journals: *Zbornik Narodnog muzeja u Beogradu: Arheologija*, *Zbornik Narodnog muzeja u Beogradu: Istorija umetnosti*, *Numizmatičar*, *Glasnik Društva prijatelja Narodnog muzeja u Beogradu*, and *Diana: Odeljenje za preventivnu zaštitu Narodnog muzeja u Beogradu*.

Art Museums and Galleries

The Museum of Applied Arts in Belgrade^[38] was founded in 1950. The museum has over 35,000 artifacts. It is a central museum for the applied arts in Serbia. It has collections of jewelry, textile, costume, furniture, photography, glass, architecture, and modern applied arts.

The Museum of Modern Art was founded as a Modern Gallery in 1958. The museum collects and preserves Yugoslav artwork dating since 1900. The museum

researches new methods in the area of visual culture, history, and theory of art. It has the collection of paintings from 1900 to 1945; the collection of paintings after 1945; collection of sculptures; collection of prints; and the collection of new art media (photography, film, video, etc.).

The Museum of Naïve and Marginal Art in Jagodina^[39] was founded in 1960. It contains about 2500 artworks from about 280 painters and sculptors. The museum organizes naïve art colonies and biennials.

The Gallery of the Serbian Academy of Science and Arts was opened in 1968. It is an organizational unit within the Academy. The gallery collects and preserves art objects owned by the Academy. It has paintings, prints, and sculptures of some 270 artists, 50 of them Academy members. The gallery organizes various art, science, and culture exhibits, public lectures, regular concert program and has a lively publishing activity. The gallery is funded by the academy, i.e., The Ministry of Science, Technology and Development. Some projects are funded by the Ministry of Culture, and the City of Belgrade Committee on Culture.

Science Museums and Galleries

The Natural History Museum,^[40] founded in 1895, is one of the oldest museums and one of the oldest specialized scientific institutions in Serbia. It is the only natural history museum in the country, and with the collection of 1.5 million objects it is one of the largest natural history museums in southeastern Europe. Before the foundation of the museum, in the first half of the nineteenth century, a large number of natural history artifacts was held in the Lyceum. The first exhibit in the Museum was held in 1904 with the king present at the opening. The same year museum participated in the World Fair in Paris. During

World War I and World War II, parts of the collection were damaged or destroyed, including the museum archives and parts of the library. Today, the museum has 118 collections. It is one of the few museums in Serbia having a scientific research department. Its education department collaborates with numerous schools in Belgrade and Serbia. The museum also has a special library, one of the oldest scientific libraries in the country, founded in 1903. The museum has been publishing a scientific journal from 1948 to 1998. In 2008 it started publishing a new journal *Bulletin of the Natural History Museum in Belgrade*. The museum has also started the digitization project.

The Science and Technology Museum^[41] was founded in 1989. The mission of the museum is the preservation of scientific and technological heritage in Serbia. Museum aims at popularizing science and enhancing scientific and technological culture by collecting, researching, preserving, and exhibiting objects related to science and technology.

The Science and Technology Gallery of the Serbian Academy of Science and Arts was founded in 1988, and started having exhibits in 1997. From 1997 till 2005 the program of the gallery, including exhibits and lectures was handled by the Science and Technology Museum. The gallery started organizing its own programs in 2006 with the emphasis on the history of science and technology in Serbia. The mission of the gallery is popularization of science and technology. The Gallery is also home to the Science and Technology Museum's special library.

The Nikola Tesla Museum^[42] was founded in 1952. The museum holds personal documents and belongings of Nikola Tesla, making it the most significant institution for the study of life and work of this famous inventor. It has over 160,000 documents, over 2000 books and journals, 1200 historical technical artifacts, 1000 blueprints and drawings, and 1500 photographs and photographic plates of the original instruments. The museum has Nikola Tesla Archive, a unique collection of manuscripts, photographs, and scientific and patent documentation. The archive was registered in UNESCO's Memory of the World program in 2003. The museum also has Tesla's personal library with 786 book titles, 323 titles of periodicals, and about 70,000 newspaper clippings.

The Science and Technology Museum initiated the foundation of the Science and Technology Museum Association of Serbia in 1991. Through this association the museum coordinates 16 museums and collections in Serbia, including the Automobile Museum, the Aviation Museum, the Mining Metallurgy Museum, the Serbian Medical Museum, the Natural History Museum, the Agricultural Museum, and the Serbian Railway Museum. One of the accomplishments of the association is the creation of standards for processing technical cultural assets. As of 2003, the association started publishing a newsletter *NAVOJ*. Its primary goals are improving the cooperation among

museums, contributing to the development of the profession, and informing expert and general public of the work that is being done for the protection of the technological heritage of Serbia.

Historical and Ethnographic Museums

The Historical Museum of Serbia was founded in 1963 to collect and preserve historical artifacts related to the economic, political, and cultural history of Serbia.

The Ethnographic Museum^[43] was founded in 1901. It has been collecting artifacts from Serbia and the Balkans. In 1926 it started publishing the journal *Glasnik Etnografskog muzeja* which is still published today. The museum has one of the richest ethnographic libraries in the Balkans. It has an active educational unit and conducts ethnographic research. It also organizes workshops to teach the traditional crafts. Since 1992 the museum has been organizing the International Festival of Ethnographic Film.

CONCLUSION

Because of its location at the crossroads, Serbia was for centuries shaped by the cultural boundaries between the East and the West. Its cultural and information institutions shared its tumultuous history. Periods of greatness and prosperity were followed by periods of devastation. Throughout the history, wars would decimate the country's printed and cultural heritage and the institutions preserving that heritage. But, the institutions would soon rebuild and consolidate themselves and move forward. Such a history left the country constantly torn between striving for modernization and preserving its traditions and cultural heritage.

Present-day institutions started to be developed only in the midnineteenth century when the conditions became favorable for the systematic development of education and the establishment of cultural and scientific institutions. Chief intellectual influence for the development of these institutions came from the Western Europe, introduced to Serbia by the Serbs living in the Habsburg Monarchy. Thus, its first reading rooms were based on the models from Western Europe and the first library catalog in the National Library followed Austro-Hungarian regulation. The first libraries and museums were not result of an organized state policy, although the state supported them financial and developed appropriate legislation relatively early.

Much greater involvement of the state came during the communist rule after World War II. During that time Serbia organized a countrywide system of central libraries performing coordinating functions which is still in place. The system provides libraries greater visibility, streamlined funding, and more clout. It is also conducive to

larger projects such as the reintroduction of cooperative cataloging through the Virtual Library of Serbia project or cooperative acquisition of scientific periodicals through the KOBSON project. In recent years Serbian libraries have increased cooperation with Western European countries.

APPENDIX

Table A.1 Timeline of Major historical events

Seventh century	Serbs, a Slavic people, settled the Balkans
Ninth century	Serbs adopted Christianity
Ninth century	Cyrillic alphabet introduced
Thirteenth century	Serbia became a kingdom with an autonomous Orthodox church
Fourteenth century	Serbia fell under the Ottoman Rule
1493	First Serbian printing office opened in Cetinje (Montenegro)
1494	First book printed in Serbian language
1690	Great migration of a part of Serbian population to Habsburg Empire
1768	First Serbian magazine published in Venice (Italy)
1791	First Serbian newspaper published in Vienna (Austria)
1808	Velika škola, the first higher education institution, was opened in Belgrade
1814	First grammar of the reformed language, <i>Pismenica</i> , by Vuk Karadžić was printed in Vienna (Austria).
1823	Srpska velika gimnazija (Serbian High Gymnasium) founded in Novi Sad
1825	First literary magazine, <i>Serbski letopis</i> , started in Buda (Hungary)
1826	Matica Srpska founded in Pest (Hungary)
1827	First bindery and bookstore opened in Belgrade
1830	Serbian principality granted a fully autonomous status by the Ottoman government
1831	State Printing Press established in Belgrade
1832	National Library founded; Legal deposit for the National Library introduced; First Serbian book printed by the state printing press in Belgrade
1834	First newspaper published in Serbia
1838	Licej Kneževine Srbije (Serbian Lyceum) founded
1842	Serbian Library Association founded; First Serbian current bibliography begun at Matica Srpska Library; Serbian Learned Society (Društvo Srpske Slovesnosti) founded; Library of the Serbian Learned Society founded
1844	Library of the Serbian Lyceum founded; National Museum Belgrade founded
1846	Reading room (čitalište) in Belgrade founded; First scientific journal published by the Serbian Learned Society
1847	Matica Srpska Gallery in Novi Sad founded

(Continued)

Table A.1 Timeline of Major historical events (Continued)

1853	First official librarian, Filip Nikolić, appointed in the National Library
1860	First private printing press opened
1867	Vuk Karadžić's new simplified orthography officially accepted
1869	First bibliography produced
1870	First Press Law
1871	Law dividing the National Library and the National Museum into separate institutions
1878	Serbia's independence from the Ottoman Empire recognized at The Congress of Berlin
1881	First law on The National Library
1891	Ministry of Education arranged interlibrary loan exchanges between the college library in Belgrade and the Court Library in Vienna
1895	Natural History Museum founded
1898	Law on the State Archives
1900	Archives of Serbia founded
1901	Law on the National Library and The Rules on Internal Organization and Work in the National Library; Ethnographic Museum founded
1918	Serbia joined the Kingdom of Serbs, Croats, and Slovenes
1928	Legal act to regulate library appointments requiring a professional examination for the employment in The National Library; National Library started producing the current national bibliography
1929	Kingdom of Serbs, Croats and Slovenes changed name to the Kingdom of Yugoslavia
1930	First union catalog of the University of Belgrade libraries created
1938	International standard format cataloging cards introduced
1940	Library journal, <i>Glasnik narodne biblioteke</i> , started being published
1941	National Library completely destroyed in German bombing
1945	Historical Archives of Belgrade founded
1946	Federal People's Republic of Yugoslavia proclaimed. Monarchy abolished
1947	Library Association of Serbia founded
1948	First library science degree program, Secondary Library Science School, founded in Belgrade
1949	Yugoslav Film Archives founded
1953	Library center (to become Department for the promotion of library services) founded in National Library
1958	Museum of Modern Art opened
1962	First undergraduate degree program in library science established at the University of Belgrade
1963	Name of the country changed to Socialist Federal Republic of Yugoslavia
1974	National Library started using UDC
1976	National Library accepted new international standards for bibliographic description, ISBD
1987	National Library started Cataloging-in-Publication service for monographs; Belgrade City Library implemented automated library system

(Continued)

Table A.1 Timeline of Major historical events (*Continued*)

1989	National Library started using the online catalog for all new acquisitions; Science and Technology Museum founded
1990	Department of Library and Information Science at the Faculty of Philology University of Belgrade founded
1991	Science and Technology Museum Association of Serbia founded
1992	Slovenia, Croatia, Bosnia and Herzegovina, and Macedonia gained independence from Yugoslavia
1992	Serbian Academic Library Association founded
1996	National Library established Internet access as well as its first Web site
1999	NATO bombing campaign; U.N. Administration of Kosovo
2001	Consortium of the libraries in Serbia for Cooperative Acquisition (KOBSON) formed
2003	National Library started Cataloging-in-Publication service for serials
2004	National Library became National ISSN center
2005	Association of Central Libraries of Serbia formed
2006	Serbia and Montenegro dissolved their union and became independent states

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Serials Collection and Management [ELIS Classic]

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Abstract

This entry discusses the selection and management of serials in libraries. It provides an overview of the process of serials collection and management as well as current issues and controversies. Relevant definitions are provided as well as a brief history of serials management. Focus is on recent developments (standards, technologies) and their impact. Selection, acquisition, access, processing (including cataloging), maintenance, preservation, and weeding of serials in all formats are covered and important players in each process are identified.

INTRODUCTION

Serials are publications that are characteristically issued in discrete, separate parts without a predetermined date on which publication of successive issues will conclude. The parts are commonly differentiated from one another by numerical or chronological designations. Serials exist in the middle of the hierarchy of related terms; they are a type of continuing resource and encompass periodicals. These characteristics differentiate serials from other types of publications and are at the heart of the challenge that their collection and management presents to libraries.

The process of collecting and managing serials is cyclical rather than linear. Serials management is an open system subject to outside influences. Budgets set outside the library, technology, and in particular, changing users and user preferences directly impact what and how a library collects. Selection and management activities mirror the users' information seeking activities as is depicted in Fig. 1. The users' process is depicted in the inner cycle. An information need is identified and leads to information seeking and identification. Information identification can lead the users to the identification of new information needs or to obtain the identified information. Information obtained is used to create new information and/or for the identification of additional information or information needs. The outer cycle reflects (albeit simplistically) the cycle of serials information management. Serials are selected, acquired, and processed before they are made accessible to the user. Maintenance of serials requires both additional processing of issues that continued to be received over time as well as preservation of existing issues. Periodic weeding is often required as items to be preserved or discarded are identified. Selection is based on the users' information needs. Acquisition, processing, and the provision of access to serials support the users' information seeking and identification, and allows them to obtain information. Some but not all users will use

the information they obtain to create new information which may then be selected for inclusion in the library collection.

This entry is organized on the basis of the cycle of serials management presented in Fig. 1. Issues and controversies among members of the serials information chain will be noted and explained as they arise in the text. For the most part, electronic serials are not dealt with separately but rather discussion of them is included in the discussion of the processes of serials selection and management, again with differentiations noted as needed. Although the introduction of electronic formats caused upheaval in the world of librarianship during recent decades, we have since, to some extent, become accustomed to rapidly changing formats; certainly they have become ubiquitous to users. Thus the focus should not be on formats alone but on the processes of selection and management with notation of the upheaval, etc. where it has recently been the greatest.

DEFINITIONS

A discussion of serials collection and management should begin with the precise definition of terms to be used in the discussion. Although often used interchangeably, definitions of the terms serial, periodical, and continuing resource are in fact different and hierarchically related to one another. The International Organization for Standardization (ISO), the body that assigns a unique International Standard Serial Number (ISSN) to serial publications, defines a serial as "a publication in any medium issued under the same title in a succession of discrete parts, usually numbered (or dated) and appearing at regular or irregular intervals with no predetermined conclusion."^[1] The National Serials Data Program (NDSP) defines a serial as "print or nonprint publications issued in parts, usually bearing issue numbers and/or dates. A serial is

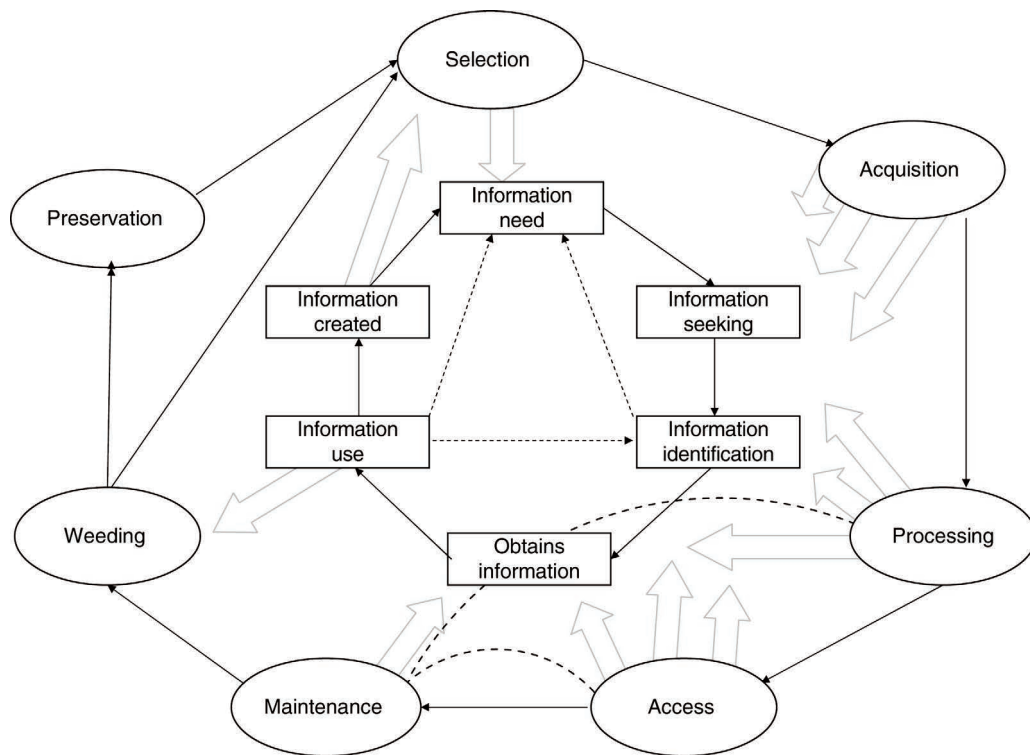


Fig. 1 The cycles of serials management and the user information process.

expected to continue indefinitely. Serials include magazines, newspapers, annuals (such as reports, yearbooks, and directories), journals, memoirs, proceedings, transactions of societies, and monographic series.”^[2] These definitions as well as definitions of serials from other authoritative sources like the second edition of the Anglo American Cataloging Rules (AACR2) have in common a number of characteristics that differentiate serial publications from other types of publications, namely:

- Successive parts
- Typically differentiated from one another by numerical or chronological designations
- No predetermined date of termination^[2]

Serials exist in the middle of the hierarchy of related terms; they are a type of continuing resource and encompass periodicals. Continuing resources are defined in AACR2 as being “issued over time with no predetermined conclusion, including bibliographic resources issued successively in discrete parts and integrating resources into which updates are incorporated without remaining discrete. Examples include serials (periodicals, newspapers, etc.), monographic series, and updating loose-leaf services, databases, and Web sites.”^[2] The term periodical encompasses newspapers, popular magazines, scholarly journals, and trade magazines. They are, by definition, serials and thus share all of the characteristics of serials. They are usually intended to be published regularly (although in practice this may not always be the case).^[3]

Typically, a newspaper is printed on newsprint, published daily or weekly,^[2] and contains editorial comment, regular columns, advertising, and/or cartoons. Popular magazines can often be distinguished by being printed on glossy paper and contain a larger proportion of advertising than other categories of periodicals (since much of their costs is covered by advertising) and subscription rates are typically low.^[2] Trade journals are usually intended for a specialized audience and often contain advertisements,^[2] book reviews and listings of employment opportunities. Scholarly journals contain few, if any advertisements and are devoted to publishing the results of original research. Research articles are usually peer-reviewed, that is, they are critiqued by a panel of experts before they are accepted for publication.^[3,4]

Although the physical form of periodicals has been used here as a distinguishing characteristic, almost all types of periodicals may also be published electronically. Serials published in electronic form are defined by the Library of Congress’s Cooperative Online Serials (CONSER) program and AACR2 as being delivered online via a network.^[1] It is important to note that other types of continuing resources are also often delivered online via a network and, in fact, this method of delivery is considered to be particularly effective for their timely delivery.

Almost every library’s collection includes serials but the type and number varies widely from one library to the

next. In general, public libraries collect fewer serials than do academic or special libraries. Public libraries spend far less of their budgets on serials (6% vs. 42% according to Black).^[2] They may collect a larger proportion of popular periodicals (magazines, trade publications, and newspapers) to scholarly journals. Academic libraries collect more scholarly journals and, often, more trade publications than public libraries although, of course, all library serials collections are based on the needs and interests of their users. Scholarly journals are usually more expensive than trade publications (sometimes a great deal more expensive), thus a larger proportion of an academic library's budget is spent on serials subscriptions. The extent of serials collecting by special libraries (for example, law libraries and corporate libraries) is more difficult to generalize since it will depend on the population the library serves.

HISTORY

A comprehensive history of serial publications itself is beyond the scope of this entry. In addition to an excellent but relatively brief review of the history of the serial provided in the second chapter of Nisonger's *Managing Serials in Libraries*,^[5] several useful and comprehensive books have been written on the subject including Davinson's *The Periodicals Collection*^[6] and Houghton's *Scientific Periodicals: Their Historical Development*.^[7] This section will focus on only the historical development of serials collection and management.

The first indexes developed at almost the same time as the first scholarly journal, around 1683 and the first abstracting service developed around 1830.^[5] A number of currently well-known indexes developed during the later nineteenth century and early twentieth centuries: Poole's index to Periodical Literature which was published from 1848 to 1907, H. W. Wilson's Reader's Guide to Periodical Literature which began publication in 1900, and Ulrich's International Periodicals Directory which was initially published under the name "Periodicals Directory: A Classified Guide to a Selected List of Current Periodicals Foreign and Domestic in 1932."^[5]

The late nineteenth century also saw initial forays into serials subscription management by agencies. Both the Faxon company (in the United States) and Blackwell's (in the United Kingdom) can trace their origins to this era. The earliest automated subscription services were introduced by Faxon and EBSCO in the 1980s.^[9]

Bibliographic control of serials was hugely advanced in the 1960s and 1970s with the development of the ISSN and the ISSN Network. The ISSN Network consists of centers throughout the world which are responsible for the assignment of ISSNs and key titles both of which are unique identifiers and are immensely helpful in differentiating serials with similar titles. ISSNs can be assigned to a serial in any format.^[5] In 2001, as the AACR2 chapter

dealing with serials was revised and renamed, ISSNs began to be assigned to continuing resources. In 2007 the standard for the creation and assignment of ISSNs was revised to include a linking ISSN or ISSN-L. The ISSN-L is a mechanism for bringing together the various formats in which a continuing resource may be published (each of which may have been assigned a unique ISSN). The ISSN-L is separate from the ISSN enabling it to be coded separately in metadata records. This provides for identification of a serial regardless of the number of different formats it is published in, by OpenURL services and in machine readable cataloging (MARC 21) records.^[8]

Additional events in library automation that impacted serials management include the development of bibliographic utilities, integrated library systems, and the Online Public Access Catalog (OPAC). Bibliographic utilities like Online Computer Library Center (OCLC) and Research Libraries Information Network (RLIN) in the United States and Auto-Graphics, Inc. in Canada provide their members with access to a database of bibliographic records which they can download, create, and modify and which rely on machine readable cataloging as well as recording serials holdings information which facilitates interlibrary loan.²¹ Noncomputer serials management systems were being developed in libraries as early as the 1940s but it would be the 1980s before computerized integrated library systems (ILS) would be developed. Initially this took place in libraries (mainly academic libraries). During the 1980s vendors like Readmore and Faxon began marketing their own ILS. Advances and widespread use of communication technologies like the Internet during the 1990s and 2000s provided libraries with greater and greater control over serials and all other library materials as well as for access to them through the OPAC.

SELECTION

Librarians, library staff members, and library users traditionally participate in serials selection either separately or through committees. The combination of selectors will vary by type of library (academic, public, special, etc.). In all cases, the users' needs are a primary selection criterion. Users may make their needs known directly, indirectly, or both. Direct communication of needs may occur through participation on selection committees or, as is often the case in academic libraries, through a program for faculty participation. Indirect communication of needs may occur through use which may or may not be formally measured.

Selection criteria related to user needs will reflect the mission of the institution and may include support for academic curricula and research, user interest, and relevance to the rest of the library collection. Additional selection criteria include access to the content through indexes, peer review of content (for scholarly journals), cost, anticipated level of use, publisher reputation, citation rates and

impact factors, physical quality, level of topical coverage in relation to existing subscriptions, type and frequency of requests, longevity, availability elsewhere, reviews, availability of desired format, inclusion in core lists, and available space in the library. The exact combination of criteria a library uses will vary by type of library and, often, within a single library over time. Some selection criteria are more universal than others, particularly format and cost.

Format. The increasing ubiquity of electronic serials in the twenty-first century makes selection decisions regarding format more complex. Prior to the development of technologies that make the delivery of serials in electronic format attractive to both users and librarians, serials subscriptions were delivered in either print or microform. Print subscriptions were generally preferred and microforms were selected based on the library's need to either conserve shelf space or to preserve content or both. Electronic subscriptions provide similar space-saving advantages to microforms and can be made accessible to patrons inside and outside of the library building virtually 24 hours a day, 7 days a week. However licensing agreements for electronic subscriptions rarely allow libraries to preserve content locally. This loss of control over content preservation has created a fear among librarians that electronically subscribed content may disappear. Thus, despite the advantages of electronic serials, a library may elect to purchase serials in print or microform rather than or in addition to an electronic version.

Advantages and disadvantages of electronic subscriptions also vary depending on the type of serials being considered. The preceding discussion focused on periodicals including scholarly journals. Additional advantages exist for purchasing continuing resources in electronic format, and, in fact, there is a trend away from publication of continuing resources in print. Continuing resources in print require substantial library staff time to remove discarded pages and replace them with pages containing updated information. Examples of this include legal materials, medical materials, and business materials, particularly stock, bond, market, and industry information. The processing time required to make these materials available in print (printing, mailing, as well as in-library processing) delays users' access to time sensitive information. These disadvantages are eliminated by making them available electronically.

Cost. Serials subscription costs became a point of contention between publishers and libraries during the 1970s and 1980s when increases in annual subscription prices began to rise at a rate above (sometimes far above) the rate of inflation. Conditions that contribute to these increases are generally accepted to be increases in the volume of published research; increases in the number of serial publications; fluctuations in the rates of foreign currency exchange; and market dominance, particularly in the fields of science, technology, and medical, of a few, profit-oriented publishers. Also contributing is the cycle of

subscription cancellations by libraries who can no longer afford a particular subscription, which results in publisher price increases made to make up for a smaller subscription base, which, in turn, results in another round of subscription cancellations by libraries, and so on. These conditions and the resultant rapidly increasing subscription costs are known as the serials crisis.

The serials crisis impacts academic and medical libraries to a greater extent than it does public libraries because more of their budgets are allocated to the purchase of serials. Academic libraries have responded by shifting funds previously earmarked for other types of library materials to their serials budgets. A 1992 study indicates that college library serials subscription expenditures increased from 31.13% of their budgets in 1973–1974 to 42.12% of their budgets in 1988–1989.^[1] The annual Library Journal Periodicals Price Survey (published in the April 15 issue each year) reports changes in periodicals prices and predicts changes for the upcoming year. Other sources of serials subscription price increases are available from the Association of Research Libraries and the Association for Library Collections and Technical Services (ALCTS) division of the American Library Association (ALA).

Most academic libraries and many public libraries develop collection development policies to guide materials selection including serials subscriptions. A serials collection development policy typically includes a list and description of approved selection criteria. Serials collection development policies may also include guidelines for the acceptance of gift subscriptions and serial back issues. An academic library is likely to describe levels of collecting by subject discipline in its policy as well as strategies for conserving shelf space like setting specific lengths of retention for periodical back issues and for selecting titles for preservation. A serials collection development policy may also address the issue of access to versus ownership of serials titles (also known as just-in-case vs. just-in-time), that is, it may contain a plan for selecting which titles are relevant enough to require individual subscriptions (ownership) and which are only tangentially relevant and for which access may be provided via document delivery services like interlibrary loan or via a full text electronic aggregation (access but not necessarily ownership).

ACQUISITION

Once a serial has been selected, the next step in its management is to purchase a subscription, to acquire it. In simple terms, an order for a new subscription is placed by the library with the publisher; the publisher is paid for the subscription and subsequently begins delivery of issues to the library. At the end of the subscription period, the subscription is either renewed or cancelled. Seldom, however, is the process really this simple.

To begin with, a library is likely to have multiple subscriptions. Small public or special libraries may have as few as 10 or 20 subscriptions while large research libraries may have tens of thousands of subscriptions. In addition to a small number of serials subscriptions, small libraries generally have small staffs and while large research libraries have larger staffs, it is easy to see how ordering, renewing, tracking receipt of, and issuing payments for multiple serials subscriptions can begin to take up a great deal of library staff time in any library. For this reason, many libraries choose to purchase the services of a subscription agent to handle these functions for the library.

A subscription agent will typically place orders, make payments, and cancel or renew subscriptions on behalf of the library. The library pays one bill to the subscription agent for multiple subscriptions plus a service charge to the agent. The agent sends the library a list of subscriptions once a year for them to approve subscription renewals and make cancellations. The agent will also alert the library to changes in their subscriptions, for instance, changes to titles, publishers, subscription rates, and publication delays and will take some of the burden of communicating with the publishers about claiming missed issues of print serials and resolving access issues to electronic serials. A subscription agent handling a large proportion of a library's subscriptions can provide the library with valuable reports describing patterns in, for example, cost increases, delayed publications, and/or claims sent and fulfilled.

Recently, in response to increasing serials costs, libraries have begun to collaborate in the purchase of bundles of periodicals. Consortial purchases benefit libraries by providing them with buying power that they would not have individually and allow them to provide their users with access to periodicals that they would not otherwise have. Subscription agents often play a part in consortial purchases by providing centralized management of the titles included in the bundles and customized billing to consortia members who may pay different percentages of the total cost of the bundle based on their institution's estimated usage of titles in the bundle or number of users or both. Publishers benefit from the agent's management of title lists and by receiving a single payment for the bundled subscription. Consortia and member libraries benefit from the management of institutional title lists (which may vary among the consortia member libraries) and by the agent's ability to customize billing to each member library.

The services of a subscription agent generally apply to subscriptions to print, electronic, and sometimes microform serials and are considered to be worth the service fees charged. Care should be taken in selecting a subscription agent. Criteria for selecting a subscription agent include the quality of services provided and the agent's reputation and financial stability. The importance of an agent's financial stability became clear in 2002 when the

divine/RoweCom/Faxon Library Subscription Service filed for bankruptcy leaving many libraries with paid but unfulfilled subscription orders.

PROCESSING

Check-In

Unlike monographic purchases, serials subscription purchases require constant tracking of receipt of multiple issues. This process is called check-in and occurs upon receipt by the library of each serial issue. In most libraries it is an automated process in which receipt of an issue is noted in the ILS where records of all of the materials owned by the library are stored and made available to users. Although check-in provides a record of receipt of materials purchased required by many institutions, there is some debate over whether check-in, particularly in the case of electronic serials, is worth the time spent on it by library staff. Some libraries have done away with check-in for serials issues in any format.

Check-in often alerts libraries to the existence of missing issues. Missing issues can then be requested directly from the publisher or from the publisher through the subscription agent. This process is called claiming. Claiming is often automated and conducted using the library's ILS. The ILS has the capability of creating a list or report of missing or late issues. The list can be printed and e-mailed or faxed to the subscription agent or publisher or it can be transmitted via electronic data interchange (EDI). EDI is a standard for structuring data so that it can be exchanged between computers quickly and efficiently. It is used by libraries and subscription agents for exchanging data required for claims as well as for prompt delivery of invoices.

Check-in also facilitates the provision of serials holdings information to users. Holdings information describes exactly which volumes and issues (or other parts) of a serial the library owns and/or provides access to. Also unlike monographic materials, libraries may provide multiple access points to serials. Holdings may be displayed in the OPAC but may also be displayed in separate lists. A current popular term for such a separate list is A-to-Z list, that is, a searchable alphabetical list of a library's or group of libraries' serial holdings. Another term for a list containing the serials holdings of two or more libraries is called a union list.

Cataloging

Although in libraries the term cataloging traditionally refers to the creation and maintenance of records containing bibliographic information in a library catalog (either paper or electronic) in order to provide access to the materials described in those records, maintaining

bibliographic information describing serials (and other materials) in A-to-Z lists, union lists, and link resolvers as well as the OPAC can be (and is) described as cataloging. Cataloging of serials in the traditional sense is accomplished by most libraries through importing bibliographic records from a national bibliographic database like the OCLC. The Library of Congress's Program for Cooperative Cataloging Cooperative Online Serials (CONSER) program provides standards for traditional serials and continuing resources cataloging. These are used in conjunction with the standards for cataloging of other materials (including serials and continuing resources) described in AACR2 and MARC 21.

During the late twentieth century, as library catalogs began to be automated, some libraries chose not to include bibliographic records for serials in the OPAC but rather to provide lists of serials titles to display holdings and to shelve periodicals in alphabetical order by title in order to promote finding.^[5] Advances in technology improved flexibility in OPACs and the emergence of electronic journals and the capability of OPACs to link to them have combined to make the inclusion of serials records in OPACs much more desirable and easily accomplished today. However, the question of whether or not to catalog serials lives on through the emergence of electronic journals and subsequent decisions required about ownership versus access.

Libraries in the early twenty-first century have the capability to make far more serials available to users electronically than they could in print and microform alone. The ability to purchase bundles of electronic serials either from publishers or from third party aggregators makes this possible. The time and staff required to catalog the much larger number of serials to which the library now provides access can be extensive. While catalog-ready MARC 21 records are often available for purchase with a bundle, some library resources are still required to download them and edit them to local standards. Libraries lacking the resources to purchase and process MARC 21 records for their electronic journal bundles often continue to elect to catalog in their OPACs only those journals to which they actually subscribe (as opposed to those to which they simply provide access).

Once the decision is made to include bibliographic records for serials in the OPAC, the library must determine the extent and level of cataloging. Libraries that shelve their print periodicals separately from the main collection and arrange them in alphabetical order by title may choose to catalog them to a lesser extent, with fewer subject headings and no classification numbers assigned, since neither are required in order to find the periodical on the shelf. Including classification numbers in periodicals' bibliographic records allows the library to arrange their print subscriptions in order by classification which has the advantage of collocating titles by subject (facilitating browsing) and either integrating them with the main

collection or not. This practice also allows the library to shelve more closely together periodicals that have undergone changes in title.

The fact that periodicals titles do change raises another issue with regard to cataloging. Until the first edition of the Anglo American Cataloging Rules (AACR) that was adopted in 1967, libraries used a method called latest entry cataloging to represent periodicals in their catalogs. In latest entry cataloging, all titles under which a single periodical has been published are integrated into a single bibliographic record which contains a complete history of the publication. The AACR and later, AACR2, calls for successive entry cataloging of periodicals. Successive entry cataloging requires the creation of a new bibliographic record for each new iteration of a periodical, for example, when the title or publisher changes. In successive entry cataloging, the new record is linked to the old record providing access to the title's publication history. Clearly, successive entry cataloging created the potential for large numbers of new bibliographic records. This was eventually seen to have resulted in too many new bibliographic records and the 2002 revision of AACR contained detailed instructions for catalogers regarding the differences between major title changes (when a new bibliographic record was required) and minor title changes (when an update to the existing bibliographic record would suffice and no new record was required).

The AACR2 and MARC 21 also call for separate bibliographic records to be created for each format in which a serial (and many other types of library materials) is available. MARC 21 Concise Format for Bibliographic Data in particular makes possible the differentiation of a wide variety of formats in which information may be contained. Each format has its own specific fields, thus the fields contained in a bibliographic record that describes material presented in electronic format will differ substantially from the fields in a record that describes material presented in print or in microform. In practice, it is argued, multiple bibliographic records describing the same material in different formats are confusing to library users. Thus some libraries choose to integrate the information from multiple records, that each describes material in a single format, into a single record that points to the library's holdings of that material in all formats. The debate has become particularly lively among serials librarians with the advent of electronic serials.

The future may hold still more changes for serials cataloging. During the 1990s, the International Federation of Library Associations' (IFLA) Study Group on Functional Requirements for Bibliographic Records (FRBR) developed a new conceptual model of the structure of the bibliographic record and its relationship with other records. In 2005, the Joint Steering Committee for Revision of AACR became the Joint Steering Committee for Development of Resource Description and Access (RDA)

and began work on a new set of cataloging codes that encompass the FRBR conceptual model.

Advances in technology have provided libraries with tools for creating and maintaining list of serials subscribed to or for which access is available as well as for linking from those lists directly to the electronic version of a serial or a fuller description of the library's print and/or microform holdings. Two of these tools are link resolvers and federated search engines. These tools use the Z39.50 standard for metadata exchange to facilitate information retrieval at the article, issue, volume, and title levels for serials. Although not restricted to serials, a link resolver facilitates a users' search for full text of a journal article, for instance, based on data from a citation discovered in an electronic index among the library's electronic resources. Based on that data, the link resolver searches the library's resources for access to the full text of the cited article.

Both link resolvers and federated search engines contain databases (sometimes referred to as knowledge bases) of bibliographic records that describe the electronic journals and other electronic resources to which the library subscribes. Serially published information is described on the article, journal, and aggregation level. That is, a knowledge base may contain records that describe the bibliographic characteristics of articles, journals, and/or collections of journals. Rules for the creation of these records vary from system to system but every library that makes such finding tools available to their users must first populate the systems' knowledge base with records describing their holdings. In other words, they must catalog them.

ACCESS BEYOND THE CATALOG

As noted in the previous section, the trend in access to serials in libraries extends beyond the OPAC. Technology allows access to serials for library users via lists like union lists and A-to-Z lists, collections of serials titles from publishers and aggregators, federated search engines, and link resolvers. Libraries also provide access to serials through services like interlibrary loan, course reserves, and document delivery. But advances in technology also complicate the library's provision of such services.

Historically, more than half of all interlibrary loan transactions are for serials. In 1976, the U.S. House of Representatives commissioned an ad hoc committee to create guidelines for interlibrary loan. The committee, the National Commission on New Technological Uses of Copyrighted Work (known as CONTU), created guidelines that allow libraries to distribute not more than six articles per year from any one serial but limited the application of this rule to issues published within the past five years.^[1]

While the availability of electronic serials improves the ability of academic libraries to work with faculty to make electronic versions of articles available to their students

via the library's Web site, the Digital Millennium Copyright Act of 1998 requires that permission be obtained and fees be paid to the authors and/or publishers. The Copyright Clearance Center (CCC) (<http://www.copyright.com>) is a clearinghouse through which such permissions may be obtained and fees paid. Many libraries assist faculty in doing so by maintaining an account with the CCC and, sometimes, budgeting for the payment of fees through the CCC.

Protection of copyright is also at issue when libraries make electronic serials available to users. Publishers and aggregators require libraries to restrict access to electronic serials to authorized users. Although authorized users usually includes anyone within the walls of the physical library, remote users (e.g., those using the library's Web site from outside the library) are usually required to identify themselves somehow (authenticate) before being allowed access to an electronic serial via the library's Web site.

Restricting access to authorized users is currently accomplished by the library in several ways. The library may choose to register the Internet Protocol (IP) addresses of computer workstations within the library. Only those patrons who are using computer workstations whose IP addresses are recognized by the publisher or aggregator's servers are allowed access. This, however, requires that users be physically in the library in order to access electronic serials. Libraries may also choose to allow users who are outside the library building to access electronic serials by implementing a system of authorization. A list of authorized users is maintained in the library's ILS. Each time an off-site user wishes to access an electronic serial to which the library subscribes they are required to enter identifying information that matches information stored in their record in the ILS before being granted access.

Because of the restrictions placed on access to electronic serials, publishers and aggregators almost always require the library to sign a contract or license agreement in which the library agrees to restrict electronic serials access to authorized library users. The negotiation of license agreements is often seen as a cumbersome and time-consuming practice for librarians. Library participation in consortial purchases of electronic serials can alleviate this to some extent since license agreements for consortial purchases are usually negotiated once on behalf of all participating libraries. There is also currently a desire among librarians to develop a standard license agreement that would alleviate the need for every library to negotiate a new (and often different) license for every electronic serial subscription or bundle that is purchased. One such initiative is SERU: Shared E-Resources Understanding (<http://www.niso.org/committees/seru>).

Not all electronic serials publishers restrict access to their publications through the payment of subscription fees. Dubbed Open Access (OA) publications, these electronic serials are made freely available to anyone with

Internet access. OA publications may be (and many are) peer reviewed and contain reports of scholarly research. In lieu of garnering profit from subscription payments, many publishers require authors to pay a fee (upon acceptance of an article by reviewers or editors) for publishing in their journals. This practice remains controversial and has yet to gain the full acceptance of authors. In 2005, the U.S. National Institutes of Health (NIH) issued a policy that "requests and strongly encourages all investigators to make their NIH-funded peer-reviewed, author's final manuscript available to other researchers and the public" (NIH, 2005). A list of OA journals may be found in the Directory of Open Access Journals (DOAJ) (<http://www.doaj.org/>).

MAINTENANCE

Serials in all formats require maintenance in order to remain findable to users. Technological advances provide vastly improved means of serials maintenance. The adoption of ILS and OPACs in libraries in particular allows libraries to more accurately track and maintain serials.

Prior to migrating to the ILS, libraries tracked receipt of serials via KARDEX, a series of cards filed in alphabetical order by title on which the receipt of each new issue was recorded. Card catalogs provided information as to whether or not a library held a subscription to a serials title but a trip to the shelves (or microform cabinets) was required in order to discover whether the volume and issue sought was available. The ILS provides electronic check-in cards as well as linking between electronic check-in cards and bibliographic records. Electronic check-in cards are displayed in the OPAC (along with holdings statements) and provide information such as the expected date on which the next issue of a serial will be received and the status of each issue (e.g., on the shelf or at the bindery).

Use of an ILS in conjunction with EDI allows libraries not only to electronically transmit claims information to publishers and subscription agents but also to receive electronic invoices from them. Electronic receipt of invoices reduces the time required to obtain and process them. It also reduces human error in entering the volume and issue or other payment information into electronic payment or order records (which, like electronic check-in records are linked to bibliographic records) in the ILS since line items from electronic invoices can be downloaded automatically.

Tracking serials in an ILS dramatically improves the library's ability to identify not only late or missing issues but also to identify lapsed subscriptions. An ILS also has the capability of processing reports of library expenditures on serials, serials holdings by subject (which can be invaluable in selection), and circulation levels.

The adoption of the ILS is only one way in which automation assists libraries with serials maintenance. As

noted above, links from bibliographic serials records have the capability to provide the user with links to electronic journals. But, as has also been noted, libraries often provide multiple access points to serials, all of which require some maintenance. For instance, when an electronic journal changes publisher, the new publisher information (and likely a new link) will need to be added to an A-to-Z list and the old information removed. When a publisher pulls a publication from an aggregation or bundle, this information must be edited in A-to-Z lists as well as in link resolvers and federated search engines. Luckily, most of these tools include some level of automated communication with aggregators and publishers so that many times the editing of records in knowledge bases happens as a matter of course.

ILS and other electronic tools that provide serials access also usually provide usage statistics which can be extraordinarily helpful in making selection and deselection decisions. Automated usage statistics for electronic serials have a reputation for being much more accurate than measures of print and microform serial usage. Usage of noncirculating print and microform serials collections in particular is notoriously difficult to measure accurately although use of radio frequency identification (RFID) technology in conjunction with the ILS offers more accuracy than do hand counts. Project Counting Online Usage of Networked Electronic Resources (COUNTER) is an international initiative that sets standards for the collection and reporting of usage statistics. It allows libraries to compare usage statistics reported by different vendors, publishers, and aggregators giving an assurance that all entities involved are using terms and statistics consistently. The provision of "COUNTER compliant" usage statistics is often a criterion used to evaluate a vendor of electronic serials.

Automation via ILS and other electronic tools allow libraries to more easily identify gaps in serials holdings. Gaps may occur in serial holdings in any format although they are most prevalent in print holdings. Filling gaps in print collections facilitates preservation by allowing libraries to bind full volumes of serials. Gaps in recent holdings may be filled via claiming but most publishers set a time limit beyond which they cannot guarantee their ability to fulfill a library's claim. Other means of filling gaps in print serials collections include back file purchases and participation in duplicate exchanges. Back file purchases, that is, the purchase of older issues of a serial, may be made from publishers or firms that specialize in providing fulfillment of older serials issues. Duplicate exchange services are groups of libraries which communicate the availability of duplicate issues (or issues that are to be pulled from a collection for other reasons) of print and microform serials. Communication is often accomplished electronically via e-mail or listserv. Needed issues are donated to the needy library for the cost of postage or shipping.

PRESERVATION

Print serials have long been preserved by binding loose issues in hard cover or by replacing print issues with microform (which has the advantage of saving shelf space). Preservation is particularly important for print serials, which are subject to loss or damage because of their size and shape, in order to provide continuing access to their contents.

Binding may be accomplished by a professional bindery or in-house. Professional binding being preferred since it generally ensures a more durable unit than does in-house binding, via binders, binder rings, and/or string and cardboard covers. In 1986, the Library Binding Institute published standards for library binding and they were included in American National Standards Institute/National Information Standards Organization (ANSI/NISO) standard Z39.78 for Library Binding. The standard describes the technical specifications for binding serial publications for libraries. For instance, a bound periodical should have a strong spine that is flexible enough to allow it to be opened face down on a copier or scanner so that a complete page image can be obtained without breaking the spine.

As mentioned, an alternative to binding serials for purposes of preservation is replacing them in another, often more compact format from which individual pages or issues can be less easily removed. Traditionally this meant microform although during the late 1990s there was a surge of serials publication on CD-ROM. Both formats share the advantage of taking up less space in the library and the disadvantage of requiring the use of machinery in order to access the content (a reader printer in the case of microforms and a computer workstation with a CD-ROM drive and sometimes additional software in the case of a CD-ROM). One of the reasons for the short-lived popularity of serials preservation on CD-ROM was that it was followed so quickly by the widespread use of the Internet for delivery of serials.

The availability of serials on the Internet has sparked controversy in discussions of preservation. Electronic communications technology allows libraries to provide their users with access to more and more serial publications but, as noted above, the library does not necessarily own all of these publications. Librarians are understandably concerned about the loss of control over their ability to provide their patrons with perpetual access to serials. License agreements prevent libraries from downloading the entire contents of one or more serial publications, even for purposes of preservation. Some license agreements for electronic journals provide for perpetual electronic access and some do not. Often, perpetual access rights can increase the cost of an electronic serial. And even if the publisher or aggregator promises perpetual access it is easy to imagine scenarios in which that access might be lost and the promise reneged upon (e.g., bankruptcy or even mergers between publishers).

In response to concerns over preservation of electronic content including serials, the Lots Of Copies Keep Stuff Safe (LOCKSS) program was initiated at Stanford University in 1999. It was released into production in 2004 and now is funded by contributions from the member libraries of the LOCKSS Alliance. LOCKSS allows libraries to create, preserve, and archive local collections thus promoting ownership of electronic information. "A library uses the LOCKSS software to turn a low-cost PC into a digital preservation appliance (a LOCKSS box) that performs four functions" (LOCKSS Web site): collect content, searches for changes in that content and makes replacements as necessary, provides access to stored content for library users, and provides Web-based administration that allows library staff to manage their LOCKSS box. LOCKSS allows libraries and publishers to retain their traditional roles in the serials information chain and provides for the safe keeping of otherwise ephemeral content.

The Controlled LOCKSS (CLOCKSS) initiative is a private LOCKSS network currently being pilot tested by seven host libraries. Whereas LOCKSS allows libraries to preserve their own collections, the function of CLOCKSS is to comprehensively preserve scholarly information and to make it available to the public if and when "no publisher has current responsibility for, nor is providing electronic access to selected content" <http://www.clockss.org/clockss/Home>. Current membership is made up of six U.S. and one U.K. libraries and eleven publishers. The pilot program is expected to conclude in 2008 at which time membership will be opened to additional libraries and publishers.

WEEDING

Although the technological advances of the late twentieth and early twenty-first centuries provide libraries with numerous alternatives to removing serials titles from their collections libraries can and do still weed. Shrinking shelf space and the publication of more and more new serials titles continue to make weeding or alternatives to weeding, like off-site storage, necessary. Users and user needs continue to change and serials titles that were relevant to users at the time they were selected often become less relevant and relatively more expensive to house and maintain. Weeding need not be a controversial or painful task in these days of electronic serials, especially if done on a consistent schedule, since alternatives like trading ownership for access or document delivery exist.

Criteria for weeding closely resemble criteria for selection and a well-written and maintained serials collection development policy can make weeding the serials collection less of a chore. Measured use of serials in all formats facilitates weeding. Unused titles may be replaced in a more compact format or made accessible via document delivery. In some disciplines, the information contained

in serials will become obsolete more quickly than in others. On the other hand, some serials may be of greater historical value than others. Bound volumes are often lesser candidates for weeding because of the financial investment in their preservation. As in selection, support of user activity and/or interest should be considered as should availability of finding tools like indexes.

In addition to the alternatives to complete deselection from the library's collection mentioned above, a library may consider off-site storage for relatively low use print and microform serials. Larger libraries in particular may choose to store less used print or microform serials in a storage facility separate from or in a remote part of the main library. There are costs to be considered for this choice including the cost of the space in which the serials are housed; either in terms of rent or in terms of other uses to which the space might be put. Also to be considered is the cost in staff time in retrieving items from off-site or remote storage when they are requested by users. The cost of off-site storage of print and microform serials makes it less likely to be considered by smaller libraries.

CONCLUSION

The past two decades have been full of upheaval and change for serials management. New technologies allow libraries to make far more serials available to their users than ever before and to manage those serials more efficiently and effectively as well. Textbooks on the topic of serials management that were written in the 1990s often included a chapter or section containing predictions about the future of serials management. For example, Nisonger^[5] correctly predicted the delivery of faculty research via university servers. Faculty research is being made available via institutional as well as disciplinary repositories like the California Digital Library, the Texas Digital Library, and the ArXiv.org Physics Archive.

Other predictions that have yet to come to pass include the full acceptance of the scholarly writing in electronic journals, required OA to articles describing the results of federally funded research, and the demise of the print and/or microform versions of serials. Some of these predictions may yet occur and may even already be occurring and some may never occur. The one constant that can currently be applied to serials selection and management is change.

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Serials Vendors [ELIS Classic]

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Abstract

Libraries spend a substantial portion of their budgets on subscriptions to serial publications, such as journals, newspapers, yearbooks, and other periodical literature. Serials vendors do not house the publication issues; they act as the intermediary between the library and the publisher on behalf of the library. The consolidation of orders with one vendor makes serials management easier because of the combined, streamlined efforts made by the vendor on the customer's behalf with the publishers.

INTRODUCTION

Academic libraries spend 50%^[1] or more of the materials budget on subscriptions, some of which are electronic journal subscriptions. Medical, public, school, corporate, and special libraries and organizations spend 20–40% of their materials budget on serials. The price of journals in all categories of library organizations has increased dramatically. In 2002, colleges and universities spent approximately 36% more for subscriptions than they did in 1998 (Table 1). With the growth of publications in print and online, higher periodicals prices, and the decline of materials budgets in the late twentieth century and early twenty-first century, the role of the serials vendor is an important one in the purchasing and management of serials.

OVERVIEW

What Is a Serials Vendor?

Serials vendors are also called subscription vendors, periodical vendors, subscription agents, jobbers or dealers, and in the early days field agents or trade agents. Serials vendors do not house the publication issues; they act as the intermediary between the library and the publisher on behalf of the library. There are many serials vendors in the world, but as larger agencies swallow the smaller ones, fewer choices remain. See the American Library Association's publication, *International Subscription Agents*,^[2] for a list of the world's serials vendors. This book provides information needed to help make vendor choices. It includes information such as phone numbers, fax numbers, cable addresses, and toll-free numbers. Services offered, handling charges, invoicing procedures, prepayment policies, the transition process when moving from one vendor to another, as well as the agent's technological capabilities are included. It is arranged alphabetically by agent and by country.

In a broad sense, a term used to refer to all types of suppliers of serial publications (i.e., both Continuation dealers and Subscription Agents), and to distinguish them from suppliers of monographs. The term sometimes is used in a narrow sense to refer to vendors who supply serials other than periodicals (i.e., continuation dealers) and to distinguish them from Subscription agents. Serials Acquisitions Glossary, prepared by the Serials Section Acquisitions Committee of the Association for Library Collections and Technical Services, Association for Library Collections and Technical Services, 1993. Copyright 1993 by the American Library Association.

How Vendors Work?

Almost any publication of a serial nature from any place in the world can be ordered through large serials vendors. Newsletters, reports, newspapers, periodicals, magazines, journals, annuals, and yearbooks are the standard fare. The consolidation of orders with one vendor makes serials management easier because of the combined, streamlined efforts made by the vendor on the customer's behalf with the publishers. With one invoice, one renewal list, and one monthly follow-up claiming system, subscriptions are managed more effectively (Fig. 1).

Because customers do not always have all the subscription orders ready at one time, vendors will accept orders throughout the year. Often, the vendor will work with the customer and publishers to arrange a common expiration date for as many publications ordered as possible, which makes the process a more efficient one. At the time of renewal, the serials vendor sends the customer a renewal list showing the expiration date(s). The list is sent about 6 months before the subscriptions expire. Once the customer reviews the list for changes and additions and sends it back, the serials vendor places the orders and pays publisher in time for the subscription

Table 1 Five year price analysis from EBSCO information services, 2001. Five-year journal price increase history (1998–2002) data are based on proprietary sales data of select EBSCO subscription services customers of various library types. A sample of customers in good standing with a representative mix of U.S. and non-U.S. titles were selected for analysis

Library type	% of total titles	% of total expenditure	1998–1999 % increase	1999–2000 % increase	2000–2001 % increase	2001–2002 % increase	1998–2002 % increase
<i>ARL</i>							
U.S. titles	66.2	45.7	8.85	8.88	8.75	7.89	39.05
Non-U.S. titles	33.8	54.3	7.37	7.40	6.12	6.55	30.38
Total titles	100.0	100.0	8.02	8.06	7.30	7.16	34.20
<i>College and university</i>							
U.S. titles	77.7	58.6	8.92	8.83	8.44	8.21	39.10
Non-U.S. titles	22.3	41.4	7.94	7.62	6.31	6.74	31.82
Total titles	100.0	100.0	8.50	8.31	7.54	7.60	35.99
<i>Academic medical</i>							
U.S. titles	63.9	44.8	10.19	9.87	9.37	8.22	43.31
Non-U.S. titles	36.1	55.2	7.90	6.89	5.81	5.69	28.97
Total titles	100.0	100.0	8.87	8.16	7.36	6.81	35.02
<i>Corporate</i>							
U.S. titles	85.7	58.7	6.88	5.44	5.21	6.03	25.72
Non-U.S. titles	14.3	41.3	7.02	7.20	5.66	6.69	29.34
Total titles	100.0	100.0	6.95	6.15	5.39	6.30	27.19
<i>Public library</i>							
U.S. titles	95.3	85.3	3.92	3.34	3.25	4.76	16.15
Non-U.S. titles	4.7	14.7	5.65	6.12	5.04	6.08	24.93
Total titles	100.0	100.0	4.15	3.74	3.50	4.95	17.36

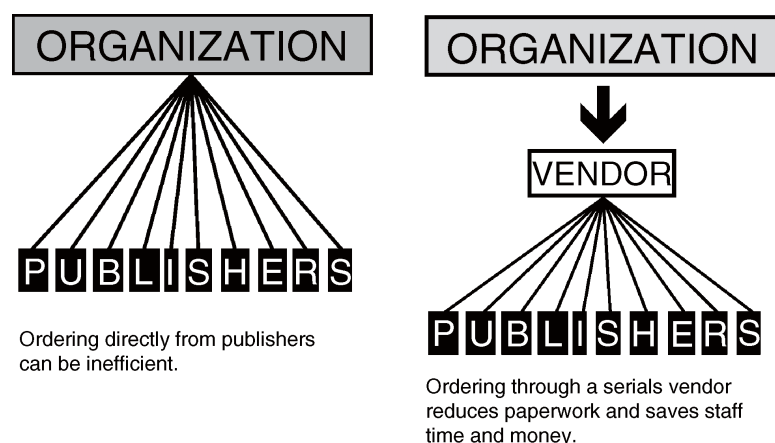


Fig. 1 Using a vendor versus ordering subscriptions directly with publishers, EBSCO Information Services, page 1.

to start the following year. This all seems fairly simple, but many exceptions arise when working with subscriptions. Publications aren't always published when the publisher says they will be. Titles can change names, change frequency, change format (i.e., from print to electronic), have delivery problems, be discontinued,

suspend publication, resume publication, merge with other journals, split off into two or more journals, or cease entirely. Publishers go out of business, merge with other businesses, publish through an organization that sponsors them, or set up other publishing arrangements. All of these events play into managing subscriptions.

Serials vendors help keep track of these changes and communicate them to the customers.

Reasons to Use a Vendor

Approximately 95% of libraries use one or more serials vendors to manage subscriptions. Customers find the ease of ordering, paying, and renewing their entire list of subscriptions annually through an agency saves time and labor. A large international vendor allows access to information on foreign and domestic periodicals and will provide price quotations, catalogs, and offer their years of experience with foreign publishers and currencies. Vendors use the relationships they have established with publishers to communicate the needs of their customers.

Some serials vendors provide the customer with one salesperson, one account manager, and one customer service representative who provide continuity in managing subscriptions. Technology has allowed smaller vendors to have equal footing with larger vendors in many ways. E-mail or online ordering allows for “instant” orders. Orders, invoices, claims, renewal lists, and serials management reports can be produced from the information housed in most vendor databases. Not all aspects of the serials-ordering process can be handled electronically, however. Some publishers and vendors do not have electronic data interchange (EDI) capability.

Two advantages of using a large vendor are their strong relationships with publishers and the number of print and on-line publications found in their more comprehensive databases. International serials vendors are also more likely to be able to communicate with and provide payments to publishers in their own language and currency. The advantage to libraries is that when the vendor does this part of the process, it frees the librarian to perform other aspects of the job.

Research Library Needs

The decision by a research library to begin a subscription to a journal has long-term effects. It usually requires a commitment to that publication for many years because the library hopes to provide the information from that journal to its users to fulfill their research needs. Research libraries strive to provide historical materials for as many years as the information is valuable to the users, which often requires the purchase of a back file for the new journals to which they subscribe. Vendors can often acquire the necessary journal volumes for the customer.

Organizational/Corporate Subscriptions

Organizations and corporations subscribe to many publications through serials vendors. The subscription service works the same for organizations as it does for libraries, although often the publications are ordered for individual

rather than organizational use. The organization gives the vendor the list of publications to order and the dates on which to start them. The vendor places the order with the publishers, pays for the subscriptions, and then invoices the organization for all the subscriptions ordered. The organization in turn pays the vendor's invoice. The vendor manages any problems that arise with orders or delivery of issues, which frees staff to do other jobs. This service also reduces the number of purchase orders and checks written that an organization might process if they were ordering each publication directly from the publisher. Libraries and other organizations may subscribe to thousands of subscriptions or as few as five. Although processing five checks to pay five publishers is not a huge task, writing thousands of checks to thousands of publishers is unmanageable and extremely costly and time-consuming. Accounting and business offices appreciate the services that serials vendors provide. Administrators can also track the flow of information coming into the organization based on reports provided by the serials vendor.

How Vendors Make Money

Serials vendors earn revenue from the discounts they receive from the various publishers whose titles are included in each customer's subscription order. By calculating the average publisher discount and comparing this to the estimated cost to service the customer's account, a vendor determines if a service charge or discount to the customer is warranted. The calculation is based on the mix of the list of titles ordered, those for which the publisher offers a discount versus those for which they do not. The current trend by publishers is to keep the discount formerly given to vendors, thereby making their titles “net” or “no discount” to customers. Some serials vendors have determined it is necessary to impose a “net title” charge, a flat fee, when the publisher does not give any discount to the vendor. This charge is intended to help the vendor recoup a portion of lost revenue. The vendor's concerns are to stay in business, stay solvent, serve their existing customers' needs, keep up with technology and expand their services while at the same time offering full service by handling all titles that publishers allow agents to order and service.

HISTORY

Subscription services have been around for many years. References in early library management books are few, but some references to vendor services have been noted since 1961. One of the first agencies to offer a consolidated subscription service to libraries was Frederick W. Faxon in 1886. The beginnings of EBSCO Information Services started in the late 1940s. Elton B. Stephens sold magazines door-to-door to pay his way through college,

and then continued by managing a periodical sales force through the Great Depression. The company he founded is now one of the largest serials vendors in the world.

New subscription agencies have started and others have expanded since the early 1960s. The U.S. federal government infused monies into research organizations to keep up with the rush to conquer space, which created programs that increased college enrollment. The number of serials titles published to support those programs led to larger library collections. Serials agents, such as Faxon, EBSCO, Moore-Cottrell, Hanson-Bennett, Franklin Square, Mayfair, Clark, Goldstein, Walter Johnson, Turner, and others, all small field agencies until that time, began to expand. As the publishing industry grew, so did libraries, library budgets, library buildings, etc., and likewise the need for a subscription agency to provide more journal titles and subscription management tools. Through the years, many agents bought smaller ones, both domestic and foreign, and the trend continues today. For example, EBSCO has purchased Franklin Square, Moore-Cottrell, Majors, McAinsh (Canada), Hill (New Zealand), Offilib (France), Lange and Springer (Germany), and others.

Publishers gave good commissions to field and trade agents in those days because the volume sold increased circulation. Higher circulation statistics allowed publishers to offer greater advertising opportunities and, in turn, reach greater sales and profit growth. As library orders grew, the commissions from publishers to agents did not. Often, the types of journals that were being ordered to support research were not those with advertising that would raise the publisher's revenue. Scientific, technical, and medical (STM) journals generally do not have advertising to boost revenue; therefore, publishers rely solely on paid subscriptions. Agents began adding a service charge to handle library accounts, their services to colleges, universities, research organizations and other types of libraries became more complex and even more essential. Commissions for handling such subscriptions are generally small. And most librarians believe that the service charge costs the library less than if it were to manage subscriptions in-house.

Early on, the management process was completely manual. Some agents kept records for orders to publishers in a card file called a wheelindex. Orders were hand-typed on 3" × 5" cards and filed in a box by publisher name. At the end of the week, they were counted by hand, photographed, and stored on microfilm. A summary of the orders and a check was typed and mailed to the publishers. All checks were hand-signed. Problem orders could be traced by reviewing the microfilm. Invoices to the customer were hand-typed and produced on a special ditto machine. They were hand-folded and mailed to customers biweekly. Renewal lists were produced at the same time as invoices and did not include prices. The renewal lists were filed by date and sent out approximately 6 months before time to renew. Follow-up reminder notices, when

necessary, were sent approximately 3 months later. Automating to use of keypunch cards in the 1960s allowed agents to place orders and keep records rapidly. Some management reports were produced on the basis of keypunched data. Automatic renewal list generation was developed. By the early 1970s, three of the large U.S. subscription agencies, Faxon, EBSCO, and Franklin Square, were automated, making the placement of orders, invoicing, claiming, and report generation easier and more efficient.

Changes in Libraries

The past 20 years have seen a dramatic change in libraries. Card catalogs of library materials have been replaced with online catalogs. Serials and other information vendors now interface with all aspects of acquisition, databases access, and management of serials and reference materials. Few printed indexes are being published. Content in electronic format, such as databases with indexes and abstracts, full-text articles, and individual journals, are available. There is a movement toward providing more full-text information in electronic format through the World Wide Web, with less physical space being required for shelving (i.e., "the virtual library"). Books available in electronic format are accessible through library workstations, handheld devices, or personal computers. But readers continue to enjoy printed books and periodicals; libraries will likely continue to subscribe to a combination of print and (electronic) e-resources.

Naturally, serials vendors are expected to remain current with changing information access capabilities and are helping to lead the way. Some now handle e-databases, e-journals (full text), e-indexes and abstracts, e-tables of contents, pay-per-view articles, alerting services, e-books, e-payment and procurement services, and e-resource usage and analysis reports.

Libraries are looking to vendors to assist with archiving data and preserving materials, but publishers are reluctant to give data to vendors for storage and management. Librarians are creating their own electronic archives for serial and monographic materials. It is a challenge to librarians, publishers, and vendors to resolve the issue of archiving and preserving digital data.

Interfaces with Integrated Library Systems

To manage and maintain materials in their collections, most librarians use automated or integrated library systems (ILS). The ILS is used for the public access catalog, circulation system, interlibrary loan, collection management, and report writing. It is, therefore, important for librarians to choose a serials vendor with proven interfacing experience with their current or planned ILS. Electronic Data Interchange (EDI) invoices are provided by some vendors for payment through the customer's

serials acquisitions module. For an exact exchange of data, some serials vendors and system vendors apply EDI $\times 12$ standards to their processes. Frequently used $\times 12$ transaction sets are Invoice, 810; Publisher price list, 832; Purchase order, 850; Claim, 869; and Functional acknowledgement, 997.^[3]

For the ILS to “talk” with the serials vendor database for claiming and invoicing, a link must be established between the two. Each record must have a vendor identification number and a Serial Item and Contribution Identifier (SICI) number, which is the ISSN from the bibliographic record. Several standards have been developed for library systems, as well as existing ones applied; these include the following: ANSI/NISO Z39; Electronic Data Interchange for Administration; Commerce and Transport (EDIFACT); and TRADACOMS (the UK standard for teleordering of books) with the help from the Serials Industry Systems Advisory Committee (SISAC). The International Committee for EDI in Serials (ICEDIS) was formed to standardize various parts of the routine exchange of business forms.

Serial orders in an ILS are different from book orders. Each book order is processed one time, and each order represents a unique item. The purchase order is entered into the ILS when the book is placed on order with a publisher; when the book arrives, it is processed and the bibliographic record is added to the catalog. Serial processing does not stop when the order is placed and the payment is made. A subscription is reordered each year and during the year issues arrive daily, weekly, biweekly, monthly, bimonthly, semimonthly, quarterly, annually, biannually, or even triannually. Each piece is received and recorded separately. Subscriptions might have billing adjustments or credits applied to them during the year. The ILS should be flexible enough to allow for all types of invoice activities and publication pattern changes.

Electronic Journals

At this time less than 10% of journals from the 60,000 active publishers in the world have developed electronic versions of their publications. Currently, electronic journals are primarily in the scientific, technical, and medical (STM) areas. As the titles change during the subscription term from print to print plus online or online only, some serials vendors provide the customer with updated information to adjust journal records in the ILS. As publishers become more comfortable with electronic publishing and provide access to the full text online, they usually change the offering to include a charge for online use. This charge is most often a percentage of the cost of the print publication. Initially some publishers required libraries to purchase print subscriptions to obtain the online full text.

Some large STM publishers offer their electronic journals only directly to libraries in a package, for a set fee. Because a serials vendor does not play its traditional role in the acquisition of these journals, this arrangement makes it difficult for a library's vendor to assist its staff with the management of those subscriptions. The librarian loses the benefit of vendor-supplied cost/invoice data on individual titles in the package as well as that of comprehensive serial management reports because those titles are acquired separately from the rest of their serial collection.

VENDOR SERVICES

Ordering

From the serial vendor's database of titles, the customer may choose from a few to thousands of titles. Orders usually can be placed through a Web-based ordering system, e-mail, fax, or produced in print form and mailed through the postal system. Large, international vendors handle most titles to which a customer might want to subscribe, currently approximately 260,000 titles from around the world. Most often, libraries order subscriptions for 1 year at a time, but subscriptions of 2- or 3-year terms are sometimes offered by publishers. Methods offered to aid in selection of publications typically include a print and/or online catalog of available titles, listing such information as title, price, publisher, ISSN, country of origin, currency, Library of Congress code, Universal/Dewey Code, term, where the publication is indexed, language, and publisher restrictions. Delivery options, such as surface, airmail, or electronic version, could also be included in the data.

Invoicing

Consolidated invoicing provided by a serials vendor reduces check writing and the numbers of invoices that accounting departments must handle. Consistent layout of the vendor's paper invoices and their inclusion of vital serial data usually make these documents valuable to librarians. Receipt of electronic invoices from the vendor through file transfer protocol (FTP) with EDI or EDIFACT standards also makes processing invoices easier.

Claiming

It is inevitable that some issues of a publication will not arrive at their destination as expected. For a research library with the purpose of collecting materials for research use, it is important to have every issue of every publication ordered. When an issue does not arrive as scheduled, the library staff must track it down to

complete the volume for binding. Serials vendors take on the task of asking the publisher to send the issue that did not arrive. This is called “claiming.” Claims are a major part of a vendor’s service. Sometimes the customer judges the vendor solely on its claim resolutions. Serials vendors who have developed good claiming systems and a reputation for getting fast results for issues claimed on behalf of their customers often use this fact in marketing their services. Most serials vendors assign customer service representatives to handle individual accounts; they establish a relationship with the customer to better meet the customer’s needs both in placing orders and resolving claims. Some integrated library systems and serials vendors have devised automated claiming procedures that pass from one system to another and onto the respective publisher, making claim resolution faster and more streamlined.

Renewals

Approximately 6 months before a subscription term ends, the serials vendor sends the customer a list of the titles ordered in the past year to use as a reminder to place renewal orders. After reviewing the list and making changes and additions, the customer sends it back to the serials vendor for renewal, allowing time for the orders to be entered. Once the vendor enters orders into its database, orders are sent with payment to the publishers in time to ensure uninterrupted service for the customer. Because it takes 6–10 weeks for a subscription to start, it is important for all parties to adhere to the renewal schedule to avoid gaps in service. By placing all orders at the same time, a customer pays one invoice for all of the subscriptions. The serials vendor pays each publisher with one transaction or money transfer for many customers’ orders.

Reports

Serials vendors not only offer title choices, place orders, send invoices, communicate with publishers, and solve claiming issues, they also provide reports based on the customer’s subscription list. Sorting subscription data in various ways allows the customer to evaluate the collection based on criteria such as cost, subject, or publisher. Reports can be designed to help librarians determine the titles published in a particular area of interest. Such reports can be programmed to show the titles on subscription or those to which the library does not subscribe. Collection managers can use these data to further develop the serial collection or to streamline it to better meet users needs. The vendor may allow the customer to use a fund/cost code to keep track of departmental expenditures. The vendor enters the designated fund/cost code and can then provide reports sorted accordingly to show the dollars spent in

that area of interest or for a specific customer department. Most serials vendors assign a subject or classification code to each entry in their title database so that reports can be produced by using various cataloging systems, such as the Library of Congress, the Dewey Decimal System, or the National Library of Medicine. Subscription price data collected by the vendor over time provides a way to review the collections based on cost history and pricing trends over a five year period. A customer may want to create lists by title, by cost per title, by country of origin, by publisher, by frequency of publication, and so forth, to meet their particular needs. The sorting and reporting capabilities are tremendous.

Services to Publishers

Serials vendors act as intermediaries between libraries and publishers and as partner with both. As many as 60,000 publishers work with serials vendors. Serials vendors develop relationships with publishers that are useful to their customers. Those relationships are based on a good understanding of each other’s services and years of doing business together. The vendor can act on behalf of the library to solve claiming issues and to work out areas of mutual concern (e.g., a name change of a publication, a change in numbering sequence, or other significant changes affecting subscriptions).

Serials vendors not only provide services to libraries and other organizations but to publishers around the world. Vendors provide customers to publishers. Orders and claims information are sent from vendors to publishers in EDI format when the publisher has the capability to accept electronic data. This speeds up transactions and eliminates keying errors. From translating correspondence to delivering payment with the orders, publishers receive comprehensive subscription service from vendors. Some vendors are involved in the delivery of serial information in all formats from the content supplier to the user.

Relationships with Other Organizations

Serials vendors enjoy relationships with other organizations and associations such as the Serials Industry Systems Advisory Committee (SISAC), International Committee on EDI for Serials (ICEDIS), CONSER, and numerous library and information-related associations. These organizations work together to standardize procedures and operating practices in the publishing world and to foster relations and increase understanding among the many and varied parties playing key roles in the distribution of information. Groups such as the North American Serials Interest Group (NASIG), the Timberline Institute, The College of Charleston Conference, and the North Carolina Serials Interest Group bring together vendors, publishers, and

librarians to discuss serial issues of mutual concern. Of interest to serials librarians might be the discussion list SERIALST, currently found at <http://www.uvm.edu/~bmacleenn/serialst.html>.

FUTURE ROLES

With the Internet and the Web-based services developed by serials vendors, customers can now generate renewal lists, management reports, and copies of invoices themselves. Serials vendors can interface with library systems such as SIRSI, Ex Libris, Innovative Interfaces, Inc., Endeavor/Voyager, and many more. EDI capabilities commonly assist technical service personnel in placing orders, paying invoices, and making claims. New automated business systems such as SAP, Ariba, Commerce One, and Oracle are being used in organizations. Each one can accept EDI to speed transactions, which helps manage information and library materials. Today more and more automated processes are being developed and used by key players in the serials industry. These greatly impact the efficiency of publisher, library, and serials vendor operations.

Future of Serials Vendors

Librarians want their vendor to be able to supply electronic journals and to negotiate the price and license agreement with the publishers. Some serials vendors include handling these requests as part of their basic services; others will do so in the future. Researchers want access to the top electronic journals in their fields. Customers expect serials vendors to provide a greatly expanded range of value-added services to assist with the myriad of tasks required to effectively manage electronic

journal subscriptions in addition to those for print publications. When ordering electronic journals for customers, the vendor needs to provide access services such as “turning on” (activating) the subscription. In the past, serials vendors worked primarily with serials and acquisitions departments in libraries and purchasing departments in organizations. Now they must also communicate with collection development staff, reference departments, campus legal departments, webmasters, and information systems staff. Other services that customers require for access to electronic journals include providing IP addresses to publishers, links to publisher websites, publisher contacts, contracts with consortia, and the archiving of license agreements.

A generic Standard License Agreement orchestrated by John Cox of John Cox Associates (UK), in association with five subscription vendors, is an example of the type of services serials vendors are providing to their customers. The license is in the form of a template that can be modified to accommodate the needs of libraries and corporations.

Libraries and other organizations have overwhelmingly embraced electronic content, and it continues to grow at breakneck speed (Fig. 2). Digitizing data (converting content into electronic format) enables a publisher to distribute content globally online and is provided through the operations of some serials vendors. The management of linking electronic journals to databases using OpenURL and SFX technology is taking place. The serials vendor continues to be the electronic serial manager for a library and can act as the aggregator of electronic information. Aggregators provide electronic gateways to many publishers' websites and full-text e-journals.

Publishers are looking for ways to control the financial stability of their companies and solutions to the concern

E-Journal Progression

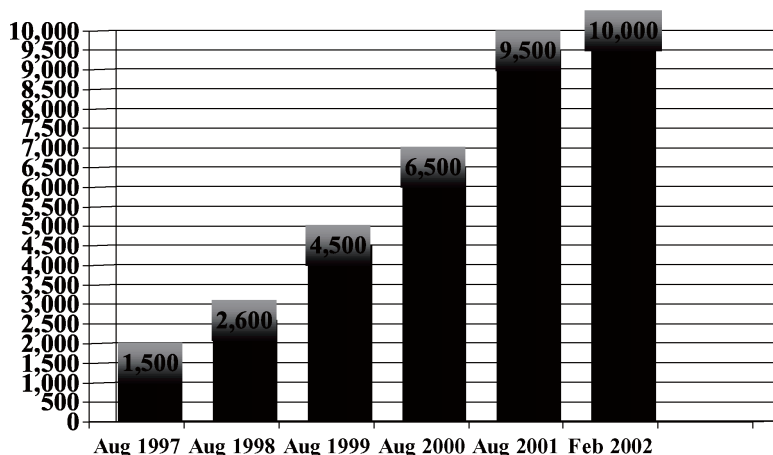


Fig. 2 Rise in number of electronic journals, EBSCO Information Services, page 9.

for preservation of materials. The issues of copyright and fair options to access are also critical to publishers. Serials vendors are working with the publishers and programmers, the courts and the librarians, and library organizations to keep these issues from colliding. All concerned parties are awaiting court decisions on various matters of copyright. Just as they have for decades with print publications, serials vendors play a vital role in the delivery of information in all formats, whereas librarians, vendors, and publishers continue to work together to reach their common goal of providing serial information to their users.

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Shared Libraries

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Abstract

Shared libraries are partnerships between school libraries and public libraries, university libraries and public libraries, community college libraries and public libraries, and any number of other combinations of library organizations. This entry will discuss the shared library as a distinct library type, outlining the major political, fiscal, management, planning, information technology, public policy, and evaluation issues. Examples of shared libraries will be described as a means of illustrating differing management models and to identify areas of the world where joint libraries are most prevalent.

INTRODUCTION

Shared libraries or joint-use libraries as they are sometimes called have been in existence in the United States and other parts of the world for decades. Historically, these libraries have been school-housed libraries where the public library has located a community branch library in a school building. Increasingly, joint-use libraries include university, college, and community college libraries partnering with public libraries to create a shared-use facility that serves as the university or college's academic library and serves as either the main library or branch library of a public library system.

DEFINITIONS

Joint-use libraries can be defined in a number of different ways. Dr. Alan Bundy, past University Librarian at the University of South Australia and prolific writer on the topic defines a joint-use library as "a library in which two or more distinct library services providers, usually a school and a public library, serve their client groups in the same building, based on an agreement that specifies the relationship between the providers."^[1] Ken Haycock, Director of the Graduate School of Library and Information Sciences at San José State University, defines dual-use libraries as "a common physical facility from which library services are provided to two ostensibly different communities of users."^[2]

TYPES OF JOINT LIBRARIES

Virtually, any type of library can merge or partner with another type of library to form a shared-use or joint-use

library. For example, there are and have been many joint school/public libraries in existence in rural areas of the United States and other parts of the world, specifically Australia and New Zealand since early in the twentieth century. The first Joint-Use Libraries International Conference held in 2007 included presentations representing many different kinds of joint-use libraries, including public, school, community college, university, health care, community center, municipal government, and vocational libraries—all partnering in some manner with another to form a shared-library space. These partnerships are similar in that two or more different library client groups are served from one shared-space facility while at the same time each is developed in a way unique to the local community needs, whether political, fiscal, or cultural.

POLITICAL AND FISCAL MOTIVATIONS

The impetus for the development of a shared-use library often comes from policy makers that perceive it as a way to address several goals and problems. Commonly, two different levels of government publicly fund such libraries. Sharing the costs of building, staffing, maintaining, and developing collections can be more cost effective than building and operating separate library facilities. In addition, the resources included in these buildings, including the collections, technology, staff, and facilities such as group study rooms and meeting rooms are readily available to more of the taxpayers who are the primary funders. Private, philanthropic funders may be more willing to contribute to a joint-use library. Policy makers are well aware that the access to information available today via the Internet makes it increasingly difficult to justify the barriers to access that exist when libraries serve more limited communities of users.

Many school/public libraries are developed to serve rural population or communities that are growing and now have a need for both new schools and community amenities, such as parks and public libraries. Policy makers see an opportunity to place such amenities in one central convenient location.

BENEFITS AND OPPORTUNITIES

Every proposal for a joint-use library has the potential of synergy, of creating a whole that is greater than the sum of its parts. Fulfilling that potential begins with the intergovernmental agreement for construction, operation, and the building's physical design. The intergovernmental agreement will specify the mission of the library, the roles of the partners, their funding and staffing obligations, ownership of the building and its contents, its governance, and conflict resolution. It may have a finite length, or specify terms and conditions of termination of the agreement. The building design will reflect the terms of the agreement. For example, if the agreement stipulates that two libraries will operate as entirely separate entities, the building design will allow for separate entrances, collections that are in an area accessible only to a specific group of users, and different hours of service.

Dr. Alan Bundy has identified a number of specific ways in which joint-use libraries can provide more efficient use of public money. These include sharing of design, construction, and facility maintenance costs, sharing of staffing costs, and access to collections, including online resources. Less obvious, but also very important, is the opportunity to locate local history and archival information of interest to the entire community in one place and the possibility of providing more hours of service. Another advantage of having more staff members than the partners would each have in stand-alone facilities is that the skills, talents, and interests of the staff are broader and deeper. In a small joint-use library, staff may have more variety of tasks, as well as opportunities for professional growth and stimulation.^[3]

OPERATIONAL ISSUES

Every joint-use library must address a number of the same issues about how the library will function. Many of these will be specifically included in the intergovernmental agreement; others will be developed as specific procedures or policies that are documented in supplementary agreements that can be modified by operational managers as needed. Operational policies, accompanied by specific procedures in larger or more complex shared libraries, must be developed for the entire range of services. These include in-house use and circulation of materials, use of computers and online resources, and collection development

policies. Licensing agreements for online resources need to provide for use by all library patrons. The partners will have to decide on ownership of collections (shared or separate). Most commonly, each partner retains ownership over materials purchased with its funds in order to ensure that the needs and requirements of its users are met. If shared, the partners must decide how the acquisitions budget will be apportioned to best meet the needs of all users.

The management and operation of technology in the shared library requires careful planning and ongoing attention. Often, one or both of the partners in a shared-use library operate other library facilities and therefore the joint-use library may be part of a larger network or networks. The holdings of the joint-use library and of other libraries in the network need to be included in an Online Public Access Catalog (OPAC). A shared-library Web site can present the library to all users as one library serving different user groups. Policies and procedures regarding use of computer resources must be set. As bandwidth requirements increase, the partners must develop and implement improvements to their network.

Library services and collections change more quickly now than in the past. The partners must have a way to alter these, as well as the way space is used in the library, as user needs change. In addition, provision for future expansion of the building should be addressed in the agreement and design. The library will eventually require renovation and replacement of building systems (i.e., lighting, electrical, heating, and air conditioning) and how the partners will share those costs should be included in their agreement. The partners must agree about building operations, including janitorial services, building maintenance and repair, security, and utilities. They must agree about who will provide these functions and how the costs will be shared.

Many joint-use libraries are located on a school, community college, or university campus. It is important that the building be sited in a way that makes its accessibility to both the campus community and the general public both clear and obvious. Often, this means that the library is located at the entrance to a campus or on an edge of the campus adjacent to the community. The College Hill Library in Colorado is a library shared by the City of Westminster and Front Range Community College. The library is located on the edge of the campus. A public parking lot is near the entrance to the first floor, designated as the Westminster Public Library. The second floor, allocated as the community college library, can be accessed via stair or elevator from the first floor, as well as from an entrance that faces the other community college buildings and student/staff parking.^[4]

Key to the long-term success of a shared library is its ability to meet the needs of its different user groups and of the partner organizations to provide library services. Effective decision-making and administrative accountability are necessary. The administrative and staffing

model for the shared library will be identified in the intergovernmental agreement. There are several options, each of which brings with it operational challenges. A director can be employed by one of the partners that have agreed to be responsible for the management and operation of the shared library. All other staff are employed by that partner. In those cases, the second partner may have a consultative role in the selection and evaluation of the manager of the library and perhaps of the other staff too. In essence, the second partner is contracting for services from the first. The second partner may feel that the needs of its users or of the parent organization itself are difficult to assert and negotiate, especially as they change over the years. It is also possible that the contracting partner may lose commitment to and interest in the partnership over time.

In a second model, the intergovernmental agreement establishes a governing board consisting of representatives from the two partners. The governing board employs a director who reports to it. Generally, one partner acts as fiscal agent and employer of remaining staff, who report to the director. Staff previously employed by the partner that is not the fiscal agent may become employees of the fiscal agent, and in that case the specifics of a change of employment including salaries, benefits, seniority, and other terms and conditions must be worked out. The governing board sets the schedule of operation and other policies to meet the needs of both partners.

In a third staffing model, codirectors hired by each partner share the responsibility for managing the library. Each partner has employees working together under the direction of their respective codirector in the shared library. In these cases, issues of differing methods and standards for performance evaluation, varying job descriptions, career paths and pay scales, arise and must be dealt with. In addition, a staffing model that has employees of two jurisdictions working together requires that the codirectors and employees be flexible enough to create a shared organizational culture while participating effectively in the cultures of their parent institutions. It is essential that the codirectors be committed to the success of the shared library and can work as a team. Although administratively the most complex of the options, each of the codirectors is responsible for ensuring that the needs of their users and partner organization are met.^[5]

ORGANIZATIONAL MODELS OF MANAGEMENT

University/Public Joint Libraries

Within the parameters of the various definitions given for shared libraries, a variety of university/public library models have been developed. NOVA Southeastern University, a private university, administers the Alvin Sherman Library, Research, and Information Technology Center, an integrated joint-use library with Broward County Public

Library system. In this scenario, the University manages the large shared facility including supervision of all staff and librarians who have become university employees. The County provided funding for the construction of the building, which opened in 2001 and provides funding to the University for operating expenses. All services and programs, as well as access to all collections, are available for all members of the community, both the university community and the Broward County community at large.

In St. Paul, Minneapolis, the Metropolitan State University Library and the Dayton's Bluff Branch of the Saint Paul Public Library System, cohabitate within a shared-use library facility. In this model, each of the library organizations controls, staffs, and manages their respective collections, services, programs, and other functions. Although library users aged 13 and up have reciprocal borrowing privileges from both collections, there are two circulation desks and two library cards. This model, where the public library leases space in the building from the University, is characterized as a partnership and not a merger.

A third model, unique to the previous two examples, is the Dr. Martin Luther King, Jr., Library (King Library), a partnership between the San José State University Library and the San José Public Library (Fig. 1). Like the Metropolitan State University Library and the City of St. Paul, the university library and the public library have retained their autonomy and identity as a university and a public library organization, respectively. However, like NOVA Southeastern University and Broward County Public Library, the libraries have merged services, programs, collections, and most significantly, staffing in four of the major functional areas of the library—circulation, information technology, reference, and technical services. All library users have access to all collections and reciprocal borrowing privileges, as well as use of the entire building. This hybrid model, where the shared library space is comanaged by two distinct and autonomous library organizations, is the largest such library in the world.

Joint School/Public Libraries

The most common type of joint-use library is the public school/public library combination. Research shows that there are common issues, advantages, and disadvantages to these partnerships, whether in the United States, Canada, or Australia. As with any type of library, the school library and the public library have missions and goals that are unique to their community, as it is defined. A public school librarian's goals are to support the school curriculum and to collaborate with classroom teachers to teach information literacy across the curriculum. The public library has a much broader mission—that of providing access to information, recreational resources, and lifelong learning for the entire community, not just the school-aged. Although these



Fig. 1 Photograph of Dr. Martin Luther King Jr., Library, joint university and public library, San José, California.

distinct missions can create tensions within a joint library, many such libraries have been highly successful. Dr. Ken Haycock identifies 10 criteria for potential success including the necessity for a legal written document, one librarian in charge of the library, a fully integrated facility, and a single independent decision-making board among others.^[6]

JOINT LIBRARIES AROUND THE WORLD

South Australia has been a leader in the world in developing joint-use libraries and formulating strong public policy that supports school/community libraries. In addition to Australia, New Zealand, Sweden, and Canada, there is ongoing development and planning of such partnerships in England and Scotland. Although the United States has had school/public shared-use libraries since the early twentieth century, with the exception of the joint libraries in Florida and the San José model, the development of new joint-use libraries has been slow.

JOINT LIBRARIES AS REPLICABLE MODELS

The question regarding joint-use libraries that needs to be addressed is whether the models that now exist, as varied and unique as they are, can be replicated in other settings. The Dr. Martin Luther King, Jr., Library in San José, California, receives visitors from around the nation and the world. The impetus for many of these visits is a desire

on the part of a municipal official or university administrator who seeks to explore the idea of a joint library as a means to mitigate the costs of building a new library facility for their constituency. After 4 years, the King Library remains the largest joint library in the world and the number of joint university and public libraries has not grown significantly. Will the joint libraries now in existence serve as models for future development? Will other large metropolitan city libraries partner with large university libraries, thus building on the NOVA Southeastern University and San José State University partnerships with the public library systems in their regions? If this does not come to pass it may be because the joint library phenomenon is tied to the specifics of the region, the organizations, and the leadership at a given time in the history of the community. In each of the joint libraries that have been developed in the United States in recent years, there have been strong local leaders and unique regional factors that made the project both feasible and ultimately successful.

EVALUATION AND ASSESSMENT

Evaluation and assessment of libraries, their services, programming, access, collections, and relevance to library users is essential for creating truly library-user centered libraries. Academic libraries as integral players in the educational institutions within which they serve have been moving from identifying inputs and outputs to becoming

more outcomes based. Joint libraries, regardless of the management model, are complex organizations requiring significant attention and intentionality with all decisions and new initiatives, whether they are specific to one or the other of the organizations, or to the joint operation. Evaluation and assessment in this context requires that not only the success of the joint library must be evaluated, but also the effectiveness of the services and support to the home constituency must also be examined critically. In order for the joint library to be successful, the service to the individual constituencies must be as good as or better than it was before the partnership. The Dr. Martin Luther King Jr., Library made provisions for the evaluation of the effectiveness of the merger well before the library opened. Surveys were conducted to measure the satisfaction level of library users prior to the merger and then twice after the merger. Overall, customer perceptions of the library programs had improved after the merger. As the library now begins to develop a more user-centric philosophy of service, a new approach to evaluation will be needed.

PUBLIC POLICY AND JOINT-USE LIBRARIES

Joint libraries have prospered in regions where public policy makers have advocated for such partnerships. This has occurred in South Australia, the United Kingdom, and in the United States. For example, in the United Kingdom, public policy actions have supported the development of many new joint libraries in the recent years. These joint initiatives are seen as politically attractive in light of New Labour policy initiatives.^[7] Many of the joint-use libraries in the United States were initiated because of the expected cost savings and not because of explicitly stated public policy issues such as bridging the digital divide, building economic development in the community, the importance of a well-informed citizenry to participate in civic matters, the need to build social capital, or the public good inherent in providing lifelong learning opportunities for all of the community. As joint libraries evolve and demonstrate through research, evaluation, and assessment that the benefits to the communities are significant, these policy matters may become more explicit.

CONCLUSION

Shared libraries have developed around the world in response to local needs, strong and creative leadership, and actions of public policy makers. As these libraries evolve over time, and as new joint initiatives take shape, their efficacy will be determined. In each case, many of the same issues are of concern—those of staffing, budgeting, management, alignment of missions, development of policies and procedures, the use of emerging technologies to provide service, and access to collections. The benefits and

opportunities, as well as the challenges that present themselves are considerable, thus making the joint library a significant institution in society.

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Site Museums and Monuments

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Abstract

This entry defines site museums and monuments and identifies the most commonly existing subtypes that fall within the definition of site museums and monuments. Examples of cultural patrimony from different regions of the world representing each type are included. The entry then provides a brief historical background, with specific reference to the role of site museums and monuments as agents of cultural unity and their subsequent vulnerability, particularly during times of war. This entry will also address legislation passed and organizations founded in the effort to protect the world's sites of cultural heritage. The entry then proceeds with an overview of some of the controversial issues concerning interpretation and preservation faced today by site museums and monuments and those charged with administering them. It ends by touching on the future prospects of site museums and monuments in an environment of globalization.

INTRODUCTION

Site museums and monuments are specific geographic locations with definite boundaries directly associated with notable events, people, or patterns of history and recognized by a particular group or entire culture for their significance relating to the history or prehistory of humankind. They are essentially institutions of public service and exist in the capacity of commemoration and/or education. As a result, these sites of cultural patrimony are often interpreted for the public through accompanying plaques, informational panels, related exhibits, or docent-led tours. Site museums and monuments exist in a variety of forms and types including commemorative monuments, structures, and landscapes; on-site museums (including house museums); and living history sites; some defy classification as a single type, embracing features or characteristics of two or more. Many are considered notable based on their status as the first, only, or oldest existing examples of their kind, but site museums and monuments hold especial value to societies and cultures for their authenticity of material and place—it is at such sites that visitors feel a mental and physical connection to the peoples and events of the past. Roy Rosenzweig and David Thelen explore the ways in which people, particularly Americans, use history in their daily lives and discuss the value of authenticity and immediacy that people associate with historic sites and museums as a central theme in their book, *The Presence of the Past: Popular Uses of History in American Life* (p. 12, 32, 105–106).^[1]

This entry will discuss in broad terms the most widely represented types of site museums and monuments in the world today, with accompanying definitions and specific examples of each type. It will then provide a brief historical background, with specific reference to the role of site museums and monuments as agents of cultural unity and their vulnerability, particularly during times of war. This

section will also address legislation passed and societies formed in the effort to protect the world's sites of cultural heritage. The entry will end with an overview of some of the controversial issues concerning interpretation and preservation faced today by site museums and monuments and those charged with administering them.

TYPES OF SITE MUSEUMS AND MONUMENTS

Commemorative Site Monuments and Landscapes

Commemorative monuments, structures, and landscapes are statuary (memorial statuary can take many different forms, e.g., cairns, cenotaphs, obelisks, and shrines) and architectural or geographic features situated on the original site of the commemorated event or a location directly associated with a notable person or a representative instance of a pattern of history. They are erected, preserved, or simply regarded by a collective body of people as a tribute or memorial to a historic event or personage, or as an extant example of a historic type or pattern. Interpretative text often accompanies these sites in an effort to formally communicate their intention, although many stand unaided by written explanation and are able to rely on the weight of their prominence, oral tradition, or other methods to convey their purpose. A closer examination of each subcategory listed above through specific examples will help illustrate the form and function of this class of cultural patrimony.

Commemorative site monument

Commemorative site monuments are man-made statuary, signage, or structures intended to indicate and memorialize

either the actual geographic location of a historic event or a specific site associated with the activities of a notable person or pattern of history. The Monument to the Great Fire of London, commonly known as simply “The Monument,” is a large-scale example of this type of cultural patrimony. The Monument was built in England near the site where the infamous fire of 1666 that razed London ignited, and was meant to forever symbolize the rebirth of the scorched cityscape. Construction of the 202-foot tall Doric column of Portland stone crowned by a gilded urn of fire was completed in 1677, and it has withstood the ravages of time, weather, and war with only routine maintenance and periodic repair. The sides of the monument feature relief carvings depicting the resulting destruction of the city, members of the Royal family at the time of the Great Fire, and other images and text chronicling this traumatic time in English history. This colossal column is a highly visible, permanent reminder of a city’s resilience, and a wonderful example of a commemorative monument and structure. For further information on The Monument to the Great Fire of London, currently in the midst of routine repairs, refer to the Monument’s Web site.^[2]

Commemorative landscape

A commemorative landscape is a geographic area or feature with demarcated boundaries that is protected, preserved, or restored as a memorial to a directly associated event, person, or instance of a historical pattern; original and/or reconstructed architectural features and related monumental statuary are often present within their borders. The Homestead National Monument of America is a case in point of a commemorative landscape complex. This 163-acre site, administered by the National Park Service of the United States, is a tribute to westward migration and the settling of the frontier—a key period of American history. The Homestead National Monument preserves the original site in southeastern Nebraska of one of the first claims filed under the Homestead Act of 1862. The significance of the site has long been recognized; it was signed into legislative existence in 1936 by President Roosevelt. Several structures deemed to add depth to the site’s story have since been added to the complex, including an 1867 log cabin from a neighboring homestead and an original one-room schoolhouse. Special events and school programs assist in educating the public about the historical meaning behind the Homestead National Monument. The National Park Service (NPS) of the United States, established in 1916 as a branch of the U.S. Department of the Interior, administers hundreds of historic sites across the country. For an excellent, albeit somewhat dated, narrative of the formation of NPS see Albright.^[3] For site directions, hours of operation, and other pertinent information, refer to the National Park Service’s Web site.^[4]

Site Museums

A site museum is an edifice or locale situated on the actual geographic location of a directly associated event, person, or instance of a historical pattern; furthermore, it is a structure erected or a site protected in an effort to preserve the historical context for which the location is recognized as significant to the history or prehistory of humankind. Many site museums incorporate original architectural or artifactual archaeological components, while others utilize reproductions of originals that were not viable or new construction specifically tailored to preservational or educational purposes. Site museums can take several forms, from the traditional museum, to house museums, to active and inactive archaeological sites, to living history sites and complexes. A separate definition and accompanying example of each will better clarify this category of site museums and monuments.

Traditional site museum

A traditional site museum is an architectural feature preserved or designed for the purpose of commemorating, protecting, or promoting (either educationally or otherwise) a directly associated event, person, or instance of a historical pattern. They often house and/or interpret original artifacts or facsimiles of original artifacts from or relating to the associated event, person, or instance of a historical pattern. The National Civil Rights Museum is a prominent institution that aptly illustrates the form and function of a traditional site museum. The museum is housed in the former Lorraine Motel in Memphis, Tennessee (United States) where celebrated civil rights activist Martin Luther King, Jr., was assassinated in 1968. Officially opened to visitors in 1991, the National Civil Rights Museum incorporates authentic King artifacts, as well as other tokens and mementos related to both the national and global human rights movements. Here, the Martin Luther King narrative is used as a lens through which to tell the larger story of the global struggle for human rights. The creation of the museum served the dual purpose of ensuring that this historic property is preserved (the Lorraine Motel was a foreclosed property by 1982) and that its story is disseminated to the public. In this way, the National Civil Rights Museum is a wonderful example of a site museum that uses the authenticity and emotional weight of an actual historic site as the foundation for a larger commemorative or educational goal. For the most current information pertaining to this institution, refer to the National Civil Rights Museum’s Web site.^[5]

House museums

A house museum is a domestic structure that is directly associated with a historically significant person or family or exists as an outstanding example of architecture and is

preserved for a commemorative or educational purpose; house museums generally hold and interpret original artifacts or facsimiles of original artifacts that formerly belonged or are related to the associated person or persons, or artifacts known to be contemporary to the structure's identified period of significance. The house museum movement is a flourishing aspect of historic preservation; the success of George Washington's Mt. Vernon under the leadership of Ann Pamela Cunningham is often recognized as the impetus for the popularity of the house museum in the United States. For an excellent summary of the house museum movement in the United States, with a particular focus on the contributions of women, see West.^[6]

The Historic Adams House in Deadwood, South Dakota (United States), pictured in Fig. 1, is an 1892 Victorian mansion that has served as a house museum as defined in this paragraph since 2000. It is dedicated to the legacy of the families of Harris Franklin and W.E. Adams, both influential and philanthropic local businessmen and civic leaders who were among the first to arrive in the fledgling gold camp of Deadwood—they are significant players in local history and, furthermore, their stories stand as excellent case studies of the industrious and successful Western entrepreneur. The artifact collection contained within and displayed at the Historic Adams House represents a nearly complete assemblage of domestic goods original to the structure that is used to tell the often-obscured story of Deadwood as a civilized oasis on the edge of the Western frontier. The contents of the Adams House are arranged much like they would have been when it was still a private residence, an interpretative technique employed often in house museums. House museums like the Historic Adams House reveal the more intimate details of history that are often excluded from other museum environments. Mary Kopco, *The Adams House Revealed* is a concise history of the Adams House

and its inhabitants, including a detailed description of the \$1.5 million museum-quality restoration it underwent before opening its doors to the public.^[7]

For those interested in further exploring the house museum genre, see Donnelly.^[8] This compilation of essays explores various interpretative techniques employed by those who administer these institutions. For a European example, see the Brontë Parsonage Museum and Brontë Society's Web site^[9] for information on the Brontë Parsonage Museum, a house museum located in Yorkshire (United Kingdom) that is preserved to both honor the memory of this famous family of nineteenth century literary giants and to educate the public about their private lives.

Outdoor Museums/Living History Sites

An outdoor museum or living history site (the two terms can be used interchangeably) is an original or reconstructed historic structure or complex of such associated structures that are used as an educational setting to present the visiting public with interpretative reenactments and displays of activities contemporary to the site's period of historic significance. Costumed interpreters are the most common medium used to convey information and conduct demonstrations for visitors. In order to be classified as a site museum, the outdoor museum must be located on the geographic location where the performed activities or reenactments actually took place at some point in the past, and must incorporate the original associated structures or facsimiles thereof. Many credit Sweden's Artur Hazelius as the pioneering force behind the outdoor museum; his Nordic Museum opened in the 1890s and utilized artifacts and representations of the past in an effort to instill native visitors with national pride. A short discussion of Hazelius' influence can be found in Murtagh.^[10]

Colonial Williamsburg is perhaps the most well-known outdoor museum in the world. Situated on the location of the pre-Revolutionary capital of Virginia (United States), Colonial Williamsburg is a designated historic district within the larger city of Williamsburg. This expansive site museum encompasses 300 acres and 500 buildings (only 88 of which are contemporary to the interpreted time period, the rest are reconstructions). Visitors to the site can walk the streets and enter various structures to observe and interact with costumed interpreters who perform skilled trades, such as blacksmithing and millinery, as well as other activities that constituted daily life in the colonial era. From its beginnings, this ever-expanding cultural complex was intended to inculcate national pride and an appreciation for the merits of American democracy, seen by many to have roots in the colonial center of Williamsburg. While many experts would argue that Colonial Williamsburg does not present an accurate picture of the



Fig. 1 The Historic Adams House in Deadwood, South Dakota (United States), former private residence and now house museum with an associated artifact collection interpreted for the visiting public through docent-led tours. (Photograph courtesy of the Historic Adams House, Deadwood, South Dakota.)

colonial landscape or colonial life, it remains a popular destination for thousands of visitors each year who seek to take a step into the past. Recent interpretative additions include a focus on the realities of life for Blacks under slavery, a sensitive issue that must be addressed accurately and fully, yet with sensitivity to those who must play the part of this exploited segment of society. Living history sites, when based on sound research and carried out with careful attention to detail, can serve as an invaluable purveyor of historical awareness for those who find traditional museums tedious and cerebral.

For the story of Williamsburg's colonial and early American prominence, its subsequent decay, and recent rise, see Kopper.^[11] For a pictorial chronicle of Colonial Williamsburg's transformation from a decaying twentieth century city to a restored step-back-in-time, refer to Yetter.^[12] Colonial Williamsburg has an in-depth Internet site that contains, among other features, a brief history of this outdoor museum, a virtual tour, and an online scholarly journal publication; refer to Colonial Williamsburg's Web site.^[13]

Archaeological site museum

An archaeological site museum is an active or inactive archaeology site with an associated interpretative element (such as interpretative panels or placards or an on-site museum) protected, preserved, and at least periodically open to the public. (An archaeology site is a bounded geographic location that contains evidence of humankind's presence that is recorded and studied using scientific and historical methods. An active archaeology site is one that is the subject of ongoing research through continuing recordation and/or excavation; an inactive archaeology site is one that is not the subject of active research necessitating sustained onsite recordation and/or excavation.) Because they are accessible to the public, even if on a limited basis, archaeological site museums are especially vulnerable to the dangers of site looting and destruction—often by collectors who are aware of the value of archaeological artifacts in the underground economy. For this reason, those who administer archaeological site museums often employ such protective measures as observation decks or viewing windows that distance the visitor from the actual site. For an examination of the hazards faced by valuable cultural artifacts, refer to Brodie.^[14]

The Pella Archaeological Site and Museum in Macedonia (Greece) is a captivating example of an inactive archaeological site museum. Visitors to Pella are presented with both an organic view of Grecian history through access to the original archaeological site, as well as an academically interpreted version of the evidence in the associated museum. The publicly accessible archaeological components at Pella allow visitors to view ancient Greek architectural features as originally uncovered by archaeologists,

some of which still contain intricate clay-tile mosaics. The associated museum, originally built in 1960 to house the artifacts excavated from Pella and the surrounding countryside and opened to the public in 1973, is located directly across the road from the archaeological site. Here visitors can view photographs and sketches resulting from archaeological digs that took place on-site and nearby, as well as original artifacts and facsimiles; they can also learn about the lives of the prosperous Macedonians who inhabited the site through interpretative text and panels. Several online sites are available that provide information about and photographs of the Pella Archaeological Site and Museum.^[15,16]

Active archaeological sites that are also open to the public present a unique educational experience for visitors. The Town Creek Indian Mound Historic Site in North Carolina (United States) is a case in point. Comprehensive excavation at this American Indian ceremonial site commenced in 1937 and persisted for 50 continuous years, with intermittent archaeological research still carried out on a reduced scale—area students are yet able to take advantage of the opportunities presented by this culturally rich and artifactually dense site. In the 1950s and the 1960s, several key features identified by archaeologists at the Town Creek site were reconstructed using information gathered from the ongoing investigation; today, visitors can walk through the original landscape and view a ceremonial earthen mound, burial house, two temples, and the surrounding stockade. An on-site museum displaying actual excavated artifacts acquaints visitors with the history and culture represented by the Mound and serves as a gatehouse regulating entry into the site. Active archaeological site museums like North Carolina's Town Creek Indian Mound are able to educate the public on many different levels and in many different ways; they have something to offer everyone, from the casual history enthusiast to the graduate-level anthropologist and archaeologist. Archaeological, anthropological, and scientific information gathered at the Town Creek Indian Mound Historic Site has been the basis for much scholarship. For a comprehensive overview detailing the history of the site, from research methodologies employed to conclusions drawn, refer to Coe.^[17,18]

Impact of archaeology on site museums and monuments: Although archaeological sites are often points of interest and a destination in and of themselves, many other sites have employed archaeological research methods for the purpose of gathering artifactual evidence; this evidence is then used to formulate a more complete understanding of the historic context at the site under investigation. To archaeologists, artifacts and monuments are an archive of past human activity, and are used in tandem with other historical and scientific sources to draw conclusions about the peoples, events, and recurring patterns of the past associated with the site. These conclusions are then used in various ways; sometimes they are simply conveyed to the

public through narratives during tours and on interpretative panels, sometimes they are used as a basis for the reenactment of events and activities contemporary to the site (such as at living history sites), and sometimes they are used in efforts to reconstruct ruins and no longer existing architectural features and structures. In many ways, archaeology research methods remain central to the interpretation of the world's historic sites and structures. For an example of archaeology used in a practical manner, refer to Ford.^[19] This article details how archaeologists and anthropologists in Britain used information obtained from archaeological excavations, along with environmental research, anthropology research, and comparisons with surviving contemporary structures to construct a blueprint to reconstruct the Silchester Church, which was to be used as a site museum upon completion.

HISTORICAL BACKGROUND

It would be impossible to create a comprehensive global timeline with specific dates and events chronicling the development of the site museum and monument as a cultural institution because they stand as universal features throughout place and time. The human phenomenon of commemoration crosses all boundaries of nationality, class, gender, sexual orientation, and religion; subsequently, site museums and monuments exist the world over, many are even thousands of years old. For these reasons, as well as in consideration of length constraints, we will limit our discussion of the historical background of the site museum and monument to a manageable time frame of roughly the last 200 years, written from the perspective of Western and, more specifically, European civilization and culture.

Site Museums and Monuments as Heritage

When discussing the reasons for societal interest in sites of cultural patrimony, including site museums and monuments, many scholars point to the emergence of the nation-state as a political and cultural entity as a major factor.^[1,20] Now, people with different skin colors, who subscribed to different religions, and who were members of varying socioeconomic levels could identify with a larger group—one based strictly on the shared geographic boundary within which they lived. This new “nation” of otherwise divergent groups could develop yet deeper bonds on the basis of shared histories, made tangible in the form of site museums and monuments.^[21] For example, the village of Oradour-sur-Glane, the French site of a 1944 invasion and massacre by Nazi invaders, was deemed a historic monument by the French parliament in 1946—just 2 years after the event took place. This village was preserved in its state of ruin to symbolize the collective instances of merciless destruction the French people suffered during World War II. Emotion-laden site museums

and monuments like Oradour-sur-Glane, be they mournful tributes or patriotic celebrations, serve as historical and cultural reference points around which groups of people can (literally and figuratively) gather. For an in-depth discussion of Oradour-sur-Glane as a commemorative landscape, refer to Farmer.^[22]

Site Museums and Monuments as War Targets and Cultural Casualties

The cultural and emotional emphasis that individual nations and their peoples place on site museums and monuments have been, and continue to make them, prime targets during times of war, despite their often neutral meaning to those who seek to destroy them. Furthermore, the dangers faced by sites of cultural patrimony have grown exponentially with the historic emergence of “total war.” Methods of combat that no longer avoid civilian areas or population-dense regions (where most historic sites and monuments are located) and advancements in weapons technology that make ultra long-range targeting effortless and exact place historic sites and monuments in escalating peril. As a case in point, the frequency of cultural casualties during the World Wars (particularly World War II and the Nazi-drive for world dominance), led to the coining of the phrase “martyred village,” used to describe communities damaged by war. Oradour-sur-Glane, discussed earlier in this entry, is one such martyred village (see the section on “Site Museums and Monuments as Heritage”).

Initially, nation-states and communities employed protective defense measures to safeguard specific cultural sites they perceived as most in danger; such tactics included removal and storage of stained glass and other fragile features and reinforcement of walls. But these methods soon proved ineffective. Cooperative treaties and other methods of international legislation were then put in place in an attempt to decrease cultural destruction. The most well-known examples are the successive global conferences known as the Hague Conventions, held in the Netherlands. Negotiations within the Hague Convention for the Protection of Cultural Property in the Event of Armed Conflict, held in 1954, led to treaties regulating the conduct of hostile enemies against and within the boundaries of those they oppose—specifically relating to those properties held as culturally significant by the nation on the defensive. Although conventions, agreements, treaties, and legislation have proved anything but failsafe in the ongoing effort to preserve the world's cultural heritage, they are a step in the right direction. For an examination and analysis of the destruction of sites of cultural patrimony during wartime, with a particular focus on Western Europe during and as a result of World War II, refer to Murtagh.^[23] For a more modern example, see Sturges,^[24] which includes a discussion of cultural destruction inflicted during the Balkan wars of the 1990s.

United States Federal Preservation Legislation

A society's values are reflected in the laws they formalize and regulate. So, by singling out legislation that directly pertains to the protection, preservation, and control of sites of cultural patrimony, we are able to see the recognition that site museums and monuments have gained nationally.

In the United States, a study of preservation-related laws shows that its leaders have identified America's cultural sites as vulnerable and in need of legislative safeguarding; U.S. law also illustrates the increased financial responsibility that the federal government has assumed to ensure the sustained existence of its cultural heritage. The Antiquities Act of 1906 was the forerunner to many later legislative acts in the United States. It gave the president the power to proclaim historically or scientifically significant public lands as national monuments, which simultaneously granted them federal protection and made them eligible for federal funding. The Antiquities Act of 1906 was a direct result of former United States' President Theodore Roosevelt's efforts to save prehistoric ruins and archaeological sites in the Southwest from destruction and looting.^[23] Ten years later, the National Park Service Act of 1916 created the National Park Service to administer sites considered too large or too expensive for adequate private protection and preservation. The National Park Service is today an intricate agency that oversees over 80 million acres of public land in the United States—including many site museums and monuments.^[25]

Probably the most significant piece of American legislation related to preservation is the 1966 National Historic Preservation Act. This act required that those planning any construction projects that rely in whole or in part on government funding must evaluate any possible impact the project may have on historical or archaeological sites (including those that could be defined as site museums and monuments) before any construction actually begins. (To download the complete text of the National Historic Preservation Act, last amended in 2000, go to "The National Historic Preservation Act of 1966, As Amended."^[26] For a summary of Section 106 regulations, refer to "Section 106 Regulations Summary."^[27]) The 1966 Act has served as a springboard for the formation of several other key preservation landmarks—such as the ever-expanding lists of the National Register of Historic Places and National Historic Landmarks and the post of State Historic Preservation Officer; all of which are dedicated to the identification, evaluation, and protection of America's cultural heritage. For a closer look at the history, key figures, and important legislation of the American preservation movement, refer to Stipe.^[28]

Preservation Groups and Societies

In addition to federal legislation, several private and international groups and societies have been formed as part of

the global effort to save sites of cultural heritage deemed significant to the history of humankind.

Cooperative efforts of private sector

One of the earliest private-sector preservation-minded groups that survives into the present day is the National Trust for Places of Historic Interest or Natural Beauty (more commonly known as simply "The National Trust"). Based in London (United Kingdom), The National Trust is a private charity started in 1895 dedicated to preserving and protecting cultural and environmental resources. As of today, it has over 3 million members and owns and oversees a collective area in excess of 623,000 acres (or 1.5% of the total land mass it serves in England, Wales, and Northern Ireland). National Trust properties include over 200 historic houses and gardens, many with associated collections. The inception and subsequent long-term success of the United Kingdom's National Trust has led to an American version, similarly titled the American National Trust for Historic Preservation. The American National Trust has a somewhat smaller preservational focus, forgoing an emphasis on natural landscapes to focus instead strictly on historic sites and communities. Since 1949, it has grown to include six regional offices and over 27,000 members. These two large and financially powerful organizations demonstrate the concern of the public sector over the need to preserve sites of cultural significance.^[29,30]

International cooperative efforts

On an international level, the United Nations Educational, Scientific, and Cultural Organization (UNESCO), a United Nations' subsidiary organization, is a prominent example of cooperative steps taken between world powers to ensure the recognition and protection of human rights and freedoms. UNESCO was formed in 1945 on the heels of World War II and its accompanying worldwide destruction of human life and cultural property to encourage respect and collaboration between international powers. Since its inception, 198 nation-states have become voluntary members of UNESCO.^[31]

A 1972 UNESCO convention established the list of World Heritage Sites in an effort to safeguard cultural and natural sites of "outstanding universal value" (as defined by internationally agreed-upon principles). The associated List of World Heritage in Danger identifies site of cultural patrimony that are threatened or impacted by natural, political, or other dangers, and provides funds to protect, preserve, and restore them. Many site museums and monuments in many parts of the world have benefited from UNESCO acknowledgment and financial backing. International efforts like UNESCO's embrace of World Heritage Sites are evidence of the growing global recognition of historic sites, monuments, and landscapes as vital cultural resources.^[32]

ASSOCIATED CONTROVERSIAL ISSUES

Challenges of Interpretation

Site museums and monuments represent complex historical units, and there are countless different ways to view and interpret the historical meanings and human stories behind each site, and even more ways to convey these historical meanings and human stories to the public. Even sites that have been open for visitation for tens or even hundreds of years need to be periodically reevaluated in light of the latest research or restructured to accommodate current modes of thinking.

The freezing of time and landscapes

The overwhelming amount of historical information each site holds is often too complex for visitors to digest at one time; for this reason, those who administer most site museums and monuments focus on one key aspect, event, or time period associated with the site. The process of spotlighting one moment in time, an interpretative device often used at site museums and monuments, is sometimes referred to as “freezing time” or “landscape freezing”; and, although usually effective at simplifying a site’s historical context, it is a technique that can also lead to the neglect (either intentionally or not) of other people or events that have also inhabited the same physical or historical space. To illustrate, landscape freezing is an interpretative technique often utilized at American Civil War battlefield sites. (For an examination of the contentious issue of landscape freezing in relation to a particular site, see Erika K. Martin.^[33]) Here, a single day or event in history is spotlighted in a particular context, an interpretation sometimes erasing all acknowledgment of the people who lived, worked, and died natural deaths on the same physical space for generations prior to and after the Civil War. Historians agree that those site museum and monuments that employ the freezing of time or landscapes should reassess their interpretation to ensure that they are not overlooking people or events that audiences want or need in order to understand the significance of the site in an inclusive historical context.

Historical perspective

Site museums and monuments are cultural mediums that present the exciting opportunity of bringing to light histories and perspectives either purposely suppressed or pushed to the side in lieu of more popular or comforting depictions of associated events and peoples. Unfortunately, those who administer sites of cultural patrimony often choose to tell history from the perspective of the white male (sometimes obscuring or misrepresenting women and minorities in the process) or, worse yet, skim

over or totally ignore parts of history that do not fit with either a political or personal agenda.

A famous example is Mount Vernon, the estate of American President George Washington located in Virginia (United States). This site monument only recently incorporated information on the realities of slavery, based in part on archaeological evidence, into their long-standing interpretation that had previously focused on the glorification of President Washington and his family.^[34] Earlier presentations of history at Mount Vernon had avoided the topic of slavery, probably because it did not fit their profile of Washington as a dedicated and progressive statesman.

Those who visit site museums and monuments are reminded to consider that the presentations of history at these sites are constructed by fallible people, even if they are considered experts, and, as result, their interpretation of a site may be incomplete or biased. Visitors who are interested in the whole story should ask questions, view the evidence, and form their own conclusions.

Preservation Controversies

Identifying a cultural site, including those that fit the definition of site museum or monument, is the easy part of historic preservation; the difficult part is deciding how exactly to preserve that site, often a contentious and complicated process.

The restoration vs. original controversy

There are several schools of thought in the preservation field regarding the correct way to manage historic sites, structures, and monuments. Perhaps the most prevalent debate centers on the divergent methods of what could be termed “preventative preservation” and its preservational opposite of “active conservation.” Preventative preservation is the more organic approach to site management in which the genuine state of cultural patrimony is viewed as the most authentic and capable of conveying historic truth. Those who administer these sites focus their attention on retaining the original fabric and form. The only active measures taken at sites maintained under the tenets of preventative preservation are those intended to protect them from threats outside the scope of natural weathering, such as demolition or modern alteration.

In opposition to preventative preservation, the main objective of active conservation is returning a historic site, structure, or monument to its state during its recognized period of significance; it is a process that often involves restoration and/or reconstruction. The restored or reconstructed feature is often based on careful study of the historic and archaeological record; in many cases the untrained eye would never be able to point out the facsimile from the original.

Preservational purists argue that conservation is actually a type of destruction in which the authenticity of cultural heritage is compromised by the addition of artificial elements—even if they are exact copies of originals. Furthermore, many archaeologists look upon restoration as destroying the value of the sites as locales of viable artifactual documentation.^[35] On the other hand, advocates of restoration contend that the viewer will gain a more complete understanding of history if they are able to see things “as they were,” in addition to the more simple argument that restored sites are more aesthetically pleasing. Of course, preventative preservation and active conservation are extreme opposites, and a balance can be achieved by the resourceful preservationist who takes into account both sides of the debate.

Eastern vs. Western: The cultural factor

When examining the appearance, condition, and intended function of site museums and monuments worldwide, one must take into consideration the varying cultural beliefs and ideals that they represent. As an illustration of cultural disparities, let us look at a few global models through the eyes of a contemporary United States preservationist.

In the ancient Buddhist tradition of Sri Lanka, it was considered a commendable fulfillment of custom to carry out routine repair and maintenance of religious structures, which were built with the expectation that they would exist in perpetuity. This set of beliefs carries over into Buddhist tradition today, suggesting that, according to Western preservational notions, no Buddhist religious building is wholly original or authentic.^[35] Next, let us consider current Brazilian culture in which the push for modernity consumes all aspects of society, and evidence of the antiquated past and native peoples is seen as negative. As a result, the demolition of structures Western preservationists would see as historically meaningful is freely carried out to make way for contemporary architecture.^[36]

These two simplified cultural scenarios exemplify the notion that the preservation of cultural patrimony, including site museums and monuments, is not simply a matter of applying a standard set of universal rules. The ideals and traditions of all cultures must be respected, even if they do not align with our current belief system.

CONCLUSION

This entry has defined, with specific examples, the different types of site museums and monuments that are represented throughout the world, provided a brief historical background explaining the source of their significance, and, finally, presented a synopsis of some of the challenges of preservation and interpretation that they

present. Readers will come away with an appreciation for the variety in form and function of these sites as a reflection of the diverse cultures that value them. Site museums and monuments exist as physical evidence of what a society perceives as worth saving, those monuments, landscapes, and sites that they feel are integral to their sense of self and their history.^[37]

With the modern phenomenon of globalization (made possible by advances in science and technology), distances seem shorter and the world seems smaller; as a result, the human community has begun to realize that although their collective history has many different chapters in many different languages, it is all part of a story that must be saved.

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Slovakia: Libraries, Archives, and Museums

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Abstract

This entry presents a brief cultural history of Slovakia while concentrating on the development of libraries, archives, and museums and the related disciplines. An overview is provided of the multiple kinds of libraries, museums, and archives with particular attention given to major representative examples. The history of relevant legislation and policy is provided along with a discussion of the contemporary legislative environment. In conclusion, the tendency toward collaboration of libraries, archives, and museums is emphasized. Future plans for libraries, archives, and museums concentrate on national projects of cultural heritage digitization and building of digital cultural portals.

INTRODUCTION

The goal of this entry is to present the development of the cultural institutions of libraries, archives, and museums in Slovakia. A brief historical background is provided that highlights a few facts and events that have had an impact on literacy and culture in Slovakia. Library systems, networks of public archives, and networks of museums and galleries are presented as part of cultural life of the Slovak people. The main sections of the text discuss libraries, archives, and museums and their respective professions. Each section provides a brief historical overview, an outline of relevant legislation, and an introduction to some of the major cultural institutions. In conclusion, we emphasize the digitization activities in the cultural sector in Slovakia. The three types of institutions are converging through the development of national digital projects of cultural heritage, of specialized digital portals, and in an integrated portal of culture.

Brief Historical, Geographic, Economic, and Sociocultural Context

Slovakia (Slovenská republika, Slovak Republic) is a state in Central Europe situated in the Carpathian Basin, between the Danube River in the south and the Tatra Mountains in the north, which are part of the Carpathian mountain range. Slovakia shares borders with Poland to the north, the Czech Republic to the west, Hungary and Austria to the south, and with Ukraine to the east. The multicultural composition of the population is a result of Slovakia's geographic location: Slovaks (86%),

Hungarians (9.7%), Roma, Czechs, etc. At present Slovakia has over 5.4 million inhabitants and its geographic area represents 48,845 km². Slovakia is a parliamentary democratic republic. It is administratively divided into 8 regions and 79 districts. The regions are represented by larger cities such as Bratislava, Trnava, Nitra, Trenčín, Žilina, Banská Bystrica, Prešov, and Košice. The capital and the center of political, economic, cultural, and university life is Bratislava. After many transformations the present economic development has been marked by positive growth, especially since 2000 (Fig. 1).

The territory of Slovakia was inhabited since the Stone Age and among the first ethnic groups were Celts. Roman military stations, which formed part of Limes Romanus, were situated just south of the Danube. Starting in the fifth century the Slavs started to settle the territory. In the ninth century, the first Slavic states appeared beginning with the Great Moravian Empire. Later on, Slovakia became part of the Medieval Kingdom of Hungary and the Austro-Hungarian Empire. The foundations of old Slavic writings in the ninth century and the rise of libraries and book culture in the thirteenth and fourteenth centuries have played an important role in the cultural history of Slovakia.^[1] The codification of literary Slovak language in 1843 and the national revival in 1848 represent milestones in cultural and historical development. In 1863, the Matica slovenská was established as an association and cultural institution aimed at defending the national and cultural interests of Slovaks in a multinational state. As part of the Matica slovenská, national library, archives, museum, and scientific institution foundations were



Fig. 1 Map of Slovakia.

Source: CIA World Fact Book. Retrieved from: <https://www.cia.gov/library/publications/resources/the-world-factbook/geos/lo.html#wfbPhotoGalleryModal>.

established. In the nineteenth century, a significant cultural contribution was made by the “Štúr generation”: politicians, linguists, and literary intellectuals gathered around the leader L’udovít Štúr.

Slovakia became a part of Czechoslovak Republic at its establishment in 1918. In 1919–1945 the foundations of a systematic approach to building cultural institutions were laid. The first Czechoslovak Republic set the conditions for the operation of the state-supported cultural institutions including universities, theaters, libraries, and museums. After the end of World War II, the Czechoslovak Republic was reestablished falling under the influence of the Soviet Union. This had an impact on further economic, social, and cultural development of the country under communist ideology. Slovakia was a part of the Czechoslovak Socialist Republic. After 1989 and the fall of communism, Slovakia was released from Soviet influence in the common Czechoslovak Federative Republic. On January 1, 1993, the independent Slovak Republic was established on the principles of democracy and market economy. It became a member of the UNO and IMF, and in 2000, Slovakia joined OECD. In 2004 Slovakia entered NATO and became a part of the European Union. Politically and economically, Slovakia became a part of the European and Atlantic region.

LIBRARY AND INFORMATION PROFESSIONS, SYSTEMS, AND SERVICES

Brief Historical Outline

In 1919 the first library Act No. 430/19 Col. in Czechoslovakia was passed, which established public libraries in every municipality. Library activity was provided under systematic professional guidance.

In 1959 the Act No. 53/59 Col. was issued establishing the national system of libraries.^[2] The unified system of libraries was composed of library networks including public, research, school, and academic libraries; libraries of

museums, archives, galleries, and ancient monuments; technical libraries; and libraries of the Slovak Academy of Sciences. The unified system of libraries was directed by the Matica slovenská. This centralized system of libraries, which was in existence from 1959 to 1989, has been marked by both the unification of professional library activities and ideological pressure. In addition, there existed a parallel system of technical and company libraries (referred to as a system of scientific, technical, and economic information), which provided information for enterprises and other institutions. Significant figures in Slovak librarianship include the bibliographers L’V. Rizner, J. Čaplovič, and I. Kotvan in the field of incunabula.

A new stage of development of the Slovak library system began in 1993. Its main characteristics are decentralization, cooperation, and a new concept of digitization aimed at the coordination of information systems in both cultural and governmental institutions. International recommendations and standards, for example, UNIMARC, ISBD, AACR2, and ISO 2709, were adopted and applied to professional procedures, systems, and services. International professional cooperation has been strengthened especially within the framework of International Federation of Library Associations and Institutions (IFLA) and OCLC.

As early as the 1960s, Slovak libraries started to automate bibliographic procedures. In the 1970s Slovakia was one of the first former socialist countries that introduced an automated bibliographic system in the Matica slovenská. In the 1980s an advanced integrated library and information system IKIS was designed with the use of what were then new technologies. Efforts for coordinated automation since the 1990s have been embodied by the Czech and Slovak Library Information Network and other cooperative regional systems and networks (e.g., KOLIN).

Current Legislation and Present Library System

In 2000, a new Act No. 183/2000 on libraries was passed followed by subsequent acts amending legal deposits of

publications (2001) and copyright act (2003). New integrated library systems of the third generation have been developed, such as library and information system of the 3rd generation (KIS3G). The library system of the Slovak Republic (SR) is part of the state information system and is included in building European electronic cultural systems. The library system comprises 9127 libraries, of which there are 2658 public libraries. In 2005 and 2006 new strategy for digitization and the integrated library and information system were introduced by the Slovak National Library (SNL).^[3] The library system is composed of the national library, 12 research libraries, 37 academic libraries, public libraries, special libraries, school libraries, libraries of churches, and nonpublic military and prison libraries. Public libraries include 8 regional libraries, 29 district libraries, 106 city libraries, 271 municipal professional libraries, 2276 municipal nonprofessional libraries, and 2 private libraries for public use in Nové Zámky and Tornaľa. Special libraries are represented by 3 independent legal libraries, 118 medical libraries, 44 technical libraries, 23 agricultural libraries, and 89 libraries of museums and galleries. There are over 5000 school libraries.

The most important libraries established by the Ministry of Culture of the SR are Slovenská národná knižnica v Martine (the Slovak National Library in Martin, the SNL), Univerzitná knižnica v Bratislave (the University Library in Bratislava, the ULB), and three state research libraries in regional cities of Banská Bystrica, Košice, and Prešov. The same position is held by Slovenská knižnica pre nevidiacich Mateja Hrebendu v Levoči (the Matej Hrebenda Slovak Library for the Blind in Levoča). The independent special libraries are Knižnica pre mládež mesta Košice (the Library for Youth of the City of Košice) and Parlamentná knižnica NR SR v Bratislave (the Parliamentary Library of the National Council of SR in Bratislava). Important libraries in Slovakia also include Centrum VTI SR (the Centre of Scientific and Technical Information in Bratislava),

Ústredná knižnica Slovenskej akadémie vied (Central Library of the Slovak Academy of Sciences in Bratislava), Slovenská ekonomická knižnica Ekonomickej Univerzity v Bratislave (Slovak Economic Library of the University of Economics in Bratislava), Slovenská poľnohospodárska knižnica pri Slovenskej poľnohospodárskej univerzite v Nitre (Slovak Agricultural Library of the Slovak University of Agriculture in Nitra), and Mestská knižnica v Bratislave (the Municipal Library in Bratislava). Professional library activities are supported by two professional associations, namely, Spolok slovenských knihovníkov (the Slovak Librarians' Association, the SLA) and Slovenská asociácia knižníc (the Slovak Association of Libraries, the SAL). The SLA was established in 1946 and manages the professional activity at the level of individual membership and specialized professional sections. Annual conferences have been organized by the SLA since the 1970s. Since 1993 the SAL has been active as a professional coalition of institutions in which membership is based on the institution's function, for example, academic, public, and special libraries. Library policy emphasizes the coordination of services and systems and the objectives of supporting an information and knowledge society.

The Slovak National Library and the University Library

Slovak National Library

Slovenská národná knižnica (the Slovak National Library, the SNL) in Martin has evolved as part of the Matica slovenská^[3] (Fig. 2). The complicated history of the Matica slovenská is tied to the social and political evolution of a number of changes in the form of government. In the nineteenth century its activities were interrupted, and in 1919 it was revived. The Matica has been developed both as a professional institution and as an association of



Fig. 2 The building of the Slovak National Library in Martin on the hill Hostihora (opened 1975).

people supporting Slovak culture. It has often resisted political influence and has undergone many organizational transformations. Following the Act No. 183/2000 the SNL has become independent from the Matica since 2000. It fulfills the tasks of the national library in the professional capacity of making national cultural and scientific heritage available through preservation of documents of Slovak origin (Slovak-subject documents—"slovaciká").

The library collections include 4.7 million documents. Historical library holdings contain incunabula, collections of prints, manuscripts, and other precious documents. Among the most precious documents are Confessionale by Antonin Florentin from 1477 (Fig. 3), Hungarian Chronicle by Johannes de Thurocz from 1488, and Pantheologia by Rainerius de Pisis printed in Basil in 1447 (Fig. 4). The most significant historical library holdings are the private libraries of M. Hamuljak and M. Rešetka and a historical library stock in Jasov. Apart from library materials, the collections of the SNL also include literary archives containing over 1.5 million items

and two literary museums. The oldest relic in the manuscript collections is the Glagolitic text on parchment from the twelfth century.

The SNL coordinates the library system in Slovakia. The SNL is also the national bibliographic agency, ISBN agency, and the leader of the KIS3G project.^[4] The project is aimed at the development of an interoperable environment for the provision of library and information services in Slovakia. The SNL is engaged in many international professional activities including cooperation with European and other national libraries (e.g., The European Library [TEL]). The SNL has recently developed several other national and international projects such as the Slovak digital library, information for innovation, paper conservation research, and the Slovak digital edition of rare medieval codices, Memoria Slovaciae in the framework of UNESCO's Memory of the World Programme and the portal of the Slovak cultural heritage—Memoria slovaca.^[3] The SNL is active in research in librarianship, bibliography, book culture, and literary archives and museums.

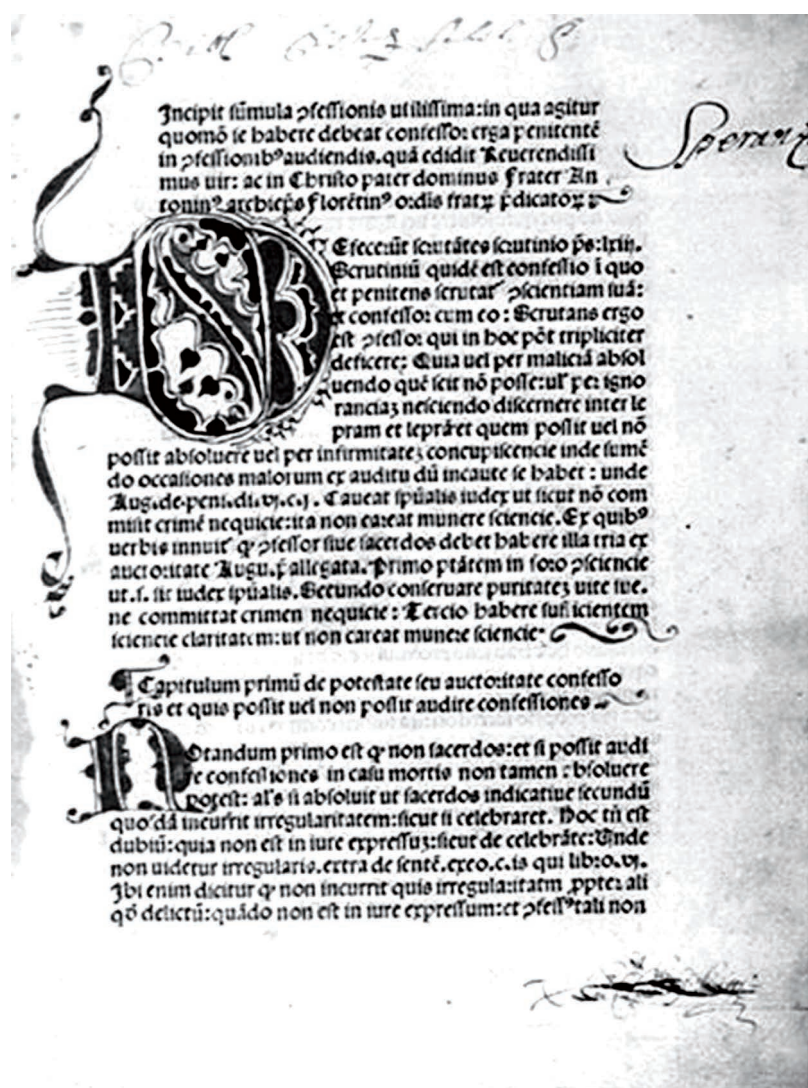


Fig. 3 Confessionale by Antonin Florentin from 1477.



Fig. 4 Pantheologia by Rainerius de Pisis. Basilee, Betholdus Ruppel, ca. 1477–1479.

University Library in Bratislava

Univerzitná knižnica v Bratislave is the next important institution in the library system of Slovakia.^[5] It was established as part of the former Elisabethan University in 1912. In 1919 it was closely connected with the newly founded Comenius University. Until 1954 it also operated as the national library. In 1954 it became an independent research library fulfilling tasks of both national and international scope. The ULB holds collections of Slovak and foreign literature with an emphasis on both science and social sciences. Its collections contain over 2.4 million items. The historical collections include manuscripts and old prints, of which the most significant is the Bašagić collection of oriental manuscripts registered in the list of UNESCO's Memory of the World. The ULB is active in library, bibliographic, research, cultural, and educational tasks and coordinates the development of national union catalogs of periodicals. It houses the international UN, UNESCO, and NATO information centers.^[6] The ULB is a member of international organizations such as IFLA,

and UNAL. The ULB is also at the center of coordination of information systems and registries in culture.^[7] It is engaged in many international programs such as e-Culture and digitization on demand (DoD). The library is housed in historic buildings in the center of the Old Town of Bratislava, namely, the Palace of Hungarian Chamber (Fig. 5), the Leopold de Pauli Palace (Fig. 6), and the Clariseum (St. Clara's order convent). Since 2005, after the reconstruction of the historical premises, the ULB has become the Multifunctional Cultural and Library Centre and is also active in digitization of its historical collections.

Academic and Research Libraries

Academic libraries in SR developed along with university education after 1919. In 1990, a new act on higher education introduced democratic principles of education and democratic management of universities. Academic libraries started to implement automation more intensely, coordinated professional procedures, and improved services



Fig. 5 The building of the University Library in Bratislava—the Palace of the Hungarian Chamber.

providing access to quality foreign literature. At present, a majority of academic libraries in universities offer electronic catalogs, electronic resources, and value-added services for students, teachers, and researchers. Academic libraries are either centralized to provide service for the whole university or decentralized within single university units. Academic libraries are interconnected through the

academic information network SANET. Major university libraries include Univerzita Komenského v Bratislave (the Comenius University in Bratislava), Univerzita Pavla J. Šafárika v Košiciach (the P.J. Šafárik University in Košice), and Slovenská technická univerzita v Bratislave (the Slovak Technical University in Bratislava).

Research libraries are divided into general and specialized libraries. The universal (general) research libraries include state research libraries in the regional cities of Banská Bystrica, Prešov, and Košice. The independent specialized research libraries include Centrum VTI SR (the Centre of Scientific and Technical Information of the SR), Slovenská lekárska knižnica (the Slovak Medical Library), Ústredná knižnica SAV (the Central Library of the Slovak Academy of Sciences), Slovenská ekonomická knižnica pri EU (the Slovak Economic Library of the University of Economics), Slovenská pedagogická knižnica (the Slovak Pedagogical Library), Slovenská poľnohospodárska knižnica pri SPU v Nitre (the Slovak Agricultural Library of the Slovak University of Agriculture in Nitra), and Slovenská lesnícka a drevárska knižnica vo Zvolene (the Slovak Library of Forestry and Wood Sciences in Zvolen).

The research and academic libraries are becoming part of the program on information innovation for the support of knowledge management and scientific and technical information.

Public Libraries

Public libraries in the SR have a complicated history. They emerged as municipal public libraries in 1919. After the act of 1959, they were professionalized and integrated into a unified system of libraries according to the act from 1959. Since 1990 changes in the organization of public libraries have been introduced as a result of the reorganization of local government authorities. There are four



Fig. 6 The building of the University Library in Bratislava—the Palace of Leopold de Pauli (1777).

basic types of public libraries: regional, county, city, and municipal. In accordance with the UNESCO Manifesto on public libraries, they take part in the democratization of culture and education in Slovakia. In 2005 the 2657 libraries of SR comprised 18.5 million library items. In 2013 more than 1.06 million of library users used libraries (19% of the whole population).^[7]

Under new social and economic conditions, public libraries are being transformed into community centers that cooperate with regional cultural institutions. Examples of such public libraries include Mestská knižnica v Bratislave (the Municipal Library of Bratislava), Knižnica P.O. Hviezdoslava Prešov (the P.O. Hviezdoslav Library in Prešov), Knižnica Juraja Fándlyho v Trnave (the Juraj Fándly Library in Trnava), Krajská knižnica L'. Štúra vo Zvolene (the L'. Štúr County Library in Zvolen), Verejná knižnica Jána Bocatia v Košiciach (the Ján Bocatus Public Library in Košice), and municipal libraries in Piešťany, Hlohovec, and Levice.

Education in Librarianship and Information Science

Since 1953 the education of librarians at the secondary level has been organized in the Škola knihovníckych a informačných štúdií (the School of Library and Information Studies) in Bratislava. In the course of its history, the school has provided part-time and further professional education as well as full-time program of study. The curricula have addressed librarianship, bibliography, archival studies, literary education, and scientific information. In 1993, the contents of studies were changed. A program on information systems and services has since been established that provides focused study in library and business information systems. The school also currently offers graduate professional education to library and information workers. The school cooperates with similar foreign institutions and makes use of international programs for the modernization of the curriculum.

The Faculty of Arts of Comenius University in Bratislava provided the first university education of library and information professionals in 1951. Independent department of librarianship was established in 1961. The subject of Librarianship and Scientific Information was offered in combination with various disciplines and foreign languages. Since 1990, the contents and the form of studies have responded to national changes in higher education.

Katedra knižničnej a informačnej vedy Filozofickej fakulty Univerzity Komenského v Bratislave (the Department of Library and Information Science [DLIS] at the Faculty of Arts of Comenius University in Bratislava) provides education for library and information professionals within the library and information studies program at three levels—the bachelor's, master's, and doctoral levels. It is the most important professional institution in the area of university education and research. Following the

European curricular models, it provides the core for studies in the subjects of information seeking and retrieval, knowledge organization, and information systems. The new curricula represent information and media studies, literary communication, and book culture. The DLIS is involved with research projects. It is a member of the international association, the European Association of Library and Information Education and Research, and organizes international conferences (e.g., 1999, 2003, 2006). The staff is involved with international projects (e.g., DELOS-CEE), publishing, and lecturing at national and international conferences. In total approximately 1400 students graduated from the department since its inception. Information science in Slovakia since 1990 has grown largely through the research of DLIS at Comenius University in Bratislava. The research topics are focused on a new paradigm of information science, human information behavior, digital libraries, on updating the curricular content, and on information ecology.

Higher education for library and information workers at the levels of bachelor and master studies is also provided by new departments at Žilinská univerzita (the University of Žilina) in Žilina, Katedra mediamatiky a kultúrneho dedičstva (the Department of Mediamatics and Cultural Heritage), and until 2013 also Prešovská univerzita (the University of Prešov) in Prešov.

Library professional development is provided through training opportunities and workshops organized by the SNL, the Centre of Scientific and Technical Information (STI) SR, and DLIS. Professional development is also supported by the electronic information portal for library and information theory and practice InfoLib (since 2003)^[8] and professional periodicals as Knižnica (library), as well as ITLib. Professional library associations and major research and public libraries take part in the continuing education of librarians as well.

Present State and Future Prospects

The present state of the library development in Slovakia can be characterized by continuing efforts at informatization and digitization. National programs of informatization are managed by the SNL and the Ministry of Culture of the SR. Recent topical strategies have focused on the provision of public Internet for libraries and schools, the development of common software, and support of small- and medium-sized libraries. Libraries are involved in European projects such as MINERVA, TEL-ME-MORE, e-Culture, DoD, DIGICULT, and TEL. International standards have been applied to the integration of memory institutions and to the preservation and presentation of cultural and scientific heritage. Digitization of Slovak cultural, scientific, and intellectual heritage is in progress based on UNESCO recommendations and those of the EU network of ministries of culture. Among the most important digitization projects are the

illuminated codices from the Bratislava Chapter Library from the Slovak National Archives (SNA) and portions of the Arabic and Persian manuscript collections from the ULB—Bašagić Collection of Islamic Manuscripts. The goal of digitization is to develop value-added services in e-learning, content industry, and culture. The first results of this digitization project are available via the national library and information system KIS3G, registries of cultural institutions, and SNL portals such as the Slovak digital library^[4] and Memoria slovacica, which provide digitized museum and archival objects.

ARCHIVES AND ARCHIVAL SCIENCE

Brief Historical Outline

The beginnings of archiving in Slovakia date back to the thirteenth century. The first historically documented public archives were founded at the so-called trustworthy locations—*loca credibilia*—and in medieval towns. *Loca credibilia* were public institutions that operated at chapter houses and convents in the Hungarian Kingdom and functioned as public notaries. Later on, *loca credibilia* were established in county/district archives, followed by the archives of mining and economic institutions. Private archives were the most common—feudal families' archives, archives of mansions, and church institutions. Guilds, and later on brotherhoods and organizations, also had their own archives. As Slovakia was part of the Hungarian Kingdom until 1918, no central archives were founded in the Slovak territory with the exception of the period between 1756 and 1785, when the royal/regional archives were moved to Bratislava due to the Turkish occupation of part of the territory of the Hungarian Kingdom. The idea of establishing the SNA originated in the Slovak national emancipation movement of the second half of the nineteenth century. Thereafter, the most important Slovak national cultural institutions such as the Matica slovenská, Muzeálna slovenská spoločnosť (the Slovak Museum Society), and Spolok svätého Vojtecha (St. Adalbert Association) began to develop archival documentation.

After establishing the Czechoslovak Republic, the Krajinský archív (the Regional Archives, 1928–1939) became the most important archives in Slovakia and was later replaced by Archív Ministerstva vnútra Slovenskej republiky (the Ministry of Interior of the Slovak Republic Archives, 1939–1945). Archív Slovenského národného múzea (the Slovak National Museum Archives) in Martin has operated continuously since 1929. The archives network in Slovakia was composed of county and municipal archives. However, at this time, it was impossible to establish either a private archiving organization or a central archiving institution or even to push through archival legislation.

The efforts to establish the central Slovak archives and archiving organization culminated in the second half

of the twentieth century. In 1948, Pôdohospodársky archív (the Agricultural Archives) was founded incorporating the collections of feudal families, mansions, and capitalist farms. In 1950, Ústredný banský archív (the Central Mining Archives) was established, and, eventually, Slovenský ústredný archív (the Slovak Central Archives) was founded in 1952 as a result of the activities of Slovenská archívna komisia (the Slovak Archiving Commission). Apart from processing archival documents and making them accessible, the Slovak Central Archives' main task was to supervise and coordinate the activities of regional, district, and municipal archives in Slovakia. In 1954 the Decree on archiving No. 29/1954 Col. was issued. It was the first legislation for archiving that created the unified archiving organization in the Czechoslovak Republic. Archiving in Slovakia was administered by Povereníctvo vnútra (the Home Affairs Authority) through Slovenská archívna správa (the Slovak Archives Administration). The archiving organization was composed of state central archives, state archives, district, municipal, special, and company archives. Church archives were also controlled by the state administration.

In 1975 the Act on archiving No. 149/1975 Col. was passed by the Slovak Parliament. As a result, archiving became part of the agenda of the Ministry of Interior of the Slovak Socialist Republic. The archives network consisted of the central archives (Štátny ústredný archív SSR, the Central State Archives of SSR, and Štátny ústredný banský archív, the State Central Mining Archives); the state regional archives in Bratislava, Nitra, Bytča, Banská Bystrica, Levoča, Prešov, Košice, and Archív hlavného mesta SSR Bratislavy (the Archives of the Capital City of Bratislava); 35 state district archives; Archív mesta Košice (the Archives of the City of Košice); archives of the organizations of special significance; and company archives. The armed forces' archives and the archives of armed security corps were administered by relevant ministries. Political parties, the national front, and trade unions established and administered their own archives. The Act on archiving considerably enhanced the professional character of the archives' activities. Štátny ústredný archív SSR became the main center for archival research. The new building of the Central State Archives of the SSR (today the Slovak National Archives) in Bratislava was established in 1983. In the 1960s and 1970s, modern technology became available and a new automated archiving system was created for recording, processing, and facilitating access to archival documents.

Current System and Legislation

Social and political changes that affected Slovak archiving after 1989 were reflected in amendments to the Act on archiving No. 332/1992 Col. More amendments were made in 1996 and 2001. Act No. 395/2002 Col. on

archives and registries came into effect on January 1, 2003, as a result of the reform of the state administration in Slovakia, the changed territorial arrangement, the complex demands on the registry system, and the adaptation of the Slovak legal system to the legal system of the European Union. This amendment significantly modified the system of archives in Slovakia—since then the system has been made up of both public and private archives. The state archives now include 47 institutions: the two state central archives (i.e., the SNA and the State Central Mining Archives) and the 8 state archives of regional territorial jurisdiction and their 38 branches. The documentary legacy of the Slovak Republic held by the state archives amounts to over 25,000 archival collections of approximately 200,000 linear meters.

Other public archives include the archives of state administrative bodies, the archives of state budget and state subsidies organizations, municipal archives and the archives of self-governing regions, archives of legal entities established by law, and the archives of legal entities and corporate entities who serve as public administrative bodies. Private archives are constituted by the archives of legal entities and natural persons. Archiving lies within the purview of the Ministry of Interior of the Slovak Republic. Archives are under the jurisdiction of the Department of Archives and Registries, and the advisory body is the Scientific Archiving Council. The act on archives and registries was amended in 2007 by the Act No. 216/2007 Col.

Access to Archives

The terms of use and access to archived documents are defined by Act No. 395/2002 Col. and by the Decree of the Ministry of Interior of the Slovak Republic No. 628/2003 Col. Access to collections is limited and is determined by each archive based on a written application. Finding aids, available in both traditional and electronic forms, serve as guides through the collections, stock lists, and catalogs and provide analyses of collections.

The National Archives, State Archives, and Administration

As mentioned previously, the administrative body of archives in Slovakia is the Department of Archives and Registries of the Ministry of Interior of the Slovak Republic. The advisory bodies consist of the Professional Archives Council, the Heraldic Commission, the Acquisition Commission, and the Document Shredding Commission.

Slovenský národný archív (the Slovak National Archives) in Bratislava^[9] is the largest and the most significant public archives in the Slovak Republic. It gathers, protects, processes, and makes accessible documents arising from the activities of the central bodies of the Slovak Republic and their predecessors and archival documents

of national importance. It is the central research and educational institution in archival science.

The Department of Early Resources and Collections administers the collections of state and administrative bodies before 1918; the archives of public figures, aristocratic families and mansions (the largest collection holds documents dating back to the thirteenth century), religious institutions, and *loca credibilia*; repositories of medieval documents; and a collection of maps and plans. The Department of New Resources and Collections administers the collections of the state and administrative bodies from the period of 1918 to 1968 as well as the collections of economic, legal, and financial organizations, political parties, associations, and unions. The Department of Prearchival Care methodologically supervises the central bodies of the state administration and of organizations of national importance in the area of registry, retention, and disposition activities. The Department of Reference Services provides public outreach and supports the use of archival documents for scientific, cultural, and administrative purposes. The department houses a study room, a library, and a film library. The Science and Research Section conducts research in archival science. The Department of Archival Preservation provides for the complex protection of archived documents and is an educational and research institution. The department also houses conservation and restoration laboratories, a photo laboratory, and a disinfecting chamber.

Outline of State and Specialized Public Archives in the Slovak Republic

State archives and their branches. The state archives collect, process, make accessible, and protect the resources of the state government and its administration, as well as the local governments and administrations including counties, agencies, committees, the justice system, army and security (including the gendarme and national security), finance, economy, agriculture, political parties, the educational system, health and social care, science, culture and history, religious organizations, significant families and mansions, prominent individuals, guilds, associations and interest organizations, and collections of other kinds of materials (registers, documents, maps and plans, sealing sticks, photographs, music materials, etc.).^[10]

Branch archives hold the collections of the state and local government concerning the administration of towns, villages, local national committees, district offices, district national committees, and notary public offices. Additional materials relate to district courts, tax offices, economic associations and chambers, cooperatives, political parties and social organizations, schools (elementary, secondary, and professional), culture and national history, health care, prominent families and individuals, guilds, associations and interest organizations, and collections.

The State Central Mining Archives in Banská Štiavnica serves as the archive for mining, metallurgy, geological research, and related branches of the economy for the period between 1255 and 1991.

The Archives of the Capital City of Bratislava houses the records of the municipal administrative bodies, schools, health and social facilities, religious organizations, families and prominent individuals, guilds, associations and interest organizations of Bratislava. Of particular note are the records of the Council Office of the City of Bratislava from the thirteenth to the twentieth centuries.

The Archives of the City of Košice keeps the resources of state and local governing bodies from the thirteenth to the twentieth centuries. The Council Office of the City of Košice, with records dating from the years 1239 to 1922, is of prime importance. Additional resources include records of the district and municipal courts, the prosecutors' office, police headquarters, materials relating to factories and manufacturing from the sixteenth to the twentieth centuries, schools, health care and social facilities, religious organizations, cooperatives, political parties and social organizations, guilds and associations, and family and personal collections (e.g., King Ján Zápoľský, 1537–1540). Other state archives are in Banská Bystrica, Bratislava, Bytča, Košice, Levoča, Nitra, Prešov, and other cities.

The specialized public archives keep a variety of materials concerning all aspects of social life. They include the archives of the central state administrative bodies, scientific, cultural, and educational institutions, as well as media archives. These archives include^[10] Archív Slovenského národného múzea (the Slovak National Museum Archives), Ústredný archív Slovenskej akadémie vied (the Slovak Academy of Sciences Central Archives), Archív literatúry a umenia Slovenskej národnej knižnice (the Literature and Art Archives of the Slovak National Library), Vojenský historický archív (the Military History Archives), Archív pamiatkového úradu SR (the Archives of the Memorial Authority of the SR), Ústredný archív geodézie a kartografie (the Central Archives of Geodesy and Cartography), Archív Ústavu pamäti národa (the Archives of the Nation's Memory Institute of the SR), Národný filmový archív Slovenského filmového ústavu (the National Movies Archives of the Slovak Film Institute), Archív výtvarného umenia Slovenskej národnej galérie (the Visual Art Archives of the Slovak National Gallery), Archív Divadelného ústavu (the Theatre Institute Archives), Archív Univerzity Komenského (the Comenius University Archives), Archív Slovenskej technickej univerzity (the Slovak Technical University Archives), Archív Ekonomickej univerzity (the University of Economics Archives), Archív Národnej banky SR (the National Bank of the SR Archives), Archív Slovenského rozhlasu (the Slovak Radio Archives), Archív Slovenskej televízie (the Slovak Television Archives), Archív Kancelárie prezidenta SR (the Archives of the Office

of President of the SR), Parlamentný archív (the Parliamentary Archives), Archív Ministerstva zahraničných vecí SR (the Ministry of Foreign Affairs of the SR Archives), Archív Zboru väzenskej a justičnej stráže SR (the Archives of the Corps of Prison and Justice Guards), and Archív Mincovne Kremnica (the Kremnica Mint Archives).

Archival Education

During the period of the Hungarian Kingdom, historians and lawyers used to work as archivists. Archival education was available only at universities abroad. The Czechoslovak Republic Štátna archívna škola (the State Archiving School) was founded in Prague in 1919. In 1950, archiving began to be studied at the Faculty of Arts of Comenius University in Bratislava. Starting in 1970, secondary extension lectures in archiving were given at the Secondary School of Librarianship in Bratislava. Later on pre-A-levels study of archiving were established at the same school. Since 2000, archiving can be studied at the independent Department of Archiving and Auxiliary Historic Sciences at the Faculty of Arts of Comenius University in Bratislava. The program of archiving and auxiliary historic sciences takes the form of bachelor's, master's, or doctoral studies. The study program provides courses in archiving, auxiliary historic sciences, administration history, national and world history, source languages (Latin, Old Slovak, Czech, Hungarian, German), information technologies, archived documents protection, and professional archival training. Since 1991 archiving can be studied at the Faculty of Philosophy of Prešov University. Graduates of university archiving programs can find jobs in public and private archives, registry centers, scientific institutions, central and local state administration, museums, libraries, galleries, publishing houses, newspapers, magazines, radio and television editor's offices, and educational and cultural institutions.

Organizations and Associations of Archivists

In 1990—Spoločnosť slovenských archivárov (the Association of Slovak Archivists) was founded in Bratislava. Its main aims are the development and improvement of Slovak archiving and the archive profession. It organizes professional conferences, functions as a permanent partner of the archiving bodies, and protects the interests and rights of its members. The association organizes annual national meetings of archivists, Archívne dni v SR (the Days of Archives in the Slovak Republic), which have international participation. It also publishes its own information bulletin—Fórum archivárov (the Archivists' Forum). Since 1980, Sekcia archívniectva a pomocných vied historických (the Archiving and Auxiliary Historic Sciences Section) has been active within the Slovenská historická spoločnosť pri Slovenskej akadémii vied (the

Slovak Historic Association at the Slovak Academy of Sciences), which organizes scientific conferences, symposiums, and exhibitions. It publishes proceedings of presentations from the events.

Archiving Magazine and Archiving Awards

Since 1966, the Department of Archives and Registries of the Ministry of Interior of the Slovak Republic has been publishing a professional magazine—*Slovenská archivistika* (Slovak Archiving). This periodical publishes research and professional articles on theory, the practice of archiving, and auxiliary historic sciences. Since 1979, the Ministry of Interior of the SR has awarded archivists P. Križko's Medal. Since 1998, the Ministry of Interior of the SR acknowledges achievements in the development of archiving by awarding the F.V. Sasinek's medal.

MUSEUMS AND MUSEOLOGY

Brief Historical Outline

The first collections of antiques and natural objects were established in Slovakia in the eighteenth century. At this time, Albert of Saxony-Cziesyn's collection was established in Bratislava (at that time the capital of the Hungarian Kingdom), and this collection now forms the basis of the Albertina museum in Vienna. Many historic artifacts were presented to the Magyar Nemzeti Múzeum in Budapest in the nineteenth century (1835). The first museum institutions in the Slovak territory, today's Múzeum mesta Bratislavy (the Bratislava City Museum) and Galéria mesta Bratislavy (the City Gallery of Bratislava), were founded in Bratislava in 1868. By 1918, museums in Košice (1872), Poprad (1886), Bardejov (1905), Ružomberok (1912), Trenčín (1876), Rožňava (1902), and Banská Štiavnica had been established. Between 1918 and 1945 museums were growing in number and in the size of their collections, and many were partly subsidized by the state. After 1948 all the museums were taken over by the state and fully subordinated to the policy and ideology of the communist party. New museums specializing in national history and special museums and galleries were established. The operation of museums was governed by the Act No.109/1961 Col. on museums and galleries, which confirmed the complete dependence of museums and galleries on the government's power.

As democracy was restored in the Slovak Republic after 1989, changes in museum administration and management were introduced. Act No. 115/1998 Col. on museums and galleries and objects of museum and gallery value altered the rights and duties of museums, galleries, and their founders and organizers. The decree of the Ministry of Culture of the Slovak Republic No. 342/1998 on

professional administration of museum and gallery collections has largely determined how museum collections are professionally processed, including digitization of records.

The Slovak National Museum: History

Slovenské národné múzeum (the Slovak National Museum, the SNM) is one of the largest and oldest museum institutions in Slovakia.^[11] The core collection was established through the *Matica slovenská*, which collected artifacts and objects from the past as evidence of the maturity of the Slovak nation. The institutional and professional foundations of the SNM were laid by the *Muzeálna slovenská spoločnosť* (the Slovak Museal Society, the SMS), which was founded in Martin in 1893. The SMS was established with the aim of collecting artifacts of the history and culture of the Slovak nation and of documenting natural history of Slovakia. The orientation of the SMS was determined by the founder of Slovak museum science, Andrej Kmet', who gathered rich collections through his own activities and donated them to the museum. The museum collections grew primarily due to gifts of artifacts in many areas of study (history, ethnography, numismatics, art history, archaeology, botany, zoology, and mineralogy). The collections were displayed in the first museum building opened to the public in Martin in 1908. The museum in Martin operated as an association with no support from the government of the Hungarian Kingdom. The SMS has provided subsidies for museum-related research in Slovakia for several decades.

The status of the museum changed after the establishment of the Czechoslovak Republic in 1918. After 1919, the SNM began to receive subsidies from the state. The activities of the museum grew under Ján Geryk who became director in 1926; he expanded the collections and hired educated curators. The new museum building designed by the architect M.M. Harminc in Martin was opened in 1933. In the same year *Národná galéria slovenská* (the Slovak National Gallery) was opened followed by the first national historic and ethnographic expositions in 1938. In 1940 the memorial exposition of M.R. Štefánik, the cofounder of the Czechoslovak Republic, was opened.

After the establishment of the Czechoslovak Republic, the state authorities supported the development of education, science, and culture in Slovakia. *Zemědělské muzeum* (the Agricultural Museum) was founded in Bratislava in 1924, and *Slovenské vlastivedné múzeum* (the Slovak Museum of National History) opened in 1928. In 1940 the two museums had been merged into the Slovak Museum. The SNM in Martin and the Slovak Museum in Bratislava concentrated their collecting activities on enriching the collections with artifacts from all scientific fields, that is, archaeology, history, art history, arts and crafts, ethnography, zoology, botany, anthropology, mineralogy, and petrography.

Changes in managing museums in Slovakia occurred after 1948 when the SNM in Martin and the Slovak Museum in Bratislava were placed under the administration of the state by Act No. 12/1948 Col. This subsequently initiated the founding of new, regional museums specializing in national history. By Act No. 24/1948 Col., Slovenská národná galéria (the Slovak National Gallery) was established in Bratislava as the specialized museum institution for documenting the history of art in all possible times and forms of expression. The gallery's resources were based on the ancient art collections of the SNM in Martin and the Slovak Museum in Bratislava. Act No. 109/1961 Col. on museums and galleries merged the SNM in Martin and the Slovak Museum in Bratislava, thus creating the SNM based in Bratislava. The construction of the first national Slovak open-air museum of folk architecture in Martin began in 1967.

Specialized Museums

The SNM in Martin became the center of ethnographic research and the development of ethnography as a science. The institutions in Bratislava were transformed into the Archaeological Museum, the Historic Museum, the Music Museum, and the Museum of Natural History. In the 1990s, departments specializing in the documentation of ethnic and minority cultures began to be founded within the SNM, and these later became the independent specialized SNM museums. They include the Museum of Jewish Culture (1992), the Museum of Carpathian German Culture (1994), the Museum of Hungarian Culture in Slovakia (2001), and the Museum of Croatian Culture in Slovakia (2005). All are located in Bratislava.

In addition to the museums in Bratislava, SNM also oversees museums and sites elsewhere in the country.^[12] The Museum of the Ukrainian–Ruthenian Culture (1956) is situated in Svidník and has been part of the SNM since 2002. The SNM in Martin includes the Museum of Czech Culture and the Museum of Roma Culture. The SNM also administers remarkable Slovak castles and palaces—for example, the Červený kameň Castle, the Krásna Hôrka Castle, the Spišský hrad (the Castle of Spiš) administered by the Spišské múzeum (the Museum of Spiš) in Levoča, the castle at Bojnice, the manor house in Betliar, and the Modrý Kameň Castle with the Múzeum bábkarských kultúr a hračiek (the Museum of Puppet Cultures and Toys). The SNM also administers two open-air museums—Múzeum slovenskej dediny (the Museum of the Slovak Village) in Martin and Múzeum ľudovej architektúry (the Museum of Folk Architecture) in Svidník. Other museums administered by the SNM include documenting historic turning points and important people in Slovak history—for example, the Museum of the SNR (Slovak Parliament) in Myjava and the Ľudovít Štúr Museum in Modra.

Slovak National Museum Collections

The collections of the SNM currently contain over 3.5 million objects documenting the development of nature and society across different eras and in all scientific disciplines. The collections of antiquities in the Archaeological Museum are particularly rich, containing materials from Egyptian, Greek, and Roman cultures (i.e., the lyceum collection), the Mohapl and Marcelová collections, and graves from the Roman period. These remarkable items of European and world significance are dated from the Bronze Age and include materials from the Halstattian and latent periods, the period of migration of nations, and up to the Middle Ages.

The specialized museums of the SNM hold collections documenting guild crafts, industry, transport and communications, education and science, and the life of urban families in the nineteenth and twentieth centuries including clothing and textiles. The collection of military objects is extensive as well. The numismatic collection of the Museum of History, containing over 100,000 items, is the largest in Slovakia. The collection contains some medals but predominantly consists of currency and coins dating from the Celtic period (“biatéc”) up to the twentieth century.

The collections of the SNM cover all historical periods in both fine art and arts and crafts—from rare Romanesque art to the nineteenth century art (burghers' portraits, realism). The Gothic and Baroque period collections are relatively rich containing the gallery of baroque portraits, the Danubian school, and ornamental sculptures from J.R. Donner's circle. The large group of arts and crafts objects consists of a variety of traditional materials—clay, glass, metal, wood, and textiles. It includes the collection of manufactured pottery from all of Slovakia, a collection of Holíč faience, a set of historical glass of Slovak provenance, and furniture dating from varied historical periods—from single pieces from the period of Renaissance to the furniture sets from the first half of the twentieth century. Artifacts of exceptional value include the original interiors preserved in their entirety at the castles of Krásna Hôrka and Červený Kameň, at the manor house of Betliar, and at the castle of Bojnice.

Documentation of the Political and Social Life of Slovakia

Apart from documenting the material culture and history of visual arts, the SNM concentrates on documenting the political and community life in Slovakia. The collections documenting the history of the national revival are very important, as are the collections documenting the Memorandum of the Slovak Nation (1861) and the iconography of Slovak industry. The SNM also administers the personal collections of important figures of science, culture, and art in Slovakia. The most important collections

include the almost complete legacy of M. R. Štefánik, A. Dubček, A. Kmeť, the painter Martin Benka, the ethnographer and cinematographer K. Plicka, musicians J. L. Bella, E. Suchoň, A. Moyzes, and A. Albrecht. The archives of the SNM include many historic guild artifacts, historic maps, and documents on the history of museums and museum science in Slovakia. The SNM library is a specialized library containing literature on museology, museography, and museum book production in the Slovak Republic.

The ethnographic collections are predominantly concentrated in the Etnografické múzeum (the Ethnographic Museum) in Martin, in the Historické múzeum (the Museum of History) in Bratislava, and in the museums of national and ethnic minorities. Ethnographic collections comprise objects documenting traditional agriculture, sheep farming, apiculture, and woodcraft. The museums also hold extensive collections of folk pottery, crafts, jewelry, furniture, folk art (wooden sculptures and paintings on glass), and toys and collections documenting traditional customs. The largest of these are the collections of folk costumes and textiles. The culture of folk music is represented in the collections of Hudobné múzeum (the Music Museum). Natural history collections are predominantly located at the Prírodovedné múzeum (the Museum of Natural History) in Bratislava, which houses the largest collection of natural materials in Slovakia. It houses anthropological, botanical, mineralogical, paleontologic, and zoological collections. The museum administers a number of important collections, for example, Souček, Roubal, Hrubý, and Holuby. The most precious of the collections are the herbarium of the flying monk, Cyprián of Červený kláštor, from the eighteenth century and the herbarium of the father of Slovak museum science, A. Kmet'. The SNM also administers extensive libraries containing over 240,000 books, of which 31,059 are the historical library collections including several incunabula (a total of 1718 of them have been inventoried). The Museum at Betliar manor house administers the extensive library of the noble Andrassy family, containing over 14,000 items.

The SNM presents its collections in 63 permanent expositions and installs over a 100 exhibitions every year. The nature of Slovakia and the biodiversity of Earth are presented in the permanent displays of the Museum of Natural History in Bratislava. The most important archaeological collections are presented in the exhibit "Jewels of the Distant Past of Slovakia" at the Bratislava Castle. The wealth and diversity of the folk culture are presented through permanent expositions at the Ethnographic Museum in Martin and the open-air museums. The number of ethnic and national minorities in the history and culture of Slovakia is represented by permanent expositions at the same museums. At present there is no permanent display showing the historical, cultural, and social development in Slovakia, but there are some long-term exhibitions at the Bratislava Castle.

Publishing Activities of Slovak National Museum

The SNM publishes two specialized periodicals—the magazine *Pamiatky a múzeá: Revue pre kultúrne dedičstvo* (Monuments and Museums: Review for Cultural Heritage) determined for the general public and the magazine *Múzeum* (Museum) for museum workers and experts in cultural heritage protection. The monograph series *Ethnography, History, Archeology, and Natural Sciences* presents research findings and scientific activities. The series *Acta judaica slovacica* publishes documents on the history of Jews in Slovakia and on the holocaust. *Acta carpatho-germanica* documents the history and culture of Carpathian Germans. The journal of the *Little Library of Museum Science Literature* publishes literature for museum professionals and information for the public. The SNM also publishes guide books, brochures, and other printed materials for the use of expositions and exhibitions. Within *Fonte's*, scientific surveys of the SNM collections are published. The SNM has been appointed to create the central registry of museum collections, using the special software ESEZ.

Museum and Gallery Network in the Slovak Republic

The museum and gallery network in the Slovak Republic consists of museum institutions differing in size, profile, specialization, collections, and topics of their expositions. They include specialized museums of national character, that is, mining, agriculture, forestry and woodcraft, military, literary, glassmaking, technological, post, coins and medals, education, physical education, transportation, police, and trading. National history museums concentrate on some of the regions of Slovakia but have a more narrow specialization, for example, tinkers' trade, papermaking, and fire-extinguishing technologies. Local museums and expositions map the history, folk culture, and people who came from a particular village. Most museums administer sites, which have been listed in the cultural heritage directory such as castles, palaces, manor houses, burghers' palaces, medieval town halls, technological monuments, archaeological sites, and open-air folk architecture museums.

There are almost 400 museums and galleries in Slovakia altogether. The museums in the SR administer over 15 million objects in their collections. Over 1000 exhibitions are prepared by the museums every year. In 2006 the museums in Slovakia were visited by 3.8 million visitors, and galleries were visited by 450,000 people.

Education in Museology and Professional Associations

Specialized studies in museology are provided by the Faculty of Philosophy at Constantine the Philosopher

University at Nitra (single-branch daily and external forms), by the Faculty of Arts at Comenius University in Bratislava (external study after completing the studies in bachelor's degree in related specializations, e.g., ethnology, history, archaeology), and by the Faculty of Humanities at Matej Bel University, Banská Bystrica (single-branch daily and external forms). Museum science is also offered at the Faculty of Natural Sciences, Comenius University as an elective course for students of biology. Postgraduate studies and continuing education of museums' employees is provided by the Cabinet of Museum Sciences of the SNM.

Since 1990 the museums in Slovakia have been associated through the Union of Museums in Slovakia, thus drawing from the traditions of the Czechoslovak Union of Museums (1919–1960). The Union of Museums is an association of museums with the shared purpose of supporting and developing the interests of museums, coordinating museum activities, and communicating with the administrators and founders of museums. Membership is voluntary and the seat of the union is in Banská Bystrica.

CONCLUSION

Libraries, archives, and museums and the corresponding professions evolved during the complex historical and cultural context of the development of the Slovak nation that has had numerous changes in the form of its government. At present Slovakia is becoming an active part of the European Union cultural and information arena.

Closer cooperation and the subsequent convergence of libraries, archives, and museums are inevitable. Information systems are successively integrated into a prospective national portal of culture as part of the European portal of culture, for example, the Central Registry of Museum Collections and Portal of Museums, the Central Registry of Visual Art Works, information systems of the Literary Information Centre, the Theatre Institute, the Music Centre, the Slovak Movies Database of the Slovak Film Institute, and the information system of the Slovak Design Centre.^[7] Common strategic goals of these cultural systems are digitization of content, services, presentations, and broadcasting. The establishment of the center for digitization is planned as part of the SNL.

Strategies for the informatization of society emphasize more electronic resources for libraries, Internet for schools, development of public portals, services of e-government, and education in public administration. In 2006, the act on information systems of public administration was passed, and national strategies for information security and interoperability were formulated. The vision of digital cultural information services is focused on the development of a knowledge society with emphasis on innovation, human resources, education, and information literacy.

National Projects of Digitization in Cultural and Information Institutions in Slovakia

The complex digitization of documents and cultural objects has been developing in Slovakia since 2010 within the national project of informatization of society. The formal framework is represented by the operational program informatization of society.^[13] The projects can be divided into digitization projects, including text documents and library collections, and restoration and conservation works. Other projects include infrastructural projects and supportive projects. The priority of digitization and digital archiving is part of the Strategy of Slovak Librarianship for the years 2015–2020 developed by the Ministry of Culture of the SR^[20] and the new library law adopted in 2015.

Among the digitization projects, the most important is represented by the national project “Digital Library and Digital Archive”^[14] led by the SNL in Martin (<http://www.dikda.sk/>). The goal of the project is to digitize more than 2.5 million objects, divided into documents and special documents (photographies, maps) of the SNL and the selected archival documents of the SNA. The project was supported by the European structural funding and other sponsors. Benefits of the project include mass digitization of documents and archival objects, building digitization workplace in Vrútky and conservation of precious documents and online services for public. Other connected digitization projects include digitizations of galleries (Slovak National Gallery, the project Digital Gallery) and museum collections (the project Digital Museum), film and audio materials (the Slovak Film Institute), and video materials, national monuments, and other memory collections. Other examples include such projects as the project of the Central Digital Archives (the University Library in Bratislava, long-term archival of digitized collections), the Memory of Slovakia, the National Centre of Excellence in Research and Protection of Cultural and Scientific Heritage (the Slovak National Library, Žilina University), or digitization of galleries (the Slovak National Gallery). All the digitization projects are in line with European tendencies of building digital libraries like Europeana and TEL and should establish closer cooperation in building digital collections, metadata harvesting, and provision of value-added services of digital libraries with respect to personalization, electronic publishing, and information sharing.

As for the electronic resources, the most important initiatives and projects are run by the Centre of the Scientific and Technical Information in Bratislava,^[19] including the national project NISPEZ (the National Information System for Support of Research and Development in Slovakia—Access to Electronic Information Resources). All the projects are funded by the European Fund of Regional Development. In line with Horizon 2020, they support scholarly community in Slovakia, innovations, transfer of technologies, and open access to digital scholarly documents and data.

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Smithsonian Institution

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Abstract

The Smithsonian Institution was established in 1846 for the “increase and diffusion of knowledge.” It now consists of an array of 9 research institutes, educational resources, and 19 museums and a zoo; indeed, it is the largest museum complex in the world. The Smithsonian serves as the national museum of the United States, with collections in the arts, cultural studies, humanities, and science, welcoming 24.2 million visitors and 183.6 million Web visits in 2007. Since the 1970s, the Institution has been automating access to its collections and since 1995 has been disseminating information via its Web site at <http://www.smithsonian.org>.

INTRODUCTION

The Smithsonian Institution is a complex organization that is best known as a group of U.S. national museums. Established in 1846 with the bequest of an English scientist, James Smithson, the Institution is dedicated to the “increase and diffusion of knowledge” in the arts, humanities, and sciences throughout the world. The Institution consists of 19 museums, a zoological park, 9 research institutes, and a variety of special programs in support of its mission. The museums include the Anacostia Community Museum; Arts and Industries Building; Cooper-Hewitt, National Design Museum; Freer Gallery of Art; Hirshhorn Museum and Sculpture Garden; National Air and Space Museum (NASM) and the Steven F. Udvar-Hazy Center; National Museum of African-American History and Culture; National Museum of African Art; National Museum of American History; National Museum of the American Indian (NMAI) and the George Gustav Heye Center; National Museum of Natural History; National Portrait Gallery; National Postal Museum; Renwick Gallery; Arthur M. Sackler Gallery; Smithsonian American Art Museum; and the Smithsonian Institution Building or “Castle”; as well as the National Zoological Park. The research institutes are the Archives of American Art, Center for Earth and Planetary Studies of the NASM, Center for Folklife and Cultural Heritage, Conservation and Research Center of the National Zoological Park, Marine Station at Fort Pierce, Museum Conservation Institute, Smithsonian Astrophysical Observatory, Smithsonian Environmental Research Center, and Smithsonian Tropical Research Institute. In addition to its library, the Smithsonian houses 12 archival repositories including the Archives of American Art, Archives Center of the National Museum of American History, Archives of American Gardens, Eliot Elisofon Archives at the National Museum of African Art, Freer-Sackler Archives,

Hirshhorn Museum and Sculpture Garden Archives, NASM Archives, National Anthropological Archives (NAA) and Human Studies Film Archives (HSFA), NMAI Archives, Ralph Rinzler Archives of the Center for Folklife and Cultural Heritage Archives, and Smithsonian Institution Archives. This entry will introduce the reader to this complex organization and provide an overview of its information resources.

THE SMITHSONIAN INSTITUTION

On August 10, 1846, U.S. President James K. Polk signed the legislation founding the Smithsonian Institution as a public trust dedicated to the “increase and diffusion of knowledge.” This legislation was the culmination of over a decade of debate among the general public and the U.S. Congress over a peculiar bequest. In 1829, an English chemist and mineralogist, James Smithson, died, leaving a will that stated if his heir died without heirs, his estate should go to the United States to found “in Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men.” After his sole heir died in 1835, the United States was notified of this bequest, sparking a heated debate between states’ rights advocates and federalists over whether such a national entity should be created, with the federalists prevailing. In 1836, the United States filed a claim for the Smithson estate in the British Court of Chancery which awarded the estate, valued at over \$500,000 to the United States in 1838. Another decade passed, however, before the Smithsonian was actually created. Congressmen, educators, scientists, social reformers, and the general public all voiced opinions as to what they believed Smithson had meant by “the increase and diffusion of knowledge.” Initially most Americans assumed that Smithson intended to found a university; thus debate



Fig. 1 The Smithsonian Institution Building or “Castle,” photograph by Ken Rahaim.
Source: From Smithsonian Institution.

centered on what type of school. Gradually other ideas were introduced—an observatory, a scientific research institute, a national library, a publishing house, or a museum. The final legislation represented a compromise among these ideas, leaving out only the university. The Smithsonian Institution was created as a trust instrumentality of the United States, not part of the three branches of government, managed by a self-perpetuating Board of Regents (see Fig. 1).

The Smithsonian Regents were given the responsibility to decide how to carry out Smithson’s vague mandate and the broad legislation. Their first act was to build a home for the Institution, a Norman “Castle” designed by architect James Renwick Jr., located on the National Mall in Washington, District of Columbia. The Regents selected as the first chief operating officer or Secretary, Joseph Henry, a distinguished physicist from the College of New Jersey (now Princeton University) who was an expert on electromagnetic induction. During his years as Secretary (1846–1878), Henry focused on increasing knowledge through scientific research and diffusing knowledge through publication of *Smithsonian Contribution to Knowledge* and through international exchange of publications. He established a national network of weather observers that led to the founding of the National Weather Service. Although the enabling act called for it, Henry was reluctant to use the Smithson fund for a national library or museum. Thus in the 1860s, he transferred the library and art collection to the Library of Congress and Corcoran Gallery of Art, and had the provision for copyright deposit at the Smithsonian repealed from the legislation. Henry

accepted natural history collections, as necessary for research, but worried about the costs of maintaining a museum collection and exhibits. The U.S. government’s collection of art works, historical memorabilia, and scientific specimens, then housed at the National Institute gallery in the Patent Office Building, was transferred to the Smithsonian in 1858. The Smithsonian agreed to care for the national collections if an annual appropriation was provided by the U.S. Congress, formally establishing the United States National Museum at the Smithsonian. The second Secretary, Spencer Fullerton Baird, turned his energies enthusiastically to creating a great national museum during his tenure from 1878 to 1887. As Smithsonian curator since 1850, Baird’s goal was to compile for the U.S. National Museum a comprehensive collection of all natural resources of North America. Baird prepared all of the government exhibits for the Centennial Exposition in Philadelphia in 1876; this gave the Institution national visibility and persuaded the Congress to build the first U.S. National Museum Building, now known as the Arts and Industries Building. When the building opened to the public in 1881, it housed exhibits on art, history, and natural history. During Baird’s tenure, the Bureau of American Ethnology was added to the Smithsonian’s programs in 1879 to document Native American cultures rapidly vanishing from the West. During the tenure of the third Secretary, Samuel Pierpont Langley from 1887 to 1906, the Smithsonian Astrophysical Observatory was established in 1890, the National Zoological Park was established in 1891, and funding was secured for a new National Museum Building.

Charles Doolittle Walcott, paleontologist and director of the United States Geological Survey, succeeded Langley as the fourth Secretary from 1907 to 1927. Under Walcott, the new museum building, now known as the National Museum of Natural History, opened in 1910 to house natural history and art collections. A National Gallery of Art, now the Smithsonian American Art Museum, was formally created in 1920. In 1923 the Freer Gallery of Art also opened, housing industrialist Charles Lang Freer's collection of Asian art and the works of James McNeill Whistler.

The fifth Secretary, Charles Greeley Abbot, served from 1928 to 1944, through the Great Depression and World War II. The National Zoological Park used the Works Progress Administration and Public Works of Art program to construct new zoo buildings. During World War II, much of the National Museum collections were moved off-site for safekeeping. The Smithsonian housed the Ethnogeographic Board which provided the military with ethnographic and geographic information about little known areas of the world, especially the Pacific. After the war from 1945 to 1952, Alexander Wetmore, the sixth Secretary, oversaw a program of exhibits modernization at the National Museum. In 1946, the Canal Zone Biological Area was placed under Smithsonian aegis. Now known as the Smithsonian Tropical Research Institute, this research station in the Panama Canal was founded in 1923 to facilitate research on the tropics. The National Museum's growing aeronautical collection, which included Charles Lindbergh's *Spirit of St. Louis*, was formally designated the National Air Museum in 1946. The Smithsonian Traveling Exhibition Service was inaugurated in 1952 to facilitate exhibits at venues outside the Institution. During the 1950s, groundwork was laid for substantial growth in Smithsonian programs under the seventh Secretary Leonard Carmichael during 1953–1964. Carmichael secured the appropriation for a new museum building for the history collections, which opened in 1964 and is now the National Museum of American History. New wings were added to the Natural History Building in the 1960s to house additional collections. The Patent Office Building was transferred to the Smithsonian in 1958 to house the national art collections. A major capital improvement program was initiated at the National Zoological Park in the 1960s, and the Smithsonian Astrophysical Observatory was revitalized and transferred to Cambridge, Massachusetts, in 1955. After the launching of Sputnik in 1957, the observatory played a major role in the tracking of artificial satellites. S. Dillon Ripley, eighth Secretary from 1964 to 1984, oversaw a major expansion in Smithsonian programs. New museums included the Anacostia Community Museum (1967), the Cooper-Hewitt, National Design Museum, located in New York (1968), the National Portrait Gallery (1968), the Renwick Gallery (1972), the Hirshhorn Museum and Sculpture Garden (1974), the National

Museum of African Art (1979), the Sackler Gallery (1983), and the S. Dillon Ripley Center (1987). The Smithsonian American Art Museum moved to the newly renovated Patent Office Building in 1968. A new building for the NASM opened on July 4, 1976 in celebration of the Bicentennial of the American Revolution, and the Arts and Industries Building was renovated to recreate the Centennial Exposition in Philadelphia in 1876. In the 1970s, Smithsonian museums began the transfer of their collection records to automated database systems. In October of 1978, at the request of the U.S. Congress, the Smithsonian initiated a database inventory of all collections in its museums. In 1983, the survey was completed and had identified nearly 100 million objects and specimens.

New programs included the Office of Fellowships and Grants in 1964; The Smithsonian Associates and the Smithsonian Environmental Research Center in 1965; Office of Museum Programs in 1966; first Festival of American Folklife in 1967 and subsequently the Center for Folklife and Cultural Heritage; Conservation Analytical Laboratory in 1969 (now the Museum Conservation Institute), *Smithsonian* magazine, Smithsonian Institution Archives, and Archives of American Art in 1970; Smithsonian Marine Station at Link Port in 1971; Office of Elementary and Secondary Education in 1974 (now the Smithsonian Center for Education and Museum Studies); Office of Telecommunications in 1975; and Office of Horticulture in 1976. Expansions of existing programs included the Fred L. Whipple Observatory in Arizona in 1968; the Conservation and Research Center of the National Zoological Park in Front Royal, Virginia, in 1975; and the Museum Support Center in 1983 to house collections storage and handling. From 1984 to 1994, Robert McCormick Adams served as ninth Secretary, presiding over a period of consolidation and renewed emphasis on research. Museums founded during his tenure were the NMAI in 1989, located in both New York and Washington, District of Columbia, and the National Postal Museum in 1990. New research programs focused on the role of man in the environment, including the Biodiversity Program established in 1986 in conjunction with the United Nations Educational, Scientific, and Cultural Organization's Man and the Biosphere Program and the Mpala Research Station established in Kenya in 1992. The National Science Resource Center was established in 1985 in cooperation with the National Academy of Sciences to develop precollege curriculum resources in mathematics and science. Expansions of existing programs included the Arctic Studies Center established in the National Museum of Natural History in 1988 and a new observatory in Mount Harquehala, Hawaii, in 1991. In 1995, the Commission on the Future of the Smithsonian Institution issued its report, *E Pluribus Unum: This Divine Paradox*, setting forth its vision for the Smithsonian of the twenty-first century. When the tenth Secretary, I. Michael Heyman, took office in 1994, he turned his attention to

disseminating information electronically and celebrating the 150th anniversary of the Institution in 1996. In 1995, the Smithsonian Institution's Home Page went live on the Internet, making the Institution's resources and exhibits available worldwide. Sesquicentennial programs included a traveling exhibit, "America's Smithsonian," and a celebration on the National Mall on August 10, 1996. Lawrence M. Small served as the eleventh Secretary from 2000 to 2007. In 2003, the Steven F. Udvar-Hazy Center of the NASM opened near Dulles Airport. Also in 2003, a National Museum of African-American History and Culture was established as part of the Smithsonian; the museum is projected to open on the Mall in 2015. In 2004, the NMAI opened on the Mall, complementing the small museum in New York City and the Cultural Resources Center in Suitland, Maryland. In 2007, biologist Cristián Samper was appointed Acting Secretary and served until the 12th Secretary, G. Wayne Clough assumed office on July 1, 2008.

Smithsonian Art Museums

There are eight Smithsonian art museums.

The Cooper-Hewitt, National Design Museum is located in the historic Carnegie Mansion in New York City and is the only museum in the nation devoted exclusively to historic and contemporary design. Through its over 200,000 objects, and educational and curatorial programs, the Museum studies the impact of design on daily life. The Museum's mission is to advance the public understanding of design across the twenty-four centuries of human creativity represented by the Museum's collection.

Located on the Mall, the Freer and Sackler Galleries house the strongest collection of Asian art in the world and are dedicated to fostering understanding of Asian art and culture. The Freer Gallery of Art contains art from China, Japan, Korea, South and Southeast Asia, and the Near East. Collections include Chinese paintings, Japanese folding screens, Korean ceramics, Indian and Persian manuscripts, and Buddhist sculpture. It also contains a collection of American art influenced by Asian art, including some 1300 works by James McNeill Whistler. A highlight of the Whistler holdings is the Peacock Room, a lavishly decorated dining room with a blue and gold peacock design that was once part of a London townhouse.

The Arthur M. Sackler Gallery houses the collection of some 1000 works of Asian art donated by Dr. Arthur M. Sackler, including early Chinese bronzes and jades, Chinese paintings and lacquerware, ancient Near Eastern ceramics and metalware, and sculpture from South and Southeast Asia. Acquisitions since 1987 have included the Vever Collection, an important assemblage of the Islamic arts of the book from the eleventh to the nineteenth century; nineteenth- and twentieth-century Japanese prints and contemporary porcelain; Indian, Chinese,

Japanese, and Korean paintings; arts of village India; contemporary Chinese ceramics; and photography. The Sackler Gallery is connected by an underground exhibition space to the neighboring Freer Gallery of Art. Although their collections are stored and exhibited separately, the two museums share a director, administration, and staff. The Freer-Sackler Archives documents its areas of collecting.

The Hirshhorn Museum and Sculpture Garden, located on the Mall, is dedicated to contemporary art and culture, providing a national platform for the arts and artists. The museum collects, studies, and shares modern and contemporary art through acquisitions, archives, exhibitions, education and public programs, conservation, and research. Its collections, assembled originally by Joseph H. Hirshhorn (1899–1981), contain all media of modern art ranging from prints, drawings, paintings, sculpture, film, and video to multimedia and includes nearly 12,000 art works by such artists as Willem de Kooning, Helen Frankenthaler, Morris Louis, and Pablo Picasso. Its outdoor sculpture garden contains works such as Auguste Rodin's *Burghers of Calais* and Alexander Calder's *Six Dots over a Mountain*.

The National Museum of African Art, located on the Mall, fosters the discovery and appreciation of the visual arts of Africa. Its collections, originally assembled by Warren M. Robbins (1923–2008) embrace the diverse artistic expressions found throughout Africa, from ancient to contemporary times. Collection objects range from ceramics, textiles, furniture, and tools to masks, figures, and musical instruments. The arts of painting, printmaking, sculpture, and other media are well represented by living artists whose works highlight individual creativity, address global and local art trends, and innovatively transform artistic traditions into modern idioms. The Eliot Elisofon Photographic Archives is a research center with over 300,000 still photographic images documenting the arts, peoples, and history of Africa over the past 120 years.

The National Portrait Gallery tells the stories of America through depictions of the individuals who have shaped U.S. history and culture. Located in the Donald W. Reynolds Center for American Art and Portraiture in the historic Patent Office Building in northwest Washington, District of Columbia, the gallery uses the visual arts, performing arts, and new media to portray poets and presidents, visionaries and villains, actors, and activists who tell the story of American history. Notable among its collections is the Hall of Presidents, the only complete collection of portraits of U.S. presidents outside of the White House, with Gilbert Stuart's iconic "Lansdowne" portrait of George Washington. The collections include such figures as Sequoyah, Babe Ruth, George Gershwin, Marilyn Monroe, and Dr. Martin Luther King Jr.

The Smithsonian American Art Museum's Renwick Gallery collects, exhibits, studies, and preserves American crafts and decorative arts from the nineteenth to twenty-

first centuries. Housed in a historic architectural landmark designed by James Renwick for the original Corcoran Gallery of Art, across the street from the White House, the Renwick features unique work in clay, fiber, glass, metal, and wood. Selections from the Renwick's permanent collection of American crafts and decorative arts are displayed on a rotating basis in the second floor galleries. Popular works include Larry Fuente's *Game Fish*, Wendell Castle's *Ghost Clock*, and Albert Paley's *Portal Gates*. Temporary exhibitions of American crafts and decorative arts are shown on the Renwick's first floor. Special exhibitions highlight contemporary artists as well as traditions in American crafts.

The Smithsonian American Art Museum, located in the Donald W. Reynolds Center for American Art and Portraiture in the historic Patent Office Building in northwest Washington, District of Columbia, is dedicated to the art and artists of the United States. All regions, cultures, and traditions of the United States are represented in the museum's collections, research resources, exhibitions, and public programs. Colonial portraiture, nineteenth-century landscape, American impressionism, twentieth-century realism and abstraction, New Deal projects, sculpture, photography, prints and drawings, contemporary crafts, African-American art, Latino art, and folk art are featured in the collection. More than 7000 American artists are represented, including major artists such as John Singleton Copley, Winslow Homer, John Singer Sargent, Childe Hassam, Georgia O'Keeffe, Edward Hopper, Jacob Lawrence, Robert Rauschenberg, Nam June Paik, and Martin Puryear. Today the collection consists of more than 40,000 artworks in all media, spanning more than 300 years of artistic achievement. Digital images of over 20,000 of those objects are available online, and information about American art is available through the Joan of Art Web site and the museum's interactive blogs.

The Archives of American Art, colocated with the National Portrait Gallery and Smithsonian American Art Museum in the Reynolds Center, is dedicated to the collection, preservation, and study of papers and other primary records of the history of the visual arts in America. Its collections, comprising 15 million items, are the world's largest single source for such information. The collections include correspondence, journals, business papers, and other documentation of artists, dealers, critics, art historians, and art institutions from the eighteenth century to the present. They also include some 3000 oral history interviews, 500,000 graphic images, and 75,000 works of art on paper.

Smithsonian History Museums

There are eight Smithsonian history and culture museums.

The Anacostia Community Museum is a local center for African-American history and culture in southeast

Washington, District of Columbia. The Museum explores American history, society, and creative expression from an African-American perspective. The museum encourages the collection, protection, and preservation of materials that reflect the history and traditions of families, organizations, individuals, and communities.

The Arts and Industries Building, which opened in 1881, was built as the first national museum of the United States. It was closed in 2006, pending renovations. Prior to closing, it housed the Smithsonian Institution Archives which collects the official records of the Smithsonian Institution, the papers of Smithsonian scholars and other staff members, and the records of related professional organizations. The Archives provides reference services to the general public and to staff of the Smithsonian Institution. The Archives maintains over 25,000 cubic feet of holdings, which include institutional records, personal papers, and special collections. Official records provide a comprehensive history of the development and activities of the Smithsonian; its role in nineteenth century American science, especially natural history; Smithsonian involvement with cultural and social issues; and the development of museums as institutions. Automated indexes and collection-level descriptions are available to more than 1100 collections in the Archives.

The National Museum of African-American History and Culture was legislated by the U.S. Congress in 2003 and is in the planning stages. The goals of the museum are to create an opportunity for those who care about or who are interested in African-American culture to explore this history; to help all Americans see how central African-American history is for everyone; to use African-American culture as a means to help all Americans see how their stories, their histories, and their cultures are shaped and informed by international considerations; and to serve as a place of collaboration, reaching beyond Washington to engage new audiences and to collaborate with the myriad of museums and educational institutions that have explored and preserved this important history. A site has been selected on the National Mall where the museum will open in 2015.

The National Museum of American History, Behring Center, uses its collections and scholarship to create a broader understanding of the United States and its many peoples. Its over 3 million objects cover such areas as the history of science, technology, and medicine, political history and history of domestic life. Iconic objects include the *Star-Spangled Banner*, the First Ladies Gowns, Dizzy Gillespie's angled trumpet, and Dorothy's ruby slippers from *The Wizard of Oz*. Its Archives Center preserves and provides access to documentary evidence of the American past, complementing the Museum's artifacts. More than 850 collections occupy some 12,000 feet of shelving; in addition to paper-based textual records, many Center collections contain photographs, motion picture films, videotapes, and sound recordings.

The NMAI has three components: a flagship museum on the National Mall in Washington, District of Columbia, which opened in 2003; the George Gustav Heye Center in New York City, located in the historic Customs Building, which features temporary exhibits; and a Cultural Resources Center in Suitland, Maryland, where Native Americans can view and use objects and consult the museum's archives. The NMAI is the first national museum dedicated to the preservation, study, and exhibition of the life, languages, literature, history, and arts of Native Americans. The museum works in collaboration with the Native peoples of the Western Hemisphere to protect and foster their cultures by reaffirming traditions and beliefs, encouraging contemporary artistic expression, and empowering the Indian voice. The museum's extensive collections, assembled originally by George Gustav Heye (1874–1957), encompass a vast range of cultural material—including more than 800,000 works of aesthetic, religious, and historical significance, as well as articles produced for everyday, utilitarian use. The collections span all major culture areas of the Americas, representing virtually all tribes of the United States, most of those of Canada, and a significant number of cultures from Central and South America as well as the Caribbean. Chronologically, the collections include artifacts from Paleo-Indian to contemporary arts and crafts. The museum's holdings also include film and audiovisual collections, paper archives, and a photography archive of approximately 90,000 images depicting both historic and contemporary Native American life.

The NASM located on the Mall in Washington, District of Columbia, maintains the largest collection of historic air and spacecraft in the world. It is also a center for research into the history, science, and technology of aviation and space flight, as well as planetary science and terrestrial geology and geophysics. The NASM Archives holds materials documenting the history of air and space flight, including a wide range of visual and textual materials, many emphasizing the technical aspects of air and spacecraft. The archival collection contains approximately 10,000 cubic feet of material including an estimated 1.75 million photographs, 700,000 feet of motion picture film, and 2 million technical drawings. The Mall museum houses such iconic objects as the Wright 1903 Flyer and Charles Lindberg's *Spirit of St. Louis*, Apollo 11 command module, and a moon rock. In 2004, its Steven F. Udvar-Hazy Center opened near Dulles Airport in Virginia to display collections that could not be viewed on the Mall, including the Boeing B-29 Superfortress *Enola Gay* and Space Shuttle *Enterprise*.

The National Postal Museum, a collaboration between the Smithsonian's National Philatelic Collection and the United States Postal Service, is located near Union Station in Washington, District of Columbia. Its exhibits feature stamps and philatelic items, vehicles that have carried the mail and a wide array of items from the history of

America's postal system. The National Philatelic Collection was established at the Smithsonian in 1886 with the donation of a sheet of 10¢ Confederate postage stamps; today the collection totals more than 6 million items. In addition to one of the world's largest collections of stamps and philatelic materials, the National Postal Museum has postal history material that predates stamps, vehicles used to transport the mail, mailboxes and mailbags, postal uniforms and equipment.

Smithsonian Institution Building or Castle

The Smithsonian Institution Building or "Castle" was the first Smithsonian building, completed in 1855 on the National Mall. Designed by architect James Renwick in the Norman style, it is constructed of red Seneca sandstone and stands in sharp contrast to most of the classical marble buildings that dominate the nation's capital. In its early years, it housed all of the Institution's research and museum functions. Today it houses administrative offices and the Institution's Visitor Center where visitors can learn about the Institution's museums and research programs, and plan their museum visits.

Smithsonian Science Museums

There is one Smithsonian science museum, the National Museum of Natural History, as well as the National Zoological Park.

The National Museum of Natural History is the Institution's largest museum and is dedicated to inspiring curiosity, discovery, and learning about the natural world through its research, collections, exhibitions, and education outreach programs. The main building on the National Mall contains 1.5 million square feet of space overall with 325,000 square feet of exhibition and public space, and houses over 1000 employees. Among its 126.6 million artifacts and specimens are some of the oldest of the Institution's collections. The Museum includes a state-of-the-art collections storage facility in Suitland, Maryland; a marine science research facility in Ft. Pierce, Florida; and field stations as far away as Belize, Alaska, and Kenya. It also houses the NAA and the HSFA. The NAA is dedicated to preserving ethnographic, archaeological, and linguistic field notes, physical anthropological data, photographs, sound recordings, and other media created by American anthropologists. The Archives' holds 8250 linear feet of field notes, photographs, correspondence, journals, sound recordings, and works of art, and more than 53,000 digital images are now available. The HSFA is devoted to collecting, preserving, documenting, and disseminating a broad range of historical and contemporary ethnographic and anthropological moving image materials. The HSFA also collects related documentation including sound recordings, photographs, manuscripts and other associated texts, field notes, camera, and sound logs

and production logs. Museum research activities are organized into seven departments, and a number of affiliated U.S. government agencies onsite contribute to the Museum's strength, including the Department of the Interior (U.S. Geological Survey Biological Resources Division), the Department of Agriculture (Systematic Entomology Laboratory), the Department of Commerce (National Marine Fisheries Service Systematics Laboratory), and the Department of Defense (Walter Reed Biosystematics Unit). The museum houses collections in anthropology, botany, geology and mineralogy, and zoology; among its iconic objects are the Hope Diamond and the Fenykovi elephant.

The National Zoological Park is located in Rock Creek Park in Washington, District of Columbia. Its mission is to demonstrate leadership in animal care, science, education, and sustainability through the highest quality animal care, research, and scientific knowledge in conserving wildlife, teaching people to protect wildlife, natural resources and habitats, and practicing conservation leadership. Its diverse collections includes animals from ants to elephants, representing habitats from tropical rainforest to local woodlands; it is perhaps best known for its Giant Pandas, Tian Tian, Mei Xiang, and Tai Shan. It has pioneered the conservation of such animals as the cheetah and the reintroduction of the golden lion tamarin. The zoo covers 163 acres and has 23 major buildings along with many smaller barns and support structures throughout the site. Its Conservation and Research Center, in Front Royal, Virginia, is dedicated to research on conservation, management, and reproduction of endangered species. Scientists at NZP's Conservation GIS Lab use satellite imagery and Geographic Information Systems (GIS) to identify, monitor, and fight habitat loss and species extinction globally. Collaborations with NASA, the U.S. Fish and Wildlife Service, and the U.S. Geological Survey allow Zoo scientists to utilize vast amounts of remotely-collected satellite images showing the condition of large and inaccessible areas—for example, the habitats and last strongholds for Asian elephants, giant panda, clouded leopard, and many other species. Zoo scientists integrate these data with their own extensive field research to monitor and assess the effects of habitat loss on these focal species.

In 2008, the Institution housed an estimated 137 million artifacts and specimens in its 19 museums, with over 126 million at the National Museum of Natural History (Table 1). The Institution shares its collections with some 152 affiliate museums in 39 states, the District of Columbia, Panama, and Puerto Rico. The Smithsonian endowment has grown to some \$1 billion, part of a net operating budget in 2007 of \$635 million, with about 70% in federal funds and the remainder in trust funds, including endowment, grants and contracts, and business income. In 2007 there were approximately 24.2 million visitors to the museums and National Zoo (see Table 2).

Table 1 Smithsonian Collections, 2007.

Museum	Collections
Anacostia Community Museum	8,781
Arthur M. Sackler Gallery	8,787
Cooper-Hewitt, National Design Museum	206,199
Freer Gallery of Art	28,450
Hirshhorn Museum and Sculpture Garden	11,536
National Air and Space Museum and	47,579
S. F. Udvar-Hazy Center	
National Museum of African Art	9,090
National Museum of American History	3,203,117
National Museum of American Indian and	826,237
G. F. Heye Center	
National Museum of Natural History	126,642,657
National Portrait Gallery	19,611
National Postal Museum	6,003,548
National Zoological Park	1,857
Smithsonian American Art Museum and	41,581
Renwick Gallery	
Other collections	48,283
Total collections	137,107,313

In 2007, a staff of nearly 6200 employees and nearly 6500 volunteers carried out its programs in 9 research institutes, 19 museums and zoological park in Washington, District of Columbia, across the continent, and around the world. The Institution employs specialists in the arts, culture, humanities and sciences, with employees in such categories as archivist, animal keeper, anthropologist, astrophysicist, biologist, curator, ecologist, education specialist, exhibits specialist, historian, horticulturalist,

Table 2 Smithsonian Visitors, 2007.

Building	Visitors
Anacostia Community Museum	37,000
Arthur M. Sackler Gallery	308,000
Arts and Industries Building	Closed
Cooper-Hewitt, National Design Museum	224,000
Freer Gallery of Art	590,000
Hirshhorn Museum and Sculpture Garden	740,000
National Air and Space Museum	6,000,000
National Air and Space Museum	1,000,000
S. F. Udvar-Hazy Center	
National Museum of African Art	310,000
National Museum of American History	Closed
National Museum of the American Indian	1,800,000
National Museum of the American Indian	281,000
Heye Center	
National Museum of the American Indian	1,000
Cultural Resources Center	
National Museum of Natural History	7,100,000
National Postal Museum	326,000
National Zoological Park	2,600,000
Renwick Gallery	132,000
S. Dillon Ripley Center	296,000
Smithsonian American Art Museum and	786,000
National Portrait Gallery	
Smithsonian Institution Building	1,600,000
Total visitors	24,200,000

librarian, network engineer, photographer, security guard, visual information specialist, woodcrafter, and writer/editor. Staff perform a wide range of duties in collections care, research, education, and public outreach. Volunteers perform a wide array of duties from museum docents, conservation technicians, and archives technicians to animal care assistants, and assist with research in the arts, culture, history, and science.

Since 1995, the Smithsonian has focused much of its energies on making its resources available to researchers, teachers, students, and the general public through the Internet, <http://www.smithsonian.org>. All research institutes, museums and the zoo have extensive Web sites, with 183.6 million visits in 2007. Museum exhibits are simultaneously presented in online format. Lectures and public programs are made available through podcasts. Information about the Institution's collections is being made available through online databases and digitization projects, such as Smithsonian Institution Research Information System (SIRIS, <http://www.siris.si.edu>). The National Portrait Gallery, for example, has an online database, the Catalog of American Portraits, a survey of American portraits in public and private collections across the United States and abroad, with information about the portrait and, often, a digital image of the art work, <http://npgportraits.si.edu/eMuseumNPG/code/emuseum.asp>. Research collections of the National Museum of Natural History are available to the public via a standard Web interface with a total of 3,892,938 specimen records currently available. Of these records, 197,372 are extant type specimen records that represent more than 55% of the museum's extant biological type specimens, <http://nhb-acsmith1.si.edu>. Several of the museums have instituted monitored blogs on topics related to their collections, such as the Smithsonian American Art Museum's Eye Level, <http://eyelevel.si.edu>. The Smithsonian Libraries Galaxy of Knowledge, <http://www.sil.si.edu/>, contains digital copies of many of its resources. The Smithsonian Astrophysical Observatory makes a wide array of scientific resources available for researchers, but also operates the Chandra X-ray Observatory Center for teachers, students, and amateur astronomers at <http://chandra.harvard.edu/>. The Smithsonian Environmental Research Center has established a distance learning center with electronic field trips on ecology that can be used in the K-12 classroom, <http://www.serc.si.edu/education/dl/index.jsp>. The Smithsonian Tropical Research Institute has a long-term environmental monitoring program for marine and terrestrial environments and now makes its data available to researchers in real time, <http://striweb.si.edu/esp/>.

CONCLUSION

The Smithsonian Institution is the largest museum and research complex in the world. The bequest by English

scientist James Smithson had a broad mandate, as did the Institution's enabling act, allowing the Institution to meet the needs of a young nation. Its complex of museums in the U.S. capital welcomes visitors from around the world without admission, displaying the arts, cultures, history, and the sciences. Its museums and research centers span the globe, and it disseminates its resources through its extensive Web sites.

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Social Epistemology

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Abstract

“Social epistemology” is the social theory or social science of knowledge. After the field’s bases in the Anglophone and Continental philosophical traditions are briefly explored, social epistemology’s relevance to library and information science (LIS) is established. LIS presumes that knowledge is both an inherently collective product that ought to be made universally available. This is exemplified in the traditionally iconic status of the library. However, the library began to lose its salience in the Cold War, with the massification, technologization, and instrumentalization of knowledge, now renamed “information” to stress its relativity to decision-making contexts. The resulting stress on user-friendly information intensified after the Cold War, with the rise of neoliberalism. In this context, LIS has stood out in reasserting at a practical level the traditional universalist goals of social epistemology. In particular, Don Swanson’s work on “undiscovered public knowledge” appears as a major achievement in applied social epistemology and a blow for “epistemic justice.” It demonstrates the utility of breaking of default information search patterns that systematically neglect relevant literature in other fields. In the final section, *Wikipedia* is discussed as a self-organizing experiment in achieving the same effect by refusing to respect any claims to epistemic privilege.

PHILOSOPHICAL FOUNDATIONS AND RELEVANCE TO LIBRARY AND INFORMATION SCIENCE

“Social epistemology” literally means the social theory or social science of knowledge. That simple definition already says a lot. It implies that knowledge is *not* normally seen as intrinsically social; hence, “social” needs to be added to specify the field of inquiry. This point is worth noting because the image of knowledge as primarily acquired by individuals through their mental faculties (as perceptions, beliefs), who then combine with other such individuals, to construct more elaborate and durable knowledge products (such as theories, sciences), rests on a particular reading of the history of philosophy that is dominant only in the English-speaking world. For philosophers more influenced by French and German developments, knowledge is “always already” social in both its constitution and import. In the United States, this distinction is marked as “analytic” versus “continental” schools of philosophy.

For example, whereas English philosophers depict Descartes as someone whose skepticism was born of the potential unreliability of his senses and intellect, French and German philosophers stress the special relationship he claimed that we have with God, who in turn underwrites the general reliability of our senses and intellect. One consequence of this difference in emphasis is that in the English-speaking world “epistemology” is naturally aligned with the philosophy of mind, which focuses on what happens inside individual heads, while in the French- and

German-speaking worlds it is more naturally aligned with the philosophy of science, which focuses on what happens between individuals in structured settings.

All of this matters to library and information science (LIS), which presupposes that knowledge is “always already” social. In other words, the relevant epistemological question is not whether we can possess knowledge but how can we come to possess it—specifically, what sorts of relationships do we need to forge with people, things, and processes to satisfy our epistemic needs. Accordingly, individual cognitive orientations can be understood as either normal or deviant expressions of preexistent culturally entrenched dispositions. While my personal experience may be unique, my public response to it is not. I know this because of the relative ease with which others can make sense of my response, even if they know little of my personal history. This does not mean that my response is completely predictable—but it can be contained within a relatively small range of possibilities. Without this strong sense of knowledge’s social boundedness, LIS’s capacity for systematically addressing society’s various knowledge-based needs would be thrown into radical doubt. However, this still leaves open the question of whether the job of the LIS professional is to reinforce or to alter typical responses to recurrent knowledge-based needs. This may be the fundamental challenge that social epistemology poses to LIS.

It is clear that this challenge was grasped by those most closely associated with the emergence of social epistemology in LIS. Although social epistemology became a worldwide interdisciplinary concern only in the late 1980s

with the establishment of a journal^[1] and the publication of a book by that name,^[2] it is now generally acknowledged that the prospects for a field called “social epistemology” were first broached in LIS as early as 1952 by Margaret Egan and Jesse Shera.^[3] Indicative of the significance that social epistemology has acquired within LIS since its largely independent rediscovery by philosophers like Goldman,^[4] Schmitt,^[5] and Fuller^[2] is the recent surge of interest in delineating the respective contributions of Egan and Shera to the development of the concept^[6] and in demonstrating intellectual affinities between what LIS professionals and philosophers mean by social epistemology.^[7]

Nevertheless, LIS professionals already had good reason to be concerned with the challenge posed by social epistemology in the third quarter of the twentieth century. The image of the library as the localized embodiment of the philosophical ideal of all knowledge available to all knowers was coming under severe strain, at both a material and an intellectual level. Materially, the book’s status as the paradigmatic unit of knowledge was being eroded by the proliferation of specialist journals and other types of sources, many of which encoded knowledge in images rather than words. While some LIS visionaries like Paul Otlet and Suzanne Briet had seen the need for a more generic category of “document” to accommodate this inevitable expansion in knowledge-bearing materials, they did not anticipate the intellectual challenge to the very idea of universal knowledge, which continued to underwrite their cataloging schemes.

As the sources of knowledge became more diverse, the role of the LIS professional seemed to shift from a gatekeeper for generalists to a service provider for specialists. This shift was reflected in a shift in the academic training of LIS professionals from the humanities to the sciences. Both Egan and Shera had received their first degrees in English literature and considered LIS a career for generalists, yet they were faced with an increasingly computerized system of document storage and retrieval that was coded to favor specialist users. It seemed, then, that LIS professionals were fated to mediate user searches only in the context of instructing users in specialist categories, a service that might be provided in the future by a computerized “expert system” (Ch. 3).^[8]

Social epistemology should be understood within LIS as a movement to mitigate, if not reverse, these trends, which are sometimes seen as having contributed to LIS’s loss of professional status in various institutional settings. Indeed, in one of his last published pieces, Shera^[9] warned of younger LIS professionals abandoning the librarian’s traditional connoisseurship for a seemingly modern technology-driven expertise that only promised to render them obsolete in the long term. At a conceptual level, this problem was symbolized by the field’s shift in focus from a philosophical conception of “knowledge” to a conception of “information” indebted, not always explicitly, to

Shannon and Weaver’s communication theory.^[10] According to this theory, information is defined relative to both the receiver and the medium of a message. Thus, a message is informative only if it makes a difference to the action taken by a given person in a given context. Such a stance implies a much more radical form of relativism than social epistemology licenses. Shannon and Weaver’s theory seemed to deny that people need to know anything more than what will enable them to act decisively, which in turn presupposes that the best epistemic strategy for dealing with users in the long term is to provide them with information that offers the path of least resistance in the short term, and hence makes minimal demands on their default cognitive tendencies.

It is worth observing that the displacement of the library as the locus of universal knowledge that so concerned the early social epistemologists in LIS anticipated by a generation the more general displacement of academia as the seat of epistemic authority that is now associated with the “postmodern condition”^[11] and the omnipresent “knowledge society.”^[12] Thus, today’s knowledge users are frequently defined as “consumers” and, unsurprisingly, knowledge bases are increasingly demand-driven by particular classes of users, without any pretence to encompassing all knowledge users. This displacement of the library and the university can be explained in similar terms, namely, a decline in the salience of the nation-state as a frame of reference for defining the knower—that is, as a “citizen” who needs to be informed about things that go beyond his or her personal interests, simply by virtue of having a stake in a larger social order.

THE POSTMODERN CHALLENGE TO SOCIAL EPISTEMOLOGY: THE END OF UNIVERSAL KNOWLEDGE

The Cold War set the stage for the last strong state-based bid for universal knowledge, as the conflict between capitalism and socialism was sublimated through a “science race” between the United States and USSR. Egan and Shera^[3] contributed to this discussion with the idea of a “macrocosmic bibliography,” but its most important—albeit chequered—legacy has been the Science Citation Index (SCI), as first proposed by Eugene Garfield to the U.S. National Science Foundation (pp. 69–73).^[13] From the standpoint of social epistemology, the most interesting feature of these proposals was their operationalization of “universality” as the multiple deployability of a common knowledge base so as to make maximum use of all that is already known. This would benefit not only the diverse interests of ordinary knowledge consumers but also front-line knowledge producers who when planning their research could avoid duplicating previous effort. At the same time, it marked a significant shift in the ideal exemplified by a universal knowledge base—from collective

identity to individual efficiency—that, if anything, has acquired a greater salience in the post-Cold War neoliberal audit culture.^[14]

Notwithstanding Shera's early concerns about the future of the library, and the LIS profession more generally, most pundits at the time took a more sanguine view about the emerging postmodern condition. Each regarded the image of the knowledge society as vindicating his own political perspective. For example, Fritz Machlup,^[15] a classical liberal, believed that the increasing contribution of knowledge-based services to the economy pointed to the ultimate triumph of locally honed competences and individual initiatives over central state planning. On the contrary, Daniel Bell^[16] argued, the prospect of computer-mediated production and distribution systems would perfect the welfare state's capacity to deal with the excesses of capitalism in order to bring about a just society. Finally, Alvin Gouldner,^[17] a critical Marxist, held that the number of highly educated people required in the knowledge society, many in relatively marginal clerical positions, unwittingly created the conditions for what he called a "culture of critical discourse" that might eventually force a radical democratization of the social order.

To be sure, elements of Machlup's, Bell's, and Gouldner's punditry remain in play today, though not quite as any of them had hoped. The preoccupation with the assignment and protection of intellectual property speak to Machlup's vision; the increasing capacity of information technology to deliver services in an efficient and customized fashion address Bell's vision; and the use of the Internet to organize people worldwide to demonstrate against globalization and climate change bears out some of Gouldner's vision. However, what these "three wise men" missed in the realization of their respective visions is the idea that knowledge might lose some of its value as it is spread more widely.

As access is increased, the advantage one gains from having access diminishes. The upside is that it becomes more difficult, especially in the age of the Internet, for esoteric knowledge to be used as an instrument of power of others. The downside is that knowledge becomes so demystified that little value is placed on how we reach a conclusion as long as it is the one we wish to reach. Thus, today's knowledge societies marry a disrespect for expertise with a craving for credentials, resulting in a proliferation of what the historian David Noble^[18] has called "digital diploma mills," such as the University of Phoenix, with its 300,000 student enrolment.

In short, the technological revolution in access embedded in a weakly regulated system of information transfer has turned the traditional normative conception of knowledge into what the political economist Fred Hirsch^[19] originally called a "positional good", that is, a good whose value is determined more by its relative scarcity than its actual utility. Accordingly, the value of a Harvard education lies less in the content of its degree programs than in

the elite nature of its student selection process. An extension of the same point applies to the value of research published by a Harvard professor: The series of hoops through which one would have needed to jump to achieve that academic status does more to underwrite it as "knowledge" than its actual content, access to which for practical purposes might be acquired by less trying means.

Writing in what turned out to be the Golden Age of the welfare state, Hirsch believed that positional goods began to proliferate only after people had adequate access to goods that served the basic needs of living in a modern society. At that point, the struggle for survival yielded to the struggle for recognition—or, "Keeping up with the Joneses," to recall a resonant marketing slogan from the period. But Hirsch was wrong, at least with regard to knowledge, which exists as a positional good even though basic knowledge needs—even within academia—have yet to be serviced efficiently. Thus, the problem of knowledge utilization continues to loom large for social epistemology.^[20] The problem has little to do with technical difficulties in the construction of search engines sufficiently responsive to a wide range of user needs. Rather, it relates to persistent, often discipline-based, biases that users—and specialist LIS professionals—bring to their searches that lead them down authorized paths that may do more to bolster an appearance of competence than directly address user needs. Thus, under the guise of what is sometimes called "information literacy," literatures may remain underutilized and user needs imperfectly addressed, as a presumption is created in favor of the "tried and tested."

This individual tendency is magnified at a collective level by the so-called principle of cumulative advantage, one of sociologist Robert Merton's^[21] notorious euphemisms, whereby researchers tend to consult the work of those whose work has been worth consulting in the past to such an extent that new researchers come to be consulted only if they have been cited by those previously consulted. This results in a few researchers, typically with elite pedigrees, receiving a disproportionate amount of attention in any given field. Extreme instances of this tendency are in evidence when famous early adopters are given credit for a discovery or invention originally made by a more obscure figure. To be sure, this finding has been rationalized (especially by economists) in various ways, ranging from vague invocations of the "invisible hand" as an intellectual quality control mechanism to more *Realpolitik* suggestions that, in a competitive high-skill labor market, academic publication is indeed more about signaling competence than transmitting knowledge.^[22]

Nicholas Rescher,^[23] following in the footsteps of philosophy's most famous librarian, Gottfried Wilhelm von Leibniz, has coined the term "epistemics" to address these interpretive problems associated with the quantitative dimension of social epistemology. Perhaps because of his early mathematical training and Cold War links to systems theory and operations research, Rescher has been the

analytic philosopher who over the past half-century has most consistently stressed themes of interest to LIS professionals. With that in mind, he has attributed to Herbert Spencer a “law of cognitive development,” whereby an exponential rise in information corresponds to a linear growth of knowledge. Rescher here captures an idea that Marxists know as the “First Law of Dialectics,” namely, that a sufficient number of elements in free combination will eventually produce structures with properties qualitatively different from those of the original elements. This “law” is meant to be applied very generally, so that the “elements” in question may include individual bits of information or containers of such bits (e.g., humans, computers, and other information processors).

A good historical example of Spencer’s Law might be the step change in technological innovation that occurred in eighteenth century Britain that we now call the “Industrial Revolution,” which is often attributed to a critical mass of skilled and literate individuals with the freedom to share their ideas and observations with each other. However, different mechanisms have been proposed to explain this transformation in social epistemology. Spencer’s own *laissez faire* approach to political economy suggested trial and error, whereby the free elements collectively defined a market—or, more precisely, a clearinghouse—that selected better from worse ideas for further development, which then intensified the process of inquiry, resulting in a more rationalized and specialized division of labor. Of course, a similar selection can be applied to better and worse “bearers” of ideas, as implied by Merton’s principle of cumulative advantage, in which case vital messages may be lost because the messenger is peremptorily shot, by virtue of possessing a poor or absent track record.

Economists, following Brian Arthur,^[24] have distracted attention away from this possibility by focusing on the increasing returns on investment in a free market for ideas, which reinforces participants’ commitment to the process, even if the ideas from which one benefits are not one’s own. It is easy to get the impression that economists attracted by Merton’s principle believe that the optimal solution for collective progress in the marketplace of ideas would be for original thinkers in obscure institutional positions to exchange their originality for mainstream acceptance by giving away their ideas to better placed thinkers to push them further while they themselves try to accommodate those ideas to mainstream thought so as to improve their own position. The reader is left to ponder the justice of a system that would reward both disrespect for individual achievement and respect for hierarchy in the guise of “peer review.” To put a positive spin on Merton’s principle, one might say that it encourages the merging of the roles of the composer and the performer than one regularly finds in the arts, whereby a noteworthy performer acquires much of the kudos that one might otherwise be reserved for the original composer.

APPLIED SOCIAL EPISTEMOLOGY: LIBRARY AND INFORMATION SCIENCE’S QUEST FOR EPISTEMIC JUSTICE

Unsurprisingly, LIS professionals, as guardians of knowledge as a material product and agents at the interface between producers and consumers of knowledge, have not been satisfied by such accounts. Perhaps most notably, Don Swanson^[25] demonstrated the potency of a proactive social epistemology that refuses to take the unread as unworthy of being read. Though trained entirely in physics, Swanson, a library and information scientist at the University of Chicago, discovered that a plausible solution to an outstanding medical problem had been overlooked by the relevant specialists because it had been published in a journal that lay beyond their normal reading habits. Heartened by such findings, “knowledge managers” outside of academia have developed “data mining” procedures for accessing knowledge that, for the most part, academia has failed to exploit but could inspire industrial applications and patents.^[8] However, there is no reason why such discovery procedures (or “retrieval strategies”) should remain in the private sector and oriented solely toward commercial interests.

One cost-effective policy that LIS professionals could ensure in the name of social epistemology is that, in preparing grant proposals, researchers have identified the full range of precedents for the proposed work, in relation to which the research project would then be formulated. Such a policy would revive the original SCI concern to avoid the duplication of effort in an expanding knowledge system. Given the increasing specialization of today’s researchers, research topics that potentially traverse several disciplinary boundaries may require LIS professionals as coprincipals to grant proposals to ensure not only the efficient utilization of the already available knowledge but also the comprehensive dissemination of the resulting research to relevant academic and nonacademic constituencies. This value-added character of LIS to the conduct of research is discussed below in terms of “epistemic justice” (pp. 24–29).^[13]

Were the knowledge system organized from an LIS standpoint, no new research into a topic would be commissioned unless the already existing knowledge base had been exploited to its full extent. Thus, resource-intensive methods of original data generation and collection could be replaced, or at least deferred and attenuated, by the development of clever-automated search engines (“knowbots”) with access to multiple disciplinary literatures. This policy would be very much in the spirit of Shera’s vision of social epistemology, which would keep technological advances in LIS firmly under the control of its original humanist animus. Translated into practice, what Swanson^[25] called “undiscovered public knowledge” supports the maintenance and use of institutional archives, in the face of increasing budgetary pressures to

discard rarely consulted old books, serials, and other documents. The general failure of universities and other knowledge-based institutions to follow Swanson's precedent has resulted in an epidemic of "corporate amnesia," aka "mad archive disease."^[26]

But it would be a mistake to conclude that corporate amnesia is merely the by-product of financially motivated negligence. It is also a design feature of science, akin to "planned obsolescence," whereby sciences with more clearly defined and rapidly advancing research frontiers have shorter citation half-lives. In other words, the relevance of each new text to the discipline's current state of play is evaluated quickly, clearly, and irreversibly. This implies a sharpening of the distinction between, so to speak, the discipline's "short-term" and "long-term" memory, corresponding to a division of labor between a practitioner and a historian of a discipline (pp. 6–9).^[13] The influential historian and philosopher of science Thomas Kuhn went so far as to argue that the functional differentiation of practitioners and historians is constitutive of scientific progress, as it operationalizes the idea that science moves forward by leaving its past behind.^[27] Indeed, Kuhn's contemporary and scientometrics' original theorist, Derek de Solla Price demonstrated that the harder the science, the sooner most of its literature is consigned to history. "Price's Index" implies that a sense of historicity is automatically generated by new literature falling, as David Hume said of his own first book, "still born from the presses" into oblivion (p. 27).^[28]

Against this backdrop, LIS stands virtually alone among academic disciplines in its presumptive commitment to what might be called a "strong universalism" with regard to knowledge. LIS aims for knowledge that is "universal" not only in terms of validity but also availability, such that knowledge functions simultaneously as a source of authority and a mode of empowerment. This prospect animates what social epistemologists call "epistemic justice." Key to the administration of epistemic justice is a reduction in the gap between historian and practitioner knowledge, so as to minimize the power that expertise can exert over lay knowledge. After all, the faster the research frontier recedes from the view, the easier it is for one to be left behind; hence, the familiar phenomenon of a once active researcher who, after a few years in university administration, finds it impossible to return to her original field. This epistemic distance often appears as a layer of new jargon (expressed in both words and symbols) that functions as a barrier to latecomers, while allowing work to be redescribed as failed, primitive, or incomplete but, in any case, superseded by the new.

Philosophically speaking, a repository for all knowledge would entail access to, as courts demand of witnesses, "the whole truth and nothing but the truth." From the standpoint of social epistemology, LIS exists in the tension between the "whole" and the "nothing but" in the slogan. An expert-driven, discipline-based epistemic culture would

have LIS focus on nothing but the truth, while a more consumer-driven, democratized epistemic culture would have the field cover truth as a whole. The former strategy is clearly more conservative than the latter, as a focus on nothing but the truth would allow, in statistical jargon, "false negatives," while a concern for the whole truth would allow "false positives." Hanging in the balance is whether LIS should reproduce the default search patterns of established disciplines. This would run the risk of peremptorily ignoring relevant work, or offer an independent and possibly more adventurous set of recommendations that itself would the risk of throwing up a lot of false leads but may end up, à la Swanson, reorienting more discipline-bound inquirers.

The two main philosophical approaches to social epistemology divide precisely on this point. On the one hand, some see the differentiation of knowledge into distinct expertises as a normal feature of the growth of knowledge. Often this process is depicted in terms of exfoliation or evolution, in both cases implying that expertise is an entitlement earned by those who have trained in and contributed to the discipline historically recognized as authorized to pronounce on a knowledge domain. From this standpoint, LIS professionals identify and police the boundaries separating these knowledge domains, directing users to the expert sources most relevant to their needs. Goldman^[29] revealingly calls this position "epistemic paternalism," implying that an increasingly complex knowledge system requires that users be given increasing guidance on appropriate sources of knowledge. However, it takes for granted that the current division of cognitive labor is itself appropriate and necessary.

On the other hand, some philosophers, especially Fuller,^[2,8] urge LIS professionals to adopt a more critical stance toward the historically contingent and institutionally entrenched character of existing disciplinary boundaries. From this standpoint, Swanson's "undiscovered public knowledge" draws attention to the increasing gaps between domains of knowledge that result from the tunnel vision induced by disciplinary specialization. But this must be distinguished from what the social science methodologist Donald Campbell^[30] called the "fishscale model of omniscience," which implies that personal expertises overlap so that, taken together, there are no epistemic gaps in the community of inquirers.

While Campbell's point may describe the aggregate of people's actual knowledge bases, Swanson nevertheless captures people's tendency to interpret what they know of neighboring fields by the standards of their own fields, thereby limiting the prospects for those fields altering their own frame of reference. Here LIS professionals can facilitate the shifting between disciplinary frames, say, by the design of search engines that cross-classify cognate material so that users are forced to confront items they would not have otherwise deemed relevant to their inquiries. The result would be to shift users into a broader-gauged

“browsing” mode, albeit within the general parameters of their original search. It would strike a small but reliable blow for epistemic justice.

WIKIPEDIA: A SELF-ORGANIZING EXPERIMENT IN EPISTEMIC JUSTICE

However, perhaps most extended experiment in epistemic justice underway is *Wikipedia*, the online encyclopedia, arguably most impressive collective intellectual project ever attempted—and perhaps achieved. It demands both the attention and the contribution of anyone concerned with the future of knowledge, not least LIS professionals. *Wikipedia*’s true significance has gone largely unremarked because of the speed with which it has become a fixture in cyberspace. Since its sixth anniversary in 2007, *Wikipedia* has consistently ranked in the top 10 most frequently viewed Web sites worldwide. As of mid-2007, everyday it is consulted by 7% of all 1.25 billion Internet users, and its rate of usage is growing faster than that of Internet usage as a whole.

Wikipedia is an encyclopedia to which anyone with a modicum of time, articulateness, and computer skills can contribute. Anyone can change any entry or add a new entry, and the results will immediately appear for all to see—and potentially contest. “Wiki” is a Hawaiian root that was officially added to English in 2007 to signify something done quickly—in this case, changes in the collective body of knowledge. Nearly 5 million “Wikipedians” have now contributed to 6 million entries, just over a third of which are in English and the other two-thirds in over 250 languages. Moreover, there is a relatively large hardcore of contributors: a good 75,000 Wikipedians have made at least five contributions in any given 30 day period. As to be expected of a self-organizing process, the quality of articles is uneven but not uniformly bad. Topics relating to sex and information technology have been elaborated in disturbingly exquisite detail, while less alluring matters have been left to lie fallow. Nevertheless, according to University of Chicago Law professor Cass Sunstein, *Wikipedia* is now cited four times more than the *Encyclopaedia Britannica* in U.S. judicial decisions. Moreover, *Nature*’s 2005 evaluation of the two encyclopedias in terms of comparably developed scientific articles found that *Wikipedia* averaged four errors to the *Britannica*’s three. That difference has been probably narrowed since then.

Unfortunately *Wikipedia* is not well served by boosters who trumpet *Wikipedia* as heralding the arrival of “Web 2.0.” Whereas “Web 1.0” supposedly focused on the ease with which vast amounts of information of different kinds can be stored and transmitted in cyberspace, “Web 2.0” renders the whole process interactive, removing the final frontier separating the transmitter and receiver of information. Yet, we have been here before—in fact, for most of human history. The sharp divide between producers and

consumers of knowledge began only about 300 years ago, when book printers secured royal protection for their trade in the face of piracy in a rapidly expanding market for literary products. The legacy of their success, copy-right law, continues to impede attempts to render cyberspace a free marketplace of ideas. Before that time, there were fewer readers and writers but they were the same people with relatively direct access to each other’s work (Ch. 2).^[8]

A much smaller, slower, and more fragmented version of the Wikipedian community came into existence with the rise of the universities in twelfth and thirteenth century Europe. The large ornamental codices of the early Middle Ages gave way to portable “handbooks” designed for the lighter touch of a quill pen. However, the pages of these books continued to be made of animal hide, which could be easily written over. This often made it difficult to attribute authorship because a text might consist of a copied lecture in which the copyist’s comments have been inserted and then perhaps altered as the book passed to other hands. *Wikipedia* has remedied many of these technical problems. Any change to an entry automatically generates a historical trace so entries can be read as what medieval scholars call a “palimpsest,” a text that has been successively overwritten. Moreover, “talk pages” provide ample opportunity to discuss actual and possible changes. And of course, Wikipedians do not need to pass around copies of their text: Everyone owns a virtual copy of the same text. But *Wikipedia*’s spirit remains deeply medieval in its content policy.

Wikipedia content policy consists of three laws: 1) no original research; 2) neutral point of view; and 3) verifiability. They are designed for people with much reference material at their disposal but no authority to evaluate a knowledge claim beyond arguing from what is contained in that material. Such was the epistemic position of the Middle Ages, which presumed all humans to be mutually equal but subordinate to an inscrutable God. The most one could hope for, then, was a perfectly balanced dialectic. In the Middle Ages this attitude spawned scholastic disputation. In cyberspace the same practice, often dismissed as “trolling,” remains the backbone of *Wikipedia*’s quality control. Thus, *Wikipedia* embodies a democratic medievalism. It does not respect claims to personal expertise in the absence of verifiable sources. To fully realize this ideal, participation in *Wikipedia* might be made compulsory for advanced undergraduates and master’s degree candidates worldwide. The expected norms of conduct of these students correspond exactly to *Wikipedia*’s content policy: One is not expected to do original research but to know where it is and how to argue about it. Compulsory student participation would not only improve *Wikipedia*’s already impressive collective knowledge base but might help curb the elitist pretensions of researchers in the global knowledge system. If anything counts as “cutting-edge” social epistemology, then *Wikipedia* certainly must.

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Social Influences on Classification

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Abstract

The social and cultural influences on classification are evident in both the content and structure of classifications. In content, warrant, the basis on which content is determined, is most significant. Warrant is related to the purpose of the classification and has varied historically from the classical Greeks to the present. Warrant, whether it be what is written or published on a topic, what is taught, natural phenomena, or other factors is susceptible to all of the biases of the society that produces a classification. Biases of race, gender, orientation, geography, culture, language, and other factors are well-documented in relation to bibliographic classification. Bias occurs not only as a result of the warrant that determines content, but also as a result of classificatory structure. Classificatory structure may be culturally specific and the hierarchy typical of western classificatory structure can convey social influence through hierarchical force, ghettoization, and diasporization. Jesse Shera suggests the social importance of librarians and their role in classification. Combining Shera's theoretical stance with the historical/philosophical record and the empirical evidence of numerous studies in bibliographic classification, the link between society and classification is robust and of significance to the field of library and information science.

INTRODUCTION

Classification, whether knowledge classification or bibliographic classification, is now recognized as being governed by what can be described broadly as social influence. Within the term “social” can be included various aspects of a society, including, but not limited to, political, economic, ideological, and cultural factors. Increasingly, social influences have a global reach. The impact of social factors can be on the structure, the content of the classification, or, arguably, both. The mechanism that determines the content of a classification is warrant. The structure of a classification is found deeper in the metaphysical foundations that are dominant within the culture.

CLASSIFICATORY WARRANT

Warrant, in classification, is encompassed in the *Oxford English Dictionary's* definition as a “justifying reason or ground for an action, belief, or feeling.” Warrant in classification is generally found in the purpose for creating a classification scheme. That is, there is generally some agenda, overt or hidden, for the construction of the classification. That agenda will determine the source of the content and, possibly, its arrangement. Clare Beghtol wrote about bibliographic classification, but her description of warrant can apply as well to classification of knowledge or of phenomena.^[1]

In general, the warrant of a classification system can be thought of as the authority a classificationist invokes first

to justify and subsequently to verify decisions about what classes/concepts to include in the system, in what order classes/concepts should appear in the schedules, what units classes/concepts are divided into, how far subdivision should proceed, how much and where synthesis is available, whether citation orders are static or variable and similar questions. Warrant covers conscious and unconscious assumptions and decisions about what kinds and what units of analysis are appropriate to embody and to carry the meaning or use of a class to a classifier, . . . The semantic warrant of a system thus provides the principal authorization for supposing that some class or concept or notational device will be helpful and meaningful to classifiers and ultimately to users of documents. (p. 110)

Historically, in western societies, classificatory warrant can be traced back to at least Aristotle. For example, in his *Generation of Animals* he based his zoological classification on animals' physical characteristics, specifically their form of reproduction, ranging from “generative slime” to human's viviparous live birth.^[2] Once he established the categories of reproduction, Aristotle arranged them according to the young that they produced. Those species that produced progeny at the most fully developed level—mammals who give birth to largely functional young—were at the top. Animals that lay eggs were considered lower because the young needed the protection of the egg and parents to sit on it for warmth in order for it to survive. Whether or not this argument is convincing, it established a classification satisfying to humans. This approach to classification has been termed scientific, in that it is the result of scientific inquiry and reflects natural phenomena. However, it is not culturally

neutral, in that it selects some particular characteristics as a basis and ignores others.

Late classical and medieval classifications of knowledge tended to have an educational purpose with main classes based on the seven liberal arts and Christian interpretations and expansions thereof; that is, on educational warrant. The classical education of free men from which our liberal (free) arts developed evolved into a codified set of topics employed by medieval scholars and, in much adapted form, into the framework for university education. Late Latin scholars ostensibly starting with Marcellinus Capella in the fifth century began a tradition of encyclopedic works that presented knowledge in the mold of the liberal arts: the trivium consisting of grammar, rhetoric, and logic and the quadrivium consisting of geometry, arithmetic, music, and astronomy. Christian scholars, such as Boethius in the sixth century and Augustin, revised this tradition for their religious goals. Hugh of St Victor, a twelfth century educator and mystic, created a classification in his *Didascalicon* to guide students through readings in the liberal arts as a preparation for the ultimate study of theology. His educational goal was to aid students in their progress toward the ultimate goal of oneness with God. The framework offered by the seven liberal arts evolved from classical practices for teaching elite boys to fit the purposes of medieval Christian education. However, after over a millennium, an alternative framework for classification developed.

In the context of the renaissance rediscovery of classical texts and a concomitant revision of the structure of knowledge, Francis Bacon classified on the basis of existing recorded knowledge—epistemological warrant—to identify a new structure of knowledge and the gaps in it that merited investigation. His epistemological view saw sense-data being recorded in memory as history, transformed through imagination into poesy, and through reason into philosophy. This tripartite framework has structured much of western classification since. Denis Diderot and Jean le Rond d'Alembert took a Baconian approach in pursuing education as a road to reason in the classification of their Enlightenment *Encyclopedie*. Even Samuel Taylor Coleridge, who regarded Diderot as the anti-Christ, applauded the encyclopedists' use of Bacon's framework. Hegel rejected Bacon's classification of knowledge, but his classificatory warrant was similar to Bacon's in technique and his Being, Essence, and Idea end up being largely parallel to Bacon's History, Poesy, and Philosophy. Hegel and Bacon certainly come together in Melvil Dewey's universal library classification.^[3] However, Hegel sought to reflect states of being rather than the process of knowing; his approach was ontological rather than epistemological.

These examples of warrant also illustrate a shift in the ordering of the classes. The seven liberal arts dominated the classical and medieval conceptions of knowledge and of the bibliographic schemes (such as Hugh's) of their time. With the Renaissance, the Baconian sequence

became more prominent and influenced the major enumerative classifications of our time that are regarded as universal classifications, notably the Dewey Decimal Classification (DDC) and, arguably, the Library of Congress Classification (LCC).

In his *The Order of Things*, Michel Foucault^[4] examines what is, in essence, warrant for arrangement of the content within this framework as it shifts from the medieval and renaissance to the classical period in Europe and from the classical period to the modern. What he finds in his studies across disciplines characterizes these changes as the transition from order based on resemblance in medieval and renaissance thought to order based on differences in identifiable characteristics in enlightenment thought and then from the latter to order based on the functions of systems in modern thought. In bibliographic classification, these stages make sense. As Alain Besson ([5], 24+) discusses, medieval bibliographic classification schemes were able to be simple because the collections were small. For broad categorization, similarity is a sufficient criterion. However, as collections grew, greater specificity came to be valued. Thus, beginning in the Enlightenment and carrying on to the enumerative schedules of DDC and LCC, differentiation is a key factor. Finally, function becomes crucial in the faceted classifications of modernity. It is apparent in Ranganathan's PMEST formula—personality, matter, energy, space, and time—in which each facet fulfills a function. Personality functions as the main topic; matter functions as the object acted upon; energy functions as a verb, an activity; space and time perform the function of defining context. Collectively they function as a system theoretically capable, in their flexibility, of representing the modern universal.

CLASSIFICATORY WARRANT AND SOCIAL INFLUENCES IN BIBLIOGRAPHIC CLASSIFICATION

Classic works on bibliographic classification set up a dichotomy between natural classification and artificial classification. Berwick Sayers ([6], §29+) called the source of warrant “the characteristic of classification.” He divided the options into the artificial characteristic “in which some accidental property of the things classified is adopted as the characteristic of arrangement” (§35) and the natural characteristic “made upon the inherent properties in things; upon those properties without which a thing could not be the thing it is.” (§36) In the former, a bat may be classified as a bird because it flies, while, in the latter, a bat does not have essential qualities of a bird and must, therefore, be classified elsewhere. Sayers' artificial classifications imply that characteristics may come from somewhere in the social, rather than the natural, order.

Henry Evelyn Bliss^[7] also identified natural and artificial or purposive classifications. However, he acknowledged that natural classifications “may have a conceptual and often purposive warp in their fabric.” (p. 149) Jesse Shera went further, proposing that classifications are invented rather than discovered, thus rejecting any universal pattern that can be reflected. Margaret Egan^[8] put classification squarely in the social context: “[t]he study of bibliographic organization is, in effect, the study of the channels through which recorded knowledge flows, set against the background of evolving social and intellectual organization which determines where, how, and by whom that knowledge can be made effective in action.” (p. 20)

In 1971, in an article provocatively titled “Misogynists All: A Study in Critical Classification,” A.C. Foskett^[9] stated bluntly that “. . . when one begins to examine almost any [classification] scheme it quickly becomes clear that, far from being objective, it is likely to reflect both the prejudices of its time and those of its author.” What followed over the next three decades were critiques of mainstream classification schemes, most notably the DDC and the LCC, but also the Universal Decimal Classification (UDC) and others. Steve Wolf^[10] began with a discussion of the gaps between the ideal of unbiased, objective, nonjudgmental classification schedules and the reality evidenced in LCC’s and DDC’s treatment of gays in the renegade collection *Revolting Librarians*. Thereafter, critiques began to appear in more mainstream professional journals, such as *Cataloging & Classification Quarterly* and *Library Resources & Technical Services*.

Critiques from the 1970s to the 1990s, suggesting bias based on culture, include documented bias regarding Africa,^[11] Kenya,^[12] African literature,^[13,14] African history,^[15] African languages,^[16] African churches,^[17] African studies,^[18] and South Africa.^[19] Other critiques relate to DDC and LCC treatment of Melanesian geography, ethnography, and languages;^[20–22] Asia and the Pacific;^[23] Arab-speaking countries;^[24] and Turkey.^[25] Indigenous cultures are poorly represented in mainstream classifications including DDC and LCC;^[26,27] adaptations developed specifically to overcome existing biases for cultures such as Alaskan native cultures,^[28] the Luiseno people of California;^[29] and Canadian First Nations.^[30]

Several of these critiques implied an imperialistic or colonial perspective, which was explicitly described as such by Martin.^[23] Pacey gives the example of national literatures in historically colonized countries which may share the language of their colonizers, but the European literatures in that language are privileged in coming first and in having more space and more specific chronological subdivisions allotted to them, while colonial literatures are scattered across imperial and indigenous languages.^[14] Muriuki puts this colonialism into the context of Kenyan libraries.^[12] Amaeshi is explicit regarding this problem in relation to African literature in both DDC and LCC.^[13] Lincoln^[28] documents the issue of LCC patterns for

“hyperborean languages of America and the kindred language of Asia” in asserting the need for a new distribution for Alaskan Native languages. Aderibigbe and Udoh note the narrow space and arbitrary alphabetical arrangement of African literature in LCC class PL that result in a miscellaneous sequence rather than one based on sound language groupings as is the case with European languages.^[16]

Related to inappropriate distribution of topics is the lack of space sometimes allocated to cultures outside of a Eurocentric field of view. Henige discusses this broadly in relation to LCC,^[15] Weinberg in both DDC and LCC,^[31] and Bethel focuses specifically on African concepts, especially as used in the area of Black studies.^[18] Soltani notes the poor appropriation of space to Iran, Arabic-speaking countries,^[24] and Islam in both LCC and DDC. McConnell’s studies^[20–22] highlight the lack of specificity for Melanesian culture in DDC, such as the fact that there are only two numbers for Melanesian languages in Table 6 when Melanesia has over 1000 distinct languages. Yeh noted a similar problem the treatment of American Indian in LCC Class E–F.

Omission of topics is another way that social norms fail to express cultural differences. Dick and Burger^[19] document this problem in regard to Africa in DDC as does Amankwe^[11] in DDC, LCC, and Bliss’s Bibliographic Classification. Afolabi examines it in detail in relation to African independent churches—a culturally-specific phenomenon.^[17]

These problems of international cultural bias that result in omissions, in space allocated, and in inappropriate distributions of topics are especially troublesome where DDC has been used to organize national bibliographies.^[32] Martin notes this problem specifically for the Asia-Pacific region.^[23]

Other critiques address gender biases such as Ishbel Lochead’s wide-ranging discussion^[33] and Robert Mowery’s look at women in literature in LCC.^[34] Mowery noted that not only the classification, but also its application were at fault with over half of the books on literary history and criticism of women’s writings being assigned to the literary numbers in classes PA–PT appropriate to women in literature. Sheila Intner and Elizabeth Futas explored how the shortcomings of LCC affect development of library collections for women’s studies because it is a collection assessment tool as well as a browsing and collocation device.^[35]

These various biases typically reflect social biases. Biases have tended to be in favor of the social mainstream. For example, the Christian bias in DDC which, even after some revision, allocates the 220s to the 280s to Christianity leaving only the 290s for all other religions. Or the DDC allocation of the 810s to American literature, a geographic distinction, when all other literatures are gathered according to language. LCC still places feminism with “Women. Feminism” (HQ1101+) hierarchically under

“The Family. Marriage. Women” between “Men” and “Life skills. Coping skills. Everyday living skills.”

Going back as far as 1972, when Steve Wolf addressed the topic in the iconoclastic collection *Revolt-ing Librarians*, bias in the placement of gays and homosexuality has been noted in both DDC and LCC. In 1981, Sanford Berman made the placement of homosexuality one of the major points in his critique of the nineteenth edition of DDC for its lack of specificity. Currently, in both DDC and LCC gay men and lesbians are still associated with sex rather than with demographically defined groups. In the previous edition, DDC21, gays were classified in 305.90664 under social groups (though relegated to the miscellaneous category “Persons by cultural level, marital status, sexual orientation, special social status”). At least gays were a social group as a primary defining characteristic. Now, however, gays are mixed in with 306.766 Homosexuality, which is in the hierarchy:

306	Culture and institutions
306.7	Sexual relations
306.76	Sexual orientation
306.766	Homosexuality

It comes between 306.74 “Prostitution” and 306.77 “Sexual and related practices” including “Masturbation,” “Sodomy,” “Oral sex,” “Sadism,” “Masochism,” and “Transvestism.” The focus of this part of the classification is clear. LCC also conflates gay people with homosexuality in HQ 75+ “Homosexuality, Lesbianism.” Hierarchically it is under “Sexual minorities” (coming after “Sexual deviations”) which is under “Sexual life.” Under “Sexual minorities” is the list of topics: “Bisexuality,” “Homosexuality. Lesbianism,” “Transvestism,” “Transsexualism,” “Sadism, Masochism, Fetishism, Etc.,” and “Prostitution.”

Social influences can also have a progressive impact on classification. DDC originally, in 1876, had no number for the status of women (only for women’s education and suffrage). By the eighth edition in 1913, “Woman’s position and treatment” was given a place in “Customs, Costumes, Popular life” between “Etiquette” and “Gypsies, Nomads, Outcast races.” Today’s placement in 305.4 under social groups suggests that DDC has come a long way at least in some ways (Romany people are also now under social groups at 305.891497 while etiquette has appropriately remained in the 390s under “Customs, etiquette, & folklore”).

Foskett, in “Better Dead Than Read,” a 1984 followup to his 1971 “Misogynists All” that kicked off much of this discussion, noted that there was some improvement in 13 years, but still much to do.^[36] Perhaps for that reason, these studies of social and/or cultural bias continue, though at a diminished pace and often in a more specialized, closely-documented, and theoretical form. Jonathan

Furner and Anthony Dunbar used critical race theory to examine the classification of people of mixed race in DDC.^[37] Eunice Kua, as recently as 2004, documented that DDC still has massive inequities in allocating space for non-Western languages and literatures that reflect the society in which DDC was contrived.^[38] Lorraine Nero’s study of the classification of popular Caribbean music^[39] is another example of how mainstream classifications still neglect that which is outside of the social mainstream. In Nero’s study, the fact that it is popular rather than classical music means that DDC and LCC are less able to accommodate. The ethnicity of the music further sets it apart.

The power of social influence is most easily seen in classification outside of one’s own society. For example, the social and ideological values of the former Soviet Union are completely foreign to most of us. So it is easy to see that Soviet adaptations of UDC and the Soviet-born Bibliotечно-библиографическая Классификация (BBK or Library-Bibliographical Classification) closely reflected their social context when they made Marxism-Leninism, The Party, and Dialectical Materialism into main classes. Their close response to social and ideological changes can be seen by the nearly instantaneous establishment of a class for “The Great Patriotic War” when the Soviet Union entered World War II with an initial subclass for “Comrade Stalin—Leader and Organizer” and then the complete disappearance of Stalin when Khrushchev unseated the cult of the personality. Since the fall of the Soviet Union, those responsible for the BBK say that “[t]he radical changes of recent years which took place in political, ideological and socio-economic life in Russia, called for a critical revision of LBC [Library-Bibliographical Classification – BBK],”^[40] acknowledging social influence on the classification.

From the early days of the Soviet Union, there was concern that a western classification such as UDC was too bourgeois, recognizing that not only does a classification reflect its society; the society is, in turn, influenced by classification. We cannot doubt that the current globalization of classification through sharing catalog records means that the mainstream western classifications used in most shared records are likely to influence the importing societies.

CLASSIFICATORY STRUCTURE

Not only do social and cultural influences affect the content of a classification scheme, they also affect its structure. For example, in dominant western culture, three characteristics build the pattern of classificatory structure and these characteristics reflect the logic that has developed as a hallmark of western culture beginning with the ancient Greek philosophers.^[41] First, western classification presumes that categories within a classification should be mutually exclusive. That is, they should have

impermeable boundaries. Second, western classification typically sequences topics within the classification (such as main classes or topics within a subclass) in a linear sequence such as abstract to concrete or vice versa. Third, western classification is hierarchical, with some topics being subordinate to others. Hierarchy is a logical result of arranging mutually exclusive categories in linear sequences that then, themselves, need to be arranged. Hierarchy is linear in a vertical sense. These three characteristics are not universal. For example, many indigenous cultures look at the world as a circle of being in which each entity plays an equally important role in the whole and the relationships between the entities may be more important than the entities themselves.^[42] In another example of a culturally specific classification, Hur-Li Lee and Wen-Chin Lan describe how, in first century B.C.E. China, a scholar and royal family member, Liu Xin, and his father, Liu Xiang, constructed a classified catalog at the order of the Han emperor, Cheng.^[43] The classification scheme developed for this catalog, known as the *Seven Epitomes*, was based on a canon of literature influenced by the political discourses of Han China and, in turn, influenced scholarship of the time and for the better part of the two following millennia.

The hierarchical classificatory structure dominant in mainstream western society is arguably culturally specific. It is a sort of intellectual infrastructure.

CONSEQUENCES OF HIERARCHICAL STRUCTURE

A hierarchical structure has ramifications that exhibit as much bias as the content derived from warrant. This bias may be simply a matter of hierarchical force, though it often comes in the form of the ghettoization and diasporization of topics that do not fit the original hierarchical structure constructed of main classes and subclasses.

A basic example of bias through hierarchical force is visible in the placement of gays in DDC noted above. Hierarchical force mandates that what is true of a class is also true of all of its subclasses. So if the class is “Sexual relations” then everything in that class is about sexual relations. By lumping gay people into the number for homosexuality, DDC is characterizing gays only according to one characteristic, their sexual relations, and not as multifaceted people.

Ghettoization is the problem of gathering and then isolating a topic rather than integrating it across the main classes. Because of the principle of hierarchical force, ghettoization can put a topic into a less than advantageous context. A classic instance is the treatment of Native Americans in classification. For example, in DDC, the general number for “American Native peoples” is 970.00497. Hierarchically, this number is under “Ethnic and national groups” under “History of North America.”

The DDC relative index lists other numbers in the histories of more specific jurisdictions, but only four other numbers outside of history; these are for religion, civil rights, folk literature, and rodeo performers. In LCC, Indians of North America in general are classified in E75-E99, which is hierarchically under American history. The index lists other numbers only in collections of American prose literature, classes of persons in the arts in general, and bibliographies of literature on music by topic. In both *DDC* and *LCC*, Native Americans are separated from mainstream North American culture and are largely relegated to history as though there were no contemporary Aboriginal cultures.^[26,27] The fact that the main classes are not easy umbrellas for cross-cultural topics can lead to ghettoization as the path of least resistance.

Diasporization occurs as different characteristics are used to make categories in a hierarchy more specific. For example, a group of people may be defined by different characteristics such as age, sex, class, ethnicity, etc. To create a hierarchical structure, groups are divided first by one characteristic, then a second, then a third. But only the groups with first characteristic will be gathered together. The others will be dispersed. DDC shows this in its classification of social groups. The basic arrangement is:

305	Social groups
305.2	Age groups
305.3	Men and women
305.4	Women
305.5	Social classes
305.6	Religious groups
305.7	Language groups
305.8	Ethnic and national groups
305.9	Occupational and miscellaneous groups

This works fine unless the groups are defined by more than one characteristic. Will African American male youths (to use DDC’s example) be classed by race, sex, or age? To solve this problem, DDC includes a table of preference:

Unless other instructions are given, observe the following table of preference, e.g., African American male youths 305.235108996073 (not 305.3889607300835 or 305.896073008351):

Persons with disabilities and illnesses, gifted persons	305.908
Age groups	305.2
Groups by sex	305.3–305.4
Social classes	305.5
Religious groups	305.6
Ethnic and national groups	305.8
Language groups	305.7
Occupational and miscellaneous groups	305.9 (except 305.908)

So material about African American male youths will be classed with other youth, subdivided by sex and last by race. African American middle class women will be classified at 305.4855108996073 grouped with women, then middle class women, and finally African American middle class women. With ethnic and racial groups coming near the bottom of the table of preference, African Americans (and other ethnic and national groups) are scattered across social groups defined by age, sex, class, and/or religion. Language groups will be even more dispersed and miscellaneous groups, including immigrants and veterans, among others, will be the most dispersed. There is no valid way to bring all material about immigrants together as a social group as there is with people with disabilities, the first group in the table of preference.

Hierarchical force, ghettoization, and diasporization are examples of how classificatory structure, itself a product of social and cultural influence, is a vehicle for the views of a society.

CONCLUSION

Mai contends “that a classification is merely one particular explanation of the relationships in a given field that satisfied a group of people at a certain point in time.” (p. 41)^[44] He goes further to argue that only automatic classification generated from the documents themselves is objective (p. 42). There is certainly much evidence to confirm that classification as developed over millennia and manifested in mainstream bibliographic schemes is not objective, but reflects the society in which it is constructed and the biases in that society. The content of a classification scheme is influenced by its basis in the choice of what is used for warrant. Since literary warrant depends upon the biases manifested in whatever literature is being classified, even automatic indexing is subject to social influence, though it may be exempt from the influence of human classificationists. Classificatory structure as an intellectual infrastructure also reflects the epistemic presumptions of a culture or society.

Recently, so-called “folksonomies” created by social tagging seem to offer a more democratic, grassroots knowledge structure. Social or collaborative tagging is the assignment of typically uncontrolled keywords by users to photographs (<http://flickr.com/>), website bookmarks (<http://delicious.com/>), scholarly articles (<http://citeulike.com/>), products (<http://www.amazon.com/>), etc. The vocabulary used appears to be free from authority, but that does not mean that it is free from cultural bias. The structure turns out to fit a power law, Zipf-like distribution and the co-occurrence of terms shows a core, not only of terms, but also of relationships between terms Kipp^[45] and Olson.^[46] Research to explore whether or not this core reflects cultural bias still needs to be done, but it seems unlikely that such an unconsciously cultural product will escape cultural bias. However, only future study will tell.

That classification is an artifact crafted in a social context is evident. More difficult to assess is whether or not the reverse is the case. Does classification, in turn, influence a society? Or does it, at the very least, reinforce social norms? Those in power in the Soviet Union clearly believed that classification has that influence. In a different context, it does not take too great a leap of the imagination to envision a library user who, browsing the shelves, finds books about men in regard to any topic consistently classed before books about women on the same topic being influenced to accept it as a natural order. Of course, such a conclusion would involve proving causation. Proof may not be available, but Shera,^[47] speaking on classification at the landmark Dorking conference, makes a convincing argument:

Librarianship is a composite of many disciplines. In a limited sense, too, it is catalytic, for it can accelerate reaction wherever it serves. If it be true that recorded knowledge is autogenetic in that it begets more knowledge, then the librarian of the future may well be regarded as the geneticist of our intellectual life. (p. 26)

Shera's position suggests the social importance of librarians and their role in classification. Combining Shera's theoretical stance with the historical/philosophical record and the empirical evidence of numerous studies in bibliographic classification, the link between society and classification is robust and of significance to the field of library and information science.

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Social Informatics

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Abstract

This entry describes the concept of social informatics, delineates the research domain the concept is intended to cover, and explains its relevance for library and information science, updating Kling's 2003 description of social informatics in this Encyclopedia. After an initial definition of the term, a brief history of social informatics is presented from the origins of the term in the 1980s among Scandinavian scholars to the appropriation of the term by Kling and colleagues in the mid-1990s to its current status as a useful lens for researchers in a wide range of disciplines to use to study computerization in society. Three main approaches of social informatics are described after which some of the main insights that have emerged from social informatics research are discussed. The entry concludes with an assessment of the impact of and potential for social informatics in library and information science.

INTRODUCTION

Computers in various forms, cell phones, global positioning systems, and many other digital devices have become part of the routine fabric of many people's lives. Recent developments in ubiquitous computing, "which may be embedded in the environment, embedded in objects, worn, or carried by the user throughout everyday life," presage a future that moves beyond the computer as a desktop artifact^[1] toward a scenario where people "have the same secure, personalized access to communications on devices everywhere, whether public or private, mobile or stationary."^[2] These and other information and communication technologies (ICTs) have become key components of the large and complex infrastructures on which many different types of organizations depend. The pace of technological innovation continues to increase and as researchers and entrepreneurs work on Web 2.0 applications, for example, the effort led by Miller to develop the technologies that are forming the infrastructure of the "Semantic Web,"^[3] there is already speculation about the next wave:

The Semantic Web community's grandest visions, of data-surfing computer servants that automatically reason their way through problems, have yet to be fulfilled. But the basic technologies that Miller shepherded through research labs and standards committees are joining the everyday Web. They can be found everywhere—on entertainment and travel sites, in business and scientific databases—and are forming the core of what some promoters call a nascent 'Web 3.0.'^[4]

This wave of innovation is sweeping over libraries and other information organizations and there is a small and growing literature about "library 2.0,"^[5–7] a vision of a

"next-generation library" based on "the application of interactive, collaborative, and multi-media Web-based technologies to Web-based library services and collections."^[8] There is even some discussion among bloggers of "librarian 2.0."^[9] As these activities intensify, one simple and profound question to ask is what this immersion in and dependence on ICTs is doing to us. This question is simple to ask and difficult to answer. In part, this is because it is difficult to study something that is both pervasive and routine; one of the implications of ubiquitous computing is that the object of study will eventually become invisible. In addition, a reliable approach is needed to study the ways in which people's work and play are affected by the ICTs they design and use that also allows researchers to understand the ways in which people are affecting the ICTs on which they rely. Research into computing and society requires an approach within which can be found the theories and concepts that will allow researchers to uncover these instances of mutual shaping. Social informatics is one useful approach that can do this because of its focus "on the social consequences of the design, implementation, and use of ICTs over a wide range of social and organizational settings" especially "the roles of ICTs in social and organizational change."^[10]

This entry describes the concept of social informatics, delineates the research domain the concept is intended to cover, and explains its relevance for library and information science; it updates Kling's 2003 description of social informatics in this Encyclopedia.^[11] After an initial definition of the term, a brief history of social informatics is presented from the origins of the term in the 1980s among Scandinavian scholars to the appropriation of the term by Kling and colleagues in the mid-1990s to its current status as a useful lens with which to study computerization in society. Three main approaches of social informatics are described after which some of the main insights that have

emerged from social informatics research are discussed. The entry concludes with an assessment of the impact of and potential for social informatics in library and information science.

WHAT IS SOCIAL INFORMATICS?

To paraphrase a question asked by Kling in 1999,^[12] what is social informatics and why does it matter in library and information science? Kling, Rosenbaum, and Sawyer recently defined social informatics as “the interdisciplinary study of the design, uses, and consequences of ICTs that takes into account their interaction with institutional and cultural contexts.”^[13] Lamb and Sawyer^[14] describe social informatics as

A body of rigorous empirical research that focuses on the relationships among people, ICTs’, and the social structures of their development and use. Social informatics studies engage a broad range of ICTs—from large, formal, organizational information systems such as medical records systems to everyday, informal, often highly-personalized devices such as mobile phones and personal digital assistants. In these studies, ICTs are seen as embedded within a larger social milieu that infuses meaning and purpose into their shaping and uses.

Social informatics focuses on the “the intended and unintended social and organizational consequences of ICT-enabled change and change efforts.”^[15] For these reasons, social informatics has a problem oriented focus^[16]; although “multidisciplinary and methodologically diverse” it “can be considered to be distinctive through the common focus on a complex problem area; namely, computerization as sociotechnical complexity.”^[17]

Social informatics researchers are not typically interested in how to build or design ICTs. Instead, they want to understand the complex relationships that are involved when these ICTs are used in different types of social, cultural, organizational, and institutional contexts. Their objects of study include the ICTs, the people who design, set up, maintain, and use them, and the different settings in which they are used. Robbin and Day argue that social informatics researchers seek “to intervene in the social construction of the meaning, value, use and even design of technologies as shaped by discourse and education” and “to intervene in the practice of theory of ICTs by means of critical examination and discourse.”^[18] Horton, Davenport, and Wood-Harper add that “there is an implicit hope that the detailed analyses developed under the banner of social informatics will provide ‘increased understanding’ that will result in ICTs that are ‘actually workable for people and can fulfill their intended functions’.”^[19] For these reasons, there is some overlap with cognate forms of intellectual inquiry such as knowledge management and

human–computer interaction, but the social informatics approach differs because its explicit focus on social, cultural, and organizational contexts within which people design, implement, and use ICTs, strongly orients researchers toward the use of social science theories, methods, and conceptual frameworks.

Social informatics matters because it addresses questions of fundamental importance in library and information science and other fields: given the types of situations described above, how can we best understand the complex relationships among people, the ICTs that they design and use, and the contexts in which design and use take place. In addition, Halavais asks:

How does the intended use of the technology relate to its use within ... existing social practices? In what ways, both intended and unintended, does the technology affect the structures of interaction and understanding within a community?^[20]

HISTORY

The term “informatics” has been part of the academic lexicon for many years; Brookes argues that Lenin should be seen as the founder of informatics!^[21] Since the late 1970s^[22] the term has been used to describe “the study of information content, representation, technology, and the methods and strategies associated with its use.”^[23] In early 1980s, however, the term acquired the modifier “social” when it was used by Norwegian social scientists whose work focused on the intersections among technology, organizations, and work. Roggen claims that “social informatics, the interdisciplinary field of informatics, ... [was] established as a science in 1982 by Stein Bråten” at the University of Oslo,^[24] Ursul^[25] and Robbin and Day^[26] claim that it became a discipline soon after. The Faculty of Social Sciences at University of Ljubljana, Slovenia established a program in social informatics in 1985^[27] stating that the term “relates to interaction between society and information-communication technologies” at macro and micro levels of analysis. Around this time, Kling, who had been studying computerization from a social science perspective in the United States since the 1970s, met with Bråten and Roggen in Norway where he learned about their new discipline and “its terms, concepts, theories, models, and research projects carried out by Bråten and his collaborators.”^[28]

In the mid-1990s, Kling and his colleagues were casting about for a label to describe more concisely the research in which he and like-minded researchers had been engaged. What had been called the “the social analysis of computing,” “human-centered computing,” the “social study of information technology,” and the “sociology of computing” became “social informatics.” According to Kling, Rosenbaum, and Sawyer,

In 1996, some participants in this research community agreed that the scattering of related research in a wide array of journals and the use of different nomenclatures was impeding both the research and the abilities of 'research consumers' to find important work. They decided that a common name for the field would be helpful. After significant deliberation, they selected 'social informatics.'^[13]

Since then, there has been considerable activity, initially driven by Kling, that has included a 1997 NSF funded workshop that set a research agenda for social informatics, the introduction of a social informatics minitrack in the America's Conference for Information Systems (now called Social Theory in Information Research), panel discussions on social informatics at the Annual Meetings of the American Society for Information Science and Technology, special issues of the Information Society and the Journal of the American Society for Information Science, the formation of a Social Informatics Special Interest Group in the American Society for Information Science and Technology which held its fourth annual research symposium at the 2008 ASIST annual meeting, undergraduate and graduate courses about social informatics, and the establishment of several centers of social informatics at universities in the United States (the Rob Kling Center for Social Informatics at Indiana University) and Europe (the Center for Social Informatics at Napier University, Scotland). Social informatics research is alive and well and the movement Kling fostered "has grown to encompass a widening and interdisciplinary interest in research that carefully examines the ways in which ... ICTs ... are bound up in everyday social and organizational structures."^[14]

ASSUMPTIONS

Social informatics research typically makes use of theories and methods of the social sciences. However, it is probably more accurate to say that social informatics is an approach to studying technology and society influenced by social science theory and method that cuts across many academic disciplines. Researchers working in information systems, library and information science, sociology, anthropology, communications, journalism, management, and other disciplines are using the concepts and tools of social informatics.^[29] Despite this heterogeneity, there is a set of assumptions that is common to their work. These can be organized into assumptions about the embeddedness, duality, and configurability of ICTs.^[30] The first, embeddedness, holds that the context matters; ICTs do not exist in social or technical isolation and are embedded in social, cultural, organizational, and institutional contexts.^[31,32] A second and related assumption is that technology involves a fundamental duality wherein ICTs, the people who design and use them, and the contexts in which they are embedded are in relations of mutual shaping, an insight that has been important in the

work of Orlikowski.^[33] Working from this assumption, social informatics research and theorizing "seeks to uncover and explain the coupling of technology and social order."^[34] One implication of this assumption is that "the situated nature and uses of computing mean that context and use are bound up through practice: to report on use is to report on the situations of that use."^[35] A related assumption about this duality emphasizes one dimension of mutual shaping. ICTs enable and constrain social actions and social relationships that are enacted within the contexts of design and use. Finally, ICTs are configurable. They are sociotechnical systems that can be interpreted and used in different ways in different settings.

APPROACHES TO SOCIAL INFORMATICS RESEARCH

There are three main approaches that characterize social informatics research. The first is normative and covers work that has as its main goal to influence practice. Researchers engaged in this type of work seek to provide empirically based findings that can be used to make recommendations intended to improve the work done by people designing, implementing, managing, and using ICTs. For example, some normative work is directed at designers and managers of ICTs, while other work seeks to influence people involved in setting ICT policy. The second is analytic and includes work that has as its main goal the development and refinement of theories of ICTs in their social, organizational, and cultural contexts. Analytic research "seeks to contribute to a deeper understanding of how the evolution of ICT use in a particular setting can be generalized to other ICTs and other settings."^[36] This type of work is important because it results in the development of a body of theory and empirical work that forms the knowledge base of the discipline.

The third and perhaps most important approach is critical, covering work that examines "disjunctions between popular and professional claims about the social values and uses of [ITC] and the empirical reality of such."^[37] Researchers adopting this approach call into question the conventional wisdom and assumptions about ICTs and, in doing so, employ "perspectives that do not automatically and uncritically adopt the goals and beliefs of the groups that commission, design, or implement specific ICTs."^[36] Day argues that this critical impulse is at the heart of social informatics and, developed more deeply, can move the discipline in novel and rewarding directions because its "empirical objects ... can be as much conceptual constructs as empirical entities, and [its] central concern [can be] the examination of the notion of information as a culturally and historically specific conception of knowledge."^[38] The critical approach easily incorporates genre and discourse analyses into the social informatics researcher's methodological tool kit as it becomes

“ultimately, a discursive and cultural examination of the construction of meaning and concepts related to ICTs.”^[39]

KEY INSIGHTS FROM SOCIAL INFORMATICS RESEARCH

Some of what has been learned from almost 30 years of research into the interrelationships among technology, organizations, people and work now seems like common sense, but at the time these findings were being reported many were challenges to the conventional wisdom about computing and society. At the time of this writing, some of these findings have not yet had impacts on the design, implementation, and use of ICTs.

Based on the assumption of embeddedness, social informatics researchers have demonstrated empirically the mutual shaping that characterizes the relationships among people, ICTs, and the contexts of design and use. On the one hand, the context of ICT use directly affects the meanings and roles the technologies have for the people using them; for example, the same information system will be used differently in an elementary school and a government agency. In addition, the interpretations that people develop to help them grasp ICTs shapes their adoption and uses of these technologies. Such a set of conventions are necessary if the interactions enabled by the ICTs are to proceed smoothly.^[40] The result is that the social and organizational contexts of ICTs play “a significant role in influencing the ways that people use information and technologies, and thus influence the consequences for work, organizations, and other social relationships.”^[32] A related insight also grounded in an assumption of embeddedness is that ICT use leads to multiple, and seemingly contradictory, effects. That the same ICT package can be implemented in two similar organizations and be used in different ways with different outcomes has been attributed to the differing contexts of use. This has been illustrated clearly by Orlikowski, who described two similar consulting firms that implemented the same software package and experienced two very different outcomes. The success of the software in one firm and the failure in the other was shown to be due to differences in non-technological organizational practices; in one firm there were organizational incentives for employee participation and in the other there were not.^[41]

There is also a set of insights about the nature of ICTs. The first is that ICTs are configurable—they are actually collections of distinct components. This means that different components and features are emphasized in different social and organizational settings. The second is that these configurations are not static. ICTs continue to evolve and change after they are implemented and sometimes in ways not anticipated by their designers. This is to be expected since there will be “ongoing adjustments of the technology and initiatives aimed at influencing the organizational context, for instance, training users, changing existing

procedures, and promoting the establishment of appropriate conventions for use.”^[42] This process has been called “technology-use mediation” and describes the efforts to align the structure and functioning of the ICTs with existing work and other organizational practices.^[43] Walsham, for example, describes a police dispatch system that was modified by the people using it.^[44] The process also has currency when considering the adoption and use of ICTs in social and domestic settings.

The third insight is that ICTs have trajectories that begin with their design and continue until they are no longer in use. It is therefore possible to study the evolution of an ICT configuration focusing on its history and future; a trajectory is composed of a social history and a trail of technological progress. These trajectories can be traced and studied, and although ICTs have the potential to be influential in social and organizational change, their trajectories often favor the status quo.^[45] Finally, there is an insight that aligns well with fundamental assumption from the social construction of technology approach concerning the role of values and ideology in the design, development, and use of ICT; technology is not value neutral. ICT use has moral and ethical aspects and these have social and political consequences. In some cases, “IT applications can . . . shift the balance of influence and power in organizations by restructuring access to information, technical staff, and the kind of authority that informational resources can bring.”^[46] Consequently, the implementation and use of ICTs typically produce winners and losers. For example, in many organizations, the implementation of enterprise resource planning (ERP) systems has led to efficiencies, but also to changes in work routines that some employees do not like and, in more extreme cases, early retirement.

SOCIAL INFORMATICS AND LIBRARY AND INFORMATION SCIENCE

At the turn of the century, in a special issue celebrating the 50th anniversary of the *Journal of the American Society for Information Science* (now the *Journal of the American Society for Information Science and Technology*), Saracevic describes information science as “interdisciplinary in nature” and “inexorably connected to information technology” with a “technological imperative [that] is compelling and constraining” its development; in addition, information science “has a strong social and human dimension, above and beyond technology.”^[47] In the same issue, Bates identifies three “big questions” for library and information science (LIS), a “physical” question about the fundamental laws and features of recorded information, a “social” question about the ways in which people interact with and make use of information, and a “design” question about the ways in which access to information can be improved.^[48]

It is clear that the assumptions and insights of social informatics as described above overlap with these

descriptions of information science. As increasingly sophisticated ICT become integrated into information organizations, including libraries, the questions that social informatics researchers ask and the problems they investigate become increasingly relevant for LIS. For example:

- How is the introduction of new technologies changing work practices, organizational structure, and culture in libraries and other information organizations?
- How are libraries and other information organizations involved in relationships of mutual shaping with ICTs, particularly those outside these organizations?
- What can we learn by studying the discourses about technology and information organizations?
- What can a social informatics approach contribute to our understanding of problems of information seeking and use?
- Bishop and Van House have already argued for the value of a social informatics approach to digital libraries. What else can we learn about them?
- How can a social informatics approach lead to better understandings of fundamental concepts of LIS such as “information?”

CONCLUSION

Information and communication technologies have become essential components of many people's work and social lives. Within organizations, activities such as distance education, virtual teamwork, telecommuting, telemedicine, the outsourcing of organizational functions such as payroll management all depend on complex digital infrastructures supporting shifting configurations of ICTs. Outside of organizations, e-commerce, e-government services, electronic banking, and other networked electronic services are becoming increasingly commonplace parts of people's lives as they do their business in the world. Wikis, blogs, and social networking sites of all kinds are taking their places in people's social lives. As computers and other ICTs become ubiquitous and recede into the background, it becomes more important to analyze them from an approach that takes seriously their embeddedness in social and organizational contexts and social informatics is one useful way to do this.

Drawing on some 30 years of research into the relationships among computers conducted in the United States and a similar stream of work in Scandinavia, social informatics emerged as a research domain in the mid-1990s. Initially driven by Kling and colleagues social informatics, a label already with currency in Europe, defined a research domain that focused on the relationships of mutual shaping among ICTs, the people who design, implement, manage, and used them, and the social and organizational contexts with which the people and technologies are embedded. Social informatics has become a

useful lens with which researchers in a variety of disciplines study ICTs, computerization, and society.

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Social Justice in Library and Information Science

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Abstract

This entry presents an overview of social justice vocabularies, conceptualizations, and philosophies as they are represented in the history of library and information science (LIS) practice and research. Emphasis is placed on theoretical descriptions of both justice and social justice, and how these constructs are historically related to past and emerging trends in the LIS professions, with a main focus on social justice in regard to public library philosophy and practice in the United States. The entry also includes a discussion of information science research as it relates to the needs of disadvantaged populations.

INTRODUCTION

Traditions of fairness, open inquiry, service, and humanism have long characterized the library and information science (LIS) professions. Indeed, these and other altruistic stances are professional mandates in the varied representations of the discipline, providing important distinctions to the LIS domain. Although so far little has been written specifically about social justice in an LIS context,^[1–3] the term is emerging as a useful conceptual tool to describe and analyze these qualitative aspects of LIS practice and research.

Presented here is an overview of social justice vocabularies, conceptualizations, and philosophies as they are represented in the history of LIS practice and research. Emphasis is placed on theoretical descriptions of both “justice” and “social justice”, and how these constructs are historically related to past and emerging trends in the LIS professions, with a main focus on social justice in regard to public library philosophy and practice in the United States. The entry also includes a discussion of information science research as it relates to the needs of disadvantaged populations.

CONCEPTUALIZING SOCIAL JUSTICE

“Justice” is often used as a legal term that describes the administration and maintenance of fair laws.^[4] The term “social justice” expands the notion of justice, referring to an ideal in which justice is achieved in every aspect of society, not simply the legal sphere.^[5] Thus, in a socially-

just society, individuals and groups are treated fairly and receive an equitable share of all of the benefits in society.

However, defining this “socially-just society” is problematic. Although social justice has been explored in philosophical, political, religious, and other contexts, no universally accepted, all-encompassing definition of “social justice” has emerged.

Historically, social justice has been concerned with the tensions between: 1) the individual’s right to choose her/his own ends; 2) conflicts with other individuals’ rights to make similar choices; and 3) the debate on individual rights vs. the good of the community. These tensions have existed in Western thought since the time of the classical Greeks.^[6] For example, in his *Republic*, Plato reflected upon similar disputations in his model of justice intended to bring harmony to the city-state and establish rights for citizens.^[7]

These notions of social justice were debated for hundreds of years (and continue to be), but the rights of individuals and the idea of the “common good” became particularly crucial issues during the vast social and political transformations of the nineteenth century. In the 1840s, the Thomistic Jesuit philosopher Luigi Taparelli coined the term “social justice” as a way to identify and conceptualize these tensions. He combined the words “social” and “justice” to refer to the intersecting tautology between the human rights of individuals and reconciling these rights to a society that is composed of groups.^[8,9]

Taparelli’s concept of social justice soon became part of ecclesiastic discourse on how societies should adjust to the Industrial Revolution. In 1891, Pope Leo XIII, a student of Taparelli, published the encyclical *Rerum*

Novarum (On the Condition of the Working Class), a key document in the early development of social justice philosophy. In this work, the Pope defended the efforts of labor unions to protect the rights of individual workers, urged nation-states to establish just societies through the protection of individuals' rights, and philosophically positioned the Catholic Church to address social issues and advocate for policies that promote class harmony, a position it retains today.^[10,11]

As the twentieth century progressed, the concept of social justice was incorporated into secular discourses on human rights, policy, and public moral philosophy. This move from the religious sphere to the secular emphasized the "social" aspects of the affects, relationships, behavior, actions and interactions between people in society.^[12] Social justice, thus, directs attention to the tangible reality of the social context in analyzing the implications of legal justice and its impact on the relations between people in every dimension of life.^[13]

Furthermore, social justice inherits the etymological and conceptual origin of justice in terms of providing crucial reasons shaping one's beliefs and actions. It incorporates both the abstract issues of ethics and morality (related to beliefs), as well as the concrete actions that impact justice in a social context.^[14] Consequently, social justice initiatives have recently emphasized progressive actions to bring positive changes in society that implement the abstract elements of justice (or typologies as further described in the entry).^[15,16] Thus, specific social justice actions are viewed favorably as "progressive" when they provided impetus to a creation and development of those social conditions or environments that embodied the actualization of justice.^[17,18] Philosophers, scholars, and activists draw close connections between this deconstructed meaning of social justice in terms of actions for change and a critical reflective process that questions traditional understandings and scrutinize existing values, practices, ideological frameworks, and processes to promote a progressive society.^[19–21] Application of social justice as a critical framework and progressive mode of analysis has further been cemented in the twenty-first century.^[22,23]

Presently, there are several movements throughout the world that are working toward various social justice goals.^[24] These study and analyze social justice in terms of its legal, political, economic, criminal, civil, philosophical, linguistic, religious, historical, and sociocultural dimensions.^[25] Also, they examine how social justice goals are shaping relationships and social exchanges in varied institutional, organizational, governmental, educational, community-based, group-related, familial, person-to-person, and other formal and informal settings.^[26] Among these movements are LIS-specific examples, including the Campaign for the World's Libraries, Librarians Without Borders, and ProLiteracy Worldwide.^[27] From these analyses, several interrelated typologies of

justice and social justice have been developed. The following are particularly useful typologies when considering social justice aspects of LIS practice and research.

Justice-as-Desert: Justice-as-desert theory propounds giving a person what s/he justly deserves.^[28] It is considered integral to natural law that presents an understanding of justice as part of a systemic process of consequences which result from any option, decision, or action.^[29] Justice-as-desert holds that justice provides individuals or groups with a consequence (e.g., goods, resources, etc.) that they deserve, merit, or are sanctioned to receive in society.^[30]

Egalitarianism/Equity: Egalitarianism refers to the equal distribution of resources.^[31] Equity enriches the concept of egalitarianism by considering political, economic, social, and cultural developments in society, and addresses limitations of treating all as equals without considering their historical or individual contexts that may lead to injustice and unfairness.^[32]

Utilitarianism: The utilitarian perspective of justice favors the good of society over the good of the individual. Utilitarianism suggests that policies should maximize the welfare of the many, even if this results in the expense of an innocent few.^[33]

Distributive Justice: Distributive justice refers to the appropriate distribution of resources, wealth, power, rewards, and respect among all or select stakeholders in a society.^[34] This notion is based on theories of fairness, status, and right.^[35]

Justice-as-Fairness: Justice-as-fairness presents the idea that societies must safeguard the rights of citizens based on rational and unbiased notions of fairness.^[36] It was put forth by the American political philosopher John Rawls,^[37] who asserts that fairness is based on principles of justice that: 1) ensure extensive and equal liberty; and 2) promote societal benefits to be arranged in such a way that the least disadvantaged persons obtain the greatest benefits possible.

Although justice and social justice theory are developed domains, LIS-specific social justice theory is in its infancy. Rarely is social justice explicitly articulated in LIS practice and research.^[38] Yet ethical and moral imperatives have long been apparent in LIS.^[39,40] The next section gives an overview of key social justice elements (i.e., fairness, humanism, individual rights, etc.) that have inhered within mainstream LIS constructs, practices, and research (e.g., intellectual freedom, service and diversity-related goals, community-based programs, etc.).^[41,42] It is followed by a critique of mainstream LIS discourses within a social justice perspective that helps identify shortcomings and blind spots of the field. A critical point of view adds a deeper dimension of analysis that questions mainstream LIS ideologies and practices concerned with social justice values. Separating the two emphases in social justice and juxtaposing them provides for a stronger

and more balanced presentation of the issues. The former provides an understanding of the LIS professions in the United States in terms of their liberating role to seek social justice ideals in the services they developed for their various constituencies, while the latter presents an analysis in terms of a limited role of LIS professions to seek social justice outcomes in their work, constrained that they have been by curtailing sociopolitical, socioeconomic, and sociocultural circumstances during different times in their history.

The discussion presented in this entry on social justice elements in LIS and a critical analysis of the LIS professions from a social justice viewpoint includes only brief temporal snapshots in the history of LIS practice and research. An in-depth analysis of each historical moment and role of LIS is beyond the scope of this discussion since each time period and topic has been extensively addressed on its own terms; additionally, here the discussion is not meant to be all-encompassing in its extent and inclusion of all activities and roles of the LIS professions. The goal in this entry is to provide representational evidence to show the liberating and limited role of the LIS professions in addressing social justice criteria and impacts during various times.

The entry acknowledges that there have been multiple interpretations and meanings associated with the various times in the historical growth and development of the LIS professions in the United States. The intention here is to present one mode of analysis in discussing the liberating and limited role of the LIS professions to further a social justice agenda.

SOCIAL JUSTICE ELEMENTS IN LIS

In the United States, the library has evolved in direct response to the existing social, political, economic, and cultural conditions during different times.^[43] These conditions influenced all dimensions of library development, particularly in regard to the library's role in furthering social justice.^[44] They have also contributed in defining libraries functionally as institutionalized organizers of world knowledge and service providers of information to meet the needs of all members in society.^[45] Tracing these central functionalities in the library institutions' activities show a connection between library practice and social justice elements, for example, in providing information access and outreach to underserved populations that runs deep in the history of American librarianship.^[46]

The nineteenth century saw the dependency of democracy on capitalism sow the seeds for social justice to meet the needs of educated workers and informed citizenry.^[47] Though not entirely based on a "capitalist agenda," American public schools and libraries responded to the social expectations in providing expanded collections and services to meet the demands of these intertwining needs.^[48]

The concept of social justice was not yet developed, yet principles of equality, justice, and fairness of service were espoused by libraries, even though they had little control over their own fate since they were a voluntary institution (i.e., people did not have to use them) and highly dependent on public financing.^[49] An increasing pressure to provide free access to information in the early nineteenth century^[50,51] solidified middle class sympathy for the library, contributing to an expanded social justice agenda. Additionally, tax-funded library development in the mid-1800s represented the following liberating roles to further social justice elements in library work:^[52]

- Library facilitation of social justice activities promoted equity in literacy services, supported fairness in information access to the middle-class, and incorporated elements of a welfare state in expanding their services to cater to all segments of their communities;
- Increased marketing efforts by the public library as "people's universities" allowed opportunities for all to learn^[53] and where immigrants could Americanize so they could find jobs;^[54]
- A growth in the community's stake in the public library as a result of its tax investment^[55] provided a regular income for the public library and helped in its growth as a community's center, cultural hub, and agent of social justice.^[56–60]

Important milestones and events for libraries in 1876 (e.g., founding of the American Library Association (ALA) and publishing of the *Library Journal*, first edition of the "Dewey Decimal Classification," and the U.S. Bureau of Education's "1876 Report" entitled *Public Libraries in the United States of America: Their History, Condition, and Management*)^[61,62] provided liberating possibilities for social justice activities resulting from the library's increased power base in a consolidated professional body and development of organization and representation tools to meet the information needs of people on society's margins.^[63]

During the period between 1890 and 1925, when semi-rural, small villages began growing into metropolises of more than one million inhabitants, libraries represented hope in the future and trust in progress.^[64] Free public library service promoted literacy,^[65] and the development of traveling libraries actualized the library's mission to provide service to far-flung immigrant communities.^[66,67] For example, between 1896 and 1914, Lutie Stearns, a founder of the Wisconsin Free Library Commission, campaigned extensively engaging in lobbying amongst small-time elites (even though such political expedencies sometimes conflicted with her democratic ideals) for the establishment of public and traveling libraries.^[68] It was such efforts and the vision motivating the actions that facilitated and consolidated the library's role as an information provider.^[69]

Expansion of free library services and construction of library buildings with expanding collections, under the generous bequests of industry leaders and wealthy, civic minded men like Samuel J. Tilden, Andrew Carnegie, and others, provided yet another opportunity for the library to further its social ideals in reaching out to a greater number of people.^[70] The generosity of industry leaders allowed libraries to extend their services in contribution towards the overall welfare of society (e.g., Carnegie libraries that were developed around the country) by creating jobs and furthering the economic wheels of a capitalist society, with its demanding appetite for a consuming middle class and literate working class.^[71]

Martin^[72] documents a rich and extensive history of the public library in the United States during the twentieth century as a reflection of prevailing sociocultural conditions during various times. For example, similar to the earlier periods, public library service in the twentieth century responded to a focused capitalist agenda to create a middle class with informed decision-making abilities, who could engage in productive work and contribute economically as a market segment owing to their significant buying potential.^[73,74] Libraries played a significant role by portraying themselves as socially uplifting agents, developing library services to meet the needs of European immigrant populations during the foundation years (1900–1917), or during the era of depression and war (1930–1945), and afterwards, where the focus was on economic recovery and revitalization. During these times, the library provided liberating directions for social justice outcomes in nurturing just and fair ideals, expanding the base of impact to include outreach populations, creating a service-based ethics in the profession, and forging partnerships with community-based social justice agencies towards common goals.^[75]

The twentieth century saw public libraries explore models and changing service philosophies to their patrons and user communities through lifelong learning, support for democracy and intellectual freedom.^[76] In the early 1900s adult services in public libraries were part of an extension and outreach movement and later the national adult education program during 1920–1930^[77] that extended the idea of library service to different underserved populations with “active transformations” of their collections, services, resources, and staff “into programmatic responses relevant to community served.”^[78] A series of essays in honor of Margaret E. Monroe identified the four basic adult services functions to include information, guidance, instruction, and stimulation,^[79] the last considered “a library’s response to community needs along the continuum from highly innovative to extensions of existing services.”^[80]

There were many library efforts to reach out to the poor and immigrant populations during the last century.^[81,82] While the record is certainly mixed in terms of effectiveness of service, and not as extensive as one would hope,

several noteworthy efforts can be considered.^[83] In *Libraries, Immigrants, and the American Experience*, Plummer Alston Jones Jr.^[84] presents a thoughtful and well-documented volume on the historical interaction between American public libraries and immigrant communities from 1876 when the ALA was founded through 1948, when the ALA Committee on Work with the Foreign Born disbanded. Phyllis Dain^[85] took issue with earlier critiques of libraries that essentially viewed them to be a creation of the social elite and recognized that a variety of people, including immigrants, believed in the value of reading and use of libraries. Gratia Countryman who led the Minneapolis Public Library from 1904–1936 and her contemporaries believed in social justice ideals making the library more user-friendly and open to all of the area’s residents, regardless of age or economic position.^[86] Similarly, many “revolting librarians” of the 1960–1970 era shared a similar faith in social justice ideals and reflective resistance towards expanding library service provision beyond its complacent boundaries and scope of activities.^[87]

Historians of American librarianship (as well as in what later became identified as a related discipline of information science with the advent of computers during the closing half of the twentieth century) have traced its philosophical, theoretical, and sociohistorical roots to reveal directions for its future development.^[88] These included social justice activities and initiatives, even though the rhetoric and vocabulary of “social justice” had not been significantly incorporated into the mainstream profession. For example, Shera’s (1903–1982) work on the foundational principles of librarianship, the library’s role in promoting literacy and its relationship to democracy, and identification of connections between librarianship, documentation, and information science have had a profound influence on the “conceptualization of public library service by the profession’s leaders as it has been transmitted and reconfigured for each changing era.”^[89] Similarly, Ditzion^[54] saw the library as an advocate for democracy and education to develop a reflective and engaged citizenry capable of sound decision-making and participation in a democratic life.^[90]

The twentieth century saw a number of policy reports and guidelines published by the ALA and others that present ideals, professional tools, directions, bench marks, and codes of ethics to apply in current library practice on how to have a greater impact on the community in terms of a social justice discourse. For example, the *National Plan for Public Library Service*^[91] developed and implemented by the ALA’s Committee on Post-War Planning during 1947–1952, focused on the Public Library Inquiry, a professional legitimizing effort that served as an “exercise in identity creation that relied heavily on the role of the public library as a sustaining contributor to American democracy.”^[92] Post World War II library support programs (e.g., ALA’s War on Poverty) during the

next two decades helped strengthen professional interlibrary relationships and build national consensus on library service conceptualization and outreach mission definitions.^[93] Several ALA publications during this time played a major role in shaping library ideals as rhetorical uplifters of the downtrodden, leading to extended dialogue, passionate discussion, and clarity in defining the library's perceived activism and its mission of serving poor people.^[94,95]

Similarly, since 1968 when the ALA established a Coordinating Committee on Service to the Disadvantaged (that eventually became the Office for Literacy and Outreach Services), there have been several professional forums that were initiated to represent the needs of the underserved (e.g., the Subcommittee on Library Services to Poor and Homeless People, the Social Responsibilities Round Table (SRRT) and its Task Force on Hunger, Homelessness and Poverty, etc.).

Recently, there have also been non-mainstream efforts to return to the heritage of "traditional library service,"^[96] serving the needs of diverse library users,^[97] developing tangible measures of the impact of library and information services^[98] on the lives of the disenfranchised, and "learning from the voices of the customers, the staff, the processes, and the organization."^[99] These and other similar shifts have allowed for recent experimentation and implementation of progressive library activities targeted towards the needs of various disenfranchised populations based on race,^[100,101] ethnicity,^[102,103] class,^[104,105] gender,^[106,107] disability,^[108,109] sexual orientation,^[110,111] age,^[112,113] and other variables associated with institutionalized social exclusion. It has provided for an appreciation of the convergence in ideals, motivations, and pragmatism in public library service delivery and its philosophy to meet the needs of specific communities based on local library planning and decision making.^[114]

The lessons from the past are today providing libraries directions to develop a new approach that recognizes: 1) importance of outcome-based, socially relevant evaluation methods in assessing library services;^[115] 2) value of local experiences and ontologies and their representation into formalized organizational tools of information; and 3) necessity in building equitable partnering efforts with disenfranchised constituencies.^[116] This has been, in part, a result of external pressures from federal, regional, and local funding agencies (e.g., the National Institute for Museum and Library Services), that have incorporated the social relevancy of library projects as strict criteria in their missions and guidelines for grant proposals.^[117] The funding of library projects with strong social relevance, in conjunction with leadership initiatives such as those spearheaded by the U.S. National Commission on Libraries and Information Science (NCLIS), are providing recognition and representation of the social value of libraries and librarians in circles of power. There is increasing external political expectations and pressure to provide the

necessary support for libraries to expand their collections, services, programs, and other creative outreach partnering efforts for disadvantaged and underserved constituencies. This has called for the library's expanded role in social justice efforts to equalize power differentials in society and partner with underserved populations as equals who bring a change in their own lives with support from others (such as LIS professionals).^[118,119]

Moreover, recent Library 2.0 efforts in the twenty-first century for information professionals to respond to constant contemporary changes by purposeful involvement of users in the design and evaluation of library and information services^[120,121] has also provided some opportunities to expand the social justice missions in LIS work.^[122] For example, Library 2.0 developments in the design of specific services, policies, procedures, programs, and technologies has required adopting participatory, collaborative and social applications via the Internet.^[123] This has furthered social justice elements of building capacity, providing value to individual experiences, knowledge, and contributions, and thereby, shifted an earlier biased library service mission of helping people to "helping people help themselves."^[38] It has resulted in efforts to equalize past power dynamics between the library and the library user and provided positive changes in public perception about the library, thereby increasing its role and function in society.^[124]

CRITIQUE OF SOCIAL JUSTICE IN LIS

Libraries today are considered notable models of service to local and recently global communities, and are expected to be unequivocally immersed in pursuing this dictum.^[125] But the implications of such a position for libraries, in terms of a social justice agenda, are not quite clear. LIS and its professional service orientation can be considered from a social justice perspective, specifically by examining the underlying power vested in libraries that has been historically perpetuated through a social contract in the American public sphere.^[126]

The assumption is that as a public institution dedicated to represent diverse social constituencies, and because of its role to provide information based on the needs of those it characterizes as "marginalized," outside society's acceptable domains, the library acquires unstated power because of this mandate to serve.^[127] For it is the library (as defined to include the institution and its library board, library director, and library staff) that decides its patrons or customer base and their information needs.^[128] It is the library that plays the role of gatekeeper and determines what resources and information to include as a part of its collections, services, and programs.^[129] This has developed a reputation of the traditional American library as an advocate of justice and a provider to the information needs of the underprivileged, based however, on

sometimes biased conceptualizations and limited understanding of people on society's margins solely in terms of their deficient characteristics.^[130] Historically, as discussed in the following critique, such unfair library practices were not always effective in changing the status-quo, and instead, may have sometimes continued to perpetuate gaps between the haves and have-nots.^[131]

Libraries as institutions that advance the "dominant culture's ideology" and symbolize places for the privileged and select scholarly^[132] can be traced back to the first "subscription library," established in 1731 by Benjamin Franklin and open to all who could afford the fees.^[133] The nineteenth century provided an environment that offered a limited role for libraries to meet social justice criteria in their work, constrained that libraries were by curtailing sociopolitical, socioeconomic, and sociocultural circumstances of the times.^[134] For example, the expanded collections and services in libraries of the times were initially limited to only those who had the money to access them.^[48] Owing to fee-structure, slavery, and a limited role of women in society, access to information was based on class and income, and subsequently on race and gender, amongst other variables.^[135] The increasing pressure to provide free access to information in the early nineteenth century^[50,51] and the solidified middle class sympathy for the library resulted in little connection with the needs of people on the ethnic margins (i.e., the indigenous Natives, Blacks and other people of color, and women from the lower middle classes).^[136] Additionally, tax-funded library development in the mid-1800s to meet the whims and demands of the privileged classes^[137] represented the following limited role for libraries to further social justice:

- Library dependency on the public tax monies provided greater power to the growing middle class white population that had control over the library budget and became the guardians and dictators of the library's policies, programs, and collections,^[138] leading to a minimal focus of library services to serve the information needs of others;^[139]
- It led to increased library efforts in aggressive public relations and expansion in their services catering primarily to appease the largest and the loudest in the community since libraries perceived them to have the greatest influence over the allocation of tax revenues.^[140]

Further, the important milestones and events for libraries in 1876 led to limiting inward-looking professional trends and practices of library leaders of the time to deliberately disengage with their local constituencies that has generated negative public criticism owing to their lack of perceived currency and relevance to everyday lives.^[141] At the same time, the concept of "the public" in the public library of 1876 was understood as anything that was not in strictly private hands, open to any segment of the population.^[142] A closer exploration of the culture and history during this

time suggests that the seemingly democratic notion of the "public" was more rhetorical rather than demonstrated action.^[143] The "public" in public libraries was largely homogenized and "imagined"^[144] to represent forces of economic, urban, and cultural development,^[145] resonating with the religious beliefs and image of the majority.^[146] Such a critique of the public library has been presented by Michael H. Harris and Gerard Spiegler,^[147] who have asserted that Edward Everett and George Ticknor, advocates for the establishment of the Boston Public Library in 1852, were "elitists who supported libraries and education as one way of raising up an 'aristocracy of talent and intellect' which would provide benign and enlightened leadership to the masses." This image of some public libraries of the time reflected the profession's own marketing agenda to retain favor with the growing middle class in order to hold-on to its tax support.^[148]

Historical research indicates that women on the public library frontier were its strong backbone^[149] actively involved in raising funds, lobbying for tax-support, and implementing outreach programs.^[150] Yet, as in many levels of society at the time, women's role to improve society through libraries and their equal representation in the library was hampered by their lack of voting rights and status as second-class citizens.^[151,152] It often led to an unfair position for women librarians, for example, even as late as 1903, when Gratia Countryman in Minneapolis became the first woman to head a major public library, her salary was set at \$2000—\$1000 less than her predecessor who was a white male.^[153]

In addition, public library service to racial and ethnic minorities was far from equitable levels since these populations were quite "invisible" and faced many barriers to becoming recognized as part of the "public" domain that the library claimed to serve during this time.^[154] For example, unequal and biased trends in public library services to non-white communities would continue till the 1960s shaped as they were by issues emerging from racial segregation and prejudice in their struggles for fair distribution, quality, quantity, and the development of services, collections, and availability of resources and opportunities.^[155,156]

The funding and support of libraries by wealthy industrialists and capitalists had definite implications for improved service, accelerated progress, and library development;^[157] it also resulted in the economic growth of the middle class that contributed in filling the pockets of the miniscule upper classes, who continued to grow richer and richer, strengthening their social control on the capital investments and industries, and thereby maintaining the status quo of widening socioeconomic gaps between those who had power and those who did not.^[158] As Andrew Carnegie himself wrote, that he was motivated in part by the idea of public libraries making "men not violent revolutionists, but cautious evolutionists; not destroyers but cautious improvers."^[159] A possibly well-intentioned and

pacifist idea, though it makes one ponder if library support had alternatively come also from the government (via increased taxes from the upper classes) and federal, state, and local funding, instead of (or in addition to) donations from wealthy benefactors such as Carnegie and others, would libraries have been as dependent on the capitalists' agenda to maintain the status quo and social order and as likely to promote the goals of these elites?^[160] Instead, we might have possibly witnessed more interaction between libraries and marginalized communities, shaping social change and social justice instead of taking a primarily reactive role.^[161,162] But obviously, such a "what if" question may seem irrelevant today since library development did not historically go down that route, yet, it does call for challenging a purist interpretation of the noble motives and philanthropic activities of American capitalists in their support of public libraries during the times.

Similarly, parallel to earlier times, public library service in the twentieth century responded to (and was limited by) focused and encompassing capitalist motives that crippled democracy and developed an impotent middle class whose informed decision-making abilities, participation in productive work, and buying potential contributed in making the upper classes wealthy and widening the social, cultural, and economic gaps in society.^[73,74] Embedded in a possibly unintentional hegemonic orchestration of profit-making for their wealthy benefactors, at this time, the development of libraries was limited in their inability to become truly culturally responsive agents.

Moreover, the vision of the library's role as an information provider was possibly facilitated without questioning the ingrained power imbalance between the library as provider and the disenfranchised population as the needy who required betterment and uplifting.^[163] In this case, the community was viewed solely in terms of a unidirectional impact of library services on the community's knowledge-deficient and information-impooverished conditions.^[164] This perspective assumed an active role for librarians and a passive role for the community as an inert receptor and consumer of library services. The activeness of libraries and the passiveness of a homogenized, deficient community perpetuated the profession's image of striving to improve the conditions of the needy members in society; helping those who were completely passive and helpless to better their own conditions. This perspective partially led to a failure of public libraries to significantly engage with a majority of disenfranchised Americans to actually use the libraries and adequately respond to new cultural and intellectual challenges of the day.^[165] Contemporary trends recognize the limitations of past service-based ethics in the profession (e.g., biased language constructs reflecting imbalanced power dynamics) and are moving towards adopting more progressive concepts and practices (e.g., community engagement, community-based action research, collaborative learning, etc.).^[166]

Historians of American librarianship have drawn flack in recent years for not taking a more aggressive stance to further social justice in their identification of future directions for the LIS professions in order to overcome the debilitating political and economic circumstances historically presented by a capitalist society. For example, critics of Shera's work identify important limitations in applying some of Shera's ideas into actual practice and creating library activities that could shape social conditions in the community and impact the everyday lives of disenfranchised people in meaningful ways.^[167] Similarly, not only did Ditzion overlook the significance of key library developments including youth services librarianship,^[168] he also ignored "long-standing gender stratification in the profession" (similar to other professions).^[169] Also, Ditzion's view of librarianship as democratic agents limited the efforts by libraries to affect social change beyond the profession's self-conceptualization as a knowledge storehouse and information provider.^[170]

Further, the post World War II library support programs and publications during the next two decades (e.g., ALA's War on Poverty) continued to remain essentially within the limited sphere of the national association, having little or no impact outside of library circles in local communities and at political and legislative levels of decision-making. For example, the *National Plan for Public Library Service* and other such subsequent efforts further perpetuated library efforts away from a social justice perspective in recommending public libraries to minimize their role among the lay public, and instead, focus more on gaining favor of only the most powerful opinion leaders in the community,^[171,172] that invariably resulted in the possible exclusion of disenfranchised minorities and those outside the influence of library domains from receiving services.^[173] An important note to make is that though the profession never completely endorsed this view nor was this strategy formally adopted by the ALA,^[174] better services for opinion leaders is a de facto practice in many libraries (e.g., reflected in the contemporary practice of selective dissemination of information that focuses on providing the "right" information to important leaders and others in the community based on a study of their interests and topics of concern to gain their favor).^[175]

Much professional energy and resources in the ALA were applied in dialogue and publications,^[176] with little action that would affect any real change in the marginalized lives of the poor and the underserved.^[177] Additionally, past ALA and other library initiatives have been criticized for their top-down focus on library leaders and administration, rather than facilitate any action for social change and extend involvement of others beyond "mainstream middle-class practices and values."^[132] Similarly, ALA's efforts since the 1970s have encouraged professional discussion and conceptualization, identified national standards as "one fit" for all,^[178] and built networks for librarians, strengthening ties within the "inner circle" of the privileged group,

though it is debatable if in the past there have been any significant inroads beyond these bureaucratic and administrative policies and procedures.^[179] For professional library avenues to represent dialogue about the underserved have included only very limited outside (beyond the profession) community members from the marginalized populations being discussed.^[180] American Library Association's role at local community levels has thus been limited, and ALA representation and participation in external efforts at national, regional, and local levels in legal, policy, and political avenues has also been minimal.^[181]

From a critical perspective, ALA's activities reflect its mission that focuses on efforts "to provide leadership for the development, promotion, and improvement of library and information services and the profession of librarianship in order to enhance learning and ensure access to information for all."^[182] It has essentially been concerned with solely professional networking, internal mobilization, and creating limited political and public representation.^[183] Contemporary democratic expectations to develop greater professional relevance of LIS warrant an expanded mission of ALA to include a proactive focus on outcome-based, community-level efforts that promote active participation of minorities and help develop stronger impacts on local communities.^[81,82]

Over the years, there have been internal philosophical struggles in the ALA and the Public Library Association (PLA) towards realization for a process "that would reflect local community needs."^[180] Lack of consolidated strategy, cultural inertia, and administrative lethargy have limited library professionals in only looking at the user in the life of the library, rather than the library in the life of the user.^[184] Since the 1980s though the PLA decided to move toward a community-oriented, user-focused planning process for development of public library services,^[185] and the first version of its planning manual recommended extensive needs assessment and community analysis; several iterations have emerged since but the goal is still (at least in principle) to establish guidelines to develop a best match between services and the localized needs of all members in different communities.^[186]

As a result of a lack of consensus, however, libraries have been struggling to mobilize public opinion of library relevance and credibility for users, and to find ways to enable local communities to build and sustain capacity.^[187] The recent non-mainstream efforts of "traditional library service" to serve the needs of diverse library users have also been partially successful, however, because they followed the traditional models of library service provision that did not go beyond knowledge organizers and information providers and struggled with classism and elitism "that pervade the library profession."^[179]

Historical developments in information science research in the United States with its deep roots (philosophical, symbolic, and tangible) in librarianship^[188] have incrementally allowed for an integration of social justice

imperatives in the LIS professions though they also inherited a limited (and often slow) tendency to shape social justice outcomes.

Pioneers in the field of documentation, a precursor to information science, maintained a humanistic view in their work.^[189] Paul Otlet, a central figure in the early documentation movement and his colleague Henri Lafontaine worked until the mid-1930s in developing universal organization schemes and storage and representational systems (e.g., library classification and library catalogs), promoting the notion that knowledge should be made available to anyone who needed it, and that organization and access to world knowledge could be integrated into efforts to promote a more peaceful and just world.^[190,191]

Over the years, information organization and classification have been recognized and critiqued as tools for including and excluding, for validating and universalization and reinforcing a dominant worldview, on the one hand, and for silencing and their transgressive potential to represent marginalized knowledge domains, on the other.^[192,193] As a socially constructed tool, classification imbues power in its role as the "scaffolding of information infrastructures" to develop a systematic (though invariably biased) process of categorization and creating like and unlike groupings for understanding and retrieval purposes.^[194,195] From the International Classification of Diseases, Library of Congress Subject Headings, Dewey Decimal Classification, to the Nursing Interventions Classification and race classification under apartheid in South Africa, amongst other examples, all categories and standards involve some form of bias and partiality. In order to further social justice ideals of fairness and equity in knowledge representation and information practice, the "knowing community" of LIS must continue to question the dominance of hierarchy and linearity, adopt fuzzy logic and web-like structures (instead of the pyramid), provide multi-lingual and metathesauri interfaces between standards, and augment traditional standards via cluster analysis to "enhance the situatedness of syntagmatic relationships," amongst other strategies, to rectify imbalances and better serve a diversity of users.^[196]

A focus on access to information and information dissemination in the early twentieth century provided a conceptual opportunity and rhetorical space to question and philosophize the nature of LIS professions at a later date and to integrate social justice elements of fairness and equality for all.^[197] At that time, however, such trends provided a broad, sweeping, and ambiguous goal of information access, leading to an unsatisfactory systems-centered approach for the design of information systems and services that was eventually found to be limited in meeting the information needs of users, especially in the scientific communities.^[198] A particular focus was placed on the adaptation of users to information systems outputs rather than creating information systems that were user-driven.

Information was seen as objective, and users were seen as simple processors of information.

With the goal to improve information services,^[199] the emergence of the user-centered paradigm in the 1980s as an alternative (or addition) to system-focused research and study of human information behavior in developing more effective and usable computer systems in information sciences^[200] provided a shift in making people the focus of study, instead of systems and technologies. This had an indirect bearing upon social justice agendas. For example, understanding the user's perspective in information seeking and use^[201,202] and in processes associated with information seeking, information gathering, and information giving,^[203] the concept of usefulness in the assessment of information services^[204] and the importance of psychological relevance and other relevance studies,^[205] all represented fairness in social justice by acknowledging the existence of the human being involved in the interaction with systems and services, even if people were considered as abstract entities from a purely theoretical perspective.

Similarly, research on human interactions with information systems provided another area where a focus on user's problems in the process of information seeking situations,^[206–208] and the user's evaluation of usefulness of information for resolution of the problem,^[209–211] had limited relevance to social justice that does not narrowly view just one "problem" that LIS users face in their lives, as conceptualized and addressed in such work. A social justice construct regards the entire experience of users (including their economic, political, social, and cultural realities that limit their access and effective use of technology and information) as a "problem" (if one identifies the meaning of the word as a barrier or hindrance) to their well-being, advancement, and change in social status.^[212,213] In such a context, evaluation of information provision must be taken into account in terms of meaningful integration and use of information within people's entire experience. Strategies to measure the effectiveness of information provision, and the usefulness of information resources and support mechanisms, must not identify them as isolated avenues, but their design, implementation and practice need to be expanded via studying their impacts in people's entirety of experiences in order to reflect what is really meaningful to people using them and how does it change their status and position in society.^[214]

An important idea about focus on the personal meanings that users seek from the information^[215–217] is relevant to social justice in terms of recognizing the personal experiences of users in their meaning-making process and decision-making. Here too, social justice translates the idea from a narrow application of meanings from "information" to making sense of meanings in relation to the entire experience of learning to further users' power and status in society.

The notion of construction of learning in information seeking as a process, and its dynamic nature, has been

proposed in other prior work such as the analogous state of knowledge hypothesis,^[218] where the researchers lay out the process of the user's information seeking from identification of the user's problem to finding a solution that satisfies the information need and solves the information problem. In situations where there is not a specific problem at hand, but the entire nature of experience has to be understood and negotiated (to improve one's "disenfranchised" sense of being), a broader framework is called for, to reflect the nuances and reality in the different and larger situation. Similarly, Taylor's significant work on information use environments^[219] and levels of information need in terms of visceral (actual but unexpressed), conscious (internal description in the brain), formalized (formal statement of need), and compromised (presented question or query) also provide limited understanding of constructive process and learning experiences in its focused application of information seeking that bypasses social justice outcomes of larger economic/political/social changes in people's lives.

As noted by Case,^[220] several researchers assert that understanding individual users' information needs is among the keys to improving information systems. Information needs are often described as being initiated by people's attempts to address everyday challenges or resolve uncertainties or knowledge insufficiencies. For example, Dervin^[201,202] asserts that information behavior begins when a user acknowledges a gap in her/his knowledge of how to deal with a life situation. Marchionini^[221] positions information seeking as a problem-solving activity "a process driven by life itself" (p. 128). Krikelas^[203] describes information need as the general recognition of the existence of uncertainty. Understanding the cognitive processes in which users engage has also been recognized as an important way to improve information systems.^[222–224] One of the most widely used frameworks for studying cognitive processes associated with information seeking and use is Dervin's Sense-Making approach. Sense-Making focuses on the notion that individuals who have information needs experience a cognitive gap that prevents them from making sense of a particular life situation, and they seek information to fill that gap. However, during this information search, an appropriate course of action is not indicated, and the individual is placed in a situation where "making sense fails." As the user collects information in the gap phase, s/he learns more about her/his situation, becomes better at interpreting it, and then is able to select a course of action or behavior that helps her/his make sense of the particular situation.^[201,202] Dervin's sense-making triangle of situation-gap-use as a perspective to understand user's information seeking and use processes provides an opening view of social justice in focusing on the user and acknowledging peoples' information use to "make sense" of a "gap" in a specific "situation" that the user experiences.^[225,226] Further, social justice must involve collecting information that addresses not one particular "gap" in a situation, but

gaps in the entire reality of experience based on lack of knowledge and power to change one's state of being.

Pettigrew et al.^[227] indicate that since the early 1990s, a key characteristic of information behavior research is a body of theory that emphasizes contextual interplays of cognitive, social, cultural, organizational, affective, and linguistic factors of information behavior. They assert that this research stream supports the notion that information behavior phenomena are part of the human communicative process. Study of context in information science research provided a recognition of the role of situational dynamics in the processes associated with people's interactions with various information systems and technologies.^[228] Such work, important from a theoretical and descriptive point of view, has indirect bearing on social justice agendas in its identification of user's learning of information systems and services as a complex mechanism where individuals go through a dynamic process in learning about a particular subject or "becoming informed." It represents fairness by acknowledging the existence of the human being involved in the human-computer interaction.

Nahl^[229] argues that cognitive processes are strongly connected to the emotions that users experience as they use information. Identifying an emerging affective paradigm in information behavior research, the researcher goes on to assert that given how deeply humans feel in response to information in newspapers, books, libraries, Internet, etc., it is critical that LIS professionals understand these emotions in order to maintain and improve information services for their constituencies. Affective aspects of information behavior are also often linked to Kuhlthau's information seeking process model (ISP), which describes the triad of thoughts, actions, and feelings associated with information seeking and use.^[230] There is need to further this model via studying the role of the "classic triad" in the lives of "marginalized" and the information poor to examine how they negotiate and change their realities to represent social justice outcomes.

A wide variety of information behavior context studies have been published in recent years that are relevant to examinations of social justice in LIS. For example, Spink et al.^[231] discussed word-of-mouth information seeking within multi-member, low-income African-American households. Hersberger^[232] examined whether economically poor people are information poor. Chatman^[104,105,233,234] explored the information needs, seeking, and use of under-served groups such as female prisoners and poor rural residents. Saumure and Given^[235] investigated the information behavior of visually impaired students. Bilal^[236] reported on how children used online search engines, and Mehra^[237,238] examined the cross-cultural learning process of international students to propose "two-way" learning outcomes where both international students and American academicians/students learn from each other.

Broader contexts have also attracted the attention of LIS researchers. Van Dijk explored how information

divides are emerging within and across demographic groups in all societies.^[239] Others position librarianship as a tool of economic and social change in the developing world.^[240-242] Seidelin and Jensen^[243] presented frameworks for how libraries can be involved in efforts to minimize HIV/AIDS, poverty, and corruption.

These are but a few areas in current LIS research that reflect social justice philosophies, methods, and/or results. In the years to come, LIS professions will continue to engage in more of such work that use social justice parameters to frame, apply, and represent needs of underserved populations in society towards the design and development of fair, equitable, and just information systems and services that are meaningful to disempowered people and empower them to promote proactive changes in their lives.

CONCLUSION

Historically, a strong emphasis on humanism and fairness in both library practice and LIS research suggests that the first formative stages of a theory of social justice in LIS are clearly present. Future directions will include greater development of LIS-specific social justice theory in order to promote active and efficacious social justice agendas in the profession. We are seeing first steps in this direction as reflected in wide-ranging efforts to develop, test, and apply new concepts, terminologies, and methods (e.g., community informatics, community engagement, participatory action research, to name a few) that share intersecting elements with social justice to push the boundaries of traditional LIS conceptualizations towards more progressive outcomes.

The active involvement of LIS professionals working on society's margins in influencing positive social justice changes is imperative. Results of LIS involvement in select social justice activities can be evidenced in steady increases in library users and the increasing role of LIS professionals in shaping the form of library collections (e.g., fiction) and other services (e.g., local programming and events) to directly meet the needs of their local communities to empower their lives.^[244]

In spite of these recent efforts, in sum, historically libraries and LIS research in the United States have been effective in bringing only moderate socially progressive changes in their communities, trapped that they have been within limited social justice parameters and constraints owing to their permitted roles within a socially structured fabric, community values, and academic streams of thought. Contemporary trends in twenty-first century LIS development, are however, showing a marked shift in attitudes, practices, management efforts, and planning to integrate social justice goals and outcomes in both practice and research. For example, positive changes and trends in LIS have included the use of computers in library

and information environments to meet the information needs of various user/customer/patron/client constituencies (as variously defined) via their active and ongoing participation in assessment and evaluation of LIS services (e.g., library–community partnerships to host computer literacy training workshops, use of social tagging and Library 2.0 software, to name a few).^[122] Such continued efforts to re-engage with local communities in terms of newly constructed modes of interaction will help to further integrate social justice ideals into LIS practices and build equitable relationships with people on society's margins to develop effective library services, programs, collections, and activities that are meaningful in the everyday lives of all members in society.

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Social Networks and Information Transfer

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Abstract

Information exchange, transfer and flow can often depend on the motivations of individuals who share that information. This in turn depends on the relationships they maintain with others, and the networks of information sharing resulting from their interconnections. This entry describes the attributes of social networks that facilitate or inhibit the exchange of information, how to discover these networks, and how different configurations of networks can constrain or facilitate information transfer.

INTRODUCTION

When people engage with others they transfer information. As they recount stories, discuss ideas, share opinions and experiences, they tell others about themselves, the activities they engage in, and the people with whom they engage in these activities. They transfer knowledge about processes, information about resources, and data about their experiences with others. This information can transfer in a one-to-one, one-to-many, or many-to-many distribution through conversation and instruction, by example or observation, and face-to-face or mediated through computer technologies. Each such transfer forms a connection with others based on a decision about what information to reveal, where, when and to whom. Such choices are tempered by expectations of who will hear or receive the information, how far the information might travel, how sensitive or timely the information is, and how well the speaker knows the audience. Patterns of connectivity, revealed by who transfers what kind of information to whom, are both formed and reinforced by existing knowledge of others. Together, the “ties” formed by information transfers between “actors” build “networks” with routes along which information travels, bridges that carry information from one social circle to another, and cul-de-sacs where information dead-ends or circulates repeatedly among the same set of friends.

This entry addresses the interplay between social networks and information networks, i.e., the way ties between individuals affect information transfer within social settings. The entry addresses who shares information with whom, what facilitates or inhibits information transfer, and how network configurations affect who receives what kinds of information.

INFORMATION NETWORKS

For the purposes of this entry, “information” is taken to refer to the intangibles of data, information, or knowledge, with no restriction on the type or purpose of the transfer, nor of the medium used for the transfer. Data on stock prices may be transferred by paper, phone, or e-mail, between brokers and clients or between friends, for investment and profit or for learning and fun. Information on health problems may transfer through online support groups, from doctor to patient, or among care-givers, for purposes of social support, medical intervention or symptom management. Knowledge on how to fix a car may be passed from parent to child through example and joint practice. In each case, while one can point to the conversation or the email text, it is not a tangible that has been transferred: the stock, the health problem, the car remain where they started. The information passes from one person to another while remaining with the originator. In this way, information networks have the potential to saturate as everyone in the network becomes aware of the same information.

As in most understandings of information, the potential for unlimited, undistorted transfer affects its value.^[1] In some cases, value may be preserved in the timeliness and exclusivity of the information, e.g., in having inside information, and in restricting who has access. For other purposes, information is most beneficial when widely disseminated, e.g., as in the diffusion of health information or awareness of a product for sale. In that case, the goal is to facilitate information movement in a network. As will be discussed below, social network structures play a role in how easily information circulates, and thus our ability to transfer information easily to others or to retain control over its distribution.

Mobilized or Accessible Information

Information transfer can happen in two ways: as direct transfers from one individual to another, or by common experience, e.g., co-attendance at events, lectures, etc. This distinction mirrors one made about social capital by Lin^[2] between “mobilized” and “accessible” resources embedded in social structures. Mobilized resources are those that are brought into use for some outcome. For example, by asking others about job opportunities we bring out their knowledge for use in our job search. This is somewhat analogous to explicit knowledge, i.e., articulated information that we make a conscious effort to transfer. Accessible resources are those that are present in a network and potentially available for use. This is somewhat analogous to the idea of tacit knowledge, now considered at the network level. For example, the tacit knowledge of knowing how to behave in a social situation, or how to perform a particular routine task, is something that can be accessed by others, but is not normally explicitly discussed. According to Lin, social capital depends on the “resources embedded in a social structure; accessibility to such social resources by individuals; and use or mobilization of such social resources by individuals in purposive actions. Thus conceived, social capital contains three elements intersecting structure and action: the structural (embeddedness), opportunity (accessibility) and action-oriented (use) aspects” (p. 35).^[2]

Building on this, we may think of information in terms of mobile and accessible forms. Mobile information includes transfers from one person to another of factual information, social support, skills, ideas, opinions, and collaborations, such as working together, socializing, or creating common understanding. By contrast, accessed information includes common knowledge created by living in the same culture, working in the same organization, or attending the same events. However, the information must be present in a network in order for it to be mobilized or accessible. Hence, the embeddedness of information in a network determines how much social capital (or we might say information capital) is possible for network members to access. Thus, too, the structures that connect the network to other larger circles of others also affect the social capital of a network. Lin’s analyses^[3,4] stress how network structures, for example cultural hierarchies, and the embeddedness of individuals within that structure, affect their access to resources, such as information on jobs. Since many of the resources that translate into social capital are accessed through information, there is much synergy in the work on social capital and on information transfer. We return to the ideas of mobilized and accessible information throughout this entry.

SOCIAL NETWORK FRAMEWORK

The basics of social networks are straightforward: “actors” maintain “relations” with others which form the “tie”

between them. The collective set of actors and ties forms the “network” of connections among all members of the particular social set. Analyses and visualizations of networks follow graph theory with the actors as the nodes and relations as lines between nodes. What follows is a brief description of these social network features. For more on social network analysis techniques, introductory texts, and edited collections, see the Bibliography section at the end of this entry.

Actors

Actors are connected by the individual relations they maintain—giving instructions, providing help, sharing resources. Collectively, this set of relations defines the tie between the actors. The challenge in examining networks is defining the set of actors to examine—i.e., the boundaries to the dataset or limit to the data collection—and the relation or set of relations to map. For studying information, many kinds of information transfer, exchange or sharing can be examined, from help on how to solve a problem to emotional support in a crisis. These different kinds of relations can describe different configurations within the network which in turn can affect the way information circulates the network as a whole.

In most cases the actors we are concerned with for information transfer are people: members of a team, employees in an organization, students in a school, or residents of a community. However, in network analyses, larger units can also function as nodes in the network. Thus, a school may be an actor in the network of educational institutions, a business may be an actor in an industry network. In these cases, information also flows and transfers, as schools receive new educational plans from boards, and businesses retain information for competitive intelligence. While the actors are different, the basic structures for analysis are the same, as are the considerations of what relations create ties between the actors, and how information transfers in networks.

Ties

A tie may consist of one relation only, and thus is entirely defined by the relation. However, most of our ties are predicated on more than one type of interaction, with the intensity and significance of each relation varying according to our particular relationship. This is the basis of the ideas of weak and strong ties. Weak ties are based on few relations of low intensity or significance. In voluntary (rather than kin-based) ties, weakly tied pairs interact infrequently, about few different things, and via few media, and their interactions involve little or no intimacy or self-disclosure.^[5–9] By contrast, strong ties involve a variety of relations, from instrumental to personal, and tend to entail reciprocal interaction (e.g., favors are returned, whether in the same or a different form).

While the weak to strong continuum is relevant across all kinds of ties, relationships may be differentiated in terms of the combination of relations the actors maintain.^[7,10] A strong work tie can exist that does not extend to social activity, a strong friendship tie can exist that has no work component; and we have kinship ties which remain even if socially or physically distant. The nature of the relationship is bound to affect the kind of information that is likely to transfer between actors, e.g., a work-only tie is unlikely to be a source of personal social support, a friend from outside work is unlikely to be a source of specialized information about that kind of work. Such information is not embedded in the structure of the tie, and thus not accessible to the actors. However, as will be discussed below, differences in what others have access to, is an important feature of information access. Thus, the friend may not know about your work, but they know about their own, and hence that information is accessible to you.

Three characteristics of relations help in assessing the nature of the tie: content, direction, and strength. “Content” refers to what is exchanged, shared or experienced together, for example, specific kinds of information, gossip, small services (e.g., babysitting), social support, cooperation and collaboration, or social services (e.g., helping neighbors). Information or resources may flow in one “direction” only, e.g., as one person gives instructions to another, or as experts show novices how to accomplish a task. Flow may also be two-way, as gossip flows back and forth, advice is both given and received, and group members keep each other aware of innovations relevant to their business. The “strength” of a relation refers to the frequency, intensity and importance of the exchange to the pairs involved; for example, communications may be daily, monthly or yearly, care may be given occasionally or full-time, and social support may be given for a minor or major crisis.

Networks

The ties formed between actors do not exist in isolation. Information transferred from one actor to another can be passed on again to others. Tracing the path the information takes describes the shape of the network. The resulting network may be dense with actors highly interconnected with others, a configuration associated with having high common knowledge because information can circulate through many channels. Or, the network may be sparse, indicating little mobilization of information among the actors. Density may appear in only some parts of the network, showing clusters and cliques of actors sharing information. Network configurations also show how particular actors may be positioned to affect information flow. Network structures and their impact on information flow are discussed further below. We turn now to considering what data to look at to assemble the network.

Data Collection

A major step in mapping networks is to determine the relation to ask about. This may be determined ahead of time, for example, if looking at the dissemination of a particular kind of health information, in using bibliometric data to examine scholarly communication,^[11–13] or examining collaborations.^[14] Or, the information transfer may be determined from the activities occurring among network members, e.g., in examining what kinds of interactions constitute a community,^[15,16] a learning network^[17,18] or a collaborative team.^[10,14,19]

Data to describe the network can be gathered in a number of ways. One typical way of collecting social network data is to ask the actors about their information transfers: Who have you given support to during a major or minor crisis? Who learns from you and who do you learn from? Who do you discuss important matters with?^[10,20,21] Other data sources include observations, legal and historical documents, and the wealth of traces left by our electronic activity, e.g., in e-mails (e.g., Diesner,^[22] regarding who knew what and when in the Enron business scandal) or web linkages.^[23]

Coauthoring and co-citation data reveal networks of collaboration, collegiality and common knowledge. Although beyond the scope of this entry to review, these data form the basis of studies of scientific collaboration and science knowledge for the fields of scientometrics and bibliometrics.^[14,24,25] While the terms used to describe the coauthor or co-citation networks are slightly different from those used in social network analysis, the principles of connection through information use and co-orientation are the same (for discussion and comparison of social and citation networks, see White.^[26] Applying this to online activity has given rise to the field of webometrics which parallels the field of bibliometrics.^[27] Here again the distinction between mobilized and accessible information becomes apparent. Data may reflect mobilized information when individuals make a conscious effort to transfer information or knowledge, or connect to another’s work, or the data may be drawn from accessible information, such as citation or web linking behaviors.

Network analysis also has another way to address accessible information. Asking who exchanges what information with whom produces a matrix of information exchange between people in the same social network, e.g., to and from every member of a class. This is known as a “one-mode network,” and it shows mobilized information. Data may also be collected as a matrix of people by events, e.g., showing which scholars attended which conferences. These “two-mode networks” yield both the who-to-whom network of who attended conferences in common, and the event-by-event network that shows overlap in attendees. Thus, a two-mode network is a way to reveal accessible information networks.

With the data in hand, we can proceed to analyzing the social network data. In social network studies the unit of analysis is the relation—the interaction, exchange, transfer or sharing—that occurs between actors in the network. The kinds of questions that can be used to address information transfer are different from typical questions about aggregate behavior. With the kind of network data described above, we can ask questions such as:

- Who shares what kind of information with whom?
- Who uses what kind of technology to transfer that information, and with whom?
- What does it mean to get information directly from someone, or second or third hand?
- What facilitates, or inhibits information mobility within a network?
- How does information circulate in this social system?
- How does the nature of the tie between actors affect information transfer behavior?
- How do configurations of information sharing affect who gets what kinds of information?

We now turn to what social network studies have found about our understanding of information behaviors, and how asking questions such as those above helps inform our understanding of information transfer.

SOCIAL NETWORKS AND INFORMATION TRANSFER

Innovation

Social network studies have revealed a number of interesting and unexpected findings about information transfer. Perhaps the first such finding relates to diffusion of innovations. Where early impressions were of the isolated innovator, adopting new processes all on their own, research by Coleman, Katz, and Menzel^[28] on the adoption of tetracycline, and the many studies on diffusion and adoption of innovations carried out by Rogers,^[29] found that it is the individuals most connected to news sources who first becomes aware of an innovation, and those well-connected with others who have successfully used the innovation who are more likely to adopt it. Although early adopters may be alone in taking up the innovation, they have been embedded in an information network that leads them to be ready to adopt. Cohen and Levinthal^[30] reinforced this point when they identified how some organizations are more ready to adopt innovations than others because of the preparedness of their employees. Attention to information circulating about their kind of work creates an “absorptive capacity” for innovation identification and adoption relevant to that work. Ahuja^[31] also found that collaborative ties between organizations net an information payoff. She found that “collaborative linkages can provide access to knowledge spillovers, serving as

information conduits through which news of technical breakthroughs, new insights or failed approaches travels from one firm to another” (pp. 427–428).^[31]

Social networks—who is connected to whom—matter in exposure to information, and in adoption decisions. While early adopters are well-embedded in information networks, later adopters have the example of those around them when adopting. They can see others’ use, the visible results of that use, and hear about others’ experiences with the innovation. Their adoption decision is heavily influenced by information from those around them. Rogers showed that influence is limited to those in close, trusted relationships with the potential adopter. Information on innovations received fourth or fifth hand is no more influential in adoption decisions than that received from mass media.

Rogers’ work describes in detail the stages of innovation diffusion and adoption and also the attributes of early and late adopters. Earlier adopters are described as more cosmopolitan, and have higher socioeconomic status (higher education, income). In Cohen and Levinthal’s terms, they have a higher absorptive capacity, based on their greater access to and readiness to recognize information useful for their purposes; in Lin’s terms, they have access to greater social capital.

Strong and Weak Ties

Innovation studies show the role of strong and weak ties in information transfer. News sources (weak ties) are important for awareness of new trends; trusted sources (strong ties) are important for influencing adoption decisions. To investigate information transfer further, it is necessary to understand in more detail what composes a strong or weak tie. As noted above, the “strength of a tie” can be built on a number of different kinds of relations, but what differentiates a strong tie is the close association between the people who maintain that tie. When such pairs are asked about what they do together, they typically report more kinds of interaction, more intimacy and self-disclosure, and reciprocity in their behavior; recent studies also show they use more means of communication to maintain contact.^[7,32] They exhibit a greater desire or need to communicate, get together, share experiences, and provide what they can for each other. These attributes are highly relevant for information transfer. Those in strong ties are more motivated to share with each other what information or other resources they have, and the exchange is more likely to be reciprocal. They create strong local bonds, with each actor within that network freely exchanging and sharing what they have so that all network members are aware of and informed by the same kind of information.

The limit to this strong local network is that the people who belong to it tend to be very similar (homogeneous). They share the same socioeconomic status, reinforced by where they live, where they travel, what kind of transport they use to get to work, the kind of news and television

coverage they receive, what schools they attend, and the kinds of the media they use. Thus, exchanges among these people tend to pool information of a similar nature. Local groups may even further restrict information access by scheduling same-sex meetings (e.g., women's groups), or meetings held during daytime hours (thereby excluding working men and women).^[33–35]

A key observation to be made about social networks in general is that time spent with one person or in one network reduces the amount of time you can spend with others. Thus, each conversational choice by necessity rules out another. Even though we often feel that the Internet has extended our ability to communicate with more, distant others, we need to ask how truly different these people are. A recent study by Hargittai of college students reveals systematic differences between users of different social networking sites in terms of ethnicity and parental education.^[36] Hispanics and students were more likely than other ethnic groups to use MySpace, and Asians and Asian Americans more likely to use Xanga; students of parents with higher education levels were more likely to be Facebook users. These findings suggest that even online social enclaves are perpetuating interaction among similar others. Although we may now maintain more extended networks in absolute numbers, we need to continue to question whether these are really any more varied than before in who we meet and with whom we exchange information.

Weak ties are our alternate information route. Since we know these others less well, and hang out with them less frequently, both we and they can come in contact with information different from what we attain in our own networks. Weak ties thus act as a bridge between different social circles. In Granovetter's^[5] words, this is the "strength of weak ties." As well as weak ties, individuals we know well may also function as such bridges, keeping one toe in different social worlds, particularly between work and home, and thereby bringing information from one world to the other. In the contemporary world, this also means bringing the means of access (i.e., computers) and skills about access from one world to another, and in particular from work or school to home. Studies by the U.S. National Telecommunications and Information Administration (NTIA), showed that in 2001, 77% of households where a computer or the Internet was used at work also used these at home, compared to 35% when these were not used at work.^[37] Use of computers or the Internet at school provides similar ways to bring this information use knowledge into the household.^[38,39] The relevant function here is the bridge between networks that hold different information, and the resulting shortening of the path length between those different resources and sources of information.

Small Worlds

In considering information received from remote others, we cannot ignore what has become known as the "small-

world hypothesis." This idea that individuals are separated from others by only a short chain of others was first demonstrated by Milgram.^[40] In his experiment, individuals in Nebraska were given letters and asked to pass them to people they knew by first name only on the way to getting them to Milgram's friend, a stockbroker in Boston. The average chain length, i.e., the number of people a letter passed through from source to destination, was six. Hence the phrase "six degrees of separation."

While Milgram's experiment has become legendary (not least in part due to the 1990 film by John Guare), there has been some question about whether this would hold in later studies because Milgram only included in his calculations data from completed chains (i.e., where letters reached the stockbroker). Newman^[41] chose to examine the small world hypothesis based on data that was more readily available and more complete. He examined the network structure of coauthorship in scientific publications from 1995–1999 with data from four major databases (Medline for biomedical research, Los Alamos e-Print Archive for theoretical physics, Spires for high-energy physics, and NCSTRT for computer science). As found by Milgram, Newman also found that scientists were, on average, separated by six degrees. Newman's work builds on that of Watts and Strogatz^[42,43] who created new models for networks that incorporate the clustering normally found in real-world networks. The Watts–Strogatz model has been used to show that a class of small-world networks exists defined by "some nontrivial local order, combined with just a fraction of long-range, random shortcuts" (p. 245).^[43] The western U.S. electrical power grid, movie actor connections, and the neural network of the nematode *C. elegans* have been shown to be small-world networks. As Watts^[43] explains, this model has further been improved on by Jon Kleinberg to take into account that human social networks are "searchable." At the local level, this means we do not choose people randomly for association, but instead choose them purposefully for their information, resources, companionship, etc. At the global level, we also search purposively to achieve the resources necessary for our local networks.

The ideas of local clustering and widespread connection are common themes in social network analyses. The work by researchers such as Watts, Strogatz, Newman, and Kleinberg is providing models that can be used to compare real-world behaviors to models of predicted behaviors (for a review, see Börner.^[44] This advance makes it more possible to compare and generalize across networks, and to test ideas such as Milgram's small world hypothesis. These models, when taken in conjunction with the explosion of data available online, are allowing greater progress to be made on analyzing human information behaviors. Although there is still a place for gathering data from individuals, automation makes it easier to collect and manage the data. As Newman^[41] points out, while manual

data collections provide detailed information on the structure of social networks, “data that are crucial to the understanding of information or disease propagation. . . the studies are labor intensive, and the size of the network that can be mapped is therefore limited—typically to a few tens or hundreds of people” (p. 404).^[41] The new “network science” provides an important addition to the tools available to understand social networks and information behaviors, complementing smaller detailed studies by identifying characteristics that hold across multiple networks and very large datasets.

Roles and Positions

The work on network models also shows that it does not take many cross-cutting links to bring our information resources closer together. Work by Newman and colleagues (cited in Watts)^[43] has shown that five random connections in a lattice model of a network can reduce path length by half, regardless of the size of the network. Although we know that human social networks do not conform to a lattice structure, cross-cutting connections are often found that bridge different social worlds. This is often deliberately implemented to achieve that effect, for example as negotiators are brought in to settle labor disputes, and as academic institutions favor hiring graduates from other universities. An entrepreneur may find a bridging position particularly profitable. Individuals who fill what Burt has called a “structural hole,” benefit from brokering the relationship between others. Such individuals possess access to information in two worlds and can decide strategically what, how much, when, and to whom they will pass on information.

In social network terms, the entrepreneurs have a high “betweenness” score, because they sit strategically on the path that information needs to take to get from one end of the network to the other. Even if not profiting from such a position, they hold a key to information transfer in the network, often holding two parts of a network together. Again, in network terms, they are a “cutpoint”—a node that if removed leaves the network in two or more separate pieces. Network analyses that show whole network structure can reveal such positions and show where there is risk of information loss (and/or redundancy) in information routes.

Typical measures of actors examine how central an individual is in the network. The network “star” has contacts with many others, and can perform the role of passing on information or making introductions (e.g., Gladwell).^[45] They exhibit a high “degree,” i.e., a high number of connections to others. Some of these ties entail information that is primarily directed to them (“in-degree”) and some entail information outbound from them (“out-degree”). A high in-degree indicates “prominence,” i.e., others seek them out for advice, information, etc., and

a high out-degree indicates “influence,” i.e., that their information is being sent out and received by others.

Across settings, many times we find people whose patterns of giving and receiving information look the same. Teachers perform the same kinds of information provision in relation to their students; libraries in different towns act in the same way in providing patrons with access to resources and the instruction necessary to use them. In these cases we see an “equivalence” in their information relations. When we discover this, we can identify particular “roles” and look for those again in other places. For example, technological gurus^[46] are often identified as present in many organizations. These individuals act as information gateways, monitoring new technologies as they appear and bringing that information to others. Recent work also suggests the importance of information gatekeepers who know “who knows what”. Studies of “transactive memory” show the importance to groups of knowing about themselves and where information resides within their own network.^[47–50] Often the gatekeeper or guru role is informal, and does not appear on any organization chart. Thus, they can only be found by asking network questions about the information flow in the organization.

Empirical discovery of roles and network structures is an essential part of a social network analysis as it reveals what is happening among network members rather than what an outsider or an inside spokesperson says is happening. It can reveal aspects of network interaction that have been ignored or simplified by conventional descriptions of work processes or social interaction. For example, socializing, play, and off-task interaction are often considered to be distractions from work, taking time away from the job to be done. But the more we examine work groups, the more we find they maintain many relations, and seemingly off-task activities such as socializing actually allow people to get to know each other and their work styles, and create trust and understanding of how to work together as a group. More has yet to be done to understand the complicated interplay between multiple relations in sustaining interpersonal relationships, group functions, and network cohesion.

Network Structures

Actors within networks may demonstrate particular roles but they can only do that in relation to others in a network: the teacher acts in relation to students, the parent in relation to a child, a friend in relation to other friends. Even without a particular role, individuals’ relations with others situate them in a position with respect to others in the network: the network star, the broker, the isolate are defined according to their ties (or lack of) with others in the network. In each case, the network demonstrates a shape that tells us how information travels, first between pairs, and then across the network as a whole.

Some of the first examinations of the effect of network structure on the circulation of information are those of Alex Bavelas and Harold Leavitt done in the 1940s and 1950s. In their laboratory setting, they compared information transfer between participants who were organized in a line, circle, Y or star shape. The communication structure was effected by isolating individuals and allowing them to pass messages to one or more others depending on the structure and their position in it (for further description, see Borgatti).^[51] The most reported finding is that the star and Y structures were much faster at achieving common knowledge (knowing which symbol the team had been assigned), used fewer messages to achieve that result, and resulted in fewer errors. In short, these were found to be more efficient structures for circulating information toward common knowledge. Other findings are mentioned less often in discussions of these results. Borgatti reports that participants in the circle and line structures enjoyed themselves more. This suggests different structures may support different kinds of relationships—coworkers, collaborators, friends—and may be optimal for different kinds of tasks or outcomes. Getting work done can be frustrating if the system is inefficient and requires extra time, but a game may depend precisely on such obstacles to information transparency. Another result was that circle and line structure participants more readily said the group had a leader. Such a finding has implications for how an individual may secure a leadership position and what structures are most likely to support an emergent information leader.

Since these early experiments, studies have continued to reveal the impact of structural aspects of networks on information transfer. The simplest observation is that in networks with a high “density,” i.e., a high number of connections among actors relative to the total possible number of connections, information transfers quickly and easily around the network because it can take nearly any route to get from one person to another. With low density, information is restricted to certain routes, and thus the likelihood of receiving that information depends on being strategically placed where the information is traveling. Highway and local road structures are an ideal analogy to explain this aspect of social networks. Superhighways carry lots of traffic, of all sizes, but do not connect all towns. Smaller roads connect more local regions, but carry limited traffic as slower speeds.

Continuing to view networks as roads, looking from above at the whole network we can see places where traffic (information) reaches a bottleneck because it all goes through only one central node (consider commuting across bridges, or traveling through airport hubs). Such a network has a high “centralization,” i.e., a high coordination around one central point. “Cliques” of highly interconnected nodes may also be apparent, showing a group of actors who represent one of the local nonrandom orderings found in large networks. Larger aggregates may also be found as “clusters” or “components” in the network. Each of these

collective units appears because of their connectivity; actors within them are more likely to have and share access to the same resources and information.

The road analogy is also useful for understanding the effect that current structures have on future structures. Highways draw traffic and attract business and residences to locate close to these roads, creating and sustaining attention to these areas. Similarly, network structures reinforce themselves. Someone who is known for having particular kinds of information continues to be sought out for that information, increasing the number of people connected to that actor. New network structures are more likely to emerge and become sustained by people with a keen interest in communicating with each other, i.e., those with stronger ties. These individuals are more likely to spend the time negotiating new ways of communicating and coming to a joint understanding of how they will communicate in a process of “adaptive structuration.”^[17,32,52,53] Continued interaction also influences individuals’ views of the network structure, and who knows what. Krackhardt and Kilduff^[54] have shown that dyads within interacting triads (pairs within interacting sets of three people) have more similar views of social relationships among organization members than those in the same organization not in these triads. Taking this kind of common knowledge as information about the organizational culture, they concluded that, compared to a random selection, dyad relations within these interacting triads “predict higher levels of cultural agreement” (Krackhardt,^[54] p. 288). Is this just because of stronger ties? Possibly, but their judgment is that “cliques lead to stronger ties and stronger ties lead to cliques in a reciprocating process that reinforces the relationship between Simmelian ties [three person ties] and agreement” (p. 288).^[54]

Discussions of collaboration, community and groups, both offline and on, stress the development of common knowledge and shared understanding (e.g., in the development of communities of practice,^[55] or in scientific collaborations),^[14] with an emphasis on strong tie needs (e.g., in the development of computer tools to support work tasks). Once initiated, strong ties can perpetuate the structure they have created, but to get there requires initiating network connections. While strongly tied pairs can influence each other and pass on information and cultural knowledge to each other, how does information circulate to weak ties or to people with no tie between them? Research on media use by strong and weak ties suggests that a group-wide means of contact (regular meeting, conference, online listserv, etc.) can create such a connection.^[17,32,56] Because those with no tie or only a weak tie are unlikely to be motivated to contact and influence each other, this means of contact needs to be established and initiated by an authority beyond the individuals themselves. Scheduling meetings, enrolling people in a listserv, or establishing a wiki creates “latent ties”—a “tie for which a connection is available technically but that has

not yet been activated by social interaction.” (p. 387).^[32] A latent tie describes the accessible information that has potential to be mobilized. The common framework provides the ground on which latent ties can be activated into weak ties with attendant information transfer and mobilization, and potentially at least some will further be enabled into strong ties. Such frameworks may also serve to maintain dormant ties, making it easier to reactivate ties, or to tap into this network for information as needed.^[57,58]

PERSONAL AND NETWORK OUTCOMES

What do actors gain (or lose) by belonging to networks, and what does the network as a whole gain by member engagement? It is generally accepted that individuals who engage with others in meaningful relationships benefit in terms of personal health and well-being reflected in social, emotional, economic, and health support. Networks gain in robustness and continuity in the face of change. Both aspects highlight the role of social capital.^[2] Individuals in networks high in social capital gain access to both mobilized and accessible resources. These are “not possessed goods of the individual. Rather, they are resources accessible through one’s direct and indirect ties” (p. 468).^[3] The robustness of a network matters because social capital is found in a “durable network of more or less institutionalized relationships of mutual acquaintance and recognition.”^[59]

Robust networks are resilient to changes in parts, have structures that persist over time, and exhibit a stable social structure. They embody known rules of behavior and membership, increasing the likelihood that others in the network will act in an expected manner. This reduces the risk associated with making ties with others because it reduces uncertainty about how others will act and react. Known behaviors, and network conformity to them, also support self-policing, with members sharing the task of monitoring behavior, further reducing the likelihood of transgressions, as well as the burden on an individual to deal with such transgressions.^[60,61] Social norms of behavior in society are one example, but such robustness is also enacted through laws and contracts and their enforcement.

While individuals gain from robust networks, there is also potential for constraint as the dense network allows more visibility of behaviors and thus the potential for more monitoring and reporting of transgressions. A nonsimple association exists on whether dense connectivity serves a positive or negative outcome, and this can vary with context.^[62] Dense personal networks can contain anxiety-causing ties, or establish rigid roles that limit what individuals can do, thereby increasing stress and its negative effects on health. However, associations with others has benefits not only in access to information, but also in support structures. One benefit often mentioned is

that married people, particularly men, live longer than their unmarried counterparts. Although it is still debated whether health is the reason for marriage or the outcome, it appears that a good marriage contributes to a healthy lifestyle and thus longer life.^[63]

That health and longevity appear to be associated with the size of personal networks explains recent concern over declines in the size of core discussion networks. Putnam^[64] first warned of the loss of civic engagement, the basis of social capital in communities. More recently, McPherson, Smith-Lovin, and Brashears^[65] used U.S. census data to compare the number of confidants people reported in 1985 and 2004. They found a significant drop, from 2.94 confidants on average in 1985 to 2.08 in 2004, and a much higher probability in 2004 that individuals would have no confidants at all. The percentage with only one or no confidant—a level described as having marginal or inadequate personal counseling—was found to have risen from 25% to 50% of the American population. Changes in work and home and consequent lack of connection to kin and local communities explain some of these changes, but, as the authors state, “[i]f we assume that interpersonal environments are important (and most sociologists do), there appears to have been a large social change in the past two decades” (p. 371),^[65] and one that deserves our attention.

SUMMARY

Information, both accessible and mobilized, form an important basis of the social capital of our personal, social networks. Our access to information provides us with opportunities for work or play, and provides the basis for getting to know others to work with, be friends with, and gain support. Co-presence in a common environment—whether considered as a common geography, online space, or intellectual discipline—situates us in an accessible information space where social network relationships, i.e., connections created and maintained by people, can mobilize information so that it is shared among network members.

This entry has focused on how patterns of information sharing among people can be examined, and how interpersonal ties and networks structures affect the way information moves among members of a network. Individuals may occupy roles or positions that provide them with access to unique resources they can then pass on when and to whom they choose. Their choice of who to pass it to is likely to depend on how strongly they are engaged with others, favoring passing information to those with whom they are strongly tied and who are present in their close local circle. When they pass information to more distant others, it is likely the information will be new to that person or that social circle because of the differences in the experiences and information exposure across social circles.

The sum of all these contacts and information exchanges may be to increase the resources available to the network as a whole, adding to its stability and persistence, reinforcing its existing structure and culture, and generating social capital for all network members. While these outcomes are possible, some reservations exist about the benefits of highly dense, potentially socially controlling networks which may reinforce interaction only among similar others. At the same time that there is an equal concern that very sparse networks may contain insufficient support, with negative consequences for the health and well-being of individuals and their communities. In all, the social network data suggest striving for an optimal level of connectivity that promotes social capital without social control, and information access without information saturation and overload.

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Social Science Literatures and Their Users *[ELIS Classic]*

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Abstract

This entry reviews the impact that electronic communication and the availability of electronic information resources are having on social science literature and its users. The two key elements to this being the effect on literature and communication in the social sciences, and the effect on the use of social science literature. The perceptions of social scientists of electronic resources and their use are outlined, and the emergence of a hybrid communication system in the social sciences, through the phenomena of parallel publishing, is highlighted. The effects on social science information seeking behavior of the availability and use of electronic resources are explored with particular reference to the use of electronic journals and Internet resources. Although the main features of the information seeking patterns of social scientists appear generally unchanged, electronic resources are altering the nature of the social science literature base and affecting aspects of its use.

INTRODUCTION

Studies of social science literature and its users can be traced back to the series of projects undertaken in the United States in the 1960s by the American Psychological Association.^[1] The results of these studies have been described by Garvey and Griffith^[2–7] and by Garvey, Lin, and Nelson.^[8–10] There was also a considerable amount of research carried out in the United Kingdom in the 1970s and early 1980s on information needs and information seeking behavior in the social sciences. In particular, in the Information Requirements of the Social Sciences (INFROSS) studies^[11–15] and the Design of Information Systems in the Social Sciences (DISISS) projects.^[16,17] These projects were followed up later by Hurych^[18] and Slater.^[19,20]

Because there are many different interpretations of what constitutes the social sciences and which disciplines or subjects should be included or excluded it can be difficult to provide a simple definition of social science literature and its users. Therefore it is probably better to work with reviews and frameworks that have been used to organize studies of social science literature and its use, and to accept that there will be some differences in the scope of these, which nonetheless does not detract from their utility in providing an overall understanding of the nature of social science literature and its use.

Hogeweg-De Haart^[21–23] provides comprehensive reviews of social science information, social scientists use of literature, and information seeking behavior to the mid-1980s. These reviews include discussion of different interpretations and definitions of what constitutes the social sciences. More recently, Rosenbaum^[24] and Janes^[25] have provided frameworks and useful bibliographies of studies of social science literature and its users

from the 1970s through to the 1990s. Rosenbaum organizes studies of the literature of the social sciences according to the history of the social sciences and social science methodology; information needs and uses in the social sciences; scholarly communication and information exchange in the social sciences; literature and bibliography in the social sciences; and data resources in the social sciences. He also provides examples of studies of different subject literatures in the social sciences—library and information science; sociology; anthropology and psychology; politics and public administration; history and geography; economics, business and management; and education and communication. Janes' bibliography on social science information needs and use studies, has a separate category on INFROSS, DISISS, and associated articles, reflecting their key place in studies of social science information use, and then provides examples of general/academic social science information user studies; studies of applied social scientists; country studies; review/position articles on studies of social science information; general reviews of the user study approach; and bibliometric studies.

However, despite the utility of Hogeweg-De Haart's discussion and reviews, Rosenbaum's framework, and Janes' bibliography, they all focus on the conventional paper form of communication in the social sciences, and are concerned almost exclusively with paper resources and their use. They do not address the extent to which the use of electronic information resources and electronic communication have been, and are having, an impact on academic communication in the social sciences. The increasing availability of electronic information resources in the social sciences, and, in particular, the availability of material through the Internet, is altering the form of the social science information base and having an effect on its

literature and use. The aim of this entry is to review how developments in electronic communication are affecting the pattern of communication in the social sciences, to assess the impact on the communication and information seeking behavior of social scientists, and to chart the extent to which the availability and use of electronic resources is altering both the nature and the use of social science literature, and, in particular, its effect on the production and use of the journal literature of the social sciences.

ACADEMIC COMMUNICATION AND THE SOCIAL SCIENCE LITERATURE

In the preface to his book *Communication; the essence of science* William Garvey recounts the following anecdote:

James D Watson and Francis Crick discussed on the BBC how they made their discovery of the molecular structure of DNA, a discovery which led them along with Maurice Wilkins, to receive Nobel Prizes in 1962. In the course of their discussion they recalled the time when Maurice Wilkins had in his possession an x-ray photograph of DNA in the B form, which he was trying to keep Linus Pauling, Watson, and Crick from seeing until he had a chance to exhaust his own study of the photograph. "But," Crick said, "he had to eventually make public the photograph because communication is the essence of science." (p. ix).^[26]

In this way Garvey and Griffith highlight the crucial role of communication in the development of science, in that, in the absence of communication of results and discussion of findings there would be no science as conventionally understood. Communication is, therefore, not an adjunct to science, but its essence. And at the heart of the scientific communication process they emphasize the place of peer review, in particular, its role in the development of the refereed journal article, which, for many, is the touchstone of scientific communication.

The origins of the contemporary refereed journal article can be traced to the late seventeenth century and beginning of the eighteenth century when the *Philosophical Transactions* of the Royal Society and the *Journal de Scavans* began to use the method. The role of peer review in both the creation and use of the social science literature by social scientists was examined by Ellis^[27] and illustrates how both journal contributors and readers have quite a clear idea of the overall pattern of journal provision in their areas, as well as associated expectations about where their material might be published, and what kinds of material they would expect to find in which journals. These expectations relate both to the substantive topics, and to the type and quality of treatment of those topics.

"Rightly or wrongly I informally operate the belief that there is a small number of top quality journals in which the relevant stuff—the best relevant stuff appears—and therefore I don't need to go into those other journals in that detail. . . . There's a notion of quality, there are good journals" (p. 56).^[27]

"You pick the journal depending upon first what is an appropriate journal for what you want to say and, given that, you tend to try and go for the most prestigious journal within that group" (p. 56).^[27]

"Whatever the subject there are obvious journal to send it, typically I would send it to the one which I felt was the most prestigious in that area" (p. 56).^[27]

The role of peer review for maintaining the quality of material published, particularly in relation to publication in the more prestigious journals in a field is widely recognized and understood. For many social scientists it is the principal defining role of peer review in the academic communication process.

"Usually you can tell on quality by the journal. On the whole you know what the reputation, reviewing procedures, and the rejection rates are. Journals have reputations, so if you know that if something appears in a reputable journal that it is going to have gone through screening procedures and it will probably be ok" (pp. 56–57).^[27]

Those researching in an interdisciplinary area may find that their material may be appropriate to different types of journals dependent partly on their findings being of interest to the readers of the journals concerned. But this only serves to influence where the material might be directed, not the form in which it would be intended to publish, where again the refereed journal article predominated.

"The thrust of our work is in applied occupational psychology and appear in the occupational psychology journals. Occasionally we will make a discovery that we will put into more clinically and medically oriented journals" (p. 54).^[27]

In some cases it can be difficult for a researcher working in an interdisciplinary area to choose which type of journal is most appropriate for the material. The choice may be critical both in terms of which journals to send the material to and for the way in which the material is written. It may be necessary to write in different ways for different audiences, and this can pose a dilemma for the researcher faced with this decision. But again this does not affect the preferred form of publication.

"Within industrial relations I was always in a terrible dilemma about whether to publish in the psychology journals or in the industrial relations journals, and, according to which I picked on, the study had to be written up in a completely different way" (p. 55).^[27]

Even for those working in areas where this sort of dilemma does not arise, choosing an appropriate journal to send material to will usually involve more thought or consideration than that of simply reading through journals' notes for contributors. Journals often have tacit criteria,

which are only apparent from reading several issues of the journal, and for those familiar with the journal and the field, these criteria may be easily identifiable, even if they are nowhere explicitly stated.

Part of it is simply that, whatever the notes for contributors say, a particular journal tends to have a theme or themes. What happens is that papers that cite certain other papers tend to be located within that particular journal, rather than some other journal. Even though, in terms of the notes to the contributors, they might formally be just as appropriately placed there. . . . You get a tendency for a particular journal to repeatedly publish from people in this little sub-group of people who are citing each other and developing their own little sub-field (p. 55).^[27]

For the traditional archival journal the refereeing process may be considered a device for maintaining the quality of the scientific archive, but it is important to recognize its other roles, such as directing papers from one journal to another, and ensuring that material is absorbed into the literature. It is not always the case that rigorous refereeing is appropriate for a journal. This depends on the function the journal has in the communication system. For the traditional archival journal the refereeing process may be the way to maintain the quality of the scientific archive. But other journals may have quite different roles to play and a too rigorous approach to reviewing material would be counterproductive, the different outlets complementing each other.

Artificial Intelligence: this publishes long papers and is consequently not right up to the minute. There is a long publication lag. That meets one of the main requirements of any science of being a respectable archive source for major publications. That's all it does meet. It doesn't have any outlet worth speaking of for the shorter note. There is now something that is only semi-refereed and not archived, this serves the complementary purpose of publishing short notes of what is going on, what people are doing or hope to be doing, what the research application was, fairly informal accounts of conferences, who to write to for papers, it's right up-to-date. (p. 55).^[27]

The refereeing process both in terms of the biases of journal editors and the judgments of referees does operate as a form of control on the type of material which is accepted for publication in a journal. As Paul Diesing^[28] pithily observed:

If one wonders about the remarkable uniformity of method displayed in certain journals and asks the authors of the articles why they write that way, they answer, "It's always done that way, that's science, isn't it? You do A, B, C, etc. Besides, we couldn't get it published any other way. Then there is the occasional anguished cry of the bewitched victim: One year of research down the drain to satisfy an editor's pet theory!" (p. 24).^[28]

LITERATURE AND COMMUNICATION IN THE SOCIAL SCIENCES

Garvey and Griffith studied and documented almost every aspect of the academic communication process in psychology, including the role of prepublication, the steps involved in publication in a scientific journal article, and the nature of postpublication processing. They produced a comprehensive model of the scientific communication process in psychology from the inception of a project through its various stages of communication in literature. This model of the dissemination process was correctly seen as taking place over a long period of time, with, typically, journal publication taking place some three or more years after the inception of a project, and integration of the findings into the wider literature taking several more years. In their model, research is initiated, and preliminary results first communicated, in the form of preliminary reports. On completion of a project results were first communicated in seminars, colloquia, and other similar fora, with the first formal communication, postcompletion, being through conference presentations and the publication of papers in conference proceedings. The next stage in the formal communication of results took the form of the submission of a manuscript for review for publication as a journal paper. If the submission was successful, the next stage was the distribution of preprints, and appearance in the list of accepted manuscripts prior to the actual publication of the article in a journal. Journal publication was seen as key for disseminating the results of a project into the primary communication system and in the secondary communication system, through publication in current contents or through entries in indexing and abstracting services. Finally, the results of the research became part of the established body of knowledge in the subject area through reviews and citations in the literature.

Garvey and Griffith's studies were undertaken before the widespread application of computer technology in the scientific communication process. As Hurd^[29] commented: "Computer based communication was not foreseen by the Garvey and Griffith's model, but any observer of contemporary research communities could not fail to see how scientists have assimilated information technologies into their daily routines" (p. 13).^[29] Hurd offered a revised version of Garvey and Griffith's model, which envisaged the displacement of paper by electronic forms of communication, but without fundamental change to the features of the model. In Hurd's version, preliminary reports are substituted by listserv discussions. On completion of a research project, publication of results would take place through electronic conference reports, and their publication in electronic conference proceedings. In the place of conventional journal publication, Hurd envisaged an electronic

version of the current paper publication model, with the submission of electronic manuscripts for review, the creation of electronic preprint databases, and, finally, electronic journal publication on the Internet. The transformation of the secondary literature was similarly seen to be that of replacing paper with electronic forms of communication. This would take place through the creation of electronic data sets, electronic articles in contents databases, and online indexing and abstracting databases. Hurd redraws the conventional paper model of communication, delineated by Garvey and Griffith, in a completely electronic form, and to some degree, developments in academic communication have mirrored this. But the evolution of the academic communication system has proceeded in a way which Hurd did not envisage, where publication in paper form and electronic form coexist, creating a hybrid communication system.

This has been documented by De Costa^[30] in her study of the impact of computer usage on scholarly communication amongst academic social scientists. She identified a number of trends in scholarly communication in the social sciences, including the emergence of electronic journals, as well as the appearance of electronic books and the increasing use of the Internet and WWW pages to disseminate research results. De Costa highlighted the increasingly widespread phenomena of combining paper-based and electronic forms of communication in the form of parallel publishing. She found that parallel publishing was seen by some as offering the advantages of the efficiency of electronic delivery while retaining the economic advantages to the publisher of the existing paper product. As Meadows argued "Parallel publishing safeguards publishers' investments, since neither authors nor readers are likely to object to such an arrangement. It should also help toward a smoother transition from paper-based usage to electronic handling" (p. 154).^[31] There are other economic and social arguments for the emergence of parallel publishing. McKnight and Price point out "Parallel publishing of an electronic version of a paper journal has enabled publishers to "test the water" for electronic journals. Since the paper journal already has a level of prestige, a readership and a back run, the electronic version can inherit these"(p. 126).^[32] However, some advocate a wholesale move to electronic communication arguing that paper is no longer the most appropriate vehicle for academic communication. For example, Morton states

Although printing has for three centuries been an agent of change in scholarly communication, we should remain mindful that central values of scholarly communication pre-dated the first learned journals; so, too, can they post-date the paper paradigm. The journal as we have known it was successful because it was the best technology available to do the job. This is no longer the case. Paper-based journals are no longer expedient because there is now a more effective and efficient technology than printing by

which to communicate among the extended scholarly community.^[33]

Electronic journals provide a medium which is cheaper than the traditional printed journal, and which can be disseminated more efficiently and effectively than printed journals via the Internet. Electronic journals are relatively easy to compile, produce, and distribute, and, therefore, the period between submitting an article and having it published can be considerably reduced. In this respect, electronic journals can be seen as a way of overcoming one of the main drawbacks of the traditional printed journal, the long time lag between submitting an article and its actual publication—up to 2 years in some cases—which does not apply to anything like the same extent to publication in electronic form. Electronic journals, however, have not been universally recognized as legitimate publication outlets, or have not carried the prestige of the more established paper journals. This situation is changing, but the perception, was, and to a greater or lesser extent still is, that electronic journal publication is not of the same standard as publication in a paper journal. As Rowland commented in the 1990s: "At present some universities and grant giving institutions will not accept electronic publications for the author's credit. This situation is likely to change, but, for some time to come, researchers whose career is not fully established may wish to play safe by putting their best work in the best traditional journals" (pp. 247–248).^[34] This perception was not restricted to universities and grant-giving institutions, the perception was shared by the academics themselves. Gomes and Meadows reported in their study of perceptions of electronic journals in British Universities

The major sticking point for authors was the perceived lack of prestige of electronic journals. Most of those who commented on this saw the way forward as being parallel publication of journals, where the print version already possessed high prestige. Since this is currently the preferred policy of most publishers, parallel publishing can be expected to dominate in the immediate future (p. 180).^[35]

In the mid-1990s Kling and Covi commented

Scholarly publishing should be viewed as one part of the scholarly communications systems that connect authors and readers. In the extremes, world-class scholars (and national class scholars) are eager to have their works read (and appreciated) by their peers, and also by some larger disciplinary or cross-disciplinary audiences that usually number in the range of hundreds to thousands. In contrast, there are other scholars who are simply happy to publish periodically, or at least publish before receiving tenure or other professorial promotions. Scholars are very sensitive to the legitimacy and status of the journals (or publishing houses) that publish their work, but they vary in their

insistence in publishing in the journals that their peers regard most highly (p. 264).^[36]

They correctly identified that the format of publication, electronic or paper, may not be the significant issue, but rather attitudes toward the two forms of publication in relation to perceptions of peer review and quality.

As with paper publications, articles that are submitted to e-journals may be lightly edited or tightly reviewed by an editorial board with strong researcher standards. Today, many scholars are confused about the formats and intellectual quality of e-journals. In extreme cases, they feel that e-journals must be of lower intellectual quality than p-journals, because they sense something insubstantial and potentially transient—ghostly, superficial, unreal, and thus untrustworthy—in electronic media. In practice, some refereed e-journals publish high quality articles, but they are not well known by their existential critics (p. 265).^[36]

This confusion seems to stem in part from the existence of a dichotomy between the form and the function of the journal in the academic communication system which has been examined by Smith.^[37] Smith deconstructs the roles of the journal in academic communication, distinguishing between the journal's logical role in the communication process and its conventional paper format. Smith also differentiates between the explicit and implicit roles of the journal. The explicit roles he identifies as being editorial; exercising quality control of content and form; conferring recognition for work; and marketing and dissemination. The editorial role is mainly subject based, and is concerned with the selection of material. Although there may be some quality control of content undertaken by the editor, through triage, quality control of content is mainly carried out by the referees through peer review. The other explicit roles of the journal, which Smith identifies are quality control of the form of publication, including copy editing and general design, the things that taken together make a journal look professional. The role of conferring recognition of work is for many authors the preeminent role of the publication process, although, as Smith points out, for some the dissemination of information may rank higher. The more obviously commercial aspects of the process are marketing to readers and customers, and dissemination and delivery to purchaser or reader.

Smith identified the implicit roles of the journal as being subject defining; community defining; and archiving. In its subject defining role a journal, or the editorial board, helps to define the areas it serves directly through invited review papers and/or editorials; and indirectly through the decisions made on the papers chosen for inclusion. The second implicit role, community defining, is the role a journal plays in defining a subject community through its contributors and readership, in effect operating as a gatekeeper on communication through inclusion and

exclusion. The third implicit role, archiving, is that of maintaining a record for posterity, mainly by libraries, and, as Smith points out, at no direct cost to the publishers, authors, or researchers.

The purpose of Smith's analysis was to present a model of the journal's function that could be used to underpin electronic alternatives to the traditional journal form. To retain the ends and purposes of the conventional peer review journal, but through different means and form. To this end Smith recommended the setting up of subject focal points and external advisory panels to take on the explicit and implicit roles of the journal, and, in particular to maintain the quality and reputation of the journal system in response to changes brought about by developments in electronic communication. Smith's analysis would suggest that the role and form of the academic communication system be separated to maintain quality control in a paperless environment. However, although technology has broken down the physical barriers between conventional paper publication and electronic publication, and provided opportunities for the rapid and widespread dissemination of the results of research, in ways which would have been impossible to contemplate even a decade or two ago, at the same time these barriers to publication have traditionally operated as a quality control or filtering mechanism on scientific communication. Academic publishers, by adopting the model of parallel publishing, have, in effect, created a duplicate system where the journal has maintained its place as the keystone of the academic communication system, but in a paper as well as electronic form.

USE OF SOCIAL SCIENCE LITERATURE

These developments in the production of the social science literature are reflected in changes in literature use by social scientists. In the 1980s Ellis^[38] developed an empirically grounded model of information-seeking behavior and information use by social scientists which had six components: starting, chaining, browsing, differentiating, monitoring, and extracting. Ellis's model categorized existing practices in relation to social scientists literature use. This was later extended in studies of physicists and chemists to include the additional, related categories of verifying and ending.^[39]

The premise of the model were that underlying the complex patterns of social scientists' information-seeking behavior were a relatively small number of different types of activity characterized as starting (activities characteristic of the initial search for information); chaining (following chains of citations or other forms of referential connection between material); browsing (semidirected searching in an area of potential interest); differentiating (using differences between sources as a filter on the nature and quality of material examined); monitoring (maintaining awareness of developments in a field through the monitoring of particular

sources); and extracting (systematically working through a particular source to locate material of interest).

The original model was extended and developed in studies of the information-seeking behavior of other groups of researchers, in particular, those of physicists and chemists.^[39] Despite the differing disciplinary backgrounds of the social scientists and the physicists and chemists, there was considerable similarity in general and detail between them in terms of their information-seeking behavior. The study of the chemists identified activities consistent with starting; chaining; browsing; differentiating; monitoring; and extracting as well as two other characteristics not highlighted in the study of the social scientists—verifying (checking that information is correct) and ending (characteristics of information seeking at the end of a project). The study of the physicists employed different terminology to that of the social scientists but it was clear that the activities themselves could be closely mapped to the characteristics of the original model—initial familiarization (activities undertaken at the earliest stages of information seeking); chasing (following up citation links between material); source prioritization (ranking sources based on perceptions of their relative importance); maintaining awareness (activities involved in keeping up-to-date); and locating (activities engaged in to actually find the information).

However, as with Garvey and Griffith's studies, Ellis's study of social scientists was based on the paper form of communication. Although some of the social scientists had made use of computer-based searches this was only to identify references from which more conventional forms of paper-based information-seeking behavior could begin. Even in the later studies of information seeking by physicists and chemists in the early 1990s, although electronic means of communication were available, the pattern of information seeking based on paper was still absolutely predominant: "In relation to the communication of research, the employment of electronic communication as a complement to or substitute for the traditional forms is, as far as can be discerned, virtually non-existent" (p. 366).^[39] A decade later Meho and Tibbo^[40] replicated Ellis's study in a Web environment. Collecting data through face-to-face and e-mail interviews they confirmed the activities of the Ellis model but also identified four additional categories: accessing information; networking; verifying; and information managing. In many respects, Meho and Tibbo confirm the relative robustness of the model of information-seeking behavior of social scientists over time, but differences are emerging as electronic communication takes a firmer hold on the academic communication process.

From the mid-1990s, with the advent of the Internet, the use of electronic information resources has increased exponentially. This development has been documented by Tenopir^[41] who has provided an extensive overview and analysis of studies of the use and users of electronic

library resources. Tenopir categorizes these studies into two broad types. The first type consists of large-scale studies, undertaken over a long period of time; the second comprises studies, which although not lesser in quality, were typically smaller in scale, or one-off projects. Only eight studies or groups of studies were placed into the first category. One of the most interesting of these, in terms of implications for social science literature use was that of SuperJournal.^[42] The study, carried out in the United Kingdom, used logs, surveys, focus groups, and interviews to explore preference and reported behavior of students and faculty. The SuperJournal study identified seven categories of e-journal users: enthused; journal-focused; topic-focused; article-focused; bingers; explorers; and window shoppers. The study identified significant differences between scientists and social scientists. The enthused category, which consisted mostly of social scientists and graduate students, employed e-journals once or twice a month and searched a wide range of both journals and articles. Scientists tended to be more journal-focused, searching frequently but concentrating on only a few specific journal titles, half of which were full text, or article-focused, searching less often and only on one journal. Social scientists tended to be topic-focused rather than journal-focused, searched less often and searched by subject rather than specific journal. Social scientists tended to search through vertical chaining from table of contents, to abstract, to full text. Scientists would often search through vertical leaping table of contents to full text. "Social scientists seemed to be more task-driven than scientists; visited the library less often than scientists when new journals appeared; expressed less anxiety about keeping up to date".^[41]

Interestingly, Tenopir notes that both scientists and social scientists valued the library as "the institution that provides them with journals."^[41] With electronic journals being perceived as being useful for "keeping current with articles in the user's area of research; keeping up to date with what is being published more broadly in related areas; gathering background information on a new area on which the user might be embarking; preparing for a specific event such as writing an essay or grant proposal; or performing tasks associated with teaching such as writing or updating."^[41] As Tenopir observes researchers "now use a variety of sources for articles, including electronic journals, print journals, Web sites of professional organizations and individuals"^[41] but points out the findings of Lenares^[43] and Rogers^[44] that increase in e-journal usage is accompanied by a decrease in the frequency of use of print journals.^[41] Significantly, Tenopir cites the finding of Speier^[45] that

The perception that electronic journals are of lower quality than print is another problem that may be diminishing as a high percentage of peer-reviewed journals are digitized. In

the late 1990s, business school faculty members surveyed reported they did not perceive e-journals to be as high quality as paper counterparts; their response changed, however, when they were asked to evaluate a well-respected print journal evolving to electronic format.^[41]

But she contrasts this with the finding of Tomney and Burton^[46] that “While more than 70% of the faculty members in a British university believe the quality of articles in e-journals is the same as in print journals, this same group cited the top disadvantage of e-journals as being the impression that electronic publication is not “real” publication.”^[41]

Tenopir records the findings of several studies that, in the social sciences, business school staff were early adopters of electronic journals, with finance and management information systems (MIS) faculty being most aware and economists the most enthusiastic users^[45–47] while faculty in history, education and the arts were slower to adopt electronic journals.^[41,46] Tenopir notes that the increasing availability of e-journals and full text databases is affecting information-seeking behavior: “As libraries make more e-journals and full text databases available to users, both browsing and searching remain important information seeking behaviors, but browsing by journal titles is decreasing while searching by topic is increasing.”^[41] Interestingly the information-seeking activities of categories of browsing, differentiating, and monitoring are evident in social scientists information-seeking patterns but this is being complemented by an increase in subject searching in electronic sources, as Tenopir points out “Most subject experts have a core group of journal titles that they browse, read from and recommend to students, but they read from a wider variety of journals through subject searching.”^[41] This is also affecting the balance between different activities, so that for example, “Although browsing and searching remain important information seeking strategies electronic journals (in particular, full-text databases) are causing a decrease in browsing titles while searching by topic has increased.”^[48,49] Browsing of core journals by tables of contents remains important, but searching by topic for additional journals and articles is increasingly popular, particularly in large, mixed-journal title databases and “experienced users also liked the ease of skimming and searching.”^[41] The increasing use of e-journals and journal title bases is increasing the demand for more with researchers expressing a “desire for more online materials, additional journal titles, a wider variety of special or out-of-the mainstream materials and complete volumes of back files of existing journals.”^[41,47–49]

The other key issue is the degree of confidence researchers place in the ability of electronic resources to fulfill the archival function. “Print is a proven archival format. Even those who prefer electronic access to journals (75% University of Michigan Faculty in economics, sociology, and anthropology), prefer books remain in print

format.”^[41,47] In the JSTOR study, which “received over 4000 responses from humanities researchers, social scientists and economists” more than 60% of the respondents “greatly value electronic journals. . .are comfortable using electronic resource, believe a variety of electronic resources are important to their research, and consider electronic databases invaluable.”^[41] But they were more qualified about their confidence of electronic sources to displace paper for archival purposes and, in particular, in relation to their perception of the effect on the archival function of the library. So that almost half agreed with the statement that “Regardless of what happens with electronic archives of journals, it will always be crucial for libraries to maintain hard-copy archives” while over half disagreed with the statement that “Assuming that electronic archives of journals are proven to work well and are readily accessible, I would be happy to see hard-copy archives discarded and replaced entirely by electronic archives.”^[41] Again, three-quarters of the respondents agreed with the statement that “With more and more journals becoming available electronically, it is crucial that libraries, publishers, or electronic databases archive, catalog, and protect these electronic resources.”^[41] Guthrie^[50] concluded “faculty do not believe that a reliable solution for electronic preservation is in place”^[41] and that the hard copy is needed for backup.

CONCLUSION

The picture which is emerging of the impact of electronic communication on social science literature and its use is a complex one. Technology and the Internet have altered the information landscape of the social sciences. The emergence of e-journals, full text databases, and e-books are altering the form of the social science literature base. Though conventional publication through paper journals and monographs continues to dominate much of academic communication in the social sciences, the availability of electronic means of communication is challenging that dominance. In some respects this is disguised by developments such as parallel publishing which offer an alternative model of communication to that of either the conventional paper model or that of full blown electronic communication. But the emergence of an electronic alternative to the paper model, even in the form of parallel publishing, offers different opportunities for information-seeking behavior. However, it is clear that traditional forms of information-seeking behavior are continuing to dominate. Features of the information seeking patterns of social scientists in the paper model are being replicated in the electronic information environment. But as electronic information resources offer alternative ways of interacting with social science literature, changes are beginning to emerge in effects on the information-seeking behavior of social scientists.

Some of these effects seem quite subtle such as the change in balance between browsing and searching in relation to electronic resources. Others appear more pronounced as researchers increasingly see opportunities for widening their information base through more extensive use of social science literature opened up by increasing the range and number of resources available electronically. Similarly, the initial reserve of many social scientists toward electronic journals appears to be diminishing, perhaps partly driven by the availability of respected journal sources electronically through parallel publishing. Ironically the growing use and acceptance of e-journal sources may be driven more by their inheritance of the prestige of their paper counterparts than by any recognition that electronic sources have superseded paper. Finally, the reservations expressed by social scientists about the reliability of electronic sources for the archival function seem to indicate a growing awareness that electronic sources may become an increasingly important constituent of the social science literature base.

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Social Science Professional Literatures and Their Users

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Abstract

Focused on the individual's welfare, the five major social science professions include teachers and librarians (intellectual growth), social workers (daily life essentials), police officers (physical safety), and journalists (civic engagement). The information environments and experiences of these five critical professions involve information technology adaptation, information literacy concerns, and continuous professional development. The often stark divide between theoretically informed research and applied scholarship leaves practitioners with gaps in their connections between praxis and new research. As government and social policies, as well as economic influences, drive the need for evidence-based practice (EBP), those gaps in research application grow more important. For all five professions, information technology influences or even drives many professional activities.

INTRODUCTION

The social science professions are defined herein as those which focus on maintaining individuals' welfare in light of society's need for self-reliant, socially responsible members. The intellectual welfare of individuals is the responsibility of teachers and librarians who support life-long learning. Social workers take on responsibility for welfare in the arena of daily life essentials. Police officers bear responsibility for individuals' safety. Journalists have responsibility for civic welfare by contributing to an informed citizenry. These fields tailor society's resources to the needs of individuals in an effort to, ultimately, build a healthy social fabric. Well-informed, self-reliant, secure, productive, and engaged individuals may need support from the social science professions at various points in their life span.

The intellectual, daily, physical, and civic lives of individuals are the *professional* responsibility of these groups as evidenced by the minimal characteristics of a profession. That is, each group maintains a code of ethics, requires specialized education, builds a corpus of knowledge constructed on theory, and supports professional associations involved in accreditation, standards, and professional development. All five of these professions have an established code of ethics. Although police and journalists may be hired in smaller organizations without the relevant baccalaureate degrees, those with the proper degrees are hired and promoted more quickly. The domain knowledge of each profession includes a substantial and interdisciplinary theoretical basis with doctoral programs in place to continue development of that knowledge base. Each of the five groups supports one primary and several secondary professional associations that address accreditation of educational programs. In the case of librarianship, that accreditation concerns graduate programs;

various police and criminal justice associations accredit not only the undergraduate programs but also the actual departments in individual municipalities.

Within the context of this definition of the "social science professions," this entry examines the information environment, common information behaviors, and primary information issues of each of these five social science professions. Teachers are examined in their primary and secondary school roles; university faculty's information issues are addressed elsewhere. Librarians in institutional settings of all types are included; entrepreneurial information industry individuals and other information specialists are not included. Social workers are included in their most traditional context although it must be recognized that lines may blur, in some jurisdictions, with public health and counseling professions. Municipal police officers involved in direct community protection and engagement are included; the larger governmental machinery, from the FBI to the judiciary, is excluded as its focus slides away from the individual within the community context. Journalists working in all formats are included.

TEACHERS

Teachers' actual information experiences and environments are studied relatively rarely. Piecing together a few in-depth studies, fragmentary case studies, examinations of professional development needs, and analyses of EBP creates a reasonable picture of their crowded information world. Their daily work entails an ever-increasing amount of statistical and narrative data on their students, including comparative data from a plethora of standardized tests, which can be analyzed along a number of variables such as socioeconomic status or geographic location. Gathering materials for incorporation into lesson plans and the

overall curriculum has long been recognized as a critical aspect of their daily work, particularly when new material must be taught or standards change. Their professional growth includes locally mandated training, serials (both research and professional practice items), and optional training via conferences and similar organized functions. Their “community of practice” information network includes on-site colleagues, mentors, and extended networks in both local and digital channels. While some teachers have access to research databases and professional development collections in their own schools, nearby college campuses, or public libraries, most lack access to a substantive collection, much less a professional librarian prepared to assist in its use. Extremely limited time and low confidence in their ability to synthesize scholarly research are factors in their preference for research summaries that distill research into contextually relevant, brief, substantive overviews.^[1]

Although biology teachers’ experiences are probably not typical of the profession as a whole, their use of the Internet and a wide range of information resources in multiple formats is encouraging. Incorporating post-Internet resources into curriculum design is not, however, matched with an equally ready use of online databases, digital libraries, discussion lists, and other electronic resources designed to support teachers. Inadequate search skills and underutilized librarian connections underpin many of these concerns. Lack of search proficiency is confounded by a general lack of time in that many biology teachers believe any useful search will take an inordinate amount of time due to their undeveloped search skills. Resources which spark ideas and cover current information are particularly valued and a digital format is generally preferred.^[2] A disciplinarily broader study of high school teachers indicates that they value the breadth, speed, and easy access of the Internet over the quality and depth of online databases although overwhelming responses to Internet searches severely discourages others.^[3]

Using the scholarly research produced by university faculty and government agencies is part of many teachers’ professional lives. That use, however, is circumscribed by their knowledge base, attitude, information need, and access to research. While research may move towards developing or refining theories, teachers are looking for concrete, practical strategies and tactics, which can be readily incorporated into their daily teaching. Primarily theoretical research study is unlikely to be viewed as worthwhile or contextually relevant. Research which provides strong and direct connections between findings and conclusions or echoes their own life experiences is more likely to be viewed as credible. The sustained opportunity to read, discuss, and engage with research increases both comprehension and understanding but is all too rare. Teachers generally lack physical access to research materials and the time with which to study them. In addition, access is curtailed by a limited sense of self-efficacy in

terms of both finding appropriate research and fully comprehending its implications.^[1] The dense academic language, confusing references to theory, and narrow focus of scholarly studies also inhibit teachers’ use of them.^[4]

The “community of practice” aspect of information use is particularly powerful for teachers who address educational problems on many levels of their organizations. Through mentoring (both formal and informal), unit/department meetings, school-wide developments, and extensive interpersonal networking, teachers embed their daily practice in social communities of shared interest in educational practice.^[5] Information which is generated by and integrated into this community of practice is more likely to be perceived as useful, credible, and accessible.^[6] Harnessing this social network to support change however can backfire if opinion leaders are presented as administratively sponsored experts. Teachers are likely to become defensive, identifying characteristics of their own situations that invalidate the “expert” advice. Organically integrated change agents can disseminate both research and experiential information in a community of practice most effectively.^[7] Contextualized, supported information seeking, use, and collaborative design develop in a social network of trusted colleagues, even in a primarily digital environment.^[8]

Finally, teachers have long been inculcated with a tremendous sense of their responsibility for effective integration of information technology (IT) into the curriculum. The last two generations have received training, studied standards, designed techniques, developed curricula, taken workshops, and otherwise striven to master and keep ahead of the IT which permeates modern Western education.^[9] The ability to search databases, manipulate statistical test data, browse the Web, and use the Internet for both communication and information dissemination are all viewed as part of their professional responsibility, much like mastery of their subject or grade area. An understandable reaction for some teachers, however, is a profound sense of futility. Since the schools rarely have high-quality hardware, intuitive software, customized professional development, or a full range of useful databases, even those who are willing to continually invest their rare fragments of unscheduled time in information skill improvement may find the return on their investment inadequate.

LIBRARIANS

Librarians’ information environment and experiences are replete with paradoxes. They are the only social science profession which requires graduate work as the terminal degree but about two-fifths of the programs fail to require a course in research methods.^[10] Although well aware of contextual influences on information experiences, research faculty sometimes fail to value the tacit knowledge of practitioners in their studies of user groups which

leads, in turn, to research designs that librarians view as less than robust. The scholarly research literature is abundant, increasingly interdisciplinary, and theoretically grounded but practitioners and scholars agree that little of it is intended to be directly applicable to professional practice. Practitioners who conduct the applied research their colleagues desire produce, at times, substandard work due to a lack of research method preparation and experience. Despite a vibrant community of practice on local, regional, and national levels, librarians may tend to focus so narrowly on their own institutions that they fail to transfer knowledge from research studies to local settings.^[11,12]

Related to these matters is the fact that information science (IS) is in its infancy as an academic discipline but it has readily subsumed librarianship and archives as “legacy” fields. As the term “legacy” implies, the associations are viewed by some as an unwelcome inheritance to be born only so long as is essential rather than as a germinal core contributing to the rich development of a new, integrated knowledge domain. Naturally, librarians find research streams generated by faculty who define their newly forming field by repudiating the quality, value, and relevance of librarianship as a profession unlikely to produce practical data or predictive theory. Other faculty and librarians embrace the potential for leveraging the breadth of IS as an evolutionary platform for major growth in librarianship through integrated, creative, responsive research and practice. As one extreme exemplar of the division, consider the impact ranking of the *Journal of the American Society for Information Science and Technology* (usually in the top 4–8) and the fact that most librarians never read it at all (p. 23);^[12] (p. 237).^[13] Faculty strive to publish in a journal that librarians rarely read. Other divisions, however, are not so sharp as evidenced by the high ranking (usually in the top 8–12) of *College & Research Libraries* which is read in full and regularly by academic librarians, many of whom receive it as part of their professional association membership.^[12]

Within that rapidly developing context, librarians make moderate use of scholarly research for professional purposes. Through conferences, workshops, and journals they seek out distilled research findings that have been carefully transliterated from a theoretical to an applied focus. (Faculty in many IS programs are actively discouraged from contributing to any of these forums on the grounds that such efforts constitute service, rather than research dissemination, and service should be focused on the scholarly field rather than on practitioners.) Regularly reading the scholarly journals of their various professional associations, librarians are particularly interested in applied research on the integration and effective development of tools on the free Internet. Librarian/faculty research collaborations, generalizable studies, and evaluative case studies have long been touted as fruitful means of more deeply engaging librarians in research and, thereby, fostering their increased use of research in daily practice.^[12]

Informal information networks among librarians are well developed in multiple channels including conferences, electronic discussion lists, e-mails, phone calls, wikis, blogs, RSS feeds, and virtual groups. Professional standards, in-house practice, digital resources, and even physical resources are deliberately sought, shared, and traded with in-house and external colleagues in the large community of practice. The experiences, insights, and opinions of these knowledgeable colleagues bear more authority than do empirical research findings.^[13]

Professional development requirements for librarians demand sustained formal and informal information seeking, analysis, and application. Information technology design, development, deployment, and evaluation combine with established domain knowledge areas such as information literacy, organization, service, and management. As laws, technology, and user expectations develop, librarians struggle to anticipate the next learning curve. In addition to domain knowledge, professional capabilities in communication, strategic planning, customer care, and IT skills require continuous professional growth.^[14] The wide range of knowledge domains and skill sets combined with the multi-role and even generalist-role of many librarians make simply keeping up with professional information a significant challenge. Seeking, filtering, evaluating, and incorporating a steady flood of information on current practice is insufficient when librarians also seek to anticipate user demand and IT developments. Trend analyses, experientially authoritative digests, and concept development works are valued for their contribution to professional development.^[15]

SOCIAL WORKERS

Licensed, degreed social workers are almost universally mandated by states to continue their professional education through accumulation of continuing professional education (CPE) units. That fact alone provides an indication of the information demands made by their professional obligation to stay current with techniques and domain knowledge. Disseminating best practices, bolstering accountability, and strengthening society’s opinion of the profession’s quality, CPE activities are sanctioned by licensing boards who privilege certain formats, e.g., formal meetings such as workshops and conferences. Social workers actually believe they learn more from and change their practices based on informal formats, i.e., reading journals and peer consultation.^[16]

As in the medical fields, IT is an increasing norm for the social worker. Striving to bring records into the field with sufficient accessibility, security, and accuracy to enhance client interactions, social work IT involves the use of customized databases, meta-analysis, visual files, and portable, wireless devices. Research suggests that acceptance of IT is more dependent on attitude than on IT

efficacy. That is, social workers who believe in the potential value of the technology are far more likely to master, adopt, and fully incorporate it into their daily work. Developing that receptive attitude requires ceding elements of design control to those who must use the end-product, establishing peer-managed deployment teams (rather than using a top-down administrative approach), providing training that highlights client benefits rather than technology mechanics, rewarding effective or innovative adoption, and creating an ongoing support system for IT utilization. The journal reading and peer consultation mechanisms preferred by social workers will dovetail neatly with these IT development techniques.^[17] As the subfield of social work informatics develops, many of these critical information issues may be addressed on a systemic, professional level rather than on an in-house, ad hoc level.^[18]

Although social workers' information needs necessarily encompass a number of disciplines (e.g., medicine, law, education) for a number of populations (e.g., domestic violence survivors, veterans, cancer patients, seniors), there is little evidence that they have the information-seeking skills necessary to step easily into the research and practice literature of other fields to retrieve requisite information. Use of professional, rather than research, journals as well as official practice guidelines and directories is common. Their understanding of librarians' capabilities, resources, and services requires updating just as their online database and Internet search skills require development.^[19] The two primary databases in field, *Social Work Abstracts* and *Social Service Abstracts*, complement each other so that both must be mastered for a thorough search.^[20] The preference for interpersonal information seeking may undercut their utilization of research. Of course, simply getting access to the Internet, printers, e-mail, and baseline computers is still a major issue for many social workers—as is library access even in settings with specialized libraries, such as hospitals. Evidence of substantial interest in learning how to seek and identify useful information provides an additional area which might be incorporated into CPE planning.^[19,21,22]

POLICE OFFICERS

The development of community policing^[23] and data-driven police administration, including knowledge management initiatives,^[24] has burgeoned in the post-9/11 world of law enforcement. The ability to mine the narrative files of individual police officers' incident reports as well as aggregated numeric data across an entire municipality requires a level of information management sophistication that is unprecedented in police work.^[25–29] In larger municipalities, administrative police officers and civilian information systems analysts work on customized, integrated information networks for data analysis and

management. Cooperating with other first responders^[30] as well as with national agencies, these high-level information exchanges require specialized training and IT. Administrative functions (e.g., budgeting, record keeping) and service delivery (e.g., dispatch, jail management) can be handled by civilian departmental employees in some settings.

On the street and in the detective units of police departments, however, individual officers face very different information needs. Individual officers work to keep up with legally mandated changes in guidelines, standard operating procedures, and criminal law. In those relatively few police departments which are accredited by the Commission for Accreditation of Law-Enforcement Agencies (CALEA), formal procedures and training requirements provide an infrastructure for that information distribution. In addition, CALEA approved departments tend to have a higher level of education required for new officers.^[31] That education is increasingly an associate's degree and, in larger departments, a Baccalaureate in criminal justice or sociology. Generally a stronger educational base strengthens the potential for effective information seeking but, unfortunately, so little is known of the information experiences of patrol officers that no definite corollary can be established. Lynda Baker's study of information needs among female police officers involved in undercover prostitution work is unique in its examination of frontline officers' full range of information needs. Their heavy reliance on interpersonal information exchanges grows directly from the highly specific nature of the work and almost certainly does not reflect the information needs of all officers.^[32]

The infrastructure required to implement an officer-level IT initiative in a police department is so complex that any change is likely to become institutionalized by the sheer weight of training requirements, regulations, procedures, and other legally required bureaucracy. The personnel training and adaptation issues become paramount when making a significant IT change.^[33] As patrol officers incorporate IT into their daily work, often riding with a networked computer in the patrol car, their appreciation of information quality and timeliness is a significant factor in their acceptance of new IT. The ease of use and utility criteria originally identified as acceptance factors have been augmented in the last decade by these two new factors, an indication—perhaps—of an increasingly sophisticated incorporation of information into daily work.^[34] Reports created by officers on digital forms can be automatically shared across departmental lines, trigger automated reminders for appropriate follow-up action, and feed into those larger aggregated systems mentioned earlier. Incorporating IT into a department causes inevitable personnel shifts, particularly a decline in the number of sworn officers and a rise in the number of civilian employees. Whether this is due to an IT-generated increase in officer efficiency or the budgetary drain of IT is yet to be determined.^[35]

JOURNALISTS

The role of “citizen journalists” in documenting national catastrophes, such as hurricane Katrina, illustrate the information environment shifts experienced by professional journalists.^[36,37] Using blogs, text messages, Google maps, e-government, and a combination of portable and desktop equipment, citizen journalists documented the disaster, disseminated information, and gathered the raw material of their analyses. The materials they send in to professional journalists connects these two groups directly, particularly in times of crisis.^[38] Like the citizens who also strive to inform the wider public, many professional journalists have been making use of extensive IT (particularly portable devices), mining gray literature and government materials online, and vigorously maximizing the Internet’s capabilities for both data gathering and communicating.

Unfortunately, a number of substantial difficulties continue to inhibit digital information seeking for some journalists. Recognizing the authority issues inherent in Internet-based information, journalists struggle to verify their findings despite a lack of sufficient contact information. Identifying high-quality information in a tsunami of options overwhelms some journalists and generates a reluctance to engage with the technology sufficiently to improve search skills. Accuracy, attribution, searchability, and easy access were sought but not always located by journalists in their Web work.^[39] As recently as 2003, among some small, Oklahoma newspapers, particularly weekly papers, Internet access was still problematic due to cost or lack of a local provider. Others chose not to use it due to a lack of training although most had incorporated it to some extent.^[40]

Librarians contribute to journalists’ work in both the classroom and the newsroom. There are some indications that the entire research function is underdeveloped in nascent journalists due to a lack of search skills but academic librarians have been able to address these issues when curricular changes do not provide a more in-depth response.^[41,42] Incorporating librarians into the newsroom information flow both increases effective use of digital information resources and enhances the connections between journalists and librarians.^[43]

SUMMARY

In all five social science professions, the profound gap between scholarly research and applied research scars the information environment. Tenure requirements, the legitimate disciplinary need for sound theory development, and academia’s tendency to place “soft” research fields toward the bottom of the prestige ladder combine to push some scholars in these fields to write for each other with minimal regard for the immediate utility of their work within

the actual professions they study. Heavy workloads, minimal educational preparation, a sharp focus on their clients’ immediate needs, and/or the constant struggle to keep abreast of externally imposed changes combine to push practitioners in these fields to seek out works which are “utilitarian, inspirational, provide immediate payoffs and meet local needs” (p. 453).^[15]

EBP requires the systemic incorporation of empirically validated data (rather than personal experience) as a deciding factor in changing daily practice. Although potentially useful on the individual level, EBP in these social science professions generally requires such substantial effort to identify, gather, and analyze appropriate information that it is practiced on a more integrated level such as that of a department or entire organization. Analyses of the relatively sparse use of EBP suggest that information is more likely to be recognized as appropriate if practicing professionals have been involved in actually formulating the research questions and research design, rather than simply used as study participants (p. 454).^[15] Legislatively mandated change, particularly when appropriately funded, is far more likely to effect change than is individual or even group-based efforts to identify and incorporate research in an EBP initiative. The IT complexities involved in manipulating, analyzing, storing, interpreting, and sharing data for EBP work calls on skills that are hardly universal and require use of software that still needs basic usability development.^[44] The “work-place culture of action, not reflection, and the absence of information resources and skills” make EBP difficult at a time when social policy tends to require it with increasing insistence (p. 191).^[27] Time constraints and a professional culture that values action to the exclusion of reflection make effective incorporation of research and praxis-based findings difficult to manage.

The social science professions impact critical aspects of our daily lives. On a larger scale, they are the living embodiment of social values and societal development. Regular, in-depth research on the information environment and experiences in which these professionals function should be recognized as a responsibility of IS scholars. By understanding and serving the information needs of these professions, we support society’s responsibility for the minds, lives, and connections of all individuals.

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Society for Scholarly Publishing (SSP)

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Abstract

The Society for Scholarly Publishing (SSP) is an international organization for both individuals and organizations that is dedicated to the facilitation of learning, communication, and the advancement of appropriate technologies for all who are involved with scholarly communication. The Society is unique in that it draws from all parts of the scholarly communication chain—authors, editors, librarians, information specialists, publishers (commercial, university, and society), printers, subscription agencies, and creators and vendors of various technology solutions. This article covers the Society's first thirty years, from its founding in 1978 and early history, its evolving organizational structure and programs, and its current and future plans for providing a forum to address challenges to scholarly publishers and producers.

INTRODUCTION

The Society for Scholarly Publishing (SSP) is an international membership organization for individuals and organizations that is dedicated to the facilitation of learning, communication, and the advancement of appropriate technologies for all who are involved with scholarly communication. The Society is unique in that it draws from all parts of the scholarly communication chain—authors, editors, librarians, information specialists, publishers (commercial, university, and society), printers, subscription agencies, and creators and vendors of various technology solutions. The SSP covers all aspects of scholarship, including the humanities, social science, science, technology, and medicine.

Any individual interested in the aims of the Society is welcome to join. The SSP originally targeted decision makers for membership. More recently, it created additional dues categories to encourage early and mid-career professionals, students, and librarians to join. A growing focus on networking and assistance in improving one's job performance is a hallmark of the Society. The tagline adopted in 2008 reflects the emphasis on individuals: "Innovative People Advancing Scholarly Communication."

The mission of SSP is to advance scholarly publishing and communication and the professional development of its members through education, collaboration, and networking among individuals in the field Fig. 1. The Society's logo, a globe with myriad points of connection, is a graphic representation of this central concept. The logo was designed by William Propert with what was then William Byrd Press. It was proposed for adoption and

unanimously approved at the July 12, 1978 meeting of the Board of Directors. The minutes provide this description: "The points of the circumference of the circle represent the various communities the Society seeks to serve and the chords across the circle symbolize the interactions and lines of communication and interest among those communities."

The SSP was founded in 1978 for educational purposes. It is incorporated in the District of Columbia as a nonprofit corporation under section 501(c)(3) of the U.S. Internal Revenue Service (IRS) code. The SSP's Board added an organizational membership category in the mid-1990s. About 40% of the membership represents individuals who work for the 50 organizational member companies, which are evenly divided between scholarly societies, commercial and nonprofit publishers, vendors, and service providers. The membership in 2000 numbered 750; by 2008, it had grown to 1000. The majority of members reside in the United States and Canada, but more than a dozen other countries are also represented.

The 2008 annual budget was \$750,000. All funding is generated from dues, Society programs (including exhibits and sponsorships), and some donations. The SSP has never been funded by outside sources, although a number of vendors have provided in-kind services over the years to help build the Society.

FOUNDING AND EARLY HISTORY

The SSP had a wealth of sources of inspiration leading to its formation. The earliest progenitor was the conference

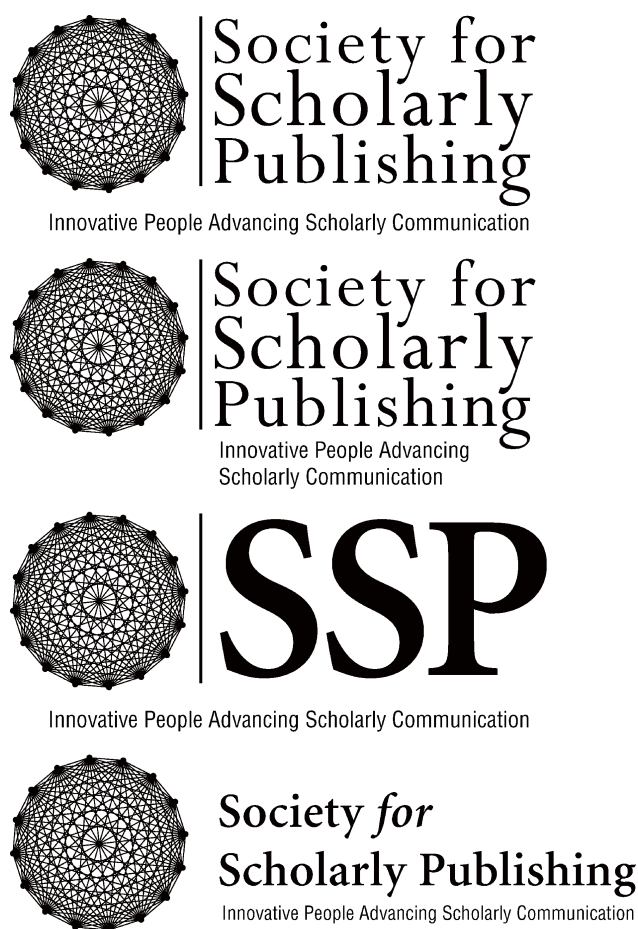


Fig. 1 The logos of the Society for Scholarly Publishing (used with permission of the SSP).

on the future of scientific and technical journals, sponsored by the Professional Communications Group of the Institute of Electrical and Electronics Engineers (IEEE) in May 1973.^[1] The idea for the conference came from George Schindler, head of technical publications at Bell Laboratories. James M. Lufkin, manager of professional publications at Honeywell, Inc., served as general chair. At the close of the meeting, Lufkin declared the foundation of the Association of Learned Journal Editors, Publishers, and Users and automatically made each registrant at the conference a member.

Two IEEE-sponsored conferences followed in 1975 and 1977.^[2,3] By 1977, the Lufkin-created association had shortened its name to Association of Scientific Journals (ASJ). At the insistence of its founder, the association had “no dues, no officers, and no formalities known to its members.” Most of the participants at the first conference were engaged directly in publishing. By the 1975 conference, the list of participants had expanded greatly and included many librarians, information specialists, and vendors. The lively debates among this wider array of individuals influenced the founders of SSP and

were instrumental in determining the breadth of membership that SSP chose to serve.

A second source of inspiration came from a project devised and funded by the National Science Foundation (NSF) from 1974 through 1978, “Improving the Dissemination of Scientific and Technical Innovation,” more commonly known as the Innovation Project.^[4] The intent of this project was to document and share information about publishing and production procedures that would be of value to those concerned with scientific and technical journals. Two contractors were chosen by NSF to complete a survey of various organizations. The outgrowth of the survey was a planning guide to assist editors, publishers, and others involved with communicating scientific and technical results. This project had an interesting definition of innovation, as described in one of the letters seeking input for the survey: “Please understand that by ‘innovation’ we do not necessarily mean the leading edge of technology. Rather, we construe it to mean anything that has not yet become standard practice. Quite often, what is considered prosaic by one organization will be considered novel by another.”

Preparation of the planning guide fell to the Capital Systems Group of Maryland. This independent management service organization was assisted by a technical advisory panel and, later, a user advisory panel. Several of those involved with the Innovation Project had also participated in the IEEE conferences. Among them was Jack Goellner, director of Johns Hopkins University Press, who suggested that the scholarly publishing community needed a lobbying organization independent of the various trade associations in existence. The voice of scholarly publishing was not being heard by Congress. This was the period of the omnibus revision to the U.S. Copyright Act.

Goellner’s comment motivated Fred Spilhaus, executive director of the American Geophysical Union (AGU), who enlisted John Strawhorn as the Innovation Project manager at Capital Systems, as well as Judy Holoviak, director of publications at AGU. The three wrote a prospectus for SSP and recruited Mark Carroll, director of professional publications at the National Park Service, to serve as president pro tem. Other members of the pro tem board of directors were inducted, and the first board meeting was held in early spring 1978. The first annual meeting was held in Boston in June 1979, where Lufkin, as founder of ASJ, was formally designated godfather of SSP.^[5]

The goals of the Society were summarized by its original mission statement:

The mission of SSP is to draw together individuals involved in the process of scholarly communication. This process requires successful interaction of the many functions performed within the scholarly community. SSP provides the leadership for such interaction by creating opportunities for the exchange of information and opinions among scholars, editors, publishers, librarians,

printers, booksellers, and all others engaged in scholarly communication.

The original import is retained in the current mission statement.

CHALLENGES TO SCHOLARLY PUBLISHERS AND PRODUCERS

The founders of SSP recognized that the problems facing scholarly publishing could best be addressed by engaging all the key individuals in the information chain. Different branches of learning have special concerns. For example, publications dealing with chemistry and math must deal with specialized characters, which complicates typesetting and layout; geological publications must be able to reproduce complex maps; medical publications have stringent demands for reproduction of images. However, most of the problems of scholarly communication cut across disciplines. Handling the peer-review process in a timely and ethical way is a concern for all disciplines. Most scholarly publications rely heavily on volunteers to serve as editors and reviewers. Convincing volunteers to give of their valuable time is another common challenge for all areas of scholarship.

More recently, the producers and users of scholarly information are dealing with the costs and uncertainties of electronic publishing. This has set up an entirely new set of problems, not the least of which are lack of standards for production and delivery and the unknown costs of maintaining and upgrading archives when technology changes.

The SSP's founders believed that because many organizations involved in scholarly publishing are small and some are made up entirely of volunteers, sharing information and addressing common problems together should help make limited resources go further and should lead to better service overall for scholars. This foundation has served SSP well, creating a supportive atmosphere for addressing challenges posed by new technologies and business models such as open access, as well as anticipating future changes in order to ensure the long-term viability of all the professions represented by the SSP membership.

Although one of the inspirations for founding the Society was the sense that the scholarly publishing community should create its own lobbying organization, SSP has never attempted to influence legislation or public policy. Within 2–3 years of its formation, the Board of Directors took a formal action to abstain from any form of advocacy. The Board was concerned that no matter how carefully advocacy positions might be developed, they could easily become divisive because of the breadth of interests represented by the members. A small organization with a very diverse membership simply could not afford

activities that might ultimately tear the Society apart. Lobbying has been left to more specialized associations. Successive boards have confirmed the wisdom of this decision.

ORGANIZATIONAL STRUCTURE

The officers and Board of Directors are elected by the membership. The individual chosen as president-elect automatically succeeds to presidency. Prior to 1996, the term of the president-elect and the president was 2 years each. In 1996, the term changed to 1 year for each position, and the individual then continued on the Board for an additional year as past president.

The other elected officer is the secretary-treasurer, who serves a 3-year term. There are nine elected directors, who serve 3-year terms, with three elected each year. The SSP officers for 2008–2009 are President October Ivins, Ivins eContent Solutions; President-Elect Raymond Fastiggi, Rockefeller University; Past President Susan Kesner, Copyright Clearance Center, Inc.; and Secretary-Treasurer Mady Tissenbaum, *Journal of Bone and Joint Surgery*.

The programs of the Society are managed by member volunteers under the guidance of the Board of Directors. SSP enjoys the active participation of many members who serve on committees, each of whom is responsible for critical programs and events serving all members' information and networking needs. Committee chairs and members are appointed by the president with the advice and consent of the Board. The president serves ex officio on all committees except the Nomination Committee. Each committee has a Board liaison, and committee chairs or cochairs are invited to Board meetings. Board meetings are held in conjunction with the annual meeting (May/June), the IN: Innovate, Interact, Inspire meeting (September) and in February.

At present, the SSP committees are as follows:

- SSP Annual Meeting Program Committee—plans and implements the SSP Annual Meeting
- SSP Development Committee—develops the exhibits and sponsorships program
- SSP Education Committee—plans and manages on-site and Web-based seminars and the Librarian Focus Group
- SSP Executive Committee—made up of Board members, acts for the Board of Directors between Board meetings
- SSP Finance Committee—makes recommendations regarding Society finances and investments
- SSP IN Committee—plans and implements the SSP IN: Innovate, Interact, Inspire Meeting
- SSP Marketing Committee—coordinates the promotional efforts of all committees

- SSP Membership Committee—solicits new members and monitors member satisfaction
- SSP Nominating and Awards Committee—prepares the slate of officer and Board candidates and identifies worthy individuals for awards
- SSP Organizational Collaboration Committee—guides the Board in decisions about collaborations with other organizations
- SSP Professional Development Committee—develops mentoring programs and administers the student and early career travel grant awards
- SSP Publications and Research Committee—oversees publications, the Web site, and development of research to provide key information to members
- SSP Web Site Development—coordinates planning for Web site technology and strategy
- SSP Web Site Editorial—maintains and updates Web site content

Since 1990, the administration of the Society has been managed by the Resource Center for Associations, an association management and consulting firm located in Wheat Ridge, Colorado. The position of executive director is held by Francine Butler, and David Stumph of Management Liaison. Ann Mehan Crosse, Associate Director, coordinates contributions from other key staff. Butler and Stumph are partners in the Resource Center for Associations.

STRATEGIC PLAN

Strategic plans over the years have served SSP well. A major initiative was implemented under the leadership of Susan Kesner in fall 2007, building on prior efforts led by publishing consultant Norman Frankel. A planning retreat of the Board and committee chairs produced a plan that addresses membership; marketing, communication, and visibility; programming; and governance, finance, and infrastructure. The plan is reviewed and updated at each Board meeting and has guided many of the changes already made and being planned. This initiative recognized and expanded the broader, more inclusive focus represented by, among other things, the establishment of Student and Early Career Travel Awards to the Annual Meeting, which was initiated in 2006 by Amy Brand, Harvard University Office of Scholarly Communication.

PROGRAMS OF THE SOCIETY

All programs of SSP are educational in nature. The Society organizes a variety of different-sized meetings. Over the years it has also had a varied publication program.

Meetings and Seminars

The SSP Annual Meeting is held in May or June each year. Until 1999, the venue was normally a major East Coast city with occasional excursions to the midcontinent and the West Coast. In 1999, a three-city rotation (Boston, San Francisco, District of Columbia area) was introduced, which simplifies site selection and arrangements. Attendance at recent annual meetings has been 650–770. The educational sessions normally last 2–2½ days with a combination of premeeting seminars, plenary sessions, and concurrent sessions on a wide range of topics. In past years, sessions were taped and participants as well as those unable to attend may purchase the tapes. The Board is revisiting this practice in light of new media options.

The educational sessions are designed to be of interest to both seasoned professionals and more junior colleagues. Topics are selected to cover the interests of authors, editors, librarians, publishers, and vendors. Sessions are often designed to look at a given problem from these different perspectives. Premeeting half-day and full-day seminars have a narrow topical focus and are more tutorial in nature than the plenary and concurrent sessions. Recently, many premeeting seminars have been concerned with issues related to new technologies.

About 30–40 exhibitors display their products and services at the annual meetings. Exhibitors are encouraged to participate fully in the educational sessions, and the schedule for the exhibit is set accordingly.

Each fall, SSP holds a 1–1½-day program for decision makers, formerly called the Top Management Roundtable (TMR). Leading-edge issues are the focus of the roundtable. The format allows for considerable discussion and debate. The originator of this very popular series was William Teare, a printing industry executive who served on the pro tem Board. To ensure uninhibited discussion, the TMR has only once been taped. The value of the TMR comes much more from the informal discussion than from the invited presentations.

In recent years, the TMR has become more like a small conference and has attracted a broader range of attendees. For several years, the meeting theme has focused on innovation, with speakers drawn from industries and communities outside scholarly communication. Beginning in 2009, the meeting was rebranded as the SSP IN: Innovate, Interact, Inspire Meeting.

Starting in 2007, the TMR was covered by a public Weblog (blog) written by Jill O'Neill, NFAIS. In 2008, blogging was continued and podcasting was added. This opening of the TMR discussions reflects the Society's mission to enhance the sharing of information to benefit all members.

SSP also sponsors 10–20 educational face-to-face or Web-based seminars each year. On-site seminars are held in the spring and fall as half-day or full-day events; often several seminars are scheduled back to back in the same

facility to reduce travel costs for attendees. Attendance is limited to ensure ample time for questions and answers. Most seminars are designed to offer something of interest to managerial-level staff. Those designed for the novice are identified as such. The Society is experimenting with adding online communities to these events.

In 2005, SSP introduced the Librarian Focus Group. This member-only event enables publishers to interact with librarians who represent many types of libraries (medical, corporate, research, small college, etc.) to hear about effective ways to market content to libraries as well as explore budget forecasts, technology and interface preferences, changing user needs, and other current topics.

The SSP has also been a coorganizer of meetings. Partners have included the Association of American University Presses, Council of Biology Editors, the Association of Earth Science Editors, the International Federation of Scientific Editors' Associations, the Geoscience Information Society, and the North American Serials Interest Group.

Publications

The SSP published the proceedings of its first 11 annual meetings (1979–1989). Submission of an article was not mandatory for speakers, and there was no attempt to provide summaries of sessions for which the speakers did not submit articles. In 1990, the Board determined that it was too costly to continue this publication series. In its place, summary reports were published in the newsletter. Once tapes of the annual meeting sessions were available for sale, the publication of summary reports ceased.

The Society publishes a printed membership directory, which is available only to members. There is also an online membership directory. The information in this directory is intended for noncommercial use by SSP members only.

The Society has had three different newsletters during its history. The first, entitled *The Letter*, was published quarterly starting in 1980. However, quarterly publication meant that it was difficult to have timely news for Society members. In 1992, the Board decided to undertake a more ambitious publication, and a totally revamped newsletter was started under the title *Scholarly Publishing Today*. It was intended to be a bimonthly publication. *Scholarly Publishing Today* continued to be published nominally 6 times a year through 1996. This incarnation of the newsletter proved too great a time commitment for the volunteers who acted as editors, reporters, and production staff, and as a result, in 1997, only four issues were produced.

In 1997, the Board decided to put most of its publication efforts into a more extensive Web site (<http://www.sspnet.org>). A four-page printed newsletter, entitled *SSP Bulletin*, was also issued at that time. It provided information in a much abbreviated form and pointed members to the appropriate places on the SSP Web site for more

details. Publication of the *SSP Bulletin* ceased in 2000. To some extent, that publication served as “push technology” while the membership was getting accustomed to turning to the Web for news notes, articles, and technical information.

In 2006, SSP reached an agreement with the U.K.-based Association for Learned and Professional Publishers to cosponsor the publication of *Learned Publishing* (ISSN 0953-1513, Online ISSN: 1741-4857). The North American editor and several editorial board appointments are made by SSP. Priscilla Markwood, American Society for Investigative Pathology, the first editor appointed by SSP, was succeeded in 2008 by Janet Fisher, Publishers Consulting Group.

Led by volunteers Alix Vance, CQ Press, and John Shaw, Sage Publications, SSP invested in an extensive Web site redesign and moved to a new platform in 2007. The SSPNET.ORG Web site includes a Wiki workspace for committees and the Board. In addition to the online membership directory, a calendar of events, a job bank, and the means for conducting Society business, the SSP Web site contains a News page for information on topics of interest to those involved in the diverse areas of scholarly publication; Publications and Links, with access to a vast array of resources as well as members-only access to *Learned Publishing*; member news releases; Standards Watch, which provides information about the development and implementation of standards in the information industry; and the Services Directory, where members can list their services for hire.

With the launch of the redesigned Web site, SSPN founding Editor in Chief Barbara Meyers Ford, Meyers Consulting Services, and Managing Editor Lois Smith, Human Factors and Ergonomics Society, developed a new e-mail-format newsletter, *SSP News*. Published up to 8 times per year, it contains news and articles of interest to members. Currently, Meyers leads an editorial team that includes Associate Editor Patricia Baskin, *Neurology*, and Managing Editor Holly Manning, American Society for Clinical Pharmacology and Therapeutics.

In 2008, the Society launched a blog, The Scholarly Kitchen (<http://scholarlykitchen.sspnet.org/>), which is written by Kent Anderson, *New England Journal of Medicine*, as well as initial guest contributors Philip Davis, a doctoral student at Cornell University, and Howard Ratner, Nature Publishing Group.

FUTURE PLANS

The Society for Scholarly Publishing continues to grow and develop, helping its members continue to succeed as scholarly communication itself changes. Networking opportunities are perhaps best realized through service on committees, task forces, and publications. A member

survey conducted in fall 2008, for which there was a 38% response rate, revealed that members gave the highest ratings to the annual meeting and other networking opportunities, in-person seminars, and the member directory. Analysis of survey responses indicates that what members need and expect from SSP is ongoing access to information that is relevant to how people do their jobs both strategically and practically. The consonance of that desire with SSP's mission statement suggests that the Society can look forward to at least another 30 years of success as it strives "to advance scholarly publishing and communication and the professional development of its members through education, collaboration, and networking among individuals in the field."

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Society for the History of Authorship, Reading and Publishing (SHARP)

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Abstract

The history, organization, activities, and publications of the Society for the History of Authorship, Reading and Publishing (SHARP) are described.

INTRODUCTION

The Society for the History of Authorship, Reading and Publishing (SHARP) is an international association of scholars, librarians, and book trade professionals interested in the history of print culture in all its manifestations, from papyri to the World Wide Web. Founded in 1991, SHARP now has more than a thousand members in more than 20 countries, with every continent except Antarctica represented. Its activities include holding annual meetings and special conferences; maintaining a Web site and an electronic discussion list; offering prizes; and publishing a newsletter and an annual journal.^[1]

HISTORY OF THE ORGANIZATION

The history of the book—also known as the history of print culture—has long been incorporated into a variety of academic disciplines, including bibliography, cultural and intellectual history, literary criticism, journalism, sociology, librarianship, business history, textual editing, legal history, and the history of education. The scholarly activities of book historians were thus scattered among a wide range of learned and professional societies, such as those of historians, educators, sociologists, librarians, and literary critics, and the professional organizations of publishers and booksellers. Despite this lack of formal unity, book historians around the world had undertaken large-scale research projects to study the national histories of the book. Such projects were under way in England, Scotland, Ireland, Wales, Germany, France, Canada, Australia, and the United States. Book historians thus felt the need for an organization to bring together those active in national projects as well as those interested in the history of print culture, regardless of academic discipline or professional activity. The purpose of such an organization would be to promote teaching and research in the field, and to enhance the visibility and status of the field itself. In 1991, two such scholars—Jonathan Rose, an American

historian, and Simon Eliot, a British historian—organized the first conference dedicated exclusively to the history of the book. This conference, held at the Graduate Center of the City University of New York, marked the beginning of SHARP.

Perhaps because its origins lie in so many disciplines, SHARP maintains close ties with other scholarly and professional organizations, including the American Historical Association, the American Printing History Association, and the Modern Languages Association. In some cases (AHA and MLA, for example), these ties are formal, with joint sessions organized at meetings. In other cases, the links are more casual: SHARP maintains liaisons with more than a dozen other scholarly societies.

ORGANIZATION AND OFFICERS

The Society for the History of Authorship, Reading and Publishing is organized under a constitution that was revised in 2007. It provides for an executive council consisting of a president, vice president, treasurer, recording secretary, membership secretary, director of electronic resources, external affairs director, director for publications and awards, and one member at large. It is further governed by a board of directors with 15–20 members. All officers are elected. Standing committees are the nominating committee (elected), and two conference committees, one for local arrangements and the other for the program. The organization's daily business (membership and periodical fulfillment) is conducted by the Johns Hopkins University Press.

The founders of the organization, Jonathan Rose and Simon Eliot, served as its first two presidents. They were succeeded by James L. W. West III, Beth Luey, Robert Patten, and Leslie Howsam. Officers have generally been drawn from the Anglophone world, but the board of directors has been more inclusive. The international aspect of SHARP is most visible, however, in its conferences.

ACTIVITIES

The Society for the History of Authorship, Reading and Publishing alternates its annual meetings roughly between North America and Europe, with focused meetings on other continents. North America meetings have been held in New York, Worcester (Massachusetts), Washington, Williamsburg, Vancouver, Claremont (California), Madison (Wisconsin), Minneapolis, and Halifax. European meetings have been held in London, Edinburgh, Cambridge, Oxford, Lyon, Mainz, and The Hague. In addition, meetings other than the annual conferences have been held in Calcutta, Cape Town, Sydney, Wellington, Venice, and Copenhagen.

Presentations at SHARP conferences are competitive, with proposals vetted by that year's program committee. The conferences are notable for the wide range of topics covered in presentations. Geographical coverage includes all continents; chronological coverage begins with the earliest scribal cultures and extends to the World Wide Web; genres discussed include children's books, literature, genre fiction, journalism, and propaganda; and topics covered include reading, authorship, illustration, bookselling, book design, marketing, book arts, printing technology, the economics of publishing, and book collecting. Roundtable sessions on teaching and curriculum are included in nearly every conference. Plenary speakers are distinguished scholars or creative writers chosen by the local arrangements committee. Another notable feature of SHARP conferences is the great variety of presenters. A panel might include the holder of an endowed professorship, a rare book dealer, and a graduate student. Although most papers are presented in English, some of the conferences have been bilingual, with simultaneous translation offered.

Between conferences, much of the conversation among SHARP members is conducted on the electronic discussion list, SHARP-L, through research questions, calls for papers, announcements of publications, and organizational business. Because members are located around the world, and because many of them are librarians at large research institutions, members are able to locate sources and have questions answered very efficiently. In addition, points of view from outside North America and northern Europe are represented, broadening and enlivening the discussions. The list is moderated and archived. It is open to nonmembers.

The Society for the History of Authorship, Reading and Publishing also maintains a Web site (<http://www.sharpweb.org>) that provides membership information, links to research projects, online resources (finding aids, research collections, and other materials), teaching syllabi and materials, and publications (periodicals, monographs, textbooks, and online collections).

The Society for the History of Authorship, Reading and Publishing offers three prizes, all presented at the annual meeting. The first prize established was the book history prize, renamed the George A. and Jean S. DeLong Book

History Prize in 2004, when it was endowed by the DeLong family. The prize, administered by a changing panel of judges, is awarded annually to the author of the "best book on any aspect of the creation, dissemination or uses of script or print." The winners to date have been:

- 1997 Ellen Gruber Garvey, *The Adman in the Parlor* (Oxford University Press).
- 1998 Adrian Johns, *The Nature of the Book* (University of Chicago Press).
- 1999 Scott Casper, *Constructing American Lives* (University of North Carolina Press).
- 2000 Kevin Sharpe, *Reading Revolutions* (Yale University Press).
- 2001 Jonathan Rose, *The Intellectual Life of the British Working Class* (Yale University Press).
- 2002 Elizabeth McHenry, *Forgotten Readers* (Duke University Press).
- 2003 Janine Barchas, *Graphic Design, Print Culture, and the Eighteenth-Century Novel* (Cambridge University Press).
- 2004 Simone Murray, *Mixed Media* (University of Michigan Press).
- 2005 Heather Andrea Williams, *Self-Taught* (University of North Carolina Press).
- 2006 Rimi B. Chatterjee, *Empires of the Mind* (Oxford University Press, New Delhi).
- 2007 James Raven, *The Business of Books* (Yale University Press).

Because so much work in book history is the product of collaborative research, SHARP also gives an Award for Distinguished Achievement every other year. This award goes to an institution, a research team, or a project that has produced a printed volume or volumes or a digital product. The first award, given in 2004, was to *Bibles imprimés du XVe au XVIIIe siècle conservés à Paris*, a catalog of the early modern printed Bibles that survive in the main Parisian libraries, edited by Martine Delaveau and Denise Hillard. The 2006 award was shared equally by two projects: the Archive of Publishers' Records at the University of Reading Library, England, for its archival, research, and service contributions to book history; and the *Waterloo Directory of English Newspapers and Periodicals, 1800–1900*, a reference work essential to the study of print culture in the nineteenth century. The prize was not awarded in 2008.

Finally, SHARP gives an award each year to the best article on book history submitted by a graduate student to its annual journal, *Book History*. The winner receives a cash prize and publication in the journal.

PUBLICATIONS

The Society for the History of Authorship, Reading and Publishing publishes a quarterly newsletter and an annual

journal. *SHARP News* (ISSN 1073–1725) includes essays, book and exhibit reviews, reports on the annual conference and other meetings of interest, calls for papers, conference announcements, a listing of new publications, notes and queries, and book history news. It is edited by Sydney Shep at Victoria University of Wellington, New Zealand.

In 1998, SHARP launched its annual peer-reviewed journal, *Book History* (ISSN 1098–7371 and ISBN varies year to year), whose first issue won the Council of Editors of Learned Journals prize for the best new journal. The journal's editors are Ezra Greenspan (Southern Methodist University) and Jonathan Rose (Drew University), who are advised by a 22-person editorial board. It is published by Penn State University Press, whose Web site provides the following description:

Book History publishes articles on the history of the book, broadly defined as the history of the creation, dissemination, and reception of script and print. It will publish research on the social, economic, and cultural history of authorship, editing, printing, the book arts, publishing, the book trade, periodicals, newspapers, ephemera, copyright, censorship, literary agents, libraries, literary criticism, canon formation, literacy, literary education, reading habits, and reader response.^[2]

Although articles are published in English and most frequently cover the Anglophone world, they have also

included work on the history of print culture throughout the rest of the world, including the Netherlands, France, Russia, Finland, China, the Philippines, Japan, Latin America, India, Nigeria, and Germany. Subjects covered include popular literature, religious reading and publishing, bookselling, censorship, paratext, library history, publishing in wartime, translation, children's literature, reading practices, and quantitative research.

CONCLUSION

Although a relatively young organization, SHARP has achieved its founding goal of providing a forum for the advancement of book history as an international scholarly enterprise. Its membership continues to grow and expand geographically, and its conferences (annual and focused) are well attended. Its prize-winning journal, like SHARP itself, continues to expand the scope of its coverage.

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Society of American Archivists (SAA)

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Abstract

The Society of American Archivists (SAA), founded in 1936, is North America's oldest and largest national professional archival organization that serves the education and information needs of more than 5000 individual and institutional members. The Society of American Archivists also provides national and international leadership for archivists on issues that relate to the identification, preservation, and accessibility of public and private records that have historical value. From ancient papyri to contemporary digital images, such records, created and preserved as evidence of communication, have been an integral aspect of human culture for thousands of years. Archivists traditionally have administered historical record formats such as photographs, moving image film, maps, and textual documents, but today they also deal with the emerging array of electronic communication media, such as audio and video recordings and "born digital" documents such as letters, memoranda, government reports, committee records, and blueprints. An important part of SAA's work also includes ensuring the preservation of a diverse and representative documentary heritage as well as promoting diversity within its membership and the archives profession as a whole. The Society of American Archivists advocates actively on behalf of archivists regarding issues such as access to public records that are important to the profession, and it cooperates with regional, national, and international archives organizations and such allied professional groups as those representing librarians, records managers, historians, and documentary editors.

INTRODUCTION

The Society of American Archivists (SAA), founded in 1936, is North America's oldest and largest national professional archival organization that serves the education and information needs of more than 5000 individual and institutional members. The Society of American Archivists also provides national and international leadership for archivists on issues that relate to the identification, preservation, and use of public and private records of historical value. Archival records encompass the entire range of documentation that human society and culture has created as evidence of communication—from ancient papyri to contemporary digital images. They include traditional and historical record formats such as photographs, moving image film, maps, and textual documents as well as the emerging array of electronic communication media, such as audio and video recordings and "born digital" documents such as letters, memoranda, government reports, committee records, and blueprints. An important part of SAA's work also includes ensuring the preservation of a diverse and representative documentary heritage as well as diversity within its membership and the archives profession as a whole. The Society of American Archivists also advocates on behalf of archivists regarding issues

such as access to public records that are important to the profession, and cooperates with regional, national, and international archives organizations and such allied professional groups as those representing librarians, records managers, historians, and documentary editors.

HISTORY OF THE SAA

The historical roots of SAA date back to the early nineteenth century. As early as 1810, Congress appointed a committee to "inquire into the state of the ancient public records of the United States," but no significant action resulted from the committee's findings beyond constructing three additional fireproof records vaults in which to store government records. At about the same time, the formation of local and state historical societies devoted to collecting the private papers and memorabilia of famous individuals as well as the official documents of government increased interest in finding more efficient ways of preserving their materials. By the early 1800s, one Ohio society developed a manner of protecting its documents in "air-tight metallic cases, regularly numbered and indexed, so that it may be known what is in each case without opening it." Following the Civil War, Congress

despaired of finding an effective way of preserving the voluminous records of that conflict and instead allocated money to select the “important” documents and publish them in a massive 128-volume series titled *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*. There was no consistency in any of the early efforts to preserve historically valuable records and each archive developed its own system of organization and storage, with varying degrees of success. It was not until the end of the nineteenth century that archival theories and practices had evolved to the point at which practitioners at societies and associations began to share their knowledge with each other, taking the first steps toward formation of a distinct archives profession in the United States.

The American Historical Association (AHA), created in 1884, took on as one of its major priorities the development of standardized systems of archival organization by facilitating interaction among the various independent archives. The AHA created several subgroups, including the Historical Manuscripts Commission (1895), the Public Archives Commission (1899) and, in 1909, a Conference of Archivists that met annually in conjunction with the AHA. This Conference of Archivists worked to establish new archives, to promote and improve those already in existence, and to codify archival methodology. In 1912, the group began plans to publish a “Manual of Archival Economy” as a basic how-to text for archivists. Although the onset of World War I and other factors worked against the completion of this project, its beginning underscored the seriousness with which the Conference on Archivists viewed its responsibility to improve the care of historical records.

During this time there was also an increased awareness of the importance of archival records at the state level. Alabama established the country’s first state archives in 1901, followed a year later by Mississippi. However, it was not until the 1930s that the federal government was moved to action. President Franklin D. Roosevelt’s Work Projects Administration created the Historical Records Survey and funded the first-ever Survey of Federal Archives. In 1934, Congress followed this lead by founding the National Archives in an effort to centralize recordkeeping and preservation that previously had been the responsibility of individual government agencies.

Establishment of the National Archives was a watershed event in many ways. It signaled a stronger governmental recognition of and support for its responsibility to preserve its records. At the same time, members of the Conference of Archivists realized that a distinction should be made between historians and scholars (who used archival materials) and archivists (who organized, managed, and made records available for use by historians and others). Archivists came to recognize that they belonged to a distinct profession for which they needed their own professional association to advance their work and

promote their common interests. The Society of American Archivists was founded in December 1936, “. . .to promote sound principles of archival economy and to facilitate cooperation among archivists and archival agencies.” A more democratic body than its predecessor, it opened its ranks not just to directors of large archival institutions, but to all “who are or have been engaged in the custody or administration of archives or historical manuscripts.” Although the original membership of SAA was composed primarily of archivists who worked for government agencies in and around Washington, D.C., archives of all sizes and orientation—from small private and business archives to large historical collections—also were included.

Once born, SAA acted quickly. A president (A. R. Newsome) and a board of directors were elected by its initial 124 individual and 4 institutional members. In its first full year, membership increased to 243 archivists and institutions, and SAA began the practice of holding an annual convention at which professional papers were delivered, information was exchanged, and philosophies of archival organization were discussed. At the June 1937 convention, President Newsome outlined a course for SAA that has been followed to the present day: “To become the practical self-help agency of archivists for the solution of their complex problems” and “to strive to nationalize archival information and technique”; to seek “the solution of archival problems involving external relations with all archival agencies, with learned societies, and with the public”; and “to encourage the development of a genuine archival profession in the United States” in which SAA would “set training standards and advance archival administration through its meetings and publications.” Primary among these publications was the society’s journal of record, *The American Archivist*, whose premiere issue appeared in January 1938.

Volunteer members ran SAA under a tight economy during the final years of the Great Depression and throughout World War II. At war’s end, SAA supported the formation of the International Council of Archives in order to encourage and facilitate exchanges among foreign and domestic archives. By the 1950s, SAA focused even greater attention on the necessity for codifying common archival techniques, such as selecting documents for preservation, and methods of organization and indexing. As the number of repositories and archives grew steadily, it became more and more important that systematic and consistent practices be widely adopted. These included criteria for identifying and prioritizing records (SAA formed a Committee on the Reduction of Archival Material in order to find ways to reduce the bulk of redundant or unnecessary material without jeopardizing the quality of information), sharing the most advanced techniques of document preservation, and standardizing the method of indexing and cataloging records.

As time passed, developments in technology offered some solutions to the problems of archival

standardization, but also created even more complex issues. Improved or expanded technologies have been a vital concern of SAA throughout its history. In the pages of *The American Archivist* there are references to or articles on the photostatic copying of important and perishable documents (1939), the use of microfilm (1940), photocopying (1951), computers (1963), and automated information handling (1966). To solve problems of interinstitutional cooperation in automated formats, SAA in 1977 formed the National Information Systems Task Force, which explored common ground among archives of all sizes, subjects, and formats and that same year created the Archival and Manuscripts Control format of the United States Machine Readable Cataloging format, to enable archivists and manuscript curators to use a common language in creating online cataloging records for loading into bibliographic systems. In 1995, a group of archivists and description experts, working with the Bentley Historical Library, the Library of Congress, and several funding agencies, took the next step by developing an encoding standard for archival description and finding aids. This standard, called Encoded Archival Description, released in its full version in 1998, enables the sharing of detailed archival information via the World Wide Web.

Concurrently with the effort to develop a cataloging standard, SAA was involved in improving other standards within the profession. Previously records were in the hands of clerks, secretaries, public officials, and others who had little or no training in their care and preservation. Even after World War II few schools offered courses in archival theory and practice and there were no set professional guidelines outlining what should be included in an archival curriculum. Archivists agreed that they required specific knowledge and skills, but there was no clear path toward obtaining them. The Society of American Archivists became a strong advocate for improved archival education programs at the graduate level. In 1977, SAA formalized the first graduate education guidelines for university training of archivists, calling for a minimum three-course sequence within a library science or history graduate program. Since that time SAA's guidelines for graduate archival education programs have been revised and strengthened several times as the work of archivists became more complex and increasingly influenced by technology and the law.

Also in 1977, SAA began planning a more comprehensive continuing education curriculum by offering a series of workshops and seminars in conjunction with its annual meeting in Salt Lake City, Utah. The seminars focused on core archival responsibilities and were so popular that SAA laid plans to expand its continuing education program to reach those archivists who were already on the job. In 1980, a grant-funded "Basic Archival Conservation" program was started and proved to be very successful with on-the-job professionals who had never had formal education in this area. In 1982, SAA expanded this

initiative by establishing a permanent education office at its Chicago headquarters in order to develop and coordinate a regular schedule of continuing education workshops, seminars, institutes and other offerings, both in conjunction with its annual meeting and throughout the year, frequently in conjunction with regional archival association meetings. The continuing education program has grown over the years and recently has begun to offer distance education learning opportunities as a cost-effective alternative for archivists who are not able to travel great distances for on-site workshops and seminars.

During the 1970s, SAA took the lead in developing a more extensive *corpus* of archival literature. Prior to that time, *The American Archivist* was the primary source of information on professional practice, along with literature from the National Archives (such as its staff information bulletins and circulars, a few monographs expanded from these publications, and translations of European classics such as the 1898 Dutch *Manual for the Arrangement and Description of Archives* that the National Archives coordinated). But in 1977 SAA undertook publication of a grant-funded "Basic Manual Series" that covered all aspects of core archival practice and served as guidebooks for a generation of archivists. This series was replaced in the mid-1980s with a series titled "Archival Fundamentals" and recently has been supplanted by a third set of core manuals for archivists (Archival Fundamentals II). In addition to these series of core manuals, SAA also has published books and monographs by contracting with individual authors and cooperating with other presses that publish in this area. Today SAA is the largest producer and distributor of archival literature in the world.

Its work in publishing *The American Archivist*, developing standards, planning and implementing conferences, initiating a basic manual series, and developing a continuing education program could not be sustained indefinitely with a part-time volunteer staff. In 1974, the SAA hired its first full-time executive director and established its national office on the Chicago campus of the University of Illinois. The subsequent hiring of editors, meeting planners, and other staff enabled SAA to achieve some of the goals that its members had long requested. A permanent staff also enabled SAA to become more effective in acquiring grant funding and completing strategic planning to guide future actions.

MEMBERSHIP INTEREST GROUPS

An increasing range of repository types and record formats has resulted in the creation of membership interest groups within SAA. Beginning in 1978, the Society established a series of Professional Affinity Groups that brought together archivists with common special interests. Twenty years later this initiative has developed into an extensive network of "Sections" and "Roundtables" that

work within the Society. These groups undertake a variety of activities that typically include conducting business at the SAA annual meeting; submitting program proposals; producing directories, newsletters, and other publications; maintaining Web sites; and identifying and providing input to SAA regarding emerging issues and other areas of professional concern. The number and focus of Sections and Roundtables is member-driven and has evolved over the years. Currently these groups include the following:

Sections: Composed of SAA members who share a common interest resulting from the nature of their work or by the type of repository in which they are employed. Sections enable members to focus attention on and give voice to the concerns that fall within their particular area of interest. Sections focus expertise on the professional functions and responsibilities that archivists share to identify, administer, and promote the use of records of enduring value. Current sections include:

Acquisitions and appraisal—Serves as a forum for the discussion of issues and interests pertaining to the acquisition and appraisal of public records, private papers, and other archival or manuscript collections.

Archivists of religious collections—Composed of professional archivists who work for national, international, and local church organizations, religious societies and orders, and theological schools. The section's members are engaged in documenting the many facets of the private and public experience with faith as it is lived out through the institutional church, religious movements, and individual experience.

Business archives—Includes members who are employed in corporations or who administer records of corporations and businesses from an historical and archival standpoint. This section also maintains an online *Directory of Business Archivists*.

College and university archives—Composed of members who are employed or have an interest in the administration, organization, and care of records of institutions of higher education. The section has published an online publication entitled *Guidelines for College and University Archives*.

Description—Includes persons involved in the development of appropriate means to organize and describe manuscripts and archives so that they may be more easily used by researchers.

Electronic records—Functions as a locus of expertise, leadership, and information sharing for the profession regarding management and preservation of records in electronic form.

Government records—Composed of archivists whose primary concern is with the administration, organization, care, and use of government records at the local, state, or federal level.

Manuscript repositories—Serves as a forum for professionals employed by historical societies and similar repositories that collect records from a variety of private, family, or government organizations.

Museum archives—Includes persons responsible for the organization, preservation, and use of records located in museums.

Oral history—Members have a special interest in the administration and use of oral history interviews in the archival setting. This section also includes members who conduct oral history interviews and those who teach oral history methodology.

Preservation—Includes persons with a special interest in the problems presented by the deterioration, restoration, and preservation of archival materials in all formats.

Reference, access, and outreach—Brings together members who work with archival researchers, particularly those with reference responsibilities and those who have an interest in using archival and manuscript materials in exhibits and other public programs.

Visual materials—Composed of members who collect, arrange, describe, preserve, or interpret still photographs, moving images, art, and graphic material.

Roundtables, like SAA sections, enable professionals to focus their attention on concerns that fall within a particular area of interest. *Membership in roundtables is freely open to SAA members and non-members alike.* Roundtables function as communities of interest that generate ideas and meet the intellectual interests of their members. They focus expertise and interest on specific professional functions and responsibilities that archivists must perform to carry out their mission. Roundtables also provide channels of communication to the SAA membership and to the SAA Council on topical matters of concern. The creation of roundtables is also member-driven and they may exist as online communities that share information through electronic discussion groups. The current roster of SAA Roundtables includes:

Architectural records—Provides a forum for members to discuss issues related to preservation, access, and management of architectural records and related fields.

Archival educators—Facilitates the exchange of information about archival education programs throughout the United States and Canada and provides a forum for the discussion of issues relevant to those who teach courses and workshops in archival administration and related topics in academic institutions or other settings.

Archival history—Composed of those who have an interest in the history of the archives profession and who promote ways of studying this history.

Archives management—Brings together archivists from different institutional settings who share an interest in the identification and consideration of management and leadership issues and techniques that are important to archivists and archival institutions.

Archivists and archives of color—Provides a forum to identify and discuss concerns that racial minorities face and encourages an exchange of ideas by archivists with diverse racial backgrounds. The roundtable also promotes wider participation of minorities within the archives profession and promotes the preservation of archival materials pertaining to minorities. Members support the development of archival services and programs to minorities and seek funding for scholarships for minority students in library/information science master's degree programs.

Congressional papers—Provides a venue for discussing archival issues related to the acquisition, processing, and administration of the papers of members of the United States Congress.

Encoded archival description—Supports the implementation, use, and ongoing development of this international encoding standard for finding aids.

Issues and advocacy—Dedicated to monitoring current and emerging issues of concern to archivists and formulating for SAA Council's consideration responses to such issues.

International affairs—Identifies and addresses issues and concerns of archives and archivists throughout the world and provides a forum for discussion, dissemination, and promotion of issues related to international archival affairs.

Labor archives—Promotes communication among archivists and institutions concerned with records in the field of organized labor and develops cooperative strategies and guidelines to ensure comprehensive documentation of the labor movement.

LAGAR (Lesbian and Gay Archives Roundtable)—Includes archivists concerned with ensuring that the archival record includes documentation of lesbian, gay, bisexual, and transgender history and culture. Members work to ensure that LGBT archival issues are identified and visible within SAA and they serve as liaisons between independent LGBT archives and SAA.

Latin American and Caribbean Cultural Heritage Archives—Provides a forum to exchange ideas and provide support among US, Caribbean and Latin American archivists about the challenges and opportunities they face of acquiring, managing, and preserving their collections.

Local government records—Provides dialog among archivists concerned with the acquisition, administration, organization, preservation, and use of records from local government offices.

Lone arrangers—Provides education, stimulates communication, and encourages support among archivists working in "lone arranger" settings. The term "lone arranger" includes those working alone or with a very small staff.

Metadata and digital object roundtable—Promotes discussion, education, and collaboration among archivists who are interested in digital archival objects and the metadata that enables their access, management, and preservation.

Native American archives—Serves as a forum to educate archivists on the complexities and beauty of Native American archives throughout the western hemisphere and as a source of communication and support for archivists working with Native American collections.

Performing arts—Encourages the exchange of information on historical and contemporary documentation of music, dance, theater, and other performance media.

Privacy and confidentiality—Provides a forum for the discussion of privacy and confidentiality issues as well as their legal and ethical implications for archival practice.

Recorded sound—Serves as a forum for discussing the importance, preservation, and use of sound recordings in archival collections.

Records management—Encourages discussion of current issues in records and information management and promotes better understanding of the importance of collaborative efforts between archivists and records managers.

RLG (Research Libraries Group)—Promotes discussion and exchange of information about current RLG program initiatives and research projects affecting the archival community.

Science, technology, and health care—Provides a forum for archivists with similar interests or holdings in science, technology, and health care, including medicine, and provides an opportunity to exchange information, solve problems, and share successes.

Security—Focuses on issues relating to the prevention of theft in archival and manuscript repositories.

Visual materials cataloging and access—Provides a venue for archivists with visual collections to discuss cataloging and access issues.

Women archivists—Monitors the status of women in the archives profession and promotes the participation of women in all phases of SAA's activities and the profession as a whole.

Women's collections—Promotes the preservation and research use of records documenting women and networks archivists with holdings concerning or created by women.

DIVERSITY

In 2003, SAA established a Diversity Committee that works to ensure that the organization's services, activities, policies, communications, and products support the goal of a more diverse SAA and professional archival community. The Diversity Committee has been a catalyst for new initiatives that are developed in coordination with various

SAA groups. It also monitors, evaluates, advocates for, and reports on matters pertaining to diversity as it relates to the archives profession, including membership recruiting, program planning, documentation of minority groups, professional development, and cooperating with other organizations that have similar interests and aims.

The 2005 SAA Position Statement on Diversity affirms:

The Society of American Archivists is committed to integrating diversity concerns and perspectives into all aspects of its activities and into the fabric of the profession as a whole. SAA is also committed to the goal of a Society membership that reflects the broad diversity of American society. SAA believes that these commitments are essential to the effective pursuit of the archival mission to ensure the identification, preservation, and use of the nation's historical record.

SAA further noted that, "The relevance of archives to society and the completeness of the national record hinge in part on the profession's ensuring that its members and the holdings of American repositories reflect more fully the diversity of society as a whole."

In support of its diversity activities, SAA also applied for and received a two-year grant, "Strengthening Tribal Archives Programs," that facilitated and supported the attendance and participation of Native American archivists in the Society's annual meeting.

GOVERNANCE AND MEMBER SERVICES

Today SAA maintains permanent headquarters in the Loop area of Chicago, staffed by an executive director and 11 other employees with responsibilities for production and sale of publications, meetings, membership development, financial operations, and continuing education. The Society is governed by a nine-member Council (serving three-year terms, with three new members elected each year) as well as a treasurer, vice-president/president-elect, and president, who presides over the meetings. Within the Council there is an executive committee consisting of the president, vice-president, treasurer, an at-large member elected from and by the Council, and the executive director. The Society of American Archivists also has a number of standing committees and boards that generally have more official, advisory, and administrative responsibilities than do the sections and roundtables and that help to oversee different aspects of the Society's operation. These include: *American Archivist* Editorial Board, Appointments Committee, Awards Committee, Committee on Education, Committee on Ethics and Professional Development, Committee on the Selection of SAA Fellows, Diversity Committee, Fellows Steering Committee, Membership Committee, Publications Board, Standards

Committee, and an annual meeting Program Committee and Host Committee.

An election is held in February of each year to elect an incoming vice-president/president-elect, a treasurer (once every 3 years), three incoming members of the Council, and members of the Nominating Committee.

The Society of American Archivists also supports a Mentoring Program that pairs new archivists with experienced professionals. The program is designed to assist those who are in the early years of their career or who are taking on new or additional responsibilities in their work. Every effort is made to pair those with similar professional positions and, when possible, geographical proximity. Although much of the mentoring activity occurs by telephone or e-mail, the Mentoring Program is also given a place in the annual meeting program so that mentors and protégés can meet in person and become better acquainted.

More than two dozen student chapters of the SAA have been established around the country since 1993. These chapters serve as a means of introducing new archivists into the profession, as well as enhancing education by providing an additional focus for students to discuss archival issues, identify with the profession, and engage in professional activities. The chapters also promote communication among student members and ultimately develop leaders of tomorrow's archives profession.

ADVOCACY OUTREACH AND COOPERATION

The Society of American Archivists continues to be actively involved in advocating on behalf of a wide range of professional issues related to the work of archivists. For example, SAA was one of a number of signatories to an *amicus curiae* brief arguing for allowing access to the papers of the "Unabomber." The SAA Council and officers were active in testifying and coordinating with 30 other archives and historical organizations opposing the process by which the Archivist of the United States was appointed in 2004, and SAA issued a public statement regarding the renewal of the USA PATRIOT Act. In cooperation with the National Coalition for History, SAA signed a letter supporting the permanent preservation of Guantanamo Bay detainee court case files and joined with other organizations in speaking out against *Executive Order 13233*, which gave former presidents and their heirs the right to keep White House papers secret indefinitely. Along with many other archives and historical organizations, SAA joined in supporting efforts to save records that had been damaged during Hurricanes Katrina and Rita, and co-signed with the Council of State Archivists and the National Association of Government Archives and Records Administrators a statement requesting cooperation in identifying and halting the sale of public records on eBay. In 2006, SAA issued a public statement,

addressed to the Archivist of the United States, opposing the clandestine reclassification of public records that had previously been declassified and made available to researchers.

Hurricane Katrina also provided a catalyst for establishing an annual program, "MayDay: Saving Our Archives," designed to heighten awareness of the importance of preserving historical records. The Society of American Archivists also participates in "American Archives Month" each October and has developed a public relations kit that archivists can use to promote activities that support their programs.

The Society of American Archivists supports an active outreach program that makes information available to archivists and others who are not members of the Society. Many SAA publications, including the *Glossary of Archival and Records Terminology* and several sets of guidelines are available on its Web site to anyone interested in seeing them. Nonmembers are permitted to join SAA roundtables and view section and roundtable newsletters to facilitate networking with other archivists who share common interests. The Society of American Archivists's online employment bulletin, the most comprehensive source of information on jobs within the archives profession, is accessible by members and nonmembers alike.

CURRENT PUBLICATIONS

In addition to *The American Archivist*, the Society also publishes a bi-monthly newsletter, *Archival Outlook*, which carries news and articles of a more timely nature covering current business and actions of the Society; regular columns by the Society's president and executive director and the Archivist of the United States; national and international news relating to archives and archivists; a calendar of upcoming events of interest to archivists; and professional opportunities. Issues of *Archival Outlook* are available online from Vol. 53, 1, 1990 issue. Beginning in 2008, *The American Archivist* has been published both in print and online versions available to members and subscribers. Access to American Archivist Online is limited to SAA members and journal subscribers for a period of 3 years, after which issues become publicly available at no cost. The Society of American Archivists is in the process of making back issues available online as well.

In addition to these publications, the Society maintains an Internet site on the World Wide Web at <http://www.archivists.org>. This site carries detailed information about the Society, its various sections and roundtables, a membership directory (accessible only to SAA members), an employment bulletin, a full publications catalog, information on professional education and recognition, and news of the annual conference. The Web site includes a number of important publications, including a *Code of Ethics for Archivists*, *Guidelines for a Graduate Program in*

Archival Studies, *Guidelines for Archival Continuing Education Programs*, and *Glossary of Archival and Records Terminology*. Recently the SAA has added a number of case studies and classic monographs on archival management that are not available in print. The Web site also carries a list of "hot topics" covering news, reports, workshop information, a listing of SAA position statements and resolutions, and other topics of more immediate interest.

CONCLUSION

The Society of American Archivists, as the primary professional organization representing a large number of archivists, curators, special collections librarians, educators, and records managers in the United States today, often finds itself on the cutting edge of many important national policy issues as information—especially the digital transmission of that information—plays an increasingly central role in the economic, educational, and cultural life of the country and of the world. Thus the topics of electronic records, digitization, Internet access to the nation's documentary heritage, preservation (of both rapidly deteriorating original materials as well as digital copies of those materials) and copyright, intellectual property rights, and "fair use" are all issues with which today's archivists are much concerned and engaged, notwithstanding that basic issues of access, preservation, and use have been at the heart of the archival enterprise from its very beginnings. The Society of American Archivists is often asked to testify before Congress and participate in various national forums, organizations, and committees in which these issues are discussed and debated. As public awareness and wider use of primary sources via the Internet become more widespread and the issues of preservation and access concomitant to those uses become better understood, the SAA is optimistic about its growing visibility and importance in this arena and the additional opportunities this presents in meeting its mission.

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Sociology of Reading

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Abstract

This entry examines major themes and questions that have been the focus of sociology of reading from the early years of the twentieth century to the present. Theoretical works dealing with the history and sociology of reading are discussed as well as recent large scale surveys of readers in France, Britain, and the United States. The concluding sections deal with the issue of functional illiteracy in developed countries and with the global impact of the Internet on reading.

INTRODUCTION

Reading has always been seen as somewhat suspect by religious and political authorities, even in the contemporary era. In the nineteenth century, the elites and the government were concerned with bringing literacy to the people, but at the same time they were troubled about the possible effect of uncontrolled reading. Until the 1920s efforts were made to prevent “bad reading” and to promote “good reading”. Such attempts at control became futile in face of the rapid growth in the production of reading materials and the increased number of readers whose choices could not be controlled. However, by the twentieth century the perceived danger of reading had changed in character and what was considered “bad reading” was not the same. In addition, there was concern about the general decrease in reading due to competition from new leisure activities as well as new media. Nonetheless, educators sought to combat the commodification of reading by promoting “good authors.” By the end of the century functional illiteracy was recognized as a problem, which, when combined with the diversification of writing (especially through web based media), led certain thinkers to decry the “death of reading.”

Even though these ideological debates were rather sterile, the importance that societies accord to the practice of reading became apparent, and sociologists made an effort to describe and to analyze the meaning and value that ordinary readers accord to their reading. The resulting picture was much more nuanced than the utopian discourse of those who believed that the Internet would promote a growth of readership or the dystopian claims of those who deplored the demise of reading.

BAD READING, MARGINAL READERS

Scholars working in the field of book history and those in the sociology of reading both attempted to analyze the

various discourses on reading (“discours sur la lecture”)—i.e., those prescriptions and symbolic representations that surround individual reading practices and necessarily influence them. In 1902 a school teacher in Aisne complained:

When all people know how to read... what will they read if one does not carefully, actively and severely monitor their reading. Too often what they are likely to read are those books and newspapers which... little by little sap authority in the name of liberty, exciting evil passions against authority of any kind: everyday they will read wild declarations against authority with renewed pleasure, as well as immoral novels which, by the means of cheap magazines (feuilletons) penetrate into the furthest village where they inflame the sensuality of youth and inspire in them... the unfettered desire for physical pleasure

(*Journal d'un instituteur de l'Aisne*, 1902, quoted in Poulain).^[1] The ideas expressed by this teacher were not much different from those expressed during the same period by the clergy who especially feared the novel. For example, according to a 1903 Catholic manual: “The love of reading is one of the passions which, in our days especially, most torments the heart of the young girl, and this dangerous reading which offers another world to her is a stumbling block that is most difficult to avoid because of the strong attraction it has over her” (*Manuel des enfants de Marie Immaculée à l'usage des réunions dirigées par les filles de charité*, 1906, quoted in Chartier).^[2] Likewise, a 1919 manual for virtuous young women warned that novel reading should be controlled because it distances the young girl from the real world: “After having read these stories which have penetrated her entire sensibility in an unhealthy fashion, where the imagination is over excited without the control of reason, where the heart is delivered up to a world of emotions and remains as if hypnotized...” After novel reading, the soul is empty and falls into a state of disenchantment and an indefinable

malaise.^[3] Certain kinds of reading were to be especially feared: newspapers whose political ideas were thought likely to lead people to revolt, and the novel, which takes women away from their duty and leads them to an uncontrollable universe of the imagination.

By the twentieth century other genres raised the fears of educators: the detective novel in France, in its “version noire” which originated in America; the comic book (bande dessinée), and science fiction—genres considered “minor” and dangerous, not part of what is considered “real” literature—at least not until they attain respectability and are admitted into the canon.

Certain readers have always been considered “weak readers” (lecteurs fragiles) incapable of putting adequate distance between themselves and the text, being completely absorbed in a simplistic identification with the characters in the novel. This term ‘weak reader’ was often applied to women readers of novels in the past, and to readers of Harlequin romances today. Certain categories of young people represent another group considered “weak readers” and among them especially young people from immigrant families living in the troubled suburbs of Europe.

THE BEGINNING OF THE SOCIOLOGY OF READING

Nicolas Roubakine (1862–1946), a Russian born scholar who emigrated to Switzerland in 1907, was influenced both by the illiteracy of the Russian masses and by World War I. As a result, Roubakine saw reading as a solution to all the evils that beset humanity. From this perspective, which he regarded as both scientific and activist, he produced numerous publications in an effort to understand various modes of book production as well as their content. However for Roubakine it was most important to understand the modes of “appropriation” of various kinds of works by readers—in other words, how readers interpreted what they read and applied it to their own lives. His grand ambition was to analyze world book production and guide the publishers so that they might produce works that exactly corresponded to the needs and expectations of readers. A utopian vision that was fortunately unrealizable!

It was also this double preoccupation, both scientific and political, that led sociologists in the United States to become interested in the effects of reading and other media on the population. The depression that began in 1929 strongly influenced researchers at the Graduate Library School (GLS) of the University of Chicago, as well as those working at the Gallup poll, which was founded in 1935 as the first institute for conducting large scale surveys. Researchers at GLS, like Douglas Waples and Bernard Berelson, had the ambitious goal of influencing political decisions so that the needs of the population

could be more adequately met. Using surveys they sought to find out who read, what they read, and why; in addition, this research attempted to identify the effect of reading on readers in relationship to socioeconomic circumstances of the time. These researchers observed that the economic crisis had motivated millions of Americans, whether or not they were unemployed, to use their public libraries and that all kinds of reading, but especially newspaper reading, had become a source of moral support for them. Overwhelmed by the effects of the economic depression, which they also saw as a crisis for democracy, the GSL researchers thought that by arriving at a better understanding of how books, newspapers, and radio were received by the public, their research could be used to improve “communication and understanding between the elite and the masses”. In the study entitled *What Reading Does to People*, they stated “reading can furnish information and influence attitudes that can promote social tolerance, social cooperation and good government.”^[4] In Germany, these same preoccupations motivated librarian Walter Hoffmann in his attempt to analyze reading and readers.^[5] Despite the utopian character of some of their ideas, researchers active during the 1930s and 1940s forged concepts are still useful today in the study of readers.

Beginning in the 1950s the sociology of books and reading and the history of the book both emerged as academic disciplines and, little by little, both fields have gained in sophistication and rigor. Large scale quantitative surveys on leisure and cultural activities were carried out and these studies allowed scholars to better understand the social landscape of reading. These large scale surveys greatly increased in number, especially after 1980, but such studies did not aid those researchers undertaking scientific analysis of reading practices. Nonetheless the abundance of such surveys is one of the signs of growing social concern surrounding questions dealing with the cultural level of people living in democratic societies. For more than half a century these democracies had been confronted with one preoccupying question in regard to reading: Why had the extension of years of schooling, the increase in the level of education, general economic growth, and the increase in leisure time “not” stimulated a more widespread practice of reading, if not a readership that was more cultivated and exigent?

DOMINANT READERS/DOMINATED READER

During the 1960s numerous sociological studies were produced in response to newly articulated social issues including:

- the necessity of recognizing “popular culture”;
- the increased awareness of hegemony exercised by the “legitimate” or dominant culture; and

- the rejection of a “cultural order” in which the values and the hierarchies were those of the dominant class.

Many scholars drew on Richard Hoggart’s pioneering book, *The Uses of Literacy: Aspects of Working Class Life* (Chatto and Windus, 1957). The British sociologist showed that the lower classes and the privileged elite related in very different ways to culture and cultural objects, such as writing. To understand this complex relationship to culture, Hoggart took a holistic approach that encompassed the entirety of life experience. For example, he found that among the poor, the modes of relating to texts, such as newspapers and “romans-photos,” could be described as “oblique attention,” casual, and at the same time an effective practice of reading. Thus the most frequent consumers of photo-romans were not taken in by them, but were able to distance themselves from what they read. The culture of the poor is not the same as the poverty of culture, as had been proposed—in part because access to high culture is of little concern to the poor whose values are elsewhere.

In his influential 1979 work entitled *La Distinction*, French sociologist Pierre Bourdieu (1930–2002) observed that the cultivated elite highly value the cultural distinction which legitimates their status whereas the lower classes prefer to adhere to the norms, interests, values and savoir-faire of their social group. Bourdieu wrote:

It must never be forgotten that the working-class ‘aesthetic’ is just one dominated ‘aesthetic’ which is constantly obliged to distinguish itself in terms of the dominant aesthetics. The members of the working class [and especially women] who can neither ignore the high-art aesthetic, which denounces their own “aesthetic,” nor abandon their socially conditioned inclinations, but still less proclaim and legitimate them, often experience their relationship to aesthetic norms in a two fold and contradictory way.^[5]

On the other hand, the cultural competence of

connaisseurs confers a self-confidence, which correlates with their certainty of having cultural legitimacy and the ease with which they can identify excellence. This produces a paradoxical relationship which is the result of the relative unawareness and the casual assurance in the familiarity that the upper bourgeoisie maintain with culture, that they regard as a kind of family inheritance to which they are the rightful heirs.^[5]

The legitimacy of cultural products, including written works, is not an objective fact that arises from their inherent literary value, but rather a social construction that permits a small group to constitute the dominant elite.

As we have seen, on both sides of the Atlantic researchers were beginning to produce a body of scholarship that dealt with the social mechanisms at work in the

creation, the diffusion and the sharing of cultural works. These studies also attempted to give space to other cultural practices, to other speech, and to other kinds of relationships with so called “dominant” texts.

READING, A CREATIVE ACT

Today the perspective of researchers is different from that of their predecessors. What has come to the foreground is an exploration of the mode of reception and appropriation of texts. French philosopher and theologian, Michel de Certeau (1925–1986), and cultural historian Roger Chartier (b. 1945) reaffirmed that reading is a creative activity for all categories readers. According to Michel de Certeau (*L’Invention du quotidien*, 1980) each reader, although equipped with unequal savoir-faire and unequal expectations, poaches on the land belonging to others “braconne sur les terres d’autrui.”^[6] An agent of creative activity, the reader is not simply a passive consumer, but rather someone who brings a text to life, and thus, in a certain fashion, creates a new text. According to noted philosopher Paul Ricoeur (1913–2005) each time a text is read it is a dynamic experience, an emigration through which the reader moves from configuration to reconfiguration of the world.^[7] After reading the reader is transformed. According to Roger Chartier, reading affords a space for “distinction and disclosure” (“distinction” et “divulgaration”), as well as “discipline and invention.”^[8,9]

In order to understand this, it is necessary to study the characteristics of the interactions between the printed book as an object (or now the computer screen), the text itself, and readers who engage in the act of reading within a particular context. Although the text itself might seem immutable, its mode of publication (form and format) and its reception by the reader is individualized and infinitely changeable—across time as well as contemporaneous with the period when the text was written. Even though reading (in terms of its objects, modalities, and benefits) can lead social cleavage, it can also be an instrument for social cohesion. There are no cultures that are so radically heterogeneous and antinomic that printed works cannot cross over boundaries among social groups and collectivities, which come together and differentiate themselves, set themselves apart, and at the same time share certain texts. The difference among these groups is constituted not in the objects of reading which can be radically heterogeneous, but rather in the manner of reading and in the benefit drawn from the text, which can be varied and variable.

READING IN CRISIS IN DEVELOPED COUNTRIES

From the end of World War II through the late 1970s, the practice of reading expanded in most of the Western democracies on both sides of the Atlantic. But there were

great changes during the 1980s and the situation today is paradoxical. Although the percentage of people holding advanced degrees has increased everywhere, and although the economic level of the population has improved (despite the growing gap between rich and poor) reading, and especially the reading of books, has diminished. In most countries the number of readers has hardly grown at all; furthermore there has been a marked decrease among avid readers who read several books a month. This decrease in reading is even more noticeable among regular readers: the proportion of avid readers has diminished, especially among students, youth, and those with advanced degrees. Even though young people remain the heaviest readers, they read less than the previous generation did when they were the same age. The only constant over time is the finding that women still read more than men, and girls more than boys. Paradoxically, in all the developed countries, the number of books published is still increasing, although the average number of copies printed is going down—a fact which underlines the rapid evanescence of the market for books. The overall earnings for publishers has increased, but so has the concentration in the book industry—causing independent publishers to experience more and more difficulties, sometimes even being forced to close or merge with another firm; meanwhile the number of scholarly works and “quality” books have declined precipitously.

Of course, reading is not limited to the reading of books. Newspapers, magazines, and electronic texts are also “reading objects.” In a 2005 survey of 2000 adults in Great Britain (<http://www.literacytrust.org.uk>), 34% said they did not read books, a third had not bought a new book in the previous 12 months. However, 96% said they had read something in the past 7 days, whether books, magazines, newspapers or text messages. Furthermore, 47% of U.K. adults are registered with their local library. More amusing, some researchers actually questioned readers about books they found disappointing. A poll commissioned by Teletext in 2007 found the top fiction books that Britons were not able to finish;^[10] these included:

1. *Vernon God Little*, D.B.C Pierre (35%)
2. *Harry Potter and the Goblet of Fire*, J.K Rowling (32%)
3. *Ulysses*, James Joyce (28%)
4. *Captain Corelli's Mandolin*, Louis De Bernieres (27%)
5. *Cloud Atlas*, David Mitchell (24%)
6. *The Satanic Verses*, Salman Rushdie (21%)
7. *The Alchemist*, Paulo Coelho (19%)
8. *War and Peace*, Leo Tolstoy (18%)
9. *The God of Small Things*, Arundhati Roy (16%)
10. *Crime and Punishment*, Dostoyevsky (15%)

To measure reading by only looking at the number of items read is certainly contestable (is it “better” to read

15 books than 12?). Attempting to discern the content of what is read is obviously more meaningful. From this standpoint, the reading of literary works is of special interest. The 2004 survey *Reading at Risk*^[11] (<http://www.nea.gov/news/news04/ReadingAtRisk.html>) estimated that in the United States the number of readers of literary works decreased between 1992 and 2002, going from 54% to 45% among adults over 18 years old. This “dramatic decline” in the reading of literature, according to the hyperbolic statement in the survey, was accompanied by an overall decline in the reading of books: 61% of American adults read books in 1992 but only 56.5% in 2002—or a decline of a modest 4.5%. Among those who read books, 21% are considered “light” readers (1 to 5 books per year); 9% modest readers (6 to 10 books per year); 12% “frequent” readers (one book per month). As everywhere else, the decline is more marked among men, among individuals who are less educated, among young people from ethnic minorities, and among the economically disadvantaged. As in other countries, the most troubling finding is that the loss of interest in reading has increased over time.

The same phenomenon is seen in France where book reading has stagnated or decreased: 25% of the population over 15 does not read books. The proportion of “moderate” readers (10 books per year) increased from 24% in 1981 to 35% in 1997. This fact had first been interpreted by sociologists as progress (the transition from non-reader to reader), but is today considered as regressive because the proportion of avid readers declined: 22% of the adult population read more than 25 books per year in 1973, but by 1997 avid readers made up only 14% of the population. Even worse, across all demographic categories there is a marked decline in women readers. Nonetheless although the categories of French readers who read the most remain much the same (the highly educated, the privileged social classes, young people and students), these readers were found to read less than they did 20 years earlier.

Since 1980 all the developed countries have also confronted the problem of functional illiteracy. Here we must distinguish between the term illiteracy which designates those persons who have never learned to read or write and functional illiteracy which refers to the situation of those people who have a basic knowledge of reading, but have lost their reading skills due to the lack of practice or to poverty. The “discovery” of functional illiteracy was met with a great deal of shock and disbelief in developed countries. This resulted in many denunciations of the failure of democracy and its deficiencies. At the same time, the demographic profile of the functionally illiterate was often the archetype of the most disadvantaged—those people characterized by lack of knowledge and other social and economic deficiencies. Such analysis would not necessarily apply to much of the world’s illiterate population, who may not perceive the acquisition of literary skills as essential to their daily lives. And in any context, the lack

literacy skills does mean not being less of an active agent in their destiny or less capable of thinking.

Little by little tentative definitions of literacy levels became more rigorous in an effort to identify “functional illiteracy” or to describe the competencies expected of those who had finished primary school. Nonetheless attempts to quantify the number of illiterates remains problematic and statistics can vary from 5% to 15% of the population in Western countries. There has been a growing recognition that functional illiteracy is a serious problem, and its eradication should be considered imperative in developed countries that seek a broader dissemination of basic knowledge and competencies among the entire population.

THE END OF THE HUMANISTIC MODEL

Changes in reading patterns in contemporary societies should not be surprising. Even if some members of society still lack adequate literacy skills, reading has become an everyday activity, a widely shared practice that is no longer a mark of elite status. Young people in particular seem to take reading for granted and adopt a relativistic attitude toward what they read. In France a 1999 study of 1200 adolescents aged 14–17 revealed that these teens regularly engaged in reading, and with no compunction whatsoever, they reported reading all kinds of books as different as *Moliere* and Stephen King, *Camus* and *Never without my Daughter (Jamais sans ma fille)*. The researchers concluded that “rather than a crisis in reading, we are witnessing a mutation of the traditional model” and they advised that instead of complaining about this change one should take action to encourage all kinds of reading.^[12] Young people do read, but they read differently, without reverence toward classic authors, and without embarrassment as to their choice of genres. In fact, they see reading as a cultural activity among others, and one that comes second to music. These researchers who conducted the 1999 study observed:

The facts are clear: reading books now occupies a modest place among leisure activities of teens. It does not represent the preferred activity of any category of secondary school students, even among girls who are the heaviest readers—or among those girls who are good students and daughters of highly cultivated families. Of the adolescents surveyed, 26% placed reading among their three preferred leisure activities, but only 5% ranked reading in first place. The proportion of those who report reading little or not at all continues to increase over the course of time: by the fourth year of the survey these non-readers and light readers represented 72% of the boys and 40% of the girls. For the majority of teens surveyed, reading is not something vital, and it is not an act of reverence to the works that represent the literary heritage. Over the years young people have openly acknowledged reading fewer and

fewer titles from the literary canon and have increasingly cited titles popular among their peers. Without the least embarrassment they are willing to be seen by the researchers as non-readers or light readers. But this indifference that they show toward the central values of traditional humanism embodied in the literary canon does not signify that in their eyes reading is deprived of any value. They see reading as an activity like any other educational endeavor or recreational pastime, subject to changing needs and interests, to their individual life experience, and to pressure from their social network. Indifferent to those who consider reading “sacred” by identifying the practice of reading with reading of the literary canon, young people engage in a more realistic and practical approach. For them, reading is never invested with an *a priori* value: it is the individual situation that creates the need to read or the pleasure of reading, and determines how books are used. As much a product of the market economy as music or the cinema, reading does not benefit from any special status among the young.^[12]

Furthermore, the researchers found that reading among young people decreases as they progress through the school curriculum, and worse still, it also decreases with the successful completion of schooling. This study showed that “students invest less time in reading as they spend more years in school...and reading continues to decline when they finish their studies. They read less in middle school and still less in secondary school.”^[12]

READING ELECTRONIC TEXT

At the same time that research on reading advances and policies to promote reading appear more and more complex, the Internet has been transforming the practice of reading and writing throughout the world. Electronic networks accessible through the Internet have exerted a profound influence on both the public sphere and private space.

The invasive presence of the Internet has produced all kinds of commentary, both positive and negative. There is unfortunately a lack of rigorous sociological research which would allow for a better comprehension of this technological and social revolution. Although there are a number of incisive and thoughtful commentaries, the debate on the social effects of the electronic revolution, whether their authors denounce or praise these changes, generally tend to be ideological discourses and not the result of solid empirical studies that analyze social behavior.

For some, the Internet is one of many indicators of social decadence; they assert that society cannot escape the pervasive influence of the market, which has been given free reign to invade the private space of individuals, as well as increasing the inequalities among social groups, and among rich and the poor countries. According to the

naysayers, these phenomena will inevitably lead to the decline of book culture.

For others, the Internet is the best hope for global democracy—direct democracy that overturns long-standing political rules and national boundaries. The Internet has the potential to increase opportunities for creativity, invention, and social communication, and will therefore stimulate a redoubled use of writing, overcoming traditional divisions of labor. As a result each person will become at the same time a reader, author and editor, and will play dynamic role in each of these activities.

The sociological study of the impact of technological innovation on its users reveals that the use of these new technologies is rarely that which was envisioned by their inventors and producers. Users sometimes decide on quite different types of uses and their appropriation of new technologies goes through various phases as it evolves. In the end, the usage of technology is the result of a negotiation (sometime virtual) between what the technological tools allow, what the producers propose and what the users construct. This construction of usage is in and of itself, pluralistic and continually evolving.

Among the questions that need to be studied is a sociology of the practices used in reading text on a screen, the question of the relationship between reading and writing. In the reading of digital text, every reader becomes a reader-author. Writing now more than ever coexists with reading. In the world of print, the writing done by the reader is found on the margins of the page. Glosses, translations, commentary on a printed page are (almost illicit) examples of the use of writing for improving access to the text. Nonetheless the reader-as-writer is confined to the margins of the page. In the Internet world, rather than becoming an author, each reader, instead becomes a “librarian,” who practices, thanks to hypertext, a kind of “meta-reading.”

Another key question for the sociology of reading concerns the mutations between the relationship to knowledge and modalities of learning. The passage of the “Internaut” through various networks is a voyage in space, a journey into a territory far more vast than that allowed in the closed space of a book, and this new knowledge domain has of necessity modified the learning process. Passage through written text becomes boundless. For their own peace of mind, it will undoubtedly be necessary for the readers to reinstate some aspects of the experience of linear reading into the fluidity of reading electronic texts.

Finally, electronic text is silent and defies the oral. The Internet user (“l’Internaut”) is alone, but connected to the entire world. In order to overcome the interdiction against the oral, s/he gives voice to the text by inventing chat, e-mail and listserves of all kinds—and by downloading music. But if each individual is a writer, each one is also deprived of the spoken word and this state could be aptly described as “interactive solitude.” In the electronic

environment, one is in a contradictory relationship with other: ever present, but always absent.

THE FUTURE OF READING

It is now a time of multiple reading practices and the traditional model of reading is not the dominant model. Even though sociology does not take a relativistic perspective, sociologists are attempting to find how each reader constructs meaning, and makes sense of the world. A constant within the contemporary sociology of reading concerns questions in regard to the dissatisfaction over the mastery of reading skills or the quality of reading in cultural situation of contemporary society. The study of the “discourse on reading,” that a society defines or promotes has become an epistemological necessity, and is itself closely bound to society’s hopes and fears.

The question posed by the Enlightenment as to why societies seek to promote reading is more than ever relevant today. When societies wish to enable everyone to master reading, is it the search for liberty, which comes through the emancipation of all? Or is society simply guided by pragmatic needs when it esteems that everyone should be information literate? Or is the motivation consumeristic—embodying the wish that the world of the imagination still be framed by the joy of novel reading?

In any case, one should not be surprised by the evolving forms, pleasures and benefits of reading. If the image of emancipatory literacy has lost its force, paradoxically it is because the diffusion of reading, despite some gaps or deficiencies, has been accomplished, and it has become clear that widespread literacy is not always synonymous with emancipation. No longer is reading inhibited or prohibited, except by the texts themselves, their unequal wealth or poverty. The more widespread reading becomes, the more it loses its symbolic image as a force for freedom. Nonetheless, this does not mean that reading is devalued, that it will disappear, or that the power of readers or reading will be diminished.

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Sociology of the Information Disciplines

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Abstract

An overview of the sociology of the information disciplines is presented. The information disciplines are described and linked to the development of the social formation that sociologists refer to as “modernity.” Development of several information disciplines is traced in relation to the phases of capitalism, the growth of the modern university, and the growth of information itself.

INTRODUCTION

This entry presents an overview of the sociology of the information disciplines (see the section “The Information Disciplines: Scope and Definition” for detailed enumeration). Its point of departure is a decisive break that occurred toward the end of the European Middle Ages, ushering in a new form of society. Economically, the break was triggered by the rise and rapid diffusion of modern capitalism; socially and historically, the advent of capitalist market economies brought about the new social formation that sociologists refer to as “modernity.” (pp. 728–729),^[1] (pp. 490–508),^[2] (p. 9945).^[3] Economically, modernity is closely associated with increasingly globalized commerce and trade. From a broadly social point of view, the coming of modernity introduces a new worldview and ethos of cosmopolitan scientific materialism. This worldview and ethos—in a word, this new culture—is accompanied by a strong ideological emphasis on the free circulation of both goods and ideas.

There is no clear consensus on the periodization of modernity: some writers begin with the rise of merchant capitalism in the fifteenth century, others emphasize the European Enlightenment of the mid-eighteenth century. Still others date the beginnings of modernity with the English industrial revolution of the 1780s. For present purposes, however, it is essential to point out that modernity is not only a historical phenomenon: it is also a distinct form of social organization (p. 727).^[1]

Fortunately, the nature of the break, and the new form of society it inaugurated, is easier to identify than it is to specify its proper historical sequence. It is convenient to delimit a phenomenon by strategic contrast: human societies before modernity were dominated economically by agriculture, mining, and commerce. The division of labor was comparatively low, reflecting a simple, relatively undifferentiated occupational structure. Available technologies were also relatively simple, and did not change substantially over long periods. Politically, societies before modernity are marked by highly personalized

power relations. Socially, they favor fixed hierarchical arrangements (e.g., in the family, the kin group, and the church). Culturally speaking, they rely heavily on oral communication leaving few fixed knowledge and information records, have low literacy levels (reading and writing are mostly confined to elites), education is family-based and informal, and they are governed largely by tradition (pp. 728–729).^[1]

Modern societies, by contrast, are characterized by increasingly dynamic and rapid social change. They are dominated economically by the systematic and planned investment of surplus resources or capital. Initially invested and reinvested in processes of agriculture, mining, and commerce, the ceaseless flow of capital eventually dominates all economic production, distribution, and human services. The division of labor is complex and growing, reflecting the constant creation, abandonment, and subsequent recreation of enterprises and occupations. As rapidly as occupations become obsolete, new occupations take their place, destined to become obsolete themselves in relatively short order. There is in modernity a constant and mounting investment in the development of the sciences, and the use of scientific knowledge to invent new technologies that revolutionize production; modern societies are thus characterized by increasing reliance on rational forms of social action and organization (p. 727),^[1] (p. 9945).^[3] Politically speaking, modern societies depersonalize power relations, relying on complex, rationally structured, highly impersonal networks and organizations charged with oversight and regulation. Socially, many new opportunities for voluntary association arise, as individual ties to older hierarchical social relations loosen (pp. 728–729),^[1] (pp. 490–508).^[2] Culturally speaking, literacy levels rise slowly at first and then much more rapidly; formal educational institutions and mass education challenge the older tradition-based cultures of the family and the village. The increasing presence of literate populations places an emphasis on writing and printing; these means of formal communication are joined later by technologies of miniaturization like microprinting and digitization. All these challenge the

supremacy of oral communication, and the traditions it perpetuated, instituting a much wider production of, and reliance upon, fixed knowledge and information records. The disciplines on which this entry focuses arise as occupational and organizational responses to vast increases in these knowledge and information records.

Because sociology itself originates as a reflective response to the rise and development of modern societies (p. 491),^[3] it is well-positioned to frame and illuminate the rise and development of the modern information disciplines. Although the modern information disciplines themselves are a product of modernity as well, they focus on practical problems, and thus cannot provide on their own the reflective intellectual turn necessary to understand their historical and social significance. Because it is scarcely possible to survey all of a highly multiply paradigmatic field like sociology in such a brief compass, a suitable representative perspective needs to be identified; the sociological concept of modernity is ideally suited to this role. In addition to the above-mentioned enumeration of the scope of the information disciplines, the reader will find sections on the social character of disciplines in modern societies, the origins of the modern information disciplines in the disciplinary matrix of the university, the expansionist logic of modernity, the roots of the information disciplines in the continuing crises of modernity, and the dissolution of the nineteenth and twentieth centuries' disciplinary configuration. Drawing on recent work on discipline formation, dissolution, and reformation, it concludes by situating the contemporary information disciplines in an environment dominated by continuous innovation.

DISCIPLINES AND SOCIAL CONTROL IN MODERNITY: THE CASE OF KNOWLEDGE

"Discipline" (Lat. *disciplina*) refers to the instructional practices of defining, organizing, and transmitting knowledge. In modern times the discovery of new knowledge joins the list, and eventually takes pride of place. The knowledge transmitted, on the other hand, has been commonly referred to as "doctrine." Taken together, discipline and doctrine define the practical and theoretical aspects of formal or institutionalized education. Along with the new knowledge acquired, fundamental aspects of individual identity—cognitive, behavioral, and ethical—are restructured. Sociologists typically refer to this alteration of identity as "secondary-," "adult-," or "occupational-socialization," in contrast to an earlier phase in the formation of the self occurring during the "primary socialization" processes of childhood.

Disciplines, viewed as social formations, share two common goals: the first is to control a body of knowledge by subjecting it to systematic organization; and the second is to shape the consciousness and conduct of those who

seek to apply this body of knowledge. This dual focus on the organization of the field and the socialization of the practitioner clearly identify disciplines as fulfilling key functions in the social control of knowledge.

Before the rise of the specialized information disciplines in more recent times much of this task of control was accomplished by two available means: specialization and classification.^[4] Viewed singly, specializations act as primary filters, screening out much of the wider field of what is known (193ff.).^[5] But when taken as an articulated system of categories, the overall arrangement of various branches of learning can be used to generate a template or grid providing a sense of cognitive integration, a kind of *de facto* classification scheme or outline of knowledge. In this grid, the names of the special fields double as organizing categories. Modernity provides a number of examples of these knowledge classification schemes that inspired the book and library classification schemes still in use today.^[6] While originally based on the logic of deduction and arranged hierarchically, the reigning current schemes characteristically arrange categories by alphabetical (e.g., in the Library of Congress classification) or numerical sequence (e.g., in the decimal classifications), creating schemes immediately transparent to all literate persons.

Discipline(s), Knowledge, and Power

The brief outline sketched above highlights the role of specialized academic cultures in the creation, transmission, and control of formal knowledge. Some writers have taken a more expansive view of the concept of discipline, broadening it to the point where it is seen to work synergistically with all aspects of social control. In this view the social control of formal knowledge and its records rests on a deeper unconscious level of control conditioning both the knowledge and the entire range of social action simultaneously. The best-known of these writers is no doubt the French theorist and historian of the human sciences Michel Foucault (1926–1984), who saw the emerging disciplines of psychopathology, criminology, and pedagogy in early modern Europe working hand-in-glove with the rise of the social institutions of the asylum, the prison, and the school. Of particular significance to this entry is the frequent and increasing recourse found in this "knowledge/power" complex, to use a characteristically Foucauldian phrase, to gathering data, then recording and storing them for future use. The ensemble of these records constitutes a "field of documentation."^[7] Notably, fields of documentation both provide disciplines with a rationally organized system of records, and at the same time furnish increasingly ubiquitous means for monitoring behavior. Thus, in the Foucauldian view, discipline refers not only to a field but also to a pervasive form of social control.

Although this significantly expanded use of discipline has not been used widely in the literature on the information fields, that use is increasing, and has been applied to

librarianship and museum studies with persuasive and striking results (p. 35),^[8] (p. 10).^[9] In this way, key organizations in information societies can be seen as agents of surveillance and bureaucratic control (p. 63).^[9] By extension, librarianship assumes a role in collecting and providing access to records of many different kinds and at the same time studying, surveying, monitoring, and recording the behavior of library users (pp. 65–68).^[9] Something of the same may be said of the realm of “material culture,” the focus of museum collecting, and museum studies. Museums originated largely as the private collections of aristocrats and a small coterie of powerful bourgeois, but by the end of the eighteenth century, their collections began moving into monumental public settings. In these new venues, collections of art objects and artifacts attested to the rising power of the great nation-states of Europe and their expanding colonial empires. The museum, from serving as an arena of privileged wealth and taste, in modernity acquired the role of educating the population and at the same time helping to transform that population into a modern citizenry (p. 169).^[10] Librarianship and museum studies, in this optic, appear as agents of control—of records, artifacts, and indeed of selves in their guises as library users or museum visitors. Much the same could be said of archivistics, the information sciences, informatics, and also of studies of readers, information users, and audiences.

THE INFORMATION DISCIPLINES: SCOPE AND DEFINITION

By the middle of the nineteenth century, the logic of expanding inquiry increasingly generated a need for new approaches and new occupational specializations to manage a constantly growing universe of knowledge records, including records containing data about users. Classification and specialization were no longer sufficient to supply the necessary organizational knowledge required for effective control. This entry draws attention to librarianship, archivistics, records management, bibliography and textual studies, document-type studies, social studies of information use, and museum studies, all sharing a broad, human-centered orientation, with quantitative methods making some inroads. The distinction between archivistics and records management is essential because, even though in North America the contrast between the two is not particularly sharp, it has for some time in Western Europe referred to two clearly distinguished fields.^[11] To these we must add a newer, closely affiliated yet more quantitative and technical group: information science, information systems design, knowledge management, and informatics, where humanistic, historical, and interpretive approaches on the other hand are less prominent, though growing in importance. This rough classification follows Bates, who has also identified the more human-centered information

fields as “disciplines of the cultural record” and the more scientific group as “sciences of information”; we also adopt that typification here.^[12]

The contrast between the disciplines of the cultural record and the information sciences recalls the familiar distinction, broadly speaking, between humanistic and scientific approaches to inquiry. In both cases, the contrast is at times a source of friction, but in the end fruitful. The friction comes from the contact between the older humanistic and the newer scientific styles of work. The tension is fruitful because the development of the information sciences, arriving on the scene relatively late, encouraged the older and more traditional disciplines of the record to treat records in more quantitative, calculative, and analytical ways. Where the more conservative, tradition-bound humanists viewed the text as largely fixed by authority, and thus alterable only with difficulty, reverence, and trepidation, information scientists approached texts and other knowledge records in a more practical, liberal, and open spirit. The tension is in any case counterbalanced by a common focus on acquiring, collecting, organizing, and preserving information in its recorded forms, in order to make records and their contents available to users.

For all the information disciplines, the increasing reliance on scientific approaches does much more than challenge older paradigms of humanism; it transforms many of the basic operations found in the institutional and organizational settings in which information work is so often carried out: libraries, archives, museums, public agencies, research institutes, think tanks, and businesses of different kinds. Although some of the characteristic tools and techniques used in these venues (for example, bibliographies, catalogs, schemes of document classification, and techniques for determining shelf location) preceded the coming of the information sciences, they were nonetheless thoroughly transformed thereby; and they were joined by many newer techniques and approaches (controlled vocabularies, numerous if often short-lived approaches to document retrieval, typed and later printed catalog and index entries, and eventually, by the 1950s, an increasing reliance on automation that continues unabated to the present). The newer techniques were by no means limited to those rooted in the applied versions of the natural sciences: so-called “rational” or “scientific” approaches to management and administration also left indelible marks.

The sociological significance of this distinction between the older humanism and modern science is large and pervasive, and reflective of epochal cultural changes. Initially crossing the divide between the field (and the laboratory) and the factory, science as method, technique, ethos, and worldview eventually moves into and colonizes the production, distribution, and use of records. This can also be seen in museum studies, which partly overlaps with librarianship, archivistics, and the information sciences. But the profile of museum studies (“museology,” as it is also called) is complicated by the arrival of an

altogether different incursion of modern scientific techniques for analyzing the artifacts of material culture, borrowed from physics, chemistry, and archaeology (124ff.).^[13] The ancient status of the cultural record as exemplar of traditional authority is eclipsed, as the record itself, recast as a tool for practical exploitation, provides mundane opportunities for information-seeking. Not surprisingly, records in this context easily become commodities to be traded in knowledge- and information-intensive markets (p. 41).^[8]

These informational commodities bear much more than traditional “use value,” to borrow a standard concept from political economy: as commodities, they also become bearers of “exchange value” (pp. 358–359).^[14] In the process, the work of the information professional reflects and increasingly incorporates the newer role of mediator between informational commodities and those wishing to use them and exchange them for profit. The shift to informational commodity mediator significantly challenges and partly displaces older text- and object-oriented curatorial and preservationist models of information work based on the traditions of intellectual craft labor and apprenticeship.

As records shift from tokens of intellectual authority to sources from which decontextualized facts, ideas, information, propositions, hypotheses, conjectures, knowledge-claims, and answers to queries may be extracted and used entirely outside the original context in which they appeared, the work situations of virtually all information professional are powerfully affected. Until well into the post-World War II era, the cultural gap between the older disciplines of the record and the new information sciences persisted. But since the 1960s, particularly in the English-speaking world, graduate and professional programs offering a kind of hybrid introduction to “library and information science” have attempted to fuse these two originally distinct approaches (3ff.).^[15] The hybrid pattern fusing older approaches from humanism and the newer scientific methods is now not only characteristic of librarianship, but also of archivistics, museum studies, bibliographical and indexing services, publishing, and social studies of information use. (On archivistics, see Rumschöttel (p. 154);^[16] on museum studies, see Hooper-Greenhill;^[10] for an overview of the increasing significance of information science in all the information disciplines, see Buckland and Liu).^[17]

THE INFORMATION DISCIPLINES: THEIR PLACE IN THE MODERN UNIVERSITY

Both the disciplines of the cultural record and the information sciences assumed characteristically modern forms by responding to the phenomenon widely known as the “information explosion,” and more accurately described as a series of continuing explosions.^[18] Triggered initially in the middle of the fifteenth century by the use of

movable-type printing and a resulting shift from scribal to print culture, these surges were dramatically accelerated in the late eighteenth and early nineteenth centuries, and even more in the twentieth. In some cases, this led to the splitting off of new fields, as the problems of record control became too great for the established academic fields to handle on their own. Librarianship and the information sciences, especially in the hybrid form so often found in the library and information science graduate programs of the post-World War II period, bibliography and textual studies, and studies of readers or users of records come clearly to mind here. In other cases groups emerged within and remained partly dependent on older academic disciplines.

For example, archivistics and records management both not only bear the imprint of scientific history, corporate management, and public administration, but were also once subsumed under them (p. 46).^[19] Museum studies, to take a different example, is significantly linked to cultural anthropology, history, art history, natural history, evolution and ecology, and archaeology (pp. 14–15).^[20] On the whole, however, all achieved separate occupational identities and university affiliation only in relatively recent times. Museum studies is the youngest of the newcomers. Once rooted in the “master and apprentice” craft-dominated training models of the nineteenth-century museum, it did not even begin to establish degree programs in university settings until the 1920s, and it required several more decades for one of the first fully fledged university departments of museum studies to appear, in 1977 (pp. 424–426).^[21]

The distinction between disciplines focused on the cultural record and the more quantitative information sciences can also be understood in terms of basic resource inequalities, a fixture of twentieth-century sociological writing (p. xii).^[22] The disciplines of the cultural record stand to the information sciences much as the humanities and social sciences stand in relation to the better-funded and more politically powerful basic and applied natural sciences. This inequality may account for the keenness of the competitions and rivalries that establish carefully patrolled boundaries staking out professional jurisdictions.^[14,23]

Despite key associations with older academic cultures, there is nonetheless a fundamental difference between these information fields and their older academic counterparts. The main difference is that the information disciplines are, in Bates’ expression, “orthogonal”: rather than occupying space in a continuum alongside them, they lie, so to speak, at a right angle to the older spectrum of disciplines, and focus in principle on the collective recorded output of all of them (p. 1044).^[8,24] Neither primary producers nor distributors of content, they mediate between these poles, positioned to enable access, retrieval, content discovery, use, preservation, and control of the ever-increasing output (p. 1044),^[24] (pp. 6–9).^[25]

THE EXPANSIONIST LOGIC OF CAPITALIST MODERNITY

The origins of the modern disciplinary system, formed largely in the nineteenth and twentieth centuries, lie in a series of epochal transformations in which millennia of traditional agricultural economies and societies become overshadowed and eventually eclipsed by the development of capitalist modernity. Likewise with the informational fields arising in response to this development, the subject of modernity has occupied the attention of a great many scholars in many different fields. In this entry the focus is limited to a narrower range of key sociologists, social theorists, and some political economists of special importance to the development of sociological thought. Of particular note in this connection are Karl Marx (1818–1883), Max Weber (1864–1920), Emile Durkheim (1858–1917), and Georg Simmel (1858–1918). All were struck by the far-reaching effects exercised by the rise and spread of capitalism toward the end of the European Middle Ages, and how it displaced a much older, largely rural, much more static, and highly traditional society characterized by strong communal ties, the central presence of religious institutions, and relatively low levels of mobility. Marx and Engels memorably captured the fast-moving, highly mobile, and disorienting quality of capitalist societies in the *Communist Manifesto*, where they wrote: “all that is solid melts into air.” These changes are all the more significant because although their origins lie in early modern Europe, a small and geographically relatively insignificant part of the world, their effect is revolutionary and their extent becomes distinctly global with the coming of the English industrial revolution.

The coming of capitalist modernity takes place in three phases: early modern mercantilism, eighteenth- and nineteenth-century industrialization, and a late nineteenth- and early twentieth-century second wave of industrialization sometimes called “reflexive modernization” (pp. 10ff.; p. 87),^[26] and also “the second industrial revolution” (pp. 402–403).^[27] While librarianship, bibliography, archivistics, and records management clearly have ancient lineages, their more characteristically modern forms do not emerge until the second and third of these three phases; and it is not until the third phase that much newer information disciplines like the information sciences, knowledge management, informatics, and museum studies make their appearance.

In early modernity, merchant capitalism, aided by the rise of modern banking and accounting, transformed and expanded commerce and the distribution of goods. In this phase, the older manuscript culture, with its characteristic “text and commentary” method (p. 101),^[28] was transformed and substantially marginalized by the invention of movable-type printing in the mid-fifteenth century, permitting the production and distribution of large numbers of increasingly standardized texts. Nonetheless,

movable-type printing remains for some time after its implementation firmly anchored in the culture of preindustrial craft production.

At this point in time, librarianship and archivistics were only barely emerging as occupations with distinct identities of their own, and not surprisingly they were frequently practiced by persons already involved with other lines of work: scholarship, religious vocations, administration, and letters, to cite the more common examples. The two pursuits were more often than not combined, if only because the collection and housing of both books and archival records so often occurred at the same location (p. 159).^[29]

Materials selection still remained largely the province of the nonlibrarian. By the latter part of the fifteenth century, there were, however, early signs of the forms these nascent pursuits will later take: newly emerging bodies of knowledge like systematic and universal bibliography, bibliographic description, a much-increased reliance on alphabetical indexing, and the use of topical key words as organizational devices (pp. 126–128).^[30] Closer to the end of this period, by the middle of the seventeenth century, as other early signs of the Enlightenment appear, formal treatises on librarianship, and the management of collections of records have begun to appear (p. 381).^[31] Part of this specialized professional literature was necessarily devoted to the development of organizational tools for, as Le Gallois pointed out in a famous treatise of the day, “order is both the soul and the form of the library”; chief among these are the many classification schemes that, in the absence of any standard classifications, had to be custom-made to fit specific collections (pp. 381, 382–384).^[31] And by the end of the seventeenth century, book and library classification schemes began to include special categories for this emerging professional literature (p. 181).^[30]

Significantly, there is also the clear emergence of a frankly materialistic sensibility among practitioners. An important new idea of early modernity is that libraries must above all be dedicated to use, rather than the housing of sacred literary relics (p. 172),^[30] (p. 385).^[31] Librarians for their part openly avowed the need for material compensation for their work (p. 175).^[30] Collection-building activity was focused heavily on exchanges, an expression of the idea of the book or text as a commodity to be traded (p. 176).^[30] In a representative statement, the English librarian Thomas Durie wrote in a language clearly taken from the discourse of political economy: “for the increase of the stock” librarians must mingle with persons “eminent in every science, to Trade with them. . .” And Durie went on to characterize the librarian in typical business terms as “a Treasurer and a Factor” who trades in “a useful commodity” (p. 176).^[30] Librarians, along with other types of workers, have become “employees” who are recruited from an increasingly fluid labor market. As such, they were free to enjoy social mobility, both geographic and occupational, and changed employers at will, seeking better pay and working conditions (p. 395).^[31,32]

In the second phase, known as industrialization, capital expanded significantly by moving into production and exploiting artificial energy. The commercial capital accumulated in the period between 1400 and about 1750 provided necessary resources for a systematic exploitation of scientific and technical knowledge in production processes. Industrialization was no doubt also powered by a new religious and ethical zeal for applying scientific and technical advances in a wide variety of practical operations.^[33] Noteworthy, advances in the technology of printing markedly increased the production and distribution of texts, providing even more commodities destined for an expanding, increasingly literate population. During this second phase of capitalist modernization, the early modern troika of theology, medicine, and law lost its dominant position in the university, where it was challenged and overshadowed by a wide variety of new fields imbued with the ethos of scientific exploration, discovery, and analysis.

Both socioeconomically and culturally, the profiles of the librarian and the archivist are strongly marked by the increasing dominance of the bourgeoisie. (This will later become true of museum curators as well.) The librarians of the period were clearly recruited almost exclusively from middle-class social strata, and only occasionally from the lesser nobility (p. 268),^[30] (p. 386).^[32] Not surprisingly, this socioeconomic profile is strongly imprinted by the bourgeois values of the time. The key value in this context is the belief that ideas and knowledge, along with the texts encoding them, must be allowed to freely circulate, just as goods in trade must be allowed to circulate. This deep ideological commitment, paired with an extensive grounding in the liberal arts and a thorough mastery of Latin, made them ideal members of scientific or learned societies where a materialist and secular spirit reigned, even further eclipsing the older influence of theology (p. 268).^[30]

The period of industrialization also provides clear evidence of additional steps taken toward the formation of distinct occupational identities, at least for librarianship and archivistics. The first known instance of the term “library science,” coined by a German writer, occurred in 1803; what is likely the first formal treatise on professional education appeared in 1820 (p. 313).^[30] Indeed, the years following the French Revolution in 1789 are highly formative in other ways as well. There is a new reliance on examinations and formal certification procedures (p. 266).^[30] The founding of the *École des Chartes* in 1821 provided government-certified professional education for librarians, archivists, and museum curators. Graduates enjoyed a virtual monopoly on appointments in libraries, archives, and major museums as early as 1839 (pp. 50–51),^[19] (p. 392).^[30] These developments in formal education in France, the United Kingdom, and Germany were accompanied by a parallel development in the professional literature (pp. 154, 156ff.).^[29]

In the third phase of capitalist modernization, the processes that earlier transformed traditional agricultural

societies began to push industrial society itself in new directions. When the forces of industrialization turn and begin to work on industrialization itself, capitalist modernity is said to enter a “reflexive” phase (p. 10).^[26] Scientific advance, technological invention, and their combination penetrated the university and acquired a legitimacy previously denied. In this third phase, which gathers speed toward the end of the nineteenth and comes to fruition in the twentieth century, the forces that earlier transformed commerce and primary production begin to also transform the accumulation and management of information, especially in its recorded forms, as these become increasingly central to the management of advanced industrial societies (p. 403).^[27]

It is largely in this third phase that the information disciplines become consolidated in forms more clearly recognizable today; during this period, they come together or “jell” as professionalizing occupations. The critical difference between the information disciplines in the nascent embryonic forms described above and the more recognizable shapes they assume in the last half of the nineteenth century is the forging of lasting links with formal, institutionalized, higher education. The information fields, among a number of other professionalizing occupations, moved into a growing middle ground between the shrinking bourgeoisie and the burgeoning industrial proletariat, claiming a special standing in the labor market based on expertise. For all these fields, the information disciplines included, university affiliation became essential. It not only provided a solid institutional disciplinary base for the generation and transmission of new knowledge but also and even more important from a sociological point of view, an acknowledged mark of competence, a recognized authenticity. And because the stamp of social legitimacy provided by affiliation with university programs facilitates social and economic success, professionalizing groups gained an important advantage in a competitive labor market. From a relatively small group of older traditional professions enjoying the benefits of professional privilege—chiefly theology, medicine, and law—the social and economic landscape of modernity became more heavily populated with new professional groups. In turn, all of these newer expertise-based occupations accumulated their own bodies of knowledge and staked claims to professional status and monopolies of control. Because these newer occupations grew rapidly thanks to the increasing circulation of capital, the bodies of knowledge, and the records they generated grew rapidly as well.

The increasing emphasis on certification, authenticity, and legitimacy by means of university affiliation subjects the information disciplines, in a way they had not been previously, to the powerful forces of bureaucratization (“rule by office,” in the common formulation of the German sociologist Max Weber and a number of his colleagues). When librarians, archivists, and museum curators had been prepared and vetted by the much less

formal mechanisms associated with the apprenticeship mode of craft labor, they had a more tenuous relation to centralized bureaucratic organization. The modern university, as it developed in the later stages of the industrial age, was by contrast a large and complex network of interdependent jurisdictions governed, like major corporations and state agencies, by rational techniques of administration. As such the university's operating philosophy was tailored to minimize the highly personal forms of authority and patronage characteristic of organizations before modernity. Thus, in this period, we find a common dual focus on organization and administration (pp. 728–729),^[1] (pp. 490–508),^[2] (p. 324).^[30] The dual focus appears clearly in an influential treatise of the period, where it is argued that professional employees in the information fields should stress “the dependence of good service upon proper division of labor, smooth operation, and minimal paper work” (p. 325).^[30] Because professional education for archivists not only acquired a formal affiliation with institutions of higher learning, but was also closely connected with major depositories, often government agencies, archivistics shows an even closer connection with the hierarchical complexities of bureaucracy (p. 65).^[19]

Striking as it was, however, the constant increase in the size of the universe of records, an increase made possible by the constant expansion of capital, reflects and is partly overshadowed by an even larger expansionist social and cultural logic with an explosive dynamic of its own. The ongoing information explosions, in fact, were only one aspect of a larger cultural crisis. The writers of the nineteenth century—both literary and scholarly, particularly in the writings of those later identified as founders and forerunners of sociology—clearly struggled with an endemic sense of malaise in which individuals appear at the mercy of overwhelming social forces. That these individuals themselves unwittingly unleashed these forces only added to the drama. The march of industrial capitalism moved nineteenth-century writers and thinkers like Marx to liken the bourgeoisie—the flagship class of capitalist society—to a sorcerer whose creations behave like monsters; once created and let loose, they endlessly fashion and refashion society and us along with it. Max Weber likened bourgeois society itself, however rational and efficient it was in comparison to earlier social formations, to a cage of disenchantment. Durkheim identified and analyzed modernity's new social environment as lacking the reassuring compasses of community, religion, tradition, and clearly understandable social norms. And Simmel found in modernity a deep ambivalence toward the material and cultural abundance of modernity, which ironically dwarfed the individual's ability to understand and absorb it (for an overview of these trends, see Berman (pp. 27–29, 87–98).^[34] The figures of speech vary, but the underlying concern is remarkably consistent: modern societies entrap and overwhelm the individual, burying it under an

avalanche of resources. Among these are the mounting populations of knowledge and information records, and the many techniques required to control them and navigate through them in order to retrieve relevant records. A century later the U.K.-based sociologist Anthony Giddens, sizing up the classical social theorists mentioned above and appraising advanced industrial society's obvious advantages along with its grave problems of control, refers to modernity as a “juggernaut” (p. 139).^[35] We note here that the problems of dealing with exploding bodies of knowledge records are not autonomous developments, because they are grounded in larger social processes occasioning ceaseless change, disruption, and disorientation. Like the upstart academic fields of the nineteenth century which displace the earlier disciplinary matrix, the information disciplines emerge against the backdrop of this larger sense of crisis.

THE ORIGINS OF THE INFORMATION DISCIPLINES IN THE CULTURAL CRISES OF MODERNITY

Before modernity, ancestral forms of the disciplines of the cultural record appeared along with early systems of writing and are found, though in much smaller numbers, in ancient civilizations (p. 65).^[9,36] Nonetheless, even the older fields of the cultural record did not begin to show a distinctively modern occupational identity until industrialization had substantially eroded the craft models of work operating in early modernity. The discipline originally called “documentation” or “documentalism,” surfaces more or less *de novo* during the late nineteenth century; by about 1960, it became much more commonly called by its current name, “information science” (pp. 273ff.).^[17] Developing separately, the disciplines of the record show varying patterns of growth. Librarianship's first training schools, university schools, professional associations, and certification procedures all date from the last quarter of the nineteenth century, the heyday of industrial modernity. Other common indicators of knowledge-intensive, discipline-based occupational development, like the development of formal codes of ethics, however, developed even later.

Even though archivistics has a long history, its professional associations did not appear until well into the twentieth century, about the same time that professional associations for information science appeared. Information science, of course, now has a number of university programs in force, but these developed only decades later than the library schools. The use of the archive as a public resource for scientific historical research, as opposed to a facility dedicated to the much older function preserving the records of ruling families, businesses, and governments (p. 162),^[36] dates from the era of the French Revolution. Like the museum, the archive in modernity reflects

the rising power of the bourgeois nation-state.^[37,38] Archival training was once universally acquired in work settings, but in more recent times has become integrated into formal university curricula, and according to a recent report is no longer based exclusively in on-the-job training, but commonly requires an advanced professional degree for any real prospect of advancement. At the same time, the disciplinary context for the degree appears to have shifted from history departments, in the period from 1940–1960, to schools of library and information science, in the period between 1984 and 2000.^[39,40] And while information science, born modern, may be dated from the early twentieth or the late nineteenth century at the earliest, a group of practitioners identifying themselves as such did not really emerge until the period between World Wars I and II (pp. 3ff.).^[25]

Controlling the recorded output of the higher learning, by itself already a formidable task, turned out, however, to be only the beginning of the story. Intense social and political pressure for universities to become involved in solving a wide variety of practical problems inevitably spurred the pursuit and application of knowledge outside the academy. At the same time that capitalism transformed the university by revolutionizing its disciplinary matrix, it was also busy increasingly investing in a wide variety of business enterprises, and the public sector, in turn, developed vast networks of government agencies to regulate and facilitate enterprise. As offshoots of their many activities, these enterprises and agencies generate large quantities of additional records, some of them quite technical and specialized, and others aimed at wider audiences. Additionally, particularly in the period after World War II, an increasing number of enterprises specializing in mass communication, advertising, and entertainment generate an enormous amount of their own recorded content. All of these pushed the information disciplines into territory well beyond the academic sphere, and there were and continue to be appreciable growths in the need for information professionals in all these areas as well.

INNOVATION, HYBRIDIZATION, AND INTERDISCIPLINARITY

Marx and Engels were probably the first major social thinkers to characterize capitalist modernity as ceaseless transformation, but they were certainly not the last.^[41] Their underlying idea, if not their precise language, was subsequently taken up by Friedrich Nietzsche (1844–1900), who along with Marx and Engels in turn exercised a strong influence on a number of subsequent writers, notably “political economists” and early sociologists like Max Weber, Werner Sombart (1863–1941), and somewhat later Joseph A. Schumpeter (1883–1950). Nietzsche and Weber recognized that Marx’s and Engels’ insight was clearly both sociological and historical, since it linked

the inherently transformative nature of capitalist societies with the risk-taking activities of the innovative entrepreneurs typically found in these societies (p. 224, n. 221).^[33] Sombart and Schumpeter, on the other hand, used the Nietzschean concept of “creative-destruction” as a means for understanding the revolutionary role played by innovative entrepreneurialism in capitalist modernity.^[41] This characteristic juxtaposition of innovation and destruction is at the root of capitalist societies’ powerful nihilistic tendencies (pp. 98–105).^[34]

Originally, this cycle of innovation, investment, and reinvestment to stimulate more innovation—this perpetual process of creative-destruction—was largely confined to economic goods production and distribution. The innovative approach to knowledge did not become socially dominant until industrialization began to revolutionize its own foundations (that is, in the third of these phases, referred to above as reflexive modernization or the second industrial revolution). (For the three stages, see the section “The Expansionist Logic of Capitalist Modernity”). In that third phase of development, the revolutionary transformation of economic production of earlier periods culminated in widespread rationalization processes. The end result is an expansion in the overall numbers of people producing, distributing, recording, and using knowledge and information. Note that the entrepreneur is the key player in initiating change, and that bureaucracy emerges as an organizational response to innovation.

Toward the end of the nineteenth century, and continuing well into the twentieth, the production and distribution of knowledge became increasingly modeled on the innovative entrepreneur; scholars, teachers, journalists, publicists, scientists, technocrats, and public intellectuals play increasingly important roles in knowledge-intensive, record-creating activities that are analogous to the activities of the innovator in goods production. These knowledge producers—to use a convenient shorthand to encompass all of them—innovate by a process aptly called “hybridization.”^[42,43] Hybridization proceeds by isolating congenial thematic strands or subfields from one larger field or discipline, and fusing one or more of them with strands or subfields from a different discipline. The result is not only a new subfield, but also a significantly more complex division of intellectual labor, and a further proliferation of records for the information disciplines to track and control (pp. 353–355).^[14]

Moreover continuing innovation and specialization has the effect of blurring disciplinary boundaries that were once much more clearly delineated; the more rapidly the innovations appear and disappear, the shorter the half-life of the newer hybrids, and the more fluid the boundaries become (pp. xi–xii).^[22] In some cases, hybrids coalesce into larger units, rivaling older disciplinary formations in size and complexity while they emerge as new disciplines or, perhaps more appropriately, “interdisciplines.”^[44] Numerous examples abound: the emergence of cultural

studies, ethnic studies, women's studies, and disability studies, hybridized by crossing various strands from sociology, history, anthropology, literature, the arts, biology, and public health, spawning new bodies of literature in the form of books, journals, audiovisual resources, and Web sites, and eventually secondary and tertiary databases, search engines, and other discovery tools. But in many cases, no larger interdiscipline emerges, leaving an increasingly fragmented landscape of isolated hybrids, awaiting further combination.

In the information disciplines, one of the first of the hybrids to emerge as an interdiscipline was library and information science, fused with strands from traditional literary subfields like bibliography, textual analysis, and the study of readers and reading on the one side and on the other with "documentation studies," as it was known in the period from 1890 to about 1940, or information science, as it was known in the post-World War II period (pp. 168–169).^[40] Library and information science during this period also emerged in contrast to a related but distinct interdiscipline, "computer and information science" (p. 9).^[45] The difference between the two interdisciplines probably has less to do with issues of content or organization, and much to do with the underlying gender order of late modernity, since library and information science still attracts and holds a clear majority of females, while in computer and information science, on the other hand, precisely the opposite is true.^[46]

Since the 1970s, a different pattern of convergence and hybridization has appeared along with the much more recent appearance of formal museum studies, sometimes called "the new museology" (p. 1).^[20] In comparison to the patterns seen in earlier times, where librarianship, archivistics, and museum curation were often practiced in close connection with each other, in the late twentieth century, the three have often diverged. But the larger picture is far from clear, since there have been liberal borrowing relationships between museum studies, which have adopted concepts like "collection development" from librarianship (p. 135),^[13] and archivistics and librarianship, which have in turn borrowed key concepts and techniques from museum studies (p. 106).^[47] It is of course too early in this process to make confident predictions, but it is significant that in both North America and in Europe there is currently a movement to co-locate the information disciplines into one institutional setting for professional education, in effect stressing similarities and overlaps over differences (p. 73).^[48] And in Europe there is evidence of an ambitious movement to combine advanced professional education in librarianship, information science, and archivistics into a single interdiscipline that will be able to function in virtually any setting requiring the systematic management of all kinds of information records (p. 323).^[11] In the future, museum studies might well join them. At the same time, of course, it must be pointed out that the appearance of larger interdisciplinary

unities is by no means the whole story, since much more specialized, smaller, and relatively isolated hybrids continue to appear ("museum informatics," for example, and others of this kind).

CONCLUSION

The information disciplines today are, more than ever, shaped by the increasing ubiquity and spread of capitalist market societies. Perhaps for this reason, it has become commonplace, at least since about 1970, to call attention to the role of information and information records as exchangeable commodities, in contrast to earlier and possibly more traditional notions of information records as public goods offering various kinds of utility.^[49,50] But we have seen that this view of information as commodity is actually very far from recent. When records and their contents acquire the status of exchangeable commodities, it means, among other things, that information disciplines and information professionals become part of a long economic chain connecting producer to end-user, and thus acquire some of the functions of the broker or trader, even though information professionals retain some of the older focus on the knowledge and information as public goods.

At the same time, however, knowledge and information records have more than utility (use value) and market value (exchange value). While their status as useful goods and economic commodities is beyond doubt, they have a distinctly sociological function not properly captured by this economic distinction, since they can also function, like any other object, as signs carrying a wide range of shared meanings. Thus, the record itself has a range of "sign values" (pp. 57–60),^[51] (pp. 33–34),^[52] and its presence and display figures in a larger social process of communication, quite independently of the much more specific communicative functions of its contents. This means that collections of records and how these are displayed can take on distinctly ideological functions. In consumerized market societies dominated by powerful and sophisticated technologies of information and communication, the information disciplines and the various venues in which information work is performed thus participate in a form of indirect advertising and display of the spectacular range of resources available in modern societies (p. 74).^[9]

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Software and Information Industry Association (SIIA)

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Abstract

The Software and Information Industry Association (SIIA) is the principal trade association for the industries. In 1999, the Software Publishers Association, founded in 1984 by the current SIIA CEO, Ken Wasch, merged with the Information Industry Association, which had represented information industry publishers for a number of years, to create the SIIA as the primary trade association for the combined industries. SIIA has a three-pronged mission on behalf of the software and digital content industry: 1) promoting the common interests of the software and digital content industry as a whole, and its component parts; 2) protecting the intellectual property of its member companies, and advocating for a legal and regulatory environment that benefits the entire industry; and 3) informing the industry and the broader public by serving as a resource on trends, technologies, policies, and related issues that affect member firms and demonstrate the contribution of the industry to the broader economy. SIIA is organized into six major divisions: software, content, education, government affairs, antipiracy, and financial and information services. SIIA has more than 500 member companies that it brings together for useful discussions via large-scale and smaller conferences, as well as board, committee, and division-related planning sessions. It runs the CODiE Award Program, established in 1986 as a way for industry professionals to peer review each other's work and celebrate their achievements. SIIA is headquartered in Washington, D.C. and more information may be found on its Web site at <http://www.sii.net>.

INTRODUCTION

With today's ever-increasing technological advancements and the ubiquity of digital content and information, the software and information industry continues to flourish. As hi-tech firms grow and thrive as part of this ongoing industry success, a unifying thread is necessary for maintaining standards and providing support—the Software and Information Industry Association, or SIIA. Indeed, SIIA has proven itself as *the* principal trade association for the industry.

SIIA provides global services in government relations, business development, corporate education, and intellectual property protection to leading companies that are setting the pace for the digital age.

Further, SIIA has a three-pronged mission on behalf of the software and digital content industry. The first objective includes promoting the common interests of the software and digital content industry as a whole, as well as its component parts. As its second objective, SIIA protects the intellectual property of its member companies, and advocates a legal and regulatory environment that benefits the entire industry. Third, SIIA informs the industry and the broader public by serving as a resource on trends, technologies, policies, and related issues that affect member firms and demonstrate the contribution of the industry to the broader economy.

HISTORY OF SIIA

The SIIA was founded in April of 1984 by its current CEO, Ken Wasch, who was originally a lawyer at the U. S. Department of Energy. Wasch's interest in emerging software development contributed to his idea of creating a trade association for the then-nascent industry. In November of the previous year, he had sent letters of proposal to potential member companies, which outlined his overall plan for the association. The responses led to the establishment of the Software Publishers Association (precursor to SIIA) and the formation of the trade association's board of directors. In 1999, the Software Publishers Association merged with the Information Industry Association, which had represented information industry publishers for a number of years, and the SIIA was established as the primary trade association for the combined industries.

DEPARTMENTS WITHIN SIIA

The SIIA is organized into six major divisions: software, content, education, government affairs, antipiracy, and financial information services division, or FISC. These departments work collectively to uphold the trade association's mission and to provide benefits to member companies as a whole.

Software division: The software division of SIIA ensures the successful direction of member companies that are the driving vehicle behind contemporary software applications and services. The division provides a collaborative environment for company executives to adapt to changes within the industry and improve their companies. The division keeps up with industry trends and cutting edge research and provides members with the latest resources and opportunities.

Content division: The content division of SIIA provides leadership and support to member companies involved in the publishing and dissemination of digital content and related services. The content division also tracks emerging issues and trends in this arena.

Education division: SIIA's education division provides opportunities and marketing resources for member firms involved in education-related technology. The division also keeps up with education policy issues on a state and federal level. A main component of the education division is the K-20 Vision, an innovative initiative designed to increase learning efficiency through technological strategies and cutting-edge software.

Government affairs: The government affairs division protects member companies by tackling legal issues within the industry and actively working toward effective and successful policies on their behalf at the federal and state level. The division recognizes member concerns and represents their joint interests within a wide range of critical issues, including e-commerce regulation, privacy, and the protection of intellectual property.

Antipiracy: The antipiracy division of the SIIA works actively on minimizing software and content piracy by creating campaigns and educating the public about the legal consequences involved. The division also conducts a Corporate Antipiracy Program, which allows sources to anonymously report instances of piracy by a particular company. In addition, the Internet Antipiracy Program produces investigations of various auction Web sites for piracy occurrences.

FISD: The FISD allows exchanges, market data vendors, consumers and banks to communicate about issues involving the administration of financial information. FISD represents the industry by creating many networking events and opportunities for communication to ensure an understanding regarding the complexities of the marketing data industry.

SIIA MEMBERSHIP

Today, SIIA has more than 500 member companies and continues to enable members to come together for useful discussions via large-scale and smaller conferences, as well as productive board, committee, and division-related planning sessions. With a mix of large brand name companies as well as smaller start-up firms, members have the opportunity to network and share information. Membership also increases company visibility and promotes a positive corporate image. Further, members are represented when it comes to public policy and regulation issues.

THE CODIE AWARDS PROGRAM

The CODiE Award Program was established in 1986 as a way for industry professionals to peer review each other's work and celebrate their incredible achievements. The CODiE title originates from the common software word "code" in convergence with the symbol for information, "i." The CODiE's are held annually and have become *the* prestige of the industry, showcasing exceptional work, and setting high standards for products and services within the software and digital information industry. Products and companies nominated for an award undergo an impartial judging process, which then leads to finalists review process. Winners are announced at an awards gala each spring so that members of the industry can celebrate the success of the industry.

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ADDITIONAL RESOURCES

1. Additional information and resources may be found on the SIIA Web site. Available at <http://www.sii.net>.
2. SIIA is located at 1090 Vermont Ave NW, Sixth Floor, Washington DC, 20005.

Sound and Audio Archives

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Abstract

This entry provides an overview of sound archives, including reasons why sound archives exist, their history and organization; types of sound recordings collected, methods of description, and access to and preservation of recorded sound materials. Recorded sound formats (e.g., cylinders, discs, long playing (LP) records, etc.) are covered in the context of how they have been (and are currently being) collected, described, preserved, and made available. Select projects and programs undertaken by regional, special, and national sound archives are covered. Professional associations that focus on sound archiving are described as are funding avenues for sound archives. Description is also included of work being carried out in the United States to modify copyright law to better enable sound archives to preserve their holdings for future generations of users.

INTRODUCTION

To a large extent, the rise of sound archiving directly parallels the development of recorded sound technology itself. Indeed, some of the earliest efforts to archive sounds came in the wake of the invention of the Edison phonograph in 1877, a device which recorded sound onto a wax cylinder. For an illustrated overview of sound record technology, <http://history.sandiego.edu>.^[1] Archival safe keeping of sound recordings during this early period was tied to the commercial distribution of recordings of popular and classical music. As molded wax (and later plastic) cylinder production was limited, these artifacts from the early period of sound recording history have become increasingly rare and valuable. “In the 1890s it became possible to duplicate cylinders and discs on a large scale and, after the turn of the century, the commercial production of recordings really got under way.”^[1] Cylinders were collected chiefly by private individuals, museums, and historic societies. Federal institutions in the United States, such as the Smithsonian Institution and the Library of Congress, which housed centers for the study of folk culture, amassed large numbers of cylinder recordings. Many of these cylinders, made by anthropologists, musicologists, ethnomusicologists, and folklorists, recorded for the first time the words, sounds, music, and cultural expressions of Native Americans, Eskimos, and African Americans.

Recognizing a need to archive and preserve the growing number of cylinders in institutional hands, the Library of Congress launched the Federal Cylinder Project.

It began in June 1979, with three main goals:^[1] to preserve wax cylinder recordings in federal collections by transferring them onto modern Mylar tape,^[2] to document and catalog the recordings, and to disseminate the results of

the project to the public, particularly to those culture groups from which the recordings were originally recorded [from a review by Richard Keeling which appeared in the *Journal of American Folklore* (101, 1988), 82].

In recent years, institutions and individual collectors have paid increasing attention to the preservation of cylinders as important artifacts. Several important projects aimed at providing increased public access to sounds recorded on these antique information carriers have been undertaken, including one notable initiative by the library at the University of California, Santa Barbara. The project, made possible through support from the Institute for Museum and Library Services, has produced a digital collection of nearly 8000 cylinder recordings held by the library’s department of special collections. The digitized recordings can be freely downloaded or streamed from the library’s Web site.^[3]

RECORDING CULTURE

Elsewhere in the world, ethnographic and anthropological museums holding collections of cylinders have taken steps to identify and preserve collections of early recordings, including, for example, the Berlin Phonogramm-Archiv—one of the most significant collections of ethnographic recordings in Europe—which contains some of the earliest recordings of the indigenous peoples of Africa, North America, Asia, Australia, Oceania, and Europe. Today the Phonogramm-Archiv, which is part of the musicological section of the Ethnographical Museum, State Museum at Berlin, Prussian Cultural Heritage Foundation, holds, “more than 145,000 recordings of music representing the heritage of many cultures all over the world.”^[4]

Sound archives have also developed, “within research and educational institutions which took up sound

recordings as yet another source of information in their specialized fields (e.g., music, ethnomusicology, and dialectology, political or social history).”^[5] For example,

In 1890 the anthropologist Jesse Walker Fewkes pioneered the use of the phonograph when he recorded songs of the Passamaquoddy Indians. In Europe, the Hungarian Bela Vikar (1859–1945) is regarded as a pioneer for his work in recording traditional folk music and dialects. With the opening in 1899 of the Phonogramarchiv (Phonographic Archive) of the Academy of Science in Vienna, the first scientific sound archive in the world was established, having as its aim the systematic collection of this new type of source material by the production, acquisition and preservation of sound recordings for all areas of scholarship.^[6]

The organization of sound archives in cultural institutions has developed along two chief lines. The *medium-centered* archive is one that collects recordings of like type, such as long playing (LP) phonograph records. The assumption here is that, “the needs of the medium take priority over any other consideration.”^[7] For certain formats such as early cylinders, the medium-centered approach can help in the long-term preservation of an endangered or artifactually important format. By contrast, the *content-centered* approach involves collecting recordings on the basis of how they relate to a particular topic or discipline. For example, an archive containing all known commercial recordings of works by Beethoven regardless of format would be an example of a content-centered approach.

Some examples of sound archives organized by content include:

- Linguistic
- Folklore
- Oral history
- Ethnographic
- Dialectic
- Music
- Ethnomusicology
- Bioacoustic (e.g., ornithology, etc.)
- Spoken word

Sound archives have also developed around national library and archives collection development mandates. For example, the British Library and the U.S. Library of Congress are both copyright depository libraries which are required by law to collect describe and preserve copies of all copyrighted materials in their respective countries. For these institutions, the business of sound archiving is integrated into the larger mandate of serving the public good by maintaining a collection of all items protected under copyright. Today, along with the Library of Congress in the United States, the British Library Sound Archive is one of the world’s leading repositories of sound recordings in all genres and formats.

The sound archive holds over a million discs, 185,000 tapes, and many other sound and video recordings. The collections come from all over the world and cover the entire range of recorded sound from music, drama and literature, to oral history and wildlife sounds. They range from cylinders made in the late nineteenth century to the latest CD, DVD and mini disc recordings. We keep copies of commercial recordings issued in the United Kingdom, together with selected commercial recordings from overseas, radio broadcasts and many privately made recordings.^[8]

Gronow notes, “The idea of a national collection of commercial recordings was first introduced in France, where the Phonotheque Nationale was founded in the 1930s.”^[9] In the United Kingdom, the British Institute of Recorded Sound collects not only commercial recordings but also wildlife sounds, documentary recordings, folk music, and broadcasts. In Sweden, the Arkivet for Ljud och Bild is the central archive for commercial recordings, radio and television broadcasts, and films. In Denmark, the Nationaldiskoteket is part of the National Museum. In the United States, the Motion Picture, Broadcasting and Recorded Sound Division of the Library of Congress, established in 1978,^[9] serves as a national repository for sound recordings.

Large, broad-based national sound archives collections help assure that a representative cross-section of the total output of recorded culture produced in a particular country or region is collected, described, preserved, and made available. For those with particular research needs, however, large broadly focused collections may be of limited value. Instead, smaller topic-specific sound archives may be more useful to those perusing specific topics such as folk music, the spoken word, or jazz.

MUSIC FOR THE MASSES

With the introduction of the mass-produced Edison disc, manufactured by means of a stamping process, the availability of sound recordings skyrocketed. The Edison phonograph with its hand crank and ornate funnel-shaped horn rapidly became a fixture in households across America and around the world. Discs were aggressively marketed by the Edison Company. Competitors began to enter the scene and with this we see the rise of the so-called “format wars” which persist today. The competitive climate that defined the early years of commercial sound recording is described in great detail in Gelat’s *The Fabulous Phonograph: From Edison to Stereo* (see the Bibliography entry by Besek, J.M.) Subsequent improvements in the disc manufacturing process enabled more grooves per inch to be added to a disc thus extending its playback time. Extended play enabled more varied repertory to be recorded. This significant improvement enabled extended popular and classical works to be recorded for the first time in their entirety usually on a series of discs. When

packaged together these multidisc sets were referred to as record “albums.” The push to increase disc program time led to the development of the LP record. Gronow notes [that] “In the 1950s, the introduction of the microgroove (long playing and single) record and the general improvement in the standard of living increased the demand for records, and for thirty years world sales increased.”^[2] The open reel tape format—the chief format for recording sound in a studio setting—was only moderately successful in the consumer market. More popular as a distribution medium was the Compact Cassette introduced by Philips in the 1960s for which many varied types of players were produced, including notably units fitted in automobiles.

A major change in the way in which sound was recorded came in 1979 with the introduction of pulse code modulation (PCM) recording technology. Pulse code modulation, the first digital music recording system for commercial use, was quickly adopted by recording studios because it was much better suited to studio recording, editing, and production than its analog counterpart. The digital compact disc (CD), and the CD player, was introduced in 1982. The CD remained the prevailing format collected by most popular and classical music sound archives throughout the 1980s and 1990s.

With the rise of the Internet as the primary means of distributing digital data (including text, moving images, and sound), the downloading of sound (currently in MP3 format) to computers and to portable devices (such as the Apple iPod) is now a preferred means of accessing sound. This mode of delivery continues to gain in popularity each year as retail sales of CDs drop at a corresponding rate.

THE RISE OF MUSIC ARCHIVES

While initial efforts to archive sound began in step with the commercial development of the earliest sound recordings, the formal shaping of archives for the purposes of supporting research and to assure preservation of the cultural record is a more recent phenomenon. National libraries and archives, university libraries and archives, and private libraries and archives have each contributed uniquely to the development of a network of repositories for commercial and noncommercial sound recordings. Archives, such as the American Folklife Center at the Library of Congress (<http://www.loc.gov/folklife/index.html>), the Smithsonian Center for Folklife and Cultural Heritage (<http://www.folklife.si.edu/index.html>), and specialty archives such as the Rutgers Institute of Jazz Studies Archive (<http://newarkwww.rutgers.edu/IJS/>), state-based folk life centers, university-hosted centers, such as the Archives of Traditional Music at Indiana University (<http://www.indiana.edu/~libarchm/>) each play an important role in shaping a community responsible for collecting, preserving, and providing sustained access to recorded sound.

In Europe and in the United States, institutions holding substantial collections of sound recordings have aligned themselves with one another through participation in the work of professional associations such as the International Association of Sound Archives (IASA) and in the United States the Association for Recorded Sound Collections (ARSC). Within this latter organization resides the Association of Audio Archives a group composed of leading institutional sound archives, including those located at the New York Public Library, Yale University, Stanford University, and the Library of Congress.

SERVING USER NEEDS

The users of sound archives vary widely and extend beyond the realm of traditional scholarship. Writing on the role of sound archives in the field of Ethnomusicology, for example, Anthony Seeger notes, [that] “Scholars are not the only people who use archives. They are also used by musicians, students, members of the public interested in a certain part of the world or learning a language, members of the society recorded, and refugees.” Seeger continues, “Field collections serve all these users better than commercial recordings because they usually provide more material and are closer to the original live performances than most commercial releases.”^[10]

Both private and corporate sound archives have contributed significantly to development of a network of sound repositories who serve a diverse range of needs. Symphony orchestras, for example, frequently possess archives which document live performances, rehearsals, and radio or television broadcasts. Jones and Trebble note that archives of sound recordings in broadcasting organizations (including the archives of the British Broadcasting Corporation, one of the world’s leading broadcast archives) were not developed until the middle of the 1930s when recording techniques, such as instantaneous recording onto lacquer discs, began to be used in radio production.^[11]

COLLECTING POLICIES

Collection development policies which set forth the type of material to be acquired by an archive are essential for effective collection management and for providing patrons with the materials they require. These written guidelines should be explicit and updated periodically. Jones and Trebble suggest the following questions be asked of items or collections being considered for acquisition:

- Is the recording likely to be of use in future broadcasts?
- Does the recording possess significance in sound, over and above the information and/or style of the script?

- Does the archive possess similar material and if so, does the new recording increase the value of the existing collection by providing additional examples, improved performances, or better technical quality?
- Is the recording technically suitable for preservation?
- Are there copyright, contractual, or other restrictions on the use of the recording?
- Should the recording be selected as a whole or in part?^[12]

TECHNIQUES OF SOUND ARCHIVING

Effective technical processing of sound recordings is essential to providing sustained access to content. This involves making certain that procedures and policies are in place for the acquisition of materials. Written collection development guidelines which define the types of materials collected by an archive and preferred formats (e.g., 78s, LPs, CDs, etc.) are of fundamental importance. Such guidelines should also articulate retention and de-accession policies and procedures and provide archives staff with direction regarding how and when to copy recordings. Copying may be required when an item is deteriorated to the extent that information is at risk of being lost. Copying may also be carried out as a means of converting sound from an obsolete or noncompliant format to one that is supported by the archive. In addition, archives staff may copy for distribution provided they are in compliance with copyright law. In each case, procedures and guidelines are critical for the consistent and correct transfer of sound from one carrier to the next.

Correct documentation tailored to the level and type of access an archives wishes to provide is also of critical importance. This begins with compilation of a complete inventory of holdings. Once items are accounted for, cataloging and description can focus upon individual items or collections depending on the level of user access required. Cataloging or metadata records can be either minimal or full. This depends on a number of factors, including the relative importance or value of particular items to a collection. Indexing provides users a means for identifying specific performers, topics, and works within an archive's cataloged collections. A variety of cataloging standards have been used over the years to describe sound recordings. Two standards currently in common use are Machine-Readable Cataloging (MARC) and International Standard Bibliographic Description for Non-Book Material (ISBD NBM).

PRESERVATION AND ACCESS

Of equal importance in the responsible stewardship of sound is managing use of collections in ways that provide users with the resources they need while assuring good preservation. Effective preservation begins with

development and use of written collection access policies which set forth the terms under which collections may be used, security guidelines, and care and handling policies. Such policies may also articulate the ways in which patrons may access recordings (onsite or remotely), how to use equipment, procedures for obtaining copies, etc. Depending on an archive's clientele and scope of activities, policies may also be needed to address such things as providing permissions for using sound recordings in publications, loan of materials for exhibitions, use of recordings for educational purposes, and broadcast.

SUPPORTING MATERIALS

A collection of sound recordings is of limited value without a catalog that enables a user to locate recordings of specific interest. Catalogs are usually organized by subject, author, genre, format, location, etc. Of special importance is supporting reference materials, such as bibliographies, discographies, and books or electronic resources pertinent to the types of recorded materials collected. Manufacturer catalogs, for example, can be invaluable reference sources for archives that collect commercially issued sound recordings.

PROFESSIONAL ASSOCIATIONS

The development and general availability of best practices for archiving sound recordings has been made possible in large part due to the growth of the profession of sound archivists. Today's sound archivist in search of information, best practices, and like-minded colleagues has a number of professional organizations to choose from. These associations and organizations serve as both convening bodies for professionals and clearing houses for information about sound archiving. In the United States, the ARSC, a nonprofit organization founded in 1966, is the largest professional association for sound archivists. As its Web site states, ARSC is, "dedicated to the preservation and study of sound recordings in all genres of music and speech, in all formats, and from all periods." Association for Recorded Sound Collections is unique in bringing together private individuals and institutional professionals. Archivists, librarians, and curators representing many of the world's leading audiovisual repositories participate in ARSC alongside record collectors, record dealers, researchers, historians, discographers, musicians, engineers, producers, reviewers, and broadcasters. The peer-reviewed *ARSC Journal*, first published in 1968, represents a wealth of landmark articles, papers, and reviews. The ARSC Newsletter delivers timely announcements, short articles, and a calendar of coming events. Topics explored in ARSC publications, at ARSC conferences, and on the ARSC List e-mail forum include, "preservation

of sound recordings, access to recordings, audio conservation and restoration, biography, cataloging, discography, history and technology, archival practices, training and education, bibliography, copyright and intellectual property issues.”^[13] The work of ARSC and its members has made a tremendously positive impact on the management of sound archives in the United States. Several of its publications, such as the landmark study by Pickett and Lemcoe, *Preservation and Storage of Sound Recordings* (1959, reprinted in 1991) are in wide use in both private and public sound archives throughout the world.

At the international level, IASA serves as the chief organization for sound archivists.

IASA was established in 1969 in Amsterdam to function as a medium for international cooperation between archives that preserve recorded sound and audiovisual documents. IASA has members from more than 60 countries representing a broad palette of audiovisual archives and personal interests which are distinguished by their focus on particular subjects and areas, e.g., archives for all sorts of musical recordings, historic, literary, folkloric and ethnological sound documents, theater productions and oral history interviews, bio-acoustics, environmental and medical sounds, linguistic and dialect recordings, as well as recordings for forensic purposes.^[14]

International Association of Sound and Audiovisual Archives, which maintains operational relations with UNESCO, holds a conference each year in a different location. Committees responsible for various issues convene at these conferences. International Association of Sound and Audiovisual Archives publishes its *Information Bulletin* and *Journal* on a regular basis, as well as special publications on various topics. At the conference there are ample opportunities for sound archives professionals to gather, network, hear papers, present papers, visit exhibitions, and tour the libraries and archives of the host country.

ASSESSING THE STATE OF COLLECTIONS

During the twentieth century, collections of sound recordings especially those in academic settings have grown to support campus learning, teaching, and research. The relative state of these collections was not well understood until 2004 when the Council on Library and Information Resources (CLIR) undertook a survey of academic library repositories to better understand their preservation needs. Staff from more than 80 institutions responded to the CLIR survey which found that, “recorded sound collections on campuses are rich and diverse. . .and [that] campuses report increased demand for the use of audio in teaching and research. But with few exceptions, barriers to such use are high and institutional readiness for improving the condition and accessibility of audio holdings is

low, especially for rare and unique materials.”^[15] Respondents tended to identify lack of funding as the greatest barrier to access. Other commonly cited barriers included:

- 1) the absence of appropriate standards and tools for cost-effective inventory and bibliographic control; 2) the lack of effective and cost-efficient means of treating and reformatting analog materials; 3) the absence of clear mandates about how to provide access to valuable collections the rights to which are ambiguous or unknown; and 4) the lack of staff who are sufficiently trained and conversant in the genres, formats, and rights issues unique to recorded sound collections.^[15]

PRESERVATION

Implicit in an archive’s mission to provide sustained access to sound recordings is a deep-seated obligation to responsibly preserve its recordings so they are available for research, study, and enjoyment. To achieve this, an archive initially conducts a preservation needs assessment of its collections. Data derived from this work help an archive understand its preservation challenges and forge a strategy to address areas of concern.^[16] Ideally this risk assessment and management process produces a series-coordinated measures to reduce risks to collections through preventive measures while providing remedial treatment for content in imminent danger of loss.

Preventive measures include making certain that the collection storage environment is conducive to long-term preservation of the media being stored. This begins with assuring the temperature and humidity levels are stable and within acceptable parameters for the materials being archived. It also requires that all materials (storage containers, record sleeves, tape storage boxes, etc.) which come in contact with the recordings are constructed of permanent and durable materials that will not interact adversely with the recordings they are designed to protect.

A frequent cause of damage to collections is through mishandling by staff and patrons. Investing in an educational program to address care and handling issues is money well spent, as it reduces unnecessary damage. Various manuals, bibliographies, and guides covering the care, handling, and storage of discs,^[17] tapes,^[18] and CDs^[19] are available.

Due to the relatively unstable physical nature of many of the recorded sound formats that have been introduced over the years, and due to the increasing obsolescence of the hardware needed to play back some of these older formats, copying (or preservation reformatting) of endangered content is often the only viable remedial preservation option available. Several useful guides are available to assist archives personnel in this exacting work.^[20] Preservation reformatting requires the skills of a trained individual (preferable a sound engineer), the correct equipment properly calibrated, and the investment of time and money.

Selected guidelines and best practices for the effective and accurate extraction of sound from older formats and its transfer (usually to digital systems) are described in *Capturing Analog Sound for Digital Preservation, Report of a Roundtable Discussion of Best Practices for Transferring Analog Discs and Tapes* (CLIR, March, 2006).^[21] Another useful guide is *Sound Directions: Best Practices for Audio Preservation* by Mike Casey and Bruce Gordon (2007). Research and development into the art and science of extracting sound from antique or obsolete formats is ongoing. One recent effort, led by Dr. Carl Haber at the Lawrence Berkeley Labs in California, involves the use of techniques borrowed from high-energy particle physics to extract sound from grooved media using a noncontact method. This approach potentially eliminates the need for a traditional analog playback machine in the reformatting process.^[22]

Following established guidelines and best practices for copying is a good starting point for extending the life expectancy of endangered recorded sounds. Following existing technical standards is also useful, including those developed by the Audio Engineering Society (AES).^[23] Unfortunately, as the 2006 CLIR study mentioned above notes, due to the idiosyncrasies of individual application of these guidelines and standards and the variables associated with equipment used and personal preferences for attaining the “best sound” no firm technical standards for doing audio transfer have been universally adopted. Such as those which exist for more well – is tablished preservation techniques such as preservation-microfilming.

FUNDING AND SUPPORT

Because of the exacting and costly nature of much of the work associated with the preservation of sound recordings and the shortage—relative to the print world—of experts trained to do this work, institutions must often seek external sources of funding to accomplish their preservation objectives. Several federal agencies in the United States offer financial assistance for sound preservation.

The National Endowment for the Humanities (NEH), “an independent grant-making agency of the United States government dedicated to supporting research, education, preservation, and public programs in the humanities”^[24] is one such agency. The National Endowment for the Humaniti offers, through its various program components, preservation support for humanities collections and resources and preservation education and training for individuals, organizations, and institutions.

The Institute for Museum and Library Services (IMLS) strives to, “provide leadership and funding for the nation’s museums and libraries, resources these institutions need to fulfill their mission of becoming centers of learning for life crucial to achieving personal fulfillment, a productive workforce and an engaged citizenry.”^[25]

Both funding agencies offer, through their Web sites and program officers, a wealth of information and guidance to organizations seeking funding.

COPYRIGHT

Copying recordings for preservation and access purposes is a core activity in most sound archives. U.S. Copyright law provides a framework for legal copying. The Digital Millennium Copyright Act, enacted in 1998, amended portions of the copyright law to address the preservation practices of libraries and archives, but it was not a comprehensive revision. For example, direction concerning pre-1972 sound recordings not presently covered by federal copyright law was omitted from the revision. This prompted the Council on Library and Information Resources and the Library of Congress to publish a study in 2005 on this issue.^[26] Concerned further with the exceptions and limitations applicable to libraries and archives under section 108 of the Copyright Act, the U.S. Copyright Office and the National Digital Information and Preservation Infrastructure and Preservation Program of the Library of Congress formed The Section 108 Study Group, “to conduct a reexamination of the exceptions and limitations applicable to libraries and archives under the Copyright Act, specifically in light of digital technologies.”^[27] Their report, published in March 2008, contains specific recommendations for amending copyright law to reflect the preservation and access needs of cultural repositories, including sound archives.

CHALLENGES OF THE DIGITAL ERA: MEETING USER NEEDS AND EXPECTATIONS

Since the late 1990s, the distribution of music has shifted from being format-based to being streamed or otherwise distributed digitally. Today’s consumers increasingly expect their favorite music and sounds to be available through their choice of digital distribution channels. This shift in user expectations is impacting sound archives. As the format era draws to a close, sound archives interested in collecting contemporary music, for example, are being challenged to refocus efforts to address a media-less environment. Increasingly, the distribution of contemporary music will be on-demand, which is to say made available to users on a “pay-as-you-go” basis, downloaded from an Internet resource. Evidence of this trend can be seen to day in the degree to which commercial music distribution services (e.g., Apple I Junes, etc.) have proliferated. How long a commercial release remains available will depend directly on demand: if an item does not sell well, it will likely not remain available for long. Fundamental changes in the ways in which commercial recordings are distributed will challenge sound archives to develop new methods of harvesting content, including perhaps

employing mechanisms for the automatic retrieval of digital content from creators, publishers, and aggregators.

Within the past decade, a growing number of libraries on academic campuses around the world have developed institutional digital repositories to preserve and provide sustained access to owned and leased scholarly material. Increasingly, these repositories are acquiring more and more sound content, much of it locally produced. This movement toward intuitions functioning as aggregators and stewards of distinctive, locally produced works represents perhaps a polar opposite to the prevailing practices of the twentieth century in which large regional or national sound archives served as the primary repositories of our recorded sound culture. The emergence of distributed models for archiving sound reflects the changing ways in which content is being created, aggregated, and used and also its value to the communities it serves.

Reflective of the proliferation of smaller institutions taking part in the archiving of sound, an increasing number of digital audio projects aimed at acquiring, describing, preserving, and distributing “born-digital” and digitally converted audio have appeared within the past 5–7 years. Several of these are noted at <http://palimpsest.stanford.edu/bytopic/audio/> a Web site devoted to preservation and conservation. A particularly useful resource, developed by the University of Washington Libraries, “Digital Projects and Developing Technologies in Music and Media” (<http://www.lib.washington.edu/music/projects.html>) provides an overview of select digital audio projects, readings on digital audio technologies, information on music metadata (documentation), audio encoding and markup language, and other tools for the production and management of digital audio and video.

Along with the emergence of new models for archiving sound, several national efforts have also been mounted to create digital sound and moving image repositories and service centers. One such initiative is the National Audio Visual Conservation Center operated under the auspices of the Library of Congress. “Located at the foothills of the Blue Ridge Mountains in Culpepper, Virginia, the Library’s newly completed Packard Campus of the National Audio-Visual Conservation Center provides underground storage for this entire collection on 90 miles of shelving, together with extensive modern facilities for the acquisition, cataloging and preservation of all audio-visual formats.” In addition to being a national repository for sound and moving image formats where digital conversion takes place, the Culpepper facility is also designed to acquire, preserve, and make available “born-digital” sound and moving image content.

CONCLUSION

Moving forward, and facilitated to a large extent by tools which enable one to create a sizable archive of sound

recordings on one’s laptop computer, one can easily imagine a time in the not-too-distant future when the infrastructure for sharing personal archives, globally mining institutional holdings, and rapidly accessing historical recordings from the collections of the great sound repositories of the twentieth century will be upon us. While there are significant cultural, institutional, and legal barriers to realizing this future, the technology needed to make possible this future is readily available today. With the strategic use of this technology directed toward providing seamless access to content, coupled with the continued good stewardship of those who are entrusted to care for recorded sounds wherever they reside, we may well reach that future sooner than expected.

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South Korea: Archives and Libraries

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Abstract

This entry covers the development of libraries and archives in Korea, and with a focus on their current status and activities and their vision for the future. The authors present an overview of Korean institutional change, and describe recent government policies concerning libraries and archives. They also discuss various types of libraries as well as professional associations and educational programs for librarians and archivists.

FACTS ABOUT KOREA

The Korean Peninsula extends southward from the north-east of the Asian continent. The peninsula, with all of its some 3000 associated scattered islands, lies between 33° and 43° north latitude. The peninsula is surrounded by the Sea of the East (Sea of Japan) on the east, East China Sea to the south, and the Yellow Sea to the west, with the Korea Strait connecting the first two bodies of water. The country shares its northern borders with China and Russia along the Amnokgang (Yalu) and the Dumangang (Tumen) rivers. Its geographical location, bridging the continental Asia and the Pacific Ocean, has been considered by foreign powers to be strategically vital over the centuries (Fig. 1).

The peninsula and Korean islands have a total area of 222,154 square kilometers, similar in size to the United Kingdom (which covers 241,752 square kilometers). But as a result of the Korean War (1950–1953), the peninsula is divided into South Korea and North Korea by the Military Demarcation Line. South Korea, officially known as the Republic of Korea, occupies 45% of the total area of the peninsula, or 99,392 square kilometers, and is a little smaller than Iceland (which covers 103,000 square kilometers). About 70% of the peninsula is mountainous.

Despite its long recorded history, spanning over 5000 years, Korea remained a “Land of Morning Calm,” as it was referred to by the great Indian poet and philosopher Rabindranath Tagore in the early twentieth century. But it broke the “calm” by successfully staging the Seoul Summer Olympic Games in 1988 and cohosting the World Cup finals in 2002. Korea joined the Organization for Economic Cooperation and Development (OECD) in 1996 to be its 29th member state, catching as a springboard for further progress into becoming an advanced economy.

Korea is a democratic republic. Its head of state is the President. The country currently maintains diplomatic relations with 186 nations. The size of the population was estimated at 48,294,000 as of July 2005. The average life expectancy reached 77.5 years (73.9 years for men and 80.8 years for women) as of the end of 2003. School attendance stands at 100% at the elementary level, 97.4% at the middle school level, 95.8% at the high school level, and 71.1% at the college and university level, respectively, as of the end of 2005. All elementary school graduates are eligible to attend middle school, 99.7% of the graduates actually enroll in middle school, and 82.1% of high school graduates enter colleges or universities. These percentages are the highest in the world, and Koreans have traditionally placed great importance on education. The nation’s unusual enthusiasm for education has played a



Fig. 1 Map of South Korea.

Source: CIA World Factbook. <https://www.cia.gov/library/publications/the-world-factbook/geos/ks.html>.

vital role in its economic and social development despite a paucity of natural resources. The government is also making continued efforts to improve its educational system in order to cultivate high-quality human resources. Korea is also the most densely wired information technology (IT) powerhouse in the world, with the highest number of Internet subscribers and the second highest number of Internet users per 10,000 persons, respectively. According to the 2006 OECD Factbook, Korea's GDP was estimated at \$1,005,300 million, ranking ninth among the OECD members at the end of 2004. With its GDP per capita income of \$20,935, the nation is continuing to energetically advance toward becoming an economic power.

ARCHIVES AND ARCHIVAL SCIENCE

Introduction

This section focuses on the development of Korean National Archives & Records Service (NARS), and it also deals with legislation concerning NARS and with the government's efforts toward long-term planning for archives and public records management. The authors end this section with a brief discussion on archival educational programs, which are now offered in 16 Korean universities.

National Archives & Services

The National Archives & Records Service (NARS) is a national agency to collect and systematically manage the nation's important records. The NARS has the primary duty to preserve these records as a national critical cultural heritage and to ensure ready access to the essential evidence of the rights of the Korean people, the accountability of governmental activities, and national experiences.

Daejeon Headquarters of NARS is the primary institution designated to set up recordkeeping policies, to collect archives of the nation's history, to computerize the conventional records systems, to research and develop the technology of restoration and conservation, and to educate the records managers of governmental agencies at all levels. Daejeon Headquarters runs an Exhibition Hall, a Government Resources Library, and a Research Room for public services and outreach. The Daejeon repository is one of the National Archives repositories in Korea, which is located on the first and second basement floors at the government complex in Daejeon. This repository is especially dedicated to storing audio and visual materials. The repository also stores documents, museum artifacts for governmental administrations, government publications, Joseon Dynasty's historical archives, microfilms, and various kinds of audio and visual records.

Since 1984, the Busan repository has been the largest archival repository in Asia, with a special facility to protect archives and records from natural disasters and accidental negligence. The repository building is equipped with a heron gas fire-extinguishing system and double fireproof walls. This repository stores various types of records including ordinary documents, drawings/blueprints, microfilms, secret records, presidential records, as well as Joseon Dynasty's historical archives.

The research room at the Seoul office provides the public in metropolitan areas access to information that the archival collections hold. The services that Seoul Office provides are the same as those of Daejeon Headquarters. The Government Resources Library provides access service to government publications of all levels to the public as well as to government employees.

Archives Legislative History

A task force was organized to develop the Public Records Management Act in the NARS in 1997. A proposal for establishing the Public Records Management Act was sent to the President through the Administration Innovation Committee in 1997. Based on the advice from the parliamentary inspection of the governmental administration in 1997, NARS was also requested to establish a systematic master plan for management of public records such as legislation of Public Records Management Laws. The Legislation of the Public Records Management Laws was selected as one of the "New Government's 100 Major

Policies” by the Presidential Appointee Initiative in 1998. There were many efforts to exchange opinions with related institutions and to hold a conference about the details of the law in order to add more comprehensive contents in 1998. The Act was presented to and passed in the National Assembly in December 1998, promulgated in 1999, and went into force beginning in 2000. It was amended in 2007. Through this law, NARS encourages and supports government agencies to establish various archives and local records centers, and to maintain strong recordkeeping systems using the Records Classification/Scheduling Scheme.

Archival Science as a Discipline

With the pressing need for both a consistent professional record management methodology and for training specialists to teach those methodologies, there is a rapid growth in the number of educational courses and institutions related to record management. There are now 16 universities in Korea that have graduate programs related to archival science. The majority of the programs consist of curricula that include courses on public administration, law, history, humanities, and social science, computer usage necessary in the age of information, introduction to record management, record management theories (organization, description, and evaluation thereof), research methodology for record management, the history of record management, Korean history of record management, and so on.

LIBRARY & INFORMATION PROFESSIONS, SYSTEMS, AND SERVICES

Introduction

This part includes the development of Korean libraries, their current status, and related activities. It covers specific facts about Korea; institutional changes, and policies concerning libraries; the present conditions of various types of libraries, library-related organizations; and librarianship education and libraries’ activities in recent years.

Korean Library Administrative and Legal Systems

Korea has a presidential system. The nation has a three-tier administrative system consisting of the central government, provincial governments, and lower-level governments of counties, cities, and wards. The central government includes 22 ministries and 16 agencies as well as various committees under the supervision of the Prime Minister. In 1995, the nation introduced local autonomous rule and held the first popular election of local government leaders in more than 30 years. As of the end of 2005, local self-governing systems were divided into 16 provincial-

level governments and 234 lower-level governments. Under these regional and local governments a total of 3595 administrative units are being operated nationwide.

The governing system is reflected in the library management system. Libraries in Korea are largely divided into national libraries, academic libraries, school libraries, and public libraries. The National Library of Korea (NLK), Korea’s leading library at the national level, runs under the supervision of the Ministry of Culture and Tourism; academic and school libraries operate under the Ministry of Education and Human Resources Development; and public libraries are legally under the administrative responsibility of the Ministry of Government Administration and Home Affairs and the Ministry of Education and Human Resources Development. However, the actual operations of public libraries are managed by provincial and lower-level governments and their offices of education. In short, Korean public libraries are managed by a dual system. At the central level, the Ministry of Government Administration & Home Affairs and the Ministry of Education & Human Resources Development are responsible for management of public libraries; at local levels, public libraries are divided into those administered by provincial and city governments and those administered by provincial and municipal education offices.

This complicated system dissuades libraries from being cooperative and supportive of each other in many areas, including policy coordination, staff training, personnel assignments, collection development, cooperative preservation of materials, and interlibrary loan. A need to streamline the system at the state level and transfer the managerial responsibility to a single government agency has certainly existed for some time, and calls for revising the law and creating a “powerful organization” to play a leading role in establishing, deliberating, and carrying out policies.

Korea follows a Constitutional law system. The Constitution takes precedence over laws, statutes, decrees, ordinances, and regulations. For libraries, the highest statute is the Library Act, accompanied by an enforcement decree and regulations. There are also various decrees and ordinances applicable to libraries of different kinds. But public libraries are managed according to the laws and regulations of respective local governments.

The Library Act, enacted in 1963, was Korea’s first law governing libraries. The law was amended later three times. The Library Promotion Act, written in 1991 to supersede the Library Act, emphasized the “nurturing and promotion of libraries” and provided that “a library should be managed by a library professional.” The Library and Reading Promotion Act, legislated in 1994, incorporated “promotion of reading,” eventually obscuring its original meaning as an “exclusive statute for governing libraries.”

The current “Library Act,” which was revised in 2006, stipulates that the state and the local governments, as well as the national government, are responsible for

management of libraries. It has the following four objectives: to strengthen the role of national libraries and the library-related policy of state and local governments; to broaden decentralization; to reduce gaps in knowledge and information; and to improve policy about library and information service to the handicapped. In particular, the “presidential committee for library and information policy” was organized to spearhead policy formulation, deliberation and implementation at a state level. Also, a “library research institute” was set up within the NLK.

Libraries in Korea

National Library of Korea

The National Library of Korea (NLK), founded in 1945, is Korea’s foremost repository of books, documents, and other forms of recorded information. Its role is to establish a collection of materials representing the cultural and intellectual heritage of Korea, and to preserve the accumulated knowledge and wisdom of the nation for future generations. Compiling and distributing national bibliographies is an integral part of this activity. Along with its role as the nation’s largest and most prominent library, the NLK also has the mission to seek to increase Korea’s knowledge assets and information capabilities. In 2007, its number of collections reached 6.5 million items, some of which are national treasures.

This library has 228 employees, and is used by approximately 1,340,000 persons annually. With a nationwide library and archive database and a computerized catalog of its holdings, it has in place a full-featured e-library system covering its most essential processes and services. In October 2005, in the ceremony celebrating its 60th anniversary, the library proclaimed its vision, “Building a Powerful Knowledge-Based Nation,” and unveiled its medium- and long-term development plans (“National Library of Korea 2010”). The plans laid out the roadmap toward the following three goals: fulfilling NLK’s role as the nation’s repository of the country’s documentary heritage, serving as a center for distribution of knowledge resources, and becoming a platform for cooperation and exchange with libraries.

The NLK is currently at work on a project to build an information-age library, temporarily named “the National Digital Library,” which is due for completion in 2009. The NLK will be open to the public, of course, open to the world via Internet in May of 2009. Meanwhile, it has been operating the new National Library for Children and Youth (NLCU) since May 2006, to help improve services for children and youth by linking school and public libraries. Even though the NLCU is under the control of NLK in terms of fiscal matters, it is almost operated independently from NLK and is located at a different area.

National Assembly Library

The National Assembly Library was established in 1952 during the Korean War. Serving the National Assembly as its primary source of information and supporting its legislative activities, the library has made major contributions to the promotion of democracy in Korea over the years. This library, with a collection of 2,761,481 volumes and 21,867 serial titles, is staffed by 275 employees as of the end of 2007, and 500,000 users visit there annually.

Its most important function is to gather, organize, and analyze information of both domestic and foreign origins, needed by the legislative body. As part of its role of national library, it also carries out activities such as compiling bibliographies of dissertations, theses, and periodicals to facilitate public access to information. A digital library project initiated in 1998 has equipped the library with a full-text database with close to 71,000,000 full-text images (equivalent to 600,000 volumes of books), quantities previously unprecedented in Korea. The database, accessed by as many as 706 universities, public institutions, and research institutes nationwide, has transformed it into a full-fledged national digital library.

The National Assembly Library’s plans for the coming years include harnessing ubiquitous changing technologies for the improvement of its programs, processes, and system capabilities to better perform its role as an information gateway that connects citizens with the legislative body, on the one hand, and the legislative body with the executive body, on the other hand.

Supreme Court Library

The Supreme Court Library of Korea, as a library serving the judicial branch, is located within the Supreme Court, the highest judicial body in Korea. The library was formally established in 1989. With a dedicated staff of 75, the library has recently prepared the means to better meet information needs in legal fields through a project to build an integrated information system. Based on cross-linked databases of precedents from 1996 to the present, legal literatures and information, the system has brought about a major improvement in information accessibility and availability. More recently, the completion of an intercourt library network has enabled the Supreme Court Library to provide guidance to lower court libraries in a more efficient manner and to serve broader tiers of public with their information needs.

Academic libraries

The first academic library mentioned in recorded Korean history (Jongyeonggak) was set up in 1474 at Sungkyunkwan, a royal college of the Joseon Dynasty (1392–1910). In the late nineteenth century, the modern

concept of education began in Korea. In May 1924, the first modern national college was created and named Kyongsong Imperial College, the predecessor of Seoul National University. In 1927, a library was added to the college, the first library affiliated with higher level schools in Korea. As of the end of 2007, Korea had a total of 516 college and university libraries. Among them, 14 have over one million volumes, and the Seoul National University Library keeps the largest collection with 3.4 million books and 16,000 serial titles. As the vital center of universities and colleges, academic libraries in Korea recently have undergone many changes and developments. First, academic libraries have increased the digitized portion of their collections, and they have focused on collecting, preserving, and managing digital contents. Second, they have decreased the portion of single volumes while enlarging academic journals and online databases. Third, academic libraries have strengthened cooperation with other libraries in their geographical vicinity to include libraries in other countries, such as Japan, China, and Russia. In particular, there is a growing trend among these libraries of sharing academic journals. Finally, academic libraries have adopted new technologies such as RFID (Radio Frequency IDentification), PDA (Personal Digital Assistant), and mobile phones in order to realize a “mobile campus (library).”

Public libraries

Korean public libraries are among the fastest growing in the world. The country's first modern concept of a public library dates back to the beginning of the 1900s. However, the development of Korean public libraries was suppressed during the Japanese colonial period (1910–1945) and the Korean War (1950–1953). In 1963, with the enactment of the first Library Act, Korean public libraries began to see a growth in numbers. During 1970–1990, Korea underwent dramatic social changes and achieved remarkable economic growth. These changes included an increase in the number of public libraries. Korea's public libraries grew exponentially over the last 40 years and also vastly improved the quality of their services. As of 2007, there are 564 public libraries in Korea. As stipulated by the Library Act, all Korean public libraries have built up a “Public Library Cooperation System” to promote interlibrary cooperation, share materials to provide better services, maximize the distribution and use of knowledge and information, and boost national competitiveness. In the future, Korean central and local governments have the following plans for improving the scale and scope of public library systems:

- Increase the number of public libraries to 750 by 2011 under the “Library Development Roadmap” announced by the Ministry of Culture and Tourism.

- Develop small-scale libraries to resolve library shortages.
- Pass the new Library Act to solve the problems in public library management and budget shortages.
- Continue to apply new technologies at public libraries.
- Use the NLCU adults to link all libraries specially fit for children.

School libraries

The modern concept of school libraries was introduced in Korea during the 1950s. At that time, a small number of progressive thinkers and school founders established libraries at several high schools in the southeastern part of Korea in order to upgrade overall education. The 1960s saw the systematic training and hiring of librarians at schools, leading to improvements in school libraries. In the 1990s, school libraries once again made remarkable progress, owing to legislative and governmental supports, and campaigns by civic groups. For example, in 1994, the enactment of the Library and Reading Promotion Act made it mandatory for schools to operate libraries. In March 2000, the Ministry of Education and Human Resources Development set up the “Comprehensive Library Informatization Plan.” In order to carry out this plan, Digital Library System (DLS), a standardized school library information system, was developed in 2001. At the end of 2006, the portion of elementary schools with libraries nationwide was 86.2%, middle schools 91.8%, and high schools 99.9%, respectively, making an overall average of 95.0% (10,010 libraries). Korea's education system has adopted many recent alternatives, including new curricula and evaluation methods. To meet the changing needs, the Ministry of Education and Human Resources Development in 2002 formed the “Comprehensive Plan for Improving School Libraries.” This plan allocated \$6.4 million (60 billion won) annually over the 2003–2007 period to equip all elementary, middle, and high schools in Korea with their own libraries.

Special libraries

The first special library in Korea was the Railway Bureau Library, which was established in Seoul in 1920. In 1966, Korea's first engineering research house, Korea Institute of Science and Technology (KIST) was founded and led to the founding of many other research institutes in Korea. In the 1980s, R&D activities brought economic development and saw the expansion of special libraries covering different disciplines. Compared to other types of libraries, these special libraries are more advanced in providing up-to-date information. There were 663 special libraries in Korea at the end of 2006.

Librarianship Education in Korea

Librarians in Korea are divided into the following three categories, depending on their qualifications: first-grade professional librarians, second-grade professional librarians, and paraprofessional librarians. Usually, university graduates with the Bachelor's degrees in library and information science (LIS) are offered second-grade professional librarianships, and 2 year college graduates paraprofessional librarianships, respectively. A second-grade professional librarian can become a first-grade professional librarian by completing supplementary classes or a regular degree program after working in a library for a certain period of time. Also, a paraprofessional librarian can be promoted to a second-grade professional librarianship by taking a given education program after accumulating experience in library service. Korea's first undergraduate and graduate courses in library science were opened at Yonsei University in 1957, when Korea began formal education in LIS at the university level. As of 2006, LIS courses are taught in 6 junior colleges, 32 universities, and 24 graduate schools. Thirteen universities have doctoral programs and 17 graduate schools of education have majors in librarianship education. There are also three educational institutes for librarians that issue certificates.

Professional Associations

The representative professional association for librarians in Korea is the Korean Library Association, founded in 1945. The association has played a crucial role in strengthening the professional ability of librarians and thus helping Korean libraries to upgrade their services. The association currently is promoting the development of libraries and improving the interests of librarians, coordination of opinions about libraries, public relations, and creation and distribution of various rules and regulations, including the Korean Decimal Classification, the Korean Cataloging Rules. The association is also performing routine tasks such as producing and distributing the Korean Library Yearbook and the monthly magazine *Library Culture* as well as over 100 kinds of professional publications, hosting the annual national library conferences, and certifying librarians.

The association has two types of members, individual or institutional. Individual members are divided into ordinary members and lifetime members. Institutional members include the NLK, public libraries, academic libraries, school libraries, and special libraries. The membership totals 1375 individual members and 1001 institutional members as of November 2007.

The General Council of Members and the 14-member Board of Directors are responsible for governing the association. The council elects the president and the members of the Board of Directors. It is organized by delegates

representing different regions and different categories of libraries. Affiliated with the association are 15 professional committees, three regional councils and seven councils of libraries of different kinds.

Library Activities in Recent Years

In recent years, many dynamic library act projects have flourished in Korea. These include the "Bookstart" movement, the "Miracle Library" project, "Children and Young Adult Services Programs," "Enhancing Library Services for the Disabled," the "Book Reading Seoul" project, the "One Book One City" movement, and the "Small Library" movement.

Bookstart was launched in Korea with a pilot program that ran from April to December 2003, under which books were given to 930 babies in the district of Jungnang-gu, Seoul. To operate the program, a civic organization called "Korean Committee for the Bookstart Movement" was formed. During the pilot period, in order to study the effects of the program, a research was carried out concerning 150 of the babies who had received books. From the latter half of 2004, the project set off as a number of local governments started their own Bookstart programs. Currently, Bookstart programs are conducted in many ways by local authorities in Seoul and countrywide.

The "Miracle Library" project is a movement to establish libraries so unique and dynamic that they are unlike any others in the world. The core of the project is to open libraries for children on the premise that all children have the right to grow up in a bright, sound, and safe environment. That is, the purpose of this project is to give all children anywhere in Korea same opportunity to use a library. The project grew out of the "Book Reading Program" initiated by a private broadcasting company in 2001. It reached a visible form with public donations; funds and resources donated by civic organizations and the private sector; and matching funds provided by local governments. The project is a unique model for private and public sector cooperation, whereby the private sector and the government build libraries together and have them operated by citizens and public servants.

"Service Program for Children and Young Adults" began in earnest in January 2004 according to a plan drawn by the KLA's Children and Young Adult Volunteer Committee. The major contents of the program include remodeling public libraries in rural areas to include children's libraries, training librarians in the art of storytelling, and workshops for children's librarians. The KLA (Korean Library Association) has taken charge of remodeling libraries in rural areas, and the storytelling program is a professional program organized by the Children and Young Adult Volunteer Committee for librarians at public and school libraries as well as small children's library managers and librarians to help them to strengthen services for children. Those who completed the program

have organized a group called the Librarians' Blue Stories, which gathers once a month to work toward establishing storytelling hours for regular volunteer service.

"Enhancing Library Service for the Disabled" is the program that helps make it possible for blind people use library resources in a regular way. As of December 2005, the number of blind people in Korea stood at around 170,000, accounting for 0.35% of the population. Library services for the blind were limited until the Korean Braille Library opened, and public libraries began providing services for the disabled in 1984. However, services for the disabled remain weak. As for Braille libraries, there are only 34 public libraries, equipped with Braille reading facilities, as of February 2006. The new Library Act, legislated in 2006, includes a clause on the establishment of both a national library and a national support center for the blind under the control of the NLK. Impelled by inequality in disabled people's right to access information, this Movement is designed to provide better library services for the disabled, and thereby protect their human rights and help them to take more active part in society. In 2004, the Seoul Foundation for Arts and Culture (SAFC) inaugurated the "Book-Reading Seoul" project, proclaiming "Seoul Citizens Become One through Books" and "Unifying Seoul through Books." In this project, public libraries took the lead in organizing a variety of annual reading and cultural programs in Seoul. This is in response to the belief that libraries must become firmly established as the places to go to read books and at the same time satisfy people's demands for culture. This project influenced fixing Korean people's thoughts about libraries being centers for knowledge and information.

The "One Book, One City" movement in Korea started from a public library in a very small town, named Seosan Municipal Library in 2003. This movement has been spreading quickly and widely nationwide, proving to be a successful model for promoting reading in Korea. This program gained public support base and turned public libraries into ones like those found in advanced countries by developing them into local cultural movements that incorporate movements to promote reading. The "One Book, One City" movement could be a means to create a society where everybody reads many books and to make libraries in local communities more accessible, thereby establishing them as the reading centers of the country.

Currently there is a very important project to build more libraries in Korea, the so-called "Small Library" movement. This movement encourages civic

organizations and private sectors to build small-scale libraries. The "Small Library" movement is a very dynamic library activity, naturally attracting more attention for social and cultural reasons. In the public sector, the central government has decided on a policy measure enabling the Ministry of Culture and Tourism and Korean Library Association to make use of public funds (lotto revenues) in order to establish 25 small libraries as a part of the official agenda in 2005. The private sector is also responding to building and operating libraries, with a particular focus on children's libraries. Small libraries in Korea are thus becoming an important means for expanding the number of libraries, either in the form of public and private sector cooperation or by each sector working separately.

CONCLUSION

Korea is a dynamic country that values information, knowledge, and reading in a digital age. Korea held successfully World Library and Information Conference (WLIC) in 2006, the world's largest and most prestigious gathering of library professionals. The 2006 WLIC was a good opportunity for participants from around the globe to take an interest in Korea. It not only helped to broaden the perspective of the Korean government and its citizens to the libraries of the outside world, but also served as an opportunity to radically shift thinking and conceptions of libraries and related areas.

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Spain: Libraries, Archives, and Museums

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Abstract

The purpose of this entry is to provide an overview of the current library, archives, and museum environment in Spain. Each library section—national, university, public, school, and special—as well the archives and museum sections, discusses administration, staffing, expenditures, collections, automation, and services, with trends when possible, and representative institutional profiles. It concludes with a discussion of professional education, associations, and cooperation.

INTRODUCTION

The Kingdom of Spain is a constitutional monarchy encompassing 85% of the Iberian Peninsula in southwestern Europe, the Canary Islands, the Balearic Islands, and the cities of Ceuta and Melilla; with an area of almost 193,000 miles², it is the 3rd largest country in Europe (excluding Russia) and the 51st largest in the world (Fig. 1).

The official language is Castilian Spanish, though Catalan, Galician, and Basque are coofficial in their respective regions; compared to other European countries, English is less widely spoken or understood. Literacy hovers at 98%. The official 2006 census counts 44.7 million people. The country has almost 20 million Internet users. With the promulgation of the new constitution of 1978, Spain's 50 provinces are officially structured in 17 Autonomous Communities (plus the Northern African enclaves of Ceuta and Melilla), a reconfiguration of the 15 former historic provinces. Spain joined NATO in 1982 and the European Union in 1986.

Spain has made great social, political, and economic strides since Franco's demise in 1975; its GDP now ranks ninth in the world, ahead of such countries as South Korea, Australia, and the Netherlands.^[1]

HISTORY

Despite the 600-year domination of the Roman Empire (200 B.C.E. to 400 A.D.) with a long-lasting cultural influence existing even today in architecture (Segovia aqueduct, several bridges) and the Latin-based Spanish language, Spain had no libraries to speak of until after the first Germanic tribes invaded the peninsula around 409 A.D. and the subsequent Visigoth kingdom that ruled the next 300 years. Like everywhere else in Europe, the first important libraries were established in monasteries as medieval bastions of culture. The culmination of

Spanish medieval scholarship is the *Etymologies* of Saint Isidore of Seville (560–636), who compiled in that work a systematic comprehensive collection of knowledge available at the time. Because of his encyclopedic effort, he was proposed—unsuccessfully—as a patron saint of the Internet in 2003.

In 711 the Moors invaded Spain and by the tenth century had overrun the entire peninsula except for the far north. For almost 700 years the Moorish civilization, based in the Caliphate of Córdoba, was one of the most advanced cultural centers of Europe. The sumptuous library of Caliph al-Hakem II (ruled 961–976) allegedly had 400,000 volumes. The caliphate itself had a university, 70 libraries, several bookstores, and numerous collections of manuscripts unequalled anywhere in the world.^[2]

The first attempt to create an academic library occurred in 1208, with the establishment of the University of Palencia, now disappeared; about 10 years later (1218), however, during the reign of Alphonse IX (1171–1230), the University of Salamanca was established, making it the oldest university in Spain still in existence and contemporary with the oldest in Europe (Bologna, Paris, Oxford). Later, in 1242 King Alphonse X the Wise (1221–1284) created the office of *estacionero* (stationer) to handle library collections in universities.

With the Renaissance and the accompanying growth of learning, some important universities were established in major urban areas: Seville (1505), Granada (1532), and Santiago de Compostela (1550). Around 1518, Ferdinand Columbus (1488–1539), the explorer's son, founded in Seville the Colombina Library, eventually with over 15,000 volumes, important as one of the first libraries to open its collection to the public. The legacy of this library exists today in the Seville diocese. On a grander scale was the library in the Escorial established by Philip II (1527–1598) in 1575. The Escorial, at once monastery, mausoleum, palace, and library, reflects the dour and austere character of its founder; the library eventually came to



Fig. 1 Map of Spain.

Source: Central Intelligence Agency. World Factbook 2007. <https://www.cia.gov/library/publications/the-world-factbook/geos/sp.html>

house a major collection of priceless religious and historical manuscripts and materials.

The earliest bibliographic undertaking was that of Nicolás Antonio (1617–1684), whose *Bibliotheca Hispana Vetus* (*Library of Ancient Spain*, posthumously published in 1696) was an ambitious attempt to identify all books written in Spain from the Romans to 1500; its sequel *Bibliotheca Hispana Nova* (*New Library of Spain*, 1672) extended the compilation to 1670. Though somewhat limited by being written in Latin, these volumes are historically significant for the identification of many writers and works of the time, many now long forgotten.

The major event of the eighteenth century was the establishment of the Royal Library in 1711, which coincided with the founding of the Real Academia de la Lengua (Royal Academy of Language, 1714), the Real Academia de la Historia (Royal Academy of History, 1738), and several other cultural institutions as direct by-products of the Enlightenment. In 1771 it was decreed that the libraries of deceased ecclesiastics would be made available to seminarians, marking an important step into opening up theretofore private libraries.

During the nineteenth century the country continued to make progress toward the expansion of libraries and cultural institutions. In 1835 Prime Minister Juan Álvarez Mendizábal (1790–1853) enacted the *desamortización* (disentailment) of all church properties, including the extensive valuable library collections they contained. Those materials that survived the confiscation were

eventually dispersed into various provincial and academic libraries. A major bibliographic effort was undertaken by Bartolomé José Gallardo y Blanco (1776–1852), whose *Ensayo de una biblioteca española de libros raros y curiosos* (*Essay of a Spanish Library of Rare and Unusual Books*, published posthumously from 1863–1889) represents the first major compilation of modern Spanish bibliography. He was also one of the first proponents of a national library system. In 1858 the supremacy of the National Library over other libraries was formalized, along with the creation of the first Spanish public library system. By 1885, there were 30 public libraries in Spain and by the end of the century, there were 14 university libraries.^[3]

Despite advances in learning and greater availability of and access to the printed word, a devastating civil war, sandwiched between two dictatorships, slowed the pace of changes in libraries in the twentieth century. In 1902 the first set of formal cataloging rules was adopted. In 1931, though, in keeping with the progressive policies of the Second Republic (1931–1936), the first significant efforts to establish public libraries in Spanish cities were undertaken. Thus, by 1936, on the eve of the Civil War, the number of public libraries had increased to about 200.^[4]

A hallmark of twentieth century intellectual thought was the provocative essay by philosopher José Ortega y Gasset (1883–1955) “La misión del bibliotecario” (“Mission of the Librarian,” 1935, English translation 1961).

One of the landmarks of universal bibliography was the publication of the *Manual del librero hispano-americano* (*Manual of the Hispano-American Book Dealer*, 1948–1977), compiled by Antonio Palau y Dulcet (1867–1954) and edited posthumously, a 28-volume work that tracks publications of Spanish works from the invention of printing to the present.

LEGISLATION

Major legislation is as follows:

- 1978: The new constitution transferred the governance of public libraries from the national government to the newly created Autonomous Communities.
- 1983: Ley Orgánica de Reforma Universitaria (University Reform Law) 11/1983 modernized and reorganized universities, including granting them greater autonomy and allowing them to organize and develop and manage their own libraries and information policies.
- 1985: El Patrimonio Histórico Español (Law of Spanish Historical Heritage) 16/1985 established the current framework for libraries; also Royal Decree 565/1985 restructured the Ministry of Culture into three branches: the Centro de Coordinación Bibliotecaria (Center for Library Coordination), the Centro de las

Letras Españolas (Center for Spanish Letters) and Centro del Libro y la Lectura (Center for the Book and Reading).

- 1987: Royal Decree Reglamento de Museos de Titularidad Estatal y del Sistema Español de Museos (Regulation of Museums under State Ownership and of the Spanish System of Museums) 620/1987 established the current organization of Spanish museums.
- 1989: Royal Decree Reglamento de Bibliotecas Públicas del Estado y del Sistema Español de Bibliotecas (Regulation of Public Libraries of the State and of the Spanish System of Libraries) 582/1989 established the present Public Libraries of the State [the so-called Bibliotecas Públicas del Estados (BPEs)] and the Spanish Library System.
- 1991: Royal Decree 1581/1991 established the present statutes for the National Library.
- 2006: Ley Orgánica de Educación (Education Law) 2/2006 reorganized the structure of higher education in compliance with the Bologna Accord.

NATIONAL LIBRARY AND INFORMATION SERVICES

Libraries in general use IBERMARC format for cataloging, in use since 1976; those in Catalonia tend to use CATMARC. For classification, most use Universal Decimal Classification (UDC), by shelf position, or a combination of both. Several global ILS firms have a strong presence in Spain (Sirsi, Innovative Interfaces, VTLS, ExLibris). Two Spanish companies have the highest market share, however. The Absys product of Baratz Servicios de Teledocumentación S.A. is the Spanish library automation powerhouse; its more than 1000 installations include major government, royal academy, public, special, and university libraries, as well as library networks and museums. Eight university libraries participate in an Absys-user consortium called RUECA (Red Universitaria Española de Catálogos Absys, Spanish University Network of Absys Catalogs.) The other big player is 3000 Informática, with a strong customer base in regional public library systems, national archives, university libraries, and government.

Data consulted in the following discussion of the different library types came from four different sources: for the National Library, the National Library Web site; for public and special libraries, Library Statistics from Spanish Statistical Institute; for university libraries, REBIUN; and for school libraries, LibEcon.

The National Library's Web site is <http://www.bne.es>. The Spanish Statistical Institute's Instituto Nacional de Estadística, Estadísticas de Bibliotecas (<http://www.ine.es>), accessed June 2007, is released in December of odd years with data for the previous year; the current data are from 2004. In 2002 it changed its classification of libraries to

comply with ISO 2789 *Information and documentation—international library statistics*. REBIUN data (Red de Bibliotecas Universitarias. *Anuario de las bibliotecas universitarias y científicas españolas 2005* <http://www.REBIUN.org/doc/estadisticas/ANUARIO%20REBIUN%202005.pdf> (accessed June 2007) was preferred for university libraries because of its currency (2005) and respect within the Spanish university library community. Data from the Spanish Statistical Institute's Estadísticas de Bibliotecas were used for the discussion of automation for university and research libraries since the REBIUN statistics do not measure that factor. Since neither the National Statistics Institute nor the Ministry of Culture tracks statistics for school libraries, data for that segment are difficult to obtain accurately. The most current and reliable data are from LibEcon (International Library Economics Research Study, <http://www.libecon.org>, accessed June 2007), based on 2002 grossed results. Data for archives are from the Ministerio de Cultura. Estadística de Archivos. http://www.mcu.es/estadisticas/docs/capitulos_graficos/AEC2006/c_archivos12.pdf (accessed June 2007). Data for museums come from the Ministerio de Cultura. Estadística de Museos y Colecciones Museográficas. http://www.mcu.es/estadisticas/docs/capitulos_graficos/AEC2006/c_museos11.pdf (accessed June 2007).

National Library

Established in 1711 by King Philip V (1683–1746), the Royal Library was opened to the public on March 1, 1712 in the Royal Palace. In 1836 it changed its name to the National Library. It opened the doors to its present headquarters in Madrid on March 16, 1896, with a second, smaller location in Alcalá de Henares in 2000 (see Fig. 2). In 1716 the first charter for the National Library was issued and the beginning of the legal deposit system was created. Some famous literati have been directors, such as playwrights Leandro Fernández de Moratín (1811–1812), Manuel Bretón de los Herreros (1847–1854), Juan Eugenio Hartzenbusch (1862–1875), and Manuel Tamayo y Baus (1884–1898) and the noted scholars Agustín Durán (1854–1861), Marcelino Menéndez y Pelayo (1898–1912), whose personal library of 40,000 volumes in philology and literary history is among the finest ever assembled by one individual, Francisco Rodríguez Marín (1912–1930) and, during the Civil War, linguist Tomás Navarro Tomás (1936–1939).

Organization and structure

The National Library (<http://www.bne.es>) is the largest library in Spain and the center of the country's library system. It operates under statutes laid down by Decree 1581/1991, which were later slightly modified in 1997, 2000, 2001, and 2005. According to its Articles of Incorporation, it is mandated with three major functions:



Fig. 2 Facade of the National Library of Spain. © Alexandra Gnatush-Kostenko—Fotolia.com.

1. Compile, catalog, and preserve the bibliographic output produced in any language about Spain for the purposes of research, culture, and information.
2. Promote research through the study, lending, and reproduction of its bibliographic resources.
3. Disseminate information on Spain's bibliographic output received through the legal deposit system.

The mission of the National Library is the conservation, management, and diffusion of the Spanish bibliographic heritage, for the purposes of 1) transforming information into knowledge; 2) satisfying the needs of the research community; and 3) spreading the nation's historical memory to all Spanish citizens.

The recently developed 2006–2008 Strategic Plan enumerates the following six objectives:

1. Convert the National Library into a place of cultural discovery for all citizens.
2. Increase access to specialized information resources necessary for study and research and to improve services to users.
3. Analyze and plan for the management of collections in the library.

4. Promote the involvement of the Library in all professional arenas for the purpose of guaranteeing an active and enriching presence.
5. Assume a leadership role in innovation in the professional arena.
6. Develop the best organizational model for the fulfillment of library functions.

The library is headed by a Director General, responsible for strategic planning and overall direction for the library; a Technical Services Director who deals with the daily administration of the various working units; and a General Manager who supervises the financial and personnel operations. The library reports directly to the Minister of Culture.

Expenditures

Annual operating expenditures for the national library are broken down as follows:

• Staff	€12,103,130
• Materials	€7,932,327
• Other	€56,735
• Grand total	€20,092,192

Collections

Its collection is one of the largest in Europe and is especially strong in the humanities and social sciences; its breakdown by format is as follows:

Total holdings exceed 18 million items.

• Monographs	6,500,000
• Photographs	2,000,000
• Posters	800,000
• Prints	700,000
• Sound recordings	550,000
• Musical scores	500,000
• Postcards	500,000
• Ephemera	200,000
• Maps	134,000
• Journal titles	110,000
• Audiovisual	80,000
• Original drawings	45,000
• Manuscripts	30,000
• Newspapers	20,000
• Incunabula	3000
• Total Titles	12,172,000

The augmentation of the collections is enhanced considerably by the library's role as the curator of the national legal deposit system, whose current regulations were

established in 1957. Every publisher is legally obligated to provide the library with one copy of every publication, but in reality the library often gets three copies: it keeps one for preservation and circulates the other two. This system is so effective that legal deposit items in all formats comprise 95% of the library's total collection. The relatively little remainder is obtained through direct purchase, exchange, and donations. In 2006 the library added almost 183,000 items to its collection, the largest category of which (55%) was in-print monographs.

Special collections

Among its priceless items is the only extant copy of the *Cantar de Mio Cid*, the early thirteenth century national epic; a manuscript of the Middle Ages masterpiece *El libro de buen amor* (Book of Good Love, 1368); the *Biblia Sacra Hispalense* (*Codex Toletanus*) (Holy Spanish Bible, Toledo Codex, 988 A.D.); and a tenth century copy of Saint Isidore's *Etymologies*.

- The Ephemera and Ex Libris (bookplate) Collections contain approximately 200,000 images of such collectables as matchboxes, wall calendars, labels from raisins and orange boxes, and cigar bands.
- The Cartography Collection consists of more than 134,000 maps (mostly of Spain); atlases; and specialized works in cartography, geography and astronomy, as well as descriptions of countries and travel writings.
- The heart of the Theater Collection's 55,000 volumes includes the personal libraries of several prominent scholars, in particular those of Juan Nicolás Böhl de Faber (1770–1863), Agustín Durán (1793–1862), and especially Pascual de Gayangos y Arce (1809–1897), who donated over 22,000 titles.
- The Africa Collection contains books, pamphlets, serials, manuscripts, photographs, postcards, maps, and graphics dealing primarily with the history and culture of North Africa.
- The library maintains two archival collections: one for the history of the library proper, and the other for the Junta Facultativa de Archivos, Bibliotecas y Museos (Archives, Libraries and Museums Supervisory Board).
- The library holds 1600 medieval codices.
- The Sala de Prensa y Revistas (Press and Journals Reading Room) contains paper, microfilmed, and digitized copies of more than 400 Spanish newspapers and serials.
- The Sala Cervantes (Cervantes Reading Room) is the library's rare book room, with over 13,000 ancient and modern manuscripts and incunabula, books printed from the sixteenth to eighteenth centuries, first editions from several epochs and especially materials relating to Cervantes and his works.

- The Sala Goya (Goya Reading Room) houses the art collection, with drawings, illustrated books, posters, photographs, art works, and maps.
- The Sala Barbieri (Barbieri Reading Room) contains the music collection, noted for its collection of scores, sound recordings, musical archives, and archived video games and computer programs.
- The Sala de Documentación Bibliotecaria (Library Documentation Reading Room) contains an extensive collection of 15,000 titles, both retrospective and current, in library science geared to the information professional.

Publications

1. The *Bibliografía española* (Spanish Bibliography) contains bibliographic records based on works which the National Library receives through the legal deposit program, including books, serial publications, maps, and music. Published since 1958, the monthly publication is available in print and online.
2. The Library also actively publishes works in its own right, usually of exhibitions that took place there. An outstanding example is the 2005 publication of *El Quijote: Biografía de un libro* (El Quijote: Biography of a Book), an elegant catalog of an exhibition that the Library sponsored in commemoration of the quadricentennial of Cervantes' masterpiece.

Databases and automation

- The Catálogo Bibliográfico (Bibliographic Catalog), called ADRIANA, is probably the library's most important database, containing over 3 million items and more than 10 million copies. It includes all works acquired since 1931, plus journals and nonprint materials from the collections. Users can export records using Z39.50 protocol.
- The Catálogo Autoridades (Authority File) contains over 400,000 records of personal names, corporate names, work titles, and subjects.
- The Directorio de Bibliotecas Españolas (Directory of Spanish Libraries), called DIBI, is an interactively searchable database containing information on over 10,000 of all types of libraries in the country with name, address, contact information, year founded, subject specialties, collections, services offered, and access policies.
- The Catálogo Colectivo de Publicaciones Periódicas (Union Catalog of Periodical Publications), or CCPP, is a union list of 88,000 serials held by 1100 Spanish libraries, with 370,000 records.
- Instrumenta Musicae: Catálogo Colectivo de Fondos Musicales del Siglo XIX (Union Catalog of Musical Resources from the 19th Century) contains 15,000

records representing 25,000 items of nineteenth century scores of all musical genres, plus monographs and facsimile editions. It represents a joint effort with seven Spanish American countries.

User services

In addition to the specialized reading rooms mentioned above, the library has a general reading room (Salón General), housing a reference collection and providing access to the bulk of the collection, newer works and copies of legal deposit items; the Sala de Información General (General Information Reading Room), where users can obtain permits and inquire about services; and the Sala de Información Bibliográfica (Bibliographic Information Reading Room), with access to general and specialized bibliographies, electronic databases, catalogs for other Spanish and foreign libraries, and a genealogy collection, as well as the card catalog which contains records for all monographs acquired through 1986.

The library has implemented a rather complex schema of five categories for library use, but in general, access is presently restricted to researchers, though at the time of this writing, management is considering having the government make the policy more open. In 2006 the library provided almost 19,000 researchers with passes to use the collection and hosted almost 130,000 readers, averaging 448 a day. The General Reading Room and the General Information Reading Room have the most visitors.

In the basement of the National Library is the recently renamed Museo de la Biblioteca Nacional (National Library Museum), formerly called Museo del Libro (Museum of the Book), which displays highlights of the collections and history of the library.

The National Library is also the ISSN national agent for Spain.

As for interlibrary loan, any publicly funded university, special or public library can borrow items from the library. Excluded from interlibrary loan are serials, reference works, manuscripts, and nonprint materials. The library will not make copies of works that are currently in print and will lend others that are still subject to intellectual property rights but only for research and not-for-resale purposes. The library attempts to supply a photocopy of a requested work if the original is not lendable.

Digitization

The library has undertaken several digitization projects:

- The most outstanding is undoubtedly the Hemeroteca Digital (Digital Newspaper Library), a copyright-free collection of over 500,000 pages from over 143 titles spanning the years 1772–1933.

- Other collections include digitized editions of *Don Quijote*, posters from the Republic and Civil War, Spanish cartography from the sixteenth to nineteenth centuries, Spanish iconography, and works of Francisco de Goya in the library.
- In late 2007 the library was scheduled to mount digitized versions of the top 100 works of Spanish literature, freely available on its Web site.

Cooperation

The library actively participates in national cooperative initiatives and sponsors conferences, workshops, and seminars; it also works closely with the major national library associations like the Federación de Asociaciones de Archiveros, Bibliotecarios, Museólogos y Documentalistas (Federation of Associations of Archivists, Librarians, Museologists, and Documentalists, ANABAD), the Federación Española de Sociedades de Archivística, Biblioteconomía, Documentación y Museística (Federation of Spanish Societies of Archives, Libraries, Documentation and Museology, FESABID), and the Asociación Española de Documentación e Información (Spanish Association for Documentation and Information, SEDIC). The National Library is also a major player in the international arena, of which the most important affiliations are the Consortium of European Research Libraries (CERL); the European Bureau of Library, Information and Documentation Associations (EBLIDA); the International Federation of Library Associations and Institutions (IFLA); the Ligue des Bibliothèques Européennes de Recherche (League of European Research Libraries, LIBER); and the European Library.

UNIVERSITY AND RESEARCH LIBRARIES

Administration and Staffing

Spanish university libraries are unique for three reasons. First, historically most campuses had decentralized libraries in the facultades (schools), some with sizeable collections; these libraries often held overlapping collections and duplicated operations with one another, and their existence was subject to the vagaries of departmental funding. Only recently have more universities established central libraries, but seven still do not have one. Second, most of the existing university libraries are of fairly recent origin. Though eight date from the seventeenth century or earlier (see Table 1), three-fourths (52) of all main university libraries today were founded since 1960 (see Table 2).

Finally, the Spanish higher education style of learning has always emphasized rote learning and memorizing professors' lectures with little emphasis placed upon inquiry into supplementary resources available from the library;

Table 1 Founding dates of the oldest University libraries.

Name of university	Year established
University of Salamanca	1254
University of Valladolid	1346
Complutense University	1499
University of Seville	1505
University of Granada	1532
University of Santiago de Compostela	1550
University of Saragossa	1583
University of Oviedo	1608

Source: Fatih, D., Ed. *Directory of University Libraries in Europe*, 2nd Ed.; Europa Publications: London, 2004; 293–331.

this mindset is slowly changing as university libraries are now modernizing their mission and establishing their importance as a premier component in the development of erudition on campuses.

Two-thirds of Spanish universities are public institutions; most of the private ones are run by the Roman Catholic Church.

The 68 university library administrative units of REBIUN have 688 service points (about ten per library).

The total staff of university libraries is 6681 persons, broken down into professionals (35%), support staff (51%), and student workers (14%).

Expenditures

Annual operating expenditures for university libraries are broken down as follows:

• Staff	€152,102,787
• Serials	€66,177,403
• Monographs	€33,195,024
• Databases	€13,522,152
• Other	€1,115,244
• Grand total	€266,112,610

Expenditures on staff comprise about 57% of total expenditures, a slight increase since 2000 (55%). Expenditures for electronic information comprise almost one-third (32%) across different materials accounts, a substantial increase since 2000 (8%). The average cost of a monograph in 2005 was €36 (a 33% increase over 10 years) and €275 for a journal subscription (a 46% increase).

Table 2 Number of central university libraries established by decade.

Decade	Number founded
1960s	7
1970s	12
1980s	4
1990s	27
2000s	2

Source: Fatih, D., Ed. *Directory of University Libraries in Europe*, 2nd Ed.; Europa Publications, 2004.

Collections

The total breakdown of university library collections by format is as follows:

• Books	35,676,734
• Electronic documents	3,374,450
• Graphics	2,125,639
• Microforms	1,238,708
• Serial titles	719,062
• Sound recordings	406,448
• Maps	334,112
• Videos and DVDs	277,544
• CD-ROMs	259,929
• Grand total	44,412,626

Books comprise 80% of university library collections, a decline of 10% from 2000, as university libraries are acquiring more nonprint materials. However, the annual net addition to the collection of about 1.4 million items has stayed fairly steady. Collections are relatively small by European and North American standards; although 8 universities have over 1 million volumes, 17 others have fewer than 100,000.

User Services

In general, use of library services, especially those for electronic materials, has increased exponentially since 2000. Visits to library Web pages, for example, increased 866% and library catalog searches were up 592% (likely due to a greater presence in 2005 than 5 years earlier). In contrast, however, total walk-in traffic was up at a more modest 26% increase and circulation even less, at 6%. University libraries are open 274 days a year and 71 hr a week on average, amounting to 5 hr more per year and 2 more per week than in 2000. The number of annual service transactions is as follows:

• Visits to Web pages	203,063,898
• Catalog searches	96,934,682
• Walk-ins	83,425,275
• Circulation	13,346,944

University libraries are net interlibrary borrowers, having borrowed 200,885 items in 2005 and lent 182,165. These figures represent a decrease from 2000, 29% in the case of borrowing and 34% in the case of lending, a decline due to the wider availability of resources in electronic formats.

Automation

University libraries have always been at the forefront of library automation, and all the REBIUN member libraries

are automated to some degree. Indeed only 6 million volumes remain unconverted into the REBIUN database. Among all institutions of higher education, however, cataloging and circulation are the two functions with the heaviest penetration of automation in public libraries; almost 91% have automated their cataloging procedures and 76% have automated circulation. 63% have a Web page and 69% have Web-based OPACs. Presently 91% of academic libraries have Internet access.

Representative University Library Profiles

The selection of the representative libraries here and in the rest of the entry is based on the author's firsthand knowledge and on the consensus of evaluations from works cited in the bibliography.

Carlos III University

Established in 1989, the university took as its namesake the enlightened eighteenth century monarch Charles III (1759–88); the university's motto *Homo homini sacra res* ("Man is sacred for man") reflects that progressive humanistic heritage. The university's 19,000 students and 1000 full-time faculty are spread out over three campuses, but the María Moliner Library located in the southern Madrid suburb of Getafe serves the largest user base and has the largest collection; the library as a whole has over 422,000 monograph volumes and almost 4000 periodical subscriptions. The library employs 78 librarians. The library subscribes to a comprehensive collection of electronic resources and has seriously reduced its paper-based reference acquisitions. Interlibrary loan is very active; book lending is up and nonreturnables are down (due to campus-wide electronic access).

Complutense University

Third in historical prestige to the University de Salamanca but first in the size of its collections, the Complutense University dates from 1499 with its founding in Alcalá de Henares by Cardinal Francisco Jiménez de Cisneros (1436–1517), an instrumental figure in the publication of the first critical edition of the Bible, the *Biblia políglota complutense* [Polyglot Bible of Complutum (the Latin name for Alcalá de Henares), 1502–1517], for which was needed an extensive research collection. The university moved to Madrid in 1836. The library has 33 branches with a total of almost 3 million books, as well as a valuable manuscript collection. Yet for all its historical holdings, the library is very much in the vanguard of promoting electronic resources. It presently makes available over 31,000 electronic books, 21,000 e-journals, and a host of databases. Its most recent

claim to fame, however, is the 2006 agreement to join the Google Books Library Project, for which it has started contributing the texts of public domain works. This digitization effort follows on the heels of four earlier open access digitization projects: the Dioscórides Digital Collection of almost 3000 books and 40,000 images in the sciences and humanities; the Complutense E-prints Institutional Archive of 4000 theses; the Collection of Ancient Drawings from the Fine Arts Faculty Library, consisting of almost 300 drawings from 1752 to 1914; and the Portal of Complutense Scientific Journals, with full-text articles (currently around 23,000) from 67 scientific journals published by the University.

University of Salamanca

Founded in 1218 by King Alphonse IX (1171–1230) and reorganized in 1254 by his grandson King Alphonse X the Wise (1221–1284), the University of Salamanca is the oldest university in Spain still in existence. One of the most reputable Spanish universities, it is commendable for its collections; its library system has over a million volumes, including those of the 22 subject area libraries which have distinguished holdings for each of their specializations. Because of the university's early founding, its holdings of older and rare materials are outstanding; the library has over 2000 manuscripts, almost 500 incunabula, and 62,000 books printed before 1801.

Major Research Libraries

CSIC libraries

Created in 1939, the Consejo Superior de Investigaciones Científicas (Higher Council of Scientific Research), or CSIC (<http://www.csic.es>), is a network of 96 public research libraries reporting to the Ministerio de Educación y Ciencia (Ministry of Education and Science); spread out over 21 cities in ten Autonomous Communities, it is the largest research organization in the country. The combined total collection, especially strong in the pure and applied sciences, approaches 1.5 million volumes with over 56,000 periodical titles, all available through its union catalog, the Catálogos Informatizados de la Red de Bibliotecas del CSIC (Automated Catalog of the CSIC Library Network), called CIRBIC. All of its electronic resources are available remotely through its virtual library portal. Because of the heavy concentration on the sciences, 86% of the acquisitions budget goes to serial publications. Each library develops its own specialization and serves its own constituents, mainly the researchers in the specialized disciplines. It is the only nonuniversity institution member of REBIUN. Staff number around 200.

Ateneo Científico y Literario de Madrid (Scientific and Literary Athenaeum of Madrid)

The Ateneo was established as a political club and literary salon in 1835 and for years had been considered a hotbed of liberal ideas and progressive thought. Many of Spain's most famous writers, philosophers, and intellectuals were members at one time or another. The library is officially open only to the 3000 members, but with a very generous operating schedule, open daily from 9:00 A.M. to 1:00 A.M. and closed only 7 days a year. The library has four fairly identical reading rooms (one houses the extensive newspaper collection), with materials encased in wooden armoires. In addition to a collection of over 150,000 titles spread over 350,000 volumes, the library maintains several unique resources that one might not expect in a library of this sort, including a first edition of the *Encyclopédie* (1751–1777), 27,000 pamphlets, a 100,000-volume newspaper section, microfilmed pages from 3124 volumes, manuscripts dealing with the history of the Atheneum, over 1440 maps, and 249 letters. Many of its early pieces were duplicate castoffs from the National Library. Those Spanish writers and intellectuals who were members are especially well represented. The library also serves as the Atheneum archive, with rich holdings of the history of the institution, in-house publications, and catalogs of artist exhibitions, proceedings of conferences and texts of lectures that were given there. The library is beginning to digitize many of its rarer and more valuable historical materials and has almost completed retrospectively converting its holdings.

PUBLIC LIBRARIES

In 1931, in keeping with the progressive policies of the Second Republic (1931–1936), the Junta de Intercambio y Adquisición de Libros para Bibliotecas Públicas (Commission for Interchange and Acquisition of Books for Public Libraries) was created to supply books to libraries and to create public libraries in locations with a minimal number of inhabitants.

In 1947 the Servicio Nacional de Lectura (National Reading Service) was created to promote reading among the Spanish public. In 1953 the first bookmobiles began operation.

Three recent initiatives to advance the technological status of public libraries were

1. The Plan de Impulso de las Bibliotecas Públicas Españolas: las bibliotecas públicas, puertas de entrada a una Sociedad de la Información para todos (Plan for Boosting Spanish Public Libraries: Public Libraries as Doorways for Access to an Information Society for All) intended to provide all Spanish citizens with access to information, including improving Internet access.
2. Info XXI: la sociedad de la información para todos (The Information Society for All), established free access to information for all citizens.

Administration and Staffing

Libraries are governed by the Dirección General del Libro, Archivos y Bibliotecas (General Board of the Book, Archives and Libraries) under the Ministry of Culture. However, they are not administered centrally, but rather fall into three decentralized models.

1. Bibliotecas Públicas del Estado (State Public Libraries), called BPEs. These libraries are located in each one of the 52 provincial capitals. Though authorized federally, they are managed locally. They have the largest collections and provide the greatest variety of services to its users.
2. Bibliotecas Centrales de Comunidades Autónomas (Central Libraries of the Autonomous Communities). These libraries are like mini-national libraries for their regions, in that their mission is to collect everything published in and about their respective regions. These 13 libraries are entirely run by the Autonomous Communities, who authorize the creation of libraries and establish guidelines for managing them. The Balearic Islands, Canary Islands, Galicia, and the Basque Country are the only regions lacking one. Six—those in Aragon, Asturias, Cantabria, Castile-La Mancha, La Rioja, and Murcia—double as BPEs and perform functions more appropriate for that type of library as well.
3. Bibliotecas Públicas Municipales (Municipal Public Libraries). These libraries are the most numerous, numbering 4043 administrative units, representing 4812 service points. Every municipality with a population of at least 5000 people is mandated by law to set up a library, though some are libraries in name only. These libraries are created and administered with local funding. The municipal libraries in the largest cities have formed networks with branches scattered throughout the city. Some of these service points are located in very creative places, including Metro stations. In addition, 69 bookmobiles operate in several provinces.

Ranking of Municipal Public Library Administrative Units by Autonomous Community

Autonomous community	Number of administrative units	Rank by inhabitants served
1. Andalusia	645	1
2. Valencia	458	4
3. Castile-La Mancha	438	9
4. Catalonia	412	2
5. Extremadura	394	13
6. Galicia	325	5
7. Castile and León	276	6
8. Basque Country	225	7
9. Aragon	213	11
10. Canary Islands	167	8
11. Balearic Islands	112	14
12. Asturias	103	12
13. Madrid	90	3
14. Navarre	80	15
15. Murcia	43	10
16. Cantabria	36	16
17. La Rioja	23	17
18. Ceuta	2	NA
19. Melilla	1	NA

All told, only 3% of the national population is without public library service.

Staffing

Total salaried staff is 10,406, of which 21% are professional librarians. Some of the workload is carried out by volunteers and student workers.

Expenditures

Annual operating expenditures for public libraries are broken down as follows:

• Staff	€29,218,269
• Materials	€60,201,778
• Other	€24,858,922
• Grand total	€114,278,453

The percentage allocated to staffing has remained fairly constant (68%) since 2000 (70%).

Collections

The item breakdown of collections in public libraries by format is as follows:

• Books and pamphlets	51,076,829
• Audiovisual materials	1,750,928
• Sound recordings	1,376,729
• Bound serials	1,185,920
• Microforms	557,983
• Electronic documents	435,623
• Other documents	390,016
• Graphics	185,868
• Sheet music	66,609
• Manuscripts	59,152
• Maps	30,438
• Grand total	57,116,095

Books comprise 89% of public library collections, down from 96% in 2000, because of the acquisition of more nonprint materials. Public libraries annually add about 3 million volumes to their collections.

User Services

As the name implies, these libraries, except in unusual cases, offer services free of charge, since national law requires that all basic public library services be available to users at no cost to users.

Public libraries had 9,811,766 registered users in 2004, a 37% increase since 2000 (7,172,882); an overwhelming majority (76%) are adults.

Total circulation transactions have increased 80% since 2000. Books and pamphlets continue to comprise the majority of circulation activity (61%). Circulation transactions are broken down by format as follows:

• Books and pamphlets	28,524,785
• Audiovisual materials	9,351,654
• Sound recordings	5,979,199
• Periodicals	1,721,117
• Electronic documents	1,220,726
• Other documents	201,477
• Grand total	46,998,958

Charging users overdue fines is not common.

Forty-one percent of libraries are open between 20 and 40 hr a week; another 32% are open between 10 and 20 hr. Only 12% are open longer than 40 hr a week.

Public libraries are net interlibrary lenders, having lent 167,713 items in 2004 and borrowed 151,747, almost exclusively to libraries within Spain. Lending has increased 8% since 2000. Libraries usually offer interlibrary loan to users free of charge.

Automation

Almost three-fourths of all public libraries perform at least one automated function. Cataloging and circulation are the two functions with the heaviest penetration of automation

in public libraries; almost 60% have automated their cataloging procedures and 44% have automated circulation. Libraries that perform at least one automated function are broken down as follows:

• Cataloging	2427
• Circulation	1778
• Interlibrary loan	773
• Acquisitions	712
• Serials control	654
• Self checkout	211

Only 383 libraries (9%) have a Web page, but 1200 (30%) have Web-based OPACs. Presently three-fourths of public libraries have Internet access, most of whom make it freely available to users. The use of filtering software is not standard practice.

Representative Public Library Profiles

Library of Catalonia

Founded in 1907 in Barcelona, the Library of Catalonia serves as the legal deposit and bibliographic compiler of works published in and about the Catalan region. With over an estimated 3 million documents, it is by far the largest and most research-oriented of the regional libraries and comes closest to defining the concept of a regional “national” library. Besides providing separate audiovisual, newspaper and art reading rooms, it houses the archives of the Catalan writer Joan Maragall (1860–1911) in his former residence. Among its many special collections are an extensive collection of the works of the medieval writer Ramon Llull (1235–1315) and the 4000-volume library of the noted Catalan poet Jacint Verdaguer i Santaló (1845–1902). In 2007 the library agreed, along with four other Catalan libraries, to digitize hundreds of public-domain works as part of the Google Books Project.

Pedro Salinas

The Pedro Salinas Public Library, one of the largest and most attractive of the 18 branches of the Madrid regional library system, is also one of the most typical. The circular structure encompasses two floors of stacks, reading rooms, a periodicals alcove, and a children’s section. This particular branch claims to have 50,000 books, 94 serials, and 3000 AV materials and performs the services one would normally expect in a modern public library: reference, circulation, interlibrary loan, programming, and Internet access. Circulation policies, however, seem somewhat liberal: a passport is apparently all one needs to check items out. However, loan periods are somewhat more restrictive: three books for 30 days, and two DVDs videos, or CDs for

7 days. It even has what they call a “collective loan”: educators can charge out up to a 100 books for up to 9 months, since the collections in school libraries are wanting.

SCHOOL LIBRARIES

Administration

School libraries have 2836 administrative units and 3429 service points.

Staffing

Total FTE library staff is 656, of which slightly more than half (342) are trained librarians. Based on these data, it appears that many school libraries are still drastically understaffed.

Expenditures

Annual operating expenditures for school libraries are broken down as follows:

• Staff	€95,122,072
• Materials	€36,802,178
• Other	€52,581,509
• Grand total	€284,505,759

The low attention paid to staffing is validated by the low budgetary allocations for staff (26%).

Collections

Books, by far the most numerous format, comprise 86% of school library collections, but audiovisual materials form an important collection component to complement the curriculum. The item breakdown of collections in school libraries by format is as follows:

• Books and bound periodicals	13,346,774
• Audiovisual materials	2,143,626
• Serial titles	43,858
• CD-ROMs	28,782
• Grand total	15,563,040

User Services

School libraries circulate 72,164,126 items a year to their users; with a served population of slightly over 10 million users, the circulation rate averages about seven items per

user. Approximately 83,303,986 users visit the library annually, or about eight visits per user.

Automation

School libraries have automated only 31% of their records. About 62% are connected to the Internet.

SPECIAL LIBRARIES

Administration

The National Statistics Institute divides special libraries into two types. The first group consists of 414 libraries (with 486 service points) that serve special populations (for example, prisons and military). The other 1777, with 1957 service points, contain special collections and include the following specific types:

• Government	324
• Associations	292
• Archives and museums	261
• Health sciences	185
• Religious	155
• Research	147
• Corporate	73
• Other	340

For the purposes of this discussion, their features will be treated together.

Staffing

Total salaried staff is 5177, of which 31% are professional librarians, the remainder consisting of support staff and subject experts.

Expenditures

Annual operating expenditures for special libraries are broken down as follows:

• Staff	€67,399,901
• Materials	€41,802,597
• Other	€10,048,908
• Grand total	€119,251,406

The percentage allocated to staffing has increased considerably (56%) from what it was in 2000 (41%).

Collections

Books, though still the most numerous format, only comprise 42% of special library collections, considering the

varied nature of the collections of these libraries. Special libraries annually add slightly over 1 million volumes to their collections. The item breakdown of collections in special libraries by format is as follows:

• Books and pamphlets	30,306,664
• Other documents	16,450,609
• Microforms	7,100,013
• Electronic documents	6,227,825
• Graphics	3,819,553
• Bound serials	3,584,088
• Audiovisual materials	1,770,559
• Sound recordings	1,162,511
• Manuscripts	911,101
• Maps	505,838
• Sheet music	159,371
• Grand total	71,998,132

User Services

Special libraries have 1,259,896 registered users; as expected, most (98%) are adults.

Even though these libraries circulate over 2 million items a year, circulation is not a major activity for them, since many of their materials are research based and for in-house use only. Books and pamphlets comprise the bulk of circulation transactions (55%). Circulation transactions are broken down by format as follows:

• Books and pamphlets	1,280,957
• Other documents	529,831
• Audiovisual materials	241,973
• Sound recordings	171,055
• Periodicals	95,478
• Electronic documents	30,739
• Grand total	2,350,033

Fifty-eight percent of libraries are open between 20 and 40 hr a week; only 1% is open longer than 40 hr a week.

Special libraries are net interlibrary lenders, having lent 402,453 items in 2004 and borrowed 136,954, almost entirely to libraries within Spain. Lending has increased 13% since 2000.

Automation

Cataloging is by far the function with the heaviest penetration of automation in special libraries; almost 64% have automated their cataloging procedures. Automated circulation, at 37%, is a distant second. The number of libraries that perform at least one automated function is broken down as follows:

• Cataloging	1411
• Circulation	818
• Serials	768
• Acquisitions	586
• Interlibrary loan	316
• Self checkout	182

567 libraries (26%) have a Web page, and slightly more (607, or 28%) have Web-based OPACs. Presently two-thirds of special libraries have Internet access.

GOVERNMENT LIBRARIES

At the national level, government libraries fall into two categories: those in the legislatures and those in the ministries. The congressional, or parliamentary, libraries, such as those of the Congress of Deputies and the Senate, serve the information needs of the legislators and generally are not open to the public. Likewise access to the collections in the libraries of the ministries is restricted to government staff. Several of these libraries have sizeable collections in their respective fields, especially those in the Ministries of Justice, Labor, and Agriculture. Government libraries also have the largest staff and expenditures of the special libraries.

Regional and provincial administrative units also have their own government libraries.

Reales Academias (Royal Academies)

The Spanish Royal Academies set standards and provide authority for each of their disciplines. Each one—fine arts, history, language, law, medicine, pharmacy, pure sciences, and social sciences—has its own library. The largest is that of History, with over 300,000 volumes; it is located in the former residence of the great nineteenth century scholar Marcelino Menéndez y Pelayo (1856–1912), who was the Academy's librarian (1893–1895) and director (1910–1912). Access to these libraries is restricted to qualified researchers only.

Palacio Real (Royal Palace)

The library in the Royal Palace was established during the reign of the enlightened monarch Charles III (1759–88), and achieved its present status when it split from the National Library in 1836. It is presently located in eight rooms on the first floor and basement of the palace. Along with the National Library and the library in The Escorial, it constitutes the third member of the triumvirate of prominent Spanish libraries and like them is open only to researchers. The main reading room consists

of bibliographies and indexes to the collection, which specializes in primary source materials. Users can also access the collection through the Catálogo Colectivo del Patrimonio Bibliográfico Español (Union Catalog of the Spanish Bibliographic Heritage). The collections were augmented during the reign of Charles IV (1788–1808) through the acquisition of the private collection of Diego Sarmiento de Acuña, the Count of Gondomar (1567–1626), of great historic value for its unique titles and his almost 20,000 very personal letters. The bulk of the 119,000 monographs are housed in an adjoining room encased in armoires, many dating from the initial occupancy. Its oldest printed book, *Rationale divinarum officiorum* (Account of the Divine Office, 1459), is one of over 260 incunabula. Almost 5000 manuscripts, some dating from the twelfth century, are stored in compact shelving in the basement. In addition the library has almost 5000 engravings, over 3000 maps, 4500 music scores, 1000 photos, and 4000 serials. The library is also known for the sumptuous binding of its materials, many of which are still bound in-house. The library publishes a quarterly bulletin, *Avisos: Noticias de la Real Biblioteca* (Notices: News of the Royal Library). Interlibrary loan is available for photocopies only. The professional staff consists of philologists and historians. Efforts are currently under way to digitize the manuscripts. The Royal Palace library also supplements the information resources of the nearby Monasterio de las Descalzas Reales (Convent of the Royal Barefoot Nuns) in central Madrid.

Museum Libraries

The Museo Nacional Centro de Arte Reina Sofía (Queen Sofia Center of Art National Museum)

Probably the most estimable museum library is that in the Queen Sofia Museum, called MNCARS (Museo Nacional Centro de Arte Reina Sofía, Queen Sofia Center of Art National Museum). The three-level building, in a new structure adjacent to the Madrid museum itself, opened in 2005. The library's collection strengths are in fine arts from 1900 and the related fields of history, museology, and architecture. The collection contains over 167,000 bibliographic records, including 111,000 monographs, 1500 serials, 1600 audiovisual materials, 6000 musical scores, and over 15,000 exhibition catalogs, plus numerous ephemera and artists' books. The library pursues a comprehensive collection policy for both current out-of-print materials, and strives to obtain and index Spanish journals relating to the history of Spanish art. The library has also begun a project to digitize its sheet music collection. With about 16,000 visitors a year, it is one of the few museum libraries in Spain that is freely open to the public.

Religious Libraries

Real Biblioteca del Monasterio de San Lorenzo de El Escorial (Royal Library of the Monastery of San Lorenzo of the Escorial)

Because it is housed in a working monastery, the Escorial library is probably the most famous ecclesiastical library in Spain, and one of the most important in Europe. The Escorial was built in 1562 as King Philip II's personal monastery, palace, and, later, mausoleum (most of the Spanish monarchs since Charles V are interred there) in San Lorenzo de El Escorial, about 25 miles from Madrid; the library was established 13 years later (1575). Access is restricted to researchers in philology, art, and history of various disciplines. Like the Royal Palace library, this other royal library has unique, specialized collections, whose treasures include tenth and eleventh century codices, autograph manuscripts of Saint Teresa of Ávila (1515–1582), and a copy of Alphonse X the Wise's (1221–1284) *Cantigas de Santa María* (Canticles of Holy Mary, 13th century). It compensates for its collection of only about 50,000 monographs with over 6000 manuscripts in Latin, Spanish, Arabic, Greek, Hebrew, French, Italian, and Portuguese; 700 incunabula; and another 25,000 rare books from the sixteenth and seventeenth centuries. Its two reading rooms include one for researchers, primarily consisting of reference books and indexes, and a much larger exhibition hall/library, which is part of the self-guided tour of the Escorial. This hall contains not only the collection in armchairs, but also globes and other artifacts from Philip's personal collection. The ceiling is gorgeously painted with figures representing the medieval trivium and quadrivium, with philosophy and theology on either end, thus in sum illustrating all known realms of intellectual pursuit at the time of its creation. Collection growth is small, since its acquisitions policy is limited to reference materials and items relating to Philip II and the Escorial. Classification is by shelf location. Interlibrary loan is for photocopies only. The library has five staff.

DIGITAL AND VIRTUAL LIBRARY COLLECTIONS AND SERVICES

In addition to the various digital efforts that were discussed above under individual institutions, some of the other more important virtual and digital libraries are mentioned below.

- Biblioteca Digital de Catalunya (Digital Library of Catalonia). Founded in 1999 for the member institutions of CBUC, it provides access to 40 e-journals, e-books, and databases as well as to Catalan-specific content.
- Biblioteca Virtual Miguel de Cervantes (Miguel de Cervantes Virtual Library). A joint Project of the

University of Alicante, the Santander Group and the Marcelino Botín Foundation, this ambitious project intends to digitize the most important works of Spanish and Spanish–American authors and make them freely available on the Internet. It incorporates four other virtual libraries: the Biblioteca Americana (American Library), with materials related to all aspects of Hispanic American literature and culture; Biblioteca de Signos (Sign Language Library), a unique resource of materials relating to sign language and the hearing impaired; the Biblioteca Joan Lluís Vives (Joan Lluís Vives Library), a digital library of Catalan language classics; and Literatura Infantil y Juvenil (Children's and Young Adult Literature), containing classics of Spanish-language children's literature.

- Universidad Oberta de Catalunya (Open University of Catalonia) Library. Users include those officially enrolled in the university as well as those who have established accounts. The library provides access to 252 databases and 7800 e-journals, mostly in the sciences. Physical resources number around 68,000 items. Founded in 1995 and a member of REBIUN, it is in the vanguard of electronic resources management.
- The Universidad Nacional de Educación a Distancia (National Distance Education University), called UNED, founded in 1972 with headquarters in Madrid, was one of the pioneers in the Open University concept. Its 68 service points provide virtual library services to over 188,000 students, faculty, and staff, the largest user base of any REBIUN member.

EDUCATION FOR LIBRARY AND INFORMATION SCIENCE

The first attempt at library education in Spain was the establishment of the Escuela de Diplomática (School for Diplomats) in 1856, which granted a degree of archivist–librarian, until its demise in 1900. The Catalan writer Eugenio d'Ors (1881–1954) was instrumental in establishing the first library school in Barcelona, the Escola Especial de Bibliotecàries (Special School for Librarians), in 1915. In 1978 the Spanish government legislated universities the authority to grant the new degree of Diplomatura in Library and Information Science.^[5] The first true graduate professional library degree, however, was not granted until 1992. So far library science education has consisted primarily of three levels: a 3-year Diplomatura (rather similar to a U.S. bachelor's degree), a 4- to 5-year Licenciatura (somewhat comparable to the U.S. master's degree), and occasionally the Doctorate. Twelve universities offer the Diplomatura, 11 offer the Licenciatura and 8 the Doctorate. This

framework is undergoing major transition as Spain adopts the Bologna Agreement, a European Union accord passed in 1999 which standardizes higher education pedagogical practices and degrees granted throughout the Union and allows for degrees granted in one country to be recognized by the others. The deadline for Union-wide implementation is 2010, though the University of Salamanca and Carlos III have already implemented the degree in library and information science.

PROFESSIONAL ASSOCIATIONS

The first professional library organization was the Facultad de Archivistas, Bibliotecarios y Antecuarios (Faculty of Archivists, Librarians and Antiquarians), created in 1858.

Among the many professional library associations in Spain, the largest is the Federación Española de Sociedades de Archivística, Biblioteconomía, Documentación y Museística (Federation of Spanish Societies of Archives, Libraries, Documentation and Museology), known as FESABID (<http://www.fesabid.org>). Founded in 1988, it is a federation of 14 other library associations, thus with a total membership of over 7000 members. The biennial conference it sponsors is the largest gathering of information professionals in the country. The federation collaborates with these national professional organizations: the Federación de Gremios de Editores de España (Federation of Publishers Guilds in Spain), or FGEE; the Universitat Oberta de Catalunya (Open University of Catalonia), or UOC; the Centro Español de Derechos Reprográficos (Spanish Center for Reprographic Rights), or CEDRO; and the Asociación Española de Normalización y Certificación (Spanish Association of Standardization and Certification), or AENOR. Finally, FESABID is a member of the International Federation of Library Associations and Institutions (IFLA), the European Bureau of Library, Information and Documentation Associations (EBLIDA), and the International Council on Archives (ICA).

Another important association in this field is the Federación de Asociaciones de Archiveros, Bibliotecarios, Museólogos y Documentalistas (Federation of Associations of Archivists, Librarians, Museologists, and Documentalists), called ANABAD (<http://www.anabad.com>), itself a federation of four associations representing each of those disciplines. Founded in 1949, it publishes the quarterly *Boletín de ANABAD* (ANABAD Bulletin) as well as reports.

A final national association is the Asociación Española de Documentación e Información (Spanish Association for Documentation and Information), or SEDIC (<http://www.sedic.es>). Founded in 1975, it publishes two journals: the quarterly *Revista Española de Documentación Científica* (Spanish Review of Scientific

Documentation) and a more irregular *Boletín CLIP* (CLIP Bulletin) as well as directories of software and information service providers.

Regional Library Associations

In addition to these national associations, several Autonomous Communities also have library associations.

- Andalusia. Asociación Andaluza de Bibliotecarios (Andalusian Association of Librarians), AAB (<http://www.aab.es>). Founded 1981. Publishes the quarterly *Boletín de la Asociación Andaluza de Bibliotecarios* (Bulletin of the Andalusian Association of Librarians).
- Asociación Andaluza de Documentalistas (Andalusian Association of Documentalists), AAD (<http://www.aadocumentalistas.org>). Founded 1990.
- Asturias. Asociación Asturiana de Bibliotecarios, Archiveros, Documentalistas y Museólogos (Asturias Association of Librarians, Archivists, Documentalists and Museologists), AABADOM (<http://www.aabadom.org>). Founded 1989. Publishes quarterly *Boletín* (Bulletin).
- Balearic Islands. Associació de Bibliotecaris, Arxivers i Documentalistes de les Illes Balears (Association of Librarians, Archivists and Documentalists of the Balearic Islands), ABADIB (<http://www.abadib.es>). Founded 1991.
- Basque Country. Artxibozain, Liburuzain eta Dokumentazainen Elkarte (Basque Association of Professionals in Archives, Libraries and Documentation Centers), ALDEE (<http://www.aldee.org>). Founded 1990.
- Catalonia. Col·legi Oficial de Bibliotecaris-Documentalistes de Catalunya (Official Association of Librarians-Documentalists of Catalonia), COBDC (<http://www.cobdc.org>). Founded 1985. Publishes the annual *Bibliodoc*, bimonthly *Document*, and the trimestrial *Item: revista de Biblioteconomia i Documentació* (Item: Review of Library Science and Documentation).
- Murcia. Asociación de Profesionales de la Información y Documentación de la Región de Murcia (Association of Professionals of Information and Documentation in the Murcia Region), curiously known as INDEX (<http://www.indexmurcia.org>). Founded 1998.
- Navarre. Asociación Navarra de Bibliotecarios (Navarre Association of Librarians), ASNABI (<http://www.asnabi.com>). Founded 1995. Publishes the annual *Revista TK* (TK Review).
- Valencia. Associació Valenciana d'Especialistes en Informació (Valencian Association of Information Specialists), AVEI (<http://www.avei.org>). Founded 1993. Publishes bimonthly *Métodos de Información* (Information Methods).

Subject Library Associations

- Asociación de Bibliotecas y Bibliotecarios de Arquitectura (Association of Architecture Libraries and Librarians), ABBA http://www.upv.es/pls/obib/est_arc.menu. With a membership of 38 libraries, it produces the ARCANO database of materials on architecture, engineering, and urban planning.
- Asociación Española de Documentación Musical (Spanish Association of Musical Documentation), AEDOM (<http://www.aedom.org>). Founded in 1993, it is the Spanish affiliate of the International Association of Music Libraries, Archives and Documentation Centers (IAML).

LIBRARY COOPERATION

The most important academic network is the Red de Bibliotecas Universitarias (Network of University Libraries), REBIUN (<http://www.REBIUN.org>). Its membership, currently at 69 institutions, includes virtually all public and private universities. Created in 1998 originally as a resource sharing network, in 2000 it launched REBIUN En Línea (REBIUN Online), ReBEL, its online union catalog. At the end of 2005, it contained over 7.7 million bibliographic records, 18.6 million titles, 35.7 million volumes, and 642,000 journal titles, serving over 1.8 million potential users. REBIUN is governed by the rectors of the member universities. Its annual publication of the statistics of its members (<http://www.REBIUN.org/doc/estadisticas/ANUARIO%20REBIUN%202005.pdf>) provides the most accurate and up-to-date data of university library collections, funding and use.

Five other major academic consortia are

- BUCLE. Bibliotecas Universitarias de Castile and León (University Libraries of Castile and León) <http://www.ubu.es/biblioteca/bucle/>. Five members. Founded 2002.
- BUGALICIA. Consorcio de Bibliotecas Universitarias de Galicia (Consortium of University Libraries of Galicia) <http://www.bugalicia.org>. Three members. Founded 2001.
- CBUA. Consorcio de Bibliotecas Universitarias de Andalucía (Consortium of University Libraries of Andalusia) <http://www.upo.es/cbua/>. Ten members. Founded 2001.
- CBUC. Consorci de Biblioteques Universitàries de Catalunya (Consortium of University Libraries of Catalonia) <http://www.cbuc.es/>. Ten full and seven associated members. Founded in 1996, it is the oldest of the academic consortia.
- Madroño. Consorcio de las Universidades de la Comunidad de Madrid y de la UNED para la Cooperación

Bibliotecaria (Consortium of the Universities of the Community of Madrid and the Nacional University of Distance Education for Library Cooperation). <http://www.consorcio-madrono.net>. Seven members. Founded 1999. Madroño has implemented a courier-lending service available between member campuses with a promised maximum delivery time of 48 hr; it is also spearheading efforts at digitization, especially for open archives, theses, and journals unique to each member institution.

The major public library network REBECA, <http://www.mcu.es/bibliotecas/MC/Rebeca/index.html> is a cooperative cataloging database of more than 860,000 bibliographic records in which 19 BPEs and 8 Central Libraries participate.

In addition, some of the most important subject-based networks are

- Catálogo Colectivo del Patrimonio Bibliográfico Español (Union Catalog of the Spanish Bibliographic Heritage) <http://www.mcu.es/bibliotecas/MC/CCPB/index.html>. Contains over 781,000 titles and over 2 million copies of printed works from the fifteenth to twentieth centuries from 722 libraries whose collections form part of the Spanish Bibliographic Heritage network.
- Coordinadora de Documentació Biomèdica (Consortium of Biomedical Documentation), CDB <http://www.doc6.es/cdb/>. Composed of most Catalan health science libraries.
- DOCUMAT. <http://wzar.unizar.es/documat/ccol.html>. Composed of 17 libraries specializing in mathematics. The union catalog of approximately 90 libraries is maintained by the CSIC.
- MECANO. http://www.upv.es/pls/obib/est_mec.menu. Composed of 112 universities specializing in engineering, computer science and technology. Its union catalog of 18,000 journal titles and 4000 proceedings is maintained by the library at the Polytechnic University of Valencia.

ARCHIVES AND ARCHIVAL SCIENCE

Administration

Like libraries, archives are administered by the General Board of the Book, Archives and Libraries under the Ministry of Culture.

Archives can generally be categorized into five groups:

1. Historical archives, which includes the national and regional archives.
2. Government archives, mostly records kept at provincial and municipal governing bodies.

3. Ecclesiastical archives, found in cathedrals, monasteries, and bishoprics.
4. Peerage archives, containing the historical records of noble families.
5. Corporate archives, containing legal records and archives for corporations and nonprofit organizations.

However, there is no accurate current figure for the number of archives in Spain; available data are woefully out of date and suspiciously incomplete. The list compiled by the National Statistics Institute includes only the 11 archives administered by the Board; the data below reflect information available for those archives only.

These archives employ a total of about 450 staff, 22% of whom are archivists and 7% are librarians.

Expenditures

Total expenditures for these archives, both from national and regional sources, were 81 million euros, one-third of which went to staff.

Collections

The format breakdown of the collections of the state archives is as follows:

• Photographic images	8,363,267
• Parchments	296,996
• Maps	84,577
• Stamps	18,637
• Art works	16,244
• Audiovisuals	1103
• Other	367
• Total	8,781,191

Added to this total is a collection of 13 million digitized images.

User Services

About 10,000 visitors annually use these archives and 15,000 visit them over the Internet; over half of all research inquiries are requested by telephone. These institutions copy between 1 and 2 million documents annually.

Representative Archives Profiles

Archivo General de Simancas (General Archives of Simancas)

Founded in 1540, the Simancas Archives are the oldest of the three major national archives. Located near the former national capital of Valladolid, it was created by order of Emperor Charles V to store valuable documents in a castle

there; in 1572 Philip II had the famous architect Juan de Herrera (1530–1597) draw up sketches for an edifice to permanently house the collection. It thus ranks as one of the earliest officially sanctioned archives in the world. In 1844 it was permanently opened to the public for historical research, but a special pass is now required for admittance. The historically valuable collection of primary materials provides access to the written record of the Spanish monarchy from the time of Ferdinand and Isabella to the early nineteenth century (see Fig. 3).

Archivo General de Indias (General Archives of the Indies)

Established 200 years later (1785) by Charles III (1759–88) in Seville, the Indies Archives were created to pull together under one roof all the documents, previously dispersed in different locations, relating to the Spanish administration in its former American and Philippine colonies. Today the Archives contain more than 43,000 files, containing 80 million pages of primary documents, and 25,000 volumes of historically valuable material.

Archivo Histórico Nacional (National Historical Archives)

Founded in 1866 by Queen Isabel II (1830–1904) in Madrid, the National Historical Archives was housed in the National Library from the time the latter opened in 1896, but in 1952 it moved into its present seven-story location. Though the newest of the three, it has the largest collection, with over half a million items. Its collections basically continue where the Simancas Archives leave off, providing access to primary government records from the middle of the nineteenth century forward. The archives are also especially strong in church records, many dating from the eleventh century, as a result of the nineteenth century disentanglement.

Associations

In addition to the national professional associations described above, mention should be made of one of the most active regional associations, the Asociación de Archiveros de Castilla y León (Association of Archivists of Castile and Leon), ACAL (<http://www.acal.es>). Founded in 1991, it publishes the quarterly *Archivamos* and the annual *Tabula*.

Education

Five universities offer advanced degrees in archival science.



Fig. 3 Simancas Castle that houses the General Archives of Simancas. © Nani—Fotolia.com.

MUSEUMS AND MUSEOLOGY

Administration

Museums are administered by the Dirección General de Bellas Artes y Bienes Culturales (General Board of Fine Arts and Cultural Assets) under the Ministry of Culture.

About one-third are private, primarily ecclesiastical. The bulk of the public ones are administered locally.

There are about 1367 museums of all types; although art and archeology comprise the largest percentage, numerous smaller, specialized ones exist throughout the country. For example, in addition to five bullfight museums, Spain is one of a handful of countries in the world with museums devoted to such unique topics as instruments of torture and playing cards.

The two Autonomous Communities of Valencia and Castile-León have the largest percentages of museums, about 12% each.

Total staffing is over 11,500, the bulk of which is dedicated to administrative and professional personnel (43%).

Expenditures

Total expenditures for museums, both from national and regional sources, are 337 million euros, almost one-quarter of which (21%) goes to staffing.

Collections

Museums house a total of about 34.6 million items, an average of about 37,000 per museum. The largest subject area is natural sciences and natural history, with almost 14 million items (about 40% of the total).

User Services

Almost all (98%) are accessible to the public. Total visitors number around 49 million a year, with attendance at fine arts museums by far the highest of all categories (almost one-third). Less than half (44%) have a library; about the same number (46%) give guided tours. Only half (49%) have a Web page, though 70% have some degree of automation. Forty-two percent engage in some variety of educational activities, both for children and adults; about 30% host conferences.

Representative Museum Profiles

Museo Nacional del Prado (National Museum of the Prado)

Construction of the Prado began in 1785 under the direction of the architect Juan de Villanueva (1739–1811). On November 10, 1819 it opened its doors as the Real Museo de Pintura y Escultura (Royal Museum of Painting and Sculpture); it became the Museo Nacional del Prado (National Museum of the Prado) in 1869 (see Fig. 4).

The Prado is one of the premier art museums in the world, especially outstanding for its collection of pre-twentieth century Spanish art. Permanently on exhibit are such masterpieces as Diego Velázquez' (1599–1660) *La familia de Felipe IV, o Las Meninas* (The Family of Philip IV, or the Ladies-in-Waiting, 1656), Francisco de Goya's (1746–1828) *El 3 de Mayo de 1808 en Madrid* (May 3, 1808, 1814), and Hieronymus Bosch's (1450–1516) *The Garden of Early Delights* (ca. 1504). In addition to exhibition catalogs, the library publishes an annual bulletin. To deal with overflow, since 1971 the Casón del Buen Retiro has displayed late nineteenth and



Fig. 4 Prado Museum. © jzoran—Fotolia.com.

early twentieth century paintings in an annex that was originally Philip IV's (1605–1665) seventeenth century hunting lodge.

Museo Nacional Centro de Arte Reina Sofia (Queen Sofia Center of Art National Museum) (MNCARS)

The collections of the Queen Sofia pick up where those in the Prado leave off, covering twentieth century Spanish art. Built in 1992 in a remodeled hospital, it was named after the present queen, a devoted patron of the arts. Now permanently exhibited here is probably the museum's most famous work, Pablo Picasso's (1881–1973) politically charged antiwar masterpiece *Guernica* (1937), under constant surveillance. The museum also has outstanding collections by the Spanish surrealists Salvador Dalí (1904–1989) and Joan Miró (1893–1983) and cubist Juan Gris (1887–1927). An addition built in 2005 houses a library and auditorium. Like the National Library and the Prado, the director reports directly to the Minister of Culture.

Thyssen-Bornemisza Museum

The third art museum in the same Madrid neighborhood (in fact visitors can see all three on the same combined discounted ticket) is the Thyssen-Bornemisza, which opened in 1992 in the former nineteenth century Villahermosa Palace. The main foci of the 1000 items on display are early European painting and twentieth century works, thus complementing the holdings of the other two nearby museums. The collection contains works that were donated, first the private collection of Baron Hans Heinrich Thyssen-Bornemisza (1921–2002), and then

that of his widow, Carmen (b. 1943). The museum publishes an irregular *Boletín de Noticias* (News Bulletin).

Museu Picasso (Picasso Museum)

Located in Barcelona, the Picasso Museum contains one of the largest single collections (over 3500 early works) dedicated to the Spanish master, who lived in Barcelona during 1895–1904. In 1970 Picasso personally donated over 900 of his works. It opened in 1963 in the gothic Aguilar Palace; four other former palaces were added later. The museum publishes guides to the collection and exhibit catalogs.

Guggenheim Bilbao Museum

Another noteworthy art museum is the Guggenheim, which opened in 1997 in Bilbao, capital of the Basque province of Vizcaya. As the name implies, it is part of the distinguished Guggenheim pedigree. The stunning architectural masterpiece that is a work of art in itself was designed by the noted architect Frank Gehry (b. 1929). The specialty of the collections is twentieth century art. The museum publishes exhibition catalogs and books dealing with the museum.

Museo de El Greco (El Greco Museum)

On a smaller scale in size but certainly not artistic import is the El Greco Museum in Toledo. Established in 1911 in a former home of the artist, the museum exhibits in one place many of the outstanding works of the Toledan native. The nearby Church of Santo Tomé displays what is perhaps El Greco's finest work, *El entierro del conde de Orgaz* (The Burial of Count Orgaz, 1586).

Museo Arqueológico Nacional (National Archeological Museum)

Founded by Queen Isabel II in 1867 in Madrid, this museum is probably the most notable archeological museum in the country. Its extensive time range runs from the Paleolithic era forward. Its most noteworthy single object is the Iberian stone sculpture, the Dama de Eche (c. 475 BCE), but the replica of the ceiling of the caves of Altamira with the prehistoric animal drawings is also a highlight. The museum publishes an annual bulletin.

Museo Nacional de Antropología. (National Anthropological Museum)

Located in Madrid, the Museum of Anthropology, Ethnology and Prehistory was founded in 1910 during the reign of King Alphonse XIII. Its present status came about as a merger in 1993 of the Museo Nacional de Etnología (National Ethnological Museum) and the Museo Nacional del Pueblo Español (National Museum of the Spanish People); in 2004 it split off again but kept its current name. The strength of this museum lies in the collections of objects from the former Spanish colonies, especially skulls, mummies, and skeletons. The museum publishes exhibition catalogs as well as *Anales* (Annals).

Real Jardín Botánico (Royal Botanical Garden)

Founded in 1755 by Ferdinand VI, it moved into its present location near the Prado in 1781. Now part of the CSIC, it is noteworthy for both its extensive grounds and greenhouses as well as the botanical research conducted there. Its library of over 30,000 volumes, some of which are of great historical interest, is one of the finest in the field of botany. The garden publishes a biennial *Anales* (Annals).

Associations

In addition to the national and regional professional associations described above, mention should be made of two independent associations. The Asociación Española de Museólogos (Spanish Association of Museologists), AEM (<http://www.museologia.net>), was founded in 1993; it publishes a newsletter and the trimestral *Revista de Museología* (Museology Review). The Asociación de Casas-Museo y Fundaciones de Escritores (Association of House-Museums and Foundations of Writers), ACAMFE (<http://www.acamfe.org>), was founded in 1993; its membership consists of 52 houses and museums associated with Spanish literary and intellectual history.

Education

Three universities offer graduate degrees in museology.

CONCLUSION

In the 30 plus years since democracy has been restored in Spain, libraries, archives, and museums have made great strides in catching up with their continental neighbors. Expenditures, collections, and use of services are increasing in all libraries, with usage of electronic resources clearly leading the pack. The government has made a concerted effort to support institutions of higher education, public libraries, and museums; school libraries and some of the smaller special libraries are not so fortunate, though their situation is improving. Automation of collections and widespread access to the Internet are also a national priority. Digitization efforts are being seriously undertaken at the national and regional level to preserve the country's rich cultural heritage. Many libraries contain priceless manuscripts and other resources unequaled and unavailable elsewhere. Universities have implemented degreed programs in librarianship, archives, and museology. Libraries are beginning to appreciate the value of cooperation through the creation of networks that facilitate the sharing of resources and technology. Members have found an effective voice through their participation in professional associations, at both the federal and local level.

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Special Collections

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Abstract

Special collections and manuscripts are discussed as an area of professional library practice, a subset of library materials encompassing rare books, archives, manuscripts, and any other materials handled outside of mainstream library work, and an institutional structure within libraries. Aspects of materials that make them eligible for special collections are outlined. The history of special collections, rare book rooms, and archives is briefly discussed, along with a brief history of professional special collections librarianship. Trends in modern special collections are described, emphasizing the uses of special collections in academic research libraries in the United States. Common professional practices and career paths for special collections' professionals, along with necessary skills, knowledge, and education for modern special collections work are also discussed.

INTRODUCTION

Special collections and manuscripts are discussed, both as an area of library practice and as a subset of library materials. The history of special collections and manuscripts in American libraries is discussed, along with the history of the profession of special collections and manuscripts librarianship. Major professional organizations and their influence on the field are noted. Trends in special collections librarianship are discussed, along with core competencies and skills necessary for special collections work. All references to "books" may be understood to include alternative materials formats that may also live in special collections. Special collections as a term is used in the modern sense, encompassing rare books, archives, manuscripts, and any other materials handled outside the mainstream activities of a research library.

DEFINITIONS

What Are Special Collections?

Special collections is a broad term for groupings of library materials that are handled separately from regular, circulating library collections, because of age, scarcity, market value, subject matter, condition, or physical format. We tend to think of special collections as rare books, manuscripts, and archives first, but special collections include many formats, including maps, games, original works of art, realia (nonbook objects, such as furniture, weaponry, or locks of hair), textiles, audiovisual materials, and digital materials, many of which are acquired in tandem with books, archives, and manuscripts as part of a dedicated collection. Area Studies collections (or portions of Area Studies collections) are also occasionally included under

the broader umbrella of special collections, particularly when the materials collected require additional care and security.

The field of librarianship that includes the skills, knowledge, and education necessary to adequately service unusual materials is also referred to as special collections work. "Special collections" is often included in the name of departments that handle these materials. These departments (and at some institutions, stand-alone libraries) often have rules for accessing their materials that differ from the rest of the library. Special collections are generally noncirculating collections with requirements for reader registration. Unlike circulating collections, which often delete circulation records to protect user privacy, special collections typically track the use of materials and maintain those records as a long-term security measure. Ink pens, along with food and drink, are generally banned to prevent damage to materials. Coats, bags, and, in some cases, file folders and notebooks are also disallowed to discourage accidental or intentional theft. Users are encouraged to use pencils and notepaper, laptop computers, mobile devices, and occasionally cameras and/or scanners instead while using special collections materials. To protect the integrity of the bindings of books in use, patrons are often supplied with foam wedges or other book supports, along with light weights to help hold books open without leaning on them. White cotton gloves, however, unless readers are specifically working with photographs, are no longer typically in use, as they may snag and tear paper-based materials, and are difficult to keep clean. For materials that themselves have significant dust or damage, latex or nitrile gloves may be offered for use instead.

Special collections exist in all shapes and sizes, varying in budget, depth, and focus. Examples of more narrowly defined special collections include small collections of local history materials at a small-town public library, or

the archives department of a community or 4-yr undergraduate college. Large stand-alone research and independent libraries devoted to special collections include the Beinecke Library at Yale University, the Rare Books Division of the Library of Congress, the Houghton Library at Harvard University, the Harry Ransom Center at the University of Texas-Austin, the Getty Research Center, the American Antiquarian Society, and the Newberry Library in Chicago. Between these two extremes, colleges and universities across the country, large urban public libraries, corporate archives, historical societies, and museums host special collections departments that serve their respective constituencies, while often providing research materials for the public at large.

What Is a Manuscript?

The term “manuscript” has meanings that have multiplied over time and across changing formats. The first meaning, taken directly from Latin, is simply “written by hand.” “Manuscripts” can also refer to illuminated pages from the medieval era; longhand drafts of poems, stories, speeches, and novels; personal journals; and handwritten grocery lists. “Manuscript” also describes original materials, either handwritten or produced on a typewriter or computer, created by a writer, often with the intent of publication.^[1] In the era of the personal computer, “manuscript” can refer to not only any and all versions of original digital files created by an author, but also the printed out, copyedited version of that file once it returns to the author from the editor. Codicology, the study of bound manuscripts (“codexes”), particularly from the medieval period, is often conducted in concert with paleography (studying the handwriting used on the manuscript), along with the study of decorations’ illustrations added by hand. Christopher de Hamel has produced numerous books that discuss the history and production of illuminated manuscripts in greater detail. Manuscripts produced after the medieval period are also studied by historians and bibliographers, who use the tools of textual editing and analytical bibliography to reconstruct the life cycle of particular literary or historical works, from notes to published product, often working to create a complete or correct text (although the debate over what constitutes “complete” or “correct” is, in many scholarly circles, still under discussion). G. Thomas Tanselle and Jerome McGann, along with D. F. McKenzie, have produced a prodigious amount of scholarship on this topic, following in the footsteps of Fredson Bowers, R.B. McKerrow, and Philip Gaskell; much of the scholarship in this area is documented in the journals *Studies in Bibliography* and *TEXT*. As texts that would have traditionally been paper-based are increasingly born-digital, a new set of skills for their study, long-term care, and use, such as digital forensics and digital preservation, are increasingly necessary.

What Makes an Item or a Collection “Special”?

Special collections at individual institutions are formed using internally developed collection development policies. While these policies will differ from institution to institution—what’s “rare” to one institution may be quite common to another—special collections materials in libraries do tend to share some common characteristics, with the preservation of artifactual integrity playing an overarching role. The Rare Books and Manuscripts Section (RBMS) of the American Library Association (ALA), along with the Antiquarian Booksellers’ Association of America, has produced a brochure, “Your Old Books,” that provides an overview of how materials are judged for inclusion in special collections. The Society of American Archivists (SAA) features brochures on donating both personal papers and organizational papers to repositories.^[2]

Age

Old books often form the core of special collections, particularly when books are being initially selected from among circulating library collections. While age is not always the sole criterion for acquisition, library users and library staff recognize it as the most often easily recognizable (and logical) factor for why an item would be placed in special collections rather than allowed to circulate. There are some age guidelines that are quite common among special collections, particularly for published books: books published anywhere in the world before 1800, in the United States before 1865, and west of the Mississippi River before 1890 are usually candidates for special collections acquisition. Regionally or nationally based collections will often set additional guidelines, based upon the dates for the introduction of printing to the pertinent locale.

Market value

Materials that have significant market value nearly always end up in special collections to protect them from theft. The more security-conscious use policies of most special collections departments assure that expensive materials purchased with library or donor funds will remain in the library as intended. Placing expensive materials in special collections also may reduce the wear and tear of daily use, ensuring the longevity of the library’s long-term investment.

The market for special collections materials can be volatile, with particular subject areas or authors moving in and out of fashion, and prices fluctuating accordingly. The two biggest factors for determining the market value of any given book are its physical condition and how many people or institutions are competing against each other to own it. Truly scarce materials are often more expensive than less scarce materials, but not always, if

there is little market interest. Aspects of the physical book that may also affect its market value include its provenance (who owned it previously), markings in the book (is it signed by the author or illustrator?), and the presence or absence of dust jackets, particularly with modern first editions. Market value for books can also vary by where on the market the book is sold, whether at auction, through antiquarian booksellers, from private individual to private individual, through estate sales or used book stores, or through bookselling or broader sales and exchange websites. Any of these sales may take place in person, over the telephone, or through the web.

Provenance

Items are often placed in special collections because of their provenance, the history of the previous owners of the item. If a book was owned or used by someone famous, or infamous, the market value of that item may be greater than if its previous owner was not well-known. Markings made by previous owners, bookplates placed in the book, and binding choices made by previous owners may all provide reason to place an item in special collections. Some items become “special” because of their presence in famous collections, past and present. Other items become special because they were used by famous writers for specific purposes. For example, books owned by Sylvia Plath, including her dictionary, are part of the Sylvia Plath Collection at Smith College. That dictionary, a commercial edition from her time in college, has special value solely because it was owned and annotated by Plath.

Provenance is also particularly important for “high-spots” (expensive, culturally iconic items) such as Shakespeare First Folios, Gutenberg Bibles, The Ellesmere Chaucer manuscript (now held at the Huntington Library in California), Old Master drawings held at the Rosenbach Library and Museum in Philadelphia, or Burmese manuscripts held at Northern Illinois University. Items that cannot prove a clean provenance through an unbroken chain of ownership may have been stolen at some point in their existence. This can create headaches for auction houses, buyers, and sellers of expensive items as legitimate previous owners come forward to protest the sale of an item that was illegally taken from them and demand restitution. The 200-year-old discussion between the Greek and British governments over the Elgin Marbles, currently held at the British Museum, illustrates the thorny issues that occur when there is a dispute over an item’s provenance.^[3]

Format

Materials not in book format that require special handling and storage, such as archival materials, manuscripts, maps, and audio–visual materials, often end up in special collections. Having one department handle “unusual”

formats frees up library staff to process books for the main collections more efficiently than staff that must move from process to process based upon the format of the item in hand. Books more likely to be damaged through circulation, such as books with moving parts or significant numbers of maps or illustrations, are also likely candidates.

Some books are produced specifically for special collections, such as artists’ books, *livres d’artistes*, and private press books. Artists’ books use the book format to create a work of art, integrating all aspects of the book (type, paper, binding, illustration) into the artistic process, as a painter uses canvas, brush, paint, and framing to make a completed piece. Some artists create unique books, while others work in small runs of duplicates, creating anywhere from five to fifty copies of a particular piece, in keeping with the nature of the format. *Livres d’artistes* include original graphic art, often produced by famous artists such as Picasso, as illustrations to a text, but the illustrations are created separately from the whole book. Private presses may issue one or both kinds of these books; but many others focus instead on the act of letterpress printing, typographic design, and keeping particularly scarce texts, such as poetry, in print. Private presses often aim for a slightly wider distribution of their work, often printing anywhere from 100 to 1000 copies of a particular title for sale.

Subject matter

Many, if not most, individual special collections are formed around some kind of unifying subject theme, or different groups of themes, which vary from library to library. Most libraries hold groups of sometimes disparate collections that may or may not relate to one another in anything other than their need for special handling. The selected subject(s) may include particular author(s) (i.e., Gertrude Stein, James Weldon Johnson, Isaac Asimov, Audre Lorde, William Blake), organizations (individual corporations, churches, or departments at a university), types of materials (cookbooks, trade catalogs, sheet music, children’s books, broadsides, dime novels) or specific topics, such as viticulture, women’s history, poetry, dance, chemistry, law, or architecture. Politically volatile and sexually explicit materials are also more likely to be held in special collections for safekeeping because of the greater chance of their being mutilated or stolen by readers that disagree with their content.

Scarcity

When only a few extant copies of a book remain, or an item is unique, it makes sense to care for those materials differently than perhaps might be done with readily available materials, placing them in special collections to keep them from being destroyed by extensive handling. Artists’ books, private press materials, limited editions, and the

like often create scarcity because they are produced in limited numbers. Commercial publishers, particularly around the turn of the nineteenth century, often created “limited editions” of collected works of particular authors with ornate, matched bindings. This artificially created scarcity marks them among collectors as valuable and worth saving, ensuring the survival of individual copies. Everyday materials produced en masse, such as newspapers, broadsides, and paperback books, do not typically survive in such large numbers over time because individual owners deem them disposable. For historians interested in documenting quotidian life, this presents a dilemma, since primary materials for their research are, in some cases, more difficult to locate than materials already deemed “important” through contemporary marketing or criticism.

Condition

Placing fragile materials in special collections for safekeeping helps to extend their natural lifespan as original artifacts. Materials that do not circulate are less likely to be damaged through rough or continuous use. Patrons who use materials in a special collections setting handle them more carefully because of their “special” status. Additionally, removing fragile items from the circulating collection removes them from ready access; although they remain accessible, they are accessed less often in a special collections setting than sitting on a shelf in the circulating collection. Condition is also a preservation concern; to avoid contamination of other materials in the collection, materials that are moldy or mildewed should not be accepted into special collections if at all possible. Excessively fragile, brittle items require additional care in handling and storage and may require additional limitations on use, such as required use of surrogates, either photocopies or electronic.

While professional repair by a trained conservator can prolong the useful life of books that have been damaged, those books are no longer as close to their original state as books that have not had intervention. Condition, including the absence or presence of dust jackets for modern first editions, is paramount on the book-collecting market and drives the price for any given book. For the library market, depending upon collecting priorities, it may occasionally prove more advantageous, both for the collection and its resources, to acquire a gently used, less-expensive particular copy of a title, than none at all while holding out for a pristine but more expensive copy.

HISTORY AND PURPOSE

Foundations of Special Collections (through the 1980s)

While special collections, in the sense of materials handled separately from main collection materials, have

existed since the library at Alexandria, the term “special collections” dates back at least to the 1940s; libraries tended to maintain “rare book rooms” separate from manuscripts and institutional archives, with each earning its own issue of the journal *Library Trends*.^[4]

Through the 1950s and 1960s, the special collections work focused on efficiently managing, organizing, and building collections, and how to distinguish one institution from another. From the 1970s through the 1990s, the profession emphasized library automation and physical preservation of rapidly deteriorating materials, as well as on theft prevention and security.^[5] The broader term was in common parlance in the library literature of the 1980s, reflecting the growth, merger, and development of larger, more comprehensive departments that handle unusual materials over the previous three decades.^[6]

The 2006 merger of the National Library of Canada and the National Archives of Canada, now combined to form the National Library and Archives of Canada, provides a recent example of this trend.^[7] The terminology change, incorporating “rare books,” “manuscripts,” and “archives” under “special collections,” was most recently codified through the RBMS of the Association for College and Research Libraries (ACRL), a division of the ALA. RBMS uses the term “special collections” and “special collections professionals” in their most recent guidelines submitted to ACRL, where they once used “rare books, manuscripts, and other special collections.”^[8]

The vast majority of special collections are tied to a parent institution: a university, a college, a city or town, a corporation. Special collections departments tied to institutions often began as “treasure rooms” or “rare books rooms” where particularly expensive or valuable volumes were kept under tighter supervision than items in the circulating collection, closely guarded by librarians, and handled only by distinguished, vetted visitors. This image of special collections persists, despite concerted efforts by the profession to dispel it. As special collections grew and evolved, the mission of the departments expanded, often in relation to resources provided by the “parent” institution, individual donors, or external funding agencies.

A few independent special collections libraries, such as the Morgan Library in New York, began as personal collections, later shared with the public through a philanthropic donation.^[9] Other independent libraries became more special as their collections aged. When the Library Company of Philadelphia was established by Benjamin Franklin in 1733, it was a circulating subscription library. The books, imported from England, were not particularly rare in the modern sense, although they were too expensive to be acquired by most individuals. The library was originally designed to be a working collection of reference works for subscribers, who were often merchants and working men. As the collection aged, however, the materials became more scarce and valuable for historical

research, and the modern version of the Library Company, although it retains its subscribers as donors, is an independent research library with a focus on American history and culture.^[10] Many special collections now actively collect subsets of contemporary materials, developing deep collections that will become more special as they age.

Special Collections in the Contemporary Era (1990s–Present)

Modern special collections in the United States no longer serve only as “treasure rooms,” collecting and holding particularly valuable materials securely for posterity and making them available to select scholars, or as storage areas for archives accessible to no one but the staff archivist. The possible audience for primary materials has been significantly expanded; both the SAA and the ALA recognized the importance of this expansion, issuing an initial joint statement of “Guidelines for Access to Original Research Materials” in 1994, revised in 2009.^[11] Regardless of the parent institution’s funding source (public, private, or some combination of the two), modern special collections now typically have a strong public service component at the core of their mission, educating the public about their materials through programs, exhibitions, publications, group and class visits, and digital projects. Just as libraries have limited resources and cannot be all things to all users, those responsible for special collections may find that they have to be selective about the types of public programming provided. For many departments, the continuing development of resources through fund-raising and grant-writing is also an integral part of special collections work. Digitization projects, a growing portion of the contemporary special collections landscape since the 1990s, have often been funded through grants. Future grant opportunities may also include projects to appropriately preserve digital special collections materials for long-term use.

Public programs and performances

Public programs, for many special collections, are an excellent way to reach out to communities beyond the small number of researchers interested in any given collection. Scholarly talks, live historical interpreters, literary readings, performances of music or plays held in the collections, and creative activities (such as crafts based upon items in the collection) emphasize the continuing relevance of the original artifacts to contemporary life. Public programs also raise the profile of the department and institution hosting the event.

Exhibitions and publications

Exhibitions of special collections materials allow for endless interpretation and reinterpretation of the artifacts

involved. Rotating exhibits can showcase particular items, while safeguarding materials by limiting their exposure to light. Loaning to or borrowing from other special collections can extend local collections and draw new patrons to view larger, more robust exhibits. Akin to museum programs for exhibit loans, RBMS has endorsed guidelines for borrowing and lending exhibit materials.^[12] Exhibitions need not be exclusively site-based; many special collections also provide online access to their exhibits, or leverage online exhibits to expand upon what can be shown in person.

Libraries may also provide enduring access to materials through publications such as exhibit catalogs, bibliographies, and collection guides. The Katharine Kyes Leab & Daniel J. Leab American Book Prices Current Exhibition Awards are presented annually by RBMS in recognition of excellence in exhibit catalog work, both paper-based and electronic.^[13] While published bibliographies and collection guides may become outdated for special collections that continue to be developed, these publications can provide a snapshot of collections at given moments in time, particularly if they document major acquisitions. Exhibition catalogs based in single, comprehensive collections related to particular topics may also become standard reference works for the field.

Teaching and research

Contemporary special collections departments in the United States typically maintain a vigorous program of teaching and research. Digital facsimiles of special collections materials have become ubiquitous in teaching and research through numerous digital projects, allowing students and professors access to materials that would otherwise be inaccessible in person. Despite the usefulness of digital surrogates, particularly for laying academic groundwork for projects and making side-by-side comparisons in teaching, the surrogates cannot replace hands-on work with primary materials. Unique historical objects have physical characteristics that cannot be fully transferred to the digital realm. The conditions under which an item is produced influence its physical aspects and tell us its own history. Particular inks and paint color formulations used in medieval manuscript production, the feel of the “bite” of type when printing on vellum as opposed to paper, and the smell of “signature” glue that may identify a master bookbinder cannot be meaningfully replicated online. Physical characteristics of a particular artifact can only be fully integrated into its study when the artifact is physically present; without access to the original artifact, the story of that particular item is incomplete.

Classroom visits to special collections provide an important countermeasure to the digital world, grounding students in the physical realities and context of the original materials from which digital objects are drawn. This is particularly important as we continue to experience the

aftereffects of mass digitization projects. Despite massive amounts of money, scanning, and bandwidth, it is unlikely that each and every book ever produced will be digitized, especially for materials placed in special collections because they didn't adhere as well to the specifications for a modern codex. It is unlikely that every set of archival records, three-dimensional artists' book, oversized atlas, or book with moving parts will be scanned. No cuneiform tablet, papyrus scroll, lap-desk, fountain pen, printing press, typewriter, or computer hard drive used for writing books in special collections will be sufficiently represented in digital form to replace the original.

There is a long tradition of scholarly research among special collections professionals, both based on the collections for which they are responsible, and in areas of their own intellectual interest. Whether they serve as faculty or as academic professionals at their own institutions, curators, catalogers, and archivists research collections for which they are responsible, add to them judiciously, document them for researchers through catalogs and bibliographies, and interpret them clearly for visitors. Scholarly research can also lead to better integration with teaching faculty at academic institutions, opening up the possibility for joint publications and collaboration on grant projects.

Public and scholarly access to special collections materials has grown through cooperative cataloging initiatives and web-based archival finding aids, but providing accurate, comprehensive information about special collections is still a challenge. In 2003, the Association of Research Libraries held a conference on the subject, which resulted in a white paper, an initiative to generate funding for "Exposing Hidden Collections," and an issue of *RBM* devoted to the topic.^[14] From 2008 to 2014, the Council on Library and Information Resources sponsored a series of grants to enhance the discovery of hidden collections.^[15]

Fund-raising and grant-writing

As library budgets have remained flat or dwindled, and the cost of library resources, particularly electronic journal databases, has increased in increments well exceeding inflation, fund-raising has become an integral part of special collections work for many professionals. Grant-writing has been a significant source of funding for special collections, particularly in providing access to materials already held. Many, if not most, early grant-funded digitization projects involved special collections materials. Many special collections departments also work closely with library friends groups, often providing tours and programming about their precious and unique materials to potential donors. In some cases, the library's friends group will be administered through the special collections department as well, particularly if there is no dedicated library fund-raising staff. Special collections is often a recipient of donations from friends groups, since a

common mission for friends is to purchase materials for the library that are too expensive for library budgets. Friends of the library may, in turn, become donors of in-kind special collections materials or financial support through endowments that support special collections acquisitions or preservation.

Security, preservation, and posterity

In addition to collection development work and public service, many special collections also provide additional security for high-risk items through vault storage and additional physical monitoring of materials use. Preservation and conservation of library materials is often part of the special collections mission. Larger special collections departments may have preservation and conservation professionals on-staff. Departments that do not have preservation staff on-site often still provide basic preservation advice to the library and the public, as well as referrals to local conservation professionals when necessary.

Special collections play a role in securing posterity for materials, both through preservation and security practices and through collection development choices. Careful collection development is paramount, as selection may indeed dictate the long-term survival of some contemporary, particularly ephemeral, materials. Materials selected for special collections placement are far more likely to survive longer, because they are more gently handled, accessed less frequently, and stored in more optimal conditions than in the main stacks.

SPECIAL COLLECTIONS IN PRACTICE

The Special Collections and Manuscripts Professional

Given the multitude of library tasks performed in a special collections setting, special collections professionals require a diverse skill set. Both the RBMS of the ALA and the SAA have produced guidelines that delineate core competencies for special collections professionals.^[16] While each special collections professional may not need every single skill noted in these documents, they do provide an exhaustive listing of necessary skills for special collections professionals over the course of a career.

Core professional requirements

In addition to a bachelor's degree, positions in special collections at the entry level generally require an ALA-accredited master's degree in library and/or information science, SAA certification, or an advanced degree at the master's level in public history or a similar academic discipline. More advanced professional positions,

particularly in libraries that maintain faculty rank for their librarians, may require an additional advanced degree in a subject specialization, either at the master's degree or doctoral level, depending upon the position and the institution in question.

Strong communication skills are essential in special collections. Only the largest special collections have internal staff dedicated to particular job functions such as technical services; many special collections professionals will find themselves working closely with technical services departments in their libraries, integrating workflow for special materials with those from the circulating collections. Modern special collections' outreach duties may include not only class visits, working with patrons and donors, and exhibitions, but also engaging with online patrons through the departmental presence on social media, highlighting individual items, collections, and events. Special collections professionals with acquisitions responsibilities must also work closely with a wide range of other professionals: book dealers, collectors, and, often, the creators of the works in question (authors, artists, etc.). Because these close working relationships always have the potential to produce conflicts of interest, both RBMS and SAA provide statements of professional ethics for special collections professionals.^[17] Communication skills are especially important for those special collections professionals that also include fund-raising work in their job descriptions. Foreign languages are a significant asset in special collections work. Many special collections materials, particularly in rare book collections, are in languages other than English. (Significant numbers of books produced in Europe during the hand-press period were published in Latin, German, or French, for example). Some special collections are formed around area studies, collecting materials from particular geographic areas such as Southeast Asia or the Middle East. Linguistic ability in relation to collections served is crucial for both building the collection in question, and serving the readers that use it.

Every special collection is unique to its institution, and gaining knowledge of the collections is a central part of special collections work. Public service special collections professionals often serve as the interlocutor between researchers and the collections that they serve. Most special collections are closed-stack areas, with access restricted to authorized staff. While the scholarly discovery method of browsing the shelves in the hopes of serendipity is available in a special collections setting, it often requires an authorized staff member to be present with the patron. Public service and curatorial professionals often have the responsibility of interpreting aspects of the collections to users through classroom or group presentations and exhibit work. Cataloging professionals that work with special collections need collection knowledge to accurately integrate new materials; the

same holds true for those professionals with archival processing responsibilities.

Another particularly useful "foreign language skill" for special collections professionals, descriptive and analytical bibliography, uses formulae to describe the physical aspects of a book. This physical description of books requires some knowledge of the history of the book, including the history of the different technologies that make up the physical object: printing, typesetting and typesetting, bookbinding, and papermaking. A basic understanding of how to preserve paper-based materials, and materials in other formats as dictated by the collections served, is also required. In the modern special collections era, an understanding of the digital realm is also an essential skill set, not only for communicating effectively with colleagues, and making currently held materials more widely accessible, but also for participating in the long-term preservation of born-digital materials, particularly when charged with collecting contemporary materials produced after personal computing became widespread. Many of the special collections-specific skills described here can be acquired through classes in library and information science programs, through internships or practicum experiences in special collections departments, or through attendance at Rare Book School in Charlottesville, VA (which offers classes at satellite locations across the United States and in Europe).^[18] Other professional development opportunities in particular topics are routinely offered through both RBMS and SAA, both nationally and regionally.

CONCLUSION: THE FUTURE OF SPECIAL COLLECTIONS

Special collections work has undergone significant changes since the formation of rare book rooms in the 1930s, with growth, consolidation, and a significant shift to accessing collection surrogates digitally. Daniel Traister suggested in his 2000 polemical essay on the future of special collections that to survive special collections professionals need to fundamentally change our approach, moving from guarding treasured materials from public abuse to making special materials as widely available as possible.^[19] This shift continues with the advent of Web 2.0 tools, which advocate user-generated content as an integral part of the digital experience of any artifact.^[20] The Association of Research Libraries sees special collections as a core ingredient in the research library of the future, codified in their Statement of Principles on Special Collections.^[21] While the shift in attitudes has already begun in the profession, it remains to be seen whether the significant financial resources necessary to remain relevant in the digital age, both through continuing acquisitions and digitization, will be forthcoming.^[22]

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Special Collections and Manuscripts

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Abstract

Special collections and manuscripts are discussed as an area of professional library practice, a subset of library materials encompassing rare books, archives, manuscripts, and any other materials handled outside of mainstream library work, and an institutional structure within libraries. Aspects of materials that make them eligible for special collections are outlined. The history of special collections, rare book rooms, and archives is briefly discussed, along with a brief history of professional special collections librarianship. Trends in modern special collections are described, emphasizing the uses of special collections in academic research libraries in the United States. Common professional practices and career paths for special collections professionals, along with necessary skills, knowledge, and education for modern special collections work are also discussed.

INTRODUCTION

Special collections and manuscripts are discussed, both as an area of library practice and as a subset of library materials. The history of special collections and manuscripts in American libraries is discussed, along with the history of the profession of special collections and manuscripts librarianship. Major professional organizations and their influence on the field are noted. Trends in special collections librarianship are discussed, along with core competencies and skills necessary for special collections work. All references to “books” may be understood to include alternative materials formats that may also live in special collections. Special collections as a term is used in the modern sense, encompassing rare books, archives, manuscripts, and any other materials handled outside of the mainstream activities of a research library.

DEFINITIONS

What Are Special Collections?

Special collections is a broad term for groupings of library materials that are handled separately from regular, circulating library collections, because of age, scarcity, market value, subject matter, condition, or physical format. We tend to think of special collections as rare books, manuscripts, and archives first, but special collections include many formats, including maps, games, original works of art, realia (nonbook objects, such as furniture, weaponry, or locks of hair), textiles, audiovisual materials, and digital materials, many of which are acquired in tandem with books, archives, and manuscripts as part of a dedicated collection. The field of librarianship that includes the skills, knowledge, and education necessary to adequately

service these unusual materials is also referred to as special collections work. “Special collections” is often included in the name of departments that handle these materials. These departments (and at some institutions, stand-alone libraries), often have rules for accessing their materials that differ from the rest of the library. Special collections are generally noncirculating collections with requirements for reader registration. Unlike circulating collections, which often delete circulation records to protect user privacy, special collections typically track the use of materials and maintain those records as a long-term security measure. Ink pens, along with food and drink, are generally banned to prevent contact with materials. Coats, bags, and, in some cases, file folders and notebooks are also disallowed to discourage accidental or intentional theft. Users are encouraged to only use pencils and notepaper or laptop computers while using special collections materials. To protect the integrity of the bindings of books in use, patrons are often supplied with foam wedges or other book supports, along with light weights to help hold books open without leaning on them. White cotton gloves, however, unless readers are working with photographs, are no longer typically in use, as they may snag and tear paper-based materials.

Special collections exist in all shapes and sizes, varying in budget, depth, and focus. Examples of more narrowly defined special collections include small collections of local history materials at a small town public library, or the archives department of a community or 4 year undergraduate college. Large stand-alone research and independent libraries devoted to special collections include the Beinecke Library at Yale University, the Rare Books Division of the Library of Congress, the Houghton Library at Harvard University, the Harry Ransom Center at the University of Texas-Austin, the Getty Research Center, the American Antiquarian Society, and the Newberry

Library in Chicago. Between these two extremes, colleges and universities across the country, large urban public libraries, corporate archives, historical societies, and museums host special collections departments that serve their respective constituencies, while often providing research materials for the public at large.

What Is a Manuscript?

The term manuscript has meanings that have multiplied over time and across changing formats. The first meaning, taken directly from the Latin, is simply “written by hand.” “Manuscripts” can also refer to illuminated pages from the medieval era; longhand drafts of poems, stories, speeches, and novels; personal journals, and handwritten grocery lists. “Manuscript” also describes the original materials, either handwritten, or produced on a typewriter or computer, created by a writer, often with the intent of publication.^[1] In the era of the personal computer, “manuscript” can refer to not only any and all versions of original digital files created by an author, but also the printed out, copyedited version of that file once it returns to the author from the editor. Codicology, the study of bound manuscripts (“codexes”), particularly from the medieval period, is often conducted in concert with paleography (studying the handwriting used on the manuscript), along with the study of decorations illustrations added by hand. Christopher de Hamel has produced numerous books that discuss the history and production of illuminated manuscripts in greater detail. Manuscripts produced after the medieval period are also studied by historians and bibliographers, who use the tools of textual editing and analytical bibliography to reconstruct the life cycle of particular literary or historical works, from notes to published product, often working to create a complete or correct text (although the debate over what constitutes “complete” or “correct” is, in many scholarly circles, still under discussion). G. Thomas Tanselle and Jerome McGann, along with D.F. McKenzie, have produced a prodigious amount of scholarship on this topic, following in the footsteps of Fredson Bowers, R.B. McKerrow, and Philip Gaskell; much of the scholarship in this area is documented in the journals *Studies in Bibliography* and *TEXT*. As texts that would have traditionally been paper-based are increasingly born digital, a new set of skills for their study, care, and use will be necessary.

What Makes an Item Or a Collection “Special”?

Special collections at individual institutions are formed using internally developed collection development policies. While these policies will differ from institution to institution—what’s “rare” to one institution may be quite common to another—special collections materials in libraries do tend to share some common characteristics, with the preservation of artifactual integrity playing an overarching role. The Rare Books and Manuscripts

Section (RBMS) of the American Library Association (ALA), along with the Antiquarian Bookseller’s Association of America (ABAA), has produced a brochure, “Your Old Books,” that provides an overview of how materials are judged for inclusion in special collections.^[2]

Age

Old books often form the core of special collections, particularly when special collections are being initially separated from circulating collections. While age is not always the sole criteria for acquisition, it is the most often easily recognizable (and logical) factor for library users and library staff that explains why an item would be placed in special collections rather than be allowed to circulate. There are some age guidelines that are quite common among special collections, particularly for published books: books published anywhere in the world before 1800, in the United States before 1865, and west of the Mississippi River before 1890 are usually candidates for special collections acquisition. Regionally or nationally based collections will often set additional guidelines, based upon the dates for the introduction of printing to the pertinent locale.

Market value

Materials that have significant market value nearly always end up in special collections to protect them from theft. The more security-conscious use policies of most special collections departments assure that expensive materials purchased with library or donor funds will remain in the library as intended. Placing expensive materials in special collections reduces the wear and tear of daily use, ensuring the longevity of the library’s long-term investment.

The market for special collections materials can be volatile, with particular subject areas or authors moving in and out of fashion, and prices fluctuating accordingly. The two biggest factors for determining the market value of any given book are its physical condition and how many people or institutions are competing against each other to own it. Truly scarce materials are often more expensive than less scarce materials, but not always, if there is little market interest. Aspects of the physical book that may also affect its market value include its provenance (who owned it previously), markings in the book (is it signed by the author?), and the presence or absence of dust jackets, particularly with modern first editions. Market value for books can also vary by where on the market the book is sold, whether at auction, through antiquarian booksellers, from private individual to private individual, through estate sales or used book stores, or through bookselling or broader sales and exchange Web sites. Any of these sales may take place in person, over the telephone, or through the Web.

Provenance

Items are often placed in special collections because of their provenance, the history of the previous owners of the item. If a book was owned or used by someone famous, or infamous, the market value of that item may be greater than if its previous owner was not well-known. Markings made by previous owners, bookplates placed in the book, and binding choices made by previous owners may all provide reason to place an item in special collections. Some items become “special” because of their presence in famous collections, past and present. Other items become special because they were used by famous writers for specific purposes. For example, books owned by Sylvia Plath, including her dictionary, are part of the Sylvia Plath Collection at Smith College. That dictionary, a commercial edition from her time in college, has special value solely because it was owned and annotated by Plath.

Provenance is also particularly important for high-spot items such as Shakespeare First Folios, Gutenberg Bibles, The Ellesmere Chaucer manuscript (now held at the Huntington Library in California), Old Master drawings held at the Rosenbach Library and Museum in Philadelphia, or Burmese manuscripts held at Northern Illinois University. Items that cannot prove a clean provenance through an unbroken chain of ownership may have been stolen at some point in their existence. This can create headaches for auction houses, buyers, and sellers of expensive items as legitimate previous owners come forward to protest the sale of an item that was illegally taken from them and demand restitution. The 200 year-old discussion between the Greek and British governments over the Elgin Marbles, currently held at the British Museum, illustrate the thorny issues that occur when there is a dispute over an item’s provenance.^[3]

Format

Materials not in book format that require special handling and storage, such as archives, manuscripts, maps, and audiovisual materials, often end up in special collections. Having one department handle “unusual” formats frees up library staff to process books for the main collections more efficiently than staff that must move from process to process based upon the format of the item in hand. Books more likely to be damaged through circulation, such as books with moving parts or significant numbers of maps or illustrations, are also likely candidates.

Some books are produced specifically for special collections, such as artists’ books, *livres d’artistes*, and private press books. Artists’ books use the book format to create a work of art, integrating all aspects of the book (type, paper, binding, illustration) into the artistic process, as a painter uses canvas, brush, paint, and framing to make a completed piece. Some artists create unique books, while others work in small runs of duplicates, creating

anywhere from 5 to 50 copies of a particular piece, in keeping with the nature of the format. *Livres d’artistes* include original graphic art, often produced by famous artists such as Picasso, as illustrations to a text, but the illustrations are created separately from the whole book. Private presses may issue one or both kinds of these books; but many others focus instead on the act of letterpress printing, typographic design, and keeping particularly scarce texts, such as poetry, in print. Private presses often aim for a slightly wider distribution of their work, often printing anywhere from 100 to 1000 copies of a particular title for sale.

Subject matter

Many, if not most, individual special collections are formed around some kind of unifying subject theme, or different groups of themes, which vary from library to library. Most libraries hold groups of sometimes disparate collections that may or may not relate to one another in anything other than their need for special handling. The selected subject(s) may be particular author(s) (i.e., Gertrude Stein, James Weldon Johnson, William Shakespeare, Isaac Asimov), organizations (individual corporations, churches, or departments at a university), types of material (cookbooks, trade catalogs, artists’ books, sheet music, children’s books, broadsides, dime novels) or specific topics, such as viticulture, women’s history, poetry, dance, chemistry, law, or architecture. Politically volatile and sexually explicit materials are also more likely to be held in special collections for safekeeping because of the greater chance of their being mutilated or stolen by readers that disagree with their content.

Scarcity

When only a few extant copies of a book remain, or an item is unique, it makes sense to care for those materials differently than perhaps might be done with readily available materials, placing them in special collections to keep them from being destroyed by extensive handling. Artists’ books, private press materials, limited editions, and the like often create scarcity because they are produced in limited numbers. Commercial publishers, particularly around the turn of the nineteenth century often created “limited editions” of collected works of particular authors with often ornate, matching bindings. This artificially created scarcity marks them among collectors as valuable and worth saving, ensuring the survival of individual copies. On the contrary, everyday materials produced en masse, such as newspapers, broadsides, and paperback books, do not typically survive in such large numbers over time because individual owners deem them disposable. For historians interested in documenting quotidian life, this presents a dilemma, since primary materials for their research are, in some cases, more difficult to locate than materials

already deemed “important” through contemporary marketing or criticism.

Condition

Placing fragile materials in special collections for safe-keeping helps to extend their natural lifespan as original artifacts. Materials that do not circulate are less likely to be damaged through rough or continuous use. Patrons who use materials in a special collections setting handle them more carefully because of their “special” status. Additionally, removing fragile items from the circulating collection removes them from ready access; although they remain accessible, they are less likely to be accessed as often in a special collections setting than sitting on a shelf in the circulating collection. Condition is also a preservation concern; to avoid contamination of other materials in the collection, materials that are moldy or mildewed should not be accepted into special collections if at all possible. Excessively fragile, brittle items require additional care in handling and storage, and may require additional limitations on use, such as required use of surrogates, either photocopies or electronic.

While professional repair by a conservator can prolong the useful life of books that have been damaged, those books are no longer as close to their original state as books that have not had intervention. Condition, including the absence or presence of dust jackets for modern first editions, is paramount on the book-collecting market, and drives the price for any given book. For the library market, depending upon collecting priorities, it may occasionally prove more advantageous, both for the collection and its resources, to acquire a gently used, less-expensive particular copy of a title, than none at all while holding out for a pristine but more expensive copy.

HISTORY AND PURPOSE

Foundations of Special Collections (through the 1980s)

While special collections, in the sense of materials handled separately from main collection materials, have existed since the library at Alexandria, the term “special collections” dates back at least to the 1940s; libraries tended to maintain “rare book rooms” separate from manuscripts and institutional archives, with each earning its own issue of the journal *Library Trends*.^[4–6]

Through the 1950s and 1960s, special collections work focused on efficiently managing, organizing, and building collections, and how to distinguish one institution from another. From the 1970s through the 1990s, the profession emphasized library automation and physical preservation of rapidly deteriorating materials, as well as theft prevention and security.^[7] The broader term was in common

parlance in the library literature of the 1980s, reflecting the growth, merger, and development of larger, more comprehensive departments that handle unusual materials over the previous three decades.^[8]

The 2006 merger of the National Library of Canada and the National Archives of Canada, now combined to form the National Library and Archives of Canada, provides a recent example of this trend.^[9,10] The terminology change, incorporating “rare books,” “manuscripts,” and “archives” under “special collections” was most recently codified through the RBMS of the Association for College and Research Libraries (ACRL), a division of the ALA. RBMS uses the term “special collections” and “special collections professionals” in their most recent guidelines submitted to ACRL, where they once used “rare books, manuscripts, and other special collections.”^[11]

Most, but not all, special collections are tied to a parent institution: a university, a college, a city or town, a corporation. Special collections departments tied to institutions often began as “treasure rooms” or “rare books rooms” where particularly expensive or valuable volumes were kept under tighter supervision than items in the circulating collection, closely guarded by librarians, and handled only by distinguished, vetted visitors. This image of special collections persists, despite concerted efforts by the profession to dispel it. As special collections grew and evolved, the mission of the departments expanded, often in relation to resources provided by the “parent” institution, individual donors, or external funding agencies.

A few independent special collections libraries, such as the Morgan Library in New York, began as personal collections, later shared with the public through a philanthropic donation.^[12] Other independent libraries became more special as their collections aged. When the Library Company of Philadelphia was established by Benjamin Franklin in 1733, it was a circulating subscription library. The books, imported from England, were not particularly rare in the modern sense, although they were too expensive to be acquired by most individuals. The library was originally designed to be a working collection of reference works for subscribers, who were often merchants and working men. As the collection aged, however, the materials held in it became more scarce and valuable for historical research, and the modern version of the Library Company, although it retains its subscribers as donors, is an independent research library with a focus on American history and culture.^[13] Many special collections now actively collect subsets of contemporary materials, developing deep collections that will become more special as they age.

Special Collections in the Contemporary Era (1990s–Present)

Modern special collections in the United States no longer serve only as “treasure rooms,” collecting and holding

particularly valuable materials securely for posterity and making them available to select scholars, or as storage areas for archives accessible to no one but the staff archivist. The possible audience for primary materials has been significantly expanded; both the Society of American Archivists (SAA) and the ALA recognized the importance of this expansion, issuing a joint statement of “Guidelines for Access to Original Research Materials” in 1994.^[14] Regardless of the parent institution’s funding source (public, private, or some combination of the two), modern special collections now typically have a strong public service component as part of their mission, educating the public about their materials through programs, exhibitions, publications, group and class visits, and digital projects. Just as libraries have limited resources and cannot be all things to all users, those responsible for special collections may find that they have to be selective about the types of public programming provided. For many departments, the continuing development of resources through fundraising and grant-writing is also an integral part of special collections work. Digitization projects, a growing portion of the contemporary special collections landscape since the 1990s, have often been funded through grants. Future grant opportunities may also include projects to appropriately preserve digital special collections materials for long-term use.

Public programs and performances

Public programs, for many special collections, are an excellent way to reach out to communities beyond the small number of researchers interested in any given collection. Scholarly talks, live historical interpreters, literary readings, performance of music or plays held in the collections, and creative activities (such as crafts based upon items in the collection) emphasize the continuing relevance of the original artifacts to contemporary life. Public programs also raise the profile of the department and institution hosting the event.

Exhibitions and publications

Exhibitions of special collections materials allow for endless interpretation and reinterpretation of the artifacts involved. Rotating exhibits can showcase particular items, while safeguarding materials by limiting their exposure to light. Loaning to or borrowing from other special collections can extend local collections, and draw new patrons to view larger, more robust exhibits. Akin to museum programs for exhibit loans, RBMS has endorsed guidelines for borrowing and lending exhibit materials.^[15] Exhibitions need not be exclusively site-based; many special collections provide access to their exhibits online.

Libraries may also provide enduring access to materials through publications such as exhibit catalogs, bibliographies, and collection guides. The Katharine Kyes

Leab & Daniel J. Leab American Book Prices Current Exhibition Awards are presented annually by RBMS in recognition of excellence in exhibit catalog work, both paper-based and electronic.^[16] While published bibliographies and collection guides may become outdated for special collections that continue to be developed, these publications can provide a snapshot of collections at given moments in time, particularly if they document major acquisitions. Often, bibliographies based in single, comprehensive collections related to particular topics become the standard for the field.

Teaching and research

Contemporary special collections departments in the United States typically maintain a vigorous program of teaching and research. Digital facsimiles of special collections materials have become ubiquitous in teaching and research through digital projects, and allow students and professors access to materials that would otherwise be impossible to study. Despite the usefulness of digital surrogates, particularly for laying academic groundwork for projects and making side-by-side comparisons in teaching, the surrogates cannot replace hands-on work with primary materials. Unique historical objects have physical characteristics that cannot be fully transferred to the digital realm. The conditions under which an item is produced influence its physical aspects, and tell us its own history. Particular inks and paint colors used in medieval manuscript production, the feel of the “bite” of type when printing on vellum as opposed to paper, and the smell of “signature” glue that may identify a master bookbinder cannot be meaningfully replicated online. Physical characteristics of a particular artifact can only be fully integrated into its study when the artifact is physically present; without access to the original artifact, the story of that particular item is incomplete.

Classroom visits to special collections provide an important countermeasure to the digital world, grounding students in the physical realities and context of the original materials from which digital objects are drawn. This is particularly important as we continue to experience the aftereffects of mass digitization projects. Despite massive amounts of money, scanning, and bandwidth, it is unlikely that each and every book ever produced will be digitized, especially those from special collections that were placed there because they did not adhere as well to the specifications for a modern codex. It is unlikely that every set of archival records, three-dimensional artists’ book, oversized atlas, or book with moving parts will be scanned. No cuneiform tablet, papyrus scroll, lap-desk, fountain pen, printing press, typewriter, or computer hard drive used for writing books in special collections will be sufficiently represented in digital form to replace the original.

There is a long tradition of scholarly research among special collections professionals, both based on the

collections for which they are responsible, and in areas of their own intellectual interest. Curators, catalogers, and archivists research the collections for which they are responsible, add to them judiciously, document them for researchers through catalogs and bibliographies, and interpret them clearly for visitors. Scholarly research can also lead to better integration with teaching faculty at academic institutions, opening up the possibility for joint publications and collaboration on grant projects.

Public and scholarly access to special collections materials has grown through cooperative cataloging initiatives and Web-based archival finding aids, but providing accurate, comprehensive information about special collections is still a challenge. In 2003, the Association of Research Libraries (ARL) held a conference on the subject, that resulted in a white paper, an initiative to generate funding for "Exposing Hidden Collections," and an issue of *RBM* devoted to the topic.^[17] In 2008, the Council on Library and Information Resources (CLIR) launched a grant project to enhance the discovery of hidden collections.^[18]

Fundraising and grant-writing

As library budgets have remained flat or dwindled, and library resources, particularly electronic serial databases, have gone up in cost increments well exceeding inflation, fundraising has become an integral part of special collections work for many professionals. Grant-writing has been a significant source of funding for special collections, particularly in providing access to materials already held. Many, if not most, early grant-funded digitization projects involved special collections materials. Many special collections departments also work closely with library friends groups, often providing tours and programming about their precious and unique materials to potential donors. In some cases, the library's friends group will be administered through the special collections department as well, particularly if there is not dedicated library fundraising staff. Special collections is often a recipient of donations from friends groups, since a common mission for friends is to purchase materials for the library that are too expensive for library budgets. Friends of the library may, in turn, become donors of in-kind special collections materials or financial support through endowments that support special collections acquisitions or preservation.

Security, preservation, and posterity

In addition to collection development work and public service, many special collections also provide additional security for high-risk items through vault storage and additional physical monitoring of materials use. Preservation and conservation of library materials is often part of the special collections mission. Larger special collections departments may have preservation and conservation

professional staff on-site. Departments that do not have preservation staff on-site often still provide basic preservation advice to the library and the public, as well as referrals to local conservation professionals when necessary.

Special collections play a role in securing posterity for materials, both through its preservation and security practices and through collection development choices. Careful collection development is paramount, as selection may indeed dictate the survival of some contemporary, particularly ephemeral, materials. Materials selected for special collections placement are far more likely to survive longer, because they are less handled, accessed less frequently, and stored in more optimal conditions than in the regular stacks.

SPECIAL COLLECTIONS IN PRACTICE

The Special Collections and Manuscripts Professional

Given the multitude of library tasks performed in a special collections setting, special collections professionals require a diverse skill set. Both the RBMS of the ALA and the SAA have produced guidelines that delineate core competencies for special collections professionals.^[19] While each special collections professional may not need every single skill noted in these documents, they do provide an exhaustive listing of what may be generally necessary for special collections professionals.

Core professional requirements

In addition to a bachelor's degree, positions in special collections at the entry level generally require an ALA-accredited master's degree in library science, or an advanced degree at the master's level in history or a similar academic discipline. More advanced professional positions, particularly in libraries that maintain faculty rank for their librarians, may require an additional advanced degree in a subject specialization, either at the master's degree or doctoral level, depending upon the position and the institution in question.

Strong communication skills are essential in special collections. Only the largest special collections have internal staff dedicated to particular job functions such as technical services; many special collections professionals will find themselves working closely with technical services departments in their libraries, integrating workflow for special materials with those from the circulating collections. Special collections professionals with acquisitions responsibilities must also work closely with a wide range of other professionals: book dealers, collectors, and, often, the creators of the works in question (authors, artists, etc.). Because these close working

relationships always have the potential to produce conflicts of interest, both RBMS and SAA provide statements of professional ethics for special collections professionals.^[20] Communication skills are especially important for those special collections professionals that also include fundraising work in their job descriptions. Foreign languages are a significant asset in special collections work. Many special collections materials, particularly in rare book collections, are in languages other than English. Significant numbers of books produced in Europe during the handpress period were published in Latin, German, or French. Some special collections are formed around area studies, collecting materials from particular geographic areas such as Southeast Asia or the Middle East. Linguistic ability in relation to collections served is crucial for both building the collection in question, and serving the readers that use it.

Every special collection is unique to its institution, and gaining knowledge of the collections is a central part of special collections work. Public service special collections professionals often serve as the interlocutor between researchers and the collections that they serve. Most special collections are closed-stacks areas, with access restricted to authorized staff. While the scholarly discovery method of browsing the shelves in the hopes of serendipity is available in a special collections setting, it often requires an authorized staff member to be present with the patron. Public service professionals also often have the responsibility of interpreting aspects of the collections to users through classroom or group presentations and exhibit work. Cataloging professionals that work with special collections need collection knowledge to accurately integrate new materials; the same holds true for those professionals with archival processing responsibilities.

Another particularly useful “foreign language skill” for special collections professionals, descriptive and analytical bibliography, uses formulae to describe the physical aspects of a book. This physical description of books requires some knowledge of the history of the book, including the history of the different technologies that make up the physical object: printing, typesetting, book-binding, and papermaking. A basic understanding of how to preserve paper-based materials, and materials in other formats as dictated by the collections served, is also required. In the modern special collections era, some understanding of the digital realm is also an essential skill set, not only for communicating effectively with colleagues, and making currently held materials more widely accessible but also for participating in the long-term preservation of born-digital materials. Many of the special collections-specific skills described here can be acquired through classes in library science programs, through internships or practicum experiences in special collections departments, or through attendance at Rare Book School in Charlottesville, VA (which offers classes at satellite

locations across the United States and in Europe).^[21] Other professional development opportunities in particular topics are routinely offered through both RBMS and SAA, both nationally and regionally.

CONCLUSION: THE FUTURE OF SPECIAL COLLECTIONS

Special collections work has undergone significant changes since the formation of rare book rooms in the 1930s, with growth, consolidation, and the shift to accessing collections digitally. Daniel Traister suggested in his 2000 polemical essay on the future of special collections that to survive special collections professionals need to fundamentally change our approach, moving from guarding treasured materials from public abuse to making special materials as widely available as possible.^[22] This shift continues with the advent of Web 2.0 tools which advocate user-generated content as an integral part of the digital experience of any artifact.^[23] The ARL sees special collections as a core ingredient in the research library of the future, codified in their Statement of Principles on Special Collections.^[24] While the shift in attitudes has already begun in the profession, it remains to be seen whether the significant financial resources necessary to remain relevant in the digital age, both through continuing acquisitions and digitization, will be forthcoming.^[25]

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Special Librarianship

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Abstract

Special librarianship is that portion of the broad profession of librarianship serving the people, subjects, and collections of information resources in limited subject areas. Unlike a public or academic library setting, where breadth of subject familiarity is expected, special librarianship operates in niche settings dealing with finance, law, publishing, health, and medicine, and other well-defined subject areas and organizations. Professional opportunities in special librarianship have both changed and grown over recent years. Technology has significantly multiplied the amount of available information. Users of information increasingly recognize their need for the assistance of expert information professionals to satisfy their requirement for locating complete, timely, and high quality information on which to base strategic decisions.

INTRODUCTION

This entry explores special librarianship; the qualities, philosophies, and competencies involved in that work; the associations and networks that help practitioners achieve excellence; and some of the major and evolving concepts of special librarianship. An attempt to suggest some of the changing roles and opportunities that may define the future of the profession concludes the entry.

HISTORICAL CONTEXT

Special collections and libraries began to appear in the early 1800s, in academic and government agency settings. The library at what is now the U.S. Military Academy at West Point, with its original emphasis in the late 1770s on engineering materials, is generally considered among the first of what can be considered a special academic library, followed by the science and engineering collections at such institutions as Rensselaer Polytechnic Institute. Through the years, the U.S. Department of State, the New York Chamber of Commerce, and several commercial firms established libraries to aid in meeting their missions and goals.^[1] Although little is known about the people staffing many of these early special libraries, it is safe to assume that they were subject specialists rather than “librarians” in the sense that today we recognize those professionals with graduate level training in the collection, evaluation, and use of specialized information sources and the management of the libraries that house those resources (See the entry on “Special Libraries” p. 4966).

Evolution

Special librarianship has evolved over the past two or three decades arguably more than any other segment of

the library profession. One of the drivers of this change has been the explosion of information technology and the opportunities and potential for gathering and sharing information that it has unleashed. In addition, as organizations, particularly those in the for-profit sector, have recognized the essential nature of and need for reliable, comprehensive actionable information, the support information professionals provide increasingly has become recognized as valuable and they have moved into strategic positions within their organizations. The terms special librarians and information professionals are used interchangeably in this entry, as they are in the literature of the profession.

Successful information professionals are those who are willing to embrace change, to continuously upgrade their competencies, and champion their value. At the time when the Internet was growing rapidly, people in management or purse-string-holder positions would question the need for information professionals if everyone in the organization had access to the Internet and everything on the Internet was free. Those professionals who had a ready answer to that annoying misperception have usually been able to survive. Those who were not prepared with a concise argument about the value of their expertise in an environment of exploding information were often at risk of losing their positions.

The Web Is Not All Free

The free Internet argument is one of the primary issues that continues to hover over special librarianship.

Mary Ellen Bates, one of the group of people in the profession classified as “super searchers,” gave a Web seminar (webinar) in the Factiva series in 2004 on the topic “Convincing Your Boss That It’s Not all Free on the Web.” She quoted from several sources about the

difficulty of finding accurate information on the Web. For example, with the billions of pages on the Web, search engines cannot retrieve everything. By one estimate, 50% of searches on the Web result in failure to retrieve the information sought. Among the many reasons for this low success rate may be that the search was not constructed well and/or the source selected was inappropriate, or that the source is not well indexed by search engines. These reasons, and more, point to the advisability of consulting an information professional. In a survey of information users by the information content consulting firm Outsell, reported in Bates' article, 85% of respondents considered themselves skilled searchers, but 52% said the desired information is too hard to find. Bates reminds readers that the "invisible Web," that portion of online sources that are not found by search engines, may actually contain up to 400 times more high-value information than the "visible Web."^[2]

The Special Libraries Association (SLA) has defined, in the introduction to their "Competencies for Information Professionals of the 21st Century," the value of specialists in information management.

In the information and knowledge age, specialists in information management are essential—they provide the competitive edge for the knowledge-based organization by responding with a sense of urgency to critical information needs. Information, both internally and externally produced, is the lifeblood of the knowledge-based organization and essential for innovation and continuing learning. Information sharing is also essential for any organization that is attempting to understand and manage its intellectual capital... IPs [information professionals] play a unique role in gathering, organizing and coordinating access to the best available information sources for the organization as a whole. They are also leaders in devising and implementing standards for the ethical and appropriate use of information.^[3]

By the mid-1990s, special librarianship began to move away from the physical space called the library. Services are provided as part of a project team or in a more virtual environment. Because funding is an ongoing concern of special librarianship, methods of recovering at least some costs of operations took the form of charge-backs to users and searches for fundraising opportunities. Through continuous training, practitioners added to the traditional jobs associated with special librarianship—materials selection; acquisition and organization of materials; reference, research, and retrieval services; and facilities planning. Responsibilities for preservation, digitization, and archiving; knowledge management; competitive intelligence; information architecture; metadata and data mining; informatics; strategic planning; technology issues represented by Web 2.0 and social networks; and other high-level information functions became part of the expected competencies. Excellent customer service is at the core of all of these activities. As

special librarians made themselves visible and demonstrated an understanding of the goals of the parent organization, as well as a willingness to join teams and committees in the organization, the more their value was recognized and their opportunities for advancement increased. Those special librarians who merged their knowledge of information with knowledge of the parent organization were most valuable. Moving from a reactive mode, where serving everyone was the goal, to an information and knowledge leadership role, special librarianship began to further specialize, in recognition of the fact that staff and resources would not grow along with the growth in need for services.

People point to the organizations that have disbanded their physical libraries, and there have been many of those. What is not as visible is the fact that many of the librarians have remained with the organization, reassigned to higher level analysis activities, working directly with project teams and specialized departments.

CAREER OPPORTUNITIES

Special librarianship is present in a broad range of organizations and institutions: nonprofits, such as museums, associations, and foundations; the financial and business environment, in banks, insurance companies, and manufacturing organizations; newspapers and other publishing ventures; law firms and health science settings attract information professionals possessing subject expertise, often requiring an advanced degree in the subject. Special subject units of large public libraries and universities are also employers of special librarians. Many professionals with special competencies work for vendors of products for the library community. Increasing numbers of professionals are working for themselves, as consultants and information brokers. The challenge for individual information professionals is to assess their personal skills and interests and then be open to opportunities that may present themselves from unexpected places.

In general, working conditions are quite good. The setting is often in a modern, well equipped office. The clientele is fairly predictable because it is common to admit people outside the organization by appointment only. The jobs within special librarianship can be stressful because of tight deadlines, understaffing, shifting organizational structures and objectives, and the need for long hours, among many other factors. Because so many organizations are now global in their activities, special librarians may find themselves working odd hours or shifts in order to provide services that "follow the sun."

One unique career option is that of "solo" librarian. In such a situation, the information professional works alone, possibly with occasional clerical assistance. Time management is a key concern to solo librarians since they are

expected to do most of the jobs and provide most of the types of services of libraries with larger staffs.

According to the SLA 2008 salary survey, salaries for the information professionals who are association members outpaced inflation rates in the United States, Canada, and the United Kingdom. In Canada, the median percent change from the 2007 survey was 5.4%. In the United States it was 5.3%. In the United Kingdom, the change was 4.2%. In the United States, median salaries in the Middle Atlantic region, coming in at \$79,125 (New York, New Jersey, Pennsylvania) and the Pacific region (California, Oregon, Washington) averaged 30% above those in the East South Central region, including Kentucky, Tennessee, Mississippi, and Alabama.^[4]

Public Image

Librarians of all types find themselves fighting traditional stereotypes. Special librarianship is no exception. When a very visible source makes observations that combat those stereotypes, it is noteworthy.

In a December 2007 posting on the U.S. News and World Report Web site, librarianship, and special librarianship in particular, was listed in a positive light.

Forget about that image of librarian as a mousy bookworm. Librarians these days must be high-tech information sleuths, helping researchers plumb the oceans of information available in books and digital records. It's an underrated career. Most librarians love helping patrons dig up information and, in the process, learning new things. Librarians may also go on shopping sprees, deciding which books and online resources to buy. . . .

In the same article, "Special Librarian" is declared to be a "smart specialty." It explains,

All sorts of organizations need librarians, not just universities and local governments. They work for law firms, prisons, corporations, and nonprofit agencies. In fact, special librarianship is the field's fastest-growing job market. . . .^[5]

Linking to a series of "Career Chemistry" articles provided on the U.S. News Web site during 2007, librarians are listed in the "Best Jobs for Investigative People" article, along with science researcher/professor, software engineer/developer, computer systems analyst/architect, and three jobs in the health sciences field.

Data organization, security, and archive management skills are in demand. The Topic of the Month in the December 2007 issue of Dialog's Quantum2 Highlights electronic newsletter for special librarianship, is "Managing Information." Expertise in three areas is recommended for those who want to increase their value in the workforce: taxonomies, records management, and information architecture. To achieve these skills, consider additional

education or collaborations with colleagues with skills complementary to yours, the Dialog consultants advise. This entry is part of a series on the concept of FUMSI (Find, Use, Manage and Share Information) (<http://www.fumsi.com>), a term that defines the purpose and philosophy of the work of special librarianship.^[6]

ESSENTIAL ISSUES

Return on Investment

Always in the forefront of special librarianship is the term Return on Investment (ROI). The concept provides a framework for establishing a value for the work, services, and expertise of information professionals. It examines the resources (money, time, personnel, etc.) committed to providing information services compared with the value of the ultimate outcomes achieved by users of the information, using support from those information services.

Technology

All branches of librarianship wage a constant battle to keep abreast of changes in technology. New electronic information resources are introduced with great frequency. It is essential to be aware of what is being offered and to evaluate whether they are essential (have-to-have) products or whether they are optional (nice-to-have), decisions often based on the impact of high prices and constrained budgets. Special librarians also must make decisions about whether to acquire electronic products or paper products, when both are available.

The skill of negotiating the terms and prices for acquiring technology-based products can be difficult to master and add a complex dimension to the competencies of special librarianship.

Another technology-supported change in the delivery of information involves the elements of Web 2.0 and the social networks. Special librarianship is faced with decisions about whether RSS feeds, wikis, You Tube, and even more recent social networks are useful tools for communicating with potential customers.

As with all technology-related issues, user expectations, needs, and demands play a large role in decisions made and priorities determined. Providing excellent customer service is a hallmark of special librarianship.

End User Training

For many years, special librarians believed that if they taught their clients how to do database searches, for example, or even taught them to understand the nature of databases, it would be a threat to the existence of special librarianship. Herb White, the provocateur of the library profession, voiced that concern as late as 2006 when he

said “Today, however, we seem determined to teach our clients everything we know, and I find that suicidal. Shouldn’t we instead be teaching them what they shouldn’t try to do on their own? Shouldn’t we let them know where their brimming self-confidence. . . is misplaced?”^[7]

Many people will agree with White’s interpretation of the end user training dilemma. However, the paranoia of information professionals has waned after they discovered that by teaching their clients how to do the every-day, repetitive tasks, they were freed to do the more interesting, challenging, detailed research that showcases their unique talents and training. One information professional in the offices of a major technology company would tell her clients that when doing their own searches for information, if they had not found what they were looking for or if they were not comfortable with the validity of what they discovered, within 15 min., they were required to come to her. She said in all the times she used that rule, not a single person asked what was magical about 15 min. and no one asked who made the rule. She suspects they were relieved to comply without asking questions.

Teaching information literacy skills—the ability to find, evaluate, and effectively use information—to end users remains a key activity of special librarianship.

Knowledge Management

The concept of Knowledge Management (KM) began to be recognized late in the 1980s. It blossomed in response to the period when organizations were severely downsizing their middle management ranks, only to discover that much of the intellectual capital represented by those managers walked out the door with them. KM originated as an attempt to encourage everyone in an organization to share their knowledge/intellectual capital and the results of their projects. KM is the term for the conscious gathering, organizing, sharing, and analyzing of resources, documents, and people skills. Internal information is paired with external sources in an attempt to avoid duplication of effort on future projects, among other things, making knowledge a strategic asset. These segments of knowledge are referred to as “explicit” (recorded) and “tacit” (personal know-how and experience) and information sharing is key to the success of a KM program. The increasing sophistication of information technology made such programs possible. KM has become ubiquitous yet challenging to define uniformly from one organization to another. Many people maintain the concept has been at the core of special librarianship for a long time.

The Boeing Company defines KM as “a discipline that promotes finding, selecting, organizing, distilling and presenting information in a way that improves an employee’s comprehension in a specific area of interest.”^[8] A Google search on the term KM results in a substantial list of definitions of the term culled from a wide variety of Web sites.

Competitive Intelligence

Competitive Intelligence (CI), as the term suggests, involves efforts to stay informed about the activities and innovations of competitor organizations. “Many corporate info pros find that Competitive Intelligence (CI) is a way to broaden their skills, raise their visibility, and more directly contribute to their firms’ operations and direction.”^[9]

Briefly defined, a complete CI program requires the ability to identify the needs of its key users (i.e., decision-makers) and define their key intelligence topics (KITs) and key intelligence questions (KIQs); plan and direct any CI projects or initiatives; conduct research using published sources (literature searches); conduct research using human sources (interviews and other primary material); analyze and package the results of the research using a range of models and tools; and share the findings of any research, analysis, and recommendations.^[9]

According to a study conducted by the Competitive Intelligence Foundation, done in cooperation with its parent organization, the Society of Competitive Intelligence Professionals (SCIP), CI is increasing in visibility, as a standalone unit, although it still may be a small function with a limited budget. In many organizations, CI is the responsibility of nearly all personnel. The majority of respondents say they spend a significant portion of their time in analysis and secondary data collection. Company profiles, competitive benchmarking, and market or industry audits are the most frequent products of their work.^[10]

Other Key Topics

Many additional terms and issues come into play in specific settings of special librarianship. Copyright in a digital age, globalization, outsourcing/offshoring, project management, and digitization are among them. Bioinformatics, an extension of the traditional roles of health information professionals, includes specializations required in hospitals and pharmaceutical and biotechnology industries, among other research and development environments.^[11]

Anticipating and managing change presents a major challenge in special librarianship. Professionals strive to continue understanding the needs and goals of their organizations, revise their services and information resources to meet those needs and goals, and maintain their personal training and competencies to keep themselves up to the task of providing value and excellence.

CHARACTERISTICS

“Flexible” is among the most frequently used terms to describe special librarianship. In one job announcement for a researcher and information specialist, flexibility was

called for because the job required working odd hours, including nights, overnights, and weekends. The job also required people who can handle multiple and varied research assignments and can work on tight deadlines in a fast-paced environment. Other terms used to describe top notch special librarians are proactive, tenacious, communicators, consultants, team players, accountable, trustworthy, entrepreneurial, and ethical. A special librarian is expected to be committed to continuous professional development, have excellent research skills, and then be able to evaluate and analyze the information retrieved and determine its relevance to a specific project or need. A customer focus goes without saying in an environment where satisfying the needs of the customer (or client, or patron—there is not universal satisfaction with a term that describes the users of an information service) is the primary reason for being.

By Any Name...

Groups of special librarians, particularly in North America, have grappled for years over the job title that will best suit the promotion of the information professionals and their value to an organization. One group is passionate about maintaining the term “librarian” because of its traditional identification with the reasons why some people joined the profession. The defenders of remaining with the tried and true term “librarian” believe that it is the actions, philosophies, qualities, and competencies possessed for information professionals that define practitioners and give special librarianship value, not the job titles by which they are called. Others believe that better salaries and greater opportunity for promotions and acceptance into the strategic work of the parent organization will result when librarians begin moving away from the traditional term that holds negative connotations and images in some environments. The debate seems not to be as strong and frequent outside North America, where “librarian” is a generally accepted term.

Several people have tried to document the specific job titles within specialized librarianship, but usually abandon the task when the numbers reach into the hundreds.

In a 1993 article in *Special Libraries* magazine, “What Will They Call Us in the Future?” Marydee Ojala, one of the original and most visible information consultants in the profession, reviews the opinions of several leaders in the field as they suggest possible job titles. Although the article is dated, the titles remain viable.^[12] Among the more common titles found in Ojala’s article, as well as some from more recent conversations, are:

Chief Information Officer
Director of Knowledge Management
InfoPro
Information Officer
Information Manager
Information Professional

Information Scientist
Knowledge Counselor
Knowledge Manager
Librarian

Some of the more unusual titles include:

Corporate Intelligence Professional
Cybrarian
Info Diva
Information Architect
Information Control Officer
Information Czar
Information Detective
Information Engineer
Information Oracle
Information Wizard
Informationist
Knowledge Coach
Knowledge Facilitator
Knowledge Services Specialist
Knowledge Thought Leader

The titles chosen by individual professionals are often a factor of the culture in which they work. In many settings, it is most appropriate to use the traditional term of “librarian” and then work diligently to create a new perception of what that job title means. In other settings, a more creative or descriptive title is appropriate.

ORGANIZATIONS

The successful practice of special librarianship relies heavily on networking, resource sharing, and lifelong learning. Professional organizations provide their members with opportunities for networking, resource sharing, leadership training, continuous professional development, impact on legislation and information policies, and other important issues. The organizations range from relatively small and specialized groups, such as the Theatre Library Association, Art Libraries Society of North America, and the Major Orchestra Librarians Association, to larger groups such as the SLA, with membership from around the globe. In all cases, these organizations provide information on their activities in a variety of ways, via Web sites (see a sampling of association Web sites at the end of this entry), blogs, newsletters, magazines, and special reports. In addition, most of them host annual conferences, conduct research, provide continuing education opportunities, and present awards and scholarships, among other activities.

Medical Library Association

The oldest of the specialized associations is the Medical Library Association (MLA), founded in 1898 by a group

of four librarians and four doctors. It represents approximately 1200 institutions and 4000 health information professionals who operate in 23 subsections of the association. The sections focus on libraries in specialized fields such as cancer, chiropractic, consumer and patient health, dental, hospitals, pharmacy, and veterinary medicine. Regional Chapters increase the reach of the network. The Academy of Health Information Professionals (AHIP) is a unique credentialing program that provides the MLA members with professional development opportunities for which they achieve levels of recognition. Back issues of the *Journal of the Medical Library Association* (JMLA) are available on PubMed Central of the National Library of Medicine from 2002 to 2007. A new initiative, "Librarians without Borders," was formed in 2005

to provide training in the field of information retrieval and library information assistance to people anywhere in the world, namely training on how to effectively conduct research using a library. The initiative also helps provide medical information for health care personnel responding to epidemics and natural and man-made disasters anywhere in the world.^[13]

American Association of Law Libraries

The American Association of Law Libraries (AALL) was founded in 1906. Its purpose is to enhance the value of law libraries, foster the profession of law librarianship, and provide leadership in the field of legal information.^[14] Members, numbering over 5000, are affiliated with law firms, law schools, corporate legal departments, courts, and government agencies. Thirteen Special Interest Sections provide opportunities for small groups to focus on areas of law librarianship such as academic law libraries, foreign and international law, legal history, private law libraries, and research instruction and patron services. Strong regional groups also are a membership benefit. Included in the AALL's long list of publications is *AALL Spectrum*, the monthly magazine of the association. Full issues are available on the association Web site, <http://www.aallnet.org>. The association conducts a biennial salary survey and publishes several reference works specific to the needs of law librarians. The "Competencies of Law Librarianship" are discussed elsewhere in this entry.^[14]

SLA

The largest of the specialized associations is the SLA. Founded in 1909, during the annual meeting of the American Library Association at Bretton Woods, NH, the SLA now includes more than 10,000 members in 60 countries around the world. Among the 58 regional chapters, and attesting to the globalization of the association, are the Asian Chapter, Australia/New Zealand Chapter, the

European Chapter, and the Sub-Saharan Africa Chapter. As is the case with its close counterparts, the SLA holds an annual conference, provides continuing education through an online initiative called Click University, gives several awards and scholarships, is active in monitoring Federal information policy developments, and issues publications in print and electronically. The SLA's official journal, *Information Outlook*, is available in print and online, through the association's Web site. Scanning back issues is an excellent way to determine the developments that define special librarianship of the twenty-first century. A salary survey and a document outlining the competencies expected of information professionals in the twenty-first century are among the special research reports published by the SLA. The latter product will be discussed later in this entry.^[15]

Association of Independent Information Professionals

Alternative careers have become common for people in the special librarianship field. The Association of Independent Information Professionals (AIIP), founded in 1987, is an important association home for information brokers and independent researchers. Members may hold degrees in library science or may have advanced degrees in science, law, business, medicine, or other disciplines. AIIP arranges group discounts to information products, holds conferences and workshops and markets the concept of independent information professionals to potential clients. It also provides a strict code of ethical business practice. The ethics code includes statements on honesty, competence, and providing clients current and accurate information. Respecting client confidentiality and recognizing intellectual property rights are also major points in the code.^[16]

Society of Competitive Intelligence Professionals

High ethical standards are a hallmark of the SCIP. The Society's Code of Ethics includes statements on avoiding conflicts of interest, accurately disclosing all relevant information when conducting a project, complying with all applicable laws, and providing honest and realistic recommendations and conclusions to clients.^[17] The SCIP organization includes 20 regional chapters. Professional development needs of members is a primary focus and the annual conference is one venue for this activity. Established in 1986, the SCIP has approximately 3000 members representing practitioners, consultants, service providers, information specialists, and academic and government institutions. The Competitive Intelligence Foundation, a SCIP affiliate, conducts research on emerging issues and the *Journal of Competitive Intelligence and Management* represents the interests of the membership.^[18]

Global Networks

Among the significant professional associations outside North America that include special librarians are the Australian Library and Information Association and the Chartered Institute of Library and Information Professionals, formed after a 2002 merger of two British associations, the Library Association and the Institute of Information Scientists. Both associations include specialized groups for various types of libraries and activities.

COMPETENCIES

Moving beyond informal lists of characteristics of special librarians and the job titles under which they work, several of the professional associations have created lists of competencies that identify superior information professionals. The documents may refer to “librarians,” “information professionals,” or “special librarians,” among other titles, but they all apply to the trained information specialists that form the membership of each association. The competencies documents contain many common elements, in addition to specific competencies unique to the special group.

AALL

The AALL has a statement on the Web site, under Professional Education, a document approved in 2001. “Competencies are the knowledge, skills, abilities, and personal characteristics that help distinguish superior performance. These competencies may be acquired through higher education such as library and information science programs, through continuing education, and through experience.”^[14]

The AALL document is divided into two sections, the Core Competencies and the Specialized Competencies. According to the document, the Core Competencies “apply to all law librarians and will be acquired early in one’s career.” Among them are a commitment to excellent client service, recognition of the diversity of the client community, support for the culture and context of the parent institution, and knowledge of the legal system and legal profession. Twelve additional statements cover ethical behavior, leadership skills and creative thinking, risk taking, commitment to working with others to achieve common goals, excellent communication skills, and the pursuit of continuing education.

Under Specialized Competencies, there are five subsections, dealing with library management; reference, research, and client services; information technology; collection care and management; and teaching. The document sets forth some stringent expectations for the information professional who wants to be respected and valued by both clients and professional colleagues.

SLA

The SLA’s “Competencies for Information Professionals of the 21st Century” was revised in 2003, building on the original version developed in 1997. It begins by defining an information professional:

An information professional (IP) strategically uses information in his/her job to advance the mission of the organization. The IP accomplishes this through the development, deployment, and management of information resources and services. The IP harnesses technology as a critical tool to accomplish goals. IPs include, but are not limited to, librarians, knowledge managers, chief information officers, web developers, information brokers, and consultants.^[15]

There is a strong emphasis on evidence-based practice in the competencies listed. Evidence-based practice is defined as “consciously and consistently making professional-level decisions that are based on the strongest evidence from research and best practice about what would work best for our clients.”

The SLA competencies document is divided into sections on Professional Competencies, Personal Competencies, and Core Competencies.

The Core Competencies are essential for everyone. There are just two points in this section. “Information professionals contribute to the knowledge base of the profession by sharing best practices and experiences, and continue to learn about information products, services, and management practices throughout the life of his/her career.” The second point states, “Information professionals commit to professional excellence and ethics, and to the values and principles of the profession.” These two points anchor all other competencies included in the document.

Under the heading of “Professional Competencies” there are sections on managing information organizations, information resources, and information services, all while applying information tools and technologies.

Personal Competencies

represent a set of attitudes, skills, and values that enable practitioners to work effectively and contribute positively to their organizations, clients and profession. These competencies range from being strong communicators, to demonstrating the value-add of their contributions, to remaining flexible and positive in an ever-changing environment.

The concepts of communication skills, proving value, being flexible, and managing change are among the characteristics most often mentioned as being essential to special librarianship.

MLA

In the “Platform for Change” developed by the MLA, there is a section on health information science knowledge

and skills. “Health information professionals will possess varying levels of knowledge and skills in seven broad areas. No one individual can achieve mastery of all knowledge and every skill, but every organization will require collective expertise in all areas.”^[13] The seven areas are:

Health Sciences Environment and Information Policies
Management of Information Services in complex institutional environments

Health Science Information Services—understand information needs and analyze, evaluate, and synthesize information for those identified needs.

Health Science Resource Management—including identifying, collecting, evaluating, and organizing resources and using them effectively

Understand Information Systems and Technology

Instructional Support Systems—teaching ways to access, organize, and use information

Research, Analysis, and Interpretation

Even a quick review of the competencies set forth by three major associations at the core of special librarianship demonstrates the expectations for the people who chose to enter the profession. Society can be assured of the high level of professionalism and skill embodied in these professionals and should never consider asking, “Why do I need you?”

Employability

In her book, *Rethinking Information Work*, Kim Dority emphasizes the “lifetime employability” of information professionals by setting forth a list of actions professionals owe to themselves, to keep competitive and happily employed during their careers.

The concept of lifetime employability “involves continually developing new ways to contribute and grow professionally and seeking out opportunities to do so.” Success “requires a sense of loyalty to your own professional goals. Although professional integrity mandates that we do our very best jobs for our employers and/or clients, we nevertheless must keep our own career goals moving forward at the same time.”^[19]

Among the career competencies on Dority’s list are an understanding of who you are and who you want to be. This understanding must include an acceptance of the possibility of low pay, lack of respect, and lack of potential for growth; a focus on solutions; an understanding and acceptance of change without fear; adapting skills to the environment and understanding the environment; an ability to anticipate and willingness to look for opportunity; a willingness to take risks; and a commitment to continuous learning and reinventing of ourselves. All are essential qualities for satisfaction and success in professional careers.

EDUCATION

As information technology has become an increasing part of the job in special librarianship, it has raised confusing issues in library education. Should the master’s level degree, which is the first rung on the professional ladder, concentrate on the core values and history of the profession, leaving the everyday needs of the job to be handled by on-the-job training, or should people graduate from Master of Library and Information Science (MLIS) programs fully able to function on their first day on the job? Employers would prefer the latter situation. However, given the limitations of the length of the curriculum and the expertise of the faculty in many graduate schools of library and information science, it is difficult to devise a curriculum that answers all needs and covers all bases. People graduate with the understanding that continuous professional education will be part of their future.

Because most graduate programs in the field require in the neighborhood of a year and a half to two years to complete the degree, it is obvious that not everything can be covered in that space of time. Should the curriculum include many of the traditional core courses of the profession, or should there be more availability of technology training and specialized topics? There is no universally accepted answer. In addition to such core courses as an introduction to the information professions, reference and cataloging (offered under several new titles to reflect the broader need to categorize information for quick and thorough retrieval), many schools offer focused courses on broad special librarianship as well as on the more specific areas of medical, law, art, and business librarianship. Multiple offerings teach information technology skills in tandem with more traditional content in some of the other courses in the curriculum.

The reality is, no matter how well prepared new employees may be, they will invariably face the need for additional training in order to move ahead in most environments. Constant updates on developments in technology and new products will be required. In law libraries, a law degree is often required or recommended for anyone who aspires to a management position. In the business and finance environment, an M.B.A. or similar advanced degree would be a plus. In many situations, competence in more than one language is a strong benefit, if not a requirement.

FUTURE PROSPECTS

Predicting the future of special librarianship is problematic. The only sure assumption is that change will continue at an accelerated pace and that professionals will be required to employ all of their skills of innovation and adaptability.

During the 2008 Leadership Summit sponsored by the SLA, delegates were divided into round table discussion groups with an assignment to envision the SLA as it

should be in 2010. Leadership was highlighted as one key role for special librarianship moving into the immediate future. Participants thought that mentors and inspirational coaches should assist professionals in stepping out of the passive role in customer service, where the philosophy is to try and serve everyone. That service philosophy gives way to greater specialization in services aimed at specific user groups. Ongoing training in management, organizational politics, time management, relationship building, and communications, among other skills, will be essential. There will be a continuing need to educate users and potential users to the value special librarianship brings to an organization. The SLA will be instrumental in building partnerships and relationships based on trust and mutual respect, to the benefit of members.

Two management gurus to special librarianship have made strong statements about the unique contributions of information professionals. Herb White states emphatically that “We cannot have good libraries until we first have good librarians—properly educated, professionally recognized, and fairly rewarded.”^[20] Tom Davenport, in an article outlining the desirable characteristics represented by special librarianship, concludes,

It is the professional librarian’s expertise in managing information and working with users to identify, anticipate, and satisfy their information needs that transforms a passive collection into an information system used to support business decisions. A special library cannot exist without a librarian, and is only as good as the information professional managing it and the level of support and commitment from the parent organization.^[21]

Because special librarians work in a broad range of institutions and organizations, they are subject to the same environmental and economic challenges as are their host organizations. For that reason, attempting to predict the future with any accuracy is problematic. What can be said with certainty is that current trends will accelerate, change will be continuous, and there will be new challenges around every corner.

Change Is a Given

“Is change an opportunity for librarians or is it a threat?” asks Pat McCauley in “From Librarian to Cybrarian: Coping with Accelerating Change in Libraries. . . Will librarians assume a proactive role and act as change agents to bridge the gap between technology and the end user?” This is a common debate encountered by librarians. Will they step up and be proactive? McCauley, echoing many other writers, says librarians have to “strive to lead or we can decide to follow. None of us can choose to remain unchanged.”^[22]

It is encouraging to observe, working with new recruits to the profession, that they include a strong cadre of young leaders in special librarianship. The challenge will be for

them and those who have preceded them in the profession, to work together and build on the strengths of each other, in order to ensure that excellent customer service continues to be at the forefront of the philosophy of special librarianship and that, through that excellent service, there will be constant reinforcement of the concept that special librarians are essential members of the team that moves an organization forward to meet its goals and to anticipate the new challenges that lie ahead.

Dority, in the text cited earlier, looks at some terms that define the self-image of special librarians: energy, innovation, thought leadership, impact, engagement, passion, excitement, self-confidence, participation, entrepreneurial, collaboration, improvisation, dynamic action, joy, contribution, laughter, politically astute, change agent, connected, adventurous, smart, resilient. The list provides a challenge to live up to, and an inspiring promise for the future of the profession.

Each of these characteristics will be necessary for LIS practitioners in the coming years as the profession continues to be driven by new circumstances we can guess at now, as well as those we can’t even imagine. We know the roles of . . . librarians will shift in response to demographic changes, technology advances, and funding issues, but what other disruptive changes are hiding in the wings? We know that fewer and fewer businesses are establishing and/or maintaining “traditional” corporate libraries, but what about the large number of information-based roles that are opening up in their stead?^[19]

Eugenie Prime, for years the iconic head of libraries at Hewlett Packard, spoke at the 1998 Annual Conference of the SLA, a presentation frequently referenced because of the impact it had on the audience. Known for her direct approach, she outlined why she thought librarians don’t reach their potential:

The fault lies not in the inadequacy of our budgets, not in the myopia of upper management. . . not in sexism or gender symbolism, not in corporate restructuring/rightsizing/downsizing or any other sizing. . . but in ourselves. . . If we lack a fundamental certainty of who we are and what we are capable of doing. . . that uncertainty will leave us incapable of handling the complex changes of this Information Age.^[23]

That analysis is just as valid, just as compelling in 2009 as it was a decade earlier. It gets at the core of expectations for special librarianship going into the future. It offers special librarians the platform and philosophy required to move into a successful future.

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Introduction to the Encyclopedia of Library and Information Sciences, Fourth Edition

How to Use This Encyclopedia

Entries are arranged alphabetically in this encyclopedia (see end papers for alphabetical list). The editors of this edition (ELIS-4) have decided to forego the Topical Table of Contents that was provided in ELIS-3 by editors Marcia Bates and Mary Niles Maack. At the time of publication of ELIS-3, the Topical TOC was crucial for readers to get a sense of how subjects were grouped and an understanding of the field or subfield through the clustering of categorical entries in the print edition. ELIS-4 is envisioned as a primarily online reference work where a Topical TOC does not serve the same purpose. The print edition is served well by the main TOC as well as the detailed index, while entries in the online version are easily discoverable through title, author, keyword, and full text searches.

In sum, relevant entries can be found by

1. Entry title (alphabetical arrangement of entries in the encyclopedia or listing in the end papers)
2. Specific name or keyword, including the index at the end of each volume

If the first name or keyword searched is not found, try several more variations—either different words or a different order of words. Most topics are described in several ways in the literature of a discipline, and the first term or phrase that comes to mind may not be the one used here.

Scope of the Encyclopedia

The title of the third edition, *Encyclopedia of Library and Information Sciences*, ended with the letter “s” because the encyclopedia was broadened to cover a spectrum of related and newly emerging information disciplines, including archival science, document theory, informatics, and records management, among others. The fourth edition continues this trend but with an extensive focus on the aspects of library and information sciences that have been heavily impacted by the adoption and reliance on online information distribution. This focus is reflected in the inclusion of numerous new entries such as digital preservation, altmetrics, web-scale discovery services, demand-driven acquisitions, and global open knowledgebases. Alongside these entries based on entirely new topics, the expanded use of the Internet for information has led to new treatment of traditional LIS topics such as resource description and access (RDA) that reflects the adoption of new standards for cataloging.

ELIS-4 also seeks to build upon the description of professional practice to round out the theoretical perspective that previous editions covered very well. Both current editors are academic research librarians and thus, focused heavily on addressing gaps in the encyclopedia related to academic research information while still relying heavily on the structure established by editors of ELIS-3. For example, ELIS-3 introduced country profiles and ELIS-4 builds upon that with new entries for New Zealand and a third on Brazil, in addition to revisions for Slovakia, Netherlands, Canada, Belarus, Kazakhstan, and Brazil among others. This edition also expands the number of entries for named cultural and information entities that did not appear in previous editions, such as the National Library of Medicine, North American Serials Interest Group (NASIG), the International Association of Scientific, Technical and Medical Publishers (STM), and ASLIB, as well as entities like the HathiTrust that have been established since the last edition was published. A number of new entries describing important information conferences such as the Acquisitions Institute at Timberline, the Charleston Conference, and Electronic Resources in Libraries (ER&L) also help round out the encyclopedia and further the description of the current state of academic research librarianship.

ELIS-4 also continues the tradition of designating important entries of historical or theoretical importance as “ELIS Classics.” These are entries by major figures in the library and information sciences or those that describe core concepts in LIS theory, practice, or education that appeared in earlier editions of the encyclopedia. The current editors preserved the approximately 40 previous “ELIS Classics” and designated 13 previous entries as new “ELIS Classics.”

There are more than 550 entries, of which more than 20 are new, another 93 are revisions to prior entries that have been brought up to date by their authors or by new authors, about 30 are ELIS Classics, and about 400 are reprinted from an earlier edition since they have remained relevant to the present. It is important to note that the editors also had to make some choices related to retiring entries that were no longer relevant—due to the passage of time and the development of the field, the technologies and theories described in those entries were deemed to be out of scope for the new edition and thus not revised or reprinted.

Encyclopedia Authors

As in past editions, the authors writing for the encyclopedia are major researchers, librarians and practitioners, and leaders in the fields and subfields in the disciplines in which they are writing. Noted scholars are well represented, and a number of authors are former leaders in LIS associations, including the American Library Association (ALA), the Association for College and Research Libraries (ACRL), the International Federation of Library Associations and Institutions (IFLA), the American Society for Information Science and Technology (ASIS&T), and the American Association of Library and Information Science Education (ALISE). In addition, there are many contributors who are current or former directors of major institutions. As in past editions, the editors are very proud of the range and diversity of authors who have written these entries for the encyclopedia and we thank them for sharing their expertise with the current and future readers and researchers in the field.

Finally, the editors for ELIS-4 have grappled with the challenges of entry generation that was noted by previous editors in nearly every edition: that not all ideas, topics, and potential entries were able to be completed for publication in this edition. While we made a valiant attempt to include entries identified by ELIS-3 editors but not secured for publication in that edition, we sometimes could not find authors willing to take those topics on. Similarly, we were sometimes unable to secure revisions to entries from new authors when previous authors were unable to perform that task. To the greatest extent possible, we endeavored to replace authors when entries were deemed important enough to appear in ELIS-4 but initial or previous authors had to decline or defaulted. No doubt, the editors of ELIS-5 will also pick up the mantle and attempt to round out the encyclopedia with entries for anything that ELIS-4 missed. As noted by editors Bates and Niles Maack in ELIS-3, this problem of missing topics was also acknowledged by Allen Kent, editor of the first edition of ELIS. Kent stated in 1973, "I have prepared this presentation to make sure the lessons of Diderot-d'Alembert are recalled in terms of encyclopedia-making as an exercise in the art of the possible."

Background and Development of the Encyclopedia

The first edition of ELIS, under the editorship principally of Allen Kent and Harold Lancour, was published between 1968 and 1982. The 33 volumes of the first edition were published in alphabetical sequence during those years. After the "Z" volume appeared in 1982, a number of supplements were published at roughly the rate of two per year, up to and including volume 73, which appeared in 2003. Miriam Drake was appointed editor for the second edition, which appeared in 2003, both online and in paper. The second edition came out at one time in four large-format volumes, with a supplement in 2005 [3]. Kent and Lancour covered a wide range of librarianship, information science, and some computer science topics. Drake, an academic library director, emphasized academic libraries, and the ELIS-2 volumes contained many profiles of major academic libraries and professional library associations.

The third edition, under the editorship of Marcia Bates and Mary Niles Maack, reflected a growing convergence among the several disciplines that concern themselves with information and the cultural record. As information science educators and noted researchers in the field, their focus was on growing the encyclopedia in the theoretical fields of information sciences as well as drawing together the associated information and cultural disciplines such as archival sciences and museum studies within the overall field of LIS.

For this edition, we have focused on developing the encyclopedia to reflect the changing nature of information production and consumption through online and digital forms. We have also endeavored to fill in gaps in the description of important people, places, and theories in the information sciences, and further enhanced the description of important concepts related to the provision of research information and the field's major institutions.

We continue to see the audience for the encyclopedia just as previous editors have: as principally consisting of 1) the educated lay person interested in one or more of its topics, 2) students learning about a topic, and 3) professionals and researchers in the several fields who want to learn about something new, or to be refreshed on a familiar topic.

We honored the previous editors by reengaging their superb Editorial Advisory Board with significant new additions of experts known to the current editors. (See listing in the front matter.) These leaders and experts from as many disciplines as are in the encyclopedia provided excellent guidance and feedback for the editors as they began the process of new topic generation, evaluation of previous entries, and offering to author or review numerous entries throughout the process of publication.

All new and revised entries were reviewed by one or more outside expert reviewer as well as one or more of the editors. Referees provided invaluable feedback to authors, including noting errors or omissions as well as making suggestions on additional aspects of the topic to cover. While we made every reasonable attempt through this process to check the accuracy of every entry and every fact, undoubtedly readers will find some topics explained more thoroughly or accurately than others. Indeed, due to the time frame from the beginning of the generation of the fourth edition and the time of publication, readers will reasonably note that some topics have been quickly superseded due to this passage of time, so the

date of acceptance of the entry will be noted on each entry since several years may have passed since the writing of the entry and the publication of this edition.

Acknowledgments

This edition of the encyclopedia was possible only through the countless hours that the editors, John McDonald and Michael Levine-Clark, spent reviewing the previous encyclopedia entries, outlining the topics that were missing or that were newly emerging in the field, and identifying appropriate expert authors to write those new entries. In addition, the editors devoted extensive time to corresponding with previous authors encouraging them to revise their entries, and finding replacement authors for important entries that needed revisions but whose original authors were unavailable.

Both editors wish to acknowledge the expertise of each other and their knowledge of our field, their extensive network of contacts, and their ability to work closely together to ensure the success of this encyclopedia. Neither of them could have completed this project alone.

They acknowledge and thank the Taylor & Francis Group editors, Claire Miller and Rich O'Hanley, as well as Susan Lee, who passed away at the early stages of the preparation of this edition, and more recently, Alexandra Torres, who supported and kept the editors and authors on track over the course of the years of work on this edition of the encyclopedia.

The editors thank the authors who wrote and revised entries, and the huge number of reviewers who refereed the entries. Without their dedication, expertise, and willingness to share their knowledge with others, there would be no encyclopedia. They also wish to thank the Editorial Advisory Board for their advice, suggestions of topics and authors, their hours spent writing or reviewing for the final edition. They also wish to thank the previous editors, Marcia Bates and Mary Niles Maack, whose organization and structure for ELIS-3 provided an excellent blueprint for ELIS-4.



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Tunisia—United Kingdom

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User-Centered Revolution—
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Special Libraries

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Abstract

Special libraries are extremely diverse and are found in many different types of organizations, serving almost every conceivable discipline. With few exceptions, special libraries exist as units of larger organizations. Special libraries arose in the United States and Great Britain in the nineteenth century and have multiplied and spread worldwide throughout the twentieth. Despite their diversity, they have certain unifying characteristics. They acquire and maintain information resources in topics and areas of importance to a limited, well-defined customer base, and they offer a range of specialized and customized services to ensure that the right information reaches the right customers at the right time. They take their mission and goals from their parent organizations, and exist primarily to improve the ability of their customers to perform their tasks effectively. Recent advances in information technology and organizational development are changing the role of special libraries, bringing them both threats and broad new opportunities.

INTRODUCTION

This entry discusses the special library as a distinct type of library and a distinct entity that exists within many diverse types of organizations. It covers the definition and distinguishing characteristics of special libraries, their history, the services typically provided by special libraries, special considerations of professional ethics in special libraries, and important considerations in the management of the special library. This entry concludes with a review of current trends and the outlook for special library services and development.

DEFINITION

Special libraries are libraries that have one or more of the following attributes: a focus on specialized information resources, usually of a limited subject scope; a focus on a specialized and limited clientele; and the delivery of specialized services to that clientele. Some authorities add that a special library is one sponsored by a parent institution, such as “business and industrial firms, not-for-profit organizations, government agencies, and professional associations.”^[1]

Some of the prominent types of special libraries are medical libraries, law libraries, corporate libraries, libraries in legislative and executive agencies of government, music libraries, art libraries, engineering libraries, and libraries of trade and professional associations, to name a few. Many specialized libraries in institutions of higher education are also considered special libraries. For example, the library of a medical school, a law school, or a

specialized research institute may be considered a special library.

Because special libraries are so diverse and may exist in many types of organizations, they may range in size from small operations administered by one person, to large institutions with their own buildings and hundreds of staff members. An example of the latter is the United States Congressional Research Service, a unit of the Library of Congress, which, while very broad in its subject interests, serves a very limited clientele—the members of the U.S. Congress and their staffs—and provides highly specialized services to its clients. The Congressional Research Services has nearly 700 staff.^[2] A very different special library is the Linda Hall Library, which is open to the public, unlike most special libraries, but has a specialized focus on science and technology.^[3]

An early definition (1914) focused on the nature of services provided as the differentiating characteristic of the special library:

It may be said, of course, that every library is in a measure special, in its own field, and that state libraries, libraries of colleges and universities, of medicine, law, history, art and other subjects may be called special. But a special library, and the special departments of more general libraries-like the business branch in Newark - are the first and as yet almost the only print-administering institutions which professedly recognize the change in library method that the vast and swiftly mounting bulk of print is demanding; realize how ephemeral, and at the same time how exceedingly useful for the day and hour, is much of the present output of things-intended-to-be-read, and frankly adopt the new library creed as to print management, of careful selection, immediate use and ready rejection when usefulness is past.^[4]

The defining characteristic of special libraries was put more succinctly by John A. Lapp, who in 1918 wrote of the "...specialist's library and ... the problem of putting knowledge to work."^[5] The phrase "Putting knowledge to work" has continued as a slogan of the Special Libraries Association to the present day.

This emphasis on special services as the characteristic of special libraries that sets them apart is also continued in contemporary librarianship by the International Federation of Library Associations and Institutions, Division of Special Libraries. It states that "The Division of Special Libraries is characterized by libraries with specific kinds of service functions and subject specialties.... These libraries vary in size but all provide specialized services to their clientele."^[6]

Perhaps because of the diversity of institutions it covers, the term "special libraries" has always been something of a compromise. Dana, writing in 1914 of the founding of the Special Libraries Association, commented, "The name Special Libraries was chosen with some hesitation, and rather in default of a better; ..."^[4] Writing 35 years later, S.R. Ranganathan echoed this hesitation, beginning an article with the sentence, "Special librarianship is a puzzling term."^[7] The imprecision of the term "special library" continues to provoke discussions in the field and beyond.

HISTORY

Origins

Specialized libraries have existed from early times. Whether as personal libraries of the wealthy, libraries of religious institutions, or of scholarly societies, the idea of a shared collection of books for a special audience is nothing new. The Commercial Library at Hamburg, Germany, founded in the 1730s, is an early example of a special library established to support commerce and industry. The Pennsylvania Hospital started its medical library in 1763.^[8] However, the idea of a "special library" as a distinct category only arose in Great Britain and the United States in the nineteenth century. In both countries, this emerging identity led to the formation of the first separate professional associations of those engaged in the operation and management of special libraries.

Twentieth Century to Present

In the United States, the rise of the library profession led to the formation of the American Library Association (ALA) in 1876. Not long afterward, continued growth in specialized libraries led to the establishment of associations for specialized libraries: the National Association of State Libraries in 1889, the Medical Library Association in 1898, and the American Association of Law Libraries in

1906. This continued growth then led to the formation of the Special Libraries Association in 1909, with 20 librarians participating. A directory of special libraries prepared by the Association in April, 1910, listed about 100 libraries.^[9]

Events in Great Britain followed a similar course. During much of the latter half of the nineteenth and early twentieth centuries, the Library Association, founded in 1877, provided a home for all librarians, including those interested in special libraries.^[10] In 1924, however, a group of these librarians formed Aslib, an association of special libraries.^[8]

Public libraries played an important role in the early development of special libraries. A prime example was the public library of Newark, New Jersey, whose librarian, John Cotton Dana, established a commercial branch in the central business district in 1904. Dana also led the founding of the Special Libraries Association in 1909. Over time, however, specialized services in public library organizations have generally ceased to be thought of as special libraries, and their staff members are rarely involved in the special library professional groups.^[8]

Over the course of the twentieth century, the number and distribution of special libraries continued to grow. Drawing on a series of published surveys and directories, Kruzas documented the increase in U.S. special libraries from 108 in 1910 to 975 in 1925 and 2480 in 1957.^[11] The 60th edition of the *American Library Directory* (2007–2008) lists a total of 7881 special libraries in the United States, plus an additional 1300 when special libraries within public libraries, academic libraries, Armed Forces establishments, and other government libraries are included, for a total of 9181. It also lists 982 special libraries (including the above-mentioned categories) in Canada. In both countries, special libraries represent about 30% of the libraries listed.^[12]

While not directly comparable, an analysis of data from the United States Bureau of Labor Statistics suggests that the proportion of library employment accounted for by special libraries is significantly lower: about 13%, or some 20,000 out of a total library employment of over 157,000.^[13] This number excludes librarians who are working in educational institutions at all levels, or in local government, i.e., public libraries. It includes librarians in state and Federal government and in all nongovernment, noneducational organizations. In part this lower number may be due to the exclusion of special libraries within academic libraries, and in part it may be due to the smaller size of many special libraries.

Globalization

While special libraries arose as a distinct type of entity within North America and Great Britain, the concept soon spread globally. Professional groups for special libraries were established in Finland in 1929 and in Switzerland in

1939.^[14] Special libraries arise in countries that undergo industrial and economic development, and are sustained in parallel with that development. By 1978, special libraries existed in many countries in all regions of the globe. The global spread of special libraries is now recognized by the existence of the Division of Special Libraries within the International Federation of Library Associations and Institutions (IFLA). The Division reported 508 members in 2002.^[15]

SERVICES

The importance of specialized services in special libraries has been central from the early days of the profession. Dana, writing in 1914, described the work of the librarian in a special library in these terms:

This librarian purchased periodicals, journals, proceedings of societies, leaflets, pamphlets, and books on the special field in which his employers were interested, studied them, indexed them, or tore up or clipped from them pertinent material and filed it under proper heading, and then either held himself in readiness to guide managers, foremen and others, directly to the latest information on any topics they might present, or compiled each week or each month a list of pertinent, classified references to the last words from all parts of the world on the fields covered by his organization's activities, and laid a copy of this list on the desk of every employee who could make good use of it.^[4]

Dana's description continues to cover much of the service mix of special libraries almost 100 years later. Special libraries serve through focused collection development, customized organization of information, knowledgeable reference and research services, and proactive delivery of news updates. More recently, special libraries have developed new or enhanced services, such as information analysis and synthesis, competitive intelligence (CI), and knowledge management (KM).

Acquisitions and Collection Development

The essence of the special library is its focus on the specific interests of its user population. The special librarian restricts acquisitions to those materials of central interest to the sponsoring organization. The special library does not seek to duplicate the general information available through other accessible sources, such as local public and academic libraries.

As an extension of their collection development function, special libraries often become responsible for acquiring information resources that do not reside in the library, such as "desk copies" of texts, handbooks, and other publications. With the advent of the licensing of digital information resources, this function has in turn expanded into

the role of contracting for, or licensing, access to digital collections on behalf of the members of the special library's parent organization. Where the parent organization is large and complex, this puts the special library squarely in the role of brokering access on behalf of the whole enterprise.

Organization of Information

Because the special library thus develops a very deep and narrow collection, the librarians often find that systems of organization developed for libraries of broader scope do not provide enough differentiation of highly detailed and technical subject matter to enable the librarian or the users to locate information effectively.

However, economic considerations lead special libraries to use general sources and systems of bibliographic description and organization, such as catalog records obtained from OCLC, Inc., containing Library of Congress and Dewey Decimal Classification numbers. Where resources are available, many of them augment the data from these sources with local subject headings and descriptors. Medical libraries make use of the specialized Medical Subject Headings (MeSH) of the U.S. National Library of Medicine. Further, the information required to meet the needs of many specialized customer groups is found not in the books typically covered by sources such as OCLC and the Library of Congress, but in specialized technical, professional, and trade serial publications. These publications are typically indexed by professional or commercial information services, using specialized thesauri. An example is the digital library service of the Association of Computing Machinery (ACM), which uses the Association's Computing Classification System to provide subject access.^[16] In some fields, libraries collect other genres and forms of material such as technical reports. An example of a specialized information service of this type, with a custom thesaurus, is the U.S. Defense Technical Information Service.^[17]

Reference and Research Center

The philosophy of the special library is to provide knowledgeable and responsive services. The emphasis on the knowledge of reference staff, and the expectation of in-depth research service, set the special library somewhat apart from its more generalized public and academic counterparts. The reference librarian in the special library is often expected to go beyond factual "ready reference" and advisory services, and to provide in-depth research services that may require a lengthy time commitment. To be effective in handling complex and sometimes technical questions, the staff must have relevant subject knowledge. For this reason, many special libraries require or prefer that their staff have relevant educational backgrounds. For example, staff members of law libraries often have

law degrees in addition to degrees in library science. Those who do not possess the law degree generally take specialized courses in law librarianship and legal research in their library science programs. Similarly, medical and health sciences libraries seek to attract staff with graduate or undergraduate degrees in biology, chemistry, and similar disciplines. Staff of special libraries who lack relevant specialized education or experience find that they must learn their new field “on the job” in order to provide the knowledgeable, in-depth service expected of them.

The service philosophy of the special library differs from that of a generalized library in other important respects. In public libraries especially, there is often a presumption against the reference librarian asking a customer why information is being sought.^[18] In the special library, it is often imperative for the librarian to understand the specific background of the request. Without this understanding, the librarian cannot focus the research and select the right information sensitively enough to be of real value to the customer. Thus the librarian commonly becomes privy to confidential and sensitive business information and is required to maintain confidentiality as a duty of employment. Along with the need for deep domain knowledge and specific understanding of the business need goes the need, for many requests, of responding very quickly. The nature of information requests in many organizational settings is that timeliness is as important as quality, and a “good enough” answer on time is valued, while a careful, detailed answer too late is not. Thus the special library staff members learn to move quickly and to “satisfice”: provide information that is good enough, not perfect.

Finally, the special library often has a different philosophy with regard to the training or teaching role of the library reference staff than that of the public, school, or academic librarian. In those latter settings, a reference question is often viewed as a “teachable moment”—an opportunity for the librarian to show the customer how to carry out information seeking tasks. In the special library, staff members are often required to provide “the answer” and to do it quickly. In such circumstances, their function is to save the time of the customer and not to take up that time by engaging in an instructional encounter.

News Updating

Because special libraries typically serve a limited population, they come to know their customers, and their customers’ ongoing information needs, quite well. As management authority Peter Drucker has said, “Librarians in a special library. . . can—and do—anticipate the customer’s information needs. They can—and do—reach out to the customer and point him or her in the right information direction. They can—and do—know what new data is in their customer’s field or sphere of interest.”^[19] Whether it is a medical specialist with an

ongoing interest in the research on a specific disease, or a business executive with an ongoing need for information about the company’s competitors in a specific product line, many customers of special libraries have ongoing needs for updated information on a topic. For this reason, from the time of Dana’s writing to the current time, special libraries have provided ongoing information services. These have gone under various names: Selective Dissemination of Information (SDI); Current Awareness, News Alerting, and specific brand names applied by specific special libraries. Whatever the name, the essence of these services includes: a subject scope narrowly defined and customized to meet the needs of a small audience; a publication coverage that may range from one source to a broad collection of sources; a frequency, again customized in collaboration with the customer, which may range from near instantaneous to daily, weekly, or monthly; and a format also customized to meet the audience’s needs, ranging from very brief summaries of pertinent stories, to synthesized synopses of stories; or the full stories themselves.

Many tools are now available to provide current awareness services. They include news alert functions from the vendors of digital library resources; e-mail subscriptions, really simple syndication (RSS) feeds, and more. As these tools have evolved, the role of the special librarian has expanded to encompass facilitating customer awareness and access to these services, helping the customer set them up, and aggregating and selecting the results of disparate services to deliver a single integrated feed to the customer.

Trends in Special Library Services

Recent service trends in special libraries include the expansion of information analysis and synthesis, including CI, and the initiation of KM services. As digital information has become ubiquitous, the role of the physical library space as the repository of information, and the role of the librarian in maintaining the order and accessibility of the information resources, has been replaced by networked access from anywhere. As networked access has further opened the floodgates of the information stream, the employees of many organizations have struggled with the need to process, analyze, and synthesize it all. The staff of special libraries have been able to leverage their knowledge of sources, information retrieval methods, and knowledge of their customers’ domains of interest to supply more sophisticated information analysis and retrieval than they could when they were preoccupied with the acquisition and maintenance of collections, and with the delivery of factual information.

Competitive intelligence is a special case of information analysis and synthesis. The practice of CI has arisen, first in for-profit corporations and more recently in non-profit and educational institutions, as organizational

managers have become more attuned to the importance of understanding the marketplace and the competitive environment of the enterprise. CI calls for highly sophisticated collection and analysis of information bearing specifically on important decisions of the strategy and market development of the enterprise. Special libraries, because of their history of responsive collection and delivery of information, have become partners and leaders in many CI programs.

Likewise, KM has become established in many organizations. This is due to two factors: the increasing recognition of information and knowledge as sources of competitive advantage; and the awareness that much of what the organization needs to know is already known by someone in the organization. Thus, the challenge becomes to facilitate the sharing of what is known. Special libraries have become partners and leaders in KM for two fundamental reasons: they possess expertise in techniques of organizing and managing information that can be applied to internally generated as well as externally acquired information resources; and in many organizations they are one of the few entities that work on a substantive basis across a wide array of organizational units. One special library manager has referred to this as the library's mandate to "work across the white space" of the organization.^[20]

ETHICS

The profession of librarianship has a strong concern with ethics. The Code of Ethics adopted by the ALA^[21] and the codes of other professional organizations are evidence of this concern.^[22,23] The application of professional ethics in a special library may be affected by its position as a unit of a larger organization. As Preer writes, "Special librarians have a dual identity arising from their work in libraries which support the goals of another profession or organization. They may find their professional values in conflict with institutional ones."^[24]

With respect to the ALA code, there are two areas of primary interest. These are, "We provide the highest level of service to all library users..." (principle I.) and "We protect each library user's right to privacy and confidentiality with respect to information sought or received and resources consulted, borrowed, acquired or transmitted." (Principle III.)

The former principle conflicts with the special library's need to respect the power and authority structure of the organization, and to take its interests into account in service decisions. Consequently, as does any other organizational unit, the special library generally is obliged to respond first to the demands of its management sponsors, and to relegate the requests of other customers to a lower priority when conflicts arise. Similarly, the question of how much access and service to provide to those outside

the organization is heavily influenced by factors of competition and proprietary interest. While some special libraries are open to the public, many others provide restricted access, or none at all, to individuals who are not affiliated with the parent organization. Still others provide services through participation in interlibrary loan networks and other multitype library consortia, but do not deal directly with members of the public.^[25]

In the latter principle, the ALA Code fails to take into account the lowered expectation of privacy that any individual has when acting as an employee and using systems and services furnished by the employer, in contrast to actions taken as a private citizen. The special librarian, on the other hand, as an employee of the enterprise, has an obligation to follow appropriate corporate policies that may provide for the disclosure of employee information pursuant to corporate policies, and with appropriate safeguards.

MANAGEMENT

Organizational Context

The unique aspects of managing a special library arise from its relationship to its parent organization. Whether it is a one-person information center serving a single unit like a marketing department or a research laboratory, or a complex library network serving an entire corporation, the special library occupies a distinctive position. Although it is often considered an administrative support function, like Human Resources or Fiscal Management, it differs from other support functions in that generally it has no mandate: no requirement that anyone use it. Therefore, the central task for the special library manager and staff is to align the library with the mission, vision, and strategy of the parent organization. The services of the special library must make a valuable contribution to the attainment of the parent organization's goals, and the special librarian must be able to articulate this contribution effectively to secure the support necessary for the library to thrive and to continue building and delivering its valuable services.

The organizational placement of the special library is critically important. Some libraries are set up to serve specific, relatively small, organizational units, such as a research and development group or a marketing department. In this case, the library takes its mission from that of the parent unit. Ideally, the library manager reports to the manager or director of the unit, and is thus able to learn about important developments within the unit, to adjust services as needed to respond to developments, and to make the accomplishments and value of the library visible to the senior manager and other managers in the unit.

When libraries serve a larger organizational unit or the entire corporation, the librarian rarely reports directly to the top manager. Libraries have been known to report to Facilities managers, Human Resource managers,

Information Technology managers, and Publications and Communications managers, to name a few. Debates continue about what is the “best” organizational placement for a special library. What seems clear is that the library manager needs a supervisor who understands the library’s role, supports it, encourages its development, and is powerful enough within the organizational hierarchy to obtain the resources it needs.

In some organizations, all or some of the library functions are outsourced. This means that the organization contracts with another organization for the delivery of these functions. This may be limited to the contracting of specific tasks, such as acquisitions, cataloging, or shelving and filing, or it may encompass the contracting of the entire special library operation. Sometimes the decision to outsource is made as a cost-saving measure, and sometimes for strategic reasons. In the latter case, an organization may decide that library services are not one of its “core competencies” and take the library outsourcing action as part of a strategy of outsourcing all noncore functions. There is ongoing controversy in the profession about whether an outsourced library can deliver services as effectively as a library staffed and led by employees of the customer organization. Hill provides a case study of an outsourced library provider that recommended the customer organization take the library back as an in-house operation for this very reason.^[26]

Planning and Budgeting

It is common for the special library to have a strategic plan, incorporating goals and multiyear action plans that are derived from the strategic plan of the parent organization. In this way, the library aligns with the parent organization.

Budgeting in the library should align in turn with the strategic plan. It has been said that “The budget is the true mission statement of an institution.”^[27] This presupposes that the library has a distinct budget, and that the library manager is responsible for preparing and defending it. The effective special librarian will adjust budget priorities to reflect the strategic priorities of the parent organization: requesting funds for staff, resources, systems, and other initiatives that are explicitly tied to the goals of both immediate and senior management.

Marketing

The need to deliver and articulate the value of the special library puts marketing at the center of its activities. The special library must identify, anticipate, and deliver services that fulfill the interests of multiple stakeholder groups in order to thrive in the organization. Key stakeholder groups include senior management of the library’s parent organization; the immediate supervising managers of the library, the customers who use the library’s services

and resources, and the managers of the customers. Each of these stakeholder groups has distinct interests that the special library must satisfy.

Because the customers and potential customers of most special libraries are limited to the members of the parent organization, marketing to this stakeholder group is relatively straightforward and often well developed. Special libraries use surveys, customer comment forms, focus groups, and other communications methods adopted from the marketing discipline to find out what their customers think about current services and resources, and what they want. A few special libraries have used the LibQual+ survey, administered by the Association of Research Libraries, for this purpose.^[28,29] Similarly, there are generally well-understood media for promoting library services to the potential customer base. These include intranets, internal e-mail lists, printed employee magazines and newsletters, and exhibits in employee cafeterias and building common areas. Special libraries may also offer tours, programs, user-education sessions, and may volunteer to speak to employee groups and organizational meetings.

The fourth stakeholder group that the special library must include in its marketing and outreach is the group of managers of its customers. These mid-level managers may or may not be direct users of the library’s services. In either case, they may be unaware of the full extent of the actual and potential value of the library to their employees, unless the library actively reaches out to them. And yet, their influence on the actions of their employees is enormous. If the manager encourages a new employee to explore the library and get to know the librarian, the employee is much more likely to do so. A desirable approach is that expressed by a technical manager at the MITRE Corporation in this quotation from MITRE’s employee newsletter:

When Omaha Site Leader Dave Poutre briefs new employees on their first day at work, he starts with what you’d expect: this is your badge, here’s your timecard, and the restrooms are over there. Then he gets serious, because the most important part of his orientation is about the support provided by the Information Services team. “I consider Information Services an incredible technical resource,” he says. “They’re a true force multiplier. They have a lot of resources, a lot of databases, and are skilled at quickly and efficiently finding what I need. They know where to go for the right information and how to package it quickly. Tremendous time-savers? You bet!”^[30]

Therefore, the special library must actively communicate both its actual value and its potential to add new value through service and resource enhancements.

Measuring and Communicating Value

The communication of value, both to customer management and through the special library’s management chain

from immediate supervisor to the executive level of the enterprise, presupposes that the library is able to articulate its value in the first place. Thus, the evaluation of library services is another critical element of managing a special library. There are several approaches to this task.

In for-profit corporations, units may be evaluated on their contribution to corporate sales and profits—the “top line” and the “bottom line.” Their contributions may come in the form of increased sales and/or cost reductions. Special libraries may contribute in both ways. The marketing library that, through its research and analysis, contributes to a successful marketing campaign that increases sales, has contributed to the “top line.” The research and development information center that negotiates a favorable license for critical technical content and extends it to cover all the research laboratories of the enterprise has contributed to cost savings both by reducing the overall cost associated with multiple uncoordinated, overlapping licenses, and by saving the time of the technical staff spent seeking the information they need to perform their work. The challenge is the actual measurement of both top line and bottom line contributions. Strouse provides a brief introduction to activity counts, the use of surveys, and the analysis of data to measure the return on investment in corporate special libraries. From his own research in a number of special libraries, he provides the following benchmark figures (in 2003 U.S. dollars):

- Time saved: \$35 per library use
- Money saved: \$42 per library use
- Revenue generated: \$777 per library use^[31]

Special libraries in government and the nonprofit sector have performed similar analyses, focused on cost savings rather than revenue generation. Tenopir and King provide a comprehensive review of the literature of these studies.^[32]

OUTLOOK FOR SPECIAL LIBRARIES: BACK TO THE FUTURE?

The special library arose as a distinct type of library because organizations needed units to acquire the specialized information relevant to their activities, organize that information, and provide customized services to get it to the right people at the right time. The special library developed and prospered in proportion to its ability to deliver on this value proposition. In the past 20 years, however, advances in information technology and changes in the nature of work have altered this value proposition.

The fortunes of special libraries have always risen and fallen with those of their parent organizations, and in times of hardship for the enterprise, the library budget is an obvious target. However, indicators of a broad threat to special libraries date at least to the early 1990s. In two surveys taken five years apart, in 1990 and 1995, it was

found that the number of libraries with over 20 employees had dropped from 11% to 6%.^[33,34] An analysis performed in 2001 identified 33 closures of information services departments in businesses in a period of a few months.^[35] In 2007, Matarazzo and Pearlstein estimated that the membership of the Special Libraries Association had declined by 20% in the preceding 10 years.^[36]

Advances in information technology mean that digital information is now ubiquitous—available to the employees of the organization via computer network anywhere, any time. As the self-serve, interconnected digital information resource becomes a reality, employees no longer need to visit the library in person, nor to consult the librarian in person. In the aforementioned surveys (see notes above), Matarazzo found that corporate executives placed a declining value on the role of the librarian as expert searcher and information intermediary. If information is digital and distributed, the role of the special library as a central place in the organization where information may be found no longer has the value it once did. To the extent that customers can identify, locate, and retrieve information from a networked digital information store, the special library’s role as gatekeeper is no longer needed.

Changes in the nature of work, both enabled and driven by the changes in information technology, place a premium on flexibility in the accomplishment of organizational goals. This flexibility takes the form of flexible teams, an increased emphasis on diverse skills, backgrounds, and viewpoints of team members, and in the demand for individuals to work anytime, anywhere, and collaborate virtually as well as face to face.

In harmony with these changes and the decline of their old value proposition, successful special libraries are now changing rapidly, and finding new ways of serving their customers. They are employing new technologies, offering new services, and developing new relationships. As this evolution takes place, the nature of the special library as a distinct organizational unit and as a physical space hangs in the balance. It may wither away, turn into a network rather than a unit, become exclusively digital, or emerge more robust than ever with both a physical and virtual presence, and new services that complement the old.

Writing in 1993, Davenport and Prusak noted the irony that as organizations have become more aware of the importance of information as a strategic asset, libraries have often played limited and even declining roles. Their call to “blow up the corporate library” meant not to do away with it, sweeping up the smithereens and carting them out with the corporate trash, but rather to turn the knowledge and expertise resident in the special library into itself a distributed, networked resource able to help the enterprise with one of its central needs and opportunities: to become a “learning organization.”^[37] This means the effective networking and distribution of information across the enterprise at the times and in the activities where it is needed.

Bauwens, writing in the same year as Davenport and Prusak, recounted his experiences as a solo librarian embedded in a functional team and collaborating remotely by the use of computers and networks. He envisioned the establishment of networks of information professionals throughout the enterprise, each serving a distinct customer group and all sharing professional insights with one another, to supplant the traditional special library.^[38]

Many special libraries have been pursuing variations of the visions of Davenport, Prusak, and Bauwens. At the National Geographic Society, the library has taken as one of its missions to work across the “white space” of the organization: defined as “those places within the library and outside the library where no one else is working.” As a result of this mission, the library has led or had an important role in developing for the Society “an intranet, . . . an internal university, . . . communities of practice” and more.^[20] The library has been responsible for developing new products, such as a short history of the Society, and routinely contributes to the development of new product ideas—not just as a source of information.^[39]

King, writing in 2004, focused on the role of digital technology in the distribution, use, and maintenance of information resources.^[40] He predicted the continuance of journals and conference proceedings as forms of publication critical to many special libraries and their customers, but he also predicted that current publications of these types will be distributed predominantly in digital form. Digital collections have indeed become increasingly dominant, and with them have come customer expectations of anytime, anywhere, self-service access to them, with cross-links among related information objects, regardless of publisher or source. This digital future is now emerging in many special libraries.

Abram provides a summary of new service roles open to special libraries.^[41] He sees the future in opportunities to partner with others across the organization and to form:

- Unified access points to information resources.
- Integration of information and learning services to strengthen the learning environment for each employee.
- Embedding librarians into organizational units and project teams to concentrate on all aspects of the information needs of the unit.
- Providing distance services and resources to an increasingly distributed and mobile workforce through mobile communications and virtual reality.
- Equipping customers to use information effectively in their work through customized information literacy training.

In this scenario, the special library becomes both a physical and a virtual presence. The physical space of the library changes from a reading room to a talking room: a space that enables face-to-face meetings and collaboration

and the encounters with information and knowledge that lead to enhanced organizational performance, and may be mimicked in cyberspace by a virtual special library with all the same attributes.

This prospect for the evolving role of the special library has been summarized as “knowledge services”: a “framework for management that embodies the highest objectives of knowledge management and combines them with the basic principles of the learning organization and the teaching organization.”^[42] In this framework, the special library takes responsibility for all the information and knowledge assets and processes of the organization. It integrates internal and external resources. It deals with recorded, recordable, and tacit knowledge, and enables connections among staff who know and those who need to know—as well as between staff of the organization and outsiders with important knowledge to share.

What seems certain is that many different organizations of different types will have an increasing need for effective management and delivery of information, and that those special libraries that continue to innovate and to “put knowledge to work” will have a bright future and an increasingly important role.

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Special Libraries Association (SLA)

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Abstract

Founded in 1909, the Special Libraries Association (SLA) serves the members of that branch of the library and information science professions generally thought of as “non-traditional.” Special Libraries Association members work in corporate, research, scientific, institutional, and government libraries, as well as in other settings where their work is characteristically described as being in support of the organizational mission or enterprise of which their libraries are a part. With more than 10,000 members in 75 countries, SLA’s role is to support professional knowledge workers in their work as they provide practical and utilitarian information, knowledge, and strategic learning to their identified knowledge customers and clients. The association has 58 regional chapters located throughout the world.

INTRODUCTION

Throughout its history, the Special Libraries Association (SLA) has served the members of that branch of the library and information science professions generally thought of as “non-traditional.” To most people, librarianship refers to the profession which provides library services through public, academic, and school libraries. Thus the work of professional employees in specialized librarianship is best characterized as what it is “not”: specialist librarians and the members of SLA do not usually work in public, academic, or school libraries (although some do, particularly in subject-specific departments in academic or public libraries). They work in corporate, research, scientific, institutional, and government libraries, as well as in other settings where their work is characteristically described as being in support of the organizational mission or enterprise of which their libraries are a part. As such, these organizational functional units are often not even referred to as “libraries” but are frequently described as “information centers,” “knowledge centers,” “research units,” or by one of the myriad other designations that have come to be associated with specialized librarianship.

The Special Libraries Association was not the first organization to represent the unique interests of specialist librarians. There were already two such organizations in existence when SLA was founded in 1909. One was the Medical Library Association (originally the Association of Medical Librarians, founded in 1898) and the other was the American Association of Law Librarians, founded in 1906, but both were, obviously, specific to the subject

interests of their unique memberships. The situation was different when John Cotton Dana and his colleagues founded SLA, for they had recognized that a practical version of librarianship was required for any specialized library, regardless of its subject affiliation. Thus, while building on the concepts and methodologies of librarianship as then practiced, SLA was created and directed toward the particular and specific needs of those seeking information, knowledge, and strategic learning in pursuit of their practical goals. Today, while retaining its connection to the LIS profession through its name, SLA continues to support that pursuit, and the association’s service sphere includes all specialist librarians, regardless of the subject specialty of the organizations where they are employed. Its Vision Statement was published in 2004, and it continues to state that case: “SLA is a non-profit global organization for innovative information professionals and their strategic partners.”

With more than 10,000 members in 75 countries, SLA’s role is to support professional knowledge workers in their work as they provide practical and utilitarian information, knowledge, and strategic learning to their identified knowledge customers and clients. The association has 58 regional chapters located throughout the world (although primarily in North America), 25 divisions representing subject interests, fields, or types of information-handling techniques, and 11 caucuses, informal groups of members who share a common interest not covered by any chapter, division, or committee. As a professional association, SLA promotes and strengthens its members through learning, advocacy, and networking

initiatives, as outlined in its Mission Statement (also published in 2004). The association's core values are also available for public examination, and SLA's members take much pride in publishing the values that they bring to their work and expect from their colleagues in their unique branch of the library and information science professions:

Leadership Strengthening our roles as information leaders in our organizations and in our communities, including shaping information policy.

Service Responding to our clients' needs, adding qualitative and quantitative value to information services and products.

Innovation and Continuous Learning Embracing innovative solutions for the enhancement of services and intellectual advancement within the profession.

Results and Accountability Delivering measurable results in the information economy and our organizations. The Association and its members are expected to operate with the highest level of ethics and honesty.

Collaboration and Partnering Providing opportunities to meet, communicate, collaborate, and partner within the information industry and the business community.^[1]

SPECIALIZED LIBRARIANSHIP AND THE ORIGINS OF SLA

The Special Libraries Association's origins are well-known within the LIS professions, and many of the association's members have over the years taken much pleasure in telling and re-telling the story. Historical information is based on that in SLA at 100: From Putting Knowledge to Work to Building the Knowledge Culture.^[2] By the early twentieth century, John Cotton Dana—head of the Newark (NJ) Public Library and a notable leader in librarianship—had recognized that the distinctions between specialized librarianship and the broader profession were significant, even critical if service delivery in those organizations that required practical and utilitarian information was to meet the needs of the library's users. Firm in his belief that better service could be provided to library users when these distinctions are invoked, Dana began thinking about how specialized libraries are different, and how these differences might be exploited for the benefit of library users.

The differences were not always immediately apparent. As Dana recognized that changes were demanded in the management of libraries (what he referred to as "library method"), he was able also to recognize that the written word—the primary method for the formal delivery of information in his time—must not be available just for the student, or just for the casual reader. As he described the evolution of the specialized library in 1914, Dana

wrote that what is read "must also serve the industrialist, the investigator or scientist, and the social service worker." Even with his ability to recognize that change was taking place, though, and even with the association having been in existence for 5 years, Dana was not quite ready to specify what the change would be: "It is too soon," he wrote, "to say in just what manner this new form of service will be rendered."^[3]

So while the needed changes were not particularly articulated at the time, SLA did indeed begin with a need for change, and the question of whether to change was not a consideration. It was to be major change, and it had even been anticipated before Dana and F. B. Deberard called a group of 20 librarians together on the verandah of the Mt. Washington Hotel in Bretton Woods, New Hampshire in 1909 to discuss the creation of the new organization. On the occasion of SLA's 50th anniversary in 1959, Elizabeth Ferguson described the meeting:

The participants in this "Verandah Conference," as it has come to be known, decided that the demands of their jobs had actually created a new kind of librarianship—that of library service geared to meet the needs of specialized situations. These librarians were breaking completely new ground. There were no patterns to follow. They had to play it by ear—a challenging but often difficult feat. They felt that they had everything to gain by forming their own working group to tackle their problems cooperatively.^[4]

Dana served as SLA's first President, from 1909 to 1911, and early on, the cooperative focus was put forward as one of the group's specific attributes. The inclusiveness and diversity of SLA's membership was clearly established as a singular characteristic of the association, as is demonstrated in the association's Constitution (adopted at Bretton Woods on July 2, 1909):

The object of the Association is to promote the interests of the commercial, industrial, technical, civic, municipal, and legislative reference libraries, the special departments of the public libraries, universities, welfare associations, and business organizations.^[5]

Dana made it clear at the time and in his later writings that the "special libraries movement" (as he and his colleagues called it) was in response to a need. The philosophy that guided general library practice in 1909 was not appropriate for meeting the demands of specific patrons who required information for totally practical—and not necessarily altruistic, intellectual, or recreational—purposes.

Nor should it be assumed that the "Verandah Conference" in New Hampshire was the only place where the necessity for addressing practical information needs had been discussed by librarians. Even Melvil Dewey had something to say in this matter. As libraries grew in numbers and, particularly, in size, more was required of

librarians as information providers, and obviously a certain level of specialization would be brought forward. Dewey was aware of this trend, and even seemed to be leaning toward recognizing that some library patrons would require a different type and level of service delivery. As he put it: "Librarians are rapidly taking on their proper function as book experts for their various constituencies. But the librarian is rapidly outgrowing the idea that he is concerned with books alone. The public pays its money, not to dignify books as such, but because it wishes information. . . ."^[6] Thus even for Dewey the connection between libraries and practical information delivery was there. But Dewey, being a citizen of his times, and an active proponent of the "uplifting" role of libraries, naturally felt a connection between that role and the provision of materials for "inspiration" and "innocent recreation" also provided by libraries.

So a new "form" of library service, a new "library method" as it was called, was required, and Dana described it in his "evolution" article in 1914:

The proper view of printed things is, that the stream thereof need not be anywhere completely stored behind the dykes and dams formed by the shelves of any library or of any group of libraries: but that from that stream as it rushes by, expert observers should select what is pertinent each to his own constituency, to his own organization, to his own community, hold it as long as it continues to have value to those for whom he selects it, make it easily accessible by some simple process, and then let it go.^[3]

Dana then went on to elaborate, as was his very personal style, on how specialist librarians should carry out this charge by putting forth what he called "The New Library Creed".

Select the best books, list them elaborately, save them forever—that was the sum of the librarians' creed of yesterday. Tomorrow it must be, select a few of the best books and keep them, as before, but also, select from the vast flood of print the things your constituency will find helpful, make them available with a minimum of expense, and discard them as soon as their usefulness is past.^[3]

Despite their good intentions, Dana and the other founders of the association found that the new rule was difficult to put into practice. As they were quick to point out, this new type of librarianship was different, a field, as they put it, "not yet greatly cultivated," and from their perspective, it was the formation of SLA that would bring some sort of order from the chaos of early thinking about specialized librarianship. Through conversations, correspondence, and the conference of 1909, the effort began to take shape, but even as late as 1914, when he was writing 5 years after the association's founding, Dana described how he was disappointed that the "New Library Creed" had been as yet adopted by very few practicing librarians. He was also quick to state that

it is gaining followers, however, in the fields of research and industry whose leaders are rapidly and inevitably learning that only by having accessible all the records of experiment, exploration, and discovery pertaining to their own expertise, wherever made, can they hope to avoid mistakes, escape needless expenditures, and make profitable advances in any department of science or in any kind of industrial social work.^[3]

From its earliest days, the name of the association and the type of professional services its members provided caused difficulty. While recognizing the "specialness" of what specialist librarians do, Dana was not shy about expressing some discomfort with the term:

The name special libraries was chosen with some hesitation, and rather in default of a better; but it has seemed to fit the movement admirably. It may be said, of course, that every library is in a measure special, in its own field, and that state libraries, libraries of colleges and universities, of medicine, law, history, art and other subjects may be called special. But a special library, and the special departments of more general libraries—like the business branch at Newark—are the first and as yet almost the only print-administering institutions which professedly recognize the change in library method that the vast and swiftly mounting bulk of print is demanding; realize how ephemeral, and at the same time how exceedingly useful for the day and hour is much of the present output of things-intended-to-be-read, and frankly adopt the new library creed as to print management, of careful selection, immediate use, and ready rejection when usefulness is past.^[3]

100 YEARS OF SPECIALIZED LIBRARIANSHIP

Celebrating its centenary in 2009, SLA as a professional association has made important contributions to the growth and development of information management, knowledge management, and strategic learning, the three disciplines that now converge into what is generally recognized in the larger management community as knowledge services. With its primary focus on the delivery of services in the corporate, research, scientific, and government fields, the association has been required to operate somewhat "outside" the usual LIS environment while attempting to continue its collaborative relationship with other library associations and working with them in an advocacy role for the larger LIS profession. From its earliest days, SLA was required to demonstrate to its members (and potential members) that their unique work placed particular and "special" requirements on the association.

By 1914, SLA had achieved remarkable success in meeting one of its goals, to serve as a clearinghouse of information. Today we would characterize this function as "knowledge sharing," and for the specialist librarians of

1914, it became tangible and practical when SLA was responsible for the creation of “PAIS”, the Public Affairs Information Service (now “OCLC Public Affairs Information Service”), an effort undertaken to provide better access to the literature of public affairs. This work had been preceded by any number of published bibliographies, finding aids, and similar tools, all of which represent examples of the move in the direction of Dana’s “practical and utilitarian” library services. As such, it represented—as Dr. John A. Lapp of the Indiana State Library (who had taken on the editorial responsibilities for *Special Libraries*, SLA’s journal) said—one of the goals of the founders. These efforts at knowledge development and knowledge sharing inspired him to come up with a motto for specialist librarians, “putting knowledge to work” a motto which served as the association’s tag-line for over 90 years.

The Great Depression brought major challenges, as did World War II. In both of these great national crises, specialist librarians and the association itself seemed to demonstrate the highest levels of commitment and service they were called upon to provide. As the 1930s began, there continued to be much enthusiasm among the association’s members and its leaders about the “idea” of specialized librarianship, about how the specialized research library could be made a “profitable” department in the organization and function as a headquarters to which questions from throughout the entire organization could be referred, thus coordinating departmental activities and avoiding the duplication, delay, and expense of reproducing data already available and saving time and money. While not revenue-producing, these services were expected to be operated along with services that produce revenue for the host organizations, and included such activities as translation services, the producing of bibliographies, “literary researches,” and the editing of technical manuscripts, tasks that could be undertaken, at a profit, by the staff of the specialized library.

The challenge during the years of the Great Depression built on the knowledge sharing that had been in evidence since the association’s earliest days. Great efforts were made to ensure that all members were able to have “knowledge of the abilities of our entire membership,” (some 1700 by 1935) as one president of SLA put it, thus providing another tangible and utilitarian benefit of membership and, hopefully, enabling the growth of the association. At the same time, this growth would result in one of the association’s early leaders primary goals, the “development of a national viewpoint” about the values and benefits of specialized librarianship.

Yet these efforts at moving specialized librarianship forward were being undertaken in a society that was constantly being subjected to external forces that could not help but influence their success. That the Great Depression was occurring while the association’s members and leadership were seeking to move specialized librarianship into the mainstream was a constant worry. The Special

Libraries Association found itself involved in a variety of ways. Unemployment was the greatest fear, and SLA’s Employment Committee was pressed into service “for the unemployed in our profession,” but the committee cautioned, at the same time, that in its work it was obliged to “maintain its ideal of placing in a new position the best qualified special librarian, whether at the time employed or unemployed.” Specialist librarians also needed to know just how they should react to the emergency situation they found themselves in, and it was not unusual for them to be offered in *Special Libraries*, encouraging and inspirational presentations about how they could get through the rough spots, with articles such as “Special Libraries in Time of Depression” being typical.

With World War II following immediately on and, in effect, ending the crisis of the Great Depression, specialist librarians found their professional skills in even more demand. One of the most impressive activities, undertaken shortly after the beginning of the war, was an effort to coordinate the services of the specialized libraries community. Recognizing that their first step was to gather data about what resources were available in the nation’s specialized libraries, surveys were organized and distributed, and some 400 specialized libraries (“largely technical and business libraries”) were contacted, with 150 reports quickly returned. These reports, “nearly all of them good, full reports which give an impressive picture of special library service and which, taken together, offer a unique tool for research,” became a valuable resource for inter-library cooperation among specialized libraries and led eventually to the development of a master file, sent to the Library of Congress, demonstrating which libraries specialize in which subject fields and what their specific strengths were. Thus the war emergency provided the opportunity for the first major analysis of research resources in specialized libraries in the United States, a goal that had often been discussed but which had never been attempted before.

That these efforts were vital to the war effort did not go unnoticed, even at the highest levels of government. President Franklin D. Roosevelt commended America’s specialist librarians, calling them “the guardians of our technical knowledge,” and noted that “through your special knowledge and through the quickness with which you work, you give to our business men and to our economists the data which they, too, need. You ask for no recognition. You work anonymously and unsung. But you are doing your job along with the army, the navy, and the air forces on America’s front line.” It was a great tribute to the members of the association, honoring them for the very skills and professional expertise that called them to their work.

It was important work. Of that there is no doubt. The war effort prompted an outpouring of professional expertise the likes of which had not been experienced before, and SLA as an organization was there to provide the

support these specialist librarians needed. So their numbers grew, and by the end of the war, membership stood at 4300. For this remarkable growth to have occurred despite—perhaps because of—the war is equally remarkable.

With this new strength in numbers, as the war ended it became clear that the “special libraries movement” of SLA’s founders was taking on new and ambitious goals. Throughout its history, public relations had always been part of SLA’s service structure, and over the years many of its leaders and members had worked long and hard to ensure that the special libraries movement was duly put forward to those for whom it would provide benefit. But the universe of prospective users of practical information, knowledge, and learning was (and continues to be) a very large one, and no leader of the association has ever been satisfied that all that could be done in bringing the value of specialized librarianship to the attention of the decision makers in society has in fact been done. By the end of the 1940s, it was now clear that the promotion of specialized librarianship could be taken to a new level. For example, the development of an advisory service to business and industry was proposed. It would be a service that would involve the appointment of one or more specialists on the SLA staff with responsibility for consulting about the establishment of special libraries. Other responsibilities would include providing information services to specific groups and industries, the development of details and plans for the organization, equipment, and staffing of new specialized libraries, and reviewing the informational needs of all types of businesses and industries and of available reference tools in order to ascertain needed bibliographical aids and other reference publications which might be sponsored by the association.

The demand for expanded services from the association was there. Only forging the link between the potential users of specialized library services and the specialist librarians themselves remained to be accomplished, and in an historical essay on corporate and technology libraries, Edythe Moore painted a very clear picture of the opportunities:

Just as had happened after WWI, there was tremendous growth in the numbers of corporate libraries, especially in scientific and technical areas, immediately following WWII. Established companies endeavored to catch up after giving their time and attention to the war effort, and new companies sprang into existence to take advantage of a whole array of sophisticated technologies developed for the military and which they now planned to use to provide products and services for civilian use.

Not only did corporate libraries proliferate following the war, but they also rapidly expanded in size of collections, staff, and services offered. Burgeoning research and development, much of it sponsored by the U.S. Government, flooded the technical community with a growing

body of literature more interdisciplinary in nature than ever before and in new formats.^[7]

Not surprisingly, this “growing body of literature” was soon perceived to be overwhelming, and leaders in the scientific and technical communities and in business management became almost desperate to find solutions to the problem. By 1955, it seemed clear that the documentation field—working alongside specialized librarianship—might provide the answers, and the association’s leadership accepted a new definition for the discipline. Provided by SLA’s Committee to Formulate Definitions on the Fundamental Characteristics of Special Librarianship, the work of specialist librarians was now defined: “The profession of special librarianship and documentation is the science of selecting, evaluating, organizing, and disseminating information in special fields of knowledge and the art of integrating and adapting information resources to the needs of a particular institution or clientele.” It was a new way of describing the profession, and for the first time in SLA’s ongoing efforts to define its discipline, the specific concept of documentation—the bringing together of useful information on a particular subject (i.e., documenting a subject) without regard to the form or format of that information—was attached to specialized librarianship.

In practice, the linking of specialized librarianship and documentation did not turn out to be a comfortable fit. Historian Robert V. Williams has written that “the term did not seem to appeal to special librarians and they continued to use special, despite their uneasiness with the word and despite the continuing need to reply to the general librarians retort that ‘all libraries are special.’” Yet his case that specialist librarians were, even reluctantly, the first American documentalists is a good one: “It is quite clear from the variety of definitions offered, their explanations of what they were doing, and how they served their users, that they were the first American documentalists.”^[8]

Nevertheless, specialist librarians and documentalists could not come together. In 1971, a proposal was put forward to merge SLA and ASIS, the American Society for Information Science, and a Joint Merger Committee was appointed to study a possible merger. Brought forward to “seek areas of mutual interest and cooperation...based on the belief that our professional interests overlap or at least converge at some points with ASIS and can be furthered through such activities as joint meetings and projects at the Association level,” the proposal did not make it past a questionnaire sent to the membership, for there was no clear mandate to continue the discussions.

One interesting development during this period was the growth of the membership and the role of SLA members as leaders. Their leadership role took on new challenges in the 1970s, particularly with issues having to do with copyright legislation. Indeed, copyright and the restructuring of

copyright legislation became the defining focus of that decade. In the mid-years of the century, it had become clear to many in government that American copyright laws would require revision, and the U.S. Congress authorized the Copyright Office of the Library of Congress and an advisory group of specialists to conduct studies of the copyright law. By 1960, the first four studies, printed for the use of the Committee on the Judiciary, were made available through the Government Printing Office and announced in the library press, including in *Special Libraries*.

The association's position on copyright was put forward in testimony before the U.S. Congress. The statement included SLA's preference for the continuation of the "long recognized concept that the preparation of a single copy constitutes 'fair use.'" After referring to the difficulties—in a specialized library—of adhering to turnaround time requirements for seeking permission to make photocopies, the statement described four specific concerns, of which the most dangerous would be those that penalized for-profit organizations:

The legislation to be enacted must not prevent or penalize the preparation of a photocopy for or by specialized libraries—particularly those in for-profit organizations. There will be immeasurable damage to the economy and the welfare of the nation if such intent is contained in the enacted version. . . or if such interpretation is possible after enactments of the law.

Finally, the association's testimony on this critically important issue made clear SLA's societal role: "The rapid transmission of man's knowledge—either to not-for-profit or to for-profit organizations—must not be impeded by law."

By 1976, the library photocopying sections of the new U.S. Copyright Law and pertinent portions of congressional reports had been mailed to all SLA members, and the next year the association published *Library Photocopying & the U.S. Copyright Law of 1976*, prepared under the supervision of the association's legal counsel by the SLA Special Committee on Copyright Law Practice and Implementation. The document, designed to assist members in understanding and complying with the new copyright law, and its distribution to the membership testified to the high level of interest SLA and its leadership had in the subject and their sense of obligation in providing direction for the association's members.

By the 1980s, this leadership role for SLA was being clearly recognized, yet there continued to be confusion about specialized librarianship and the role of specialized libraries in the organizations where they are part of the research structure. To clear the air, Past President Edward G. Strable bravely stepped forward to articulate the distinctions between specialized librarianship and other forms of professional practice within the LIS profession:

- Special libraries can be difficult to find—most are not visible to the general public.
- Most special libraries deal with a single subject or related group of subjects. The special library is the library of the organization, most often the only library, and serves all information needs.
- The scope of the special library's collection and service is determined by the objectives of the parent organization.
- Special libraries are usually found in organizations whose objectives are not primarily a library objective.
- Special libraries serve different kinds of clientele—almost never used by "everybody"—populated by user groups who have a work relationship with the organization which maintains the library.
- Special librarians—like their users—are frequently specialists.
- Special libraries tend to be comparatively small, often one-person. They also frequently have small user groups.
- A good number of special libraries are supported by private and not public funds. They spring from and are much a part of a competitive capitalistic system.
- Special libraries are characterized by risk—risk of failure is always present in business and industry, in associations and societies, and in the professions. Special libraries can be dissolved because they cost too much and don't bring in enough of a benefit to the sponsoring organization.^[9]

Strable painted a very good picture of this branch of the profession, and his strong description seemed to match other forces that were coming into play. In that same year (1981), the great potential of electronic data processing and the value of the personal computer in business management was being clearly established (with *Time* magazine identifying the personal computer as the magazine's "Man of the Year" that year). With the strengths of information science now playing a major role in the management of research assets in many companies and organizations, SLA's leaders and members were quick to demonstrate that the association, as a professional, scientific, and educational organization, had an interest in playing a leading role as society transitioned into this new era of information, knowledge, and strategic learning. And for the most part, the members of the association—and certainly the leadership—understood that for themselves, as information professionals, leadership in information management was a natural role. Indeed, by 1983 SLA had published that "The mission of the Special Libraries Association is to advance the leadership role of its members in putting knowledge to work in the Information Society." Specialist librarians wanted and expected to participate in this era in which, as described often, the advantages of computerized information transfer would be available to and accessible by the greater lay public.

Knowledge workers, including specialist librarians, would be called upon to perform their professional roles in an environment in which important societal benefits, often forecast by idealists and futurists, would lead to the breaking down of societal boundaries, to an increased recognition of the value of diversity among the peoples of the world, and to the realization of social, economic, and cultural advantages through the transparent and non-hierarchical transfer of information.

Within a decade, the association began to look in yet another—and complementary—direction, with the identification, growth, and embrace by its members and leadership of knowledge management. In 1990, Microsoft Windows was introduced, and within 3 years, the U.S. Government officially went online, a fact that had serious implications for the association now that its headquarters had moved from New York City to Washington and its daily interactions necessarily coincided with those of the Federal government's information planning and service delivery. Two years later, e-commerce was introduced and by the end of the decade, some 90 million users in the United States and Canada were estimated to be "online," the descriptor which had now become standard in describing how people dealt with information transfer. Resonating strongly with SLA's membership—simply because of their role in the business and research environment—Thomas Stewart's seminal cover story about intellectual capital in the June 3, 1991 issue of *Fortune* set the stage for the transition from the focus on information in the information age to the coming focus on *managing* knowledge. "Intellectual capital," Stewart wrote, "[is] the sum of everything everybody in your company knows that gives you a competitive edge in the marketplace."^[10] And who knew better in 1991 what everybody in their organizations knew, what they were working on? For specialist librarians, the promising framework for connecting information management, knowledge management, and strategic learning was being built. Special Libraries Association's members were ready to take on their leadership role in the process of delivering what would come to be known as knowledge services—the convergence of information management, knowledge management, and strategic learning—to their clients.

One approach was to take yet another look at the professional contributions specialist librarians bring to their employing organizations. In 1992, SLA's Presidential Commission on Professional Recruitment, Ethics, and Professional Standards, popularly known as "The PREPS Commission," had a specific charge, to focus on how the association and its members could encourage the best, the brightest, and most qualified people to enter the field of specialized librarianship. Emphasis was to be given to the unique role that specialist librarians play in information management, with the study commission looking at the issues of recruitment into specialized librarianship, ethics and the place of a code of ethics for specialized

librarianship, and standards and basic competencies for the discipline. The commission's work built on, as its chair Mary Dickerson described, "...the premise that special librarianship is a unique branch of the profession of librarianship; that despite the great diversity within special librarianship itself, special libraries nonetheless have different missions, focuses, and purposes than libraries in other branches of the profession."

The work and influence of the commission was a major step forward for the association, as it sought to codify some of the concerns associated with information services and the management and delivery of information by practitioners who had been educated as librarians. In identifying how SLA's members could recruit the brightest and best people into this branch of the profession, the PREPS Commission was also issuing a challenge, asking SLA's members to recognize that the difference between specialized librarianship and other types of librarianship was a very real difference, asking them to contemplate "if perhaps the time has not come to separate ourselves from others in the profession and promote that we are, in fact, an entirely different branch of the profession?" Of particular concern—as had been the case throughout SLA's history—was the fact that graduate programs in library and information studies did not provide sufficient particular attention to the skills and competencies required for success in specialized librarianship. In its findings, the commission noted that professional learning for specialist librarians could be expected to be provided in the future through another avenue, presumably through training, continuous education, and professional learning offered through professional organizations like SLA or through commercial learning providers.

Thus the face of specialized librarianship continued to change, and as it did, perceptions about this branch of the profession began to change as well. By the mid-1990s, it was clear that specialist librarians and information professionals—the very people who made up the membership of the association—were indeed thinking about themselves very differently than they had in earlier times. In fact, the focus shifted from themselves and their perceptions of themselves to the influence that they brought to their professional workplace, and it was time now to change the way management and organizational leaders thought about specialized librarianship and information management.

Following the work of the PREPS Commission, competencies became the subject of the association's next major effort, to devise and deliver to the business and research community a standardized framework for establishing criteria for successful performance in the information profession. The appointment of a Special Committee on Competencies for Special Librarians in 1994–1995 and the publication, in May 1996, of *Competencies for Special Librarians of the 21st Century*—which

identified and described key competencies required for the successful management and delivery of excellent information services—might arguably be characterized as one of the most important events in the history of the association. For the first time, the emphasis was on the people who work as information professionals and not on facilities, collections, services, or products. Indeed, the significance of the work was well understood by all involved, including not just the special committee but the association's leaders, members, and many with whom they came in contact in the broader information management community.

These professional employees, now characterized as information professionals and not as special or specialist librarians, began to be further recognized as leaders in the management of information, knowledge, and strategic learning. Indeed, there was a strong movement within the association to move to the term, and despite a failure to change the name of the association in 2003, the characterization of its members as "information professionals" became the norm. The revised competencies statement of 2003^[11] used the term instead of "special librarians," and the association's Web site added a page describing these knowledge workers and their contributions to their employing organizations:

About Information Professionals

An Information Professional ("IP") strategically uses information in his/her job to advance the mission of the organization. This is accomplished through the development, deployment, and management of information resources and services. The IP harnesses technology as a critical tool to accomplish goals. IPs include, but are not limited to, librarians, knowledge managers, chief information officers, web developers, information brokers, and consultants.

Information Professionals work for information organizations, which are defined as those entities that deliver information-based solutions to a given market. Some commonly used names for these organizations include libraries, information centers, competitive intelligence units, intranet departments, knowledge resource centers, content management organizations, and others.

The diverse responsibilities that Information Professionals may include:

- Developing and maintaining a portfolio of cost-effective, client-valued information services that are aligned with the strategic directions of the organization and client groups
- Building a dynamic collection of information resources based on a deep understanding of clients' information needs
- Gathering evidence to support decisions about the development of new services and products
- Maintaining current awareness of emerging technologies

- Assessing and communicating the value of the information organization, including information services, products and policies to senior management, key stakeholders and client groups
- Contributing effectively to senior management strategies and decisions regarding information applications, tools and technologies, and policies for the organization^[12]

By the end of the twentieth century—90 years into SLA's history and in the very last month of the century—the distinctions between specialized librarianship and other kinds of library and information work were clearly identified by Professor Marion Paris. Addressing the practitioners themselves, Paris was very specific in describing how specialized librarianship is different from other types of library work and her description of specialized librarianship can almost be seen as an update of John Cotton Dana's "New Library Creed":

In searching for the technical, the obscure, the undocumented fugitive report, or the one final detail that will win a new client, special librarians have always been indifferent [to] walls and boundaries. Special librarians networked long before the noun underwent linguistic conversion into a verb. . . . Whether the context is a corporation or a museum or a military installation or a specialized academic collection or a research and development laboratory, the ethos of special librarianship veers sharply away [from that of other types of libraries]. . . . According to the [American Library Association's] Library Bill of Rights special librarians are heretics. You practice censorship; you do not as a rule educate your customers; you do your clients' work for them, you acknowledge and admit that all customers of your libraries are not created equal. Summoning the totality of who you are (in possession of intelligence, education, experience, discernment and no small amount of cultivated prescience), you anticipate needs and cater to your customers. Moreover, it is essential to your credibility and to the continuing prosperity of your libraries that you make judgments about information sources and means of locating them. Means, by the way, that may be unconventional, but invariably their ends justify them. You create new information on demand. Knowledge management is merely a fresh take on your expertise: You collect information, organize it, store it, find it, and you repackage it.^[13]

In the twenty-first century, the further evolution of this branch of the profession continues to take place with SLA taking the lead. In its Vision Statement of 2004, SLA identified networking, education, and advocacy as its core purposes. These are exemplified in the association's use of technology—unimaginable to the association's founders—to enhance globalization, professional development and learning, and communication (both between the association and its members, and among the membership itself). In SLA's second century, the foresight of John Cotton Dana and the association's other founders is

evidenced by the fact that “putting knowledge to work” continues to be the overarching goal for the many information professionals who make up its membership.

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Specialty Museums

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Abstract

The term “specialty museums” is broadly defined and difficult to classify. The term includes institutions that do not fit into the traditional museum categories of Art, History, and Science. Specialty museums lack a single organizing entity and determining the number of specialty museums presents serious challenges. Despite this, specialty museums have some unifying characteristics, albeit ones that raise important questions about the definition of museums as a whole.

INTRODUCTION

For the purposes of the Encyclopedia, this entry considers a number of different types of museums under a single entry. The term “specialty museum” is extremely broad and is often used as a catchall for any institution that does not fit into the traditional major museum categories of Art, History, and Science. Because of this, specialty museums run the gamut from sports halls of fame to stamp museums. The level of professionalism also varies widely, encompassing everything from multimillion dollar exhibits in state-of-the-art facilities, to one person’s private passion run out of their basement. In both the United States and internationally, all museums, regardless of type, are often loosely organized even when they have much in common. Membership in museum associations tends to be voluntary and only rarely requires adherence to set standards of management or behavior. Due to the wide diversity of specialty museums, there is no single group or organization that unites them in a coherent whole.

Caveats aside, specialty museums share certain features that unify all museums. The first is the acquisition and care of collections. Although museums may define their collections in a dizzying variety of ways, most museums have the acquisition and care of physical artifacts as a core element of their mission.^[1] A second, more recent development that unifies museums is a commitment to public service. Since the 1970s there has been an increasing emphasis on the service component of museums’ missions. Today, all widely accepted listings of the defining characteristics of museums stress that institutions must not only collect but also work to provide a positive benefit to people and society.

The following sections detail the different types of specialty museums, the difficulties in categorizing and counting them, the changing definitions of museums, examples of some categories of specialty museums, and how specialty museums fit into current museum trends.

Types of Specialty Museums

The American Association of Museums (AAM) is the largest and most comprehensive museum organization in the United States. Every year, with AAM’s guidance, National Register Publishing prints *The Official Museum Directory* which lists 38 separate categories for “Specialized Museums.” The 38 categories of specialized museums recognized by AAM are^[2]

- Agriculture Museums
- Antiques Museums
- Architecture Museums
- Audiovisual and Film Museums
- Circus Museums
- Comedy Museums
- Communications Museums
- Crime Museums
- Culturally Specific
- Electricity Museums
- Fire-Fighting Museums
- Forestry Museums
- Furniture Museums
- Gun Museums
- Hobby Museums
- Horological Museums
- Industrial Museums
- Lapidary Arts Museums
- Logging and Lumber Museums
- Mapariums
- Mining Museums
- Money and Numismatics Museums
- Musical Instruments Museums
- Philatelic Museums
- Photography Museums
- Religious Museums
- Scouting Museums
- Sports Museums
- Technology Museums

- Typography Museums
- Village Museums
- Wax Museums
- Whaling Museums
- Woodcarving Museums

These categories are not exhaustive, and it is likely that many of them could also be classified in one or more of the traditional categories of Art, History, or Science also listed in *The Museum Directory*. For example, an Agriculture Museum could also be categorized as a History Museum if its main focus were the study of the history of agriculture. Indeed, *The Museum Directory* takes a mixed approach to the problem of defining museum categories. It separates museums mainly by the type of collections they hold (History, Art, Science, etc.) but also categorizes some institutions by their governance structure (such as College and University Museums).^[2]

Organization of Specialty Museums

There is no single lobbying or professional group for specialty museums in the United States or internationally. None of the 26 Councils of Affiliates recognized by the American Association of Museums focuses on specialty museums as a separate entity, and it appears that most institutions categorized as specialty museums do not feel a strong affinity with other museums in their category.^[3] There are, however, advocacy groups that represent subsets of the specialty museum category such as the Association of Railway Museums, the Council of American Jewish Museums, and the Council of American Maritime Museums. Although specialty museums can fit into a number of categories, and groups of specialty museums may band together to support mutual interests, specialty museums as a whole do not work as a unified advocacy group and do not necessarily even see themselves as distinct from other museum types.

Number of Specialty Museums in the United States and Internationally

The fragmented nature of specialty museums is a problem endemic to the museum community as a whole. With disparate missions, collecting interests, and governance structures, museums are loosely organized in the best of circumstances, and specialty museums are even more diffuse. There are no reliable data on the number of museums in the world and even less information on the number of specific types of museums. The American Association of Museums estimates that there are 17,500 museums in the United States alone, but only lists 9,500 of them in *The Official Museum Directory*.^[4] Statistics on the number and type of international museums are even more challenging to determine with confidence. The United Kingdom's Art

Fund estimates that there are 2,500 museums in the United Kingdom and that 1,800 of these have earned accreditation. The Fund classifies these institutions by governance structure, not by type, so it is impossible to determine how many museums in the United Kingdom may fall into the specialty category.^[5] On a broader scale, the International Council of Museums (ICOM) has assembled information from a number of countries and provides both the number of museums and their types, but this data is admittedly incomplete at best.^[6]

Issues Surrounding the Definition of Specialty Museums as a Category

It is possible, but not entirely satisfying, to consider the problem of specialty museums by exploring how these institutions conform to accepted definitions of the term "museum." Museum themselves have long had difficulty precisely defining what is and what is not a museum, and these definitions have changed over time. While noting that museums are "infinitely diverse," the American Association of Museums' *Code of Ethics for Museums* notes that the common denominator for museums is making a "unique contribution to the public by collecting, preserving, and interpreting the things of this world."^[7] The *Code* also acknowledges the wide variety of sizes and types of museums: "Their numbers include both governmental and private museums of anthropology, art history and natural history, aquariums, arboreta, art centers, botanical gardens, children's museums, historic sites, nature centers, planetariums, science and technology centers, and zoos."^[7] The International Council of Museums offers an equally broad definition of a museum as "a non-profit making, permanent institution in the service of society and of its development, and open to the public, which acquires, conserves, researches, communicates and exhibits, for purposes of study, education and enjoyment, material evidence of people and their environment."^[8] Finally, another widely accepted definition comes from the Museums Association of the United Kingdom which states: "A museum is an institution which collects, documents, preserves, exhibits and interprets material evidence and associated information for the public benefit."^[9]

Museums are most commonly classified by their type of collection, but it is also possible to categorize them by

- The operating agency.
- The geographic area they serve.
- Their intended audience.
- The way in which they exhibit their collections.^[10]

Although collection type remains the most common way to categorize museums, this method has been challenged in recent times (see section: "The Changing Face of Museums"). Museum theorist Stephen E. Weil in his classic book *Rethinking the Museum and Other Meditations*

(1990) advances the idea that the importance of museums is not how they accomplish their goals, but rather *why* they do it. Weil suggests that the core definition of museums hinges not on what they collect, but rather on how they serve the public and society.^[11]

Expertise of Specialty Museums

Unlike more general museums which may hold collections from a wide variety of times and places, many specialty museums have the advantage of being able to concentrate in one area and develop specific expertise that may not be found in any other institution. A museum of railroading might well be expected to employ curators who are considered experts on both railroads and their construction, whereas a more general history museum might contain railroading artifacts, but lack in-depth expertise in interpreting them. In addition, many specialty museums also possess subject-focused libraries that may include rare books or manuscripts devoted to their specialized subject. These libraries typically serve as an institutional resource, and may only be accessible to museum staff and not the general public. In addition to research libraries, some specialty museums have also developed unique controlled vocabularies to describe their collections in more depth than seen in other museums. For example, many history museums in the United States use *The Revised Nomenclature for Museum Cataloging* (1995) to describe their collections. *Nomenclature* was developed to describe artifacts typically found in the collections of history museums, and many specialized museums find its standard vocabulary lacks the ability to adequately describe more comprehensive collections. For example, because *Nomenclature* only contains a few terms which describe Jewish religious artifacts, some museums specializing in Judaica have developed their own additional subject-specific controlled vocabularies in order to better describe these collections.

Examples of Specialty Museums

Specialty museums are nearly infinitely diverse, but most still conform to the standard definition of a museum as a place that collects, preserves, and interprets artifacts and information. At the Mütter Museum in Philadelphia, visitors can see sectioned pieces of human heads, conjoined twins, and thousands of specimens of human tissue showing the ravages of disease. Although it sounds like a freak show, the Mütter is a place of science. Founded in 1858 to “educate future doctors about anatomy and human medical anomalies,” the Mütter’s exhibits have a serious, educational focus, but also try to entertain (the museum’s tagline is: “Disturbingly Informative!”). Although out of the mainstream and certainly a specialty museum, the Mütter does indeed collect, preserve, and interpret for the education and improvement of society.^[12]

Not all specialty museums are so high-minded, however. The Museum of Bad Art (MOBA) in Dedham, MA was created in 1993 to exhibit the worst art its volunteer curators could find. The institution stages tongue-in-cheek exhibits that challenge the elitism the curators see as inherent in traditional art museums. Despite its low budget and nontraditional focus, however, MOBA’s mission statement conforms perfectly to traditional definitions of what constitutes a museum: “The Museum of Bad Art (MOBA) is a community-based, private institution dedicated to the collection, preservation, exhibition and celebration of bad art in all its forms and in all its glory.”^[13] Although not a “serious” museum, MOBA does indeed perform a public service and is very popular with visitors!

Other specialized museums attempt to capture the essence of major discoveries or chart technological progress. The United Kingdom’s National Museum of Computing has a mission “to collect and restore computer systems developed primarily in Britain and to enable people to explore that collection for inspiration, learning and enjoyment.”^[14] The National Museum of Computing’s collection includes The Colossus, an early mainframe computer used by the British to break the German Lorenz cipher during World War II. In contrast to many other technological museums which display collections in a static state, the National Museum of Computing plans to restore every one of its artifacts to working order. The Museum has painstakingly rebuilt The Colossus to wartime specifications in order to evaluate and record the machine’s ability to break German cipher texts from World War II. In a more traditional museum, the artifact would be exhibited, but not in working order. Another specialized computer museum, California’s Computer History Museum, takes a more conventional approach to telling the history of technology. Although the museum has also restored some computers to working order, its exhibits consist of more familiar historical timelines and exhibits of advertising materials. The museum also possesses considerable staff expertise in its specialty area with an online searchable artifact catalog, an aggressive oral history program, and professional archival finding aids.^[15]

In contrast to technological museums which chart the progress of a technology or invention, religious museums instead focus on communicating aspects of a specific faith. For example, the newly opened Sharjah Museum of Islamic Civilisation in the United Arab Emirates is housed in a traditional Middle Eastern *souq* or indoor market.^[16] The museum displays over 5,000 artifacts in accordance with Islamic faith principles and celebrates the achievements of Muslims around the world. The museum boasts an Islamic Faith Gallery which describes key faith tenets, as well as a science and innovation gallery showing achievements by Muslim scientists. The Islamic Civilisation Museum attempts to convey Islamic history and culture around the world and also throughout all time periods. Thus, although the museum falls into the category of a

specialized museum, it is in many ways a general museum of history and culture with a religious focus. Many other religious museums have a similar emphasis in conveying both the historical and cultural aspects of their faith, although most focus on the religion within a specified geographic region. The prominent Jewish Museum in New York City is “devoted exclusively to 4,000 years of art and Jewish culture.” This Museum attempts to answer two fundamental questions: “How have the Jewish people been able to thrive for thousands of years, often in difficult and even tragic circumstances? [and] What constitutes the essence of Jewish identity?”^[17] In addition this organization in New York, at least 13 other institutions worldwide also use the name “The Jewish Museum,” and each also focuses on interpreting and preserving Jewish culture.

Some specialty museums target their appeal to a narrower field of subject enthusiasts or collectors, as does the Cody Firearms Museum in Cody, Wyoming. The Firearms Museum is part of the larger Buffalo Bill Historical Center, which houses five museums each examining some aspect of western art, history, culture, or the natural environment. The Firearms Museum “houses the most comprehensive assemblage of American firearms in the world” and is geared primarily to firearms collectors.^[18] The museum’s curatorial staff responds to all general questions for free but also conducts serial number research on Winchester, Marlin, and L.C. Smith firearms for a fee. The service provides a considerable and unusual income stream for the museum. The Firearms Museum also maintains an extensive library of books, articles, engineering drawings, and other documents related to the firearms industry. Although the Firearms Museum’s exhibits do chart the technological development of firearms from their inception to the present, its displays are mostly of interest to collectors who want to see the subtle differences between every possible make and model of western firearm. The Cody Firearms Museum is a place of pilgrimage for many gun collectors, and articles written by the museum’s staff are given extra credence in the collecting world due to the scope and depth of the institution’s collections.

The Changing Face of Museums

Although statistical evidence is hard to find, it seems clear that much of the growth in the number of museums in recent years has been in the specialty category. Some authors have argued that specialization has become a trend because people are attempting to make a connection with something focused and definable in an increasingly diffuse and globalized world.^[19]

As museums continue to change, it is debatable to what extent the current definitions of what a museum is will remain viable. Although museums are still traditionally categorized by the content of their collections, there has been an effort in recent years to modify museum definitions to “convey the fundamental character of the museum

rather than describe the variables.”^[20] These efforts have been spurred by the fact that there are an increasing number of idea-focused, rather than artifact-focused, museums. These new museums (most famously the Museum of Tolerance in Los Angeles, although there are many others) choose an issue common to all people and then ask visitors not to passively receive information, but instead mobilize them to take a stand and engage in political or social action.^[21] These “idea museums” may collect, preserve, and interpret artifacts, but it is ideas-not things-that are at the core of their missions.

In the future, the museum community will also have to consider the role of virtual museums and how they fit into the traditional definition of museums. The Museum of Online Museums (MOOM) provides listings of dozens of online museums, some have physical sites, but most of which only exist virtually.^[22] Certainly, the “World’s Largest Webseum of Pocket Protectors” and the “Vintage Finnish Pulp Paperback Gallery” seem tailor-made for the specialty museums category, but what do institutions which exist only online share with more traditional brick and mortar museums? The museum community will continue to wrestle with these questions, and it is doubtful that any of the problems surrounding the classification and definition of what it means to be a museum will be resolved in the near future.

Conclusion

How do you categorize the unclassifiable? The term “specialty museum” remains nebulous with a nearly unimaginable diversity of museum types in 38 distinct categories. The definition of specialty museums is so broad that it is of limited use—except to categorize an institution as outside the three traditional categories of Art, History, or Science museums. The definition’s usefulness is further hampered by the fact that specialty museums do not see themselves as members of a unified, distinct category. In addition, although specific subsets of specialty institutions may band together, they do not, as a rule, work cooperatively. However, specialty museums may be the fastest-growing category of museum in the United States and internationally. These institutions most commonly focus on traditional museum functions—the collection, preservation, and interpretation of artifacts, but the increasing numbers of museums that are focusing on ideas, not things, are changing the field. However they are classified, specialty museums range from the serious to the seriously wacky, and most do indeed benefit society and enrich the cultural fabric of the world.

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State Archives

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Abstract

State archives, as state agencies, perform an administrative role in state governments in the United States, managing the full life cycle of records produced in the conduct of state government. Records managers provide a system for managing records while the documentation is fulfilling the purpose for which it was created, while archivists manage that portion of records that has enduring value. Though records of state and equivalent levels of governments prior to the establishment of the United States were produced from the founding of the colonies, the first state archives was not created until 1779, the last almost two hundred years later. The history of state archives largely is a history written since 1901. Though interest in history motivated the increase in the number of state archival agencies in the first several decades of the twentieth century, administrative justification sustains them at the beginning of the twenty-first century.

INTRODUCTION

The term “state archives” designates: an *agency* of state government (and equivalent jurisdictions, as the District of Columbia and Territories such as Guam, the United States Virgin Islands, Northern Mariana Islands, American Samoa, and Puerto Rico, statistics for which, being not uniformly available, are excluded here), the *records* of entities of state government judged to have enduring value, and the *building* that houses the state archival agency and state archival records.

The mission of a state archives is the protection of the legal and economic rights and obligations of both state government and the citizens, former, present, and future, of the state by ensuring the integrity (validity and authenticity) of the records of government. The work of a state archives is identifying and securing state agency records of enduring value, preparing the records for use, ensuring their long-term preservation, and assisting those who come to use the records. Additionally, some state archives collect private archives of individuals and organizations for historical study.

Though the history of records of state governments (and their predecessors) dates from the establishment of European settlement in what is now the United States, the first state archives was not created until 1779, the last almost two hundred years later. The entry provides a history of U.S. state archives—both records and agencies.

NATURE AND FUNCTIONS

State archives are documents of every kind and sort—including hard copy and electronic; printed and manuscript;

and promulgated documents, drafts, and notes—created in and used for conducting the business of state government. More specifically, state archives are the portion of those records that have enduring value and usefulness beyond the purpose for which they were created and initially used. This portion is estimated to be between 2% and 5% of the total. Before the establishment of the archival profession in the United States with the inauguration of the National Archives in 1935 and the founding of the Society of American Archivists (SAA) in 1936, the archival value of state records was judged primarily on a historical basis—the extent to which the information in the records contributed to knowledge of historical developments in the state. This view is predicated on the “Informational value” of records. Since the 1980s, however, the emphasis has fallen on the value of the records in documenting the activity of government, both for accountability and to ensure the authenticity of the documentation in relation to the activity in the conduct of which the records were created. This perspective prioritizes records’ “Evidential value.” Among the greatest challenges presently regarding state records is capturing the records of enduring value created in electronic form for preservation in or under the control of the state archival agency.

A state archives (which, in the singular, refers to the agency holding and managing the state archival records) performs an administrative service by documenting the functions and activities of state government. The mission of a state archives performing the archival and also the records management function designed to manage the accumulation of records in and the flow of records through office environments, is to protect the legal and economic rights and obligations of both state government and the citizens, former, present, and future of the state. The work

of the state archives, coupled with the records management function for which state archives in all but 12 states in 2009 were responsible (excludes Arkansas and Minnesota that lacked functioning records management programs), is to identify and schedule agency records of archival value for eventual disposition in the state archives, to secure those records at the proper time, to ensure they are “arranged” (organized) as faithfully as possible in the files and order in which they were used while fulfilling the purpose for which they were created, to describe them so that users unfamiliar with the organization are able to locate the information they seek, to ensure preservation of the records to serve the information needs of state government and private citizens, and to assist those who come to use the records. Fundamental to the work is maintaining the integrity (validity and authenticity) of the documentation—that is, ensuring that the relationship of the records to the activities in the conduct of which they were created is undisturbed and clearly documented (Fig. 1).

Clear and explicit laws relating to the keeping and management of records are essential to the effective operation of a state archives program. A critically important element of such laws is defining the records for which the state archives has responsibility. Initially, to be encompassing in defining what is a state record, these statutes commonly borrowed from the 1943 Federal Records Act the phrase “regardless of physical form or characteristics.” The growth of electronic records in the 1990s spurred state legislatures to refine and strengthen their definition of records to establish control over such records. The lawmakers, however, have yet to place in the state archivist the blanket, supreme authority both to determine in specific instances what is an archival state record and to secure that record for the state archives after it has fulfilled the purpose for which it was created. Similarly, while some states provide for the state archivist being a professional archivist, others assign the title to political positions.

Though all states have state archival agencies, only four (Vermont, 1779; California, 1850; Texas, 1876;

Massachusetts, 1896) established them before the twentieth century. Of the 50 state archival agencies in 2009, only seven (Alabama, Arkansas, Indiana, Maryland, Mississippi, New Mexico, and South Carolina) were independent agencies of government with a history or records management function, or both. The office of secretary of state, the office of record in state government, in 15 states continues to have direct responsibility for the state’s archival records. State archives were discrete units of state historical societies in 11 states, of state libraries in nine states. (Precision in these numbers is difficult since in two states, the state archives is a unit under the state library, which in turn is a responsibility of the secretary of state.) The last states to create state archives as distinct agencies were Alaska, New York, North Dakota, and South Dakota, all of which did so between 1970 and 1977.

Appropriations to fund state archives vary from hundreds of thousands of dollars in small states to millions in large states. But, these appropriations are slim in relation to the size of the state budget and rarely have been commensurate with either (1) the potential disruptions to state government and citizen rights that would occur were use of the archival records to be compromised or lost or (2) the cost of recreating and validating the information in the affected records. Funding of the state archival agency commonly is less than one-tenth of 1% of the total state budget.

State archival agencies have two principal constituencies. One is state government employees needing to consult the records in the conduct of their work. The other is persons outside of government who need the information in the records. Among the most common nongovernment uses are: genealogy (predominant in 28 states), preparing for conducting business with a state agency, proving eligibility for a government service, legal and property research, and writing history. Since the 1980s, state archives recognizing the general unfamiliarity of the general public with archives have devoted attention specifically to promoting use of their holdings. The New York State Archives has led in developing programs to encourage teachers and students to use its holdings.

As use of the Internet for discovering and obtaining information has increased, so have demands for broader access to the holdings of archives of all sorts, and especially government archives. In response, state archival agencies have devoted substantial energy and resources to making finding aids (archival inventories of individual bodies of documentation, lists, and indexes) accessible electronically. Though in 2009, use of the extensive holdings of state archives continues to require in most cases that the user go to the repository to view the records, mounting of digital copies on the World Wide Web is proceeding at a rapid pace, especially of records sought by genealogists. The volume of state government records holdings in 2006 ranged from a total of 4600 cubic feet in



Fig. 1 Texas State Archives.

Source: Photograph taken by the author.

Vermont to 101,000 cubic feet in New York; the mean volume for the 50 states in 2006 was 37,100 cubic feet of state records, another 13,000 cubic feet of local records, and another 7000 cubic feet of private archives, for a total of 57,100 cubic feet (Fig. 2).

In addition to being responsible for the records of state government, 45 state archives have either advisory or custodial responsibility for records of local governments, though 10 of these states had no staff member assigned to local records.

Thirty-seven state archives fulfill an additional cultural role by collecting private archives—papers of individuals and records of organizations outside of state government—for the purpose of documenting and providing a resource for study of historical developments within the state. Only the state archives of Wisconsin (a unit of the Wisconsin Historical Society) has a greater volume of these holdings than of state records. How the state archives (both the records and the agency) are defined—whether as a cultural service or as an administrative service—is critical to the position of the agency within state government. Whereas an administrative role is essential to the functioning of government, the cultural service has been judged to be of secondary importance. In at least six states between 1933 and 2008 (Colorado, Florida, Maine, Michigan, Texas, and West Virginia), the governor or a legislative committee considered the state archives to be primarily a cultural service and proposed eliminating it, particularly by transferring its holdings and aspects of its work to a state university. None of the five initiatives succeeded.

HISTORY

The history of state archives can be divided into six periods:



Fig. 2 Entrance to California State Archives Search Room.
Source: Photograph taken by the author.

Period 1: Records before Agencies, Prior to 1901

Though officers of colonial government recognized the importance of using records in the conduct of the people's business, management of administrative records in the small government operations was left largely to their individual discretion, which often meant that the records were treated as personal property and carried home at the conclusion of a term of office. Some governors complained over the disappearance of needed records. Between this lack of institutional provision for archives and the many fires that occurred in those years, much was lost. The first building constructed to house the records of a colony was the Public Records Office in Williamsburg, Virginia, put up in the 1760s in response to a fire in the capitol.

Vermont in 1779 became the first state to make provision in law for management of state records by seating the responsibility with the secretary of state. A handful of states followed suit during the first half of the nineteenth century. Where they were worked on, "historical" state records commonly were reorganized into chronological order, rather than being maintained in files related to the business in the course of which they had been generated. Little attention was paid to contemporary records that by subsequent generations would be considered historical or archival. Richard Bartlett (1792–1837), Secretary of State of New Hampshire in 1836, harshly condemned this neglect. Succeeding generations of office holders and users of archives have echoed his condemnation as they have had to conduct affairs without the benefit of essential documentation.

In response to the 50th anniversary of the beginning of the American Revolution, many of the states with colonial histories spent large sums searching national archives (agencies) of European countries, especially Great Britain, and copying records relating to the state's colonial past. Since publication of these records provided both access to the records and preservation through multiplication of the texts, some states undertook ambitious programs of documentary publication. Though the work withered in the years leading up to and during the Civil War, the approach of the centennial of the Declaration of Independence revived concern for collecting and preserving local and state records.

The change in attitude toward the keeping of state archival records that resulted in the creation of formal repositories for them had its origin in the concern of historians for the availability of primary source materials (those created in the conduct of contemporary affairs or by participants recalling those affairs). Scientific historiography, which originated in Germany in the second half of the nineteenth century and took root in American graduate history programs in the final quarter of the century, required that practitioners conduct extensive research in archives. Few collecting archives (agencies) existed in the mold of the Massachusetts Historical Society, which in the

last decade of the eighteenth century initiated the practice of collecting into a central repository the archives of individuals and organizations. For this reason primarily, the “scientific historians” focused on institutional (specifically government) history and sought access to state archives (records). In 1899, the American Historical Association (AHA) created the Public (meaning “government”) Archives Commission (PAC) to survey and describe holdings of governmental records, including the condition in which they were found. Reporting in 1900 that the quantity and condition of records varied considerably from state to state, the commission advocated improvements in the care of state and local records.

Period 2: Founding of State Archives, 1901–1930s

The second period in the history of state archives began in 1901 with the founding of the Alabama Department of Archives and History as an independent agency of government. Spurred in part by the PACs work and under the direction of Thomas McAdory Owen, who had been instrumental in securing its creation and who served as the department’s first and longtime head, the Alabama Department of Archives and History acquired not just government records but also a wide range of private archives, newspapers, and physical objects for exhibition.

During the first decade of the century, 16 states passed laws establishing state archives. One-third of the new state archives were established in the South (Alabama, Arkansas, Mississippi, North Carolina, Tennessee, and Virginia) and, as in Alabama, shared the common mission of the “diffusion of historical knowledge.” That these state archives (agencies) arose in the South reflected a strong sense of regional identity and especially a concern with preserving records of Confederate military service. In the Midwest (Iowa, Ohio, and Wisconsin, led by Kansas and Nebraska in 1905), state archives were formed more commonly within historical societies. In a handful of states (Connecticut, Oklahoma, Tennessee, Texas, and Virginia) they were created as part of or moved into the state library. Though in many of the new state archives, years passed before resources and facilities were provided sufficient to accomplish the work prescribed to the state archival agency, state archivist Dunbar Rowland in Mississippi was able in 1914 to publish a guide to the state archives (records) that described all of the holdings of the agency; this guide was the first of its kind in the United States.

In 1909, under the leadership of Victor Paltsits of New York, the PAC organized a Conference of Archivists within the American Historical Association to provide a forum in which the historians who were accepting responsibility for or were taking jobs in state archives could meet and discuss issues common to their work. This was the first professional organization of archivists in the United States. At the same time, to help disseminate knowledge of best practices in the field, the National Association of

State Libraries formed its own Committee on Public Archives. Starting in 1911, the committee published reports outlining developments in archival practice, and the progress of legislation relating to archival institutions and government records. Due substantially to the country’s engagement in World War I, the Conference of Archivists failed in its attempt to produce a manual of practice. Cassius C. Stiles, the state archivist of Iowa, filled the void in 1928 when he published the first handbook widely consulted for their management, *Public Archives: A Manual for Their Administration in Iowa*. Before it ceased to exist, the AHA’s PAC in 1932 published *The Preservation of Local Archives: A Guide for Public Officials*.

This founding period saw the establishment of state archives as agencies of government in two-thirds of the states to manage the historical records of the state, but few states drew on and profited from the experience of state archives in other states.

Period 3: Solidifying the Foundation, 1930s–1940s

Illinois state archivist Margaret Cross Norton opened a new period in the development of state archives. In 1929 at the annual meeting of the National Association of State Libraries, she read a paper titled “The Archives Department as an Administrative Unit of Government,” in which she argued that state records are, first and foremost, legal and administrative documents of the state, the primary purpose of which is to fulfill not a historical, but an administrative role. Though the audience dominated by historians received her assertion in “stony silence,” a half century later, Norton’s view prevailed. Director of the Illinois State Archives for 35 years, 1922–1957, Norton became one of the most influential figures in the development of state archives. She fashioned an exemplary archival program, oversaw the construction of one of the first purpose-built archival repositories in the United States, passionately argued the value of archives, and published extensively on a wide range of archival issues.

Among the activities developed by the Works Progress Administration in 1934 in response to the Great Depression was the Historical Records Survey. While revealing the continuing negligence in the care of state and local records, it served as a training ground for state archivists and archival workers by exposing them to the volume of records that had accumulated, and the amount of work needed to establish effective control over them. Chief among the generation of state archivists who labored in the Survey were: Lester J. Cappon (Virginia), Christopher Crittenden (North Carolina), Milo M. Quaife (Michigan), William D. Overman (Ohio), and Morris L. Radoff (Maryland).

The first courses in archival administration were offered only at the end of the 1930s and beginning of the 1940s. The instructors had gained archival experience in

public archives. Norton and Solon Buck, formerly with the Minnesota Historical Society, each taught for a period in the School of Library Service at Columbia University.

The founding of the SAA in 1936, the year after the new National Archives of the United States began operation, invigorated the state archival agencies. The archivists accepted Norton's views, and under the leadership of the SAAs first president, Albert Ray Newsome of North Carolina, who had been one of the proponents of the Historical Records Survey, agreed that the formulation of a model state archives law would be one of the first activities of the Society. Though the archivists achieved their goal in 1946, the model law was not widely adopted.

Period 4: Rise of Records Management, 1940s–1960s

During World War II, state archives began to apply the practices of the emerging field of records management, to control the growing mass of records created in the conduct of state business. Records management emerged independently and nearly simultaneously in the National Archives and in state archives (Texas, for one) in response to the dual needs to determine which among the millions of cubic feet of government records had enduring value without having to inspect each document and file, and to provide better access to the mountains of records for workers needing to use older files for the conduct of contemporary business. Archivists interested in records management, several of whom became the first generation of records managers, developed a system of functions designed to control the creation, flow, and disposition of the records in organizations. This allowed office workers to have at hand the records needed for the work they were doing and to avoid the uncontrolled accumulation of records that no longer served the needs of the worker.

With increasing frequency in the 1950s and 1960s the question arose whether responsibility for records management, including scheduling and destruction, should rest with the archival agency or other departments of government. No single answer emerged, though experience showed that administering the programs jointly improved the securing of archival records in the state archives and realized more efficient management of records throughout their life. By 2009, in 36 states the archival and records management programs were jointly administered. In the management of electronic records, this arrangement is proving to be especially advantageous.

Vigorous state archival programs under strong leaders at mid-twentieth century were Georgia under Mary Givens Bryan and Colorado under Dolores C. Renze.

Period 5: Building on Knowledge, 1960s–1980s

With funding from the private Council on Library Resources, Ernst Posner in 1962–1963 conducted the first

in-depth study of state archival and records management programs. Published in 1964, his *American State Archives* recounted the history of state archives, described the program of each state, and offered standards for the organization of the archival service, the functions of state archives, and records management. The work showed that lethargy and neglect by state policy makers continued to characterize the archival and records functions of most states. Exceptions were Illinois under Norton and North Carolina under H. G. Jones.

A decade later, in 1974, to reunite archivists and records managers, who had lost their close association after the formation of professional associations for records managers, the leaders of state archival and records programs formed the National Association of State Archives and Records Administrators. In 1984, local and federal archivists and records managers were welcomed into the organization, and its name changed to National Association of Government Archives and Records Administrators.

In 1975, at the urging especially of South Carolina state archivist and former SAA President Charles E. Lee, Congress added the records program to the National Historical Publications Commission, thereby creating in the National Historical Publications and Records Commission (NHPRC), an office within the federal government giving grants to encourage archival work throughout the country. Orienting the program to the state level, the NHPRC required that grant requests from archives within a state be vetted by a State Historical Records Advisory Board (SHRAB) chaired by the head of the state archival program. This put the state archivist in a central position regarding archival development in the state. In the wake of President Ronald Reagan recommending elimination of the NHPRC as a money-saving measure, the NHPRC Records Program, at the initiative of director Larry J. Hackman (who subsequently became state archivist of New York and raised the New York program to national prominence) allocated what appeared to be the last NHPRC Records Program money for states to conduct surveys following on the example of Posner's work. The first 20 SHRAB studies formed the basis for the analysis *Documenting America: Assessing the Condition of Historical Records in the States* (1983), which showed a "cycle of poverty" of such magnitude that state archives collectively—and individually—were "unable to provide adequate care for their records." The hope that state legislatures, seeing the need, would take the responsibility they had long neglected for encouraging archival work within state government proved futile. Nevertheless, the structures set up in the states as a result of the NHPRC proved of sufficient value to the archival communities in the states that supporters successfully pressured Congress to save the NHPRC from elimination under Reagan and as requested consistently in the budgets of President George W. Bush. The SHRABs continued to function in 2008.

Period 6: Formalizing Standards, Pursuing Advocacy, and Grappling with Electronic Records, 1990s

Securing appropriate space in which to maintain state archives, for protection and to provide room in which to use them, has been difficult throughout the history of state archival agencies. Archival records, by their very nature being of enduring value, only and always increase in volume. Though half of the state archives occupy buildings constructed since the 1970s, the oldest facility was built in 1890. Twelve new facilities have been constructed since 1990, those of Arizona, Georgia, Mississippi, and Utah, since 2000, and plans are far along for construction or significant renovation of 27 more. Beyond providing for housing and use of the state archives (records), the new and renovated structures provide up-to-date environments for preservation, security, and fire suppression (Fig. 3).

The state archivists in 1989 created the Council of State Records Coordinators to formalize communication with and influence priorities of the NHPRC. Principal among the new initiatives were efforts to develop ways to manage electronic records. In forms that never existed before, combining text with sound and image, and incorporating hot links to other documents, records in electronic form presented new challenges. Among these were defining “the record” anew, determining the systems most appropriate for capturing bodies of documents of enduring value that have no physical manifestation (and for which any physical manifestation through printing robbed them of their unique qualities as electronic documents) and realizing methods for extending the life indefinitely of electronic records. The work continues.

In 2005, the Council of State Records Coordinators, having secured a staff through which to pursue the

interests of state archivists as a group, especially the developing mission of advocating for state archival and records programs, reflected the new and growing emphasis by changing its name to Council of State Archivists. To provide the basis for its advocacy, the Council of State Archivists continued its predecessor’s work of gathering and publishing documents [as *The State of State Records: A Status Report on State Archives and Records Management Programs in the United States* (2007)] compiling data from all the states for use by state archivists both in running their programs and in documenting the importance of archives to the public and to resource providers.

CONCLUSION

State archives (records) are essential to the functioning of state government and provision of services to the citizens entitled to those services. Once considered primarily a resource for historians, state archives (records) have come to be seen as primarily performing an essential administrative role within state government and for the citizens of the state. Though all states maintain state archives (both records and agencies), all but a handful of state archival agencies were established between 1901 and 1977. Only seven of these are independent agencies; the rest are units within larger offices and departments.

State archives (agencies) are at once similar in their archival functioning and as different in their operating environment as the governments they serve. In the colonial period when the volume of records produced in running government could be managed in offices, the history of state archives is one of the records themselves. In the twentieth century it is the history of both state records and state archival agencies. The dramatic increase in the volume of state records produced in the functioning of state government in the twentieth century led to formulation of techniques for managing records that were fulfilling the purpose for which they were created. Growing out of the archival function of controlling records of enduring value that had completed their initial use (archival enterprise), records management became separated from archival enterprise, but in the state government environment increasingly is being reunited. In the second half of the twentieth century, efforts expanded to include gathering information on all state archival programs, first by virtue of private funding of the Council on Library Resources, then at the initiative of the federal government through the National Historical Publications and Records Commission, and finally by the state archivists themselves organized in the Council of State Archivists. The information empowered state archivists to advocate for strengthening the archival programs of each and every state.



Fig. 3 Georgia Archives Building.
Source: Courtesy of Georgia Archives.

APPENDIX

Table A.1 Establishment and administrative location of state archival and records management programs February, 2009.

State	State archives established	Records management established	Program relationships	Archives parent agency	Records management parent agency (if separate)
Alabama	1901	1955	Joint	Independent	N/A
Alaska	1970	1955; Active 1968	Joint	State Library	N/A
Arizona	1937	1974	Joint	State Library	N/A
Arkansas	1905; Implemented 1911	authorized 1973; Currently suspended	Archives only	Independent	N/A
California	1850	1949	Separate	Secretary of State	General Services
Colorado	1951	1955	Joint	Administration	N/A
Connecticut	1909	1911	Joint	State Library	N/A
Delaware	1905	1977	Joint	Secretary of State	N/A
Florida	1967	1967	Joint	State Library	N/A
Georgia	1918	1971	Joint	Secretary of State	N/A
Hawaii	1905	1957–1958	Joint	General Services	N/A
Idaho	1947; full time archivist hired 1990	1998	Separate	State Historical Society	Administration
Illinois	1922	1979	Joint	Secretary of State	N/A
Indiana	1913	1979	Joint	Independent	N/A
Iowa	1906	1974	Joint	State Historical Society	N/A
Kansas	1905	1950s; funded 1992	Joint	State Historical Society	N/A
Kentucky	1958	1958	Joint	State Library	N/A
Louisiana	1956; implemented 1966	1956	Joint	Secretary of State	N/A
Maine	1965	1965	Joint	Secretary of State	N/A
Maryland	1935	1953	Separate	Independent	General Services
Massachusetts	1896	1976	Joint	Secretary of State	N/A
Michigan	1913	1952	Joint	Cultural Resources/ Affairs	N/A
Minnesota	1947	1963	Archives only	State Historical Society	N/A
Mississippi	1902	1981	Joint	Independent	N/A
Missouri	1965	1965	Joint	Secretary of State	N/A
Montana	1969	1977	Separate	State Historical Society	Secretary of State
Nebraska	1963	1969	Separate	State Historical Society	Secretary of State
Nevada	1965	1967	Joint	State Library	N/A
New Hampshire	1963; state archivist established 1979	1963	Joint	Secretary of State	N/A
New Jersey	1945	1953	Joint	Secretary of State	N/A
New Mexico	1959	unavailable	Joint	Independent	N/A
New York	authorized 1971; opened 1978	1950	Joint	Education	N/A
North Carolina	1903	1913	Joint	Cultural Resources/ Affairs	N/A
North Dakota	1977	1961	Separate	State Historical Society	Information Technology/ Management
Ohio	1927	1985	Separate	State Historical Society	General Services
Oklahoma	authorized 1939, 1947; staffed 1968	authorized 1961; staffed 1968	Joint	State Library	N/A
Oregon	1945	unavailable	Joint	Secretary of State	N/A
Pennsylvania	1903	1956	Separate	State Historical Society	Administration
Rhode Island	1930; in legislation 1989	1981	Joint	Secretary of State	N/A
South Carolina	1905; reorganized 1954	1966; in legislation 1973	Joint	Independent	N/A

(Continued)

Table A.1 Establishment and administrative location of state archival and records management programs February, 2009. (*Continued*)

State	State archives established	Records management established	Program relationships	Archives parent agency	Records management parent agency (if separate)
South Dakota	1975	1967	Separate	State Historical Society	Administration
Tennessee	1907	1957	Separate	State Library	General Services
Texas	1876	1947	Joint	State Library	N/A
Utah	1951	1970	Joint	Administration	N/A
Vermont	1779	1937	Joint	Secretary of State	N/A
Virginia	1902	Authorized 1942; established 1950	Joint	State Library	N/A
Washington	1909, fully functional 1957	1957	Joint	Secretary of State	N/A
West Virginia	1905	1961	Separate	Cultural Resources/ Affairs	Administration
Wisconsin	1907	1947	Separate	State Historical Society	Information Technology/ Management
Wyoming	1951	1959	Joint	Cultural Resources/ Affairs	N/A

Source: Courtesy of Council of State Archivists.

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State Libraries and State Library Agencies

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Abstract

State Library agencies which vary from state-to-state as to history, role and scope, legal functions, personnel strength, and services, are reviewed. A book could be written about each of the fifty state library agencies and their impact on the development of libraries in their particular geographical area and nationwide. From little known agencies at the fringes of state government in the early nineteenth century to robust multipurpose agencies administering millions of state and federal dollars today, their growth has been most pointed in the past 55 years. This can be best viewed in the development of national standards for library functions at the state level, the introduction of federal aid in 1956 matched by hundreds of millions of dollars in state funds, the professionalization of state librarians and staff, and the broadening of state library functions and the accountability which follows.

INTRODUCTION

The literature about “state libraries” is not as robust as that of public, school, academic, and special libraries. This may be because of the relatively small number (less than 1%) of professional librarians working in state libraries, the relatively small number of scholars publishing in the field; and the specialized nature of use of state library collections. From the beginning of state libraries in the early nineteenth century, it took nearly 150 years of existence before these libraries began to become more than mere collections of books headed by a person with political connections. This entry seeks to inform the reader about early history and growth of state libraries and through change from an agrarian, oral-based culture to a culture based on the written word, it became possible to have establishment of national state library organizations for focused action, standards for library functions at the state level, professionalism of the state librarian and staff, and federal aid matched by millions of dollars from state and private sources. This entry also points to common characteristics and some notable examples of current state libraries.

DEFINITION

State library agencies are among the least understood and historically among the most obscure agencies in state government. The first elements of a commonly accepted definition of a state library agency were published in 1977 as a result of National Center for Education Statistics funded survey of the 50 states.^{[1], [2]} The definition has been since codified both in federal law and The National Information Standards Organization, Z39.7-2004, 2.1.14.^[3] and reads: “A State Library Agency is the official agency of a State

charged by the law of that State with the extension and development of public library services throughout the State, and has adequate authority under the law of the State to administer State plans in accordance with the provisions of Library Services and Technology Act (LSTA).” While this is the commonly accepted state library agency definition it does not cover the breadth of possible functions of such agencies as viewed in the twenty-first century. Such a definition would be hard to develop as there are only 10 state library agencies which manage the state archives of a state, 15 which offer preservation/conservation services, three which manage a state museum/art collection, 50 state library agencies which provide in some manner access to the Internet and World Wide Web, national and state databases, and interlibrary loan services, 27 which fund or host a State Center for the Book derived from the model at the Library of Congress, 19 which provide reference and loan materials directly to the public, 40 which provide support for literacy programs, and 22 which certify public librarians.^[4]

No two state library agencies are the same in personnel strength, facilities, role and scope, legal foundation and authorizations, collections, services and activities, and history of development. There is no clear predetermined model for a state library agency although there are enough similarities to provide a historical overview, a discussion of trends, and brief overview of the leadership that has made state library agencies important during the years since the first federal aid act was signed into law in 1956.

“Successful state librarianship is a mixture of politics, personality, alliances, and position.” The word “position” can be further defined as the socioeconomic trends and geographic history and place which establish the context for a state’s government and functions. “How successful an agency is can be measured in how many lives are touched directly or indirectly by its services and

activities.” Thus state library leadership is paramount to success. Each state has developed differently based on its own politics, personalities, alliances, position and the socioeconomic trends, and geographical position in the United States.^[5]

HISTORY

From the beginning of the nineteenth century, state libraries were largely insular institutions with the “state librarian” drawn from politicians, friends of politicians, and occasionally a learned man who had more than a passing interest in books. Because of their insularity as Dr. Wayne Wiegand has written, early state library agencies reveal the “staccato growth” characteristics of state funded programs on the margins of power.^[6] This is what you would have found in the earliest territorial library in Florida where all materials were loosely packed into the offices of the Secretary of State who also served by law as ex-officio State Librarian. Except for a couple of appropriations in the 1850s prior to the United States Civil War, it was decades later that regular appropriation became available.

The states in the northeastern United States and those in the Far West benefited from more regular funding. The great federal survey of public libraries in United States published in the U.S. Centennial Year of 1876, provided a review of state and territorial libraries. It is interesting to note that all of the states at that time had a collection of books called a “state library” and all were legally established.^[7] All of the state libraries listed in the 1876 survey were “traditional” state libraries—those units of state government which were formed to assemble the many volumes of books which were acquired from the federal government, exchanged with other libraries, or as a result of gifts, and needed some state government location overseen by an interested individual. Services were passive and the usage of materials was largely derived from visiting scholars and residents of a state, or by various officials of a state, like legislators, jurists, and government employees.

In 1893, historian Frederick Jackson Turner declared an end to the American frontier. A number of historians have pointed out that the growth of industrial power, coupled with heavy growth in cities and towns, populated with many new immigrants changed our culture from an agrarian oral tradition to a written tradition. Library leaders like Melvil Dewey in New York, C. B. Galbraith in Ohio, James L. Gillis in California, and Mary Spenner in Michigan brought traveling libraries to their states in the belief that states had a role in assisting in the education of their residents.

During the later part of the nineteenth century, a schism developed between traditional state library leaders and those who believed that states should bring books and

reading to all areas of a state. State library commissions were established to develop the library extension movement and many of the leaders of this movement did not want the new service housed in the traditional state library. In fact, as late as 1937, James I. Wyer, State Librarian of New York, noted that of the 154 existing state libraries in the 48 U.S. states, a large majority did not support the library extension movement. One might ask why there were 154 “state libraries” instead of one per each of the 48 states in 1937. The main reason is that the existing national association of state libraries was made up of traditional state libraries, legislative reference bureaus, state historical societies, state archives, and several library extension agencies (see Appendix).

As the various state library commissions were established, states drew their statutory language from each other in defining the duties of the new agencies. Massachusetts, Wisconsin, North Carolina, Michigan, Maryland, Colorado, Indiana, Rhode Island, New Hampshire, and Pennsylvania were among examples of states which had both a state library and a newly formed state library commission, the latter charged with library extension.

During the ensuing decades between the World Wars, state government began to look at measures to streamline state government and looked for convenient ways to consolidate and merge agencies that seemed to have like functions, i.e., anything with the word “library.” At this time a number of state library commissions and state libraries were merged under state departments of education.

In the southern part of the United States, traditional state libraries continued. When library commissions were established, these entities received poor public funding and received some grant funding from the private Carnegie Foundation or the Rosenwald Foundation. Fortunately, southeastern state library commission had leaders who influenced national library developments particularly in encouraging the first federal aid to libraries in the mid-1950s, and who established the first standards for library functions at the state level in 1963. Leaders included Essae Mae Culver (Louisiana), Estellene P. Walker (South Carolina), Lucille Nix (Georgia), Evelyn Day Mullen (Alabama), and Bessie B. Moore (Arkansas).

FEDERAL AID FROM CONGRESS

State Library Functions Development

There is little doubt, that the greatest impetus for the development of state library agencies as organizations of change and the growth of public library services came through passage of the initial federal Library Services Act in 1956.^[8] Following this initial act, the Library Services and Construction Act was passed in 1966 adding federal aid for public library construction. In 1996, a rethinking of

federal aid purposes brought changes in not only federal administration from the U.S. Department of Education to the new Institute of Museum and Library Services, but funds were increased for library networking and electronic communications and in providing assistance for all types of libraries.^[9] Because of the 1956 legislation, at least two states established a state library administrative agency to administer the state's share of federal aid (Utah, South Dakota) and the last of the traditional state libraries merged with their state's library extension agencies and adopted the "State Library" name. Other significant changes included enactment of state aid to public library laws, establishments of library development units staffed with consultants to assist local government in establishing and developing public libraries, collecting and publishing library statistics, providing continuing education opportunities, summer reading support, and assisting in library planning, evaluation, and support. Other functions having grown out of federal aid, have been reference and referral services, statewide electronic database access coordination, and state-funded public library construction aid. And, finally as a result of other federal legislation, the state library administrative agencies were viewed in the 1990s as the natural lead agencies in coordinating e-rate, or reduced telecommunication rates for public libraries.

PROFESSIONAL ORGANIZATIONS

As with most like-minded groups of people who wish to share their experiences, state library leaders gathered at the national level to discuss issues, collections, standards, education, services to state employees, and legislatures. The National Association of State Librarians had an initial meeting in 1898 although there were earlier antecedents. Because of the makeup of this association with traditional state libraries, library extension commissions, legislative reference bureaus, and other agencies, nearly all attempts to develop national state library standards failed.^[10] In 1936, the American Library Association published *The State Library Agencies; Its Functions And Organization*, which began to enumerate library functions of a state library agency. In 1950, the American Library Association established an Executive Board committee to study state library agencies as a basis of setting standards and strengthening services. (Information on early history of state library agency organization within American Library Association drawn from unpublished research by American Library Association, Research Library, Director, Karen Muller; Assistant Director, Valerie Hawkins; Intern, Elias Pera, November 2008.) However, it was not until 1963, under the American Association of State Libraries, a division of the American Library Association, that the first national standards for library functions at the state level were published.^[11] A major revision was published

in 1970^[12] and a 3rd edition was published in 1985.^[13] These standards gave descriptions of what functions and services should be provided in a state library administrative agency but were constructed from inputs rather than empirical data about what works.

State library agencies have long been represented within the structure of the American Library Association, generally at the division level. This distinction is important because it has allowed the interests of state libraries to have a seat on the Council, the governing body of the American Library Association, to have representation on important national association committees and assembly's, authority to speak for state library interests on its own as if it had been issued by the American Library Association, and to develop and publish standards.

National names of professional organizations representing state libraries developed from the National Association of State Librarians (1898), the National Association of State Libraries (1904) (NASL), which were separate from the American Library Association. The latter merged with the newly formed State Library Agency Division of ALA in 1957. The result was the American Association of State Libraries (AASL) in 1957 which was shortened in 1971 to the Association of State Libraries Agencies (ASLA). In 1978, the Health and Rehabilitative Services Division merged with the ASLA to form the Association of Specialized and Cooperative Library Agencies (ASCLA). There is a State Library Agencies Section under the latter named ALA division.

CHIEF OFFICERS OF STATE LIBRARY AGENCIES

With the growing influence of state library agencies in the planning and development of library services nationwide because of state administration of federal aid, a tension developed between the U.S. Department of Education and the 50 states. The U.S. Department of Education during the 1960s and 1970s had regional offices. Each regional office had a Federal Program Officer for administration of the Library Services and Construction Act and depending on each officer's interpretation of the law and administrative rules, were either relaxed or strict. The tension between state interpretation of a "state-based" program and federal interpretation of the law and rules, became so severe that the 50 state library chief officers decided to form an organization separate from the ALA to better represent their interest. Thus in 1973, the Chief Officers of State Library Agencies, Inc. (COSLA) was established. Its immediate goal was to speak with one voice to the U.S. Department of Education officials about federal administrative matters particularly concerning uniformity in interpretation of law and rules, and the second was to provide a unified voice to the Congress, the profession, and other national organizations and agencies on state library issues and programs.

Gradually some accommodation was reached with federal Education officials and it resulted in regional program officers being withdrawn from the regions and centralized in Washington, D.C. This resulted in coordination of responses to administrative questions from state library agencies.

Although the internal structure of COSLA has changed somewhat, its main organizational interests concern Legislation, Networking, Research and Statistics, Continuing Education, liaisons with various federal agencies including the Library of Congress, Institute of Museum and Library Services, National Library Service for the Blind and Physically Handicapped, and various national organizations including the American Library Association, International Federation of Library Associations and Institutions, Gates Foundation, E-Rate, Federation of State Humanities Councils, and various organizations representing the interest of archivists and government records managers. Two of these national organizations deserving special mention are the Gates Foundation and the E-rate program. These two national programs have provided millions of dollars, coordinated by state library agencies, to public libraries for linking to the Internet and helping make access to this international resource affordable to poorer residents of communities and for providing reduced rates to public library for linkages to the electronic networks.

COSLA Accomplishments

There is little doubt that one of the most significant accomplishments of COSLA has been its leadership in the conception, development, and passage of the federal Library Services and Technology Act in 1996 to replace the 40 year old Library Services and Construction Act and its antecedent. By the time of the 2nd White House Conference on Library and Information Services in 1991, Congress was asking the national library community for something new to replace the decades old federal aid program. The COSLA Legislation committee cochaired by Sara Parker (Pennsylvania) and Barratt Wilkins (Florida) outlined and developed what became a final draft of the new legislation. It called for consolidation of federal aid programs, a shift in federal administration from the U.S. Department of Education to the new Institute of Museum and Library Services and emphasized electronic linkages and networking among libraries, providing access to information, developing public and private partnerships, and targeting individuals who have difficulty using a library.

Among other accomplishments has been the work of members of the Research and Statistics Committee in helping design, formulate, and provide leadership in persuading the federal government to collect and disseminate national data on public (1990) and state (1993) libraries annually. The data has proved beneficial in establishing base line information about the development and growth

of public libraries and state library agencies nationwide. COSLA liaisons with the Gates Foundation and federal administration of the E-rate (reduced telecommunications rates) have been invaluable in advising and coordinating information between these organizations and the states thus ensuring that funds made available by private and public sources are expended as wisely as possible.

The work of COSLA and the expenditure of billions in federal dollars and the state dollars used to match those national funds, have caused the state library agencies to become more visible than they have ever been before. The funds have enabled the extension of library services to almost every citizen of the United States, it has helped equalize and provide for library service to the disabled and institutionalized, it has aided in the construction of a myriad of public library facilities, and it has developed strong public libraries in almost all areas of the country. Finally, these funds have provided assistance in developing multitype library cooperation, networks, and many of the statewide electronic libraries existing in the first decade of the twenty-first century.

STATE LIBRARY DEVELOPMENT ISSUES

Place in Government

A topic producing sharp differences of opinion and debate has been determining what is the best place for state library agencies in a state government structure. Fifty years ago as state policy makers began to move state library agencies from governance by gubernatorial-appointed commissions and boards to larger units of state government as in departments of education, departments of state, and departments of culture, Philip Moneyppenny was finding other evidence to suggest that the strongest state libraries were independent state government agencies.^[14] Seven years after Moneyppenny's report in 1961, Douglas St. Angelo found that those state library agencies operated by public officials like state superintendents of schools, Governors, Secretaries of State were better in securing greater per capita support than those under independent board/commissions.^[15]

A 1977 study found an almost even split between those state library agencies in state departments of education and those which were still under a gubernatorial-appointed commission or board. By 2000, the fifty-fifty split continued, but the number in each category declined as more state library agencies became parts of Departments of State, Departments of Cultural Resources, Cabinets concerned with Arts and Humanities, and other departments concerned with Children, Families, and Learning; Community and Economic Development; Administration; Information; and, the State Legislature. State library agencies in state education departments were more likely to be lost in comparisons with other larger components such as

higher education, public schools, and vocational and technical education. State library agencies under an independent board/commission have been found to have the most discretion in policy and library development but are very dependent on the power and influence of their board members.

State Librarian Qualifications

The education and preparation for the position of state librarian and the political standing of the state librarian have been issues of discussion in states since Dr. James I. Wyer, New York State Librarian in 1937, pointed out that the position in many states was a political pawn and that a southern commonwealth had appointed a state beauty queen as State Librarian.^[16] As noted in a 2000 article, “how the state librarian takes advantage of the appointed nature of the position is one of personal preference, politics, individual state experience, and the energy and practical intelligence of the individual.”

Education of State Library Personnel

Library educators have not placed much emphasis on providing courses to prepare individuals for careers in state libraries or for state librarianship. Recently retired Florida State University Information Studies Dean Jane Robbins quoted an article by James Beasley in 1971, that “the state library is more an idealized form than a structure with a clear national identity.” As there are no pure examples of a “state library” and that these agencies are so diverse in their structure and broad in their various missions, “that it has seemed more expedient to skim over them in educational programs.” This has largely been the case in library education over the decades and it is even more so today as library education focuses on “information” rather than “libraries.”^[17]

As noted in 2000, some state librarians have used the position to make powerful differences in the development of library services in their states and in the nation. State librarians now serve generally from 4 to 8 years and some have been in office for less than four. The era of state librarians serving a quarter of a century or more in the state librarian’s position appears to be over. Maine, Louisiana, Florida, Kentucky, and Indiana have all had recently retired examples of such long tenures.

Successful state librarians are not preoccupied by state issues and policies, nor do they indulge in insularity only focusing on in-state programs. For the State Librarian, that position’s influence can be measured in what other state boards or commissions the individual serves on, the unfettered access to statewide elected officers, access to state legislators, staff and committee personnel, and involvement in regional and national level committees or professional organizations. As University of South Florida Distinguished Professor of Library and Information

Science Kathleen de la Pena McCook has noted “librarians must be at every table.”^[18]

TRENDS AND ISSUES AFFECTING STATE LIBRARIES

Recent national trends being either influenced by state libraries or affecting state libraries include federal intrusion into the privacy of library users (USA Patriot Act); reduction in federal sources of information from changes in the U.S. Government Printing Office; withdrawal of previously available information from federal document depository libraries because of new sensitive or secret classifications; providing guidance to libraries and policy makers with the Children’s Internet Protection Act (CIPA); expansion of state electronic libraries to include all types of libraries and funding to pay for the expanding access; the pressure to fund, digitize, and preserve more public and private information sources; pressure to increase state funding to aid local public library construction projects or to reinstitute federal construction aid withdrawn in 1996. Some recent state trends include reductions in state aid program appropriations because of shortfalls in state tax revenue; the loss of state personnel from downsizing; and state tax initiatives which threaten to reduce the amounts that local government can tax to provide local services.

STATE LIBRARY VITAL STATISTICS, FY 2006

All State Libraries, except Hawaii, offered public service hours from a high of 60 hr to a low of 32 hr. Total books and serial volumes were 23.4 million with two state libraries having collections exceeding 2 million books and serials. Of these two, the only Association of Research Libraries (ARL) member was the New York State Library. State libraries held 27.2 million uncataloged government documents. The State Libraries employed 3500 full-time equivalent (FTE) positions in FY 2006 of which approximately 1100 were professional librarians. State Libraries reported expenditures from all sources of \$1.1 billion of which 82% was from state funds. State Librarian salaries ranged from \$63,283 to \$137,000 with an average of \$92,404. Thirteen state librarians had salaries exceeding \$100,000 in FY 2006.^[19] For photographs of state library agency main buildings, go to <http://www.cosla.org/Image Gallery>.

NOTABLE STATE LIBRARIES

Examples of notable state library agencies were drawn from either conversations with the chief officer of the state library agency, their agency’s URL, or the Chief Officers of State



Fig. 1 Artist drawing of new entrance to the Archives Building of the Arizona Department of State Library, Archives, and Records Management, now under construction 2008–2009.

Library Agencies, Inc., URL All state library agencies have programs and services which stand out from time to time. The criteria for measurement are subject to debate as well as the standing of a state's library agency compared with others. For instance, the Arizona State Library, Archives and Public Records (Gladys Ann Wells, State Librarian, 1997–) agency is noted for its melding of the interests cited in its name into a strong service-oriented agency under the Arizona State Legislature—one of the two in the nation. A new multimillion dollar home for the State Archives unit of the agency is under construction. (Fig. 1)

Like Arizona, the Connecticut State Library (Kendall F. Wiggin, State Librarian, 1998–) is a large multipurpose agency. It is governed by a semiautonomous board comprising members from all three branches of government—the judiciary, the Legislature, and the Governor. Its units include history and genealogy, state archives, public records, library for the blind, museum of state history, law

and legislation, and government information. Successes include achieving funding for a state digital library, historic preservation funds, and state-funded library construction.

A notable example of a state library agency under a board of regents of a state university system, is the Georgia Public Library Service (Dr. Lamar Veatch, State Librarian, 2001–). In this “home” there is a high tolerance for independence and the agency benefits from not having legacy services like a state library collection and government documents. It operates a statewide library automation and lending network for public libraries, provides a robust program for local public library construction and major repair and renovation, and conducts an innovative program for identifying new leadership for librarianship. The GPLS recently won a second annual Mellon Award for Technology Coordination.

Because of its small scale, the Maine State Library (Gary Nichols, State Librarian, 1973–2008) program under a



Fig. 2 Artist drawing of lobby to Texas State Library and Archives Building, now under construction.
Source: Architect—Bailey Architects, Inc. Rendering by Don Oelfke.



Fig. 3 Artist drawing of new and enlarged Library of Virginia Building in Richmond, Virginia, 2009.

gubernatorial-appointed board, has more flexibility and it can act quickly. Perhaps its greatest accomplishment is having a seat on the board which governs the Maine Educational Technology Account. Moneys provided from this source underwrite a free-of-charge electronic network to over 1000 public and school library units.

One of the oldest state library agencies in existence is the New Jersey State Library (Norma Blake, State Librarian, 2001–) established in 1796. It is the only state library agency affiliated with a state college—the Thomas Edison State College. It has received national recognition for its Library Development program as one of the most exciting and dynamic in the nation. Its State Librarian Norma Blake was just named the 2008 Librarian of the Year by *Library Journal*.^[20]

The Oregon State Library (James Sheppke, State Librarian, 1991–) is best known for its innovative state-funded program which aids public libraries in literacy for children (aged 0–5) and for children (aged 10–15)

The Texas State Library and Archives (Peggy Rudd, State Librarian, 1999–) is governed by a gubernatorial-appointed board. Its success and issues are large because of the state's geographical size. Successes include getting the Legislature to fund the first State Aid for public libraries in 2002 and in integrating medical libraries with public and academic libraries into its electronic library for resource sharing. The State Librarian is also noted for winning recognition for securing Governor's Office records and making them available for public use and access. (Fig. 2)

Fig. 3 provides an illustration of the new Library of Virginia building (which also houses the State Archives) in Richmond, Virginia.

CONCLUSION

This review of state library agencies has pointed out their slow development which did not gain national attention until after the Second World War. In the past 55 years

national standards for library functions at the state level were first published, the role and scope of state library agencies were first enumerated, the first federal funds for library development were made available by Congress, the professionalization of state librarians occurred, and national organizations of and for state librarians were established for joint action on issues and programs. In the future, more work will be done by scholars and state and federal agencies on the value of state libraries, measurements of impact, accountability, and efficiency and whether other forms of state coordination of library and information services will develop.

APPENDIX

Table A.1 State Library Establishment Dates.

State	City	Established
Alabama	Montgomery	1901
Alaska	Juneau	1957
Arizona	Phoenix	1864
Arkansas	Little Rock	1935
California	Sacramento	1850
Colorado	Denver	1876
Connecticut	Hartford	1854
Delaware	Dover	1901
Florida	Tallahassee	1845
Georgia	Atlanta	1897
Hawaii	Honolulu	1913
Idaho	Boise	1901
Illinois	Springfield	1839
Indiana	Indianapolis	1825
Iowa	Des Moines	1838
Kansas	Topeka	1855
Kentucky	Frankfort	1834
Louisiana	Baton Rouge	1925
Maine	Augusta	1839
Maryland	Baltimore	1886
Massachusetts	Boston	1826
Michigan	Lansing	1828
Minnesota	Roseville	1895

(Continued)

Table A.1 State Library Establishment Dates. (Continued)

State	City	Established
Mississippi	Jackson	1926
Missouri	Jefferson City	1907
Montana	Helena	1929
Nebraska	Lincoln	1854
Nevada	Carson City	1859
New Hampshire	Concord	1716
New Jersey	Trenton	1796
New Mexico	Santa Fe	1929
New York	Albany	1818
North Carolina	Raleigh	1812
North Dakota	Bismarck	1907
Ohio	Columbus	1817
Oklahoma	Oklahoma City	1890
Oregon	Salem	1905
Pennsylvania	Harrisburg	1745
Rhode Island	Providence	1852
South Carolina	Columbia	1943
South Dakota	Pierre	1913
Tennessee	Nashville	1854
Texas	Austin	1909
Utah	Salt Lake City	1957
Vermont	Montpelier	1825
Virginia	Richmond	1823
Washington	Olympia	1853
West Virginia	Charleston	1929
Wisconsin	Madison	1899
Wyoming	Cheyenne	1871

Source: Compiled by staff of Library, American Library Association, October 2008.

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State-Sponsored Destruction of Books and Libraries

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Abstract

The circumstances and motivations for state-sponsored destruction of books and libraries are explored. Various historical examples are described, and commonalities across instances of “libricide” are drawn out of the histories. (Editor’s abstract.)

The survival of books and libraries during war and political instability has always been problematic. Throughout history, as empires rose and fell, the circumstances surrounding the destruction of libraries typically followed one of three major patterns. Some libraries were lost as part of the ritualized ravaging of captured cities, palaces, and temples. As texts came to be seen as valuable property, a second pattern emerged: libraries and books became “loot” of war and were carried away at the prerogative of the victor. The removal of whole libraries demonstrated dominance in a new and different way from destroying them. At the same time as the conquered people were humiliated, the prestige and cultural patrimony of the conquering society was further enhanced. A third pattern evolved under ideological mandates (religious or political) that labeled certain materials offensive and called for censorship through violent purging or selective destruction. While all three patterns figured in the destruction of books and libraries in the twentieth century, permutations of the third pattern were the most significant; millions of books were sacrificed for extremist ideas.

These atrocities were but one type of loss in an extremely bloody century. Government-authorized mass murder of *civilians*—not soldiers—accounted for most deaths. Along with an increase in human casualties, state-sponsored destruction of culture rose dramatically. Two new terms, *genocide* and *ethnocide*, came into use to reflect a distinctly modern, analytical understanding of complex atrocities as phenomena with recognizable patterns. It was the truly unprecedented annihilation of 6 million Jews by the Nazis that led to the use of the term genocide, which combined the Greek *genos*, meaning “race” or “tribe,” and *cide*, “killing.” Coined in the 1930s by Raphael Lemkin, an émigré jurist, the term was institutionalized in a 1946 United Nations (U.N.) resolution (96-1) that condemned genocide and in a 1948 convention that banned it. In the next 50 years, researchers established a connection between modern genocide and ideology. In 1976 Irving Horowitz wrote of genocide as a policy, the “structural and systematic destruction of innocent people by a state bureaucratic apparatus” that sought to assure

conformity with its ideology and model of society (p. 18).^[1] Evidence of Communist genocides engineered by Stalin, Mao, and Pol Pot strengthened the theory of an ideological connection, and revealed a flaw in the U.N.’s definition: the omission of political groups as certifiable victims. Scholars then moved to address this issue. For example, in Frank Chalk and Kurt Jonassohn’s 1990 study, *The History and Sociology of Genocide*, genocide is defined as “a form of one-sided mass killing in which a state or other authority intends to destroy a group, *as that group and membership in it are defined by the perpetrator*” (emphasis added) (p. 23).^[2]

Because the U.N. definition of genocide emphasized bodily harm and physical circumstances and excluded attacks on a group’s culture or institutions, a different term, *ethnocide*, was introduced to describe the organized commission of specific acts with intent to extinguish *culture*, utterly or in substantial part. This could include deprivation of the opportunity to use a language, to practice a religion, to create art in customary ways, to maintain basic social institutions, and to preserve memories and traditions.^[3] Genocide, then, is the denial of the right of existence of entire human groups, as homicide is the denial of the right to live of individual human beings (General Assembly Resolution 96-1), while ethnocide is the destruction of a culture without necessarily killing its bearers.^[4]

Recently a link has been established among genocide, ethnocide, and the destruction of texts.^[5] A scholar in the history of books has introduced the word *libricide* (to date used only rarely in reference to the “murder” of a book) to delineate the destruction of texts as a pattern occurring within the larger context of ethnocide. Libricide is the state-sponsored and systematic destruction of books and libraries, and shares the same impulse toward negation as genocide and ethnocide. Libricide (like its parent phenomena) is *not* the sum of spontaneous crimes of passion committed by barbarians, as is commonly thought, but a method of problem solving that is deliberate, systematic, and violent. Books and libraries are targeted because of the functions they serve and the humanist values they support.

Libraries organize knowledge and support structured religious and political perceptions that legitimize the governing power.^[6] Michael Harris,^[7] a prominent library historian, has posited that libraries are part of an ensemble of institutions dedicated to the creation, transmission, and reproduction of hegemonic ideology—that is, the guiding doctrine. In Western libraries in the twentieth century this doctrine was increasingly defined by humanism, a belief in intellectual freedom (the inalienable right to think, write, and read) and the ultimate authority of the mind in human living.^[8] Humanism emphasizes individual intellectual and cultural achievement (as its Latin root, *humanus*, “centered on human beings,” indicates) and looks upon books as tools for the acquisition of information and self-confidence and for the development of reason, understanding, and initiative. As the century progressed, humanism came to be associated with democratic societies, in which it took the form of generalized ideas and ideals such as equality, pluralism, individualism, and tolerance.

As extremist regimes arose and promulgated beliefs that were the antithesis of these values, the stage was set for intense conflict. Ideologues stressed orthodoxy, the subordination of the individual to the collective, and adherence to a single vision. Under highly nationalistic or revolutionary regimes, the dissemination of information was controlled, publications had to be ideologically correct, and library services were geared toward achieving ideological objectives. Books and libraries channeled the individual’s development toward the goals of a utopian society, in which the “new man” replaces personal desires and aspirations with collective visions of a transformed society. In order to tether the individual in this way, extremist regimes had to mandate intolerance of opposing information and discourse, and target the material expression of humanism (unfettered books and libraries) with violence.

Books and libraries also, of course, hold historical records and support collective memory—the “stories” or myths that give meaning to the past, explain the present, and provide guidance for the future. In all cultures, these stories involve principles that help cultures organize their institutions, develop ideals, and find authority for their actions.^[9] Democracies provide a fairly wide range of access to information and use records to support diversity. Ideologues exert greater control over written records in order to reconstruct history and foster myths of a glorious past, present victimization, and transcendent future, myths that will motivate followers to pursue extremist goals. The destruction of books and libraries belonging to enemies is a mechanism by which a regime and its followers, who are influenced by the emotional appeal of a distorted collective memory, seek to legitimize their domination of competing minorities or press claims to territory and resources. While emphasizing those written records that

support their claims, extremists may also seek to destroy any records that could compromise their position.

One might argue that the destruction of libraries is overdetermined, because of the interplay of many contributing forces. Indeed, the overlay of influencing factors and chaotic conditions often makes it difficult to determine whether acts of destruction are accidental or intentional. Libricide—systemic destruction—is usually intentional and relatively coordinated. Destruction can be internal—carried out within a nation and ranging from quiet deeds of censorship to aggressive acts of vandalism, terrorism, civil war, or genocide—or it can be external, a function of war or conquest. While small-scale destruction may occur during civil unrest, major internal destruction occurs when a change in the ruling regime initiates censorship and purging. This may extend to the annihilation of the materials of a particular despised group, often a religious, racial, or political group. In extreme cases, massive destruction is carried out by revolutionaries who view libraries as remnants of a pernicious social or political system; their anti-intellectual, antihumanist, and antihistorical attitudes make the censoring and restructuring of existing libraries imperative. Communism, a *revolutionary* ideology, has been heavily implicated in genocidal practices, as Stalin’s devastation of the *kulaks* and Pol Pot’s destruction of Cambodia’s urban and educated population have clearly demonstrated.

Communism evolved from events that were rooted in great social distress: the French Revolution, which set the precedent of revolt against blatant economic and political inequality; and the Marxist movement, an intellectual response to the brutal working conditions and social disintegration brought about by industrialization. Marxism, as developed by German philosopher and economist Karl Marx in the 1800s, identified class struggle as the main agency of historical change and predicted the succession of capitalism by a socialist order—or classless society. Communism emerged after the Russian Revolution in 1917, when Marxist doctrines were adapted to Russian conditions, most profoundly by Lenin. Under Lenin and then Stalin, “socialism” became a facade for the pursuit of power, transforming Russian Communism into a fanatical ideology that justified the destruction of all human and institutional opponents. The Communists exported their revolution by making people aware of the possibility of other realities, and then posing Communism as the inevitable alternative to oppression. Communist doctrines would ultimately provide an ideological base for the overthrow of power structures in many countries.

A revolution has been defined as “political and/or social and/or economic and/or cultural upheaval which calls for a fundamental change in the existing order; it is relatively rapid and generally employs the use or threat of force” (p. 8).^[10] J. W. Fulbright once observed, “A true revolution is almost always violent and usually it is extremely violent. Its essence is the destruction of the social fabric and

institutions of a society, and an attempt, not necessarily successful, to create a new society with a new social fabric and new institutions” (p. 405).^[11] Under Communism, the economic and political elite of the previous order, including intellectuals, were seen as recalcitrant reactionary counter-forces and thus became natural targets. Since libraries supported tradition and existing power structures, to the Communists they were the embodiment of cultural systems that assigned lower-status groups to varying degrees of cultural invisibility.^[7] Communist genocide almost always extended to traditional cultural materials and institutions, and thus to books and libraries.

In China, party radicals viewed books as tools of the oppressors because they supported the skills, values, and way of life of the bourgeoisie. Books were vanities that, by perpetuating the past, became a hindrance to present and future revolution and to creativity and progress.^[12] Marx^[13] once wrote that the “tradition of all the dead generations weighs like a nightmare on the brain of the living” (p. 15). In the mid-1960s, years after the initial revolution, Mao Tse-tung led a “revolution of revitalization” against the four olds—old ideas, old cultures, old customs, and old habits—especially targeting China’s intellectual and cultural structure: “For the modern utopian the destruction of the learning of the past, or its radical revision and reduction, represents the cessation of historical process and constitutes a basic precondition for happiness and justice” (p. 519).^[12] Indeed, for revolutionary regimes, history begins with the revolution. Utopians (including the revolutionaries that adapted Marxism) harbored no doubts about their methods of selecting books for destruction or about the permanent implications of irrevocable destruction. Denying later generations the right of choosing what they would read ensured that the new order would remain forever.

By the twentieth century, libraries throughout the world had come to be associated with intellectuals, education, scholarship, history, tradition, democracy, and humanism. When these sociocultural structures and values were subjected to attack and modification by Communist revolutionaries, the fate of libraries as bastions of tradition and Western ideals became problematic. When, as in pre-*glasnost* Russia, the Communist leadership was striving for industrialization and technological superiority, libraries became essential in carrying out mandates for universal literacy and supporting scientific progress—within the constraints of ideology, thus at the same time as there was purging, censorship, and narrow restriction of selection policies, library systems that *supported* the revolution were expanded, an ethos of socialist librarianship was promoted, and a few specialized, closed libraries with foreign and scientific materials were quietly maintained by the government. On the other hand, when the Communist leadership vacillated between visions of industry (in which technological progress demanded access to information) and agriculture (in which sophisticated printed materials are

irrelevant), libraries underwent cycles of growth and depletion. This was the case in China under Mao Tse-Tung. The massive destruction of books and libraries during China’s Cultural Revolution (1965–1975) marked a retreat from industrialization and modernization into a peasant agrarian society. When the ultimate vision of a Communist regime is a radical agrarian society operating at an intellectual ground zero and when thus the ability to read and write is punishable by death, as it was in Cambodia under Pol Pot (1975–1979), libraries become superfluous.

Revolutionary ideologues, most notably the Communists, were not the sole agents of twentieth-century libricide. Virulent nationalists first purged their own libraries and then, through imperialism, the libraries of their enemies. While nationalists tend to be rightwing, as in the case of the Nazis (during World War II) and the Serbs (in the 1990s), leftist politicians have also expressed nationalistic tendencies and destroyed books and libraries when socialist doctrines have been compromised by imperialist impulses (the case with China and Tibet, e.g.). In struggles between competing nations, the destruction of libraries has always been justified as a wartime prerogative because these institutions contain materials that legitimize the competing power structure and express the enemy’s national prestige and culture. When long-term occupation or annexation is envisioned, books are seized as loot, and information infrastructures are dismantled as part of initiatives to obliterate the identity and sovereignty of a defeated opponent and assume control of that nation’s resources.

Destroying the enemy’s intellectual and cultural institutions can break the will to resist; thus eliminating competition and neutralizing the threat that other creeds and values pose to one’s own. In 1990 the Iraqis destroyed Kuwaiti libraries as part of a plan to reduce the country to a neutralized nineteenth colony, subject to the will of Iraqi nationalists—a pattern reminiscent of the Nazis’ destruction of Poland. The Chinese destroyed Tibet’s libraries because these institutions supported a separate Tibetan identity based on Buddhism, a creed antithetical to socialist transformation and Sinocization. The Serbs destroyed Muslim libraries because of the perceived imperatives of ethnic cleansing. When the goal of battle is the obliteration of a culture (as opposed to simply unseating a regime), the conquest of territories and their populations is accompanied by the destruction of libraries and any other institutions supporting memory or legitimizing past identities.^[14]

From its roots in Europe, nationalism has grown to become the dominating political ideal of modern times. Nationalism is the identification of a people with a state formed around a specific geographical location. The identity of this “imagined community”^[15] is forged within communal bonds of primordial identities shaped by common language, ethnicity, or religion. Loyalties once rooted in local familial or spiritual identities are channeled into a broader identity—nationalism—that derives its charismatic appeal from a combination of political legitimation and

emotional power; that is, the power sensed from “belonging,” from being assigned an esteemed identity. Nationalism carries the potential for polarization based on clear rules for inclusion and exclusion, however. In the hands of extremists, nationalism may be pitched at a virulent level, co-opted to rationalize violent policies, and developed as the ideological foundation for fanatic behavior. Nationalism has been, alternately, an integrative and a deconstructive force. Expressed as patriotism, a devotion and loyalty to one’s own nation, it has supplied the foundation for modern political and organizational structure. It has also ignited vicious regional and global wars when patriotism has led to policies of militarism and imperialism.

Hans Kohn^[16] describes nationalism as a political creed that inspires the supreme loyalty of the majority of people to the nation-state, and that serves as the indispensable framework for all social, cultural, and economic activities. Nationalism has various manifestations because it is conditioned by the social structure, the intellectual traditions and cultural history, and the geographic location of the society in which it is found. What is striking, however, is the basic similarity of the pattern that occurs when nationalism shifts from benign creed to toxic ideology: a progression of social disruption, grievance, and then receptivity to authoritarian leaders who espouse transformative solutions. As an ideology, nationalism “expresses the inflamed desire of the insufficiently regarded to count for something among the cultures of the world” (p. 261).^[17]

In considering the destruction of texts, nationalism concerns us as an ideology; an encompassing, belief-driven sociopolitical program that provides systematic rules and seeks the ultimate transformation of society. Leaders such as Hitler, Milosevic, and Saddam Hussein have exploited the real grievances of their people by invoking great myths of national destiny and national persecution in order to marshal support for aggression and violence. The support of a critical mass of the population paves the way for scape-goating and the identification of the “enemy;” anyone who interferes in the realization of the idealized nation by rejecting its claims, occupying “national” territory, or otherwise blocking its aggrandizement. Because of the function of libraries as material and symbolic keepers of memory and of national and cultural identity, libraries provide stubborn witness against nationalistic claims, and thus come to be perceived as enemy forces.

Nationalism is often supported by militarism and a quasi-ideological policy, imperialism. Militarism is effectively established when a state’s armed forces assume command of both military and civil affairs and unilaterally determine the nature of basic institutions, the choice of leaders, the allocation of resources, and the rights and duties of citizens.^[18] Militarism adapts very well to extreme ideologies, because the very term military implies an acceptance of organized force as a legitimate means for realizing social objectives.^[19] Militarists view that which is alien, foreign, or outside the frontier as barbarian, and

hold other attitudes that lend themselves well to enforcing the values of imperialism and pursuit of national self-interest and manifest destiny. Militarism and imperialism rationalize war to the extent that it becomes imperative.^[20]

Nationalism, militarism, and imperialism together form a lethal trinity, rendered even more toxic when prejudice reaches the point of racist policy—yet another level of paranoia that equates “otherness” with “enemy.” Racism takes on ideological characteristics when extremist leaders seek to promote the superiority of their own race through official programs that deny simple rights to other races. It thrives when a society is disintegrating, when desperate populations will embrace what seems a simple, clear-cut solution to their plight, and a scapegoat provides a channel for their aggression. Tapping into a basic human fear of strangers, racist ideology can rapidly turn a majority against a subsection of the national populace simply by presenting the goals of the nation as dependent on race-linked attributes.

Germany’s National Socialist doctrine (Nazism) stands as a prominent and infamous example of a racist ideology that resulted in genocide and libricide. Nazis constructed an image of the Jews as the “specter of an absolute menace” (p. 95)^[21] and held Jewish blood responsible for contaminating and weakening the nation. Thus causing the loss of World War I and postwar depression and decline. According to the Nazis—a group that included many scholars and intellectuals—full realization of the preordained dominance of the Aryan race was dependent on extinguishing Judaism. Then, in an absolute, unapologetic commitment to racism—a concentrated effort to distinguish “us” from “them”—the Nazis moved beyond anti-Semitism to devise programs to deal with all “inferior” ethnic groups. For example, they moved quickly to destroy the Poles and Polish culture and killed 3 million non-Jewish Poles along with 3 million Polish Jews—22% of its total population.^[22] Nazi programs demonstrated a totality of intention^[20] that extended beyond the taking of lives to the dismantling of targeted groups’ cultural artifacts and institutions: approximately 70% of all books in Poland were destroyed.

In Germany and Poland, synagogues were demolished and Jewish books and libraries were methodically burned, pulped, or confiscated for use in institutes devoted to addressing the “Jewish problem.” Those institutes and any scholarship, whether “scientific” or “historical,” that demonstrated the superiority of the Aryan race received generous funding. It is a common practice in extremist systems; all social and cultural institutions eventually become instruments of ideological promotion, and prejudice becomes intellectualized as fact.^[20] Because cultural artifacts and institutions express identity in such a concrete fashion it becomes necessary to expunge from disputed territories any evidence of an opposing group. In Liberia, Burundi, and Rwanda, continuing racist acts of terrorism, ethnic cleansing, and related archival cleansing

have almost completely destroyed all repositories and archives.^[23]

“Ideology” can be defined broadly as any body of doctrine or thought. While sometimes used as a synonym for creeds and outlooks, twentieth-century historians and political scientists have increasingly leaned toward defining ideology as a *political* belief system that seeks the total reconstruction of society; it differs from creeds and outlooks in its greater explicitness, systematization, comprehensiveness, and urgency, as well as in the high intensity of concentration focused upon it.^[24] To these scholars, ideology refers to an extremist sociopolitical program or philosophy constructed around a transforming idea. Political regimes use ideologies to organize beliefs and attitudes into a common, public, and broadly agreed-upon set of rules that help to regulate and control behavior in social and political contexts.^[25] Ideologies replace traditional value systems, such as those based on religious or ethical principles.

In extremist political climates, both individual and cultural behavior must conform to the ideology. In the eyes of political extremists, for example, reading and research are political acts (their sole purpose being to further ideological goals) rather than inherently valuable activities that enrich the individual and advance the knowledge base of the human community. Citizens under an extremist regime need not—indeed, must not—have recourse to ideas that fall outside the ideological system of thought. A regime composed of ideologues does not regard “the disciplined pursuit of truth—by scientific procedures and in the mood characteristic of modern science—as part of its obligations” (p. 73).^[24] The concepts of autonomous spheres of activity, an autonomous tradition of disciplined intellectual pursuits, and even the value of an individual’s independent cognitive powers and strivings are alien to the orthodoxy demanded by an ideological orientation. Although strength appears to come from the unity of ideas, fear is the real source of power. Citizens fear their governments; ideologues fear books, any system in which information reaches the people, and unfettered scholarship and learning. Because ideologies thrive on intellectual closure, books and libraries fall under tremendous suspicion as entities that support both traditional systems and intellectual expansion and have the potential to influence individual perception and sow dissent.

In terms of psychological mechanisms, aggression against libraries can be seen as the result of a group’s cultural predispositions that are activated—at least in part—by difficult conditions or “hard times.” The psychological and cultural origins of mass killings (i.e., political violence) lie in responses to the social disintegration brought on by war and/or upheaval from rapid urbanization, secularization, and economic depression.^[26] This same constellation of factors is also involved in violence to culture, the end product of a process set in motion by frustration, and an “underlying malaise in society that in

various ways blocks the paths to personal or collective fulfillment of basic human needs” (p. 4).^[27] Populations most likely to turn to ideological solutions are those with inclinations toward authoritarian power structures and with established patterns of submission and conformity, punitive rejection of other groups, and a tendency to see the world in black and white.^[25]

When individuals perceive security, well-being, self-concept, world view, and even life itself as threatened, and when cultural and social conditions create demands exceeding a people’s resources to cope, then anger, resentment, and despair mount.^[28] Traditional sociocultural and political patterns are discredited, and people turn to alternate visions—nationalism or Communism, for instance—that promise identity, hope, and control. In post-World War I Europe, the large and vague expectations on the part of millions of unemployed and uprooted peasants, war veterans, frontline heroes, and dissatisfied students created a breeding ground for nationalism, which promised reassurance and novelty as well as shelter, food, stability, and jobs.^[29] Nationalism subsequently took on fascist overtones and proffered the security of group identity, guidance, and structure. At the same time, in Russia Communism posed an alternate vision of an end to oppressive economic structures and the promise of an egalitarian and just society. In general, both fascist nationalism and Communism offered visions of a radically new and better world.

Political ideologies are particularly seductive in that they justify action in response to the victimization, frustration, and impotence brought on by hard times. Further, by identifying scapegoats, ideologies provide a channel for aggression stemming from this vulnerability. Identifying an enemy has beneficial psychological effects in times of chaos when there is no overt aggressor.^[24] Any threat to well-being, safety, and survival can be construed as “the enemy,” as when neighboring states or distant powers are seen as “thwarting” nationalist destiny, when other races “contaminate” bloodlines and prevent dominance by a master race, or when a class of society “sabotages” the revolution. Because any entity with this kind of potential is likely to have an institutionalized cultural framework that includes books and libraries, these material artifacts and institutions become targets.

Ideologies flourish under authoritarian regimes because they provide a philosophical basis for acquiescence and abandonment of the self, referred to by Erich Fromm^[30] as “an escape from freedom.” Under conditions of acute social stress, the freedom to claim privacy, to struggle with justice, injustice, and difficult life conditions, and to express ideas in a social context^[25] is exchanged for the certainty and simplicity of ideology. Anxiety over basic needs and securities is exchanged for a closed intellectual system based on simple suppositions that explain and rationalize fate.^[31] In a totalitarian system there is finally no separateness and no autonomous spheres, but also no

authentic group life. Every facet of life is understood in terms of politics. The governing party demands total conformity and assumes an unchallengeable power to bind an entire people to its vision. Books are feared as an alternative voice—a voice not necessarily of dissent but of difference. When deified cult leaders and persuasive ideologies numb intellectual processes (not the least of which is doubt), citizens become agents of authority and suspend critical evaluation of the morality of an action. Both the leader and those followers who carry out acts of extreme violence share a psychological process that begins within fanaticism and progresses to antisocial behavior and then to an incapacity for empathy.^[26] Neither human beings nor those cultural ideals (such as religious beliefs or humanism) or artifacts that were once held most dear are accorded value by the totalitarian government.

As the regime consolidates its power, ideology becomes a rationale for totalitarianism; ideological orthodoxy crowds out all dissent and difference, and conformity is imposed, if necessary, through violence. Because books and libraries preserve memory, provide witness, store evidence of the validity of a multitude of perspectives, facilitate intellectual freedom, and support group identity, they are carefully controlled, sanitized, and even extensively purged. When texts are too closely associated with an enemy, they are attacked along with the renegade group. When the human voice is extinguished, texts as the disembodied material expression of that voice are also destroyed.

During the twentieth century, post-Renaissance ideals of man using ideas to transform society and affect progress through reason took a toxic turn when ideologues redefined human advancement. Libraries became battlegrounds between humanists, for whom the destruction of books is the destruction of human potential—that which advances and uplifts individuals and society—and extremists for whom a specific instance of destruction is instrumental in bringing utopia and is thus a “liberating, redemptive act” for humanity (p. 30).^[32] As we enter the twenty-first century, a humanism that accommodates pluralism and democracy will most likely remain on a collision course with ideologues, and the fate of books and libraries will remain problematic.

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Still Image Indexing

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Abstract

General considerations in still image indexing are addressed, and theoretical foundations and major approaches to image indexing among several communities are explained. The most frequently used tools that support this endeavor are discussed. Newer approaches are considered, and major research topics for the future are presented.

INTRODUCTION

The topic of still image indexing has grown from a subject of interest primarily limited to a small community of professionals within libraries, archives, museums, and cultural heritage organizations, to a topic widely discussed not only in scholarly literature but also in the popular press. A major impetus for this expansion of interest has, without a doubt, been the rapid evolution of tools enabling the widespread creation of digital images, and the growth of networked collections of images available to ever-wider audiences through the Internet. Collections of images now range from groups of images posted by individuals on Web pages to shared collections such as those on the popular Flickr Web site to art and other museum exhibitions created and curated on Web sites or in virtual worlds such as Second Life. Finding images relevant not only to scholarly or professional interests but to a variety of personal interests is now a daily activity for millions of people across the world. This demand has stimulated the rapid expansion of commercial digital image services, and still image indexing is seen as an economic driver within the commercial sector, as well as an active area of scholarly research.

Still image indexing falls within the larger domain of visual information description and retrieval, that includes mechanisms for indexing and providing access to both still and moving images, as well as a variety of multimedia documents. For all these document types the single image (or frame for moving images) could be considered the most basic level of analysis. Therefore, the topic of still image indexing in this overview is referred to simply as “image indexing,” with the understanding that this is referring to a fundamental and discrete unit of description of a single still image within a range of types of visual materials.

This entry covers general considerations in image indexing, theoretical foundations, and major approaches to image indexing among several communities, and the most frequently used tools that support this endeavor.

Newer approaches are considered, and major research topics for the future are presented.

CONSIDERATIONS IN IMAGE INDEXING

It should be noted that in the image indexing literature, “indexing,” “classification,” and “cataloging” may all be used informally to refer to the processes of assigning descriptors to images. Subject indexing is defined in a generalized sense, as “the indication of the theme or topic of any document, indeed any retrieval artifact, by any meaningful string of alphanumeric characters.”^[1] Kaiser takes the “reduction of literature to a smaller compass” as the common basis of these activities.^[2] While the processes of reduction can differ (elimination, selection, concentration, recapitulation, and analysis), the goal remains the same, the creation of a succinct representation or surrogate for an item. It should also be noted, however, that in a continuum from subject cataloging to indexing, the general movement is toward increased term specificity and granularity of access.

Still image indexing is a process in which image features or attributes are selected for representation either by human indexers assigning textual descriptors or by a variety of digital methods, such as computer algorithms, that produce output representing features by text, numerals, mathematical formulas, or a combination of these. In the context of visual media, Medin and Barsalou propose a useful definition of an attribute: “any kind of feature, component, or property of a stimulus that can be represented by an information processing system.” They continue: “We make no assumptions about the format of these representations... nor do we assume that the attributes correspond to innate detectors.”^[3] In this definition, “information processing system” includes both organizational and retrieval systems. An image attribute is therefore a feature, component, or property of a stimulus (an image) that can be represented by an information

processing system. An image attribute is thus not limited to purely visual characteristics, but can include other cognitive, affective, or interpretive responses to the image such as those describing spatial, semantic, or emotional characteristics.

While there are a variety of issues associated with still image indexing, a major issue is the fact that still images by and large do not contain their own feature descriptors in a text format. A text document contains terms which themselves generally convey the subject or topic of a document, while an image may be “of” something but carry meanings that extend beyond the visual content, ranging from symbolic objects to abstract concepts. Bibliographic records associated with images typically give sparse, if any, visual content description. Visual percepts such as color and texture may also be difficult to describe with text, and many have commented on the inadequacy of language as a recording medium for describing image content that may essentially span several different domains. Image indexing languages, largely derived from traditional sources such as subject heading lists, often lack terminology that can convey either visual richness or symbolic, narrative, or affective aspects of an image, as these have been considered out of scope within standard indexing guidelines.

It is useful to employ several lenses through which to view progress in still image indexing. As noted above, the primary method of indexing images has been using text, placing it within the larger domains of document description and information retrieval research. Within the text domain, there has been a long-standing debate between proponents of free-text, or keyword, indexing vs. use of controlled vocabularies for document description. This debate extends back to the Cranfield II experiments that tested the retrieval capabilities of 33 indexing languages for text documents; this and subsequent studies found that a minimally controlled vocabulary (for instance, for word ending variants) performed as well as or better than a controlled vocabulary. (For a full discussion of controlled vocabularies, including their history, see Svenonius).^[4] This debate continued through the rise of online subscription database indexing and searching services, the availability of full-text searchable databases, and continues today whenever discussions of the popular Web searching tool Google take place within the information industry. The more recent arrival of systems that allow end-users to “tag” items with descriptive terms has also created popular interest in what were once more esoteric discussions.

While this debate can be framed in terms of explicit questions concerning the functionality of these different types of access mechanisms, an implicit question also underlies this debate: the question of locus of authority. That is, which communities should be permitted to contribute to the mechanisms of document indexing, whether these be subject experts in museums or professional indexers developing controlled vocabularies, computer scientists who understand how to manipulate discrete packets of digital

information, or the end-user who knows what they want to call an object in an image, regardless of what others may select as an appropriate representation of it. This question has been brought to the forefront with systems that allow users to assign index terms, or “tags,” to images and other documents. The development of image retrieval algorithms that operate directly on image components, bypassing text altogether, has also contributed to this debate.

This conflict between the desire for creating a perfect description and a user’s simply finding the desired item still exists, while a middle ground is sought by institutions that grapple with it, and “it still remains to be seen if a middle ground between expert classification and no classification can be found in the process of determination of categories to enable users to browse image sets.”^[5] Others question the notion of “correct form” in relation to “findability,” and suggest that limited time and resources would be better spent in putting in many words and phrases rather than laboring to produce “a few properly verified and expressed ones, particularly since so many of our potential users know little except the almost random nature of cyber searching.”^[6]

A variety of competing requirements and demands shape image indexing decisions within an organization. Among these are:

Collection considerations: These involve decisions such as whether to index the individual items within a collection or simply to provide a pointer to an entire collection. Granularity of indexing also becomes an issue as collections grow. Broad subject terms may be adequate for browsing and retrieval in a smaller collection, but do less to discriminate among images as their number increases. When cataloging is at the collection level, then providing links among related collections must be considered. Additionally, providing meaningful links among specific items within collections may also be desirable.

User considerations: User-centered indexing (as opposed to document-centered indexing) is considered by many to be basic to meeting users’ information needs. Indexing can be oriented to the users of a specific collection [as has been done with the development of domain-specific thesauri such as the *Art & Architecture Thesaurus (AAT)*] or toward the needs of specific types of users, as has been done for stock photography collections with the addition of attributes of interest to graphic designers and other publication professionals (e.g., terms relating to image orientation or composition). However, determining the user group becomes more difficult in the digital environment, and images, with their various interpretations, can serve multiple user audiences and needs.

Vocabulary considerations: The decision as to which controlled vocabulary to use (if any) relates to both user and collection considerations. Choices include

controlled vocabulary tools such as a thesaurus or subject headings, the use of free-text description in the form of keywords, or the use of associated texts such as captions, surrounding text, or literary works of critical analysis and interpretation. Each of these choices requires further decisions as to what kinds of structures should carry the indexing terms, or what kinds of tools are needed to enable selection of terms for indexing. While the type of collection and its typical users often determine the choice of vocabulary, there has been little empirical work testing the utility or the outcomes of these various vocabulary choices in relation to user needs. A more general image indexing vocabulary, to complement the domain- and collection-specific ones in existence, would also assist in indexing images across collections.

Image considerations: There are a number of decisions to be made concerning the access points provided for individual items. These relate to the scope of the indexing and whether indexing is limited to visual content such as the objects in an image, or will include higher-level semantic and interpretive aspects of images (symbolic meanings, aboutness), and image complexity. An additional consideration is whether to provide links among these multiple levels. These decisions obviously impact on the vocabulary considerations and should be contemplated in light of user and collection considerations as well.

Context considerations: These relate to information that is external to the image, such as the circumstances of production and the history of the item. Other factors (especially in the case of an image of an art object or cultural artifact) would be technique, medium, and other facets related to the production of the original item. Some recommend an archival perspective, speaking of what can be lost when cataloging or indexing of images takes place without regard to context. Standard access points such as country, ethnic group, content, source, and subject used in image collections are not enough to convey the larger value or meaning that an individual image may have as part of a larger collection. When an image is considered as an objective and independent entity, apart from other related works in a collection, the collection becomes an “infinite catalog of random observation.”^[7] Krause also argued early for providing additional indexing of the “soft” aspects of pictures, cultural, and historical meanings that may be clear such as “horrors of war,” or “inner-city decay.”^[8] Of course, these meanings are also subject to change as history, cultures, and understandings and interpretations change.

As this brief overview reveals, the framework of image indexing decisions is complex and these decisions are not mutually exclusive of one another. Within these multiple

and sometimes conflicting perspectives this overview covers the theoretical foundations of image indexing, the tools and technologies typically employed in the process, and how the knowledge base underlying this activity is being impacted by advances in cognitive psychology, empirical research aimed at understanding users of image collections, and end-user image indexing behavior within individual and social contexts.

Frameworks for Image Indexing

A framework adopted by many authors for considering still image indexing utilizes two major indexing approaches, “concept based,” and “content based,” based upon the historical development of tools and technologies employed in the indexing process by two largely different communities.^[9] Concept-based indexing refers to the use of text descriptors assigned to images by human indexers, whether these are selected from some type of controlled vocabulary or are natural language that is either assigned or drawn from accompanying text sources. Index terms cover the subject of the image and may include important people, events, objects, dates or time periods, locations, relationships, and meanings. Affective components or emotional impact of an image are usually considered out of scope. While this is the traditional approach most libraries, museums, and archives have adopted, indexing in this manner is time consuming and labor intensive, and thus expensive, and indexing consistency can vary greatly among indexers, collections, and institutions.

In contrast, the second approach, content-based indexing (usually referred to as content-based retrieval (CBR) because of its methods of implementation) uses image processing methods from computer science to “parse” images into mathematically describable components such as color, texture, shape, edges, and regions and assign labels or codes (that may or may not be human-readable) to these. This approach has the ability to process large numbers of images automatically and with some degree of consistency, but does not necessarily address features of interest to searchers.

While this framework provides a convenient starting point for discussing a variety of image indexing methods, tools, and technologies that have been researched and adopted, it does not directly address the underlying theories supporting each approach. Nor is the separation between the two approaches as distinct as this framework would suggest. In an “ideal” implementation, each approach aims for a complex and complete description of an image that will serve the retrieval needs of image searchers, and both draw upon theories that recognize the necessity for multiple levels of description. Each approach has evolved separately within different communities of practitioners and researchers and both approaches suffer from technical limitations. Content-based retrieval has focused primarily on the digital image, bypassing many

of the other considerations surrounding indexing decisions, such as those discussed above. Concept-based retrieval, in contrast, has focused primarily on the users that particular institutions typically serve (as is appropriate) but have failed to recognize the power that an image gains when it becomes digital: the ability to reach a much larger audience and serve multiple purposes and needs. Many researchers are now recognizing that the most fruitful approach may be some combination of methods that utilizes the most powerful and appropriate aspects of several different approaches to the particular tasks at hand.

CONCEPT-BASED INDEXING

History

A number of communities have contributed to the development of concept-based image indexing methods. Historically, indexing of images has taken place largely within libraries, museums, and archives, where the need for access to and use of images is often immediate and tied to the particular tasks of a user community, such as teaching or research. Description has largely been accomplished through the use of some form of controlled vocabulary, considered a necessity as natural language lacks precision and order and can create many access problems in both physical and digital storage and retrieval systems. However, there is also an underlying tension existing in indexing of images or images of objects: the need to preserve the uniqueness of the object or image (especially as represented by written records of an art historical nature), while providing access to the object through some type of controlled vocabulary within an information retrieval system.

Although slide collections were in existence by the 1880s, the earliest slide and picture librarians had few resources to draw upon through the first half of the twentieth century. Broad subject access was provided through subject heading lists and reflected a practical orientation, responding both to user needs and a need to organize physical collections, yielding very limited multiple access points. Hierarchies were typically shallow, and the consistency, depth, and breadth varied considerably both within and across individual systems. (One of the earliest was *The Picture Collection: Subject Headings*, first published in 1910 as part of *The Picture Collection* by John Cotton Dana.^[10] Current image indexing systems developed for specific collections still share a pragmatic, collection- and user-centered focus,^[11] and these locally developed vocabularies often supplement more standard controlled vocabularies.^[12]

The art history and museum communities have focused on images as objects in their own right (as cultural heritage) or as surrogates for art or museum objects. Art/museum image indexing serves a variety of purposes, such

as management of inventory, documentation of provenance, and preservation of fragile original materials, and distinguishing between the original and a surrogate are of particular concern. As museums are mostly concerned with unique items, more specialized terminology is desirable, and correct application of this terminology is paramount. Most art-oriented controlled vocabulary systems have followed a basic hierarchical structure starting with medium, and subdivided by period, country, geographical or cultural area, artist, and subject or type of object. Many of these have been developed in academic settings and are still in use today.

Theoretical Basis

Erwin Panofsky's discussion of the question of meaning in art^[13,14] forms the basis for much of the theoretical work that has been done on the description and classification of images, including nonart images. Following initial visual perception of image fundamentals such as colors and shapes, Panofsky describes three successive levels of a viewer's understanding and interpretation, moving from the "of," or visual content of the image, to the "about," or the meaning of the image. The first level of pre-iconographical description requires only knowledge acquired from practical, everyday experience to interpret objects that primitives such as colors and shapes represent. Iconographical analysis draws upon literary and cultural sources for understanding aspects such as symbolism, and iconological interpretation may involve multiple subjective interpretations. Iconography is an important part of art historical description, but may also lead to information loss and increasing levels of subjectivity, as interpretive and symbolic meanings become the major access points and description of visual content is de-emphasized.

Given that one of the aims of indexing is to increase consistency in retrieval, consistency in indexing has been a prime goal of all indexing systems, and subjective aspects of images have generally been considered out of scope in most general indexing systems.

Shatford,^[15] concerned with the lack of a theoretical basis for construction of subject-oriented organizational schemes for pictures, combined Panofsky's work with standard classification theory to provide an expanded basis for image classification. She proposes that a single image will have many meanings, from the specific object that the image represents (the Golden Gate Bridge) to generic or abstract words ("bridge" or "architecture"). She then extends the concept of "Generic Of" and "Specific Of," as well as the concept of "About," (derived from Panofsky's first and second levels) to a faceted classification system capable of answering a series of questions such as Who, What, When, and Where within each of these levels. She proposes that, as a minimum, an image should be indexed with both the "Generic Of" (skyscraper, office building) and "Specific Of" (Empire State Building).

The purpose of her system is to prevent possible useful subjects from being overlooked by those who are classifying or indexing these pictures. She cautions that any system for classification must be used within the context of the nature of a specific collection, and that until further research is done on types of user requests, the indexer should concentrate on the main subject of a picture within the framework of a special vs. a general collection. However, even determining the “main subject” of a picture can be complex, and depends upon the classifier’s point of view. The main contribution this work makes to the image indexing community has been to emphasize the two major components to think about when indexing images, the “of” and the “about” of an image.

Tools

There are three major components of textual image description: 1) the terms used to describe the images, and the tools used to derive these image descriptors; 2) rules for when these terms or descriptors should be applied; and 3) a structure that stores and organizes the terms, such as fields in a database or metadata structures. More succinctly, these are often referred to as:

Data *value* tools provide values or terminology for representation

Data *content* tools provide guidelines for how terms are chosen and applied

Data *structure* tools organize and house the terms or values

Indexing and classification are processes in which images are described by employing data value tools and data content tools to determine and select terms appropriate to represent an image’s features. Data structure tools organize these terms into a framework and may give them additional functionalities. An additional type of tool is a data “communication” tool, used for sharing information between data structures. While these tools are often discussed independently, their ability to facilitate image description is interdependent on all of them. A term for an image feature cannot be selected from a data value tool if there is no defined structure that will accept it, and likewise a data structure tool may be rich in what it can represent but values must be available to populate these structures. Tools such as these often develop into accepted standards.

Data value tools

Controlled vocabularies such as subject heading lists and thesauri are typical and widely used data value tools. Image indexing often relies on the use of a thesaurus rather than a list of subject headings for increased specificity in description. A thesaurus contains, in addition to controlled vocabulary terms, logical and semantic relationships among

terms. Svenonius notes that the language of art can be particularly problematic in creating controlled vocabularies for visual materials. It is rich in synonymy, shades of meaning are sometimes considered critical, and determining warrant for usage is complex; no one term may be dominant, and different specialties may prefer different terms, necessitating the incorporation of linguistic diversity.^[16]

Another more serious problem for art thesaurus design concerns the description of objects of material culture, the objects and artifacts produced by a culture, including all those objects associated with their daily activities. When thesauri are constructed drawing upon frequently used terminology from the documents of a particular domain (a practice known as “literary warrant,” where frequency of usage provides the authority for inclusion), the range of terms is limited to those occurring in the literature of that domain. However, in a thesaurus being used in museums for descriptions of objects of material culture as well as art, objects may go well beyond those normally considered within the literature of art history, and the number and type of objects needing description is potentially limitless. When object names are included in a thesaurus as compound terms (e.g., “iron hammer”), any frequently occurring term (e.g., the types of hammers and materials from which they are constructed) can cause an unacceptable burgeoning of the thesaurus. A faceted approach can limit the number of terms needed by allowing compound terms to be constructed from different facets (e.g., materials and types of tools), but limiting compound terms within a thesaurus can also constrain useful hierarchical structures that provide domain knowledge about how an item may be classified by a particular culture.

Two major data value tools are used in image indexing: the Library of Congress’s *Thesaurus for Graphic Materials (TGM)* and the *AAT*. These two tools exemplify established approaches to the development of controlled vocabularies for image indexing and illustrate the issues associated with each approach. The main source of terminology for the first edition of the *TGM* was the *Library of Congress Subject Headings (LCSH)*, itself drawn from subject matter within the collections of the Library of Congress, including the Library of Congress Prints and Photographs Division whose collections range from documentary photographs and architectural drawings to editorial cartoons and fine prints. The *TGM* was designed to provide “a substantial body of terms for subject indexing of pictures, particularly large general collections of historical images” through a controlled vocabulary “for describing a broad range of subjects, including activities, objects, and types of people, events, and places.” Its historical focus extends to some abstract ideas found in allegorical prints and editorial cartoons.^[17] New terms are added to the *TGM* as the topic is encountered in the course of cataloging and indexing. Cataloging projects (such as LC’s American Memory project) and the disparate nature of indexing activities also give rise to variation in the

selection and application of the indexing vocabulary. The TGM currently contains over 7000 terms.

The AAT, unlike the TGM, was constructed independently of the cataloging operations of any single institution.^[18] It was designed to provide terminology for indexing the art, architecture, and material culture of the Western world from antiquity on, and it incorporates art historical and other highly specific concepts that relate to the creation, description, and appreciation of art and architecture. The AAT vocabulary was developed inductively using the concept of literary warrant and was developed to a high level of specificity in constructing the hierarchies that compose it. It is a compiled resource with contributors from outside institutions, as well as from internal Getty projects, and undergoes continuing scholarly review. The Getty is currently developing the Cultural Objects Name Authority, expected to join its other two name authority files (the *Union List of Artists Names*® or ULAN, and the *Getty Thesaurus of Geographic Names*® or TGN) in 2011. These vocabularies, available online, together comprise the Getty Vocabularies and are updated every month. The AAT contains about 34,000 concepts and 131,000 terms and is organized in over 30 hierarchies within its seven top-level facets: Associated Concepts; Physical Attributes; Styles and Periods; Agents; Activities; Materials; and Objects.

Neither of these two tools includes the more specialized iconographical terms found in *Iconclass*,^[19] a hierarchically ordered collection of definitions of objects, persons, events, and abstract ideas that can be the subject of an image. It has 10 main divisions reflecting its primary concerns: subjects, themes, and the iconographical interpretation of images. The divisions consist of general areas such as religion and magic, nature, human beings, society and culture, and abstract ideas and concepts, and “special” topics such as history, the Bible, and mythology. *Iconclass* uses alphanumerical classification codes, and notations begin with a digit corresponding to one of its 10 main divisions. Every notation is part of a hierarchical structure and thus incorporates all of the iconographically broader terms in the hierarchy above it. This systematic classification has advantages over both uncontrolled and controlled vocabulary terms, as it can facilitate automatic searching up or down the hierarchy. For example, a search for paintings of flowers can return paintings of different kinds of flowers, without having to name each type individually. Additionally, the notational system is independent of language but can still be approached through natural language.

Issues with the TGM include a high degree of pre-coordination (compound terms formed from two terms that may be from different hierarchies, e.g., “straw hat” and “cowboy hat”), reflecting its origins in the LCSH and limiting the usefulness of much of the terminology (for instance, the ability to construct a term such as “straw cowboy hat”). It also lacks a true genus–species

relationship among many parent–child terms, contributing to an overall lack of specificity. In contrast, the AAT and *Iconclass* contain highly specialized or technical terms, often requiring indexers to consider terms appearing across several different facets and within a number of hierarchies. This, combined with the technical nature of these indexing languages results in the need for extensive training in their use and also in increased indexing time. These types of tools, by their nature, have more difficulty responding quickly to evolving patterns of usage.

Data content tools

Indexing should accomplish two goals: first, providing access to individual documents through specific attributes, and second, providing a means to form groups of like documents. Guidelines for terminology selection in the broad area of image indexing remain largely informal. Decisions as to depth of indexing are a consistent problem encountered across indexers and collections. Elings^[20] describes the conflict:

Subject indexing, depending on how it is applied, can offer the user broad or specific access to these collections. Broad subject indexing helps to unify collections by their content and can aid researchers at a higher level of information retrieval. Specific indexing can be time consuming for the cataloger but rewarding to the researcher. Too much specificity, however, can become an issue of indexing vs. analysis. In the end, the cataloger’s task is to make the information broadly available and to provide some reasonable level of access. It is still up to the researcher to interpret the content and analyze the collection at a very specific level.

Shatford^[15] proposes three questions to consider in relation to attributes to be indexed: which attributes need to be indexed, which can simply be noted in conjunction with the image, and which may be left to the searcher to perceive. These questions must be considered in relation to the type of collection and its users.

Several of the major data value tools for images provide general guidelines. The introduction to the TGM (<http://www.loc.gov/rr/print/tgm1/ia.html>) discusses some of the multiple aspects of pictures that catalogers should consider when trying to decide which subjects to index, such as historical significance or novel aspects of the subject matter, whether the subject is better represented elsewhere, the relationship of an item to other materials or collections, whether a particular point of view or message necessitates the indexing of the image’s context, and image content that is unique primary evidence of a particular time and place.^[21] The indexing should also provide both the specific (of) and generic (about) levels of access. These guidelines point to the particular emphasis of the TGM on historical and collection-level access. The *Thesaurus*

Iconographique, widely used in French museums, provides similar guidelines,^[22] while the AAT provides more detailed instructions for use.

Until recently, there has not been a data content tool comparable to those data value tools available for unique art and material culture objects. The creation of *Cataloging Cultural Objects: A Guide to Describing Cultural Works and Their Images* (CCO) was designed to fill this gap.^[23] While the primary focus of CCO is art and architecture, it also covers many other types of cultural works, including built works, installations, archaeological sites, artifacts, and functional objects from the realm of material culture. This tool is designed to provide guidance in structuring the elements of description and recommends the use of accepted data value tools, as well mapping to core data structure tools.

Data structure tools

Data structure tools, frequently developed as metadata frameworks, organize the terms representing image attributes. The need to share object and collection information in a networked environment has stimulated a number of recent metadata standardization efforts and exchange formats. A shared metadata structure enables interoperability and information exchange. This, coupled with the adoption of standardized sources for controlled vocabulary, can facilitate description consistency and shared cataloging efforts across multiple institutions.

The *Categories for the Description of Works of Art* (CDWA) was originally created by the Art Information Task Force and was intended to guide decisions about what information should be included in art information systems.^[24] The need to “uniquely and unambiguously” identify particular art or museum objects or cultural artifacts guided the identification of core categories that can be modified according to local need and practice. Now part of the Getty Standards Program, it includes 512 categories and subcategories and can distinguish between information intrinsic to the work and information (related persons, places, and concepts) extrinsic to the work. Extrinsic information is stored in separate authorities that can then be reused. The CDWA also distinguishes between information for display (full descriptive texts) and information for retrieval, and for the latter recommends carefully chosen controlled vocabularies and authorities. A core set, designed to enhance accessibility across databases, includes Object/Work, Classification, Titles or Names, Creation, Measurements, Materials and Techniques, Subject Matter, Current Location, and Related Textual References, as well as core authorities: Person/Corporate Body, Place/Location, Generic Concept, and Subject.

Core categories for visual resources. Developed by the Visual Resources Association (VRA) Data Standards Committee, the VRA Core is an adaptation of

the CDWA expanded to cover architecture and site-specific structures.^[25] It provides metadata categories for the description of “works of visual culture as well as the images that document them” (VRA 2000). The Core is designed to facilitate sharing of information about visual works and is not intended as a complete set of elements; therefore, it can be extended by adding fields according to local needs. The latest version, *VRA Core 4.0*, contains changes that more easily enable its expression in XML.

Dublin core. The least-complex metadata structure discussed here is the Dublin Core (DC), which has been extended to accommodate visual materials. The “Simple Dublin Core” 15-element set is intended to facilitate discovery of resources in a networked environment. The DC has been developed through a series of workshops sponsored by Online Computer Library Center, Inc. (OCLC) and such cosponsors as the National Center for Supercomputing Applications, and the Coalition for Networked Information (CNI). The third workshop focused on description of visual resources of a particular kind, discrete images that can be identified as bounded or fixed (in the sense that the resource looks the same to all users). One conclusion of the workshop was that images and text are quite similar in their “discovery” requirements (CNI/OCLC Image Metadata Workshop, September 24–25, 1996, Dublin, Ohio). Thus, development of this metadata scheme has proceeded with the goal of formulating one structure for both images and text.^[26] The Qualified DC includes three additional elements and has added qualifiers to support additional functionalities.

CONTENT-BASED INDEXING

Image indexing utilizing the techniques of computer processing of images is referred to as content-based indexing, or, more commonly CBR or content-based image retrieval. Images that are not “born digital” can be converted from an analog to a digital format, enabling automated feature extraction, computation, manipulation, and to some degree interpretation. Electronic images can be defined as “sets of data” and the term “pixel” refers to a single measurement within an image produced by this method. Image features such as color and texture are derived directly from the pixels in an image. A pixel, or group of pixels, while being a basic unit of measurement of the visual content of a digital image, will not necessarily map to what we would call an “indexing term.”

Theories of Cognitive Processing

Much of the current work supporting machine processing of images comes from earlier research in artificial

intelligence and machine vision, with the goal of recognition and automatic classification of objects (a useful introductory text is by R.C. Jain in Jain).^[27] Research in cognitive science may be informative in several ways: for defining models of image similarity; for determining those image features having priority in the indexing process; and as models for machine processing of images. Evidence suggests that a number of different image attributes and relationships interact in the process of perceiving, understanding, and remembering an image. Many of the cognitive theories of perception have been used as models for complex methods of computer image processing that build from lower levels of color, texture, and shape to object recognition to object identification within limited domains.

Visual perception is thought to begin when an image or scene is decomposed into primitive elements such as color, motion, orientation, depth, contrast, and spatial resolution; shape and spatial relations are extracted and primitive features are assembled into larger objects and scenes. Elements that share the same information are grouped together perceptually, and grouping mechanisms override their individual constituents, whether of shape, size, color, or motion; an image, therefore, is perceived as a whole entity, or a “Gestalt,” before its individual components are perceived. Contextual organizational principles known as the Gestalt principles^[28] thus appear to organize parts of a picture into regions and objects that are perceived before the component parts are. This theory suggests an object or image in a Gestalt possesses features that are not inherent in the smaller features or regions from which the object or image is assembled. Gestalt theory holds that overall form, rather than lower level features, is the fundamental unit of perception, and perception of form is governed by cognitive rather than sensory processes. Eye-tracking experiments demonstrate that fixations occur in specific areas that correlate with both the Gestalt principles of “good form” (which describe perception of visual constructs such as texture, e.g., objects in proximity are perceived as a single entity) and experimental results in image memory: areas of detail; contrast, contours, and unfamiliar features considered to be of “low predictability.” The Gestalt principles are today widely used in graphic design.

Other theories, such as *Recognition by Components*, suggest that an understanding of an object is facilitated by a process that assembles low-level features into larger understandable regions.^[29] Physiological research demonstrating selective response of cells in the visual cortex to features in specific orientations supports these feature-based models. Even though patterns can vary, relationships among local features that are the most important to the pattern hold, thus allowing many varying images of an item to be recognized as a member of a class. While both the physical and semantic relations of objects in the visual field appear to affect interpretation and understanding, it is still not known exactly how these processes work, or if one takes precedence over the other at different points in the processing.

Tools

CBR

The analysis process for machine vision tries to determine the composition of complex objects in terms of simpler objects. Complex objects are defined using composition rules and constraints among the objects composing the complex object. Thus, machine processing of images proceeds by segmenting an image into processable units and performing some kind of analysis of these units in order to end up with a description in terms of specific features. Object recognition and image understanding involve moving from lower to higher levels of abstraction and require increasing levels of inference and reasoning. Lower level output of these processes can consist of color representations such as histograms, and an image composed of one or several such features is represented by fixed-length feature vectors with multiple real values. Higher level output can consist of either labeled graphic output or textual description. Such image processing involves both a loss of information at lower levels and computational complexity from increasing levels of inference and reasoning.

While machine vision has been an active field of research for several decades, CBR is a more recent application of these techniques. In the vocabulary of CBR, an image is represented by a “signature,” composed of features such as color derived from its pixel values. Retrieval operates by defined rules for comparing features. Features may be either “global” or “local.” A global feature represents the image in its entirety, such as the overall color distribution. Local features are determined by segmentation of the image into smaller regions using color, texture, and shape and can be used to identify objects within an image. From the perspective of CBR, image statistics produced by these methods could be sufficient for helping users find desired images, but in reality these methods are largely limited to searching for images with a similar distribution of image properties or features (color, texture, edges, and regions). While a wide range of features and query types is defined as being in the realm of CBR, in practice most research has focused on low-level features that can be extracted automatically.

Within computer science the lower syntactic levels have been extensively researched, producing multiple processing methods, and some systems operating on these principles are now in use. One early system, known as QBIC (for Query by Image Content, thus where the expression “CBR” comes from) was developed using IBM’s technology. It utilizes a visual query constructed by a searcher as search input and matches this against stored image signatures representing features such as color, shape, and texture. This method is known as Query by Visual Example or QBVE. Some museums, most notably the State Hermitage Museum in St. Petersburg, Russia,

have adopted this method as a search tool for their digital image collections.^[30]

One difficulty with these systems has been the requirement that searchers construct an input image composed of primitives such as a round red object over a large blue area to represent a sunset over water; these searches are more useful when a searcher requires a specific layout, but less useful when a searcher wishes to search on concepts. Another difficulty is that multiple types of objects, for instance, pumpkins as well as sunsets, will be retrieved by the visual matching algorithms, confusing and frustrating searchers. Once a searcher finds an image similar to the one sought for, the searcher can then query the system to retrieve images that are visually similar.

The gap between what can be derived computationally and what a human might assign as an indexing term or use as a search term for an image has been referred to widely in the literature as the “semantic gap,” or the gap between human similarity judgments that are based on multiple factors and visual similarity, based on a more constrained set of attributes. Current machine processing capabilities are limited in bridging computable low-level features and regions and higher inferential levels such as object identification, abstract concepts, symbols, and meanings. An early model attempting to bridge this gap and unify content and concept-based indexing is a 10 level “pyramid” that builds from syntactic features to interpretive levels of generic, specific, and abstract object understanding and meaning.^[31] Efforts to build semantic retrieval systems rely on methods of machine learning (derived from neural network models) using a set of labeled or captioned images as input to develop models of common semantic concepts. However, these systems are limited in that the system has no way to learn concepts that are not labeled. This method is further extended by the Query by Semantic Example method that uses an input image rather than a text query.^[32] This input image can be translated into an internal semantic representation expanding the range of possibilities among image features that may be matched. While success is still limited, this approach is showing more promise than just matching on visual features that possess limited similarity value in the context of many image queries.

IMAGE TAGGING SYSTEMS

Within image indexing, the issue of “locus of authority” comes into play at the level of the semantic gap (while the term “semantic gap” came into existence in the context of content-based retrieval, many would argue that it also applies to differences in image description between communities of scholars and end-searcher communities who may have very different needs), and most notably in discussion of workflow

considerations in organizations doing image indexing. The volume of visual materials needing access points is overtaking the ability of standard processes to handle them in the controlled way seen necessary for bibliographic description. At the same time, systems that allow users to view and share items are also providing means for those same users to describe these items, through an informal process of assigning natural language terms, or tags, to items. While the phenomenon of social tagging is beyond this discussion, museums, libraries, and archives with visual collections (as well as commercial sites such as Flickr) are leading the way in providing tagging utilities for their users. Tagging is seen as a low-cost, if somewhat uncontrolled, method of providing multiple access points for these visual documents. There are currently several projects undertaking evaluation of tags supplied for image collections, the most notable being the *steve* project (<http://www.steve.museum>) that has a number of museums implementing tagging of their digital images and an active research community around these efforts. The appropriateness of tagging for these collections and the role that tagging will play in increasing access to image collections remains to be seen, but early results are demonstrating value in the increased number of access points being provided. There are a number of interesting questions remaining, such as how tags can best interface with existing descriptions, and what additional sources, such as associated texts, could supply tags.

CONCLUSION

A great many tools have been developed for still image indexing in the past several decades. There is an evolving consensus that both controlled vocabularies and natural language descriptions are useful, depending upon the information exposed to the search tool, the mode of searching (browsing versus known-item search), and whether precision or recall is more important to the task. We have reached the point where more empirical research is needed to establish within what contexts searchers gain the greatest utility from the variety of tools available. There is much fascinating research remaining to be done in the area of still image indexing and in visual retrieval in general. Standardized test beds for different methods remain lacking, as do easily used integrated indexing records (that can accommodate data in a variety of formats), and studies of end-user image searching remain scarce. Indeed, decisions as to what to index are complex, knowledge about image searching is incomplete, guidelines and tools are plentiful but evaluations of these are scarce as well, and many valuable access points are potentially lost in the indexing process unless a variety of searchers and needs are taken into consideration.

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1. An overview of the Gestalt principles and their application in design may be found in the paper “Identifying Commonly-Used Gestalt Principles as a Design Framework for Multi-Sensory Displays,” by Chang and Nesbitt in *Systems, Man and Cybernetics 2006*. SMC ‘06, 3: 2452–2457.
2. For more details of human visual processes, the reader is referred to books such as Gregory’s *Eye and Brain* and Hendee’s *The Perception of Visual Information* (Gregory, 1997; Hendee and Wells, 1997). A good nontechnical introduction can also be found in Hoffman’s *Visual Intelligence* (Hoffman, 2000).
3. For more detailed information on visual perception, the reader is referred to the excellent chapter for the lay reader, “Light, Color, and Shape: The Science of Vision,” *In the Eye of the Beholder* (Bruce and Young, 1998).
4. Jørgensen, C. *Image Retrieval: Theory and Research*; Scarecrow Press: Latham, MD, 2003.

Still Image Search and Retrieval

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Abstract

We describe approaches and techniques for indexing and retrieving still images from multimedia databases. We specifically emphasize content-based image retrieval (CBIR), a class of techniques where the user composes queries that specify the content of the desired images. After a brief overview of digital image formats, we analyze different approaches to content specification: in terms of low-level visual features, of objects, and of metadata. We then describe a general progressive framework that combines these approaches. We finally conclude the entry with an overview of common applications of image repositories and digital libraries, such as medical imaging, remote-sensing imaging, and data for the oil industry.

INTRODUCTION

During the first decade of the twenty-first century digital images have rapidly supplanted traditional film-based images in many application areas. The most visible example is consumer photography, where, due to technological advancements, the digital medium has overtaken the traditional film. Digital cameras with high-quality optics and high-resolution sensors are much smaller than old 35 mm cameras. Cellular phones often have built-in digital cameras with resolutions that match that of a typical mid-range computer monitor. External USB hard disks with 1 Tb of capacity or more are available at a fraction of the cost of a personal computer, allowing consumers to store large numbers of digital pictures. Distributing digital images is also very easy: telecommunication companies offer services to share images acquired via cellular phone cameras, while social networking sites provide intuitive interfaces for posting personal photographs on the Internet. Accessing images over the Web has become almost instantaneous, thanks to the widespread availability of broadband connectivity for home use, over the phone lines (using DSL, i.e., Digital Subscriber Line, technology), or over the cable-television networks.

Digital imagery has quickly supplanted traditional imagery in scientific fields, particularly in radiology. Several types of radiological images have always been acquired through electronic sensors—magnetic resonance imaging (MRI), TAC, and Positron emission tomography (PET), for example. The availability of high-resolution sensors and especially of high-resolution, high-contrast computer displays has made it possible in many cases to replace traditional, film-based x-ray imagery with digital images. Technological advances are making digital radiography appealing even in applications where high-resolution images are required, such as for mammography.

Advances in imaging techniques have also enabled the reproduction of precious documents, historical artifacts, and figurative art masterpieces with sufficient wealth of details to be usable not only by the general public, but even by scholars. This trend was pioneered in the mid-1990s, for example, by the Vatican Digital Library initiative;^[1] more recent development include the digital rendering of Michelangelo's David statue.^[2]

Quite interestingly, techniques for *retrieving* digital images from large collections or from the Internet have only partially kept up with the pace of the digital imagery explosion. The most widely used search engines can retrieve images through keyword-based searches and build image indexes based on the HTML tags of the images and on keywords that appear in the text in the proximity of the images. Specific scientific fields have developed metadata standards to describe information on how images are acquired and on their content. However, the ultimate goal, the ability of retrieving images by specifying the desired content, is still a research topic and, despite the numerous advances in the field, has proven, so far, to be an elusive achievement.

In this entry, we provide an overview of still-image retrieval by content. We start section "Introduction" by discussing how images are represented in digital format. In section "Image Formats and Data Compression" we introduce the concept of content-based retrieval of still-image data (CBIR, for content-based image retrieval). Section "Query Specification" introduces the definition of *objects* as the building blocks for content representation within an image. In section "Content Representation and Objects" we identify different abstraction levels at which objects can be specified. We discuss how simple objects can be defined as connected regions that are homogeneous with respect to pixel-level, feature-level, semantic-level, and metadata-level characteristics. We describe how

information can be efficiently represented at these different levels, how a user can specify content, and what mechanisms can be used to perform the search. Simple objects can also be defined simultaneously at multiple abstraction levels, and aggregated to form composite objects. The semantics of both types of objects, and the techniques required to search for them are the subject of section “Defining Content at Multiple Abstraction Levels.”

In section “Progressive Search at Multiple Abstraction Levels” we briefly introduce a different perspective on image retrieval, affective image retrieval, where the image is treated as a signifier and the user specifies the desired signified. For example, a user could ask the system to retrieve images that convey “happiness,” that describe “democracy,” or that illustrate “Memorial Day.”

In section “Effective Image Retrieval” we then discuss specific applications of the techniques described in the entry to Digital Libraries. We analyze specific examples of digital libraries of scientific data: medical image databases, repositories of remotely sensed images, and databases used by the oil industry.

IMAGE FORMATS AND DATA COMPRESSION

Data compression techniques are commonly used in image databases to reduce the required storage space. As we shall see in later sections it is sometimes possible to use properties of the compression algorithms for indexing and retrieval purposes. Hence, we briefly review some fundamental concepts of image compression.

The goal of source coding (data compression) is to produce a representation of the original signal which requires fewer bits. Compression is accomplished by reducing the redundancy present in the original data, and possibly by selectively discarding some information. Methods that discard information are called *lossy*, and the remaining ones are called *lossless*. In (gray scale) images, there are two main sources of redundancy: the similarity of spatially close pixels, and the nonuniformity in the overall intensity distribution.

Neighboring pixels commonly have similar brightness (intensity), and it is often possible to rather accurately estimate a pixel value from those of the surrounding ones. Hence, only the difference between the predicted and the original values needs to be encoded, and this difference in general can be represented by fewer bits than the original grayscale value. Two main classes of approaches exist to reduce spatial redundancy. The first operates in the *spatial domain*, by exploiting local redundancy. A typical example is the lossless mode of JPEG standard: here, the image is scanned line by line from left to right, the value of each pixel is predicted using the values of the closest previously scanned pixels and the difference between predicted and actual values is computed (this approach is also known as predictive coding). The second class of approaches

operates in a *transform domain*. Natural images have higher energy in the lower frequencies of the spatial spectrum, that describe slower intensity variations, than in the higher frequencies. The *two-dimensional Fourier transform* [3, Chapter 8] hence concentrates most of the image energy in a few low-frequency coefficients. Each Fourier coefficient is generated from the entire image, and is not easily predicted from neighboring coefficients, hence the transform effectively reduces spatial redundancy. The *two-dimensional block discrete cosine transform* (DCT), used in the JPEG standard^[4] is closely related to the Fourier transform, but is more local in nature: the image is first blocked into 8×8 squares, and each block is transformed separately. Again, most of the energy is concentrated in a small subset of coefficients, and coefficients cannot be effectively predicted from the values of their neighbors because their statistical dependence is weak. The *wavelet transform*,^[5] used in the JPEG2000 standard,^[6] relies on a high-pass filter (H) and a low-pass filter (L). The image rows are filtered separately, and the result is filtered column by column. This operation produces a subband, which is commonly identified by the used filters: for instance, if rows are filtered with the high-pass filter and the columns with the low-pass filter, the resulting subband is denoted by HL. Hence, there are four possible subbands, LL, HL, LH, and HH, depicted in Fig. 1. Subbands are downsampled by retaining each other row and each other column. A ℓ level wavelet transform repeats the described operation on the LL subband $\ell - 1$ times. The transform yields both spatial and spectral information. The lower-frequency subband (LL at level ℓ) is well localized in frequency and each coefficient depends on a large number of image pixels. The higher-frequency subband (HH at level 1) is well localized in space, but contains information on roughly the top half of the frequency spectrum. Most transform coefficients at the higher levels have values close to zero, while most of the energy is in the lower-frequency subbands. Fig. 1 illustrates this concept. The LL subband is a smaller version of the original image, the LH subband captures edges aligned with the horizontal axis, the LH subband captures edges aligned with the vertical axis, and the HH subband captures diagonal edges.

From both wavelet transform and block DCT it is easy to obtain a multiresolution representation of the image, that is, a sequence of increasingly smaller and coarser approximations to the original. As we shall see in subsequent entries, this property can be advantageously used during search.

The second cause of redundancy is present in most images: some of the intensity values are more common than others, and data compression can be achieved by encoding them with shorter codewords. Numerous techniques exist to accomplish this task, such as Shannon coding, Huffman coding, Arithmetic coding, and Lempel-Ziv-like codes, etc. An introduction can be found in Cover.^[7] In general, higher intensity redundancy results in better compression. Spatial redundancy reduction almost

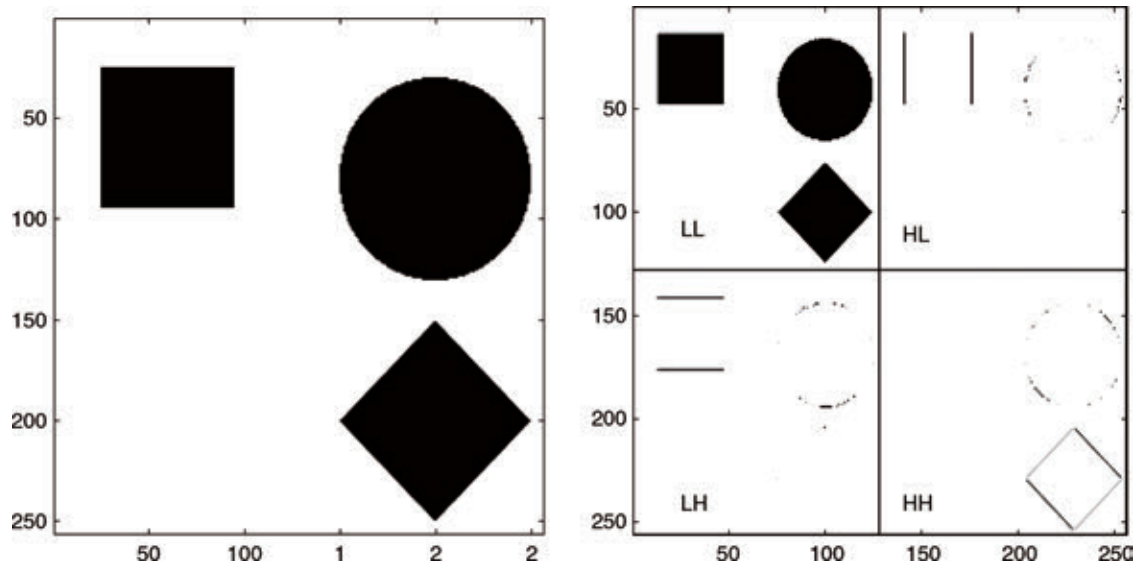


Fig. 1 A simple image (left) and its two-dimensional wavelet transform (right).

invariably yields a significant increase in the intensity redundancy, and for this reason favors compressibility.

With lossless techniques, images typically compress by a factor of 2–3. If higher compression ratios are desired, information must be selectively discarded to improve compressibility. Two mechanisms are available, thresholding and quantizing,^[8] which are usually applied after the spatial redundancy reduction and always before the intensity redundancy reduction. Thresholding changes to zero all values that are close to it. For example, in predictive coding, all small prediction errors could be set to zero. Quantizing (via *scalar quantization*, SQ) means reducing the number of allowed intensity values, by partitioning the intensity scale into regions (bins), assigning a representative intensity value to each bin, and changing each pixel to the representative value of the bin into which it falls. Both thresholding and quantization can be used simultaneously.

A substantial amount of research has been devoted to a general class of quantization schemes, called *vector quantization* (VQ).^[8,9] VQ has its root in the well-known result in Information Theory that states that quantizing *independent* Gaussian random variables together yields lower distortion at the same rate than quantizing them separately (see, e.g., Problem 13.1 in Cover and Thomas^[10]). Further improvements can be achieved if the random variables are not independent, as it is typically the case for neighboring image pixels. VQ compression of an image consists of: tessellating the image into groups of neighboring pixels having the same size, say d (e.g., dividing the image into 2×2 pixel regions); partitioning the d -dimensional space of pixel groups into bins; selecting a representative group of d pixels for each bin; and mapping each group of pixels from the image to the representative group of the bin into which it falls.

If thresholding, VQ, or SQ are used, either on the image or on its transform,^[11,12] it is generally not possible to recover the original data from its compressed version. To select the thresholding and quantization parameters, often a measure of similarity between the original and reconstructed image is used, such as the mean squared error. Compression ratios of 10 to 1 or better are possible with lossy schemes, without appreciable deterioration of the image quality. However, since these techniques nevertheless introduce visual artifacts, their application to scientific data is rare, and essentially limited to remote browsing of the images over slow networks. By combining a lossy scheme with lossless encoding of the difference between the original and reconstructed image, it is possible to obtain a lossless scheme which can also be used for image retrieval.

SEARCHING IMAGE REPOSITORIES BY CONTENT

In traditional relational databases, queries are expressed using a highly structured language, such as SQL. This is possible because the information managed by the database is itself highly structured and can be stored, for instance, in one or more tables. Images, like many other types of multimedia data, are by nature unstructured. Therefore, they are difficult to organize using relational or object-relational databases and to retrieve using a structured query language. No universal solution exists to the problem of organizing and searching data in image databases: information retrieval from image repositories is a field of research that is currently in the process of reaching maturity.

Ideally, multimedia repositories should be searched by allowing the user to specify the desired content of the data to be retrieved. However, the old proverb “a picture is worth a thousand words” describes well the difficulties that a user encounters when attempting to specify exactly what the retrieved images should contain. The almost universal approach to overcome this difficulty is to rely on similarity-based search. The large class of heterogeneous methodologies developed for searching multimedia databases is commonly known in the field as *content-based retrieval* (CBR).^[13] The main challenges posed by content-based search are automatic extraction and indexing of the content (to which this entry is devoted), query specification, and display of the results. In practice, however, the problem is very hard. In particular, a chasm exists between what search features can be extracted by existing systems from the user’s query, and what content the user is actually interested in. This is called *semantic gap*,^[14] and was well characterized by Smeulders et al.,^[15] as the “lack of coincidence between the information that one can extract from the visual data and the interpretation that the same data have for a user in a given situation.” Most of the research in CBR has been devoted to map information that can be extracted automatically from images, from associated metadata, and from context information (such as text near images embedded into documents) to user’s semantic.

QUERY SPECIFICATION

There are numerous query specifications styles that are appropriate for image databases. The early CBR systems, such as QBIC,^[13] VisualSeek,^[16] and Virage,^[17] used an example-based interface where the user would construct queries by supplying one or more examples. Graphical Query Languages offer an appealing alternative; however they have a steep learning curve and limited support for multimedia datatypes and relationships. A drag-and-drop interface supporting a quasinatural query language that combines English-like sentences with multimedia data, such as images, has been proposed in Bergman et al.^[18] and used in conjunction with the SPIRE system^[19] in a variety of application scenarios. This interface supports the composition of the type of queries described in this entry. Intelligent user interfaces for CBIR are described in Vermilyer.^[20]

Many CBR systems rely on a paradigm for interaction with the user called *Relevance Feedback*.^[21] In relevance feedback, the user issues a query and, upon receiving a set of results, inspects them, selects those that are most relevant and submits them to the system. The system appropriately modifies the query based on the user’s feedback. The turn-taking dialog between user and system continues until the user is satisfied with the results.

CONTENT REPRESENTATION AND OBJECTS

In this entry, we define the content of images in terms of *objects*. We distinguish between simple objects, which can be thought as the building blocks of an image, and composite objects, collections of simple objects grouped by spatial (or temporal) relations. Therefore, we will not distinguish between a “scene” and the image of a complex object with multiple parts: our concept of composite object encompasses both.

Simple Objects and Attributes

A *simple object* is a connected region of an image which is homogeneous with respect to some specific characteristics. An entire image and any connected portion of an image are therefore simple objects, defined by constraints on pixel locations.

Objects have *attributes*. We distinguish *defining* attributes, that are used in the definition of a particular type of object, from *non-defining* attributes, that do not characterize the type of object. For example, a forested area can be defined as a region of a remotely sensed image having specific spectral reflectance and textural characteristics: in this case texture and spectral reflectance are defining attributes, while the location of the forest and its size in pixels are not.

Attributes can be *numerical* or *categorical*. Surface area and location are examples of numerical attributes. The type of a lesion observed in a MRI scan of the brain is a categorical attribute. Categorical attributes can be further characterized as *sharp* or *fuzzy*. An attribute of a geological stratum in a formation microscanner imager (FMI) is its thickness. Thickness can be defined as a sharp attribute, and measured for instance in feet, or as a fuzzy attribute, taking fuzzy values such as “thin,” “medium,” and “thick.” A stratum 4 ft thick could also be characterized by membership values of .6 to the “thin” category, .4 to the “medium” category and 0 to the “thick” category. Attributes can also be either *deterministic* or *probabilistic*. Consider measuring the area of a lake in square meters (thus, we define it as a numerical, sharp attribute) using a remotely sensed image: while some pixels clearly fall entirely within the lake, some contain both dry land and water. Hence, the lake surface cannot be measured exactly, and only an estimate can be produced. This estimate can be treated as a random variable, and confidence intervals can be constructed from the image, for example by counting the number of pixels containing both water and dry land. Similarly, consider classifying automatically a forested area using a remotely sensed image, and assume that the statistical classifier decides that with probability .9 the forest is an evergreen forest, and with probability .1 is deciduous. Here the class label (a categorical attribute) is probabilistic rather than deterministic.

It is important to note the distinction between fuzzy attributes and probabilistic attributes. In the forest

example, the classifier is telling us that of all forested areas looking like the one being analyzed, 90% are evergreen forests, and 10% are deciduous forests. This is different from saying that 90% of the trees in the patch of vegetation are evergreen and the remaining 10% are deciduous. The former characterization is probabilistic, the latter is fuzzy.

Finally, we note that attributes can be either *scalar* or *vector-valued*. The size (in number of pixels) of an object is an example of scalar attribute, its color histogram (section “Color Descriptors and Color Matching”) is a vector-valued attribute.

Composite Objects

Simple objects are not sufficient to characterize the content of images. A *composite object* or *compound object* is a collection of simple objects that satisfy a set of spatial or temporal relations. A river delta as seen in a FMI image can be defined as a group of well-defined strata, arranged in a specific order.

Like attributes, spatial and temporal relations can themselves be sharp (for instance, “within n pixels”) or fuzzy (for instance, “near”). Composite objects provide a powerful paradigm for specifying the content of images, especially those used in scientific applications.

Examples of object-based image representations are the paradigm adopted in SPIRE,^[19,22] described in this entry, the *blobworld* representation,^[23,24] and the framework used in VisualSEEK.^[16] The blobworld approach, based on segmenting images with an Expectation-Maximization (EM) algorithm^[25] applied to combined color and texture features, is well-tailored toward identifying objects in photographic images, provided that they stand out from the background. Each object is efficiently represented by replacing it with a “blob”—an ellipse identified by its centroid and its scatter matrix. In VisualSEEK, the query is specified in terms of color regions and their spatial organization.

DEFINING CONTENT AT MULTIPLE ABSTRACTION LEVELS

Attributes of image objects, or, more generally, of multimedia data, can be represented, described and searched at different levels of abstraction. We can readily identify four such levels, namely raw-data, feature, semantic, and metadata level. Simple objects can be defined at each level, or simultaneously at multiple levels.

Searching Images at the Raw Data Level

Digital images are two-dimensional arrays of pixels. Each pixel is represented as one or more numeric values

denoting the intensities in different bands of the electromagnetic spectrum at its specific location. A pixel-level object can be defined as a connected portion of an image. Two pixel-level objects are equal if they have the same size and shape, and if the pixels in the corresponding positions have identical values.

Similarity between two pixel-levels objects having the same size and shape is defined in terms of similarity between the values of the pixels in corresponding positions. A pixel-level object having n pixels can be represented as a n -dimensional point, by making each pixel correspond to a different coordinate. The difference between two pixel-level objects can then be defined in terms of the Euclidean distance between the corresponding points. Alternatively, a pixel-level object can be represented as an n -dimensional vector, starting at the origin and ending at the above defined n -dimensional point. In this case, the similarity between two objects can be defined using their inner product.

The SPIRE system^[19] supports image search at the numerous levels, including the raw-data level.

Progressive pixel-level retrieval

Computing the Euclidean distance (or the inner product) between a query object and all the subsets having identical shape and size, of all the images in the database, is a very expensive operation. Matching can be based on cross-correlation, or the correlation coefficient. [3, Chapter 20] Here, image representation can significantly reduce the computational complexity. Cross-correlation is still an expensive operation in the pixel domain. However, multiplying the Fourier transforms of two images (a much faster operation) is equivalent to computing the cross-correlation in the pixel domain. In Vaidyanathan,^[26] the author notices that cross-correlating the corresponding subbands of two images and adding the results produces a subsampled version of the cross-correlation. By noticing that the wavelet transform concentrates most of the energy in the lower-frequency subbands, and that a similar property holds for the low-frequency components of block-DCT, Li, Turek and Feig^[27] and Castelli et al.^[28] concluded that the results of Vaidyanathan,^[26] can be well approximated by just considering the cross-convolution of the lower-frequency subbands (or DCT coefficients). Local maxima in this approximation suggest possible location of matches. Once candidate locations are identified, the search can be refined by computing and adding contributions from higher-frequency subbands. Large computational savings are achieved by refining the search only around candidate matches rather than on the entire image.

Rather than being a general mechanism, raw-level search has specific applications. It is extremely useful to identify distinctive objects across a time series of images or of images acquired from different instruments, hence

it is useful for coregistration purposes. For example, remotely sensed images of the same region acquired by the same instrument vary over time because of slight differences in the orbit, altitude, and orientation of the platform. To coregister the images, ground control points are identified, using pixel-level techniques, and their positions used to compute the warping mapping between the images. Analogously, in medical imaging, distinctive anatomical features must be precisely identified to compute the exact position of the tissues or organs of interest.

Features

The term *feature* denotes an aspect of an image that can be captured by a numeric or, more rarely, categorical quantity (called a descriptor) computed from the raw data. By definition, features do not have an immediate semantic meaning. In the literature, the term feature is often used to denote the descriptor.

Typical image features describe color, texture, and spatial properties, such as shape. We distinguish between *global features*, that represent an image in its entirety, and *local features* that capture localized properties. Global feature descriptors are often used for photographic images, but have in general poor retrieval qualities. It is likely that the use of global features originated with one of the early CBR systems, QBIC,^[13] which represented each image with a color feature vector, a texture feature vector, and a shape feature vector. In reality, when a new image is ingested in QBIC, the operator is supposed to manually outline a region of interest, from which the feature descriptors are extracted, and that becomes the subject of the image. Local feature descriptors are much more useful for indexing purposes. They are either extracted by first segmenting the image into homogeneous regions and computing features for each region (as in the blobworld,) or by dividing the image into a large number of small, overlapping windows (e.g., overlapping), and computing features for each window.^[28] The advantages of the first approach are that it produces a smaller data volume, and that an appropriate segmentation scheme often produces results that are acceptable from the viewpoint of the user. The advantage of the second approach is the increased flexibility, since objects are not predefined and can be extracted to better match the query.

We now discuss two of the most commonly encountered classes of features in image databases: color and texture. In each subsection, we briefly describe how the category is used, what descriptors are commonly used and how similarity is captured. We conclude each subsection with remarks on specific applications, and, when appropriate, on how to speed up the search by relying on properties of image compression schemes.

Color Features

The use of color for retrieval

Color is commonly used to index images,^[29] and is one of the main features used in early CBIR systems, such as QBIC^[13] and Virage.^[17] It is a very important feature for photographic images and works of art, and histological images. It has limited applicability to radiological imaging, which is almost universally displayed in gray scale (and only rarely using false-colors, which are not useful in indexing), in oil-exploration imagery (where, again, false coloring is used), and in satellite imagery, where the multispectral information is used to extract semantics and not used directly as a low-level property.

Color descriptors and color matching

Color features for similarity retrieval are usually variations of the color histogram. The first step in the feature computation is a selection of the color space. For typical digital photographs, where each pixel is represented as the superposition of three basic colors, red, green, and blue, the RGB space is the most natural choice. Here, each pixel value corresponds to a point in a three-dimensional space, whose coordinates are the red, green, and blue intensity. Pixels of images compressed with the JPEG image compression standard can be immediately represented in the YCrCb space. The natural color space for television data (such as newscasts, sport events, movies, etc.) depends on the standard: NTSC uses the YIQ space, PAL and SECAM use the YUV standard. None of the mentioned color spaces is perceptually uniform, in the sense that Euclidean distances between points in the color space do not capture well the subjective similarity between colors. Hence, numerous other color spaces have been used with moderate success by different authors, such as the hue-saturation-value (HSV) space,^[29] the Munsell color space,^[30] the opponent-axis space,^[31] or the CIE-LUV space.^[32]

The second step in the color histogram computation is quantization: the color space is subdivided into cells, a representative color is selected for each cell, and all the pixel values falling in a specific cell are replaced by the representative value. The quantized color space usually contains anywhere from 64 to 4096 different colors.

The color histogram of an image is finally computed by counting how many pixels fall in each cell of the quantized color space. The counts can be normalized (divided by the size of the image), in which case they sum to 1. A non-normalized color histogram having b bins can be represented as a point in a b -dimensional space, the i th coordinate of which is equal to the number of counts in the i th bin. If the color histogram is normalized, it lies on a b -dimensional simplex, which is a $(b - 1)$ -dimensional surface.

Different functions on the color histogram spaces have been proposed to capture similarity between images. These functions are usually distances between the points representing the histograms. While the choice of the color space and of the number of quantization bins appear to affect the quality of the retrieval, the choice of the similarity function is less important, and most commonly used ones are essentially interchangeable.

Image representation can be combined with color feature extraction. For instance, research has been done on how to approximate the histograms of images compressed with the JPEG standard with the color histogram of the DC components.^[33]

Further Uses of Color

Color is a powerful means for conveying meaning and emotions. Itten^[34] codified a psychological theory on the use of the color in art to convey semantics. It is unsurprising, then, that color has been used to retrieve images of paintings from collections of art works. Colombo, Del Bimbo, and Pala^[35] analyze the color content of photographs of paintings, and derive measures of harmonic accordance, contrast of luminance, contrast of saturation, and contrast of warmth. As a response to a query, the system returns the most similar paintings with respect to one or more of the listed color quantities. Del Bimbo et al.^[36] extract color and shape using a multiresolution representation of the image. By using a low-resolution approximation (which can be easily obtained from the wavelet transform or the block-DCT), the system can make judgments about the overall color composition of the painting and use them during retrieval.

Texture Features

Definition and use

Texture describes the local intensity variations in an image. In natural images, texture is a property of individual surfaces, and is an important visual cue especially for categorizing materials and substances: water, wood, grass, snow, cloth, fur, brick walls, sand, etc. are just few examples of entities that humans can identify even in black and white pictures based on texture.

Texture is extremely important in scientific imagery, where commonly expert use textural characteristics to interpret the data. For example, in remotely sensed images, erosion patterns, types of tree associations, and types of crops can be analyzed in terms of texture. In well-bore and core images, the stratigraphical analysis is exquisitely textural in nature. In some types of medical images, such as mammograms, texture is a powerful indicator of pathology.

Texture descriptors

Texture descriptors are generally extracted from gray-scale images. For color images, descriptors are computed from the overall intensity map (computed by adding the square of the pixel values in each color band), from each individual color band, or from selected color bands. Color textures have been the subject of rather few studies.^[37–39]

There are three main classes of texture descriptors.

Spatial-domain descriptors are computed directly from the image (or the intensity map). Several feature sets belong to this class, and here we describe the most common ones.

The *gray-level differences histogram*^[40] counts how many times the differences between pixel values in a window and the value at the center occur within an image or a region. Statistical properties of the histogram, such as its mean, variance, central moments, entropy, etc., are used to represent texture properties, such as overall brilliance, intensity variations, etc.

The *co-occurrence matrix* counts how many times a pair of intensity values occurs in pixels having a fixed distance in a predefined direction. Corresponding texture descriptors^[41–43] are derived properties of the matrix, such as the entropy or the moments, and have been related to visual properties, such as regularity, homogeneity, directionality, and periodicity of the texture.

Tamura's features^[44] were selected to capture specific characteristics of the human visual system, and describe texture in terms of coarseness, directionality, roughness, regularity, contrast, and line-likeness. Studies show that, in practice, coarseness, contrast, and directionality alone yield most of the discriminatory ability of the feature set, and that adding the remaining three features improves retrieval results only marginally. Tamura's features capture very well high-level characteristics of texture, but fail to provide fine-level discrimination.

Transform-domain descriptors are computed from a transform of the image. When an image is compressed with a transform-based method, the corresponding texture descriptors can be obtained at a very moderate computational cost.

Wavelet-based descriptors^[45] capture the local spatial frequency content of the image. $2^k \times 2^k$ portion of an image is described to a good degree of approximation by $3d + 1$ subblocks of a d -levels wavelet transform: one in each of the three high-frequency subbands (HL, LH, HH) at each level, and one in the low frequency subbands at level d . A block at level ℓ has size $2^{k-\ell} \times 2^{k-\ell}$. Smith and Chang^[45] suggest computing the wavelet transform of the image, conceptually dividing the image into nonoverlapping square blocks, and considering for each block the corresponding $3d + 1$ portions of the transform. The mean value and the variance of the coefficients within each transform portion are then computed, and concatenated to

produce a texture feature vector. The authors also suggest an algorithm for merging adjacent image blocks to segment the image into regions of homogeneous texture.

Gabor-based features^[46] are among the most discriminating texture descriptors available. The (even, symmetric) Gabor filters are uncorrelated Gaussians with variances σ_x and σ_y in the x - and y -directions, modulated by a sinusoid of frequency ϕ varying along the x -axis, and rotated by an angle θ , hence they are defined by four parameters. In the spatial frequency domain, they correspond to two Gaussians having variances $1/(2\pi\sigma_x)$ and $1/(2\pi\sigma_y)$, centered at ϕ and $-\phi$ respectively, in a reference frame rotated by θ . Their main property is that they trade off optimally localization in the spatial domain and in the frequency/orientation domain. Hence, the magnitudes of the Gabor coefficients give a good indication of directionality and periodicity of the texture. A texture feature vector is constructed by selecting a group of filters at various orientations, scale (variances), and frequencies, computing the corresponding Gabor coefficients, and concatenating them. Experiments show that Gabor features are competitive with other texture descriptor sets in a wide variety of application domains,^[45,47,48] and have been successfully used for texture discrimination and classification^[49] and image segmentation.^[50]

Random-field models describe texture as a spatial stochastic process. Technically, in this context a spatial stochastic process is a probability measure on the collection of possible images.^[51] Practically, a random field is a probability distribution over sets of neighboring pixels. Markov random fields (MRF) are a special class of processes specified through the conditional distribution of the value of a pixel given the values of specific neighbors. Due to their effectiveness, they have been used for a long time for description and representation,^[52–54] classification,^[55–57] synthesis,^[58,59] compression,^[59] and segmentation of texture.^[60–64] Gaussian MRF are particularly appealing, due to the simplicity of the model: here pixel values can be written as the sum of a linear combinations of the values of their neighbors and of a correlated Gaussian noise. Simultaneous autoregressive models (SAM), where the Gaussian noise is white (i.e., uncorrelated), are even simpler, and have been widely used for image retrieval field. Typical texture features obtained from random field models are the parameters of the model itself: for example, a SAM texture descriptor would consist of the vector of coefficients used in the linear combination and of the variance of the white Gaussian noise. It is also possible to simultaneously fit different models to the data (characterized, for instance, by different neighborhoods), and use the index selected model a further descriptor.

Texture Similarity and Texture-Based Retrieval

Similarity (or better, dissimilarity) between texture feature vectors is usually measured by means of a distance

function. Let $\mathbf{x}$ and $\mathbf{y}$ denote two such vectors. The most commonly used metric is the Euclidean distance, defined as

$$D^{(2)}(\mathbf{x}, \mathbf{y}) = \sqrt{\sum_{i=1}^d (\mathbf{x}[i] - \mathbf{y}[i])^2}$$

It is rotationally invariant and weights all the features equally. This last property is undesirable when the ranges of the different feature descriptors vary significantly. For example, the variance of the gray scale difference histogram is often much larger than the mean, and would have a significantly bigger effect in determining similarity. Furthermore, additional flexibility is required when the system is allowed to learn the relative importance of different features from the user input and feedback. Metrics that can be used to satisfy both requirements are the weighted Minkowsky distances and the generalized Euclidean distance. The former is defined as

$$D^p(\mathbf{x}, \mathbf{y}) = \left[\sum_{i=1}^d w_i |\mathbf{x}[i] - \mathbf{y}[i]|^p \right]^{1/p}$$

where

p is a positive number

w_i are weights

d is the length of the feature vector

The latter is defined as

$$D(\mathbf{x}, \mathbf{y}) = [(\mathbf{x} - \mathbf{y})^T \mathbf{K} (\mathbf{x} - \mathbf{y})]^{1/2}$$

where $\mathbf{K}$ is a positive definite matrix having determinant equal to 1. Further details on similarity measures for retrieval can be found in Santini and Jain.^[65]

Progressive texture retrieval

As previously described, several texture features can be extracted from image transforms, and therefore are easily computed when the images are compressed using a transform-based scheme. Texture features extracted from different levels of the multiresolution pyramid can also be used to speed up search.^[40] Here, an optimal starting level in the pyramid is identified using the examples provided with the query. Pruning of the search space is then performed by texture matching at this starting level: note that higher starting levels are characterized by fewer homogeneous regions within images, and hence yield faster matching. However, a higher starting level introduces a larger approximation in the matching, as details are lost, and therefore the selectivity threshold for the pruning must be relaxed accordingly. Since the two effects are contrasting, there is always an optimum starting level

from the speed viewpoint. Only the regions that pass the pruning stage are retained and further analyzed at the immediately finer level of the multiresolution pyramid. The process is repeated until the full-resolution level is reached. Tenfold increase in retrieval speed have been observed with this technique.

Shape Features

At a first glance, searching images repositories by specifying the shape of desired contained objects appears to be a natural and intuitive approach to CBR. In reality, however, it is a problematic endeavor at best. First, most animate objects are not rigid and their shapes can vary substantially as they move. Even for rigid objects, perspective and angle of view can radically change the shapes recorded in an image. Additionally, shape is not invariant with respect to rotations of the image. In spite of these difficulties, shape-based image retrieval has been an active and often successful field of investigation. Another difficulty with shape features is that they rely heavily on accurate images segmentation, which is largely unsolved. If objects cannot be precisely segmented, shape features can be misleading or even meaningless. In contrast, color or texture features are not so sensitive to inaccurate segmentation. For example, if an object is segmented into two pieces, the colors from the two pieces still reflect the object, but the partial shapes can be arbitrary and dramatically different from the true shape.

Indexing images by shape requires solving three separate classes of problems. The first is *shape extraction*: images must be analyzed to extract shapes of objects. The literature in this field is very large, and image retrieval has borrowed techniques from other disciplines, such as robotic vision. The wide spectrum of approaches to shape extraction range from accurate segmentation, to approximate representation of shape regions, to extraction of low-level features that capture aspects of shape, such as edges.

The second problem is *shape representation*: the shape must be described by numeric quantities that can be used for retrieval. Numerous descriptors have been proposed in the literature, which can be classified along several dimensions. A first distinction is between *global* and *local* descriptors. Global descriptors capture properties of the shape as a whole, for example its elongation or the overall smoothness of the contour. Local descriptor capture properties of selected regions of the shape, for example, the presence of sharp angles in the contour. A second distinction is between *complete* and *partial* descriptors. Complete descriptors attempt to retain all properties of the shape, while partial descriptor capture only characteristics that are deemed salient for retrieval. A third distinction is between *interior* and *boundary* representations. Interior methods describe a shape, for example, by means of approximations or using a sequence of approximations. Boundary methods describe properties of the contour line, for example, by

means of piecewise polynomial lines. Other dimensions distinguish between *rotationally invariant* and *rotationally variant* features, *single-scale* and *multi-scale* features, *composition-of-part* and *deformation* methods.

The third problem is *shape matching*. This is typically accomplished by means of an appropriate distance function. Unfortunately, there is no universal shape similarity metric: different feature are matched with different, specific similarity functions. A detailed discussion of these metrics, a more in-depth view of the categorization reported in this section can be found in Kimia,^[66] which is an excellent introduction to shape-based retrieval.

Shape-based techniques have had only limited application in photographic image retrieval, where often segmented shapes are associated with texture- and color-based representations of the interior.^[67] In contrast, shape has been successfully used in several specialized application areas, such as medical imaging,^[68] biometric identification,^[69] and retrieval of logos, trademarks, and watermarks.^[70] A survey on recent advances in CBR of three-dimensional shapes can be found in Icke.^[71]

Searching Images at the Semantic Level

Semantic content characterization

Searching images at the semantic level is one of the most difficult tasks faced by CBIR systems. The main challenges are representing semantics, extracting it automatically from the images, and indexing it. These problems are particularly severe in databases of photographic image, where the subjectivity of the user perception plays a major role. For example, a specific image could be described as “an outdoors scene,” “a picture from an outdoors sport event,” “a picture from a golf tournament,” or “a picture of the 18th hole at the St. Andrews golf club in the year 2000, taken while Tiger Woods is putting to win the tournament and the golf grand slam.” Scientific data, however, is often more amenable to automatic extraction of semantic content. We first discuss photographic images, and later scientific imagery.

Jaimes and Chang^[72] proposed a scheme to represent multimedia content which uses 10 abstraction levels, divided into two groups. The first group contains levels related to percept, corresponds to the pixel and feature levels, and divides into different levels global and local content. The second group, containing six levels (generic object, generic scene, specific object, specific scene, abstract object, abstract scene,) provides a very good framework for describing semantic content in photographic images and video, and can be successfully used as guideline for constructing indexes. Referring to the example of the previous paragraph, the first two descriptions would be indexed at the generic scene, while the last belongs to the specific scene level.

Semantic content extraction

While researchers have proposed solutions on how to organize semantic content for search purposes, the automatic extraction of semantic content from photographic images and video is still an unsolved problem and will remain such at least for the next few years. Some of the difficulties encountered are very similar to those raised by the automatic object recognition problem, to which the computer vision discipline has devoted decades of efforts. Specific algorithms exist to identify particular classes of objects within images, such as deciduous trees,^[73] naked people and horses;^[74] specific types of scenes, such as sunsets, outdoors, and indoors images;^[75] and some very high level semantics such as warmth, and harmony of a painting.^[35] Automatic image annotation is a form of semantic context extraction: Li and Wang^[76,77] propose methods for automatically associating a collection of labels to images.^[78]

Still-image retrieval at the semantic level can pose challenges beyond those related to object recognition: users, for example, might look for images with a specific purpose in mind, for example, to evoke desired emotions (e.g., images that evoke sadness, images with dramatic effect, etc.), which is discussed in the section “Affective Image Retrieval.”

Following Liu et al.,^[79] we classify the technical approaches to semantic content extraction into five categories:

1. *Defining high-level concepts through object ontology.* Methods of this class rely on small-size vocabularies of simple descriptors and a mechanism for mapping low-level features extracted from the image into the vocabulary. An example of such descriptor could be “bright-green region.” High-level semantic concepts are expressed in terms of the descriptors: a “lawn” could be described as a “bright-green region located in the bottom half of a photograph.” The main limitation of the approach lies in how to appropriately design ontologies for specific tasks.
2. *Using supervised or unsupervised learning.* In the case of supervised learning, a training set consisting of examples labeled with high-level semantic labels is used to train a classifier. The classifier learns to associate low-level features with semantic concepts. In unsupervised learning, the low-level features representations of a large collection of images are partitioned into similar groups, and groups are associated to semantic concepts. The similarity measure is defined on the feature space, or on the space of probability distributions over the feature space, such as in Li and Wang.^[77]

The main limitation of supervised learning methods is their reliance on large manually labeled

training sets. The main limitation of unsupervised learning methods is that the correspondence between groups and semantic concepts is incidental.

3. *Interacting with the user via relevance feedback.* Semantic concepts are learned on the fly by a classifier through an iterative refinement process. During a turn of the iterative refinement process, the user is shown candidate examples picked by the classifier, marks some as positive (in some cases, as negative); the classifier then updates its internal model using the user feedback. The main limitation of the approach lies in the limited number of examples that a user can reasonably label.
4. *Matching content through semantic templates.* A semantic template is the “signature” of a semantic concept extracted from a collection of representative images. Unlike when using supervised learning, the designer of semantic concepts must often have a good understanding of the underlying features.
5. *Combining image features and features from surrounding text.* This approach is well suited for retrieval of images from the World Wide Web, which are embedded within HTML pages. Currently, the analysis of the surrounding text is often limited to keyword selection, but advances in natural language processing make the approach increasingly appealing. An important challenge arises from the difficulty of determining whether the surrounding text is actually descriptive of the image content.

Scientific data offers numerous opportunities for automatic semantic content extraction. Experts often interpret the imagery by relying on low-level visual cues, which might be captured by a computer. Additionally, a great deal of the semantic content can be described in terms of objects and their spatial relations, there are no scenes, and the abstract levels of Jaimes and Chang are irrelevant. We briefly discuss three cases: remotely sensed images, oil well-bore images, and medical images.

One of the main uses of multispectral remotely sensed images is to identify and distinguish different types of land cover. The applications are numerous: from management of forestry to the identification of diseases in crops, to crop yield prediction, to environmental monitoring. Different types of land cover have different spectral reflectance: for instance, vegetation reflects in the green part of the spectrum, absorbs in the red (hence, leaves and grass look green), and is highly reflective in the near infrared; barren terrain, on the other hand, has moderate to high reflectance in all the visible and near-infrared spectrum. Automatic classifiers can be constructed to label the individual pixels, identify connected regions and produce semantic objects such as “forests,” “urban areas,” “bodies of water,” etc. These classifiers are usually specific to an instrument, a particular geographical region and a given time of the year.

Well bore data for the oil industry contain both image-like information (acquired, for instance, by the FMI instrument) and one-dimensional data, acquired by appropriate log instruments. Bulk lithology (the type of rock) can be inferred from the log data, and classifiers can automate the task. The well can then be partitioned into labeled strata and rock formations, defined as associations of strata satisfying relative position constraints, can easily be searched.

Radiological imagery has recently received substantial attention as a prime candidate for automatic extraction of semantic content. In addition to the data acquired by the medical instrument, each image is analyzed by a trained radiologist, who produces a reading containing semantic information. This reading is then stored in the medical information system and linked to the image, together with additional metadata, as mandated by the standards with which the repository complies. An ontology based approach for retrieving semantic content from medical image repositories is reported in by Wei and Barnaghi,^[80] while Lehmann et al.^[81] describes a strategy for automatic image categorization according to a large number of semantic classes. An overview of recent results related to CBIR from medical images can be found in Müller et al.^[82]

Progressive semantic retrieval

Progressive techniques that rely on properties of compression schemes exist to speed up the daunting task of labeling the tens of gigabytes produced daily by an instrument. Progressive classification^[83] analyzes the multiresolution pyramid. It uses a different classifier for each level of the pyramid. Starting from an appropriate level, the appropriate classifier decides whether each pixel corresponds to a semantically homogeneous region at full resolution, in which case it labels the entire region, or not, in which case it marks the pixel. The marked pixels are then analyzed at the immediately finer resolution level, using an analogous classifier. The process terminates when the full-resolution level is reached and all marked pixels are labeled. This approach is not only several times faster than pixel-wise classification, but, under general condition, it is also more accurate.

Metadata

Metadata is the highest content abstraction level. It corresponds to information that cannot be inferred or extracted from the image itself, or that is associated to the image in a manual fashion. The date and time of a photographic image, the names of the people appearing in it, the author of a painting and his biography, the location of a well, the name and medical history of a patient, the satellite used to acquire an image are examples of metadata.

Metadata is either structured, and is characterized by the presence of predefined fields whose values have well-specified types, or unstructured, for example textual captions of images. Standards exist or are emerging to

regulate structured metadata. They are always specific to a particular application domain, such as medicine, geographical information, remotely sensed data, etc.

Structured metadata is amenable to management using a traditional database. Unstructured metadata can be indexed using information retrieval methodologies. Both cases are beyond the scope of this entry.

PROGRESSIVE SEARCH AT MULTIPLE ABSTRACTION LEVELS

Only the simplest multimedia queries are expressed in terms of a single attribute. These queries are called *atomic* by Fagin.^[84] They retrieve the simplest simple objects. For example, one could ask a photographic database for pictures of the current president of the United States (semantic query), a museum digital catalog for paintings by Renoir (metadata query), a fashion archive for fabric having a certain mix of colors (feature-level query). The repository would probably answer the query by returning a large number of results. More specific queries that return a smaller, better defined set of images, are expressed in terms of multiple attributes. For instance, the user might want to retrieve images of paintings by Renoir having as subject scenes from “la Grenouillère,” or images of a tumor (metadata-level) having specific size and contour characteristics (feature level).

To support multiple-attribute queries, an image repository has to solve several problems, related to both the semantics of the query and its execution. In this section we discuss these classes of problems and describe solutions proposed in the literature.

The Semantics of Combining Multiple Attributes

Image and multimedia databases must support approximate queries: the user can only provide an approximate description of the desired content, and ask the repository to return the images that best match the specification. It is acceptable to ask for images of gray cars, and have the system return a ranked list of three images, containing respectively a gray sedan, a “metallic silver” convertible and a “silver frost” SUV. The similarity search paradigm yields a significant amount of flexibility, but at the same time complicates the interpretation of queries. Consider asking a photographic image database for pictures of “red cars.” In a traditional database, this query would be expressed in SQL as `select image_id where subject='car' and color='gray'`, and the result would be a list of image identifiers containing gray cars. In the example, only the gray sedan would be returned.

In a multimedia database, the equalities in the constraints are substituted by similarity functions, and the “and” connective becomes a function that combines the similarity values of the two constraints. Early CBIR

systems, such as QBIC, allowed the user to combine similarities with respect to color, texture, and shape. The user selects the importance of the three features using a graphical user interface, the similarity of images to the query is then computed separately for each feature, and the three resulting scores are combined by means of a weighted average with coefficients proportional to the importance of the features. This approach is simple, but lacks flexibility.

The query framework implemented in the Garlic system^[85,86] solves the problem by treating similarity scores as fuzzy membership functions.^[84,89] Scores obtained from matching individual constraints are normalized between 0 (no match) and 1 (perfect match), and combined using fuzzy Boolean connectives. The simplest forms of fuzzy AND and OR are respectively, the minimum and the maximum of the connected scores, while the negation (NOT) corresponds to subtracting the score from 1. Hence, if the color “silver frost” matches gray with a score of .8 and an SUV matches a car with a score of .9, the silver frost SUV matches the query for a gray car with an overall score of .8, the minimum of the two.

This framework can conceptually be extended to composite objects,^[90] by noting that relations between simple objects produce sharp or fuzzy scores that can be treated in the same way as the object attribute scores.

Searching at Multiple Levels of Abstractions

Fagin^[84,89] proposes an algorithm that executes queries containing m constraints on attributes. The algorithm assumes that the search engine can return the top k results in response to atomic queries, and that can compute the score of a database item with respect to an atomic query. The algorithm first evaluates in parallel the m atomic queries, returning for each the smallest set of top results such that there are k distinct database items that appear in each result set. Clearly, when the atomic queries are combined with the minimum function, or with a function which is monotonic in the scores, these k database items constitute the result set L . The algorithm then combines, for each item of L , the scores of the individual atomic query, to produce its score. The scored results are finally sorted in decreasing order and returned to the user.

A sequential processing algorithm for retrieving composite objects is described by Li et al.,^[90] and consists of three procedures. The first procedure consists of linearizing the description of a composite object into a set of subgoals. The ordering is a function of the dependence between simple objects and of the availability of precomputed indexes for executing atomic queries. The result of the step is a chain of subtasks. The second procedure manages the computation of sets of L results from each subtask. The first time the procedure is invoked on a subtask, it produces the best L matches, the second time it produces the next best L matches, etc. The third procedure

controls the execution flow in a dynamic programming fashion: it starts from the first task in the chain, and retrieves the best k matches (out of the block of L items retrieved by the second procedure), then it executes the second task, and retrieves the best k matches for the subproblem consisting of the first and second task. The computation continues by subsequently adding tasks, and keeping track of the scores of the individual subtasks and of the current set of results. It is possible that the score of the k th partial result be smaller than the scores of the worst result currently produced by a particular subtask: if this is the case, the algorithm might be ignoring relevant database items, and a backtracking is invoked, that retrieves further objects from the offending subtask.

Further enhancements of the algorithm are presented in by Li et al.^[91] where several fuzzy relations are discussed, and details are given on the execution flow control.

When ordering the subtasks, it pays to consider the abstraction level at which they operate. Metadata atomic queries are usually faster to execute and more restrictive than queries at any other level. They are in general followed by semantic queries, feature-level queries, and raw-data queries in the order. Further optimization can be performed in a query-dependent fashion: the system can collect statistics on how effective different types of queries are at pruning the search space, and use the information while staging the query execution.^[92]

AFFECTIVE IMAGE RETRIEVAL

Up to this point, we have concerned ourselves with the problem of describing the visual content of images for the purpose of search and retrieval. However, since the early days of mankind, imagery has been used as a powerful way of describing concepts that transcend the pictorial representation. The image acts as a signifier and refers to a signified which could be an emotion (e.g., sadness, tranquility, etc.), an abstract concept (e.g., portrait paintings often convey information on the personality of the sitter), an event or a recurrence (e.g., the Vietnam War, the Declaration of Independence, etc.). Paintings have also been used to convey philosophical or theological teaching (e.g., the background of the Mona Lisa captures Leonardo's view of a dynamic, ever changing nature, and contains clear references to the author's fascination with hydrodynamics and hydraulics). Affective image indexing and retrieval is a discipline that lies at the intersection of affective computing^[93] and CBIR; its goal is to support queries containing the specification of the emotions evoked by the desired images.

Most approaches to affective image indexing and retrieval rely on the correlation between low-level perceptual cues and the emotions they cause.^[35] For example Li et al.,^[94] map texture features to a thesaurus of affective

concepts; Wu et al.^[95] analyze the usefulness of color, text, shape, and their combination for affective image retrieval, while Bianchi-Berthouze and Kato^[96] describe a system that interactively creates a Kansei user model based on low-level features extracted from Web images.

IMAGE REPOSITORIES AND DIGITAL LIBRARIES

Early research in still-image retrieval was often pursued in connection with the field of *multimedia digital libraries*. Digital libraries are organized collections of multimedia data, providing storage, retrieval, and transmission functionalities. They are used to manage text,^[97] music and audio,^[98] images,^[30] video,^[99] and other forms of electronic content. During their development, early digital libraries posed numerous challenges in all fields of computer science. At the hardware and system software levels, new computer architectures have been invented to efficiently store and transmit large amount of data; requirements have been imposed on operating systems to provide the desired quality of service and data integrity; and new assumptions on how data is accessed and modified have guided the design of file systems that efficiently manage multimedia files. At the application level, new systems for acquiring digital content have been developed; novel content representation models have been devised; algorithms for efficiently searching large collections of data have been explored; and simple, yet powerful user interfaces have been investigated to specify the desired content and to represent the returned results.

In recent years, efforts have been pursued in different directions that often depend on the application field. For example, in remote sensing the focus has shifted from creating large repositories containing data from a large variety of sources to supporting federations of data as service providers. For example, the Federation of Earth Science Information Partners, or ESIP—<http://www.esipfed.org/>—, originated from a NASA grant, is composed of distributors of satellite and ground-based data sets, providers of data products and technologies, organizations that develop tools for Earth Science, and strategic funding partners. As a consequence, problems of metadata standardization and of interoperability of data sets and data products derived from the data sets have taken the precedence over the original still-image retrieval problems. Other fields of investigation include collaborative learning,^[100] data fusion, digital library federation, leveraging new computation paradigms such as grid computing,^[101] supporting e-Science,^[102] all of which are beyond the scope of this entry. The present section contains an overview of the early work in the area of digital libraries for image data, where a substantial emphasis was devoted to image retrieval.

The ground work in the general area of digital libraries was sponsored by the Digital Libraries Initiative (DLI).

The first studies were conducted at Carnegie Mellon,^[99] U.C. Berkeley,^[103] U.C. Santa Barbara,^[104] University of Illinois at Urbana-Champaign,^[97] University of Michigan,^[105] and Stanford University.^[106] The field of research has since seen a proliferation of projects. Early image digital libraries organized photographic images, catalogs of museums and art galleries,^[107] fingerprints,^[69] medical data,^[108,109] geographically referenced data,^[104] satellite images,^[28] etc. We briefly review some of these applications.

Medical Image Databases

Medical imaging^[110] is one of the most powerful diagnostic tools available. X-ray radiographs are essentially the only radiological images acquired using film, in analog format: most other modalities acquire data in digital format, hence can be managed by a digital library. Digital radiography and digital mammography are becoming increasingly popular, and we will see in the near future filmless radiology departments. Enabling technologies in digital radiology include: advances in sensor quality (resolution, signal-to-noise ratio), which make the quality of digital images comparable to that of film-based images; improvements in high-resolution, high-contrast flat-panel displays, which increase the productivity of radiologist; and high-speed connections to the Internet, that enable teleradiology, whereby a specialist can diagnose images acquired in multiple hospitals or imaging clinics.

Medical imaging is characterized by a variety of modalities, which are suited to investigating different types of properties, and yield data in different formats. Anatomy, physiology, biochemistry, and spatial properties of the body and its organs can be studied with appropriate radiological instruments.

X-ray radiography is the most common form of medical imaging. It directly measures the opacity of the body or of contrast media to electromagnetic radiation having wavelengths in the 100 to 0.01 Å range. The part of the body to be imaged is placed between a source that produces a large, non-diverging beam of x-rays and a sensor array, which records the intensity of the transmitted radiation. A digital radiograph is large: for example, a digital mammogram is a gray-scale image whose typical size is 4000 × 4000 pixels, and where each pixel is represented as a 12 or 14 bit number: hence, a single mammogram corresponds to 32 megabytes of data.

Computed tomography (CT) produces indirectly images of slices of the body. A series of digital radiographs of the same thin area of the body are acquired from different angles. The resulting set of projection is then analyzed by a computer which reconstructs a slice, whose typical size is 512 × 512 pixels, each represented by 2 bytes. During an examination, several slices are acquired, and about 20 megabytes of data are generated.

MRI measures the amount of water present in tissues, by aligning the spins of the hydrogen atoms in a thin slice of the body to a strong magnetic field, tilting them, and measuring the variations in magnetic field while the spins realign. A computer analyzes the signal and produces a 256×256 pixels image, where each pixel requires one or two bytes. Numerous slices are typically acquired during a single examination, and 10–20 megabytes of data are generated. Functional MRI is a novel technique that measures activity of organs, typically the brain. Angiographic MRI is used to image blood vessels. Diffusion MRI images the diffusion of liquids in tissues, and is used in the diagnosis of ischemic strokes.

PET measures positrons emitted by radioactive dies which are injected in the body and distribute themselves within the target organ in proportion to the physiological activity of its various parts. PET therefore measures the distribution of the source of radiation within the body.

Ultrasounds are extremely useful for imaging soft tissues, but cannot penetrate bones. Their use is mostly limited to the abdomen and the heart. During an ultrasound examination, the apparatus measures the reflectance (rather than the transparency) of the tissues to the ultrasounds emitted by a source. Doppler ultrasound is a special technique that allows to measure the blood flow within desired organs, such as the liver, and is the only type of medical image to be displayed in color for diagnostic purposes.

Several other diagnostic imaging techniques exist, including single photon emission computed tomography (SPECT), magnetic source imaging (MSI), digital subtraction angiography (DSA), electrical impedance tomography (EIT), electrical source imaging (ESI), etc.

A typical radiology department can easily generate several gigabytes of data a day. The data is heterogeneous in nature: even within the same modality, scanners produced by different manufacturers generate data with different characteristics and formats. The two main problems in this field are dealing with the large number of different equipment types (from scanners, to display workstations, to communication networks, large storage subsystems, database management systems, etc.) that form a picture archiving and communication system (PACS), and managing the sheer volume and the different formats of the data. Recently the ARC-NEMA Digital Imaging and Communications in Medicine (DICOM) standard has specified a non-proprietary digital image format, a specific data file structure and protocols for the interchange of biomedical images and associated medical information.

Medical image databases have an incredible potential in diagnostic medicine, in medical research, and in education; however, their use in such applications is still limited. For example, we can envision that future medical image databases will be powerful differential diagnosis tools: the radiologist, facing an unclear case, will be able

to retrieve and consult all the images containing a similar lesion stored in the data repository, but there still are no commercial systems supporting this capability. In medical research, we auspicate that image features will be widely included in clinical studies. Education is probably the application where image databases are starting to realize their potential: for example, the Uniformed Service University of Health Sciences, the U.S. federal government health sciences university, operates an online medical image database called MedPix™, which incorporates peer-reviewed radiological teaching files. MedPix contains images with associated textual information and provides image and textual search tools. MedPix is a prominent example of the radiological resources available on the World Wide Web. A survey of these Web-based resources can be found in Schiller and Fink.^[111]

Query-by-content from medical image databases has mostly relied on metadata, texture, and shape features, since most medical images are typically in gray scale. In a recent study,^[81] the authors investigate the use of the combination of texture features with scaled representation of the images to categorize medical images for CBR purpose. They report that, even with global features and with a large number of categories,^[81] they were able to achieve 85% classification accuracy and the correct class was within the top ten guesses in 98% of the cases. Specialized applications of texture in the medical domain include the analysis and enhancement of mammograms. A mammogram is essentially a texture image that rarely contains objects with a well-defined contour. Digital enhancement of mammographical images should increase the visual difference between normal tissue and abnormalities,^[112] and filters that match the specific texture of abnormalities should be used.^[113] Similarly, texture features are extremely valuable inputs to automatic classifiers of medical images.^[114] We conclude this section by directing the reader interested in CBIR in the medical domain to Müller et al.,^[82] which contains a broad overview of the topic as well as an extensive bibliography.

Remotely Sensed Image Databases

Remotely sensed images provides us with a wealth of information that find applications in meteorology, earth sciences, environmental studies, urban planning, forestry management, agriculture, education, and, of course, law enforcement and defense.^[115]

Instruments are carried on satellites (platforms) that orbit the earth. Often several instruments are carried on a single platform. Geostationary satellites are on an equatorial orbit, while lower-altitude platforms are usually on a quasipolar orbit. An instrument consists of one or a few parallel rows of sensors. Each row contains from a few dozens to a few tens of thousands sensors, each of which acquires a pixel of data, requiring one or two bytes. For polar-orbiting satellites, the rows are parallel to the

surface of the earth and perpendicular to the direction of motion of the platform. At predefined intervals, each row of sensors acquires data from a long and narrow strip of the surface of the earth, and produces a line in the image. Between intervals, the platform moves along its orbit, and at different acquisition times the field of view of the instrument covers a different strip. The imaging process is therefore somewhat analogous to that of a desktop scanner.

Satellite images represent different quantities. Most instruments acquire data reflected data in one or more spectral bands. Instrument having long sensor rows usually acquire data in few spectral bands. The LANDSAT Thematic Mapper (TM), for example, acquires data in 6 spectral bands from blue to mid-infrared and in one thermal band, at 30 m resolution, and has more than 6000 pixels per line. Spectrometers, on the other hand, acquire data simultaneously in hundreds of narrow spectral bands, but typically have shorter sensor rows. For example, the CASI instrument has 288 spectral channels and 512 pixels per line.

Few instruments image emissions in the far infrared portion of the electromagnetic spectrum, and essentially measure the temperature of the surface of the earth, of the oceans, or of strata in the atmosphere. Synthetic aperture radars (SARs) measure the reflectance of the surface to microwave or short wave emissions generated on the satellite, as well as the distance between the surface and the satellite, and they yield images that can be used to produce elevation maps or to study certain types of land covers, such as ice.

Satellite instruments image the surface at a wide variety of resolutions. In some meteorological satellites, a pixel corresponds to several square miles on the surface. The NOAA AVHRR instrument acquires data having resolution of about 1 km. The LANDSAT Multi-Spectral Scanner is a medium resolution instrument with resolution of 79 m on the ground. The French SPOT 1 and 2 have resolutions of 10 m. Until recently, satellites capable of acquiring high-resolution images have had only military applications. More recent commercial satellites can acquire images with impressive details: for example the QuickBird satellite owned by DigitalGlobe is capable of 60 cm (roughly 2 ft) resolution in panchromatic mode and of 240 cm in multispectral mode. Images from QuickBird form part of the high-resolution images available via the popular Web-based application Google Earth mapping service. Some images from the Google Earth mapping service have an even higher resolution; at the time of this writing these images are actually aerial photos, rather than satellite images.

Numerous properties of satellite imagery pose challenges to the image database technology. Orbiting instruments generate data at an impressive rate: for example, the Earth Observing System satellites produce about 300 gigabytes a day. The data is collected at few sites, and its

distribution in electronic format is difficult due to its sheer volume. The image content is extremely dense, and different information is useful in different application fields: hence satellite data management requires powerful indexing methodologies.

Image Databases for the Oil Industry

The oil industry is a major producer and user of image and volumetric data. Using seismic techniques, large three-dimensional models of geological formations are constructed. From the types of strata and their formations, it is possible to infer the presence of oil, the extension of the reservoir, and to determine the best strategies for drilling. The resolution of such three-dimensional data is in the order of meters or of tens of meters, and each model corresponds to a surface area of tens or hundreds of square km, and to depths of several km.

The relatively poor resolution of such data makes it inadequate for fine-tuning the drilling process. In some occasions, the stratum containing oil is only a few feet deep, and the drill has to be steered right into the stratum. Different types of images are used for this purpose. During the drilling process, it is possible to extract portions of the core, which are then cut, polished, and photographed. Similarly, packs of instruments are lowered to the bottom of the well and slowly retrieved. Some of the instruments measure global properties of the surrounding strata every few feet, such as the gamma ray emission, while others have arrays of sensors that are pressed against the walls of the well, and produce high-resolution measurements of properties such as electric conductivity. The formation FMI has 196 such sensors that measure the electrical resistivity along the circumference of the bore at depth intervals of 0.1 in. FMI data is usually represented as a false-color image having 196 columns and tens of thousands (or more) rows.

In some cases, microphotographs of core samples are used to assess the yield potentials of an oil field.

Besides the large amount of data, image databases for the oil industry face the challenge of data fusion: three-dimensional data, well-bore images, and microphotographs are often used in conjunction to make operative decisions. Powerful indexing techniques are also needed: for example, when combining three-dimensional seismic data (which provides a global, low-resolution view of the oil field) with images from the different well bores (which provide a sparse, highly localized, and high-resolution characterization), the analyst is often interested in determining the exact depths of specific geological formations at all well locations, to improve the accuracy of the model. This is currently a slow, labor-intensive process that requires manually matching hard copies of FMI images, tens of meters long. Automatic extraction and indexing of the data can substantially simplify the task.^[48,116]

CONCLUSIONS

We have defined a framework for defining, representing, and searching the content of image repositories at different abstraction levels. We have discussed how raw-data, feature, and semantic level descriptions can be extracted from the images and automatically indexed. We have noted how the combination of image representation (compression) and processing yield significant speedups in content extraction at each abstraction level.

Simple objects, defined as connected image regions which are homogeneous with respect to specific characteristics, form the atomic unit of content retrieval. They can be defined and searched at one or more abstraction levels. Composite objects are sets of simple objects satisfying spatial or temporal constraints. We have discussed the semantics of simple and composite objects and described appropriate retrieval methodologies.

There are numerous open problems in the field. The automatic extraction of semantic content from photographic images is probably the most complex. The investigation of new high-dimensional indexing structures supporting flexible metrics is also an open area of research. Improvements in the interaction between the user and the system where the system learns how individual users tend to formulate queries are needed to make large digital libraries easier to use. Standards need to be defined, to allow a search engine to simultaneously query multiple repositories, and combine the contained information. Finally, a better infrastructure, with faster communication lines, is needed to remotely query large image repository.

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BIBLIOGRAPHY

We conclude this entry by listing additional resources for the interested readers. In recent years, several books have been published on the topic of still-image repositories, search, and retrieval. A general introduction can be found in Chen,^[117] while Feng^[118] describes a Machine Learning approach to CBIR. Numerous books on multimedia repositories contain sections on image collections,

including Marques^[119] and Wilhelmus.^[120] In addition to these publications, which can be used as introductions to the topic or as textbooks, several collections of selected papers have appeared in the literature.^[121,122] Numerous articles review current results in CBIR,^[123,124] CBIR systems,^[125] shape-based retrieval,^[71] semantic-level retrieval,^[79] as well as for applications such as CBIR for medical imaging^[82] and retrieval from the World Wide Web.^[126]

Storytelling

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Abstract

Storytelling is an increasingly ubiquitous term applied in various fields with markedly different meanings. This article addresses the meanings of the term, the kinds of stories and storytelling, a brief overview of the history of storytelling, some advice for practicing storytellers, and a discussion of the myriad contexts in which storytelling occurs today.

INTRODUCTION AND SCOPE

As the contexts of information work expand beyond the traditional walls of the library, so too have the uses of the word “storytelling.” Indeed, “storytelling” is currently so fashionable in so many contexts that it is becoming somewhat hackneyed and cliché. Most anything can be considered storytelling. Marketing professionals use it to describe strategies for establishing an organization’s brand identity. Advertising executives espouse its power to sell products. Corporate managers employ it in conflict resolution, and fiction writers and video game designers claim it as fundamental to their art. Storytelling is perhaps so pervasive because—some scholars argue—humans actually *think* in story format,^[1] and story forms the basis for human communication. Etymologically, the English word “story” evolved from the Old French *estoire*, and earlier still, from the Latin *historia*.^[2] The word “tell” evolved from the Old High German word *zählen*, meaning to count or reckon.^[3] Thus, to tell stories was to recount life histories.

Whereas all of these uses of the term are powerful, storytelling in information and library science contexts has traditionally meant face-to-face, oral performance of folk literature for children in a special “storytime” setting, and its use in this entry emphasizes—yet extends—these traditional roots. It is the face-to-face, synchronous communication of narrative that separates (and, hence, defines) storytelling from its other contexts and from related performance arts such as traditional theater or reading books aloud. What makes storytelling unique is that the storyteller(s) and the listener(s) create the storylistening experience together as the story unfolds because the storyteller changes the developing narrative in response to an audience’s feedback.

KINDS OF STORIES AND STORYTELLING

Because stories are so pervasive and cross disciplinary boundaries, there is no definitive typology for the various kinds of stories and storytelling. As folklore scholar William Bascom explained many years ago, “Definitions and classifications are neither particularly interesting nor necessarily fruitful, but if any field of study needs clarification of its basic terminology, it is clearly folklore, which has so long been plagued by inconsistent and contradictory definitions.”^[4]

Librarians, for example, might divide “story” into fiction and nonfiction, and then subdivide the former by genre and the latter by content. Later library storytelling manuals, such as Caroline Feller Bauer’s 1977 classic *Handbook for Storytellers*, organize stories into such categories as folktales, literary tales, fables, myths, epics, legends, and religious stories.^[5]

An early manual of storytelling (1925) for the child education community by William Forbush divides the world of story into six categories: primitive stories (stories of the forest and animal world), myths, fairy stories, epic stories, biography and purposive stories, and storytelling poems.^[6] Polish-American educator Anne Pellowski’s more recent and scholarly overview, *The World of Storytelling*, categorizes storytelling both by function and by context: Bardic, Religious, Folk, Theatrical, Library & Institutional, Camp/Park/Playground, and Hygienic/Therapeutic.^[7]

In folklore, *Funk & Wagnalls Standard Dictionary of Folklore, Mythology, and Legend* proposes the division of stories into prose narrative, speech, proverb, and riddle.^[8] Prose narrative is further subdivided into “myth,” “legend,” and “tale,” a fairly common approach, but not entirely agreed upon. Under the entry entitled “folktale,”

the editors include legends and traditions, fairy tales, animal tales, and myths.^[9] For prose narratives, Bascom has proposed the distinction between myth, legend, and folktale such that, “*folktales are prose narratives which are regarded as fiction... myths are prose narratives which, in the society in which they are told, are considered to be truthful accounts of what happened in the remote past... [and] legends are prose narratives which, like myths, are regarded as true by the narrator and his audience, but they are set in a period considered less remote, when the world was much as it is today.*” (italics in original).^[10] More recent scholars agree that “most [folklore] genres are not well defined, and researchers currently use crude heuristics or intuition to assign the genres”,^[11] however, Nguyen and her colleagues still propose their own set of narrative genre categories, including fairy tales, legends, saint’s legends, urban legends, personal narratives, riddles, situation puzzles, jokes, and songs.

HISTORY

The Origins of Storytelling

The very earliest storytelling may have been poetry. Strabo tells us, “Ornate poetry was the first to make its appearance, and was well received.” The words “rhapsody,” “comedy,” and “tragedy,” he points out, are all derived from “ode.” (This is more apparent in the ancient Greek: Ode = ὕμνη. Rhapsody = ῥαψῳδία. Comedy = κωμῳδία. Tragedy = τραγῳδία.)^[12]

It makes sense that early performative speech would be in the form of poetry because the poetic form lends itself to being remembered. In the absence of writing, one must, as Walter Ong puts it, “Think memorable thoughts.” He specifically mentions the following mnemonic devices: rhythm, pattern, repetition, antitheses, alliteration, assonance, epithets, and formulae.^[13] These are typical characteristics of poetry. Poetic speech is deeply intertwined with orality.

Johan Huizinga, writing on human play, also argues for poetry as the progenitor of performative speech. He identifies “[t]he true appellation of the archaic poet” as “*vates*, the possessed, the God-smitten, the raving one.” He says that the “poet-seer splits up into the figures of the prophet, the priest, the soothsayer, the mystagogue and the poet as we know him; even the philosopher, the legislator, the orator, the demagogue, the sophist and the rhetor spring from that primordial composite type, the *vates*.”^[14] From poetry comes all performative speaking and writing. From the *vates* comes, among the others mentioned, the storyteller.

The oldest known story, Lugalbanda, comes from Sumeria. It was written down as two poems on clay tablets and had been passed down orally before that. Gilgamesh,

which was believed to be the oldest story for some time, references the story of Lugalbanda, who was Gilgamesh’s father.^[15]

Before the invention of writing, narrative storytelling, did much more than entertain. Narratives were the libraries of a culture, preserving information about the cultural group, and their way of life. Ong states, “Most, if not all, oral cultures generate quite substantial narratives or series of narratives, such as the stories of the Trojan wars among the ancient Greeks, the coyote stories among various Native American populations, the Anansi (spider) stories in Belize and other Caribbean cultures with some African heritage, the Sunjata stories of old Mali, the Mwindo stories among the Nyaga, and so on.”^[16] The narrative form holds information together, makes it more memorable, and more easily transferable.

Following are brief descriptions of the use of oral narrative in a variety of cultures. The list is not exhaustive, but highlights some notable examples.

Storytelling was a fine art in early Iceland and many people told their own sagas. This, then, evolved into Icelanders telling stories they heard as well as lived. We know from Ari, who wrote a history of Iceland (*Íslendingabók*), not only many of the sagas, but also their provenance. “Ari was born about 1067, and his chief source of information was his foster-father Hallr, an old man and famous for his wisdom, who in early life had been acquainted with St Olaf. Among his other informants are mentioned Teitr, another foster-son of Hallr, and grandson of Gizurr the White; Oddr, a grandson of Hallr á Síðu; and Thuriðr, a daughter of Snorri Goði. Gizurr, Hallr á Síðu, and Snorri Goði are among the most prominent characters who figure in sagas relating to the beginning of the eleventh century.”^[17] Before Ari recorded these sagas, the lives of generations were preserved through oral narrative.

As stated above, Ong specifically mentions the cultural significance of the Coyote narratives. Karl Kroeber says of the Native American trickster, “Nothing more upsets conventional Western logicians than this buffoonish embodiment of self-destructive greed - who simultaneously is the creator of culture.”^[18] Coyote does not just preserve culture, he makes it. Gerald Vizenor says Coyote is “not a neutral instrument that reveals codes and structural harmonies in tribal cultures.”^[19] Coyote stories help the listeners make sense of their world and understand how to interact with it.

Other cultures also preserved sacred knowledge through narrative. Nora and Munro Chadwick, in their analysis of the Old Testament, state, “It is apparently the prevailing opinion now among Hebrew scholars that the early narrative texts were largely derived from saga.”^[20] The stories in the Old Testament are oral narratives transferred to text.

The Chadwicks write of some of the Turkish peoples, “In the art of extemporisation especially the Tatars are

past masters.” And “the powers of memory were highly valued and cultivated among these people.”^[21] Storytelling for them could be an improvised performance or a faithful rendering of a traditional tale. In Islam, as in other religions, the main repository of sacred knowledge, for some time, was not texts, but people. The Chadwicks describe a “custom among the richer chiefs, notably those of the Kirghiz and the Turkomans, of keeping a mullah, or educated Mohammedan scholar, in their camps.”^[22] This person, among other things, was a storyteller.

The Polynesians were also very concerned with memory. Their sagas and poetry have preserved historical events that occurred as far back as 20 generations in their past. Chronology of this area is accepted as relatively accurate dating back to 1300 (European discovery of Polynesia was in the late 1500s) due to oral histories and genealogies. Social standing was inherited, so perfect accuracy, at least in one’s own genealogy and family stories was a necessity. Some of the ancient poetry can no longer be fully translated because it contains obsolete words.^[23]

Stories told today in Sudan still maintain the memory of the culture. In the introduction to *The Clever Sheikh of the Butana*, Stephen Howard talks of Ali Lutfi Abdallah listening to stories as a child. “The old women of the community were the lending libraries for these stories, remembering and embellishing as their energy permitted or as the children’s restlessness demanded. . . . But as is characteristic of an oral society, their memories served to preserve ancient traditions. Older women are often a conservative force in this culture as well, in that they conserve the values which they were taught as girls.”^[24] The power of the oral narrative is not lost in the presence of writing, but the place of storytelling has changed in the modern world.

Recent History

Organized storytelling in the United States has its roots in the kindergarten movement established by educator Friedrich Froebel in Germany in 1837. German immigrants brought with them Froebel’s belief that storytelling should be part of the kindergarten program, and they included it when the first kindergarten was incorporated into a U.S. public school in 1873. Soon after the American Library Association was founded in 1876, storytelling began to appear in public libraries across the nation. The rise of storytelling in libraries is often credited to a national tour by acclaimed English storyteller Marie Shedlock in 1900–1901, though several years earlier public libraries had experimented with the art form and established “story hours” for children. Children’s librarians were captivated by Shedlock’s performances, and they soon made storytelling a major part of children’s story hours. Kindergarten teacher Sara Cone Bryant’s *How to Tell Stories to Children* was the first American publication (1905) to

address the practice of storytelling, and it started a wave of storytelling manuals written by educators and librarians.^[25]

The early 1900s was a volatile growth period for storytelling. Children’s librarians used their performances to help indoctrinate immigrant children to American values and ideals. The rise of the library “branch” movement in the 1920s allowed storytelling to reach more children, and in the 1930s churches and public parks began offering regular storytelling experiences. Schools other than kindergartens began to emphasize storytelling in the classroom, and an explosion of “how-to” manuals helped spur its distribution. The new medium of FM radio (1933) brought even greater dissemination of stories, though it changed the experience dramatically. The rise of pre-schools in the 1940s with their concomitant emphasis on reading and literacy began a decline in storytelling in favor of reading books aloud. The growth of the picture book format in children’s literature and developments in color printing quality throughout the first half of the twentieth century augmented this decline, and the introduction of the color television in the 1950s and 1960s so captivated the population, that by the late 1960s, storytelling was no longer an emphasis, though it was still widely practiced.^[26]

Then in 1975, a new organization was founded in the United States—The National Association for the Preservation and Perpetuation of Storytelling (now the National Storytelling Network)—that began to promote storytelling in the United States as a professional career.^[27] Other organizations soon followed, including the Story Circle Network, helping women share the stories of their lives and raising public awareness of the importance of women’s personal histories;^[28] the National Association of Black Storytellers;^[29] the California Indian Storytelling Association;^[30] the League for the Advancement of New England Storytelling;^[31] the Northlands Storytelling Network;^[32] the Jewish Storytelling Coalition;^[33] the Network of Biblical Storytellers;^[34] Spellbinders, training retirees as volunteer storytellers in schools;^[35] and many state and local associations or guilds that sponsor festivals, workshops, and other storytelling events.

The 1980s and 1990s saw a rise in professional storytellers in the United States, and many children’s librarians began to hire professional performers instead of learning the art themselves. Storytelling in library education also began to wane as the field of librarianship expanded into the vast, new information economy. In the early decades of the twenty-first century, we see the field of storytelling continuing to expand and change. The prevalence of video and audio recordings of modern storytelling create new ties to the library world through the need for curation and dissemination.

The Moth, a New York storytelling show, consists of novice performers sharing brief, true, personal stories. The show has gained an enormous following, creating tours,

spinoff shows, radio hours, and podcasts that reach across the globe.^[36]

StoryCorps, although not live storytelling, has brought attention to the need to preserve our personal and family stories. Individuals record their stories in an interview, directly to a digital format, and all the stories are archived by the American Folklife Center at the Library of Congress in Washington, DC. There are community archive centers in various locations throughout the country and interviews produced for national broadcast are available on the Web.^[37]

Contemporary storytelling is not exclusively personal. Members of the Society for Creative Anachronism meet informally in Bardic Circles to share stories and songs.^[38] Mythology story slams following the Myth-Off format occur internationally.^[39] There are also events, like the Going Deep retreat, during which performers share long-form traditional stories.^[40]

Storytelling remains vital around the world. The Storytellers of Canada, “connects storytellers across Canada through its publications, Web site, annual conference and ongoing advocacy to form a nationwide community of storytelling,” and there are many regional associations and guilds.^[41] The Storytelling Guild of Australia is a national network of storytellers, librarians, educators, and therapists whose objective is to “promote the craft and skills of storytelling; offer opportunities, resources, workshops, coaching, [and] accreditation for storytellers; [and] provide a forum for storytellers to share skills.”^[42] The website is hosted by the National Library of Australia. The New Zealand Guild of Storytellers, founded by a librarian, “is dedicated to preserving, practicing and promoting the art of Storytelling.”^[43] The Scottish Storytelling Center and Network’s purpose “is the support and development of storytelling in all sectors of society, in all parts of Scotland, and in international contexts.”^[44] Similar work is done in the United Kingdom by the Society for Storytelling.^[45]

In other parts of the world, storytelling efforts are supported by associations connected with reading, communication, theatrical arts, language and literacy, museums, and other cultural heritage organizations. The Indian Storytelling Network “draws upon many ancient Indian traditions regarding developing ways of using Stories and Storytelling for Education, Therapy, and Coaching.”^[46] The Asian Storytelling Network “offers storytelling programmes for every occasion and venue.”^[47] Storymoja, an African publishing company, collaborates with international partners to produce a storytelling festival in Nairobi annually.^[48] and the Kanoon Institute for the Intellectual Development of Children & Young Adults hosts a festival in Iran.^[49] The Norwegian Storytelling Forum’s members work in educational, health, and business contexts to promote storytelling and storytellers.^[50] Rumah Dongeng Indonesia provides a similar set of services for storytellers across Indonesia,^[51] and the Storytelling Association does

so for Singapore.^[52] The International Storytelling Network, based in Spain, “is a site of storytellers open to spreading Storytelling, Promote reading, Literary creation, and Performing arts.”^[53]

FINDING STORIES

Storytellers search many sources to find appropriate stories to add to their repertoires. Traditional stories in collections, picture books, audiobooks, and e-books provide a wealth of opportunities to read and hear stories, and the Internet is replete with full-text story websites. Some of these provide access to specific types of stories, like Snopes.com^[54] for contemporary legends or Aesopfables.com^[55] for Aesop’s fables. Some provide a variety of different story types, such as Americanfolklore.net,^[56] with categories for spooky stories; tall tales; myths and legends; urban legends; folk tales; fables and fairy tales; campfire stories; children’s stories; animal stories; and jokes, riddles, and tongue twisters. This site also has broad geographic and ethnic subcategories. The folklore and mythology electronic texts archive created by the University of Pittsburg^[57] is another excellent source of full-text stories. The Perseus database, run by Tufts,^[58] contains numerous Greek and Roman myths in their original language and in translation. The Project Gutenberg site^[59] has access to many public domain collections of folktales.

There is more to finding a good story, however, than stumbling upon it during exploratory reading. Folklorists have devised two principal indexing strategies to facilitate access to world folktales: the type index and the motif index.

Type indices treat stories as a unit, drawing very similar stories together for comparative analysis. Each story type is assigned a number and letter (i.e., 510A Cinderella) based upon the classification system designed by Antti Aarne and Stith Thompson in 1961, called *The Types of the Folktale: A Classification and Bibliography*.^[60] The bulk of the index is the type classification system with associated short, story descriptions and keyword bibliographic references to the source texts. It is a superb, scholarly work that indexes academic and abstruse sources, and is, therefore, best used by folklore scholars who have access to such erudite material. For those needing access to more readily available sources, D. L. Ashliman’s *A Guide to Folktales in the English Language* is an easier source to use, with more complete story annotations and a layout that makes tracking specific stories down much simpler, but it lacks the motif analysis included in the Aarne document.^[61]

Motif indices, on the other hand, break stories down into component parts and then index those story “pieces.” Any particular folktale may have as many as 20 or 30 motifs present (i.e., the Cinderella tale includes motifs: S31: Cruel stepmother; D315.1: Transformation: rat to

person; R221: Heroine's threefold flight from the ball; and H36.1: Slipper test, among many others).^[62] Stith Thompson is, perhaps, the name most often associated with folklore motif indexing as his classification scheme *The Motif Index of Folk Literature* in 1960 became a standard for other indexers of folktales. Many other scholars have pursued similar structuralist objectives, resulting in myriad motif indices emphasizing particular cultures or audiences that broaden the coverage of folklore and deepen and extend the original classification scheme Thompson envisioned. A sampling of these indices includes Hireko Ikeda's *A Type and Motif Index of Japanese Folk-Literature* (1971),^[63] B.F. Kirtley's *A Motif Index of Polynesian, Melanesian and Micronesian Narratives* (1980),^[64] Helen Flowers' *A Classification of the Folktale of the West Indies by Types and Motifs* (1952),^[65] Lena Neuland's *Motif-Index of Latvian Folktales and Legends* (1981),^[66] Hasan El-Shamy's *Folk Traditions of the Arab World: A Guide to Motif Classification* (1995),^[67] and Margaret Read MacDonald and Brian W. Sturm's *Storyteller's Sourcebook: A Subject, Title, and Motif Index to Folklore Collections for Children, 1983–1999* (2001),^[68] as well as Margaret Read MacDonald's earlier work, *The Storyteller's Sourcebook* (1982).^[69]

LEARNING STORIES

How to learn a story for performance depends on many factors, including personal preferences, cultural storytelling traditions, and the social and political context of the storytelling experience. Some cultures are conservative and require storytellers to learn and perform stories verbatim in order to preserve traditional performance styles and keep the content of stories accurate and culturally authentic. Others adopt a liberal approach that provides storytellers more creative license to adapt and alter their stories. While the former leads to more choreographed and memorized story learning, the latter demands more improvisational skill from the performer. Some cultures merge the memorized with the extemporaneous in performance, as documented by Albert Lord in his analysis of singers of Slavic oral epics (byliny); Lord found that these performers had vast repertoires of stock formulae and phrases that could be combined, repeated, and interspersed throughout their impromptu compositions.^[70]

Modern storytelling manuals offer many suggestions for how to learn a story for performance; the most common is to visualize the story so that the storyteller can “see” the tale like a movie or series of pictures that unfold in the mind's eye as the story proceeds. Storytellers then improvise the words to match the pictures they see, often incorporating memorized words or phrases that augment the cultural authenticity or ethnic “flavor” of the story. There are, however, myriad other techniques to aid in

learning a story, from storyboarding (creating a series of illustrations that outline the plot), “scening” (using short phrases that divide the story into chunks or scenes), outlining (creating a detailed overview of the plot), and scripting (adding staging and performance notes to an outline), to writing out the entire plot for memorization (for people who are word-learners).

PERFORMING STORIES

There are several key points that most manuals of storytelling address in their attempt to help novices master the art of story performance. First, the story is carried on the breath, so storytellers must explore the full potential of their voices: volume (loud or soft), pitch (high or low), emphasis, emotional tone, rate (fast or slow), rhythm, enunciation, and silence. Second, effective communication involves the body: facial expressions, gestures, posture, muscle tension, proximity to audience, eye contact, and the use of physical contact. Third, appearance also influences a performance, including clothing, hair styles, color choices, and adornment. Fourth, storytellers must determine the relative merits of accessories or props such as musical instruments, puppets, magic, noisemakers, pictures, string figures, balloon animals, paper cutouts, or projected images.

At each moment of the performance, many of these elements are at play, and the storyteller must constantly adjust each of them to maximize the impact of the story for the audience. In short, so long as each element of the performance improves the *story* and the immersion of the audience in the story world, the storyteller is performing well. Common advice from storytellers and storytelling manuals includes

- Only tell stories you love as your enthusiasm for the story is *very* contagious.
- Recall the mood of the story and open with that mood.
- Use large gestures at the beginning of the story if appropriate to relieve nervousness.
- Pause after the introduction to “signal” the story's beginning.
- Watch the audience for feedback and change the story to increase its impact.
- Speak slowly and clearly as the audience only gets one chance to hear the story's message.
- Vary the rhythm and pacing to create an “ebb and flow” in the story's intensity.
- Practice, practice, practice.
- Know how long your story is and how to adjust the length during the performance if necessary.
- Prepare for your storytelling environment: microphone, large or small space, indoors or outdoors, ambient noise.

STORYTELLING IN CONTEXT

Storytelling in Business

Storytelling is currently used in many areas of the business world. Annett Simmons lists the following story types organizational leaders and salespeople use to inspire trust:

1. “Who I Am” stories
2. “Why I Am Here” stories
3. “The Vision” story
4. “Teaching” stories
5. “Values-in-Action” stories
6. “I Know What You Are Thinking” stories^[71]

Stories are also used to create a brand and advertise products. Employees at all levels share stories in order to better understand their role in an organization and communicate their experiences. Stories preserve institutional knowledge. Storytelling can also be a part of organizational analysis and strategic planning.^[72] Some companies even ask customers “to tell personal stories about their consumer experiences.”^[73] These stories influence how the company moves forward.

Storytelling in Education

“All over the world and in all races, listening to stories has...always been to children one of the most effective doorways unto life and knowledge.” Storytelling “is of great value in training the memory”; it increases vocabulary, “awakens and educates real and natural feelings,” and assists in “the development of character.”^[74] Whereas these claims by Forbush are undocumented, Kendall Haven has collected much of the research on storytelling and its power in his book *Story Proof*, which documents the value of storytelling in such areas as text comprehension, logical thinking, meaning-making, motivation for learning, community-building, language mastery, writing success, and memory.^[75]

Hamilton and Weiss state that storytelling has value for children in schools because hearing stories: stimulates the imagination; instills in children a love of language and motivates them to read; improves listening skills; improves such language skills as vocabulary, comprehension, sequencing, and story recall; encourages creative writing; and gives children a common set of words and ideas that help create the classroom culture.^[76]

Collins and Cooper concur and extend these ideas, stating that storytelling: enhances imagination and visualization, develops appreciation of the beauty and rhythm of language, increases vocabulary, refines speaking skills, improves listening skills, allows students to interact with adults on a personal level, enhances writing skills, develops reading skills and sparks interest in reading, enhances critical and creative thinking skills, nourishes students’ intuitive

side, helps students see literature as a mirror of human experience, and helps students understand their own and others’ cultural heritage.^[77]

There is also value in students as storytellers. They use storytelling to communicate things they have learned and to begin to impose a narrative structure on personal accounts. Storytelling helps students work through difficult situations and emotions. It teaches empathy by allowing them to live briefly in another person’s world. Retelling stories they have read encourages students to engage more fully with the text, imagining what characters felt, how they spoke, and what they did with their bodies. Most importantly, storytelling, like other arts, increases students’, “self-observation, standard setting, self-reaction, and self-efficacy.”^[78] It helps students learn how to learn.

Storytelling teaching artists visit schools to entertain, and to inspire teachers and students. Teaching artists offer residencies (instruction over a period of time) in areas such as storytelling, literacy development, writing, digital storytelling, improvisation, bullying prevention and self-respect, cultural enrichment, and storytelling arts-integration with any curriculum subject.^[79–81]

Healing Storytelling

Folktales and storytelling are valuable on psychological and therapeutic levels. Child psychologist, Bruno Bettelheim’s seminal work, *The Uses of Enchantment*, explores how folktales resonate with archetypal images and scenarios that help children cope with the emotional challenges of growing up.^[82] Similar work has been done for adults by Marie-Louise von Franz, Robert Bly, Allan Chinen, and Clarissa Pinkola Estés, among others.

Storytelling focuses the attention, allowing listeners to become “completely immersed in the present”; it “charms the mind, rests the perturbed spirit and even helps prepare the body either for sleep or for renewed activity”; it aids in “broadening social imagination and thus developing the spirit of generosity.”^[83] Listening to stories can make one calm, collected, and maybe even a better person.

Telling stories is therapeutic for the performers as well. Veterans, former addicts, survivors of various traumas, and even those just making their way through the typical challenges of everyday life, find peace in telling their stories. The Administration for Native Americans, in their page on Native American Veterans and storytelling for healing, says healing stories contain important values that include, “acceptance, courage, truth, and spirituality. When these are in place, some individuals can begin to make meaning of their experiences.”^[84] Listeners gain understanding, and if they are in a similar situation, take comfort in knowing they are not alone.

Stories heal communities. Jo Carson, storyteller, playwright, and one of the founders of Alternate ROOTS, worked with communities across the country to tell their

most important stories through plays.^[85] She collected oral histories from the community and turned them into plays that were performed by members of the community. These plays consisted of more storytelling than dialog. The communities often chose the theme themselves. Stories might center on a past traumatic event or episodes from the community's history that spoke to current challenges. In her book, *Spider Speculations*, Carson says projects like these “change people's perceptions of their place and their community so that it somehow becomes a place worth keeping,” or restore the soul and keep alive the feeling of community.^[86]

There is some interest in the power of words to heal physical ailments through such techniques as neurolinguistic programming. NLP involves understanding another person's preferred way of sensing the world, and communicating with them using this mode. However, at this time there is not sufficient evidence to indicate that these techniques have a significant effect on physical health outcomes.^[87]

Religious Storytelling

Although the sacred texts of many of the world's religions have long since been immortalized in writing, telling the stories aloud is understood to have a continuing inherent value. “For centuries the meaning of the stories of scripture lay in the *experience* of hearing them. The faithful located their own experience within the framework of that overarching story.”^[88] Hearing religious stories told aloud allows the listener to better relate the story to his or her own life.

Yitzak Buxbaum tells a story about religious storytelling: “[T]he famous hasidic leader, the Seer of Lublin, told how he once passed by a synagogue from which shone a supernal light.” He thought, “Certainly, there are great scholars inside, studying the Torah in holiness.” But when he entered, he saw two ordinary hasidim, not studying Torah but sitting and conversing. He asked them, “Friends, what are you talking about?” The hasidim answered, “We are telling stories about the deeds of the tzaddikim.” “When he heard that, the Seer was very moved, for he realized that their storytelling produced the same divine light and illumination as does Torah study.”^[89] Telling religious stories here is equated not with reading the Torah, but studying it. Storytelling enables deeper understanding.

For these reasons, a number of individuals and organizations participate in religious storytelling. The Network of Biblical Storytellers, for example, supports performances based on the Christian scriptures through their organization, website, yearly festival gathering, and magazine.^[34] The Jewish Storytelling Coalition similarly connects Jewish storytellers.^[33] Traditional Japanese storytelling is being used to share the teachings of Buddhism.^[90] Harikatha, a form of storytelling in South India, is based on religious texts and incorporates music and

dance.^[91] Storytelling continues to be a main method for transferring religious knowledge.

Storytelling in Libraries

Librarians tell stories alongside the reading of books during story hours and other library programs. These stories often have a literary connection, allowing the librarians to suggest books children might like to read if they enjoyed the story. Libraries also hire professional tellers to perform, usually for child audiences, but occasionally for teen or adult audiences. Professional tellers may or may not make a direct connection between their stories and books in the library as they often tell these same stories in other venues as well. However, storytellers and other performers are most sought-after during the summer reading program, so they will often tailor these performances to the summer reading theme.

As keepers of the printed, digital, and spoken word, libraries are also beginning to consider the challenges surrounding the preservation of oral narrative. After speaking with several First Nations elders, Charles Maina writes of some of the complexities libraries face when collecting traditional knowledge. He mentions the loss of context when an oral performance is fixed in a medium, issues of ownership, and the difficulties of classifying holistic wisdom.^[92] The digital medium has encouraged a general attitude that almost anything and everything can be preserved; however, digital files do deteriorate, and the devices used to read them can become obsolete. Even after oral knowledge has been respectfully collected, actually preserving it as audio or video in a long-term archive takes careful planning.

Storytelling in Arts and Cultural Institutions

Museums, historical centers, parks, and other cultural institutions use the power of story to share information in a meaningful and memorable way. Historic Philadelphia's Once Upon a Nation program, for example, shares stories that “cover a wealth of topics and span time from the seventeenth century through today and share American history with 21st-century flair.”^[93] Many parks, similarly, have performers tell the stories of their place throughout time. The Milwaukee Public Museum has “Museum Storytelling” once a month, often based around exhibits, like the Hebior mammoth and Egyptian artifacts.^[94] Storytelling brings to life the information these institutions have to share.

Storytelling Events

Finally, storytelling also happens just for the sake of storytelling. The National Storytelling Festival in Jonesborough, Tennessee, was first held in 1973, and “sparked a renaissance of storytelling.”^[95] Other festivals

now occur throughout the United States every year, such as the Timpanogos Storytelling Festival in Orem, Utah,^[96] The Texas Storytelling Festival in Denton,^[97] and the Peach State Storytelling Festival in Atlanta, Georgia.^[98] At these festivals, paid tellers take the stage before an audience that has come for stories. Often, the day is broken up with workshops, open mic sessions, story slams, or simply different genres of storytelling.

Dedicated storytelling performances have also moved off the festival stage. At The Moth and events inspired by The Moth, amateur tellers perform for crowds assembled in bars. Unlike festivals, which feature all kinds of storytelling, Moth events contain exclusively true, personal stories.^[36]

Story slams are sometimes held as a portion of a larger event, like a festival or as stand-alone events. Slams are competitions, with each teller being awarded points in categories such as artistry, adherence to a theme, staying within a time limit, etc. At the end of the slam, winners are recognized. Some slams feature personal stories, like Connecticut's Campus Slammer,^[99] and others like MythOff^[100] feature traditional stories.

CONCLUSION

Storytelling grew out of a need to preserve and transmit the wisdom and values of a culture. In spite of the ever-changing and growing field of communication technology, storytelling continues to be culturally significant. It still teaches, still heals, still connects human beings in a way nothing else can. Storytelling embraces technology: books, radio, television, the Internet, and beyond. These things add to the transmission of stories, but do not replace face to face oral transmission. Even the so-called "digital natives" are gathering to share and listen to stories. Some of the venues have changed. The styles have changed. But people young and old see the value in getting together, breathing the same air, and telling their stories.

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Strategic Planning in Academic Libraries

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Abstract

The core concept of strategic planning is addressed, as well as the historical context of its development in academic libraries, and contemporary approaches to library strategic management. It reviews published literature and current practice, concentrating on planning processes, strategy documents and key elements of strategic planning.

INTRODUCTION

Strategic planning is essentially about deciding and refining organizational objectives and working consistently and persistently to translate those objectives into actions and outcomes. It requires insight and foresight to interpret past events and present trends to determine future directions. Strategic planners need to have eclectic interests, a flexible mindset, and an inclusive style that involves people in envisaging change, developing strategies, and making plans.

Planning is often a formal requirement, but in any case it is good management practice and has several potential benefits, particularly when carried out in a participative style with stakeholder involvement. For example:

- It brings new perspectives and insights to service development by posing unusual questions and forcing consideration of options.
- It strengthens the case for funding and provides the necessary context for both the annual budget round and special funding bids.
- It enables delegated decisions and quick flexible responses on the front line, improving satisfaction for customers and staff.
- It inspires confidence in the service by demonstrating an understanding of the key issues and showing how they will be addressed.
- It creates a shared view of the future and commitment to doing new things, facilitating change by giving people a sense of ownership.

Strategic planning has various functions: to clarify organizational purpose and objectives; to establish corporate directions and priorities; to assess environmental drivers and constraints; to identify critical issues and pressures; to determine resource allocation and utilization; to improve internal coherence and coordination; and to inform operational decisions and actions.

This article covers the core concepts of strategic planning, the historical context of its development in academic libraries, and contemporary approaches to library strategy. It reviews published literature and current practice, concentrating on planning processes, strategy documents and key elements of strategic planning.

CORE CONCEPTS

Effective strategic planning involves understanding the business arena, assessing your resource base and creating a shared view of the future, by asking fundamental questions such as:

- Why do we exist? What business are we in? (mission)
- Where are we now? How did we get here? (situation audit)
- What factors will impact our future? (environmental appraisal)
- What do we want to be? Where do we want to go? (vision and goals)
- How can we get there? What are the implications? (strategic options)
- What needs to be done? Who will do it? When? (action plans)
- How will we track progress? (performance indicators)

The terminology of strategy and planning is confusing. There is no standard usage; the same terms are used in different ways, and they can have different meanings according to context. People often confuse “policy” and “strategy” and find it difficult to differentiate “mission” and “vision.” Commentators often conceptualize aims, directions, goals, objectives, strategies, and targets as a hierarchy of objectives (using “objective” as a generic term) but may place these terms in different orders; the choice of term at successive levels in the hierarchy is not significant, but it is important to have consistency of usage

within an organization to aid communication and avoid confusion.

The word “strategy” is used at one level to denote overall direction, as indicated by Johnson and Scholes, “Strategy is the *direction* and *scope* of an organization over the *long term*: which achieves *advantage* for the organization through its configuration of *resources* within a changing *environment*, to meet the needs of *markets* and to fulfil *stakeholder* expectations.”^[1]

However, as well as representing the overall objective for an organization or what it aims to do, “strategy” is also used to describe how an organization will achieve its objective or aim. At this level, strategies are defined sets or emerging patterns of actions and tasks taking the organization toward its goals and targets. Drucker accordingly describes “strategy” as “a company’s basic approach to achieving its overall objectives” and defines “strategic planning” as: “the planning for a company’s long-term future that includes the setting of major overall objectives, the determination of the basic approaches to be used in pursuing these objectives, and the means to be used in obtaining the necessary resources to be employed.”^[2]

Despite differences in terminology and presentation, literature and practice point to general consensus about what constitutes strategic planning or “strategic management” (the term often preferred now to emphasize the iterative nature and comprehensive scope of the strategy process). There are four main aspects, that can be seen as a set of interlocking components: environmental appraisal, strategic profiling, strategy development, and program management.

Environmental Appraisal

This aspect covers researching and analyzing the forces of the external world, including your own industry/sector and its marketplace, as well as reviewing and auditing the internal situation, especially your performance and resources. The tools used include environmental scanning, PEST/STEP analysis, stakeholder mapping, competitive benchmarking, SWOT, and cross-impact analysis. The typical output is a set of formal planning assumptions to inform other aspects of the planning process.

Strategic Profiling

This involves discussing and agreeing fundamental issues, such as the scope, purpose, and functions of your organization; its guiding principles and philosophies; your desired future situation and the direction required to get there. Tools used include: mission, positioning, vision, and values statements; key result areas; critical success factors; goals; and targets. The typical output is a series of related objectives statements to inform the development and evaluation of strategies.

Strategy Development

This requires the formation and adoption of strategies, action programs, and resource plans, by identifying and evaluating options and sensitivities, considering supporting strategies and contingency plans, and specifying performance indicators. Tools used include generic strategy models, portfolio matrices, and cost-benefit analysis. The typical output is a formal strategy document or plan to inform operational/project planning and funding bids.

Program Management

This aspect includes taking actions and monitoring progress, reviewing objectives and refining plans, elaborating tasks and incorporating targets into annual budgets and operational plans. Tools used include gantt charts, milestone plans, responsibility charts, risk analysis, and performance measurement. Typical outputs are project plans, operational plans, budget projections, risk registers, progress reports, financial reports, and other monitoring statements.

There is considerable overlap between corporate/business strategy and marketing strategy, and many of the models and tools used in strategic planning are concerned with marketing variables. However, strategic planning is essentially about defining the business (or businesses) of the organization and setting overall business objectives, whereas marketing plans elaborate strategies to achieve these objectives; market research is an essential aspect of the environmental analysis that underpins strategic planning.

HISTORICAL CONTEXT

Strategic planning originated in the United States during the 1960s and spread to Europe and beyond in the 1970s and 1980s, becoming an accepted part of managerial thinking and practice in the business world and the public sector. It is distinguished from other types of planning by its focus on environmental trends and concern with fundamental questions about where an organization is going and how it will get there. Although long-range planning is associated with incremental growth and evolutionary change, strategic planning is particularly associated with revolutionary change or even total reconception.

The adoption of strategic planning concepts and techniques by library and information service managers has followed the general trend, with American libraries acting as pioneers from the 1970s onward, and libraries in other countries gradually following their lead. In the United States, many university libraries engaged in planning as part of an institutionwide activity, but in the United

Kingdom, they often became involved in strategic planning ahead of their parent bodies.

The Association of Research Libraries (ARL) has played a significant part in the development of strategic planning in academic libraries through its Office of Management Studies, which carries out consultancy and training for its members^[3–5] and has published several collections of library planning documents.^[6–8] In the United Kingdom, the Society of College, National and University Libraries (SCONUL) has worked with the Universities and Colleges Information Systems Association and the Higher Education Staff Development Agency to develop strategic management capability in the sector, by offering a strategic management program for service directors and including strategic planning and scenario development in a course for service managers.^[9]

Funding pressures in the higher education sector over the last two decades have made strategic planning a managerial necessity, and many institutions now have elaborate and sophisticated systems to meet internal needs and external requirements. In the United Kingdom, funding bodies have formally required institutions to submit both general (corporate) plans and more specific strategies as a condition for the release of funds. Library planning, therefore, needs to be linked to and integrated with an array of institutional, functional, and departmental strategies and plans, in a complex system, which is best seen as a network or web of strategies, rather than the traditional conception as a hierarchy of plans. This issue was highlighted by the Ellard report on performance indicators for academic libraries in 1995, which included “the cohesiveness between the mission, aims and objectives and strategic plan of the institution and those of its library” as an indicator of integration.^[10]

PUBLISHED LITERATURE

There are numerous publications on business planning and corporate strategy but relatively few titles on strategic planning for academic institutions and their libraries. Most of the literature on strategic management in higher education is based on practical case studies, with some authors offering a more objective or theoretical perspective. Academic library strategists have accordingly drawn on models outside higher education as well as learning from professional colleagues.

Academic Strategy

Among the many strategy writers cited, Chandler,^[11] Bryson,^[12] and Steiner^[13] have been particularly influential, in addition to marketing guru Kotler^[14] and the higher education specialists, Cope^[15] and Keller.^[16] Although American writers have led the field, contributors from other countries have emerged more recently with Meade’s

account of strategic reorientation at the University of Otago^[17] and Watson’s reflections on strategic management in contemporary England, which draw on the remodeling of the corporate and strategic plans of the University of Brighton.^[18]

The central place of strategic planning in higher education is further evidenced by more specific and practical publications issued in the last few years. Berge and Schrum describe how the development and implementation of technology-enhanced distance learning programs need to be integrated into institutional strategic planning (and budgeting).^[19] At a more general level, Lerner’s “strategic planning primer for higher education” takes readers through the key steps and alerts them to potential pitfalls. She also explains the distinctive features of university planning and highlights business models that have proved useful in the sector, providing links to the California State University Northridge strategic planning site.^[20] In England, the Higher Education Funding Council has issued a 44-page guide for heads of institutions, senior managers and governing bodies, based on consultation and case studies across the sector.^[21]

Library Planning

Textbooks on library planning began to appear in the 1980s. The pioneering 1984 volume by Riggs, *Strategic Planning for Library Managers*, looks somewhat dated now, but it made a significant contribution in introducing business concepts and techniques to the library community.^[22] McKee’s 1989 book, *Planning Library Service*, ranged more broadly across the whole field of management and was the first British treatment of the topic.^[23] More practical guidance on strategic planning was provided in Jacob’s *How-To-Do-It Manual*^[24] and Corral’s *Know How Guide*.^[25] The latter was subsequently revised and expanded into a much more comprehensive handbook, *Strategic Management of Information Services*, which includes many examples from the literature and practice of academic librarianship.^[26] Other books have concentrated on particular aspects of or approaches to library strategy: Giesecke introduces the theory and practice of scenario planning;^[27] Weingand explains how futuring methods can be used with conventional marketing/planning techniques;^[28] and Gorman discusses the core values of libraries and librarianship.^[29]

Articles on academic library planning can be traced back to the same era. Although the concept of strategic planning is not mentioned and the term “strategies” is only used in passing, McClure’s 1978 contribution to *College & Research Libraries* is in practice an early discussion of the benefits of a formal approach to strategy with practical suggestions about how to do it.^[30] Davis (writing from the perspective of a sympathetic bystander) similarly advocates a proactive approach to planning, with staff participation and stakeholder involvement.^[31]

Case studies

With the exception of the monographs by Biddle^[32] and Hayes,^[33] much of the literature on academic library planning consists of journal articles describing and evaluating the planning processes used at particular institutions. Thus, Ensor details the data-gathering methods used at Indiana State University,^[34] Baker describes the top-down process adopted at Massachusetts Institute of Technology,^[35] Brindley outlines the more participative style used at Aston University,^[36] Gratch and Wood discuss the approach taken to implementation at Bowling Green State University,^[37] Butler and Davis reflect on their respective experiences at Michigan State University and the State University of New York at Albany,^[38] Lee identifies factors determining success at Harvard College,^[39] Blunden-Ellis elaborates the key issues addressed in planning the Consortium of Academic Libraries in Manchester,^[40] and Shoaf describes the proactive and highly participative approach used at Brown University.^[41]

In contrast to these relatively brief accounts, Lynch provides an in-depth case study with extensive insights into the planning issues facing the University of Illinois at Chicago Library. This volume contains eight chapters from colleagues involved in the planning process, reflecting their different views on the library and its environment. The book also reproduces the strategic plan eventually developed by the library.^[42] Another distinctive collection is the volume edited by Williams containing 14 articles offering multiple perspectives on the planning processes at 12 U.S. institutions. The authors include college and university presidents, provosts, and planners as well as librarians.^[43] Among these is an early appraisal of how strategic planning can facilitate the convergence of a library with cognate services: Watson argues that the cooperation required to develop a unitwide plan helped managers “gain a broader perspective of the roles of each of the components and envision new ways in which the components might interact in support of each other.”^[44]

Specific aspects

Other authors focus on specific dimensions of strategic planning. Wilson^[45] and Brophy^[46] both discuss the mission of the academic library; Forsman suggests how organizational values can be used in planning;^[47] Birdsall and Hersley present a planning model emphasizing stakeholder involvement;^[48] Michalak considers the strategic planning of library facilities;^[49] Hewison describes a participative approach to vision statements;^[50] Tuck considers the use of surveys and evaluation in implementing and monitoring a strategic plan;^[51] Bevan and Dolphin describe the incorporation of an IT strategy into a library plan;^[52] Birdsall revisits stakeholder engagement and

explores the political dimensions of strategic planning.^[53] Corrall and Brewerton report on the use of scenarios in strategic visioning and space planning;^[54,55] and Feinman shows how library staff can contribute to and influence university strategic planning.^[56]

PLANNING PROCESSES

Both planning horizons (time spans covered by plans) and planning time lines (time devoted to the process) have shortened significantly in recent years. In past decades, long-range plans covered 5, 10, or even 20 yr, but today organizations generally opt for no more than 5 yr—often only 3—and the same pattern is evident in academic libraries. Irrespective of the period covered, strategic plans are usually reviewed annually to inform yearly budgets and operational plans and sometimes “rolled forward” by dropping the first year and adding another at the end. (This practice of edging forward incrementally is quite different from the sort of fundamental review that strategic planning requires and, therefore, should only be seen as an interim exercise limited to no more than two or three iterations.)

In the 1980s, it was quite common for first iterations of strategic planning to be conducted over a period of 12 months or longer, with some reported instances of exercises taking 18 months to 2 yr—notably, the University of Illinois at Chicago.^[42] Today, the period of any formally defined process is more likely to be 6 months or less, because the pace of change is so fast that a longer gestation period makes little sense. This compression of the formal strategic planning process into a matter of months makes the requirement for library managers to engage staff continuously in less formal strategic thinking and environmental scanning even more important.

One of the trends evident in both library planning and business strategy processes is the move to a more participative and inclusive style, with more extensive involvement of staff, customers, and other stakeholders. Another tendency is for managers to acknowledge “real-time strategy” as a continuous (learning) process instead of seeing it as a “one-off” exercise or part of an annual ritual. The formal or organized planning process has thus become more concerned with capturing information and decisions rather than initiating environmental scans, competitive benchmarking, customer surveys, etc. because the latter are now ongoing activities in many academic libraries.

Strategic planning has been conceptualized as a series of fundamental questions and a set of interlocking components. It can also be seen in more practical terms as a sequence of iterative steps. Models for operationalizing the strategic planning process vary and need to be considered in relation to the size and type of organization and the scope and purpose of the plan. Library managers have learned over the years that planning processes (whatever their scale) need to be properly managed and carefully

planned. The key tasks involved can be summarized as follows:

- Defining the project.
- Auditing the situation.
- Setting strategic objectives.
- Identifying different strategies.
- Evaluating the alternatives.
- Preparing budget estimates.
- Formulating the plan.
- Initiating action programs.
- Monitoring strategy progress.
- Reviewing the plan.

These tasks can be interpreted at various levels. For example, “setting strategic objectives” could include a full review of organizational values, purpose, and functions, and the development of a strategic vision, or it might be confined to determining or just confirming strategic directions and goals for the next year or two. Apart from the crucial first step of defining the task (“planning to plan”), the ordering of tasks is largely a matter of personal (or organizational) choice, so that some people like to start with strategic objectives (including mission and vision), whereas others prefer to begin with situation analysis. The last three tasks move beyond planning to implementation, but often information obtained and insights gained here will prompt revision and rethinking of earlier work, demonstrating that the process needs to be seen as iterative and interactive, rather than linear.

Practical Examples

Academic libraries use a variety of planning models and methods, but some common themes are evident from their websites and documents, such as the use of steering committees, management retreats, facilitated workshops, and focus groups. New Mexico State University Library designed a planning process around five special committees,^[57] whereas the University of Memphis Libraries worked through a Strategic Plan Team and five Goal Teams, with Objective Teams to oversee implementation.^[58]

The University of Queensland Library sees strategic planning as a dynamic activity involving all staff and has used an “appreciative inquiry process” (discover, dream, design, deliver) since 1998.^[59] Curtin Library and Information Service followed the University’s strategic planning framework, based on Kaplan and Norton’s Balanced Scorecard,^[60,61] and the University of Arizona Library works through a team structure using tools and techniques based on the Japanese concept of Hoshin planning to focus on “a few breakthrough goals that are vital to the Library’s success.”^[62]

Textbooks and case studies point to the pitfalls of planning exercises. Common mistakes include: allowing some managers to opt out; assigning responsibilities to committees

rather than individuals; confusing strategic planning with operational planning; constructing overelaborate systems and procedures; generating long lists of unprioritized initiatives; ignoring resource implications and funding issues; and not following through from strategy to action.

STRATEGY DOCUMENTS

Many critics argue that it is not worth bothering with formal plans because they become out-of-date almost as soon as they are written. This view assumes that strategy documents are static entities, but a sensible process makes provision for refining and updating both the plans of an organization and the assumptions on which they are based. Mount Holyoke College Library, Information, and Technology Services explicitly describe their plan as “a continually evolving document whose evolution is very dependent upon feedback from the community.”^[63]

Many academic libraries are actually required to submit some form of plan as part of an institutional planning and budgeting cycle, but in any case there are sound reasons for documenting plans in print or electronically.

1. The process of writing and editing a strategy documents forces people to think through their goals and objectives and serves as a double check on overall consistency, organizational capacity, and other critical issues.
2. Written plans provide a visual medium of communication for both internal and external audiences and make it easier to convey a consistent message to staff and others in different places at different times.
3. A formal record of intended activities provides a vital mechanism for control, enabling regular and ad hoc monitoring of whether specified actions have been carried out and underlying assumptions have proved correct.

The level of detail included in a plan will be influenced by formal requirements, personal preferences, and specific decisions on whether to develop a hierarchy or family of plans presenting successively more detailed elaborations of strategies, actions, and timetables. The plan needs to state what you intend to do and why, how you will do it and when, with enough information on background and resources to convince readers. It is essential to define the scope of the plan, particularly the period covered and the services included (e.g., library services only or library, IT, and educational media provision). It is desirable to provide a contents list and an executive summary if the document runs to more than five pages.

Contemporary academic library planning statements vary significantly in length, format, and contents. The trend is toward more concise documents, covering shorter

time spans, with a sharper focus on intended results. Lengthy descriptions of service characteristics have generally been replaced with brief summaries of strategic issues, proposed approaches, and performance indicators. Vision statements have become more prominent, often forming the main narrative section of the plan and sometimes comprising a set of alternative scenarios representing different planning assumptions. Many elements previously included (such as SWOT analyses and statistical data) are now relegated to appendices or excluded altogether.

Practical Examples

Most plans today cover 5–10 pages, although there are a few examples of much longer documents—notably, the plans of Monash, Rutgers, and Syracuse universities, which all contain around 25–30 pages.^[64–66] The first library plans produced in the 1980s ranged from basic typescripts for internal use only to glossy publications made available to all. Many libraries now publish their plans via their websites, often offering several formats (typically, HTML and PDF or Word).

The style of presentation is generally quite simple, but some libraries have been more creative in their use of layout and design: Macquarie University Library makes use of blocks and columns of text in double-page spreads to convey “where we want to be,” “desired outcomes,” and “how we will do it” in relation to teaching partnerships, research partnerships, and community outreach.^[67] Other university libraries have given their plans meaningful titles to reinforce the key messages of their documents (e.g., Rutgers: “A bridge to the future;”^[65] Syracuse: “Targets for transformation;”^[66] and the University of Sheffield: “New worlds of information.”^[68]

More significantly, there is a trend toward using websites to make the planning process more transparent and participative. The strategic planning home page of the University of Arizona Library provides links to extensive documentation, such as the “team charge” and other descriptions of the planning process, in addition to end products from that process (including a 17-page Current Situation Analysis).^[69] The University Libraries at Virginia Tech have a web page devoted to Library Strategic Plan Steps 2000–2001, which lists their Steering Committee and Coordinators and then describes the process, with links to working papers, workshop outputs, and draft plans.^[70] The website for the Syracuse plan provides links to progress reports, invites questions about the plan, and allows library staff to express their interest, suggest an initiative, or submit a report. The introductory part of the plan provides an explanation of the process and a glossary of planning terminology; definitions of terms (such as “mission statement” and “planning themes”) are also repeated at the relevant points in the text.^[66]

In summary, contemporary planning statements generally have three main components:

- An introductory section, which sets the context of the document, covering both the external factors and institutional issues.
- The overall strategy, which states the ambitions of the service, expressed in its vision, mission, values, and goals.
- The forward plan, which lays out the intentions for the period, elaborated as strategies and actions with responsibilities and timescales.

The latter may form a separate document, and additional information may be included as appendices (e.g., the remit and/or membership of the planning team, the results of customer surveys, risk analyses, and contingency plans). The introduction may be prefaced by a foreword (from the director or dean).

KEY ELEMENTS

Irrespective of whether their strategy is formally presented in a single strategic plan or as separate statements, academic libraries typically consider the following areas as part of their planning activities: their mission or purpose; their values and beliefs; their view of the future, expressed in a single vision or multiple scenarios; their directions and goals; their plans for actions and the financial resources required.

Library Missions

Most academic libraries include a formal statement of their fundamental purpose or mission in their strategy documents. The terms “mission” and “purpose” are generally used interchangeably, but some institutions distinguish between purpose as a timeless expression of an organization’s reason for existence and mission as a more time-specific concept relating the enduring purpose to current directions and goals. Others see mission as a comprehensive construct embracing not only purpose and function but also values and culture, so that it covers behavioral aspects as well as business focus. The length and format of such statements also varies from a few lines to several paragraphs or a full page, and academic library examples reflect this full spectrum.

A common model is to begin with a sentence or paragraph summarizing the overall role and then supplement this with a set of bullet points or sentences, highlighting key functions or activities. New Mexico State University Library provides a short statement of this type.^[57] Sheffield uses a longer version, starting with three sentences that relate its mission to that of the university, locate the library

within the institutional structure, and state its leadership role, before listing nine principal objectives or functions.^[68]

Although the purpose of an academic library has not changed fundamentally, the shifts of emphasis from holdings to access, from print to electronic and from mediation to self-service have led to changes in the phrasing of mission statements to reflect more accurately the customer focus and networked environment of contemporary services; thus, the Mission of the University of Washington Libraries refers to “connecting people with knowledge.”^[71] Some libraries have also used their mission statements to differentiate themselves from their peers, by highlighting distinctive aspects—exemplified by Birkbeck College Library’s Mission to “develop and maintain services which especially suit the needs of students who are in employment.”^[72]

Service Values

The production of formal statements of the beliefs or principles that underpin organizational or professional philosophies has become more common over the past decade, and this is reflected in the prominence given to values in current academic library plans. Values statements can be seen as a part of the framework that guides discretionary decision making, along with vision and direction statements. Such statements can be particularly useful at times of rapid change as a means of reassuring people that underlying values remain constant when other things are altering radically. Values statements can also be used to support cultural change by asserting new values seen as critical to success in the future (in conjunction with old ones).

Values statements in library plans typically take the form of a set of words or phrases as headlines, which are then elaborated in a longer phrase or sentence. Libraries have traditionally concentrated on values associated with our professional mission, such as the preservation of our cultural heritage, promotion of information literacy, and protection of intellectual freedom, but they have often also incorporated into their statements references to more general humanistic values, such as democracy, diversity, equity, integrity, literacy, and privacy. Contemporary examples still reflect these important concerns but tend to give more prominence to modes of working and styles of delivery thought necessary for success in the changing environment around us, notably collaboration and partnership, flexibility and responsiveness, initiative and innovation.

Formulating a values statement is a challenging task as the final choice of concepts selected for emphasis inevitably raises questions about points considered but not included in the end product. However, most libraries restrict their statements to around half a page, accepting that it is hard to make key messages stand out in a lengthier presentation. The statement of the University of Western Australia Library is a typical example, built around the

values of responsiveness, innovation, collaboration, and commitment to quality.^[73] In contrast to American and Australian practice, few British academic libraries include values statements in their strategy documents.

Strategic Visioning

Visioning is now a frequent activity in all types of organizations, as an integral part of strategic planning and management, particularly associated with radical organizational change. Visioning exercises and vision statements are seen as an effective way to capture ideas about the future and to communicate the scale of the transformation envisaged to stakeholders. The content and length of vision statements vary, but most commentators agree that visions need to be both aspirational and inspirational, which means that style and tone are critical factors. Visioning has connotations of a “best,” “desirable,” or “ideal” future, but there has been a noticeable shift recently from “soft” statements to harder, more realistic, and specific descriptions that contain “actionable” concepts or components. The challenge is to manage the inherent tension between ambition and capability by striking the right balance between idealism and realism.

Library vision statements are mostly around one or two pages long, but published examples range from a few paragraphs to several pages. Purdue University Libraries have used visioning to plan shorter-term changes and also for team building at branch or department level.^[50] At the other end of the scale, SCONUL has conducted two visioning exercises to produce a shared national view of academic information services in the future, which have provided guidance and stimulus to members developing their institutional strategies and plans, as well as supporting the work of SCONUL in dealing with other bodies. The resulting statements (which also include planning assumptions) have been used as reference documents, lobbying materials, educational aids, and communication tools at local, regional, national, and international levels.^[74,75]

Edinburgh University Library exemplifies the trend toward more realistic and specific vision statements that emphasize capability and actionability. Its strategic vision runs to two pages and contains six key messages, each supported by one or two paragraphs explaining the situation envisaged in more detail. This vision also gains immediacy and power by using the present tense to describe the future.^[76] Other academic libraries have chosen to present their visions much more succinctly in a short paragraph or even just a single sentence. Short statements run the risk of blandness and require careful drafting (and redrafting) to ensure that they have real meaning and sufficient focus to distinguish the service from its peers. The University of Washington Libraries have succeeded in outlining several dimensions of their service in only three sentences: “The University of Washington Libraries will anticipate and meet the needs of our communities in their search for

knowledge. We will do this at any time and any place. We will use our extraordinary staff and our world-class portal to resources and services in creating a model information literature community.”^[71]

In a slightly longer statement, the Virginia Tech Libraries concentrate on only two key aspects—collaborative partnership and support in any location—preferring instead to emphasize the library’s task as supporting the business of the university:

We will be collaborative partners with members of the university community as we collectively work to position the university as a top-tier research institution. Wherever they are located, members of the Virginia Tech community will be supported by the library as they engage in research, as they share in quality learning experiences at the undergraduate and graduate levels, and as they work in transferring knowledge and expertise between the university and society.^[77]

Macquarie University Library similarly promotes the aspiration of success through partnership in a very short “vision”: “To be an indispensable partner in the provision of quality education and research at Macquarie University.”^[67]

Shorter forms of vision statements such as the above are often referred to more accurately as “positioning statements” or statements of “strategic intent,” particularly when they are used alongside longer descriptions of an organization’s desired future.

Scenario Development

Scenarios are simplified descriptions of multiple futures—alternative visions—and are particularly useful when there is concern about the uncertainty of critical planning assumptions. Scenario development involves identifying a range of possible outcomes for key environmental influences and then selecting combinations of these alternative states to articulate different but plausible futures. Properly done, it combines environmental scanning with strategic visioning, using both facts and perceptions—hard and soft inputs—to illuminate the dynamics, cross-impacts, and cause-and-effect relationships of external and internal forces potentially affecting an organization. The scale and pace of change over the last decade has led to renewed interest in scenario development and new publications on the subject, which have been cited and used by library managers.^{[30][78,79]}

Scenarios are often used to convey the impact and implications of technology on organizations, and this has been a common theme in library scenarios. In 1984, ARL designed four scenarios to use in planning library staff needs for the next decade.^[80] In 1996, to stimulate thinking about a future network-based scholarly communication system, Peters similarly formulated four scenarios written from the perspective of higher education institutions and their libraries: “Another marketplace for global

enterprise”; “Mass customisation for and by individuals”; “Knowledge guilds reign supreme;” and “Ivory towers in cyberspace.”^[81]

Another common use is the production of “resource scenarios” to illustrate the implications of budget adjustments (usually cuts) for organizations. For example, Shapiro describes how administrators at Michigan State University were asked to prepare three brief scenarios showing how their unit would look if its base budget were reduced by 5, 10, 15%.^[82] More positively, Dewey refers to a request for the University of Iowa Libraries to add three scenarios to their plan, showing what they could accomplish with a 15% increase, 5% increase, and 5% decrease in their budget.^[3]

Scenarios (like visions) can be used at various levels (e.g., the organization as a whole, a particular department, or a specific project) and for a variety of purposes. They have proved popular and effective in library space planning, enabling more dramatic presentation of the potential impact of a new building on the local learning environment than a conventional proposal. At Reading University Library, alternative scenarios were successfully used in 1997 to communicate the different service implications of building an extension and remodeling existing space.^[54] Significantly, the second scenario was not intended to be a “doomsday” vision: it represented a genuine attempt to remodel existing accommodation to meet future needs, but its logic showed the spiraling knock-on effects of space constraints.^[83] In 1998, a more structured approach to scenario development was used at the University’s Bulmershe Library, in a highly participative exercise involving a wide range of stakeholders.^[55]

At the University of Arizona Library, the Branches Libraries Space Planning Team developed four divergent scenarios—“Book truckin,” “Tomorrowland,” “Full stop,” and “Future on the cheap”—which were summarized as bullet points on a matrix diagram and then described in more detail with current situational abstracts for each one.^[84] Staff used a 12-step methodology adapted from established models, covering the whole planning process from identifying the critical decision issue to producing a facilities master plan.^[85]

Other organizations have developed scenarios for strategic plans or reports purely as illustrative material showing how the same future might look from different perspectives (rather than describing different futures based on varying interpretations of the environment). For example, in 1993 the Follett report offered three “sketches” to illustrate some of the possibilities opened up by the technology of the “virtual library,” written from the perspectives of an undergraduate, an academic, and a “virtual librarian.”^[86] Similarly, Rutgers included five “Scenarios of the future” in their 1999 plan explaining how a professor, an undergraduate, a graduate student, and researchers might find and locate information resources if the proposed Digital Library Initiative became a reality.^[65]

Examples of this type are more accurately described as “sketches” or “scenes” (rather than “scenarios”) in the context of strategic planning.

Goal Statements

Strategic goals (also known as strategic objectives) are direction statements that indicate the movement or improvement needed to achieve the desired future state (as expressed in the vision). Effective goals are expressed in action-oriented terms that are capable of conversion into specific targets enabling managers to plan tasks and measure performance. Libraries usually group their goals/objectives and targets under broad headings, variously described as “strategic directions,” “strategic issues,” “strategic priorities,” or “strategic thrusts”; “key action areas,” “key performance areas,” or “key result areas”; “planning imperatives” or “planning themes.” For example, Purdue’s *Plan 2004: A Framework for Action* groups its goals under four strategic directions: The Learning Library, Scholarly Communication, User-Centered Services, and Infrastructure.^[87]

Alternatively, people sometimes just use the term “goal” to denote broad areas that provide a framework for organizing initiatives and actions in groups that have some coherence but not necessarily reflecting day-to-day organizational boundaries. The goal translation process, whereby each top-level “goal,” “objective,” or “strategy” is converted from a general statement of what you want to achieve to a more specific description of how it will be done, is the key to successful strategy implementation. Moreover, this “what/how” translation process needs to take place at successive levels in the organization, so that institutional goals are converted into library goals and high-level librarywide goals are translated into lower-level goals for library sites or teams.

The University of Sydney Library offers two views of the relationship between University Goals and Library Strategies by ordering things differently in its 5-yr Strategic Plan and annual Key Results document. In the former, Library Strategies are grouped as a bullet-point listing under each major University Goal; in the latter, the Strategies (together with details of Actions, Resources, Responsibility, Target Dates, and Performance Indicators) are grouped under 10 Key Result statements, with one or more Associated University Goals listed under each Key Result area. In this way, the library not only shows how it proposes to support each university goal but also explains how the actions taken in a particular year relate to those goals.^[88]

Goals specify the key directions for an organization or service over the planning period, but they cannot be finally confirmed until strategies have been properly developed to the point where the resource implications and organizational dependencies of the actions required can be assessed. Strategy development needs both analytical and creative inputs; many libraries have found it useful to follow a

systematic process. For example, the six-step STRIDE model takes planners through a series of questions:

- Situation: What is the current position of the service, product(s), or facilities?
- Targets: What is the overall goal and what are the intermediate objective(s) or milestone(s)?
- Restraints: Are there constraints on progress, such as policies or resources?
- Insights: What information and ideas are needed for a workable strategy?
- Delivery: What exactly needs to be done, by whom, and when?
- Evaluation: How will success be judged and performance measured?^[26]

Action Planning

It is debatable how far strategic plans should be developed into action plans, and there is significant variation in practice, with some organizations expressing their strategies in rather general terms, whereas others include quite specific objectives (with numbers attached). There are trends in both directions, with many managers favoring broad-brush statements to give them some flexibility if circumstances change suddenly, but also more organizations requiring identifiable outcomes and making managers formally accountable for the results specified in their plans.

The plan of the University of Washington Libraries is an example of the former type: each Key Action Area is defined by four or five sentences indicating some of the underlying issues, but any statements of intent are at a very general level.^[71] Plans of this type, where there are few measurable outcomes specified, could more accurately be described as policy statements in this context. Others state explicitly in the introductory sections of their strategic plans that action planning is separately documented; thus, Sheffield states that “the Library compiles annual Operational Objectives on a rolling three-year basis to enable the plan to be implemented effectively.”^[68]

There is considerable variation in the detail provided in strategic action plans, ranging from simple lists showing completion dates and persons responsible against the required tasks or desired results to elaborate formulations of initiatives and actions incorporating priority rankings and status reports as well as showing the people involved and the planned timetable. The plan of Birkbeck College Library is at one end of the spectrum, with sets of one-line actions, responsible people, and target dates grouped under eight headings.^[72] At the other extreme, for each of its 17 goals, Syracuse University Library provides information on their priority and feasibility (ranked as high/medium/low), the rationale, success indicators, and specific initiatives, and then details the project manager, action team leader, start date, and timescale (short/mid/

long-range) for each initiative. Further details are recorded in Action Plan Progress Reports, including action team members, actions to date, modifications to the plan and/or team, obstacles or barriers to progress, and timetable for completion.^[66]

It is clear that many academic libraries have learned from experience that if they do not develop tightly specified action plans to support their strategies, the desired service developments will just not happen, because of the continuing pressure of day-to-day service delivery. Managers also need to think about the extent to which their plans depend on actions and resources from other parts of the organization and take that into account in their planning. Irrespective of whether action plans are included in the strategy document, action planning needs to be seen as part of the planning process.

Financial Commentary

There is evidently much pressure on academic libraries to identify outcomes and justify expenditure, so it is quite surprising that resourcing and funding issues do not feature more prominently in their strategic plans. Although managers may regard budget reports and projections as confidential or sensitive information, some mention at least of the financial implications or feasibility of their strategies might be expected. Some libraries have at least flagged resourcing as an issue, albeit in fairly general terms. For example, Sheffield draws attention to “the declining purchasing power of its present budget” in the introduction to its plan and also has a specific section on resources reinforcing this point after reference to other funding issues.^[68]

Others make explicit statements about the funding required to implement their strategies comprehensively. In the Memphis plan, the objectives listed under each major goal are subdivided into those “that can be met with existing resources” and those “that require new/additional resources beyond what the unit is able to generate through restructuring and internal reallocation.”^[58] The Rutgers plan has a substantial appendix entitled “Budgetary Overview,” which sets the goal of parity with the top quartile of AAU universities (in line with institutional aims) and outlines several funding strategies.^[65] Edinburgh gives even more prominence to expenditure requirements and income streams, placing “Funding” and “Cost Recovery and Income Generation” first and second of its eight strategic goals, setting targets under both headings and similarly proposing benchmarking against comparators.^[76]

CONCLUSION

Strategic planning in academic libraries has evolved over the past three decades from a management concept to established practice. Planning frameworks and strategy

processes in higher education have grown in line with administrative changes and external demands. Convergence of library and computing services is taking place at several levels (operational, tactical/developmental, and strategic), and this is reflected in the changing scope of library and information service plans and the development of comprehensive information strategies.

The proliferation of strategies is shifting the focus of attention from the production and implementation of plans to the linking and integration of a “strategy web.” Academic libraries have generally seen their strategic plans as both supporting and influencing the higher-level strategies of the institution, but libraries that seize the opportunities offered by creative partnerships to develop joined-up (or joint) plans with related services may see this balance alter and their influence increase. Strategic planning has served us well in the past, and if we continue to adapt and refine our systems and processes, it will help us to create a better future.

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Students' Information: Needs and Behavior

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Abstract

Students' information behavior is affected by their physical and cognitive developmental stage. Current students are widely understood to be experienced and confident in using online information and communication technologies, although their skill levels commonly are considered to be insufficient. Significant opportunity exists to develop more sophisticated searching skills, as well as ability to critically evaluate information. Information literacy instruction is key to developing these skills. Library use mostly occurs virtually, for both on campus and distance students, and students strongly prefer information available online in full text.

INTRODUCTION

This entry describes current understanding of students' information needs and behavior, based on recent research in library and information science. Students are defined as people at secondary and postsecondary school age (including high school, college, and university students); young children are therefore not included. In addition, students are not necessarily homogeneous in their age groupings. For purposes of this entry, student age groups are assumed to be generally homogeneous; that is, high school students are assumed to be in their mid to late adolescence (e.g., 15–18 years of age), undergraduates or college students are assumed to be in late adolescence and early adulthood (e.g., 18–23 years of age), and graduate students are in early adulthood (e.g., 21–25 years old).

In addition, this entry focuses on young people in their role as students, rather than in any other everyday life role (e.g., employee, family member, leisure group member); the context of interest is the school or academic context. It is important to keep in mind, however, that often these life roles intermingle, so clear separation of information behavior in terms of the student role may not always be differentiated clearly from a person's role as a friend or family member. Information behavior is defined broadly and holistically as including cognitive, behavioral, and affective aspects of active and passive information seeking and information use. The entry makes generalizations about students' information behavior. Clearly, some students will not think and behave in ways that are typical for their age group.

DEVELOPMENTAL CHARACTERISTICS

Because the group of people under consideration in this entry are mid- to late adolescents and young adults,

developmental issues are relevant to understanding their information behavior. Students are in the process of developing their reasoning skills; some are able to think more abstractly, logically, and rationally than others. Some are able to consider multiple possibilities and consider the world hypothetically. The ability to “think about thinking” or to think “meta-cognitively” is also developmental; students will have varying abilities to reflect on their feelings, and their thinking. These abilities typically improve as students grow older. Biologically, the brain's frontal lobe development is not complete until people are in their 20s; this part of the brain is responsible for planning and judgment. Thus, age-related physical development also will affect information behaviors.

Developmental approaches to cognition recognize that thinking develops from a stage where relying on received authority is typical, to more active meaning-making and conscious decision-making among many possible alternatives. Implications for information behavior may include passive acceptance of online information as inherently authoritative at earlier cognitive stages, with increased ability for critical evaluative analysis of information at later stages. Therefore, high school students may uncritically rely on information found on the open web through general search engines to a greater degree than more experienced, and developmentally more mature, graduate students. It is also commonly accepted that as people develop they become more cognitively flexible and reflective. These changes may lead older students to greater openness toward new information, and motivate more active information searching, as well as reflection about the credibility and value of information that is found. It is quite possible that a wide range of cognitive ability and flexibility, tendency toward reflection, and epistemological orientation will exist among any group of high school or postsecondary students, making it unwise to draw strict conclusions about cognitive developmental stage.

However, it is prudent to recognize that among students as a group a wide range of cognitive characteristics will exist, including thinking that is not as advanced developmentally as many adults' thinking. And, ability to think and plan will necessarily and profoundly affect information behavior.^[1]

THE NET GENERATION

Currently, it is widely recognized that most students in North America belong to a generation variously labeled as the "net" generation, or as "millennial" generation. While this label undoubtedly generalizes, an understanding of how it may describe many students can be helpful in developing appropriate information services for this user group. The "net" generation label connotes a number of attributes, many of which relate directly to information behavior. Most basically, the vast majority of students use the Internet regularly, and the majority report that they access the Internet in their school setting, in addition to home or other access.^[2] In the United States, as of 2014, 97% of 18–29-year-old people used the Internet; the largest proportions are white and urban or suburban, and enjoy higher-income levels.^[3] Net generation students are flexible with respect to media format; they are open to seeking and receiving information in a variety of formats, although they express a clear preference for electronic formats, such as the Internet, the web, and cell phone technology. Instant messaging is preferred over email, and multimedia social computing software such as Facebook is very popular. There is significant confidence in using electronic technologies, although for complex information searching situations, there may be a large gap between confidence and actual skill level. Indeed, testing for search skills and ability to evaluate credibility of information reveals these gaps and is generating widespread concern about general skill levels among student populations. This concern relates to students' actual ability to locate and evaluate information appropriate for academic purposes, but also relates to information sought and used for personal decision-making (e.g., for sexual health). Students' weaknesses when judging credibility may relate to a drop in respect for authority, perceived by some observers, along with increased emphasis on social computing and democratic principles of collective effort, so that "authority" of information may be less important for this generation than was the case for older generations. The well-known popularity of democratic information sources such as Wikipedia is a good example.

Another common trait among the net generation is little tolerance for print formats, which may be viewed as old-fashioned, unwieldy, and too slow; timely information retrieval is of the essence. There is also a preference for multimedia, so there is a predilection for information contextualized by music and images. These students are

purported to be skilled multitaskers, apparently able to simultaneously attend to multiple sources of information; whether that is truly the case is uncertain. Their preferred learning style is experiential, so that active and enjoyable and entertaining methods of learning are favored over reading print or listening to lecture material alone. An inclination for collaborative learning also affects information behavior, increasing a focus on group information sharing. Speed and convenience, as well as habitual use of the web for information seeking in general, are key variables in information source preference. Thus, quick, and very possibly relatively ineffective, general web searches (e.g., using Google) often suffice to provide information for many purposes, including school assignments. Libraries and librarians may be viewed as associated with a dated institution, and there is often little understanding that academic databases used to complete assignments are likely provided by libraries rather than simply existing on the open web.

This set of generational characteristics presents a multitude of challenges for information service providers, in terms of meeting expectations and preferences for information format, and in communicating with students whose learning styles and communication preferences differ substantially from those of service providers who identify with an older generation.

INFORMATION SEARCHING BEHAVIOR

Information searching specifically means the active, typically online, searching for information that students do as they seek to fulfill assignment requirements. One of the most influential theories of information searching by students, which is user-centered and has proven to be very robust, is the Information Search Process (ISP), developed by Carol Kuhlthau.^[4] The ISP is based on the principle of uncertainty and assumes that students search for information in order to make meaning. The ISP describes information searching along three continuums: thoughts, feelings, and actions; thus, it is holistic in its approach and is particularly noted for including affect or emotion as integral to information behavior. According to the ISP, students progress relatively predictably through a series of stages in their information searching, beginning with initiation, moving to selection, exploration, formulation, collection, and presentation. Each of these stages is characterized by affective experiences (such as relative anxiety or confidence), thoughts (e.g., vague or interested), and physical actions. Each stage is associated with a particular goal related to the ISP, and specific tasks related to achieving that goal. Understanding where a particular student might be on this continuum can help information services providers to give assistance appropriate to the stage. In addition, when students themselves understand that information searching is a process, and that their feelings and

experiences are shared by others, anxiety can be reduced and search effectiveness can be improved.

Like most searchers, students' searching behavior is constrained by time limits (especially when meeting assignment deadlines) and information overload. Many students make choices about what information to use based on expedience, or convenience, which is a "satisficing"^[5] approach. Convenience supersedes quality as a criterion for information source selection. Timeliness is a key factor for information selection; students prefer information that can be found quickly. One result is that when quickly identified information is found, searching may be brought to a premature close, with the result that better quality, more detailed, or more topically relevant information may not be found. This focus on convenience, including time-savings, ease of access, and ease of use, can be explained by gratification theory and rational choice theory.^[6] Students primarily focus on the product of their information seeking, rather than the process.^[7] However, students can be taught to consider information seeking as a process and to appreciate the skill set (information literacy) involved in information seeking. Unfortunately, students who demonstrate relatively low levels of information literacy tend to overestimate their information literacy expertise.^[8] Research across many institutions, with students of a wide age range and who are studying in a variety of disciplines, consistently demonstrates that students generally are challenged by selecting appropriate databases, constructing effective search strategies, and evaluating information found. Search strategies are often ad hoc and incoherent, and identifying keywords and terms is a significant challenge.^[9] There also is a tendency to believe that all online information is equally valuable. More sophisticated searching is observed from students with greater domain knowledge; thus, students who are more experienced with subject content (e.g., graduate students) will be more sophisticated searchers than novices. Improved searching skills demonstrated by more senior students also results from greater experience and from more information literacy skills training. In general, the open web is much preferred over formal online sources such as databases or specialized portals. Google is the most used Internet search engine and is favored because it is perceived as easy to use. In addition, many students use it out of habit because it is the search engine of choice for personal information needs. Naturally, that habit develops because these users experience success; that is, they find information that, in their judgment, satisfies their needs. Other search engines, such as Yahoo!, are used far less frequently than Google, and library catalogs are used very little, even for school assignments. Wikipedia is often used at the beginning of the search process to locate background or summary information; students like Wikipedia for its coverage, currency, comprehensibility, and convenience.^[10] Students with relatively low information skills tend to have learned their skills from friends and family.

Students who can demonstrate higher skill levels have often learned these skills from professionals such as teachers and librarians. Interestingly, many students view information literacy skills as relatively easy to acquire and prefer to learn this skill set from other people rather than an online training tool.^[7]

Students experience information overload and are frustrated by the challenges of starting information searches. They are also frustrated by the need to sift through unwanted search results, including outdated information. Students also are often confused by library classification practices and by unusual information sources, such as statistics. Students often lack the context needed to conduct efficient and effective searches, such as understanding appropriate steps in a search for academic information, understanding terminology and key terms for an unfamiliar topic, and setting boundaries on a search. Wikipedia can be helpful to address these specific issues.^[11] Students often turn first to course readings and materials, but they also appreciate the databases provided by libraries, even if the range of databases searched is narrow. However, students tend not to make use of the expertise and support that librarians can provide.^[12]

Among the personality characteristics that affect approach to searching behavior is self-efficacy or the belief that one can achieve one's goals. Self-efficacy is related to confidence, but is a distinct trait that is open to development. When students feel self-efficacy about their searching skills, or even computer use in general, they are more likely to explore unfamiliar territory and to search more deeply. Self-efficacy also has been positively correlated with library use.^[13] A range of other personality characteristics, such as extroversion, neuroticism, and level of engagement (motivation), have been found to affect searching behavior, but the practical implications of this understanding for information providers are not yet clear. For example, the depth with which information searching occurs may be related more to personality than to discipline of study.^[14] Other individual differences, such as gender and cognitive style, may be relevant to searching effectiveness.^[15] External factors such as group dynamics may also affect information seeking as young persons are often significantly influenced by their peers.

LIBRARY USE

In the student role, young people frequently are expected by their instructors to make use of libraries for research. Even if libraries are significantly less preferred than the web, and even when students do not realize that access to proprietary databases is provided as a library service, libraries do play a role in students' information behavior. For most students in most educational settings, little use is made of in-person reference services and virtual reference services are not popular, although students prefer online

chat over other forms of reference service.^[16] In addition, because most students prefer to use online information sources, in-person searching for information, and use of print materials are significantly less important for this user group. Efficiency and predictability are the principles guiding students' academic research.^[17] Most freshmen are challenged by searching academic library portals, with reading scholarly materials, and with effective database searching and library use in general.^[18] Indeed, many students actively avoid using the library as a physical space for information searching, although that space may be sought out for studying or socializing purposes. Many students also actively avoid consulting library staff because staff expertise is not well understood and sometimes because of negative experiences with library staff who lack understanding of the developmental and affective aspects of information seeking. Library anxiety is a phenomenon affecting many students; they are intimidated by the library and lack confidence in their ability to successfully negotiate its intricate and complex systems. Library anxiety is also characterized by a fear of asking for help. International students with additional language barriers may be particularly affected by library anxiety. Interestingly, and for unknown reasons, African-American graduate students appear to experience less library anxiety than do their white peers; differences among different student groups have not been fully explored, however.^[19] Students are largely unaware of the materials and services that libraries offer; for example, they often do not know that libraries can provide access to databases containing information directly relevant to school assignments. This points to a significant need for greater assistance to students, online and in person, as well as more training opportunities (see section "Information Literacy").

Attempts to increase library use, or at least help students to appreciate library services, such as knowing about licensed online databases, requires a marketing orientation informed by understanding students as a user group (see "Net Generation"). There are some libraries that are central to the information seeking of their students, and the research literature does provide examples where library staff have worked closely with teachers to meet students' needs effectively. In particular, when library websites can meet students' preferences for convenient, effective access to quality online information, those libraries are valued by their student users. One of the challenges facing students who use library websites is the jargon that is understood by librarians but not by users. Another challenge is that, due to students' emphasis on convenience, full-text information is greatly preferred over information that must be located via a multiple-step process (e.g., locating print sources on the basis of citations). Thus, information that is not made available online in full text may be underused or never used at all.

INFORMATION LITERACY

Information research requires a skill set commonly referred to as "information literacy." These skills include the ability to recognize information needs, to efficiently and effectively search for information required, and to use information ethically (e.g., to avoid plagiarism and to cite references appropriately). Information literacy includes cognitive understandings (e.g., understanding Boolean logic), behavioral skills (e.g., keyboarding), affective attributes (e.g., confidence to use databases), and attitudes such as respect for intellectual property. Relational models of information literacy emphasize information literacy as a process and as knowledge-building. Whether conceived a list of skills or as a more complex set of concepts, there is little disagreement about the need to develop information literacy. As a group, students particularly require information literacy skills to conduct the research required to complete assignments. These skills are not innate, nor are they developed through experience alone. Explicit instruction is required in order to learn sophisticated, efficient, and effective skills to find and evaluate information. There is ample evidence that teaching information literacy skills results in increased skill level, increased confidence in using libraries and in information seeking, improvements to learning outcomes, and increased program retention rates. Indeed, college students who have graduated from high schools with librarians and library programs perform significantly better in their academics at the postsecondary level. In addition, students are able to apply information literacy skills learned in a library context to other areas of their lives, improving their information search and evaluation skills for information seeking and decision-making in personal situations.

There is disparity in the training that students receive at the high school level. Training opportunities at the postsecondary level vary as well. At some educational institutions, mandatory information literacy skills training ensures minimal exposure to search skills and critical evaluation skills. However, many colleges and universities do not require information literacy training for students. Most institutions offer some training opportunities, however. These range from introductory orientations and library tours, to 1-hour focused workshops, to course-integrated workshops. Logical sequences of skills training opportunities also are available at many institutions, while others offer elective credit-bearing information literacy courses. Because of this diversity of opportunity, many students receive little or no formal training in information literacy skills. In addition, many students do not feel confident to ask for help in person, or by other means, often because they are concerned about appearing stupid. If students enter a physical library, they often receive informal at-need specific instruction if they ask library staff for help. This may take the form of quick database searching tips, for instance. In addition, libraries typically provide

online information literacy skills training through their websites. This ranges from online “pathfinders” to interactive tutorials focusing on how to search particular databases or skill sets (e.g., how to avoid plagiarism or how to accurately cite source material). A minority of students receive training in how to use the Internet, which is the most significant information source for this user group.

Teaching methods appropriate to students will vary with the specific group, but high school students may be particularly motivated by methods that incorporate contemporary themes and pop culture references. In addition, active learning methods, such as hands-on instruction in a laboratory environment, are generally more effective than more passive methods, such as lecturing. Information literacy skills are best taught in a context of close collaboration between librarians and teachers or faculty, within the context of the curriculum. Thus, the timing of development of specific skills correlates with what students are learning and with the assignments they are working on. Students learning within a problem-based curriculum, as is often the case in health-related disciplines, tend to develop more sophisticated information literacy skills because these skills are critical to find the research- or evidence-based information for successful learning.

Despite the apparent need to develop information literacy among students, significant barriers exist for librarians who wish to undertake this work. These barriers include negative or ambivalent student attitudes toward libraries and lack of understanding of librarians' expertise. Institutional barriers such as complex librarian-faculty relationships, which hinder collaboration on information literacy initiatives, ambivalence on the part of library administrators, and lack of funding for staff and teaching resources, are also challenging. In addition, some librarians are uncomfortable with the teaching role, and many librarians who are tasked with providing information literacy instruction are relatively unprepared for that work.

SPECIFIC STUDENT GROUPS

Some differences in information behavior are discernable between different subgroups of students. It has already been noted that search skills and ability to critically evaluate information appears to improve over time, so older students (e.g., graduate students) are likely to be more efficient and successful information searchers than high school students. In part, this is due to increased domain knowledge as disciplinary specialization deepens, but is undoubtedly also due to biological maturation. As the brain reaches developmental maturity, judgment and planning ability improve.

Disciplinary differences among students are not as sharp as those observed among different disciplinary groupings of scholars and scientists; students in different disciplines behave far more alike than they do differently.

Standard conceptions about the preferences by humanities scholars for browsing, for instance, are not necessarily applicable to students studying in those disciplines, particularly at the undergraduate level. This is the case despite the strong influence of educators, who presumably are disciplinary experts, on the information-seeking behaviors of their students (especially in recommending specific databases). Thus, the typical behaviors described earlier apply to students across areas of study. One analysis of students grouped by broad disciplinary characteristics found that undergraduates in “soft,” “pure,” and “life” disciplines are more active information seekers than their peers in “hard,” “applied,” and “nonlife” disciplines. “Hard” disciplines included engineering and physical sciences, while the “soft” label was applied to humanities and social sciences. “Pure” referred to physical sciences, humanities, and social sciences, while engineering, business, and education were considered to be “applied.” Social sciences and education were considered to be “life” disciplines; the others were labeled “nonlife.”^[20] At best, these kinds of differences suggest that focusing library and instructional services on those students who are the least active information seekers might increase their information searching activity. However, curricular imperatives, assignment structures, and instructor expectations will all play significant roles in mediating students' information behavior.

Some groups of students encounter additional barriers to their information seeking. International students are a group worthy of special attention by information services providers. Language and cultural barriers often combine to make information searching and library use particularly challenging for these students, and database searching can be especially difficult for students whose first language is not English.^[21] Library anxiety may be especially acute, and lack of confidence may stand in the way of seeking much needed help. In addition, unfamiliar and complex library systems and organization, including confusing library jargon and alien physical arrangements such as open stacks, may increase anxiety. There is little doubt that providing focused information literacy and library use instruction for international students is critical to ensure effective information access. In addition, African-American students may face barriers due to actual or perceived impacts of racism because many academic libraries are largely white (majority) environments.^[22]

CONCLUSIONS

As a user group, today's students present information service providers with a variety of opportunities and challenges. Students' information-seeking habits in their academic contexts appear to be less rational and are less effective than information experts would like. Partly motivated by developmental stage, and partly by their unique

experiences as the “net” generation, students are focused on finding full-text online information as conveniently and quickly as possible. Sophisticated search strategies, critical evaluation of information, and appreciation for intellectual property are skills and attitudes that require development. Information literacy instruction is critical if students in general are to become skilled information seekers and ethical information users. Experience using computers and general web search engines is insufficient. More likely, experience engenders confidence, which is unmatched by demonstrable skill. This situation provides librarians with significant opportunity to reimagine their services and to fill an important instructional role. Librarians alone have the expertise required to guide students to sophisticated information-seeking strategies. Students have much to gain from that expertise. The challenge will be to meet these opportunities with conviction, resources, and a clear understanding of the preferences and habits of this user group.

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Subject Cataloging Principles and Systems

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Abstract

After an introduction that addresses the means people use to search for information, this entry articulates the principles underlying various subject access options, including both controlled vocabulary systems and classification. It begins with a brief history of subject access provisions, including an account of the impact of automation, and goes on to discuss in some detail the principles underlying American library practice in respect to subject access. It then, briefly, describes selected subject-access schemes (including both subject heading lists and classification systems) in terms of how they reflect the principles presented, and how well they fulfill their stated functions.

INTRODUCTION

Ever since libraries have existed, those in charge of them have tried to make it possible for the people who use them to select and retrieve from their collections items that are relevant to their queries. Apparently, this was true even over 2000 years ago, for the hundreds of thousands of papyrus scrolls in the ancient Alexandrian library—although no index still exists.^[1] As of this writing, October 2008, there is much discussion in the library profession about whether traditional thinking about subject access is still relevant to existing conditions. This entry takes the position that it is, that subject cataloging—a term that embraces both subject heading assignment and classification—may even play an increasingly significant role in the information retrieval world of the future.

APPROACHES TO SEARCHING

For many years now, there have been three approaches to searching by subject: through controlled vocabulary, through full-text or keywords, and, less so than the others, through classification.

Controlled Vocabulary Searching

Controlled vocabulary searches are usually made on library catalogs and indexes consisting of document surrogates (*document surrogates* is the current terminological usage for what have traditionally been called bibliographic or catalog records and, more recently, metadata records). Controlled vocabulary access depends on two circumstances: 1) the existence of a controlled vocabulary,

i.e., a list of preferred terms—called a subject heading list or thesaurus—of which *Library of Congress Subject Headings* (LCSH)^[2] is the best known in the English-speaking world; and 2) the assignment of terms from the list to the documents in a collection or database. (Assigning subject terms to documents is called subject indexing or subject cataloging.) In library classification, the counterpart to subject indexing from a term list, the same requirements prevail: the existence of a classification scheme (such as the *Library of Congress Classification* [LCC]^[3] or the *Dewey Decimal Classification* [DDC]),^[4] and the assignment of class numbers from the chosen scheme to documents. “Numbers” is used here to reflect common usage in respect to classification-based notation. Notation used for extant classification systems varies from one scheme to another: DDC’s notation is almost fully numerical; LCC’s is alpha-numerical; and both the Colon Classification (CC) and the Universal Decimal Classification (UDC) include punctuation marks in their notation.

In controlled vocabulary or classification number searching, users input query terms or class numbers, and the system delivers material tagged with those terms or numbers. The fact that the term *subject cataloging* is sometimes used for both subject heading and classification number assignment reflects the parallelism between the two operations.

Controlled vocabulary lists

In a controlled vocabulary list, one term among synonyms is chosen as the preferred term (called subject heading or descriptor): the others are included in the list as lead-in terms with SEE or USE references that direct searchers to the preferred term. Other cross-references are given under

the preferred term, directing users to broader, narrower, and related terms. Such sets of references, with their associated preferred terms, are referred to as a list's *reference structure*, and are an essential part of controlled vocabulary lists. A controlled vocabulary search delivers a high proportion of material in the database searched that pertains to the topic indicated by a user's query term, and reports very little else. A means of searching that is akin to controlled vocabulary searching is searching by assigned classification numbers. The numbers representing class positions in a classification scheme can also be considered controlled, in the sense that much thought has gone into both designing the scheme and assigning the numbers to documents.

Authority control

An important point regarding controlled vocabulary lists is that, for each preferred term, a record must be created that shows what preferred-term decisions were made, what the bases for such decisions were, and what cross-references are associated with the term. Such a record is called a subject authority record, and a collected set of all authority records is called a subject authority file. System managers try to keep such files meticulously up to date because authority records are essential to the management of any controlled vocabulary system, whatever its venue or setting.

Keyword and Full-Text Searching

Keyword or full-text searching is most commonly done through the Internet, with its vast, hardly imaginable, store of resources. In keyword searching, users submit query terms that are then matched against the full texts of items in the database of the system offering the search service used. One advantage of keyword searching is that information is retrieved on the authors' own words, which often reflect the most current terminology in a particular subject field. Others are that keyword searching is fast and easy, and many are satisfied with its search results. A major drawback, however, is that if searchers want to retrieve all information, or as much information as possible, on a given subject, they must search on all the synonyms for that subject. A second problem is that most keyword searches pull up an overwhelming number of items. In the interests of improved efficiency and effectiveness, therefore, many search services have taken to partitioning their databases. There are now several Googles, for instance, including Google Earth, Google Travel, and Google Scholar.^[5]

Searching by Classification Numbers

The last subject-search practice to be discussed is classification. For generations, people roamed library stacks to

find material of interest. When they found something promising, they often found neighboring materials of interest as well. This is because traditional classification schemes group similar materials together and arrange them hierarchically.

Shelf browsing may be losing its attraction as people turn more and more to online searching. However, some online public access catalogs (OPACs) allow the option of displaying catalog records in class number order. (Looking through a list of classification numbers online recreates, without the ambience, an experience similar to browsing in library stacks.) Furthermore, it is possible that future programs may be developed that preserve and enhance the benefits of shelf browsing by mapping classification and controlled subject terms one against the other.^[6] Such mapped systems could become powerful retrieval tools.

HISTORY OF SUBJECT ACCESS IN LIBRARY CATALOGS

Early library catalogs were primarily finding-lists providing both author entries and catchword title entries for each item along with a symbol or number indicating its location in the collection. A catchword was the leading word in a title if it expressed subject content, but in cases like *An Introduction to Physics*, "physics" would be used as the entry word. This practice indicated that, by 1850 or so, librarians had begun to be aware of the significance of the subject approach to library material.^[7]

During the 1800s many libraries had what were called classed catalogs, with subject headings in the form: *Plants—Trees—Evergreens—Pines—Southern pines*. Such a catalog required an index to use effectively. A catalog assigning *Southern pines*, or *Pines, Southern* for the same book was called a dictionary or alphabetical-specific catalog. By 1900, almost all American library catalogs were in dictionary form.

Early Standard Subject Lists

Before there was a standard list for subject headings, catalogers in individual libraries assigned subject headings as they saw fit. The advantages of having a standard list had become apparent by the early 1890s, probably due to the increase in interlibrary loan operations and the introduction of centralized cataloging.

In 1895, the first standard list for subject headings appeared: the *List of Subject Headings for Use in Dictionary Catalogs* (commonly called the ALA List), produced by an American Library Association (ALA) committee.^[8] It was discontinued after 1914 when the Library of Congress (LC) began publishing its own list, now titled *Library of Congress Subject Headings*^[2] and referred to as LCSH.

After LC started distributing printed catalog cards at the beginning of the twentieth century, the Library's descriptive and subject cataloging practices gradually became the de facto standard for American libraries. However, LCSH and its predecessors were designed for, and reflect the practice of, large research collections. They have never been ideally suitable for medium-sized or small collections. Early on, the gap was filled by a list compiled by Minnie Earl Sears and first published in 1923 under the title *Subject Headings for Small Libraries*. This list was based on LCSH, and so is compatible with it. It was later renamed *Sears List of Subject Headings*, with the nineteenth edition appearing in 2007.^[9] Despite the ease of using the LC subject headings that appear in cataloging copy, (i.e., records prepared by other agencies that can be downloaded for use in one's own system), the *Sears* list is still favored by many American school libraries and small or medium-sized public libraries. (This list is discussed in somewhat more detail later in this entry.)

Later and a book about FAST is in publication many lists of subject headings were developed for special fields and applications. Probably the best known among these is *Medical Subject Headings* (MeSH). In recent times, an interesting system is under development, (FAST), *Faceted Application of Subject Terminology* a subject headings list based on LCSH vocabulary used under highly simplified application rules. FAST began as an attempt to make the richness of LCSH vocabulary available for tagging Internet resources, and is now (fall 2008) in the testing stage. (FAST is described in more detail later in this entry).^[10]

Impact of Automation

The impact of automation on library-based subject access over the last several decades has been immeasurable. In the late 1950s, when it was clear that the computer was becoming an important player in all phases of American life, LC took steps toward automating its operations. An important element in its automation drive was the development of *Machine Readable Cataloging* (MARC), an encoding language now known as MARC 21 Formats.^[11] In October 1966, LC began trial distribution of MARC tapes containing cataloging records with MARC codes. Not long after, LC and many libraries nation-wide began work on converting all their records to machine-readable form. With general catalog conversion, the long-familiar banks of wooden catalog-drawer cases began disappearing, to be replaced by computer terminals, many accompanied by printers. These terminals were off-line tools at first. By the 1980s, many library catalogs were online and were known as OPACs Online Public Access Catalogs. By then, the Internet had become a factor to be reckoned with, the first appearance of the term *Internet* having been in 1974. And during 1989, a new system was in development at the Center for European Nuclear Research (CERN) in Switzerland; it combined hypertext and Internet technologies and

was called the *World Wide Web*.^[12] CERN released the Web in 1991, to enthusiastic popular acclaim. OPACs made considerable gains in sophistication during the 1990s and later, offering not only Internet access but highly refined search options. Many now refer to them as WebPACs. Furthermore, libraries have provided access to more and more online resources through their portals. Some of these resources are cataloged and incorporated into local OPACs.

PRINCIPLES GOVERNING CONTROLLED VOCABULARIES

The discussion turns now to the principles underlying the design and construction of controlled vocabulary systems. Early on, theorists and practitioners realized that retrieval effectiveness was increased if certain principles were followed in designing their systems, and so moved toward standardization. Among the early writers on the topic was Charles Ammi Cutter. Perhaps ironically, because of how early he was active, it was Cutter who articulated the basic principles of effective subject cataloging in his 1876 *Rules for a Dictionary Catalog*.^[13] What he said has been much discussed ever since, but never significantly improved upon. Among Cutter's statements were two objectives, much quoted even now: 1) to enable a person to find a book of which the subject is known; and 2) to show what the library has on a given subject. The first addresses the need to locate individual items, the second the need to collocate materials on the same subject.

Most of the principles governing current thought and practice on subject access vocabulary either spring directly from Cutter's work or reflect his thinking to a considerable degree. The terms used for various aspects of such vocabulary are discussed below. These are 1) convenience of the public; 2) uniform and unique headings; 3) specific and direct entry; 4) consistency and currency in terminology; and 5) provision of cross-references. All of these apply just as forcefully to nonlibrary surrogate systems as they do to library practice.

Convenience of the Public

For Cutter, the most important consideration in the cataloging of library materials was "the best interest of the user." He called this principle "the convenience of the public." He felt that catalogers should be concerned with "the public's habitual way of looking at things" and that such habits should not be ignored even if they occasionally demand a sacrifice of logic and simplicity. It is worth noting here that the library user population in Cutter's day was probably more homogeneous than it is in this century. Cutter's *common usage* principle, though unassailable in intent, is the hardest of his recommendations to implement effectively today because of the wide spectrum of

information needs in the population now using libraries and other information services. One approach to solving the user-variability problem is to try to develop a system that adheres to strictly formed principles, on the assumption that a logical and consistent system can be learned by its users. When one looks beyond Cutter's insistence on reflecting general usage, one finds that his early rules went a long way toward laying the groundwork for a logical and consistent subject access apparatus.

Uniform and Unique Headings

In order to show what a collection or a database has on a given subject, its subject access system must adopt a principle of uniform headings, that is, all material on a given subject must be tagged with the same heading. If a subject has more than one name ("ascorbic acid" and "Vitamin C," for instance) one must be chosen as the valid or authorized heading, with *SEE* or *USE* references from alternate terms. In general, it is hoped that the term chosen is unambiguous and familiar to all users of the catalog. The converse of the principle of uniform headings is that of unique headings, a principle that requires that the same term should not be used to represent more than one subject. If the same term must be used in more than one sense, as is often the case when different disciplines or fields of knowledge are involved, some qualification or clarification must be added so that it will be clear to the user which meaning is intended, for instance, "iris (eye)" and "iris (plant)."

Direct and Specific Entry

The rule for direct entry was set forth by Cutter in his *Rules for a Dictionary Catalog*: "Enter a work under its subject headings, not under the heading of a class which includes that subject. . . ."^[13] The principle of *direct entry* applies to how headings are formulated: the heading *Monkeys* is direct; the heading *Mammals—Primates—Monkeys* is indirect, although they are both just as specific. The principle of *specific entry* governs how headings are assigned to documents, and calls for as close a match as possible—in terms of generality or specificity—between the heading used and the material being cataloged. In other words, a chosen heading should be neither broader nor narrower than the topic it is intended to cover. In recent years there has been much theoretical discussion on just what *specificity* means in the context of subject indexing.^[14] It is doubtful the question was problematic for Cutter, as one of his concerns at the time was presumably to counteract the then prevalent tendency of catalogers to think in classed-entry terms. An informative discussion of specific and direct entry may be found in *Library of Congress Subject Headings: Principles and Application*.^[15]

Consistent and Current Terminology

It follows from what has been said above, particularly regarding the justifications for uniform headings, that heading terminology should be both consistent and current. So should the terminology in classification schemes. Two elements are particularly important in this respect: synonymy and changing usage. Choices among synonymous terms may require difficult decisions. By principle, common usage prevails when it can be determined. However, the more specialized a library's collection and clientele, the more specialized its indexing terminology should be; special libraries, therefore, often develop their own controlled vocabularies or make extensive modifications in standard lists. A change in usage should be reflected in terminology, but there is often an unavoidable delay because, for emerging subjects, it takes time for terminology to crystallize. Controlled vocabulary lists, including subject heading lists, thesauri, and classification provisions, must therefore undergo constant revision to be maximally effective. The goal is to reflect new terminology as soon as it is stabilized, and to replace obsolete terms as soon as they are recognized as being out-of-date. Revision is a job that posed a serious workload problem in manual environments and is not trivial even in the online environment.

Design Factors

The factors discussed just above focused on terminology. Two other factors are of equal importance: cross-reference structure and whether the system is enumerative or faceted.

Provision of cross-references

In any catalog or information service product using subject tags from a controlled-vocabulary list, cross-references are essential at least from lead-in terms to the relevant preferred terms. Modern systems also offer references to broader terms, narrower terms, and related terms. Cross-references have been a desirable feature in library catalogs ever since Cutter's time, and have been an essential factor in user success in controlled vocabulary searches in both manual and online environments. (They are also important to subject catalogers in both subject heading and classification number assignment.)

Enumeration versus faceting

In a fully enumerative system all headings, including main-heading/subdivision strings, appear in full in the list. In a faceted system, terms are listed in separate groups, each group representing a facet that contains terms which share the same characteristic, such as concept, object, time, place, language, genre, and so on.

An alternative approach which is exemplified by LCSH and Sears is a system containing a primary term list of

main headings, with subsidiary or auxiliary lists of terms that may be assigned as subdivisions or additional headings whenever they are appropriate for works in hand. Another practice lying between enumeration and faceting is the use of “pattern” or “key” headings. In this practice, the subdivisions under main headings that represent a category may be used as a guide under other main headings in the same category. For example, Shakespeare is a key heading for authors in Sears. A third practice, exemplified in LCSH, is to issue lists of “free-floating” subdivisions, i.e., subdivisions that are listed separately and may be attached to main headings where appropriate. An example of such lists is *Free-Floating Subdivisions: An Alphabetical Index*, issued by the Library of Congress.^[16]

Precoordination versus postcoordination

Enumerative systems are by nature precoordinate systems; faceted systems, on the other hand, can be used either precoordinate or postcoordinate, depending on whether the combination or synthesis takes place at the cataloging stage or at the point of retrieval. In a precoordinate system, single-concept terms may be precombined to represent multiple-concept topics during the creation of the vocabulary list (i.e., by the creator of the list) or during the assignment of the complex term or heading to a particular document (i.e., by the indexer or the cataloger), both resulting in the presence of complex subject heading strings in the bibliographic record. In a postcoordinate system, on the other hand, single-concept terms are listed separately both in the vocabulary list and in the bibliographic record, and the combination takes place at the point of retrieval (i.e., by the searcher). In other words, in postcoordinate systems end users infer document content from the sum of assigned terms.

Summary: Controlled Vocabulary Principles

In sum, the topic of subject access through controlled vocabulary lists can be considered in the following way. On choice of terminology, the same principles have governed practice since Charles Ammi Cutter articulated them in 1876: convenience of the public, common usage, uniform and unique headings, and generous cross-references. Within these boundaries, lists may be either enumerative or faceted, or lie somewhere in between.

PRINCIPLES GOVERNING CLASSIFICATION SYSTEMS

Classification Theory

Classification, broadly defined, is the process of organizing knowledge into some systematic order. It has been considered the most fundamental activity of the human

mind. The essential act of classification is the multistage process of deciding on a property or characteristic of interest, distinguishing things or objects that possess that property from those that lack it, and grouping things or objects that share a common property or characteristic into a class. Other essential aspects of classification are establishing relationships among classes and making distinctions within classes to arrive at broader and finer divisions. Those who devise and use library classification schemes do much the same thing. The classification of library materials can thus be seen as a special application of a much more general human intellectual activity.

Traditional classification theory

The traditional ideas of library classification were borrowed from the logical or philosophical principles of classification. Early classificationists began with the universe of knowledge as a whole and divided it into successive stages of classes and subclasses, with a chosen characteristic, also called *facet*, as the basis for each stage. In classical systems, for a broad subject area called a main class, such a progression is from general to specific, forming a hierarchical or “tree” structure in which each class is a *species* of the class on the preceding level and a *genus* to the one below it. The “array” of classes on each level, ideally mutually exclusive and totally exhaustive categories, forms a coordinate relationship from one to another: in other words, progressive subclasses on different levels in each hierarchy form a “chain” reflecting superordinate and subordinate relationships.

Modern classification theory

One of the approaches of modern classification theory, instead of cleaving to strict hierarchical principles, is to start with specifics, identifying the basic components of subjects and listing under each discipline, or main class, the elements or aspects that are topically important within that class. The same operation can be thought of as the *analysis* (or breaking up) of a subject into its component parts and the *synthesis* (or reassembling) of those parts as required for the purpose at hand. Most major subjects or disciplines have their own class-specific *facets*: for instance, a discipline such as Education might have a facet for Persons Taught, a facet for Subjects Taught, a facet for Educators, a facet for Methods of Instruction, a facet for Educational Institutions, and so on. In her *The Intellectual Foundation of Information Organization*,^[17] Elaine Svenonius defines “facets” in part in the following terms: “Facets are groupings of terms obtained by the first division of a subject discipline into homogeneous categories. To characterize a facet as semantically cohesive is to say that the terms in it have similar referents. For instance, terms in one facet may all refer to processes, like mining,

building, or cataloging; in another they may refer to concrete objects, like coal, houses, or books.”

In addition, recurring or common facets, such as form divisions, geographical divisions, and chronological divisions, are usually listed separately for application to all classes. In cataloging with such a scheme, the act of classification essentially consists of identifying appropriate component facets and combining them according to a predetermined *citation formula*. Such a classification is called a faceted classification. An example is Ranganathan’s *Colon Classification*, primarily important today because it brought the idea of faceted classification to the attention of the Western world.^[18] The brief description of the Universal Decimal Classification (UDC) at the end of this entry presents a hierarchical system with many provisions for synthesis by facets.^[19–21]

Library classification

Traditionally, library classification has involved labeling materials in a collection according to the provisions of an inclusive, usually hierarchically arranged, grouping scheme. The labels, called notation, usually in the form of numerals or letters or a combination of both, serve a dual function: to arrange items in a logical order on library shelves, and to provide a systematic display of bibliographic entries in printed catalogs, bibliographies, and indexes. In any grouping operation, the basis for grouping must be determined. In library classification, it is subject. In biological taxonomy, on the other hand, it is ontogeny, the development of life forms.

The two major library-oriented classification systems in the United States today, DDC and LCC, are both large fully developed hierarchical systems that are general in scope.^[3,4] Both are considered only briefly at the end of this entry, because they are the main foci of systems described and analyzed in other entries in this ELIS edition.

Classification according to such hierarchical principles, with biological taxonomy as the prevailing model, was in a particularly active stage of development during the latter part of the nineteenth century. DDC and LCC both originated at that time and still, to an increasingly limited degree, reflect the general intellectual climate of that era. Each would be seriously out of date by now were it not for the fact that each responsible organization, OCLC’s Dewey Services and LC’s Policy and Standards Division, is conscientious about undertaking revisions and issuing updates.

Design and application principles

The parallel between classification and controlled vocabulary as avenues to effective information retrieval continues to hold both for the design of classification systems and for using them to assign class numbers to physical

items or to organize lists of bibliographic items. Space limits prevent thorough analysis here; the following list of considerations presents an overview.

Scope: The system should cover the range of material of interest to the persons expected to use the collections for which the classification scheme is being built.

Literary warrant: The system should accommodate new concepts showing up in material being cataloged, and should, in general, offer provisions (classification positions) that mirror the information environment in which the system is used.

Terminology: Wording within the system should be uniform, unique, current in respect to subject matter covered, and in line with the usage of those for whom the scheme was developed.

User aids: Explanatory notes, cross-references, and indexes should be generously provided, with end-users as well as catalogers in mind.

Application guidelines for subject analysis: All possible aids, some in addition to those just noted, should be available to catalogers, to help them determine the best fit between the subject matter of the piece in hand and the provisions of the classification scheme being used.

Revision: Constant revision is needed, to keep the scheme as hospitable, as responsive, and as up-to-date as possible.

Summary

In the online age, the idea of subject access through traditional classification schemes does not come readily to mind. Yet such an approach has been used by generations of searchers who realized that if they knew of one work that gave them helpful information they were likely to find other helpful items if they looked before and after the shelf placement of the one they started with. That is because classification brings similar works together in an order that proceeds from the most general to the most specific, an array that many searchers find more helpful than tools that point them directly to a specific subject. With many classification schemes now available in full online, some of the advantages of shelf browsing are now available from desktops. Furthermore, tools taking full advantage of computer potential could be devised—indeed have been proposed—that would play classification and controlled vocabulary terms against each other to result in a very powerful search tool.^[6]

SUBJECT ACCESS SYSTEMS: CONTROLLED VOCABULARIES AND CLASSIFICATION

We now turn to a consideration of subject access systems, reporting on how they reflect the principles described above, and noting the extent to which they carry out the functions for which they were designed. We begin with

the controlled term lists LCSH, FAST (Faceted Application of Subject Technologies), Sears List of Subject Headings, and MeSH. We continue with the classification schemes Bibliographic Classification (BC), Colon Classification (CC), DDC, LCC, National Library of Medicine (NLM) Classification, and UDC. However, CC, DDC, LCC, LCSH, and UDC are represented by other entries in this ELIS edition, and so are treated here only in respect to the aspects noted above: reflection of principles and functional performance.

LCSH

LCSH is the most widely used system of its kind in the world. It is also the largest controlled vocabulary in English. In 1999, an ALA committee on subject access stated that LCSH offers many advantages as a means for subject access.^[22] Among them are that it is a rich vocabulary of very wide scope, with synonym and homograph control and generous cross-references, and that it is a dependable scheme, continuously updated, with the support of the US Library of Congress behind it.

An important consideration is that LC pays attention to the needs of other cataloging agencies that use LCSH, and provides frequent notifications of additions and changes as well as ample instructional materials (particularly the *Subject Cataloging Manual: Subject Headings* and the Library's *Weekly Lists*).^[23,24]

A study of LCSH shows that it reflects the general principles of controlled vocabulary construction detailed above, and that it fills the need for which it was first undertaken. In addition, the system has gone beyond its early warrant to cooperate with the whole library community, in America and abroad.

FAST (Faceted Application of Subject Terminology)

In 1998, the Online Computer Library Center (OCLC) began exploring a new approach to subject vocabulary while it was in the process of searching for a subject access system that would optimize the use of technology for Dublin Core (DC) metadata records.^[24] In keeping with DC premises, it was determined that a subject vocabulary suitable for the Web environment should be 1) simple; 2) easy for catalogers to assign and maintain; 3) easy for searchers to understand and search on; and 5) flexible enough for use across disciplines and in various knowledge discovery and access environments—not the least of which is the OPAC.

In creating a new subject schema, decisions must be made on both vocabulary (semantics) and on whether the system will be enumerative or faceted. Regarding semantics, OCLC decided to retain the vocabulary of LCSH for the following reasons:

1. It is a comprehensive list.
2. It is well supplied with cross-references.
3. A system based on it would be compatible with LCSH proper and with MARC-coded records.
4. An automatic conversion of LCSH headings would be possible.
5. There would be cost benefits from the fact that many of the changes to LCSH can be incorporated into the new schema, thus minimizing maintenance.

A drawback to the use of LCSH as it stands was found to be its complex set of application rules, so complex that only professionally trained catalogers can apply LCSH effectively. For this reason, OCLC decided to devise a simplified syntax for governing how subject headings would be applied. Such a change would not only make the system easier at the tagging end but would also allow computer technology to be used to greater advantage in thesaurus maintenance and subject authority control. Work proceeded on those premises. The result of these considerations was the design of a schema called FAST.^[10]

The FAST schema

As its name implies, the FAST system consists of separate elements. These elements comprise eight facets: seven subject facets and a form/genre facet. Headings in the subject facets reflect what the work being cataloged or indexed is *about*; form/genre headings, on the other hand, represent what the work *is*, for example, “dictionary.” Subject facets include Topic, Place, Time, Person, Corporate body, Event, and Title of works. All FAST headings are fully established and appear in the FAST authority system as such, even those which in LCSH were constructed using pattern headings or free-floating subdivisions. In other words, FAST is an enumerated system with very few decisions required of those who use it.

FAST headings look very much like those in LCSH, the salient difference being in subdivisions. In FAST, all the terms in a subject string must come from the same facet. The following example shows the difference between LCSH and FAST subject headings for a work on alcohol and aging.

LC subject headings:

Older people—Alcohol use—United States
Alcoholism—United States
Aging—United States—Psychological aspects
Aging—United States

FAST headings:

Alcoholism (Topic facet)
Older people—Alcohol use (Topic/subdivision facet)
Aging—Psychological aspects (Topic/subdivision facet)
United States (Place facet)

The above examples illustrate the fact that FAST terms that belong to different facets are listed on documents separately, with end users inferring meaning from the sum of assigned terms. This fact brings FAST in, line with the basic principles of the Dublin Core,^[25] one of the initial aims of the project. However, some complex terms within a given facet may be listed in precombined form, that is, as term strings. Alcoholism—Psychological aspects and Older people—Alcohol use are both examples of precombined FAST terms. Note that for each combination, both words belong in the same facet; otherwise precombination would not be possible.

FAST name headings

FAST geographic headings containing jurisdictional names are derived from the Name Authority File maintained by the LC (LC/NAF), and those containing non-jurisdictional headings from LCSH. The structure of FAST geographic headings is based on the MARC Code List for Geographic Areas.^[26] Local places are represented in the indirect form, for example, **France—Paris**. FAST headings for other types of proper names (including persons, corporate bodies, events, and uniform titles) that have been used as subject headings are also based on the LC/NAF or extracted from the LCSH list and LC headings on MARC records in OCLC's WorldCat.

FAST authority files

The FAST authority files are built from LCSH headings and LC/NAF and subject headings extracted from MARC records in OCLC's WorldCat. Multiterm Readings are broken into FAST facets by means of a computer-based deconstruction program. For example, the LCSH heading **France—History—Wars of the Huguenots, 1562–1598—Pamphlets** results in the following FAST headings:

<i>Topical:</i>	Wars of the Huguenots
<i>Geographic:</i>	France
<i>Period</i>	1562–1598
<i>Form:</i>	History Pamphlets

Because of its wide acceptance, the MARC 21 format for authority data^[27] was adopted for the creation of FAST authority records.

At this writing, fall 2008, work on the FAST authority files is near completion. The FAST authority records will be extensively tested and evaluated, and the evaluation will determine if the FAST team has achieved its goal of creating a new subject schema for metadata that retains the rich vocabulary of LCSH while being easy to apply and use.

Summary

In sum, FAST is a system which is

1. Based on the LCSH vocabulary.
2. Designed for the electronic environment.
3. A faceted vocabulary.
4. Usable by people with minimal training and experience.
5. Amenable to automated authority control.

Because tests of the FAST system are still in progress, one cannot yet judge whether it will perform as it was designed to do. If successful, the effort will not only have helped the whole information community, but will have demonstrated that much can be gained by maintaining the essence of a time-tested system and only changing application rules that may have facilitated searches in manual systems but have no role to play in the online environment.

Sears List of Subject Headings

Background

The Sears list of Subject Headings^[9] was created in the early 1920s because LCSH, which was designed for large academic and research libraries, was not a good fit for the access needs of small and medium-sized general libraries. It was a cataloger named Minnie Earl Sears who decided to make a list to fill the gap. After studying usage patterns in many small libraries, she chose, for her list, to follow the underlying principles and patterns of the LCSH system, with adaptations to meet the particular needs of small libraries. Her adaptations were, in the main, reduction in scope and simpler vocabulary.

Features

Therefore, although the Sears list is not an abridgment of LCSH, it is similar in principle, format, and structure. It is a list of preferred terms and lead-in terms, with generous cross-references. Like LCSH, it is a partially enumerative system, with *key headings* analogous to LCSH pattern headings, and with considerable freedom (following guidelines) given to its catalogers to use terms not in the list. An interesting feature of Sears is that, its headings are followed by classification numbers taken from the *Abridged Dewey Decimal Classification*.^[28] There have been many editions of *List of Subject Headings for Small Libraries* since the first appeared in 1923, the most recent being the nineteenth, in 2007, under the title *Sears List of Subject Headings*.^[9]

Summary

Today, in America, the Sears list is used widely by school libraries and most public libraries. And, because it parallels

LCSH fairly closely, it exemplifies the principles, articulated earlier in this entry, on which LCSH is based. Managers of the Sears list deserve professional support and acclaim because they serve a population that is not adequately served in other information retrieval situations.

The foregoing description of the Sears list has been necessarily terse. Readers who want or need more information are directed to the preface to the latest edition of Sears.

MeSH

LCSH and *Sears List of Subject Headings* are not the only controlled vocabulary systems used in American libraries and information agencies. Most of the others are designed for special subject fields. The discussion now turns to MeSH as an example of a specialized controlled vocabulary. MeSH is the system designed and used by the NLM for assigning indexing terms to books and journal articles in the biomedical sciences. It has gained considerable acceptance outside of NLM and is now widely used by biomedical and health sciences libraries and by the abstracting and indexing services that serve the field. MeSH now exists in an online version, accessible on the NLM Web site and available for downloading in several data formats (including XML, ASCII MeSH, and MeSH/MARC).^[29]

MeSH structure

MeSH was originally based on LCSH but has departed considerably from it as, over the years, MeSH has become an increasingly faceted postcoordinate system.

MeSH tree structures

The most striking feature of MeSH is its categorized system of descriptors (called “tree structures”) that show hierarchical relationships among terms. *Tree Structures*^[30] consists of 15 categories in which each heading is placed in relationship to other headings that represent similar areas and concepts. A system of “tree numbers” (each consisting of a capital letter followed by one or more digits) reflects the hierarchies. Each category is subdivided into one or more subcategories, with headings arranged hierarchically in each, and each heading is accompanied by the full tree number giving the location of the heading in the “tree.” If a topic represented by a given heading belongs to more than one subcategory, that heading may appear in several places in the *tree structures*. When a concept appears in more than one hierarchy, it is assigned multiple tree numbers. The tree structures provide a classificatory approach to medical subjects,^[31] manifesting hierarchical principles and providing a logical basis for the cross-references. In online retrieval, the tree numbers, also called descriptor codes, can be used to search for related

subjects. MeSH contains the following types of terms: Descriptors (main headings), Qualifiers, Publication Types, Geographics, and References. Descriptors, also called main headings, represent main topics, usually in the form of single words or phrases, the latter sometimes inverted.

MeSH qualifiers

A *qualifier*, formerly called a *subheading*, is used to refine the meaning of a main heading by specifying one of its aspects. Qualifiers are used with descriptors to collocate those documents concerned with a particular aspect of a subject. Because not every qualifier is suitable for use with every main heading, there is a list of “Qualifiers by Allowable Category”^[32] which contains 62 subject categories and their associated qualifiers. There are two types of qualifiers: topical and publication type. An example of a publication type qualifier is “Abstracts [publication type].” MeSH also includes geographic headings, which include the names of continents, regions, countries, states, and other geographic entities. These are listed in category Z of the tree structures but do not appear in the alphabetical list.

Cross-references

MeSH makes full use of cross-references, and is particularly generous with nonpreferred entry terms with their associated *see references*.^[33] In types, MeSH references are similar to those in other controlled-vocabulary systems.

Summary

The brief account above should demonstrate that those in a special field can construct a controlled vocabulary system that will encompass all the terms and relationship-indicators they need to represent adequately the subject content of materials in their collections without losing compatibility (in other words, interoperability) with other systems. There are many special-purpose systems, and, as complexity increases in all endeavors, there are likely to be many more. For some, especially those dealing with materials not in written form, special markups or coding languages have been devised. These are described in chapter 4 of *Cataloging and Classification*.^[34]

MAJOR CLASSIFICATION SCHEMES

In American libraries, the two major classification systems in use today are the Dewey Decimal System (DDC) and the Library of Congress Classification (LCC).^[3,4] Both are basically enumerative hierarchical systems, reflecting traditional classification principles and departing from a strict enumerative pattern only through their use of auxiliary tables. Both systems are obviously successful, as

evidenced by their strong influence on classification systems elsewhere in the world. Both, also, are covered by other entries in this ELIS edition and so receive little more than a mention here.

However, there are other classification systems that are particularly worthy of notice. One is a special system devised by the NLM in cooperation with the Library of Congress (LC), which is described below.

Another is the Colon Classification (CC),^[18] important primarily because it has contributed so much to modern classification theory: it is the grandfather of the principle of creating a classification built on individually listed terms representing aspects of topics, in other words, built on facets. The CC is covered in a separate ELIS entry and so is not discussed further here.

A third is the Bibliographic Classification (BC), a well-thought-out scheme developed by an American librarian named Henry Evelyn Bliss.^[35] This classification was not adopted by many American libraries, but received considerably more attention in the United Kingdom. It is particularly interesting at the present time because of its long list of auxiliaries; in other words, BC has now moved a long way in the direction of faceted classification. (J. D. Anderson points out the potential of BC facets in his current ELIS entry on LCSH.)

A fourth system is the Universal Decimal Classification (UDC),^[19–21] important because it has moved so far toward faceting and, like the BC, embodies powerful features that designers of new classification systems might find beneficial if incorporated into the schemes under development.

An account of the *NLM Classification* follows, and a brief account of the *UDC* (also the subject of a separate ELIS entry) follows in turn.

NLM Classification

The *NLM Classification*^[36] is an example of a special-subject classification system that was expressly designed to be fully compatible with an extensive, existing general classification system. In this case the general system is the *LCC*.^[3] What the original designers of the NLM Classification proposed was a classification scheme that would (first) follow LCC in both style of classification and general pattern of notation; (second) develop its own classification scheme for medicine and related subjects, fitting it into LCC's vacant class W; and (third) develop its own scheme for the preclinical sciences, using LCC's vacant subclasses QS through QZ (in LCC main class Q for science). In response, the LC agreed with NLM that the main class W and subclasses QS to QZ would be permanently excluded from LCC. For any material in its collection that does not fall within either medicine or the preclinical sciences, NLM uses LCC as it stands.

The resulting NLM classification system has many advantages for a specialized medical library such as

NLM. The organization and development of the subject matter that is its primary concern is fully under its control, while provisions for peripheral subjects are developed and kept up to date by outside specialists, in this case the LC staff. Yet the two parts of the system are fully compatible. One especially useful feature of the system is its detailed index, which contains terms chosen to conform to those in MeSH and follows each major term or sub-term with a class number or range of numbers, including numbers from LCC.

UDC

The UDC is discussed here because it is such an interesting example of how a classification system can develop. UDC began as an adaptation of the Dewey system to make it useful for compiling a universal bibliography and indexing the journal articles the bibliography would cover. Considerably more detailed provisions are required for journal indexing than for book cataloging, and perhaps for this reason the UDC designers turned more readily toward modern classification theory than did either of the two major American classification systems. As UDC grew, it incorporated many of the features of a faceted scheme, providing for a considerable degree of synthesis, or number building, through combining concepts by means of auxiliary devices. An especially interesting feature is the use of punctuation marks or other symbols to indicate the relationships of the parts of a built number: a colon for simple relationship, equal sign for language of work, quotation marks for time or period, and so on.

In sum, UDC is a powerful system, one that is particularly suited to the machine environment: relatively simple retrieval algorithms can be written that can refine or expand searches simply through operations on its class numbers. UDC deserves attention from retrieval theorists in the English-speaking world. It has a lot to offer.

More information on UDC can be found in *The Universal Decimal Classification: A Guide to its Use*,^[19] at UDC online,^[20] and at (<http://www.udcc.org/about.htm>).^[21]

CONCLUDING SUMMARY: SUBJECT ACCESS SYSTEMS

This entry began with an account of twenty-first century provisions and practices in regard to subject access, as they stand in the early fall of 2008. It did not address any omens of future change to be found in current happenings and current literature. Suffice it to say that large changes seem to be in the air.

What the entry did attempt was to present the theoretical foundations of currently functioning subject access systems in the hope of illuminating the factors that must be considered in developing new or improved subject access systems. To this end, it described the advantages

and drawbacks to both controlled vocabulary and full-text searching, and went on to mention the particular (though not often used) benefits of searching by classification arrays.

On controlled vocabulary searching, it made the point that if appropriate search terms are submitted, controlled-vocabulary searches deliver a high fraction of available material of likely use to a searcher, and very little else. On full-text searching, it acknowledged that such searching is fast and easy, and that user satisfaction with that approach is usually high; it went on, however, to point out that the lists of found items are often of overwhelming length, and that searchers must submit multiple synonyms of query terms to have a hope of attaining a representative sample of potentially helpful material.

The discussion then turned to the principles governing the construction of extant subject access systems. Those used by search engines are proprietary, and not available to outsiders; they are therefore beyond discussion. Those on which controlled vocabulary and classification systems are built are well known and much studied: both were discussed at some length in the body of the entry. The piece finished with brief analyses of how well prominent systems exemplify the principles discussed, and how well they appear to be serving the target populations for which they were designed. The controlled-vocabulary systems covered in some detail are FAST, MeSH, and Sears; the only classification system given more than cursory attention is the *NLM Classification*. *LCSH* figures in the discussion when it is particularly relevant, but only in brief because it is the main focus of another entry in this ELIS edition. The same is true for *LCC* and *DDC*. The entry closes with a short section on *UDC*, even though it is the focus of another ELIS entry. Its inclusion here stems from the authors' desire to point out how very well the system is suited to the online age. Its schedule captions and particularly its notation could well serve as the base for powerful search algorithms.

BIBLIOGRAPHICAL NOTE

Much of the material in this entry mirrors, in greatly reduced detail, information and analyses which appear in the third edition of Lois Mai Chan's *Cataloging and Classification* (The Scarecrow Press, Inc.: Lanham, Maryland, Toronto, Plymouth, U.K., 2007.)

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Subscription Libraries [ELIS Classic]

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Abstract

The author's survey of subscription libraries includes discussion of both libraries owned by subscribers, and libraries that are commercial lending libraries, otherwise known as *circulating libraries*. The primary emphasis is on libraries in the United Kingdom.

—*ELIS Classic*, from 1980

INTRODUCTION

The term *subscription library* is used here to denote two main categories of library:

1. Collections founded and administered out of funds drawn from a membership in the form of subscriptions and entrance fees, the library being the property of the entire membership and managed by a committee of trustees elected by and from the members.
2. Commercial lending libraries, usually called *circulating libraries*; these derived their income from the loan of books to borrowers, who paid a periodic subscription and/or a small fee for each volume borrowed.

Libraries in the first category tended to become permanent collections; the latter were often dependent on the prosperity of individual booksellers from whose premises they were usually managed. There were variations within each of the two kinds, but it is on the libraries' significance rather than on the descriptive details that this article dwells.

HISTORY

In whatever form, the subscription library was an eighteenth-century phenomenon. However, traces of them are observable from the seventeenth century and even earlier, and many survived into the twentieth century; some are still active in Great Britain today. They were a product of that kind of social enterprise—one might almost say code—characteristic of the Augustan Age, which was at its most representative in the club, the salon, and the *conversazione*, those focal points of civilized discourse patronized by the rising middle class of business and professional men in London and in the country at large. The rise of cultural manifestations of the kind we are about to survey is explained by the advancement of science and the diffusion of a humane culture beyond the narrow confines of

theology so typical of earlier generations and by the expanding economy and its concomitant, surplus wealth for the trading classes. The indulgence of a proper curiosity about a world that was impinging upon insular British society more and more, and the intellectual cultivation of subjects whose range increased every year, rested largely with an elite that used the word *gentlemen* to describe itself. It is the word most fitting as a description of the class and the culture that founded the libraries of the period. Those perceptible changes in the economic and social structure of the nation after the accession of Queen Anne (1702) brought with them a secularization in learning and, more gradually, in politics; and the complexion of libraries began to change. The collections of ecclesiastical learning—of Greek, Latin, and Hebrew synonymous with the great public and private libraries of the sixteenth and seventeenth centuries (the Bodleian, Sion College, Lambeth Palace, and the parish libraries throughout Britain)—served a traditional clerical readership, the custodians of scholarship.

With the Hanoverian monarchs came changes, the most instrumental of which were the stagecoach, the newspaper, and the political coffee house, securing a wider reading public and a general increase in communication and sophistication; in short, the *literate* reader began to replace the *learned* reader. Amused and instructed by such new and palpably untheological papers as the *Tatler* (1709–1711) and the *Spectator* (1711–1713), and later still by the wholly successful *Gentleman's Magazine* (1731; whose title identifies the new readership and a new kind of journal), the man of affairs was fed with new worlds of information on a regular basis. His expectations and his attention were redirected. Books and pamphlets designed for a public with a devouring interest in current affairs began to multiply. The first great journalist, Daniel Defoe, busily supplied the needs of the new readership, and many lesser figures followed his example. Emphasis on the contingent and the contemporary encourage a climate in which the novel flourished, itself a derivative of a vigorous newspaper and periodical press. Translations of French and Italian prose romances and new realist narratives

offered surcease from the strain of business or, for the wives of the new merchant aristocracy, surcease from ennui. They provided the imaginative stimulus of the new age for the leisured classes. Yet the book trade, that most conservative of institutions, kept prices high, and the limited technical resources of the hand printing press restricted the size of editions. Hence, it is no surprise to find that ingenious means were devised to circumvent high prices and make books more available at lower cost to interested readers. What the book trade could not or would not supply cheaply, mutual cooperation would provide. Quite simply, the idea of subscription (already familiar to authors and booksellers as a publishing device by which to share production costs) was applied to the purchase of books that could be enjoyed by a wide circle of readers willing to pay a relatively small annual sum for borrowing privileges. The purpose of such mutual aid is succinctly stated in the prospectus issued by the projectors of the Liverpool Library in 1757, the library claimed as the first public subscription library in Europe: "With a view to furnishing an ample fund of amusement and improvement at the easiest expense."

The book clubs and reading societies that flourished from the early years of the eighteenth century usually comprised a small, restricted membership. They supported a small, transient collection of books, and their function was social as well as intellectual. Although secular in character, they modeled themselves on the informal groups of clergy that had met in earlier days to enjoy each other's company and that often had combined to create a private collection of books to provide subjects for discussion. The Society of the Clergy of Doncaster (1714) is an example of this kind of clerical-professional group; but their aim was explicitly "the improvement of Christian knowledge," and they met, as was customary, in each other's houses. The Gentlemen's Society of Spalding was formed in 1710 (and survives to this day), to read and circulate new publications. They met in a coffee house, a typical venue, and offered each other enlightenment by giving papers on a variety of subjects (antiquities, natural history, topography, improvements in applied sciences) and through literary conversation. Such public—yet private—assembly was typical of the age, and the fact that the intellectual activity was book-based stimulated a natural desire for more reading matter and so helped promote the market for books. The book club may fairly claim to be the prototype not only of the subscription library for the middle class but also of the early nineteenth-century working-class reading clubs and, by a natural extension, of the Mechanics' Institute libraries. From the privileged to the less privileged, from the few to the many, habits are thus diffused. As Frank Beckwith put it:

in the book club lies the germ of the proprietary library; the latter is only an extension of the former, and differs in degree not kind.^[1]

The reading society of the early eighteenth century provided the model for the future shape of libraries as a means of mutual aid in the acquisition and circulation of books. Money for purchases came from the joint subscriptions of members, and a steady supply of serious, contemporary publications was assured, ready to be discussed in an agreeable environment, whether tavern, coffee house, or private house. When interest in the books flagged, they were sold to members, or auctioned, or divided up by lot. Later in the century, against the background of political revolution in France and the newly emergent United States, book clubs acquired a radical tinge and tended to be associated with extremist political sects. Many reading rooms and clubs opened to support and debate republican issues; they often operated on the fringes of legality and specialized in collections of pamphlets and periodicals rather than full-length books. Whichever section of society they served, book clubs and reading groups were always the most economical form of library provision, requiring no large book stock or paid librarian and no elaborate premises beyond a few shelves in a corner, or perhaps a modest room at most.

SUBSCRIPTION LIBRARIES

The permanent subscription library may therefore be described as a lineal descendant of the book club and the learned society library that had been a feature of London life since the founding of the Royal Society in 1662. In an age when personal patronage was on the decline and municipal or state aid not yet conceived, collective private enterprise was the only source of book supply other than by private purchase. The value of a permanent library, properly housed and administered, must have been obvious to the gentlemen—most of them prominent citizens—who had begun to assemble the informal collections in coffee house and home, in the larger towns and cities. An amenity of this kind must have seemed desirable as a matter of civic pride. Development proceeded toward the first "public" library, albeit limited to the purses that could afford the subscription. In the nature of things, readership was bound to be confined to the educated, professional classes; yet the objective, a permanent repository of the best books of the day, was creditable in any community, and it would lead to unforeseen consequences. Once made, the transition—from an ephemeral collection of interest to a small circle of readers, to a consciously selected, cumulative collection for the use of any who could afford it—was irreversible and it was an incentive to change in the political and intellectual life of the nation.

It is vain to argue the case for the "first" subscription library. Like so many other social phenomena, it appeared quite suddenly within a short space of time in sundry places. As so often in the field of education (formal and

informal), Scotland appeared as the pioneer, and pride of place as the first permanent subscription library is usually accorded to the lead miners of Leadhills, Lanarkshire, who founded what they called a Reading Society in 1741, though its book collection was clearly to be permanent. The first gentlemen's subscription libraries also seem to have been Scottish: the Society Library of Dumfries was founded in 1745, and what was significantly described as the Public Library of Kelso, in 1751. In England, in 1757 Liverpool founded the first public subscription library from two reading societies, part of an energetic local renaissance of culture founded on mercantile prosperity. The mode by which the new subscription library evolved from the simpler organism may be illustrated by the Liverpool example. The two reading societies were the Coffee House Club, which met at the Merchants' Coffee House, and the Talbot, which met at a tavern of that name. The members of both clubs inserted an advertisement in the *Williamson's Liverpool Advertiser* of February 10, 1758:

To all gentlemen and ladies who desire to encourage the progress of useful knowledge, to procure themselves a rational entertainment, and do a great deal of good at small expense, the following scheme is proposed. The two reading societies who meet at the Merchants' Coffee House (Dale St) and the Talbot (Water St) being willing to make their plans as extremely useful as possible, and sensible how much some public provision of this kind is wanted, here mutually propose to throw their present stock of books together and thereby lay the foundations of a public library. The manner of which will be determined by a Committee, to be chosen out of both clubs.

That is a material illustration of the evolutionary process from club to permanent institution.

The organization of a typical subscription library was essentially simple. An entrance fee was charged, which usually entitled the member to a share, making him a proprietor; hence the term *proprietary library* often used of these institutions. Together with an annual subscription, such fees provided the income that paid for the books and running costs. The committee of members, chaired by a president, was the responsible body, and they appointed the librarian, who was their servant, not their equal.

Fees ranged from one guinea to five guineas a year, and membership varied from perhaps a score in a village to the 450-strong Leeds Library in 1791. The managing committee, the president, and the secretary were annually elected at the annual general meeting, the real power being in the secretary's hands. The librarian held office indefinitely, once appointed. He was usually ill-paid, the mere custodian of the books with no personal power of book selection or policy; his function was solely to carry out the wishes of his committee, and his duties were strictly defined and often menial. But the novelty of this emergent

species of library lies in the fact that for the first time in library history, a permanent body of management and officers worked in concert. Their continuity was guaranteed so long as a membership could be recruited, a pattern that remedied the weakness of earlier attempts at library organization: chronic instability.

The new structure promoted efficient management: proper records were kept, library routines were laid down, and technical expertise in cataloging, classification, and library administration began to develop. The result was a consciously created organism made visible on the shelves, in commodious premises furnished for use, rather than in a room haphazardly fitted. The library was more than a club; it was a monument to local pride, a public conservatory of knowledge and information (though of a traditional kind), and a symbol of the eighteenth-century oligarchic conception of society. Because the book stock was the sole and undivided property of the whole society, permanence was a condition implicit in the organization. This was an incentive to the creation of a balanced, judiciously chosen collection—one strongest in the humanities, since education in that age pivoted upon study of the *literae humaniores*. Sectarian or learned bias was avoided (as befitted the true English gentlemen); above all, partisanship (political and denominational) was eschewed.

In the largest cities, the proprietary library soon became identified with the place itself; Birmingham Library and Leeds Library meant the subscription libraries. In most towns, however, the library's aims, like its premises, were much more modest. Experience in the administration of libraries grew gradually but noticeably; the regulations served as models to later generations of librarians concerned about the day-to-day governance of their collections and readers. Terms of loan, action with defaulters, care of books, and the organization of knowledge became more systematic in this more secure environment; in a word, a *professional* ethos was created in the best libraries. Their survival over so many years in an unaltered form is a tribute to their essential soundness. While librarians' salaries were meager, at least the practice of budgeting for annual growth on a practicable basis was possible. Though practice varied, usually about one-third of the income was devoted to the purchase of books and the librarian's salary, and the remaining two-thirds was spent on rent and rates of buildings, printing, stationery, candles, and other vital provisions.

London was not well served by proprietary libraries. A London Library and a Westminster Library existed in the late eighteenth century, and they amalgamated in the early nineteenth century. However, this institution soon failed, and the barrenness of library provision in the capital city was not remedied until 1841, when Thomas Carlyle and others created the London Library we know today. It became the largest of all in due course—it has a stock now formidable in range and depth, it still serves London and country subscribers, and its printed catalogs and

subject indexes are models of bibliographical accuracy and valuable sources of reference.

The decline of the provincial subscription libraries dates from the mid-nineteenth century. Library provision was developing from other quarters. As reading habits permeated more social levels, so did book supply. Working men's clubs began subscription libraries for their members from about 1820, the earliest trade union libraries date from 1832, Chartist libraries are known in 1839, Robert Owen's Halls of Science contained libraries, and even some factories operated "libraries" of a kind for use by the workers in the 1830s. Most important of all, the Mechanics' Institutes were founded in 1823. These were financed on the same principle as the gentlemen's libraries, by entrance fee and subscription suited to the pockets of the superior artisans. But, few records remain of the attempts by the working class to organize their own subscription libraries, though their existence argues a vigorous attempt to engage with the political and social problems of the day. After 1850, the first rate-supported, and therefore truly public, libraries became a reality, and they must have drawn many upper-working-class readers to them, wretchedly inadequate though they were. Slowly, then, but inevitably, changes brought about the closure of the proprietary libraries: competition from the new public libraries and the success of commercial circulating libraries. The poor financing of the public libraries delayed their effects on the subscription libraries until the twentieth century, by which time only the largest cities could support both. It is interesting to note the attempts made by the latter to retain their members by intensified purchases of current literature and an emphasis on recreational reading. However, in the efficient supply of such publications, they could not compete with the highly organized network of shops and other agencies provided by the new library phenomena of the age: W.H. Smith in his railway book-stalls and Charles Edward Mudie from his enormous circulating library in New Oxford Street, each supplying a host of readers throughout the kingdom with their leisure reading. The fate of the subscription libraries was sealed. Some surrendered their collections to the local public or university library; in Liverpool, for instance, the Lyceum continued as a club in its splendid building erected in 1801, but its collections were handed over to the Liverpool public libraries in 1942. There are some notable survivors that offer the quiet atmosphere of a club, reasonably good service in contemporary literature, and strong and unrivaled collections of eighteenth- and nineteenth-century materials: Birmingham, Nottingham, Leeds, and Manchester are examples of extant veterans, though their financial situation is precarious.

In sum, the proprietary subscription library was a substantial part of the intellectual history of Great Britain from 1750 to 1900. As institutions, they could never have served more than a privileged fraction of the whole reading community, but they were entitled to bear the label

"public," even if in a restricted sense. They served an affluent minority, but their example supplied the humbler reaches of society with an incentive to establish libraries for their own political and educational needs. The educated classes secured entrance by the purse and as part of the traditions of their class; it was a matter of prestige. Within these limits, the libraries served their purpose as fully as possible, though their claims to be all things to all men were abridged by the intrinsic nature of their allegiance and structure. Their purposes did not include the supply of thorough information on great questions of public and national interests. Nevertheless, they were the bridge between the older, exclusive world of theological learning and the modern world of almost universal book provision from public funds. And the tradesmen's libraries and working men's libraries of the early nineteenth century, short-lived though they were, at least made reading accessible for a modest fee and so formed habits of discussion that assisted the education of political leaders in the second half of the nineteenth century.

CIRCULATING LIBRARIES

Like the proprietary library, the circulating library was a response to a social need in an age of increasing leisure. There were two characteristics common to these libraries: they lacked (whether justified or not) the image of a serious readership, and, as a branch of the book trade, they appeared early. In the late seventeenth century books could be borrowed for a few pence per week from some booksellers' establishments, as we know from surviving advertisements. This promoted business in a small world of readers. Since that time the slow process of democratizing the reading public has continued, with consequent effects on standards of taste that are debated with unflagging zeal to this day.

Although the term *circulating library* was sometimes employed by subscription libraries, it is convenient to apply it solely to that class of library organized for profit by booksellers. The formal literature associated with learned society libraries made little provision for the emotional as distinct from the intellectual life of the average reader, particularly the growing numbers of women readers. Hence, the history of circulating libraries may be said to be coeval with the history of popular taste during the period when leisure reading was emergent; that is, the period of the rise of the novel, somewhere between the time of Aphra Behn (ca. 1680) and Henry Fielding (1750). French romances translated into English coincided with the provision by the first women novelists of a steady supply of fiction to suit the appetites of a growing leisured class (many of whom were presumed to be female, though there is little firm evidence to support that assumption). Eliza Heywood (1693–1756) was the first woman to earn her living from her pen and is representative of the new

class of writer. Journalism catered to the contemporary taste for realism, combining topicality, adventure, and piety in an irresistible blend. This was the age of the first daily paper, the *Daily Courant* (1702), and its many imitators; and of the first elegant essay serials, emblemized in the *Tatler* (1709–1711) and *Spectator* (1711–1713). Novels like *Love in Excess* reached six editions between 1719 and 1725. Booksellers were quick to discern a new market as a means to extend business, and, without doubt, the idea of the circulating library conferred economic benefits on both borrowers and lenders. Thus, a new leisure industry was created; it was significantly present in resorts and spa towns, and in the centers of fashion: Hastings, Bath, Cheltenham, and Leamington. Not only booksellers but other tradesmen reaped extra rewards if they included a lending library among their stock-in-trade; notably, milliners, haberdashers, and tobacconists.

The few notices that tell us of the existence of a rudimentary lending system in the late seventeenth-century book trade are found in contemporary newspapers and booksellers' advertisements. Francis Kirkman, a stationer, offered some of his stock in 1661 "lent to read," and a certain Widow Page in 1674 offered "all sorts of histories to buy or let out to read." When Benjamin Franklin was working as a printer in 1725, he made a private arrangement with a London bookseller under which he hired books for home reading, which testifies to the practice. Allan Ramsay, the Edinburgh bookseller and man of letters, is usually credited with the first organized circulating library in Great Britain; it was a lucrative part of his bookselling business. In 1728, one Thomas Sendall opened a library in Bristol, and, very soon, the new habit was part of the social scene. The main period of growth was 1740–1800. London is alleged to have had nine circulating libraries by 1740, but the first names of which anything is known are those of T. Wright, William Bathoe, and Samuel Fancourt. While the actual priority is in dispute, there is no doubt that Samuel Fancourt's establishment at Crane Court, off Fleet Street, opened in 1742, quickly became preeminent, and seems to have been the first known library to have used the term *circulating* to describe itself. In fact, his enterprise was a mixture of commercial circulating library and nonproprietary subscription library; that is, its subscribers were in no sense proprietors owning shares, but they could elect a committee of members who acted as trustees under the controlling direction of the benevolent Mr. Fancourt, the real proprietor. Samuel Fancourt was the librarian and the business was conducted for his profit. His bulky catalog, an *Alphabetical Catalogue of Books and Pamphlets Belonging to the Circulating Library in Crane Court* (2 vols., 1748), reveals that a high proportion of his stock was theological. In general, the range was wide and the books of substantial merit and seriousness; there is little here to support any charge of frivolity. The fact that Fancourt was a Dissenting minister perhaps makes his case unusual, but the plan

he outlined in his catalog and the details of his organization were those of the classic circulating library. He was declared bankrupt in 1759, despite initial success, and disappeared into history—not before he hinted at the key to a prosperous lending business, which, he said, was the subscription, "the active and vivifying principle." Another pioneer was Francis Noble, who started his Large Library of Useful and Entertaining Books in 1746.

Prerequisites of success were business efficiency, reliable methods of dealing with the routines of stock acquisition and lending procedures, and the publication of catalogs, which were used by the customers for selection. As in proprietary libraries, early procedures in circulating libraries prefigured later developments in library economy. Fixed subscription rates, loan periods, borrowers' registers, accession books, accounts, tickets, labels, and library stamps—all the paraphernalia associated with library work even today in the age of computerized issue systems and catalogs—had to be created with little precedent. As book stocks grew larger, separate premises were opened as complete libraries in themselves, and the most successful became household names: Wright, Bathoe, Bell, William Lane, Day (the last named persisting until 1957 when it was absorbed into Harrod's, the London department store, as part of their circulating library). Many went bankrupt—bookselling and lending was an unpredictable form of commerce—and a bankruptcy attracted rival firms avid for stock at cheap rates to replenish their shelves. In fashionable towns like Bath competition was fierce.

Borrowers paid their subscriptions by the month, the quarter, half year, or year; and rates varied from 5 shillings for the season to the standard 1 guinea per annum. The device of classed subscriptions allowed the new publications to be reserved for those able to pay the higher fees or permitted more books to be issued at one time (up to six volumes instead of the customary two). Nonsubscribers were allowed to borrow books for a lending fee of a few pence per volume and were obliged to leave a deposit equal to the value of the book borrowed. Printed catalogs sold at 6 pence or 1 shilling, and the readers ordered their titles from them. Although direct access to the shelves was not unknown, a clerk normally served as intermediary. Time allowed for reading varied from two days to one month, depending on the recency of the books, and books could be changed on the same day they were issued. Fines were charged for overdue books, and books lost or damaged had to be paid for in full. Delivery to local and country subscribers was prompt; they were sent by carriage and this service cost more. Shelf arrangement was probably by size, as the catalogs were usually so arranged: duodecimo, octavo, quarto, folio, with separate shelving for pamphlets. Popular works were bought in multiples, especially novels, and the majority of the duodecimo works (in which format most three-volume novels appeared) were bound in quarter leather with marbled

boards. In the most flourishing agencies, book stocks must have accumulated quickly; Bell's British Library in the Strand, for instance, claimed to have 100,000 volumes in 1787.

As to the perennial question on the proportion of fiction in the stock of circulating libraries, the difficulty is lack of evidence. Despite their notoriety as warehouses of worthless romances, the evidence we have is inconclusive simply because neither business records nor catalogs have survived in sufficient quantities to warrant irrefutable deductions. Surviving records indicate an average fiction percentage of 20%, which hardly suggests drug shops; but this evidence comes from the larger, better-known establishments with a varied clientele, chiefly those in London. The many small businesses that were the backbone of the trade throughout the country have left no trace, and it is in their shops that we might suspect a high proportion of fiction and light literature, as in the tobacconists' libraries of the twentieth century. Indeed, a pamphlet published in 1797 (*The Use of Circulating Libraries Considered; with Instructions for Opening and Conducting a Library upon a Small Plan*) is explicit on the point: it recommends a stock comprising 80% fiction for the best returns! The borrowers' registers that survive are scanty, and there are only two catalogs from the earlier period: Samuel Fancourt's, already mentioned, and William Bathoe's (1760). From them we can deduce that not only novels, but also sermons and pamphlets were among the most popular reading matter. The only eighteenth-century list of subscribers to survive is that of Marshall's of Bath (fl. 1793–1796); it shows twice as many men as women readers, a fact that does not support the popular picture of readers as being overwhelmingly female, and there is no reason to assume that Marshall's was an unusual case.

There is little doubt that the libraries must have changed the habits of the semieducated readers, particularly women. The growing numbers and efficiency of the libraries, the corresponding growth in demand, the whole machinery of loans, and the rise in the leisured reading public suggest some degree of cause and effect, if studied against the kinds of best-selling fiction of the period 1750–1770 and of the later period, 1770–1780. There was a progressive decline in quality—a narrowing of range and an increased superficiality—as if novelists were supplying material to assuage a prodigious appetite rather than an educated sensibility. After Smollett's death in 1771, the decline accelerated and the quantity of prose fiction of inferior type is manifest. The reputation of the libraries as purveyors of worthless literature had begun. Smollett was followed by Mrs. Radcliffe; Sterne, by Henry Mackenzie; and Samuel Richardson, by Mrs. Sheridan. The number of novels printed between 1750 and 1770 was about 600; in the period 1770–1780, it was 1,400, of a standard so trivial that magazines scarcely reviewed them. These factors

probably accounted for the correlation in most critics' minds between the circulating libraries and bad fiction. The oft-quoted remark of Sir Anthony Absolute in Sheridan's play *The Rivals* (1774) confirms the current view:

A circulating library in a town is an evergreen tree of diabolical knowledge. It blossoms through the year. And depend on it, Mrs Malaprop, that they who are so fond of handling the leaves will long for the fruit at last (Act 1, Scene 2).

Others deplored the commercial atmosphere and compared the novels to factory-produced printed cloth. And, in the *Gentleman's Magazine* of 1805, we read:

The circulating libraries and reading rooms in every market town degrade us by the impertinence and abuse of curiosity. They poison our leisure hours without improving them, and introduce negligent systems of religion compared to which the formal systems of antiquity, whether Papist or Puritan, were the strictest care of religious parents.

Yet they were not without supporters; Southey said of Bull's circulating library at Bath:

It was then to me what the Bodleian would be now.^[2]

In the *Monthly Magazine* (1821), an anonymous contributor wrote:

It is computed that there are in the United Kingdom at least 1500 circulating libraries, each supported by an average of 70 subscribers.

Further confirmation of the fashion is given in J. Britton's *Picture of London* (24th ed., 1826), which indicates that there was a circulating library in nearly every small town. In general, their influence was thought by orthodox spokesmen to be pernicious, a view summed up neatly in the *Quarterly Review*:

The Circulating Library has been the chief hotbed for forcing a crop of writers without talent and readers without discrimination.^[3]

The most enterprising library of the late eighteenth century was William Lane's Minerva Library (fl. 1790–1820), a by-product of Lane's "fiction factory," which produced the "Minerva novels" around the turn of the century. The name became synonymous with light fiction of the emptiest kind, and as both publisher and disseminator, Lane exercised a virtual monopoly in this profitable field. He would furnish lending libraries and classified catalogs to shops anywhere in London or the provinces; by the year 1795, he was publishing more novels than all

the other 25 London publishers combined. The vacuous romance and the sensational gothic tale were his stock-in-trade, and he created a fortune for himself by concentrating his product on a specific class of reader, women of the middle class in town and country. How far his control of this medium affected the fortunes of the novel and the standards of future popular novelists is an interesting question, which would be worth investigation if space allowed. By sustained advertising and shrewd promotion, he won a faithful clientele with this kind of publicity:

The Historian is furnished with Remarks; the Gay and Volatile with Amusement; the Sedate with a useful Friend for Solitary Hours; Theatrical Amateurs with an Agreeable Companion. In every point of view Institutions of this Kind must be forcibly Convenient to all Classes of People, of General Service and Utility.^[4]

Observe the emphasis on utility in an age when that principle was at the heart of the latest philosophical system.

The history of the circulating library in the nineteenth century is the history of its growing complexity and concentration in fewer hands. Two names are eponymous in the field: Charles Edward Mudie and W.H. Smith. Both started business life as news agents, and by observing the habits of customers and their taste for unexceptionable novels, they built their respective empires. Improved transport (especially rail), after 1840, was a major factor in the speed and efficiency of supply, and so in the expansion of a business. W.H. Smith opened his first bookstall in 1848, and he promptly applied for the monopoly of news agencies and bookstalls in the railway stations serving London and the northwestern regions, an enterprise that became wholly his when Mudie refused to collaborate. He controlled the railway reading public as Mudie did the residential borrowers, and he operated on the same principles of selection, earning himself the nickname "The North Western Missionary." In 1852, Mudie opened his purpose-built premises in New Oxford Street and was soon a national institution serving thousands of customers in London and the country. His publishing orders were so huge that he was a guarantee against failure but also a force to be reckoned with when criteria for selection were in question. The relation between Mudie's overt control of the fiction market and the type of novel published is fairly plain: any work that transgressed canons of Victorian orthodox morality was excluded as "pernicious." Circulating libraries, publishers, and authors combined to produce an acceptable commodity for the mass middle-class market. The typical Mudie's reader would approve Mrs. Henry Wood's fiction, Martin Tupper's verse, and *Eliza Cook's Journal*. The subscription of 1 guinea a year per volume meant that a novel in three volumes brought in more revenue, so that the continued life of the three-decker novel was assured until the 1890s despite its high price of 31/6. At the time of his death in 1890, Mudie's

business was supported by 25,000 patrons. Speedy supply of new books and concentration on works of transient appeal meant a conditioning of taste with implications for the developing, newly emancipated reading public that came into being after the Education Act of 1870 and also for the sophisticated printing technology of the late nineteenth century.

By the end of World War I, other agencies were supplying books to a much enlarged readership; most notable were the public libraries, which became financially respectable after the removal of the penny rate limitation in 1919. Their books began to compare more favorably with what was offered by the commercial agencies. Increased public finance, more public library branches, and the newly founded County Library Service ushered in the final phase in the life of the commercial lending libraries. When a public service demonstrates its capacity to provide not only collections of depth and variety but also current material—and with specialized attention to the needs of children, students, and professional people—then the recreational circulating library cannot long compete. In their efforts to survive, their provision grew shallower and soon they were extinct. The commercial book club was the natural successor to the circulating library, and if Mudie were alive today, he would be running a book club. Mudie's closed its doors in 1937. The era of the chain-store lending libraries—Boots Cash Chemists "Booklovers Library" (1900), W. H. Smith's bookshop libraries (1906), the Times Book Club (1905)—ended in the 1960s. Boots issued one million books in 1930 from its 450 branches. Smith's administered 690 branches with their concomitant libraries, but financial difficulties forced them to operate at a loss as an inducement to customers until the losses could no longer be sustained. Smith's closed its service in 1961; Boots, in 1966; and the Times Book Club, in 1962. The many rental agencies in tobacconists and other retail shops that loaned books at 2d per volume were a common sight in the suburbs before World War II, their stock-in-trade consisting entirely of superficial escapist literature. By the 1960s, they, too (like the chain-store prototypes) disappeared. A phenomenon that had endured as part of the social scene for over 200 years, serving a reading public by purely private enterprise on strict market principles, had become extinct.

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Switzerland: Libraries, Archives, and Museums

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Abstract

This entry offers a brief history of libraries, archives, and museums in Switzerland, a federal republic with 26 cantons. The authors focus on contemporary developments including the creation of consortia, professional education, digital libraries and virtual archives.

INTRODUCTION

Brief Historical, Geographical, Economic, and Sociocultural Context

Switzerland is a multiethnic, multilingual, and multi-confessional nation held together by the desire of its people to be united. It has been a federal State since 1848—one of 23 in the world and the second oldest after the United States. Switzerland has a federal structure with three different political levels: Confederation, cantons, and communes. The Confederation is the term used in Switzerland to describe the State. The Confederation has authority in all areas in which it is empowered by the Federal Constitution, such as in foreign and security policy, customs and monetary affairs, nationally applicable legislation and defense. Tasks which do not expressly fall within the domain of the Confederation are matters for the cantons, which are the next level down. According to the Federal Constitution culture is above all under the authority of the cantons. The Confederation may only act in this field as far as questions of national importance are concerned. Switzerland has 26 cantons. All the cantons are divided into communes, of which there are currently over 2700. Their number is in decline as a result of amalgamations.

Switzerland is bordered by Germany to the north, Austria and the Principality of Liechtenstein to the east, Italy to the south and France to the west. Switzerland is a small, mountainous country, extending over a part of the central Alps and the northern pre-Alps. With its mountains and hills, rivers, and lakes, Switzerland boasts a diverse landscape despite measuring only 220 km (137 mi) from north to south and 348 km (217 mi) from west to east (Fig. 1).

The population of Switzerland is 7,581,520 (July 2008 est.) and its people speak three official languages: German 63.7%, French 20.4%, Italian 6.5%. The Swiss economy is mainly geared towards the provision of services. While in

the 1960s half of all employees were still working in the industrial sector, at the beginning of the twenty-first century this proportion had sunk to around 25%. At the same time, the proportion of workers in the service sector grew from 39% to over 70%, while less than 4% gained their income from agriculture. The proportion of exports in Switzerland's Gross Domestic Product (GDP) is high compared to other nations. A first rate educational system is one of the foundations of Switzerland's economic competitiveness.

Switzerland's culture is influenced by its geography and multilingualism. Its central position between three major European cultural areas (the German speaking area, France, and Italy) and its own linguistic division have led to great diversity in its literature, art, architecture, music, and customs. Each linguistic region has its own radio programs and numerous newspapers. Famous music and film festivals, art exhibitions, a large number of museums and numerous traditional customs attract large numbers of foreign visitors.

LIBRARY AND INFORMATION PROFESSIONS

Systems and Services

Brief overview of legislation and types of libraries

In line with Swiss federal structure, legislation for libraries in Switzerland is not enacted at a national (federal) level but at a state (cantonal) or local (communal) level. Only three publicly accessible libraries are financed at the federal level (though restricted-access libraries are also funded federally): the Swiss National Library (NL) and two libraries of the Swiss Federal Institute of Technology (Ecole polytechnique fédérale de Lausanne, Eidgenössische Technische Hochschule Zürich). The latter functions as the Swiss Center for Information on Science and Technology.



Fig. 1 Map of Switzerland.

Source: CIA *The World Factbook*. <https://www.cia.gov/library/publications/the-world-factbook/geos/sz.html>.

This structure gives rise to a wide variety of policies and in addition makes it difficult to calculate the number of libraries in the country. It has been estimated that there are around 6000, ranging in size from very small volunteer libraries up to the NL, and including the libraries of the international organizations. However, this figure cannot be confirmed.^[1,2] The most reliable and up-to-date figures about the range of public and scientific libraries in Switzerland are available from the Swiss Federal Statistical Office. They categorize libraries as follows:

- National
- University
- Networks of university libraries
- Networks of specialized further education libraries
- Public libraries
- Special libraries

School libraries are not included in the statistics. The analysis of any figures is complicated by the fact that many university libraries are also cantonal or even municipal libraries (or vice versa) and are open to the general public. Cantonal libraries may have a dual role of collecting the cultural heritage of a canton and also providing public library services.

National library and information services

In 1894 the federal parliament established the first federal decree concerning the establishment of a Swiss NL, fixing its location (Bern) and its cultural goals: the mandate of the Swiss NL, then as now, is to collect Helvetica (a new law in 1992 specified all formats on- and off-line, print,

and digital) published since 1848, the founding of the Swiss Confederation.^[3] The term Helvetica covers all works by Swiss authors (fiction and nonfiction); publications translated in Switzerland or by Swiss authors; works published abroad concerning a topic or a Swiss public figure. It also covers all newspapers and serials published and/or printed in Switzerland; associations' publications, timetables, telephone directories, theses, official publications, maps and atlases, and musical scores. It should be noted that there is no legal deposit at a national level in Switzerland, though it exists at the cantonal level for Vaud, Geneva, and Valais. Consequently, the Swiss NL has to negotiate with publishers to acquire material through voluntary deposit. Helvetica produced before 1848 are located in state and university libraries across the country. In addition to collecting, cataloging, and preserving its collection, the NL is unusual compared to other national libraries in that it is also mandated to lend material to the general public as well as researchers, both in reading rooms and in users' homes or offices. [The Swiss National Library is mandated to collect, catalog, preserve, and make available all information either printed or on other media, having a link with Switzerland (Art. 2, alinea 1, Federal law on the Swiss National Library 1992).]

Despite the lack of legislation concerning national projects or cooperation, the NL has a tradition of working with other libraries in Switzerland and abroad as the following examples illustrate.

The NL maintains the Swiss Union Catalogue (CCS/GK) which serves all Swiss libraries and documentation and information centers. It contains the Union Catalogue of monographs: a microfilmed card catalog listing foreign publications as well as Swiss publications from before

1900 but reported before the end of 2002 by libraries in the Swiss interlibrary loan network. Initially set up in 1928, it manages a catalog of more than 5 million titles and remains an important research tool for foreign collections held in Swiss libraries up to the end of the twentieth century. Post-1900 publications are listed in the online catalog Helveticat. It is complemented by the Swiss Virtual catalog^[4] a meta-catalog that searches simultaneously in 18 catalogs of libraries and networks in Switzerland and in Liechtenstein, and by the Swiss Gateway to periodicals (SZP/PSP) which gives access to serial titles in the main catalogs of Swiss libraries.^[5]

The NL cooperates in “BibliOpass” a network of almost 600 Swiss university and cantonal libraries. A user card from one of the libraries enables a user—without any additional fees—to register in all the network’s libraries and to consult their collections and borrow documents.^[6]

In the online environment, the NL has launched the project E-Helveticat which covers the collection and archiving of e-publications.^[7] The project began in 2001 under the leadership of the NL which cooperates on it with cantonal and university libraries as well as commercial publishers (Karger and Stämpfli) and noncommercial publishers. The goal is to create the environment and conditions that will enable the collection, description, dissemination, and long-term conservation of Helveticat in electronic form and to develop an archival system for electronic publications. Projects within this initiative include archiving of online theses, of journals and of Web pages.

In 2006, the NL launched a survey into digitization activities in Swiss cantonal libraries with a view to coordinating activities and avoiding duplicate effort. As a result of the study, the creation of a site bringing together digitization efforts was evaluated in 2007. Here again, lack of legislation means that all such cooperation is voluntary but Swiss libraries are aware of the need to pool resources. This can also be seen in the work to create the Swiss poster collection, a cooperative digitized poster collection bringing together museums and libraries.^[8]

Internationally, the NL is a founding member and partner of the European Library a portal for the 45 European national libraries and their resources (digital and print).^[9] This service was launched by the CENL (Conference of European National Librarians) of which the NL is an active member.^[10]

In the field of bibliographic control, the NL manages the Swiss ISSN centre which assigns ISSNs on request from the publishers and also retrospectively for earlier titles of a publication. Titles are entered in Helveticat, the NL online catalog, then sent to the ISSN register which cooperates with all the national centers worldwide. The NL is also a training library, providing training for those entering the information and documentation schools; apprenticeships for LIS assistants and training for graduate librarians.

Academic and research libraries—very brief overview

As indicated above, academic and research libraries may have a dual function as cantonal or public libraries. Many of them date back to the sixteenth to eighteenth centuries and supplement the cultural heritage collections of the NL. They are funded by the cantons or in some case are managed as foundations. As stated earlier, the two libraries of the Swiss Federal Institute of Technology in Zurich and Lausanne are funded centrally. University and research libraries have a long tradition of cooperation, exemplified by the library networks that have been developed in the past years, for example RERO, the Library Network of Western Switzerland,^[11] IDS, the German-Swiss Network^[12] the Consortium of Swiss Academic Libraries^[13] and the Swissbib project launched in 2007.^[14]

Digital library collections and services—a few examples

There are no nationally funded programs for the creation of digital library collections or digitization. As previously indicated, there are plans to harvest Web sites in cooperation between cantonal libraries and the NL. Some central financing was made available to launch the Swiss Consortium for licensing electronic publications. Otherwise, libraries and other institutions must finance their projects, though some assistance is available through the auspices of MEMORIAV a foundation for the preservation of the Swiss audiovisual heritage (e.g., Swiss posters).^[15] In addition to the initiatives mentioned under the Swiss NL, activities of note include the RERO DOC digital library^[16] containing books, theses, and dissertations, the digitization of the *Journal de Genève* (600,000 pages, a cooperative effort of the Swiss NL, the Bibliothèque de Genève and the publisher Le Temps), and the digitization of 100,000 books from the University Library of Lausanne in cooperation with Google.

Education for LIS: examinations, certification, university level programs and continuing education (information provided by Ms Yolande Estermann on the Swiss-lib list, June 29, 2007).

In Switzerland, LIS training is organized in two main areas:

- Basic training
- Continuing education

Basic training may be in a field of technical competence, or general or senior management.

It is organized according to the training scheme managed by the Federal office for professional Education and technology.^[17] The following routes to the profession are available:

Vocational training through an apprenticeship following the end of obligatory school education. The official title of this is: CFC d’assistant en information documentaire. This

federally recognized certificate in LIS is carried out in an accredited institution and supplemented by classes. More details may be found at the Web site of the Association of Information and Documentation Assistants.^[18]

Following this, the holder of a CFC in AID may take what further examinations to enter a HES (specialized high school). Additionally, a holder of what is in Switzerland termed a “maturité gymnasiale” (high school diploma) may also enroll in the HES program without having followed the CFC AID on condition that he or she has professional experience of 40 weeks in a LIS service.

The HES studies may be carried out in Geneva (in French) or Chur (in German) and are aligned to the Bologna system i.e.,

- A Baccalaureate in LIS of 180 ECTS (European Credit Transfer and Accumulation System), after 3 years of full time study. This Baccalaureate has been accredited by the Federal government and allows the schools to deliver the degree “Bachelor of science HES en information documentaire.”

This level of training aims to allow recipients to carry out the following professions: librarian, researcher, archivist, documentalist, records manager, and manage small units of up to 10 people.^[19,20]

In addition, the two schools have submitted a request for accreditation for a Masters program (90 ECTS). In Geneva, this takes the form of a 50/50 cooperation with the School of Library and Information Science of the University of Montreal. Students (Canadian and Swiss) will follow one year of study in Montreal and one in Geneva, concentrating on areas such as strategic management with a goal to working within large private companies, international organizations, networks, or major libraries.

The second area of training concerns continuing education and is aimed at those who have already acquired basic training in LIS or in another field. It comprises Certificates of Advanced Studies (around 10 ECTS, available at Bern University, Fribourg, Zurich, and Luzern), Diplomas of Advanced Studies (around 30 ECTS, available at Geneva and Zurich) and Masters of Advanced Studies (around 60 ECTS, available at Chur, Geneva, and Zurich).

There is no tradition in Switzerland of recognition of experience as a substitute for study as is the case in France, but this approach will be studied.

The multiplicity of routes to diplomas and the current restructuring still underway (a new law is planned for 2011) mean that it is difficult for employers at present to understand the structure of higher education in Switzerland, and the requirements for different categories of employment but the alignment with Bologna should in the long term facilitate exchange and mobility.

Professional associations: History, membership, and major achievements

The Swiss Library Association (Association des Bibliothèques et Bibliothécaires Suisses (BBS) is the national association for libraries and information centers and serves as an umbrella for a variety of sub-groups and working parties (see Web site for details).^[21] There are around 300 institutional members and 1450 individual members (2007) covering all sectors of libraries and information centers, national, regional, local, public, private, specialized. The goals of the BBS are as follows:

- To represent its members in discussion with the political public arena
- To lobby the political and cultural decision makers to encourage and support the development of libraries, copyright matters, education, and training
- To network, exchange information and professional experience nationally and internationally
- To support LIS training and continuing education, including the organization of training for its members
- To give information to members on current areas of interest for the profession
- To support the development of the Information society in Switzerland, including activities within the World Summit on the Information Society (WSIS)

These are carried out through its Web site, journal, training programs, conference, and publications. National partners include: The Swiss Documentalists Association (Association suisse de documentation (ASD)), the Association of Swiss Archivists (Association des archivistes suisses (AAS)), the Working community of Swiss public libraries (Communauté de travail des bibliothèques suisses de lecture publique (CLP)), the Swiss-French Documentation group (Groupe romand de documentation (GRD)), different interest groups, working groups, committees.

Internationally, the BBS is a member of the following organizations:

- International Federation of Library Associations and Institutions (IFLA)
- European Bureau of Library, Information and Documentation Associations (EBLIDA)
- Fédération des utilisateurs de droits d’auteurs et voisins (DUN)

The BBS was founded in 1897 with the name d’Association des bibliothécaires suisses (ABS) and along with the associations of the United States (1876), Great Britain (1877), and Austria (1896), is one of the oldest library associations in the world. In 1927, the ABS was one of the founding members of IFLA. Between 1937 and 1998 the Association was in charge of the librarian diploma,

replaced in 1998 by the AID (see above) and Information specialist diploma. The Association changed its name to become BBS in 1992. In August 2007 members of BBS and ASD will vote on a proposal to merge the two associations to become the Swiss Information Association (official name still to be determined).^[22]

ARCHIVES

Legislation

The Federal Act on Archiving (Archiving Act, BGA, 1998) regulates archiving at the federal level and requires all federal authorities and all private institutions and individuals carrying out federal functions to archive their records. It also stipulates the duties and responsibilities of the Swiss Federal Archives (SFA) and the right of access, free of charge, to federal fonds. Cantonal laws or regulations constitute the legal basis for archiving at cantonal and communal (local) level and are entirely independent of federal legislation. Communal archives are covered by cantonal archives.

There is no real legal obligation for private institutions to archive their records for the long term. However, the code of obligations and other (international) liability regulations may require private institutions to archive at least part of their records independently though there is no requirement to grant public access.

The Swiss Federal Archives and Archival Services

The SFA is located in Bern, the capital of Switzerland. It was founded in 1798 under the Helvetic Republic and is now attached to the Federal Department of Home Affairs. It houses the archives from the time of the Helvetic Republic (1798–1803), the mediation (1803–1813), the Tagsatzung [assembly of envoys from all over Switzerland] period (1814–1848) and the Federal State (1848 to present). The archives include documents from the Federal Parliament (legislative), the government and the federal administration (executive). The Federal Courts (judicial) are responsible for their own archiving in accordance with the principles of the Federal Archiving Act; so, too, are the Swiss National Bank and various autonomous federal institutions (e.g., ETH Zurich/EPF Lausanne, Swiss Post, the federal railways). The SFA also keeps over 550 private archives of people and organizations with a close link to the federal state. Information on access to the Federal Archives can be found on the Federal Archives' Web site: <http://www.bar.admin.ch>.

The SFA is the Confederation's service center for sustainable records management. It advises the administrative offices on their records management, assesses documents together with them, accepting and preserving any documents worth archiving; it allows interested parties access,

free of charge, to the archives once the protection periods have expired (normally 30 years). In this way the state's accountability is ensured. Archives also serve as a source for historically orientated research.

The SFA is the largest public archive in Switzerland in terms of the size of the archival records (50 lkm, 12 TB) and the number of employees (around 50 staff). Even without formal authority over the cantonal and communal archives, it plays a leading role and is often at the cutting edge of further specialist developments (e.g., digital archiving). It also represents Switzerland abroad and is a point of contact for foreign archive agencies.

Apart from the SFA, the Swiss Film Archive, the Swiss National Sound Archives and other institutions such as the Swiss Social Archives and the Swiss Business Archives also have archiving tasks or manage collections of national importance.

Cantonal and Local Archives

Each of the 26 cantons manages its own archives, the size of which varies enormously (from archives with one or two people to archives with 25 employees). They mostly come under the cantonal government's staff office or the Department of Education and Culture, or very occasionally the Department of Home Affairs or the Department of Justice. These archives have kept records from the early Middle Ages, and in some instances also contain church records, which were taken over by the state from the time of the reformation until the nineteenth century.

The Conference of Archives Directors acts as a consulting and discussion forum for archiving matters at cantonal and federal levels. Out of some 3000 political communes, it is mainly the larger towns that have professional archives which are subordinated to the appropriate cantonal archive. They often contain also parish archives. The civil status registers (formerly known as baptism, marriage, and death registers) are only found at communal or cantonal level. Their records are in high demand at the local and regional levels.

Some cantons are the successors of large city states (Bern, Zurich). In the nineteenth century the archives were separated (canton or city records, sometimes even the "Burgergemeinde"). The separation of archives was also necessary for new cantons such as Aargau and Vaud which had been independent cantons since 1803 (separation of the archives of the city state of Bern); in 1972 the same separation had to be made owing to the creation of the canton of Jura.^[23] An overview of all cantonal and communal archives can be found at <http://www.vsa-aas.org/Archivadressen.241.0.html>.

University Archives

The Federal Institutes of Technology also manage their own archives as laid down in the Federal Act on

Archiving. The cantonal universities have their own archives which are supervised by the cantonal archives; some of these were only created recently.

Film and Audiovisual Archives

The two important institutions for film and sound are the Swiss Film Archive in Lausanne and the Swiss National Sound Archives in Lugano. The former is a private foundation that is two-thirds subsidized by the private sector. The organization, which was founded in 1948 and restructured in 1981, is responsible for preserving and making accessible (screening) films that were either made in Switzerland, about Switzerland or by Swiss. It also preserves foreign films that were shown in Switzerland and film posters and photographs (<http://www.cinematheque.ch>). The Swiss National Sound Archives in Lugano is financed by a private foundation set up in 1987. It is responsible for collecting and cataloging any recordings that make a reference to Swiss history or culture and making them available. It carries out this task in collaboration with the Swiss NL in Bern. The National Sound Archives collaborates with the Swiss Broadcasting Corporation (SRG SSR idée suisse) to digitalize and archive historic radio broadcasts. The National Sound Archives also collects all recordings by SUISA (Swiss Authors Copyright Society) that it receives in connection with the administration of authors' and reproduction rights (<http://www.fonoteca.ch>).

In the area of photography there are several nationally important institutions in Switzerland such as the Photography Foundation in Winterthur (<http://www.fotostiftung.ch>), the Musée de l'Elysée in Lausanne (<http://www.elysee.ch>) or the Photography Museum in Vevey (http://www.cameramuseum.ch/d_basis.php).

Even at the regional level there are specialized institutions such as the La-Chaux-de-Fonds library with its film documentation center which collects and conserves audio-visual and iconographic sources of regional significance. Other examples are Lausanne's city archives or the new media libraries in Valais. Many archives, libraries, or museums have major photograph collections (e.g., Basel-Stadt's state archive and Bern's Burgerbibliothek).

Memoriav,^[15] the association for conserving audiovisual cultural heritage in Switzerland, organizes a network for these institutions. It was set up by the Swiss NL, the SFA, the Swiss Film Archive, the Swiss National Sound Archives, the Federal Office of Communications (OFCOM) (supervisory authority of the SBC) and the Swiss Broadcasting Corporation (SRG SSR idée Suisse) and now numbers around 160 members. With a budget of just under CHF 3 million per annum, the association promotes restoration measures, cataloging work and communication activities such as exhibitions, film screenings, etc.

Other Archives

In addition to Switzerland's state sector archives there is a rich archiving landscape including institutions of international, nationwide, regional, or local importance. The archives of international organizations are mostly located in Geneva, e.g., the headquarters of the ICRC, of the League of Nations and the United Nation's European office. The archives of the ICRC and of the League of Nations, in particular, are of international importance, whereas archiving at the United Nations organizations (e.g., UNHCR, ILO, WTO, ITU, WHO, WIPO, Human Rights Commission) is difficult to gauge as the level of professionalism varies considerably. Interestingly, the WSIS took place in Geneva, which was of great importance for archiving worldwide. The Human Rights Commission is also interested in archives as institutions of democracy and the rule of law. Also housed in Geneva are the World Council of Churches' archives (since 1948).

Lausanne is home to the archives (and museum) of the International Olympic Committee (set up in 1993). These archives contain many collections of photographs and documents in addition to the traditional archives. Given that environment, other sports associations such as the International Cyclists' Union (UCI, since 2002) or UEFA and FIFA (Zurich, 1932) also set up their headquarters in Switzerland. Many of these archives are open to the general public.

Other institutions of national importance are the Swiss Social Archive, the Archives of Contemporary History in Zurich and the Swiss Business Archive in Basel. The Social Archive (set up in 1906 by pastor and social democrat, Paul Pflüger) combines a library, a comprehensive collection of literature on the social history of Switzerland and the archives of persons and institutions involved in workers', women's, or youth movements (e.g., trade unions) (<http://www.sozialarchiv.ch>). The Swiss Business Archive (founded in 1910 by Rudolf Wackernagel, the state archivist of Basel-Stadt) documents industrial and business history and holds the archives of companies that have been liquidated; it is affiliated to the Basel University library. It plays a key role in the Private Business Archive working group of the Association of Swiss Archivists (ASA) and operates the Web site <http://www.arCHeco.ch> that lists all the business archives accessible for research purposes (<http://www.ub.unibas.ch/wwz/wwzprosp.htm>).

The Archives of Contemporary History (set up in 1974) is affiliated to the Institute of History at the Federal Institute of Technology in Zurich (ETH Zurich) and collects the archives of private individuals and associations (e.g., the archives of the Swiss Trade and Industry Association) and documents contemporary history from the First World War up to the present day (<http://www.afz.ethz.ch>).

In the last decades of the twentieth century the number of specialized archives increased dramatically. Notable examples include the Gosteli Foundation, an archive on

the Swiss women's movement, located in Worblaufen (Bern), the "Associazione Archivi Riuniti delle Donne Ticino" in Melano, the "Archive de la Construction moderne" at the Federal Institute of Technology in Lausanne (EPFL), ETH Zurich's gta (Geschichte und Theorie der Architektur [history and theory of architecture]) archive and the "Archivio del Moderno," which is part of the "Accademia di architettura di Mendrisio."

There is currently a tendency for all these institutions to combine their functions as a repository and documentation center and to open their archives to the public, while at the same time assuring the protection of private data. The Swiss NL also comes under this category. Since 1991 it extended its standard collection with the creation of a Swiss literature archive and collects the "fonds" of writers that they have endowed, bequeathed, or sold to the Confederation.

At the regional level private archives focusing on local history emerged. Examples are the "Archives de la vie privée" in Geneva (created in 1994) or the "Archives de la vie ordinaire" in Neuchâtel (set up in 2003). Finally, special collections with a specific theme also exist such as the Max Frisch Archive and the Thomas Mann Archive in Zurich, not to mention botanical archives, music archives etc.

A new phenomenon has emerged since the end of the twentieth century: virtual archives. These are often run by interest groups that define themselves either through specific media carriers or a specific subject. These groups conserve and catalog documents but, rather than physically conserving them themselves, they pass on such fonds to existing (public) archives. The "Archiv für Agrargeschichte" [agricultural history archive] for instance, established in 2002, first cataloged the archives of 13 semi-state organizations of national importance in the field of agriculture and afterwards passed them on to the SFA in 2004.

The number of professional company archives is still small and the number of enterprise archives open to the public even smaller. Apart from the requirement under the Swiss Code of Obligations to conserve company books and papers there is no formal requirement in Switzerland to keep archives as such. Nevertheless, some of the large internationally active banks, insurance companies and industrial firms (e.g., pharmaceuticals or food sectors, machine industry) have very well maintained archives which, building on professionally organized records management, have become an essential management tool. Another group of companies with often professional archives are traditional (family) enterprises such as private banks or watch manufacturers (e.g., Patek Philippe SA in Geneva, Jaeger-Le Coultre, au Le Sentier). However, most of them are rather inaccessible to the general public; only the "Independent Experts Commission: Switzerland—Second World War," established by parliament in 1996, had unrestricted access to these archives for 5 years.

The situation with associations, unions, political parties, trade unions, etc. is not much better. Some have,

nonetheless, deposited their archives with public institutions (e.g., the Social Democratic Party and some trade unions have deposited their archives in the Swiss Social Archive).

The Private Business Archive working group of the ASA brings together historians and archivists from private companies and public institutions with a view to raising companies' awareness of their responsibility to archive and to create an overview of existing company archives.

The oldest archives in Switzerland are those of the Roman Catholic Church. They comprise archives from dioceses, parishes, orders, and religious congregations (such as the Swiss Capuchins in Lucerne) and abbeys (such as St. Gallen, St. Maurice, Einsiedeln, Engelberg, and Disentis).

Added to that, there are the archives of missionary societies.

The Protestant church is organized at cantonal level and its archives are closely linked to Switzerland's political structure. The ASA's "spiritual archives" working group plays a role in coordinating, supporting, and sensitizing. Furthermore it also keeps track of the "fonds" of spiritual institutions and is now trying to involve other important denominations.^[24]

Digital Archival Collections

There are already several fonds available in digital format, but the main challenge lies in creating archival systems capable of archiving digitally produced documents, deeds, and data. The SFA plays a key role here. At federal level, this task is one of the government's key projects for the transition to the information society and the establishment and extension of eGovernment/eAdministration structures, which should allow barrier-free contact and exchange among authorities, and between the authorities and the business world and private citizens (<http://www.bar.admin.ch/themen/00532/00536/index.html?lang=de>).

Some of the items available in digital format include the federal government's official publications (the Federal Gazette, <http://www.amtsdruckschriften.bar.admin.ch>); others are yet to be digitalized. Selected documents on foreign policy from 1848 to 1961 are also available from the Swiss Diplomatic Documents project (DoDiS, DDS: <http://www.dodis.ch/d/home.asp>). The Archives of Contemporary History operates a virtual reading room (<http://www.afz.ethz.ch> and <http://onlinearchives.ethz.ch>). Since 2005 the Basel-Stadt state archive has been gradually making its collection of photographs accessible online (<http://www.staatsarchiv.bs.ch>). Memoriav offers access through its Memobase online database to various collections of photographs, sound and film documents, partly with direct access to the documents themselves (<http://www.memobase.ch>).

Archival Science in Switzerland and Archivist Education

For a long time there was no actual professional training in Switzerland to become an archivist. The professional association has offered in-service introduction courses and further training events. Since 1998, however, there has been I+D (Information and Documentation) training, I+D university of applied sciences syllabuses, and since 2002 a university-level certificate course called archiving and information science, which in 2006 became the Master of Advanced Studies in Archival and Information Science (<http://www.unibe.ch>). The I+D training courses now incorporate the former vocational training courses for librarians, archivists, and documentalists. The I+D training delegation was formed jointly in 1994 by the Swiss Association of Libraries and Librarians (BBS), the Swiss Documentation Association (SVD), and the ASA and aims to coordinate these training courses (<http://www.bda-aid.ch/delegation.html>).

Professional Associations

As a professional association the ASA attends to the interests of its members, is committed to further training of the archival community and to raising awareness of the importance of archives for society (<http://www.vsa-aas.org>).

In addition, at the conference of leading archivists at cantonal and federal levels and from the Principality of Liechtenstein, archival concerns are discussed at national level, joint projects initiated and carried out and information policy conducted. The conference is currently concentrating on finding solutions to digital archiving.

Electronic Records

One of the key projects in the Swiss government's strategy for an information society (1998) is the establishment of an electronic archive. Strategic planning and work began in 2000, and the first prototype applications have been developed, tested, and put into operation with the appropriate infrastructure. These are being developed further so that they can be rolled out for general use.

In 2006 the Federal Council also commissioned SFA to draw up a plan of action for the uniform and standardized use of electronic data and documents in the federal administration. This essentially consists of managing the information lifecycle of digital information and streamlining the federal administration's heterogeneous information systems.

The federal government, 18 cantons and the Principality of Liechtenstein have also created a coordination office for the sustainable archiving of electronic documents in order to give an incentive to and coordinate troubleshooting within the federal structures (<http://www.kost-ceco.ch>).

The ASA's eCommittee working group is concerned with digital archiving at association level. The committee

manages its own projects but supports third party projects with a focus on education. It also promotes awareness of problems and increases understanding for all aspects of digital archiving.

Preservation

The job of maintaining the fonds is based on several principles and does not necessarily mean preserving fonds in their original form. The main problem is the lack of quality of industrially produced paper. The Federal Archives together with the Swiss NL is operating a mass neutralizing procedure to remove the acid from this paper and make it more durable. A new challenge is posed by the variety of information carriers and the conservation of audiovisual and electronic documents. In the audiovisual area particularly the Memoria association focuses on methodology and project financing. Basically, the aim is to preempt any problems in order to keep restoration work to a minimum. This means that the purchase and use of information carriers suitable for archiving is an important part of prevention.

MUSEUMS AND MUSEOLOGY

Some Statistics

Switzerland has a total of more than 948 museums (as of 2006). This corresponds roughly to one museum per 8000 residents and is therefore the highest museum density in the world. The Swiss museum landscape is characterized by remarkable recent growth. In 1960, Switzerland had just 274 museums; in 1980, 508 and by 2000 there were already 923 museums. There are numerous reasons for this enormous growth (conserving the identity at the local, regional, and national levels; private collection activities, tourism, etc.). Swiss museums are well attended. Art museums (25%) and zoos (24%) accounted for a quarter each of all visitors. 26 Swiss museums (3% of all museums) had more than 100,000 visitors in 2006. Additional statistical data is available on the homepage for Association of Swiss Museum (<http://www.vms-ams.ch>).

National Museums

The federal government itself has only seven museums due to the federal character of Switzerland and the associated cultural primacy of the Cantons. Three cultural-historical museums are housed under "The Swiss National Museum" brand. The museum group possesses the most important cultural-historical collection in Switzerland encompassing some 1 million objects of national significance. The three museums forming the Swiss National Museum group provide a national and international looking glass into the culture and history of the Swiss

living area. As museums for cultural history, the exhibitions, special exhibits and events focus on developments within the area referred to today as Switzerland; from prehistoric to early history up to the present day. They are dedicated to a broad meaning of the word culture that endeavors to merge history, applied and visual arts as well as historical settings into a comprehensive cultural-historical viewpoint. Details on the other Federal Museums are available on the homepage of the Swiss Federal Office of Culture (<http://www.bak.admin.ch>).

Major Museums at the Subnational Level

There are another 933 museums in addition to the federally-owned museums. Museums with national and to some extent even internationally acclaim include, among others: *Major art museums:*

- Foundation Beyeler
- Kunsthaus Zurich
- Kunstmuseum Basle
- Zentrum Paul Klee, Berne
- Museum of Fine Arts, Berne

Science and natural history museums:

- Museum of Transport, Lucerne
- Technorama, Winterthur
- Museum of Natural History of Geneva

Historical museums:

- Historical Museum Basle
- Historical Museum Bern

Zoos and botanical gardens:

- Zurich Zoo
- Basle Zoo
- Botanical gardens, Geneva

Digital Museum Exhibits and Services

Seventeen percent of Swiss museums have digitally recorded a significant portion of their collections. Only a few museums have, however, an Internet presence including a presentation platform for their collections.

Museology and Education

Basic and continuing education courses in museology are rather modest: for a number of years now, the Association of Swiss Museums (ASM) has offered a basic training course in museology in cooperation with the International Council of Museums, Swiss branch (ICOM) as well as various continuing education courses. At the university

level, the Universities of Neuenburg, Geneva, Lausanne, and Fribourg will begin offering a masters program in museology starting in the winter semester 2007/2008.

Professional Associations

The following larger associations are active in museums in Switzerland:

- Association of Swiss Museums (<http://www.vms-ams.ch>)
- International Council of Museums, Swiss branch (<http://www.icom-suisse.ch>)
- Swiss Association of museum cultural mediators (<http://www.mediamus.ch>)
- Swiss Association of Museologists (<http://www.museologie.ch>)
- Swiss Association for conservation and restoration (<http://www.skr.ch>)

Key Contemporary Issues

The key contemporary issues for museums include:

- Problems with financing due to a decline in public funding.
- Higher internal financing causing neglect in preservation activities of collections.
- High competitive pressure among museums compared to other leisure activities.

CONCLUSIONS

Switzerland's numerous museums, archives, and libraries are a visible sign of its concern to preserve its heritage and pass it on to future generations. The principal role of these institutions in showcasing a society and its culture is filled at the federal level by the Museums of the Confederation, the Federal Archives and the NL, but also as through the monetary support of the Federal Office of Culture (OFC). This office has the job of fomenting culture in all its diversity and making sure it can develop in complete independence. It supports creation in the fields of cinema, art, and design. Moreover, it promotes and encourages training for young Swiss people from abroad, and projects of the diverse linguistic and cultural communities. The OFC also oversees the conservation of the architectural heritage, monuments, and archeological sites which allow the passing on of knowledge from one generation to the next.

Culture may go on for ever, but it is far from being immutable. It evolves with the passing of time, through cross-fertilization and encounters made along the way. Like mankind, it can progress and develop. But it is vital to remember that every cultural manifestation owes its existence to what went before. Just as the values of the

past help us in our understanding of those of our everyday life, they need to be flaunted, exhibited, and studied. We need to preserve these treasures, both material and immaterial, if we are to ensure the survival of cultural values from before our time.

In terms of culture, the legacies of history are cataloged, preserved, and made as accessible to the public as possible by the museums, archives, and libraries. All citizens should understand the cultural universe in which they move, and should therefore have access to the subjects, the studies and the research which others before them have approached and gone into in depth. The places and institutions where these testimonies are preserved give an idea of humankind's incredible ingenuity. They display human creativity and fertile imagination. They demonstrate that when an artist creates a finished product to transcend, challenge, or discuss the original from which inspiration was drawn, something undeniably positive has taken place.

By definition, museums, archives, and libraries are vast sources and fascinating inventories of this variable but ongoing phenomenon we call culture. They are the custodians of the past, and by the same token the vectors of the future.

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Tanzania: Libraries, Archives, Museums, and Information Systems

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Abstract

This entry outlines the historical development and current status of library and information systems and services in Tanzania. It places emphasis on the Tanzania Library Services Board, which includes the National Central Library and which constitutes a hub of the library system in the country, and its key players in that evolution. It also covers academic libraries; school and children's libraries; special libraries and specialized information services and agencies; archival systems; museums; botanical gardens, zoos and herbaria; professional development and associations; and scholarly publishing. Finally, the entry touches on policy initiatives related to information and communications technology-enhanced information services and learning for national development. The majority of libraries in Tanzania were created immediately after that country's independence in 1961, with the exception of a few libraries that were established and run by private bodies or by colonial government-sponsored associations to cater to their members. Therefore, most of the existing libraries developed out of not only the Government's need to exercise its responsibility for developing a literate society but also its recognition of the fact that libraries and similar institutions are important elements of a nation's cultural heritage. It is because of this that libraries and other agencies covered in this entry were created as central institutions for preserving and disseminating information resources and providing information systems to support learning and research for national development. The Tanzanian government and its agencies provide funds for most library and related operations.

INTRODUCTION

Tanzania (also known as the United Republic of Tanzania) is located in East Africa, bordering the Indian Ocean to the east; Kenya and Uganda to the north; Burundi, Congo DR and Rwanda to the west; and Malawi, Mozambique, and Zambia to the south. The country occupies a total of 364,900 sq. mi (945,087 sq. km) of which 22,799 sq. mi (59,050 sq. km) constitute water bodies. The climate varies from tropical along the Indian Ocean coast, semi-arid in the central parts to temperate in the highlands (lowest elevation is 0—sea level—and the highest elevation is 19,340 ft or 5895 m—Mt. Kilimanjaro). The estimated population as of July 2007 is 39,384,223 with the annual growth rate of 2.1%^[1] and, according to 2002 census, the adult literacy rate was estimated at 69.4%. Kiswahili/Swahili is the national language while both Swahili and English are official languages. English is primarily the language of commerce, administration, and higher education. There are about 120 ethnic groups each with its own language plus several dialects in each group; however, Swahili is a common language spoken by everybody and as a medium of instruction in all public primary schools (most private primary schools use English as a medium of instruction). The official capital of Tanzania is

Dodoma, but most government business and commercial activity is conducted in Dar es Salaam. The government is gradually moving to Dodoma (all parliamentary sessions are held there).

Historically, the country was colonized by Germans in the late nineteenth century. After World War I, it was under British administration (it was then called Tanganyika). It became independent on December 9, 1961 and united with Zanzibar in 1964 to become what is now known as Tanzania. The country is divided into 21 administrative regions on the mainland (former Tanganyika) and 5 in Zanzibar (Fig. 1). Zanzibar has its own government and a parliament while the union government administers the mainland part of the country along with such key union government ministries as foreign affairs, national security, and defense.

Tanzania's economy is still dependent on agriculture, accounting for about 40% of the country's Gross Domestic Product (GDP); other sectors are industry (18% GDP) and services (39% GDP). The country's current GDP's real growth rate stands at about 7% and the estimated GDP per capita is \$1300.^[1]

In terms of indicators for information and communications technologies (ICTs) and associated services, the capacity of existing networks is generally low but with

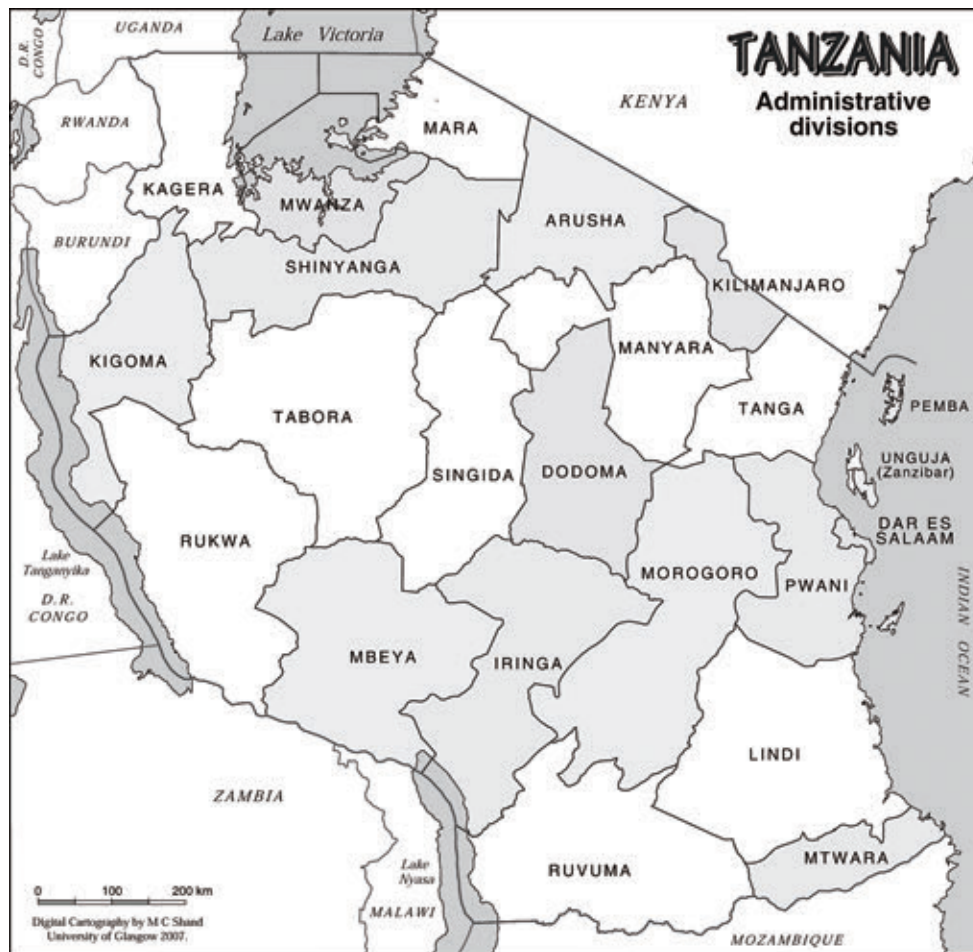


Fig. 1 Map of Tanzania showing administrative regions: 1) Currently, there are branch TLSB libraries (regional libraries) in all but two mainland regions (Manyara and Singida); 2) Zanzibar (Unguja and Pemba) has five regions—Pemba North (Wete), Pemba South (Mkoani), Zanzibar Central/South (Koani), Zanzibar North (Mkokotoni), and Zanzibar Urban/West (Zanzibar); 3) Map reproduced with owner's permission.

great potential for expanding digital mobile capacity. While there are only 240,000 estimated subscribers of landline telephones (0.58% penetration), there are nearly 9.5 million subscribers of cell phone services which is about 24% penetration. There are about 20,800 Internet hosts in Tanzania providing services to some 400,000 users according to 2007 estimates.^[1,2] However, it is difficult to estimate the number of Internet users in Tanzania as well as in most other African countries since most Internet users get the service through public access points (such as Internet cafes, schools, libraries, offices, etc, even via a neighbor's computer) rather than individual ownership of access terminals. For more indicators, see Table 1.

The country has a network of libraries and information centers which include the Tanzania Library Services Board's National Central Library (NCL) with its branches in 19 regions, special libraries that also include those under different government departments, academic

libraries [the major ones being those of the University of Dar es Salaam (UDSM) and Sokoine University of Agriculture (SUA)], school libraries, and several libraries or information centers under nongovernmental organizations (NGOs) and international cultural relations agencies. In addition, there are specialized information services—with or without library support—that take advantage of evolving ICTs to provide services to users. This entry describes these libraries and information centers, along with existing records administration and archival systems; museums; botanical gardens, herbaria and zoos; scholarly publishing situation; professional development in library and information sciences; professional associations; and an outline of key policy initiatives that advocate the role of ICTs in national development. There are parallel services in Zanzibar, mostly under the Zanzibar Central Library and the Department of Archives, Museums, and Antiquities.^[7]

Table 1 Tanzania: Country characteristics and key ICT/development indicators.

Country name	Tanzania (or United Republic of Tanzania)
Region	East Africa
Size	364,900 sq. mi (945,087 sq. km)
Capital	Dodoma [pop. 324,347]; Major city: Dar es Salaam [pop. 2,497,940] (2002 census);
Population	34,569,232 (2002 census); 39,384,223 (2007 est.)
Independence	December 9, 1961
Legal system	Founded on English common law
Governance	Executive branch (President, Vice President); legislative branch (National Assembly); judicial branch (Chief Justice)
Languages	Swahili (national; official; primary education); English (official; commercial; higher education); more than 120 indigenous languages and dialects
Adult literacy rate	69.4% [male 77.5%; female 62.2%] (2002 census)
Combined primary, secondary, and tertiary gross enrolment ratio	50.4% [global average: 67.8] (2005 est.)
Life expectancy at birth	51.5 years (2007 est.)
People living with HIV/AIDS	6.5% of the population (2005 est.)
GDP contribution by sector	42.8% agriculture; 38.7% service; 18.4% industry (2007 est.)
GDP growth rate	7.3% (2007 est.)
Inflation rate	7% (2007 est.)
GDP per capita	US\$ 1,300 (2007 est.)
Currency	Tanzanian Shilling, TSh (1 TSh = 100 cents)
Human development index value	0.467 [global average: 0.743] (2005 est.)
Internet hosts	20,757 (2007 est.)
Internet users	400,000 [1% pop.] (2007 est.)
Telephone subscribers	Landlines: 236,500 [0.58% pop.]; Cell phones: 9,358,000 [23.8% pop.] (2007 est.)
Number of radio stations	47 (year 2006)
Number of TV Stations	29 (year 2006)
Number of newspapers distributed nationwide	42 (2005 est.)

Source: Adapted from CIA,^[1] Internet World Stats,^[2] UNAIDS/WHO,^[3] UNDP,^[4] ITU,^[5] and TCRA.^[6]

LIBRARY AND INFORMATION SYSTEMS AND SERVICES

Public Libraries (see Appendix A—Chronology)

Pre-independence synopsis

It has been well established that certain kinds of written materials in the form of book or manuscript collections

were in existence during precolonial period in Tanzania. There are Swahili manuscripts dating back to the 1790s (see Swahili Manuscripts Database from the School of Tropical and Oriental Studies' Web site at <http://www.swahilimanuscripts.soas.ac.uk/>, accessed August 20, 2008). Also, there are indications that there likely existed a library within the ancient city of Kilwa Kisiwani along the East African coast of present southern Tanzania^[8] characterized by current medieval ruins in Kilwa (For pictures of the ruins see http://en.wikipedia.org/wiki/Kilwa_Kisiwani or http://www.utalii.com/Off_the_normal_path/kilwa.htm or <http://www.umiacs.umd.edu/~yaser/AFRICA06/kilwa.html>, accessed February 28, 2008). However, the history of modern library services in Tanzania is relatively short and most of the current network of libraries for public access in the country was developed after independence in 1961. Prior to that, library services were tied to those of the other two East African countries (Kenya and Uganda) which—like Tanzania—were under the British colonial administration until early 1960s. Further, like in many other African countries such as Nigeria,^[9] the first modern libraries to be established in Tanzania were special libraries that aimed to serve specific information needs of colonial rulers and their interests, thus not accessible to general public. As Olden^[10] states:

Libraries were the tool of the colonial state in the sense that the earliest collections had been built up around agricultural and mining research institutes, which were concerned with maximizing cash crops of value to the imperial power or with the exploitation of mineral resources and with the running of government secretariats and law courts [69]. But, as has been shown, library provision in Tanganyika at the time of independence was meager indeed (p. 440).

Therefore, at independence, there were three broad categories of libraries in Tanzania.^[11,12]

- Libraries with restricted access such as those run by colleges, schools, various government agencies clubs, and other voluntary agencies;
- Subscription libraries—open to people who could afford a fee, such as King George VI Memorial Library in Tanga, Ismailia Community libraries and the libraries under the East African Literature Bureau (EALB);
- Freely accessible libraries, only two—the British Council Library/British Information Service and the United States Information Services.

Early pre-independence efforts

In 1944, the East African governments decided to commission an expert, E. Huxley, to conduct a survey on the state of library and literature services, and to suggest best ways to develop library services in East Africa. He submitted his report to the three governments in 1945.

Subsequently, the EALB was founded in 1948 as a constituent component of the East African High Commission (EAHC) which was also created in the same year to “administer services common to Tanganyika, Zanzibar, Kenya, and Uganda” (p. 423).^[10] The first EALB librarian was George Annesley, and the funding for establishing the Bureau was made available through the colonial Development and Welfare Fund. The Bureau’s main objective was to address an ever-increasing demand for documents among Africans. Annesley studied Huxley’s report and prepared another report that centered on implementing Huxley’s 1945 recommendations. Prior to that, according to Ilomo^[11] “the first library legislation of its kind in the history of Tanzania, the Municipalities Ordinance, was enacted in 1946” (p. 99) to empower town and municipal entities to build and run libraries for their constituents. However, the Ordinance didn’t work because it lacked strategies for resource allocations. The EALB started a library service in Tanganyika in 1951, based in Dar es Salaam. The library also maintained book collections in 76 centers around the country and provided services through postal services for users not served through the established centers.

In 1953, the Bureau Librarian attended a United Nations Educational, Scientific, and Cultural Organization (UNESCO) seminar (For more details about the seminar see: UNESCO. *Development of Public Libraries in Africa: The Ibadan Seminar*; UNESCO Public Library Manuals, No. 6; UNESCO: Paris, 1954; 1–153.) on public libraries in Ibadan-Nigeria. Thereafter, he visited Ghana, whose Library Board was already well established and considered a good example of library systems for Africa (it seems several African countries later decided to adopt the Ghanaian model of national library services). Meanwhile, the British Government had adopted a policy of developing library services in East Africa. Thus in 1959 the Colonial Secretary, Sir Alan Lennox Boyd, sent a dispatch No. 932 dated August 27, 1959 to the EAHC’s Administrator, regarding the British Government’s proposal to finance library development in East Africa via the British Council.^[13] As a result, the Colonial Office approved the appointment of S.W. Hockey as the libraries organizer in East Africa under the British Council, owing to his previous 15 years of similar experience in the British West Indies.^[13] Hockey conducted a survey of then existing library facilities and prepared a report on the development of library services in East Africa; this was later submitted to East African governments. He recommended the following: 1) appointment of a library board; 2) establishment of a pilot library project, followed by construction of a central library; 3) progressive establishment of regional branch libraries around the country plus mobile libraries; 4) development of a school library service; and 5) coordination of government library resources.

Postindependence developments

By early 1961, Tanganyika which had already been given internal self-government by Britain, was preparing for its Independence Day and was the first East African country to accept the Hockey Report.^[13,14] Furthermore, in July 1961, the Government of Tanganyika adopted a postindependence 3-year Development Plan 1961/1962–1963/1964 that also comprised strategies for library development. The plan included a proposal to build a new NCL that could serve as: 1) a public library service from the City of Dar es Salaam; 2) a national library to house all printed items received under legal deposit; and 3) the administrative head office for nationwide public and school library systems. It was not possible to implement the plan because the anticipated director did not arrive early. The government created a library planning committee to recommend ways of implementing the plan.

Tanganyika became independent on December 9, 1961 and the following year the government enacted the Libraries (Deposit of Books) Act 1962. The Act required that each Tanganyikan publisher would give a copy of each of their books(s) to the University College of Dar es Salaam—later the University of Dar es Salaam.^[11] In October 1962, the Library Planning Committee met and decided that the anticipated national library service be called the Tanganyika Library Services (TLS), and necessary legislation to that effect was developed. Mr. Hockey, in consultation with the EALB director, was responsible for drafting that legislation.^[11–13] On July 11, 1963, President J.K. Nyerere assented to the TLS Board Act (see <http://www.parliament.go.tz/Polis/PAMS/Docs/39-1963.pdf>). This was amended by an Act of Parliament No. 6 of 1975 (<http://www.parliament.go.tz/Polis/PAMS/Docs/6-1975.pdf>) to replace the name “Tanganyika” with “Tanzania” and to broaden the functions of TLSB (accessed September 2, 2008 from the Tanzania Parliament’s Web site <http://www.parliament.go.tz/>) of 1963 with the objectives to: promote, establish, equip, manage, maintain, and develop libraries in Tanganyika (followed the Ghanaian model of national library services).

In August 1963, Edward Maxwell Broome arrived in Tanganyika to take up his responsibility as the first Director of Library Services (there was no single trained local librarian at the time). He immediately started necessary consultations with the architects for a new NCL. The TLS Board was appointed on November 1, 1963 and commenced its work immediately. Between November 1, 1963 and March 31, 1964, TLS operated under the auspices of the EALB from which it inherited books, equipment, funds, and staff. The library started with an initial collection of 30,000 volumes inherited from EALB plus 20,000 volumes donated to Tanganyika by the British Council (very few of the books were cataloged). The library had one full time librarian, the director, and one part time staff. The library lacked effective services to

open to public until early 1965. According to Kaungamno and Ilomo:^[12]

the Pilot Library earlier envisaged by the Hockey Report was opened to the residents of Dar es Salaam in a makeshift building along Suleiman Street, later renamed as Mkwepu Street. Response to this new service was considerable. In fact it was an overwhelming success although some people seemed to be satisfying their personal curiosity and therefore did not register for membership. The greatest response came from school children and students who have since formed the backbone of users of TLS libraries. As far as adults were concerned, the majority who visited the libraries were foreigners. This is understandable because they came from countries where libraries had long been established and assimilated into their culture and social structure. The number of African adults was quite substantial and [they] used the library for study and reference purposes (p. 94).

Generally, for the new director, it was challenging, but he experienced a smooth start because he enjoyed an especially favorable political environment provided by a new nationalist government; and, as such, he was able to carry out his duties effectively. The new institution was created on a firm foundation.^[12]

To make provision for the depository status to TLS, Libraries (Deposit of Books) Order 1963 was enacted to amend the Libraries (Deposit of Books) Act 1962. Further development led to the rebirth of TLS as a semiautonomous body (a parastatal organization) under the Ministry of Education, with its head office in Dar es Salaam. In the same year, TLS opened its first branch in Iringa Town (southern Tanzania) with its library located in a makeshift building. On July 1, 1964, the government adopted the TLS Board's Library Development Plan and incorporated it into the National Five-Year Plan 1964–1969. In 1965, the King George VI Memorial Library in Tanga and the Kilimanjaro Native Cooperative Union Library in Moshi were absorbed into TLS, abolishing the subscription system.^[14]

President J.K. Nyerere opened the new building of the NCL on December 9, 1967 to mark 6 years of independence. In his address he said:^[11,14]

When I formally open this building today on the sixth anniversary of our independence, we shall be taking a further step towards the fulfilment of the goals we set ourselves in 1954, at the beginning of TANU. For we shall be marking the beginning of another opportunity for self-improvement and dignified enjoyment, by the citizens of our free country. ...books are very important way to knowledge and to self-improvement; from them we can learn ideas, new techniques of working and new methods. We can learn about the development of man and all its different aspects; we can broaden our understanding of other people, and even of ourselves. All experiences of mankind, all his discoveries and his inventions, can be

learned about through reading. ...the real importance to our nation of this Central Library derives from the fact that it is the hub of the wheel from which spokes will reach out to towns and villages throughout mainland Tanzania. ...would like to give everyone an assurance that the Tanzania Government will continue to give to the work you have started all support which is within its power.

In its effort to spread library services throughout the country, the TLS opened two branch libraries in 1968; one in Mwanza (south of Lake Victoria) and another in a permanent building in Iringa. Other branches followed suit, including Bukoba (west of Lake Victoria, 1969); Arusha and Moshi (northern highlands, 1970), Kibaha (about 20 mi west of Dar es Salaam, 1970); Morogoro (about 120 mi west of Dar es Salaam, 1974); Tabora (western Tanzania, 1976); Mbeya (southern highlands); Mtwara (south-eastern); Musoma in Mara (east of Lake Victoria, 1979); Sumbawanga in Rukwa (south-western Tanzania, 1983); Dodoma (central Tanzania and the new capital, 1997); and Lindi (south-eastern Tanzania, 1998). Apart from its own funds, the Government received foreign support to construct branch libraries; for instance Denmark funded nine libraries, the United Kingdom (one library), other Nordic countries (one), and one was acquired from the King George VI Memorial Trust. As early as 1964, the TLS Board started to locate and acquire suitable sites, particularly in the hearts of major shopping, trading and employment centers, for its network of libraries with full support from the newly independent government. Later, new regional libraries were opened in Kigoma, Mtwara, Ruvuma, and Shinyanga, plus several district and divisional libraries (For more details about TLS and a list of regional and district libraries visit the TLS' Web site at <http://www.tlsb.or.tz/default.asp>, accessed August 20, 2008).

Libraries and literacy education

On July 1, 1969, the Government of Tanzania adopted the Second Library Plan and incorporated it into the Second National Five-Year Development Plan 1969–1974.^[15] The plan placed emphasis on extending library services to rural areas using both fixed and mobile libraries; building six branch libraries; and establishing a school library service. Later in the year, a UNESCO-supported project for rural library service was inaugurated. This literacy enhancement-oriented project started in Mwanza Region. While addressing the nation for the New Year on December 31, 1969, President Nyerere declared 1970 as an adult education year. He said:^[14,16]

We all have to be students, that is, we all have to be willing to learn, and anxious to use every method of learning that is available to us ... we have to be willing to teach whatever skills we have by whatever method we can—by

demonstration and example, by discussion, by answering questions or by formal classroom work. If we play our part, both as students and teachers, we shall really make some progress . . . the importance of adult education both for our country and every individual cannot be over emphasized.

Libraries, through TLS, were instrumental in the successful implementation of adult education campaign,^[17–22] complemented by the use of Swahili as a universal language in Tanzania and the enforcement of universal primary education. One of the functions bestowed to Tanzania Library Services Board (TLSB), in the Act of Parliament that established it, states: “to initiate, sponsor, participate in, finance, and assist in campaigns for the eradication of illiteracy” [See Appendix B,^[4] (1f)]. The TLS took part in the establishment of about 3000 village/rural libraries, coordinated bookmobile service in rural areas, and a book lending program by mail for library users from remote parts of the country. These mobile library services were also extended to secondary schools and colleges.^[23] However, the mobile library services were later disbanded in the mid-1980s due to economic constraints. In addition, radio and cinema programs were widely used in that campaign, and rural newspapers were as important as books. Dahlgren^[18] notes that, in implementing the national literacy campaign, the government of Tanzania:

recognized the need for printed materials to eradicate illiteracy. So in 1974 Unesco [UNESCO] and a Norwegian agency funded a monthly rural newspaper called *Elimu haina mwisho* (*Education has no end*) and experienced instant success. It has a standard format of four pages: national news, local news, miscellany, and practical matters; and has a circulation of about 100,000 (p. 4).

Clearly, pre-independence colonial government in Tanzania did not give due priority to literacy education; for instance, at the time of independence in 1961 the adult literacy rate was mere 15%.^[24] When J.K. Nyerere launched literacy campaign on December 31, 1969, the literacy rate was nearly 24% (his aim was to eradicate illiteracy by 1975). By the mid-1980s when he retired, the adult literacy rate had surpassed 90%,^[19,24–28] but it has now gone down to around 69%. Many development scholars blame “side-effects” of the Structural Adjustment programs of the 1990s for this dismal reverse of illiteracy in Africa and other related regions.^[28,29] However, the government is currently implementing several programs to improve the situation, including reemphasizing universal primary education, adult education, and vocational training, as well as improving library services.^[24,30]

Bibliographic Control

In April 1975, the Parliament enacted the Tanzania Library Services Board Act 1975 that repealed the 1963

Library Act and widened the Board’s functions, responsibilities, and powers relating to, for example, documentation services, professional training, promoting literacy education, and advocating development of indigenous literature (For details, see <http://www.parliament.go.tz/Polis/PAMS/Docs/6-1975.pdf>, accessed August 20, 2008). Subsequently, TLS established the Tanzania National Documentation Centre to disseminate information via such services as bibliographic, referral, reference, document delivery, and current awareness—especially in key sectors of agriculture, industry, health, and education.

Also, the National Bibliographic Agency was founded in 1983 “to collect, record, and conserve the national literacy output for current use and for posterity,”^[12] and one of its products was the Tanzania National Bibliography. In the same year, the African Standing Conference on Bibliographic Control was held in Tanzania. At that meeting, UNESCO pledged to supply a microcomputer to facilitate processing and storage of information; to that end, TLS received the package in 1985. Subsequently, TLS created a national bibliographic database using UNESCO-supplied CDS-ISIS program (does not require software-license fee). Minja^[31] reports that TLSB implemented the Windows version of CDS-ISIS, WINSIS, to facilitate the production of the *Tanzania National Bibliography* (TNB). Apart from producing TNB, the Agency administers allocation of ISBNs and ISSNs in Tanzania on behalf of the International ISBN Agency (London) and the Centre International de l’ISSN (Paris). In doing so, the agency promotes standardization of bibliographic records in Tanzania.^[32]

Shifts in institutional structures and policies

In a major shift in the development of library services in Tanzania, TLS introduced user registration fees in 1996. This turn of events has since been received with skepticism, because it seems to contradict various national policies and priorities of ridding Tanzania of poverty and illiteracy.^[8,33–35] Many government-run functional literacy campaigns (including those related to preventive medicine and modern farming) need to go hand in hand with free access to and use of library services. Matovelo and Lwehabura^[8] have explored and discussed wider implications of users fees for socioeconomic development of Tanzania and other developing countries, noting,

Discouraging a fee for basic library services for the time being may have a positive impact on the long-term social and economic development. For libraries in economically less developed countries, this time should be considered as the time for investing in the value information and expansion as well as creation of public library clientele [and] library services demand. It should be a period of advocacy rather than [a period of] restrictions and barriers to the service (p. 26).

Also, Malmgren^[35] reports the introduction of user registration fees at Arusha Regional Library led to decreased library use by women. Malmgren notes “One conclusion that is possible to draw from this is that one of the greatest effects of introducing membership fees was that adult women stopped coming to the library while the share of adult men increased.” (p. 31) However, other observers looked at this development from a different angle. For instance, Mlaki^[36] reported initial success: “The new procedure for membership enrolment is proving successful. Actually it has reduced the congestion of users and many library users are now feeling responsible for the library facilities” (p. 171).

Other developments that might have affected the structure and functions of TLS include local government reform measures that were introduced in the mid-1990s. Under these measures, the local governments would take up some role in running public libraries in their constituencies; as such TLS is gradually decentralizing many of its functions and responsibilities. Consequently, local government library boards were established in 1997.^[36] Currently, TLS and regional or local authorities have established a partnership in which these authorities cover construction costs for new library buildings while TLS provides furniture, equipment, reading materials, and expertise. In view of these developments and other challenges facing TLS, the TLSB launched the institution’s five-year strategic plan (1999–2004) in November 1999 which addressed the following issues as the Board’s key development components:^[37,38] fund raising, decentralization of regional libraries, rehabilitation of library buildings, human resources development, establishment of regional libraries, collection development, strengthening extension services, and strengthening the School of Library, Archives and Documentation Studies (SLADS), increased automation of TLS information systems, marketing of library services, introduction of civic education in regional libraries, revival of the printing unit, professional support, and staff development.

The current organizational structure of TLSB comprises the Board Chairperson who is appointed by the President of Tanzania and 10 board members appointed by the minister responsible for education, plus the Director General of TLS as the Board’s secretary (ex-officio). The Board is responsible for policy formulation and implementation. Even though the main library building in Dar es Salaam is popularly known as the NCL, there is no mention of a national library in the Act that established the TLS Board (1975) or its 1963 predecessor. Kaungamno (the former director) and Ilomo (the former chief librarian) contend that,^[12]

It would seem that the Government feared that if the NCL were designated as a NL for Tanzania, TLS would probably be unable to perform adequately the proper functions of a NL and those of a public library network. In the

1970s, the government decided to establish a NL in Dodoma (sic!). It would also seem that the idea was born after the new capital city planners had visited capital cities in the world. Indeed national libraries are prestigious institutions. They optimize the cultures and intellectualism of the countries which have them. As a progressive country, Tanzania would not wish to lag behind in this respect. In mooted the idea of a NL, librarians were not consulted. It was an independent decision. . . (p. 133).

The TLS collection includes about 802,834 book volumes and 900 titles of periodicals (456,002 pieces) including newspapers.^[31,39] It is estimated that the system acquires about 20,750 volumes of books annually (via purchase, exchange programs, and donations) and employs about 80 professionals, 60 paraprofessionals, and around 215 support staff.^[31] In addition, TLS currently maintains a total of 143,340 registered users and about 13,762,083 occasional users.^[39] Public access to the Internet at NCL is based on a cybercafé layout operated by the library; that is, users pay to use library computers.^[40]

Cultural–educational relations and NGO libraries/information centers

The history of library development in Tanzania is also associated with the existence of several libraries or information centers that were established by foreign nations with bilateral relations with Tanzania to foster mutual cultural understandings. In addition, there are libraries or information centers operated by local and international NGOs and intergovernmental organizations. Almost all of them are based in Dar es Salaam. Notable examples include the Thomas R. Pickering Information Resource Center which is “a research and reference service of the U.S. Department of State, specializing in current U.S. Policy, Democratization, Rule of Law and Human Rights, Trade Liberalization, and Media. It promotes understanding between Tanzanians and Americans by providing information on topics important to our bilateral relationship” (For details on the services offered, visit <http://tanzania.usembassy.gov/irc.html>, accessed September 1, 2008 from the Embassy of the United States in Tanzania Web site, <http://tanzania.usembassy.gov/index.html>). The British Council and its library have for years been a destination for students and other users for information resources. (For details, visit the British Council Information Services Web site at <http://www.britishcouncil.org/tanzania-information-services.htm>, accessed September 1, 2008.) Others include the Alliance Francaise (for details see Alliance Francaise Dar es Salaam Web site at http://www.ambafrance-tz.org/rubrique.php?id_rubrique=54, accessed August 20, 2008), the Russian Tanzanian Cultural Centre, Iranian Cultural Centre, Korean Cultural Centre, and Libyan Cultural Centre.

Like other similar centers worldwide, the United Nations Information Center in Dar es Salaam (see <http://www.unic.undp.org/>, accessed September 1, 2008) informs the public of the aims and activities of the United Nation. It is therefore a

unique source for UN documents, reports, and public information materials, including complete coverage of the proceedings of UN conferences; sessions of the General Assembly; Security Council; Economic and Social Council; and other UN bodies dealing with such issues as peacekeeping, peacemaking, human rights, disarmament, economic and social development, environment, disaster relief, refugees, and election monitoring.^[41]

Another important UN agency, the International Criminal Tribunal for Rwanda (ICTR), maintains a specialized library (for details, visit the ICTR's Library homepage at <http://69.94.11.53/default.htm>, accessed September 20, 2008) on international criminal law. Based in Arusha, the library also maintains databases and other resources on international criminal law, and "Given its location in the East African region, which is increasingly sought after for information searches by law societies, legal institutions and universities of the host country and its neighbours, the ICTR library is rapidly establishing itself as the Legal Reference Library in the subregion."^[42]

One notable example of NGO libraries is the African Medical Foundation's Information Centre and its Online Resource Centre (for details visit AMREF's Web site at <http://www.amref.org/info-centre/online-resource-centre/our-services/>, accessed August 21, 2008) that provides such services as reference, document lending, and online access to full-text resources. Membership registration at a fee is required.

Academic Libraries

UDSM and academic libraries

The academic library system in Tanzania has for years been associated with the country's main institution of higher learning, the UDSM. This university was established in 1970 following a decision by three East African nations of Kenya, Tanzania, and Uganda to elevate three constituent colleges of the University of East Africa to create three independent universities for each country: Makerere University (Uganda), UDSM (Tanzania), and the University of Nairobi (Kenya). The University College of Dar es Salaam itself dates back to 1961 along with the existence of its library under Harold Holdsworth as its first librarian.^[10] All other Tanzanian universities are relatively recent and the second largest one, SUA, was UDSM's faculty of agriculture until it became a full-fledged university in 1984. Moreover, the university

library at SUA serves as the National Agricultural Library (this was established the Sokoine National Agricultural Library Act, 1991, (see <http://www.parliament.go.tz/Polis/PAMS/Docs/21-1991.pdf>, accessed from the Parliament of Tanzania's Web site) and a legal deposit center for related publications in Tanzania. Similarly, the Muhimbili University of Health and Allied Medicine (MUHAS), as well as Ardhi University (lands and architectural studies) were until 2007 the constituent colleges of UDSM. The library at MUHAS maintains the largest collection of medical-related information resources in the country.

The UDSM has seven faculties (equivalent to schools in the U.S. universities), three constituent colleges and eight institutes and centers (for details visit UDSM's Web site at <http://www.udsm.ac.tz/>, for academic units, see http://www.udsm.ac.tz/academic_units/academic.html). Its student population is about 13,000 and still growing (see http://www.library.udsm.ac.tz/about_us/index.php, accessed February 20, 2008 from the University of Dar es Salaam's Library and Information Services Web site) plus about 800 faculty members.^[43] As noted above, the development and status of academic libraries in Tanzania essentially reflect those of UDSM and, like UDSM, they face increasing student enrollment challenges. Some students from these other universities have sought to use UDSM library facilities^[44,45] under informal or formal arrangements. This library maintains substantial volumes of monographs, journal subscriptions, newspaper collection, maps, government publications, the East Africana collection, manuscripts, and other specialized collections. (For details see the UDSM-Library's Web site at <http://www.library.udsm.ac.tz/index.php> and its guide at http://www.library.udsm.ac.tz/about_us/Library_guide.php, accessed August 20, 2008.) These are searched via the Library's online public access catalog as well as its backup manual catalog. The library maintains its own IT unit for coordinating automation of services, ensuring their quality control, and for providing digital resources and corresponding information literacy training to the academic community. The law library at UDSM maintains the largest collection of legal materials in East Africa^[44] and it is included in the university-wide public online catalog.

Policy shifts and expansion of institutions of higher learning in the 1990s

Until around mid-1990s the national education policy stipulated that higher learning education should be under government control and public funded. As Kiondo^[46] puts it,

These universities were fully financed by public funds as part of the Tanzanian policy that major socio economic and political activities were strictly under government control. In the late 1980s and 1990s the burden of strict control of educational and other sectors was too heavy for

the government to bear. Under strict austerity measures the capacity of the universities to fulfil the key mission and run its activities was severely affected ... At another level, the pressure of globalisation and the need for socio-economic and political reform as a way forward for sustainable development have had tremendous impact on Tanzanian society. One of [the] significant impacts has been the dramatic shift in the management of national affairs through a liberalisation policy [that] has led major reforms in almost every sector including the education sector. Under the Education sector reform, privately funded Universities were for the first time established. At the same time, there was a dire need to expand access to higher education in state owned Universities by increasing enrolment and to transform them to modern universities of the 21st century.

Therefore, both government and the private sector—including NGOs—established new universities and the Government started to expand existing public universities.

Thus, additional institutions include the Open University of Tanzania (public, distance learning, founded in 1992; with branches in all regions); Tumaini University (private, established in 1996 under the Lutheran Church in Tanzania) with four constituent colleges; St. Augustine University of Tanzania (private, established in 1998 under the Catholic Church) with three constituent colleges; Mt. Meru University (private, accredited in 2005, founded and managed by the Baptist Churches of East Africa and the Southern Baptist Convention of the United States); The Hubert Kairuki Memorial University (private; established 1997, accredited in 2000); the International Medical and Technological University, Dar es Salaam (private; established 1995); the Dar es Salaam Institute of Technology (public, established 1997); The University of Arusha (private, formerly Tanzania Adventist College under the Seventh-Day Adventist Church); and Mzumbe University (public, established in 2001). Others are the University of Dodoma (abbreviated UDOM, public, established 2007. This is the newest public university that is “designed to be a comprehensive university, which will train and produce human capital in the major professions for economic development. UDOM will enrol 40,000 students when fully operational,” (<http://www.udom.ac.tz/the%20University.html>, accessed September 1, 2008); Saint John’s University of Tanzania (private, established in 2007 under the Anglican Church of Tanzania); Stefano Moshi Memorial University College (private, established in 2007 under the Lutheran Church in Tanzania); the Aga Khan University—Tanzania Institute of Higher Education (private, under the Aga Khan Foundation); Teofilo Kisanji University (private, established in 1996 under the Moravian Church in Tanzania); and Muslim University of Morogoro (private, established in 2004 under the Muslim Development Foundation).

In Zanzibar, there are three universities: State University of Zanzibar (public, established in 2002), Zanzibar

University (private, under the Darul Iman Charitable Association, opened in 1998), and Zanzibar/Chukwani College of Education (private, under the International University of Africa, Khartoum). For the status of libraries and related information services of these institutions see their URLs in Appendix C and click their library links.

Changing roles and challenges

Like other academic libraries all over the world, academic libraries in Tanzania are responding to many challenges of the twenty-first century that have prompted their universities to undergo major transformations.^[47] These universities and other institutions of higher learning have to design market-driven academic and research programs and to increase enrollments in both the traditional and new programs, coupled with improvement of overall university infrastructure in order to meet national manpower demands. Correspondingly, academic libraries are challenged to support their institutions to meet their academic and research missions in an ever-changing environment of information-resource landscape. To that end, Nkhoma-Wamunza^[45] observes (p. 37):

the role and survival of academic and research libraries depends largely on their ability to satisfy and meet user needs from a wide range of disciplines, and the extent to which they have effectively integrated library and IT resources to support teaching, learning and research and service to the community as well as their ability to build comprehensive and balanced collections.

These challenges are even more important in many developing country academic libraries where their nations are striving to increase human resources capacity to meet the needs of developing economies. In that connection, Kiondo^[46] underscores the role of university libraries in the context of Tanzania (p. 2):

In the process of transforming Tanzanian [u]niversities into modern [u]niversities, libraries have been part and parcel of the process by undertaking several innovative activities. These include applying Information Technology in organisation and management of information services, imparting new skills to staff, building databases and providing electronic information services.

To that end, one of the initiatives that UDSM Library has taken is to forge special arrangements with other institutions and organizations, such as the International Network for the Availability of Scientific Publications (INASP), to ensure access to information resources in various forms and means,^[45] including the Programme for the Enhancement of Research Information. (For details see <http://www.inasp.info/file/104/peri-programme-for-the-enhancement-of-research-information.html>, accessed September 20, 2008.) This goes hand in hand with staff

and user training and retraining on new information services and their applications especially in utilizing electronic resources and embracing the whole concept of “digital libraries” and its implication in the LIS school curricula.^[43,48] Also, in collaboration with the Norwegian International Development Agency, UDSM Library microfilmed its East Africana (apart from its notable manuscript collection, the East Africana Collection includes government publications, United Nations documents, maps, theses and the liberation movement materials. The Tanzanian legal deposit materials are kept in this section) manuscripts as well as its newspaper collection for improved access and preservation; and it contributes to the Database of African Theses and Dissertations under the Association of African Universities. The UDSM participates in the African Virtual University, “a technology-enhanced learning network to increase access to quality higher education for those living in sub-Saharan African countries.” (For details visit <http://www.avu-lc.udsm.ac.tz/index.html> and <http://www.distancelearning-tz.org/>, accessed September 20, 2008.)

School Libraries and Library Services for Children

School libraries

School libraries cater to thousands of primary and secondary schools in Tanzania. In 2008, 8,410,094 pupils were enrolled in about 15,673 primary schools; most of the schools (more than 14,440) were government schools.^[30,48,49] The enrollment in secondary schools was 1,222,403 in 3798 schools.^[49] The net enrollment ratio for primary school was equivalent to 96.1% in 2006; however, on average, each required text book was shared by three pupils^[49] underlining the importance of school libraries to fill the gap and to provide other information resources to school communities. To that end, postindependent development of library services went hand in hand with concerted efforts to develop school libraries in the country. For example, in 1965, Mary Tizzard, then Head of Schools and Children’s Services at TLS, conducted a survey of school libraries and produced a report which would have set a foundation for improving school libraries in the country.^[11,14] However, her report was never published or implemented due to ensuing events. For example, in that year (i.e. 1965), Tanzania broke diplomatic relations with Britain following Ian Smith’s unilateral declaration of independence in Rhodesia (now Zimbabwe). As a result, the TLS Board lost £250,000 library development fund which was enough to build 17 branch (regional) libraries in the country. In the 1970s, the government, through the Tanzania Library Services’ committee on services to school libraries, adopted a “model system”^[11,50] because, given limited resources, it was not possible to cover all

schools at once. Under that system, a few well-equipped libraries were developed in different parts of the country as a first step toward expanding the service to other schools. The implementation of this project started with three secondary schools:^[51] Mzumbe (Morogoro), Mazengo (Dodoma), and Iringa Girls School (Iringa), and the project received financial support from UNESCO. This was a successful approach as it also involved training of teacher-librarians, and it is reported that two associations of teacher-librarians were formed to share their experiences in running school libraries and to help spread the approach to other schools.

Even though school libraries are not under the auspices of TLS, they still depend on it for professional expertise; also, secondary and primary school students constitute the largest user-group of TLSB libraries owing to resource-constraint nature of school libraries. Moreover, the TLS services are highly skewed in favor of urban area,^[34,52] largely because during postindependence evolution of library services, TLSB chose to establish libraries in the following order of priority:^[36] Regional→District→Division→Village. So far, judging from the list of libraries given in the TLSB’s current Web site, 19 of 21 regions have regional libraries while there are about only a dozen district libraries in 125 districts. (For more details about TLS and a list of regional and district libraries, visit the TLS’ Web site at <http://www.tlsb.or.tz/default.asp>, accessed August 20, 2008.) One of the ongoing Government’s strategies to redress the shortcoming is to improve access to information resources through ICT-enhanced projects and to improve general infrastructure in rural areas (see the sections on “The Role of Information Technology in Teaching and Learning” and “A Note on Key Policy Initiatives”).

Library services for children

Over the years, library services for children have been part and parcel of TLS operations through its children’s library at the NCL; these include such services as reference, lending, story-telling, and access to audiovisual materials. Moreover, the inauguration of the Children’s Multimedia Resource Centre in 1999 at the NCL’s children’s library was a milestone in these services. The center exposes various computer-based tools—such as games/video/audio objects—to children. The Center is intended to achieve the following objectives (extracted from the TLSB’s Web site at <http://www.tlsb.or.tz/projects.asp>, accessed August 20, 2008):

- To stimulate children and youth minds and (to) enable them (to) get easy access to the library’s collection of audio and visual materials.
- To attract more children/youth to join the library, hence develop a reading habit and love of books.

- To expose the children/youth to the use of latest information and communication technology in computerization and related facilities.
- To enable children/youth to get access to information in various forms such as textual, sound, still, and moving pictures.
- Enable children/youth to see the library as a place for adventure, filled with stories, facts, pictures, and music.
- To create interest in creative activities and prepare them to become good future citizens.
- To make the centre a cultural and a social meeting place for children and youth.

Apart from library services, the Government and a group of foreign donors initiated the Children's Book Project in 1991 to produce and distribute reading materials for children. (For details visit the Children's Book Project's Web site at <http://www.cbp.or.tz/default.asp>, accessed September 20, 2008.) The project also advocates supporting indigenous authors of children's books and other materials.

The role of information technology in teaching and learning

The Government of Tanzania recognizes the fact that advances in information and communication technologies have the potential for enhancing teaching and learning processes. In 2007, the Ministry of Education and Vocational Training (MoEVT) inaugurated the ICT Policy for Basic Education^[30] along the lines of the Tanzania National ICT Policy of 2003.^[53] This is based on the MoEVT's conviction that "the use of ICT in teaching and learning as well as administration and management represents a powerful tool with which to achieve educational and national development objectives."^[30]

According to MoEVT, the basic education entities that this new policy encompasses include preschool, primary, secondary/high school, teacher education, and nonformal and adult (literary) education. The policy's phased implementation strategy accords priority to teacher education—both preservice and in-service—followed by secondary education, primary education, and an education management information system. It also exploits other national initiatives (e.g., see the section on "A Note on Key Policy Initiatives") to support areas that are not in the initial phases of implementation and complementing priority areas. Examples of complementary initiatives include community telecenters that avail their services to neighboring primary and secondary schools, NGOs that donate refurbished computers, the ICT for Rural Development Pilot Project, and university-based (especially the University of Dar es Salaam and the Open University of Tanzania) ICT tools to facilitate learners and trainers with

disabilities. As such, the policy's implementation strategy takes a holistic approach. Currently, very few primary schools have access to Internet (or computers for that matter). Radio is the most commonly used media to support learning in both primary and secondary schools through nationally-broadcast programs; also, almost all of these schools have radios while only some of them have TVs.

Special Libraries and Specialized Information Services

The emergence of special libraries

As noted before, special libraries predate all other libraries in Tanzania owing to the fact that they have served special interest and professional groups over the years. According to Dahlgren,^[18] there were 120 special libraries in 1922. We can include libraries of different government agencies in this group of libraries such as those of the Ministry of Agriculture and of its network of research stations scattered all over the country, the ministries or agencies responsible for lands, minerals, planning, finance, environment, science and technology, transport, communication, and so on. Just to give an example of one area of specialized libraries in Tanzania—law libraries—to see their composition, as enumerated by Msuya;^[44] these include the Attorney General Chambers libraries in Dar es Salaam and Zanzibar, the Tanzania Legal Corporation library in Dar es Salaam with its branch libraries in Arusha and Mwanza, the National Assembly Library in Dodoma and its branch in Dar es Salaam, the Law Reform Commission of Tanzanian library in Dar es Salaam, and small libraries related to human-rights NGOs. The materials held in these libraries comprise those related to pre- and postindependence legislation (such as acts of parliament), the Tanzania Law Reports (formerly the Tanganyika Law Reports and included in the former East African Law Reports). A series of these reports are available in CD-ROMs. The National Bureau of Statistics has a statistical library that acts as a reference center for statistical information including national economic trends, population census and demographic data, and sector-related surveys. (For details visit the National Bureau of Statistics Tanzania Web site at <http://www.nbs.go.tz/>, accessed September 24, 2008.)

Specialized information services

Specialized information services that also employ information technology tools have recently evolved out of various specialized libraries or agencies to improve the provision of specialized information resources to their users. Notable examples include the Parliamentary Online Information Service, POLIS (see what constitutes POLIS at <http://www.parliament.go.tz/polis/Bunge/Polis.asp?Menu=0>,

accessed September 3, 2008 from the Parliament of Tanzania's Web site at <http://www.parliament.go.tz/>), that was inaugurated in 2004 to help members of Tanzania's Parliament gain access to "information on members, legislation, bills, budget, Hansard (the record of debates), committees, and elections."^[54] There are also several management information systems and centers such as the Tanzania Development Information Center (for details and important links see the Tanzania Development Information Center's Web site at <http://www.tdic.or.tz/>, accessed September 2, 2008), the Tanzania Global Development Learning Centre (<http://www.tgdlc.go.tz/>, accessed September 1, 2008), the Integrated Financial Management System,^[55,56] e-procurement,^[55] (see also the Public Procurement Regulatory Authority's Web site at <http://www.ppra.go.tz/>, accessed September 2, 2008), Health Management Information Systems,^[55] the Education Information Management System,^[55] the Tanzania Education Network,^[55,57] as well as the proposed sustainable land management information system.^[58] One information service that was created in the 1970s is the Tanzania National Research Information Service under the auspices of the Commission for Science and Technology, COSTECH (for details and links related to COSTECH, including an Act of Parliament that established it visit its Web site at <http://www.costech.or.tz/>, accessed August 20, 2008), which functions as a government agency for monitoring and coordinating scientific research and technology development in and about the country. The COSTECH also coordinates community-based telecenters in the country.

Many government agencies upload current information related to their areas on their Web sites. (Most of them have PDF links; see for example the Web site of the Law Reform Commission of Tanzania at http://www.lrc.tz/acts_page.php where recent acts of parliament are listed and available for downloading.) Furthermore, the official online government portal (<http://www.tanzania.go.tz/>) provides links to information and documents related to different government agents. Online access to government documents is a milestone in Tanzania since there have been delays in publishing important information by the sole publisher of government publications—the Government Printer—due to resource constraints; sometimes, even when these documents are released the number of copies has not satisfied local demand. For example, Msuya^[44] reports on the situation regarding legislation materials (p. 54):

Since independence, the Government has passed new laws and amended out-dated ones. However, there are major delays from the time the laws are passed by Parliament to the time they are printed by Government Printer, due to the relatively out-dated technology used and frequent machine breakdowns. As a result, the Government Printer does not have the ability to produce sufficient copies to meet the demand.

While researchers, educators, libraries, and a few citizens are able to access these documents online, the majority of other citizens—particularly the rural population—have no access since the Internet connections have not spread to many rural areas. This is an important challenge to developing nations along with addressing the issue of archiving electronic resources.

ARCHIVES AND ARCHIVAL SYSTEM

Record Management Structures

Like the development and status of library system, the existing system of record management is relatively recent in Tanzania even though Karugila^[59] reports that "[A] properly organized government registry was functioning by 1891" (p. 14) under the administration of German Imperial Government. Postindependence record management system in Tanzania has been under the Tanzania National Archives (TNA) which was established by an act of parliament of 1965, amended in 1979, and then repealed through the Records and Archives Management Act of 2002. (For details of the Records and Archives Management Act, visit <http://www.parliament.go.tz/Polis/PAMS/Docs/3-2002.pdf>, accessed September 2, 2008 from the Tanzania Parliament's Web site <http://www.parliament.go.tz/>.) These were preceded by the Records Disposal Ordinance Cap 9 of 1931 under British colonial administration. Prior to the enactment of the 2002 Act, it was believed that previous legislation had many inadequacies in providing sound direction for efficient records management.^[60] The Records and Archives Management Act of 2002 established the Records and Archives Management Department (RAMD) to "provide for the proper administration and better management of public records and archives throughout their life cycle, to repeal the Records (Disposal) Ordinance, 1931, and the National Archives Act, 1965, and for connected matters." (For details of the Records and Archives Management Act, visit <http://www.parliament.go.tz/Polis/PAMS/Docs/3-2002.pdf>, accessed September 2, 2008 from the Tanzania Parliament's Web site <http://www.parliament.go.tz/>.) Like TLS, the RAMD is based in Dar es Salaam; in addition, it administers six branches (regional offices) in Arusha, Dodoma, Mbeya, Mwanza, Singida, and Tanga.

Schneider^[61] outlines the composition of the materials held in the national archives of Tanzania; this also reflects the country's history of government administration (p. 447):

The three major groups of materials retained within the TNA system are records from German colonial times (pre-1916/17), the British records (pre-1962), and records from various levels of government and administration of post-independence documents that originate from central

government and ministerial headquarters. A considerable number of post-1962 records originating from local level government and administration have been moved to Dar es Salaam. However, the regional branch offices also house such materials in collections of varying sizes. As a rule of thumb, the majority of those local files that had been closed by 1968, and that have been brought into archives system, are in Dar es Salaam. Much of the recent material that has found its way into the TNA system is retained by the regional branches.

Zanzibar has its own national archives under the Zanzibar National Archives in the Department of Archives, Museums, and Antiquities. (For details and the history, structure as well as the list, and description of collections under the auspices of the Zanzibar National Archives, visit its homepage at <http://www.zanzibarheritage.go.tz/Archives.htm>, accessed September 20, 2008.)

Status and Downside

Records and the information these records hold as evidence of various decisions and actions are invaluable resources for current and future functions and decision-making processes of government and organizational entities.

Without reliable records, government cannot administer justice and cannot manage the state's resources, its revenue, or its civil service. It cannot deliver services such as education and health care. Without accurate and reliable records, and effective systems to manage them, governments cannot be held accountable for their decisions and actions, and the rights and obligations of citizens and corporate bodies cannot be upheld.^[62]

Therefore, the importance of managing and preserving records cannot be overemphasized. Schneider^[61] observes that the records in the national archives of Tanzania in Dar es Salaam are generally poorly organized which makes it difficult for researchers to locate materials. In addition, according to Schneider, the system lacks comprehensive assessment of what materials have been made available to TNA over years, and, on the whole, many records seem to have been lost during different transitions between three major administrative periods (Germans/British/postindependence). Still, Schneider contends that many colonial records made their way to the TNA while hardly a handful of them still exist outside of TNA with the exception of the two former colonial authority nations and the archives of their allies such as Belgium (who colonized Congo DR and whose troops temporarily occupied western Tanzania when German troops were defeated at the conclusion of World War I). Karugila^[59] reports that most of the German colonial records prior to 1890 are maintained by the Zanzibar national archives (the capital of German colonial government—German East Africa—moved from Zanzibar to Dar es Salaam in January 1891).

As Schneider observes above, the problem of poor record management in Tanzania affects not only their access by researchers but also makes it difficult to track the nation's past experience to gain better informed knowledge for purposes of current and future development programs. Nyirenda^[63] has discussed a number of factors that might contribute to the situation including colonial legacy (colonial governments sent important records to Europe for preservation and took no effort in developing viable record management systems in Africa; as such, newly independent nations had to start from scratch). Also, Nyirenda pinpoints ineffective postindependence legislation related to record management as the issue of records management program was not explicitly defined in the substantive law; instead, it was redefined through government circulars that were not observed all the time. Katundu^[60] addresses this deficiency as well, noting

A good example here has been the absence of legal provisions in the 1965 National Archives Act as regards the management of current and semi-current records in most public agencies. The act has been silent on this and implicitly it was left to the creators of these records to determine their management. This can create an environment conducive to poor accountability, corruption, fraud and maladministration (p. 78.)

Other factors noted by Nyirenda are resource constraints (human, physical, and financial) and general administrative incompetence coupled with weaknesses in adhering to standards and regulations in record management which in turn affected administration of national archives. The Act of 2002 was intended to address some of these deficiencies; for instance, Katundu^[60] remarks (p. 76):

The Act is primarily the most significant change in the way record keeping is to be coordinated by public offices for a number of reasons. Firstly, it legally lays the foundations of effective records and archives management in relation to legislation. . . . Secondly, the Act is crucial as it intends to resuscitate achievements in records and archives administration recorded between 1965 and 1969 when deterioration and collapse of records management and archives administration systems began. . . . Thirdly, through its various provisions specifically on structural mechanism of managing records, the Act tries to provide and facilitate a unified records management structure both at central and local government levels. The act has therefore come at the right moment in trying to create the basis for facilitating the maintenance of good record keeping systems which is of particular significance specifically now when vital records are needed in response to the public sector reform currently underway in the country.

Despite the above developments, Katundu, in providing a critical analysis of the Act, decries its deficiencies in the sense that it lacks necessary provisions for making available adequate resources for manpower training and,

especially, for management of electronic records. Accordingly, the Act only defines electronic records as types of records but it lacks a guiding principle for their management. Katundu also notes that the Act vests too much power to the Director of Records and Archives Management in the President's Office. Other observers^[62] note that the current legislation is not explicit on the management of electronic records "because the supporting legislation, referring specifically to electronic records as evidence, had yet to be defined. Records and Archives Management Department has sent several staff for introductory training in electronic records management and is developing an electronic records management policy" (p. 5).

The shortcomings surrounding record management systems are not only confined to government departments. Wema^[64] discusses the shortcomings in the management of university records at the UDSM and proposes an efficient program for managing those records, while Mnjama^[65] talks of the problems still facing the management of records a regional body that preceded the current East African Community.

MUSEUMS

National Museum System

There are several museums in Tanzania even though many people think of the museum building in Dar es Salaam as a sole representative of the historical artifacts of the country. Historically, the main National Museum in Dar es Salaam can be traced back to 1934 when the then Governor of Tanganyika Territory Sir Harold Mac Michael initiated the idea of creating a museum for Dar es Salaam.^[66] Following the death of King George V in 1936, it was decided that his Memorial Museum be built, and it was later opened to the public in 1940. The location has since remained along Shaaban Robert Street and the museum includes such exhibition halls (for details see <http://www.houseofculture.or.tz/exhibitions.htm>, accessed August 20, 2008) as the Hall of Man (cultural and biological evolution), the Biology Hall (Tanzania's biodiversity), the History Gallery (history of Tanzania through exhibitions of objects, manuscripts, photographs, and other thematic illustrations), and the Ethnographic Hall (Tanzania's cultural diversity). One of the historical treasures displayed at the National Museum is a skull of the first human, *Australopithecus boisei* (this was discovered by Dr. Leakey in 1959 at Olduvai Gorge in Arusha, northern Tanzania), as well as related foot prints. The Museum also displays many antique artifacts from various ethnic groups in Tanzania, as well as several memorabilia from World War I. It is a clear destination for researchers, students, tourists, and for general public enjoyment; it also organizes educational programs and tours for adults, children, students, and teachers.

The main National Museum (renamed "Museum and House of Culture" in 2003) (see http://www.houseofculture.or.tz/house_of_culture.htm, accessed August 20, 2008] in 2003) is part of a body corporate—the National Museum of Tanzania—that was established by an Act of Parliament (<http://www.parliament.go.tz/Polis/PAMS/Docs/7-1980.pdf>, accessed August 21, 2008) of 1980 which repealed the National Museum Act, 1962. Accordingly, the National Museum of Tanzania is "a scientific educational and cultural institution charged with the duties of collecting, conserving, displaying, and researching on all materials relating to Tanzanian's cultural and natural heritage."^[66]

Apart from the main Museum, the present National Museum of Tanzania incorporates the Village Museum (for example, see pictures at http://www.houseofculture.or.tz/village_museum.htm, accessed August 20, 2008) in Dar es Salaam (on-site collection of traditional houses from various ethnic groups and places in Tanzania); the Natural History Museum (see http://www.houseofculture.or.tz/natural_history_museum.htm, accessed August 20, 2008) in Arusha; the Arusha Declaration Museum (see <http://www.arushamuseum.ac.tz/>, accessed August 20, 2008) in Arusha with its exhibition depicting "the development of Tanzanian societies from precolonial period to present with particular emphasis on the political and economic changes"^[67] and the Mwl. J.K. Nyerere Museum in Butiama, Musoma (birth- and burial-place of the First President of Tanzania (the Father of the Nation), Julius K. Nyerere).

In Zanzibar, the museums are under the jurisdiction of the Department of Archives, Museums, and Antiquities. Zanzibar has a substantially rich and long cultural history as reflected in previous archaeological investigations.^[68,69] However, until as recently as the 1990s, the postrevolution government in Zanzibar did not promote most of its historical artifacts since the Island's history was also marred by such bitter memories as slavery and colonialism.^[70] A new museum building is currently under construction at Unguja Ukuu Archaeological site where an ancient town (500–900 A.D.) was based in Zanzibar.^[71]

Private Museums

Apart from government-sponsored museums described above, there are private or community museums that aim to promote specific cultural traditions. For instance, the Sukuma Museum in Mwanza is "a community based organization that promotes and celebrates the traditional and contemporary arts of the Sukuma culture" (For details and online galleries visit the museum's Web site at <http://philip.greenspun.com/sukuma/>, accessed August 20, 2008). Bagamoyo Museum is located in the historical town of Bagamoyo (the first capital of German East Africa), about 45 mi north of Dar es Salaam. Its exhibitions depict the town's history and its direct past

connection to outside world, namely Arab and Indian traders, European explorers, and European Christian missionaries. The exhibitions include documents, a few artifacts from slave trade and old photographs. In northern Tanzania, the Maasai Cultural Museum^[72] depicts the Maasai people and their culture. It is located about 15 mi west of Arusha Town, within the Meserani Snake Park.^[73] The Mkwawa Memorial Museum in Kalenga-Iringa, exhibits the skull of Mkwawa, the Hehe Chief. The skull was repatriated from Germany in 1954 (for details see <http://community.iexplore.com/planning/journalEntryFreeForm.asp?journalID=25336&entryID=13769&n=Mkwawa+Museum> and <http://www.mkwawa.com/day4kalenga.asp>; accessed February 3, 2009). The newest museum, the Museum of Tanzanite, was recently opened in Arusha to display the Tanzanite gemstone and its vestiges. This museum will be known as the “Tanzanite Experience Museum” (see media reports at <http://www.ippmedia.com/ipp/guardian/2008/08/21/120977.html> and http://www.safariland.org/index.php/technology/more/worlds_first_tanzanite_museum_opens_in_arusha_tanzania/, accessed September 25, 2008).

Private Art Galleries

There are several private art galleries in Dar es Salaam and other major cities that attract tourists, scholars, and other visitors. They usually exhibit paintings, traditional wooden carvings, do performances and related displays that depict Tanzanian or East African contemporary art. These include La Petite Galerie (Oysterbay), Nyerere Cultural Centre, Raza Art Gallery, Tinga Tinga Art Center (see for examples <http://www.africanstudies.uct.ac.za/postamble/tingatinga.pdf> for background information, and <http://www.africanstudies.uct.ac.za/postamble/pernille.php>, accessed September 1, 2008), Color Center, Mandawa Studio, Twiga Art Gallery, African Art and Tanzanite; all in Dar es Salaam. The African Art and Tanzanite displays masks, ebony, Masai collection, bone work, leather articles, wildlife products, Zanzibar furniture, and antiques (see <http://www.africaart.co.tz/>, accessed August 20, 2008).

Antiquities

Both the museums and the antiquities in Tanzania are under the Tanzania Museums and Antiquities Agency within the auspices of the Ministry of Natural Resources and Tourism. The Antiquities Division itself is entrusted with ensuring the sustainable preservation of nation's cultural heritage in the form of historical sites, monuments, and relics such as:^[74,75]

- any building, fortification, interment, midden, dam or any structure erected built or formed by human agency in Tanganyika before the year 1863;
- any rock painting or any immovable object painted, sculptured, carved, incised or modified by human agency in Tanganyika before the year 1863;
- any earthwork, trench, edit, well, cave, tunnel or other modification of the soil or rock dug, excavated or otherwise engineered by human agency in Tanganyika before the year 1861;
- any ethnographical object or any wooden door or door frame carved in Tanganyika in any African or oriental style before the year 1940;
- any object declared to be a protected heritage by the minister responsible for the Antiquities Department.

These are just examples of the antiquities as defined in the principal legislation, the Antiquities Act of 1964, as amended through the Antiquities (Amendment) Act of 1979.^[74] The Antiquities Act of 1964 repealed previous legislation, the Monuments Preservation Ordinance of 1939/1949, to broaden the coverage of the heritage objects earmarked for conservation such as any ethnographic objects. Some of the cultural heritage sites include Kilwa Kisiwani and Songo Mnara islands in Indian Ocean (about 175 mi south of Dar es Salaam) which contain ruins of such historical monuments as the twelfth-century mosques, a palace, a prison, and urban structures. Similar structures and early Swahili settlements can be found in Bagamoyo and Zanzibar. Also, there palaeoanthropological and archeological sites such as the Olduvai Gorge; Ismila Middle Stone Age (Iringa); Laetoli Footprints (about 28 mi south of Olduvai Gorge, estimated to be 3.5 million years old); prehistoric burial site in the Ngorongoro Crater; Kiara rock-shelter paintings (Bukoba); Kwihara Tembe-Kigoma (Dr. David Livingstone's anti slavery “museum”); several German era buildings of architectural importance in various towns; Amboni caves (Tanga); Mbozi Meteorite, Mbeya (weighs about 25 metric tons); Kondoa-Irangi Rock Paintings-Dodoma (some of them 30,000 years old); ruins of an ancient (fifteenth century) irrigation site in Engaruka, and so on. Some of these sites and monuments—such as Kilwa Kisiwani and Songo Mnara, have been incorporated into the UNESCO's World Heritage List.^[76]

In Zanzibar, the conservation of historical sites is under the Department of Archives, Museums, and Antiquities. The Zanzibar's Old Town is of particular interest to tourists and researchers alike. (For details see <http://www.zanzibarheritage.go.tz/Antiquities.htm>, accessed September 20, 2008.)

BOTANICAL GARDENS, HERBARIA, AND ZOOS

Botanical Gardens

The Dar es Salaam Botanical Gardens (adjacent to the main Museum building) were established in 1893 under the first Director of Agriculture, Dr. Franz Stuhlmann, of

German East Africa (Tanganyika) administration. It became fully operational in 1906. Comprising mostly indigenous plants and a few exotic species, the gardens offer relaxing as well as educational experience to visitors as noted in the following statements:

offer the perfect place to enjoy some peace and quiet and to examine the country's colourful native flora. Wander among purple bougainvillea, blue jacaranda, scarlet flame trees and red hibiscus. As well as the indigenous plants and flowers, this is one of the few places in the world where you can see the coco-de-mer palm tree, native to the Seychelles.^[77]

These lovely gardens are a remnant of the German era in Tanzania. Beautiful palms and many types of ferns grow here. Majestic peacocks can be spotted walking around the gardens. The gardens offer a haven of peace and tranquility in the midst of Dar es Salaam's chaotic city life.^[78]

The Germans also set up another botanical garden in Amani, Tanga (north-eastern Tanzania) in 1893. This was later developed into an agricultural institute—Biological-Agricultural Institute of Amani—that became operational in 1902 with resident and visiting scientists, and with such facilities and functions as “botanical, zoological, and chemical laboratories performing soil analyses, disease, fertilizer, and other basic biological research, and by 1907 a total of 650 ‘useful plants’ were cultivated there.”^[79] After World War I, the British administration renamed the institute “East African Agricultural Research Station” and some of its facilities were transferred to Kenya (see the section on “Herbaria”). Most initial plantations of the Amani Botanical Gardens now are incorporated into the Amani Nature Reserve in the East Usambara Mountains. The Reserve was legally established by a declaration order in 1997 through the Gazette of the United Republic of Tanzania No. 19 Vol. 78.^[80] According to the Tropical Biology Association, the Reserve is “globally recognized centre of biodiversity and one of the most valuable conservation areas in Africa . . . It is likely that the Amani Botanical Garden still contains one of the largest collections of exotic plants in Africa. It is estimated that about 600 different taxa were planted with about 460 still surviving.”^[81]

Herbaria

The National Herbarium of Tanzania (NHT) is based at the Tropical Pesticides Research Institute (TPRI), Arusha, and was instituted through an Act of Parliament of 1979 that established TPRI. The NHT's mandate is centered around “cataloging the entire flora of Tanzania and recording the resultant information for easy access by the general public and other institutions,”^[82] and to carry out taxonomic research.^[83] The herbarium also maintains a database of indigenous plants of Tanzania and its repository contains over 65,000 specimens.^[84]

Other key herbaria in Tanzania include the UDSM Herbarium under the Department of Botany (120,000 specimens), mainly used for training purposes. Others are under the Tanzania Forestry Research Institute (60,000) and the College of African Wildlife Management (~5,000), all these ranging from 27 to 104 years old.^[84] The largest collection of herbarium materials in the country was established at Amani, alongside the Amani Botanical Garden during German administration; in 1948 the herbarium was relocated to Nairobi-Kenya (see <http://www.bgci.org/garden.php?id=1335&ftrCountry=TZ&ftrKeyword=&ftrBGCIem=&ftrIAReg=>, accessed September 1, 2008) as part of the East African Herbarium.

Zoos

Zoos are not very popular in Tanzania probably because of the country's rich natural wildlife parks and virgin forests; thus potential investments in zoos seem not to have received noticeable priority from either government or private agencies. There is one small zoo in Usa River, a small town about 15 mi east of Arusha. It was established initially as a game sanctuary for orphaned and ill wild animals. In addition, it “has a pond with flamingos, pelicans and gardens grazed by eland and zebra—a good place for lazy Sunday afternoon with the kids.”^[85] Other popular zoos include the Saa Nane Island Game Reserve in Mwanza, north-western Tanzania around Lake Victoria^[85] and the Meserani Snake Park in Arusha.^[73] The snake park displays different varieties of snakes “common in Eastern and Southern Africa from the Black Mamba to the Black and Red spitting Cobras and the African Python.”^[72] The park also contains such other reptiles as crocodiles, lizards, and tortoises, and it serves as a sanctuary for injured or orphaned birds.

SCHOLARLY PUBLISHING

Situation Analysis

As in many other African countries, Tanzania's publishing industry is generally marginal in terms of its contribution to the global publishing market. It tends to concentrate on the production of text books for primary and secondary schools^[86] while scholarly publishing is generally minimal despite postindependence efforts to promote scholarly publishing through establishment of the Dar es Salaam University Press (DUP) (for details, see <http://www.dup.co.tz/>, accessed September 1, 2008) and other publishing houses. Bgoya^[86] suggests possible reasons for the marginalized situation, including lack of interest in African-generated scholarly materials by international book market (booksellers, buyers, and librarians). But, Bgoya also argues that African governments have not

given due priorities—in terms of allocation of resources—to their universities or even to provide incentives to their own scholars (including those based in Europe and North America) to enhance local scholarly publishing. According to Bgoya, the university presses in Africa have deteriorated, thus negatively affecting the quantity and quality of scholarly publishing outputs that would better compete in international markets and contribute to the global knowledge pool. However, he takes notes of gradual recoveries brought about by different initiatives that publishers are taking to ensure and sustain their survival.

Apart from DUP, other key publishers that also produce scholarly publications include the Tanzania Publishing House, Mkuki na Nyota Publishers (for details, visit <http://www.mkukinanyota.com/home.html>, accessed September 1, 2008), and Oxford University Press, Dar es Salaam. Moreover, the first printing presses in Tanzania were established by early Christian missionaries to publish religious and school materials, especially in local languages. Most of these presses still exist and have evolved into full-fledged publishing houses, such as Vuga Press (see <http://www.elct-ned.org/index.php/newsclips/2198-vuga-press-is-also-a-publishing-house>, accessed September 1, 2008) (Soni–Lushoto, Tanga, north-eastern Tanzania), Benedictine Publications and Peramiho Printing Press (Songea, southern Tanzania), the Ndanda Mission Press (see <http://www.ndanda.org/>, accessed September 1, 2008) (Mtwara, south-eastern Tanzania), the Tanganyika Mission Press and Publication (Tabora, western Tanzania), and the Catholic Publishers Limited (Dar es Salaam).

Current initiatives

Tanzania's major publishers participate in various initiatives to facilitate publication and distribution of locally-created scholarly materials. These include

- The African Publishers Network—founded in 1992 “to promote indigenous publishing throughout Africa.”^[87] It is based in Abidjan Cote d'Ivoire.
- The African Books Collective (for details see <http://www.africanbookscollective.com/>, accessed September 1, 2008)—founded in 1989 and representing member publishers to distribute African literature in the English-language in Europe, North America, and in Commonwealth countries outside Africa. It is coordinated from Oxford, United Kingdom.
- The Book Development Council of Tanzania—an NGO, was founded in 1999 to “coordinate and stimulate the activities of public and private sector agencies in the book industry of Tanzania so that more and better books of all kinds may be made available to the readers of all kinds. . . of all ages throughout Tanzania” (for details see <http://www.bamvita.or.tz/default.asp>, accessed August 21, 2008).

- Exploring Electronic Publishing Opportunities.^[86,88]
- Initiatives from the INASP—such as improving journal quality, publishing, publicity, and access; electronic journal publishing and dissemination such as the African Journals Online (for details see <http://www.inasp.info/file/121/>, accessed August 21, 2008).
- Promoting Scholarly Publishing in African Languages.^[86,89]

Various professional associations in Tanzania and East Africa as a whole play a key role in promoting scholarly publishing through their variety of activities including journal publications (for example, some of the selected scholarly journals listed in Table 2 are published by professional associations).

INTELLECTUAL PROPERTY REGULATIONS

Pre-independence regulations and related legislation on intellectual property rights were basically meant to protect the interests of colonial powers and their allies, and their subjects who came to settle in Tanganyika.^[90] Such regulations were governed through the Trade Marks Ordinance of 1922, the Copyright Ordinance of 1924 and the Patents Ordinance of 1924. Some authors still take these pre-independence regulations with skepticism, noting that they “were promulgated to inhibit innovative activities among the indigenous Tanzanians.”^[90] Accordingly, the newly independent nation of Tanzania was somewhat silent on intellectual property regulations until 1966 when the new Copyright Act repealed the Copyright Ordinance of 1924. Likewise, the Trade and Service Marks Act of 1986 repealed the Trade Marks Ordinance of 1922, and the Patents Act of 1987 repealed the Patents Ordinance of 1924. The significance of these new legislations was that they removed a precondition for granting intellectual property rights in the United Kingdom before they were made effective in Tanzania through registration; in other words, the intellectual property rights-granting agencies in Tanzania were given powers to grant rights to deserved authors of creative works or innovators.

The latest legislation that is relevant to the scope of this entry is the Copyright and Neighboring Rights Act No. 7 of 1999 that repealed the Copyright Act of 1966. This new legislation is intended to “make better provisions for protection of copyright and neighbouring rights in literary, artistic works and folklore, and for related matters” (for details see <http://www.parliament.go.tz/Polis/PAMS/Docs/7-1999.pdf>, accessed September 20, 2008).

In order to administer the economic and moral rights of copyright owners, the Copyright and Neighboring Rights Act of 1999 established the Copyright Society of Tanzania (COSOTA) under the Ministry of Industry and Trade. Specific functions of COSOTA include the following

Table 2 Selected key scholarly journals published in Tanzania.

<i>Africa Theological Journal</i> (Makumira University College)
<i>African Journal of Finance and Management</i> (Institute of Finance Management)
<i>The African Review Journal</i> (University of Dar es Salaam)
<i>East African Journal of Public Health</i> (East African Public Health Association)
<i>Eastern Africa Law Review</i> (University of Dar es Salaam)
<i>Huria: Journal of the Open University of Tanzania</i> (Open University of Tanzania)
<i>Journal of Building and Land Development</i> (Ardhi University)
<i>Journal of Development Studies</i> (University of Dar es Salaam)
<i>Journal of Population Studies and Development</i> (University of Dar es Salaam)
<i>Journal of the Geographical Association of Tanzania</i> (Geographical Association of Tanzania)
<i>Kioo cha Lugha: Journal of Kiswahili Department</i> (University of Dar es Salaam)
<i>Mulika: Journal of the Institute of Kiswahili Research</i> (University of Dar es Salaam)
<i>Papers in Education and Development: Journal of the Faculty of Education</i> (University of Dar es Salaam)
<i>Tanzania Dental Journal</i> (Tanzania Dental Association)
<i>Tanzania Journal of Forestry and Nature Conservation</i> (Faculty of Forestry and Nature Conservation, Sokoine University of Agriculture)
<i>Tanzania Journal of Health Research</i> (National Institute for Medical Research)
<i>Tanzania Journal of Science</i> (Faculty of Science, University of Dar es Salaam)
<i>Tanzania Medical Journal</i> (Medical Association of Tanzania)
<i>Tanzania Veterinary Journal [The Tropical Veterinarian]</i> (Tanzania Veterinary Association and Faculty of Veterinary Medicine of Sokoine University of Agriculture)
<i>Tanzania Zamani</i> (Historical Association of Tanzania)
<i>Tanzanian Economic Trends (TET) Journal</i> (University of Dar es Salaam)
<i>Tanzanian Mathematical Bulletin</i> (Mathematical Association of Tanzania)
<i>UHANDISI Journal</i> (University of Dar es Salaam—engineering colleges)
<i>University of Dar es Salaam Library Journal</i> (University of Dar es Salaam Library)
<i>UONGOZI Journal of Management and Development Dynamics</i> (Mzumbe University)
<i>UTAFITI: Journal of the Faculty of Arts and Social Sciences</i> (University of Dar es Salaam)
<i>Western Indian Ocean Journal of Marine Science</i> (Western Indian Ocean Marine Science Association)

(for details see <http://www.parliament.go.tz/Polis/PAMS/Docs/7-1999.pdf>, accessed September 20, 2008; see also COSOTA's Web site at <http://www.cosota-tz.org/frameset-t5.html>, accessed September 20, 2008):

- To promote and protect the interests of authors, performers, translators, and publishers;
- To collect and distribute royalties of the copyright owners;

- To maintain registers of works, authors, performers, translators, producers, and other copyright owners;
- To identify and publicize the rights of owners; and in case of a dispute or an infringement, to provide necessary evidence;
- To advise the responsible minister on all matters related to this copyright law.

Certain observers have reported a lack of effective enforcement of intellectual property laws in Tanzania. They note, for example, that “despite the recent legislation, enforcement of intellectual property rights remains ineffective. Violations are not seriously investigated, and the courts lack experience and training in IPR issues” (see <http://www.state.gov/e/eeb/ifa/2006/62039.htm>, accessed September 20, 2008). To that end, a group of authors established the Tanzania Writers Association in 1978 to—among other objectives, safeguard the interests and rights of creative writers in the country. There is a parallel association for music performers and producers, the Tanzania Dance Music Association.

On the international scene, Tanzania is a founding member of the African Regional Intellectual Property Organization (ARIPO)—established in 1976, based in Harare-Zimbabwe—and a party to ARIPO's protocols on patents and trade marks. Also, since 1963, Tanzania has been a party to the Berne Convention (relating to the protection of literary and artistic works) and the Paris Convention (relating to the protection of industrial property: patents, trademarks and industrial designs), both of which are administered by the World Intellectual Property Organization (WIPO) of the United Nations. Tanzania joined WIPO in 1983. Likewise, since 1999 Tanzania has been a contracting nation to the Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of Registration of Marks, and the world-wide Patent Cooperation Treaty.

PROFESSIONAL DEVELOPMENT

Post-independence Challenges and Remedies

As noted before, like many other newly-independent African nations, Tanzania lacked sufficient trained librarians, information specialists, and related professionals, and had to rely on expatriates (mainly from the United Kingdom, United States of America, Canada, Australia, and Scandinavian countries), technical advisers from UN agencies (especially the UNESCO) and volunteers (Peace Corps, VSO [Volunteer Service Overseas (of UK)], etc. In 1971, the first Director of Library Services, E.M. Broome, returned to the United Kingdom and a Tanzanian, Ezekiel Kaungamno, assumed the position. According to Kaungamno and Ilomo, at the time of

Mr. Broome's departure, TLS had become steadily-established and of some standing among library professional circles.^[14]

To alleviate shortages of trained professionals and to meet manpower demands of a growing network of libraries in Tanzania, the Government through TLS embarked on a vigorous professional training program.^[11-14] The goal was to develop a cadre of library and information professionals of TLS and its branch libraries, and to support other (non-TLSB) libraries. Subsequently, in 1972 the government established the National Library Assistant's Certificate course at Dar es Salaam Teacher's College; this was transferred to the NCL's building in 1974. The program still provides basic training for library paraprofessionals. In the same year, the TLS Board adopted the Staff Development Program for senior staff, leading to substantial enrollments in various library schools abroad. In addition, several mid-level staff went to the East African School of Librarianship (Makerere University) in Uganda, where they pursued professional training at "diploma" and, in later years, degree levels. In addition, the TLS Board thought that there was a need to establish a locally-based school to train mid-level staff in librarianship and archival studies, hence the founding of the School of Librarianship and Archives and Documentation Studies in 1989. At the same time, many more graduate level staff went to the School of Information Studies for Africa, Addis Ababa University, Ethiopia, for master's level studies. Many others went to universities in Europe, North America and Australia for graduate (M.A./M.Sc., Ph.D.) degrees. Most of those who went abroad received fellowships from Government (of Tanzania and such foreign and international agencies as the British Council and the International Development Research Center of Canada. These and other donors and NGOs have also sponsored students to attend local schools; for example, the Norwegian Agency for International Development has supported students to attend a 2 year diploma program at School of Librarianship and Archives and Documentation Studies. (See the Tanzania Library Association's Chairman's report at SCECSAL conference at <http://www.scecsal.org/stlacr06.html>, accessed August 21, 2008.)

Apart from attending long-term programs, information professionals in Tanzania have benefited from short courses, mostly through partnerships among national and international institutions such as the Tanzania Library Association (TLA), INASP, the Center for Agricultural and Rural Development, The British Council, The World Bank, UN agencies, Association for Strengthening Agricultural Research in Eastern and Central Africa, Southern African Center for Cooperation in Agricultural and Natural Resources Research and Training, NGOs (e.g., Libraries without borders), and several international and bilateral donor agencies. Some of these donors, such as the Swedish International Development Cooperation Agency and its Department for Research Cooperation, have played key

roles in supporting capacity-building projects of local institutions to develop ICT-enhanced training.

Training Institutions in Tanzania

Reflecting on locally-available resources for professional training in the field, basic professional training in library and information sciences is provided by TLS through its national library assistants' course. Mid-level "diploma" training is available from SLADS, while higher level training programs (first degree, masters, Ph.D.) are obtained from the UDSM (Department of Information Studies) and from a number of the newly-established public and private universities. Table 3 provides a summary of institutions that provide information/library-related training programs and the programs they offer.

PROFESSIONAL ASSOCIATIONS

The TLA is the main professional association in the field. It was initially affiliated with the East African Library Association (EALA) until its formal establishment in 1973 following the dissolution of EALA. It promotes the profession through such activities as workshops, short courses, formal talks, conferences, online discussion groups, film programs, and publication of a newsletter. (For details, see <http://www.tla.or.tz/index.htm>, accessed August 20, 2008.) The TLA is also affiliated to the Standing Conference of Eastern, Central, and Southern African Library and Information Associations (SCECSAL) (for details about SCECSAL, a list of current member countries and its conferences visit its Web site at <http://www.scecsal.org/>, accessed August 20, 2008) which stemmed from the EALA's former members' decision to retain their biennial conference and decided to invite other countries in the region. There are also proposals to transform SCECSAL into a regional federation of library and information associations. In addition, TLA is affiliated with the International Federation of Library Associations and Institutions as a member along with other several individual institutions in Tanzania. In addition, many information professionals in Tanzania who went to foreign countries for graduate studies joined professional associations in those countries and retained their memberships after their return to Tanzania. In doing so, they have helped to strengthen their local institutions through transfer and diffusion of innovations from other countries.

The book publishing industry has its own association, The East African Book Development Association, which is a registered society in Tanzania, Kenya, and Uganda. Its motto is "Enhancing Literacy for Poverty Eradication" and its vision is "A literate and enriched people through the promotion of books and reading," while its mission is to "support development of all functions of the book sector in the East African region and to enhance cross-border

Table 3 Institutions that provide information/library-related training programs in Tanzania.

Institution	Department/school/faculty	Location	Programs (and year started)	Outputs
UDSM	Faculty of Arts and Social Sciences, Department of Information Studies	Dar es Salaam (DSM)	Information Studies, 1997	Master of Arts in Information Studies Ph.D. in Information Studies
UDSM	Department of Computer Science	DSM	Information Systems Computer Science CISCO Program	B.Sc./M.Sc. in Computer Science B.Sc. with Computer Science Diploma in Computer Science
UDSM	UDSM Computing Centre (Business entity of the University to meet market demand for skills in ICT applications)	DSM	Computing and Information Technology Various professional courses (for details see http://www.ucc.co.tz/services/training/courses.php)	Certificate and Diploma in Computing and Information Technology Various course certificates
St. Augustine University of Tanzania	Ruaha University College, Faculty of ICT	Iringa (southern Tanzania)	Information and Communication Technology (ICT), 2005	Bachelor of ICT (Information Systems) Bachelor of Computer Science Diploma in Computer Science
Tumaini University	Tumaini University Dar es Salaam College (former Waldorf College-Tanzania)	DSM	Library and Information Services, 2003 Mass Communication, 2003	Bachelor of Arts in Library and Information Studies Bachelor of Arts in Mass Communication
TLSB	School of Library, Archives and Documentation Studies	Bagamoyo	Library and Information Science, 1989	Diploma in Librarianship Certificate in Librarianship
TLSB	Tanzania Library Services	DSM	National Library Assistants Certificate Course, 1972	Certificate in Librarianship
University of Dodoma	College of Informatics and Virtual Education.	Dodoma	IC, 2007	Bachelor of Science in Information Systems
Institute of Finance Management	—	DSM	Information Technology and Management	Master of Information Technology and Management Advanced Diploma in Information Technology Certificate in Information Technology Certificate in Record Management
Tanzania Public Service College	(http://www.tpsc.go.tz)	DSM	Record Management, 1997	Certificate in Record Management
Mzumbe University	Faculty of Science and Technology, Department of ICT	Morogoro	ICT Management (ICTM), 2003/2004	B.Sc. in ICTM Certificate in ICT
College of Business Education	—	DSM and Dodoma	ICT	Certificate in ICT
Institute of Accountancy Arusha	Department of Information Technology	Arusha	Computer Science and IT, 2001	Certificate and Advanced Diploma in IT/Computer Science

trade in books” (For details and for the objectives of EABDA, visit its homepage at <http://www.eabda.com/home.php?LinkID=0c3c8322b833376d737f14a98a77d998>, accessed September 20, 2008). Likewise, the Tanzania Writers Association brings authors together to promote creative writing.

As noted before, Tanzania is also witnessing exponential growth of its universities; as well as several individual institutional strategies to employ ICT-enhanced library

and information services aimed to improve access to information resources by academic communities. Their libraries want to bring their efforts together through the proposed Tanzanian Academic and Research Libraries Association. This might lead to establishing formal networks that will promote sharing of meager resources through, for example, coordinated acquisition of library materials and subscriptions of licensed electronic resources.

A NOTE ON KEY POLICY INITIATIVES

Apart from the National and MoEVT ICT policy plans,^[30,53] Tanzania is implementing a number of national initiatives and participating in related international agendas that take into account, among other things; the need to enhance citizen-centered development of information-based society that benefits from potentials of ICTs in achieving national development goals. These include the following:^[30,53,91,92]

- The Tanzania Development Vision 2025—envisioning high-quality livelihood, peace, good governance and well-educated and learning society.
- The National Strategy for Growth and Reduction of Poverty, Tanzania—envisioning empowered citizens with more access to information and related ICTs for better decisions in individual income-generating activities that lead to better life and poverty reduction.
- The Millennium Development Goals, Tanzania—envisioning a universal primary education, redressing gender disparities in education and advocating global partnerships for development and ultimate poverty reduction.
- Education and Training Policy of 1995, Tanzania—recognizing the importance of computer training in enhancing scientific technological development in Tanzania; thus incorporating computer studies in school curricula.
- The Education Sector Development Programme, Tanzania (primary and secondary education)—striving to improve enrollment, quality teacher education, and employing ICT-enhanced education and training.
- Education Sector Review, Tanzania—increasing the use of ICTs to improve education quality.
- National ICT Backbone Infrastructure Initiative, Tanzania—developing a vibrant and sustainable national ICT infrastructure to support economic development.
- National e-Government Strategy, Tanzania—employing ICTs to improve delivery of and access to government services.
- Rural Telecommunications ICT Fund and Universal Communication Access Fund, Tanzania—through the Universal Communication Access Act of 2006, a fund was established “for enabling accessibility and participation by communication operators in the provision of communication services, with a view to promoting social, education, and economic development of the rural and urban under-served areas; to provide for availability of communication services by establishing a legal framework for universal service providers to meet the communication needs of consumers and to provide for related matters.” (For details see <http://www.tcra.go.tz/policy/ucsa.pdf>, accessed September 24, 2008.) It thus entails building an ICT infrastructure backbone linking all district and regional headquarters by 2010 using fiber optic technology.

- Local Government Reform Programme, Tanzania—including implementation of management information systems to improve planning, budgeting, and reporting processes.
- Rural Electrification Programme, Tanzania.
- The World Summit on the Information Society (WSIS)—aiming to create citizen- and development-centered information society, focusing on integrating ICTs into all levels of education and domestic policies through implementing the WSIS Declaration of Principles and Action Plan (Tanzania is a signatory to this declaration)
- Various sector policy documents and strategies. (Visit the official online gateway of the Government of Tanzania at <http://www.tanzania.go.tz/> for links to various sectors, accessed August 20, 2008.)

CONCLUSIONS AND CHALLENGES AHEAD

The foregoing sections describe the historical development and current status of library and information systems and services in Tanzania, focusing on the postindependence situation and also touching on pre-independence evolution. Most of the library and information systems came into fruition after independence in 1961, with the exception of a few special libraries. The public library system under the auspices of the Tanzania Library Services Board constitutes the hub of the library system in the country, including the NCL, 19 branch libraries spread over 19 of 21 regions of Mainland Tanzania and several district libraries. There is a long way to go to spread libraries in rural areas and there are strategies to improve communications infrastructure in those areas including initiating ICT-enhanced teaching and learning strategies in secondary and primary schools.^[30,93] Also, the TLSB is coordinating efforts to expand its network of libraries in partnership with local governments throughout the country. Zanzibar maintains its public library services under the Zanzibar Central Library.

There are around 50 institutions of higher learning—both public and private—in Tanzania, with varying levels of library holdings; however, the UDSM Library is the largest academic library in the country. Recent years have seen a sharp growth of universities as a result of Government’s policy of encouraging the private sector to enhance its participation in promoting education for national development while the government itself is expanding public universities to increase student enrollments. As a result, these institutions are facing challenges of meeting the information needs of the expanded academic communities with meager resources—including skilled staff—by employing ICT-enhanced strategies aimed to improve access to information resources. Several observers in the profession have suggested strategies to address impending twenty-first century challenges to

developing-countries academic libraries and their institutions, other libraries, and information centers. The strategies include open access initiatives;^[93,94] revisiting library collection development policies taking into consideration the balance between print and electronic resources;^[95] enhancing information literacy and e-learning programs;^[93,96,97] augmenting training in electronic information management (including electronic records); digital networking and audiovisual archiving for improved preservation and shared access;^[43,48,62,64,95] and exploring the potential of cell phones as a tool for accessing information resources and learning.^[30,98]

The entry also describes school libraries, information services for children, as well as special libraries and specialized information services; focusing especially on ongoing national initiatives to utilize potentials of information technology to facilitate teaching and learning, and access to information resources. To that end, the entry highlights the situation of professional development efforts, scholarly publishing and professional associations and their contributions in addressing the impending challenges. In addition, the entry outlines the structures of the archival system, museums, botanical gardens, zoos, and herbaria in Tanzania, citing how researchers have reported the difficulties in accessing records in the national archives of Tanzania and how the legislation on archives is not explicit on electronic records management. Finally, the entry goes further to outline broader national policy initiatives that aim to address broader socioeconomic challenges and the role of ICTs in that endeavor.

Generally, much of the progress thus far in terms of library development, literacy education, and overall learning achievements in the Tanzanian society have been achieved over a brief four-decade span of independence. In particular, the first president, Julius K. Nyerere, was instrumental in advocating the development of a literate society in Tanzania by committing government resources to develop libraries, schools, and adult learning programs. These were supported by different legislations that have been mentioned in this entry and listed in the chronology (Appendix 1). All these were implemented by a dedicated team of local pioneers in the field, including the first TLS director, Ezekiel Kaungamno.

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APPENDIX A

Table A Chronology of library and information system development in Tanzania.

1944	Representatives of the East African governments met and decided to commission an expert who would survey the state of library and literature provision and make recommendations for their improvement. E. Huxley was commissioned to undertake the survey.
1945	E. Huxley submits a report on literature and library provision to East African governments.
1946	Municipalities Ordinance 1946 as subsequently amended empowered councils to establish, erect and construct, acquire, maintain, assist, promote and control <i>inter alia</i> public libraries either within, or with the consent of the Minister without the geographical limits of the Municipality.
1948	Founding of the East African High Commission (EAHC). Founding of The East African Literature Bureau as a branch of the EAHC. George Annesley, ALA, arrives in E.A. as the first Bureau Librarian. Publication of the Annesley Report on the implementation of the Huxley Report.
1951	The East African Literature Bureau started a library service in Tanganyika.
1953	George Annesley, the Bureau Librarian attended the Ibadan UNESCO Seminar on Public Libraries; thereafter, he visited the Ghana Library Board which had already made progress and considered a model public library system for the rest of Africa to emulate.
1946	Colonial Secretary Sir Alan Lennox Boyd sent dispatch No. 932 of August 27, 1959 to the Administrator, EAHC, on British Government's proposal to finance library development in East Africa through the British Council.
1947	Colonial Office approved the appointment of S. W. Hockey, MBE, FLA, as a British Council Libraries Organizer in East Africa. He had been on a successful similar assignment for 15 years in the British West Indies. Mr. S.W. Hockey surveyed existing library facilities and submitted a report to 3 East African governments on the development of library services in East Africa.
1961	The Tanganyika Government accepted the Hockey Report—the first East African country to do so. In July, the Tanganyika Government adopted post-independence Three-Year Development Plan 1961/62–1963/64. The plan included a proposal to construct the National Central Library which would be related to the territorial expansion of libraries. December 9, 1961: Tanganyika became independent.
1962	Enactment of the Libraries (Deposit of Books) Act 1962. It provided for one perfect copy of every book printed in Tanganyika to the

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Table A Chronology of library and information system development in Tanzania. (*Continued*)

	University College of Dar es Salaam. October: A Library Planning Committee resolved that the national library service to be established should be called the Tanganyika Library Services (TLS) . The National Museum Act 1962, enacted.
1963	July 11: President J.K. Nyerere assented to the Tanganyika Library Services Board Act 1963. August: E.M. Broome Esq. FLA arrived in Tanganyika to take up his responsibility as first Director of Library services. November 1: The Tanganyika Library Services Board was appointed and commenced its work. Libraries (Deposit of Books) order 1963 made under the Libraries (Deposit of Books) Act 1962. Between November 1, 1963 and March 31 1964 TLS operated under the canopy of the East African Literature Bureau from which it inherited books, equipment, funds and staff.
1964	April 1: The Tanganyika Library Service was born as a parastatal organization under the Ministry of Education. Opening of Iringa Library in a makeshift building July 1: Adoption of the TLS Board's Library Development Plan and its incorporation into the National Five-Year Plan 1964–69. The Antiquities Act, 1964, enacted.
1965	Absorption of King George VI Memorial Library, Tanga and the Kilimanjaro Native Cooperative Union Library into TLS. Miss Mary Tizzard, Head of Schools and Children's services at TLS HQ surveyed school libraries and produced a report that would form a basis for improving school libraries in the country (it remained unpublished/unimplemented). Tanzania broke diplomatic relations with Britain following Ian Smith's unilateral declaration of independence of Rhodesia/Zimbabwe. As a result the TLS Board lost £250,000 that had been earmarked by the British Government to support library development in Tanzania.
1965	National Archives Act, 1965 enacted.
1966	Survey of government libraries leading to the F. N. Fogg Report, recommending the integration of all types of libraries into a single national library service with TLS as its nucleus and playing a leading role. The Copyright Act, 1966, enacted. The Act repealed the Copyright Ordinance of 1924.
1967	December 9: The National Central Library building was opened Mwl. J.K. Nyerere, first President of the United Republic of Tanzania. Opening of Iringa and Mwanza branch libraries.
1968/9	Survey of school libraries and the establishment of 3 model secondary school libraries by Emma Frost, a UNESCO expert.
1969	February 7: Opening of Bukoba Branch Library. July 1: Adoption of the Second Library Plan; this was incorporated into the National Five-Year

(*Continued*)**Table A** Chronology of library and information system development in Tanzania. (*Continued*)

	Development Plan 1969–74. Inauguration of rural library services through the support from UNESCO's literary work-oriented project, Mwanza. December 31: President Nyerere declared 1970 as an adult education year. TLS fully involved.
1970	Opening of Arusha, Kibaha and Moshi branch libraries.
1971	Inauguration of a School Mobile Library Service for secondary schools in several regions. The first Director of Library Services, E.M. Broome, Esq. FLA, returned to the United Kingdom; a Tanzanian, Ezekiel Kaungamno took over.
1972	Establishment of the National Library Assistants Certificate Course at the Dar es Salaam Teacher's College.
1974	July 1: The National Library Assistants Certificate Course was transferred to the National Central Library. Morogoro branch library opened. Charles P. Bourne surveyed Tanzania's library and information services and produced a report "Planning for a National Information Research Centre." He carried out this work on behalf of UNESCO. Adoption of the TLS Board's Staff Development Program for senior staff.
1975	April: Enactment of the Tanzania Library Services Board Act 1975. The Act repealed the 1963 Library Act and widened the Board's functions, responsibilities and powers. Opening of Mbeya and Mtwara branch libraries. Planning for the Tanzania National Documentation Centre began followed by the arrival of Mr. Kulkarni, an Indian expert recruited from the Commonwealth Secretariat by the Tanzania Government as a TLS's adviser on the subject. K. Samaha, a UNESCO consultant visited Tanzania at the request of the Government and produced a report on the Establishment of a National Focal Point for Scientific and Technological Information. A proposal for establishing a library school was submitted to the government for the first time.
1976	R.F. Munn from Morgantown, Virginia, United States undertook an assignment at the invitation of the government of Tanzania and produced a report, "Improving Agricultural Library Services in Tanzania." Opening of Tabora branch library.
1978	The TLSB submitted to the Ministry of Education a detailed document on the proposed library school.
1979	TLSB was given the responsibility to plan, build and manage a national library to be built in Dodoma, the new capital (not implemented as of September 2008). February: Opening of Mara regional library in Musoma. The National Archives (Amendment) Act, 1979 (Act No. 6/79) to amend the National Archives Act, 1965. The

(*Continued*)

Table A Chronology of library and information system development in Tanzania. (*Continued*)

	Antiquities (Amendment) Act, 1979, enacted (amending the Antiquities Act of 1964). The Tropical Pesticide Research Institute Act, 1979, enacted. The Act also established the National Herbarium of Tanzania.
1980	The National Museum of Tanzania Act of 1980 enacted; the National Museum Act of 1962 repealed. Construction starts of TLS printing and binding unit building in Dar es Salaam.
1981	Economic crisis led to massive cancellation of journal and book subscriptions.
1983	January: National Bibliographic Agency (NBA) founded to collect, record and conserve the national literacy output for current use and for posterity. February 16: Opening of Rukwa regional library in Sumbawanga. TLS submitted to the Ministry of Education a national library policy proposal. African Standing Conference on Bibliographic Control was held in Tanzania. The National Bibliographic Agency (NBA) was founded at TLS.
1985	International conference on resource sharing within southern African countries was held in Tanzania.
1986	The TLS received a microcomputer and accessories for computerizing the NBA database. The Trade and Service Marks Act, 1986, enacted. The Act repeals the Trade Marks Ordinance of 1922.
1987	The Patents Act, 1987, enacted. The Act repeals the Patents Ordinance of 1924.
1988	The TLS launched a diploma course at the School of Library, Archives and Documentation Studies in Bagamoyo.
1993	Tanzania Broadcasting Services Act of 1993 [for details see http://www.tcra.go.tz/policy/Tanzania%20broadcasting%20Act%206%20of%201993.pdf (accessed September 24, 2008).] enacted.
1996	Library user registration fees introduced. Local government reform measures introduced. These would result in the decentralization of TLS functions and responsibilities.
1997	National Telecommunications Policy of 1997 [for details see http://www.tcra.go.tz/policy/NTP1997.pdf (accessed September 24, 2008).] launched. Declaration order to establish the Amani Nature Reserve in the East Usambara Mountains (the Amani Botanical Gardens based in this reserve).
1997/8	Regional libraries opened in Dodoma and Lindi.
1999	The TLS' five-year strategic plan 1999–2004 launched. Inauguration of a multimedia centre in the Children's Library at the National Central Library, Dar es Salaam. The Copyright and Neighboring Rights Act No. 7 of 1999 enacted. The Act repealed the Copyright Act of 1966.
2002	Enactment of the Records and Archives Management Act [for details of the Records and Archives Management Act, visit http://www.parliament.go.tz/Polis/PAMS/Docs/3-2002.pdf (accessed September 2, 2008 from the Tanzania Parliament's Web site http://www.parliament.go.tz/).] of 2002 [repeals the Records (Disposal) Ordinance of 1931 and

(*Continued*)**Table A** Chronology of library and information system development in Tanzania. (*Continued*)

	the National Archives Act, 1965; establishes the Records and Archives Management Department]
2003	National Postal Policy of 2003 [for details see http://www.tcra.go.tz/policy/NATIONALPOSTALPOLICY.pdf (accessed September 24, 2008).] inaugurated. Tanzania Communications Act of 1993 [for details see http://www.tcra.go.tz/policy/Tanzania%20Communications%20Act%2018%201993.pdf (accessed September 24, 2008).] enacted. Tanzania Communications Regulatory Authority Act of 2003 enacted "for the purpose of regulation of telecommunications, broadcasting, postal services; to provide for allocation and management of radio spectrum, covering electronic technologies and other Information and Communication Technologies (ICT) applications and to provide for its operation in place of former authorities and for related matters" [for details see http://www.tcra.go.tz/policy/Tanzania%20Communications%20Regulatory%20Act-2003.pdf (accessed September 24, 2008).]. National ICT Policy of 2003 launched ^[53] National Museum building renamed "Museum and House of Culture"
2006	The Universal Communications Service Access Act of 2006 [for details see http://www.tcra.go.tz/policy/ucsa.pdf (accessed September 24, 2008).] enacted.
2008	An Act No. 7 of 2008 to provide for the establishment of the UNESCO National Commission and to provide for related matters (http://www.parliament.go.tz/Polis/PAMS/Docs/7-2008.pdf).

See the section on "Academic Libraries" for the years of establishment of various academic institutions in Tanzania (by implication, their libraries were set up when these institutions were established).

Source: Adapted from Kaungamno and Ilomo^[12] plus scores of other sources with amendments/updates by the author.

APPENDIX B

Table B Functions and powers of the TLSB.

Functions
4.
1. The functions of the Board shall be:
a. to promote, establish, equip, manage, maintain, and develop libraries in the United Republic;
b. to set up, establish, equip, manage, maintain and develop documentation centers and to provide documentation services;
c. to provide facilities for the study of, and for training in, the principles, procedure, and techniques of librarianship, and such other related subjects as the Board may from time to time decide;
d. to conduct examinations and to grant diplomas, certificates and other awards of the Board;
e. to sponsor, arrange and provide facilities for conferences and seminars for discussion of matters relating to library and documentation services;
f. to initiate, sponsor, participate in, finance and assist in campaigns for the eradication of illiteracy;

(*Continued*)

Table B Functions and powers of the TLSB. (*Continued*)

Functions
g. to provide an efficient library service both in the urban and rural areas and to stimulate public interest in literature generally and in Tanzania literature in particular;
h. to sponsor, promote, assist and engage in the production of books and other literary works;
i. to assume responsibility for the revival, production and preservation of indigenous and traditional literary works;
j. to plan and coordinate library and documentation services in the United Republic;
k. to advise the Government and parastatal institutions on all matters relating to the production of books and other literary works;
l. to advise the Government and parastatal institutions on all matters relating to library and documentation services;
m. to provide advisory services and financial technical assistance necessary for or incidental to the proper and efficient development of enterprises engaged in the production of books and other literary works;
n. to carry out research in the development of library and documentation services and the production and marketing of books and other literary works;
o. to do all such acts and things, as in the opinion of the Board may be necessary to uphold and support, the credit of the Board and to obtain and justify public confidence, and to avert and minimize any loss to the Board;
p. to do anything or enter into any transaction, which in the opinion of the Board, is calculated to: facilitate the proper and efficient exercise by the Board of its functions under this Act, including: (i) the carrying on of any of the activities of the Board in participation with any other person; (ii) the acquisition, by agreement, of interests in enterprises engaged in activities in which the Board may lawfully be engaged under this Act, and the management of the affairs or the continuance of the business of such enterprises; (iii) the establishment of branches within the United Republic or elsewhere.

Powers in relation to libraries

- 5(1) The Board may, with the consent of the Minister, make by-laws:
- a. requiring all or any category of public libraries in Tanganyika to be registered with the Board and providing for the form of and the fee for such registration;
 - b. prohibiting employment of any person as a librarian of any public library unless such person holds a degree, diploma or other award specified in such by-laws;
 - c. requiring such schools and other educational institutions, including institutes of higher education, as may be specified in the by-laws to establish and maintain libraries in such manner and of such standard as may be prescribed;
 - d. requiring public libraries registered with it to comply with such requirements as to the maintenance of

(*Continued*)**Table B** Functions and powers of the TLSB. (*Continued*)

Powers in relation to libraries
indexes, the preparation of registers of members, the submission of financial and other returns and such other matter as may be prescribed.
(2) It shall be the duty of every person who prints or produces or causes to be printed or produced in Tanganyika any book or other literary work intended for sale or public distribution or exhibition, whether in consideration of any fee or otherwise, to supply the Board, free of charge, not less than two copies of such book or other literary work: Provided that in the case of any of any gramophone record, film or other book, not being a printed material, the Board may direct that the person producing the same shall supply the Board with one copy only.
(3) It shall be lawful for the Board by notice in writing, to require the person responsible for the management of any public library registered with it to make available in or to remove from any library such books and other literary works as the Board may in such notice specify.
(4) Any person who contravenes any by-law made under subsection (1) or fails to comply with the requirement of subsection (2) or with any notice given under subsection (3) shall be guilty of an offence and shall be liable on conviction to a fine not exceeding twenty thousand shillings or to imprisonment for a term not exceeding three years or to both such fine and imprisonment.

Source: Adapted from United Republic of Tanzania. *Tanzania Library Services Board Act No. 6 of 1975*; Dar es Salaam, Tanzania, 1975; Sections 4(1) a–p, 5(1–4); pp. 42–43 (see also <http://www.parliament.go.tz/Polis/PAMS/Docs/6-1975.pdf>).

APPENDIX C**Table C** Major higher learning institutions in Tanzania and their URLs.

1. University of Dar es Salaam (UDSM)—<http://www.udsm.ac.tz> (Dar es Salaam)
 - Dar es Salaam University College of Education—<http://duce.ac.tz/> (Dar es Salaam)
 - Mkwawa University College of Education—<http://muce.ac.tz/> (Iringa)
 - The Institute of Journalism and Mass Communication—<http://www.ijmc.udsm.ac.tz/> (Dar es Salaam)
2. Sokoine University of Agriculture (SUA)—<http://www.suanet.ac.tz> (Morogoro)
 - Moshi University College of Cooperative and Business Studies—<http://www.muccobs.ac.tz/> (Moshi)
3. Muhimbili University of Health and Allied Sciences (formerly Muhimbili University College of Health Sciences, MUCHS, of UDSM)—<http://www.muchs.ac.tz> (Dar es Salaam)
4. Ardhi University (formerly University College of Lands and Architectural Studies, UCLAS, of UDSM)—<http://www.uclas.ac.tz> (Dar es Salaam)
5. Open University of Tanzania (OUT)—<http://www.tanzania.go.tz/out.htm> (Dar es Salaam)

(*Continued*)

Table C Major higher learning institutions in Tanzania and their URLs. (*Continued*)

6. Mzumbe University (MU)—<http://www.mzumbe.ac.tz/> (Morogoro)
7. State University of Zanzibar—<http://www.suza.ac.tz/> (Zanzibar)
8. Tumaini University—<http://www.elct.org/tumaini.html>
 - Makumira University College—<http://www.makumira.ac.tz/> (Arusha)
 - Kilimanjaro Christian Medical College—<http://www.kcmc.ac.tz/KCM%20College.htm> (Moshi)
 - Iringa University College—<http://www.elct.org/iringa.html> (Iringa)
 - Dar es Salaam College—<http://www.tumainidsm.ac.tz/> (Dar es Salaam; formerly Waldorf College Tanzania)
9. St. Augustine University of Tanzania—<http://www.saut.ac.tz/> (Mwanza)
 - Bugando University College of Health Sciences—<http://www.bugando.ac.tz/> (Mwanza)
 - Mwenge University College of Education—<http://www.mwuce.org/> (Moshi)
 - Ruaha University College, a Constituent College of Law and Technological Sciences—<http://www.ruco.ac.tz/> (Iringa)
10. Mount Meru University—<http://www.mmu.ac.tz/> (Arusha)
11. The University of Arusha—<http://www.universityofarusha.ac.tz/> (Arusha)
12. The Hubert Kairuki Memorial University—<http://www.hkmu.ac.tz/> (Dar es Salaam)
13. International Medical and Technological University—<http://www.imtu.edu/pou.htm> (Dar es Salaam)
14. Zanzibar University—<http://www.zanvarsity.ac.tz/> (Zanzibar)
15. Zanzibar/Chukwani College of Education—(Zanzibar)
16. University of Dodoma—<http://www.udom.ac.tz/> (Dodoma)
 - College of Education
 - College of Humanities and Social Sciences
 - College of Information and Virtual Education
 - School of Life Sciences
 - School of Health and Allied Sciences
17. Saint John's University of Tanzania—<http://www.sjut.ac.tz/> (Dodoma)
18. Stefano Moshi Memorial University College—<http://mwikacollege.com/> (Moshi)
19. The Aga Khan University—Tanzania Institute of Higher Education—(<http://www.aku.edu/>)
20. Teofilo Kisanji University—<http://teku.ac.tz/> (Mbeya)
21. Muslim University of Morogoro—<http://www.mum.ac.tz/> (Morogoro)
22. Dar es Salaam Institute of Technology (DIT)—<http://www.dit.ac.tz> (Dar es Salaam)
23. Technical College Arusha (TCA)—<http://tca.habari.co.tz>
24. Mbeya Institute of Science and Technology (MIST)
25. Institute of Finance Management—<http://www.ifm.ac.tz/> (Dar es Salaam)
26. The DMI-St. Joseph Group of institutions—<http://stjoseph-tanzania.com/index1.html>
 - St. Joseph College of Engineering and Technology (SJCET), Dar es salaam
 - St. Joseph Institute of Information Technology (SJIIT), Songea

(Continued)

Table C Major higher learning institutions in Tanzania and their URLs. (*Continued*)

- Tanzania Institute of Management(TIM), Dar es salaam
27. College of Business Education (Dar es Salaam and Dodoma campuses)—<http://www.cbe.ac.tz/>
 28. Institute of Accountancy Arusha—<http://www.iaa.ac.tz/08/>
 29. Eastern and Southern Africa Management Institute (ESAMI), Arusha—<http://www.esami-africa.org/> (regional institution)
 30. College of African Wildlife Management, Mweka-Moshi—<http://www.mwekawildlife.org/>

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Task-Based Information Searching: Research Methods

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Abstract

It is widely agreed that searching is part of a larger task performance and that it should be studied in this context. To be able to reveal the process nature of searching, a task-based approach can be used. This entry discusses task-based approach and its use as a framework for field studies, discusses relevant task features, and presents some of the typical methods for studying task-based information interaction in the real-world context.

INTRODUCTION

This entry provides an overview for studying task-based information searching in the real-world context. In order to understand which methods to use in a task-based field study, one has to consider several aspects of the complex task-based setting. Since so little is known about the relations of searching and the underlying tasks, the study of information-intensive task performance requires research methods that are mostly exploratory and descriptive real-world studies. This allows reporting actual behavior with the contextual aspect. By using a task-based approach, the actions of the searcher with both the cognitive and affective aspects can be studied.

People search for information in order to better accomplish tasks at hand.^[1] Task trigger information needs,^[2] or anomalous state of knowledge (ASK),^[3] that lead to various information interactions, including searching. Task-based information searching entails a task that is conducted. When people perform information-intensive tasks, they tend to use the whole information environment available, including various types of information, search tools, and data repositories. During task performance processes, people use several tools in an integrated way to access various types of information. Typically, information-searching studies view at a small piece of the process at time or use only one search tool in a test situation, which lead to narrow understanding of the holistic process of searching. By using too narrow research setting, it is not possible to study the heterogeneous nature of the information source use or the task-related characteristics that affect the search situation. This complexity and the process nature of searching necessitate task-based fieldwork studies in real-life context.

Task-based information searching is a complex phenomenon influenced by contextual characteristics, searcher's personal traits, and the prevailing information environment.^[1] Contextual characteristics include the organization, its culture, and its information environment;

the task performer's traits, searcher's previous knowledge, experience with similar tasks. One should not forget the varying tasks themselves that affect information behavior. Learning from the experiences of the searchers requires data collection based on multiple methods and triangulation of the findings because no single method is reliable and sufficient in order to study the complexity of real-world searching. Further, there is not a common understanding what are the characteristics of tasks that actually affect the searching. If we understood better the tasks and their intrinsic search tasks, it would not only increase understanding of this important area but also bring more power to experimental test design or even user simulations.

This entry provides a short background, discusses tasks, task complexity and task-based approach, and lastly, gives an overview of some research methods, such as questionnaires, interviews, and shadowing, which are used in fieldwork in task-based information searching.

BACKGROUND

Nowadays, information access is ubiquitous and happens continuously—inseparable from the work task in many cases. In a matter of fact, information is searched in order to fulfill an information need, which is triggered by problems, situations, and daily activities people are in.^[1,4–7] Information searching does not occur in a vacuum but is an inseparable part of the surrounding activities, situations, and contexts.^[8] The situations people are in may call just some very timely information—such as a bus schedule—or aimlessly passing time, or they may require learning of new skills and knowledge creation in order to accomplish a larger goal. One way to frame the situations for research purposes is to use the task-based approach. Instead of looking at search tasks—querying one information system—task-based approach to information searching is taking the underlying larger task as a starting

point to examine information searching. During task performance, people may need some additional information that cannot be remembered or created with the existing knowledge. This need, which is also called anomalous state of knowledge,^[9] prompts information seeking. This might include asking a colleague, checking one's own notes, or searching an information repository.

Since the information searching occurs during a task, the searching should be studied, and evaluated, in relation to the task performance process.^[7,10,11] The focus is on the information interaction that happens during that process. A related term, information retrieval, has been defined as the study of how the system replies to a request, or as how humans interact with a system. The task-based approach adopts the latter view, but in a larger context. There has been a turn in information interaction studies from a search task setting into a wider perspective, taking the whole work task as a context of searching. In studying the searching in the context of a task, task-based information searching takes a cognitive viewpoint on information retrieval and human information activities.^[1] This viewpoint entails the idea that personal information needs should be treated as potentially dynamic contrary to the static view in traditional information retrieval research.

Searching, even when studied during work task performance, is tightly coupled with the use of information systems or search tools. These tools are used in order to get to the contents, not just to interact with the system interface. Information searching entails the whole cycle from the searcher's cognitive state to the representation of the information itself. While much is known about how systems work in retrieving documents, there is lack of knowledge on the user side and of how searching relates to task performance, how people use the information tools available to them, and where the tools fail to meet their needs.^[12,13] Understanding and exploiting contextual information may transform how people perform information discovery, analysis, and synthesis tasks.^[1] In order to build better tools, our understanding about searchers, underlying information environments and tasks, and their interrelations is crucial. In case of studying interactive information systems, in order to know the "goodness" of a system, their ability to advance the underlying task should be tested.^[10]

Information searching has been both studied with experimental settings in laboratory conditions and as natural settings in the real world. These branches of research differ from their research goals and methods.

Both are needed and the first approach seems more common at this point of time.^[11] Although these branches have different goals, there are some connections in between: real-world studies may reveal something that can be further tested in laboratory conditions. In order to test something relevant, one should know first what to test. This knowledge is gathered by field work in real-life situations and exploratory and descriptive studies of this kind

may inform hypothesis formation to be further tested in controlled experimental settings.

Experimental settings usually entail researcher involvement and controlled environments and report quantitative results. Some of these elements may be included in field studies as well, but usually fieldwork occurs in natural environments without any excessive researcher involvement. Moreover, usually in experimental interactive information retrieval and search studies tasks are seen as a vehicle for research,^[14] whereas in fieldwork tasks are regarded as inherent part of human daily performance. In controlled settings, it is very demanding to create long-lasting task processes with assigned tasks and therefore experimental studies commonly use more limited search tasks.

Fieldwork studies are intended to observe how real people search in order to complete real tasks. However, experimental studies in information searching are intended to study particular effects of the selected variables on human or system behaviors. This requires control over the situation. In experimental research designs, assigned tasks help with controlling the setting. Assigned tasks are hard to design and they may lack contextual features or personal aspects such as motivational or affective triggers that, in the real world, are present in search processes. Borlund^[15] and Wildemuth and Freund^[16] provide recommendations on how to design assigned tasks. Despite the challenges in designing tasks, there are experimental studies that have incorporated exquisitely real-world features.^[17,18] In these studies, assigned tasks are designed to reflect real-world situations.

The present entry focuses on fieldwork methods. The aims of fieldwork lie on understanding how people behave with the tools they are used to work with and during the tasks they are doing. Nevertheless, for those more interested in experimental settings, Kelly^[14] provides a broad overview on how to study interactive information retrieval and evaluate systems with users, Kelly and Sugimoto,^[19] a recent review on interactive evaluation research, and Wildemuth et al.,^[20] a review on assigned task difficulty and complexity in experimental settings.

TASKS IN TASK-BASED INFORMATION SEARCHING

A task is an activity to be performed in order to accomplish a goal.^[6] Task-based information searching is interested in the information interaction related to the task performance. A task at hand may be either a leisure or work-related task. It is seen as a triggering force behind the information needs,^[21] or ASK,^[9] possibly leading to information searching. According to Järvelin and others,^[11] it is a part of a larger task performance process, which can be cut down into activities, searching being one of them. Searching is one small part of the larger task,

among other activities, that are all aiming at task fulfillment.^[11,22]

Task Granularity

Human task performance and searching may be examined in different context and on different levels of abstraction.^[1] Tasks are interpreted at multiple levels of granularity, and this is related to one's understanding about the task.^[22] Task doer needs to understand the preconditions and goals for performance. As her understanding about the task increases, and if the focus is formulated, she is more capable of decomposing the task into smaller pieces. These pieces are conceptualized as stages,^[23,24] during which the cognitive and affective states evolve, or as successive subtasks or actions,^[11] which advance the fulfillment of the task.

Byström and Hansen^[22] look at the task granularity as a hierarchical structure, where information-seeking tasks are part of a larger (work) task, and search tasks are part of an information-seeking task. They also discuss information use as an essential part of a larger task and as a contributing factor in task accomplishment. Järvelin and others^[11] decompose a (learning) task into five cognitive and behavioral activities, which are task planning, searching information items, selecting between them, working with them, and synthesizing and reporting.

Similarly to Byström and Hansen's levels in their task hierarchy, Kekäläinen and Järvelin^[25] present a nested model of context to evaluate information searching.^[1,25] They separated sociocultural, organizational, the work task, the information-seeking task, and the information retrieval levels. Tasks may be analyzed on these levels as task descriptions or goals. All these levels are present in a task performance process and the phenomena during task performance may belong to varying contextual levels.^[26] The contextual levels also outline the methods and the participants in the study to some extent. On the socio-organizational level, research interest may lie on decomposing networked phenomena and identifying its actors.^[27,28] On the organizational level, one may be interested in task flows in the organization and of division of labor, etc.,^[29] or studying on the high-level task context in collaborative information searching during teamwork.^[30,31] This entry, however, takes the view of studying one individual at time, but similar settings may also be applicable to groups of people.

Typically studies on information searching take the search task level as a starting point. However, in real world the goals and constraints of the tasks are derived from higher-level tasks.^[1,24,32] Taking the higher-level context into account, the missing links between larger tasks and search tasks may be found. The larger, motivating task is binding the subactions together, which might seem atomistic if separated from each other. If just the single search task is taken as a starting point, one system

setting might seem reasonable. However, if the scope is broadened toward a larger task, one may have to accept the whole information environment composed of multiple types of information systems providing heterogeneous data or information, such as audio, pictorial, numerical, or text data. The actual information is created during the process, collected piece by piece from various sources and finally interpreted and used in knowledge creation.^[33] The task has several features additional to the granularity one being the task complexity, which is discussed next.

Task Complexity

Task complexity and difficulty are very commonly integrated in information searching research.^[20] Research in information searching has discussed task complexity from both objective and subjective perspectives. These two perspectives have different background. Objective task complexity supposes "an objective task external to and independent on task performers."^[34] In the objective task complexity, the structure of the task and aspects related to the task are used in assessing the task complexity. The increasing number of choices (paths) leading to the desired outcome increases task complexity. Objective task complexity is the complexity of the prescribed task seen by the person prescribing the task, and subjective task complexity is the complexity of the actual task for the task performer executing it.^[34]

Tasks may be difficult to perform by many factors; for example, there might be too many alternatives to consider, imprecise or missing raw data, a great deal of irrelevant information, lack of ideas, or insufficient methods.^[1,35] This characterization, which considers the features of the task, treats complexity as a function of objective task characteristics.^[36]

Further, Campbell^[36] and Liu and Li^[34] consider task complexity as composed of number of subtasks. Albertson and Meadows^[37] use similar construction: complex search tasks contain multiple subtopics. Objective task complexity may be defined also as the number of steps required in order to reach the completion. Li and Belkin's^[38] comprehensive task categorization uses both objective and subjective characteristics. It is based on earlier categorizations in information research literature and includes a number of dimensions, which may be divided into objective and subjective parts. Objectivity here means the number of paths between which the task performer has to choose during the task. The subjective aspect in the categorization is called difficulty.

An example of more subjective approach is a priori task complexity. Byström and Järvelin's^[39] approach to task complexity is an intersection between the task and actor characteristics: it evaluates task complexity on the basis of the actor's a priori understanding about the features of tasks—namely the information needed, the process, and the outcome. If all the aspects are known, the

task is routine, and if none, the task is considered as complex.^[39,40] There are different levels in between. In complex tasks, the actor lacks a mental model sufficient for enabling him or her to assess what needs to be done. The a priori task complexity has been used in field studies because it does not require subject expertise. In a priori task complexity, the task performer's previous knowledge on similar tasks affects the complexity assessment, because the more experience the person has with similar tasks, the more focused the conceptual structure of the task.^[41] Byström and Järvelin's^[39] a priori task complexity has been applied also to some extent by Bell and Ruthven,^[42] Kumpulainen,^[40,43] and Kumpulainen and Järvelin.^[26,33]

Both objective and subjective views on task complexity may be employed in fieldwork. However, if a person does not know what the outcome is or cannot describe the possible paths, it is very hard to count or consider the different aspects or the paths to the completion. In fieldwork, the task complexity can be assessed only after the task performance, when all the queries and needed steps or subtasks are already conducted.

However, researchers cannot be sure during fieldwork that the participant is actually going to end the task during the research time period. Therefore, the a priori task complexity may be more useful in real-life studies. This way, a task complexity assessment can be collected for all task performance sequences even if the task processes do not reach the completion. One should keep in mind that natural research settings include always some compromises and instability. Therefore, because of the (possibly) uncompleted and incomplete tasks, it is hard to compare different task performance sessions with another ones if one uses the objective complexity and the numbers of subtask constructs, or the total number of paths, are needed.

Whether the task is self-formulated or assigned, it is the perceived task that is performed after all. The perceived task is the task performer's current understanding about the task goals and the suitable path(s) leading to that goal. This means that people who have the same assigned task treat it according to their understanding. This perception may change during the task performance due to learning about the task itself. Perception of the task and possible solutions are evolving and getting clearer toward the end of the process. One critical point is the focus formulation phase, during which the actor creates a clear understanding what the task is about.^[23,41] Focus formulation allows the searcher to make pertinent judgments about the retrieved items. Without this formulation, a task can be performed, but the outcome might not be good.^[44]

The Process Nature of Searching

Task performance and searching are evolving, iterative processes. According to Toms,^[32] the process of achieving

the task outcome determines the success in task performance. Therefore, tasks and search tasks internal to them should be studied as processes. The processes may be decomposed into smaller events. There are models that look task performance in stages,^[23,24] and models that decompose tasks into subtasks, which are performed as series of actions.^[11,43,45,46]

One of the early stage models was the Kuhlthau's ISP model.^[23] The ISP model consists of six stages, during which the information search process evolves, and the searcher formulates a focused understanding about the topic. According to the model, this point is critical since the focus formulation enables the searcher to assess the relevance of information items. Kuhlthau's model examines the searching process at levels of physical actions, cognitive and affective aspect, and it was developed to inform librarians. Vakkari's^[24] task-based information search model was based on the ISP, and it consisted of three stages. Both models used stages, and the searcher moved from a stage to another in the course of searching. Models in information searching research that decompose task processes into subtasks are not very common. A very recent model of Järvelin and colleagues^[11] decomposes a learning task into five subtasks and discusses program theories^[47] of these subtasks as a tool for information retrieval evaluation.

The berry-picking model by Bates was one of the first models that described searching and exploration task performance as a process.^[48] It was developed in an OPAC (online public access catalog) environment, which included references to full texts. Bates' berry-picking model is based on the idea that pieces of information are collected from separate documents or information objects during the search, and the understanding about the task was created during the berry-picking episodes. This is a natural way humans explore their information environments, and this applies also to web environment.

The study of task-based searching as a process entails that the subtasks, the search stage, or phase should be taken into account. The process of searching affects the searchers' understanding about the task itself, the perceived utility of information, and what will be the next step in the process. Together with the procedural approach, task features such as complexity and granularity are worth consideration in research setting. Due to their complexity, these task-related phenomena often require multimethod research. In the next section, we discuss some of the methods that may be used in task-based field studies.

STUDYING TASK-BASED INFORMATION SEARCHING IN THE FIELD

Due to the complexities of studying information searching during tasks in their context, it requires multiple and often

tedious means of data collection. The traditional means of data collection for studying human actions include questionnaires, interviews, diaries, and observation.^[1] The quality of results obtained from field research depends greatly on the data gathered in the field.

There are some field studies that relate searching to larger tasks. Typically, the type of task-based research uses multiple methods. To review a few, Byström and Järvelin^[39] studied information seeking related to tasks in municipal administration through diaries and questionnaires. Saastamoinen and others^[49] revisited this study and studied how task complexity was related to the information types in municipal administration by using task shadowing and questionnaires. Kumpulainen and colleagues,^[33,40,50] Huuskonen and Vakkari,^[51,52] Freund and colleagues,^[53] and Markkula and Sormunen^[54] used shadowing combined with some other method. Kumpulainen and colleagues^[33,40,50] examined how query types and the use of various systems varied according to task complexity in molecular medicine. They used shadowing, interviews, logging, and photographs. Huuskonen and Vakkari^[51] studied by using worksite observations and interviews, how social workers record and use information in a client information system during various tasks. Freund and colleagues^[53] used a multimethod approach using focus groups, interviews, shadowing, and resource audits in their study on software engineers' task-based information behavior. Markkula and Sormunen^[54] used interviews and task observations to study the work processes of journalists, which included various stages, and these stages shaped information access and interaction.

Attfield and Dowell also studied journalists, but they used interviews and grounded theory for analysis.^[55] Bartlett and Toms^[56] also used interviews as a data collection method in their study of biotechnology experts work tasks and made a detailed task analysis showing each subtask in the workflow. Vakkari and Huuskonen^[44] used questionnaires, search logs, and expert outcome evaluations in their study, which analyzed which aspects of search process and search output were associated with the task outcome in medical students essay writing assignment.

Consequently, it seems that multiple methods are used in studying task-based information searching. In the following, we discuss the typical methods used and data triangulation, which facilitates the in-depth study of complex task performance sessions.

Questionnaires

Questionnaires are a very economic way to collect data and are typically used to study topics that are already known to some extent. However, like all the methods represented in the entry, questionnaires can be used in different types of research settings.^[57] Firstly, exploratory research questionnaires benefit from open-ended

questions, which allow deep understanding and some unexpected findings. Second type is descriptive survey, which may be used, for example, in collecting opinions about some issue, and typically includes multiple choices and predefined categories. This type is considered as conclusive due to its quantitative nature. Thirdly, one may use questionnaires in explanatory studies in order to study the causality. In explanatory research, careful preplanning of the questions is required. The aim is to explain the cause and effect relationship between variables. Causality may be studied to reveal which variables are the cause and which are the effect and to study what is the type of the relationship between the causal variables and the effect to be predicted.

Questionnaires are usually understood as a means of quantitative research, but they can be also used as a qualitative manner with open-ended questions in an exploratory research setting. The questionnaires in information searching and seeking studies are typically circulated among some social group or staff in an organization, so everyone in the target group is included. Therefore, no actual sampling method is used.

The value of collected data completely depends upon how well respondents answer on questionnaires, and, on the other hand, how good the wording in the questionnaire is. Usually, an explanatory survey is based on a theory from which a hypothesis is derived and the concepts are operationalized. However, in task-based approaches one useful way is just to survey in an exploratory or descriptive manner, for example, what is the perceived information environment like, what are the populations preferences for suitable information tools and to survey what kinds of tasks they perceive doing.^[58,59] This kind of research is typical of task-based searching studies. There is no attempt to explore why a phenomenon occurs, but just to state that it does. This is the case if very little is known about, for example, the tools people use in their daily activities. However, since the control over how people respond to a questionnaire is low, questionnaires also benefit if used in combination with some other methods.

Nowadays, questionnaire studies are typically published in web form and a link to the form is distributed via web home page or email. Via web questionnaires, researchers are able to reach large groups of people quickly and simultaneously, they are easy to handle, and the data are already structured in suitable form for further analysis (e.g., a spreadsheet form). However, web questionnaires may be subject to a bias toward certain groups (active, willing to answer, tech savvy, etc.), and they typically suffer from low response rates. Web questionnaires also suffer from the same deficiencies as the paper form questionnaires: it is hard to capture the meaningful aspects of human actions and to place the actions or phenomena that are captured in any context in which they occur—not to mention the process nature of searching. Further, questionnaires have been criticized to block creative thinking

and imagination beyond the research setting.^[60] However, despite the criticism, open-ended qualitative-style questionnaire studies are very useful in the case the researcher does not know much about the field and needs to get a quick overview of the information environment the people are engaged with and their opinions about it.

Interviews

Interview is one of the major approaches of data collection in qualitative research. Interviews are the best way to collect in depth data on how people understand or feel about phenomena in their everyday lives.^[51] It is a means to uncover their experiences and the meaning of these experiences. Interviewing is a good method of studying the “why” questions, and interviewing is focused in comparison with shadowing; one does not have to see everything. During the interview, the researcher creates a personal contact but access to the field is easier than when observing.^[50]

Maybe the most used type of interview in task-based studies is a semistructured interview. In this type of interview, the interviewer has broad themes and topics, which are discussed, and the interviewer steers the situation toward the central topics. Preparation is important to be able to steer, and the interviewer should make an interview guide, which includes all the topics that should be covered. In semistructured interviews, the interview guide keeps one on track but still allows her to collect unlimited qualitative data.

There should be a clear purpose for the interview. During the whole interview, the interviewee must feel confident to talk freely. The flow of conversation should be kept going and the interviewer should listen actively and keep the questions simple. However, interviews are open to bias and problems. Opinions regarding behavior are not the same as actual behavior, and the respondents may not correctly remember the answers to questions or they might be unwilling to tell the flow of actual events. People are not good in recalling simple tasks that are executed on a routine basis or exact protocols they follow. More precise accounts of actual behavior are collected by observation, but interviews are very useful when collecting data about people’s interpretations about their tasks (e.g., perceived difficulty) or opinions about the search tools they use.

Critical Incident Technique

The critical incident technique is a set of procedures used for collecting the observations of human activity and behaviors.^[61] Typically, the participants are asked to recall a recent incident that has relevance to the research questions, and it is used as a vehicle for interviews. The participants may answer the interview questions by reflecting their actions related to that recalled incident or demonstrate their behavior during that recent incident.

This helps the participants to anchor their thoughts and behaviors to a certain incident, and may introduce some reality to basic interview settings. Critical incident technique is suitable for collecting data in the field and in more controlled environments. Critical incident technique is a very flexible method and helps to bind the findings to practical real-world tasks. In task-based information searching, the participants are asked to recall a recent task that included any information-searching episodes. Then, they are interviewed about the causes, descriptions, and outcomes of the task. The actors’ feelings and perceptions of the situation are collected and the actions taken during the task are either interviewed or demonstrated. These scenarios can be presented as narratives, visualized in diagrams, or as a causal model. Examples of use of the critical incident method are research by Zach,^[62] Auster and Choo,^[63] and Roos and others.^[58]

Critical incident method can be used also as a vehicle for observational research.^[51] The participants are asked to recall a recent situation or a task and to perform the task. Task may be observed at the participants’ work place, home, or any other place or environment where the critical incident task has been previously conducted. Also, making people recall a recent task is a good way to bring naturalistic tasks into experimental settings.

This method is very flexible and suitable for studying everyday problem solving, but its challenges lie already in the remembering of the task. The tasks that are recalled tend to be rather simple, and the participants may remember the actual behaviors imprecisely and present idealized workflows. This method, however, helps to bind the searching activities and the underlying task together and it may help in revealing the procedural nature of task performance.

Diaries

Diaries are a good way to collect data on participants’ recollections of transactions, such as tasks and used information systems. Usually, diaries are collected with structured forms and diaries are filled after a workday or task performance. People are asked to describe relevant actions and, for example, information sources they used during particular task performance processes. There might be questions about reflecting the events or their features, which relate to the research questions. Therefore, in addition to just collecting the events, diaries provide clues to the importance of events for the participants and their attitudes about those events. Diaries also provide data in textual form, which is easy to analyze compared with voice recordings, for instance, or video diaries. Diaries may be collected via web forms, so that makes the data even easier to handle. Diaries can be a useful strategy for data collection when periods of prolonged participant observation are not practical. This might be the case in

order to have a rich source of data of reflections that communicate the stories of their daily lives.

Usually in task-based studies diaries are used in combination with some other data collection method. Byström,^[39,64] Hansen,^[65] and Saastamoinen and colleagues^[49] used diaries in their studies and triangulated the data collection with some other type of data, such as interviews and shadowing. They collected information about the participants' reflections on the task complexity and the use of various information resources, among other things. However, despite the usefulness of diaries in some occasions, participants may find filling in the diaries time consuming and cumbersome. If the diaries are not collected during observations, the researchers cannot know how long after the event the diary was actually made and, consequently, the events might be not remembered correctly. Processes may be collected with diaries, but as discussed previously, they are a means of collecting recollections. People do not describe sequences of actions precisely and sometimes they even tidy up their descriptions of performance. Instead, they tend to describe idealized procedures leaving out some workarounds or problems.

Shadowing

Shadowing is a qualitative method, which involves a researcher closely following people over a period of time to uncover the real-time actions performed in some context.^[66,67] It enables the study of information searching in context of real everyday practices and situations and reveals such barriers and routine like workflows that people are not actually aware of. Shadowing facilitates the study of complex tasks and task processes as they are and it is a very agile method. As it is known, people are not good in describing what really happens, but they describe their ideal ideas how things go. This is not necessarily what actually happened. Shadowing can be done over long periods of time or applied more rapidly to gain a quick understanding about a problem.

Before starting the shadowing, it is important to get to know both the organizational environment and the information environment they work with in case of studying information searching. Without knowing what the participants refer to makes it very hard to follow the flow of actions at the start of shadowing. Also, taking some time to carefully select the participants and the venue is important: participants need to take the actions that contribute to the research questions. It is of high importance to carefully select suitable participants for the study. The investigator should be aware of the current tasks the participants are going to conduct, and the shadowing sessions should be arranged so that the kinds of actions, for example, searching, really occur during the shadowing. One practical way is just to simply ask the participants that when they have planned to do some searching and arrive at that point of time to collect the data.

The shadowing method does not require undistorted situations. The participants certainly are aware of being shadowed, and this may have an effect on their behavior and task performance. However, nearly all participants usually become comfortable with the situation after a short while. The method is about gaining an "inside view" of the research questions. Throughout the shadowing period, be it few hours or several months, the researcher asks questions, which will prompt a commentary from the participant. Some questions will be for clarification, other questions to reveal a purpose of actions. During the shadowing, the researcher will write a continuous set of field notes. Shadowing yields data that is more detailed than data gathered through many other data collection methods. Shadowing does not collect the accounts of participants' opinions but observes it directly and gives the researcher first-hand detailed data both on aspects that are habitual or mundane, and the problematic to express, which may be otherwise difficult to collect.

A task is performed in task sessions. These task sessions are observed. During a task performance session, a person is working on a particular task. There might be several ongoing tasks over time, but just one session at the time is performed. Multitasking or parallel task performance means that people switch between the tasks. An actor starts at some point, for example, in the morning when she comes at the working place, or just stops the previous task and changes to another. There might be interruptions during the task, but the task session may continue after the break.

One important aspect in shadowing is to build trust. If the participant does not feel comfortable, critical information could be missed. The researcher must continually work on the personal relationship throughout the shadowing period. By providing information on what purposes the collected data is used and to allow participants to discuss the suitable shadowing times might help the participants to feel they have some control. The agreement that the shadowing may be stopped or paused at any time if it gets too distressing also eases the participants' situation.

Shadowing produces a massive detailed data set that is rich and thick in every aspect. Also, shadowing is a physically and cognitively burdening method for the researcher. It is not easy to follow people around day after day and still trying to stay focused. One of the questions that are of main importance is to keep the research questions in mind all the time, and not "going-native," which means adopting the views and opinions of the research participants. One of the biggest challenges in shadowing is the data handling.^[66] The researcher should already before the fieldwork plan how to collect the data and how to analyze it. This also brings more focus to the fieldwork. For collecting the notes, a pen and a hardback notebook are the best. The data handling might be assisted by the use of smart pens or other devices. With the handwritten

notes, the researcher already creates a focused view on actions, and so a part of the first-round analysis is already done. Video recordings of several hours are hardly usable, but it can be used if one needs detailed data on a short occasion.

Transaction Logs

A transaction log is “an electronic record of interactions that have occurred between a system and users of that system.”^[68] There are basically two ways to collect transaction log data, namely client-side or server-side log data. Client-side data collection may be more intrusive than server-side, but it is more accurate and can reveal participant’s interactions with the whole information environment via varying channels^[33] while server-side logs reveal the interactions with materials on one server. Both have their advantages providing detailed data on user behavior, and they allow studying the process nature of searching. However, the log data lacks depth and are ineffective as a methods of gaining an understanding of the underlying motivations, affective characteristics, cognitive factors, and contextual aspects that influence task-based information searching.^[68] User intent analysis based solely on transaction logs has been described as guessing.^[69] This is because similar queries are used for quite different search goals. Even an obvious known item search (e.g., for a homepage) may in fact be an unknown fact search (for an email address). However, this method is very valuable if used in a concerted way with some other (qualitative) method, such as shadowing or questionnaires. Despite its benefits, the biggest obstacle to successfully use client-side logging is that organizations or participants may prohibit any data collection on their computers.

Triangulation

Triangulation means the use of two or more methods of data collection in the study of some aspect(s) of human behavior.^[70] In other words, it refers to a multimethod research. Although triangulation may be of combining theories, methods, data sets, and investigators in the study of the same object,^[70] in this entry, however, the focus is on triangulating the methods. Triangulation advances the study of circumstances when a complex phenomenon requires analysis when some controversial aspects needs studying or when an established approach provides a limited and perhaps distorted picture and where a researcher is engaged in a case study. These all are conditions for a task-based information searching study.

Triangulation of methods raises the research above the possible biases related to the personality of the researcher that stem from a use of a single method.^[70] Using more than one method to examine the same research question enables the strengthening of the validity and confidence of the findings. However, sometimes research methods may

show opposite or discrepant events. In this case, the researcher should interpret why this happened and maybe use just one source of data in the analysis. However, there should be an understanding, which is the main data and use that in the interpretation of analysis. By the use of data triangulation, qualitative information can be added to flat quantitative data, such as questionnaire or log data, and more accurate quantitative data may increase the validity of the qualitative data.

Even before the data collection, the researcher should have some understanding about how the analysis will be done. After the triangulated data collection, data need to be merged. By collecting various types of data during the information intensive tasks, researchers should find a way to ensure that they know which data are connected to which task in possibly separate data sets (e.g., time stamps and personal account on log data). In the task-based studies, the point of departure for analysis is the task as a unit of analysis.^[64] One way to study the processes of tasks is to analyze the data as task performance sessions. A task performance session is the period of time, during which the participants are conducting a particular task; if the task is ended or changed, the session ends. This can be done by merging all data about each task performance session and then analyzed it together.

Fig. 1 depicts an approach to frame a task session. It has been used in Kumpulainen’s^[31] studies in task-based information searching in the biotechnology domain. In the procedure, every time a participant starts a task session, the participant is interviewed about what is the aim of the task, how well the participant is able to describe the task content, what information and which sources are to be used, and with which procedures the task is to be performed. These questions aim at assessing the a priori task complexity. During the task performance, field notes and interaction logs were collected. When the participant indicates that the task session might be at the end, some questions take place that ensure the ending of the session. Participants may switch to another task, stop working, or just have a break and continue after a while.

After framing the task sessions, other aspects related to research questions, such as task complexity, type, or stage, can be analyzed. Data may be analyzed using qualitative methods, for example, by classifying, the grounded theory



Fig. 1 Task session procedure for triangulation of interview data, transaction logs, and shadowing field notes.

approach, content analysis, visualizations, etc., or by quantifying it. One option to analyze the data is task analysis, which is a way to do detailed task decomposition.^[56,71] If task analysis is too fine grained, processes may be studied also by event analysis.^[72]

Ethical Concerns

Always, when using humans in research, an informed consent is needed. The researcher needs to think about the confidentiality and protect the identity of the participants. Participants should be informed about the purpose of the investigation and the main features of the research design. There might be some confidential material that the researcher is exposed to during the research, and the way shown to address this kind of material should be agreed in advance. The researcher should cause as little harm to the participants and their organizations or social environments as possible.

CONCLUSION

Real-world information searching is a combination of inquiry, discovery, and serendipity. It is nonlinear and iterative and entails the use of various heterogeneous information types from wide ranges of sources. By task-based studies, we are able to more realistically describe the human behavior during a task performance process, and by this inform not only system design, but also other highly controlled research settings such as simulation studies. On the downside, field studies focus on a specific organizational setting or a specific domain, where limited number and type of tools and data are used in tasks typical to that domain. The specific findings cannot be generalized to other contexts. However, it is not yet clear how the searcher should be modeled or simulated, so there is a world still to discover. Fieldwork remains under pressure due to costs and resource demands, but it still is an invaluable way to study how things really happen.

The existing models of task-based information searching suggest that task performance and information searching are processes that should be studied longitudinally over several work task performance sessions and search sessions. The task-based research is still uncommon, and there is still a need for investigating how and what features of tasks affect the searching. Therefore, the task-based approach provides a useful framework to study complex situations during information intensive work tasks, and further, a means to reveal the procedural nature of searching.

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Taxonomy

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Abstract

Taxonomy reflects the human instinct to organize. Once limited in Western culture to certain natural sciences, in the early twenty-first century, it has expanded to many domains, practices, and uses. Domains now include almost anything of interest, but particularly those motivated by business needs. Practices and uses include description, analysis, prediction, mapping terminology, information access, representation of knowledge, and tool-building. For information science, taxonomy is a powerful tool for connecting information content with information consumers effectively and efficiently.

INTRODUCTION

The practice of taxonomy reflects the human instinct to organize our experiences and perceptions of the world. Many organisms categorize objects: the practice is essential to survival, if only to classify possible food sources as edible or inedible, situations as safe or dangerous, environments as habitable or inhabitable, and so forth. Once such classifications are made, new experiences, objects, and situations may be placed in them, thus simplifying mental processes and interaction with the environment. Humans have developed this instinct to a high degree of sophistication, possibly because of the ability to perceive and process a great many details about the physical world they inhabit. But for people, organization goes far beyond survival needs. It inhabits the very core of human understanding and knowledge. With organization, facts and data become information and eventually knowledge, a rich source of philosophical discourse. Even for those not philosophically inclined, organization of information is an essential part of truly understanding and knowing a topic. According to cognitive psychology, all humans classify; the associations formed by classifying afford economy of thought for understanding the world.

Furthermore, classification may be the earliest technique of scholarship, and classifications provide building blocks with which to construct understandings.^[1,2] Many teachers believe that thoroughly understanding the terminology of a discipline is at least half the task of learning it; using taxonomy is one very effective path to such learning. Classification enables children to identify objects correctly, and they use it extensively.^[3] Organizing and classification is a useful vehicle for communication; if several parties agree on organization, they have a solid foundation for agreement on meaning, and therefore, mutual understanding. Finally, organizing things is one component of manipulating the environment; for humans, that is an essential

survival mechanism. Thus, even at its most abstract, organization has roots in the continuation of life. That makes it a deeply seated, perhaps essential, part of living.

Given the universal practice of organizing things, it is remarkable that only in the most recent 2500 years of human history has attention been paid to the principles and practice of categorization, classification, and taxonomy. Once almost exclusively the domain and practice of the natural sciences, taxonomy is now practiced in many other disciplines and venues, including the social sciences, computer science, information science, linguistics, cognitive science, and Internet site design and construction. Within these fields, taxonomy has acquired a wide range of meanings no longer restricted to the classical understanding of biology.^[4–6] Taxonomy is now applying its early sense of organizing things in accord with particular principles (“taxis”: arrangement; “nomos”: law) to a broader range of domains after several centuries of limitation to biology and other natural sciences. In the 1990s, taxonomy was redefined as any semantically significant, systematic organization of content^[7,8] or as the process of developing such organization.^[9] This definition sometimes includes any collection whose individual elements have been assigned to various nodes of a classification system. Thus, taxonomy is sometimes considered the process of matching collection items with predefined labels, and sometimes it is the creation and arrangement, as well as the resulting product, of the classification system itself.

A much overlooked and seldom discussed motivation for taxonomy is the desire of humans to communicate. Understandings of meaning contribute significantly to the human experience; shared and mutually agreeable understandings facilitate communication and connection, a fundamental goal of humans (and possibly other creatures); differences often generate undesired outcomes. Taxonomy, because it organizes entities using representations

of them (usually words), creates and facilitates language agreement; users of any particular taxonomy implicitly (and sometimes explicitly) agree upon the organization represented and, equally important, the terminology and semantics.

Taxonomy, in and of itself, through the process of organization and creating (or making explicit) agreement of language, performs an important and valuable role—describing the human experiences and perceptions of the world. When integrated with tools and processes for further exploration and discovery, dialogue and communication, taxonomy can perform a role central to the success (or failure) of such tools and processes; and, through them, the fundamental motivations for their existence and operation: making sense and communicating.

HISTORY OF TAXONOMY

Although Aristotle receives credit for setting out principles of biological taxonomy, one of the earliest recorded taxonomic structures is from the Book of Genesis, “These are the sons of Ham: Cush, Mizraim, Put, and Canaan. The sons of Cush: Seba, Havilah, Sabtah, Raamah, and Sabtechah. . .”^[10] a genealogy of the descendents of Ham (and, by extension, Adam), which predates Aristotle by many centuries. The *Historia Animalium* by Aristotle (384–322 B.C.E.) based taxonomy on the concept of grouping entities because of inherent properties, which collectively define similarities and differences. Properties are determined empirically, by examining many specimens for such characteristics and is an inductive process from observed examples, resulting in a lexical definition.^[11] According to Aristotle, important properties included mode of reproduction and habitat, as well as form.^[12] Aristotle’s basic methodology is still in use, although with some refinement. Linnaeus (1701–1778) introduced the practice of deriving the various levels of a taxonomy from the properties of the organisms or objects in the entire collection. With this development, he prepared the way for later scientific work involving the collection and examination of minute details of many specimens. His procedure contrasted with the practice established by Aristotle and is now commonly called bottom-up classification. By the time Darwin (1809–1882) wrote *The Origin of Species* in 1859, enough data had collected that additional principles of grouping division were necessary. He proposed that evolutionary lineage be considered as one criteria for the classification of species. Thus began the transition of biological taxonomy from a phenetic (observable characteristics, such as form) basis to a phylogenetic (evolutionary history of genetically related groups) basis. This eventually resulted in the ongoing debate whether evolutionary history is a necessary and sufficient criteria or only one of several to consider for accurate classification.

TAXONOMY

Classical Taxonomy

Taxonomy, as developed by Aristotle and refined by Gessner, Ray, Lamarck, Linnaeus, and Darwin, is a form of classification in which objects in a collection are grouped into nested subcollections based on observed similarities and differences. Such analysis has the goal of systematically organizing information and knowledge of organisms.^[13] In this sense of the word, taxonomy, as applied in biology, has been called systematics. Although different methodologies have been practiced, the basic principle has remained the same: entities are classed on the basis of inherent properties.

In biology, taxonomy is used to develop classifications of living organisms according to characteristics of form and evolutionary history and to assign newly discovered organisms to existing classifications. These classifications have developed into hierarchical systems composed of lineages, or branches, progressing with increasing specificity from common origins to increasingly divergent specializations, or species. At the top of the hierarchy are five kingdoms: animals, plants, fungi, protista (predominately single-celled organisms), and monera (bacteria). Under these kingdoms, organisms are arranged into at least six ranks, each more specialized than the preceding: phylum, class, order, family, genus, and species. An organism is always classed at least as specific as the species, and possibly more specifically if it is identified as a subspecies, a varietal, or a hybrid. Although most taxonomists are in general agreement concerning the assignment of various species to particular genera, wide disagreement can exist for assignment of genera to family and even more so respecting family membership in particular orders. For some kingdoms, there is dispute whether some of the categories actually have meaning or useful purpose, or whether they are not finely enough defined. One outcome is a set of intermediate classes, such as subkingdom, subphylum, superclass, subclass, infraclass, cohort, and tribe.

Three major strands of thought prevail in biological taxonomy: the phenetic, which considers physical characteristics only; the phyletic (cladistic), which considers evolutionary lineage only; and evolutionary taxonomy, which uses observed similarities and differences, as well as evolutionary history. Because knowledge of evolutionary descent is determined by meticulously examining all characteristics of form, such as the macrolevel of skeletal fossils or the microlevel of molecular biology, the reality is the phenetic and the phyletic tend toward convergence. If the fossil record for any group were complete and taxonomy completely established, phenetic and phyletic arrangements would be identical.^[11]

Chemistry and physics provide a well-known example of a classification, which is seldom labeled a taxonomy

but most certainly represents one: the periodic table of the elements, in which chemical elements are arranged in a highly structured format according to inherent properties. One measure of the validity and usefulness of the periodic table is its power to predict new elements, a function at which it excels. Another measure of its strength is its descriptive power. The taxonomy structure of the periodic table represents very detailed knowledge about any given element, and the ability to read the table enables one to learn much about elements and their relationships to each other.

As scientists extend human senses with ever more detailed examination of basic units of matter, such as DNA and subatomic particles, definition and classification of common taxonomic subjects continues to shift. A case in point is that of wolves, illustrating ongoing debate over defining a species.^[14]

Numerical Taxonomy

The advent of molecular biology—with modern research instruments and methodologies, massive numbers of data points, and corresponding quantities of data values—has prompted the development of new techniques for discerning similarities and differences in organisms. A strictly phenetic approach, numerical taxonomy (also known as taximetrics) is the application of multivariate analysis to measurable features. By using quantitative methods to manipulate large amounts of data and numbers of specimens, numerical taxonomy derives classes and populates them on the basis of inherent properties. Depending on the techniques used, numerical taxonomy either clusters organisms directly, on the basis of similarities (correlation) or indirectly by virtue of differences (distance). In cluster analysis, correlation and distance measures are the inverse of each other.

Many measures of correlation exist, but it is often computed using the Pearson product–moment correlation:

$$r = \frac{\sum (x_1 - m_x)(y_1 - m_y)}{(n-1)s_x s_y}$$

where

r is the product–moment correlation coefficient

x_1 and y_1 are the x and y values for one member of a population

m_x and m_y are the mean of x and y , respectively

s_1 and s_2 are the standard deviations of x and y , respectively

n is the number of measurements

The value of r varies from -1 to 1 , with the strength of correlation expressed by the distance from 0 , giving an r value for either positive or negative correlations. Assuming two variables with normal distribution, r is a reasonable correlation measure to use. If the distributions deviate widely from normal, or the sample is not large, other

correlation measures are more appropriate.^[15] Because the correlation and distance measures are inverse, one might think that measuring dissimilarity would simply involve taking the inverse of r . Although that is possible, a more direct approach is to compute the Euclidean, or Pythagorean distance, d , between pairs of values. The equation is expressed in many forms:^[16]

$$d = \sqrt{((x_1 - x_2)^2 + (y_1 - y_2)^2 + \cdots + (x_{1n} - y_{1n})^2)}$$

where

x_1 and x_2 are the x and y values for one member of a population

y_1 and y_2 are the x and y values for another member

n is the number of measurements

For the purposes of numerical taxonomy, strong correlations (or, correspondingly small distances) are taken as indications of similarity.

Numerical taxonomy is not without criticism. It has not been adequately considered whether the mathematical and statistical techniques involved are appropriate for taxonomy.^[11] Furthermore, there is some risk of selecting irrelevant observations as variables; a trivial example would be to calculate r for species and habitat (to say several organisms are similar because they live in the same vicinity would be erroneous).^[12] A more serious risk is that of grouping things based on the absence of a particular feature (many men are balding, and balding is a genetic trait; nevertheless, not all balding men are related).

Contemporary Taxonomy

It is no longer possible to think of taxonomy as process and practice and taxonomies as products in two or three closely related senses only; the terms have acquired a variety of widely disparate meanings, depending on discipline, domain, and application. Interest in and practice of taxonomy has exploded in the early years of the twenty-first century, with Google Scholar returning over 880,000 search results for “taxonomy” in free text and over 825,000 in the title in mid-July, 2008. Noteworthy is the large proportion of results categorized as from the domain of social sciences, arts, and humanities, 16%; and 11.5% from engineering, computer science, and mathematics. Considering that information science overlaps the two categories, it seems reasonable to posit that taxonomy has recently attained considerable status as a research topic outside its traditional sphere of the natural sciences (46.5%). Thus, the proper field of discussion is classifications that have taxonomic characteristics, known as taxonomic classificatory structures, or simply, taxonomic structures. Such constructs can describe abstract concepts, such as opinions, thoughts, behaviors, intentions, emotions, ideals, mores, and beliefs, as well as physical objects that exist independently of human thought.

Whether abstract concepts can have inherent and immutable properties is open to debate. Nevertheless, organization of them seems amenable to certain taxonomic principles, and useful classifications are possible. In this entry, taxonomies and taxonomic structures are used somewhat interchangeably, although taxonomy often refers to process and practice, as well.

Many disciplines, such as biology, physics, astronomy, psychology, and linguistics, generate taxonomies of a classical nature and use them primarily for descriptive purposes. In some cases, classifications are used as research instruments, in which their predictive powers provide a means for testing hypotheses. A different application is the use of taxonomic structures for their ability to affect, wholly or in part, computer and information operations: artificial intelligence (AI), information science, and object-oriented programming (OOP). Artificial intelligence and information science both construct taxonomic structures to deal with massive amounts of information, whereas OOP uses them as integral parts of its methodology and computer programs.

Ontologies in AI

Taxonomic structures in AI are more commonly known as ontologies. Because AI draws heavily from deductive logic, which depends heavily on assertions and facts, AI developers compile facts and data about the objects within particular domains of interest. These compilations are called knowledge bases, and ontologies are an essential tool for managing them. As used in AI, an ontology is more closely akin to kinds of abstract entities to be admitted to a language system. Such concepts are organized generally in a manner that permits sharing and reuse.^[17] Ontology and taxonomy often have the same sense: a classification of categories or kinds of concepts, maintained in a knowledge base.^[18] In AI, the term ontology has several senses. Some researchers in the AI community consider an ontology to be an abstraction, without realization in concrete form—the conceptual and logical mental construct that forms the basis of a knowledge base—the design, which may be either explicitly formalized or implicitly assumed. Others consider an ontology to be some explicit terminological or semantic structure that captures and expresses the abstract logical design.^[18] It is the latter sense that more closely fits the notion of taxonomic structures.

Object-oriented programming

An object-oriented program has many of the characteristics of a taxonomic structure. Essential to OOP are the notions of class and inheritance, both essential components of a taxonomy. Class, in OOP, refers to the concepts of object type (which enables reuse based on type) and modular program structures. For the purposes of understanding an object-oriented program as a taxonomic

structure, classes can be thought of as software concepts that are instantiated with programming objects. Classes (thus, objects) have degrees of similarity and dissimilarity, characteristics that enable relating them to each other in hierarchical structures. Because computers require explicit instructions to function, OOP has developed very explicit rules for construction of classes and development of inheritance. Classes may be variants of other classes; a subclass will have all the properties and methods of its superclass, plus some additional characteristic, and they may be combinations of other classes, again with all the features of their ancestors; the intersection of features sets them apart from their ancestors. It is the two qualities of defining program elements in terms of other elements and relationships (particularly hierarchical ones) between the elements that define object-oriented programs as taxonomic structures.

Information access systems

Although taxonomic structures of several types have been essential components of information access systems for many years, the rapid growth and development of the World Wide Web, as well as various intranets that use technologies developed for the Web, have prompted renewed research and development. Indeed, as the distribution of Google Scholar search results for the social sciences, arts, and humanities topic area (19%), plus engineering, computer science, and mathematics (14%) indicates, the information industry has fueled the expansion of taxonomy more than any other factor. At the opening of the 1990s, taxonomy, with few exceptions, meant the descriptive arrangement of organisms and objects in the natural sciences. Scholars often developed small, very limited, highly specialized taxonomies as instruments for research in psychology and the social sciences. The principles of taxonomy were also receiving close scrutiny by computer scientists in AI and OOP. That was the extent of interest in taxonomy. By the end of the twentieth century, however, taxonomy had become a phrase to describe almost any information access system that attempted to match an information user's terminology with the terminology in a system. Given almost another decade, the label "taxonomy" has been applied to such wide variety of language and terminology compilations as to severely dilute the original meaning of the term in common parlance. "Taxonomic structure" represents an attempt to more systematically define the discipline. Exponential growth in the volume of information on both the Web and various intranets has highlighted the need for such terminology control.^[27]

Researchers and practitioners continue pursuing taxonomic structures as a means of providing useful and reasonably sized search results from Internet catalogs containing several million sites. The explosion of information available over the Internet and private intranets has exceeded the ability of simple keyword searches to

retrieve information; as a result many sites have turned to classification schemes, often called taxonomies, to help users find information.^[28] Some system builders use techniques from natural language processing (NLP) to generate classification of key words and phrases from text. These classifications can be combined into a single, virtual taxonomy for retrieving information from the Web. The primary purpose of these taxonomies is to resolve ambiguity and duplication in language.^[19] Although many of these classifications are not taxonomies by classical definition (especially internal ones for nonpublic use), research and development continue in the theory and practice of constructing effective taxonomic structures. At the same time, development and use of more traditional taxonomic structures continues. The following systems are particularly important, being almost alone among taxonomic structures in information access systems as having been developed according to widely accepted practices and standards: hierarchically arranged subject heading lists (Library of Congress Subject Headings), geographic place names (Thesaurus of Geographic Names), traditional classifications (Library of Congress Classification and Dewey Decimal Classification), and various indexing languages and thesauri [Art and Architecture Thesaurus, INSPEC Thesaurus, (ERIC) Thesaurus of ERIC Descriptors, to name a few]. The accepted standards for developing thesauri and indexing languages are: Guidelines for the Construction, Format, and Management of Monolingual Thesauri, ANSI Standard Z39.19-2003; Guidelines for the Establishment and Development of Monolingual Thesauri, ISO 2788; Guidelines for the Establishment and Development of Multilingual Thesauri, ISO 5964; Guidelines for the Establishment and Development of Monolingual Thesauri, BS 5723; and Guidelines for the Establishment and Development of Multilingual Thesauri, BS 6723.

THEORY AND PRINCIPLES OF TAXONOMY

Taxonomy has legitimate roots in the natural sciences, logic, linguistics, semantics, and the cognitive sciences; collectively, these contribute to a body of theories and principles that provide rigorous guidance to the construction of taxonomies. Taxonomy is also pragmatic; a taxonomic structure must serve at least one useful purpose or be discarded, no matter how carefully and correctly constructed. Because of this dual nature, one must sometimes turn to the practice of taxonomy to discern theory and principles, and other times study theory and principles to establish practice, which is well illustrated in the earliest taxonomies. Aristotle established the practice of observing characteristics of form, habits, and habitats of plants and animals, using these properties to identify and define the organisms. In doing this, he also explicated certain principles and established an early theory of

taxonomy. Aristotle's categorization of organisms was well grounded in the philosophy of logic, particularly deduction. Theory posits as an axiom that organisms sharing certain characteristics are related to one another. In fact, if they share enough particular characteristics, they are separate instances (members) of the same category. Empirical observation notes that certain organisms share certain characteristics. Logic deduces the organisms are related. The circularity of this argument, based as it is on an accepted axiom, does not detract from utilitarian practicality of the resulting categories. Thus, theory and practice have collaborated to produce a useful outcome. To be correct, of course, the syllogistic argument must be logically correct (i.e., the axiom properties pair must entail the conclusion). In other words, the axiomatic properties must establish necessary and sufficient criteria for membership in the category. Therein lay the difficulty, unaddressed for many hundreds of years: how many and which properties are necessary and sufficient? Furthermore, what degree of difference or similarity must be present to class something in one class or another? Pragmatism states that utilitarian practicality is the final arbiter.

Hierarchically arranging structures of knowledge is another important principle and practice of taxonomy, sitting solidly in the pragmatic camp as a means of representing knowledge. Although organizing and categorizing things, information, and concepts are instinctive and practiced by all humans, arranging categories hierarchically seems to be a learned behavior and is possibly not practiced by all cultures. In Western tradition, hierarchical classification [i.e., representations which graphically display similar entities (in clusters) and dissimilar entities (as apart or separate from each other)] did not arise until the work of Andrea Cesalpino, with his *De plantis* (1583), a systematic taxonomy of plants. Empirical attention to inherent characteristics does not proceed for long without the observation that not only are some specimens more alike than others, but some groups of specimens are more alike than others. It makes sense to cluster groups and to cluster those clusters repeatedly until all clusters are gathered into one. This methodology, building ever-larger groups with a process of gathering like items together, did not prevail prior to Linnaeus. Until his time, the standard practice was a combination of empirical observation, which identified specimens as members of a species, and successive division of a large class into ever-smaller groups until suitable categories were found for the species. Often the intermediate groups were created by examining habitats (shore birds, alpine flowers, desert shrubs, etc.), modes of locomotion (wading birds), or function (hunting dogs, draft horses, aromatic plants, medicinal plants). In some cases, groupings created on the basis of observation of action (perching birds) coincided with orders defined on the basis of inherent properties (Passeriformes); but the overlap was accidental, not based on a rigorous principle of grouping organisms because of common inherent

structural qualities (e.g., the shape of certain birds' feet). Linnaeus applied the principle of inherent properties to the higher categories (taxa), which is still in use. Darwin considered evolutionary lineage as a characteristic to include when developing hierarchical categories. In this he introduced the new principle of developmental stages as a method of hierarchical arrangement. Although the use of evolutionary history applies, strictly speaking, only to biological organisms, the principle of arranging taxonomic structures according to lines of ancestry and descent has broader application. A common example is a genealogy or family tree. Other examples include a series of product lines, the history of inventions, and the growth of ideas; all of which are topics amenable to classifying with hierarchical taxonomic structures along evolutionary, or developmental lines.

With widespread adoption of these five principles of logical entailment, empirical observation, hierarchical arrangements based on similar inherent properties, evolutionary history (or developmental stages), and pragmatic utility, taxonomy has a solid foundation. Understanding gained in the twentieth century from linguistics, semantics, and cognitive psychology has added new theoretical principles and refined existing ones. The very strict requirements of programming computers for AI, NLP, OOP, and information access have renewed attention to understanding language and how the mind works. A significant contribution from linguistics is understanding of the relationships between words. Semantics focuses on the words used for labeling the concepts classified in taxonomic structures. From cognitive psychology comes awareness of how the mind organizes thoughts and processes language, especially for different purposes, such as determining relevance, generality, or subsumption. Purposes in classification are accomplished by using language, and evaluating terms for appropriate use seems to be driven by mental constructs, which may be called principles.^[20] The relationship between a concept and a lexical unit (lexeme) represents a binding function in language; various relationships connect thoughts, meaning, ideas, objects, anything about which communication is possible. Certain relationships are particularly important: generic (a.k.a. genus-species, kind-of, IsA or Is A), meronymy (partitive, or whole-part), genealogical (ancestor-descendent), membership, equivalence, association, causality, and temporal precedence. Many relationships are hierarchical in nature, but the associative relationship has received increased attention in recent years.^[21] The generic relationship, which is hierarchical, is equivalent to logical entailment: concept A, represented by term A, has all the characteristics necessary for concept B, represented by term B, to be a "kind of" A. In this the relationship is not only logical but also definitional (semantic). Definitions determine subsumption, which is similar to the logic involved in entailment. Entailment, or subsumption, may be used to test the equivalence of

definitions; the absence of equivalence can be interpreted as the presence of subsumption.^[22] The meaning of a concept, or lexeme, determines logical relationship among concepts and lexemes.

Careful attention must be given to the words used for labeling concepts in taxonomic structures, the "nomenclature." Classical taxonomy has developed rules for naming nodes at each level of a taxonomic tree. At the species level, for instance, plants and animals have a binomial name consisting of the genera and a differentia, a term setting one species apart from all others in the same genera. Indexing languages (thesauri) following standard guidelines cast most concept labels in the form of plural nouns, which reduces ambiguity in cases where the singular form could be any of several distinct lexemes, each with its own sense of meaning. For example, "map" without a definite article might be a verb or a noun. "Maps," isolated from a sentence, is more likely understood as a plural noun. In cases of nouns alone, having no possible confusion with verbs of the same form, the singular always refers to one of something, whereas the plural refers to many, which constitutes a class or group of things. Classes are the fundamental elements of classification and taxonomy. Use of the plural form reduces confusion as to whether the referent is a concept, or an instance or exemplar of the concept. Lexemes may be single, compound, or multiword. As compound and multiword terms, they frequently serve to subdivide classes of things. For example, the class of tools called *saws* may be divided into cross-cut saws, rip saws, and coping saws, or chain-saws, electric saws, and gas-driven saws, respectively. Clearly, the form of a lexeme serves to create an implicit placement in a hierarchical taxonomic structure.

The particular example of saws illustrates two principles of classification: by use or application (cutting across the grain, cutting with the grain, making small, curving cuts), and by inherent property (saws with teeth fastened to a chain, saws driven by electricity or power). Seemingly trivial in this example, classification by external attributes, such as activity, habitat, diet, clothing, or associations, has rationalized oppression for millennia. Taxonomy, poorly done, runs the risk of incompletely and inaccurately describing human experience, perception, and beliefs, with consequent detrimental outcomes.

Cognitive psychology provides insight into classification as mental process, giving strong support to incorporating hierarchy into taxonomic structures and establishing guidelines regarding terminology choice and form. Organizing perceptions, data, information, and thoughts is an important part of acquiring information, making sense of that information, and problem solving. With classification, people develop mental pictures of topics and problems, which may be divided and subdivided, thus simplifying the learning of complex knowledge. Classification is also useful for developing inferences or expectations directed at achieving specific goals. Classification and taxonomy

are fundamental components of learning, communication, and comprehension.^[3] The importance of hierarchy as a feature of taxonomic structures cannot be overstated. Several studies support the notion that hierarchical structures are a fundamental and essential component of memory.^[23] Word association tests elicit information, not only about the test words but also about the classes that contain them. Other studies indicate a mental transformation of nonhierarchical statements into hierarchical form, possibly in an effort to place new perceptions into some familiar context. Grouping of concepts that seem similar is thus a means of generalization and simplification.^[23] Taxonomic structures provide efficient storage mechanisms for data and information; if such structures accurately model internal mental constructs, they are more likely to be useful. Classification enables people to deal with categories and groups, rather than individual instances, thus enabling more efficient use of memory and cognitive processes.^[1]

METHODOLOGY AND PRACTICES

Methodologies

- Systematic
- Organic

Practices and uses

- Description
- Prediction
- Language mapping
- Information finding

Classification can mean either assigning entities to existing classes or creating classes by clustering existing entities. Taxonomy means both: classing entities and creating new classes. Collections of entities are examined to create a taxonomic structure and individual entities are assigned to the classes (taxa) created. Once the initial collection is classified, new specimens, or entities, are assigned to existing taxa; the structure is dynamic and, if necessary, new taxa may be created. An example of this is the recent creation of two biological superkingdoms to reflect fundamental differences in cell structure.

Discussion of taxonomy methodologies and uses may, itself, be organized into a simple taxonomy, illustrated here in an indented outline:

Methodologies

- Systematic
 - Manual
 - Automated
 - Numerical
 - Semiautomated

- Organic
- Uses
 - Descriptions
 - Abstract pattern visibility
 - Analysis
 - Visible patterns clarify further direction
 - Visible patterns expose gaps
 - Visible patterns expose overlaps
 - Predictions
 - Language maps
 - Structures
 - Hierarchical—existential relationships
 - Synonymy—semantic relationships of equivalence
 - Associative—situational and/or contextual relationships important to communities of interest and practice; e.g.:
 - Process—product
 - Geographic location—governing entity
 - Object—purpose
 - Event—unit of time
 - Information retrieval systems

Use of this outline to discuss methodologies, practices, and uses, will illustrate some of the power of taxonomy for organization and communication.

Systematic taxonomy follows, as one might expect, rigorous processes and policies, which have themselves been through several cycles of development, test, revision, and adoption; they have, in other words, withstood the tests of time and pragmatic utility. In manual taxonomy construction, a collection of elements is examined carefully, and inherent properties are listed. Through an iterative process, the properties, and thus the elements, are grouped into taxa of similar entities, which, in turn, are grouped into a hierarchy of increasing specialization. Automated taxonomy has a similar goal but attempts to attain it in different ways. In numerical taxonomy, mathematical techniques of cluster analysis are applied to listings of inherent characteristics. The same techniques are also applied in domains with inadequate inherent features. One solution is to use the technique of content analysis to evaluate data from various sources such as questionnaire responses, interviews, and usability studies. One school of practice attempts to extract taxonomies from text based on linguistic features: notably, word and phrase frequencies, cooccurrence, part-of-speech, and proximity. Many variations of this approach exist, but the basic theme is that literature about similar topics will use similar language, and such similarities can be discovered and revealed by using mathematical techniques. One of the variations involves a simple raw processing of text, accepting the results. Most efforts, however, “train” computer programs with manually constructed taxonomies and carefully selected corpora of text, a process in which the program “learns” which word and phrase patterns are significant within chosen design criteria. The program is then used to

analyze a much larger body of text. In many respects, this procedure is only the classing, or indexing, half of the taxonomy process; it makes no pretense of generating taxonomic structures from scratch. A semiautomated process would be that in which mathematical techniques generate a suggested taxonomy, which is then subjected to a manual review and edit process, producing the final taxonomic structure.

Organic taxonomy, in the form of “folksonomies,” and other “social” phenomenon, represent the human desire for involvement and autonomy in the very fundamental acts of sense-making and communicating as simultaneous social and individual behaviors. Folksonomies and other shared tags created by end-users, rather than authors or professional intermediaries, have received a great deal of attention in recent years.^[24–26] Although they do not represent formal taxonomy, they serve similar pragmatic purposes and address some of the issues plaguing taxonomy; notably the problems of scale, complex rule sets, and arriving at consensus for agreement about language. Noteworthy characteristics of folksonomies include: flat lists of terms (keywords), multiple meanings for identical terms (homography), and multiple terms for one concept (synonymy). At best, the three features alone maintain the ambiguity inherent in natural language (particularly when out of context). At worst, they increase ambiguity. Folksonomies by themselves do little to facilitate agreement about meaning, nor do they serve well as classifications. Without reasonably disciplined and systematic attention to the principles and practices of taxonomy, folksonomies are informal categories at best.^[25] Nonetheless, folksonomies provide valuable insight into the thinking, behaviors, needs and desires, and properties of many more people and information entities than might otherwise be possible. They offer potential as useful additions to the taxonomy toolbox.

In the absence of reasonably defined and desired purposes, taxonomy has little value other than satisfying individual interests and motivations. More communal uses include description, analysis, prediction, language agreement, and retrieving information, as outlined above.

At its most basic, taxonomy has descriptive power; if any given taxonomy, particularly its structure, does not describe the covered domain, identification of it as a taxonomy comes into question. At best, the structure might be a collection of loosely related categories. Description sets baselines, provides foundations, creates common starting points for extending taxonomy to other purposes. Following description, taxonomy facilitates information and knowledge analysis. It reveals patterns which help clarify possible future actions; it exposes gaps and overlaps in representations of knowledge. Such exposures, in turn, identify other possible actions. Highly structured and richly detailed taxonomic structures, such as the periodic table of the elements and evolutionary trees, predict the existence of yet-undiscovered elements and prehistoric organisms.

In information science, taxonomy performs the very useful function of mapping language. When integrated into information systems, particularly for browse and search, taxonomic structures serve many purposes, all working together toward both high recall and accurate precision, an elusive goal for many decades. Simply listed, taxonomy functions in information systems to

- Represent communally accepted language.
- Promote shared use of language.
- Provide clear paths into detailed levels of specificity.
- Enable aggregated retrieval of selected specific concepts using a broader collective label.
- Convert end-user search terminology to that developed by communities of practice.
- Use that terminology for search, both metadata enabled and free-text.
- Suggest related avenues of exploration and search.
- Programmatically deliver information of possible interest to select individuals and communities based on inherent and situational characteristics of them.
- Facilitate reporting and analysis of end-users, content, content creators and providers, and storage and delivery systems.
- Enforce regulatory compliance.

This list does not exhaust the possibilities. In short, taxonomy connects the dots, closes the loops, and provides the linguistic and semantic backbones necessary to complete information transactions.

After years of research and development, integration of taxonomy with information systems has still not expanded much beyond relatively small academic pilots and applications in private industry or large government agencies. Obstacles to adoption include scalability, funding, and, often, misunderstanding regarding the value of such systems.

SUMMARY AND CONCLUSION

From its beginning as a process and system for organizing plants and animals, taxonomy has developed into a widely varied collection of classification schemes and practices applied in many disparate disciplines. In various natural sciences, particularly biology, astronomy, and geology, taxonomy continues as an important practice within each discipline. In the twentieth century, new techniques using statistical analysis and computers came into use for classifying natural objects and organisms on the basis of inherent properties that were previously unavailable for study. This is particularly the case in microbiology where numerical taxonomy creates clusters of organisms having similar genetic properties. Numerical taxonomy has also been applied in the social sciences and information access applications, although the

validity of the clusterings as accurate representations on inherent similarities in those disciplines is open to question. Taxonomies are an important part of systems developed for exploring AI. There, they take the form of ontologies, highly structured compilations of data, information, and knowledge that are used to support the logical reasoning attempted by AI. The computer science practice of OOP also incorporates taxonomy in the sense that object-oriented programs can be categorized as taxonomies. They have the features of class and inheritance, which correspond to the taxonomic features of taxa and relationships of entailment, expressed in hierarchical structures. Information access systems utilize taxonomies for navigation of Web sites and to aid searching for information on the Internet. In the context of electronic online information, taxonomies support retrieval of as many relevant information items as possible and retrieval of highly specific items. An essential contribution of taxonomy to such systems is their ability to disambiguate terminology by representing the relationships between concepts and thus providing context in which to understand and use domain-specific vocabularies. Having begun in the study of biology, taxonomy has developed a solid structure of theory and principles that guide methodology and development of taxonomic structures, with application and use far removed from taxonomy.

Beginning with the collection and study of inherent characteristics of many members of a domain of interest, taxonomy uses principles of logic and linguistic entailment, semantics, and meaning, plus insight into human mental activity to create taxonomic structures with practical utility. Regardless of where practices or with what final purpose, taxonomy utilizes of the common methodology of examining many specimens of examples of things to be classified into a taxonomic structure. Such examination may be manual, automated, or semiautomated. Each emphasizes different principles of taxonomy theory, with manual being the most comprehensive and semiautomated attempting to use automation to handle large amounts of data needing human interpretation. Automated methods include clustering algorithms and various techniques from NLP.

Regardless of the methodology and techniques used to develop taxonomic structures, in the final analysis, they are utilitarian objects, whether they serve academic research and descriptive purposes or more commonplace information retrieval from the Internet and other information systems. Well-designed and constructed taxonomic structures have descriptive, predictive, and analytical powers, which make them essential components of many information science endeavors. Integrating taxonomy with information systems can enhance end-user experiences and retrieval of desired information in many ways, all part of a chain of transactions, characterized as “connecting the dots.”

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Technical Writing

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Abstract

Technical writing conveys practical information for readers to put to use. Technical writing is done in most workplaces by a variety of professionals whose interest in writing is secondary to their primary work function, while specialists in technical communication concentrate on the processes of effective writing and knowledge creation. Professional and technical writers research and articulate solutions for professionals who need to write effectively. Therefore, technical writers construct and manage others' writing environments, and are responsible for managing documents, knowledge, and information flow in organizations. Technical writing is writing with a purpose in an organization, and so is distinguished from creative writing and academic writing in its purpose, scope, and audience.

INTRODUCTION

Defined narrowly, technical writing articulates process, procedural, and practical information both for specialized and general audiences. Technical writers interpret complex technical concepts and articulate ideas in accessible language to enable users to accomplish their goals. To present appropriate content, writers must understand the audience who will use the document and their purpose in using it. Audience analysis is a key feature of technical writing. Technical writing is writing with a specific purpose, intended to convey information from producer to consumer in the clearest and most effective way possible. Technical writers work with a variety of genres: they inform their organizations by preparing whitepapers and research reports, support decision-making with recommendation reports, and support organizational knowledge by writing procedural manuals, writing and maintaining policy, and managing collections of internal documentation. Common forms of technical writing include procedure guides and how-to manuals for household appliances and electronics. As an academic field of study, technical writing expanded in the late twentieth century as personal computers became ubiquitous and Internet connections common. Indeed, as computers moved from desktop publishing to network communication devices, digital Web-based new media have redefined the boundaries of a field once limited to written communication. In the late twentieth century, technical writing grew to include a wide variety of communication media, and hence expanded to the more expansive moniker of technical communication. Today, technical communicators work under a variety of professional titles. The list, of course, includes technical writer, but new titles are as varied as copywriter, content manager, user-experience designer, information architect, information designer, and document manager. Technical communication specialists continue

to advise organizations on effective communication practices.

The rise of technical and professional writing in America is closely tied to the development of the Morrill Land Grant Colleges in the twentieth century. Indeed, the location of these programs, their names, and specialties are very much a product of local conditions and traditions. Technical writing is most closely tied with a tradition of nonacademic writing that supported writing instruction for engineers and scientists. Professional and business writing often accompany writing instruction in business schools. Recently, more programs have taken on the name technical communication to reflect the expanded role in speech and multimedia presentation. In the middle to late twentieth century, the growth and expansion of technical communication as a field in its own right is closely tied to the expansion of personal computing technology and, at the turn of the millennium, the growth in popular use of the World Wide Web. Recent interests in information design and information architecture closely link the research being produced in technical communication programs to the research being undertaken by researchers in library and information science, creating opportunities for collaboration and hybridization between the two fields. Technical writing is complex, dynamic, and expanding, technologically sophisticated, and concerned with the role of users in producing, accessing, storing, retrieving, and perhaps most importantly, understanding and putting to use the information stored in texts written to support high technology. Both technical communication and information science share an interest in innovation and expansion into the growing culture of new media and the storage and retrieval of human knowledge through the World Wide Web. There are analogous, if sometimes competing, definitions of technical writing, often quibbling over the scope of the term and asserting differences: that professional communication contains technical and business writing

rather than technical communication serving as the larger term. Such taxonomic distinctions are important to specialists in the field, often revealing institutional as well as historical lineage as well as political and cultural sympathies of various departments and programs within higher education. Technical writers emerge from the study of rhetoric and rhetorical theory, and technical writing provides the nonacademic counterpoint to the large field of academic writing often called composition, which focuses on the first year as well as upper-level academic writing in postsecondary institutions of higher learning. Rhetoric and writing programs are gaining recognition, and increasingly are being titled “writing studies.” This entry discusses the long history of technical writing with particular attention to the post-World War II era through the late twentieth century. The late twentieth and early twenty-first century development of technical writing is closely associated with personal computing and the World Wide Web, and the entry concludes with discussion of emerging digital media, with special attention to developments in information design and architecture.

RECENT RESEARCH

Recent research in technical writing has moved beyond the 1990s concern with professional recognition and legitimation. The field’s preoccupation with its own status is exemplified, and seems to have concluded, with publication of the two-volume collection *Power and Legitimacy in Technical Communication* edited by Teresa Kynell-Hunt and Gerald Savage.^[1,2] Recently, activity theory has emerged as a viable foundation for grounding technical writing research, exemplified by Clay Spinuzzi’s 2003 *Tracing Genres Through Organizations*.^[3] Spinuzzi’s book historicizes genre, encourages teachers to include history and rhetoric in technical writing pedagogy, and connects present research to the constructivist tradition, such as Joann Yates’ *Control Through Communication*,^[4] an example of cultural history tracing the development of business and technical writing through the nineteenth century. Recent books, such as the edited collection *Critical Power Tools*,^[5] have articulated the relationship between technical writing and cultural studies and the role of new media, as with Carol Lipson and Michael Day’s *Technical Communication and the World Wide Web*.^[6] Methodology in technical writing research has been a perennial concern; emerging from a humanities perspective, scientific methods have sometimes been mismatched with the goals of technical writing. Some of this uneasiness seems inevitable as technical writers often represent the needs of non-specialists to scientists and engineers. The history of rhetoric is older than that of scientific inquiry, and measuring effective communication in context is a qualitative rather than quantitative endeavor. In response, some researchers have used rhetoric’s uneasy relationship with

empirical methodology as a strength, opening spaces for critical, reflective research.^[7] Johndan Johnson-Eilola and Stuart Selber’s *Central Readings in Technical Communication*^[8] collect landmark essays in the twentieth century while also asserting the centrality of journal articles to the development of the field: the development of technical communication research has been driven by articles in a healthy number of scholarly and professional journals such as (alphabetically listed) *Business Communication Quarterly*; *IEEE Transactions on Professional Communication*; *Information Design Journal (Document Design recently merged with IDJ)*; *Journal of Business Communication*; *Journal of Business and Technical Communication*; *Journal Of Computer-Mediated Communication*; *Journal of Computer-Supported Cooperative Work*; *Journal of Technical Writing and Communication*, *Kairos: A Journal of Rhetoric, Technology, and Pedagogy*; *Management Communication Quarterly*; *Written Communication*; *Technical Communication*; and *Technical Communication Quarterly*. Technical writing research has for the most part left concerns of the field’s legitimacy behind in the late twentieth century^[1,2] and much recent research has been articulating what Bruno Latour^[9] calls the parliament of people, texts, and technology.

TECHNICAL WRITING AS A FIELD OF STUDY

Technical writing as a profession was boosted in the late twentieth century with the widespread adoption of personal computing technology in the workplace and for home use. There was a need, within the hardware producers and programming organizations, as well as among independent writers, to clearly document and guide growing numbers of users through the process of effectively utilizing digital computers on the job and in the home. In the early twenty-first century, as more documentation is available online, there is less need for print-based documentation separate from the program as many new applications integrate guidance within the programs themselves.

Technical writing can no longer, if it could ever accurately, be defined simply in functional terms or limited to the scientific need to write with clarity, brevity, and specificity. This is, in the early twenty-first century, considered a limited and antagonistic definition (referred to as the “CBS” school) that arises out of a history of technical writing’s uneasy placement within the humanities. In higher education institutions, most often located in departments of English, technical writing was often discounted as service primarily presented to programs in engineering and business schools. English departments eschewed their service roles in preference for literary study through the twentieth century. Late in the twentieth century and continuing to the present, growing numbers of writing programs are emerging with concentrations in both academic

writing, or composition, and nonacademic writing. While technical communication is predominantly taught in English departments located in colleges of humanities, specialized programs exist in engineering and business as well as journalism schools in addition to dedicated rhetoric and writing studies programs.

The rapid expansion of technical writing in the late twentieth century to meet the demand for documentation of personal computers created opportunities for writers without formal training in technical writing. Practitioners of technical writing have a wide range of training and experience, and with writing programs offering more and better workplace and professional writing curricula, researchers have noted generational tensions in the workplace between those professionals with coursework in rhetoric, project management, and usability and those with more traditional English coursework.

Early History

Earl Morrogh^[10] takes a long view of the history of technical writing, tracing its emergence as prior to and part of the inspiration for written literacy. Opening with clay tablets to the emergence of the alphabet to Roman military texts, this perspective is consistent with mid-twentieth century scholars' attention to literate representations for specific commercial purposes. Walter Ong^[11,12] traces the emergence of literacy back to cuneiform clay tablets used to account for trade in the eastern Mediterranean. These prealphabetic texts were technical in nature, counting the numbers of vessels of goods held in the holds of ships plying the calm waters of the ancient Mediterranean sea before even the Egyptians were building pyramids. These earliest texts were technical in their functional interest and attempt to record wealth, trade value, and to account for decisions made in foreign ports by agents of newly centralizing power. That is to say, technical communication is synonymous with the invention of centralized human society and cocreative of the modern human mind. Ong asserts that the Semitic alphabet was the first of its kind, replacing both the cuneiform tablet writing and pictographic representation of the Egyptians and that all subsequent alphabets are at least inspired by if not derived directly from the ancient Hebrew.

Similarly, Earl Morrogh asserts a very long lineage for what he titles information architecture, which he defines broadly as the struggle "to create, communicate, manage, and preserve information" (p. 3).^[10] Following Morrogh, technical communicators often define themselves in terms of the first two elements of the definition: creation and communication of information, while library and information scientists are concerned with the second two elements, management and preservation of information that others have authored. In the age of computers, ubiquitous access, and information overload, both technical communicators and library and information scientists find

themselves concerned with effective information storage and retrieval. Morrogh narrates a number of moments in the long history of human development in which information production outstripped contemporary technologies for storage and retrieval, and our current age of Information Anxiety^[13] is only the latest in a long series of epochal change: from speech to text to print, and the technologization of the word from telegraph, telephone, radio, and television, to our own information age augmented by the World Wide Web. Information architecture, then, is the field of inquiry where technical communicators and library and information scientists find their interests most closely aligned.

From Roman military manuals to the mining books of secrets written by Agricola, powerful and valuable technical knowledge was stored in written form. These texts, as described by Bernadette Longo,^[14] were both powerful and valuable, and as such were often written in code or the information was purposely misrepresented in order to keep the uninitiated in ignorance. Often, these how-to texts were both encoded and contained misleading information: acting as mnemonic devices, the books of secrets would unlock the magic of metallurgy, or of medicine, or of civil administration only if one had a guide to the books. These manuals were not intended for everyone: they were reminders to the initiated—memory books—and instruction manuals for the aspiring metallurgist, civil servant, or soldier, and reading would be accompanied by a learned guide during the period of apprenticeship.

The nineteenth century rise of mass culture and urbanization was accompanied by the rise of the corporation and genres of business communication that we recognize today. Memos, reports for decision-making, research and technology, and technical illustrations, as well as patent applications became common forms of intra- and interorganization communication. This is also roughly when card catalogs and written collection inventories, which become library holding databases, become common elements of both corporate and public library collections, information storage and retrieval processes that became part and representative of industrial age information storage and retrieval from the civil war through World War I.^[4]

Twentieth Century

Robert R. Johnson^[15] and Robert Connors^[16] locate the next major turning point in technical communication at the massive scientific and administrative expansion necessary to administer the movement of people and equipment in World War II. Accompanying the administrative and material challenges were the increasingly technical weapons and tools employed around the globe, from radar to mobile weapons and, in the increasingly swift processes of recursive design, upgrades to these systems on the battlefield. It became necessary to document new designs—improvements—so that soldiers in the field could, with

their existing literacy skills, open a weapon's packing crate, read the instructions, and successfully assemble and deploy new weapons. Robert R. Johnson reports that the first attempts at such user-centered design were disasters, resulting in mechanical malfunction, misfires, and bodily injury and even occasionally in an operator's death. Often these so-called accidents were attributed to operator (human) error; however, on closer reflection, it appears that there were, in the words of Donald Norman,^[17] "Gulfs of Evaluation and of Execution between the designer and user of the technologies." To solve this problem with human error (and the dangers of industrial accidents), designers had to consider the design not from their own but from the users' perspectives. Technology could be designed not merely for esthetic or functional ends but for easier, safer operation and the design of technologies could aid in their ease of use and adoption into the users' working lives. This realization leads, in Johnson's argument, to the rise of *user-centered design*.

After World War II, accompanying the expansion of need for technical expertise among soldiers on the line was the massive rise in technical consumer goods purchased for use in the increasingly popular suburban tract house. Everything from washing machines to refrigerators to, later, televisions were finding their way into the living rooms, garages, utility rooms, and basements of these single-family, lower-density houses. Lower-density neighborhoods encouraged greater reliance on automobiles. Automobiles required technical manuals to support regular maintenance, as America became a mobile, suburban culture in the middle twentieth century. These developments also resulted in expanding the vision of technical communication to include household technologies, as Katherine Durak^[18] argued, asserting "the household as a setting of consequence." From Agricola's books of mining secrets to the post-World War II suburbanization of American culture, technical communication has participated and expanded upon the spread of literacy to an increasingly high percentage of people, beginning with the preliterate need for accuracy in trade, expanded through the advent of the printing press, providing for the informational needs of an increasingly technological culture. Technical communication followed need into technical and engineering universities, exemplified by American land grant public institutions of higher learning, and into suburban homes with the adoption of domestic technologies from sewing and washing machines to refrigerators and later entertainment devices like radios and televisions. At the end of the twentieth century, technical communication became increasingly user-centered as the personal computer required precise task-oriented documentation and guidance. Online, the Web has many guides and documents showing how users can put their technological investments to better use. The widespread use of these many kinds of texts supported the dissemination and spread of the technological information these documents

contained, paving the way from what some critics have called a democratization of technology.^[19]

The postwar period of industrial expansion chugged along, building wealth and expanding the cold-war period of Pax-Americana, leading to the multiplication of access and complexity resulting in the dawn of the information age as exemplified first by the early adoption of personal computers in the form of hobbyists followed by the more robust and culturally significant spread of computer use with the commercialization of the World Wide Web (Web) and electronic mail. Personal computing further lowered the obstacles to the tools of printing and dissemination of texts. Even before the Web, do-it-yourself desktop publishing made it possible to produce many paper copies of documents. Document design^[20] became a concern of writers, further lowering the financial barriers to disseminating printed work. With the growth of personal computing, the need for clear, end-user-centered documentation increased, and programmers could no longer assume that their user had a similar level of technical preparation. Especially with the move from computer operating systems that ran on command line interfaces (CLI) to graphic user interfaces (GUI), many more citizens were able to purchase and put to use respectably powered computing devices in their homes and offices. And all this was possible before the advent of the Web.

Through the late 1990s, the Web created a cottage industry of secondary market how-to books for personal computing. Even before the Web, many technical writers found a thriving market in teaching new users how to take advantage of productivity software, digital tax and financial tools, databases, and word processing and desktop publishing applications. Bookstores reflected this expanding need for documentation that was better than the manuals produced by large programming organizations, eventually resulting in the humorously titled "Dummies" and "Idiots" guides to just about everything. These books are the result of the realization that we are a nation of experts who have deep expertise in a very narrow set of specialized knowledge. For the vast majority of high-technology situations, we are novices, or in the unfortunate construction of these books, we are geniuses in our specialties but idiots and dummies in everything else.

Understanding the user as human being is at the heart of user-centered and human-centered design that works to present a technology interface that effectively presents the power of the technology to the user, in a human scale and task-oriented perspective. Users need not understand the underlying technology represented by the interface but rather see how the tool lying behind the interface can fulfill their needs. Indeed, the interface is the face the tool presents to users. The shift from system to user-centered recognizes the widespread dissemination of high-technology digital tools throughout culture, the democratization of access in which all have a printing press, radio, and television receiver as well as broadcast

capability, and the PC moved from being seen primarily as a personal *computing* device and becomes a personal *communication* device. Technical writers filled a need by documenting and presenting information for effectively using these communication devices by people who had no interest in knowing how or why the technology works.

The New Millennium

The shift from computing to communication is a shift from, in Richard Lanham's^[21] words, looking at technology to looking through technology. For many, their personal computers have become their promised video phones, and although the travel is virtual, they are likewise personal transporters, allowing users to transport their vision, their gaze, across the globe and, through NASA's rovers and telescopic devices—our virtual eyes—out into space and to the very edges of the solar system.

The cost of entry was vastly reduced: no longer was it necessary to train—to become expert—in the use of computers. What followed was the need to increasingly redesign the interface and the procedures to get online and participate on the Web so that the greatest number of users could become self-sufficient online, getting connected to the internet at speeds that made new online media viable. YouTube is the latest example of an organization that learned how to better deliver video. By creating generally understood accessible standards for video upload, conversion, and distribution, almost all Web users have access to acceptable quality video—if users can access youtube.com, they have access to content. In this way, YouTube is a victory for participation and access, even if the content leaves many scratching their heads and wondering what value the content may have to culture. In sum, users get to participate in the creation of Web content and also access what has been posted, without regard for the meaning or value of what has been posted. Users accessing YouTube are not thinking about search algorithms, taxonomic structures, or about how the videos are encoded and made available online. However, each of these elements is of importance to the new generation of technical communicators who take very seriously design, placement, and accessibility of digital video: the very things that make YouTube an enjoyable rather than frustrating experience.

Accompanying the expansion of access for posting and viewing is an expansion to access to the organization of content. So-called folksonomies, which are augmenting more centrally controlled taxonomies, represent a new level of user-participation, actually labeling content with searchable metadata, so that users become organizers and archivists as well as end-users. This control not just of the content but of the organization and navigability of content—or its findability, to borrow a phrase from Peter Morville—is a hallmark of what has been called the second wave of internet entrepreneurship, commonly referred

to as Web 2.0. Folksonomies may seem to challenge the accustomed control and authority of the information organization professionals: that is, of information and library scientists. And perhaps from certain perspectives, it does. However, opportunities exist to invent, support, and change with evermore creative means of opening information up to user labeling and organization. Recent books like *The Wisdom of Crowds*,^[22] *Glut*,^[23] and *Everything is Miscellaneous*^[24] all assert a new and interesting role of information and library science, but this role is different from traditional librarianship, and shares much in common with recent research in technical writing.

Brenton Faber^[25,26] argues that “change” is both a powerful trope and new constant in the information organization. Libraries, traditionally described as beginning in the United States with Benjamin Franklin's subscription group through Carnegie-funded public lending libraries, have traditionally been seen as a site for access to printed material. However, just as railroads and shipping companies had to rethink their identities at the dawn of the information age, so too do libraries find themselves rethinking identities and embracing change, seeing themselves not strictly as providers of access to books. Rather, libraries are redefining themselves as providers of access to information, which also requires developing a critical sense of information valuation, so that library patrons can become increasingly effective users of information resources. However, the Internet age has given individual users much greater access to information. Likewise, librarians and information science professionals are encountering similar change and some have begun to reimagine their profession and responsibilities in terms of teaching library patrons effective and critical information assessment and retrieval, both online and in print. It is also ripe for deeper collaboration with technical writing as well as with closely and further flung specialties. Culture is and will continue to reconsider the definition of deeply held values, such as literacy, and information professionals are well-placed to not only participate but to create innovative practices in collaboration with professionals in related fields, like technical writers who also see the challenges of information architecture and user-integration as central to the challenges of this current wave of technological and cultural change.

This current age of change, seen from the perspective of technical writing and communication, has to do with the changing nature of expertise. Experts are expected to help guide nonexperts, what this entry refers to as end-users, or simply users, to accomplish what they want. Balanced with the challenges of user-centered design is awareness of experts, or stakeholders, who have responsibilities to the local institution, the national and international standards of professional conduct, and to historical identity. The rise of do-it-yourself culture is exemplified by the hobbyist programmer, seen as an information

seeker who challenges traditional modes of patron behavior in the library. Effectively preparing for Web-savvy internet users further complicates librarianship. Like librarians rethinking their role in an age of information, technical writers are redefining their professional responsibilities to take advantage of opportunities made possible with digitization of information, like findability, critical information assessment, and user-centered design. These skills are needed *in addition to* traditional professional responsibilities. And it is no easy task to develop whole new arenas of expertise and responsibility.

Jay David Bolter and David Grusin,^[27] writing about new media, coined the term *remediation* to describe the process of new media's impact on old. Radio impacted fictional novels. Television changes radio. And all have been affected by the massive and incredibly fast adoption of digital computing technology—specifically the worldwide expansion of use of the Web. It is important, as Bolter and Grusin explain, to remember that radio didn't simply disappear when NBC, CBS, and ABC started broadcasting. So too, the three networks didn't cease their broadcasts when cable became another common way of accessing televisual media. Mentioned above, railroad executives—or managers of old transportation media—who saw themselves as operating engines and cars on rails, soon found themselves at a distinct professional and cultural disadvantage to those visionaries who saw trains as part of a network that transported goods around the world. These postindustrial workers engineered better systems for transporting these manufactured goods and raw materials between cargo ships, trains, and trucks—an arm of business management now known as logistics—found themselves in widespread demand and valuable members of the team of symbolic analysts who support the postindustrial global economy. So too, technical writers who see their profession in limited ways as creating static documents for packaged software systems with long development lives and slow redesign cycles have witnessed reduced opportunity and less prestige, while those who have ventured into Web-based delivery, experimented with new software models like open source and usable systems, have found themselves in increasing demand for their expertise. As Faber argues, change has become the one constant.

FUTURE OF TECHNICAL WRITING

Technical writing sees one of its future directions of growth and development in information architecture, of creating structures users can participate in and better take advantage of greater access to information resources. Technical communicators see information scientists and librarians as potential partners rather than rivals with whom the future of information architecture and design can be invented and communicated. Whereas technical

communicators emphasize the creation of content, effective writing and reading, and writing texts that help readers comprehend and put information to use, information science professionals emphasize storage and retrieval of that information. Opportunities for hybridization, cross-fertilization, and cooperation in understanding and innovating in an era of great technological and cultural change exist. Technical writers look towards a future integrating processes of information design and information architecture into their traditional roles of writing effectively to be read, as information scientists learn how to better support the challenges of user-initiated search, and accommodate the expansion of access to information through the Web, as the definition of librarian changes to include emerging responsibilities of information scientists.

CONCLUSION

In the early twenty-first century, technical writing is in a state of transition and flux. Like so many professions with roots in the expansion of industrial post-World War II American culture, technical writing is struggling to rearticulate its expertise in the postindustrial, global, and digital age of information. Research in the field of rhetoric and writing studies has articulated numerous directions for technical writing to take in its twenty-first century redesign. Most promising among these are information design and architecture, which rearticulates technical writing expertise in terms of Robert Reich's symbolic analytical work, redefining work as symbolic manipulation, a definition much in synch with earlier twentieth century rhetorical articulations of humans as "symbol-using animals," as Kenneth Burke has asserted. Technical writing, with its dual histories as both writing for specific purposes and as nonacademic writing, asserts an identity separate from the academic study of writing and pedagogy in the first year composition class, yet shares much of the same rhetorical basis and intellectual history. Two threads characterize this identity of professional and technical communication. The first larger group is comprised for the most part of professionals working in a variety of fields, from doctors to lawyers to engineers, programmers, and managers, all of whom spend a sizeable amount of their working time writing. These are the professionals writing who need the support of the second, smaller group of professional technical writing researchers who can articulate best practices and research-based solutions to problems shared by a variety of professionals who need to write effectively. This second group of professional writers, technical communication scholars, and rhetoric researchers will also find themselves increasingly called upon to solve challenging communication problems faced by professionals from various fields of postindustrial work as new media and new economy challenges require innovative solutions.

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Test Collections

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Abstract

Research and development of search engines and other information retrieval (IR) systems proceeds by a cycle of design, implementation, and experimentation, with the results of each experiment influencing design decisions in the next iteration of the cycle. Batch experiments on *test collections* help ensure that this process goes as smoothly and as quickly as possible. A test collection comprises a collection of documents, a set of information needs, and judgments of the relevance of documents to those needs.

INTRODUCTION

In the early 1960s, a librarian employed by Cranfield Aeronautics was working on search systems to help aeronautical engineers locate research papers relevant to particular engineering questions. His systems involved combinations of cataloging and labeling methods called “precision devices”—those designed to increase the proportion of matching material that was relevant—and “recall devices”—those designed to increase the proportion of relevant material that was found.^[1] Between these two broad classes of devices, many permutations and variations were possible. He needed a way to measure the utility of one precision device over another, one recall device over another, or a precision device versus a recall device. In other words, he needed to be able to *evaluate* the devices’ performance and compare them to one another.

A straightforward way to go about this is to bring in actual users of the system, have them interact with it for a while, and measure how well and how fast they are able to complete certain tasks. Today this is called a “user-based evaluation.” While user-based evaluations are invaluable for measuring certain aspects of retrieval systems, they are also slow, expensive, and inefficient: each iteration of the design cycle requires a new study with new users, who must be compensated for their time. Meanwhile, differences between systems commingle with the abilities and preferences of the users, limiting conclusions that can be drawn about the systems independent of the particular users in the study. Finally, the data the users generate is not reusable; once a design cycle starts anew, the entire process must be started from scratch. Comparing a wide variety of systems with different (and sometimes very subtle) combinations of precision and recall devices made this process far too inefficient.

Instead, the librarian—Cyril Cleverdon—hit upon an idea that would allow them to *automatically* differentiate

between the performance of different devices. He in effect reverse engineered a user study. He assembled a collection of research papers and contacted their authors, asking them to provide the research questions that had inspired the paper. He then asked the authors to rate each of the cited references on a scale of 1–5 with regard to how relevant it was to each of the research questions. This produced data by which he could simulate a user study: the author-provided research questions were a set of information needs that would be similar to those of the system’s users, and the judgments of relevance told him which articles would be better to retrieve. The same data could be used again and again, under the assumption that the ability to answer that particular set of research questions better would generalize to the wider space of research questions that users would want to ask.

This basic method (and indeed the documents, questions, and judgments themselves) was picked up by Professor Gerard Salton of Cornell for the evaluation of his highly influential automatic text indexing and retrieval system SMART.^[2] As a result, it is now the de facto approach to evaluating automatic retrieval system performance, and it is referred to as the “Cranfield paradigm.” Evaluations within this paradigm are called “system-based evaluations.” The key component to a system-based evaluation is a *test collection*: a set of documents or other objects that will be indexed and searched, a set of information needs that are representative of the needs of typical users, and judgments of the relevance of indexed objects to those information needs.

The test collection resulting from the above study—the Cranfield collection of aeronautical engineering abstracts—consisted of 1400 documents, 225 information needs, and roughly 1800 relevance judgments, on average eight per information need. Those that were not provided by the authors were filled in by students later on. Since then, test collections have grown with the size and complexity of organization and retrieval problems. Modern

test collections in information retrieval (IR) research consist of millions of full-text documents, and in development of Web search engines, tens of billions of Web pages and other information.

This entry is about the components of a test collection, how test collections are assembled, and particular test collections used in current research and development. Before getting to that, it is important to understand how a test collection reflects a particular retrieval task and a definition of relevance.

RETRIEVAL TASKS AND RELEVANCE

People use search engines for many different reasons: library catalog search, Web search, literature search; routing and filtering; known-item search, novel-item search, passage search; question answering, summarization, media search, and so on. Each of these is a different *retrieval task*, and a test collection built to study one task is not necessarily the right collection for studying another. Each task suggests a different definition of *relevance*; since the definition of relevance affects every judgment to every document in the test collection, the use of a particular test collection entails the use of a particular definition of relevance designed to handle a particular retrieval task.

The prototypical task is called ad hoc retrieval: a user enters an arbitrary query and the engine returns a ranked list of documents that “match” the query according to some model. The query is considered a one-time event, with the corpus unchanging from the time the query is entered to the time the results are returned. This contrasts with tasks such as routing or filtering, in which the corpus changes over time and new documents are constantly checked for relevance against “standing” queries, or question answering, in which the query is a natural-language question and the ranked list consists of natural-language answers that are not necessarily literally attested in any document in the corpus. Tasks such as known-item retrieval,^[3] home page finding,^[4] and topic distillation^[5] are similar to ad hoc retrieval in the basic framework, but differ in that users performing one of these tasks is looking for something more specific than information about a topic; they are looking for (respectively) a particular document, a home page, or pages that are entries into hyperlinked sites of dispersed but relevant material. Novel-item retrieval has the goal of retrieving things—often passages rather than documents—that have *not* been seen before^[6] (where “before” is generally taken to mean “higher in a ranked list”).

More than any other factor, the retrieval task dictates the definition of relevance that is used when judging documents. In IR broadly defined, relevance is considered to be a semantic or pragmatic property of documents and queries. It is not syntactic, as in database systems: a

document cannot be considered relevant only by virtue of containing the query terms, nor can it be considered nonrelevant only because it lacks some or all query terms. Because words can have multiple meanings and concepts can be represented by words that the user has not thought of, it is always possible that a document is relevant despite containing none of the query terms (or, similarly, that a document is nonrelevant despite containing all of the query terms). The relevance of a document must therefore be assessed independently of the query and the system that retrieved it, but with respect to the retrieval task and the full information need.

To see the influence of task on relevance, consider the criteria for relevance under different tasks. In tasks like ad hoc and routing, a document is typically considered relevant if it contains any information about the topic. Known-item retrieval and home page finding require only one relevant document (or a very small set). For the topic distillation task, relevant pages may contain no information about the topic at all; it is sufficient that they be a gateway to a site about the topic. Determining whether pages are “novel” depends on knowing what has been ranked above them,^[7] or possibly on what a user has seen in the past.

Even within the domain of a particular task, relevance can be difficult to define precisely.^[8–10] Befitting the concept of system-based evaluation, the most widely used notion of relevance is *system-oriented*, in which the relevance of a document to a query is dependent only on the representations of the document and query, and not on any “external” features of the user that submitted the query, the state of the corpus, other documents in a ranking, and so on.^[11] This sort of definition clearly facilitates repeatable system-based evaluations, though other definitions by which relevance is ranking-dependent or corpus-dependent certainly do not make such evaluations impossible. Definitions of relevance that are conditioned to a greater degree on the user result in experiments that are not as easily repeatable, as a user’s needs can evolve in time even as the corpus is considered static.

There is also the question of whether relevance should be measured on a binary, graded, or continuous scale, or whether it is better treated as a preferential judgment between two or more documents.^[12] Topical relevance is typically defined on a binary scale: a document is either relevant (on-topic) or it is not. On the Web, where queries are very short, often ambiguous, and users tend not to look past the top 10 documents retrieved, relevance on a 3- or 5-point graded scale has become standard (cf. Burges, Shaked, et al.^[13] and Carterette and Jones^[14] for Web-inspired work on ranking and evaluating using graded judgments). Rorvig proposed that relevance be assessed as a relative property between two documents, which could translate into a continuous measure of utility.^[12] These decisions depend to a large extent on the task as well.

TEST COLLECTION CONSTRUCTION

Putting together a test collection that is interesting for IR research is a difficult task.^[15] The documents should be heterogeneous enough that one can expect performance to generalize to other collections, but homogeneous enough that query samples will cover a fair amount of the possible space of information needs. The information needs should be representative of the space of needs users of the corpus will have, and large enough that statistically significant conclusions about systems can be reached. They should not be too easy for the systems (i.e., an untuned system should not be able to find all of the relevant documents), but they should not be too hard either (an untuned system should be able to find at least a few relevant documents). Queries that are too easy or too hard are not the ones that one can expect to achieve gains on through research and development, and thus are not ideal for testing. It should be noted that *some* easy and hard queries should be interspersed in the set. If a system cannot answer the easiest query, it is clearly a poor system; further testing is not required.

Tague-Sutcliffe explicates some of the particular considerations in the construction of a test collection.^[16] In assembling a corpus, one must consider “size, concentration, form, medium, subject coverage, and warrant or expected use of the database,” which in turn refer to the number of documents, the degree of homogeneity among them, the “completeness of the representation” (short citation, abstract, full-text), the “communication medium” (text, sound, video). All of these are to some extent influenced by the task (the expected use of the database). As for queries, it is preferable that they come from real users of the system, but, as Tague-Sutcliffe says, this is often more difficult and expensive than one might think, particularly when it comes to vetting their queries for coherence and ease. Artificial queries can be generated from the documents (for example, by using words in document titles), or the researcher/developer can “backfit” queries to fit a particular set of documents.

Then there is the issue of relevance judgments. Since these are semantic (or pragmatic) judgments, they require some human input. Typically they are made by assessors hired expressly for the purpose of making relevance judgments. Sometimes these assessors may provide information needs and queries as well; it stands to reason that the person best equipped to judge a document is the one who came up with the information need that retrieved it. The standard way to collect relevance judgments is by *system pooling*.^[17] the set of test queries is run through the set of systems to be compared, and the top *N* results from each system for each query are pooled. This entire pool is then judged for relevance. This focuses the judging effort on those documents least likely to be nonrelevant, and allows exact understanding of precision (the proportion of retrieved documents that are relevant) up to rank *N*. It

leaves some uncertainty in recall (the proportion of relevant documents that were retrieved), since there may be relevant documents that were not retrieved by any system and thus unjudged by any assessor.

In practice, a retrieval system developer may have a corpus ready to be searched, for example an intranet, a large database of short texts, or a collection of books, and a set of information needs that can be sampled. The problem is not in finding a corpus or information needs, but in acquiring enough relevance judgments that will allow them to have confidence in the evaluation.

Repeatability and Reusability

In an ideal setting, system-based evaluations over test collections are *repeatable*: the same experimental environment produces the same results every time. This means that published results can be verified by other researchers and developers, and results can be directly compared across developers and over time. Additionally, an ideal test collection is *reusable*: though its relevance judgments may have been collected from a particular set of systems, they should be complete enough that they can reliably evaluate new systems with properties that are as yet unknown. This way, new systems can be reliably compared to old; as well, the high cost of collecting judgments can be amortized over many experiments.

If a test collection contains a relevance judgment of every document to every query, it goes without saying that the test collection is reusable. Test collections constructed using the pooling method are not so complete, which raises the question of whether they are reusable. This was answered in the positive for a class of collections (the *TREC collections*; see below) by Zobel;^[18] while pooling failed to find up to 50% of the relevant documents for some of the test queries, these missing judgments did not seriously affect comparisons between systems. It is likely that pooling requires some degree of diversity among systems that has not been measured, and in a setting in which such diversity is not available, test collections may be less reusable.

Assessor Agreement

The system-oriented notion of relevance treats it as a *semantic* property, concerned with the meaning of the query and the document. User-oriented approaches are *pragmatic*, concerned more with what is needed by the user at the time the query was entered. In either case, relevance judgments are subject to disagreement among assessors.

The effect of disagreement on system-based evaluations is an important one and deserving of study. Cormack et al. proposed a method for acquiring relevance judgments called “Interactive Searching and Judging” (ISJ), by which assessors submit a query to a retrieval engine,

judge retrieved documents, and then reformulate the query based on what they have learned in making those judgments.^[19] Using this method to acquire judgments for a particular widely disseminated set of information needs produced a set of judgments that overlapped only 33% with the provided judgments. Despite this, the evaluation of systems over those topics did not substantially change; other studies have independently reached the same conclusion.^[20,21] This suggests that evaluations are rather robust to disagreement between assessors. Presumably there is much greater agreement on some documents than others, and those documents that assessors agree highly on tend to be the ones that are most useful for differentiating between systems.

AVAILABLE TEST COLLECTIONS

Some of the test collections that have appeared most frequently in the literature are the Cranfield collection of aerodynamics technical papers, the OHSUMED corpus of medical abstracts, the CACM corpus of abstracts from *Communications of the ACM*, the INSPEC corpus, the Text REtrieval Conference (TREC) news corpora, consisting of articles from the *New York Times*, *Wall Street Journal*, *Associated Press*, and more, and the TREC GOV corpora, consisting of millions of Web pages in the .gov domain. The first four of these contain fewer than 30,000 documents; it is only in the last 20 years that large test collections have become widely available for IR research.^[22] Each of these has an associated set of information needs either taken from actual needs of users of the corpus or developed for the express purpose of retrieval research.

In 1980, a corpus of 11,000 documents was considered “unusually large” (q.v. Robertson et al.^[23]). Part of the reason is the computational power available at the time, of course, but by 1990 corpus sizes had not grown significantly larger.^[22] I have not found any paper before 1992 using a collection of more than 30,000 documents. Tague-Sutcliffe and Hawking have both observed that the limited size of these test collections limits the conclusions that can be drawn about system performance; as a result, small collections like Cranfield, CACM, OHSUMED, and INSPEC are no longer in wide use.

IR research has been a fast-moving field, and as a result, in its early days small collections that had been developed for one task were often coerced into use for another. This was partially due to the cost of constructing a test collection: though cheaper than a series of user studies, there is still a significant startup cost that a small research group cannot necessarily afford. This was one of the motivating factors for the TREC, which began in 1992.^[22,24] The first large-scale test collections for general research purposes came out of TREC: Where previous collections had been no more than several megabytes of

short text articles, the new TIPSTER collection was about 3 GB and consisted of over a million full-text documents from the Associated Press, Wall Street Journal, and Federal Register, along with abstracts from the Department of Energy.^[24] The sets of information needs were smaller (50 topics rather than the several hundred queries in previous collections), but more tightly focused, well-defined, and assembled with greater quality control.^[22] This collection was developed for the standard ad hoc task, and in the intervening time more documents and queries have been added, new domains sampled, and new tasks represented. Today there are research test collections with up to 25 million documents and tens of thousands of queries (though the relevance judgments are very sparse). There are test collections designed for many different tasks, including routing and filtering, home-page finding, known-item finding, topic distillation, question answering, expert finding, patent search, and many more.

The collections produced by TREC, which are available from TREC’s Web site (<http://trec.nist.gov>) are now standard and ubiquitous in IR research. Similar evaluation conferences such as NTCIR (NII Test Collections for IR Systems; <http://research.nii.ac.jp/ntcir>) and CLEF (Cross-Language Evaluation Forum; <http://clef-campaign.org>) have emerged to provide a greater breadth of data for retrieval in other languages and for other tasks (such as patent retrieval, image retrieval, and video retrieval) as the field has grown substantially over the last decade.

CONCLUSION

A test collection comprises a set of documents, a set of information needs or queries, and a set of judgments of relevance of documents to those information needs. They enable rapid IR research and development through batch evaluations of system performance.

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Text Encoding Initiative (TEI)

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Abstract

The result of community efforts among computing humanists, the Text Encoding Initiative or TEI is the *de facto* standard for the encoding of texts in the humanities. This entry explains the historical context of the TEI, its fundamental principles, history, and organization.

INTRODUCTION

Computers can only process texts whose characters are represented by a system that relates to the binary system computers can interpret. This is called character encoding. One such character encoding scheme based on the English alphabet is ASCII (American Standard Code for Information Interchange). Character encoding facilitates the storage of text in computers and the transmission of text through telecommunication networks. Character encoding, however, does not say anything about the semantics, interpretation, or structure of a text. Such information on a text is called meta-information. If we want to add any meta-information to a text so that it can be processed by computers, we need to encode or markup texts. We can do this by inserting natural language expressions (or codes representing them) in the text with the same character encoding the text is using, but separated from the text by specific markers. One such expression, we call a tag. All of the tags used to encode a text together constitute a markup language. The application of a markup language to a text, we call text encoding.

The Text Encoding Initiative (TEI) is a standard for the representation of textual material in digital form through the means of text encoding. This standard is the collaborative product of a community of scholars, chiefly from the humanities, social sciences, and linguistics who are organized in the TEI Consortium (TEI-C <http://www.tei-c.org>). The TEI Consortium is a nonprofit membership organization and governs a wide variety of activities such as the development, publication, and maintenance of the text encoding standard documented in the *TEI Guidelines*, the discussion and development of the standard on the TEI mailing list (TEI-L) and in Special Interest Groups (SIG), the gathering of the TEI community on yearly members meetings, and the promotion of the standard in publications, on workshops, training courses, colloquia, and conferences. These activities are generally open to nonmembers as well.

By “TEI Guidelines” one may refer both to the markup language and tag set proposed by the TEI Consortium and to its documentation online or in print. Informally “TEI Guidelines” is often abbreviated to “TEI.” In this entry “TEI Guidelines” is used as the general term for the encoding standard. The *TEI Guidelines* are widely used by libraries, museums, publishers, and individual scholars to present texts for online research, teaching, and preservation. Since the TEI is expressed in terms of the eXtensible Markup Language (XML) and since it provides procedures and mechanics to adapt to one’s own project needs, the *TEI Guidelines* define an open standard that is generally applicable to any text and purpose.

The entry first introduces the concepts of text encoding and markup languages in the humanities and then introduces the TEI encoding principles. Next, the article provides a brief historical survey of the TEI Guidelines and ends with a presentation of the Consortium’s organization.

TEXT ENCODING IN THE HUMANITIES

Since the earliest uses of computers and computational techniques in the humanities at the end of the 1940s, scholars, projects, and research groups had to look for systems that could provide *representations* of data which the computer could process. Computers, as Michael Sperberg-McQueen has reminded us are binary machines that “can contain and operate on patterns of electronic charges, but they cannot contain numbers, which are abstract mathematical objects not electronic charges, nor texts, which are complex, abstract cultural and linguistic objects” (p. 34).^[1] This is clearly seen in the mechanics of early input devices such as punched cards where a hole at a certain coordinate actually meant a 1 or 0 (true or false) for the character or numerical represented by this coordinate according to the specific character set of the computer

used. Because different computers used different character sets with a different number of characters, texts first had to be transcribed into that character set. All characters, punctuation marks, diacritics, and significant changes of type style had to be encoded with an inadequate budget of characters. This resulted in a complex of “flags” for distinguishing uppercase and lowercase letters, for coding accented characters, the start of a new chapter, paragraph, sentence, or word. These “flags” were also used for adding analytical information to the text such as word classes, morphological, syntactic, and lexical information. Ideally, each project used its own set of conventions consistently throughout. Since this set of conventions was usually designed on the basis of an analysis of the textual material to be transcribed to machine-readable text, another corpus of textual material would possibly need another set of conventions. The design of these sets of conventions was also heavily dependent on the nature and infrastructure of the project, such as the type of computers, software, and devices such as magnetic tapes of a certain kind that were available.

Although several projects were able to produce meaningful scholarly results with this internally consistent approach, the particular nature of each set of conventions or encoding scheme had lots of disadvantages. Texts prepared in such a proprietary scheme by one project could not readily be used by other projects; software developed for the analysis of such texts could hence not be used outside the project due to an incompatibility of encoding schemes and nonstandardization of hardware. However, with the increase of texts being prepared in machine-readable format, the call for an economic use of resources increased as well. Already in 1967, Michael Kay argued in favor of a “standard code in which any text received from an outside source can be assumed to be” (p. 171).^[2] This code would behave as an exchange format which allowed the users to use their own conventions at output and at input (p. 172).^[2]

MARKUP LANGUAGES IN THE HUMANITIES

Procedural and Descriptive Markup

When human beings read texts, they perceive both the information stored in the linguistic code of the text and the meta-information which is inferred from the appearance and interpretation of the text. By convention, italics are, for instance, used as a code signaling a title of a book, play, or movie; a foreign word or phrase; or emphatic use of the language. Through their cognitive abilities, readers usually have no problems selecting the most appropriate interpretation of an italic string of text. Computers, however, need to be informed about these issues in order to be able to process them. This can be done by way of a markup language that

provides rules to formally separate information (the text in a document) from meta-information (information *about* the text in a document). Whereas markup languages in use in the typesetting community were mainly of a procedural nature, that is, they indicate procedures that a particular application should follow (e.g., printing a string of text in italics), the humanities were also and mainly considered with descriptive markup that identifies the entity type of tokens (e.g., identifying that a string of text is a title of a book or a foreign word). Unlike procedural or presentational markup, descriptive markup establishes a one to one mapping between logical elements in the text and their markup. In order to achieve this, descriptive markup languages tend to formally separate information (the text in a document) from meta-information (information *about* the text in a document).

Early Attempts

Some sort of standardization of text encoding for the encoding and analysis of literary texts was reached by the COCOA encoding scheme originally developed for the COCOA program in the 1960s and 1970s,^[3] but used as an input standard by the Oxford Concordance Program (OCP) in the 1980s^[4] and by the Textual Analysis Computing Tools (TACT) in the 1990s.^[5] For the transcription and encoding of classical Greek texts, the beta-transcription/encoding system reached some level of standardized use.^[6]

The Standard Generalized Markup Language (SGML)

The call for a markup language that could guarantee reusability, interchange, system and software independence, portability, and collaboration in the humanities was answered by the publication of the Standard Generalized Markup Language (SGML) as an ISO standard in 1986 (ISO 8879:1986).^[7] Based on IBM’s *Document Composition Facility Generalized Markup Language*, SGML was developed mainly by Charles Goldfarb as a metalanguage for the description of markup schemes that satisfied at least seven requirements for an encoding standard (pp. 28–29):^[8]

1. The requirement of comprehensiveness.
2. The requirement of simplicity.
3. The requirement that documents be processable by software of moderate complexity.
4. The requirement that the standard not be dependent on any particular characteristic set or text-entry device.
5. The requirement that the standard not be geared to any particular analytic program or printing system.

6. The requirement that the standard should describe text in editable form.
7. The requirement that the standard allow the interchange of encoded texts across communication networks.

In order to achieve universal exchangeability and software and platform independence, SGML made use exclusively of the ASCII codes. As mentioned above, SGML is not a markup language itself, but a metalanguage by which one can create separate markup languages for separate purposes. This means that SGML defines the rules and procedures to specify the vocabulary and the syntax of a markup language in a formal Document Type Definition (DTD). Such a DTD is a formal description of, for instance, names for all elements, names and default values for their attributes, rules about how elements can nest and how often they can occur, and names for reusable pieces of data (entities). The DTD enables full control, parsing, and validation of SGML-encoded documents. By and large the most popular SGML DTD is the Hypertext Markup Language (HTML) developed for the exchange of graphical documents over the Internet.

A markup scheme with all these qualities was exactly what the humanities were looking for in their quest for a descriptive encoding standard for the preparation and interchange of electronic texts for scholarly research. There was a strong consensus among the computing humanists that SGML offered a better foundation for research-oriented text encoding than other such schemes.^[8,9] From the beginning, however, SGML was also criticized for at least two problematic matters: SGML's hierarchical perspective on text, i.e., the representation of text as a hierarchical tree structure, and SGML's verbose markup system.^[9] These two issues have since been central to the theoretical and educational debates on markup languages in the humanities.

The eXtensible Markup Language (XML)

The publication of the eXtensible Markup Language (XML) 1.0 as a W3C recommendation in 1998^[10] brought together the best features of SGML and HTML and soon achieved huge popularity. Among the strengths XML borrowed from SGML are the explicitness of descriptive markup, the expressive power of hierarchic models, the extensibility of markup languages, and the possibility to validate a document against a DTD. From HTML it borrowed simplicity and the possibility to work without a DTD. Technically speaking, XML is a subset of SGML and the recommendation was developed by a group of people with a long standing experience in SGML, many of whom were members of the TEI community.

For example, a simple two-paragraph document could be encoded as follows in XML:

```
<?xml version="1.0" encoding="UTF-8"?>
<document>
  <!-- paragraphs go here -->
  <paragraph number="1">Paragraph one of
    <title>an XML example</title>.</paragraph>
  <paragraph number="2">Paragraph two of this
    example.</paragraph>
</document>
```

This is an example of an XML document, representing both information and meta-information. Information (plain text) is contained in *XML elements*, delimited by *start tags* (e.g., <document>) and *end tags* (e.g., </document>). Additional information to these XML elements can be given in *attributes*, consisting of a name (e.g., number) and a value (e.g., ^[1]). *XML comments* are delimited by start markers (<!--) and end markers (-->). This particular example illustrates how XML enables semantically transparent encoding of a document (<document>), which consists of two paragraphs (<paragraph>), the first of which contains text identified as a title (<title>). By providing facilities to define own tags and attributes, XML allows encoders to devise their own markup languages for their document (types).

Among more technical ones, Steven DeRose pointed out substantial advantages of XML to the TEI community: by allowing for more flexible automatic parsing strategies and easy delivery of electronic documents with cheap ubiquitous tools such as Web browsers, XML could spread the notion of descriptive markup to a wide audience that will thus be acquainted with the concepts articulated in the TEI Guidelines (p. 19).^[11] Because of its advantages and widespread popularity, XML became the metalanguage of choice for expressing the rules for descriptive text encoding in TEI.

TEI: GROUND RULES

Guidelines

The conclusions and the work of the TEI community are formulated as guidelines, rules, and recommendations rather than standards, because it is acknowledged that each scholar must have the freedom of expressing their own theory of text by encoding the features they think important in the text. A wide array of possible solutions to encoding matters is demonstrated in the TEI Guidelines which therefore should be considered a reference manual rather than a tutorial. Mastering the complete TEI encoding scheme implies a steep learning curve, but few projects require a complete knowledge of the TEI. Therefore, a manageable subset of the full TEI encoding scheme was published as TEI Lite, currently describing 145 elements.^[12] Originally intended as an introduction and a didactic stepping stone to the full recommendations, TEI

Lite has, since its publication in 1995, become one of the most popular TEI customizations and proves to meet the needs of 90% of the TEI community, 90% of the time.

The ground rules discussed in this section apply to the most recent version of the TEI at the time of writing, i.e., TEI P5. See the section on TEI: History for more details about P5 and previous versions of the TEI Guidelines.

Text Structure

The TEI Guidelines^[13] define a set of rules to mark up the phenomena in a wide range of texts in a descriptive fashion. This means that, for example, encoders can (and should) not just indicate *that* a bit of text is printed in italics, but *why* this is the case: either because it appears to be a title in a bibliographical reference, or a technical term, a foreign word, a regular word with rhetorical emphasis, and so on. Texts that are enriched with intelligible meta-information not only can be preserved and reused more easily by humans, but also can be processed more intelligently by computers.

The TEI guarantees this potential by imposing a common structure on texts:

```
<TEI xmlns="http://www.tei-c.org/ns/1.0">
  <teiHeader>
    <fileDesc>
      <titleStmt>
        <title><!-- Title - -></title>
      </titleStmt>
      <publicationStmt>
        <p><!-- Publication Information - -></p>
      </publicationStmt>
      <sourceDesc>
        <p><!-- Information about the source - -></p>
      </sourceDesc>
    </fileDesc>
  </teiHeader>
  <text>
    <body>
      <p n="1">Paragraph one of <title>an
        XML example</title>.</p>
      <p n="2">Paragraph two of this
        example.</p>
    </body>
  </text>
</TEI>
```

This example, as any TEI text, is recognizable as a TEI text by the outermost *<TEI>* element, which is declared in the dedicated TEI namespace (<http://www.tei-c.org/ns/1.0>). The TEI considers texts units of information that are composed of two mandatory parts:

- A header (*<teiHeader>*) containing descriptive meta-information. This should minimally document following aspects of the electronic file itself (*<fileDesc>*):
 - The title statement (*<titleStmt>*), providing information about the title, author, and others responsible for the electronic text.
 - The publication statement (*<publicationStmt>*), providing publication details about the electronic text.
 - A description of the source (*<sourceDesc>*), documenting bibliographic details about the electronic text's material source (if any).
- the actual text (*<text>*) containing meta-information about the text's structure and the actual text. This should minimally contain a text body (*<body>*). The body contains lower-level text structures like paragraphs (*<p>*), or different structures for text genres other than prose: lines for poetry, speeches for drama.

Apart from simple texts, TEI provides means to encode composite texts, either by grouping structurally related texts in a *<group>* element inside *<text>*, or treating them as a corpus of diverse texts, using *<teiCorpus>* as the outermost element.

TEI Modules

As illustrated by this example, a significant part of the rules in the TEI Guidelines apply to the expression of descriptive and structural meta-information about the text. Yet, the TEI defines concepts to represent a much wider array of textual phenomena, amounting to a total of 503 elements and 210 attributes. These are organized into 21 modules, grouping related elements and attributes:

1. The TEI Infrastructure
Definition of common datatypes and modular class structures used to define the elements and attributes in the other modules.
2. The TEI Header
Definition of the elements that make up the header section of TEI documents. Its major parts provide elements to encode detailed metadata about bibliographic aspects of electronic texts, their relationship with the source materials from which they may have been derived, nonbibliographic details, and a complete revision history.
3. Elements Available in All TEI Documents
Definition of elements and attributes that may occur in any TEI text, of whatever genre. These elements cover textual phenomena like paragraphs, highlighting and quotation, editorial changes (marking of errors, regularizations, additions), data-like structures (names, addresses, dates, numbers, abbreviations),

- cross-reference mechanisms, lists, notes, graphical elements, bibliographic references, and passages of verse or drama.
4. **Default Text Structure**
Definition of elements and attributes that describe the structure of TEI texts, like front matter and title pages, text body, and back matter. These may contain further divisions, possibly introduced by headings, salutations, opening formulae, and/or concluded by closing formulae, closing salutations, trailing material, and postscripts.
 5. **Representation of Nonstandard Characters and Glyphs**
Definition of specific provisions for representing characters for which no standardized representation (such as defined by the *Unicode Consortium* <http://www.unicode.org/>) exists.
 6. **Verse**
Definition of specific elements and attributes for dedicated analysis of verse materials, such as caesurae, metrical systems, rhyme schemes, and enjambments.
 7. **Performance Texts**
Definition of specific elements and attributes for dedicated analysis of drama materials. These include provisions for encoding specific phenomena in front matter and back matter, like details about performances, prologues, epilogues, the dramatic setting, and cast lists. Other drama-specific structures include speeches and stage directions. For multimedia performances, elements for the description of screen contents, camera angles, captions, and sound are provided.
 8. **Transcriptions of Speech**
Definition of elements and attributes for (general purpose) transcription of different kinds of spoken material. These cover phenomena like utterances, pauses, nonlexical sounds, gestures, and shifts in vocal quality. Besides this, specific header elements for describing the vocal source of the transcription are provided.
 9. **Dictionaries**
Definition of elements and attributes for representing dictionaries, with provisions for unstructured and structured dictionary entries (possibly grouped). Dictionary entries may be structured with a number of specific elements indicating homonyms, sense, word form, grammatical information, definitions, citations, usage, and etymology.
 10. **Manuscript Description**
Definition of specific header and structural elements and attributes for the encoding of manuscript sources. Header elements include provisions for detailed documentation of a manuscript's or manuscript part's identification, heading information, contents, physical description, history, and additional information. Dedicated text elements cover phenomena like catchwords, dimensions, heraldry, watermarks, and so on.
 11. **Representation of Primary Sources**
Definition of elements and attributes for detailed transcription of primary sources. Phenomena covered are facsimiles, more complex additions, deletions, substitutions and restorations, document hands, damage to the source material, and illegibility of the text.
 12. **Critical Apparatus**
Definition of elements and attributes for the representation of (different versions of texts as) scholarly editions, listing all variation between the versions in a variant apparatus.
 13. **Names, Dates, People, and Places**
Definition of elements and attributes for more detailed analysis of names of persons, organizations, and places, their referents (persons, organizations, and places), and aspects of temporal analyses.
 14. **Tables, Formulae and Graphics**
Definition of specific elements and attributes for detailed representation of graphical elements in texts, like tables, formulae, and images.
 15. **Language Corpora**
Definition of elements and attributes for the encoding of corpora of texts that have been collected according to specific criteria. Most of these elements apply to the documentation of these sampling criteria, and contextual information about the texts, participants, and their communicative setting.
 16. **Linking, Segmentation, and Alignment**
Definition of elements and attributes for representing complex systems of cross-references between identified anchor places in TEI texts. Recommendations are given for either in-line or stand-off reference mechanisms.
 17. **Simple Analytic Mechanisms**
Definition of elements and attributes that allow the association of simple analyses and interpretations with text elements. Mechanisms for the representation of both generic and particular linguistic analyses are discussed.
 18. **Feature Structures**
Definition of elements and attributes for constructing complex analytical frameworks that can be used to represent specific analyses in TEI texts.
 19. **Graphs, Networks, and Trees**
Definition of elements and attributes for the analytical representation of schematic relationships between nodes in graphs and charts.
 20. **Certainty and Responsibility**
Definition of elements for detailed attribution of certainty for the encoding in a TEI text, as well as the identification of the responsibility for these encodings.

21. Documentation Elements

Definition of elements and attributes for the documentation of the encoding scheme used in TEI texts. This module provides means to define elements, attributes, element and attribute classes, either by changing existing definitions or by creating new ones.

Each of these modules and the use of the elements they define are discussed extensively in a dedicated chapter of the TEI Guidelines.

Using TEI

In order to use TEI for the encoding of texts, users must make sure that their texts belong to the TEI namespace (<http://www.tei-c.org/ns/1.0>) and adhere to the requirements of the text model proposed by the TEI. In order to facilitate this conformance, it is possible (and strongly suggested) to associate TEI texts with formal representations of this text model. These formal *structural grammars* of a TEI compatible model of the text can be expressed in a number of ways, commonly referred to as a *TEI schema*. Technically, a TEI schema can be expressed in a variety of formal languages such as *Document Type Definition* (<http://www.w3.org/TR/REC-xml/#dt-doctype>), *W3C XML Schema* (<http://www.w3.org/XML/Schema>), or the *RELAX NG* schema language (<http://www.relaxng.org/>). It is important to notice that no such thing as “the TEI schema” exists. Rather, users are expected to select their desired TEI elements and attributes from the TEI modules, possibly with alterations or extensions where required. In this way, TEI offers a stable base with unambiguous means for the representation of basic textual phenomena, while providing standardized mechanisms for user customization for uncovered features. It is a particular feature of TEI that these abstract text models themselves can be expressed as TEI texts, using the documentation elements defined in the dedicated module *Documentation Elements*. A minimal TEI customization file looks as follows:

```
<TEI xmlns="http://www.tei-c.org/ns/1.0" xml:lang="en">
<teiHeader>
  <fileDesc>
    <titleStmt>
      <title>A TEI customization</title>
      <author>generated by Roma</author>
    </titleStmt>
    <publicationStmt>
      <p>for use by whoever wants it</p>
    </publicationStmt>
    <sourceDesc>
      <p>created on Thursday 24th July 2008
        10:20:17 AM by the form at
        http://www.tei-c.org.uk/Roma/</p>
```

```
      </sourceDesc>
    </fileDesc>
  </teiHeader>
  <text>
    <front>
      <divGen type="toc"/>
    </front>
    <body>
      <p>My TEI Customization starts with modules tei,
        core, header, and textstructure</p>
      <schemaSpec ident="TBECustom" docLang="en"
        xml:lang="en" prefix=" ">
        <moduleRef key="tei"/>
        <moduleRef key="header"/>
        <moduleRef key="core"/>
        <moduleRef key="textstructure"/>
      </schemaSpec>
    </body>
  </text>
</TEI>
```

Besides the common minimal TEI structure (<teiHeader> and <text>), a TEI customization file has one specific element which defines the TEI schema (<schemaSpec>). A TEI schema must minimally include the modules which define the minimal TEI text structure: the *TEI infrastructure* module, the *core* module with all common TEI elements, the *header* module defining all teiHeader elements, and the *textstructure* module defining the elements representing the minimal structure of TEI texts.

In the vein of *Literary Programming* (<http://www.literateprogramming.com/>), a TEI customization file not only contains the formal declaration of TEI elements inside <schemaSpec>, but may also contain prose documentation of the TEI encoding scheme it defines. Consequently, TEI customization files are commonly called *ODD files* (One Document Does it all), because they serve as a source for the derivation of

- A formal TEI schema (either as a DTD, W3C XML Schema, or RELAX NG schema).
- Human-friendly documentation of the TEI encoding scheme (in HTML, PDF, or XML).

In order to accommodate the process of creating customized TEI schemas and prose documentation, the TEI has developed a dedicated piece of software called *Roma* <http://www.tei-c.org/Roma/>. This is an ODD processor, offering an intuitive Web-based interface for the creation and basic editing of ODD files, generation of according TEI schemas and prose documentation in a number of presentation formats.

A TEI schema, stating all structural conditions and restraints for the elements and attributes in TEI texts can then be used to automatically validate actual TEI documents with an XML parser. Consider, for example, following fragments:

[A]

```
<TEI xmlns="http://www.tei-c.org/ns/1.0">
  <teiHeader>
    <fileDesc>
      <titleStmt>
        <title>A sample TEI document</title>
      </titleStmt>
      <publicationStmt>
        <publisher>
          Taylor & Francis
        </publisher>
        <pubPlace>London</pubPlace>
        <date when="2008"/>
      </publicationStmt>
      <sourceDesc>
        <p>No source, born digital</p>
      </sourceDesc>
    </fileDesc>
  </teiHeader>
  <text>
    <body>
      <p>This is a sample paragraph, illustrating a
        <name type="organization">TEI</name>
        document. </p>
    </body>
  </text>
</TEI>
```

[B]

```
<TEI xmlns="http://www.tei-c.org/ns/1.0">
  <text>
    <body>
      <p>This is a sample paragraph, illustrating a
        <orgName>TEI</orgName> document.</p>
    </body>
  </text>
</TEI>
```

When validated against a TEI schema derived from the previous ODD file, file [A] will be recognized as a valid TEI document, while file [B] will not:

- The TEI prescribes that the `<teiHeader>` *must* be present in each document, and that it precede the `<text>` part.
- The minimal set of TEI modules does not include the specialized `<orgName>` element. Although it is a TEI element, using it requires selection of the appropriate TEI module in the ODD file (in this case, the module for *Names, Dates, People, and Places*).

TEI: HISTORY

After the concise overview of the most recent version of TEI (P5) in the preceding section, this section explains the historical development of the TEI Guidelines.

Poughkeepsie Principles

Shortly after the publication of the SGML specification as an ISO Standard, a diverse group of 32 humanities computing scholars gathered at Vassar College in Poughkeepsie, New York in a 2-day meeting (November 11 and 12, 1987) called for by the Association for Computers and the Humanities (ACH, <http://www.ach.org>), funded by the National Endowment for the Humanities (NEH), and convened by Nancy Ide and Michael Sperberg McQueen. The main topic of the meeting was the question how and whether an encoding standard for machine-readable texts intended for scholarly research should be developed. Among the delegates were representatives from the main European text archives and from important North American academic and commercial research centers. Contrary to the disappointing outcomes of other such meetings in San Diego in 1977 or in Pisa in 1980, this meeting did reach its goal with the formulation and the agreement on the following set of methodological principles—the so-called *Poughkeepsie Principles*—for the preparation of text encoding guidelines for literary, linguistic, and historical research (pp. 132–133),^[14] (p. E.6-4),^[15] (p. 6.):^[16]

1. The guidelines are intended to provide a standard format for data interchange in humanities research.
2. The guidelines are also intended to suggest principles for the encoding of texts in the same format.
3. The guidelines should
 - a. Define a recommended syntax for the format
 - b. Define a metalanguage for the description of text-encoding schemes
 - c. Describe the new format and representative existing schemes both in that metalanguage and in prose.
4. The guidelines should propose sets of coding conventions suited for various applications.
5. The guidelines should include a minimal set of conventions for encoding new texts in the format.
6. The guidelines are to be drafted by committees on
 - a. Text documentation
 - b. Text representation
 - c. Text interpretation and analysis
 - d. Metalanguage definition and description of existing and proposed schemes coordinated by a steering committee of representatives of the principal sponsoring organizations.
7. Compatibility with existing standards will be maintained as far as possible.
8. A number of large text archives have agreed in principle to support the guidelines in their function as an interchange format. We encourage funding agencies to support development of tools to facilitate this interchange.
9. Conversion of existing machine-readable texts to the new format involves the translation of their conventions into the syntax of the new format. No

requirements will be made for the addition of information not already coded in the texts.

For the implementation of these principles the ACH was joined by the Association for Literary and Linguistic Computing (ALLC, <http://www.allc.org>) and the Association for Computational Linguistics (ACL, <http://www.aclweb.org/>). Together they established the Text Encoding Initiative (TEI) whose mission it was to develop the *Poughkeepsie Principles* into workable text encoding guidelines. The Text Encoding Initiative very soon came to adopt SGML, published a year before as ISO standard, as its framework. Initial funding was provided by the US National Endowment for the Humanities, Directorate General XIII of the Commission of the European Communities, the Canadian Social Science and Humanities Research Council, and the Andrew W. Mellon Foundation.

TEI P1 and TEI P2

From the Poughkeepsie Principles the TEI concluded that the TEI Guidelines should

- Provide a standard format for data interchange.
- Provide guidance for encoding of texts in this format.
- Support the encoding of all kinds of features of all kinds of texts studied by researchers.
- Allow the rigorous definition and efficient processing of texts.
- Provide for user-defined extensions.
- Be application independent.
- Be simple, clear, and concrete.
- Be simple for researchers to use without specialized software.

A Steering Committee consisting of representatives of the ACH, the ACL, and the ALLC appointed Michael Sperberg-McQueen as editor-in-chief and Lou Burnard as European editor of the Guidelines.

The first public proposal for the TEI Guidelines was published in July 1990 under the title *Guidelines for the Encoding and Interchange of Machine-Readable Texts* with the TEI document number TEI P1 (for Proposal 1). This version was reprinted with minor changes and corrections, as version 1.1 in November 1990.^[17] Further development of the TEI Guidelines was done by four Working Committees (Text Documentation, Text Representation, Text Analysis and Interpretation, and Metalanguage and Syntax) and a number of specialist Working Groups among which groups on character sets, text criticism, hypertext and hypermedia, formulae, tables, figures, and graphics, language corpora, manuscripts and codicology, verse, drama and performance texts, literary prose, linguistic description, spoken text, literary studies,

historical studies, print dictionaries, machine lexica, and terminological data. The extensions and revisions resulting from this work, together with extensive public comment resulted in the drafting of a revised version, TEI P2, that was released chapter by chapter between March 1992 and the end of 1993^[18] and that included substantial amounts of new material.

TEI P3

The following step was the publication of the TEI P3 *Guidelines for Electronic Text Encoding and Interchange* in 1994^[19] that presented a further revision of all chapters published under the document number TEI P2, and the addition of further chapters. A final revised edition of these P3 Guidelines correcting several typographic and other errors, and introducing one new element was published in 1999.^[20] The publication of this 1292 page documentation of the definitive guidelines defining some 439 elements marked the conclusion of the initial development work. With this work, the Poughkeepsie Guidelines were met by providing a framework for the encoding of texts in any natural language, of any date, in any literary genre or text type, without restriction on form or content and treating both continuous materials (“running text”) and discontinuous materials such as dictionaries and linguistic corpora.

TEI P4

Recognizing the benefits for the TEI community, the P4 revision of the TEI Guidelines^[21] was published in 2002 by the newly formed TEI Consortium in order to provide equal support for XML and SGML applications using the TEI scheme. The chief objective of this revision was to implement proper XML support in the Guidelines, while ensuring that documents produced to earlier TEI specifications remained usable with the new version. The XML support was realized by the expression of the TEI Guidelines in XML and the conformation to a TEI conformant XML DTD. The TEI P4 generated a set of DTD fragments that could be combined together to form either SGML or XML DTDs and thus achieved backward compatibility with TEI P3 encoded texts. In other words, any document conforming to the TEI P3 SGML DTD was guaranteed to conform to the TEI P4 XML version of it. This “double awareness” of the TEI P4 is the reason why this version was called an “XML-compatible edition” rather than an “XML edition.” This was achieved by restricting the revisions needed to make the P4 version with its 441 elements to error correction only. During this process of revision, however, many possibilities for other, more fundamental changes had been identified, which led to the current TEI P5 version of the Guidelines.

TEI P5

In 2003 the TEI Consortium asked their membership to convene Special Interest Groups (SIGs) whose aim could be to advise revision of certain chapters of the Guidelines and suggest changes and improvements in view of the P5. With the establishment of the new TEI Council, which superintends the technical work of the TEI Consortium, it became possible to agree on an agenda to enhance and modify the Guidelines more fundamentally which resulted in a full revision of the Guidelines published as TEI P5.^[13] TEI P5 contains a full XML expression of the TEI Guidelines and introduces new elements, revises content models, and reorganizes elements in a modular class system that facilitates flexible adaptations to users' needs. Contrary to its predecessor, TEI P5 does not offer backward compatibility with previous versions of the TEI. The TEI Consortium will, however, maintain and error correct the P4 Guidelines. This means that users still have the option between P4 and P5.

TEI: ORGANIZATION

The TEI Consortium was established in 2000 as a not-for-profit membership organization to sustain and develop the Text Encoding Initiative (TEI). The Consortium is supported by a number of host institutions. It is managed by a Board of Directors, and its technical work is overseen by an elected technical Council who take responsibility over the content of the TEI Guidelines.

The TEI charter outlines the consortium's goals and fundamental principles. Its goals are

1. To establish and maintain a home for the Text Encoding Initiative (TEI) in the form of a permanent organizational structure.
2. To ensure the continued funding of TEI-C activities, for example: editorial maintenance and development of the TEI Guidelines and DTD/Schema training and outreach activities, and services to members.
3. To create and maintain a governance structure for the TEI-C with broad representation of TEI user-communities.

The Consortium honors four fundamental principles:

1. The TEI Guidelines, other documentation, and DTD/Schema should be free to users.
2. Participation in TEI-C activities should be open (even to nonmembers) at all levels.
3. The TEI-C should be internationally and interdisciplinarily representative.
4. No role with respect to the TEI-C should be without term.

Involvement in the consortium is possible in three categories: voting membership which is open to individuals, institutions, or projects; nonvoting subscription, which is open to personal individuals only; and sponsorship, which is open to individual or corporate sponsors. Only members have the right to vote on consortium issues and in elections to the Board and the Council, have access to a restricted Web site with prerelease drafts of Consortium working documents and technical reports, announcements and news, and a database of members, sponsors, and subscribers, with contact information, and benefit from discounts on training, consulting, and certification. The Consortium members meet annually at a Members' Meeting where current critical issues in text encoding are discussed, and members of the Council and members of the Board of Directors are elected. The membership fee payable varies depending on the kind of project or institution and its location depending on where the economy of the member's country falls in the four-part listing of Low, Lower-Middle, Middle-Upper, and High Income Economies, as defined by the World Bank.

CONCLUSIONS

Computers can only deal with explicit data. The function of markup is to represent textual material into digital form through the explicating act of text encoding. Descriptive markup reveals what the encoder thinks to be implicit or hidden aspects of a text, and is thus an interpretive medium which often documents scholarly research next to structural information about the text. In order for this research to be exchangeable, analyzable, reusable, and preservable, texts in the field of the humanities should be encoded according to a standard which defines a common vocabulary, grammar, and syntax, while leaving the implementation of the standard up to the encoder. A result of communal efforts among computing humanists, the Text Encoding Initiative documents such a standard in the TEI Guidelines. These guidelines are fully adaptable and customizable to one's specific project while enhancing this project's compatibility with other projects employing the TEI. For over two decades, the TEI has been used extensively in projects from different disciplines, fields, and subjects internationally. The ongoing engagements of a broad user community through the organization of the TEI Consortium consolidates the importance of the text encoding standard and informs its continuous development and maintenance.

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Text REtrieval Conference (TREC)

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Abstract

This entry summarizes the history, results, and impact of the Text REtrieval Conference (TREC), a workshop series designed to support the information retrieval community by building the infrastructure necessary for large-scale evaluation of retrieval technology.

INTRODUCTION

The Text REtrieval Conference (TREC) is a series of annual workshops designed to support the information retrieval community by building the infrastructure necessary for large-scale evaluation of retrieval technology. The conference series is organized by the U.S. National Institute of Standards and Technology (NIST) with financial support from the U.S. defense and intelligence community. The first workshop was held in November, 1992 and there has been a workshop each year since then. Text REtrieval Conference participants are researchers in text retrieval and related natural language processing fields representing academic, commercial, and government organizations. Almost 300 organizations from six continents have participated in some TREC.

The Text REtrieval Conference is a modern example of the Cranfield tradition in which retrieval system effectiveness is evaluated through test collections. Test collections are abstractions of real user information-seeking tasks that allow researchers to quickly and inexpensively compare the relative effectiveness of competing retrieval technologies. They support tight development cycles leading to improved effectiveness in shorter development time. The Text REtrieval Conference has created a variety of publicly available test collections, has standardized the experimental methodology for using test collections, and has demonstrated the validity and efficacy of the methodology for the typical ad hoc retrieval task. In addition, TREC has extended use of the test collection methodology to new tasks. The results have been significant. Retrieval effectiveness for the ad hoc task approximately doubled in the first six years of TREC, and the retrieval techniques used for the ad hoc task have been demonstrated to be effective for other tasks as well.

This entry summarizes the history, results, and impact of TREC. The next section places TREC in the historical context that led to its inception and outlines the mechanics of how TREC works. The following section reviews what has been learned about text collection evaluation methodology

from TREC. The final main section of this entry provides an overview of the variety of different tasks that have been examined in TREC and highlights the retrieval results that have been demonstrated in those tasks.

HISTORICAL CONTEXT

Test collections were introduced in the 1960s by Cyril Cleverdon and his colleagues in the Cranfield tests, a series of experiments designed to identify appropriate indexing languages for document retrieval.^[1] A test collection consists of a set of documents; a set of information need statements, called topics in TREC; and a list of which documents in the collection should be retrieved for which need, called relevance judgments. While the use of a static set of relevance judgments to represent the user in a retrieval experiment was controversial, other researchers started using the Cranfield collection to perform different experiments. Over the course of the following 20 years, many experiments were performed and additional test collections were built. But by 1990 there was growing dissatisfaction with the methodology such that even some experimenters were questioning its usefulness.^[2] There were two main problems. First, the available test collections were small, containing at most several thousand documents and a few tens of topics. Operators of the commercial retrieval systems of the day were not convinced that techniques demonstrated on small test collections would transfer to their much larger environments. Second, there was no concerted effort on the part of different research groups to use the same data or evaluation measures. As a result, the experimental findings from different groups were usually incomparable and it was not possible to build on one another's work.

In 1991, NIST was asked to build a large test collection for use in evaluating text retrieval technology developed as part of the Defense Advanced Research Projects Agency's (DARPA) Tipster project. The National Institute of Standards and Technology agreed, and proposed that in

addition to building a large test collection, it would also organize a workshop to investigate the larger issues surrounding test collection use.

The first two TRECs had two tasks, the ad hoc task and the routing task. The ad hoc task is the prototypical retrieval task such as a researcher doing a literature search in a library. In this environment, the system knows the set of documents to be searched (the library's holdings), but cannot anticipate the particular topic that will be investigated. In contrast, the routing task assumes the topics are static but need to be matched to a stream of new documents. The routing task is similar to the task performed by a news clipping service or a library profiling system.

The National Institute of Standards and Technology supplied a common set of test documents and a set of 50 topic statements for each task. The format of the topic statements varied over the years, but generally consisted of at least a brief natural language statement of the information desired (e.g., *Document will discuss how MCI has been doing since the Bell System breakup.*). Participants used their systems to run the topics against the document collection, and returned to NIST a list of the top-ranked documents for each topic.

Since the document sets used in the first TRECs contained between 800,000 and 1,000,000 documents, they were too large for each document to be judged for each topic. Instead, TREC implemented a technique called pooling that had been suggested by Karen Spärck Jones and Keith van Rijsbergen as a way to build relevance judgments for large collections.^[3] As used in TREC, a pool for a topic consists of the union of the top X (usually 100) documents across runs submitted to that task. The documents in a pool are then viewed by a human and judged as to whether they are relevant to the topic. Documents that do not get added to the pool (because no system retrieved them at high enough ranks) are not judged but are assumed to be not relevant.

Once all the relevance judgments for all of the topics in the test set were complete, NIST evaluated the retrieval runs on the basis of the relevance judgments and returned the evaluation results to the participants. A little more than a month later, researchers who had submitted runs gathered for a workshop to discuss the results and share their experiences.

Starting in TREC-3 (1994), additional tasks, called tracks, were added to TREC, and today TREC is comprised of a constantly evolving set of tracks. The tracks serve several purposes. First, tracks act as incubators for new research areas: the first running of a track often defines what the problem *really* is, and a track creates the necessary infrastructure (test collections, evaluation methodology, etc.) to support research on its task. The tracks also demonstrate the robustness of core retrieval technology in that the same techniques are frequently appropriate for a variety of tasks. Finally, the tracks make TREC

attractive to a broader community by providing tasks that match the research interests of more groups.

In addition to the variety of TREC tracks, TREC has inspired other evaluation projects that are based on the TREC model. These projects include the Japanese National Institute of Information Test Collection for IR Systems project (NTCIR, <http://research.nii.ac.jp/ntcir/>), the Cross Language Evaluation Forum (CLEF, <http://www.clef-campaign.org/>), and the Initiative for the Evaluation of XML Retrieval (INEX, <http://inex.is.informatik.uni-duisburg.de>).

TEST COLLECTION EVALUATION METHODOLOGY

One of the motivating goals for TREC was to establish a common evaluation methodology for retrieval from realistically sized collections. The goal of having experimenters report the same evaluation measures was largely met by introducing *trec_eval*, an evaluation program that provides a common implementation for over 100 different evaluation measures. A much smaller set of measures, including the recall-precision graph, mean average precision, and precision at ten documents retrieved, has become the de facto standard by which retrieval effectiveness is characterized. But TREC has done more than provide a standard scoring routine and common data sets. The Text REtrieval Conference's scale—both the size of the test collections and the number of retrieval results—has provided a unique opportunity for validating the use of test collections and exploring the limits of the evaluation methodology. This section summarizes the findings of three such investigations: examining the effect of changes in relevance judgments, examining the effect of judging only a subset of the document collection, and examining the soundness of the conclusions reached in test collection experiments.

Consistency

One objection to test collections that dates back to the Cranfield tests is the use of relevance judgments as the basis for evaluation. Relevance is known to be very idiosyncratic,^[4] and critics question how an evaluation methodology can be based on such an unstable foundation. An experiment using the TREC-4 and TREC-6 retrieval results investigated the effect of changing relevance assessors on system comparisons.^[5] The experiment demonstrated that the absolute scores for evaluation measures did change when different relevance assessors were used, but the relative scores between runs did not change. That is, if system A evaluated as better than system B using one set of judgments, then system A almost always evaluated as better than system B using a second set of judgments (the exception was in the case where the two runs

evaluated as so similar to one another that they should be deemed equivalent). The stable comparisons result held for different evaluation measures and for different kinds of assessors, and was independent of whether a judgment was based on a single assessor's opinion or was the consensus opinion of a majority of assessors.

Completeness

An important criterion for test collections is that they be reusable, that is, they can be used to compare not only the original result sets that contributed to the pools but also subsequent result sets produced using the same topic and document sets. The use of pooling where only some documents are judged for a topic caused people to question whether TREC collections were reusable since they believed runs that had not contributed to the pools would be unfairly penalized. Examination of larger pools did confirm one aspect of the critics' fears: there are unjudged documents remaining in the collections that would have been judged relevant had they made it into the pools.^[6] Further, the quality of the final test collection does depend on the diversity of the runs that contribute to the pools and the number of documents selected from each run.^[7] But tests also showed that the TREC collections are not biased against unjudged runs. In these tests, the documents uniquely retrieved by a TREC run are treated as not relevant when that run is evaluated. The difference in the evaluation results for runs evaluated both with and without their own uniquely retrieved relevant documents has until recently been smaller than the difference produced by changing relevance assessors.^[8]

Repeating the uniquely retrieved relevant test on the very latest collections built from millions of Web pages suggests that pooling has a size dependency that prevents it from producing reusable test collections for arbitrarily large document sets.^[9] Devising new techniques for building massive test collections is thus an area of active research.

Soundness

Retrieval effectiveness is reported as an average over a set of topics because retrieval system performance is known to vary widely depending on the topic. An analysis of variance model fitted to the TREC-3 results demonstrated that the topic and system effects, as well as the interaction between topic and system, were all highly significant, with the topic effect the largest.^[10] This variability in topic performance has a profound effect on retrieval system evaluation because it is difficult to isolate the relatively small differences in performance that can be attributed to retrieval system differences.

The repository of runs that have been submitted to TREC made it possible to empirically determine the relationship between the number of topics in a test collection,

the observed difference in evaluation scores (*delta*), and the likelihood that a single comparison of two retrieval runs will lead to the correct conclusion.^[11] Once the relationship was established, it was used to derive the minimum difference in scores required for a certain level of confidence in the results given the number of topics used in the comparison. As expected, the likelihood of an erroneous comparison decreases as the number of topics used increases. The likelihood of an error also decreases as the size of *delta* increases, though requiring large differences in scores before deciding two runs are different decreases the power of the experiment. However, the percentage difference in retrieval scores required for confidence in the conclusion for 50 topics (the number of topics in a typical TREC test collection) was larger than has generally been used to signify meaningful differences in the IR literature.

This conclusion that a comparatively large difference in scores is required to have confidence that a single comparison correctly indicates the better system does not invalidate the usefulness of test collections. The primary use of test collections is not cross-system comparison but optimizing the effectiveness of a single system. Experiments with variants of a single system require much smaller absolute differences in scores to yield meaningful results because most of the variance due to system–topic interaction is controlled. In addition, the confidence in a cross-system comparison can be significantly increased by repeating the comparison using multiple collections. Even a very small difference that is consistently present in multiple collections is likely to represent a true difference among systems.

THE TRACKS

The TREC track structure enables TREC to extend the test collection paradigm to tasks other than ad hoc retrieval. The set of tracks run in any particular TREC depends on the interests of the participants and sponsors, as well as on the suitability of the problem to the TREC environment. The decision of which tracks to include is made by the TREC program committee, a group of academic, industrial, and government researchers who have the responsibility for oversight of TREC. Tracks are discontinued when the goals of the track are met, or when there are diminishing returns on what can be learned about the area in TREC. Some tracks run for many years but change focus in different years.

Fig. 1 shows many of the tracks that were run in the different years of TREC, grouping the tracks by the aspect that differentiates them from one another. The aspects, listed on the left of the figure show the breadth of the problems that TREC has addressed, while the individual tracks listed on the right show the progression of tasks within the given problem area. This section provides a

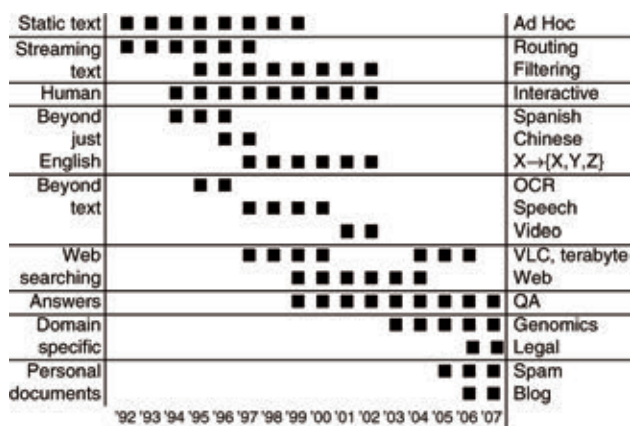


Fig. 1 A subset of the TREC tracks and the years in which they were held. The track name is given on the right while the distinguishing focus of the track is given on the left.

recap of the main lessons learned about the various tasks and aspects.

Static Text

The main task in TREC for the first eight years was the ad hoc task, a task in which systems rank the documents in a known document set against not previously seen topics. The eight years of the task produced eight test collections, each consisting of a document set, a set of 50 topics, and a set of pooled relevance judgments. The document sets consist of full-text documents, mostly news articles with some government documents and a small amount of other types of documents also included. The final three years of the task (TRECs 6–8) used the same document set, so the combination of the topics and relevance judgments from those years represents a test collection with 150 topics.

Improvement in retrieval effectiveness cannot be determined simply by looking at TREC scores from year to year. It is invalid to compare the results from one year of TREC to the results of another year since any differences are likely to be caused by the different test collections in use. However, developers of the SMART retrieval system kept a frozen copy of the system they used to participate in each of the eight TREC ad hoc tasks.^[12] After every TREC, they ran each system on each test collection. For every test collection, the later versions of the SMART system were much more effective than the earlier versions of the SMART system, with the later scores approximately twice that of the earlier scores. While this is evidence for only one system, the SMART system results consistently tracked with the other systems' results in each TREC, and thus the SMART results can be considered representative of the state of the art at that time. The improvement was evident for all evaluation scores that were examined, including mean average precision and precision and recall at various cutoff levels.

The results from the top-performing systems in the ad hoc task suggest the increased effectiveness arose from improvements in two general areas, query expansion, and indexing of full-text documents. The most common way of expanding the query is to use pseudorelevance (or blind) feedback: retrieve a first set of documents using the original query; assume the first X documents are relevant; perform relevance feedback with that set of documents to create a new query (usually including both new terms and refined query weights); and return the results of searching with the new query to the user. Doing a similar type of expansion but using a document set other than the target collection has also been effective. For document indexing, the following best practices emerged from the ad hoc task results:

- Tokenization that regularizes word forms is generally helpful. The most common form of regularization is stemming, but normalizing proper nouns to a standard format can also be helpful.
- Simple “phrasing” techniques are generally helpful. The most helpful part of phrasing is the identification of common collocations that are then treated as a single unit. More elaborate schemes have shown little benefit.
- Appropriate weighting of terms is critical. The best weighting schemes reflect the discrimination power of a term in the corpus and control for document length. There are several different weighting schemes that achieve these goals and are equivalently effective. Language modeling techniques are both effective and provide a theoretical justification for the weights assigned.

Streaming Text

The second task in the first TRECs was the routing task. In the routing task, systems used old topics with known relevance judgments to produce queries that were then used to rank a new document set. A more realistic formulation of this task emerged several years later as the filtering track. In a filtering task a system makes a binary decision for each document in a document stream whether to retrieve that document in response to a standing query. There are different variants of the task depending on the timing and amount of feedback (relevance information) the system is given. Effectiveness in the filtering track was generally evaluated using a utility measure in which the system gained one amount of points for correctly retrieving a relevant document and lost a lesser amount of points for incorrectly retrieving a nonrelevant document. Comparison between routing and filtering results from the same systems demonstrated that forcing a binary retrieval decision is a much more difficult problem than simply ranking documents since the former requires setting a retrieval threshold.

Human in the Loop

The interactive track was one of the first tracks to be added to TREC. The goal of the interactive track was to study text retrieval systems in interaction with users, where both the process and the final search outcome are of interest. A main difficulty of studying the interactive behavior of retrieval systems is that searchers and topics generally have a much larger effect on search results than does the retrieval system used.

The experimental design of the TREC-6 interactive track included the use of a common baseline system.^[13] The particular retrieval system used at a site (an experimental system) was compared to the common control system that was also run at each site. The direct comparison between the experimental and control systems was used to derive a measure of how much better the experimental system was than the control, independent of topic, searcher, and any other site-specific effects. The expectation was that different experimental systems could then be indirectly compared across sites relative to the common control. Unfortunately, analysis of the track results could neither confirm nor refute the equivalence of the direct and indirect comparison of systems, and without clear positive evidence for the usefulness of the control system it was difficult to justify the cost of adding another system to an experimental design.

Beyond English

Another of the early tracks to be introduced into TREC was the Spanish track. The task in the Spanish track was a basic ad hoc retrieval task except the topics and documents were written in Spanish rather than English. The track was discontinued when the results demonstrated that retrieval systems could retrieve Spanish documents as effectively as English documents. Another single language track, this time using Chinese as a language with a very different structure than that of English, was introduced next. Again, systems were able to effectively retrieve Chinese documents using Chinese topics.

A successor to the single language tracks was the cross-language track. A cross-language retrieval system uses topics written in one language to retrieve documents written in one of a variety of languages. In the first TREC cross-language track participants searched for documents in one target language using topics written in a different language. Later versions of the track had participants search for documents using topics in one language against the entire combined document collection; still later versions of the track used more disparate languages (English topics against either Chinese or Arabic document sets). One of the unexpected results of the cross-language track was the demonstration that cross-language retrieval can be more effective than the corresponding monolingual search due to the expansion that results from translating the query.

Beyond Text

In addition to testing the ability of retrieval systems to retrieve text written in languages other than English, TREC contained a series of three tracks designed to test the ability of systems to retrieve information encoded in media other than electronic text. In the confusion track, systems retrieved documents that were the output of an OCR process. In the spoken document retrieval track, systems retrieved documents that were the output of speech recognition systems. In both tracks, the goal was to measure the effect of mistakes in the text (i.e., corrupted text) on retrieval effectiveness. The results in both tracks suggested that natural language is sufficiently redundant that error-filled text can be retrieved as effectively as clean texts for error rates likely to be seen in real-life applications. For speech recognition output, the worst effect on retrieval effectiveness was out of vocabulary (OOV) words. Participants compensated for OOV words by using adaptive language models to limit the number of OOV words encountered, and by expanding recognized text by related clean texts to include OOV words in the documents.

The video track focused on retrieving information recorded in digital videos. A document in the track was defined as a video shot, and ad hoc search topics were expressed as textual statements of information need, possibly including a still or video image as an example of the type of information sought. Unlike OCR and speech recognition output, there is no obvious way of reducing video to a set of words. As a result, there is little overlap in the techniques used to retrieve text documents versus video documents. The video track was spun off from TREC as its own TRECVideo evaluation workshop in 2003 (see <http://trecvid.nist.gov>) and continues to date.

The Web and Size

While two gigabytes of text was a large amount of text when TREC began, it was soon eclipsed by the ever-growing stores of information commercial retrieval engines were searching, especially with the advent of the World Wide Web. A series of tracks explored the related issues of Web search and retrieval efficiency in the context of document collections much larger than the TREC ad hoc collections.

The first of these tracks was the very large corpus (VLC) track. The track used a 100 gigabyte static subset of the Web as its test set and evaluated systems on both precision of the top 20 documents retrieved and speed at which the results could be assembled. This naturally led to a Web track to investigate information-seeking tasks on the Web. Web search is different from searching other large data sets in several important ways, including the massive link structure, the lack of editorial control, the different uses of search on the Web (finding information, locating services, navigating the link structure), and the use of active content. The main results of the Web track

were to demonstrate that the different search tasks require different strategies for best effectiveness. Traditional retrieval methods based on page content generally worked well for information-seeking topics, for example, whereas navigational queries such as finding a home page required making use of the link structure (such as using anchor text or link counts). The terabyte track (which actually used a 426 gigabyte crawl of the .gov domain) returned to the search efficiency focus while also exploring the question of how best to build reusable test collections for massive data sets. Getting an unbiased judgment set through traditional pooling for document sets of this scale is too expensive because too many documents must be judged. Alternative sampling strategies have been suggested but remain to be adequately vetted.

Question Answering

While a list of on-topic documents is undoubtedly useful, even that can be more information than a user wants to examine. The TREC question answering track was introduced in 1999 to focus attention on the problem of returning exactly the answer in response to a question. The initial question answering tracks focused on factoid questions such as “Where is the Taj Mahal?”. Later tracks have incorporated more difficult question types such as list questions (a question whose answer is a distinct set of instances of the type requested such as “What actors have played Tevye in “Fiddler on the Roof?”) and definition/biographical questions (such as “What is a golden parachute?” or “Who is Vlad the Impaler?”).

The question answering track was the first large-scale evaluation of open-domain question answering systems, and it has brought the benefits of test collection evaluation observed in other parts of TREC to bear on the question answering task. The track established a common task for the retrieval and natural language processing research communities, creating a renaissance in question answering research. This wave of research has created significant progress in automatic natural language understanding as researchers have successfully incorporated sophisticated language processing into their question answering systems.

Domain-Specific Retrieval

Domain-specific retrieval tasks look to exploit knowledge about the subject area to improve retrieval effectiveness. Implementing domain-specific evaluation tasks requires people with expertise in the domain to create topics and perform relevance judgments.

The first domain-specific track in TREC was the genomics track. The scenario assumed in the track was that of a biological researcher (that is, someone who already has considerable domain knowledge) confronted with the need to learn about a new gene very quickly. The track included a number of different types of tasks in the different years it

was run including ad hoc document retrieval, passage retrieval, document classification, and aspect retrieval. Topic development and relevance judgments were made by people with a background in biology; in several years the topics were derived from information needs solicited from practicing biologists. Results of the track showed that careful use of domain resources could improve retrieval effectiveness, though good generic retrieval technology was surprisingly competitive.

The legal track is focused on a specific aspect of retrieval in the legal domain, that of meeting the needs of lawyers to engage in effective discovery of digital documents. Currently, it is common for the two sides involved in litigation to negotiate a Boolean expression that defines the set of documents that are then examined by humans to determine which are responsive to a discovery request. The goal of the track is to evaluate the effectiveness of this and other search technologies in facilitating the discovery process. The track uses hypothetical complaints and corresponding requests to produce documents developed by practicing lawyers as topics. Relevance judgments are made by legal professionals who follow their typical work practices in reviewing the documents. The track is relatively new having started in 2006. Results to date have demonstrated that several different techniques including the Boolean query produce document sets that have similar numbers of responsive documents yet retrieve only some responsive documents in common. This is an important finding since high recall (the need to find most of the responsive documents) is a requirement of the real-world task.

Personal Documents

The final two tracks are distinguished by the personal nature of the documents used in the track. In the spam track the document set is an e-mail stream; in the blog track the document set is a large collection of blog pages.

The goal in the spam track was to evaluate how well systems are able to separate spam and ham (non-spam) when given an e-mail sequence. The primary difficulty in performing such an evaluation is getting appropriate corpora to use in a public test. Making real e-mail streams public is not possible due to privacy concerns, but artificially generated streams and privacy-protecting modifications to real streams tend to compromise the information used by classifiers to distinguish spam and ham. The track solved this problem by requiring filters to conform to the interface defined by a software jig and having participants submit filters to be run on the sequestered private e-mail stream. The overall results of the spam track were consistent across the three years in which it was run. Detecting spam is easier when feedback is frequent and plentiful, but even in the more difficult cases filters were able to detect the vast majority of spam with high accuracy. There was no indication that more recent spam was any harder to detect than earlier spam, though the total amount of spam included in the private stream (which included all of the

mail sent to a single individual in three distinct time periods corresponding to the different years of the track) increased significantly over the years while the amount of ham stayed roughly constant.

Blog pages are personal in that they are often used to express an opinion of the author. They are also interesting as retrieval test documents because language use within blog pages tends to be more informal than in other types of documents. The main task within the blog track has been to find documents that contain an opinion about the target cited in the topic statement. Results of the track to date show that the effectiveness of finding opinion documents is strongly dominated by a system's ability to find topically relevant documents.

CONCLUSION

When TREC began, there was real doubt as to whether the statistical systems that had been developed in the research labs (as opposed to the operational systems that used Boolean searches on manually indexed collections) could effectively retrieve documents from "large" collections. Text REtrieval Conference has shown not only that the retrieval engines of the early 1990s did scale to large collections, but that those engines have improved since then. This effectiveness has been demonstrated both in the laboratory on TREC test collections, and by today's operational systems that incorporate the techniques. Further, the techniques are routinely used on collections far larger than what was considered large in 1992. Web search engines are a prime example of the power of the statistical techniques: the ability of search engines to point users to the information they seek has been fundamental to the success of the Web.

At the time of this writing TREC 2007, the 16th TREC workshop, has just concluded. Plans are underway for TREC 2008, and it is expected that TREC will continue for the foreseeable future. The TREC Web site, <http://trec.nist.gov>, contains a wealth of information about TREC including the full proceedings for each of the workshop (in the Publications section) and details regarding how to obtain the test collections (in the Data section). The call for participation in TREC is issued each December and is posted on the main page of the TREC Web site while it is active.

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This entry is based largely on the introductory and evaluation chapters of the TREC book and summary articles that have appeared in the American Society for Information Science and Technology's *Bulletin* and the *Communications of the ACM* publications. As noted above, the TREC Web site contains a wide variety of information about TREC.

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Theft, Vandalism, and Security in Libraries and Archives

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Abstract

The scope of library theft is difficult to determine because accurate statistical data regarding annual losses of library materials in the United States are not available. Possibly over \$25 million worth of library materials continue to come up missing from American library shelves, and the unauthorized accessing, and possible tampering, with digital collections or administrative records can be a problem as well. Book dealers can be effective allies in combating library theft, whether the perpetrator is a patron or a staff member. The notorious cases of theft by Daniel Spiegelman from the Columbia University Rare Book and Manuscript Library collections and of Stephen Carrie Blumberg, whose collecting mania spurred him to help himself to items from 327 libraries, are summarized. These cases illustrate the difficulties of detection or deterrence without the effective application of legal statutes and sentencing. The importance of the implementation of consistent security measures, whether it is the installation of security systems or policies as a planning process for the prevention of this type of disaster, is stated. Some suggested measures for theft prevention mentioned here are the installation of alarm systems, video surveillance, patron searching upon exiting, materials marking, and the use of colored photocopy paper. The need for effective communication among librarians and book dealers for the reporting and possible prevention of theft losses is noted.

SCOPE OF THE PROBLEM

When I first approached this topic in 1992, I discovered that there was very little accurate data that had been compiled indicating losses due to thefts or attrition of library materials. The best figures that were available were estimates, which was astonishing for a profession that prides itself on collecting such accurate data regarding circulation figures and the number of volumes and journals that are collected. (These are used as one measure of comparison among libraries for ranking their collections.) Katherine Keyes Leab was the administrator of formerly the only computerized database of reports of missing library items operating in the United States, Bookline Alert: Missing Books and Manuscripts (BAMBAM). As she expressed it, “one of the problems is that there are no numbers. That in itself is significant.”^[1] Unfortunately, she has discontinued it for lack of financial support.^[2] Others in the profession agree. Ronald Lieberman, former chair of the Security Committee of the Antiquarian Booksellers’ Association of America (ABAA), concurred that there is “no good substantial statistical information available at this time.”^[3]

The International League of Antiquarian Booksellers has established a database for compiling reports of stolen books since June 15, 2010, and the Antiquarian Booksellers Association encourages the reporting of thefts on The New Antiquarian—a blog on the security section. These two sources can provide current data regarding the problem. The Antiquarian Booksellers blog includes

postings regarding security issues, with a minority actually reporting a specific theft. There were nineteen thefts reported from libraries in 2013 to the International League of Antiquarian Booksellers database, and sixteen thefts were reported from libraries in 2014 (only one of those was from an American library), and the majority of the reports posted during both years were primarily from book dealers and book collectors.^[4]

The Rare Book and Manuscript Section of the Association of College and Research Libraries (ACRL), affiliated with the American Library Association (ALA), has a blog for the posting of thefts. For the year 2013, there are ten thefts reported, four from U.S. libraries, one from Canadian institutions, and five from foreign libraries. During 2014 six American libraries and institutions reported thefts.^[5]

One estimate from Alice Harrison Bahr in 1978 stated that

In the United States, where the nation’s libraries contain an estimated 1.5 billion volumes, a loss of even 1% annually amounts to some 15 million books. Again, using an average cost of \$15 to replace a missing book, the total amount replacement cost would be \$225 million. This is more than 10% of what libraries spend annually. The 15 million volumes are almost 16% of the 95 million volumes added annually by the nation’s libraries.^[6]

And many of the items stolen from libraries are worth far more than \$15. Rare books and manuscripts present an especially inviting target. A well-known book theft

scholar, Lawrence S. Thompson, noted the increasing activity of professional thieves which has made "the record of major thefts in the last 15 years ... little short of appalling." Current reports back him up.

Whether spurred on by love or greed, book theft has become a serious, costly problem and one that is not easily solved. Studies indicate that electronic security systems can be effective book theft deterrents, but alternative theft prevention programs have also been successful. Evaluation of theft control programs is in a state of flux. The only program librarians unanimously find unworkable is the honor system. In 1968 the Tarlton Law Library in Texas left legal treatises on open shelves to test the honor system. At the end of one year over \$4000 worth of material had been lost.^[7]

Another factor that contributed to the problem being underreported and neglected is that in the past it was more common for an institution not to report the theft than to report it. This was usually due to concerns about offending or driving away potential donors. Sometimes elaborate measures have been taken to recover the stolen items, even going so far as to buy them back at auction rather than explaining to the dealer before the sale and presenting proof of ownership to be awarded custody of the items through replevin.

Communication among librarians and with book and manuscript dealers is the best defense against this sort of criminal activity. For the most part, book dealers are honest; they will post notices in their trade newsletters regarding any unscrupulous dealer activity and warn their colleagues not to deal with him or her for the next five years. This type of crime needs to be taken more seriously. Art theft, which includes book theft, is the second most prevalent type of crime after narcotics activity internationally. It affects a similar percentage of victims, including institutions.^[8]

Data regarding cases of art theft have been compiled for the United States by the Federal Bureau of Investigation (FBI) and by the International Foundation for Art Research (IFAR) in New York. Even so, firm statistics regarding the recovery rate of these stolen items do not exist either; only estimates can be made. According to Constance Lowenthal of the IFAR, the recovery rate of stolen art items is about 10%. (Less than 14% of art stolen internationally is ever recovered and returned to its rightful owner.) This is not a firm statistic because the owners of the items do not always report the recovery of their items to the authorities that were notified at the time of the theft. For famous works of art, the recovery rate is closer to 50%, but this is also an estimated figure, and these figures are not linked to whether the thefts were initially made public or not.^[9] The motive for such crime is clearly monetary gain since the average art theft broken down statistically nets the thief approximately \$25,000 per item or \$50,000 per incident. This is in contrast to the

average bank robbery that only nets the thief approximately \$1400 in cash per incident.^[10]

The FBI has been primarily involved in the investigation of theft and recovery of other types of property in the United States, that is, other than books and library materials, although they have investigated thefts of large numbers of library materials stolen, often reported as missing from more than one institution. One major focus of their investigation has been into art thefts, and as an aid in this matter, they created the National Stolen Art File (NASF) in May of 1979. This database includes information on approximately 5000 paintings, prints, and sculptures valued at \$2000 or more that have been reported as stolen. The database is updated annually, and when a stolen art object is reported as having been recovered, the report is removed from NASF. Although this database primarily records data concerning stolen art items, valuable manuscript items are also included.^[11]

The problem of library and archival theft has not been at the forefront of institutional concerns, but estimated losses such as these suggested by Alice Harrison Bahr indicate that perhaps they should be. Many institutions have been more occupied with budgetary planning and the constraints placed on them by lack of sufficient funds and the subsequent impact on the level of staffing or on collection maintenance, development, or expansion. Libraries have to assess the rate of depletion of materials in their collections because in order to maintain services for their users, materials that are not returned or recovered will have to be replaced. The problem of theft of materials, either in their entirety or partially by the mutilation of certain pages from a volume, should receive greater attention because when materials are missing from a collection, it not only detracts from the integrity of that collection, but it detracts from the collective cultural heritage.^[12] This was acknowledged in the sentencing of Daniel Spiegelman by Judge Lewis Kaplan for the theft of forty items from Columbia University.^[13] Replacement of stolen or mutilated library books is sometimes an option because duplicates can be purchased, either in reprint or in a microfilm of the volume that may be available, but archival materials are unique, and when they are gone it is very difficult to obtain another item of comparable value to the collection, either from the same record-creator or concerning the same subject matter from the same time period.

The topic of library theft has not gone unnoticed in the library profession. The published literature in the librarianship and archival journals discuss incidents of theft of materials from institutions that are open to the public where presumably some of their visitors have helped themselves to the books and manuscripts from those collections and kept them.^[14] Sometimes they attempt to sell the materials to book and manuscript dealers or sometimes to a librarian, which can lead to their arrest.^[15]

Alerting these or any other organizations that might be appropriate that materials are missing from the collection is only the first step. An accurate inventory of which items have been determined to be missing should be drawn up listing the appraised value of the items and describing them in as much detail as possible, mentioning if they are marked items (and if so, where the markings appear) and if they have any other distinguishing markings or evidence of any repair work. The investigation of the theft can take a long period of time, so a chronology of all events related to the investigation should be compiled from the day the theft is reported until the materials are recovered and/or a suspect in the theft is prosecuted and, hopefully, convicted.^[16]

Two of these organizations (BAMBAM and the FBI) established a national database for logging the reports of stolen or missing items, and the third (ABAA) has a network for dissemination of this information. ABAA, due to its close links with the book dealer trade in America, has traditionally been in a good position to get the word out to book dealers that certain items have been reported as stolen through a regular column in *Antiquarian Bookman* that circulates widely in the trade. Daniel Leab and Katharine Keyes Leab, as the editors of *American Book Prices Current*, founded BAMBAM in 1981 as a nonprofit database whereby libraries could log onto their system directly and record the information regarding lost and stolen items. This system did not usually operate in this manner, since more frequently the reporting officer for the library telephoned Katharine Leab and report the information to her to be entered into the system.^[17] However, the entry of data into this system was not organized into a standardized format, such as the machine-readable or MARC format used by other data systems, which made it difficult to search efficiently because the data was sometimes entered by library staff members and sometimes by staff members at BAMBAM. When an item was reported as having been recovered, the record was deleted from BAMBAM's database. The lack of standardization meant that the compilation of accurate statistical information about the thefts reported on the database could not be compiled. A plan to incorporate the reporting features of BAMBAM with the MARC format was formulated. Katharine Leab coordinated BAMBAM for fourteen years, and negotiations fell through to get the Online Computer Library Center (OCLC) to administer it instead and standardize the data into MARC format in conjunction with ABAA and the Rare Book and Manuscript Security Committee Section of ALA,^[18] and as mentioned earlier, it has been terminated.

As of May 1992, there were 1400 records in the BAMBAM database, but not all of those records were for individual items; some of them represented entire archives.^[19] In July of 1984, 118 items were listed in BAMBAM^[20] and in the summer of 1987, 77 items were listed.^[21] With sporadic figures such as these, it is

impossible to determine overall annual trends. Hopefully, according to Ronald Lieberman, the OCLC database would have been a useful tool for providing this type of information and to help determine the patterns of losses.^[22] Susan Allen, of the Special Collections Department at the Claremont Colleges and former chair of the Rare Book and Manuscript Section of the ALA, is presently also attempting to gather statistical data on library thefts. During the week of April 20–24, 1992, she sent an electronic mail message to various colleagues at other libraries in the United States to ask if anyone had compiled figures of such reports and to ask for their help in such an effort. Since 1987 she has compiled the reports of items reported missing throughout the country that she has become aware of and has kept a narrative list.^[23]

These databases have also been created in response to a rising crime rate in the United States as a whole, which has included crimes in libraries, archives, and art museums. Evidence of this problem has been compiled by Alan Jay Lincoln, who served as the editor of a special issue of *Library Trends*, "Protecting the Library."^[24] Trends in library crimes, which include thefts of library, patron, and staff property as well as assaults of patrons and staff members are reported in *Crime in the Library: A Study of Patterns, Impact and Security*^[25] and in *Library Crime and Security*, which was coauthored by Carol Zall Lincoln and appeared in *Library and Archival Security*.^[26] Alan Jay Lincoln does not only report the problem of library crime, he also includes suggestions for combating the problem, including the installation of security systems and the implementation of new procedures.

In his introduction to the special issue on *Protecting the Library*, Lincoln states that the range of problems of crime and disruption affecting libraries has become greater, and the impact of crime in and against libraries more widespread.^[27] He continues by stating

Perhaps the oldest problem, . . . is the theft of books. The problem continues today and in many libraries is considered a major operating cost. This involves the theft of rare books by profit-oriented thieves as well as the theft of expensive but commonplace volumes by "ordinary" patrons, students, and faculty. Unlike the professional thief, others steal for selfish motives; they "need" the book, they "like" the book, they "can't find the book anyplace else," and so on. In academic libraries, the perceived competition for scarce resources entices students and faculty to take what they "must have." Of course, taking a popular volume not only improves one's own chances of success, but simultaneously reduces others' chances.

As libraries continue to develop their nonbook resources, these materials become increasingly popular targets of thieves. Episodes of theft are not confined to books. Records, tapes, software and hardware have become favored targets in some libraries. At times, these items -

as well as books - are not stolen but are mutilated, reducing both the value and usefulness of the materials. Mutilation may be in the form of slashing needed pages from journals or books. In terms of motivation, this action may be more similar to vandalism in that the perpetrator's goal is to obtain some desired material rather than destroy it. We were told of one episode of valuable information stored on computer discs being thrown in toilets by intruders. Acts of property destruction also occur with alarming regularity. Buildings are defaced and occasionally burned, equipment is damaged, and files are destroyed. Libraries also are likely to be targets for the so-called "white collar" crimes of false billing and other fraud, counterfeit money exchange, and theft by employees. The theft of personal items belonging to staff and patrons also may be a problem in some areas. As we shall demonstrate later, it is the unusual library that is free of all crime and disruption.

While property crimes against the library are the most common types of offenses, they may not be the most feared. Crimes against persons evoke strong reactions from those involved or concerned. Even when a library is free from personal crimes, the anticipation of a possible episode can be devastating to employee and patron morale.^[28]

Alan Jay Lincoln presents the results of the Library Crime Research Project in his article *Patterns and Costs of Crime*.^[29] This was a three-year study of the crime and disruption patterns in public libraries in all fifty states. It was a broad study designed not only to assess problems of crime and disruption but also to identify many of the conditions that facilitate or help to control these problems. The survey questions covered a variety of topics including 1) characteristics of the library and community; 2) descriptions of patrons and patron use patterns; 3) experiences with eighteen different types of crime and disruption; and 4) direct and indirect costs of crime including the use of security equipment and procedures. A total of 2,920 surveys were distributed to a sampling of the public libraries listed in the *American Library Directory*, and the 1647 surveys that had been returned by August 1983 were analyzed.^[30] In regard to theft of library materials, four kinds of theft were measured. These were book theft, which was the most common offense reported, reference material theft, theft of equipment, and other theft. Eighty percent of the responding participants reported at least one episode of book theft, and the majority of these involved six episodes.^[31] The results of this survey are outlined in the tables compiled from this study. (See Leab and Leab, Table 1, p. 71; Table 2, p. 73; Table 3, p. 74.)

The prevailing attitude in the past was that a theft should not be publicized to any outside authorities. This practice is no longer seen as ethical in the professional or library world. Virtually all institutions, large and small, have experienced theft problems.^[32] Efforts to keep thefts quiet sometimes led some institutions to take peculiar

measures to recover their stolen items, such as buying back at public auction the letters and other documents that had been stolen from them previously, rather than approaching the auction house and proving their ownership of the documents and requesting their return.

Instances of library theft continue to be reported by libraries throughout America, whether it is committed by staff members or visitors. Staff members have been reported to removing not only collection materials from the premises, items that have been accessioned and catalogued, and items that have not been fully accessioned and processed such as books, compact discs (CDs), and DVDs but also cash from fines collected or benefit book sales and office supplies.^[33] An instance of theft by a visitor includes the case of E. Forbes Smiley III, a map dealer and collector who was sentenced to 42 mo in prison by U.S. District Judge Bond Arterton on September 27, 2006, and was instructed to make a payment of \$1.9 million in restitution to the antiquarian booksellers and collectors he defrauded.^[34] Mr. Smiley had admitted to purloining 97 maps over an eight-year period from various libraries including the New York and Boston public libraries, Chicago's Newberry Library, Yale University, Harvard University, and the British Library.^[35] Mr. Smiley was attributed with stealing 108 maps, but the total number of missing maps from those institutions is 256. Mr. Smiley was sentenced to forty-two months and he served three years and six days. He officially earned parole on January 17, 2010.^[36]

The Wisconsin Historical Society was the site of a brash break-in when Matthew Brooke smashed the glass bookcase containing the bound volume of the *Pennsylvania Evening Post* containing issues dating to January to April 1777. Although the volume is valued at \$3000–\$5000, the explanation for the crime offered to the court by Mr. Brooke when he was charged in September of 2005 was that he wished to read an article about a historical figure named William Hill, not to profit from the sale of the item.^[37] Digital recordings are also of interest to library patrons as well as library staffers, as illustrated by the case of Binh Huu Hoang who pled guilty to first-degree theft for stealing \$3000 worth of CDs and DVDs from the Multnomah County Library (Oregon). Mr. Hoang was banned from the library and sentenced on July 28, 2005, to three days in jail, three years of probation, and 160 hr of community service.^[38]

Electronic articles available from libraries by purchase or subscription and personal data are targeted by cyber criminals around the world. The National Terrorism Advisory Board reported that Chinese hackers claimed to have exploited the City College of New York Library Proxy Server, downloading 25,000 e-mails and passwords. This incident occurred on September 16, 2013, and was reported to the City College of the New York Information Technology Department on September 30, 2013. The Information Technology Department subsequently shut down the City College of New York Library Proxy Server

without notifying either the chief librarian or the library computing manager. This server facilitates off-campus access for members of the City College of New York community to electronic material including database subscription articles and electronic books. There was no evidence that the Library Proxy Server was compromised. Proxy Server access was subsequently restored.^[39]

These and other motivations for library theft have been noted in the past and continue to be reported. The reasons for library theft listed in the 1971 doctoral thesis by Stephen Glen Poland, "Characteristics, Behaviors and Attitudes of Male College Students who have Committed Theft," were

1. Acquisitive vandalism
2. Tactical vandalism
3. Ideological vandalism
4. Play vandalism

An instance of tactical vandalism is presented as a case study by Bruce Shuman where the perpetrator, a law student, tried to borrow a reference work *Black's Law Dictionary* only until the end of the term from a public library branch because the competition for access to this work was so great among his classmates that he felt he needed his own copy because he was determined not to fail law school.^[40] An instance of ideological vandalism was reported by the San Francisco Public Library.^[41] An instance of vindictive vandalism, not to a library's physical assets, but to its financial assets, was perpetrated by a former employee, the information systems manager, whose actions were all the more insidious because this individual entrusted with access to the computing systems and network, the detection of the implanted program was all the more difficult to detect prior to the creation of the damage to the personnel, payroll, vendor, and circulation records. This computer programmer was convicted in Fort Worth, Texas, in 1998 of inserting a computer virus into his former employee's system that wiped out 168,000 records. The virus activated two days after he was fired, similar to a time bomb waiting to perpetuate the sabotage.^[42] An instance of play vandalism by several teenagers was reported by the Pennsauken Free Public Library (New Jersey) when they threw books and began yelling, creating a chaotic scene for fifteen to twenty minutes while there was a power failure. Order was restored after the emergency lighting activated and police arrived on the scene.^[43]

Libraries that have been perceived in the past as safe places to work or study have become sites for crimes of assault, equipment theft, and electronic data tampering or deletion, as mentioned earlier. Some of these assaults have included instances of rape^[44] or other bodily harm causing death.^[45] The murder of a librarian in Georgia brought home the issues of workplace safety. The victim was working alone in a small-town library in 1993. The

16-yr-old youth arrested for the crime stated that the motive for the crime was the desire to obtain the staff member's expensive jewelry.^[46]

Other threats to library property and visitors have been reported, demonstrating that libraries are not isolated from these dangers that are present in the current environment. Bomb threats^[47] and the concerns left in the wake of the shootings at the Virginia Tech on April 16, 2007,^[48] have left library managers considering installing metal detectors or instituting patron searches as they enter the library to prevent the admission of weapons into the facility in addition to the search of patrons or their belongings as they leave the library to prevent the unauthorized removal of materials.

With regard to the safekeeping of digitized information, librarians have to countermand intrusion from two constituencies, the government and criminals that might be computer crackers or hackers. With regard to the former, in the wake of the Patriot Act, patron records regarding activity and circulation have to be reprogrammed in order to prevent unnecessary inspection of such records. The massive flow of partially encrypted data across networks designed to allow for the unhindered flow of digital information potentially enables the criminal element access to data in order to perpetuate identity or financial theft.^[49]

By following the guidelines mentioned earlier, and implementing the sound security practices they advocate, hopefully thefts of library materials will be prevented by all but the most determined professional criminals. Good basic security and preservation policies should be practiced, such as marking valuable materials so that proof of ownership can be established if they are stolen, maintaining accurate cataloguing and inventory records so that an accurate report of what has been determined to be missing can be filed in case they are stolen, and keeping copies of those records that can be made available in order to prove ownership. Only by continual maintenance of accurate inventory, cataloging, and shelf list records can the theft of materials be determined with precision, whether it was by a patron or a staff member. Accurate record keeping is especially important for archival repositories, which include the maintenance of accurate inventory records, particularly the calendars of papers for the sets of papers in the collection, retention of the paging call slips with the name of each patron who requests materials, and of the registration forms filled out by the researchers. The paging slips are useful when items are discovered to be missing, and it can be determined more easily who may be the culprit. It has been suggested that each folder should be inspected or weighed by a staff member before archival materials are turned over to a patron in order to prevent the patron from being able to claim that those materials were not in the folder when it was given to them for use and that they are not responsible for any missing items.

In order for the library and archival profession to assess the problem of the theft of materials, to prevent further thefts, and to recover their materials, the scope of this problem must be determined accurately. A standardized computerized national database, such as the one that had been proposed by OCLC was a first step. Only with accurate reporting can overall annual or regional trends be determined. Institutions might be able to take preventive measures based on the emerging pattern, perhaps microfilming their collections of letters by Franklin Roosevelt if they seem to be the target for possible theft or placing volumes of illustrated botanical texts in closed stack areas if they are being mutilated in libraries in other parts of the country. Greater efforts to microfilm or digitize as much manuscript material in archival collections as possible should be undertaken because the replacement film copy reduces wear on the originals and provides documentation of proof of ownership if they are stolen, and if the master microfilm is stored off-site, the film can be a substitute for the originals if they are permanently lost or destroyed due to fire or flood.

IMPORTANCE OF GOOD COMMUNICATION WITH BOOK DEALERS

Open links of communication to the community of book dealers have been instrumental in the recovery of several of the items stolen from the Columbia University Rare Book and Manuscript Library. This theft was first discovered on July 5, 1994. The next day, on July 6th a list was compiled that went out on *ex libris*, to the ABAA network, to *AB Bookman*, and to the art theft networks. This list was subsequently updated to include the twenty-two items finally posted, valued at \$350,000. Descriptions and photographs of some of the stolen items were published in *IFAR Reports* over the next several months. In June of 1995, Jean Ashton, the director of the department, was about to send the list to the book dealers in the secondary market when they got a break in the case with an arrest.^[50]

When the theft of the seventeen rare manuscripts was originally discovered in July 1994, it had been speculated that it had to be an inside job. However, when the Dutch police arrested a suspect in Amsterdam on June 7, 1996, they found a convicted forger from Yonkers with two fake passports and a fake Columbia University identification, according to Federal agents.^[51]

The arrest, prosecution, and subsequent sentencing of Mr. Daniel Spiegelman (aka Mr. Kikabidze) brought a certain sense of relief, particularly since he subsequently told the authorities where some of the stolen items were stored, in safety deposit boxes in various locations in New York City and State. The items that were recovered—including two fifteenth-century *Books of Hours*, the historical chronicle from Caesar to Charles VI, a nineteenth-century Koran, a papal letter written in 1202, and documents bearing

signatures that appeared to be those of George Washington and John Adams—were all intact. There were seventeen codices taken, including European manuscripts produced in Europe from the thirteenth to the sixteenth centuries, and eight of these have not yet been recovered. There were twenty-three document sets taken and seven of those have still not been recovered. Some of the outstanding documents include two boxes of papers from the Thomas Alva Edison collection. The removal of leaves or miniatures by the thief for separate sale was the greatest fear of Jean Ashton and of those investigating this case. This fear was realized when the nine-volume Blaeu atlas was recovered, and it was determined that more than 250 maps had been cut out of the atlas set. As Jean Ashton explained at the Fatico Hearing for *United States vs. Spiegelman* on March 20, 1998, there was a five-year loss from 1993 to 1998 of scholarship, while the students of Columbia University would not have had the opportunity to be exposed to the materials that had been stolen by Mr. Spiegelman. The complete experience of intellectual examination continues to be curtailed because not all of the items have been recovered and sixteen of the stolen items may never be recovered such as the copy of the *Nuremberg Chronicles* that Mr. Spiegelman admitted to selling in Europe. This loss to scholarship is incalculable.^[52] The felon never named any accomplice.^[53]

Mr. Spiegelman was extradited to the United States. Law enforcement officials theorized that he tried to hold some bargaining chips to better his position since he must have realized that it is not good to go to prison for a long time. The authorities had him extradited to the United States for prosecution (something that Mr. Spiegelman tried to prevent; attorneys from the U.S. Attorney's office traveled to the Netherlands to argue for his extradition, which was scheduled for December 21, 1995), particularly since any statements he made in Holland where he was held were not valid in U.S. courts. In November 1997, Mr. Spiegelman was in custody awaiting trial. A prior plea bargain was retracted. The defendant gave information relative to his selling of maps and books in Paris. This information was forwarded to the French authorities who were unable or unwilling to further the investigation or recovery of the items.^[54]

He was turned in to the authorities and to Jean Ashton by three book dealers in Germany, Switzerland, and the Netherlands who called her and Detective Kalafus to notify them that the pieces had appeared on the market. Detective R.J. Kalafus was a 30-yr veteran of the New York City police force assigned to the 26th Precinct, who investigated cases of theft from three of the Columbia University Libraries. The dealers told Jean Ashton that a man calling himself William Taylor offered to sell a set of rare manuscripts that contained several pieces missing from the Columbia University Libraries collection. The suspect showed the dealers photographs of one of the *Book of Hours* and of another manuscript he also offered

for sale for 70,000 Dutch Guilders (about \$44,500). One of the dealers in Amsterdam agreed to pay 60,000 guilders. When the man returned with the merchandise, he was arrested because the authorities had been contacted in the interim.

Judge Lewis Kaplan sentenced Daniel Spiegelman in April of 1998 to 60 mo in prison, 3 yrs of supervised release, 300 hr of community service, and restitution of \$314,150 for the theft of works valued at \$1.3 million. Judge Kaplan imposed a lengthier sentence because the magnitude of the crime meant the deprivation “of a generation of scholars and students of the irreplaceable raw materials by which they seek to discern the lessons of the past and help us to avoid repeating it. That’s what differentiates [this] offense from a simple theft of money or other easily replaceable property.”^[55]

Mr. Spiegelman’s activities did not end there. In October 1999, Jean Aston received a call from an autograph dealer in Greenwich, Connecticut, Basil Panagopolous, because he had been offered some papers of Thomas A. Edison and Presidents Thomas Jefferson and James Monroe that Mr. Panagopolous suspected were from the Columbia University Libraries collection. Apparently Mr. Spiegelman had escaped from his work release program in Manhattan, retrieved the materials from an unknown location, and crossed state lines in an attempt to sell them. The alertness of the manuscript dealer led to Mr. Spiegelman’s rearrest and an additional twenty-four-month sentence. This sentence was imposed by Judge Loretta Preska on May 24, 2000, followed by an additional three years of probation. It is clear that Mr. Spiegelman is still aware of the location of materials taken from the Columbia University Rare Book and Manuscript Library that have never been recovered.^[56] Mr. Spiegelman served his sentence of a little more than six years in custody and was released on July 19, 2001.^[57]

This type of crime should be taken more seriously as the Stephen Blumberg case, in which thousands of volumes were eventually recovered, illustrates. Valued at a total of \$5.3 million, the materials were taken from 327 public, private, and university libraries in 45 states over a 20-yr period. This case and others highlight the value of the materials that were stolen. Stephen Carrie Blumberg, born in 1951, was arrested on March 20, 1990, and sentenced to 5 yrs in prison. He was released on December 29, 1995, after serving his term. He was not fulfilling the terms of his supervised release or parole and subsequently surrendered to authorities and was rearrested on January 5, 1996. He was subsequently held in a federal prison hospital mental health facility in Rochester, Minnesota, for psychiatric evaluation and released in June 1997.^[58] His bibliokleptomania led him to accumulate 11,000 books, letters, and manuscripts, which filled his house in Ottumwa, Iowa.^[59] His obsession with books grew out of his earlier collecting manias for doorknobs and other such hardware items.

As a notorious recent case, it dramatizes the problem of library theft for the library community,^[60] as do others. The library community was aware of the activities of Stephen Blumberg prior to his arrest, but due to poor communication among libraries, he eluded apprehension until an informant helped the federal authorities. Stephen Blumberg obtained false identification and passed himself off as Professor Matt McGue, a faculty member of the University of Minnesota. Although he was arrested and convicted of trespass at the University of California-Riverside library and of possession of burglary tools under this identity, he apparently continued his activities until his subsequent arrest even though a report of this incident had been published in *Library & Archival Security*.^[61] The search of his premises by the FBI revealed materials reported missing from more than 327 institutions in 45 states and Canada. He was convicted on January 31, 1991, in U.S. District Court of all the felony counts with which he had been charged, including conspiracy to transport stolen property across state lines, two counts of transportation of stolen property, and one count of possession of stolen property. He had pleaded insanity to the charges.^[62] Although he had been arrested previously for pilfering materials from a library under an assumed name, the pattern of his activities was not revealed to the library community as a whole until his arrest, trial, and conviction. This case has underscored the need for an accurate national database to record missing materials from libraries so that if a pattern of these activities is present it can be revealed sooner and librarians can be alerted to the possible danger to materials in their collections.

As various libraries began to discover that books were missing due to Mr. Blumberg’s activities, the ACRL Rare Book and Manuscript Section Security Committee began in 1987 to gather a single listing of library thefts, the “Incidence of Theft.” A member of the committee volunteered to keep it up to date and to issue a revised version prior to each annual ALA meeting. A document of one page in length grew to 22 pages by 1995, highlighting the problem and the exchange of information among libraries.^[63]

TREASURES MISSING FROM THE LIBRARY OF CONGRESS

The Library of Congress, the de facto national research library, has been plagued with problems of theft and mutilation of their materials since 1992.^[64] As a response to this problem, procedures were into place at that time, including closing the stacks whereby the library beefed up security by barring all but essential personnel from the collections and an agreement that it would notify both the U.S. Attorney’s office and the FBI of any “property offenses.” Despite the assurances of James Billington, the Librarian of Congress, when he stated in October 1994 that security was “one of the three top institutional

priorities of the library,” Deborah Maceda contended that the ransacking of the library’s collection continued unchecked. Deborah Maceda was the library’s Protective Services Office staff member who was removed from office on July 12 for submitting notification of missing materials. She compiled a list in June 1995 of mutilated documents that filled 68 pages, showing that 26,985 plates are known to be missing from publications valued at a total of \$1.75 million. Former Senator Connie Mack called for a General Accountability Office investigation into security lapses and the magnitude of the losses. Senator Mack, Florida Republican, as former chair of the Appropriations Subcommittee that oversees the library, had the authority to call for such an investigation, especially after receiving memos and reports of these losses from Deborah Maceda. An aide to Senator Mack said other committees with jurisdiction over the library were notified.^[65] Hearings investigating these allegations were held before the Joint Committee on the Library of Congress and the Appropriations Committee on November 29, 1995.^[66]

Sometimes cases of theft can even lead to murder. A robbery of 89 ancient manuscripts from the Russian National Library in St. Petersburg dating from the thirteenth to the eighteenth centuries was posted on the ABAA Stolen Book List by Vladimir Zaitsev, the library director. Dmitry Yakubovskiy, a controversial lawyer and alleged former KGB agent with the nickname “General Dima,” was arrested after being detained on December 20, 1994, on suspicion of complicity in the theft of those eighty-nine manuscripts worth about \$100 million from St. Petersburg’s National Library. He had emigrated to Canada and then returned to Russia prior to his arrest. According to reports, Mr. Yakubovskiy had very good relations with many top Russian officials. Yevgeny Melnitsky joined the team to defend Mr. Yakubovskiy in August 1995. The attorney, Yevgeny Melnitsky, 49, was found by his driver in his apartment on September 25, 1995, with his throat cut and his head bludgeoned, according to police detective Marina Gurina.^[67] Authorities said they found no sign of forced entry or evidence of anything having been taken from the apartment. Police said they were investigating a potential link to his work in defending the controversial lawyer Dmitry Yakubovskiy. Mr. Melnitsky had important documents related to the case that were “dangerous to some people,” one of the other Yakubovskiy defense lawyers said, on condition of anonymity.^[68] On September 20, Melnitsky had been elected chairman of a District Electoral Commission. The Electoral Commission does not believe that his murder has anything to do with these activities, but rather with the legal case.^[69]

REPLEVIN

As mentioned earlier, sometimes libraries have taken elaborate measures to recover their stolen items. In the case of

the documents that were stolen from three Texan institutions, proving their prior ownership to the satisfaction of the Parke-Bernet Galleries would have been relatively easy since these letters had been referred to in publications concerning early Texas history, and the source for these documents had been cited as these respective repositories. Members of the staff at the Texas State Library did not exercise their right of replevin or recovery by a person or institution of goods claimed to belong to them, on the promise to test the matter in court and give the goods up again, if defeated. Cataloging records alone formulates a weak case; other documentation should be produced to prove ownership definitively in court, such as microfilm of the manuscript items, a citation in an exhibit catalog, or credit to a repository in the publication of a set of papers. Forty-two items among the lots sold in an auction held at Parke-Bernet Galleries on November 21, 1967, belonged to the Texas State Library, the University of Texas, or Rosenberg Library in Galveston. Representatives for the University of Texas were present at the sale and bought back many of these items, which were returned to the Texas State Library, having been “recovered” in New York.^[70]

SUGGESTIONS FOR PREVENTION

Spend the Money on Security Systems and Trust No One

Detective R.J. Kalafus, as mentioned earlier, has investigated cases of theft from three of the Columbia University Libraries, and he offers two main points for the prevention of this type of crime: spend the money on security systems and trust no one. Spending the money for security systems, whether they be alarm systems or video surveillance, may be difficult in this time of budget cuts, but the consequences may be more costly. When choosing a security system, it would be wise to consult with a law enforcement agent to get a recommendation. Something else to keep in mind is to limit the number of keys issued to staff for access to secure areas. Only a limited number of those keys should be issued to authorized personnel.

In the course of his investigation of the theft from the Columbia University Rare Book and Manuscript Department, following the initial report of the theft, Detective Kalafus visited the department to survey their security system and arrangements. He assessed their alarm system to be fairly good, and any loud noise will set it off, even the sound of a closing elevator door. To help him with his inquiry, he was given six book storage boxes by staff members to take with him for examination. He found it ironic that as he was leaving with these boxes, no one stopped him or questioned him regarding what he was doing with them, it was not until he stopped to light a cigarette that half a dozen people suddenly appeared to

tell him to put it out. He has determined that there were too many keys issued to various staff members.

Another thing to remember is trust no one. When security procedures are implemented, they should be applied consistently. As mentioned earlier, the Library of Congress implemented new procedures in 1992 which were not followed, resulting in very little change in the numbers of mutilated volumes on the shelves.

Use Consistent Security Procedures: Search Everyone

When security procedures are implemented, they should be followed consistently. At the very least, everyone should pass through a security checkpoint upon exiting. If it is determined that someone should be subject to a search, which may be objectionable, it should be explained gently but firmly that this is for everyone's benefit, since whenever any materials are permanently removed from a library collection, it detracts from the overall integrity of that collection and diminishes our overall cultural heritage.

Of course, no alarm system designed to alert one to an outside break-in can protect the collection from an inside theft. Terry Belanger, speaking at the 1983 Oberlin Conference on Theft reported in *Library Journal*, estimated that "25% of the thefts are inside jobs committed by students, professors, librarians, staff members, and janitors, rather than professional criminals."^[71] Ronald Lieberman, former chair of the Security Committee of the ABAA confirmed that "insider theft is a problem."^[72]

Two cases of insider theft that have come to light occurred at the University of Georgia library in Athens and at the Rosenbach Museum and Library in Philadelphia. Materials belonging to the rare book collection including more than a thousand rare maps, manuscripts, and folio places, estimated as being worth over \$1 million, were discovered to have been stolen over a period of several years. The theft was discovered when it was determined that items were missing from the map collection in June of 1986. During a subsequent inventory of the collection, the list of missing items was expanded to include a 1776 British atlas, and a set of nineteenth-century botanical folio prints, *Les Liliacees* published in eight volumes, and duplicate copies of various items in the map collection. Thomas E. Camden, the head of the Hargrett Rare Book and Manuscripts Collection, noted that their "biggest problem is trying to identify the materials as ours once they have been located," since many of the items were not marked.^[73] A former employee, Robert "Skeet" Willingham Jr., resigned on October 15, 1986, after an investigation into the suspected thefts had already begun in June of 1986. He became the prime suspect for these thefts after his home had been searched four separate times by campus police who found materials that could have come from the library in the course of those searches.

The campus police filed an affidavit in connection with these searchers and stating that "It is known that [Willingham] has sold property belonging to the University of Georgia."^[74] Thomas Camden, commenting on this insider theft problem, noted that the University of Georgia library with closed stacks has had few problems with theft by patrons, but added that "I don't know of any system that will protect a library from within."^[75]

The case of the missing materials at Rosenbach Museum and Library in Philadelphia was more insidious because in the course of their investigation it was revealed that inventory records had been purposely altered by the perpetrator of the thefts to cover up the fact that he was pilfering documents from their collection and selling them through book and manuscript dealers. When Ellen Dunlap took over as director of the Rosenbach Museum and Library in 1983, she had no idea that she would inherit a serious problem as a result of the activities of the former director, Clive Driver. Not only had he worked there for twenty years and served as director since 1965, he had actually been allowed to live on the premises.^[76] When Dunlap took over as director in 1983, an investigation of a file marked "Missing Items" was inconclusive. A more serious problem emerged when the Rosenbach was contacted by telephone on February 26, 1987, by Mary Jo Kline of Sotheby's inquiring about a 1790 John Adams letter to John Trumbull that was about to be consigned to auction. The staff of the Rosenbach were unable to establish if the Rosenbach had ownership of this document or not, particularly since the inventory book had been emended in blue pencil, creating doubt as to whether it had been deaccessioned after 1959. During the course of the continuing investigation into this mystery, Mary Jo Kline revealed that the current holder of the letter was a Massachusetts dealer, Paul Richards. Paul Richards in turn identified the person who had sold him this document as Clive Driver, who had recently retired nearby.

When this revelation was made, the alarm bells went off and Ellen Dunlap had to go into action. After conferring with their lawyer and members of the board, changing the locks, and contacting the insurance agent, she filed a civil suit in federal court to seek return of the Rosenbach's property.^[77] In November of 1989 the civil suit was settled with a provision for the return to the Rosenbach of fifty-eight documents disseminated by Clive Driver. Criminal charges were also filed against Driver who was convicted on felony charges and sentenced to pay a \$50,000 fine and serve 3 years of probation that includes 2,000 hr of community service for the interstate transportation of an historical document.^[78]

The case of the materials stolen from the Rosenbach Museum and Library by Clive Driver that were sold to the Massachusetts dealer, Paul Richards, and the case of the materials stolen from the Columbia University Rare Book and Manuscript Department by Mr. Spiegelman both illustrate the point that the staff of libraries and archival

institutions should foster good relations with book and document dealers so that they will be more likely to notify the authorities and those institutions known to them as collecting books or documents concerning a particular subject category when they are offered materials for sale that are related to that topic. This would not only help in the recovery of stolen materials but also could be a means of increasing the holdings in a collection within a certain subject area since the institution could consider purchasing the material from the dealer. Reporting missing items to ABAA and getting it listed in the column published in *Antiquarian Bookman* is only part of the recovery process, and staff members at institutions should make direct contact with those dealers who specialize in materials relevant to their collections. Also, the curator of a special collection or rare books collection in a library should be familiar with the current market value of materials in the collection by consulting dealer catalogues and listings of prices paid in an auction house sale of items comparable to those in the collection.^[79]

Microfilming

Mimi Bowling, former curator of the Manuscript Department at the New York Public Library, suggests another approach—microfilming. Microfilming manuscripts reduces the wear on the originals while providing an acceptable substitute for most researchers. As she explains it, “Good security measures are good preservation practice for anything valuable. Be sure not to [have it] handled more than [it] needs to be, limit [the] use to film [as] one solution.”^[80]

Also, in keeping with the idea of limiting the number of keys that are issued, at the New York Public Library Manuscript Department, only a few members of the staff have been issued electronic key cards that open the containerized steel shelf units, and the system records the key code used to operate it and the time that the shelves were opened. Since the key codes are each linked to a specific staff member, the access to these stacks can be monitored.^[81] Although it is possible to withdraw materials from one area of the stacks and place them in another stack area, if accurate shelf lists are maintained, it should be quickly apparent that the materials are out of place.

Mark Materials and Use Colored Photocopy Paper

The practice of marking manuscripts and other library materials has been the subject of controversy within the library profession. Each set of guidelines promoted by the RBMS Security Committee give specific instructions as to how to mark these materials in such a fashion that they will not be disfigured to such an extent that they will be unusable by researchers or prohibit them from being exhibited by the institution that owns the material. The Library of Congress recommends the marking of paper

manuscripts with a proof of ownership and will even provide upon request bottles of ink that can be transferred by means of a five-point ownership stamp. This ink has been tested for its resistance to removal by application of solvents or bleaches and for its slightly alkaline pH of 7.0 to 7.5, and it is nonmigrating to other pages and nondestructive to the paper.^[82] At the Oberlin Conference on Theft in 1983, Katherine Leab of BAMBAM recommended the establishment of a national registry of library markings.^[82] The importance of marking archival materials with a distinctive stamp denoting ownership and keeping track of the different designs for these ownership marks used by the institution was emphasized again by Katherine Leab.^[84] Ronald Lieberman, the former chair of the Security Committee of ABAA, also recommends the use of marking library materials as an aid in proving ownership and for deterring theft.^[85] However, he does not neglect to mention that cancellation of these ownership marks is equally important and marking the materials as “WITHDRAWN” or indicating that they were deaccessioned in some fashion. Of course, the cataloging and inventory records should also indicate if certain items were deaccessioned.^[86] Lieberman also mentioned that accurate inventory records are important because then one can be more “aware [of] what is in the collection so that it will be more apparent that [any materials are] missing.”^[87] Those inventory records are vital for proving ownership and are an aid in recovery as well.

These guidelines regarding the marking of library materials for security reasons state that all materials should be marked. This includes Medieval and Renaissance manuscripts, incunabula and early printed books, single-leaf manuscripts, broadsides, prints, maps, and printed books. The process of adding an ownership mark to library materials at the time of acquisition could be incorporated into the initial processing of materials, but the retrospective marking of a large collection is a difficult undertaking. Such a project has to be planned carefully so that it is implemented in an orderly way to make the best use of staff resources and time and of money from the budget.^[88] Considering the constraints placed on most institutions by limited budgets, it is unrealistic to expect that most of them will undertake such a procedure. It is unlikely that institutions will try to mark the contents of their entire collection; therefore efforts should probably be directed at those items that have been appraised to have a high value because they are likely to be targeted by thieves. The marking of library materials either with an inked stamp, a perforated pattern, or an embossed pattern also violates one of the principles of conservation, not to carry out any procedure on library materials, which is irreversible. Even though this may be the case and such marking can detract from the aesthetic or exhibition value of the materials, Katherine Leab believes that archivists should spend more of their time marking the manuscripts in their care. Katherine Leab has also suggested for

manuscript collections that make photocopies of their materials available to researchers on demand should make the photocopy on colored paper so that the patron cannot substitute the copy for the original document when the folder is returned. The copy should also be clearly marked as such by the institution.^[89]

The preparation of manuscript or other library materials for microfilming would take about the same amount of time as retrospectively marking them, because in each case the materials have to be physically handled by staff members for a period of time to carry out either procedure. Since microfilming is usually not destructive to the original materials and does not detract from their aesthetic value nor is it an irreversible procedure, it is a better security option. In addition, the microfilm and the records stating that the materials were scheduled for microfilming are additional documentation that can prove ownership if the originals are stolen.

BETTER AWARENESS: LOBBY STATE LEGISLATURES

Another program that can be undertaken by institutions to help prevent library theft is to lobby for stronger statutes for the conviction and prosecution of library crimes. Hopefully, if criminals are aware that they will be prosecuted under strict legal codes if they are caught, they will think twice before perpetrating such crimes. The Society of American Archivists sponsored the drafting of model legislation in 1975 and lobbied the law enforcement community to enact the proposed legislation. A law passed in Virginia that contains provisions that can be effectively be enforced served as the model. This legislation (Virginia Code SS42.1-72/1.74.1) defines the crime of mutilation of library materials as a class I misdemeanor. The concealment of a book or other library material while still on the premises of the library or removing it in a concealed fashion is defined as larceny. This is highly significant because it prevents a prospective thief from claiming that he forgot to return the manuscript or book or that he meant to have the material charged out. This legislation also grants the archivist or librarian immunity from civil liability for actions arising out of the detention of a suspect. However, if a patron is detained due to suspected activity that may constitute theft, the library staff should handle the situation carefully. The person can be detained on the library premises preferably by two staff members, one of them can be a member of the institution's security force, and no action should be taken until municipal law enforcement officials arrive.^[90]

How seriously a municipality takes library theft can be reflected by the punishments allowed under local laws. Massachusetts passed a law in 1990 allowing for fines of up to \$25,000 and 5 yrs in jail for stealing library materials. The need for such a strict measure was demonstrated

by one small-town library serving a population of 23,000 was losing \$12,000 worth of books each year. It was estimated that throughout this Commonwealth, public libraries had material losses of \$1.1 million yearly.^[91] It is amazing that it took so long for such a statute to be enacted. During the 1930s a ring of book thieves visited libraries throughout Massachusetts and other eastern states by either simply taking volumes off the shelves and hiding them in their overcoats or checked them out as library patrons under an alias and never returned them. They removed or disguised any library ownership marks and sold them to secondhand book dealers on Fourth Avenue in New York.^[92]

Some locations abroad, such as Nigeria, take a rather serious view of such infractions. A conviction of theft of library property can earn the perpetrator up to seven years in prison, if the magistrate sees fit to impose such a sentence.^[93]

SECURITY DEVICES

One widely utilized prevention measure that has been taken by libraries throughout the United States is the installation of electronic and other mechanical security devices. Some of these security devices detect intrusions on the premises when they are closed for operation to personnel and the public. They can also detect intrusion into secured areas while the institution is open for normal operations. These magnetic sensors, pressure sensitive mats or sensors, and photoelectric or ultrasonic beams can all activate an alarm system when they are triggered, either an alarm audible on the premises that can frighten away the intruder or an alarm that is silent at the premises but that activates a signal at another location, such as a nearby police station or at the office of a contracted security service.

A security system that has been installed in libraries throughout the country since the 1970s is the security system that electronically surveys patrons as they exit to detect if they have any improperly charged out library materials. For these systems to work, treated detector tags must be placed in each material in the library collection, and when these tags are taken past the sensing screens, usually located near the circulation desk or at the exit point for the library premises, an alarm will sound if the materials are not charged out properly. These detection tags are placed in the library materials when they are initially processed at the time of acquisition.^[94] Such systems are not foolproof in this age of ever more sophisticated technology. Tattle tags can be silenced with a device that could be purchased for \$17.99 at Radio Shack.^[95] A tattle-tape system is difficult to implement in archives in any case because the materials are often single leaves that make it more difficult to attach the tags to the leaves than it would be to attach them to bound volumes. The number

of single-leaf items in an archive poses a similar problem to that of marking manuscripts, and it is very difficult for an institution to allocate the amount of staff time that would be needed either to attach the special tags or to mark the individual leaves. Also archival materials never circulate, so it would be better for the institution to direct their resources to monitoring the use of the materials on the premises.

The recently introduced technology for the library security market, radio-frequency identification, offers an alternative to magnetic strip tattle tags and barcode identification tags. The smaller tag size makes it possible to attach them more easily to individual document items. However, the greater cost per unit, around \$0.65–\$0.75 each, versus about \$0.02 for barcode tags has prevented a large penetration into the library market. In addition, the feature allowing for more universal tracking of the item and potentially of the user who has the item in his or her possession has raised questions regarding privacy invasion of the user. Until the privacy issues and cost factors regarding the per unit cost and the cost of interfacing the technology with circulation transactions can be standardized, many libraries are likely to remain with barcode identification systems.^[96]

Careful planning and layout of the reading room where archival materials are used can aid the staff members to accurately monitor how materials are being used and if they might be concealed by a patron. What is of primary importance is to have at least one staff member present at all times. The desk area where the staff member is positioned should be elevated and have a clear line of sight to all work areas at the reading tables. If additional staff members have offices located nearby, glass walls can be installed so that they can periodically assist in the monitoring effort. Strategic placement of two-way mirrors and of closed circuit television cameras can be included to aid the staff member in surveying the activities in the reading room (see illustration on page 5 in Timothy Walsh, *Archives and Manuscripts: Security*. Chicago: Society of American Archivists, 1977). Although it is difficult for the staff member to observe the closed circuit monitor and the patrons in the reading room and it may be too expensive to assign a member of the institutional security force to constantly watch the monitor, the presence of an active camera can be a deterrent to a thief, and the videotape is important evidence for the eventual prosecution of the perpetrator.^[97]

When someone is convicted of this type of theft, stronger sentencing should be implemented. As illustrated by the examples of the cases mentioned earlier, Stephen Blumberg, who has served his five-year term, and Clive Driver, who was sentenced to three years probation, including 2,000 hours of community service with a \$50,000 fine illustrate, this type of crime is not taken seriously enough. In yet another case of insider theft, Carol Ann Van Swearingen, a former librarian at Tremont

Road library in Upper Arlington, pled guilty to one count of theft for having nearly 6000 books and other materials in her home without library permission. For this crime she has been given two years of probation whereby she must seek counseling for her obsession with books, perform 160 hr of community service, and pay a \$2500 fine.^[98] However, some public libraries are adopting “get tough” attitude and are calling for help from their local police. The Rolling Meadows Library in Illinois now asks for police help when a patron has kept materials worth \$250 or more for a period of 60 days. A uniformed police officer pays a call on the recalcitrant patron and requests the missing materials and instructs them that they have to appear before a judge. This kind of enforcement of the Illinois law against library theft is getting results; about \$4000 worth of materials have been recovered.^[99]

COMMUNICATION AMONG LIBRARIANS ABOUT THIS PROBLEM

Members of the library and archival profession have also discussed the problem of what to do about missing library materials in meetings such as the one convened at Oberlin College in 1983 to discuss the problem of library theft in the wake of the thefts by James R. Shinn, who was apprehended in April 1981 by William A. Moffett, director of the libraries at Oberlin College. James Shinn was linked to the theft of \$750,000 worth of valuable books from the open stacks of some 40 libraries throughout the country.^[100] The Society of American Archivists has periodically sponsored discussion of this issue at a conference held in Detroit in 1979^[101] and at their annual meeting in September 1991, which included a panel discussion of insider theft of archival materials in the program. The panelists included Ellen Dunlap formerly of the Rosenbach Museum and Library; Daniel Traister of Special Collections at the Van Pelt Library, the University of Pennsylvania; and Robert Bazin from the Philadelphia office of the FBI.^[102] A Preconference Workshop on “Security in Archives and Manuscripts Repositories” was scheduled on September 12, 1992, as one of the activities associated with the annual meeting in September 1992 of the Society of American Archivists held in Montreal. Mimi Bowling, curator of manuscripts at the New York Public Library, and Richard Strassberg of Cornell University were going to lead the discussion. It was canceled due to lack of enrollment.

The various public and private libraries that have the responsibility for the safekeeping of materials for the public trust and to make them available for scholarship have formulated guidelines through professional associations as to what measures to take to prevent the loss of the materials in their possession and what to do in the event that any materials are discovered to be in fact missing and possibly stolen. The ACRL and the ALA have been

particularly active in this area. The Society of American Archivists sponsored the publication in 1977 of *Archives and Manuscripts: Security* by Timothy Walch that engendered discussion of the issue of library security within the archival and library professions by suggesting a basic checklist system approach for planning a security program.^[103] The ACRL approved a set of "Guidelines Regarding Thefts in Libraries" in 1988.^[104] The set of "Guidelines for the Security of Rare Book, Manuscript, and Other Special Collections" drafted by the ACRL Rare Book and Manuscript Section's Security Committee in 1982 and approved in June of 1990 are of particular interest to the archival profession.^[105]

These sets of guidelines suggest that a security officer should be appointed from among the staff members who will act as a liaison with the institution's legal counsel and security force as well as with the Security Committee, Rare Book and Manuscript Section, ACRL, and ALA. The security officer will coordinate the steps to be taken regarding the notification of outside organizations that materials have been discovered to be missing. The major reporting organizations for library thefts are the ABAA, BAMBAM, and the FBI if the value of the stolen materials is greater than \$5000, and there is reason to believe the items could be transported across state lines.^[106] Local and state police authorities should be notified in the event there is any criminal activity in a library, whether it is the theft of library materials or of cash from the fines box or in potentially serious cases when a patron is assaulted by another patron.^[107]

CONCLUSION

What can I say in conclusion? Take steps to plan for such a disaster just as for a fire or flood beforehand. Install security devices and implement consistent security procedures. Mark or microfilm or digitize the materials in your collection, especially manuscript materials. Foster good relations with law enforcement agents and book dealers; they are your best allies for turning in a suspect in case of a theft. Also, it is the responsibility of the director of any manuscript department to keep track of the market and have a sense of the value of the items in his or her care. If a theft does happen in your institution, the first thing you as a staff member in authority should do is to start a log of events, starting from the first day the theft is detected. Such a log may become useful for building the case against any suspects. Hopefully if perpetrators are caught and prosecuted under existing statutes and receive sentences that are more strenuous than community service, they will realize that the personal or monetary gain is not worth the risk, and libraries can turn their efforts to other areas, possibly promoting programs to serve their users and their community.

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Theft, Vandalism, and Security in Museums

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Abstract

Theft and vandalism are two criminal acts that occur within museums and other cultural heritage institutions. This entry provides a historical context for art theft with an international scope, and highlights such famous examples as the thefts of the *Mona Lisa*, two versions of *The Scream*, and multiple masterworks stolen from the Isabella Stewart Gardner Museum in Boston, Massachusetts. Next, the complex definitions of vandalism, citing case study examples of Mary Richardson's attack on the *Rokeby Venus*, and Yuan Chai's and Jian Jun Xi's actions on Tracey Emin's work, *My Bed*. Finally, a discussion of museum responses to incidences such as these highlights the preventative measures and security devices that cultural heritage institutions employ to deter potential wrong-doers and protect the objects they hold in the public trust.

INTRODUCTION

As public institutions, museums, art galleries, and historic sites are professionally and ethically bound to protect and conserve their collections from all forms of deterioration, damage, and loss. The theft or destruction of any artwork or artifact is a collective loss for society, and as caretakers of these material goods, museums have an essential role to prevent these crimes from occurring. The International Council of Museums (ICOM) Code of Ethics describes the primary responsibility of museums "to protect and promote this heritage as well as the human, physical, and financial resources made available for that purpose."^[1] Museum stewardship includes intrinsic notions of "rightful ownership, permanence, documentation, accessibility, and responsible disposal."^[2] In short, they ideally ensure that all objects in their collections will survive for the benefit of present and future generations. Acts of theft and vandalism, therefore, pose very real threats to the proper functioning of all cultural heritage institutions.

Famous examples of theft provide a historical context for this type of crime on an international scale, and include such examples as the thefts of the *Mona Lisa* from the Musée du Louvre in Paris, France (created 1502; stolen 1911); two versions of *The Scream* from the Norwegian National Gallery and the Munch Museum in Oslo, Norway (created 1893; stolen 1994 and 2004, respectively); and multiple masterworks stolen from the Isabella Stewart Gardner Museum in Boston, Massachusetts (multiple

dates; stolen 1990). Vandalism varies more considerably in its levels of criminality, depending upon the intent of the action, and case study examples of Mary Richardson's attack on the *Rokeby Venus* (created ca. 1640s–1650s; vandalized 1914); and the instance when Yuan Chai and Jian Jun Xi jumped onto Tracey Emin's work, *My Bed* (created 1998; vandalized 1999), serve to illuminate the political and artistic motivations behind this behavior. Incidences such as these and many others have prompted museums to develop preventative measures and security devices to deter potential wrong-doers and protect the objects that they hold in the public trust. In addition, a host of international government and professional organizations designed to track stolen and affected cultural property have evolved, including the International Foundation for Art Research (IFAR) New York, International Committee on Museum Security (ICOM-ICMS) Paris, the Federal Bureau of Investigation (FBI) Art Crime Team Washington, the Metropolitan Police Arts and Antiques Unit London, the Interpol Art Theft Division Lyon, and others.

THEFT

Definitions of Theft

A variety of definitions are associated with theft, including moral, legal, and popularized types. In a moral sense, theft

is defined as the act of stealing; the unlawful or wrongful taking of property with intent to deprive the owner of his or her possession.^[3]

In a literal, legal sense the Criminal Code of Canada states that “An act of theft is committed by taking or converting anything, whether animate or inanimate, with intent to deprive, temporarily or absolutely, the owner of it, or a person who has a special property or interest in it. This also includes transformations to anything in such a manner that it cannot be restored in the condition in which it was at the time it was taken or converted.”^[4]

The U.S. Criminal Code specifically articulates a definition of theft in the context of museums: “Theft of a major artwork” refers to a person who

steals or obtains by fraud from the care, custody, or control of a museum any object of cultural heritage; or knowing that an object of cultural heritage has been stolen or obtained by fraud, if in fact the object was stolen or obtained from the care, custody, or control of a museum (whether or not that fact is known to the person), receives, conceals, exhibits, or disposes of the object.^[5]

In this description, theft is distinguished from acts of vandalism and forgery. Theft is usually intentional, with the criminal’s intent to take an object for trade, bargaining, or selling outright. The most common motive for theft from museums and cultural heritage institutions is financial gain. Whether sold illegally on the black-market, or used as ransom or leverage, art theft is a \$6 billion industry.^[6]

A Brief History of Theft in Museums

The history of art is laden with examples of objects changing hands under questionable circumstances. Issues such as wartime looting and the many problematic examples of repatriation are but two of a vast list of potential starting points for the study of such crimes; these particular issues are addressed in other entry (see entry on “Art Looting and Trafficking,” p. 272 for more information). A brief historical introduction here provides information on two key individuals inextricably linked with the history of art crime.

Adam Worth (1844–1902) is known as “the Napoleon of the criminal world.”^[7] He is most famously remembered for stealing a portrait of the Duchess of Devonshire by Thomas Gainsborough from the Thomas Agnew & Sons gallery in London, England (created 1787; stolen 1876). With the help of his accomplices, Worth stole the painting, which at the time had been sold at auction for 10,000 guineas, and was then the most expensive work of art in the world. Worth held onto the painting until just before his death in 1902, when he was forced to relinquish it due to financial reasons.^[8]

Author Simon Houpt frames Joseph Duveen (1869–1939) as a master opportunist, and one of the most successful art dealers of all time. Duveen, who is best known

for saying that “Europe has a great deal of art, and America has a great deal of money,” was a British-born entrepreneur who made his fortune by purchasing the collections of failing European aristocrats and facilitating their reselling to American industrialists seeking a means of class distinction. Although his methods were sometimes described as unscrupulous, Duveen nonetheless contributed greatly to the development of North American collections as well as the museum system in England, funding wings at both the Tate and National galleries.^[9]

Famous Cases of Theft in Museums

Although art crimes continue to occur at an alarming rate around the world, there are certain examples which illustrate the unfortunate history of events that mark the past. Three of the most recognizable instances of theft occurred in Paris, Oslo, and Boston in 1911, 1994/2004, and 1990, respectively. The thefts of the *Mona Lisa*, two versions of *The Scream*, and the masterworks stolen from the Isabella Stewart Gardner Museum, constitute ample illustrations for a succinct study of art theft from the last century.

The *Mona Lisa* was stolen from the Musée du Louvre in August 1911 by Vincenzo Peruggia, an employee of the museum. Peruggia, a carpenter by trade, had been hired to install protective glass cases around certain works, including the *Mona Lisa*, as a result of recent attacks by vandals to the museum. Peruggia removed the painting from its wall hanging after quietly emerging from a storage closet that he had hidden in overnight. He then proceeded to separate the work from its frame in a stairwell, placed the painting inside his coat, and walked out of the museum, which was closed that day. Peruggia kept the work in his apartment in Paris for 2 years, but was caught by police when he tried to sell it to the Uffizi in Florence, for the price of 500,000 lira. He was eventually convicted in court and served a sentence of 7 months and 9.^[10]

As a result of its disappearance, the *Mona Lisa* gained immense popularity and is recognized worldwide. Darian Leader, an author and psychoanalyst, postulated that Leonardo da Vinci’s *Mona Lisa* really only became famous after it was stolen. In his publication, *Stealing the Mona Lisa: What Art Stops Us from Seeing*, Leader states that “in the ensuing months [after the theft] composers wrote tunes about the Mona Lisa and its subject’s beauty; editorial cartoonists mocked police efforts to find her. . . .”^[11] Peruggia’s motives for the theft are not wholly clear, however during his trial he claimed that he had acted as a patriot, endeavoring to return an important piece of cultural property to its native Italy.^[12] His efforts to sell the *Mona Lisa* suggest that monetary gain was a motivating factor in the theft. Another theory proposes that Peruggia had been hired by Eduardo de Valfierno, an Argentine con man, to steal the work, and that Valfierno had planned to make forgeries of the artwork and sell them

across the globe to buyers who thought that they were acquiring the authentic *Mona Lisa*.^[13]

In a second, equally brazen theft, four men broke into the Norwegian National Gallery on February 12, 1994, and stole one of Edvard Munch's iconic versions of *The Scream* (1893), leaving behind a card upon which was written "thanks for the poor security."^[14] Prior to its theft, the painting had been moved to the ground floor of the gallery as part of the festivities surrounding the XVII Olympic Winter Games in Lillehammer (1994). Following a coordinated sting operation orchestrated by the J. Paul Getty Museum (Los Angeles, California) and the Metropolitan Police (Scotland Yard, London, England), the painting was recovered without significant damage on May 7 of the same year. Ten years later a second version of *The Scream*, as well as a *Madonna* also painted by Munch, was stolen from the Munch Museum on August 22, 2004, by masked gunmen. The City Government of Oslo offered a reward of 2 million kroner (approximately \$368,000) for the recovery of the painting, and, after a lengthy search, it was recovered on August 31, 2006. Of six original suspects, three were eventually convicted for the crime. Police disclosed no details surrounding the recovery operation, but both paintings are undergoing conservation for damage they suffered while out of the museum's care. Further to these restoration activities, the museum itself closed its doors for a period of 10 mo, during which time it underwent a \$5 million security overhaul, and upon reopening was dubbed by Norwegian journalists, "Fortress Munch."^[15]

A third example of a significant theft occurred at the Isabella Stewart Gardner Museum on March 18, 1990, and remains to this day the largest art theft committed in the United States in terms of value and number of works stolen. Disguised as Boston police officers, thieves entered the museum and stole 13 works by such distinguished artists as Johannes Vermeer, Rembrandt Harmenszoon van Rijn, Édouard Manet, and Edgar Degas along with French and Chinese artifacts. The significance of this crime lies not only in the number of works stolen, but also in their collective worth, which is estimated at upwards of \$500 million.^[16]

To this day the case remains unsolved. Due to the strict stipulations outlined in Isabella Gardner's will, the collection must remain on display permanently, forcing the museum to exhibit the empty frames of the stolen paintings in their original locations. A \$5 million reward for information or assistance in solving the crime has attracted numerous investigators and art theft institutions, however none have been able to successfully track down even one of the stolen works.^[17] Harold J. Smith, an iconic private art investigator, is immortalized in Rebecca Dreyfus' documentary of 2005, *Stolen*, which examines the theft at the Gardner and provides insight into the workings of art crime and the people and organizations that combat its continual spread. Until his death in 2005, Smith made cracking the Gardner theft his top priority.

Museum Responses to Theft

In the past, cases of theft have depended on the efforts of police officers and specialist art hunters, who have pursued museum objects as they would other types of stolen goods. In part, the search for these objects has been successful, because of the difficulties inherent in the disposal of well-known artifacts for criminals. It is challenging to sell recognized pieces on the open market unless a buyer is already arranged, since the fame of the object alone provokes a great deal of attention from members of the general public and the antiquities market, as well as legal authorities. For these reasons FBI Special Agent Robert Wittman noted that "the real art in art theft is not stealing, but selling."^[18]

There are a number of databases and search engines on the Internet today dedicated to tracking and locating stolen material. They allow for the systematic cataloging and access of stolen materials from around the world. The purpose of these types of research tools is to allow for the identification of stolen items before a purchase is made by an institution or individual, and also increase intelligence on illicit trade and sale. The Art Loss Register is the world's largest private online database of lost and stolen art, antiquities, and collectibles, listing approximately 170,000 items in 2006. It was created in London in 1991 as a result of the need for stakeholders in businesses, insurance companies, and associated art industries to minimize and deter art crimes, as well as facilitate the recovery of lost or stolen works.^[19] Many countries have created comparable databases; one American example is the National Stolen Art File used by the FBI Art Crime Team.^[20] Other organizations, such as the Association for Research into Crimes against Art (ARCA) and IFAR, have focused on the study of the motivations behind vandalism, theft, and even forgery, acting as consultants on protection and recovery issues.^[21,22] In addition to databases and think tanks, international police forces and investigation teams have made significant progress in deterring, recovering, and solving crimes by collaborating over a vast and complicated worldwide network of agencies. The three most established forces are those of the FBI Art Crime Team, the Metropolitan Police Art and Antiques Unit, and the Interpol Art Theft Division, which facilitate the sharing of information among different police departments.^[23–25]

Despite the sophistication of the international art tracking network, Julian Radcliffe, the Chairman of the Art Loss Register, has argued that art theft has remained a low priority for most of the world's police forces and governments.^[26] It is condemned by law throughout the world in the form of National Protective Laws on art and cultural property,^[27] and there is an increasing need for legitimate provenance, or history of the object, in the art and antiquities market; however few governments are willing to provide the funds or resources necessary to adequately hunt for lost art and artifacts. Italy is one of

the few countries to implement a strong political policy on this issue, including funding for specialized police forces that are equipped with hundreds of personnel, who specialize in crimes against cultural property.^[28] These groups include the Tutela Patrimonio Culturale, which protects Italy's cultural heritage, and the Nucleo Tutela Patrimonio Artistico, which specializes in the protection of artwork and in the recovery of stolen paintings.^[29]

Museums assist in counteracting weaknesses in art trade regulation and law enforcement by helping to publicize cases of theft in the media. The Art Gallery of Ontario issued news releases immediately following the theft of five ivory reliefs in 2004, which alerted the general public and art dealers to the crime, and made the pieces far more difficult to sell. The gallery also offered a \$120,000 Canadian reward for the return of the ivories, and a week after the theft, they were returned through an intermediary.^[30–32] The Isabella Stewart Gardner Museum has not yet recovered any of its stolen masterworks despite the \$5 million reward, but on the 15th anniversary of the theft, the museum issued a press release pleading for the proper maintenance of the works.^[33]

Unfortunately, some institutions have been tempted to minimize the situation in order to avoid negative publicity. One particularly dangerous and costly habit is the payment of ransom to thieves in return for stolen material. The Tate gallery in London, England, won back two J.M.W. Turner paintings that were stolen while on loan to the Schirn gallery in Frankfurt, Germany, in 1994 after paying over £6 million in ransom over many years. The J. Paul Getty Museum was also instrumental in the reclamation of Munch's *The Scream* in 1994 (mentioned earlier), on behalf of the Norwegian government.^[34] Responses like these may lead to the successful recovery of a prized artwork, but few organizations have the funds necessary for successful ransom payment, and there is concern that compliance with ransom demands may perpetuate the problem.

VANDALISM

Definitions of Vandalism

Unlike the more straightforward examples of theft, there is no singular, shared definition of vandalism within and among law, academia, and cultural heritage institutions. The disparity centers on questions of motivation and purpose, since “not all destruction is perceived as deliberate, but an event can be considered intentional or unintentional according to one's conception of nature or agency, and according to one's specific intentions in speaking of the damage.”^[35,36] Due to its sometimes ambiguous nature, few criminal codes even mention vandalism. The Criminal Code of Canada Section 430 refers to vandalism instead as “mischief” and describes it as willful destruction or damage of property that hinders the use, enjoyment, or

operation of the property for others.^[37] In the United States, the FBI Art Crime Team in Washington, DC, defines vandalism as an act with the intent “to willfully or maliciously destroy, injure, disfigure, or deface any public or private property, real or personal, without the consent of the owner or person having custody or control by cutting, tearing, breaking, marking, painting, drawing, covering with filth, or any other such means as may be specified by local law.”^[38] There are many other identified forms of vandalism, including burning, melting down, and decapitation, dismemberment, burying, and others.^[39] The tools vandals use to commit their crimes range from paint, lipstick, nail files, and gum to more violent devices, such as knives and acid.^[40]

Most of the academic definitions of vandalism come from the field of psychology. In *The Psychology of Vandalism*, Arnold P. Goldstein summarizes various definitions for vandalism and points out that they “collectively highlighted intentionality, destructiveness, and property ownership as the central features. . . of vandalism. . . [It] is an intentional act of destruction or defacement of property not one's own.”^[41] Many scholars have also proposed typologies and theories to explain vandalism and motivations for the act. Three theories in particular are most relevant to the discussion of vandalism in museums: Czikszenmihalyi and Larsen's “Enjoyment Theory,” which suggests that vandalism happens when intrinsic rewards from acts of destruction overpower the punitive effects of its consequences; Allen and Greenberger's “Aesthetic Theory,” which proposes that an interest in the appearance of an object after being vandalized could be an eliciting stimuli for vandalism; and Fisher and Baron's “Equity-Control Theory,” which offers that vandalistic behavior is a means to correct situations perceived to be wrong.^[42]

As art critic Michael Kimmelman noted, “it's tempting to look for a grand, unified theory of vandalism, but the specific motivations of the people who attack art are. . . as diverse as the objects they choose to hurt. More often it's not pranksters who slash art but self-promoters with a supposed cause.”^[43] It is, however, useful to have certain parameters to qualify cases of vandalism as art or crime, especially when debates between the two remain inconclusive and the boundaries between art and crime continue to blur.

A Brief History of Vandalism in Museums

The origin of the word vandalism comes from the Vandals, a Germanic tribe that invaded Western Europe in the fourth and fifth centuries A.D. Destroying Roman buildings and cultural artifacts, their actions were described as “barbaric ignorance, [with a] lack of taste and sensibility.”^[44,45] The association of their actions with art and culture ties the original meaning of “vandal” to the destruction and damage of cultural heritage. The term vandalism was officially coined in 1794, when

participants of the French Revolution destroyed art and monuments throughout the country,^[46] reinforcing the historic link between culture and the political acts of vandals.

Statistics show that public property is more often the target of vandalism than private property, due to the seemingly anonymous nature of both the owner of the object and the crime itself.^[47] Public sculptures are particularly vulnerable, pointed to by the theft and subsequent destruction of Henry Moore's *Reclining Figure* (created 1969–1970; vandalized 2006) from the Henry Moore Foundation in Hertfordshire, England, which was believed to have been melted down for the value of its bronze.^[48] In addition, the act of publicly assigning value to works of art and reinforcing perceptions of museums as “temples of fame” contribute publicity to the perceived benefits of vandalizing cultural heritage objects.^[49]

Some argue that destruction is an intrinsic aspect of culture as “the destruction of objects produces new meanings and practices, and damaged things may become more valuable than previous.”^[50] This phenomenon has even inspired new design aesthetics. The initial connection between vandalism and the accepted aesthetic is rooted in the Dada art movement with Marcel Duchamp and many other artists creating “non-art” in protest of society's bourgeois indulgence. Initially, the work focused on attacking imagery, such as Duchamp's work of art entitled *L.H.O.O. Q.* (1920), which involved vandalizing the cultural icon of the *Mona Lisa* with a drawn-on mustache and goatee applied to a reproduction of the famous painting.^[51] While the original work itself was not vandalized, Duchamp invoked its destruction by defacing the copy. Other inspired aesthetics progressed even further including “vandalizable sculpture” and auto-destructive art, developed by William Turnbull and Gustav Metzger, respectively, in the 1960s, as well as graffiti art made famous by Robert “Banksy” Banks, selling his works for over half a million dollars in the 1980s.^[52,53] Indeed, “the vandalism of the last century becomes today's tourist attraction” and institutions that argue against such forms of modern art may be interpreted as attacking “artistic innovation.”^[54,55] These forms of art that incorporate vandalism, as well as manifestations of performance art, challenge the status quo by forcing a duality of both condemning vandalism as a crime and inviting works of art rooted in vandalism into museum collections.

The historic role of the museum has also been in question regarding the acquisition, interpretation, and preservation of collections. When an artifact was removed from its original location, the link between the object and its ritual context changed, ultimately altering its appearance, value, and meaning, which were redefined through the representation and interpretation of that object in the institutional setting.^[56] In addition, material culture conservation sought to improve upon the past by altering its relics, revealing that “not even the most painstaking renovation conformed with original work.”^[57] The ethics of

conservation practice have since sought less intrusive treatments that are reversible. The reality that the work of conservators is not seen as vandalism illustrates the important role that societal perceptions and intentionality play in understanding vandalism within the museum context today.

Famous Cases of Vandalism in Museums

When Mary Richardson attacked Diego Rodríguez de Silva y Velázquez' *Rokeby Venus* on March 10, 1914, at the National Gallery in London,^[58] she demonstrated an instance in contemporary history of a case of vandalism that was clearly criminal. Richardson smashed the protective glass around the painting and cut the canvas seven times with a meat cleaver that she had concealed in her jacket.^[59] After attacking the painting, she was arrested at the museum. Despite her political motives to support the suffragette movement,^[59] Richardson's intentions in this case of ideological vandalism were to cause damage to the masterpiece. This political motivation drew attention to her specific cause through the destruction of cultural property.^[60] Richardson knew that she had no rights to, or ownership of, the painting, and she was aware that slashing the canvas would destroy it completely. In her statement to the Women's Social and Political Union she wrote, “I have tried to destroy the picture of the most beautiful woman in mythological history as a protest against the Government for destroying Mrs. Pankhurst, who is the most beautiful character in modern history.”^[58]

Vandalism also occurs when performance artists damage artifacts or works of art in order to make an artistic statement. In these cases of aesthetic vandalism, the artists' behaviors are no less vandalistic and illegal than the previous example, but the criminality is debatable in terms of artistic discourse, considering the underlying intention to create new art. On October 24, 1999, two art students, Yuan Chai and Jian Jun Xi, jumped onto Tracey Emin's work, *My Bed*, at the Tate gallery, and named the action *Two Naked Men Jump Into Tracey's Bed*.^[61] The pair was seminaked and staged a pillow fight on the bed, then attempted to drink from one of the vodka bottles on display.^[62] Security guards took them away before they could finish the rest of their performance plans, including touching the bed, smelling it, and performing “critical sex,” all of which they felt were necessary responses to the piece.^[61,62] Chai and Xi had slogans written on their bodies in English and Chinese that they claim were statements to “make the public think about what is good art.”^[61] They were detained at the police station, but ultimately were not charged, in accordance with the wishes of the artist and the museum.^[61,62]

As acts of vandalism are brought into public discourse, some forms, such as graffiti (mentioned earlier) eventually become recognized and legitimized as art. It was once seen as a form of “subversive public communication,”^[63]

but now is considered an art form from certain perspectives. In the process of creating graffiti, public property is defaced and therefore considered an illegal act of vandalism. However, the artistic quality of many graffiti paintings on buildings and moving subway cars attracted the attention of art collectors and entered the world of museums and art galleries in the form of large canvasses or pieces of paper in the late twentieth and early twenty-first centuries.^[63] For instance, from June 30 to September 3, 2006, the Brooklyn Museum presented an exhibition, titled *Graffiti*, which displayed 20 large-scale graffiti paintings from multiple artists.^[63] Such exhibitions blur the boundaries of graffiti's status as both a form of art and an accusable crime. Although the gallery graffiti pieces involved a change of medium from public property surfaces to canvasses or paper, the legitimization of graffiti as an art form extends from within the gallery or museum into the public sphere.

Museum Responses to Vandalism

Vandalism presents another serious threat to the ethical and professional responsibilities of museums and galleries. As with theft, the best responses are preventative measures that protect collections on display and prevent damage from occurring. Once vandalism has happened, museum responses are influenced by the severity of the damage and the value of the work that is affected.

The most passive response is no response, to the point where no legal action or claims for damages are made at all. This strategy might be explained by the belief that great publicity of a sensational crime only encourages the perpetrator and inspires other vandals, since ideological vandalism, for example, relies on publicity for the transmission of the message to a wider audience.^[64] The attack on the *Rokeby Venus* was impossible to hide in this manner, since the crime and political cause was so highly contentious. The gallery was closed temporarily, but women who attempted to visit it unaccompanied were denied admission for a longer period of time. More recently in 1999, Lars Kiel Bertelsen and Klaus Christensen were not permitted access to any archive files on the case in the National Gallery, London, and the writers argue that this refusal is symptomatic of the institutional repression of such acts of vandalism, even when the act itself was impossible to repress at the time.^[58]

While some museums have suppressed the effects of vandalism, others have attempted to harness the violence and chaos inherent in such acts in the name of creative expression. The Detroit Museum of New Art's (MONA) *kaBOOM!* program in 2002 is an example of a gallery show that encouraged visitors to participate in the creation and manipulation of art through its destruction. MONA announced that over the course of the exhibition, visitors would be invited "to smash, drop, throw, and slash artworks..." as an expression of the chaotic, violent

nature of modern life.^[65] The show was inspired by the work of the Dadaists, which rejected the traditional standards of aesthetics and intellectualism by embracing chaos, irrationality, and surrealism in literature, theater, and the visual arts. These artists also attempted to provoke violent visitor participation, as with the 1920 *Dada Spring Awakening* show, which included a large sculpture of the Dadaist, Max Ernst, with an axe beside it, along with an invitation to smash anything in the gallery.^[66] Both *kaBOOM!* and *Dada Spring Awakening* investigated the relationship between the artist and the visitor. Although the question remains as to whether permitted defacement can actually be defined as vandalism, by allowing visitors to demolish or alter works of art, these shows also transform the relationship that exists between the public and otherwise untouchable museum or gallery pieces. In this context vandalism is no longer a crime, but a positive, creative act that connects museums to their visitors.

An artifact or a work of art that has been vandalized requires some form of treatment to minimize the damage and prevent any further deterioration of the piece. Instances of smeared lipstick or smudged ink are relatively easy to treat while more serious cases, such as cuts in a canvas or cracks in a sculpture, require treatments that are more costly and time-consuming, and may even raise ethical issues for the museum because the restoration of an object automatically alters its original state. For example, Rembrandt's *Danae* (created 1636; vandalized 1985), which is held at the State Hermitage Museum in St. Petersburg, Russia, was slashed with a knife, and poured over with approximately 1 L of sulfuric acid. The attack occurred on a Saturday afternoon when the museum's director and members of the restoration department were off site. Since no immediate professional assistance was on hand, the damage to the painting was considerable. The first direct action taken to salvage the work was suggested by two professors from the St. Petersburg State Institute of Technology nearby, who arrived on the scene about an hour after the event and advised that the picture be kept upright and rinsed with water in order to minimize the destruction until the return of properly trained staff. Afterward, the work was painstakingly inspected by professional conservators, and over the next 12 years restorers at the Hermitage worked over the canvas with microscopes and specialized equipment, using a full-sized reproduction as a mapping guide. The process was extremely difficult, and the use of water has since been critiqued on the grounds that the extra liquid facilitated the spread of the acid, highlighting the many challenges museums face in responding to acts of vandalism.^[67]

PREVENTION OF THEFT AND VANDALISM IN MUSEUMS

As repositories for cultural property, museums have a public responsibility not only to respond to acts of theft

and vandalism appropriately, but also to protect the collections in their care. In 1974 ICOM established ICMS to publish a compilation of security recommendations, titled *Museum Security* (1977, 1993), for cultural heritage institutions worldwide. This was followed by the *Museum Security Survey* (1981), a companion book in the form of a detailed questionnaire designed to identify security risks in cultural facilities.^[68] Two principles that these books advocate are that every individual is responsible for the protection of cultural heritage, and that preventing crime in the museum means keeping the building secure 24 hr a day, every day of the year.^[69]

Security policies and procedures are an important aspect of museum protection. They allow staff to identify security goals and objectives, and to implement them in an institution-wide effort. Policies designate levels of responsibility and authority while setting out the existence of procedures, including key control, locks, access, property control, investigative services, security surveys, artifact escort, alarms, guards, exhibit security requirements, and storage security requirements. Both staff members and volunteers alike use procedures and regulations such as these when working in museums, which help to ensure a high standard of care for their respective collections.^[70]

From the building's exterior perimeter to the galleries' display cases, numerous low-tech measures are taken to prevent theft and vandalism in museums. Objects are separated, and thus protected, from visitors through the use of glass encasements, velvet ropes, metal bars, and raised platforms. To prevent theft, security hardware for cases and frames are used, such as specialized fasteners, screws, and hooks.^[70] To deter unwanted graffiti and some forms of play vandalism on art, ink- and scratch-resistant coatings are available for use on durable material types.^[71] To prevent damage, many museums establish rules of behavior for their galleries and require that large groups are chaperoned.^[72] Most institutions provide some form of a complimentary coat-check service so that visitors do not take bulky garments or oversized bags into the museum, because both of these could be used to smuggle tools into the galleries or sneak stolen objects out. Museums attempt to prevent theft and vandalism in the off-hours by locking all doors and windows and using exterior lighting as a deterrent for potential predators. Whenever possible, security systems ranging from alarms to on-duty security guards or regular police patrols are used to protect the museum and its collections.^[73]

In addition to these security measures, many museums are adopting a technological approach to protecting their objects within galleries and storage spaces, typically through alarms and surveillance. Equipment used to monitor a space includes closed-circuit television (CCTV) cameras as well as electromagnetic locks and key cards. CCTV cameras are installed in public spaces, while the image feeds to a central station, contacting security guards in the event of a suspicious incident. The systems may

range from elaborate color cameras with the ability to pan and tilt, to simpler cameras that provide black and white, static images.^[74]

Internal security is an extremely important measure for preventing theft and vandalism from occurring within gallery spaces. Limiting and tracking access to collections minimizes the risk of theft from storage areas. Few employees should have keys to a storage room, and in some cases, an identification check with a security guard is required prior to entry.^[75] Damage or theft can also occur when visitors gain access to these areas. A collections access policy is used to determine procedures, supervision, and levels of permission for visitors. Study areas, learning centers, visible storage, online catalogs, and photographs are all used to provide access to the collection without admittance to secure storage areas. Visitor screening is a common practice with permission given only to genuine researchers or students. In some cases, institutions require access request letters or forms, including institutional affiliation, purpose, duration of the study, proposed use of the information, and references. Vigilant record keeping discourages potential thieves and vandals as periodic inventories identify and potentially halt such acts.^[76]

Mechanisms to detect theft or vandalism can encompass an entire building or focus on a single artifact. Regardless of the area or object being protected, alarms consist of a sensor to identify a problem, a method of communicating and announcing the problem, and a response.^[74] There are a number of different types of sensors that are used to activate an alarm, including those triggered by vibration, motion, pressure, or disruption of an electric current. Exhibit cases carry such alarms, using sensors that activate when the glass is broken. Motion detectors are also useful in exhibits where artifacts or artworks are not contained within a case. If a visitor wanders too close, the alarm will chirp alerting both the individual and security personnel. Magnetic detectors are more suitable as general intrusion alarms around perimeter windows and exterior doors.

Traveling exhibitions and outgoing artifact loans are another security risk for museums. Formal loan agreements detail artifact inventories, conditions, insurance, and security procedures. A common practice is to use a designated courier whose responsibility it is to ensure the safety of the objects at all times.^[77] Transportation details are usually undisclosed, in the sense that travel routes, dates, and times are maintained on a need-to-know basis.^[78] Fine art transportation is a lucrative business worldwide with 79 independent firms belonging to the International Convention of Exhibition and Fine Art Transporters, where members meet annually to develop professional standards for the care and transport of art and antiquities.^[79]

Outdoor sites are more vulnerable to theft and vandalism because these spaces are not easily enclosed and are rarely guarded 24 hr a day. In many countries, laws exist

to deter theft by establishing such sites as protected and the artifacts as national property, prohibiting their collection, trade, or export. In 1970, in response to market demands for cultural property, the United Nations Educational, Scientific and Cultural Organization held the Convention on the Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property;^[80] it is ratified by 102 countries to date.^[81] In many countries, however, this does not eliminate cultural theft, since most artifacts from outdoor sites are not documented, and are either indiscoverable as protected objects or are inadequate evidence in court.^[82] The prevention of theft and vandalism to these types of public spaces is a continuing struggle facing professionals in the cultural heritage field today.

CONCLUSION

Accounts of theft and vandalism in museums and other public spaces highlights the value that society places on its collective heritage, and blurs the definitional lines between what is considered crime and what is considered art. In each instance, the motivations behind the action and the value of the art or artifact involved determine how the museum or public will respond to its loss or desecration. Theft presents a clear example of crime in museums, which may serve to increase both the monetary and emotional value of the object with its disappearance, as described in the case study of the theft of the *Mona Lisa*. While vandalism has traditionally been associated with some of the worst examples of museum crime, it has also acted as a powerful tool of self-expression and inspired art movements, pointed to by the discussion of the Dadaists and graffiti artists. The introduction of new technologies and systems in today's cultural heritage institutions allows for increased security and prevention against these and other criminal acts, as well as the shared knowledge and international effort toward the recovery of stolen goods. With these organizations and institutions working together, along with increased public awareness and societal responsibility, museums will ensure that all objects in their collections survive for the benefit of future generations.

KEY INDIVIDUALS AND ORGANIZATIONS

Art Loss Register: The world's largest private database of lost and stolen art, antiquities, and collectibles, created in London in 1991 to minimize and deter art crimes, as well as facilitate the recovery of lost or stolen works (<http://www.artloss.com>).

Association for Research into Crimes against Art (ARCA): Focuses on the motivations behind art vandalism and theft, as well as forgery, acting as consultants on art protection and recovery issues (<http://www.artcrime.info>).

Federal Bureau of Investigation Art Crime Team: The FBI established its Art Crime Team in 2004, composed of 12 Special Agents, each responsible for addressing art and cultural property crime cases in an assigned geographic region. The team is coordinated through the FBI's Art Theft Program in Washington, DC (<http://www.fbi.gov>).

International Convention of Exhibition and Fine Art Transporters (ICEFAT): A worldwide democratic organization of independent art transporters dedicated to promoting the highest standards of professionalism in the field of museum and gallery shipping (<http://www.icefat.org>).

International Council of Museums (ICOM): An international network of museum professionals, institutions, and committees held to their own Code of Ethics in museums (<http://icom.museum>).

International Committee on Museum Security (ICOM-ICMS): A committee formed by ICOM to represent and support their aims and objectives with reference to museum security by providing advice, programs, and forums for museum professionals.

International Foundation for Art Research (IFAR): This organization offers information on authenticity, ownership, theft, and legal and ethical issues related to stolen objects, including issues of looting followed by repatriation, and scholarly information related to ownership and law (<http://www.ifar.org>).

Interpol Art Theft Division: A division of the U.K. police force, which facilitates the sharing of information related to the theft and disappearance of art and artifacts among different police departments in the effort of recovery (<http://www.interpol.int>).

Metropolitan Police Art and Antiques Unit: This unit is responsible for the collation and dissemination of intelligence pertaining to art crime and continues to run and update the London Stolen Art Database (<http://www.met.police.uk/artandantiques/>).

Museum Security Network (MSN): This organization provides a listserv for museum professionals, providing current events related to security and crime in cultural heritage institutions (<http://www.museum-security.org>).

National Stolen Art File: An American register used by the FBI Art Crime Team to minimize and deter art crimes, as well as facilitate the recovery of lost or stolen works (<http://www.fbi.gov>).

United Nations Educational, Scientific and Cultural Organization (UNESCO): A United Nations agency that promotes international cooperation in the fields of education, science, culture, and communication (<http://www.unesco.org>).

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Theological Librarianship

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Abstract

Christian theological libraries trace their origins to the early church. Early centers included Jerusalem, Alexandria, and, most famously, Caesarea, where the library supported the work of such scholars as Origen, Eusebius, and Jerome. The Vivarium, a religious community founded by Cassiodorus, provided a model for medieval monastic libraries. At the close of the Middle Ages faculties of theology developed libraries that continue to this day. In North America independent seminaries and schools of theology appeared in the early nineteenth century in response to the rise of Unitarianism. The American Theological Library Association was founded in 1947 in part to improve standards for theological libraries. It has played a leadership role in the professional development of theological librarians, and the indexing and preservation of theological literature. Theological libraries range in size from small operations supporting the curriculum to comprehensive research institutions. Many theological libraries remain small and underfunded.

When you come, bring the cloak I left with Carpus at Troas, also the books, and above all the parchments (2 Tim.4:13).

Theology is a text-based discipline. From their beginnings, Christians used books. For Christian theology those texts begin with the Bible, originally the Hebrew Bible, or Old Testament, and its Greek translation, the Septuagint. Then, early in its history, Christians adopted selected apostolic writings as the New Testament. There were also other, noncanonical writings, both Christian and Jewish, almost from the beginning, some of which no longer survive. Other early Christian literature includes sermons, letters, and, increasingly as time went by, polemical and apologetic treatises. The growth of the literature of theology led to the creation of libraries.

ORIGINS

There were three types of early Christian libraries: congregational, larger libraries in Christian centers, and monastic. Even small communities built libraries that served their liturgical, catechetical, and archival needs. The libraries established at larger centers helped to support scholarship, often with the support of the local bishop.^[1] Early centers included Jerusalem, Alexandria, and, most famously, Caesarea.

The library at Caesarea is a model for how Christian libraries were created and how they were supported during the first centuries after Christ. Origen (ca. 185-ca. 254) moved from Alexandria to Caesarea, bringing with him his personal library, which included Biblical texts,

commentaries, and technical works. Origen used his library as the basis for a prolific output of commentaries, homilies, and other works of scholarship. His most notable work was the Hexapla, which included the Hebrew and Greek texts of the Old Testament in parallel columns. Late in the third century, a wealthy Christian presbyter, Pamphilus (d. 310), settled in Caesarea and began to accumulate a library of sacred works, the core of which came from Origen's library. The collection that he built became so famous in latter antiquity that it was described, with some exaggeration, as the Christian equivalent of the library of Alexandria. Like the library of Alexandria, this was no mere collection of books, but a place where books were copied, emended, and produced. Eusebius (260–339), Pamphilus' student and the eventual bishop of the city, continued to expand the library and based his scholarship upon it. Jerome notes that Euzoios, bishop of Caesarea from ca. 376 to ca. 379, set out to restore the library by having its holdings copied from papyrus scrolls onto parchment codices.^[2]

Christians were early adopters of the codex. By the end of the first century the codex became the standard format used by Christians, while others in the ancient world continued to use the papyrus scroll. The advantages of the codex include economy (writing on both sides of paper), compactness, comprehensiveness (collected editions), convenience of use (it can be read using one hand rather than two), and ease of reference.^[3]

One of the best documented monastic libraries was that founded by Cassiodorus (ca. 487–ca. 580). After a distinguished political career, Cassiodorus founded a monastic community called the Vivarium. Here he brought together a large library of Christian and classical texts for the

education of the community of monks, as described in his *Institutiones divinarum et saecularium litterarum*. The community was not only to study the books he gathered, but was also charged with producing copies.^[4] The Vivarium came to serve as a model that was followed by monastic communities during the Middle Ages. Indeed, it is due in no small part to these monastic communities that the literature of antiquity, both Christian and secular, survived. An example of the use to which such a library could be made is provided by the Venerable Bede (673–735), who, working independently, but with access to a good library at the monastery at Jarrow, produced impressive works of scholarship that were highly valued throughout the Middle Ages. The library upon which he relied was destroyed by Viking raiders in about 860.

EUROPEAN THEOLOGICAL LIBRARIES

Effective as they were at preserving the literature of antiquity, monasteries were not learned academies, but rather, “schools for the practice of virtue.”^[5] While Roman civilization remained alive in isolated communities, there was a general decline in learning after the fall of the Roman Empire. This was arrested for a time by the Carolingians, who aimed for nothing less than the reform of society through education, especially in the language arts, with the goal of establishing a Christian civilization. Their essential contribution was that they established a minimal standard of literacy to be promoted “by every bishop and every abbot,” and that the enterprise was to be underwritten by the consistent and generous patronage of the state.^[6] The result was a sustained period of creativity. Scholars emended ancient texts and wrote new works designed to undergird the study of the liberal arts and sacred texts. Teams of scribes toiled in scriptoria to produce manuscripts both for their own use and for distribution.^[7] Indeed, very little literature survives from the ancient world, sacred or profane, that was not copied during the Carolingian era. To train the scribes, religious leaders, and government officials necessary to support their empire and its programs, the Carolingians established schools that were supported by the public authority. Associated with the better schools were libraries. Laon stands as one example of the cathedral library.^[8]

By the twelfth century the cathedral and monastic schools began to give way to a new way of studying of theology. Up to this point scholars had worked largely independently, despite the advances made under the Carolingians. In the twelfth century for the first time there was a large enough community of teaching masters and an environment in which they and their pupils could meet freely for it to be possible to speak of a general revision of educational methods and purposes.^[9] In this context the study of theology as an academic discipline evolved. Bernard of Chartres described himself and his twelfth-century

contemporaries as “dwarfs standing on the shoulders of giants.”^[10] The masters of the twelfth-century were not, for the most part, great men, but the schools they set up were for the first time recognizably “academic” in the modern sense, in that they were characterized by a steady aggregation of small changes. The schools that grew up in the twelfth century prepared the way for the development of the university in the thirteenth. The books that were to become the basic theological textbooks for the remainder of the Middle Ages were written during the twelfth century, including the *Glossa ordinaria*, a compilation of patristic commentary on the Biblical text, the *Historia scholastica* of Peter Comestor, an aid for understanding the literal sense of the Bible, and, most important, the *Sentences* of Peter Lombard, which might be characterized as the first systematic theology textbook. These textbooks were a new kind of book—not meant to be read straight through, but rather to serve as references, complete with such apparatuses as indexes, running heads, and marginal notations.^[11]

The educational model that developed was for basic education to take place in the grammar school, then the study of the seven liberal arts in an academy or Latin school, followed by the study of theology in a university faculty of theology.^[12] As the schools developed, they gathered libraries to support their teaching. The pattern remained much the same following the Reformation, with the exception that the faculties of theology would be either Protestant or Roman Catholic.

THE NORTH AMERICAN EXPERIENCE

From colonial times Protestants in North America adopted the English model for training clergy. Colleges were established for the training of leaders for “church and civil state,” in the words of Yale’s charter. For most clergy in colonial times the bachelor’s degree provided sufficient training. A minority might choose to read theology with a college professor or with a local clergyman. This practice increased somewhat after the Great Awakening, so much so that some senior clergy became what might be called “one-teacher schools,” with several students in residence at any given time.^[13] The rise of Unitarianism in the beginning of the nineteenth century led to the perceived need to have better trained clergy, which led to the creation of theological seminaries, beginning with Andover in 1808. Within the next two decades the number of theological seminaries and divinity schools mushroomed. Many of the smaller seminaries were “poorly endowed, inadequately staffed and under-enrolled.” There are three indicators of the relative strength of the schools: the size of faculty, the number of students enrolled, and the size of library. “Although the number of books in the library was not an absolute guide to the quality of education, a rough correlation existed between library acquisitions and

educational standards,” for the availability of an adequate library was the major factor supporting the professional development of faculty.^[14]

Standards for theological seminaries remained problematic throughout the nineteenth century and into the twentieth. The Conference of Theological Schools was created in 1920 to help the schools address this problem. This organization was restructured in 1936 as an accrediting agency, the American Association of Theological Schools (AATS). Of the 46 schools accredited in its first year, all but 11 had notations for lack of adherence to standards. One initiative the AATS (later, ATS) undertook to improve the libraries of its member institutions was to help to found the American Theological Library Association (ATLA) in 1947. Yet, even though each successive version of the AATS standards would raise the bar for seminary libraries, especially for professional staff, many seminary libraries have remained small and poorly financed.^[15]

THE ATLA

The first meeting of what was to become the ATLA took place June 23–24, 1947, at Louisville Presbyterian Seminary. For a fuller account of the first 50 years of the American Theological Library Association, see O’Brien and O’Brien.^[16] AATS invited 110 institutions to the meeting. Fifty librarians, one seminary president, and one dean attended. From the outset they faced daunting problems, and set about immediately to address them. At the very first conference a committee was appointed to look into the indexing of theological journals. By 1952 the committee had devised a plan whereby staff at 20 institutions would share responsibility for indexing, under the leadership of Stillson Judah. The result was the *Index to religious periodical literature*. The 1949 conference appointed a Committee on Microphotography. Initially the purpose of its program was to reproduce the literature of theology so that the texts could be distributed to member institutions. In 1951 a committee on cataloging and classification was appointed. One of the problems they faced was that theological libraries at the time were using at least three different classification systems: the Dewey Decimal System, the Library of Congress classification system, and the system devised by Julia Pettee at Union Theological Seminary in New York. For more on her remarkable career, see Spoor.^[17] In 1952 there was a joint ATLA/AATS committee on accreditation standards. The new standards shifted the emphasis on adequacy away from quantitative measurement to a focus on the educational process.

The importance of ATLA’s efforts was recognized within a decade of its founding by the awarding of several grants. In 1956 the Sealantic Fund gave ATLA a grant of \$110,000: \$80,000 for microtext and \$30,000 for

indexing. To oversee the expenditure of these funds, the following year the Board of Microtext was organized, with Raymond P. Morris as chair (he served until his retirement in 1972). That same year the Board on Religious Periodical Literature was established with Jannette E. Newhall as chair and Lucy Markley as editor. In 1960 Calvin Schmitt was appointed chair (he retired in 1979) and G. Fay Dickerson as indexer (she retired in 1984). The experiment of having volunteers prepare the index came to an end.

In the 1960s ATLA received a series of grants from the Lilly Endowment and the Sealantic Fund for the training of theological librarians. The normal pattern up to that time was that schools would appoint a faculty member as the librarian, who would oversee a staff with training in library science, but no background in theology. The programs developed with this funding were sufficiently successful that a decade later the norm became that library staff would have training in both library science and theology.

Another transformative grant was received in 1961: the Sealantic Fund gave \$875,000 to support the Library Development Program. The primary objective of the Program was to increase book purchases, thereby strengthening the libraries’ collections. The Program was designed in such a way that participating libraries would also have to increase staffing levels to participate. By the third year of the grant, all 85 eligible AATS institutions participated in the Program either fully or in part. Library expenditures rose in those three years from \$2.8 million to more than \$3.877 million. For more on the Library Development Program, see Stuehrenberg.^[18]

By the 1970s there was a growing recognition of the need for preservation of microfilming. Charles Willard and Andrew Scrimgeour conducted a study that led to the creation for preservation microfilming program for monographs. In September 1985 Robert P. Markham was hired as the Director of Programs for the preservation effort. ATLA became a significant participant in national efforts to reformat brittle books. Over the period of 1987–1992, ATLA received nine National Endowment for the Humanities (NEH) grants totaling \$1,524,330 and filmed 19,000 titles. ATLA continued an active preservation program into the new millennium. Recent microfilming projects receiving NEH funding include Christianity and the Encounter with World Religions, 1850–1950, African American Religious Serials, 1850–1950, and Religious Periodical Literature of the Hispanic and Indigenous People of the Americas, 1850–1985.

In 1976 the *Index to religious periodical literature* was renamed *Religion index one*, and ATLA began the publication of *Religion index two: multiauthor works*. This was followed in 1980 by a volume indexing *Festschriften, 1960–1969*, which was prepared by Betty and Elmer O’Brien. In 1982 a retrospective project, *Religion index two: multiauthor works, 1970–1975*, filled in the gaps

between the two publications. The last print volume of *Religion index two* appeared in 1999.

The *ATLA religion database*, incorporating both *Religion index one* (periodicals) and *Religion index two* (multiauthor works) first appeared on CD-Rom in 1989. Initially it was published and distributed by H.W. Wilson. That arrangement ceased in February 1993, when ATLA first produced its own disc. For an account of the birth of the ATLA religion database on CD-Rom, see Moore.^[19] In 2008 ATLA discontinued all CD-Rom products, with the database now available online.

The *Ethics index* was conceived of as a way for ATLA to broaden its presence in the electronic reference marketplace and to serve as a source of additional revenues during a period of institutional downsizing and scarcity of funds among theological libraries. It first appeared in February 1994. However, the anticipated expanded market did not materialize, and the ATLA budget was in deficit for two years in a row. ATLA abandoned the project, with the last CD-Rom appearing in June 1996. ATLA was forced to reduce staff in order not to go bankrupt, and then began rebuilding.

In 1997 ATLA signed contracts with SilverPlatter and FirstSearch to distribute the *ATLA religion database*, followed in 1999 with Ebsco. These agreements paved the way for a dramatic increase in ATLA's revenues, a phenomenon that has continued to this day. The *ATLA religion database* is now accepted as the standard index for religious periodical literature in the academic marketplace.

In 2001 ATLA undertook the Retrospective Indexing Project, which consisted of the indexing of pre-1949 volumes of titles included in the *Index to religious periodical literature*. More than 100 institutional members pledged support. Originally 134 titles were on the list for retrospective indexing. The project ended in August 2005 with 40,000 index records for 47 periodical titles.

In 1999 ATLA announced the coming of ATLAS (ATLA serials), with a promise to supply full-text electronic access to 50 years of 50 journals. The project was launched on January 31, 2001, with a \$3.94 million grant from the Lilly Endowment. As of August 2006 there were 86 journal titles in ATLAS and 192,768 articles.

Also in 1999 ATLA completed the conversion of the back file of *Old Testament abstracts* and signed an agreement to produce an electronic edition of *Catholic periodical and literature index*. In 2004 *New Testament abstracts* was added to its electronic publications.

From 1985 to 1991 ATLA underwent a thorough restructuring of its governance, programs, finances, and staffing. The restructuring followed a financial management study by Peat, Marwick funded by a \$25,000 Lilly Endowment grant. Previously ATLA's management structure was thoroughly decentralized, with operations dispersed between such places as Chicago, Princeton, and St. Meinrad, with bank accounts in Fort Worth,

incorporation in Delaware, and executive responsibility changing location each year to wherever the president might be located. The reorganization merged ATLA's two semiautonomous program boards (Preservation and Indexing) with the Board of Directors, resulting in one Board with the power to define the association's mission and to set policy. By appointing an executive director as the chief executive officer, bringing all staff together at a headquarters location, adopting a unified budget, and following accepted accounting procedures, ATLA was able to use its resources more effectively.^[20]

In the reorganization, ATLA adopted the Carver Policy Governance model (<http://www.carvergovernance.com/model.htm>), under which the Board of Directors sets policies and charges the Executive Director with carrying them out within certain executive limitations. The mission of ATLA is currently defined as fostering the study of theology and religion by enhancing the development of theological and religious libraries and librarianship. In pursuit of that mission ATLA (<http://www.atla.com/about/html>) has four organizational ends:

1. To foster the professional growth of its members, and to enhance their ability to serve their constituencies as administrators and librarians.
2. To advance the profession of theological librarianship, and to assist theological librarians in defining and interpreting the proper role and function of libraries in theological education.
3. To promote quality library and information services in support of teaching, learning, and research in theology, religion, and related disciplines, and to create such tools and aids as may be helpful in accomplishing this.
4. To stimulate purposeful collaboration among librarians of theological libraries and religious studies collections; and to develop programmatic solutions to information-related problems common to those librarians and collections.

The membership elects the Board of Directors, who have "moral ownership" of the Association. The structure of the annual conference was changed from having standing committees to the establishment of "Interest Groups," which are created by the membership. The current interest groups include Collection Evaluation and Development, College and University, Judaica, Lesbian and Gay, Public Services, Special Collections, Technical Services, World Christianity, and World Religions. Denominational groups also meet at the annual conference.

Since the Executive Director is responsible for carrying out policies established by the Board of Directors, the Executive Director appoints advisory committees that help the Executive Director to understand the interests of the membership. Current advisory committees include the Professional Development Committee and the

Publications Committee. The Executive Director also appoints the Annual Conference Committee and the Education Committee, which is responsible for continuing education at the annual conference. Standing committees of the Board of Directors include the Endowment Committee and the Nominating Committee. The Special Committee of the Association for International Collaboration coordinates the Association's activities regarding international theological librarianship, supports efforts of individual libraries and librarians to participate in international theological librarianship activities, and plans annual conference activities relating to international theological librarianship.

Before the reorganization members volunteered hundreds of hours each year to running the projects, programs, boards, and committees of the Association. With the reorganization members now rely on professional staff to manage the Association's affairs, leaving the members free to focus on furthering the professional ends of theological librarianship.

Begun as an association of Protestant theological libraries from North America, ATLA now is the premier professional association for theological libraries for all branches of Christianity, Protestant, Roman Catholic, and Eastern Orthodox. While member libraries are still primarily from North America, ATLA has a growing number of international library institutional and individual members, as well. Individual and institutional members are listed in the annual *Summary of Proceedings*.

OTHER PROFESSIONAL ASSOCIATIONS SUPPORTING THE WORK OF THEOLOGICAL LIBRARIES

The Association of Christian Librarians (<http://www.acl.org/>) was established in 1957, and today has more than 500 individual and nearly 150 institutional members representing a wide spectrum of denominations. Members work in a variety of libraries, including Bible colleges, seminaries, colleges, and universities. Members are asked to subscribe to a statement of faith. They publish the periodical the *Christian librarian*, and print and online versions of the *Christian periodical index*, the leading guide to periodical literature from the evangelical perspective.

The Association of Jewish Libraries (AJL) (<http://www.jewishlibraries.org/ajlweb/index.htm>) promotes Jewish literacy through enhancement of libraries and library resources and through leadership for the profession and practitioners of Judaica librarianship. AJL was created in 1965 as a result of the merger of two organizations: the Jewish Librarians Association (founded in 1946), which concerned itself with collections of Judaica in academic, archival, or research institutions and the Jewish Library Association (founded in 1962), which concerned itself

with collections in synagogue, school, and community center libraries, as well as other smaller libraries and media centers. They publish a quarterly newsletter, convention proceedings, and an annual scholarly publication, *Judaica librarianship*.

Established in 1921, the Catholic Library Association (CLA) (<http://www.cathla.org/index.php>) is an international membership organization, providing its members professional development through educational and networking experiences, publications, scholarships, and other services. CLA coordinates the exchange of ideas, provides a source of inspirational support and guidance in ethical issues related to librarianship, and offers fellowship for those who seek, serve, preserve, and share the word in all its forms. Members come from a variety of institutions, from primary schools and congregational libraries to universities and seminaries. CLA publishes a quarterly journal, the *Catholic library world*, and the *Catholic periodical and literature index* (now distributed in electronic form in partnership with ATLA).

INTERNATIONAL THEOLOGICAL LIBRARY ASSOCIATIONS

Australian and New Zealand Theological Library Association (ANZTLA) (<http://www.anztla.org/>), founded in 1985, is an association of both individual and institutional members. It maintains the *Australasian religion index online* (formerly published as a print index since 1989) and the *Australasian union list of serials in theological collections online* and an online *Newsletter*.

The Forum of Asian Theological Librarians (ForATL) (<http://www.foratl.org/index.htm>) traces its origins to the Consultation of Asian Theological Librarians held in May 1991 in Chiang Mai, Thailand, under the sponsorship of the Programme for Theology and Cultures in Asia. It has institutional and individual members from throughout Asia. Membership is chiefly from Protestant institutions. It sponsors periodic consultations and has published a directory of Asian theological libraries.

Bibliothèques Européennes de Théologie (BETH) (<http://www.theo.kuleuven.be/beth/>) was founded in 1954 under the auspices of UNESCO as the International Association of Theological Libraries. Today BETH is an ecumenical association of the national theological library associations in Europe, with additional members gathered from among the various individual theological libraries that are recognized as extraordinary in their scope, either from their collections or from their influence in the international sphere. For an account of the founding of BETH, see Geuns and Wolf-Dahm.^[21]

Red Latinoamericana de Información (RLIT; formerly the Latin American Theological Information Network, <http://www.ibiblio.org/rlit/>) was founded in 1994 and has members from throughout Central and South America. It

is open to all theological libraries, but membership is predominantly Protestant.

In addition, there are national theological library associations in many countries.

THEOLOGICAL LIBRARIES TODAY

Theological libraries today are a diverse group of institutions, ranging from one-person operations to denominational seminary libraries to university-related divinity libraries. Theological libraries can be divided into four categories. The first two types have collections that essentially support the curriculum in the broader sense; that is, besides the curriculum proper, they provide access to the Christian heritage reflected in the curriculum. The first type collects materials almost exclusively North American publications, with only a minimum of foreign materials. This type of library likely acquires between 800 and 1200 volumes per year and not more than 200–300 journals. Type two libraries would acquire additional foreign materials and their acquisitions programs might double that of type one libraries. A type three library also gathers documentary literature, understood as a broad segment of non-scholarly religious literature, such as the literature produced by a denomination. Type four libraries are research institutions. They seek to acquire the scholarly literature essential to the history and development of all branches of Christian thought without regard to language, date, country of origin, and theological perspective. The focus is not on being exhaustive, but on acquiring the scholarly literature that has defined and is shaping Christian thought.^[22]

In the 1970s ATS encouraged theological schools to merge their libraries to make it possible to build larger, more efficient libraries. The Graduate Theological Union in Berkeley, CA, is one of the more successful examples. Nine schools went together to create what instantly became one of the largest theological libraries in the country. Their cooperation also enabled them to create a graduate program that none of them could have accomplished on their own. Another example is the JKM Library in Chicago, which now serves the Lutheran School of Theology at Chicago and McCormick Theological Seminary. Both institutions, while maintaining their separate identity, are now located in the same complex with a common library. The three seminaries of the Eastern Cluster of Lutheran Seminaries (located in Columbia, SC; Gettysburg; and Philadelphia, PA) have undertaken the experiment of having one library in three locations, with a common collection development policy. Books remain in the physical location where they last circulated. Many other seminaries have developed distance education sites, or satellite campuses, requiring them to find creative ways of providing library services.

The world of theological librarianship is relatively small. In 2005 ATLA had 492 individual members and

265 institutional members. That means that there are relatively few positions open at any given time. But when a position does come open, qualified candidates are highly sought after. Theological libraries in North America today tend to prefer candidates for professional positions who have at least masters' degrees in both library science and theology (or a related discipline). For training in library science, most candidates follow the academic librarianship track in ALA-accredited schools. ATLA now sponsors a course in theological librarianship offered through the University of Illinois that can be taken by students at other institutions as a part of their program. Postings for some directorships require a doctorate, usually in one of the disciplines of theology. Many institutions outside of North America tend to require less theological training for library staff, often assigning some professional activity, such as book selection, to faculty.

In a recent survey two-thirds of the theological librarians responding considered theological librarianship to be a ministry, while the other third considered themselves to be in an occupation that happened to be at a theological institution.^[23] Many theological librarians, especially those in denominational seminary libraries, may also be ordained clergy. Many theological librarians have faculty status, especially for the director, sometimes for other professional staff as well. Theologically trained librarians also work in other types of libraries, as well, especially college and university libraries, doing a variety of tasks, such as subject bibliographers, general reference, and cataloging of humanities resources.

As is the case with librarianship in general, technology is changing theological librarianship. While an increasing number of theological journals are available electronically, many are still available only in print, and likely will be for some time. In part this is because most religion periodicals are published by organizations that issue one or two journals. As already noted, ATLA is one of the major providers of electronic periodicals through ATLAS. On the other hand, since theology is a text-based discipline, there is an increasing corpus of theological texts available electronically. Several publishers provide packages of Biblical texts and reference works, including Logos Bible Software and BibleWorks. Patristic and medieval authors are covered by the electronic editions of *Patrologia Latina*, *Patrologia Graeca*, and *Corpus Christianorum*. *Past Masters* provides critical texts for selected philosophers and theologians. And there are electronic texts available for an increasing number of theologians, including such figures as Thomas Aquinas, Martin Luther, and Karl Barth.

What of the future of theological libraries? According to Dan Aleshire, Executive Director of ATS, they will be with us for the foreseeable future. The purpose of the academic library has been to provide access to trustworthy, authoritative knowledge. The library has historically controlled for "authoritative and trustworthy" through its

collection development policies, and controlled for "access" through its organizing, cataloging, and circulating.^[24] While the manner in which libraries deliver those services in the future may vary, teaching and research will continue to have need of those services.

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Topic Maps

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Abstract

Topic Maps is an international standard technology for describing knowledge structures and using them to improve the findability of information. It is based on a formal model that subsumes those of traditional finding aids such as indexes, glossaries, and thesauri, and extends them to cater for the additional complexities of digital information. Topic Maps is increasingly used in enterprise information integration, knowledge management, e-learning, and digital libraries, and as the foundation for Web-based information delivery solutions. This entry provides a comprehensive treatment of the core concepts, as well as describing the background and current status of the standard and its relationship to traditional knowledge organization techniques.

INTRODUCTION

Topic Maps is a standard technology for describing knowledge structures and using them to improve the findability of information. It is based on a formal model that subsumes those of traditional finding aids, such as indexes, glossaries, and thesauri, and caters for the additional complexities of digital information. The model is defined in an ISO standard (ISO 13250), along with interchange syntaxes, a formal semantics, and a graphical notation. Ancillary standards define a Topic Maps Query Language (TMQL), a Topic Maps Constraint Language (TMCL), and mappings to other knowledge organization specifications, such as Dublin Core. Since its initial standardization in 2000, Topic Maps is finding increasing application as the foundation for Web sites and portals, as well as in knowledge management (KM), e-learning, and more.

This entry provides a comprehensive treatment of the core concepts, in addition to the background and current status of the standard, its relationship to traditional knowledge organization techniques, and examples of the kinds of applications for which it is being used. This entry follows the established convention of using initial capitals (“Topic Maps”) when referring to the standard itself or the technology in general, and lower case (“topic maps”) when referring to the document-like artifacts created through the application of that technology.

BACKGROUND AND HISTORY

Origin and Development

The concepts of Topic Maps originated in the context of the Davenport Group, during the development of the DocBook application, as an answer to the problem of how to automate the merging of (digital) back-of-book

indexes. The key insight, due to Dr. Steven R. Newcomb, was that such indexes are in fact models of knowledge. Their digital encoding is based on their surface appearance, but they actually have an implicit, underlying structure. If that structure could be represented formally, it would be possible to automate the merging process.

An initial model was defined in 1992 using the concepts of the HyTime standard, of which Dr. Newcomb was coeditor, under the auspices of a project called the Conventions for the Application of HyTime (CApH), sponsored by the Graphics Communications Association Research Institute (GCARI). After a number of iterations, during which the model was gradually refined, the work was brought into ISO, and went through further revision cycles before being adopted as ISO 13250:2000 under the editorship of Newcomb and coeditors Dr. Michel Biezunski and Martin Bryan. Responsibility was given to Working Group 3 of the subcommittee ISO/IEC JTC 1/SC 34.

The standard was originally defined in terms of an SGML DTD. In fact, it was defined in terms of a “meta-DTD” according to the SGML Architecture facility offered by the draft HyTime standard. Although never finally standardized, the concepts inherent in meta-DTDs found their way into DITA, XML namespaces, and HTML “microformats.” By the time it was published, Extensible Markup Language (XML) was replacing SGML, especially on the Web. In order to create an XML-based version of the specification an ad hoc working group called TopicMaps.Org was formed by Newcomb and Biezunski and this resulted in the publication in March 2001 of *XML Topic Maps (XTM) 1.0*,^[1] edited by Steve Pepper and Graham Moore.

In addition to defining a new, XML-compatible DTD for representing topic maps, the new specification removed the dependence on HyTime, clarified some of the terminology, and simplified parts of the model. XTM gained immediate recognition and has to all intents and

purposes replaced the original version. In 2003, the XTM DTD was folded back into the second edition of the ISO standard^[2] and from that point on stewardship of the standard passed back to the ISO committee.

Current Status

In 2003 a road map was devised for the further development of the standard, to include a data model, reference model, query language, and constraint language. As of the present writing (late 2008), the Topic Maps family of ISO specifications is as follows:

- ISO/IEC 13250: Information Technology—Topic Maps—
 - Part 1: Overview and basic concepts^[3]
 - Part 2: Data model^[4]
 - Part 3: XML syntax^[5]
 - Part 4: Canonicalization^[6]
 - Part 5: Reference model^[7]
 - Part 6: Compact syntax^[8]
 - Part 7: Graphical notation^[9]
- ISO/IEC 18048: Information Technology—TQML^[10]
- ISO/IEC 19076: Information Technology—TMCL^[11]
- ISO/IEC TR 29111: Information Technology—Topic Maps—Expressing Dublin Core Metadata using Topic Maps^[12]

Parts 2 and 3 were published in 2007. Most of the remainder exist as stable drafts and are expected to be published in 2009. Work continues in SC 34/WG 3 and interested parties are encouraged to attend meetings and participate through their national standards bodies. For further information, see the SC 34 Web site at <http://www.jtc1sc34.org> and the WG 3 Web site at <http://www.isotopicmaps.org>.

CORE CONCEPTS

This section presents the core concepts of the Topic Maps paradigm. The back-of-book index is used throughout as a familiar point of reference for illustrative purposes. In line with long-established tradition in the Topic Maps community, this entry will use the domain of opera for its examples, based on the *Italian Opera Topic Map*.^[13]

Subjects

The core concepts of Topic Maps are relatively few and for the most part easily grasped. They are often referred to as the “TAO of Topic Maps,” after the eponymous paper which has served as a basic introduction since it was first published in 2000.^[14] However, even more fundamental than the TAO is the emphasis on *subjects*.

In the Topic Maps world view, the most essential property of information is not where it resides (the document-

centric view) or which application was used to create it (the application-centric view), but its *aboutness*, i.e., the subject (or subjects) that it is about. This subject-centric view lies at the very heart of the Topic Maps paradigm.

There are many reasons for insisting on the primacy of subjects: the starting point for most acts of information retrieval (e.g., searches on the Web) is one or more subjects; in the aggregation of information and knowledge, subjects usually constitute the most useful collation points; in fact, the whole purpose of creating information can be viewed as capturing knowledge *about certain subjects* in order that it can be shared and reused. While other forms of metadata such as author, publisher, and creation date are important for certain information management tasks, for the key end-user task of information retrieval, aboutness is most critical. Since the purpose of Topic Maps is to alleviate infoglut and improve the findability of information, subject-centricity is the central feature.

Subjects and topics

The concept of “subject” is defined by ISO/IEC 13250:2006^[4] as follows:

3.14 subject

anything whatsoever, regardless of whether it exists or has any other specific characteristics, about which anything whatsoever may be asserted by any means whatsoever

A subject, in other words, is literally anything about which the author of a topic map wishes to make assertions. Typical subjects in the domain of opera might be the composer Giacomo Puccini; his operas, including *Tosca* and *Madama Butterfly*; Lucca, the city where Puccini was born; and Teatro Costanzi, where *Tosca* was first performed. These are also the kind of subjects one would expect to find in the index of a book on opera.

The Topic Maps data model (TMDM)^[4] defines a model for representing subjects such as these, and assertions about them, within an information system. The Topic Maps Reference Model (TMRM),^[7] which offers a more abstract and low-level model, is described below. In order to represent a subject a proxy is required, and this is called a “topic.” A topic is thus the (symbolic) representation of a (nonsymbolic) referent, i.e., the subject. In the words of the standard:

3.18 topic

symbol used within a topic map to represent one, and only one, subject, in order to allow statements to be made about the subject

A topic map covering the domain of opera will thus include topics that represent subjects such as Puccini, *Tosca*, and Lucca.

The collocation objective

Topic Maps employs the nearly synonymous words “topic” and “subject” as very precise terms for the two components of a representation relationship: symbol and referent (Fig. 1).

There is a one-to-one relationship between topics and subjects in the sense that each topic, by definition, represents one and only one subject. Because of this, the terms “topic” and “subject” are often used interchangeably in informal discourse about Topic Maps. The goal of any Topic Maps application is to ensure that each subject is represented by one, and only one, topic. Once this goal (referred to as the “collocation objective”) is achieved, everything that is known (within a given system) about a particular subject becomes accessible from a single point, via the one and only topic representing that subject, and thus the problem of information retrieval is in principle solved.

The means by which the collocation objective is achieved within a system relies heavily on the Topic Maps concept of “identity,” which can also be applied across systems, and thus provides the foundation for “global knowledge interchange”—the potentially unrestricted collation of knowledge from disparate sources. The term “global knowledge interchange” is due to Steve Newcomb.^[15]

Identity

The fundamental issue in achieving the collocation objective is to know when two topics represent the same subject, a situation that can often arise when merging topic maps. When this is the case, the two topics in question must be merged into a single topic that has the union of the characteristics (i.e., names, occurrences, and associations) of the original topics. Once the two topics have been merged, order will have been restored and collocation will once more obtain.

Since the merging of topic maps is intended to be an automated process, the key question is, how can a machine “know” when two topics represent the same subject? The solution adopted in the TMDM is to use explicit, globally

unique identifiers. If two topics share an identifier they are deemed to represent the same subject and merging occurs. Identifiers usually take the form of Uniform Resource Identifiers (URIs) and these come in two flavors: “subject identifiers” and “subject locators.” The TMDM actually allows any kind of “locator notation” to be used, but the interchange syntax (XTM) only supports Internationalized Resource Identifiers (IRIs), an extended form of URIs which permits international characters. A third kind of identifier, item identifiers, are only of interest to implementors of Topic Maps systems. Subject locators were called subject addresses in the first version of the standard.

Subject locators, as their name suggests, are URIs that identify subjects via their location. They can therefore only be used with subjects that have a specific location that can be expressed using a URI—in other words, network-addressable information resources, such as documents (in the broadest sense), newsfeeds, and other data that can be retrieved via Web-based queries. Subjects like this can be identified *directly* via their network addresses.

Most subjects, like Puccini, *Tosca*, and Lucca, do not fall into this category. They reside outside any computer system and are thus in some sense “ineffable”; there is a chasm between the “outside world” in which they exist and the computer system in which they are represented, and this chasm can ultimately only be bridged by human intellect. This is achieved in the Topic Maps paradigm through *indirect* identification using subject identifiers.

A subject identifier is (also) a URI, but it does not address the subject directly; rather it addresses it indirectly, via a “subject descriptor,” which the TMDM defines as an “information resource that is referred to from a topic map in an attempt to unambiguously identify the subject represented by a topic to a human being.” Subject descriptor is sometimes also termed “subject indicator.”

Fig. 2 shows how an ineffable (or “non-addressable”) subject, such as Puccini, can be identified indirectly via a subject descriptor, whose address (<http://psi.ontopedia.net/Puccini>) functions as a subject identifier.

The distinction between direct and indirect identification, which is supported in both the TMDM and the interchanges syntaxes, provides a solution to what has been widely referred to as the “identity crisis” that has caused concern in the Semantic Web community over a number of years.^[16] At the same time, the duality of subject identifier and subject descriptor neatly reflects the dichotomy of the human/computer relationship. Subject identifiers are for use by computers in ascertaining whether or not two topics represent the same subject: if two topics have an identifier in common, they are simply merged; computers have no need to resolve the URI to ascertain exactly what the subject is. Humans, on the other hand, need to be able to do this, because it is they who are ultimately responsible for assigning identifiers; the subject descriptor provides them with an “indication” (through a description, definition, illustration, or whatever) of the subject in question.

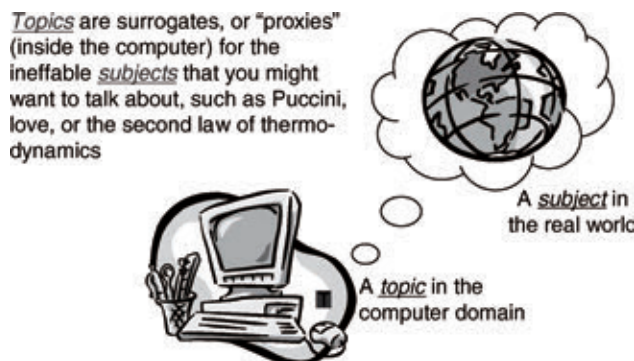


Fig. 1 Subjects and topics.

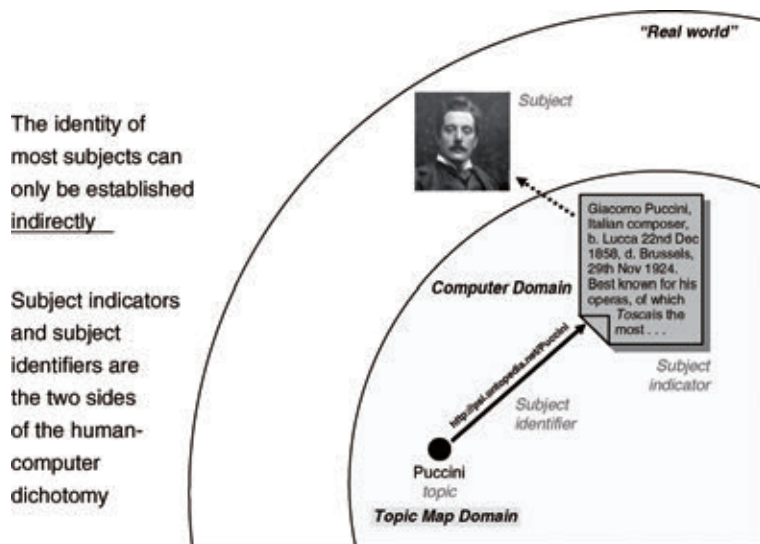


Fig. 2 Subject identifiers.

The concepts of indirect identification using subject identifiers and subject descriptors has been extended into a whole paradigm, known as “published subjects” that seeks to provide an open, distributed solution to the problem of defining and discovering globally unique subject identifiers.^[17]

The TAO of Topic Maps

Having covered the essentials of subjects and how they are represented by topics, we now turn to assertions about subjects.

A topic map is a representation of a set of assertions about one or more subjects. The TMDM defines three kinds of assertion—or “statement”—that can be made about a subject: “names,” “occurrences,” and “associations” (Fig. 3). Associations represent general relationships between subjects; occurrences represent a particular form of “aboutness” relationship in which the participants are an information resource and a subject that the resource is “about”; and names represent relationships between subjects and the labels used by humans to refer to them.

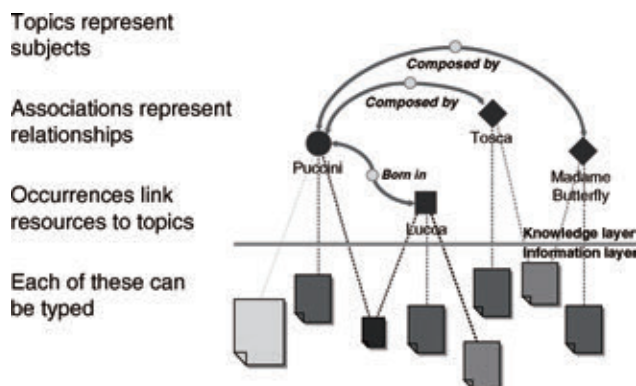


Fig. 3 The TAO model.

The following section describes each of these in more detail.

Associations and roles

Associations express relationships among subjects, for example between Puccini and *Tosca*, or between Puccini and Lucca. They correspond to *See also* entries in a back-of-book index and serve a similar navigational purpose. But there is an important difference in that associations permit the nature of each relationship to be made explicit using “association types”: thus, the relationship between Puccini and *Tosca* can be stated to be of type “composed by,” whereas that between Puccini and Lucca is of type “born in.” The ability to distinguish association types adds precision, provides more information to the user, and improves findability. Association types are themselves subjects and are therefore represented as topics.

A single association may involve any number of subjects. Binary associations (involving two subjects, as in the examples given so far) are by far the most common, and also the easiest to process; they correspond somewhat to transitive verbal constructs in natural language, such as “Puccini composed *Tosca*.” Ternary associations (involving three subjects), while less common, can be useful for relationships that in English might be expressed using a ditransitive verb or an additional thematic role (“*Tosca* kills *Scarpia* with a *knife*”). Associations of higher arity are infrequent; the relationships they might be used to represent (such as that between an opera and multiple librettists) are usually better expressed using multiple binary associations. Unary associations (involving a single subject) are also possible; they often correspond to intransitive verbs and can be used to represent “relationships” that in other modeling paradigms might be expressed using Boolean properties (e.g., “*Turandot* was unfinished”).

Describing a relationship in natural language can give a false impression of directionality: there is no difference, in terms of the basic relationship being described, between the statements “*Tosca* was composed by Puccini” and “Puccini composed *Tosca*.” The difference is rather one of focus. This situation is reflected in Topic Maps by the absence of any formal notion of direction in associations. The order in which topics are specified has no significance; instead, the nature of the subject’s involvement in the relationship is expressed through the concept of “association role.” Each participant in an association is deemed to play a “role” of a certain type. In order to clarify the respective roles of the participants in the example above (and avoid the possible interpretation of Puccini having been composed by *Tosca* instead of vice versa), it must be explicitly stated that Puccini plays the role of (say) “composer,” and that *Tosca* plays the role of (say) “work.” In more precise Topic Maps terminology, “composer” and “work” are “association role types” and, like association types, they are represented by topics (Fig. 4). Exactly what constitutes the roles in this relationship (as opposed to the role types) is less immediately intuitive; one approach is to think in terms of Puccini qua composer of *Tosca* (as opposed to Puccini qua composer of *Madama Butterfly*—or indeed qua husband of Elvira or qua pupil of Ponchielli).

Association types (and role types) are defined by the topic map author according to the requirements of the information, the knowledge it embodies, and the application for which it is intended. There is thus no limit to the kinds of relationship that may be expressed in Topic Maps. However, because of their ubiquity (and utility) in knowledge modeling, two association types are given special status. These are “type-instance” and “supertype-subtype” which carry particular semantics defined in terms of membership of sets of topics called “topic types.” Their special status consists in the following: 1) the standard defines identifiers for these association types (and their corresponding role types) in the TMDM; 2) special syntax is available for type-instance in XTM and Compact Topic Maps Syntax (CTM); and 3) they invoke the application of

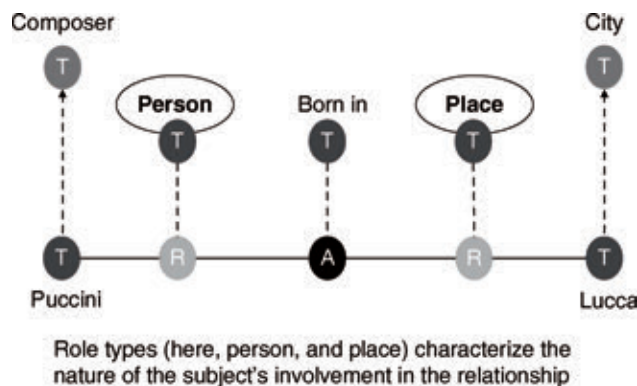


Fig. 4 Anatomy of an association.

inheritance mechanisms in certain forms of processing in the query and constraint languages.

Topic types constitute a built-in mechanism for classifying topics and for building a certain kind of hierarchy. That is, type hierarchies—not subject hierarchies of the kind used in subject classification systems, where the subjects do not necessarily (or usually) constitute sets or classes, and the transitivity of type hierarchies does not hold. These can be represented in Topic Maps (as discussed below) but not by using the predefined association types. Topic types for the example topics mentioned so far might be “composer” (for Puccini), “opera” (*Tosca*), and “city” (Lucca). These might in turn be defined as subtypes of “person,” “musical work,” and “place,” respectively.

It is important not to conflate the concepts of topic type and association role type. The former classifies a subject in terms of its “essential being,” whereas the latter merely describes the role it plays in a particular relationship. Sometimes, however, the same topic is used as both a topic type and an association role type. This is because the essential being of a subject is often defined in terms of some kind of relationship: it is precisely because Puccini composed *Tosca* (and many other operas) that he is today regarded first and foremost as a composer; he both *plays the role of* “composer” (in the relationship with *Tosca*, etc.) and at the same time *is a* “composer.” On the other hand, the roles he plays in his relationships with his teacher Ponchielli, his wife Elvira, and his birthplace Lucca, are of different types, namely “pupil,” “husband,” and “person” (Fig. 5). Note that there is almost always an implicit supertype-subtype relationship between the role type and the type of the role playing topic, but there is no general rule for which is which.

Occurrences

Occurrences represent a particular kind of relationship—that of “aboutness” between an information resource and a subject. The resource in question may be very small, such as a string representing a date, in which case it is normally

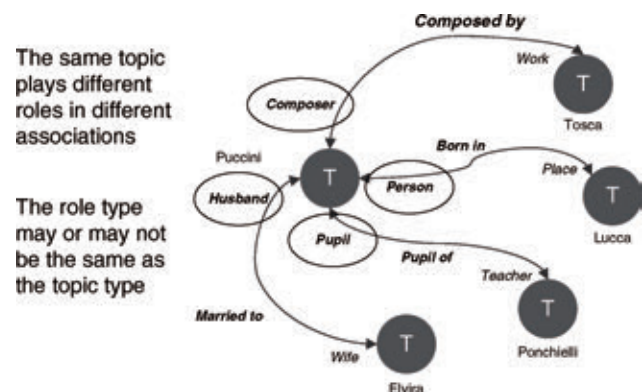


Fig. 5 Role type and topic type.

included in the topic map and known as an “internal occurrence.” Or else it may be stored externally, because of its size, notation, provenance, or whatever, and referenced via a locator—normally a URL—which corresponds to a page number in a back-of-index (itself a locator for some piece of information relevant to the subject in question). In the latest version of the Topic Maps standard, support is included for specifying the data type (i.e., notation or format) of an occurrence.

Like associations (and association roles), occurrences may be classified by type; typical “occurrence types” in the domain of opera might be “biography” and “date of birth” (for topics of type “composer”); “synopsis” and “premiere date” (for topics of type “opera”); and “map” (for topics of type “city”). Occurrence types provide more information to the user about the nature of the related resource (in contrast to an unqualified list of page numbers in a typical back-of-book index).

Finally, occurrence types—like association types and role types—may be freely defined (again, as topics) to suit the needs of users and applications; there are no predefined types.

Names

Because of their importance in providing labels by means of which humans can refer to and discourse about subjects, names are given privileged status in the Topic Maps model. They may be regarded as a special type of occurrence that carries naming semantics. Like occurrences, names may be typed (and once again, name types are represented as topics), but unlike occurrences they are restricted to a single data type, “string,” in order to ensure that they can always be processed by any system.

It is also possible to specify “variants” of a name, and this facility is widely used to represent sort keys, alternative orthographies, transliterations, misspellings, and so on.

In order to cater for synonyms, the model allows multiple names for the same subject. Distinctions such as language, preferred status, and context of use may be indicated using name types or the concept of “scope” (discussed below).

There is no specific facility in the model for handling homonyms because there is no need: there are no restrictions on what names a subject can have, nor on whether two (or more) subjects have the same name, so homonymy is not an issue as far as the model is concerned. It is left to the application to provide disambiguation based on contextual information available in the topic map: the first line of disambiguation is usually the topic type (“Tosca the opera” as opposed to “Tosca the character”); when this does not suffice, some other association can be used, as with “Puccini’s *Bohème*” (i.e., the *La Bohème* composed by Puccini) as opposed to “Catalani’s *Bohème*,” or “the Paris located in France” as opposed to “the Paris located in Texas.”

Fig. 3 illustrates the basic TAO model and depicts an information layer (below), containing information resources of any and every shape and form, and a knowledge layer (above). The latter consists of (typed) topics and associations, and is connected to the information layer via (typed) occurrences. Identity, scope, and reification (described below) are not depicted.

Ontologies

The term “typing topic” is used informally to refer to any topic that is used (or intended to be used) to type some other construct, whether it be a topic, association, association role, occurrence, or name. Taken together, the set of typing topics in a topic map constitutes a description of the kind of “things” (i.e., subjects) and the kind of relationships that exist in the domain in question (e.g., opera). Viewed in this way, the typing topics can be said to represent the “ontology” of the topic map and the topic map to contain its own ontology. There is no single, broadly accepted definition of the term “ontology” in the information sciences, nor is it defined in the Topic Maps standard, but the informal usage adopted here corresponds very closely to that of John Sowa who defines ontology as a “classification of the types and subtypes of concepts and relations necessary to describe everything in the application domain.”^[18]

Constraints on the types (or classes) that constitute an ontology are defined using TMCL, discussed below.

Additional Concepts

The basic model of (typed) topics that can have names and occurrences and play roles in associations with other topics is very simple and yet powerful enough to express a broad range of knowledge structures—in fact, to make any kind of assertion about any kind of subject—and many current applications of Topic Maps use no more than this core functionality. Additional concepts that provide further expressivity are “scope” (for qualifying assertions in terms of their contextual validity) and “reification” (for making assertions about assertions).

Scope

Knowledge that is aggregated from different sources through the merging of topic maps is likely to contain contradictory statements or have varying relevance in different contexts. For this reason, Topic Maps includes a built-in mechanism called “scope” for expressing the contextual validity of any assertion. Scope is expressed as a set of topics which qualify a statement (i.e., a name, occurrence, or association) and indicate the context in which the assertion represented by the statement may be considered valid. If no scope is explicitly specified, the scope is said to be “unconstrained.”

The interpretation of what it means to be “valid,” and precisely how the scoping topics “indicate” context, is left to the application and as a result the interoperability of scope is limited. However, usage conventions emerging among users of Topic Maps are resulting in increased interoperability. These include specifying the historical applicability or natural language of names and expressing the provenance of occurrences and associations.

Examples of the use of scope in the *Italian Opera Topic Map* include:

- English names of certain operas.
- Provenance of conflicting assertions (e.g., whether the opera *Isabeau* was first performed at the Teatro Colon or the Teatro Coliseo).
- Source of multiple synopses of the same opera (e.g., from Arizona Opera and Opera News).
- Context in which a character has a certain voice type (e.g., Musetta, a soprano in Puccini’s *La Bohème* and a mezzo in Leoncavallo’s).

Reification

Scope can be regarded as a special case (asserting the *contextual validity* of an assertion) of a more general capability (asserting *anything* about an assertion). Assertions represent relationships between subjects, but a relationship can be regarded as a subject in its own right, about which one might want to make further assertions. One way to do this is to represent the relationship as a topic from the outset; another is to “reify” the name, occurrence, or association in question.

Reification (literally “thingification”) in the Topic Maps sense of the term is defined as “making a topic represent the subject of another topic map construct,” in other words, turning a name, occurrence, association role (or even the topic map itself) into a topic in order to make assertions about the thing it represents. This is equivalent to nominalization in natural language, as in “Reagan met Gorbachev in Reykjavík. The meeting took place in October 1986.” In the *Italian Opera Topic Map* the relationship between *Tosca* and Rome (where the opera takes place), is reified as a “The setting of *Tosca* in Rome” in order to provide an appropriate subject for classifying Susan Nicassio’s book *Tosca’s Rome*.

The most widespread use of reification is to reify the topic map itself, thereby creating a topic that can be used for specifying metadata about the topic map (for example, using Dublin Core as discussed below).

THE TOPIC MAPS FAMILY OF STANDARDS

The model described in the preceding sections is specified in detail in the TMDM, which is Part 2 of the ISO standard.^[4] This section provides a brief overview of the

remaining parts (excluding Part 1, which is merely a nonnormative introduction), along with short descriptions of two related standards, ISO 18048 (TQML) and ISO 19756 (TMCL), and a technical report, ISO TR 29111 (Expressing Dublin Core Metadata in Topic Maps).

Syntaxes and Notations

Part 3 of ISO 13250^[5] specifies an XML-based syntax called XTM whose purpose is to enable topic maps to be interchanged between systems. This is the core interchange syntax; it is defined in terms of a mapping to the TMDM and all conforming Topic Maps systems are expected to support it. The original HyTime-based syntax (HyTM) is no longer part of the standard and most tools do not support it. However, because it is rather verbose, XTM is not generally considered suitable for hand-editing, and for that reason other, nonstandard syntaxes were devised (Fig. 6). The most widely used of these are LTM^[19] and AsTMA,^[20] both of which offer compact, text-based notations. A standard text-based notation called CTM^[8] has been defined more recently; a visual notation called Graphical Topic Maps Notation (GTM)^[9] provides a common way of visualizing topic maps and their ontologies, and a canonicalization syntax (CXTM)^[6] supports conformance testing of Topic Maps systems.

The Reference Model

Part 5 of ISO 13250^[7] defines a low-level model called the TMRM which is more abstract and has fewer ontological commitments than the TMDM. Its purpose is to serve as a minimal, conceptual foundation for subject-centric data models such as the TMDM, and to supply ontologically neutral terminology for their disclosure. It defines what is required to enable mapping between different subject-centric data models in order to meet the overall goal of the Topic Maps standards, that each subject has a single location for all the information about it.

The TMRM is defined in terms of proxies consisting of properties which themselves are key/value pairs; the only ontological commitments are two types of relationship: *sub* (subclass of) and *isa* (instance of). In addition to requirements on constraint languages and merging operations, the TMRM includes a path expression language and a mapping to the TMDM, and thereby provides a formal semantics for the latter. It also provides a formal foundation for the related standards TQML and TMCL.

The Query Language

Topic Maps Query Language^[10] provides a standard way of accessing Topic Maps-based information, just as Structured Query Language (SQL) does for relational data and XQuery does for XML data. The initial version provides

access functionality only; later versions are expected to also cover updates. The language currently offers three very powerful and isomorphic ways to express queries:

- All three types of expression can return results in tabular form; `FLWR` expressions can additionally generate XML and Topic Maps output.

Topic Maps Constraint Language^[11] defines a language for expressing ontology-based constraints that a class of topic maps is expected to follow, thus ensuring greater consistency and more predictable results for both users and applications.

- All topics of type “composer” must play the role of “composer” in at least one “composed-by” association.
- Every “composed-by” relationship must involve exactly two topics of types “composer” and “opera,” playing the roles “composer” and “work,” respectively.

Constraint types are defined in terms of the TMDM and their formal interpretation in terms of TQML.

One of the most important aspects of Topic Maps is the ability of the model to represent virtually any kind of knowledge structure or data model. It is this capability—coupled with the ability to merge arbitrary topic maps—that underlies its value proposition: improved information management and enhanced findability through connecting disparate systems and collating information and knowledge from different sources.

Most back-of-book indexes consist of a set of *entries*, arranged alphabetically by *main heading* (sometimes called an “access point” or “subject heading”) and containing zero or more *subentries* (or “subheadings”), *reference locators*, and *cross-references*.^[22]

In Topic Maps terms, every *entry* (except those that only consist of a *See* cross-reference, discussed below)

corresponds to a topic and its *main heading* corresponds to a topic name. *Subentries* are named topics that are related to the topic of the main entry by an association of type “subentry of” (with the role types “main entry” and “sub-entry”). *Reference locators* equate to the locators of (external) occurrences, which would normally take the form of URIs rather than page numbers. *See also* references correspond to generic associations (of type “see also,” or simply “related to”) between topics that represent the respective entries. Finally, *See* references indicate alternate labels for the topics represented by the referenced entries and thus correspond to additional names (of type “alternate name”) for the topics representing those entries.

In some indexes the typeface used for main headings may vary (usually italic in addition to roman, sometimes also boldface). This is a simple form of classification by topic type. Similarly, the use of a different typeface for a reference locator (i.e., page number) is a simple form of classification by occurrence type. Finally, some books contain multiple indexes (e.g., people, places, subjects), which again corresponds to the use of topic types.

Glossaries

A glossary is a list of terms in a particular domain of knowledge along with their definitions. Like indexes, glossaries consist of a set of alphabetically arranged entries, each of which is the equivalent of a main heading. Subentries are not usual, but *See* and *See also* cross-references may occur. Most importantly, each glossary entry contains a definition instead of reference locators.

Using Topic Maps a glossary can be modeled exactly like an index, except that instead of multiple external occurrences, the topic corresponding to each glossary entry will have a single internal occurrence of type “definition.” Thus multiple indexes and glossaries can all be represented within a single topic map.

Thesauri

A thesaurus consists of a set of *terms* and *scope notes*, organized through three kinds of semantic relationship: *equivalence*, *hierarchy*, and *association*. Terms are the names of concepts and thus correspond to topic names; scope notes consist of information pertinent to the topic and therefore correspond to occurrences of type “scope note.”

The equivalence relationship handles synonyms and thus corresponds to topics with multiple names; a *USE* relation would indicate the default (preferred) topic name, while a *USED FOR* relation would indicate a name of type “non-preferred” or “alternate.”

Hierarchy relationships are created by pointing to *broader terms* (BT) and *narrower terms* (NT). Since these are the inverse of each other, they correspond to associations of a single type (“broader/narrower”) which link topics representing broader concepts (e.g., “opera”) to

topics representing narrower concepts (e.g., “aria”). In some thesauri other, more semantically explicit kinds of hierarchical relationship are used (e.g., generic and partitive). These can be represented using more specific association types. Note that the BT/NT relationship, despite being hierarchical, is not the same as the supertype/subtype relationship defined in the Topic Maps standard.

Finally, associative relationships (indicated using *related terms*, RT) equate to *See also* references in back-of-book indexes: they are (nonhierarchical) relationships of no specific type and thus correspond to associations of type “related to.”

Since indexes, glossaries, and thesauri can all be represented by the same model, they can be combined in a single topic map, thus removing potential redundancy. In fact, if the topics that represent index and glossary entries are arranged hierarchically, using associations of type “broader/narrower,” the result is a thesaurus—or possibly multiple thesauri, depending on the number of hierarchies involved. Individual documents or information resources are classified against such a thesaurus by making them occurrences of one or more thesaurus topics.

Taxonomies and subject classification systems are similar to thesauri; they are often somewhat simpler, and they may be more constrained (for example, some taxonomies allow only a strict-type hierarchy based on the generic supertype/subtype relationship), but their representation as topic maps and their practical application is essentially the same.

Faceted Classification

A faceted classification system can be viewed as a set of classification subjects that are grouped along axes called facets. In a topic map this is represented as a set of topics, each of which is related via an association to a topic that represents a facet, and some of which may be organized hierarchically via additional associations.

Bibliographic Records

Bibliographic records are descriptions of information entities, which may be abstract (works) or concrete (documents).^[23] They employ bibliographic languages to describe the attributes of those entities, ranging from the properties of *works* (e.g., author, title, subject), to the properties of *expressions* (translator, editor, language), *manifestations* (publisher, ISBN, format), and *items* (location, call number, condition). Attributes are described as property/value pairs in which the value can be a string, date, integer, or some other data type; or else the name of another entity (such as the author or publisher).

Bibliographic records based on languages of this kind can be represented as topic maps by creating topics to represent each information entity and using statements (names, occurrences, or associations, as appropriate) to represent the attributes. Those attributes with naming

semantics (e.g., title) become topic names; attributes that name other entities (e.g., author, publisher), or that represent terms in an authority file (e.g., a predefined set of media types) become associations and give rise to topics that represent the entities or terms in question; other attributes are represented as either internal or (occasionally) external occurrences.

One widely used bibliographic language is the Dublin Core Metadata Set^[24] which defines a basic set of 15 abstract “elements,” along with a number of “other elements and element refinements,” a set of encoding schemes, and a (media) type vocabulary. An ISO Technical Report^[12] describes how to represent Dublin Core descriptions using Topic Maps.^[25] A similar approach can be used with MARC-21.

In the FRBR (Functional Requirements for Bibliographic Records) model, relationships between works and expressions are represented by an association, as are relationships between expressions and manifestations, and between manifestations and items. Entities of all kinds (including groups 2 and 3) are represented as topics.^[26]

Other Data Models

In addition to the knowledge models described above, most forms of structured data can be represented as topic maps through some kind of schema-dependent mapping. This section looks briefly at how this works with XML (hierarchical), RDBMS (relational database management system), and Resource Description Framework (RDF) (associative) data, respectively.

XML allows the structure of information to be represented in a hierarchy of elements and subelements, with some annotation of elements (via attributes), including linking across (and beyond) the element hierarchy. The semantics of the element and attribute types are vocabulary dependent, but they can be extracted and represented as a topic map using techniques described by Pepper and Garshol^[27] and Garshol and Bogachev.^[28]

In the entity–relation (ER) model, entities equate to topic types and relations to association types, while attributes correspond to names, occurrences, and identifiers (Fig. 7). When mapping relational data to a topic map, each row in an entity table (for example, “Organizations”) gives rise to a topic of the corresponding type (in this case, “organization”); each column can result in an identifier, name, occurrence, or association, depending on whether the data is an ID, a string with naming semantics, some other kind of string data, or a foreign key reference, respectively. Each row in a relation table (for example, “Employment”) results in an association of the given type (here, “employed by”) whose role players are found via the foreign key references.

The associative (graph-based) model of the RDF is much closer to the Topic Maps model than XML or ER, and this means that RDF data can be used in Topic Maps systems with almost no mapping.^[29,30] It has also been demonstrated that data conforming to EXPRESS data models can be transformed to Topic Maps with relative ease, although this work has not yet been published. The EXPRESS modeling language is part of the product data standard STEP (ISO 10303).

The screenshot shows the Omnigator web application interface. The main content area displays a topic map for "Puccini, Giacomo". The interface includes a navigation bar with links like "Home", "Manage", "Website", "Support", and "About". Below the navigation bar, there is a search bar and a list of topics. The main content area is divided into several panels:

- Untyped Names (3):**
 - Puccini, Giacomo
 - Giacomo Puccini - Scope: Normal form
 - Puccini - Scope: Short name
- Associations (18):**
 - Born in: Lucca
 - Composed: La Bohème, Edgar, La fanciulla del West, Gianni Schicchi, Madama Butterfly, Manon Lescaut, La rondine, Suor Angelica, Il Tabarro, Tosca, Turandot, Le Villi
 - Died in: Brussels
 - Exponent of
- Subject Identifiers (1):**
 - http://en.wikipedia.org/wiki/Puccini
- Internal Occurrences (4):**
 - Bibliography:**
 - Budden, Julian: "Puccini: His Life and Works", Oxford University Press (Oxford, 2002)
 - Sadie, Stanley (ed): "Puccini and His Operas", Macmillan (London, 2000)
 - Date of birth:** 1858-12-22
 - Date of death:** 1924-11-29
- External Occurrences (12):**
 - Article:**
 - http://en.wikipedia.org/wiki/Giacomo_Puccini - Scope: Web; Wikipedia
 - http://localhost:8080/operamap/occurs/sn/puccini.htm - Scope: Local; Store Norske Leksikon
 - http://www.ontopia.net/topicmaps/examples/opera/occurs/sn/puccini.htm - Scope: Store Norske Leksikon; Web
 - Gallery:**
 - http://localhost:8080/operamap/occurs/puccini-gallery.htm - Scope: Local

Fig. 7 A topic page in the Omnigator.

AREAS OF APPLICATION

As the preceding section has shown, virtually any form of structured data, information, or knowledge can be represented as a topic map. This is not to suggest that all information should be maintained directly in Topic Maps form. A more common scenario is to use Topic Maps as a meta-model for integrating portions of data that originate from different systems (some of which may be Topic Maps-based). The procedure is to generate multiple topic maps from disparate sources and then merge them to provide a unified view of the information gestalt.

It is the flexibility of the Topic Maps model and the robustness of the identity paradigm on which merging is based that provide the clue to identifying application scenarios in which the technology can excel. Another quality of Topic Maps is its intuitiveness: experience shows that the TAO model is very easy for users to grasp, presumably because it derives from artifacts, such as indexes, that humans have used for centuries to locate and manage information. The associative nature of the model is also a factor in this, reflecting as it does how people think, learn, and store information in their own “semantic memories.”

Most applications of Topic Maps fall into four broad categories: enterprise information integration (EII), KM, e-learning, and Web publishing.

From the EII perspective, Topic Maps offers an out-of-the-box “meta-model” for integrating information, and a powerful identity mechanism for enabling subject-based merging. A topic map can provide an aggregation layer on top of existing information systems, or function as a

hub for transferring data between systems, or both. Either way, Topic Maps removes the need for costly point-to-point system integration.

From the KM perspective, Topic Maps provides—arguably for the first time—the ability to really capture and manage some degree of *human knowledge*—not just information—in a standards-based form, enabling it to be shared and reused across departments, organizations, and systems. The topic/association layer constitutes a distributable and queryable knowledge base, which can be tightly coupled with content management systems via the occurrence axis.

In the domain of e-learning, Topic Maps has particular relevance, not just because of its strengths as a content management technology, but because it bridges the gap between information and knowledge.^[31] In Norway, successful experiments have been conducted in which school students are encouraged to create topic maps to record what they have learned, and the National School Curriculum itself now has its definitive expression in the form of a topic map.^[32]

One application whose potential is as yet largely untapped is the use of Topic Maps as the foundation for digital libraries. At its most basic, a digital library can be defined as digital content that is organized along bibliographic principles. It requires technology of a new kind that is attuned to the needs of digital information while at the same time supporting bibliographic principles and practices. Topic Maps is just that. An early example of the application of Topic Maps to this purpose is the award-winning New Zealand Electronic Text Centre (Fig. 8).^[33]

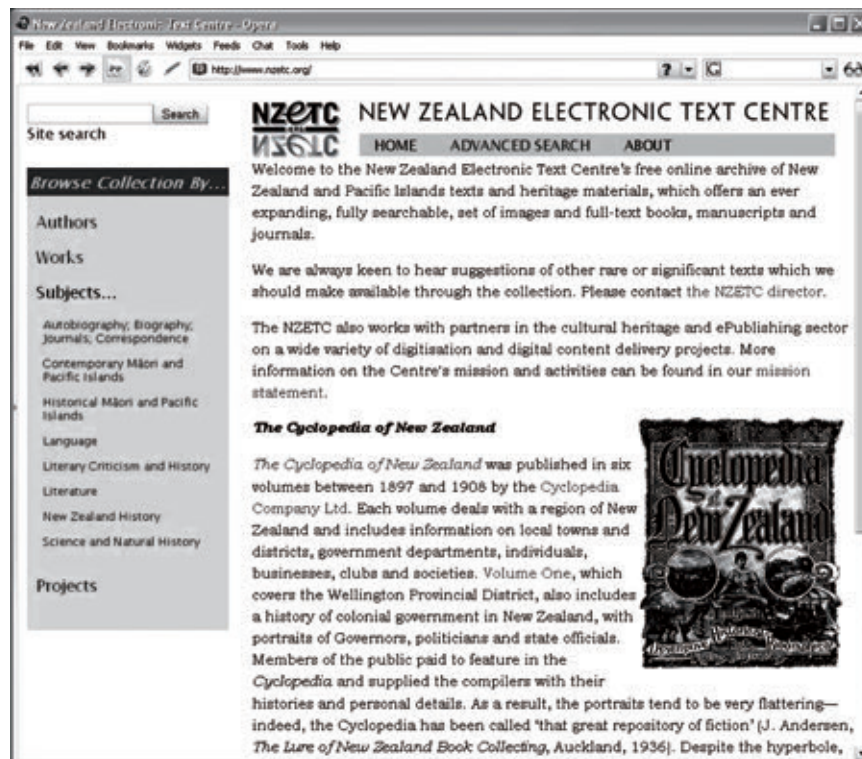


Fig. 8 A Topic Maps-based digital library.
Source: <http://www.nzetc.org>.^[33]

In all of these applications, and many others besides, the World Wide Web provides the most important channel for disseminating information, via Web sites, portals, and intranets. Despite in some ways predating the Web, Topic Maps has proven to be well-suited to this form of publishing: the TAO model offers a readymade “information architecture” in which each page is devoted to a single well-defined topic and contains information collated from the names and occurrences of that topic, with intuitive navigation paths between pages generated from associations between topics. An increasing number of second and third generation Web sites are currently reorganizing their content into topic maps, and a product such as the *Omnigator*,^[34] which is a Web-based browser for topic maps (Fig. 7), is essentially a tool for creating “instant Web sites”: when it loads a topic map, the result is a bare-bones, out-of-the-box Web site.

CONCLUSION

Topic Maps is a paradigm-shifting technology. Through its emphasis on the centrality of subjects, rather than documents or applications, it presages a radically new way of using computers to manage information and knowledge, dubbed subject-centric computing.

The key strengths of Topic Maps are a flexible model that can represent any kind of data structure; a robust model of identity; the ability to merge arbitrary topic maps; a well-defined syntax for exchanging topic maps between systems; status as an ISO-approved international standard; and a vibrant and committed user community. Witness the annual user's conference in Oslo, the annual academic conference (Topic Maps Research and Applications, TMRA) in Leipzig, the Web site <http://www.topicmaps.com>, various mailing lists, etc.

Topic Maps is particularly well-suited for integrating information from disparate sources, bridging the gap between information and knowledge, and acting as an information architecture for Web-based information delivery.

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Tunisia: Libraries, Archives, and Museums

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Abstract

This entry provides factual data and background on the development and current state of libraries, archives, and museums in Tunisia. Emphasis is on the more-significant components of these sectors historically and culturally. The development of cultural institutions since Tunisia became independent and important legislation concerning these institutions are addressed in some detail. The conclusions point out that despite considerable investment in cultural and information infrastructure and services, there remain considerable hurdles to overcome for this emerging albeit studious country.

INTRODUCTION

Tunisia is a compact but kaleidoscopic North African country of 10 million located on the southern shore of the Mediterranean Sea, wedged between Algeria and Libya. Its strategic position and climate have made it a coveted land since ancient times. Vestiges of past civilizations remain visible testimony to the country's rich and diverse history, stretching back 3000 years. Culturally, modern Tunisia represents a rich admixture of native and foreign influences. While predominately Arab and Muslim these days, the country has been deeply imbued with diverse civilizations, including Berber, Phoenecian, Roman, Arab, Ottoman, and European. Contemporary Tunisia retains numerous traces of its long and diverse past. From the flourishing Roman era that lasted six centuries and witnessed the advent of Christianity, some of the best Roman mosaics in the world still survive. Rich Islamic architectural patchwork coexists with vestiges of French colonial influence. As a token of the country's rich patrimony, Tunisia is home to at least seven monuments and sites on the UNESCO World Heritage list. Rivalries between European interests over Tunisia in more-recent centuries culminated in a French invasion in 1881 and the establishment of a protectorate regime that lasted until 1956 (Fig. 1).

The newly independent republic has since pursued modernizing social policies, giving high priority to universal education and establishing rights for women unmatched by neighboring nations. As the Arab country that most wants to be seen as modern, Tunisia has taken a moderate stance domestically as well as in its foreign relations and is now among the region's emerging countries being the one with the fastest economic growth. More than 20% of the Tunisian government's annual budget goes to education and cultural institutions such as libraries, archives, museums, and arts centers. The following sections highlight Tunisia's most significant achievements

and infrastructures in the fields of library and information science, archival systems, and museology.

LIBRARY AND INFORMATION PROFESSIONS, SYSTEMS, AND SERVICES

Historic Background

Libraries and books in preindependent Tunisia

Perhaps the oldest, continually existing library in Tunisia is that of the Grand Mosque of Qayrawan (also spelled Kairouan) and its attendant, now defunct, university, which is considered "amongst the first universities throughout history."^[1] Tunisia is practically a bilingual country; French is widely used in daily life besides Arabic. In this study, transcription and romanization of Arabic is based largely on the ALA-LC Romanization Tables: Transliteration schemes for non-Roman scripts (<http://www.loc.gov/catdir/cpsd/romanization/arabic.pdf>). As the country's holy Muslim city and the site of the oldest religious shrine in western Islam, Qayrawan was founded in 670 A.D. and had developed into a great center of learning. By the tenth century its religious, cultural, and scholastic influences reached parts of Africa, Europe, and Asia, attracting students and scholars from afar. The Grand Mosque has preserved some of the remnants of its great intellectual apogee and memory of its scholars through books and documents they wrote or assigned others to write. Many of these unique documents were part of the curriculum taught then and were considered "the largest and best known collection in the Arab Islamic world."^[2] The Grand Mosque's library included mostly religious manuscripts and Korans written in large part on parchment. Following the sack of the city in the eleventh century, much of the library's collection was lost. Many of the surviving works are now preserved at the National Library



Fig. 1 Map of Tunisia.

in Tunis. A handwritten catalog containing a quite detailed description of the contents of the Grand Mosque's library, compiled in 1293 A.D., was uncovered in the mid-twentieth century (Fig. 2).^[3]

Another cultural and learning hub in Qayrawan was Bayt al-Hikmah (House of Wisdom, or House of Knowledge), a pioneering gathering of scholars-cum-translators whose principal role was to render into Arabic what had survived of the mathematical, scientific, and philosophical legacy of the ancient world^[4] that had been lost to medieval Europe. Established at the end of the ninth century, Bayt al-Hikmah of Qayrawan rivaled its famous counterpart in Baghdad in the study of medicine, astronomy, engineering, grammar, and translation.^[5] A crucial

contemporaneous development tightly linked to books and knowledge diffusion that should be mentioned is papermaking and the establishment of paper mills all over the Islamic provinces by the eleventh and twelfth centuries. In North Africa the work of eleventh century Prince al-Mu'izz ibn Badīs al-Zīrī, a patron of the arts, included a brief account of medieval papermaking in his treatise *Umdat al-Kuttab* (Staff of the Scribes and Implements of the Discerning, or, The Pillar for Penmen), the only medieval Arabic work on the art of the book to survive.^[6]

Other Tunisian cities' grand mosques also had library collections, the remnants of which can still be found today. The Zaytūnah Mosque, in Tunis, which was once also one of the oldest universities, has a considerable library.^[7] Large numbers of its manuscripts and books were housed in the Zaytūnah's al-Abdalīyah Library. Although not the oldest of the country's libraries, it was possibly the richest of all. It had several collections totaling in the tens of thousands. Most rulers of the Hafsid dynasty of the thirteenth to sixteenth centuries in Tunis vied with each other for the prestige associated with building the collection, which at some point exceeded an estimated 100,000 volumes, including rare manuscripts.^[8] When Spanish troops invaded and occupied Tunis between 1534 and 1574, many of the precious books and manuscripts in its libraries were looted or destroyed. The succession of Turkish dynasties that subsequently expelled the Spanish restored and expanded the Zaytūnah Grand Mosque and its affiliated libraries.^[9] The nineteenth century country's ruler, the bey of Tunis, Ahmad Pasha I, was the patron and promoter of the Ahmadiyah Library and added large numbers of books to its collection.^[10]

Independent Tunisia

Tunisia had generally enjoyed a period of relative political and social stability from the late sixteenth century until the establishment of the French Protectorate in 1881. That was also an era of idle cultural, intellectual, and scientific life. French colonial rule shook the country and brought many important social and political changes. Not long after the end of the World War II, France felt compelled to make some concessions to Tunisia, a process that culminated in the end of French colonial rule in 1956 and the establishment of a republican-presidential style regime. The French legacy, however, endures to date and is visible in many aspects of daily life. Since the earlier years of independence, the new regime's top priorities have been to reform education and encourage culture, and it has set aside a sizable portion of its operating budget for that purpose. Schooling became compulsory, free, and state-guaranteed between the ages of 6 and 16. By the 2006 school year, primary, secondary, technical, and vocational schools had a total enrollment of close to 2.5 million. The number of institutions of higher education increased from a couple at independence to 178 in 2006 with an estimated



Fig. 2 The seventh century Qayrawan Grand Mosque.

enrollment of 365,000 students, 56% of whom were female students.^[11] The constitution of the new republic provides for freedom of the press and of speech. The Tunisian press began publishing in the second half of the nineteenth century and flourished under colonial rule. It followed the French model, by which newspapers were highly editorialized and represented the official position of the government. That tradition has continued in independent Tunisia. The country now has 22 daily newspapers for an aggregate circulation of 375,000 copies, over 210 national weeklies and monthlies with a circulation close to 900,000, and more than 700 foreign magazines and newspapers.^[12] The Internet reaches over 953,800 subscribers, a tenth of the population in 2005.^[13] Tunisian book publishing, generally divided between Arabic and French, is a relatively small industry of approximately 125 publishers.^[14] Book production has been on the increase over the years, from just a handful of titles published in the early years of independence to about 1500 in 2006. However, for 65% of those titles, print runs rarely surpass 500 copies.^[14] Tunisia's most prestigious literary distinction is the "Comar d'Or" (Golden Comar)—from the name of a Tunisian philanthropic insurance agency that organizes and funds the event every year. The country's library system is diversified and relatively well established compared to other Arab and African nations. Overall, its information and cultural infrastructures, as spotlighted in the following sections, are impressive for a country of this size.

National Library and Information Services

Dār al-Kutub al-Waṭanīyah (Bibliothèque nationale, <http://www.bibliotheque.nat.tn/>)

The National Library of Tunisia (Fig. 3) is an administrative public establishment under the Ministry of Culture

and Safeguard of Patrimony. Its origins as a national repository go back to 1885, when it was the *Bibliothèque française*, (also *Bibliothèque française de Tunis* and *Bibliothèque générale*). Its first holdings consisted mainly of the private collection of Charles Tissot, a French diplomatic officer and researcher in Tunis at the time. They were gradually enriched with thousands of Arabic books and manuscripts transferred from the Grand Mosque of Tunis and other madrasa schools. In 1910 the library was relocated to a building in a sector of the old city called al-ʿAṭṭarīn, which served since 1813 as one of five military barracks in the capital. Later, under French rule, it was used as headquarters of the Antiquities Administration (*Direction des antiquités*). It became known then as the *Bibliothèque française de Tunis*. Upon independence in 1956, the library started to function as the de facto national library. Its mission was to build collections in all formats, especially of works published in Tunisia, which



Fig. 3 The new building of the Tunisian National Library.

must by law be deposited there; conserve them; and make them available to the public. It functioned as a research library with a strong focus on the humanities. The introduction of mandatory legal deposit in 1956 required commercial publishers to provide copies of all published books to the National Library. In 1967 and by virtue of a government decree, all “public manuscripts” held in public libraries, mosques, and zawiyahs (religious shrines) were ordered to be transferred to the National Library.^[15] The library currently has over 2 million monographs, 40,000 manuscripts, 13,000 periodicals (titles), and 5000 maps.^[16]

The library’s main publications are two annuals: *al-Kitāb al-Tūnī: al-Bībliyūghrāfiyā al-Waṭanīyah Waṭanīyah* = *Bibliographie nationale tunisienne* = *Le Livre tunisien* and *al-Fihris al-‘Āmm lil-Makḥaṭūṭat* = *Catalogue général des manuscrits*. It also issues an annual bibliographic list of university theses and dissertations and occasionally puts out special bibliographies. Its online catalog is actually the previously mentioned Tunisian National Bibliography and is searchable in Arabic and Latin characters for titles published in 1997 and later. Bibliographies of the years 1997–2002 are now accessible online (http://www.bibliotheque.nat.tn/asp/index_ar.htm). *Tunisiana*, a Latin-script-only database, gives access to entries for documents published in Tunisia prior to 1966. There are several projects under way concerning the conversion into PDF of the full text of periodicals and serials (examples: *al-‘Alam al-Adabī*; *Shabab*; *al-Mabahith*; *al-Ra’id al-Tunī*) as well as a number of manuscripts and original legal texts (Tunisian Constitution, the Personnel Status Code). The National Library, which began the automation of its bibliographic data in 1997, has undertaken the retrospective conversion of the old catalogs and files dating back to the end of the nineteenth century. Its multilingual catalog includes books published between 1500 and 1830. An in-house facility for retrospective conversion was set up in 2002. The ISBD and UNIMARC standard formats for recording bibliographic data were introduced in the 1980s. Bibliographic databases have been established using:

- UNESCO’s common communication format (CCF), a standard for creating bibliographic cataloging records developed by UNESCO in 1984 for nonlibrary agencies. Common communication format offers a simple platform for machine-readable bibliographic data for the benefit of developing nations. Unlike MARC, CCF specifies no rules for description, permitting minimal records and groups of fields called record segments that allow for relationships between fields and records.
- UNESCO’s CDS/ISIS, a bibliographic information management software to develop catalogs of manuscripts and old documents. This free library information storage and retrieval software for microcomputers was introduced in 1985.

- MINISIS, an integrated multiplatform software, for information production and management in a variety of languages and character sets.

By the mid-1990s the National Library started considering the acquisition of a MARC-format-compliant, multiscript-capable, integrated library system (ILS). In 2005 the Horizon integrated library system, developed by Ameritech Library Services and Arabized by a Saudi Arabian company, was chosen as the ILS system. The National Library has adhered to the ISBN system since 1988. It started using the CDS-ISIS bibliographic software in 1991 to catalog legal deposit items to be listed in the Tunisian National Bibliography. For all ongoing retrospective conversion projects, UNIMARC is the format used. The old Roman script catalog (up to 1966) with 200,000 bibliographic records was converted between 2001 and 2005; the old Arabic manuscripts catalogs were automated in 2005. The conversion of the more-recent Roman script catalog (1966–1998) started in 2006.^[17] To complete the picture, a national authority file using UNIMARC Authority format was planned for 2006. In its effort to build what is hoped will be the national virtual library, the National Library embarked on digitizing first the “main national heritage works,” such as manuscripts and older print documents, books, periodicals, and bibliographies, many of which are also being made available as CD-ROMs. The National Library opened to the public in February 2005 in a new location in downtown Tunis. The new building covers 35,000 m² of space and includes a spacious room for reading documents, a conference room, a laboratory, an exhibition hall, a visitors’ gallery, a restaurant, and a 10,300 m² parking lot.

Legislation Concerning Libraries

Legal deposit and copyright

Modern Tunisia inherited from its former French colonial occupier (1881–1956) a political structure and a cultural environment that are still visible everywhere. The French instituted the first press and publishing codes during colonial rule, and after independence in 1956, the government enacted legislation related to media and cultural institutions, many of which were drafted on the basis of the French “Depot Legal” system. Embedded in the Tunisian Press Code,^[18] the system of legal deposit impacts all sorts of publications. Publishers, distributors and printers, public agencies, and university institutions must submit copies of all printed material to the Ministry of Culture, the National Library, the Ministry of the Interior, and the Public Prosecutor’s Office. The categories of documents subject to legal deposit include official and unofficial publications as well as academic publications. Upon deposit of the copies, a receipt (*récépissé*) is issued by the Ministry of the Interior; only then can the publications be

produced and distributed. Foreign publications must get clearance from the Ministry of the Interior before distribution in the country. The Press Code was amended in 1988, 1993, and 2001. The more-recent amendments removed punitive measures that had included prison sentences and payment of fines for publishing without a legal permit. In theory, by virtue of these amendments, no newspaper can be suspended without a court decision. A 2005 amendment to the Press Law abolished the legal deposit process altogether, including related sanctions and punitive measures.^[19] Some jurists and observers have questioned such legislation and the sincerity of the recent reforms to abolish the legal submission process.^[20]

Tunisian law provides for intellectual property rights and copyright protection, including publication procedures, the transfer of rights and permission to photocopy.^[21] But, as elsewhere, enforcement is an ongoing problem.

Statutes and legislation concerning libraries and librarianship

Since independence, administrative oversight of Tunisian libraries has shifted several times among government agencies and ministries. Libraries and library staff and professionals are largely part of the public service, and their status is covered by provisions of legislation governing Tunisia's public administration. Laws addressing specific library entities, the jurisdictions they fall under, their funding, organization, and governance have been enacted and amended over the years. The following decrees and laws are the more significant:

- Decree no. 92-1353, July 20, 1992. Fixing the conditions and requirements governing nominations of library directors at universities and institutions of higher education and research. The law covers compensation, benefits, indemnities, and advantages accorded to appointees.^[22]
- Decree no. 94-559, March 15, 1994. Concerning structure and organization of the National Library and outlining its areas of responsibility.^[23]
- Decree no. 99-2762, December 6, 1999. Addressing the particular status of all personnel working in libraries and documentation centers that are part of the public administration.^[24]
- Decree no. 79-756, August 1979. Concerning mission, description, and organization of the National Library.^[25]
- Decree no. 79-698, August 1979. Regarding creation and transfer of positions at the National Library.^[26]
- Decree no. 75-254, April 1975. Addressing the status of management staff (cadres) of libraries, documentation centers, and archives.^[27]

All statutes and decrees consulted for this study were published in French in the official *Tunisian Gazette*, *Journal officiel*, and are available in digitized format in the

online database of the Centre national universitaire de documentation scientifique et technique: <http://www.cnudst.rnrt.tn/wwwisis/jort.06/form.htm>.

Academic Libraries

There are currently 178 institutions of higher education, among them 13 universities (Ezzitouna Islamic University, Manouba University, Tunis University, Tunis El Manar University, University of 7 November at Carthage, Jendouba University, Sousse University, Sfax University, Gabes University, Kairouan University, Monastir University, Gafsa University, and the Virtual University), in addition to the 24 Higher Institutes of Technological Studies (ISETs), 6 Higher Institutes of Teacher Training (ISFMs), and about 20 licensed private higher education institutions.^[28] One hundred fifty-five institutions are under the supervision of the Ministry of Higher Education, and 23 others come under shared supervision of that and other ministries (Communication and Technologies; Youth, Agriculture, Social Affairs, etc.)^[29] The student population in 2006 was estimated at 430,000.^[30]

Each university has a central library, bibliothèque universitaire centrale (BUC), responsible for all institutional information needs. All central libraries are part of a national electronic library network of BUCs in the country.^[31] The total university libraries holdings is estimated at over a million titles, not including 100,000 published and unpublished theses and dissertations.^[30]

The National University Network, Réseau national universitaire (RNU), is a project to create an online academic network connecting all institutions of higher education and research establishments in Tunisia to each other and to the Internet. By 2007 the number of RNU users was estimated at 221,924. The computer center al-Khawarizmī (Centre de calcul el Khawarizmi, CCK) was designated the Internet service provider for all institutions of higher learning in 1997. Included among its services are Web hosting, electronic mail, file transfer, database development and management, faculty training, and hosting of the university library system union catalog, BIRUNI (Bibliothèque Informatisée pour la Rénovation UNiversitaires, previously known also as Bibliothèque des Ressources UNiversitaires). It was initially launched in 1996 and was envisioned as a virtual library project using VIRTUA, the ILS by VTLS. The BIRUNI union catalog's main page functions as a gateway for searching all university catalogs. It also provides clustered links to Tunisia's university library catalogs by region: "Catalog of the North" "Catalog of the Center" "Catalog of the South." Although the site lists the categories "electronic periodicals" and "online theses," at the time of this writing the links to them are not active. Access to fee-based electronic resources and online databases is through the National Academic Center for Scientific and Technical

Information (Centre national universitaire de documentation scientifique et technique, CNUDST).

Centre national universitaire de documentation scientifique et technique (CNUDST, <http://www.cnudst.rnrt.tn>)

The center was created in 1979 as a unit of the Ministry of Higher Education with the broad mandate to support the acquisition of, and access to, scientific and technical information for the Tunisian research community (law No. 78-59 of December 29, 1978, and Decree No. 99-2241 of October 11, 1999).^[32] Centre national universitaire de documentation scientifique et technique holds the legal deposit right to receive one copy of every publication issued by institutions of higher education and scientific research in the country and is responsible for acquiring all such scientific documents by Tunisians in French universities. It houses the “virtual library of research” and provides gateway access to electronic resources consisting of subscriptions to databases and full-text online scientific periodicals. Centre national universitaire de documentation scientifique et technique negotiates database licenses on behalf of higher education and research establishments. Moreover, the center has developed, on its own, four freely accessible, online bibliographic databases:

- TUNIDOC. Lists documents, monographs, theses, articles, etc. relating to Tunisia or written by Tunisians. There were 37,129 multilingual, multidisciplinary entries as of April 2007.
- TUNIPER. A union catalog of serials and periodicals available in 130 Tunisian institutions. As of February 2007, 17,739 titles were listed.
- JORT [*Journal officiel de la république tunisienne*]. A bibliographic and full-text, online database of most laws, legislation, and other legal statutes published in the Official Journal of the Republic of Tunisia since January 1, 1956. As of March 2007 it contains 55,235 entries in Arabic and French.
- BDRGI (Base de données des ressources gratuites sur Internet). A selected online guide to electronic resources available on the Internet.

EUMEDCONNECT

This is a project funded by the European Commission to provide dedicated Internet connections between the research and educational communities of the Mediterranean region. It will link the national research and education networks of Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, the Palestinian Authority, Syria, Tunisia, and Turkey to Europe through the pan-European research and education network called GÉANT. The potential benefit from this initiative for Tunisia's

research and education sector is dedicated connectivity to research in state-of-the-art research information databases and facilities in European research institutions. DANTE, the “Delivery of Advanced Network Technology to Europe,” runs the circuit that links Tunisia to the network through Italy in coordination with Réseau fédéré de la recherche (RFR), managed by the Tunisian Secretary of State for Scientific Research and Technology.

Public Libraries

There are about 380 public libraries throughout the country,^[33] supervised by the Ministry of Culture (Ministère de la culture et de la sauvegarde du patrimoine). The Public Libraries Service (Direction de la lecture publique) in that ministry, founded in 1965, administers almost all public Tunisian libraries and publishes an annual Bulletin. Estimated total library holdings as of 2005 were about 5 million books, but only 60,000 of them are unique titles. Libraries are divided as follows:

- 311 public libraries, of which 305 have children's branches.
- 24 regional libraries and 28 mobile libraries.

In 2004 there were 5,230,179 public library visitors, almost half of them children and young adults. Of that number only 167,000 were registered users, who checked out 3,760,059 books.^[34] Public libraries charge an annual fee, the equivalent of U.S. \$1 for adults and half of that for youths, for use of all library services including the Internet.

Most public libraries that have been using card catalogs and traditional methods to manage their collections are becoming automated. Increasingly, modern information technologies, such as integrated library systems, computer catalogs, and library networks, are being introduced. In 1998 a pilot public library, the Médiathèque Ariana, went live with a biscript (Roman–Arabic) ILS based on UNIMARC. In 2004 the French government funded a project to promote public reading and the public library sector. One of its aims was to computerize the Ministry of Culture's Public Reading Service (Direction de la lecture publique) as a first step toward full automation and networking of the public libraries countrywide. The funding also includes acquisitions of book materials, especially for youth, and covers staff education and training at the Tunisian Higher Institute for Documentation (Institut supérieur de documentation) and in France.

There remains room for improvement when it comes to the role public libraries play in most people's lives; there is a lack of well-established reading habits, and books continue to be viewed outside school curriculums as unaffordable luxury items. But a vast action-program launched in 1997 with the aim of gradually connecting public libraries to the Internet has been a promising development.

School Libraries

Despite limited resources, the Tunisian government has allocated, in the decades since independence, about 7% of the gross national product (GNP) to education, one of the higher such ratios in the world. In 1991 a new education-system reform law^[35] was passed instituting compulsory and free schooling for children up to the age of 16 and stipulating that public education of all children of school age is a “right” and an “obligation.” As a result, enrollment reached over 99% among 6-year-olds. It is worth noting that, based on the available government statistics, regional disparities of access to schools persist: coastal and north-eastern regions continue to achieve the best schooling rates compared to rural areas in the northwest and southwest.^[36]

The rate of enrollment in primary education for children 6 to 11 years old was 98% during the 2005/2006 school year, for a total of 1,120,424 pupils in the primary cycle of public schools (“Premier cycle de l’enseignement de base,” 6 years) and 571,986 in the second cycle (“Deuxième cycle de l’enseignement de base,” 3 years). Enrollment in secondary public schools (enseignement secondaire) during the same year was 503,531.^[37] Tunisian primary and secondary schools have strong language programs, allocating more time to foreign language instruction than most European countries (29% of total instruction time in Tunisia in contrast to 10% in Europe). French is introduced at age 8, English at age 10, and a third language in secondary school.^[38] All school libraries in primary through preparatory and secondary schools are, in terms of human resources, administration, and funding, under the purview and centralized supervision of the Ministry of Education and Vocational Training, Service of Means and School Libraries (Ministère de l’éducation et de la formation, Service des moyens et des bibliothèques scolaires).^[39] The ministry acquires books through group purchases, a centralized process established in 1991.^[40] There are no available surveys of school library holdings. Secondary schools tend to have more libraries than primary schools; the concept of library in the latter category, if it ever applies, should be used loosely. School directors have small discretionary budgets for incidental expenses, including book purchases, and many accept additional supplies from other community sources. Other than textbooks, most titles, for the use of students and teachers, are in Arabic and French and cover literature, philosophy, science, technology, and economics. School libraries are not well funded and are rarely considered the focal point for learning in Tunisian schools. As a consequence, they are not well stocked. The limited commitment to school library service reflects a salient lack of learning opportunities outside the formal classroom, attributed quite often to limited funding. When it comes to the extras outside the classroom programs, however, libraries compete with sports, music, etc. for time and funds. Moreover, the

textbook is perceived as a complete book—other classroom teaching materials complete the picture.

The advent of the Internet, its spread throughout educational institutions, and its general popularity has been a mixed blessing for libraries and reading. In fact, school libraries (and all kinds of public libraries) are increasingly called “médiathèques,” that is, basically media centers offering a range of learning resources from textbooks, dictionaries, and encyclopedias to media materials, audio-visual aids, and increasingly the Internet—hardware and connection offered for free to all schools, courtesy of the government and the Ministry of Education.

The Tunisian government has invested heavily in computer training, technology, and online services and has succeeded in providing all secondary schools and tertiary institutions with computers, IT laboratories, and Internet connections. It has been working on a program that will bring all primary schools technologically up to speed by 2006. In addition, the Education Ministry has established a Virtual School to support distance learning and has set up EduNet (<http://www.evt.edunet.tn/indexan.htm>), an educational gateway and network linking Tunisian elementary and secondary schools to the Internet. EduNet provides a variety of Web services such as general information, e-learning sites, e-mail, databases, etc. By the late 1990s, EduNet had connected almost 500 primary, all 400 secondary, and over 50 technical schools.

In 2002 the ministry launched the Educational Virtual Library (Bibliothèque virtuelle éducative (BVE), presented as a tool linking the education community to online resources useful for information research and supplementing what is available in print, including: JSTOR Journal Storage, *Blackwell Synergy*, IEEE’s *POP ALL*, Proquest’s *ABI/INFORM Global*, Elsevier’s *Scopus*, and Thomson ISI’s *Web of Science*. The system’s gateway (<http://www.bve.edunet.tn/fr/index.php>) is bilingual, French and Arabic, and allows online searching by Dewey classification numbers.

Outside the Tunisian school system there are a number of international schools, often affiliated with foreign organizations or countries and their cultural missions. Worth mentioning is the American Cooperative School of Tunis (ACST) which, since 1959, provides elementary, middle, and high school American education. The school offers a curriculum that essentially follows the guidelines of U.S. public schools adapted to the needs of international students and a program leading to a U.S. academic diploma and the International Baccalaureate diploma. At the beginning of the 2006/2007 school year, enrollment was 494 (pre-K to grade 5: 264; grades 6–8: 114; and grades 9–12: 116). The 10-acre campus includes an administrative pre-school building containing an elementary library with an amphitheater and elementary computer lab. For the upper school there are computer labs, art rooms, and the main library with more than 12,000 volumes and a computer research area. The ACST Middle and High School Library

sets up monthly displays of books, artifacts, and interactive materials surrounding a current topic.

Special Libraries

Tunisia has a number of wide-ranging special libraries maintained by associations, government departments and services, research institutions outside universities, learned societies, NGOs, etc. Their collections are, as is usually the case for this type, in a specific field such as agriculture, law, social sciences, medicine, economics, and engineering. Collections and services are for the most part designed to provide for the information needs of their primary users and other specialists in the respective field and to a lesser extent the needs of members of the public at large. Some of the largest special libraries are those under the jurisdiction and direct supervision of government ministries.

In 1977, a national commission for documentation and information (Commission nationale de documentation, CND) was charged with developing a plan for setting up a national information system network structured by sector (libraries, documentation centers, archives, etc.) and connected to international information networks. Each component of that system was to be called a Centre national pilote sectoriel, CNPS (national specialized pilot center). Each of the resulting 12 CNPSs is assigned to build a network in its respective sector of specialty. Together, all the CNPSs form Réseau national d'information et de documentation (RNID), the national information and documentation network.

Generally, technical and scientific information and documentation is the responsibility of three main bodies: Centre de documentation nationale (CDN); Centre national universitaire de documentation scientifique et technique (CNUDEST), described in a previous section; and Centre national de documentation agricole (CNDA).

Centre de documentation nationale (CDN)

The National Documentation Center collects and preserves all documents and information on cultural, political, social, or economic issues available anywhere and directly relating to Tunisia. Created in 1966, the status of the CDN is defined and governed by a 1982 Presidential Decree^[41] as the cornerstone of the national information network. It currently has a library of about 8,000 monographs, 2,400 periodicals, 10,000 press documents ("dossiers de presse"), and 50,000 photographs,^[42] most of them accessed through the center's computerized database, TANIT. It has developed a guide to information services in Tunisia and created a number of databases including ITARAT, on governmental structures and related information, and ASSO, on associations. The CDN is an IIP focal point for UNESCO (Intergovernmental Informatics Program). The CDN is also the subregional focal point for the Francophone database Banque

internationale d'information sur les états francophones (BIEF), and its program named "La Francophonie," a network of focal points in 52 Francophone member states.

Centre national de documentation agricole (CNDA)

The National Center for Agricultural Documentation was conceived under the Ministry of Agriculture as a central hub for collection and dissemination of current and retrospective agricultural information and data. It publishes TUNAGRI, the national agricultural bibliography, and CARIST, a quarterly bulletin that covers current research information, reference documents, and agricultural facts and figures, as well as places, names of agricultural scientists in the country, and other online resources (market research, agricultural politics, etc.). It also has a legal resources database, JORTAGRI, for texts of legislation, laws, decrees, etc. relating to agriculture (<http://www.onagri.nat.tn/Default.htm>). The center also provides gateway access to automated agricultural databases. The AGRINET, managed by the Institut de la recherche et de l'enseignement supérieur agricole (IRESA), connects 14 institutions of higher education in agriculture as well as 7 regional research centers. It also connects the various departments of the Agriculture Ministry as well as its regional representations (Commissariats régionaux) throughout the country. The CNDA is affiliated with the international agriculture system, AGRIS, the international information system for the agricultural sciences and technology created by the Food and Agriculture Organization (FAO) of the United Nations.

Réseau national de santé (RNS)

In the medical and health fields, the National Health Network provides connectivity to 84 hospitals, including all the 20 university hospital centers and 44 regional hospitals and 23 regional branches of the health Ministry (Directions régionales de la santé). It is managed by the Ministry's Centre informatique du ministère de la santé publique (CIMSP), providing distance information services, "télémedicine," to doctors in remote regions of the country and services to health centers far from large population areas.

Library, Information Science, and Archival Education and Training

Specialized training and education in librarianship and information sciences in Tunisia has developed very slowly, arduously, and sometimes erratically. After several years of being scattered among a few institutions it became, in the last couple of decades, centralized at one institute. Historically, formal professional training for librarians and archivists started in 1964 at the Institut Ali Bash Hamba, a public institution initially set up with

assistance from the German foundation Friedrich Naumann Stiftung several years after the country gained independence. Its main and somehow vaguely defined goal was the development and dissemination of cultural, economic, social, and technical information in Tunisia. Between 1966 and 1971 it offered training sessions lasting six months each, conducted by a corps of international instructors dispatched by the International Federation for Information and Documentation (Fédération internationale d'information et de documentation, FID). This college-level training program attracted students and professionals from French-speaking countries in Africa; about 100 of them graduated with degrees in documentation. In 1965 the Tunisian Ministry of Cultural Affairs was prompted to start a course specifically for librarians at the National Library. Although it did not last very long, the program graduated two groups of assistant librarians and four groups of library assistants at the end of four years. By the early 1970s, training of librarians was transferred to the National School of Administration (Ecole nationale d'administration, ENA). This is the school, similar to its famous French counterpart, where government officials and functionaries are trained under the jurisdiction of the Prime Ministry. The Friedrich Naumann Stiftung again provided financial support, including scholarships and recruitment of foreign lecturers. The curriculum was organized into three training cycles, each lasting two years. By 1979 library science and archival training was moved to the Institute of Journalism and Information Sciences (Institut de presse et des sciences de l'information, IPSI) under the purview of the Ministry of Higher Education, Scientific Research and Technology. It was first planned as a four-year undergraduate-level program. However, that program in turn was scrapped and replaced by another two-year professional program in library science; candidates for admission were required to take an entrance exam. A two-year graduate-level program was introduced in 1984–1985 at IPSI that accepted students with the equivalent of a bachelor's degree in any subject. Lacking in experienced faculty and relying mainly on professional librarians as part-time lecturers, that program was also cancelled a few years later despite attracting about 100 students a year. A major improvement started in the mid-1980s, when the Institut supérieur de documentation (ISD) (<http://www.isd.rnu.tn/en/default.asp>), took responsibility for developing a full-fledged undergraduate program in librarianship and archival sciences. According to its founding law,^[43] ISD is a public institution of higher education and research that provides training for managerial and professional staff in library sciences, documentation, and archives. It is part of the University of Manouba, Tunis, under the Ministry of Higher Education, Scientific Research and Technology. The ISD's original course of studies consists of a two-year training cycle for three categories of students:

- 1st category:
Beginners holding new high school finishing diploma (Baccalauréat) who plan to graduate as library assistants after a two-year program.
- 2nd category:
Graduates in other specialties planning to become librarians, documentalists, or archivists after undertaking an additional two-year training.
- 3rd category:
Holders of an undergraduate degree (four years) in other disciplines, especially humanities, who plan to be curators (conservateurs) in libraries and other resource centers.

Since 1988, ISD has offered a four-year specialized program leading to a full university degree (Maîtrise: four years). More recently it set up a graduate-level program, "Diplôme d'Etudes Supérieures Spécialisées (DESS)," roughly the equivalent of a master's degree. Admission to the program is subject to a competitive entrance examination. The Institut supérieur de documentation is currently the only university-level institution that is dedicated to providing specialized training in the field of library, information, and archival science. As of the 2006–2007 academic year, total enrollment at ISD was 1466 students: 363 in the 1st category mentioned above, 289 in the 2nd, and 814 in the 3rd; it also has 74 teaching faculty and staff. Graduates of ISD programs can apply to, and be recruited by, the National Archives, the National Library, public libraries, university libraries, resource centers and archives units (in ministries and public administrations), and private firms and companies.

Library, information science, and the archival profession

L'Association Tunisienne des bibliothécaires, documentalistes et archivistes (ATDBA), is the only professional association for librarians, archivists, and researchers in the field of information science. It was founded in 1965 and currently has 250 active members. Its main publication is RASSID: Revue de l'Association tunisienne des documentalistes, bibliothécaires et archivistes pour l'information documentaire, a multilingual journal issued four times a year.

ARCHIVES AND ARCHIVAL SCIENCE

The Superior Council of Archives, Conseil supérieur des archives, is the official governing and advisory board responsible for setting national archival policy. It is under the jurisdiction of the Prime Ministry and presided over by the prime minister. Established by virtue of Decree no. 94-1618 of 26 July 1994,^[44] the council is made up of

10 ministers and government secretaries as well as a Technical Committee charged with compiling materials to be considered and approved by the full council. The Technical Committee includes professionals and researchers in the archival field, the general director of the National Archives, representatives of the association of archivists, and archives users.

Legislation Concerning Archives and Records Keeping

- Decree no. 70-118 of April 11, 1970, concerning the reorganization of all government services under the Prime Ministry, including archives administration, which was renamed "Division des archives générales."^[45]
- Decrees no. 88-1979 and 88-1981 of December 13, 1988, concerning the general organization, structure, and management of the national archives; fixing procedures of handling and disposition of archival records.^[46]
- Decree no. 389 of February 21, 1997, containing general provisions regarding the organization and management of the National Archives that include the definition of its structure, administrative hierarchy, budget, financial arrangements, and contracts. (Decree no. 389 repeals the Decrees of December 13, 1979 and December 1988). Accordingly, public services and state bodies in Tunisia are required to elaborate, in collaboration with the National Archives, a program for the management of their records and to agree on procedures and work out methods of handling archival records throughout their lifecycle. The program should cover all functions meant to ensure proper handling of records in terms of appraisal, inventory, and classification.^[47]

The National Archives

al-Arshīf al-Waṭṭanī al-Tunīsī (Archives nationales tunisiennes, <http://www.archives.nat.tn/>)

The founding of the Tunisian National Archives (Fig. 4) dates back to 1874, when a small archival section was created within the Grand Ministry (Prime Ministry). It was initially named Centre des correspondances de l'état, or State Correspondence Center, and designated a repository of public and official records that were transferred from such locations as the royal Bardo Palace and various other document-producing sources of the civil service and state institutions. During the French colonial period (1881–1956), the Tunisian staff and administration of the center was maintained but it came under the supervision of a French senior official, *secrétaire général du gouvernement*, and its functions were restricted to internal affairs that were directly linked to the "indigenous" Tunisian population only, such as regional and local

administration, justice, religion and worship, endowments, etc. At that time, the French "resident general" (high commissioner) exclusively ran the important ministries of war and foreign affairs. In 1883 the Archives générales du gouvernement (State General Archives) was established as the repository of all official documents under the secretary general of government. Records collected by the services directly relevant to the French resident general in Tunisia were transferred to France. Since 1983, Tunisia has actively proceeded with microfilming or obtaining copies of these records. When the country became independent, the Archives générales du gouvernement took the name Archives générales. In 1967 the archives administration became known as the Division des archives générales et de la documentation (General Archives and Documentation Division). Its task was to collect and preserve the state's general archives. By 1970, it was again renamed Division des archives générales.

With a current staff of 56, including 24 professional archivists and conservation specialists, the National Archives, a financially autonomous institution that, under the oversight of the Prime Ministry, is responsible for collecting, preserving, and making accessible all archival resources, including those available abroad and deemed relevant to Tunisia. The National Archives works in close collaboration with record-producing bodies and institutions such as government ministries and public departments, institutions, and services. These bodies are required by law to develop specific methods and schedules for appraisal and management of their records. The Common records appraisal schedule, established by a prime minister in 2000 is a management tool completely integrated into the administrative processes of all government and public bodies. It fixes for each type of record the period for which it is to be preserved and made available, the period for which it is preserved as a semicurrent record, and the destination of a record or file following the expiry of its retention period, which is often disposed



Fig. 4 New building of the Tunisian National Archives.

of or transferred to the National Archives. On a local level, for regional entities such as municipalities that are outside the direct purview of the central government, the system for archival records communication and management is still in development.

The most ancient preserved record available at the National Archives dates back to 1582 A.D., although the bulk of the archives concerns mainly the period from the seventeenth century to the present and is divided into the following major groups:

- The Ottoman Period
- The Colonial Period
- Independent Tunisia
- Documentary Holdings (mostly printed monographs, periodicals, and newspapers)

The National Archives' "historical library" includes more than 6000 monographs, mainly in Arabic and French, in addition to manuscripts in Arabic, Turkish, French, Italian, and English dating back several centuries. There are also an estimated 725 periodicals and historical newspaper titles in Arabic, French, Italian, and Hebrew.

The best organized and maintained records and holdings are from the Ottoman period in Tunisia, with particularly rich holdings covering the Husaynite dynasty (1705–1881) and French colonial Tunisia, from 1881 to 1956. Most of the documents and texts concern the Tunisian state and reflect essential aspects of the political and administrative organization of the country, as well as its economic and social and cultural changes for a good part of three centuries.

Access to records is available on site at the National Archives and is strictly regulated according to type and age. "Current" official records are practically inaccessible to the general public. For noncurrent records, the periods after which public access becomes possible are according to the following categories:

- 30 years beginning with the date of the public record's creation.
- 60 years for records that:
 - Are a threat to the private life of individuals or related to national security matters
 - Contain personal information or relate to private life and behavior
 - Relate to legal matters
- 100 years for
 - Civil registers and similar official records
 - Records comprising of personal medical information and personal files

Clearance to consult records for research purposes prior to the expiration of the specified retention periods is given only if the user can provide written approval from a research institution and agrees to undergo a background

check to establish that the information wanted is not a threat to individual safety and public order.

Public access to records and use of the National Archives' reading rooms requires a small one-time fee to obtain a reader's card. Foreign nationals are allowed access provided that they display a pass approved in advance by the director of the National Archives.

Photocopying is authorized for a fee in conformity with internal Archives regulations.

Records and record groups are cataloged according to a hierarchical classification system using common characteristics such as similarity of function, subject, and type. The system, consisting of several levels of grouping, proceeds from the "general" to the "specific" and is presented in a hierarchical form with each level (class, subclass, division, and subdivision) indicated by a heading and a classification index:

- *Class:* 3000 Financial resources management
 - *Subclass:* 3100 Budget elaboration
 - *Division:* 3170 Budget change
 - *Subdivision:* 3171 Application for extra credits

Descriptors, accompanied by a classification index, are arranged alphabetically with cross-references and associated terms.

Two databases are used as the National Archives' online catalog:

- *Kitāb*
For preserved works such as monographs, documents, and periodicals in Arabic or other languages available at the National Archives. The number of records is estimated at about 10,000 with a 5–10% annual increase.
- *Dhākrah*
For records, official documents, and treaties and comprising about 75,000 entries (with a 5–10% annual increase).

ISAD (G) (General International Standard Archival Description, 2nd edition), is the standard followed for archival description in this database.

The National Archives publishes finding aids, studies, research papers, and pedagogical tools. Its official publication is "Inventaires des documents d'archives conservés."

In 2004 Tunisia established a National Archives Day, which is celebrated every February 26th "to focus attention on archives... as a key to national memory and as a source for study and research." (Fig. 5)

It is important to point out that, other than the National Archives, several local and foreign institutions hold important records relating to the modern and contemporary history of Tunisia. The most important ones are



Fig. 5 Poster celebrating Tunisia's first National Archives Day.

- The Higher Institute for the National Movement History, at Mannouba campus, holding microfilm records of the French colonial "Résidence générale."
- The Ministry of the State Property, Department of Documentation and Archives, holding historical documents of the Endowments Administration, "Jam'iyah des Habous."
- Municipalities responsible for the preservation of records relating to the civil register acts (birth, marriage, and death certificates) and those concerned with city planning.
- Courts in charge of holding and safeguarding the documents they produce.
- The Archbishopric of Tunis, holding all records relating to the Catholic population that lived in Tunis during the French colonial rule.
- The French Consulate in Tunis, holding all records relating to the civil register acts (birth, marriage, and death) of French nationals who lived in Tunisia during the Colonial Period after 1914.

Foreign-based repositories of documents that are relevant to Tunisia include notably:

- Direction des Archives du ministère des affaires étrangères (Department of the Archives of the Ministry

of Foreign Affairs), Centre Parisien 37, Quai d'Orsey, 75007, Paris, holds civil register acts of the European community in Tunisia prior to 1914 and the diplomatic correspondence of the Ministry of Foreign Affairs.

- Archives nationales, in Paris, previously named Centre historique des archives nationales de France.
- Centre des archives d'outre-mer, Aix-en-Provence, France.
- The diplomatic archives of several countries, namely, England, Italy, Germany, United States, Sweden, and Norway, have records relating to the history of modern Tunisia.

Archival education and the profession

Training and education for archivist at the university level is at the Institute of Information Science (ISD), described in a previous section. The main professional association is also the Tunisian Association of Documentalists, Librarians, and Archivists (ATDBA), established in the mid-1960s.

Finally, it should be mentioned that in 2005 the International Association of Francophone Archives launched its International Francophone Archival Portal (PIAF) (<http://www.piaf-archives.org>) as a clearinghouse offering training for archivists of the Francophone community. International Francophone Archival Portal offers free online basic training on records and archives management focusing on the continuing education needs of archival technicians and professionals, but it does not result in a diploma.

MUSEUMS AND MUSEOLOGY

General Background

There are two leading bodies in the area of museology, historic preservation, and cultural heritage in Tunisia:

1. The Agency for Heritage Development and Cultural Promotion, Agence de mise en valeur du patrimoine et de promotion culturelle (AMVPPC) (<http://www.igm.com.tn/amvppc/eng/accueil.php>), is a national agency established in 1988 under the authority of the Ministry of Culture and Heritage Conservation to restore and manage the country's historical and archeological heritage.^[48] Its mission is to implement government policy in various fields related to the restoration, preservation, management, and promotion of the country's archaeological and historical heritage at about 60 sites, monuments, and museums. It is the body in charge of delivering authorization required for any activities taking place within the confines of sites under its responsibility. Agence de mise en valeur du patrimoine et de promotion culturelle is headed by a director general and has seven departments: Technical, Cultural Promotion, Management, Production and

Organization, Study and Programming, Administration and Finance, and Coordination and Follow-Up. The agency undertook the rehabilitation of older museums such as the National Bardo Museum, and the museums of Enfidha, Nabeul, and El Jem, as well as the Popular Arts and Traditions museums of Monastir and Houmt-Souk. It created new museums as well in Moknine, Chemtou, and Mahdia and the Sahara museum in Douz and also participated in the creation and design of museums for other parties: the National Military Museum (Qasr al-Wardah), the Mareth Line Museum, the National Guard Museum, and the Film Museum. As a promoter of cultural tourism, it played a central role in the creation of the Carthage-Sidi Bou Said Archaeological Park; the refurbishment of the Baron d'Erlanger's palace in Sidi Bou Said, housing the Center of Arab and Mediterranean Music; the Archaeological Park of Dougga; and the Sbeitla-Kasserine Archaeological Park. In 2002, in an effort to modernize the country's cultural infrastructure, the Tunisian government launched, with support from the World Bank, a multiyear project that would improve the sector through strengthening the legal and institutional framework, encouraging cultural tourism, and refurbishing six selected sites: Ancient Carthage, Bardo Museum, Sousse Museum, the Medina Old City of Qayrawan, the archaeological site of Oudna, and the island of Jerbah. A unit operating within the AMVPPC is responsible for the project's implementation.

2. The National Institute for Cultural Heritage, Institut national du patrimoine (INP) (<http://www.inp.rnrt.tn/>), was founded in 1957 as the Institut national d'archéologie et d'art, before changing its name in 1993. It is a technical and scientific institution under the Ministry of Culture in charge of preserving, studying, and making the cultural, archeological, historic, and artistic heritage of the country accessible to the public. The institute has various technical facilities, such as a central laboratory, a center for the restoration of Qayrawan manuscripts (Centre de restauration des manuscrits de Kairouan), a center for calligraphy (Centre national de la calligraphie), and an education center (Cours de Tunis) for training Tunisian and North African architects in different conservation specialties. Its publications include

- Africa: journal for research and excavations in prehistoric and Islamic antiquities in Tunisia, 1966–
- Reppal: research journal for Phoenician, Punic, and Lybico-Berber antiquities
- La Revue des arts des traditions populaires, specializing in folklore and popular cultural monuments, objects, traditions, rituals, and beliefs
- Bulletin du CEDAC: annual information letter published by the Centre d'études et de documentation archéologique de Carthage, an affiliate

institution of INP, reporting on archeological digs and excavation results at the Carthage site.

Tunisia's cultural assets include many archaeological sites, parks, and historical settlements, several of which are listed as World Heritage Sites under the international convention administered by UNESCO. There are numerous museums located throughout the country, varying widely in significance from the national and prestigious to the smaller and pedestrian. Among the 18 historical and archaeological sites in Tunisia that receive visitors and the 27 museums, "antiquariums," and archaeological, historical, and natural parks, the following are particularly noteworthy.

Museums

Musée national du Bardo (<http://www.di.com.tn/museebardo/>)

The Bardo National Museum (Fig. 6) houses the largest—and arguably the finest—collection of Roman mosaics in the world. Situated in Bardo, a near suburb of Tunis, the museum building was originally a residence/palace that had been restored and expanded over the centuries before being dedicated first in 1882 as a museum, namely, al-Mathāʾaf al-ʿAlawī: Le Musée Alaoui. In 1899 a second extension space, called the small palace, was added to it to house collections of Islamic arts and artifacts. In 1956, at Tunisia's independence, it officially became the National Museum in Bardo.

Bardo Museum is spread over approximately 11,000 m². The exhibits represent vast collections of relics from every period of Tunisia's past, and collections are presented by department-era: Prehistory, Punic, Roman, Christian, Arab-Moslem, Bronze and Greek marbles, etc. Many of



Fig. 6 Bardo National Museum main entrance, on the right, as seen in the summer of 2007 prior to renovation work.

the exhibits are impressive from an archaeological point of view, as well as compelling and beautiful, although the premises, the labyrinthine ground plan, and exhibition rooms have been in need of renovation for many years. Work on the renovation and alteration of the building has been contracted to the French architectural agency Codou Hindley and is expected to last 27 months. It will enlarge the museum by doubling the existing space. The planned modernization will add new, handicapped-accessible structures and underground spaces for public displays in addition to an auditorium, a laboratory, a cafeteria, and a restaurant.

Musée national de Carthage

Carthage National Museum, also known as the National Archeological Museum, is located on the hill of Byrsa in close proximity to the ancient city of Carthage and to several important excavation sites. Officially founded in 1964, it is a repository of numerous antiquities and the product of archaeological excavations since the nineteenth century. It has a great mosaics collection and other archeological materials. Exhibits include information about the course of the different excavation campaigns, a small scale model of Punic Carthage, the Capitol built by the Romans on the ruins of Punic Carthage, tophets used for child sacrifice, Punic and early Christian antiquities, mosaics, jewelry and ornaments, everyday objects, clay masks, funerary stelae and sarcophagi, etc. The two-story museum itself is relatively small but is incorporated into an area of another seven sites, or the museum gardens, where a variety of ancient remains are on display, including a 10 f high marble statue commemorating Louis IX's crusade to Tunis (1270)—though the statue is in fact a likeness of Emperor Charles V. The museum is the official center for all research activities, preservation, and administration of the Carthage site, where the Centre d'études et de documentation archeologique de Carthage is located (see Bulletin du CEDAC). It is therefore a first stop immediately before exploring the ruins of Carthage itself, a UNESCO World Heritage site.

Musée national d'Utique (<http://www.inp.rnrt.tn/Museeutique.htm>)

Commonly known as the first colony founded by the Phoenicians in North Africa, Utica was originally founded around the eighth century B.C. as a port north of Carthage on the trade route of the Phoenicians to the western Mediterranean. Excavations at the site have yielded two Punic cemeteries and Roman ruins, including baths and a villa with mosaics. The two-room museum is located on the site and contains Punic and area exhibits going back to the seventh century B.C.

Musée archéologique de Chintou (<http://www.chintou.com/>)

The museum and ancient site at Chintou, the country's site museum, is an archeological complex of 10,000 m² developed under the authority of the Tunisian Institute of National Heritage with assistance from the German Archaeological Institute in Rome.

The museum contains four exhibit rooms in three wings—more than 16,145 ft² displaying the results of over 25 years of excavations at the ancient quarries and the site of Chintou. Chintou's famous golden marble was first quarried under the Numidians (149–118 B.C.). Under Roman rule, the marble served as decoration in public buildings all over the empire, including in Rome. The site offers a number of finds from various historic eras, including pagan temples, Numidian tombs, the remnants of a fifth century Christian church, a Roman way, marble quarries, and a turbine-driven grain mill. At the beginning of the twentieth century the marble yard was restored to working condition. The museum itself houses, in addition to an information space and lecture theatre, an exceptional treasure of 1647 gold coins and stresses the Numidian civilization and the extraction of marble by the Romans. The exhibits are arranged by topic:

- Protohistoric Simitthu 500–100 B.C.
- The Royal Numidian Altar
- Marmor Numidicum
- The Ancient Marble of Simitthus
- Roman Town Colonia Iulia Augusta Numidica Simitthensium
- Funeral Monuments

Musée des arts islamiques de Rakkada

The Raqqada Museum, created in 1986 and housed in a former presidential palace near the city of Qayrawan, has the country's largest collection of Islamic art, in particular, manuscripts of the Koran from the Great Mosque of Qayrawan, famously called the Blue Koran. It also has an interesting collection of ceramics, glass, and bronze objects and numerous coins from various medieval periods.

Musée de Sidi Kasim al-Jalizi (Ceramic Museum)

Located in the mausoleum of Sīdī Qāsim al-Jalīzī, a famous saint and ceramist of Andalusian origin, in the western part of the old city in Tunis. It is a small museum featuring old ceramics. The fifteenth century mausoleum is an homage to this saint, whose history reports that he was a manufacturer of ceramic squares, hence its name (ceramic squares in the North African dialect are called *jalīzi* or *zalīz*). Since 1981 this restored building has sheltered an old ceramics collection

(thirteenth to sixteenth centuries) and an epigraphic collection of old funerary steles.

Musée des arts et traditions populaires

The Museum of Popular Art and Tradition, also known as Musée Dar Ben Abdallah and as Musée du patrimoine traditionnel de la ville de Tunis, was inaugurated in 1978 and housed in an eighteenth century bourgeois residence in the center of the Medina (old city) of Tunis. It has two sections, one for family life, customs, and rites and the other for public life in the city. On display are various collections of traditional Tunisian domestic objects, costumes, jewelry, and old furniture. There is a display room reserved for the horse and the rider and their gear and ornaments.

Musée Dar Cherait (<http://www.darcherait.com.tn/>)

This is the first private and possibly the best “living museum” in the country. Founded in 1990 in Tozeur, a southern desert oasis town that for centuries served as a caravan station, it contains art objects depicting the life-style in bygone times of a well-to-do middle-class Tunisian family, complete with reconstructed rooms, scenes of daily life, and samples of pottery, utensils, and antiques. There are also replicas of the bedroom of the last *bey* (Tunisia’s monarch), a palace scene, and a Bedouin tent. The private collection contains good examples of centuries-old Tunisian artifacts. The museum building, part of the Dar Cherait Complex, is housed in a restored mansion and a Bedouin tent.

Musée Sidi Zitouni

This popular art and traditions museum was set up in 1968 in the shrine of the saint Sīdī Zitounī, located in Hāawmat al-Suq, on the southern island of Jerbah. Its unique collections depict traditional daily life in several adjacent towns and villages and include formal Jewish and Moslem clothing as well as samples of silver jewelry that was the specialty of local Jewish artisans; a reconstruction of a pottery workshop; and a display of utensils, pottery, and old furniture.

Additionally, there are other important historical and archeological museums throughout the country that should be mentioned: Musée du site de Bulla Regia, Musée du site de Makthar, Musée archéologique d’Enfidha, Musée archéologique de Sousse, Musée archéologique de Nabeul, Musée du site de Kerkouane, Musée archéologique de Sbeitla, Musée archéologique de Chintou, Musée archéologique de Lamta, Musée archéologique de Salakta, Musée archéologique d’El Jem, Musée archéologique de Gafsa, and Musée archéologique de Sfax.

The World Heritage Committee has inscribed on its World Heritage List for cultural values the following Tunisian Cultural Properties: amphitheater of El Jem, in 1979; site of the ancient city of Carthage, in 1979; the Medina (old city) of Tunis, in 1979; Punic town of Kerkouane and its necropolis, in 1985; Medina of Sousse, in 1988; the old city of Kairouan, in 1988; Dougga/Thugga archeological site, in 1997; and the nature preserve Ichkeul National Park, in 1980.

Education and the profession in museology

Training and education in archaeology, museology, ethnography, protection, and evaluation of the national heritage is done mostly within the INP. For many decades curators and cadres in the field have also been graduates of L’école du Louvre à Paris en muséologie in France. The country’s quasi-professional association is the Comité national des musées, founded in 1961 and currently headquartered at the Bardo Museum.

National Parks

Natural parks and sites

Ichkeul National Park. Of Tunisia’s six national parks, the most significant is the one around the lake, Ichkeul, in the north. Officially designated as a Wetland World Heritage Site, it is one of only two water-based, UNESCO-protected biosphere reserves in the world—the other is the Florida Everglades. It is the best vantage point from which to watch Tunisia’s most colorful birds. As a bird sanctuary, the park is best visited between October and February, when it becomes a hugely populated stopping point for waterfowl and game birds migrating between Africa and Europe. Among other animal species there are water buffalo, wild boar, jackals, mongoose, and European genets as well as a limited number of crested porcupines. Djebel Ichkeul (Ichkeul massif) was originally acquired by the state in 1891; until that date the lake surrounding Djebel Ichkeul had been used as a hunting reserve. The creation of the national park was ratified by Presidential Decree No. 80-1608, of December 18, 1980.^[49]

Belvédère Park and zoological gardens

Established in 1892 on a hill near the center of Tunis, Belvédère was designed by Joseph Lafacade, chief gardener of the city of Paris, France, and first opened to the public in 1910. Today the park is the largest urban park in the country, covering 110 ha. At its center is a sixteenth century Qubbah, a pavilion that provides an excellent view of the city and an example of neo-Moorish-inspired Tunisian architecture. Beside the park there is a zoo, Parc Zoologique de la Ville de Tunis, featuring African fauna, including 61 mammal, 94 bird, and 5 reptile species.

It was set up in 1963 with German assistance and covers 15 hectares.

Musée océanographique de Salammbô “Dar el Hout” (<http://www.mes.tn/instm/fr/infrastructure/musee.html>)

The national maritime and oceanography museum was built in 1924 during the French era in Tunisia in Salambo, not far from ancient Carthage, on a site called Palais des Suffètes de la Mer. Today, after a number of restructuring improvements, the museum has, in addition to a laboratory, a library, and a conference room, eleven display rooms, or “salles,” that include aquariums:

- Salle 1: La Tunisie pays marin
- Salle 2: La Tunisie et la Méditerranée
- Salle 3: Les aquariums d’eau douce
- Salle 4: Les lagunes Tunisiennes
- Salle 5: Migration de l’anguille
- Salle 6: Les îles et les espèces protégées
- Salle 7: Le littoral
- Salle 8: La communauté d’oiseaux
- Salle 9: Les techniques de pêche
- Salle 10: Les poissons
- Salle 11: Les aquariums d’eau de mer

Cultural and Arts Centers

Maison des arts “Dar el founoun”

As the preeminent national center for cultural and musical activities and art exhibitions affiliated with the Ministry of Culture, the center’s original mission was to encourage and showcase plastic arts by Tunisian and foreign painters. Its activities revolve mainly around free exhibitions and occasional conferences. It has a 6000-volumes library and publishes monographs, catalogs, and brochures on a small scale. The site is close to the Belvédère garden in Tunis and existed as a cultural center long before it gained its new name and vocation in 1992.

Centre d’arts vivants de la ville de Radès

In 1982, the Ministry of Culture created the center as an education and training academy for student artists and professionals in the arts field. In addition to courses, it organizes exhibitions, conferences, and workshops for new and established artists. It also functions as a fine arts academy, accepting applications for artist-in-residence positions that last three to six months. It is open to the public and periodically organizes special workshop sessions for youth.

Centre culturel international d’Hammamet

Located in a villa built in 1927 in the north-eastern resort town of Hammamet by a wealthy Romanian named

George Sebastian, the International Cultural Center was founded in 1962. It includes an open arena and theater stage built in 1964 based on Greek and Roman models. It is the setting of an international festival of music and drama that takes place in July and August each year. Described by Frank Lloyd Wright as the most beautiful villa in the world, Sebastian’s house and surrounding gardens with over 300 species of plants was a destination of prominent personalities such as Winston Churchill, Anthony Eden, and Field Marshall Erwin Rommel and a variety of artists who came to visit and create. It continues to function as an international artists’ retreat.

CONCLUSION

Since the country gained independence, successive Tunisian governments have pursued reformist and modernist policies, especially in the cultural and educational spheres. While well aware of its millennia-old cultural roots and being custodian of vestiges that are considered important World Heritage sites, this emerging country faces a number of challenges. In spite of Tunisia’s economic and social successes, its cultural scene is still in need of realizing full potential. The state remains the dominating sponsor and patron of culture and the arts. In this respect, it has succeeded in developing a considerable cultural infrastructure throughout the country. It has also built an adequate statutory framework consisting of legislation related to cultural matters that is designed to ensure, for instance, the protection of intellectual and artistic property, the preservation of the country’s heritage, and guaranteed freedom of information and the media. In reality, however, the country still faces a long road ahead with regard to all of these issues. Moreover, despite concerted efforts over the decades since independence, there is a manifest lack of interest in books and reading among a large swath of the population, and publishing levels outside official and educational institutions continue to be low. Critics also see serious shortcomings in the areas of artistic creation and theatrical and cinematographic productions. Tunisia’s rich cultural heritage and assets are underappreciated, and the various concerted measures undertaken by the government authorities in recent years to encourage, for instance, cultural tourism were mainly geared toward foreign visitors. There is arguably looming danger to many historical sites as a consequence of the conflicting pressures on land use from urban, agricultural, and tourism expansion. Some historical sites are deteriorating due to aging and weathering or inadequate maintenance. Finally, it must be pointed out that in the area of information and communication technologies, the Tunisian government has invested heavily in online services, computer training, and hardware acquisition so much that the World Economic Forum recently designated the country as first in Africa for network readiness.

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Ukraine: Libraries

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Abstract

The geopolitical location of Ukraine in Central-Eastern Europe has significantly influenced the historical and present development of the country and its libraries. The Ukraine became a fully sovereign state in 1991, after long periods of successive domination by Poland-Lithuania, Russia, and the Soviet Union. Since Ukraine became independent libraries have been rethinking their role in society, considering different goals and facing new challenges. Those challenges are closely linked to democratic changes occurring in Ukraine during the last decade. This entry gives a brief history of libraries in Ukraine, reviews conditions and development of Ukrainian libraries, and discusses new trends in their activities. It also contains basic information about some of the major libraries in Ukraine.

INTRODUCTION

Ukraine is located in Central-Eastern Europe (see Fig. 1). The geopolitical location of Ukraine has significantly influenced the historical and present development of the country. Ukraine is the second largest country in Europe. The Ukrainian culture and dramatic history goes back to the 5th century, when Kyiv (the capital of Ukraine) was founded. The Ukrainian Parliament passed a declaration of sovereignty in July 1990 and, in August 1991, declared Ukraine independent of the Union of Soviet Socialist Republics (USSR).

Libraries and librarianship in Ukraine reflect the history and development of the country and its people. Because Ukraine became an independent sovereign state, the libraries have been rethinking their role in society, considering different goals and facing new challenges. Those challenges are closely linked to democratic changes occurring in Ukraine during the last decade. This entry gives a brief history of libraries in Ukraine, reviews conditions and development of Ukrainian libraries, and discusses new trends in their activities. It also contains basic information about some of the major libraries in Ukraine.

HISTORY OF LIBRARIES IN UKRAINE

Earliest chronicles of libraries in Ukraine date from the 11th century (the Library of Saint Sophia's Cathedral, also known as "The Prince of Kyiv Rus Yaroslav's the Wise Library" and "The Library of the Kyiv-Pechers'ka Lavra").^[1] "At the beginning of the 14th century a large collection (215 manuscripts and books) was housed at Supral' Monastery; there were smaller ones at Sluc'k (founded 1494), L'viv (founded 1579), and elsewhere."^[2] There were well-known libraries located in monasteries

and private libraries owned by famous clergymen and Cossack's nobility during the 16th–18th centuries. Examples of these are the libraries of L'viv Stavropygian Brotherhood (16th century); Petro Mohyla (1596–1647), later donated to the Kyiv Academy; Dmytro Tuptalo; Feofan Prokopovych (1681–1736), containing 3000 volumes; and Lazar Baranovych.^[2]

During the 19th century, many academic and public libraries were founded. Some of them are the libraries in Kharkiv (1805), Odesa (1829), and the Library of Kyiv University (1834).^[3]

There was a short period when Ukraine attempted to establish itself as an independent state (1918–1921). At that time, the National Library of the Ukrainian State was established (1918). However, Ukraine lost its own state system and became a part of the USSR in 1922. During the World War II, German troops occupied Ukrainian territory (1941–1944). This war brought great losses to the libraries. Before the beginning of the Second World War, there were 44,662 libraries with total book collections amounting to 102 million items.^[1] The official estimates of losses say that more than 40,000 libraries were ruined or damaged and about 80 million books were destroyed or stolen. Nevertheless, the library network in Ukraine was basically restored by 1950.^[1] Under the Soviet regime, the libraries had a strict centralized administration ensuring strong censorship and dictating communist ideology. The Soviet Union had proclaimed a new "nationality," "the Soviet human being," which meant the erasure of individual national and ethnic identities. The libraries were an important instrument toward the achievement of that goal. The libraries of the Soviet republics were deprived of their individual identities. They were all headed by the Moscow library administration, and they served Moscow politics and ideologies.



Fig. 1 Map of Ukraine.

Source: CIA World Factbook <https://www.cia.gov/library/publications/the-world-factbook/goes/up.html>.

CONTEMPORARY LIBRARY SYSTEM IN UKRAINE

Most of the modern library network in Ukraine had been formed during the Soviet era (1920–1991). Since 1991, when Ukraine achieved its desired independence and became a sovereign state, the libraries have been rethinking their role in the society, considering different goals and facing new challenges. The library community is currently working toward “new library policies in Ukraine based on free access to ideas, library materials and services. Intellectual freedom issues are the basis of contemporary library and information policies in Ukraine.”^[4] Intellectual freedom is closely connected to important issues such as open and free access to information and resistance to censorship. Successful achievement of these goals is highly contingent on changes in the librarians’ attitudes and training.

The information technologies that have changed the missions, goals, and functions of world libraries during the last 10 years have become a part of library practice in Ukraine. Users of the Internet in Ukraine in 1999 have increased 3 times (from 0.5 million at the beginning of the year to 1.5 million at the end), and the user growth rate was the highest among all the European countries.^[5] The impact of computerization has significantly changed the tradition functions of library services. Now Ukrainian librarians, along with their traditional services, are providing virtual services such as e-mailed reference, electronic catalogs, and Internet access. Most librarians welcome technological changes but also see the value in their historical function of assisting people to find information—whether digitized or between the covers of a book. They understand that for success, the professional librarian needs a combination of communication and computer skills. When the computerization of libraries is

successfully completed and a general unified network is created, the new information technologies will ease the tasks related to bibliographic and authority control.

Another important task for libraries is the creation of a national bibliography “Ukrainica,” which will accumulate all publications published in Ukraine, all publications in Ukrainian language, irrespective of place of publication, and all publications linked to Ukraine irrespective of language. Three libraries, the Vernadsky National Library, the National Parliament Library, and the Stefanyk Lviv Scientific Library, are at the head of this undertaking. The Vernadsky National Library has already published the fifth volume of the “National Bibliography of Ukraine.”

The decade has not been easy for the Ukrainian people as they strive to create a democratic state, a free-market economy, and a civil society. This transition period has been extremely difficult for libraries and librarians who now have far less financial support from the government than during the Soviet period.^[6]

In recent years, there has been positive movement in the state library politics. Important documents such as “The Law of Ukraine on Libraries and Librarianship” (1995), “The Program on the Preservation of Library and Archival Collections, 2000–2005” (approved by the Cabinet of Ministries of Ukraine, 1999), “The Program of Libraries’ Acquisitions for the Period up to 2005” (approved by the Cabinet of Ministries of Ukraine, 2002), and two Presidential Decrees, “Establishment of the All-Ukrainian Day of Librarians—September, 30th” (1998) and “Urgent Measures toward Development of Libraries of Ukraine” (2000), have been signed.^[7] Those documents increase the prestige of the libraries and give them new parameters for improved and increased operations. Although Ukraine has affirmed these documents, they

have not been followed by either sufficient funding or support to meet the libraries' growth and development needs.

Ukrainian libraries are striving to integrate into the international library society. They are working on extending their international contacts, seeking international partnerships and funding, and participating in international associations and programs. One of the results of such partnerships is the bilingual (Ukrainian/English) Internet reference site, "Ukrainian Library World Gateway."^[8] This Web-based directory has been developed by the British Council in Ukraine, the Ukrainian Library Association, and the Library of the National University "Kyiv-Mohyla Academy." It is a centralized source of information regarding to Ukrainian libraries and professional information for Ukrainian librarians.

The present library network of Ukraine consists of public, academic, school, university, and special libraries (Fig. 2). The greatest problems facing Ukrainian libraries of all types are insufficient budgets for collections and general operating expenses, substandard salaries for librarians, and low levels of computerization and Internet access for both library professionals and users.

Ukrainian librarians have two professional associations: The Association of Ukrainian Libraries (ABU) and The Ukrainian Library Association (UBA). Membership in both associations is open to individual librarians as well as for the libraries. The Association of Ukrainian Libraries (ABU), founded in 1991, unites mostly academic, medical, agricultural, technical, and some university libraries. Information on this organization can be founded on its Web site.^[9] The Ukrainian Library Association (UBA) was founded in 1995. The Web site for this organization provides practical information for professionals in the field.^[10]

There are two levels of professional library education: "medium" that is the equivalent of 2-year college program and "high" level of professional education that requires completion of a 4-year program at an accredited college or university. Three academic institutions in Ukraine

currently certify the librarians with "high" qualification: The Kyiv National University of Culture and Arts,^[11] The Kharkiv State Academy of Culture,^[12] and The Rivne State Institute of Culture.

Public Libraries

Public libraries are the most extended library system under the patronage of the Ministry of Culture and Arts of Ukraine. According to the Ministry statistics, there are almost 20,000 public libraries in Ukraine. The complete book collections of them amount to 302 million issues. On average, a public library contains 16,000 publications; a village library contains 10,000. The book supply, per capita, is about 6 issues in municipal libraries and 10 issues per capita in village libraries. These numbers are relatively high in comparison to the IFLA standards, which recommend sustaining collections based on a count of three books per capita in small towns and villages and two books per capita in more populated areas. The book supply in Ukrainian village libraries is three times larger than world standards. It is estimated that there are 17 million users of the public libraries in Ukraine. However, the amount of new acquisitions in recent years is three times less than the International Federation of Library Associations and Institutions (IFLA) standard, 70 publications per 1000 people.^[13] Compared to other types of libraries, the public libraries are funded better, their collections are more or less updated, and more and more regional libraries are opening their own Web sites. An important role in solving the problem of public libraries' computerizations belongs to the Library Electronic Access Project (LEAP). This is a project of the Public Affairs Section of the U.S. Embassy. It helps to create free Internet centers in public libraries and to provide an open exchange of information and communication. Public libraries have received grants up to \$24,000 for computer equipment, software, Internet access, and training. In the last 2 years, 71 Internet centers have been opened in public libraries throughout Ukraine.^[14]

The National Parliamentary Library of Ukraine

Founded in 1866, as a public library, this library became the State Library of Ukraine in 1957. In 1994, the status of national library was conferred and it was renamed "The National Parliamentary Library of Ukraine" (NPLU). This library is the main library of the Ministry of Culture and Arts of Ukraine, and it is the central library of the Ukrainian public library system. The NPLU is a research institution in library science and bibliography. It serves as a national depository for all Ukrainian publications and is a center for international book exchange. Its collection is universal in character and amounts to more than 4 million issues, including rare Old-Slavonic books of the 16th–18th centuries.^[15] NPLU considers formation of an electronic

Type of Libraries	Amount of libraries	Amount of collection (million)	Amount of readers (million)	Use of library materials (million)	Amount of library staff (thousand)
Public	20,000	350	17	350	36
Libraries of educational institutions, including schools	20,800	8	1,6	10	18,7
University libraries	267	106	1,5	102	6,5
Technical/Industry	2,500	156	0,75	10	3,5
Medical	1,033	30	0,77	25,3	2,2
Agricultural	275	21	3	20	2
Academic	96	29	0,37	8	1
Total	45,000	700	25	500	70

Fig. 2 Libraries in Ukraine statistics.

database, including the establishment of electronic catalogs linking them to other library and research institutions around the world, as its primary goal. At present, the library has established an electronic catalog of new acquisitions (containing more than 209,000 bibliographic records) and an electronic catalog of articles from Ukrainian and Russian research publications (more than 200,000 bibliographic records). The creation of the information system and expanded access to world information resources is growing through grants and aid from international charitable foundations and International Research & Exchanges Board (IREX).^[16]

Korolenko State Scientific Library in Kharkiv

One of the oldest and largest libraries in Ukraine was founded in 1886 as a public library. A significant role in the development of the library was played by notable figures in Ukrainian history and culture; among them are professors Bahalii and Sumtsov and librarian Khavkina. At the beginning of the 20th century, many foreign libraries contributed to the development of the unique collection of the library, including The New York Public Library, The Library of Congress, and The National Library of France.^[3] In 1921, the library acquired the designation of state library and became a national depository. The collections of the library run to more than 6 million items, including 50,000 in the rare book collection, more than 600,000 Ukrainian language publications, and a unique collection of musical scores (104,000 items). Like other Ukrainian libraries, this one is working toward the automation and computerization of library processes. The library is also a research center in the field of library science. Each year, it publishes approximately 30 titles of bibliographies and books on librarianship.^[15]

The State Library of Ukraine for Children

Founded in 1967, it is the primary children's library in Ukraine and the national depository of children's literature. It is also the research, reference-bibliographic, and consulting center for more than 1000 children's libraries and about 22,000 school libraries in Ukraine. Its collections run to 440,000 books, magazines, audio recordings, videos, and CDs. Each year, about 18,000 users visit the library. The library hosts many different activities and events for children at the library. Examples include a puppet theater, theater studio "Ovation" and a club of connoisseurs of Ukrainian arts, and circles of soft toys "Fantastic Needle." The library publishes the bibliographies of recommended reading for different age groups (also available online), some topical bibliographies, and method materials for teachers and children's librarians. The library Web site and online catalog are also available.^[17]

Academic Libraries

The network of academic libraries in Ukraine consists of The Vernadsky National Library, The Stefanyk Library of the National Academy of Sciences of Ukraine, and 96 other libraries of the scientific-research institutions of the National Academy of Sciences of Ukraine. The complete academic library network's collections amount to 26 million items of materials, including about 6 million in foreign languages. These collections serve as a document base for scientific research and experiments in different areas of humanities, social sciences, engineering and technology, business, sciences, and arts. Annually, the academic libraries of Ukraine serve more than 208,000 users.^[18]

The Vernadsky National Library of Ukraine

The Vernadsky National Library of Ukraine is the largest library in Ukraine. Founded in 1918, as the National Library of the Ukrainian State, it changed its functions several times as well as its name. In 1996, the library received the status of the National Library and its contemporary name and designation. The library contains many distinctive collections that are universal in scope and range from the 3rd century BC to contemporary foreign and Ukrainian publications. A fire in May 1964 inflicted significant damage on the collections of the library.^[19] In October 2002, more than 200,000 books, magazines, and newspapers were heavily damaged by water, steam, and humidity when a pipeline in the library's central heating system began leaking.^[20]

There are more than 14 million items in the library holdings. Annually, the library receives 140,000–160,000 documents (books, magazines, newspapers, etc.). Each year, about 250,000 readers use the library resources and receive 3.5 to 4 million documents.^[21] Since 1969, the library has developed a large collection of publications of the United Nations (UN) and its specialized bodies. Every year, it receives more than 15,000 UN documents. The library maintains an international book exchange with more than 1400 academic foreign institutes and libraries participating. There are more than 30 catalogs and card files and a specialized collection of 160,000 reference and bibliographical publications, including one of the few sets in Eastern Europe of the printed catalog of the New York Public Library in 800 volumes.^[19] The Vernadsky National Library has more than 250 computers in use for creating the National Electronic Library of Ukraine and to serve readers by providing electronic information resources. The library has about 40 departments, staffed by 900 employees.^[21]

The Lviv Stefanyk Scientific Library

The Stefanyk Library of the National Academy of Sciences of Ukraine is one of the largest libraries of Ukraine.

It was founded in 1940, based on the collections of several private and institutional libraries, including the libraries of the Ossolineum, The Shevchenko Scientific Society, and The Lviv National Home. In 1989, the library acquired the status of an official research institute. The sole Research Center of Periodicals in Ukraine functions in this library. The Lviv Stefanyk Scientific Library's research priorities include the following: "Documental Memory" of Ukraine, bibliography and librarianship, and rare books collection. The library personnel numbers about 300 employees. The library collections have more than 7 million items, including the remarkable collection of Ukrainian periodicals of the 19th–20th centuries, rare books (250,000 items), and manuscript holdings of more than 120,000 units from the 13th to 20th centuries. These collections make The Lviv Stefanyk Scientific Library the second richest library in Ukraine.^[22]

The University Libraries

The Maksymovych Scientific Library of the National Shevchenko University

The library was founded in 1834, at the same time as the university. Its collection was based on the library of the Kremenets Lyceum holdings. Now the library collection counts more than 3.5 million items including more than 16,000 titles of periodicals. Among these are rare books of the 15th–19th centuries in Old-Slavonic, Ukrainian, Russian, Polish, German, French, Italian, and English, the works by University professors from 1837 until present, and books (with autographs) of famous figures in the fields of science and arts. Annually, more than 72,000 readers are served in 32 reading rooms and 13 circulation divisions. The library provides different activities such as authors' readings, literature debates, and book exhibitions. The library is a research center that coordinates and consults with more than 150 other university and college libraries in Ukraine.^[15]

Scientific Library of the National University "Kyiv-Mohyla Academy"

This library is one of the newest research libraries in Ukraine. It is an important part of the university education and creative laboratory. This library began in 1992, with one book and two librarians. Ten years later, at the beginning of 2002, its collections consisted of 300,000 volumes/80,000 titles. The library provides services for students and professors based on its own collections and database as well as utilizing the resources of other Ukrainian libraries. The library introduced methods such as barcoding in circulation and checkpoint monitoring systems. This library is one of the very few libraries that uses international standards such as Anglo-American cataloging rules (AACR-2), U.S. machine readable cataloging

(USMARC) format for bibliographic and authority data, and the Library of Congress Subject Headings. The library has received financial support and grants from International Renaissance Foundation (IRF), the America House, International Research & Exchanges Board (IREX), the German Library Institute, Lange & Springer, McArthur Foundation, and others. The library has an electronic catalog and database.^[23]

Special Libraries

Special libraries include a wide range of libraries that belong to different businesses and organizations. They incorporate medical, technical, and agricultural libraries as well as libraries of different ministries and governmental organizations. The libraries for the blind also belong in this category.

The State Scientific Medical Library of Ukraine

The State Scientific Medical Library of the Healthcare Ministry of Ukraine, founded in 1930, is one of the largest medical libraries in Europe. It is a research, consulting, and administrative center for 998 medical libraries in Ukraine. It is also a national depository of publications on medicine and related fields. Its complete book collection amounts to 1.3 million items, dating from the 16th century to current editions.^[15] The library also maintains the largest department of patents and normative technical documentations in medicine in the country. The library has official exchange partners in 32 countries that allow improvement and development of the library collection. There are a few card catalogs, including alphabetical, systematical/topical, and subject catalogs. Since 1993, the library has generated electronic catalog of books and dissertations, and since 1998—electronic catalog of articles. The library Web site (only in Ukrainian) gives information about the library, its facilities, reference sources, and links to other medical libraries.^[24]

Agricultural Libraries

In the category of special libraries, the agricultural libraries play a very important role in agrarian Ukraine. The network of agricultural libraries consists of 273 libraries, including 20 libraries of agricultural universities, 77 libraries of agricultural research institutes and their branches, 61 libraries of research-experimental stations, and 115 libraries of agricultural colleges. They have concentrated about 20 million of items of general and specific information resources of agriculture and related fields. Annually, more than 700,000 users visit the agricultural libraries and borrow 19 million documents, including books, magazines, newspapers, and patents.^[25]

The Scientific Agricultural Library of the National Agricultural University

Founded in 1921, the library is the main research, consulting, and interlibrary loan center of the agricultural libraries network. It is also the national depository of agricultural publications. The library collection runs to more than 1 million books, magazines, and dissertations in Ukrainian, Russian, and other languages. Annually, the library receives more than 30,000 books and 600 periodical titles, including foreign publications.^[15] The special collection of rare books includes the works by famous agricultural scientists Dokuchaev, Vavilov, Chaianov, and Williams. The library contains valuable Russian periodicals of the 19th century, e.g., “Trudy Volnogo Ekonomicheskogo Obshchestva” and “Selskii khoziai” (1888–1917). The library has Yearbooks of the Department of Agriculture of the United States dating from 1896.^[3] The library activities are not limited to collection development and public service. They include research and consultation services on the specifics of agriculture libraries, and they provide continuing education for agricultural network librarians. The library also publishes information relevant to both the fields of agriculture and agriculture librarianship. The library has developed and begun to create an “Electronic Agricultural Library.” They organize seminars, workshops, and conferences for librarians. On the pages of the Library’s Bulletin (first published in 2001), readers can find reviews of the practices of agricultural libraries and exchange information and experiences in that field.^[25] Besides the bulletin, the library publishes monthly lists of new agricultural publications and some topical bibliographies.

The State Scientific Technical Library of Ukraine

Founded in 1935, the library is the primary and the largest technical library in Ukraine. It is a national depository of technical publications. Its collections consist of 20 million items, including books, magazines, dissertations, Ukrainian and foreign standards, technical specifications, and special catalogs of Ukrainian- and foreign-manufactured products. One of the most important and popular departments among users part of the library is its patent department. There are approximately 18 million documents acquired from 57 countries in the patent department. There is a complex of different catalogs, card files, and electronic databases that allow retrieval of information.^[26]

The Central Library of the Ukrainian Association of the Blind

Founded in 1936, the library is an important educational and cultural center for visually impaired people.^[15] The library collection consists of about 170,000 items, including talking books, Braille books, Ukrainian and Russian audio periodicals (Gorizont, Obrii, Zdorov’ia, Svit

liudyny), CDs, and descriptive videos. It includes materials in Ukrainian, Russian, Polish, Romanian, Bulgarian, and Esperanto, among other languages. The library provides reference and information services for users.^[3] The Central Library for the Blind has, for many years, been the distributor of Ukrainian and Russian Braille Bible excerpts to sight-impaired people all over Ukraine. The library sends Bible Portions to 78 other libraries for the blind throughout the country.^[27] Annually, the libraries for the blind serve 40,000 readers.^[15]

CONCLUSION

The libraries have always played an important role in the history and culture of Ukraine. They have preserved the rich Ukrainian heritage and have served as the frontline resource in education and as the heralds of new ideas. Recent changes in political situations have greatly affected Ukrainian society and libraries. The libraries of Ukraine are now active participants in the international library society and are becoming a contributing part of the world information force. Now Ukrainian librarians can discover the accomplishments of their colleagues abroad and share their own experiences in the field of library science.

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Undergraduate Library Collections *[ELIS Classic]*

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Abstract

The undergraduate library is a collection specifically set aside to serve the research needs of undergraduate students. Generally, it is in a building separate from the main research collection. Historically, it is a recent phenomenon, located primarily in the United States within the past 50 years. This entry will examine the reasons why this special collection is desired and developed, and continues to be useful in today's hyper-information-rich culture; and will look at the history, architecture, collections, and services of undergraduate libraries.

BACKGROUND

An undergraduate library's purpose is to serve expressly the needs of students in their first 4 years of college. Although the collection is not limited to resources that are required for an undergraduate education, it is expected that the majority of the student's research needs will be met with finely tuned holdings. Undergraduate libraries are most often found at large research institutions where there are multiple libraries, many of which are highly specialized. In effect, undergraduate libraries are designed to help the inexperienced student researcher find a way through too many research options. According to the American Library Association (ALA), "as a group, most first-year students share the following characteristics:

1. They do not yet have the sophisticated research skills needed to exploit the research library's potential.
2. They are intimidated by the complexity and size of a large library system.
3. They are often reluctant to ask for assistance in the use of a library.
4. They are unaware of the many services and resources that are available in university libraries."^[1]

Many undergraduates lack research experience and sophistication. Although a small college library is better able to direct users to materials, universities the size of University of California at Berkeley, Michigan, or Harvard are frustrating mazes of multiple libraries that confuse and discourage novice researchers. The undergraduate library makes space for young researchers in a complicated library system.

HISTORY

The yearning for a specialized library serving the undergraduate population is neither original nor recent. In 1601,

at the University of Uppsala, Olef Rudbeck proposed a duplicate library for undergraduates. He felt that it "should be set up in the main building for students who may always use them (the books) there."^[2] Not long after, in 1602, the Bodley Library (precursor to the Bodleian) opened. As early as 1608, the new librarian, Thomas James, inquired into building a special collection to better serve his young clientele. He received this response from Sir Thomas Bodley:

Your deuise for a Libarie for the yonger sort will haue many great exceptions, and one special force. That there must be an other keeper ordeined for that place. And where yow mention the yonger sort, I knowe what books should be bought for them, but the elder as well [as] the yonger, may hae often occasion to looke vpon them: and if there were any suche, they can not require so great a rowme. In effect, to my understanding, there is much to be saied against it, as vndoubtedly your self will readily finde, vpon further consideration. (Wagmen.^[3])

It is fascinating and telling to realize that the issues of staffing and audience were readily invoked in the nascent history of library management, in the end trumping public service for the presumed lack of funding.

In spite of Thomas James' request for a special collection, early library collections were not concerned with undergraduates. With nowhere near the number of publications that libraries now offer, books were rare, valuable, and not readily available. It was difficult to make books accessible to students, much less have duplicate collections, when folios were chained to the wall to discourage theft. In addition, the pedagogy of the day relied on rote memorization that did not require the use of a large number of books. The emergence of the research university model revolutionized old disciplines. Two countries, Scotland and Germany, developed the single-discipline professorial model we know so well. The advent of an industrial society, from around 1789 to 1939, transformed education.

Just as the division of labor segmented the work environment, so it came to effect the educational system. According to Harold Perkin, most universities were envisioned as seminaries, with a few other disciplines also taught. Schools had ignored the need for technically trained students, even as “the applied science and technology needed for the new manufacturing, mining, and transport industries had to be taught in new institutions”.^[4] Along with the expansion of disciplines in higher education came changes to the library’s collections. Although the early university libraries had strong “divinity” collections, along with law and science, the new education model, with its stress on research, emphasized growth in the subjects of literature, political thought, and natural sciences. As libraries collected more titles, the use of monographs went up accordingly.

The expanding curriculum did not immediately change undergraduate education. But over time, students began to desire access to the stacks and to a greater variety of titles. One solution was for student societies and student libraries to purchase and manage a selection of basic texts. Person^[2] notes that “student-owned libraries were particularly strong at Yale, Princeton, Columbia, and Dartmouth, and in some cases surpass(d) the college libraries themselves in holdings.” Harvard and others used a model of “house,” or dorm, libraries where each house owned a working library of titles necessary for research.

In 1857, Harvard students proposed a separate collection of books specifically for their needs. They pointed out the “utter inadequacy of the College library to meet the wants of undergraduates in their last two years.”^[5] In 1907, Columbia College, just down the road in New York City, listened to the students and developed the Columbia College Study, which became the first special library service directed toward undergraduates. Although the Columbia College Study was a step in the right direction, it did little more than highlight a service dilemma: How is a library to serve the deep research needs of graduate students and faculty while also supporting the very general needs of a large, inexperienced group of undergraduates?

Further complicating the issue, President Franklin D. Roosevelt signed into law the Servicemen’s Readjustment Act of 1944. Also known as the GI Bill, this law helped millions of veterans reacclimate to civilian and academic life. From 1946 to 1948, returning veterans made up almost 50% of all students. This influx of students overburdened libraries and universities, and caused a flurry of building and expansion matching the growth of the student body.

Widener Library (Harvard’s primary research library in the humanities and social sciences), always tight on space, became more crowded. How do we serve both the faculty and the growing number of undergraduate researchers? The answer came from Harvard in 1949 when Lamont Library, the first undergraduate library, opened to great anticipation. Keyes D. Metcalf, the Director of the

Harvard University Library at the time of Lamont’s completion, had strong objectives in mind for Lamont. These objectives, one could say, can still be applied to any successful undergraduate library, as follows:

1. To concentrate as far as practicable the library service for undergraduates in a central location;
2. To make the books readily accessible to the students;
3. To encourage general and recreational, as well as assigned and collateral reading.^[6]

The opening day collection of 39,000 titles (over 80,000 volumes) was a great success—unless you were a student from Radcliffe. Although students from both Harvard and its sister school, Radcliffe, were now allowed into the Widener stacks with a pass, it took until 1967 for women to be allowed into Lamont. Female students were barred from Lamont Library for fear that making the secluded stacks coed might distract students from their studies and encourage romantic trysts. Today, there are few limitations on which campus users can enter into an undergraduate library, with many faculty and graduate students enamored with the ease of use and open stacks.

ARCHITECTURE

Undergraduate libraries have many physical commonalities. Most have a modern architectural sensibility that comes from both a recent history and an embracing of the contemporary aesthetic of function over ornate form. The Lamont Library, for example, was the first modern building built on the Harvard campus to break from the neo-Georgian brick tradition. It has smooth lines, an abundance of large windows, burnished woodwork, and natural light in the tradition of mid 20th century architecture. Although nobody will deny that it is much easier to use than the Widener Library, Lamont did have detractors. An article in the *Harvard Crimson* pointed out that,

in the past five years, some of the enthusiasm for blonde wood and plate glass has evaporated, and unfortunately for Lamont, its machine-like, often submarine atmosphere has proved the main deterrent to its complete popularity. Nevertheless, by and large, the story of these five years is a success story.^[7]

The Moffitt Library, at University of California at Berkeley, also incorporates a contemporary design. The modernist concrete frame building is meant to suggest a Japanese garden pavilion but has instead been nicknamed the “parking garage.” Critics aside, the radical way in which undergraduate libraries simplified research encouraged a whole new approach to the library as a “place.”

A successful undergraduate library will be located smack dab on undergraduate traffic routes. The University of Texas at Austin did a fabulous job in locating its undergraduate library between the student union building and the main library. Such libraries should be easily accessible with the open stacks and materials arranged with user ease in mind. Library services, such as reserve reading, a circulation desk, and a welcoming reference desk, are designed to be front and center on entering the building. Seating and study space is more important in a library where students gather for long periods of time. Crowded dorms, lack of quiet study space, and the desire to be near friends usually guarantee that the undergraduate library is a popular destination. Other special resources such as media and computer centers as well as group study rooms are incorporated into the design. Undergraduates use these services more heavily than senior researchers; thus it makes sense to place them in an easily accessible location. It is also true that undergraduates incorporate new technologies into their lives more readily. Therefore many undergraduate libraries are the first to add cutting-edge technologies and new media into their services.

When Harry H. Ransom (Main University Vice President and Provost, at the University of Texas at Austin) conceived of the undergraduate library, he understood the contemporary reasons for building a specialized collection. However, he also understood the shifting nature of academics when he outright acknowledged the need for an undergraduate program to mutate.

Its (the library's) planners have resisted all influences to make the place a mausoleum of dead ideas attended by the undertakers of polite scholarship. No amount of planning can anticipate the opportunities and obligations that a dynamic educational program will produce from year to future year. Equally important inhabitants of the mere building, of course, will be both the immortal words and the growing, mortal minds. Therefore the really significant changes that lie ahead will be mental rather than architectural.^[8]

Ransom is an example of the forward thinking that allowed University of Texas at Austin to develop innovative partnerships with campus computing, resulting in its highly successful web-based library education site, TILT.^[9]

It is not an overstatement to emphasize the importance of the library to the undergraduate. As a sense of place, it defines the learning experience, the socializing of students, and the exploration of new subjects. In many institutions, the undergraduate library is the central academic experience. What we do not know is how future library use and technology will affect the infrastructure of the library. Seers have been announcing the end of brick-and-mortar libraries for over a decade. And although building and collection use has changed phenomenally, the desire on the part of faculty and students for a place to be surrounded by books (and computers) is unabated.

COLLECTION DEVELOPMENT

The onus of an undergraduate collection is to reflect and support the institution's curriculum. The collection is seen as an ever-changing reflection of classic readings and current topics. In general, undergraduate titles circulate for a shorter period of time, reflecting the tighter schedule and general nature of their scholarship. The need for weeding is ongoing, and it is the mission of the selector to keep abreast of new classes and departments. Being that it was first, the Lamont Library card file became the standard that latter undergraduate collections were built on. The University of Michigan's Shapiro Undergraduate Library holdings were also referred to as a supreme example of a public university's undergraduate collection. Static lists of titles, in the long run, were not very useful in building dynamic collections. In 1964, the ALA and the Association of College and Research Libraries began to publish *Choice: Current Reviews for Academic Libraries*. *Choice's* purpose was to provide reviews of recently published books that best fit in an undergraduate collection. *Choice* subject editors choose a limited number of titles that are then reviewed by librarians. As the *Choice* web site says, their reviewers are

selected for their subject expertise, their active involvement with undergraduate students and curricula, their diverse viewpoints and backgrounds, and their sensitivity to scholarly trends. Reference publications are reviewed by practicing academic librarians, many of whom are subject specialists with advanced degrees.^[10]

In today's collection climate, approval plans are often the default for building undergraduate collections. A librarian with a solid understanding of a user's needs and the ability to fine-tune an approval plan can receive shelf-ready books more quickly than ever.

When building or maintaining an undergraduate collection, ALA encourages a well-thought-out collection policy that considers the following:

1. Because many undergraduate courses require large numbers of students to use the same library materials, direct curriculum support will be provided through reserve collections and through purchase of multiple copies of items with high demand.
2. Undergraduate libraries provide effective access to information resources through reference sources in a variety of formats. Reference collections in undergraduate libraries should concentrate on the more standard and interdisciplinary indexes and sources. Periodical collections should emphasize the titles covered by these indexes.
3. Subject coverage of collections in undergraduate libraries encompasses a broad range of disciplines that offer the information needed for papers, speeches, and projects required in the wide variety of courses taken

by undergraduates. More specialized and advanced needs will be met by specific referral to other library sources on campus.

4. The library experience of undergraduates should encourage them to seek information of personal interest. Collection policies should include access to information on current events, cultural interests, careers, and recreational reading, among others, to encourage exploration of information resources as a part of everyday life. Because of the special nature of undergraduate libraries, collection policies should include withdrawal practices. Collections should be dynamic and responsive to the needs of a changing curriculum and clientele.^[11]

The joy of a well-developed undergraduate library is that it informs and serves all university researchers while staying current and useful. For upper-level undergraduates as well as professors and graduate students, the undergraduate library is an excellent starting place. For deeper information needs, there is always the option of visiting the research library.

CONSTANTLY MUTATING PURPOSE

Throughout the decades, the expansion of undergraduate libraries continued, peaking with 30 undergraduate-specific libraries being added from 1960 to 1970.^[12] The increase of undergraduate libraries matched the growing number of students enrolled in college. However, the 1970s saw a decline in the number of undergraduate libraries as missions changed, space was reallocated, and libraries were merged or shut down. Henry W. Wingate, author of *The Undergraduate Library: Is It Obsolete?* claimed,

The reasons for the disenchantment with the undergraduate library concept can be traced to 1) changes in curriculum and teaching methods, and 2) tighter library budgets that preclude the extensive duplication of books and services required, and, perhaps most importantly, the realization that a separate facility works to deprive the undergraduate of a learning experience that only a large research library can offer.^[13]

Undergraduate libraries succeeded when they developed a well-thought-out mission that supported a user-centric focus. In Irene Braden's 1970 book, *The Undergraduate Library*, she lists six categories in which undergraduate libraries differ from research libraries, as follows:

1. Providing open access to the collection to avoid the difficulties of the closed stack system;
2. Centralizing and simplifying services to the undergraduate;

3. Providing a collection of carefully selected books, containing the titles all undergraduates should be exposed to for their liberal education, as well as incorporating the reserved book collection;
4. Attempting to make the library an instructional tool by planning it as a center for instruction in library use, to prepare undergraduates for using larger collections, and to staff it with librarians interested in teaching the undergraduates the resources of a library and the means of tapping those resources;
5. Providing services additional to those given by the research collection;
6. Constructing a building with the undergraduates' habits of use in mind.^[8]

In effect, Braden took the physical qualities of the earliest undergraduate libraries (a distinct building and collection) and added a pedagogical purpose that would build critical learning skills into library research. Braden was a harbinger of the importance of instruction in undergraduate libraries—a trend that has yet to slow down.

Libraries have become more complicated as online resources multiply and universities develop multiple catalogs to handle their metadata. The need for understanding how information is researched, published, and made available is one of the most important tools we can pass on to our students. Critical thinking skills—the ability to develop, question, test, and prove one's own as well as another's hypothesis—are the basic purpose of undergraduate education. The undergraduate library is often the locus of discovery. Paula Kaufman (Librarian, University of Illinois, Urbana-Champaign) states, "There is a renewed interest in undergraduate teaching in research universities. Also we feel acutely the need to provide a different kind of instruction to our students, most of whom are undergraduate students."^[14]

Many of our students feel they are competent online researchers. They troll the Internet, find full-text articles, and link to sites that fulfill their curiosity. The reality is that they do find information, just as students were able to find titles in the research library, when allowed access. The question asked by instruction librarians throughout the 1980s and 1990s is broader: Now that you have found information, do you know how to evaluate it, then find even more that is on target for your research and ever-growing information needs?

UNDERGRADUATE LIBRARIES TODAY

The 1990s were a time of refocusing on the undergraduate library's purpose, as well as questioning the purpose of all libraries. As the Internet and online resources threatened funding and a lessening of faculty support, innovative libraries looked to transform how they were viewed and used.

One unusual example is the David Adamany Undergraduate Library at Wayne State University. Built in 1997, it is the newest undergraduate library in the nation. The rethinking of a library for undergraduates culminated in a building with 500 computer workstations providing access to electronic resources and a media collection of videos, DVDs, laser discs, and audiotapes. A one-stop service, the undergraduate library also provides students with information on careers and student survival skills. And yes, it still holds books and periodicals.

UWired, at the University of Washington, is the perfect example of the library collaborating with the Office of Undergraduate Education and Computing and Communications. This amalgam promoted “broad-based discussions, experimentation, and analysis about the following areas:

- Innovation in teaching and learning with technology tools;
- Fluency in information technology;
- New ways for students and faculty to access technology-enabled tools and resources.”^[15]

Those three points could not be more different, and yet similar, to the reasons for constructing the Lamont Library more than 50 years ago.

In their article, “One Size Doesn’t Fit All: Designing Scaleable, Client-Centered Support for Technology in Teaching,” Mark Donovan and Scott Macklin explain that,

though UWired began as an initiative to support student uses of technology, the UWired partners understood that parallel efforts aimed at supporting teachers were a necessity. UWired’s efforts to support faculty were initially confined to workshops and faculty showcases. These early efforts were driven by the energies of those faculty who were pioneering educational uses of then-new technologies such as email and the Web.^[16]

Working in space donated by the undergraduate library, UWired became highly lauded as a model of instruction/library/technology partnership.

Information commons and information gateways are two other terms that have gained relevancy. The term *commons* refers back to community, a collective entity. It is the library trying to recreate a sense of place, shared community, and information sharing. The gateway concept relates to the opening of an access point, perhaps to the commons. Interestingly enough, the physical undergraduate collections at the University of Washington are kept in the Odegaard Undergraduate Library and Computing Commons, whereas the University of Indiana has the Information Commons/Undergraduate Services. The traits shared by information commons and gateways are not unlike those shared by the earliest undergraduate libraries.

For many libraries, the collection focus has changed to a combination of virtual and physical resources—relying

heavily on computers and wireless access. Yet the sense of purpose continues with the focus on undergraduate-specific collections as well as common study space and furniture appropriate for lounging. In addition, most libraries now incorporate a café and/or coffee shop. The café is a certain moneymaker, replacing the once-golden copy center. But more than that, it is a social center that is yet another hook for pulling in users. In the past, smoking was the number one social consideration when designing an undergraduate space. Today, it is coffee.

UNDERGRADUATE LIBRARY ORGANIZATIONS

The ALA’s subgroup, the Association of College and Research Libraries, sponsors the Undergraduate Librarians Discussion Group.^[17] Known as UGLI, they are the primary group for conversation on subjects of interest to the operation of undergraduate libraries. They support a basic web site and list of active undergraduate libraries. The endnotes from previous citations refer to the ALA web site where two important undergraduate library documents are located. *The Mission of a University Undergraduate Library: Model Statement* and the *Guidelines for University Undergraduate Libraries* are useful reads for any library that serves undergraduates, even if undergraduates are not the primary audience of collection. Directly below is a list of self-designated undergraduate libraries. Although the numbers are down from the peak in the 1970s, it is still an impressive list of institutions that have made a symbolic, budgetary, and pedagogical priority of our “yonguer sort.”

CURRENT UNDERGRADUATE LIBRARIES

Columbia University (New York, NY)
 Philip L. Milstein Family College Library
 Cornell University (Ithaca, NY)
 Uris Library
 George Mason University (Fairfax, VA)
 Johnson Center Library
 Harvard University (Cambridge, MA)
 Lamont, Harvard College Library
 Indiana University-Bloomington (Bloomington, IN)
 Undergraduate Library Services
 Purdue University (West Lafayette, IN)
 John W. Hicks Undergraduate Library
 Southern Illinois University at Carbondale
 (Carbondale, IL)
 Undergraduate Library Division (in Morris)
 Stanford University (Stanford, CA)
 Meyer Library
 State University of New York at Buffalo (Buffalo, NY)
 Oscar A. Silverman Undergraduate Library
 University of Arizona (Tucson, AZ)
 Integrated Learning Center

University of California at Berkeley (Berkeley, CA)
Moffitt Undergraduate Library
University of California at Los Angeles (Los Angeles, CA)
College Library
University of California at San Diego (San Diego, CA)
Center for Library and Instructional Computing Services (CLICS)
University of Chicago (Chicago, IL)
Harper Library
University of Illinois at Urbana-Champaign (Urbana, IL)
Undergraduate Library
University of Michigan (Ann Arbor, MI)
Shapiro Undergraduate Library
University of North Carolina at Chapel Hill (Chapel Hill, NC)
R. B. House Undergraduate Library
University of Southern California (Los Angeles, CA)
Thomas and Dorothy Leavey Library
University of Texas at Austin (Austin, TX)
Undergraduate Library
University of Virginia (Charlottesville, VA)
Clemons Library
University of Washington (Seattle, WA)
Odegard Undergraduate Library
University of Wisconsin-Madison (Madison, WI)
Helen C. White College Library
Wayne State University (Detroit, MI)
David Adamany Undergraduate Library^[18]

CONCLUSION

The one constant in the half century since Lamont was built is its focus on undergraduates and their research needs. It is important that developing scholars have a safe place in which to learn how to use the multitude of research options available to them. The building design is as important as the selection of the collection and the service configurations that help acquaint users with the tools. As libraries become ever more complicated and as students are faced with a growing number of full-text resources, students will need guidance in formulating their research strategies and selecting appropriate and trustworthy artifacts (physical or not).

Although many libraries have changed how they serve undergraduates, there will most certainly be a number of large research libraries that will continue to support their undergraduate libraries as part of their research and library mission.

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UNESCO: Communication and Information Sector

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Abstract

This entry presents a brief overview of UNESCO and the activities implemented by its Information Society Division in pursuit of its overall mandate to promote the free flow of ideas and universal access to information. It looks at the origins of the program, its current strategic objectives, and some of its activities, especially those relating to libraries and archives, which are designed to meet the development needs of the world's population.

INTRODUCTION

For 60 years, the United Nations Educational, Scientific and Cultural Organization (UNESCO) has had the responsibility of ensuring the spread of knowledge through improved access to printed and published materials. Much of this is available in libraries and archives, which are the traditional caretakers of knowledge. This entry is intended to provide an understanding and appreciation of the work of UNESCO in the development of libraries and archives and the new thrusts in information management in the cyberspace age.

UNESCO was founded in the aftermath of the Second World War as a specialized agency with lofty ideals of creating and maintaining a culture of peace, by changing mentalities. To achieve this goal, it has sought to promote dialog based upon mutual respect and dignity of different cultures by maintaining, increasing, and diffusing knowledge as decreed, in part, in its constitution, by assuring the conservation and protection of the world's inheritance of books and monuments of history and science, as well as by encouraging cooperation among nations in all branches of intellectual activity, including the exchange of publications, objects of artistic and scientific interest, and other materials of information.

Policy and direction are approved sexennially (Medium-Term Strategy) by the General Conference of Member States and are concretized in its biennial programs and budgets, which focus on development priorities. Currently, the major emphasis is on attaining the United Nations Millennium Development Goals which, inter alia, target the reduction of global levels of extreme poverty, attaining universal primary education, elimination of gender disparity, and development of strategies for sustainable development.

These ambitious goals are achieved through a pragmatic approach covering the five Program Sectors of UNESCO (Education, Natural Sciences, Social and Human Sciences, Culture, Communication, and Information). UNESCO's

current *Medium Term Strategy for 2008–2013* (<http://unesdoc.unesco.org/images/0014/001499/149999e.pdf>)

proposes that the Organization adopt a bolder policy with respect to national development priorities, including, in the information field, for it to assume a stronger leadership role in the provision of universal access to knowledge. To this end, it has set “building inclusive knowledge societies through information and communication” as one of its overarching objectives.

Consequently, the priority of promoting the free flow of ideas and universal access to information is high among the principal strategic objectives of the Communication and Information Sector; the others being promoting the expression of pluralism and cultural diversity in the media and world information networks as well as promoting access for all to information and communication technologies (ICTs). The sector is composed of three divisions, namely

- The Communication Development Division
- The Division for Freedom of Expression, Democracy, and Peace
- The Information Society Division

The Information Society Division has been assigned the responsibility of steering policies for universal access to information, which includes the formulation of national information policy frameworks; the preservation of documentary information in all its forms; building information literacy capacities; encouraging the development of knowledge societies and fostering ethical considerations for the information society.

The Division was established at the start of the twenty-first century to lead information developments and respond to the challenges of the third millennium. It was born of a merger of the former General Information Program (PGI) and the Intergovernmental Informatics Program (IIP). PGI had in turn been established in 1977 in response to the convergence between scientific and

technological information (UNISIST) and documentation, libraries, and archives (NATIS) whereas IIP had been set up in 1985 to develop and implement concrete projects in the field of informatics.

UNESCO's Department of Documentation, Libraries and Archives (DBA) created in 1966 dealt with the development of information infrastructures while the UNISIST program had been established in 1972 as an intergovernmental program to coordinate cooperation in the field of scientific and technical information. However, the recommendations of the Intergovernmental Conference on the Planning of National Documentation, Library and Archive Infrastructures (NATIS) organized by DBA in 1974 revealed overlaps with those formulated by the 1971 UNISIST Conference. Duplication in the Programs led to proposals for a merger of the two as the PGI under an Intergovernmental Council that would be responsible "for guiding the conception and planning of the program, in particular by making recommendations on the content of the biennial programs and budgets and the Medium-Term Plans, reviewing the results achieved, recommending priorities, and encouraging the participation of Member States in the implementation of the program."

The retention of the name "UNISIST" was recommended by UNESCO's General Conference "for appropriate use" and can still be found on a number of documents produced by the Information Society Division, but although documentation, library, and archives infrastructures remain integral to the Program, the acronym "NATIS" was dropped from UNESCO usage.

The information program has always been both interdisciplinary and intersectoral with applications for all branches of knowledge and sectors of human activity even though structures, lines of emphasis, and approaches have been modified over the years as philosophies and technologies evolved. An evaluation of the Program (<http://unesdoc.unesco.org/images/0008/000805/080582eb.pdf>) provides more in-depth information on the history, activities, and accomplishments of PGI during its first 10 years.

IIP, on the other hand was established in order to "strengthen international cooperation and national efforts devoted to the training of specialists, the development of infrastructure, the definition of national policies, and the better recognition of the role of informatics."

With the information revolution, an increasing overlap of the two programs was perceived, as both were progressively concentrating their activities on two main areas: content for the information society, and building "infostructure" through training, the establishment of information policies, and the promotion of networking. UNESCO's Director-General therefore suggested in 1996 that they would be best served by a single secretariat and that a new program should be designed to meet the needs of the information age.

Following a wide consultative process guided by an Ad Hoc Working Group, the Information for All Program

(IFAP) was created as a platform for global discussion on information access, enabling participation of all in the global information society, and on ethical, legal, and societal consequences of the use of ICTs. IFAP provides a framework for international cooperation and partnerships in the information field by developing strategies and tools to narrow the digital divides of the information society. It is guided by an Intergovernmental Council composed of 26 members representing all geographic regions of the world. Its secretariat is assured by the Information Society Division.

An evaluation in 2006 concluded that IFAP had achieved limited success only as the scope of its action had, to a large extent, been overtaken by the World Summit on the Information Society (WSIS) process and this action is now being implemented by other stakeholders. To maintain its relevance in the information age, IFAP's program has been reviewed, and it has been tasked to attain five main strategic targets: information for development, information accessibility, information literacy, information ethics, and information preservation with libraries and archives playing a major contributory role in achieving each of these objectives.

While other bodies and organizations have concentrated on providing digital connectivity as well as the technology to help leapfrog into the information age, UNESCO has tended to place more emphasis on its concept of Knowledge Societies, that is, facilitating access to content and building capacities to make effective use of information. In this regard, it has identified four anchors on which to ground its principles of inclusion and pluralism that are based on human needs and rights. These are knowledge creation, knowledge preservation, knowledge dissemination, and knowledge utilization.

Our organization has been working on a wide variety of approaches and actions to help build national and regional capabilities and its contribution to the WSIS succeeded in broadening the debate to the point where the final Declaration of Principles and the Plan of Action of the Summit entrenched the four principles espoused by the organization, namely freedom of expression; universal access to information; the promotion of cultural diversity, multilingualism, and local content; and equal access to education. The Action Plan reflects UNESCO's belief in the importance of "democratization of access" and focuses on the ability to use technology rather than on technology itself. This means that in capitalizing on the opportunities offered by ICTs, greater attention is being paid to capacity building in support of societal transformation and on the adoption of best practices in e-governance services, with particular focus on addressing the obstacles to progress, especially in developing countries.

The role of information in addressing development issues has not always been fully understood by some governments or countries. Knowledge-based and knowledge-led development has the potential to achieve many of the

targets set under the Millennium Development Goals especially those relating to universal primary education and sustainability, on condition that there is equitable access to and use of requisite information and expertise. For this reason, emphasis is being given to *information for development* as a strategic goal of the IFAP and the Information Society Division, and a major focus of UNESCO's policy is to contribute to the formulation of national information policies and laws that reinforce the position of libraries, archives, and other knowledge institutions to fully accomplish their function as content providers contributing to continued access to recorded information.

This is particularly applicable in developing countries, which face problems caused by globalization and its impact on their societies. Globalization is largely driven by ICTs, which are radically transforming societies, both modern and traditional, and shaping patterns of growth, and wealth creation. They can provide for the expansion of home-based job opportunities and offer potential benefits to all of humanity. But sadly, in many regions of the world, this is still an unrealized dream. So, while information or knowledge has become a principal force of social transformation, much of it still remains out of the reach of those for whom it is absolutely indispensable to revolutionize their lives in order to rise from the misery of poverty. Countries that are technologically equipped to maximize the advantages of the information society are speeding along the information highway, while others that need to invest much more in human resources or infrastructure development are mere hitchhikers. However, inequitable access plagues all countries, not just the poorer ones, and increases the divide within, and among, nations.

It is therefore incumbent on governments and local authorities to reduce these divides, and as information is largely channelled by libraries and archives, they can have a key role to play in enabling all sectors of society to receive, generate, and/or disseminate information on all areas of interest, in addition to being a facilitator between the policies of, and services provided by, local and national government and the community or nation they serve. The challenge for these institutions is to provide access to content in support of a greater social qualitative change while respecting their individual charters. By promoting empowerment and participation through equitable access and sharing of knowledge, community information points contribute fundamentally to development.

For an information component to be successfully integrated into development plans, the capacity to access and use information is a prerequisite. While access to ICTs can enable greater participation in the benefits of knowledge societies, people must be adept not only in their use, but, as defined in the Alexandria Proclamation which was adopted by the High Level Colloquium on Information Literacy and Lifelong Learning in Egypt in November 2005, they must also have the ability to "seek, evaluate, use, and create information effectively to achieve their

personal, social, occupational, and educational goals." In other words, they must be information literate.

All libraries, especially public and community libraries, must be able to contribute to achieving *information literacy* and part of UNESCO's main strategy in this area consists of awareness-raising about the importance of information literacy at all levels of the educational process and of establishing guidelines for incorporating information literacy issues in curricula. A key plank in this strategy is the integration of libraries into information literacy programs as they provide resources and services in an environment that fosters free and open inquiry and serve as catalysts for the interpretation and application of knowledge in all fields of learning. UNESCO is therefore developing a conceptual framework whose objectives, strategies, and actions will contribute to both critical understanding and active participation by enabling the interpretation of data and making of informed judgments by users of information sources.

To this end, the Organization has conducted international meetings, funded projects, published guides, and created an Internet portal to sensitize those interested in learning about the concept and its applications. A number of workshops across the globe have provided trainers with the basic skills required to transmit to others how to effectively access and assess information from different sources. Much of its work in the field of information literacy is being conducted in cooperation with the International Federation of Library Associations and Institutions (IFLA). This includes the creation of an international directory database (<http://www.infolitglobal.info>), in English and Spanish, of information literacy resources. These resources can be adapted or be used as examples in building new information literacy applications or to assess achievements and plan future policies.

As mentioned earlier, technological advances have given rise to new opportunities, but they have also led to concerns about the use of information, especially digital information, which can be easily manipulated. UNESCO has consequently initiated an international debate on *information ethics* (infoethics) to examine the ethical, legal, and societal aspects of the application of ICTs. While acknowledging the right to freedom of expression, universal access to information, especially public domain information and the right to education as being of primary importance, other rights including the right to privacy and proprietary rights must also be respected.

The challenges and opportunities presented by ICTs require that appropriate mechanisms and safeguards are in place to guide development and enable policy makers to explore benefits and risks especially for the protection of the more vulnerable members of their community, as well as striking the balance between intellectual property rights and the rights of users to access information. One option that is being explored is the possible establishment of a national advisory body composed of all stakeholders

to address ethical issues such as peace, upholding fundamental values of freedom, equality, tolerance, shared responsibility, and respect for nature in order to establish a national framework.

IFAP's strategic objective of *information accessibility* takes into account the wide range of factors that can block access to sources of information with a consequent impact on development. ICTs have transformed, for better and for worse, traditional practices that provided access to information needed for development or to address areas of concern. Issues related to copyright, piracy, and protection of data have led to the impositions of conditions that restrict access to sources of information and knowledge, which used to be easily available in the past. At the same time, the Internet has opened up new and broader opportunities with the potential to allow unprecedented numbers of people to share and obtain information from wider sources and in their own language. Admittedly, a huge percentage of the world's population has yet to publish content in native languages but the expansion of digital services and connectivity should lead to an evolution of this situation. Furthermore, the incremental growth in the use of cell phones is viewed as an exciting possibility for the transmission and reception of information in local languages in future.

UNESCO's *Recommendation concerning the Promotion and Use of Multilingualism and Universal Access to Cyberspace*, which was adopted in 2003, has been important in this regard as it has opened new vistas promoting multilingualism and multilingual search tools on the Internet with a corresponding increase in linguistic diversity on the Internet. This is an important step in protecting some of the world's endangered languages. UNESCO is further encouraging research to assess the extent of progress in achieving a multilingual cyberspace so as to adjust its area of focus as required. Emphasis is currently being given to activities that will lead to the inclusion of additional languages and the dissemination of more local content in cyberspace, as well as to the development of Internationalized Domain Names (IDNs).

Accessibility to information is also boosted by UNESCO's promotion of Free and Open Source Software (FOSS), Open Educational Resources (OER), and its Open Training Platform (OTP) while contributing to building capacities in their use. It has focussed on the development of open information processing tools, interoperability standards, metadata, and more, that permit equitable access to the use of ICTs. These can also be particularly beneficial to the approximately one-third of the world's population, which is affected by disability or reduced mobility by removing their isolation from the outside world and aiding their social and economic participation in society. UNESCO's program helps to promote the rights and needs of people with disabilities, including increasing awareness of accessible technologies and supporting their development as well as publishing

accessibility guidelines for community information centers to cater to people with disabilities.

Much of constructing knowledge societies relates to ensuring adequate access to information. However, the flip side of the coin, or *information preservation*, is of equal, if not more, concern to UNESCO since the disappearance of information leads to an impoverishment of humanity.

From the founding of UNESCO, its documentary heritage program, whether as an independent unit or as a Division attached to a Program Sector, has always had one constant goal, that of enabling access to the knowledge, and information produced anywhere in the world, and ensuring its continued availability through preservative actions. In fact, UNESCO's first budget made provision for the reconstruction of libraries; and libraries and archives continue to be among its priorities some 60 years later, even as their form and role have changed in response to technological progress or societal transformations.

Training and capacity building for information personnel have been traditionally supported by UNESCO since its creation. In addition to sponsoring workshops, training courses and symposia, the Organization has set up two information portals: the *UNESCO Libraries Portal* (http://www.unesco.org/webworld/portal_bib) and the *UNESCO Archives Portal* (http://www.unesco.org/webworld/portal_archives) as a public service access to online resources related to, or to issues affecting, the information profession. They include institutional Web sites, training, and job opportunities as well as other resources related to information management and to international cooperation in these fields.

Since 1946, the Organization has been involved in the construction, or reconstitution, of some of the major libraries of the world, including the Bibliotheca Alexandrina in Egypt, the National Library of Latvia, and the rebuilding of the National and University Library of Bosnia and Herzegovina following its destruction in 1992. It has also contributed to establishing library expertise in most countries of the world; provided assistance in the move from traditional to electronic information management; and advised on coping with technological obsolescence, among other activities, in enabling libraries to contribute to lifelong learning, economic, and personal development as well as promote preservation of heritage.

Apart from serving as physical or virtual information access points, libraries have a social responsibility to eliminate barriers to knowledge, to constructive participation, and the development of democracy. The enormous potential of libraries is still largely untapped but their mix of resources and services provide for equal and democratic access to information.

In 1979, UNESCO created its Records and Archives Management Program (RAMP) in cooperation with the International Council on Archives (ICA) to support national development, archival training, and protect archival heritage. This was extended in 1980 to audiovisual

archives with the adoption of the *Recommendation for the Safeguarding and Preservation of Moving Images*. To preserve this heritage, UNESCO works closely with a group of NGOs under an umbrella structure better known as Coordinating Council of Audiovisual Archives Associations (CCAAA) (<http://www.ccaaa.org>) composed of AMIA, IASA, ICA, IFLA, FIAF, FIAT/IFTA, and SEAPAVAA whose main objective is to cooperate on influencing the development of public policy on issues of importance to professional audiovisual archivists.

UNESCO's archives programs have achieved significant gains through tangible outcomes such as the publication of model legal guidelines for the establishment of archives or the organization of the highly successful Joint Technical Symposia (JTS). Other projects include promoting the creation of human rights archives particularly in countries in the process of transition to democracy. These archives are of fundamental importance as evidence supporting victims' rights for reparation.

Yet, despite all efforts to protect and safeguard documentary heritage, threats to its existence continue to be a cause of alarm as natural disasters, chemical decomposition, wars, negligence, deliberate destruction, ignorance, and obsolescence contribute to losses with drastic consequences, as millions of items have either disappeared, or are on the verge of doing so. Conservative estimates are that more than 80% of the early films have been deliberately destroyed or have otherwise been lost. A graphic picture is painted in "Lost Memory: Libraries and Archives destroyed in the Twentieth Century" which was commissioned by UNESCO to obtain accurate information on the losses that occurred in the twentieth century alone.

This dramatic situation called for an urgent response and in 1992, UNESCO created the *Memory of the World Programme* (<http://www.unesco.org/webworld/en/mow>) as its flagship project to protect and promote the documentary heritage. The objectives of the Program are

1. To facilitate preservation, by the most appropriate techniques, of the world's documentary heritage.
2. To assist universal access to documentary heritage by encouraging the digitization of access copies of items while respecting legislative, cultural sensitivities, and other limitations to access.
3. To increase awareness worldwide of the existence and significance of documentary heritage, especially through the Memory of the World registers.

Four main strategic actions form the pillars of UNESCO's action to accomplish these goals and they can be summarized as

Identification of documentary heritage: This involves identifying documentary and assessing its impact for the country concerned. If it is determined that its

influence has been felt beyond national borders, or that the rest of the world would benefit from greater knowledge of the content, it could be listed on a Memory of the World register.

Raising awareness: This is especially important in regions where documentary heritage is endangered or awareness is low. Emphasis is given to preservation techniques and cooperation with professional bodies and associations.

Preservation: This is the main focus of the Program with particular attention accorded to heritage listed on a Memory of the World register. While the original document may be important as an object in itself, the content that resides on the carrier is the main focus of the program.

Access: Permanent access is the fourth goal of the Program as everyone has the right of access to their documentary heritage, the right to know it exists, and where to find it.

An International Advisory Committee of 14 members is appointed by the Director-General of UNESCO in their personal capacity to guide the planning and implementation of the Program and make recommendations concerning the inscription of nominations on the International Register, as well as the award of the UNESCO/Jikji Memory of the World Prize in recognition of outstanding preservation work.

Public impact and education are crucial in raising awareness of the vulnerability of information and the Memory of the World Register (<http://www.unesco.org/webworld/en/mow-register>) is the main component in this strategy. Currently there are 193 items from 80 different countries, 3 International Organization and 1 private foundation, and items cover all types of information carriers whether these are films or rock inscriptions, sound recordings or photographs, and tapestries or printed pages. Some are as recent as the 1986 Radio Broadcast of the Philippine People Power Revolution or as old as the Hittite cuneiform tablets from Turkey that date from the 2nd millennium B.C. Age is not a deciding factor; what matters is that the item is considered significant for the whole of humanity.

Paradoxically, modern documents are more endangered than older ones. The increase in digital materials and their short life expectancy have given rise to concerns about long-term preservation. Furthermore, as audiovisual and electronic documents are machine readable only, they need specific equipment and/or software to be retrieved. But playback equipment rapidly becomes obsolete resulting in the inability to access the content. Therefore, timely migration to newer technologies, operating systems, and software platforms must be factored into digital preservation policies and plans. Traditional preservation policies are irrelevant where digital materials are concerned.

Digital preservation, which is closely related to the strategic priorities for *information development* and

information accessibility, is a key component of the Memory of the World Program. Management of digital information has its own specific problems, added to which is the fact that it is still not yet universally known that the costs of systematically preserving digital information is higher in the long term than those required to preserve traditional analog documents.

UNESCO has developed a strategy for digital preservation, which is built on raising global awareness of the dangers facing digital heritage through its *Charter on the Preservation of Digital Heritage*, disseminating technical guidelines and capacity building in association with governments, policy makers, information producers, heritage institutions, and experts as well as the software industry and standard-setting organizations.

One recent initiative is the creation of a World Digital Library (<http://www.wdl.org>) being set up in collaboration with the Library of Congress in the United States. This project is designed to foster intercultural dialogue and understanding, preserve heritage, and facilitate greater access to knowledge. It is being implemented as part of the Memory of the World Program and a prototype, developed by the Library of Congress and UNESCO with partner institutions (Bibliotheca Alexandrina, the National Library of Egypt, the National Library of Brazil, the National Library of Russia, and the Russian State Library) was demonstrated in October 2007 ahead of a formal launch which took place on 21 April 2009 at UNESCO's Headquarters in Paris. It currently functions in Arabic, Chinese, English, French, Portuguese, Russian, and Spanish and libraries and archives around the world are encouraged to be part of this global endeavor.

CONCLUSION

This description of the major areas of the work of the Information Society Division relating to information

management and building knowledge societies covers but a small part of UNESCO's vast programs in education and learning, sciences, culture, communication, and information. Through its action and flagship projects, UNESCO has been able to contribute to achieving global development objectives such as those outlined in the WSIS's Plan of Action, or the Millennium Development Goals. This focus on creating "infostructures" and equipping all peoples, including disadvantaged, marginalized, and vulnerable groups, with the capacities to benefit from access to information and knowledge, remains true to its own constitutional mandate of spreading access to, and protecting, the world's sources of knowledge.

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Unicode Standard

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Abstract

The Unicode Standard is the single, universal character standard for all text, covering all of the world's writing systems, modern and ancient, as well as other elements of text such as technical symbols. Unicode provides the basis for the processing, storage, and interchange of textual data worldwide; it is fundamental to modern software and information technology protocols, and provides the character infrastructure of the World Wide Web. Unicode underlies modern systems and software products for libraries. Use of Unicode is explicitly included in the specifications for MARC 21 and UNIMARC records, and Z39.50 information retrieval, and is implicit in library standards and protocols based on Extensible Markup Language (XML) or Hypertext Markup Language (HTML).

INTRODUCTION

The Unicode Standard is the universal character encoding for the world's writing systems, and is fundamental to information technology worldwide. The first half of this entry covers key features of the Unicode Standard as well as the rationale for its development. The second half describes use of the Unicode Standard, with particular emphasis on library standards and protocols.

THE UNICODE STANDARD IN GENERAL

The Unicode Standard provides a uniform, universal architecture and encoding for all languages of the world, with over 100,000 characters currently encoded. Supporting the needs of all types of users, its coverage includes minority and historical scripts as well as those in common use. In addition, the Unicode Standard contains the largest set of characters for mathematical and technical publishing in existence, and an extensive set of musical symbols.^[1]

The Unicode Standard is the basis for the processing, storage, and seamless interchange of textual data worldwide. Unicode underlies modern software and Internet protocols, and provides the character infrastructure of the World Wide Web.^[2]

Much more than just a large character set, the Unicode Standard also defines how characters function. The extensive set of character attributes and the implementation algorithms specified in the Unicode Standard exist to ensure interoperability among implementations.

There are three constituent parts to the Unicode Standard: the book *The Unicode Standard*, the Unicode Character Database (UCD), and the Unicode Standard Annexes (UAXs). (All three constituent parts are available online;

The Unicode Standard is also available as a book. All updates to the constituent parts are published online.)

The Unicode Character Database (UCD) is a collection of data files that

- Contain the Unicode character code points and character names.
- Specify properties assigned to Unicode characters.
- Provide certain mappings between Unicode characters (e.g., 1:1 case mappings).

The UCD also contains explanatory documentation on UCD file formats and data in the files.^[3]

The 12 Unicode Standard Annexes (UAXs) cover significant features of the Unicode Standard in detail. Some UAXs, such as the Unicode Bidirectional Algorithm and the Unicode Line Breaking Algorithm, provide specifications for particular programming tasks.

DEVELOPMENT OF THE UNICODE STANDARD

By the late twentieth century, many different international, national, and corporate coded character sets had been developed for the processing, storage, and exchange of the characters of writing systems.^[4] Multilingual software applications had to deal with two serious problems: the same code value used to represent different characters, and different codes for a particular character encoded in multiple character sets.

When several character sets are used together in computer data, International Standard ISO/IEC 2022 provides a technique to distinguish them.^[5] Data in a particular character set is identified by means of a preceding "announcer," the *escape sequence*, so called because it begins with the control character *Escape* (1B hexadecimal).^[6] The International Organization for Standardization (ISO) administers

a registry that assigns a specific escape sequence to each character set submitted for registration. The problem with the ISO/IEC 2022 technique is that it is “stateful.” As a result, if identification of the applicable character sets is missing, correct interpretation and presentation of the coded data is not possible.

Both the MARC 21 and the UNIMARC formats permit use of multiple character sets, and specify the ISO/IEC 2022 technique of escape sequences to identify character sets.^[7–9] The problems described above may occur in library data encoded using multiple character sets.

MARC 21 and UNIMARC character sets both exhibit use of the same code value to represent different characters. In the individual MARC 21 character sets, for example, the value 66 (hexadecimal) represents five different letters: *Latin small letter f*, *Arabic letter noon*, *Cyrillic capital letter ef*, *Greek small letter epsilon*, and *Hebrew letter zayin*. The value 66 can also occur in 3-byte encodings of the East Asian Character Code (EACC).^[10]

Use of different codes for the same character is seen in the Extended Latin character sets of MARC 21 and UNIMARC: MARC 21 Extended Latin (a superset of ANSEL), and International Standard ISO 5426, respectively.^[11–13] The two character sets have 52 characters in common, but only one character has the same encoding. For example, the lowercase form of *Latin letter o with stroke* is encoded as 32 (hexadecimal) in MARC 21 Extended Latin but 79 (hexadecimal) in ISO 5426.

For over two decades, EACC was used in MARC 21 records for Chinese, Japanese, and Korean (CJK) data. Libraries in Asia, however, used either a national standard character set or an industry set such as Big-5. While many ideographs occur in all of these character sets, the various character sets encode the ideographs differently.^[14]

The primary goal in developing the Unicode Standard was to remedy the chaotic situation in multilingual software. The developers of the Unicode Standard envisioned a uniform method of character identification that would be a paradigm shift in multilingual computing. Unicode was designed to be universal, unambiguous, and efficient.

The Unicode Standard, Version 1.0 was published in 1991. There have been five major versions to date. The number of graphic characters in the Unicode Standard has grown from 28,282 in Version 1.0 to 100,507 in Version 5.1. Unicode is fundamental to modern information technology worldwide, and is used in all types of applications, from hand-held devices to massive databases.

THE UNICODE STANDARD AND ISO/IEC 10646

The Unicode Standard is code-for-code identical to International Standard ISO/IEC 10646, the *Universal Multiple-Octet Coded Character Set*, also known as the Universal Character Set (UCS).^[15] The Unicode Standard is the official way to implement ISO/IEC 10646.

The ongoing development of ISO/IEC 10646 is the responsibility of Working Group WG 2 of ISO/IEC JTC 1/SC 2, the subcommittee responsible for international standards for coded character sets. ISO/IEC JTC 1 is the Joint Technical Committee on information technology standardization of ISO and the International Electrotechnical Commission (IEC).

The Unicode Consortium and ISO/IEC JTC 1/SC 2 and its WG 2 have had a formal liaison relationship since 1992, and work closely together to coordinate and synchronize all additions to either standard, thus maintaining exactly the same character names and code points in both. Version 5.1 of the Unicode Standard is synchronized with ISO/IEC 10646:2003 plus its Amendments 1 through 4.

An implementation that is conformant to Unicode is also conformant to ISO/IEC 10646, but the reverse is not necessarily true because the Unicode Standard also specifies character properties and implementation algorithms.

DESIGN PRINCIPLES OF THE UNICODE STANDARD

The Unicode Standard is based on a set of 10 design principles: universality, efficiency, characters (not glyphs), semantics, plain text, logical order, unification, dynamic composition, stability, and convertibility. Except for a library-related comment on dynamic composition, this section is a condensation of Section 2.2 “Unicode Design Principles” from *The Unicode Standard, Version 5.0*.^[16]

Universality

The character repertoire of the Unicode Standard is intended to be universal in coverage, containing all the characters for textual representation in all modern writing systems and in most historic writing systems, as well as symbols used in plain text.

Efficiency

To keep character coding simple and efficient, the Unicode Standard assigns each character a unique numeric value and name. This unique identification of each character eliminates the need for cumbersome escape sequences and shift states. All of the Unicode encoding forms (described below) are self-synchronizing and nonoverlapping, facilitating access and searching within streams of characters.

Characters, Not Glyphs

Characters are abstract representations of the smallest components of written language that have semantic value.

Glyphs	Unicode Characters
À Á Â Ã Ä Å Æ	U+0041 LATIN CAPITAL LETTER A
à á â ã ä å æ	U+0061 LATIN SMALL LETTER A
п n ū	U+043F CYRILLIC SMALL LETTER PE
ه ه ه ه	U+0647 ARABIC LETTER HEH
fi fi	U+0066 LATIN SMALL LETTER F + U+0069 LATIN SMALL LETTER I

Fig. 1 Characters versus glyphs.
Source: *The Unicode Standard, Version 5.0*, Fig 2-2, p. 15. ^[16]
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Examples of such components are the letters, punctuation, digits, and other signs comprising natural language text and technical notation. The Unicode Standard encodes the character, not the various ways it can be visually represented.

Glyphs are the visual representations of characters as they are written or displayed, and can have various forms or shapes. Some writing systems require the use of particular glyphic forms. The form that the character takes when it is displayed (e.g., on a computer screen) is determined by text rendering software and the font currently in use.

Figure 1 shows the distinction between characters and glyphs. The illustration includes two examples of customary use: the positional forms for the Arabic letter *heh*, and the Cyrillic small letter *pe* with the italic alternatives used in Russia and Serbia, respectively.

Semantics

The Unicode Standard views character semantics as inherent to the definition of a character. A character’s semantics are determined by its identity, normative properties, and behavior. The Unicode Standard defines more than 50 different character attributes, called properties. The Unicode Character Database, an integral part of the Unicode Standard, provides machine-readable character property tables for use in implementations.

Examples of character properties are

- The name that formally and uniquely identifies the character.
- The script of the character.
- The general category of the character (letter, punctuation, symbol, white space, etc.).
- The numeric value when the character is a digit.
- Casing (upper, lower, title, and folding).
- Sequences of characters that are equivalent.
- Whether the characters may be used in program-language identifiers.
- How the character behaves in text with mixed directions, such as Arabic or Hebrew with English.

- Properties related to text boundaries, such as word breaks and line breaks.

Many of the properties assigned to characters are needed for algorithms that make use of them to produce expected results; for example, the Unicode Collation Algorithm, that specifies the default sorting behavior of text.^[17]

Plain Text

Plain text represents the basic, interchangeable content of text, not its appearance. Plain text contains enough information to permit the text to be rendered legibly, and nothing more. Additional formatting that affects the appearance of text (for example, language identification, font size, color, or hypertext links) is determined by higher level protocols and is not specified by the Unicode Standard.

Logical Order

Unicode characters are stored in logical order from first to last in the representation of text in computer memory. This approximates the order in which the characters are typed on a keyboard. When Unicode data is displayed, the text rendering process needs to recognize the directionality of each character and display text correctly for reading.

In some writing systems, such as Arabic and Hebrew, text is written and read from right to left. Text rendering becomes complicated when a document contains text in different directions (e.g., text in Arabic and English). The Unicode Bidirectional Algorithm specifies how mixed left-to-right and right-to-left horizontal text can be displayed in proper reading order.^[18]

Unification

The Unicode Standard avoids duplicate encoding of characters by unifying them within scripts across languages: characters that are equivalent are given a single code. Common letters, punctuation marks, symbols, and diacritics are given one code each, regardless of language, as are common East Asian ideographs (used to write Chinese, Japanese, Korean, and historical Vietnamese).

Dynamic Composition

Dynamic composition is the rendition of composite textual elements, such as accented letters or modern Korean Hangul syllables, from a sequence of characters. In other standards that cover accented letters or modern Korean Hangul, the accented letters or the Hangul syllables are usually encoded as single characters (i.e., as a static *precomposed* form of the textual element).

Librarians are familiar with the concept of dynamic composition; the use of separate diacritical marks with the letters of the English alphabet dates from MARC's beginning.^[19] EACC, in contrast, contains over 2,000 characters that are precomposed Hangul syllables.

Some text elements can be encoded either as static precomposed forms or by dynamic composition. For static precomposed forms (included for compatibility with certain standards), the Unicode Standard provides a mapping to the equivalent dynamically composed sequence of characters. Neither of these alternatives is prescribed as the "correct" one; each is merely equivalent to the other.

Stability

Certain aspects of the Unicode Standard must be absolutely stable across successive versions, so that implementers and users can be guaranteed that text data, once encoded, retains the same meaning. Most importantly, this means that once Unicode characters are assigned, their code point assignments cannot be changed, nor can characters be removed. Unicode character names are also never changed, so that they can be used as identifiers that are valid across versions. Stability guarantees also apply to certain important character properties.

Convertibility

For particular national, international, and corporate standards, character identity is retained for interchange of data between Unicode and these other standards. When a variant form or even character duplication exists in one of these standards, these characters are kept separate in the Unicode Standard instead of being unified. This guarantees accurate convertibility between the specified standards and Unicode.

UNICODE CHARACTERS AND ENCODING FORMS

This section presents an overview of the character content of the Unicode Standard, followed by a summary description of the three Unicode encoding forms (including UTF-8, which is specified for MARC 21 use). It condenses information from several sections of *The Unicode Standard, Version 5.0* (identified in the references).

Allocation of Unicode Characters

In computer processing, characters are represented as numbers. The *codespace* is the range of numbers available to code characters. A particular number in this range is called a *code point*. Each code point can be assigned to a character or designated for another use. The entire codespace of the Unicode Standard contains 1,114,112

unique code points which is more than sufficient for all known requirements.^[20]

It is convenient to think of the Unicode codespace as being divided into planes, with each plane containing 65,536 (64K) code points. The first 64K code points of the Unicode codespace are designated as the Basic Multilingual Plane (BMP); also called Plane 0. To date, only 6 of the 17 planes (0–2, 14–16) have defined uses.^[21]

The BMP contains all the common-use characters for all the modern scripts of the world, as well as many historical and rare characters. There are 53,333 characters allocated to the BMP (as of Version 5.1). Figure 2 shows the allocation areas on the BMP, with the General Scripts area shown in more detail on the right. The numbers to the left of each shaded bar are code point values in hexadecimal notation.^[6]

The General Scripts area encodes many of the scripts in modern use, such as Latin, Greek, and Cyrillic. The first 128 characters in the Unicode Standard (beginning the Latin block) are exactly compatible with those of the ASCII standard and ISO/IEC 646, the International Reference Version of ASCII.^[22]^[23] The first 256 characters are exactly compatible with International Standard ISO/IEC 8859-1, also known as Latin-1.^[24] Additional scripts are encoded in the Supplementary General Scripts area, after the Symbols area.

The CJK Miscellaneous area includes Hiragana and Katakana for Japanese, punctuation for East Asian scripts, and a large number of East Asian compatibility characters. The CJKV Ideographic area occupies a large part of the BMP. It contains unified Han ideographs for Chinese, Japanese, Korean, and historical Vietnamese, divided into two blocks: the Unified Repertoire and Ordering (20,924 characters), and Extension A (6,582 characters). The Asian Scripts area contains 11,172 Hangul syllables for Korean, plus several other Asian scripts.

The Surrogates area contains only surrogate code points used in the UTF-16 encoding form. The Private Use area contains 6,400 code points whose use can be defined by private agreements among cooperating users. The Compatibility and Specials area contains many compatibility variants of characters from widely used corporate and national standards that have other representations in the Unicode Standard.

Version 3.1 saw the first use of the supplementary planes with the addition of 44,946 characters including CJK Unified Ideographs Extension B on Plane 2. Version 3.2 added 1016 characters including a large set of symbols, which benefit mathematical and technical publishing. A large number of additional minority and historic scripts and various symbols and punctuation marks were added in Versions 4.0 through 5.1.

Unicode Encoding Forms

The Unicode Standard defines three encoding forms that allow the same data to be transmitted in a byte, word or

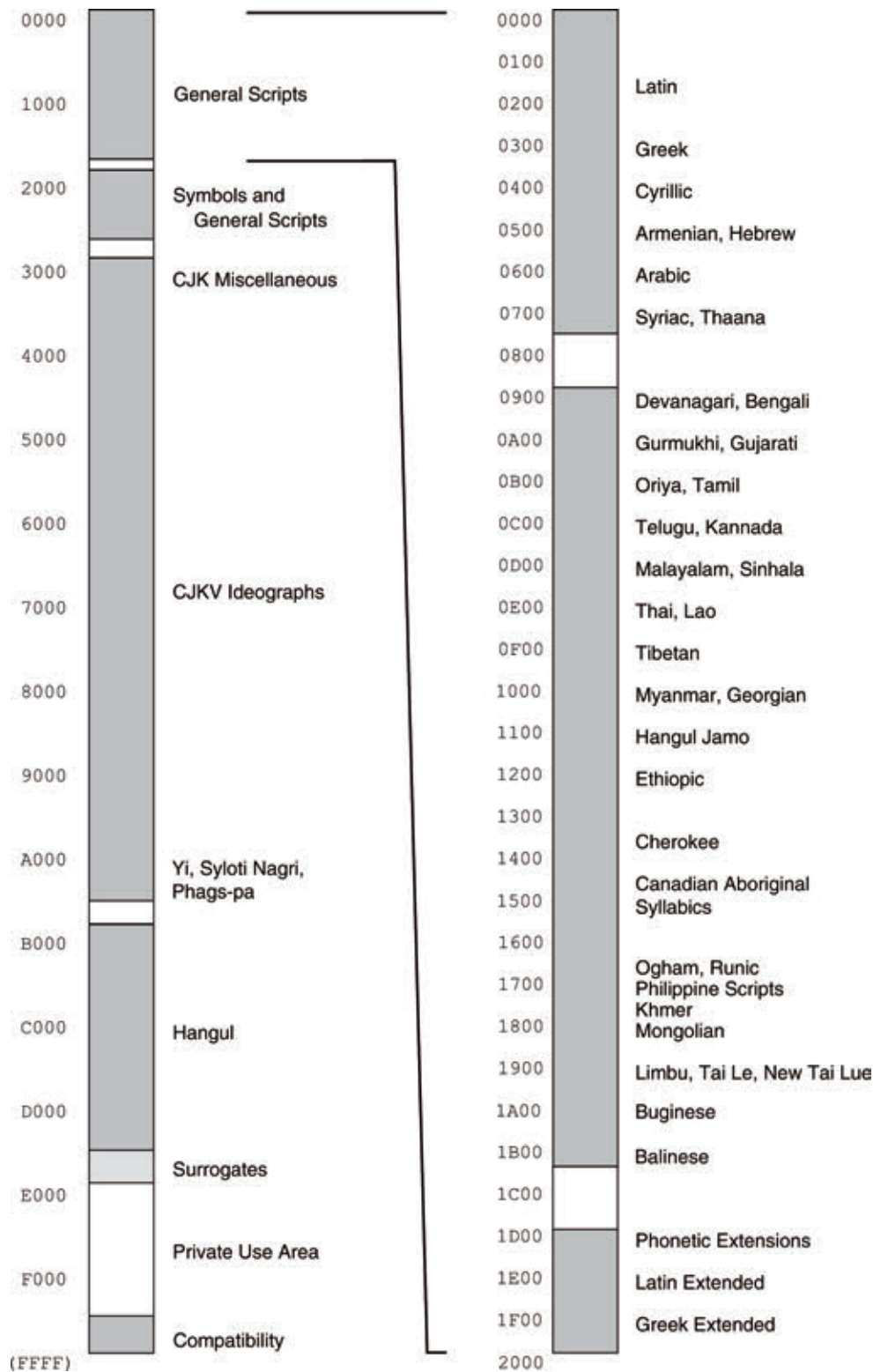


Fig. 2 Allocation on the Basic Multilingual Plane (BMP).
Source: *The Unicode Standard, Version 5.0*, Figure 2-14, p. 44.^[21]
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double word oriented format (i.e., in 8, 16, or 32 bits per code unit).^[25] All three encoding forms encode the *same* common character repertoire and can be efficiently transformed into one another without loss of data. All

three encoding forms need at most 4 bytes (or 32 bits) of data for each character. The Unicode Consortium fully endorses the use of any of these encoding forms as a conformant way of implementing the Unicode Standard.

UTF-8 is a way of transforming all Unicode characters into a variable length encoding of bytes. UTF-8 has these advantages:

- The Unicode characters corresponding to those of ASCII have the same byte values as ASCII.
- Unicode characters transformed into UTF-8 can be used with much existing byte-oriented software without extensive software rewrites.

The MARC 21 Specifications stipulate that when exchange records are encoded in Unicode, UTF-8 must be used.^[26]

UTF-16 is reasonably compact and all the heavily used characters fit into a single 16 bit code unit, while all other characters are accessible via pairs of 16 bit code units (*surrogate pairs*). UTF-16 is popular in many environments that need to balance efficient access to characters with economical use of storage.

UTF-32: Each Unicode character is encoded in a single 32 bit code unit when using UTF-32. UTF-32 is popular where memory space is no concern, but fixed-width, single code unit access to characters is desired.

The Unicode encoding forms correspond exactly to forms of use and transformation formats defined in ISO/IEC 10646. UTF-32 corresponds to the international standard's four-octet form UCS-4; UTF-8 and UTF-16 are defined in annexes of ISO/IEC 10646.

THE UNICODE CONSORTIUM

The Unicode Consortium was incorporated in 1991 as a nonprofit organization under the name Unicode, Inc.^[27] The Consortium's purpose is to develop, extend, and promote use of the Unicode Standard and other standards related to internationalization technologies.

Unicode Consortium members associated with academia and libraries include (as of October 2008): The University of California at Berkeley (Institutional Member), and Bibliothèque universitaire des langues et civilisations (BULAC). Columbia University, Ex Libris, Getty Trust Information Technology Services, Innovative Interfaces, LIB-IT, OCLC, SIL International, Utilika Foundation, VTLS, and the Wenlin Institute (all Associate Members).

Liaison Membership in the Unicode Consortium is offered by invitation only to standards organizations that have interests in common with the Consortium, particularly in technical areas. Liaison members associated with academia and libraries include (as of October 2008) Linguistic Society of America (LSA), National Endowment for the Humanities (NEH), National Information Standards Organization (NISO), Research Institute for Languages and Cultures of Asia and Africa (ILCAA) at the Tokyo University of Foreign Studies, Research Institute for the Languages of Finland (RILF), Special Libraries

Association (SLA), and United Nations Group of Experts on Geographical Names (UNGEGN).

The Unicode Consortium and ISO 15924

International Standard ISO 15924, *Information and Documentation—Codes for the Representation of Names of Scripts* was developed by the ISO technical committee TC 46 (Information and documentation) following on earlier work by ISO/TC 37 (Terminology and other language and content resources).^[28] The script codes created under the provisions of ISO 15924 are “devised for use in terminology, lexicography, bibliography, and linguistics, but they may be used for any application requiring the expression of scripts in coded form.”

ISO appointed the Unicode Consortium as the Registration Authority for ISO 15924.^[29] The Registration Authority is responsible for maintenance of the script codes, including evaluation of proposals for additional codes. It is advised by a Joint Advisory Committee (JAC); members of the JAC represent the Registration Authority and other relevant ISO technical committees and agencies.

UNICODE IN COMPUTERS AND ON THE WEB

Microsoft's Windows NT 3.1, released in 1993, was the first major operating system to support Unicode.^[30] Today, the Unicode Standard provides the foundation for an increasingly global information technology industry based on the World Wide Web and XML (Extensible Markup Language).

The World Wide Web Consortium (W3C) has developed two syntaxes for Web documents—HTML (Hypertext Markup Language) and XML—both of which allow use of Unicode. *Unicode in XML and Other Markup Languages* has been published jointly by W3C and the Unicode Consortium.^[31]

HTML allows use of various character sets, including Unicode (as its International Standard counterpart, ISO/IEC 10646). Unicode was adopted as the document character set for HTML in HTML 4.01.^[32] Specifically, section 5.1 *The Document Character Set* states: “The ASCII character set is not sufficient for a global information system such as the Web, so HTML uses the much more complete character set called the *Universal Character Set* (UCS), defined in [ISO10646]. This standard defines a repertoire of thousands of characters used by communities all over the world.” and “The character set defined in [ISO10646] is character-by-character equivalent to Unicode ([UNICODE]).”

XML, developed initially for electronic publishing, is increasingly used for data storage and exchange.^[33] Unicode is XML's default character set. In *Extensible Markup Language (XML) 1.0*, Section 2.2 “Characters”

states: “Legal characters are tab, carriage return, line feed, and the legal characters of Unicode and ISO/IEC 10646.” Section 4.3.3 “Character Encoding in Entities” requires “All XML processors MUST accept the UTF-8 and UTF-16 encodings of Unicode 3.1.”

The *Character Model for the World Wide Web 1.0: Fundamentals*, approved as a W3C Recommendation in 2005, provides “a common reference for consistent, interoperable text manipulation on the World Wide Web” and builds on “the Universal Character Set, defined jointly by the Unicode Standard and ISO/IEC 10646.”^[2] It discusses the concepts *character*, *encoding*, and *string*, as well as processing issues such as string indexing.

The *Character Model for the World Wide Web 1.0: Normalization* is currently at the Working Draft stage.^[34] The *Character Model for the World Wide Web 1.0: Resource Identifiers*, currently at the W3C Candidate Recommendation stage, addresses character encoding of resource identifiers, “a compact string of characters for identifying an abstract or physical resource.”^[35]

UNICODE AND LIBRARIES

In libraries, the predominant interest in Unicode has been its potential to improve access to material written in non-Latin scripts that were not covered by MARC 21 or UNIMARC, but this is only one of the benefits of using Unicode for library data.

The overall benefit is that use of Unicode eliminates the isolation of libraries from mainstream information technology. Because Unicode supports the needs of all types of users, including libraries, there is no longer any need for library-specific character sets. All modern software and protocols utilize Unicode, so commercially available software and fonts can be more easily used in library applications.

In 2007, the MARC 21 specifications were amended to remove the restriction permitting use of only a subset of Unicode characters.^[36] A much-desired benefit of this amendment is the ability to include additional non-Latin scripts in MARC 21 exchange records.

For scripts that have always been permitted in MARC 21 records, the benefit of this change is that additional elements of text may now be transcribed directly, instead of being represented via a cataloging convention (such as a description enclosed in brackets) or in romanization. Examples of characters that may now be used in MARC 21 records include

- For Latin script, additional letters include those such as *B with hook*, needed to write certain African languages, and the letters *yogh* and *wynn* of archaic English.
- Five times as many East Asian ideographs in the Unicode Standard as in EACC: over 70,000 compared

to over 13,000.^[37,10] National and industry character sets of East Asia were important sources for the ideographic content of Unicode.

- An extensive repertoire of mathematical, technical, and musical symbols.

Libraries are making increasing use of general information technology standards, XML in particular. Because Unicode is fundamental to modern information technology, new protocols and products for libraries are making increasing use of Unicode, if only through using a particular methodology that, in turn, relies on Unicode. Unicode is specified as the default character set of XML, so a library application based on XML uses Unicode, unless an alternative encoding is explicitly declared.

The remainder of this section discusses use of Unicode in those library technology specifications that originated before HTML and XML were available: MARC 21, UNIMARC, and Z39.50.

Unicode and MARC 21

Prior to the development of the Unicode Standard, MARC 21 specified 12 individual character sets, (sometimes referred to as “MARC-8” because of their use in an 8-bit environment).^[38] Five of the character sets—Basic Latin (equivalent to ASCII), Extended Latin (a superset of ANSEL), superscripts, subscripts, and Greek symbols—were used in records in any of the MARC 21 formats.^[22,12] The other seven—Basic Hebrew, Basic Cyrillic, Extended Cyrillic, Basic Arabic, Extended Arabic, Greek, and EACC—were used only in bibliographic records.

For records encoded with the MARC-8 character sets, the default character sets are Basic Latin and Extended Latin.^[39,11] In many systems used by libraries, the five character sets common to all MARC 21 records were implemented as a single “Latin” or “Roman” character set.

Use of Unicode in MARC 21 records was approved in 1998 with acceptance of MARBI Proposal 98-18.^[40] MARC 21 records must be encoded either in the Unicode encoding form UTF-8 or in the older individual character sets. The Library of Congress has published mappings from the characters of the individual MARC 21 character sets to Unicode equivalents (expressed as UTF-8 byte sequences).^[41] Initial use of Unicode in MARC 21 records was limited use to a specified subset of writing systems, corresponding to the scope of the individual MARC 21 character sets; the restriction was lifted in 2007.^[36]

Use of Unicode in MARC 21 affects the order of combining characters relative to the base letter. (*Combining characters* is the term used in MARC 21 documentation for what are called *diacritics*, *non-spacing graphic characters* or *character modifiers* in other library contexts.) With the introduction of Unicode as an encoding option

for MARC 21 exchange records, the position of the base letter relative to combining characters now depends on the encoding being used. When data is encoded in UTF-8, the Unicode convention of base letter first is followed. When data is encoded in the MARC 21 character sets, the original MARC convention of base letter after the combining character(s) applies.

In 2007, the Library of Congress announced that non-Latin characters were to be allowed in references in name authority records.^[42] Initially, the character content of the records is limited to the repertoire of the MARC-8 character sets. Authority records exchanged between NACO nodes are encoded in UTF-8. (NACO is the Name Authority Cooperative Program of the Program for Cooperative Cataloging.) Cataloging Distribution Service subscribers may choose MARC 21 authority records in either UTF-8 or the MARC-8 character sets.

Because some older library systems may still be limited to the individual MARC-8 character sets, two methods have been defined for representation of Unicode characters that cannot be mapped to any of the characters in these sets.^[43] One method, which substitutes the vertical bar character (ASCII hexadecimal 7C) as a placeholder for the unmappable character, is *lossy*, that is, destructive because the identity of the unmappable character is lost. The alternative method is *lossless* because the character that could not be converted is explicitly identified by a numeric character reference (NCR), modeled on character entity references in HTML.

Unicode and UNIMARC

UNIMARC, published by the International Federation of Library Associations and Institutions (IFLA) is the other international exchange format for MARC records.^[8] Manuals have been published for the bibliographic, authorities, and holdings formats; the classification format is under development.

Like MARC 21, UNIMARC specifies use of individual character sets, nine published by ISO, and one (Basic Cyrillic) registered with ISO. When individual character sets are used in a UNIMARC record, the default character set is ISO/IEC 646, the International Reference Version (IRV) of ASCII.^[23]

UNIMARC also specifies “ISO 10646 Level 3 (Unicode, UTF-8)” as a valid character set. No other character sets are used in this case. “Level 3” is a feature of ISO/IEC 10646 to designate data that may include combining characters.

A unique feature of UNIMARC is the ability to include coded information about use of scripts in a record. UNIMARC specifies 16 two-letter codes, rather than using the codes defined in ISO 15924.^[28] Additional codes indicate the reading direction of the script; left to right, or right to left. These script and direction codes are used in

the *General Processing Data* field (tag 100) and in subfield 7 that conveys script information for specific fields.

Unicode and Z39.50

Z39.50 is the original cross-system search and retrieve protocol developed for library use.^[44] Version 3 was updated in April 2002 to add the “10,646 character set” to the character set choices for character set and language negotiation.^[45] Supplementary choices cover *collection*, *implementation level*, and *syntax*.

Using this terminology derived from International Standard ISO/IEC 10646, Unicode data has these features: collection designation to identify which version of the Unicode Standard is used, implementation level 3, and one of the syntax choices UTF-8, UTF-16, and UCS-4 (=UTF-32).^[46]

LIBRARY SYSTEMS

Surveys conducted in 2002 and 2006 of providers of library systems and services showed that most integrated library systems already utilized Unicode internally to some extent.^[47,48] The earlier study by Tull identified two record storage situations: use of UTF-8, and storage in the MARC-8 character sets with conversion to UTF-8 for browser display. With the removal of the restriction on data content of MARC 21 records in 2007, any integrated library system that does not utilize Unicode end-to-end will soon do so.

The MARC 21 restriction applied only to the exchange of data. Some libraries and organizations began to use additional scripts within their own system before the restriction was removed e.g., OCLC introduced support for Tamil and Thai in 2006; Bengali and Devanagari were subsequently added.^[49,50]

Changes to the MARC 21 formats (e.g., the changes related to Unicode use introduced in 2007) are not always implemented in library software products. The ALCTS (Association for Library Collections and Technical Services) Task Force on Non-English Access received comments pointing out that products supporting interlibrary loan, bibliographic citations, and federated searching do not support non-Latin script data adequately; the cause is undetermined.^[51,52]

CONCLUSION

The development of the Unicode Standard is one of the most significant events in information technology. Unicode is fundamental to the worldwide exchange and display of textual information in multiple languages and scripts. Its use is now well established in all types of systems, software, and standards.

In the library community, Unicode has been viewed as the solution to the lack of support for non-Latin scripts in library systems, but it is far more than that. Finally, libraries and the information industry are using the same method to encode data, which means that mainstream technology can be brought into libraries with considerably less effort. The enormous increase in the repertoire of available characters allows for more the accurate description of library resources. The need for romanization is greatly reduced, significantly improving access to library resources, particularly for those who use non-Latin writing systems. The Unicode Standard brings major benefits to libraries and their users worldwide.

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Unified Medical Language System[®] (UMLS[®]) Project

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Abstract

The Unified Medical Language System (UMLS) is a long-term research and development effort of the National Library of Medicine, aimed at assisting users in finding information from multiple sources without understanding the intricacies of each particular source. Consisting of three major knowledge sources, a Metathesaurus, a Semantic Network, and a set of lexical processing tools, the UMLS is produced and released twice yearly. Recent efforts have been aimed at expanding coverage in genetics and in clinical vocabularies designed for use in medical record systems. RxNorm, produced and released on a monthly basis, with weekly updates, is an outgrowth of the UMLS, focusing on medication terminology.

INTRODUCTION

In 1986, Donald A. B. Lindberg, M.D., Director of the National Library of Medicine (NLM), initiated a long-term research and development effort known as the Unified Medical Language System. Anticipating increasing amounts of biomedical information available in electronic form, he believed that NLM should facilitate the development of advanced information systems that could retrieve and integrate information from a variety of disparate information sources, including bibliographic databases, patient record systems, factual databanks, and knowledge bases. He recognized that a major barrier to effective retrieval and integration of information from multiple sources was the “naming problem,” the variety of different ways that the same concepts are expressed in different information sources and by different information seekers.

To address the complex problems of relating user inquiries to the content of biomedical information sources and of aggregating comparable data derived from disparate databases, the NLM assembled a multidisciplinary in-house research group and also awarded a series of research contracts to a number of primarily academic investigators. The first several years of UMLS research were devoted to studying user needs, developing research tools, identifying required capabilities, exploring alternative methods for delivering these capabilities, and defining in general terms the new knowledge sources that would be needed to support integrated use of information from disparate electronic biomedical sources. Based on the results of this early work, the conception of UMLS components as “middleware” designed for use by system developers emerged. Rather than build a single vocabulary based on classical approaches, a methodology of integrating the disparate terminologies was designed. Since 1990, NLM

has issued regular editions of UMLS Knowledge Sources and associated lexical programs, at least annually. The current frequency of releases is two times per year.

Over the past 18 years, the UMLS resources have grown and developed, the methodology for creating them has matured, and their utility has been demonstrated in many different information systems. Today more than 3000 individuals and institutions worldwide license the UMLS resources, which are free-of-charge. The majority of the licensees use one or more of the UMLS components in information systems, often in creative and innovative undertakings. The NLM itself uses UMLS components to enhance retrieval from a number of its information services, including the MEDLINE database available via PubMed, the ClinicalTrials.gov database of ongoing clinical trials sponsored by the National Institutes of Health and other organizations, and the NLM Gateway, which provides a single point of entry to a number of different NLM databases. The Library also relies heavily on the UMLS resources to aid its high volume indexing and cataloging operations and in its natural language processing and digital library research programs.

Subsequent sections of this entry describe: 1) UMLS Knowledge Sources in general, 2) key characteristics of the Metathesaurus and the Semantic Network, 3) the production of the Metathesaurus and the distribution mechanisms for the UMLS resources, 4) MetamorphoSys, a utility program that assists UMLS users in unpacking new releases and customizing the Metathesaurus for particular applications, and 5) RxNorm, a standardized nomenclature for clinical drugs, that addresses special requirements for linking medication vocabularies that were not amenable to Metathesaurus construction techniques.

THE KNOWLEDGE SOURCES

There are three major UMLS knowledge sources: a large Metathesaurus® of concepts and terms from many biomedical vocabularies and classifications; a Semantic Network of sensible relationships among the broad semantic types or categories to which all Metathesaurus concepts are assigned; and the SPECIALIST Lexicon which contains syntactic, morphological, and orthographic information for biomedical and common words in the English language. The Lexicon and its associated lexical resources are used to generate the indexes to the Metathesaurus and also have wide applicability in natural language processing applications in the biomedical domain. From 1991 to 1998, the NLM also produced a fourth UMLS Knowledge Source, an Information Sources Map that described the scope, content, and access conditions for many publicly available biomedical databases. The development of the World Wide Web offered other promising approaches to addressing the problem of determining which of many information sources contain content relevant to a particular inquiry.

The Metathesaurus and the Semantic Network will be discussed in this entry. Those interested in the SPECIALIST lexicon and its related natural language processing resources should consult the Bibliography at the end of this entry.

The Metathesaurus

The Metathesaurus is the central vocabulary component of the UMLS. The term Metathesaurus draws on Webster's Dictionary third definition for the prefix "Meta," i.e., "more comprehensive, transcending." In a sense, the Metathesaurus transcends the specific vocabularies and classifications it encompasses.

The Metathesaurus is a database of information on concepts whose names appear in one or more of a number of different controlled vocabularies and classifications used in the field of biomedicine. In general, the scope of the Metathesaurus is determined by the combined scope of its source vocabularies. The Metathesaurus preserves the meanings, hierarchical connections, and other relationships between terms present in its source vocabularies, while adding certain basic information about each of its concepts and establishing new relationships between concepts and terms from different source vocabularies.

The Metathesaurus contains concepts and concept names from more than 145 vocabularies and classifications, some in multiple editions. The April 2008 release of the Metathesaurus (2008AA) includes approximately 1.55 million concepts and 7.78 million concept names. Most of the source vocabularies are included in their entirety. Some material from the UMLS Metathesaurus is from copyrighted sources.

Of particular note are two collections of source vocabularies relating to important areas in modern biomedicine. The inclusion of major genomics vocabularies—the Gene Ontology, the Human Genome Organization (HUGO) Gene Nomenclature, and the names of clinical genetic syndromes from Online Mendelian Inheritance of Man (OMIM)—makes the UMLS Metathesaurus a useful tool in mining the genomics literature for data and in linking genomic and clinical information together.

The UMLS Metathesaurus also includes standard vocabularies believed useful in building, indexing, and aggregating electronic health records and in enabling sophisticated clinical decision support at the point of care. As the central coordinating body for standard clinical terminologies within the Department of Health and Human Services, NLM plays a leading role in making key clinical terminologies freely available within the United States and in mapping them to administrative coding systems, used in health statistics and health care billing. Since 1999, NLM has funded the ongoing development and free dissemination of Logical Observations Identifiers Names and Codes (LOINC), a standard nomenclature for laboratory tests and other clinical measurements. In 2003, the Library negotiated an innovative U.S.-wide license for the Systematized Nomenclature of Medicine—Clinical Terms (SNOMED CT) to make this vocabulary available for U.S.-wide use. NLM also assisted the formation of the International Health Terminology Standards Development Organisation, which purchased SNOMED CT from the College of American Pathologists in 2007. NLM is the U.S. member of this new international organization. The Library itself produces the RxNorm clinical drug terminology (see below). The UMLS Metathesaurus is one of the dissemination vehicles for these standard clinical terminologies and for the mappings from them to administrative classification and coding systems, such as the International Classification of Diseases, Current Procedural Terminology, and the Healthcare Common Procedure Coding System.

Organization of the Metathesaurus

I. A. Richards, in his introduction to Roget's Pocket Thesaurus, described a thesaurus as the opposite of a dictionary, where you go to look up a word when you know the meaning. By this definition, a thesaurus is organized by the principle of semantic locality. That is, words and phrases close to one another in meaning can be found in the same area. A review of the first thesaurus in the English language, which was designed by Roget, illustrates that principle. Organized in general categories, then into more specific ones, are lists of words and phrases close in meaning to one another.

The Metathesaurus is organized according to this broad principle. All words and phrases that mean the same thing form a distinct concept or synonym class in the

Metathesaurus. Each separate meaning appears as its own concept, together with links (represented relationships) to other concepts in the Metathesaurus. These relationships to the other concepts serve to define the semantic neighborhood of the concept. A user of the Metathesaurus, whether human or program, can navigate within this semantic neighborhood to find the names for the concept sought.

Multiple meanings of the same term are dealt with by separating the meanings and presenting them in different semantic neighborhoods. If you look up the word “tree” in a dictionary you will see one entry with multiple definitions. If you search for “tree” in the Metathesaurus you will find that it names two separate concepts. One concept is the plant and the other one means hierarchy. Each of these meanings has differing relationships within the Metathesaurus.

Although the Metathesaurus can be usefully compared with Roget’s thesaurus, it does not fit the common information science definition of “thesaurus” as a list of preferred subject headings or descriptors, often with a cross-reference structure, created for use in the organization and retrieval of documents within some domain. This definition of thesaurus applies to some of the source vocabularies within the Metathesaurus, but not to the Metathesaurus itself, which necessarily encompasses vocabularies with a wide range of different purposes and semantic and structural properties.

Concept structure

The first step in organizing the Metathesaurus is to connect the alternative names for the same concept. Each concept record contains the strings of alphanumeric characters and terms that express the meaning of the concept. Strings that are lexical variants of each other (that is, identical after a series of well-defined manipulations that can be done computationally, e.g., making all characters lower case, putting all words in a defined order, and changing all plural forms to singular) are grouped together as a single term. One string is designated, by convention, as the preferred form of that term. Table 1 illustrates the terms for one meaning of, “Milk Hypersensitivity.” In Table 1, “Milk Hypersensitivity” and “Hypersensitivity, Milk” are lexical variants. Also in Table 1, the ten terms all have the same meaning. They are therefore linked together as alternate names of the same concept, with one term designated as the preferred name of the concept. The designation of preferred forms and preferred names is done by algorithm based on an order of precedence among source vocabularies. Because this is done by an arbitrary convention, any user can change and select their own order of precedence among vocabularies using their own tools or MetamorphoSys (see below).

Each concept in the Metathesaurus has a unique concept identifier (CUI), which itself has no intrinsic

Table 1 Synonymous terms and their sources.

Term	Source/term type/code
Milk hypersensitivity	MSH2008_2008_02_04/MH/D016269
Milk hypersensitivity	NDFRT_2004_01/DI/C6882
Hypersensitivity, milk	MSH2008_2008_02_04/EP/D016269
Hypersensitivities, milk	MSH2008_2008_02_04/PM/D016269
Milk hypersensitivities	MSH2008_2008_02_04/PM/D016269
Allergy, milk	MSH2008_2008_02_04/EP/D016269
Milk allergy	MSH2008_2008_02_04/EN/D016269
Milk allergy	MEDLINEPLUS_20040814/ET/T1256
Milk allergy	MDR11_0/PT/10027633
Milk allergy	MDR11_0/LT/10027633
Allergies, milk	MSH2008_2008_02_04/PM/D016269
Milk allergies	MSH2008_2008_02_04/PM/D016269
Food allergy to milk	CCPSS99/PT/0006002
Food allergy to milk product	CCPSS99/PT/0026295
Hipersensibilidad a la Leche	MSHSPA2008/MH/D016269
Alergia a la Leche	MSHSPA2008/EP/D016269
Alergia a la leche	MDRSPA10_1/PT/10027633
Alergia a la leche	MDRSPA10_1/LT/10027633

The meaning of the Source Abbreviations and Term Types can be obtained by reviewing the UMLS documentation.
Source: Material drawn from the 2008 UMLS Metathesaurus.

meaning. This unique identifier is represented in the Metathesaurus by the letter C followed by one or more digits (i.e., C0010028). This identifier remains the same across versions of the Metathesaurus, irrespective of the term designated as the preferred name of the concept. This facilitates file maintenance and management, as well as tracking the meanings assigned to a given term changes over time. It is “the name [of a concept] that never changes.”

Relationships

The Metathesaurus also represents relationships between different concepts. Many relationships are derived directly from the source vocabularies. For example, the fact that there is a relationship between “Opium” and “Plant Extracts” is derived from the hierarchical tree structures in the Medical Subject Headings (MeSH) vocabulary. The exact nature of the relationship may or may not be represented in the source vocabulary, although the contextual and hierarchical relationships are identified as such. Relationships between concepts from different source

Table 2 Relationships within the UMLS Metathesaurus.

Relationship	Definition
Broader (RB)	Has a meaning which includes that of the concept.
Narrower (RN)	Has a meaning which is included in that of the concept.
Other related (RO)	Has a relationship other than synonymous, narrower, or broader.
LIKE (RL)	The two concepts are similar or “alike.” In the current edition of the Metathesaurus, most relationships with this attribute link MeSH supplementary concepts which are largely chemicals. Many of the concepts linked by this relationship may be synonymous and will be in a single concept identifier in future editions of the Metathesaurus. Source-specific mappings from one vocabulary to another also have this relationship, along with the label for the relationship attribute of “mapped_to.”
Parent (PAR)	Is a parent in a hierarchy of a Metathesaurus source vocabulary.
Child (CHD)	Is a child in a hierarchy of a Metathesaurus source vocabulary.
Sibling (SIB)	Shares a parent in a hierarchy in a Metathesaurus source vocabulary.
AQ	Is an allowed qualifier for a concept in a Metathesaurus source vocabulary.
QB	Can be qualified by a concept in a Metathesaurus source vocabulary.

vocabularies are also, on occasion, created during Metathesaurus construction. For example, the MediSpan (MDDb) concept “Infant Foods Powder” is identified in the Metathesaurus as having a narrower-than relationship to “Infant Food,” a concept that is present in MeSH, SNOMED, and others.

Nine types of relationships exist in the Metathesaurus. They are listed in Table 2. Relationships are reciprocal, so that, for example, where one concept is broader than another, the other is noted as being narrower than the first. Relationship attributes, describing the exact nature of a relationship, may be assigned to a given relationship. These attributes include the set of permissible relationships within the Semantic Network (discussed below), with additional relationships, including that of “mapped_to.” Other relationship attributes originate from the source vocabularies.

Many of the source vocabularies included in the Metathesaurus place the concepts they include in some context. These contexts are in general hierarchical arrangements, for some organizational or classification purpose. NLM endeavors to preserve all of these different contexts in the Metathesaurus, so a single concept in the Metathesaurus can appear in multiple different hierarchies. As an example, several of the contexts in which the concept “fruit” appears are shown in Table 3. There is no

attempt to merge or combine the different contextual views into one coherent hierarchical arrangement for the Metathesaurus. Given the different perspectives and purposes of the many UMLS source vocabularies, this would be an essentially impossible task.

Semantic types

Each Metathesaurus concept is assigned at least one semantic type. The types are drawn from the Semantic Network (see below). The types provide a general categorization of the concept, and allow some reasoning about the possible meaning of the concept. In all cases, the most specific semantic type available in the hierarchy is assigned to the concept. For example, the concept “Macaca” receives the semantic type “Mammal” because there is not a more specific type, e.g., “Primate,” available in the Network.

Additional attributes

Within each concept, there are many data elements provided both by the sources and created by NLM. There are over 110 attributes and data elements in the Metathesaurus. Each attribute in the Metathesaurus is labeled with the source, which asserted that attribute.

Of particular note is that there may be narrative description(s) of the meaning of the concept. The majority of these definitions come from MeSH and National Cancer Institute (NCI) Thesaurus, but there are also definitions from a number of other sources. A few definitions are created specifically for the Metathesaurus when they are needed to distinguish among different meanings of the same string.

The Semantic Network

The Semantic Network is tied very closely to the content of the Metathesaurus. In general, semantic networks attempt to impart common sense knowledge to computers, allowing them to “reason” and draw conclusions about entities by virtue of the categories to which they have been assigned. The semantic links provide the structure for the network and represent important relationships in the domain. The UMLS Semantic Network consists of 135 semantic types, broad categories intended to indicate the general area of meaning of a Metathesaurus concept, together with 54 relationships or semantic links.

The Semantic Network can be visualized as a diagram where the types make up nodes within a network. The top of the network has two nodes, “Entity” and “Event.” The remaining types each appear only in one location within the network. Figure 1 includes a portion of the UMLS Semantic Network.

The primary link between the nodes is the “isa” link. This establishes the hierarchy of types within the Network

Table 3 Representative hierarchical contexts for the concept “fruit”.

Alcohol and other drug thesaurus
Technology, safety, and accidents
Technology, manufacturing, and agriculture
Food product
Beverage +
Chocolate
Dietary fiber +
Fish, shellfish, other seafood
Food-product ingredient
Fruits
Grain, cereal +
Junk food
Meat and dairy products +
Nut, seed
Pastry, sweets
Vegetables
Vitamin supplement
SNOMED CT
Substance +
Dietary substance +
Foods +
Fruit nuts and seeds +
Fruit
MeSH
Organisms (MeSH Category)
Plants
Plant components
Plant components, aerial
Flowering tops +
Fruit
Nuts
Seeds +
Plant epidermis +
Plant leaves +
Plant shoots +
Plant stems +
Technology, food and beverages (MeSH category)
Technology, industry, agriculture (MeSH category)
Food and beverages
Food
Bread
Candy +
Cereals +
Condiments +
Crops, agricultural +
Dairy products +
Dietary carbohydrates +
Dietary fats +
Dietary fiber
Dietary proteins +
Dietary supplements +
Eggs +
Flour
Food additives +
Food, genetically modified
Foods, specialized +
Fruit
Honey

Table 3 Representative hierarchical contexts for the concept “fruit”. (Continued)

Meat +
Micronutrients +
Molasses
Nuts
Seeds
Vegetables +

Concept name bolded for readability.
+Indicates has children not shown.
Source: Contexts drawn from 2008 UMLS Metathesaurus.

and is used for deciding on the most specific semantic type available for assignment to a Metathesaurus concept. In addition, a set of nonhierarchical relations between the types has been identified. These are grouped into five major categories, which are themselves relations: “physically related to,” “spatially related to,” “temporally related to,” “functionally related to,” and “conceptually related to.”

The relations are stated between semantic types and do not necessarily apply to all instances of concepts that have been assigned to those semantic types. That is, the relation may or may not hold between any particular pair of concepts. So, although “treats” is one of several valid relations between the semantic types “Pharmacologic Substance” and “Disease or Syndrome,” a particular pharmacologic substance (e.g., penicillin) may not treat a particular disease (e.g., AIDS).

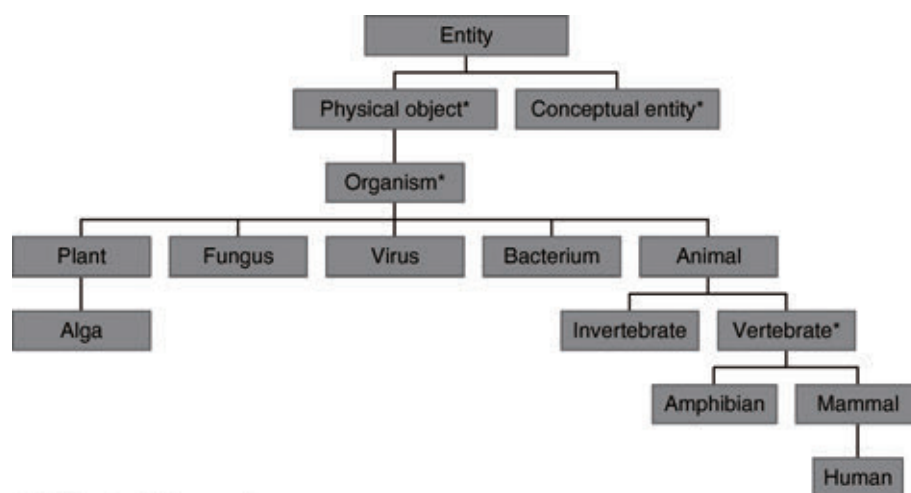
PRODUCTION AND DISTRIBUTION OF THE UMLS

Making the Metathesaurus

To understand the process of making the Metathesaurus, it is helpful to review the steps taken in adding a new vocabulary to the Metathesaurus. (Adding an update to a vocabulary already present in the Metathesaurus is quite similar.) The NLM begins by acquiring the rights to incorporate a vocabulary into the Metathesaurus. The rights include permission to include and represent the vocabulary in this form, and to distribute the vocabulary to UMLS licensees. However, a UMLS license alone does not permit a licensee to use every source vocabulary for any purpose. For some applications of some source vocabularies, the user must also establish a separate agreement with the individual vocabulary producer. The UMLS license describes when this is necessary.

Once a machine-readable version of a vocabulary is made available to the NLM it is converted into a “normal” or canonical form. This “inversion” process requires careful consideration of how the source represents its meanings and attempts to make all of this representation explicit. Depending on the vocabulary and the context of

(Continued)



* Additional children not shown

Fig. 1 A portion of the UMLS semantic network.

a given term, the meaning of that term, what is being named by it, can differ from the same term in other vocabularies. Each source is then added to the existing Metathesaurus. Terms from different sources which are lexically similar to each other or to existing terms in the Metathesaurus, or which appear from other indications to be semantically identical to concepts in the Metathesaurus, are brought together (merged) as proposed synonyms located in a single Metathesaurus concept.

After this merging, the results are reviewed by editors, largely to assess if the proposed concept merge is appropriate. This human step, which requires understanding of the meaning of a term in the source is the key to successful linking of that term to different terms from different source vocabularies. Contextual information about what is being named can be almost entirely implicit (e.g., a vocabulary describing medical procedures with a drug term name may really mean the procedure of administering that drug), or represented more explicitly. Judging whether or not the same referent is being named can be difficult. Practical decisions of what constitutes synonymy are dominated by the consideration of what an expert in the area might discern as a notable difference in meaning. Editors also may add information such as additional relationships and semantic types. This human review is expedited by computational assistance, as is the quality assurance that takes place after the editing.

In categorizing the concepts, editors are encouraged to consider the most specific semantic type available. If the concept is broad or not represented by a more specific type, a broad category in the semantic type hierarchy is used. For example, a sub-tree under the node “Physical Object” is “Manufactured Object.” It has three nodes, “Medical Device,” “Drug Delivery Device,” and “Research Device.” It is clear that there are manufactured objects other than medical devices, drug delivery devices, or research devices. Rather than proliferate the number of semantic types to encompass multiple additional

subcategories for these objects, concepts that are neither medical devices nor research devices are simply assigned the more general semantic type “Manufactured Object.”

Periodically various types of quality assurance efforts are performed. The most important of these are efforts to ensure that there is no missed synonymy, i.e., no terms meaning exactly the same thing in different concepts. Another important effort is made to ensure that every concept is linked to others by some relationship.

In preparation for releasing of the next version of the Metathesaurus, all new releasable concepts are assigned CUIs, while concepts previously present in the Metathesaurus retain their CUIs. The Metathesaurus is released as a set of relational tables. Each term in a source is identified with its own unique identifier, and a group of terms judged synonymous share the same CUI.

Licensing and Distribution of the UMLS

The UMLS is available free of charge to anyone who wishes to license it. The license agreement, available at <http://www.nlm.nih.gov/research/umls/>, must be completed and signed electronically. As noted above, UMLS licensees may also have to enter into separate license agreements with the producers of specific vocabularies present in the Metathesaurus. No additional agreements are required for use of the other UMLS components.

Licensed users may ftp the UMLS Knowledge Sources or access them interactively from the UMLS Knowledge Source Server. On request, DVDs are provided to users who do not have adequate connectivity to ftp the large files.

MetamorphoSys

As the Metathesaurus has grown in size, dealing with the file sizes and the many constituent vocabularies has introduced new challenges, requiring custom compression

techniques for the packaging and distribution of the content. This has consequently created the need for a tool to allow users to unpack the data at their local installations. Furthermore, due to the different needs of the users, the entire content of the Metathesaurus is rarely needed or wanted for any specific application. Some content may actually be harmful to particular applications, or users may not have the additional licenses required for some uses of some source vocabularies. Thus, the need arises to create useful, user-definable subsets of the Metathesaurus with all the data and referential integrities present in the full release. This, in general, is a nontrivial task beyond the scope of many users.

MetamorphoSys is a utility program designed to meet these and other needs. An early version for subsetting was first introduced in 1999 and has since then grown into its current form as an installation, subsetting, and browsing tool for the UMLS Metathesaurus. It is implemented as a platform-independent Java application freely distributed with the UMLS data on the DVD or available as an Internet download.

MetamorphoSys is first an installation program for the UMLS. It is required to unpack the UMLS knowledge sources from the internal, compressed distribution format. It allows customization on a variety of axes: inclusion/exclusion by source and term type, semantic type, language, content view, etc. It permits reorganizing the ranking precedence of the different sources that contribute meaning to concepts. Users can also modify the suppressibility of concept names that might not be useful, or even harmful, in their applications. It comes with input and output handlers for a variety of formats. It provides load scripts to allow the Metathesaurus and Semantic Network data for subsets to be loaded into a database management system. It is designed with an open, extensible architecture so users can define custom filters to include or exclude either whole concepts or constituent elements of concepts in predictable ways.

Included as part of MetamorphoSys is a browser application that can be used to browse the custom subsets of the Metathesaurus created. The browser can display reports for concepts searched for in a variety of ways: by concept unique identifier, by code, or by words in the concept names. Both the search and display can be constrained by source, semantic type, and content view. There is an integrated tree browser that allows users to navigate the hierarchies of all sources that provide contexts.

RxNorm

RxNorm is a standardized nomenclature for clinical drugs. RxNorm, and its associated contributing vocabularies, address an important issue in supporting interoperability that could not be addressed by the traditional means of building the Metathesaurus. Unlike other portions of the

Metathesaurus, RxNorm deals with the problem of unrecognized synonymy by establishing standard, normalized, names for the clinical drugs, defined as ingredients and strengths provided in a dosage form. Each drug has a name created using a standard methodology, with controlled segments, and with defined relationships to other concepts in RxNorm. The names are created by reviewing the names within one of the source vocabularies, and then using the information in that name and source to create the standard name, asserting synonymy between that source vocabulary name and the created name.

In response to the perceived need for frequent updates to clinical drug information, RxNorm provides monthly releases of all of its source vocabularies, together with the standard names created in the RxNorm system, with more frequent releases of new additions. The file formats are essentially identical to that of the Metathesaurus. Identifiers from the Metathesaurus are consistent with the identifiers in the current extant version of the Metathesaurus. At the time of release of the Metathesaurus, the next (usually simultaneous) release of RxNorm is consistent with the new release.

CONCLUSION

The NLM produces and distributes the UMLS, consisting of multipurpose, electronic Knowledge Sources and associated software tools for system developers and researchers in the fields of biomedicine and health. The unique characteristics, large scale, and regular update schedule of the UMLS resources have promoted their heavy use in wide range of information retrieval, natural language processing, data creation, and decision support applications.

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Uniform Computer Information Transactions Act (UCITA)

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Abstract

The Uniform Computer Information Transactions Act (UCITA) is an attempt to conform state law relating to software and information licensing to a uniform national standard. UCITA began as a proposed revision to the Uniform Commercial Code (UCC). For more than 10 years the National Conference of Commissioners on Uniform State Laws (NCCUSL) and the American Law Institute (ALI) debated the merits of various proposals to cover the licensing of software and information, including the proposal UCC 2B, but were unable to agree on a solution. In May 1999, the ALI withdrew its support after concluding that the UCC 2B approach was flawed. Despite opposition from the ALI and dozens of educational, library, and consumer groups, NCCUSL ratified the model legislation in July of 1999, renamed it UCITA, and sent it to the states for enactment without either the endorsement of the ALI or a review by the American Bar Association. UCITA enjoys strong support among the high-technology community including large software companies like Microsoft and Internet companies like AOL. UCITA has also met with stiff opposition throughout its 10 years history. Critics have expressed concerns about its wide-reaching scope, its effect on existing copyright and consumer protection laws, and its questionable fit with the First Amendment. These and other issues, such as its favorable treatment of choice of law and forum clauses and the difficulty of meeting its standard of unconscionability, have resulted in its failure to gain acceptance in most states. Courts are still trying to resolve many of these issues today. The overall trend appears to be toward enforcement of shrink-wrap license agreements when the licensee has an opportunity to review the terms and accept or reject them. Thus, in spite of NCCUSL's failure to gain wide acceptance of UCITA, decisions by the courts could ultimately have a similar impact on the way information transactions are viewed.

INTRODUCTION

The Uniform Computer Information Transactions Act (UCITA) is an attempt to conform state law relating to software and information licensing to a uniform national standard. Specifically, the legislation was drafted to address the problem of “shrink-wrap” software licenses, which bind consumers to their tenets as a condition of use. Often this term generically encompasses “click-through,” “active click wrap,” and “browse-wrap” licenses, which accompany much of the information found online. Unlike shrink-wrap licenses, which take their name from the plastic they are often printed on, click-through, active click wrap, and browse-wrap licenses exist only electronically. They typically appear on the monitor as a condition of accessing information or installing software. Most users agree to these conditions as a matter of course, without stopping to read or consider their restrictions. Although licenses such as these have become commonplace, some courts have hesitated to enforce them. Disparate judicial treatment of these agreements led to an attempt to standardize the law relating to them.

HISTORY

UCITA^[1] began as a proposed revision to the Uniform Commercial Code (UCC). Most states have adopted the UCC or some version of it, and it is generally considered the most influential source of contract law in the United States. It is drafted by two groups, the American Law Institute (ALI)^[2] composed of some 3000 elected judges, law professors, and lawyers and the National Conference of Commissioners on Uniform State Laws (NCCUSL),^[3] an organization comprised of approximately 300 lawyers, judges, and law professors appointed by states as commissioners. If both organizations approve a revision, it is then generally reviewed by the American Bar Association (ABA) before being submitted to each state government for adoption. Each state then enacts the proposed section or selected provisions, and those enactments become the law of that state.

For more than 10 years the two groups debated the merits of various proposals to cover the licensing of software and information, including the proposal UCC 2B, but were unable to agree on a solution. Current law is based on transactions of tangible goods. Both sides saw a need for

consistent and clear uniform rules for transactions involving software and information. In May 1999, the ALI withdrew its support after concluding that the UCC 2B approach was flawed.^[4] Despite opposition from the ALI and dozens of educational, library, and consumer groups, NCCUSL ratified the model legislation in July of 1999, renamed it UCITA, and sent it to the states for enactment without either the endorsement of the ALI or a review by the ABA.

The model legislation has been studied by or introduced to at least 27 state legislatures, but only Virginia and Maryland have enacted it. Although Virginia, in 2000, was first to enact this legislation, a compromise was struck by the General Assembly that delayed the effective date of UCITA in Virginia until July 1, 2001, allowing for a year of study and amendment.^[5] Maryland, the only other state to enact this legislation, set an effective date of October 1, 2000.^[6]

UCITA enjoys strong support among the high-technology community including large software companies like Microsoft and Internet companies like AOL. They support a free market where the parties choose models that support their transactions. It is opposed, however, by diverse groups, such as the Americans for Fair Electronic Commerce (AFFECT) which includes a coalition of library associations, newspaper and magazine publishers, insurance companies, and small engineering and software companies.^[7] A number of state Attorneys General signed a letter to NCCUSL expressing reservations about the proposed legislation.^[8]

Because of the controversial nature of the model legislation and the hearings and debates by numerous states, the matter was brought to the ABA. At its 2001 annual meeting, the ABA appointed a task force comprised of representatives from both sides of the debate to study further UCITA. On January 31, 2002, the ABA published a report of its findings on UCITA.^[9] Although the ABA acknowledged that UCITA is a worthy goal, and some measure of uniform regulations are needed for computer transactions, the ABA believed UCITA to be inadequate and too convoluted.^[10] NCCUSL responded with several amendments in 2002, however, these amendments failed to adopt some key ABA recommendations, including a requirement for pretransaction disclosure of terms.^[11] Anticipating rejection of these amendments, in February 2003 NCCUSL withdrew its resolution before it was voted on by the ABA House of Delegates.^[12] Without ABA support, in August of 2003 NCCUSL discharged the UCITA Standby Committee and announced that no further resources would be expended to promote UCITA.^[13] The debate has been spirited on both sides.

UCITA CONCERNS

UCITA has met with stiff opposition throughout its 10 years history. Critics have expressed concerns about its wide-

reaching scope, its effect on existing copyright and consumer protection laws, and its questionable fit with the First Amendment. These and other issues, such as its favorable treatment of choice of law and forum clauses and the difficulty of meeting its standard of unconscionability, have resulted in its failure to gain acceptance in most states. Courts are still trying to resolve many of these issues today.

Scope

This controversial legislation would have a profound effect on library operations because the definitions of information and computer information in UCITA cover just about everything. Information is defined as "data, text, images, sounds, mask works or computer programs, including collections and compilations of them."^[14] Computer information is defined as information in an electronic form which is obtained from or through the use of a computer or which is in a form capable of being processed by a computer. The term includes a copy of the information and any documentation package associated with the copy.^[15] These definitions include most information a library acquires, although UCITA excludes traditional written forms such as books. Only software and information in electronic format is covered, so a book on CD-ROM would be covered.

Two types of licenses are considered: mass-market licenses and specific one-on-one licenses. Mass-market licenses are those such as general retail or consumer licenses. They are nonnegotiated licenses. The specific one-on-one contracts are usually aimed at industry and are also covered. UCITA is the default when contracts are nonnegotiated or fail to address an issue. A UCITA license could allow content providers to bypass many of the protections traditionally afforded by the public law of copyright, and will likely replace it with the private law of contracts, becoming the central body of law governing information transactions. It gives greater power to copyright holders to write agreements restricting the use of their products.

Copyright and Software Licenses

Public policy

The Copyright Act of 1976 struck a careful balance, granting protection to authors in exchange for certain public uses of their works.^[16] Authors and other content providers are enabled by UCITA to contract around the important public uses guaranteed by copyright law. The statute would validate shrink-wrap and click-through licenses that would restrict uses by libraries allowed by federal copyright law. Libraries most rely on the following sections of the Copyright Act to carry on their day-to-day activities: section 109 of the Copyright Act establishes the

first sale doctrine as a result of which libraries can lend, sell, or otherwise distribute materials they have purchased; section 107 permits fair use on which libraries rely to make and distribute certain copies; and, section 108—the exemptions for libraries and archives—provides for preservation, lending, and interlibrary loan.

The first sale doctrine, set out in section 109 of the Copyright Act of 1976, terminates the rights of the author in the work after its initial sale, and allows the new owner, such as a library, to resell, dispose of, display, and make use of newly purchased content. Many functions, such as lending, browsing, and resale are triggered by the first sale of the work. More specifically, section 109 permits a nonprofit library or a nonprofit educational institution to lend software for nonprofit purposes.^[17] Because UCITA allows authors and publishers to license their works instead of selling them, no sale occurs, and the protections afforded under the first sale doctrine never ripen. Critics of UCITA argue that it limits rights of users to sell or transfer licensed software effectively overturning the Copyright Act's first sale doctrine.

In the absence of a sale, the right to sell or transfer licensed information remains with the author or his designee. The author of the work may impose restrictions on lending or reselling the information. Additionally, licenses last only for a finite period, driving costs higher as libraries repeatedly pay for access to the same information. The archival function of libraries could be severely curtailed: the expiration of the license may terminate access to the information, and any right to make archival copies could be limited by the terms of the license.

Even core values such as fair use are threatened by UCITA. Shrink-wrap and click-through licenses allow vendors to condition access to information on acceptance of the terms of an agreement. To access information, end users may have to agree to not reproduce the material. The fair use exemption on which educators rely for classroom^[18] and reserve^[19] copying may be in jeopardy. Moreover, copying done by individuals for purposes allowed under fair use of the Copyright Act^[20] such as copying for research and criticism also may be limited by shrink-wrap and click-through licenses. Although fair use would remain a defense to any copyright claim, the publisher could prevail on any claim based on the contract, rendering the copyright defense moot.

Libraries and archives fear that clauses in a UCITA contract would allow vendors to dictate limitations on rights otherwise available to them to conduct business. For example, without negotiation, interlibrary loans could be prohibited and remote access to information by students, faculty, and researchers could be limited by license terms. Such limitations would be particularly aggravating when the supplemental information to a book is supplied on a CD that may be loaned under section 108 of the Copyright Act,^[21] but may not be loaned with its companion book under a clause pursuant to UCITA.^[22] A license

could also limit copying to preclude the copies allowed for preservation purposes or even backup.

The Copyright Act exemptions allow users and libraries to make copies under restricted conditions without seeking permission and/or without paying royalties. These limitations were carved out of the copyright holder's exclusive rights based on public policies to encourage creativity. State laws like UCITA supplement federal intellectual property laws and policies, but in many ways they may impose new business models. The issue is the extent to which federal preemption controls.

The relationship between preemption under the federal copyright act of a state law that is equivalent to a right granted under copyright law and state contract law, which varies the effect of section 301 of the Copyright Act, is unclear.^[23] The legal issues are extremely complicated and are unresolved. Section 105 of UCITA speaks of the relation to federal law and fundamental public policy:

§ 105 Relation to Federal Law; Fundamental Public Policy; Transactions Subject to Other State Law.

- (a) A provision of this [Act] which is preempted by federal law is unenforceable to the extent of the preemption.
- (b) If a term of a contract violates a fundamental public policy, the court may refuse to enforce the contract, enforce the remainder of the contract without the impermissible term, or limit the application of the impermissible term so as to avoid a result contrary to public policy, in each case to the extent that the interest in enforcement is clearly outweighed by a public policy against enforcement of the term. . . .^[24]

As written, UCITA provides that if a federal law invalidates a state contract law or contract term, federal law controls. Section 105(a) refers to preemption but no general preemption of contracting issues arises under the copyright law.^[25] The model legislation does not specify when federal preemption may occur. Under section 105 of UCITA a court may refuse to enforce a contract if it violates fundamental public policy.^[26]

The commentary accompanying UCITA addresses the complexity of the problem, however, it leaves the broader issue to be resolved by a different body.^[27] Courts may follow the analysis set out in the commentary but are not required to do so. A contract may, however, be unenforceable because of federal preemption based on public policy. The issue is whether courts will consider fair use a fundamental public policy.

Public policies attempt to balance competing interests and define the allocation of risks between parties to prevent undesirable results that occur due to unequal bargaining power and strengths between parties. For example, the copyright law gives a creator a limited exclusive right to control the work for a finite term of protection and an incentive to create it.^[28] Society gains the benefit

of using the work after the limitation expires and the work becomes part of the public domain. The public also gains restricted access during the term of protection through exemptions to the exclusive rights based on public policy. Public policies apply to everyone. In contrast, contract law often allows the contracting parties to circumvent the balance struck by public policies. This competing value is known as “freedom of contract.”^[29]

While there are circumstances in which contracting around a public policy results in a socially and economically desirable result, when the circumstance does not permit negotiation, such as with a standard form contract, it is of substantial concern. Transactions costs may be minimized, but the end result for the nondrafting party may be a waiver of rights. Licensing terms for mass-market retail or online information products such as those used by libraries can “limit access to and use of electronic materials, prohibit making copies of materials for archiving or preservation or prevent interlibrary loan, or prohibit the transfer or donation of electronic products.”^[30]

National library amendment

Library groups in opposition offered an amendment that would replace existing section 105(b) with proposed 105(b)(1) and (2). The proposed amendment would allow parties to contract around public policies in a negotiated contract, facilitating commerce in the way that the drafters of UCITA envisioned, but would prevent the drafting party from imposing overreaching licenses in a standard form contract that favor the drafter, thus maintaining the benefit of public policies when the licensee has virtually no negotiating power. In some instances, a party might be willing to give up fair use rights. The proposed language, however, would have limited the broader effect of standard form contracts that might severely limit the ability to cite, criticize, reverse engineer, or otherwise use these works to society’s benefit.^[31] The proposed amendment attempted to balance the laissez-faire drafters, who would permit a new business model to try anything, with a certainty of social benefits to protect weaker parties. Unfortunately, none of these proposed changes have been adopted.

Some authorities in attempting to redress the imbalance between the freedom of contract of private property rights and the public good uses of information propose strict scrutiny of socially questionable terms and offer a doctrine of “public-interest unconscionability.”^[32] Undoubtedly, the enforcement of negotiated contractual agreements is a “fundamental public policy.” The question is how to handle agreements that arise from standard form contracts of adhesion. One way is to respect the traditional balance of public/private interests; the other way is to submit standard form contracts to a high level of scrutiny proposed by the public-interest unconscionability doctrine.^[33]

Virginia libraries amendment

During the year of study between the enactment and the effective date of UCITA in Virginia, the Virginia Library Association, concerned that UCITA would preclude the lending of a CD-ROM of information, perhaps even the supplement to a companion book, persuaded the General Assembly to amend the legislation to allow nonprofit libraries and archives to lend tangible copies (CD-ROMs) under restrictive conditions.^[34] NCCUSL met with members of the library community in the hope that language could be negotiated to become an amendment to the model version of UCITA that could be submitted to other states.

The statute permits a qualified library or institution to make a tangible copy available to users for course reserves or ordinary lending, including interlibrary loan; to copy for archival and preservation purposes; and to make use of the copy for classroom purposes.^[35] The amendment applies to conduct that is “not otherwise unlawful or restricted under the Copyright Act...” This arguably includes any act undertaken by a library under fair use or any other exemption that allows libraries, archives, and nonprofit educational institutions to carry out their missions; all of these exemptions are restrictions under the Copyright Act. Next, the statute provides that the standard form contract covers the use of a tangible copy of information content to a licensee. The question is whether a user must first determine if the shrink-wrap or the click-through license is a standard form contract. The benefit of this exemption is surprisingly not limited to a nonprofit library or archive or a nonprofit educational institution. Initially, the drafts included a very restrictive definition of libraries that would not include museums or government agency or court libraries, but after much debate between NCCUSL representatives and members of the library community, a clause was added to clarify that the “terms nonprofit library, archive or educational institution have the same meaning as used in section 108, 109, 110 of the Copyright Act, 17 U.S.C. §§ 108, 109, and 110.”^[36]

Much of the library community viewed the Virginia amendment as too restrictive and withdrew their support as a national amendment.^[37] The Virginia Association of Law Libraries (VALL) had several problems with the language offered to libraries, but because of the concern that opposition might affect funding for public libraries and other institutions it remained neutral during the legislative session.^[38] VALL, in particular, objected to the amendment’s narrow application to only tangible copies obtained by libraries, such as CD-ROMs, at a time when publishers are moving away from tangible products towards the online environment. It does not apply to online databases or to other content distributed directly over the Internet, therefore, providing only a short-term benefit, if any.^[39] Worse, it could be read to restrict further rights that otherwise are available under copyright law. By

specifying which uses can be made of tangible copies, the statute could be read to prohibit all other uses.

The amendment permits the copyright holder to vary the terms of the license providing that the change in terms is conspicuous, that the library manifests assent to the changes, or that the library knew or had reason to know that the terms would follow when it ordered a copy.^[40] There are numerous problems with this part of the statute. There is no definition of conspicuous. Although authorities have debated manifestation of assent, there is generally no accepted definition for behavior that would constitute assent. Because staff, who may have little or no training in issues of intellectual property law, open most material received by libraries, by opening the package their behavior may constitute assent. Moreover, the software often must be loaded and run before the terms can even be reviewed. Loading software may or may not be a sufficient manifestation of assent. Any action taken by staff, regardless of their authority to bind the organization to an acquisition in an online environment, may authorize the license. Must the terms appear on the home page of a site or is it legally adequate to post a button on the page that would take the user to a screen with terms and conditions for use? Must a user click "I agree" in order to manifest assent? Most authorities recommend that the user be required to agree to the terms and conditions by taking some type of formal step such as clicking "I agree" before being bound by them. Again, staff who are unaware of the legal consequences may undertake the initial step of adding material to the collection by using the site, by bypassing the click button, or even by clicking "I agree."

The library has a right to return the software in the same manner that a library could return a book that upon inspection was found inappropriate for the collection.

Finally, the Virginia statute does not alter the general burden of proof in an infringement, contract, or other action. The Virginia library amendment does nothing to clarify the relationship between a contract that violates a public policy, including whether such policy is under the federal copyright law, and one that does not.^[41]

Consumer Protection and Warranties

A UCITA license will affect more than copyright law. It will fundamentally change the way consumers interact with software and information vendors. Because libraries are among the largest consumers of software and digital information, the language in licenses is critical to users. Several provisions of UCITA illustrate how this legislation reshapes the relationship between information consumers and information vendors. Some of these sections create doubts about whether software transactions are covered by consumer protection laws.

Despite the lack of opportunity to review the terms of a license, a licensee may be bound by "manifesting assent" to the terms. Section 112 defines how a person or an electronic agent manifests assent and includes formation of a contract by double-clicking after payment and delivery.^[42] This section coupled with Section 208, which provides that the terms of a record become the terms of the contract if the party manifests assent^[43] to the terms, permits vendors to impose potentially restrictive terms on use of information postpurchase or to impose additional costs by requiring return of goods rather than preacquisition presentation of terms. There are no presale reviews of the product.

Under a shrink-wrap or click-through license subject to this legislation, vendors could unilaterally modify the terms of a contract during its operation.^[44] Such a modification could be viewed as accepted by the licensee by their continued use of the software or information. Courts likely will enforce the modified contract unless it is "manifestly unreasonable." This is one of the most pernicious part of the model legislation and opponents view it as the worst kind of bait and switch to lure consumers to the product. In the context of mass-market sales of software in a box in a store, it is not feasible to disclose the entire license prior to the sale of the software; however, it makes no sense to permit postassent contractual modifications to a click-through license.

In spite of the 2002 amendments, which provide that state consumer protection laws apply when a license is otherwise silent on the matter, UCITA permits copyright holders to include clauses in their licenses that disclaim warranties and liabilities. The model legislation immunizes software and information providers from liability when the software they provide is "flawed" or "buggy." Vendors are afforded similar protection when the documentation is inadequate or incorrect. The provision allows a vendor to sell "as is" even when the vendor knows of the defects and fails to disclose the problem to the user.^[45] A licensee will have the benefit of an implied license only when it undertakes a reasonable inspection that fails to reveal the defect. Moreover, the Virginia version of UCITA states that the occasional failure to provide service does not constitute a breach of contract.^[46] This leaves libraries and other subscribers to online databases without a remedy when online services are inaccessible to their patrons.

A self-help provision^[47] that allowed software or content providers to remotely disable software if they had reason to believe that a licensee was in violation of its license agreement was particularly controversial. Late payments or perceived misuse of a product were deemed just cause to trigger the self-help provisions. A vendor could disable the software even for an unknowing and minor infraction of the license. The model legislation was redrafted to require reasonable notice before this remedy could be effected.^[48] Although the 2002 Amendments banned "electronic self-help," the problem still exists

because the statute permits “electronic regulation of performance,” which is essentially the same thing. These measures could further complicate the mission of libraries because electronic products may disappear at the expiration of the term of the license. The disappearance of information without notice could hamper preservation activities.

Finally, UCITA legitimizes e-mail, recognizing communications by this method for the purposes of contracting and legal notice.^[49] While this is a laudable goal, the statute falls short by failing to require that the addressee actually read the message. Electronic mail notification is recognized if the message is properly addressed and received. Messages thwarted by full in-boxes or buggy e-mail are just as effective as messages properly delivered.

First Amendment Issues

Even traditional First Amendment principles such as fair comment are called into question by the UCITA statute. Access to software or information may be conditioned on a licensed agreement that says the software package or information cannot be reviewed or critiqued by a magazine or newspaper without the permission of the vendor. This would allow a vendor to preclude public comment or criticism of the product by preventing negative reviews from appearing in print to the detriment of users and potential purchasers of the information or software; however, in July 2002, NCCUSL amended this section so that vendors will no longer be able to silence critics through contract.^[50] Provisions that prohibit users, in most cases, from reverse engineering a product are permitted by UCITA. Users may be allowed to reverse engineer for interoperability.

Choice of Forum/Choice of Law

Under a UCITA contract the licensor may designate the forum, generally the state in which the software producer is located, in which any issues would be litigated, making it inconvenient if not impossible for the licensee to resolve the issue. In other cases, the licensor may not designate the state where the issues will be litigated, but may designate instead the body of law that the court must consider.^[51] It is likely that such licenses will designate a body of state law that includes UCITA with its clauses favorable to the producers. Venue and choice of law clauses may render some state contracts unenforceable. For the resolution of conflicts between state institutions such as colleges and universities or public libraries and licensors, jurisdiction must be within the state. Typically a state agent authorized to bind the state cannot enter into a contract that specifies the law of another state as controlling. For others, these sections continue to present significant issues.

Some states that considered the enactment of UCITA found these provisions particularly objectionable and passed “bomb-shelter” legislation to protect the residents

of their state. For example, North Carolina legislators passed language that provides.

§ 66-329 Choice of Law in Computer Information Agreement.

A choice of law provision in a computer information agreement which provides that the contract is to be interpreted pursuant to the laws of a state that has enacted the UCITA, as proposed by the NCCUSL, or any substantially similar law, is voidable and the agreement shall be interpreted pursuant to the laws of this state if the party against whom enforcement of the choice of law provisions is sought is a resident of this state or has its principal place of business located in this state. For purposes of this section, a “computer information agreement” means an agreement that would be governed by the UCITA or substantially similar law as enacted in the state specified in the choice of law provisions if that state’s law were applied to the agreement. This section may not be varied by agreement of the parties. This section shall remain in force until such time as the North Carolina General Assembly enacts the UCITA or any substantially similar law and that law becomes effective.^[52]

This poison-pill type of legislation has been passed or considered by states that do not have to appease technology industries.^[53] It protects the interests of the citizens of the state while giving UCITA time to prove that it is working in Virginia and Maryland.

Although support for UCITA has declined, narrower efforts at reform have simultaneously been underway. One such effort resulted in recent amendments to UCC Article 1 regarding, among other things, choice of law.^[54] Previously, contracts containing choice of law provisions had to bear a “reasonable relation” to the designated state whose law would govern.^[55] The revision, however, gives greater autonomy to the parties by providing that choice of law clauses can be upheld “whether or not the transaction bears a relation to the State designated. . . .”^[56] Because courts currently rely on the UCC for transactions in computer information, if adopted by the states, this change could have a similar impact as that proposed by UCITA. Of the 28 states that have adopted the Article 1 amendments, however, all have rejected this particular change and have chosen to use alternate wording which maintains some form of the “reasonable relation” requirement.

Unreasonable Standard Amendment

The standard for unconscionability proposed by the drafters of UCITA in Section 111 requires that a term must “shock the conscience” to be void on any ground other than public policy under section 105. This is a very high legal standard. AFFECT proposed a change from an unconscionable standard to an unconscionable or unexpected standard for determining whether a term within a standard form contract is valid.

Section 111. Unconscionable or Unexpected Contract or Term

- (a) If a court as a matter of law finds a contract or a term thereof to have been unconscionable or to have frustrated the reasonable expectations of the nondrafting party at the time it was made, the court may refuse to enforce the contract, enforce the remainder of the contract without the unconscionable or unexpected term, or limit the application of the unconscionable or unexpected term so as to avoid an unconscionable or unexpected result.
- (b) If it is claimed or appears to the court that a contract or term thereof may be unconscionable or unexpected, the parties must be afforded a reasonable opportunity to present evidence as to its commercial setting, purpose, and effect to aid the court in making the determination.^[57]

A standard form contract under UCITA, however, may include a surprising term that does not reach the level of a public policy concern. The statute as drafted does not address this situation. The reasonable expectations standard is more appropriate than the unconscionability standard in a standard form contract under UCITA because it facilitates evaluation of the term from the perspective of the nondrafting party. The term does not necessarily need to “shock the conscience.” The library community believes that many, if not all, unconscionable terms, by definition, would frustrate the reasonable expectations of the nondrafting party.^[58]

COURTS AND RELATED LEGISLATION

Fear of the unknown causes publishers to include restrictive language. The last thing either side wants is litigation. UCITA offers a new legal framework by which libraries and educational institutions would acquire and use information, and which would affect the ability of these organizations to carry out their missions. However, because of the many controversial and unresolved issues surrounding UCITA, it has been enacted in only two states.

In the absence of a legal template such as UCITA, courts have relied on existing copyright and intellectual property law, industry norms, and the UCC in dealing with computer information transactions. Although the United States Supreme Court has yet to provide any definitive ruling, several lower courts have heard cases arising from shrink-wrap or click-wrap license agreements. These cases present two central issues. First, whether shrink-wrap and click-wrap licenses are enforceable generally or, alternatively, should be treated as unenforceable contracts of adhesion. Second, if licenses are found to be enforceable, whether particular terms of the license which override traditional copyright exemptions, such as the

doctrines of fair use and first sale, are enforceable. Courts remain divided on the first issue of general enforceability. Some decisions, such as *Meridian Project Systems, Inc. v. Hardin Construction Company, LLC*, 426 F. Supp. 2d 1101 (E.D. Cal. 2006), uphold licenses.^[59] Others, such as *Wachter Management Company v. Dexter & Chaney, Inc.*, 144 P.3d 747 (Kan. 2006), find such licenses to be unenforceable under the UCC.^[60]

Two early decisions from the U.S. Court of Appeals for the Fifth and Seventh Circuits take opposing positions with regard to the second issue. In *Vault Corporation v. Quaid Software Ltd.*, 847 F.2d 255 (5th Cir. 1988), the court determined that shrink-wrap license terms which prohibited the copying of a computer software program were preempted by a Copyright Act limitation on the exclusive rights of the program’s creator.^[61] In *ProDC, Inc. v. Zeidenberg*, 86 F.3d 1447 (7th Cir. 1996), however, the court concluded that the agreed-to terms of a shrink-wrap license under state law are not preempted by federal copyright law.^[62] In recent years, in cases where the license is held to be enforceable generally, courts are usually in agreement with *ProCD* regarding preemption. The overall trend appears to be toward enforcement of shrink-wrap license agreements when, whether made available before or after purchase, the licensee has an opportunity to review the terms and accept or reject them. Thus, in spite of NCCUSL’s failure to gain wide acceptance of UCITA, decisions by the courts could ultimately have a similar impact on the way information transactions are viewed.

A recent amendment to the UCC adds to the difficulty courts face. Traditionally, courts have applied UCC standards to transactions that involve a mix of goods and information and, in some instances, those that deal solely with information. This is because the UCC is well established and, for the most part, consistent across all states. In 2004, however, NCCUSL and ALI amended UCC Article 2 to explicitly exclude information from the definition of “goods” covered by the UCC.^[63] Such a change could be problematic because it directs courts to discontinue application of the UCC in pure information transactions, and creates doubt about its applicability in mixed transactions, without providing a framework to replace it. Because most states have not yet adopted this change, its full impact remains to be seen. Currently, most courts continue to interpret the UCC with enough flexibility to govern software and other information-related transactions.^[64]

CONCLUSION

The trend is no longer the acquisition of physical copies of information but rather the access to information in a digital format. Libraries are seeing increased use of click-through licenses and shrink-wrap licenses as they acquire

digital supplements to traditional products, receive updates to online products, and gain access to new sources. Limiting rights which are otherwise available to libraries and users under the Copyright Act is generally not an issue when such limitations are the result of negotiation between the parties. The problem with UCITA, however, is that it allows for these rights to be limited without notice or agreement by the consumer.

Whatever the direction this area of the law takes, it is clear that librarians and information specialists must learn as much as possible about the issues and be watchful of restrictions applicable to their users and institutions. Users should expect nothing less in a license agreement than rights librarians are urged to ensure in a negotiated agreement.^[65] Understanding and complying with licenses will be a cost of doing business. Look to your licenses, print copies of them, and date them. Educate staff and users about terms of use recognizing the copyrights of the licensor and your rights as licensee. Like risk management decisions in determining whether a particular use of a copy is a fair use, reviewing licenses and determining the extent to which you can use the information is a cost of business.

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 40. Va. Code Ann. § 59.1–503.10(b) (2006).
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 44. Uniform Computer Information Transactions Act § 304, *supra* note 1.
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 47. Uniform Computer Information Transactions Act § 605, *supra* note 1.
 48. Uniform Computer Information Transactions Act § 617, *supra* note 1.
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 59. *Meridian Project Sys., Inc. v. Hardin Constr. Co., LLC*, 426 F. Supp. 2d 1101, 1107 (E.D. Cal. 2006).
 60. *Wachter Mgmt. Co. v. Dexter & Chaney, Inc.*, 144 P.3d 747, 751 (Kan. 2006).
 61. *Vault Corp. v. Quaid Software Ltd.*, 847 F.2d 255, 261 (5th Cir. 1988).
 62. *ProDC, Inc. v. Zeidenberg*, 86 F.3d 1447, 1455 (7th Cir. 1996).
 63. U.C.C. § 2-103 (2007).
 64. *See, e.g., Wachter Mgmt. Co. v. Dexter & Chaney, Inc.*, 144 P.3d 747, 750 (Kan. 2006) (holding that services provided by vendor were incidental to buyer's purchase of software, and therefore software qualified as "goods" under UCC).
 65. Principles of licensing electronic resources. <http://www.arl.org/sc/marketplace/license/liprinciples.html> (accessed January 2009).

Unions in Public and Academic Libraries

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Abstract

The role of unions and collective bargaining in U.S. public and academic libraries is stated with a summary of historical development. After noting the lack of national association attention to unionization, the evolution of the American Library Association-Allied Professional Association (ALA-APA) is described. The connection between human rights and unions is discussed. Appendices with URLs of public and academic library worker unions in the United States and Canada as compiled by the author are included.

INTRODUCTION

Unions contribute to a stable, productive workforce—where workers have a say in improving their jobs. Library workers in public, academic, and school libraries have organized in unions for better wages, working conditions, and benefits. In 2006 taken as a whole, U.S. union library workers earned almost 21% more than their nonunion counterparts.^[1,2] A stratified sample of 3418 public and academic libraries found the union advantage extends across all library sizes and types. Union membership varied by region from a high of 15.9% in the North Atlantic to a low of 1.9% in the Southeast. This clearly demonstrates the power of unions to raise salaries in the predominantly female, underpaid library world. If wages and salaries are so much higher among unionized library workers, why is union membership—overall, less than 20% of the workforce? There is no simple answer. The field is not monolithic. Academic librarians function in educational settings tied to the fortunes of their colleges or universities and usually—when collective bargaining is in place—to a faculty union. Public librarians work in the public sector in a variety of governmental structures—city, county, district. The professional associations have not placed the betterment of library workers at the center of their agendas as have the American Federation of Teachers (AFT) or the National Education Association (NEA), but have focused on the development of the institution. The largest association in the United States is the American Library Association (ALA), not the American Librarian Association. Nevertheless, many librarians have organized in unions or as part of larger unions. While these may not account for the majority of librarians, they do account for a large number and collective bargaining is an important aspect of the structure of the field's human resource component.

PUBLIC LIBRARIES

The first public library unions were affiliated with the American Federation of Labor (AFL): New York Public Library and the Library of Congress formed in 1917; Boston Public Library and the District of Columbia Public Library formed in 1918 and the Philadelphia Free Library formed in 1919.^[3] Bernard Berelson has examined the historical context of these first public library unions and their dissolution. All but the Library of Congress union disbanded by 1929 due to the overwhelming strength of the opposition or poor leadership.^[4] Of special note is the debate that took place about the status of women as articulated by union organizer/suffragist Maud Malone of the New York Public Library Employees Union.^[5]

In his overview of unionism written for *Library Trends*, “Employee Organization and Collective Bargaining in Libraries,” (1976) Herbert Biblo characterized the years 1934–1949 as the second wave of public library unionism.^[6,7] The passage of the National Labor Relations Act, (also known as the Wagner Act) in 1935 and the creation of the National Labor Relations Board to regulate collective bargaining fostered organizing. The Cleveland Public Library Employees Union was organized as part of the American Federation of State, County, and Municipal Employees (AFSCME, AFL) in 1937, but became part of the State, County, and Municipal Workers of American (SCMWA, CIO) later that year.

Joyce M. Latham has tracked the State County and Municipal Workers of America, a white-collar CIO union, and in particular the development of the Chicago Public Library's Local 88 (1937)—one of “several unions which emerged as a response to the failure of middle class structures in the face of the economic challenges of the Depression.” Latham's work is especially recommended as a thorough and extensive analysis of the origins of public librarians' engagement in challenges to dominant social

and cultural constructs during the period of the late 1930s–1940s.^[8] Other public library unions founded during this period include Milwaukee, Grand Rapids, Detroit, Minneapolis, Atlanta, Newark, Boston, and Wayne County. Biblo notes that these unions came and went with Atlanta and Grand Rapids never reemerging after their initial organization.

During the 1950s no new public library unions emerged, but in the 1960s a new wave of unionization began with locals formed in Philadelphia, Milwaukee, Boston, Chicago, Cleveland, Detroit, Brooklyn, Buffalo and Erie, Washington, DC, Enoch Pratt, Contra Costa, Los Angeles, New York, Queens, Santa Monica, Youngstown, Oshkosh, Berkeley, Bloomfield, Enfield, Morris County, Newark, Oakland, and San Francisco. Additionally, John F. Kennedy's Executive Order of January 17, 1962 on Employee-management cooperation in the Federal service set the tone for increased labor organizing in governments. At the state level some enacted laws like California's Meyers-Milius-Brown Act passed in 1968 to govern labor relations in local governments. Librarian unionism was documented by Melvin S. Goldstein in his 1968 report on collective bargaining efforts on behalf of professional librarians in the United States which included digests of collective bargaining agreements currently then in force as well as the status of negotiations.^[9]

At the 1975 watershed conference, "Collective Bargaining in Libraries," Don Wasserman of AFSCME, presented the context for increased bargaining activity in the public sector and noted that bargaining entered more readily into "mission of the agency," than had blue-collar workers.^[10] In his 1975 monograph, *Unionization: The Viewpoint of Librarians*, Theodore Guyton accounted for the emergence of library labor unions, their goals, and their patterns of growth. His study provides a solid overview of unionization grounded in labor history and theory and includes a survey of librarians' attitudes toward unionization.^[3]

The high-water mark of library union literature came in 1981 with the publication of *Librarians and Labor Relations* which assessed economics, politics, and history in light of new laws, court decisions, and changing personnel trends. The volume examined librarian-management relations and placed library worker unionizing in the larger context of the labor movement.^[11] Doreen Lilore, a former president of a public library local and staff member at AFSCME, wrote an exceptional study of the state of public library unions in 1984 with attention to negotiating the labor agreement, contract administration, analysis of grievance procedures, and a content analysis of public library labor agreements. Her review of the external interaction between the local and management is a major contribution to the history of public library unionism^[12] and built on the earlier analysis by Joseph Vignone.^[13]

However, after the 1980s the literature and reporting of public library unionism declined. Public sector unions

came under much duress after the Professional Air Traffic Controllers Organization (PATCO) strike in 1981 and the Reagan testing of the strength of the labor movement.^[14] The ALA focused on issues of pay equity and comparable worth during the 1980s and 1990s, but did not provide a forum for ongoing discussion of labor issues or unions within the association.

Public library workers' unionization issues are very situational and differ greatly from library to library. Much depends on the larger context of unionization in a government jurisdiction. If there is an overall organizing unit of government employees—AFSCME or Service Employees International Union (SEIU)—then library workers might be a part of the larger union. In other cases librarians organize as locals of larger units. While one library might divide workers between librarians and clerical and support workers, another might combine them into one local. Weber's 1992 article on support staff unions in Ohio demonstrates the need for unions to reflect local and state situations. For example, at the time of his article the Toledo-Lucas County Public Library had two unions. Office, clerical, and maintenance employees were represented by the Communication Workers of America and the librarian local under the Marine Engineers Beneficial Association.^[15]

In 2002 the journal, *Public Libraries*, published a forum on unions, edited by Hampton (Skip) Auld. The discussion was spurred by the support of some ALA members for striking Marriott hotel workers during the Association's 2001 conference.^[16] Ann Sparanese, a public library shop steward and her local's delegate to the County Labor Council, expressed her opinion: "I do think the union helps ensure fairness and respect on the job and is a powerful shield for all employees against a management that would like to act against an employee without doing the necessary homework."^[17]

The longest strike in the history of public librarianship—89 days—by the 800 members of CUPE (Canadian Union of Public Employees) 391 of the Vancouver Public Library in summer 2007 was documented in an extensive essay by Anita Galanopoulos. The CUPE 391 strike was for pay equity, improved benefits, rights for part-time and auxiliary workers and better job security/technological change protection. The "Bargaining and Strike Chronology" included on her essay provides a detailed look at the blueprint of a strike.^[18]

See Appendix I. for a list of public library unions in the United States and Canada.

ACADEMIC UNIONS

Academic library workers, unlike public library workers, almost never organize as a local within a larger union. Herbert Biblo noted that the Librarian Shop, Howard University, Local 10 UFWA, CIO seems to have been the first

collective bargaining agreement to cover an academic library staff in the United States (1945).^[6] However, since the beginning of formal collective bargaining involving college faculty academic librarians have participated in faculty bargaining units based on a community of interest.

The three unions that account for the majority of unionized academic librarians are the American Association of University Professors (AAUP), the AFT, and the NEA. Those wishing a foundational study of the growth of the AFT and the NEA should refer to *Blackboard Unions*.^[19]

The literature of academic library unionism is scant. Weatherford's 1976 Council on Library Resources study, *Collective Bargaining and the Academic Librarian*, places library bargaining in the context of the national organizations as he summarized the commingled history of academic librarians and classroom faculty. He also underscored the role of faculty status for librarians vis-à-vis the librarians' participation in the bargaining unit.^[20,21] In the literature of academic librarianship continued concern over faculty status has seemed to override discussion of collective bargaining issues.^[22,23]

At the national level the Association of College and Research Libraries (ACRL) intertwines issues of faculty status and collective bargaining. The policy regarding collective bargaining current as of 2008 is that "academic librarians shall be included on the same basis as their faculty colleagues in units for collective bargaining. Such units shall be guided by the standards and guidelines of ACRL pertaining to faculty and academic status."^[24,25]

The most comprehensive source for unionization information about higher education is *The Directory of Faculty Contracts and Bargaining Agents in Institutions of Higher Education* a compilation of every collective bargaining relationship covering faculty in the United States. As of January 2006, over 375,000 faculties had union representation in the United States organized into 575 separate bargaining units and distributed across 491 institutions or systems of higher education with 1125 campuses.^[26]

A state of the art of support staff unionization in 1986 and a literature review: *Unions for Academic Library Support Staff* examined unionization at 176 academic libraries.^[27] There is no single list of support staff unions in academic libraries. Collective bargaining generally encompasses multiple job classifications on a campus such as AFSCME or SEIU.

The literature of academic librarianship has few discussions of faculty unionism. However, one recent essay, "Librarians as Key Players in Faculty Unions," that describes the role of library faculty at Eastern Washington University provides insight into the articulation of faculty status for librarians and collective bargaining. The essay demonstrates the collegiality developed through teaching and library faculty working toward common goals.^[28] More articles that provide a functional analysis of the role of unionism in faculty worklife would contribute to better

understanding of the importance of unions to academic librarians.

A rare program at a national conference sponsored by the American Library Association-Allied Professional Association (ALA-APA) at the ALA Conference in New Orleans on June 25, 2006 addressed the role of unions in academic libraries. John Buschman, one of the presenters, summarized: "unionized library faculty have both rights and responsibilities to the library and its services as a whole, and their sponsoring institution. If the status is meaningful beyond a mere title, then librarians must take the responsibilities and the power they have seriously and utilize them judiciously, and this means going well beyond pleasing the boss."^[29]

See Appendix II. For a list of academic library unions in the United States and Canada.

Unions and the ALA

The lack of ALA's focus on unions has been noted by many researchers. After a short-lived Library Union Round Table that existed from 1938 until the 1950s there was no formal entity in the national association that addressed union concern. The ALA's Office for Library Personnel Resources did develop and distribute a packet on Unionization and Collective Bargaining in 1982 as part of that Office's overall commitment to library personnel issues under the stewardship of Margaret Myers.^[30] A search of the ALA's archives turns up very little information about library unions and collective bargaining.

The election of Maurice J. Freedman as president of the ALA in 2001 saw a new focus on library worklife. Freedman established a Special Presidential Task Force on Better Salaries and Pay Equity. As part of this initiative the Task Force published the "Advocating for Better Salaries and Pay Equity Toolkit" coordinated by Margaret Myers, retired director of ALA's Office for Library Personnel Resources that included contact information for and links to unions, FAQs on unions in libraries, and a sample neutrality agreement.^[31] This work led to the formation of the Library Advisory Committee to the AFSCME and a Library Workers Caucus. The union working group also connected with SEIU, which reported on the relative pay and benefits of union and nonunion library workers.^[32]

With the ALA climate for considering library worklife issues changing in the twenty-first century the ALA-APA was established in June 2001 as a companion organization to the ALA. The ALA-APA is a nonprofit organization for the purpose of promoting "the mutual professional interests of librarians and other library workers." It enables certification of individuals in specializations beyond the initial professional degree and also has the charge of advocacy for the "mutual professional interests of librarians and other library workers."

The union subcommittee of ALA-APA is charged: 1) to investigate the extent of the presence and role of unions

among library workers; 2) to report findings to the ALA-APA Standing Committee on the Salaries and Status of Library Workers; 3) to work towards the initiation of a relationship and dialogue among ALA, ALA-APA, and national unions representing library workers, in order to improve their salaries, working conditions and status; 4) to encourage ongoing research and publishing on unionization in libraries; 5) to develop union support and advocacy materials for the Better Salaries Task Force Tool Kit; and 6) to be the permanent interest group within ALA-APA that would serve as a resource for both active and developing unions of library workers.^[33]

Unions Today

There is no single source that lists all unions in which library workers participate. The author has created a list of public and academic unions with links to Web sites as appendices to this entry. These lists were put together by numerous searches state by state and may not be comprehensive, but they are the single most complete source of union information at this writing. They will be updated at the *Union Librarian* blog.^[34] Readers should be aware that there is some fluidity to unions across the United States and Canada and some data may have changed since this entry was submitted. Library workers belong to a variety of unions including, but not limited to the AAUP, the AFT, AFSCME, National Association of Government Employees, SEIU, United Autoworkers, United Service and Allied Workers of RI, United Public Employees of California (UPEC), United Service and Allied Workers of RI.

Unions and Human Rights

In 2008 the world celebrated the 60th anniversary of the Universal Declaration of Human Rights (UDHR). During the drafting of the Declaration there had been tension between the World Federation of Trade and the International Labor Organization about the inclusion of union rights. Mrs. Roosevelt “explained that the United States delegation considered that the right to form and join trade unions was an essential element of freedom.”^[35] Unionization as a human right was included in the UDHR as Article 23.

Article 23.

1. Everyone has the right to work, to free choice of employment, to just and favorable conditions of work and to protection against unemployment.
2. Everyone, without any discrimination, has the right to equal pay for equal work.
3. Everyone who works has the right to just and favorable remuneration ensuring for himself and his family an existence worthy of human dignity, and supplemented, if necessary, by other means of social protection.

4. Everyone has the right to form and to join trade unions for the protection of his interests.^[36]

Sixty years later, unions continue to be viewed as fundamental to democracy. Elaine Bernard wrote in 2008: “Unions are the premier institution of a free, democratic society, promoting democracy in the workplace, as well as economic and social justice, and equality. They have this role because they are instruments of transformation of members and of society at large. In this wonderful transformation rests the real power of unions.”^[37]

The democratic victories in the 2008 general U.S. elections had enthusiastic support from unions. Unions to which the majority of library workers belong (AFSCME, AFT, NEA, SEIU) contributed funds and volunteers to get out the vote. It remains to be seen as the Democratic Party holds power in the federal government if the more positive climate for unionization provides an opportunity for unions to grow among library workers in the public and educational sectors.^[38]

APPENDIX I: PUBLIC LIBRARY UNIONS

Canada

Canadian Union of Public Employees, <http://cupe.ca/>
Le Syndicat canadien de la fonction publique (SCFP), <http://scfp.ca/about?slashSess=199b096f1f24b748eb866bb05e396ae6>

Alberta

Calgary Public Library (CUPE 1169), <http://www.1169.cupe.ca/>

British Columbia

Canadian Union of Public Employees BC Division (CUPE BC), <http://www.cupe.bc.ca/>

CUPE BC Library Committee, <http://www.cupe.bc.ca/405>

CUPE Local 391 (Vancouver Public Library and Gibsons and District Public Library Workers), <http://www.cupe391.ca/index.html>

Gibsons District Public Library, <http://gibsons.bclibrary.ca/> *

British Columbia Government and Service Employees' Union. Component 6. Social, Educational and Health Services, http://www.bcgeu.ca/C6_Social_Information_and_Health *

Vancouver, <http://www.cupe391.ca/index.html>

Quebec

Montreal

Syndicat des professionnelles et professionnels municipaux de Montréal, <http://www.sppmm.org/index.html>

United States

California

Los Angeles County Librarians. SEIU Local 660, <http://www.seiu721.org/Default.aspx>

Los Angeles Public Library. Local 2626 of AFSCME, <http://www.librariansguild.org/>

San Francisco Public Library. SEIU Local 790, <http://www.seiu1021.org/>

San Jose, <http://www.afscme-mef.org/mission.html>

Shasta County. United Public Employees of California (UPEC), <http://www.upec792.org/>

Connecticut

Cheshire (CT) Public Library, <http://www.cheshirelib.org/>

District of Columbia

Library of Congress Professional Guild, AFSCME Local 2910, representing over 1600 employees at the Library of Congress, <http://www.guild2910.org/>

Florida

Broward County—[Collective Bargaining Agreement between the Board of County Commissioners Broward County, Florida and the Government Supervisors Association of Florida Opeiu, Afl-cio, Local 100 Broward County Supervisory unit October 1, 2002, to September 30, 2005], <http://www.broward.org/humanresources/hui02836.pdf>

Jacksonville, <http://cwa3106.org/> *

Orange County Library System SEIU local 8, <http://www.seiufpublicservicesunion.org/>

Massachusetts

Boston Public Library, <http://www.bpl.org/>

Massachusetts Library Staff Association, <http://www.mlsa-4928.org/>

Includes:

Abington Public Library
 Attleboro Public Library
 Braintree: Thayer Public Library
 Bridgewater Public Library
 Cambridge Public Library
 Everett: Parlin Memorial Library
 Foxborough: Boyden Library
 Franklin Public Library
 Holbrook Public Library
 Hull Public Library
 Lexington: Cary Memorial Library
 Lynnfield
 Medford Public Library
 Middleborough Public Library
 Milford Town Library
 Milton Public Library
 North Reading: Flint Memorial Library
 Pepperell: The Lawrence Library
 Quincy: Thomas Crane Public Library
 Stoneham Public Library
 Stoughton Public Library
 Wakefield Public Library
 Wayland Free Public Library
 Weston Public Library
 Weymouth Public Libraries
 West Springfield Public Library

Winthrop Public Library & Museum
 Woburn Public Library

Worcester Public Librarians part of National Association of Government Employees.

Local 495, <http://www.worcpublib.org/index.html>

Michigan

Detroit Public Library UAW 2200, <http://www.uaw.org/about/localunions.html>

Minnesota

Hennepin County. AFSCME Local 2864 (Professional Employees, including HCL Librarians), <http://www.afscmelocal34.org/>

Support staff are Local 2822 AFSCME

New Hampshire

Nashua Public Library Employees Local 4831.

New Jersey

Ocean County Library, <http://www.unitedworkersunion.org>

New York

Brooklyn Public Library, <http://www.local1482.org/index.html>

Buffalo and Erie County Public Library, <http://www.buffalolib.org/employment/>

Librarians, <http://labecpl.bfn.org/>

Civil Service Employee Association (CSEA)

American Federation of State, County and Municipal Employees (AFSCME)

New York Public Library, <http://www.local1930.org/>

Queens Public Library, <http://www.local1321.org/>

Tompkins County Public Library [NY], <http://uaw2300.clarityconnect.com/> *

Ohio

Cincinnati (Public Library of Cincinnati and Hamilton County), <http://www.seiu1199.org/plch.cfm>

Cleveland Public Library, <http://www.seiu1199.org/docUploads/ClevelandPublicLibraryContract.pdf>

Hamilton County (Public Library of Cincinnati and Hamilton County), <http://www.seiu1199.org/plch.cfm>

Lucas County—Toledo—Lucas County Public Library Association of Public Library, <http://www.seiu1199.org/plch.cfm>

Employees. APLE. UAW Local 5242, <http://www.orgsites.com/oh/aple/index.html>

Stark County Library District (Canton), <http://www.seiu1199.org/plch.cfm>

Toledo—Lucas County Public Library (Association of Public Library Employees. APLE. UAW Local 5242), <http://www.orgsites.com/oh/aple/index.html>

Pennsylvania

Philadelphia Free Library, <http://www.library.phila.gov/>

Rhode Island

Providence Public Library. United Service and Allied Workers of Rhode Island. (USAW- RI).

Washington (State)

Council 2, <http://www.council2.com/>

THE WASHINGTON State Council of County and City Employees, (WSCCCE) AFSCME, AFL-CIO represents more than 16,000 employees who provide services to the citizens of Washington state. It is a democratic union providing a real voice for its members through active participation and professional representation. The Union works to preserve and enhance workers' compensation and benefits. It also promotes job security and improves other employment conditions.

King County Public Library [WA], <http://www.kclsvoice.org/> *

Wisconsin

Milwaukee Public Library, <http://www.afscme48.org/local426.html>

Wisconsin Council AFSCME 40, <http://www.afscmecouncil40.org/units.htm>

Source: McCook, Kathleen de la Peña. *Union Librarian*, <http://unionlibrarian.blogspot.com/>.^[34]

APPENDIX II: ACADEMIC LIBRARY UNIONS

Canada

Acadia University Faculty Association, <http://www.caut.ca/aufa/>

L'Association des Professeur(e)s de Bishop's University, <http://www.caut.ca/apbu/index.htm>

Athabasca University Faculty Association, <http://aufa.ab.ca/>

Bishop's University, <http://www.caut.ca/apbu/index.htm>

Brandon University, <http://www.bufa.org/index.asp>

Brock University, <http://www.bufaweb.com/>

Canadian Association of University Teachers, <http://www.caut.ca/en/links/index.asp>

Cape Breton University, <http://www.cbufa.ca/main/>

Carleton University, <http://www.caut.ca/cuasa/>

Concordia University, <http://alcor.concordia.ca/%7Ecufa/>

Dalhousie University, <http://www.dfa.ns.ca/>

Lakehead University, <http://www.lufa.org/>

Laurentian University, <http://www.lufapul.ca/>

McGill University, <http://maut.mcgill.ca/>

Non-Academic Certified Association (MUNACA), <http://www.munaca.com/eng/>

McMaster University, <http://www.mcmaster.ca/mufa/>

Memorial University of New Foundland, <http://www.mun.ca/munfa/>

Mount Allison, <http://www.mafa.ca/press.htm>

Mount Saint Vincent University, <http://www.3.ns.sympatico.ca/msvufa/>

Nipissing University, <http://www.nipissingu.ca/nufa/>

Northern Ontario School of Medicine, <http://www.nosmfa.ca/>

Ontario Public Service Employees Union, <http://www.opseu.org/caat/colleges.htm>

Queen's University, <http://www.qufa.ca/>

Ryerson University, <http://www.ryerson.ca/~rfa/>

St. Francis Xavier University, <http://www.stfx.ca/stfxaut/Main.html>

Saint Mary's University. Halifax, <http://www.smufu.org/>
Saint Thomas More College, <http://www.stmcollege.ca/facultyunion/index.html>

Simon Fraser University, <http://www.sfufa.ca/>

Trent University, <http://www.trentu.ca/org/tufa/>

University of Alberta, <http://www.uofaweb.ualberta.ca/aasua/>

University of British Columbia, <http://www.facultyassoc.ubc.ca/>

University of Calgary, <http://www.ucalgary.ca/UofC/departments/TUCFA/>

University of Guelph (Ontario), <http://www.caut.ca/ugfa/>

University of Lethbridge, <http://www.uleth.ca/ulfa/>

University of Manitoba Faculty Association, <http://www.umfa.ca/>

Université Université de Moncton, http://www3.umoncton.ca/templates/udem2/udem02.cfm?CFID=475205&CFTOKEN=11554667&user_id=369&page=11231&template=35&resultat=0&order_num=&mot_recherche=&write=0&student_id=0&debut=0&curr_page=1#session.addtoken

University of New Brunswick, <http://www.unb.ca/AUNBT/>

University of Ottawa, <http://www.apuo.uottawa.ca/>

University of Prince Edward Island, <http://www.upeifa.org/>

University of Regina, <http://www.urfa.uregina.ca/>

University of St. Thomas, <http://www.caut.ca/faust/>

University of Saskatchewan, <http://www.usaskfaculty.ca/>

University of Toronto, <http://www.utfa.org/>

University of Victoria, <http://web.uvic.ca/facassn/>

University of Waterloo, <http://www.fauw.uwaterloo.ca/>

University of Western Ontario, <http://www.uwofa.ca/>

University of Windsor, <http://athena.uwindsor.ca/wufa/>

University of Winnipeg, <http://uwfa.ca/>

Wilfrid Laurier University, <http://www.wlufa.ca/index.html>

York University, <http://www.yufa.org/>

United States

Alaska

University of Alaska. United Academics, <http://www.unitedacademics.net/>

California

California Faculty Association, <http://www.calfac.org/>

California State University Bakersfield

California State University Channel Islands

California State University Chico

California State University Dominguez Hills

California State University East Bay

California State University Fresno

California State University Fullerton

Humboldt State University

California State University Long Beach

California State University Los Angeles
 California Maritime Academy
 California State University Monterey Bay
 California State University Northridge
 California State Polytechnic University, Pomona
 California State University Sacramento
 California State University San Bernardino
 San Diego State University
 San Francisco State University
 San Jose State University
 California Polytechnic State University, San Luis Obispo
 California State University San Marcos
 Sonoma State University
 California State University Stanislaus

Los Angeles College Faculty Guild, <http://www.aft1521.org/>

City College
 East L.A. College
 Harbor College
 Mission College
 Pierce College
 Southwest College
 Trade Tech College
 Valley College
 West L.A. College

San Francisco Art Institute, http://www.aaup-ca.org/sfai_home.html

University of California, <http://www.cft.org/councils/uc/index.html>

The University Council-AFT is the governance body of the eight campus locals of lecturers and librarians employed by the UC system. UC-AFT is the bargaining agent for units 17 and 18 systemwide, <http://www.cft.org/councils/uc/History.html>

UC-AFT Librarians Contract, <http://www.cft.org/councils/uc/lib.contract.html>

University of California Berkeley. UC-AFT BERKELEY-SAN FRANCISCO LOCAL 1474, <http://berkeleyaft.org/>

Yuba College, <http://www.yubacollegefaculty.com/>

Colorado

Regis University, <http://www.regis.edu/regis.asp?scn=facst&p1=res&p2=rc&p3=aaup>

Connecticut

Connecticut State University, <http://www.ccsu.edu/aaup/csu/Default.htm>

University of Connecticut, <http://www.ucpea.org/>

Florida

United Faculty of Florida, <http://www.unitedfacultyofflorida.org/> Includes:

Broward Community College
 Florida A&M University
 Florida Atlantic University
 Fla. Comm. College at Jacksonville

Florida Gulf Coast University
 Florida International University
 Florida State University
 Hillsborough Community College
 New College of Florida
 University of Central Florida
 University of Florida
 University of North Florida
 University of South Florida
 University of West Florida

Hawaii

University of Hawaii Professional Assembly, <http://www.uhpa.org/>

Illinois

Chicago State University, <http://www.upilocal4100.org/text/csuIndex.htm>

College of DuPage, <http://codfaculty.org/>

Eastern Illinois University, <http://www.eiu.edu/%7EEiuUpi/>

Governor's State University, <http://www.upigsu.org/index2.htm>

Illinois Education Association, <http://www.ieanea.org/>

Northeastern Illinois University, <http://www.upi4100.org/neiu/index.htm>

Northern Illinois University Instructors, <http://www.upi4100.org/niu/>

University of Illinois at Springfield, <http://www.upilocal4100.org/text/WhoStuff/CampusChapters.html>

University Professionals of Illinois, <http://www.upilocal4100.org/>

We stand 2700 strong. The University Professionals of Illinois, Local 4100, IFT, AFT, AFL-CIO, Is the recognized leader in academic bargaining for higher education in Illinois, representing seven of the 12 Illinois public universities at the bargaining table.

Western Illinois University, <http://www.wiu.edu/UPI/>

Iowa

University of Northern Iowa, <http://www.uni.edu/unitedfaculty/>

Kansas

Fort Hays University, <http://www.fhsu-aaup.com/>

Maine

Universities of Maine-Professional Staff Association, <http://umpsa.maine.edu/index.html>

University of Maine at Augusta
 University of Maine at Farmington
 University of Maine at Fort Kent
 University of Maine at Machias
 University of Maine
 University of Maine at Presque Isle
 University of Southern Maine

Maryland

MONTGOMERY COLLEGE, <http://www.fhsu-aaup.com/>

Massachusetts

Emerson College-Adjunct Faculty, <http://www.emersonafec.com/>

Suffolk University-Adjunct Faculty, <http://www.saf-aaup.org/>

University of Massachusetts, Massachusetts Society of Professors, <http://umassmsp.org/>

Michigan

Eastern Michigan University, <http://www.emu-aaup.org/>

Michigan Education Association, <http://www.mea.org/Design.cfm?p=5573>

Michigan Technological University, http://webpages.charter.net/mtu_aaup/

Northern Michigan University, <http://myweb.nmu.edu/~aaup/>

Oakland University, <http://www.oaklandaaup.org/default.asp>

Wayne State University, <http://wayne.edu/>

Western Michigan University, <http://www.wmich.edu/aaup/index.php>

Minnesota

Minnesota State College Faculty (MSCF), <http://mscf.educationminnesota.org/>

Nebraska

University of Nebraska-Omaha, <http://www.unomaha.edu/aaup/>

Nevada

Truckee Meadows Community College, <http://www.unr.edu/nfa/tmcc.htm>

New Hampshire

University of New Hampshire, <http://chaucer.unh.edu/aaup/>

New Jersey

LIBRARIANS COMMITTEE of the Council of New Jersey State College Locals http://www.cnjscl.org/lib_committee.htm

Council of New Jersey State College Locals, AFT, AFL-CIO which represents over 8,000 faculty, adjunct faculty, librarians and professional staff at the following institutions of higher education: <http://www.cnjscl.org/>

The College of New Jersey <http://www.tcnj.edu/~aft/aft.htm>

Kean University <http://www.kft2187.org/>

Montclair State University <http://aftlocal1904.org/>

New Jersey Institute of Technology

New Jersey City University <http://aftlocal1839.org/>

Ramapo College of New Jersey <http://ramapoaft.org/>

Richard Stockton College <http://intraweb.stockton.edu/eyos/page.cfm?siteID=147&pageID=1>

Rider University AAUP <http://www-usr.rider.edu/~aaup/>

Rowan University <http://nj.aft.org/023730/>

Rutgers, The State University of New Jersey <http://www.rutgersaaup.com/about.htm>

The College of New Jersey <http://www.tcnj.edu/~aft/aft.htm>

Union of Rutgers Administrators, AFT Local 1766, represents Administrative Assistants, Library supervisors and Library Associates at all three campuses of Rutgers University and a few other titles such as Digital Resources coordinator, Media coordinator, Graphics coordinator. <http://www.ura-aft.org/>

Union County College <http://www.ucc-aaup.org/>

University of Medicine and Dentistry of New Jersey (UMDNJ)[includes University Libraries] <http://www.aaupumdnj.org/>

William Paterson University <http://www.aft-local-1796.org/>

New York

Adelphi University, <http://www.aaupadelphi.org/>

City University of New York-Professional Staff Congress, <http://www.psc-cuny.org/>

D'Youville College, <http://ddl.dyc.edu/%7Eaaup/>

Hofstra University, <http://www.aaup-hofstra.org/>

New York Institute of Technology, <http://www.aaupatnyit.org/>

United University Professions, <http://www.uupinfo.org/>

United University Professions (UUP) is the union representing more than 31,000 academic and professional faculties on 29 State University of New York campuses, plus System Administration, Empire State College, and the New York State Theatre Institute. UUP is affiliated with the New York State United Teachers and the American Federation of Teachers, AFL-CIO.

With some 800 job titles included in the bargaining unit, UUP reflects the diversity of the State University. Members include Librarians.

Albany

Alfred, <http://web.alfredstate.edu/uup/>

Binghamton, <http://www.uupbinghamton.org/>

Brockport, <http://www.uuphost.org/brockport/>

Brooklyn Health Science Center

Buffalo Center, <http://wings.buffalo.edu/uup/>

Buffalo Health Science Center

Buffalo State, <http://www.buffalostate.edu/orgs/uup/>

Canton, <http://www.canton.edu/>

Cobleskill

Cortland, <http://www.uuphost.org/cortland/>

Delhi

Empire State

Environmental Science and Forestry, <http://www.esf.edu/la/>

Farmingdale, <http://snyfarvc.cc.farmingdale.edu/~uup/>

Fredonia, <http://www.fredonia.edu/uup/>

Geneseo

Maritime

Morrisville

New Paltz, <http://www.uuphost.org/newpaltz/>

New York State Theatre Institute

Old Westbury

Oneonta, <http://organizations.oneonta.edu/uup/>

Optometry, <http://www.uuphost.org/optometry/Oswego>
 Plattsburgh
 Potsdam
 Purchase, <http://fafner.openlib.org/~purchaseuup/index.html>
 Stony Brook Center, http://www.uuphost.org/sbwest/Stony_Brook_Health_Sciences_Center, <http://www.uuphost.org/stonybrookhsc/index.html>
 System Administration, <http://www.uupsysadm.org/>
 Upstate Medical University, Syracuse, <http://www.uupinfosyr.org/>
 Utica/Rome

Ohio

Cincinnati State Technical & Community College, <http://www.cinstataaup.org/>
 Cleveland State University, <http://aaupuc.org/>
 Cuyahoga Community College, <http://www.ccc-aaup.org/>
 Kent State University, <http://www.aaupksu.org/>
 University of Akron, <http://www.akronaaup.org/>
 University of Cincinnati, <http://aaupuc.org/>
 University of Toledo, <http://www.utaaup.com/splash.shtml>
 Wright State University, <http://www.wright.edu/admin/aaup/aaup.html>

Oregon

Oregon University System-Collective Bargaining Units, <http://www.ous.edu/hr/labor/>
 Eastern Oregon University, <http://www2.eou.edu/~repres/>
 Portland State University, <http://www.pdx.edu/oaa/documents/AAUP.pdf>
 Portland State University—Part-Time Faculty, <http://www.pdx.edu/oaa/documents/AFT.pdf>
 Southern Oregon University, <http://www.sou.edu/apsou/contracts/2005-2007/05-07%20Final%20Agreement.pdf>
 Western Oregon University Federation of Teachers, <http://www.wouft.org/us.html>

Pennsylvania

Allegheny, Community College of. CCAC/AFT LOCAL 2067, <http://www.ccac.edu/default.aspx?id=138130>
 Association of Pennsylvania State College and University Faculties, <http://www.apscuf.com/>
 Bloomsburg University, <http://www.apscuf.com/bloomsburg/index.html>
 California University, <http://www.apscuf.com/california/contact.html>
 Cheyney University, <http://www.apscuf.com/cheyney/news.html>
 Clarion University, <http://www.apscuf.com/clarion/index.html>
 East Stroudsburg University, <http://www.esu.edu/apscuf/>
 Edinboro University, <http://www.apscuf.com/edinboro/index.html>

Kutztown University, <http://www.apscuf.com/kutztown/index.html>

Lock Haven University, <http://www.lhup.edu/apscuf/>
 Mansfield University, <http://www.apscuf.com/mansfield/index.html>

Millersville University, <http://www.apscuf.com/millersville/index.html>

Shippensburg University, <http://www.apscuf.com/shippensburg/index.html>

Slippery Rock University, <http://www.apscuf.com/slipperyrock/index.html>

West Chester University, <http://www.apscufwcu.com/>
 Philadelphia Faculty and Staff Federation of Community College of Philadelphia (FSFCCP), <http://www.aft2026.org/>

Texas

Texas A&M System, <http://www.tamus.edu/>
 Many A&M System employees participate in collective bargaining contracts with labor organizations for issues regarding wages, hours of employment, or work conditions?

A: No. Any such collective bargaining contract is void under Texas law. Additionally, labor organizations may not be recognized as bargaining agents for a group of public employees.

Vermont

University of Vermont, <http://www.unitedacademics.org/>

Washington

University of Washington-AAUP-Advocacy Chapter-not union, <http://depts.washington.edu/uwaaup/>

Washington State, United Faculty of, <http://www.ufws.org/>

Central Washington University, <http://ufcentral.org/>
 Eastern Washington University, <http://www.ufws.org/eastern/index.html>

Western Washington University, <http://www.ufww.org/>

Source: McCook, Kathleen de la Peña. *Union Librarian*, <http://unionlibrarian.blogspot.com/>.^[34]

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United Kingdom: Archives and Archival Science

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Abstract

This entry traces the development of record keeping and archives services in the United Kingdom, highlighting the differences between the constituent home countries, local authority responsibilities, and the diversity of business, religious and community archives. It looks at the development of the archive profession and training, and suggests that information management may become the way the profession develops in an electronic age. The role of the main professional organizations and societies relating to archives and records management is outlined, with an emphasis on the crucial advocacy role they play in ensuring that the importance of the records, in whatever format, is not overlooked.

INTRODUCTION

Archives and records in the United Kingdom are an unrivaled source of historical information with some of the main series of national archives surviving in an unbroken tradition from the twelfth century. As the United Kingdom embraces four different home countries, the arrangements for the records and archives vary in each. This is further complicated by the different legislative systems in Scotland and by the devolution of Scotland and Wales in the recent past. Other archives of businesses, religions, local authorities, and communities also differ in their arrangements for records management and permanent preservation with globalization resulting in additional complexities.

LEGISLATION AND ACCOMMODATION FOR ARCHIVES AND RECORDS

England and Wales

The Public Record Office (PRO) Act 1838 was the first legislation for archival material in England and Wales, bringing together the records of the ancient departments of state, in particular, the Exchequer, Chancery and Courts of Law in a government department, the PRO headed by the Master of the Rolls. It did not cover papers held in government departments, though these were often transferred once the PRO, as a repository in Chancery Lane in central London, became a place of safekeeping. An Order in Council of 1852 regularized the existing situation by extending the remit of the Master of the Rolls, but the PRO staff had no control over selection in departments nor was there any provision for the destruction of unwanted material. Access issues were not addressed, although search rooms were provided in the late

nineteenth century additions to the PRO building in Chancery Lane.

In 1869, the Royal Commission on Historical Manuscripts was created to locate and provide access to records held in private collections. It published reports on them, providing details on the type of information contained in the manuscripts and where they were located. It continued this work on the premises of, and in conjunction with the staff at the PRO but in 1959 it received a further royal warrant and moved to new accommodation in Quality Court, Chancery Lane. By this time, it was in charge of the National Register of Archives (created in 1945), a project that was deliberately focused on nongovernmental archives and which was the forerunner of the more ambitious and all-embracing electronic databases that are now current.

Sir Hilary Jenkinson (1882–1961) was one of the dominant figures in the early twentieth century as a shaper of British archival theory. This was to become the basis of practice both at home and in many of the then colonies. He worked at the PRO, eventually becoming Deputy Keeper (effective head) in 1947, and it was here that he developed the concepts which were outlined in his book *A Manual of Archive Administration* (Oxford: Clarendon Press, 1922). He used his experiences to direct and guide the emerging profession to ensure that modern records, as well as those of greater age, were catered for adequately and many of his innovations, such as The National Register of Archives, survived well after his death.

After the Second World War, concern over the uncoordinated accumulation of records led to the publication of a report by the Grigg Committee (Command Paper 9163) in 1954 recommending

- Clear reviewing procedures for selection by the department.
- The appointment of departmental record officers.

- An advisory role for the PRO and the appointment of a records administration officer and staff to oversee the new procedures.
- The transfer of responsibility for the PRO from the Master of the Rolls to a minister.
- Access provision to material held by the PRO for material over 50 years old unless there were special considerations.
- The inclusion of cinematograph film, photographs, and sound recordings as public records where appropriate.

These provisions were incorporated into the Public Records Act 1958, which was followed by a further Act in 1968 to reduce the closure period to 30 years. Concern that records of the Second World War should be released en bloc, apart from those of service personnel, led to their release in 1972, following the precedent of the release of those of the First World War.

By 1976, pressure on the space required to store the increasing volume of national archives resulted in the opening of a new facility at Kew, in south west London, to which the nineteenth and twentieth century holdings were transferred. The latter was extended in 1996 to house the entire archive and the central London repository was closed apart from a Family Record Centre for genealogists, run jointly with the Office of National Statistics. This closed in 2008 due, in part, to the increasing number of archival resources available online.

Access provisions were changed by the Freedom of Information Act, which came into force in 2005 guaranteeing a general right of access to information held by public authorities subject to certain provisions about public interest. A Code of Practice was issued from the Lord Chancellor's Office to guide departments in carrying out the Act. Further consultation is currently (2008) being conducted into the feasibility of a reduction of the 30 year rule. An Access to environmental information is regulated by the EU Directive 2003/2004 EC, replacing the 1992 Environmental Information Regulations. This ensures the right of access to environmental information held by public bodies.

Data Protection legislation, initially (1984) referring only to data held on individuals electronically, was revised by the Data Protection Act passed in 1998 to cover the protection of data on individuals in all formats, while permitting the legitimate collection of such data by organizations that require access for research purposes.

The partnership established in 2003 between the Royal Commission on Historical Manuscripts (HMC) and the then PRO vested the responsibilities of the Commissioners in the Keeper of Public Records, who was thereafter known as the Chief Executive of The National Archives (TNA). This enabled TNA to advise about the location and the condition of private papers and manuscripts, in addition to managing public records. The TNA now comprises

the former PRO, the Royal Commission on Historical Manuscripts, the Office of Public Sector Information, and Her Majesty's Stationery Office.

Despite the remit of the PRO as the government archive, some private collections have been deposited with the public records since, at the time of transfer, the record office was regarded as the most appropriate location. These include some Church of England material, notably the probate records for the Archdiocese of Canterbury. These records are among the most regularly consulted since they cover the testamentary records of many famous, and not so famous, people up to 1858. Together with other records of interest to genealogists these are now online.

Records designated as public records on account of their enduring value are mainly kept at TNA but a significant minority are kept in over 200 other repositories, many of them are local record offices. These are known as Places of Deposit, and the public archives held in each are subject to the same regulation as those held centrally. The National Advisory Service (the merger of the Royal Commission on Historical Manuscripts and the Archive Inspection Unit of the former PRO) has published *The National Archives Standard for Record Repositories* setting out best practice for archive provision. It is supported by a Framework of Standards, covering a wider range of best practice to cater for the equally wide range of repositories. The governing bodies of those holding public records are asked to subscribe to the Standard, and those attaining the essential requirements are approved by TNA.

Scotland

Responsibility for the archives in Scotland is vested in the Keeper of Records and legislation consequently relates to this post. The Public Records (Scotland) Act 1937 was largely concerned with the transfer to the Keeper of the records of the central and local courts of law as well as government departments, agencies, nondepartmental public bodies, statutory bodies corporate, and local authorities. In 1937, the Keeper also had the responsibility for the creation and maintenance of the Register of Saisines (Seisins [The instrument [in Scotland] by which the possession of feudal property is proved. (*Oxford English Dictionary*)]), but that function was split by the Public Registers and Records (Scotland) Act 1948 as a recognition of the difference between the two activities. The U.K. wide Public Records Act 1958 (see above) enabled the transfer of records of public bodies operating partly or wholly in Scotland to the National Archives of Scotland (NAS), and provisions similar to those outlined in the 1958 Act for selection, transfer, and preservation of the records were adopted by the Scottish Office in 1962 for public bodies in Scotland; at the same time similar access provisions were adopted together with the reduction to a 30 year limit in 1967.

The Keeper has also been able to take in private records, following an amendment to the Act in 1985, in which procedures for disposal were set out and the Scottish Advisory Council was established. Data Protection provisions for Scotland are in line with those for England and Wales; similarly, the Freedom of Information Act (Scotland) 2002 covers public bodies in Scotland. Currently (2008), a review of legislation on government records in Scotland is being carried out to ensure that they are appropriate and accessible; this follows the recommendation of the Shaw report (2007) (<http://www.scotland.gov.uk/Publications/2007/11/20104729/>). The NAS is situated on three sites in Edinburgh, two of which are open to the public, General Register House and West Register House. In addition, Thomas Thomson House, in the west of Edinburgh is its main repository and also houses the conservation department and offices.

Northern Ireland

The Public Records Act (Northern Ireland) 1923 established the Public Record Office of Northern Ireland (PRONI) shortly after the destruction of many of the Irish public records in the fire in the Four Courts, Dublin in 1922. The Act stipulated that it was legal for PRONI to bring in records, which were not expressly created by government as a deliberate attempt to ensure that as many documents as possible were retained to compensate for the very serious loss in Dublin. Private records, in particular, were targeted for collection, safekeeping, and public access. After the Second World War, the pressure on storage space increased and the Northern Ireland government followed the recommendations of the 1954 Grigg report (see above) to introduce regular reviews of material in government departments and disposal schedules. In 1976, in accordance with the practice elsewhere in the United Kingdom, the 30 year rule was introduced.

The Public Record Office of Northern Ireland has moved to different parts of the government of Northern Ireland being part of the Department of Finance from 1924 to 1984; part of the Department of the Environment until it changed to become an executive agency in 1995; and finally part of the Department of Culture, Arts and Leisure (DCAL) in 1999. Following the review of Public Administration in 2006, it ceased to be an agency and its status is now as a division of DCAL. The frequent changes have been due, in part, to the recent troubled history of devolved government in Northern Ireland. In response to demand from government departments, PRONI drew up the Northern Ireland Record Management Standard (NIRMS) in 2002.

Wales

Welsh public records are governed by the same provisions as those in England; they were moved to the PRO in the

mid-nineteenth century but requests for a specific record office for Wales were being made in a bill introduced to Parliament as early as 1913. No further progress was made until the Public Records Act 1958 nominated repositories in Wales as suitable Places of Deposit for public records (see above) and also authorized the return of the bulk of the Welsh records to the National Library of Wales.

The Government of Wales Act 1997 made provision for the concept of Welsh Public Records, which, in the following Government of Wales Act 2006, included a list of bodies whose records were to be accorded that status. The U.K. Public Records Acts 1958 and 1967 remain in force until provisions are established.

Local Records in England and Wales

No specific legislation relates to local administrative records or the provision of county or borough archive services. The Local Government (Records) Act 1962 conferred discretionary powers on local authorities (now including all county councils, London boroughs, metropolitan districts, and unitary councils) to provide a limited archive service relating to the acquisition of and access to archival material, not restricted to official material. Stewardship and wider advisory powers were not included. The Local Government Act 1972 (s224) required local authorities to make proper arrangements for archives belonging to, or in the custody of, officers of the council; this was followed in 1999 by guidance on “proper arrangements,” issued by the department then responsible, the Department of the Environment, Transport, and the Regions. It refers to the management of records, in whatever format and the historical records that should be kept by an established archive.

Manorial records, held in local record offices are nominally under the custodianship of the Master of the Rolls and come under special protection due to the enduring legal position of many of the properties mentioned in the records. All pre-1925 manorial documents, except deeds and other evidence of title, are protected under the regulations published in the 1924 amendment to the Law of Property Act 1922, (s122A). Original responsibility for maintaining the register of manorial property was undertaken by the PRO on behalf of the Master of the Rolls, then by the Royal Commission on Historical Manuscripts following the Public Records Act 1958, and subsequently by TNA; Historical Manuscripts Commission when the two combined in 2003. The rules prevent the removal of manorial documents from England and Wales without the permission of the Master of the Rolls, require ownership details, or changes, to be registered, require custodians to provide safe and appropriate storage conditions and permit the removal of any documents to a more appropriate place of deposit if necessary.

Responsibility for documents relating to tithes paid to the Church of England is also held by the Master of the

Rolls and also exercised by TNA: Historical Manuscripts Commission. The original tithe apportionment maps and schedules, created as a result of the Tithe Apportionment Act 1838 (6&7 Will.IV, c.7) are held at TNA, and the two copies are held locally, often by now in the appropriate county record office. Rules have been issued relating to the care and custody of the records.

The Parochial Records and Registers Measure, passed by the General Synod of the Church of England in 1978, was a recognition of the public interest in these records and the need to ensure their security and preservation as well as providing access. Diocesan record offices had been established by the Parochial Records and Registers Measure 1929 but in practice, the spread of local record offices has resulted in many being designated as diocesan repositories. The principal duties imposed by the measure include the deposit of all noncurrent records and registers over 100 years old in the appointed diocesan office with reasonable access during working hours and regular inspection of the conditions provided for those which are retained.

The Local Government (Wales) Act 1994 required all new unitary authorities to provide plans to the Secretary of State for proposed archive delivery services. These were to include all records belonging to the local authority or of which they had custody.

ARCHIVE SERVICES

The functions of TNA in all three home countries are broadly similar; the main principles remain the provision of selection, preservation, and access services, together with advisory services especially on electronic materials.

In England and Wales, TNA offers services to the records management community and all custodians of records with the responsibility for caring for records, including private owners. The National Advisory Services offer advice and guidance on the creation, management, care, and use of records and archives by

- Setting standards and outlining best practice.
- Advising archive professionals using *The National Archives' Standard for Record Repositories*.
- Advising private owners and organizations on archive issues.
- Developing guidance and policies on electronic records management for government.
- Providing advice and guidance for statutory Places of Deposit to ensure the maintenance of high standards of care and access to public records.
- Promoting good records management and the cultural and historical importance of archives for evidence of good governance; this includes business archives and religious archives.

In England, services to users include the provision of resources on-site at the record office in Kew, in south west London. The service varies between the traditional advice to readers delivered in person by knowledgeable staff, to the recent *Your Archives* wiki, a Web site designed to allow users to contribute their knowledge of archival sources held by TNA and other U.K. archives. Development of the TNA web site has also enabled TNA to put its own catalog online for users to consult prior to a visit and to participate with others in the English strand of the beginnings of a virtual national archives catalog for the United Kingdom, *Access to Archives* (A2A). Gradually this objective is being achieved through the Global Search function on the TNA Web site where it is now (2008) possible to access information on collections held both at TNA and elsewhere.

Research services also include corporate research, TNA having been given Independent Research Organization status in 2005. This is frequently undertaken in partnership with university departments whose staff have specialized knowledge of TNA collections but also in the form of applied research in conservation science, information, records and archives management, digital preservation, and the provision of public sector information. It is intended to support decision making in TNA and by extension to the wider archive and library community.

Access services have changed considerably in the recent past, leading to a much wider audience through electronic means. Investment in developing these services has been high, particularly in the digitization of archival material. Access to the basic information remains free but charges are levied for copies of material, which has been downloaded, ensuring continuing income for further investment. Information on the records available in this format is on the relevant Web sites and catalogs. Partnerships, with private genealogical services in particular, have resulted in the management of such digital resources to be undertaken out of the public sector.

Access hours at Kew have increased as a result of the wider focus on citizens' rights. Regular surveys are made by the Public Services Quality Group (PSQG) to measure the satisfaction of users with services and offer users the chance to suggest improvements. These have resulted in changes to improving access and to developing a dialogue with the users.

Scotland, Wales, and Northern Ireland

Like its counterpart in England, NAS offers advice to government departments on all aspects of records management, to public and private owners of historical material and to the general public on using the records in its care. Similarly, it works in partnership with other organizations to promote Scottish archival interests, and it has been to the fore in developing online services, particularly for genealogists.

In Wales, the National Library manages the Welsh archival material deposited there that includes both public records and private transfers. Services are broadly similar to those offered in England and Scotland. The Welsh Assembly has the responsibility for records management services to Assembly departments.

In Northern Ireland, PRONI has the same responsibilities for the Northern Ireland Civil Service records management and the services to users of the record office as the TNA in the other countries.

Local Archives Services

Local authorities in England and Wales manage their own archive services while those that are designated as Places of Deposit for public records (see above) have to comply with the relevant regulations for their safekeeping and access. Most countries and some metropolitan areas have archive services though some combine them with local history centres (e.g., Surrey) or libraries (e.g., Birmingham). A noticeable trend in the last 20 years has been the reduction in the number of county archivists, the posts being either downgraded or being merged with that of those responsible for History Services or Local Studies.

Changes in local government organization and geographical boundaries have resulted in some amalgamations of historic collections or joint services with several contributing partners. The results of the 2007 self-assessment exercise (Nicholas Kingsley 'Self assessment of local authority archives 2007: the results revealed' *Record Keeping*, Winter 2008, pp. 10–15) (see above) suggests that size matters; larger organizations are better able to provide a wider range of services to a higher quality than small organizations which struggle with limited resources. This suggests that further amalgamation may be the only way in which to maintain high service standards.

Local authority archives keep not only the records of that organization covering a wide range of materials including those relating to the Poor Law, health, and education but also many records donated or deposited by the community. These can include solicitors' and estate agents' papers, transport records, business and industrial records, antiquarian material, voluntary organizations' records including those of charitable bodies, local societies and clubs, literary archives, diocesan material (see below) including parish registers, estate and family archives including manorial records, and many other types of archival material local in nature. Court records from the Quarter and Petty Sessions often survive locally, and many hospitals and national health organizations deposit their material with local authority record offices.

The emphasis on delivery for archives, both local and public in the early twenty-first century is on the contribution that the services can make to government initiatives such as education, health care, and citizenship as well as

the insights into historic information that have been the traditional services offered.

ARCHIVES OF HIGHER EDUCATION ORGANIZATIONS

College and university archives are maintained by their institutions, often in conjunction with manuscript and other collections. They vary from the medieval college foundations of Oxford and Cambridge universities to the modern collections of, for example the University of Warwick where many contemporary political and trade union records are kept. Notable alumni of universities often donate their papers to these institutions in later life; these are kept as appropriate but if the content is more applicable to another organization the authors are often advised on which is the more appropriate repository.

Services to readers vary according to institution but the central point of access to descriptions of archives held in higher education organizations is the online *Archives Hub* (<http://www.archiveshub.ac.uk>); this is progressively adding information at collections level and increasingly to complete catalog descriptions. Another higher education cataloging project is AIM25 (<http://www.aim25.ac.uk/>), an organization which provides electronic access to collection level descriptions of the archives of over 90 higher education institutions and learned societies within the greater London area, the name signifying that they are within the orbit of the London ring road, the M25.

BUSINESS ARCHIVES

Many businesses in the United Kingdom hold their own archives, including those which relate to enterprises in both the United Kingdom and abroad. These range from major international companies such as BP, Diageo or Marks and Spencer, banks including the Bank of England and major mining and excavation companies to smaller local organizations. Local record offices frequently aim to retain material where the original business is no longer trading, though it is often in the way of a rescue operation; recently the records of a paper manufacturer, William Sommerville and Son Ltd., a major nineteenth century employer in Midlothian, Scotland were deposited with the Midlothian Local Studies and Archive Service having been salvaged from a skip and this is not at all unusual.

While business archives are private, and therefore not subject to government regulation apart from the requirements for retaining certain financial records, many participate in wider activities to promote education or encourage genealogists to use their resources. The services they offer may be curtailed due to commercial needs and confidentiality agreements but where necessary these are managed sensitively. Initiatives among the larger

organizations include the digitization of N.M. Rothschild & Sons' records relating to the involvement of the banking firm in nineteenth century Brazil and the development of a museum by another banking firm, HBOS, in Edinburgh with a particular remit to promote financial education among schoolchildren. Local businesses may well be associated with other activities in local study centers, contributing photographic and other material to displays. In some areas, communities have come together to ensure the survival of personal and community archives that record past local employment opportunities and businesses (see below).

Business archives are promoted by the Business Archives Council established in 1934 to encourage the preservation of British business records, and to advise on their administration and management. The Council is acutely aware that the continuing existence and accessibility of business archives is closely linked to the fortunes of their owners, and of the need to strengthen rescue activities and respond to collections at risk. Consequently, it keeps in close touch with record offices and local study centers to advise them of opportunities and to encourage the deposit of materials at risk.

FILM AND AUDIOVISUAL ARCHIVES

The British Film Archive was founded in 1935 as a part of the remit of the British Film Institute "to maintain a national repository of films of permanent value." It is recognized internationally as one of the four founders of the International Federation of Film Archives (FIAF). It collects U.K. film of all kinds as well as material produced overseas, and currently (2008) holds over 7 million stills, 1 million transparencies, and 20,000 posters. The collecting policy is wide, including feature films, professional and amateur films, documentaries, propaganda films, and television programs. It is also the official repository for video recordings of Parliamentary proceedings and government films selected for permanent preservation by TNA. The services include involvement in film festivals, regular release of material to be seen at local cinemas, and the release of film and television programs on DVD. The preservation section is housed in premises funded by the late John Paul Getty and the staff work on the restoration of degraded materials with a view to enabling screening. Highly flammable nitrate film is housed separately.

Twelve public sector film archives are established in different parts of the U.K. forming the U.K. film archive forum. The English regional film archives have a remit to collect moving image material of relevance to their region. This includes audiovisual material made either in or by people from each region. Some operate within a record office, such as the Wessex Film Archive at the Hampshire Record Office, others within universities, such as the

Media Archive for Central England (MACE) at Leicester University or the East Anglia Film Archive at the University of East Anglia. Wales and Scotland have their own film archives held in both cases in their respective national libraries, with the same regional emphasis. No dedicated archive exists for Northern Ireland but some film material is available in the Ulster Folk and Transport Museum. The services offered vary according to funding arrangements but often include local screenings, talks to interested groups, and retrieval of material for individual and commercial use.

Specialist film archives include the extensive collections held by the Imperial War Museum, which is dedicated to film and video related to twentieth century conflict involving British and Commonwealth forces. The British Broadcasting Company (BBC) holds about 4 million items from radio and television as well as collections of sheet music and press cuttings. Material is made available both to the BBC and to individuals, and much use is made of the Web site to promote film and sound recordings of notable events and anniversaries.

The British Sound Archive is maintained by the British Library, and it holds over a million discs, 185,000 tapes, and many other sound and video recordings from all over the world, covering the entire range of recorded sound from music, drama, and literature, to oral history and wildlife sounds. The archives range from cylinders made in the late nineteenth century to the latest CD, DVD, and minidisk recordings. It includes copies of commercial recordings issued in the United Kingdom, together with selected commercial recordings from overseas, radio broadcasts and many privately made recordings. Increasingly these are being made available online.

Film and video material held in higher education organizations is promoted by the British Universities Film and Video Council (BUFVC) through its library and viewing and editing facilities.

RELIGIOUS ARCHIVES

Religious archives, other than those of the Church of England (see above), are normally kept either by the denomination in question, in a special library or in local record offices. Although each faith has different arrangements for deposit and access most have Web sites from which it is possible to ascertain opening hours. Dr. Williams' Library in Gordon Square, London is a rich source for a wide variety of both manuscript and printed sources for the history of nonconformity in the United Kingdom. More information is available from the Religious Archives Group of the Society of Archivists and a recent report on the state of religious archives in the United Kingdom (<http://www.nationalarchives.gov.uk/archives/advice-corporate.html>).

The Roman Catholic Church in England maintains diocesan records, some (e.g., in Birmingham) dating back to the seventeenth century although the Roman Catholic church was not officially recognized in England until 1850. The Scottish Catholic Archives are currently (2008) maintained in Edinburgh; many of the archives date back before 1878 when the Hierarchy was re-established in Scotland.

The central archives of the Religious Society of Friends (Quakers) are held in Friends House Library, London though local records, as for other nonconformist groups, are often found in the relevant record office.

The national Baptist archives are held in the Angus Library at Regent's Park College in Oxford and include the records of some local Baptist churches from the seventeenth century, though these are also found in local record offices.

The central archives of the Congregational Union of England and Wales are held in Dr. Williams' Library (see above).

Jewish archives in England are scattered between different synagogues and university deposits, including those of prominent Jews. In Scotland, the Scottish Jewish Archive in Glasgow has been established to collect a wide range of materials to document the history of the Jewish diaspora in Scotland since the eighteenth century.

COMMUNITY ARCHIVES

Community archives have developed during the past 10 years largely as unofficial records of communities where information about earlier activities, including industry, are in the danger of being forgotten. The definition of the term is still being debated but in essence, it is agreed that a community archive should be a collection that includes primary sources, in whatever format, rather than a series of articles. All groups, of whatever origin, are encouraged to contribute to the growing corpus of information held online by CommunityArchives.org.uk as well as collecting their own materials. Typically, they are based on location but can also include literature and arts archives. The movement is supported by the National Council on Archives Community Advisory Group.

RARE MANUSCRIPT LIBRARIES

Many libraries in the United Kingdom hold rare manuscripts including the National Libraries of Scotland and Wales and the British Library in London. The university libraries have major collections and in many cases, individual colleges, especially at the older universities also hold important materials. Professional bodies frequently own library and archival collections donated by former members.

ARCHIVAL PROFESSION

The archival profession in the United Kingdom grew up in the middle of the twentieth century, successor to a long line of record keepers, librarians, and antiquarians who were charged with the care of archival and historical materials. The development of a separate profession after the Second World War was due, at least in part, to the increasing number of archives deposited in local authority care.

Postgraduate courses were originally established at the School of Library, Archive, and Information Studies at University College London (SLAIS), at Liverpool University, and at the University of Wales at Bangor and Aberystwyth. In-house training was provided by some of the larger institutions such as the then PRO (now TNA) and the Bodleian Library in Oxford. Sixty years later the number of courses has risen to reflect the changes in need and the technological advances that make physical presence at a course less necessary. The archive and records management course at SLAIS continues to offer programs to both home and overseas students, and it has developed a research center, ICARUS. Liverpool University Centre for Archive Studies (LUCAS) also undertakes research as well as offering archive and records management courses at both postgraduate and undergraduate levels both on-site and for distance learners, and Aberystwyth University uses the advantage of collaboration with the History and Welsh History Department for the Information Studies programs. The latter offers distance learning options as does the Centre for Archive and Information Studies (CAIS) at the University of Dundee where the centre also caters for family and local historians. The University of Northumbria offers a distance-learning course in records management.

Information management has increasingly been the focus of many of these courses with the development of electronic communications, not the least at Glasgow University where the Humanities Advanced Technology and Information Institute (HATII) was formed in 1997, bringing together expertise in Information Communication and Technology (ICT) in the heritage sector. It offers an MSc in Information Management and Preservation (Digital) and has an extensive research program.

An important link between the universities and the profession is maintained by the accreditation of courses by the Society of Archivists (see below), which also offers additional training and short courses for professional development.

PROFESSIONAL SOCIETIES AND ORGANIZATIONS

The Society of Archivists (<http://www.archives.org.uk/>) was founded in 1947 as the first professional organization

for archivists, and it has grown to include conservators, records managers, and institutional affiliates. It exists to promote the care and preservation of archives and the better administration of archive repositories, to advance the training of its members, and to encourage relevant research and publications. It has a range of benefits for its members, now (2008) nearly 2000, and plays an important role in relation to professional qualifications (see above). It holds an annual conference, has regional representation, and works with other related bodies in promoting archives. Many special interest groups operate under the umbrella of the Society.

The Records Management Society (<http://www.rms-gb.org.uk/>) launched in 1983, recognized the needs of an ever-increasing number of people working in the fields of records and information management, including those who wish to develop new management systems. It supports professionals through sharing expertise and knowledge.

The Institute for Conservation (ICON) (<http://www.icon.org.uk/>) was formed in 2005 from several groups of conservators in all disciplines, including archive conservation. It is the lead body for conservation in the United Kingdom and provides guidance, advocacy, training, and education opportunities, uniting the conservation profession and the wider heritage community.

The National Council on Archives (NCA) (<http://www.ncaonline.org.uk/>) was established in 1988 to bring together the major bodies and organizations, including service providers, users, depositors, and policy makers, across the United Kingdom concerned with archives and their use. It aims to develop consensus on matters of mutual concern and provide an authoritative common voice for the archival community. It encourages and assists the education of the public about archives, and some of its objectives are delivered through the PSQG and the Community Archives Development Group (see above).

The Museums, Libraries and Archives Council (MLA) (<http://www.mla.gov.uk/>) is the designated non-departmental public body with a responsibility for strategic work to promote the role of museums, libraries, and

archives in the United Kingdom and within government programs. It has an importance in bringing the different parts of the heritage sector together to work in partnership rather than in isolation, emphasizing the value of coordination.

CONCLUSION

The twentieth century witnessed the development of the professional care for archives in the United Kingdom, and archive and records management services relevant to communities and individuals. The profession has progressed from one dominated by antiquarians to one which seeks to offer services to users of all kinds, based on the belief of the fundamental right to information. Management of that information is becoming the dominant theme in training archivists and records managers, together with partnership with libraries and museums to provide a stronger and wider platform for the heritage sector. The development of electronic communications will continue to challenge the profession, testing long held principles and offering new ways of delivering services.

FURTHER READING AND INFORMATION

All the organizations mentioned above have Web sites with additional and up-to-date information. In addition, Janet Foster and Julia Sheppard (eds.) *British Archives; A Guide to Archive Resources in the United Kingdom* 4th ed. (Palgrave, 2002) gives useful information about over 1000 archives in the United Kingdom, though current arrangements for access should be checked online or by phone. Online resources for this include the TNA Archon Directory (<http://www.nationalarchives.gov.uk/archon/>). *The Public Record Office 1838–1958* (HMSO 1991) and its subsequent volume *The Public Record Office 1959–1969* (Public Record Office 2000) give extensive details on the organization and its development.

United Kingdom: Libraries and Librarianship

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Abstract

This entry provides an overview of contemporary libraries and librarianship in the United Kingdom. After an introduction which identifies some of the key phases and determinants of library development, separate sections are included which discuss national libraries; public libraries; academic (university) libraries; school and college libraries; special libraries. In each case a basic structural and statistical description is provided, the history of the sector is presented in outline, and current policy issues and concerns are discussed. The entry concludes with an examination of United Kingdom librarianship, its professional associations, and library education and research.

INTRODUCTION

The United Kingdom of Great Britain and Northern Ireland (U.K.) is a parliamentary democracy and constitutional monarchy of, in mid-2007, an estimated 60.95 million people.^[1] The United Kingdom is a permanent member of the UN Security Council; a founding member of NATO and of the (British) Commonwealth; and since 1973 a member of the European Union, although not its economic and monetary union. The centralized governance of the United Kingdom has been recently modified by constitutional reform, which, in 1999, created devolved administration of domestic affairs (including libraries) in Scotland, Wales, and Northern Ireland. The U.K. economy is now overwhelmingly postindustrial with an estimated 80.4% of the labor force employed in services; 18.2% in industry and 1.4% in agriculture. In comparative global terms, the United Kingdom is a prosperous and advanced capitalist democracy with a per capita GDP of \$35,300 in 2007.^[2] However, significantly for libraries, higher level literacy rates in the United Kingdom are relatively low compared with other advanced economies: 16% of adults over 16 years of age have literacy levels equivalent only to those expected in children of 11 years or less.^[3] Also of importance for libraries is the multicultural character of U.K. society. In the 2001 population census 7.9% of Britons described themselves as of minority ethnicity (that is, a category other than “White British” in census returns). London is the most ethnically diverse city in the United Kingdom, with 40% of Londoners belonging to a minority ethnic group.^[4]

The modern history of the United Kingdom is underpinned, on the one hand, by its rise to preeminence as the “first industrial nation” and, on the other, by its maritime dominance which, by the late nineteenth century, had created an empire which covered one-quarter of the Earth’s surface. Since then, two narratives of British

twentieth century history have competed for the attention of historians. The first, an epic chronicle of two world wars and decline of empire, is at first sight of little relevance to libraries—although see the counterarguments made, for example, by G.K. Peatling.^[5] The second—which charts the evolution of modern British society, its transformations of class and culture and the rise and decline of its social institutions—has provided a much firmer context for the historical analysis of library and information services. In particular, the history of the British welfare state, the scrutiny of its character and limitations, and the examination of its more recent partial dismantling provide arguably the most appropriate framework and chronology for understanding modern U.K. library and information services.

This is not to say, however, that the development of libraries in the United Kingdom was entirely dependent on the state. Before the mid-nineteenth century a diverse range of libraries had flowered in Britain in response to the demands of an increasingly literate society, financed by private contributions, subscriptions, and endowments. Libraries of colleges and the ancient universities; religious libraries; scientific and philosophical society libraries; circulating and subscription libraries; mechanics institutes; the library of the British Museum itself (founded in 1753)—all of these amounted to an arguably impressive aggregation which catered for many diverse and specialized needs. However, by 1850 the limitations of these libraries had become clear. On the one hand, they offered uneven and unsystematic provision of knowledge, increasingly inadequate in a modern industrial state becoming conscious of its utility and value. On the other hand, these libraries, in the main, limited their provision to specific client groups or those with the capacity to pay—a situation which became gradually recognized as untenable in a society where universal education, numeracy, and literacy were becoming utilitarian, moral, and spiritual goals.

As a result, the passage of an act enabling the establishment of taxpayer funded public libraries in 1850 (1853 in Scotland and Ireland) was as significant for its symbolic as well as its practical consequences. Between 1850 and 1914, library expansion as a whole in the United Kingdom became more and more dependent on public support, either from local ratepayers (in the case of public libraries) or through central government grants. These years saw the foundation of over 500 public library authorities; the expansion of existing university libraries and six new ones in “civic” universities; a hugely expanded British Museum Library which evolved into a “national” library; and the establishment of the National Library of Wales. Important as such expansion was, it remained however partial and uneven, reflecting local and sectional interests, legislation which was permissive rather than mandatory and in some cases, still, the generosity of benefactors such as Carnegie and Passmore Edwards. Only after the shock of the First World War did the construction of library systems become a truly organized state project; the Kenyon Report of 1927 encouraging their development as an “engine of great potentiality for state welfare.”^[6] Over the next 50 years or so, the United Kingdom, with a great deal of success, attempted to develop comprehensive networks of national, public, academic, and specialist libraries. These were usually locally managed but were often co-ordinated by focused policy networks comprising government advisors and powerful professional groupings such as the Library Association (founded in 1877); Aslib (the Association of Special Libraries and Information Bureaux, founded in 1924), and SCONUL (the Standing Conference on National and University Libraries, founded in 1956). Such governance crystallized in influential policy reports such as those by McColvin on public libraries (1942),^[7] Dainton on national libraries (1969),^[8] and Parry on university libraries (1967),^[9] which determined strategic direction and state funding priorities. These were sometimes linked to formal legislation such as the 1964 Public Libraries Act and the 1972 Act which established the British Library.

By 1979, U.K. library provision was widely admired throughout the world not least because it seemed to combine secure financial support from a social democratic state with a relative autonomy of governance and ethics which minimized direct political interference. However, this U.K. model was not without its critics. Some claimed that U.K. information services were disorganized and uneven, compared, for example with the seemingly comprehensive state scientific and industrial services provided in the USSR.^[10] United Kingdom public library services, others argued, were limited and conservative, focusing on a middle-class clientele and neglecting outreach and other service models which might attract disadvantaged users.^[11] However, since the mid-1980s, critiques such as these have been largely superseded by arguments more sympathetic to Conservative Prime Minister Margaret



Fig. 1 The United Kingdom.

Source: <https://www.cia.gov/library/publications/the-world-fact-book/geos/uk.html> (accessed December 31, 2008).

Thatcher's project of rolling back the U.K. welfare state. The U.K. library sector has become, it is claimed, largely unresponsive to the demands of a dynamic free-market economy which is now linked to the fast developing “information” revolution.^[12] As a consequence, libraries in Britain have been exhorted simultaneously to commercialize their management and marketing and to informatise their services and provision, replacing books and documents

with electronic networks and products. United Kingdom public, academic, national, and special libraries have, as we show in subsequent sections, responded to these pressures with differing strategies and with varying levels of success.

NATIONAL LIBRARIES

The United Kingdom is perhaps unique in possessing three “national” libraries: the British Library (BL); the National Library of Scotland (NLS); and the National Library of Wales (NLW). The British Library is, of course, preeminent among these and is the subject of a separate entry in this encyclopedia (see the entry, “British Library,” p. 677). The library can trace its origins back to 1753 when a library was established in the British Museum based on the bequeathed collections of Sir Hans Sloane; the library subsequently expanded exponentially in Victorian times, especially under the tenure of librarian Antonio Panizzi (Keeper of Printed Books 1837–1856 and Principal Librarian and Director 1856–1866) who oversaw the development of its Bloomsbury site and the famous round reading room. Subsequent developments in the later nineteenth and twentieth centuries saw the foundation of a series of “national” libraries: the Patent Office Library (from 1854); the Science Museum Science Library (from 1883); the Central Library for Students (from 1916 to 1931, after 1931 the National Central Library); and the National Lending Library for Science and Technology (from 1957). The British Library Act of 1972, which created the modern-day BL, effectively unified this by then unwieldy number of national services and collections in science, commerce, reference and interlending. Subsequently the library has rationalized its operations around two locations: its public face at the St Pancras Building in North London, opened in 1998; and its back office and collection storage facilities at Boston Spa, West Yorkshire. The library employs an estimated 2000 staff who operate on resources of approximately £120 million per annum (2007). It maintains collections of approximately 14 million monographs and 880,000 serial titles as well as numerous manuscript, audiovisual and, increasingly, digital sources. (For more detailed statistical information see the separate entry *British Library*.) It is one of six legal deposit libraries in Britain and Ireland (others being the NLS; the NLW; the Bodleian, Oxford University; and Cambridge University Library and Trinity College, Dublin) and is entitled, under the terms of the Legal Deposit Libraries Act (2003) to receive copies of all U.K. publications including, now, certain forms of electronically published material. In line with this, the contemporary BL is strategically committed to expanding its digital presence—in terms of collecting electronic publications; electronic catalogs and access; and digital conservation. In

the era of the World Wide Web, it aims to be a “national library which serves the world.”

The National Libraries of Scotland and Wales might reasonably be said to have less ambitious goals: most significantly since the advent of devolved government in the United Kingdom in 1999 they have become focused on their public role as a focus of Scottish and Welsh national culture. Historically, NLS has a longer lineage: its origins can be traced to the Edinburgh Advocates Library founded in 1682 which in 1709 was given the privilege of legal deposit. Throughout the eighteenth and nineteenth centuries this library was regarded as a national library in all but name—eventually it became one by Act of Parliament in 1925. The modern library is now located in its George IV Bridge Building in Edinburgh with a second site, completed in 1995, at Causewayside, further from the city centre. NLW is, by contrast, a mainly twentieth century institution: it was created by Royal Charter in 1907 and sited, despite opposition from Cardiff, in Aberystwyth, geographically central in Wales but away from its most populous cities. The library is housed in an imposing neo-classical building above the town which was eventually completed in 1965. Like the NLS, it benefited from extensive refurbishment in the 1990s.

Functionally, both libraries are similar in many respects: both are U.K. legal deposit libraries; they have collections of a comparable size (circa 6 million monographs in Wales, 8 million in Scotland); they employ similar numbers of staff (265 in Scotland; 300 in Wales); they operate on comparable budgets—total operating incomes of £13 million in Wales (2006/2007); £12 million in Scotland (2004/2005).^[13,14] Both effectively serve as hybrid regional research and national libraries, balancing the general needs of researchers with a growing awareness of their public function as centers of the printed word in Scotland and Wales. Since 1999, when oversight and funding of each library was transferred to the Scottish and Welsh Executives, respectively, both have adopted strategic plans which highlight this latter role and which stress the promotion of national heritage, languages, and culture.

PUBLIC LIBRARIES

United Kingdom public libraries currently constitute a network of 4657 static and mobile service points, administered by 208 local authorities who are responsible for library provision. The largest public library ranked by book issues is now the Norwich and Norfolk Millennium Library which lends 1.157 million books per year; the busiest library in terms of visits is Birmingham Central Library with 1.564 million visitors. In total, U.K. public libraries issue 315 million books per year (2006/7), a decline of 61 million since 2001/2002; although children’s book issues have remained static over the same period at 90 million per annum. To some extent this decline has

been counterbalanced by an increase in library visits to 337 million per year—a 6% increase on 2001/2002. Many of these extra visitors have undoubtedly been attracted by the establishment of a “People’s Network” of (in the main) free to use Internet points in libraries comprising 41,000 workstations by 2006/2007. Expenditure on public libraries currently amounts to £1157 million per annum and this, despite the People’s Network, has remained largely stable since the advent of the Labour government in 1997. Fifty-five percent of this sum is spent on staff; 12% on books and materials and 33% on buildings, equipment, and other items.^[15] The comparatively low expenditure on books and materials has attracted vociferous criticism in recent years.^[16]

Public libraries in England and Wales are managed within the framework of the 1964 Public Library and Museums Act, which requires that each local library authority provide a “comprehensive and efficient service.” (Scotland has its own public library legislation, most recently the Public Libraries Act (Scotland), 1955). In England, the central government Department for Culture Media and Sport (DCMS) is responsible for ensuring the implementation of the act and through its agency the Museums, Libraries and Archives Council (MLA) it coordinates policy and strategic direction; the Scottish, Welsh and Northern Ireland devolved executives now exercise similar functions in these regions. In recent years DCMS and MLA have tried to bring a degree of consistency to uneven local library services through the introduction of public library standards in 2001. However, these have been subsequently diluted, not least because of lack of clarity regarding the consequences of non-compliance. Perhaps more important has been the policy document *Framework for the Future* (2003) which DCMS heralded as a “long term strategic vision for the public library.”^[17] This tried to resolve, albeit with a mixed degree of success, some of the dilemmas facing the public library in an advanced “information” society (see discussion below).

The history of the U.K. public library movement is now well documented and the facts of public library development are clear enough. The basic picture is one of enabling acts of parliament supported by government enquiries and reports leading to gradual long-term expansion and improvement, albeit punctuated by alternate periods of inertia and reform. The initial public library act of 1850 was sponsored by the utilitarian radical Liverpool MP William Ewart and supported by evidence gathered by Edward Edwards, a British Museum library assistant later to become City Librarian of Manchester. The act permitted any municipal borough with a population above 10,000 to establish a “free” library provided two-thirds of ratepayers supported one, setting a limit on the local tax which could be raised. The first local borough to adopt the act was the city of Norwich (in 1850); although the most important early civic library to be opened was Manchester in 1852, at a ceremony attended

by Dickens, Thackeray, and other distinguished Victorians. Until the 1880s further expansion was slow—by 1886 only 125 authorities had established libraries. After amending legislation in 1886, however, which relaxed the conditions for adoption, new libraries burgeoned, encouraged also by endowments from philanthropists such as Scots-American steel magnate Andrew Carnegie and journal publisher John Passmore Edwards. By 1918, 561 municipal boroughs—the majority—had established libraries, some with a fairly large network of branches.^[18] Subsequent periods of expansion included the 1920s and 1930s, after a 1919 act which enabled rural counties to operate as library authorities and finally the 1960s, when the integrated national library system recommended in the famous McColvin Report of 1942 finally reached near fruition. Arguably the “golden age” of the U.K. public library, the 1960s saw a doubling of real expenditure on the service; the construction of many modern library buildings; the expansion of information, children’s and outreach services, and a rationalization of administration through the creation of larger authorities in England and Wales in a Local Government Act of 1972. Since the 1980s, however, fortunes have been rather more mixed: in common with much of the U.K. welfare state, public libraries have faced expenditure cutbacks, decreasing professional staff numbers and a worrying fall, since the 1990s, in adult (although not children’s) book loans. Nevertheless, public librarians have attempted to innovate through community librarianship and “outreach” initiatives; improving “customer” responsiveness; implementing the aforementioned “People’s Network” and opening some impressive new library buildings—aptly at Norwich, the first U.K. public library authority and more recently in award-winning buildings at Peckham, South London, and Brighton.

Beyond this relatively straightforward narrative of growth and development, however, U.K. public library history is undoubtedly more complex than it first appears. In contrast to its steady material progress, the underlying philosophy and rationale of the public library has always been contested, and an analysis of over 150 years of debate about the purpose and societal impact of the service reveals a series of unresolved tensions at the heart of the public library idea. Perhaps the most fundamental of these were the differences between Benthamite liberals, such as Ewart, who saw libraries primarily as a vehicle for *individual* self-improvement and opportunity, and late Victorian idealists, socialists and even some nationalist conservatives, who emphasized the benefits of the library for *communities* and society as a whole. Many subsequent public library policy debates can be traced back to these differences: the legitimacy of libraries’ leisure role and specifically the “great fiction question” (regarding provision of leisure reading) which surfaced in the 1890s; the debates over provision to, and expenditure on, reluctant, “disadvantaged” and mainly working-class library clients

which began in the 1930s; conflict between “localism” and the perceived need for national structures and standards; tensions, especially from the 1960s onwards, between stock provision driven by reader demand and more culturally conservative collection management policies. Most of these issues have never really been resolved: instead, in the mid-twentieth century years of plenty, public libraries attempted arguably to be all things to all people. Questions of fundamental purpose were certainly sidelined in favor of a functional consensus of “public service,” typified by the 1971 statement of *Public Library Aims and Objectives*, produced by the Public Library Research Group.^[19] This defined public libraries as a “multipurpose information-education-culture agency” and enumerated their objectives under the headings of education; information; culture, and leisure. Most subsequent government policy documents—including the recent *Framework for the Future*^[17] have continued this all inclusive public service convention.

Partly as a consequence of this legacy, twenty-first century public library policy tends to be hampered by unresolved problems of purpose and rationale. These are complicated still further by the onset of the “information” society which has brought with it the informatisation and networking of libraries; new business-led managerial practices; and market-oriented “retail” models of service. Initially, from its inception in the mid-1990s until its near completion in 2004, the key library informatization project—the People’s Network—was heralded optimistically as a “turning point” for the U.K. public library, marking, perhaps, a reconstitution of the “public sphere” in the information society. More latterly, however, and despite the network’s undoubted initial success, such optimism has been replaced by a realization that wiring up the library is perhaps not the panacea it once seemed—especially as home Internet access becomes cheaper and more universal in the United Kingdom (in 2006, 57% of U.K. households had home Internet access).^[20] The focus on the network has consequently dissipated and been superseded by an eclectic mix of ideas and blueprints for the public library’s future. These include the initiatives of radical and “community” librarians who advocate refocusing the service around literacy, community engagement and social inclusion; the visions of “modernizers” who want to reinvent public libraries as centers of new digital technologies and rebrand them as “Idea Stores” or “Discovery Centers”; and the arguments of traditionalists who favor a “back to basics” approach of restoring expenditure on books and a return to the core purpose of book provision, linked usually to a retail led strategy of improved marketing and promotion. The impact of such competing ideas—none of them dominant—is difficult to gauge. However, in a climate of financial pressures, falling book issues and the disaggregation of U.K. local government, the clamor for urgent and sometimes contradictory action has undoubtedly engendered a sense

of uncertainty and insecurity in public library circles. Perhaps it is finally the case that the public service consensus, which has sustained British public libraries over the last century or so, is beginning to dissolve.

ACADEMIC LIBRARIES

In the United Kingdom, libraries in universities and colleges of higher education (commonly known as “academic” libraries) now operate within a unified framework of state higher education created in Education Reform Acts of 1988 and 1992. (In the United Kingdom “higher” education is defined as degree or diploma level education targeted at students of 18 years old or over.) They are funded in the main through their parent universities or colleges, which receive most of their income in turn from block grants made by regional funding councils (for England, Wales, Scotland, and Northern Ireland) and student tuition fees. Academic libraries provide services in a total of 168 higher education institutions, 106 of them universities and the remainder colleges of higher education. They serve an estimated total of 2.34 million students (1.79 million undergraduates, the remainder postgraduate) and 165,000 academic staff; total higher education library expenditure amounted to £561million in academic year 2005–2006. Within these institutions there are a total of 864 separate academic library service points employing in 2007 10,565 staff, 3979 of them professional, the majority of the latter being members of CILIP.^[15]^[21] Collectively, U.K. academic libraries are represented by the Society of College, National and University Libraries (SCONUL) which serves as a forum and lobbying body for the whole sector. In addition, Research Libraries UK (formerly CURL, the Consortium of University Research Libraries) performs a similar function reflecting the interests of 25 leading university research libraries, together with Britain’s national libraries and the Victoria and Albert Museum.

United Kingdom academic libraries have, of course, a long heritage dating back to the foundation of the medieval universities in the late thirteenth and fourteenth centuries. Recognizable university libraries were established at Oxford in 1412; Cambridge in 1424; St Andrews in 1411, and Glasgow in 1451, although collections of donated books in particular colleges predate these. Subsequent development of university libraries progressed unevenly, although major advances paralleled the proliferation of the printed book in the late Tudor period and saw the expansion of Cambridge University Library, the establishment of Edinburgh (1580) and the foundation of the Bodleian Library at Oxford (1602). It was not, however, until after 1750 that these libraries really began to resemble the familiar institutions of today: the century after that date witnessed, often for the first time, reader access to shelves; transparent catalogs, and skilled librarians. By 1849 the

Bodleian, for example, comprised 220,000 printed volumes and 21,000 manuscripts compared with only 30,000 volumes and 6000 manuscripts, respectively, in 1714.^[22] By then, moreover, the medieval universities had been joined by new universities in London and Durham each of which began to develop library systems. Perhaps even more significantly, by the end of the nineteenth century, libraries were being established at several new “civic” universities and colleges in Britain’s major cities, many of them with a scientific and technical bias. By 1925, 13 such institutions were operating, most of them funded by the British state, which had established a University Grants Committee (UGC) in 1919.

Between 1930 and 1960 academic library development continued piecemeal, although some impressive buildings, such as the Brotherton Library at Leeds (see Fig. 2) date from this time. Although library services gradually became professionalized (SCONUL was founded in 1956) and libraries were developed as the number of colleges and universities grew, there was little uniformity in the resources which parent institutions granted to libraries, or in the services and priorities of the libraries themselves. Two key developments of the 1960s changed matters. The first, a report for the UGC subsequently known as The Parry Report (1967), recommended a number of minimum standards for academic libraries including the principle that universities should devote “about six percent” of their budget to library provision, and these were broadly accepted. The second, the creation first of a group of new elite universities and, more widely, of a large number of vocationally oriented “polytechnics” with degree awarding powers, spawned the development of a large

number of new libraries in higher education, establishing the service structures still in place today. Library development between 1970 and 1992 subsequently coalesced around two broad models:

- An academic/research model which prioritized collection development and management and was mainly adopted by larger, older, and elite universities with substantial research resources (many of these libraries founded CURL in 1983).
- A teaching and learning library model which focused on currency of resources and renewal of stock together with undergraduate student needs and user education. This model was largely adopted in polytechnics, colleges of higher education, and some smaller “modern” universities.

In many ways, of course, contemporary adaptations of these models of academic library provision still persist. However, arguably since 1992 when the United Kingdom moved to a uniform system of HE, the direction of academic library policy has been instead dictated by a new educational paradigm of massified, and more latterly networked, higher education. In 1988/1989 U.K. universities enrolled 517,000 undergraduate students. By 2005/2006 this figure was 1.79 million.^[21] The Universities Funding Council commissioned Follett Report (1993) heralded a period of unprecedented change for academic libraries as they adapted, in the main very positively, to this new environment. Following Follett, the new post-1992 Higher Education Funding Councils (for England,



Fig. 2 The magnificent interior of the Brotherton Library, University of Leeds. Opened in 1936, the central rotunda consciously imitates the famous British Museum Library reading room.

Source: University of Leeds.

Scotland, Wales, and Northern Ireland) together provided over £140 million which was spent on over 100 new building developments. Even more significantly for the future, through the Funding Councils' Joint Information Systems Committee (JISC, established in 1993), Follett inaugurated the so-called E-Lib program in which a £15 million budget contributed to over 60 developmental ICT projects in fields such as electronic journals; digitization of catalogs and source material; online publishing and electronic document delivery.

After the completion of E-Lib in 2001 and the concurrent stabilization of networked technologies around the World Wide Web, many U.K. academic libraries moved rapidly to a "hybrid library" model of complementary electronic and print-on-paper services. Such moves were often accelerated by the convergence of library management with that of ICT and media resources across whole institutions, together with, since 2003/2004 the adoption by many universities of virtual learning systems such as WebCT or Blackboard. Spurred on by these developments, some academic librarians have become especially focused upon the theory and practice of information literacy, SCONUL itself developing the now ubiquitous "seven pillars" approach to student information skills. According to SCONUL, U.K. academic libraries over the next 10 years are likely to become increasingly personalized and customer focused and be characterized by "complex blended systems" and multiuse, multipurpose buildings.^[23] While many influential U.K. academic librarians actively embrace this vision of flux and change, others urge caution at such "postmodern" approaches, worrying openly about the custodial and collection management role of the university library, the decline of scholarly research and authoritative published knowledge.^[24] Such tensions, perhaps, together with the consolidation of interest groupings such as Research Libraries UK, suggest that the character of U.K. academic libraries (like higher education itself) may become increasingly heterogeneous and diverse.

SCHOOLS, COLLEGES, AND SERVICES TO CHILDREN

Colleges of Further Education

Although many of the United Kingdom's universities have now developed a focus on technical and vocational qualifications, the bedrock of U.K. provision in this field is a network of 495 Further Education (FE) Colleges. These colleges offer a range of subdegree qualifications to students aged 16 years and over; a few also offer higher level qualifications such as "Foundation" degrees in collaboration with local universities. Most of the colleges were established in the 1950s and 1960s: initially they were administered by local education authorities; however,

following the reorganization of the sector in 1992 they are now corporate bodies overseen and funded by a Learning and Skills Council (in England) and similar bodies in the rest of the United Kingdom. All of the colleges have developed libraries serving the needs of staff and students but these vary considerably from college to college: there are no statutory requirements regarding service levels, although colleges are subject to an inspection regime overseen by OFSTED (the U.K. Office for Standards in Education) which includes scrutiny of learning resource standards. Consequently, some colleges and their librarians have developed innovative, well resourced learning resource centers which characteristically locate the library at the center of the college managed and virtual learning environment. At the other extreme, however, some college library services are undoubtedly under-resourced, marginalized and lacking in professional library staff. The most recent CILIP survey in 2003^[25] found, for example, that only 7.2% of college libraries received over 1% of the college budget and that several small colleges (those with less than 8000 students) were operating without qualified library staff. The median number of professional staff in these small colleges was one; in medium colleges (8000–18,000 students) it was two and in large colleges of over 18,000 students, four. Notwithstanding such problems, however, many U.K. FE college librarians maintain a vigorous commitment to modernizing and improving services in the field. They are represented by the CoFHE group of CILIP (which produces important guidance on standards and good practice)^[26] and the Council for Learning Resources in Colleges (CoLRiC) which acts as a lobby group for the enhancement and improvement of services.

School Libraries

Libraries in U.K. schools have, of course, a much longer heritage than those in FE colleges. Some English grammar schools began to develop systematic collections of books in the sixteenth century and by the late seventeenth century several of these schools had relatively large libraries of a few hundred books or more with written rules and designated masters in charge.^[27] However, it was not until the early twentieth century that school libraries began to appear in publicly funded schools: in 1906 the U.K. Board of Education stipulated that every new secondary school (for pupils aged 11 and over) should keep a library. Subsequent progress was slow—in 1936 the Carnegie United Kingdom Trust reported uneven and largely poor school library provision, a situation that only gradually improved before the 1970s. By then, school libraries had become almost universal in secondary schools and most local education authorities (LEAs) in addition funded school library support services which provided materials and professional advice for libraries in both secondary and primary (elementary) schools. By this time also, school librarianship in the United Kingdom had become organized

professionally, the Library Association maintaining a specialist School Libraries Group and a separate School Library Association (SLA—founded in 1937) attracting the support of interested teachers and teacher-librarians. Both of these organizations acted as foci for progress and innovation, producing journals which disseminated good practice together with standards and guidelines. Spurred on by such activity, the 1970s and 1980s were, by and large, decades of expansion and improvement in school library services, especially through the development of integrated school resource centers and quality provision of book stock. Some local education authorities, such as Nottinghamshire and the Inner London Education Authority (both of which appointed qualified librarians in all secondary schools), were at the forefront of these innovations.

Since 1990, however, it is generally the case that the progress made toward universal high quality school library provision has been complicated if not reversed. In spite of pressure from the LA (more latterly CILIP) and the SLA, and in part because of continuing tensions between them, the issue of professional staffing in school libraries has never been resolved: the most recent survey by CILIP (2002) estimates that only 30% of the 4000 or so secondary school libraries in the United Kingdom are managed by a chartered librarian; 20% are run by teachers or teacher librarians; and the remaining 50% by library assistants or others.^[28] Moreover, local management of school budgets, introduced in 1990, has severely affected the stability and effectiveness of LEA school library support services: these services no longer receive direct funding from LEAs but instead enter into contractual agreements with individual schools who “purchase” their services and are no longer required to use them. Some schools have consequently opted out of this provision—the most recent figures estimate that 15/193 LEA support services have been forced to close since 2000–2001 and that they now serve only 82% of primary school children compared with 90% at that time.^[15] In spite of these difficulties, however, expenditure on school library services as a whole has been maintained roughly in line with inflation (a total spend of £39 million or £1.85 per pupil in 2005/2006) and U.K. school librarianship as a professional activity continues to thrive. Many schools have developed model services and initiatives in fields such as reading and literacy; information skills; materials selection; special needs provision; and children’s access to and use of the World Wide Web. Many of these new developments are embedded in CILIP’s *Guidelines for Secondary School Libraries* (2004) and *The Primary School Library Guidelines* (2002).^[29,30]

Public Library Services to Children

Closely linked to school library support services in many areas of the United Kingdom are children’s departments of public libraries: both are operated by local authorities and

often share a number of professional and administrative functions. Unlike schools, however, public libraries are legally obliged to provide children’s services by the 1964 Public Libraries Act. As on March 31, 2006 they held 25.3 million children’s books, equivalent to 2.3 per child, and they spent approximately £50 million per annum on the service. United Kingdom public libraries are estimated as employing approximately 600 FTE professional children’s librarians, with a further 100 employed in shared posts with schools services. In 2005/2006 they loaned approximately 90 million books, a figure which, unlike its adult counterpart, is rising again at a rate of 4% per annum after falls in the 1980s and 1990s. An estimated 55% of U.K. children aged 0–14 are registered members of public libraries.^[31]

Children’s public libraries in the United Kingdom date back almost to the inception of the public library itself—Manchester Public Library opened a separate room (for boys) in 1861 and in 1871 Birmingham Public Library recorded a collection of 456 books for children.^[32] However, subsequent development of children’s services was uneven, although the decade before World War I (when many separate children’s collections were first established) and 1925–1939 (when children’s librarianship as a distinct profession emerged) marked significant advances. It was not until the late 1960s and 1970s, however, that services experienced major advance. Underpinned by the statutory force of the 1964 Act, fueled by a quantum leap in both the quantity and quality of children’s books and inspired by classic professional texts such as Janet Hill’s *Children are People* (1973),^[33] children’s librarianship became arguably the most proactive, creative, and successful component of U.K. public library provision. Since then children’s librarians have played a leading part in developments such as outreach, services to teenagers, ethnic minorities, and children with special needs; they have engaged in literacy and more latterly information literacy work—the latter especially in conjunction with the establishment since 2000 of the “People’s Network” in the public library. Since 1997 children’s libraries have also become important in a number of the Labour government’s multiagency “social inclusion” initiatives—the most significant of these perhaps being “Bookstart” (and its successor “Surestart”), a literacy and social care initiative targeted at children under 5 years of age and offered now in 85% of U.K. local authorities. In part because of work such as this, children’s services tend to have avoided much of the uncertainty of purpose which has dogged the rest of the U.K. public library movement. Despite recurring problems of funding, management, and inconsistency in service levels, children’s services in general enjoy the rhetorical support of policymakers because of their clear educational focus and relevance to literacy. There is, moreover, general professional agreement on a strategy for developing children’s libraries—embodied in the policy document *Start with the Child* (2002) this proposes a program of innovation and

diversification of provision in response to new media and the changing culture and needs of children.^[34] Access to resources to fully implement such plans, however, continues to be problematic.

SPECIAL LIBRARIES

Specialist information provision in the United Kingdom is now, as one would anticipate in any advanced post-industrial society, kaleidoscopic in its subject range and heterogeneous in its institutional arrangements. The current *ASLIB Directory of Information Sources in the United Kingdom* lists over 10,700 organizational repositories of information: only a minority of these are obviously libraries.^[35] However, special *libraries*, in the sense of collections and services in limited subject fields, and more especially “workplace” libraries, serving distinct groups of occupational and institutional users, clearly still constitute an important subsection of this specialist information landscape. Some of these employ large numbers of people in complex organizational settings—the BBC Information and Archives Department, for example, having a staff of over 600^[36]—whereas many services in small companies and voluntary organizations are operated by lone librarians. The extent of special library provision is, of course, notoriously difficult to map, but the most recent reliable U.K. survey data, recorded in 1998–2002 suggests a distribution by sector as in Table 1.

Significant specialist areas absent from this survey include libraries in the National Health Service (an estimated 375 libraries in 2002);^[38] news, media, and publishing (an estimated 80 media organizations with libraries in 2008);^[39] and industrial sectors beyond energy and pharmaceuticals. All in all, an informed estimate would probably gauge that around 5000 specialist information units which are recognizable as libraries currently operate in the United Kingdom: this figure roughly tallies with CILIP estimates of approximately 4000 professional members working in the special libraries sector (see section “U.K. Library and Information Profession”). However, as we

shall see, some sectors, such as commercial, industrial, and media libraries, have been subject in the past few years to closure, contraction, or drastic organizational change, whereas others, such as libraries in health and other government services, appear to be consolidating around new “hybrid” models of service provision.

The first genuine examples of specialist library provision in the United Kingdom are generally held to have been founded in the early modern period, although arguably some collections (such as, for example, those of medieval monasteries) predate these. The institutions of the traditional professions—medicine, law, and the church—tended to develop libraries from the mid-sixteenth century onward, such as those in the Royal College of Physicians and the Inns of Court in London. The scientific revolution of the seventeenth and eighteenth centuries subsequently underpinned the foundation of important libraries such as those of the Royal Society (1666) and a number of provincial and specialist scientific societies; the increasing reliance of government on knowledge and information also began to be acknowledged through the creation of the Foreign Office Library (1801) and the House of Commons Library (1818). However, it was not until the second part of the nineteenth century that special libraries began to noticeably proliferate in significant numbers. Impelled by a cluster of societal forces linked to accelerating modernity—the increasing specialization of knowledge; the diffusion of knowledge reliant industries; the rise of professional occupations; the expansion of the state and its bureaucracy; the invention of new information and communication technologies—libraries and information or “intelligence” bureaux of diverse kinds began to penetrate the United Kingdom’s governance and economy. By the 1920s, large industrial concerns such as Metropolitan Vickers in Manchester and Rowntree in York had established libraries linked to sophisticated research and intelligence centers; the state itself also began to fund technical libraries in “Research Associations” linked to specialist industrial sectors. In 1924 a grouping of 84 such public and private sector concerns organized themselves in ASLIB—the Association of Special Libraries and Information Bureaux—an umbrella group which acted less as a professional association than a “clearing house” for an envisaged national network of specialized information services. From 1944 ASLIB attracted state funding to further this goal; by 1960 it had 2500 corporate members, processed a workload of 35,000 enquires per annum; employed over 40 staff and supported a prestigious research department.^[40] By this time, specialized library and information networks in most of the sectors enumerated above had been established along lines that are recognizable today: central government libraries expanded enormously in the three decades after World War II (for example, the Board of Trade Library in 1950 had a staff of 40 with one professional librarian; by 1976 this had grown to 147 staff with 46 librarians^[41]) and, by

Table 1 Distribution of U.K. special libraries by workplace sector (1998).

Sector	Number of libraries
Government departments	60
Other government organizations	379
Voluntary agencies	1390
Professional societies, etc.	210
Legal	1400
Commercial; financial	211
Energy	83
Pharmaceuticals	93
Management/information consultants	200

Source: From LISU, *Library and Information Statistics Tables*, LISU, Loughborough University, U.K.^[37]

1972, a survey estimated that 1182 industrial and commercial libraries were operating in Britain.^[42] Most of these libraries by the 1970s offered a proactive information service to their users. This generally included the use of the techniques of documentation pioneered in Britain by S.C. Bradford and others in the mid-twentieth century, and it supplemented the traditional librarian's function of the collection and organization of information with techniques of analysis and dissemination. Some of this work became professionally recognized as "information science" in the 1960s and 1970s, specifically through the foundation (in 1958) of the Institute of Information Scientists (IIS), an organization which had 750 members by 1970.^[40] By comparison, "special librarianship" in Britain, in contrast to the United States, never convincingly evolved as a specialist profession, although the U.K. Library Association did set up a rather poorly supported Reference, Special and Information Section in 1949.

All in all, by the mid-1970s, the United Kingdom could boast a relatively well-developed and well-organized network of specialist library and information provision, in part supported by the state through ASLIB grants and other mechanisms of arms-length subsidy. Over the next 30 years, however, this system of state-sponsored pluralism would in large part fragment as a result of the economic, technological, and political transformations linked to postindustrialism. In the commercial and industrial sectors, many hitherto site-specific libraries, especially those in large companies, were restructured or downsized as a result of accelerating globalization and corporate realignment. In the public (state) sector similar upheavals were experienced in the wake of the privatization, between 1979 and 1997, of large state utilities such as energy, water, coal, steel, telecoms, and railways. Even libraries in government departments themselves, and those in state-funded services such as health, underwent a commercialization of sorts through the introduction of private sector management regimes such as cost-benefit analysis; market testing and performance measurement—procedures which became ubiquitous in all United Kingdom special libraries by the end of the century. Linked to, and facilitating, many of these trends was the information technology revolution: especially the advent of organizational intranets from the late 1980s and the Internet from the late 1990s onward. These technical changes heralded a major transformation of the structures, functions and scope of United Kingdom special library and information services. On the one hand, they seemed to promise a prominent role for library and information services in the exploitation of a newly recognized and valued commodity; on the other, they threatened the potential extinction of the "library" and the special librarian and their replacement by the database, the World Wide Web and the intelligent network.

At the present time many of these transformations are still incomplete; however, what is clear is that the shift to a postindustrial political economy has had an uneven impact

on the United Kingdom's special library networks. ASLIB has contracted, losing its government funding in the late 1970s and transforming itself into a commercially focused "Association for Information Management" in 1983, offering information consultancy services, training and publishing to an international market. (ASLIB finally abandoned its charitable status in 2004 and now operates on full commercial lines. It currently has a corporate membership of approximately 380 members.^[43]) Some special library sectors have similarly suffered: in news and media provision an almost complete revolution appears to have been effected since 1998 with the traditional "cuttings" service being completely replaced by digital systems where editorial staff have direct access to electronic data and records.^[36] Other service sectors, however, such as health, legal information, and voluntary agencies have witnessed a proliferation of small library and information units as the importance of information has come to be acknowledged in, for example, medium-sized law firms and headquarters of charities. More traditionally run library services, such as those in central government and professional and learned bodies, have typically contracted in size and been forced to change, but they have in the main retained their institutional integrity. Even in these cases, however, a constant theme—not unique to the United Kingdom—has been modernization: the challenge faced by specialist librarians to establish a new role for themselves and their libraries in the face of constant organizational and technical change. Consequently, most special libraries in the United Kingdom now transparently operate in a "hybrid" library environment, coupling traditional elements of document based provision—needs assessment; current awareness; collection management; enquiry work—with an increasing focus on the creation, organization, and accessing of digital resources and the "digital consumer." As their parent organizations inexorably move toward an integrated digital environment it seems likely that the specialist information professionals of the future will gradually supplant their traditional "intermediary" role with a broader remit for organizational information resources, encompassing new functions such as internal records management, digital archiving, information auditing, and knowledge capture. Whether or not this new aggregation of professional work—variously labeled "information"; "knowledge" or "records" management—will result in the salvation or the demise of the special library, remains, of course, to be seen.

THE U.K. LIBRARY AND INFORMATION PROFESSIONS

The Workforce

According to the most authoritative current estimate, the total U.K. library and information workforce comprises

61,230 employees as at mid-2005.^[44] Fifty-eight percent of these employees are estimated to be female, 42% male; 52% work full-time, 48% part-time. These figures include 21,691 full-time equivalent posts in public libraries, 9470 in academic and school libraries, and 2252 in the British Library and other national libraries. In public libraries an estimated 23% of posts are of professional level; in academic libraries the proportion is a predictably higher one of 34% and in national libraries 41%. Recent trends indicate a marked decline by 5% since the year 2000 of professional posts in public libraries; however, this is counterbalanced by a similar rise in the professionalized workforce in academic libraries. The extent of professionalization in the wider information sector—business, industrial, voluntary, and other specialized information services is unclear. However, CILIP (see below) in 2003 reported 1737 members working in industry and commerce; 746 in medicine and health; 1066 in specialist government libraries; and 288 as independent consultants.^[45] This amounts to a total of approximately 4000 members, or 25% of the institute's membership.

CILIP

CILIP, the Chartered Institute of Information and Library Professionals, is the main U.K. body representing this librarianship and information science (LIS) workforce. CILIP was inaugurated only relatively recently on April 1, 2002 as the result of a merger between the former Library Association and the Institute of Information Scientists. It is governed on democratic principles with an elected President and Council of Trustees, although in practice the permanent Chief Executive (currently Bob McKee) is perhaps the most influential figure in its management and strategic direction. CILIP is organized into 12 regional branches including CILIP in Scotland (Slainte), Wales, and Ireland—entities which effectively superseded partly autonomous library associations there. Its membership currently stands at 21,000^[46] and is drawn almost equally from public libraries (24%) academic and school libraries (24%) and specialist information services (25%); the remainder comprising members in national libraries (3%) and overseas, retired, and student members.^[45] The main level of membership within the Institute is that of chartered member (MCLIP) which is the basic professional credential in U.K. information work. Through CILIP's recently approved Framework of Qualifications this is now complemented by the award of fellow (FCLIP) for excellence in professional achievement and certified affiliate (ACLIP), an award which accredits achievement and experience among paraprofessional workers.

In addition to these core membership functions, CILIP undertakes a very wide range of activities which belie its relatively small size and resources. As well as the aforementioned regional branches, the Institute supports 29 specialist interest groups which range across the spectra

of library and information science and management, and many of these groups sponsor world class journals, conferences, and professional training. CILIP maintains a publishing arm (Facet Publications) which produces leading research monographs, textbooks, and handbooks. It also publishes *Library and Information Update*, the key monthly newsletter and review of the U.K. library and information community and it organizes a regular program of training, conferences, and professional development events. CILIP's work in policy and advocacy (see also below) is also becoming increasingly important, focusing currently on aspects of information society policy such as copyright and legal matters; social inclusion; information literacy; equal opportunities; and economic development. Some of this policy work can be seen to be of international significance: CILIP's *Ethical Principles and Code of Professional Practice*, for example, serving as a model for many LIS organizations worldwide. International work more generally continues through CILIP's numerous links with IFLA and its efforts to bring an LIS professional influence to bear on global informational developments, for example through input to the UNESCO World Summit on the Information Society.

History of the Library and Information Professions

The professionalization of library and information work in the United Kingdom is linked to the establishment and evolution of a number of professional groupings in the century between 1870 and 1970. Although most of these groupings are now unified under the umbrella of CILIP, this has not always been the case. The largest and most important of these, the Library Association (LA), was founded in 1877, one year after its American equivalent and arguably as a direct consequence of the impact of the latter's inaugural meeting. Although the LA's initial objectives were impressively broad—"to unite all persons engaged in or interested in library work for the purpose of promoting the best possible administration of existing libraries and the formation of new ones where desirable"—during its first 50 years the association proved itself rather exclusive. True, it was in 1898 granted a Royal Charter and the right to award professional qualifications. By 1899 it had also created what proved to be the seminal journal in early twentieth century librarianship—the *Library Association Record*. However, its leaders—initially until 1895 a group of eminent bookmen and bibliographers, and after that a succession of leading public librarians such as Duff Brown, Jast, and Berwick Sayers—were arguably overly concerned with status, professional standards, and policy lobbying. Membership matters were certainly neglected. Little was done to encourage the bulk of library staff—library assistants—to support the association; they formed a separate Library Assistants' Association (LAA) in 1895. Moreover, the perceived public

library bias of the LA deterred potential members in universities and special libraries. By 1928 membership stood at a disappointing 897 members, a situation which set limits on both the influence and range of activities of the association.^[47]

During the 1930s, however, reforms largely associated with Ernest A. Savage (Hon. Secretary of the LA, 1928–1934) and Lionel R. McColvin (Hon. Secretary 1934–51) expanded both the LA's membership base and its range of professional activities. The Association of Assistant Librarians (formerly the LAA) became a section of the LA in 1930 and some formerly independent regional groupings became branches. A logically planned structure of specialist interest sections and regional branches was established. Money was obtained from the Carnegie United Kingdom Trust and the Rockefeller Foundation to establish a professionally staffed headquarters and information service. A public profile, typified by the inauguration of awards like the Carnegie Medal for Children's Literature in 1936, was established. By 1939, membership had risen to over 6000 and although World War II brought a pause, expansion resumed in the 1950s and 1960s. The establishment of permanent schools of librarianship in Colleges of Advanced Education and later universities, together with the reform and streamlining of the LA's own associateship regulations and examinations, ensured a steady supply of new members. The proliferation of public, academic, and public sector specialist libraries, in what would prove to be the heyday of the British welfare state, provided ready employment for them. By 1965, LA membership exceeded 15,000; by 1980, 3 years after its centenary year, it had reached 25,000, its historic peak.^[48] By this time the LA had become a sophisticated, multifaceted modern bureaucracy which, despite periodic complaints of members, operated effectively and by and large on democratic lines. Its range of functions—course accreditation; conferences; training; publishing; professional advice; international work; policy development and lobbying; continuing professional development—typified those of a progressive professional body. Most would be familiar to observers of post-2002 CILIP.

Despite these advances, the impression (some would argue misplaced) that the LA was, at root, a public library association continued to persist. Although academic and school librarians did join in increasing numbers after 1950, and although specialist LA interest groups were formed, these specialisms in the end found it necessary to organize professionally outside the association in the guise of the School Library Association (formed in 1937) and SCONUL (formed in 1956—see the sections on School Libraries and Academic Libraries). More importantly still, despite the creation of successive Reference, Special and Information Sections from the 1950s onward, the LA continued to find it difficult to recruit members from industrial, technical, and commercial libraries. In part this was due to the continuing growth of ASLIB (see section

“Special Libraries”), which despite its corporate membership structure in effect functioned very much as a professional forum for these librarians until the 1970s. In part also, this schism was based on the developing contention in the 1940s and 1950s that “documentation” and, more latterly, “information science” was a distinct and arguably more sophisticated occupation than librarianship. Such ideas were to result in 1958 in the foundation of the U.K. Institute of Information Scientists (IIS) by a group of scientific and industrial information officers led by Jason Farradane, a Scientific Information Officer then employed by the Tate and Lyle Sugar Company. Led by Farradane (who moved on to an academic career) the Institute successfully sponsored the development of a number of degree courses in Information Science in the late 1960s and 1970s. This academic ethos subsequently attracted a good number of intellectuals and researchers in information related fields to its ranks, ensuring that it attained a certain prestige and influence, especially in professional education and publication (see also below). It never, however, became a mass membership association, even after the perceived expansion of information work as an occupation in the 1980s. In 1970 it had 750 members;^[40] at its dissolution in 2002 this figure was 2200.^[49]

Since 1980, the steady growth of the U.K. library and information profession has given way to a more turbulent environment associated with the so-called “information revolution.” Although some commentators conjectured that librarianship would prosper in emerging information-work employment markets, it quickly became apparent that the challenges of a shifting “postprofessional” information landscape potentially outweighed the benefits. Some traditional librarianship tasks, and posts, were rendered obsolete by technical change. Cutbacks in (especially professional) posts in the U.K. public sector, especially during the tenure of the Conservative government of 1979–1997, eroded the LA's core employee base; moreover some employers in public and academic libraries began to question the need for professional librarianship credentials and “open up” library posts to applicants with generic IT; management, and business skills. In specialist and commercial fields, new competitors (computer professionals; systems specialists; information and knowledge managers) emerged to claim that they, and not librarians or information scientists, were experts in the handling of information. As a result of these pressures, LA membership fell into gentle, although not catastrophic, decline; IIS membership stalled, failing to grasp the potential (as some saw it) of the proliferation of “information” work.

The U.K. library and information profession's response to this was, as we have seen above, one of rationalization, merger, and the formation of CILIP in 2002. Such a merger had been mooted since the mid-1980s by influential establishment figures such as Wilfred Saunders, who in his *Towards a Unified Professional Organisation for Library and Information Science and Services* (1989)

argued for a federation of the LA, the IIS, and ASLIB as the most effective strategy of competing in the new professional environment. Most commentators, and indeed association members, accepted such rationalization as sensible and inevitable, although in the event ASLIB remained outside the arrangement, pursuing a path of corporate consultancy, publication and training and commercial governance (see section “Special Libraries”). In the 6 years since its creation CILIP, as we have seen, has undoubtedly consolidated its respected public profile as the United Kingdom’s leading information work (as opposed to information technology) professional grouping, although its influence with government, and more especially the private sector, remains uneven. Tensions, too, persist between its disparate occupational sections and, perhaps more significantly, between its professional traditions of rigorous accreditation and occupational control and the need now to compete for members in a fluid and deregulated neo-liberal occupational environment. The ability of CILIP to successfully resolve some of these issues will, to a large degree, determine the nature and extent of professionalization in the United Kingdom library and information workforce in the decades to come.

LIBRARIANSHIP AND INFORMATION SCIENCE— EDUCATION, TRAINING, AND RESEARCH

Closely linked to the evolution of U.K. professional associations was the development of training and education for the nascent U.K. library occupations. Between 1898, when it received its Royal Charter, and 1939, the LA laid down and incrementally improved an examination system linked to a register of professional members. This established the basic standards and structure of professional librarianship in the United Kingdom, comprising “associates” and “fellows” who were both classed as chartered LA members. Students prepared themselves for these examinations through a mixture of part-time classes, summer schools, and a correspondence course operated from the 1920s onward by the Library Assistants’ Association. Examination syllabi consisted largely of “practical” topics: library administration; bibliography; cataloging, and classification, but knowledge of (initially) English literature was tested. (Eventually this was replaced by a paper allowing candidates to specialize in a choice of “information sources” options.) University College London School of Librarianship, founded in 1919, constituted the one exception to this professional monopoly of library education: by the 1930s, under its charismatic head E. A. Baker, it offered a 2 year diploma and 1 year postgraduate course as an alternative to LA examinations. Both of these were broader in scope and more critical and theoretical than the LA scheme.

By 1945, however, it had become clear that the prewar system of professional preparation was inadequate in

meeting the needs of an expanding labor market: although the LA had 6510 members by then only 1617 of these were qualified/chartered.^[50] Consequently, in the wake of recommendations in the McColvin Report, the United Kingdom finally embarked upon establishing a national system of library education based in universities and colleges. At first, between 1945 and 1955, schools of librarianship were created in nine technical and commercial colleges in major British cities; these schools prepared students for a reformed LA diploma, and after 1966 for degrees awarded by the Council for National Academic Awards (CNAA). In the 1960s, they were joined by six university departments offering degrees and postgraduate diplomas validated and examined internally. Traditional LA examinations continued throughout this time, but they gradually diminished in popularity and were discontinued in 1985. The LA, by now joined by the IIS, gradually became in effect an accrediting body for courses rather than an examining body. However, in membership terms it reaped the reward of this expanded system: by 1972 its chartered members numbered 12,988.^[50] By 1980, the first edition of the student guide *Which Library School* listed 16 U.K. schools of library and information studies providing 24 undergraduate degrees and 17 postgraduate diplomas and masters’ awards. Librarians and information scientists were finally becoming a graduate profession.

One major consequence of this expanded system of training and education was blossoming in the United Kingdom of the academic disciplines of librarianship and, a little later, information science. Before 1939, theoretical writing and research activities in the library and documentation fields had been limited to intellectual “scholar” librarians such as Duff Brown; Jast; Baker, and Bradford. However, with the advent in the 1950s and 1960s of full-time professional employment in library education, the main dimensions of a British interpretation of both librarianship and information science began to be laid down. Raymond Irwin, head of the UCL school, set out the main features of U.K. “librarianship” (which he contrasted to U.S. “library science”) in his *Librarianship: Essays in Applied Bibliography* (1949); Bradford did the same in his *Documentation* (1948). Gradually, in the 1950s and 1960s, an accepted “core” librarianship curriculum emerged comprising applied bibliography; cataloging and indexing; library management; libraries in society: a subject structure reflected in the revised Library Association examination syllabus of 1964. Farradane, Saunders, Vickery, and other information scientists developed an “information science” variant of this in the late 1960s and 1970s, codified in the *Criteria for Courses in Information Science* approved by the IIS. Academic journals, such as the *Journal of Documentation* (established 1945) and the *Journal of Librarianship* (1969), further underpinned these developing disciplines and in the 1960s LIS education began to be supplemented by consistent and professional research activity in the field. Some schools of LIS,

such as the postgraduate school at Sheffield and the large department at the Polytechnic of North London developed a major research focus, although they never attained a monopoly of LIS research: important centers elsewhere in the professional LIS community, such as the ASLIB Research Department, saw to that. Nevertheless, research in the field had become sufficiently legitimized for funding to be provided between 1964 and 1973 by the U.K. government Office of Scientific and Technical Information (OSTI) and after that, with an expanded remit, by the British Library Research and Development Department (BLRDD). The era of the BLRDD (1974–1999), a government agency with dedicated research funding for libraries, had few parallels elsewhere. In 1975–1976, its most generously funded year, BLRDD distributed £1.1 million in LIS research funding and, although its inflation adjusted grant declined after that, it still accounted for 46% of total LIS research funding in 1985. It supported a very wide range of projects ranging from information storage and retrieval through to public, academic, and school libraries and professional education itself. Overall, between 1975 and 1988 BLRDD funded 712 LIS research projects, 29% of them based in schools of LIS.^[51] This represented arguably a golden age in U.K. LIS research.

By 1980, LIS and its associated education and training programs in the United Kingdom arguably constituted a classic public service formation—comprising the state as educator and main employer; the professional bodies and the academy. Over the next 25 years, however, the “information revolution,” in tandem with the contraction of the British welfare state, would herald major change, creating a less uniform, more flexible, and disorganized educational system which some would argue marks the beginnings of decline. Core LIS curricula laid down in the 1960s and 1970s have been superseded by a range of information-related courses, beginning in the late 1980s with “information studies” programs and subsequently shifting in the 1990s to “information management” curricula constructed around new management studies approaches to information resource management (IRM). More latterly, a good number of LIS schools have experimented (not totally successfully) with fashionable “niche” offerings such as Knowledge Management; Health Informatics; Web Information Management; and so on. Flexible modes of study such as distance and “blended” learning have also become popular: Aberystwyth University and Robert Gordon University, Aberdeen currently offering successful distance degree programs. (CILIP provides a list of currently accredited courses).^[52] An alternative mechanism for demonstrating professional competence (and route to CILIP membership) has also been created through the establishment of a state regulated National Vocational Qualification (NVQ) in Information and Library Work—a program which ironically echoes much of the apprenticeship culture dominant in U.K. librarianship before the “academic drift” of the

1960s. CILIP, and most of the U.K. LIS community, have welcomed these developments, pointing to the expansion of LIS into new fields such as knowledge management and its responsiveness to a flexible, postindustrial labor market. However, these changes have also been accompanied by institutional retrenchment in the schools and departments of LIS. Undergraduate degrees in librarianship and information science have declined in popularity—only 13 of these were offered in 2007 compared with 24 in 2000.^[53] Library schools themselves have been forced to cut back their staff numbers, and the majority, especially those in the new universities (former “polytechnics”), have lost their autonomy being absorbed into computing, information technology or business schools and faculties. Two universities, Queen’s University Belfast and Birmingham City University (formerly Birmingham Polytechnic), no longer offer accredited courses in LIS.

The permanent impact of these developments on the future of the LIS disciplines in the United Kingdom is still uncertain. On the positive side, however, it is clear over the last decade that, despite the retrenchments noted above, and despite the final demise of BLRDD in 1999, research in the LIS field has recovered and in some areas flourished. British Library Research and Development Department has been replaced by a multiplicity of research funders—the European Commission (which made 89 awards in 2003); the U.K. Joint Information Systems Committee (74); the Arts and Humanities Research Council (AHRC) (31); and the Museums Libraries and Archives Council (10) being the largest sources of support.^[54] This devolution of funding has undoubtedly resulted in a broadening of the scope of research compared with the BLRDD era: LIS research has more or less effectively expanded into fields such as information policy; European research; information resource management; and information and library history. Moreover, the interest of some new funders in supporting highly applied, developmental, “evidence-based” and contract-driven projects has cemented the involvement in the field of research consultancies such as Electronic Publishing Services Ltd; TFPL; TALIS; and Information Management Associates.

Despite this competition, most academic schools of LIS have managed to expand their research activities. Research “centers,” such as CERLIM at Manchester Metropolitan University and CIBER at City University (more recently UCL) have fostered research cultures and focused research interests, and the majority of LIS schools have increased their throughput of doctoral students. Librarianship and information science departments have also taken the lion’s share of “academic” research funding allocated to the discipline by the AHRC. Most important, however, has been the impact of the Higher Education Funding Council’s Research Assessment Exercise (RAE), a periodic review of research performance in U.K. universities which began in 1992 and was repeated in 1996, 2001, and 2007. (See Nicholas^[54] for the 2001 RAE tables and

ratings of schools and departments. The 2007 Research Assessment Exercise is still underway at the time of writing this entry, July 2008). Library and Information Management effectively established itself as a separate “unit of assessment” for these exercises, and this has enabled research intensive schools (such as those at Sheffield University, Loughborough University, and City University—all awarded a top 5 or 5* rating in 2001) together with groupings of successful LIS researchers elsewhere to showcase their activities in the eyes of their parent institutions, the wider academic community and the funding bodies. In this way, visibly successful research has, over the last 10 years, to some degree compensated for the problems faced by U.K. schools of LIS with issues such as curriculum offerings, student recruitment, and institutional restructuring. Whether or not LIS researchers and academics will be able to consolidate this position—and maintain library and information science as a distinct “discipline” in British universities in the twenty-first century—will depend not only on the quality of their research and teaching but, ultimately, upon the future resilience (and influence) of the U.K. library and information community itself.

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United Kingdom: Museums and Museology

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Abstract

This entry attempts to capture the rich diversity of museums in the United Kingdom. Following a discussion of the evolution of British museums in their historical context from the private collecting through the profound impact of global exploration the authors examine major changes in the museum sector in the latter part of the twentieth century. Because discussion on types of museum organized according to discipline is rendered problematic by the frequent occurrence of multidisciplinary in U.K. collections, this entry uses a framework of organization and funding to identify seven types of institutions: 1) national; 2) university; 3) armed services; 4) local authority; 5) independent; 6) English Heritage; 7) the National Trust; and 8) the living collections of zoos and botanical gardens.

INTRODUCTION

The museums scene in the United Kingdom has been described as “fascinatingly variegated” and “idiosyncratic,” a state of affairs resulting from a history of perpetual development linked to an engagement with shifting social needs but without a strategic framework.^[1] This entry attempts to capture this arguably unique diversity, first locating the museums of the United Kingdom in their historical context—from the private collecting for founding collections that enabled their establishment in the country, through the profound impact of global exploration, trade and empire, the significance of national societies and local literary and philosophical societies, and the effects of the Museums Act (1845) and other Acts of Parliament in the mid-1800s, to the major changes in the sector in the latter part of the twentieth century.

An overview of museum provision is then presented. Discussion on types of museum organized according to discipline is rendered problematic by the frequent occurrence of multidisciplinary in U.K. collections, thus they are articulated here according to frameworks of organization and funding—national, university, armed services, local authority, and independent—with additional classifications for English Heritage, the arguably statutorily anomalous National Trust, and the living collections of zoos and botanical gardens. The record reveals that the United Kingdom was in the vanguard of public museum provision, but as understanding of the factors that lead to *effective* provision has advanced, so the significance of the integrated museum profession, and the mix of skills, knowledge, and attitudes of those engaged in museum work, has become clear. An outline of the museum workforce and museum work follows, together with a brief

account of the professional associations, specialist groups and museum training courses that underpin them.

Currently, the museums of the United Kingdom are seen as a public service, redefined and moved beyond their traditional cultural role into coordinates for change in society. They have undergone a remarkable renaissance over recent years with important funding strands coming online, but the sector is still seen as fragile and a formal national structure, anchoring museums’ support within government, remains a cultural policy challenge.

A BRIEF HISTORY OF MUSEUMS IN THE UNITED KINGDOM

The history of U.K. museums has been exceptionally well-documented, with publications devoted to the histories of individual national museums,^[2] individual provincial museums,^[3] regional museum provision,^[4] and university collections.^[5] Early phases of collecting have been described by MacGregor^[6] and Hunter,^[7] amongst others. Academics have also addressed issues such as the history of museum architecture,^[8] collecting,^[9,10] and exhibitions.^[11,12] Although Alexander^[13] provides interesting insights on museum development in the United Kingdom, arguably the most comprehensive account has been provided by Lewis;^[14] much of the following is based on this.

Early private collections were formed in Britain in the early seventeenth century. Sir Robert Cotton (1571–1631), best known for his library, also collected coins, medals, and antiquities, and his friend Sir Walter Cope (d. 1614) traveled widely and amassed a variety of natural and cultural objects. John Tradescant I (1570–1638) knew Cope and had seen his museum, and it may be that the nature of

"Tradescant's Ark" at Lambeth, London was influenced by Cope's collection. Tradescant visited mainland Europe, Norway, and Algiers and used his contacts to develop his museum; when he died his son John II (1608–1662) took over the collection, adding to it during three visits to Virginia. In 1656, a catalog of the collection—*Museum Tradescantianum*—was published, "the first recorded use of the word 'museum' in England in its currently accepted form."^[15] The collection eventually passed to Elias Ashmole (1617–1692), who in turn gave it to Oxford University; the building which housed the collection in Oxford, with its associated laboratory and teaching facilities, eventually became known as the Ashmolean Museum.^[16]

Although the Tradescants are well known, there were rivals to the "Ark," including the museum belonging to Robert Hubert (Forges) near St. Paul's; Hubert was an entrepreneur, inviting the nobility and academics to see his collections, so giving them additional status. He created special exhibitions, held private views and could give guided tours in four languages. Other collectors from the same period include John Bargrave (1610–1680) and Sir James Balfour (1600–1657). Later in the century, collectors such as James Petiver (1663–1718) were beginning to take a different approach to their collections, publishing catalogs of them, and actively promoting scientific and rational collecting. Petiver's collections were acquired by Sir Hans Sloane (1660–1753), whose museum became the foundation of the British Museum.

The Enlightenment witnessed the creation of an international scientific network. Diderot (1713–1784) produced his *Encyclopedie* (1751–1777); people began to question the nature of fossils and geological time, Lamarck (1744–1829) and Erasmus Darwin (1731–1802) pondered the nature of evolution. There was a growing interest in other cultures and in world geography and from about 1750 there was new emphasis on aesthetics, sentiment, and common virtues which were expressed in poetry, fashion, and art. There was increasing access to information and free speech, and above all the use of reason to understand the world. These changes had a profound effect on collecting and the establishment of museums in Britain and elsewhere in Europe. At the forefront were national societies, especially the Royal Society (founded 1660), but local societies such as the Manchester Literary and Philosophical Society (1781), the Birmingham Lunar Society (1766), and the Philosophical Society of Edinburgh (1732), all developed major collections. The end result of this intellectual activity was the establishment of the first public museums—for example in Britain the Ashmolean Museum (1683), the Sedgwick Museum, Cambridge (1728), and the British Museum (1759). Meanwhile the private museums developed by Sir Ashton Lever (1774) and William Bullock (1795) were also extremely popular with the public, using novel methods of display such as habitat groups of animals.

The nineteenth century was a time of massive social change, a drift to urban living began, as did the generation of wealth which allowed some people a degree of leisure time. It was a time of educational reforms and the founding of learned organizations such as the Belfast Natural History Society (1821), Leeds Literary and Philosophical Society (1821), Manchester Natural History Society (1821), and the Newcastle upon Tyne Literary and Philosophical Society (1793). Brears and Davies^[4] have discussed the significance of the Literary and Philosophical Societies in the formation of provincial museums in Britain. Other bodies played a vital role in promoting local museum collections which were made accessible to the public—especially Naturalists' Field Clubs and Mechanics Institutes. The former encouraged active field work, the formation of local collections, and the dissemination of knowledge in local specialist journals.

Urbanization and industrialization created cities of great economic strength and power; they were frequently centers of trade with the rest of the world, at a time when Britain was developing its Empire and exploring all corners of the world. Cities such as Liverpool, Bristol, Glasgow, and Newcastle had access to new cultures, new environments. The combination of growing wealth, civic pride, and fashionable learned societies, aided by the Victorian ethic for self-improvement, led to collection-building on a grand scale. Many of Britain's great museum buildings were established at this time, including the British Museum (1823), the National Gallery (1838), the Fitzwilliam Museum, Cambridge (1816), and the Hunterian Museum, Glasgow (1807).

Many of the collections formed by the learned societies and private individuals were transferred to local governmental authorities following the passing of the Museums Act in 1845 which enabled local authorities to levy a 1/2 penny rate if the population exceeded 10,000. Lewis^[17] notes the museums were to be provided "for instruction and recreation." Sunderland Museum is notable as the first ever municipal museum (1846), its founding collections made by a late eighteenth-century scientific society; Canterbury (1847) and Warrington (1848) followed, again utilizing collections made by local learned societies. Other Acts of Parliament followed, including the Public Libraries and Museums Acts of 1850 and 1855; from this time Libraries were mandatory functions of local authorities, whereas museums remained a discretionary service. The Acts had an immediate effect; by 1860 there were some 90 museums in Britain; when the British Association reported on museums in 1887 this figure had grown to 217.^[18] This growth in the number of municipal museums led to a call for increasing professionalism; consequently the Museums Association was inaugurated at York in June 1889 to represent not only curators but also representatives from museum committees. The educational potential of museums began to be more widely recognized about this time, with Liverpool organizing loan collections for use in schools from 1884.

Lewis^[19] regards the period between the two World Wars as a time of “reassessment and consolidation,” and describes in detail the various reports aided by the Carnegie United Kingdom Trust, the Museums Association and the Standing Commission on Museums and Galleries. The Miers Report (1929) is regarded as particularly influential in changing conventional practices in museums, encouraging them to relate more closely to their local communities, promote educational activities, and provide better training for museum staff. The years following World War II, a period of severe financial restraint, saw little investment in museums; despite this a survey of provincial museums carried out in 1963 recorded some 876 sites with collections and open to the public. The period up until 1975 was one of even more rapid growth and diversity in the museum sector; site museums, community involvement, industrial museums, interpretive centers, and an emphasis on the conservation of natural and cultural areas flourished against a backdrop of the growing environmental movement. New museums were opened, including the Museum of London and branch museums of the Science Museum in York and Bradford; by 1987 the Museums Association estimated that the total number of museums in the United Kingdom had reached 2131.

The latter part of the twentieth century witnessed major changes in the museums sector in the United Kingdom. Concerns about minimum professional standards led to the Museum Association’s “Accreditation” guidelines, and then to the Museum and Galleries Commission’s “Registration” scheme. Museums entered the digital age, with the initial emphasis being on the ways new technologies could assist with collections documentation; support and the setting of documentation standards was aided by the Museums Documentation Association from 1977. Arguably the main impact on museums from the 1980s onwards was reduced levels of government funding; in order to deal with financial strictures museums had either to cut costs—usually through voluntary and forced redundancies or reductions in activities—or seek new ways of raising money. Museums increasingly had to demonstrate they were using funds wisely; such accountability also meant a significant change in the staff structures of museums as specialist curatorial posts were reduced to make way for marketing and promotional staff or those delivering public oriented projects. There were major changes in management style in museums as they became more business oriented; strategic planning, marketing, corporate sponsorship, business development, and project planning became techniques employed by all museums. Priorities were re-assessed and financial targets considered against the growing demands on museums to not only conserve the nation’s heritage but also to play a major social role, contributing to education, the economy, and quality of life. These multiple pressures on museums have continued to grow in the twenty-first century and are discussed further below.

MUSEUM PROVISION IN THE UNITED KINGDOM: MUSEUM TYPES

The distinctiveness of museums in the United Kingdom can be observed in terms of their disciplinarity and frequently their multidisciplinarity, but also in the ways they are organized and funded.^[20] Although there is merit in describing the U.K. museum scene by focusing on the museums’ *raison d’être*—their collections, their arguably unparalleled diversity makes such classification problematic. The scene, comprising some 2500 museums,^[21] can be more usefully articulated through an engagement with governance. Through this, they can be categorized into five main groupings, namely national, university, armed services, local authority, and independent, with an additional classification for those museums owned and managed by the National Trust and by English Heritage. The Museums and Galleries Commission’s DOMUS database categorized museums in this way.^[22] Differentiated by exhibiting living objects (examples of natural history)^[23] but sharing many common features in performing scientific, educational and recreational roles, zoos, botanical gardens, and aquaria are *forms* of museum^[24] and are included here.

National Museums

In the United Kingdom, there is no statutory definition of National Museums, their authority residing in miscellaneous acts, charters, and Treasury minutes.^[25] However, those institutions recognized as such can be defined in practice by their direct or core government funding, their administration by Boards of Trustees on the nation’s behalf, and the national significance of their collections.^[26] The Museums, Libraries and Archives Council’s *List of Museums with Full Registration or Accreditation: July 2008* records a total of 53 individual museums within its National Museums section.

The National Museums are based in London, Liverpool, Edinburgh, Cardiff, and Belfast, and most have branches in other cities or operate from several sites. The British Museum in London, established by an Act of Parliament in 1753 around a collection bequeathed by the physician, naturalist, and collector Sir Hans Sloane, is the oldest and largest. Other prominent London Nationals include the Victoria and Albert Museum (art and design), the Natural History Museum, and the Science Museum, all arrayed on a tract of land established in South Kensington as a cultural and educational district after the Great Exhibition of 1851. The National Gallery, housing one of the world’s greatest collections of Western European paintings, and the Tate, a family of four galleries (two in London) holding British Art from 1500 and international modern art, complete the “big six” of the 13 based in the capital. On Merseyside, National Museums Liverpool is a

varied grouping of eight museums made public following the abolition of Merseyside County Council in 1986. Amgueddfa Cymru/National Museum Wales is a network of seven museums, with the National Museum Cardiff, opened to the public in 1927, at its heart. In Scotland, the National Galleries of Scotland has branches in Edinburgh, while National Museums Scotland operates sites both within the capital and further south near Dumfries (National Museum of Costume) and in East Kilbride (Museum of Rural Life). More recently, the National Museums and Galleries of Northern Ireland was established under the Museums and Galleries (Northern Ireland) Order of 1998.

Between them, the National Museums receive approximately 35 million visits a year (figures for 2005/6 from a National Museums Directors' Conference brief after Department for Culture Media and Sport data, see the National Museums Directors' Conference),^[27] and in 2005–2006 were allocated some £300 million in grants-in-aid with just over £22 million capital grants-in-aid from central government.^[28] Income is also generated by the National Lottery, donations and sponsorship, and trading. The overall economic impact of the National Museums is hugely significant, at approximately £1.5 billion per annum.^[29]

University Museums

The genealogy of museums in the United Kingdom is intimately linked to its universities.^[30] The oldest public museum in the country, and arguably the world, is the Ashmolean Museum of the University of Oxford. Its founding collections, based on the miscellaneous curiosities of the Tradescant Ark (see history section above), emerged in the public domain within a purpose-built museum in 1683. Other donations to higher education institutions were recorded much earlier, but the subsequent development of systematic collections in scientific disciplines facilitated the emergence of several great teaching and research museums.^[30] Cambridge University, for example, developed a substantial new museum of geology, zoology, and archaeology. The Sedgwick Museum was founded by the bequest of Dr John Woodward (1665–1728) on his death in 1728. In 1842 Woodward's collection (then the "Woodwardian Museum," comprising four cabinets of minerals, rocks and fossils), was moved to the new Cockerell building, its first permanent home. After the extensive collecting of Professor Adam Sedgwick (1785–1873), the Museum moved again in 1904 to the present Sedgwick Museum building (for more on the founding collection, see Price).^[31] Elsewhere, Glasgow University was bequeathed the anatomical collection of John Hunter and opened the Hunterian Museum (1807), while Owens College (later Manchester University) took over the long-established collections of the local Natural History Society to create

the Manchester Museum (1888). Numerous other smaller departmental collections also emerged.

The importance of the major university museums is signaled today by the Department for Culture, Media, and Sport (DCMS) identification of their collections as being of national or international significance ("Designation"); there are currently around 400 higher education museums, galleries and collections, together comprising 4% of the United Kingdom's museum sector,^[32] but they are keepers of 30% of all Designated collections in the country.^[32] Along with the Ashmolean, the Sedgwick, and the Manchester Museums, other holders of Designated collections include the Fitzwilliam Museum (Cambridge University) together with the more constrained but comparable institutions of the Whitworth Art Gallery (Manchester University), the Courtauld Institute Gallery (University of London), the Barber Institute of Fine Arts and the Lapworth Museum (Birmingham University), and the Pitt Rivers Museum and the Museum of Natural History at Oxford University. These great institutions are among the hundred or so higher education museums open on a regular basis, and among the 38 that receive core funding from the Arts and Humanities Research Council (AHRC) in England and the Scottish Higher Education Funding Council (SHEFC).^[32] The AHRC/SHEFC-funded museums deliver beyond their traditional commitment to academic audiences, maintaining a range of public services, education, and exhibition programs comparable to those of regional and national museums. Attracting some 2 million visitors a year (2002 figures), they have a good track record of wider social engagement, and thus are increasingly important in advancing the cultural contribution of their parent institutions. The vast majority of higher education museums, galleries and collections, however, are little known. Buried within their departments and institutions, they "are solely dependent on the very modest resources available to them from higher education teaching and research budgets, generally under the auspices of their academic department."^[30] According to a recent report, many have deteriorating physical infrastructure, and are suffering from decreasing revenue funding and a consequent erosion of their intellectual and heritage capital.^[33]

Armed Services Museums

A third category of museums that are mainly or partly funded by central government is that of the approximately 200 museums of the armed services.^[34] The long and rich tradition of the British armed forces (the Royal Navy has been extant for 450 years, the British Army's history spans over three centuries, and the Royal Air Force has been in operation since 1918), and particularly the stable units of the army with set depots in which historical artefacts could accumulate and the strong county connection of the regiments, account for this unusually high number of

museums dealing with some aspect of military history or containing military collections.^[35] Of these military museums, four Nationals have a direct armed services remit: the National Army Museum, the Royal Air Force Museum, the Imperial War Museum, and the National War Museum of Scotland (part of National Museums Scotland).

The National Army Museum, established by Royal Charter in 1960 and now sited in Chelsea, is a repository of the history and heritage of the Regular and Auxiliary forces of the British Army and of the Commonwealth. Through its collections of uniforms, weapons, medals, paintings, drawings, archives, and transport, a narrative from Agincourt in the early fifteenth century to peace-keeping in the twenty-first is presented. The Museum also has a role “supporting the Defence Purpose through its contribution to the Army’s image in society; to the remembrance of those who have served, and to the education of Servicemen and Servicewomen,”^[36] and is committed to broader societal learning output. The Royal Air Force Museum was founded 3 years later, with collections held in Hendon (London) and at its outstation in Cosford, Shropshire comprising materials recording the history of the Royal Air Force and its relationship with aviation generally. It was World War I, however, that stimulated the formation of an all-service national museum dedicated to all aspects of armed conflicts involving Britain and the Commonwealth since 1914. The Imperial War Museum’s original intent to comprehensively record and commemorate the Great War effected an encyclopedic coverage of that conflict, but its terms of reference were soon extended, initially to World War II and then to British military actions up to the present day. In Scotland, the National War Museum (formerly the Scottish United Services Museum) sited in Edinburgh Castle also has the combined services in its mandate (albeit within the Scottish context) and was created in 1930 to commemorate the sacrifice made by Scotland in World War I.^[37] Portrayal of the Royal Navy is not undertaken by a single museum, “its essential story being told by the National Maritime Museum and the four designated but non-national museums: The Royal Navy Museum Portsmouth, The Royal Marines Museum in Southsea, The Royal Navy Submarine Museum in Gosport, [and] The Fleet Air Arm Museum in Yeovilton.”^[38]

Other Nationals, namely the Royal Armouries (1680s) and the Science Museum (1857), have collections related to the history of defence, but “the depiction of war through museums exhibitions (in the United Kingdom) is most likely to be found in regimental museums”^[39] and those allied to the corps of the British Army. Over 130 exist,^[40] including strong regimental museum provision in Scotland and Wales, and five in Northern Ireland. (Those in Northern Ireland are: Royal Irish Fusiliers Regimental Museum, Armagh; Royal Ulster Rifles Museum, Belfast; North Irish Horse Regimental Collection [temporarily closed to the

public], Belfast; Royal Irish Regiment Museum, Ballymena [closed pending relocation]; Royal Inniskilling Fusiliers Regimental Museum, Enniskillen, see Army Museums).^[41] Formed not to present war per se, but “for the specific purpose of instilling and fostering in the regiment the *esprit de corps* which enables it to fight more effectively,”^[39] regimental museums have strong territorial links—regionalism and the military being a binary notion forged by King George III, “who first realized the importance of fostering regional loyalties and attitudes for soldiers serving together.”^[42] Despite the amalgamations of many regiments in the 1960s, longstanding local links have enabled many collections to be assimilated into local authority museums. Indeed, the Museums and Galleries Commission report of 1990 on armed services museums noted that nearly 40 were managed within local authority museums.^[43] Notable regimental and corps museums include those among the first to be formed (often museums of technology as well as military)—the Royal Artillery Regiment Museums in Woolwich (1778) and the Royal Engineers Museum in Chatham (1875) have collections based on the models and exhibits used at their training establishments—and the Tank Museum at Bovington.

Almost all regimental and corps museums are instituted as charitable trusts, most receive support from the Ministry of Defence (MOD) (grant-in-aid funding of about £4.8 million to the National Army Museum, and £4–5 million to 69 others, see Stephens)^[44] and just under half still occupy MOD property.^[45] Their development today is also aided to a considerable degree by the Army Museums Ogilby Trust, a charity set up in 1954 to assist the museums with funds, advocacy, information, and advice.

Local Authority Museums

Prior to any direct reference to local authority museums, some explication is pertinent of the rather arcane local government environment within which they operate. Indeed, a greatly-increased complexity has characterized this environment over the last decade, with devolved governments in Edinburgh, Cardiff, and Belfast adding a further layer of complication.^[46] Babbidge^[47] provides a good overview of the local authority sector in Britain and its interface with museums, but its structure can be briefly drawn here. The architecture of local government in the United Kingdom is, as noted, complex, its history one of gradual evolution and change since the Middle Ages. The historic counties, established in England for Norman administration and based on earlier Anglo-Saxon kingdoms and shires, however, acted as agencies of the state for several hundred years and continue to form (albeit with altered boundaries) the basis of modern local government. In Wales, Henry VIII (r.1509–1547) imposed an administrative structure on that country with the Act of Union (1536), and the names and boundaries remained virtually the same until reorganization in 1974. In Scotland, the

royal free burghs (a “burgh” is a Scots term for a town or municipality) were highly autonomous units of local government from the twelfth century, developing provision of basic services for local people until their abolition in 1975; current arrangements for Scotland and Wales, however, date from the mid-1990s with the creation of 32 all-purpose unitary councils in the former and 22 in the latter. The 1970s also ushered change in Northern Ireland, when the present pattern of local government with 26 councils was established. The single tier all-purpose council, also found in parts of England and including the City of London, 32 London Boroughs, 36 Metropolitan and 47 Shire Unitary, is responsible for all local authority functions. In 2000 a new Greater London Authority was created (directly-elected Mayor and separately elected Assembly) with responsibility for four functional bodies—the Metropolitan Police Authority, the London Fire and Emergency Planning Authority, Transport for London and the London Development Agency. The London Borough Councils, however, essentially perform the same functions as any single tier authority. The remainder of England has a two tier system, in which two separate councils divide responsibilities—county councils (the upper tier) are mandated core functions and district councils (the lower tier) deliver more local services. Across Britain, the bottom tier of local government comprises Town, Parish, and Community Councils.

Most councils (around 75% of the 442 first and second tier local authorities in Britain) operate some form of museum service (Babbidge describes how the councils use one, or a mix of some, or all, of the following means of provision: “193 (44%) make direct museum provision; around 25 have devolved management of their museum services to a specially-created charity; approximately 50 participate in joint arrangements with other local authorities; one-third core-fund independent museums, whether in their localities, or occasionally, outside their administrative areas”),^[48] although the museums under their (direct or indirect) authority vary considerably in size, quality, and importance. Many of the major regional museums were founded in the nineteenth century with encyclopedic collections (see history section above) and are housed in elegant civic buildings. Examples include museums and galleries at Birmingham and Bristol. Birmingham Museum and Art Gallery, opened in purpose-built accommodation by the Prince of Wales (later King Edward VII) in 1885, originally represented the desire of prominent citizens to improve manufacturing quality in the “City of a Thousand Trades” as well as to better the lot of the working man through exposure to art and natural history.^[49] It drew on contributions and donations from the Birmingham glass manufacturer Thomas Clarkson Osler, the great industrialist Richard Tangye, the glass-worker Thomas Collier Barnes, and the proprietor of the Birmingham Daily Post, John Feeny. Today, the institution’s collections cover fine and applied arts, archeology

and ethnography, natural history and social history. In Bristol, the City Museum and Art Gallery’s origins lie in the foundation of the Bristol Institution for the Advancement of Science and Art (1823) and the slightly older Bristol Literary and Philosophical Society, and it benefited from the donations of the tobacco baron Sir William Henry Wills (1830–1911). In Scotland, the first municipal authority to consider museum provision was Glasgow, and when the coachbuilder and art collector Archibald McLellan (1796–1854) bequeathed a collection of 400 paintings, the core of the city’s Old Master collection was laid down. Museum provision of other local authorities in Scotland around the time included Paisley (1870) and Dundee (1873), the latter founded on the collections of the Watt Institution.^[50]

Outwith the large conurbations a huge number of smaller, district authority museums perform an important and active role as “interpreters of local history, and as biological, geological and archaeological record centres,” all maintaining a commitment to local education and community service.^[51] The Central Museum at Southend on Sea, for example, covers geology, archeology, social and local history, local wildlife, and the industrial history of South East Essex.^[52] Smaller independent museums are also supported by many local authorities in whose areas they operate.

Local authorities form a significant museum provider in the United Kingdom, with the 22 largest local authority services attracting some 12 million visitors annually.^[53] Lawley^[53] notes that 40% of Registered museums in the United Kingdom are operated by local councils. Overall, however, regional provision is variable, a characteristic rooted in recent years in unreliable revenue funding, and historically in piecemeal development *sans* clear legislative frameworks.^[54] In England and Wales, the nature and extent of provision is articulated by the Public Libraries and Museums Act 1964, which gives county and district councils *discretionary* powers to “provide and maintain museums and art galleries within their administrative area or elsewhere in England and Wales and do all such things as are as necessary or expedient for or in connection with the provision and maintenance of those museums,” and in Scotland by the Local Government and Planning (Scotland) Act 1982 (as amended), which places upon local authorities a duty to “ensure that there is adequate provision of facilities for the inhabitants of their area for recreational, sporting, cultural, and social activities.”

A much stronger strategic and operational framework for museums and galleries in England was envisaged with the publication of the Resource report *Renaissance in the Regions* (2001). Produced by a task force convened at the behest of Chris Smith, then Secretary of State for Culture, Media, and Sport, to review the state of the nation’s network of regional museums, the report identified problems including inconsistent provision, sectoral fragmentation, and a failure to sustainably deliver government policy

(e.g. education, creativity, and social inclusion), and recommended a major redefinition of museum structural interfaces and cooperative practice. It proposed a transformational initiative that sought to make museums fit for the twenty-first century. With the uptake of Renaissance, years of under-investment have been reversed, with nearly £150 million allocated to regional museums between 2002 and 2008, and a new structure—"a 'hub' for each of the nine regions made up of a group of the largest museums, funded by central government and working together to improve museums across the whole region"^[55]—put in place. The achievements of Renaissance, however, have not reduced the vulnerability of nonstatutory services. In 2005/2006, council spending on museums and galleries in Britain amounted to just over £320 million, or 0.19% of total local authority net expenditure,^[56] and cuts and closures in London^[57] and a funding crisis in Wales, where "there is nothing like the investment of Renaissance,"^[58] remain major concerns.

Independent Museums

A substantial number of museums in the United Kingdom are managed outside the traditional frameworks of central or local government. In the nomenclature of recent years they are known as "independent" museums. Defined by the Association of Independent Museums (AIM) as having "a board of trustees or other policy making body which are not directly controlled by or the direct responsibility of any central government department or local or regional authority or similar political subdivision," they comprise museums with charitable status (and therefore within the public sector) and those that operate for commercial gain.^[59] Some have considerable public authority financial support, and others receive little or none.^[60] In 2000, there were thought to be approximately 1215 such museums in the United Kingdom, with around half of a specialist nature.^[61]

Although the majority have been created since the mid-1960s in a flurry of growth, the first generation of independent museums in the United Kingdom is arguably those with roots in the activities of societies, clubs, or other groups of interested people. As Cossons^[60] points out,

many of the great collections now held by public authorities, and some of the buildings that house them, have their origins in the activities of... societies, and gentlemen's clubs, which if they were still being run in this way today, would certainly place them in the category of independent museums.

Despite local authority accession of numerous collections and buildings, some societies' museums, such as that of the Sussex Archaeological Society at Lewes (1846), still exist in their original forms, and others retain an

independent identity with a governing body replete with society members.^[60] Overall, however, the decline of society museums—run as originally established—was effected by monetary constraints. Holding to principles of free admission, they were sustained by membership subscription and endowments, a funding pattern that collapsed after the first generation of members disappeared. Rising operating and care costs compounded the issue and necessitated a linkage with local authorities.^[62] Cossons^[62] notes that four decades ago it would have been a rational assumption that "these early society museums formed part of the transitional, formative phase of museum development in this country, a phase that had been superseded by a more formalized Local Authority based structure of museums" delivering a service to people in their locality. In the 1970s, however, shifts in public attitudes toward the material traditionally held in museums, increased affluence, leisure and mobility, a new popular awareness and sensitivity toward the environment and place, and a keenly felt need to record the changing industrial landscape coalesced and catalyzed a new breed of museum.

The independent museums that emerged swept away the "dull and dusty" image projected by local authority museums^[63] at the time and could be characterized by "a pioneering spirit, a can-do attitude and an innovative, entrepreneurial approach."^[64] Established by community or industry groups and covering areas previously generally unrepresented in the traditional museums milieu—industrial archeology, transport history, vernacular architecture, and building preservation (often *in situ*)—they operated as charitable trusts and raised their revenue from admission fees and commercial activities. As well as the world renowned Ironbridge, now a collection of 10 museums, they included the Weald and Downland Open Air Museum in West Sussex, the National Motor Museum at Beaulieu in Hampshire, the Bass Museum in Burton upon Trent (latterly the Coors Visitor Centre), and the Gladstone Working Pottery Museum in Stoke-on-Trent.^[63] Ironbridge and the Gladstone Working Pottery Museum typify the important strain of new museums created as a direct result of the changes in the industrial landscape, where the unattractive relics of past industrial activity—evidence of an important cultural phenomenon of world significance—were being rapidly eliminated. The former was established in 1967 to preserve and interpret the remains of the Industrial Revolution around the gorge spanned by world's first cast iron bridge at Coalbrookdale. The latter, centered on bottle ovens typical of hundreds that dominated the Stoke skyline in the nineteenth and early twentieth centuries, opened in 1974 as a result of an eleventh hour reprieve from demolition after local people mobilized to save the site. Other smaller independent museums have been initiated by local communities and embrace all subjects within a locality, tapping into a local scale desire to see evidence of communities' own history collected, and preserved in their own local museum.^[65]

The independent museum constituency continued to grow in the decades following the 1970s, and its total income is now approximately £300 million, a quarter of the total museums economy.^[59] Their influence on the wider museum world in the United Kingdom has been strong, especially their entrepreneurship and commercial attitude; running shops, events, cafes, and visitor attractions have been widely adopted as mainstream museums accept the notion of social entrepreneurship.^[63] Many of the display and interpretation techniques employed by independent museums have also been embraced by the public sector.^[66] More recently, it is “The Trust model popularized by independents [that] is now heading for the mainstream as a growing number of local authorities explore the advantages of converting their museum services to (semi) independent charities.”^[67] The management of Glasgow’s museums and galleries, for example, has been entrusted to a charitable company—the Culture and Sport Glasgow Trust—in a move to facilitate greater financial flexibility and tap into Lottery and other funds. While other museum services, such as Sheffield and York, are also now run by charitable trusts, in Glasgow the new company will be responsible for the city’s entire cultural division.^[68]

NATIONAL TRUST AND ENGLISH HERITAGE

National Trust

Although for many years the National Trust ethos held that it did *not* operate museums,^[69] it is now widely recognized that the organization’s “entire ensemble of objects, buildings, gardens, landscapes and the cultural networks they are part of constitute a very live and relevant museum holding.”^[70] This museum holding is considerable. In 2006, the Trust became the largest accredited museum authority in the United Kingdom, with 149 properties registered as museums, or almost 10% of the national constituency of registered museums.^[71] Its land holdings comprise over 600,000 acres and 700 miles of coastline in a broad geographical spread over England, Wales, and Northern Ireland (Many National Trust properties house important collections of furniture, fine and decorative art, costumes, and antiquities. In the mid-1990s, the Museums and Galleries Registration Scheme was extended to include such collections. The National Trust’s land holdings, however, cannot be registered as museums, see Resource).^[72] The Trust is a charity completely independent of government, managed since 2005 by a Council and Board of Trustees, and relies on income through the fees of its 3.5 million subscribing members, donations and legacies, and revenue raised from commercial operations.^[73] Over 12 million visitors are attracted annually to the Trust’s charging properties, while over 50 million visit its open air holdings (Figures given

are for 2007, see National Trust).^[74] In Scotland, the National Trust for Scotland—founded in 1931 at the initiative of Rural Scotland—has similar statutory powers as the National Trust, but operates with an entirely independent constitution. Around 188,000 acres of countryside are in its care together with 128 properties, holdings that are supported by a membership of almost 300,000 and attract some 1.25 million visitors annually.^[75]

The National Trust was founded as a result of the vision and mobilizing activities of three Victorian philanthropists—Octavia Hill (1838–1912), a social reformer active in improving housing for the urban poor, Sir Robert Hunter (1844–1913), a solicitor involved with the Commons Preservation Society (founded in 1865 by John Ruskin, John Stuart Mill, William Morris and others to help protect the remaining communally held lands against enclosure), and Canon Hardwicke Rawnsley (1851–1920), a Lake District clergyman and poet—who recognized the need for an organization to act as a guardian of the nation’s natural and cultural heritage at a time of increasing threat from uncontrolled development and industrialization. The catalyst that led to the idea was the threat to a garden in Deptford, east London. The garden was Sayes Court, created by the seventeenth century diarist John Evelyn, whose “original plan of 1653 shows what must have been one of the finest gardens of the time.”^[76] In 1884 an Evelyn family scion approached Octavia Hill with a view to its safeguarding for the enjoyment of the public, but no organization was extant that had the legal power to hold property for preservation in perpetuity. She decided to engage with the ideas laid out in a paper sent to the National Association for the Promotion of Social Science by Robert Hunter in which he posited the notion of a “land company,” formed “with a view to the protection of public interests in the open spaces of the country.”^[77] The idea had come too late to secure Sayes Court,^[78] but some ten years later, in January 1895, the “National Trust” was formally constituted as a public, nonprofit organization, vested with the power to:

promote the permanent preservation for the benefit of the nation of lands and tenements, including buildings, of beauty or historic interest, and as regards lands for the preservation, so far as practicable, of their natural aspect, features and animal and plant life (National Trust Act 1907).

The first building acquired by the Trust was the fourteenth century half-timbered Clergy House at Alfriston, Sussex, in 1896, but soon Barras Head, overlooking the rocky outcrop associated with King Arthur on the Cornish coast, the sixteenth century Joiners’ Hall in Salisbury and a small part of Wicken Fen near Cambridge (the Trust’s first nature reserve) were acquired, and the small but dedicated membership went on to amass more scenic lands and grand historic buildings. By 1900, Trust membership

stood at approximately 250 members and 180 properties, including the Farne Islands, large stretches of the Lake District, Bodium and Tattershall castles, Chedworth Roman villa and the Elizabethan manor house Barrington Court, came under Trust ownership.^[79] The year Barrington Court was purchased, the National Trust Act (1907) reached the Statute Book, conferring on the Trust the power to declare property inalienable. Today, the majority of Trust properties are protected in this way, securing their future in perpetuity.

English Heritage

English Heritage (officially the Historic Buildings and Monuments Commission for England) is a national agency with a broad remit of managing the historic environment in England. As an executive nondepartmental public body sponsored by the DCMS, it is the government's statutory adviser and works in partnership with central government departments, voluntary organizations and the private sector to "conserve and enhance the historic environment, broaden public access to the heritage (and) increase people's understanding of the past."^[80] These responsibilities are articulated in the National Heritage Act (1983) and are met by the organization in multiple ways, including championing the heritage nationally and internationally, conservation grant-giving, provision of preservation advice, and registering, protecting, and promoting significant historic buildings, monuments, and landscapes.^[80] English Heritage also maintains a public archive, the National Monuments Record, but is arguably most widely known for its care of Stonehenge and over 400 other historic properties on behalf of the nation. Although English Heritage receives grant-in-aid from the government (£129.4 million in 2007/2008), these historic properties generate valuable revenue (£11.4 million in admissions and a further £9.9 million from retail and catering in 2007/2008) through visitor numbers exceeding 5 million.^[81] They also provide the milieu for a membership of some 665,000.^[81] Similar bodies operate in Wales (Cadw), Scotland (Historic Scotland), and in Northern Ireland (the Environment and Heritage Service Northern Ireland).

ZOOS AND BOTANICAL GARDENS

Zoos

The pursuit of looking at wild animals has always been popular in Britain,^[82] with the first exotic specimen—a walrus—purportedly being exhibited in England during the reign of Alfred the Great (r. 871–899).^[82] There are accounts of the Norse explorer Othere, whose voyages in the northern seas was incorporated by King Alfred into an Anglo-Saxon translation of Orosius' universal history,

presenting the king with walrus tusks. Indeed, King Alfred's reign saw an influx of walrus ivory into England.^[83] Collections of exotic animals were exhibited in traveling fairs from Elizabethan times into the twentieth century, their acquisition facilitated by the great discoveries of the fifteenth and sixteenth centuries and access to a global mercantile shipping trade, but the first permanent zoological collection—comprising lions, lynx, leopards, camels, porcupines, and an owl^[82]—in the country was the result of a diplomatic gesture in the form of a ceremonial gift from William of Montpellier to King Henry I (r. 1100–1135). Another gift, this time of three leopards from the Holy Roman Emperor Frederick II to King Henry III (r. 1216–1272), led to the establishment of a menagerie in the Tower of London,^[82] some animals of which (including an elephant) could be viewed by the public.^[84]

From the late Middle Ages, the practice of keeping wild animals was still the province of the nobility and wealthy, and nonsystematically organized private collections in castles and estates across Britain proliferated, both conferring power and status on their owners and gratifying curiosity. At the beginning of the nineteenth century, however, serendipity (although still rife in determining the composition of many menageries of the era including the popular, arcade-like Exeter Exchange on London's Strand) was abandoned when the first zoological collection to be specifically founded for scientific purposes was established, that of the Zoological Society of London.

In a climate of colonial expansion, imperialism, and nationalism, Sir Stamford Raffles, a former colonial administrator in the East Indies, began the Zoological Society of London in 1826, its stated rationale being "the advancement of Zoology and Animal Physiology and the introduction of new and curious subjects of the Animal Kingdom"; The conferring of power enabled by the practice of keeping wild animals had now shifted to the nation, as "the rhetorical goal implicitly shared by Raffles and the other founders of the Zoological Society (was) to acquire, maintain and display representatives of the animal kingdom in a way that echoed and emphasized British pre-eminence."^[85] Two years later, the London Zoological Gardens opened in Regent's Park to fellows of the society and in 1846, to the public. The emphasis of policy and investigations carried out in the zoo at the time was shaped by landowners within the society, who promulgated domestication and acclimatization (a breeding farm was established at Kingston Hill to this end), and the naturalists, who "wished the zoo to stock exotic animals of taxonomic interest, without regard for their attractiveness, edibility, or other usefulness,"^[86] and focus on comparative anatomy and pathology. Today, the opportunities for scientific research are much broader, and the remit of the Zoological Society's research division (the Institute of Zoology, now in a strategic partnership with Cambridge University) spans evolutionary biology, genetics, ecology, reproductive biology, and wildlife epidemiology.^[87]

London Zoo, then *primus inter pare*, continues to be one of the world's greatest with excellent research and a mission that privileges the conservation of wild animals and their natural habitats.

The conservation message at London Zoo is explicit and reflects a sea-change in U.K. zoos in recent years as they have reconsidered their roles, often in light of “dwindling attendances and budget shortfalls.”^[88] Change has also been forced by the environmental lobby (as concern escalates for the preservation of wild stocks of animals), and shaped by the debate (triggered in the United Kingdom by the critical financial problems of London Zoo in the early 1990s) on the ethics of keeping wild animals and the need for “clarity about captivity (that is) essential to the humane transformation of zoos.”^[89] Furthermore, U. K. zoos are now regulated through the Zoo Licensing Act 1981 (as amended) under which they must meet minimum standards in *inter alia* animal husbandry and are obliged to participate in conservation and to promote public education and awareness of biodiversity conservation.^[90] Today, Holtorf^[91] notes, “Zoos are the most frequently visited types of museum in the world.” Despite an overall decrease in U.K. zoo attendance in the 40 years prior to 1998,^[92] shifts in zoo dynamics heavily promoting conservation as a key objective and the transformation of zoo environments (with commensurate enhancement of their credibility among the public) have arguably resulted in a gradual increase in zoo visits over the last 20 years in the kingdom.^[92,93] Indeed, Mackay^[94] has indicated that zoos generate some 7 million visits a year. This popularity has been crucial as many U.K. zoos operate under charitable status and “Visitors and their gate receipts, on-site expenditure and animal sponsorship are the lifeline for zoos, representing the major funding source for the majority of zoos in the United Kingdom.”^[95]

A large number of establishments display wild animals to the public in the United Kingdom—*The International Zoo Yearbook*^[96] lists 65 zoos and aquariums “together with a number of institutions with important animal collections, such as primate research centers, universities, and bird parks,” while the Department for the Environment, Food, and Rural Affairs’ list of licensed zoos operating in England alone in 2007 was much larger at 270 establishments.^[97] The Born Free Foundation’s 2000–2004 survey listed approximately 479 establishments displaying wild animals to the public for seven or more days a year in Britain.^[98] The Foundation’s latest estimate for the United Kingdom is over 530.^[99] London Zoo aside, at the developmental and attendance vanguard, some are particularly notable. Chester Zoo, generally acknowledged as the largest conventional U.K. zoo at 110 acres,^[100] was founded in the early 1930s by George Mottershead with a collection of animals from an earlier zoo at Shavington, near Crewe. Mottershead’s original desire to have a “zoo without bars” perhaps explains the zoo’s international renown today for innovative enclosure

designs. It is also known for its breeding successes and involvement in cooperative breeding programs, and plays an important role in developing conservation outreach, research, education, and marketing strategies. In 2007 visitor attendance was approximately 1.3 million, making the zoo the United Kingdom’s leading wildlife attraction and fourth in the kingdom’s most visited overall attractions.^[101] Edinburgh Zoo is also a highly successful visitor attraction (the second most visited charging attraction in Scotland), with 650,000 visitors recorded in 2006.^[96] The Royal Zoological Society of Scotland, founded in 1909, opened the zoo in 1913 and today it occupies 82 acres of parkland and is a leading center of conservation, education, and research.^[102] Recognizing the educational potential of defragmenting the exhibits and making reference to the “vital and multitudinous interfaces between plants and animals,”^[103] the zoo has adopted a holistic approach to habitat creation and plans to redevelop the entire site around four complex biotic communities, or biomes. (The four biomes are: Oceans and Wetlands, Tropical Forests, Woodlands, and Grasslands. The society is also creating two biomes at the Highland Wildlife Park, with Mountain and Tundra species.)^[104] Zoogeographic display is also a feature of Paignton Zoo in Devon after its £6 million transformation into an environmental park in 1996.^[105]

Botanical Gardens

At the turn of the new millennium a project described as “a showcase for economic botany and ethnobotany” constructed in the moon-like space of an exhausted china clay quarry in Cornwall attracted some 2 million visitors in its first full operating year, and through visitor spending brought £155 million into the economy of the county.^[106] The Eden Project, although differing from a traditional botanic garden in that its primary purpose is to draw a broad public contingent, interest them in plants and demonstrate human dependence on plants,^[107] is a hugely popular recent addition to the long and distinguished history of the maintenance of plant collections for scientific study and educational purposes in the United Kingdom.

Although the garden of John Gerrard in Holborn (1575) had botanical aspects and the formal gardens attributed to Dr. William Turner at the Duke of Somerset’s Syon House are linked to the naturalist’s *Names of Herbes* (1548),^[108] the earliest botanic garden in Britain was established with the benefaction of Sir Henry Danvers, first Earl of Danby, in 1621 by the University of Oxford as a physic garden, growing plants for medicinal research. Its “Nursery of Simples,” and plants in a conservatory “heated by a four-wheel fire basket of burning charcoal hauled back and forth by a gardener,” allowed students to learn their *materia medica* at a time when “the development of other sciences was being hampered by medieval tradition.”^[109] Contemporaneous with Oxford was the private garden (c. 1630) of John Tradescant (1570–1668) in South

Lambeth, (although Allen^[110] notes that he was more concerned with flowers that exhibited size, color, and strangeness, and fruits of succulence, than with the value of simples), and in 1673 the Chelsea Physic Garden was formed by the Society of Apothecaries. Scotland's first physic garden dates back to 1670 when a small plot of land at St. Anne's Yards adjacent to Holyrood Palace in Edinburgh was laid out by Dr. Robert Sibbald (later first Professor of Medicine at Edinburgh University) and Dr. Andrew Balfour.^[111] Although relocated in 1763 to a "green field" site on the ancient high road to Leith,^[111] the garden now known as the Royal Botanic Garden Edinburgh has unbroken lineage, an aspect shared with the Chelsea and Oxford gardens.

British botanic gardens morphed in the seventeenth and eighteenth centuries into colonial tropes of expansion and commercial development (Calcutta, Pamplemousse in Mauritius), and in the nineteenth century into civic gardens, established by "enlightened local government authorities (Sheffield, Glasgow)...as havens of green space in industrial cities"^[112] and advancing the horticultural aspects of their living collections. Today, the notion of a botanical garden as a sanctuary has emerged,^[113] responding (like zoos) to the demands of the conservation movement and taking "much of the responsibility for the genetic protection of threatened species, along with *ex situ* protection of plants with economic and ecological importance."^[113] Although Davis^[114] has argued that the influence of environmentalism on botanical gardens in the United Kingdom has been less evident than in other countries—especially the United States of America—there are some notable exceptions. The Royal Botanic Gardens Kew, is an iconic example.

The Royal Botanic Gardens, Kew is broadly recognized as one of the foremost centers for counsel, assistance, and action on plant and fungus conservation in the world, increasingly contributing to the development of international conservation strategies. Its programs engage with myriad endangered and threatened plants and their ecologically connected plant communities, and employ an advanced array of techniques (storage and cryopreservation of seeds, embryos and pollen, and micropropagation) to support *ex situ* and *in situ* conservation projects.^[115] The eminence and global influence of Kew, inscribed on the list of World Heritage Sites in 2003, has been constructed over centuries. From 1752, when Princess Augusta assisted by the keen botanist the third Earl of Bute and the architect Sir William Chambers began to develop her ten acres at Kew House, the Royal Botanic Gardens has functioned as a *ferme ornée* (an "ornamental farm" — a country estate laid out for profit [through gardening] and pleasure [by using aesthetic principles]) for King George III; the hub of botanical collecting and exchange (where economic botany had a direct practical relevance to both Britain and her colonies) under the "superintendence" of the king's chief botanic advisor Sir

Joseph Banks and similarly later under Dr. Joseph Dalton Hooker; a nursery for botanists and gardeners; and currently, in an age of ecological crisis, as a global leader in ecological stewardship.

Kew is a major visitor attraction. In 2007/2008, Kew and its sister garden at Wakehurst Place, West Sussex achieved just over 1.9 million visits.^[116] It is an executive nondepartmental public body (created by the National Heritage Act 1983) governed by a Board of Trustees and sponsored by the Department for the Environment, Food, and Rural Affairs, receiving £25.2 million grants-in-aid, with additional visitor income, investment income and fundraising totalling £30.8 million.^[116]

MUSEOLOGY AND FUTURE TRENDS

The Museum Profession

The (numerical) growth of the museum workforce in the United Kingdom has been considerable over the last 50 years, reflecting a major expansion in museum numbers (almost three new museums a week were opening in the 1980s) and the wider role of museums' approved missions within their communities and regions.^[117] The Digest of Museum Statistics analysis of 1999^[118] provides an indication of museum employment numbers across the then 1300 registered museums in the United Kingdom: 15,365 FTE (full-time equivalent) paid staff, of which 12,590 were in "permanent" positions, 2275 held temporary contracts, and 744 were employed as freelance specialists. However, the paid staff were considerably outnumbered by a volunteer workforce of approximately 25,206 FTE individuals. The survey revealed the national museums (6065), local authority museums (4799) and independent museums (3307) to be employers of the majority of paid staff, while the latter's utilization of some 15,786 volunteers placed it substantially ahead in unpaid staff numbers. In recent years, shifts in the U.K. labor market toward greater flexibility have been reflected in museums as "far higher levels of consultant and temporary or short-term contract staffing" have become evident.^[119] While the gender diversity of the museum workforce is generally good (51% of all curatorial and managerial positions in local authority sector and 46% for the nationals and independents)^[120]—indeed in some areas of museum practice (e.g. development) women dominate in numbers and seniority^[121]—there are still few women in the top museum posts.^[121] The ethnic diversity of the museum workforce, however, does not mirror the plurality of society (see issues section below).

Museum work has traditionally been associated with the curator, "an academic specializing in a specific collection-related field who can perform all the tasks necessary to the museums,"^[122] and in many parts of the world museums continue to function with a narrow range of staff

mainly consisting of “scholar-curators” at the professional level.^[123] In the United Kingdom, although the curator is still pivotal, Parr’s^[124] observation that museums “encompass a plurality of professions” is pertinent. The workforce comprises a variety of specialists in both subject and service fields, a result of the increasingly complex nature of museums and a more sophisticated understanding of all the factors that lead to effective provision. As Kavanagh^[122] notes:

In the larger museums teams of people work side by side: curators, education officers, conservators, exhibition technicians, designers, registrars, gallery assistants and attendants, outreach workers, audience advocates, writers, marketing specialists, security experts and managers. In smaller museums, curators, trained to have a high level of awareness and a good degree of competence in these skill areas, operate to the limits of their own versatility. They often work with freelance specialists.

The increasing prevalence of museum studies courses in the United Kingdom and frequent reference to a “museum profession” might suggest the homogenization of museum careers and a unitary profession,^[124] but the diversity in knowledge and skills noted above required *within* museums, and the diversity *among* museums in type, collections, and audience expectations, render this notion nugatory. As Kavanagh^[125] points out, “uniformity within the profession can be found more in a jointly held, but broad philosophy about the value of museums” and “an overarching sense of social and educational purpose” than in specific sets of skills and tasks. There is evidence of “a shared identity of museum professionalism,”^[125] and an understanding of professionalism not as an end in itself but as a “spiritual behaviour through which we seek to accomplish larger purposes.”^[126]

In Britain, momentum for the professionalization of museums and museum work began apace at the end of the nineteenth century, part of the growth in the new social phenomenon of professionalization that had seen many groups of workers—outwith the traditional learned professions of theology, medicine and law—seek status and recognition of their vocational endeavors through the constitution of distinct “professions.” This movement among museum workers, stressing the notion that the multiple museum types faced many of the same practical problems, effected the creation of the first museum association in the world (1889), and the earliest production of museological literature.^[127] Today, the Museums Association is the “single authoritative voice for the whole museum community,”^[128] disseminating information through *Museums Journal* (1901) and other print and Web-based output, lobbying government and setting ethical standards, engaging its members (5000 individual, 600 institutional and 250 corporate) in events around museum issues (including an annual conference) and furthering the position and qualification of museum staff.^[129]

Other professional associations operating at a national level include ICOM-UK, ICON (Institute of Conservation, the lead voice for the conservation of cultural heritage in the United Kingdom), the Museum Professionals Group (exists to provide a forum for its constituency of new museum professionals), the National Museum Directors’ Conference (founded in 1929 and funded by the participating institutions, provides a discussion and collaboration platform for its membership, also represents the interests of national museums to government and other stakeholders), the AIM (Association of Independent Museums), and the University Museums Group U.K. Museums in the United Kingdom also have a remarkable contingent of support and advocacy at national level in the form of specialist groups whose remit embraces a facet of museum function or issues allied to the subject of museum collections. The earliest of these is the Group for Education in Museums (1948), but their real growth came in the 1970s^[130] and relatively recent counts list more than 20 such groups.^[131] The specialist groups include: Natural Sciences Collections Association (NatSCA), Geological Curators Group (GCG), Dress and Textile Specialists (DATS), Association for Cultural Enterprises (ACE), Museum Ethnographers Group (MEG), Social History Curators Group (SHCG), Society of Museum Archaeologists (SMA), Touring Exhibitions Group, Visual Arts and Galleries Association, Museums and Galleries History Group), although today there are many more. Subject specialist networks were a key element of the *Renaissance in the Regions* report (2001), and consequently over £500,000 of Renaissance funding has been invested in existing and new specialist groups.^[132] At a regional level, professional groups exist in a country-wide network of federations. The regional federations include: South Western Federation of Museums and Art Galleries, Midlands Federation of Museums and Art Galleries, South Midlands Museums Federation, North West Federation of Museums and Art Galleries, Scottish Museums Federation, and Federation of Museums and Art Galleries of Wales.^[133]

Recognition of the need for specialized training in museum work has been extant in the United Kingdom for many years, with early initiatives following a Royal Commission investigation into the problems of the national museums and galleries between 1927 and 1930.^[134] The Museums Association took the lead in 1930 with the establishment of its Museums Diploma training, operated on a voluntary basis by experienced staff in leading national and local museums, and the first one week training course was run that year in London. In 1980, the Association released the formal teaching elements of the Diploma to the University of Leicester. Today, the Association retains control of admission to the successor to the original Diploma, the Associateship of the Association, but the future nature of this professional qualification is currently under review. The first full-time postgraduate diplomas—now Masters degrees—in Museum Studies

were introduced by the University of Leicester (1966) and then by the University of Manchester (1971), with curricula and aims based on the Museums Association's Diploma program. Nowadays many courses are offered in Museum Studies and related subjects at universities throughout the United Kingdom, and other recent initiatives by the Museums, Libraries and Archives Council have been established to encourage new entry routes into the sector.

Key Contemporary Issues

Museums have been part of the fabric of society for some considerable time in the United Kingdom, shifting to serve different generations and to satisfy the agendas of the day. The last 10 years have been particularly notable for the policy discourses of the Labour government (elected in 1997) that have "continuously layered ever greater and ever more diverse expectations onto the museum sector and museum professionals."^[135] These expectations are centered on the redefinition of museums as a public service, moving them beyond their traditional cultural role to one in which they become coordinates for change in society, resolving problems such as social exclusion (defined by the government's Social Exclusion Unit in 1997 as "a shorthand label for what happens when individuals or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environments, bad health and family breakdown") and orientating their work toward lifelong learning, identity and community building, public health, and economic and social integration. Initial formal articulation of the government's social inclusion expectations of museums appeared in the 1999 document *Museums for the Many*^[136] with its focus on widening access, but the broader agenda was signaled by the publication of *Centres for Social Change*.^[137] While many academics/ practitioners^[138–140] find the proactive use of museums' potential to address social problems justifiable, the coherence and feasibility of this "partly reimagined museum" have been questioned by others.^[141]

Requirements for U.K. museums to assume new roles as agents of social inclusion have rendered workforce diversity increasingly important to the sector. Although there was "explicit recognition in the early 1980s that the profession... was insufficiently diverse,"^[142] a 2006 survey by the Museums Association into the cultural diversity of staff (the Museums Libraries and Archives Council defines cultural diversity as "diversity based around ethnicity and race,"^[143] at hub museums across England identified the percentage of staff from black and minority ethnic (BME) backgrounds as 2.49%, compared with 8% of the population total, with severe under-representation in educational, interpretation and curatorial positions.^[144] These results echoed the imbalance found in an earlier report into cultural diversity at national museums by the National Museums Directors' Conference.^[145] Sandell^[142] has cited outdated workplace cultures and structures as contributory and

perpetuating factors, including a passive response to the problem, whereby under-representation is attributed to the demographic profile of a region and a lack of BME candidates for jobs ("museums do not operate discriminatory practices and... responsibility for change lies, therefore, not with the museum, but with people from ethnic minority communities, their attitudes and aspirations"),^[146] and the exclusionary corporate culture of "homosocial reproduction" (a tendency to recruit to an implicit model that reflects the existing demographics of the profession). Within the context of strategic imperatives for museums to consider diversity issues, however, recent initiatives have emerged (see, for example, the Museums Association workforce development agenda), many of which can be characterized by the use of "positive action."

Overall, the last decade has been notable for the remarkable renaissance of museums in the United Kingdom, largely made possible for English regional museums with *Renaissance* funding (see local authority museums above), and for all museum types with the financial support of the Heritage Lottery Fund (HLF). The creation of a National Lottery in 1993 and the decision not to use the principle of additionality (i.e., replace existing government spending) with the profits, but to benefit "good causes" (arts; charities; health, education and the environment; heritage, sports), has generated enormous sums of money for those causes. The good cause that has principally benefited museums is Heritage, and the HLF is the distributing body, operating across England, Scotland, Wales, and Northern Ireland. Since 1994, the Fund has awarded £4 billion to more than 26,000 projects,^[147] from tiny community events to multimillion pound capital schemes. Brown^[148] provides examples of nonnational museum beneficiaries—the Horniman Museum and the Dulwich Picture Gallery in south London, the New Art Gallery in Walsall, and the Ashmolean in Oxford, but the bold and costly national museum projects—the Tate Modern (the transformation of a disused power station on London's South Bank) and the British Museum (the iconic dome over the Museum's inner courtyard)—are perhaps the most well-known.

CONCLUSION

Guarantees about the future of U.K. museums, however, are not possible. In developing a national strategy for museums in England, Swain^[149] has emphasized that the sector is fragile and at a tipping point. Continued investment and development is seen as crucial to make a long term beneficial difference to all society. In Europe, recent trends have been for nations to reexamine their cultural legislation and strengthen legislative structures for their national heritage, in the case of museums, often creating linkages between national museums and designated regional and local institutions, articulating measures for constructive protection and guaranteeing public

access.^[150] As Babbidge^[151] notes, in the United Kingdom, *Renaissance* has begun to deliver a comparable framework for English museums but,

What is lacking is a formal status that cements the system, so that it has a long-term purpose rather than becoming another short-term initiative. It could also provide an opportunity to define a national structure that takes National museums into account, builds bridges with other parts of the heritage, and defines the core legal requirements for being a 21st century museum.

There can be no doubt that U.K. museums have made remarkable strides through free entry to the nationals, *Renaissance*, the HLF, and new methods of engagement, but long-term, joined-up, sustainable (economic and environmental) processes and vision will safeguard the nation's diverse and great cultural assets—some of the finest museums in the world.

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United States: Archives and Archival Science

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Abstract

The archival tradition in the United States of America consists of two components, a public records tradition and a personal papers or historical manuscript tradition. This entry will explore both traditions and their effects on the archival profession over time. It will also discuss professional development and professional organizations for American archives. It includes profiles of significant archival repositories.

INTRODUCTION

Early American colonists brought with them the habit of keeping public records from Europe. The founding generation added a strong personal papers component. These two traditions intertwined to form contemporary American archival theory and practices.

This entry will explore the history of archives in America as it descended from the English tradition; developments in the practice of archives and records management; the types of materials kept; the types of repositories that exist; professional development and training; and recent developments in the archival field.

EARLY HISTORY

Recordkeeping has long been vital to society. Knowing who was born when or who owns certain property allows for a civil society. When the European colonists came to America, they brought with them their traditions of public recordkeeping. These records would be filed with the local government or churches. They were not necessarily at that time managed as archival records, and there were no archivists *per se*. Clerks and administrators cared for the records created and filed.

The colonists who broke with England and became the founding generation of American citizens were well aware of the importance of keeping records. Their inability to access records was one of the grievances listed against King George in the Declaration of Independence.^[1] When they wrote the Constitution, they required the Congress to maintain journals. They also codified in the Fourth Amendment the right of citizens to protect their personal papers from unreasonable search and seizures.^[2] Unfortunately, this awareness did not lead them to establish proper archives or to take adequate preservation measures for government records, and many records were lost or

destroyed over time due to neglect and disasters, both natural and man-made. One exception to this is Vermont, where, in 1779, the recordkeeping responsibility was enumerated as a function of the Office of the Secretary of State.

These early Americans were also very aware of their own role in the making of the country and founded some of the earliest historical societies in the country to preserve their legacy. The earliest was the Massachusetts Historical Society, founded in 1791. Others soon followed, including the New-York Historical Society in 1804, and the American Antiquarian Society in 1812.

This began the duality of the American archival tradition wherein public records were maintained by governments and sometimes churches, while personal papers and other historical manuscripts were preserved by historical associations. From the beginning, the traditions served two fundamentally different purposes. The public records captured transactions and served a legal and administrative function. The manuscript tradition primarily served history and historians and was meant to record the achievements of a particular person or group of persons. However, at times, historical societies would also accept deposits of government records in the absence of any other formal programs for managing them.

Because historical societies saw themselves as serving history, they focused more on collecting and preserving the documents and other items that would add to the collective knowledge. Preservation and access, at least access for scholars, were key components. Early “archivists” in the historical societies were usually trained as historians.

These practices remained the same until the end of the nineteenth century. After the Civil War, the volume of records being produced greatly expanded, a pattern that would be repeated after World War II. The U.S. Congress passed the first records disposal legislation in 1889 in response. It met with limited success as agencies remained reluctant to part with their records. This was followed in

1903 with legislation to allow agencies to transfer their records to the Library of Congress (Fig. 1). Among the records transferred were those from the Continental Congress.^[3]

At the same time, the movement to establish formal state archives programs began. This was primarily led by the Southern states to preserve the Confederate legacy of the Civil War. The Alabama State Archives was founded in 1901 and was followed quickly by Mississippi in 1902. Throughout the first decade of the 1900s, many other states would also establish archives. Even Hawaii, as a territory, established its archives in 1906. New York was the most recent state to establish a program, in 1971. It is, unusually, a program of the State Education Department. It is also worth noting here that the bulk of New York's early records were destroyed in a fire in 1911.

Meanwhile, the 1880s and 1890s saw an increased emphasis on the use of primary sources in historical scholarship. To aid these efforts, many historical societies published collected works of their materials to provide for both access and a certain level of preservation of the contents through duplication. The American Historical Association (AHA) was founded in 1884 and quickly initiated several studies and committees on archives. These efforts eventually led to the establishment of the Public Archives Commission within the AHA in 1899, followed by the first Conference of Archivists held in 1909. These were formed in part to address the AHA's need to better understand and access primary source materials for historical scholarship. Also, increasingly, there was a need felt within the AHA to incorporate federal records into historical research.

Additionally, fires, always a hazard, continued to plague government agencies and their records storage. In 1877 and again in 1896, the U.S. Congress began

exploring the idea of building a Hall of Records for the storage of inactive agency records. Competing interests prevented authorization of the planning and funding for such a building until 1904. Even with funding, efforts to build a Hall of Records would again be delayed, because advocates were instead supporting the movement to build a proper National Archives for the long-term preservation and public access to records. Chief among them was J. Franklin Jameson, who would pursue this ideal until the National Archives were established.^[3]

THE MODERN ERA

The fight to establish the U.S. National Archives was a long one. The AHA created a committee on the National Archives in 1908. Authorization for the building finally came in March 1913, at the very end of Taft's administration. Unfortunately, the authorization did not include funding.^[3] During World War I, efforts and funds were directed elsewhere and no progress was made towards establishing the Archives. Once the conflict ended, congressmen wanted federal buildings located in their districts and kept resisting the building of new structures in DC without corresponding new buildings in their districts. The impasse broke in May 1926, with an omnibus buildings law that came complete with funding. It would take another 12 years before the building was finished and opened for research (Fig. 2). In 1934, the National Archives Act authorized the creation of the new executive agency to protect the records of the federal government.^[3]

In a parallel development, the Conference of Archives within the AHA continued to grow throughout the 1910s and 1920s, moving away from the historian/scholar model and more toward a true archivist model. These archivists



Fig. 1 The first Manuscript Division Reading Room, Thomas Jefferson Building, ca. 1920s. Photograph courtesy of the Manuscript Division, Library of Congress.



Fig. 2 National Archives Building, Washington, D.C.
Source: Photograph courtesy of the National Archives and Records Administration.

began to feel the need for their own association, separate from the AHA. In December of 1936, the Conference met separately for the first time, and the Society of American Archivists (SAA) was launched. SAA has held an annual meeting every year since 1937 and has published the *American Archivist* since 1938. From the beginning, it has been open for membership to archivists, rather than institutions, and during its first year had 124 members. Today, SAA has over 4000 individual members.

A third development during the 1930s was the beginning of the implementation of formal archival methods. Public records organizations, particularly the National Archives with its brand-new staff, needed better ways in which to proceed to organize the records they held.

Once again, Americans looked to the Europeans. English, Dutch, and German theories and practices were studied. As the European tradition was primarily related to public records, these newly imported methods mostly applied to government and organizational records and not to manuscript collections. Early proponents of this approach included Margaret Cross Norton, State Archivist of Illinois, and Theodore R. Schellenberg and Oliver Wendell Holmes, two prominent historians who became National Archives staff members.

Part of the appeal of the European approach for government archivists is that it brought a “scientific” methodology to the organization of records. This approach introduced the concepts of provenance and original order, which drew upon the administrative history of the records. The manuscripts tradition continued to emphasize the uniqueness of the materials and organized them by subject classification, more like library classification, to suit historical scholarship needs (Fig. 3).

The European approach also brought with it some efficiency, in particular, being able to work the records in

groups rather than at the item level. This efficiency became especially important during the 1940s. During World War II, there was an increase in the number of federal agencies as well as a quite rapid expansion in the volume of records being produced. This led Schellenberg and Holmes at the National Archives to develop the twin concepts of record group and record series. These two concepts, based on the principle of provenance, allow archivists to organize collections of records according to the administrative structures that created them. This approach had an immediate impact on government and other institutional records repositories, but it would not be adopted for use in historical societies and other manuscript collections until more than a decade later.

The World War II boom in records production was not limited to the federal government. State governments



Fig. 3 Archivist Harry Heiss and archives technician Scott McLemee processing the Victor Gruen Papers.
Source: Photograph courtesy of the Manuscript Division, Library of Congress.

also saw an increase in volume and many collecting repositories had increased donations or started collecting manuscripts in new areas. For example, the Sophia Smith Collection at Smith College (Fig. 4) began collecting materials related to women's history in 1942 and what is now the Schlesinger Library at Harvard University followed suit a year later.

In the post-war era, the seed of records management that began in the 1930s and grew during the 1940s came to fruition in the 1950s. By this time, records management—the systematic control of an organization's records from the records' creation through their final disposition—was seen as a discipline separate from archives, which focused only on managing permanent records. Also introduced during this time was the new field of study, information science, which used computers for collecting, storing, classifying, retrieving, manipulating, and disseminating information.

One unfortunate consequence of the focus on records management and administrative efficiency was that the National Archives was too successful at promoting it and lost its status as an independent federal agency.^[4] In 1949, the National Archives became the National Archives and Records Service, a division of the General Services Administration, the administrative agency of the federal government. It would take until 1985 for the National Archives to regain its independent status and another new name, National Archives and Records Administration.^[5]

While the 1940s and 1950s saw an increase in the growth of state archival programs, the 1960s and 1970s witnessed a rapid increase in nongovernmental archival institutions. These new institutions were primarily academic and cultural repositories. They added a new element to the archival mix, as they combined both the tradition of public recordkeeping in the form of maintaining institutional history and organizational records and the historical manuscripts traditions as they

collected materials from their communities and in support of their academic research goals.

PROFESSIONAL SOCIETIES AND PROFESSIONALISM

At various times during its history, SAA has been perceived as not meeting the needs of all archivists, and this has led to the formation of other archival associations. As records managers felt that they were focused on different tasks and duties—primarily those of current records rather than historical records—from archivists, they chose to form the American Records Management Association (ARMA) in 1955. It is now known just as “ARMA International” and consists of approximately 11,000 members.

Also in 1955, the Rare Books Section was established with the American Library Association (ALA). Its membership was drawn primarily from academic institutions. It became the Rare Books and Manuscripts Section in 1967 under guidance of Richard Berner and Arline Custer.^[6]

The 1960s witnessed the founding of the National Endowment for the Humanities (NEH) in 1965 and the establishment of the grants program of the National Historical Publications and Records Commission (NHPRC) in 1964. Since its creation as part of National Archives in 1934, the NHPRC focused on producing scholarly editions of the papers of the founding fathers. The new grants program greatly increased this work. In 1975, the NHPRC's role expanded to protect records at risk and establish archival programs. As part of this expansion, it also required the establishment of State Historical Records Advisory Boards (SHRABs). The directors of the SHRABs eventually organized into a group, one that is now known as the Council of State Archivists. Additionally, the NHPRC funded publication of SAA's first set of basic archival manuals in 1977.^[4]



Fig. 4 Gymnastic exercises in Alumnae Gymnasium, 1904. The space shown now houses the reading room for the Smith College Archives and Sophia Smith Collection.

Source: Photograph by Katherine E. McClellan, used with permission of the Smith College Archives, Northampton, Massachusetts.

The rapid growth of nongovernmental archival institutions led to many changes within the archival profession during the early 1970s. The focus of the profession shifted from managing buildings and institutions to maintaining professional identity.^[7] SAA grew larger and changed its focus, as academic archivists joined the Society and began to have a greater role in its governance. This led to some more groups splitting away. In 1972, the National Association of Government Archives and Records Administrators (NAGARA) was formed to concentrate on the issues related to governmental materials. Many regional archival associations also began during this time. These had the benefit of being smaller and local, providing more opportunities for contact within the profession. The two largest of these, the Mid-Atlantic Regional Archives Conference (MARAC) and the Midwest Archives Conference (MAC), were both established in 1972.

Until the 1970s, there was little formal academic training available for archivists. The earliest archivists would have been either historians or clerk/administrators whose responsibilities happened to include caring for records and manuscripts, and all training was done on the job. While many historians began to see the need and advocate for more formal approaches to archives management during the late 1800s and early 1900s, no formal training emerged.

It was not until the founding of the National Archives, with its immediate need for a full staff, that the awareness of the lack of training programs became more acute. The number of archivists needed prior to this was fairly small and could be drawn from the historian and librarian communities. The Archives need could not be filled by drawing on those who had already become archivists. Due, however, to the Great Depression occurring in the United States at that time, many historians and librarians were out of work, and the Archives was able to employ many of these people to create its initial staff. At the same time, the Works Progress Administration (WPA), a federal project during the Great Depression for employing the unemployed to work on public projects, hired many historians for its historical records survey. The WPA trained these people to conduct inventories of records. They looked primarily at records being produced at the state and local government level, but also included some private collections and other records. Some of the WPA-trained people would come to work for the National Archives later. Therefore, as had happened previously, most training continued to be postemployment.

Several efforts examined the training issue from different angles. Both the ALA and SAA established committees to study the educational needs of archivists. Both advocated some level of training in library methods as well as history. A few programs adopted this approach. The first academic program for archivists was established in the renowned library program at Columbia University in 1938, where a series of courses were offered.

The following year, Ernst Posner arrived from Germany and began teaching in the history department at American University. His classes, which were offered in conjunction with the National Archives, became the standard training for Archives employees for many, many years. This derailed many other needs for more formal training of archivists elsewhere. The next archival training program to be instituted in a history department would not appear until Wayne State University began offering archives classes in 1962.

Most training for archivists remained on-the-job or through an apprenticeship program. Then, in the 1970s, the number of academic programs began to expand. This paralleled the growth in awareness over professional identity within the greater community of archivists. These courses were offered in both history and library science departments, primarily at the graduate level, and were primarily taught by practicing archivists serving as adjunct faculty. During this time, the first dual degree program in both subject areas was offered by Case Western University. Unfortunately, this program no longer exists. As did many other institutions during the 1980s and 1990s, including Columbia University, Case Western University chose to eliminate its library science program.

SAA also developed its first set of guidelines on graduate archival education, which were issued in 1977. As Richard Berner points out,

While the SAA's committee [on education and training] continued its work in developing specifications for formal archival education as a subfield of an established academic discipline such as librarianship or history, the committee also addressed the well-known fact that most practicing archivists had been self-taught. Consequently, it promoted post-employment training programs.^[6]

Another important development during these decades was the recognition of the need for standardization. It began with the publication of the *National Union Catalog of Manuscript Collections (NUCMC)* in the 1950s, which "... attempted to gather standard information about archival collections from widely differing repositories and to reduce that information to a uniform catalog card format."^[4] This raised the question of how to create standards for materials that were unique and reemphasized the differences between public records and manuscript collections.

While each repository would continue to implement their own way of managing their collections, they began to use common means for description. Description standards became and continue to be an important component of the professional discourse. In addition to the *NUCMC*, archivists developed the SPINDEX system for preparing and indexing archival finding aids in the 1960s, the Machine Readable Cataloging-Archival and Manuscripts Control (MARC-AMC) format for use in library

cataloging systems in the 1980s, and Encoded Archival Description (EAD) for use on the Internet in the 1990s. In 2004, SAA released *Describing Archives: A Content Standard (DACS)*.

Much of the focus on description standards came from the availability of technology to be used as a tool in doing this work. The technology also added a new component to the archival landscape—that of electronic records. While machine-readable records had started with the first IBM punch cards, their importance as archival materials was not seen until the 1960s. The Inter-University Consortium for Political and Social Research (ICPSR) was established in 1962 to provide an archives for data users. In 1970, the National Archives accessioned its first electronic records. A conference on data archives at the 8th World Congress of Sociology in 1974 led to the founding of the professional association for data librarians and archivists, the International Association for Social Science Information Service and Technology (IASSIST). SAA offered numerous workshops on managing electronic records during the 1980s and 1990s, and these workshops continue to be in high demand today. In the 1990s, the NHPRC once again expanded its focus and established the electronic records research agenda.

During the last quarter of the twentieth century, the debate over education and qualifications for archivists continued. The need for a common professional identity in a field which did not have one path for careers, especially since SAA was not in a position to manage the accreditation of graduate archival programs, led to the founding of the Academy of Certified Archivists in 1988. Not all agreed as many archivists saw certification as a move toward a preference for technical training over a liberal arts education.^[7] SAA also updated its guidelines for graduate archival education twice during this time, in 1988 and 1994, and yet another version was released in 2002. The related guidelines for archival continuing education were adopted in 1997 and revised significantly in 2006.^[8,9]

Today, archivists continue to enter the profession from many different directions, as shown by the results of the 2005 SAA archival census.^[10] Some have received formal academic training, some participate in apprenticeship programs, others take short courses, and still others receive no formal training at all. Most archival professional associations continue to offer postemployment workshops and training to aid archivists in acquiring the skills they need for their positions.

In the 2000s, the two areas of widespread focus were digitizing materials and reducing the amount of materials in the processing backlog. The NHPRC revised its guidelines for the scope of electronic records projects; allowed for funds to be used for digitization projects; and promoted the publication of electronic editions. The federal government expanded its requirements for hiring archivists to allow archival science classes to meet the necessary education requirements. (Prior to the change,

the Office of Personnel Management's Individual Occupational Requirements for the Archivist job series only allowed classes in history, American civilization, economics, political science, public administration, and government to be counted toward the educational requirements.) There was a growing interest in the archival field as the SAA student chapters increased to 28 in number. Academic programs also began to offer online classes, and professional organizations offered online workshops.

CONCLUSION

Since the founding of the nation, archives in America have had a bifurcated nature. The first citizens kept both public records and historical manuscripts of the events occurring. These two traditions have been maintained over the intervening years, sometimes focusing on their differences and at other times embracing their similarities. Even groups that have split apart have occasionally rejoined forces, such as with the joint meeting of SAA, NAGARA, and the Council of State Archivists in 2005.

Currently the divide is most apparent in the argument over which is a better educational path to a career in archives—an advanced degree in history or library science, with a couple of institutions establishing programs that lead to an advanced degree in archival science. Some even argue that no degree is needed at all. Most agree, in very basic terms, that it is a combination of the skills one learns while doing the work and learning a certain level of archival theory that makes one trained as an archivist.

As recently as 2008, the president of the Society of American Archives questioned “whether [archivists] are a united profession” or a group divided by its distinctions. He reiterates the thought that all who “preserve the primary documentation that sustains cultural and institutional memory” should be considered part of the profession.^[11] The similarities of what archivists do should outweigh the differences.

PROFILES OF ARCHIVAL REPOSITORIES

This section provides information about many archival institutions, representing the diverse nature of archives in the United States. The repositories were chosen for a variety of reasons, including the prominence of the institution, the significance of the founding of the institution, the programmatic activities of the institution, the activities of the staff within national or regional professional associations, or the authors' familiarity of the programs. The profiles are not provided as a comprehensive or definitive list, but merely as a means to convey the breadth of diversity. Many of the institutions listed could have been placed easily into another category.

The information provided in the profiles comes directly from the Web sites of the institutions themselves. In some cases, the information has been edited for brevity and style.

National Archives and Records Administration

The U.S. National Archives was established by Congress in 1934 as an independent executive branch agency of the federal government. In 1949, it became a division of the General Services Administration and was renamed the National Archives and Records Service (NARS). In 1985, it again gained independent status and another new name, the National Archives and Records Administration (NARA).

NARA collects all of the permanent records of the federal government. It is the keeper of the Declaration of Independence, the Constitution of the United States, and the Bill of Rights. Additionally, there are at present approximately 9 billion pages of textual records; 7.2 million maps, charts, and architectural drawings; more than 20 million still photographs; over 3 million data files; and more than 365,000 reels of film and 110,000 videotapes.

At first housed in a single building in Washington, DC, NARA now has 38 facilities across the United States including 14 regional repositories and 13 presidential libraries. For fiscal year 2008, NARA had 138,167 in-person daily researchers; 377,040 public program attendees; 3,046,809 exhibit and museum visitors; and 37,806,682 online visitors. That same year, NARA received 1,221,858 written reference requests, of which 1,148,870 pertained to records at the National Personnel Records Center in St. Louis, Missouri.^[12]

NARA also provides for the management of records created by all three branches of the United States federal government—executive, legislative, and judicial. It runs a government-wide records management program that identifies records of permanent value, assures the timely destruction of temporary records, and provides federal agencies with guidance on managing their current records. The regulations for federal agencies are codified in 36 CFR §§1220-1239. Links to all of NARA's regulations may be found at <http://www.archives.gov/about/regulations/index.html>.

NARA also administers the Federal Register (FR) and the National Historic Records and Publications Commission (NHPRC). The FR is the daily newspaper of the federal government. It provides legal notice of administrative rules and notices and Presidential documents in a comprehensive, uniform manner. The NHPRC supports a wide range of activities to preserve, publish, and encourage the use of documentary sources through grants and other activities.^[13]

State and Local Government Archives

The phrase “state or local government archives” generally refers to records of permanent value created by state or

local governments, the agency that preserves those records, and the buildings in which the records are housed. While NARA is responsible for federal records management programs and archives, there is no national guidance for state, city, county, or other local government archival programs. Each state has its own regulations for programs, and local governments may institute their own additional measures.

All 50 States and the District of Columbia have archival programs. Some are managed as historical societies, some as archives, and some as divisions within other branches of state government, such as the Office of the Secretary of State or Education.

The entry on State Archives elsewhere in this volume provides more detail on these programs. The profiles below detail examples of local government archives.

Multnomah County (Oregon) Archives

The Multnomah County Archives contains records documenting county activities from its formation in 1854 until the present. Given the County's history, the bulk of the records represent the actions of the Board of County Commissioners and, after 1967, the County Chair's Office. But most departments, offices, and programs have at least some representation in the county's archival record. The archives contains roughly 950 cubic feet of records, 18,200 maps and drawings (both flat and rolled), 500 volumes, 800 recorded discs, 4750 cassette tapes, and 13,000 reels of original microfilm.^[14]

New Orleans Notarial Archives

Founded in 1867, this repository holds over 40,000,000 pages of signed acts compiled by the notaries of New Orleans, Louisiana, over three centuries. The only repository dedicated to notarial records in the United States, the materials within this repository include information on land purchases, loans, contracts, and surveys. One unique aspect of this repository is that all of the records are bound in volumes to ensure arrangement and proper housing of the records. The collections are microfilmed and the microfilm is housed at the Louisiana State archives.^[15]

San Antonio Municipal Archives Program

The San Antonio Municipal Archives Program was begun in February 2007 under the Office of the City Clerk, and in partnership with the San Antonio Public Library's Texana/Genealogy department, and the San Antonio Public Library Foundation. Prior to this date, there was no formal program or policies in place for the preservation of historical documents created by City departments. Located in the Municipal Records Facility, the program aims to appropriately house, organize, and make available for research the history of the City of San Antonio. Historical

records, aerial photographs of the city, a mayoral collection and other valuable items can be found in the City's first ever San Antonio Archives Program. The program, envisioned to possibly become a model for other municipal governments, is intended to preserve the City's historical findings.

Currently, the collection includes archived City Council minutes, ordinances, aerial photographs of the city, maps from the City Engineer and historical items such as letters from Mexican General Santa Anna.^[16,17]

Academic Repositories and Digital Projects

Archival programs in academic settings frequently include both the formal institutional archives as well as many "special collections," i.e., manuscript collections in particular subject areas as well as personal paper collections from faculty and other community members. While there are some national rules for recordkeeping based on protecting student privacy, most private academic archival programs are not regulated. Public colleges and universities must follow the requirements of their governing jurisdictions, which are usually state-issued regulations.

While government archivists have frequently been at the forefront of electronic records management, academic archivists have led efforts in digitalizing archival and library materials. They have been instrumental in creating digital libraries and digital institutional repositories.

Cornell University

Officially established in 1951, the original purpose of the Cornell archives was to document everyday life in upstate New York. This changed in 1945, when the repository acquired the Ezra Cornell Papers. These materials documented the founding of Cornell University and its establishment through the sale of Western lands. In subsequent years, the papers of the early presidents and trustees were added as were the personal and professional papers of individual faculty members.

Currently, the Archives collect and preserve records of historical, legal, fiscal, and/or administrative value to Cornell University. Holdings include official records and reports of the university, its officers, and component parts; private papers of faculty, students, staff, and alumni; official and student publications; maps and architectural records; audiovisual materials including still photographs and negatives, motion picture film, oral history interviews, and audio and video tapes; and artifacts and ephemera documenting Cornell's history.

The Cornell University Archives is part of the Division of Rare and Manuscript Collections. The Division holds 400,000 printed volumes, more than 70 million manuscripts, a million photographs, paintings, prints, and other visual media. These include collections in East Asian

history and culture, sexuality and gender, travel and tourism, and science and technology.

Cornell has also been at the forefront of developing digital collections. They have worked to provide digital surrogates of their collections and have also been involved with a number of collaborative projects with institutions such as the National Agricultural Library, the National Science Foundation, and the Massachusetts Institute of Technology to create digital collections. It is also one of the partners in the Making of America project, which is described later in this entry.

Cornell staff has also been involved with creating several programs such as the Digital Imaging Tutorial and the Digital Preservation Management Workshop and tutorial to help train archivists in how to create and preserve digital content. Cornell University staff have also written and presented extensively on digital library issues.^[18–20]

The University of Michigan

The Bentley Historical Library at the University of Michigan was established in 1935 by the University Regents to carry out two functions: to serve as the official archives of the University and to document the history of the state of Michigan and the activities of its people, organizations, and voluntary associations. The library has extensive holdings on the history of the state and the university, including more than 30,000 linear feet of archives and manuscripts, 57,000 printed volumes, 1.5 million photographs and other visual materials, and over 10,000 maps.

Collections include the Michigan Historical Collection, which documents the history of Michigan from the days of exploration to the present and the archives of the University of Michigan. The Bentley is also home to several archival training programs, which have helped shaped many leaders of the archival profession. It is also of interest that one of the former heads of the Bentley, Robert Warner, was the guiding force behind the National Archives and Records Administration becoming an independent government agency.

Moreover, in 1993, the University of Michigan library launched its first digital project. In addition to working to bring over 200 collections online, staff have helped created OAIster, a union catalog for digital collections, and the Digital Library eXtension Service, which provides the foundation and the framework for educational and non-profit institutions to fully develop their digital library collections, as well as many other projects to develop standards and provide support for digital programs. It is also one of the partners in the Making of America project.^[21,22]

Making of America

A collaboration between the Cornell University Library, the University of Michigan, and the Library of Congress,

the Making of America project provides access to digitized copies of books and periodicals from all three institutes. The initial project was a collaboration between Michigan and Cornell in the hopes of developing a collection of materials that would serve both campuses and would also document American social history in the last half of the nineteenth century. In 1999, the Library of Congress joined the project by providing access to the periodical *Garden and Forest*.

At present, Michigan has contributed 10,000 books and 50,000 journal articles with nineteenth century imprints. Cornell has contributed 267 books and 955 serial volumes. The collection is particularly strong in the subject areas of education, psychology, American history, sociology, religion, and science and technology.^[23,24]

California Digital Library

The California Digital Library, established in 1997, supports the assembly and creative use of the world's digital scholarship and knowledge. In addition, they work to improve the development and management of digital collections, innovation in scholarly publishing, and the long-term preservation of digital information. They work to improve Web capture technology; provide access to primary sources through the Calisphere project, the Mark Twain project, and the online archive of California; and to insure preservation to digital content.^[25]

Duke University

The Digital Collections Program at Duke focuses on digitizing and making available the manuscripts, rare books, documentary photographs, historic advertisements, popular music, and other materials found within the Duke Library collections. Collections include historic sheet music from the late nineteenth to the early twentieth century, historical medical images, extensive photograph collections, and material on the history of Duke University and the town of Durham, North Carolina.^[26]

Massachusetts Institute of Technology and DSpace

The archives at the Massachusetts Institute of Technology (MIT) houses the documents that tell the history of the institution, the papers of noted professors and students, books written by MIT staff and students, and oral histories of members of the MIT community. They also manage the institutions records management activities.

MIT is also the home of DSpace. DSpace was created in collaboration with Hewlett Packard so that MIT could save, share, and search its digital research materials. Released in 2002, DSpace was created as Open Source Software. It stores data in a nonproprietary format, which allows for access by users even if the original software used for the creation of the document disappears. This

allows users to customize DSpace to meet their institution needs. DSpace can capture, store, index, preserve, and redistribute the material created by scholars in digital format. It allows access to scholarly documents that have been created only in digital form and creates a searchable digital archive with documents using a variety of formats including text, images, audio and video items, and databases. It also allows for flexibility in the use of metadata, allowing users to customize DSpace to work with the policies and procedures already in place at their institutions.

The DSpace Foundation was created with other repositories around the world to study how DSpace is being used and to provide support to smaller repositories using DSpace. It also provides leadership for the DSpace community and also works to encourage wider use of the DSpace software.^[27,28]

Stanford University

Stanford University's digital collections include material drawn from throughout its collections. Included are covers from dime novel and penny dreadfuls, maps, material from the Stanford Geological Survey, correspondence from Athanasius Kircher, and the records of the General Agreement on Tariffs and Trade. Stanford has also been at the forefront of the digital library movement helping to develop standards and supporting documentation to help in the creation and support of digital collections. One of the major initiatives is the LOCKSS (Lots of Copies Keep Stuff Safe), which provides open source software to help repositories keep their digital collections safe.^[29,30]

University of Chicago

The manuscript holdings of the Special Collections Research Center of the University of Chicago Library measure 6055 linear feet and span the period from the second century A.D. to the present. Collections held by the University include the Berlin Collection acquired by William Rainey Harper in 1891; the manuscript collection of the John Crerar Library, which focuses on science and medicine; late medieval and Renaissance secular and religious texts; and commonplace books, musical scores, sermons, papal dispatches, poetry, and letters. Among the more important of the modern manuscript collections are the editorial files of *Poetry Magazine*, which contain letters and manuscripts of many leading American and English poets of the first half of the twentieth century, including T. S. Eliot, Robert Frost, Amy Lowell, Marianne Moore, Ezra Pound, Wallace Stevens, Sara Teasdale, William Carlos Williams, and William Butler Yeats; the personal papers of Poetry's editor, Harriet Monroe; and the papers of Morton D. Zabel and others associated with the publication of modern poetry, especially in Chicago.

The collections also include the papers of Stephen A. Douglass, Saul Bellow, Ida B. Wells, Julius Rosenwald, the Chicago Jazz Archive, the Illinois chapter of the American Civil Liberties Union collections, the American Association for Public Opinion Research, and the Adlai Stevenson Institute of International Affairs.^[31]

The University of North Carolina at Chapel Hill

The University of North Carolina at Chapel Hill has been at the forefront of digitizing collections focusing on North Carolina and the American South. One of their major projects has been the Documenting the American South collection. This collection provides Internet access to texts, images, and audio files related to southern history, literature, and culture. Currently, Documenting the American South includes 12 thematic collections of books, diaries, posters, artifacts, letters, oral history interviews, and songs.^[32]

Yale University

The resources held by Manuscripts and Archives include over 1700 collections of personal and family papers and organizational records that document a variety of areas, and the Yale University Archives. Originally established in 1938, the Historical Manuscripts Room served as a place to hold historical collections that did not have a home of their own.

The Yale Archives began 1906 when the staff of the Yale Memorabilia Room began to collect publications, records, and objects, particularly those related to Yale College classes. A curator for this collection was appointed in 1918, and the first university archivist was appointed in 1958. In 1961, the library established the combined position of university archivist and curator of historical manuscripts that, along with the building of the Beinecke Rare Book and Manuscript Library, led to eventual consolidation of the Memorabilia collection, the Yale Archives, historical manuscripts, and the House collections. Collection strengths include public policy and administration; diplomacy and international affairs; political and social thought and commentary; science, medicine, and the environment; legal and judicial history; the visual and performing arts; urban planning and architecture; environmental policy and affairs; psychology and psychiatry; and lesbian, gay, bisexual, and transgender history and culture. In addition, the department has extensive holdings on New Haven, Connecticut, and New England history. A recent acquisition is the Fortunoff Video Archive for Holocaust Testimonies, which holds more than 4300 testimonies providing firsthand experience of the holocaust.^[33]

Manuscript Repositories and Historical Societies

A manuscript repository is an institution that collects historical materials from people or organizations other than

itself. A historical society is a manuscript repository that focuses its collecting on a specific topic, such as a geographical area or a particular event.

The entry on Historical Societies elsewhere in this volume provides more detail on those institutions, particularly State Historical Societies. The profiles below detail examples of other types of historical societies and manuscript repositories.

Library of Congress

The Manuscript Division was one of several “departments” established in 1897 when the Library of Congress moved from the United States Capitol to a separate building nearby. In 1903, by an act of Congress and an executive order, the State Department began transferring historical papers, including several presidential collections, which had been acquired by the federal government, to the Manuscript Division.

The Manuscript Division broadly collects materials relating to political history, cultural history, and the history of science, and materials from nongovernmental organizations. At present the Division holds nearly 60 million items contained in 11,000 separate collections (Fig. 5).

The Library holds papers from 23 presidents starting with George Washington and ending with Calvin Coolidge. Some presidential papers such as the John and John Quincy Adams papers are held in repositories near their homes. Later presidential papers are held in presidential libraries overseen by the National Archives and Records Administration. The Library also holds papers of other notable governmental officials and leaders such as John Paul Jones, George S. Patton, Alexander Haig, Daniel Patrick Moynihan, and Thurgood Marshall.

The Manuscript Division serves as the archival repository for a number of nongovernmental organizations, which have significantly affected American life, including the National Association for the Advancement of Colored People, National Urban League, National American Woman Suffrage Association, National Woman’s Party, and Brotherhood of Sleeping Car Porters. Other large organizational collections include the records of the League of Women Voters and the American Colonization Society.

Additional notable collections include the papers of Susan B. Anthony, Frederick Douglass, Margaret Sanger, Luther Burbank, J. Robert Oppenheimer, Groucho Marx, Lillian Gish, Jessica Tandy, Hume Cronyn, Frederick Law Olmsted, and Ludwig Mies van der Rohe.

Though the Manuscript Division has the largest number of manuscript collections, the Performing Arts Reading Room and the American Folklife Center also hold manuscript collections.

Begun as a pilot project in 1990 to digitize materials and make them available on CD-ROM, in 1994, the Library of Congress launched the American Memory



Fig. 5 The current Manuscript Division Reading Room, Madison Building.

Source: Photograph courtesy of the Manuscript Division, Library of Congress.

historical collections as the flagship of the National Digital Library Program—a pioneering systematic effort to digitize some of the foremost historical treasures in the Library and other major research archives and make them readily available on the Web to Congress, scholars, educators, students, the general public, and the global Internet community.^[34,35]

American Philosophical Society

The American Philosophical Society was created by Benjamin Franklin in 1769 to help “improve the common stock of knowledge.” Early members included doctors, lawyers, clergymen, and merchants interested in science, and also many learned artisans and tradesmen like Franklin. The Society served as the prototype for a number of other learned societies and also provided space for the University of Pennsylvania. It has provided grant funds to encourage scientific research, given awards to honor outstanding work in the sciences, and developed publications to encourage researchers to share their knowledge.

The Society houses over 7 million manuscripts within hundreds of collections of personal papers and archival materials. Collections include the papers of Benjamin Franklin, Charles Darwin, Charles Willson Peale, and Franz Boas. The collections range from the mid-eighteenth century to the present, with an emphasis on documenting anthropology and its subfields (ethnology, biological anthropology, linguistics, and archaeology), the mathematical and physical sciences, the earth sciences, and the life sciences (evolutionary theory, genetics, eugenics, biochemistry, molecular biology, and paleontology). The repository also houses over 200,000 volumes and bound periodicals and thousands of maps and prints. Many of its long series of American and foreign scientific publications are not easily available elsewhere. Rare books include first editions of Newton’s *Principia*,

Franklin’s *Experiments and Observations*, and Darwin’s *Origin of Species*.^[36]

Chicago History Museum

The Chicago History Museum is a privately endowed, independent institution devoted to collecting, interpreting, and presenting the rich multicultural history of Chicago and Illinois, as well as other aspects of American history. The Museum has over 22 million artifacts and documents. The Archives and Manuscript Division holds collections that document life in the region from 1683 to the present day, focusing on topics such as the Chicago area’s early history, social conditions and problems, twentieth-century neighborhood life, community organizations, African American history, ethnic history, women’s history, civil liberties and civil rights, politics, religious-centered social action, labor unions, environmental concerns, teachers, and school reformers. Also of interest to users will be the Studs Terkel/WFMT Oral history archives, which include audio recordings of interviews, readings, and musical programs aired during Studs Terkel’s tenure at WFMT Radio from the early 1950s through 1999. People heard on the recordings include Mahalia Jackson, Louis Armstrong, Carl Sandburg, Ralph Ellison, Dorothy Parker, and Mike Royko.^[37]

Urban Archives at Temple University

The Urban Archives was established in 1967 to document the social, economic, and physical development of the Philadelphia area from the mid-nineteenth century to the present. The Archives functions as a repository for organizational records and related materials, and as a research facility for those interested in urban studies. The Archives collections are particularly strong in areas involving social service organizations, unions, housing development, community organizations, and contain many records from

organizations involved with African Americans, education, and crime.^[38]

Military Archives

Military archives are historical societies that focus on the history of military service.

Air Force Historical Research Center

The Air Force Historical Research Agency is the repository for Air Force historical documents. It consists today of over 70,000,000 pages devoted to the history of the service, and represents the world's largest and most valuable organized collection of documents on U.S. military aviation. Included within the collection are unit histories, the papers of retired general officers and other Air Force personnel, documents from various military actions, and oral histories.^[39]

Center for Military History

The Center of Military History is responsible for the appropriate use of history throughout the U.S. Army. The Center records the history of the Army during peace and wartime. Officially this section dates back to the creation of the historical branch in 1943 and its work to preserve the history of World War II. Their work includes creating documents studying the activities of the Army, maintaining the organizational history of Army units, preserving the history of significant units during reorganizations, and providing an annual history of the Department of the Army.

The Center for Military History serves as a clearinghouse for oral history programs and also maintains its own oral history collections including end of tour interviews for staff. The Center also manages a system of 59 Army museums and 176 other holdings, encompassing some 500,000 artifacts and over 15,000 works of military art.^[40]

Naval Historical Center

As the official history program of the United States Navy, the Naval Historical Center manages the Navy Department Library, 12 Navy museums, art collections, archives, and an underwater archaeology program. The Center prepares and publishes reference, documentary, analytical, and narrative works on the history of the U.S. Navy.^[41]

Religious Archives

Religious archives are archival repositories that collect materials pertaining to religion and spirituality. These archives may be the institutional archives for a particular religious organization or group or a manuscript repository that collects material pertaining to the religious life.

American Jewish Historical Society

Founded in 1892, the American Jewish Historical Society's holdings include 20 million documents, 50,000 books, paintings, and other objects that document the contributions of the American Jewish community to life in the Americas from the sixteenth century to the present. Included within the collections are the first American book published in Hebrew and the handwritten original of Emma Lazarus' *The New Colossus*, which graces the Statue of Liberty.

The American Jewish Historical Society houses approximately 1000 archival collections, comprising 10,000 linear feet. Notable personal collections include the papers of Haym Salomon, Emma Lazarus, Henry Roth, and Stephen Wise. Organizational collections include the papers of the Council of Jewish Federations and Welfare Funds (now called United Jewish Communities); the American Jewish Congress; the National Jewish Welfare Board, the Jewish Reconstructionist Federation; Congregation Shearith Israel, New York; the Graduate School for Jewish Social Work, New York; the National Association of Hillel Directors; and the Grand Street Boy's Association.

The American Jewish Historical Society also holds photographic collections that depict the efforts of immigrant aid organizations and Jewish businesses throughout the United States. There are also images of Jewish chaplains and soldiers who served during World War I and World War II, Jewish community centers, orphanages, and synagogues.^[42]

American Jewish Archives

The American Jewish Archives, which is housed at the Hebrew Union College in Cincinnati, Ohio, holds nearly 800 major manuscript collections and over 16,000 smaller collections. The repository holds over 13,000 images. Originally founded by Jacob Rader Marcus in 1947, its goal is to provide a documentary heritage of the religious, organizational, economic, cultural, personal, social, and family life of the American Jewish community. Included within the collection are the papers of several noted rabbis, information on women within the Jewish community, and material on noted Jewish organizations and on the Holocaust.^[43]

Archdiocese of Chicago

The Archdiocese of Chicago's Joseph Cardinal Bernardin Archives & Records Center is the official repository for the records of the Roman Catholic Archdiocese of Chicago. This collection was started in 1966 by then Archbishop John Cody. The Archives has more than 8000 cubic feet of materials, making it one of the world's largest repositories of Archdiocesan Archives. Most of the material is from the twentieth century. Materials included

within this collection include the papers and photographs of former ordinaries (Cardinals: Mundelein, Stritch, Meyer, Cody, and Bernardin), auxiliary bishops, chancellors, vicar general, and the administrative records of various Archdiocesan agencies and programs. Also included are organizational papers for the Chicago House of the Order of the Poor Clares, the St. Vincent de Paul Society, the Catholic Action Federation, and the Catholic Youth Organization. The Archives houses the oral history projects for Rev. Steven Avella and Michael Hartnett.

The Archives also maintains collections of sacramental registers (pre-1916 available on microfilm), student transcripts, yearbooks, class photographs, parish annual reports, liturgical and devotional materials, cemetery records, diocesan deceased priest files, *New World* obituaries, deed and construction files, orphanage records, and architectural drawings from Archdiocesan institutions. Commemorative books are available for parishes, religious orders, diocesan clergy, and institutions.^[44]

Archives of the Episcopal Church U.S.A.

The Archives of the Episcopal Church U.S.A. is the official repository for the records of the Episcopal Church. The Archives also gathers the records of national Church bodies, the various offices of missionary program and administrative support of the Episcopal Church Center, affiliated Episcopal organizations, and the personal papers of prominent lay and ordained leaders. The Archives of the Episcopal Church is the official repository for records of the Church's General Convention, its committees, boards and agencies, and the corporate body of the national Church, the Domestic and Foreign Missionary Society of the Protestant Episcopal Church in the United States of America. Included in these umbrella bodies are the various program and administrative offices of the Episcopal Church Center in New York City. The official papers of the Primate and the Office of the Presiding Bishop are also located in the Archives. The Archives also holds the records for other churches that may no longer exist to ensure that these materials are available for future researchers.^[45]

Billy Graham Center Archives at Wheaton College

The focus of the Billy Graham Center Archives is to gather, preserve, and make available materials on the history of North American nondenominational Protestant efforts to spread the Christian Gospel. These collections include private papers of individuals, records of organizations, and hundreds of oral history interviews. These collections include the papers of the Billy Graham and the Billy Graham Evangelistic Association (BGEA) and other groups working to spread the word of the gospel around the world.^[46]

Family History Center of the Church of Jesus Christ of Latter-Day Saints

The Family History Library has the largest collection of genealogical materials in the world. Most of the records are on microfilm; other formats include microfiche, books, maps, charts, and CD-ROMs. Most of the records of the collection date from 1550 to 1920. The Family History Library had its beginnings in 1894, with the founding of the Genealogical Society of Utah. Leaders of The Church of Jesus Christ of Latter-Day Saints organized the society to assist Church members with their family history and genealogical research. Its extensive record collection is available to professional genealogists and amateur researchers alike.^[47,48]

United Methodist Church

The Archives and History Center of the United Methodist Church was officially opened on October 2, 1982, and is housed on the campus of Drew University in Madison, New Jersey. It contains a museum, a large collection of books, documents, records, photographs, and artifacts relating to United Methodist History. The purpose of the Center is "to gather, preserve, hold title to, and disseminate materials on the history of The United Methodist Church and its antecedents." The collections include the papers of some of the notable leaders of the Methodist Church and of some of churches within the denomination. Also included are recording from radio programs documenting items of interest to the community.^[49]

Business Archives

Business archives house the corporate records of the parent organization or, in some cases, are historical societies that focus on the acquisition of corporate records. The entry on Business Archives in North America elsewhere in this volume provides more detail on the history of those programs. Also included in this category are organizations that are in the business of managing archives for institutions that do not have an archival staff in-house to work with collections.

Coca-Cola

The collections of the Coca-Cola Company run from 1880 to the present day and measure approximately 2000 linear feet. At present, nearly 1200 items from the archives are on display in the World of Coca-Cola exhibit which is seen by nearly a million visitors a year. In addition to the memorabilia that is on display, the Coca-Cola Archives has administrative, financial, legal, and marketing materials.^[50]

Ford Motor Company

The Ford Motor Company Archives, which was established in 1951, is one of the oldest and most comprehensive corporate archives in the United States. The company archives contains more than 13,000 boxes of company records. The archives was started as part of the Ford Motor Company's 50th anniversary celebration. Dr. Robert Bahmer, then Assistant Archivist of the United States, developed the proposal for the archives indicating the benefits of maintaining archives to the Ford Motor Company leadership. After a very active start after the celebration of the anniversary, the Archives faced major budget cuts and was deemed not to be important. It was also suggested that material be destroyed or sent to other repositories. Though the archives did continue with limited support until the mid-1990s, it took another anniversary celebration to again focus interest on the archival collections. At that point, a professional archivist was brought on-board and work was done to help show the importance of the archives to the organization. Thanks to the work of the archivist, the Ford Motor Company began again to recognize how the archives could assist not only with anniversary celebrations but also with issues relating to many aspects of the organization including design, marketing, and legal support.^[51,52]

Levi Strauss

The Levi Strauss historical collections of documents, clothing, photographs, films, posters, advertising materials, and artifacts dates back to the mid-1800s and includes items such as the 1974 Levi's® edition of the Gremlin automobile. There are 400 linear feet of documents, including letters from Cary Grant, Henry Kissinger, Lady Bird Johnson, and Clint Eastwood; 4500 photographs; 5000 garments including the oldest pair of 501 jeans from 1879; and marketing materials including posters and different artifacts.^[53]

History Associates

History Associates Incorporated was started in 1981 when two of the founders were commissioned to write a book about the U.S. Department of Energy's response to the Three Mile Island disaster. They along with two other colleagues realized that they could help business and government leaders realize the importance of the historical materials they held. The company provides historical research and writing of company histories and other documents, managing historical records and providing records management support, and a place to store important historical records off-site.^[54]

History Factory

The History Factory started in 1979 as Informative Design Group, Inc. Originally the company planned to merge historical research with graphic design to inform and educate members of the company and the general public. This mix of archives and marketing was appealing to clients and helped them to realize the importance of their historical collections. They asked the company for assistance in preserving their historical materials.

In 1989, the company changed its name to the History Factory and in addition to the marketing work it had done in the past they began to offer archives management support and support for oral history programs. They continue to work to supply support for corporate anniversary programming, corporate history books, and heritage-based marketing and communications initiatives as well as supplying archival support and storage for their clients.^[55]

Data and Electronic Records Archives

Data archives are repositories that preserve databases and other records in electronic form that were created in a format that only a computer can process. Traditionally they have been focused on collecting data files in the social sciences and providing services that promote the secondary use of the data. More recently, electronic records archives have expanded to collect other digital formats, such as text documents and Web pages.

Inter-university Consortium for Political and Social Research (ICPSR)

Established in 1962, Inter-University Consortium for Political and Social Research (ICPSR) at the University of Michigan is the world's largest archive of digital social science data. ICPSR provides leadership and training in data access, curation, and methods of analysis for a diverse and expanding social science research community. One of ICPSR's primary activities is to provide raw data for analysis. They collect data from a variety of resources and make it available for users.

In addition to their work to provide access to data, they are also at the forefront of activities to ensure long-term access to digital data. They host the Digital Preservation Management tutorial, which helps users learn about issues involved in digital preservation and ways to deal with some of these issues, as well as hosting workshops on digital preservation.

ICPSR is also one of the leaders of the Data Preservation Alliance for the Social Sciences (Data-PASS). Data-PASS is a broad-based partnership devoted to identifying, acquiring, and preserving data at-risk of being lost to the social science research community. Examples of at-risk

data include opinion polls, voting records, large-scale surveys on family growth and income, and many other social science studies. The other leaders in the partnership are the Roper Center for Public Opinion Research at the University of Connecticut, the Howard W. Odum Institute at the University of North Carolina-Chapel Hill, the Henry A. Murray Research Archive (a member of the Institute for Quantitative Social Science at Harvard University), the National Archives and Records Administration, and the Harvard-MIT Data Center (also a member of the Institute for Quantitative Social Science at Harvard University). The project is supported by an award from the Library of Congress through its National Digital Information Infrastructure and Preservation Program (NDIIPP).^[56]

Electronic and Special Media Records Services Division, NARA

The Electronic and Special Media Records Services Division—The National Archives and Records Administration (NARA) custodial program for electronic records—began as the Data Archives Staff in 1968. The Division accessions, preserves, and provides access to electronic records of continuing value created by the U.S. Congress, the courts, the Executive Office of the President, numerous Presidential Commissions, and nearly 100 bureaus, departments, and other components of executive branch agencies and their contractors. Through these activities, NARA enables researchers to gain access to federal records designed for computer processing that federal agencies have transferred to archival custody. The holdings are as diverse as the activities and interests of the federal government and consist of more than 3 million unique files. The records may be from any type of computer applications, such as database management systems, word processing, computer modeling, or geographic information systems. The records may concern virtually any area or subject in which the Federal Government is involved, including: agricultural; attitudinal; demographic; economic and financial statistics; education; environmental; health and social services; international; military; and scientific data.^[57]

Electronic Records Archives, NARA

In the late 1990s, the National Archives and Records Administration (NARA) began work to deal with the changing nature of electronic records that were arriving from federal government agencies. NARA needed to figure out how to best manage born digital records that were not databases, including determining how best to acquire, appraise, preserve, and provide access to these materials and help government agencies learn how to deal with the lifecycle of electronic records.

In 1998, NARA began working on the Electronic Records Archives (ERA) project, with the goal of being

able to authentically preserve and provide access to electronic records created anywhere in the federal government, free from dependence on any specific hardware or software, and enabling NARA to carry out its mission into the future. After several years of conducting research in collaboration with other state and federal government agencies, computer scientists, and others to determine the problems involved with handling electronic records and to consider solutions, NARA launched the first phase of the ERA information technology system in 2008.^[58]

Minerva/Library of Congress Web Archives

The Library of Congress Web Archives (LCWA) is composed of collections of archived Web sites selected by subject specialists to represent Web-based information on a designated topic. It is part of a continuing effort by the Library to evaluate, select, collect, catalog, provide access to, and preserve digital materials for future generations of researchers. This project, originally called MINERVA, started in 2000 by collecting Web sites relating to the 2000 elections. Staff members reviewed ways to select, collect, and provide access to these Web sites. Later staff worked to capture Web sites that documented the 2002, 2004, 2006, and 2008 elections; the Iraq war; the events of September 11, 2001; the reaction to Hurricane Katrina; and the Papal transition.^[59]

Museum Archives

Archives within museums "...document the history and development of the museum, its collections, exhibitions, and programs as well as the contributions of individuals and groups associated with the museum."^[60]

Smithsonian Institution

The Smithsonian Institution Archives started in 1891. It collects the papers of the Smithsonian and of people associated with the Smithsonian. The most recent guide to the collections notes that there over 1100 record units comprising more than 15,500 cubic feet of archival material. In addition to the institutional archives of the Smithsonian, several of the museums have their own archives.^[61]

The Air and Space Museum archival collection contains approximately 10,000 cubic feet of material including an estimated 1.7 million photographs, 700,000 feet of motion picture film, and 2 million technical drawings which span the history of flight from ancient times to the present day.^[62]

The National Anthropological Archives and Human Studies Film Archives collect and preserve historical and contemporary anthropological materials that document the world's cultures and the history of anthropology. The collections include the Smithsonian's earliest attempts to document North American Indian culture, the diaries of

John Wesley Powell, and the ethnographic and linguistic research of Franz Boas, Frances Densmore, Alice Cunningham Fletcher, Albert S. Gatschet, John Peabody Harrington, and J. N. B. Hewitt. They also include early 635,000 ethnological and archaeological photographs (including some of the earliest images of indigenous people worldwide); 20,000 works of native art (mainly North American, Asian, and Oceanic); 11,400 sound recordings; and more than 8 million ft of original film and video materials.^[63]

The Archives Center of the National Museum of American History holds more than 1000 collections. They include material on advertising, music, and technology. These include original television scripts, sheet music, advertising campaign literature, and personal paper collections including Henry Tupper, the creator of Tupperware.^[64]

The Archives of American Art, open since 1954, has collected roughly 16 million letters, photographs, diaries, oral history interviews, sketches, scrapbooks, business records, and other documents that support the study of the history of the visual arts in America.^[65]

Getty Museum

The Getty Research Institute is dedicated to furthering knowledge and advancing understanding of the visual arts. The library holds over 190 collections of letters and other materials from artists and scholars such as Man Ray, Beaumont and Nancy Newhall, Paul Outerbridge, and E. Maurice Bloch.^[66]

United States Holocaust Museum

The United States Holocaust Museum, which opened in 1993, has one of the largest and most comprehensive collections of Holocaust-related materials in the world. The collections include material on Jewish life in Europe before the Holocaust; the rise of the Nazi movement; their persecution of various groups including homosexuals, Roma and Sinti (Gypsies), Jehovah's Witnesses and political dissidents; information on ghettos, concentration camps and killing centers; the liberation of Europe and the war crimes trials; and the various Holocaust memorials and commemorations around the world.

The Archives branch consists of nearly 42 million pages of records including personal papers, memoirs and testimonies of Holocaust survivors and victims, oral histories, photographs, and microfilm copies of material from countries around the world on the Holocaust. In addition, there is over 1000 hr of historical films and film clips documenting the Holocaust and World War II.^[67]

Warhol Museum

The Warhol Museum and Archives documents the work of noted artist Andy Warhol. The collection currently

consists of over 8000 cubic feet of material. This collection includes scrapbooks of press clippings related to Warhol's work and his private and public life; art supplies and materials used by Warhol; posters publicizing his exhibitions and films; over 4000 audio tapes featuring interviews and conversations between Warhol and his friends and associates; thousands of documentary photographs; an entire run of *Interview* magazine, which Warhol founded in 1969; his extensive library of books and periodicals; hundreds of decorative art objects; many personal items such as clothing; and over 30 of the silver-white wigs that became one of Warhol's defining features.^[68]

Audiovisual Archives

Audiovisual archives are collections that contain photographs, art, maps, technical drawings, sound recordings, sheet music, film, and other types of records that are primarily not textual. Detailed articles on Sound and Audio Archives and Film and Broadcast Archives may be found elsewhere in this encyclopedia.

Museum archives frequently have extensive visual materials, such as with the Smithsonian's various archives. The National Archives' Special Media Archives Division holds an estimated 8 million photographs and graphic images; over 15 million maps, charts, aerial photographs, architectural drawings, patents, and ships plans; nearly 300,000 reels of motion picture film; and more than 200,000 sound and video recordings. The Library of Congress Prints and Photographs Division has more than 13 million images, including photographs, fine and popular prints and drawings, posters, and architectural and engineering drawings.^[69]

Performing Arts Archives

A special type of audiovisual archives is the performing arts archives, which documents theatre, dance, music, and other types of performances.

Center for Black Music Research

The Center for Black Music Research at Columbia College Chicago was founded in 1983 and is the only organization of its kind. The Library and Archives of the center includes the personal papers and music manuscripts of many composers and musicians including William Grant Still, Robert Leigh Morris, and Guido Sinclair. It also includes scores donated by musicians, and the papers of the National Association of Negro Musicians and the Society of Black Composers. The collection also includes recordings covering the 1900s to the present with a focus on vernacular and popular music focus on the United States, Caribbean, South Africa, Central Africa, and Central America.^[70]

Folger Shakespeare Library

The Folger Shakespeare Library has the world's largest collection of Shakespeare materials and major collections of other rare Renaissance books, manuscripts, and works of art. The Folger opened in 1932 as a gift to the American nation from Henry Clay Folger and his wife Emily Jordan Folger. The library houses more than 256,000 books; 60,000 manuscripts; 250,000 playbills; 200 oil paintings; some 50,000 drawings, watercolors, prints, and photographs; and a variety of other materials, including musical instruments, costumes, and films.

The Folger's collection of 60,000 manuscripts range in date from the late thirteenth century to the present day, and offer a wealth of unique material relating to Shakespeare, the theater, or the early modern period. Included in the collection are letters written by the poet John Donne, prompt books for Shakespearian productions, papers of noted actor and theater owner David Garrick, and papers that document the lives of those living in the sixteenth and seventeenth centuries.^[71]

New York Public Library for the Performing Arts

The New York Public Library for the Performing Arts houses one of the world's most extensive collection of circulating, reference, and rare archival collections in its field. The music and dance collections were merged together in 1965 at the Lincoln Center. Included within the collections are historic recordings, videotapes, manuscripts, sheet music, set, light and costume designs, posters, programs, and photographs. The Dance Collection has over 1 million manuscript items documenting all forms of dance and includes the personal papers of Merce Cunningham, Vaslav Nijinsky, Rudolf Nureyev, Agnes de Mille, and Jerome Robbins. The Music Collections includes original manuscripts by Bach, Mozart, Beethoven, and Wagner as well as material from contemporary composers such as Charles Tomlinson Griffes, Louis Moreau Gottschalk, Leo Smit, Ray Green, and Andre Singer.

In addition to these collections, the repository also holds the Rodgers and Hammerstein Archives of Recorded Sound. This collection holds a variety of sound recordings from symphonic work to presidential speeches and works to ensure the preservation of recorded sound.

The Billy Rose Theatre Collection of The New York Public Library is one of the largest and most comprehensive archives devoted to the theatrical arts. Within the collections, users can find a 1767 program for a performance of *Romeo and Juliet* in Philadelphia, read a letter from Edwin Booth to his daughter, review the working script for Orson Welles *African-American Macbeth*, study costume designs from the film *Anna and the King of Siam*, analyze a videotape of *A Chorus Line*, or read scripts from current television hits. In recent years, the Theatre

Collection acquired the archives of famed theatrical producer Joseph Papp and theatre and screen star Lillian Gish. Also included within this collection is the Theatre on Film and Tape Archive, which is authorized by all of America's theatrical guilds and unions to videotape live theatre performances from across the United States. More than 4500 tapes include Broadway, Off-Broadway, and regional theatre productions; theatre-related television programs, films, and documentaries; and interviews with distinguished theatre professionals.^[72]

Popular Culture Archives

Popular culture archives document a wide range of hobbies, entertainment, and special interests in the United States.

Baseball Hall of Fame

The A. Bartlett Giamatti Research Center holds a large collection of baseball books, magazines, newspaper clippings, and archival material on baseball and related topics. The collections include historic newspapers, baseball guides, clipping files, publications created by baseball teams, contract cards for the players and archival collections including the Doubleday papers, the Mills Commission papers, the Roger Angell collection, the Garry Herrmann papers, and the Landis papers. The collections also include over 500,000 images of players, teams, stadiums, events and miscellaneous subjects and over 12,000 hours of moving image and sound recordings. The collection includes interviews, game highlights, television and radio broadcasts, animation, and music.^[73]

Brown Popular Culture Library at Bowling Green University

The Brown Popular Culture Library was founded in 1969 and is dedicated to the acquisition and preservation of research materials on American popular culture created after 1876. It is the most comprehensive repository of its kind in the United States. The manuscript collections support and complement existing print collections in the areas of popular fiction, popular entertainment, and the graphic arts. Many of the manuscripts also document the history of popular culture and pioneers in the field. These manuscript collections include literary manuscripts; movie and television scripts; dime novels; storypapers and nickel weeklies; pulp magazines; fanzines and other amateur publications; comic books and graphic novels; and posters, postcards, greeting cards, and mail-order catalogs.^[74]

Cultural Heritage Archives

The collections in cultural heritage archives illustrate the diversity of personal experiences in the United States. They document the history of ethnic and racial communities.

American Folklife Center

Originally created as the Archive of Folk Song in 1928, the American Folklife Center is one of the largest repositories of traditional life in the world. It includes over 3 million photographs, manuscripts, audio recordings, and moving images that document traditional culture from all around the world. Started by Robert Gordon, it was eventually taken over by John Lomax who traveled throughout the United States eventually with his son Alan to collect folk music. Eventually the focus of the Center expanded to include the collection of folk stories, verbal arts, and oral history. The 1976 legislation that established the American Folklife Center directs it to “preserve and present American folklife” through programs of research, scholarship, training, live performances, exhibits, publications, and preservation. The Center is involved in the Save Our Sounds project to preserve historic sound recordings and the Veterans History Project, which works to obtain firsthand account of war time experiences of veterans and those actively supporting war efforts from World War I to the present Afghanistan and Iraq conflicts. They also sponsor regular performances from groups providing traditional music and dance performances and lectures from those working to learn more about and preserve traditional folkways.

Also of note, the American Folklife Center is the custodian for the September 11 Digital Archive. This collection uses electronic media to collect, preserve, and present the history of September 11, 2001, and its aftermath. The Archive contains more than 150,000 digital items, a tally that includes more than 40,000 e-mails and other electronic communications, more than 40,000 firsthand stories, and more than 15,000 digital images. In September 2003, the Library of Congress accepted the Archive into its collections, an event that both ensured the Archive’s long-term preservation and marked the library’s first major digital acquisition.^[75]

American Heritage Center

The mission of the American Heritage Center is to preserve a clearly defined set of primary sources and rare books—reflecting the written, image, and audio history of Wyoming, the Rocky Mountain Region, and select aspects of the American past—and to make those sources accessible to all. The major collecting areas include Wyoming and the American West, the mining and petroleum industries, U.S. politics and world affairs, environment and natural resources, journalism, transportation, the history of books, and twentieth century entertainment such as popular music, radio, television, and film.

The American Heritage Center was officially established in 1945. The manuscript collections have nearly 90,000 cubic feet of historically important documents and artifacts.^[76]

Amistad Center

As the nation’s largest independent archives specializing in the history of African Americans and other ethnic groups, the Amistad Research Center is dedicated to preserving America’s ethnic heritage. The collection contains approximately 250,000 photographs dating from 1859. Literary manuscript holdings contain letters and original manuscripts from prominent Harlem Renaissance writers and poets. The manuscript collections contain over 15 million documents that record the efforts of those who have charted African American history and race relations. While about 90% of the holdings document African American history, 10% document other ethnic groups such as Appalachian whites, Asian Americans, and Native Americans.^[77]

Balch Institute, Historical Society of Pennsylvania

The Balch Institute was incorporated on April 12, 1971. The Institute collections included material documenting the immigration of southern and eastern Europeans; the records of the *Atlantis*, the first successful Greek newspaper in the United States; materials documenting Puerto Rican immigration to Harlem; the American Friends Service Committee; and the Anthracite Region Ethnic Archives Project, which started by documenting the miners especially those immigrants from the eastern and southern parts of Europe living in the Anthracite region and later expanded to include the various organizations supporting ethnic groups within the community.

As of January 2002, the Balch Institute merged with the Historical Society of Pennsylvania, and the mission and collections of the Balch have been fully integrated into the Society.^[78]

Centro de Estudios Puertorriqueños, Hunter College, City University of New York

The Centro Library and Archives is devoted to collecting, preserving, and providing access to resources documenting the history and culture of Puerto Ricans. Established in 1973 as a component of the Center for Puerto Rican Studies, the Centro Library and Archives was dedicated to activist and educator, Evelina López Antonetty in 1986. The Centro Archives, known as the Archives of the Puerto Rican Diaspora, were formally established in 1989. The collections include books, newspapers, periodicals, audio, films and videos, manuscripts, photographs, prints, and recorded music. The holdings include personal papers, records of organizations and institutions, photographic collections, broadsides, programs, and ephemera.^[79]

Clark Atlanta University

The Robert W. Woodruff Library of the Atlanta University Center, Inc., is an independent entity organized and

operating to provide an academic library for the exclusive benefit of its member institutions—Clark Atlanta University, the Interdenominational Theological Center, Morehouse College, and Spelman College. The Archives and Special Collections department houses over 7000 linear feet of manuscript collections and organizational records, and over 35,000 books, pamphlets, and other printed materials. The core of the manuscript holdings is built upon the Atlanta University Trevor Arnett Library's Negro Collection. The collections document civil rights, race relations, education, literature, visual and performing arts, religion, politics, and social work. They include the Countee Cullen/Harold Jackman Memorial Collection, and papers of Hoyt Fuller and Wayman Carver that focus on black contributions to literature, music, performing and visual arts; personal papers of scholars C. Eric Lincoln and Walter Rodney, and religious leaders Harry V. Richardson and Edler G. Hawkins; records of civil rights organizations such as the Commission on Interracial Cooperation, Southern Regional Council, and Southern Conference for Human Welfare; files documenting African American education such as the Freedmen's Aid Society, Southern Education Foundation, and United Negro College Fund.

The Atlanta University Center entered the forefront of the African-American archives with the 2006 acquisition of a historic collection of writings, sermons, and other items representing the life and work of Dr. Martin Luther King Jr. by King's alma mater, Morehouse College. The Robert W. Woodruff Library of the Atlanta University Center was designated as "custodian" of the Morehouse College Martin Luther King Jr. Collection, and charged with housing and overseeing the security and preservation of the collection. The approximately 10,000 items within this collection cover much of King's life and work between the years 1944 and 1968.^[80,81]

Heard Museum Archives

The Archives of the Heard Museum includes a wide range of materials that document Native American history, culture, and art. The materials cover all indigenous peoples of the Americas. The majority of the holdings date from the mid-nineteenth century to present. The collections emphasize Native American artists and provide context for the understanding of the museum's ethnographic and fine art collections.

The Archival materials reflect a broad spectrum of relationships and activities with Native Americans, including more than 300,000 historic and contemporary photographs. Major collections include the Fred Harvey Company photographs and papers, the R. Brownell McGrew photographs and papers, the Barry Goldwater color photography collection, American Indian Boarding School Collection, and the collections of Native American artists Pop Chalee and Joe Baker. The Archives hold approximately 300 linear feet of manuscripts, personal collections, and other cultural

materials, including more than 150 linear feet of institutional records from the Heard.^[82]

Japanese American History Archives

The Japanese American History Archives is an extensive collection of books, periodicals, documents, maps, photographs, art, and film relating to the Japanese experience in the United States from the mid-1800s to the present. Created in 1977, it provides a strong collection of material documenting the Japanese-American experience but also assists many other institutions by translating documents from Japanese to English and English to Japanese.^[83]

Moorland-Spingarn Research Center at Howard

The Moorland-Spingarn Research Center at Howard University is recognized as one of the world's largest and most comprehensive repositories for the documentation of the history and culture of people of African descent in Africa, the Americas, and other parts of the world. Its collections include more than 175,000 bound volumes and tens of thousands of journals, periodicals, and newspapers; more than 17,000 feet of manuscript and archival collections; nearly 1000 audio tapes; hundreds of artifacts; 100,000 prints, photographs, maps, and other graphic items.

The foundation of this collection was a gift from the Reverend Jesse E. Moorland who donated over 3000 books, pamphlets, and other historical materials to the University in 1914. Another major landmark was the 1946 purchase of the private library of Arthur Barnette Spingarn, who chaired the NAACP's legal committee and also served as its president. The work of developing the research center continued under the watchful eye of Dorothy Porter Wesley, the first African American woman to get a masters degree in Library Science from Columbia University. She worked for the next 43 years on the research center and the annual lecture series given at the Center now bears her name.

By 1957, the collection had added a number of collections including the papers of Alain Locke, the Joel Spingarn Papers, photographs by Carl Van Vechten, and the Oswald Garrison Villard collection of Anti-Slavery papers. Starting in 1974 work again continued to develop archival collections and the papers of Paul Robeson, Vernon Jordan, Charles Diggs, Jr., Benjamin Mayes, Charles H. Houston, and Rayford Logan were added to a growing number of collections being donated to the Center. At present, there are over 190 manuscript collections available.^[84]

Museum of Chinese in the Americas

Founded in 1980, the Museum of Chinese in America is dedicated to preserving and presenting the history,

heritage, culture, and diverse experiences of people of Chinese descent in the United States. One of the Museum's major goals is to make Chinese American history accessible to the general public, ranging from scholars to young children, from community members to international tourists.

Some of the manuscript collections include paper sculptures created by passengers of the ship *Golden Venture* while they waited in detention to find out their immigration status, material from the Chinese Musical and Theatrical Association that document the activities of the Cantonese opera clubs that flourished in North American Chinatowns from the 1930s to the present, materials documenting the life of an immigrant family who eventually created a number of major business in New York's Chinatown, and the papers of Hazel Ying Lee, a noted Chinese American woman aviator during the 1930s and 1940s.^[85]

Schomburg Center for Black Culture

The Schomburg Center for Research in Black Culture is one of the world's leading research facilities devoted to the preservation of materials on the global African and African diasporan experiences. Today, the Schomburg Center contains over 10,000,000 items and provides services and programs for constituents from the United States and abroad.

The Manuscripts, Archives, and Rare Books Division collection has grown through the years, beginning with the rare treasures from Arturo Alfonso Schomburg's personal holdings. Today, it contains more than 3900 rare books, 580 manuscript collections, and 15,000 pieces of sheet music and rare printed materials. These include the original manuscript of Richard Wright's *Native Son*; the papers of Dr. Robert Weaver, the first black U. S. cabinet officer; Gustavus Vassa's autobiography, which provides evidence for Granville Sharp's attack on slavery in the British colonies in 1796; and records of the Civil Rights Congress.

Also included within the Schomburg's collections are images from mid-eighteenth century graphics to contemporary documentary and art photographs. The more than 500,000 items include portraits of many prominent nineteenth- and twentieth-century black artists, political figures, actors, musicians, athletes, and social activists. The collection also documents black life throughout the world, including scenes from Africa and the slave era through the twentieth century Americas. Among the photographers represented are James VanDerZee, Gordon Parks, Edward Steichen, Coreen Simpson, Bert Andrews, and Chester Higgins.

The Schomburg also has a large collection of audiovisual documentation of black culture including music, oral history recordings, motion pictures, and videotapes. Included are early radio broadcasts and recordings of

statements by celebrated personalities such as Marcus Garvey, Booker T. Washington, and George Washington Carver. Musical documentation ranges from African chants to American jazz. Of special interest is the Oral History/Video Documentation Project, which videotapes interviews with historically or culturally significant figures. It offers over 5000 hours of oral history recordings and more than 5000 motion pictures and videotapes.^[86]

Women's History Archives

Women's history archives collect materials that record the contributions women have made to society. Often begun because traditional repositories only inadequately captured the efforts of women, these archives continue to focus their efforts on documenting underrepresented populations.

Sophia Smith Collection

The Sophia Smith Collection at Smith College was founded in 1942. Named for the founder of Smith College, its collections include 585 collections of manuscripts, archives, photographs, oral histories, and other primary sources documenting women's history from the colonial era to the present.

Subject strengths include birth control and reproductive rights, women's rights, suffrage, the contemporary women's movement, U.S. women working abroad, the arts (especially theatre), the professions (especially journalism and social work), and middle-class family life in nineteenth- and twentieth-century New England. Of special interest is the YWCA archives, which includes 800 boxes documenting the history of this important organization and its role in assisting racial and ethnic minorities, immigrants, and working class women.^[87]

Schlesinger Library at Radcliffe College of Harvard University

The library's origins date back to the gift of Maud Wood Park, a leader in the suffrage movement, who in 1943 donated her collection of books, papers, and memorabilia on women reformers. To honor Harvard University historian Arthur M. Schlesinger and his wife Elizabeth Bancroft Schlesinger, who were strong supporters of the mission of the women's rights collection, the library was renamed in 1965.

The library's principal holdings date from the founding of the United States to the present and include materials on the women's rights movements, feminism, health, social reform, education, professional life, volunteer and civic efforts, family relationships, and travel. Collections include the archives of Radcliffe College, the papers of Charlotte Perkins Gilman, Dorothy West, June Jordan and Pauli Murray and the records of the National Organization

for Women, 9 to 5: National Association of Working Women, the Boston's Women's Health Book Collective, and the National Association of Women Judges. The archival collections also include material focusing on the culinary arts, including the papers of Julia Child and M. F. K. Fisher.

The collections also include over 90,000 photographs, ranging from casual snapshots to the works of professional photographers as well as audiotapes, videotapes and oral history tapes, and transcripts.^[88]

Sallie Bingham Center for Women's History and Culture

The Sallie Bingham Center for Women's History and Culture in Duke's Special Collection Library acquires preserves and makes available to a large population of researchers published and unpublished materials that reflect the public and private lives of women, past and present. Collecting areas of interest include the lives of southern women, girl culture, women's sexuality and gender expressions, lay and ordained church women, and the history of feminist theory and activism.^[89]

Iowa Women's Archives

The Iowa Women's Archives holds more than 1100 manuscript collections that chronicle the lives and work of Iowa women, their families, and their communities. These personal papers and organizational records date from the nineteenth century to the present. Together with oral histories, they document the activities of Iowa women throughout the state and beyond its borders. Subjects covered include suffrage, women and sports, and the lives of women in rural communities.

Of special interest is the Mujeres Latinas project that works to preserve the history of Latina women living in Iowa. This collection includes oral histories and manuscript collections documenting those women who came to Iowa to assist with the harvest and decided to stay in the community.^[90]

Gender and Sexuality Archives

Gender and sexuality archives promote the study of human sexuality, gender identification, and reproduction.

Cornell Human Sexuality Project

In 1988, the Mariposa Education and Research Foundation donated its accumulated archive to Cornell, which formed the basis of the Human Sexuality Collection. The principal emphases of the collection are lesbian, bisexual, gay and transgendered lives, and the politics of sex.

The Human Sexuality Collection contains a wealth of information that documents women's lives, including the

emergence of the American lesbian and gay rights movement and different perspectives on the pornography business. Notable collections include the National Gay and Lesbian Task Force papers; documentation of lesbian publishing including lesbian and feminist periodicals from the 1950s to the present from across the United States, lesbian pulp novels, and contemporary lesbian erotica; oral history projects; and photographs of leaders of the gay rights movement.^[91]

GLBT Historical Society

The Gay, Lesbian, Bisexual Transgender (GLBT) Historical Society collects, preserves, and interprets the history of GLBT people and the communities that support them. The Archives and Manuscripts collection are focused on gay, lesbian, bisexual, transgender, and queer life in the wider San Francisco Bay area and Northern California. The organization works to document the tremendous diversity of GLBT life, its sexual, social, political, economic, cultural, religious, and spiritual dimensions focusing not only the lives of GLBT leaders, but also ordinary people, organizations, and informal groups.^[92]

Kinsey Institute

The Kinsey Institute at Indiana University promotes interdisciplinary research and scholarship in the fields of human sexuality, gender, and reproduction. The Institute was founded in 1947, just before the publication of *Sexual Behavior in the Human Male* in 1948. The Kinsey Institute houses extensive archival collections, including the papers of Dr. Alfred Kinsey, the records of the Institute and materials of other research scholars such as Alex Comfort, Havelock Ellis, and Albert Ellis, and organizations such as Sexual Freedom League and Society for the Scientific Study of Sexuality.^[93]

Lesbian Herstory Archives

The Lesbian Herstory Archives is home to the world's largest collection of materials by and about lesbians and their communities. Started in 1972 to ensure the preservation of lesbian culture the collection includes an extensive collection of books, newsletter and periodicals, photographs, films, diaries, posters, and oral histories. Archival collections of note include material from the Black Lesbian Study Group of New York, the Lesbian Resource Center of Seattle, and the Lesbian Avengers.^[94]

National Gay and Lesbian Archives

The ONE National Gay & Lesbian Archives honors the past, celebrates the present, and enriches the future of all lesbian, gay, bisexual, and transgender people by supporting education and research. ONE is dedicated to

collecting, preserving, documenting, studying, and communicating the history, challenges, and aspirations of gay, lesbian, bisexual, and transgender community. They collect manuscripts, photographs, memorabilia, graphics, ephemera, and other historically significant materials.^[95]

Labor Archives

A late twentieth-century phenomenon, labor archives in the United States seek to document unions and the labor movement.

George Meany Memorial Archives

The American Federation of Labor-Congress of Industrial Organizations (AFL-CIO) established the George Meany Memorial Archives in 1980 to honor the memory of its first president, and to provide a program to preserve its historical records and make them available for research. The George Meany Memorial Archives holds the records of the AFL-CIO, including administrative and staff departments, constitutional trade departments, and some federation-sponsored programs. Dating from the earliest days of the American Federation of Labor (1881), but offering almost complete records from the founding of the AFL-CIO (1955), the collections provide rich resources for historians, political scientists, trade union activists, and undergraduate and graduate students who want to examine a wide range of twentieth-century American political and social issues.^[96]

Kheel Center at Cornell University

The Kheel Center for Labor-Management Documentation & Archives was founded in 1949 as the Labor-Management Documentation Center. Its purpose is the preservation of original source materials relevant to the history of American labor unions, management theory as it applies to labor and industrial relations, and the history of employees at the workplace. The collections include 350,000 images documenting the labor movement in the twentieth century. It also includes over 19,000 linear feet of manuscript letters and documents. Included are the papers of the Amalgamated Clothing Workers of America, the International Ladies' Garment Workers' Union, the Brotherhood of Railroad Trainmen, and the National Consumers' League.^[97]

Reuther Library, Wayne State University

The Walter P. Reuther Library of Labor and Urban Affairs is the largest labor archive in North America. Its mission is to collect, preserve, and provide access to the documentary and visual heritage of the American labor movement, related reform movements, and individual participants. The collection also includes records related to urban affairs, with emphasis on the history of metropolitan Detroit.

The Reuther holds more than 2000 collections related to such topics as union history and working class organizations, African Americans and women in the labor movement, as well as radical, social, and political reform movements. Collections also focus on the history of twentieth century Detroit, including such topics as social welfare, health care, politics, civil rights, women's rights, and metropolitan Detroit social communities. The Reuther also houses the archives of Wayne State University. The collection traces Wayne State's growth from the Detroit Medical College in 1868 to its emergence as a world-class research university.^[98]

Tamiment Library and Wagner Archives, New York University

The Tamiment Library and Robert F. Wagner Labor Archives at New York University provide extensive research collections for scholarly research on Labor and the Left. The primary focus is the complex relationship between trade unionism and progressive politics and how this evolved over time. Archival, print, photograph, film, and oral history collections describe the history of the labor movement and how it related to the broader struggle for economic, social, and political change.

Tamiment/Wagner holds more than 400 manuscript collections, a total of more than 15,000 feet of original papers and records. Some of the collections include material from various locals of the Communications Workers of America, the papers of Eugene V. Debs, Elinor Ferry, Nelson Frank, and recordings of songs by Joe Glazer. It is also the repository for the Archives of Irish America, the Abraham Lincoln Brigade Archives, and a growing Asian American labor collection. The library also holds has more than 500,000 photographs documenting a wide range of subjects including: union organizing, the changing nature of work, strikes, rallies, demonstrations, progressive political campaigns, socialists, communists, anarchists, and members of other leftist organizations. They also depict working class resorts, summer camps, New York City street scenes, and architecture.^[99]

Science, Technology, and Health Care Archives

Science, technology, and health care archives collect materials relating to the natural, physical, and social sciences; engineering; technology; medicine; and health care.

Alan Mason Chesney Archives, Johns Hopkins Medical School

The Alan Mason Chesney Medical Archives is the official archival repository of the Johns Hopkins Medical Institutions. Holdings include materials from the Johns Hopkins Hospital and from the health divisions of the Johns Hopkins University (Bloomberg School of Public Health,

School of Medicine, and School of Nursing). The collections include the records of the Johns Hopkins Medical Institutions and over 200 collections of personal papers covering the years of 1900 to the present. Some of the papers include laboratory notebooks, research data, and personal diaries. Notable collections include the papers of Alfred Blalock, who pioneered the “blue baby” operation; Alan Mason Chesney, who served as dean of the medical school; W. Horsley Gantt, who explored the relationship between physiological functions and behavior; and William Osler, who established the training program used by medical students in the United States.^[100]

California Academy of Sciences

The California Academy of Science has over 400 archive and manuscript collections, and over 300,000 images. The archives includes material on the history of the Academy, research on the Galapagos Island, the Elkus Indians papers that documents Indian Affairs from 1922 to 1963, the paper of C. Templeton Crocker, Benjamin Draper, Frank Talbot, and John McCosker.^[101]

California Institute of Technology

The Institute Archives preserves the papers, documents, artifacts, and pictorial materials that tell the school's history, from 1891 to the present. The Archives houses close to 200 manuscript collections, the majority of which are the papers of Caltech's faculty and administrative officers. These include the papers of Lee A. DuBridge, Richard Feynman, George Ellery Hale, Theodore von Kármán, and Robert A. Millikan. Since 1978 the Archives has conducted an oral history program centered on the Caltech community which includes more than 150 interviews.^[102]

Charles Babbage Center

The Charles Babbage Institute is dedicated to preserving the history of information technology and promoting and conducting research in the field. The archives collects, preserves, and provides access archival collections and rare publications documenting the history of technology. Collections include the papers of the Association for Women in Computing, Edmund C. Berkeley, Martin A. Goetz, and Curt A. Monash. The Institute is also home to the historical archives of the Burroughs Corporation, once the nation's largest manufacturer of adding machines and, later, a major computer company. The collection includes over 100,000 photographs depicting the entire visual history of Burroughs from its origin as the American Arithmometer Corporation in 1886 to its merger with the Sperry Corporation to form the Unisys Corporation in 1986.^[103]

Claude Moore Library at University of Virginia

The Historical Collections and Services division of the Claude Moore Library is dedicated to the preservation and presentation of the history of the health sciences at the University of Virginia and around the world. The collection includes a large number of rare books including a collection of books on optics gathered by Adolph Lomb of the Bausch and Lomb Optical Company. Archival collections include the Philip S. Hench Walter Reed Yellow Fever Collection, which documents the work of Reed's and others to stop the spread of Yellow Fever; the papers of Henry Rose Carter, who eventually became Assistant Surgeon General of the United States; the papers of Wade Hampton Frost, who studied water pollution and established epidemiology as a field of medical research; and documents from the Blue Ridge Sanatorium, which worked to prevent and eradicate tuberculosis.^[104]

David Sarnoff Library

The David Sarnoff Library documents David Sarnoff's life; the history of radio, television, electronics, and communications; and the history of the Radio Corporation of America (RCA). Built in 1967 by RCA, the David Sarnoff Library contains a museum, the archives, and a library. Besides Mr. Sarnoff's papers and memorabilia, the Library's holdings include 25,000 photographs and thousands of notebooks, reports, publications, and artifacts related to the histories of RCA Laboratories and RCA.^[105]

Linda Hall Library

The Linda Hall Library is the largest privately funded library of science, engineering, and technology in the world open to the public. The Library has acquired several strong collections over the years including the collection of the American Academy of Arts and Sciences, founded in 1780, portions of the Franklin Institute's library, the notebooks of A. B. Nichols, who worked as an engineer on the Panama Canal, and the collections of the Engineering Societies Library.^[106]

National Agriculture Library

The National Agricultural Library Special Collection division houses rare books, manuscript collections, nursery and seed trade catalogs, photographs, and posters from the 1500s to the present. Materials cover a variety of agricultural subjects including horticulture, entomology, poultry sciences, natural history, and are not limited to domestic publications.

The Library's Special Collections houses over 300 manuscript and archival collections containing materials from the nineteenth through the twenty-first centuries.

Manuscript collections include papers of individuals who worked for or were associated with the U.S. Department of Agriculture or who were involved in agricultural activities. These collections include the papers of Charles Valentine Riley, John Wyss, and Layne R Beaty, and a small collection of Jefferson manuscripts focusing on his farming activities.^[107]

National Library of Medicine

The National Library of Medicine houses a large collection of archives and manuscripts related the history of medicine. Most of the archival and manuscript material dates from the seventeenth century and includes approximately 10,000 linear feet of material. The Library also owns about 200 pre-1601 Western and Islamic manuscripts. Significant modern collections include the papers of U.S. Surgeons General, including C. Everett Koop, and the papers of Nobel Prize-winning scientists, particularly those connected with NIH.^[108]

Niels Bohr Library and Archives and Center for History of Physics, American Institute of Physics

The Niels Bohr Library & Archives and the Center for History of Physics work to help preserve and make known the history of modern physics and allied sciences. They collect a wide variety of materials including photographs, oral histories, books, AIP, and Member Society archives. Photograph collections include portraits and snapshots primarily of modern American physicists, astronomers, and geophysicists but includes many other scientists, as well as photos and illustrations of laboratories, telescopes, accelerators and other instruments, objects, and places. There are over a thousand tape-recorded oral histories that provide information on the lives and work of noted scientists. Manuscript collections include the records of the American Institute of Physics as well as the personal papers of Samuel A. Goudsmit, Robert W. Wood, John Van Vleck, and Lew Kowarski.^[109]

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United States: Libraries and Librarianship in the 21st Century

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Abstract

This entry gives an overview of libraries and librarianship in the United States and explores several trends that will continue to have an impact on American libraries for the foreseeable future. These trends include: network neutrality and digital rights management; recruitment and diversity of library workers; the continuing development of the Internet; Library 2.0 and beyond (blogs, podcasts and wikis); libraries and the gaming phenomenon; librarian and library worker salaries; and library advocacy and funding.

Editor's Note: We have commissioned John Berry, an eminent library leader and former president of ALA, to contribute an entry that provides a general overview of the status of American libraries followed by a discussion of trends, issues, and technologies that impact American libraries and librarians in the first decade of the twenty-first century. His approach differs from that taken in our county entries because American libraries and library history are well represented in other entries in ELIS-3, and because most of the major library associations headquartered in the United States are covered by individual entries. Because American museums and archives are less fully covered by ELIS-3 entries, those two sections provide more historical background and discuss differences among various types of archives and museums. Beverly Sheppard, former head of Institute of Museum and Library Services, has contributed the section on Museums in the United States. The section on American Archives was prepared by Cheryl Stadel-Bevans formerly with the National Archives and Records Service and by Danna Bell-Russel with the Library of Congress. Each of the three sections has its own abstract, keywords, and reference list.

FACTS ABOUT LIBRARIES IN THE UNITED STATES

The American Library Association (ALA) estimates there are 123,291 libraries of all types in the United States in 2008 (see Table 1). No single annual survey provides exact statistics on all types of library spaces. The public, academic, and school library statistics below come from four surveys by the *National Center for Education Statistics (NCES): Public Libraries in the United States: Fiscal Year 2005; Academic Libraries: 2004 (2006); A Brief Profile of America's Public Schools (2007)* for the number of school library media centers in public schools and BIA (Bureau of Indian Affairs) schools; and the *Schools*

and Staffing Survey, 1999–2000 (2002) for the number of school library media centers in private schools. Figures for special libraries, armed forces libraries, and government libraries are from the American Library Directory 2007–2008 (Fig. 1).

ALA also reports that operating budgets in all libraries are increasing at 3–4% each year, mostly going to staff salaries, but services and collections in libraries are also increasing. Public library visits are rising, and circulation of audio and video materials have risen by 14% annually from FY 2003 through FY 2006 even as book circulations have declined substantially. <http://www.ala.org/ala/aboutala/hqops/library/libraryfactsheet/alalibraryfactsheet4.cfm>

The State of America's Libraries: A Report from the American Library Association

In April 2007, a report called *The State of America's Libraries*, published by the American Library Association found that

Public, school and university libraries are flourishing, both in traditional ways and in the still-exploding universe of the Internet. Library use is up nationwide among all types of library users, continuing a decade-long trend. Almost 1.8 billion visitors checked out more than 2 billion items last year at everything from one-room rural libraries to spectacular facilities such as Seattle's Central Library which opened in 2004.^[1]

ALA also found that the number of visits to public libraries in the United States increased 61% between 1994 and 2004.

Investment in e-books at academic and research libraries rose by 68% from 2002 to 2004, the most recent year for which federal data are available. Electronic serials expenditure has also increased at major research libraries

Table 1.

Public libraries (administrative units)		9,208
Centrals ^a	9,050	
Branches	7,542	
Buildings	16,592	
Academic Libraries		3,617
Less than four year	1,334	
Four year and above	2,283	
Total	3,617	
School Libraries		99,783
Public schools	82,569	
Private schools	17,054	
BIA (Bureau of Indian Affairs)	160	
Total	99,783	
Special Libraries^b		9,066
Armed Forces Libraries		296
Government Libraries		1,159
Total		123,129

^a The number of central buildings is different from the number of public libraries because some public library systems have no central building and some have more than one.

^b Special libraries include Corporate, Medical, Law, Religious, etc.

Source: ALA Fact Sheet 1, [http://www.ala.org/ala/aboutala/offices/library/libraryfactsheet/alalibraryfactsheet1.cfm#^{\[2\]}](http://www.ala.org/ala/aboutala/offices/library/libraryfactsheet/alalibraryfactsheet1.cfm#^[2])

and usage of electronic materials has skyrocketed. At the same time, circulation has declined slightly and reference services have declined more steeply.^{[3] [4]}

Public libraries are on the forefront in delivering new programs to their users while still providing the traditional services that people expect from their libraries—the tools to conduct a job search, write a résumé, and learn new work skills. Despite a growing body of research that links school libraries and positive student achievement, school library media centers have been hard hit by funding cuts in recent years.

The American library community continues its work to defend the First Amendment rights of library users against

secret government surveillance, including the USA PATRIOT Act passed in October 2001. Librarians also continued their efforts to oppose censorship challenges that restrict the free flow of information and ideas to both adults and children.

From Awareness to Funding: A Study of Library Support in America (2008)

In July 2008, OCLC, the world's largest bibliographic records utility, with the private market research firm Leo Burnett, published a new study of U.S. public libraries called: *From Awareness to Funding: A Study of Library Support in America* by DeRosa and Johnson.^[5]

The following are the key findings of this study:

- The American public's awareness of libraries is based on yesterday.
- The research provides important insights into what U.S. voters and their elected officials know, and what they do not know, about public libraries and public library funding.
- Most U.S. residents are aware of the traditional "informational" library services, such as books, newspapers, magazines, and Internet access.
- Far fewer know about the many value-added and "transformational" services provided by their libraries, such as teen programs, computer training, and "English as a second language" (ESL) classes.
- Support for library funding comes from those who believe libraries transform lives, and not necessarily from those who use the library.

Many American public libraries have responded by launching marketing campaigns focused on increasing



Fig. 1 Fleet library at the Rhode Island School of Design.(2007 winner American Institute of Architects/American Library Association Library Buildings Awards Program).

Source: Renovation by: office dA, Boston, MA. Photograph by: John Horner Photography, Somerville, MA.

awareness of the library and its services. Despite numerous marketing and communications efforts across the country, the perception of the library as “a physical place offering traditional information services (books and information)” remains well entrenched in the minds of library users.

And while the perceptions of the library may remain fixed, the information landscape is changing rapidly. The knowledge landscape is expanding and the library’s once unique position as the “place that provides books and information” is increasingly crowded. Powerful rivals with deeper pockets such as Google and Barnes & Noble are able to fund stronger marketing initiatives to reach information consumers and are redefining user expectations of information access. Without action, the survey argues, it is almost certain that the library’s brand will continue to be seen as a *legacy* service, a “nice to have” but not critical institution, more relevant in the past than for the future.

This OCLC sponsored advocacy research identified that residents are not aware that libraries are under financial stress. Most residents do not realize that libraries—maybe even their local library—have cut services, reduced hours or limited new material acquisitions due to reductions in their operating budgets or increases in operating costs, such as health care, collections, and utilities. On the other hand, elected officials are generally supportive and aware of the financial needs of their libraries. Those surveyed report that they are aware of the varied and important services offered by their libraries and recognize their importance to their communities. But the research also revealed that despite their appreciation for the library, local elected officials are not typically inclined to increase library funding. The majority felt that their libraries have sufficient operating funds.

If, despite the efforts of existing marketing campaigns, the library brand is still about “books and information,” the survey asks how the library can be positioned as a “transformational force” in the minds of more users and voters? If current library marketing campaigns are focused mainly on driving usage of libraries and awareness of their services, what is needed to increase library funding to inspire, and activate, residents and local elected officials to increase funding for libraries the survey asks.

Not all residents in a community are equal when marketing or advocating for increased funding for libraries. This inequality is not unexpected or unusual.^[14] As described by OCLC’s market research partner, Leo Burnett:

Not everyone is alike and different people want different things from the category. They evaluate, perceive and use brands differently.^[14] No brand has “universal appeal” and the more brands there are in a category, the more this is true. “For every brand, there is a greater chance to build business [funding] among some segments of consumers than others. If these segments can be identified, the brand

has a ‘roadmap for growth’ and can customize marketing efforts to the most likely prospects.”^[4]

The Library Supporter Segmentation Pyramid for this research identified four public library market tiers: 1) residents who are not registered or do not typically vote in elections (Chronic Nonvoters); 2) voters with high barriers to supporting the library (Barriers to Support); 3) voters who are probable library funding supporters (Probable Supporters); and 4) voters who are definite library funding supporters (Super Supporters). Within these four overarching market tiers the study made an additional 10 distinct market segments, named to reflect their distinctive characteristics: 1) Chronic Nonvoters; 2) Financially Strapped; 3) Detached; 4) The Web Wins; 5) Just for Fun; 6) Kid Driven; 7) Library as Office; 8) Look to Librarians; 9) Greater Good; and 10) Super Supporters.

The OCLC research identified several important shared values and beliefs across the target market segments, the Probable Supporters and the Super Supporters:

- They are involved in their communities.
- They recognize the library’s importance to the community and to a child’s education.
- They are not always heavy users of the library, but believe the library is a noble place, important and relevant to the community.
- They recognize the value of a “passionate librarian” as a true advocate for lifelong learning.
- They see the library as a vital community resource like public schools, fire, and police, and are willing to increase their taxes to support the library.^[5]

The survey concludes that awakening and reinforcing the transformational value of the library is the most important factor in increasing library funding support.

A successful library funding support campaign must

- Make the library relevant for the twenty-first century.
- Instill a sense of urgency by putting the library in a competitive context for funding, alongside the public schools, fire department, and police department.
- Activate conversations about the library’s importance in community infrastructure and its role in the community’s future.^[18] “To thrive tomorrow, libraries must translate belief to awareness, and awareness to action.”^[5]

Key Issues for Academic Libraries and Librarians

In its Environmental Scan 2007 (2008), The Association of College and Research Libraries (ACRL) identified the “Top Ten Assumptions for the Future of Academic Libraries and Librarians”^[6] and they include

1. There will be an increased emphasis on digitizing collections, preserving digital archives, and improving

methods of data storage, retrieval, curation, and service.

2. The skill set for librarians will continue to evolve in response to the changing needs and expectations of the populations they serve, and the professional background of library staff will become increasingly diverse in support of expanded service programs and administrative needs.
3. Students and faculty will continue to demand increasing access to library resources and services, and to expect to find a rich digital library presence both in enterprise academic systems and as a feature of social computing.
4. Debates about intellectual property will become increasingly common in higher education, and resources and educational programming related to intellectual property management will become an important part of library service to the academic community.
5. The evolution of information technology will shape both the practice of scholarly inquiry and the daily routine of students and faculty, and demands for technology-related services and technology-rich user environments will continue to grow and will require additional funding.
6. Higher education will be increasingly viewed as a business, and calls for accountability and for quantitative measures of library contributions to the research, teaching, and service missions of the institution will shape library assessment programs and approaches to the allocation of institutional resources.
7. As part of the “business of higher education,” students will increasingly view themselves as “customers” of the academic library and will demand high-quality facilities, resources, and services attuned to their needs and concerns.
8. Online learning will continue to expand as an option for students and faculty—both on campus and off—and libraries will gear resources and services for delivery to a distributed academic community.
9. Demands for free, public access to data collected, and research completed, as part of publicly funded research programs will continue to grow.
10. The protection of privacy and support for intellectual freedom will continue to be defining issues for academic libraries and librarians.^[7]

In addition, the ACRL Research Committee identified several “emerging issues” that are already of considerable local significance in academic libraries and will likely grow in importance in years to come.

- There will be broader collaboration between academic, public, special, and school librarians on topics of

common concern, e.g., public engagement, information, and media literacy.

- Pressure to make library facilities “greener” will increase. Developments in this area will likely take place as part of broader institutional efforts.
- Library facilities and services will become increasingly integrated with research, teaching, and learning programs across campus, including those housed in information technology programs and student services program.
- The library’s print materials will be moved from prime library space and relocated to off-site locations; space currently housing collections will be repurposed to support collaborative learning, new modes of research support, and interactive learning areas.
- Tensions will continue to grow each year as decisions are made that determine what portion of the budget will be used to purchase digital collections as opposed to will be used to preserve and provide access to unique collections held by the library.
- Library patrons will use semantic Web search techniques to locate information resources. The need to meet the needs of e-science and e-scholarship in the social sciences and the humanities will increase and require new approaches to the design and delivery of core library services.
- Collaboration between academic libraries and university publication programs will increase as their roles become increasingly complementary.
- The focus for academic libraries will shift from the creation and management of large, on-site library collections to the design and delivery of library services.
- Regional and professional accrediting bodies will require greater accountability using a wide range of assessment techniques.
- A crisis will occur in Library and Information Science (LIS) education as schools prepare students to assume new roles in academic libraries and as contributors to campus programs.
- Interdisciplinary studies, new models of undergraduate and graduate education, and newly developed areas of inquiry will stretch library resources and service model. The tools and techniques of social computing will provide new opportunities for the design and delivery of library resources and services, but will also make increasing demands on library staff and systems.

Librarians and Library Salaries

ALA estimates that the total number of professional librarians working in the United States is approximately 150,000 (see Table 2). The ALA Library Fact Sheet 2 notes that “the library work force includes librarians and other professionals, paraprofessionals, clerical and technical personnel.”^[7] The fact sheet summarizes the latest

Table 2 Librarian and library employees in the United States.

	Librarians	Other paid staff	Total paid staff
Academic Libraries	26,469	67,121	93,590
Public libraries	45,354	92,501	137,855
Public school libraries	50,553	30,785	81,338
Private school libraries	11,060	3,360	14,420
BIA school libraries	88	63	151
Total	133,524	193,830	327,354

Source: ALA Fact Sheet 2, <http://www.ala.org/ala/aboutala/hqops/library/libraryfactsheet/alalibraryfactsheet2.cfm>.^[7]

available statistics on the two major categories—librarians and other professionals, and other paid staff—in the three types of libraries for which reliable national figures are available from National Center for Education Statistics (NCES) and the Institute of Museum and Library Services (IMLS).

The ALA fact sheet also notes that firm numbers for those employed in special libraries (e.g., libraries serving businesses, scientific agencies, hospitals, law firms, and nonprofit organizations) are not available. However, based on information available from several related associations (such as the Special Libraries Association), ALA estimates that in 2001 approximately 15,307 librarians were employed in special libraries.

Salaries paid to librarians vary by type of library and by region of the country, and are also affected by other factors; for example salaries are usually lower in rural areas and highest in major cities. Results of the annual ALA-APA (Allied Professional Association) Salary Surveys in 2007 offer hope for advocates of higher salaries for library workers. According to the surveys, the mean salary of librarians rose faster than most estimates of inflation.

Six-figure salaries were reported for several non-MLS positions. Two surveys: *ALA-APA Salary Survey: Librarian—Public and Academic (Librarian Salary Survey)* and *ALA-APA Salary Survey: Non-MLS—Public and Academic (Non-MLS Salary Survey)* are highlighted below.

- According to *ALA-APA Salary Survey: Librarian—Public and Academic (Librarian Salary Survey)*, the mean librarian salary rose to \$57,809, an increase of \$1550 from 2006.
- Significantly, this increase of 2.8% was higher than the Consumer Price Index of 2.4% for the same time period (February 2007). The U.S. Bureau of Labor Statistics' Employment Cost Index (ECI), another measure of inflation, was between 2.4% and 3.1% for 2005, the latest figures available.^[9]

Non-MLS salary survey

The scope of the 2007 survey was expanded to include positions not requiring an ALA-accredited MLS to assess salaries of other professionals working in libraries, including accountants, human resource professionals, grant writers, and information technology staff. This data will

allow for comparisons of their salaries in the external market. Salary data are from the 2006 and 2007 *Librarian Salary Survey* and *Non-MLS Salary Survey*.^[10]

RECRUITMENT AND DIVERSITY

The U.S. Census Bureau, based on definitions from the Bureau of Labor Statistics, distinguishes between “credentialed” and “noncredentialed” librarians. Credentialed librarians are defined as librarians who report that they have completed a master’s degree or another degree higher than a master’s. The area of study is not asked in the census, hence it is inferred that librarians with a master’s degree have completed their degree in library science.^[11]

Noncredentialed librarians are all other persons whose occupation is listed as librarian but who have not completed a master’s degree. Similar degree-based distinctions are not made for library assistants or clerks.

Credentialed and noncredentialed librarians, as well as library technicians and assistants, are predominantly female, white, and are not limited by disability. This finding held true in both the 1990 and 2000 decennial census data.

Credentialed librarians are predominantly women, aged 45–54 years, and white. They are not limited by disability and work full-time (40+ hr per week). Noncredentialed librarians represent approximately 43% of those reporting for the industry “library” and have a slightly more balanced ethnic and racial distribution than do credentialed librarians. Sixteen-point-eight percent (16.8%) of noncredentialed librarians selected nonwhite race/ethnicity categories, whereas only 11% of credentialed librarians did so. Three^[14] percent more Latinos reported holding noncredentialed librarian positions, and 2% more African Americans. Other distribution differences were less than 1%. Type of library employed varies little from credentialed to noncredentialed librarians.

Library assistants are even more predominantly female than librarians, are more likely to be 35 years of age or under, and white. They, too, are not limited by disability. Unlike their librarian counterparts, they almost equally work full- and part-time weekly schedules. Type of library employed largely mirrors that reported by credentialed and noncredentialed librarians, except that higher education/academic was the second largest employer of non-MLS staff.

As American communities, urban, suburban, or rural, become more diverse in nearly every dimension, the profession of librarianship has placed more emphasis on ensuring that libraries remain in touch with the communities they serve. The ALA data suggests that libraries strategically plan around human resource development and succession planning. The persistent lag in diversity in library education programs, the number of librarians and library assistants leaving the profession prematurely, the aging and retirement of racial and ethnic minority library workers, and the continued under-representation of workers with disabilities, suggests a proportionally less diverse library workforce in the future.

Finally, the diversity study suggests that diversity should not be seen as a separate programmatic effort, but as a central framework of twenty-first century library and information science practice. “The very existence of libraries rests on our ability to create institutions and resource centers where would-be users see their information needs and themselves reflected.”^[11]

KEY ISSUES FOR ALL AMERICAN LIBRARIES

Network Neutrality and Digital Rights Management

Network neutrality (also called net neutrality, Internet neutrality, or simply NN) is a principle that is applied to residential broadband networks and potentially to all networks. A neutral broadband network is characterized by being free of restrictions on the kinds of equipment that may be attached to it, on the modes of communication allowed, it does not restrict content, sites, or platforms, and communication is not unreasonably degraded by other communication streams.

The American library community believes that intellectual freedom is critical to our democracy, because the nation relies on people’s ability to inform themselves. The growth of the Internet connecting people of diverse geographical, political, and ideological backgrounds, has greatly enhanced everyone’s ability to share and to inform both themselves and others. The American Library Association and allied associations have taken the position on network neutrality that owners and managers of the information “pipelines” should not be able to control the content nor switch some information providers to slower “lanes.” While many states are addressing this issue, there is likely to be another effort at the federal level by allied associations on one hand and the broad providers and other telecommunications service on the other.

In the context of the net neutrality debate, it is equally important that the freedom of libraries and librarians to provide innovative new kinds of information services will be central to the growth and development of a democratic culture. A world in which librarians and other

noncommercial enterprises are, of necessity, limited to the Internet’s “slow lanes” while high-definition movies receive preferential treatment is counter to a central tenet in a democratic society—the necessity of enabling educators, librarians, and, in fact, all citizens to inform themselves and each other just as much as the major commercial and media interests can inform them. The ability of the Internet to spread and share ideas is increasing rapidly. With cutting-edge technology, individuals and small groups can produce rich audio and video resources that used to be the exclusive domain of large corporations. ALA continues to support effective network neutrality policies that assure freedom of expression on the Internet and equity for all types of information providers. It is hoped that future discussions on network neutrality will be less polarized and able to reach consensus on this difficult and divisive issue. Consensus would ensure a fair distribution of Internet connectivity and speed that enables rather than restricts citizen access to the global Internet.

Digital Rights Management: A Brief Introduction

Digital Rights Management (DRM) is a term used for technologies that control how digital content is used. While copyright holders have exclusive rights of copyright—such as the right to make a copy or the right to distribute a work to the public—to date, they have not had the right to control how works are used (the right to see a work, for example, or to read a work). In addition, fair use, a statutory exemption to the copyright law, allows users to exercise a copyright under certain conditions.^[12]

Depending on the outlook of the individual or group defining the term, it can have a number of connotations including the following:

- “Digital rights management technologies are aimed at increasing the kinds and/or scope of control that rights-holders can assert over their intellectual property assets.”—*Electronic Frontier Foundation*
- “DRM must be about the ‘digital management of rights’ not the ‘management of digital rights.’”—*W3C Workshop Report on DRM for the Web*
- “The purpose of DRM technology is to control access to, track and limit uses of digital works.”—The American Library Association
- “DRM are the technologies, tools, and processes that protect intellectual property during digital content commerce. . .” —Publishers’ Requirements for DRM, *W3C Workshop Report on DRM for the Web*
- “DRM systems restrict the use of digital files in order to protect the interests of copyright holders.”—*Electronic Privacy Information Center*^[13]

The well-established user privileges in the analog environment are generally seen as threatened by DRM in the American community. Copyright owners have acted in

response to the proliferation of digital content, where the 1000th copy is identical to the first. In terms of distribution, the Internet now enables instantaneous distribution of digital content across a global network moving content owners and users into a new arena where each is adjusting to ensure, assert, and in some cases, enhance their rights. Content owners are looking to DRM technologies as a means to control the use of their content. Many public interest organizations, including the leading U.S. library associations, fear that DRM technologies will be “used by copyright owners to erode capabilities that had previously been permitted to the public by copyright law under the ‘fair use’ doctrine (or its cousins, such as first sale or limited term).”^[14]

DRM technologies can also be used for unethical and illegal activities including infringing on privacy, personal profiling, and price discrimination based on personally identifiable information and obstructing the development of open source software. For libraries, DRM technologies can additionally impact first-sale, preservation activities, and institute pay-per-use pricing.

The entertainment industry, led primarily by the Motion Picture Association of America (MPAA) and the Recording Industry Association of America (RIAA), is actively pursuing DRM-friendly policy initiatives through federal legislation and regulations, the courts, and standards organizations. The consumer electronics and the information technology industries are also joining the debate because their products would need to be redesigned to meet entertainment industry needs. Profits, business models, and the implications of technology mandates are driving this part of the debate. Meanwhile, libraries, educational institutions (K-12 and higher education), and consumers will be heavily affected by any decisions made by the federal government, courts, and standards bodies. Public advocacy groups have broadened the policy debate to include user rights such as privacy, fair use, first-sale, and preservation.

Gaming in Libraries

The library field is seeing all types of libraries adding the phrase “gaming and libraries” to their array of services.

A 2007 issue of *Library Technology Reports* examined the growing, and increasingly visible, intersections the library profession has with the gaming phenomenon.

Historically, gaming and games have been central to leisure and learning activities in societies since ancient times. Sumerian games, ancient Egyptian games, medieval games, turn-of-the-century games, and contemporary games all have threads in common:

- Games test problem-solving skills.
- Games are inclusive.
- Games create community.
- Games facilitate learning.

- Games provide fields for practice of leadership and team skills.
- Games develop identity.^[14]

Since the beginning of the twenty-first century, college and university courses, departments, and academic fields have been formed to study video games, and educators and librarians, and health care professionals are examining ways to incorporate these threads into schools, universities, hospitals, and nursing homes. A growing contingent of librarians are creating new intersections of services, where libraries can meet and serve gamers.

In mid-2008, the American Library Association launched an innovative project to track and measure the impact of gaming on literacy skills and build a model for library gaming that can be used nationally. Funding for the project is a \$1 million grant from the Verizon Foundation, justifying such a project by that: “Gaming is a magnet that attracts library users of all types and, beyond its entertainment value, has proven to be a powerful tool for literacy and learning.”^[15]

As part of the grant, ALA will work directly with 12 leading gaming experts to document the use of gaming as a literacy tool and monitor the results of gaming initiatives. The information will be used to build “The Librarians’ Guide to Gaming,” a comprehensive, online literacy and gaming toolbox, which will then be field-tested by several libraries.

The experts creating the best practices during the initial phase of the project are from 14 libraries across the United States.

Web 2.0 and Library 2.0

Web 2.0 is a term used to denote several different concepts:

- Web sites based on a particular set of technologies such as AJAX (Asynchronous JavaScript and XML).
- Web sites which incorporate a strong social component, involving user profiles, friend links.
- Web sites which encourage user-generated content in the form of text, video, and photo postings along with comments, tags, and ratings.

Some sites are easy to classify: social networking sites such as Facebook and MySpace are often held up as prototypical examples of Web 2.0, primarily due to their social networking aspects which include the user as a first-class object, but also due to their use of new user interface technologies (Facebook in particular). Other sites are resolutely Web 1 in their approach: Craigslist, for example, emulates an e-mail list server, and has no public user profiles, or fancy dynamic pages.

The term Web 2.0 was coined in 2004, and many of the first truly Web 2.0 sites began emerging in late 2003 and

early 2004. A definition of Web 2.0 by O'Reilly (2005) emphasizes viewing the Web as a platform. Some of the important features that mark out a Web 2.0 site include:

- Users as first class entities in the system, with prominent profile pages, including such features as age, sex, location, testimonials, or comments about the user by other users.
- The ability to form connections between users, via links to other users who are “friends,” membership in “groups” of various kinds, and subscriptions or RSS feeds of “updates” from other users.
- The ability to post content in many forms: photos, videos, blogs, comments, and ratings on other users’ content, tagging of own or others’ content, and some ability to control privacy and sharing.
- Other more technical features, including a public API to allow third-party enhancements and “mashups,” and embedding of various rich content types (e.g., Flash videos), and communication with other users through internal email or IM systems.^[16]

Library 2.0 Defined

The term Library 2.0 was coined by Michael Casey on his blog LibraryCrunch as a direct spin-off of the terms Business 2.0 and Web 2.0. Casey suggested that libraries, especially public libraries, were at a crossroads where many of the elements of Web 2.0 had applicable value within the library community, both in technology-driven services and in nontechnology-based services. In particular, he described the need for libraries to adopt a strategy for constant change while promoting a participatory role for library users.^{[17] [18]}

Library 2.0 made its conference debut at Internet Librarian 2005 when Michael Stephens, then of Saint Joseph County Public Library (IN) addressed the idea in relation to the typical library Web site. With Library 2.0, library services are frequently evaluated and updated to meet the changing needs of library users. Library 2.0 also calls for libraries to encourage user participation and feedback in the development and maintaining of library services.

The active and empowered library user is a significant component of Library 2.0. With information and ideas flowing in both directions—from the library to the user and from the user to the library—library services have the ability to evolve and improve on a constant and rapid basis. The user is participant, cocreator, builder, and consultant—whether the product is virtual or physical. Library 2.0 has been a source of debate in the blogosphere. Some librarian bloggers have argued that these key principles are not new and have been part of the service philosophies of many library reformers since the nineteenth century. Others are calling for more concrete examples of how libraries can get to Library 2.0.

Proponents of Library 2.0, such as Stephen Abram, Michael Stephens, Paul Miller and others, have spoken to these criticisms, arguing that while individual pieces of Library 2.0 may not be entirely new, the convergence of these service goals and ideas with many new Web 2.0 technologies has led to a new generation of library service.

Libraries are exploring ways to meet the rapidly changing needs of users by using Web 2.0 technology. Some of the aspects of Library 2.0 include commenting, tagging, bookmarking, discussions, using social networking software, plug-ins, and widgets. Inspired by Web 2.0, it is an attempt to make the library a more user-driven institution.

Blogs and Blogging

A blog (a shortened form of “Web log”) is a Web site, typically maintained by an individual, with regular entries of commentary, descriptions of events, or other material such as graphics or video. Entries are commonly displayed in reverse-chronological order. Blog can also be used as a verb, meaning to maintain or add content to a blog.

Many blogs, including several in library and information sciences, provide commentary or news on a particular subject; others function as more personal journals or diaries. Blogs combine text, images, and links to other blogs, Web pages, and other media related to its topic. The ability for readers to leave comments in an interactive format is an important part of many blogs and what makes them part of Web and Library 2.0. In December 2007, the blog search engine *Technorati* was tracking more than 112 million blogs worldwide.^[19]

Podcasts

A podcast is a series of digital media files distributed over the Internet using syndication feeds for playback on computers and portable media players. The term podcast, like broadcast, can refer either to the series of content itself or to the method by which it is syndicated; the latter is also called podcasting.

Though podcasters’ Web sites may also offer direct download or streaming of their content, a podcast is distinguished from other digital media formats by its ability to be syndicated, subscribed to, and downloaded automatically when new content is added, using an aggregator or feed reader capable of reading feed formats such as RSS (Really Simple Syndication).^[20]

Wikis

A *wiki* is a collection of Web pages designed to enable anyone who accesses it to contribute or modify content, using a simplified markup language. Wikis are often used to create collaborative Web sites and to power community Web sites. The collaborative encyclopedia, Wikipedia, is one of the best-known wikis. Wikis are used in business to

provide intranets and Knowledge Management Systems “Wiki” (/wiki/) is originally a Hawaiian word for “fast.”^[20]

Taken together, blogs, podcasts, and wikis, along with social networking sites, make up the digital framework for Library 2.0.

Library 2.0 Debates

Although many libraries are adopting features of the new social networking of Web 2.0, it is not yet clear how these new features will be incorporated into existing library services. In a program preceding the 2008 American Library Association Annual Conference, the Urban Libraries Council (ULC) brought together library directors, managers, and young librarians to consider transformational trends in learning and social networking that demand faster library innovation. “In an era of Google, what do libraries become?” asked ULC’s “virtual” scholar Jeff Garreau, a scenario planner and author of *Radical Evolution*.

John Seely Brown, author of *The Social Life of Information*, discussed the notion of twenty-first century literacy—“that technologies are central to success”—and the shift from “I think therefore I am” to “We participate, therefore we are” and “I am what I produce and other people build on.” Two other invited panelists who had been expected to endorse those ideas challenged Brown’s social learning construct. Owen Wasow, cofounder of BlackPlanet.com, contradicted Brown, saying that core skills—reading, writing, math—are key to success. “Technology should be subservient to higher goals,” he said. J.C. Herz, *Joystick Nation* author and founder, emphasized libraries as “the social space around content,” especially books, and urged librarians to be “the network (or community) around books.”

A third panelist, Joe Janes, University of Washington I School Associate Dean, said that “digital neighborhoods are bereft of the services and resources we represent. How do you provide that service?” One answer might be in the new values for the profession Janes proposed: “collaboration, participation, interaction, creativity, connectivity and connectedness, openness, vision, reflection, and play.”^[21]

CONCLUSION

Libraries and librarianship in the United States have an exciting and challenging future—a future that is driven both by traditional collections and services and by an expanding array of new, largely technology-based materials and services. The fundamental nature of the library and information space in this century will continue to be influenced by the global Internet, savvy technology companies with deep financial resources, and agendas for continuing growth and expansion. Web 2.0, Library 2.0, and their future iterations will also determine, in large part, what future libraries will be.

Funding is a central issue for all types of libraries, especially those in the public sector. Library supporters will need to use sophisticated advocacy and marketing strategies to maintain and increase support from government officials and community leaders and build partnerships and collaborative relationships with the private sector.

The possibilities of libraries being widely perceived as a nonessential legacy service are very real. Dynamic and creative leadership by the next generation of library leaders is essential to ensure that libraries will not only serve users for the foreseeable future, but also increase their role in the education of users with skill sets appropriate to twenty-first century global citizens.

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United States: Museums

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Abstract

America's museums are among the nation's most important cultural assets. These museums are remarkably diverse in size and discipline and increasingly reflect the issues, diversity, and complexity of their communities. American museums are highly professionalized, working within well-defined standards with well-trained, specialized staff. National leadership and support for museums comes through the American Association of Museums, the Institute of Museum and Library Services and numerous discipline-based professional associations. The museum field today works more closely with the public and communities than ever before, reflecting a trend toward accountability, collaboration, and the creation of public value.

INTRODUCTION

America's museums are among the nation's most important cultural assets. Although no current census of museums exists, the American Association of Museums (AAM) estimates approximately 17,500 museums are located across the country, in communities of all sizes.^[1] These institutions are both collecting and non-collecting institutions that share a common mission of service to the public. The majority of American museums are nongovernmental (privately operated) organizations, governed by boards of trustees, incorporated within their states of residence and operation, and given exemption from payment of federal taxes, with approval from the Internal Revenue Service. There are also a number of museums that are supported at least in part by municipal, state, or federal entities.

America's best known museums are its large urban institutions, such as the Metropolitan Museum of Art and Museum of Modern Art in New York City, the Field Museum and Art Institute in Chicago, and the Getty Museum in Los Angeles. The Smithsonian Institution in Washington, D.C. is a full campus of world class museums, and many other cities, such as Baltimore, Atlanta, Philadelphia, and Boston offer urban aquariums, zoos, science centers, history museums, art museums, and children's museums as part of their rich assemblage of distinguished museums. Small museums, located in America's small towns and rural areas make up as many as 75% of the nation's museums.^[1] Their collections often represent local and regional history.

American museums are remarkably diverse. They include art museums, history museums and historic sites, children's museums, museums committed to science and technology, natural history museums, zoos, aquariums, botanical gardens, and arboreta. The increasing number of ethnically specific museums—museums focusing on the history of such groups as African Americans, Latinos,

and Asian Americans—demonstrates America's current interest in building museums to preserve and share diverse cultural developments and contributions.

DEFINITIONS

The *Code of Ethics for Museums*,^[2] written by the AAM identifies the common denominator of all types of museums as making a "unique contribution to the public by collecting, preserving, and interpreting the things of this world." Recent publications, such as AAMs *Excellence and Equity*,^[3] further stress the importance of the educational purpose of museums, asserting that education should be specifically identified in every museum's mission statement.

The federal government, in the Museum and Library Services Act,^[4] defines a museum as, "A public or private nonprofit agency or institution organized on a permanent basis for essentially education or aesthetic purposes, which, utilizing a professional staff, owns or utilizes tangible objects, cares for them, and exhibits them to the public on a regular basis." This definition provides the criteria for federal funding to museums as administered by the Institute of Museum and Library Services (IMLS).

Further criteria for federal funding require that a museum must:

- Be organized as a public or private nonprofit institution that exists on a permanent basis for essentially educational or aesthetic reasons.
- Care for and own or use tangible objects, whether animate or inanimate, and exhibit these objects on a regular basis through facilities that it owns or operates.
- Have at least one professional staff member or the full-time equivalent, whether paid or unpaid, whose

primary responsibility is the acquisition, care, or exhibition of the public objects owned or used by the museum.

- Be open and provide museum services to the general public for at least 120 days a year.

BRIEF HISTORY

Charles Wilson Peale founded America's first museum in 1786. Peale, an artist, scientist, and Revolutionary War officer and patriot, opened his eclectic museum in Philadelphia. Its contents included living species of toads, lizards, snakes, and other amphibians, along with his collection of stuffed and mounted animals. He eventually included the entire skeleton of a mastodon which he helped excavate from a farmer's field in upper New York State. Peale exhibited his natural and scientific curiosities and collections alongside many of his own paintings, including an extensive collection of miniatures of Revolutionary War officers. Peale's painting, *The Artist in his Museum*, completed in 1822, is a self-portrait of Peale lifting a heavy velvet curtain to reveal the wonders exhibited inside. In 1806, Peale also founded the Pennsylvania Academy of Fine Arts, the nation's first art school. His emphasis on education, both in the museum and the art school, may have set in motion the educational role that museums continue to pay today.

The nineteenth century was America's first great era of museum building. Museums became the handsome symbols of a growing civic pride. Historical societies opened in large and small towns, celebrating their community's founders and collecting icons of local accomplishment. The Smithsonian Institution, dedicated to "the increase and diffusion of knowledge," was founded in 1846 and became an integral part of the nation's capitol. The first American zoo opened in Philadelphia in 1854, the first botanical garden in Washington, D.C. in 1850, and the first children's museum in Brooklyn in 1899. Museums created after the Civil War quickly developed into models of professional museums—with their objects displayed in an orderly and purposeful manner. Private collections became public, and art collections, housed in magnificent urban temples, proved that American cities could compete as world-class cultural centers. Individuals such as Henry Frick and Isabella Stewart Gardner provided the contents of their homes to be converted into museums for the public. The 1870s also witnessed the founding of such great institutions as the Museum of Fine Arts in Boston, the Metropolitan Museum of Art, and the Philadelphia Museum of Art. The power and wealth of their benefactors could be seen in every aspect of their majestic facades and their world famous collections.

The work of these early museums focused on collections, scholarship and cultural authority, developing world standards in collecting, researching, conserving, and managing collections. An educational mission was also present

early on, and the school field trip became a core practice, acknowledging museums as places that could open new worlds to all who visited. Throughout this early era, enormous personal philanthropy built America's great collections and museums. Even today, individual and foundation giving remains the cornerstone of museum finances. An array of government entities, including such national agencies as the IMLS, the National Science Foundation, the National Endowment for the Arts, and the National Endowment for the Humanities, provide some funding in support of museum programs, exhibits, conservation, and research. However, most museums rely far more substantially on private funding and earned income.

Museum building continued during the twentieth century. Indeed, as many as half of the nation's museums have been started since 1960. Many of the country's small historical societies developed in response to the bicentennial celebrations in the 1970s when American history took center stage. Science centers and children's museums have shown considerable growth in recent years, providing new ideas about interactive and experience-based learning. They parallel a contemporary interest in and concern about science literacy, early learning opportunities and learning outside the classroom. As noted, many special interest and special purpose museums, such as those chronicling Native American, African American, and gay and lesbian history and culture have contributed in recent years to the diversity of American museums. Such great variety of museums suggests that Americans see museums as places that offer significant ways of encountering and understanding a complex world.

During this same period, many American museums took on broader social responsibilities. Zoos, for example, quickly changed from "menageries" to educational displays of animals in natural habitats. In the last 40 years, they have become centers of learning, promoting conservation, and education about all forms of animal life. Similarly, botanical gardens have expanded their missions—building campuses of public gardens, classrooms, and research facilities to share issues of biodiversity and a threatened natural world.

Children's museums and science and technology centers have been clear about their educational mission from their beginnings. Just as Americans delighted in their discoveries of scientific wonders and technology at the Philadelphia Centennial Exposition of 1876, they quickly became captured by such major institutions as the Museum of Science and Industry in Chicago and the National Air and Space Museum in Washington, D.C. Science and technology centers have become increasingly prominent across the country and are among the most interactive of America's museums, inviting learning in a direct and engaging manner. More than 100 science museums opened their doors in the 1990s. With a similarly direct educational mission, children's museums also are now the fastest-growing sector of the museum community.

American museums were seeing unparalleled attendance and growth in the late twentieth century. Numerous studies in the late 1990s depicted a lively and prosperous time for museums. Statistics gathered by the AAM^[5] suggested that American museums welcomed approximately 865 million visits a year, a total that reflected a 50% increase over the previous decade. Thirty-six percent of travelers surveyed noted that their travels would include a museum destination. In addition to providing exhibits and programs for general visitors, museums were also increasing their school services. A study from the IMLS determined that 88% of museums actively provided programs for students from kindergarten through the 12th grade, and many of those also provided specific educational offerings for teachers.^[6]

The optimism of the twentieth century, however, was decidedly interrupted by the events of September 11, 2001, and the subsequent financial downturns that rocked the nation and the world. The bright museum reports of the 1990s have been replaced in recent years with serious reports of increasing debt, declining attendance, critically deferred maintenance, and overstretched government and private funding sources. The events of a dramatically changed era are also changing museums and forcing renewed thinking about museum missions and purposes in an altered world. As a result, new attention is being given to such topics as community collaboration, renewed educational emphasis, new approaches to the use of technology, and the role of museums in creating public value.

HOW MUSEUMS OPERATE

Museums may be public or private, university-owned or controlled, owned by a government entity, such as a city or country, or organized as part of a larger cultural complex. The majority of museums are not-for-profit entities. Their business models are structured to provide public services and benefits, rather than to make financial gains for their shareholders. They require Boards of Trustees or Directors who maintain the financial oversight as well as responsibility for establishing the policies that guide the institutions.

Day-to-day operations are managed by professional museum staff, trained to manage finances, maintain collections, undertake research, develop exhibits, plan educational programs, and communicate with the public. Staff positions may include administrative and financial personnel, curators and registrars, conservators, scholars, educators, exhibit designers, and an array of support personnel. Museums are guided in their work by institutional mission statements. Museum missions generally speak to collecting, preserving, exhibiting, and interpreting with a focus on providing value for the public.

Museum directors are their institution's chief executives. The director manages the day-to-day operations of

the museum, sets operational goals and objectives, oversees personnel and reports to a Board of Directors. Directors may come from many different backgrounds. Increasingly, directors are stepping into their leadership roles from the world of business rather than scholarship. While for many years, directors exhibited strong academic backgrounds in the subject areas of their institutions, such as art history, zoology, botany, or history, Boards of Trustees, responsible for hiring the chief executive, have begun to look outside of academic disciplines, seeking administrative and financial experience.

Recently, the director's role has become more heavily focused on fundraising and financial management. Some institutions, such as the Philadelphia Museum of Art, have experimented with dividing the leadership roles between an artistic director and a business administrator. Others now routinely hire a Chief Operating Officer (COO), taking another model from the business sector. The COO manages the day-to-day operations while the Director focuses on fundraising and key policy issues.

The decade of the 1990s and the early twenty-first century, has been a time of great change in museums, leading them increasingly toward greater self-sufficiency as business enterprises. The museum director in this changed environment now needs to demonstrate a breadth of leadership skills, not unlike those found in the for-profit business world. Financial and marketing acuity are essential to make certain that the museum survives in a new, competitive, and global marketplace.

The curatorial positions in a museum are highly specialized. They require significant subject matter scholarship, as well as deep knowledge of issues related to the care of collections. In an art museum, for example, there may be a curator of twentieth century art, of prints and drawings, of European art, Asian art, etc. The largest of museums will have many different curators, each responsible for specific collections. It is not uncommon for a small museum, however, to have a single curator, who oversees all collection functions.

Curators, registrars, and conservators share important responsibilities for the management of collections. Curators are generally responsible for undertaking collection research and acquisition, developing object provenance, maintaining collection records, and making certain collections are properly cared for and preserved. Registrars are highly specialized members of the curatorial staff who oversee all aspects of record keeping and collection management. Conservators assess, maintain, and repair artifacts of all kinds. They are the museum's specialists in advising on and establishing the optimal conditions for collection storage.

Curators are often the primary exhibit developers. Their knowledge of subject matter and objects within a collection is the creative force behind most museum exhibitions—the primary educational vehicles that enlighten visitors with fresh information and insights related to a

central theme and illustrated through objects and text. Thus, the curators are often the creative “authors” of the exhibit content.

In most museums today, however, curators do not work alone on the design and development of exhibits. Many museums routinely work in exhibit teams, groups of staff that represent the various perspectives that connect the exhibition to its audience. The exhibit team will often include members of the museum education staff, marketing staff, exhibit designers, and evaluators, each of whom brings a specific expertise to the process. Museum educators, for example, are becoming increasingly important in museums, charged with the primary responsibility of understanding how people learn in informal settings and representing the public perspective throughout the exhibit development process.

The educational role of American museums took on new importance with the 1992 report *Excellence and Equity: The Public Dimension of Museums*, published by the AAM.^[3] This landmark report stressed the educational dimension of every area of a museum’s practice, encouraging all museums to integrate their educational purpose in their mission statements, and to enhance their ability to reach diverse audiences with rich opportunities for life-long learning. With this report, the role of museum educators grew dramatically in importance.

Museum educators specialize in understanding how people learn in informal settings. Their responsibilities are to ensure that exhibit design, way-finding, programs, and special activities incorporate current educational theories and optimal learning experiences. Educators may specialize in student audiences, working closely with schools, or they may focus on adult or family learning, program development or the development of teaching materials. Museum educators are expected to be deeply knowledgeable about both content and theory and should oversee their applications within the museum setting.

Other departments within museums include:

- Public information offices, responsible for marketing and public relations and frequently publications.
- Development or advancement offices, charged with the primary goal of raising funds through such activities as membership, grants writing, and fundraising campaigns.
- Facilities and grounds, maintaining all aspects of the museum site.
- Security personnel, responsible for human safety as well as disaster planning and mitigation.
- Librarian and/or archivist, organizing and maintaining scholarly materials and archival collections.
- Adjunct business personnel, such as museum shops and food service, all designed to add earned revenue to the financial mix.

In addition to the above, museums are employing greater use of technology in all of their functions. Information and

technology specialists are essential to maintain technology equipment and connections and to advise and develop many new tools and learning applications. Many museums are experimenting with handheld devices, powered by wireless technology, as educational aids and visitor guides. Interactive computers, videos, and large-screen theaters also require major growth and specialty within a museum’s technical staff.

Most American museums are highly professionalized. Access to professional standards is widely available through the many associations that serve museums and through numerous publications, conferences, and workshops. Since 1970, the AAM has set and promoted standards and best practices through its Accreditation Program. Museum associations, such as the American Association for State and Local History, have also developed standards that are specifically applicable to small museums, including those that are managed by small paid staff or are fully operated by volunteers. Other specialized associations, such as the Association of Zoos and Aquariums offer their own, more highly focused, accreditation programs. These programs reflect the changes over the years in traditional museum practices, expanding to embrace evolving roles and issues in collecting, educating, and serving the public. They include an emphasis on museum ethics and address such emerging issues as collections related to Nazi-era provenance and Native American repatriation.

The AAM is the overarching professional association serving the nation’s museums. However, a number of affiliate organizations, who work collaboratively with AAM in professional deliberations, exist to meet the specialized needs of the diverse museum types. These affiliates include:

- American Association of Museum Volunteers.
- American Association for State and Local History.
- American Federation of the Arts.
- The American Institute for Conservation of Historic and Artistic Works.
- American Public Gardens Association.
- American Zoo and Aquarium Association.
- Association for Living History, Farm, and Agricultural Museums.
- Association of African American Museums.
- Association of Art Museum Directors.
- Association of Children’s Museums.
- Association of College and University Museums and Galleries.
- Association of Railway Museums, Inc.
- Association of Science Museum Directors.
- Association of Science-Technology Centers Incorporated.
- College Art Association.
- Council for Museum Anthropology.
- Council of American Jewish Museums.

- International Association of Museum Facility Administrators.
- International Museum Theatre Alliance.
- Museum Computer Network.
- Museum Store Association.
- Museum Trustee Association.
- National Science Collections Alliance.

In addition to these associations, museums are also served by six regional associations and a number of professional interest committees.

Museums also have representation at the federal government level. The IMLS, established by the Museum and Library Services Act of 1996 and its subsequent reauthorization, is the federal agency with primary responsibility for government funding in support of both museums and libraries. The Act authorizes the agency to undertake the following leadership roles:

- To encourage and support museums in carrying out their public service roles of connecting the whole of society to cultural, artistic, historic, natural, and scientific understandings that constitute our heritage.
- To encourage and support museums in carrying out their educational role, as core providers of learning and in conjunction with schools, families, and communities.
- To encourage leadership, innovation, and applications of the most current technologies and practices to enhance museum services.
- To assist, encourage, and support museums in carrying out their stewardship responsibilities to achieve the highest standards in conservation and care of the cultural, historic, natural, and scientific heritage of the United States to benefit future generations.
- To assist, encourage, and support museums in achieving the highest standards of management and service to the public, and to ease the financial burden borne by museums as a result of their increasing use by the public.
- To support resource sharing and partnerships among museums, libraries, schools, and other community organizations.^[7]

Each year, Congress and the Executive Office determine the amount of support allocated to these purposes within the federal budget. In 2007, the support for museums was approximately \$32 million.

Additional grant support for museum programs and services may also come through the National Science Foundation, the National Endowment for the Arts, the National Endowment for the Humanities, and the National Institutes for Health. Occasional funding is sometimes related to special initiatives of other federal agencies as well.

STEWARDSHIP OF COLLECTIONS

The core activities of most museums are found within their mission statements and are generally identified as collecting, preserving, researching, exhibiting, and interpreting. Each activity is undertaken as part of the public trust, which assigns the care and conservation of collections to the museum in return for learning more about these collections and their role and relationship to the human experience.

Collections are at the core of the museum experience and are often cited as what differentiates the museum experience from other similar experiences. Museums offer the opportunity to learn from authentic objects. Museum collections have had many sources. They may have been amassed by a private collector, by such an institution as the Catholic Church and its leadership, through the spoils of war, by a civic enterprise seeking to preserve its history, a university, a scientific expedition, or perhaps an informal association bound to a common preservation goal. Many large urban museums set on a course of assembling great collections as a source of civic pride. Many small institutions exist to share the quirky interests of a single, dedicated collector. Scientific and natural history collections have often been acquired by subject specialists interested in studying specific species or scientific phenomenon. Whatever the source, collections become a centerpiece of museum activity and require significant care and organization.

Frequently, as much as 80–90% of a museum's collection is not on public view at any given time. Stored collections must be carefully housed in conditions that provide appropriate temperature and humidity controls. Further, they must be kept safe from pest damage or other environmental factors that can erode their physical integrity and must be kept secure from theft. They must be protected from light as well, and often kept in mini environments designed specifically to preserve their unique materials and constructions. Providing such a safe environment and proper care is a fundamental responsibility of all museums. It is, however, very expensive and often requires highly skilled personnel.

The best of museums do provide such adequate care, but a recent survey undertaken by Heritage Preservation and funded by the IMLS, found extensive risk to the nation's collections, largely the result of inadequate funding. The report, known as the Heritage Health Index,^[8] states that over 4.8 billion artifacts are held in trust by more than 30,000 archives, historical societies, libraries, museums, scientific research collections, and archaeological repositories across the United States. Among the artifacts described as at risk are 4.7 million works of art; 13.5 million historic artifacts, such as flags, quilts, pottery, and Presidential memorabilia; 153 million photographs; 189 million natural science specimens, and as many as 270 million rare and unique books, periodicals,

and scrapbooks. Clearly, the care of collections, considered an essential responsibility of all of those institutions charged with preserving our heritage, is a massive undertaking.

Environmental controls, security, and disaster planning are needed to preserve collections. Also necessary, and frequently part of the museum's activities, are conservation practices that can repair and stabilize collections. The conservation of the enormous American flag at the National Museum of American History of the Smithsonian Institution drew national attention to the art of conservation. Conservation practices are always critical following such natural disasters as the Hurricane Katrina and many lesser but highly damaging events such as fires, floods, leaks, and insect damage. These efforts are a much underfunded aspect of many museums' essential work.

The acquisition and disposal of collections is generally governed by a Trustee-approved collections' plan that adheres to profession-wide policies. Deaccessioning policies, governing the sale of collections, have become increasingly controversial. Most museum associations have policies requiring that proceeds from such sales be used solely to support future acquisitions or serious conservation needs. Recently, some museums have challenged these restrictions, citing the need to use deaccessioning revenue to relieve severe financial stress. The topic is under review by several associations.

CURRENT TRENDS IN MUSEUMS

The late 1990s and early twenty-first century may be described as an era of accountability, particularly among government agencies and the foundation world. The focus on the tools of accountability, such as benchmarks, standards, and performance indicators, has had a profound impact on the nation's nonprofit organizations. The new and sweeping interest in quantitative and qualitative measures of success are leading to a new discipline within museum practice, that of audience research and evaluation.

The tightening of funding at all levels, including government sources and private foundations, has increased the scrutiny over the uses and impacts of such funding. Reporting requirements have changed. Emphasis has shifted from a reporting of project "outputs"—such as, the number of people served, lists of programs and events, descriptions of exhibits, types of activities—to "outcomes"—evidence of how these activities have benefited audiences and communities.

In 1993, the Government Performance and Results Act^[9] required that all federal funding agencies begin to gather objective evidence of the public good accomplished through such funding. Similar patterns and interest are now common among private foundations that support the work of nonprofit institutions of all kinds. Museums

and other cultural institutions have had to create and apply new measurements to their work, to capture both the quantitative and the qualitative impact of their programs and exhibits. Research and evaluation in museums is now receiving strong interest, both to meet the needs of these funding sources, as well as to provide essential feedback to museum practitioners.

The increased interest in obtaining evidence of impact is presently leading to consistent use of such techniques as audience surveys, focus groups, online questionnaires, and on-site interviews. Museums are hiring consultants and new staff to conduct evaluations of exhibits and programs at all stages of development, testing concepts before they are fully developed, trying out new exhibit models, and undertaking extensive summative evaluations to learn from each experience. The audience voice has never been so keenly sought in the history of American museums.

The accountability standards are just one aspect of a current museum trend to look toward the for-profit world for business models. Just as museum directors are frequently coming from the business world, boards of directors are exploring how new management techniques might apply to the operation of museums. The early years of this new century are filled with apprehension about the fiscal stability of many not-for-profit institutions, including museums. This concern emerges from changes in philanthropy and ongoing debates about the role of government in funding America's cultural organizations. Museums in most European countries, and indeed in many nations, enjoy much stronger, centralized support for their museums. The history of this country, however, and its support of entrepreneurship and private enterprise have created a much different model. America's museums are deeply engaged at this time in considering how best to achieve sustainability into the future. As in the past, much of the support for these institutions comes from individuals in the private sector. Competition for such dollars runs high, and museum boards and administration continue to explore new models consistent with the social and economic changes around them.

One such exploration has been in building closer and more direct relationships between museums and their publics. The enhanced role of audience feedback noted in the trend toward audience evaluation and research is also a significant factor in creating active communication between museums and their publics. The expectation that museums will serve broad public needs continues to expand. The last three decades have witnessed a growing trend for museums to shift their primary activity from the internal functions of collections care and exhibit development to an external interest in putting museum assets to work for the public good.

The image of a museum as a center for debate and discussion, controversy and convening is quite a different image from the museum as a treasure house of beautiful objects. However, the contemporary world of museums

and museum associations is advocating for a stronger public role for their institutions. The enormous collections of museums have the capacity to connect to current public issues in numerous ways. Children's museums, seen as trusted environments for young children and their parents, are using their popularity to address issues of concern to American families. Science museums are exploring such critical issues as global warming and other assaults on the environment, using the visual impact of their collections and trust in their scholarship to encourage their visitors to take action. Zoos and aquariums have long understood the public's affection for animals, dolphins, whales, and many kinds of living creatures. This understanding allows these institutions to use this positive response as a springboard to lessons in conservation. History museums, likewise, recognize the opportunity to present historic events that strongly echo current issues to enable visitors to link the lessons of the past to contemporary concerns.

Other forms of creating social value are also more commonplace in today's museums. In recent years many science-based institutions have created programs for underserved audiences. Science museums, for example, seeking to overcome gender bias have added numerous programs to attract girls to careers in science. Youth and teens have been given new voice in museum settings through programs focusing on building self esteem and social skills. Museums of all disciplines have showcased the achievements of diverse nationalities and races, serving as a catalyst for tolerance and cultural understanding. Following the events of September 11, 2001, for example, museums mounted exhibitions on Islamic art, science, and religion to present a more enlightened view of Islamic culture than what many Americans held. The rise of ethnically specific museums, such as African American and Native American museums, reflects the need to hear the

silent voices of the nation's past and celebrate the contributions of these societies and groups to American life. Recent years have witnessed the development of gay–lesbian–transsexual museums as well, also noting the degree to which American museums reflect and respond to current social concerns. Following challenges to the teaching of evolution, for example, some religious groups developed biblical museums to provide alternative points of view.

The dynamic history and development of America's museums, their breadth of collections and scholarly expertise, their educational impact and their deeper integration into the nation's communities are all challenging old images of stuffiness or pretension or exclusivity. These institutions are evolving with society and the idea of the American museum as a public forum is clearly a growing phenomenon.

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Universal Decimal Classification (UDC)

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Abstract

This entry outlines the history, application, and nature of the Universal Decimal Classification (UDC). It explains its structure, management, revision, and the many changes that have taken place since the Task Force for UDC Development reported in 1990, and the UDC Consortium was formed. This led to the creation of the machine-readable database, or Master Reference File (MRF), consisting of some 66,000 terms, which forms the basis of all published editions and is revised and updated annually. Revision procedures and applications in an online environment are noted and the potential for future development discussed.

INTRODUCTION

The Universal Decimal Classification (UDC) is one of the major general classification schemes available for the organization of information. In many ways, it was the forerunner of later developments since, although it is based on the Dewey Decimal Classification (DDC), from the outset it included a number of auxiliary tables for the expression of recurring concepts, such as forms, languages, places, dates, the majority of which were not incorporated into the DDC parent scheme until well into the twentieth century. It is translated into a number of different languages, issued in a range of sizes and formats and now is controlled at the UDC headquarters in The Hague. An outline of the history, content, application, and potential together with the management that controls it is provided below.

HISTORY

The UDC has its origins in the project conceived by two Belgian lawyers, Paul Otlet and Henri La Fontaine at the end of the nineteenth century. They embarked on an ambitious enterprise to create a comprehensive listing of everything that had been written since the invention of printing, a *Répertoire bibliographique universel*. They decided to organize this information systematically in a vast card index and therefore sought an appropriate method for the arrangement. They were attracted to Dewey's *Decimal Classification* which, in 1895, had recently reached its fifth edition, so they entered into an agreement with Dewey to use his classification, with certain clearly defined modifications and expansions. At that time the scheme had only a few thousand subdivisions but its notation had great potential for universal usage because of the wider application of Arabic numerals than any other notational system. Otlet and La Fontaine expanded Dewey's scheme to suit their requirements and added a number of synthetic devices and

auxiliary tables which in due course turned the enumerative structure of the original into the much more flexible and detailed *Universal Decimal Classification*. The first edition of this expansion was published between 1905 and 1907 as *Manuel du Répertoire bibliographique universel*.^[1] It consisted of some 33,000 subdivisions and had an index of ca. 38,000 entries.

It became widely used in Europe in a range of different libraries, but World War I and the resultant shortage of funds led to the abandonment of the major bibliographical endeavor. The classification, however, survived and a much expanded second edition in French, now entitled *Classification décimale universelle*,^[2] was published in four volumes between 1927 and 1934. This second edition, together with later expansions and additions was used as the basis of all future editions for many years. Work began on editions in German and in English in the early 1930s, but again war interrupted work and the German edition was not completed until 1953^[3] and the full English edition was never completed.

The originators set up an organization to take responsibility for their work and to publish the accompanying classification, the Institut International de Bibliographie (IIB) also known as the Brussels Institute, after its original location. In 1931 the organization's name was changed to the International Institute of Documentation (IID) and as the result of increasing Dutch influence, largely emanating from Frits Donker Duyvis who had been an active participant in work on the scheme throughout the 1920s, its headquarters was moved to Deventer in the Netherlands and in 1937 it was moved once again to The Hague and its name was changed yet again, to the Fédération Internationale de Documentation (FID). Donker Duyvis's control of the scheme became absolute after the outbreak of World War II, and the deaths of La Fontaine in 1943 and of Otlet in 1944.^[4]

Editions of varying fullness have been published throughout the whole history of the scheme and by the

1980s it had been published in many languages and formats. The full edition consisted of over 200,000 classes at this date and it was supported by the worldwide network of FID's membership which consisted of around 100 countries. It has been calculated that it is used in approximately 111 countries^[5] and is available in some 38 different languages. It is frequently thought that its use is principally by specialized and in particular scientific and technical institutions. This is certainly true in the English-speaking world, and to a certain extent in Russia and the former members of the Soviet Union where its use was obligatory in such institutions. But it is widely used in libraries of all types in Spanish-speaking countries, in Portugal, and in many countries of Eastern Europe, ranging from children's libraries to large public and university libraries.

Historically, it was developed to three different levels, the full edition, medium editions (which became particularly popular from the 1970s onwards, thanks partly to the impetus from a three-language edition in French, German, and English envisaged as part of the celebrations for the centenary of Dewey's *Decimal Classification* in 1976) and abridged editions. It was also published in "special subject editions," with the major discipline(s) given the full expansion while other parts of the scheme which were the "fringe topics" to the principal interest but were needed for the organization of a specialist collection were outlined in an abbreviated form. Such editions include the *ABC Abridged Building Classification*^[6] and the *Universal Decimal Classification for Polar Libraries*.^[7] The most up-to-date such version is the *Global Forest Decimal Classification*^[8] which in 2006 is being revised and converted into an online version.^[9]

For many years, until the 1990s, the maintenance of the classification was undertaken in The Hague by the editor. This was originally under the supervision of Donker Duyvis and latterly in the charge of Geoffrey Lloyd and his staff together with the Secretary General of FID and a Central Classification Committee. This Committee was made up of representatives of the various language editions of the classification, together with representatives from the national committees responsible locally for the scheme. All changes had to be approved by this body and were circulated for approval prior to implementation. There was also at that time what was known as a "starvation policy" whereby no number could be reused with a different meaning for a period of 10 years. This revision method was an extremely slow and time-consuming exercise, especially the requirement to gain the approval of all the national committees prior to implementation. By the end of the 1980s FID found it was no longer in a position to maintain the classification at the level of development achieved in the past and that it was becoming both too expensive and too outdated in parts to be a manageable undertaking for the organization.^[10] It set up an international Task Force to investigate the viability of the classification and to recommend a policy for the future.^[11]

This body reported in 1990 and recommended among other improvements, the setting up of a Consortium of publishers to manage the classification and the creation of a machine-readable Master File of a maintainable size, approximately the size of that which had previously been known as a Medium Edition (ca. 60,000 + entries). This Consortium is known as the UDC Consortium (UDCC) and is managed by an Executive Committee, together with an Editor-in-chief and an Editorial Board, set up in 1994, who take care of the development of the classification. The "ten-year starvation rule" was also abolished at this time, permitting greater flexibility and the ability to incorporate new expansions and revisions in their logical place more speedily. The headquarters remain in the Koninklijke Bibliotheek in The Hague, and until its demise in 2000 FID was a member of the Consortium. Other members are the publishers of major language editions, such as English, French, Spanish, and Russian. Editions in other languages are produced by national publishers under license in a variety of formats and sizes. The office in The Hague is managed by the UDC Director who is responsible for issuing licenses, organizing subscriptions, and the day-to-day running of the business.

The machine-readable master file, known as the Master Reference File (MRF) is maintained in The Hague and is updated annually on January 1st, after the publication of the annual *Extensions and corrections to the UDC* in the preceding November. The original version of the Master File was based on the English Medium Edition of the Classification (BS 1000M: 1985) together with subsequent revisions and amendments up to 1992 as that material was already available in a machine-readable format. Most editions of the classification published since 1992 are the size of the MRF, approximately 66,000 entries in "standard" editions, or smaller editions, some as abbreviated as 4000 entries. It is issued in a range of different formats such as on CD-ROM or online as in the British Standards Institution's UDC Online, as well as in hard copy. The MRF is the authorized text and any developments that exceed its content are not authorized by the UDCC. The MRF exists in English only, but there is scope for expansion to include a range of other languages and proposals for a multilingual edition have been made. There are editions in French, Spanish, and Czech of similar size to the English master text which could form the basis of such an undertaking, but many published editions of the scheme are based on different stages of development and revision depending on the year when the translation began, and this creates obvious editorial problems for coordination.

STRUCTURE OF THE CLASSIFICATION

The outline of the main classes corresponds broadly to its parent, with the exception of class 4 which was vacated in the 1960s and has not been used since that date. But unlike

the original, there is no three figure base and each number is treated as if it were a decimal:

- 0 Generalities (including computer science, management)
- 1 Philosophy. Psychology
- 2 Religion. Theology
- 3 Social sciences (including gender studies, demography, sociology, politics, economics, law, public administration, and education)
- 4 Vacant
- 5 Mathematics and natural sciences (including environmental studies)
- 6 Applied sciences (including biotechnology, medicine, agriculture, transport, and technologies)
- 7 Fine arts. Applied arts. Entertainment. Games. Sport
- 8 Language. Linguistics. Literature (including philology)
- 9 Archaeology. Geography. Biography. History

NOTATION

In addition to its prime function of mechanizing the order, the UDC notation aims at expressiveness. Frequently the addition of a digit symbolizes a subdivision on a hierarchical basis:

597/599	Vertebrata
599	Mammalia. Mammals
599.8	Primates
599.88	Hylobatidae and Pongidae. Anthropoid apes
599.883	Pongidae
599.883.1	Orang utan
599.883.4	Chimpanzees
599.883.6	Gorilla

The notation makes two distinct uses of the numerals that are available; firstly, they are used as main numbers 1–9, expanded as required, and secondly as auxiliary numbers. The latter are numbers added to the main numbers to express additional facets of a subject, such as physical forms, geographic areas, chronological subdivisions, commonly recurring properties, etc., each with a distinct facet indicator. Each digit should be regarded as a decimal fraction, less than unity. For ease of reading a point, which has no mathematical significance, is introduced and a long number broken up, normally after every third digit:

6	Applied sciences
62	Engineering
622	Mining
622.2	Mining operations
622.23	Excavation
622.233	Drilling for blasting
622.233.4	Hammer drills and drilling

AUXILIARY TABLES

The auxiliary tables are of two kinds, common auxiliaries which express generally recurrent characteristics and special auxiliaries which denote locally recurrent characteristics. The common auxiliary subdivisions consist of numeric tables together with certain linking symbols used to join any concept in the main tables to any other. Each table has a distinctive piece of notation:

- 1a Co-ordination. Extension
+ , /
- 1b Relation. Subgrouping. Order fixing
:, [. . .], ::
- 1c Language
= . . .
- 1d Form
(0/09)
- 1e Place
(1/9)
- 1f Race, ethnic grouping and nationality
(= . . .)
- 1g Time
“ . . . ”
- 1h Subject specification by notations from non-UDC sources, e.g., A/Z
- 1k General characteristics
 - 02 Properties
 - 03 Materials
 - 04 Relations, Processes, and Operations
 - 05 Persons

In addition to these commonly applicable auxiliaries constantly recurring concepts within a limited subject field may be expressed by the use of special auxiliaries. Unlike the common auxiliaries the same notation may be used with a different meaning in the special auxiliaries occurring in different parts of the main tables. Three kinds of notation are used in special auxiliary tables: the hyphen series -1/-9 [but not -0 which is used for the common auxiliaries of general characteristics (Table 1k)] employed principally for an analytical or differentiative function, e.g., 82-1/-9 to denote literary form, etc.; the point-nought series, covering aspect studies, specialized activities, and operations, etc., e.g., in class 7 to denote styles and specialized principles, techniques, etc. in the Arts; and the apostrophe series which are usually more specific and are often synthetic in function, e.g., in 547—Organic Chemistry for chemical compounds.

Special auxiliaries may be used both to amplify the common auxiliaries, e.g., in the Area Table (1e) to express such concepts as the points of the compass:

(1-11)	East. Eastern
(4-11)	Eastern Europe
(44-11)	Eastern France
(443.61-11)	Eastern Paris

and to express particular concepts recurring throughout a single discipline or group of disciplines

7.079	Arts festivals
791.65.079	Film festivals
82:7.079	Literature festivals

Full details of the content and application of the main tables and the auxiliaries are set out in the introduction to the classification and in *The Universal Decimal Classification: A Guide to its Use* published by the UDCC.^[12]

THEORETICAL BASIS

Unlike its contemporaries at the end of the nineteenth century, the UDC incorporated a number of devices to make it more flexible and better to provide for the detailed specification essential for the bibliographic undertaking for which it was originally planned. It was the first truly analytico-synthetic classification, enabling any one concept to be linked notationally to another. In this way it foreshadowed the fully faceted schemes developed originally by Ranganathan some 35 years later, and followed especially by the Classification Research Group in the United Kingdom for the development of special classifications and indexing systems such as PRECIS in the years following World War II. It permits synthesis in several ways. Classes that have been developed or revised since the 1980s are all fully faceted. Examples include Class 2—Religion, Class 8—Literature and Language, and Class 93/94—History. This is implemented through the use of the colon and the other connecting symbols outlined above to join together two or more concepts. This facility makes it possible to express compound topics and to develop the classification to accommodate new topics which frequently have their roots in previously existing disciplines. Classes that have been developed by means of this device include 502/504—Environmental Science and 60—Biotechnology, where much of the detail is gained through the use of the colon, e.g.:

502.3.272:531.62	Energy conservation
502.3:551.510.534:502.12	Ozone layer depletion
602.6:599.323MUS	Creation of transgenic mice
602.643:54-126	Polymers as vectors
602.72:612.646:602.9	Cloning of human embryos for stem cell research

The array of common auxiliaries also makes for considerable flexibility, as does the facility for intercalation of those which have a clearly marked beginning and end, such as the notations in Tables 1e and 1f for Area and

Time, respectively. Intercalation provides the means of changing the citation order to suit individual needs. Class 34—Law provides an example of this, where the main schedule for Law is divided first by legal topic, but it may be found more convenient to have an arrangement of Legal system—legal subject, e.g.:

347(410.5).23 Scotland—Property law
rather than
347.23(410.5) Property law—Scotland

This flexibility has been greatly enhanced by the development of Table 1k, especially the concepts listed at -02—Common auxiliaries of Properties and -04—Common auxiliaries of Relations, Processes, and Operations.

All revisions which have taken place since the 1980s have been fully faceted and have a notation that reflects the hierarchical position of each concept, to aid machine-searching, so that it is possible to search up and down a hierarchy by truncating or extending the notation. Class 2—Religion provides an excellent example of this approach. This classification was introduced in 2000 and is the first attempt by a general scheme of classification to present an unbiased approach to the discipline.^[13] The class is arranged so that each religion is listed and accompanied by a series of auxiliary tables enabling the enumeration of appropriate concepts. The classification therefore provides a listing of faiths and the notation used for listing those faiths is simply an ordering device, and in no way implies any subordination of one to another, because of the problem of enumerating so large a number. The religions are arranged according to their historical origin, beginning with prehistoric and primitive religions. The “big five” faiths, Hinduism, Buddhism, Judaism, Christianity, and Islam are all allocated a two-digit number, the remainder in some cases have longer notations. Moving on from the enumeration of the various faiths and religions, the principal facets (in inverted order, following the principle adopted in all recent revisions) are as follows:

Religion	
(Theory and philosophy)	Religious concepts and ideas
(Evidences of religion)	Sacred books. Scriptures
(Agents)	Persons in the subject
(Operations)	Social and ritual practice and observance
(Processes)	Development, decline, interfaith relations
(Parts)	Religious organizations, associations, orders, sects, and movements
(Kinds)	Religions by various characteristics e.g., Orthodox, Liberal, monotheistic
(Entities, Systems)	Specific religions and faiths

CITATION ORDER

There is no official introduction to UDC editions and the many editions of the classification usually include their own introductions, frequently copied (with or without permission) from other editions. Instructions on usage appear in the various guides issued in a range of languages, the most recent being translations of *The UDC: A Guide to its Use*^[14] but notable for its clarity and authority is Jack Mills' Guide of 1963 authorized by the British Standards Institution (BS1000C: 1963).^[15] A fixed, obligatory citation order raises problems with so flexible and adaptable a classification. International exchange of bibliographic information requires a standard order but this can conflict with maximum expressiveness and the flexibility of the scheme appeals to many of its users who can adapt it to suit their own circumstances. Nowhere is there laid down a standard, compulsory order, but the MRF provides instructions on citation order in a number of places, particularly in the instructions for the application of the Common Auxiliaries, especially those in Table 1k the Common Auxiliaries of Properties, Materials, Relations, Processes and Operations, and Persons which may not be used independently or cited first in a compound notation. The current MRF is far from uniform in its recommendations in this matter but the default citation order, which follows the principle of inversion, works well in the majority of cases where there is no specialist requirement. As at present constituted, it would be exceedingly difficult to impose a rigid citation order and it is most unlikely that it would be followed by users who are accustomed to adapting the classification to their specialized requirements.^[16]

FILING ORDER

Unlike citation order, which depends to a certain extent upon the needs of individual circumstances, a fixed filing order is laid down for the arrangement of the various codes which represent concepts in the UDC. There is a fixed order for the filing of the various symbols so that a user should be able to anticipate the arrangement when consulting a UDC file.

The filing order in the UDC is based on the principle of proceeding from the general to the particular and is demonstrated below:

Symbol	Example
Independent auxiliaries	
= =112.2	German language (i.e., documents in German)
(0...) (0.035.22)	Microfilmed documents
(1/9) (430)	Germany
(=...) (=1.410)	British nationals
"..." "19"	Twentieth century
+	622.341.1+669.1
	Iron-ore mining and ferrous metallurgy

/	622.341.1/2	Mining of iron ores and manganese ores
Simple number		
	622.341.1	Iron-ore mining
Auxiliaries as suffixes		
:	622.341.1:338.124.4	Economic crises in iron-ore mining (<i>may be reversed</i> to form 338.124.4:622.341.1)
::	622.341.1::338.124.4	Economic crises in iron-ore mining (<i>may not be reversed</i>)
=	622.341.1=112.2	Documents in German about iron-ore mining
(0...)	622.341.1(0.035.22)	Microfilmed documents about iron-ore mining
(1/9)	622.341.1(430)	Iron-ore mining in Germany
(=...)	622.341.1(=411.21)	Iron-ore mining amongst Arabs
"..."	622.341.1"19"	Iron-ore mining in the twentieth century
*	622.341.1*Fe ₂ O ₃	Mining of red haematite (Fe ₂ O ₃)
A/Z	622.341.1GOE	Named iron ores: Goethite
-0	622.341.1-057.2	Manual workers in iron-ore mining
-1/-9	622.341.1-78	Protective devices and measures in iron-ore mining
.0	622.341.1.03	Geological character of iron-ore deposits
/	622.341.1'17	Wastes, residues from iron-ore mining
Next simple number		
	622.341.11	Mining magnetite-haematite ores

The filing order, by and large, follows the principles implicit in the standard citation order whereby within any given class mark subject concepts precede forms and place and time come last in the subject sequence. The use of the colon, however, may result in a more specific concept filing ahead of a general one, for example:

622.341.1:338.124.4 Economic crises in iron-ore mining
is much more specific than

622.341.1(0.035.22) Microfilmed documents about iron-ore mining

MAIN CLASSES

Although in broad outline, the classification resembles the DDC, there are many places where the two schemes diverge in detail. This is particularly true in classes 5 and 6 where different standard classifications for the sciences

have been followed. In the future, the detail of these classes may be altered to use the currently vacant class 4 to extend such disciplines as Medicine and its related sciences of Psychology, Biochemistry, etc. Class 0 has also been developed to incorporate Computer Science at 004 and Management at 005, since both are seen as being generally applicable. Both classes are fully faceted and contain concepts that will be needed throughout the classification, e.g.:

004.78:336.717	Online computing systems for banking transactions
005.521:330.133.1	Value analysis
005.912:656.874	Use of courier services

One development in 2006 which is noteworthy is collaboration of the UDC with its parent scheme. The DDC has been investigating the possibilities of adapting the new classification of class 2 for the creation of a less biased approach to religion. A project has been undertaken to map the UDC scheme onto the Dewey Class 200 and to convert the classification into a Dewey-like notation in order to improve the unbiased approach that Dewey has been attempting to achieve in recent editions. A pilot study mapping UDC 24—Buddhism to Dewey’s 194 class has been conducted and the conclusion has been reached that the more profitable approach is to use the UDC base with a revised DDC notation. Because the UDC is a fully faceted schedule and DDC’s auxiliaries differ considerably from those of UDC, mappings will be developed at the facet level for topics within the Religion schedule of both schemes. UDC has more detail than DDC and it is not intended to expand DDC to the same level of detail. The revised schedule for DDC is intended to be issued as an alternative in the first instance.^[17]

AUTOMATION AND THE UDC

The UDC was one of the earliest of the general schemes to be explored for its possibilities for mechanized retrieval. M. Rigby^[18] prepared a report in 1981 and subsequent research has resulted in the scheme’s application in a number of automated systems ranging from KWIC (Key Word in Context) indexes to the computerization of classified catalogs. The classification is particularly suited to machine searching. Its hierarchical structure facilitates searching up and down for more specific or more general concepts. The meaning of a number remains constant and therefore it is easy to retrieve concepts that have been expressed precoordinate in a postcoordinate manner.

A long-standing problem with the scheme has been the use of the colon to express relationships of all kinds, without distinction. Perrault,^[19] as long ago as 1968, published a “schema” of relators to clarify the ambiguities inherent in the use of the colon. This was a lengthy

schedule with an alphabetical notation identifying a large number of different types of relationship. It was circulated by FID in the previous year but was not received with much enthusiasm and was never incorporated into the structure of the classification. Another proposal along similar lines was made by Caless as the result of work at the VELA Seismic Information Analysis Center of the University of Michigan.^[20] This also, was never incorporated into the scheme. However, the introduction of Table 1k-04—Table of Common Relations, Processes, and Operations in 2003 has resulted in the ability to express 11 different phase relations, such as bias phase, association, dependence, complementarity, etc., thereby greatly improving expressiveness and addressing the problems identified half a century previously.

One of the earliest projects with machine-retrieval was Automatic Direct Access to information with Online UDC System (AUDACIOUS) undertaken by Freeman and Atherton in 1967–1968 at the American Institute of Physics.^[21] This was a command-driven, interactive system which used the nuclear science sections of the UDC schedules with English descriptions. It provided remote direct access to files containing 2330 items from Nuclear Science Abstracts which were indexed by UDC and was part of a larger project which provided machine-readable files of UDC, automatic typesetting, composition of UDC schedules, and a statistical evaluation of the classification as a retrieval tool. The resultant conclusions had considerable influence on future applications. Throughout the late 1960s and early 1970s a series of conferences was held to examine the possibilities of the UDC as a retrieval tool.^[22–24] The impetus faded, however, with the financial problems of FID during the 1980s and it was not until a decade later that much interest was demonstrated in the use of UDC in a networked environment. Buxton^[25] in 1990 examined the feasibility of using the scheme in these circumstances, drawing attention to examples of automated usage and also highlighting the shortcomings of the scheme for such application, such as the tendency to repeat the same concept in different parts of the schedule, due to the dependence of the classification on “aspect.” This is a problem that recent revisions have taken note of and continue to address and correct. There are many concepts scattered throughout the schedules, as in the following example of “alcohol”:

Practical laboratory chemistry	542.423	Heating by alcohol
Analytical chemistry	543.632.532	Hydroxyl groups, free alcohols
Organic chemistry	547.26	Saturated monohydric alcohols
Medicine	613.81	Alcoholic drinks
Engineering	62-631.4	Alcohol
Chemical technology	661.72	Alcohols and their derivatives
Industry	678.744.7	Polyvinyl alcohol

There are, however, bonuses to this apparent scattering, as if one wishes to contextualize a search and focus on browsing to improve precision, the aspect element of the classification is a considerable advantage, since it is possible, for example, to retrieve everything concerning medical aspects of alcohol and exclude all other contexts by simply using the 613.81 notation rather than searching on words. Recall is improved further in systems where it is possible to use words in combination with UDC numbers.

The advent of the Online Public Access Catalog (OPAC) presented opportunities for exploiting the facility for searching, browsing, and displaying classification data that the UDC offers, and which traditional classified catalogs had used to advantage for decades. By and large, this feature of the classification has not been realized. Where its potential has been implemented in an OPAC it is by libraries which purchased specially designed systems such as ETHICS at the Eidgenössischen Hochschule in Zurich^[26] and the MUSCAT system used by the Scott Polar Library in Cambridge (U.K.).^[27] For the UDC to be effectively applied in an OPAC it is essential to have an automated classification schedule, an authority file for the classification, and an interface which permits the display and browsing of hierarchies and provide both simple and postcoordinate search facilities that use both classmarks and natural language.

The use of classification on the Internet has resulted in a number of research projects such as DESIRE, NORDIC, SCORPION, and CORC, and these have demonstrated that classification can play a significant role in improving searchability. The full potential of library classification in general and of UDC in particular has yet to be realized. The classification is, however, used to provide quality information via certain services which attempt to create directories by analyzing and classifying resources intellectually and employ programs for the automatic harvesting and classification of resources. Automatic classification of Internet resources becomes all the more urgent as their growth makes any manual classification unmanageable. Services classified by UDC include SOSIG and NISS. SOSIG—Social Science Information Gateway (<http://sosig.ac.uk>) has over 50,000 social sciences Web pages stored in the database which is regularly updated. In 2006 it incorporated Law and was relaunched as INTUTE (<http://www.ukcle.ac.uk/directions/previous/issue4/sosig.html>). NISS—National Information on Software and Services) Information Gateway (<http://niss.ac.uk>) is a U.K. national information service for the education community which is part of HERO (Higher Education and Research Opportunities in the United Kingdom) (<http://www.hero.ac.uk>). Both services are based on very broad headings from UDC and on out-of-date versions of the scheme, though they may incorporate more recent amendments. This cannot be discerned as they do not display the UDC structure on the interface or UDC numbers in the metadata.^[28]

Automatic classification using UDC should ideally make provision for creating both simple and compound numbers, using vocabulary built up in an authority file. A more rigorous approach to defining the content of Web documents has been detected in Web sites which integrate UDC into their operation.^[29] The synthetic approach of UDC means that concepts are expressed by a notation that is built up during the process of classification, rather than appearing readymade in the schedules. Hence the necessity for an authority list which must be accompanied by an index to the scheme enhanced by natural language terms that may occur in a full-text database. This is not an easy task to create, and the majority of existing automatic classification systems tend to extract terms from the schedules and to limit their selection to simple numbers. Examples of services which have experimented with automatic classification include WWW Subject Tree of WAIS (Wide Area Information Server) Databases. This gateway is part of the Nordic WAIS/World Wide Web Project (http://www.ub2.lu.se/autpo_new/UDC.html).^[30]

Another project using UDC for automatic classification was GERHARD (German Harvest automated Retrieval and Directory (<http://www.gerhard.de/>) which was focused on the classifying and indexing of German Web pages. It integrated both searching and browsing facilities. The researchers used a trilingual version of UDC comprising 60,000 entries, and 15 different relations are possible. Each entry includes a UDC notation and a natural language description with synonyms in German, English, and French. The objective was to convert the classification to a lexicon that mapped classification entries to the codes in the scheme. Natural language expressions of the documents were matched with the UDC entries using linguistic classification. GERHARD demonstrates the advantages of having a classification as the backbone of the retrieval system. The number of documents assigned to a given category is clear, as is the number of documents in displayed subcategories. It is easy to move through the hierarchy of categories and the system is user-friendly. Until 2006, when it ceased to be available, it was the most sophisticated application of the UDC for the purpose of Internet resource discovery.

CONCLUSION

The UDC is a classification that is widely used in the non-English speaking world, both for the traditional purpose of arranging books on shelves and for application in more sophisticated retrieval systems. It has great potential for application in a networked world since it is possible to create a system that permits searching on each separate element in a classmark and to combine words and numbers for the purposes of searching. Recent revision work has concentrated on increasing the basis of facet analysis throughout the scheme and on eliminating places where

the same concept is repeated in a different context, in order to improve the structure for machine searching. The use of a sophisticated system such as this is very expensive and the full potential of UDC has yet to be realized in the modern environment.

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University Archives

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Abstract

Universities, colleges, polytechnic institutes, arts academies, and other postsecondary institutions have established archival programs to hold and make accessible the documentary heritage of those institutions in order to protect individual and institutional rights and to provide a cultural context for understanding of the institution's past. University archives are managed by professional archivists following best practices of the archival field, but they are reflective of the distinctive history of the particular institution.

EMERGENCE AND DEVELOPMENT OF UNIVERSITY ARCHIVES

The post-World War II era's great expansion in higher education has supported an equally dramatic growth in the establishment and scope of university archival programs. After many years largely in the shadow of governmental archives and private historical societies, academic archives have finally come into their own, and many academic archivists have assumed leadership positions in the international community of archivists. Indeed, the archives now found in the world's universities, colleges, and other institutions of postsecondary education contain some of the most important materials for understanding culture and society. Over the same period, while historically a discipline separate from library and information science, archives have grown closer to library practices. Although manuscripts and special collections have been part of academic libraries for decades, they were often relegated to the periphery, and a typical approach was to apply item-level cataloging and subject-oriented description rather than archival methodology. During the more general broadening of librarianship's scope starting in the early 1990s, archivists in academic libraries have experienced a greater acceptance of their need for autonomy to follow archival methodology at the same time that archival approaches have shown their usefulness for expanding areas of library materials.

Advances in technology for both the control of information materials and the very materials themselves have enabled a convergence of library and archives practices for capturing, preserving, and making accessible diverse information resources. However, there are enduring characteristics of archives that differentiate archivists from librarians: 1) archival materials are treated as aggregates; 2) the materials are viewed as organic or naturally occurring as the result of administrative action rather than as synthetically and retrospectively created; and 3) their nature inherently varies greatly from institution to institution, thus making standardization difficult.^[1,2]

The variety among higher education archives renders generalizations difficult because, when examined closely, any generalized picture may not fit well with the characteristics of a given archives, its parent institution, or even the overall type of educational institution to which an archives belongs. Still an overview is enormously useful as an introduction, as a way of assessing relative practices, and as groundwork for the identification of norms for future development.

DEFINITIONS

Some definitions are needed to frame the discussion of the scope, contents, and functioning of university archives. For the purpose of this entry, archives may be defined as the organized noncurrent records of an institution, organization, family, or individual deemed to have enduring value and retained for administrative or research use. The purposes of archives include accountability, preservation of heritage, and services as a laboratory for educational programs. Archives also refers to the formal program that manages records of enduring value, the physical place occupied by the program, and to the materials held in such repositories. Additionally, in common professional parlance, "archives" is used to describe a wide variety of documentary forms from institutional and private sources, whether created formally as part of a systematic records system or as the result of private collecting of material based on its subject content.^[3]

Nevertheless, there is value in understanding the differences among three related categories of archival materials: traditional records created by official institutional transactions; privately generated or "personal archives;" and "manuscript collections"—materials synthetically collected and retained for their subject matter pertinence. The distinction of archives from manuscripts is a particularly relevant in regard to university archives because of the tendencies of academic libraries to focus on subject

matter pertinence and item-level control even when dealing with manuscripts. Although the methodologies and resources needed for archives, private papers, and manuscript collections vary, university archival programs frequently contain all three categories, because all three often have a bearing on the fundamental university archival responsibility of providing accountability and preserving heritage. However, to understand the core of university archives worldwide, it may be best to focus only on the basic institutional records program, along with that limited body of private papers bearing directly on the institution, such as faculty papers. In this context, the core would not include the unrelated “manuscript” gatherings that have become so popular in U.S. colleges and universities.^[4]

Equally important for this entry is a definition of “university.” University archives occur in all types of postsecondary educational institutions, whether they are polytechnic institutes, 2 or 4 year programs, graduate research universities, specialized professional colleges (such as law or medicine), or arts and music schools. Further diversity is introduced by the matter of sponsorship or affiliation: universities may be official organs of a governmental authority or privately supported by tuition funds and endowments. In addition, one particular type of private institution—the religiously affiliated—will also result in significant differences, depending on denominational or doctrinal connection and institutional mission (general education vs. training of clergy for religious service).

VARIABLES AFFECTING THE NATURE OF UNIVERSITY ARCHIVES

There are additional typologies which can have significant bearing on university archives’ holdings and user constituencies. For example, in a general research university with both graduate and undergraduate programs in the arts and sciences, the archives can serve as a research laboratory where undergraduate and graduate students in disciplines such as history, anthropology, and languages may exploit the university’s past as a means of learning how to do research or narrative writing. In a university that is predominately a professional school (e.g., law, medicine, or engineering), connecting students with the university’s past through archivally based assignments may be less possible, and the archives may find that a proportionately greater part of its users are the alumni and fund-raising offices. Schools of art, music, dance, and theatre are similar in many respects to the professional and technical schools, but they may place greater emphasis on non-textual records. At nonresidential 4-year undergraduate and 2-year “junior” colleges, the archives’ challenge may be to connect with the students when their time on campus is far more limited, necessitating a more active outreach

program so those archivists may engage their student clientele.

All of these variations can come together to have an important influence on what kinds of records and manuscripts are available to the archives. While certain core administrative records (e.g., catalogs, faculty minutes, executive officers’ reports, correspondence, and policy documents) will be fundamental to any kind of university, the variety and scope of faculty personal papers may be far greater in a general university with strong social science programs than in, for example, an engineering institute or music academy where the disciplines themselves are much less focused on textual studies and textual production. Of course, this is not to say that the papers of engineers and musicians are any less valuable; rather, documenting the careers of such faculty may be a greater archival challenge.

Two other environmental variables can have further significant effect on the nature of the university archives: country/national traditions and age of institution. Country of origin, national traditions, or other governmental mandates can dictate much of the character of a university. Beyond the clear effect that national public-records laws have on the archivist’s authority to control what does and does not come to the archives and on what is mandated for public access, national traditions can effect the character of universities and thus their archives. For example, a postcolonial public university in an African or South Asian country may well be focused on technical training, technological advancement, and the development of a national literature. In a European postcommunist country, traditions of centralized control may still persist, making it possible for its archivist to apply administrative mandates for the management of records. By contrast, in the United States, the fierce tradition of state-by-state independence and distrust of central government authority makes it difficult to develop consistent archival policies for the routine systematic transfer of records to university archives.

While there are a number of important universities well-known for their great age, e.g., Bologna, Paris, Oxford, and Harvard, the inescapable fact is that worldwide, the majority of institutions date from the twentieth century. Universities of significant antiquity face challenges in balancing attention to very old documents (with almost relic status) against modern items that by comparison to medieval papal bulls or princely commissions with wax seals can seem quite mundane. On the other hand, newer universities do have an opportunity to apply the most modern professional archival standards to their heritage but with the proximity of their own past and their urgent need to establish their authenticity, their relatively young age may lead such universities to discount their past so much that archives are at the bottom of their priority lists for financial and policy resources.

NATURE OF A UNIVERSITY ARCHIVES AND DOMAINS OF ARCHIVAL WORK

Recognizing the limits of generalizations, we can still define a university archives as a formally authorized and professionally managed program for the selection, accessioning, arrangement, description, preservation, and use of the official records, personal archives, and private manuscripts of enduring value for telling the story of the university, its programs, people, and place. An archives exists to support accountability and documentation of institutional and personal rights, and to enrich the university and its people by the preservation and presentation of its cultural heritage.

Professional management of the university archives consists of systematic practices in seven distinct archival domains:

Effective authorization of the archives by the parent institutions allows the program to ensure the retention, preservation, and utilization of archival holdings.

Authentication of documentary information through the analysis of its content and evidence obtained during the process of its accession or through a systematic records management program ensures the integrity of the archival record.

Appraisal of documents for their value as evidence and information on the basis of anticipated use in relation to the costs of description and retention ensures the selection of the smallest and best body of records.

Arrangement of information according to source and original order to sustain the integrity the documents had while in active use, following the related principles of *respect des fonds*, provenance, and sanctity of the original order guarantee that the archival holdings reflect their original meaning and relationships.

Description of documents, according to best practices and standards, via finding aids, guides, and inventories enables long-term access to their informational contents and ongoing administrative control of the holdings.

Preservation or physical protection ensures the future availability of documents in a safe environment and on physical media that will remain accessible, renewable, or convertible for the period of expected use.

Archivists promote and facilitate the use of documents to explain the past, provide guidance in the present, and accountability to the future.

In the three common understandings of the word “archives”—as documentary material, as a physical place, and as a program that manages these materials—it is the documentary content which has the greatest visibility to the program’s parent institution and constituencies. Archival material can come in all physical formats including

stone, cloth, parchment, paper, glass, plastics, and electronic media. Likewise, archival information can be recorded as words, numbers, codes, images, sounds, and moving images. To achieve its purpose, the university archives must be all-inclusive of physical media and recording structures.

HOLDINGS OF A UNIVERSITY ARCHIVES

Regardless of physical materials or record formats, an overarching typology of the holdings needed in a university archives consists of the following: official or office records (correspondence, reports, minutes, images, etc.) created by university officers and staff to complete their individual mandates; publications (documents produced by the institution in multiple print copies or via broadcast/posting on the Internet) whether of a bureaucratic, promotional, scientific, or cultural nature; and personal papers (material in all physical formats created and retained by individual students, faculty, and alumni reflecting their professional and private lives as members of the social community of the institution). Adequate documentation of the university requires attention to all three of these categories, although those archives maintained primarily for administrative purposes may emphasize official records and publications at the expense of the more personal, human, and diffuse picture that is drawn by personal papers.

Some professional literature has attempted to list the variety of specific records that should be part of a university archives.^[5] These inventories proceed on a hierarchical structural analysis mentioning such items as catalogs, graduation lists, policies and regulations, minutes, reports and correspondence of the board of control, chief executive officers, academic officers (provosts, rectors, and deans), faculty assemblies, and student affairs administration, and facilities managers. Such lists are useful points of reference, but a functional rather than structural analysis may provide a more strategically useful typology.^[6] True, one might end up identifying such a broad array of documentation for the archivist to manage that it may seem to offer little advantage over the more traditional structural and hierarchical model, but the functional approach is an efficient way to strategically sequence decisions centered on the context of the records. The functional analysis approach should help archivists at different types of institutions to de-emphasize some areas when they are not relevant to that type of institution. For example, at a 2-year or 4-year undergraduate college, the archivist might make the strategic decision to de-emphasize the function of the creation of new knowledge while an archivist at a general university with a strong research emphasis may make the strategic choice of de-emphasizing efforts to accessions of materials on primary- and secondary-school teacher training.

CORE UNIVERSITY FUNCTIONS TO BE DOCUMENTED

In general, the core functions of a university to consider in relation to a university archives are:

Establish and sustain functions are those legal and administrative activities that create and support the continued existence of the university. This area includes not just charters and legislative mandates, but also records of financial administration, fund-raising, property acquisition, physical plant planning and development, employment management, and institutional reporting.

Educate. While many universities have been particularly wily in taking on multiple personae, by definition their signature function is to educate students. Important documentation of this function may include course catalogs, syllabi, grade records, Web course sequences, and student notebooks, exams, and papers. Operating strategically, a university archives may elect to limit accessions for the educate function to just course descriptions and grade records, or if funded sufficiently, it might decide to document the learning process by capturing Web course content, class blogs, and student essays.

Creation of knowledge. Universities, especially those with postbaccalaureate programs put a great emphasis on having faculty and advanced students engaged in the discovery of new knowledge, the writing of scientific research studies, and the making and performance of cultural and artistic works. Inevitably, documentation of this function requires attention to the personal papers of faculty and sometimes students through materials such as laboratory notebooks, manuscript drafts, or audio, and video recordings of performances, but it also requires administrative office records on the management of research laboratories, research funding grants and contracts, performing arts facilities, and cultural and scientific museums.

Socialization. Whether one regards higher education as an authoritarian effort to restrain the excesses of post-adolescent youth or merely confine them until the hormones settle, the fact is that universities bring together large numbers of maturing individuals who quickly form social networks through educational and extracurricular activities. Not only is the place of the university in the former student's life very much defined by the socialization that occurs there, but the university itself is also defined by its student and faculty life. Socialization can be one of the most important educational functions of the university. By its very nature as a matter of intangible personal interactions, the socialization function is difficult to document. Clearly, personal papers, (such as diaries, scrapbooks, blogs, MySpace[®] sites, photo albums, and correspondence) will be essential for documentation of this function in any depth. Because such materials can be complicated to acquire, describe, and preserve, some university archives may choose to limit their work in this area to keeping only the official records and publications

pertaining to the institutional structures in which the socialization occurs, such as housing regulations, programs for intramural clubs and athletics, student newspapers, and organization Web sites, although broader coverage may provide for a very lively archival program of appeal to many extra-institutional researchers.

Public engagement. An enduring function of universities is the broad range of activities by which the institution interacts with the general populace as a whole. These activities include continuing education and extension programs whereby the knowledge of the university's specialized disciplines is distributed to the public as applied services and thus can range from agricultural information bulletins, medical services, and veterinary clinics to evening and distance-learning classes. Public engagement activities can also include music extension courses, art exhibitions, musical and dramatic performances, and public athletic events. The popularity of some of these activities can often mean that the university has great public visibility and that the archives receives many reference requests for historical information about these engagement programs. Thus, even though some such activities (e.g., "big time" intercollegiate athletics) at first might not seem to be central to the mission of higher education, failing to document them, even if only at the strategically limited level of maintaining a record set of event programs, will deprive the archives of an opportunity to connect with a nonspecialist public audience.

PROGRAMMATIC ACTIVITIES OF A UNIVERSITY ARCHIVES

A successful university archives is certainly more than a gathering of interesting and important historical records. It needs to incorporate a number of programmatic activities beyond those identified as the seven core domains noted above. Although not every archives can be deeply engaged in each, attention to a healthy mix is important. These programs can include oral history to capture the memories and character of members of the university community, and to fill-in gaps in the "written" record.^[7] Exhibits and other outreach programs, such as concerts, open houses, exhibitions, lectures, performances, history contests, media appearances, curricular presentations or instructional programs to the campus and community schools, publications, etc., are important for ensuring a steady flow of research users to the archives and to counteract the false impression that archives are merely dusty obscure documents of little relevance to today's public. Limited by the strictures of intellectual property law, digitization projects that result in Internet posting of historical documents of interest to the general public (e.g., genealogical information) can be an effective way of engaging the public in the archives' mission while also enhancing the university's reputation.^[8] Records and information management services, while related to the

core ability to document the university, can also be built as a supplemental program to extend beyond mere records disposition scheduling to include a full suite of records and information services (e.g., files management, scanning and imaging services, or vital records protection) and can help the archives expand its campus credibility while also improving the overall quality of university information.

CONSTITUENCIES SERVED

As evidenced by both the basic services to be offered and expanded programmatic activities, university archives have multiple and sometimes divergent constituencies. Its value to each will likely be rooted in different, if sometimes conflicting interests and expectations. For example, legal affairs and core administrative units rely on the archives to supply as complete a record as possible when the university needs to ensure that its actions are free of liabilities. Likewise, archives are needed in instances when the university must respond to claims against it. Alumni affairs and campus fund-raising offices may be most interested in the archives for historical narratives that enable them to connect the university's past with donors able to fund future developments. Faculty may look to the archives as a laboratory-like setting where their students can go to write research papers and speeches. Faculty also see archives as places where they can go to deposit collections of relevance to their own disciplines. For example, the archives may be asked by a faculty geographer to take on the records of a regional environmental action council that just succeeded in blocking a river damming project. Students are also an important, though highly divergent, archival constituency. On the one hand, the archives may be simply the place they go to learn how to use primary sources or to look up some historical fact in fulfillment of a class assignment. On the other hand, the archives may contain historical background on a club or activity they are seeking to join or revive. In less common, but not unheard of circumstances, students may come to the archives to absorb everything possible about the institution as they discover how compelling the past of something familiar can be. Similarly, for alumni, the archives is an ideal resource from which they can recreate those days of fond and intense memories. In addition, there are important external constituencies, including graduate students and scholars from other universities, local school groups, and news media writers and researchers. Understanding the different interests and needs of each constituency can be a challenge for the archivist, although the archivist should be careful not to cater so exclusively to any single constituency that it is defined primarily by that group. In fact, failing to cultivate multiple constituencies will jeopardize the success and even survival of the archives when resources become short, when administrations change, or when one particular constituency becomes alienated or weakened.

THE ARCHIVIST'S CHARACTERISTICS AND PROFESSIONAL BACKGROUND

As suggested by the breadth and depth of responsibilities, holdings, programs, and constituencies, the university archivist must perform quite a juggling act. University archival work requires strong written and oral communication skills, an interest in and patience for research, and a general tenacity. While such general management skills are absolutely essential, the archives clearly needs persons with training not only in historical methods but also in archival theory and methodology. Exact training options will vary from region to region and country to country, but they generally include course work and internships in archival studies presented in postbaccalaureate programs in history or library-science schools, or sometimes in national archival agencies. Regardless of preappointment training, it is important for the university archivist to be actively engaged in archival professional associations. On a regional, national, and international basis, such organizations offer continuing education opportunities, standards development, public policy advocacy, professional literature, and social networking through which university archivists can share problems and develop solutions.^{[9],[10]} Most importantly, they offer the challenge of a framework in which the university archivist examines his or her own problems and solutions in the context of practices and professional standards elsewhere, as well as in relation to archivists in other kinds of institutions such as governments, businesses, and religious bodies. At the same time, some of the general archival organizations often include subgroups just for university archives, such as the International Council on Archives' Section on University and Research Institution Archives (<http://www.library.uiuc.edu/ica-suv/>), the Society of American Archivists' College and University Archives Section (<http://www.archivists.org/saagroups/cnu/index.asp>), the Australian Society of Archivists' University Archives Special Interest Group (<http://www.archivists.org.au/structure.html#uni>), the Association of Canadian Archivists' University and College Archives Special Interest Section (http://archivists.ca/special_interest/university.aspx), or the Society of Archivists (U.K.) Archives for Education and Learning Group (<http://www.archives.org.uk/content.asp?id=148>). It is through such bodies that the profession has been defined and by which the advances of university archives will be measured.

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Usability Testing of User Interfaces in Libraries

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Abstract

As libraries face increasing competition in providing information, we must insure that our library systems are usable, effective, efficient, and perhaps even enticing. How do librarians know that systems give users what they need and want? One way is usability testing. Usability testing has been around the computer industry for at least a decade, but library use of the method is relatively new. It has been a common perception that library systems were designed for librarians. Even if the user was considered, it was from the perspective of librarians who worked with the user. Those perceptions were anecdotal, and librarians frequently disagreed with one another about user behavior and knowledge.

WHAT IS USABILITY TESTING?

Usability testing is the process of actually observing users working on a system or product, taking the information gained in that process, and making changes in the system under test, then testing again to see if the changes improved the system for users. It is not a formal research process, as a limited number of people are tested. It is not based on statistics, but on observation. What is proven again and again is that a small number of users, anywhere from three to eight, will yield 80% of the problems people will have with the system. In fact, in testing eight people, observers will begin to see patterns of problems after seeing four or five test participants.

WHY DO TESTING?

Rather than spending hours in committee meetings discussing effective system design, creating a system and then testing it will save time and energy. The order of buttons, how much information to include, whether a help function is usable, whether terminology is understandable, whether navigation paths are understood, where people will expect to find information, etc.—all of these aspects of systems can be evaluated via usability testing. The predictability of effective use of a library's online catalog or a website can be enhanced through such testing. Endless hours spent with programmers can be avoided. Results of usability testing can be used with system vendors to provide input on system upgrades. In fact, if system vendors do their own usability testing, their own design processes will be more efficient. Why should every library that buys a system have to go through time-consuming implementation to find errors that could have been caught early in the vendor's design process? As systems vendors offer more custom options, there are more choices

that need to be made. The best way to determine the effectiveness of choices is to ask the user.

Usability testing does not necessarily have to be a major time or effort commitment. It is better to test in small "chunks" rather than all-encompassing efforts. Common wisdom is to test small and often. For example, rather than test all aspects of the online catalog, focus on serials.

HOW DOES USABILITY TESTING DIFFER FROM BETA TESTING?

System vendors beta test to see if their systems work before delivery to customers. Beta testing differs from usability testing. While systems may work technically, they need to work effectively and efficiently and be understood by users. A system can be sophisticated in terms of having "bells and whistles," but users may not understand when to use those capabilities. Terminology and navigation may create inadvertent barriers to the usability of the system.

What are the various methods that can be used to test usability? In addition to formal usability testing, there are other ways to gain important input into user's perceptions and experience with the system. These include the following:

- Formal usability testing—actual users are observed using a system performing a list of predetermined tasks. Participants are asked to "think aloud," and observers record what is said and what is done.
- Card sort—used to gain information on the structure of a system or web page, index cards representing individual concepts are given to participants who arrange them in a structure that makes sense to them.
- Category membership—tests participants' understanding of various categories, including what they think should be in each category and what the category should be named.

- Focus group—small groups of people share their opinions and ideas on the system.
- Field study—users are observed in their natural environment as they carry out normal tasks.
- Automated testing—an automated form of usability testing that uses software to conduct test sessions and collect data.
- Walk-up kiosk—may be used in combination with automated testing, a booth with a computer allows users to interact with a system.
- Cognitive walkthrough—designers of the system try to predict users' actions by doing actual tasks themselves.
- Questionnaire—a set of questions is designed to collect responses and opinions of users regarding the system.
- Site usage log—server logs collect user transactions and movements and actions, and these are subsequently analyzed.
- Heuristic evaluation—a system interface is analyzed by evaluators using a set of usability principles.
- Interview—a semistructured conversation is held between individual users and information gatherers about the system being tested.
- Opinion poll—questions are asked of system users to get feedback on specific topics related to the system.

For more information on these various techniques, see <http://www.vancouver.wsu.edu/fac/campbell/usability/acrl>.

Usability testing can provide valuable feedback regarding on-line catalogs, web pages, and user guides—anything that is designed for users to find information, use information, etc. Signage, handouts, stack labels, stack arrangement, almost anything in the library that is designed to help users, can be evaluated and made more effective with usability testing.

DOING USABILITY TESTING

The following is a guide for libraries interested in doing usability testing. Start by doing some reading on the subject (<http://www.vancouver.wsu.edu/fac/diller/usability/usebib.htm>). There are several good books about usability testing and good websites. Jeffrey Rubins' *Handbook of Usability Testing* is a particularly good source for process and practical advice that can easily be adapted for library use.

PREPARE FOR TESTING

For an outline of formal usability test procedures, see <http://www.vancouver.wsu.edu/fac/campbell/usability/acrl>. For examples of all of the materials needed for usability testing, see <http://www.vancouver.wsu.edu/fac/diller/usability/contents.htm>.

Preparation for testing includes complying with institutional policies related to the use of human subjects, constructing a timetable, and formulating a purpose statement, problem statement, and task list.

While most universities have policies and procedures for testing human subjects, it may not be clear if usability testing is covered by these policies. The kind of human subject testing covered by institutional policy is usually physical or psychological. The university compliance office or institutional review board can determine if the library's testing is covered. Appropriate forms should be submitted for the project to the institutional review board or compliance officer.

A timetable is a guiding document and is essential in setting up tests and implementing them. The timetable specifies expectations, tasks, and all of the steps necessary to design and complete the testing. In libraries, it is often the case that those doing the testing have other responsibilities. The timetable lets everyone involved know what needs to be done and when tasks need to be completed.

The purpose statement is the key to a successful usability test. It answers the question of why testing is being carried out and helps to ensure that testing is directed to the processes for which user feedback is essential. For example, if the online catalog is being tested, the goal is to test people's ability to use that tool, not what is in the catalog, circulation policies, collection development effectiveness, etc.

The problems to be investigated relate to the purpose statement. Adherence to the purpose statement ensures that the problems relate specifically to the purpose of the project. The task list builds from the problem statements, as the problem statements build from the purpose statement, going from general to specific. Each step should help in refining the next, but care must be taken to make sure that each truly relates to and focuses on the next step.

The task list includes questions that comprise the actual test. Depending on the purpose and scope of the project, the test can vary from a few questions to many. Experts counsel that more focused tests and testing more often are more effective. Even if the test is fairly wide in scope, the test session should not exceed 1 hr, and 30 to 40 min is preferable. After a full hour, the participant and the observers will likely be tired.

How much to cover in any given usability test is an open issue. The number of questions to be included in an hour session can vary depending on the complexity of questions and tasks. Experience will likely indicate that shorter sessions with focused questions are better than longer sessions. This strategy will enable more effective smaller scope tests rather than comprehensive ones.

PREPARE MATERIALS

Materials to be prepared include introductory script, human subject consent forms, documents related to any

financial reimbursement, and data input sheets. Any equipment to be used in the test should be tested in advance to ensure a smooth test.

The introductory script is read to test participants to give them a uniform platform of understanding. It sets the tone for the session and helps to make the participant comfortable. The introduction should contain information on why the library is doing usability testing; the goals of the test; how results will be collected and used; and expression of gratitude for the persons' participation.

The human subject form needs to be explained to test participants and that institutional policy requires that they sign the form to indicate their consent. It is important that participants understand that the usability test is not an invasive one.

If a financial incentive is being offered, paperwork needs to be completed to make sure reimbursement occurs through the library or institution business office. Participants need to know that if their check is not received in a timely manner, they should check back with one of the observers.

Data input sheets are used to record whether or not the participant successfully completes the task; the time taken to complete the task; whether or not there were false starts; the steps taken to complete the task; and all comments made by the participant during the process of completing the task.

Equipment needed for the test will include, at minimum, a tape recorder, cassettes, a computer, and a clock. Participants need to know that they are not being tested, it is the system that is being tested. This message needs to be reemphasized to reassure the participant, especially if the person is having difficulty with the tasks during the session. Participants need to know that failure is as instructive as successful completion of tasks, because observers need to know the aspects of the system that work and those that do not work.

Self-confidence is important. Observers and test conductors will gain confidence as tasks are completed. Test participants will pick up observers' tension or lack of confidence. Careful and complete preparation increases confidence with the purposes and tasks of the test. Usability testing is serious business, but it can be fun for participants and observers.

TEST PARTICIPANTS

There are many ways to recruit volunteers for usability testing—flyers in the library, ads in campus or community newspapers, website notices, personal contacts at library service desks, etc. If demographics are important, it is advisable to use a screening questionnaire. For example, if a college, university, or public library is interested in testing the usability of its online catalog or website among its diverse community, each client segment can be tested

or a larger sample of people can be recruited. In a sample size of eight participants, an academic library could have three undergraduate students, three graduate students, and two faculty. Within that group, one would want a mix of males and females, traditional age students, and older students, etc. The screening questionnaire can help in choosing the volunteers. Questionnaires should identify status (undergraduate, graduate student, or faculty), age, sex, computer literacy, library use and knowledge, etc.

Librarians who have done usability testing report varying experiences in recruiting test participants. For some, it is easy to collect a pool of interested people, but for others, the process has been more difficult. Incentives help in either case. Whether the incentive is money, copy cards, gift certificates to the campus bookstore, etc., offering them lends a touch of credibility to the process. A little extra cash always appeals to students. Some universities may have policies against paying faculty for activities such as usability testing and faculty may participate as a symbol of support for the library.

In the case of universities, at least three communities of users—undergraduates, graduate students, and faculty—use the library and need to be tested. One of the obvious solutions is a two level interface—one for novices and one for the sophisticated user. It may be that this is not possible for system design or financial reasons. Regardless of whether there is one interface or two, the system still needs to be tested for usability. In the case of the website, there likely will be only one approach. In testing, one could have one group of test participants representing a demographic sampling of users, or one could have three groups of three representing the three primary user groups (undergraduates, graduate students, and faculty).

Pretesting the test questions helps to ensure that participants understand them. Are the tasks doable? Is the terminology easily understood? In a dynamic environment such as a website, are the test questions still appropriate or have changes been made that make the question no longer relevant?

Observers should actually take the test themselves so they have a sense of what steps will be necessary to complete the task. This testing will help observers follow test participants actions and judge whether or not their courses of action are legitimate, efficient, and effective. There may be several ways to get to an answer, but there is likely to be one "best way." Whether or not that is obvious to the user may be important.

In preparing for test sessions, tasks should be assigned to observers in advance. Who will meet the test participant and guide them to the test site? Who will read the introductory information? Who will ensure data sheets are in the room? Who will be responsible for seeing that the equipment is there in place and operating correctly? Who is activating the tape recorder? (If a video camera is being used, a third person should run it, but a tape recorder can be operated by one of the observers.) Who will give the

participant the summary general impression debriefing sheet? By deciding these questions in advance of the session, the test will run smoothly and appear to be more professional.

Some universities have invested in usability laboratories that enable them to use two video cameras and a separate observation room. OCLC Online Computer Library Center has three rooms—a control room, a test room, and a closed-circuit observation room. It is feasible for libraries to do a distinctly low-tech operation. A meeting room or office with a computer can be used as a bare-bones test facility. While it is beneficial to have at least one video camera trained on the screen, it is possible to use a cassette recorder to capture the test participants' comments. The audiocassette will enable observers to go back to check any comments that might have been missed or reconcile the observers notes on the comments. If an office or meeting room is used for testing, the environment needs to be uncluttered so that the atmosphere is conducive to concentration.

A clock should be available to test the time taken for each question comprising the test. The time taken is important, even if the tasks are completed successfully. If it takes more than a minute or two to answer straightforward questions in the test, the system needs to be examined in terms of efficiency.

Define success—there may be numerous ways to get the answer to a question. Is there one efficient and effective path or are there several? The answers need to be decided before administration of the test, so that the observers will agree as to whether or not a question has been successfully completed.

THE TEST SESSION

Meeting test participants and escorting them to the test facility will let users know their participation is valued. This time can be used to thank the person for volunteering and to begin to put the person at ease with small talk. In the test room, the participant should be introduced to observers and others in the room. The introductory script should be read by the designated observer, institutional policies regarding human subjects should be explained, and the participant should be asked to sign consent forms. Ask the person if there are any questions. Start the test.

During the test, the observers need to be alert and follow everything that is done and said. Once each task is completed, or the person has become hopelessly stuck and is ready to give up, observers should indicate that it is all right to move to the next task. If additional time is needed to complete recording of tasks and comments, ask the person to wait until the observers are caught up. Observers should ask the participant any questions they have about the process used or comments made before moving on to the next task.

One of the most difficult aspects of the process is having test participants verbalize what they are thinking and doing. This aspect of the test process is important, as it will offer clues and important information on how information is being interpreted, the logic of steps taken, and the understandability of terminology, content, etc. Recording ensures that nothing important is missed in the comments. It is beneficial to have the session videotaped, as the comments can relate more clearly to what is happening at the keyboard and on the screen.

The timing and content of observers' dialog with the participants is a difficult aspect of the process, as it is tempting to jump in to help, especially if the person appears to be lost. Experienced observers will gain confidence in their ability to talk with participants without unduly interfering, adding to a person's knowledge and therefore potentially "corrupting" the results. Periods of silence while the person struggles can be uncomfortable for all involved, but observers need to err to the side of caution to allow the test participant time to struggle through as they would in a real-life situation, where they needed information and were on their own with the library system.

AFTER THE TEST

Post-test activities consist of debriefing participants and observers and determining if changes need to be made in the system or if problems can be solved by instruction or online help.

The importance of debriefing after each test session cannot be overestimated. Debriefing the participant will give the person a chance to relax and to chat about the test experience. One of the most important aspects of this debriefing is the opportunity to do a little library instruction. Telling people what went wrong if they had problems with a particular task will enable them to immediately use the system more effectively. It is not unusual for participants to leave the test session with benefits in terms of things they did not know that they could immediately put into practice. This learning serves as another benefit of participation.

One of the elements involved in the debriefing can be a "general impression" questionnaire that gives participants the opportunity to make general comments about the system and to rate the system in general terms.

Debriefing the observers also is important. It is critical to do this debriefing in a timely fashion, preferably right after each session. Observers should go over the data input sheet and note any discrepancies in impressions of the results. Is there agreement on whether each task was completed successfully? What happened that was surprising or particularly interesting? As sessions proceed, are there common patterns or themes?

In analyzing test results, the goal is to decide what is needed to improve the problem areas. As soon as possible after a round of testing, data should be collected in terms of identification of problems areas—places where failures in completing tasks successfully occurred or the participants took too long in completing tasks or there were false starts, even if the tasks were accomplished successfully.

Given what was learned in the usability test, careful consideration should be made as to how the system can be improved. This may require some intensive thought and discussion, as the solutions to problems may not be obvious or simple. It is best not to put any constraints on thinking about how the changes can be implemented. Changes in the system are later steps in the process. Solutions may be two pronged—changes in system design as well as emphasis in library instruction. Who needs to be involved in making the changes? Is there a team that oversees changes to the website, or does a technical services unit (acquisitions, cataloging or serials processing) need to be approached to determine the feasibility of changes in the way information appears in the online catalog?

After initial evaluation of test results, the responsibility for making changes needs to be determined. Is the system customizable so that changes can be done in-house? If the answer is theoretically yes, are there resources to do it? If the answer is no, can the system vendor can be contacted directly, or is it necessary to go through a user group/enhancement process? Can the system be improved by education or instruction; can effectiveness be improved through by bibliographic instruction sessions? Would more online help in some form improve the system?

Retesting should be done every time changes are made in the system, whether those changes come about through usability testing or they are incorporated in a normal new release of software. If the changes have come about through usability testing, care should be taken to make sure the retest is similar to the initial test, to see whether the changes have actually helped the user in the identified problem areas. Ideally, the same questions should be asked again.

OUTCOMES

What Have Librarians Learned Through Usability Testing?

Users do not have a great deal of trouble navigating through systems. They become quickly frustrated and disenchanted with multiple layers.

Users do not understand normal library terms such as serial, monograph, volume, etc. There are a number of ways to deal with this problem, although none of them are guaranteed. Online glossaries, emphasis in library instruction sessions, use of standard terminology (not library jargon), and mouse-overs all may work to help the

situation. Users do not understand concepts such as the difference in content between the online catalog and full-text indexes. If they are asked to find a journal citation, more likely than not, they will look in the online catalog rather than full-text indexes. Again, the solution to this may be to attack the problem on as many fronts as possible, library instruction, mouse-overs, etc.

Users expect consistency. All of the students on a large university campus use the same catalog, and they may well use more than one library on campus. The library's website needs to contain the same information for each library on campus, preferably in the same place. If the libraries are decentralized, this can be problematic, but testing will prove that users expect consistency. As education becomes more and more interdisciplinary, the need for consistency will increase.

More and more library users access library systems from their dorm rooms, apartments, offices, computer labs, etc. Remote users should have as easy a time using the library's systems as do in-library users. Remote access impacts system design in relationship to images, etc. Even if systems are readily accessible from remote locations, different computer capabilities may exist for distance education students, disabled students, and others.

CONCLUSION

Librarians who have done usability testing quickly become advocates for the technique. Testing can yield quick results that can lead to increasing the effectiveness of the library's online catalog or the website. As outlined above, the process need not be expensive in terms of economics or effort. Although the first test experience may be more time consuming, the experience will make each successive test easier. Lessons learned in each process will bring efficiency to further testing. Usability testing is a rewarding way to bring accountability to critical library tools and to improve library operations.

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User-Centered Design of Information Systems

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Abstract

User-centered design (UCD) emerged a couple of decades ago because people had difficulties in using systems. It is founded on the principle that users need to be involved in the design and development process for systems to be truly usable—efficient, effective, and satisfying. This entry provides an account of the background—the technological and social forces that affect the evolution of systems development, an explanation of the theoretical foundation on which UCD is build, and a description of a typical UCD process.

INTRODUCTION

Rationale, Definition, and Scope

User-Centered Design (UCD) was founded on the premise that knowledge of users and their participation in the way systems are designed is essential.^[1] User-centered design is a “multidisciplinary design approach based on the active involvement of users to improve the understanding of user and task requirements, and the interaction of user design and evaluation.”^[2] The emphasis is on “quality in use,” the ultimate goal of a UCD process. This is not merely about pandering to the wants of the consumer (i.e., developing what sells), as the marketplace is littered with market flops; it is about understanding and uncovering the current and prospective needs of the user, and developing solutions that do not “frustrate, cost, confuse, irritate, and kill us.”^[3] It is not to be confused with making products “user friendly,” a phrase that conjures up a rather pedantic notion of design, while at the same time making an implicit assessment about the “unfriendliness” of early systems.^[4] The UCD approach was intended to make systems that are “easy to buy, easy to unpack, easy to set up, easy to upgrade, easy to learn, easy to use, engaging, intuitive, and integrated.”^[5]

As a result of this human-machine mix, UCD is inherently inter- and multidisciplinary, drawing from a blend of psychology, computer science, artificial intelligence, linguistics, anthropology, and sociology,^[6] and in recent years particularly with web developments, graphic design, and animation as well as information science and business.

This entry first provides background on the genesis of UCD, following by a section on the philosophy and theoretical underpinnings of UCD, and then a description of the method as it is generally practiced.

Foundations

Traditionally systems design and development followed a system-centered, expert-driven methodology in which a set of requirements were defined at the beginning of a project, and the development process unfolded in a linear fashion from the list of specifications (i.e., what the system is supposed to be able to do) to the final product. This was adequate while systems were used by experts. With the emergence of end-user computing, users—the average people on the street—were unable to use products that resulted from such a process. The problems lay in the design of the user-interface, that part of the system that is visible to the user and with which the user interacts with the system. Users made mistakes, did not understand how to proceed, and could not figure out how to complete a task. The final assessment was that insufficient effort had been placed in understanding how users typically behave and perform the tasks for which the product was designed. In short, users were too much of an afterthought in the design process.

One of the earliest advocates of a focus on people first was Don Norman, a cognitive psychologist, who observed how people used many products including refrigerators, stoves, teapots, and doors as well as all sorts of electronic and digital devices.^[7] Norman noted the mismatch between what the system expected the user to do, and what users typically do when faced with possible choices. Sometimes the product lacked an appropriate affordance, the property of a product which suggests what to do with it (compare a door knob which suggests twisting, with a lever-style handle). Sometimes there were no visible cues as to what to do next or a mismatch between what the user expected to do, and what appeared to be available (consider even today's cell phones in which some phones are turned on by pressing “end,” or turned off by pressing “start”).

Sometimes the system provided no feedback as to whether anything had occurred when a user pressed a button, clicked on a menu choice, or issued a command (the “loading page” feedback mechanism within today’s web browsers show the extent to which the browser has loaded the page). In those early days (and to a certain extent today), the user’s conceptual model of the system, that is the user’s notion of how the system should work, did not match how the system actually functioned. Emerging out of this understanding was the need for more UCDs. “Know thy user”^[8] became the mantra, and often appended is the phrase “for they are not you,” a statement directed at system developers.

User-centered design can be traced back to the 1960s when human factors started to address the way that scientists and engineers interacted with costly large mainframe computer systems; this was primarily but not solely related to the ergonomics of the hardware. The concept of the interface was limited in scope, as the interface was solely for command-line interaction, in which the system provided a prompt, and the user entered a response or command; the cost was strictly in programmers’ time which was inexpensive when compared with the cost of the technology.

By the late 1970s to early 1980s, personal computers made word processing, spreadsheet manipulation, and simple graphics creation accessible to the person on the street. In 1981 IBM introduced its personal computer for home and small business users who had knowledge of the application domain, but no interest in the internal workings of the computer, unlike the typical computer users of the previous era. The concept of the graphical user interface or GUI (as in “goosey” as it was fondly called), emerged and, with it, the demand for more user centered technologies.

The need to support the end user brought an increased awareness of the need to understand simply how people function: their cognitive processes, including motor learning, problem solving, semantic memory, and perception, and how these processes affect peoples’ use of technologies. Human-computer interaction (HCI) emerged as a discipline and the Association of Computing Machinery established the Special Interest Group on Computer-Human Interaction (SIGCHI) devoted to promoting human factors in the human-computer interaction process. UCD and HCI are sometimes used interchangeably, but UCD is a methodology of HCI.

Two core publications of the mid-1980s focused attention on the UCD problem. Norman and Draper’s^[6] edited monograph, *User Centered Systems Design* emerged out of a workshop at the University of California, San Diego in 1984 (and included a blue ribbon group of human-computer interaction pioneers). In the introduction, the two editors expressed their goals for the book, which have become the underlying foundation of UCD:

We wish to...ask what the goals and needs of the users are, what tools they need, what kind of tasks they wish to perform, and what methods they would prefer to use. We would like to start with the users and to work from there.^[9]

This was, at the time, a novel idea; but this book was the first consolidated synthesis to an emerging concept. At about the same time, Gould and Lewis outlined three core principles for design that included a focus on users, empirical measurement, and iterative design.^[10] These have stood the test of time, and today serve as the basis for much of UCD practice. Emerging from this work was the concept of usability, and as already stated was not to be confused with user friendly. Making systems usable is a more complex construct that includes learnability, efficiency, memorability, being error-free, and subjectively pleasing.^[11]

The 1980s also saw the emergence of a new type of information system for the information consumer. With the introduction of CD-ROM technology, large bibliographic databases which were formerly only accessible to expert intermediaries and domain experts willing to learn a cryptic code were now reachable by working domain professionals (e.g., scientists, lawyers, doctors, journalists) who had limited computer expertise within months, the former databases that contained abstracts and bibliographic citations to published newspaper, journals, and technical publications evolved into full-text systems, also available initially on CD ROMs and later on mainframe systems with client-side graphical user interfaces.

At about the same time, how society, organizations, and culture shape the use of technology was being noticed. This introduced the importance of context: the situation in which the technology is being used affects that use and must be attended to within the design process. Suchman’s ground-breaking study of the lowly photocopier identified how situatedness affected human social behavior in the context of technology use.^[12] As a result, the need to integrate those influences called for more social and organizational analyses to be included in the design process. The concept of user incorporated more that the qualities of the individual.

By the 1990s, technology was not solely about transactional based technologies with structured data (e.g., numbers, codes) as its core; the emergence of the Internet and Web “informational” systems provided access to unstructured information (think text rather than numbers) that included ordinary homepages, newspapers, and the complete contents of books, journals, and videos. This placed new design needs on the concept of the user, the user’s task, and the environment in which the user was situated. With the emergence of the Web, the custodians of information—from publishers to libraries, from government to the not-for-profit sector and e-commerce—had to re-think and transform their existing approaches to systems development.

Surprisingly, early technological developments did not match expectations in terms of increased productivity. Landauer claimed that the problem lay with inadequate engineering design for application software which was due to the lack of systematic testing of technologies in terms of their actual utility.^[13] Instead he asserted that too much attention was focused on characteristics such as the speed of technology, its data storage capacity, the flawless operation of the technology, the number of features implemented, and its graphics quality. He argued for more testing of the ability of the technology to assist people in doing the work they needed to do. Despite the plethora of usability testing that was emerging at this time, Landauer claimed that too much of that testing was being devoted to aspects of the interface that would affect sales such as color and gadgetry, rather than addressing the formal functionality and usability of the system. Even today, customer satisfaction is considered the core success factor in assessing UCD processes internally.^[14]

By the twenty-first century, the focus was all about the user or customer, as e-commerce entered the arena; the economic consequences of non-user oriented technologies now had a direct effect on a firm's economic survival. Users now "marched" with their mice from one non-usable Web site or e-commerce storefront to another. With the emergence of the Web, social computing enabled users to not just march with their mice, but also to complain, comment, and compliment technologies and services in listservs, blogs, wikis, and consumer-oriented Web sites.

Companies and organizations could no longer hide behind a poor technology. Today UCD is practiced by a range of systems developers including IBM, Microsoft, Google, Apple, and SAP. It has been a cornerstone of operations within IBM.^[15] Within the information world, and libraries in particular, the concept of UCD came late, since most of the systems used by this group are produced by third-party vendors who have a limited marketplace for their products, and thus limited resources to apply to UCD. For example, it was not until 1990 that OCLC created its Usability Lab.

Emerging from this history was UCD as both a philosophy and a process. As a basic principle, UCD places the person—the user, and not the system at the center of systems development.

It is a process that considers cognitive factors (such as perception, memory, learning, problem-solving, etc.) as a core influence on a person's interaction with an object. This concept is as relevant to the design of teapots as it is to the computer mouse, word processors, search engines, and webcasting systems, and to the myriad of information appliances that are emerging in the marketplace.

PHILOSOPHY

Central to UCD is the conceptual foundation on which it is built. In this section, the three core concepts: information

system, design, and user referenced by UCD, are defined, and then integrated into the core theoretical perspective that underpins UCD.

Information System

Information system is a complex term. It is an application of computing and information technology developed to meet a defined need or purpose. The term is used to include the database and application programs as well as the procedures used to manipulate the database in concert with the application programs, and the hardware (e.g., computers, printers, telecommunication devices, and networks) used for processing data and information.

Information system is often identified with business applications, in particular, transaction processing systems such as payroll, book lending, and interlibrary loan systems. These could be classed as operational systems intended for planning and control within an organization. But the term information system is also used and continues to be used for both tactical and strategic information systems such as decision-support systems, executive information systems, and financial systems.

With the emergence of the Web in particular, information system is now used not just to reference transaction-based systems that manipulate structured data. When technology enabled mass storage and the ability to completely represent and present an information object (rather than just to access to its metadata), information systems enabled and facilitated many human information processes: finding, reading, synthesizing, evaluating, and so on of unstructured information. Now the range of tasks supported by information systems spans routine operations of, for example, automatic bank machines, to complex decision-making and problem-solving systems that require extensive backtracking and digressions.

This description above specifies the entire system, from a UCD perspective, the system begins with that aspect seen by the user—the user interface.

Design

User-centered design, as a philosophy, has its roots in industrial and architectural design. Design emerged around the fourteenth to fifteenth centuries, although there is no specific event to which this concept is attached.^[16] Design arose with "the separation of thinking and doing"^[16] after the work of master craftsmen, for example, was divided into architects and builders, and today that distinction can be used to separate designers from programmers in systems development.

The word design may be interpreted in multiple ways: on the one hand it specifies the process used, while on the other it references the arrangement of all of the components contained in the design. Design is imposed, and "only when the constituent parts of a whole have the

unique end of contributing to the consummation of a conscious experience, do design and shape lose superimposed character and become form.”^[17] Dewey was talking about art, but the same sentiment is true of systems design. Eames took a more pragmatic approach in referring to design as “a plan for arranging elements in such a way as to best accomplish a particular purpose.”^[18] The end product of a design is not purely a visual object, but a complex artifact that may support one or all of the senses depending on its purpose. From a systems design perspective, when all of the elements, procedures, and objects work in harmony, the system almost “disappears” as the user is “one” with the visible components.

In practice systems design stems from industrial design with a focus on the action and activities that define the purpose of the product. As such design involves a two-stage process: the first is a conceptual process to identify what the product is expected to do and how the action will unfold; and the second is the physical where the conceptual elements are rendered into real-world objects, such as layout, menu labels, icons, and buttons. The lines between the conceptual and physical are blurred in UCD.

User

Early users of information systems were experts who performed often routine and predictable actions with applications. They were technically trained and technically oriented, and more than willing to learn the arcane commands or procedures required to use an application. Over time, the user became anyone who applied a set of actions to a computing device, and the designer of a system was no longer comparable to the person who would subsequently use the application.

User as a concept has met with considerable discussion. Bannon pointed out very early in the development of UCD that a user was not necessarily a person who makes only casual use of a system.^[19] A novice or naïve computer user may be an expert in the application domain, for example, accounting, medicine; and, sometimes a novice in the application domain may be an expert computer user.

Instead, the word, user, is a generic concept that is intended to be replaced with a specific “job” or task function as in lawyers when speaking of legal information systems, or accountants when speaking of accounting systems. But a system might also have multiple levels of expertise as a citizen, mayor, or property inspector for municipal information systems. A typical user may be classed according to many attributes such as skill level (naïve vs. expert, e.g., a law student vs. a partner, a history undergraduate student vs. a history professor); and by nature of use (ad hoc or daily). Nielsen characterizes users along three dimensions: computer expertise, computer experience, and knowledge about the task domain.^[11] As a result, the concept of user is more complex than one

imagines which somewhat explains the nature of UCD methodology (discussed later on).

Particularly within the engineering community, the term “stakeholders” is preferred to reflect the broader group from implicit to explicit consumers of the system. Lodge,^[20,21] classed stakeholders into six types of users: governing body, sponsor, user specified, end user, input generator (the person who will enter data into a system) and the output receiver. This nomenclature tends not to be used within the human–computer interaction and information science communities.

Conceptual foundation of UCD

How design, user and information system are blended is reflected in the early thinkers of UCD. In what is now considered a seminal work, Moran posited that “to design the user interface of a system is to design the user’s model. The designer needs to understand... what knowledge goes into the user’s conceptual model”^[22] so that ultimately the user should not have to struggle to figure out what the designer intended. This led to thinking about how users act, behave, and perceive.

Card and colleagues^[23,24] proposed a “model human processor” that could be used by the designer in contemplating how a person interacts with a computer at the interface. The model included three human systems, each with its own memories and processes: 1) a perceptual system that connects a person’s sensations from the physical work to internal representations in the mind; 2) a motor system that translates human thought into physical actions; and 3) a cognitive system that retrieves facts, solved problems, and selects a suitable course of actions. Notably, for some tasks, the human behaves as a serial processor (clicking on a button in response to a display), while in others, the action requires integrated, parallel operations that engage the three human systems at once (reading from and selecting from, and finally resolving the information contained on a single webpage). In addition to describing how complex and dynamic a human is, Card and colleagues specified both the typical and range of values that could be expected in human performance. In doing so they provided a standard for the measurement concerns of Gould and Lewis.^[10]

At about the same time, Norman described a “theory of action” to assist in understanding how users use systems^[25] as illustrated in Fig. 1. In general, a user approaches a system with a goal likely dictated by the task to be accomplished, but personal to the individual. The goal is converted into an intention which is acted upon, and subsequently executed using the system. The system is in a certain state of readiness; imagine a computer that has just been turned on. The user perceives, interprets, and evaluates the response from the system. Norman claimed that the users’ goals and the perceived state of the system had to traverse two “gulfs” before users could make use of

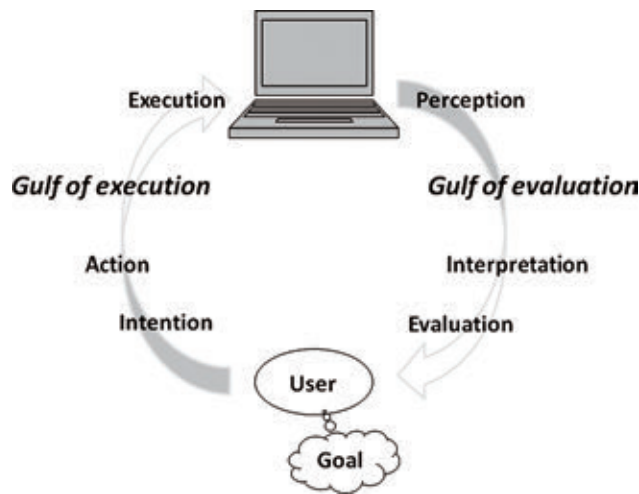


Fig. 1 Norman's "Gulfs" embedded in his "theory of action" to describe how people interact with systems.^[26]

the system to achieve their goals. Thus, when the user approaches the system, the first challenge is what action can be taken to "bridge" the Gulf of Execution. When the system responds to a user's action, the user must now interpret that response to cross the Gulf of Evaluation. In using any system, this pairing of action and evaluation is a constant and continuous process.

Design needs to account for that process as the most elegantly designed systems fail when the user is uncertain about which action to take, or the system responds with a non-interpretable reply. At the beginning of a project (see Fig. 2), a designer envisions a conceptualization of the system, called the Designer Model, which is imposed on the system and is reflected in the System Image that is represented in the physical world by the user interface and represents the programmer's implementation of the designer's specifications.^[27] The user approaches the user interface with a preconceived notion of what to expect; we consider this the User Model. Designers' models consist of the ideas that the designers attempt to embody in a system; the users' conceptual model is a mental representation that is formed by experience—experience with older technology, the physical world, related applications, and so on.^[28,29] If the user's conceptual model is in line with the designer's model of the system, then the user is able to perform actions, and interpret responses made by the system. But when the two models are mismatched, the user is unable to bridge the Gulfs illustrated in Fig. 1. The degree of discontinuity is directly related to how well the designer's model and the programmer's rendering of it actually match the user's model of the system. The user interface serves as the "bridge" between these two conceptual models. In general, when the designer fails to take user needs and requirements into account in the design process, the system is unlikely to succeed.

User-centered design emerged from this awareness of the tension between the designer's view of the world and

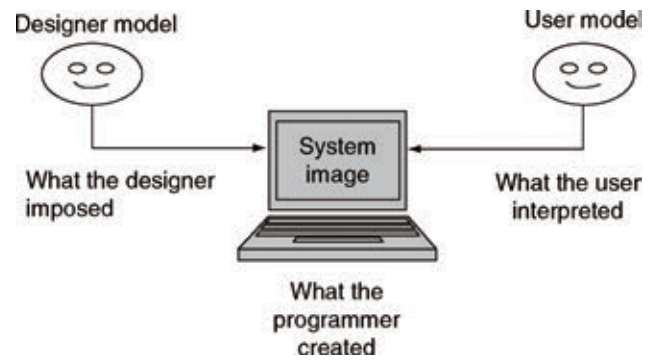


Fig. 2 Designer, user, and programmers perspectives of the user.^[29]

the user's and is fundamentally the foundation for UCD practice. Over time, the focus on the user model morphed into the need for a full understanding of user in context—environmentally, socially, physically.^[12] In more recent years, affect, the user's emotional response to systems has also emerged as a core factor in design; it is no longer sufficient for a system to be fully functional, but now needs to be "attractive" and perceived by its users as attractive as well.^[29]

PROCESS

In addition to having a strong conceptual foundation, UCD defines a process—a practice or procedure—for the design of information systems. Back in 1985, Gould and Lewis^[10] identified three principles that would lead to a UCD system:

1. Focus on users and their tasks early in the design phase.
2. Assess and evaluate through the design/development process.
3. Use an iterative design process so that the result can be improved over the developmental life cycle.

These have been modified and augmented over the years, and Shneiderman's principles^[30] illustrated in Fig. 3 is one of the most parsimonious examples of these.

What is believed to be the first example of UCD in practice is the 1984 Olympic Messaging System designed to provide voicemail and communication support for athletes at the Games.^[31] The following brief synopsis of that work serves to illustrate the UCD process in practice.

At the beginning, an initial analysis of requirements was prepared and commented on by designers, managers, and prospective users. From this assessment, a number of functions that the system was expected to enable were modified, and some were removed. Simulations of these functions were tested and evaluated by the intended user

1. Strive for consistency.
2. Enable frequent users to use shortcuts.
3. Offer informative feedback.
4. Design dialogs to yield closure.
5. Offer error prevention and simple error handling.
6. Permit easy reversal of actions.
7. Support internal locus of control.
8. Reduce short-term memory load.

Fig. 3 Shneiderman's principles of UCD.^[30]

groups: athletes and their friends and families. In addition, site visits to the Olympic village and interviews with those involved with the Olympics brought new information and data. Finally a prototype was build and tested with a wide range of people. Over the course of its development from the initial concept to the first prototype (and subsequently the final product), the design followed the three principles developed by Gould and Lewis.^[10]

The UCD Process

Although practices may vary from organization to organization and from text to text, the International Standards Organization's standard, "Human-Centered Design Processes for Interactive Systems,"^[32] describes the core elements. Written at a high conceptual level, the standard is not prescriptive, but provides guidance in the form of a five-stage model illustrated in Fig. 4.

Plan the human centered process

As suggested by the title, the intent of this stage is the development of a plan for the succeeding stages, and for how the UCD process fits within the entire systems development project. This is a living document that is updated over the life of the project.

The complexity of the plan will depend on whether the system is an innovation (i.e., nothing currently exists), replacement technologies for an existing product (e.g., word processor replaced the typewriter, and the online catalog replaced the card catalog), or a new version of an existing digital product. Thus, in some situations, the knowledge of users and their context may already be known, or the existing technology may place constraints on the design such as an application that works in a Windows environment rather than a Macintosh, or a technology that will be an added component to an existing application.

Understand and specify the context of use

In this stage, understanding users and their tasks as well as the organizational and physical environment in which the

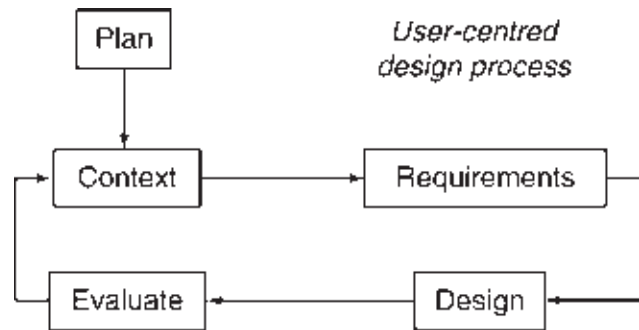


Fig. 4 UCD process as described by ISO 13497.

system will be used are the core components. These will subsequently guide design rationale and additionally prescribe how evaluation—success of the product—will be measured. The context of use is described in terms of:

1. Who the users are and what special characteristics they have.
2. What work tasks users will need to perform, and how those tasks are interrelated, including the allocation of human and technological resources needed to complete a task.
3. The matrix of user and task characteristics, so that specific scenarios of use can be described.
4. The context or specific environment (including physical and social characteristics) in which the system will be used.
5. The benchmarks that will be used to define both minimal and optimal requirements.^[32]

This stage identifies the range of intended users, the scope of their tasks and the contextual environment in which they operate. Central to this is an understanding of what the work is supposed to achieve; this is not about what the computer system is supposed to do, rather an explanation of the work task in isolation from the technology.

Specify user and organizational requirements

At this stage, the functional requirements of the system are specified with respect to users and the organization. What must the system do for it to be considered successful? This will describe:

1. Required performance of the new system with respect to operational and financial objectives, and to relevant statutory or legislative requirements (including safety and health).
2. Task performance and its integration with work design and organization.
3. Operations and maintenance feasibility.^[32]

This stage will document the design goals, guidelines and constraints, identify the priorities, and provide measurable

criteria for testing the design, including usability criteria (e.g., efficiency, effectiveness, and satisfaction levels).

Produce design solutions

This stage includes devising the rough concept through to sketching and developing a complete design. This requires integrating existing knowledge and technological capability with knowledge of users and the context. It may include visual design, information architecture, and interaction design. Potential designs are:

1. Created using existing standards, best practices, accepted guidelines and examples of other systems etc.) to develop a proposed design solution.
2. Rendered using simulations, low-fidelity prototypes, mock-ups, etc.
3. Evaluated by users who are observed performing specified tasks, with or without the assistance of evaluators, and modified from feedback.
4. Modified until design objectives (including usability objectives) are met.^[32]

This stage involves building a range of prototypes from low-fidelity paper prototypes, to high-fidelity prototypes that simulate the activity of the system.

Evaluate designs against user requirements

This stage evaluates the design with the user community using the application in a realistic environment. Depending on the number of iterations, this stage may be a formative evaluation intended to provide feedback to improve the design, or it may be summative to determine how well the system meets the criteria set out in the original plan.

These five stages are intended to be repeated as often as is required over the life of the project. Iteration and evaluation are considered critical to the success. In addition to the ISO approach, other variations have been well documented.^[33–35]

Each of these five stages uses a variety of methodologies to collect the essential data required to fulfill the requirements of that particular stage. For example, in understanding context (Stage 2), a collection of formal and information techniques are used to find out what the system is intended to do. This stage usually involves a visit to the workplace and an observation of how things are currently being done, as the way work is performed is often not like the way that procedural manuals stipulate. Observation and interviewing (formal and informal) together with careful note taking and sometimes videotaping provides a wealth of data from which to identify the issues. Stage 5, the evaluation component, uses a variety of techniques depending on how many iterations of the process have been completed. Early evaluation

techniques are more likely to be done with cognitive walkthroughs, and heuristic evaluation; later stages will do user testing with real users performing real tasks.

STANDARDS, PRINCIPLES, RULES, AND STYLE GUIDES

An international standard for UCD (previously discussed) specifies the design and development process, but is not the only standard relevant to UCD. ISO 16982 specifies usability methods that support “human”-centered design and is complementary to ISO9241-11, *Guidance on Usability* which identifies how usability can be evaluated in terms of user performance (efficiency and effectiveness) and satisfaction. This is somewhat related to ISO 9126 which defines six categories related to software quality for the software engineering community: functionality, reliability, usability, efficiency, maintainability, and portability, as well as the overall goal of achieving quality in use. Other related standards recommend specifications for usability of consumer products (ISO 20282), icon symbols and functions (ISO 11581), pen-based interfaces (ISO 14754), mobile—PDAs—tools (ISO 18021), multimedia user interfaces (ISO 14915) (55) and documentation (ISO 15910) and a format for writing reports of usability test results (ISO 25062).

In addition to standards, a variety of principles such as the ones mentioned earlier are used. In the actual conduct of design, a number of rules or heuristics are applied such as number of items to use in menus, color and font combinations, and layout. In addition, individual organizations have developed “style guides” to prescribe how design is accomplished for products developed by that group. IBM, Microsoft, and Apple all have developed style guides for the development of software. As a result, UCD has some consistencies in practice, but could not be considered a standardized methodology.

USE AND VALUE OF UCD

The term UCD is not exclusive; some groups refer to it as customer-centered design, experience design, or usage-centered design. Raskin^[36] distinguished between human centered and user-centered design. He claims a two-level design process in which the first stage is to ensure that the design relates to universal psychological attributes common to all humans, such as visibility of interface objects, amount of memorization that is acceptable, and human use of graphical elements. Once a system meets normal human physiological and psychological constraints, then the designers should attend to the task requirements of that particular user group. Raskin alleged that designers hand over responsibility for the human element to industry who is not always attuned to human capabilities.

The value of UCD is not universally understood or accepted. In a snapshot of UCD penetration among experienced practitioners, nearly three-quarters of respondents reported that UCD affected development within their organization and improved the usability of the final product.^[37] But, it also provided a picture of a methodology that was not universally adopted. Often cited as a barrier to UCD practices are resources and organizational resistance, because there are no clear metrics about how to assess a UCD process. These findings result from a survey distributed in 2000 and 2001.^[14] Undoubtedly with the growth in consumer digital products and the web, UCD now has greater penetration in organizations that produce consumer products. Ease of use for example, has been touted as the top factor contributing to conversion rates for Web sites, that is, getting customers to translate their visits into actions, or, in other words, purchases. Clearly in order to actually do that, one needs to adapt a UCD approach.

CONCLUSION

User-centered design is a process based on a strong conceptual foundation embedded in understanding how people function as human beings, and within the particular job function that a technology is intended to facilitate. The end product of such a process will provide a good fit between the user and the tasks that the user needs to accomplish, and the system that is intended to facilitate that activity. This is tightly integrated to a particular context that has social, political, and legal implications.

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User-Centered Revolution: 1970–1995 [ELIS Classic]

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Abstract

Nahl traces the increasing emphasis on an orientation to the user as central to information service design, information system design, and library education for professionals and end users.

—*ELIS Classic*, from 1992

THE NEW PARADIGM ESTABLISHES ITSELF

The user-centered revolution in library and information science was generated by the general availability of search technology for novice and users who rapidly outnumbered experts and intermediaries. The needs of this new class of searchers have changed the priorities in the information environment. In response, researchers have developed new types of data that more closely represent users' actual experience with systems. This interest led to an evolution in the methodologies applied to user studies over the past twenty-five years, from survey questionnaires and feedback forms to interviews, journals, logs, and case histories. The development in methodology represents a shift in focus from gathering anonymous, statistical data on users to individualizing users through ethnographic and psychological approaches.

With technology came transaction logs, a new online, real-time data-gathering method that records every keystroke of every user. Such logs have become a unique source of detailed information on what people do when they search. However, even this level of detail was not sufficient to understand why people make particular command choices and errors. Systematic self-reporting methods were introduced to obtain cognitive and affective data on reasonings, reactions, and decisions. Ethnographic studies using personal journals, protocol analyses, and self-witnessing methods uncovered the overwhelming quality of feelings in the research process. This new knowledge about users is driving the development of new systems and interfaces designed around user-centered principles. However, there was some resistance among designers, administrators, and librarians to the idea of taking care of novices' feelings.

User-Centered Versus System-Centered Approaches

The term user-centered arose in the minds of librarians and information specialists who wanted more services for end users, patrons, clients, students, and the public at large

within the information environment. They saw the status quo as "system-centered"; that is, insufficiently responsive to user needs and realities. One early observer notes the "growing movement" at the time for *user-oriented* systems to shift from "source-controlled" to "receiver-controlled".^[1] The expression user-centered has become a maxim—a principle—and represents a new paradigm for defining, measuring, and explaining the behavior of library users, database searchers, and Internet navigators. A search of the literature of the past two decades yields dozens of articles and some books bearing in their title or abstract one of the following expressions of this new orientation:

- User-centered
- User-friendly
- User-based
- User-oriented
- User-responsive
- Client-centered
- Human-centered
- People-centered

Two themes emerged in reviewing literature with a conscious user-centered focus: (1) methods of application that seek to alleviate specific user needs and (2) the integration of theoretical justifications and accounts that researchers have proposed for transforming the information environment through user-centered interventions.

It is worth noting at the outset that the system-centered approach in the design of information facilities routinely advises a testing procedure with actual users within the design process before features are finalized. However, this technique has proved to be inadequate, primarily because user categories have been based on designers' intuitions rather than on research about how users actually perceive, think, and organize and what their intentions are during the information-seeking process. As pointed out by Walther and O'Neil in the early days of online users, "Intuition and good judgment on the part of the designer seem insufficient for specifying the features which an

interface should possess” (p. 115).^[2] Despite this attempt to give users a greater weight in the interface design equation, system-centeredness has remained essentially the same. The reason for this is clarified in the discussion of the advent of the user-centered paradigm and its essential characteristics. In speaking of this basic shift, one commentator points to a distinction between the concept of information as “like a brick,” whereas users are like “empty buckets into which [information] bricks can be thrown” (p. 160).^[3] According to Dervin, the invalidity of this metaphor is shown by two outcomes; the “nonuse of information” by both professionals and the general public, and the user-oriented case studies of how people acquire and assimilate information in their daily lives and occupations. Reviewing the data, Dervin concludes

The important point here is, when it comes to understanding how and why and with what effect human beings pay attention to, process, and use something that an outside observer calls information, we must start by understanding what the user (or potential user) calls information. Information processing and use are, within the context of relativistic assumptions about information, sense-making activities. The emphasis here is on the word “making” for it denotes that the perceiver of the information is not an empty bucket but is actively making sense (pp. 164–165).^[3]

Information as an “observer construct” has had to give way to information as a “user construct” because the “empty bucket has evolved into a thinking, self-controlling human being” and “information changes from brick to clay, moved and shaped in unique ways by each perceiver” (p. 169).^[3] Because making sense of the world is part of the human condition, knowledge building is therefore a “personal information-seeking” activity.

Questions asked have dealt with locating self and other (Where am I? Where are they?), with finding possibilities (What can I do?) and evaluating possibilities (Will it work?), and with assessing aloneness (Is anyone listening? Doesn’t anyone else agree? Am I the only one?). Perhaps the most important aspect of the findings to date is that they support the premise that looking for information relativistically is a more powerful entry for understanding information needs and use (p. 170).^[3]

Looking at information seeking relatively requires one to recognize that situation-specific factors are more important to users than general considerations. For example, users’ interests and involvement (“issue oriented”) are better predictors of information-seeking activity than users’ education or experience. When individuals see their situation as giving them options for decision or movement, they are more likely to engage in information seeking than when they see themselves under total constraint (pp. 171–172).^[3] Another reason that information is “relativistic” is that “the effect of the information received is the use created for it by the user.” In other words, the situation-specific,

momentary information need determines what information will have impact at that time. Research in this new “relativistic information framework” can help systems designers make the shift to this user-centered orientation.

Replacing the Centrality of the System

In the early days of the new paradigm, there was not yet a full appreciation of the need to remove the centrality of the system. User-centered consciousness was not fully awakened until one saw the necessity of designing systems through understanding users. The following is an example of an early attempt to promote “an empirical approach to user-centered design.”

The problems which accrue to the human user by virtue of being made a component of the system—of the *user* actually being placed on-line to the computer—were largely ignored until very recently. A user protest led to calls for a shift of emphasis from the elegance of algorithms and computational efficiency to the discovery of ways to make the on-line user interface more acceptable to the user (p. 114).^[2]

As it turned out, more than “a shift of emphasis” was required. For instance, Walther and O’Neil define the flexibility of an interface as “the factors inherent in the interface program which would make it easier or more convenient for the user to express his commands, given that the commands had to follow a specific syntax” (p. 116).^[2] However, this orientation remains part of the system-centered paradigm because it passively accepts the priority or fixity of the system, although it recognizes that acceptability and convenience to users is to be taken into account. Another example is in the earlier attempts to use empirical or objective measures of *user satisfaction*. Researchers often turned to existing “attitude measures” such as the semantic differential,^[4] which provides subjects with a series of bipolar scales on which to rate their attitude toward aspects of the system.

The results indicate that the users of the flexible version [of the online editor], irrespective of any other factors, rated their version as more tolerant, more flexible, more like a person, more friendly, and more pleasant than the inflexible version (p. 117).^[2]

Future development of the user-centered paradigm will view such attempts as insufficient. Attitude scales have the following three inherent weaknesses relating to the object being rated, the timing of the rating, and its content. These problems need to be remedied by utilizing different techniques that avoid them.

First, the *object to be rated* by the user needs to be the user’s experience, not the system. Thus, *not* “On a scale of 1 to 7, how easy is this editor to use?” but rather, “On a scale of 1 to 7, how much confusion did you experience with this editor?” Second, the *act of rating* needs to be in

proximity to where the activity occurs, not at the end of a session, or even later, but concurrently, during the activity itself. Thus, more than a single probe is necessary, as a user's experience may vary greatly from one minute to the next, depending on various difficulties. Third, the *content of the rating* category must originate from the user's mental structure rather than the experimenter's, otherwise measures such as attitude scales, survey questions, census data, and personality tests represent system-centered accommodations to user protests of user-unfriendly systems.

More recent statements of user-centered system evaluation and design continue to promote the centrality of users^[5], but there is a shift in emphasis away from treating users as a method of determining baseline measures for design standards, toward “application-based evaluation procedures.” This represents an orientation toward operational effectiveness rather than design efficiency. In this view, system redesign can be motivated by how inconvenient it is to learn rather than how effectively it can perform under ideal conditions.

Criteria for User-Friendliness

Wallace has proposed a framework for evaluating the user-friendliness of a system.^[6] The list includes the following types of measures:

- Users must be given options for preferences.
- Online system operation and assistance should be available at beginner and more advanced levels.
- System behavior has to be transparent to users.
- Warning messages must be benign or lighthearted.
- System design must take into account the physical and psychological needs of users.
- System use should require no special skills.
- The general language of novices and their routine level of communicative skills should not be surpassed in instructions or explanations.
- The system should behave in a uniform way to allow users to anticipate functions.
- A variety of types of problem solving should be available for particular operations.
- Learning by doing should be the preferred mode of instruction and presentation.

One project that implemented these and additional user-friendly features is known as ELSA, “an intelligent electronic library search assistant.”^[7] Four design concepts guided the development of ELSA.

- Using labels that are transparent to users (e.g., buttons with the names “run search,” “new search,” and “show full list”)
- Providing assistance with controlled vocabulary (e.g., a synonyms list)

- Actively helping users explore topic areas (e.g., providing suggestions for narrower topics and screening out more distantly related items)
- Accommodating different styles of interaction (e.g., an option to type in search items or select them with the mouse from a list)

Another historical example is the user-centered redesign of the MELVYL system in response to empirically discovering the answer to the question, “What do users really want?” According to Farley,^[8] the process of collecting and maintaining a comment database optional to users has uncovered bugs in the system as well as numerous user-unfriendly features that could form the basis for redesign. Today, with Internet networking of libraries, MELVYL has learned to “compete in attractiveness” to users who are more sophisticated and computer literate, although still novice searchers.

The development of intelligent search assistants such as ELSA would not have occurred without the climate created by the user-centered revolution that gave it scientific legitimacy and made research grants available for user studies. The first phase of the transformation concluded when *user-friendliness* became a legitimate scientific research issue. An important thrust came from the human-computer interaction field populated by engineers, programmers, and applied psychologists.

Toward Human-Centered Design

In a whimsical mood, one of the architects of the user-centered revolution in the area of systems design and technology describes a still common attitude regarding the introduction of new technology.

One of the things that stands out when talking to long-term users of poorly designed systems is that these people take great pride in their skills. They had to go through great difficulties to master the system, and they are rightfully proud of having done so. . . . Rather than ease the situation for those who follow, it becomes a sort of initiation rite. The hardy survivors of the experience claim to share a common bond and look with disdain upon those who have not been through the same rites. They share horror stories with one another (p. 176).^[9]

Norman reveals that he “got attacked by hundreds of professional programmers across the country” when he wrote an article criticizing the UNIX system as user-unfriendly: “If I didn’t approve of UNIX, they told me, I had no business using it. Besides, who was I anyway to criticize computer software? In other words, you weren’t allowed to criticize unless you were a professional. Being a mere user of the stuff didn’t qualify” (p. 177).^[9] However, a new paradigm was in the ascendancy, and it is achieving full

victory. The user-centered revolution not only gives users more clout in the design equation but works to make users the *central* point of focus and interest for planners, backers, designers, engineers, and trainers of information systems.

Understandability and usability are two principles that apply equally to design and documentation issues. According to proponents of “cognitive engineering,”^[10] Understandability of instructions depends on providing a good conceptual model of the task or system. Good models are those that allow users to predict the effects of their actions. Users will invent false models when the appearance of some system features (the visible setup) does not match the functions desired (p. 16).^[10] The designer’s model is formalized by the design process itself. The user’s model evolves through interaction with the system. The system image consists of the visible structure or appearance of the interface (control, keys, instructions, labels, visualization aids or interface metaphor, etc.). All communication between designer and user takes place through the system image. If the system image does not make the design model clear, users end up with a wrong mental model as evidenced by symptoms such as an inability to predict, difficulty in using, a shallow understanding, and an inability to solve problems. One of the key factors in helping users develop an accurate conceptual model is to provide immediate feedback for every action or choice made.

User Errors

By studying the psychology of everyday actions, cognitive engineers have discovered many reasons why people make errors. First, one should note that people blame themselves for errors: “It is as if they take perverse pride in thinking of themselves as mechanically [or technologically] incompetent” (p. 35).^[10] Second, experience has shown that good system interfaces can be designed that make errors easy to detect and easy to reverse or, if not, have minimal consequences. Good designers heed the maxim: If an error is possible, someone will make it. One common source of errors is inadequate mapping, where users develop misconceptions in their mental models of the system. The existence of conflictual habits is another source of error (e.g., frequently hitting the wrong key for a particular operation). Users are reassured when they are reminded that making errors is routine in everyday automated activities such as keyboarding. Natural situations allow for routine correction of errors, such as retyping or abandoning a sentence midway and beginning a new sentence. This explains why error recovery procedures have become essential in designing computer systems in the user-centered era.

Norman (p. 107)^[10] has identified several types of user errors. *Capture errors* occur when a frequently performed activity suddenly takes charge instead of the intended one (e.g., hitting the wrong function key; hitting return instead

of an F key; waiting while staring at the screen without having entered the command). *Description errors* result from performing a correct action but on the wrong object, which occur when we are distracted, bored, or fatigued. *Data-driven errors* occur when the sight of some object or information intrudes into an action sequence (e.g., typing the wrong information on a line; choosing an unintended menu item). *Associated activation errors* occur when an association of ideas or thoughts triggers a nonrelevant action (e.g., typing an incorrect subject heading phrase). *Loss of activation errors* occur when the goal of an action is momentarily forgotten or when part of a sequence is temporarily inhibited. *Mode errors* occur when users forget what mode they are in when there are several (e.g., typing a command appropriate to another mode). Inherent in creating a user-friendly information environment is the requirement to discover what errors users routinely make, to expect them, and to provide accessible remedies for them.

For the first time in history, we are truly free to make machines that fit human needs, independent of mechanical constraints. New information technologies can enhance the power of human thinking, for machine plus person can do more than either alone, but only if the technology complements human abilities. We need more information-processing tools that complement our thinking, reasoning, and memory skills as comfortably as the calculator enhances our arithmetic skills. We can transform the hard technology of computers and information processing into soft technology suitable for people if we start with the needs of the human users, not with the requirements of the technology (pp. 52–53).^[11]

At this stage, according to one commentator, designers of information systems are now committed to a “user-centered design philosophy,” and have begun implementing interfaces that take into account “end-user information seeking needs.”^[12]

User-centered online design philosophy

Marchionini makes three assumptions about the characteristics of end users in electronic environments.^[12] First, end users are not interested in system characteristics such as design, elegance, or data structure. Instead, they want to get to the end of their work; they want answers, not pointers; they want document delivery, not information retrieval. A second assumption is that “end-users want to achieve their goals with a minimum of cognitive load and a maximum of enjoyment” (p. 156).^[12] This assumption echoes the law of least effort.

Moreover humans seek the path of least cognitive resistance and prefer recognition tasks to recall tasks; most people will trade time to minimize complexity. Finally, humans will perform better and continue to use systems that are pleasurable or interesting (pp. 157–158).^[12]

Computer-augmented information seeking can create a more relaxed, less stressful, more pleasant search environment. In other words, if it is user-centered, it is affectively more benign. In the past, attempts at designing more user-friendly information systems have led to software interfaces known as “metaphors,” such as the Desk Top metaphor for the operating system on Macintosh computers, and its competitor, the Windows metaphor. This approach has been applied more recently to developing alternatives to traditional command language interfaces. For example, Borgman and colleagues developed the “library metaphor” for an Online Public Access Catalog (OPAC) interface in an elementary school that uses the Dewey system and allows students to browse hierarchical graphic bookshelves (pp. 55–68).^[13] Some of the more recent search support innovations include the following, according to Marchionini’s review:

- Query-by-example^[14]
- Spatial database representations^[15]
- Online thesauri tied into the search command sequence^[16]
- Interfaces that offer suggestions to users, including dynamic queries that evolve as part of the interaction with the system^[17]
- Problem articulation as pruning (where users begin with all items in the database selected and each query results in a subset; e.g., computer library CD-ROM)
- Problem articulation “on the fly” through active browsing and judicious navigation in hypertext systems^[18]

Other developments include the addition of alternate input devices such as data gloves, gesture recognizers, speech recognizers, and eye trackers (p. 160).^[12] Marchionini quotes Gauch, saying that, “In electronic environments, the IR problem is not finding information, it is filtering information” (p. 161).^[12] This comment reflects a fundamental dilemma of end users in today’s information environment. However, novice users still do have great difficulties finding information because of their inadequate knowledge of search logic and vocabulary selection difficulties. Marchionini concludes that user-centered interfaces should accommodate individual differences, cultural diversity of individuals, and users’ affective and cognitive characteristics.

Writing Affective Point-of-use Instructions

The potential importance of help instructions in influencing the user’s affective information environment was demonstrated in an experimental study. Nahl showed that the stress and anxiety routinely experienced by novice searchers can be alleviated by adding a distinctly affective component to the instructions, consisting of providing additional orientation, advice, and reassurance.^[19] The importance of psychological factors in searching was examined by asking subjects to indicate on a self-efficacy

scale how confident they were in their ability to achieve a successful search outcome. Subjects who felt more optimistic in predicting a positive outcome has significantly better outcome scores than those who predicted low success for their searches. This suggests that optimism and self-confidence as a searcher empower users to better cope with the information environment. For instance, they found the instructions more helpful and comprehensible, they expressed more satisfaction with search results, and they spent less time per search. By contrast, searchers who expected low success expressed more frustration during the search activity, tried out a greater number of unsuccessful strategies, found the instructions less helpful, and spent more time per search. Fortunately, the pessimistic user self-orientation appears to be modifiable.

Optimism in searching is a learnable affective skill that involves generating positive self-regulatory sentences throughout the searching process. Point-of-use instructions and online Help facilities can either ignore this aspect of the user’s environment, or they can attempt to deal with explicitly. Future research will have to discover the specific verbalizations that need to be added in the form of elaborations to the instructions so that searchers will come to expect probable success rather than probable failure. One approach might be to identify what verbalizations are used by novice searchers who operate under a positive role model through think-aloud protocols, and then to incorporate these sentences in point-of-use instructions (p. 187).^[20]

Because the affective information environment is dynamic and challenging, users need to be taught coping skills that reduce stress and errors.

Written point-of-use instructions and online help screens provide good opportunities for user-centered interfaces to deliver both cognitive and affective information services. As reviewed by Nahl,^[20] user-centered consciousness in the area of software documentation and help instructions first took the form of “minimalist,” advancing the principle that verbose text is tedious, confusing, and repelling to users in general. Shorter, well-organized, and indexed manuals are not only preferred by users but are also less costly to produce. This trend was beneficial, as it enabled systems professionals to focus on what users prefer in terms of length or detail and easy-to-understand language.

A sample of written point-of-use instructions for CD-ROM database searching typical of university library handouts was analyzed and found to be minimalist in both cognitive and affective information, but especially the latter.^[20] Breaking minimalist principles in user instructions, Nahl edited and lengthened an existing point-of-use instruction sheet by adding sentences that served as “affective speech acts,” providing users with extra orientation, extra advice, and plenty of reassurances. The elaborated version was three times longer than the former but was rated significantly more helpful and comprehensible to subjects in a controlled experiment.

Perceived Self-Efficacy as a Searcher

An interesting and unexpected finding from the preceding experiment was that novice users enter the search situation with definite beliefs about their probable success. Subjects were asked to review five search tasks they were about to perform and predict their probable success. The group was then divided for analysis into two subgroups, namely the upper and lower halves in terms of self-confidence as searchers. The results showed significant differences in all of the dependent measures of user behavior, despite the fact that the students in the two subgroups did not differ in searching or computing experience. Novice users who had higher expectations of search success also had higher retrieval scores, expressed greater satisfaction with results, felt less frustrated during the searching, were more effective in their search strategies, and were more efficient. Rather than viewing these features as permanent psychological or demographic differences, Nahl sees a searcher's self-efficacy beliefs as a learned mental habit that, with effort and instruction, can be further developed.

Nahl relates these findings to prior research and theory on *self-efficacy beliefs*^[21,22] and *speech act theory*.^[23–25] As users engage in the act of searching, a continuous stream of silent verbalizations is produced as a means of making things understandable, and as a by-product of their affective involvement, by taking charge, users can consciously manage these sentences and use them to regulate their behavior.

One method of self-control involves the use of self-regulatory sentences thought to oneself. *Self-regulatory sentences*, viewed as habitual speech acts of users in a learning setting, can be witnessed and deliberately changed in self-modification attempts. “Learned optimism”^[26] is an affective habit some users evolve by acquiring an “optimistic” style of talking to themselves during searching by expressing greater self-confidence in a successful search outcome. “Learned pessimism,” on the other hand, is a habit of “helplessness” in the face of challenge and apparent constraint. Users who have low self-efficacy beliefs as searchers have acquired “pessimistic” habits of thinking and express lower self-confidence in their search success. Because habits can be retrained, Nahl suggests that instructions and help assistance contain advice and reassurance that counteract negative self-talk and help users establish more adaptive self-regulatory speech acts while operating in the information environment.

Boolean Pitfalls

One of the stumbling blocks for novice users of online systems such as CD-ROM bibliographic and full-text databases is that search principles operate by Boolean logic, which at first may seem counterintuitive. For example, in ordinary language, a query problem may state

“Search for articles on the dangers and risks of caffeine and caffeine products to pregnant women.” One possible solution might be the search statement:

(danger OR risk) AND caffeine AND pregnant women

Note that in Boolean logic, the *and* between “dangers and risks” requires a transformation to the OR operator. In “caffeine and caffeine products,” the words and *products* should be ignored. Transforming that AND to OR would not be a fatal search logic error, but in ordinary language, it appears to novices as if the search statement should read as follows:

dangers AND risks AND caffeine AND caffeine products
AND pregnant women

In the words of one novice attempting to think in Boolean: “You need to find out about both caffeine and caffeine products, so you need to put AND between them.” However, this search statement is not likely to produce the expected results.

There is evidence of the occurrence of a leakage between the semantic and the logical features of Boolean cognitions. Semantically, both caffeine and other caffeine-related products are of interest here, and it is true; however, the operational logic of searching requires the OR operator if either subject is wanted. In order to block semantic leakage from influencing the logical requirement, a cognitive transition must take place in which the primary focus is on searching the text of records rather than on the semantic features of the topic. This semantic to search logic transition may at first seem contrary to ordinary thinking.

As pointed out by Nahl,^[27] composing valid Boolean search statements depends on an accurate understanding of both the semantic and logical features of the operation. Searchers must learn to keep intact the boundary between these two aspects. There must not be any leakage in the rational “membrane” that separates the semantic from the logical functions. The following example shows how one novice searcher, after reading the instructions, did not separate the semantic aspects from the purely logical features of a Boolean search statement. The task was to:

Circle the concept(s) that must appear in every article retrieved by this strategy: (driving behavior OR drivers) AND risk-taking

The subject inaccurately circled “driving behavior” and wrote the following explanation:

Because the interest is in driving and correlation to behavior, style, motive, etc., I feel that the circled concept must be in every article.

In operation here is the act of reasoning by similarity instead of reasoning by search probability logic. The

problem should have been solved purely from the perspective of formal Boolean logic [i.e., (A OR B) AND C, requiring that concept C appear in each of the retrieved records]. Instead, *semantic leakage* from the topic “driving” led this novice to ignore the necessary logical implications of the Boolean connector. Data such as these indicate which aspects of Boolean reasoning need to be specifically explained and taught.

User-centered online design philosophy must take into account several dynamic factors. Some researchers point to the need for accommodating individual differences, cultural diversity, and affective and cognitive characteristics. Novices need different types of elaborations in oral and written instructions for using systems, especially those that provide orientation, advice, and reassurance. Even the self-confidence of novice searchers plays an influential role in their style, success, and satisfaction. Avoiding Boolean pitfalls and understanding search logic cannot be left to self-instruction. The recognition that users require training that incorporates all of these dynamics has led to a change in public awareness.

THE PUBLIC SECTOR

In the area of library management, one study refers to “a user-oriented approach” when priorities for library services are set through the use of survey data^[28] comparing the budgets and opinions of three special library directors with the research staffs of three organizations as to their attitudes and priorities. Surveying users to get data relevant for planning information services is a response by the system to calls for becoming more user-centered. An early expression of the user-centered paradigm is found in the work of Parks,^[29] who focused on information needs in the public library sector for the handicapped and the elderly. Parks identifies the passage of Titles IV-A and IV-B of the Library Services and Construction Act as marking the beginning of a new community attitude and practice toward the institutionalized and the challenged in our society. This trend has seeped into the *physical* environment of libraries (e.g., signs, central floor plan, electric-eye doors, color, plants, fish tanks) the *organizational* environment (e.g., hours, formal teaching, special programs), and the *human* environment (e.g., social climate, group rituals, flexibility, individualized response, initiative, poise). The passage of the Americans with Disabilities Act continues to deepen this trend.

The Role of Technology

Two factors seem to drive the movement of the user-centered paradigm shift: the rapidly increasing number of novice end users and changing technology. These two factors are interrelated. An increasing population of novice users and greater technological complexity combine to

exert social pressure on the managers of information environments. The role of technology was described this way by a library educator.

In short, this is an era of stressful change brought on by convulsive waves of shifting values on every front. Change is not new to libraries, of course, but what is new is the collapsed time-scale of change. In the past change was faced as it happened, but lately social and technological alternatives have occurred at so great a rate that change must be dealt with continuously. The order of change is entirely different from anything which came before. Whether one calls this change revolutionary or evolutionary hardly matters; what counts is the degree to which such change will affect the library’s role in society. As one librarian put it recently, “the trouble with our times is that the future is not what it used to be” (p. 409).^[30]

A recent review of Ranganathan’s 1928 “Five Laws of Library Science” shows where these principles operate today within the new information technology. According to Sharma’s analysis, new technology “is enabling the realization of Ranganathan’s vision of user-centered, user-friendly information service implied in his Five Laws” (p. 258).^[31]

1. Books are for use.
2. Every reader his book.
3. Every book its reader.
4. Save the time of the reader.
5. The library is a growing organism.

The *open access* technology has enabled realization of the first law as embodied, for example, in online catalogs that “show whether a document is on the shelves of the library or not; and if charged out, when it is due back in the library” (p. 260).^[31] *Resource sharing* and networking have helped validate the second law, and the third law is facilitated by cross-references and keyword search modes in online databases. Finding information in the shortest possible time with online searching, full-text, and CD-ROM technology serve the fourth law; planning and organization of libraries can promote the fifth law. Realistically, these laws are potentiated by new technology, but technology must assist users in more significant ways before these laws can be attained.

With the new networking technology, “information space” has become so vast that new methods have been invented to allow users to “navigate cyberspace.” Various “browsers” introduce their own problems in usability. Old skills for reading paper formats and sequential paging habits have to be modified and applied to screen-presented text, scrolling, and hypertext linking within and across documents. Text formatting, color, highlighting, and speed of access have become important user-related considerations that influence the quality and success of “surfing sessions” on the Internet.

Futures Planning

Those who plan for library services for the next century have adopted a clear user-centered focus. For example, Shapiro and Long (p. 286)^[32] advocate the “reengineering” of user services in academic libraries by spelling out a number of principles.

- Recognizing and dealing with the whole range of user needs (i.e., reference service, telecommunications software assistance, and searching difficulties).
- Transforming services staff into information “case-workers” so that librarians try to maintain postconsultation follow-up procedures to track what happens to users after they have been referred to other specialists.
- Process or procedures must be developed to suit users rather than organizational structure, and continuous change based on feedback or evaluation is essential for effectiveness of information delivery.
- Information technology must not be used merely to provide access through automation but to assist users, such as automated problem-tracking systems and information desks or kiosks.
- Collaboration across the campus with faculty groups and the computing center is essential in producing “symbiotic” operations in support of users.

One study investigated what users of a university library think libraries of the future should be like. The most frequently cited “critical” use of the ideal library of the future was “speedy retrieval and simplicity of use” (p. 307)^[33] Other desired uses included computerized catalog, online searching of databases, full-text retrieval, wide availability of terminals, remote access, twenty-four-hour availability, and personal library assistance services. Another commentator on types of services that would be offered in “user-responsive research libraries” warns that

Some futurists foresee them becoming outmoded storehouses of printed materials, repositories that lie outside of the mainstream of academic life. Others predict that they will become vital information centers, growing more central to research and teaching as the information world becomes even more complex. A cogent case can be argued for either of these opposing extremes, but the final outcome is still beyond our field of vision (p. 59).^[34]

To ensure a positive final outcome to the user-centered revolution, the following system features are recommended for the electronic information environment:

- It should be more access-oriented, less size-oriented.
- There should be universal adaptation to the technology by the entire library staff.
- Personnel should give up the myth that researchers and scholars are skilled users.

Dougherty calls for “a significant overhaul of the duties of most reference librarians and bibliographers” to assist them in developing a better understanding of faculty information needs, their information-gathering habits, and their service preferences.

Customer Service Philosophy

The knowledge needed by information workers to deliver adequate services has become quite broad, according to a recent textbook that addresses “customer service in the information environment.”

It is Mr. St Clair’s premise that the information services practitioner must be broadly defined to include persons engaged in every aspect of information service from records management to technology-based information transfer. The connecting link in all of this information work and the basis for this book is that user needs determine the nature of the information service and that the user’s knowledge of the subject area is a critical component in determining how the information services practitioner will organize the information and make it accessible in the most efficient manner possible, (from the foreword by John Ganly).^[35]

The recognition that information systems should represent how users think rather than how librarians organize information has become the cornerstone of the new paradigm. The “new philosophy of service” aims for “the provision of quality information to its customers,” including such customer service mottoes as the following:

1. People come first.
2. We give accurate and reliable information.
3. We are serious about our high level of service.
4. We cannot afford to give one wrong answer.
5. We are accessible and easy to approach.
6. We are doers—we work hard.
7. We are often pleased but never satisfied.
8. We want our staff to be happy working for us.
9. Service is a state of mind. People must care and have a desire to do it right and to do it now.
10. The client is always right.
11. Everyone must be thinking about how to do his or her job better and more effectively.
12. Enthusiasm and faith are necessary to remove barriers and increase productivity and decrease costs (pp. 5–6,^[35] attributed to Meg Paul).

This new philosophy of information service strikes some librarians as a model more appropriate for commercial settings than academic and public libraries.^[36] This conflict illustrates how the new user-centered paradigm is being extended. It appears that new technology, in such forms as the Internet and World Wide Web, has deepened

the connection between marketing principles and library and information services. This shift is reflected in the historical sequence of designations referring to recipients of library and information services: readers, patrons, clients, end users, and customers. “Customer” service in the information environment brings marketing principles to librarians and information specialists.

Central to the new marketing attitude of information provision, whether for the corporate library or public school multimedia lab, is the “information audit” or user survey. Needs analysis identifies the character of the constituent user groups. Focus groups can help determine what kind of information delivery users prefer. Test runs reveal which procedures users resist or are reluctant to follow, or that produce errors. User surveys elicit responses and comments by potential users. In considering the question of why the wishes of the information consumers have not been better taken care of in the past, St Clair points out that

We have been remarkably successful in using technology in the organization of information, and we are justifiably proud of our long history of using information technology in creating information products and services *for our customers*. What we haven’t done is to use the same technology for creating programs to help us learn more *about* our customers. We haven’t taken the time because we’ve been so busy developing the information products that we forgot who we were developing the products for (p. 93).^[35]

“User-oriented evaluation” (UOE) has been promoted as *action research* “carried out with the aim of generating information which may be used, in some way, to improve information systems and services” (p. 93).^[37] UOE methods include test searches, user attitudes, failure analysis, case study, microevaluation, and other forms of situation-specific qualitative and quantitative analyses. The complexities of studying the user in the information environment require new and more intensive methods.^[38]

The user-centered trend is creating a basic revision of library management and operation in the form of incorporating user input at various levels as a structural component of the management process. One expert advises a phasing-in process starting with the creation of a collection development committee with liaisons to faculty and jointly established written procedures.^[39] Collection vendors would be invited to receive input from the joint committee. Similarly, faculty would serve on a serials development committee and initiate procedures for campuswide departmental input. The structural integration of users into the management fabric itself creates the “client-centered library” (p. 351).^[39]

The Role of Legislation

Legislation and community attitude are important influencing factors in shaping information institutions to

their users. In 1979, the board of the Association of American Library Schools set up a task force to examine the implications of the White House Conference on Library and Information Services,^[40] in which the principal theme was a reaffirmation of free and full access for all citizens. Although the members of the task force recognized this thrust and supported it, they felt that even more needs to be done, such as “recruiting to the profession representatives from the information impoverished, who may have the advantage of instant credibility with their constituencies” (p. 250).^[40] At least one of the “elements of a comprehensive national library and information services program” was explicitly from a user-centered point of view, recognizing the idea that *access* includes *education*.

A-5. Access to Library and Information Services

That institutions educating library and informational services practitioners assume responsibility to address the need of said consumers through their training and education, and that guidelines by appropriate governmental leaders establish standards of in-service training and that training standards for library professionals be implemented without delay

In other words, librarians need to be educated in how to instruct users to gain access to filter and evaluate information.

Educating Information Specialists

The education of future librarians to function in technologically reengineered library settings is addressed in a study describing “a model of how academic libraries and schools of library and information studies (LIS) may collaborate to provide useful education experiences to LIS students and reliable reference services to library users.”^[41] Students study and apply information-retrieval principles and reference interview theory, as well as “role playing, analysis of frequently asked questions, and philosophy of information service” (p. 292).^[41] The emphasis is on the case-study approach, as students were required to follow up on the advice and instruction they gave to library users, to test its efficacy, and to study the entire information-retrieval cycle.

In both the courses and the fieldwork, students were urged to accept a client-centered philosophy of reference librarianship and to view library users and librarians as linked in the research process. Students were encouraged to be approachable at the information desk, to look out for people who might need information, to ask follow-up questions in reference interviews, to encourage people to return to the desk to go to another service point for further assistance, and to express a variety of user-centered values and attitudes while at the information desk.

This reference fieldwork allowed LIS students to gain experience in answering online catalog and directional

questions at one of the library's busiest information service points. The experience enabled LIS students to make the immediate connection between the theoretical content of the course and the actual experience of reference work in a large academic library. The students consistently expressed their appreciation of this integration of theory and practice that allows them to try out various principles in vivo and receive immediate feedback from library users.

The two factors driving the user-centered movement are the increase in the number of novice end users and the rapid change in technology. Future planning in library services for the next century supports a clear user-centered focus. The customer service philosophy, although not acceptable to everyone, nevertheless points to the recognition that information systems should represent how users think rather than solely how librarians organize information. Legislation, community attitude, and education of information specialists are moving toward a client-centered philosophy of reference librarianship. The increasing social consciousness of the importance of the user cannot by itself create an intellectual revolution unless supporting scientific theory evolves along with it.

COMMUNICATION THEORY

Sense Making

One of the earliest statements defining the concept of user-centeredness is attributed to the critique of Zweizig and Dervin, whose approach is based in American communication research.

Since the 1970s, critical attitudes toward the narrow conceptions germane to a system-centered approach were evinced. Institutions such as libraries distributing information were seen as instruments serving information seeking and use, not as an end. The critique was made explicit by Douglas Zweizig and Brenda Dervin, precursors of the *user-centered approach* to information seeking and use. They proposed that instead of asking who is using the library or how much is the library used, the question should be for what purpose was the library used and how did it help? Thus the important question would be not library use, not library users, but library uses.^[42] Since the late 1970s, suggestions for a refocus of research on the individual actors seeking and using information in practical social and cultural contexts have become more frequent [see, e.g., 43–45]. Today we see that these efforts have been successful—the user-centered approach is about to offer the traditional intermediary-centered approach a serious paradigmatic alternative (p. 14).^[46]

Sense-making research investigates behavior, both internal (i.e., cognitive) and external (i.e., procedural), allowing individuals to construct and design their movement through time-space. Sense-making behavior is thus

communication behavior. Information is the sense that is created at a specific moment by an individual. Information does not exist apart from the subjective, constructive process. The central activities of sense making are information seeking, processing, creating, and using. Sense making is a process; sense is the product of this process. According to Dervin, “sense” includes “knowledge,” but also a host of other subjective factors that reflect an individual's interpretations of a situation, including “intuitions, opinions hunches, effective responses, evaluations, questions, etc.” (p. 16).^[46] Thinking and perceiving are referred to as “moving forward in the cognitive terrain.” When there is a lack of relevant information or there is confusion and uncertainty, routine thinking no longer works effectively, and a situation called “gap-facing” arises and elicits “gap-defining” and “gap-bridging” activities. People evaluate their gaps differently; “optimists” may see no problem where “pessimists” are stumped. They may differ in “rigidity” or “flexibility” in their gap-bridging.

Dervin's sense-making concept, defined as the “movement of thoughts and questions through cognitive time-space,” is explained by another commentator as follows:

In this sense, one may be said to move through a series of thoughts and experiences, to encounter “barriers” to one's progress, to “lose” one's way, etc. In either case, any given movement can be interrupted when an individual is confronted by the need for some form of guidance; that is, when they need to know something. Based on the work of Carter,^[47] such conditions are considered cognitive “gaps,” and may be exemplified in their most general form by the need for street directions or instructions on the use of Boolean connectors, depending on the behavior context. Information seeking is defined within this framework as “gap bridging.” Gap bridging can be accomplished by thinking up an answer, asking for help, looking for useful information, or by any other functional method that enables the individual to continue moving. These gap-bridging attempts are operationalized as “questioning,” whether spoken by individuals or unspoken (p. 649).^[48]

In an attempt to apply Dervin's sense-making theory to the day-to-day operation of a library, Morris asks such basic questions as, “What does it mean to have a user-centered reference service?” or “What should a user-centered approach to cataloging entail?” (p. 20).^[49] User-centered in this theoretical context means viewing information as something “construed by users” and designing systems and services that are tailored to how humans think and feel when processing information to meet a need. This is in contrast to the traditional system-oriented definition based on the work of Shannon and Weaver^[50] that views information as having an objective existence outside the individual.

When we seek information through the traditional paradigm, our goal is to find the external “information reality”

that corresponds to our internal need. As Dervin points out, we don't talk as if we hold this traditional view of information. On the contrary, we admit that knowledge isn't absolute, that what really matters are people, that people change, and that a message sent doesn't equal a message received (p. 21).^[49]

In the sense-making model, information becomes “whatever an individual finds ‘informing’ ” (p. 22).^[51] Information triggers changes in the user's perceptions, which alter how the information is perceived. The user is seen not as a passive receptacle but as an active participant in a constructive process of information processing. Although users are unique individuals, there is a common or universal process through which all users pass in adaptation to a particular information activity. Addressing user-centered services to these commonalities requires scientific knowledge about the actions, thoughts, and feelings that constitute the experience of being a novice user.

According to Morris, a primary goal of information professionals should be “understanding and clarifying ambiguous information needs” (p. 25).^[49] Ambiguity and uncertainty can be unpleasant and stressful feelings; hence, library services such as reference interviews need to be negotiated by librarians with a view to “intervening” in the person's state of information challenge. Vague requests, or those that are too broad or too narrow, may require probing with open questions, addressing the need behind the demand rather than the want or demand as first formulated by the user. An interesting point raised by Morris is that users tend to operate under the system-centered paradigm in their own views of what information is or what the process of finding it is like. The self-contradictory nature of users is captured vividly in the following description:

The picture of the individual that emerges from these studies in psychology holds complex implications for a user-centered, constructivist model of information. Humans are, by their nature, contradictory: drawn to make quick decisions that reduce uncertainty but struggling to understand clearly enough to make a good decision; striving for order, but enjoying the intellectual challenge of disorderly facts and unconventional ideas; needing the familiar, but craving the risk of the unknown; unable to express what is needed, but nonetheless perpetually asking questions; highly knowledgeable, but unable to transfer that knowledge. This is the user whom we wish to serve (p. 29).^[49]

In a radical proposal, Dervin^[52] urges that we abandon the traditional system-centered categories of users such as demography (age, race, education, gender), personality (cognitive styles and preferences), ability or literacy levels (language, computer, knowledge), purpose for using the system (information, entertainment, research), and user-satisfaction ratings. Such categories, Dervin argues, “lead us to a view of communication systems that makes haves and have-nots inevitable” (p. 217).^[52] The “haves” are

those who successfully use the system, whereas the “have-nots must somehow get more of what they lack—education, money, literacy, motivation to read news, computer skill, cognitive complexity, etc.—so that they can become like the haves” (p. 217).^[52]

Revising User Categories

Dervin proposes a radical redesign of the information world based on a deliberate refocusing of the nature of user categories.

The actor's situation. This category of user behavior identifies “why in a given situation a person tries to use an information or communication system” (p. 225).^[52] How complex is the situation? Is it a piece of a larger project? Under what constraints is the user operating? What barriers does the user perceive?

Gaps in sense making. A query points to some gap in information and the outcome of a search yields a message that can help close the gap by constructing new meaning or new understanding. An information gap is not to be defined by topical categories or subjects, as in the system-centered orientation. Instead, gaps are “gaps regarding the characteristics, aspects, or dimensions of self, others, objects, events, timing, spacing, causes, consequences, and what-ifs” (p. 225).^[52]

Actor-defined purpose. System-defined purposes for “looking for information” traditionally include such broad categories as information, entertainment, social, cultural, and escape. User-centered purposes are more situationally specific, such as “getting pictures (cognitions), finding direction, gaining skills, getting motivation, avoiding bad places, getting out of bad places, getting support, getting connected, achieving goals, getting happiness, getting rest” (p. 225).^[52]

Information-Using Strategies, Values, and Traits

User strategies are adaptive mechanisms that people employ in searching for and using information. These include “browsing, formatting, grouping, highlighting, indexing, citing, digesting, abstracting, formulating, transmitting, interpreting, connecting, and skimming” (p. 225).^[52] “Actors” (i.e., searchers) evaluate information in terms of its meaning to them; that is, its “timeliness, breadth, adaptability, accuracy, specificity, touchability, moveability, and newness” (p. 225).^[52] The term “information traits” covers “the specific characteristics of how the user would like the information presented,” such as quantitative data versus qualitative assessment, precedence setting versus futures planning, hard facts versus opinion, single point versus options, and clinical observation versus census.

When comparing traditional user categories with these user-centered dimensions, a clearer view emerges of how

the information world needs to be redesigned to make it more serviceable to users in terms of instruction, assistance, and organization (cataloging and indexing). In terms of *user assistance*, build a focus on user categories. Under what constraints is the user operating? Is the user more interested in gaining an understanding of something specific or exploring without a fixed goal? At what stage of the seeking process is the user at this time? Does the user want to take the information home? Does the user want to see hard facts only or is there an interest in clinical studies also?

In terms of user-centered *information organization*, the focus is on indexing content in terms that users can recognize in relation to their momentary and variable intentions and motives. How do I just browse? How do I reformat this text? Where do I find a citation for this? What would help reformulate this? Where can I find a digest of this? I need to see an interpretation of this (and so forth). A user-friendly environment anticipates and accommodates, facilitates, reassures, and above all, delivers and satisfies. To achieve the goals, information professionals have developed methods for identifying and measuring users' behaviors—their actions, thoughts, and feelings during the information-seeking or knowledge acquisition process.

MODIFYING USER BEHAVIOR

Learning Principles for Searcher Self-Modification

A number of writers in the field of library science have urged the application of learning theory principles to library instruction and services.^[53–55] The field of psychology has broadly discussed the “conditions of learning” that need to be present when acquiring new habits, and some of these were summarized for the narrower field of acquiring information retrieval skills.^[55]

Sufficient motivation for learning

Search behavior is goal-directed behavior hierarchically organized so that subgoals constitute larger goals. For instance, looking up a word or entry in an index is a subskill within the larger skill of locating a document. The subskill requires the searcher to inspect the list, look up and down, page through, select terms, and so on. This subskill has its own goal and motivation. If the searcher lacks sufficient motivation to persist in the look-up operation, the subactivity will be prematurely abandoned, with negative consequences to the overall search effort. A single global assessment or rating of a user's motivation or interest in completing a task is thus unlikely to predict accurately a person's multiple motivational requirements with all the subtasks. The information environment needs

to be designed to encourage and facilitate the emergence of sufficient motivation at multiple levels of administration and instruction.^[56]

Active responding

Instruction must provide for some form of responding or active participation from the user. In the sensorimotor domain, locating an item on a computer screen is a prerequisite skill that needs to be practiced beyond some minimum level before one can expect users to have success in finding information. In the cognitive domain, users need to be given learning opportunities to rehearse reasoning sequences such as “What would happen if I do X?” or how to redirect a search strategy that is not effective. In the affective domain, novices need to be given the experience of overcoming an information challenge by helping them complete a task or operation successfully.

Providing reinforcement

In the educational and clinical psychology literature, a “reinforcing stimulus” is an incentive that works; that is, if that reward is systematically applied in a teaching context, learners will acquire that target habit more quickly. Of course, some incentives do not work. One guiding principle is to discover what users find relevant and rewarding in specific information situations. Although it is universally recognized that rewarded repetitions lead to learning new skills, given the hierarchical organization of information skills, global rewards are not always sufficient to maintain consistent reinforcement. Sometimes too much emphasis may be given by users and professionals alike to the end result or to overall search success. If this is unsatisfactory, a general negative pall is cast over the entire information-seeking enterprise. Instead, users can be *taught to appreciate* the little successes within the overall (temporary) impasse.

Reinforcement strengthens the behavior to which it is applied. The repetition and rehearsal that occur with hands-on experience become opportunities for applying reinforcement and evolving a routine habit. These experiences need to be instructionally managed to provide sufficient success for subactivities. Both external and internal levels need to be considered by information professionals. Special attention must be given to *self-reinforcement* activities by searchers, as explained in this description.

Search behavior continuously operates to overcome the aversive stimulus of unfulfilled information needs. Every subactivity is accompanied by affective and cognitive reactions. Success builds self-esteem; failure engenders depression. Part of BI [bibliographic instruction] might be teaching patrons how to “self-reinforce” during searching. Many patrons are ill-equipped to deal with the emotions that are aroused during searching. They may engage in

damaging self-talk, making self-accusations such as: “You stupid fool. Why did you forget to write that down?” or “I’ll never get this done in time.” BI could therefore include the teaching of appropriate self-talk such as: “It is normal to feel confused in the beginning of a search” or “Other people make the same mistakes.” Teaching students to use self-reinforcing “speech acts” while searching is part of encouraging independent learning skills; the librarian’s words, if not the librarian, are present to guide and regulate search behavior (pp. 79–80).^[55]

Broadening user instruction to include motivational skills and self-regulatory speech acts may appear to some information professionals as too personal or even invasive. However, from a user-centered perspective, the new inner focus on users is both legitimate and beneficial to their needs, preferences, and growth potential in life long holistic information activities.

Search Behavior as Problem Solving

There are three broad components of information seeking (p. 402);^[57] information need, search strategy, and execution of strategy. Search behavior is redefined as “a problem-solving activity in which subskills are organized and retrieved according to the individual’s perception of a current information need” (p. 403).^[57] conducting a search is a broader unit within which are embedded hierarchical subskills, one of which might be the strategy of using periodical indexes. Similarly, this subskill has other organized subskills within it, such as deciding on search terms, selecting the right index, looking up the subject in the index with the most current date first, and so forth. Each subskill is itself composed of other hierarchically organized skills. Search behavior is thus “goal-directed problem solving” (p. 403).^[57] User-centered instruction takes this into account: “Library use is an activity of one mind seeking contact with other minds. The study of the cognitive processes of library users allows librarians to develop a new focus on the inner microenvironment of information seekers” (p. 407).^[57]

Indexing is the language chosen by information specialists to reflect the “about-ness” or content of documents. “User-centered indexing,” according to Fidel (p. 572),^[58] “cannot be developed before searching behavior is understood better.” A number of issues that guide the practice of indexers are related to users. One is the issue of user language; that is, the level and specificity of the index terms. Another is the exhaustiveness or comprehensiveness (i.e., what to cover and what to leave out). In the older paradigm, also known as “the document-oriented approach” (p. 573),^[58] “indexing can be done with no knowledge or consideration of users or their needs,” but in the new paradigm, “request-oriented indexing” acknowledges the centrality of users. One example cited

by Fidel is a study in which a “filtering” technique is employed to check each descriptor chosen by the indexer: “Would any one of our users who is interested in the content of this document use this descriptor as part of the query formulation?” (p. 574).^[58] Request-oriented indexing depends on the indexer’s ability to anticipate user requests. Each document is represented in the database by a list of anticipated requests, and these elements form the index language.

Automated indexing has grown in the past thirty years, and its developers claim that retrieval performance is at least as good as systems that use intellectual indexing (p. 575).^[58] Several reasons are given in favor of the user-friendliness of automated indexing. One is that search requests expressed in natural language are accepted and Boolean query formulation is not required. A second advantage cited is the provision for relevance feedback based on user ratings of retrievals and how these can improve the search. Other advantages mentioned are ranked output of retrievals in terms of relevance and the capability of automatic query expansion. Thus, on the one hand, automated indexing provides advantages in flexibility, dynamism, and control. On the other hand, its terms are limited to the language of the text itself, as no descriptors or keywords are employed.

An experimental study attempted to implement a user-responsive search system that allowed people to “add keywords to the indexing of an online retrieval system based on their use of the documents in the system” (p. 153).^[59] A dynamic system that adapts to the needs of users is indeed a user-centered feature, although we still lack the practical knowledge for implementing such a system. In this case, the system had difficulty dealing with user language and error control. Variant spellings, errors in spelling, and terms that are too broad need more complex expert systems than are now routinely available. In an attempt to remedy this insufficiency, Denning and Smith^[7] tested ELSA, an intermediary system that features the capability of “intelligent search functions” that solve some of the problems associated with user spelling and language. For example, when users are not familiar with the syntax of a system, they may type in “Search James, William” which does not work, as the system expects “aut/James, William.” ELSA helps with this problem by accepting variant forms for author searches and by making lists of available concepts as well as lists containing synonyms that trigger available concepts.

There has always been the recognition among indexers that indexing and searching are related, but now the powerful tools of automation are providing new user-centered capabilities. The trend is not to choose one system over another, but to make all systems available simultaneously in the service of accommodating user styles, needs, and backgrounds. This is especially desirable because there is “little agreement in the names people use and the names recommended for use by LC [Library of Congress Subject

Headings], implying that retrieval systems should do more to accommodate common naming behavior” (p. 116).^[60]

Types of Moves in Searching

To understand the user’s perspective, Fidel^[61–63] has studied how users make decisions by observing their “moves” within a search activity. Examples of moves made by searchers include any activity that allows them to continue progressing, such as the following:

- Using help files
- Reading the screen
- Issuing commands
- Guessing
- Rereading the screen
- Asking questions of themselves or others
- Consulting documentation
- Trying to get to a menu
- Trying to get out of a menu
- Trying to figure out where they are
- Modifying a search string
- Displaying a record

Fidel has studied several aspects of online searching behavior, including (1) choosing databases, (2) choosing search terms; (3) conducting the search, (4) reviewing results (feedback review), (5) making new decisions in response to the evaluation of results, and (6) terminating the search and getting a printout.^[61–63] Her approach consists in identifying incidents in which a search key was selected, and then fitting each incident into a decision tree, resulting in a catalog of criteria for decisions. For instance, during the process of choosing search terms, the first decision point is to determine whether a “single-meaning term” (which is good for free-text searching) is wanted or a “common term (broad and fuzzy meaning with too many contextual variations)” (p. 493).^[61] In case it is a single-meaning term, the next decision point is to map the term to a descriptor. For example, the topic “Anxiety about using computers” is matched to descriptors such as **TECHNOPHOBIA** (narrower) or **ANXIETY** (broader). This matching process involves a semantic content (or the concept) and the system language (controlled vocabulary). If no exact match is found, then a partial match may work in conjunction with text words (key terms) for an inclusive search. If no match is found, text words can be used to probe indexing further. This case-history approach demonstrates that searchers use intuitive as well as explicit “rules” for decisions.

Descriptive efforts on how users make decisions in an information retrieval situation produce knowledge engineering trees that can help in the design of intermediary

systems that assist the searcher through “dialog box” inquirers about the user’s purpose and scope of the search as well as requesting evaluation of sample retrievals. According to Fidel

Understanding how searchers of all types look for information, and how they interact with existing systems, can provide guidelines for searchers’ training and assistance (p. 501).^[62]

It is evident that decisions during searching are guided by users’ *perceptions*. These can be identified by asking them to state the reason for a particular decision. These reasons or perceptions can often be validated by objectively observable evidence such as transaction logs that record what keys have actually been pressed in sequence. Another method of validation consists in examining frequency distributions and correlations across several searchers for a single search, or across several searches for one individual. Other variations include the number of databases, different subject areas, type of information venue (research, industry, other), and the number of moves required (task complexity). Having conducted research with these variations, in her conclusions Fidel emphasizes the finding that search decisions and strategy are heavily determined by system features, especially the structure of controlled vocabulary and the availability of effective online thesauri.

Thus, research should be carried out to discover which features of databases and their thesauri can be standardized without affecting retrieval quality. The role of intermediary expert systems will then be to bridge the necessary differences, employing switching languages and other terminological and semantic networks (p. 514).^[62]

Fidel analyzed the verbal and search protocols of forty-seven professionals in the hope of discovering “what characteristics of searching behavior constitute a searching style” and “in what way one individual searcher is different from another, all external conditions being equal” (p. 515).^[63] Fidel, citing Fenichel,^[64] estimates that research on online search behavior has declined recently because prior experiments have failed to provide conclusive results on such individual differences as experience, cognitive attributes,^[65] personality traits,^[66] and type of request.^[67]

A common explanation given for these partly negative results is that “individual search styles override most measured attributes of searching behavior” (p. 515).^[63] Fidel thinks that this attitude is premature because we do not yet understand the specifics of search styles. She analyzed data on verbal protocols of thought processes, both while searching and from interviews with searchers to determine reasons for their search key selections. Fidel built a

two-layered model to represent the derivation of six types of moves. A move is defined as any modification in search strategy aimed at improving results. Operational moves do not change the meaning of a request, whereas conceptual moves do. For instance, type 2 moves are operational moves aimed at increasing precision. Other examples of moves include the following:

Type 1

- Intersect free-text terms to occur in a predetermined field
- Limit time (by date)

Type 3

- Add synonyms and variant spellings
- Eliminate restrictions previously imposed

Type 4

- Intersect a set with a set representing another query component
- Select a narrower concept

Type 6

- Enter a broader descriptor or term
- Group together search terms to broaden the meaning of a set

Of the 1244 moves made by the forty-seven professionals in their 281 searches, 60 percent were operational and 40 percent were conceptual. The number of moves to increase recall was about double the number of moves to increase precision. Fidel takes this as a sign of “the difficulty in achieving satisfactory recall in the databases currently available” (p. 518).^[63] Operational moves are used to improve precision or to reduce a set, whereas conceptual moves are used to improve both precision and recall. The average number of moves per search was five, with a range of one to eighteen. It is of interest that these professional searchers only used 25 percent of the available moves, indicating that “search systems should remind searchers of the complete array of moves possible in online searching” (p. 519).^[63] Interactivity (number of moves) was not related to purpose, concern with recall, or subject area. It thus appears to be an element of search style.

In conclusion, Fidel uncovered three search style characteristics of professionals that were not related to results or success.

1. Level of interaction or number of moves
2. Preference for operational versus conceptual moves
3. Preference for using text words versus descriptors

Nahl believes that these search style measures can be influenced by the speech act content of instructions, as well as by other searcher characteristics such as success,

satisfaction, self-confidence, and frustration.^[20] Because both the cognitive and affective domains of the user’s world must be addressed, it is clear that the new user-centered perspective needs to focus on a broader spectrum of the user’s involvement in the search process.

Reformulations

According to Dalrymple, “the user-centered approach derives its questions and methodology from the behavioral sciences” (p. 272).^[68] In her study, subjects were assigned search problems, and their cognitive processes were studied by having them think aloud while searching. Of special interest were the “reformulations,” an expression that refers to the attempt to refine the terms of a query.

Reformulations are assumed to be cognitive processes that interact with searchers’ long-term memory retrieval operations and may be conceptually similar to database access and retrieval operations. “Presearch reformulations” transform the language of the information need into terminology that initiates the search. “Search reformulations” are modifications of search terms during the search. For example, the statement, “I’m looking for books about women writers in twentieth century German literature” needs to be translated into the form, “Feminist writers.” This presearch reformulation may be modified later during the search by adding, “Feminist writers German literature.” Dalrymple found that a significantly greater number of reformulations were made when subjects searched an online catalog as opposed to a card catalog. She calls for additional investigations on reformulation to determine whether or not it can be taught, how it is affected by the urgency of the information need or by individual differences in search style, and whether or not it functions as a request for feedback from the system.

Transaction-Log Analysis

The need to study more closely the cognitive processes of searchers was aided by software capabilities that permit a detailed approach to the study of online search behavior known as transaction-log analysis. The authors of a “manifesto regarding the future of transaction log analysis,” Sandore and colleagues,^[69] urge the development of unobtrusive measures for expanding the information base librarians have about users’ style and pattern of information seeking, including searching, browsing habits, circulation activities, and evaluating and digesting information. Such expanded “tracking” will allow the resolution of the fundamental question “whether it is the system or the user that requires improvements” (p. 106).^[69] The authors suggest that

It is possible to conceive of an IR system that was so adaptable that it could make searches successful when

conducted by someone with a totally misguided mental model of the search process. If we design systems that are “idiot proof,” are we encouraging mediocrity by not attempting to educate users with feedback from their searching mistakes (p. 106)^[69]?

These researchers advocate helping users become proficient searchers, and to accomplish this, one needs a research program using transaction-log analysis to advance the knowledge base that information professionals have available about users. Transaction-log analysis “provides a glimpse of the world of user searching that is otherwise inaccessible” (p. 106).^[69] The sequence of cognitive activity is captured in the verbatim record of keystrokes of a searcher, representing decisions made throughout the search. Common strategies, varieties of errors, predominant search modes, and the like are revealed, providing heretofore unavailable information on how users adapt to the system.

User-centered design in the 1990s dovetails with the area of human-computer interaction (HCI), incorporating cognitive engineering, software engineering, and usability engineering, including artificial intelligence (AI).^[70] There is a new awareness and concern about the need to “overcome the gulf that exists between system designers and users” (p. 438).^[70] There is a new desire to deal with users’ psychological blocks and frustrations by building systems that accommodate the various levels of skills and try to eliminate unnatural human-computer exchanges such as having to wait for the execution of a command without knowing how long it will take or even if it is processing the command. Currently, more information-retrieval software designers are providing transaction-log utilities that can aid in studying the local use of systems. Transaction logs do not capture the thoughts and feelings of searchers and thus cannot provide insight as to why search decisions were made. To achieve a fuller description of an individual’s search process, a complementary methodology is required to supplement the transaction-log data.

The Affective-Cognitive Connection

The desire to assist novice users in learning to operate unfamiliar information systems has naturally focused on what knowledge needs to be imparted to allow users to become independent explorers. However, working with novices within an educational setting made it clear to several researchers^[19,56,60,71,72] that dealing with cognitive issues is not sufficient. The affective domain in learning is equally important and possibly more fundamental. Without the desire and continuous motivation to learn, few novices would become independent searchers and cyberspace navigators. There is a significant dimension of *resistance* to information seeking that reflects feelings of technophobia, information shock, and depression

commonly experienced by novices within a bewilderingly complex information world.

There has been a lack of integration of cognitive and affective functions in the user as illustrated in an experimental study on 120 sixth graders comparing their recall scores on entries from Compton’s Multimedia Encyclopedia on CD-ROM.^[73] The research question was whether multimedia presentations were more effective than simple text on screen. No significant main effects were found, and the authors conclude that “it is not sufficient to add animation to text in order automatically to enhance children’s learning” (p. 527).^[73] Although this conclusion is qualified in some ways, it appears that the system’s assessment is based on the children’s performance on cognitive skills alone (recall and inference). The authors report that “reactions to the CD-ROM were almost uniformly very positive” and that students “found the animation sequences appealing,” but still conclude that “its effectiveness as a means to improved learning is dependent on a number of factors such as text, text type, and media integration” (p. 527).^[73] It is clear that the affective aspect is given no weight in the assessment of improved *learning*. The tendency to use comprehension measures without integrating them with affective measures is a characteristic feature of user studies in the older paradigm.

The following is an example of an experimental study that does not integrate the affective and the cognitive domains, but gives equal weight to them in systematic contrasts and evaluation. Seventy graduate students in LIS were introduced to HyperLynx, a hypertext bibliographic information retrieval system.^[74] They were given five search queries, one of which was “to find documents that discuss information retrieval effectiveness.” Search success varied with the query; some were more difficult than others. In the cognitive domain, knowledge of hypertext systems was assessed in interviews, and it was found that this variable had no effect on ability to search or success. In fact, the knowledge differential was small because few students had more than a slight reading knowledge of what hypertext is. In the affective domain, users were asked to compare the hypertext system with the Boolean-based systems they had experienced previously. There was generally favorable response to the hypertext system by the majority, but at the same time, all subjects expressed frustration at not being able to use Boolean searching with the full-text documents. It is concluded that user “preference for string searching for particular search tasks such as authors and very specific content suggests the need for a hybrid system with both string and hypertext search capabilities” (p. 27).^[74] In this study the cognitive and the affective domains were equally addressed, to the greater benefit of users as they struggle to operate in fluid information environments.

An explicit attempt to integrate the affective and cognitive domains of information behavior is found in a study

by Metoyer-Duran (p. 320).^[75] She was interested in how information in a community is diffused by “information gatekeepers,” or “persons who help individuals gain access to resources needed to solve problems.” Information providers and librarians are information gatekeepers by profession, but many people in a community act as agents of information diffusion, for example, housewives who attempt to alter the family’s eating habits and present them with a new dietary philosophy for which they rely on new information. She presents a taxonomic framework with three interacting domains: (1) *cognitive skills*, specifying the conceptual knowledge needed for information literacy, including terminology and logical reasoning strategy; (2) *technological skills*, referring to the operational literacy of information systems and data structures; and (3) *affective skills*, referring to the gatekeeper’s “innovation diffusion and learning behavior” (p. 332),^[75] including resisting or impeding the flow of information or absorbing information selectively and distributing it to others.

The importance of connecting affective and cognitive functions is well known in theory, although considered difficult to apply in practice. Two comments by psychologists illustrate this emphasis: the first goes back to the first modern behaviorist (i.e., after Descartes) and the second is a current research report sponsored by the Air Force Human Resources Lab.

Man has two faculties; will and understanding. When the understanding is governed by the will they together constitute one mind, and thus one life, for then what the man wills and does he also thinks and intends (no. 35).^[76]

These two parts, the will and the understanding, are most distinct from each other, and for this reason, as before said, the human brain is divided into two parts, called hemispheres. To its left hemisphere pertain the intellectual faculties, and to the right those of the will (nos. 45 and 644).^[76]

All activities are changes of state and variations of form, and the latter are from the former. By state in man his love is meant, and by changes of state the affections of love; by form in man his intelligence is meant, and by variations of form his thoughts; and thoughts are from affections (no. 1146).^[77]

It is simply not possible to design either cognitive or psychomotor instruction without including some affective component. The very act of establishing an instructional goal implies some value to the person, organization, or society in its achievement. The motivation to learn may already exist in the student before instruction, or it may need to be generated or enhanced by the instructional program. It is precisely because the affective is so entwined with the cognitive and psychomotor learning achievements that it needs careful attention during the design and development of instruction (p. 18).^[78]

The ACS information unit

In the field of LIS, Kuhlthau has consistently called attention to the neglect of the affective domain.

While information seeking is recognized as a cognitive process, the affective process is rarely considered as interacting with the cognitive as part of a whole experience. Incorporation of the affective . . . is essential for fully understanding the experience of information seeking, but it has not yet occurred on any significant scale. . . . There is much we do not know about how individuals construe and reconstrue during information seeking. These studies do indicate, however, that the process is not purely cognitive. Feelings of anxiety are prevalent early in the search, and levels of confidence increase considerably during the process. . . . While it may not be necessary to dwell on feelings in information-seeking situations, it is necessary to incorporate an awareness of affect into our professional construct of information seeking. Until the triad of thinking, feeling, and acting is fully accepted as the nature of information seeking, mediation [i.e., instructional intervention] is likely to be fragmented and limited (pp. 112, 117, and 127).^[72]

Kuhlthau astutely points to the need for information professionals to become more systematic and more holistic in their approach to instructing users by addressing affective and cognitive domains.

To this must be added attention to the sensorimotor domain of hand-eye coordination and action. In an effort to express this connectivity of function among the three behavioral domains, a three-dimensional model of learning information structure was proposed by Jakobovits and Nahl-Jakobovits^[79] emphasizing the principle that every information skill from the smallest to the most general is constructed from affective, cognitive, and sensorimotor behaviors acting together as a unit within a hierarchical behavioral system.

The instructional significance of the Affective Cognitive Sensorimotor (ACS) information unit is that teaching people to become searchers, or helping searchers to be better searchers, involves the management of three different types of human memory— affective, cognitive, and sensorimotor. Affective memory is required for acquiring affective information skills, just as cognitive memory is required for learning cognitive information skills. The same is true for sensorimotor memory. Advances in research and practice will reveal the characteristics of each memory and how these may be applied to curriculum design (p. 460).^[79]

The suggestion that information teaching and services adopt a behaviorally integrated design broadens and deepens the user-centered consciousness of information professionals because it involves a holistic orientation toward users. *Holistic user-centeredness* provides “a

unifying framework for preparing curricula in any subject” and “represents a shift from impressionistic instruction that is based on expert knowledge alone to an approach based on both formal analysis of learner needs and expert knowledge” (p. 74).^[80] The permanence of the user-centered revolution may depend on productive research and development of a comprehensive theory of user behavior in the information environment.

Longitudinal Study of Information Seekers

In a series of studies on information seeking from the user’s perspective, Kuhlthau^[81] explored the cognitive and affective aspects of users’ experiences in information-seeking situations. She points to a gap between how searchers think and feel, on the one hand, and how information providers think and organize information on the other. At one end of the spectrum, the system’s pattern is based on certainty and order; at the other, the user’s pattern is based on uncertainty and confusion. Thus, information has a mechanistic as well as a human dimension. Users assimilate information from various sources and transform it into meaning by constructing a personal point of view and creating new knowledge that is sharable with others (p. 361).^[81] Her review of the research on information seeking from the user’s perspective includes the following highlights:

1. Most studies conducted in the past are from the perspective of the system.^[82]
2. There is a new interest in moving away from system-oriented research toward a focus on users of information, especially on their problem-solving and decision-making behaviors.^[83]
3. A fresh approach provides a cognitive science point of view that takes into account the user’s thinking processes and evaluations of the information retrieved.^[84]
4. Users interpret information in terms of personal life characteristics and these are likely to be as important as system considerations in information retrieval.^[85,86]
5. To understand how people find and use information, we need to combine their cognitive maps of the searching environment with a model of the system’s design features.^[87]
6. The users’ ability to articulate requests to the information system depends on their levels of understanding their problems. Because their level of awareness of their information need may be initially low, they may have little success in specifying what is needed.^[87]
7. Users’ queries involve at least four levels of awareness of information need: “visceral” (below the threshold of awareness), “conscious” (aware of the need but not yet formulated in specific terms), “formalized” (explicitly

expressed), and “compromised” (translated into the terms of the system).^[88]

Kuhlthau emphasizes that an information search “is a process of construction which involves the whole experience of the person, feelings as well as thoughts and actions” (p. 362).^[81] To put it more specifically,

A model representing the user’s sense-making process of information seeking ought to incorporate three realms of activity: physical, actual actions taken; affective, feelings experienced; and cognitive, thoughts concerned both process and content. . . . While purely cognitive conceptions of information need are adequate for some research purposes, consideration of the affective dimension of users’ problems is necessary to address a wider, holistic view of information use (p. 362).^[81]

Kuhlthau argues for a new “dynamic” perspective on the searcher’s world. An information need becomes “the gap between the user’s knowledge about the problem or topic and what the user needs to know to solve the problem” (p. 362).^[81] She argues her perspective through “personal construct theory,” originated by personality theorist George Kelly.^[89] This cognitive approach describes how new information is assimilated, beginning with “confusion” brought about by “inconsistencies and incompatibilities” between the new information and currently held constructs. Doubting the validity of the information may follow confusion, and experienced threat may lead one to discard the new information. Alternately, users may attempt to incorporate new information by constructing new hypotheses that allow a more inclusive construct system.

Kuhlthau’s focus on longitudinal studies represents an interest in the dynamic evolution of an information-seeking problem within the personality parameters of a user. To obtain data on this private arena of the searcher’s world, Kuhlthau’s subjects kept written records of their feelings, thoughts, and actions about their library research project. They also kept logs in which they recorded the sources they used, the procedures they went through in finding sources, and their evaluation of their usefulness. In addition, they filled out a questionnaire that asked about their perceptions in six areas of library activity: topic selection, research assignments, focus formulation, procedures for gathering information, frequency of library use, and role of mediators. Taped interviews were conducted in which students drew flowcharts describing the process they followed.

With this intensive and longitudinal data on twenty college students, Kuhlthau developed a six-stage model of the research process. The model was verified with 385 college students at eleven universities with three temporal data points; initiation of the research assignment, its mid-point, and its closure. Her observations draw an affective progression in the search process, from initial states of

uncertainty with vagueness to later stages of optimism, confidence, and satisfaction with more narrowed, focused, and synthesized information (p. 367).^[81] Kuhlthau notes three broad psychological effects; (1) interest in a topic increases as a search progresses; (2) the topic changes as information is gathered; and (3) a central theme evolves as information is gathered. Her conclusion on the importance of the affective component is explicit.

By neglecting to address affective aspects, information specialists are overlooking one of the main elements driving information use (p. 370).^[81]

The primacy of affect has been known in education and psychology, and only recently has come under consideration in information environments.

The Taxonomic Model

The taxonomic model has been applied by Metoyer-Duran to form three-dimensional profiles to idealized types of information gatekeepers;^[75] for example the “broker profile,” the “information professional profile,” or the “unaffiliated gatekeeper profile.” This last refers to individuals who think of themselves as ordinary people rather than innovators, yet they respond out of “personal conscience, or a sense of social obligation, to community members who turn to them for information or referral to help resolve basic problems” (p. 336).^[75] The information behaviors that occur within the unaffiliated profile are ranked at a low level in all three information domains in comparison to the professional profile. In the affective domain, information professionals and managers have a facilitating function, whereas conservative community members are seen as having an impeding function because they tend to express opposition to innovation. Metoyer-Duran’s analysis is of interest to the user-centered paradigm because it encourages a view of information-seeking behavior as culturally influenced and interprets it within a social and communicative perspective.

Another attempt at integrating the cognitive and affective domains of users is the taxonomic approach to information-seeking behavior representing Nahl’s research.^[20,71,79,90] The level of integration of the three behavioral domains may be seen in the following example (p. 75):^[80]

These three behavioral domains are interdependent, so that every *affective* behavior is accompanied by related *cognitive* and *sensorimotor* behavior. For example, a student who gets an assignment from a professor suddenly has a new *goal*; to get the assignment done by the due date. Then the student must cognitively *plan* how to accomplish it. And finally *execute* the required steps. Within this global process, many sub-goals and intermediate plans and acts occur. For example, “Search PsycLIT

for journal articles on the topic” is a sub-goal. Within this, there are sub-sub-goals of selecting search terms, planning search statements, and entering them on the keyboard.

This approach contrasts with the profile model used by Metoyer-Duran,^[75] primarily in the specificity with which the information behaviors are identified. The affective-cognitive integration needs to be applied at both the general level (as in Metoyer-Duran^[75] and the microdescriptive level, as in the following illustrations (p. 7).^[91]

1. In the *affective* domain; feeling excitement at a discovery; experiencing stress from doubt; being disappointed after a search; persisting in an effort; taking care to be thorough; being pleased with a quotation; sticking to a plan; overcoming technophobia
2. In the *cognitive* domain; devising a search protocol; deciding to retain a title; summarizing an article; noting a connection; evaluating relevance; rank-ordered preferences; thinking of a productive keyword; using correct command statements
3. In the *sensorimotor* domain; walking to locations; discriminating between symbols; hand-eye coordination; taking notes; noticing presence or absence; copying precisely; operating a terminal; following a map; alphabetizing; following range numbers and guide words; finding information on screen displays

An integrated approach in the user-centered paradigm involves all three behavioral domains at the general and specific levels.

The Novice Searcher’s World

The taxonomic cataloging of user behaviors in information environments, also referred to as the “matrix approach,”^[92] promotes the user-centered paradigm by facilitating the identification of skills and errors that populate the searcher’s world. In a detailed study of some of the psychological factors that are presented in the searcher’s dynamic world^[19,20] seven environmental layers were identified. Fig. 1 illustrates the complex information retrieval environment of the novice; first, the *search query*, which provides an overall context because it is the ultimate goal that motivates the beginning and end of a search effort; second, the *subject headings* and indexes, which limit the universe of searchable topics; third, the *search software*, which imposes particular requirements for operation; fourth, the *point-of-use instructions* and online help, which provide suggestions and examples to facilitate problem solving or troubleshooting; fifth, the *sensorimotor* environment, which determines how users interact with the screen and the keyboard; sixth, the *cognitive* environment of users’ reasoning processes and the formulation of search strategies;

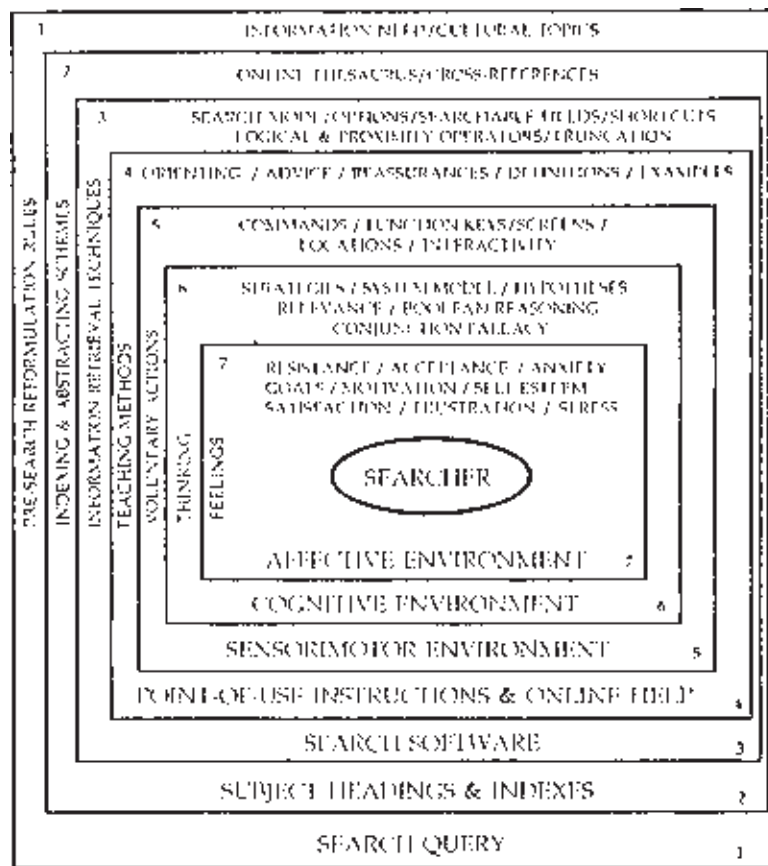


Fig. 1 The searcher's dynamic world.

and seventh, the central *affective* environment populated by users' emotions and motives.

These seven environmental layers envelop searchers and create a dynamic world that the user-centered approach needs to address, individually as well as globally. For example, an attempt was made to address the affective and cognitive environment of searchers through point-of-use instructions that were specifically written to anticipate common problems experienced by novice searchers using a CD-ROM database.^[20] As a guide to developing the language of the instructions, an affective taxonomy was used that lists instructional speech acts at three levels. First, the *orienting* level is intended "to reduce anger and maintain reality check"; for example, "telling what is reasonable to expect" affects whether a searcher is being realistic or is disappointed, and "telling how long it takes (seconds or minutes)" helps alleviate impatience due to unfamiliarity. Second, the *advising* level "counteracts anxiety and builds positive attitudes"; for example, "giving feedback (what will happen if...)" helps alleviate anxiety and builds confidence, and "rank-ordering options or strategies" reduces fear of failure and builds feelings of trust. Third, the *reassuring* level is

intended "to overcome resistance and encourage acceptance"; for example, "affirming principle that users are never at fault" eases acceptance by reducing resistance, and "reinforcing user's perceived self-efficacy" helps users overcome feelings of helplessness and leaves them feeling empowered. Taking care to orient, advise, and reassure novice users helps reduce the psychological cost or operating in challenging information environments.

Affective Management Principles

Other features of the information environment have been identified in support of the affective needs of users. In one study, four principles are stated. First, *affective knowing* asserts that "a procedure is not fully understood until it is performed for some desired goal" (p. 25).^[56] In other words, users learn most when given the freedom to practice searching for topics in which they have some interest. Second, *social facilitation* refers to the strengthening of motivation and persistence when the search is performed jointly with a peer or within a small group. Third, *affective feedback* calls for "manifesting the affective reactions of individuals to themselves" through an attitude scale that

visibly shows where the raters are in relation to their own ideal. This activity “clarifies for them the distance they need to cover to master target skills” (p. 27).^[56] Another method is to help learners correct their errors in feedback sessions to facilitate their continuous striving for improvement. Fourth, *validation* is the process of orienting, advising, and reassuring users so that they can more easily cope with the challenges of the information environment.

Questioning Behavior of Novice Searchers

In the information retrieval literature, user questions are considered to be equivalent to topical information needs or research queries.^[3,93,94] However, the search process plunges users into another parallel domain of information needs (i.e., they need information about searching itself): “The basic underlying assumptions. . . are that question generation arises from an information need and that questioning is a behavioral act to satisfy that need” (p. 95).^[86]

An interesting finding about the needs of searchers was reported by Nahl and Tenopir^[90] who tape-recorded and analyzed every question that seven novice searchers asked a human monitor during five one-hour sessions while searching a full-text database for information on their own topics. More than 1000 questions were asked at an average of one per minute. One-third of these user questions were in the category *seeking confirmation*, defined as a question that contains the answer, so that the monitor always responds affirmatively (e.g., “Is it 3 comma k?” or “So now I want to combine both of them?”). In other words, searchers knew the answers but needed confirmation in order to proceed comfortably. As the authors point out,

From a system-centered point of view it might appear that seeking confirmation questions are superfluous, since no new cognitive information is provided. However, from a user-centered view-point it is assumed that confirmation questions are essential to help searchers persevere instead of quitting prematurely. Searchers need continuous motivation to keep postponing quitting. Confirmation seeking is simply a method for providing searchers with this continuous motivation. It is thus affectively essential, even if cognitively superfluous (p. 282).^[90]

Other types of questions included *formatting input* (e.g., “So what do I press?” or “Do I have to leave a space?”), *search strategy* (e.g., “Is this something I’d want to truncate?” or “What if I just want a picture and this database doesn’t have pictures?”) and *personal chat* (e.g., “Do most people try to keep up with reading all of the [full text]?” or “Can you imagine a bookless library?”). The authors point out that

Some affective system functions now exist in the form of confirmation requests presented by the system after a

command is given, e.g., after issuing a quit application command, the system may present a question. “Really quit? No [Yes].” Others include notifying searchers of what the system is doing during processing time, e.g., “Searching . . .” and “Please be patient, this takes awhile” and “I’m reversing the order of your search terms for a faster search”; and warnings about the possible negative consequences of a search act, e.g., “EDUCATION is a long search” (p. 285).^[90]

In this study, users spontaneously asked a long series of questions throughout their searches that pertained to many aspects of navigating in the system environment. The importance of feelings in the search process became evident when the transcripts of the search session were analyzed.

The analysis of these naturally occurring questions reveals not only the reasoning process of these novice searchers but also the dynamics of feelings, which indexes the users’ hesitations, desire for confirmation, avoidances, fears, and the like. These interact with the user’s knowledge and reasoning to determine the outcome of their external actions. For example, novices sometimes quit a search prematurely without obtaining needed information, when it is easily obtainable through a simple modification in strategy. The present data reveal that *information need* is not unitary: instead, there exists a stream of hierarchically organized information needs (p. 281).^[90]

Affectively oriented questions primarily dealt with the users’ need for continuing motivation to carry out their intentions in the moment-by-moment decision making that constitutes a search. If this motivation wanes, users terminate searches. The human monitor’s response provided the reassurance that searchers were interpreting the situation correctly and performing the right move. *Cognitively oriented questions* dealt with the users’ need to understand results and select search steps. Sensorimotor questions dealt primarily with the users’ need to format input with the correct search syntax and grammar. In both cases, the monitor’s answers supplied the missing information to enable searchers to progress. Nahl and Tenopir call for the development of “affectively oriented system functions” that are more responsive to users in the area of their greatest needs. An awareness of this principle may already be observed in many systems for novice end users, such as the following:

- Providing an option for confirmation request (e.g., “Really quit? No [Yes]”, or “Delete file xx N [Y]”)
- Notifying searchers of what the system is doing during processing time (e.g., “Searching . . .” or “Connecting . . . Waiting for reply . . . Transferring data . . . 23K out of 35K read . . . 12 secs. remaining”)
- Warning about the possible consequences of a search act (e.g., “HISTORY is a long search! DO you wish to specify further?”)

As research on users accumulates, a professional knowledge base will be developed for understanding and serving people's information needs.

Providing a user-centered environment requires an understanding of how users learn and acquire proficiency in information seeking. Three factors have been identified from learning theory that ensure the orderly acquisition of affective, cognitive, and sensorimotor skills, namely, "sufficient motivation, active responding, and reinforcement."^[55] According to this view, information seeking is a complex behavior that is acquired to some extent through the laws of conditioning. Good decisions are automatically reinforced because they lead to positive outcomes. Thus, the sequence of actions that led to the results is strengthened (i.e., it has been added to the learner's repertoire of search behavior skills and is therefore more likely to be repeated as a habit). Positive consequences improve skills, whereas failures weaken the behavior. The information environment needs to address user failure: "The remedy for negative consequences in online searching is to have workable alternatives to continue the search in a new direction. Bibliographic Instruction (BI) can facilitate this by teaching users how to respond to system error messages, too few or too many 'hits,' and other searching problems" (p. 77).^[55]

Uncertainty and Zones of Intervention

As discussed previously, the importance of the affective information environment is fully recognized and addressed in the work of Kuhlthau (p. 187),^[72] who recommends the counseling approach to library services.

The mission of the 1980s was to automate and to network library and information services. Access has been dramatically expanded by automation, networking collections, and databases. Operations for providing information and resources have been streamlined by technological applications. While automating and networking continue to be a priority, the mission of the 1990s, and beyond, calls for services that promote the understanding of ever-increasing amounts of information. A mission of library and information services of the 1990s is to counsel people in the use of resources and information for learning, working, and living. It is no longer sufficient for library and information services merely to provide resources and to offer assistance in the location of materials and information. In the technological age, people require services that counsel them in understanding information and guide them in the process of seeking meaning.

Kuhlthau's central thesis is that vast information pools coupled with rapid technological change engenders unpredictability: "Uncertainty is pervasive in the seemingly certain technological environment. The confrontation between the uncertain person and the certain system requires professional intervention. There is a critical need

for professional counseling in seeking meaning and understanding information" (p. 187).^[72] As pointed out by Morris (p. 230),^[49] Kuhlthau's method is close to Dervin's sense-making approach reviewed above in viewing information seeking as the construction of personal meaning. Cognitive enrichment is preceded by affective uncertainty and followed by affective satisfaction.

Relying on the writings of George Kelly, Jerome Bruner, and S. Vygotsky, Kuhlthau attempts to locate the information search activity within the basic personality structure of the individual. Although Kuhlthau does not use the following specific descriptions, her approach is consistent with this type of behavioral model.

The affective domain drives the information search process through one's awareness of an information need. A person is "driven" to seek answers, and when information is perceived as personally relevant, it is seized upon by the cognitive domain and thus acquired as one's own. The person is now changed because different thoughts and feelings occur. One's conclusions are different (or reconfirmed and strengthened) and one's outlook or mood has changed. This process of personality involvement with new information includes certain feelings and thoughts that are common or universal as psychological processes. These include feelings of uncertainty, confused thoughts, resistance to new information, anxiety, and depression. Individual differences exist in how intense or enduring these processes are, and how well the individual is equipped to cope with challenge and stress.

Kuhlthau recommends various strategies for implementing "a process approach" to information counseling. One important step at the beginning is to help users become aware of the stages of information seeking, especially the reality of uncertainty, confusion, stress, and discouragement. The strategy of "charting" helps users visualize the entire research process, thus making expectations more objective. Seeking meaning is a "constructive process," and ignorance of this process frequently limits the choices people make. This fits with the idea that helplessness is a learned habit, or that self-efficacy beliefs are based on habitual modes of explanations in one's thinking and coping strategies. Kuhlthau emphasizes the importance of "conversing" or discussing with users their research steps throughout the process and not just during an initial consultation period.

Kuhlthau's proposals reinforce Nahl's description of the novice searcher's world as dynamic in both the affective and cognitive domains of behavior. An information need creates a gap between what the user knows and what information is needed to solve a problem,^[96] and as the information-gathering process unfolds, the user's state of mind changes, cognitively and affectively. It is a unique experience in which "the choices along the way are dependent on personal constructs rather than on one universal predictable search for everyone" (p. 9).^[72] To be valid, user-centered approaches must allow for individualization.

Self-Witnessing Methodology

Nahl's taxonomic model, especially its structural integration of levels and domains of user behaviors, is compatible with Dervin's sense-making theory and Kuhlthau's counseling approach to the information search process. These three orientations converge on placing the user at the center and employing scientific techniques for discovering the details of the user's live experience in the information environment. Self-witnessing methodology emerges as a common tool serving objectivity, empiricism, and a theoretical framework, even if still in development. There are three basic characteristics to this behavioral methodology; concurrent self-reports, authentic self-descriptions, and integrated probing.

Concurrent self-reports

A major problem with system-centered "user-centeredness" is that it is insufficiently objective, despite the use of summative rating scales and survey data. It uses categories of measurements intuitively selected by the experimenter in order to obtain global, summarative, and *retrospective* judgments from users. In a major scholarly effort, Ericsson and Simon^[97] fully establish the superiority of *concurrent* reports obtained throughout the time user activity and experience are occurring. *Protocol analysis* involves tape-recording users saying aloud the thoughts and feelings they experience during the task, transcribing the audio, and analyzing it to reveal thought sequences, decisions points, intentions, and reactions. The categories that emerge from such analysis are thoroughly user-grounded, with minimal imposition by the experimenter. They are objective because users are the only source of data for their thoughts, reasons, and perceptions. Reporting on such data as they occur is a natural process of language activity and does not depend on special abilities or training, as illustrated in another major study.^[98]

Authentic self-descriptions

Two reasons may be stated why self-witnessing data are more authentic and useful than data based on summative rating scales or surveys. First, they use natural language expressions, which are more accurate and specific. Second, they are spontaneous responses to the ongoing mental activity and state. However, intermittent probing by the experimenter is necessary in order to ensure relevance and completeness of information obtained.

Integrated probing

Research on the self-witnessing method^[24,97–99] indicates that although the user's self-reports are spontaneous and natural, they are incomplete unless the experimenter

provides adequate prompts. What constitutes adequacy in prompting varies with the theoretical justification of the study. In the taxonomic approach, probes are defined by level and domain, especially the latter. For instance, cognitive prompts elicit rationales for decisions, whereas affective prompts call forth motives and intentions that seek fulfillment from cognitive rationales through sensorimotor executions.

User-Based Behavioral Objectives for Bibliographic Instruction

Within the bibliographic instruction field, the most recent version of the model formulated by the profession is user-oriented in its purpose, attempting to incorporate and "outline the pertinent processes individuals use when gathering information" (p. 257).^[100] However, the model statement of educational objectives for user instruction remains at a broad level of description, in the form of general and terminal objectives. From a user-centered perspective, the model statement needs to evolve toward specifying the actual behaviors performed by users during an information-seeking or -processing activity at the level of enabling objectives. The authors of the objectives recommend that instructors select terminal objectives from the model statement and create necessary enabling objectives specific to local needs. A step toward this elaboration was proposed and involves content analysis of user self-reports (or "structured diaries") that describe one's feelings, thoughts, and actions while engaged in searching.

The self-reports of library users provide access to relevant information about their mental processes as they pursue an assignment. We obtained information on inaccurate assumptions and other errors, on skills learned during the assignment, and on how to improve assignment instructions. Self-reports indicate part of what students feel, think, and do in carrying out an assignment. Such information may be helpful in understanding the nature of library users' feelings, thoughts, and actions. It is an advantage to be able to correctly anticipate user behavior and to communicate adequately with users, accommodating our suggestions to their level and pace (p. 6).^[91]

Nahl-Jakobovits and Jakobovits present a "taxonomy of library speech acts" in the affective, cognitive, and sensorimotor domains to help information specialists develop empirical, user-based enabling objectives in the planning of instruction. The deepening of user-centered consciousness is possible when the information skills of the users are defined as "integrated behavioral objectives."

Bibliographic Instructional Design (BID) represents the new paradigm in B1, a shift from a tool-based library instruction approach to an interactive, access-based approach focused on active learning and critical thinking. BID places an emphasis on the needs and behaviors of

information seekers in complex information environments. B1 librarians have accepted the vital role of teaching people how to interact with information systems, how to evaluate output, and how to gain control of the information environments (p. 73).^[80]

The authors propose a taxonomy of terminal objectives for information literacy that is organized in a matrix of three levels and three behavioral domains. Information literacy begins with *critical thinking skills* (level 1), proceeds to *information retrieval skills* (level 2), and matures in *lifelong learning to learn skills* (level 3). Each level includes affective, cognitive, and sensorimotor learning objectives. For example, affective skills at the critical thinking level (A1) involve “becoming sensitive to the need to evaluate information.” Cognitive skills at the information retrieval level (C2) involve “formulating a question and planning a search strategy. Sensorimotor skills at the learning to learn level (S3) involve “facilitating one’s life through lifelong information seeking and enjoying its rich benefits.”^[80] Similarly, using the matrix definition, all nine zones of instructional objectives are defined. Information specialists can use this taxonomy to plan instruction and assistance that is *integrated*, so that the objectives address the affective, the cognitive, and the sensorimotor domains of user behavior.

From the perspective of user-based design or planning of instruction and assistance, objectives are laid out in a synthetic or developmental order; from over-all goals to general objectives, terminal objectives, and enabling behavioral objectives. For example, a decision to provide an Internet connection in an academic library might lead a committee to decide to provide instruction in how to conduct Veronica searches of Gopher menus. This is a *general* objective. A subcommittee might then consult with other experts and draw up a list of terminal objectives that might include navigating menus, formulating queries, applying Boolean operators, and saving documents to users’ disks. The list of *terminal* objectives would then be assigned to instructional staff to work for locating Internet documents through Veronica searches. *Enabling* objectives at the behavioral level normally require demonstrations, supervised search practice, handouts, charts, the user of online help, and other learning activities. Enabling objectives guide instructional procedures and need to be very specific and detailed. For example

General objectives: Teaching new Internet users to conduct Veronica searches and save retrieved documents to their disks

Terminal objectives: Accessing the Gopher menu; accessing the Veronica screen; formulating queries; using Boolean operations; saving a document

Enabling objectives: Locating Gopher; highlighting Gopher indexes; using line numbers on Gopher menus; canceling a request; selecting possible Gopher titles for

various topics of interest; beginning a Veronica search; devising search terms; using Boolean operators; using bookmarks; using the history function; using commands for saving and printing options; inserting and ejecting disks; and so forth.

Note that as we descend the synthetic tree from general to specific, there is a need to include greater detail. However, from the user’s perspective, the order of learning and understanding is exactly reversed. Users begin with an ability to understand at the level of the enabling objectives. How do I get out of this screen? How do I get there directly? Where did I go before this? What’s the save command? These are their immediate problems and their total focus. The solution to a lack of enabling skills is provided at the next level up, where terminal objectives organize individual skills into the ability to execute complex goal-related tasks. At the third level, users begin to acquire self-confidence in their general ability as an information-literate person capable of sitting down at a terminal and figuring out how to search the Internet. Users thus see *analytically* (from frustrating detail to general know-how), whereas instructors see *synthetically* (from general goals to specific objectives).

Research on the modification of users’ behavior with systems highlights the complexity of the user’s involvement in the information environment. Some researchers perceive the need to consider the whole user and have proposed holistic theories to help safeguard user-centered consciousness in the applied world of system design and user access.

Constructing a Scientific Basis for User-Centeredness

The past two decades have brought user-centered consciousness to the fore; the next few years should yield greater theoretical sophistication and efficiency. Theoretical integration with psychology, education, sociology, and communication is already visible. Table 1 is a summary of the work to date of three researchers who have independently evolved a scientific and empirical orientation toward user-centeredness. The list is not meant to be exhaustive, and other researchers could be included whose work and ideas are compatible.^[12,58,94,96,101,102]

Although distinctly different in procedure and disciplinary grounding, the writings of Brenda Dervin, Carol Collier Kuhlthau, and Diane Nahl together encompass a broad section of scientific research and method giving credence to the expectation of a new user-centered paradigm, effective enough to produce a permanent change in how the information world continues to develop.

The three approaches listed in Table 1 taken together cover the entire spectrum of the user’s universe.

Table 1 Dervin, Kuhlthau, and Nahl: Key Concepts of Three Complementary User-Centered Methodologies

The topic		
Dervin’s sense-making Communication Theory	Kuhlthau’s diagnosis—intervention orientation	Nahl’s self-witnessing behavior model
The main question		
How users assimilate information and apply it to their life situation	What stages users go through and how to assist them in the information-seeking process	What users feel, think, and do during an information-seeking session or task
The main answer		
Empowering users by facilitating information transfer within society	Diagnosing user problems and intervening with particular information services at the appropriate stage	Instructing lifelong novices to acquire integrated behavioral self-modification habits
Key concepts		
• Constructivism • Information as clay versus brick • Observer versus user constructs • User-based user categories • Relativistic information framework • Searching filling an information gap • Knowledge as information transfer • Information exchange as a communicative act	• Constructivist personality theory • Searching is seeking meaning • Longitudinal stages in the information search process • Attention to affective and cognitive needs • Overcoming uncertainty and information anxiety • Zones of intervention for information services • Information counseling	• Integrated ACS information unit • Self-witnessing method • Affective micro-information skills • Teaching self-regulatory information speech acts • Modifying self-efficacy beliefs of searchers • Planning user-based behavioral objectives • Lifelong novicehood and information literate novices

Dervin: How users assimilate information in reaction to their life situation

Kuhlthau: What challenges users go through in the information search process and how to assist them in life-long information seeking

Nahl: What users feel, think, and perform during information sessions or tasks.

Dervin’s conceptual basis lies in the mechanisms that tie the social setting to the individual’s mental framework. Information is not so much a fixed resource or product as a social occasion for communicative exchanges between author-producer and user-consumer. Information is what consumers use to alter their life situation. Affective needs reveal cognitive gaps that propel the person to seek, whereupon one seizes what seems relevant and meaningful; that is, what will make a difference in one’s situation. This difference translates into acquiring understanding, changing attitudes, solving problems, constructing interpretations, or becoming more persuasive with friends or employees. Dervin’s descriptions of the information user or consumer make it clear that we are all information seekers and consumers. Being a user or a novice is not a demographic category or personality factor, it is a continuous lifelong process, a state of operating that we all must regularly assume as part of our societal functioning.

Kuhlthau’s conceptual basis is grounded in a psychological maxim. People seek meaning in life, and information seeking is driven by this deep need to make sense out of reality, to attribute causes to events, to hypothesize about what might be. But there is a turmoil associated with

this reality construction because events change or new forces and constraints come into being. With mounting pressure to know, analyze, and decide, one is thrown into states of confusion and uncertainty, sometimes with such intensity that the individual may withdraw or resist further information seeking. The syndromes of technophobia, infoshock, and avoidance can be scientifically studied and cataloged. With knowledge of the stages that users go through, information professionals can provide effective assistance by accurately diagnosing the stage a user is in and intervening with appropriate affective and cognitive facilitation procedures.

Nahl’s taxonomic self-witnessing contributes two basic ideas from behaviorism: first, that thoughts and feelings are behaviors like motor actions; and second, that the three domains (affective, cognitive, sensorimotor) are exhaustive and integrated categories of human behavior. During a search session or activity, users produce a continuous stream of goal-motives, reasonings, and coordinated sensorimotor executions. This stream of behavior is hierarchically organized with goal-feelings directing cognitive sequences that explode into overt decision and action. Behaviors are organized into habits that serve goals and situational demands. They can also be changed by using appropriate behavioral modification techniques such as modeling, imitation, role taking, self-witnessing, instruction, and communication.

User-centered instruction and management needs to view the target behaviors of users guided by bibliographic instruction design that addresses all three domains of human endeavor. Being optimistic about search outcomes

and feeling enthusiasm for one's successes are *affective skills* that can be targeted as behavioral objectives in instruction and measurement. Doubting oneself, avoiding technology, and feeling depressed or overwhelmed in an information crisis are routine affections, cognitions, and acts that respond well to self-modification attempts through self-regulatory speech acts and social support. Higher motives have a controlling influence on lower motives, and users can be given self-witnessing tools to help them become aware of the negative and positive learning contingencies in their information environment. Such tools include inventories of the skills and errors users frequently make in specific situations, along with taxonomic descriptions of information states, stages, and processes.

THE FUTURE OF USER-CENTERED APPROACHES

User-centeredness became visible with policy, was advanced through methodology, and eventuated in a new theory, a new view of the global dimensions that impinge upon users. As policy, user-centeredness continues as an organized affirmative-action-like program attempting to reverse the user-unfriendly atmosphere of the system-centered information environment. This includes the sphere of legislation, planning of services, and the education of professionals. As methodology, user-centeredness has evolved a wide range of measures for user factors in the information equation. Three degrees of shifts have occurred. Nearest to the system-centered orientation are user data obtained through rating forms, survey questionnaires, and interviews. Further along, and closer to users' search activities, are transaction logs, journals or diaries, and longitudinal case histories. Closest to user-centeredness are concurrent think-aloud protocols and directed self-witnessing reports, including rating scales, if used concurrently, about one's actions, thoughts, and feelings throughout the search process.

As theory, user-centeredness has evolved an entirely new range of explanations of what it is like to be users and how to manage their needs. Cognitive science, communication theory, and educational psychology each play visible roles in the development of the user-centered paradigm. The *cognitive science* influence is a source of knowledge for understanding how users think within the information sphere, including how they solve problems, how they make decisions, how they represent systems conceptually to themselves, how they deal with special terminology, and what errors they are prone to make. Influence from *communication theory* continues to evolve a transactional perspective on information as a subjective, creative, or constructivist accomplishment. The information gap that users face with disturbing feelings of uncertainty demands an existential confrontation with oneself and the world of

information. Managing this world for users is unavoidably involving to information professionals, demanding an activist mind-set that pursues, probes, and guides users through various types of interventions.

The influence on user-centered consciousness from *educational psychology* may be seen in the *taxonomic* approach that relies on behaviorism as a means for studying thoughts and feelings in an objectified manner. The matrix approach attempts to identify the simpler components that make up the complex. It relies on two basic concepts known to educators and psychologists, namely, *levels of development* and *domains of behavior*.

User-Centered Principles

Summarizing the trend of the past two decades, the following user-centered principles have emerged.

1. *Counseling interventions.* Information professionals can operate more effectively as information counselors than simply as information providers.

Acknowledging the wholeness and integrity of users as human persons consists of providing affective support within cognitive information transfer.

Understanding users consists of recognizing the common experience of a *predictable cyclic process* feeling challenged, reacting with infoshock and resistance, accepting assistance and redirection, viewing one's progress with satisfaction, and feeling restored and empowered. This up-and-down cycle recurs many times within a search effort, and managing its natural evolution with every user is the routine business of information professionals in the new paradigm.

2. *Role taking.* Information professionals can gain a more developed consciousness of user-centeredness by role taking, or putting themselves in the place of users.

Role taking is a major concept in social psychology and communication. Taking the steps that users go through, coming up against the same barriers users must cope with, overcoming blocks, feeling overwhelmed by too much or too little information—these are useful experiences that may help information professionals tune in to user perceptions. One approach is to search for information that is personally relevant and observe the process from beginning to its resolution, if ever. Information professionals need to be users and searchers on a continuous and lifelong basis. Another approach is to participate in a group exercise of role taking in which one professional assumes the role of user, a second takes the role of the librarian, and the third acts as an observer who provides feedback afterward for a discussion of the interaction. The three then exchange roles.

3. *Discourse management skills.* Information professionals can be more serviceable by acquiring

discourse management skills such as interviewing, negotiating, counseling, and reformulating.

Examples include the use of open questions to avoid premature closure, to personalize the topic, to ask follow-up questions, to identify where the user is in the information search process, and to identify the user's area and level of information need.

4. *Follow-up services.* Information professionals are user-centered when they follow up on user activities in an attempt to establish closure.

Following up on searchers completes the cycle of assistance. It is the recognition that users are real people who need to go through actual steps. Creating a link back to the information professional may be critical to ensure accuracy, success, and satisfaction for users.

A deeper understanding of user-centered consciousness may be gained by applying humanistic principles to the design of the information world. A well-known approach is that of Carl Rogers, a founder of the humanistic psychology movement.^[103,104] A basic tenet of this approach is that humans have an inborn need for *positive regard*, which is to receive sympathy, care, and acceptance from relevant sources. Out of this need to receive positive regard from others, we evolve the need for *positive self-regard*, which manifests itself as holding favorable self-perceptions. A problem arises when the positive regard others give us is constrained by *conditions of worth*. For example, children learn that they can have their parents' love and respect only if they behave in accordance with their parents' wishes. This conditional acceptance helps develop the children's conscience. At the same time, however, it leads to internalization of unfavorable self-assessment. One's perception of self-worth suffers and frequently leads to maladjustment such as alienation, anxiety, denial, and self-blame.

Rogerian therapy attempts to remedy this state of mind by giving clients *unconditional positive regard* so that they might experience positive self-regard even in failure. To reflect this orientation and commitment to the client, Rogers termed the approach "*client-centered therapy*," also referred to as *nondirective therapy* because it encourages clients to solve their own problems within a proper atmosphere. It involves the attempt to understand clients' *internal frame of reference*, which includes their thoughts and feelings in their struggle to cope. If we substitute "searchers" for clients, and "librarians" for therapists, we can summarize the Rogerian form of user-centered instructions in the following five additional principles.

5. *Affective contact.* Information professionals and users must be in affective contact; that is, they must express to each other the relevant feelings that the search environment evokes in both. Instructing must therefore

have an affective component explicitly dealing with the feelings engendered by the search environment.

6. *Incongruence or uncertainty.* Information professionals can gain a deeper understanding of searchers when they perceive them as being in a state of incongruence or uncertainty, needing to succeed while lacking sufficient knowledge.

User-oriented management of the affective information environment will take steps to legitimize the searcher's negative or stressful psychological state by presenting it as an ordinary problem created by the setting requirements rather than by the searcher's deficits.

7. *State of congruence with users.* Information professionals are in a state of congruency in relation to searchers when they accept searchers' weaknesses and ineptitudes and at the same time desire to help searchers acquire positive self-regard.

To be "accepting" simply means to acknowledge such insufficiencies as normal at the beginning, with routine remedies in the form of assistance, exploration, and instruction.

8. *Empathic understanding of users.* Information professionals can acquire an empathic understanding of searchers' internal frame of reference.

User-centered instruction or assistance takes the point of view of the searcher instead of the system. To do this adequately, research will have to discover empirically what users' cognitive and affective needs are while searching and build responses to these into systems.

The dynamic pace of change in the information world has spawned a new status for those who actively strive to work within information structures, that of the "perpetual novice."^[105]

9. *Lifelong novicehood.* The greening of the information world will have arrived when information professionals fully acknowledge the primary reality of the information environment i.e., novices will always be with us.

The recognition of this reality does not come easily, even for sophisticated observers. For example, Morris^[49] analyzes the role of expertise in the process of knowledge transfer, and refers to a study by Kaplan et. al.^[106] that tries to identify the differences between experts and novices in various disciplines. A major conclusion is that "experts are not experts by virtue of some generic problem-solving skill, but only in their knowledge of a particular content domain" and that "the way in which experts initially *perceived* a problem is what distinguishes them from novices; how they proceed after the problem has been set up was not significant" (p. 29).^[49] There is a general tendency on the part of information specialists to assume that the quicker we get rid of novices in the information world the better it will be, as if novicehood were a temporary state to be ended upon the completion of the

instruction. In addition, many believe that as computer literacy becomes more widespread, very little instruction in system use will be needed. There is as yet an insufficient consciousness among many professionals of the reality that *novicehood* in the information world never ceases.

In the mid-1970s, librarians were discussing whether or not patrons and researchers would want to do their own searching on the commercial information-retrieval systems and whether that would be a good idea. The end-user revolution is now behind us, and its character is beginning to unfold as an unprecedented number of people are attempting to operate on a daily basis within a rapidly evolving technological environment—so rapid that a new social phenomenon is occurring; we find that even as information professionals we are all novices all of the time, struggling (intellectually and emotionally) to learn, keep up with, and operate the latest versions of multiple systems, continuously adding new systems to our repertoire.

We need to understand this organic change in our information environments. What does it mean for a person to forever be a novice, to never know a system completely, to discover after months of use that an unknown easy shortcut could have saved much effort, to be deprived of support in acquiring system skills? Who does not feel this on a regular basis, whether it is students learning to search online catalogs and databases or librarians exploring Internet search engines? Are hackers and computing facility administrators exempt from “the state of novicedom?”

Information-literate novices

The information age has created a new status for users that may be referred to as “lifelong novicehood,” an expression that represents the reality for most people who are intermittent yet steady users of the information superhighway. The kaleidoscope of networked information systems requires novices or intermittent users to actively participate in the successful operation of these evolving systems. This interactivity requires *information literacy* because it involves a variety of information-management skills, including the following:

- Figuring out screen instructions and command option lines
- Understanding the notion of canceling a command
- Constructing a viable cognitive map of the system
- Maintaining routinized checking procedures for typing accuracy
- Paying close attention to command structure, spacing, and shortcuts
- Keeping notes that are retrievable when needed
- Retrying operations with slight modifications and refinements until they succeed

Before the advent of user-centered consciousness, the idea of “being information literate” and the idea of “being a

novice” appeared contradictory or mutually exclusive. However, although we see ourselves forced to assume life-long novicehood, there is no substitute for information literacy, and this has rightly assumed a topic of importance among bibliographic instruction specialists.^[80] As the user-centered revolution passes the point of no return, the information world is endeavoring to restructure in order to create a user-friendly environment for information-literate novices. Without information literacy, novices cannot function.

The Perpetual Novice

Currently, in libraries, campus computer labs, and computing center units we can observe confusion, inexplicable technical delays, and intractable passing of the buck regarding who is supposed to know what. This reflects the reality that technical and administrative experts in the information world normally operate in a mode that appears very much like the way novice users operate. This is because the hardware and software they get used to are frequently updated and made compatible with new hardware and software. Experts in the computer world can never stop having to learn a new system, thus being a novice user of it. The challenge of working out compatibility in each unit or location is intense, as is evident from newsgroups for systems directors and information professionals. The principle that novices will always be with us is thus an outcome that is a feature of the structure of the information world rather than of the mental state of users. The information world has the inherent character of changing at a rate faster than users can assimilate. They are thus in a perpetual state of information shock. User-centered consciousness can come of age by promoting an information environment that is designed for “the perpetual novice.”

Novices may take two paths one of which—if carried to its logical extreme—may lead to a “happy hacker” mentality; while the other path may lead to a state of being which I call “the perpetual novice.” In effect, I am saying that regardless of “how” you classify yourself when you first begin to learn the technology, some of you may overcome whatever reluctance you may have had initially to become enthusiastic users of these services, while others of you will begin to (or continue to) show some reluctance about this mode of communication in perpetuity. Ultimately, the latter group may turn into “perpetual novices” who “must” use the system for work and will do so, while still keeping empathy with the newbies. You may find yourself in that position because of your job requirements or social requirements or even an internal driving force that keeps you wanting to learn about new technologies though you know you will never grasp it all. Many things in this field (specifically speaking about telecom) and in our society are rapidly changing and one can find it difficult if not impossible to keep up with everything. I find the term “perpetual novice” or “perpetual newbie” very applicable

to myself. Partially due to my job, mostly due to my own curiosity. I am always finding myself in a game of catch up, even when teaching others my new “discoveries.”^[105]

A GRADUATE STUDENT WROTE

I think I approach anything computer-related from the perspective of “goodie, here’s a new challenge!” I always like playing or working on computers. Basically, the more “user-friendly” the computer is, the more I hate it!! I like the old low-level archaic systems. For example. I like MS-DOS. Unix shell, and OS/2’s shell. I hate Macs. . . I think part of this comes from a “hacker mentality,” whereby you think you are doing some wickedly complex scheming quite easily. Others get the impression that you are some kind of “wizard.” The whole thing comes back to bravado. I get really excited when I get far into a system, especially if I think I’m not supposed to be that far under the system.^[105]

In the last analysis, it seems, hackers and novices differ only in self-image. There is no big mystery about the expert and the computer hacker—they just never give up! Lifelong novicehood creates new kinds of challenges for information professionals because nothing can be taken for granted about what particular users may already know. An illuminating expression of this dilemma was posted to the bibliographic instruction listserv Bibliographic Instruction List (BI-L) by Rick Newell of Washington Library Network (WLN) in the fall of 1994.

This is going to sound like a very strange question: Do any of you ever give instruction on how to press keys on a computer keyboard? I do training for library staff (including clerks, paraprofessionals, and librarians) on Internet, online searching, etc. I just assume that everyone knows how to press keys, but I’m starting to conclude that this isn’t true. Sometimes people will hold a key down too long (especially the “enter” key), and of course the function of that key repeats, and they get unexpected results. Or when I tell someone to press “Control-C”, they don’t always know that means to hold “Control” and press “C”. Some people don’t know that F1 is function key 1, not “F” followed by “1”. I’ve always said I would like to quickly move beyond teaching “which key to press” and talk about more interesting things like search strategies, but I’m starting to think that perhaps more instruction is needed in the mechanics. I could point out all these “which keys to press,” and “how to press them” things at the beginning of each class, but I’m afraid that people who are already experienced computer users will be offended. Probably most BI-L subscribers teach college students who already are familiar with computers. Any comments??

There exists a wide range of experiences and skills across user populations; still, the majority of novice searchers are also novice computer users.

Surfing Versus Searching

We can gain a deeper understanding of what is user-centered by studying the growth of the Internet as a natural or cultural phenomenon. The spontaneous development of homepage architecture on the World Wide Web is an expression of the user-centered revolution. Through its worldwide telecommunications network, the information superhighway functions as a physical scaffolding for virtual cyberspace. Users are now *navigators*, and “cybernaunts,” a status equivalent to the *information literate novice*. It is now expected that an information-literate user can approach a terminal, launch an application such as Netscape, and begin exploring the multimedia global network of the World Wide Web. Visible command buttons on the screen and standardized pulldown menus allow the first-time information-literate user to surf around in cyberspace, traversing time and geography, hopping from hypertext links placed there by other cybernaunts eager to serve as travel guides and commentators. The term surfing expresses a certain freedom in navigating or gliding around at will, deciding to follow a link purely on the basis of a momentary attraction or curiosity, and backing out of it, retracing steps, or going on to new places. Although traditional search functions are available, browsing is the primary method of navigation on the Web.

Electronic Bookmarks

A truly user-centered feature of cyberspace is the universal availability of navigation *browsers* with hypertext capability that have two basic functions. One allows users to *navigate* by hopping from link to link at will, and the other allows users to retrace their steps in a variety of convenient ways. For instance, the bookmarks facility in many multimedia browsers on the Internet permits users to save any address of any location they travel to by creating a permanent personal address list that they can activate at any time and search, thus providing a permanent record of one’s travels through cyberspace. The bookmarks list is “hot” in the sense that one can select and click any item and be taken to that address location again almost instantaneously. This function is user-friendly and allows serendipitous browsing and collecting of links to be revisited and explored more fully at other times. In effect, the bookmarks facility for hypertext networks such as the World Wide Web permits users to create personalized indexes, catalogs, and personal information retrieval systems almost effortlessly and without advance technical skills.

Clearly, the next stage for end users is creating individualized information-retrieval and delivery systems on the Net. Many end users are already providing information services for themselves and interested others on the Web in the homepage format. Homepages permit end users to design information presentation, retrieval, and delivery systems tailored to the owner’s expertise and topical interests.

In cyberspace, everyone is an expert in self-defined specializations. “Websters” create personalized calling cards, resumes, family histories; they impart their knowledge on subjects, point visitors to other related or interesting sites, or provide a service of some kind that visitors may request. For example, Tony’s Bad Style homepage presents his evaluation of homepages that he visits. He makes it his business to travel the Web, critiquing homepages because he is interested in developing acceptable quality control standards for homepage structure and content and hopes to influence others with his prescriptive analyses. Some other examples include homepages dealing with selling products and services (e.g., magazines, advertise their print versions; record companies display pictures and bios of artists and you can hear part of a song; and shopping malls of various types are advertised), emotional support, searchable directories of visual artists with pictures of their works, gardening advice, home-buying advice, confessions, and a catalog of useless sites (like litter on the information highway). End users may also receive mail from visitors and have them fill out questionnaires directly on their homepage.

Navigation history

History is another user-friendly function of hypertext browsers that keeps track of every document one has accessed and highlights that link in a special color, irrespective of where the link occurs. World Wide Web indexes and documents each have unique access locations known as URL (uniform resource locator) addresses. When browsers click on a hot link that appears on a Web “page” (or screen), the client browser (e.g., Netscape) accesses that URL location through live telecommunications lines (telnet, FTP, etc.). The same URL address on a link can appear anywhere on anyone’s homepage or document. In addition, when one creates a link, one can choose any title or description for it as long as the URL address is the same, in other words, the same document or index page appears under many different titles or descriptive annotations throughout cyberspace. The history function shows users what pages or documents they have already seen at least once, even though the link names or titles are variable or entirely different. This is user-friendly because it allows greater control over navigation and helps users avoid endlessly reviewing the same material. With the history feature, the same document or file has a variety of different names, but this is an advantage, because it allows multiple independent access to the same information, not unlike cross-references in thesauri and subject indexes.

Personalized subject indexes

Another user-friendly feature of Web browsers allows novices to instantly construct individualized subject indexes on any desired topic or activity. Standardized subject indexes are easily accessed by clicking a link and are

maintained and updated as a free service from many sources on the Web—academic, commercial, and individual (e.g., Yahoo, Whole Earth Catalog, InfoSeek). These are user-friendly and contribute to more orderliness on the Internet. First-time users may also click on Netscape’s search button and type topics in natural language (e.g., automobiles, skin care, cats, museums, or Hawaii). Within seconds, a new document appears on the screen as a subject index containing hot links to addresses that relate to the specified topic. This list can be saved as a permanent file and one can collect as many as desired. Within minutes, a first-time user can create an individualized database on a topic for personal use or for the use of others.

Forces Against the User-Centered Revolution

It may be surprising to have to raise this issue, and yet familiarity with the information world today reveals the existence of social forces that act to divert or retard the user-centered revolution. Four such counterproductive influences follow.

Technophobia

It is ironic that many people experience an aversion to or fear of computers, because the user-centered revolution is taking place in an electronic information environment. Although unpleasant, this is nevertheless a normal affective response in human–machine interaction in the early stages of becoming information literate. The ability or skill to overcome technophobia is part of the repertoire of the lifelong novice. There may, however, be large individual differences in the time it takes to acquire self-confidence as a searcher or navigator, and there are conflictual and emotionally challenging intermediate states. User-friendly systems and affectively oriented instructions can ease the transition; yet being lifelong novices, people may regularly regress into technophobia when the old repertoire does not work with a new system. The kindly management of generalized technophobia remains a central goal of the user-centered paradigm as more and more novices of all ages and backgrounds begin to participate in the cyberspace world.

Information shock

A second counteracting force is *infoshock* or the emotional reactions of feeling overwhelmed by unfamiliar and complex information. Experience in an academic setting shows that students learning to use the Internet as a course-integrated assignment go through weeks of frustration, anxiety, and even depression. These are their reactions to being pressured by course deadlines while being challenged by what seem to be information deadends. Research is needed to discover effective techniques for managing users’ experience of information shock in the electronic environment.

Information illiteracy

If lifelong novicehood is to be endured by users, they need to be given *metatools* that empower them to operate by systematic trial and error instead of semirandomly or illogically. Information literacy skills provide users with the prerequisites of how to read instructions, evolve mental maps of systems, keep notes that are needed later, check one's typing, retrieve, filter, and evaluate information, and retrace one's electronic steps. Lacking these skills, information-illiterate users may be overcome by technophobia, discouragement, and avoidance. Information illiteracy creates an insurmountable barrier, defeating the gains of the user-centered revolution.

Maintenance cost

As the Internet grows, the cost of running it and keeping it user-friendly becomes a potential threat to the user-centered revolution. For instance, nonacademic users pay a monthly access fee and cumulative connect time. The latter cost can exert a prohibitive pressure that interferes with the convenience of browsing freely without undue concern for how long one can stay on a screen. In addition, millions of users have already moved past the navigation state to full-fledged membership as World Wide Web homepage owners. Millions more will follow. This means that one must rent disk space on a Web server. The space issue becomes potentially prohibitive even with academic and professional users who receive Internet services as part of their job setting. As more people begin to own virtual real estate in cyberland, space and traffic becomes forces that threaten users' ability to explore and build the virtual information world.

User-Centered Consciousness in Cyberspace

The rapid development of the Internet would not have been possible in the absence of the user-centered revolution of the past twenty-five years. Driving the mass explosion of the information world are entertainment technologies and information services. There is a sensitivity to "customer needs-based networking," as described by one commentator.

The newest mandate for the online information networks is to develop applications for the general public. This is the message conveyed by the feverish superhighway activity in Washington, DC, by the new commercialism cropping up everywhere on the existing networks, and, forcefully, by the joint venture takeover frenzy in the cable, broadcast, entertainment and general communications industries. The new dawning is focused on the great masses of potential general users, who so far never have experienced the joys of telnet, and perhaps never will have sufficient time, energy or interest to appreciate its more arcane beauties (p. 12).^[107]

Because "the new dawning is focused on the masses," it is thoroughly steeped in user-centered consciousness. But note a certain pessimism about users who "never will... appreciate its more arcane beauties." It may be better to work with an orientation that strives to eliminate arcane beauties and make them openly accessible to all novices. As more novice users join in, there is a growing need to demystify the Internet.

The cyberspace of the Internet has the potential to empower users by providing a public platform for individuals to display and share their expertise in a wide variety of areas (e.g., dog care, computer systems, racing cars, emotional support, poetry, and recipes). This explosion in self-publishing permits unprecedented self-expression and creativity, and mirrors the exponential growth of end-user computing. In these early days in the cyberspace community, a characteristic phenomenon is the willingness of so many people to post detailed answers to strangers' questions on electronic bulletin boards and discussion groups. One may wonder what motivates this kind of public spirited, "gift giving" effort. One webmaster who was asked this question said that he responds out of a sense of mutuality and identification with other webmasters who are stumped by some technical problem to which someone else may have found a solution. "The whole thing would stop working if we didn't come to each other's rescue," he insisted.

We are at the threshold of achieving universal access to the global Internet infrastructure. It is an exciting historical time when cyberspace communities on the World Wide Web are being founded in all departments of societal information activities—educational, scientific, governmental, cultural, commercial, artistic, and personal. Homepages of all types and functions spring up literally by the hour! There is a frontier spirit of pioneering and innovation that parallels population forces that brought immigrants to the new World and adventurers out West. The new attitude is thoroughly steeped in user-centered consciousness because *the cyberspace revolution is the user's revolution*. Hackers, net potatoes, scholars, students, marketers, consumers, publishers, public officials—these and others make up the Internet. They have all unwittingly taken on a new status, that of lifelong novicedom.

Community-Building Forces in Cyberspace

Just as there are social forces that counteract the user-centered revolution, those that operate in the progressive direction are no less vigorous and impressive. Two are mentioned here.

Cybersocialization forces

It is remarkable to observe the positive social forces that operate within the user-centered electronic revolution. *Cybercommunities* are virtual in the sense that they are

independent of place, geography, and even demographic variable. One may wonder what motivates thousands of people to build up the virtual architecture of cyberspace. Professional and commercial motives have not been among the principal initiating forces in the evolution of networking.^[108] Today, a search on “homepage” yields many more individuals, families, and membership clubs than businesses or institutions. We are currently on the threshold of an explosion in homepages and homepage development services. One educator has created a “generational homepage” involving new students every semester in a virtual learning community that produces an unending virtual superdocument on the topics of the courses.^[109] It is easy to imagine families producing and maintaining elaborate generational genealogical homepage multimedia scrapbooks on the Web, complete with home videos and family travelogues.

The homepage phenomenon can be seen as an expression in cyberspace of the spirit of frontier development. Librarians and information professionals will no doubt become involved in working with individuals, faculty, students, and community members to develop their own homepages for presenting and retrieving online information. This is a natural outgrowth of the traditional reader service, as homepages are personalized information delivery systems with resources collected by and for the individual. For example, faculty members may ask librarians to assist them in creating homepages for particular courses that include useful Internet addresses, the full text of course materials and lecture notes, and model student assignments.

Freedom

Surfing the net has become a technological expression of an individual's inalienable right to pursue happiness. Internet technology allows one to pursue only what one desires. Attraction is the decision point for traversing a path (or not). Just as people loved the advent of highways that allowed them to take off to wherever they pleased, today the information superhighway provides people with the new freedom of browsing where they will. Furthermore, social contacts in virtual reality take on new dimensions of freedom previously unattainable in human experience. *Cyberpersonalities* and “virtual selves” allow users to strip themselves of their regular identities and perhaps shed some inhibitions in the process. In cyberspace, everyone is an actor who can play different roles of choice and even become famous. This tendency to develop anonymous personas has been the focus of a warning cry in political places with the consequent promotion of regulation and legislative oversight of the Internet.

Roles of Information Professionals

Some in the field see that user-based methodologies can create new forms of data on library use that provide

opportunities “to redesign libraries in fundamental ways” (p. 301).^[110,111] The end-user revolution has engendered new roles for information professionals that place them directly within the sphere of user concerns. The trends toward creating information that exists only online, creating machine-readable text of older books, articles, and images, and providing online access to current text and information services, along with the online self-publishing explosion establish the new technological milieu for information professionals. With the advent of new research methods, the knowledge base on end users has grown and has focused on their inner world, establishing the new psycho-social milieu. The evolution in user methodologies represents a graphic shift in perspective on users from the retrospective, summative, distal data of surveys, to the concurrent, formative, proximal data of ethnographic methods. At this stage, theoretical integration of these approaches will promote a holistic approach in the further creation of the information environment.

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User-Centered Revolution: 1995–2008

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Abstract

This entry reviews a sample of current research on information behavior (IB), examines recent research on online IB and use of electronic resources offered in libraries, describes the state of user-centered design, provides evidence of a commitment to the user-centered paradigm in library and information science research and education, and presents the response to the unprecedented rise of online participatory culture.

INTRODUCTION

In the past two decades, the field of library and information science (LIS) has become increasingly multidisciplinary in theory building, research focus, methodological sophistication, and praxis. Library and information science programs have diversified their faculty, programs continuously update and create innovative curricula and degree offerings, and researchers collaborate with and borrow from communication, anthropology, cognitive science, and computer science among other disciplines. A “user-centered” individual, organization, business, locale, or system must focus on discovering and responding to actual wants and needs of the people determined to be the users. To that end, researchers and system designers have developed and adapted methods to obtain relevant details of user behavior in order to improve systems and services. A previous entry, “The user-centered revolution: 1970–1995,” traces the origins of the user-centered focus to a shift in clientele from experts to novice end users.^[1]

The user-centered revolution in library and information science was generated by the general availability of search technology for novice end-users who rapidly out-numbered experts and intermediaries. The needs of this new class of searchers have changed the priorities in the information environment. In response, researchers have developed new types of data that more closely represent users’ actual experience with systems. This interest led to an evolution in the methodologies applied to user studies over the past 25 years [1970–1995], from survey questionnaires and feedback forms, to interviews, journals, logs, and case histories. The development in methodology represents a shift in focus from gathering anonymous, statistical data on users, to individualizing users through ethnographic and psychological approaches.

The present entry reviews a sample of the LIS literature that treats user issues since 1995, with emphasis on topics

concerning the emergence, rapid expansion, and full integration of the World Wide Web into social life and work. This brief period has experienced unprecedented penetration of the user-centered paradigm. The literature reveals that by 2001 the user-oriented perspective had entered every LIS subarea.

The trend toward user-centeredness is termed “revolution” because software engineers and interface designers produced applications and systems experienced as hostile by many users. The computer revolution was brought about by technologists, however, as computer use expanded to the population at large, an increasing proportion of users found themselves in frustrating states of mind marked by puzzlement, anger, phobia, and helplessness. The computer engineering field was slow to address these user reactions and concerns. The general attitude toward “end users” was that improving their computer literacy skills would solve their problems. While the software and interface environment was experienced as psychologically hostile and unfriendly to millions of users, it was not recognized that systems were responsible for user-problems. By the time the Internet became popular in the mid-1990s “usability testing” had become a standard subject in interface design courses and texts. When software engineering adopted the human factors maxim of fitting technology to people instead of requiring people to adjust to technology, the burden of making systems work for people shifted to the designers and the user-centered revolution was underway. One indication of the deepening of the user-centered revolution is the dramatic upsurge in user-centered language in disciplinary databases and on the Web.

User-Centered Language

Earlier reviews of the print and online literature concerning the user-centered revolution covered material containing a variety of user-focused terminology.^[1] Table 1 shows that since 1970 the internalization of a

user-centered philosophy has given rise to continuously expanding user-oriented concepts that highlight the activities of interacting, experiencing, and participating online. Google searches were conducted on the terms used in the earlier print and online literature concepts and some related terms. Table 1 supports the conclusion that user-centeredness has become an essential concern to system architects in every content area.

Terms relating to user factors continue to proliferate, with 19 new terms added for the period 2001–2008 to the original set of eight terms in Table 1. In 7 years occurrence of the term “user friendly” increased from nearly 1.5 million to nearly 28 million postings, while “user centered” also grew from 33,000 to nearly a million by the end of 2008. Other terms with very large postings include usability (23 million), user experience (11 million), user defined (8 million), user generated (6.5 million), user created (5.6 million), customer experience (4.5 million), user contributed (4.5 million), and user input (2.8 million). On

<http://www.amazon.com>, 2051 titles appeared under the subject “Web usability” in December 2008, more than 30 times the 67 “usability” titles offered in 2001. The term “user-centered” retrieved 2569 titles in December 2008. The list in Table 1 is not exhaustive, and while search results are dynamic the increasing trend continues. A full analysis would yield many more related terms that emphasize a user orientation, and a requirement to pay attention to what people actually do while using systems and operating within information environments (IEs) in order to support, augment, and enhance their activities.

This entry reviews a sample of current research on information behavior (IB), examines recent research on online IB and use of electronic resources offered in libraries, describes the state of user-centered design (UCD), provides evidence of a commitment to the user-centered paradigm in LIS research and education and in libraries, and presents the response to the unprecedented rise of online participatory culture.

Table 1 User-centered terms: A comparison of early print literature and the Web

Print literature 1970–1995	Google.com September 2001	Terms searched within quotes	Google.com December 2008
user-centered	33,000	user centered	909,000
user-friendly	1,400,000	user friendly	27,700,000
user-based	34,000	user based	743,000
user-oriented	32,000	user oriented	435,000
user-responsive	800	user responsive	855,000
client-centered	22,000	client centered	828,000
human-centered	18,000	human centered	409,000
people-centered	13,000	people centered	189,000
	570,000	human centered	111,000
	251,000	user defined	8,000,000
	41,000	user needs	2,230,000
	595,000	user perspective	1,060,000
	39,000	usability	22,900,000
	18,000	usability testing	803,000
	6,000	user testing	962,000
	8,300	user evaluation	90,900
	16,000	usability evaluation	154,000
		usability engineering	223,000
		user centric	404,000
		user driven	626,000
		user created	5,660,000
		user generated	6,500,000
		user contributed	4,560,000
		user input	2,830,000
		user determined	83,800
		patron driven	6,290
		user experience	11,300,000
		customer experience	4,540,000
		user interactions	443,000
		interaction design	1,930,000
		user experience design	283,000
		user centered design	406,000
		user centered web design	6,250
		participatory design	172,000

DESIGNING HUMAN-CENTERED IES

Several large studies have produced findings to guide the continuing design of the IE. The IE includes all physical and online settings where people are engaged in the perusal and/or exchange of data, images, text, information, or knowledge, including details about anything in life such as work, events, beliefs, imaginings, relationships, health, entertainment, etc. An IE may be grounded in technological affordances such as computers and other telecommunications devices, or a self-contained setting such as home, library, school, home improvement center, physician's office, hair salon, neighborhood coffee house, or any community setting. The studies reported in this section reveal major trends in IB made visible through enormous and mushrooming public use of the World Wide Web over the past 15 years. The following top trends for libraries emerged in recent studies of user behavior, including users of public libraries, academic libraries, school libraries, government sites, etc.:

1. Increasing use of electronic resources in libraries
2. Search engine (SE) supremacy
3. Web 2.0 interactivity and participation
4. Difficulties with academic electronic resources

For most public and academic library users the convenience of full-text electronic resources makes them preferable to print material. People of all generations love SEs more than any other information retrieval mode, and libraries are responding with “next generation” online catalogs that resemble familiar SEs. The interactive applications introduced by Web 2.0 have sparked the public's imagination, and have increased the appetite for interactivity and establishing connections with others online. As a result, libraries have implemented a variety of Web 2.0 interactive services dubbed as Library 2.0 (see the section “Information is personal”). The escalating preference for a Web-style information seeking experience is evident in data from several studies where people report that the formality and structure of academic databases requires more effort, more time, and more technical vocabulary in queries.

Carol Tenopir's meta-analysis of over 200 research studies on users and uses of electronic resources provided in libraries yields a rich set of findings on user behavior and makes several user-centered recommendations. Tenopir found “Both faculty and students use and like electronic resources and most readily adopt them if the sources are perceived as convenient, relevant, and time saving to their natural workflow” and “Experts in different subject disciplines (work fields) have different usage patterns and preferences for print or electronic. There is no one right solution for services or system design for every subject discipline.”^[2] The wide variety of differences in undergraduate, graduate, faculty, and researcher uses of electronic databases challenge providers and libraries to

meet needs on many levels. Tenopir's review shows “The concept of a single typical ‘user’ of information systems is clearly a fallacy.” Some of the user-centered recommendations include

- Allow users to customize and personalize electronic resource pages.
- Publishers create products that better support the workflow of users.
- Recommend electronic resources to users to increase awareness of relevant material.
- Teach students how to evaluate found material and help them with search strategy.
- Develop virtual reference services to support increasing electronic resource use.
- Provide both “viewer-friendly” (html) and “printer-friendly” (pdf) full-text formats.

Tenopir's report provides a plethora of data illustrating the diversity of users and uses of electronic resources and the inherent complexity of the IE.

A 2007 Pew study, *Information Searches that Solve Problems*, found libraries performed well when people face personal problems that require obtaining information for decision-making:^[3]

Library help is effective. Among those who received help at the library, 88% say they found a lot or some of what they were seeking, including 38% who say a lot. By contrast, among those who did not seek help at the library, only 53% found a lot or some of what they were seeking, including 29% who say a lot.

Though in some studies Generation Y users (ages 18–29) report avoiding the library, Estabrook, Witt, and Rainie found that young adults in the Pew study are the heaviest users when it comes to looking for information about personal matters or anything else, and that they valued library resources and access to technology.^[4] One of the main user-centered findings from the Institute of Museum and Library Services (IMLS) *Museums and Libraries Engaging America's Youth* study encourages librarians to “substantively involve youth in program design and decision making” and recommends “Programs should strongly align institutional focus and audience needs, especially by performing needs assessments to inform program selection or design.”^[5] In November 2007, *Library Trends* issued a Call for Papers for a special issue devoted to exploring the current use of Web 2.0 technologies in libraries that serve teens, and how future services might be developed to better meet the needs of Web 2.0 savvy young adults. The issue focuses on the following user-centered areas:

- MySpace, Facebook, and other social networking sites
- Use of blogs
- Security and safety

- Getting staff and managers onboard
- Gaming—does it have a place in libraries?
- Online reading groups
- Podcasting—library tours and other uses
- Web 2.0 approaches to information skills
- Wikis and online communities

Involving tweens and teens in the design of Web 2.0 services is consistent with the deepening user-centered participatory trend.

The 2007 Association for College and Research Libraries (ACRL) Environmental Scan produced a set of Top 10 Assumptions about users of college and university information services.^[6] The research found that demand for online library services will continue to strengthen (p. 13):

Students and faculty will continue to demand increasing access to library resources and services, and to expect to find a rich digital library presence both in enterprise academic systems and as a feature of social computing.

The 2007 Scan also highlights the significant changes brought about by Web 2.0 and subsequent challenges of implementing Library 2.0 for improving infrastructure, contributing and creating content, and designing and delivering interactive services. Recent research in the application of user-centered social media in libraries is examined in the report; however, the area is nascent, rapidly evolving, and the professional literature continues to expand.

The Joint Information Systems Committee (JISC) study of college students and researchers in Britain, found they have become “information consumers” comfortable using commercial SEs, online library services and databases, wikis, social networking, and other forms of information access.^[7] Ian Rowlands describes “horizontal” information seeking behavior characterized by “bouncing, checking and viewing...” calling users “promiscuous, diverse and volatile.”^[7] Users in this study spent an average of 4–8 min on e-book sites, but did more navigating than reading, and exhibited “squirreling behaviour” in gathering information in case it might be needed in the future.^[8] As for online abilities,^[9]

Digital literacies and information literacies do not go hand in hand. A careful look at the literature over the past 25 years finds no improvement (or deterioration) in young people’s information skills.

However, a majority of students in the 2007 Educause study of Undergraduates and Information Technology reported that they use and are skilled with a wide variety of technologies, and only 26% indicated they wanted more technology training.^[10] Carol Tenopir uncovered evidence in the findings of a meta-analysis of 200 studies between 1995 and 2003 that these trends have been developing since the early Web began attracting users. For example,

“Most high school and undergraduate students turn first to the Internet for class assignments and feel they are expert searchers” and “Younger users rely on electronic resources more heavily and rate themselves more expert in using them than do older users.”^[2]

Eszter Hargittai studied the digital fluency of 1160 first year students at Princeton including their perceptions of their online skills as well as their understanding of online concepts.^[11] This wired generation reported high confidence in their digital abilities, “52.2 percent claimed to be fairly skilled, 33.0 percent believed themselves to be very skilled and the remaining 8.5 percent thought of themselves as experts” (p. 10). Hargittai had students rank their level of understanding to explore perceived knowledge of the online concepts, “frames, preference settings, pdf, spam, jpg, bookmark, newsgroup, mp3, and browser” and the more recent Web terms “bookmarklet, feed reader, malware, mashup, phishing, podcasting, real simple syndication (RSS), social bookmarking, tabbed browsing, torrent, tagging, Web feeds, widget, and wiki” (pp. 12–13).^[12] The *Oxford English Dictionary* defines mash-up as “a mixture or fusion of disparate elements” and *MSN Encarta* defines it as a “digitally created mix of songs: a song in digital format created by combining parts of different songs, for example the music track of one song and the vocal track of another.” While the majority of students gave high ratings on the basic concepts, on the more recent terms most reported low levels of understanding. Hargittai proposes 11 user-centered areas of skill that need greater attention in research and teaching (pp. 13–14):

1. Effective and safe ways of communicating with others.
2. Knowledge of how to contribute to group discussions and share content.
3. Knowledge about and use of tools.
4. Knowledge of what is available.
5. Ability to find content.
6. Efficiency in Web navigation.
7. Ability to assess source and message credibility.
8. Understanding of privacy issues.
9. Understanding of security issues.
10. Knowledge of where and how to seek assistance with questions.
11. Customization.

Taken together, these studies identify the IB of the Net Generation of college students as driver of the expansion in the use of interactive technology in society, particularly on campus. These digital natives were born into technology and will continue to drive its social uses; however, they need to deepen their understanding of and abilities with new forms of content provision.

In the space of one school day, 21st-century children might converse with their friends using instant messaging,

watch webcams of live events happening anywhere in the world, read e-books that contain links to relevant information, use videoconferencing to share ideas with students at schools in other states or on other continents, and use the Internet to access databases and websites containing information on a topic of choice.^[13]

Net Gen search behavior emphasizes speed, simplicity in concept, interface and database, full gratification in answers, and ease.^[14]

Still, the international 2005 OCLC Perceptions of Libraries and Information Resources study found that most people are not aware of online library services.^[15]

The findings indicate that information consumers view libraries as places to borrow print books, but they are unaware of the rich electronic content they can access through libraries.

The vast majority (84%) found information using a SE and were very satisfied with results (93%), claiming that the quality and quantity of information provided is higher than from libraries. These user assessments are based primarily on the generally high confidence users express in their abilities to evaluate the quality and trustworthiness of retrieved information (86%). Other studies of the predominance of SE use among college students found that Google was used 45% and library catalogs used 10%.^[16]

- Students prefer to locate information or resources via a SE above all other options, and Google is the SE of choice.
- Students' use of academic resources is low.
- Students find it difficult to locate information and resources.
- Students may trade quality of results for effort and time spent searching.
- Students' use of SEs now influences their perception and expectations of other electronic resources.

Frequently cited reasons given for low use of academic electronic resources are the need to find, choose, and search different databases; hierarchical arrangement, complexity, and differing interfaces; the lack of total full-text retrieval; and the technicality of academic vocabulary combined with less full-text makes it difficult to retrieve relevant material.

The perceived difficulty of online catalogs and subscription databases, the need to justify their escalating cost, and the development of the SE, the greatest technology trend of the Internet age, has stimulated universities to create novel user-centered approaches to win back students to their resources. Indiana University has an agreement with SE ChaCha, touting its "Human Guide" component that allows online catalog users to link to a librarian for assistance during a search session.^[17] ChaCha

maintains a knowledgebase of vetted answers, so as it is used could become more valuable to the university community. The interface is similar to the sparse Google search page with a Guide button on the results page, and ubiquitous Google Ads, revealing that online catalogs, like other SEs, can be accepted as revenue-producing entities. Trend watchers point out that user-centeredness is key to successful catalog improvement.^[18]

The most significant difference between traditional library catalogs and the "next generation" library catalog lies in: 1) the enhancement of the discovery process and 2) providing services against the collection beyond simple identify. Putting the users' needs and characteristics at the center of the query process will greatly enhance the discovery process.

The broader interface design community has come to a similar conclusion.

Centrality of Users in Design

It is recognized that interfaces have physical, social, cognitive, and affective aspects.^[19–24] A central concern of human-computer interaction (HCI) research has been to determine the effects of human physical, cognitive, and affective characteristics on the interactions between users and computers for specific tasks. As HCI researchers from a variety of disciplines developed models of human activity and used these models to design new interfaces, it became evident that a new design protocol must include a variety of interactive process and social approaches.

The UCD movement in computer science, particularly the area of HCI, has transformed a field which has shifted orientation, has redefined its scope, and has adopted a process approach that emphasizes the user experience, not only in interaction with information technology, but interaction with information in any form, in any setting, and in collaboration with others. In the second edition of *Interaction Design*, Helen Sharp, Yvonne Rogers and Jenny Preece describe the new user-centered process approach as "... creating user experiences that enhance and augment the way people work, communicate, and interact."^[25] The four main principles of interaction design may be applied in any discipline or setting and are not limited to computer interface design or telecommunications technology design.^[26]

1. Identifying needs and establishing requirements of the user experience.
2. Developing alternative designs that meet those requirements.
3. Building interactive versions of the designs so that they can be communicated and assessed.
4. Evaluating what is being built throughout the process and the user experience it offers.

Inherent in each of these activities is the focus on the agency of individuals and groups in their use of information systems. Interaction design seeks to discover user priorities and desires in order to facilitate and accommodate those goals in interactive environments. To that end “user experience architects” (UX) utilize a variety of process and ethnographic methodologies to gather user data throughout the stages of design. “Experience designers” seek feedback on thoughts, feelings, impressions, and preferences through observing users engaged in natural settings, interviews, questionnaires, performance tests in the lab, having users interact with prototypes, having users think aloud during activities, biometric measurement during activities, having users participate in and contribute to design sessions, and other process methods.

These user experience design principles are expressed in greater detail through design principles that have evolved within the HCI field:^[27,28]

- Visibility
- Feedback
- Constraints
- Consistency
- Affordance

In practice these five principles interact, creating complex dynamics that must be worked out with users within the design process. Affordance is a key concept that helps users notice what they can do at any given point in use or on a given screen, for example, a visible link invites (affords) clicking.^[29]

The marked shift in orientation from an exclusive focus on “system” to “user and system” to the “user experience in interaction with systems of any type” profoundly influences the design process. Sharp et al. distinguish between “usability goals” and “user experience goals” and emphasize that each design must address both types of user goals with different approaches and analyses. Traditional usability goals inherited from the field of human factors include the following quality components:^[30]

- Effectiveness
- Efficiency
- Safety
- Utility
- Learnability
- Memorability

Some usability goals include specific attention to identifying errors and how satisfied users are with the design.

User experience goals constitute a different, highly affective set of positive and negative qualities, feelings, and preferences. For example, designers elicit user responses regarding whether an experience is:^[31]

- Satisfying
- Engaging
- Entertaining
- Helpful
- Motivating
- Pleasurable
- Provocative
- Challenging
- Frustrating
- Boring
- Annoying

User experience goals are often said to be subjective while usability goals are considered objective. However, researchers find great value in open-ended responses offering rich, spontaneous user discourse that reveals the centrality of affect in information reception and use. Capurro and Hjørland make the point that “Meaning is, however, determined in social and cultural contexts.”^[32] Individual interpretive responses, therefore, reflect the community practices that enable designers to create supportive and symbiotic systems.^[33]

Participatory design, also termed cooperative design or contextual design, is a user-centered approach that integrates users throughout the process as design partners.^[34–36] This design philosophy is deeper than UCD, which includes user input at various points throughout design, while participatory design makes users codesigners. For example, the International Children’s Digital Library (ICDL) project of the Human-Computer Interaction Laboratory at the University of Maryland hired several children of varying ages to work with researchers in the Lab designing the site for children.^[37] Researchers involve children from many different countries and regions of the world who contribute in a meaningful way to the site’s design as well as to the growing content it offers. Children contribute to design elements, help select books to add to the international online collection, and write reviews of their favorite books for other children.^[38] International Children’s Digital Library researchers study the children’s response to reading e-books as well as to reading other children’s online reviews, finding that children incorporate novel expressions describing how a book made them feel. Their affective language is added to metadata to help kids in searching the collection because it reflects their own way of thinking. For example, ICDL added several affective search terms contributed by kids, including happy, sad, scared, and funny, among others.

Divergently, user-centered pioneer Jakob Nielsen cautions that designers should not rely on what users say about an interface because their descriptions may be neither accurate nor reliable. To design an easy-to-use interface, he recommends paying attention to what users do and not what they say, because users tend to base their evaluation of a product on surface features, which are often quite different from reports based on actual use.^[39]

Another example is the drop-down menu. Users always love the idea: finally a standard user interface widget that they understand and that stays the same on every page. However, while they offer users a sense of power over the design, drop-down menus often have low usability and either confuse users or lead them to unintended parts of the site.

Yet despite such problems, the drop down menu is present in most interactive systems. Nielsen warns that focus groups can give mixed results.^[39] When discussing past behavior, users self-reported data is typically three steps removed from reality. This is because users cannot remember specific details of complex processes and tend to fill-in memory gaps with what seems plausible. Second, people construct things or speculate about what might be easier or harder for them rather than rely on actual recalled aspects. Concurrent data gathering methods such as observing users interacting with a system or recording think aloud protocols can provide more accurate data on what users actually experience in a process.

Designing for Diversity

Global computing has necessarily strengthened the fundamental user-centered concern for how to accommodate the diversity of users, which shows itself in individual differences in perceptual and motor capacity, in cognitive ability and intellectual skills, in emotional coping skills, in handling complexity, as well as in personality, cultural background, and expectations. Computer literacy depends on memory for detail and order and the ability to solve problems to make appropriate decisions. Since these cognitive abilities are normally distributed in a diverse population, half of the users of a system will have below average intellectual skills, yet many interfaces must accommodate the wide range of skill in the entire population.

The design community has responded to people with diverse physical challenges by creating adaptive hardware and software. These efforts are aided by the mandates of equality of accessibility in the Americans with Disabilities Act.^[40–43] People also differ in perceptual skills such as time perception and scanning ability to locate information on screen displays. There are both individual and culturally based orienting habits and mindsets that the computing environment must accommodate.^[44] Affective habits also vary in a diverse population, for example, moods or motivational states of users vary from hour to hour, day to day. Some respond to lower levels of frustration while others tolerate a bit of anxiety and uncertainty. Illness or injury, drugs or medication, sleep deprivation, and emotional distress affect perceptual and cognitive abilities. Eventually, such diverse conditions must be anticipated and provided for by system designers.^[45,46]

Cognitive problems of users involve difficulties in acquiring progressive computer literacy skills for many whose educational background has not prepared them adequately with basic skills. They are overwhelmed by the bewildering complexity of software and hardware options in an era when designers still believe that simplicity is a sacrifice rather than a desired feature. Libraries have created many new services to bridge the digital divide, for example by engaging tech-savvy teens to teach senior citizens computer, networking, and gaming skills that help people overcome limitations, understand technology, and increase their participation in the life of the community and their families.^[47,48]

Standardizing UCD Principles

Inspection of design Web sites demonstrates a strengthened advocacy for users and a high degree of agreement concerning what constitutes good UCD. One example is the updated and expanded IBM design specifications:

In the following four sections, this site addresses the challenge of creating great user experiences through the discipline of User Engineering, supported by design guidelines, tools and other relevant materials.^[49,50]

The shift in terminology to the more encompassing “user engineering” that incorporates UCD, illustrates the deepening of the trend toward holistic design, and the opening of the design process to include frequent and systematic feedback from potential and future users. The previous 2001 IBM document pointed out that the Web connects everybody to everything with a single interface but cautioned that there is a difference between physical access and functional use since numerous people who may be connected are nevertheless incapable of using many of the available systems.

Many people acknowledge and accept the standards for such things as power voltage, power plugs, and even e-mail headers, but deny the need for standardizing user interfaces. They argue that users are intelligent and instinctive individuals and can adapt to any given design. It is true that users can adapt to almost anything. They surely had to do so in the past. Why should users have to adapt to machines? Do they voluntarily or involuntarily adapt to machines? Research on human factors in human-computer interaction shows that users of a new interface demonstrate a consistent desire to get started right away. . . This distinct desire or preference forces them to figure out. . . the interface without the benefits of a user-friendly design.^[49,50]

Despite the humanizing shift in design philosophy, it is common to struggle with technology and design during routine information tasks. For example, a study of 50 state health department sites reported that universally they are

deemed not user friendly.^[51] People are supposed to be able to conduct a variety of medical information tasks using these sites such as filing medical claims, comparing health care providers, determining eligibility for assistance programs, and becoming aware of and informed about services. Two-thirds of the sites had a reading level too difficult for an average person, many did not provide for non-English speakers, and more than half “did not meet the minimum recommended accessibility standards...”^[51]

In addition, as desktop and laptop systems have become more powerful, operating systems and applications have become more complex. Both affective load and cognitive load rise with uncertainty, and the frequent transitions to upgrades or new software makes it increasingly difficult for an ordinary user to install a system and its components. Replacing its focus in 2001 on standardization and universality of interfaces to solve ease of use problems, IBM’s 2008 design site content emphasizes value, diversity, personalization, and collaboration.^[49] Eleven design principles are provided and the fourth is Users:

Principle: Users

Description: Each group of users must be identified and characterized. This includes identifying the user goals and how they are measured. This is critical data for the Business Model work product and for tracking progress during the design process. The total user experience must be defined for each user group. Those aspects addressed by the project are identified, consistent with the business goals. Details of the tasks performed by each user group must be recorded, together with all important measures. In addition, information must be collected on how users wish to perform their tasks.

Purpose: Provide a clear understanding of the users’ world and what it will take to satisfy their expectations.

User eXperience Research gathers and records all user requirements including who they are (roles), what they want to achieve (goals), how they wish to do it (tasks), and their success criteria (measures & targets).

Ideally, typical or target users are incorporated into the design process to test the design until it is accepted. IBM invites visitors to its Web site to volunteer for user experience design studies.^[52] As the Web grows, usability becomes more important because users are often lost or get stuck, not knowing what to do next.

Jakob Nielsen discusses Web usability principles and what to avoid.^[53,54] Nielsen’s annual Top 10 Mistakes in Web Design essays document numerous ongoing follies of design and the consequences in lost productivity, and lost revenue due to user frustration and loss of customers, including not answering users’ questions, inconsistency, user-hostile messages, obtuse page titles, animations,

pop-ups, advertisements, and more.^[53,54] Still, the ubiquitous and obtuse “404 Not Found” Web error message continues to plague users:

We understand what 404 means: Page Not Found. But the average internet user has no idea what 404 means or what to do about it. To them, it’s yet another unintelligible error message from the computer. Most 404 pages are unvarnished geek-speak.^[55]

The Department of Health and Human Services has produced a set of extensive usability guidelines based on research intended to “...reflect HHS’ commitment to identifying innovative, research-based approaches that result in highly responsive and easy-to-use Web sites for the public.”^[56] The current set of *Guidelines* increased by 10% to 209 items, demonstrating the growing complexity of creating usable and acceptable sites. Chapter two of the *Guidelines* is devoted to Users, Chapter 17 covers Search, and Chapter 18 is devoted to Usability. Search includes the following user-oriented *Guidelines* to support term discovery:^[57]

Guideline: Construct a Web site’s search engine to respond to users’ terminology. Keep in mind that designers’ preferred keywords may not match users’ preferred keywords, and content writers may overestimate the specialized vocabulary of their audience. (p. 5)

Guideline: Provide templates to facilitate the use of search engines. Templates are predefined sets of keywords that help users select relevant vocabulary for their search topic. (p. 9)

The *Guidelines* recommend arranging topics in hierarchies. Similarly, the usability chapter reports that^[58]:

Inspection methods, such as heuristic evaluations or expert reviews, tend to generate large numbers of potential usability’ problems’ that never turn out to be actual usability problems. (p. 1)

Guideline: Solicit usability testing participants’ comments either during or after the performance of tasks. (p. 3)

Therefore, system-centered usability testing that employs inspection evaluation is inefficient in comparison to user-centered testing that isolates germane problems sooner. The *Guidelines* recommend the use of think aloud or retrospective critical incident methods to ensure discovery of the most salient user requirements. The goal of universal usability and ease of use will continue to be a challenge to the design community into the distant future because the diversity of users and uses ensures that one size cannot fit all.

One of the underlying forces working against user-friendly software, hardware, databases, digital libraries, and content-laden Web sites was termed “infomania” in

2005 by Edwin Hallowell, also referred to as information overload or Attention Deficit Trait (ADT):

Infomania is the mental state of continuous stress and distraction caused by the combination of queued messaging overload and incessant interruptions.^[59]

Zeldes, Sward, and Louchheim report that knowledge workers typically accomplish a mere three minutes of uninterrupted work during a task. Sources of distraction include “e-mail, instant messages, phone calls, text messages, and coworkers” among others.^[59] Incessant incoming information accumulates and pressures people to attend to it, process it, file it, make decisions with it, organize it, store it, and delete it. This situation creates stress as people experience frequent frustration in information-intensive environments, and the resulting losses in productivity can soar to billions annually.

SPREAD OF THE USER-CENTERED PARADIGM IN LIS

Researchers in virtually all subareas of LIS have adopted a user-centered perspective in their investigations. While many cite Dervin and Nilan’s 1986 *ARIST* review article as the inception of the user-centered turn in LIS, some prominent researchers have published historical reviews tracing its origins to the 1950s and 1960s studies of information practices of scientists in particular disciplines as well as other groups.^[60–63] Marcia Bates credits the work of Stanford communications professor William Paisley who focused on behavioral aspects of information use.^[61,64,65]

Current areas of special interest include: user generated content, IB models, emotional aspects of information seeking and use, information architecture, building community networks, Web 2.0 social software, open digital content, virtual services, and gaming, among others.^[66] Mike Eisenberg encourages libraries to lead in the rapidly evolving technological environment, where social media dominate in a “parallel information universe,” where content is delivered and users are interactively engaged through a variety of online devices, applications, and services.^[67] Inspection of recent conference programs in information science and technology shows a prevailing user-centered concentration in research.

Professional Conferences with a User Focus

American Library Association’s (ALA) Office for Information Technology Policy (OITP) and the Association for Library and Information Science Education (ALISE) jointly sponsored a 2008 session on “Participatory

Librarianship and Web 2.0 in the Curriculum.” The call for participation reflects a sense of urgency to integrate new user-oriented services into LIS curricula to ensure that graduates are prepared to enter a more user-defined IE:

The library landscape is constantly in flux. New technologies, new practices, and new theories are the sign of an active field. However, these dynamic forces also lead to confusion and conflict. It also leads to a spate of new services and functions that are sometimes awkward to integrate into existing research, operations and curricula. In today’s world of Web 2.0, Library 2.0, social networks, blogs and wiki’s what concepts are durable and what is new that must be imparted to the next generation of professionals?^[68]

The variety of Web 2.0 applications continues to swell so that a critical process for adoption must be developed to equip graduates with adequate tools for making new service decisions. For example, the 2007 ACRL New York Annual Symposium, “Library 2.0 a New Social Model” illustrates the demand for instruction in the application of social media. It offered practitioners three sessions that covered “Social Software in Academic Libraries,” “Technical Services 2.0: “Mashing up” Traditional and New Services,” and “Library 2.0 and Web 2.0, Changing the Face of Professional Development.”^[69]

The Computers in Libraries 2008 program lists sessions on SecondLife, YouTube, and other Web 2.0 topics:^[66]

- Social software
- Communities and collaboration
- User generated content
- Engaging the audience
- Gaming and learning
- Open source

The user-centered focus was evident at the American Society for Information Science and Technology (ASIST) 2007 themed, “Joining Research and Practice: Social Computing and Information Science,” including presentations on

- Social information architecture
- Participation behavior
- Social tagging
- Folksonomies
- Social computing
- Online communities
- Blogs and wikis for scholarly communication
- End-user collection building
- Digital natives

The ASIST 2008 annual conference program “People Transforming Information—Information Transforming People” continues the strong focus on social interaction:^[70]

- Individual identities and how they are transformed by the impact of information technologies.
- The societal archive—is it disappearing and/or being marginalized?
- Societal attentions and how emphasis on information technology either allows or hinders these.
- Openness, access, and privacy issues.
- Generational, economic, and sociocultural dimensions of impact of information on people's lives.
- Cognitive and emotional aspects of interactions with information.
- Reshaping the boundary between personal and public information space.
- The effect of collective information creation on authority and trust.
- Information by the people for the people.
- The role of information in connecting people and community building.
- How well is current technology meeting human needs, and what should future technology research and development involve to better meet our needs?

The American Society for Information Science and Technology (ASIST) held its first Social Computing Summit in 2008, to focus on “Social networking services, data portability, open social networks, mobile services, social computing and politics, global voices, social computing and the enterprise, and youth social computing.”^[71]

The Annual Research Symposium of the Special Interest Group on Information Needs, Seeking and Use (SIG USE) takes an inherently situated, social, constructivist, relational, interactive, and holistic approach to the study of IB.^[72,73] Special Interest Group on Information Needs, Seeking and Use is the leading ASIST SIG for user studies and has published two edited volumes of IB research and theory.^[24,74] The 2006 Symposium focused on emotional design and affect in IB, and the 2007 Symposium featured research on the use of mobile devices during a wide variety of user-driven information-intensive activities:

- Searching WebMD
- Checking stock portfolios
- Meeting up through *dodgeball.com*
- Chatting with friends on MySpace
- Playing online games
- Sharing photos
- Making plane reservations
- Paying bills and shopping

The Information Seeking in Context (ISIC) conference that originated in 1996 is entirely devoted to the study of situated IB, examining an ever-widening variety of particular user groups in specific information contexts and settings.^[75,76] A sample of the ISIC 2006 conference program presentations illustrates the current trend in

diversification of the user-centered paradigm in user group, methodology, and granularity of analysis:

- Uncertainty
- Interpersonal information seeking
- Information sharing
- Personal information seeking
- Motivation and information seeking

Investigations of everyday information seeking is a burgeoning area that has attracted experienced information retrieval researchers who have turned their attention to the micro level to study the information needs and uses of particular user groups within social contexts. These efforts to further specify levels in the human aspects of IB will continue to extend to narrower domains and into deeper layers of thinking, perceiving, learning, valuing, and accepting information. The Second International Symposium on Information Interaction in Context (IIX) exemplifies this user-centered thrust.^[77]

- Case studies, field experiments, simulations, etc. of context-sensitive information seeking and retrieval.
- Context-aware retrieval models.
- Relevance feedback—implicit and explicit—and query modification issues for capturing context.
- Other approaches to eliciting, identifying, and expressing/capturing contextual information.^[78]
- Task-based interactive information retrieval and seeking behavior.
- The effect of genre, media, language, modality, and structure on context.
- Personalized and collaborative information access in context.
- Contextual information interaction theory.
- Interactive information retrieval and interface issues.
- Nature of relevance in contexts.
- Measures of performance in context and situation-sensitive information access.
- Test collections for context-sensitive research.

There was some focus on user perspective at the IA Summit 2007, themed “Enriching Information Architecture,” but one year later at IA Summit 2008 the theme “Experiencing Information” focused entirely on the user experience.^[79,80]

- Information quantity and the experience of choice
- The timing of information encounters and information use
- The subconscious consumption of information
- Rapid or intuitive processing of information
- The social and participatory aspects of information and information communities
- The wide range of information media: the Web, virtual worlds, ubiquitous computing, mobile technology, physical spaces

The Association for Computing Machinery (ACM) Computer/Human Interaction 2007 Conference, CHI 2007, highlighted the continuing efforts of the HCI community to humanize the interface and to design for interaction and the user experience:

- Beyond usability: Social, situational, and contextual factors
- Rethinking humans, computers, interaction and design
- People looking at people
- Emotion and empathy
- Programming by and with end-users
- Ethnography
- Capturing Life Experiences

These conferences and a growing group of others demonstrate that information science and computer science research has taken the user-centered turn. It follows that degree programs preparing information professionals and information scientists have altered and enhanced curriculum to support users in the IE.

The Rise of Informatics and Participatory Culture

A study of 26 LIS programs was conducted between 1998 and 2000 in the Kellogg-ALISE Information Professions and Education Reform project known as KALIPER. The results of this detailed case study analysis revealed six trends affecting curricular change.^[81,82] The second trend that emerged from an analysis of program mission statements, course descriptions, course titles and syllabi revealed a predominant focus on the social and cognitive aspects of information, information systems, and information use.^[84] The programs emphasize user constructs and dynamics that permeate their core and elective curricula in the areas of information seeking, user behavior, user needs, user-centered information services, and user engagement practices.^[85] Markey warns programs to look beyond the user-centered paradigm to prepare future information professionals because, due to the spread of information and communication technology (ICT), disintermediation will likely displace libraries in that domain. She recommends, “Instead, programs should stake out unclaimed or disputed areas such as the organization of information, content creation, authoritative information, and/or collection preservation.” Informatics has emerged within several disciplines as a user-oriented specialty.^[86–92]

Informatics refers to the study of information systems, particularly the relationships among people, information, and information technology. Undergraduate and graduate programs in informatics offer a definitively human-centered approach to the study of information systems and technology. Students completing these degrees develop conceptual understandings of information and technology, a variety of technical skills, a human-centered perspective in designing, implementing and evaluating information

system use, engagement with communities of practice to foster networking, they share tools and resources, and work with open source “communityware” information and content management systems that are designed for public use. Ann Bishop and colleagues in the University of Illinois Community Informatics Initiative^[93,94] focus on understanding the social context that has led to the digital divide, and work to develop models for public libraries to collaborate with underserved groups in the creation of innovative technology-based information services relevant to people’s everyday lives.^[95]

The core of the CII is community inquiry: collaborative action to create knowledge and technology connected to people’s values, history, and lived experiences; the development of models of engagement that are just, democratic, participatory, and open-ended; and the integration of theory and practice in an experimental and critical manner.

As further evidence of the social participation trend in curricula, the theme for the 2008 meeting of the ALISE was Community Engagement: Integrating Learning, Research, and Practice. American Library Association’s OITP published the Participatory Librarianship Starter Kit^[96] that encourages creating participatory networks, and enhancing material offered to users by linking topics to a variety of resources (conversations) from the library, the Web, the community, and beyond, including existing sets of “answers”:

Simply put participatory librarianship recasts library and library practice using the fundamental concept that knowledge is created through conversation. Libraries are in the knowledge business, therefore libraries are in the conversation business. Participatory librarians approach their work as facilitators of conversation. Be it in practice, policies, programs and/or tools, participatory librarians seek to enrich, capture, store and disseminate the conversations of their communities.

For example, virtual reference service aims to “look at the core of the reference process as a conversation between a librarian and a patron.”^[97,98] Reference conversations proceed through exchanging understandings and “are ultimately a learning act.” The focus on human interaction, participation, and the value of acting together to change lives for the better, orients information professionals to maximizing the social utility of technology and content or expression by gaining technical skills, networking skills, engagement skills, and needs assessment skills.

Some refer to this human-centered activism as evidence of a Copernican paradigm shift from a primary focus on libraries and librarianship to a focus on information, from organizing information containers to understanding the role of information in people’s lives and helping them make productive uses.^[99,100] This change in

locus was first seen in the flurry of programs adding information to their names, missions, goals, and objectives, and course titles, and in user studies applying qualitative and ethnographic social science methods to investigate the human experience in needing, accessing, and using information. The impetus for understanding users' IB can be traced to the increasing pressure of an intensifying societal expectation that people become informed in every aspect of life including health, legal, insurance, personal finance, consumer product, and environmental knowledge, as well as interpersonal competencies or emotional intelligence.^[101] A responsible person can no longer simply rely on professionals to advise and recommend, instead, one must become informed through personal research and obtain second opinions to make intelligent choices about available opportunities, options, or treatments, and one must use information to help avoid disease, disability, penalties, fines, or unfavorable judgments, and to make informed decisions.

By "life information" is meant information needed for successful living. The area of need ranges all the way from sheer survival (stay away from dogs that walk funny and foam from the mouth) to the most advanced forms of self-realization (where can I study ceramics or transcendental meditation?). The scope of information falling under this rubric is greater than may at first appear. It includes vast amounts of information about how to do many different things in one's culture that will be acceptable and lead to one's survival and emotional satisfaction.^[102]

The information age provides abundant information to those who are connected to the networks, nevertheless, one must make the necessary effort to value, notice, identify, locate, obtain, store, evaluate, and utilize information; determine its ultimate effectiveness; and often, report the results to others (family, physicians, friends, fellow students and teachers, employers or coworkers, etc.) and find it again at a later time on a different occasion. In addition, there is the ever-expanding information universe of work that continuously pushes people to update and upgrade their knowledge and skills within an IE that demands lifelong learning. Informatics research will continue to gather importance because of the trend toward a continuously enlarging responsibility to obtain and manage personal information.

Multidisciplinary Influences in LIS Curriculum

The field of HCI has been at the forefront of the UCD, interaction design, and user experience design movement.^[103] Library and information science programs and I-Schools have developed curricula based in the computer science design philosophy, which has become increasingly multidisciplinary through integrating psychological, sociological, and anthropological theory and methods. As

evidence of the expansion of the trend to incorporate users in interface design, usability assessment texts have emerged that treat the needs of information-intensive, content rich Web sites produced and maintained by librarians for their user communities.^[104–108] Stephen Bell advocates applying design thinking "to help users accomplish their work by removing barriers or inefficiencies. . ." and introduces the user-centered IDEO design method and the Designing Better Libraries blog.^[109–111]

Courses offered in information programs have diversified from the single usability or UCD course to include varied offerings and tracks. Some examples include

- Usability Analysis
- Information Users in the Knowledge Society
- Information Behavior
- Seminar in Information Use and Users in Context
- Information Architecture
- Communities of Practice
- Assessing Information Needs
- Human Dimension in Information Systems
- Interface and Interaction Design

In 2008, the University of Michigan School of Information (SI) launched six new specializations, including four user-centered tracks^[112–115]:

- Social Computing
- Incentive-Centered Design
- Community Informatics
- Information Analysis and Retrieval

The courses in these areas integrate such user factors as design ethics, psychological principles, interaction principles, social network analysis, online communities, computer-supported cooperative work, public goods, personalization, information use in communities, and user contributed content, among others.

The San Jose State University School of Library and Information Science (SLIS) was first to create a Second Life portal to deliver courses in the virtual world that allow students to create services, build information service environments, and conduct research in the SLIS virtual information space.^[116] Courses for practitioners in the Virtual Worlds CE Series were offered for the first time in 2007 at the University of Illinois Graduate School of Library and Information Science:

- Second Life 101
- Introduction to Virtual World Librarianship
- Survey of Librarianship in Virtual Worlds
- Technical Skills for the Virtual World Librarian
- Intermediate Virtual World Librarianship—Programming and Planning
- Libraries and Immersive Learning in 3D Virtual Environments

- Working with a Class in Second Life
- Setting Up an Educational Presence in Second Life

The I-School at the University of Washington began offering a Certificate in Virtual Worlds for professionals seeking advancement in the following new skill areas:^[117]

- Design virtual worlds, including multimedia
- Build in and account for human interaction
- Program and integrate with databases
- Evaluate the effectiveness of virtual worlds

The strong multidisciplinary user-centered trend in LIS curriculum development will continue and widen beyond system design and use into traditional areas of the field including archives, preservation, serials, acquisitions, information organization, reference services, and information access.

Information Literacy Mandates

Information literacy (IL) is an area of curriculum development that has lagged behind the profession. Heidi Julien analyzed the curricula of 93 LIS programs worldwide and determined that most programs did not have a course that prepares graduates to take on responsibilities for managing existing IL, digital literacy, and information fluency programs, including designing, planning, and teaching sessions, workshops, and full courses that are predominant in libraries around the globe.^[118] In academic libraries, IL librarians must provide leadership in campus efforts to integrate IL components in General Education reform, and in school libraries developing IL skills is fundamental to every grade level. Julien argues for curriculum development to address this neglected core competency.

Information literacy, media literacy, digital literacy, and technological literacy coalesce in the online environment. In the past two decades, IL programs, user instruction services, instructional Web sites, and interactive online tutorials have proliferated in libraries worldwide. Information fluency has become a strong movement, evidenced in the mission and goal statements of academic, public, and school libraries which commonly cite endeavors to teach users to become independent, critical, and ethical information seekers and information users. The annual survey of freshmen in 700 American colleges by the University of California at Los Angeles (UCLA) provides a representative picture of the IL skills of entering students.^[119] The survey reports that 76% used the Internet for assignments but only 35% said they critically evaluated information found in Internet searches.^[120] In the past decade, accrediting bodies began mandating IL instruction in higher education. Outcomes assessment of IL competencies has gained momentum driven by the mandates from accrediting bodies, that is, schools must

demonstrate that graduates are information literate.^[121] Standard 2 states: “Baccalaureate programs engage students in an integrated course of study . . . to prepare them for work, citizenship, and a fulfilling life. These programs also ensure the development of core learning abilities and competencies including . . . Information literacy . . .” Other accrediting bodies have similar requirements. The outcomes assessment model fits within data-driven strategic planning models that predominate in libraries. Professional associations have developed IL standards, competencies, and curricula to assist information professionals in measuring gains in skills.^[122–126] The Reference and User Services (RUSA) division of ALA published six Guidelines for the Introduction of Electronic Information Resources to Users, of which the fourth is devoted to user-centered instruction. Guideline 4.3 addresses individual user factors:^[127]

4. User Education/Instruction

4.1 Determine the appropriate type and level of instruction for a new electronic information resource.

4.2 Determine the extent to which the service should be incorporated into existing user instruction and the extent to which new instructional sessions or methods would be helpful.

4.3 Design user instruction to accommodate various learning styles and experience levels and include a combination of point of use instruction for individuals, group instruction, peer assistance (both user-user and instructor-instructor), tutorials, documentation, and/or signage.

The American Association of School Librarians (AASL) Standards for the twenty-first Century Learner overlap significantly with the ACRL Competencies while acknowledging that “Learning has a social context.” In addition to acquiring critical thinking and evaluation skills,

The Standards describe how learners use skills, resources, and tools to

3. share knowledge and participate ethically and productively as members of our democratic society;

4. pursue personal and aesthetic growth.^[128]

The AASL Standards’ emphasis on the social aspects of learning, the ethical use of resources, and the value of self-improvement reflects the user-centered active learning movement in education that integrates learning community, collaborative learning, reflective learning, service learning, problem-based learning, inquiry learning, and informal learning models. These relational approaches continue to rise in prominence in higher education, particularly with the influx of social media and gaming models in learning, and will likely influence the future revision of the ACRL Competencies.

Originating in 1990, the Instruction Section of the International Federation of Library Associations (IFLA) has worked to promote IL skills in libraries worldwide. The 2006 Guidelines set international standards for global citizens.^[129,130]

Information skills are vital to the success of lifelong learning, employment, and daily interpersonal communication of any citizen, such as when a person needs information about health services for someone in his/her care, or a student requires specific information to complete an assessment.

The IFLA Guidelines take a constructivist approach to lifelong learning of IL skills, and overlap with the ACRL and AASL standards, with a strong emphasis on ethical use of information systems and resources. The IFLA Guidelines do not mention other social aspects present in the AASL standards, such as the social nature of learning and aesthetic values of learners. IL standards for these professional groups will evolve to address social learning and personal values as the user focus continues to strengthen.

INFORMATION IS PERSONAL

As a result of the societal forces of participation and community engagement, theory building has been developing at the intersection of the fields of communication, anthropology, sociology, and the psychology of information retrieval. The “sense making” approach was formulated by Brenda Dervin whose model is thoroughly user-centered, and grounded in constructivist assumptions about information seekers and users.^[131,132] In this view, information is defined in terms of people’s attention, processing, seeking, and use. Dervin’s approach to user-centeredness complements Carol Kuhlthau’s constructivist approach to information problem solving and information counseling, Marcia Bates’ cognitive-behavioral approach to understanding searching, and Paul Solomon’s approach to situated information discovery.^[133–135] These person-centric approaches view the IE of systems and interfaces in terms of users’ behavior. Information behavior is defined as what users do when they handle information and adjust to it.^[136] “Information behavior...encompasses information seeking as well as the totality of other *unintentional* or *passive* behaviors (such as glimpsing or encountering information), as well as purposive behaviors that do not involve seeking, such as actively *avoiding* information.” Salient user factors include: what they do and see, what they think or know, and what people feel that motivates them to continue or quit, to be satisfied or to continue searching, to strive to comprehend or

remain bewildered, to continue as a novice or strive to become an advanced daily user. In the purest sense in this approach there is no information, only situated IB, that is, information is embodied in IB.

The study of IB in a rapidly evolving technological society demands close attention to a full range of broad and specific user dynamics.^[24,74,137] The multidisciplinary theoretical approaches in IB research acknowledge the centrality of the user’s values, feelings, and perceptions in the information reception and use process. Each approach focuses on how the perspective of users determines their IB. Findings from IB research show that users are highly interactive, with dynamic motives and intentions. As goal-directed sense-makers, users are seeking meaning, bridging information gaps, dealing with uncertainty and anomalous states of knowledge, translating their own ideas into system terms, actively updating personal frames of reference, filtering both information and feelings, and applying personal constructs in the information seeking, reception, use, sharing, and creation process.^[24] The users have become the creators, producers, and disseminators of content, therefore information retrieval systems and environments must concretely incorporate this reality into design to achieve the user-friendly systems that people need.^[45,138]

In 2003 nearly half of all Internet users had added online content through file sharing, building or posting to Web sites and blogs, or posting content for businesses and organizations.^[139] According to Henry Jenkins, director of MIT’s Comparative Media Studies Program,

...a participatory culture is a culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing one’s creations, and some type of informal mentorship whereby what is known by the most experienced is passed along to novices.^[140]

The forms of participatory culture include memberships in online communities (*Friendster*, *Facebook*, *MySpace*, *Twitter* and other more specialized online communities such as *LinkedIn*), metagaming, producing digital sampling, “skinning” and “modding,” videomaking, fiction writing, zines, “mash-ups,” working in teams to complete tasks and develop new knowledge (e.g., *Wikipedia*), and shaping the flow of media (podcasting, blogging).^[141–145]

Wikipedia defines metagaming as “a broad term usually used to define any strategy, action or method used in a game which transcends a prescribed ruleset, uses external factors to affect the game, or goes beyond the supposed limits or environment set by the game.” MSN Encarta defines “digital sampling” as an “electronic process used in telecommunications for transforming a constantly varying (analog) signal into one composed of discrete units, a digital signal” and one definition for “skinning” is “to

change the appearance of images produced by existing software, without changing their function.” A description of modding via Technology Source is, “Many of today’s games—especially the first-person perspective, three-dimensional world games—are “open” to mods (modifications) of an enormous number of their features, including the environment, the characters, and the game play. Through modding, it is even possible to construct an entirely new game.”

A user-centered emphasis enhances access to the full range of information activities, and advocates integrating the individual via engagement and involvement into the ongoing social practices of the community, so that technology works synergistically in the user’s daily life of activities.^[146] Library 2.0 pioneers advocate a major shift in perspective from “library functions and resources” to customer and user goals, interests, and desires for simplicity and ease of use. The digital user’s focus is on participation, collaboration, membership, social networking, teamwork, task optimization, and successful completion. Self-expression is thus performed within intersubjective environments of communities of practice, and libraries are uniquely well placed to establish and foster active user communities by utilizing the new social media.^[147]

Web 2.0, Library 2.0, User 2.0: The Social Software Revolution

After the total acceptance of SEs, User Generated Content (UGC) is the biggest user-centered trend affecting libraries, publishing, and news media. User Generated Content involves the use of social networking, folksonomies, blogs, wikis, and other interactive online facilities that allow self-expression. User Generated Content, also called user defined content or user contributed content, has surged as people flock to online sites to ask questions and seek answers, deposit their thoughts, musings, views, strong opinions, knowledge, evaluations and reviews, images, activity status updates, creativity, and vision for others to read or ignore, perhaps to attract comment and interact in an exchange of ideas or strong disagreements and agreements. The social software movement has sparked controversy over the traditional top-down prescriptive model of information standards and authority and the disintermediating, bottom-up inductive dynamic of social media. Professional news organizations now provide e-mail and blogs welcoming user input, and regular segments are devoted to “news” reported by “citizen journalists” who log in to leave information, including e-mail, voicemail, photos, and video. For example, the major cable networks have instituted the user-centered i-Report, U-Report, and News to Me segments, and viewers are implored to take polls on questions of the day and post comments and questions on the network’s Facebook, MY Space, and Twitter pages. Some consider this

democratizing trend to be positive, persistent, and highly collaborative, while others deplore its baseness, lack of authority, anonymity, irresponsible demagoguery, and other cultural offenses.^[148,149] As the lively debate evolves, the newly empowered authors and content creators will continue to find their voice and to prevail in Web 2.0 territory and beyond. Library users have begun to interact and provide input using the Library 2.0 participatory services designed and implemented by tech-savvy Librarian 2.0 information professionals.^[150–161] Authors will write regularly updated reports about their initiatives for at least two years on a wiki hosted by the Association for College & Research Libraries (ACRL).

Library 2.0 represents the library that immerses itself in the advanced functionality of Web 2.0 technology to benefit the user experience by providing access to content through a personalized and co-constructed infosphere. According to Habib,

The term Library 2.0 was introduced by Michael Casey in September 2005. . . . The term was exposed to a wider audience when Michael Stephens discussed Library 2.0 on the ALA’s Techsource Blog.^[162]

The “Librarian 2.0” according to Stephen Abram,

understands his or her users at a deep level – not just as pointers and clickers. Librarian 2.0 understands end users deeply in terms of their goals and aspirations, workflows, social and content needs, and more. Librarian 2.0 is where the user is, when the user is there. This is an immersion environment that librarians are eminently qualified to contribute to.^[163]

Social software for library-related interaction and services incorporates blogs and RSS feeds to involve users in participatory exchanges that link comments, chat rooms, online discussions, blogs, wikis, photo and video sharing sites, podcasts with streaming media, e-mail, and Instant Messaging (IM).^[164] Through these recent technological developments librarians have become involved in creating conversations, connections, and community within their user populations.^[158] According to Abram “we are entering a period of enormous change - far greater than what we’ve ever experienced in our lives to date.”^[163] The new global transformation in the infosphere is powered by interactivity on an unprecedented scale. Social collaboration is as old as community and society, however the social-technological environment has become organic and symbiotic.^[23] Despite the digital divide, human-machine symbiosis encompasses daily life for greater numbers of people, such that there is hardly a portion of the day that people are not connected to some technological device, creating and exploring intersubjective communication spaces in which our daily life of thinking, feeling, and sensing is shared virtually and co-experienced with many others.

The early Web environment also offered new ways for people to connect, including e-mail, Usenet groups, hyperlinks, directories, surfing, SEs, online shopping, and e-Bay bidding.^[165] Beyond connectivity and access to vast information, Web 2.0 provides the living thrill of participatory culture where people take a personal hand in co-constructing a dynamic information world of *intersubjectivity*.^[166–168] Social theorists and researchers use the term intersubjectivity to refer to use of the shared knowledge of jointly accepted group practices when people interact. Individual values, meanings, information, and knowledge are shared and dynamically created in social interaction, hence “Knowledge and knowledge structures are neither objective nor subjective, but intersubjective, produced within a shared system of meanings.”^[168] Social networking magnifies the intersubjective sphere, rendering the former Web paradigm limited, formal, and impersonal. Today’s Web “page” is dynamic as the screen explodes in striking visuals and sounds, streaming video, sidebars with animated ads and polls, RSS content updated to the moment, and with deep level inserts like content filters, cookies, notebooks, dictionaries, SEs, polls, maps, fill forms, interactive graphics, widgets, customization and personalization, user tags and metadata, archived discussions, user reviews, ratings, and comments. Social technology has become an organic component of community life, a transformative user-generated trend in computing and communication.

Technology users today are empowered and enhanced because people can do more, see more, hear more, network more, enjoy more, and create more of what they want together. The meaning of technology has shifted from “computation” and “connection,” to collaboration, co-construction, community, continuity, and co-presence in real time and in virtual senses.^[169] Web 2.0 is explosively producing global intersubjectivity within an infosphere that is organized in channels defined by what people do, think, and feel on the daily round.^[170] Floridi defines the infosphere as “the whole informational environment constituted by all informational entities (thus including informational agents as well), their properties, interactions, processes and mutual relations. It is an environment comparable to, but different from cyberspace (which is only one of its sub-regions, as it were), since it also includes off-line and analogue spaces of information. We shall see that it is also an environment (and hence a concept) that is rapidly evolving.” Web portals and user gathering places are organized by special interests, niche topics, and targeted activities. Originally information space was organized by topic or subject matter, but the new social information dynamic has added a layer of content that is organized by activity. People go to sites to do things: to shop, transfer funds and pay bills, meet with online friends, send e-cards, trade stocks, find map directions or an address, order pizza, play online games with avatars, contribute to collaborative wikis, consult live

online reference librarians, attend classes in immersive learning environments, see and contribute to the latest postings on blogs of interest, view and respond to updates on friend’s activities, upload and download songs, videos, photographs, ringtones, resumes, and tax forms, etc. In social media users define the uses.

Stephen Abram provides a list of the technologies that “serve as the emerging foundation for Web. 2.0”:^[163]

- Really simple syndication (RSS)
- Wikis
- New and revised programming approaches like AJAX and APIs
- Blogs and blogging
- Commentary and comments functionality
- Personalization and “My Profile” features
- Personal media such as Podcasting and MP3 files
- Streaming media audio and video formats
- Reviews and user driven ratings
- Personalized Alerts
- Web Services (e.g., virtual reference service)
- Instant messaging and virtual reference including co-browsing
- Folksonomies, tagging, and tag clouds
- Photo and video sites (e.g., Flickr, Picasa, YouTube)
- Social networking software
- Open Access, Open Source, Open Content
- Socially driven content
- Social bookmarking (such as Delic.io.us)

Michael Stephens also identifies the following:^[159]

- Building a community Web site with a blog
- Libraries and social sites like MySpace, Facebook, YouTube
- Messaging in a 2.0 World: Twitter & SMS
- Podcasting

A survey of public libraries in South Carolina confirms that social technologies are quickly transforming public libraries into participatory gathering places.^[171] Services offered include instant messaging for reference services (30%), photo sharing accounts (23%), library blog (40%), and wiki (10%). More than half of the librarians have an instant messaging account, and one in three have a personal blog and participate in adding content to a library wiki. Libraries are also experimenting with building online communities, online library book clubs, user forums, offering library news using RSS, hosting webcasts and webinars, providing widgets for building personal digital collections^[172–175] and digital DVD downloads, among many other user-centered interactive services. Some librarians caution that simply adding interactive services does not guarantee that people will use them or provide input, and that needs assessment, active participation of librarians and continuous evaluation are necessary to success.^[176]

Benefits of Tagging and Social Bookmarking

The 2008 Library of Congress report on the Future of Bibliographic Control opened the gates to UGC in stating “User-contributed data, such as reviews or rankings, can help other users identify resources of possible interest to them.”^[177] In an unprecedented agreement with the image-tagging site Flickr.com, the Library posted large collections of digital photographs with a request for input, “You’re invited to help describe photographs in the Library of Congress’ collection on Flickr, by adding tags or leaving comments.”^[178] The Library intends to harness “key caption information” from masses of people viewing the images on the Flickr Commons site, effectively making indexers of users.

For libraries, “Tagging, as with del.icio.us and other social bookmarking tools, lets libraries label books in ways that make more sense to patrons than traditional subject headings.”^[179] Sites such as LibraryThing and Shelfari provide libraries with a user-centered approach to reducing barriers to participation, enabling users to post reviews, ratings, and tags to ease retrieval for other users.^[172] The marvel is that people are keen to descriptively tag items, to comment on their usefulness, and to receive recommendations based on similarly tagged items. Users also want to build online collections using widgets that post book jacket images for new books with certain tags, or random books, or favorite books read by friends, or books one has read in one’s lifetime, or books one plans to read, or the ICDL Children’s Book of the Day, etc. The same holds good for music and video. Users love to arrange and organize information. The next generation online catalogs incorporate tagging and other social software features, but also promise “opportunities to get away from the OPAC and focus resources on new areas, such as 3-D information visualization, mass digitization, Library 2.0, and metadata related to digital resources.”^[180,181]

Second Life Immersive Social Learning Environment

It is often claimed that Generations X and Y have been brought up in a world of videogames that have become more complex and graphically elaborate since their inception in the 1970s with the simple yet fascinating Pong computer game. Web 2.0 librarians, young adult librarians, and instruction librarians see an opportunity in designing user-centered services involving games, gaming, and gamers. Libraries that offer ludic programming have instituted videogame tournaments and have created IL instruction using gaming formats.^[182–185] Sharon Stoerger notes that participatory information technology is habit forming to the “Net Generation or Millennials” who have been raised on games and the Internet.^[186] The teaching approach of lecture, textbook, and report assignment that has served previous generations now seems

insipid, dry, and staid. Today’s young adults are enlivened by participation and engagement, from which comes involvement and excitement. There is less value attached to merely new information if it is not optimized by participatory experience in an interactive media-rich virtual environment. This social reality laid the foundation for adapting a virtual world gaming environment to provide library services. In the Second Life virtual environment thousands of patrons visit Second Life Libraries every day, experiencing in world reference services from the main teleport landing on Info Island I.^[187] Volunteer avatar librarians serve the many virtual reference stations through the Alliance Library System.

According to technology forecasters, “By the end of 2011, 80 percent of active Internet users (and Fortune 500 enterprises) will have a second life.”^[188] In 2007 more than eight million people had “resident accounts” in the collaborative virtual world of Second Life, one of dozens of virtual environments specialized for children, tweens, teens, or adults.^[189] In April 2006, the Alliance Library System began work in the 3-D multiuser virtual environment (MUVE) of Second Life, helping to develop in-world libraries, collections, and immersive reference services.^[190] What began as a single library, in less than two years grew to 43 islands of the Info Archipelago where over 1000 avatar librarians provide in-world reference service, create and provide virtual spaces for students and educators for classes and collaborative projects, create teleport boards linking the libraries and collections, market and hold events to support literacy, reading, authors, artists, and technology development for libraries, and develop collaborative projects with colleagues, students, and others.^[191] Avatar librarians also provide course and research support to educators teaching in-world, and offer orientation classes and professional development programs for librarians and LIS graduate students who wish to explore work in Second Life.^[192] The myriad advantages of 3-D virtuality for avatar librarians include flying, teleporting, automatic language translation in reference and other collaborations, serving a global clientele and new forms of diversity in user avatars, collaborating with colleagues worldwide, enhanced social and professional networking via affinity groups and friending, enhanced social presence for distance communication, virtual building, scripting, filming, and creating innovative interactive information affordances. The constructivist virtual environment stimulates imagination and feeds innovation in developing new library and information services. Second Life offers a complete research environment for avatar information studies, information seeking in virtual worlds, virtual IL, embodied distance learning, HCI interface studies, AI, and other areas.^[193] In 2008 the American Library Association opened a virtual Washington Office in Second Life’s Cybrary City on InfoIsland.^[194]

The wildly popular social networking sites have sparked another user-revolution that is inherent in the new “participatory culture” consciousness.^[195,196]

The Second Life browser software comes equipped with build-tools, group options, communication tools such as chat and instant messenger, and a menu-driven video capture tool for users to record “machinima” of their experiences, simulations or live events. Machinima is familiar to millions of gamers around the world and is defined as “animated filmmaking within a real-time virtual 3D environment.”^[189]

Librarians also create “story-based *machinima* instruction series” that combine filmmaking, animation, and 3-D video-gaming for instructional delivery. In the machinima (machine-cinema) environment, avatar actors and events in the virtual world are controlled by scripts chosen by users. Some avatar librarians create machinima to document and archive informational, cultural, and educational events in Second Life.^[197] On video-sharing sites, collaborative software allows users to edit or piece together a multimedia film from the raw footage of video uploaded by other users, enabling group editing and storyboarding for joint media productions and community information sharing with collaborative content creation.

Library and information science programs have begun to offer courses and workshops on social computing and the immersive learning environment Second Life that focus on how to make use of the game-based, virtual environment created by the engaging online Second Life world for instruction and self-development. The University of Illinois GSLIS wants to “take the library forward to its future incarnations” beyond the “traditional read-lecture-and-discuss format,” making use of the new game-based immersive learning technology that can provide new ways of library instruction and reference services.^[198] In 2009, the University of Washington I-School began a three-course Certificate Program in Virtual Worlds designed to prepare professionals for work in virtual environments.^[117] A *YouTube* video shows how the San Jose State University School of Library and Information Science is integrating Second Life into its graduate teaching and research program.^[199] The eLearning virtual campus contains classrooms, individual computer workstations, buildings, faculty offices, walkways on grassy paths, and an eCafe used as a social gathering place. The virtual version of the San Jose LIS School sits on a virtual island surrounded by other islands that house libraries and projects by other institutions. Lili Luo and Jeremy Kemp’s research on early adopters among LIS educators found that Second Life is considered a viable instructional platform for 85% ($n = 20$) of respondents.^[200] In the broader context, the 2008 JISC *Serious Virtual Worlds* report provides a review of the use of virtual worlds to support learning and training, including a review of the field and

case study examples, a typology and a list of virtual worlds, and a prediction that future education will take place within virtual worlds.^[201]

Although virtual worlds have been around for over 20 years, it is only really in the last five years that the real potential for virtual worlds has been recognised, and the next 20 years could bring about a virtual world revolution that has the capability to radical (sic) shift how we learn. To ensure that this revolution is successful at engaging students and supporting the development of higher order thinking skills it is vital that we work together as a community and integrate our plans so that the learners of the future have an educational system that gives them an enriched learning experience, does not suppress creativity and helps to create a cohesive community that works together for the greater good.

To ensure that this happens, we need to monitor closely what the exact implications will be of virtual self-organised communities, we need to refocus our educational practices upon the key aims and objectives of our society and we need to find ways to promote excellence in cross-disciplinary research and methodologies.

Learners are fast becoming co-creators of their learning experiences, and virtual worlds and Web 2.0 offer the most constructivist platforms for those activities. The Web 2.0 and 3D infosphere is not merely a more complex information platform for providing users with interactive Web applications. Abram sees the evolving interactive technology as a vehicle for providing “deeper user experiences.” The Internet is thus not merely more collaborative, but transformational. Collaborative constructions are not merely social, but a new way of creating content, meaning, and value.^[202] Open communication, decentralization of authority, and disintermediation of specialty are producing a new intersubjectivity whose content is a living expression of humanity, diversity, and inventiveness.

Information Ethics

As vast numbers of people have entered the online domain they have created new uses and abuses of its systems and content. An ethics vocabulary is emerging with terms users need to understand such as cyberethics, computer ethics, information technology ethics, global information ethics, Internet ethics, content filtering, digital rights, acceptable use policies, electronic privacy, and netiquette.^[203–208] The ethical implications of online use are central to increased legislation and social debate over proper and improper or illegal use of online systems. There is much for users to be concerned about in the online environment, including: e-mail scams, phishing, pharming, and spam, spy software, information security, identity theft, cyber-stalking, grieving, unobtrusive monitoring, information warfare, firewalls, reliability, privacy

policies, and Web spoofing, as well as defense against virus, destructive worms, Trojan horse, denial of service, and other malicious code attacks. All creators of information products and artistic content must be concerned about the ease of online copyright violations, censorship, identity, and intellectual property theft.

A user-centered discipline has emerged in response to a phenomenon that challenges privacy and security of personal information. “Exoinformation” refers to the electronic trail left behind when people are active online: accessing a Web site, sending e-mail, participating in chat rooms, shopping online, filling in registration forms or applications, entering a search query, checking a stock quote, clicking a link, time spent on a page, and many other forms of information left behind through use. With the onset of ubiquitous, integrated, global computing, the sheer amount of exoinformation about ourselves that we leave behind is enormous: what route we take to work at what speed, what we bought at the supermarket, who left a message on our voicemail, what documents we accessed in an electronic library, which news we read daily, when our parents passed on and from what cause, who our online friends are, our favorite books, music and DVDs, what groups we belong to, and so on. According to Benjamin Brunk “an entire industry devoted to collecting and making sense of exoinformation already thrives.”^[209] This naturally raises concerns among users and watchdog groups over misuse, abuse, and criminal activities involved in stealing, manipulating, and profiting from such information. System design and information policy has been evolving a user-centered focus to protect people online; however, such efforts add significantly to the information management work for each individual, as passwords and privacy policies accumulate in an overwhelming barrage of new data to track and keep. In addition, fears are sparked routinely with pop-up warnings and alerts threatening dire consequences if a user ignores the interruption.

CONCLUSION

Complexity is continuously increasing in the IE and human complexity remains a vast domain to explore. It is early in the development of widely used online systems, and there is too little research on interface use and design in LIS and in HCI, particularly with new Web 2.0 applications and virtual platforms. Originally LIS studies concentrated on subject experts and expert searchers, and few in HCI have studied large information systems and their users. Even the rising tide of LIS and HCI Web studies is too small to predict a universal simplified system, and findings about user diversity from the past decade suggest that is a false goal. The rise of virtual environments as immersive learning and work platforms portends greater change and innovation for the information professions. It is clear that user-oriented research will continue to evolve in many fields of study where

understanding IB is considered important to facilitating progress. The LIS field is the most advanced discipline in user-centered focus, theory, methodology, and application. Multidisciplinarity has enhanced the field’s ability to diversify and extend the user-centered paradigm. This continued evolution has the potential to inform other disciplines concerned with understanding IB. Just as twentieth century general systems theory revolutionized thinking and research across disciplines, twenty-first century user-centered research will revolutionize theory and praxis applicable to diverse settings, industries, disciplines, communities, and groups. The user-centered trend led by LIS has become as pervasive as ubiquitous computing and is fast becoming user-driven.

This total involvement or “immersion” in the ecology of information technology has become the new basis for learning. Technological affordances are synergistically linked to sensory organs and motor output, mediated by cognitive and affective procedures that validate belongingness and self-confidence.^[23] Sensory-motor engagement with technological affordances is critical to the process, but it is not the primary motive for the experience or participation. The value and motive for interacting with technology centers on users’ feelings in conjunction with their thoughts, which are necessarily grounded in social group practices. From this arises an intention to interact with a technological affordance. People are motivated to optimize information by engaging with it through their collaborative goals and plans. Recent research and praxis show that people have a strong desire to create and publish content, to write and publish reviews of content, to index and tag content, and to organize and arrange content, and this for individual as well as altruistic uses. The increasing democratization of the IE has engendered new roles for information professionals. In the current and evolving IE, people are free to engage systems to communicate, design, and create. Blending games, community, and learning produces engagement, interactivity and fun, and that core of the user experience will continue to drive the development of user-centered systems and services in the twenty-first century IE. It is clear that user-centeredness will be implicit in all systems.

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User-Oriented and Cognitive Models of Information Retrieval

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Abstract

The domain of user-oriented and cognitive information retrieval (IR) is first discussed, followed by a discussion on the dimensions and types of models one may build for the domain. The focus of the present entry is on the models of user-oriented and cognitive IR, not on their empirical applications. Several models with different emphases on user-oriented and cognitive IR are presented—ranging from overall approaches and relevance models to procedural models, cognitive models, and task-based models. The present entry does not discuss empirical findings based on the models.

INTRODUCTION

The Cranfield model of information retrieval (IR) has dominated IR research until recently—up to 2005. Currently, user-oriented research is popular but theoretical development is quite scarce. The focus of system-driven research is IR algorithms and their evaluation. Algorithms are evaluated for their capability of finding topically relevant documents.

Laboratory IR has recently been challenged by progress in the research into *relevance*, *interactive IR*, and *information seeking*. Recent work in analyzing the concept of relevance has resulted in identifying higher-order relevances, such as cognitive relevance and situational relevance, in addition to algorithmic and topical relevance. Real human users of IR systems introduce nonbinary, subjective, and dynamic relevance judgments into interactive IR processes. Moreover, recent theoretical and empirical work in information seeking suggests that IR is but one means of information seeking, which takes place in a context determined by, for example, a person's task, its phase, and situation. For larger tasks, one may identify multiple stages, strategies, tactics or modes of information access, and dynamic relevance. IR strategies, tactics, and relevance assessments are therefore affected by the stages of task performance.

Because of these empirical findings and theoretical arguments, the traditional Cranfield model of IR evaluation was challenged for its (lack of) realism. It has therefore been suggested that the developers of IR algorithms should consider how the algorithms are to be evaluated—in which frameworks and how to guarantee validity. Ingwersen and Järvelin^[1] discuss the

limitations of, and challenges to, the system-driven laboratory IR.

User-oriented research on the IR phenomena was (and is) not necessarily based on any specific epistemological perspective. It might be practice related or very pragmatic in scope. On the other hand, since its start in 1977, the cognitive approach to IR could briefly be characterized as user and intermediary oriented, with an explicit epistemic approach underlying its scope. Since mid-1990s the approach has gained momentum and turned into a holistic view of *all* the interactive communication processes that occur during information transfer—including those associated with the retrieval engine. Simultaneously, a user-centered IR research shifted focus from exploring traditional (scholarly) online interaction with the human intermediary as a central actor to web-based IR with the end user as the player.

A cognitive turn took place in IR in the early 1990s. Robertson and Hancock-Beaulieu^[2] see this turn to consist of three facets (or revolutions) that are crucial to understand in order to proceed toward a more integrated (holistic) theory of IR: the cognitive, the relevance, and the interactive revolutions. The cognitive and interactive revolutions combined entail the ideas that personal information needs ought to be treated as potentially dynamic, not static. They may change over time—probably due to learning and *cognition* in context during IR interaction. Relevance assessments, hence, also become dynamic and may take place in a variety of dimensions, so that the traditional topicality as a measure of relevance does not stand alone.

The present entry first discusses the domain of, and the kinds of models one may build for, user-oriented and cognitive IR. The focus of the entry is on the models, not on their empirical applications, and therefore we present

several models with different emphases on user-oriented and cognitive IR—ranging from overall approaches and relevance models to procedural models, task-based models, and cognitive models. Due to space limitations, we had to choose between candidate models to present, and therefore some excellent models had to be excluded.

THE DOMAIN OF USER-ORIENTED AND COGNITIVE IR

When the system-driven IR research could be seen to neglect information seekers in its modeling and experimentation, user-oriented IR research focused precisely on them. The complementary nature of these two areas may be seen in the light of Fig. 1.

The system-driven IR research focused on the left side of the figure, on authors' texts, their representation, queries, and retrieval. Text includes all kinds of signs included in documents, such as video, photos, and sound. The user-oriented and initial cognitive IR research focused on the right side, on users' problem space, information problems, requests, interaction with intermediaries, interface design, and query formulation but hardly on analyzing authors' texts, their representation, queries, or IR techniques. With the turn into a holistic view in the 1990s of *all* the interactive communication processes that occur during information transfer, the cognitive approach finally encompassed all the components of Fig. 1—including the algorithmic and document areas. The cognitive and user-oriented approaches were compared to the systems-driven one in several respects (Ingwersen and Järvelin,^[1] pp. 192–194). Salient among the former are:

- *Task dependency*: The perceived work task (or non-job-related daily-life task or interest) situation is seen as the underlying reason for information need development.

- *Role of intermediary*: The role of human intermediaries was originally much in focus but has declined in and after the 1990s; likewise, automatic intermediary systems were in focus in the 1980s, but this focus faded away in the 1990s; currently, end-user behavior and interaction is in focus.
- *Interaction*: This is seen as the central process for cognitive IR; interaction has the purpose to benefit from the cognitive differences between various actors in the IR process; harmonizing such differences is regarded futile.
- *Relevance*: This is seen as objective and subjective, multidimensional, dynamic, and of nonbinary nature.
- *Context*: IR is placed in context in a holistic way: all components/cognitive actors and structures of information seeking and IR are contextual to one another.

CONCEPTUAL MODELS IN INFORMATION RETRIEVAL

There are several different types of models in user-oriented and cognitive IR research. The terminology in the area varies—scholars discuss various models, paradigms, metatheories, etc.—while often meaning the same or a very similar notion: socially shared *ontological* (what is out there to investigate?), *conceptual* (how to name that?), *factual* (what to take as givens?), *epistemological* (how can we possibly know about it?), and *methodological* (how can we learn about it?) assumptions in a research area. The present entry discusses them as *conceptual* models (Ingwersen and Järvelin,^[1] p. 12).

Functions of Conceptual Models

Conceptual models provide the conceptual and methodological tools for formulating hypotheses and theories. Thus, they are, in fact, broader and more fundamental than

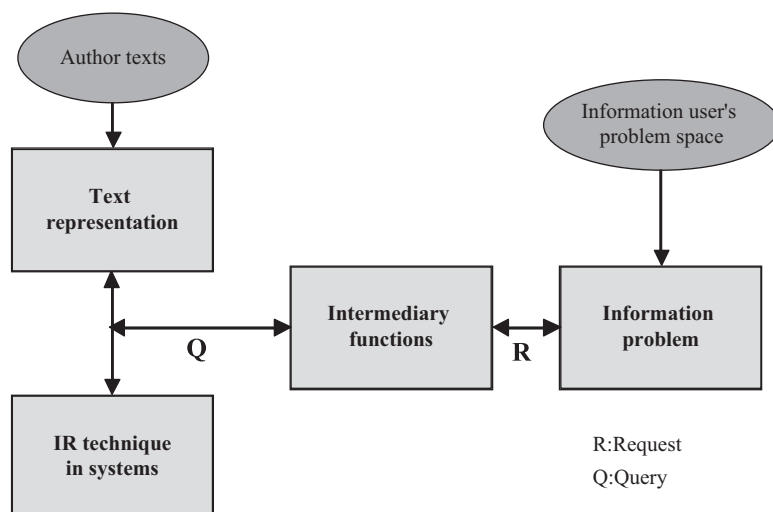


Fig. 1 IR research areas.

Source: From Ingwersen and Wormell.^[1]

scientific theories in that they set the preconditions of theory formulation. When they are also seen to represent schools of thought, chronological continuity, or principles, beliefs, and values of the research community, they become paradigms.

The conceptual model of a research area is always constructed—it does not simply lie somewhere out there waiting for discovery. The construction of conceptual models in a research area often requires conceptual and terminological development. This may involve defining concepts better—regarding preciseness, accuracy, simplicity, generality, and suitability for expressing propositions. Moreover, good concepts represent essential features (objects, relationships, events) and classify central phenomena in ways that lead to interesting hypotheses. This means that the concepts should relate to each other explicitly and in systematic and fruitful ways (Ingwersen and Järvelin,^[1] pp. 11–13).

In the following, models are grouped into generic models and relevance models (“Generic Models” and “Relevance Models” sections), process models (“Online Interaction–Process Models” section), models on cognitive structures and actors (“Cognitive Structures and Actors” section), and task-based models (“Task-Based Models” section).

MODELS OF USER-ORIENTED AND COGNITIVE IR

Generic Models

To map out a research area, one needs a model of a broad scope. Often such models are, in addition to being broad, also generic summary models over a large domain. The Ingwersen–Wormell model and Wilson’s model, discussed in the following text, are such examples.

The Ingwersen–Wormell model

The interaction model by Ingwersen and Wormell^[3] (Fig. 1) represents the components and the interactive processes in IR. The right-hand side presents the user’s (or actor’s) problem space, for example, as part of a process of interest fulfillment or problem solving. If not solved by the actor alone, this “problem space” may lead to an information problem or need that results in a request for information, often formulated for an IR system.

In the middle, the intermediary functions consist of the entire system’s capacity to understand and support the information problem of the current actor, as well as the search possibilities and logic of the source system. These functions form part of the professional knowledge of the human intermediary (librarian/information specialist) or may be skillfully adapted to a front end to the system as a search interface, in order to support retrieval. On the left side, components consist of author texts to be

represented through indexing and of IR techniques that determine the behavior of the IR system.

Interaction takes place between an intermediary and an actor having a desire for information, whereby request formulation and reformulation (R) may occur. The query denotes reformulation or transformations (Q) of the request(s) for information, in the form required by the actual IR technique. At search time, the IR technique and actor’s request and query (re)formulation interact.

The model reflects the typical pre-web and pre-PC research situation strongly involving a human intermediary or an interface construct consisting of intermediary knowledge and functionalities—see also the MONSTRAT and Mediator models (“Cognitive Structures and Actors” section). The model points to a number of central variables involved in IR interaction, most of which were studied intensively. The text representation component and processes were the least investigated—yet note the Anomalous State of Knowledge (ASK)-based studies (“Cognitive Structures and Actors” section) and the THOMAS system,^[4] which early on included this aspect.

Wilson’s model

Wilson^[5] summarized the central user-oriented or cognitive research models associated with information behavior studies, including interactive IR. His overall model (Fig. 2) demonstrates the nesting of the central concepts, hereby also showing their contextual nature.

The central idea in Wilson’s model is that interactive IR always takes place in the context of information seeking that again constitutes one of several information behavioral activities. As Wilson saw it, many IR models were basically confined to IR (the Cranfield model of IR) or interactive information retrieval (IIR)—not covering the information-seeking process. A limitation of such models would be—as they contain strong elements of IR systems—that they do not explicitly point to softer seeking processes *not* involving formal information channels. The model points to ideas about which kind of behavioral processes are distinctively

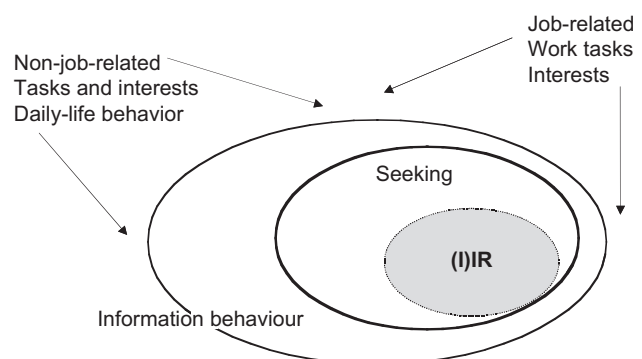


Fig. 2 A nested model of information behavior.

Sources: Modified from Wilson^[5]; Ingwersen and Järvelin.^[1]

not seeking processes, as, for instance, communication and generation. Wilson's model depicted in Fig. 2 contains, as an added feature, also the underlying situational reasons for information (seeking and IIR) behavior: the notions of "daily-life interests" and "work task."

Relevance Models

The concept of relevance has been a difficult issue in information science and IR through the years. It received a lot of attention in the 1960s and 1970s—as reflected in Saracevic's^[6] review. The main orientations in the notion of relevance were found early: on one hand, one may speak about topical relevance and on the other hand, about user-oriented relevance. After a decline of interest in relevance in the 1970s–1980s, there was a revival of interest in the 1990s, producing several models of relevance based on a dynamic, multidimensional, and multigraded view of relevance. Here the models by Saracevic, Cosijn, Wang and Soergel, and Borlund are discussed.

Saracevic's stratified model

Saracevic's stratified model of interaction levels^[7] was inspired by the idea of actors placed in a context—called the "environment." The model (Table 1) served dual purposes: it pointed to three communication levels and led to a revised view of the types of relevance involved in IR. The communication levels consisted of a *surface processing stratum* (light gray) dealing with data processing between sources and interface—based on a query; this stratum is hence concerned with morpholexical and syntactic levels of information processing. The second stratum is the *interactive cognitive communication level* (gray) embracing the processes of perceiving information during human–machine interaction in relation to the perceived need for information. The third stratum is called "situational" (dark gray) and refers to information use with respect to a perceived work task in context. The latter

two strata also rely on semantic and pragmatic levels of information processing.

Saracevic proposed a range of relevance types in IR interaction,^[7] suggesting five increasingly subjective types of relevance: 1) "algorithmic" relevance, which is the basis for the ranked output by the search engine and refers to the statistical and morpholexical relationships between request (or query) and retrieved objects; 2) "topicality" relevance, basically dealing with the aboutness relationship between document contents retrieved and request, as assessed by a person [owing to the human assessment (interpretation), this type of relevance is not objective but rather of subjective, emotional, and intellectual nature]; 3) "pertinence" relevance, which is associated between the nature of retrieved objects and the information need as perceived by the actor at a given point in time; 4) "situational" relevance, corresponding to the relation between the retrieved objects and the work task (or daily-life) situation as perceived by the individual actor; and 5) "emotional/intentional" relevance. This stratified model became later extended to include graded relevance as an additional dimension by Spink, Greisdorf, and Bateman.^[8]

The Cosijn model

Cosijn and Ingwersen^[11] further developed the Saracevic's model. They saw the emotional/intentional type as forming a natural part of *all* the subjective relevance categories;^[2–4] they also replaced it by a "socio-cognitive" relevance category referring to domain, context, and collective situational preferences. The socio-cognitive relevance by Cosijn and Ingwersen is objective and tangible. It signifies situational relevance assessments and interpretations made by *several* cognitive actors, simultaneously (like in a team or program committee) and/or temporally (citations, in links).

Fig. 3 integrates relevance types with the stages of an interactive IR process. Moving from the lower right-hand corner upward signifies awareness and perception of the work task context that influences the information-seeking processes turning into IR interaction and finally algorithmic IR. The opposite move implies feedback from the system and possible request and need modification, as well as the use of information for task performance, influenced by the simultaneous relevance judgments. Automatic query modification takes place in the upper left corner, based on algorithmic relevance assessment. This model suggests hypotheses on relationships between relevance types and criteria, and information-seeking, and retrieval processes and actions.

The Wang–Soergel model

Moving into the details of using information resulting from IIR, Wang and Soergel produced their document

Table 1 The Saracevic stratified model in tabular form

Figure 1. The Saracevic stratified model in tabular form			Information use	
Interaction	Layer	Adaptation		
The diagram illustrates the Saracevic stratified model. It consists of a central column of layers: Environment (dark gray), Situation (dark gray), User knowledge, tasks, etc. (light gray), Query characteristics (light gray), Interface (light gray), Computational resources (light gray), and Informational resources (light gray). To the left of these layers is a vertical double-headed arrow labeled 'Interaction Levels/strata'. To the right of the layers are two vertical double-headed arrows labeled 'Adaptation', one between the top three layers and one between the bottom three layers. To the far right is a vertical double-headed arrow labeled 'Information use'.	Environment	Adaptation	Information use	
	Situation			
	User knowledge, tasks, etc.			
	Query characteristics	Adaptation		
	Interface			
	Computational resources			
	Informational resources			

Source: Adapted from Saracevic,^[7] p. 218.

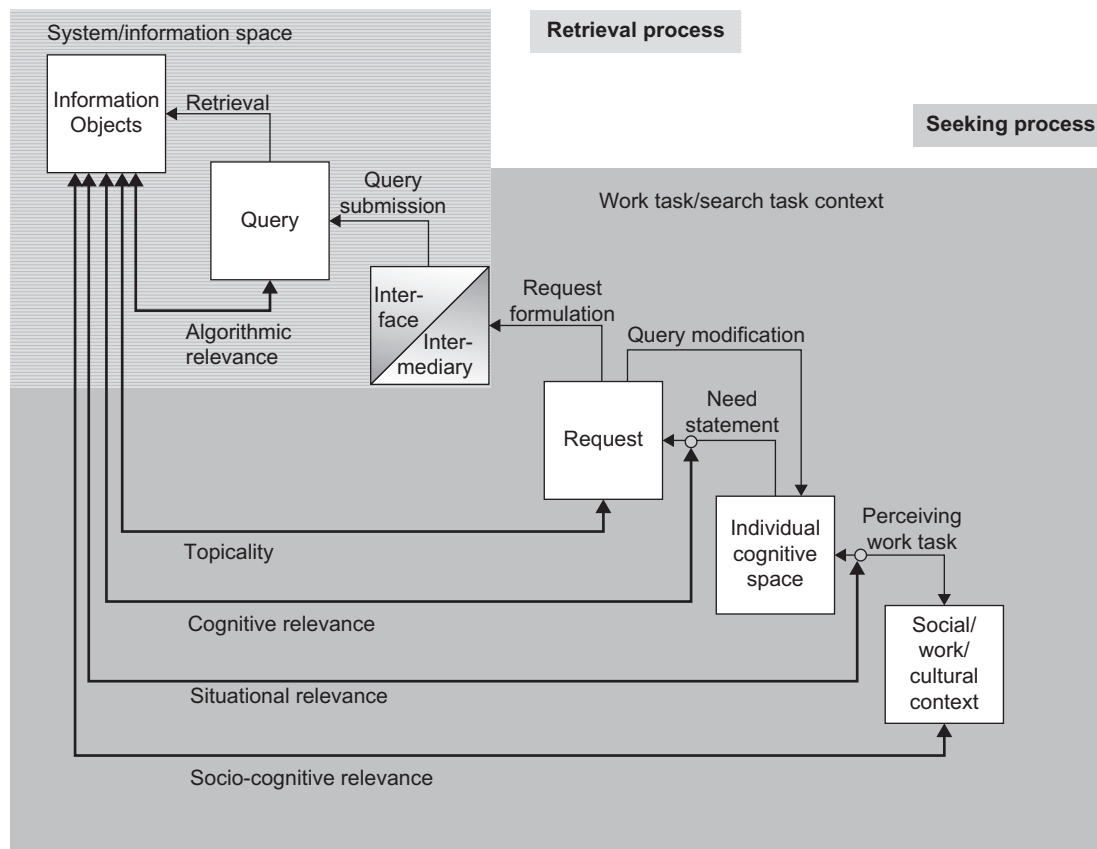


Fig. 3 Integrating relevance types with the process stages of interactive IR.

Sources: From Cosijn.^[9,10]

selection framework.^[12] It was based on a longitudinal empirical study of 25 self-selected faculty and graduate students in Agricultural Economics. The framework, Table 2, was also a stage model. It presents in great detail the decision stages by applying 11 relevance criteria and five document value dimensions for the decision to select (and potentially later to use) retrieved documents. In addition, it succeeds in combining the criteria, values, and decisions with so-called document information elements, that is, author-generated document structures and data elements, as well as significant data connected to the “isness” of information objects. These are representations of additional cognitive actors responsible for the being of documents. It supplies highly interesting and novel possibilities of hypothesis generation on relationships between *structured* document *features*, actor knowledge, multiple relevance criteria, and perceived value(s) of documents. It supplements the Cosijn model pinpointing to assessment variables at each point of subjective relevance judgment.

The Borlund model

Borlund summarized and discussed relevance research.^[13] Her model seeks to cover all the relevance types discussed

earlier in an analytical manner, taking into account the temporal dimension too (Fig. 4).

The double circle signifies that more than one actor (assessor or user) may be influenced by the same work task situation, also over time, and thus produce socio-cognitive relevance assessments.^[11] Each actor may dynamically over time perceive the work task differently (CW–CWⁿ) and thus produce new versions of the actor’s information need (N–Nⁿ). Algorithmic relevance (A) takes place in the real world and is objective, whereas intellectual topicality (IT), as Borlund calls “topicality,” and pertinence (P) are seen as subjective manifestations of relevance. IT curves into the actor to signify interpretation activities. The model may in addition point to other relationships and comparisons, for instance, between the real work task and formulated requests and queries or between the task, its fulfillment, and the retrieved objects.

Online Interaction–Process Models

A number of models describe and analyze online searching, mainly in a Boolean real-life searching environment. Models by Fidel and Bates, discussed here, are representative and, owing to their generic nature, also still highly useful in the web IR context. Further, a model by

Table 2 A tabular representation of Wang–Soergel document selection decision stages

		Knowledge of	Decision rules		
		Topic	Elimination		
		Person	Multiple criteria		
		Organization	Dominance		
		Journal	Scarcity		
		Document type	Satisfice		
			Chain		
Process					
Document →	DIEs →	Criteria →	Values →	Decision	
Components					
	Title	Topicality	Epistemic	Acceptance	
	Author	Orientation	Functional	Maybe	
	Abstract	Quality	Conditional	Rejection	
	Journal	Novelty	Social		
	Series	Availability	Emotional		
	Date	Authority			
	Type	Relation			

DIEs, document information elements; values, document values/worth.

Source: Adapted from Wang and Soergel,^[12] p. 118.

Kumpulainen is presented as it includes dimensions of searching patterns in heterogeneous information environments. The models focus on the actor's behavior in online interaction, especially on the acts (at various levels of conceptualization) that the actor may choose to implement.

Fidel's models

Fidel and Soergel^[15] developed a comprehensive model on factors affecting online bibliographic retrieval. They classified hundreds of searching variables into seven categories such as the *retrieval setting* (the organization, the status of online searching within it, the actor group), the *actor* (e.g., personality, education, and experience), the *request* (e.g., domain, complexity, and specificity), the

database(s) used for searching (like coverage, structure, and cost), the *search system* (e.g., searching aids and output formats), the *search process* (e.g., interaction with the actor and query formulation), and *search outcome* (recall, precision, and other measures). This model suggests a large number of variables and their possible relationships. The authors also noted that, taken individually, the variables seem to have little influence on the search outcome. This model is abstract and analyzes to some degree the relationships of categories and their proposed variables. It is a specific model for all online (bibliographic) IR—but can easily be usable in web IR environments.

In a range of empirical studies, Fidel investigated the basic dimensions of online searching.^[16–21] She first observed online searchers doing their regular job-related searches. This led to a characterization of *operationalist*

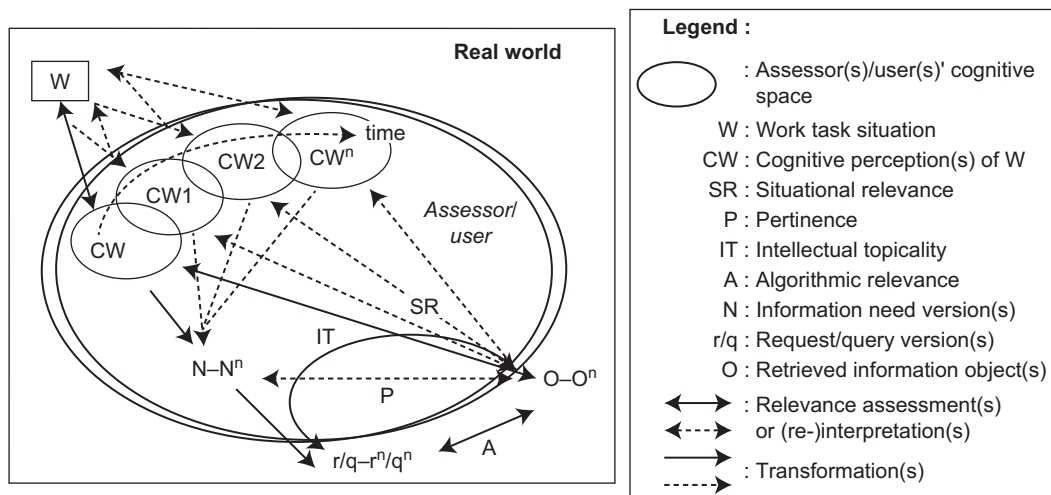


Fig. 4 Types of relevance in a temporal setting.

Sources: Modified from Ingwersen and Järvelin^[11]; Borlund.^[14]

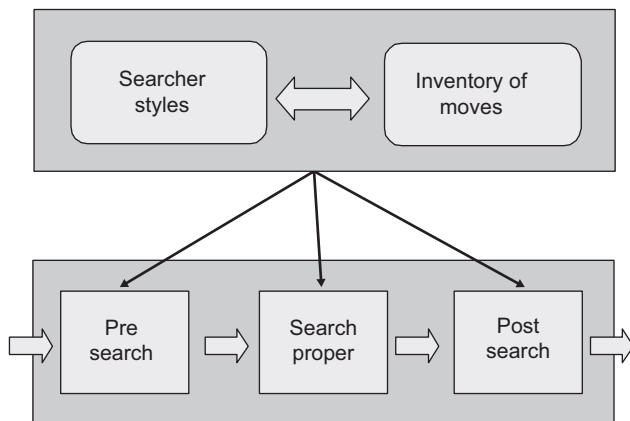


Fig. 5 A simplified view of Fidel's model.

Source: From Fidel and Soergel.^[15]

and *conceptualist searchers* at pre-search, search proper, and post-search stages (Fig. 5). The former tended to use a large range of IR system capabilities in interaction (operational moves), focus on precision, but tended not to modify the specific meaning of requests. On the contrary, the latter tended to map requests into a faceted structure, focus on recall, and to use conceptual moves and thus modify the specific meaning of requests.

Subsequently she analyzed the searchers' moves in interaction that are used to cut down or enlarge, or to move, a search to better target it. Eighteen operational moves and a dozen conceptual moves were identified. The former keep the meaning of a search formulation intact but affect the result size or target, for example, by limiting a search key to an index term field, adding a synonym, or limiting by year of publication or language. The latter changes the conceptual content of a search formulation, for example, by intersecting the formulation with a new conceptual facet and by using broader or narrower index terms.

Finally, Fidel analyzed the searcher's selection of search keys and searching styles during operational online IR. Searching style was found to have a primary effect on retrieval behavior over three dimensions: 1) level of interaction; 2) preference for operational or conceptual moves; and 3) preference for text words or index terms. The *operationalist searcher* prefers to employ operational moves and is less concerned with recall than the *conceptualist* counterpart. The *free-text searcher* prefers to apply text keys and avoids consulting a thesauri. In effect, Fidel's model is a model on the interaction process stages, possible moves, search key selection, and the searching actor's styles.

Bates' berrypicking

Bates^[22,23] classified information search and idea tactics, which were intended for use in teaching and facilitating

searching—seen as an interactive process using a (Boolean) IR system. In all, 29 search tactics in four categories and 17 idea tactics were proposed. The tactics can be used to analyze what happens in a search process and to facilitate further steps in an ongoing process—related to Fidel's moves. The tactics themselves do not contain factors that would connect the search process to its context—for analysis and explanation.

Later, Bates^[24] criticizes the narrow view of IR (traditional online and laboratory noninteractive) as searching based on a stable topical need. To Bates, real-life IIR was exploratory like *berry picking*. She developed berry picking as a principle for actor behavior that became very influential during the 1990s. The principle entails that each new piece of information that the actors encounter provides them potentially with new ideas and direction to follow through interaction, and consequently a new conception of their information need. At each stage of the search, the actor may identify useful information items leading the actor onward. Therefore the actor's requests and queries have several versions, which may change owing to the system feedback and actor's interpretation. Thus, we may here not simply talk of alternative versions of the request but also of more profound modifications. During the process, the actor may also repeat a query or revisit some earlier retrieved objects due to knowledge processes and cognition. Bates called this mode of retrieval an "evolving search." The information need situation is hence not satisfied by a single final retrieved set, but by a series of selections on the road, so to speak, of individual (elements of) information objects. Bates suggested several capabilities that might support the actors better in their various information-seeking strategies than the IR systems of that time. In effect, Bates' model is an abstract descriptive model of IR interaction.

Search trails

Kumpulainen^[25] presented a task-based approach to model search behavior patterns. Influenced by earlier search process models reflecting people's real-world search behavior (e.g., Fidel,^[18] Bates),^[22] Kumpulainen's model targets a need to understand search behavior across several search systems. Search patterns across information systems are named "trails" and defined as follows: "A trail is a manual integration pattern, which includes one or more sequences of queries, and which may spread over several search systems containing heterogeneous information types" (Kumpulainen,^[25] p. 857). Based on a qualitative study within the domain of molecular medicine, Kumpulainen empirically identified and modeled five different trail types: 1) *single* trails where only one query and one system is involved; 2) a *list* formed by similar types of queries submitted into a single system; 3) a *chain* formed by searches to several systems in a chain-like manner; 4) a *branch* formed by a search to several systems, which can

Table 3 The communication system of information science

Linguistic level of the system		
Generators	→ Texts	↔ Recipients
Cognitive level of the system		
States of knowledge	→ Information	↔ ASK

Single-headed arrows (→) denote transformations and double-headed arrows (↔) interaction.

Source: Adapted from Belkin^[26]

be concurrent and are unordered; and 5) a *berry-picking* trail formed by an exploratory search behavior and a dynamic information need. The strength of the modeled trail types is that they reflect a real-world heterogeneous information environment where actors might submit several queries across different search systems.

Cognitive Structures and Actors

The cognitive approach to IR produced several models of cognitive structures and actors and their interaction. The seminal ASK model by Belkin and colleagues and the MONSTRAT and Mediator models by Belkin and colleagues and Ingwersen are discussed in the following text. The latter were part of the active development of intelligent intermediary systems for IR in the 1980s and early 1990s.

The ASK model

Belkin^[26–28] developed the ASK hypothesis and a concept of information for information science. The model in Table 3 is very general and abstract. Initially, it signified the cognitive communication system of information science;^[26] later on, it mapped the IR interaction at the two most important levels of cognition: 1) the cognitive and 2) the linguistic (surface) levels of communication.^[27] In contrast to earlier and contemporary common beliefs in user studies and laboratory IR that an information need “jumps out of the blue”—and is context free—the ASK hypothesis attempted to explain *why* information need situations occur. The fundamental reason behind an ASK was the problematic situation the actor was facing if the actor could not manage to fulfill an issue or solve a problem at hand. In addition, ASK implies that the ensuing information (search) situation is dynamic, and needs and requests may change with variation in cognition over retrieval session time. At the surface level of a message, we have the texts (signs), with which the recipient interacts. If the recipient perceives the signs, information is communicated at the cognitive level, and the ASK is thus under change. This model led to more detailed cognitive communication models for information transfer, for example, by Ingwersen,^[29] p. 33, and further to the “bag” models for interaction (Ingwersen and Järvelin,^[1] p. 33, p. 50). Also, the ASK model led, through several empirical studies, to the MONSTRAT model by Belkin, Seeger, and Wersig.^[30]

Table 4 Functions of the MONSTRAT model

Name of function	Description
Dialogue mode (DM)	Determine appropriate dialogue type for situation, e.g., natural language, menu, form-based
Problem state (PS)	Determine position of user in problem treatment process, e.g., formulating problem for a paper (student)
Problem mode (PM)	Determine appropriate mechanism capability, e.g., reference IR or referral to institutions and persons
User model (UM)	Generate description of user type, goals, beliefs, e.g., graduate student, thesis or paper, R&D person, etc.
Problem description (PD)	Generate description of problem type, tonic, structure, environment, wanted attributes in texts (doc.type)
Retrieval strategy (RS)	Choose and apply appropriate retrieval strategies to knowledge resource, e.g., exact match, extended Boolean
Response generator (RG)	Determine propositional structure of response to user appropriate to situation, e.g., list document titles
Input analyst (IA)	Convert input from user into structures usable by functional experts, e.g., parse NL request text, note option selection
Output generator (OG)	Convert propositional response to form appropriate to user and situation, e.g., display new menu, rank titles
Explanation (EX)	Describe mechanism operation, capabilities, etc. to user as appropriate

Source: Adapted from Belkin et al.,^[31] p. 399.

The MONSTRAT and Mediator models

Belkin and colleagues followed up the work on the ASK hypothesis by a functional discourse analysis of pre-search client–librarian interactions. This led to an analysis scheme consisting of 10 categories and a number of sub-categories (Table 4). The metacategories of the scheme correspond to the intermediary functions that constitute the analytic MONSTRAT Model (*modular functions based on natural information processes for strategic problem treatments*) developed by Belkin, Seeger, and Wersig,^[30] which, again, was the basis of the active development of intelligent intermediary systems in the 1980s.^[31]

Probably owing to its foundation in the analysis of search interviews, the model encompasses the functionality of an interface for interactive IR but emphasizes strongly the human actor side. Only the retrieval strategy (RS), response generator (RG), and the output generator (OG) functionalities are associated with underlying IR engines and/or information sources. Hence, intelligent systems built on MONSTRAT (and similar expert system architectures) become stand-alone systems. The underlying document collection and the retrieval engine is

integrated with the interface and hence not really modeled by MONSTRAT. This led Ingwersen to propose an extension to MONSTRAT, the Mediator model.^[29] That model is based on 13 major functionalities and more than 50 minor ones. A rather symmetric cognitive view of the information transfer processes and knowledge types involved is reflected in the principle of the model. According to the Mediator model, an intermediary mechanism must possess knowledge of the underlying *system setting*, including knowledge of documents, representation algorithms, and database structures, and the *IR processes*, that is, source selection and strategies. Symmetrically, it should contain knowledge of users (human actors) and their potential preferences and expectations, IR know-how, and domain knowledge (a preconditioned *user model*) and be able to carry out *actual user and request model building* during retrieval, based on the user model. In order to be operational, it must consist of knowledge concerned with *domains and domain tasks* (emotional/conceptual structures) and have *intentionality*, that is, means to store and use expectations based on past experiences and are able to plan its actions. Bates^[32] discusses critically the desirable level of automatic support in IR interfaces.

Ingwersen's interactive IR model

A more symmetric perspective of IR interaction and transfer in general, centering on the interface–actor interaction, is observable in the contextual models by Ingwersen (Ingwersen;^[29] extended in),^[33] which further explore the IR processes and components originally depicted in Fig. 1. Ingwersen^[29,33] modeled IR interaction by incorporating the socio-organizational environment (context) of the current actor. That context includes the scientific or professional domain(s) with information preferences, strategies, and work tasks that influence the perception of the actor. The model also emphasized polyrepresentation in documents, in search engines, and in the cognitive space of searchers at any point in time. Further, the model introduced the influence of context on the information and system spaces and the social interaction between socio-organizational factors and actors. It is in this model that cognitive actors appear for the first time, signified by the notion of “models” in each component. However, the model did not explicitly demonstrate the relevance and information use dimensions of interactive IR. The principle of polyrepresentation is derived from the cognitive models and is further analyzed.^[34]

Task-Based Models

Toward the end of the 1990s, the cognitive models of IR increasingly developed into explicitly task-based models. Vakkari^[35,36] extended the Kuhlthau model of information seeking into the field of task-based IR. Ingwersen

and Järvelin^[1] further developed Ingwersen's model (“Cognitive Structures and Actors” section) into a genuine multidimensional research framework for IR and seeking studies, Xie's model^[37] suggested how to integrate macro- and microlevels of interactive IR, and finally, Järvelin and colleagues^[38] proposed and modeled an evaluation framework encompassing the complexity of task-based information interaction in practice.

Vakkari's model

Vakkari^[35,36] extended the Kuhlthau model of information seeking^[39] in the field of task-based IR, based on a series of longitudinal empirical studies (Fig. 6). His model explicates the relationships of task performance stages, kinds of information sought and its potential contribution, factors related to searching, and relevance assessments and information use. In addition to the analysis explicated by the model, Vakkari showed that phases in task performance were systematically connected to the information searched for, and the search tactics and usefulness of the information retrieved.

The strengths of the model include the following: 1) There is a clear-cut and necessary distinction between domain knowledge associated with (work) task performance, and IR knowledge. 2) Work task stages and the use of information in work task performance are clearly separated from search task execution. The end product of the search task that of relevance assessments bridges back to the use of information in task execution. 3) There exists the concept of “expected contribution,” which refers to the experience gained by the actor in temporal sense.

The Ingwersen–Järvelin integrated model

Ingwersen and Järvelin,^[1] (p. 261, 274) further developed and extended the cognitive and task-based IR models to a comprehensive model of information seeking and retrieval (IS&R) (Fig. 7). Numbers on the model basically deal with processes of interaction (1–4) such as social interaction (1) or refer to different kinds of generation and transformation of cognition or cognitive influence (5–8). They are explained in the following text in more detail.

The model (Fig. 7) emphasizes the information processes that are executed during IS&R in context over time: First, processes of social interaction (1) are found between the actor(s) and their past and present sociocultural or organizational context. Social interaction may instigate IS&R activities, but may also form part of their fulfillment. Second, information interaction also takes place between the cognitive actor(s) and the cognitive manifestations embedded in the IT, and the existing information objects via interfaces (2/3). The latter two components interact vertically (4) and constitute the core of an information system. This interaction only takes place at the linguistic sign level. Third, cognitive and emotional

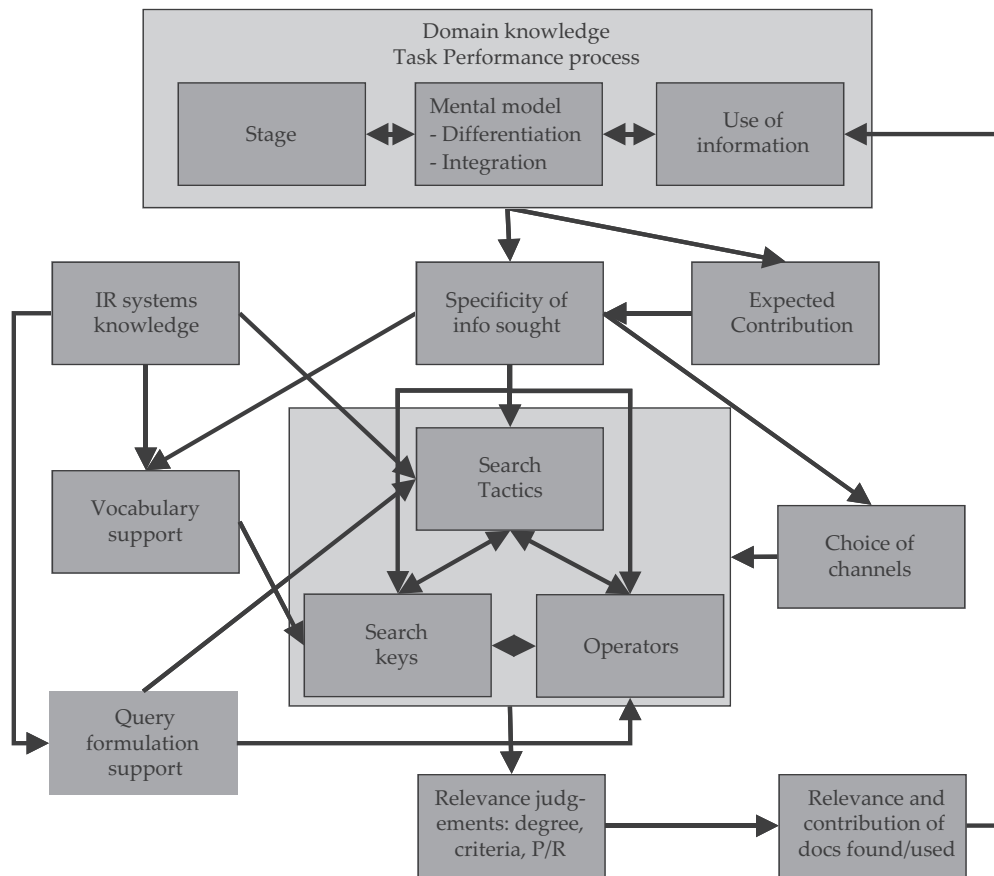


Fig. 6 Stages in work and search task performance. Arrows represent the direction of impact.

Source: Vakkari.^[36]

transformations and generation of potential information may occur as required by the individual actor (5/7), as well as from the social, cultural, or organizational context toward the IT and information object components (6/8) *over time*. This implies a steady influence on the information behavior of other actors—and hence on the cognitive–emotional structures representing them. The impact entails that actors may collaborate in teams—like in collaborative IR(CIR)—and collectively adapt to their surroundings.

The model emphasizes that all the participating cognitive structures are in context of all other cognitive components of the model. Hence, there exists a mutual dependency of context and actor or component, including intracomponent structures. For instance, images in objects naturally act as context for the surrounding text—and *vice versa*. At a more detailed level, depicted inside the nodes, the model develops further into the complexity of cognitive structures associated with its five components. Each structure may take a different form depending on the type of information objects, media, and domain.

The framework suggests *empirical variables* that can be combined for research, and from which one may make hypotheses and predictions of potential solutions, for instance, for IR systems development or evaluation

(Ingwersen and Järvelin,^[1] pp. 274–275). A more complete set of research variables categorized into nine dimensions extracted from this model, as well as suggestions for research designs, are discussed in Ingwersen and Järvelin,^[1] pp. 313–376.

Xie's planned-situational interactive IR model

With an aim to integrate macro- and microlevels of interactive IR, Xie^[37] proposed in 2008 the planned-situational interactive IR model (Fig. 8). The model builds on earlier interactive IR models, empirical research, the planned model approach from cognitive science, and theory of situated action derived from social science. At the microlevel, the model illustrates the determining factors of information-seeking strategies. Thus, it presents the relationship between 1) levels of actor goals and tasks including dimensions of work/search tasks, 2) actor's personal information infrastructure, and 3) information-seeking strategies constituted by interactive intentions and retrieval tactics. Further, the model illustrates how plans and situations codetermine interactive intentions and retrieval tactics in the information-seeking process (Xie,^[37] p. 236) and thus argues that information-seeking

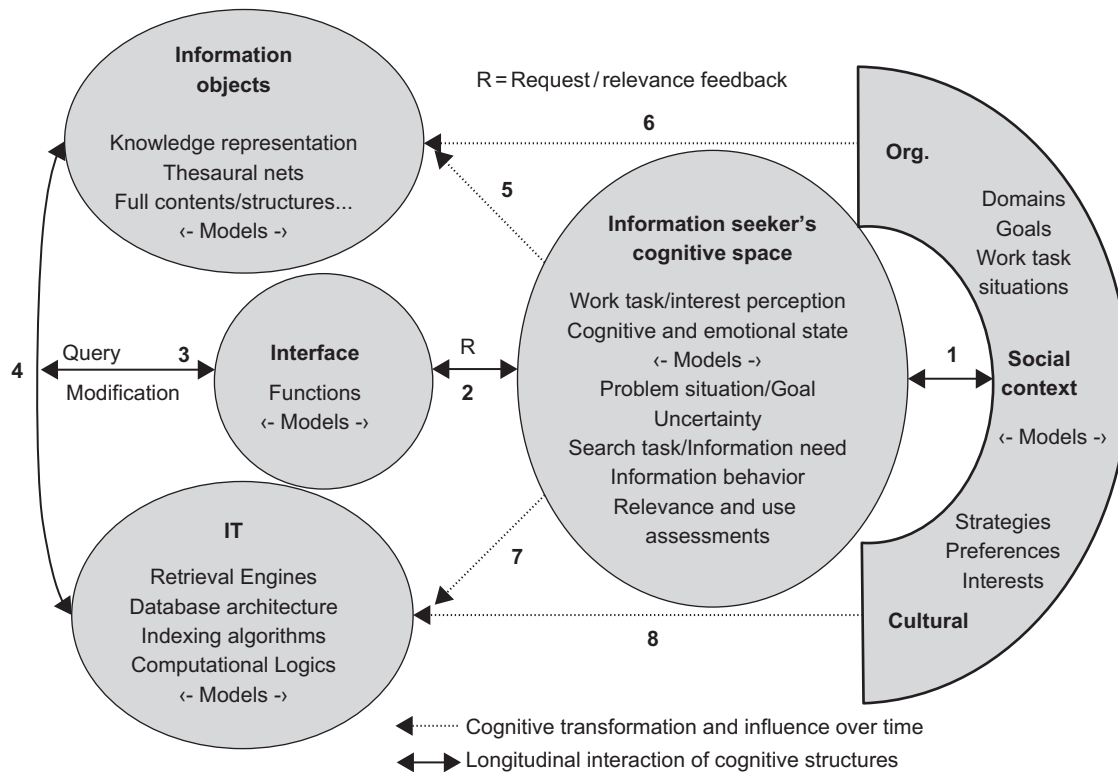


Fig. 7 Cognitive framework of interactive information seeking, retrieval, and behavioral processes.

Source: Ingwersen and Järvelin.^[1]

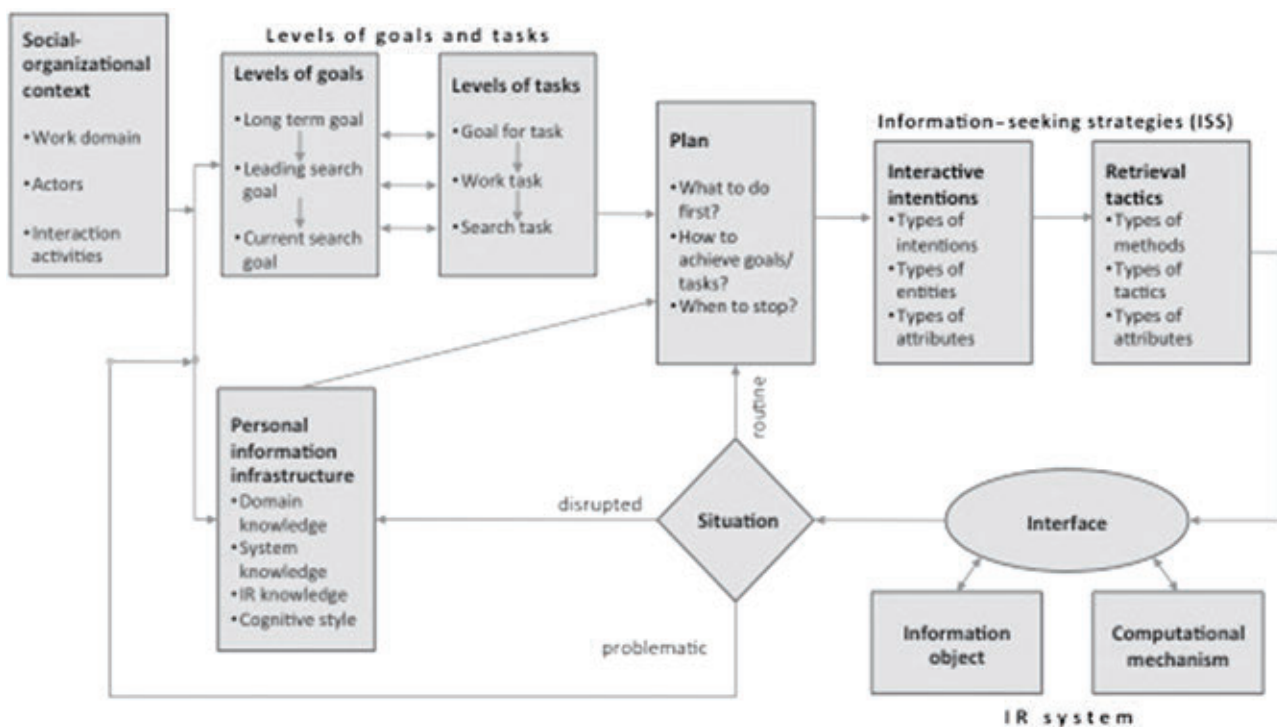


Fig. 8 Planned-situational interactive IR model.

Source: From Xie.^[37]

strategies can be seen as a product of plans and situations. In contrast to earlier models by Xie, the planned-situational interactive IR model includes the social-organizational context and actor-system interaction at the macrolevel. The model can therefore be seen as a further development of the Ingwersen-Järvelin integrated model^[1] illustrating how to integrate microlevel elements of interactive IR process to the macrolevel processes. This is the main strength of the model in combination with the comprehensive explanation of how the model relates to and builds upon earlier user-oriented and cognitive IR models (Ingwersen and Järvelin,^[1] Bates,^[22,23] Vakkari,^[35] Kuhlthau,^[39] Ellis^[46]).

Task-based information interaction evaluation framework

Järvelin and colleagues^[38] pointed to the need for a comprehensive and systematic evaluation framework encompassing the complexity of task-based information interaction in practice, that is, involving actors, contextual factors, and highly interactive search situations and focusing on how interactive IR improves human task performance—in contrast to taking a traditional IR approach measuring ranking of relevant documents. Accordingly, the authors modeled an overall evaluation framework illustrating the components in a task-based information interaction (Fig. 9). Building on program theory,^[40] the evaluation framework aims to generate program theories upon which task-based information interaction evaluation can be built. The evaluation framework consists of 1) *inputs* of contextual factors, perceived task, and actor; 2) *activities* undertaken during the process, namely, task planning and assessment, searching information items, selecting items, working with items, and synthesizing and reporting; 3) immediate *outputs* such as documents or presentations; and 4) possible *outcomes* measuring learning or task outcomes. Järvelin and colleagues describe in detail how the framework supports the evaluation of each of the individual activities using their specific program theories. A main strength of the evaluation framework is

that it focuses on explaining causal relationships between program components *and* explaining how components are related to each other. Accordingly, evaluation is not limited to, for example, performance of the individual tool, but aims to encompass the complexity of humans performing tasks with tools in contexts.

CONCLUSION

In contrast to the Cranfield model of IR, there must exist several models for information seeking and interactive IR that complement one another. Which one to use is dependent on the kind of IS&R processes one wishes to study, in particular when involving seeking actors. The latter models constitute a form and level of complexity not dealt with in system-driven information research and models.

The future may see the development of models and frameworks that increasingly encompass (task-based) context. Here it seems important to stress not only that socio-cultural and organizational contexts are central to information interaction but that the system, network, and information space—the systemic context—are vital for understanding such processes. Even relevant infrastructural features, like bandwidth or legislation, may necessarily form part of such contextual models.

FURTHER READING

Ingwersen and Willett^[41] is an introduction to systems-oriented and cognitive approaches to IR. In addition, there are early ARIST reviews on search techniques,^[42] cognitive research,^[43] and the user-oriented perspectives of IR research and analysis methods.^[44] Further reviews and discussions of the cognitive approach to IR during the 1980s can be found in Belkin's overview,^[45] in Ellis's^[46,47] critical essays on the cognitive paradigm, and in Ingwersen's,^[29] monograph. Belkin outlined the major contributions of analytic and empirical nature that have been rather explicitly based on the cognitive approach. The latest

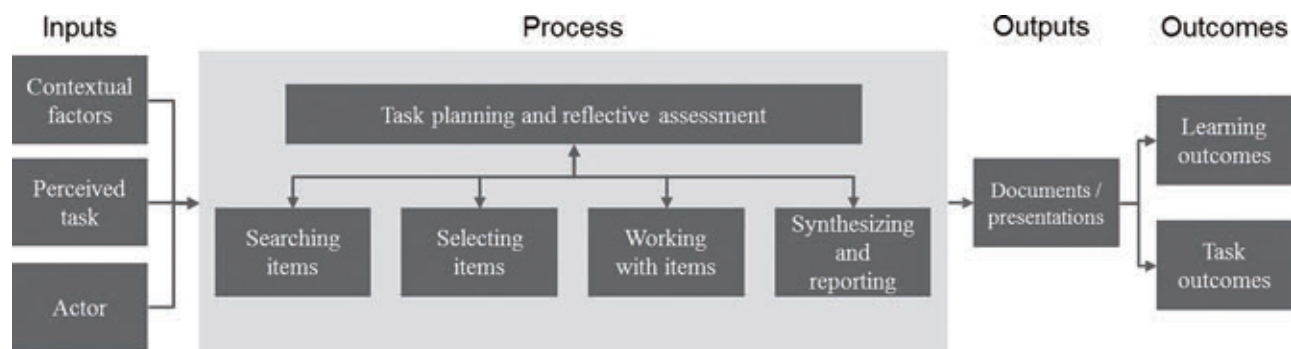


Fig. 9 Overall task-based interactive information evaluation framework based on program theory and five activity types.

Source: From Järvelin et al.^[38]

period sees the review on relevance research by Schamber,^[48] while Efthimiadis^[49] and Spink and Losee^[50] provide in-depth discussions of models and empirical results of (human) query expansion and feedback issues, respectively. Harter and Hert^[51] review the approaches and methods for the evaluation of IR systems, also of relevance to user-oriented evaluations. In addition, Kelly and Sugimoto^[52] present a systematic review of 40 yrs of interactive IR evaluation studies. Vakkari reviews the issues addressed in research on task-based information searching.^[53] Web searching studies during the period and comparisons to more traditional (I) IR studies are reviewed by Jansen and Pooch.^[54] Studies of the reading and use of academic literature is discussed by King and Tenopir^[55] Further reviews and discussions of the cognitive approach to IR during the 1990s can be found in Ingwersen's^[56] ARIST chapter, and Ingwersen^[57] discusses the user's role in interactive IR evaluation studies. Ingwersen and Järvelin^[1] develop a synthesis of laboratory and cognitive approaches to information seeking and retrieval.

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Venezuela: Libraries and Librarianship

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Abstract

This entry presents a general, brief, and nonexhaustive overview on the origin, development, and the crises of Venezuelan libraries and librarianship. The first section offers an historical background on the first Venezuelan libraries, highlighting the origin of the National Library, together with some of the most important characters of this early history. Moreover, it narrates milestones such as the first Law of Libraries of the country, the celebration of librarian's day, and the *Caracas Declaration*. The second section briefly presents some current types and examples of Venezuelan libraries, such as academic, public, special, digital, and repositories. The third section discusses the development of Venezuelan librarianship, the related professional degree and professional education, including the main schools, programs, and curricula. The fourth section summarizes the current crisis faced by libraries and the profession itself. Finally, some brief comments are offered as a conclusion.

The university cannot be neutral in the historical debate between democracy and dictatorship.

—Rómulo Betancourt (1959)

A National Information Policy has more possibilities of receiving significant government attention if it were supported by information professionals.

—Iraset Páez Urdaneta, *In Information for the development of Latin America* (1990)

Manuel Segundo Sánchez showed, in his patient and quiet labor, that there was a liberating force of the spirit, that there was an escape and an alibi to arm the resistance, which was no other than mankind's culture, in front of which dictators and warlords in power would never understand their unassailable argument.

—Karl Krispin (2007)

Public Libraries (NSPL) was established between 1970 and 1980, and the base of the pyramid is comprised by the academic libraries, which are located throughout the main cities of the country. Some special and institutional libraries are noteworthy, but they are isolated cases. The National Library (NL) is the main library institution in the country; public policies of the sector and the planning of the NSPL stem from it. However, this institutional figure has not been enough to carry out large projects and a responsible and stable professional scholarship. Within a complex political, social, economic, and cultural context, Venezuelan libraries claim to be vindicated.

HISTORICAL BACKGROUND

Historians set the arrival of books to Venezuela between the sixteenth and seventeenth centuries. From 1600, the presence of books starts to be notorious in colonial time cities.^[1] Books arriving from Spain made possible to start developing the first libraries with these manuscripts or printed books, from approximates of 25–500 volumes, and in no way they represented the ideal institutions for the custody, preservation, and classification of collections, which started to appear from the nineteenth century.^[1] This section summarizes the first Venezuelan libraries, the first printed publications, the origin of the NL, as well as the most important figures of this early stage of Venezuelan libraries and librarianship, such as the first bibliographers and the leading roles of Rómulo and Virginia Betancourt. Moreover, some notable developments are presented, such as the first and only law of libraries in the

INTRODUCTION

The topic of libraries and librarianship in Venezuela is challenging. Over the last years, this sector has had the same results as any aspect of national life: fragmented, dispersed, confused, hermetic, and uncertain. In this Latin American country, librarianship is an undervalued profession; it is not taken into account, even by the academia. Only two universities offer undergraduate programs on librarianship, and they keep a technical paradigm tied to archival science. In general, library infrastructure is scarce given the national population of over 30 million inhabitants. The development of school libraries is practically inexistent, the National System of

country, the events leading to the commemoration of the librarian and archivist day, and the *Caracas Declaration*.

First Steps and the Establishing of the National Library

The first known colonial library belonged to the Convent of Our Lady of Salceda in St. Anne of Coro, it was established by the end of the sixteenth century, and according to chroniclers, historians, and librarians, it comprised 300 volumes which were sometimes lent to the city's inhabitants.^[2] Libraries from the seventeenth and eighteenth centuries were mainly private and belonged to national aristocrats, destined to family use, as well as those belonging to the clergy.^[1]

In 1691, there was a notable decree by the provincial of the Franciscan order, Diego de Hoces, which indicated how convent libraries should function and it called for the appointment of a librarian to be in charge of the loan service for 2 hours each day and to maintain a written log for this service. This is the earliest registered presence of a librarian in Venezuela. A century later, in 1790, the first known librarian appeared: Father Cristóbal de Quesada, who also taught Latin and grammar to Andrés Bello, and worked at the library of the Convent of the Mercy in Caracas.^[1] At the time of the Independence (nineteenth century), there were two key moments: the first Venezuelan periodical, the weekly *Gazette of Caracas*, was printed in 1808; and in 1810, the first book was printed, the *Manual Calendar and Universal Guide of Foreigners in Venezuela* for the year of 1810. Both publications were prepared in the press owned by Gallagher and Lamb.^[2] Furthermore, the idea of a new type of library which would allow readers access emerges: the public library (PL). Its role was also intended as a tool for public instruction after the date of the Declaration of Independence, on April 19, 1810.^[1] This idea was published in a printed sheet that began to circulate by the beginning of 1811, *Thinking of a public library in Caracas*, signed by Juan Germán Roscio and possibly written by Francisco Javier Ustáriz,^[1,2] both signatories of the *Declaration of Independence*. It was the first intention of a project to create a public library, which was deferred by the Independence War. Even so, during the period of the *War till Death* (1814), the Liberator Simón Bolívar commissioned the collecting of books and ordered the formation of a public library.^[2]

From 1830, the idea of creating a NL appears. Particularly in 1831, the Interior Secretary Antonio Leocadio Guzmán manifested the need of merging the convent libraries and books dispersed throughout government offices.^[1] Diverse decrees with the intention of creating the NL were issued in the subsequent years, but these initiatives were not so successful. Some of such decrees were 1) by president José Antonio Páez in 1833, pointed out by some scholars as the date of the foundation of the

NL;^[3,4] 2) by president José Tadeo Monagas in 1850; 3) a decree from 1852, which also assigned a budget to the NL; 4) by president Julián Castro in 1858, which appointed several directors and organizational changes; and 5) by president José Ruperto Monagas, in 1869, which presented improvements for the NL in areas such as staff salary and service regulations. Finally, in 1870, it was during the government of the president Antonio Guzmán Blanco that a solid base for the functioning of the NL was established.^[1] The first statistical report of the NL collection appeared in 1873, being comprised by 5862 volumes. In 1874, Guzmán stipulated that the collections of the convent libraries were to be delivered to the Universidad Central de Venezuela (UCV), the first and largest public university. These collections were to be incorporated to the NL, which was located at the time in the university campus. In 1875, Adolfo Enrns publishes the *Catalog of the Library of the University of Caracas*, the first printed catalog of the NL and of Venezuelan bibliography. Ernst directed the NL from 1876 to 1889. In 1892, the library separated from the UCV and in the following year it was moved to another location through a decree by the president Joaquín Crespo.^[1]

At the beginning of the twentieth century, the situation of the country was critical due to the Civil War. When Juan Vicente Gómez got into power in 1908, he decided to appoint the construction of a dedicated headquarter for the NL, so in 1910, he commissioned architect Alejandro Chataing with this construction. This new headquarter was built next to the UCV and it was inaugurated in 1911, coinciding with the commemoration of the Centennial of the Independence. In 1937, after the end of the dictatorship, a stage of modernization of the NL was started by its director Enrique Planchart. From 1950 toward the end of the twentieth century, the library had five directors; the most important of them took office in 1974 and transformed the institution into an autonomous organization, among other improvements. In 1960, the Book Bank was created as a nonprofit organization, thereby starting a new vision of library services. In 1974, Venezuela became the first Latin American country to have policies for the creation of the NSPL.^[1] The current headquarter of the NL, designed by José Tomás Sanabria, consists of a building with a total size of 80,000 m², which was constructed from 1981 and began to function in 1989.^[2]

The First Bibliographers

In this brief historical journey, it is relevant to mention the first characters that conducted activities related to this discipline. In the first place, there were the fathers of Venezuelan bibliography, Arístides Rojas, Adolfo Ernst, Juan Piñango Ordoñez, Adolfo Fryndesberg, and Manuel Segundo Sánchez. The latter was a true pioneer in setting the bases of Venezuelan bibliographic research, by

establishing the foundations for the development of this discipline in Venezuela, and from 1913 to 1920 he directed the NL. Among his most important works were *Venezuelan Bibliography* (1914), which includes nearly 1500 records and until now it is considered the only work of its kind; the *Venezuelan Library* (1917), *Bibliographic Yearbook* (1917), which the NL took as a model from 1942 in order to systematically compile its own yearbooks; and the *Bibliography of Bibliographic Indexes Related to Venezuela* (1939). He also conducted research on the printing press in Venezuela and created the denomination of *Venezuelan incunabula* for every Venezuelan publication printed from 1808 (year of the first printed publication) and 1821 (Battle of Carabobo). Curiously, Walter Lichtenstein acquired the private library of Sánchez and his books ended up in universities of the United States such as Harvard, Northwestern, and the University of Chicago. Finally, there is the figure of Pedro Grases, compiler of the fundamental writings of Venezuelan intellectuals and statesmen. His most important works are related to the history of the printing press in Venezuela, an inventory of printings of the period between 1808 and 1812, the trajectory of the *Gazette of Caracas* from 1808 to 1822, the Angostura printings of 1817–1822, the *Venezuelan Constitution* of 1811, his bibliographic research on various subjects and profound reflections on Venezuelan bibliographic research.^[5]

Rómulo and Virginia Betancourt

Rómulo Betancourt was the first president of the Venezuelan democracy (1959–1964), he belonged to the Generation of 1928, a group of student leaders which organized the first popular manifestation against the dictatorship of Juan Vicente Gómez (1908–1935). Being a strong opponent of the Gómez regime, he lived a part of those years in exile. Between 1931 and 1935 he lived in Costa Rica, where he started his ideological journeys throughout Latin America. In those years, he worked at the National Library of Costa Rica, taking advantage for advancing and deepening his reading of works such as the 15 volumes of the *Contemporary History of Venezuela* by González Guinán, resulting in his writing of a magnificent summary.^[6] Betancourt was a militant in diverse clandestine political organizations such as the Venezuelan Communist Party and the National Democratic Party. The latter was the predecessor of the political party Democratic Action (AD), founded in 1941 by Betancourt and other Venezuelan left-wing leaders. Betancourt converted a country of warlords and militaries into one of a civil society and republican institutions.^[7] Because of his political views, he was eternally pursued, but despite this persecution and his strong dissident activities he never stopped reading, studying, writing, and publishing journalistic articles, booklets, and books.^[6] His daughter, Virginia Betancourt, will always be appreciated by the educated and democratic Venezuela for her efforts as the director of the NL

between 1974 and 1999, her contribution in the founding of the Book Bank in 1960, and her labor in preserving and classifying her father's personal archive.^[6] During her administration of the NL, he was responsible for establishing the autonomous character of the institution, creating the NSPL, and promoting the Law of Libraries of 1977. Additionally, she encouraged professional meetings and of Latin American integration, such as the one which originated the *Caracas Declaration*. She also participated in the creation of the Association of Ibero-American National Libraries (ABINIA) and her labor made her worthy of the International Federation of Library Associations and Institutions (IFLA) Medal in 2005.

Law of Libraries (1977)

The National Library Autonomous Institute and Library Services (NLAILS) Law^[8] created the figure of the NLAILS from the NL and was the basis for the creation of the NSPL. It was during the era of the discourses about systems, networks, and library management, besides the modernization and transformation of the NL. Legislators and leaders took the advantage of this opportunity to start building the library network throughout the country. With this law, Venezuela stepped forward into the vanguard of the library movement in Latin America, being the third country of the region to create a law of this kind,^[9] which was even considered a model for some library movements in Latin America.^[10]

The NLAILS Law is still in effect, as no new legislation has been passed, despite the fact that it is obsolete and it does not develop the particular area of public libraries. The law is now obsolete because it is antiquated and inadequate given the current circumstances it must govern. It was passed more than 30 years ago, when another constitution ruled the country's destiny, thus overpassing the limits of Venezuela's legal reality. The current constitution of 1999 brought significant changes in every institutional area, mainly materialized through different legal reforms made by the new parliament and especially with legislation through presidential decrees. The NLAILS Law is a *survivor* of that time of major legal reforms. In consequence of the mentioned changes, this Law stopped being useful in its area of application, and nowadays it is officially mentioned exclusively when the president makes changes in the direction of the NL.

Librarian and Archivist's Day, One Date and Three Motives (1982)

The National Librarian and Archivist's Day is celebrated every July 27. This date was chosen as the most iconic for the profession for three reasons. First, July 27, 1945 is recorded as the date of death of Manuel Segundo Sánchez. Second, July 27, 1950 corresponds to the graduation of the first cohort of library and archives professionals from the UCV. The third event happened on July 27, 1977 with the

enactment of the *NLAIS Law*.^[8] Considering these events, on July 23, 1982 the Presidential Decree N° 1.564 was published in the Official Gazette of the Republic of Venezuela N° 32,522, declaring July 27 as the *National Librarian and Archivist's Day*. The document states:

the activities of Library and Archives professionals constitute factors of progress and development for the country, because they fulfill support to education, research, and to the development of science and technology through libraries, archives and information and documentation centers, hence it is fair to recognize their function within the Venezuelan society (p. 245827).^[11]

Caracas Declaration (1982)

The *Caracas Declaration for the Public Library as a factor of development and instrument of social change in Latin America and the Caribbean* was the product of the consensus between experts from 30 countries, that was reached during the *Regional Meeting on the Current State and Development Strategies for the Development Public Library Services in Latin America and the Caribbean*, during October 25–29, 1982. *The Declaration* is the first and most important technical-normative document on PL of the region because it allowed pushing the library movement in Latin America and the Caribbean (LAC).

The Declaration was a regional agreement celebrated in the Venezuelan capital and supported by the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Regional Center for the Promotion of the Book in Latin America and the Caribbean (CERLALC), IFLA, and the Venezuelan NLAIS. *The Declaration* contains the shared visions of the region's professionals at an historical moment: one which opened the door to wider views of social reality, democratic life, and regional integration. Hence, one of the first aspects it mentions is the support to the main principles stated in the UNESCO Public Library Manifesto of 1972. From these principles, the main needs of the region were compared and they were adapted to LAC reality in order to adopt them.

The first part of *The Declaration* enumerates eight principles for a PL of the region, in order to assume the commitment toward development, democracy, and social change in LAC. These principles “express the will of a library majority on what the public library should be in our countries.”^[12] These are summarized as follows:

1. Ensure free access to information which must be broad, current, and representative of the sum of different thoughts, in various formats.
2. Stimulate people's participation in national life, enhancing the role of the library as a facilitator of social change and participation in democratic life.
3. Promote the understanding, dissemination, and defense of national indigenous and minority culture to assert

cultural identity and the recognition and respect toward other cultures.

4. Promote the formation of critical, selective, and creative readers through reading, thus training each individual to play an active role in society.
5. Support lifelong learning, eradicating illiteracy, and supporting services for children, teenagers, neo-readers, and disabled readers, both socially and physically.
6. Serve as information and communication centers for the community.
7. Develop national library services.
8. Support an economically strong and culturally independent national and regional editorial industry.^[13]

The second part refers to the basic conditions for the development of PL in LAC, conforming a vision closer and more real regarding the state of the LAC library, stating the true needs or shortcomings, mainly institutional, which prevented (and in some cases, still prevent) the improvement of services in the region. *The Declaration* states the need of a legal framework to regulate the functions of the PL, contemplating State obligation to offer library services, a national coordination, a system of services, normalization of technical processes, strategies to train human resources, and the sustainable endowment of services. It highlights the role of the State “regarding its functioning and development, and emphasizing the need of the libraries to be included in the development plans of each country, in pointing the State obligation to offer public library services and assigning them sufficient yearly budget for their development” (p. 17).^[14] Moreover, issues such as “to stimulate citizen participation in democratic life” (p. 16)^[10] started to be taken into account.

VENEZUELAN LIBRARIES

The national library infrastructure is currently scarce, given a population of over 30 million inhabitants. Regardless, this section mentions the main libraries: academic, including university and school libraries; the dense network of public libraries and their variations; special libraries supporting the labor of both the private and public sectors; institutional and governmental libraries; and lastly some experiences in digital libraries and repositories.

Academic Libraries

Venezuelan academic libraries include university and school libraries. In public and private universities, there are libraries which fundamentally support professional development and research. The most relevant from public universities are those of Universidad Central de Venezuela, Universidad Simón Bolívar, Universidad de Los

Andes, Universidad de Carabobo, Universidad del Zulia, Universidad de Oriente, and Universidad Nacional Abierta. The most relevant from private universities are those of Universidad Católica Andrés Bello, Universidad Metropolitana, and Universidad Santa María. The main national universities also count with specialized academic libraries according to the faculty or field of knowledge to which they dedicate. School libraries can be found in private institutions but especially in public schools. The responsibility of the State in the conformation of a public school library system rests in the Ministry of Education. In the mid-1980s, there were nearly 1700 school libraries dependent from the mentioned governmental office.^[1]

Public Libraries

The NLAILS is the governing body of the NSPL, and it was inspired by both the *UNESCO Public Library Manifesto* and the *Caracas Declaration*.^[4] The system is comprised by 727 libraries nationwide, organized in 24 state library networks with a total capacity for approximately 38,229 readers, 3687 of them are located in the capital city of Caracas.^[15] Despite these figures, some of its weaknesses are related to the lack of clear policies, technological infrastructure, and an inadequate library staff selection, which in general is neither professional nor trained for such functions.^[4] Regarding statistics, 88% of PL users are students, with an average age of 20 years, and 71% of them study in public institutions. Only 12% of the total users do not study and their average age is 37 years, from this percentage 75% of them are employed.^[15] Part of the explanation behind these figures is that in many cases PLs fulfill the roles or alleviate the lack of school libraries in many sectors throughout the country.

Among the PL, one of the most emblematic is the Book Bank because it was established in 1960, before the NLAILS Law was even drafted, but still it started to provide the basic framework to start developing a network of school and public libraries, first in Caracas and then in other regions of the country. The Book Bank is the “depository of a valuable collection comprised by books for children and teenagers, specialized literature on these literary genres, documental records, periodicals, and texts related to the book and reading promotion” (p. 25).^[3] The Book Bank researches, experiments, innovates, and proposes guidelines for reading promotion and also carries out diverse cultural activities that are not necessarily related to reading.

Special Libraries

The Marcel Roche Library of the Venezuelan Institute of Scientific Research (IVIC) might be the most relevant special library of the country and because it is subordinated to the Ministry of Science, Technology and

Innovation, it is one of the few libraries that can afford and acquire academic databases and scientific journals, given the currency exchange control imposed by the government since 2003. Other notable special libraries are those from each of the National Academies: Language, History, Medicine, Political, Economic, and Social Sciences; Physical, Natural and Mathematical Sciences; as well as the Ernesto Peltzer Library of the Central Bank; the libraries of the Supreme Court of Justice, National Assembly, Attorney General; those in the museums of Natural Sciences, Fine Arts, and Contemporary Arts; the library of the Rómulo Gallegos Center of Latin-American Studies; and those within some foundations, such as the *Rojas Astudillo*, *Pedro Manuel Arcaya*, *John Boulton*, *Vicente Lecuna*, *Humboldt*, *La Salle*, *Centro Venezolano Americano*, among many others.^[1]

Digital Libraries and Repositories

Regarding digital libraries, the Venezuelan experiences have been incipient. The closest related cases are repertoires of specialized information, such as the *Scientific, Humanistic and Technological Information System* of the UCV, university digital journals and some repositories such as: *National Repository of Open Source Software*, *Intellectual Production Repository Universidad Centrocidental Lisandro Alvarado*, *SABER UCV*, *SABER Universidad de los Andes (ULA)*, *Institutional Repository Universidad de Oriente*, *Institutional Repository Universidad Pedagógica Experimental Libertador*, and *Intellectual Production Universidad Simón Bolívar*. Finally, there is the repository *Metadatum*, which aims to group all the academic repositories of the country that are using the OAI-PMH protocol, and to serve as a metasearch engine.

Although there are many repositories in the country's main universities, the first and only institutional open access mandate dates from 2009 and corresponds to the ULA. This consists in preserving the following documents in institutional repositories: 1) theses, 2) research products funded by the Scientific, Humanistic and Technological Development Council, and 3) all University publications.^[16] Despite this scenario, it is important to point out that Venezuela has the sixth place in number of publications indexed in the Network of Scientific Journals from Latin America and the Caribbean, Spain and Portugal (Redalyc), with a total of 54 quality scientific journals, in open access.^[17]

VENEZUELAN LIBRARIANSHIP

There are two Venezuelan traditional Library schools: the Schools of Libraries and Archives of the Universidad Central de Venezuela (EBA-UCV) and its counterpart in the Universidad del Zulia (EBA-LUZ). The UCV is

located in Caracas, the capital city. It was founded in 1721, and it is among the oldest universities in the occidental hemisphere. This university has been the alma mater of many notable Venezuelan scientists, humanists, intellectuals, and presidents. Its current location, the University City of Caracas was built between 1940 and 1960, it was designed by Carlos Raúl Villanueva, with the collaborations of avant-garde artists from the era, and in 2000 it was declared a World Heritage Site by the UNESCO. The EBA-UCV was founded in 1948, and it offers two 5-year bachelor programs, one in library science and the other in archival science. It also offers two master programs: *Management of Information Networks* and *Information and Communication for Development*.

The EBA-LUZ was created in 1962, and it offers the same bachelor programs together with a master in *Information Sciences*. Other universities with more recent academic options are the Universidad de Carabobo, centering on documental certification courses and bachelors; the Universidad Católica Andrés Bello, with a master on *Information Systems*; and the Universidad Yacambú, with a bachelor in *Information and Documentation*. Sadly, there are no doctoral options in the field, resulting in a few doctors with LIS PhDs obtained in other countries and the majority of doctors with a LIS background have obtained PhDs in education, sociology, social sciences, among other disciplines. For the year 2001, there were a total of 3490 LIS professionals registered in the country, nearly 1900 of them were women.^[18]

Origin of the Professional Degree (1950)

The period between February and July 1950 saw the definition of the university degree conferred on the first library and archives professionals of the country. The first director of the EBA-UCV, José Fabbiani Ruiz, manifested his unrest on the matter on February 4, proposing the title of *cataloger-librarian*. Just a month before the graduation of the first cohort of students, in the Assembly on June 26, Fabbiani argued that even if the previously mentioned title was approved in a previous session, the students, director, and teachers of the School thought that the alternative title of *librarianship technician* was more adequate. That was mainly because the title of *catalogers* would presumably prevent them from directing a library, being necessary to obtain a more general and positive title, one that would be a promise and not a menace, according to Fabbiani. The ensuing discussion had interventions from professors Acosta Saignes, Olivares Figueroa, Oliver, Rosenblat, Granell, the Faculty Dean Casanovas, and Fabbiani himself. Finally, several titles were proposed: *library technician*, *library technique graduate*, *library assistant*, *library auxiliary*, and *librarianship technician*. After some deliberations a voting took place, the winning alternative was the one proposed by the School. Hence, on July 27, 1950,

the first *Librarianship Technicians* of the country had their graduation.^[19]

Professional Education

Venezuelan librarianship professional formation was in part caused and inspired by the seminal speech that José Ortega y Gasset delivered in the Second IFLA International Congress, in the Universidad de Madrid, on May 20, 1935. The mentioned discourse was published as the book titled *Librarian's Mission*, which was the way these ideas were disseminated in Venezuela, before there were professional education schools. The mentioned ideas made people start to realize that the profession was a collective need and it was socially indispensable, thus making vital to professionalize a traditionally empirical occupation.^[20] Some of Ortega y Gasset's ideas that are inherent to the essence of Venezuelan information professionals and the early curriculum designs are 1) a concern with enabling access to information as a human right, either for the purpose of scientific and financial advancement as well as for communication and recreation; and 2) the idea that the right to information is the means that ensures the scientific, humanistic, technological, and social progress of the country and the world.^[20]

Moreover, from the cited ideas, library, and archives, schools are responsible of developing professionals who may contribute in part to their profession, through teaching and research; and also to society, being aware of social, financial, and scientific development at a global level and to answer any need of information, science, and culture that society may have. The national professional training has seven bases that were stated from the beginning as different skills: basic, administrative, technical processing, information sources, documentation and information, research, and understanding of human nature.^[20] These bases have been kept until today, adding additional facets such as to have historical and social consciousness of the objects and areas of study, as well as topics of social relevance such as user formation, reading promotion programs, and information literacy. Moreover, there are the technological facets, of information policies, and of informetrics. All these facets are not necessarily integrated in the compulsory curriculum, but they may be developed by the student through elective courses or as transversal axes in the curriculum design. Regarding their attitudes, the ideal professional must be competent, critical, reflexive, and participant in the issues of their context. Additionally, good Venezuelan librarians are characterized for their service vocation, constancy, professionalism, their lifelong learning, and for pushing to the limit the resources and possibilities at their disposal for providing their services and fulfilling their mission.

It is complicated to summarize the current state, the challenges, and opportunities of Venezuelan professional training, because every institution has their characteristics

and circumstances. In the frame of developing some contributions to the curricular change, three stages of the curricular evolution in the EBA-UCV have been defined: technical, disciplinary, and transdisciplinary, indicating that the revision and updating of the curriculum and the naming of the professional studies in the field have been deferred.^[21] The transition in the EBA-LUZ has passed from a theoretical and technical formation, then reinforcing management and technological areas, and finally it has diminished the general formation, enhancing professional and research courses.^[21,22] In both cases, the main considerations behind the initiatives of curricular change have been driven by academic and employment dynamics, both nationally and internationally, which are also what informs the construction of the professional profile. In the country, there have been curricular evaluations in the EBA-LUZ^[22] as well as comparative evaluations between the Venezuelan curricula. The latter have set the bases for developing guidelines and methodologies to guarantee aspects such as quality assurance, pertinence of formation, the degree to which formation answers the needs of the discipline and society, the possibility of national and international accreditation, and internationalization.^[23] Regarding the comparative study of Venezuelan curricula, it turns out that both are academicist, humanistic, and sociological, but the elements to revise in national curriculum design are teleological, axiological, transdisciplinary, cooperation, and interchange fundamentals, as well as to develop market studies to achieve an empirical and common grounding for curricula design, being aware of the local and global relationship, to strengthen the construction of a pedagogical theory, and encourage the configuration of knowledge, learning, and research networks.^[24] Finally, the need of introducing the competency-based curriculum has been stressed, and it is something that the EBA-LUZ has already tried.^[25]

Apart from the cited experiences that improve the curricula, some authors highlight the dubious need of framing the curriculum to the initiatives of the current Venezuelan government administration (1999–2014), thus presenting the Information Sciences Formation Program.^[26] This program, given its definition and except for its ideological fixation, results redundant when considering the already established learning options, as it indicates that it is innovative simply because it seeks to overcome anachronisms that sadly are grounded in the general perception that people have about the information professional but that the mentioned traditional university formation already takes into account. These perceptions are the exclusive role of a custodian, to grant access to information to the communities, and to improve means and devices for information handling. In conclusion, this tends to erroneously insinuate that the established formation programs do not take into account the needs of the society as well as those from public and private institutions.

CURRENT STATE

The Venezuelan situation has become more complicated during the last 22 years, with events that have resulted in the current and never before seen financial, political, and social crisis, such as the Black Friday, the Caracazo, failed coups d'état, trials to government officers for corruption charges, a new Constitution, devaluations and currency exchange controls, a new political class in power, the enterprise and oil strikes, instability, an unsafe country, as well as polarization and confrontation. It is only to be expected that Venezuelan libraries and librarianship are outside of these issues and like it has happened with other sectors, they have suffered the ideological and polarizing onslaughts that have been occurring during current government administration (1999–2014).

Libraries and Their Public

For 1999, Venezuela had already shown a high literacy rate, with approximately 92.3% of the population of over 15 years.^[27] However, it seems that in Venezuela, the discussions on libraries have been put aside, because of the country's situation, of society, and librarians themselves, of the development of information and communication technologies (ICTs) or because the Internet has displaced reference librarians and now everyone searches independently for information, for better or worse. Moreover, libraries have not been given their place, importance, and the fundamental value they deserve, thus there is a general lack of interest in them. The figures confirm it, 80% of the population recognizes that they do not go to a library, barely a 9.1% visits a public library, and an ephemeral 1.2% goes to the NL for information and education needs.^[28] Officially, it has been reported as a significant achievement that in 2012, the NL had attended more than 11 million users (p. 414).^[29] Furthermore, the paradox of a raising number of readers but not of books sold is starting to be envisaged. The main cause of this phenomenon can be found in the infamous currency exchange control, which is described in the following section.

Financial Issues

In order to discuss the financial issues of Venezuela, it is necessary to take into account the presence of a set of complex rules that have regulated a governmental currency exchange control during the past 12 years. These rules have contributed to a massive inflation, costs speculation, and innumerable challenges for any person or institution intending to travel or acquire imported products or services. This currency control was established in 2003, it is based on official exchange rates for US Dollars (USD) and Euros, and it is still in place with complementary or

alternative currency exchange systems. These schemes complicate the financial situation, because they started with an exchange rate of 1.60 Bolívars Fuertes (BsF) for each USD, then BsF 1.92/USD in 2004, and BsF 6.30/USD in 2013.

Today, the currency control is based on a new scheme of three values, one fixed to 6.30/USD for “priority” sectors and the other two are “complementary”: the first starts at BsF 11.36/USD, but with high fluctuations, and the second is an alternative system that seeks to eliminate the alternative black market, by fluctuating according to supply and demand, and starting at BsF 51.86/USD. This control, together with the currency reconversion of 2008, which eliminated 3 zeroes to the national currency and the calculation of the National Budget according to the prices of the oil barrel, has resulted in the creation of development funds that are discretionally managed by the government and has cast serious doubts about their transparency. Academic libraries have felt the most direct impact of the currency exchange control, because for them it is very hard, if not impossible, to receive the foreign currency needed to subscribe academic databases and import library materials that are not manufactured in the country. This makes the IVIC library, because of its subordination to the State, one of the few libraries of the country that can currently count with these resources.

The current main economic activity of the country is the oil exploitation, between 2000 and 2008 there was a spectacular rise in oil barrel prices, from 20 to more than a 100 USD. Despite its condition of being a single product economy, Venezuela has been privileged because of the volatility of prices and the immediate liquidity of oil sales in the international market. According to the National Institute of Statistics, between 2003 and 2012, the government made a social inversion (SI) of 772,000 million USD, mainly through the so-called Social Missions. The SI for the period 1999–2011 represented around 60% of the State’s income.^[30] Moreover, between 2008 and 2012, the State oil company *Petróleos de Venezuela* (PDVSA) received a total income of 520,000 million USD (p. 156).^[31] It has been calculated that the revenue for 2013 was between 82,000 and 85,000 million USD.^[32]

Between 2004 and 2009, Venezuelan SI was directed firstly toward education, then social security, health, housing and services, social development, and participation.^[33] However, the investments made in culture, communication, and science and technology occupy a precarious space in the assignment of public expenditures. Considering the magnitude of the SI, it is valid to ask how much have been invested in Venezuelan libraries. Sadly, it is difficult to offer a detailed scenario with the scarce statistical data offered by the NLAILS; moreover, on its website there are no data available on any library indicator. Furthermore, the available statistics go only as far as 2005, and except for the *Cultural Statistical Yearbook, 1990–2003: Venezuelan Book’s and Libraries’ numbers*;^[15]

one copy of the *2007 Statistical Yearbook of the NL* and the *Annual Reports and Accounts of the Ministry of Culture* (MCMPPC),^[34] there are not enough pertinent data sources. Through the study of the different editions of this last source, it is possible to calculate that the total inversion dedicated to the NLAILS and hence to our libraries between 2005 and 2013 was of 1169.9 million BsF, or 315.9 million USD. During this period, NLAILS has directed its plans through projects which essentially reiterate every year the reinforcement and push of the NLAILS and the NSPL. This indicates that this goal has not being achieved or not completed. It also means that the majority of the resources should have been directed to invest and develop the NSPL.^[34] In order to put the previously mentioned amount in perspective, we can take into account that PDVSA’s income between 2008 and 2012 was over 520,000 million USD. Then, the resources transferred to the NLAILS in the same period were of 186.4 million USD. This means that the SI directed to the PL sector in Venezuela represents 0.03% of the total revenue generated by the sales of oil. Thus, a great deal of the issues of the NSPL is originated by budget problems.

The obstacles highlighted in NLAILS report during the execution of the mentioned projects are insufficiency of financial resources, insufficient assignation provided by the *Law of Budget*, suspension of the Information System *Northwestern Online Total Integrated System* (NOTIS), noncompliance of the *Law of Legal Deposit*, cuts in the planned investments for the acquisition of collections, deterioration of infrastructures, lack of preventive and corrective maintenance of the public libraries, obsolescence of computer equipment, obsolescence of collections, lack of resources for the paper edition and dissemination of technical documents for librarians, difficulties for compiling statistics, lack of imported resources and materials which affect the activities of preservation and conservation, lack of capable and specialized professionals, among others.^[15,34] Moreover, the lines of action of recent projects start to contain an ideological charge, by talking of concepts such as the *First Socialist Plan*.

Most of the challenges academic libraries and the NLAILS are reporting and facing are related to financial issues, which are aggravated by the currency control. The main problem for libraries is that very few of the resources they must acquire are currently manufactured or sold within the country. Hence, the resources that can be imported imply extra charges over the product’s cost, which are derived from the currency control itself, the speculation of costs, and disproportionate import duties and taxes from the State. This situation is further complicated for public libraries, from the NLAILS to the smallest ones, because budget allocations are marginal. The currency control and the scarce financial resources are part of a vicious circle, because with the limited budgets libraries can acquire less resources every year due to the fluctuation of exchange rates, together with inflation, speculation, and State taxes that do not forgive even books.

Legal Issues

NLAIS' administrative activities face different lingering challenges; the majority of them are caused by budget insufficiency, which raises some doubts about the legal bases supporting our libraries, the convenience of institutionalism, centralization, decentralization, or administrative de-concentration. Libraries' public service character is mandated by the Constitution of the Bolivarian Republic of Venezuela (CBRV),^[35] but the question is: how we can socially transform libraries in order to fulfill this constitutional mandate that would be their *raison d'être*? Article 108 is the only part of the CBRV where the word "library" appears, it states:

"Media, both public and private, must contribute to citizen formation. The State will guarantee public services of radio, television, and library and computer networks, with the purpose of allowing universal access to information. Educational centers must incorporate the knowledge and application of new technologies, their innovations, according to the requirements established by law" (p. 23).^[35]

Apart from the first and only *NLAIS Law*,^[8] other two legal instruments have supported libraries: 1) *Legal Deposit Law* of 1993, which compels the editorial sector to send a copy of all publications produced in the country to the NL; and 2) *Organic Municipal Regime Law* of 1989, which mandated the existence of municipal PL according to the amount of inhabitants or population, but such disposition is nowhere to be found in the new *Organic Public Municipal Power Law* of 2010, which replaced the previously mentioned legislation. CERLALC points out that Venezuela does not offer data regarding reading and library indicators (p. 5),^[36] specifically the number of PL for every 100,000 inhabitants. This is due in part to the elimination from the current legislation of the requirement of offering municipal library services. However, recently the NLAIS Press Department declared that a new NL Law is being drafted, announcing the "discussion" of a project. It draws attention to the fact that this notice seems to be a reaction in front of the controversial *Organic Culture Law*, approved in August 2013 and also that the promoters of the so-called library constituent are conducting the "debate and analysis" of the future legal text behind closed doors, when what would be required is a broad, open, diverse, and inclusive consultation, which is characteristic of the participative democracy advocated by the CBRV.^[35] This consultation should count not only with working groups in the NL, but it should also take into account what the traditional library schools might have to say, as well as the professional associations (despite their dispersion), the national library workers, cultural promoters, and citizens.

CONCLUSION

This is the moment to vindicate Venezuelan libraries, to restore their fundamental value, and teach their usefulness

to the nation's development. Information professionals and librarians have the responsibility of demonstrating the vital importance of libraries to political leaders, and to make sure their constitutional provision is assumed on the basis of human rights. National library schools must include in their curricular design a much broader and less rigid social vision of libraries, which allow for the identification of the professional role in front of society and diverse communities. Research and comparative librarianship are essential to entrepreneurship, innovation, and competitiveness in a world that is increasingly an information society.

Venezuela faces one of the most difficult times of its history. Libraries as institutions and librarianship as profession are instruments for social change and the strengthening of democracy. It is fundamental, now more than ever, to make Venezuelans understand that without information, education, and culture there would never be a "powerful country," much less a "motherland." Before extracting all oil reserves, we must learn to read, and to think in a free, critical, and selective way. Moreover, we have to see our fellowmen as just one more person in the construction of great deeds and not as an adversary that must be ignored because of their political affiliation or their ideology. Finally, before building bridges, highways, schools, hospitals, or even large libraries, first we must build citizenship together. Being citizens is what will open us the way toward development.

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Version Control

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Abstract

Broadly, version control is the attempt to define the relationships among multiple iterations of a scholarly text, particularly journal articles. Version control existed in the print world, but the electronic environment has exacerbated the matter due to a number of varied factors, including the ease with which digital scholarship can be distributed and adapted. Political and technological issues also affect the problem of version control. Because any given article may have a preprint, a postprint, a version in the official journal, and a version in an institutional repository, among other copies, some mechanism must exist to relate and explain the relationships among these manifestations. Several current initiatives are underway within the information industry to address the problem of version control.

INTRODUCTION

For library and information science, version control is the activity of identifying and managing iterations of a document for archival and retrieval purposes. While version control can be problematic for documents and information objects of all types and formats, it is especially so for scholarly communication—particularly journal articles—distributed in electronic formats.

In all the many unforeseen challenges that electronic publishing has unleashed for the information profession, there exist two principle elements: political and technical. Version control is no exception. Many stakeholders in the information industry are shaping the version control discussion, and these discussions have resulted in recommended solutions and directions.

In 2002, a research team headed by Raymond Siemens produced a report entitled “The Credibility of Electronic Publishing” for the Humanities and Social Sciences Federation of Canada (HSSFC). This report attempted to define and assess the current state of affairs for scholarly electronic publishing as well as provide some recommendations for future action.^[1] One of the sections of the report, “Archiving and Text Fluidity/Version Control,” specifically addresses the unique situation that electronic publishing presents for text alteration. In this section, members of the HSSFC-appointed research team note:

Texts can be adapted, abstracted, translated, edited, condensed, corrected, marked up, transcribed, annotated, amended, paraphrased, transliterated, illustrated, indexed, or abridged. They can be commented upon or referenced by other texts. They can be analysed or synthesized.

These modifications, and any others that might be considered, produce distinct versions, all related to the original text.^[2]

Indeed, what is important to note is that any alteration(s) to an original text produces a distinct version. Therefore, versions of a text need to be uniquely identifiable while simultaneously containing information that describes the relationships among the various versions. Version control, then, is the effort to “name the versions of the text” and to specify “the differences between the revision and the original text.”^[2] Moreover, version control endeavors to define what is meant by the original and authoritative text.

In 2005, the U.S. Government Printing Office (GPO) prepared a white paper on version control of documents within the purview of the Federal Depository Library Program. The GPO was particularly concerned with electronically disseminated documents. Government Printing Office concerns fall into seven broad categories. These include version definition, or “unique manifestation of a publication”; version control, which includes “acquiring, cataloging, storing, preserving, and retrieving different versions of publications”; version triggers, which are changes that exceed agreed upon limits; version detection, which deals with identifying and detecting alternate versions; version identifiers, which are metadata tags; version crosswalks, which are a subset of version identifiers and provide links to all other versions; and depository library responsibilities for superseded versions. While it focuses on government documents, the GPO report is extensible in that it offers parameters that can be applied to any discussion of version control.^[3]

In April 2008, the National Information Standards Organization (NISO), in partnership with the Association of Learned and Professional Society Publishers (ALPSP), released a report that defines specific stages or iterations of a journal article. Similar to the GPO's seven broad categories, the NISO/ALPSP Journal Article Versions (JAV) Technical Working Group identified seven terms, or stages, of an article's development. According to members of the JAV Technical Working Group, the report is meant to offer recommended practices for the scholarly publishing community. The report summarizes the issue:

Researchers, their institutions, and journal publishers are rapidly moving on from using static, single copies of research papers that are essentially "images" of a printed document. Changes in the way we create, edit, circulate, validate, publish, find, use, and update articles are producing multiple versions whose status and provenance is often unclear. Online searching now allows multiple versions to be found but rarely makes clear the relationships between them.^[4]

Specific recommendations of the group are discussed in subsequent sections.

SCOPE AND HISTORY

Standards, rules, local practices, terminology, and definitions evolved over many years to ensure version control of printed matter. Even so, it has always been problematic to ensure that a published text is in complete agreement with all other versions of that text. Pirated or plagiarized editions, misreadings of manuscripts, and other issues have long clouded issues of text authenticity and authority. With the emergence of electronic publications, these rules, practices, and so forth face much greater challenges. Contemporary efforts to address long-standing problems of unique manuscript identification are addressed by Matthew J. Driscoll in "The MASTER Project: Defining Standards for Electronic Manuscript Catalog Records." The international Manuscript Access through Standards for Electronic Records (MASTER) Project's "document type definition" (DTD) standards and application of the closely associated Text Encoding Initiative's (TEI) *Guidelines for Electronic Text Encoding and Interchange* are applied to archived medieval manuscripts. TEI guidelines allow for description along several broad and flexible categories, including its physical location; title, place of origin, and language(s); contents; physical description; history; and administrative issues such as availability and custodial history.^[5]

The shift from printed manuscripts to electronic documents greatly accelerated the appearance of document iteration. This acceleration becomes problematic when coupled with the fact that gate-keeping functions

traditionally associated with scholarly and commercial publishing diminish when authors, or any other person, can, in some cases, disregard copyright law and change a text at will, store it on a server, and disseminate it via whatever scheme he or she chooses. Copyright becomes a tangled Web when one considers that the author may no longer hold copyright to his or her own work if he or she has agreed to transfer copyright to the publisher for a limited or unlimited amount of time. Therefore, he or she may not possess the legal permission to post particular versions—especially the final "published" version—of his or her own work by self-archiving on a personal Web site or in an institutional repository.

Self-archiving is usually the process of an author maintaining a document copy in electronic format. This electronic document may be made available to the author or anyone else designated by the author. The clear benefit of self-archiving is easy access and information dissemination within the scholarly community. One potentially negative consequence is that variant versions of a particular document may circulate in this way. An institutional repository is "defined to be a Web-based database (repository) of scholarly material which is institutionally defined (as opposed to a subject-based repository)"^[6]

Issues of copyright and permission to disseminate work are usually negotiated between the author and the publisher at the time of publication; many publishers have specific policies and guidelines regarding how an author may alter and/or disseminate versions of his or her work after publication. For instance, some publishers allow authors to retain copyright to their work but negotiate from the author the one-time rights, exclusive for a given amount of time (e.g., 90 days), to be the first publisher of the work, and the right to distribute the work exclusively for a given amount of time (e.g., 90 days) after publication. After this predetermined period (e.g., 90 days), the author may distribute, reprint, etc., as he or she pleases. On the other end of the spectrum, some publishers have much stricter and more limited agreements with authors wherein the author transfers copyright to the publisher in perpetuity.

Regardless of the copyright issues involved and the myriad possibilities for agreements between the publisher and the author, it remains that many different versions of any given article do and can exist. To focus on the journal article for purposes of explication, one journal article can exist in multiple electronic versions. In 2005, Sally Morris offered a partial list of possible versions of one journal article:

1. Privately circulated early draft (could be >1 iteration).
2. Version presented at public event (again, could be >1).
3. Pre-submission version(s).
4. Version as submitted to journal x (may differ when resubmitted to journal y).
5. Version amended after peer review (may go through >1 round of amendment).

6. Version as accepted by journal x.
7. Accepted version, with substantive editing by journal editor and/or publisher (again, may be multiple iterations).
8. Accepted version, with substantive editing and copyediting—ready for publication.
9. Publication version (as above, formatted and paginated)—proof.
10. Publication version corrected and passed for publication.
11. Published version, not on publisher's site (e.g., PDF), thus potentially lacking some functionality.
12. Published version (on publisher's site, with full functionality).
13. Post-publication version with errata/addenda (maybe on publisher's site, with functionality) or elsewhere without it.^[7]

VERSION OF RECORD AND OPEN ACCESS

While it is beyond the scope of this entry to explore the complicated world of open access (OA), it is impossible to discuss version control without addressing some of the major features of OA. Broadly, OA is the movement to make scholarly literature “digital, online, free of charge, and free of most copyright and licensing restrictions.”^[8] Morris does not explicitly refer to any particular publishing models in her list; she does not overtly refer to OA or toll-based models because version control issues prevail in both worlds. Indeed, journal articles published in the more traditional toll-based scholarly literature, or journal articles published in OA journals can be versions of record.

The NISO/ALPSP JAV Technical Working Group defines version of record (VoR): “a fixed version of a journal article that has been made available by any organization that acts as a publisher by formally and exclusively declaring the article ‘published.’”^[4] Furthermore, the notes to the VoR definition explain:

The VoR may exist in more than one location (e.g., a publisher's Web site, an aggregator site, and one or more repositories). That is, there may be more than one *copy* of a VoR but there is only one *version* of a VoR. In Functional Requirements for Bibliographic Records (FRBR) terms, there may be more than one *manifestation* or *instance* of a VoR, but there is only one *expression* of it.^[4]

In other words, VoR transcends notions of multiple copies. Yet, the increasing prevalence OA archives and repositories have ultimately complicated the issue of version control for the scholarly community. The mere existence of such OA material (and other toll-based copies such as those that exist in aggregator databases) requires the reliance on FRBR differentiation between manifestation and expression.

Version control faces two distinct sets of challenges: political and technological. OA itself is an increasingly

political movement, especially in light of the Consolidated Appropriations Act, 2008, which includes a provision directing the National Institutes of Health (NIH) to require “scientists to submit final peer-reviewed journal manuscripts that arise from NIH funds to the digital archive PubMed Central upon acceptance for publication.”^[9] This Act was signed into law despite lobbying efforts of the Partnership for Research Integrity in Science and Medicine (<http://www.prismcoalition.org>), which is a coalition that has the support of the Professional and Scholarly Publishing Division of the Association of American Publishing.

In addition to the complexities that OA introduces, version control often resembles a Gordian knot because divergent groups have a vested interest in insuring that their voices are heard in any effort to create standardized solutions. Publishers, authors, researchers, vendors, aggregators, subscription agents, OA advocates, universities and other research centers, librarians, standards organizations—while there is some consensus of opinion among this variegated list, each group nonetheless represents a particular constituency with unique goals and interests. The JAV Technical Working Group's report lists the following stakeholders as important variables in identifying the dimensions of an article version: author, editor, referee, publisher, librarian, reader, and funder. Other dimensions articulated by the JAV Technical Working Group are time, added value, manifestation, and siblings.^[4]

PEER REVIEW

In 2000, a working group of publishers acknowledged one outcome of the version control problem as changing the context within which peer-reviewed articles are perceived: “The peer-reviewed article will continue to play a crucial part in the certification, communication, and recording of scientific research. However, in the electronic environment it represents one point on a potential continuum of communication.”^[10] Peer review—in one form or another—has represented the bedrock of reputable scholarly output since at least the beginning of modern science in the seventeenth century, and any discussion of a potential change in its role in scholarly communication is significant.

The issue of peer review as it relates to OA and thus version control is a volatile one, with information industry stakeholders arguing many sides of this complicated issue. Some say that peer review in OA scholarly output is as rigorous and honest as it is within conventional toll-based publishing; others argue that peer review and thus quality of scholarship suffers in the face of OA. In her 2005 article, “Version Control of Journal Articles,” Morris noted the emerging problem of definitive or authoritative versions of documents versus “good enough” versions and its implications for scholars. The problem, as described by Morris, is pernicious. As listed earlier, she identifies 13

basic variants, from privately circulated early drafts, through post-publication versions with errata and addenda and argues that a reader cannot easily discern differences between these versions.^[11]

Steven Harnad addresses the worries of researchers, university administrators, and librarians in terms of version control and peer review. He notes that there is no need to be concerned about self-archiving because:

There will be self-archived preprints, revised drafts, final accepted, published drafts (postprints), updated, corrected post-postprints, peer comments, author replies, revised second editions. OAI-compliant Eprint Archives will tag each version with a unique identifier. All versions will be retrieved by a cross-archive OAI search, and the 'hits' can then be identified and compared by the user to select the most recent, official or definitive draft, exactly as if they had all been found in the same index catalog.^[12]

OAI is the Open Archives Initiative, and it “develops and promotes interoperability standards that aim to facilitate the efficient dissemination of content.”^[13]

APPROPRIATE COPY AND OpenURL

In addition to the implications for readers, Morris observed that version control is of great concern to libraries, which are faced with the multifaceted problems of tight budgets; appropriate copies based upon institutional affiliation; multiple, free online versions; and versions which are either self-archived or archived by independent institutions or other repositories. In response to some of these issues, libraries point users to their appropriate copy via link resolvers and the OpenURL framework. It is important to distinguish between the version control and the appropriate copy problem. The appropriate copy problem has two equal dimensions: 1) the multiple availability of any given resource from a variety of sources and 2) the subsequent challenge of pointing the reader to the copy of this resource appropriate for him or her, usually by virtue of his or her institutional affiliations.

If restricted to the toll-based universe, a given journal article might be available from the publisher or from a number of secondary aggregators (e.g., EBSCO, ProQuest, Gale). A researcher at a university may have access to only some of these article copies, and the library or information center wants to insure that the researcher reaches those copies which are appropriate for him or her. If expanded to include the OA universe of materials, the phrase “appropriate copy” then comes to “denote the copy of a resource to which a user has rightful access, usually by virtue of his or her institutional affiliations but perhaps also by virtue of an information object being *open access*.”^[14]

The OpenURL framework was developed to address the appropriate copy problem, and it is now a NISO

standard, Z39.88, OpenURL v. 1.0. Via link resolvers, the OpenURL framework is widely used to point users to their appropriate copies. The appropriate copy problem and its solution in OpenURL/link resolvers primarily address a problem of access; version control, on the other hand encompasses issues of authority and management as well as defining the stages in the life cycle of an article. OpenURL also primarily focuses on pointing users to versions of record, which, again, can be in multiple locations. The other versions of an article—such as more ephemeral ones kept in an author’s institutional repository, for example—are currently outside the technical capability of the OpenURL/link resolvers. With version control, many technological hurdles remain, including: a standardized schema to identify the VoR or authoritative version as well as an extensible model to identify and explain the relationships among the different iterations of a document.

TECHNOLOGICAL INITIATIVES

One such effort to clearly articulate the different stages in the life of an article as well as the relationships among those stages was released in an April 2008 report by a joint partnership between NISO and ALPSP, the JAV Technical Working Group. Perhaps the most definitive work to date on the issue of version control, the recommended practices released by the JAV Technical Working Group attempts to “provide a simple, practical way of describing the versions of scholarly journal articles that typically appear online before, during and after formal journal publication.”^[4] The working group builds upon earlier, previously mentioned efforts.

In September 2005, NISO and ALPSP charged the group with creating a plan that included:

1. Creation of use cases to identify the most common journal article life cycles.
2. Analysis of use cases to determine common life cycle stages.
3. Selection of preferred vocabulary for the most common life cycle stages.
4. Development of appropriate metadata to identify each variant version and its relationship to other versions, in particular the definitive, fully functional published version.
5. Establishment of practical systems for ensuring that the metadata is applied by authors or repository managers and publishers.^[15]

Cliff Morgan, Vice President, Planning and Development and Director, John Wiley & Sons, Ltd., was the chair of the joint NISO/ALPSP working group. In an August 2007 interview, Morgan noted: “In the digital world, multiple versions of journal articles are often available online. This can cause confusion because there is no way of identifying

the various versions by either a common terminology or identification scheme.” Morgan went on to explain that the working group “will recommend terms and definitions for journal article versions and define the relationships between these versions. We’re focusing on key stages rather than every possible iteration of an article from origination to publication.”^[16]

Critical to the working group’s efforts is the notion that the group focuses on “key stages” of the version continuum rather than “every possible iteration.” The group considered a variety of attributes in order to describe different versions: “Ownership, bibliographic context, identifiers [e.g., digital object identifier (DOI)], relationships, fixity, and peer review are explicitly stated in the terms and definitions that we recommend. They can be described by the article version names and some are already covered by standard metadata elements (e.g., bibliographic reference, date, and DOI).”^[4] Of particular note is the attention paid to the version of record. Morgan elucidated the importance of this stage:

The VoR constitutes the ‘minutes of science’—the formally certified record of a research project. It is this version that has been peer-reviewed, edited, composed, and verified by the author; it is this version that benefits from publisher investment in managing the above process, building the journal brand, and adding functionality such as linking and e-alerts, and for which the publisher takes legal responsibility. This is also the version that is most likely to be cited by other researchers.^[16]

If the VoR is easily identifiable, then the problem of researchers questioning which version is the final, authoritative one is solved.

The seven stages identified by the working group are:

1. Author’s Original.
2. Submitted Manuscript Under Review.
3. Accepted Manuscript.
4. Proof.
5. Version of Record.
6. Corrected Version of Record.
7. Enhanced Version of Record.

Each stage is accompanied by a full definition and note. Also included in the report are graphical representations of the relationships among formal and gray literature as well as a number of “use cases” to provide a clearer picture of how the recommended terms would apply in real-world situations.

What remains to be seen is to what extent the recommendations in the report will be implemented by publishers and other stakeholders in the information industry. Version control is still very much an issue in flux, and thus it presents interested parties with a moving target. Some publishers have already created and maintained internal

practices for version control that may or may not be consistent with the group’s recommended practices. If a publisher has invested significant capital in creating and maintaining an internal schema, then only time will tell if the said publisher will implement the NISO/ALPSP recommendations. Additionally, while the report explains some relationships among formal and gray literature, the group primarily concerned itself with a fairly narrow scope: journal articles. The continued evolution of the formally published journal article itself presents problems. If the electronic version with an assigned DOI is the version of record, then it begs the question about the necessity of assigning volume, issue, and page numbers for a journal article version of record. Questions of version control for other formal literature—book chapters, proceedings, etc.—remain. Moreover, an ocean of gray literature exists. With the advent of electronic publishing, gray literature and other informal publishing enjoy unprecedented accessibility. Such accessibility arguably leads to formerly “hidden” scholarship now occupying a more prominent place in our intellectual space and community of scholarship. Ultimately, many questions remain and while the group’s work is essential, it is only one step toward an unknown future.

Version control is an international issue and as such, there are multiple initiatives underway to address its unique challenges. Two other programs created to study version control are the United Kingdom-based Joint Information Systems Committee Validating Repository Content project (VALREC, http://www.jisc.ac.uk/whatwedo/programmes/programme_rep_pres/tools/valrec.aspx and <http://valrec.eprints.org/>) and the London School of Economics VERSIONS Project (<http://www.lse.ac.uk/library/versions/>).

CONCLUSION

Version control remains a thorny issue with many technological and political barriers. The very nature of electronic information allows for an ease of replication and adaptation heretofore unheard of in scholarly communication. However, information industry stakeholders have recognized the issue and have formed a variety of international projects to study and recommend standardized solutions for identifying and managing iterations of a document for archival and retrieval purposes.

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Vietnam: Libraries, Archives, and Museums

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Abstract

Vietnam has a long and illustrious history of information services development - from the introduction of printing in the 14th Century, through the French influence in the 19th Century when many valuable collections and guidelines for libraries were developed, to the modern advances information services development, with some state-of-the-art information centers and services. The richness of the culture and the development of the society is reflected in the valuable collections and services currently offered in it's libraries, information centers, museums and archives.

SOCIALIST REPUBLIC OF VIETNAM (CONG HOA XA HOI CHU NGHIA VIETNAM)

VIETNAM

Vietnam, a 1500 km narrow stretch of land, is located in Southeast Asia, bordered by the Gulf of Tonkin and the South China Sea to the east, China to the north, Laos and Cambodia to the west, and the Gulf of Thailand to the south (see Fig. 1). Diacritical Vietnamese language marks have not been used in this entry, to simplify printing.

History

The modern-day history of Vietnam dates back to the tenth century—during the time that the Ngo (939–965), Dinh (968–80), and Pre-Le (980–1009) dynasties began to consolidate and defend an independent country. Previous to that Vietnam had been conquered by China in 207 B.C. and dominated by Han until the 111 B.C. In the fifteenth century, China made its final attempt to dominate Vietnam but was defeated.

Commencing in the mid-nineteenth century, the country came under the dominance of France when Indochina, consisting of Vietnam, Cambodia, and Laos, was established under a French decree of 1857. Vietnam declared independence from Japan and France on September 2, 1945. However, it remained under French control until the communist Viet Minh defeated French forces at Dien Bien Phu on May 5, 1954.

The Vietnamese trace the origins of their culture and nation to the fertile plains of the Red River Delta in northern Vietnam. After centuries of developing a civilization and economy based on the cultivation of irrigated rice, the Vietnamese, in the tenth century, began expanding southward in search of new rice lands. Until the mid-nineteenth century, the Vietnamese gradually moved down the

narrow coastal plain of the Indochina Peninsula, ultimately extending their reach into the broad Mekong River Delta.

The conquest of Vietnam by France began in 1858 and was completed by 1884. It became part of French Indochina in 1887. Vietnam declared independence after World War II, but France continued to rule until its 1954 defeat by Communist forces under Ho Chi Minh. Under the Geneva Accords of 1954, Vietnam was temporarily divided at the 17th parallel when North Vietnam was reconstructed as the Democratic Republic of Vietnam. South Vietnam struggled another 20 years for independence against U.S. forces and Saigon's government until the Paris Agreements of 1973 when U.S. troops withdrew. In 1975, Ho Chi Minh and his forces overthrew the Saigon Government and unified the country as the Socialist Republic of Vietnam, with Hanoi being declared the capitol. As of 2005, a three-person collective leadership has been responsible for governing Vietnam. This triumvirate consists of the Vietnam Communist Party, VCP General Secretary, the Prime Minister and the President.

Vietnam's history is a story of struggle to develop a sense of nationhood and to maintain that against internal and external pressures.

Population

Vietnam's population is over 84 million, and is growing at a rate of about 1.2% each year.^[1] Recent estimates put Vietnam's age distribution as follows: 0–14 years of age, 29.4%; 15–64, 65%; and 65 and older, 5.6%.

Vietnamese, or "Viets," also known as Kinh, are the predominant ethnic group, constituting about 86% of the population. Chinese account for 3% of the population, while the remaining numbers are of other ethnic backgrounds—estimated at around 54 groups—the largest being the Hmong, Thai, Khmer, Cham, and Montagnards.



Fig. 1 Map of Vietnam.

Source: CIA *The World Factbook*.

Most of these indigenous live in the Central Highlands and extreme northern Vietnam.

Vietnamese is the official language of Vietnam, with English increasing in popularity as a second language. French remains a language of record for many historical documents, and some Russian documents are of note. With 7.6 million followers, Buddhism is the most popular religion. The second most popular religion is Roman Catholicism, with 6 million adherents.

Vietnam's literacy rate is about 94%, including 95.8% for men and 92.3% for women. Educational attainment is less impressive. Although, 5 years of primary school education is compulsory, and about 92% of eligible children are enrolled in primary school, only about two-thirds of them complete the fifth grade.

Economy

Although Vietnam's economy, which continues to expand at an annual rate in excess of 7%, is one of the fastest growing in the world, that economy is growing from a low base. It still reflects the crippling effect of the Second Indochina War (1954–1975) and the repressive economic measures introduced in its aftermath.^[2]

LIBRARIES

Libraries and information centers in Vietnam can be categorized in two groups: 1) a network of scientific libraries (National System of Scientific and Technological Information—NSSTI) and 2) a network of public libraries, including central, city and provincial, district and children's libraries.

History

The introduction of printing, using wooden blocks and boards, has been dated sometime after the fourteenth century. However, manuscripts, dating before that time, formed the first collections of “library” materials. Much of the collections developed before the time of the Nguyen dynasties in Hue (1802–1945) have been lost or destroyed due to civil wars and invasions and only about a fourth of the Nguyen collections survived the wars of the twentieth century.^[3] Many of those surviving Han-Nom writings (combining the classical Chinese characters of Han with Nom, the Vietnamese language style) are now located in the Vietnam Academy of Social Sciences—Institute of Han-Nom Studies in Hanoi which has a large number of ancient texts on Confucianism in VietNam.^[4] During the second part of the nineteenth century, French colonization of Vietnam brought the development of a number of libraries, including libraries of the Société des Etudes Indochinoises and the École Française d'Extrême Orient (EFEO). Most of those early collections belonged to learned societies or the government under French direction.

In 1917 a Frenchman, Paul Bourdet, arrived in Vietnam and immediately introduced the idea of development of a Direction des Archives et des Bibliothèques de l'Indochine^[5] in order to:

- Establish a central library and archive in Hanoi, with branches in Saigon, Hue, and Hai Phong (this latter one

never materialized), as well as Phnom Penh in Cambodia and Vientiane in Laos

- Develop and institute legal deposit laws
- Initiate cooperative assistance to other libraries and archives in existence^[6]

The library in Saigon became the Bibliothèque Central Cochinchine and adopted the role of that earlier Library and Archives (BCC). In 1919, the Bibliothèque Centrale Hanoi (BCH) was created with legal depository rights for all of Indochina.

In the first half of the twentieth century, several major collections were developed in libraries, particularly in Hanoi and Saigon. However, in 1945, with the commencement of military conflicts with Japan many resources were damaged and some were moved to France in the early 1950s. With internal conflict came a move to relocate some resources, including books, journals and archives, from the Bibliothèque Central Hanoi (BCH) in Hanoi to Saigon. In 1959, the Directorate of National Archives and Libraries (DNAL) was established in South Vietnam with the aim of creating a national library with resources from the old BCC and those materials brought south, while some were removed to France. The resources of this new unit became what was called the General Library [now the General Science Library, the major public library—other than the National Library of Vietnam (NLV)] which was named the National Library of South Vietnam in 1971 when a new library building was opened. Three years later the DNAL was disbanded. The library holdings are a part of the General Science library in Ho Chi Minh City. Earlier, in the 1960s, public libraries began to establish a network of town and district public libraries.

Years of turmoil in the country have taken a toll on the development of information services, and many segments of the system of information services are attempting rapid recovery. This recovery is being aided by a number of international organizations working with various information services institutions. Those international efforts include UNESCO, International Federation of Library Associations and Institutions (IFLA), and other who have contributed substantially by advising and encouraging an efficient library and information services infrastructure in Vietnam. Vietnamese librarians are becoming more involved in international professional activities, including those of IFLA, the Congress of Southeast Asian Libraries, UNESCO, and other. In addition, philanthropic organizations have supported both the development of libraries and the education of librarians, primarily Atlantic Philanthropies which has contributed in the form of financing the development of state-of-the-art Learning Resource Centers (LRCs) in major universities in the country (Can Tho, Da Nang, Hue, and Thai Nguyen). They, along with Harvard Yenching Foundation, and others have supported the graduate education of over 50 master's degree students at Simmons College in Boston, United

States of America—under the educational direction of Dr. Patricia Oyler—and of other programs at the University of New Zealand in Wellington. Many of those graduated librarians are now in leadership positions in academic libraries and information center throughout the country. Dr. Oyler has been recognized by the Vietnamese government, as has Mr. Michael Robinson, formerly of Atlantic Philanthropies, as international colleagues who have made significant contributions to library and information services in the country. Librarians have also received archival and librarianship training in several other countries—Australia, Japan, Great Britain, and France among them. UNESCO has been supportive of many preservation efforts in the library community.

Several library organizations are involved in digitization projects, including: the National Library (digitization of abstracts of thesis), National Center for Scientific and Technological Information (NACESTI) (digitization of technical reports); Han-Nom Institute (digitization of paper rubbings of Han Nom steles); Vietnam National University (VNU) (digitization of course packs for students), Natural Sciences Library, Ho Chi Minh City (sponsored translation of Greenstone software into Vietnamese); and General Sciences Library (GSL) (digitization of SaiGon-HCMC Collection).

Today, all libraries and information centers in Vietnam operate under the Ordinance on Libraries, the highest legislation on library and information services passed in 2001 by the National Assembly of Vietnam with the intent to develop library resources and to increase state management efficiency in library activities. Another piece of legislation affecting information services, augmenting the 2001 ordinance, was passed by the Vietnamese National Assembly on November 20, 2005. That law relates to intellectual property for noncommercial purposes—including cultural exchanges or propaganda—indicating the fact that permission need not be obtained from creators/owners or royalties paid. This enhanced information services provided by nonprofit libraries and information centers. It addresses rights and responsibilities of organizations and individuals in library activities; library organization and operation; library investment and development; state management on library development; reward and handling violation in library activities; and implementation provisions.

Libraries are organized by category and/or type and are the responsibility of four different government ministries. Academic libraries and school libraries are discussed under one topic, since they are both under the supervision of the Ministry of Education.

The four categories are: public, academic, school and special

Public Libraries

The current public libraries system was set up in 1954, after the Indochina War. The system includes not only the National Library, but also provincial libraries located in

capitals of the provinces, district libraries located in capitals of the districts, and village libraries. The public library system supports many literacy efforts through the development of programs—children’s art exhibits, book exhibitions, reading classes, story-telling, lectures on important topics, and mobile services to remote areas of the country.

The Public Library System, administratively under the Ministry of Culture and Information, now the Ministry of Culture, Sports, and Tourism, is organized at four levels, correlating to levels of government. They include:

- NLV
- 64 provincial libraries of the 64 province administrative units
- 589 district libraries within the 633 district administrative units
- 8677 ward and commune libraries, including Reading Rooms for Children and Village libraries or book cabinets^[7]

The NLV

The primary public library unit in the country is the NLV.^[8] The impetus for a National Library, as indicated above, was establishment, by the General Governors of Indochina on November 29, 1917, of the Central Library, located in Saigon. The National Library in Hanoi was named NLV by the Provisional Revolutionary Government of the Democratic Republic of Vietnam on October 22, 1945. However, it was not until the 1960s that Vietnam began further development of the central collections of the NLV in Hanoi. The Library has the statute at the Department level within the Ministry of Culture and Information, now renamed the Ministry of Culture, Sports, and Tourism. The NLV is now organized and operated in accordance with the Government’s Resolution No. 401/Ttg dated September 9, 1976 on the Library’s Functions, Targets, and Missions. This Ordinance was amended by the National Assembly in 2001. Its adoption of the intellectual property law went into effect on July 1, 2006. A new library building was completed in 2001, adding to the infrastructure of the Library.

The National Library serves as the primary depository of the nation’s recorded history. Its charges include:

- Compiling and publishing the national bibliographies of Vietnam
- Developing and preserving a national Vietnamese collection by deposit of domestic publications, doctoral thesis, and patents
- Collecting relevant foreign materials of different forms, on Vietnam and works of Vietnamese living abroad, as well as manuscripts of famous Vietnamese writers through purchase and exchange
- Organizing materials and developing an information reference system to serve readers as the nation’s information centre for culture and arts

- Publishing monthly and annually national bibliographies of Vietnam
- Maintaining an awareness of new developments in order to provide professional guidance to the public library community nationwide
- Providing professional guidance to all library systems nationwide; especially the public library system through the establishment and administration of the Local Area Networks and the Wide Area Networks (WANs) of the public library system, and carry out R & D projects on library and information sciences
- Coordinating library activities such as acquisition on foreign periodicals and books, union catalogs, and carry out interlibrary loan^[9]

In 2005, NLV completed the national project “Building the National Electronic/Digital Library in the NLV” which was begun in 2001 and most major public and academic libraries and information centers have now joined that Integrated Library System.

The *National Bibliography of Vietnam* has been a production of the Library since 1955 and compiled monthly and annually. Since 1997, the NLV has been developing and maintaining a WAN system for public libraries in accordance with Resolution No. 579 by Ministry of Culture and Information. It has adopted and adapted MARC21 for its own use and that of the public library system. In 2006, under contract with OCLC (Online Computer Library Center), the NLV began, and has now completed, translating the Dewey Decimal Classification, Abridged Edition 14 into Vietnamese for use by libraries in the country. It provides some computers with peripheral equipment and photocopy machines for each provincial library. The National Library is also supporting an international effort to develop the Vietnam Union Catalog in an effort to create an international union list of Vietnamese *quoc ngu* titles held in Vietnam’s major libraries.

The National Library maintains several databases, including:

- The book (SACH) database, which contains records of books in Vietnamese and Latin languages from 1950 to the present time, as well as some books in Cyrillic, Chinese, and Japanese script.
- The serial publications database (JM) which includes records of serial publications, acquired by NLV since its establishment to the present. This database contains newspapers and magazines in Vietnamese and foreign language, including serial publications in Cyrillic characters.
- The thesis database (LA) which contains records of over 5500 doctoral dissertations by Vietnamese citizens in Vietnam and abroad. This database contains half of the total number of thesis stored in the NLV.
- The newspaper and periodicals of Indochina database (NCUU) which includes about 1700 titles.

GSL

The GSL in Ho Chi Minh City, formerly Saigon, is the other major public library in Vietnam and is the genesis of the original national library established by France in the nineteenth century. The term “general sciences” is a misnomer in the library’s title, since the library serves the primary role of an open public library with extensive services to the general public, to schools and to other public libraries in the area. In addition, it is an important preservation center, including archives and preservation facilities. Founded over one hundred years ago as the Library of the Admirals and Governors, the library was later recognized as the National Library of South Vietnam. It now possesses over 1.5 million books.

In the international arena, the library acts as a deposit library for UNESCO, World Bank, the Food and Agricultural Organization and the International Atomic Energy Agency. It is responsible for collecting and maintaining materials of all kinds published inside and outside the country. The library, under the former dynamic leadership of Ms. Nguyen Thi Bac, now reaches over 150,000 users yearly. Ms. Bac, a Simmons graduate of 1994, took early retirement in 2008, to work with several Scandinavian NGOs and is now country director for the Right to Read Foundation.

In addition, the library supervises 24 district libraries in the city and provides professional support to 21 provincial libraries. With Ho Chi Minh City being the country’s center of business and commerce, no other public library in the country has as much activity, including an extensive exchange program with international agencies, overseas acquisitions, and constant use of the collection by scholars from abroad. It publishes the journal *Library Information Bulletin of South Vietnam*.

General Sciences Library has a unique and extensive collection of Vietnamese materials from 1954 to 1975 and the Library is working with the NLV, the legal depository, to include those holdings in the database of Vietnamese publications. Notable special collections of over 400,000 volumes include seventeenth and eighteenth century French/European and Indochinois materials. Notable services include model programs for the visually impaired, titled “Library for the Blind” project, and a state-of-the-art digitizing and microfilming services, as well as archives and preservation center.

Other Public Libraries

Other large libraries include those in Hanoi and Hue. In recent years, more than 1500 new public libraries have been created—as Cultural Village Bookcases, Pagoda Libraries, Bookcases of Commune Cultural Post Offices, etc. More than 150 mobile libraries have been developed within the last few years, as well as such activities as

Libraries on Boats, Book Bags for Border Guards, Bookcases in Communes, Cultural Post Offices, etc. This is in support of promoting culture and information in remote and rural regions.

Academic Libraries

The administration of both university and general educational/school libraries is under the jurisdiction of the Ministry of Education and Training. There are 45 academic libraries in Vietnam under the Ministry of Education and Training. In addition, there are a number of international universities, such as the RMIT (Royal Melbourne Institute of Technology) National University Vietnam, located in Ho Chi Minh City, whose libraries are under the regulations of those international governments or organizations.

All academic libraries are administratively under the Ministry of Education and Training. Several digital library projects are in the planning stages or being implemented, including the e-Book project at the VNU, Hanoi, Library and the use of the Greenstone Digital Library open source software at the VNU, Ho Chi Minh City University of Natural Sciences Library. Integrated library management systems have been or are being implemented in many of the academic libraries.

There are two academic library associations: NALA—The Northern Academic Library Association of Universities and Colleges (Hanoi) and FESAL—The Federation of Southern Academic Libraries (Ho Chi Minh City).

On February 12th, 2001, Decision No. 15/2001/QĐ-TTg reorganized the two national universities in the country: they are each amalgamations of 10 previously existing higher education institutions. Libraries within those amalgamated universities are:

VNU Hanoi Library and Information Center

Vietnam National University now provides information services for all colleges and member units within its system. The university, itself, has had several name changes over the years: the University of Indochina (established in 1906); VNU (Dai hoc Dong Duong, established November 1945); the University of Hanoi (Dai hoc Tong hop Ha Noi, June 1956). This University’s unified Library and Information Center was established in 1997 on the basis of amalgamating the libraries of the University of Hanoi (previously named the College of Social Science and Humanities), the College of Natural Science, and the former Hanoi Foreign Language Teachers’ Training College, currently named the College of Foreign Languages.

VNU Ho Chi Minh City Central Library

Vietnam National University Ho Chi Minh City was founded in 1995 by a government decree 16/CP and now consists of five universities and one faculty. The library

system of the VNU Ho Chi Minh City consists of the Central University and one library in each of the universities which make-up the system.

Other Academic Libraries in Vietnam

Several universities have been provided with new library buildings called LRCs have been provided with new library buildings, with a substantial information infrastructure, including technology and access to on-line resources, through grants from Atlantic Foundation. Those LRCs are located in: Can Tho University, Da Nang University, Hue University, and Thai Nguyen University. These projects of developing state of the art academic resource centers have been implemented through contracts with RMIT in Australia, and the professional staffs have been educated with master's degrees in library and information science, primarily through contracts with Simmons College in Boston, Massachusetts, United States of America.

School Libraries

Some 17,000 school libraries about half of the secondary schools have libraries, with an equal number in elementary schools. Organizations, such as Room to Read, are working with local area residents to create school libraries in villages. Over 160 such libraries have been created in Vietnam.^[10]

Scientific, Technological and Other Special Libraries and Information Systems

Most special scientific and technical libraries are under the Ministry of Science, Technology, and Environment. There are approximately 60 research libraries run by research institutes and 218 other special libraries. Other special information centers are under various ministries or other governmental agencies.

National Agency for Science and Technology Information of Vietnam

According to the Government Degree number 28/2008/ND-CP, dated March 14, 2008, on the functions, responsibilities, authorities, and organizational structure of the Ministry of Science and Technology in Vietnam, what was formerly known as NACESTI has been changed to the National Agency for Science and Technology Information of Vietnam, NASTIV, with added responsibilities. The organization was originally established in accordance with the Decision No. 497/TCCB dated September, the 24th, 1990 by the Chairman of the State Committee for Science on the basis of merging two former organizations: the Central Library on Science and Technology (Founded in 1960) and the Central Institute for Scientific and

Technical Information (founded in 1972). Under Dr. Ta Ba Hung's leadership NASTIV is the primary force in the development of scientific and technological information services in the country. One activity of particular importance for information services is that both MARC21-VN and AACR2 were translated by NASTIV Added responsibilities, under the new designation, include:

- Management of Science and Technology Information Network in Vietnam
- Management and implementation statistical data on Science and Technology
- Management and operation of Vietnam Research and Education Network (VinaREN)

Its primary role is to manage and coordinate scientific and technological library activities in the whole country and formulate national S & T information and Documentation Policy. National Agency for Science and Technology Information of Vietnam serves as the leading center of the national information system on scientific and technological information and documentation and has responsibility for managing overall scientific, technological, and environmental information and documentation activities in Vietnam. It, therefore, has a twofold mission: management of S & T information activity and serving as the national information center for science and technology^[11] by providing traditional and electronic library services to readers.

Since 2001, NASTIV's Library has subscribed to hundreds of online e-journals in the applied sciences, business, and management. In order to facilitate information sources sharing, NASTIV established VISTA (Vietnam Information for Science and Technology Advance)^[12] in 1997. This is a nationwide information network that is playing an important role in resource sharing and meeting the information requirements of scholars and the SME community in Vietnam. Through VISTA various types of information, collected, or produced by NASTIV, are distributed to those who can access the Internet. Through VISTA, all 61 provinces are interconnected for sharing information on science and technology by leased lines or by dial-up through the public telephone lines.

National Agency for Science and Technology Information of Vietnam has been a leader in digital library development as a major trend in library and information services development in Vietnam. This is an approach strongly supported by both high-ranking policy-makers and library communities. In 2007, it hosted—along with the NLV, General Science Library of Ho Chi Minh City (GSL), the Library & Information Center of the VNU Hanoi (LIC/VNUH), Hanoi University of Technology, Vietnam Association on Scientific and Technological Information & Documentation (VASTID), Vietnam Library Association (VLA), Vietnam Association for Information Processing—the 10th International Conference on Asian Digital Libraries with the theme “Asian Digital libraries.”

In order to meet the urgent needs of Internet users for digital information in the Vietnamese language and in English, NASTIV publishes a number of electronics bulletins and e-journals that are accessible over the Internet. National Agency for Science and Technology Information of Vietnam's major databases include: the Central Library for Science & Technology Catalog, a multidisciplinary database that reflects a rich Vietnam collection of monographs on science and technology; SCITEC, a foreign multidisciplinary scientific and technological documents database covering journal articles and conference proceedings; KQNC, a domestic R & D projects reports database that reflects completed R & D projects financed by the government budget; STD, a comprehensive multidisciplinary database on science and technology that covers domestic periodicals' articles, conference proceedings; and VNDOC, the Vietnam Science and Technology Abstracts (in English); as well as a Foreign Periodicals Union Catalogue Database, covering the holding information on about 6000 foreign periodicals titles available in about 40 leading information centers and libraries in the country.

The National Center for Social Science and Humanities Library

The National Center for Social Sciences and Humanities of Vietnam, was originally set up in 1975 with the mandate to develop and maintain a collection of research materials. In 2004, it was renamed the Vietnamese Academy of Social Sciences (VASS). Within VASS there are roughly twenty seven institutes and centers. This main library is located at the Institute of Social Science Information. Each institute, likewise, has its own library. Today that library has the largest collection in the country of social sciences and humanities materials. It preserves many valuable documents, including ancient books, handwritten documents, very precious photographic materials, etc. It is a leader in library and information activities of the social sciences and humanities. The Center itself serves 16 institutes, seven research centers, a museum of ethnology, and various research support offices.

The Central Institute for Medical Information and Libraries

The Ministry of Health Library was set up in 1979 on the foundations of the former Central Medical Library. The Institute's library is the leading medical-pharmaceutical information institution in Vietnam responsible for using information technologies in providing medical library and information services; providing the health and medical information; training and guiding the library and information in the medical library and information system throughout the country. It is also the national focal point

for international relationships in the medical library and information area.

The Military Library System

Section 4 of Article 19 of the government's Ordinance on Libraries^[13] states that "Libraries of the people's armed force units" are established to serve the demands of officers and men with such units, and may serve other subjects according to such libraries' regulations. The system of military libraries is under the Ministry of Defense and includes some 1500 libraries and mobile unit libraries. Of them there are 54 main libraries, each with a collection of from 200,000 to 300,000 volumes.

LIBRARY AND INFORMATION SCIENCE EDUCATION AND TRAINING

Education and training of information and library services staff is promulgated at several levels:

- Certificate of Library Technician, awarded to those who have completed secondary vocational school.
- Bachelor of Library Science, Bachelor of Information, Library and Computer Science: for undergraduates who have successfully completed university. A diploma for "Scientific and Technological Information Engineers" is under consideration.
- Master of Library Science awarded to graduates who have completed the post-graduate requirements.

Master of Library and Information Science programs are offered at some universities. Most universities or colleges now offer the bachelor's degree, the basic educational degree for librarians in Vietnam. Some offer diplomas. Five higher education institutions offering library and information science programs are:

VNU Hanoi, University of Social Sciences and Humanities

Faculty of Library and Information Science

The newly designated faculty was established in 2004. However, the program continues a tradition of education and scientific research first developed by the Department of Library Science which belonged to the Faculty of History—Hanoi University, established in 1973, and later designated as the Department of Library and Information Science—University of Social Sciences and Humanities (USSH), VNU in 1996. Since that earlier time the University has been training undergraduate students at this Hanoi campus. The primary goal of the faculty is one of educating both undergraduate and postgraduate students and developing their professional skills and theoretical

knowledge relating to library and information science. Currently both graduate and doctoral programs provide deeper insights, methodologies, and analytical skills in library and information science.

The Hanoi University of Culture

The Hanoi University of Culture was established in 1961 as the Cultural College of Hanoi on the foundations of the former Cultural, Theoretic, and Professional School. From its beginning it has trained library technicians and undergraduates who received a diploma, and since 1991, the University has offered the master's degree in Library Science. Unlike other higher education institutions the cultural university reports to the formerly named Ministry of Culture and Information, now the Ministry of Culture, Sports, and Tourism, and is responsible for training vocational students as well as undergraduates in areas that include culture, library science, and museology.

VNU Ho Chi Minh City USSH

School of Library and Information Science

The unit was established in 1976, from the former Saigon University of Sciences. The Faculty of Library Science was set up in 1986–1987 to offer a Bachelor of Library Science program for the Southern provinces. The School now prepares students for three degrees: technician, undergraduate, and postgraduate.

The Ho Chi Minh City College of Culture

The College was established in 1976 to train secondary vocational level students in the cultural professions. This College, as with the Hanoi University of Culture, reports directly reports to the Ministry of Culture, Sports, and Tourism. Since its establishment, it has trained library technicians. In 1985, it has been allowed by the Ministry to enroll students for short-term courses to train librarians for Southern provinces. It also offers a certificate program.

Can Tho University Learning Resources Center

Library and Information Management Program

This new program, established in 2006, is an undergraduate program educating library and information science students, particularly from the Mekong Delta area.

Several other organizations, including the National Library, NACESTI School of Central Archives and the Army Libraries, offer training programs on topics of importance in educating professionals responsible for providing information services.

THE VLA

The original VLA (Hoi Vien VietNam) was founded in 1959 but was in existence only a couple of years. It was reestablished in 1968 and was in existence until 1975.

The recently reinstituted VLA, the nationwide grouping of Vietnamese librarians, was officially founded on October 22, 2006 with more than 300 librarians and information professionals representing all types of library systems in the country. According to the Association's Charter, the VLA has the objectives to: Advance and strengthen Vietnamese librarianship; enhance the roles and positions of librarians and library institutions in the Vietnamese people's social and cultural life; make positive contributions to the economic, social, and cultural development of the country. Vietnam Library Association also strives to:

- Establish, maintain and strengthen networks, partnerships and linkages among Vietnamese and foreign librarians, libraries, library schools, and library associations and related organizations in order to share and improve professional knowledge; foster the development and international integration of Vietnamese librarians and library institutions.
- Serve as a national forum for library professionals, library related people and library friends to share experience, to promote mutual understanding, and to unite their intellectual power to solve major issues of the Vietnamese library professions.

Vietnamese Library and Information Science Journals

Two primary journals relating to library and information services in the country are:

- *Vietnam Library Journal* (Tap chi Thu Vien VietNam), revival of the previously published *Library Bulletin* (Tap San Thu Vien) National Library of Vietnam, Hanoi, Quarterly, 2007.
- *Journal of Information and Documentation* (Tap San Thong Tin Va Tu Lieu) NACESTI, under the Ministry of Science, Technology and Environment, in Hanoi. Quarterly, 1990—This journal is in Vietnamese with abstracts in English. It is also published online. (<http://www.vjol.info/>).

Other journals and newsletters include:

Southern Library and Information Newsletter (Thong tin & Th vien phia Nam). General Sciences Library Association for Library Information Science & Documentation.-Ho Chi Minh City, semi-annual; 1993–

Library-Information Technology Newsletter (Ban tin Cong nghe Thong tin Th vien): University of Natural Sciences.— Ho Chi Minh City. Monthly 1998—(<http://www.glib.hcmuns.edu.vn>).

National Technology and Science—Information and Documentation Center Newsletter (Ban tin Trung tam Thong tin—T lieu Khoa học va Cong nghe Quoc gia) Ministry of Science Technology and Environment.— Hanoi, Quarterly, (<http://www.vista.gov.vn>)

Newsletter of Pedagogical College of Ho Chi (Minh City Ban tin th vien), Monthly; 2002—

ARCHIVES

Manuscripts formed the basis for the first archival collections and have existed since the Ly dynasty in the eleventh century. An exact date has not been determined for the introduction of printing, the use of wooden blocks and boards, began sometime after the beginning of the twelfth century. During the twelfth to seventeenth centuries there was development of archival collections, primarily under the Tong (1460–1497) dynasty. However, official archives had been kept from the early days of the kings of Dai Viet, so that by the time of that Nguyen Dynasties (1802–1945) a substantial repository for official documents existed under the administrative control of a state office for libraries and archives. This repository housed both manuscripts and printed materials in cur Han (classical Chinese, the official language of the court until the early years of the twentieth century) and later the ideographic *chu nom* and romanized *quoc ngu* scripts, including land records and official court documents known collectively as *chau ban*. This was a substantial repository for official documents under the administrative control of a full-blown state office for libraries and archives. Most of those materials have not survived and, indeed, only about 5% of pre-1802 Nguyen dynasty (1802–1945) materials have survived. Approximately three-quarters of all Nguyen dynasty court records were destroyed during the First Indochina War of 1946–1954. Those which survived and are still in the country are in the National Archives Center #1, National Archives Centre #2, and the Institute of Han-Nom Studies Library in Hanoi.

Record keeping, of a more western approach, was introduced in the 1860s by French colonial authorities who enacted legislation to archive documents of national importance. During the early years of the colonial period, French government documents were stored in a variety of different government offices throughout the country. However, following the decree of the Indochinese General Governor, the Central Archives, and Library of Indochina was set up in Hanoi in 1917, with satellite archives in Saigon and Hue. Some few wood-block printed editions,

of earlier Buddhist texts, dating from the 1650s, are now in the National Archives in Hanoi. The majority of those surviving documents date from 1802, when the last ruling dynasty, the Nguyen (1802–1945), was in power. After 1954, the depositories in Hanoi and Saigon, respectively, housed the state archives of North and South Vietnam.

The current system of state archives dates from September 8, 1945 when the Provisional Government of the Democratic Republic of Vietnam issued a Decree establishing a National Service of Archives, Official Documents, and Libraries under the Ministry of Education. Shortly thereafter, on January 3, 1946 President Ho Chí Minh signed Circular 1C-VP, which emphasized the special values of archival materials in the task of national reconstruction. That decree prohibited destruction of any official record without the consent of competent authority.

Prior to 1962, the northern archives operated as a branch of the National Library, but Decree 102/CP of that year set up a separate National Archives Department within the Prime Minister's Office. Following Reunification in 1975 the public records office in Ho Chi Minh City became National Archives Centre 2. Today all of the older holdings of the Vietnamese National Archives are stored in these two repositories. A state-of-the-art new repository—National Archives Center 3 was opened in April 2002 to house the records of national, regional, and interregional agencies and institutions of the Democratic Republic of Vietnam (1945–1976) and the Socialist Republic of Vietnam (1976–present).

In 2003, the National Archives Department was renamed the State Records and Archives Department of Vietnam.

The northern archives operated as a branch of the National Library until 1962 when Decree 102/CP set up a separate National Archives Department within the Prime Minister's Office. At that time the old colonial records office on the grounds of the National Library became an annex known as National Archives Center #1. Following Reunification in 1975, the public records office in Ho Chi Minh City became National Archives Center #2. Today all of the older holdings of the Vietnamese National Archives are stored in these two repositories. A new state-of-the-art repository, the National Archives Center #3, was opened in April 2002 to house the records of national, regional and interregional agencies and institutions of the Democratic Republic of Vietnam (1945–1976) and the Socialist Republic of Vietnam (1976–present).

State Records and Archives Department of Vietnam

On January 25, 1991 Decision 24-CT of the President of the Council of Ministries made the Archives State Department responsible for the management of archives activities in the country and in 1992 the State Archives was placed under the Government Committee on Organization and Personnel, Ministry of Home Affairs. On April 4,

2001, the National Assembly's Standing Committee passed the Ordinance on National Archives. Cultural Heritage Law and in 2003 the National Archives Department was renamed the State Records and Archives Department of Vietnam.

The State Records and Archives Department of Vietnam consists of a network of some 70 provincial and municipal archives which are responsible for keeping, caring for and making accessible records of the events and decisions that shaped the nation, including central and local records of the Viet kings, the French colonial government, the US-backed Government of South Vietnam, the Democratic Republic of Vietnam, and the Socialist Republic of Vietnam.

However, the most important archival and printed texts, under public control, are held in those repositories in Vietnam including the National Archives centers, two in Hanoi and one in Ho Chi Minh City, and the three research institutes in Hanoi, under the control of the National Center for Social Sciences and Humanities, those being: the Sino Nom Research Institute; the Historical Institute; and the Social Sciences Information Institute.

Other major collections, as previously mentioned, are in the National Library in Hanoi and the GSL in Ho Chi Minh City. Some materials also can be found in several other archives and libraries, including the Archives of the Central Committee of the Communist Party, the Army Library, the former library of the Pasteur Institute, and several provincial repositories^[14] as well as archives in various ministries, however declassified noncurrent records of the Ministries of Foreign Affairs, Defense, and Public Security are transferred to the National Archives Centers after 30 years. Other government organizations also maintain some archival records as do some provincial archives centers, and some professional organizations, as well as academic units within universities. For instance, special archives include the Institute of Music Sound Archive, the cinematic archives of the Vietnam Film Institute, and archives of the Vietnam Buddhist Association and the Catholic Church in Vietnam.

The State Records Management and Archives Department of Vietnam is responsible for, among other things:

- Developing long-term and short-term plans for archives development on a country-wide basis, as well as directing and controlling their implementation.
- Directing research work and application of scientific and technological advancements into archival work.
- Conducting training and retraining for records management and archival work personnel; regulating emulation and rewards in archival activities.^[15]

In order to preserve safely and make full use of archives, one of the primary measures directed by the SADV (State Archives Department of Vietnam) is to reinforce the application of information technology in archives

work. It has established databases to serve the management, multiuser access and security preservation of some valuable Chauban (Emperor's records), Mocban (Woodblock records) of Nguyen Dynasty, and sound recordings, on CD-ROM.

The National Archives

The National Archives operates as the chief agency of the archives sector in Vietnam with the mission of carrying out the unified and centralized administration of archival work and archival national records at the nationwide level, including the task of applying information technology in the archives domain. It is responsible for organizing, guiding, and inspecting the implementation of government regulations on archives and records management. With that responsibility it manages the holdings of the State Records and Archives Department, including (instructing, selecting, preserving, and utilizing records at the National Archives Center as well as historical archives and at archives of all government agencies.^[16] The three centers are:

National Archives Center #1 in Hanoi is responsible for collecting, acquiring, preserving, and making effective use of archival records of national significance from feudal times (with the exception of woodblock records), including the French colonial period. It includes 60 archive collections and records groups, plus a range of books and materials dating from 1488 to 1945, including: Han-Nom (Chinese and Sino-transcribed Vietnamese) records produced by the feudal dynasties of Vietnam, principally royal records (and land records of the Nguyen kings and records of the Royal Viceroy in Tonkin and what is now Hanoi from 1802 to 1945; Records of the French colonial administration from 1858 to 1945, and records produced by the French-backed administrations in the north of Vietnam between 1945 and 1954 and historical books, periodicals, reviews, and official gazettes published prior to 1945.

National Archives Center #2 in Ho Chi Minh City is responsible for collecting, acquiring, preserving, and making effective use of archival records of national significance from the feudal period and from the French colonial territories of Annam and Cochinchina, the southern region of Vietnam including 55 archival collections and records groups, disks, sound recordings, and photographs and negatives dating from 1802 to the present, including: administrative records produced by the Governors General of Cochinchina, the Governors of Annam, the U.S.-backed Government of South Vietnam and various revolutionary organizations established in the south after 1975. It also houses scientific and technological records such as maps and atlases dating from 1862 to 1975; audiovisual records, photographs, films, newsreels, and sound recordings produced before 1975; woodblock records of various books and bibliographies produced by

the Nguyen dynasty (1802–1945), and a collection in Han-Nom (Chinese and Sino-transcribed Vietnamese).

National Archives Center #3, opened in 2002) in Hanoi, is responsible for collecting, acquiring, preserving, and making effective use of archival records of national significance created by central, regional and interregional agencies, and institutions of the Democratic Republic of Vietnam (1945–1976) and the Socialist Republic of Vietnam (1976–present), which includes administrative records produced by state central agencies and institutions such as the National Assembly, Government, Ministries, and regional and interregional committees from 1945 to the present; scientific and technological records, including records of the design and construction of important national works such as the Ho Chi Minh Mausoleum, videotapes and documentary and newsreel films of historical value; and personal papers and records, including personal papers, manuscripts of creative works by famous scientists, writers, artists, and political figures.

Besides those three archive centers, the Department also operates a Center for Scientific Research, an Information Technology Center, a Center for the Secure Preservation of National Archives and two secondary level training schools—the Central Secondary School of Records Management and Archives in Hanoi and the Central Secondary School of Records Management and Archives in Hồ Chí Minh City.

Those centers house only limited materials of potential significance for Cold War scholars.^[17] The post-1945 section of the National Archives in Hanoi contains documents generated prior to 1975.^[18,19] The National Library houses the primary collection of materials relating to the records of war in the country, which were produced in various resistance zones from 1946 through 1954.

Center for Conservation and Restoration of Archive Materials

The Center^[20] was established in 1993 to function as a repair and restoration center for the records of the national archive centers and various other institutions. Its primary responsibilities are: preparing and implementing long-term and short-term plans for the restoration, disinfection, fumigation, and deacidification of national archive records; coordinating with other organizations and individuals in identifying records and archives in need of conservation measures; receiving materials and undertake the necessary conservation and restoration work, ensuring that works are safeguarded during the process; and participating in studies toward and applications of scientific and technological advances in the conservation and restoration of archives. UNESCO has worked with colleagues at the center, and others in Southeast Asia, to address primary issues, including “Cultural Heritage Management.”

Institute for International Affairs

This Institute in the Ministry of Foreign Affairs maintains the archival materials of the Cold War period, but those materials remain primarily inaccessible to both Vietnamese and foreign researchers. Collections of materials for that period are in the Foreign Ministry, Communist Party, and Army collections and have not been deposited into the National Archives.^[21]

Vietnamese Record and Archives Association

The Association was founded under Decision 28/2001-QĐ-TCCBCP issued on May 23, 2001 by Minister-Chairman of Government Committee of Organization and Personnel as a social/professional organization representing Vietnamese individuals and organizations engaged in the archives profession and other concerned branches.^[22] It is chaired by the Director General of the Department. The Association’s aims are to:

- Assemble and unify members for exchange and dissemination of professional knowledge and experience.
- Enhance professional capacity.
- Coordinate with institutions and organizations engaged in archival profession to contribute to the development of Vietnamese archives in order to preserve safely and make effective use of national archival records for the national construction and defense of the Socialist Republic of Vietnam.

Archival Journals

Vietnam Records and Archives Review is published bimonthly by the Vietnam Record and Archives Association as a forum for research, instruction, guidance, and the exchange of information and experience on records management, archival, and office work.

Vietnam Records and Archives Magazine is published bimonthly by the State Records and Archives Department of Vietnam. The journal is similar to *The American Archivist* in that it contains articles on archival theory and practice, and also highlights specific projects in state archives centers around Vietnam. The journal publishes, among other topics, articles describing current practices and trends in archival science, including digital access and preservation of electronic records.

Archival Studies Education

In 1968, an archives education program was begun within the history department of Hanoi University, to train archivists at the tertiary level. In 1996, it became a separate “Faculty of Archival Studies and Office Management” in the University of Social Sciences and Humanities within

the VNU complex. Both a 4 year BA and a 2 year MA program are offered.

In 1974, the Archives Department of Vietnam founded a secondary school in Hanoi—the Central Secondary School of Archives and Office Skills 1—to train records and archives staff at intermediate level. A second school was opened in Ho Chi Minh City—as the Central Secondary School of Archives and Office Skills 2—in 1979. They both offered Secondary Certificates in Records and Archives Management. The one located in Hanoi was upgraded in June 2005 to a college level degree. In addition, the State Records and Archives Department of Vietnam and the Association of Vietnam Archives also provide regularly the short-term intensive training courses in archives.^[23]

MUSEUMS

History

The concept of the museum in Vietnam was introduced by the French who founded the Mission *archéologique d'Indochine* in Saigon (now Ho Chi Minh City); in 1901. It later moved to Hanoi and became the EFEO, with the aim of describing the archaeology of French Indochina, conserving its monuments, collecting its manuscripts, and undertaking research into the region's linguistic heritage. The first museum was developed in Hanoi in 1910 to display archaeological and ethnological artifacts, and paraphernalia from the Nguyen kings, including particularly royal regalia.^[24] The scholarly work of the EFEO provided the groundwork for the establishment of the Cham Sculpture Museum (1915–1916) in DaNang; the Musée Louis Finôt (1926), now the Vietnam History Museum in Hanoi and the Musée Blanchard de la Brosse (1927), now the Vietnam History Museum in Ho Chi Minh City. After 1954, the *Musée Blanchard de la Brosse* in Saigon became the National Museum of South Vietnam, but prior to 1975 no other museums were constructed by the South Vietnamese authorities.

During this same period in the north the Musée Louis Finôt became the Vietnam History Museum and a number of new museums were established—the Museum of the Vietnamese Revolution (1959), the Vietnam Military History Museum (1959), the Vietnam Fine Art Museum (1966), the Museum of the Viet Bac Autonomous Region (1959)—now the Museum of Ethnology in Thai Nguyen—and the Hai Phong City Museum (1959).

Ministry of Culture and Information, through its National Cultural Heritage Department, formerly the Museums and Conservation Department, is assigned responsibility for managing the five national museums as well as for providing general professional guidance in the fields of conservation and museology at the national level. It is the governmental agency responsible for managing cultural

activities throughout the country, including museums, preservation of cultural heritage and libraries.^[25]

On June 29, 2001, the National Assembly adopted the current *Law on Cultural Heritage*, which acknowledges that cultural heritage plays a significant role in the continuing national development and preservation of the culture of Vietnamese people. The law states that “The State’s policies shall encourage work to collect, compile, translate, inventory, classify, and preserve works of literature, art, science, oral tradition, and folklore of the multi-ethnic Vietnamese community.”^[26]

In 1954, a separate Preservation and Conservation Department had been established and this unit became a Division of the Department of Cultural Heritage, following the introduction of a new law enacted in July 2003. This mandate was enacted in order to fulfill the objectives of preserving and promoting the country’s cultural heritage. The information technology section and information on archives section of the Department of Cultural Heritage are now integrated as an Office of Information and Documentation, with the future goal of providing an information system repository on national relics, using modern information technology. Several “virtual museums” are directed by another unit, the Division of Relic Management which administers five heritage sites that have been recognized by UNESCO as world heritage sites (Hoi An’s Ancient Town, My Son Sanctuary, Ha Long Bay, Hue, and Phong Nha Ke Bang Caves).

Vietnam currently has over 120 major museum institutions in which to date some 4 million objects have been inventoried and preserved. Five of these institutions are National Museums managed by the Ministry of Culture and Information. Some 30 others fall under the management of various other government offices, mass media organizations and agencies, including the Ministry of Defense (People’s Army of Vietnam), the Ministry of Industry, the Vietnam Academy of Social Sciences, the Vietnamese Women’s Association, the Pasteur Institute, the Oceanographic Institute, the Hoi An Centre for Monuments Management and Preservation, the Hue Historic Monuments Conservation Centre, and various tertiary training colleges. However, by far the greatest number of Vietnam’s museums—more than 90 in number—fall under the direct management of the country’s 63 provincial and municipal authorities.^[24] The overall system of Vietnam museums includes several categories, including national, provincial, and city museums; as well as those nongovernmental specific museums, and museums belongs to the armed forces.

Museology Education

A 4-year graduate training program in conservation and museology was initiated by the Faculty of History at the Hanoi National University during the 1970s. In the late 1980s, the program was transferred to the University of Culture in Hanoi as a Faculty of Conservation and

Museum Studies (*Trng Đại học Văn hóa Hà Nội*). The Hanoi University of Culture also has a training program on “Cultural Management.”

National Museums of Vietnam

National Museums under the Ministry of Culture and information. The National Museums are responsible for collecting, preserving, and exhibiting artifacts about the nation's history and culture. Five of these institutions are National Museums managed by the Ministry of Culture and Information.

Ho Chi Minh City Museum (Bao Tang Ho Chi Minh)

Located in a beautiful building was constructed in 1885–1890 by a French architect as a museum but became the Cochinchina Governor's residence. The Museum was opened on May 19, 1990, President Ho Chi Minh's birthday. Housed in a four-storey building designed in the shape of a lotus, the museum depicts the life and times of Ho Chi Minh and his major contribution to the founding of the Socialist Republic of Vietnam. The main showroom exhibits more than 2000 documents, articles, pictures, and exhibits illustrating not only President Ho Chi Minh's achievements but also the most important contemporaneous events that occurred throughout the rest of the world during his lifetime. The museum also incorporates a library and research rooms.

National Museum of Vietnamese Revolution (Hanoi) (Bao Tang Cach Mang)

As regulated in the Decision 37/2004/QĐ-BVHTT dated June 28, 2004 of the Ministry of Culture and Information, Originally established in January 1959, the Museum of the Vietnamese Revolution is housed in an elegant two-storey building formerly used by the Trade Department. It has been renovated and redesigned into 30 exhibition rooms which contain more than 80,000 historical artifacts. The first room presents Vietnam and the Vietnamese. The exhibition continues with exhibits on the national liberation movements of Vietnam against the French before the establishment of the Communist Party (1858–1930); the struggle for independence under the leadership of the Communist Party (1930–1975); and the construction and defense of the Socialist Republic of Vietnam (1976–1994).

Vietnam Fine Arts Museum (Hanoi) (Bao Tang My Thuat)

As regulated in the Decision 37/2004/QĐ-BVHTT dated June 28, 2004 of the Ministry of Culture and Information, Vietnam Fine Arts Museum has the responsibility of

conserving, exhibiting typical art work, materials, and objects of Vietnam. It was built in the 1930s by the French, and reserved for the French colonial rulers' daughters throughout the Indochina who came to Hanoi to study. In 1962, the government requested the Ministry of Culture to transform the building from the western architecture into a Vietnamese appearance with ornamental details from the traditional architecture of communal house and fit for exhibiting works of fine arts. On June 26, 1966 Vietnam Fine Arts Museum was officially inaugurated. Throughout 40 years, the Vietnam Fine Arts Museum has been the center for fine arts and culture study, contributing to the preservation and promotion of the nation's cultural heritage. It is an information services organization, directly affiliated to the Ministry of Culture and Information, whose role is one of conserving, exhibiting typical art work, materials, and objects of Vietnam. Objects and artworks date back to prehistoric times.

Museum of Vietnam History (Ho Chi Minh) (Bao Tang Lich Su)

The museum was originally established in the 1920s as the *Musée Louis Finot* and housed in a building which typifies the hybrid “Indochinese style” of architecture. The archeological collection includes relics from the Hung era and Neolithic graves, Bronze age implements, bronze drums from Ngoc Lai and Mieu Mon, Chom relics, stele, statues, ceramics. This museum traces the history of the Vietnamese people from the earliest times to the present day using displays of cultural and ethnological significance. Exhibits are displayed on two floors which cover an area of more than 2000 m.

Vietnam Museum of Ethnology (Hanoi) (Bao Tang Dan Ltoc Hoc)

This is both a research center and a public museum exhibiting the ethnic groups of Vietnam. Proposal for the Vietnam Museum of Ethnology was officially approved on December 14, 1987. On October 24, 1995, the Prime Minister made the decision on establishment of the Vietnam Museum of Ethnology, under National Centre for Social Sciences and Humanities. The Museum opened in 1997. The mission of the Museum is scientific research, collection, documentation, conservation, exhibition, and preserving the cultural and historic patrimony of the nation's different ethnic groups. The museum also serves to guide research, conservation, and technology that are specific to the work of an ethnographic museum. It is a vital museum in maintaining and promoting the treasure of cultural, artistic heritages of Vietnamese ethnic communities. As a center for ethnographic research the museum employing many experts on the different ethnic groups, located in Thai Nguyen.^[27]

Other Major Museums

Vietnamese Women's Museum (Hanoi)

Was dedicated on October 20, 1995, the 65th anniversary of the Vietnamese Women's Association, in honor of the brave Vietnamese women who had played an integral part in the social and political scenario of Vietnam. It honors the involvement of Vietnamese women in the fight for national independence and national construction. The Vietnamese woman is expressed through their struggle to liberate women, as well as exhibiting traditional handicrafts and costumes of the 54 Vietnamese ethnic groups.

Vietnam Military History Museum (Hanoi)

Military history from King An Duong era to the present day. Vietnamese victory of Dien Bien Phu showed the accomplishment of the Vietnamese people and army's protracted struggle against the French. On October 10, 1954, the Vietnamese army took Hanoi. In celebration, on July 17, 1956, an official decision was taken to form a board in charge of building the Army Museum. When war spread over the country, the Museum changed its direction corresponding to wartime, strengthening scientific research, preserving and protecting objects, collecting artifacts at battlefield. On December 12, 1959, President Ho Chi Minh, State and Party leaders came and inspected the exhibition then permitted holding the museum's opening ceremony on December 22, 1959 on the occasion of the 15th anniversary of founding the Vietnam People's Army. In 2002, the Army museum changed its name into the Vietnam Military History Museum.^[28] Its exhibitions present the Vietnamese military history from the first period of founding the country to the Ho Chi Minh era.

Geological Museum of Vietnam (Hanoi)

Geological Museum of VN now is an official member of the International Council of Museum, belongs to the Natural Scientific Museum system in VN. It is a leading national office, which conserves geological-mineral specimens. After the establishment of Geological Survey of Indochina in 1898, the two French geologists Lantenois and Mansuy received the task of building up the Geological Museum. In 1997, the Geological Museum was unified with the Institute for Geological Information and Documentation to form the Institute of Geological Information, Archives, and Museum, but in 2003 the Geological Museum was again separated from the Institute of Geological Information, Archives, and Museum.

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Visitor Studies

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Abstract

The field of visitor studies seeks to document and understand the experiences and outcomes of visitors to museums and other informal educational settings. Both research and evaluation studies help to inform what we know about visitors to these settings and the impacts of their visits. This entry explores the theoretical foundations, goals and objectives of the field, commonly used research methodologies, and what we have learned about visitors in museum-like settings.

INTRODUCTION

The field of visitor studies is grounded in the context of museums and other informal learning environments, such as science and nature centers, zoos, aquariums, gardens, national parks, IMAX movie theaters, planetariums, or libraries. The main objective of visitor studies is to understand how people benefit from and utilize these settings, and to help inform institutions in the development of exhibitions, programming, and other public education activities. In contrast to marketing research, visitor studies focuses on institutions and experiences that have a learning agenda or educational mission. This “learning” is defined broadly within visitor studies to encompass all levels of cognition, affect, skill development, and personal growth. Researchers in the field focus on the experience and impacts on the “whole person,” not just the learning of facts.

While educational theorists and other scholars began to study the visitor experience in museums in the early part of the twentieth century,^[1–4] visitor studies did not fully emerge as a recognized discipline until the 1980s, roughly coinciding with the founding of the U.S.-based Visitor Studies Association (VSA) and its initial publications. This period also saw a substantial increase in the number of research studies related to visitor learning in museums and other informal contexts.^[5] These efforts to understand the impacts of museum programs and exhibits on visitors were driven largely by mandates from federal funding agencies to show accountability for grants received, but also out of recognizing the value of incorporating the “visitor’s voice” into museum exhibition and programmatic planning.

While requirements from funders still drive many studies, the field has continued to expand in the past several decades and many institutions now utilize visitor studies to help establish mission and goals, align programs and exhibits with mission, develop and refine visitor

experiences, and better meet the needs and interests of a diverse range of audiences. The field of visitor studies has addressed such issues as motivation for visitation, socially mediated learning, family learning, personal meaning-making, cultural relevance, the role of identity and memory in museum learning, and long-term impacts of museum experiences. In this entry, we will address the definition of visitor studies, the key theoretical foundations that underlie the field, goals and objectives of the field, commonly used research designs and methods, what we have learned about visitors in museum-like settings, and current trends in visitor studies research.

WHAT IS VISITOR STUDIES?

Visitor studies takes place within multiple disciplines, including museum studies, leisure and tourism studies, interpretation, informal science education, and environmental and conservation education, though it is considered by many an academic and professional discipline in its own right. In contrast to marketing, visitor studies provides the voice of the visitor, while marketing research aims to provide the visitor with what the visitor wants or expects. Visitor studies, however, allows for audience input into a system that is also driven by other criteria, such as curatorial and educator input, or alignment with the institution’s mission and goals. It is also important to note that visitor studies extends beyond actual visitors to a museum or museum-like setting, and can include the perspectives of potential visitors, non-visitors, or even a community as a whole.

The field of visitor studies is often divided into two key activities: 1) research and 2) evaluation, or applied research. While both research and evaluation use similar approaches and methods, they differ in their questions, goals, and applications. Basic research in visitor studies, as in any discipline, seeks to expand the knowledge of the

field and provide generalizable data—that is, knowledge that is not bound by one specific context or situation. This research can be hypothesis-driven (deductive) or emergent (inductive). Evaluation, on the other hand, seeks to answer specific questions about a particular population's experience of a specific exhibit, program, or other informal learning activity. The results of evaluation are not intended to be generalizable beyond the specific circumstances in which the study was carried out.

Evaluation is divided into three main stages: 1) Front-end evaluation, which is conducted in the early stages of planning and development, is designed to assess the needs, interests, and perceptions of potential visitors and non-visitors as a means to inform the planning process, test assumptions, and reveal visitors' awareness, knowledge, and understanding about a specific topic or idea; 2) Formative evaluation, which takes place during the development of an exhibition or program, when changes are still possible, aims to change or improve the exhibit or program based on visitors' responses, reactions, and behaviors (when a program or exhibit is completed and tested in full and in situ, the evaluation is referred to as "remedial" evaluation); and 3) Summative evaluation, which is carried out after an exhibit or program is considered complete, is designed to assess the effectiveness of the exhibit or program in reaching its intended goals and outcomes for visitors.

It is important to note that while visitor studies and evaluation are often thought of as synonymous, museum evaluation in itself does not necessarily include the visitor voice—it is only within the context of visitor studies that evaluation becomes visitor-centered. Evaluation is also a much larger field of study, reaching beyond museums, to focus on diverse educational and social enterprises. The American Evaluation Association (AEA) defines evaluation as "assessing the strengths and weaknesses of programs, policies, personnel, products, and organizations to improve their effectiveness."^[6] Indeed this is the role evaluation plays within visitor studies, but visitor studies is commonly thought of as being somewhat different from evaluation.

Multiple terms have been used to define the type of learning studied by visitor studies. One is "informal" learning, meaning learning that takes place outside a formal, structured environment such as school. Another commonly used term is "free-choice learning," which emphasizes the idea that individuals are generally choosing to spend time at places like museums, zoos, science centers, and gardens—or, even if they are taken there by someone else, such as a parent or grandparent, they make choices about where they go and what they do. In a free-choice learning environment, no curriculum guides the learning and visitors attend to what is interesting to them. Other terms commonly used in visitor studies are "non-formal learning" which is often used in environmental education to distinguish visitors who take part in defined

programming from those who self-explore, who are called informal learners; and "lifelong learning," which is used to emphasize this type of learning as taking place in informal settings across one's lifespan.

It should be noted that "informal" learning is referred to in other disciplines, such as sociology, as learning that takes place when sender and receiver of information have no learning or teaching agenda—for example, when people exchange information in conversations or through observing others in their daily life. Visitor studies looks at this particular aspect of learning only as it occurs within the walls of the institutions we study.

Another key component of this type of learning is that it is not measured or assessed through testing, as in formal education, and allows for multiple experiences and outcomes. Informal or free-choice learning is not entirely predetermined by the institution staff, but rather influenced by the environment that is created. This type of learning also differs from formal education as it occurs throughout one's lifetime in a variety of contexts. While visitor studies is focused on "learning" in informal contexts, the field defines learning in broad terms to include outcomes related to personal and social growth, building awareness, shifting attitudes, and affective or emotional responses—not just the cognition of "facts." The field recognizes that experiences in museum-like settings provide individuals with more than just the opportunity to learn new facts, but to make connections to themselves and to others, reinforce or challenge knowledge and ideas they already had, or to inspire curiosity or interest in new topics.

THEORETICAL FOUNDATIONS OF VISITOR STUDIES

Visitor studies has naturally drawn a great deal of its theoretical foundation from education and learning theory, as well as cognitive psychology and human development. We will briefly describe some of the key theoretical foundations here. The basis of all theories of knowledge and learning is the field of *epistemology*, which asks "What is knowledge?"^[7] Epistemological theories generally lie on a spectrum between two extremes: realism, which purports that there are objective truths in the world that can be known or learned by individuals; and idealism, which states that knowledge exists only in the minds of individuals and that there is no objective truth. Most theories of learning reside somewhere in between these two extremes.

One framework that has informed visitor studies is *behaviorism*. Descriptions of behaviorism focus on attempts to understand people's actions through observable behaviors in response to stimuli without regard to internal processes or mental states. In some visitor studies circles, this has led to the linking of behaviorism with the "transmission-absorption model" of communication,

whereby it is assumed that a fact or concept, if communicated well, will be understood by a target audience. Within visitor studies, behaviorism has influenced the development of methods designed to use observable behaviors as indicators for learning and other processes. A more commonly used framework in visitor studies is *constructivism*, which posits that learning occurs through the active participation of the learner, who “constructs” or makes meaning as they explore and discover.^[8] In other words, learning is highly personal, internally constructed, and based more in the process than in outcomes. Another key foundational theory used in visitor studies is *socioculturalism*, which asserts that an individual’s social world plays a significant role in how that individual interprets what they see, experience, and learn.^[9] In this perspective, it is crucial to examine the social and cultural context in which learning takes place in order to fully understand the processes and impacts of such learning.

More recently, researchers have explored learning theories such as social learning, in which learning is viewed as a social process where individuals build or “scaffold” on each other—rather than an individual pursuit. Often this social learning is explored through the analysis of conversations that groups have during museum visits.^[10] Within this realm, some researchers have focused specifically on family learning,^[11] or how intergenerational groups connect, interact, and learn from and about one another in informal learning contexts. Some researchers have focused specifically on youth learning, sometimes drawing upon *positive youth development* frameworks to understand the broader impacts of programs on the development of youth in relation to areas such as self image, confidence, social skills, compassion, empowerment, and civic engagement.^[12]

Researchers in visitor studies have also explored how identity and motivation might relate to learning, or to what degree and in what ways an individual’s “entry narrative” (or prior knowledge, perspectives, interests, and motivations for visiting) impact what and how they learn, and the degree to which identity plays into the experience of learning itself.^[13–16] Other theoretical pursuits include the role of memory as a precursor to impacts; that is, the role of the museum in the construction of the self and “possible selves” (who one can become, both personally and professionally) over the course of one’s lifetime.^[17] Another lens recently used by researchers in visitor studies is that of long-term impacts, or how experiences in informal learning contexts may affect an individual over time. The idea behind this perspective is that the impacts of a museum visit do not all occur during or immediately after the experience, but may develop and shift for days, weeks, months, or years beyond it.

At the applied level, visitor studies often uses program theory to structure experiences that align goals and objectives with activities, in order to achieve specific outcomes. A process of *logic or program modeling* is used to help

institutions plan or reflect upon the ways in which their mission is reflected in their outputs (or activities and products) and, ultimately, in visitor outcomes. Drawn from the field of program evaluation, this technique helps the researcher and the program staff to verify that the program accomplished what it sets out to do. Program modeling helps institutions understand to what degree activities and actions provided are linked to visitor outcomes.

GOALS AND OBJECTIVES OF VISITOR STUDIES

The overarching goal of visitor studies is to bring the “visitor voice” to the table when it would not otherwise be present. That is, as museums and other informal learning institutions engage in planning, development, and alignment of their mission with outputs and activities, visitor studies allows these institutions to incorporate the perspective of current and potential visitors, as well as non-visitors, into these processes. It is important to recognize that the work of visitor studies is not prescriptive; it does not tell institutions what to do or how to do it, but serves as a tool by which to inform them of how visitors and non-visitors think and feel about a given experience (e.g., exhibit or program), concept, topic, or even the museum as a whole, as well as to measure the effectiveness of an exhibit or program, and underlying mechanisms that support or hinder visitor engagement.

Visitor studies can be viewed as supporting four main, though not necessarily distinct, objectives: 1) providing valuable information on the effectiveness or impacts of a specific exhibition or program; 2) supporting visitor learning more broadly, including a wide range of audiences based on type of group (e.g., families or intergenerational, school groups, the elderly), cultural background, personal interests, prior knowledge, or identity; 3) informing strategic and interpretive planning for informal learning organizations; and 4) increasing our knowledge of how, where, what, and why people choose to learn in their spare time across their lifespan.

One of the most basic objectives of visitor studies is to provide feedback, from the visitors’ perspective, on specific museum experiences, most often an exhibition, exhibit component, interpretive strategy, or program. In this way, visitor studies supports informal learning institutions in creating accessible, relevant, and valuable experiences that align with institutional goals and mission. Essentially, visitor studies can be used in very specific, targeted ways to assess the nature or impacts of a particular experience.

Another primary goal of visitor studies is to more broadly support the needs and interests of a wide range of visitors. Museums were historically designed and developed as collecting institutions and were not concerned with the value of those collections vis-à-vis the general public. Even as museums became more aware of

themselves as important learning institutions in the first half of the twentieth century, exhibits and programs were largely created from the curatorial perspective with little understanding of visitors' wants, needs, or prior knowledge related to a given topic. In more recent years, visitor studies has been recognized as an essential practice in understanding and supporting the broad range of needs, interests, and learning styles of museum visitors and visiting groups.

Through the accumulation of knowledge about the visitor experience in museums, professionals engaged in visitor studies have increasingly served the role of informing institution-wide strategic and/or interpretive planning efforts. Often focusing on more than one specific exhibition or program, the objective of these efforts is to help institutions think more broadly about the audiences they serve, approaches to engaging new audiences, and how to integrate visitor perspectives throughout all levels of the institution. In this capacity, visitor studies provides empirically based knowledge (through research, evaluation, and/or literature reviews) that supports informal learning institutions in making crucial decisions about exhibition design, interpretive approaches, and public outreach and education strategies.

Finally, one of the underlying objectives of visitor studies is to increase our general knowledge of how people learn, what motivates them to learn, the types of factors that influence learning (such as an individual's "entry narrative"—which includes prior knowledge, experience, attitudes, and reasons for visiting), and the role of the sociocultural context in which learning takes place. This knowledge adds to our understanding of the significant role that museums and museum-like settings can play in people's lives across their lifespan.

VISITOR STUDIES AS A PROFESSION

Visitor studies as a profession in its own right emerged in the 1970s and 1980s. One of the early visitor studies-focused publications, *Visitor Behavior*, was first published in 1986. The journal exemplified the need for those already engaged in visitor studies to create a space for communicating findings and supporting professional practice.^[18] Two years later, in 1988, VSA was founded and held its first conference.^[19] At this first conference, a major goal was to identify indicators that visitor studies had emerged as a distinct field, including a critical mass of professionals involved in visitor studies, institutional commitment to the field, and a literature base.^[20] VSA became the publishing organization for *Visitor Behavior*, the full archives of which can be accessed through the VSA Web site (<http://www.visitorstudies.org>). Concurrently, the field of evaluation also coalesced into a recognized discipline, as exemplified by the first annual conference of the AEA in 1986.^[21]

Since the 1980s the field of visitor studies has become increasingly professionalized and academically minded. Developments include the creation of the Committee on Audience Research and Evaluation (CARE) within the American Association of Museums (AAM) and the committee's authoring of professional standards of "competent and responsible support and practice of visitor studies."^[22] A continuing concern facing the field is supporting and ensuring professional practice by identifying key competencies and hosting professional development workshops. In another parallel with the broader evaluation field, visitor studies professionals and organizations have pushed for a formalized system of credentialing professionals. Unlike evaluation or museum studies, which are degree granting fields taught at universities, visitor studies as such has no degree program at this time. However, there are advanced degree programs in informal learning, such as through the Center for Informal Learning and Schools, a partnership of the Exploratorium, King's College London, and UC Santa Cruz (<http://cils.exploratorium.edu>), University of Pittsburgh's Center for Learning in Out of School Environments (<http://upclose.lrdoc.pitt.edu/>), and the program in Free-Choice Learning at Oregon State University (<http://seagrant.oregonstate.edu/freechoice/index.html>).

Major associations and conferences that present visitor studies and support the profession include VSA, AAM, the Association of Science-Technology Centers (ASTC), the Association of Zoos and Aquariums (AZA), American Educational Research Association (AERA). Journals that publish visitor studies include *Visitor Studies* (published by VSA), *Curator*, *Science Education*, *The Journal of Museum Education*, *Informal Learning Review*, *Environmental Education Research*, and *Museums & Social Issues*.

RESEARCH DESIGN AND METHODOLOGY

As is typical in social science-based research and evaluation, visitor studies may use quantitative or qualitative research designs or use a mixed-method approach. A review of the literature is recommended before the study is begun to ground the study in what is already known about the subject. Given the interdisciplinary nature of visitor studies, researchers tend to review literature from a wide range of disciplines for any one study they undertake. Theories from the social sciences may inform the lens the researcher uses to frame their investigation (e.g., behaviorism, constructivism, socioculturalism), to provide focus to the subject of the investigation or to interpret the data.

While research designs can be broadly categorized as quantitative, qualitative, or mixed, it is important to note that specific methods used to gather data (such as surveys, interviews, and observations) are not for the most part tied

to being quantitative or qualitative, and can be analyzed through either lens, depending on the nature of the research or evaluation questions.

Quantitative Research Designs

Quantitative research designs are commonly used in visitor studies. These studies may use experimental, quasiexperimental, or nonexperimental designs. Experimental designs usually compare two different treatments based on random assignment to the treatments. This design is more likely to be used in a laboratory-type setting, rather than on the museum floor, because it allows for greater control of the experience by the researcher. An example of an experimental design could be asking two or more groups to complete the same task but some element of the experience is varied, like the signage, for each group. Quasiexperimental designs also use two or more treatments, but the treatments are not based upon individual random assignment. Instead, a matched-sampling technique may be used, as is common in studies of school groups where two similar classrooms or schools are matched together, each receiving a different treatment. Nonexperimental quantitative designs use no comparison groups or multiple treatment types. This design is commonly used in surveying visitors as they complete an exhibition or program. The sampling technique used may or may not be random, depending on the nature of the research question(s) being asked.

Quantitative research designs use methods that allow for statistical analysis and the reporting of numerical data. Surveys, interviews, observing visitor behavior, and visitor tracking are used to gather quantitative data about visitor's knowledge, attitudes, and behaviors. SPSS and SAS are social science software packages designed for the analysis of quantitative data, although Microsoft Office applications may also be used.

Qualitative Research Designs

Qualitative research designs are commonly used in visitor studies. Qualitative research designs are used to uncover the meanings behind events, gather perspectives from participants, and find out how or why something occurred. Qualitative designs are intended to contextualize events, people, and behaviors. All qualitative study designs have in common the use of techniques which generate word-based descriptions that attempt to capture "thick descriptions" of people, events, or phenomena.^[23] While multiple types of qualitative methodologies have been identified,^[24] case studies and ethnography are used most frequently.

Qualitative methods include interviews, observations, focus groups, and other methods to generate textual data that is not analyzed numerically. These data may be analyzed using techniques of pattern, theme, and content

analysis.^[25] Specifically designed software such as Atlas.ti, HyperRESEARCH, NUD*IST and NVivo are becoming more common tools for qualitative data analysis as the capabilities of the software improve.

Mixed Method Research Designs

Mixed method studies use both qualitative and quantitative methods within a single study. Methods may be combined to use the strengths of both quantitative and qualitative approaches or for triangulation of data. For example, both tracking and interviews may be combined in an attempt to understand how visitors utilize an exhibition, with one set of data confirming, supporting, or enriching the other. Mixed method studies are often nested or iterative, meaning the project is multistage and one study builds upon another. A good example of this would be using an open-ended interview to explore an idea with a limited number of visitors and then a close-ended survey to gather more generalizable data, or using a survey with visitors as they leave an exhibition and following up months later with an open-ended telephone interview.^[26]

WHAT WE KNOW ABOUT VISITORS

Who Visits and Why Do They Visit

Other than the number of tickets sold on an annual basis, museums often have very little detailed information about their visitors. In the United States, organizations such as AAM, AZA, and ASTC annually survey their member institutions. This information adds to our knowledge about who visits these institutions, as well as field-wide differences. For example, zoos commonly have higher attendance than other types of museums and attract a larger number of families.

Over the last 30 years, statistics have shown that museum visitors are well-educated, have relatively high incomes compared to the rest of the population, and are usually White/Caucasian. According to the National Science Board, roughly 60% of the population averages three visits a year to museums.^[27] These trends in attendance are relatively stable over time and across multiple countries. A study comparing Southern Californian museum visitation in 1984 and 2005 found that despite the increasing percentage of Latinos in the general population, museum visitors were no more likely to be Latino; instead Caucasians made up the majority of museum visitors in both 1984 and 2005.^[28] However, a critical factor that is more relevant in predicting who will visit is childhood visitation. Regardless of education or income, visiting museums as a child with one's family has a positive correlation with visitation as an adult. Note that school visitation as a child does not have the same impact on adult museum-going habits as visiting with one's family.

Marilyn Hood undertook some of the field's original studies into who visits museums, who does not, and why. Non-visitors do not visit because the message or value of the museum has not been communicated to them.^[29] In a study of visitors, occasional visitors, and non-visitors in the Toledo, Ohio, area, Hood found that non-visitors valued leisure experiences that allowed for social interaction, active participation, and feeling comfortable in their surroundings, and did not visit museums because they felt museums did not encompass these attributes.^[30] Recent studies have shown that non-visitors perceive specific museums as not being culturally relevant and also hold negative preconceptions about museums in general.^[31]

Visitors come to museums and museum-like institutions for a range of reasons. While museum professionals often think of their institutions primarily in terms of the educational mission, visitors think of much more than education. Museums are seen as a place for entertainment, spending quality time with family and friends, a “must-see” destination, or even a place to go to get out of the rain or the summer heat. The field of social psychology has much to share with researchers investigating visitor motivations. Underlying these reasons for visiting a museum are issues of self-determination, self-fulfillment, and intrinsic motivation.^[32,33] People visit museums because they find something appealing or rewarding in the visit. Visiting is an intentional behavior that allows for the fulfillment of desires or perceived needs, all within an enjoyable setting.

What Are the Outcomes of the Visit

Just as a range of reasons for visiting have been identified, a range of outcomes have also been identified by the field of visitor studies. These outcomes are grouped under the heading of “learning” and include knowledge, affective responses, and behaviors. Visitor studies traditionally emphasized the knowledge-based or cognitive outcomes from a visit. Museum practitioners wanted to know how much of the main message or big idea of the exhibition or program visitors could express at the end of their visit. Visitor studies supplied the data that allowed designers to see how many visitors “got” the exhibition.

As the field grew, researchers pushed the boundaries of what counted as “learning” in or from an experience. Books like *Family Learning in Museums* and *Learning Conversations in Museums* and the Contextual Model of Learning posited by Falk and Dierking embraced the idea that visits do more than impart factual knowledge to visitors.^[34–36] Recent discussions in publications like *Informal Learning Review*, *Science Education*, and *Environmental Education Research* broadened the perspective of possible and desirable outcomes further.^[37–39]

Learning during and after a visit is embedded in the social and physical contexts of the visitor. With this broadened view of what learning is and how it occurs,

researchers began to look more broadly at learning outcomes from a visit. Current studies are just as likely to investigate emotional or affective responses as cognitive gains. Affective responses include attitudes and perceptions towards an exhibition itself or the content. How did a visitor feel about modern art before, and after, an exhibit?

Visitor studies research also investigates visitor behaviors during and after the visit. Behavior change is an important facet of many conservation-focused institutions such as zoos or aquariums. These organizations have a strong interest in teaching their visitors about the wildlife in their collections, and how human activity impacts the ecosystems of these organisms in the wild. These institutions, however, commonly attempt to leverage this knowledge of nature and ecosystems to have their visitors make a change in their behavior: recycle, use less water and energy, donate to WWF, or write their congressperson. The field of visitor studies is just beginning to tap into the wealth of knowledge on behavior change from other fields. Drawing from fields such as health, psychology, and environmental education, the interdisciplinary nature of visitor studies allows researchers to seek out theories that have been formulated in other fields and apply them to visitor studies.

One can state that most experiences that are researched by visitor studies are of relatively short duration, and hence the relative intensity of individual impacts is sometimes rather small: latent knowledge is brought to the fore, awareness is raised, emotional connections are made, enjoyment and fulfillment is reached, a sense of belonging is rekindled, or quality family time is spent. In contrast to school assessment, visitor studies often deals with small changes on the individual level that, aggregated over many visitors, amount to considerable benefits to society. Few experiences that visitor studies concerns itself with are transformative for individuals alone, and those tend to come from programming that is longer-lasting and more involved, like volunteering as an interpreter in a museum or taking part in a citizen-science project. A new field in visitor studies is focusing on the value of entire institutions to their community and on the relative contribution of individual experiences within a stream of lifelong engagement in leisure-time learning. It is within these contexts that the field of visitor studies is able to document the benefits of lifelong, informal, or free-choice learning.

CURRENT RESEARCH TRENDS IN VISITOR STUDIES

As more is learned about visitors and why they come, we realize how much there is that we do not know. The boundaries of the field have been sketched and now there is a real push to add to the depth of knowledge. Researchers have been pushing for more longitudinal

studies, more investigations into the role of social groups in learning, and personal factors such as motivations and identity. This is not to say that researchers have overlooked these issues, only that the field as a whole needs to know more about the role of these factors in visitation and the impacts of visitation.

Longitudinal studies allow researchers to learn more about aspects having to do with on-going behaviors or outcomes of a visit. For example, a study conducted six months after a visit to an aquarium allows researchers to ask questions about whether behavior change *actually happened*, whereas at the time of the visit only a visitor's *intention* to change can be documented.^[40] A recent review of long-term visitor studies pointed out, however, that there are few such studies and most look at a relatively short length of time (i.e., a year or less).^[41] The field needs to undertake more longitudinal studies and studies of greater temporal length. These types of studies will allow the field to say with more certainty what the impacts of visitation really are and how museum visits fit into the fabric of a person's life.

Likewise, more research is needed on how the outcomes of a visit are mediated by the social group with which one visits. Both what and how people learn is impacted by the social setting in which the learning takes place. People within groups talk about their own experiences in relation to what they are seeing, they draw upon the skills and memories of others, and the act of visiting creates another shared experience among the group. In light of the fact that most museum visitors come to the museum as part of a social group, visitor studies research has only just begun to touch upon the social aspects of visiting, learning, and visit outcomes.

Greater investigation into personal aspects such as motivations and identity are also needed in the field of visitor studies. Recent studies and discussion in the field have described motivations for visiting in terms of the enacted or situated identity of the visitor. In one recent study, researchers grouped zoo and aquarium visitors into five identity-related motivations (explorer, facilitator, experience seeker, professional/hobbyist, and spiritual pilgrim) and found that slightly more than half (55%) of those interviewed had a single strong motivating factor for their visit.^[42] These conversations hearken back to the reason why people choose to visit in the first place. What do we really know about how a museum visit supports a person's view of themselves? By continuing to draw from the theories and results of diverse disciplines, researchers will add to our knowledge of what drives visits to museums.

The field of visitor studies also is under increasing pressures from forces outside the field. Funding agencies such as the National Science Foundation and the National Institutes of Health play a role in shaping the practices of the field, both the questions that are asked and the way the research is conducted. Recent trends include the push for

rigorous studies as defined by the U.S. Department of Education Report of the Academic Competitiveness Council from May 2007 (mostly experimental or quasiexperimental research designs), and the enforcement of federal regulations guiding the protection of human subjects in research in educational settings that had previously not focused on these issues (NSF-ISE, NIH-SEPA).^[43] Professional associations like VSA and AEA are working to actively shape policy and let funding agencies know how these changes effect how visitor studies are conducted.

CONCLUSION

Visitor studies have impacted the way museum practitioners view their visitors and, therefore, the types of experiences that are created. Whether through evaluation or basic research, visitor studies pushes the museum field to learn more about why visitors come to these institutions and what happens during and after the visit. Visitor studies are increasingly being used to frame the importance of learning throughout the lifespan.

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Visual and Performing Arts Archives

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Abstract

This entry offers a brief introduction to visual and performing arts archives. It discusses some of the main issues concerning the creation, archiving, and management of visual arts and performing arts materials, it lists examples of materials and of repositories in which they are held, and it points to professional associations and resources in these fields.

INTRODUCTION

Visual arts may be defined as “the arts created primarily for visual perception, as drawing, graphics, painting, sculpture, and the decorative arts” (s.v. “visual arts”).^[1] The performing arts may be defined as “arts or skills that require public performance, as acting, singing and dancing” (s.v. “performing arts”).^[1] These simple definitions are appropriate for the purpose of this entry, although they might be greatly broadened and made more articulate, according to the very complex discussions and competing points of view that exist in the visual and performing arts worlds. A full list of visual arts is almost impossible to compile. Other examples that may be added to the ones above include architecture, photography, design, illustration, installation, video art, digital art, cartooning, and comic art. The notion of performing arts expands to include live events such as theatre, dance, music, opera, musical theatre, pantomime, puppetry, circus, and fairs, and events that imply recording, such as film and broadcast. Live and recorded elements of course may merge in the same event, as it happens, for example, in multimedia theatre and digital performance. Canadian performance scholar Catherine Graham writes that nowadays the boundaries “between theatre and other art forms, between recorded and live...forms of dramatic performance are increasingly blurred, both in practice and in theory” (p. 3).^[2] Performance art is considered one of the visual arts (s.v. “visual arts”),^[3] but has also a key place in the larger world of performance.^[4] Film may be considered part of both the visual and the performing arts. The various activities carried out in the visual and the performing arts produce materials with different functions and in different formats. Many of these materials end up in archives. Archives preserve memory and the records “created and received in the course of individual or institutional activity and set aside (preserved) as evidence of that activity” (s.v. “record”),^[5] as well as “for action or reference” (s.v. “record”).^[6] The word “archives” may designate: the

whole of the holdings, and be therefore used as a plural with a singular article (“an archives”); the institution that manages the holdings (e.g., The U.S. National Archives and Records Administration); the physical space in which the holdings are kept (see Pearce-Moses,^[5] s.v. “archives”). The goal of this entry is to offer a brief introduction to issues concerning the archiving and management of visual arts and performing arts materials, to list examples of materials and of repositories in which they are held, and to point to professional associations and resources in these fields. The entry opens with a brief discussion of how visual and performing arts materials come into being, and it presents examples of materials and of repositories in which they may be held (“Visual and Performing Arts Materials: Creation, Types and Repositories”); it then briefly discusses some key issues in relation to the archiving and management of visual and performing arts materials (“Archiving and Managing Visual and Performing Arts Materials: Selected Issues”). Finally, it summarizes the main issues (“Conclusion”), and points to selected references cited in the text or recommended for further reading.

VISUAL AND PERFORMING ARTS MATERIALS: CREATION, TYPES, AND REPOSITORIES

In archival theory and practice it is key to understand the context of the materials (s.v. “context”).^[5] For example: who created them, how, and why; what their original use was; how they were organized; what relationships exist among the materials originating from the same individual or institution; what happened to the materials over time; and more. Many people and institutions are involved in the creation; for example, artists, directors, theatre companies, film studios, galleries, managers and impresarios, costume and set designers, lighting designers, technical staff, marketing staff, the audience, and more. Visual and performing arts materials are born from both individual

and collaborative efforts; collaboration is an essential aspect of the performing arts, and is also a strong element in the visual arts. Materials may relate directly to a specific outcome or event (such as a visual art creation or a theatre performance); to a specific creator (such as a painter or an actor, or a company/studio/gallery); or to several events and creators at once. Materials may therefore relate to specific individuals, institutions, outcomes or events, or to a combination of all these. Materials may remain with their original creator or they may be transferred elsewhere; they may have a very complex life, existing in different places and with different purposes at different points in time. Some examples:

- American theatre artist Robert Wilson maintains his own archive, The Robert Wilson Archive at the Byrd Hoffman Water Mill Foundation; he has also donated videos of his performances to the Theatre on Film and Tape Archive of the New York Public Library for the Performing Arts and part of his papers to the Columbia University Rare Book and Manuscripts Library.^[7]
- A substantial part of the personal papers of Austrian-born actor and director Eric von Stroheim first stayed with him and then with his family for decades, until the family donated them to The Margaret Herrick Library of The Academy of Motion Picture Arts and Sciences in Los Angeles in 2002.^[8]
- American artist Romare Bearden donated his papers to the Smithsonian Institution Archives of American Art between 1977 and 1983.^[9]

Visual and performing arts materials originate from a complex process. Australian performing arts librarian Richard Stone writes that:

Common to all the performing arts is a progression from creative impulses and inspiration, to preparation and execution, to the ultimate performance/s before an audience. At any point of this process objects, documents and publications are generated. All of them are potential for heritage consideration, for being collected and preserved. (p. 31)^[10]

With a slight modification, the above paragraph may also be applied to the visual arts. The process of creation is of course not necessarily linear and sequential in time, and the stages described above should be seen as possibly recurring and overlapping. Many materials originate from the creative and technical processes that ultimately lead to visual art creations and to performances. The process is as important as the final product, therefore all materials are potentially relevant for preservation in archives, and archivists need to thoroughly understand the process in order to acquire and manage the materials.^[11] The final outcome is not always fixed in form: for example, a live performance such as a concert, a ballet, or a spoken-word show is never exactly the same in its different instantiations; a digital

performance may change depending on technical considerations; and an installation may adapt to different environments. The final outcome may or may not be in the archives. For example, a painting might be in a private home, a gallery, or a museum, although some paintings end up in archives. Live performances cannot be in an archives, because they do not survive in their entirety after being performed, although recordings of them often exist in archives. Digital performances may sometimes be preserved, although with difficulty; in these cases, they may be held in archives. Film and broadcasts are usually held in archives. In terms of types and formats of materials, archivists need a broad understanding of: the materials generated in the course of the creation process (e.g., sketches of a painting or of the costumes for a show); the final outcomes of the process (e.g., a painting, or costumes for a show); and the entire variety of materials related to the final outcomes (e.g., the correspondence of a painter, a contract with a costume designer, posters advertising a show). Different types of repositories may hold different materials.

To try and visualize how materials are created and where they are kept, we can make a couple of hypothetical examples. An artist may create a painting in his studio having his wife as a model; the artist may be part of a movement or a creative group; the painting may be commissioned by a gallery, shown in an exhibition and then sold to an art collector; when the collector dies, his family may decide to donate the painting to a museum. Besides the work of art in itself, many other materials are created through time in the course of this process. Some examples may be: sketches of the painting; diaries by the painter or his wife discussing the experience; photographs of the wife posing as a model for the painting; correspondence with other artists who are part of the same movement or group; legal correspondence with the gallery that commissioned the work; documentation of the exhibition, in form of photographs, newspaper accounts and critic reviews, advertising materials such as posters and promotional postcards, and more; contracts and papers detailing the sale of the work to a collector; papers regarding the donation of the work from the collector's family to a museum, and more. These are only a few examples of materials related to the creation and life of a specific work of art, which may end up in archives. The sketches, diaries, photographs and correspondence would be part of the artist and artist's wife archives; copies of the legal correspondence with the gallery and documentation of the exhibition might exist in both the gallery's and the artist's archives; copies of papers concerning the sale of the work to a collector would exist in both the collector's and the gallery's archives; copies of papers regarding the donation to a museum would exist in both the collector's family archives and the museum archives; and so on. Of course, the artist's/gallery's/collector's papers could eventually be acquired by the museum that ultimately got the work, or

by another archives, institution, or foundation. Archives in the strict sense of the term, made only of materials preserved because of their enduring value (s.v. “archives”),^[5] will not exist in every case; individuals and institutions sometimes keep too much or too little. A theatrical production may produce a great deal of materials. For example: A playwright writes a play; the play is based on personal experience and on research, of which a documentation is kept; several drafts of the play are composed before getting to the final version; the play has been commissioned by a theatre. The theatre produces the play for its new season; the theatre is of course a very complex organization, with a structure encompassing administrative, legal, financial, artistic, technical, educational, marketing, and publicity requirements and activities. Among those specifically employed in the production there are actors and dancers, the director, the dramaturg (who is not the author of the play, but the one who analyzes and explains a play in view of its staging), the playwright, the costume designer, the set designer, the lighting designer, the composer, the production manager, and more. In different degrees, all of these people base their work on research and preparatory work, which produces documentation; they then create materials in the course of the production (annotated scripts and promptbooks, notes, videos of rehearsal, sketches, charts, scores, props, costumes, and more). The production is of course supported by all of the theatre’s administrative, management, and technical staff, with all the materials that this entails. Among the many activities, it is advertised (with posters, news releases, photographs, and more) and explained to the audience (e.g., in the programs, in summaries and analyses posted on the theatre’s Web site, and more). Once the production opens, it is video-recorded and photographed (in the course of a regular performance in front of the audience, or during a performance staged just for this purpose); it is reviewed by critics; it is discussed by the audience; it tours in different cities and countries, maybe with changes in cast, or in other aspects, such as the costumes; and more. Performances in a production are not identical and differ from one another, according to several factors (performers, audience’s reactions, and more). Once a production is over, some of the materials created in relation to it are re-used, while others are discarded. For example, set designs may be used in another show, as they are or with some alterations; or they may simply be discarded. The same thing may happen with costumes. In some productions costumes and sets are especially created, while in others they are simply rented. Advertising materials such as posters and programs may easily disappear. As in the first example discussed above, the materials are many and complex, and may belong to different archives at different stages. The playwright’s drafts, notes, research materials, and copies of the correspondence with the theatre will initially stay with her, and may later be donated to an archives. The materials related to the production and chosen for long-term preservation

will stay in the theatre’s archives, if the theatre has one, or will go to another archives (e.g., a city archives) once they have served their initial purpose. Costume and set designers’ sketches will stay with the theatre if theirs was a work for hire, or will stay with the designers. Some of the actors’ and director’s notes and papers will likely stay with them initially, and so on.

Visual and performing arts materials, of both local and international relevance, will therefore be part of a variety of archives, including personal archives, in-house archives (such as the archives of theatres and galleries), archives of art and research institutions, archives of foundations, university archives, municipal archives, national archives, and more. Visual and performing arts materials will also be present in a variety of special collections in libraries. The next section presents some examples of repositories.

Examples of Repositories

Among national repositories, examples are

- The U.S. National Archives and Records Administration (NARA) (<http://www.archives.gov/>; accessed August 12, 2008) has several relevant holdings, including: Motion Picture Films and Sound and Video Recordings (<http://www.archives.gov/research/formats/film-sound-video.html>; accessed August 12, 2008); Cartographic and Architectural Records (<http://www.archives.gov/research/formats/cartographic.html>; accessed August 12, 2008); Photographs and Graphic Works (<http://www.archives.gov/research/formats/photographs-dc.html>; accessed August 12, 2008).
- Library and Archives Canada (LAC)/Bibliothèque et Archives Canada (BAC) (<http://www.lac-bac.ca/>; accessed August 12, 2008) has many relevant holdings, including: moving image; architectural records; photographs; sound recordings; music documentation; works of art; and personal papers.^[12]
- The Library of Congress (<http://www.loc.gov/index.html>; accessed August 12, 2008) has several relevant departments, including: The American Folklife Center (<http://www.loc.gov/folklife/>; accessed August 12, 2008); the Motion Picture, Broadcasting and Recorded Sound Division (<http://www.loc.gov/rr/mopic/>; accessed August 12, 2008); the Music Division (<http://www.loc.gov/rr/perform/>; accessed August 12, 2008); and the Prints and Photographs Division (<http://www.loc.gov/rr/print/>; accessed August 12, 2008).
- The Smithsonian Institution in Washington, District of Columbia, encompasses several research units, including: the Archives of American Art (<http://www.aaa.si.edu/>; accessed August 12, 2008); the Smithsonian Institution Archives (<http://www.siarchives.si.edu/>; accessed August 12, 2008); the Smithsonian Institution Libraries (<http://www.sil.si.edu/>; accessed August 12, 2008); and the Ralph Rinzler Folklife Archives and Collections,

part of the Smithsonian Center for Folklife and Cultural Heritage (<http://www.folklife.si.edu/center/archives.html>; accessed August 12, 2008). The Smithsonian also houses extremely large photography collections (<http://photography.si.edu/>; accessed August 12, 2008).

- The British Library's (<http://www.bl.uk/>; accessed August 12, 2008) relevant departments include the Music Collections (<http://www.bl.uk/reshelp/bldept/music/index.html>; accessed March 26, 2009), and the British Library Sound Archive (<http://www.bl.uk/nsa>; accessed March 26, 2009).
- La Bibliothèque nationale de France (BnF) (<http://www.bnf.fr/default.htm>; accessed August 12, 2008) has many relevant collections and departments, including: the Département des Arts du Spectacle, the Département de la Musique, the Département de l'Audiovisuel, the Département des Estampes et de la photographie, and the Bibliothèque-Musée de l'Opéra (<http://www.bnf.fr/pages/zNavigat/frame/collections.htm?ancre=arts.htm>; accessed August 12, 2008).

Among dedicated repositories, examples are

- The Research Institute of The Getty in Los Angeles (<http://www.getty.edu/research/>; accessed August 12, 2008); its Research Library holds general library collections, special collections, and a Photo Study Collection, with a focus on "the history of art, architecture, and archaeology with relevant materials in the humanities and social sciences"^[13] (http://www.getty.edu/research/conducting_research/library/index.html; accessed August 12, 2008).
- The Museum Archives (<http://moma.org/learn/resources/archives>; accessed March 15, 2009) of the Museum of Modern Art (MoMA) in New York City (<http://moma.org/>; accessed August 12, 2008) holds documentation on the Museum's activities, and on aspects of modern and contemporary art. There are also several study_centers at MoMA; they include the Lily Auchincloss Study Center for Architecture and Design, The Drawings Study Center, the Joseph and Sylvia Slifka Painting and Sculpture Study Center, Erna and Victor Hasselblad Photography Study Center, The Abby Aldrich Rockefeller Print Room, the Celeste Bartos International Film Study Center, as well as The Celeste Bartos Film Preservation Center in Hamlin, Pennsylvania (http://moma.org/learn/resources/study_centers; accessed March 15, 2008).
- The Academy Film Archive (<http://www.oscars.org/filmarchive/index.html>; accessed August 12, 2008) and The Margaret Herrick Library (<http://www.oscars.org/library/index.html>; accessed August 12, 2008) of The Academy of Motion Picture Arts and Sciences in Los Angeles (<http://www.oscars.org/>; accessed August 12, 2008) are, together with MoMA, among the largest film repositories in the world.
- The George Eastman House International Museum of Photography and Film (<http://www.eastmanhouse.org/>; accessed August 12, 2008) promotes many activities and has a world-famous museum of photography and film archives (http://www.eastmanhouse.org/inc/the_museum/welcome.php; accessed August 12, 2008). Its collections include photography (<http://www.eastmanhouse.org/inc/collections/photography.php>; accessed August 12, 2008), motion picture (http://www.eastmanhouse.org/inc/collections/motion_picture.php; accessed August 12, 2008), and photographic and cinematographic equipment (<http://www.eastmanhouse.org/inc/collections/technology.php>; accessed August 12, 2008). The Richard and Ronay Menschel Library is part of The George Eastman House and focuses on photography and motion picture (<http://www.eastmanhouse.org/inc/collections/library.php>; accessed August 12, 2008).
- The New York Public Library for the Performing Arts (<http://www.nypl.org/research/lpa/lpa.html>; accessed August 12, 2008) "houses the world's most extensive combination of circulating and non-circulating reference and research materials on music, dance, theatre, recorded sound, and other performing arts."^[14] The Circulating Collections include: Arts Administration; Dance; Drama; Music; the Orchestra Collection; Recorded Sound and Moving Image.^[15] The Research Collections include: the Jerome Robbins Dance Division; the Music Division; the Rodgers and Hammerstein Archives of Recorded Sound; and the Billy Rose Theatre Collection.^[15] The Theatre on Film and Tape Archive (TOFT), championed by Betty Corwin, is part of the Billy Rose Theatre Collection and, since 1970, "has been engaged in a unique documentation effort"^[16] recording theatre productions and documenting theatre personalities.
- The Metropolitan Opera (The Met) Archives in New York City (<http://www.metoperafamily.org/metopera/history/>; accessed August 12, 2008) are "devoted mainly to Met history and the holdings consist of written record, photographs, costumes, art works and related material."^[17]
- The Harvard Theatre Collection (<http://hcl.harvard.edu/libraries/houghton/collections/htc.html>; accessed August 12, 2008) is part of the Houghton Library at Harvard University in Cambridge, Massachusetts, and documents the history of the performing arts. The Harvard Theatre Collection is considered "the oldest major theatre collection in the world."^[18]
- The National Theatre Archive (<http://www.nationaltheatre.org.uk/?lid=7058>; accessed August 12, 2008) "is the repository for the administrative and technical records of the National Theatre" in London, United Kingdom.^[19] The National Theatre has developed a Web site about its productions and educational activities, Stagework (<http://www.stagework.org/stageworks/index.html>; accessed August 12, 2008).

- La Bibliothèque-musée de la Comédie-Française in Paris, France (http://www.comedie-francaise.fr/dev/institution_bibliotheque-musee-infos.php; accessed August 12, 2008) houses archives, iconographic materials, publications, artworks, and three-dimensional objects related to the history and activities of the Comédie-Française.
- The Biblioteca e Raccolta Teatrale del Burcardo (Burcardo Library and Theatre Collection) in Rome, Italy (<http://www.burcardo.org/english/index.htm>; accessed August 12, 2008) is “an office of the Italian Society of Authors and Publishers - SIAE”^[20] and houses special collections, a library, and a museum, as well as the SIAE Historical Archives. Its holdings are among the largest in Italy.

There are several portals, lists, and directories that point users to visual and performing arts archives and special collections. One example is the *SIBMAS International Directory of Performing Arts Collections and Institutions*, available through the SIBMAS Web site (<http://www.sibmas.org/>; accessed August 12, 2008).

Many archives also digitize some of their materials and make them available as online collections. Archives and institutions often develop online exhibitions, too. Some archives and institutions also use theirs and other materials to develop projects and Web sites for education and outreach.

ARCHIVING AND MANAGING VISUAL AND PERFORMING ARTS MATERIALS: SELECTED ISSUES

Archivists working with visual and performing arts materials follow the general principles and practices of their profession, but also need to tailor them to the specificity of the materials. This section will briefly address some key aspects of visual and performing arts archivists' work. For a more complete discussion, readers may refer to the works cited in the references and bibliography sections, as well as to the Web sites of institutions and associations mentioned in this entry.

How do you document the visual and performing arts? Their complexity and dynamic characteristics make it in most cases impossible to thoroughly document all of their aspects. Especially the live components of a performance or dynamic art event can never be adequately captured. The intention of many artists is actually to create something that cannot be fixed. Some artists and theorists question and investigate the attempt to create a record of the visual and performing arts.^[21–23] Many artists, companies and institutions are involved in documentation efforts, though. This is done for many reasons: reflecting on the work done; making it available for future reference and inspiration; producing materials that can be used for

publicity and outreach; preserving the artistic and cultural heritage; and more. Video-recording, photography, and many other means are used in documentation efforts; all of them have both advantages and limitations, and there exist a strong debate on why and how to use them in both the traditional and the digital environment.^[24] Many archivists become directly involved in the documentation process, especially, but not only, when they work in in-house archives such as archives of theatres and galleries. Archivists may promote and/or help coordinate the documentation efforts, according to internal policies and existing guidelines, when in place. The people who are part of the visual and performing arts are essential sources, with their minds and bodies, for transmitting and perpetuating knowledge; interviews and oral histories, among other methods, are therefore important to documentation efforts.

Given that the visual and performing arts are dynamic and happen through time, archivists need to be proactive in acquiring existing documentation or in actually promoting the creation of new documentation; this active engagement makes visual and performing arts archivists different from more traditional archivists.^[11]

In order to communicate with artists and to acquire/create documentation in a timely manner, visual and performing arts archivists need to thoroughly understand visual and performing arts practice. As described earlier, the process through which materials are created is very complex and multifaceted, and often as important as the final outcome; materials go through a very complex life. Archivists need to understand this complexity and the reasons why materials were created in the first place. Archivists acquire this knowledge by staying in close contact with practice, and by sometimes taking part in it; many visual and performing arts archivists are actually artists and performers.^[11] An understanding of practice also implies acquiring the technical knowledge necessary to manage the materials. Archivists need to be knowledgeable of the wide range and complexity of formats (audio, video, digital and more), techniques and skills used in the visual and performing arts, in order to correctly manage, preserve, and make available the materials. Given the proliferation of formats and media, and many other considerations, preservation is an extremely difficult endeavor in these fields. Understanding the materials is essential for arranging and describing them, too, especially since existing standards and guidelines generally need to be adjusted and tailored when applied in the fields of visual and performing arts. All of these skills are also necessary when providing service to users and explaining the materials to them. Archivists in these fields are very close to the users, who come from a wide range of areas and have different purposes (p. 14).^[11] Archivists often serve the creators directly, as it happens in in-house archives, and are very active in supporting creativity and promoting use through a variety of activities and initiatives.^[11] Even

more than other types of archives, visual and performing arts archives are there to be actively used, for practical needs, creativity, inspiration, research, and more. In managing visual and performing arts materials, issues of copyright, intellectual property and privacy are crucial. Archivists need to consider artistic and commercial needs, and privacy issues that may arise from managing sensitive and controversial materials, which are very common in the visual and performing arts. Archivists also face ethical issues related to the overall process of documentation and to the nature of the materials. Given the complexity of their work, visual and performing arts archivists need the full support and expertise of their professional communities. Being actively part of professional associations is therefore essential; the next section highlights some relevant associations.

Visual and Performing Arts Professional Associations

Professional associations support the work of those who manage visual and performing arts materials, and also provide useful help to the creators and users of the materials. Professionals are usually part of more than one association. Broad-interest associations include the Society of American Archivists (SAA; <http://www.archivists.org>; accessed: August 12, 2008) and the Association of Canadian Archivists (ACA; <http://www.archivists.ca>; accessed: August 12, 2008). The following are examples of professional associations and groups that specifically focus on issues relevant to visual and performing arts archives:

- The Visual Resources Association (VRA), the international association of image media professionals established in 1982 (<http://www.vraweb.org/>; accessed August 12, 2008).
- The Art Libraries Society UK & Ireland (ARLIS/UK & Ireland) established in 1969, which supports professionals involved in the documentation of the visual arts, including architecture and design (<http://www.arlis.org.uk/>; accessed August 12, 2008).
- The Art Libraries Society of North America (ARLIS/NA), established in 1972 (<http://www.arlisna.org/>; accessed: August 12, 2008), and other affiliated organizations (<http://www.arlisna.org/about/affiliates.html>; accessed August 12, 2008).
- The International Federation of Library Associations and Institutions (IFLA) Art Libraries Section, which is “concerned with all formats of textual and visual documentation for the visual arts”^[25] (<http://www.ifla.org/VII/s30/index.htm>; accessed August 12, 2008).
- The Society of American Archivists’ Visual Materials Section Cataloging and Access Roundtable (VMCAR), established in 1990, which supports archivists and other professionals working with visual materials (<http://www.lib.lsu.edu/SAA/vmcar.html>; and <http://www.lib.lsu.edu/SAA/VMhome.html>; accessed August 12, 2008).
- The International Council of Museums/Conseil international des musées (ICOM), established in 1946, is an international organization of museums and museum professionals, and it maintains formal relations with UNESCO^[26] (<http://icom.museum/>; accessed August 12, 2008).
- The Association of Moving Image Archivists (AMIA), established in 1990, which supports professionals working with moving images (<http://www.amianet.org/>; accessed August 12, 2008).
- The Fédération Internationale des Archives du Film/International Federation of Film Archives/Federación Internacional de Archivos Fílmicos (FIAF), established in 1938, “is a collaborative association of the world’s leading film archives”^[27] (<http://www.fiafnet.org/>; accessed August 12, 2008).
- The Fédération Internationale des Archives de Télévision/International Federation of Television Archives (FIAT/IFTA), established in 1977 (<http://www.fiatifta.org/>; accessed August 12, 2008).
- The Association for Recorded Sound Collections (ARSC), established in 1966, is an international organization that focuses on all aspects of recordings and recorded sound (<http://www.arsc-audio.org/>; accessed August 12, 2008).
- The International Association of Sound and Audiovisual Archives (IASA), established in 1969 (<http://www.iasa-web.org/>; accessed August 12, 2008).
- The Music Library Association (MLA), established in 1931 in the United States (<http://www.musiclibraryassoc.org/>; accessed August 12, 2008).
- The International Association of Music Libraries Archives and Documentation Centres (IAML), established in 1951 (<http://www.iaml.info/>; accessed August 12, 2008).
- The Canadian Association of Music Libraries, Archives, and Documentation Centres (CAML)/Association canadienne des bibliothèques, archives et centres de documentation musicaux (ACBM), established in 1971 (<http://www.yorku.ca/caml/>; accessed August 12, 2008).
- The Dance Heritage Coalition (DHC), established in 1992 in the United States, “is a national alliance of institutions holding significant collections of materials documenting the history of dance”^[28] (<http://www.danceheritage.org/>; accessed August 12, 2008).
- The Société Internationale des Bibliothèques et des Musées des Arts du Spectacle/International Association of Libraries and Museums of the Performing Arts (SIBMAS) was established in 1954 (<http://www.sibmas.org/>; accessed August 12, 2008).
- The Theatre Information Group (TIG), which “originated as Theatre Information Group London in 1979 and is the U.K. affiliate of SIBMAS.”^[29]

- The Theatre Library Association (TLA) was established in 1937 in the United States (<http://tla.library.unt.edu/>; accessed August 12, 2008).
- The Society of American Archivists' Performing Arts Roundtable (PAR) was established in 1986 (<http://www.archivists.org/saagroups/performart/index.html>; accessed August 12, 2008).
- The Performing Arts Heritage Special Interest Group of Museums Australia (PASIG) was established in the early 1990s (<http://www.museumsaustralia.org.au/site/page78.php> and <http://amol.org.au/pasig/>; accessed March 4, 2009).

The above-mentioned associations also work together with other associations of scholars and practitioners such as the International Federation for Theatre Research (IFTR)/ Fédération internationale pour la recherche théâtrale (FIRT) (<http://www.firt-iftr.org/firt/home.jsp>; accessed August 12, 2008) and the College Art Association (<http://www.collegeart.org/>; accessed August 12, 2008).

CONCLUSION

This entry has provided a brief introduction to visual and performing arts archives, which are extremely dynamic, complex and fascinating for both archivists and users. Materials originate from a multitude of interrelated and often collaborative activities, present a great variety of formats, and are kept in different types of repositories. Since the visual and performing arts are very alive and always experimenting with the new, archivists need to be in close contact with artistic practice, and need to be proactive in their work. Archivists need to always be aware of the big picture, in order to encourage creativity, promote use, and address the ethical and practical issues that arise from archiving and managing visual and performing arts materials. This entry hopes to serve as a useful introduction to those who work in the visual and performing arts, to the archivists who work with visual and performing arts materials, and to the users who are interested in accessing them. The arts are a vital part of life and there are different ways of engaging in them and supporting them; working with visual and performing arts archives is one way to do this.

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Visual Resources Association (VRA)

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Abstract

This entry provides an overview of the Visual Resources Association (VRA), an international organization for image media professionals. Beginning with an introduction to the organization and its mission, the entry then provides a history of VRA, including events leading up to its founding in 1982, and gives the background for its importance in the field of information sciences today. Following is an explanation of the organizational structure, a description of the VRA Foundation, and information on the regional chapters, appointments, and standing committees. Two important data standard initiatives, VRA Core and *Cataloging Cultural Objects* (CCO), are described. The entry also provides information on the publications and communications of VRA, the annual conferences, the jointly sponsored (with the Art Libraries Society of North America) Summer Educational Institute for Visual Resources and Image Management (SEI), and VRA's affiliates.

INTRODUCTION

The Visual Resources Association (VRA) is a multidisciplinary organization dedicated to furthering research and education in the field of media management within the educational, cultural heritage, and commercial environments. The Association is committed to providing leadership in the visual resources field, developing and advocating standards, and offering educational tools and opportunities for the benefit of the community at large. VRA implements these goals through publication programs and educational activities. The Association offers a forum for issues of vital concern to the field, including preservation of and access to media documenting visual culture, cataloging and classification standards and practices, integration of technology-based instruction and research, digital humanities, intellectual property policy, visual literacy, and other topics of interest to the field. Through collaboration, partnership, and outreach with the broader information management, educational, and scholarly communities, the Association actively supports the primacy of visual information in documenting and understanding humanity's shared cultural experience.

The international membership includes information specialists; digital image specialists; archivists; art, architecture, film, video, metadata, and digital librarians; museum professionals; architectural firms; galleries; publishers; vendors; rights and reproductions officials; photographers; art historians; artists; scientists; and academic technologists.

Information for this section was culled from a number of Association documents and the VRA website. Many of these sources are anonymously written and reflect an accumulation of information over a period of years by different

writers and editors including known contributors: Kathe Hicks Albrecht, Heather Cleary, Lise Hawkos, Benjamin Kessler, Elisa Lanzi, and Elaine Paul.

VRA HISTORY

From as early as 1968, visual resources curators had been meeting during the annual College Art Association (CAA) conferences. The curatorship of slide and photograph collections required special skills and techniques that were not generally available in established curriculums and could be gained only through experience. For the earliest practitioners in the field, who were often isolated within their respective institutions, this knowledge was hard earned and therefore of great value when they had occasion to meet and share information. During these sessions, curators discussed issues of particular interest to CAA members whose work involved the management of art slide collections. Given the success of these meetings, during the next several years, attempts were made to formalize the relationship of these curators with the larger CAA, yet the group remained essentially an ad hoc committee of visual resources curators for some years.

In 1972, the Art Libraries Society of North America (ARLIS/NA) was founded. Visual resources curators comprised a significant special interest group whose purpose was to provide support and development for those members of ARLIS/NA involved in visual resources management.

By the late 1970s, both regional activity and international activity were under way. Comité International d'Histoire de l'Art (CIHA) recognized the visual resources subgroup as an important part of the international association. Visual

resources sessions were provided during the *CIHA conference* in Bologna in 1979. On the regional level, in 1972, curators began meeting at annual conferences held by the Mid-America College Art Association (MACAA) and in 1976 at the *Southeastern College Art Conference* (SECAC) meetings.

While this range of meeting venues encouraged participation, it also meant that visual resources remained an adjunct to larger concerns and that affiliation along professional lines was episodic and impermanent. An attempt to organize visual resources curators more formally as a subgroup within the CAA in 1973 was rebuffed by that organization's executive board over the technicality that the only level of suborganization allowed by bylaws was that of a committee.

During this time, a number of educational initiatives, including seminars, workshops, and college courses, were developed for slide and photograph collection curators. A short-lived master's program, called "Curatorial Science for Slide Collections and Photographic Archives," was inaugurated in 1969 at the Allen R. Hite Art Institute of the University of Louisville. Sustained largely by the efforts of dedicated individuals in the visual resources field, some of these early initiatives faltered for lack of institutional support.

One particularly dedicated individual was Nancy DeLaurier, Curator of Slides and Photographs at the University of Missouri, Kansas City. Under her leadership, the MACAA visual resources group began to meet independently, creating workshops and sessions on various aspects of visual resources management. In 1976, DeLaurier began conducting a summer workshop offering fundamentals of collection administration for slide curators. The workshop, "Basic Training for Slide Curators," was held in Kansas City from 1976 to 1983. From 1984 to 1997, the summer workshop was continued and expanded at the University of Texas at Austin, primarily led by Nancy Schuller (University of Texas at Austin) and Christine Sundt (University of Oregon).

For the workshops, members developed several kits for the benefit of attending visual resources curators. These kits included information on slide room organization, standards of visual resources management, and other practical aspects of the visual resources profession. These eventually evolved into guides published by MACAA, which, in turn, gave rise to what would later become VRA *Special Bulletins*. This group also began regular publication of the *Slides and Photographs Newsletter*, which for a number of years was the main conduit of information for the visual resources community. The *Slides and Photographs Newsletter* was published under the sponsorship of the CAA from 1972 to 1974 and from 1974 to 1979 under the sponsorship of the MACAA. This newsletter eventually became known as the *International Bulletin for Photographic Documentation of the Visual Arts*. DeLaurier was also responsible for the publication

of the first edition of the *Slide Buyers' Guide* (University of Missouri, Kansas City, 1972).

Parallel to these developments, in 1974, Betty Jo Irvine, then head of the Fine Arts Library at Indiana University, published her monograph *Slide Libraries: A Guide for Academic Institutions and Museums* (Libraries Unlimited for Art Libraries Society). After surveying over one hundred visual resources collections, Irvine presented the first comprehensive, scholarly overview of the field. Irvine treated visual resources as a special, if idiosyncratic, branch of librarianship, and thus governable by general principles of librarianship at large. To this end, she emphasized the value of library education and methodology, in contrast to the extensive subject knowledge and more empirical on-the-job training advocated by DeLaurier, Schuller, and other authorities. Schuller's *Guide for the Management of Visual Resources Collections* was published by the MACAA Visual Resources Committee in 1979.

Visual resources literature in the 1970s addressed a wide variety of topics, including classification, copy photography, slide vendors, equipment, and conservation. However, a round of surveys confirmed that the most pressing issue of the day was professional status, as of then not yet truly conferred by any authoritative body. While both CAA and ARLIS/NA agreed in principle on the need for professional recognition of visual resources curators, the requirement of some measure of library education, favored by ARLIS/NA, proved to be a subject of disagreement within the profession. A sequence of committee deliberations resulted in a statement supporting professional status that, while an important first step, lacked definitive standards.

In 1980, the *Slides and Photographs Newsletter* was renamed the *International Bulletin for Photographic Documentation of the Visual Arts* and soon was independently supported by subscription. With the new decade, it was clear that the profession was ready to form its own organization. Discussions were held, and in 1982 a survey measuring organizational preferences was made of curators in ARLIS/NA, CAA, MACAA, and SECAC. While this survey had inconclusive results, it gave rise to a more pointed referendum that offered four choices: 1) maintain the status quo; 2) make an existing group such as ARLIS/NA or the Special Libraries Association the focus for all national visual resources activities; 3) form an information clearinghouse to coordinate the visual resources activities of other organizations; or 4) form a new and separate visual resources organization.

Although only forty-two people voted, a clear majority favored the creation of a new organization. It was on this basis that the VRA was incorporated as a nonprofit organization in Kansas City, Missouri, in August 1982. From a legal standpoint, VRA was a self-chartered continuation of the CAA committee. Temporary officers were Christine Sundt (chair), Nancy Schuller (vice chair), and Nancy DeLaurier (secretary/treasurer). Bylaws were drawn up

and the first official meeting was held during the annual CAA meeting in Philadelphia in February 1983. Membership was extended to those curators who subscribed to the *International Bulletin for Photographic Documentation of the Visual Arts*. In Philadelphia, officers were elected. They included Christine Sundt, president; Suzanne Babineau-Simenauer, vice president; Helen McGinnis, secretary; Nancy Schuller, treasurer; and Nancy DeLaurier, former president.

The new organization thrived, growing in membership, providing professional support, and continuing to develop a strong publications program. The latter included the publication of a scholarly journal independent of the *International Bulletin for Photographic Documentation of the Visual Arts* entitled *VRA Bulletin*.

The 1990s brought the development and rapid explosion of the Internet and the subsequent expansion of the visual resources field to include managing digital media. During this time it became clear that VRA no longer served just its membership, but played a new and significant role educating the public and contributing research to the broader field of library and information science and instructional technology. The organization led in the effort to develop public understanding of issues on copyright and intellectual property rights, protocols for dissemination of digital materials, standards of cataloging, and the importance of providing a broad public access to cultural information in the digital age.

The organization was invited to send a representative to the Conference on Fair Use (CONFU), which was convened in September of 1994 under the auspices of the United States Patent and Trademark Office and the United States Copyright Office. Attending the conference were representatives from more than sixty different commercial, public, and educational interest groups. CONFU representatives met monthly through 1997 in an attempt to develop fair use guidelines for use of digital and electronic media in image archives, multimedia, interlibrary loan services, electronic reserves, and distance learning initiatives. Despite the fact that the process did not yield workable guidelines, it was an important forum for VRA as it gave the organization recognition on the national scene as a significant contributor on issues of intellectual property rights in the digital age. The VRA was asked to participate in a series of public forums on copyright that were organized by the National Initiative for a Networked Cultural Heritage (NINCH). These Copyright Town Meetings were held in venues across the country between 1997 and 2003 and were open to the public for discussion and debate.

In other developments during the 1990s, VRA annual conferences began attracting a growing number of non-members interested in learning about visual resources; VRA-L, the Association's listserv, became a dynamic resource for members; and the VRA website evolved into an important source of information for students, professionals, freelance photographers, and intellectual property

rights managers in the image media world. Members of the VRA began to educate the larger community on issues such as copyright, image management, technical digital image issues, data standards, cataloging standards, and other emerging issues of importance. At the turn of the millennium, data standards came to the forefront with the Cataloguing Cultural Objects project (CCO) and the introduction of VRA Core. *Cataloging Cultural Objects: A Guide to Describing Cultural Works and Their Images*, published by the American Library Association in 2006, gained national recognition by standardizing the cataloging of visual information, and CCO sponsored workshops, the CCO website, and other outreach efforts began educating a broad audience. VRA Core, based on Dublin Core, grew from a list of elements to describe art and architectural images into a recognized data standard, with an XML schema to promote the sharing of records describing images of cultural heritage materials.

VRA Education Committee began to sponsor conference workshops on important topics of broad interest and offering these workshops and sessions at VRA and other professional conferences. *The Digital Scene*, later called *Image Stuff* and then *Images*, was featured on the VRA website. It was used to disseminate information on collaborative projects, new standards in imaging and metadata, digital preservation issues, consortial projects, training opportunities, and reports from the field. In 2004 VRA, in conjunction with the ARLIS/NA, began offering the Summer Educational Institute for Visual Resources and Image Management (SEI) to provide in-depth educational opportunities to new and seasoned professionals in the field.

Standards for the profession have remained an important consideration. In 1995, ARLIS/NA and VRA adopted *The Criteria for the Hiring and Retention of Visual Resources Professionals*, a set of guidelines for visual resources professionals. This document was revised in 2002 and is currently undergoing a further update. The division within the profession on the desirability of formal library training versus an advanced degree in a content area was resolved by recognizing that different degrees would be applicable to varying situations (academic institutions, research collections, museums, historical societies, archives, public libraries, governmental agencies, and corporations). And, as a variety of media types may be found in a visual resources collection, the electronic management of those materials has become a primary consideration for the profession.

The combined effects of rapid technological change and the financial crisis of 2008 resulted in the elimination of numerous visual resources positions and facilities. VRA convened a White Paper Task Force to respond to these measures, which in 2009 produced the white paper entitled "Advocating for Visual Resources Management in Educational and Cultural Institutions." The paper asserts the continuing importance of visual resources to teaching, learning, and institutional identity. Arguing that

administrative responses to budgetary crises at this time were often shortsighted, the paper identifies six strategic areas for consideration in planning for the future: 1) multiple sources for images; 2) ways of integrating personal and institutional collections; 3) social computing and collaborative projects; 4) the life-cycle continuum of image assets and their description; 5) rights and copyright compliance; and 6) visual literacy.

Several years later, the visual resources profession remains in a state of transition, with many positions' duties attending to image-related tasks beyond curating collections, such as providing instruction in digital imaging and image research, specialization and support in instructional technology, and facilitating various types of digital scholarship. In response to these transformations, VRA charged a Professional Status Task Force with investigating current professional status issues within the field of image and media management. A final report was submitted in June 2016.

Since 1988 the VRA has honored an individual who has made an outstanding career contribution to the field of visual resources and image management with an annual Distinguished Service Award. Nominees must have achieved a level of distinction in the field either through leadership, research, or service to the profession. The Nancy DeLaurier Award, named for one of the pioneers of the visual resources profession, annually honors a visual resources professional for distinguished achievement in the field. Originally conceived in 1997 as a writing award, to be presented in recognition of a published paper, the Nancy DeLaurier Award now recognizes other forms of achievement in the field, as measured by immediate impact, and may take the form of published work, oral presentation, project management, software development, technology application, website creation, or other outstanding effort.

Today VRA is a firmly established international association with hundreds of active members. The association provides its members wide-ranging benefits. VRA is now a leader in developing public awareness on copyright and intellectual property rights, establishing protocols for the dissemination of digital materials, recommending cataloging standards, and promoting broad public access to cultural information in the digital age.

ORGANIZATIONAL STRUCTURE

VRA is governed by an executive board comprised of five regular officers serving two year terms plus an officer who serves one year as president-elect and then two years as president. The other officers are the secretary, treasurer, vice president for conference arrangements, vice president for conference program, and the public relations and communications officer. The former president serves 1 year in a non-board advisory capacity. Officers are nominated by a committee and elected in balloting by eligible VRA

members. The board makes appointments, oversees standing committees and task forces, and approves the organization of regional chapters.

VRA FOUNDATION

In 2004 a task force was appointed by the VRA board to investigate the tax status situation of VRA and to make recommendations. The VRA was incorporated in 1982 as a 501(c) 6 organization, a trade association. Although a trade association is nonprofit, it is an organization established solely to provide direct services to its members. VRA is a fine example of a well-functioning and significant 501(c) 6 organization. As it has grown, the Association's importance has come to extend beyond its member services. Yet, due to the U.S. Internal Revenue Service tax status limitations, VRA, as a 501(c) 6 trade association, has not been able to pursue major grants to engage in research or other educational endeavors.

The Association's educational and research components are now important assets and major resources for the general public and the field of information management. After a year of studying the issues, the task force recommended that from an organizational standpoint, a separate 501(c) 3 VRA Foundation offered a way to most efficiently oversee and extend these significant and influential educational and research efforts.

In July 2007, the VRA Foundation was incorporated in the state of Delaware, and in September 2007 the Internal Revenue Service granted the Foundation 501(c) 3 tax status. The purpose of the VRA Foundation is to develop and expand educational and research opportunities in the public interest; establish standards for emerging electronic media; manage grants and develop programs to improve the visual resources field; conduct and/or sponsor research in the information sciences and educational technology; publish informative articles, guidelines, and online resources; and complement the work of VRA by providing educational, literary, and scientific outreach to the larger community and general public. Through the VRA Foundation, VRA furthers its significant and growing educational and research efforts. Accordingly, the VRA Foundation has assumed responsibility for the Summer Educational Institute and Cataloguing Cultural Objects.

The VRA Foundation board is comprised of seven directors serving two-year terms. Four of the directors are appointed by the VRA board, and three by the Foundation board. Three officers—a chair, treasurer, and secretary—are selected by the directors from their ranks.

REGIONAL CHAPTERS

VRA has fourteen active regional chapters. The Chapter program was developed to extend VRA outreach and

professional support to the local level. Attending chapter meetings provides opportunities to make professional contacts, share knowledge and expertise with colleagues, and benefit from continuing education events. The following regions are represented: Canada, Great Lakes, Greater New York, Mid-Atlantic, Midwest, New England, Northern California, Pacific Rim, Southeast, Southern California, Texas, Upstate New York, the Wild West (Mountains and Plains states), and an International Chapter with members from various countries across the globe.

APPOINTMENTS

The VRA board appoints both individuals and task forces to undertake short- or long-term projects, investigations, initiatives, or service. Current appointees include the editors of Association publications and website, a Communications Technology Advisor, a Social Networking Contributor, a VRA Archivist, a representative to the Picture Licensing Universal System Coalition (PLUS) Board of Directors, Affiliate Representatives who liaise with VRA's affiliated organizations, and several working task forces. Appointed independent contractor positions include a membership services coordinator, an accountant, and a bookkeeper.

STANDING COMMITTEES

VRA maintains a number of standing committees to work on Association projects, initiatives, and outreach. Standing committees include Awards, Data Standards, Development, Education, Financial Advisory, Intellectual Property Rights, Membership, Nominating, Travel Awards, and VRA Core Oversight.

PUBLICATIONS AND COMMUNICATIONS

The VRA Bulletin

The *VRA Bulletin* is published twice a year by the Association. A journal of professional practice and the flagship publication of the Association, it features articles on important professional issues ranging from cataloging, copy photography procedures, image and data standards, and collection management and administration. Also included in the *VRA Bulletin* are reviews of recent publications, and updates on commercial image sources.

VRAweb.org

The VRA website, located at the URL <http://www.vraweb.org>, has both public- and members-only sections. The home page features a dynamic News section that provides current updates on Association activities and events. Other

sections of the publicly accessible site contain the VRA Constitution and Bylaws; Association history and mission; listings of current executive board members, appointees, chapters, and committees; information about VRA affiliates, past and future conferences, membership benefits, the awards program, employment opportunities, the Mentor Program, and special interest groups; as well as links to numerous VRA documents and initiatives.

The members-only section of the site includes the member directory, as well as business meeting minutes, annual reports, financial statements, strategic plans, outreach materials, and forms and documents used for leadership and management purposes.

VRA Listserv

The VRA Listserv, VRA-L, is intended to expedite communication among VRA members on important issues related to the Association, to visual resource curatorship, to related technologies, and to the profession. Appropriate postings forwarded from VRA nonmembers are welcome. Subscription to VRA-L is restricted to VRA members or paid subscribers to VRA-L. VRA-L was started in 1991 and has been an active Listserv serving as a vital communication tool for its members.

Social Media

VRA's appointed Social Networking Contributor coordinates VRA's communications via social media. Current accounts include Facebook, LinkedIn, and Twitter.

Special Bulletins

The *Special Bulletins* are occasional publications, each on a different, specific subject. While *Special Bulletins* are no longer being published in favor of disseminating content in the *VRA Bulletin* and on the VRA website, many of the *Special Bulletins* are still in print and available through the Association. Selected titles are also available for downloading as electronic documents. The publications include guides to cataloging Asian and Chinese Art, subject classifications for image collections, standards for photograph and slide conservation, a guide to copy photography, disaster planning for visual resources collections, a description of iconographic contents and diagrams for cataloging complex works of art, and, most recently, strategies for transition to the use of digital media.

DATA STANDARDS

Cataloging Cultural Objects (CCO)

Cataloging Cultural Objects: A Guide to Describing Cultural Works and Their Images (CCO) is a data content

standard for the description of art and cultural objects and their visual surrogates, sponsored by VRA, and published in 2006 by the American Library Association (ALA). CCO was developed by the VRA to provide guidance to visual resources curators, museum documentation specialists, librarians, archivists, and others engaged in describing works of art and architecture, objects of material culture, and their images. Oversight of CCO has been assumed by the VRA Foundation.

VRA Core Categories

Since the 1980s, VRA has worked on creating standards to describe images. As every visual resources collection uses different and variant standards, the Association has worked toward creating a usable and common standard. VRA Core 4.0 is a data standard for the cultural heritage community that was developed by the VRA's Data Standards Committee. It consists of a metadata element set (units of information such as title, location, date) as well as an initial blueprint for how those elements can be hierarchically structured. The element set provides a categorical organization for the description of works of visual culture as well as the images that document them.

The Metadata Encoding and Transmission Standard (METS) Editorial Board officially endorsed VRA Core 4.0 schemas (release version April 9, 2007). This endorsement confirms VRA Core 4.0 schemas (both restricted and unrestricted) are in line with nationally recognized metadata standards and will work well as an extension schema for any METS objects that contain images of cultural heritage resources.

Based on the Dublin Core model, VRA Core has grown from a list of elements to describe art and architectural images to a data standard, with an XML schema to promote the sharing of records, for describing images of cultural heritage.

Five versions of VRA Core have been released:

1. VRA Core 1.0—published in 1996
2. VRA Core 2.0—published in 1998
3. VRA Core 3.0—published in 2002
4. VRA Core 4.0 beta—published in 2005
5. VRA Core 4.0—published in 2007

ANNUAL CONFERENCE

VRA conducts an annual conference, held in a different city each year. This event provides workshops, sessions, and seminars on issues of interest, a chance to meet colleagues both formally and informally, and the opportunity to view current commercial products. VRA members and nonmembers alike attend the VRA annual conferences to learn about the profession and network with colleagues in the field.

SUMMER EDUCATIONAL INSTITUTE FOR VISUAL RESOURCES AND IMAGE MANAGEMENT

The SEI began as a joint VRA and ARLIS/NA project in 2004. Now administered for VRA by the VRA Foundation (VRAF), the Institute provides a standardized and sustainable program for training in image collection management, with a focus on issues related to the transition from analog to digital collections. SEI is held in diverse geographical locations in order to encourage broad participation by professionals seeking standardized training.

Professionals in the field of visual resources currently have to master several different sets of knowledge/expertise to successfully administer existing resources, preserve unique collections within those resources, and engage in the process of converting analog resources to digital modes of presentation. In addition, they have to be conversant with national and international standards, organizations, metadata initiatives, and online resources. As most library and information science programs do not address the needs of image collection professionals, the jointly sponsored ARLIS/NA–VRA Summer Educational Institute is intended to provide a standardized and sustainable program for visual resources training, with a focus on issues related to the transition from analog to digital collections.

As an ongoing endeavor, SEI changes in focus and emphasis each year to meet the needs of new professionals and of institutions facing the demanding metamorphosis from analog slide collections into digital image resources.

SEI is open to professionals, paraprofessionals, and graduate level students in visual resources, library science, the fine arts, related humanities fields, and other image information disciplines. Anyone with a need to learn about managing image collections is encouraged to participate. SEI is designed to serve various levels of expertise including individuals new to the profession, librarians or other information professionals with new responsibilities to oversee and manage image collections, and visual resources managers and art librarians who wish to update their knowledge of current practices.

AFFILIATES

VRA seeks mutually beneficial affiliations in support of its mission, with the goal of facilitating steady communications, collaborative opportunities, and participation in the events and activities of like-minded organizations. Current VRA affiliates are the Art Libraries Society of North America (ARLIS/NA), the College Art Association (CAA), the Society of Architectural Historians (SAH), and the *Southeastern College Art Conference* (SECAC). Other like-minded organizations are listed on VRA's website.

CONCLUSION

The VRA, an international organization, has an active membership of professionals in the image management field from educational, cultural heritage, and commercial environments. The Association was formed in 1983 by slide and photograph curators from institutions of higher learning and museums who supported the teaching and research of art and architectural and art historians. It has

grown to include a wide range of specialists supporting image collections and other image- and media-related endeavors. Educational and informational outreach is provided through annual conferences, the SEI, the *VRA Bulletin*, and the VRA website. VRA has been a leader in educating the larger community on copyright and fair use issues, image management, digital image technology, data standards, and cataloging standards.

Visual Resources Management in Cultural Institutions

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Abstract

Visual resources collections play a vital, yet virtually invisible, role in the life of a museum. They exist to support the mission of their institution through dissemination of the accurate reproduction of works in the collection as well as being the central repository for images acquired for publications and exhibitions. This entry will primarily discuss the history, collections, organization, and professional protocols of art museum visual resources collections in the United States, realizing that the scope of collections and activities of those entrusted with them can be generalized to any cultural institution's needs. It seeks to highlight how collections are built from various sources and the skills and knowledge a manager of those collections must possess to effectively carry out their duties. An extensive recommended reading list is included to point the reader to standard literature for a deeper understanding of important aspects of managing visual collections. An emphasis is placed on understanding issues with digital image formats, rather than film, since most collections are shifting workflows and staffing to accommodate digital formats. Issues surrounding the preservation and dispersal of film-based collections will also be addressed.

INTRODUCTION

Museums are institutions that collect, preserve, and interpret all manner of things, from masterpieces of art to the most common of utilitarian objects (<http://icom.museum/the-vision/museum-definition/>). By creating and maintaining the visual record of museum objects and events, visual resources collections play a vital, yet virtually invisible, role in the life of a museum. Visual resources collections may contain any of a number of different types of photographic formats from glass-plate negatives to high-resolution, direct-capture digital images, all with the purpose of documenting the history of the cultural institution, the objects in the collection, the way in which they are exhibited, and the role of the object in history. This entry will primarily discuss the history, collections, organization, and professional protocols of art museum visual resources collections in the United States, realizing that the scope of collections and activities of those entrusted with them can be generalized to any cultural institution's needs. This is due to the authors' affiliation and the wide range of documentation relating to art museum collections; however, collection stewardship guidelines and issues surrounding management of digital collections can be applied to visual resources collections within any cultural institution.

Various names are assigned to the department that acquires, organizes, and distributes images. Traditionally, it had been called the visual resources library—a name that reflects the content—a library of images used for publications, programs, and teaching. With the introduction of digital formats came a natural progression of new

responsibilities based on the ease of reproducibility and repurposing of images in-house, followed by a name more descriptive of the function rather than the content. Several art museum collections have changed department names to reflect broader imaging functions. In 2002, the department of Photographic Services, once a separate department at the Museum of Fine Arts, Houston, was moved to the Image Library and renamed the Photographic and Imaging Services Department when it was recognized that the functions of both departments were intertwined. The Dallas Museum of Art's visual resources library was renamed Imaging Services, has also included the photographers and rights management since 2002, and in 2014 moved all non-object photography to the institutional archives, with imaging staff reporting to information technology (IT) and digital media. Other museums have formed departments based on the digital format such as the Brooklyn Museum of Art's department, Digital Collections and Services, formed in 2005 that includes the photo studio, scan lab, rights-related activities, and digital asset management. For this entry, we will refer to the activities of acquiring, organizing, and distributing images, as visual resources management.

HISTORIC CONTEXT

The reproduction of works of art by artists, collectors, and, later, museums is well documented in the history of art. Painted copies and drawings after original works created a precedent for later mechanical reproductions, such as printed copies that could be made in great numbers, not

only to grace the walls of humbler owners but also to disseminate information about new and important objects. The photographic reproduction of art objects was a natural result, and museums were quick to embrace the new medium as early as the 1850s. The history of visual resources collections in museums dates back almost to the beginning of photography itself. Museums hired photographers to document their objects and events to promote not only scholarship but also the museums themselves. Museums have always taken advantage of the newest photographic formats available, moving from glass negatives and salt prints in the mid-nineteenth century to film and now to digital. For the majority of the twentieth century, museum visual resources collections housed extensive libraries of black-and-white negatives and prints, color transparencies in various sizes (120 mm, 4 × 5 in., 8 × 10 in., with 4 × 5's being the standard), and 35 mm color slides. With the introduction of direct digital capture, the standard format of the early twenty-first century has moved to high-resolution digital images captured on high-end DSLR cameras and professional digital camera systems. A chronology of the "slide library" can be found online at http://en.wikipedia.org/wiki/Slide_library.

Although the professional standards for visual resources managers are the same for collections in universities and museums, the roles played by the collections are much different. This is evident especially in the way that the museum visual resources collection supports traditional noneducational activities. Visual resources collections in universities exist primarily to support the teaching curriculum of the university or department. Museum visual resources collections often function in this way, but it is just one of the many functions of the department. A major role of many visual resources collections is to promote the museum and its collections through the dissemination of high-quality reproduction images. In the case of art museum collections, the responsibility of providing high-quality images is extremely important since a poor reproduction of a great painting could be seen as a reflection on the quality of the art collection itself.

BUILDING COLLECTIONS

The content of visual resources collections varies according to the needs of the institution and constituency that they serve. Some purely consist of photography relating directly to the objects in their own collection. Others include noncollection materials that provide historical or subject context in which the museum's objects can be understood. The collections may either be available for public use or have access restrictions limiting patronage to staff and/or volunteers. For example, the American Museum of Natural History's Photographic Collection in New York City dates back to the Museum's beginnings.

Albert Bickmore, founder of the Museum, who became superintendent of public education, gave lantern slide lectures to school teachers. A lantern slide lending library was formed under the auspices of the department of public education. Meanwhile, Museum scientists were traveling the globe and returning with negatives. Prints were often pasted into scrapbooks in the science departments; and the negatives and scrapbooks were later deposited in the Museum's education department. The Museum Library's Special Collections is now in charge of virtually all of the negatives in the institution, and most of the prints, as well as many of the historic lantern slides. The collection as it is known today is supervised by the museum archivist and head of Library Special Collections.

The origin of the content, whether physical film or digital image, will depend on whether the image originates with the institution or if it is documenting an exterior event or object, in which case a third-party provider will need to be consulted for terms of use. For institutional images and event or program documentation, the institution may have staff photographers or photographers that are hired for a specific project. Many museums require that non-staff photographers sign "work for hire" contracts that relinquish the copyright of their photography to the museum, thereby granting full ownership of the photography to the museum. Consultation with museum counsel is necessary when contracts such as these are drafted. Cataloging and stewardship of those images may reside with staff in the visual resources library or be the responsibility of another department, such as the archives. There are instances where photography is created for a specified purpose. Images that document a work's condition or complex installation procedure could be created by the museum's photographer or a conservator, but may not be housed in the visual resources library due to confidentiality. Those images may be linked directly to object documentation, but access would be limited to specific staff.

Other Content Sources

Reference images, those images whose content is owned by a third party, can come from a variety of sources. Reference images might be used for study purposes by staff, illustrations for a lecture, reproductions in an exhibition catalogue, or didactic materials in an exhibition. Ideally, the images would be obtained from the source that created the image; however, that is not always practical, or necessary. Third-party providers can fill most needs for teaching images and related uses, but not all. Those images will be subscribed to or purchased for educational use and will have use restrictions. In some cases, for example, with ARTstor, museums are both contributors and subscribers to third-party content. ARTstor is a subscription service that provides remote access to a growing database of images for teaching (<http://www.artstor.org/>). While not generally needed for educational use, at times,

visual resources managers may need to license images from stock photo collections such as Getty Images or Art Resource. Frequently, images for teaching are scanned from previously published sources in the tradition of copy-photography. This content source should only be utilized within the parameters of copyright laws in the region, such as Fair Use in the United States. Several organizations have published Fair Use Statements in recent years and they are listed in the “Visual Resources Management Resources” section.

An Ever-Changing Landscape

Storage issues have always been a major concern for visual resources managers. In the past, physical storage of photographic negatives and positives has posed interesting and sometimes dangerous problems. Some materials require cold storage (color positives), while others do best in dark, dry, temperature-neutral environments (black-and-white negatives). In an extreme case, nitrate negative films must be housed in secure, cold, pressurized containers to prevent explosive reactions with air. The common thread for these types of materials, however, is the need for physical space for storage. Storage rooms and sometimes even whole floors are necessary to provide the physical storage space for photographic materials. Visual resources managers must also be knowledgeable in the conservation requirements for each type of material in their collection and make suitable arrangements for the storage and housing of each type of material.

Digital storage may not require the physical space of earlier materials, but it is no less important for the viability of any visual resources collection. The actual footprint of storage space can be reduced drastically if the digital files are stored entirely on local or cloud-based servers. The decision to keep all files on servers requires that server technology is kept up to date, and data migration policies are implemented. As technology changes and new digital file formats are developed, migration policies must be in place to ensure that files created today will be able to be accessed in the future. The information contained in a digital image file is dependent on the format chosen. File formats become obsolete as newer formats are developed, so institutions have to make a commitment to migrate data files to current formats. The use of compressed file formats or proprietary formats is discouraged. Compressed files, most notably “lossy”-type formats, cannot be depended upon for future accuracy of information. Proprietary formats are often the first types of files to become obsolete and therefore very difficult to access in the future. Digital files may also be stored off-line on media such as magnetic tape, optical drives, and CD/DVD media. This method is not recommended and the choice to save files on such media presents its own preservation issues that involve the obsolescence of the physical media as well as the computer hardware to access it. The visual resources

manager must weigh the benefits of storing files off-line, which may be less expensive in the short term in terms of network storage costs, against the costs of physical storage space for the media and the staff time and expense of migrating both media and file data. Off-line storage also makes retrieval and distribution difficult.

Working in conjunction with institutional IT staff, visual resources managers must plan for scalable solutions that will protect the digital collections they have toiled to create. In managing collection documentation, especially of art objects, image file sizes can become huge and inefficient to store in-house. Cloud-based storage services are being used for management of large collections and can be useful if a reliable and secure service is selected. The choice to outsource file storage can eliminate the need to increase back-up storage solutions to meet demands for preservation and retrieval if a server fails in-house.

The downside of having virtual assets rather than physical ones, however, is that access and retrieval are now totally dependent on computer searches, making proper and often complex cataloging systems necessary. In the past, many museums did not see the need to undertake extensive cataloging initiatives for their film-based visual resources collections, relying instead on a physical filing system for retrieval. Larger museums, with larger collections of images such as Harvard University’s Fogg Museum of Art, invested in cataloging systems and became the prototype for others. With the advent of digital collections, even the smallest museum is now having to deal with retrieval issues making database and system decisions important. While some museums have chosen to create their own databases in software applications such as FileMakerPro or Microsoft Access, it is recommended that visual resources collections employ specialized digital asset management systems (DAMS), which combine sophisticated cataloging data with retrieval and distribution functionality. DAMS that also include elements of digital rights management are preferred, but are currently difficult to obtain and require much customization.

Best Practices

The digital revolution has affected every aspect of our daily and professional lives. To that end, sustainability is a concern for many and research is ongoing at universities and coalitions of organizations to create best practices for those working in the field. Through the advice of these organizations, the field of visual resources management is becoming more standardized, and museums are embracing the idea that sustainable image collections are important in intellectual and fiscal terms. By following the basic guidelines outlined by these best practices, museums have a means of creating and caring for collections that will provide rich resources for scholars and museumgoers now and in the future.

Issues have come to pass with the establishment of digital imaging that visual resources collections did not have to deal with previously. When photographic collections were film-based, many visual resources collections had limited technology concerns beyond transparency viewing. For some institutions, common office supplies and furniture sufficed for the care of collections, while others employed state-of-the-art conservation supplies for housing materials, the choice of which was often based on funding and how each museum administrator viewed the importance of the collection. Typewriters and, later, word processors and computers were used to create labels for the materials. With the advent of digital collections, however, the visual resources collection may be the department with the most sophisticated computer equipment in the entire museum.

With digital formats come a new set of variables to manage when providing images for users. Current equipment and software are as important for efficient processing of requests as is knowledgeable staff. Visual resources managers work in a fast-paced environment where requestors expect to be able to access images without delay. There is a perception that digital image creation is faster than traditional photography. While that is not completely true, managers who can integrate the processes of image capture (whether directly from the object or scanned from existing photography), image manipulation, cataloging, and reliable delivery systems will encounter the least number of problems when delivering a requested set of images. Settling on standard image formats and consistent workflows ensures delivery of high-quality images.

Color management is one of the most important aspects of digital quality control and must be integrated into all visual resources activities. It involves a wide range of processes including matching digital images to displays and prints, calibrating printers, and using color management tools. At the very least, digital systems require a basic knowledge of how to synchronize monitors throughout the lab to ensure a consistent image output for users. Art museums spend a great amount of time working with printing presses to ensure color fidelity for images of their objects. The Universal Photographic Digital Imaging Guidelines, which promotes color sustainability from the viewpoint of the museum photographer, is one such resource for best practices (<http://www.updig.org/index.html>).

The use of digital systems requires that visual resources staff maintain a close working relationship with IT staff. In a film-based collection, interaction with the IT department was only necessary to provide support for word-processing programs, database application issues, or e-mail problems. Now, the department head must communicate a variety of requirements such as the need for and issues about image manipulation software, color management tools, servers to store images, fast connections to the

server to transfer images, and outsourced storage for large files, just to name a few.

Although collections may be acquiring images and filling requests in strictly digital formats, issues surrounding film storage and production continue to be relevant to the visual resources manager. As long as collections house or produce film or prints, best practices for processing, duplication, and especially storage must be maintained. For example, the Library of Congress includes collection care guidelines on their website <http://www.loc.gov/preservation/care/photo.html>.

Visual resources managers are routinely entrusted with digital conversion projects. This is where knowledge of film formats and capabilities of those formats are invaluable. Whether converted on a case-by-case basis or en masse, unique collections are being converted to digital formats for ease of distribution or presentation online. For example, when cultural institutions work with partners on a project, as in the case of a catalog related to a traveling exhibition, one partner might only have images on film for an object. In order for these images to be distributed to the publisher, the film has to be converted to a standard digital format.

Archival Images

If an institutional archive has not been established in a cultural institution, then master images taken of events, exhibition installations, and personnel are most effectively managed by centralizing them in the visual resources collection. Exhibition installation images are critical to documenting one of the most important activities of the museum and are requested frequently for publication, especially for reproduction within an artist monograph. Acquisitions for the permanent collection and the display or exhibition of those and other works is a primary activity for cultural institutions, and one for which a careful record must be maintained. For any event that takes place at a museum, there is the possibility that a photographic record will be created. Program documentation includes photography of speakers at a lecture, dance performers, school groups, family activities, or exhibition openings. Additions or changes to the public spaces, building exterior, object storage, or landscape are important historic records and are of interest as documents showing changes that have taken place over time. If staff portraits are taken and archived, the visual resources collection may be the repository for these images.

The nature of documentation images makes them a prime candidate for transfer from film formats to digital. Digitization allows for effective distribution (of copies) and preservation (of the original) because the documented event, now passed, is not available to reshoot with direct digital capture. The library at the American Museum of Natural History is systematically scanning its rare book illustrations as well as extensive documentary image

collections estimated to contain over 1 million images between negative, print, large format transparency, lantern slide, and 35 mm slide collections. After completing a pilot project for digitization and online access, Picturing the Museum: Education and Exhibition at the American Museum of Natural History (<http://images.library.amnh.org/photos>), the AMNH Research Library established Digital Special Collections (<http://lbry-web-007.amnh.org/digital/>), supervised by the museum archivist and carried out by the visual resources librarian with assistance from project managers, lab managers, and volunteers. In addition to building collections, the new visual resources team also works with museum departments and researchers to provide data and images for special events, exhibition needs, and publications. Through conversion to digital formats, the vast photographic collections at the AMNH Library can be accessed by researchers and the public for a fascinating glimpse into the past.

Object photography occasionally requires updates due to changes in the physical state of an object, changing tastes in three-dimensional object backgrounds, or the need for an image taken from a different angle. Previous versions of object photography might be retained for documentation of an object's condition over time.

To simplify the discussion of archival documentation, only photographic images were addressed here in detail; however, the ability to create audio and video documentation of the subjects noted is becoming commonplace and carries its own set of issues for storage and distribution. Since these files are also moving to direct digital capture, visual resources managers have needs in common with creators of that content and might even collaborate on finding solutions for the institution.

COLLECTION ACCESS

User Services

Visual resources staff need to be effective teachers. They have to communicate instructions on many levels that range with the patron's familiarity of the image collections. Staff new to the museum will need to be trained in the scope of the content and services as well as basic methods for making requests. When film was the primary delivery format, the choices were limited, and requests could be filled by sending film to a professional photography laboratory that employed standard formats for development or duplication. With digital images, and the variety of possible end-user formats, an initial in-person interview setting is generally the most efficient way to arrive at the final format necessary to fill a request.

Imaging staff become well versed in the activities of the institution as a whole while filling image requests. Making formats available, appropriate to the end use, is important to being able to fill the requestor's needs. Staff involved in

museum activities other than curatorial and education will primarily need access to digital images from one of three categories: the permanent collection, recent events, or upcoming exhibitions. The staff who are in charge of interpreting and exhibiting the collection will require a wholly other set of images to study, teach about, and interpret objects in their care. The ability to effectively communicate with scholars on a full range of topics is a unique and valued quality of the museum visual resources professional.

There are several levels of collection sharing that either originate with or are facilitated by staff in imaging. The most basic level of service is filling requests for in-house uses that can either be for a program taking place at the institution, a staff person who is asked to speak on the collection elsewhere, or via printed materials that are produced about exhibitions or programs. A fast-growing resource for learning about all aspects of a cultural institution is their website where users expect to see images of the collection, details about upcoming programs, and a variety of educational materials. The visual resources staff is central to this primary communication vehicle since many images that appear online are delivered directly or indirectly through the visual resources department.

Virtual Organization

In digital collections where a DAMS has not been implemented, images may be organized in a variety of ways and may or may not be available for browsing, and staff intervention is frequently necessary if the correct images are to be found. Object collection photography is filed or stored on a server according to the object's accession number or some close variation of that. Events are generally described according to the department of origin and the date the event took place. Exhibition images are generally organized by the exhibition title and selected by the organizers to represent the overall theme. They are used in print or website advertising, on invitations, or as illustrations for articles and reviews in newspapers or journals.

Images that originate on film are converted to a digital format before printing. In many cases, scanned images are produced in-house, and central scanning services have been integrated into the workflow of the imaging department. The more that staff in visual resources know about digital formats for printing and online use, the more relevant the department will be to filling institutional needs now and in the future. When preparing a digital image for any request, the most important question to ask is, "How will the image be used?" The ability to deliver correct formats for an end use is a critical function of visual resources.

Collection Preservation and Dispersal

Images produced by direct digital capture, and permanent retention of the resulting digital files, have resulted in

many print and film-based collections being disposed of, downsized, or ceased and physically moved to special collections or archives departments. When this is the case, staff find that the format of the image drives departmental priorities to shift and emphasize management of and access to the digital files using multiple computer systems. In cases where the image format has dictated reporting structure, organizations are actively seeking staff skilled in technology applications and well-developed metadata management and database skills. Deep subject knowledge is required as an educational foundation, but technical expertise and experience has become a deciding factor for many new hires. Distribution of digital content relies heavily on consistent metadata application and efficient workflow management. This transition of focus has been prompted in many cases by an increased emphasis on online access, with image collections as a central audience draw.

Dispersal of collections has prompted much discussion among professionals, and in 2014 the Visual Resources Association's Slide and Transitional Media Task Force published *Guidelines for the Evaluation, Retention, and Deaccessioning of 35 mm Slide Collections in Educational and Cultural Institutions*. Emphasis is placed on retaining unique collections, which in some cases results in simply downsizing teaching collections to retain only one copy of an image, or transferring documentation image management to institutional archives collections.

At the Dallas Museum of Art, an administrative reorganization led to legacy image collections in several formats being physically moved to the department of archives. Images included exhibition and permanent collection gallery installations, events, building and construction documentation, and portraits or informal images of people. Formats included black and white prints, color prints, 35 mm slides, 35 mm negatives, 4×5 negatives, 4×5 transparencies, and images on optical disk (if digital files were removed from the media and cataloged in the digital asset management system, the disks were discarded). In terms of organization, for ease of access and reference purposes, the transferred prints, negatives, slides, and disks were added to existing collections of permanent print photography and each collection was simultaneously reprocessed. In this case, slides have been removed from cabinets and sleeved during reprocessing, though one could choose to process slides as a separate series and store them in boxes or drawers. The analog photography collection at the Dallas Museum of Art is considered closed since the museum is no longer producing print or film-based image records.

Cataloging and Standards

Images need descriptive cataloging for intellectual control and to create paths for access to images for a particular use. Terms need to be assigned consistently and stored

relative to the image or with a path to the location of an image. To facilitate image sharing, standards for data fields, such as Categories for the Description of Works of Art, and content creation, such as Cataloging Cultural Objects, were introduced that are now becoming sophisticated and essential to managing digital collections. Without good cataloging, standard image naming, and reliable storage systems, a growing digital collection can become useless in a very short amount of time. See "Visual Resources Management Resources" for relevant cataloging content and data standards. For examples of online museum image collections, see the British Museum <http://www.britishmuseum.org/>, or the Metropolitan Museum of Art <http://www.metmuseum.org/>.

Digital Asset Management Systems and Digital Rights Management Systems

Content management systems (CMS), including DAMS, are integrated computer systems used to manage, distribute, and store digital files. The term DAMS most often refers to such systems that manage only nontextual files such as image, video, audio, and gaming-related formats. DAMS allow for the ingestion of master files and accompanying metadata, the ability to search for specific files meeting specific search criteria, the creation of derivative files from the master for a variety of uses, the storage of the master files, and in some cases active file preservation and migration platforms.

Digital rights management systems (DRMS) are systems designed to manage the usage rights for digital files. While many CMS and DAMS include some digital rights management services, the two types of systems are not identical, and care must be taken by visual resources management professionals to ensure which institutional solutions are chosen that balance the need for access against the intellectual property rights afforded to the creators of digital materials.

The need for sophisticated computer systems to manage digital assets and digital rights arrives at different times at different institutions. In some institutions, DAMS and DRMS implementations are part of a larger institution-wide initiative to gain control of digital assets ranging from text documents to video footage. At others, the decision to implement these systems happen at a departmental level, focusing on only one type of digital asset, such as still photographic images. Implementation of DAMS often occurs when the number of redundant files becomes so confusing on shared network servers that questions arise concerning authoritative data and file accuracy.

Data linkage between a museum's collection management system and its DAMS should exist for images of works from a museum's collection to promote consistency across museum departments when releasing information to the public. The combination of data found in the

collection management system with the descriptive cataloging data often employed in the visual resources collection provides a very sound basis for searching collection objects by patrons from the most dedicated university scholar to the occasional museum visitor.

Rights and Reproductions

A function that might be assumed by the visual resources collection in a museum is the acquisition and granting of reproduction rights, especially when the visual resources department houses the photography or images in question. Museums are often asked by outside parties for permission to reproduce images of objects from their collection. Some museums see this function as a revenue-generating activity and set monetary goals that the department must meet. Others see this function as a way to expand knowledge about the museums' collections, so they take a less profit-driven approach. A growing number of museums have separated commercial from scholarly requests and have begun to grant free access to images for scholarly publications through services such as ARTstor's Images for Academic Publishing (<http://www.artstor.org/content/collaborations>) or added features to their own site, such as the Open Access for Scholarly Content option at the Metropolitan Museum of Art. Most museums continue to charge reproduction and/or image usage fees for nonscholarly or commercial reproduction requests.

Copyright

Staff members that work with or are in the position to distribute visual collections to users and potential publishers need to be aware of intellectual property law and guidelines. This is essential in any collection where unique intellectual content is being recorded and distributed. In the United States, an understanding of the Fair Use Doctrine of U.S. Copyright Law is also a necessity since misunderstandings of this doctrine are rampant at nonprofit institutions. A common statement heard in visual resources collections is, "My use is educational; therefore my use falls under Fair Use." Use must meet certain requirements to be seen as Fair Use, so it is incumbent on visual resources professionals to fully understand the parameters of laws in the region in which they work. In the United States, see <http://www.copyright.gov/fls/fl102.html>.

Museums, like most libraries and archives, are in the position of owning objects for which they do not own the copyrights. In order to publish catalogs, produce retail objects, and even post images of art objects on their own institution's websites, museums must often negotiate with individual rights holders or clearing houses. American visual artists might choose to outsource requests for reproduction of their work to clearing houses such as Artists Rights Society (ARS) (<http://www.arsny.com/>) or Visual

Artists and Galleries Association (<http://vagarights.com/>), which are based in the United States. A list of organizations outside the United States is summarized on the ARS website.

VISUAL RESOURCES STAFF

Visual resources professionals from both museums and universities began meeting at academic conferences in the 1960s to discuss common issues and solutions to caring for art history slide collections. Since that time, the profession has evolved to include members from a wide variety of institutions that care for images in all formats on a variety of topics. Organizations such as the Art Libraries Society of North America and the Visual Resources Association have developed and advocated professional competencies for members of the field, and these have become more widely adopted by museums over the past decade.

Levels of staffing will vary with the type of activities performed. Depending on how many image functions have been centralized in an institution, the size of the staff can vary. For example, in an art museum, there might be a department head, a cataloger, a database specialist, a rights and reproductions manager, an administrative assistant, and/or photographers.

In terms of organizational structure, visual resources collections are administratively aligned with a wide variety of areas including the museum library, archives and special collections, registrar, education, collections and curatorial, IT, and academic deans in the case of collections affiliated with a university. Visual resources management has been performed by both professional and volunteer staff, depending on the institution. With the advent of digital technologies, especially the Internet and museums' presence on the World Wide Web, professional staffs and sophisticated data management practices are becoming the norm at even the smallest institutions.

Competencies

The competencies listed here outline the primary abilities needed to perform a range of tasks or functions within visual resources management. They can be used to assess a level of excellence for the visual resources manager or as a basis for training staff to perform a specific role in the image library. The professional organizations, VRA and ARLIS/NA, have published detailed studies and articles on the topic, which are listed in the "Visual Resources Management Resources" section.

Visual resources managers should have both broad and specialized subject knowledge in a field appropriate to the type of institution and/or library and information science. A minimum educational requirement for professional staff includes a postbaccalaureate degree in either area with

broad coursework or comprehensive on-the-job experience in the other area.

Managers and staff should access, use, and distribute information ethically and legally with attention to copyright guidelines and demonstrate a cooperative attitude, initiative, self-motivation, and the ability to advocate for and motivate others.

Managers should be effective instructors, capable of self-management and the management of others. They should help shape the future of their institution or organization and their profession. Successful managers will plan and manage projects, set and attain goals, establish workflows, and delegate tasks effectively. To keep staff informed and current, managers must have a broad understanding of technology issues and working knowledge of best practices in the areas of usability, interoperability, and digital preservation.

All visual resources staff should have the following skills and abilities for successful execution of their duties:

Organizational and time-management skills for priority setting, and setting and meeting deadlines
 Financial management skills including basic accounting, record-keeping, and reporting
 The skills necessary to ensure quality access, presentation, and preservation of digital image collections
 Flexibility in adapting to frequent changes in IT formats and methods of delivery
 The ability to select appropriate technological tools and apply them effectively, particularly those tools that are vital to caring for cultural collections, such as DAMS, DRMS, and photographic equipment

The Role of Professional Organizations

Attendance at professional meetings serves multiple purposes, but primarily extends training to include current issues. Several organizations offer one-day or longer workshops, sessions, meetings, and opportunities to get involved in the community and contribute to the shaping of this profession.

Further educational opportunities are available through annual workshops offered such as The Summer Educational Institute (SEI). The SEI is a joint VRA–ARLIS/NA program that provides a standardized and sustainable curriculum for training in image collection management. Each year, the focus on issues related to the transition from analog to digital collections becomes more relevant. The curriculum includes focused study on intellectual property rights, metadata, digital imaging, and discussions on current issues and expanding the role of the image management professional. Notification of like opportunities for specialized or in-depth investigation of a topic can be found by joining one or more professional organizations and subscribing to their listserv. There are multiple

opportunities every year to attend local and national meetings. For collections with limited budgets for professional travel, some have awards that are offered by application on a competitive basis.

Involvement is also considered a competency for effective management of visual collections. Contribution to the advancement of the visual resources profession involves knowledge sharing that includes publication and presentation of research findings and professional practices. Networking activities and participation in lifelong learning and professional development opportunities that build on existing knowledge and experience are also encouraged and necessary to remain current with the ever-changing landscape.

Planning and Administration

Whether a one-person department or the leader of a team of staff, a visual resources collection manager has a responsibility to plan for the future at all times. Departmental budgets and future planning are inextricably intertwined. Providing that the IT department absorbs costs related to software and asset management systems, specialized imaging equipment and qualified personnel are the primary expenditures when managing a VR collection, and the manager must communicate that essential need to budget preparers to meet user expectations over time. Equipment upgrade schedules (generally a two-year rotation) need to be communicated to and understood by the institution's IT department; in fact it is most effective if a VR staff person is assigned to keeping an equipment "wish list" current so that when budgets are prepared the most current needs can be addressed.

In the case of a larger staff, there are more management responsibilities. The department head must contribute to the recruitment, orientation, training, supervision, and evaluation of their staff. Securing and retaining qualified personnel is an ongoing concern. The skills necessary to providing seamless service are the direct result of appropriate levels of expertise and ongoing training. A good manager can contribute to the success of everyone on the team by advocating for further education and encouraging staff to stay current with best practices and to upgrade skills as opportunities become available. Staff training is continuous since new techniques and approaches are constantly being developed. Staff members must be good communicators with knowledge of the subject matter at hand and have a baseline expertise in software programs. For example, to work in an art museum, a fine art or art history background is expected in addition to technical competencies specific to their job.

The manager also sets the tone for open communication, cooperation, and team building, which is essential in an environment where deadlines are ever present and the needs of various departments will eventually overlap. Marketing key services of the department to staff is one way to create departmental support. Marketing can

include collaboration with other departments on institution-wide projects (such as a publication) or simply helping new staff to understand the role of visual resources within the institution. It is sometimes necessary for visual resources staff to willingly take on new responsibilities to grow with the needs of the institution. The manager sets the tone for the department's success.

CONCLUSION

Visual resources staffs play a vital role in the life of a cultural institution. The proliferation of images, in their various formats and for numerous uses, requires the attention of a professional manager to effectively acquire, manage, and circulate the collections. Guidelines for housing, cataloging, preserving, and distributing images are evolving at a rapid rate, especially since the introduction of digital formats in the mid-1990s. Since then, the focus on creating and distributing best practice guidelines has dominated the field and highlighted standards for quality that can be controlled and effected at the institutional level. Visual resources professionals are being acknowledged for their expertise in project management, copyright issues, digital technologies, and image creation and reuse.

Advances in digital imaging technology and image sharing methods are driving professional conference program content and conversations. Each year, new ideas about fair use of images, copyright interpretation, cataloging guidelines, image formats, and software advances are being published and presented at conferences. Digital formats and a variety of asset management systems have brought new scenarios for the profession and future generations of image users.

VISUAL RESOURCES MANAGEMENT RESOURCES

Assessing Copyright Status

Young, A.M., Ed. *Rights & Reproductions: The Handbook for Cultural Institutions*; Indianapolis Museum of Art: Indianapolis, IN; Washington, DC: American Alliance of Museums, 2015.

Lawson, R. Copyright and fair use in the art museum library: An overview. In *Art Museum Libraries and Librarianship*; Benedetti, J.M. Ed.; Scarecrow Press: Lanham, MD, 2007; 53–60.

A good summary of the issues and related legislation.

The Digital Image Rights Computator (DIRC), <http://dirc.vraweb.org/>

This program is intended to assist the user in assessing the intellectual property status of an object.

Copyright term and the public domain in the United States, <https://copyright.cornell.edu/resources/publicdomain.cfm>

An annually updated chart.

WIPO guide on managing intellectual property for museums, http://www.wipo.int/copyright/en/museums_ip/

Assists museums in learning to use the intellectual property (IP) system to improve the management of their collections in the digital environment.

Aufderheide, P. *Copyright, Permissions, and Fair Use among Visual Artists and the Academic and Museum Visual Arts Communities: An Issues Report*; College Art Association: New York, 2014.

<http://www.collegeart.org/pdf/FairUseIssuesReport.pdf>

The fair use issues report completed the initial phase of a multi year project to develop CAA's *Code of Best Practices in Fair Use for the Visual Arts* in 2015.

Code of Best Practices in Fair Use for the Visual Arts; College Art Association: New York, 2015. <http://www.collegeart.org/pdf/fair-use/best-practices-fair-use-visual-arts.pdf>

Statement on the Fair Use of Images for Teaching, Research, and Study. Visual Resources Association, June 2013.

http://vraweb.org/wp-content/uploads/2011/01/VRA_FairUse_Statement_Pages_Links.pdf

This statement was drafted by members of the VRA's Intellectual Property Rights Committee and draws on expertise of members as well as existing documentation surrounding the longstanding practices of image use in educational contexts.

Guidelines for the Use of Copyrighted Materials and Works of Art by Art Museums; Association of Art Museum Directors: New York and Washington DC, 2017. https://aamd.org/sites/default/files/document/AAMD_Fair%20Use_%20FINAL_%203_24_17%20-%20Guidelines%20for%20Copyrighted%20Materials%20and%20Works%20of%20Art.pdf

Transition to Digital Formats

Hamma, K. Public domain art in an age of easier mechanical reproducibility, *11* (11), <http://www.dlib.org/dlib/november05/hamma/11hamma.html> (November 2005).

RLGDigiNews Special issue: Introduction: Managing digital assets in US museums, *10* (6), <http://worldcat.org/arcviewer/1/OCC/2007/07/10/0000068924/viewer/file1.html> (December 15, 2006).

Waibel, G. From hand-crafted to mass-digitized. <http://hangingtogether.org/?p=256> (August 29, 2007).

Organizations and Sources for Project Reports and White Papers

Note: Useful and timely resources will be linked to the appropriate menu item on each organization's website; serial publications are noted where available.

ARLIS/NA (*Art Documentation*, ISSN 0730-7187), <http://www.arlisna.org/>

ARLIS/UK and Ireland (*Art Libraries Journal*, ISSN 0307-4722), <http://www.arlis.org.uk/>

College Art Association, <http://www.collegeart.org>

See Image Resource Directory, http://www.collegeart.org/ip/ip_image.

See CAA Committee on Intellectual Property, <http://www.collegeart.org/ip/>.

Getty Research Institute, http://www.getty.edu/research/publications/electronic_publications/index.html

The Institute publishes numerous professional resources and makes them freely available online and available for purchase in print.

Library of Congress—Standards, <http://www.loc.gov/standards/Museum Computer Network>, <http://www.mcn.edu/>

NINCH Guide to Good Practice, <http://www.ninch.org/programs/practice/> includes sections on Metadata and Digital Asset Management.

OCLC Research Reports, <http://www.oclc.org/research/publications/reports.html>

Society of American Archivists (*American Archivist*, ISSN 0360-9081), <http://www2.archivists.org/>

See Visual Materials Section, <http://www2.archivists.org/groups/visual-materials-section>.

Visual Resources: An International Journal of Documentation; Taylor & Francis. ISSN 0197-3762 (Print), ISSN 1477-2809 (Online)

Visual Resources Association (*Visual Resources Association Bulletin*, ISSN 1046-9001), <http://vraweb.org/>

Additional professional organizations are listed at <http://vraweb.org/about/affiliations/>.

VRA-L is a membership-based listserv that is widely considered essential reading for visual resources professionals.

Cataloging

Baca, M., Ed. *Introduction to Art Image Access: Issues, Tools, Standards, Strategies*. Getty Research Institute: Los Angeles, CA, 2002, http://www.getty.edu/research/publications/electronic_publications/intro_aia/index.html

Authorities

Union List of Artist Names (ULAN), Cultural Objects Name Authority (CONA), Library of Congress Name Authority Files (LCNAF), Library of Congress Subject Headings (LCSH).

Vocabularies

Art & Architecture Thesaurus (AAT), Thesaurus for Graphic Materials - Library of Congress (TGM), the Getty Thesaurus of Geographic Names (TGN).

Content

Baca, M. *Cataloging Cultural Objects: A Guide to Describing Cultural Works and Their Images*; American Library Association: Chicago, IL, 2006. ISBN 778-0-83:9:5-64.4, http://cco.vrafoundation.org/index.php/toolkit/cco_pdf_version/. See also the CCO Commons for practical application, <http://cco.vrafoundation.org/>.

Provides guidelines for selecting, ordering, and formatting data used to populate catalog records based on core [data standards] categories in CDWA and VRA Core.

Describing Archives: a Content Standard; 2nd Ed.; Society of American Archivists: Chicago, IL, 2013. (DACS) ISBN 978-1-931666-08-4. http://files.archivists.org/pubs/DACS2E-2013_v0315.pdf

Content standard for writing consistent archival descriptions.

Data Standards and Guidelines

Introduction to Metadata, http://www.getty.edu/research/publications/electronic_publications/intrometadata

Metadata Standards Crosswalk, http://www.getty.edu/research/conducting_research/standards/intrometadata/crosswalks.html

Categories for the Description of Works of Art (CDWA), http://www.getty.edu/research/publications/electronic_publications/cdwa

Dublin Core Metadata Initiative (DCMI), <http://dublincore.org/>

Machine-Readable Cataloging (MARC), <http://www.loc.gov/marc/>

VRA Core 4.0, <http://www.loc.gov/standards/vracore/schemas.html>

Staffing and Advocacy

Advocating for Visual Resources Management in Educational and Cultural Institutions. October 2009. Visual Resources Association White Paper. http://vraweb.org/wp-content/uploads/2013/02/vra_white_paper.pdf

Ball, H. et al. *Core Competencies and Core Curricula for the Art Library and Visual Resources Professions*; Art Libraries Society of North America: Calgary, Alberta, Canada, 2006. (Occasional Paper No. 15) ISBN 0-942740-21-1. See also ARLIS NA Core Competencies for Art Information Professionals, <https://arlisna.org/publications/arlis-na-research-reports/435-arlis-na-core-competencies-for-art-information-professionals>

The criteria for hiring and retention of visual resources professionals. In *Guidelines for the Visual Resources Profession*; Kopatz, K., Ed.; Joint publication of the Art Libraries Society of North America and the Visual Resources Association: Laguna Beach, CA, 2000; 1–5. Updated 2002. <http://vrawebor.ipower.com/resources/general/criteria.html> and <http://www.collegeart.org/standards-and-guidelines/guidelines/hiring-visual-resources-professionals>; under revision 2017.

Iyer, H. Core Competencies for Visual Resources Management. http://vraweb.org/wp-content/uploads/2016/09/iyer_core_competencies.pdf

Iyer, H. (2009). A profession in transition: towards development and implementation of standards for visual resources management. Part A—The organization's perspective. *Information Research*, 14 (3), 412. [Available from September 9, 2009 at <http://InformationR.net/ir/14-3/paper412.html>]

Iyer, H. (2009). A profession in transition: towards development and implementation of standards for visual resources management. Part B - the professional's perspective and beyond. *Information Research*, 14 (4), 413. [Available from November 3, 2009 at <http://InformationR.net/ir/14-4/paper413.html>]

Collections

Whiteside, A.B. et al. *Collection Development Policies for Libraries and Visual Collections in the Arts*; Art Libraries Society of North America: Calgary, Alberta, Canada, 2000. (Occasional Paper No. 12) ISBN 978-0-942740-17-2.

Wythe, D., Ed. *Museum Archives: An Introduction*; Society of American Archivists: Chicago, IL, 2004. ISBN 1-931666-06-7.

Includes chapters on photographs and audiovisual materials.

Software Selection

Digital Asset Management and Museums—An Introduction. Canadian Heritage Information Network (CHIN). http://www.rcip-chin.gc.ca/contenu_numerique-digital_content/fiches_techniques-tip_sheets/gestion_contenus_numeriques-digital_assets_management-eng.jsp

Digital Image Database Standards: A checklist that highlights issues and functionality to consider when choosing a database for image management and distribution.

<http://www.arlisna.org/images/researchreports/pubsarchive/didsc.pdf>

The DAM Maturity Model <http://dammaturitymodel.org/>

The DAM Maturity Model (DAM-MM) identifies four categories within the digital asset management ecosystem: People, Information, Systems, and Processes. The DAM-MM can be used to assess the level at which an organization has successfully implemented digital asset management and can help identify areas to prioritize for improvement.

Museum Computer Network, Digital Asset Management (DAM) SIG.

The DAM SIG is one of several MCN special interest groups that may be of interest to visual resources professionals. Its focus is to share information regarding digital asset management strategies for the cultural sector.

Volunteer Services in Cultural Institutions

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Abstract

This entry offers a brief introduction to volunteerism in museums, science centers, historical societies and sites, and related mission-driven cultural institutions. It discusses the primary models and categories of public and institutional service to these cultural institutions, in common with and distinct from libraries. It points to the ways in which trends in population impact and change volunteerism and provides a guide to the growing bibliography and professional literature concerned with volunteerism and volunteer management.

INTRODUCTION

Museums and related institutions have a long tradition of volunteer participation. Many art museums and historical societies or sites were founded by their original volunteer corps. The primary mission of most institutions, “to collect and interpret” artifacts, generally relies on individuals presenting information to the public. That function is often shared among staff and different groups of volunteers. Volunteers serve many functions behind the scenes in institutions.

The contemporary movement to transform museums, like libraries, into culturally competent services also relates to volunteerism. The professional organizations in both fields recommend expanding the recruitment and use of volunteers from different age groups, from adolescence to senior citizens, and from the full range of communities and populations served (or targeted) by the institutions. Volunteers are seen more and more as change agents. Concurrently, the field of volunteer management has developed into a professional offshoot of nonprofit management.

HISTORY AND TRADITIONS OF VOLUNTEERISM

Volunteerism is considered a quintessential value in American culture. It has been linked to most political and social movements of the last three centuries and the literature that documents them. Volunteerism is an inherent factor in the social mission of museums and related institutions, that philosophy which distinguishes a museum from a collection. There are hundreds of definitions of volunteering, as that word is used in different contexts (see the Map of the Volunteer World on the Energize.com Web site). The social sciences study volunteering as it reflects and impacts on American life.^[1] The phrase “museums and related institutions” refers to museums,

historical societies and sites, parks, botanical gardens or arboreta, zoos and aquariums, children’s museums, and science and technology centers, as well as similar mission-driven organizations that display, preserve, and interpret artifacts or sites.

SERVICES TO PUBLIC

“Smile Desks”

The most common, traditional volunteer service is in orientation and greeting. There are “smile desks” at the entrances to most museums, in common with hospitals, libraries, public buildings, and many performing arts nonprofits. Typical statements of responsibilities include “welcome and directing the public, hand out support materials and answer questions about the grounds, programs, history and facilities.”^[2] As audiences change, “smile desks” are frequently staffed with volunteers able to answer questions and distribute information in multiple languages, learning modes, and such responses to Americans with Disabilities Act accommodations as Braille and large-print publications.

Many of the efforts to expand visitorship result in a parallel expansion of service points and hours. Museums with large education programs may have separate entrances for class visits. Free nights and concerts designed to attract young adults, “Gen-X and -Yers,” require additional “smile desks” and the volunteers to staff them.

In some institutions, the “smile desk” also serves as an admission desk or shop, which can require volunteers to handle funds. Responsibilities may also include institutional development services, such as selling memberships and donation forms. Other public service points that may require volunteers to handle identification documents or cash equivalents (credit cards, etc.) are distribution points

for the various forms of audio guides. This contentious issue may become moot if museums switch to audio content for visitors' own electronic equipment (cell phones, PDAs, etc.).

SERVICES SPECIFIC TO MUSEUMS

In general, docents are volunteers who have been trained by the museum professional staff to give tours of exhibitions, permanent galleries, or sites. A typical statement of the rewards of docent service can be found on the Oakland Museum site's volunteer page: "It's the excitement that comes with learning from top professionals in your chosen field. It's the opportunity to make new friends with people who have similar interests. It's being part of a great institution. Most of all, it's helping to ignite a spark in a young person's imagination, or the pleasure of leading visitors toward making discoveries that bring new insights about life in our great state."^[3]

Docents in Art and History Museums

Docents are required to obtain extensive training in the content and context of the collections, exhibitions and gallery artifacts, and in the educational philosophy of the institution. For example, the information for prospective docents in the Bruce Museum (Fairfield, Connecticut) Web site specifies that they be "interested in giving tours that generate conversations with their audience through questions (inquiry-based)," as well as being "the Museum's ambassador to the public [and] leading groups of children, teens, and/or adults."^[4] Training schedules vary, but generally include 1 year of intensive classes and observation, with required continuing education and curatorial talks.

Gallery Interpreters in Science Museums

In addition to docents, who are trained by the institution, science museums and centers often use young or retired scientists as gallery interpreters for specific exhibitions or projects that relate to the docents' academic field. They generally receive orientation to the exhibit or gallery and training in the educational style preferred by the institution, but not the general classes required by art and history museums.

Volunteers in Historical Societies

One set of functions that are associated with historical societies, houses, and sites are the use of large numbers of volunteers as costumed interpreters and reenactors. Their participation is vital since they provide not only large numbers, but also the range in ages needed to duplicate the extended families in historical populations. Institutions that recreate communities at specific periods in history engage both paid staff and volunteers to serve

specific roles or trades and seek out community members who know and can demonstrate those processes in the appropriate period manner. Connections are made through the modern-day equivalent, whether nonprofit based, such as 4-H Club members serving as farmers, or commercial, such as a knitting store or class providing spinning or knitting demonstrators. They are then trained in historical methods of production and in museum theater techniques of maintaining character.

Historical sites which are associated with battlegrounds or specific events require large number of volunteers as reenactors. Although they can also provide regularly scheduled services, they are most in demand at annual festivals and commemorations. The American Association for State and Local History's Technical Leaflet on *Planning Commemorations*^[5] credits volunteers as the "most important source of extra labor," providing reenactors and interpreters, but also law enforcement, medical staff, and support services. The authors, Andrew Dupstadt, Rob Boyette, and Sgt. Damian J.M. Smith, recommend partnering with local military organizations, ROTC programs, and local civic groups to obtain the volunteers.

Botanical Gardens

Botanical gardens frequently use volunteers as on-site demonstrators, modeling correct methods of garden preparation and maintenance or woodland rehabilitation, as appropriate to their sites. These institutions have also partnered with related local organizations, such as parks conservancies and outreach programs, to work with community gardening programs, *casitas* farming, or park restoration. A library of model volunteer manuals and application forms can be found on the Web site of the professional organization, <http://www.publicgardens.org>. In many urban centers, these projects serve as community access points (see below).^[6]

Additional Public Services

As nonprofit institutions increase partnering to improve community service, more opportunities are made available to volunteers that do not specifically relate to museum functions. These "floating" services with partnership cultural institutions generally focus on mentoring or enriched reading, literacy, and other forms of homework assistance, often involving before- or after-school programs. These services are discussed further in the section on community access.

INTERNAL SERVICES

Institutional Advancement

Volunteers also support the institutional advancement functions of institutions. They assist in fundraising

activities through event planning, invitation addressing, and acquisition of in-kind donations for events, especially auctions. In smaller institutions, they often manage membership services and communication. The cyclical relationship between volunteerism and membership is analyzed in the AASLH Technical Leaflet #237, "Membership Matters: Establishing a Vital Membership Program in Your Museum" (2007).^[7] Members become volunteers and provide contact information and service for membership drives. The required skills range from attractive handwriting to knowledge of computer hardware and software. As more volunteer applications are available online, institutions are increasing the detail provided for volunteering opportunities and the skills that are required. The Wave Hill application, for example, offers garden-specific and "indoors" opportunities and differentiates among a gallery attendant, business office assistant, development and membership assistant, family art project assistant, public program administrative assistant, public program assistant, public relations assistant, [and] shop attendant."^[11] Additional paraprofessional service can range from carpentry and embroidery, for a historic house, to gardening.

Museum Professionals as Volunteers

As the impact of the 2005 hurricane season on New Orleans and the area became known, the museum community itself organized corps of professionals giving volunteers service. Museums Helping Museums: A National Relief Effort for the Gulf Region linked the American Association of Museums (AAM) with affiliated and regional organizations of museums. A related effort was made by the American Association for State and Local History and American Institute for Conservation to form the History Emergency Assistance Recovery Team project. Together, these professional organizations, as well as Heritage Preservation, rescued artifacts, buildings, and staff in the impacted areas and provided models and professional education for disaster planning and recovery for the field.^[8,9] Many regional museum associations and related organizations have annual volunteering projects connected to their annual meetings, such as the Mid-Atlantic Association of Museum's "White Glove Gang," which sends registrars, conservators, and collections management staff to local small or understaffed museums for 2 days of service.

THE CHANGING FACE OF VOLUNTEERS

"Women's lib," the migration of women into professional careers, was considered a seismological sociological shift which resulted in studies of volunteers and their motivations. Challenging the widely held assumption that young adult women volunteered because it was expected of them

has resulted in literature which focused on volunteering as a means to serve self-expression and self-esteem (as discussed in Susan J. Ellis, *The Volunteer Recruitment and Membership Development Book*, 1996).^[10] More recently, studies of volunteerism have developed in parallel to visitor studies, resulting in empirical evaluations of volunteer expectations and motivations across gender^[11] and age categories.^[12] While very important in understanding volunteerism in American society, they have not specified museum service at all, but are more likely to lump it under "other." In addition, those studies that differentiate between "community action" and "civic engagement" do not specify into which category museum service falls.

FUTURE TRENDS

The Corporation for National and Community Service, in partnership with the Bureau of Labor Statistics and the U.S. Census Bureau, produces "a detailed breakdown of America's volunteering habits and patterns..." in *Volunteering in American: 2007 State Trends and Rankings in Civic Life*.^[13] In this most recent edition, the authors identify three age groups driving the growth in volunteering from 1974 to 2006: young adults, midlife adults, and older adults. (Introduction, pp. 3–4).

Young Adult Volunteers

The use of young adults as service providers has grown in libraries and cultural institutions. Many now put in hours of community volunteering for service organizations, such as the National Honor Society, graduation requirements, or such cultural coming-of-age traditions as B'nai Mitzvah programs. Museums and related institutions currently make up a very small percentage of teen volunteering opportunities.^[14] However, museums have developed and documented many creative programs to target and facilitate service by young adults. An early model for programs was provided by YouthALIVE (Youth Achievement through Learning, Involvement, Volunteering, and Employment), a 1991–1999 initiative of the Association of Science and Technology Centers (ASTC) with support from the Wallace-Reader's Digest Fund. Recognizing the participants in youth programs "develop intellectually . . . gain social competence . . . and learn about the world of work," ASTC institutions were urged to develop programs with adolescents. They were trained for visible volunteering positions, which included explainers/interpreters, who work in the galleries "involving visitors more directly with the exhibit by discussing concepts, answering questions, and providing assistance with the operation of exhibit" and demonstrators, who "work with mobile carts of stations in public areas where they lead activities."^[15]

Professional periodicals in both the library and museum fields have actively promoted the use of adolescents as volunteers in a variety of roles. The most reported in libraries and organizations that partner with libraries have been literacy and homework help programs that target adolescents to work with their peers and younger children. The American Library Association's guide to *Creating a full-service homework center in your library* (Cindy Mediavilla, 2001) described model programs in Minnesota, Queens, New York, and California, which use high school and college students provided with pay, no pay, and service learning credits. Elizabeth Lai wrote about the Toronto Public Library's model program for teens as successful literacy volunteers for reluctant readers in "The Buddy System" in *Children and Libraries*.^[16]

High school students are also now found in advisory councils for art and history museums and related institutions and serve in educational roles in galleries. In *Museum News* (September/October 2005), Deborah Schwartz analyzed programs in art and science museums across the country.^[17] The teenagers' roles in the museums include gallery explainers, peer docents, and advisory councils, as well as virtual volunteering (see below) in technologically advanced institutions. She points out that museums can attract adolescents with authentic experiences coupled with flexible informal learning opportunities, but that staff must be prepared and committed to the projects. The article, which was based on a panel presented at the 2005 AAM annual meeting, provides a list of 18 model programs across a range of institutions.

Midlife Adults

The Corporation for National and Community Service tracked a 30 year rise in volunteering by midlife adults (which they defined as 45–64 years old) and credited it to Baby Boomers. An analysis of this report published in *New York Nonprofit Press* (April 2007, p. 14) credited Boomers' education level and propensity to have children later in life. "Once their children leave, Baby Boomers could maintain relatively high volunteer rates because of the higher education levels and expectations that they will work later in life than previous generations."^[18] The highest retention rates were for volunteers who perform management activities ("such as strategic planning, volunteer management and coordination, and marketing"), rather than active public service, such as tutoring, mentoring, and coaching. The report recommended matching volunteers with appropriate and challenging assignments and provided professional development opportunities for volunteers ... to increase and sustain volunteer participation." These factors favor museum volunteer docent programs, which tend to require continuous training.

This population also gained from the rising trend in corporate support for cultural and service nonprofits—providing support for active volunteering, rather than, or as well as, funding. This trend grew from practices in specific industries, such as telecommunications and Silicon Valley, and has become widespread. Some firms target individual institutions or providers and design team-building volunteer activities for their staff. Others provide work-release, flex time, or annual leave programs for an employee's own choice of institutions or providers.^[19] Midlife adults also provide services through "virtual volunteering" (see below).

Older Populations

Volunteering in America 2007 notes that the volunteer rate for older adults (65 and older) increased over the last three decades. Volunteering offers social contact and a community of respect for older adults without impacting on pension or Social Security income. Longer life expectancy is expected to add to this trend, although it may be balanced by delays in retirement ages.

It is necessary to pay attention to services and access issues for volunteers as well as visitors. Age-related changes in vision, hearing, and mobility could have precluded older populations from volunteering, but museums now have much more information and access to services to provide accommodations that facilitate their continuing participation. Since museums and related institutions have 10 years of experience developing accommodations for visitors covered by the Americans with Disabilities Act, they can serve in leadership roles in working with volunteers with late life and ADA challenges.

VOLUNTEERS AND COMMUNITY ACCESS

Over the last decade, the progressive library literature has focused on public libraries as points of entry for new users, new immigrants, and new populations into their communities. Camilia Alire and Orlando Archibeque's *Serving Latino Communities: A How-To-Do-It Manual for Librarians*, 1998, exemplifies guidebooks for this movement toward culturally competent institutions. As they pointed out, institutions are expected to provide services that had previously been supported by other nonprofit or governmental entities, among them, English as a Second Language, adult literacy, citizenship and GED training, as well as immigrant law advisories. They provide a list of tips for recruiting Latino volunteers which can serve as a model for all volunteer managers in a much wider range of institutions. It begins "check out your current staff," to which we can include current volunteers; enlist the help of formal and informal community leaders; work with other institutions, from senior

citizen centers to recreation centers; and ends “invest in your young adults.”^[20]

Through partnerships, museums and, especially, urban historical societies have joined or supported libraries and immigrant-specific programs. Institutions and staff who had committed themselves to creating dialogic museums and the goals of civic engagement had long been promoting community advisory groups for facilities, interpretation, and exhibition planning. The 2002 issue of the *Journal of Museum Education* (volume 27, nos. 2&3), for example, focused entirely on community liaisons, community involvement, and off-site community programs. In AAM staff members Kim Igoe and Alexandra Marmion Roosa’s report on the AAM’s Museums and Community Initiative, they referred to volunteering in the “limitations of museum” section, citing complaints about “a homogeneous staff and volunteers” (p. 19).^[21] In response, museums have adopted from public libraries the important role of community connectors—advising the institutions to the community’s needs and notifying community members of the institutions’ willingness to serve. Most institutions use volunteers in these roles, but are, whenever possible, guiding them into professional training.^[22]

VOLUNTEER MANAGEMENT

The field of volunteer management itself has grown concurrent both with the changes in the volunteering population and the rise of academic study of nonprofit management. James Fisher’s *Leadership and Management of Volunteer Programs* (San Francisco: Jossey-Bass, 1993) cites S. J. Ellis and K. H. Noyes’ description of the three “historical categories of volunteer leadership: first, the member of a volunteer groups selected to be the leader. . . ; second, the paid staff person who supervises volunteers as a secondary responsibility. . . ; third, the staff person, full or part-time, paid or unpaid, whose primary function is to coordinate the work of volunteers.”^[23]

The rising number of volunteers who have or had had substantive professional careers is believed to have pushed the professionalism of management. The field mirrors most of the concerns of management and administration, including policies, risks, job or task descriptions, screening and selecting volunteers, supervision, assessment and ethics. Fisher, Ellis, and Noyes (now Noyes-Campbell) have written extensively on the field of volunteer administrators for publishers and imprints devoted to nonprofit management. Many of their examples relate to medical and community-based organizations, not museums. The American Council for the Arts and the AAM Volunteers published a standard text, a handbook for volunteer program administration specific to museums and related institutions in 1993. The AAM has updated it as *Transforming Museum Volunteering: A Practical Guide for Engaging 21st Century Volunteers*, by Ellen Hirzy. Online resource

libraries of special value to the field of volunteer management can be found on <http://www.energizeinc.com> and <http://www.managementhelp.org>.

IMPACT OF THE INTERNET

The Internet is changing the way people use libraries and museums. But the ways that institutional Web sites can be used to prepare for visits has not resulted in less need for volunteers. It has augmented and facilitated volunteer management. In her “Volunteer Line” column, Bonnie McCrae wrote on using the Internet for recruitment and training of volunteers, citing many resources for management, free technical support, and training.^[24]

The Internet has spawned a new group of volunteers available to cultural institutions. An additional change facilitated by the Internet lies in the growth of referring organizational sites that offer potential volunteers with a menu of opportunities for single-time or long-term commitments. In some areas, they are independent screening sites; in others, they are services of municipalities or nonprofits with wide-ranging projects. In the online version of *Library Journal*, the WebWatch section provides descriptions of three kinds of Internet-based services for volunteerism—general Web sites for nonprofit management that provides information for potential volunteers and sites that target specific age groups or professions.^[25]

“Virtual volunteerism” began in the IT field as programmers and other professionals donated their services to cultural and community nonprofits for the development of data bases, systems, and Web sites through TechSoup.com, NetAid.org, serviceleader.org, and similar projects. The term also now includes the virtual community that assists institutions through less specifically technological skills, such as researching and database preparation. Conhaim points out that these people can include “nontraditional” volunteers, who “travel too much . . . , have conditions that interfere with their mobility, [and] have unusual work schedules.”^[26] Jayne Craven has emphasized the value of virtual volunteers to institutions with her columns on Coyote Communications and TechSoup.^[27]

RESOURCES

The following institutional Web sites can provide helpful information, models for programming, and additional links.

General organizations for museum service:

American Association of Museums (<http://www.aam-us.org>)

Standing Professional Committee on Diversity in Museums (<http://www.aamdivcom.org>)

Affiliate organizations:

American Association for Museum Volunteers (<http://www.aamv.org>)
 American Association for State and Local History (<http://www.aaslh.org>)
 American Public Gardens Association (<http://www.publicgardens.org>)
 American Zoo and Aquarium Association (<http://www.aza.org>)
 Association for Living History, Farm and Agricultural Museums (<http://www.alhfam.org>)
 Association of African American Museums (<http://www.blackmuseums.org>)
 Association of Art Museum Directors (<http://www.aamd.org>)
 Association of Children's Museums (<http://www.childrensmuseum.org>)
 Association of College and University Museums and Galleries (<http://www.acumg.org>)
 Association of Railway Museums, Inc. (<http://www.railwaymuseums.org>)
 Association of Science and Technology Centers (<http://www.astc.org/resource/youth>)
 International Museum Theatre Alliance (<http://www.intal.org>)
 Museum Trustee Association (<http://www.mta.org>)

Organizations for volunteers:

Action Without Borders/Idealist.org (<http://www.idealists.org>)
 Network for Good (<http://www.networkforgood.org>)
 Senior Corps (<http://www.seniorcorps.org>)
 USA Freedom Corps (<http://www.freedomcorps.gov>)

Organizations for volunteer management and/or training:

Association for Volunteer Administration (<http://www.avaintl.org>)
 Energizeinc (<http://www.energizeinc.com>)
Information Today (<http://www.infotoday.com/linkup>)
 National Docent Symposium Council (<http://www.docents.net>)
 (<http://www.Philanthropy.com>)
 Volunteer Management Resource Library (<http://www.managementhelp.org/staffing/>)

CONCLUSIONS

Cultural institutions are increasingly reliant on volunteers to serve the public, serve the institution, and present the institution and its mission to the public. Volunteerism provides institutions with their most immediate response to

societies' trends. Museums and other cultural institutions are developing an independent literature on volunteering and volunteer management, but the specific needs and opportunities of cultural volunteering have not yet been the focus on empirical studies. It remains a challenge to define institutions relationships with their volunteers, communities, and stakeholders.

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Wayfinding and Signage

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Abstract

The mental processes, physical elements, and materials involved in wayfinding and wayfinding signage are explored. Wayfinding is defined, and thematic and physical wayfinding are distinguished. The professions doing wayfinding design are described; copious examples of such design are provided. The importance and character of signage are developed, and the histories of both wayfinding and signage are briefly described. Detailed information on common types of substrates and additives for both fixed-content and nonelectric changeable-content signs is provided in tabular form.

INTRODUCTION

There are an estimated 117,000 libraries and 17,500 museums of all kinds in the United States today.^[1] Through all those public institutions, and so many others, there is a steady stream of visitors, some of whom have no idea how to get where they are going, or how they will find what they want when they get there. Resolving these shortcomings is the job of wayfinding and signage. Wayfinding is a research, design, manufacturing, and installation discipline practiced mostly by professionals for the benefit of all people who need to move around in the digital and real-worlds.

In its practical application, wayfinding is a coordinated program. This program includes how people think about their institution and its visitors, what programs and information are made available to those visitors, and what physical spaces and objects are provided for visitors' wayfinding use. Signage of all types is an important part of any wayfinding program.

use of color, lighting, and type styles might set the theme for an exhibit, separating it from other spaces and uses. In a library the themes of the spaces are more straightforward.

Physical wayfinding deals with a person's understanding of, orientation to, and navigation and movement through a space. This entry will deal with physical wayfinding, primarily in libraries and museums, calling it, simply wayfinding. Many of the concepts and principals discussed can be applied to thematic wayfinding as well.

In short, wayfinding can allow an institution to present a welcoming attitude toward its visitors. This is referred to as an institution's *visitability*. *Visitability* encompasses every aspect of an institution's amenities, offerings, and creature comforts no matter how small or large, and addresses whether or not they are sufficient and of high enough quality for all visitors.

Wayfinding can be defined as the *mental processes* and *physical elements* needed for people to recognize and understand an environment, orient themselves, and move around.

Mental processes

Research in neuroscience beginning in the early 1990s has allowed researchers to pinpoint which areas of the brain are functioning during various wayfinding activities. Using functional magnetic resonance imaging (fMRI) and positron emission tomography (PET) scanning techniques, researchers are able to "see" brain function in real time as test subjects perform recognition, orientation, and navigation tasks in both familiar and unfamiliar virtual environments.^[2,3] For example, it was found that the right hippocampus and right caudate nucleus areas of the brain are associated, respectively, with knowing and navigating place locations accurately, and doing so quickly.^[4]

The wayfinding process is different for different people. All humans, however, use their senses and various parts of their brains to follow two broad patterns while

WAYFINDING

Definition and Types

Wayfinding should be thought of as a coordinated plan of policies, physical elements, and programs designed to make that facility's form, structure, contents, amenities, and offerings recognizable and accessible—or "transparent"—to the visitors. It can welcome visitors, ease their new-space anxieties, tell them where they are, guide them to where they are going, and, most important, remove any barriers that might get in the way of visitors' receptivity, involvement, enjoyment, and learning.

Two forms of wayfinding are "Thematic" and "Physical." Thematic wayfinding deals with why a person is in a place, and what that person might expect. In a museum, the

wayfinding through a space. The first is recollection of other experiences. The second, called topology, is a recognition and use of enclosure, order, proximity, and separation in spatial relationships.^[5] Along with these patterns, wayfinding in general has two parts: making decisions, and moving. Decisions on how to move are based on the mode of movement to use, time constraints, movement speed and direction, and what route to follow.^[6]

Within these patterns and parts, the five steps in the wayfinding process could be listed as follows:

1. Recognition. What is this place? What's familiar? What's unfamiliar?
2. Orientation. Where am I? Where am I going?
3. Understanding. Why am I here? What will I do here?
4. Navigation. How will I get there? How will I move next? How will I get back?
5. Debriefing. What has been the outcome of my visit? Would I recommend it or do it again?

The sequence from 1 to 3 has a thematic component, and can sometimes proceed in another order. Some of these processes occur remotely, before a visitor ever leaves home. The acronym created by the first letters of the five wayfinding processes is R-O-U-N-D. This is a useful way to remember that any visit involves not only the whole of each visitor's abilities, but also starts and ends in the same place.

Museum visitors practice recreational wayfinding,^[7] which may include specific objectives or destinations, but is primarily to explore and enjoy a setting. Library visitors are much more likely to practice directed or goal-oriented wayfinding activities combined with occasional explorations.^[8] During any activity, people sort out their surroundings by forming cognitive maps.

The Cognitive Map. The most important mental process practiced by humans while interacting with spaces is cognitive mapping, described as "...the process by which an organism makes representations of its environment in its brain."^[9] All people form "maps" in their minds of the environments they experience. When visiting a familiar place, people form cognitive maps before they begin. In unfamiliar spaces, maps can only be formed on the go.^[10] These "maps" have an enormous impact on any visitor's behavior. The formation process has two parts: the person's background knowledge and his or her experience of the environment.

Background knowledge refers to information, experiences, and skills people carry with them. These include the following categories common to all humans:

1. Biological. Bilateral symmetry (the two sides of our bodies are more or less mirrors of one-another); two distinct genders—with differences in wayfinding strategies;^[6] balance; major sensory organs except touch located in our heads; and bodily functions.

2. Environmental. Spatial and aesthetic sensibilities; and the human conditions that new spaces cause anxiety, and order is comfortable while disorder is not.^[11]
3. Cultural. Conventions and ethics; language; behavior; and architectural shapes and landmark recognition.
4. Personal. Level of education; degree of interest in a subject; physical and mental abilities; social skills; and age.

Each person's mental map is unique based on his or her abilities of sight, hearing, smell, taste, touch, reasoning, and sense of time; and each map serves the orientation and navigation needs of its creator. Therefore, mental maps do not necessarily resemble conventional maps. A mental "picture" of a place created by a person who is blind, for example, would be far different from one created by a sighted person.

Physical elements

The physical elements available to a visitor for purposes of wayfinding can be grouped into four general categories: spaces, structures, objects, and content. They are hardly ever used in isolation, one from another, nor are they necessarily encountered in that order.

Properly designed and sequenced, physical elements allow visitors to undertake their own personal mental processes, and progress from introduction to decisions to action in a smooth continuum. To facilitate these activities, spaces, structures, objects, and wayfinding content must be "legible." Legibility means presented clearly and plainly, and able to be read. Since physical elements are meant to be accessed, approached, entered, moved throughout, and exited, it is necessary that they possess unmistakable *positive attributes* in order to function well.

Positive attributes of physical elements in alphabetical order, with examples:

1. Circulation. Logic of flow plays an important part in visitors' comfort, understanding, and use of space, and any institution's visitability and marketing effort. Circulation necessarily proceeds from the macro (airports, highways, parking lots) to the micro (exhibits, rest rooms, benches) by way of:
 - a. Paths. The routes available for movement.
 - b. Edges. The boundaries or barriers between regions or elements.
 - c. Districts. Identifiable regions into which, and out of which, visitors can move.
 - d. Nodes. Locations on which visitors can focus and into which they can enter. They may be intersections, activity centers, or convergences of paths.
 - e. Landmarks. Points of focus, like nodes, but primarily important to visitors at a distance for direction or orientation.^[12]

2. **Clarity.** Understanding of the form and function of practical elements should be easy to acquire: Information should be presented in languages or symbols understandable by the majority of visitors.
3. **Cleanliness.** Clutter and dirt can be disorienting, unappealing, or dangerous: Clean rest rooms, for example, are essential for visitors' well-being, and are an important part of an institution's marketing and visitability.
4. **Clues.** Functioning parts need to have their operation apparent in their design: It should be obvious from the look and feel of a door's handle, for example, whether it is meant to be pushed, pulled, or turned.
5. **Comfort.** An environment should be psychologically and physically easy to use, and provide creature comforts: Low sound levels usually calm and soothe people, and contribute to a facility's marketing and visitability.
6. **Communication.** Physical elements can be designed and located in order to telegraph their functions: Large ornate centrally located doorways say "grand entrance."
7. **Community.** Environments should be designed with an overall sense of inclusion: Physical features designed to accommodate visitors with disabilities commonly function better for all visitors. This is the basis of *Universal Design*, defined as: Physical sites, systems, and attitudes that are designed and built to accommodate as wide a range of people as possible with the fewest exceptions or special cases.
8. **Completeness.** If a facility needs something that is not there, it is incomplete: Providing staff members for wayfinding assistance is fairly common, but if the personnel are not properly trained, supported, equipped, dressed, and positioned for the task, their presence and function are incomplete.
9. **Composition.** Environmental elements should be shaped, sized, scaled, colored, positioned, oriented, and related to one another in ways that enhance visitors' awareness and improve visitor movement: Any given wall can be an impediment to movement, or a channel for it.
10. **Concept.** Having a general theme for a physical place enhances the visitor experience and an institution's mission and visitability: During the nineteenth century, the concepts of "library" and "museum" were imprinted on the conscience of Americans using imposing architecture.
11. **Conciseness.** An environment should include all the information needed but no more: Simpler is better.
12. **Conservation.** Physical elements can be installed to increase public awareness of existing problems; to prevent environmental degradation of sensitive areas by visitors; and, by using sustainable and nontoxic materials, as ecological solutions in themselves.
13. **Consistency.** Once an element is presented in a certain way, that presentation should remain the same throughout all uses: Identical waste receptacles placed on the right side of each public door would be an example of a constant.
14. **Conspicuousness.** Elements should be sized and placed according to their use: Interior spaces intended as gathering areas should be large, centrally located, and easily accessed by multiple routes; restrooms can be "tucked away" as long as paths to them are clear.
15. **Contrast.** Elements with different functions should be distinguishable as such: A glass door should not look like a glass window; light gray words do not show up on white backgrounds.
16. **Control.** Periodic evaluation of a facility is necessary to stay informed about subjects such as safety, security, cleanliness, and relevance to visitors: Evaluation must be accompanied by a willingness to update obsolete or dysfunctional elements as needed.
17. **Conventions.** Conventions are commonly agreed upon standards or rules: Using yellow as a warning color is an example of a convention.
18. **Correctness.** Elements should be as accurate as possible: The phrase "visitor services" has come to mean information available about attractions outside a facility. It is used incorrectly, then, on signage to refer to amenities inside a facility, such as a food service or restroom.
19. **Correlation.** Wayfinding visuals should agree with the facility they represent in overall layout and in their details: A 45° left turn would not correlate with a sign arrow pointing 90° left.
20. **Creativity.** A pretty, innovative, or engaging environment will enhance visitor appeal, prolong involvement, and stimulate absorption: A willingness to break new ground in design approach, materials, and function is important.
21. **Current.** Environments should be kept up to date: Evolving, repairing, and improving might all be needed to meet the needs of visitors and maintain an institution's visitability.^[13]

These positive attributes should be incorporated into the four general categories of *Physical Elements*:

Physical Elements categories in order from the macro to the micro:

Spaces. We humans have a long background of relating our location to that of the sun, moon, and stars. In outdoor settings that relationship is used, sometimes unconsciously, for orientation. On a more regional scale, landmarks such as mountains, hills, and rivers offer the same opportunities. Locally, visual recognition of landmarks and vistas can impact how a

visitor recognizes a place, chooses a direction, or follows a route.

Structures. Built environments fall into only a few broad categories of usage: residential, commercial, industrial, recreational, educational, medical, and governmental. Generic elements used to sculpt structures for wayfinding include spaces, shapes, relative scale, colors, paths, textures, boundaries, sight lines, lighting, sound, and temperatures. These qualities are embodied in specific elements such as doors, windows, walls, or stairs. To the largest extent possible, these elements should be designed and constructed as part of a master wayfinding program, adhere to the qualities of “legibility,” be aesthetically pleasing, and be composed of sustainable and nontoxic materials.

Objects. Objects refers to any built or manufactured element smaller than a structure. This could include something as large as an information desk or as small as a doorknob. This also includes signs and printed materials of all kinds. As with structures, all objects should be designed, installed, and operated as part of a master wayfinding program, adhere to the qualities of “legibility,” be attractive, and be made of sustainable and nontoxic materials whenever possible.

Content. In order to function for wayfinding, spaces, structures, and objects need content. Beside the general elements of color, shape, etc., content also refers to more explicit components in the environment as well as on published pieces and the Web. Virtually all content is rendered in digital form at some point before being used in its final form. There are five general categories of content:

1. Graphics. Drawings, diagrams, schematics, and other representations are more commonly used for exhibits and displays, but occasionally come in handy for wayfinding.

A map is the most common nonsymbol graphic used for wayfinding. It is also the most popular wayfinding tool sought by visitors after a knowledgeable staff member.^[14] Map design and illustration should conform to the 21 positive attributes listed above. There are only two basic illustration styles for all maps: a plan view from directly overhead and one of a variety of bird’s-eye-views from some side angle. Varieties of these two styles is common. See Fig. 1 for an example of a combination view map. An attractive map also works well as a branding and marketing tool and enhances an institution’s visitability.

2. Images. Photographs, videos, scale models, and reenactments are popular for printed pieces, computer installations, kiosks, and introductory theater presentations. They are used less for non-electronic wayfinding signage, but are used extensively in interpretive installations. See Fig. 2 for a scale model.

3. People. A knowledgeable staff member, properly trained and located, can be the most successful component in an institution’s wayfinding program, and is the source of information most sought after by visitors to museums and libraries.^[14]
4. Symbols. Recognized standard colors and graphic symbols for accessibility, activities, direction, lodging, services, transportation, and warning are essential for legible communication, and particularly for comprehension by people who do not read the written language in any given location.^[15]^[16] Institutional logos or corporate marks can also serve as devices for identity, branding, promotion, marketing, and enhancing visitability. See Figs. 3–5.
5. Text. The written word constitutes the bulk of content when signage, printed media, and electronic devices are considered. The use of text on wayfinding signs is usually minimal and in large sizes. Several requirements for appropriate type styles, contrast with background, height-to-width ratio, stroke width-to-height ratio, and height-to-viewing distance are set down in the Americans with Disabilities Act (ADA) of 1991, and other sources.^[17]

People and Wayfinding

Who needs wayfinding?

Anyone who moves about by any means in an unfamiliar environment needs wayfinding assistance, each according to his or her reasons for visiting, mental processes, and physical abilities.

It is important to emphasize that “visitors” does not just mean the customers who walk through the front door of a facility. Visitors must also include staff, volunteers, and service or materials suppliers. Due to their specific service and wayfinding needs, these various categories of people must sometimes share space congenially and safely, but are sometimes intentionally kept separate. All their wayfinding needs must therefore be successfully addressed. It is not good planning, for example, to provide wheelchair access at the front door, only to neglect an efficient means of refuse removal out back. All functions of a facility directly or indirectly impact visitors’ uses of that facility.

Who designs wayfinding?

Several professional disciplines have responsibility for understanding wayfinding behavior—vital for providing wayfinding programs and signage systems—and creating and installing spaces, structures, objects, and content suitable for use by visitors. Wayfinding is interdisciplinary, and these professionals often work in concert. These are

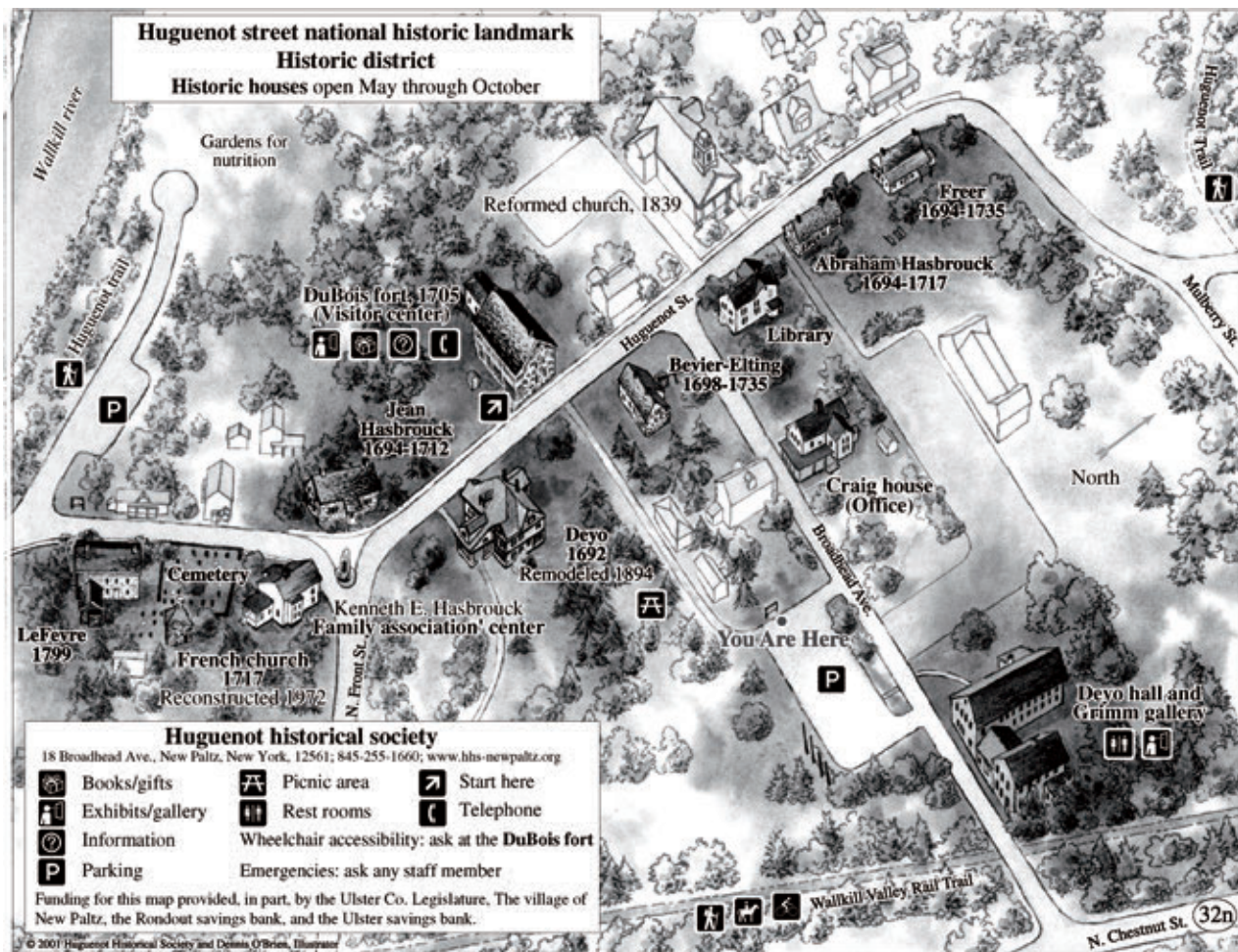


Fig. 1 You-Are-Here map of Huguenot Historical Society, New Paltz, New York. The layout is a plan view of the property, while the buildings are illustrated in a bird's-eye-view. Design by the author.

the most common professions, in broad categories, listed alphabetically:

1. Architects. People who are responsible for planning, designing, and constructing buildings, their mechanical systems, and their attending environs. Architects
2. Consultants. People called in to advise on a project due to their skill or knowledge in a specific

must be familiar with building materials, local and federal regulations governing all aspects of structures, use of space, and aesthetics.



Fig. 2 The three-dimensional tactile map of the U.S. Capital area used for orientation in the Capital Building, Washington, D.C.

Source: Photograph by the author.



Fig. 3 The four accessibility symbols required by the Americans with Disability Act of 1991(4). From left to right they are the international symbols of Accessibility, Access for Hearing Loss, Telecommunications Device for the Deaf (TDD), and Volume Control. There are thousands of other “standard” symbols available, worldwide.

discipline or area of expertise. Anyone involved in a project for an institution who is not employed there can be considered a consultant.

3. **Contractors.** People responsible for constructing a facility. They must have knowledge of materials, building practices, and regulations. The discipline can include carpenters, steel workers, plumbers, electricians, masons, or construction managers.
4. **Designers.** Plan and create spaces, structures, objects, or content in a specific discipline or area of specialization. Their output is, in turn, used by fabricators and contractors to build and install the designed elements. Designers can work in areas such as graphics, industrial products and processes, wayfinding, computers, fashion, lighting, sound, or automobiles.
5. **Engineers.** Responsible for the detailed structure, fabrication, and operation of any technologically complex object, environment, or process. They can work in disciplines such as aerospace, chemistry, communications, computers, construction, the environment, fluids, light, and sound.
6. **Fabricators.** Build and install components of facilities such as signage, exhibits, furniture, or cabinetry, rather than the whole facility. Fabricators must be

familiar with the materials and manufacturing processes of their discipline, and often have design experience as well.

7. **Landscape architects.** Concentrate primarily on everything outside of structures. This discipline does not concern itself only with land and plants, but can include creating all manner of outdoor facilities such as paths, walls, out-buildings, patios, and installations involving water.
8. **Planners.** Formulate strategies for short- or long-term change or growth in an area or institution, often incorporating programs, policies, and development as well as structures and other physical elements.
9. **Psychologists.** Study issues relating to the function of the human mind. They can operate in many disciplines. The most important for wayfinding is environmental psychology, which is focused on the relationship between humans and the physical world.
10. **Sociologists.** Study issues of human associations in groups such as societies and cultures. They, too, can function in one of several sub-disciplines, and as such, can contribute valuable insights into human relations with specific categories of public institutions.

History of Wayfinding

The many elements contained in modern wayfinding were not all developed simultaneously. Some, not surprising, are far older than others.

Maps. Maps are the oldest form of wayfinding communication, preceding both written and numeric language in the upper Paleolithic.^[18]

One of the earliest graphics that is clearly a map came from Nuzi in northeast Iraq, and dates to 2500–2300 B.C.^[19] Egyptians, too, developed a sophisticated tradition of measured mapping by 2000 B.C.



Fig. 4 A highway sign in Vermont showing international standard and locally relevant symbols and non-standard colors used together.

Source: Photograph by the author.



Fig. 5 The business logo for Atlantic Merchants, Mystic, Connecticut. This symbol was used much like most logos, on outdoor signage, stationary, bumper stickers, self-stick labels, and other uses.

Source: Design by the author.

Very little evidence exists that the Greeks, centuries later, had much time to advance the art of map-making on a local level, or contemplate itineraries, the forerunners to guidebooks and road maps.^[20]

The Imperial Romans were avid travelers, and, unlike the Greeks, had detailed *Itinerarium* (guide books) and to-scale you-are-here maps to assist them on their journeys. Caesar Augustus had a large version of a map of the entire Roman Empire produced by Agrippa around 19 B.C. engraved in marble in 7 B.C., and installed near the Pantheon. It is quite possible that this map and its copies throughout the Empire were the prototypes on which the first Roman *itinerarium* were based.^[21] By A.D. 200, *itinerarium* were produced on papyrus and leather-bound.^[22]

Two types of *itinerarium* existed in Imperial Rome. Of the first type, written guidebooks without maps, the best known is probably *Guide Book of Greece*, written between A.D. 160 and A.D. 180 by Pausanias.^[23] Pausanias was so thorough that his guidebook was still popular among nineteenth century travelers, and can be considered the direct precursor of the *Guide Bleus* and the guidebooks of Karl Baedeker.^[24]

Of the second type of *itinerarium*, maps with scant text, the lone existing example is an eleventh- or twelfth-century copy of a third-century original known as the Peutinger Map (*Tabula Peutingeriana*), named after Konrad Peutinger who discovered it. The map covers the Roman Empire from India to Britain. It was designed and constructed to fold and fit into a carrying case.^[25,26] The

Peutinger Map included accurate road distances, illustrated symbols representing different size cities, temples, lighthouses, spas, bathing facilities, forts, imperial residences, way-stations, and sketches of trees representing the forest regions of Germany and Syria.^[26]

Advancements in the skill of map-making all but ceased during the period from about 500–1000 A.D. For the period referred to as the Middle Ages, the Christian Church promulgated its own theories about the world, subjecting virtually every human endeavor, including representing the physical world, to its mindset. During this period, countless works of geography and cartography were suppressed or destroyed by church officials.^[27–31]

The tradition of the measured survey that had been almost lost in Western cultures since the fall of Imperial Rome reappeared in Europe between the ninth and twelfth centuries with the copying of the Roman treatises on estate surveying.^[32] The *Chronica majora* (1253) was an update of the Roman itinerary designed and illustrated by the English Benedictine monk Matthew Paris. At the same time this type of “strip map” was a more sophisticated version of the Peutinger Map style of illustration, it was the beginning of the future of European cartography.^[33,34]

Not long after, and continuing up to the present day, maps improved in accuracy, and depicted closer relationships to the world they represented. Thus, the strip map, as useful as it had proved for so long, gave way to a map style showing a truer network of roads. This tradition, of course, corresponded with the ever more complex matrix of roads available for travel throughout most of the world.^[35]

Wayfinding devices. The first known appearance of the wheel was around 3500 B.C. in Mesopotamia, with roads, bridges, way-markers, and road maps following shortly thereafter.^[36] There were also post stations at intervals manned by grooms, and containing itineraries—papyrus maps—showing distances between posts.^[37]

Like the Persian roads, Egyptian roads were dotted with posts to assist travelers.^[37] The Egyptian desert roads were marked with “stone cairns and also, it is suggested, by an occasional glyph that gave directions or distance.”^[38]

The Greeks employed a more rudimentary system of marking distances on their roads from that of the Egyptians by placing simple piles of stones, and, later, *hermae*—square stone pillars with busts of Mercury on top—in towns.^[39]

Traveling for pleasure and culture started in earnest with the Imperial Romans. As a result, wayfinding, including well-made roads, directional signage, mile markers, inns, guidebooks, “fast food,” and guides, were firmly established by the second century A.D.^[40] The Roman *Miliaria*, or milestones, are of particular importance as the grand ancestors of wayfinding objects. They were huge cylindrical columns of stone, usually over six feet high and weighing two tons or more, positioned on all Roman roads every 1000 paces (a Roman mile) after 123 B.C. They contained a wealth of information often including

the distance from the town where the road originated, the name and titles of the originating emperor, and sometimes the builders' names and completion dates.^[36]

As an important component of wayfinding, tourist guides in the ancient world were quite common.^[41,42] The Greek Herodotus (ca. 424 B.C.), for example, traveled extensively and relied on priests and locals everywhere he went for information.^[43] In another example, the city of Pompeii, when unearthed from its volcanic grave of A.D. 79, was found to be primarily a seaside resort town specializing in tourists and soldiers on leave.^[44] Under those circumstances, it can be assumed that there were ample guides on hand for all manner of assistance.^[45]

From approximately A.D. 500 to A.D. 1000, travel in the Western world was both sparse and hazardous: "Where the barbarians had passed, the roads, communication systems and inns that the Romans had built fell apart."^[46]

From around 1000 A.D. to the middle of the thirteenth century, travel for the benefits of pilgrimage steadily increased. By the fifteenth century travel for pursuits religious and secular were on the rise all over Europe and the Middle East. These travelers enjoyed businesses providing nearly all the wayfinding amenities of today's tourism: assistance bureaus, beggars, guidebooks, inns, outdoor signage, promotional literature, roadside fast food stands, digestive problems, travel agencies, and travel books.^[47,48]

Another way in which tourism and accompanying wayfinding evolved slowly during the eighteenth century, and more rapidly during the nineteenth, was in the number and relative affluence of the travelers. Also, during the eighteenth century, museums, zoos, and botanical gardens began opening to the public, while public libraries mushroomed in number and popularity during the nineteenth century.

SIGNAGE

Definition

The definition of "sign" is any object containing graphic displays of text and/or visuals intended to communicate information. This is a broad definition, and includes, in practical installations, a necessarily diverse array of stationary, mobile, non-electric, and electric objects.

See Table 1 for a listing of the most common signage substrate materials for fixed or changeable signs, content materials applied to substrates, and nonelectric changeable sign types.^[49] See Table 2 for expected outcomes of a successful wayfinding and signage program.

Two general design principals

Two overarching design principals guide the creation of wayfinding signage programs:

1. A system of wayfinding signs must have a consistent look throughout. This refers to structure, content, and placement. See Fig. 6 for an example of a signage program for the interior of a library.

Repetition and consistency of look and usage throughout a signage program is key to successfully funneling visitors in toward a facility, and guiding them through it. Imagery should be recognizable as visually and thematically consistent every time it is used, including a Web site, building graphics and signs, handout maps and brochures, and ID badges. To compliment any branding or marketing program this repetition and consistency should be incorporated into non-wayfinding uses.

Federal, state, and local regulations often dictate the size, design, and placement parameters within which a signage program is achieved, in whole or in part. Working within regulations requires familiarity with personnel and regulations, patience, flexibility, and innovation.

2. A wayfinding signage program should have elements that are plain, simple, uncluttered, and stylistically distinct from all other visuals throughout a facility. Complying with the regulations for proper use of signage set down in the Americans with Disabilities Act^[17] will go a long way toward achieving this.

History of Signage

Evidence for signs communicating specific information such as advertising a shop's wares seems meager until Dynastic Egypt. Egyptian shops did, on occasion, have signs advertising their products or services with inscriptions and visuals.^[50] The prolific Greek signage primarily took the shape of carved or painted images affixed to the outsides of various establishments. The images were designed and rendered to represent the wares or services offered within, and thus became the historic precedent for shingle signs as well as trademarks.^[51] See Fig. 7 for a modern example of both in one sign.

By the time of Imperial Rome, there existed about the same level of signage as a typical contemporary American shopping mall. Business identification, advertising signs, political and opinion placards, billboards, sporting marquees, graffiti, and banners competed for the attention of the public.^[52,53] Written and pictorial street signs were also common, but more often they were made of stone or terra-cotta relief and "let into the pilasters at the side of the open shop-fronts." Some streets even derived their names from signs of businesses displayed along them.^[50] This is very well documented because of the approximately 900 shop signs unearthed from the volcanic ruins of Pompeii and Herculaneum.^[52,53]

After 1000 A.D. The Roman pictorial tradition in signs had evolved in two ways. First, the relief and painted signs

Table 1 Most commonly used sign materials.

Category/ brand	Material contents	Strength	Durability	Look/sizes	Formation process	Compatible materials	Installation locations	Relative cost	Uses
Substrates^a									
A. Paper, <u>Illustration</u> <u>Board</u> , <u>Posterboard</u> , <u>Cardboard</u>	Paper, wood, cloth; sometimes recycled, sometimes plasticized.	Low	Short term	Matte, glossy, smooth, or rough depending on process. Paper: all colors Boards: most colors. Various sizes.	Water squeezed out of pulp mat with a binder rolled or pressed.	Wet or dry traditional media. Glued 2D/3D objects. Digital inks. ^b Self-stick products.	Interior mostly.	Low	Professional and amateur posters, notices, signs, announcements. Hung or folded self-standing. Recyclable.
B. Foam board	Polystyrene foam core, clay-coat paper.	Medium	Long term. Easily dented.	Matte surfaces. White, black, gray, several colors. Self- stick surfaces available. 4' × 8' sheets 1/8"– 1" thick	Extruded polystyrene core. Laminated both sides with high- quality clay- coated paper.	Wet or dry traditional media. Glued 2D/3D objects. Digital inks. ^b Self-stick products.	Interior mostly.	Low	Professional and amateur posters, notices, signs, announcements. Hung or folded self-standing. Recyclable. Cuttable, foldable for model making and display. Archival, flame retardant, and memory foam available.
C. Medium density overlay (MDO)	Exterior-grade plywood with high resin solid overlays. Phenolic on both sides, UV curing available.	Very high	Very-long term	Smooth surfaces Minimum grain. Wood color. 4' (w). 8', 10', or 12' (l). 5/16"–3/4" thick	Multiple wood layers glued under pressure. Coated.	Paint, coatings, self- sticks. Can be nailed, sawed, routed, and glued.	Exterior	Medium to high	For permanent installations.
D. Alucobond	Polyethylene core. Aluminum faces (85% recycled aluminum)	High	Very-long term	Virtually any color or finish; 4'2 × 14'2" sheets, 5'2" × 16'4" sheets, 3, 4, or 6 mm thick	Solid polyethylene core bonded to 2.02" sheets of Kynar system painted aluminum.	Can be folded, bent, cut, painted, or printed.	Interior or exterior	High	Architecture, display, signs, cladding.
E. Coroplast [Cloroplast]	Corrugated plastic	Low to medium	Long term	Varied surfaces; many colors; additives: anti- UV, flame retardant, anti- static/	High impact polypropylene copolymer extruded twin- wall corrugated sheets [<i>recycled material</i>]	Screen printing, paint, self-sticks. Can be die cut, cut, hot air/sonic welded, and glued into custom shapes/packaging.	Interior or exterior	Low	Packaging, display, signs.

F. Banner Vinyl (Vinyl/nylon) [Nylon]	Organic ethenyl (Combination) [Polyamide]	High	Long term to medium term (exterior use)	corrosion, custom colors, etc.; Widths to 106". 2–10 mm thick. Gloss/semi finish (Matte finish, woven look) [Woven, "rip-stop"]. Any color; Standard/custom sizes—16' width, any length.	Extruded strands woven to cloth.	Print inks, paints, self-sticks, appliques.	Interior or exterior	Medium	Signs, displays, flags, backdrops. Flame retardant.
G. Sintra, Komatex, Celtec	PVC plastic	Low to high (depending on thickness)	Long term	Matte surfaces, 12 homogeneous colors; 4' × 8', 5' × 10' sheets. 1, 2, 3, 4, 5, 6, 10, 13, or 19 mm thick	Closed-cell high-density expanded polyvinyl chloride sheets.	Can be heat/vacuum formed, bent, sawed, cut (to 3 mm). Print, paint (in some, products), self-stick, glued, screwed, riveted.	Interior or exterior	High	Signs, display, shapes, 3D products.
H. High impact styrene (Styrofoam)	Thermoplastic	High (Low)	Long term	Glossy surfaces. Clear, many colors; 4' × 8' sheets. 0.02", 0.03", 0.04", 0.06", 0.08", 0.1", 0.125", or 0.187" (Expandable foam) thick	Petroleum based polymer. (Expanded polystyrene)	Paint, self-sticks, sawed, cut, drilled, sheared, punched, heat/vacuum formed. (Molded)	Interior or exterior	Medium	Signs, esp. ADA, displays, 3D products (Insulation, packaging)
I. <u>Uvex</u> , <u>Gemex</u>	Cellulose, acetate, butyrate.	High	Long term	High-glossy faces, UV resistant; 4' × 8' sheets, 0.06"–0.25" thick. Film rolls: 0.003–0.03"	Cellulose modified by butyric and acetic acids. Non-petroleum, renewable resource.	Inks, paints, self-sticks, colorants.	Interior or exterior	Medium	For signs, displays, individual letters. As panels for illuminated signs.

(Continued)

Table 1 Most commonly used sign materials. (Continued)

Category/ brand	Material contents	Strength	Durability	Look/sizes	Formation process	Compatible materials	Installation locations	Relative cost	Uses
<u>J. Wood</u>	Pine, Cedar [Redwood]	Medium to high	Long to medium term (exterior use)	Coated/ finished to any luster; To 12" w × 6" thick 16" l	Cut, milled, cured trees. Sometimes coated or impregnated.	Self-sticks, ink, paint. Can be sawed, cut, sandblasted, etc.	Interior or exterior. Coatings extend life.	Low to medium	Signs, displays, 3D products, letters. Easy to work. [Used less frequently] Recyclable.
<u>K. Metal</u>	Bronze, brass, aluminum. [Steel]	High	Long term	Glossy, matte, brushed, textured surfaces; Shapes and sizes: standard/ custom by manufacturer.	Molded/cast formed from raw/ recycled materials.	Paint, self-sticks, printed, cut, drilled, sheared, punched, bent, sand/water blasted, molded.	Interior or exterior	High	For signs, displays, architectural/3D elements, bases for other materials, letters. [Magnetic]
<u>L. X-board</u>	97% postconsumer paper waste, organic adhesives.	High and crush resistant.	Long term (Interior)	Matte to glossy. White surfaces: 1200 (w) × 2440 or 2900 mm. 10, 12, 16, 20, or 32 mm thick.	Stiff paper surfaces bonded to a honeycomb interior.	Self-sticks, paint, print, laminated with veneers. Can be cut, sawed, and miter folded.	Interior	Medium	Signs, walls, 3D products, furniture. Recyclable.
<u>M. Paperstone</u>	100% FSC certified recycled paper, water- based phenolic resin with cashew nut shell binder, pigments.	High	Long	Grainless panels: 60" × 144". ¾", 1", and 1¼". 6 standard edges Custom by manufacturer.	Heat and pressure. Can be pressure "embossed" for signage.	Paints, coatings. Can be worked like hardwood.	Interior or exterior	Medium	Signs, esp. ADA. Counter tops and other architectural uses.
<u>N. Medium-density fiberboard (MDF, MDFB, Customwood, Craftwood) [Particle board]</u>	Soft wood fibers, binders, resins. Sometimes scrap/ waste wood, bamboo, glass, steel, recycled paper. [Larger particles, different glues]	High	Long term interior use, exterior when sealed	Grainless various surfaces or Green: moisture resistant. Red: fire retardant. 2.5–30 mm thick. Sizes standard/ custom by manufacturer.	Fibered materials combined with resins under heat and pressure.	Paints, inks, self- sticks, veneers. Can be sawed, cut, routed, etc., like plywood.	Primarily interior. [Not good with water/ humidity]	Lower than wood	Architectural/3D products, furniture. Signs, displays. Can be made from recycled materials and also be recyclable.

Surface additives

A. Adhesive vinyl	Polyvinyl chloride (PVC), plasticizers.	High	Long term (interior use).	Matte to glossy. Dozens of colors, clear, metallic, transparent; 2-7 mm thick. Rolls 15"-48" (w) × 5, 10, 50 yards (l).	Cast formulation mixed/poured onto a sheet and moved through a series of ovens. Calendered: No solvents. "Dough" is extruded/squeezed between rollers.	Can be printed or cut by hand or CNC machine, and applied to most surfaces. Comes with backing paper.	Interior or exterior	Medium	Letters, logos, shapes, large surfaces, windows (forward or backward) back lit surfaces
	Additives such as colors, UV absorbers, stabilizers, fillers. ^a Single adhesive surface. Comes without adhesive.		Medium (exterior use)						
B. Ink/paint #1 ^c (Solvent-based)	Various petroleum-based vehicles.	High	Long term	Matte to glossy, depending on additives. Unlimited colors.	Solvents, dyes, pigments, resins, lubricants, etc. ^c	Most surfaces porous or nonporous. Dries fast. Cures slowly.	Interior or exterior	Medium to high depending on additives	Apply images/text to almost any surface. ^c High-color brilliance. Toxic fumes and nonbiodegradable.
	Pigments. High VOC, 4-butyrolactocyclohexanone.								
C. Ink/paint #2 (Low-solvent based)	Diethylene glycol. Diethyl ether.	High	Long term	Matte to glossy, depending on additives. Unlimited colors.	Solvents, dyes, pigments, resins, lubricants, etc. ^c	Most porous surfaces. Dries fast.	Interior or sometimes exterior	Low	Apply images/text to almost any surface. High-color brilliance. Low-toxic fumes. Nonbiodegradable.
	Tetraethylene glycol. Pigments. Medium to low VOC								
D. Ink/paint #3 (oil-based)	Mineral oil. Pigments.	Medium to low	Medium (interior use). Low (exterior use)	Matte to glossy, depend on additives. Unlimited colors; Cartridge or bulk.	Mineral oil, dyes, pigments, etc. Lengthens print-head life.	Most porous surfaces. ^c Dries fast. Cures fast.	Interior or sometimes exterior	Low	Apply images/text to almost any surface. High-color brilliance. Low-toxic fumes. Nonbiodegradable
E Ink/paint #4 (water-based). [Aqueous]	Latex/acetylene glycol/pigment. [Ethylene oxide surfactant/wetting agent/penetrating agent/pigment/water]	Low	Long term (interior use). Short term (exterior use).	Matte to glossy, depending on additives. Unlimited colors; Cartridge or bulk. Dyes, pigments, etc. Sometimes drying inhibitors.	Water solvent	Most porous surfaces. ^c Dries fast.	Interior or sometimes exterior	Low	Paper surfaces. Nontoxic fumes. Nonbiodegradable.

(Continued)

Table 1 Most commonly used sign materials. (Continued)

Category/ brand	Material contents	Strength	Durability	Look/sizes	Formation process	Compatible materials	Installation locations	Relative cost	Uses
F. Ink/paint #5 (Eco- solvent based)	Various vegetable solvents: soy, corn. Binders: Cotton wood pulp.	Medium to low	Long term (interior use), short term (exterior use)	Matte Unlimited color. High- color brilliance.	Lighter solvent. Less pigment needed.	Most porous surfaces. Dries slower.	Interior or sometimes exterior	High initially but low ultimately	Apply to most porous materials. Nontoxic. Mostly biodegradable.
Non-electric changeable signs^a									
Category/ brand	Material contents	Flexibility	Look/sizes	Formation process	Compatible materials	Installation locations	Relative cost ^d	Uses	
A. "Menu Boards"	Frame of plastic, wood, bronze, or aluminum. Grooved felt board. Plastic letters inserted into the grooves with pegs on back.	Individual letters inserted in felt grooves form lines of words. Some lighted. Some covered with acrylic. Some boards switch with cork boards.	Frame colors by material. 12" × 18"-96" × 48". Felt in several colors. Letters black/white. 5/ 16"-2" height. Wall mounts. 1 or 2 pedestal styles.	Extruded metal/ plastic frame. Rigid felt board in frame. Molded acrylic letters.	Symbols, arrows available with letters.	Interior. Exterior with cover or under shelter	Low	Churches, schools, restaurants, any place with constantly changing messages on signs.	
B. "Slider" add-ons	Frames of aluminum, bronze, wood/PVC, acrylic, etc. Text strips of acrylic, paper, vinyl, metal.	Text strips slide into channels from the side. Some covered. Some lighted.	Frame colors by material. Standard/custom sizes. Text strips in standard/ custom sizes/ colors/typesyles/ materials.	Extruded metal/ plastic frames. Text strip channels integral with frame or inserted in frame. Text strips printed, routed, etched depending on material	Larger custom panels available: maps, graphics, phrases, logos.	Interior. Exterior with cover or under shelter	Medium to high depending on material	Directories, room door, or function identifiers. Any place needing semipermanent text/ graphics, or an expanding list. Some include Braille. Some permanent.	
C. "Face" add-ons	Frames/ panels of bronze, wood, PVC, metals, acrylic, etc. Attachments of various	Attachments onto backing by clips, clip channels, magnets, screws, pressure, velcro, glue.	Frame/panel colors by materials. Standard/custom sizes/shapes. Attachments in standard/custom sizes/colors/	Extruded frames. Panels manufactured by material. Attachment strips extruded/cast. Other shapes manufactured by	Larger custom panels available: maps, graphics, phrases, logos.	Interior. Exterior with cover or under shelter	Medium to high depending on material.	Directories, room door, or function identifiers. Any place needing semipermanent text/ graphics, or an expanding list. Some include Braille. Donor	

	<u>woods</u> , <u>plastics</u> , <u>metals cast</u> <u>stone</u> , depending on use.	Some covered. Some lighted.	typetypes. Shapes: strips or standard/ custom ovals, rectangles, tree "leaves," etc.	material, printed, routed, etched, etc.			recognition. Some permanent.
D. Pedestal frames: "A" frame with wheels. [Dry- erase.] Chalkboard. { Snap frame } Channel frames	Frames of <u>chrome</u> , <u>bronze</u> , acrylic, <u>wood</u> , baked enamel <u>steel</u> , depending on style. Inserts are <u>paper</u> , any printable poster/ information material, depending on use. [Melamine, polyester coated steel, enameled steel (magnetic)]. Some with felt boards.	Frames take a poster or board for temporary use. Poster slides in a channel or { frame "snaps" apart/together } Boards in frame take [makers], chalk, press-in letters in felt. Some covered. "A" frame is 2- sided easel.	Frame/pedestal colors by material. 1 or 2 pedestals. Some clamp/slat-wall/ magnetized. Frames take various sizes rectangles, [precut arrow]. Frame atop pedestal. Straight pedestal. Straight letters in felt. 60" h. Clamp, slat-wall, magnetized. Table styles are 8"-11" h.	Extruded frames/ pedestal posts. Some frames molded. Wood/ pedestal bases/ other styles manufactured according to material/use.	Posters in slots can be of any material that fits, contain any message.	Interior mostly. Plastic styles exterior.	{ Low } to high depending on materials/styles/sizes. Any installation needing temporary to semipermanent information free- standing and/or movable. Some clamp to shelf/ table.

For a more complete table of sign materials, see <http://www.mapsandwayfinding.com>; Underlined and Italic text denotes environmentally responsible processes or recyclable materials, in whole or in part.

ADA, Americans with Disabilities Act; FSC, Forest Stewardship Council; CNC, Computer Numerical Control; VOC, Volatile Organic Compound.

^a Specifications are for most commonly available materials.

^b Must be able to fit substrate through printer.

^c All printing inks and paints must be matched with appropriate substrates for compatibility.

^d Compared with other changeable sign types.

Table 2 Outcomes an institution can expect from a successful wayfinding and signage program.

- A. Compliance with local, state, and federal regulations.
- B. Removal of physical and cognitive barriers for all visitors.
- C. Enhancement of visitability.
- D. Benefits for visitors, staff, volunteers, and suppliers of goods and services.
- E. Savings of staff time and money.
- F. Clarity and focus of brand recognition.
- G. Improvement of "good neighbor" standing.
- H. Recognition by the community, colleagues, and industry organizations.
- I. Contributions to environmental efforts.
- J. Upturn in visitors' word-of-mouth enthusiasm.
- K. Opportunities for new visitor niche markets.
- L. Options for new advertising directions.
- M. Increase in revenue.



Fig. 7 A men's room sign in the Honolulu airport, Hawaii: an example of a shingle sign with standard international symbols with English and Chinese text.

Source: Photograph by the author.

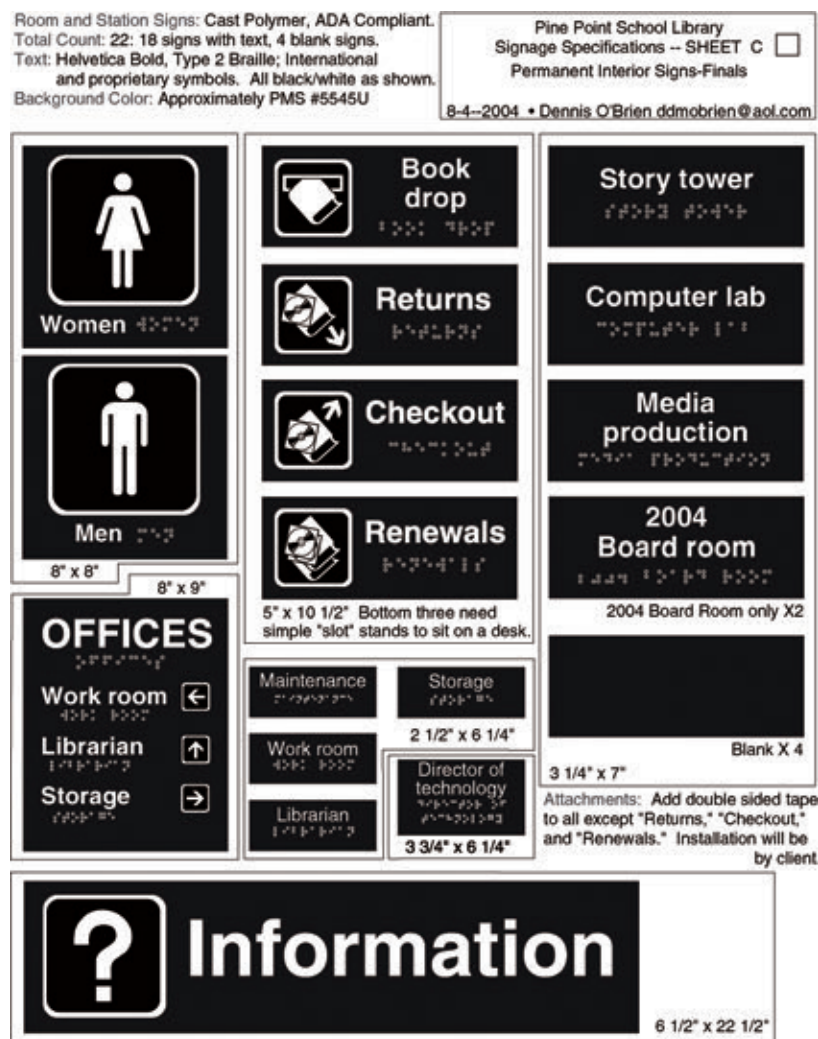


Fig. 6 A signage program containing international standard and proprietary symbols, standard colors, and uniform sizes and shapes. Pine Point School Library and Information Center, Stonington, Connecticut.

Source: Designs by the author.



Fig. 8 A free-standing frame sign with proprietary logo, colors, text font, and sign design. Westerly Land Trust, Westerly, Rhode Island.

Source: Design and photograph by the author.



Fig. 9 Three types of wayfinding information: a city parking regulations sign, a warning printed on a sidewalk, and a mirror positioned so a truck driver can “see around a corner”. New Orleans, Louisiana.

Source: Photograph by the author.

had been supplanted more typically by shingle signs. Second, the images had become more sophisticated and specialized, not only depicting services within, but in the case of inns and taverns, displaying images or icons designed to attract specific groups of travelers. Thus a cross might be used to attract the Christian traveler, a star or moon used for the pagan, or a sword advertising a place catering to a military traveler.^[54]

By the end of the fourteenth century, every conceivable type of wayfinding signage in existence today was already in place. The primary difference between then and now was in sophistication, use of electricity, and ever-increases in size.

During the seventeenth century German Inns displayed heraldic symbols by their front doors as testimony to their acceptability to visiting nobles. As with the modern custom of displaying a window full of chamber of commerce, Triple A, or assorted endorsement stickers, the more symbols displayed, the better the establishment.^[55] This technique was a boon to both the travelers and the inns.

Types of Signs and Materials

General types or functions

Wayfinding signage can be classified in five major message groups.

1. Directional. Point the way to a location or function. They usually contain a combination of an arrow and text or symbol.
2. Identification. Name a location or a facility at a location. Street addresses and names of buildings are examples.



Fig. 10 An interpretive sign made of an imbedded thermosetting resin on aluminum post legs. Westerly Land Trust, Westerly, Rhode Island.
Source: Design and photograph by the author.

3. Information. Explain, describe, or list data for a location. Building directories, hours, or stationery maps are examples.
4. Regulatory. Communicate special uses or instructions. “Do Not Enter” or “Private” are examples.
5. Warning. Communicates a danger or hazard. “Watch out for poison ivy” or “Danger, High Voltage” are examples.^[56]

Specific types

The following are more specific types of signs listed by installation styles, uses, and materials used for signs and content. There are hundreds of materials used in the sign industry, each formulated for its most appropriate use in regard to strength, durability, look, formation processes,

compatibility with other materials, installation location, intended audience, and cost.

Fixed content signs. These are “carrying” surfaces, called substrates, with accompanying content that do not change once they are manufactured. Some are meant to be temporary, others are not meant to be removed or replaced easily. These can be single installations or separate letters on a surface, and lighted in a variety of ways, including from inside the sign or letters.

1. Temporary signs can be posters, banners, or signs usually made with less expensive materials.
2. Permanent signs can be installed indoors or outdoors, and include street signs, building identification, room and restroom signs, most vehicle graphics, most You-Are-Here information, and advertising. These signs



Fig. 11 Changeable electric sign: a pedestrian crossing light with speakers installed on top to send audible signals to people who are blind, Albany, New York. Streetlights, crosswalk lines, curb cuts, under-foot texture changes, open vistas, and important building landmarks are also wayfinding elements.

Source: Photograph by the author.



Fig. 12 Changeable electric sign: Backlit and LED matrix flight information sign, Copenhagen Airport. Design by Mollerup Designlab, Copenhagen, Denmark.

Source: Photograph by the author.

can be walls with painted or attached content, panels attached to a wall or hanging from it at 90°, “shingle” style, free standing panels in frames, or on poles, “A” frame stands with panels and content on both sides. See Figs. 8–10.

Changeable content signs. These signs can have permanently attached or portable substrate, with changeable or programmable content. Uses include announcement boards, warnings or advisories, identification of temporary locations, crowd control, interpretation information, or advertising.

1. Nonelectric types have letters or lines of text, images, etc., that can be applied and changed mechanically. The most common examples are menu boards and directories.
2. Electric styles have content that can be changed by electric and/or digital means. They can range in size and use from huge animated outdoor advertising to handheld interactive computers.

See Figs. 11 and 12 for two types of changeable signs.

CONCLUSION

Wayfinding and signs have been a part of Western culture for thousands of years, coming to a developed level during the height of the Roman Empire, by which time all today’s basic types of wayfinding elements, maps, and signage had come into being. Today, the materials involved in wayfinding have gotten more sophisticated, immediate, and interactive, owing to a long history of advances in concepts, principals, and materials.

The charge of wayfinding is that people of all types and abilities be afforded the chance to move around freely and find what they need wherever they go with a minimum of confusion or barriers. There is a vast discipline of professionals, and an impressive number of materials and processes available to insure that this charge is accomplished as often as possible in an attractive, straightforward, and environmentally sound fashion.

Human behavior, thought processes, design principals, positive attributes of elements, people, and categories of uses and materials all contribute to the creative mix known as wayfinding and signage.

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Web Scale Discovery Services

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Abstract

Web scale discovery services facilitate a streamlined discovery and delivery environment for end users. These services began gaining traction in the library marketplace around 2010, as multiple services from various vendors entered general release into general release. These services consist of a modern web interface used to search and retrieve results from a large preaggregated and optimized central index hosted and maintained by a discovery service vendor. Compared to earlier library search tools, web scale discovery services offer a single search box approach, with queries returning results to a much greater level of granularity than the traditional library online public access catalog (OPAC) (such as returning results indexed at the individual article level). Web scale discovery services search a greater pool of content, sourced from both local library repositories (e.g., OPAC holdings, digital collection holdings) and remotely licensed sources (e.g., publisher or aggregator provided electronic journal content). Web scale discovery services can be compared to an earlier predecessor, “federated search.” A primary differentiator with web scale discovery resides in the fact that a pre aggregated and optimized central index is searched, as opposed to a real-time search of multiple, disparate targets. Compared to earlier library search technologies, web scale discovery services offer the promise of quickly returning results at a granular level, typically ranked by relevancy. Web scale discovery services are at an early stage of development, with some noted concerns, which may be addressed in the future as the product space matures.

INTRODUCTION AND DEFINITION

Compared to earlier search and retrieval tools, web scale discovery services offer a more expansive and responsive search across library owned and licensed content. Relative to older technologies such as the library OPAC (online public access catalog), web scale discovery services are in an earlier stage of maturation. This entry seeks to provide a definition, note several precursor search technologies, and briefly discuss the interface, content, and technical infrastructure typically associated with this services. The conclusion provides a brief mention of some current noted challenges, initiatives, and potential future developments.

“Web scale,” as noted by Breeding, can be characterized as “Large-scale technology platforms; applications delivered through multitenant software as a service; massively aggregated approaches to data; highly cooperative arrangements among participating libraries.”^[1] Web scale discovery services can be considered a growing and important component of the library information management/discovery/delivery ecosystem. As noted by Hoepfner, web scale discovery can be considered “a preharvested central index coupled with a richly featured discovery layer that provides a single search across a library’s local, open access, and subscription collections.”^[2] The National Federation of Advanced Information Services (NFAIS) notes,

“A Discovery Service can be broadly defined as a link between the information User and the Platform on or

location at which the information resides . . . a Discovery Service is defined as one that provides a ‘single search box’ to access a central index of pre-indexed metadata and/or full text. The content that is pre-indexed is harvested from both remotely and locally held repositories to create a searchable broad central index of robust metadata. This is done via agreements with Content Owners who may license access to their metadata and/or full text for indexing purposes directly or through a Content Aggregator, via access to open collections and repositories, and via agreements to access local library resources and special collections. The central index allows for rapid search and retrieval of information resources to which a library has right of access within their own holdings or through shared/open resources and interlibrary loan and is integral to the discovery service infrastructure.”^[3]

As noted by Vaughan,^[4] “Web scale discovery can be considered a service capable of searching across a vast range of preharvested and indexed content quickly and seamlessly.” Components typically include a cloud hosted search service (allowing the end user to perform searches against indexed content stored a large, centralized, pre-indexed database of metadata encompassing a variety of local and remote content. “Web scale” can connote the size of the index and expansiveness of search. Development and adoption of web scale discovery services involve several chief stakeholders, including libraries and their users, content providers, and vendors creating, hosting, and evolving the interface and indexing infrastructure for

the services. Web scale discovery services include a technological component (front-end search interface, back-end index) and a content component (metadata and/or full text associated with local holdings and remotely licensed content). Together, a modern user interface provides a mechanism to initiate a search against a unified, pre-aggregated index, with results returned at a more precise, granular level than previously realized with earlier library tailored discovery tools.

Web-scale discovery services have involved arrangements encompassing multiple, and sometimes overlapping, stakeholders. As noted by NFAIS, there are multiple participants at some level or another associated with the provisioning and utilization of web-scale discovery services. These include the original content owner, the platform hosting the content, the discovery service itself, the discovery service subscriber (such as an academic library) and the user (such as a faculty member or student).

PRECEDENTS AND HISTORY

In the networked library environment, precedents of web scale discovery services include the OPAC and federated search discovery tools. The OPAC, with development dating back to the late 1970s and which ultimately largely replaced hardcopy card catalogs services, provides an electronic interface enabling search and retrieval functions against a database of content normally tied to a local library's collection and normally indexed to the bibliographic / item level of granularity (e.g., monographs, e-books, etc., but not, for example, individual journal articles). OPACs gradually evolved from a text-based to a graphical user interface accessible via a web browser, and eventually allowed for inclusion of hyperlinks to hosted content beyond the local library. Later, "next-generation" OPACs, introduced in the early twenty-first century (and still in use by some libraries at present), added additional features such as faceted searching (allowing users to narrow down an initial retrieved list of results on factors such as publication date, material type, etc.) and the ability to include harvested content from other, usually local, repositories (e.g., such as content found in asset management systems or other institutional repositories). The OPAC traditionally included only local content, and typically only fielded metadata was searched (though, as products evolved, search capabilities grew to include advanced keyword searching, and search of richer content such as tables of contents).

Beginning in the 1990s, the advent and growth of remotely hosted, often subscription based electronic databases (providing abstracting and indexing information, and, in some instances, native full text) contributed toward what became known as a "siloeed" information environment. A large number of search interfaces and content pools associated with a multitude of databases and online journals contributed toward a disjointed discovery

environment. Adequate awareness, skill, and time were necessary to perform comprehensive and encompassing information searches. Federated search tools, first debuting in the late 1990s, provided a web-based single search box, and represented an early attempt to ease the fragmented search environment. Users typed in their search term(s), which were then broadcast simultaneously in real time to preconfigured targets (resources searched). This often included both local targets, such as the OPAC index, and remotely hosted targets, such as abstracting and indexing (A&I) and/or full-text databases of remotely hosted content licensed by the library. As such, federated search provided access to a larger set of content than usually contained in an OPAC alone. Frequently noted limitations of federated search included slow performance, poor presentation of returned results, challenges in deduplication of results, and providing effective relevancy ranking across the set of returned results (e.g., such as the tendency to provide results from the first, not necessarily best, remote database to respond to the search query).

Google Scholar, a search tool debuting in 2004 from Google, Inc., has many features similar to web scale discovery services developed later, specifically tailored toward the library environment. Google Scholar provides a web-based search interface, returning ranked results from a pre-aggregated index of content including journal articles, books, and other content types. Content within the index can include repositories outside the library (e.g., academic publishers, etc.), and, through leveraging additional services (via local library link resolvers and OCLC's Open WorldCat service), can optionally provide greater end-user awareness of local library content. Google Scholar differed from earlier federated search tools by having a pre-aggregated index, capable of quickly returning results ranked by relevancy.

In the library environment, use of the label "web scale discovery services" often refers to the commercial products debuting around late 2007, specifically tailored toward the library environment. These products are normally marketed as "services," given that there is ongoing work by the vendor (interface development content additions to the index, etc.), and, consequently, an annual service cost to libraries subscribing to the service. Examples of current services include OCLC WorldCat Local (introduced in 2007), Serials Solutions Summon (2009), Ebsco Discovery Service (2010), and Ex Libris Primo Central (2010). Visioned as a whole, the evolution of these services signifies an evolving end user search environment, from an earlier one often geared toward known-item search, to one which has a larger serendipitous, interdisciplinary discovery aspect.

CHARACTERISTICS: CONTENT

Relative to earlier indexes associated with library content, indexes associated with web scale discovery services are

large in size and broad in depth of included content types. Depending on vendor, the reported size of individual records associated with web scale discovery indexes range from hundreds of millions of item to over one billion. Items are indexed to a more granular level than traditional OPAC systems, a level such as individual journal articles, discrete photographic images within a digital collection, etc. Content can include both locally hosted content as well as remotely hosted/licensed content which is often matched against licensed / paid content subscribed to by the library, from a variety of. Content, regardless of source, is typically ingested into a large, centralized prebuilt and normalized index. Typical examples of locally hosted content can include records associated with locally held books, digital collections, and other materials found in institutional repositories. Examples of remotely hosted content types include scholarly journal articles, consumer magazine articles, newspapers, conference proceedings, abstract and index records, and electronic books. Leveraging a discovery and delivery ecosystem also comprised of technologies such as knowledgebases and link resolvers, the Such content can include licensed/paid content (matched against library subscriptions in the overall discovery and delivery ecosystem)) as well as free, open access content. For indexing purposes, content providers may provide item fulltext, standard fielded metadata (title, author, publication date, etc.), and/or value-added metadata (such as keywords, abstracts, subject headings). External content providers can include the original primary publisher of the content, producers of abstracting and indexing data, and other content aggregators. A chief way library-tailored web scale discovery services differ from a general web search engine is that the index is comprised of content that could be considered at least somewhat vetted by the library, in the sense it's comprised of content with some level of collection oversight—content which is often owned, licensed, or otherwise at least minimally selected by the library.

CHARACTERISTICS: INTERFACE AND TECHNICAL INFRASTRUCTURE

Web scale discovery services are accessed via a web browser and include features, which, in the library environment, were often initially introduced in late-generation library OPACs. This includes a (default) single search box (alleviating the need to choose a specific index such as author, title, etc.), with an option for a more tailored, often fielded search via an advanced search option. The interface includes faceted search, allowing users to refine a set of returned results on parameters such as publication date range, material type, or location (dependent on the particular vendor). Richer evaluative record content may be included, such as monograph cover images, reviews, and summaries, and web 2.0 social community reviews or

recommender services. Other elements include “did you mean,” type prediction, spell checking, rich export, and automated citation management functionality. By default, results are normally returned ranked by relevancy, determined by factors such as publication date, appearance of the search term in particular metadata fields, and proximity of search terms relative to each other. Alternate presentation orders can be selected, such as most recently published items first. Compared to predecessors such as earlier OPACs and legacy federated search tools, and facilitated by central hosted by the vendor, enhancements for web scale discovery services normally follow a rapid development cycle, which can include rapidly expanding indexes and evolving interfaces.

Content metadata associated with a discovery service's centralized index can be sourced (harvested) from many providers, both locally and remotely hosted. Metadata associated with this content is typically normalized to the discovery vendor's particular record schema. The centralized index may grow over time as new content is ingested and incorporated into the index. This approach differs to earlier federated search tools, which searched multiple dispersed indexes (often with different record schemas) in real time. In the case of more modern web scale discovery services, the user searches a massive, uniform, single index, allowing for results returned more rapidly. This approach also facilitates the return of results ranked according to the discovery service's algorithm (or sorted, often at the end-user's discretion, by parameters such as newest items first. Depending on the particular vendor's implementation, records of the same discrete item sourced from different providers (e.g. a particular journal article) received from different content may be deduped or merged into a single record.

In the content delivery ecosystem, web scale discovery services typically utilize an OpenURL link resolver to facilitate resolution to the final item a user hopes to retrieve (e.g., such as a fulltext article hosted by the original publisher). Vendors may provide APIs allowing local customers to enhance or develop alternate search and retrieval interfaces that still search the centralized hosted index.

The discovery index and search interface are typically hosted by the discovery service vendor, in a software as a service (SaaS) context, in a cloud-based infrastructure. Competing web scale discovery services vary in the degree their search services are curtailed or restricted for nonauthenticated users; in some products, the full index may not be open for search (let alone full content retrieval/view) for unauthenticated users. Web scale discovery services may tailor or scope results to each individual library customer, with the goal that returned results match subscription holdings, locally hosted content, and open access content, all materials which the library user should have legitimate access to. In some services, the index may be open to search by the local library user as well as those not

affiliated with that particular library (i.e., all users can search, but authorization credentials may be requested at the time they tried to retrieve the licensed full text).

Discovery services may make underlying service calls to other repositories for real-time information (such as availability status for a monograph owned by the library, or to place a hold on a locally owned item). To present the final resolution content, such as a full-text journal article, the user may be taken out of the immediate discovery service context, (e.g. such as taken to a different website through a new browser window or tab). Given the number of different associated components in the information discovery and delivery ecosystem, some components of which may come from disparate vendors, there exists the chance of failure in the user seamlessly retrieving the full content associated with an item.

As noted above, web scale discovery services are normally marketed as a subscription service, with the maintenance, hosting, development, and backup handled by the vendor.

Responsibilities of the local library can include initial metadata field mapping of local content to the vendor's record schema, as well as sending local repository record loads to the vendor (e.g., such as bibliographic records from the library's local catalog). This can include an initial load to initiate the service with local materials, and incremental loads that reflect local content additions, deletions, or changes. The local library may also have some capacity to determine if certain interface features are activated and available in their instance for their particular end user clientele.

INITIAL CHALLENGES/AREAS OF FUTURE DEVELOPMENT

Web scale discovery services for libraries are at maturing but still relatively an early stage of development, and some initial challenges have been evidenced. Some of these are reflective of the complex array of stakeholders involved in the provisioning and usage of web scale discovery services. Content providers, content aggregators, and librarians each have unique concerns and perspectives, and interests they wish to advocate and emphasize. A chief issue is librarians' contention that discovery service vendors have lacked transparency in stating precisely what content is included in the searchable index, which in turn makes it difficult to educate end users as to whether a particular set of content (e.g., a particular journal title important to their discipline or research interest) is included. Content coverage comparisons between current vendor services are hard to conduct. Size of index is only one consideration in comparing products, and, while index size was an early differentiator among products, this has lessened over time as each major index now contains a large amount of content. Some vendors can conduct at

least a partial content overlap analysis (e.g., for serial titles held/subscribed to by the library) to help the library determine what portion of their content is included and indexed by their discovery tool.

Another observed challenge relates to how content is indexed. As noted above, different vendors, for the exact same item, may index a different amount of associated data related to that precise item. In building their service's index, vendors may have one data source for a particular item, or multiple data sources. Source data may include a citation, an abstract, the full text, particular metadata fields, or a combination. The vendors may themselves provide additional enhancement services against the metadata after receipt by the original content provider, such as the addition of subject headings. Such distinctions are important, in that the depth of indexing for an item can positively or negatively impact the relevancy of returned results for a search. This becomes increasingly significant when considering the sheer size of the index being searched, as relevancy can be harder to tune as an index grows in size. In the future, vendors may look to incorporate additional factors to help determine relevancy, such as better understanding the user's context, research interests, or previous search queries.

Another challenge revolves around the concept of vendor neutrality. Several discovery service vendors are associated with parent companies whose other responsibilities include native content provisioning. Concerns have been raised by librarians (and competing vendors) that this could compromise the ability to remain content provider neutral (i.e., the possibility exists to promote content from the service's parent company above content sourced from other providers). Similarly, concerns have been raised that some vendors may be entering into exclusive agreements with some publishers, hindering such content from being included in the indexes of other services.

A NFAIS report mentions additional challenges, such as diminishment of content owner or aggregator brand awareness, potentially negative alterations in usage patterns / counts experienced by content providers, and a lack of transparency related to search algorithms used to determine relevancy.

Web scale discovery services provide a more streamlined discovery and delivery environment than earlier tools. While the single search box and optimizations in full text delivery have perceived advantages (the search experience is more "Google-like"), it also represents change for librarians in how they inform, educate, and provide assistance to library end users seeking information. As they presently exist, web-scale discovery services may be ideally suited to a particular user or particular type of research need. Efforts may be needed to educate users that library web scale discovery services do not include ALL content, acknowledging that other resources, depending on the research need, may still need to be consulted should a user wish to conduct a truly

comprehensive search. This can be challenging as it competes against a “need-it-now” search environment, with many users looking for easy, rapid returns for a search query. Similarly, some content by its specialized nature may be better attuned to different indexing schema or presentation of results, and such search and retrieval flexibility may not exist with a standard web scale discovery index or interface.

Two significant initiatives which worked to synthesize and provide recommendations for some observed concerns related to web scale discovery services included one sponsored by NISO and another sponsored by NFAIS. NISO established an Open Discovery Initiative, which released a recommended practice entitled “Open Discovery Initiative: Promoting Transparency in Discovery” (NISO, Open Discovery Initiative: Promoting Transparency in Discovery. 2014; <http://www.niso.org/workrooms/odi/publications/rp/rp-19-2014> [accessed August 8, 2017]). NFAIS released a report entitled “Recommended Practices: Discovery Services” (NFAIS, Recommended Practices: Discovery Services. 2013; https://nfais.memberclicks.net/assets/docs/BestPractices/recommended_practices_final_aug_2013.pdf [accessed August 8, 2017]). These initiatives sought to synthesize and provide recommendations related to several observed concerns associated to web scale discovery services.

CONCLUSION

Libraries are increasingly adopting web scale discovery services, as vendor offerings mature and libraries dedicate budgets toward web scale discovery service subscriptions. Searching across a wide body of scholarly content has been a goal for libraries for some time, as evidenced by the earlier development of the Z39.50 protocol and the later advent of traditional, first-generation federated search products. The centralized pre-indexed database

associated with modern web scale discovery services mitigates several noted problems of earlier search technologies and offers a more streamlined discovery and delivery environment for a significant cross section of end users.

Various avenues of potential development may be pursued in the future, perhaps to help address challenges noted above. Several discovery service vendors have released modern “library services platforms,” targeted to replace the traditional “integrated library system,” utilizing new information architectures geared toward more efficient management of electronic content and based on a more open data foundation. In the future, discovery services associated with a particular vendor may increasingly be integrated into the particular library service platform offered by the same vendor. Relevancy ranking will continue to be honed and discovery services may become more aware of “where the user is,” perhaps evidenced by deeper integration in social media as well as greater responsiveness or dedicated applications (e.g. mobile access). As discovery services evolve, the traditional discovery portal of libraries, the OPAC, will increasingly be relegated to a shrinking, supporting role in the discovery ecosystem.

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Webometrics

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Abstract

Webometrics is an information science field concerned with measuring aspects of the World Wide Web (WWW) for a variety of information science research goals. It came into existence about five years after the Web was formed and has since grown to become a significant aspect of information science, at least in terms of published research. Although some webometrics research has focused on the structure or evolution of the Web itself or the performance of commercial search engines, most has used data from the Web to shed light on information provision or online communication in various contexts. Most prominently, techniques have been developed to track, map, and assess Web-based informal scholarly communication, for example, in terms of the hyperlinks between academic Web sites or the online impact of digital repositories. In addition, a range of nonacademic issues and groups of Web users have also been analyzed.

INTRODUCTION

Webometrics, which has been described as one of the dominating forces in library and information science research at the start of the twenty-first century,^[1] is “the study of the quantitative aspects of the construction and use of information resources, structures, and technologies on the WWW drawing on bibliometric and informetric approaches.”^[2] This definition emphasizes a heritage in the information science field of informetrics, in addition to the scope of studies (the Web) and their methodological orientation (quantitative). Webometrics is sometimes given other interpretations; the widest is simply quantitative studies of Web-related information—which is similar to computer science Web metrics/dynamics.^[3,4] A closely related term is cybermetrics, which is quantitative research into all aspects of the Internet, including e-mail and network traffic. Much information science webometrics research has been concerned with link analysis or search engine evaluation. In fact, individual researchers and articles have often investigated both because search engines have often been used to gather raw data for link analysis. Other webometrics topics include online citation analysis, analysis of the online profiles of individuals, longitudinal studies of Web change, and investigations of the online spread of issues. After an overview of the history of webometrics, an introduction will be given to the main topic areas.

HISTORY

The term webometrics was coined in an early article of Almind and Ingwersen,^[5] and by the end of 1997 a number

of quantitative Web studies had been published, some by information scientists. One prominent study was Ray Larson’s conference paper: *Bibliometrics of the World Wide Web: An Exploratory Analysis of the Intellectual Structure of Cyberspace*. The idea of using Web page hyperlinks to extract relationships from the Web emerged within information science at this time, in parallel with the invention of the influential link ranking algorithm PageRank for Google, which had its intellectual roots in bibliometrics.^[6]

The first information scientist to publish a discussion of the potential for transferring information science techniques to the Internet was the Brazilian Marcia J. Bossy,^[7] with an article in a French online and print journal. Larson^[8] published the earliest “bibliometrics of the Web” study of real data, seeking link-based methods for identifying topic organization on the Web. Rodriguez i Garin^[9] and Almind and Ingwersen^[5] simultaneously identified the ability of advanced search engine interfaces to deliver powerful statistics about Web pages and links. At the time AltaVista was the most potent instrument for this kind of research. Rousseau^[10] took a more mathematical approach, identifying Zipf’s law on the Web and predating the later more famous statistical physics discoveries of power laws in the Web. Essentially, a power law indicates a highly skewed distribution. For example, a few Web pages attract an enormous number of links whereas most Web pages attract only a few. Another important milestone was Aguillo’s^[11] claim that new indicators for research and development could be constructed from the Web. This helped to trigger European funding for Web indicator research. In terms of meetings, webometrics has been most associated with scientometrics and has been well represented in all recent International Society for Scientometrics and Informetrics conferences.

The first webometrics journal special issue was published in a 2001 volume of the journal *Scientometrics*, with van Raan^[12] predicting—accurately so far—that the potential uses of the Web for research would not threaten the status of high quality peer-reviewed journals, and that traditional bibliometrics would therefore continue to be important. The special issue served as a warning for information scientists of the dangers of uncritical acceptance of Web data from search engines and of drawing unjustified conclusions from hyperlink data in particular.^[13,14] Subsequent research, reported below, including some in a 2004 *Journal of the American Society for Information Science and Technology* special issue, has shown that the problems identified are not insurmountable.

SCHOLARLY COMMUNICATION

Although there has been some webometric link analysis research on nonacademic domains,^[15] it has been in a minority so far, and so this review will be dominated by the academic link analysis tradition. Much information science research into scholarly communication has focused on extracting information from documents, such as journal articles, produced by scholars. A natural question to ask about the Web, therefore, is whether academic Web pages could yield useful new information about scholarly communication. This has led to different lines of enquiry, for instance concerning e-journals or university Web sites. Most research has focused on hyperlinks as potential indicators of impact through analogies with citations.^[16,17] Background information about the link structure of the Web can be found in two popular science books.^[18,19]

Journals

Journal articles form a key component of research in most disciplines and have traditionally been central to bibliometric research into scholarly communication. Journal impact factors, calculated by Thomson Reuters (formerly Thomson Scientific, and the Institute for Scientific Information or ISI), are influential estimates of the average impact of the articles published by a journal. They are the average number of citations that articles from a 2 years period (e.g., 2003–2004) receive from articles published the following year (e.g., 2005).^[20,21] The citations used in the calculation come from the documents (mainly academic journals) indexed by the ISI.

Webometric studies have calculated online versions of these impact factors by replacing citations with one of the following types of interdocument connection.

- Counts of hyperlinks to journal articles or whole journal Web sites.
- Counts of online citations, i.e., traditional citations in Web pages.

- Counts of citations of the URLs of online articles: “URL citations.”
- Counts of either of the two above: “Web/URL citations.”
- Counts of citations in Google Scholar or in online digital libraries.

Calculations are typically not time-constrained in the way that journal impact factors are. In other words, counts are performed irrespective of the age of the source or target document. A number of studies have assessed whether link calculations can give useful results. A standard technique has been to correlate ISI impact factors with online versions, looking for statistically significant similarities between them.^[22,23] Although early findings were inconclusive, later research did find significant correlations, as summarized below.

- Links to journal Web sites correlate with journal impact factors, provided that a single discipline is analyzed.^[24,25] Nevertheless, different fields show a different ratio of Web site inlinks to ISI citations, and factors that contribute to higher inlink counts for a journal Web site include the site age and the quantity of information hosted.^[26]
- Web citations, URL citations and Google Scholar citations of journal articles correlate significantly with print citations for most journals and across a range of science and social science disciplines.^[27–29]
- About 25–30% of Web citations of journal articles represent intellectual impact, and this figure is quite stable across a range of journals.^[28,30] There are typically more Web citations for a journal article than ISI citations.
- There are significant disciplinary differences in the extent to which articles are cited on the Web, at least for open access articles.^[29]

Despite the significant correlations found, a practical problem for using Web links/citations as a replacement for journal impact factors is that they can originate in large replicated or automatically generated pages. These include online library catalogs and journal publishers’ digital libraries. A promising approach, however, is the calculation of online statistics from large quality-controlled collections of articles online. Two examples are the CiteSeer computer science public Web library^[31,32] and arXiv.org, a self-publishing archive,^[33] but these currently represent field-specific possibilities.^[34]

Log Analysis of Journal Usage

Web log analysis is different from most webometrics because log file data is about the Web rather than being part of the Web itself. Nevertheless, research into the use of digital libraries is directly relevant to other

webometrics research into scholarly communication. Indeed, since log files can give direct evidence of the usage of articles, including some user demographics,^[35] and publishers like Elsevier now provide their editors with summary statistics about the number of online accesses of individual articles, it seems that this kind of data may significantly supplement or replace citations for evaluation purposes.^[36] The main drawback is that log file statistics are dependant upon the organization of the digital library Web site and some technical decisions about how to track users and so are not directly comparable, unless a standardization initiative can circumvent this problem. This is a sensitive issue since journals can be compared and ranked based upon usage statistics.^[37] In addition this data is of commercial value to the publishers and so may not be made available for research and evaluation without specific authorization.

An early Web log study used an individual open access online journal, *First Monday*, and defined “classic articles” as those that were downloaded most frequently.^[36] When analyzing individual open access journals, there is a need to “clean” the log files from automated download requests, such as from search engine crawlers. An early large-scale analysis of a publisher’s digital library was that of Elsevier in Taiwan, which was able to count instances of browsing and downloading journals and use them, amongst other things, to identify the most popular subjects and journals. Interestingly, the list of the top downloaded journals was significantly different from the top browsed journals and so future research should be careful not to use browsing statistics as a proxy for downloads.^[37] An investigation into open access publishing in arXiv.org found a significant but fairly moderate Pearson correlation between the natural logarithms of downloads and citations for articles in four different disciplines, including mathematics (0.347) and physics (0.462).^[38] In contrast, another approach is to combine citations to and “reads” of an author’s articles in order to produce a longitudinal profile of their changing pattern of influence.^[39]

People

Cronin et al.^[40] constructed a typology of online invocations of a small group of scholars. They used a search engine to find pages containing the scholar’s name and then classified the reason why the scholar was mentioned in the invoking page (if the invocation referred to the correct person). The most common type of page mentioning a professor’s name was online conference proceedings. An important finding was that the contexts of invocations on the Web were different from reasons for academic citation, and so the Web gave an opportunity for tracking “modes of communication” that were previously difficult or impossible to study.

Later research hypothesized that Web mentions might be used alongside other media mentions as indicators of

the fame of academics.^[41,42] It is not clear yet, however, how valid this approach is.

Universities

Can the overall impact of the research of an entire university be estimated by counting the number of links to its Web site? This is perhaps a strange question to ask since impact assessments are usually applied to individual scholars, research groups or departments, but rarely to entire universities. Nevertheless, this is a logical methodological question to assess whether links can be used for impact assessment. This is because entire university Web sites are sufficiently large, at least in developed nations, to give a degree of stability to link count statistics. The World Universities’ Ranking on the Web initiative (<http://www.webometrics.info>) is a high profile example of using links, in conjunction with other Web presence factors, to generate simple online indicators.^[43]

After much research into link counts as impact indicators for universities, some clear findings have emerged, albeit from investigations mainly restricted to the United Kingdom. University Web sites attract inlinks from other universities approximately in proportion to the research productivity of the owning university.^[44] University Web sites source outlinks on the same basis, and so the number of links between any pair of universities will be approximately proportional to product of their research productivities.^[45] The cause of more productive universities attracting more inlinks is not the increased impact of their pages, however, it is simply that they produce more pages.^[44] In the experiments deriving these results, straight link counting was found to be less effective than other forms that minimize the effect of large numbers of replicated links in Web sites.^[46] Longitudinal studies of static HTML pages have shown that the results of link analyses are relatively stable over time, and suggest that academic Webs in some countries have stabilized and ceased to experience exponential growth.^[47,48]

In addition to research productivity, geography is also a factor in linking: closer universities tend to interlink more.^[49] On an international scale, proximity and shared languages also seem to be important, despite English being extensively used on the university Web sites of non-English-speaking nations.^[50]

Research into departmental level interlinking has found results broadly consistent with those concerning university level interlinking. The outcomes of statistical tests of linking have been less significant, however, suggesting that departments have too few pages to give stable results. Nevertheless, departmental studies allow the investigation of linking by discipline, allowing comparisons to be made. As an example, U.S. departments of chemistry, history, and psychology have been compared:^[51] U.S. historians were found to hardly use the Web (but some historians do operate actively online),^[52] with chemists using it by far

the most and extensively interlinking. Other research has investigated library and information science^[53,54] and computer science,^[55] and physics, sociology, and math.^[56] One important (and rare) qualitative link investigation has shown how links can be valuable pointers to disciplinary differences and how qualitative interpretations can support the construction of effective frameworks for link analysis.^[57]

At the lower organizational level of research groups, some studies have sought to relate inlinks to home pages with off-line factors such as gender, collaboration networks, and research productivity within the life sciences. Of these, there was some evidence that female scientists and older scientists received less inlinks than others and, counterintuitively, the same was true for those with larger collaboration networks.^[58]

Link Creation Motivation

Although counts of links to university Web sites correlate significantly with university research productivity, this does not prove that a university's research causes others to link to its Web pages. Motivation studies have sought to find out if this is the case. In fact, relatively few links to university Web sites directly target research papers hosted in their general Web pages, only about 1%. There is a connection between research and link creation, but it is more indirect. About 90% of interuniversity links relate in some way to scholarly or educational activity,^[59] although a smaller percentage of these links relate more directly to scholarly or educational activity.^[60] This connection includes token links such as link to the home page of a collaborating researcher, or their department or university home page. Link counts, then, should be interpreted as reflecting a wide range of types of informal scholarly and educational communication. The importance of this statement is that inlink counts should not be used to assess the impact of a university's research. Nevertheless, a university that receives fewer links than should be expected for its research productivity should be concerned about whether its site is hindering its academics' online informal scholarly communication.

There is a problem with using a link classification exercise to attribute creation motivations to links in order to interpret link counts because different user groups (e.g., academic fields) can create links for different purposes.^[56] Subsequent research has reinforced the complexity of link creation motivations. Bar-Ilan introduced a multifaceted framework for classifying links that included the source page, linked area, the link itself, and the target page, using it for an extensive classification of links between Israeli academic institutions.^[60] The classifications included many categories and subcategories. Bar-Ilan's findings clashed to some extent with other research due to the problem of deciding which type of activities should be

classified as academic-related. There is also a classification problem in differentiating between educational and research-related links.

Other Academic Studies

Some research has addressed interesting questions that do not fall into the above categories, despite being quantitative, academic-related, and Web-related. A unique and promising line of investigation is Björneborn's^[61] small world analysis. He investigated the local structure of academic Web links, identifying chains of links between Web sites, particularly those that cross topic boundaries. This has the potential to give new insights into the kind of information that could be extracted from Web links, and why links are created.

Leydesdorff and Curran^[62] have used AltaVista to gather time series data for connections between university, industry, and government Web sites, comparing the Netherlands to Brazil. This research exploited AltaVista's recording of the "last modified by" date on Web pages, which allowed queries for old pages: those that had not been modified since the specified date. Such facilities are now provided in the Internet Archive in a more powerful form: allowing the retrieval of old pages even if they have subsequently changed. Also focusing on university–industry–government interconnections, Stuart^[63] used the case of the U.K. West Midlands Automobile Industry to show that citing practices differed greatly between the three sectors, with many collaborations not reflected on the Web in any way. A larger-scale study then found that the majority of intersector links did not reflect collaboration.^[64]

Online text-based evidence of connections between universities and business has been sought through an investigation of the occurrence of the names of academic journals in business Web sites.^[65] The results showed that this type of analysis was difficult because of pages that listed large numbers of journal names in the form of a list, without any real indication that individual journals were contributing knowledge to the hosting company.

Heimricks et al.^[66] have compared Web link patterns to citation and collaboration patterns. This multiple data source triangulation seems to be an effective way of exploiting Web data without relying exclusively upon it. This combining of different data sources to illuminate different aspects of the same situation is a promising direction for webometrics research.

Visualization

A minority of the academic Web link analysis articles have used visualizations to display the relationships between Web sites or organizations. Diagrams are a useful way to succinctly convey large link data sets. For example Heimricks and van den Besselaar^[67] used two-

dimensional multidimensional scaling maps to display clusters of interlinked Web sites,^[68] network diagrams to illustrate the strength of interlinking between the Web sites of various countries, and a colored hybrid cluster and link diagram to illustrate a combination of the two. A similar type of diagram has also been used to display the interlinking of national and technological sector differences within a single diagram.^[69]

NONACADEMIC LINK ANALYSIS

Vaughan has pioneered the application of information science link analysis to business Web sites. She has shown that colinks can be used to identify similar business organizations from the Web.^[70,71] In addition, a number of studies that have elements of quantitative Web analysis have origins outside of information science but are nevertheless relevant to webometrics. Three will be discussed briefly below, all concerning sociological analyses of specific phenomena.

Garridos and Halavais^[72] used hyperlinks between Web sites to illustrate and explore an online network connected to the Zapatista grass roots movement in Mexico. This gave insights into the range of different issues that were prominent amongst online activists, such as women's rights, and was also able to support a previously made assertion about the role that Zapatista support groups play in binding together a range of diverse types of nongovernmental organizations. This approach has been codified to some extent in a book of similar examples.^[73]

Web Sphere Analysis^[74] is an example of an integrated method for combining different information sources to study an online activity. This is described as "a 'mid-range' approach to making sense of linking practices, midway between close rhetorical/ethnographic analysis of links and large-scale link mapping." Hyperlinks are used, but only as one component of a wider Web analysis. For example, in an investigation into Web sites relating to the U.S. presidential election of 2002, no strong patterns emerged, leading to the suggestion that linking was still in an experimental phase in presidential elections, and than norms of activity had yet to be established. Related research has shown that there can be connections between off-line factors and Web presences for politicians^[75] and has discussed the use of a range of blog-related indicators to analyze online political campaigns.^[76]

The trend to integrate link analysis into a wider theoretical framework is a positive one, which could be increasingly successful if Web practices become more standardized and stable. The need to embed a study of Web links into other phenomena is exemplified by Hine's Virtual Methodology,^[77,78] which explores online activity through its organic relationship to off-line activities.

WEB 2.0

There have been many quantitative examinations of blogs and other Web 2.0 sites by computer scientists, webometricians, and the wider social science community. This section reviews those most relevant to webometrics.

A number of blog analyses have had computer science objectives but generated interesting results about the structure of blogspace. A temporal investigation into how topics are discussed within blogs showed that there were several common patterns: "mostly chatter," a steady volume of discussion; "spikey chatter," the constant discussion of a topic, like Microsoft, with occasional peaks caused by identifiable events; and "just spike," the sudden appearance of a topic and its subsequent eventual disappearance.^[79] The discovery of trends within blogs has received particular attention, with the development of a variety of algorithms to identify spikes or hot topics of discussion.^[80,81] In addition, there have been analyses of trends in discussion around particular events, such as the London Attacks,^[82,83] using a time series of the daily number of relevant blogs containing a particular word. This technique is able to reveal the frequency with which small topics occur within larger discussions. Interestingly, simple searches in free blog search engines, such as BlogPulse, can be used to gain retrospective insights into public discussions of topics,^[84] which is probably the first general-purpose source of retrospective public opinion.^[85]

Folksonomy is another aspect of Web 2.0 that has attracted quantitative research. A folksonomy is a set of user-generated tags for Web pages, images, videos, or other resources. The frequency distribution of tags within such a system is of interest for information retrieval purposes because the most frequent tags are necessarily the most general and hence it is desirable for a system to encourage users to use lower-frequency, more specific tags, even though some high-frequency tags may suit some user needs better.^[86] A specific study of university groups in the image sharing system Flickr found a tag distribution and types of tags which suggested that grouped images may tend to be more altruistically tagged.^[87] A more systematic study of tagging behavior (one of many about the issue) included informetric-style analysis of tags created by users and showed that habit was an important factor in explaining how users tag, but was not the only factor, with others including the influence of group norms.^[88]

One of the most innovative webometric studies is Voss's^[89] of Wikipedia, which showed that national Wiki growth tended to begin linearly but then to become exponential. Wikipedia links exhibit a classic power law, both for inlinks and outlinks, and the number of editors per article also follows a (broken) power law. Article sizes, in contrast, follow approximately a lognormal distribution with a distinct mean, probably reflecting attempts to

regulate article lengths. Another innovative approach is the History Flow visualization technique that is able to illustrate the editing history of Wikipedia articles.^[90] One finding was the existence of edit wars, during which the same changes were made and removed repeatedly over a period of time.

The Facebook social networking system is interesting for the insights that statistics can give into the way in which such systems can be used.^[91] Facebook started out as a college-oriented system and appears to have achieved almost universal usage amongst U.S. college students. A statistical analysis of usage patterns suggests that its use is primarily for communication between students at the same university, rather than for distant connections, and that its use was integrated into student's patterns of study rather than being a separate activity.^[91]

DATA COLLECTION

Most webometric studies rely upon data from commercial search engines, such as Google. Nevertheless, there are alternatives and methods of speeding up data collection. The main alternative is to use a Web crawler to download the pages from a set of Web sites and then analyze the results. Currently available free crawlers for research purposes include SocSciBot (<http://socscibot.wlv.ac.uk>) and Issue Crawler (<http://www.issuecrawler.net>). Data collection from search engines can also be automated using the Applications Programming Interface technology,^[92] and free online software for this includes LexiURL Searcher (lexiurl.wlv.ac.uk) and the Virtual Observatory for the Study of Online Networks (VOSON, voson.anu.edu.au).

EVALUATING SEARCH ENGINES

Early Web research discovered that the results returned by search engines were not reliable.^[93–95] The “hit counts” reported could change by orders of magnitude from one moment to the next. A key cause of this was the probabilistic nature of reporting algorithms. To save time, a search engine may query only a fraction of its database, estimating the total hit count with a probability calculation. Rousseau^[93] proposed that researchers should use the median of repeated queries in order to get more stable data. Mettrop and Nieuwenhuysen^[96] also analyzed search engines from a longitudinal perspective. They planted documents on the Web where search engines could find them and analyzed the results of search engine queries that should have returned the documents. They found that search engines behaved in an unpredictable way so that changes in search engine results did not necessarily reflect real changes in the Web. Further research into the hit count estimates returned by search engines has shown that they can include systematic biases: with low hit counts

reflecting a different kind of estimate to that of high hit counts.^[97] In addition, deliberate biases can be introduced into search engine results by organized groups.^[98,99]

It is important to set search engine research in the context of Web coverage. Search engines have been shown to crawl and index only a minority of the publicly available Web pages.^[100] Unfortunately for webometrics, however, and in addition to undesired fluctuations, this minority is biased by site age and country of origin, although not directly by language.^[101,102]

WEB EVOLUTION

Longitudinal or evolutionary studies take snapshots of the Web over a period of time and compare the results, looking for important trends. There are two types: those that study the results of search engines and those that monitor the Web directly.

An example of direct monitoring is the study of Koehler,^[103] who monitored a set of pages existing in 1996 on a weekly basis until February 2001, using a program to download and analyze the pages. The pages came from the random URL generator facility offered by a search engine of the time (WebCrawler). He found that pages of different types had very different longevities. For example, in commercial sites, navigational page type tended to be periodically updated, but content pages were more likely to remain unchanged for long periods of time. Interestingly, the opposite was true for academic pages: content pages were the more likely to be repeatedly updated. A trend for increasing stability over time was also found: an old collection of pages should experience less change than a young one.

Two large computing companies have combined to produce a very large scale, but short-lived, longitudinal study through direct crawling.^[104] The data set was 151 million pages, which were downloaded weekly for 11 weeks from December 2002 to February 2003. The experiment produced some interesting results, including: trivial changes to documents that did not affect their contents (e.g., HTML tag changes) were very frequent; and large documents changed more frequently than small documents. Less surprisingly, the amount of change in pages was significantly affected by the page's top level domain, and pages that changed frequently were likely to continue to change frequently.

A different type of longitudinal investigation is that of Bar-Ilan and Peritz,^[105] who studied the evolution of the results sets of search engines for queries for the word “Informetrics” from 1998 to 2003. They found that almost half of the pages in the results lists disappeared or changed between consecutive data gathering stages: 1998, 1999, 2002, and 2003. These results were in fact more stable than for general Web pages, which may indicate that

academic information tends to fluctuate less in search engines than other kinds.

Non-webometrics research has also conducted longitudinal studies in the sense of tracking the loss of information on the Web. For example, Veronin^[106] tracked the attrition-rate of health Web sites and Casserly and Byrd^[107] and Lawrence and Giles et al.^[108] analyzed the disappearance of URLs cited in academic papers. The latter studies touch a point that is fundamental to academia. If an article's cited resources disappear from the Web, does this undermine the credibility of its findings?

Finally, Web evolution has become an active research topic in computer science, under the name of Web dynamics.^[109] This research area typically uses mathematical modeling and large-scale experiments over the Web in order to derive results that would be useful aids to algorithm design, for example to help search engine ranking algorithms.

CONCLUSION

Webometrics has been reviewed, primarily focusing on link analysis and information science approaches relating to scholarly communication. Academic link analysis has perhaps not fulfilled early expectations of being an online counterpart for citation analysis because links are not created in the systematic way that citations can be, and are often not quality-controlled in any way. It is much more of an arbitrary decision whether an author chooses to add links to their page and, if so, which kinds of resources or pages to link to. Nevertheless, links can provide useful information if either the scale of a study is large enough to average out inconsistencies in link creation (i.e., whole universities) or links are used in combination with other sources to give a more nuanced overall picture. Recently webometrics has begun to embrace the increasing trend toward user content-creation with studies of blogs and other Web 2.0 phenomena, and has also seen webometrics-style research appearing in media studies, communication science, and politics. A second recent change is the use of text analysis to identify connections between Web sites or documents, even if they do not interlink. Future webometric research is likely to continue to extend link analysis techniques to more contexts outside of the academic arena, to react to new types of Web 2.0 spaces, and to focus on developing effective methods to visualize relationships between Web sites.

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Word Processing: Early History [*ELIS Classic*]

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Abstract

This brief history of word processing hardware and software demonstrates that the ever-familiar word processing program of today had a more complicated and slowly-evolving history than might be expected.

—*ELIS Classic*, from 1992

DEFINITION

The term and concept of “word processing” are by now so widely used that most readers already are familiar with them. The term, created on the model of “data processing,” is more vague than commonly believed. A human editor, for example, obviously processes words, but is not what is meant by a “word processor.” A number of software programs process words in one way or another—a concordance or indexing program, for example—but are not understood to be word processing programs.

The term “word processor” means a facility that records keystrokes from a typewriter-like keyboard, and prints the output onto paper in a separate operation. In the meantime the words are stored, usually in memory or magnetic media. A word processor also can make improvements in the stream of words before they are printed. At their most basic these include the ability to arrange words into lines. An “editor,” such as the infamous EDLINE distributed with the Microsoft Disk Operating System (MS-DOS), lacks the ability to structure lines.

Commonly a word processor is understood to be a software program, and in the 1980s and 1990s it usually meant a program written for a microcomputer. However, preceding this period and continuing through it there have been hardware word processors. These are pieces of equipment sold for the sole purpose of word processing, containing in one package a keyboard, printer, recording and playback device, and in all recent examples a video or liquid crystal display screen. These machines include word processing software permanently stored in memory and processor chips, or in the earliest examples its equivalent in relays and wiring. A great disadvantage is that their storage media are usually incompatible with those of other machines, meaning words cannot be transferred from one system to another.

PREDECESSORS

The fundamental use of a word processor is to record, edit, and play back keystrokes. The printing press, whose

storage medium was lead type that had been “input” by the human or mechanical typesetter, itself carried out this function. While the press itself need not be especially bulky or expensive, the cost, weight, and complexity of the equipment and procedures needed to prepare the type for the press were great. Thus printing has rarely been found in offices, and has been relegated to a separate business, the printing shop.

Experiments in recording typewriter keystrokes, early in the twentieth century, used mechanical, air-driven mechanisms, borrowed from or inspired by the player piano. These were scarcely more than curiosities. The electric typewriter appeared in the 1930s, but despite its higher-quality output, it did not become dominant until two decades later. It seemed to offer the potential for more economical recording and reproduction of keystrokes, but it was not until the 1950s that a machine carrying out these functions was manufactured and sold in quantity: the Friden FlexoWriter. The FlexoWriter used punched paper tape as a storage medium, thus providing some compatibility with other data processing equipment.

Keystrokes could be deleted from the punched tape, which backed up as the backstroke key was pressed. The “delete” or nonprinting character consisted of all possible holes punched; this was later implemented in the ASCII character set, in which the highest character, 127, with all bits set, was a “delete” character. However, insertions could only be made by splicing the paper tape, and there was no means to turn carriage returns into spaces or vice-versa. The difficulty of revision made the noisy FlexoWriter impractical for routine office correspondence. Its main use was for what soon became known as the “form letter,” in today’s terminology a merge operation: a standard text with different names, addresses, or other data inserted. These were used for political purposes, fundraising, and sales.

THE MT/ST

The first true word processor, and IBM’s first entry into the field, was the Magnetic Tape Selectric Typewriter or MT/

ST, introduced about 1969. Much larger and more expensive than the FlexoWriter, the MT/ST included a model of IBM's workhorse Selectric Typewriter built into a small desk. Accompanying it was a console, about half as large as the desk, containing control relays, the tape recording and playback facility, and control buttons and dials.

As typing took place, keystrokes were recorded on 16-mm magnetic tape, using a head moved by solenoid and spring across the tape, one character per pass. The backspace key on the keyboard backed the tape up so the character could be overwritten with a new one. Cassette tapes of 100' held approximately 25K of data. A 7-bit data set was used, providing different codes for upper and lower case letters, and an increased set of control codes. In a technique borrowed from mainframe computers, the operator could mark the tape with electronic divider codes, called "Search Codes." While the concept of named files was still in the future, the machine counted the number of Search Codes on the tape and could thus search for a file. In a crude way it could thus assemble standard chunks of text into a composite output document.

The MT/ST incorporated a number of other innovations. While it had no block movement capabilities, except by very cumbersome block export and import, it did have insertion and revision capabilities. At each carriage return, one space on the tape was reserved for insertions. More important, all except the very first models incorporated two tape stations, and the ability to play from one tape while recording an updated tape on the other, incorporating insertions and deletions as desired. The two tape stations could also be played back simultaneously, typically merging a letter on one tape with a name and address list on the other.

The MT/ST also introduced what may be called word processing concepts. Within a fixed zone (1") preceding the right margin, spaces were converted into carriage returns, and outside it returns were changed into spaces. The concept of a "soft hyphen" was used for the first time: a hyphen that would print only if it fell within the 1" hyphenation zone, and would otherwise be ignored. An overstrike code was also implemented; this permitted underscoring.

Whereas the FlexoWriter only operated on a character basis, the MT/ST also operated on a word, line, and paragraph basis. The machine understood a word to be any string terminating with a space; a line was a string terminating with a carriage return. Two carriage returns constituted a paragraph boundary, and were not turned into spaces as single returns could be.

However, the MT/ST had no concept of a page; the division of text into pages and the numbering of pages had to be done by a human operator. While possible points of hyphenation in a word could be premarked, it had no hyphenation capability of its own. The machine did not permit operator hyphenation while playback was in process, and thus line endings were not always satisfactory. As it had no display screen, the only way to know what was on a

tape was to print it out at 15 characters per second. No tape updating without printing was possible either. The operator needed to listen to the tape transport to know whether it was skipping text or awaiting keyboard input. The MT/ST required alertness and discipline from the operator.

OTHER DEDICATED WORD PROCESSORS

Subsequently, IBM introduced a number of word processors incorporating various improvements; other manufacturers followed IBM's lead. None of these achieved the success of the MT/ST. The Magnetic Card Selectric Typewriter (1969) incorporated the concept of the page into processing; one page was stored on each magnetic card. In 1971 the Lexitron (not an IBM product) added a display screen, using paper only for the final output. IBM's Magnetic Card Executive Typewriter (1972) had proportional spacing in a single type face, sacrificing the interchangeable type elements of the Selectric. Magnetic Card Selectric Typewriter II (1973) added memory, allowing text to be stored and moved in memory and only stored on media when editing was completed. It also had the double pitch available on later Selectrics.

IBM's DisplayWriter and word processors from Wang and Lanier moved closer to the word processor as we know it today. Floppy disks gradually replaced cassette tapes as storage media. Named files were introduced. On-screen menus of functions and labeled function keys made it easier to perform tasks; opening, saving, combining, printing, and deleting files; moving, centering, justifying, and underlining text; combining standard text (a letter or a financial document) with varying data; adding page numbers, headers, and footers.

WORD PROCESSING ON MULTIPURPOSE COMPUTERS

Although not customarily thought of as such, the above pieces of hardware are computers, with input and output devices and data storage and manipulation ability. However, their programming was limited to that supplied by the manufacturer, and they could not be used for other tasks. Word processing has been done on both mainframe and minicomputers, in both of which the computer simultaneously served several users, but these never achieved acceptance outside of large businesses. Besides the cost of the computer, the printers were the primary limitation. Only daisy-wheel printers could produce office-quality output in the early 1980s, and they were slow in comparison with the processor speeds. Software for mainframe and minicomputer word processing soon trailed behind, in features and ease of use, that available on microcomputers. Mainframe administrators did not consider word processing a task particularly appropriate for their

computers, as it required large blocks of memory but did not need mainframe processing speed.

EARLY MICROCOMPUTERS

The microcomputer arrived on the scene in the mid-1970s. Early models used tape cassettes for data storage, with data encoded in an unreliable audio (analog) signal. There were two main families of central processing chips, the 8080 and the 6502 chip, which were later to evolve into the IBM-compatible and the Macintosh lines of computers, respectively. The commands used by the chips were the same for all machines using that chip. However, the formats by which data was stored and displayed on a screen were not standardized, meaning that each model of computer required a different version of the same program, and computers could not share data. Early dot-matrix printers, typically using a 7-pin matrix, produced a legible but low quality product, unsuitable for business correspondence. Very primitive software was written by hobbyists, or provided by hardware manufacturers.

The addition of floppy disk drives to computers in the late 1970s marked a great advance in the reliability and speed of data storage. It became practical for independent programmers to write and sell software. The only word processing program from this period to achieve recognition was Michael Shroyer's Electric Pencil, which introduced word wrap, eliminating the need to press the carriage return key at the end of each line. This was a great innovation for its day.

The advent, in the late 1970s, of the standard operating system CP/M (Control Program/Micro) brought vastly increased standardization. Formats for file and memory structure were standard across all machines of that class. By 1980 IBM Selectrics and Diablo and Qume daisy-wheel printers were coupled to computers, giving a good quality printed output and a variety of type styles, although at a high price. Changing type style meant stopping the printer and manually changing the printing element (in the case of the daisy-wheel printers this was a disk about 3 inches in diameter). The addition of memory to printers made bidirectional printing possible. This eliminated the delay caused by the return of the print head to the left margin position at the beginning of every line.

While the logical disk structure was standard, physical disk organization was unique to each computer. Standardized 8 inch disks were replaced with less standard 5.25 inch disks. The screen display codes were also not standardized. This meant that slightly different versions of a program were still required for each brand, and in some cases each model, of computer. It also meant that different brands of computers could not exchange disks, although conversion software and facilities appeared in the mid-1980s.

WORDSTAR

Throughout the CP/M period the predominant word processing program was WordStar, although there were other minor competitors, such as Select and Perfect Writer. By recent standards CP/M WordStar was very primitive, lacking features now taken for granted, such as a spelling checker, footnotes, and proportional spacing. Onscreen help was limited, and installation often required a technically knowledgeable operator. It could only support one printer at a time; multiple printers required that different versions of the program be prepared. Nevertheless, WordStar took full advantage of the features of the printers of the early 1980s. It supported super- and subscript, bold or shadow print, underscore, page numbers, and one-line headers and footers. It achieved a great success with its keyboard structure, in which cursor movement commands were arranged in a logical, one-hand design (Control-E for up, Control-S for left, Control-D for right, and Control-X for down). The MicroPro Corporation, publisher of WordStar, successfully sold its product to hardware manufacturers, such as KayPro and Morrow. It was thus "bundled" with the computer; purchase of that brand of computer featured WordStar included, at a much lower price than it would cost if purchased separately. "WordStar To Go," an abbreviated version, was stored on memory chips and sold with some of the first laptops.

MS-DOS WORD PROCESSING

In the early 1980s the CP/M computers were replaced by more powerful machines using the Microsoft Disk Operating System (MS-DOS). This system was chosen by IBM for its microcomputers, and although IBM never dominated microcomputers as it wanted to, it served to set a common technical core for a large family of "IBM-compatible" computers. Among other things, IBM's floppy disk format became standardized over a large number of brands of computers, permitting exchange of data with an ease that CP/M computers, with their manufacturer-specific formats, never achieved. A software producer needed only to prepare a single version of a program, which would then run on the machines of many manufacturers. The MS-DOS computers also vastly increased available memory, added subdirectories to their disk structures, added function keys and an "Alt" key to the keyboard, and were easily customizable without sacrificing compatibility.

This new standardization, plus the added speed of the machines, created a great hardware and software boom in the 1980s. The microcomputer software industry grew at a rapid pace; customers were eager to purchase the newly standardized machines for which abundant software was available. Prices of hardware plunged. Software gained

dramatically in features and ease of use, while also declining in price.

GENERAL CHARACTERISTICS OF MS-DOS WORD PROCESSING PROGRAMS

MS-DOS word processing programs offered more of everything. The increased memory and disk storage capability meant that more extensive on-screen help could be made available. Dot-matrix printers improved the quality of their letter shapes dramatically; print quality never attained that of daisy-wheel and Selectric printers, but the dot-matrix printers were much faster and far more flexible. They offered proportional spacing (available on some daisy-wheel printers, but never successfully supported by CP/M programs), italic, a variety of type sizes, better support for foreign language characters, and the ability to print pictures. All of this kept the word processing program developers scrambling, successfully, to keep up.

New features were added to the programs yearly: footnotes; endnotes; the ability to edit more than one document; descriptive, nonprinting file headers; split screen editing; mathematical functions on data contained within the document. The features of third-party (supplementary) programs were gradually incorporated into the main programs; macros (master commands to automate repetitive operations); data exchange with other programs; spelling checkers; thesauri; data encryption; outline processors; graphics (illustration) creation and editing; charting; file comparison; indexing; an equation editor. A word processing program actually became a package of programs, filling many disks. WordPerfect 5.0, for example, in addition to installation and setup programs came with PTR.EXE, a program to edit printer definition files; CONVERT.EXE, a file conversion program to import and export text and data; GRAPHICNV.EXE, a program to import illustrations; SPELL.EXE, to edit the spelling dictionaries; and WPINFO.EXE, a program to provide information about the user's configuration to assist in diagnosing installation problems. Available for a small additional cost was a macro editor, later incorporated into the main program.

These new features meant more complex programs, and frustration for many users. A new industry sprang up to provide training and learning aids (books and videos). Still, a significant body of users do not make efficient use of their word processors, and find them intimidating and confusing. Even experienced users often find the complexities of the programs frustrating, and to master every feature of a major program is a full-time job.

Specific Programs

WordStar failed to make the transition from CP/M to MS-DOS machines. The greatest failure in the history of word processing was WordStar 2000, an improved version of the

program with many new features such as footnotes, but with a completely different command structure and user interface. It was received indifferently by the existing user base, who already had put in overtime to learn the previous commands and were not eager to repeat the process. There were never enough first-time users of WordStar 2000 to mark the program as a success and force users of the older WordStar 3 to make a switch. As a result, faced with irate users, the publisher retreated to its previous user interface, and released WordStar 4. WordStar was further damaged by a group of dissident employees who founded a new company and offered a competing program, NewWord.

WordStar 4 offered macros, improved installation, and better on-screen help, but was basically an adaptation of the older CP/M program. During the time these developments were under way, WordStar was overtaken by Microsoft Word and WordPerfect, which were first to offer such new features as laser printer support and print preview. In one of the most egregious examples of "version inflation," WordStar released versions 5, 5.5, and 6.0, while WordPerfect more honestly released version 5.0 and 5.1. The implication is of course that the program with the higher number is better; since this view would be held only by less knowledgeable users, it is tantamount to a declaration of defeat.

Microsoft Word

In the mid-1980s, Microsoft Word was the leading word processing program, followed by WordPerfect, and very much in third place was XyWrite, a respected program for serious writers which never achieved the sales its partisans said it deserved. Word was written to take full advantage of the graphics capability of the MS-DOS computers. This allowed it to have a better display, including screen fonts for foreign language characters. It also offered superior formatting capabilities and style sheets; it was the first major program to incorporate an outline processor. Word was well-placed, by its graphics-based structure, to become the most successful program for the similarly graphics-based Macintosh, and to gain an early lead as the word processor for the IBM graphic interface Windows (also a Microsoft product). However, Word's lead, in the MS-DOS world, did not last long. Its menus were cryptic; function codes could not be searched for; and Microsoft, a controversial company which had many other software products, did not give Word as high a priority as the WordPerfect Corporation did its principal product.

Wordperfect

From the late 1980s and into the 1990s, the predominant word processing program was WordPerfect. This is only partly due to the features of the program. WordPerfect is a character-based (as opposed to graphics-based) program, its function keys are arbitrary and hard to learn, and while

it has been a strong competitor, it has never held the lead in flashy features.

The triumph of WordPerfect as the predominant word processing program is due at least as much to good management and business decisions as it is to the program's features. First, the program is available for a greater variety of operating systems than any other, although the MS-DOS version is the most popular. It currently is the only word processor that has a common file format for both MS-DOS and Macintosh versions. It has also been a leader in government and international sales, providing many more foreign language versions, and more support for foreign characters and alphabets, than any competitor. It has been more successful than any other company in providing a package of programs; a spreadsheet (PlanPerfect), a database (Data-Perfect), a drawing program (DrawPerfect), and a shell providing mail, calendar, and file management functions (WordPerfect Office). A number of other characteristics, while not as easy to proclaim in advertising, have endeared it to data processing professionals, whose recommendations have had a major impact in corporate decisions to adopt it; a macro programming language and editor, a merge programming language, soft keyboards, and the broadest printer support of any program. WordPerfect also has the best documentation in the industry, a significant advantage in a field long characterized by poorly written or inaccurate documentation.

Perhaps the biggest single factor in the success of WordPerfect is quite external to the program itself: the company's liberal policy for telephone assistance. It is WordPerfect's policy to provide purchasers of its microcomputer programs unlimited telephone assistance free of charge, and indeed it subsidizes the service within the United States by supplying "800" numbers. At first the company would verify that the caller had purchased its program; subsequently it provided service even to those with stolen copies.

The contribution of this decision to WordPerfect's success cannot be exaggerated. For new users, confused or faced with installation problems, it offered reassurance and help; for the intermediate it offered help with advanced features; for advanced users faced with program bugs it offered confirmation of the bugs and indirect access to expert assistance. The telephone assistance and reduced user frustration and greatly increased loyalty to the product. A feature much commented on was the addition of "hold jockeys," similar to radio disk jockeys, to calm users on hold during busy periods by playing music, giving progress reports on their calls, and offering news about WordPerfect products. The telephone help service also provided WordPerfect with invaluable feedback on user perceptions of its programs, and the company has shown an admirable ability to assemble and use the data so generated. However, the costs of providing this service have been heavy. It remains to be seen whether WordPerfect will be able to maintain this free service indefinitely.

Simpler Word Processors

As the major word processors grew so complex, a number of smaller, cheaper, and simpler alternatives emerged in the mid-1980s. These included PC Write, Bank Street Writer, First Choice, and a number of others. While each has a number of users, none of them has achieved predominance. In 1990, WordPerfect released LetterPerfect, a simpler and smaller version of its program that retained file compatibility.

Macintosh Computers

The CP/M and IBM-compatible microcomputers all use members of a single family of processing chips: the 8080 and its descendents the Z-80, 8088, 8086, 80286, 80386, and 80486. The other main family of computer processing chip, the 6502 and its descendents, gave birth to the Apple and then to the Macintosh computer, with the short-lived Lisa as an intermediary. The Apple computer, whose color, joysticks, and oversized letters made it very successful in schools, was never used for serious word processing. Its video display was too poor to have an 80 column by 24 line screen; thus it was not possible to see at all what things would look like on the screen.

The Macintosh, introduced about 1984, quickly gained a loyal and vociferous group of followers. Its operating system, self-installation, and graphical user interface made it far easier to install and use than IBM-compatible computers, which the company emphasized in its advertising. Documents could be seen on the screen just as they would be printed, and the writer had precise control over fonts and type sizes. In contrast with the IBM microcomputers, patents and copyrights protected the Macintosh from competitors, and to date there are no Macintosh-compatible computers. This meant, however, that prices remained much higher than in the more competitive IBM-compatible environment.

The Macintosh was never much used in an office environment or for word processing. The dot-matrix printer sold with it produced an output only marginally suitable for correspondence. For some time, there was no intermediate step between that printer and an expensive PostScript laser printer. The mouse was awkward for good typists, as it required that a hand be removed from the keyboard, and the control over typeface and type size was not only unneeded but even distracting to writers.^[1] The Macintosh's greatest success was in publishing and advertising, for which its graphics screen and precise preview of type, illustrations, and layout were invaluable.

WORD PROCESSING AND TYPESETTING

Reducing the cost of typesetting so that it could be incorporated in an office or small business budget has been a

long-standing goal of office equipment. Traditional lead type required expensive equipment and highly trained operators; it was slow to produce and correct. Adaptations of the electric typewriter provided proportionally spaced output of typeset quality, but justification—making an even right margin—meant that each line needed to be typed twice. The first keyboarding mechanically counted the length of the line, and the repetition inserted fractional spaces between words so as to align the right margin. IBM's entry in this field was the Selectric Composer, a piece of hardware vaguely resembling but much more complex than the Selectric typewriter, with proportional spacing and with three pitches (15, 17.4, and 19.8 characters per inch). Special ribbon and paper were used to obtain a very black and crisp output, suitable for offset printing.

A model of the Selectric Composer was soon fitted to read tapes created and corrected on the MT/ST. The machine calculated interword spaces, and it was thus necessary to type only once to achieve a justified output. Hyphenation during playback, though operator assisted, was implemented for the first time. While the Magnetic Tape Selectric Composer was still out of the price range for most offices, and was limited to a maximum type size of 12 points, its input could be prepared by a secretary without the special training required of a typesetter. It marked an important first step in the marriage of word processing and typesetting.

Although from early in the computer age, typesetters had developed the hardware needed to use computer files as input, this was limited to letters, numbers, and punctuation; formatting, control of type face or size, and use of special characters were only possible if complex codes were added to the computer files. The results could not be previewed on the computer, nor could the transferred files, once processed on the target hardware, be returned for further editing on the computer. The output devices were far too expensive for office or small business use.

Production of typeset output on the microcomputer itself required an affordable output device with good resolution, speed, and print quality, the ability to handle a variety of type sizes and special characters, and the processing power to calculate microspacing needed to justify lines. The latter is the simplest; the program uses a table containing the widths of each character, calculates the total length of the letters in a line by adding the width of each, subtracts this from the desired line length (measure), and divides the remainder by the number of interword spaces. The result is then sent to the printer as fractional spacing instructions. Additionally, good typesetting requires kerning; removing space between selected pairs of letters to achieve a satisfying visual effect. This added to the previous requirement the need to look up pairs of characters in a table and send fractional spacing adjustments to the printer between letters.

Proportional spacing was partially implemented on CP/M machines, and fully adapted on both MS-DOS and

Macintosh machines in the mid-1980s. Kerning was implemented with WordPerfect 5.0, in 1988. The output device of choice proved to be the laser printer. Daisy-wheel printers could handle proportional spacing, but not varying type sizes. Changes from roman to italic required that the machine be stopped twice for manual change of print wheels. Dot-matrix printers could change to different type sizes and styles without operator intervention, but were unacceptably slow when operated at their finest resolution. The blackness of their output was also unreliable.

These problems were resolved with the laser printer, which appeared on the scene in the mid-1980s. By the end of the 1980s prices had so declined that it was available to almost anyone needing to produce typeset material. Using a print engine adapted from the photocopy machine, the laser printer offered high speed and reliability together with good print quality.

All laser printers came with some typefaces built in. All but the earliest accepted and housed in memory electronic type stored in the memory chips of plug-in cartridges, or sent by the computer. The electronic type consisted of patterns of dots that would be printed on the page when the appropriate letter was sent from the computer. Any size or style of type could thus be accommodated. By the end of the 1980s and early 1990s, production of electronic type had grown into a new industry, offering the microcomputer-based typesetter virtually all the choices in type style previously available on dedicated typesetting equipment costing many times the price. Many previously unavailable fonts appeared, both ornamental (e.g., based on handwriting) and practical (exotic foreign languages; dead languages used in Biblical and historical studies).

Page design programs, sometimes described with the misleading label "Desktop Publishing," allowed microcomputer users to arrange headlines, text, and illustrations on pages with ease and precision. The leading programs were Aldus PageMaker and Ventura Publisher, and several simpler and less expensive alternatives.^[2]

THE FUTURE OF WORD PROCESSING

Hardware has always set the boundaries for word processing. Hard disks and larger computer memories meant larger and more powerful programs could be stored and run. Better graphics displays meant more characters could be shown. Better printers allowed growth from letter writing to typesetting.

The huge storage capacity of the optical disk means that word processing will be linked even further with a multimedia environment including pictures and sound. At the same time, access to huge bodies of electronic text, locally or remotely stored on optical media, is rapidly becoming a reality. Reading will eventually take place primarily on a screen, and word processing software will be used for reading as well as a writing. The software

offers the possibility of reading texts in new, nonlinear ways, creating links between blocks of text or between files (“hypertext”) which have no parallel in the conventional, printed world.

As written communication shifts to electronic rather than paper transmission, word processors will become more closely linked with electronic mail systems. If past trends continue, functions presently carried out by separate programs from different manufacturers—grammar checking, concordance producing—will also be incorporated into the concept of word processing. Typesetting will become even less distinguishable from word processing. Users will have the option of having display screens emulate the type styles of printed books. As operating systems become more standardized—Microsoft Windows, the very successful new user interface for the

IBM-compatible, resembles the Macintosh in many ways—word processors will also come to resemble each other more. They will thus become easier to learn. Voice input and output is also in the near future, as is hardware designed to place less stress on the human body (arms, fingers, back, and eyes).

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World Intellectual Property Organization (WIPO)

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Abstract

The World Intellectual Property Organization (WIPO) is a specialized agency of the United Nations that promotes the development of a balanced and effective international intellectual property system through cooperation among Member States and other international organizations and through the administration of international treaties. Long dedicated to the promotion and use of intellectual property as a means of stimulating innovation and creativity, the organization in recent years has directed effort toward matters relating to access to information in the public interest. Because the WIPO is responsible for international norm-setting on copyright, its decisions have an impact on the work of libraries and archives. The WIPO benefits from the participation of international and national library and archive organizations as accredited observers. This entry outlines the WIPO's activity and efforts to address international legal and policy issues that affect libraries, archives, and the public at the WIPO within the framework of advocacy.

INTRODUCTION

The World Intellectual Property Organization (WIPO) is a specialized agency of the United Nations (UN) with headquarters in Geneva, Switzerland, that promotes the international protection of intellectual property and fosters cooperation on copyrights, trademarks, industrial designs, and patents. Within the UN system, WIPO functions as an autonomous international organization established by intergovernmental (IGO) agreement. It is one of the 16 specialized agencies having wide international responsibilities in economic, social, cultural, educational, health, and related fields under Article 57 of the UN Charter and brought into relationship with the UN according to Article 63 of the charter. Others include UNESCO, the International Labour Organization, the World Health Organization, the International Monetary Fund, and the World Bank.

WIPO addresses the protection of intellectual property worldwide as a means of stimulating innovation and creativity through cooperation among Member States and in collaboration with other international organizations. In the field of copyright and related rights, WIPO administers a system of legal norms that have their origins in the invention of the printing press in the mid-fifteenth century and developed into an international copyright system in the second half of the nineteenth century. International norm-setting through treaties and other instruments provides direction for the international community and shapes national laws that have effect within the respective jurisdictions of Member States. From its origins, international copyright has been a dynamic system and this is no less true today. Copyright laws that protect literary, artistic, musical, dramatic, and other original creative works, and

related rights that extend to certain groups of rightsholders such as performers, producers of phonograms, and broadcasting organizations are in a constant state of evolution as they adapt to social change and new technologies.

In the twenty-first century, WIPO faces unique political, social, and cultural challenges in the field of copyright and related rights. First, digital technology has radically transformed the copyright landscape. As the means to access and share intellectual and creative content expand and as new digital content is created at exponential rates, maintaining copyright norms that serve the interests of creators and the needs of the world's users is a central challenge. Second, the concerns of developing nations in the global information society have become more pronounced. Efforts to strengthen the voice of developing and least developed nations and to mitigate the effects of globalization in the area of information access have resulted in numerous initiatives mainstreamed across WIPO committees toward equitable participation of all nations in the global information society. Third, the organization in recent years has directed attention generally toward access to information in the public interest, following its mission to "to lead the development of a balanced and effective international intellectual property (IP) system that enables innovation and creativity for the benefit of all."^[1]

WIPO benefits from the participation of international and national library and archival organizations as accredited observers. Within the framework of advocacy, they address international legal and policy issues that affect libraries, archives, and the public because of the many evolving aspects of intellectual property rights in the digital age. WIPO's engagement since 2004 on the issue of copyright limitations and exceptions to benefit blind and visually impaired persons, libraries and

archives, and education is a key effort toward achieving balance in international norms for the twenty-first century.

HISTORY

WIPO has its origins in the Paris Convention for the Protection of Industrial Property established in 1883 to set minimum international standards for the protection of industrial property (patents, marks, industrial designs, utility models, trade names, and geographical indications) and the Berne Convention for the Protection of Literary and Artistic Works established in 1886, the world's first international copyright treaty. These treaties were the result of an effort that began in the mid-nineteenth century to standardize protection of intellectual property among nations. The administrations of these conventions, or Unions, merged in 1892 to form the United International Bureaus for the Protection of Intellectual Property, commonly known by the French title *Bureaux Internationaux Réunis pour la Protection de la Propriété Intellectuelle* and the French acronym BIRPI. In 1960, BIRPI moved from Berne to Geneva. At the Intellectual Property Conference of Stockholm held from June 11 to July 14, 1967, a new treaty was adopted, the Convention Establishing the World Intellectual Property Organization (WIPO Convention), designating the International Bureau of WIPO as a successor to BIRPI.

WIPO began its work as an IGO organization in 1970 when the administrative provisions of the 1967 Stockholm Act of the Berne Convention entered into force, with the objectives of “promot[ing] the protection of intellectual property throughout the world through cooperation among States and, where appropriate, in collaboration with any other international organization” and “ensur[ing] administrative cooperation among the Unions.”^[2] In 1974, WIPO acquired the status of a specialized agency of the UN to promote the worldwide protection of intellectual property through cooperation of Member States and other international organizations and to administer the international treaties under its authority.

MEMBERSHIP AND GOVERNANCE

WIPO is a consensus-based organization in which Member States set the strategic direction for activities related to intellectual property and approve the organization's activities. With a constitution of 187 Member States, WIPO's reach extends to nearly all nations of the world. Delegations from Member States comprise the decision-making core of the organization. In addition, WIPO admits IGO and nongovernmental (NGO) organizations to serve as accredited observers. IGO and NGO representatives participate in the work of WIPO by making statements in

assemblies and committee meetings, providing written statements on issues under discussion, consulting with WIPO delegations, and engaging in other core WIPO activities within the framework of advocacy. There are currently 70 IGOs and 319 NGOs accredited as observers, representing the interests of libraries, archives, and museums, educational institutions, blind and reading disabled persons, indigenous peoples, consumers, members of the public, rightsholders, intellectual property industries, and other stakeholders in the intellectual property system.

ORGANIZATIONAL STRUCTURE

Various WIPO bodies are responsible for discussion, negotiation, and decision making on intellectual property issues and for administrative activity. Formal guidelines outlined in the WIPO General Rules of Procedure serve as standards for conduct of procedure and deliberation within WIPO bodies.^[3]

Decision-Making Bodies

The main decision-making bodies, which meet annually, are responsible for the highest-level decisions within the organization:

- The WIPO General Assembly, described in Article 6 of the WIPO Convention, is composed of the Member States of WIPO, which are also members of any of the Unions. Its main functions are to appoint the director general upon nomination by the Coordination Committee, to review and approve reports of the director general and reports and activities of the Coordination Committee, to adopt the biennial budget of the Unions, to adopt the financial regulations of the organization, to determine the working languages of the Secretariat, to invite states to become parties to the WIPO Convention, and to accredit non-Member States and organizations as observers.
- The WIPO Conference, described in Article 7 of the WIPO Convention, consists of states that are parties to the WIPO Convention. Its main functions are to discuss intellectual property issues and adopt recommendations, to adopt the biennial budget of the Conference, to establish the biennial program of legal–technical assistance, to adopt amendments to the WIPO Convention, and to accredit non-Member States and organizations as observers.
- The WIPO Coordination Committee, described in Article 8 of the WIPO Convention, consists of States that are party to the WIPO Convention and also members of the Executive Committee of the Paris Union or the Executive Committee of the Berne Union, or both. It gives advice to the organs of the Unions, the General

Assembly, the Conference, and the director general, on financial and other matters. It prepares the draft agenda for the General Assembly and the draft agenda, draft program, and budget of the Conference. It also nominates a candidate for the position of director general for appointment by the General Assembly and appoints an acting director general if the position becomes vacant between sessions of the General Assembly.

In addition, decision-making capacity is exercised by the assemblies of the Member States of the Unions.

Activity

The organization's activity is carried out through assemblies, committees, and working groups consisting of delegations from the Member States, as well as through the work of the Secretariat that develops programs to implement strategic goals and provides expertise to Member States.

WIPO has defined nine strategic goals:

1. A balanced evolution of the international normative framework for intellectual property
2. Provision of premier global intellectual property services
3. Facilitating the use of intellectual property for development
4. Coordination and development of the global intellectual property infrastructure
5. World reference source for intellectual property information and analysis
6. International cooperation on building respect for intellectual property
7. Addressing intellectual property in relation to global policy issues
8. A responsive communications interface between WIPO, its Member States, and all stakeholders
9. An efficient administrative and financial support structure to enable WIPO to deliver its programs

WIPO bodies advance the organization's strategic goals through a broad range of activity:

- *Norm-setting*: Administration of multilateral treaties, conventions, and agreements and supporting the further evolution of the international intellectual property framework by developing laws and standards.
- *Services*: Providing global intellectual property services that offer easy and cost-effective means for obtaining international protection for patents, trademarks, designs, and appellations of origin, and for resolving disputes.
- *Development and technical assistance*: Within the framework of capacity-building, assisting governments

and organizations in developing and least developed nations to build national intellectual property infrastructures through policies and strategies that support economic development.

- *Technical infrastructure*: Providing access to free WIPO databases of intellectual property information and technical platforms for sharing of information among national intellectual property offices.
- *Promoting intellectual property*: Promoting intellectual property and understanding and respect for intellectual property norms internationally.

WIPO cooperates with other agencies of the UN in Geneva and has external offices in New York, Rio de Janeiro, Singapore, and Tokyo. On December 22, 1995, WIPO signed an agreement between the World Intellectual Property Organization and the World Trade Organization (WTO), which came into force on January 1, 1996, establishing a commitment to support and cooperate with the WTO in matters relating to intellectual property.^[4]

Committees

WIPO Member States participate in a large number of committees. The committee structures evolve with the directions taken by WIPO in international norm-setting and development. Advisory committees and ad hoc committees may focus on emerging issues in intellectual property, to serve as a means for exploration, study, and scoping of issues. This often involves the creation of reports, recommendations, and proposals. Any committee or other body may establish working groups to study specific issues in more detail. Some of the most important committees include the following:

Permanent committees

- The Program and Budget Committee sets the biennial budget, closely linked to the strategic goals and priorities of the organization.
- The Committee on Development and Intellectual Property (CDIP) addresses issues related to intellectual property and development as part of the organization's commitment to the WIPO Development Agenda adopted in 2007.
- The Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC) works toward normative solutions for the protection of genetic resources, traditional knowledge, and traditional cultural expressions, also referred to as expressions of folklore.
- The Advisory Committee on Enforcement addresses global enforcement issues through technical assistance to Member States and coordination with private sector organizations to fight piracy and counterfeiting and

engages in education and training activity, within the framework of recommendation 45 of the WIPO Development Agenda.

Standing committees

WIPO established a system of standing committees in 1998 to facilitate the progressive development of international intellectual property law. Standing committees bring together representatives of Member States at regular intervals to discuss and reach consensus on global intellectual property norms. Norm-setting activity includes making recommendations to the General Assembly to conclude new treaties, to amend treaties, or to adopt other forms of international agreement. The adoption of new treaties requires the convening of diplomatic conferences, high-level meetings of Member States where the language of new treaties is finalized.

- The Standing Committee on the Law of Patents is a forum for discussion, coordination, and guidance on the development of patent law.
- The Standing Committee on the Law of Trademarks, Industrial Designs and Geographical Indications is a forum to discuss issues, facilitate coordination, and provide guidance on the development of international law on trademarks, industrial designs, and geographical indications, including the harmonization of national laws and procedures.
- The Standing Committee on Copyright and Related Rights (SCCR) advances international norms in copyright and related rights. Many of the issues on the committee's current agenda concern the development of copyright law that addresses new technologies and the Internet.
- The Committee on WIPO Standards was created in 2009 as a forum for discussion of standards relating to industrial property information and documentation. It grew out of the work of the Standards and Documentation Working Group of the Standing Committee on Information Technologies.

WIPO Secretariat

The Secretariat provides administrative and specialized support to all WIPO bodies. It consists of the WIPO staff of specialists in intellectual property law and practice, administration, and related fields such as economics, information technology, public policy, and translation. The WIPO Secretariat, called the International Bureau, is responsible for coordinating meetings of Member States and implementing their decisions, administering international registration systems, developing and implementing programs established to achieve the organization's goals, and providing legal-technical assistance to Members. The

Secretariat operates under the directorship of the WIPO director general and the deputy or assistant director general of each of its seven sectors: brands and designs, development, global issues, innovation and technology, administration and management, culture and creative industries, and global infrastructure.

WIPO's program of technical assistance to developing and least developed nations is one of its major activities, providing legislative advice, training and consultation programs in intellectual property, support for national policy development and national intellectual property infrastructure, human resource and institutional development, automation services, and enforcement programs.^[5] It is worth noting that this activity is often criticized by civil society organizations for having an inherent bias toward the interests of rightsholders in developed nations because of the emphasis on strengthening standards of intellectual property protection and enforcement in developing nations.

TREATY ADMINISTRATION

WIPO administers 26 international treaties, of which 7 are in the area of copyright and related rights. The most recent WIPO treaty, the Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled, was adopted on June 27, 2013. The 26 treaties administered by WIPO include its foundation treaty:

- Convention Establishing the World Intellectual Property Organization (1967)

Treaties in the area of copyright and related rights include

- Berne Convention for the Protection of Literary and Artistic Works (1886)
- International Convention for the Protection of Performers, Producers of Phonograms and Broadcasting Organizations (Rome Convention) (1961)
- Convention for the Protection of Producers of Phonograms against Unauthorized Duplication of their Phonograms (Geneva Convention) (1971)
- WIPO Copyright Treaty (WCT) (1996)
- WIPO Performances and Phonograms Treaty (WPPT) (1996)
- Beijing Treaty on Audiovisual Performances (2012)
- Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired or Otherwise Print Disabled (2012)

Intellectual property treaties establishing basic standards of protection in each member country in the area of patents, trademarks, industrial designs, utility models, and geographical indications include

- Paris Convention for the Protection of Industrial Property (1883)
- Madrid Agreement for the Repression of False or Deceptive Indications of Source on Goods (1891)
- The Brussels Convention Relating to the Distribution of Program-Carrying Signals Transmitted by Satellite (1974)
- Nairobi Treaty on the Protection of the Olympic Symbol (1981)
- Treaty on Intellectual Property in Respect of Integrated Circuits (Washington Treaty) (1989)
- Trademark Law Treaty (1994)
- Patent Law Treaty (2000)
- Singapore Treaty on the Law of Trademarks (2006)

Global protection system treaties providing an international registration or filing system for intellectual property to simplify the application or filing process in all countries in which protection is sought include

- Madrid Agreement Concerning the International Registration of Marks (1891)
- Hague Agreement Concerning the International Registration of Industrial Designs (1934)
- Lisbon Agreement for the Protection of Appellations of Origin and their International Registration (1958)
- Patent Cooperation Treaty (1970)
- Budapest Treaty on the International Recognition of the Deposit of Microorganisms for the Purposes of Patent Procedure (1977)
- Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks (1989)

Treaties that create classification systems that index information on inventions, trademarks, and industrial designs and facilitate information retrieval include

- Nice Agreement Concerning the International Classification of Goods and Services for the Purposes of the Registration of Marks (1957)
- Locarno Agreement Establishing an International Classification for Industrial Designs (1968)
- Strasbourg Agreement Concerning the International Patent Classification (1971)
- Vienna Agreement Establishing an International Classification of the Figurative Elements of Marks (1973)

WIPO AND THE DEVELOPMENT OF INTERNATIONAL COPYRIGHT NORMS

In the global information society, international copyright norms govern access to information in all parts of the world. International copyright treaties and agreements, implemented into national legislation, form a system of interrelated laws that provide a basis for copyright

protection for literary and artistic works and neighboring rights protection for performances, producers of phonograms, and broadcasting organizations.

Copyright laws are shaped by the international treaties and agreements that have developed since the late nineteenth century to provide some degree of harmonization across national jurisdictions. For more than a century, major treaties and conventions have been established to respond to needs arising from the increasing interdependence of nations. International agreements are in a constant process of change and are shaped by social and economic needs and technological advances.

The Berne Convention for the Protection of Literary and Artistic Works was adopted in 1886 as the result of an effort that began in the mid-nineteenth century, when international cooperation was needed to standardize protection of authors' rights among nations. It was amended eight times over the course of nearly a century to meet the evolving social and technological landscape. Gradually, there was a need to address specific aspects of copyright protection relating to computer technology and digital networks. The WCT and WPPT were adopted in 1996 for this purpose. Expanding on the Berne Convention, they adapted copyright to the digital age. The Beijing Treaty on Audiovisual Performances was adopted in June 2012 to protect the rights of audiovisual performers, defined as actors, singers, musicians, dancers, and other persons who act, sing, deliver, declaim, play in, interpret, or otherwise perform literary or artistic works or expressions of folklore. The treaty was designed to fill the gap in related rights protections left by the 1996 WPPT that protected audio performers but not audiovisual performers.

The adoption on June 27, 2013, of the *Marrakesh Treaty to Facilitate Access to Published Works for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled* was the result of an effort spurred by citizens and civil society organizations to facilitate uses of new information and communication technologies to benefit persons with visual impairments or with other print disabilities through an enhanced legal framework at the international level. It is the first treaty in history dedicated to the expansion of copyright limitations and exceptions.

WIPO continues to deliberate on the adoption of a treaty for the protection on broadcasting organizations. Proponents of the treaty proposal argue that advances in technology are not adequately covered by the 1961 Rome Convention, and that a treaty covering broadcasting and cablecasting is necessary in order to prevent piracy and theft of signals. This is also an issue that was left out of the WPPT. Discussions that began at the WIPO Worldwide Symposium on Broadcasters' Rights in 1997 gradually led to treaty proposals that continue in the SCCR.

WIPO's engagement since 2004 on the issue of copyright limitations and exceptions to benefit blind and visually impaired persons, libraries and archives, and education is a key effort toward achieving balance in international norms for the twenty-first century. Following

the success of the Marrakesh Treaty, the SCCR continues its discussions toward the possible adoption of treaty instruments to benefit libraries, archives, and education.

LIBRARIES, ARCHIVES, AND INTERNATIONAL COPYRIGHT

WIPO benefits from the active participation of international and national library organizations as accredited observers at committee meetings and other events. Library and archival groups contribute to the promotion of a balanced and equitable international intellectual property system and share common interests with other non-governmental, nonprofit organizations working in the public interest, such as those dedicated to environmental and sustainable development concerns, consumer groups, charities, organizations representing the interests of blind and visually impaired persons, organizations representing indigenous peoples, and organizations representing educational institutions.

Because WIPO is responsible for international norm-setting on copyright, its decisions have an impact on the work of libraries and archives. Decisions made at WIPO may result in new international treaties that are implemented into national copyright laws. They may also result in nonbinding forms of norm-setting such as recommendations, resolutions, declarations, or guidelines. Libraries share a unique social responsibility for preservation of and access to the world's intellectual heritage and have an interest in promoting copyright laws that provide the broadest possible use of information for creativity, research, and education. Library and archival associations with accreditation at WIPO actively respond to and develop proposals to influence international copyright norms at the SCCR. They have also been active at the CDIP and the IGC and in other fora. Participation of library and archival organizations at WIPO benefits the broadest possible range of social interests.

Among the accredited international NGOs are those representing libraries, archives, and museums: Electronic Information for Libraries (EIFL), the European Bureau of Library, Information and Documentation Associations, the International Council of Museums, the International Council on Archives (ICA), the International Federation of Library Associations and Institutions (IFLA), the Scholarly Publishing and Academic Resources Coalition, and the Special Libraries Association. Among the national NGOs representing libraries, archives, and museums are Corporación Latinoamericana de Investigación de la Propiedad Intelectual para el Desarrollo (Corporación Innovarte), the German Library Association, the Library Copyright Alliance (LCA), the Italian Library Association, and the Society of American Archivists.

LIBRARY ADVOCACY AT WIPO

Issues being discussed at the highest levels in international policymaking have direct implications on the work of libraries and the future of information access.

Copyright Limitations and Exceptions for Libraries and Archives

One of the key issues of library advocates at WIPO is the need to reinforce copyright limitations and exceptions by means of a new international agreement. Work on limitations and exceptions occurs at the meetings of the SCCR. In successive meetings of the SCCR and the WIPO General Assembly, with increasing involvement since 2004, library and archival groups have argued in favor of global norms for limitations and exceptions that enable uses of works without prior consent of or payment to the copyright holder for purposes such as research, scholarship and teaching, library preservation, and interlibrary loan. They take the position that limitations and exceptions are a fundamental part of the copyright system but have not expanded at an equal pace with standards of protection introduced by new WIPO treaties in the last two decades and by the 1994 WTO Agreement on Trade-Related Aspects of Intellectual Property Rights that added a new dimension of enforcement by linking intellectual property protection with international trade. Other factors that have prompted library and archival organizations to voice their concerns include extension of copyright terms, anticircumvention legislation, and an increasing culture of enforcement in many nations. Their concerns are expressed in statements, referred to as interventions, at official meetings and also in panels and discussions held as side events in the course of committee sessions.^[6]

Library and archival advocates generally support the positions of developing and least developed nations in opposing higher and more rigid standards of protection that are not in the interests of developing nations and that hinder them from equitable participation in the global information society. In keeping their markets open for other types of trade, developing and least developed nations often adopt higher standards of protection than might best serve them domestically, with the effect that available limitations and exceptions are not used optimally for creativity, research, and education. Free trade agreements that incorporate high standards of intellectual property protection are considered by library advocates to hinder access to knowledge and to thwart social, cultural, and economic development. IFLA, together with ICA, EIFL, and Corporación Innovarte, is working with WIPO Member States to gain support for a binding international instrument to update copyright limitations and exceptions for libraries and archives worldwide.

To address matters of the public interest, in the last decade WIPO has initiated a series of expert studies highlighting the importance of copyright limitations and exceptions in the interest of blind and visually impaired persons, libraries and archives, and education:

- *WIPO Study on Limitations and Exceptions of Copyright and Related Rights in the Digital Environment*, prepared by Sam Ricketson^[7]
- *Automated Rights Management Systems and Copyright Limitations and Exceptions*, prepared by Nic Garnett^[8]
- *Study on Copyright Limitations and Exceptions for the Visually Impaired*, prepared by Judith Sullivan^[9]
- *Study on Copyright Limitations and Exceptions for Libraries and Archives*, prepared by Kenneth Crews^[10]
- *Study on the Limitations and Exceptions to Copyright and Related Rights for the Purposes of Educational and Research Activities in Latin America and the Caribbean*, prepared by Juan Carlos Monroy Rodríguez^[11]
- *WIPO Study on Limitations and Exceptions for Copyright and Related Rights for Teaching in Africa*, prepared by Joseph Fometeu^[12]
- *Study on Limitations and Exceptions for Copyright for Educational Purposes in the Arab Countries*, prepared by Victor Nabhan^[13]
- *WIPO Study on the Copyright Exceptions for the Benefit of Educational Activities for Asia and Australia*, prepared by Daniel Seng^[14]
- *Study on Copyright Limitations and Exceptions for Educational Activities in North America, Europe, Caucasus, Central Asia and Israel*, prepared by Raquel Xalabarder.^[15]

The studies are comparative in nature, comparing levels of limitations and exceptions across national laws worldwide. The *Study on Copyright Limitations and Exceptions for Libraries and Archives* provides the first comprehensive overview of statutory provisions in national copyright laws of WIPO Member States for the benefit of libraries and archives and underlines the need for expanding the scope of copyright limitations and exceptions worldwide.

In support of increasing minimum levels of limitations and exceptions internationally, the US-based LCA, along with EIFL and IFLA, drafted a *Statement of Principles on Copyright Exceptions and Limitations for Libraries and Archives* in May 2009.^[16] The statement outlines the urgency of taking action to expand limitations and exceptions to meet the needs of librarians and the public in the digital environment. The statement asks WIPO Member States to address the gaps in copyright provisions for libraries and archives in their national laws. It supports WIPO's commitment to developing nations in the WIPO Development Agenda adopted in 2007 to ensure that intellectual property law and policy continue to serve the public good in a balanced way in all parts of the world. It

respectfully requests Member States to adopt 12 principles to guide the formulation of copyright limitations and exceptions for libraries and archives in national copyright laws:

- *Preservation*: A library should be permitted to make copies of published and unpublished works in its collections for purposes of preservation, including migrating content to different formats.
- *Legal deposit*: Legal deposit laws and systems should be broadened to include works published in all formats and to allow for preservation of those works.
- *Interlibrary loan and document supply*: Libraries should be able to supply documents to the user directly or through the intermediary library irrespective of the format and the means of communication.
- *Education and classroom teaching*: It should be permissible for works that have been lawfully acquired by a library or other educational institution to be made available in support of classroom teaching or distance education in a manner that does not unreasonably prejudice the rightsholder. A library or educational institution should be permitted to make copies of a work in support of classroom teaching.
- *Reproduction for research or private purposes*: Copying individual items for or by individual users should be permitted for research and study and for other private purposes.
- *Provision for persons with disabilities*: A library should be permitted to convert material from one format to another to make it accessible to persons with disabilities. The exception should apply to all formats to accommodate user needs and technological advances. To avoid costly duplication of alternative format production, cross-border transfer should be permitted.
- *General free use exceptions applicable to libraries*: A general free use exception consistent with fair practice helps ensure the effective delivery of library services.
- *Orphan works*: An exception is needed to resolve the problem of orphan works, where the rightsholder cannot be identified or located.
- *Copyright term*: Consistent with the Berne Convention, the general term of copyright should be the life of the author plus 50 years.
- *Technological protection measures that prevent lawful uses*: It should be permissible for libraries and their users to circumvent a technological protection measure for the purpose of making a noninfringing use of a work. Implementation of anticircumvention legislation in many nations exceeds the requirements of Article 11 of the WIPO Copyright Treaty, effectively eliminating existing exceptions in copyright law.
- *Contracts and statutory exceptions*: Contracts should not be permitted to override exceptions and limitations. The goals and policies providing for exceptions

are important statements of national and international principle and should not be varied by contract.

- *Limitation on liability:* There should be a limitation on liability for libraries and library staff who act in good faith, believing or having reasonable grounds to believe, that they have acted in accordance with copyright law.

The statement is part of the sustained effort that began in 2004 to encourage WIPO to address copyright limitations and exceptions for blind and visually impaired persons, for libraries and archives, and for education. As the issue advanced at WIPO, in November 2010 the SCCR officially placed limitations and exceptions on its agenda and established a work program and a timetable for discussion over several years.

An effort by library and archival associations to prepare more formal proposals in the form of a draft treaty produced the *Treaty Proposal on Limitations and Exceptions for Libraries and Archives* by IFLA, ICA, EIFL, and Corporación Innovarte.^[17] The draft treaty sets out key issues for libraries and archives in taking a global approach to copyright limitations and exceptions to secure the effective and unhindered flow of information essential for global equality of access to research, ideas, and innovation. The treaty proposal is composed of 30 articles outlining the rights and obligations of Member States in reinforcing the role of libraries and archives in the digital future. Core articles cover

- Right to Parallel Importation
- Right to Acquire Works
- Right to Library and Archive Lending and Temporary Access
- Right of Reproduction and Supply of Copies by Libraries and Archives
- Right of Preservation of Library and Archival Materials
- Right to Use of Works and Material Protected by Related Rights for the Benefit of Persons with Disabilities
- Right to Access Retracted and Withdrawn Works
- Right of Use of Orphan Works and Materials Protected by Related Rights
- Right to Cross-Border Uses
- Right to Translate Works and Materials Protected by Related Rights
- Obligation to Respect Exceptions to Copyright and Related Rights
- Obligations Concerning Technological Protection Measures
- Limitation on Liability for Libraries and Archives
- Legal Deposit
- Government Publications
- Right to Extract and Reuse Facts and Information

At the SCCR/23 meeting in November–December 2011 and in subsequent meetings, library and archive groups

gained sufficient support from WIPO Member States to bring their proposals into an official working document, the *Working Document Containing Comments on and Textual Suggestions towards an Appropriate International Legal Instrument (in Whatever Form) on Exceptions and Limitations for Libraries and Archives*.^[18] An extensive document, it contains proposed text and comments offered by Member States in the course of discussions on 11 cluster topics: preservation; right of reproduction and safeguarding copies; legal deposit; library lending; parallel importations; cross-border issues; orphan works, retracted and withdrawn works, and works out of commerce; limitations on liability of libraries and archives; technological measures of protection; contracts; and the right to translate works. As of January 2014, the SCCR was continuing its text-based work toward an appropriate international legal instrument or instruments—whether model law, joint recommendation, treaty, or other form—with the target to submit recommendations on limitations and exceptions for libraries and archives to the WIPO General Assembly by late 2014.

Digital Preservation and Copyright

Digital preservation has attracted attention at WIPO as an issue deserving more analysis. One of the most critical areas in which copyright limitations and exceptions have failed to maintain a balance in the digital environment is library preservation, which faces an uncertain future due to the absence in many nations of adequate copyright laws and policies. In July 2008, WIPO held its first International Workshop on Digital Preservation and Copyright at which national representatives presented preservation scenarios in their own countries, revealing variations and flaws in public policy and legal approaches to preservation of cultural heritage and memory. The workshop coincided with a study released in July 2008 by the International Digital Preservation and Copyright Initiative to survey recent developments and trends in digital preservation and copyright. The *International Study on the Impact of Copyright Law on Digital Preservation*^[19] provides recommendations to improve national copyright and related rights laws and policies that concern the digital preservation of copyrighted works.

The report and the workshop emphasized the global need for more attention to limitations and exceptions for digital preservation in view of the fact that many works are physically disappearing, resulting in loss of cultural heritage and the historical record. Highlighting that this problem is likely to become more serious more in the coming years, participants in the workshop supported adoption of provisions in copyright laws to enable more robust systems of digital preservation.

Copyright Limitations and Exceptions for Persons Who Are Blind, Visually Impaired, or Otherwise Print Disabled

The World Blind Union (WBU) set a path for development of new international standards for limitations and exceptions in the public interest that culminated in the adoption of the Marrakesh Treaty in June 2013. With strong support from civil society groups, in 2003 the WBU resumed efforts dating to a 1985 report that recommended a new international instrument permitting production and distribution of special media materials and services for handicapped persons.^[20] The WBU actively urged WIPO to address the needs of the visually impaired, emphasizing the need for greater harmonization in copyright limitations and exceptions globally and for provisions permitting cross-border export and import of works in accessible formats.

In October 2008, the WBU presented a proposal for a possible Treaty for Improved Access for Blind, Visually Impaired and Other Reading Disabled Persons.^[21] It was formally introduced at the May 2009 SCCR meeting by Brazil, Ecuador, and Paraguay. The two main features of the proposed treaty were to provide a minimum standard for limitations and exceptions for the blind and visually impaired and reading disabled, reflecting current technological opportunities, and to allow for the import and export of works in accessible formats by eligible parties.

Library organizations strongly supported the proposal, arguing that the need for improved access to copyright-protected works in readable formats, such as Braille, large print, and audio versions is universal. National laws in some countries allow such copying and adaptation without the permission of rightsholders, but in other countries such activity could infringe copyright if undertaken without authorization. The decision of the SCCR in 2010 to include limitations and exceptions officially in its agenda led to intensive discussions of this proposal as well as those concerning libraries and archives and education in sequence. The WBU effort succeeded in the adoption of the Marrakesh Treaty at a diplomatic conference in Marrakesh on June 27, 2013, coinciding with the birthday of Helen Keller. It is the first international treaty in history dedicated to the expansion of copyright limitations and exceptions. As of January 2014, the treaty had been signed by 60 nations.^[22]

Copyright Limitations and Exceptions for Education and Persons with Other Disabilities

Work on an international instrument to expand limitations and exceptions for education is also in progress at WIPO and is strongly supported by civil society organizations asserting that a binding international instrument would be particularly effective in facilitating uses for education in

developing and least developed countries to bridge the knowledge gap and the digital divide. Additionally, it would include exceptions for disabilities not covered by the Marrakesh Treaty.

A compilation of proposals and comments proposed by the Member States was prepared by the WIPO Secretariat as a lengthy working document, the *Provisional Working Document towards an Appropriate International Legal Instrument (in Whatever Form) on Limitations and Exceptions for Educational, Teaching and Research Institutions and Persons with Other Disabilities Containing Comments and Textual Suggestions*.^[23] It constitutes the basis for continued text-based work being undertaken by the SCCR.

Topics included in the working document cover definitions, generally applicable considerations including flexibilities; uses (educational, teaching, and research institutions; in-classroom uses; uses outside the classroom; availability on an interactive basis and communication to the public for educational purposes; anthologies and chrestomathies; distance learning; research; and reverse engineering); persons with other disabilities; broader topics with implications for education (technology; orphan works and withdrawn or out of print works; public domain; contracts; Internet service provider liability; importation and exportation; and public health or security).

WIPO Development Agenda

Library groups have been active in support of the WIPO Development Agenda, a set of 45 recommendations adopted on September 28, 2007, by the WIPO General Assembly.^[24] It aims to address the interests and needs of developing and least developed countries within the international intellectual property system. This initiative originated in an effort to ensure that intellectual property law and policy continue to serve the public good by encouraging and rewarding innovation and creativity in a balanced way in all parts of the world. Upon its adoption, the WIPO Development Agenda was viewed as a major historical shift in the direction of WIPO because it addresses the knowledge gap and the digital divide that separate wealthy nations from poor nations.

The library groups at WIPO offer a critical perspective on the possibilities of social, economic, and cultural development through access to information and knowledge. Libraries have long served as the foundation for the preservation and broadest possible dissemination of knowledge in societies. Library organizations have articulated support for a copyright system that is balanced to serve all members of society in all parts of the world. In contributing to discussions that transform the 45 recommendations into concrete activities, the library community has advocated at WIPO to enable developing and least developed

countries to fully benefit from the global intellectual property system through

- A fair balance between intellectual property protections and the public interest
- Minimizing levels of copyright protection in developing and least developed countries
- A robust public domain
- Adequate limitations and exceptions for the purposes of education, research, learning, creativity, and preservation of information
- Access to knowledge and technology to foster innovation, material progress, and social well-being
- The goals of information literacy
- Bridging the digital divide
- Library participation in local efforts at technical assistance and capacity building in developing and least developed countries
- Balanced IP education in developing and least developed countries
- New approaches to the licensing of copyrighted works
- The social good that results from a true balance between intellectual property protections and the public interest.^[25]

The WIPO CDIP is concerned exclusively with the WIPO Development Agenda, but the work program to implement the recommendations is being mainstreamed into the activity of other WIPO bodies.

Traditional Cultural Expression

The international community has been engaged for over four decades in discussions concerning copyright and other legal protection of traditional cultural expression. Traditional and indigenous communities have long sought respect and recognition for their creative expressions ranging from stories, myths, folk tales, songs and music, to symbols, designs, paintings, sculptures, carvings, handicrafts, dances, and rituals. Existing international and national legal systems are not typically compatible with indigenous culture and law, and they do not sufficiently address the concerns of indigenous peoples for protection of their creative heritage.

There is no international mandate for protection of traditional cultural expression, and there is great variation in the level of protection for indigenous and traditional works in national laws. Some nations protect traditional cultural expression, while others do not, and still others do not specify in their laws. There is still a lack of consensus internationally about the type of protection, if any, that would best apply universally to traditional works. The issue has taken on new dimensions since WIPO established the IGC that began working in 2001 toward a solution to the protection of traditional

cultural expressions, also referred to as expressions of folklore.^[26]

The Berne Convention was amended in 1967 by Article 15(4) to provide a means for protecting works of folklore. Various sets of model laws and provisions have also been drafted over the years by WIPO and UNESCO. Expert groups have addressed the issue, and indigenous groups have been active advocates at WIPO. The IGC has been working toward possible *sui generis* protection, a special kind of protection for traditional cultural expression that falls outside the framework of the existing copyright system because the copyright system is not suited for works that are traditionally unpublished, often not fixed in tangible medium, created not by one individual known author but collectively by a community, and created not on a certain date but over time.

After years of discussion that did not lead to agreement, the committee's mandate was renewed in October 2013 and it continues to work on text-based negotiations with the goal of reaching an agreement on an international legal instrument or instruments to ensure the effective protection of genetic resources, traditional knowledge, and traditional cultural expressions, if consensus can be reached on this issue.

CONCLUSION

As the governance of intellectual property evolves in the twenty-first century through norm-setting activity at WIPO and as technology further advances, decisions made by WIPO will continue to have a direct impact on libraries and archives. Participation by library and archival organizations in WIPO discussions builds the cooperation and understanding necessary for a balanced evolution of copyright law, the key to WIPO's mission. Library and archival organizations view their engagement with WIPO Member States as a way to influence the direction of copyright law and to support fair and equitable use of copyrighted works into the digital future.

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World Summit on the Information Society (WSIS)

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Abstract

Promoted by the United Nations organizations, the World Summit on the Information Society was initiated to interrogate the global issues and challenges resulting from the widespread use of information and communication technologies and the growth of the information economy and to propose global strategies. Its first phase, held in Geneva in December 2003, was directed toward the adoption of a declaration and an action plan. The second phase, held in Tunis in November 2005, focused on reaffirming the commitment and advancing implementation of the agreed goals. Identifying the crucial role of libraries and information services as enablers for a fair and just information society, the International Federation of Library Associations and Institutions, worked successfully in concert with other civil society organizations to highlight the vital issues including freedom of access to information, information literacy, and strategies to overcome the digital divide.

INTRODUCTION

The proposal to hold a global summit meeting on the information society emerged from the growing concern about the implications of the “digital divide,” the gap between communities or nations with adequate access to information and communications technologies—and the services they make possible—and those whose access is deficient. Initiated at the 1998 session of the Plenipotentiary Conference of the International Telecommunication Union (ITU) in Minneapolis, United States, the proposal for the Summit was formally adopted by the General Assembly of the United Nations (UN) on December 21, 2001.^[1]

That resolution proposed that the outcomes of the World Summit on the Information Society (WSIS) should consist of a common vision and understanding of the information society, a declaration or principles, and an action plan to be implemented by Governments, international institutions, and all sectors of civil society. This signaled at the outset that this Summit process, to a greater extent than previous UN summit meetings, would recognize and involve civil society. The resolution also made particular reference to the urgency of providing effective access to information, knowledge and communication technologies for all, and especially people in developing nations. In addition, the resolution acknowledged the complexity of the issues to be addressed by endorsing the holding of WSIS in two phases, the first in Geneva from December 10 to December 12, 2003 and the second in Tunis in 2005, again unlike the singular process adopted for previous summits.

PROCESS

The framing of the Summit’s purpose drew on background work by the ITU and the UN Administrative Committee on Coordination and the consensus about future global priorities expressed by nations in the UN Millennium Declaration. Responsibility for coordinating the summit was assigned to the ITU guided by a high level organizing committee of representatives of UN agencies.

The process, in which representatives of governments and intergovernmental agencies were well versed, consisted of a series of preparatory committee meetings, or PrepComs, plus regional meetings in various parts of the world.^[2] A number of UN agencies, including UNESCO, organized consultative meetings and many organizations held conferences or meetings on specific questions. During the first phase, they included the “Pan-Arab Regional Conference on WSIS” on June 16–18, 2003 in Cairo (Egypt), the World Information Technology Forum, August 27–29, 2003 in Vilnius (Lithuania), the World Summit of Cities and Local Authorities on the Information Society on December 4–5, 2003 in Lyon (France), and the conference on “The Role of Science in the Information Society” which was organized by the European Organization for Nuclear Research and held in Geneva (Switzerland) on December 8–9, 2003, immediately before the first WSIS summit meeting.

In the first phase, these activities were focused on identifying the issues of concern and ways of addressing them. The issues, underlying and guiding principles, and strategies for addressing both were codified into a *Declaration of Principles*^[3] and a *Plan of Action*^[4] by government representatives during the extended PrepComs in order to

finalize agreed documents before the formal Summit meetings at which set speeches would be made by heads of government, senior ministers, or their representatives. In the second phase, similar activities aimed to develop some momentum to achieve the agreed goals by the UN Millennium deadline of 2015, again formulating an agreed plan, the *Tunis Commitment* and the *Tunis Agenda for the Information Society*,^[5] through negotiation in the PrepComs.

In both phases, a number of major concerns and the intransigence of some governments threatened to derail the process. Despite the efforts of the presidents of the PrepComs and behind the scenes negotiations, both preparatory processes came down to the line, with agreement secured very late during the night preceding the opening of the summit meeting. In the first phase, the third and final PrepCom was not concluded in September 2003 as planned, and despite an Intersessional Meeting held in Paris in July, but it had to be reconvened in Geneva on November 10–14 and again December 5–6, only concluding late on December 9. In the second, a “Group of Friends of the Chair” was used to try to smooth the process, but nevertheless the third PrepCom held in Geneva on September 19–30 had to be reconvened on the eve of the summit in Tunis November 13–15.

ROLE OF CIVIL SOCIETY

The WSIS process and documents recognized the tripartite—“multistakeholder”—interests of governments, civil society, and business entities, taking the central role of the intergovernmental agencies for granted. Space was made available and some logistical and administrative support was provided to civil society and business entities. That recognition of nongovernmental stakeholders was instituted in accordance with the UN resolution but was an unprecedented innovation for a UN sponsored summit. It went well beyond the involvement permitted to business and nongovernmental organizations during previous summits such as the World Summit on Sustainable Development held in Johannesburg in 2002. But, welcome as it was, the multistakeholder approach was somewhat grudgingly accepted by many of the governmental delegations which clearly regarded themselves to be “more equal” than the other elements of the process, in keeping with their traditionally central role in international negotiations. Crucially, the capacity to intervene vigorously in the process was severely constrained because opportunities to speak in the formal PrepComs were largely limited to governments and intergovernmental organizations, especially those of the UN system but including the Bretton Woods organizations such as the World Bank. Interventions by business entities and civil society

organizations were restricted to 15 min. slots once or twice a day; slots in which the myriad organizations had to vie for opportunities to make 2–3 min addresses.

Nevertheless, civil society took full advantage of the opportunities provided. “Civil society” is a misnomer: it is the term employed by the UN agencies for the broad coalition of nongovernmental organizations (NGOs), which represented the many dimensions of civil society in the WSIS process. They extended from globally active transnational social movement organizations such as Greenpeace to localized NGOs including the Computer Association of Nepal to professional peak bodies such as the International Federation of Library Associations and Institutions (IFLAs). Many very different organizations with very different agendas, structures, and capabilities were trying to influence the process and outcomes. Their concerns ranged across many domains from feminist issues, environmental concerns to broad human rights agendas. Most were concerned about redressing inequity, especially the digital divide and its consequences, and the inequalities between developed and developing countries, urban and rural populations, and mainstream and marginalized peoples.

The civil society organizations demonstrated a remarkable capacity to self organize with guidance from the Conference of NGOs in Consultative Relationship with the UN (CONGO), a vehicle for NGOs which wish to interact with the UN and its agencies. Regular meetings of participating civil society organizations were held under the aegis of the Civil Society Bureau during the PrepComs and other meetings and a number of thematic caucuses and working groups were established, such as “Education and academic,” “Cultural and linguistic diversity,” and “Persons with disabilities.” Reflecting the level of leadership which emerged from the groupings, some appeared to work quite well, others struggled to find a common voice. Although they were a useful device to focus discussion on specific domains of concern, so that key issues and draft phrases for documents could be identified, the thematic groupings poorly served organizations with wide interests but limited resources such as IFLA.

“Business entities” participating in WSIS largely comprised peak bodies representing business interests although some powerful companies such as Microsoft were individually influential. Offered the same support and opportunities as civil society organizations, business entities showed less capacity or interest in self-organization and appeared to focus on key issues of importance to them individually with little apparent coordination. Their participation was most visible during the formal summits in Geneva and Tunis where extensive trade exhibitions, ICT4All, were held.

In contrast, civil society organizations showed remarkable unanimity, putting aside their differences and specific

concerns in the shared interest of emphasizing the big issues. They achieved considerable success but were often frustrated by the attitudes of most government delegations who clearly felt that international negotiations were their province and resented the involvement of other parties. The concerns and frustrations of the civil society sector in the WSIS process were expressed in an alternative civil society declaration which was agreed and issued during the Geneva Summit.^[6]

THE ISSUES

Effective access to information, knowledge and communication technologies for all, and especially people in developing nations, was the key issue identified in the UN resolution. Consequently, the desired outcomes were initially considered to fall essentially in the technological realm. For that reason and because the host organization was the ITU, responsibility for participation in the WSIS processes was assigned by most governments to ministries of communications, information technology, and similar areas. Thus, the governmental representatives who advised and worked with the nations' accredited diplomatic representatives to the UN in Geneva came mainly from such ministries and focused on the primary, largely technological, concerns of those ministries.

That technologically deterministic approach to the information society characterized early discussions. Challenging that orientation and seeking to introduce other issues—social, cultural, linguistic, gender, environmental, etc.—then became the first and major obstacle that civil society organizations, international agencies with broader priorities, and some likeminded governments had to surmount. UNESCO, for example, took an early lead by organizing four thematic meetings at its Paris headquarters in February 2002 to begin to draw up an agenda on educational, scientific, social, and cultural matters which should be raised in the WSIS processes.^[7]

Setting the common vision of the information society on a firm and unqualified foundation of agreed fundamental human rights principles, as a just and fair information society for all, became the second major challenge. The crucial importance of establishing that foundation was fiercely advocated by the coalition of civil society interests and forcefully promoted by many governmental delegations, including especially those of the European Union. It was, however, opposed by some which sought to qualify such rights by asserting the supremacy of governments.

The Group of 77,^[8] an alliance of developing nations which seeks to advance their economic interests through collaborative advocacy, argued strongly that a major focus on development was an essential key to creating an information society for all. The Group emphasized both the need to prioritize development and to resource it. Achievement of this third key element was vigorously

supported by the civil society organizations but did not appear to be a priority for the business sector. All government delegations expressed support for development as a desirable goal but differed on the means of achieving it.

The major technological questions came fourth and were not strictly technological in nature but rather contextual factors which would condition technological developments. Primary among them was the question of governance of the Internet, a question which placed the U.S. representatives in opposition to most other governmental representatives and divided opinion among civil society organizations.

LIBRARY AND INFORMATION SECTOR INTERVENTIONS

As the peak international organization for libraries and information services, the IFLAs, strove to highlight the central role of libraries and information services “at the heart of the information society.” International Federation of Library Associations and Institutions embarked on its most extensive advocacy campaign ever to try to ensure that the sector's concerns, including freedom of access to information and the digital divide, would be recognized in the WSIS outcomes. International Federation of Library Associations and Institutions representatives worked with cognate peak professional bodies such as the International Publishers' Association, participated in consultative meetings, accredited delegations to the PrepComs, and organized conferences before each summit meeting. Formal submissions, statements on key issues, and a booklet of library success stories were produced and used in lobbying in the WSIS processes and in home countries.^[9]

These interventions, which extended from the UNESCO meeting in early 2002 to the Tunis summit meeting at the end of 2005, demanded an intense period of focused activity by IFLA staff, members of the Governing Board, and library representatives from many nations, including notably a team of Swiss librarians and students who provided essential logistical support and representation in Geneva. Also important was the strong support provided by a number of national delegations, especially the representatives from New Zealand, which articulated the sector's concerns in preparatory meetings in which civil society representatives, including those from IFLA, were not permitted to speak. The campaign demonstrated the need for IFLA to establish an effective advocacy capability while still drawing on the knowledge, persuasiveness, and contacts of members.

During the first phase, the *Libraries @ the Heart of the Information Society Pre Summit Conference* was crucial in providing an opportunity for librarians to gather in the General Assembly Hall of the Palais des Nations in Geneva (Fig. 1) a month before the summit meeting to highlight the centrality of library and information services to the information society and to meet with members of



Fig. 1 Libraries @ the Heart Pre Summit Conference, Geneva, December 2005.

their governments' delegations. More than 70 countries were represented at the Conference, and in many cases discussions with governments continued in national capitals. Delegates called upon the nations of the world to:^[10]

Support and extend the existing global network of library and information services to make available and preserve knowledge and cultural heritage, to provide information access points and to develop the twenty-first century literacies which are essential to the realization of the information society. High quality library and information services provide access to the information required by the communities they serve: a modest investment in them would quickly return significant dividends.

Those interventions within the WSIS processes were echoed by initiatives taken by a number of national library associations within their own countries. For example, the participation of IFLA President Kay Raseroka in a meeting organized by the Danish Library Association and other Danish NGOs lead to the inclusion of library views in the Danish government position which was presented at PrepCom3. Other library associations and national libraries sought to interact with the responsible ministries and, in some cases, were successful in gaining representation in the governmental delegations.

The library and information service sector argued that libraries and information services serve as gateways to knowledge, thought, and culture for individuals and groups and promoted the benefits of lifelong literacy, as the range of competencies necessary to engage fully with the Information Society. A broader vision was also expressed, a vision based on the right to both access and express information without restriction in which

libraries and information services contribute to the development and maintenance of intellectual freedom and help to safeguard democratic values and universal civil rights.

Advocacy continued in the same vein during the second, Tunis, phase but with increased emphasis on demonstrating practical outcomes. The success stories list was redeveloped as a database and libraries and information services were encouraged to submit local examples of good practice. Another presummit conference was held, *Libraries: the Information Society in Action*, at the Bibliotheca Alexandrina in Alexandria, Egypt on November 10–11, 2005. Highlighting the importance of information literacy, this conference was held in conjunction with a UNESCO supported to *High Level Colloquium on Information Literacy and Lifelong Learning*. Communiqués from both conferences were used at the summit meeting in Tunis the following week at which IFLA gained a rare invitation to give a plenary address.^[11]

OUTCOMES

After all the negotiation and brinkmanship, a compromise *Declaration of Principles* was agreed. It has three parts: a statement of shared vision about the developing information society; a list of key principles to underpin the developing information society; and, a summary of the processes which will lead the world's peoples toward an equitable information society.

At its outset, the first part "Our Common Vision of the Information Society," places people, their rights and

inclusiveness at the heart of the information society but also highlights sustainable development and a global focus. The vision then identifies the transformative potential of information and communication technology (ICT) to promote the eradication of extreme poverty and hunger and achievement of a range of other contemporary international priorities including the empowerment of women, reduction of child mortality, elimination of diseases, promotion of environmental sustainability, and creation of global partnerships for development. This section reads as an affirmation of faith in technocratic management through the effective use of ICTs.

The Declaration then turns to human rights and fundamental freedoms, proclaiming their universality, and reaffirming without qualification the right to freedom of opinion and expression stated in Article 19 of the Universal Declaration of Human Rights. It asserts that this is “an essential foundation of the Information Society.” The inclusion of this unqualified statement, despite the resistance of several nations, represented a major success for civil society and the governments which advocated the inclusion of this principle. The vision ends with recognition of its ambitious nature and introduces as new term to characterize the required commitment, “digital solidarity.”

The second part identifies 11 key principles “for building an inclusive Information Society”:

1. The role of governments and all stakeholders in the promotion of ICTs for development.
2. Information and communication infrastructure: an essential foundation for an inclusive information society.
3. Access to information and knowledge.
4. Capacity building.
5. Building confidence and security in the use of ICTs.
6. Enabling environment.
7. ICT applications: benefits in all aspects of life.
8. Cultural diversity and identity, linguistic diversity, and local content.
9. Media.
10. Ethical dimensions of the Information Society.
11. International and regional cooperation.

Some of these are indeed principles, others expose the compromise nature of the Declaration and some of its undercurrents, including the discomfort of governmental delegations with the recognition accorded to civil society organizations and concerns about security and control.

The *Declaration of Principles* was accompanied by a *Plan of Action* which assigned responsibilities for implementation of the agreed aims largely to governments but with some priorities in the province of intergovernmental agencies. Although earlier versions of the plan had identified a number of intermediate target dates, the final version placed the deadline at 2015, as for the UN Millennium Declaration.

The Tunis summit meeting, 23 months later, was intended to encourage the implementation and offer some early examples of success. It reaffirmed the outcomes achieved in Geneva and promoted concerted action toward 2015 in the *Tunis Commitment* and the *Tunis Agenda for the Information Society*. Major issues during this phase included the lack of progress in regard to Internet governance and recognition of the Digital Solidarity Fund and continuing concern at the reluctance of some governments to support unqualified recognition of human rights as an essential foundation for a just and fair information society. This last concern was heightened by the holding of the second summit meeting in Tunisia which, in the view of many especially from civil society organizations, had a repressive government. That view was confirmed during the summit meeting when a large police and military security force attempted to prevent the open expression at a number of events.

Despite sharing these concerns, the library and information sector and IFLA in particular was well pleased with the WSIS outcomes.^[12] Although not always accorded the sector's priorities, all its principal issues were included in the declaration and action plan. And it was recognized that, for the first time at a global level, governments had devoted considerable time to discussing and agreed on the core concerns of libraries and information services.

UNFINISHED BUSINESS

The compromise agreed in Geneva and reiterated in Tunis had secured the unqualified recognition of human rights but left two major issues unresolved. A most contentious issue lay in the governance of the Internet, a question ultimately of control. To date, the successful development and growth of the Internet has been overseen by the Internet Corporation for Assigned Names and Numbers, a not-for-profit company registered with the U.S. Department of Commerce.^[13] Some governments were uncomfortable at the possibility of interference by the U.S. government; many of the developing nations felt that they needed more influence; and some repressive governments wished to exert more control. Some suggested oversight by an international agency, possibly the ITU or a new agency, but the U.S. government and business representatives wished to continue to apply a market model. Civil society representatives sympathized with the developing nations' view, but largely felt that the current model had served the global community well and were consequently doubtful about the merits of change. In the event, this dilemma could not be resolved in Geneva or Tunis. It was referred to the Secretary-General of the UN who was requested to establish a working group, the Internet Governance Forum, to seek a solution.

The other main issue which provoked deep division in Geneva was a proposal by the President of Sénégal to

establish a “Digital Solidarity Fund” which would help to reduce the digital divide. This proposal was soundly condemned by the richer nations, led by the European Union. They argued that there were many other international sources of funding that should be tried first and stated their absolute opposition to the creation of such a fund. Representatives from developing nations and many from civil society interpreted this position as an unwillingness to take urgent and decisive action to reduce inequality. Further discussion in the Tunis phase resulted in grudging acceptance but little commitment to the fund.

For libraries and information services, these outstanding issues and others which were somewhat blurred in the compromise are significant and will require continuing action. However, the achievement of satisfactory, albeit compromise, outcomes outweighed any deficiencies. If the WSIS processes had collapsed, as appeared possible in Geneva, the cause of recognizing the importance of promoting a just and fair information society for all and, specifically, the sector’s priorities would have suffered a major setback.

CREATING THE “INFORMATION SOCIETY FOR ALL”

The UN General Assembly endorsed the outcomes of the WSIS without a vote on March 27, 2006. The resolution welcomed the strong orientation toward development and the progress achieved toward “a multistakeholder approach to building a people centered, inclusive and development-oriented information society.”^[14] Signaling the success of advocacy by developing countries, the Assembly also endorsed the Digital Solidarity Fund which it cast as a means of securing voluntary sources of “solidarity” financing to support the transformation of the digital divide into digital opportunities for developing countries. Responsibility for oversight of implementation was assigned to the Economic and Social Council and the Secretary-General was requested to convene the Internet Governance Forum.

CONCLUSION

By linking its outcomes to the UN Millennium Declaration, WSIS proclaimed that the creation of an equitable information society for all must be a global priority for the twenty-first century and that its attainment would require concerted action by all nations, the business sector, and civil society. A half century after the endorsement of the Universal Declaration of Human Rights, the summit affirmed that the global information society should be based on those agreed rights, especially the right to express and access information and should seek to redress inequality.

This was a watershed for organizations concerned with information and knowledge management because it placed information and knowledge—its creation, sharing, curation, and use—at the core of the desired new global society. The WSIS outcomes, agreed by all governments and endorsed unanimously by the United Nations, provide a strong foundation for the proliferation and further development of libraries and information services, but the process and outcomes also demonstrated the vital importance of effective and continuing advocacy in partnership with like-minded organizations.

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World Wide Web (WWW)

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Abstract

The World Wide Web (WWW) is a system for creating, organizing, and linking documents so that they may be easily browsed. The Web has transformed the ways in which we communicate, learn, and socialize, and it has changed the ways in which we think about information, information seeking, and interacting with information systems. It is, moreover, one of the principal factors underlying globalization, in the process creating a vast array of connections involving individuals, groups, and institutions and providing a platform that has redefined workflow in many organizations through computer-to-computer data interchanges as well as the creation of collaborative communities. The Web has succeeded because of the following: (1) many relevant conditions were “right” and (2) it has relied from the outset on a simple, derivative architecture, consisting of the Hypertext Markup Language (HTML), the Hypertext Transfer Protocol, and the Uniform Resource Locator. The Web’s stewards have managed the continuing development of the underlying technologies to ensure its openness and in ways that have led to gradual changes and subtle transformations, rather than radical shifts. At the same time, the Web’s stewards, most notably the World Wide Web Consortium, have fostered important innovations, such as the development of the Extensible Markup Language and the Cascading Style Sheets specification, the proposal to develop the “Semantic Web,” and the evolution of HTML leading to the development of HTML5. In the process, the World Wide Web has had profound effects on libraries, librarians, and library users, changing the way in which librarians relate to vendors, clients, bibliographic utilities, and other libraries and giving rise to new, often highly creative approaches to serving readers.

INTRODUCTION

The World Wide Web is a system for creating, organizing, and linking documents so that they may be easily browsed. Created by Tim Berners-Lee, the World Wide Web is also one of the most remarkable developments of the last 25 years, and it is virtually certain that it will continue to be a pervasive influence on both information producers and information consumers for the foreseeable future.

The Web has transformed the ways in which we communicate, learn, and socialize. Perhaps even more to the point, the World Wide Web has changed the ways in which we think about information, information seeking, and interacting with information systems.

The World Wide Web may be an incomplete and imperfect manifestation of the ideas about hypertext that Ted Nelson set forth in the mid-1960s, but it has changed the ways in which we think about the world, and it has changed forever how ideas, information, and knowledge are shared.^[1] According to Thomas Friedman, in his *The World Is Flat: A Brief History of the Twenty-First Century*, the World Wide Web is one of the principal factors underlying globalization, in the process creating a vast array of connections involving individuals, groups, and institutions and providing a platform that has redefined workflow in many organizations through computer-to-computer data interchanges as well as the creation of

collaborative communities. As Friedman has also noted, it is an environment that seems almost ideally suited to the needs of information seekers with what he calls a high “curiosity quotient”—Friedman believes that when curiosity is combined with passion in the exploration of a subject of interest, an individual of average intellectual endowment may be able to acquire knowledge comparable to that of a highly intelligent person, because of the vast amount of information resources available through the Internet—and it clearly appeals to writers in search of new and more expressive modes of communication.^[2] For them, documents are, as Lisa Gitelman has observed, “instruments used in the kinds of knowing that are all wrapped up with showing, and showing wrapped up with knowing,” and the Web affords both technologies and cultural milieus of greater power and scope than traditional, analog forms of information exchange.^[3] The product, from the perspectives articulated by Timothy Morton, are often “hyperobjects,” by which Morton means objects so massively distributed in time and space that they transcend “spatiotemporal specificity.”^[4]

Less flattering are the views of critics like Louis Menand, who has characterized the Web as an imaginary space—he calls it a “spatial imaginary”—in which visual change is often experienced (and confused with) as a physical change. Menand argues that the use of “real estate vocabulary,” in the form of terms such as “address,”

“site,” and “domain,” reinforces this dislocating illusion and changes how we think about information resources and use them in ways that obscure underlying realities.^[5]

The emergence of Web 2.0, a new layer of activities shaped by participatory architectures based on cooperation rather than control, lightweight programming models, enriched user experiences, and a fuller realization of the Internet as a platform for computing, changed yet again the way in which we think about and use the Web and its contents. In its first phases, Web 2.0 allowed users to comment on published articles; participate in social networks; tag items such as digital photographs, images, and documents; and share Web bookmarks.^[6] In the second phase of Web 2.0, software as a service came to maturity, through the integration of application programming interfaces (APIs), Ajax programming using JavaScript and the Document Object Model (DOM), and cloud-based storage, in the form of Web-based applications such as Google Docs, YouTube, and Microsoft Office 365.

More recently, Hypertext Markup Language 5 (HTML5), a synthesis of HTML and XHTML that integrates the DOM into the markup language and offers new opportunities for the incorporation of audio and video media, has further enhanced what may be conveyed through a Web page. It includes processing models designed to encourage more interoperable implementations, extends and improves the markup available for documents, and introduces markup and APIs for complex web applications.^[7]

Looking to the near future, it seems likely that the ideas associated with the Semantic Web will soon begin to have more obvious effects, transforming the Web from a vast file system to an equally vast database capable of supporting various processes, including discovery and search, with perhaps unparalleled precision.

The Semantic Web has long been a controversial subject, marked by high aspirations and serious doubts. The debate began the day Berners-Lee, James Hendler, and Ora Lassila unveiled their proposal, focusing mainly on questions about its feasibility.^[8] There were almost no doubts expressed about the desirability of this vision for the future of the Web, but many experts were not optimistic about the success of the initiative, owing to its complexity and its stringent requirements and, as Clay Shirky observed, because most of the data we use are not amenable to the syllogistic recombination that the Semantic Web presumes.^[9] Others have noted, similarly, that the proposal “disregards the fundamental fuzziness and variability of human communication” and that the “rigid formality” that characterizes the Semantic Web cannot be enforced or ensured, resulting in an “interoperative polyglot” akin to, for example, RSS (Rich Site Summary or Really Simple Syndication).^[10]

However, the vision of a near future in which semantically oriented technologies that systematically describe the content of the Web are coupled with artificial

intelligence to create a new layer within the Web infrastructure has persisted.^[11] More important, essential parts of this new infrastructure have been built, and the transformation, in which metadata in standardized forms pervades the network and affords the basis for a wide array of services, ranging from more precise retrieval of information to the automatic generation of documents, is well under way.

But the doubts persist. In 2010, the Pew Internet Research Center surveyed a group of experts on Web technologies in an effort to understand the prospects of the Semantic Web. Some of the experts, 41% of the survey’s 895 respondents, thought that the concepts on which the Semantic Web is founded would be realized by 2020, while 47% of those surveyed expressed skepticism about its feasibility, agreeing with the notion that “[b]y 2020, the semantic web envisioned by Tim Berners-Lee will not be as fully effective as its creators hoped and average users will not have noticed much of a difference.”^[12]

Around the same time, Berners-Lee returned to the debate, arguing then and later that efforts to mark up and link datasets, but especially datasets derived from scientific research, would lead inexorably to a new version of the Web organized on the basis of semantic information interpreted by both humans and computers.^[13]

Another aspect of Berners-Lee’s vision for Web is the annotation. It is a feature that Berners-Lee had originally intended to incorporate, but in the effort to retain control over the technology and guarantee its openness in the mid-1990s, it was set aside. But when he wrote *Weaving the Web* in the late 1990s, Berners-Lee noted that “[w]e need the ability to store on one server an annotation about a Web page on another [server].”^[14]

In recent years, the idea of creating a standard for annotations and integrating it into the Web infrastructure has been taken up by the World Wide Web Consortium (W3C) and others, in the form of Open Annotation Data Model. The primary aim of the Open Annotation Data Model is to create a “single, consistent model,” within “an interoperable framework for creating associations between related resources, annotations, using a methodology that conforms to the [a]rchitecture of the World Wide Web,” and in so doing provide “a standard description mechanism for sharing [a]nnotations between systems, with the mechanism facilitating sharing or migration of annotations between devices.”^[15]

There is considerable interest among developers in the annotation as a mechanism for information enhancement and exchange, manifest in a variety of projects active at this writing. But it is not clear if there is a widespread interest among users. Other projects of similar purpose, such as the W3C’s Annotea Project, have met with limited success.^[16] Perhaps even more to the point, there is no sufficiently simple mechanism for support of the Open Annotation Data Model that is available for deployment; so, the model and its potential remain untested at this writing.

HOW BIG IS THE WEB?

Since the World Wide Web does not operate under any central authority, the question of the Web's size is difficult to answer precisely. Domain name system (DNS) services, the Internet services that translate domain names into IP (or Internet Protocol) addresses, list the domain names that exist, but not every domain contains a website; many domains contain more than one website, and DNS registrars are not obliged to report how many domains their databases contain. So most of what is known about the size of the World Wide Web is based on survey results, which differ substantially, and/or the number of pages indexed by Web search engines, such as Google and Yahoo. However, within the limits of what can be measured, there is evidence not only that the Web continues to grow at a rapid rate but also that it is taking on increasing complexity and substance in the content it transports.

The Internet has been growing exponentially since at least 1993. Current estimates indicate that slightly more than a billion live websites have been created since 1991. Today, there are at least 760 million websites, with approximately 103 million new sites added in 2013 alone. How many of the current websites are active? The number depends on how "active" is defined. One source indicates that 67% of the current sites are active, while another suggests that about three-quarters of the active sites are "parked," or dormant.^[4]

According to the findings of surveys last updated in 2014, there are 2.7 billion Web pages that have been indexed and approximately 2.6 billion Web users. Current estimates indicate that slightly more than a billion live websites have been created since 1991 and that there are roughly 672 million websites in existence, with about three-quarters of them dormant (or "parked").^[4] (This finding is largely consistent with the results of a series of studies conducted by OCLC between 1997 and 2003, in which investigators discovered that perhaps as many as half of the websites on the Web had effectively been abandoned by their respective owners.^[17])

Active sites present a total of 14.3 trillion pages, 48 billion of them indexed by Google, and consist of a total of 672 exabytes of accessible data. More than 2 trillion searches were conducted through the Google search engine in 2013, by an estimated 1.45 billion users.^[18] (Another source indicates that the number of Web users is much larger, in excess of 2.5 billion people.)^[19]

In principle, the World Wide Web remains an open and egalitarian enterprise. Anyone can launch a website, but the vast majority of the top 100 websites, the most visited sites, are run by corporations, the most important (and almost only) exception being *Wikipedia*.^[20]

The so-called deep Web, the part of the Web that is not indexed by search engines, which is generally restricted in its access and which may include non-HTML, unlinked, dynamic and/or scripted content, is thought to be much

larger than the "surface Web." Recent estimates suggest that the "deep Web" may make up as much as 90% of the Web, but the size and continuing growth of the Web make it impossible to determine precisely how large it is or how much of it is part of the "surface Web" or the "deep Web." However, according to Bright Planet, an organization that specializes in content extraction, the "deep" or "invisible" Web contains nearly 550 billion individual documents, as compared to the one billion documents contained within the "surface Web."^[21]

Almost 60% of the Web's users are employing mobile devices, that is, smartphones and tablets. The popularity of various Web browsers is a matter of constant contention, but it appears that Internet Explorer remains the most popular Web browser at this writing, with a combined market share of 49%. Google Chrome has a market share of 18%, and Mozilla's Firefox browser and Apple's Safari each have shares of approximately 11%.^[22,23]

According to the HTTP Archive, the average page is currently 1890 KB in size, compared to 828 KB in May 2012, with an annual growth rate of about 50%.^[24,25] Images typically make up about 55–60% of the overall payload. The use of Cascading Style Sheets (CSS) and JavaScript is increasing, whereas the number of requested pages including Adobe Flash is slightly below 30% and declining markedly.^[26]

It is not entirely clear why Web pages are growing in size and complexity. It seems reasonable to assume, however, that there are several highly influential factors. The first is increasing penetration of broadband Internet services, which allow the creators of Web content to create and transfer files of substantial size with ease. Moreover, the widespread availability of broadband services, particularly in the developed world, means that many files with richer content can reach large audiences quickly and without difficulty. A second factor is competition. Competition for the attention of Web users, but particularly for consumers using the Web as a marketplace, is intense, and there is evidence that richness of content is often a necessary condition for success. Finally, there is the availability and use of authoring and site management tools that make it relatively easy to create HTML and/or XML documents of considerable complexity, and to be able to do so without detailed knowledge of the relevant coding languages.

Another major factor adding to the complexity of the Web is the use of streaming media, which has increased by more than 100% each year since 2000. Audio or video files that are transmitted continuously from a server can begin playing as they are being downloaded to a computer. This process is now enhanced by the Dynamic Adaptive Streaming over HTTP (DASH) standard, which has made video-on-demand a "standard" Internet application similar in its impact to e-mail and Web browsing.^[27]

While videos account for only a small percentage of the responses from Web servers, the most popular video services, Netflix, YouTube, Amazon Video, Hulu, and

iTunes, generate between 50 and 55% of the bytes transferred via the Web, with Netflix producing slightly more than 31% of the traffic in 2014 and YouTube accounting for about 12% of the overall traffic.^[28]

Interest in downloading or streaming videos via the Web is likely to continue to grow in accord with broadband's market penetration and the increases in the speed of data transfer that are now an integral part of the market for Internet services and with improvements in the DASH protocol and end-to-end congestion controls. So, it seems reasonable to assume that the demand for videos will continue to grow, perhaps even sharply, and that the bandwidth required to fulfill those requests will continue to be a major factor in the use of the Internet, the management of Internet backbone resources, and the politics of the Internet.

Is the Web getting faster? Google claims that it is significantly faster today than it was only a couple of years ago, owing mainly to improvements in the core infrastructure, much faster mobile networks, and improvements in Web browser design.^[29] However, there are other sources that dispute such findings, but resolution of the question is not possible at this time, because there is no consensus about the methods of measurement or analysis.^[30]

A BRIEF HISTORY OF THE WORLD WIDE WEB

The development of the World Wide Web may be divided into three phases. In the first experimental phase, Berners-Lee developed a collaborative hypertext environment based on an adaptation of the TCP/IP protocol and aspects of Standard Generalized Markup Language (SGML). As noted in his original proposal, "the working structure of the organization is a multiply connected 'web' whose interconnections evolve with time."^[31] Berners-Lee then made the source code available over the Internet, facilitating experiments with and improvements of the basic technologies, a process that continues to this day largely through the W3C.

According to the *Encyclopedia of Computer Science*

Hypertext is both the concept of interrelating information elements (linking pieces of information) and the name used to describe a collection or web of interrelated or linked nodes.^[32]

Vannevar Bush is generally given credit for developing the idea of hypertext, as first articulated in an article entitled "As We May Think," which was published in the July 1945 issue of *The Atlantic Monthly*.^[33] However, recent research indicates that the ideas set forth by Bush were not new and that the idea of a machine that would connect an individual to diverse sources of information and effectively help to synthesize such information had also been expressed previously, perhaps most notably by H.G. Wells

in his pre-WWII lectures on *World Brain*, by Paul Otlet, a Belgian bibliographer who proposed in 1934 a plan for a global network of "electric telescopes," which would allow anyone in the world to access to libraries of books, articles, photographs, audio recordings, and films, and by Emmanuel Goldberg, who patented a device called the "Statistical Machine" in 1927 that allowed a user to search and retrieve large volumes of data stored on microfilm by using a so-called search card and who later proposed a technique that would allow a user to enter a query via telephone.

Bush called his machine the "memex." Wells talked about an interactive encyclopedia controlled by subject experts that would function as a form of collective intelligence. He wrote the following:

[W]hat I am saying . . . is this, that without a World Encyclopaedia to hold men's minds together in something like a common interpretation of reality, there is no hope whatever of anything but an accidental and transitory alleviation of any of our world troubles.^[34]

Otlet called his knowledge network the Mundaneum. (Previously, Otlet and Henri La Fontaine had launched a project called the Universal Bibliography, or *Répertoire Bibliographique Universel*, a plan to catalog of all the world's published information. The project eventually resulted in the creation of more than 15 million entries, stored on index cards and classified under a system called the Universal Decimal Classification, an adapted version of the Dewey Decimal System.)^[35]

In considering the history of hypertext, scholars tend to focus on the various mechanisms that were proposed as ways of bringing greater order to the formal communications of scholars and affording greater precision in the use of such materials, and in the process may not always pay enough attention to Bush's notion that memory is an associative process, and that we should build information storage and retrieval systems whose organizing structures mimic associative memory as closely as possible. So, in Bush's mind, the linking functions that connected chunks of text and articles to one another, what we now call hypertext links, represented the best available way to imitate this aspect of human memory. (This was not a new concept; in fact, the notion can be traced back to Aristotle, whose thoughts about memory and recollection may be viewed as the first articulation of principles of association and order. Bush's greater service was bringing these ideas into discussions about how to make information systems more effective, and by suggesting that "spatializing" ideas, or the chunks of text, data, and imagery, into more discrete units of presentation could enhance memory and recollection.^[36])

Similarly, the idea of a "world brain" as set forth by Wells may sometimes be dismissed too quickly, in part because Wells was vaguer than, say, Otlet or Bush, about

how his system might work at a mechanical level, but also because he used an ancient and familiar form, the encyclopedia, as the basis for his proposal. What gets lost are Wells' insights into the sociology of knowledge production; specifically, his recognition of science as a highly collaborative enterprise and his sense that technology, in the form of a distributed network, could enhance and extend the process known as "peer review," and thereby bring greater order and clarity to human knowledge.

There were a number of experiments with hypertext from the mid-1960s through the end of the 1980s, including Ted Nelson's Xanadu Project, whose goal was the creation of a computer file system based on hypertext concepts and Douglas Engelbart's NLS/Augment, the first distributed, shared-screen, collaborative hypertext system in 1968. Other prototype and commercial hypertext systems appeared in the 1970s and 1980s, including Document Examiner, gIBIS, Guide, Hypergate, HyperTIES, Intermedia, MacWeb (by LIRMM), Max, Neptune, NoteCards, PHIDIAS, StorySpace, Writing Environment, and ZOG/KMS. (In June 2014, 54 years after first announcing the Xanadu Project, Nelson finally released a prototype of his system, which may be viewed at <http://xanadu.com/xanademos/MoeJusteOrigins.html>. According to information on Nelson's website, he believes today that the Xanadu document format could supplant PDFs but is unlikely to displace the basic architecture of the World Wide Web.)^[37]

One hypertext system, Apple's HyperCard, which was based on the idea of virtual "cards" in a stack akin to a Rolodex and a scripting language called HyperTalk, came into widespread use as part of the package of applications developed for and included with Apple's Macintosh computer. But HyperCard was never fully adapted for use in networked environments or recompiled to run under OS X, and Apple ceased work on its development during the transition to the OS X operating system, eventually dropping it altogether in 2004. It has been argued, moreover, that HyperCard was not a genuine hypertext system, because it lacked many of the navigation, annotation, and structural features that characterize "true" hypertext systems. But, true hypertext system or not, by the time the powers that be at Apple had lost interest in HyperCard, another initiative, developed by Tim Berners-Lee and eventually known as the "World Wide Web," had taken hold, changing forever the Internet and how we think about computerized text.

In 1989, Tim Berners-Lee was working as a software engineer at CERN, the European Organization for Nuclear Research. (The name CERN is derived from the acronym for the French "Conseil Européen pour la Recherche Nucléaire," or European Council for Nuclear Research, a provisional body founded in 1952 with the mandate of establishing a world-class fundamental physics research organization in Europe.) Scientists working at CERN used all sorts of operating systems and software on their

computers, and as a result, one scientist often could not find or access another scientist's research, but then, Berners-Lee noticed

All these systems looked different but in fact you're reading stuff on a screen and sometimes clicking on bits. So you could imagine a thin layer which would map all these existing systems into one virtual system. Wouldn't that be cool?^[38]

Berners-Lee's supervisor at CERN thought the idea was vague but worth exploring, so he commissioned Berners-Lee to create a system for collaborative authoring and document sharing that could run over the local area network at CERN and entail a number of different types of computers and operating systems.

To make such a system operational, Berners-Lee needs to create a mechanism for the transport of textual data and a document format that could be interpreted by all of the operating systems that would be connected across the CERN network. And because he was interested incorporating ideas about hypertext into the system, he needs to establish a way of creating links within and among documents. According to Berners-Lee

The idea of the Web was prompted by positive experience of a small "home-brew" personal hypertext system used for keeping track of personal information on a distributed project. The Web was designed so that if it was used independently for two projects, and later relationships were found between the projects, then no major or centralized changes would have to be made, but the information could smoothly re-shape to represent the new state of knowledge.^[39]

Owing to the requirements of his assignment, the limited resources available for its support, and inspired by the success of the "home-brew" hypertext system, Berners-Lee elected to focus his efforts on the use of existing resources available to him under open licenses and/or technical standards. He realized almost from the beginning that the transport layer of his system could be built on top of the IPs—the so-called TCP/IP suite of rules for conveying data over the Internet—by adding a compatible layer, which he dubbed the Hypertext Transfer Protocol, or *http*.

Berners-Lee designed the HTTP to function as a request-response protocol under a client-server computing model, and he wrote the programming code for both a client and a server capable of carrying out the specified actions. In accord with this model, a client application, typically what we now know as a Web browser, submits a request message formed on the basis of the HTTP to a server that has been outfitted to recognize and respond to requests formatted in this way.

The key element of the request is the Uniform Resource Locator (URL). The URL is a specific character

string that constitutes a reference to a resource. The now-familiar components of a URL are

- The scheme, which defines how the resource will be obtained
- The domain name or numeric IP address of the destination location for the URL
- The port number
- The path specifying the location of the resource requested on the server

The URL may also include

- A query string containing data to be passed to software running on the server
- A fragment identifier, which, if present, specifies a part or a position within the overall resource or document

The server, which provides resources such as HTML files and other content or performs other functions on behalf of the client, returns a response message to the client, using another URL to route the response to the client. The response contains completion status information about the request and may also contain requested content in its message body.

In addressing the question of how the documents mounted on the server and fetched by the client would be formatted, Berners-Lee confronted a thornier problem, in part because the process of standardizing the formats for electronic documents was nascent. However, Berners-Lee discovered the SGML in the early going and recognized that under the SGML grammar a document is separated into three parts: (1) an SGML declaration; (2) a prologue; and (3) an instance, with the prologue constituting a document type definition (DTD). He noted further that the SGML declaration determines the lexicon of the grammar, specifies the document character set, and establishes the code positions associated with those characters, binding the abstract syntax of SGML to a concrete syntax expressed through the DTD. The concrete syntax formulated by Berners-Lee on the basis of SGML and the ISO standard defining the 7 bit coded character set for information interchange became known as the Hypertext Markup Language, or HTML.^[40,41]

So the HTML began as a subset, also referred to as a “document type definition,” of the SGML.^[42] As noted previously, Berners-Lee had been commissioned to create a system under which documents could be shared, edited, and annotated across a network, and the project required a way of formatting documents using a code base—ASCII (the American Standard Code for Information Interchange), as it happens—that was shared by a variety of computers and operating systems. Early on, Berners-Lee not only became aware of the SGML, but he also realized that SGML allowed for the creation of formatting subsets and related expressions rendered in ASCII.

The DTD Berners-Lee created was a simple expression, conceptually and syntactically. And that simplicity plays no small part in the success of the World Wide Web, because it is clear in retrospect that a more complicated scheme would have been much more difficult to implement or standardize. However, that same simplicity also became a curse of sorts, as it became clear that the wide variety of document types that authors sought to make available via the Web could not be supported adequately by a single DTD.

The system introduced by Berners-Lee provided a text-only interface. Acceptance of this system was slow. The text-only browser was not easy to use and the resources to which it had access were limited. However, that state of affairs changed in 1993, with the creation of a graphical Web browser for UNIX, known as Mosaic, by Marc Andreessen, an undergraduate student working at the National Center for Supercomputing Applications, and the distribution via the Internet of versions of Mosaic for Windows and the Mac OS in 1994. Mosaic’s introduction was the culmination of the first stage of Web development, and its effect was transformative. From the perspective of end users, the Web became a graphical medium, with Mosaic as the lens, and while it would take another 10 years before Web content began to achieve real richness and sophistication in visual terms, Mosaic was a clear indication of what was possible.

(In the early days of the World Wide Web, as programmers worked to develop browsers and other tools, questions about how to format HTML documents for presentation arose, and those questions became particularly acute with the development of graphical Web browsers such as Mosaic. Under SGML, formatting for presentation had been treated as a separate issue, with the focus placed instead on structural tagging. As graphical Web browsers came into more general use, one of the limits of this approach became obvious—most of the formatting of Web documents was being rendered by the browsers themselves and determined in large measure by the default settings of the specific browser in use. While permitting the browser to format the Web page had advantages, it also placed sharp limits on the extent to which the author of a Web page could control how that page was presented to a user. In the short term, the solution was to incorporate formatting attributes and tags into HTML, which in many ways adulterated the original concept. The longer-term solution came in the form of a compatible but distinct language for formatting, which came to be known as the “Cascading Style Sheets,” or CSS, specification.^[43])

In the second phase, the infrastructure that supports the Web through the present day was established. Jim Clark and Andreessen founded Netscape and released its Web browser in late 1994, ending the experimental phase in the Web’s development and initiating its commercialization. Microsoft, after ignoring the development of the Internet for a number of years, responded with the development of

a Web browser called Internet Explorer and the subsequent release of other, Web-related technologies, including the Internet Information Server. The Apache Project, dedicated to building secure Web server software in an open-source environment, was established in 1995. In 1999, as the Web turned from this “buildout” phase to a period of rapid expansion predicated on increasingly stable server technologies and more and more sophisticated approaches to document rendering, IBM embraced open-source software and played a key role in establishing the Apache Foundation, which has become one of the leading organizations in the ongoing development of the software that runs the Web. In 2001, the first podcast was presented (in the form of a Grateful Dead recording), Wikipedia was founded, and Pope John Paul II sent the first papal e-mail from a laptop in his office at the Vatican. In 2003, Apple’s iTunes music download service was launched. In 2004, Tim Berners-Lee was knighted, and Google became a public company.^[44]

In this “buildout” phase, one of the most critical developments was the introduction of the CSS specification in 1994. The purpose of CSS was twofold: First, it was intended to separate structural markup and formatting in order to simplify both coding and interpretation, and, second, it was designed to enlarge and enrich opportunities for formatting HTML documents, ranging from the ability to define families of fonts to absolute positioning and the use of so-called floats to wrap text around images to the cascade itself, which was defined as “the process of combining several style sheets and resolving conflicts between them.”^[45,46]

How important has CSS been to the development of the Web? Håkon Wium Lie, who wrote and published the first CSS specification in 1994, has asserted that CSS “saved HTML,” because it gave “authors a way to express their designs without adding new HTML tags.” Perhaps more to the point, CSS has afforded authors an effective mechanism separate and apart from structural markup for creating visually richer and more interesting Web pages.^[47]

In the third phase, which began in 2004–2005, the Web entered into a more highly interactive phase, characterized by network-resident applications, participatory architectures, the increasing use of XML-based technologies, and metadata interchanges that presaged the Semantic Web.

Under HTML5, yet another phase in the development was initiated. HTML5 provided a more coherent framework for the creation of Web pages and the development of Web applications. For example, whereas HTML 4 was imprecise in defining the structure of a document, HTML5 provides an “outline algorithm,” under which all content residing within the `<body>` of a document is also part of a section, and sections are defined explicitly within the `<body>`, `<section>`, `<article>`, `<aside>`, `<footer>`, `<header>`, and `<nav>` tags.^[48] In a related vein, under HTML5 headings, for example, `<h1>` and `<h2>` are defined and ranked within sections of the `<body>` of the

document. Relative ranking of the headings matters only within a section, with the structure of the sections determining the outline, and not the heading rank of the sections.

HTML5 supports video and audio tracks without plug-ins; provides programmatic access to a resolution-dependent bitmap canvas that is useful for rendering graphs, graphics, or other visual images and native support for scalable vector graphics (SVG) and math (MathML); and features supporting the development of and access to rich applications. (The HTML5 `<canvas>` element is used to draw graphics, on the fly, via scripting. The `<canvas>` element is a container for graphics, with the script, usually a JavaScript, which actually draws the graphics. A canvas is a rectangular area on an HTML page, with incorporated methods for drawing paths, boxes, circles, and text and adding images.)

HTML5 has been in use throughout its development. According to a 2014 survey, 42% of 10,000 developers polled are using the combination of HTML, CSS, and JavaScript for all or part of their mobile applications, and Gartner Research has identified HTML5 as one of the top 10 mobile technologies for 2015–2016, as “an essential technology for organizations delivering applications across multiple platforms.”^[49,50]

With the publication of the fifth version of HTML5 in late 2014, the W3C announced that HTML5 would serve as the core of the Open Web Platform, through which the W3C intends to lower the cost of developing cross-platform applications by focusing on the following issues:

- Security and privacy
- Web design and development
- Device interaction
- Media and real-time communications
- Performance and tuning
- Usability and accessibility
- Related services, including the social Web, payments, annotations, and Web of data^[51,52]

WHY HAS THE WEB BEEN SUCCESSFUL?

The Web has succeeded not only because many relevant conditions were “right” but also because it has relied from the outset on a simple, derivative architecture, consisting of the HTML, the HTTP, and the URL. A URL is a URI that also specifies the location of an identified resource and the protocol for retrieving it. In popular usage and in many technical documents, it is often confused as a synonym for uniform resource identifier.^[53] In the beginning, as Berners-Lee has noted, the World Wide Web represented a “basically trivial” expression of ideas, mainly about hypertext systems, that had been in circulation, in some instances for many years.^[54]

Moreover, since the advent of the graphical browser in 1995, the technologies of the World Wide Web have been easy for end users to manipulate, and that aspect coupled with the increasing rich blend of text, graphics, and links has created a huge global audience. Of equal importance is the fact that the Web's stewards, including Berners-Lee in his role as director of the W3C, have managed the continuing development of the underlying technologies in ways that have led to gradual changes and subtle transformations, rather than radical shifts. (Berners-Lee established the W3C in 1994 as a means of ensuring that Web-related standards would remain open. It was founded at the Massachusetts Institute of Technology Laboratory for Computer Science, with the support from the European Commission and the Defense Advanced Research Projects Agency, and quickly expanded its membership to include many other organizations, including most of the leading companies in the computer industry. By 2014, W3C membership had increased to 385 organizations.) For example, the path from the first version of the HTML to HTML 4.01 and XHTML and HTML5 is one marked by a commitment to interoperability and spirit of accommodation, whereby "[e]ach version of HTML has attempted to reflect greater consensus among industry players so that the investment made by content providers will not be wasted and that their documents will not become unreadable in a short period of time."^[55] At the same time, however, the interest in innovation that has driven the development of the Web has been manifested in other aspects of this stewardship, most notably in the development of the XML and proposal to develop what Berners-Lee and others refer to as the "Semantic Web."

In the longer term, the World Wide Web has succeeded because it is networked, but separate from the Internet. Berners-Lee has argued that this separation is of fundamental importance, because it allows the two layers of technology, the Internet and the Web, to work together while advancing independently.^[56] Moreover, the value of what the Web provides has grown in proportion to data, services, and users connected through it. Positive network externalities, the so-called network effect, have been reinforced by the extensibility of the Web's underlying technologies and the availability of an increasing large and diverse set of resources, often available to both content creators and users at little or no cost.

Of at least equal importance, the World Wide Web has succeeded and will endure because of a commitment to open technical standards that was made at the outset by Berners-Lee, and which he and others have sustained over the years, through the W3C, the Apache Foundation, and a host of other efforts. The commitment to open standards has thwarted efforts to exert private control over the Web and its technologies, and it has been a key factor in the Web's remarkable growth, allowing other innovators and entrepreneurs to leverage the Web's technologies in often creative ways. In the beginning, Berners-Lee opted for

technologies based on open standards, because his sponsor required interoperability and because he could afford no other choice. In so doing, he set in motion processes that have radically altered the course of the digital document's evolution.

The W3C endorses the Modern Paradigm for Standards, which is based on "[r]espectful cooperation between standards organizations, whereby each respects the autonomy, integrity, processes, and intellectual property rules of the others." Under the Modern Paradigm, standards are developed on the basis of five principles:

1. Due process, under which decisions are made with equity and fairness among participants, where no one party dominates or guides standards development, and standards-making processes are transparent and opportunities exist to appeal decisions, as well as review and update standards
2. Broad consensus, whereby processes allow for all views to be considered and addressed in order to facilitate agreement
3. Transparency, based on easily accessible records of decisions and the materials used in reaching those decisions and public comment periods provided before final standards approval and adoption
4. Balance, ensuring that standards activities are not exclusively dominated by any particular person, company, or interest group
5. Openness, providing relevant information to all participants and interested parties equally^[57]

IMPACT OF THE WORLD WIDE WEB ON LIBRARIES

The impact of the Web on libraries has been profound, changing the way libraries relate to vendors, clients, bibliographic utilities, and other libraries. What is more important is that the World Wide Web has liberated librarians and engendered new and often highly creative approaches to serving readers. The Web has had similar effects on publishers, ranging from scholarly presses to the U.S. Government Printing Office.^[58]

An example of how influential the Web has been may be found in the case of electronic journals. In the early 1990s, the publisher Elsevier ran The University Licensing Program (TULIP), an experimental project aimed at establishing an infrastructure for the distribution and delivery of e-journals.^[59] What is significant about TULIP in retrospect is that engineers at Elsevier assumed that the most effective and efficient means of delivering content would be to create a system under which digital subscriptions were maintained locally (meaning, in this instance, that copies of subscribed content would be maintained on servers situated with the subscriber's Internet domain) and updated regularly via the Internet. What they did not

envision was an Internet that would be fast enough to support the real-time distribution of journal articles or the emergence of a hypertext environment capable of linking databases to e-journals, journal articles to other journal articles via hyperlinked citations, articles to datasets, and so on. By the end of the 2000s, research libraries had reached a “tipping” point, whereby electronic journals, almost all of them delivered to libraries by means of the World Wide Web, outnumbered print subscriptions.^[60]

Integrated online library systems have been enhanced in a wide variety of ways, incorporating published and personal reviews of materials, support for bookmarking and personal account management, Web-based readers, citation formatting services, virtual reference services, etc. In recent years, access to library resources has been improved markedly, through the ongoing development of increasingly powerful discovery services and link resolvers. (The development of link resolution services is a great example of how the commitment to open standards has enhanced the functionality and efficacy of the Web as a medium for information interchange. Such services are based primarily on the OpenURL standard, which was developed by Herbert Van de Sompel and others in the late 1990s and early 2000s and then established as NISO standard in 2004.^[61])

Google Scholar is another interesting and important case in point where libraries and the Web are concerned. Google Scholar is designed to access to the scholarly literature through a single portal, supplying a means to find scholarly papers, abstracts, and citations, locate papers via libraries and/or websites, and learn about key works in “any area of research.”^[62,63] In many research library environments, it is also being used as a discovery system. (How effective is Google Scholar? It has been a matter of controversy, with some studies suggesting that Google Scholar’s coverage was substandard, but a recent study found that “as regards strict scientific impact, the analysis of GS data provides very similar results to the results obtained from traditional citation-based databases, with the advantage of being able to retrieve a larger and more varied number of citations, since they come from a wider range of document types, different geographical environments, and languages different to English.”^[64,65])

In addition, owing to the considerable efforts of archivists, curators, and scholars, there is a large and constantly expanding body of primary source materials available via the Web. Well-established projects like the American Memory Project at the Library of Congress continue to grow in terms of the number of collections available and the availability of collateral services.

The American Memory Project draws upon the collections of the Library of Congress and other institutions to provide “a digital record of American history and creativity.”^[66] In the process, materials to which access had previously been highly limited have become

available to the general public, in most instances accompanied by expert commentary. An early contribution to the American Memory Project concerning poet Walt Whitman and his notebooks is a good case in point. Conceived as a “test bed” for digital preservation and making collections available via the World Wide Web, digital facsimiles of four of Whitman’s notebooks, including a notebook that contains early drafts of segments of *The Leaves of Grass*, were rendered and made accessible via Web in a presentation entitled *Poet at Work: Recovered Notebooks* from the Thomas Biggs Harned Walt Whitman Collection.^[67] The significance of *Poet at Work: Recovered Notebooks* may be expressed on many levels, but it may be sufficient to say that in making available a body of material that has previously been available only to credentialed Whitman scholars, the American Memory Project changed forever the relationship between the Library of Congress and library users and that the World Wide Web served not only as the medium of presentation but also as an agent of change in a process that has brought the Library of Congress substantially closer to the goal of “serving the public as a resource for education and lifelong learning.”

Many newer projects are distinguished not only by their original content but also by their use of newer, interactive technologies; for example, the Georgia Virtual History Project is dedicated to recording the history of the state in digital forms and making those records available via the Web to “multiple audiences,” ranging from middle school students and the general public to college students and scholars.^[68] Another example is the eHistory website, as developed by the University of Georgia’s Center for Virtual History. eHistory was founded in 2011 by two historians in the belief that digital technologies afford new forms of research, in which students, scholars, and members of the public may act as collaborators. Like sites that call on “citizen scientists” and to gather and analyze data, eHistory projects involve “citizen historians” in amassing and analyzing historical data. The creators of eHistory that what has been labeled “citizen history,” often better reflects the way knowledge is created and consumed in the digital era.^[69]

The Web, or, to be more precise, the audience that the World Wide Web brings, has been the impetus for a series of scanning/content preservation projects, ranging from the controversial Google Books project to JSTOR to the Internet Archive. And the World Wide Web is also changing the form of the journal article, as publishers move from the PDF format to composite document formats based in significant part on HTML5. What Elsevier has dubbed the “article of the future” is a good example of widespread efforts to deploy “better ways to create and deliver the formal published record” by taking advantage of the expressive possibilities manifest in the continuing improvement markup and scripting languages.^[70]

GENERAL EFFECTS OF THE WORLD WIDE WEB

Technological Impact

The technological impact of the World Wide Web begins with the fact that Berners-Lee constructed a hypertext system based on open standards and capable of running in networked environments. It ends, for the time being, with the ongoing development of the Semantic Web and the emergence of compound documents within a multimodal “interaction domain.” It encompasses the development of an increasingly sophisticated system for structuring and formatting digital documents within an open technical framework and the creation of languages that define, respectively, concepts and relationships within domains of knowledge—the Web Ontology Language (OWL)—and establish a functional basis for statements, in the form of triples, for example, (Subject, Predicate, Object) or (Subject, Property, Value), linking data in order to describe both concepts and objects, the Resource Description Framework (RDF).^[71]

On another level, the World Wide Web has changed expectations in regard to computing and networking, to the point that with the rise of so-called cloud computing, the notion of the Web as a computing environment has taken on genuine meaning, in the form of myriad services, ranging from cloud storage services such as Google Drive to productivity software like Microsoft’s Office 365.

Social and Cultural Effects

The social and cultural effects of the World Wide Web are many, but perhaps the most pronounced have been observed in publishing, information retrieval, and collaborative work. Simply put, the Web has changed the meaning of the word “publish,” providing new and breathtakingly broad connotations and linking traditional forms of publication, such as book, newspapers, and journals, with blogs and wikis.

According to research conducted by the Pew Research Center, 14% of the adult population in the United States used the Internet. In 2014, 81% of U.S. adults use laptop and desktop computers somewhere in their lives, 87% of the adults in the United States use the Internet, and 73% use social media, a pattern of growth that Pew’s researchers attribute largely to the growth and popularity of the Web and the emergence of more interactive formats within the framework of the Web. In the so-called second generation of the Web, users have taken an increasingly active role. Almost all users are now able to “create new content, share it, link to it, search for it, tag it, and modify it”—Wikipedia, Facebook, Twitter, and YouTube being the most significant, and now classic, examples of this Copernican revolution.”^[72] The social impact of an enterprise as vast as the World Wide Web is difficult to gauge

in the fullest sense, but 90% of the Internet users polled by Pew believe that the Internet and the Web have been good for them personally, 76% regard the Internet and the Web as positive developments for society in general, and two-thirds of them indicated that “online communication has generally made them socially richer.”^[73,74]

In the realm of information retrieval, the Web has been a test bed that renewed and enlarged interest in information retrieval as a set of complex conceptual problems and procedural issues. At a practical level, the Web has facilitated the development of powerful tools, such as the Google Search Engine, it has placed those tools at the disposal of hundreds of millions of users, and it has created a competitive environment for IR services that virtually guarantees ongoing, vigorous commitments to basic research and development.

In terms of contemporary culture, the Web has altered how people inform themselves. News comes from the websites of CNN, *The New York Times*, the BBC, and tens of thousands of other outlets on the Web. Stock quotes, television program listings, restaurant menus, airline flight information, up-to-date weather information, satellite maps, and the current address of a distant relative or a long-lost friend are all types of information that hundreds of millions of people use the Web to locate and retrieve.

Even language has been altered. In the English-speaking world, “Google” has become a verb. A neologism arising from the popularity of the eponymous search engine, the American Dialect Society chose it as the “most useful word of 2002,” and it was officially added to the Oxford English Dictionary on June 15, 2006, and to the 11th edition of the Merriam-Webster Collegiate Dictionary in July 2006.^[75] (An interesting side note: Google has actively discouraged the use of the word as a verb, compelling some lexicographers to use a lowercase version of the word in order to avoid legal conflict with Google.)

The Web has also provided an operational as well as social environment consistent with the rapid development of systems for collaborative work, encompassing content management systems, collaborative authoring tools, learning management systems for asynchronous learning, Internet telephony, video conferencing, and resource sharing.

Scientists use the World Wide Web as an environment for providing remote access to and control of scientific instruments; they use the Web as the medium for grid-based architectures that combine entail parallel distributed computation, distributed data management and archiving, and interactive integrated visualization tools in support of their research.^[76]

Today, as “cyberinfrastructures” designed for research and development emerge, the focus of development in systems for computer-supported cooperative work is shifting to knowledge sharing within collaborative frameworks and building shared work environments that incorporate the ontological schema and services of the

Semantic Web. However, to date, the most significant collaborative project to be hosted by the Web is Wikipedia.

Wikipedia has created a remarkable amount of controversy, but it also stands as witness to the equally remarkable social forces that the Web has unleashed. It may not have been Jimmy Wales's aim to stand H.G. Wells notion of the "world brain" on its head, but Wikipedia and its many allied projects have demonstrated the reach of digital volunteerism and have shattered, perhaps forever, the myth that valuable knowledge resides mainly within universities.^[77] The Wikipedia model will undoubtedly undergo many modifications in the years ahead, some of them intended to bring collaborative models for building knowledge resources closer to the technocratic control that Wells envisioned, but no matter what happens in the future, the Wikipedia of the early twenty-first century will be remembered as revolutionary in nature and effect, because it has changed the way in which we think about encyclopedias and how they are made.

THE FUTURE OF THE WORLD WIDE WEB

When contemplating the future of the World Wide Web, it is necessary to consider what we actually know and understand about the system in its many dimensions and manifestations. Not long ago, it was argued that "[d]espite the Web's great success as a technology and the significant amount of computing infrastructure on which it is built, it remains, as an entity, surprisingly unstudied."^[78] That state of affairs has changed markedly in recent years, to the extent that many studies have been conducted and published, resulting in a plethora of data. However, what we know or understand about the Web, and particularly in reference to the Web as a social machine, remains limited and ultimately inadequate. In *Weaving the Web*, Berners-Lee "hypothesized that the architectural design of the Web would allow developers, and thus end users, to use computer technology to help provide the management function for social systems as they were realized online."^[79] In view of the fact that the success or failure of Web technologies often depends more on social factors than it does on technological issues, it may be argued that the ability to design and deploy successful applications requires a significantly better understanding of the features and functions of the social aspects of the systems.

At a technical level, the future of the World Wide Web is well defined, at least in the near term, by HTML5 and the Semantic Web. Each is an evolutionary extension of the World Wide Web.

The Semantic Web is an initiative and a broad area of work in which the semantics of information and services on the Web are defined in order to increase the precision of the results that are delivered to users in response to their queries.^[80] The core idea of the Semantic Web is to create

the metadata describing data, which will enable computers to process the meaning of things. Once computers are equipped with semantics, they will be capable of solving complex optimization problems.

The Semantic Web is based on Tim Berners-Lee's vision of the Web as a universal medium for data, information, and knowledge exchange and his belief that the existing Web may be so transformed through schemes based on the XML, focusing specifically on shifting the underlying structure of the Web from a vast file system into a huge, integrated database by marking up data and documents by content. From another perspective, the Semantic Web comprises a set of design principles, collaborative working groups, and a variety of enabling technologies. Some of the key elements of the Semantic Web are expressed as future possibilities that are yet to be implemented or realized. Other elements of the Semantic Web are expressed in formal specifications. These elements include RDF, a variety of data interchange formats (e.g., RDF/XML, N3, Turtle, N-Triples), and notations such as RDF Schema and the OWL, all of which are intended to provide a formal description of concepts, terms, and relationships within a given knowledge domain.

Is the Semantic Web inevitable? The answer is yes, insofar as it is the latest expression of humanity's desire to create better tools, because it is the logical next step in the development of information processing and distributed computing services, because its realization will play a major role in driving the global economy of the twenty-first century, and because it will also play a critical role in the development of the systems that are needed to ensure continuing progress in science, biomedical research, and other matters vital to humanity.^[81] When will the Semantic Web arrive? The key building blocks—RDF, OWL, etc.—are here already, but it will take some time, perhaps a long time, to annotate and capture the world's information in the appropriate ways.

One of the factors that may speed or delay the arrival of the Semantic Web is the speed with which intelligent applications, software implementing concepts from artificial intelligence that facilitate machine-to-machine communications, grow in operational sophistication. Realizing Berners-Lee's vision depends on an ability to generate and assimilate metadata on a scale and at a speed beyond collective human capabilities, and that process will depend, in turn, on the skill with which software agents (or "bots") are designed and deployed.^[82]

There are issues associated with HTML5, too. Owing to the rapid pace of device change and the attendant platform fragmentation—each browser and device vendor chooses what HTML5 features to implement—the deployment of HTML5 is uneven. Software tooling is regarded as inadequate, and many developers are not yet proficient in its uses.^[83] Even bigger problems stem from the differences in purpose that troubled the development of

HTML5. Web developers want HTML to become a better application platform, and, even though HTML5 has been approved by W3C, there is continuing concern among developers that the W3C, the organization that made a long and probably ill-advised commitment to XHTML, is neither flexible enough nor future-oriented enough to provide the necessary stewardship.^[84]

But the future of the World Wide Web will also be defined by a series of collateral developments and factors. Mobile computing is clearly one of the major factors. A rapidly growing array of smartphones and tablet computers already provides access to a large majority of the Internet's users in the United States, and because the devices themselves are growing more powerful and more sophisticated, this trend is not only expected to continue but to reshape more general patterns of computer (and Web) usage. Gaming systems will continue to play an important role in the future of the Web, as will online video, already a major force on the Web in the form of YouTube and Netflix. Software as a service will serve as a medium for more and more end-user computing, in many instances supplanting the personal computer, and evolutionary changes in the design of operating systems and applications will produce growing amounts of structured information, thus paving the way for more intelligent computing.

In education, the Semantic Web's greatest impact will be in the ways in which data integration influences how knowledge is aggregated, organized, and presented to students. As noted in a related essay

One vision of a well-developed semantic web includes a search feature that would return a multimedia report rather than a list of hits. The report would draw from many sources, including websites, articles from scientific repositories, chapters in textbooks, blog dialogue, speeches posted on YouTube, information stored on cell phones, gaming scenarios played out in virtual realities—anything appropriate that is accessible by the rules of Web 3.0. The report would consist of short sections that coalesce around knowledge areas that emerged naturally from your research, with keywords identified and listed conveniently off to one side as links.

The information in the report would be compared, contrasted, and collated in a basic way, presenting points of agreement and disagreement, and perhaps associating these with political positions or contrasting research. Because the web knows something about you, it also alerts you to local lectures on related topics, books you might want to read, TV programs available through your cable service, blog discussions you might find relevant, and even local groups you can contact that are also focused on this issue. Unlike a standard report, what you receive changes as the available information changes, and you might have wiki-like access to add to or edit it. And because you told your agent that this topic is a high priority, your cell phone will beep when a significant

development occurs. After all, the semantic web will be highly inclusive, providing a common language for many kinds of media and technologies, including cell phones. The net result, ideally, is that you spend less time searching and sifting and more time absorbing, thinking, and participating.^[85]

Education will also be affected, perhaps profoundly, by the rise of “just-in-time” learning. Unlike traditional educational models, which are essentially supplier-driven systems that work efficiently for instructors, “just-in-time” learning is predicated on consumer-driven systems that are designed to work effectively for students, making learners active participants in the educational process. The new model focuses on learning rather than on teaching. More to the point, “just-in-time” models achieve their goals by moving from standardized to customized content, from discrete time and place to anytime and anyplace delivery, and from passive lecture models to interactive and applied learning, all of which can and will be supported by the technologies of the Semantic Web.

For libraries and archives, the changes are likely to be many and great, encompassing many, if not all of the trends noted earlier. The decline of the importance of the library as a place is inevitable. Competition for the attention and loyalties of digital information consumers will grow only keener, and librarians who wish to survive and flourish will necessarily adopt new approaches to serving clients. However, perhaps the most profound change before librarians and archivists may well be changes in the form of documents, as new technologies and the continuing pressure to improve formal communications in science, technology, and medicine combine to alter both the form and content of the scholarly (or professional) paper. The result will be the compound digital document, basically a framework for integrating text, multimedia, datasets, and hyperlinks, and those documents will present new, serious challenges across the spectrum of bibliothecal functions. (Librarians are certain to face major challenges in the area of client privacy. As the personalization of Web-based services increases, libraries will be challenged by consumer expectations and forced to confront the inevitable conflicts between the demand for more personalized services and the traditional guarantees of privacy that libraries and librarians in many countries have maintained zealously.)

Finally, the dominant role of the United States in the use and development of the World Wide Web will be somewhat diminished, as continuing growth in China, India, and parts of Africa changes the demographics of the Web's user population and broadens the base of developers and providers. Internet governance issues have become more important and more difficult. A new and potentially more balanced order for Internet governance is emerging, but there are myriad challenges to that new order, the most significant of them being government

censorship and surveillance. In the midst of these changes, the stability of the Web will depend, as it has for the last 20 years, on the W3C, the commitments that Tim Berners-Lee has fostered with such great success, and the ability of its leadership, in the midst of change and contentiousness, to maintain a unifying sense of purpose.

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World Wide Web Consortium (W3C)

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Abstract

The World Wide Web Consortium (W3C) is the organization that leads the development of standards for the Web. Sir Tim Berners-Lee, the founder and current director of the W3C, envisions a linked network of information resources that guides Web standards development and points the way towards the creation of a Semantic Web. This entry describes the pioneering role of Berners-Lee in the development of the Web, the accomplishments and vision of the W3C, and the development of the Semantic Web.

INTRODUCTION

This entry introduces the World Wide Web Consortium (W3C) by outlining the pioneering role of Sir Tim Berners-Lee in the creation of the Web and Web browsers, the development process employed by the W3C community to construct Web standards, and the vision and development of the Semantic Web.

In 2007 the W3C was an international consortium with more than 400 members. Berners-Lee leads a team of about 60 researchers and engineers who are located primarily in three institutions: the Massachusetts Institute of Technology Computer Science and Artificial Intelligence Laboratory (MIT/CSAIL); the European Research Consortium in Informatics and Mathematics, Nice, France (ERCIM); and Keio University in Japan.

The W3C is the leading organization in the development of Web standards and general guidelines for Web development. Its general mission is the development of Web standards and protocols that maximize benefits for the greatest number of people. While the process model of the W3C is consensual agreement and cooperation, it lacks any means to coerce the adoption of its standards and protocols.

Since 1994, the W3C has published more than 90 Web standards called W3C Recommendations. By building applications that comply with W3C recommendations, a Web developer supports the community of users and software that promote the sharing of information and platform independence. Berners-Lee and the W3C can justifiably be credited with inventing the World Wide Web, pioneering the development of the Web browser, and developing the protocols that make sharing information possible.

THE VISION OF THE W3C

The ultimate motivation of the W3C springs from the vision of Berners-Lee for the Web, and has been

variously expressed as the W3C motto: “To lead the World Wide Web to its full potential by developing protocols and guidelines that ensure long-term growth for the Web,” or more simply “Leading the Web to its full potential...” This vision privileges the notions of interoperability and device independency, and suggests a public network where information can be easily shared among strangers, and is not confined to a specific application software suite or a particular vendor’s products. The essence of the W3C vision is that a document or program that follows W3C specifications should work identically across different applications and different computers. To “work identically” in this context means that the essential information or functionality is preserved, while conceding that presentation issues such as the size of the display device, color options, accessibility accommodations, and so on, may introduce variability.

The vision of the W3C is displayed by its future of the Web document^[1] which claims that the Web is for:

- *Everyone* (regardless of culture, abilities, etc.).
- *Everything* (applications and data stores, and on devices ranging from power computers with high-definition displays to mobile devices to appliances).
- *Everywhere* (from high to low bandwidth environments).
- *Diverse mode of interaction* (touch, pen, mouse, voice, assistive technologies, computer to computer).
- *Enable computers to do more useful work* (through advanced data searching and sharing).

To complement its advocacy of interoperability and device independence, the W3C also promotes accessibility. Accessibility refers to the degree that application software is sympathetic to people with disabilities, but also in a more general sense, the degree to which applications can be used in environments degraded by noise, lighting, etc.

THE SEMANTIC WEB

Residing behind the W3C's vision of the Web as networked personal and corporate information is the more ambitious vision of the Web as a network of semantics. An early statement of this particular vision of the Semantic Web appeared in the *Scientific American*.^[2] This entry sketched a Web network of publicly available documents that possessed semantics structured as metadata. These metadata were to be harvested mechanically and manipulated by inference tools to solve ad hoc everyday problems such as finding the office hours of the closest doctor, the cheapest available tickets for the theater, and so on. The subtitle of the *Scientific American* article summarizes this vision of a Semantic Web: "A new form of web content that is meaningful to computers will unleash a revolution of new possibilities."

This original description of the Semantic Web was refined^[3] by suggesting the difference between the Web of public HTML documents destined to be displayed in Web browsers, and a web of structured data that would be amenable to mechanical harvest. Theoretically, these two Webs would coexist and even overlap as HTML documents destined for display in Web browsers might also contain structured metadata. An example technology that could be used in this way would be Resource Description Framework attributes (RDFa). Examples of the data that exist on the Web and that could be harvested mechanically might be calendar data, travel arrangements, photograph descriptions, and financial transactions.

The vision of the Semantic Web as a web of linked open data has come to dominate. The result might be called a web of data, where islands of semantics exist; that is, pools of structured documents on the open Web that could be harvested mechanically. Current efforts are now focusing on linking common data points that are related but exist in different semantic islands on the Web. In summarizing the achievements and challenges of constructing the Semantic Web, Ivan Herman^[4] gives a voice to the shift of the Semantic Web from a single huge, central ontology organizing all knowledge, which would be unmanageable if not impossible to construct. Instead he described the use of numerous ontologies and vocabularies, such as Friend of a Friend (FOAF) and Dublin Core (DC) that would capture local richness and encourage the discovery of new relationships among data. The challenge of such architecture is linking disparate data points together.

The Linking Open Data project^[5] centralizes the increasingly common construction of resources that are available for the mechanical harvest of structured information. The following enumerates some of the structured data available on the Web, which are, in effect, islands of semantics that might be linked together:

- IgentaConnect (<http://www.ingentaconnect.com/>) offers bibliographic metadata storage and has more than 200 million RDF triplets available.
- RDFS/OWL Representation of WordNet (<http://wordnet.princeton.edu/>) has 150MD of RDF/XML available for download. WordNet facilitates the browsing of meaningfully related words and concepts.
- "Département/canton/commune" is available from the French Statistical Institute and represents statistical surveys on population, employment, wages, prices, business, economy, and French national accounts.
- Geonames Ontology and Data has information on 6 million geographical features.
- RDF Book Mashup makes information about books, their authors, reviews, and online bookstores available on the Semantic Web. Information drawn from sources such as Amazon, Google, and Yahoo can be integrated into the Semantic Web.
- dbpedia is a community effort to extract structured information from Wikipedia and link this information to other sources of structured information.

Semantic Web Case Studies and Use Cases^[6] list descriptions of systems that have been deployed in industry that use Semantic Web techniques.

HISTORICAL HIGHLIGHTS OF THE W3C

The invention of the World Wide Web in 1989 was a by-product of Berners-Lee's solution to a document sharing problem at CERN (European Organization for Nuclear Research). He proposed a global hypertext project of linked documents to help people coordinate their work during large project development. To manifest his vision he created the first World Wide Web server and the first browser/client called "World Wide Web." This early Web browser was first offered to CERN in December 1990 and then to the Internet at large in the summer of 1991.

During the period of 1991 to 1993, Berners-Lee extended the development of the Web by constructing basic technologies such as Uniform Resource Identifiers (URIs), Hypertext Transfer Protocol (HTTP), and Hypertext Markup Language (HTML). As an early model of community development, Berners-Lee's technological initiatives were modified by feedback from the nascent Web community. In 1994 Berners-Lee founded the W3C at MIT/CSAIL where he is a senior research scientist.

The beginnings of the World Wide Web can be found in the proposal "Information Management: A Proposal"^[7] placed by Berners-Lee before CERN's governing board. Its ambition was to solve the information management problems of large projects by utilizing the idea of a hypertext, which had been pioneered by Nelson.^[8] Such a hypertext featured human-readable information linked together in ad hoc and unconstrained ways, thus

promoting the discovery of hitherto unrecognized parallels or points of convergence among disparate texts.

In September 1992 Berners-Lee gave an invited presentation to the Computing in High Energy Physics 92 conference, where he claimed that the “W3 project merges networked information retrieval and hypertext to make an easy but powerful global information system...W3 now defines the state of the art in networked information retrieval, for user support, resource discovery and collaborative work.” In 1993 the CERN W3 software suite appeared in the public domain.

The first W3C recommendation, for Portable network graphics (PNG), appeared in October 1996. Within several years, major recommendations were issued that were foundational for the growth and development of the Web. These included the recommendation for HTML 4.0 in December 1997, which added tables, scripting, and style sheets. These features permitted authors to create significantly more expressive Web content. And in February 1998, the recommendation for XML 1.0 appeared. XML provided a platform for a host of following recommendations and has evolved into a universal language of the Internet.

The following enumerates some of the important historical achievements of the W3C:

- The portable network graphics recommendation in October 1996 provides a cross-platform graphics format.
- The Cascading style sheets recommendation of December 1996 laid the foundation for a uniform strategy for adding style (e.g., fonts, colors, spacing) to Web pages.
- The Web accessibility initiative of February 1997 promoted accessibility of the Web through four primary areas of work: technology, tools, education and outreach, and research and development.
- The HTML 4.0 recommendation of December 1997 added new features to Web publishing such as tables, scripting, style sheets, internationalization, and accessibility.
- The XML 1.0 recommendation of February 1998 introduced the fundamental technology that would become an influential Web standard.
- In August 2000, the scalable vector graphics recommendation introduced two-dimensional graphics and graphical applications in XML.
- XML schema recommendation of May 2001 provided a standard method of architecting XML vocabularies.
- Web services activities introduce a fundamental protocol for Web services in January 2002.
- In May 2003 the W3C adopted a royalty-free patent policy and encouraged the development of open standards.
- Two fundamental protocols of the Semantic Web, RDF and Web ontology language (OWL) were introduced in February 2004.

- In March 2004, VoiceXML promoted the use of interactive voice response applications to Web-based development and content delivery.
- The W3C mission of universal access was promoted in February 2005 with the introduction of the character model recommendation. The goal of the character model recommendation was the ease of use of the Web regardless of language, script, writing system, and cultural conventions.
- The mobile Web initiative of May 2005 set the mission of making Web access from a mobile device as simple as Web access from a desktop device.
- In November 2005, the Semantic Web for health care and life sciences interest group (HCLSIG) deployed standardized Semantic Web specifications for the medical industry.

This historical listing illustrates the foundational role of the W3C in designing specifications and protocols that foster the sharing of information. The culmination of the worldwide sharing of information is expressed in the vision of the Semantic Web.

MEMBERSHIP OF THE W3C

The W3C brings together a diverse group of stake holders to achieve its mission of developing Web standards and protocols. As of 2008 there were more than 400 members of the W3C representing more than 40 countries. Approximately 37% of these members are American and about 9% are from the United Kingdom. The stake holders of the W3C represent many different types of organizations with the largest category being consultants and systems integrators followed by the university research and development category and the general software companies category. Other categories of members include vendors of technology products and services, content providers, corporate users, research laboratories, standards bodies, and governments.

ACTIVITIES OF THE W3C

The activities of the W3C manifest themselves as various kinds of groups. Working groups focus on technical developments, interest groups focus on nontechnical issues, and coordination groups focus on the communication among related groups.

The following is an overview of some of the leading activities of the W3C:

- XML activities represent a core set of technologies around which orbit a number of working groups that are focused on development in the areas of extensible

stylesheet language (XSL), efficient XML interchange, XML binary characterization, XML processing model, and XML linking, query, and schema.

- Graphics activities focus on the development of scalable vector graphics (SVG) technologies.
- The HTML activities group works on the evolution of this standard language of the Web. The current goal is to evolve HTML into an XML-based markup language and thereby ease its use with other markup languages.
- Internationalization activities work to ensure that the W3C's formats and protocols are amenable to all of the world's languages, writing systems, character codes, and local conventions.
- Math activities facilitate the use and presentation of mathematics on the Web.
- Mobile Web activities are working to overcome fundamental interoperability and usability problems associated with mobile Web access. They attempt to integrate the key players in the mobile area: authoring tool vendors, content providers, handset manufacturers, browser vendors, and mobile operators.
- Multimodal interaction activities target the ability of Web users to dynamically switch to the most appropriate mode of interaction. Ideally, a multimodal Web application would permit users to input data via speech, handwriting, and keystrokes, and receive output via displays, prerecorded and synthetic speech, audio, and various haptic displays.
- Patent policy activities alert the W3C community about developments in the legal and standards environment.
- Rich Web client activities focus on Web-based applications that extend the user experience on the Web beyond static HTML. Often these applications support compound documents that combine multiple formats such as Extensible Hypertext Mark-up Language (XHTML), SVG, Synchronized Media Integration Language (SMIL), and XForms.
- Security group activities focus on the security context of Web applications that prevent surfers on the Web from being deceived and defrauded.
- Semantic Web activities focus on the creation of a universal medium for the exchange of data. Ideally both personal information and enterprise applications would be smoothly integrated creating a global sharing of commercial, scientific, and cultural data.
- Style activities focus on style components of Web pages. This group is working to extend style to other types of documents such as XML, SVG, and SMIL.
- Synchronized multimedia activities focus on choreographing multimedia presentations where audio, video, text, and graphics are combined in real time. A Timed Text working group is working is designing formats for streaming text synchronized with other timed media.
- Ubiquitous Web applications activities focus on enabling value-added services and business models for ubiquitous networked devices.
- Voice browser activities aim at technologies for capturing and producing speech and managing the dialog between user and computer.
- Web content accessibility initiative (WAI) focuses on accessibility to the Web resources, while the WAI technical group focuses on the technical aspects in three areas: Web content, user agent, and authoring tool accessibility.
- Web services activities promote the technology of Web services as a standard means of interoperability between different software applications running on a variety of platforms and frameworks. This group is designing the infrastructure, architecture, and core technologies for Web services.
- XForms activity focuses on the use of Web forms for the collection and distribution of information.

New areas of interest and activity are incorporated into the W3C by a recommendation development process.

RECOMMENDATION DEVELOPMENT PROCESS

The W3C strives to create high-quality standards for the Web through the strategy of community consensus. The general public is encouraged to join the members of the W3C in coming to consensus of Web standards and protocols. A new development begins with expressions of interest in a topic, and perhaps a workshop that brings interested persons together for the exchange ideas and information. Next, a proposal for a new activity describes the scope and duration of the project, as well as working groups, interest groups, and coordination groups that will carry out the work. As the development work proceeds, candidate specifications and guidelines cycle in revision and review as they advance to recommendation status. This may be a long process that may ultimately lead to a success recommendation, or may result in the abandonment of the proposal. As successful proposals near completion, a W3C advisory committee finally examines the mature proposal and issues a recommendation.

CONCLUSION

The W3C has had a major influence on the creation of the World Wide Web, arguably the most important public information utility of our age. It has taken as its mission the development of the Web in the manner of consensus building with the aim of creating the greatest benefit for the greatest number. As the Web grows in size and sophistication, more and more Semantic Web applications are appearing.

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XML Information Retrieval

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Abstract

Nowadays, increasingly, documents are marked-up using eXtensible Mark-up Language (XML), the format standard for structured documents. In contrast to HTML, which is mainly layout-oriented, XML follows the fundamental concept of separating the logical structure of a document from its layout. This document logical structure can be exploited to allow a focused access to documents, where the aim is to return the most relevant fragments within documents as answers to queries, instead of whole documents. This entry describes approaches developed to query, represent, and rank XML fragments.

INTRODUCTION

Documents can be structured or unstructured. Unstructured documents have no (or very little) fixed predefined format, whereas structured documents are usually organized according to a fixed predefined structure. An example of a structured document is a book organized into chapters, each with sections made of paragraphs and so on. Nowadays, the most common way to format structured content is with the W3C standard (<http://www.w3.org/XML/>) for information repositories and exchanges, the eXtensible Mark-up Language (XML).

Much of the content available on the Web is formatted in HTML. Although HTML imposes some structure on a Web content, this structure is mainly for presentation purposes and carries little meaning. In contrast, XML is used to provide meaning about the stored content. More precisely, in the context of text documents, with which this entry is concerned, XML is used to specify the logical, or tree, structure of documents, in which separate document parts (e.g., chapter, section, abstract) and their logical structure (e.g., a chapter made of sections, a section and its title, an article and its abstract) are explicitly marked-up. As an increasing number of documents are being made available in XML format, effective means to access them are needed. As for standard (unstructured) documents, this requires appropriate query languages, representation methods, and ranking algorithms.

Approaches for accessing logically structured documents were first proposed in the 1990s.^[1–4] In the late 1990s, as XML was adopted as the standard document format, approaches for what became known as XML information retrieval were being developed.^[5–7] Research in XML information retrieval was then further boosted with the set-up in 2002 of the Initiative for the Evaluation of XML Retrieval (INEX),^[8] a yearly evaluation campaign that provides a forum for the evaluation of approaches specifically developed for XML information

retrieval. INEX provides test collections and evaluation measures, which make it possible for organizations worldwide to evaluate and compare their XML information retrieval approaches.

By exploiting the logical structure of XML documents, the goal of an XML information retrieval system is to implement so-called focused retrieval strategies, which aim at returning document components, i.e., XML elements, instead of whole documents in response to a user query. These focused retrieval strategies aim to break away from the traditional retrieval unit of a document as a single large (text) block. This is believed to be of particular benefit for information repositories containing long documents, or documents covering a wide variety of topics (e.g., books, user manuals, legal documents), where the users effort to locate relevant content within a document can be reduced by directing them to the most useful parts, i.e., the most useful XML elements, in the document.

To identify the most useful XML elements to return as answers to given queries, XML information retrieval systems require:

- Query languages that allow users to specify the nature of relevant components, in particular with respect to their structure.
- Representation strategies providing a description not only of the content of XML documents, but also their structure.
- Ranking strategies that determine the most relevant elements and rank these appropriately for a given query.

In this entry, we provide an overview of “Query Languages,” “Representation Strategies,” and “Ranking Strategies” developed for XML information retrieval. The representation and ranking strategies presented in this entry were evaluated within the INEX evaluation campaigns.^[9–14]

The entry finishes with some conclusions on XML information retrieval research, and some references to early work related to XML information retrieval.

QUERY LANGUAGES

XML documents are organized into a logical structure, as provided by the XML mark-up. For example, a scientific article, such as those forming the INEX test collection used in INEX (see Fig. 1), consists of a front matter (<fm>), a body (<bdy>), and a back matter (<bm>). The front matter contains the article's metadata, such as title, author, publication information, and abstract. Following it is the article's body, which contains the actual content of the articles, and is structured into sections (<sec>), subsections (<ss1>), and sub-sub-sections (<ss2>). These logical units start with a title, followed by a number of paragraphs. The back matter contains a bibliography and further information about the article's authors.

Users may want to specify conditions to limit the search to specific XML elements. For example, a user may want sections discussing "XML retrieval evaluation," whereas another user may look for paragraphs about

"effectiveness measures" contained in sections about "XML retrieval evaluation." Here we have a combination of content constraints, "XML retrieval evaluation" and "effectiveness measures," typical to information retrieval, and structural constraints, "section," "paragraph," and "paragraph within section." XML query languages have been developed with the aim to express various levels of content and structural constraints. They can be classified as content-only or content-and-structure query languages.

Content-only queries make use of content constraints only, i.e., they are made of words, which is the standard form of input in information retrieval. They are suitable for XML retrieval scenarios where users do not know, or are not concerned, with the document logical structure when expressing their information needs. Although only content conditions are being specified, XML information retrieval systems must still determine what are the best fragments, i.e., the XML elements at the most appropriate level of granularity, to return to satisfy these conditions. For example, the best answer for a query "XML retrieval evaluation" may be a subsection and not a section, as the section, although relevant, may be less specific to the query than the subsection. An XML information retrieval system task is to determine this appropriate level of granularity for any given query.

Content-and-structure query languages provide a means for users to specify content and structural information needs. It is toward the development of this type of queries that most research on XML query languages lies. We can distinguish between three main categories of content-and-structure XML query languages, namely in sections "Tag-Based Languages," "Path-Based Languages," and "Clause-Based Languages." For the latter two types, we provide a brief description, mainly through examples, of current languages, namely XPath and Narrowed Extended XPath I (NEXI), and XQuery and XQuery Full-Text, respectively.

Tag-Based Queries

With tag-based queries, words in the query are annotated with a single tag name, which specifies the type of desired result elements, e.g., a section, an abstract. For example, the information need "retrieve sections about XML retrieval evaluation" would be expressed as `section: XML retrieval evaluation`. An example of a tag-based query language is XSearch.^[15]

Tag-based queries are intuitive, and have been used in domains outside XML information retrieval (e.g., faceted search, Web search). However they only express simple, although important and likely common, structural constraints. They cannot express, for instance, relationship (structural) constraints, e.g., "a paragraph contained in a section," which may be needed for complex retrieval scenarios.

```

<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<fm>
  <title>XML Retrieval Evaluation</title>
  <author>
    <author>John Doe</author>
    <author>Jane Smith</author>
  </author>
  <pubinfo>
    <journal>Journal of XML</journal>
    <volume>1</volume>
    <issue>1</issue>
    <pages>1-10</pages>
  </pubinfo>
  <abstract>
    This paper discusses the state of the art in XML retrieval evaluation.
    It covers various methods and metrics used to assess the effectiveness
    of retrieval systems.
  </abstract>
</fm>
<bdy>
  <sec>
    <title>Introduction</title>
    <p>XML retrieval evaluation is a complex task that involves assessing the
    performance of retrieval systems against a set of criteria. This section
    introduces the various methods and metrics used in the evaluation process.
  </sec>
  <ss1>
    <title>Methods</title>
    <p>There are several methods used to evaluate XML retrieval systems, including
    precision, recall, and F-measure. Each method has its own strengths and
    weaknesses, and it is important to understand how they are calculated.
  </ss1>
  <ss2>
    <title>Precision</title>
    <p>Precision is a measure of the accuracy of the retrieved information. It is
    calculated as the number of relevant items divided by the total number of
    items retrieved.
  </ss2>
  <ss2>
    <title>Recall</title>
    <p>Recall is a measure of the completeness of the retrieved information. It is
    calculated as the number of relevant items divided by the total number of
    items in the collection.
  </ss2>
  <ss2>
    <title>F-measure</title>
    <p>The F-measure is a harmonic mean of precision and recall. It provides a
    single metric that takes into account both the accuracy and completeness
    of the retrieved information.
  </ss2>
</bdy>
<bm>
  <bibliography>
    <ref>
      <author>Doe, J.</author>
      <title>XML Retrieval Evaluation</title>
      <journal>Journal of XML</journal>
      <volume>1</volume>
      <issue>1</issue>
      <pages>1-10</pages>
    </ref>
  </bibliography>
  <authorinfo>
    <author>
      <name>John Doe</name>
      <email>j.doe@example.com</email>
    </author>
    <author>
      <name>Jane Smith</name>
      <email>j.smith@example.com</email>
    </author>
  </authorinfo>
</bm>

```

Fig. 1 Sketch of the structure of a typical article in the INEX test collection.

Path-Based Queries

Path-based queries are based upon the syntax of XPath (XML Path language, <http://www.w3.org/TR/xpath>), which has been defined by the W3C to navigate to components of an XML document. The most important concept in XPath is the location path, which consists of a series of navigation steps characterizing movements within an XML document.

For example, `chapter/section` is a location path, where `chapter` and `section` are steps that navigate to elements of types “chapter” and “section,” respectively. The fact that the steps are separated by “/” means that the location path selects section elements directly below chapter elements. Section elements are referred to as children of chapter elements. The navigation steps can be separated by “//”. For example, `chapter//section` navigates to all section elements that are directly or indirectly below a chapter element. Section elements are referred to as descendants of chapter elements. Special steps include the self step denoted “.” and parent step “..”. For example, `./section` returns all section elements contained directly or indirectly in the currently navigated element.

At each step, predicates can be specified between “[” and “]”, which must be satisfied for elements to be navigated into. For example, the following XPath query `//article[@year=2002]/title` selects the “titles” of “articles” published in 2002, and only those.

An important function in XPath for the purpose of XML information retrieval is the function `contains()`. For example, the query `//section [fn : contains (. /title, “XML retrieval”)]` will return all section elements with a title containing the string “XML retrieval”. The result of this XPath query is a set of section elements, and not a ranked list of section elements. Thus XPath is not an XML query language that can be directly used in XML information retrieval. Nonetheless, it is used by, or has inspired, other path-based query languages, some of which allowing the ranking of results, e.g., XXL,^[16] XIRQL,^[17] and NEXI.^[18] We discuss the last one, NEXI.

The NEXI query language was developed by INEX, as a simple query language for XML information retrieval evaluation. NEXI consists of a small but enhanced subset of XPath. The enhancement comes from the introduction of a new function, named `about()`, which requires an element to be about some specified content criteria. It replaces the XPath `contains()` function, to reflect that an element can be relevant to a given query without actually containing any of the words used in the query.

A small subset of XPath was chosen because NEXI was not developed to test the expressiveness of a query language for XML information retrieval, but to evaluate XML information retrieval effectiveness. For instance, the parent/child navigation step “/” was considered

particularly problematic as it was open to misinterpretation by assessors, and hence was dropped. We recall that in information retrieval evaluation, assessors are used in the process of building a test collection. Their task is to judge the relevance of the information returned to them as answers to given queries. All result elements must have at least one `about()` function. This is because for the purpose of evaluating retrieval effectiveness, what matters is that the relevant elements are actually returned. For instance, the following query `//section [about(., XML retrieval)]/title`, which requests titles of sections about “XML retrieval evaluation,” is not allowed in NEXI; it is indeed a mechanical process to return the title of a section deemed relevant to “XML retrieval.”

We finish with an example of a NEXI query:

```
//article [about(. //bdy, XML retrieval)]//
section [about(., evaluation)]
```

This query is asking for section elements about “evaluation” contained in articles that have a body that discusses “XML retrieval.”

NEXI was developed by INEX for the purpose of evaluating XML information retrieval effectiveness. It remains the task of the XML information retrieval system to interpret a NEXI query, where the interpretation is with respect to the `about()` condition as implemented by the retrieval model, and the structural constraint as implemented by the query processing engine, used by the XML information retrieval system. Sections “Scoring Strategies” and “Combination Strategies” describe approaches used to implement the `about` conditions, whereas section “Processing Structural Constraints” describes approaches used to process structural constraints, for the purpose of ranking XML elements for given queries.

Clause-Based Queries

Clause-based queries for XML information retrieval can be compared to SQL, the standard query language for (relational) databases. These queries are made of nested clauses to express information needs. The most prominent clause-based query languages for XML information retrieval are XQuery (<http://www.w3.org/TR/xquery/>) and XQuery Full-Text (<http://www.w3.org/TR/xpath-full-text-10/>).

XQuery is an XML query language that includes XPath as a sublanguage, but adds the possibility to query multiple documents and combine the results into new XML fragments. The core expressions of XQuery are the FLWOR expressions, which we illustrate with an example. The following query is a FLWOR expression that lists the authors, ordered by their last name, that have written at least 100 articles:

```

for $aut in (doc ("aut.xml")//author)
  let $c:=
    count (doc("article.xml")/article
      [author=$aut])
    where $c>100
    order by $aut/lastname
  return
  <author>{$aut/lastname,$c}</author>

```

The `for` (F in FLWOR) clause binds the variable `$aut` so that it iterates over the author elements in the document “aut.xml” in the order that they appear. For every such binding, the `let` (L) clause binds the variable `$c` to the number of articles from author `$aut` (from the document “article.xml”). Those author elements for which the condition in the `where` (W) clause is true are selected, i. e., number of articles is above 100. The resulting bindings are sorted by the `order by` (O) clause on the author last name. Finally, the `return` (R) clause creates for each binding `$aut` and `$c` in the result of the preceding clause a new author element that contains the last name element of the author, and the associated number of articles.

XQuery is a powerful XML query language. However, its text search capabilities are limited and, in addition, the result is a set of (new) XML fragments; no ranking is performed. Thus its usefulness in XML information retrieval is limited. This has led to the development of XQuery Full-Text.^[19]

XQuery Full-Text has been inspired by earlier query languages for searching structured text, e.g., ELIXIR,^[20] JuruXML,^[21] XIRQL.^[17] The added text search capabilities come with the introduction of the *FTContainsExpr* expression, as shown in the following example:

```

//article[./title ftcontains {"XML",
  "retrieval"}
all] // author

```

which returns the authors of articles whose title contains the words “XML” and “retrieval.” XQuery Full-Text defines primitives for searching text, such as phrase, word order, word proximity, etc. For example, the following XQuery Full-Text expression:

```

//article[./title ftcontains {"XML",
  "retrieval"}
all window 6 words]//author

```

restricts the proximity of the matched words to appear within a window of six words in title elements.

To support the ranking of results, *FTScoreClause* expressions have been introduced to allow for the specification of score variables. For instance, the following query:

```

for $b score $s in //article [./section
  ftcontains

```

```

{"XML", "retrieval"} all]
  order by $s descending
  return <article title= "{$arti-
    cle/title}"
    score= "{$s}"/>

```

iterates over all articles whose sections contain both “XML” and “retrieval”, where the `$b` variable binds the score of each such article to the score variable `$s`. These variables are used to return the titles of the articles and their scores in order of decreasing relevance.

XQuery Full-Text does not implement a specific scoring method, but it allows an implementation to proceed as it wishes. In other words, each XQuery Full-Text implementation can use a scoring method of its choice. Therefore, an appropriate implementation of XQuery Full-Text can allow ranking of results. From a user perspective, XQuery Full-Text may be viewed as far too complex, which is one of the reasons the INEX community developed NEXI, a path-based query language with less expressiveness than a clause-based query language, as its query language. A second one was to keep the construction of the test collections manageable, for instance during the assessment task (see explanation on “assessors” earlier in the entry). Nevertheless, XQuery Full-Text is needed in applications involving expert users, e.g., medical domain, patent industry, law.

REPRESENTATION STRATEGIES

To retrieve documents relevant to a query, the first task of an information retrieval system is to index all documents forming the searched collection. The indexing task aims to obtain a representation of the content of documents (i.e., what each document is about), which can then be used to score each document according to how relevant it is to a given query. Classical indexing strategies in information retrieval make use of term statistics, the most common ones being the within-document term frequency, *tf*, and the inverse document frequency, *idf*. *tf* is the number of occurrences of a term in a document and reflects how well a term captures the topic of a document; a term that occurs frequently in a document can be considered a good description of the document content (apart from common words, referred to as stop words, e.g., “the,” “every” in the English language). *idf* is the inverse number of documents in which a term appears and is used to reflect how well a term discriminates between relevant and non-relevant documents; a term that appears in all documents of the collection is not good at discriminating between the content of two documents, and hence their relevance or nonrelevance.

With these term statistics, an index is build, for instance in the form of an inverted file, which gives for

each term in the collection its *idf*, and for each document containing that term, the corresponding *tf*. Indexing algorithms for XML information retrieval require similar terms statistics, but at element level, i.e., they require so-called within-element term frequency, *etf*, and inverse element frequency, *ief*. The indexing of a collection of documents involves other steps than calculating term statistics. These include tokenization, stop word removal, stemming, etc.^[22] In XML information retrieval, the same steps are applied, and other steps such as parsing the XML format, which are not discussed in this entry. Also not discussed in this entry is that an index of the structure is build in order to record the relationships between elements.

In XML information retrieval, there are no a priori fixed retrieval units. The whole document, a part of it (e.g., one of its sections), or a part of a part (e.g., a paragraph in the section), that is, elements at all levels of granularity, all constitute potential answers to a given query. The simplest approach to allow the retrieval of elements at any level of granularity is to index all elements. Each element thus corresponds to a document, and conventional information retrieval representation techniques can be used. Term statistics (*etf* and *ief*) for each element are then calculated exactly in the same way as for *tf* and *idf* but based on the concatenation of the text of the element and that of its descendants.^[23]

This is the most common approach. It however raises an issue because of the nested nature of the units forming an XML document: the *ief* value of a term will consider both the element that contains that term and all elements that do so in virtue of being ancestors of that element. For instance, for a section element composed of two paragraph elements, the fact that a term appears in the paragraph implies that it also appears in the section. This “double” occurrence may have an adverse effect with respect to using *ief* to discriminate between relevant and nonrelevant elements.

As a consequence, alternative means have been used to calculate *ief*. For instance, *ief* has been estimated across elements of the same type^[24] or across documents.^[25] The former greatly reduces the impact of nested elements on the *ief* value of a term, but does not eliminate it if elements of the same type are nested within each other (as it is the case with the Wikipedia test collection used at INEX^[26]). The latter is the same as using inverse document frequency, which completely eliminates nested elements. Experimental results^[27] indicate that estimating *ief* across documents shows slight improvement over using elements. However, other experimental results^[28] show that better performance was obtained estimating *ief* across all elements than across elements of the same types. As of today, it is not yet clear what is the best way to estimate *ief*, whether the estimation strategy depends on the retrieval model and its artifacts used to rank elements, or whether the issue of nested elements actually matters. Further research is needed here.

An alternative to using the concatenated text in an element to estimate term statistics is to derive them through the aggregation of term statistics (both *etf* and *ief*) of the element’s own text, and those of each of its children elements.^[29,30] Aggregated-based ranking, discussed in section “Aggregation,” uses the aggregated representation of elements to rank elements.

A second alternative approach is to only index leaf elements. A leaf element is one at the bottom of the document tree structure, i.e., an element with no children elements, or an element that is considered the smallest possible unit of retrieval. This implies that term statistics will only be calculated for leaf elements, which can then be used to rank the leaf elements themselves. With such strategy, the ranking of non-leaf elements requires propagation mechanisms (discussed in section “Propagation”) that combine the score of their children elements into that of the element.^[31] Both this and the above (aggregation) strategies overcome the issue of nested elements with respect to the calculation of *ief*.

It has also been common to discard elements smaller than a given threshold (usually expressed in terms of number of words),^[23] which are often considered not meaningful retrieval units (they are too small to make much sense as results). It was however argued^[32] that although the small elements should not be returned, they might still influence the scoring of enclosing elements, so they should still be indexed, in particular when a propagation mechanism for scoring non-leaf elements is used.

A final strategy,^[25,33] referred to as selective indexing, is to only index those element types with the highest distribution of relevant elements in past relevance data. With this strategy, a separate index is built for each selected element type (e.g., for a collection of scientific articles, these types may include article, abstract, section, subsection, and paragraph). The statistics for each index are then calculated separately. Since each index is composed of terms contained in elements of the same type (and likely comparable size), more appropriate term statistics are generated. In addition, this approach greatly reduces the term statistics issue arising from nested elements, although it may not eliminate it. At retrieval time, the query is then run in parallel on each index, and the list results (one for each index) are merged to provide a single list of results, as discussed in section “Merging.”

It is not yet clear which indexing strategy is the best, as obviously which approach to follow would depend on the collection, the types of elements (i.e., the DTD), and their relationships. In addition, the choice of the indexing strategy has an effect on the ranking strategy. An interesting research would be to investigate all indexing strategies within a uniform and controllable environment to determine those leading to the best performance, across, or depending, on the ranking strategies.

RANKING STRATEGIES

Given an indexed collection of XML documents, the next task of an XML information retrieval system is to return for each submitted query, with or without structural constraints, a list of XML elements ranked in order of their estimated relevance to that query. In information retrieval, retrieval models are used to calculate what is called a retrieval score (usually a value between 0 and 1), which is then used as a basis to rank documents. Many of the retrieval models developed for unstructured text (document) retrieval have been adapted to XML information retrieval to provide such a score at element level (section “Scoring Strategies”). These scores may be used to directly generate the ranked list of elements, or as input to combination strategies required for some indexing strategies in order to rank elements at all levels of granularity (section “Combination Strategies”). For content-and-structure queries, in the context of INEX as expressed by the path-based query language NEXI (see section “Path-Based Queries”), the structural constraints must be processed to provide results that not only satisfy the content, but also the structural criteria of such queries (section “Processing Structural Constraints”). Finally, not all relevant elements should be returned as results, as they may contain overlapping content. This is because of the nested nature of XML documents, which often means that a parent and its child element may both be estimated as relevant, although to a different extent. Some processing is needed to deal with overlapping elements in result lists (section “Removing Overlaps”).

Scoring Strategies

Whatever the representation strategy, i.e., whether all elements or only a subset of them are indexed, a scoring function is used to estimate the relevance of these elements for a given query. With the propagation strategy (discussed in section “Propagation”), the scoring function is applied to leaf elements only, whereas in other cases, it is applied to all potentially retrievable elements. Scoring functions used in XML information retrieval have been based on standard information retrieval models, such as the vector space, BM25, language models, to name a few. These have been adapted to incorporate XML-specific features. As an illustration, we describe a scoring function defined upon a language modeling framework inspired by Sigurbjornsson, et al.^[23]

Given a query $q = (t_1, t_2, \dots, t_n)$ made of n terms t_i , given an element e and its corresponding element language model θ_e , the scoring function expressed by $P(e/q)$ is defined as follow:

$$P(e/q) \propto P(e)P(q|\theta_e)$$

$P(e)$ is the prior probability of relevance for element e and $P(q|\theta_e)$ is the probability of a query being generated

by the element language model θ_e , and can be calculated as:

$$P(t_1, \dots, t_n|\theta_e) = \prod_{i=1}^n \lambda P(t_i|e) + (1 - \lambda)P(t_i|C)$$

$P(t_i|e)$ is the probability of term t_i in element e , $P(t_i|C)$ is the probability of query term t_i in the collection, and λ is the smoothing parameter. $P(t_i|e)$ is the element model based on element term frequency (modeling *itf*), whereas $P(t_i|C)$ is the collection model, for example, based on inverse element frequency (modeling *ief*).

One important XML feature is the length of an element. Indeed, it was shown^[34] that considering element length is necessary in XML information retrieval to cater for the wide range in element sizes. This can be incorporated by setting the prior probability $P(e)$ as follows:

$$P(e) = \frac{\text{length}(e)}{\sum_C \text{length}(e)}$$

where $\text{length}(e)$ is the length of element e . Examples of other XML-specific features used in XML information retrieval include the path length,^[35] the type of an element (its tag),^[36] and the number of topics discussed in an element.^[37]

The size of elements forming XML documents varies greatly. For example, compare a paragraph to a section in a 10-page scientific article. There are likely to be fewer terms indexing the paragraph than the section, leading to a higher chance of a vocabulary mismatch between a paragraph (or any small elements) and a query than between a section (or any large elements) and the same query. In addition, the fact that a paragraph element does not contain all query terms, but is contained in a section element that contains all query terms, is likely to be more relevant than if contained in a section element that does not contain all query terms.

More generally, the context of an element, i.e., the parent, all or some of its ancestors, or the entire document, can provide more evidence on what an element is or is not about. To incorporate the selected context(s) in estimating relevance, the score of an element is modified to include that of its (selected) context(s). The most common technique is to use the document containing the element as context (the document is also an element, albeit a large one, and corresponds to what is being referred to as the root element). This means combining the score of the element to that of the XML document containing that element, where the element and the document retrieval scores are estimated by an XML information retrieval model. The combination can be as simple as the average of the two scores.^[38] A scaling factor can be used to emphasize the importance of one score compared to the other.^[33] This technique (using element and document

scores) has been shown to increase retrieval performance, in particular for long documents, and has been widely used in XML information retrieval.

Combination Strategies

Three of the representation strategies described in section “Representation Strategies” require combination strategies to provide a rank list of all potentially retrievable elements. These combination strategies are propagation (section “Propagation”), aggregation (section “Aggregation”), and merging (section “Merging”).

Propagation

The propagation strategy is needed with the representation strategy that only indexes leaf elements. The relevance of the leaf elements for given queries is estimated on this indexing, resulting in retrieval scores for leaf elements. The relevance of non-leaf elements is estimated through a propagation mechanism, where the retrieval score of a non-leaf element is calculated on the basis of the retrieval scores of its descendant elements. The propagation starts from the leaf elements and moves upward in the document tree structure.

The most common propagation mechanism consists of a weighted sum of retrieval scores. For instance, the number of children elements of an element has been used as a weight^[31]:

$$\text{score}(e, q) = D(m) \sum_{e_c} \text{score}(e_c, q)$$

where $\text{score}(\cdot, q)$ is the retrieval score of an element with respect to query q , e_c is a child element of e , m is the number of retrieved children elements of e , $D(m) = 0.49$ if $m = 1$ (e has only one retrieved child element), and 0.99 otherwise. The value of $D(m)$, called the decay factor, depends on the number of retrieved children elements. If e has one retrieved child then the decay factor of 0.49 means that an element with only one retrieved child will be ranked lower than its child. If e has several retrieved children, the decay factor of 0.99 means that an element with many retrieved children will be ranked higher than its children elements. Thus, a section with a single relevant paragraph would be considered less relevant than the paragraph itself, as it is simply better to return the paragraph as returning the section does not add anything more. On the other hand, a section with several retrieved paragraphs will be ranked higher than any of the paragraphs, as it will allow users to access these several paragraphs through the returned section.

This approach, known as the GPX model, has been very successful within INEX, across test collections and retrieval scenarios. Another successful approach, implemented in the XFIRM system,^[32] is to define the

weight used in the propagation based on the distance between an element and its retrieved leaf elements.

Aggregation

This combination strategy is applied when the representation of an XML element is defined as the aggregation of the representation of its own content (if any) and the representations of the content of its children elements (if any). Retrieval is then based on these aggregated representations. The representation of the element’s own content is generated using standard indexing techniques, whereas an aggregation function is used to generate the representation of the non-leaf elements. The aggregation function can include parameters (referred to as e.g., augmentation factor^[29]) specifying how the representation of an element is influenced by that of its children elements (a measure of the contribution of, for instance, a section to its embedding chapter). Aggregation is to be contrasted to propagation; in the former, the combination is applied to representations, whereas in the latter, it is applied to retrieval scores.

To illustrate aggregation, we describe an approach based on the language modeling framework inspired from Ogilvie and Callan.^[30] There, each element e is modeled by a language model θ_{own} based on its own content. Now assume that e has several children, e_j , each with their own language model θ_{e_j} . Let $P(t|\theta_{\text{own}})$ and $P(t|\theta_{e_j})$ be the probability of query term t being generated by the language models θ_{own} and θ_{e_j} , respectively. The language model, called θ_e , modeling the element e based on its own content and that of its children, is defined as a linear interpolation of language models:

$$P(t|\theta_e) = \lambda_{\text{own}} P(t|\theta_{\text{own}}) + \sum_{e_j} \lambda_j P(t|\theta_{e_j})$$

where

$$\lambda_{\text{own}} + \sum_{e_j} \lambda_j = 1$$

The λ parameters model the contribution of each language model (i.e., element) in the aggregation, here implemented as a linear combination. The ranking of the elements is then produced by estimating the probability that each element generates the query (e.g., similarly to the formulation described in section “Scoring Strategies”). The effectiveness of the aggregation, however, depends heavily on the appropriate settings of the λ parameters, whose values are usually estimated through learning methods.

Merging

The last combination strategy is that of merging, which is needed when a selective indexing strategy is used. With

this indexing strategy, a separate index is created for each selected type of elements (e.g., article, abstract, section, paragraph, etc.). A query submitted to the XML information retrieval system is run against each index separately, resulting in separate ranked lists of e.g., article elements, section elements, paragraph elements, etc. These lists need to be merged to provide a single ranking, across all element types.

In Mass and Mandelbrod,^[33] the vector space model is used to rank elements in each index. Let e be an element and q a query. The following scoring function is used:

$$\text{score}(e, q) = \frac{\sum_{t \in q} w(t, q) \times w(t, e) \times \text{ief}(t)}{||q|| \times ||e||}$$

where $w(\dots)$ is the term weight based on within-element (etf)/query term frequency, and $\text{ief}(\dots)$ is the inverse element frequency. To merge the lists, normalization is performed to take into account the variation in size of the elements in the different indices (e.g., paragraph index vs. article index). For each result list, the element scores are normalized with $\text{score}(q, q)$, which corresponds to the score of the query as if it was an element in the collection run against the corresponding index. This ensures that scores across indices are comparable. The lists are then merged based on the normalized scores.

Processing Structural Constraints

We described so far approaches that were developed and evaluated during the INEX campaigns to rank elements given the content condition of a query. Given a query consisting of terms, these approaches deliver a list of elements ranked according to how they have been estimated relevant to that query. As discussed in section “Query Languages,” content-and-structure query languages have been developed to allow users to specify structural constraints, e.g., “give me a section in an article about XML technology that also discusses in one of its section book search.”

Within INEX, structural constraints are viewed as hints as to where to look to find relevant information. The reasons for this view are twofold. First, it is well-known that users of information retrieval systems do not always, or simply cannot, properly express the content criterion (i.e., select the most useful query terms) of their information need. It is very likely that this also holds for the structural criterion of the information need. For instance, a user asking for paragraph components on “XML retrieval evaluation measures” may not have realized that relevant content for this query is scattered across several paragraphs, all of them contained within a single section. For that user, it may make more sense to return the whole section instead of individual paragraphs. Second—and to some extent as a consequence of the first reason above—there

is a strong belief in the XML information retrieval community that satisfying the content criterion is, in general, more important than satisfying the structural criterion. For instance, even if a user is looking for section components on a particular topic, returning to that user abstract components would still be satisfactory, as long as the content criterion is satisfied.

Two main approaches have been developed to process structural constraints in XML information retrieval following this so-called vague interpretation of the structural constraints in content-and-structure queries. A first approach is to build a dictionary of equivalent synonyms. If, for example, $\langle p \rangle$ corresponds to paragraph type and $\langle p1 \rangle$ corresponds to the first paragraph in a sequence of paragraphs, it would be quite logical to consider $\langle p \rangle$ and $\langle p1 \rangle$ as equivalent tags.^[39,40] The dictionary can also be built from analyzing past relevance data.^[41] If in such a data set, for example, a query asked for $\langle \text{section} \rangle$ elements, then all types of elements assessed relevant for that query can be considered equivalent to the $\langle \text{section} \rangle$ tag. Thus with this approach, if the structural constraint refers to, e.g., $\langle \text{section} \rangle$, then any element that is of type considered equivalent to $\langle \text{section} \rangle$, will satisfy that structural constraint.

A second technique is that of structure boosting. There, the retrieval score of an element is generated ignoring the structural constraint of the query, but is then boosted according to how the structural constraint is satisfied by the element. The element structure and the query structure are compared and a structure score is generated. This structure score can be based on comparing the paths,^[21,24] and/or the tags in the paths.^[42] An important issue here is to determine the appropriate level of boosting, i.e., how much the initial content-based score should be boosted by the structure score.

The above techniques and their variants are mostly used to determine the relevance of an element according to the content condition and tag-based like structural constraints, e.g., “retrieve sections about XML retrieval.” For more complex structural constraints, as allowed by a path-based language such as NEXI, e.g., “retrieve paragraphs about ranking algorithms contained in sections about XML retrieval,” a first step is usually applied, which is to divide the query into two tag-based like subqueries, e.g., “retrieve paragraphs about ranking algorithms” and “retrieve sections about XML retrieval.” Each subquery is then processed according to its content condition, and its tag-based like structural condition as described in the previous two paragraphs. Each subquery results in a ranked list of elements. To generate a ranked list for the whole query, the two ranked lists are compared, e.g., only elements returned for the “paragraph” subquery whose ancestors are contained among the elements returned for the “section” subquery are then retrieved. The final score depends on the implementation of the contain operation, e.g., a simple set containment, or using fuzzy operators.^[43]

Techniques for processing structural constraints were evaluated in the context of INEX, where the relevance of an element was assessed based on content only. In other words, there was no assessment of whether, for instance, a section element was a better element type to return than another element type (if both were relevant according to their content). Also, considering the structural constraints did not usually increase retrieval performance, apart maybe at very early ranks.^[44] This result may however be due to the evaluation methodology. More research is needed regarding the usefulness and the impact of structural constraints for XML information retrieval.

Removing Overlaps

We recall that the aim of an XML information retrieval system is to return the most relevant elements for a given query. Because of the nested structure of XML documents, when an element has been estimated relevant to a given query (by any of the XML ranking strategies presented in this entry), it is likely that its ancestors will also be estimated as relevant, although likely to a different extent. This is because the same text fragment can be contained in several elements along a same path (e.g., a paragraph, its enclosing subsection, the enclosing section, etc). Thus the element itself, its ancestors, and a number of its descendants may be contained in the result list, eventually leading to a considerable amount of redundant information being returned to users, which may not be acceptable to them.^[45]

The outcome of any of the ranking strategies described so far in section “Ranking Strategies” is a list of elements ranked according to their estimated relevance to a given query, without looking at the overlap issue. XML information retrieval systems may have to decide which elements should be returned from a list of relevant but overlapping elements. Several approaches have been proposed to generate overlap-free result lists. Their starting point usually consists of the list of elements returned as results to a query, which they then process.

The most common approach, referred to as brute-force filtering, selects the highest ranked element from the result list and removes any ancestor and descendent elements from lower ranks. The process is applied recursively. This approach relies on the provision of ranking strategies that rank, among overlapping elements, those that should be selected at higher ranks. However, the ranking may not be appropriate for the purpose of returning the list of the most relevant non-overlapping results. This has led to a number of alternative approaches, where the tree structure of the XML documents has been considered to decide which elements to remove from a list of overlapping results.

In the first such approach,^[41] a notion of the usefulness of an element is introduced to decide which elements to

remove. Usefulness is modeled through a utility function defined upon the retrieval score of an element, its size, and the amount of irrelevant information contained in its children elements (implemented as the “amount” of text contained in the non-retrieved children elements). An element with an estimated utility value higher than the sum of the utility values of its children is selected and its children are removed. Otherwise, the children elements whose utility values exceed some set threshold are selected and the element is removed.

An alternative approach^[46] looks at the distribution of retrieved elements in the XML document’s tree structure, in addition to their score, to select the elements to retain. For instance, an element that has many of its descendants retrieved, but which are evenly distributed in the corresponding subtree structure, and in addition has a similar score to the parent element, is selected. This is because already from that selected element, all its descendants, many of which are being estimated as relevant, can be accessed. Otherwise, its descendants are selected to be themselves further processed.

A third approach^[47] calculates a new score for each element on the basis of the retrieval scores of its (if any) descendent elements. This is done through a bottom-up propagation mechanism, using for instance the maximum or average operation to recalculate the scores. These scores are used to generate a new ranked list, which is then filtered by selecting the highest ranked elements, and then removing either all ancestors or all descendants of that selected element from the list (e.g., brute-force filtering). The best performances were obtained using the maximum function and removing the descendants.

Techniques that explicitly considered the document logical (tree) structure to remove overlaps usually outperformed those that did not. There is, however, the issue of speed, as the removal of overlaps is done at query time, thus requiring efficient implementations. An interesting question would be to investigate the effect of the original result list (how good it is, and how we define “goodness”) on the overlap removal strategy. There are indications that a good initial result list, where good depends on the definition of relevance in the context of XML information retrieval, leads to better overlap-free result list than a less good one.^[48]

DISCUSSION

XML information retrieval research is related to work on structured document retrieval. The term “structured document retrieval,” which was introduced by the information retrieval community, refers to “passage retrieval” and “structured text retrieval.” In passage retrieval, documents are first decomposed into passages (e.g., fixed-size text-windows of words,^[49] fixed discourses such as paragraphs,^[4] or topic segments through the application of a

topic segmentation algorithm^[50]). Passages are then retrieved as answers to a query (and have also been used to rank documents as answers to the query). Since 2007, INEX has a passage retrieval task.^[51]

Structured text retrieval is concerned with the development of models for querying and retrieving from structured text,^[52] where the structure is usually encoded with the use of mark-up languages, such as SGML, and now predominantly XML. Examples of pre-XML/NEX approaches include.^[1,3,53] Most of the early structured text retrieval models, however, do not return a ranked list of results. Approaches that were specifically developed for XML retrieval, but still pre-INEX include.^[54–57] A survey on indexing and searching XML retrieval is from Luk, et al.,^[58] and two workshops on XML retrieval held at the SIGIR (<http://www.sigir.org/>) conference were reported.^[5,7] A recent overview on XML retrieval research is from Amer-Yahia and Lalmas.^[59]

Research on XML retrieval significantly flourished since the set-up of INEX, as the latter allowed the evaluation and comparison of XML information retrieval approaches. Nowadays, XML retrieval is almost a synonym for structured document retrieval, or structured text retrieval. In this entry, we described many of the strategies used for representing and ranking XML elements, which were experimented on the INEX test collections. We also described query languages that were developed to access XML documents with respect to both content and structural conditions.

It is not yet possible to state which approaches, whether for querying, representing, or ranking, or their combination, work best, since many factors are involved when deciding how relevant an element is to a given query (e.g., the size of an element, the type of element, the relevance of structurally related elements, the interpretation of the structural constraint, etc.). Indeed, XML information retrieval can be regarded as a combination problem, where the challenge is to decide which evidence to combine and how to combine it for effective retrieval. We can however postulate that considering the context of the element, the size of the element, and the element's own content (directly or using a propagation or aggregation strategy) to estimate that element relevance to a given query has been shown to be beneficial for XML information retrieval. An open research question is the processing of structural constraints, as so far, only limited improvement in retrieval performance has been observed with structure-and-content queries.

The querying, representation, and ranking strategies described in this entry have been developed with the purpose of estimating the relevance of an element for a given query, which is only one retrieval scenario. This may not necessarily be the end task in XML information retrieval. Returning overlap-free results is another retrieval scenario, one where users do not want redundant information (approaches developed for this purpose were described in

section “Removing Overlaps”). Another retrieval scenario investigated at INEX is the relevant in context task.^[60] This task is concerned with returning the most relevant documents for a given query, and within each document, identifying the most relevant elements. Such a retrieval scenario was identified as important, if not expected, in a user study carried out within a software company regarding the benefit of focused retrieval.^[61]

In the relevant in context task, elements from the same documents are grouped together. A system could also create so-called “fictitious” documents, i.e., new documents made from some intelligent aggregation of elements coming from different documents, which is another retrieval scenario, currently receiving increasing attention in information retrieval research.^[62] XQuery Full-Text would be an appropriate language for this task, as it allows the specification of new XML fragments to return as results.

Another retrieval scenario, also investigated at INEX, is the best in context task.^[60] There, the aim is to identify the one and only best entry point in a document, i.e., the XML element, from where one could start reading relevant content. Such a retrieval scenario makes sense with a collection of relatively medium size documents (e.g., Wikipedia documents used at INEX since 2006^[26]).

Although not discussed in this entry, two important issues in XML information retrieval are interface and interaction. Appropriate interfaces are needed to cater for the richer and likely more complex interaction between users and XML information retrieval systems, for example, with respect to expressing content-and-structure queries.^[63] Since 2004, INEX runs an interactive track (iTrack) that looked at interaction issues in XML information retrieval.^[64] One outcome of iTrack is that users did not like being returned (at least too much) redundant information (overlapping results). This led to the development of algorithms specifically dedicated to remove or reduce overlaps (see section “Removing Overlaps”). A second outcome was that users expected to have not only access to relevant elements, but also the context of these elements (e.g., the document containing, or the parent element of, a retrieved element). This led to the proposal of a table of a content shown in conjunction to the element being accessed^[65] or the use of heatmap highlighting relevant elements within a retrieved document.^[66]

Information retrieval approaches developed for querying, representing, or ranking are relevant to applications concerned with the effective access to repositories of documents annotated in XML, or similar mark-up languages. XML retrieval is becoming increasingly important in all areas of information retrieval, and in particular in the area of so-called focused retrieval.^[67] Current applications of XML information retrieval technologies already exist.^[68] An example is that of book search,^[69] which is a research track being investigated at INEX since 2007.^[70]

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Young Adult Library Services Association (YALSA)

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Abstract

As part of the continuum of total library service of the American Library Association, the Young Adult Library Services Association (YALSA) is a specific division which mission is to advocate, promote, and strengthen service to young adults ages 12 through 18. The Young Adult Library Services Association celebrated its 50th anniversary in 2007 with, still, a high energy that has drawn to it a wide variety of members: librarians, youth advocates, and publishers. These members participate through the division's many committees and other activities such as publishing, special initiatives, and continuing education activities. The five decades of its existence have been marked by profound alterations in attitudes toward young people in new kinds of media and technology as well as in changes in society. The division continues to note these changes and adds and subtracts where needed. It is a division proud of its abilities not only to keep up but to lead.

INTRODUCTION

As part of the continuum of and commitment to total library service by the American Library Association (ALA), the Young Adult Services Association (YALSA) is a specific division which mission is to advocate, promote, and strengthen service to young adults, ages 12 through 18. The Young Adult Library Services Association celebrated 50 years of dynamism and creativity in 2007. It is now the fourth largest division of the many ALA divisions and its membership is now more than 5600—librarians (both school and public), youth advocates, publishers, and library students. These members have opportunities to participate at all levels of YALSA activities through the division's many committees and other activities such as publishing, special initiatives, continuing education activities, and literary awards. The 50 years of YALSA's existence have been marked by profound alterations in societal attitudes toward young people as well as enormous and ever-changing technological and media advancement. The division notes these changes and adds and subtracts where needed. It is a division proud of its abilities not only to keep up but to lead.

OVERVIEW

In 1957, the Association of Young People's Librarians, which had been established in 1941, split into two divisions: Children's Library Association (CLA) and the Young Adult Services Division (YASD). Mildred Batchelder served as the first Executive Secretary of both divisions. One of the first acts of the two divisions was to defeat a proposal by ALA to absorb "Top of the News,"

the CLA/YASD publication, into its own "Bulletin." In 1961, when the American Association of School Librarians (AASL) was given the right to evaluate, select, and interpret materials for school use, YASD issued a function statement to clarify its role:

The Young Adult Services Division is interested in the improvement and extension of services to young people in all types of libraries. YASD has a specific responsibility for the evaluation and selection of books and non-book materials and the interpretation and use of materials for young adults, except when such materials are designated for only one type of library.

In the 1950s, although the assignment of YASD committees to other divisions often occurred, the new YASD division became increasingly visible within ALA. The Young Adult Services Divisions' annual lists of recommended books were produced and reprinted in ALA publications such as "Booklist" and "Top of the News." When the National Education Association asked YASD to create a book list to serve college-bound students, a committee to fulfill the request was formed and the "Outstanding Books for the College Bound" was born. This list has gone through several revisions and is issued approximately every 5 years. The revisions reflect changing users, social climate, and add new titles and subtract titles no longer valid. In the 1950s, another popular publication was "Bookbait" edited by Elinor Walker.

In the 1960s, the division became more visible to the world outside the library world. In 1964, after a successful conference between publishers and librarians, the Publishers' Liaison committee was formed and first preconference was held in New York City called *Two Blocks Apart*. The preconference addressed the needs of

disadvantaged youth. In 1966, the first attempt to provide guidelines for public library service to young people was published. A Television Committee was also established in the 1960s which created related book lists on request such as NBC's "Teachers' Guide to Television." During National Library Week, in 1968, over 40,000 copies of the book list "Happenings" was distributed published by the Free Library of Philadelphia. At the 1967 Annual conference in San Francisco, YASD sponsored a preconference called *Intellectual Freedom and the Teenager* in conjunction with the Intellectual Freedom Committee of ALA. Another example of outreach to libraries was the availability of attractive and informative slide series showing new approaches to young adult services available on loan to state libraries. The White House Conference on Youth in 1960 included a delegate from YASD, and "Youth in a Changing World" was published and distributed.

In the late 1960s, the ALA Committee on Organization asked the divisions to reexamine goals and activities. Although YASD conducted a membership survey, response was minimal and very little change ensued. They dissolved three committees and formed an Organization Committee to deal with further changes.

The most active committee during this time was the Book Selection Committee that, after several name changes, became the prestigious Best Books for Young Adults committee. The Peace Corps subcommittee prepared special paperback book lists, programs and exhibits, and the Dial-a-Book project at the 1964 World's Fair proved highly successful by promoting one-minute book reviews for young people.

In the volatile 1970s, an invigorated YASD emerged because of a new dues structure by ALA (which had previously given two free division memberships included in an annual membership). The new dues structure allowed the divisions the freedom to operate on an independent basis. In 1975, Evelyn Shaevel, who had been serving only four-fifths time as YASD Executive Secretary, became a full-time staff member. The social changes the country was undergoing were reflected in book lists such as the "Now Scene," one of several new additions to the latest revision of "Outstanding Books for the College Bound." In an effort to add multiculturalism to its list of recommended books, "Richer by Asia" was produced which was funded by the Asia Foundation, and then, with its own expertise, YASD published "African Encounter."

Recognizing the enormous impact of media on young people, a preconference in Dallas in 1971 focused on audio/visual materials, equipment and methods of integrating them into more traditional services. A pamphlet titled "Mixed-Means Programming with Young Adults" was a product of this preconference. The new AV Committee published "Film Profiles for Youth" which emphasized the interest in other media besides books shown by librarians and teenagers. The first cover drawn by teens was featured on the 1974 "Best Books for Young Adults"

list. Also, during that year, an official liaison from YASD was appointed to the Freedom to Read Foundation, and the Publishers' Liaison Committee gathered a list of young adult review sources and sent speakers to regional conventions to talk about young adult books. For the first time, *Top of the News* was available on subscription basis.

Also, in 1974, the Survival Kit Committee produced a list of helpful resources for establishing, promoting, and maintaining young adult services at the local level. In 1975, the Media Selection and Usage Committee established guidelines to create the first annual "Selected Films for Young Adults" list of recommended films. In 1977, the publication "Directions for Library Service to Young Adults" provided guidelines for library service to young adults.

Notable events of the 1970s included the publication of "Look, Listen, Explain: Developing Community Library Services for Young Adults." In 1975, "Book You" was the fourth preconference sponsored by YASD. Participants discussed the titles on the "Best Books for Young Adults" lists of the past 15 years and from them selected the "Best of the Best: Still Alive in '75." This was the beginning of a series of "Best of the Best" preconferences. In 1979, ALA Bylaws were amended to include the election of a representative from YASD to ALA Council.

Even though YASD members voted for a dues increase in 1983, which enabled YASD to establish specific reachable goals and objectives with appropriate strategies to achieve them, YASD did not become self-supporting. Efforts to increase membership continued, however. In 1986, 150 new members were registered after a direct mailing to school librarians publicizing a resolution passed in response to the Department of Education report "A Nation at Risk." The resolution emphasized the roles that librarians working in schools and public libraries play in the personal and educational growth of young adults. Because of scarce financial resources, YASD agreed to participate in an innovative shared staffing arrangement with the Association of Specialized and Cooperative Library Agencies.

To adequately reflect the concerns and interests of the membership, *Top of the News* (TON) was renamed *Journal of Youth Services in Libraries* (JOYS), and, in 1988, the joint boards of the Association for Library Service to children (ALSC) and YASD made JOYS a refereed journal to increase research-related articles and submissions from academia and other scholars.

By the end of the 1980s, YASD's mission statement: "to advocate, promote and strengthen service to young adults as part of the continuum of total library service" was still in use. The division formed new committees to fulfill that mission. They included Intellectual Freedom, Legislation, Selected Films and Videos for Young Adults, Education, Organization and Bylaws, Program Planning Clearinghouse and Evaluation, Recommended Books for the Reluctant Young Adult Reader, Public Relations, Publications, Library Service to Young Adults with Special

Needs, Executive, Budget and Finance, Baker & Taylor/YASD Conference Grant, Computer Applications, Long-Range Planning, Local Arrangements, Youth Participation, Division Promotion, *School Library Journal* (SLJ)/YASD Author Achievement Award (Margaret A. Edwards Award), and Membership Recruitment. These new committees, besides fulfilling needs and goals of the division, offered increased opportunities for membership input and participation.

Reacting to the membership's desire to see genre book lists compiled to appeal to the young adults they served, in 1988 five genre committees were established: Horror, Mystery, Romance, Sports, and Science Fiction. Publication of these lists, for distribution to libraries and other venues, was expedited by the ALA Public Information Office and was partially funded by Baker & Taylor. In 1989, two more committees and subsequent lists were created: Fantasy and Humor. These lists were followed in 1991 by the Historical Fiction list.

Lists of publications produced from the 1980s through the 1990s attest to the vitality and active participation of a membership eager to provide the highest quality guidelines and reader's advisory services to young adults and the librarians that serve them. The publications include:

- 1981—"Young Adults Deserve the Best: Competencies for Librarians Serving Youth."
- 1981—"Cheap CE: Providing Continuing Education with Limited Resources: A Resource Guide."
- 1983—"Youth Participation in Libraries: A Training Manual."
- 1989—"Teen Pregnancy Crisis: Libraries Can Help."

In 1982, grants were established and supported by a variety of funders. The Frances Henne/YASD/VOYA Research Grant of \$500 encouraged the research activities of YASD members. In 2009, this grant was increased to \$1000. The Baker & Taylor Conference Grant enabled two librarians working with young adults (one in a school library and one in a public library) to attend their first ALA conference. In 1991, this grant was increased to \$1000. The Econo-Clad Award (now the Sagebrush Corporation Award) for a Young Adult Reading or Literature Program for \$1000 enabled the winner to attend an upcoming ALA conference. It was first awarded in 1990. Another award was established in 1994 by the Book Wholesalers, Inc. A Collection Grant of \$1000 is given to two librarians to assist them in the development of the collection of resources for young adults in their library.

In 1985, the National Endowment for the Humanities (NEH) awarded the division a grant entitled "Courtly Love in the Shopping Mall" to present four regional workshops to train librarians working with young adults to design and implement humanities programs. In addition, a preconference based on the grant gave participants excellent ways to start such programs in their own

libraries. The Young Adult Services Division received a supplemental grant from the NEH to support an additional two regional workshops.

In 1986, the Allerton Institute focused on library service to young adults. This conference, although sponsored by the University of Illinois, was partially funded by an ALA/World Book Goal award and was titled "Missionaries and Managers: Library Services to Children and Young Adults in the Information Age." The goal of the conference was to assess the current status of library service to young adults and update goals and strategies for meeting the future information needs of youth. That same year the U.S. Department of Education worked with YASD to survey the accessibility of resources and services for young adults in public libraries and resulted in the first edition of "Services and Resources for Children and Young Adults in Public Libraries." The second edition was published in 1995.

In 1988, in collaboration with the Library Administration and Management Association and the ALSC, YASD developed a regional workshop, "Managing Youth Services," which was offered to library systems as a continuing education opportunity. The two presenters for each workshop were Mary Somerville and Vivian Wynn. This workshop was discontinued in 1991.

A new award was developed that would honor an author for lifetime achievement in writing that had lasting appeal to young adults. *School Library Journal* agreed to sponsor the award on a biannual basis beginning in 1988. The first winner was S. E. Hinton for *The Outsiders*. The award brunch was so well received that the YASD Board of Directors decided to make it an annual event. The award was originally called "The SLJ/YASD Author Achievement Award" but was changed to the "Margaret A. Edwards Award" in 1991 in honor of Margaret Alexander Edwards, a young adult specialist at the Enoch Pratt Library in Baltimore, Maryland, for many years and the author of the young adults services classic, *The Fair Garden and the Swarm of Beasts*. Information about the award and past winners can be found at <http://www.ala.org/yalsa/edwards>.

In 1989, the Board of Directors and the YASD Legislation Committee worked on the White House Conference on Library and Information Services II (WHCLIS) developing information packets. The Legislation Committee assisted in writing the paper "Kids Need Libraries: School and Public Libraries Preparing the Young of Today for the World of Tomorrow." This provided the conference delegates with a framework for discussion of issues relating to the improvement of library services for young people in this country. The Young Adult Services Division members and members of other youth divisions as well as other advocates lobbied intensively for the Omnibus Youth Literacy through Libraries Bill as the number one priority from WHCLIS II. When Evelyn Shaevel left YASD to take another position in ALA, the Board of Directors

decided to share staffing with the AASL. Ann Carson Weeks was Executive when Susan Horiuchi resigned, Linda Waddle, a former board member, became Deputy Executive Director of YASD. Also, in 1991, the chairs of the Organization and Bylaws Committee and the Budget and Finance Committee became ex officio members of the Board of Directors. The Board of Directors adopted a proposal that the age definition for “young adults” for the purposes of research was ages 12 through 18. Student dues were also approved. In 1992, after several years of study, the YASD changed its name to the Young Adult Library Services Association, and the new name and its euphonious acronym, YALSA, led to increased recognition within and without the library community; its new identity, image, and name brought a dynamic liveliness to decades of tradition.

From 1994 until 2001, activities, publications, and programs proliferated. Presidents of the division identified themes for their terms of service and presented popular programs based on those themes. A new strategic plan was developed and reflected commitments to three areas: advocacy, coalition-building, and equity of access. The Board of Directors provided impetus and leadership to produce a remarkable array of accomplishments as a single entity and in partnership with other ALA divisions such as ALSC and AASL. New book lists were introduced and updated when needed. A speaker and consultant resource directory was created and, also, updated when needed.

During this period, coalitions with other organizations and divisions further integrated YALSA's work into the larger community of youth service. The Board of directors recommended collaboration with Friends of the Library, U.S.A. to develop a database of teen library groups that became the National Youth Participation Database. The Young Adult Library Services Association connected with other young adult advocacy groups through the National Organizations Serving Young Adults Liaison Committee. With other national entities and divisions, YALSA cosponsored events at the Midwinter and Annual meetings and served as consultants to organizations studying youth issues.

Two events marked the 1990s as a period of innovation and energy—Teen Read Week and the Great Books Giveaway, both of which continue to present day. Begun in 1998 as an initiative in collaboration with the ALA Public Information Office and ALA Graphics, Teen Read Week grew exponentially. The overall theme continues to be “Read for the Fun of It,” and by its 4th year over 1400 schools, public libraries, and book stores participated. At present, it has more than 5,000 registrants and is sponsored and promoted by sponsors such as Mirrorstone Books, which has given large donations, and various publishers. In addition, World Wrestling Entertainment sponsors the WrestleMania Reading challenge project which challenges teen readers to read one book a week for the ten

weeks following Teen Read Week, with the chance to win a trip to WrestleMania. In addition, World Wrestling Entertainment Teen Tech Week, which encourages teens to use nonprint resources at the library, has joined these special events, and various publishers. The Great Book, Giveaway Competition, another creative project begun in the 1990s continues generating visibility for YALSA and much excitement among participating libraries. Libraries that apply are asked to describe their young adult program highlights and needs. They must also have a Board-approved selection or collection development policy. The latest recipient 2009 was the Lincoln County Public Libraries in Libby, Mont. which received a “ton” of books—a huge collection of materials such as children's, adult and young adult books, videos, CDs and audiocassettes, DVDs, etc. that publishers and producers submitted to YALSA for review by the division awards and selection committees, materials estimated to be worth thousands of dollars. The YALSA office received so many materials that a second and third prize was given out in 2009. An emphasis on teen participation, so much a mark of the 1980s and 1990s led to the first-time development of teen-oriented products in collaboration with ALA Graphics. Such items as temporary tattoos, posters, bookmarks and water bottles promoted Teen Read Week, and other events. These products and other YALSA services were promoted via the Internet through the ALA Web site.

Publications proliferated through the 1990s and the 2000s with a variety of revised editions as well as new ones. The Young Adult Library Services Association now produces its own quarterly journal (*YALS*), a quarterly email newsletter (*YAttitudes*) and at least two books a year. In 2008 and 2009, YALSA published *The Official YALSA Awards Guidebook*, edited by Tina Frolund; *Excellence in Library Services to Young Adults*, Fifth Edition, edited by Amy Alessio; *Quick and Popular Reads for Teens*, edited by Pam Spencer Holley; and *Cool Teen Programs for under \$100*, edited by Jenine Lillian.

For the first time since 1981, *Young Adults Deserve the Best: Competencies for Librarians Serving Young Adults* was revised and, in Past President of YALSA Michael Cart's words, aided in “redefining the profession for the 21st century.” Book lists selected by a variety of YALSA committees continued to be revised and distributed. Long-lived annual lists such as *Best Books for Young Adults* and *Quick Picks* were joined by *Popular Paperbacks for Young Adults*, *The Alex Awards*, *Amazing Audiobooks for Young Adults*, *Fabulous Films for Young Adults*, and *Great Graphic Novels for Teens*. Books were made from these lists, including *Best Books for Young Adults* by Holly Koelling, and *Outstanding Books for the College Bound* edited by Marjorie Lewis.

Reading lists to complement the HBO six-program series “Life stories: Families in Crisis” were prepared. *Directions for Library Service to Young Adults* was revised as was *The Fair Garden and the Swarm of Beasts*,

the classic by Margaret A. Edwards. Other publications were *Youth Participation in School and Public Libraries: It Works*, *Hit List: Frequently Challenged Books for Young Adults* and *Excellence in Library Service to Young Adults*. In the works are Annotated Booklists for Every Teen Reader, Multicultural Programs for Teens and Tweens, Risky Business, and Young Adults Deserve the Best.

In 2007, YALSA won an ALA World Book Goal Award to produce the program “Teens Need Libraries.”

In the 1990s, 10,000 generalists and other staff members were trained in order to provide exemplary library service to young adults. The Excellence in Library Service to Young Adults project, begun in 1993, became a triennial event with grants to school and public libraries and a publication highlighting the winning entries. The Young Adult Library Services Association also participated in the ALA conference on Professional Education. Two annual awards were instituted honoring young adult literature the Edwards Award named for Margaret Alexander Edwards is given to an author whose writing for young adults exemplifies the highest quality books for young adults, and the Printz Award for Excellence given to an author whose young adult book is considered to be of outstanding literary quality each year. Other YALSA awards are the Alex Awards for adult books with teen appeal, the Morris Award for debut authors, the Odyssey Award for best audiobook production (co-administered with ALSC), and beginning in 2010, a nonfiction award. These awards have brought increased recognition to those who work with and those who write for ages 12 through 18.

New committees, offering membership greater opportunities to participate in division business were formed and committees that outlived their usefulness were sunsetted during the 1990s. Sunsetted were the Public Relations Committee, eight genre committees, the Econoclad Award Committee, the Baker & Taylor Conference Grant Committee and the Book Wholesalers Award Committee. The grant committees were made the responsibility of some other standing committees. Renamed and Reorganized committees included computer applications which became Technology for Young Adults, Long-Range Planning became Strategic Planning, and Membership was combined with Division Promotion to become Division and Membership Promotion. Recommended Books for Reluctant Young Adult Readers became Quick Picks for Reluctant Young Adult Readers and Selected Films and Videos for Young Adults became Selected Videos for Young Adults — which then became Fabulous Films for Young Adults. New committees included Popular Paperbacks for Young Adults and new award selection committees.

In 1993, *JOYS* benefitted from a new attractive format and a change in editorship. By including speeches from ALSC and YALSA programs, such as those given by

award winners and increasing the pool of referees from 33 to 50, the publication better informed membership about division news and views.

By 2007, seven book and media lists were published: the ever-popular *Best Books for Young Adults (new edition)*, *Great Graphic Novels for Teens*, *Popular Paperbacks for Young Adults*, *Quick Picks for Reluctant Young Adult Readers*, *Amazing Audiobooks for Young Adults*, and *Selected DVDs and Videos*—newly named *Fabulous Films for Young Adults*.

The Young Adult Library Services Association now celebrates Support Teen Literature Day during National Library Week. Beginning in 2008, YALSA will host a Young Adult Literature Symposium every other years partially funded by the Morris endowment. Keeping up with new innovations, YALSA has a blog and a wiki, is known for its electronic discussion lists within ALA and has a distinctive presence on Face book as well as other social networking sites. The Young Adult Library Services Association is considered a leader in advocating safe use of the Internet.

The enormous growth of Internet users throughout the 1990s gave YALSA the opportunity to reach a wider audience of teens and librarians as well as educators and publishers. The Young Adult Library Services Association has had a Web site since 1992 at <http://www.ala.org/yalsa> which includes information about the division, projects in the works, mission and vision statements, publications, and graphics. In 2000, YALSA created the first ALA members-only Web site.

The increasing importance of technology in the 1990s to young adult patrons was recognized by the development of the popular Web site “Teen Hoopla,” and its hits produced book reviews, discussions of issues and numerous links to other sites of interest to young adults. After criticism of “Teen Hoopla’s” link with Columbia University’s Web site “Go Ask Alice,” YALSA united with ALA’s public information office, and other ALA units to defend its action.

In 1996, mission and vision statements were composed to serve as guides for YALSA’s activities, goals and priorities; the vision statement, in fact, served as a model for other ALA divisions. These statements together were the basis for a strategic plan adopted by YALSA’s Board of Directors in June 1997. The plan’s key concepts of advocacy, coalition and equity of access became YALSA’s guiding principles directing the division’s plan of action for the next 4 years until 2000 when, inspired by ALAction 2005, a new strategic plan was adopted with six key action areas:

- Action
- Coalitions
- Twenty-first century literacy
- Diversity
- Equity of Access

In its strategic plan, YALSA mapped out its mission, vision, and specific strategies for action. The plan took a look at strengths and weaknesses of the division. Among its strengths, it acknowledged the high level of member participation, the diversity of its leadership and its openness to change and experimentation. Among its weaknesses it listed its aging membership, lack of research into the effectiveness of its book lists, too small a staff and lack of sufficient revenue. In describing environmental opportunities, the report mentioned the changing face of ethnic United States, a great growth in the number of high school students by 2009, a gradual banding together of services to young people and the value of the Internet for global involvement. In looking at environmental challenges, it recognized that young adult services suffer from low visibility, the unwillingness of school libraries to coordinate efforts and the lack of enough librarians to serve young adults at a time when such librarians' special training is increasingly important.

In 2001, *JOYS* stopped publication when *Young Adult Library Services*, a quarterly publication, was launched. In 2002, *YALS* began. In 2003, standards for serving teens in

libraries were published. The 2000s also saw a YALSA mentoring program which paired experienced librarians with new young adult specialists.^[1]

The Young Adult Library Services Association's momentum continues to rise — its 50th year sees an increased passion to serve young adults! That energy and dynamism exemplifies the resurgence of interest in teens, adolescent literacy and the importance of library service to those teens, one of the fastest-growing segments of the population. It gives training and guidance to librarians who serve young adults and has become a widely respected knowledgeable partner to other organizations and agencies who work with young adults. The division offers the members enormous opportunities to hone their leadership skills so that they can become leaders in their libraries and in the larger library world.

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Young Adult Services in Libraries

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Abstract

Highlighting the major components of young adult services, this entry discusses adolescent development, staff, collections, group programs, space, and major issues impacting the service such as censorship, mass assignments, parents doing homework, and technology.

INTRODUCTION

“Young adult (YA) services” is the term used to describe a variety of library services tailored to the adolescent clientele, primarily those young people in middle, junior high, and high school, or between the ages of 12 and 18, regardless of setting, although the term is most commonly used to describe public library services.^[1] While library attention to adolescents actually dates from Caleb Bingham’s gift of books to the Bingham Youth Library in Salisbury, Connecticut in 1803, a cohesive service perspective only began when Anne Carroll Moore, fearing that all her good work in the children’s rooms of the New York Public Library (NYPL) was not continued in the adult departments there once children graduated from eighth grade, hired Mabel Williams to work with the high school clientele in NYPL’s Office of Work with Young People. Secondary schooling was not mandatory then, but as more high schools were established, Moore saw them as a way to continue personalized service to young people through outreach and collaborative activities.^[2,3]

Since YA services grew out of children’s services at a time when books and reading were the predominant recorded means of learning and understanding the world, reading and reading promotion traditionally remain a large part of what the service is about. This continued emphasis can be seen both in the array of committees and in the activities surrounding Teen Read Week in the American Library Association’s (ALA) Young Adult Library Services Association (YALSA) devoted to identifying and promoting books of interest to, or worthy of acclaim for adolescents, in various categories.^[4] In Moore’s time, there were no juvenile publishers involved in producing books specifically for adolescents, and YA services librarians spent their time identifying adult books of particular interest to teen readers. Since then, changes in publishing and in the formats available for library collections, as well as the growth and influence of mass media and the Internet on

the YA audience, have extended the nature of what is included in library collections purchased for young adults.

The public library bias of young adult services not only stems from the fact that many of the pioneers in this service, such as Mabel Williams and Margaret Scoggin of the New York Public Library, Margaret Alexander Edwards of the Enoch Pratt Free Library in Baltimore, and Jean Roos of the Cleveland Public Library, were all public librarians, but also because tax-supported public libraries predate tax-supported school libraries historically in the United States.^[5] The service also predates the ascendancy of the reference/information paradigm within the profession at large, with Edwards in particular being emphatic about library services doing more for adolescents than helping them in the mindless pursuit of facts, which is how she viewed reference services, a view largely discounted or ignored by contemporary YA practitioners. This bias is further exacerbated because of the pronounced differences between public and school library services that have emerged because of the influence of technology on the learning process in schools and also because of the national standards for school libraries promulgated by ALA’s American Association of School Librarians (AASL). These standards downplay reading promotion at the secondary level of schooling in favor of information literacy instruction as the primary role of the school library media specialist.^[6]

These institutional differences vary widely in specific circumstances though, in part because only a minority of large public libraries have librarians with the title, “young adult specialist” on staff, even though they serve the age group. Other common staffing configurations include extending the children’s services staff to include young adolescents in their service clientele and renaming the department “Youth Services”; assigning the service responsibility to the adult services staff on the rationale that YA interests were more adult, or that they use more adult materials, than children’s.^[7]

THEORETICAL FOUNDATIONS

While services for young adults share other theories that inform library practice, YA services are primarily supported by theories and research on the physical, social, cognitive, and psychological development of adolescents. Young adult services emphasize how library service can augment various internal and external assets that promote positive youth development in the categories of support, empowerment, boundaries and expectations, constructive use of time, commitment to learning, positive values, social competence, and positive identity.^[8] Long before a recent Gallup poll asked U.S. young people how many of them were experiencing the five promises identified by America's Promise, young adult services were helping provide caring adults, safe places and constructive use of time, a healthy start and healthy development, effective education for marketable skills and lifelong learning, and opportunities to make a difference through helping others.^[9] In many ways, YA services are the most client-centered of library services because they are grounded in the nature of their contemporary adolescent audience.

THE YOUNG ADULT SERVICES AUDIENCE

Definitions

The profession lacks an agreed-upon professional definition of "young adult" that is congruent with individual library service histories or school district divisions. In most public libraries, for example, middle school students (grades 6–8) are a shared constituency between children's and adult or young adult departments, depending on where the YAs present themselves whereas for any particular middle school, those are the only people there. ALA's Young Adult Services Association defines young adults as people between ages 12 and 18, but there are ongoing discussions within the Division about whether the audience focus needs to be expanded to include either tweens or older teens and 20-somethings or both.^[10]

While the YALSA definition quantifies the intended YA service population by age, it is less helpful in terms of the social psychology of, and communication with, adolescents to explain library services for and problems with the age group for librarians. Adolescents do not easily fit the neat categories that libraries and the larger society create for them. They want a say in what happens to them, while often lacking the experience or resources to influence events. They are also a highly stigmatized group who arouse deep suspicion in adults who tend to misread their appearance and are often more interested in controlling them rather than either listening to, or serving them. Since most adults that YAs come in contact with outside their families seem to have total amnesia about or only an

idealized memory of their own adolescence, current young adults cannot always count on them for any kind of residual empathy in or outside of libraries. Thanks to compulsory schooling and laws regarding the age at which one can leave school and work, plus the advanced preparation necessary for many highly paid jobs, there often seems to be no adequate social place for young adults in the United States outside schools, despite a developmental need for social and intellectual competence within a highly sexualized and commercial mass culture. This is a gap that good young adult services attempt to fill.

Adolescent Development

The following is an overview of adolescent development which is the basis for young adult services, with examples of how these characteristics relate to what young adult librarians do. It is important to remember that developmental characteristics can occur at different times even within the same or same-aged individuals. Social characteristics are mediated by culture, so the following generalizations can only be understood for individuals within actual social contexts. Except for the connections to library and information practice by the author, all of these developmental characteristics are drawn from the work of Jean Piaget, Lawrence Kohlberg, Joseph Adelson, David Elkind, Gisela Konopka and Joan Lipsitz' work at the Center for Early Adolescence. They can be found in any adolescent development textbook. A particularly useful book is *Adolescence: The Survival Guide for Parents and Teenagers*.^[11] There has been research on the teenage brain, suggesting that remarkable changes occur during this period; however, there is little agreement to date on the applicability of this research to practice. A summary of this research appears at <http://www.nlm.nih.gov/publicat/teenbrain.cfm>.^[12]

Physical

Early adolescence, roughly ages 10–15, is the second greatest time of growth velocity in human development. Height, weight, and secondary sex characteristics all grow or become obvious at this time. As one young person put it, "Adolescence is when you grow hair and smell bad." This is also the time at which young people reach reproductive maturity physically. Since physical growth is highly variable, even within the same age or grade, there is much angst among adolescents over what is normal and what is not. It is also disconcerting for many young adults to find themselves taller than their parents, for example, or for the girls to be taller than the boys of their same age cohort. It is worth noting that young adults who are "early bloomers," that is, those who mature physically earlier, are at risk in several ways. Girls can draw unwelcome attention from older boys while still lacking the social skills to cope with the attention; boys who are early

developers often do not develop other aspects of their personalities. Physical “late bloomers” suffer from being regarded as childlike, when often, their cognitive abilities are superb. Science fiction conventions seem to specialize in bright adolescent late bloomers, for example.

Cognitive. Adolescence is the time during which a move into formal operational thinking occurs, if it occurs at all. This is the ability to hypothesize about something which has not yet been experienced and is tied to the development of higher order ethical and political thinking because it helps people to understand abstractions. This thinking ability is what allows young adults to dream about and work toward possibilities. It is also the reason why speculative stories such as science fiction, fantasy, and horror are so popular with young adults. It is not inevitable that everyone will reach formal operational thinking, and many people, even when they do, do not reach this stage of cognitive development until their early twenties. Besides the link between this level of cognitive development and media interests, there is also the problem of adults expecting abstract thinking from people who may not be capable of it. This is where serious misinterpretations of behavior are likely to follow.

Psychological. The overwhelming adolescent quest is identity—that is, figuring out who one is, while at the same time reevaluating familiar relationships with parents, siblings, and friends from new perspectives, while encountering many “first” experiences. Adolescent psychology basically takes two forms, which are related. The first is the “personal fable” in which the young adult feels that he or she is alone in the universe and is experiencing events for the first time. Only experience tempers this, but in the meantime, this can lead adolescents to feel invincible, and make it very difficult to get any cautionary information through to them to mitigate risky behaviors. This is why, for example, so many books in YA collections are written in the first person from the perspective of teenage protagonists.

The second facet of adolescent psychology is called “the imaginary audience.” Young adults feel that everyone is looking at them. This makes them extremely self-conscious in many social circumstances, especially when they experience some unanticipated bodily function, such as sudden pimples or spontaneous erections or the emergence of breasts, or when they are ignored in service encounters. This is also why many adolescents have a particularly difficult time with cyber-bullying, which seems to have become a negative effect of new technologies.

Adolescents are exceptionally self-conscious, in part because of changes to their bodies, or in the case of “late bloomers,” the long time it takes for the changes to start. This egocentrism is encouraged, not only by the age segregation experienced by adolescents in U.S. culture, but also by media targeted to adolescents as a consumer class.

Since many adolescents have little real work and intergenerational experience outside their families or schools, it is easy for them to feel that they are heroes in their own “personal fable,” and therefore invincible in terms of various risk-taking activities. One of the more difficult information sharing activities with adolescents is figuring out how to cut through this psychological shield of invincibility to help them take risks within safe boundaries. It is hardly accidental that the Extreme Sports Games are primarily composed of adolescent competitors.

Social. Adolescence is the time that young people move (or are thrust) outside the protective influence of the family into the interdependent relationships of the larger community to test and reconfigure their identities while moving into increasingly adult roles. Relationships are very important during this time. Besides figuring out romantic and sexual relationships with the opposite or same sex and renegotiating power relationships with parents and adult authority figures, adolescents depend on friends to help figure out what is and is not normal with all the changes going on in their lives. Librarians are often dismayed by adolescents in groups, but this behavior is developmentally normal; whereas the lone, seemingly friendless young adult who, while possibly more palatable in libraries, is also more at risk. This need to keep in touch with friends is also the developmental force behind young adult preoccupations with text messaging and Internet Web sites that promote social interaction such as MySpace and Facebook. E-mail is considered a technology for “old people” by today’s teenagers. Unfortunately, dependence on friends can become exaggerated when no strong parental bond exists and also because teenagers, especially those who are racial or ethnic minorities, are highly stigmatized in U.S. culture, except for when they can be slotted as “consumers.”

Structural age segregation separates young adults from both adults and younger children outside the home, through work limitation and mandatory schooling laws. As a result of this, young adults display all the characteristics of a subculture with specific symbols, such as clothing and language, to delineate that status. These subcultural symbols, often inspired by celebrities, are frequently misinterpreted by adults, including librarians, and often lead to unpleasant confrontations in retail settings or misunderstandings with the police. Age segregation has another effect, too, which is increasing lack of access to caring adults. Adolescents cannot mature by themselves, and librarians serving as caring adult role models for them is considered a normal and attractive part of young adult services. There are also many examples of intergenerational YA services that address this issue.

The social “place” designated for young adults is school. Here they are supposed to become critical thinkers and inquirers, developing both lifelong skills for navigating an increasingly complex information society, and

deciding what kind of career they wish to pursue. Some actually achieve these things, but more often, they encounter “imposed queries” they are ill-prepared to negotiate. The very technology they love to play with outside school does not prepare them for the informed demands of information technology within school, hence the almost total preoccupation of the school library section of the profession with information literacy instruction.

Emotional. Mood swings are common in adolescents, partly because of hormonal changes and partly as a result of many first experiences, such as falling in love, for example. The swing from euphoria to depression can be very swift and disconcerting to adults, especially parents. Fears of imagined or real experiences are common, and only diminish as the young person acquires enough life experience to be able to distinguish among events where a likely emotional reaction is appropriate. This is why, for example, early adolescents are much more outraged at discriminatory treatment than senior high counterparts who are better able to think about alternative explanations for the behavior in question.

THE YOUNG ADULT SERVICES PROGRAM

Young adult services in public libraries usually consist of staff, a YA advisory group of some sort, collections, space, policies, group programs and outreach efforts to parents, schools, other libraries, and community youth organizations. Young adult services in schools consist of staff, collections, space, policies, an instructional program, collaboration with teachers and other librarians in the school district, and outreach to local public libraries and the school’s parent association.

Staff

There are actually very few public library positions with the title “Young Adult Librarian,” because only large libraries have them. Services are delivered by adult or children’s librarians in smaller places. Other public libraries have amalgamated “youth services” departments where children and young adults are served by the same staff from birth through early adolescence. The specific services offered to young adults may depend on the boundaries imposed by a particular position description and also where the librarian is organizationally situated. Secondary school librarians are usually credentialed as teachers as well as librarians.^[13,14] One of the myths about being a young adult librarian is that the person has to be young. This is not true; regardless of age, there is general agreement that the person must be mature, technically competent as a librarian, understand and genuinely like teenagers, have good interpersonal skills, and have a good sense of humor. For school library media specialists,

formal teaching skills are also important, but informal teaching skills are equally important for public librarians because of the various information technology learning curves encountered among users. Librarians working with young adults need to be able to have collegial relationships with other adults as well as excellent service skills with young adults, since a large part of YA services is advocating for YA needs with colleagues.^[15,16]

Young Adult Advisory Groups

Since their new cognitive abilities often make them question everything, young adults want input into what libraries do for them because they want to know why these services are being offered. Also, their interests can be so fleeting that it is difficult for librarians to keep up. The response to these needs has been the almost universal establishment of YA advisory groups in public libraries, and some in schools. The groups vary in focus, but basically serve as idea-generators, communication conduits, publicity helpers, program volunteers, collection evaluators, advocates for library services, staff trainers, etc., anything needed to keep the library on track in terms of their age group. Young adult advisory groups also offer youth participation opportunities to local adolescents, and as such, are a YA service in themselves.^[17]

Young Adult Collections

For personal reading

Since contemporary adolescents are, in general, the most “wired,” multimedia generation ever, YA collections should be multimedia themselves. Many school library collections stay within the limitations of curriculum support, but public libraries tend only to have print collections of books and magazines for young adults, with other formats such as music, audio books, DVDs, computer games, etc. representing their interests in other sections of the library that YAs also have access to. Ideally, all items of interest to young adults, regardless of format, would be housed together, but this often proves difficult because of the overlap between YA and adult interests.

Another problem with YA collections is the public library’s philosophy about separate collections. Some do not have separate YA collections at all; others interfile all juvenile materials with adult; some only interfile nonfiction, etc. There is a wide variety of YA collection locations within public libraries, but it should be noted that young adults do not necessarily limit themselves only to what collections are labeled “YA,” regardless of location.^[18]

It is still conventional wisdom among many YA services librarians and publishers that a “YA book” is a mass-market sized paperback, since the format is by far the most preferred by adolescents for reading in book form;

however, with the development of and subsequent inclusion of graphic novels in YA collections, it may now be equally true that a “YA book” is a graphic novel. The importance of this format for young adults was established first with a standing-room-only audience at a preconference on graphic novels sponsored by YALSA at the ALA annual conference in San Francisco, which, in turn, led to the establishment of a standing YALSA committee to determine the “best” graphic novels for young adults annually, followed by the selection of the graphic novel, *American Born Chinese*, for the 2007 Printz Award. The importance of the format is also underscored by research on boys and reading that points out that many of them love comics, making graphic novels a natural reading progression.^[19,20]

Thanks to the establishment of the Printz Award for literary quality by YALSA in 1999 in memory of beloved YA librarian Mike Printz, of Topeka West High School in Kansas, books published specifically for young adults now receive new respect from publishers, authors, and librarians alike, while increasing both the literary sophistication and the range of stories available for the age group. In addition to titles published specifically for young adults, however, YA collections and reading interests extend well beyond the “YA” category of publishing, as documented by the adult titles of interest to young adults selected annually by the Alex Award Committee of YALSA, named for Margaret Alexander Edwards, the first YA Coordinator of the Enoch Pratt Free Library in Baltimore. Many of these titles are subsequently produced by audio book publishers and offer opportunities for young adults who are aural learners or reluctant readers. Young adults also form a major segment of the reading audience for adult science fiction and fantasy stories, whether in print or video formats.

For specific information-seeking

While school libraries include printed reference materials and subscribe to electronic databases of particular usefulness for curriculum-supported research by young adults, public libraries usually house such materials in the adult reference department and allow young adult use there, unless the library has a separate homework center or YA space with its own separate computer access. There is a growing research literature about YA information-seeking in conjunction with school assignments that can be summed up by saying that, without instructional intervention, many young adults may be great surfers of the Internet, but they do not how to search and evaluate what they find, nor do they respect intellectual property. In terms of personal or “everyday” information-seeking by young adults, peers are a preferred source of information with many adults often perceived as not helpful unless adolescents perceive them as both expert and accessible.^[21,22]

Young Adult Spaces

An important trend in young adult services is how to create separate spaces, primarily within public libraries that respond to YA developmental, cultural, and aesthetic needs, although at least one study has also examined school libraries. As Anthony Bernier puts it, “Young adult areas need design elements to harmonize with the way teens sit, study, relax, read, and socialize.”^[23] Inspired by Teen’Scape in the Los Angeles Public Library and Teen Central in the Phoenix Public Library, this interest has led so far to new theories of spatial organization, an ongoing column presenting YA spaces in *Voice of Youth Advocates* (VOYA) and a book by Kimberly Bolan now in its second edition.^[24] The teenager’s need to lounge and eat and socialize while working is finally being recognized architecturally in libraries, although undoubtedly, not every librarian is happy over this trend.

Group Programs

While young adult services are similar to library services for other age groups in terms of offering one-on-one reference and readers’ advisory service, one of the major accomplishments of young adult services is group programs, especially where the young adults themselves help plan and deliver the program. Since several hallmarks of adolescent development are learning that one is both normal and part of a particular generation, and learning how to relate to the opposite sex, any learning activity that allows teens to interact with each other or with other generations becomes an important information service, whether it is a teen talent show, a tutoring program, discussion programs, workshops, etc. The sheer range of young adult services programs is an ongoing topic on several YALSA electronic lists, highlighted annually in VOYA, summarized in five volumes of *Excellence in Library Services to Young Adults*, and summarized in a “best practices” overview.^[25–30]

ISSUES IN YOUNG ADULT SERVICES

Censorship

Young adult materials and services are frequent targets of adult censors, partly as an ongoing product of the larger “culture wars” in the United States, but also because YA interests frighten or offend many adults who would prefer that young people not know or be interested in the topic or format. There are many people, including many librarians who sincerely believe that information may be harmful to youth; whereas, the profession has taken the position that getting information is a positive activity. The problem inevitably arises when young adults want information that some adults do not want them to have. Graphic novels, for

example, come under scrutiny because many adults still consider comics to be “trash” and not worthy of library collections, and also because many of the imported Japanese graphic novels are published for adults in Japan and are not particularly sensitive to American notions of what should or should not be in books for minors. Just a brief perusal of ALA’s most challenged lists shows a high percentage of popular titles aimed at young adults as well as the old standby, *Catcher in the Rye* by J. D. Salinger. While sex and “bad” words will still cause controversy such as Judy Blume’s *Forever*, censors are also concerned about disrespect for adult authority as depicted in *Killing Mr. Griffin* by Lois Duncan, anything that presents homosexuality in a neutral or positive way, such as *Arizona Kid* by Ron Koertge, or the depiction of the rape scene in Stephen Chbosky’s *Perks of Being a Wallflower*. Caroline Cooney’s *Terrorist* has been challenged ever since 9/11, usually by people who have not read it but object to the title. The wildly popular Harry Potter series has been challenged for catering to the occult. A list of the reasons for all censorship challenges compiled by ALA between 2000 and 2005 include anti-ethnic, insensitivity, racism, sexism, homosexuality, nudity, sex education, sexually explicit, antifamily, offensive language, political viewpoint, religious viewpoint, unsuited to age group, abortion, drugs, occult/Satanism, suicide, violence, or inaccurate.^[31]

Young adult librarians need to be prepared to defend decisions made in accordance with selection policies at any time, either orally or in writing, while at the same time respecting the free speech rights of the person disagreeing with library policy. Guidance for doing this is available in toolkits from ALA’s Office for Intellectual Freedom and YALSA’s *HitList* publication.^[32,33]

Censorship challenges are not limited to books, however, but also to music and visual images, as well as to information gathered from the Internet on library terminals. Since many library users serve themselves on Internet terminals rather than go through librarians, adult concerns over youth viewing pornography have led many libraries to institute “acceptable use” policies where users sign an agreement not to visit such sites. This solution did not placate adults who wanted youth access controlled, so a law mandating electronic filters on all library terminals accessible to anyone under 18 in public libraries that received federal E-rate funds (raised by tax surcharges on phone lines) was approved by the U.S. Supreme Court. Prior to that ruling, many school districts already filtered terminals, which can lead to problems for young adults when using Internet connections in school libraries for research, since useful sites get filtered along with those deemed “inappropriate.” The problem with many filters is that they are not able to be turned on and off easily, and they depend on language or image screening methods that are imprecise. For example, a perfectly good photograph of a breast for the purpose of illustrating breast cancer is as likely to be filtered as erotic images of the same body part.

The other problem with filters is that, since their programming is proprietary, librarians cannot always find out on what basis filtering decisions are made. Filtering companies also sell to home users, and what may be fine in a very conservative religious home is probably not appropriate in a public institution used by everyone.^[34] Censors, however, usually generalize from their own worldview, assuming that everyone does or should believe exactly what they do. A good young adult librarian is one who is well-prepared to respond to challenges with good policies for selection and services, due process protections for public response and input, and also has good communication skills as well as the support of library or school administration and significant adult community members.

Young Adult Behavior

Congregating in groups

Young adults congregate in public places, libraries among them.^[35] This is normal, inevitable teenage behavior that allows teens to socialize, flirt, make friends, etc., outside parental view. Most libraries, however, are constructed with solitary intellectual pursuits in mind, and normal young adult behavior winds up being labeled “disruptive” and viewed as aberrant in that setting. Adolescents talking with their friends is actively discouraged and disparaged in several ways through arbitrary restrictions on the number of people who can sit at tables at any particular time, the prohibition of chat room use on Internet terminals, the absence of group study rooms, the prohibitions on meeting room reservations by age and use, and the type of architecture and furnishings chosen when libraries are being built. Librarians seem to feel that making a library look like a study hall will make users act like they are in one.

Young adult librarians then have to enforce one-size-fits-all behavior rules with teenagers who, by definition, do not fit the rule. In one-room libraries, admittedly, group behavior can be a problem, but larger libraries often have the option of designating quiet vs. noisy areas. Both school and public libraries often have conference or meeting rooms that can be opened for groups of young adults to work together. As Thomas has observed, “This approach essentially privileges users for whom learning is understood as individual and task-oriented, and disaffirms activities which could be considered as cooperative, social, or reflective.”^[36,37]

Reference queries

The expressed information needs of adolescents in public libraries tend to cluster primarily around homework assignments which forces many teenagers to look for information on the same topic. This is the so-called mass assignments problem. Although this is an ubiquitous problem for public libraries, many librarians merely complain

about it and scapegoat school librarians for “not doing their job,” with little understanding of what school media specialists actually do. Planning for mass assignments by contacting local schools for curricula, buying multiple copies of needed items, creating temporary “reserve” shelves, creating pathfinders, and calling teachers when needed, even in the face of documented public support for the public library’s taking a formal educational support role.^[38]

The professional literature on information-seeking behavior until recently did not acknowledge that there is a class of questions that do not originate with the person asking them, so-called imposed queries, or that the person forced to ask may be less than interested in the topic of the query. Nearly all homework-related questions fall into this class.^[39]

Adolescents inevitably present themselves at the last minute (because they are still learning how to be future-oriented using their new thinking abilities), with homework questions on topics they do not fully understand or care about, often unprepared to find the answer without more help than most busy public librarians are prepared to give them.

The idea that a public librarian should also be an information literacy instructor is just beginning to take hold in the field, because changing technology has changed the learning curve for everyone and made them all “adolescent users” in some fashion. This is why many public libraries have decided to offer homework centers or some sort of formal educational support besides one-on-one reference service which usually cannot bear the brunt of doing information literacy training in this fashion without breaking down under the numbers needing it.

The problem created by imposed queries for the reference encounter is further complicated by the lack of agreement among reference librarians on whether the librarian just gives users the desired information or whether the librarian just starts users on the path toward finding it for themselves and tries to teach users how to search for the next time they need something.^[40] There is some hypocrisy in the way in which this unresolved dilemma is visited upon adolescents, though. Most librarians in public libraries automatically assume that all homework assignments presented by adolescents are intended to teach the user how to use the library, as opposed to any queries from adults, regardless of the fact that there is little evidence used to support this supposition. This causes the “just-get-them-started” method to be used almost exclusively (and punitively) with adolescents until it becomes obvious that the teenager does not know how, nor will be able to do the assignment without more instructional help in accessing and evaluating library resources.

Adolescent reference queries also come through surrogate users in the form of parents trying to help their children with their homework. These parents are often frustrated themselves over having to do it, and frustrating

to librarians because they do not fully understand what is needed, leaving the librarian never sure whether the correct question has been answered. The situation is even more frustrating when the parent and teenager appear together, and the parent does all the talking for both of them. This situation is also ubiquitous in public libraries.

Preference for and use of technology

As Elaine Meyers points out in her classic article, “The Coolness Factor,” young adults love the Internet, (90.3% having access from more than one location in 2007), and they are very frustrated with the scarcity of familiar technology in libraries.^[41] They hate waiting in line for computers they can only use for short periods of time, and the genders use the Internet differently. To attract this age group, a library needs to understand teenage Internet use and offer information and access using Web-based technology as a conscious part of young adult services. This might include reference service available through instant messaging, a library presence on social networking sites like MySpace or Facebook (used by 55% of teens in 2007), posting library and library-sponsored teen videos to YouTube, full text databases for research, a YA presence on the library Web site with YA input for its design and content, a computer gaming club or programs, downloadable music and book formats compatible with the most popular recording devices used by young adults, if possible, and participatory formats such as wikis and folksonomies.^[42–44]

CONCLUSION

Young adult services remain an important component of overall library services because of the importance of a developmentally sound response to this stage of life. All secondary school libraries are “young adult services” by definition and many public libraries serve young adult users in multiple organizational and staffing formats. However the services are delivered, they must encompass the presence of caring and technically skilled adults who understand adolescent development and can advocate for the age group wherever needed in library bureaucracies. Young adult services include materials collections in the formats most desired by contemporary adolescents, relevant and topical group programs responsive to local teen interests, youth participation in service conceptualization and delivery, and access to information and communication technology. Young adult services are vibrant and fluid, very much like the audience served. Young adult services exist to serve the information needs of adolescents in the present with an eye toward the future adults they may become.

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Youth Information: Needs and Behavior

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Abstract

The information needs and behavior of youth is a research area that continues to be ripe with research questions. Work investigating these users has been informed by theories of development from the field of psychology as well as models and theories of information behavior developed in the field of library and information science. Much of what is known about youth information needs and behavior is focused on the context of school and the use of electronic resources. While a body of work is accumulating related to information seeking in school and information seeking with electronic resources, there are significant gaps in our knowledge and methodological issues that need to be addressed to build a solid research base. Youth information seeking in information spaces outside of school, the place of various media in youth information seeking, and the information needs of very young children are particular topics that need to be addressed. Increasing use of theory and the inclusion of youth in research are two ongoing trends that will strengthen understanding of young people's information needs and behavior as well as inform the development of information services, systems, and resources that better respond to the needs of this diverse population.

INTRODUCTION

The information world of youth has long been defined by adult perceptions of youth information needs and adult prescriptions concerning how these needs are best met. In the early 2000s, this started to change as the voices and active participation of young people were increasingly included in studies focused on understanding what young users want to know and how they would like information resources, services, and systems to be configured. Youth information needs and behavior is an active area of study that still has much to achieve before it can provide a full picture of the diversity of needs, skills, and interests of youth as well as how these operate within the various contexts in which information needs and behaviors operate. Research in this area remains scattered and limited by research designs that are not generalizable. Many investigations have small sample sizes and with few replications or follow-up studies.^[1–3] Furthermore, minimal differentiation between subsets of this population, based on developmental levels, is made in terms of subjects chosen to participate or in the analysis of the data. The result is that we cannot speak easily about the information behavior of youth at specific age levels. Even though interest in this research area continues to grow, there are still more questions than there are researchers to address them.^[4] For these reasons, a comprehensive understanding of youth information needs and behaviors has yet to emerge.

This entry provides an overview of what current literature has to say about the information needs of youth, predominate theories and models that inform this literature, and a summary of current understanding of youth

information behavior. Youth, in this discussion, includes both children (birth to age 12) and young adults (age 13–19). The definitions of information need, information seeking, and information behavior are adopted from Case.^[5]

An information need is a recognition that your knowledge is inadequate to satisfy a goal that you have. Information seeking is a conscious effort to acquire information in response to a need or gap in your knowledge. Information behavior encompasses information seeking as well as the totality of other unintentional or passive behaviors...as well as purposive behaviors that do not involve seeking, such as actively avoiding information.

(p. 5)

YOUTH INFORMATION NEEDS

Youth is an extremely broad category involving the full range of human development and requires consideration of developmental level (physical, cognitive, social, etc.) as well as the attainment of a variety of skills, such as reading, writing, and increasingly, information literacy and information and communications technology (ICT) skills. In addition, competency in content areas such as math, science, health, finance, and civics is increasingly important today. Investigations of the information needs of youth have been mainly pragmatic, rather than driven by theory, and based on adult assessments of what the data mean, rather than seeking to understand information needs from the user's point of view. Where developmental

theory has been brought to bear in the research area, a common approach is to incorporate understandings of cognitive development from the field of psychology, such as those provided by Jean Piaget, Erick Erickson, Abraham Maslow, and Lev Vygotsky as a structure for the investigation or as an aid to data analysis. Models of information seeking behavior are also used as frameworks in this literature and are discussed further in the following.

Due to the vast developmental differences from birth to age 19, it is clear that adults play a central role in the information worlds of youth, especially for the very young. The identification of information needs, as well as the ability to satisfy them, cannot be completely divorced from adult views of what is appropriate for youth as well as adult interest in making information accessible or inaccessible.

One approach to understanding the information needs of youth has been to categorize the kinds of information youth need. Walter,^[6] based on in-depth interviews with informants such as teachers, scout leaders, ministers, and other adults interested in children, suggests that adults are not necessarily conscious of their role as information providers to youth and that much of the information children need does not get to them, including basic information that is important to their welfare. She suggests that children's information needs can be conceptualized along the same lines as Maslow's hierarchy of needs ranging from basic physiological needs to the highest level of information need, self-actualization. She describes children as information-poor and sees children's lack of status in our society as well as the low level of communication between children and adults as two of the major barriers they face in meeting their information needs.

A study of computer use at home of 7-, 9-, and 11-year-olds revealed motivations such as curiosity, a desire to play games, and school work.^[7] The relationship between school work and computer use at home intensified with age. School work was a primary motivator for 11-year-olds, the second most important motivator for 9-year-olds, and least important among 7-year-olds.

A survey study of 641 fifth and sixth grade students in Taiwan,^[8] focused on information use, demonstrated that almost two-thirds of the respondents would seek information to cope with daily life problems. Information seeking behavior was more likely among older children and did not vary by gender. Students who felt their problems were outside of their control perceived information seeking as difficult or as requiring too much time, tended to avoid trying to find information to solve their problems. Among students who sought information, the author summarized reasons for seeking information as to solve a problem, to escape from thinking about a problem, to calm down and work toward a future transition out of the problem, and to affect a mood change that would help them feel better. Information seeking for many of these participants is

described as a process used to control emotions and as not necessarily requiring that problem itself be resolved.

Another scheme for identifying the information needs of children is offered by Shenton and Dixon^[9] who used qualitative methods with youth ranging in age from 3 to 18 years of age to determine who they go to when they consult people for information and what types of information they seek. Twelve categories of information needs were identified that included both the need for content as well as affective needs. These categories include "advice, spontaneous 'life situation' information, personal information, affective support, empathetic understanding, support for skill development, school-related subject information, interest-driven information, self-development information, preparatory information, reinterpretations/supplementations, and verification information" (p. 222).

Meyers et al.^[10] used a "Tween Day" methodology that included interviews and focus groups to study the information needs of children aged 9–13. They found that many of the information needs of this group were related to things that were currently going on in their lives and not long-term concerns. They wanted information to complete homework, for personal hobbies and interests, related social events, and popular culture. They also voiced a need for information about personal safety related to dealing with bullies and strangers, information about drugs and alcohol, and a strong need to share private information within a trusting relationship. These youth did not feel that they could necessarily expect that formal information would be available to help them with daily life concerns.

A study of the school and personal needs of high school students^[11] demonstrated that students are most likely to seek information for school-related reasons. However, they also sought information for information needs related to health, relationships, current lifestyle, and for making future plans. This study also revealed that students may consciously decide not to seek information, preferring to figure things out on their own, especially if they feel their concerns are subjective or unimportant, feel time pressures, or do not believe that relevant resources exist for their problem. Students also pointed to procrastination and denial as reasons not to seek information.

Agosto and Hughes-Hassell,^[12] using data from group interviews with urban young adults aged 14–17, developed a typology of the questions they identified as part of their everyday life information seeking (ELIS). The resulting categories support other research on youth information needs and include "schoolwork, time/date, social life/leisure activities, weather, daily life routine (e.g., meal and clothing selection), popular culture, current events, transportation, personal finances, consumer information, personal improvement (including self-help, college, and scholarship information), and job information" (p. 159).

Laplane^[13] used social network analysis to study the use of social networks among 15–17-year-olds seeking help with homework. Data were collected using in-depth

interviews with 19 students from public schools in Montreal, Canada. Respondents had a preference for people they had established relationships with (parents, friends) and who were convenient at the time information was being sought. Homework help was categorized as procedural help (how to perform a task), proofreading, comparing answers, factual (e.g., definitions, URLs), and executive help (described as copying someone else's work). Students who solicited help through social networking sites (SNS such as Facebook) tended to keep their help-seeking private by asking friends who were already signed on and using chat features rather than posting questions on their wall.

Special Populations

The information needs of special populations have also been the subject of investigations interested in youth. For example, Hamer's study^[14] focused on the information seeking of gay males related to disclosing their sexual orientation to others. Interviews were performed with young men in their late teens and early twenties revealing information needs related to understanding and forming their own gay identity, the decision to label themselves gay, and the consequences of self-identifying as gay. Participants reported periods during which they avoided these information needs, felt the need to conceal information seeking activities, and interacted with other young gay adults in online forums.

Hersberger et al.^[15] studied the information use environment of abused and neglected children aged 1–17 who had been removed from their homes. These children were found to first need information related to adjusting to their situation such as understanding what happened and why. After adjustment, children begin to grapple with the question of what is going to happen to them next. They cope with this question from the time of temporary placement until they are reunited with their family, placed with a relative, or moved into court-approved custodial care or possible adoption by a third party.

Agosto and Hughes-Hassell^[16] chose to study urban teens as this is a group that has not been given much attention in the literature. Urban—or inner city—teens have special circumstances in that they live in high-density areas of low socio-economic status and may lack strong role models, and libraries are in a good position to provide the information they need. They found that ELIS for these teens was centered on issues related to achieving adulthood in order to better understand themselves and the world. The researchers conceptualized urban teen information behavior as supporting development of the social self, the emotional self, the reflective self, the physical self, the creative self, the cognitive self, and the sexual self, and related these to a typography of 28 topics the teens' identified as areas of information need that they experience.

Koo^[17] investigated the information-seeking behaviors of newly arrived, high school-aged Korean immigrant youth in the United States. She wondered, given the importance of peers as an information source, how youth who had yet to establish relationships with peers compensate for this important resource. She found that during the period of social isolation their primary concern was doing well in school. They wanted information on how to improve their English in order to excel in class and better participate in school-related activities. They were also interested in developing social skills in order to make friends and to increase their comfort in American culture. These students demonstrated a strong preference for people when seeking information. However, in the absence of peers they relied on parents (mainly their mothers), teachers, and a do-it-myself attitude.

Lilley^[18] used mixed methods to study the information behavior of Māori students recruited from four secondary schools in New Zealand. A total of 139 students participated in a survey and 45 students participated in focus groups. The data reveal that these students prefer to seek information from people they personally know, such as friends, teammates, parents, siblings, extended family, and teachers. Students used opportunities in and around school to socialize and share information. Specific places where information exchanges take place were identified as school grounds, which includes restrooms, gym, organized sports practice, around the school shop (which sells food and school supplies), and the smoker's hangout. Information exchanged tended to center on social topics (e.g., music, film, gossip) and schoolwork.

INFORMATION SEEKING MODELS

Outside reference to developmental psychology, the use of theory to inform investigations of youth information seeking is limited. There are, however, three models of information seeking that have been widely referenced in this literature: Kuhlthau's information search process (ISP), Savolainen's ELIS, and Gross' imposed query model.

The ISP Model

The ISP model^[19] seeks to describe the constructive process of completing a research assignment by taking into account the cognitive, affective, and physical dimensions of information seeking. The research process is broken down into six stages: task initiation, topic selection, prefocus exploration, focus formulation, information collection, and search closure. At each stage, an assessment of the feelings, thoughts, actions, strategies, and mood of the information seeker are tracked demonstrating an interesting pattern of movement in which confidence grows as the thought process becomes increasingly specific and interest

grows as information-seeking actions become more specific.

The ISP has provided a useful framework for research and has informed interventions structured to help people gain information literacy skills. This model has been effective in bringing awareness of the role of affective response in information seeking and that recognition of uncertainty, confusion, and even frustration as a normal part of the process helps students deal with the uncertainty inherent in the process of refining a topic for study. It stands out in that it has been extensively tested in a variety of libraries and with a variety of users.^[20]

One example of a recent study of the ISP sought to understand the metacognitive knowledge of adolescents working through the ISP and the potential relationship between metacognitive knowledge and the cognitive, affective, and behavioral dimensions of the ISP.^[21] Using a think aloud protocol, Bowler was able to identify 13 metacognitive categories and to argue for teaching metacognitive strategies to students to support the development of information literacy skills.

Everyday Life Information Seeking

Everyday life information seeking^[22] brings into focus the world of information seeking that exists outside of work and school. The framework of ELIS is made up of two major concepts, way of life and mastery of life, and suggests how they manifest as approaches to information seeking. Way of life refers to how an individual has organized daily activities and prioritized them. Way of life describes the personal context an individual sees as “normal” and how they strive to maintain that condition. Mastery of life describes the individual’s ability to maintain an acceptable level of satisfaction with the way of life they have established. When things are going well, mastery of life may be a passive state. However, when problems arise or the way of life is threatened in some aspect, mastery of life may require an active stance to deal with whatever stimuli is being presented.

Like the ISP model, ELIS takes into account both the cognitive and affective nature of information seeking. However, the affective domain described by ELIS moves along a continuum of optimism versus pessimism concerning the prospect of being able to solve the information problem. It also points out that familiar information sources may not only be preferred, but their use may become so natural that they are not considered critically or considered in light of other resources or opportunities for information gathering.

One recent example of the application of ELIS to research on youth information seeking is the development of Agosto and Hughes-Hassel’s model of the everyday life information needs of urban young adults.^[16] The authors conclude that “the essence of teen ELIS is the gathering and processing of information to facilitate

the multifaceted teen-to-adulthood maturation process” (p. 1399). To demonstrate this, the model has as inputs seven variables related to a teen’s self-understanding that may work as motivators for information seeking: the emotional self, the reflective self, the physical self, the creative self, the cognitive self, the sexual self, and the social self.

Imposed Query

The imposed query is another model that has contributed to understanding of the information seeking process.^[23] This model differentiates between information seeking that is self-generated (the user who thought up the question also pursues the answer) and information seeking that is imposed (the user is acting as an agent by pursuing a response to questions given to them by someone else). Over 14 categories of imposer/agent relationships have been identified that result in imposed information seeking. The four most common imposers found in a study of adult reference desk use are children, instructors, spouses, and employers. A study of children aged 4–12 in an elementary school setting revealed that while teachers are the main imposers in this environment, the children also impose information seeking on teachers, parents, and other children.^[24]

A key point made by the imposed query is that there are many opportunities for the transaction of imposed queries to break down. Problems such as poor communication, beliefs and stereotypes about imposers, the nature of the relationship between the agent and the imposer, and the skill level of the person in the role of agent can all work against their successful resolution. To date, the imposed query model has been used to inform both research and practice in the areas of reference work, reference evaluation, investigations of youth and the Internet, information retrieval, information seeking, and the design of digital libraries.

A recent example of work that incorporates the imposed query is Bowler’s^[25] analysis of the development of student curiosity when working on a class assignment. Because of the specifications and time restraints that come with class assignments, students had to manage their level of personal interest, which could sometimes be a problem. While the development of personal interest helped to motivate students to complete the assignment, the assigned nature of the work can be at odds with fulfilling their developing personal interest. This put students in a position that can be both pleasurable and painful. Managing curiosity was a central concern when an imposed task begins to provoke self-generated questions.

YOUTH INFORMATION SEEKING BEHAVIOR

The research on the information seeking behaviors of youth is limited, but growing. Almost all investigations of

youth information seeking behavior have taken place in the context of school and are focused on the use of electronic resources. These studies have mainly been pragmatic in nature, focused on the performance of specific children in specific contexts mainly in response to school assignments. In addition, research has been more focused on searching behaviors than on information needs.^[9,26] Little is known about youth information seeking at home, in the public library, or in other information providing spaces. Likewise, little is known about the information needs and information seeking of very young children.

One issue that affects the information seeking of youth is the extent to which they have access to the resources they need to respond to their information needs. Young children may need help formulating their information needs and their access to information is often mediated, if not controlled by adults, if only to the extent that children often lack funds, transportation, and the independence to allow them the number of information options that adults enjoy. Issues of equity of access to information and services for youth in libraries are a continuing concern as challenges to materials, issues of filtering, inequities in information services for youth, and practices that discourage youth from interacting with librarians persist.^[27–30]

It is clear, however, that youth access to technology and the Internet continues to increase. Use of the Internet by youth at home, in the library, and at school is growing, and mobile devices are increasingly providing access to information for young people; however, equity of access for all youth remains a concern.^[31]

Resource Preferences

The resources used by youth to respond to both imposed and self-generated information needs can be summarized as people, the Internet, and books. Like other user groups, youth tend to go to the most accessible sources first, prefer people and resources available in the home, such as books they already own or computers they have access to. One characteristic of youth information seeking is a preference for the familiar. Children tend to prefer resources they have already interacted with whether these are print-based or electronic in format. The known story or website is generally preferred. Gradually, these preferences widen incorporating similar stories or subjects, books by the same author, and books of the same type or genre. Another issue, especially for children, is the high reading level at which many nonfiction texts are written and the difficulty of finding age-appropriate resources online. Children are very often required to use resources above their reading level when interacting with information resources.

People

In addition to the examples provided under the section, Youth Information Needs, Posten-Anderson and Edwards^[32]

investigated the information seeking of 13- and 14-year-old girls. They interviewed 28 girls and found them interested in information about relationships, school, and work. The girls revealed that factual information was the easiest to find, but that information needs that required interpretation were harder to satisfy. Likewise they felt school and work information was easier to find than information that would allow them to meet concerns about relationships. These girls did not see the school library as a place they could take their relationship concerns and preferred instead to talk to other people to try to satisfy these needs.

Agosto and Hughes-Hassell^[12] also demonstrated a preference among young people, of age 14–17 for using other people as information sources. However, librarians are not preferred resources for youth, who would rather consult friends and family. Preferred people^[9] include those who are convenient, such as parents and siblings; people youth recognize as having similar concerns, such as peers; and those believed to have expert knowledge, such as teachers. Stemmle and Ladd^[33] demonstrated that even very young children have the ability to recognize expertise in others and bring this type of critical thinking to bear in their choice of peer informants in their information seeking.

The Internet

A recent report by the Pew Foundation found that teens are heavy users of the Internet as compared to adults.^[34] Almost all youth aged 12 and over have cell phones, and about 75% of youth use mobile devices to access the Internet. Furthermore, while lower-income youth and youth from lower-education homes continue to have less access to the Internet, they “are just as likely and in some cases more likely than those living in higher income and more highly educated households to use their cell phone as a primary point of access” (p. 2). Studies are demonstrating that young adults are avid users of social media, and there is a call in the literature for further study of youth information behaviors related to virtual environments.^[35]

Studies concerned with youth access to the Internet mainly look at access in the schools and indicate that young people generally are not very skilled at using the Internet to find information.^[11,36–38] Vansickle^[39] wondered if academic track (i.e., technical, college preparatory, and honors students) would correlate with ability and asked students to self-rate their skills. Uniformly students said they taught themselves how to search the Internet or learned from friends, and they all believed their search skills to be sufficient. No difference was found related to academic track.

Bilal has performed several studies^[40–42] that look at children’s use of search engines for imposed and self-generated information seeking. Her studies reveal that young people do not have the skills they need to find

information easily and have a particularly hard time with questions that require them to retrieve information from more than one resource. Students were more satisfied with the process of answering self-generated questions than they were with retrieving information for imposed queries.

Recent research on the information literacy skills of first-year college students has demonstrated that while students are very confident about their ability to search, their actual skill level tends to be poor.^[43] The majority of first-year college students in these studies report having taught themselves to use the Internet or having learned from peers. However, they also cite classroom teachers, school and public librarians, and parents as people who have taught them information literacy skills. It is not clear to what extent young people are being taught to find, evaluate, and use information via formal instruction in grades K-12.

Of particular concern is the ability of youth to assess the credibility of digital resources. Because they often lack the skills and training needed to evaluate sources, they tend to rely on the design of web pages and how the information is presented rather than focusing on content.^[44]

Flanagin and Metzger^[45] used large-scale surveys to study differences in how adults (18 years and older) and young adults (ages 11–18 years) perceive the credibility of information across three online encyclopedias: Encyclopedia Britannica, Citizendium, and Wikipedia. Their results indicate that both groups are aware of Wikipedia, but that many are unclear as to how content on Wikipedia is supplied. Both groups recognize that content on Encyclopedia Britannica is more credible than content provided on the other two sites. However, both groups report using Wikipedia “sometimes.” Young adults are more questioning than adults of content presented as being from Wikipedia but rely heavily on contextual clues, such as recognition of the source, in making credibility judgments.

In a John D. and Catherine T. MacArthur foundation report^[46] related to the Flanagin and Metzger study, the authors found that children “consistently overestimate their own skill levels and capacity to discern good information from bad information as compared to others” (p. 106).

Books

It has been established since the 1940s that reading for fun declines with age, and that age 12 is a pivotal point at which recreational reading drops precipitously.^[24,47] However, traditional ideas of reading and of what a book is are variables that may need redefinition in reading studies to gain a full picture of what reading and writing look like for today’s young people. The high level of Internet use indicates that youth are reading online as well as using print-based works to respond to school assignments and to support personal information and recreation needs.

National surveys have been criticized for defining reading in ways that do not reflect actual reading practice.^[48] While there have been numerous surveys that have raised concern about the reading habits of the young, a 2009 National Endowment for the Arts survey^[49] demonstrated an increase in the amount of time spent reading, and a 2010 Kaiser Family foundation report^[50] demonstrated that heavy readers do better in school and that time spent “on screen” is not replacing time spent with print media.

A 2012 Pew report^[51] found that 83% of young people of age 16–29 had read a book in the last year, that young people read for imposed and self-generated reasons, and that E-books were more popular with 18–24-year-olds than among high school age youth. A 2014 Pew report^[52] discovered that people under the age of 30 are more likely to have read a book (includes all formats) weekly and over the course of a year, than those over age 30. Further young people are now “e-reading” at a rate similar to adults between the ages of 30 and 49.

Searching for Information

Early studies focused on children’s use of library catalogs revealed many barriers to their use, including lack of key-boarding, spelling, and vocabulary skills, as well as problems with Boolean logic.^[53,54] Children prefer to use natural language and need assistance formulating queries. They prefer browsing to searching and prefer searching library shelves to using the catalog to find books. Researchers have continued to be interested in assessing youth information seeking using electronic resources,^[55] and though there continue to be many gaps in the research, the findings tend to be consistent across studies. Research studies indicate that children and young adults need help formulating searches and benefit from formal training in information-seeking skills. Visual images help children compensate for low-level reading skills, and children perform better on interfaces designed especially for them that take into account limitations related to maturation and skill attainment.^[56,57]

While children and young adults can perform well on electronic interfaces, they tend to use them in a superficial way, often not taking advantage of advanced features, and overall their ability as information seekers tends to be low. Older children perform at a higher level than younger ones but do not necessarily attain competency in information seeking at school. The provision of formal information literacy instruction in primary and secondary schools is uneven, and studies^[43] have demonstrated that many entering college freshmen have nonproficient information-seeking skills. Interestingly, gender differences in computer use have almost disappeared. While the culture of computing between boys and girls may differ, the gap in skill levels appears to be closing.^[58]

Studies of children’s use of systems are complicated by the wide range of skills and maturity that youth

demonstrate. Early literature on children's use of information systems has limited usefulness as it often does not discriminate between developmental stages, does not assess skill with technology, and reflects use of systems that are now outdated.^[57] While information systems have been developed especially for children, some authors point out that the use of such systems is not always practical, nor necessarily responsive to individual needs.^[7]

Use of Reference Services

As with access to other resources, adults often mediate children's use of reference services in both the physical library and the virtual library. Adults play several roles in this respect, acting as role models, facilitating information seeking on the part of the child, and acting as agents for child users. The imposed query is common in reference work in the children's room. In fact, it is a common assumption that the majority of children's reference questions are related to schoolwork, although there is not sufficient information to know if this assumption is correct or not. Clearly, children have life situations and personal interests that can also be satisfied using library resources and that lead them to the reference desk. Because of the nature of traditional reference work, there is little documentation available to tell us what children are looking for when they seek assistance at the reference desk. Studies of children's use of computers in public libraries have demonstrated a high level of recreational use, such as for gaming.^[59,60]

Although it might seem that digital reference, which often provides a transcript of the reference transaction, would be able to answer some questions about the nature of reference services with youth, little work has been done in this area. Silverstein^[61] analyzed questions posed by youth (elementary through high school students) to science-oriented ASKA services and determined that 13% of these queries were not in response to school assignments but reflected self-initiated learning on the part of these users. Walter and Mediavilla^[30] reviewed virtual reference transactions between public librarians and young adults as part of an assessment of a homework help program. They found that 40% of these queries were referred to Live Homework Help because students asked for tutoring help. Other queries, represented as reference questions by users, were later referred for tutoring based on the librarian's assessment of the users need. The majority (60%) of the 114 queries identified as homework were math problems and only 8% were science topics.

Luo^[62] held focus groups with 36 teens aged 13–19 to learn about their use of text reference services. Only one teen was aware that the service was provided and none had used it. In projecting why they thought they would or would not use the service, participants felt they would most likely use it to satisfy an imposed query. However, they had concerns about the use of text reference related to

response time, interacting with librarians using a technology they perceived as meant for personal use, and the constraints of the technology itself. Here they were mainly concerned not only with cost, but also the limited number of characters, and concern that text reference might be limited to questions that had short answers.

Determining Relevance

Another important research question that has received limited attention is the ability of youth to determine the relevance of information resources to their search. Such judgments are connected to their ability to think critically about resources as well as to the amount of formal instruction they have received concerning the research process. Students have been shown to depend on title information, graphics, and book covers, when they have the book in hand, as the primary determinants of the relevance of a source to a search. In electronic searching, their confidence is increased when system terms match terms used in school texts.

In general, elementary grade children have difficulty assessing electronic sources. In Hirsh's^[63] study of fifth graders, she found not only that the students were interested in issues of authority, accessibility, and currency as well as the interest level of the material to themselves and their intended audience (their classmates), but also that students tended to stop searching as soon as they found an item that met the requirements of the assignment. Alexandersson and Limberg's^[64] study of 11-year-olds completing a school assignment about the sea demonstrated that these students saw information seeking as a procedure in which they searched for and then compiled and presented facts. Little attention was given to developing personal questions or understanding related to the topic. Students did not report much difficulty finding books in the library or using computers to find information, but the researchers observed that students did not use the library classification system to find works and often reported there was nothing available on the Internet for their topic. None of these studies are generalizable; however, they are consistent with other work that has demonstrated an inability among middle and high school students to assess resources and to connect what they find to what they already know.

YOUTH AS PARTICIPANTS IN RESEARCH

In 1986, Dervin and Nilan^[65] published a now classic article on information seeking that heralded a paradigm change from a system perspective to a user perspective in research and practice. While the important change in orientation documented by this article has had a widespread effect on research and professional work in libraries, it has had limited impact on youth services. The design and delivery of information services for children continue for

the most part to be seen as the purview of professional librarians, school library media specialists, teachers, parents, and other adults interested in child welfare.

As Walter^[6] makes clear in her research, there is an important logic to this. People do not always know what they need and children especially cannot be expected to be able to identify their own information needs in all areas. For example, they may very much need to know how to cross the street safely, but it may not occur to them without help, that this is something they need to know. Children do have their own ideas concerning what they want or need to know. They have their own interests and hobbies and can be articulate about their information needs and resource preferences.

In addition to the views of interested adults, the inclusion of youth in research, service design, and system development is increasingly recognized as important. Young adult advisory panels are increasingly used in libraries to help guide professional decisions concerning collection development and programming. Likewise, youth are increasingly participants, rather than just subjects, in research focused on their information behaviors. They are also being included as team members in the design and development of information technologies that are being created especially for them. However, these trends have yet to include very young children to a significant extent.

Perhaps, the most substantial example of the integration of youth in research and system development comes from the intergenerational design work by a research team at the University of Maryland. Using participatory design, this group has undertaken several innovative projects such as the SearchKids visual search interface and the International Children's Digital Library (ICDL).^[66] The inclusion of young people as full members of the design team has resulted in tools that help children search by providing the support they need in a developmental sense as well as responding to their search preferences. For instance, in addition to the typical searching functions such as keyword searching, the ICDL allows users to search for books in ways children expressed as useful, such as by the color of the book cover or by story length. The successes of this approach have influenced others not only to design technologies with children in mind, but also to include them in the design process. Examples include Bilal's efforts at Web portal design that use children as design partners^[67] and the use of intergenerational research teams described by Large et al.^[68,69] to visualize and develop consensus on the design of information technologies meant for children.

In terms of information services for children in libraries, the Project CATE model, developed with the support of the IMLS at the St. Louis Public Library, describes an outcome-based planning and evaluation process in which youth and other stakeholders are central.^[70] Stakeholders collaborate not only to make decisions about information and technology services, but also to agree on what the

target outcomes of services will be. Potential outcomes include changes in knowledge, behavior, skills, attitude, or status.

CONCLUSION

The information needs and information-seeking behavior of youth are two areas that continue to be ripe for investigations that will inform both research and practice. While a body of work is accumulating related to information seeking in school and information seeking with electronic resources, there are significant gaps in our knowledge and methodological issues that need to be addressed to build a solid research base. Youth information seeking in information spaces outside of school, the place of various media in youth information seeking, and the information needs of very young children are particular topics that need to be addressed. Increasing use of theory and the inclusion of youth are two continuing trends that are resulting in new insights and improved information services, systems, and resources that respond to the needs of this diverse population.

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Zoological Park and Aquarium Libraries and Archives

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Abstract

Animal collections have existed since about 3000 B.C.; however, professional wildlife husbandry only began with the evolution of zoological parks in the early nineteenth century. This significantly increased during the second half of the twentieth century as the institutions, professional literature, and libraries matured together. Archives developed at a later and slower pace. Internationally, zoo and aquarium libraries and archives have progressed at varying rates in different countries depending on the profession's development in each country. Zoological park and aquarium libraries have services primarily concerned with the needs of their staffs. They have a specialized emphasis, reflecting the wildlife husbandry profession and its literature. As this body of literature grew, and the need for this literature became an essential part of the profession, libraries became increasingly important functions within zoos and aquariums. As these institutions grew older a sense of history encouraged them to establish archives and preserve their historic legacy.

INTRODUCTION

Zoological parks and aquariums have libraries primarily concerned with the academic and professional needs of their staffs. It is therefore important to understand the development of wildlife husbandry and the literature supporting this profession. Recognition of a need for libraries developed as the literature grew, became more sophisticated, and became a necessary part of learning the profession. Establishment of these libraries is viewed as an integral part of zoo and aquarium history and includes a review of the current status of libraries and library services in U.S. zoos and aquariums, along with a brief sampling of international zoo and aquarium libraries for comparison. Zoo and aquarium archives developed later and more slowly than the libraries. Establishment of these archives came out of a sense of history as the institutions grew older and reached significant anniversary milestones. The establishment of archives and their current status are discussed. The future of these libraries, archives, and their services is also considered.

ZOO AND AQUARIUM LITERATURE

Professional Development

Collections of living wild animals have been maintained since about 3000 B.C. when they first appeared in Mesopotamia, Egypt, and China. Central and South America explorers encountered New World animal collections in the early 1500s that had existed for a long time prior to their discovery. Likewise, early explorers in Asia found animal collections as well. Libraries have also existed for

an equally long time in societies that maintained animal collections, but having a specialized library as part of an animal collection is a more recent combination of activities.

Captive wildlife management during ancient times, and throughout most of our history, had its roots in domestication and farm animal husbandry. Keeping and domesticating wild animals began about 10,000 B.C., but collections of wild animals were not feasible until the development of the early, urbanized civilizations, which occurred about 3000 B.C. Wildlife husbandry remained a practical matter for a very long time and did not differ to any great extent from agricultural husbandry until the animal collections (later known as menageries) developed into modern zoological parks during the early 1800s.^[1,2]

Neither agricultural nor captive wildlife husbandry, despite several thousand years of activity, developed an organized body of knowledge that could be taught or systematically improved upon until the nineteenth and twentieth centuries. Difficulties existed for those who tried to establish academic and professional foundations in these professions, since it was felt that animal husbandry was a practical matter, not a scientific one, and what had to be learned could be taught verbally by word of mouth. Veterinary medicine and zoological park management suffered a similar fate.

Modern zoological park management began with the transition of European menageries into zoological parks, especially with the opening of the Zoological Society of London's zoo in 1828. Other important early European collections included Tiergarten Schonbrunn, Vienna (1752); Menagerie du Jardin des Plantes, Paris (1793); Zoologischer Garten, Berlin (1844); Natura Artis Magistra, Amsterdam (1838); and Zoologischer Garten

Breslau, Germany, 1865 (now Miejski Ogród Zoologiczny, Wrocław, Poland). Modern aquariums are a more recent development. The first public aquarium was built at the London Zoological Gardens in 1853, and others appeared soon afterward in Europe and the United States.

Exotic wild animals have been exhibited in the United States since 1716, traveling menageries since the early 1800s, and small urban menageries since the 1860s. However, the first modern U.S. zoological park was the Philadelphia Zoological Garden, chartered in 1859 and opened in 1874. After the American Civil War, public and professional consensus favored improved collections and higher standards of animal care. Throughout the decades of the late 1800s and the 1900s, there continued to be improvements in many areas affecting zoos: in community standards for cultural institutions, in the aesthetic sensibilities of the public, in the educational level of the populace, in the level of scientific knowledge, in the conservation of wildlife, in the overall standard of living, and in the expertise of zoo and aquarium staffs. This period was also a time when many occupations, including wildlife husbandry, became professionalized.

Professional zoo associations began forming after the first association, the Verband Deutscher Zoodirektoren (Association of German Zoo Directors), was established in 1887. An American zoo and aquarium profession was formerly recognized with the founding of the American Association of Zoological Parks and Aquariums [AAZPA, now the Association of Zoos and Aquariums (AZA)] in 1924. With a professional association came a professional code of ethics, professional registration of individuals, and professional accreditation for institutions. Improvements in all aspects of administration and animal husbandry were made during the twentieth century, and these improvements intensified in the period following World War II. During the 1960s, there was a significant increase in the professional literature and the number of zoo and aquarium libraries. The decades of the 1970s and 1980s were a time when zoos and aquariums recognized the need for archives (at least in the United States; zoos and aquariums in Europe recognized this need earlier). As several U.S. zoos and aquariums reached their centenaries and the AZA reached its 75th anniversary, a sense of history began to permeate the profession, along with a better appreciation of libraries and archives. Even so, some zoos and aquariums still do not have these facilities, or they have operations that are not appropriately maintained and funded.

GROWTH IN THE PROFESSIONAL LITERATURE

Although the practice of wildlife husbandry at any point in time was appropriate for the time in which it occurred and although it steadily improved over time, there was little in

captive wildlife husbandry to inspire the development of its literature and little in the literature to promote the development of wildlife husbandry during most of its history. In so far as literature is an indication of a profession's development, it appears that the zoo and aquarium profession evolved significantly during and after the 1960s.

Prior to the 1960s, zoos and aquariums improved professionally but at a slower rate that was in keeping with the times. The first U.S. zoo research facility, the Penrose Research Laboratory, began about 1901–1905 at the Philadelphia Zoological Garden, the first zoo veterinary clinic was set up in 1916 at the New York Zoological Park, the first zoo field research station was established in 1916 by the New York Zoological Society, and the New York Zoological Society began publication of the first scientific journal for zoo-based wildlife research, *Zoologica*, in 1907.

Internationally, the Frankfurt Zoological Society began publishing the first zoo journal, *Der Zoologische Garten*, in 1859; the Director of the Calcutta Zoo wrote the first modern book on captive wildlife management, *A Handbook of the Management of Animals in Captivity in Lower Bengal*, published in India in 1892; *International Zoo News* began publication in 1954; and two regionally important zoo journals in Germany and Poland were founded in the 1950s. In addition, as Table 1 indicates, a tremendous increase in the professional literature took place after 1960, led by the all-important publication the *International Zoo Yearbook*.^[3]

With continual changes and improvements in wildlife husbandry taking place, the 1960s was the decade when it became clear to many that word-of-mouth training was no longer adequate. Formal training and published information were starting to be recognized as important to the profession's improvement. In addition to commercial publications, there were publications from the institutions and their support organizations, as well as publications from the professional associations (which have now grown to 40 national, regional, and international associations according to the 1998 *International Zoo Yearbook*). In 1978, a Librarians Special Interest Group was formed within the Association of Zoos and Aquariums to coordinate efforts at improving zoo and aquarium library services and to help the association with library-related matters. One of their projects was to sift through the huge increase in professional literature that had developed by the 1980s in order to list the core literature that was considered essential to have in zoo and aquarium libraries.^[4]

This large body of literature developed because there was a need for it. Wildlife husbandry information had become recognized as a necessary part of the work. Providing a boost to this recognition was the *International Zoo Yearbook*, published annually since 1960 with articles on every aspect of zoo, aquarium, and wildlife husbandry management. This publication, along with *International Zoo News*, provides a worldwide historical glimpse into

Table 1 Significant publications related to the wildlife husbandry profession.

1859–	<i>Der Zoologische Garten</i> (Frankfurt Zoological Society). This is a journal providing national and regional zoo research and news.
1892	<i>A Handbook of the Management of Animals in Captivity in Lower Bengal</i> . R.B. Sanyal (Bengal Secretariat Press; Calcutta, India). The earliest known book (in modern times) concerned with captive bird and mammal management.
1897–	<i>Wildlife Conservation</i> (Wildlife Conservation Society/formerly New York Zoological Society). Formerly <i>Animal Kingdom</i> (1942–1990), and before that the <i>Journal</i> (of the NYZS) and <i>Bulletin</i> (of the NYZS) (1897–1942). A popular magazine containing information about zoos and natural history articles.
1907–	<i>Zoologica</i> (New York Zoological Society). This was a scientific journal that provided wildlife husbandry and natural history contributions from the Bronx Zoo staff. In its later years, it was intended to be a research journal for the American zoo community, but this was not accomplished.
1923	<i>Disease in Captive Wild Mammals and Birds</i> . Herbert Fox (Lippincott: Philadelphia, PA). This is the earliest known book (in modern times) on the diseases of captive wildlife. It is based on work done at the first American zoo research center, the Penrose Research Laboratory, Philadelphia Zoological Garden.
1926–	<i>ZooNooZ</i> (Zoological Society of San Diego). A popular magazine containing information about zoos and natural history articles.
1932	<i>Zoological Parks and Aquariums: An Annual Assemblage of Information and Facts</i> (American Association of Zoological Parks and Aquariums/AAZPA, now the AZA). Despite its title, only this one volume of articles and facts about zoos was published.
1950	<i>Wild Animals in Captivity</i> . Heini Hediger (1964, Dover reprint: New York). The first of three books by Hediger concerning the basic principles of wildlife husbandry.
1954–	<i>International Zoo News</i> (John Aspinall Foundation: Chichester, UK). The most significant resource for news and information on the world's zoos and aquariums.
1955	<i>The Psychology and Behavior of Animals in Zoos and Circuses</i> . Heini Hediger (1968, Dover reprint: New York).
1957–	<i>Przegląd Zoologiczny</i> [Zoological Review] (Polish Zoo Association: Wrocław, Poland). This is a national scientific journal of regional and international importance.
1958–	<i>Zeitschrift des Kölner Zoo</i> [Journal of the Cologne Zoo] (Zoologischer Garten: Köln, Germany). This is a scientific magazine of regional and international importance.
1960–	<i>International Zoo Yearbook</i> (Zoological Society of London: London, UK). An annual serial with articles on all aspects of zoos, aquariums, and wildlife husbandry, this is the most important reference resource for the profession. It also includes statistical information on zoos, aquariums, and their wildlife collections covering 1959 to the present.
1960–	<i>AZA Communiqué</i> (American Zoo and Aquarium Association/AZA). Formerly the <i>AAZPA Newsletter</i> (1960–1991) and <i>AAZPA News</i> (1924–1960).
1964	<i>The Management of Wild Mammals in Captivity</i> . Lee S. Crandall (University of Chicago Press: Chicago, IL). This is the second known book on captive mammal management.
1964–	<i>Dodo</i> (Jersey Wildlife Preservation Trust: Jersey, Channel Islands). An annual journal with scientific articles written about the zoo's collection and its conservation programs in the wild.
1968	<i>Zoological Park Fundamentals</i> . Lawrence Curtis (AAZPA). First known book summarizing the philosophy, planning, design, and administration of zoos. A substantially revised and enlarged edition, <i>Zoological Park and Aquarium Fundamentals</i> , was published in 1982 (Karen Sausman, Ed.).
1968–	<i>AZA Annual Conference Proceedings</i> (AAZPA/AZA).
1968–	<i>AAZV Annual Proceedings</i> (American Association of Zoo Veterinarians).
1968	<i>Zookeeper Training: A Suggested Guide for Instructors</i> (AAZPA). A manual for formal institution-based zookeeper training courses.
1969	<i>Man and Animal in the Zoo</i> . Heini Hediger (Delacorte Press: New York).
1970–	<i>Journal of Zoo and Wildlife Medicine</i> (AAZV). Formerly the <i>Journal of Zoo Animal Medicine</i> (1970–1988).
1972	<i>General Principles of Zoo Design</i> . Geoffrey Schomberg (Lutra Consultants: London, UK).
1973–	<i>AZA Regional Conferences Proceedings</i> (AAZPA/AZA).
1974–	<i>Animal Keepers Forum</i> (American Association of Zoo Keepers/AAZK). The monthly magazine of the AAZK.
1974–	<i>National AAZK Conference Proceedings</i> (AAZK).
1975	<i>Zoo Design: International Symposium on Design and Construction</i> (Paignton Zoo and Botanical Gardens: Paignton, UK). Additional proceedings were published in 1976 (<i>Zoo Design</i> 1), 1980 (<i>Zoo Design</i> 2), 1982 (<i>Zoo Design</i> 3), and 1989 (<i>Zoo Design</i> 4).
1975	<i>Capture and Care of Wild Animals</i> . E. Young (Curtis Books: Hollywood, FL).
1975–	<i>Breeding Endangered Species in Captivity</i> . R.D. Martin, Ed. (Academic Press: New York). Proceedings of the first conference on captive breeding programs. Subsequent proceedings have been published in the <i>International Zoo Yearbook</i> and elsewhere.
1976	<i>The Chemical Capture of Animals</i> . Antoine Harthoorn (Bailliere, Tindall: London, UK).
1977–	<i>Bongo</i> (Zoologischen Gartens Berlin). This is a scientific magazine of regional and international importance.
1977–	<i>International Zoo Educators Journal</i> (International Association of Zoo Educators).

(Continued)

Table 1 (Continued)

1978	<i>Zoo and Wild Animal Medicine</i> . Murray Fowler (Saunders: Philadelphia, PA).
1978	<i>Restraint and Handling of Wild and Domestic Animals</i> . Murray Fowler (Iowa State University Press: Ames, IA).
1978	<i>Behavior of Captive Wild Animals</i> . Hal Markowitz and Victor Stevens (Nelson-Hall, Chicago, IL).
1982–	<i>Zoo Biology</i> (Wiley-Liss: New York). A scientific journal, independently published, but in cooperation with AZA, devoted to research conducted at zoos and aquariums.
1980s +	Important professional publications increased during the 1960s and 1970s, as these examples indicate. The number of publications, however, increased significantly during and after the 1980s, and there are far too many to list here. These more recent publications include both commercially published titles and professional association titles. Not included in this list are the numerous magazines and newsletters published by associations that support each zoo and aquarium.

the profession as it developed during the second half of the twentieth century, including the development of species ecology, animal behavior, reproductive physiology, genetics, small population biology, veterinary medicine, nutrition, exhibit architecture, education, conservation, public relations, fund-raising, and administration. Along with a recognized need for publishing this professional literature, there came a recognized need to access and store it.

ZOO AND AQUARIUM LIBRARIES

Recognizing the Need for Libraries

United States libraries have existed since the colonial period, and about the time of independence there were some 133 libraries in existence. By the time the first zoological park opened in 1874, there were some 5817 libraries in the United States. However, few of those were specialized and only about 123 (2%) were devoted to science and technology, and none were then found in zoos.^[5] In contrast, natural history museums and botanical gardens have been established in the United States since the 1700s. With their emphasis on the scientific aspects of zoology and botany, these institutions were more dependent on the scientific literature to support their work and research. U.S. zoos, on the other hand, evolved out of popular entertainment and education; a more public-oriented, rather than a research-oriented, evolution. Early zoo work consisted of practical animal husbandry rather than taxonomic studies and scientific research. These developments delayed the need for a body of professional literature, the establishment of libraries to hold this literature, and the use of archives to preserve this literature. But all of this was to change as the profession emerged during the twentieth century.

Some zoos and aquariums did recognize the need for libraries early in their existence. Individuals, such as medical doctor R.W. Shufeldt, traveled widely and were familiar with zoological parks, and they held their own opinions on how these institutions should be organized and administered. In 1889, Shufeldt published his ideas, including the following opinion on libraries:

No well-appointed zoological building in connection with a garden would be complete without its reading room and library. In the latter should be found, in time, all the standard works that have appeared upon the various branches of natural science, and more particularly upon vertebrate zoology and morphology, including, of course, such subjects as classification and geographical distribution of animals, and the reports of other zoological gardens and societies. On the reading tables should appear the various authoritative zoological periodicals of the day, and bound volumes of the same should be upon the library shelves.^[6]

Expressing the need for zoo libraries and achieving their establishment were two different matters, even for the large, better financed institutions. Shortly after the New York Zoological Park (the Bronx Zoo, now the Wildlife Conservation Park) had opened in 1899, its director William T. Hornaday complained to Andrew Carnegie about his lack of support, especially since the zoo’s need for several buildings, including a library, were financially pressing matters for the zoo:

From the beginning it has been my fond hope that the ‘Model Millionaire’ would set the example for the other leading men of New York by giving a complete equipped building. Yes, I know that you have given us \$5000—as much as anyone has given. But of our Managers, no other is giving away millions, and almost forgetting us! If you could see how our buildings are crowded with eager people every Sunday when the toilers can come, and note how eager they are to enjoy our beautiful wild creatures, surely we would fare as well at your hands as the people of Emporia and Tucson.^[7]

Those libraries that did emerge at zoos and aquariums developed independent of the mainstream library profession in America. They were part of the zoo and aquarium profession and followed zoo and aquarium programs. Even the librarians’ organization (the Librarians Special Interest Group) is a committee-like group within the Association of Zoos and Aquariums, whereas the botanical garden librarians have an independent organization (the Council on Botanical and Horticultural Libraries) and the natural history museum librarians (the Natural History

Caucus) are affiliated with the Special Libraries Association. The disadvantage of developing within the zoo and aquarium profession has been the competition with other programs and activities within the zoos and aquariums for recognition. However, the advantage is that there is a close working relationship between the librarians and the animal staff at zoos and aquariums.

Establishing the Early Libraries

Shortly after the Zoological Society of London was founded in 1826, it resolved to not only establish a collection of living animals (founded in 1828) but also a museum of preserved animals, and a library. The first books for the library arrived in 1827. By 1964, when many U.S. zoo and aquarium libraries were just getting started, there were 120,000 volumes in the Zoological Society of London's collection and the library needed rebuilding and modernization. Because of its collection size and maturity, the library's influences have been significant. Most specially, its resources have been used to develop the world's foremost index to the zoological literature, the *Zoological Record*.^[8]

Table 2 Earliest American zoo and aquarium libraries and archives.

	Year established		
	Zoo/aq.	Library	Archives
Philadelphia Zoological Garden [1 st zoo]	1859	?	?
Central Park Zoo (WCS ^a)	1861	1900	?
Lincoln Park Zoo	1868	?	1979
Cincinnati Zoo	1875	?	1970
Ross Park Zoo	1875	?	1988
Baltimore Zoo	1876	?	1980
National Zoological Park	1889	1898	1898
Zoo Atlanta	1889	?	1988
Prospect Park Zoo (WCS)	1893	1900	?
Seneca Park Zoo	1894	?	1976
Denver Zoo	1896	?	1988
New York Aquarium (WCS)	1896	1900	?
Bronx/New York Zoo (WCS)	1899	1900	?
Toledo Zoological Gardens	1900	1937	?
Chaffee Zoo	1908	1950	1965
San Antonio Zoo	1914	1929	1968
San Diego Zoo	1916	1916	1916
Cheyenne Mountain Zoo	1926	1927	?
Detroit Zoo	1928	1950s	?
Tulsa Zoo	1927	?	1976
Mesker Park Zoo	1929	1945	?
Shedd Aquarium	1930	?	1985
Brookgreen Gardens Zoo	1931	1931	1931
El Paso Zoo	1941	1956	1970s
Pittsburgh Aviary	1952	1952	?
Cameron Park Zoo	1955	?	1976
Indianapolis Zoo	1964	?	1988

^aWCS = Wildlife Conservation Society (formerly New York Zoological Society), which serves all of these zoos and aquariums with a central library and archives.

Only 15 libraries were established in U.S. zoos and aquariums prior to 1960, as Table 2 indicates. However, the establishment of a library within an institution is a difficult matter to determine and many zoo librarians (or zoo directors) simply do not know when their libraries began. As the latter decades of the 1900s progressed, accumulations of books, journals, and newsletters began filling shelves in directors' and curators' offices. These publications were often not organized, or recognized, as libraries. Many directors, curators, and keepers had their own personal libraries at work or at home, or they had access to local public and university libraries. This may have diminished the perceived need for an institutional library, but eventually, the quantity of specialized literature made it too difficult for each individual to expand their own libraries and made institutional libraries more of a necessity.

Transforming an accumulation of publications into an institutional library, however, is often a gradual process rather than one that occurs at a discernable point in time. Another problem with defining these libraries has been a lack of understanding within the zoo and aquarium community of how a professional library should be managed or that libraries are managed according to standards established by another profession. In addition, AZA accreditation standards for zoos and aquariums have not required these institutions to have in-house libraries. Nevertheless, the accreditation standards do stipulate that zoo and aquarium staff must have access to an appropriate local library. Accepting the appropriateness of the local library and its use is at the discretion of the accreditation review team.

While the decades of the 1960s and 1970s witnessed an upsurge in the establishment of zoo and aquarium libraries, the remaining decades of the twentieth century saw improvements in the professional management of the libraries. The AZA Librarians Special Interest Group was established in 1978 and began publishing a newsletter, *Library News for Zoos and Aquariums*, in 1982. A directory of zoo and aquarium libraries is published periodically, as is a core list of recommended publications, a set of guidelines for operating libraries, a procedures manual, and a union list of journals and zoo newsletters.^[4,9–12] Several surveys and articles review the progress of zoo and aquarium libraries in the 1980s, including a special issue of *Science & Technology Libraries*.^[13–16] The *Directory of Zoo and Aquarium Libraries* provides much of the information gathered in these surveys.^[9] These data have also been reviewed in two previous *Encyclopedia of Library and Information Sciences* articles.^[17,18] A 2008 online survey by the Librarians Special Interest Group brings the data up to date.^[19]

Current Status and Services of the Libraries

Zoo and aquarium libraries vary greatly in size and functionality from institution to institution. Being specialized

they encompass the breadth of staff activities at these institutions, including business administration, personnel administration, financing and fund-raising, public relations, legislative matters, visitor surveys and demographics, buildings and grounds maintenance, garden and landscaping, master planning, exhibit designing, labeling and graphics, education, animal management and nutrition, veterinary medicine, genetics and biotechnology, reproductive biology, conservation, small population biology, and in situ field ecology.

Professional zoo librarians with a master's degree in library science are still few in numbers. Many zoos and aquariums rely on non-MLIS librarians (some of which have other degrees), part-time librarians, office staff, or volunteers to maintain their collections. Because of a loose interpretation of what constitutes a library, survey results have differed. A 1981 survey indicated that 104 zoos had libraries; however, a 1984 survey, using the presence of a professional librarian and information services as criteria to define a library, reduced that number to only 40.^[13,14] A 1988 survey, using a full-time professional librarian, circulation of the collection, and information services as criteria for defining a library, found that only 11 zoos had what could be considered full-service libraries.^[15] According to the 1988 survey's total responses, 12 zoo and aquarium libraries were established prior to 1960, 14 were established during the 1960s, 27 during the 1970s, and 19 during the 1980s.

The *Directory of Zoo and Aquarium Libraries* for 2000 lists 43 U.S. libraries and 12 international libraries while a more recent 2002 edition lists 34 U.S. and 9 international libraries.^[9] The U.S. libraries listed in this directory are the primary libraries among those that exist at the 218 accredited U.S. zoos and aquariums. An analysis of the information these libraries provide in the directory reveals how the more professionally active American zoo and aquarium libraries are doing. Three large library systems exist: the Steinhart Aquarium Library is a branch of the California Academy of Sciences Libraries; the National Zoological Park Library is a branch of the Smithsonian Institution Libraries; and the various libraries at New York City zoos are part of the Wildlife Conservation Society (formerly New York Zoological Society) library system. One of these libraries is not considered in the following analysis because it provided statistics for the larger system of which it is a part. The international libraries listed in the directory represent a very small random selection but will be considered nevertheless (like the various surveys, providing information for the directory is voluntary, and the directory is not meant to be a comprehensive listing of all libraries). The 2008 survey included 73 U.S. and international zoo and wildlife libraries.^[19]

The 2000 directory and 2008 survey provide different kinds of data, so both will be briefly reviewed here.^[9,19] Out of the 42 U.S. zoo libraries listed in the directory, 35 have a librarian (with a variety of titles) or someone who serves as a librarian (perhaps a zoologist, but more often

someone from the education department). In the survey, there are three libraries with more than one librarian and 10 have only half-time librarians. The survey also indicates that 16 librarians have professional librarians with an MLIS degree. Budgets vary (when there is one), but in 2008 tend to be in the \$1000–5000 range.

Collections vary greatly in size. Based on the directory data, 7 have fewer than 1000 books in their collection, 7 have 1000–1999, 16 have 2000–3999, and 11 have more than 4000 (one did not provide this information). The larger book collections are those at Brookfield Zoo (with 15,000 books), San Diego Zoo (12,000), Shedd Aquarium (10,000), Bronx Zoo (7500), and the National Zoo (6500). Twelve subscribe to less than 30 journal titles, 6 have 30–49, 9 have 50–99, 11 have 100–200, and three have more than 200 (one did not provide this information). The larger journal collections include those at San Diego Zoo (850), Brookfield Zoo (310), and Bronx Zoo (210). The survey data indicates that most book collections are in the 1000–10,000 range and that online journal subscriptions, while few, are increasing.

Special collections listed by the libraries include zoo and aquarium newsletters, zoo and aquarium annual reports, studbooks, guidebooks, vertical files, graphic material, slides and photographs, video and DVDs, newspaper clippings, reprints, teacher resource materials, children's bookshelf, staff publications, maps, oral histories, and informational CD-ROMs. As of 2008, 18 specifically mention having archives and four libraries have rare book collections.

Library services usually include interlibrary loan (21 libraries in 2008) and online catalogs (11 libraries in 2008). Reference is always provided at those libraries with a librarian, but often it is only for the staff (limited reference is provided to the public over the phone or if the public is allowed to use the library). Other services include current awareness bulletins, new acquisitions newsletters, compiling bibliographies, providing book reviews, and routing journals or journal contents. Electronic databases provided at the libraries include Aquatic Sciences and Fisheries Abstracts, Biosis, CAB, Dialog, Fish and Fisheries Worldwide, OCLC (as a database and 11 libraries use it for cataloging), PubMed, Species Information Library, Wildlife and Ecology Worldwide, Web of Science/Knowledge, and Zoological Record. In 2008, digital projects became more commonplace (at 18 libraries) as did consortia and listserv memberships.

In 2008, there were 23 libraries open to the public. Library users always include staff, usually include society members and docents, and sometimes include the public. Of those zoos and aquariums allowing the public to use their library in 2000, all but one required appointments. Other users mentioned include researchers, interns, teachers, and students.

Although the 2000 sample of international zoo and aquarium libraries is random and small (12 libraries), it

may be of interest to review their statistics. All 12 have a librarian. Two have book collections in the range of 1000–1999, 5 in the range of 2000–3999, and 5 have more than 4000. The largest book collections are at the London Zoo (with 170,000 books), Berlin Zoo (12,200), and Melbourne Zoo (10,000). Two have subscriptions to less than 30 journal titles, 4 have 50–99, 4 have 100–200, and 1 has more than 200 (one did not provide this information). The largest journal collection is at the London Zoo (with 1300 titles). Seven provide interlibrary loan service, and 5 provide online searching. Their library users include staff (at 12 libraries), society members (at 9 libraries), and the public (at 10 libraries, 8 of which require appointments).

ZOO AND AQUARIUM ARCHIVES

A Sense of History and the Need for Archives

Zoo and aquarium archives evolved over time as materials accumulated and a sense of history emerged. Just as some institutions consider an accumulation of books to be their library, some consider the storage of older material to be their archives. Of those institutions surveyed in 1989, 11 did not know when their archives were established, 5 archives began during the 1960s, 6 during the 1970s, and 6 during the 1980s.^[20,21] Of the 43 libraries listed in the *Directory of Zoo and Aquarium Libraries*, only 8 mentioned having archives.^[9] Of the 73 institutions surveyed in 2008, 18 indicated they had archives.^[19] Among the total number of zoos and aquariums, only a relatively small number of archives exist. Primarily, this is because many institutions still do not understand what archives are, why they are needed, or their value. Zoo and aquarium librarians who do understand and appreciate the need for archives have difficulty getting and maintaining support for them.

Archives began receiving more attention within the profession during the 1990s, although it is not clear how many new institutional archives were established during this time. Archives were established for the Association of Zoos and Aquariums during this time and are located at the Smithsonian Institution Archives, which also houses the archives of the National Zoological Park and the International Union of Directors of Zoological Gardens. An introductory workshop to archives, document retention, and preservation was held at the 1999 annual AZA conference, with help from a representative of the Minnesota Historical Society, State Archives Department (which houses the archives of the Minnesota Zoo). This attention to archives at the national level was helped in part because the AZA celebrated its 75th anniversary in 1999 and in part by the efforts of the AZA History Committee, which was established in 1991. In addition, a number of U.S. zoos and aquariums have recently reached their centennials and several more will do so soon. This milestone often imparts a sense of history that in turn provides an interest in preserving historical documents.

Current Status and Services of the Archives

Although there have no doubt been changes since the 1989 in archives surveys, no newer information is available, so the analyses from these surveys will be reviewed. The archival material found at zoos and aquariums is often the same found at any other institution, including staff and administrative records, reports, correspondence, photographs, newspaper articles, and memorabilia. Also included, though, are rather unique materials, such as animal inventories, studbooks, veterinary records, animal husbandry record books, and wildlife research records.

Of the 28 archives surveyed in 1989 (which is 36% of the 78 zoos and aquariums with libraries surveyed separately in 1988 and 13% of the 218 U.S. zoos and aquariums accredited in 2008), archivists or librarians managed only eight of these facilities. Ten archives had 2 or 3 full-time individuals working with the collection, whereas 8 had only one full-time person. The other archives used part-time help or volunteers. Ten of the collections had been cataloged, 21 had material available for study, and 6 had restored their material. Most provided limited access to the archival collections. Nineteen contained material dating back to the establishment of the institution, and of these 7 were zoos established prior to 1900. To what extent these collections are housed under proper climate control is not known. Some collections are maintained on site at the institution, whereas others are housed at municipal archives or at local and regional historical society repositories. The National Zoological Park archives are housed at the Smithsonian Institution Archives because it is a branch of the Smithsonian Institution. The Minnesota Zoo archives are housed at the Minnesota Historical Society, State Archives Department, because it is a state institution. While only 18 institutions surveyed in 2008 said they had archives, this number is probably a more realistic recognition of well-managed archives (8% of the 218 zoos accredited in 2008; however, this survey also included some international zoos and wildlife conservation institutions).

CONCLUSION

Interest in archives will increase as more U.S. zoos and aquariums reach their centennials and develop a sense of history. This milestone is not as significant in Europe where, for example, the Schonbrunn Zoo (Vienna) celebrated its 250th anniversary in 2002. European zoos and aquariums, as well as other world zoos and aquariums, have extensive archives. Unfortunately, too much material from zoos and aquariums has already been lost. In addition, there are many zoos and aquariums that have closed with little or no trace of their existence. In the United States some 250 zoos and aquariums are known to have closed since the first zoo opened.^[22]

Interest in the history of zoos and aquariums is increasing as well. A number of graduate research theses and

dissertations have recently been completed on the cultural history of zoos and aquariums and the Bartlett Society, an international society for the study of zoo and wild animal husbandry history, was founded in 1984. Several institutional histories have been published recently, as have two history books, essentially the first since Gustave Loisel wrote *Histoire des Menageries de l'Antiquite a nos jours* (Octave Doin et Fils and Henri Laurens, Paris) in 1912.^[1,2] There is still much to be learned and documented. As Ken Kawata points out in his historical commentaries, many in the zoo profession do not even know the names of individuals who made important contributions to the profession in the past, or what those contributions were.^[23,24]

There is still a need to stabilize and improve the quality and quantity of libraries as well. After some 5000 years of practical animal husbandry, the keeping of wild animals has come of age quickly. And as zoological parks and aquariums continue to evolve, their libraries and archives are destined to play a larger role within the institutions and the profession, providing the increasingly sophisticated information needed by the profession and preserving what is left of the historical records.

ACKNOWLEDGMENTS

The Librarians Special Interest Group and the Association of Zoos and Aquariums have made significant contributions to the development and professionalization of zoo and aquarium libraries and archives. They have also been responsible for gathering information about these libraries in order to benefit and improve the services these libraries provide.

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